Power Budget References

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Motivation

- Action Item from May 2018 meeting to provide a consistent way to reference power budgets.
  - See comment #142

Use of term “Power Budget”

- Power Budget ≠ PMD. Power Budget is a characteristic of a link
  - Result of a combination of OLT PMD with an ONU PMD
- In clauses 60 (1G-EPON PMD) and 75 (10G-EPON PMD) we extensively used the term “power budget” when we intended to say “PHY link”
- We gave power budgets different names to indicate
  - power budget value:
    - Low (PR[X]**10**)
    - Medium (PR[X]**20**)
    - High (PR[X]**30**)
    - Extended (PR[X]**40**)
  - line rates used in upstream and downstream
    - Symmetric 1Gb/s (**PX**)
    - Symmetric 10Gb/s (**PR**)
    - Asymmetric 10Gb/s down + 1Gb/s up (**PRX**)
  - Letters **X** or **R** represent the line coding format (X: 8b/10b; R: 64b/66b). In Clause 60 and 75, we hijacked these letters for power budget names because each unique line coding also used a unique line rate.
    - Doesn’t work anymore because 64b/66b (type R) and 256b/257b (type Q) can both operate at 10.3125 Gb/s

“Power Budget” examples

75.1.4 Power budgets

Each power budget class is represented by PRX-type power budget and PR-type power budget as follows:

— PRX–type power budget describes asymmetric-rate PHY for PON operating at 10 Gb/s downstream and 1 Gb/s upstream over a single SMF [see objective b 1) in 75.1.2].
— PR–type power budget describes symmetric-rate PHY for PON operating at 10 Gb/s downstream and 10 Gb/s upstream over a single SMF [see objective b 2) in 75.1.2].

Each power budget is further identified with a numeric representation of its class, where a value of 10 represents low power budget, a value of 20 represents medium power budget, a value of 30 represents high power budget, and a value of 40 represents extended power budget. Thus, the following power budgets are defined in Clause 75:

— PRX10: asymmetric-rate, low power budget, compatible with PX10 power budget defined in Clause 60.
— PRX20: asymmetric-rate, medium power budget, compatible with PX20 power budget defined in Clause 60.
— PRX30: asymmetric-rate, high power budget, compatible with PX30 power budget defined in Clause 60.
— PRX40: asymmetric-rate, extended power budget, compatible with PX40 power budget defined in Clause 60.
— PR10: symmetric-rate, high power budget, compatible with PX10 power budget defined in Clause 60
— PR20: symmetric-rate, high power budget, compatible with PX20 power budget defined in Clause 60
— PR30: symmetric-rate, high power budget, compatible with PX30 power budget defined in Clause 60.
— PR40: symmetric-rate, extended power budget, compatible with PX40 power budget defined in Clause 60.

More examples

The operating ranges for PR and PRX power budget classes are defined in Table 75–1. A PR or PRX compliant transceiver operates over the media types listed in Table 75–14 according to the specifications described in 75.9. A transceiver which exceeds the operational range requirement while meeting all other optical specifications is considered compliant.

Table 75–1—Power budgets

Description	Low Power Budget		Medium Power Budget		High Power Budget		Extended Power Budget		Units
	PRX10	PR10	PRX20	PR20	PRX30	PR30	PRX40	PR40	
Number of fibers	1								–

Recommendations

1. Limit the usage of “power budget” to its direct meaning
   - Power budget = a PHY link parameter that represents the difference between transmitter launch power and receiver sensitivity
   - In .3ca, there are only two power budgets:
     - **Medium** (24 dB)
     - **High** (29 dB)
2. Define multiple Nx25G-EPON PHY link types
   - PHY Link names should indicate
     a) Power budget
     b) Line rates
     c) Which wavelengths are used in each direction

PHY Link types

- There are 20 unique PHY link types in .3ca

Aggregated Data Rates	×	Power budget	×	Coexistence options	×	Total
• 25/10 • 25/25 • 50/10 • 50/25 • 50/50		**20**: Medium **30**: High		**G**: GPON **X**: 10G-EPON		
5	**×**	**2**	**×**	**2**	**=**	**20**

Complete list of .3ca Link types

Upstream/ Downstream MAC data rate	Downstream wavelengths	Upstream wavelengths	Medium power budget	High power budget
25G/10G	DW0	UW0	**25/10-PQ20G**	**25/10-PQ30G**
	DW0	UW1	**25/10-PQ20X**	**25/10-PQ30X**
25G/25G	DW0	UW0	**25/25-PQ20G**	**25/25-PQ30G**
	DW0	UW1	**25/25-PQ20X**	**25/25-PQ30X**
50G/10G	DW0 + DW1	UW0	**50/10-PQ20G**	**50/10-PQ30G**
	DW0 + DW1	UW1	**50/10-PQ20X**	**50/10-PQ30X**
50G/25G	DW0 + DW1	UW0	**50/25-PQ20G**	**50/25-PQ30G**
	DW0 + DW1	UW1	**50/25-PQ20X**	**50/25-PQ30X**
50G/50G	DW0 + DW1	UW0 + UW1	**50/50-PQ20G**	**50/50-PQ30G**
	DW0 + DW1	UW1 + UW2	**50/50-PQ20X**	**50/50-PQ30X**

Usage of PHY Link Types

- In various contexts, C141 needs to refer to a group of link types, combined by certain criteria. For example:
  - **PQ** – all link types defined in .3ca
  - **PQ30** – all links that support high power budget (regardless of the wavelengths or line rates)
  - **25/10-PQ** – all links that use asymmetric line rates (regardless of power budgets, wavelengths, or coexistence options)
  - **PQ-X** – all links that support coexistence with 10G-EPON (regardless of line rates or power budgets)
  - **PQ20G** – all links that support medium power budget and can coexist with GPON (regardless of line rates or the number of wavelengths)

Thank You