

Optical budget power margins in 10GEPON systems

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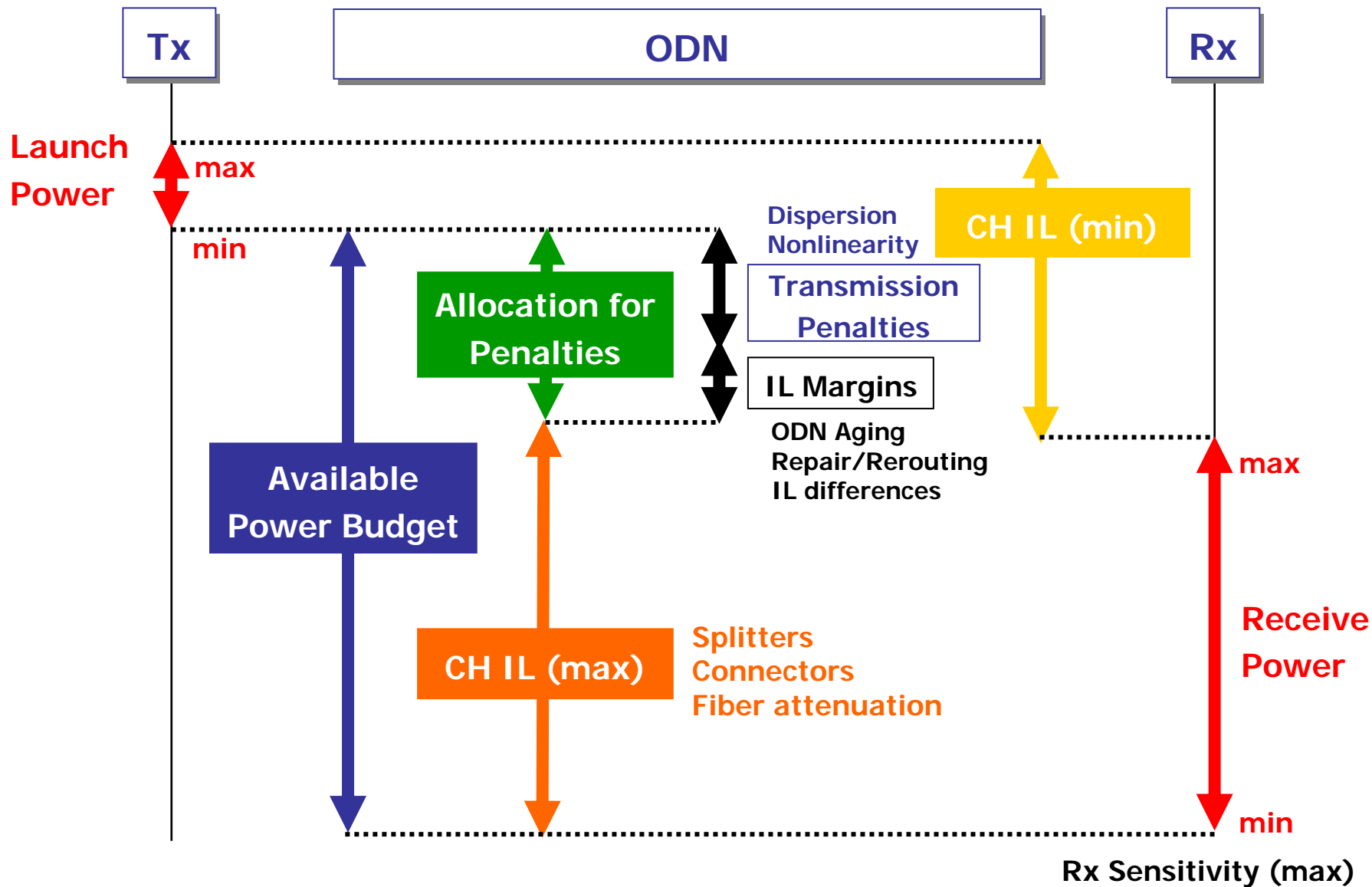
(*) Alphabetic order

Objective

Estimation of power margins in 10GE-PON systems, which corresponds to “allocation for penalties” in the following Table 60-9 of 802.3-2005, according to its definitions of terminology.

Description	1000BASE-PX10		1000BASE-PX20		Units
	US	DS	US	DS	
Fiber Type	B1.1,B1.3 SMF				
Wavelength	1310	1550 ^a	1310	1550 ^a	nm
Nominal distance	10		20		Km
Available power budget	23.0	21.0	26.0	26.0	dB
Channel insertion loss (max)	20	19.5	24	23.5	dB
Channel insertion loss (min)	5		10		dB
Allocation for penalties	3	1.5	2	2.5	dB
Optical return loss of ODN (min)	20				dB

Definitions of Terminology in 802.3-2005



Margins for Penalties

Penalties	Who's responsible?	Remarks
Optical transceiver <ul style="list-style-type: none">- Degradation- Fluctuation	Optical transceiver Vendors	These should be included in launch power and Rx sensitivity ranges.
Transmission <ul style="list-style-type: none">- Dispersion penalty- Nonlinear penalty	Optical transceiver vendors(?)	These can be analytically derived if optical parameters are specified. Each vendor may adopt proprietary technologies to mitigate them.
Insertion loss of ODN <ul style="list-style-type: none">- Degradation- Repair/Rerouting- Loss difference	Operators	The estimation of these values is very difficult, because these depend on operator's policy. We can refer to the survey results.

Penalties in 802.3-2005

Allocation for penalties (Units: dB)

Distance	EPON (US/DS)	10GBASE-L	10GBASE-E
10	3/1.5 [2] (~1?)	3.2 [3.2] (0)	
20 / 30 for 10GBASE-E	2/2.5 [1.5] (0.5-1)		3.6 [3.0](*) (0.6)

[] : maximum dispersion penalty specified in the standard, (*) : transmitter and dispersion penalty
O : IL margins derived by as follows; (IL margin)=(allocation for penalties)–(dispersion penalty)

IL margin values in 802.3-2005 seems to be inconsistent, and we should first clarify how to derive values in the above table.

In 10GE-PON systems, the additional transmission penalty of Raman crosstalk would be considered if analog video system is used.

Conclusion: What should we do next?

(1) Investigate in detail how to derive and estimate the allocation for penalties based on 802.3-2005

(2) Confirm how to estimate dispersion penalty analytically

(3) Estimate the dispersion penalty over 10km and 20km transmission by using the following wavelength and modulation schemes:

- 1.31um (Direct/External)
- 1.45um (External)
- C-band (External)
- L-band (External)