

Discussion Points for EPON Optics

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Introduction

- The following slides are intended to aid in discussions on the following points
 - ▶ Link budget and penalty allocations
 - ▶ Sensitivity and launched power
 - ▶ Jitter budget allocations

Link Budget Considerations for Upstream -PX10 and -PX20 Links

Summary of Link Parameters from D1.3

	1000BASE-PX10 Upstream		1000BASE-PX20 Upstream		Comment
	$\lambda = 1260 \text{ nm}$ rms = 1.9 nm, k=0.6 $\varepsilon \leq 0.168$	$\lambda = 1260 \text{ nm}$ rms = 1.43 nm, k=1.0 $\varepsilon \leq 0.115$	$\lambda = 1260 \text{ nm}$ rms = 0.95 nm, k=0.6 $\varepsilon \leq 0.168$	$\lambda = 1260 \text{ nm}$ rms = 0.72 nm, k=1.0 $\varepsilon \leq 0.115$	
Launch Power (min)	-2	-2	-2	-2	Value from Table 58-14 Fibre Attenuation from Table 58-17 Difference Between CIL and Attenuation Value from Table 58-14
Sensitivity (max)	-25	-25	-28	-28	
Available Power Budget	23	23	26	26	
Allocation for Penalties	3	3	1	1	
Fibre Attenuation	4.2	4.2	8.4	8.4	
Splitter Loss 1:16	14.5	14.5	14.5	14.5	
Misc	1.3	1.3	2.1	2.1	
Channel Insertion Loss	20	20	25	25	
P_{MPN}	1.5	1.5	1.5	1.6	
P_{ISI}	1.2	0.92	1.17	0.93	
Misc	0.5	0.5	0.33	0.27	
Total	3.2	2.9	3	2.8	
Channel Insertion Loss + Dispersion Losses	23.2	22.9	29	28.8	

Launched Power and Receiver Sensitivity Considerations

Current Launched Powers and Receiver Sensitivities

Not the most cost effective receiver design

		Launched Power (min) / dBm	Receiver Sensitivity (min) / dBm
-PX10	Upstream	-2	-25
	Downstream	-4	-25
-PX20	Upstream	-2	-28
	Downstream	+1	-25



**These sensitivities are difficult
to achieve in volumes**

Sensitivities of 1000BASE-LX Dual SMF Transceivers

NOTE: A single fibre TRx may have a lower sensitivity due to WDM filter

Supplier	Sensitivity Typical dBm	Sensitivity Max dBm	Part Number
Agilent	-	-20	HFCT-5701L/LP
Finisar	-24	-20.5	FTRJ-1319-x
Infineon	-	-20	V23818-K15-Lx
Luminent	-22	-20	C-13-1250-F-SLC
PicoLight	-	-20	PL-XPL-00-L13

Conclusion

- The receiver sensitivities required for EPON are not readily available with current dual fibre GBE parts. This increases TRx costs.
- It is proposed to reduce the EPON Rx sensitivities by 1 dB
- Increase the launch powers by 1 dB. This is not as cost sensitive as the current Rx sensitivity requirements.
- Keep the current Power Budgets, i.e., links still work for 10 & 20 km with 1:16 splits

