

100m MMF reach objective
Tx and Rx parameters
working document

Post 10th January 2013

MMF ad hoc

- Tx and Rx tracker tables
 - with formulae for dependent parameters agreed in Dec 13th MMF ad hoc
 - updated references to Petrilla_1_1212 (work reviewed Dec 20th)
 - and parameter values as revised during 10th Jan 2013 MMF ad hoc

Transmitter characteristics (each lane)

Description	Type	Unit	dawe_01a_0912	Petrilla_1_1212	Table 86-6, Cl. 86	Fibre Channel	Strawman
Signal rate		GBd		25.78125 ±100ppm		28.05 ±100ppm	25.78125 ±100ppm
Center wavelength	range	nm	840 to 860	840-860	840 to 860	840 to 860	840 to 860
RMS spectral width	max	nm	0.65 / 0.6	0.6	0.65	0.57	0.6
Average launch power	max	dBm	2.4	TBD	2.4		2.4
Average launch power	min	dBm	-7.6	TBD	-7.6		-9.1 (tbc)*
Optical Modulation Amplitude (OMA)	max	dBm	3	TBD	3		3
OMA	min	dBm	-5.6	TBD	-5.6		-7.1 (tbc)*
OMA at max TDP	min	dBm	TBD	-3.0	-3.0	-3.2	-3.0
Launch power in OMA minus TDP			-6.5	TBD	-6.5		-8 (tbc)*
Difference in launch power between any two lanes (OMA)	max	dB	TBD	TBD	4		TBD (4 or greater)
Transmitter & dispersion penalty (TDP) at target BER before FEC			TBD	TBD	3.5		5 (tbc)*
Extinction ratio (min)		dB	3	4	3		3
RIN ₁₂ OMA (max)		dB/Hz	No spec	-128	No spec	-129	no spec
Transmitter reflectance		dB	No spec	-12	none		no spec
Optical return loss tolerance (max)		dB	12	12	12		12
Encircled Flux			≥ 86% at 19 μm, ≤ 30% at 4.5 μm	TBD	> 86% @ 19um, < 30% at 4.5um		≥ 86% @ 19um, ≤ 30% at 4.5um
Transmitter eye mask definition {X1, X2, X3, Y1, Y2, Y3}, 5×10 ⁻⁵ hits/sample			Around 0.25/0.21, 0.36/0.32, 0.45, 0.27,0.35,0.4	TBD	0.23, 0.34, 0.43, 0.27, 0.35, 0.4	TBD	TBD
Average launch power of OFF transmitter	max	dBm	-30	-30	-30		-30

*TDP value and dependent parameters are subject to confirmation

Receiver characteristics (each lane)

Description	Type	Unit	dawe_01 a_0912	Petrilla_1_1212 Link model values	Table 86-6, Cl. 86	Fibre Channel Link model values	Strawman
Signal rate		GBd		25.78125 ±100ppm		28.05 ±100ppm	25.78125 ±100ppm
Center wavelength	range	nm	840-860	840-860	840-860	840-860	840 to 860
Damage threshold	min	dB	+3.4	TBD	+3.4		3.4
Average power at receiver	max	dBm	2.4	TBD	2.4		2.4
Average power at receiver	min	dBm	-9.3/-9.5	TBD	-9.5		-11 (tbc)*
Optical Modulation Amplitude (OMA)	max	dBm	3	TBD	3		3
Stressed receiver sensitivity in OMA	max	dBm	-5.4	TBD	-5.4		TBD
Unstressed Rx sensitivity BER=5x10 ⁻⁵ , (BER=10 ⁻¹²)	max	dBm	No spec	-11.2 (-8.6)	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	dawe_01a_0912	Petrilla_01_1212*	Strawman
Supported fiber types		OM4, OM3	OM4	OM4, (OM3²)
Effective Modal Bandwidth	MHz*km	4700, 2000	4700	4700, (2000²)
Power Budget	dB	8.0³ to 9.5¹	8.2¹	8.2¹
Operating Range	m	TBD (20 to 100)	0.5-106	0.5-106
Channel insertion loss	dB	1.6 to 1.9	1.9	1.9

