Optical System Budgeting V2.

Mike Dudek Qlogic
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Introduction to V2 & V3

- **V2**

  - This is an update to the presentation made 7/3/13 to the MMF ad hoc based on discussions during this meeting.

  - Key differences are feedback that RIN is included in the TDP test, a request for some clarification on some items, plus further thought on the stressed receiver sensitivity including how the timing offset should be handled which resulted in some changes.

- **V3**

  - Typos corrected.

Introduction

- **The optical system budget in 802.3bm draft 1.0 does not add up, and I've made comment 173 against this.**

- **This presentation is a review of my understanding of how to obtain the numbers required for the standard and the relationships required. It does not intend to suggest what the independent variable numbers are.**

- **It assumes that there is already an agreed system model (spreadsheet) with appropriate basic parameters. I've listed some columns for the 10GBE spreadsheet but the method is also applicable to modified spreadsheets with appropriate modifications.**

Some Comments on specific items.

- **TDP**
  - TDP is Transmitter and Dispersion Penalty. The intent of the test is to control the the basic parameters (eg risetime, jitter etc.) so that they can be traded for each other in a manner that produces penalties no worse in the full system than allowed in the TDP test. For MMF systems because the fiber launch conditions are not controllable and dramatically effect the fiber performance the test does not have a significant length of fiber, but the receiver bandwidth is made narrower than the reference receiver bandwidth to represent the effect of the worst case fiber bandwidth (combined chromatic and modal bandwidth). The max value allowed should be determined by performing the TDP test using the spreadsheet with the worst case Transmitter parameters and a short link with no modal noise and with the Rx bandwidth equal to what it is for the calibration and the test. (may be different bandwidths or the same for the calibration and the test depending on how the TDP test method is written).

Some Comments on specific items 2.

- ## Penalties used in the stressed sensitivity test.
  - These should be approximately equivalent to the expected worst case stress that a Rx will be subjected to. Typically the bandwidth effects in the link are modeled by VECP. Jitter is made similar to what the link is expected to produce and any noise like impairments (eg Modal noise) are not included in these penalties but are accounted for by setting the stressed input power at a lower value. The penalties should be calculated from the spreadsheet using the degradations present in the stressed test (eg no modal noise or PMD or Reflection penalty) and using the reference receiver including any timing offset. (not the TDP receiver), and including any unallocated margin being assigned to the Rx, but not including unallocated margin assigned to the Tx.

Independent variables and relationships.

Parameter	variable or equation	Alternative equation	Source
Channel insertion loss	a		Value in spreadsheet. (column C in 10GBE).
Allocation for penalties(for max TDP)	b		Equals the penalties number in the spreadsheet (in 10GBE was column V if assuming central eye sampling.) plus unallocated margin which will appear in the spreadsheet as margin (column W in 10GBE.)
Additional insertion loss allowed.	c		
Unallocated margin			Not shown in the Standard. Included in the allocation for penalties. Often set to zero.
Power Budget (for max TDP)	=a+b+c	=e+f-g	
Launch power in OMA minus TDP(min)	e		
TDP (max)	f		Obtained from Spreadsheet by doing the TDP test in the spreadsheet.
NomSens OMA	g		Does not appear in standard (unless informativite only). Used in the spreadsheet only.
Penalties used in stressed test.	h		This is the penalties given by the spreadsheet set up with the calibrated stressed sensitivity test. Another way of calculating this is as b (allocation for penalties) minus (any penalties (degradations) not included in the stressed signal (eg Modal noise).
Stressed sensitivity.	=e+f-a-c-(b-h)	g+h	

Further Comments on items.

- ## TDP
  - Because the TDP test does not include all the effects of the link the Max TDP should be less than the allocation for penalties. (Typical additional penalties are modal noise, Mode Partition noise, reflection noise and the larger "cross" penalty generated by these. Note that these penalties are controlled by separate specs. (modal noise by max connector loss, Mode Partition noise by spectral width and fiber dispersion)

- ## Penalties used in the stressed sensitivity test.
  - This is calculated separately and should not be expected to be identical to TDP and will generally be larger than VECP due to eg Pcross effects.