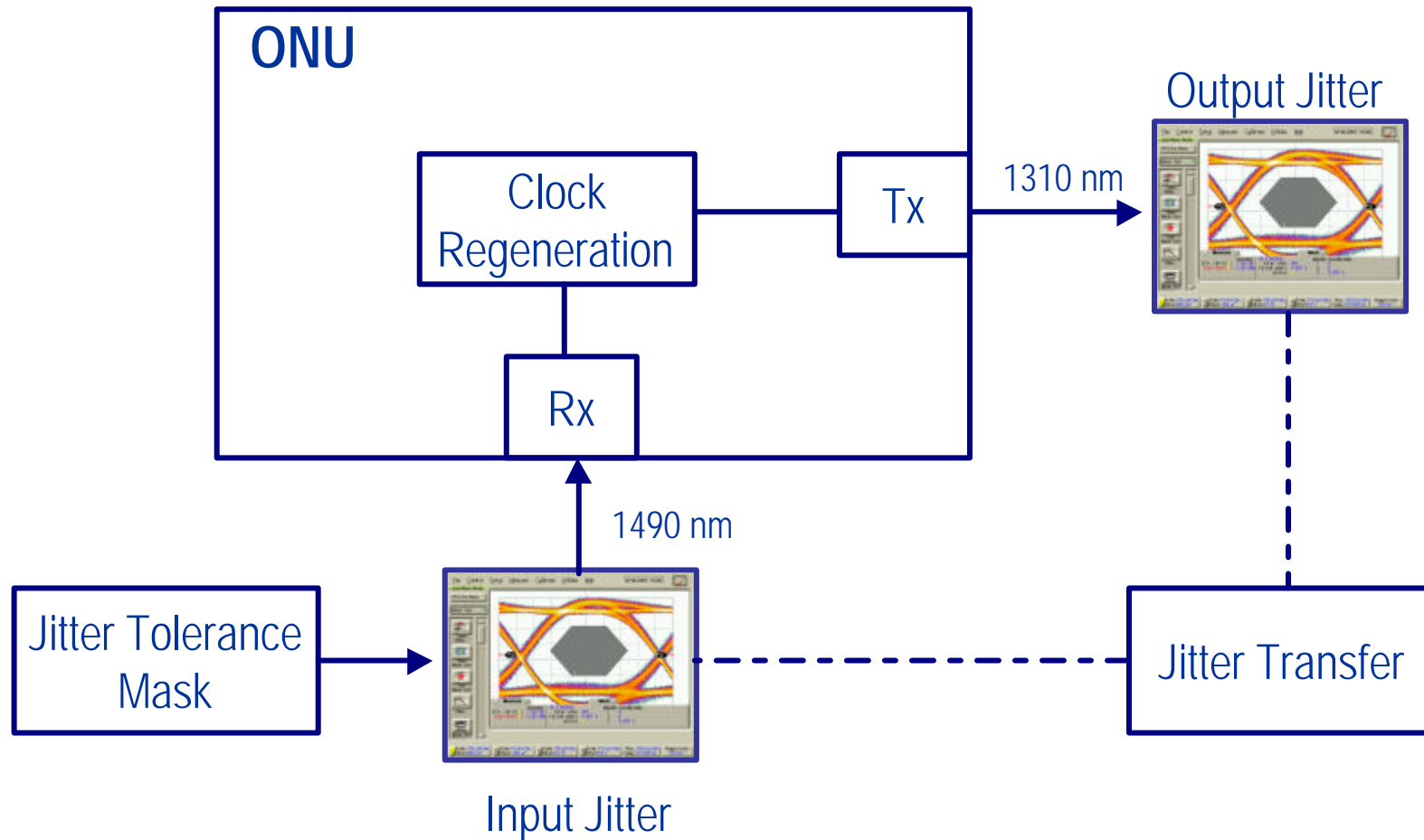
Proposed Changes

		Launched Power (min) / dBm	Receiver Sensitivity (min) / dBm
-PX10	Upstream	-1	-24
	Downstream	-3	-24
-PX20	Upstream	-1	-27
	Downstream	+2	-24