- Note 1: with KR4 FEC
- Note 2: Equivalent reach on OM3 is for further study
- Note 3: without KR4 FEC, BER = 10⁻¹²

- * Petrilla_1_1212, reviewed in the December 20th MMF ad hoc, updates the link model results for a Q consistent with a BER at the PMA service interface of less than 5×10^{-5} , as recommended in Anslow_01a_1112

- 100m objective remaining TBDs
(following slides show results of revisions made during 10th Jan 2013 MMF ad hoc)

100m Tx TBDs

Description (Tx)	Type	Unit	Name	Formula/notes	Strawman
Average launch power	max	dBm	Tx_{av_max}		2.4
Average launch power	min	dBm	Tx_{av_min}	$=Tx_{OMA_min} - 2$	-9.1 (tbc)*
Optical Modulation Amplitude (OMA)	max	dBm	Tx_{OMA_max}	$=Tx_{av_max} + 0.6$ note 1	3.0
OMA	min	dBm	Tx_{OMA_min}	$=Tx_{OMA@TDP} - TDP + 0.9$ note 2	-7.1 (tbc)*
OMA at max TDP	min	dBm	$Tx_{OMA@TDP}$		-3.0
Launch power in OMA minus TDP	min	dBm	$Tx_{OMA-TDP}$	$=Tx_{OMA@TDP} - TDP$	-8.0 (tbc)*
Difference in launch power between any two lanes (OMA)	max	dB	$Tx_{\Delta P}$	FFS	TBD (4 or greater)
Transmitter & dispersion penalty (TDP) at target BER before FEC	max	dB	TDP	From Petrilla_1_1212	5 (tbc)*
Transmitter eye mask definition {X1, X2, X3, Y1, Y2, Y3}, 5×10^{-5} hits/sample				FFS	TBD

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

*TDP value and dependent parameters are subject to confirmation

100m reach Rx TBDs

Description (Rx)	Type	Unit	Name	Formula/notes	Strawman
Damage threshold	min	dBm	P_{dmg}	$= TX_{av_max} + 1$	3.4
Average power at receiver	max	dBm	Rx_{av_max}	$= TX_{av_max}$	2.4
Average power at receiver	min	dBm	Rx_{av_min}	$= TX_{av_min} - IL$	-11.0 (tbc)*
Optical Modulation Amplitude (OMA)	max	dBm	Rx_{inOMA_max}	$= TX_{OMA_max}$	3
Stressed receiver sensitivity in OMA	max	dBm	SRS	FFS**	TBD **
SRS test conditions				FFS**	TBD **

*TDP value and dependent parameters are subject to confirmation

**Editor's comment :

SRS spec and SRS test are linked. SRS testing can be a complex trade off of practicality and rigour, and is for further study and optimization in the task force.

- An example: Expected SRS for worst case Tx and channel is $[TX_{OMA@TDP} - IL - MNP - RINpen, - MPNpen - Xpen] = -5.6$ dBm with VECP = 3.9 dB, based on Petrilla_1_1212 with a stressed eye with worst case jitter and VECP; module Rx output must meet the target Q of 3.89 and appropriate error statistics*

Link characteristic TBDs

Parameter	Unit	Name	Formula/notes	Strawman
Power Budget	dB	PB	<i>Value from Petrilla_1_1212</i>	8.2¹
Operating Range	m		<i>Value from Petrilla_1_1212</i>	106
Channel insertion loss	dB	IL	<i>Value from Petrilla_1_1212</i>	1.9*

- Note 1: the power budget is 'min Tx OMA at max TDP' minus the unstressed receiver sensitivity at 5×10^{-5}
- *Channel insertion loss = cable loss + 1.5 dB connection & splice loss