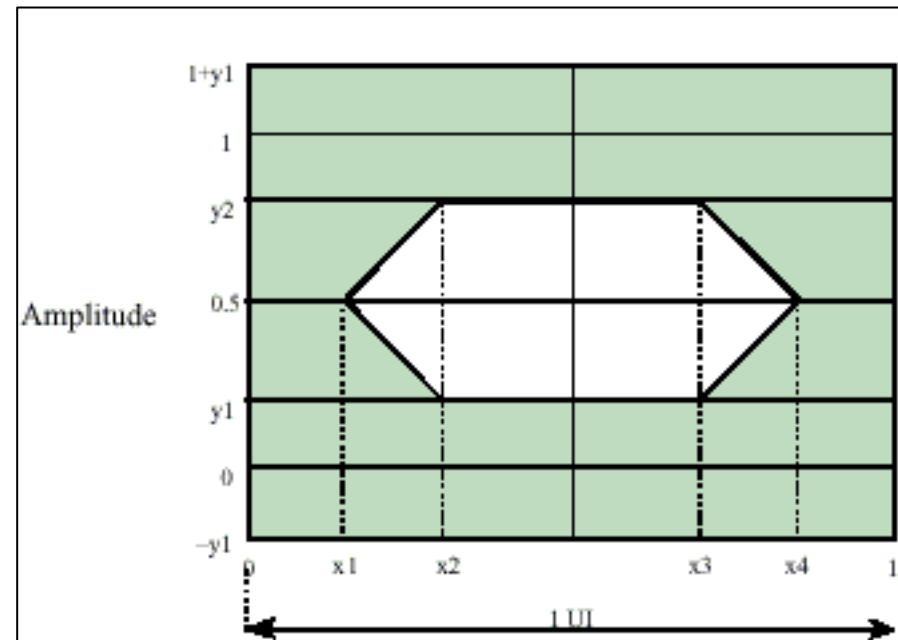
Jitter Considerations for EPON

FSAN Synchronous Clocking Structure

ONU Clock regenerated from downstream signal

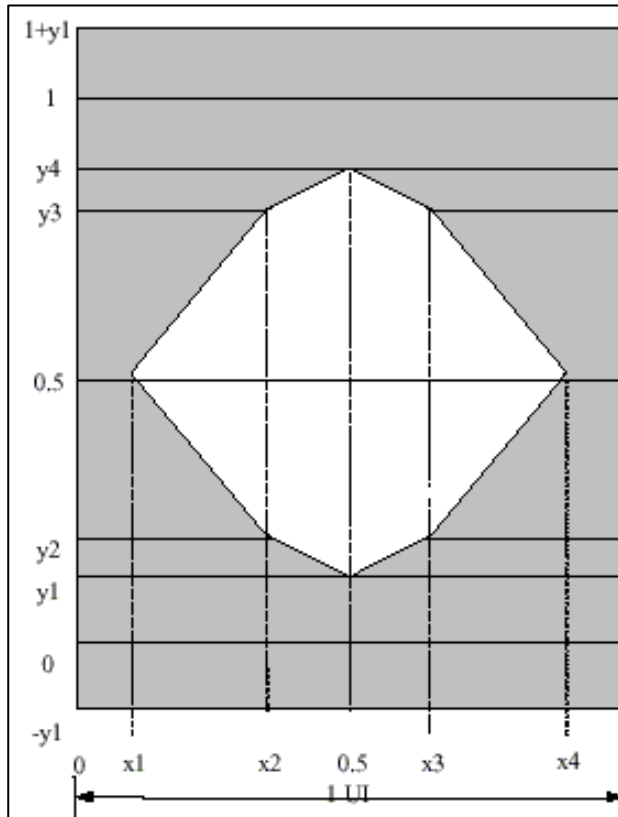


Downstream Eye Mask



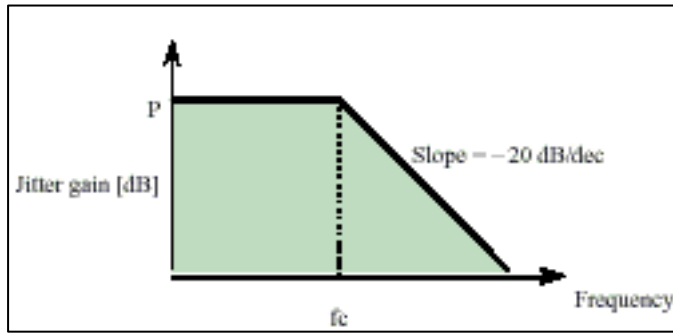
	1244.16 Mb/s
x_1/x_4	0.28/0.72
x_2/x_3	0.40/0.60
x_1/y_2	0.25/0.75

Upstream Eye Mask



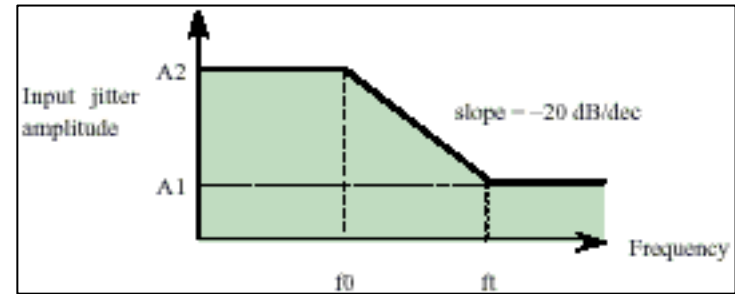
	1244.16 Mb/s
$x1/x4$	0.22/0.78
$x2/x3$	0.40/0.60
$y1/y4$	0.17/0.83
$y2/y3$	0.20/0.80

Upstream Eye Mask



Downstream bit rate (Mbps)	f_c (kHz)	P1[dB]
1244.16	1000	0.1

Jitter Transfer



Downstream bit rate	f_c [kHz]	f_0 [kHz]	A1 [UI p-p]	A2 [UI p-p]
1244.16	500	50	0.075	0.75

Jitter Tolerance Mask