Channel Link Model

Activity Report

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Participants

- Alphabetic list of contributors to Channel Link Model ad hoc (I do hope to have them all):
  - Andrey Kobyakov
  - Duane Remein
  - Frank Effenberger
  - Marek Hajduczenia
  - Pete Anslow
  - Piers Dawe
  - Robert Lingle
  - Sergey Ten
  - Tsutomu Tatsuta

General information

- Chartered tasks
  - Update the existing Excel spreadsheet to reflect the 10G transmission channel impairments:examine:
    - last version accepted by EFM – available at: http://ieee802.org/3/efm/public/tools/EFM0_0_2.7.xls
    - Spreadsheet aligned to 802.3ae D3.2, D3.3 available at:
    - http://ieee802.org/3/ae/public/adhoc/serial_pmd/documents/10GEPBud3_1_16a.xls
  - Include splitter loss in the overall channel loss figure
  - Account for downstream video overlay @ 1550 nm
  - Account for SBS and SRS due to analog signal transmission at high power levels
  - Make the spreadhseet user friendly

Activity report [1]

- Completed tasks
  - Account for downstream video overlay @ 1550 nm
    - It was decided that the video overlay related channel impairments will be calculated in a separate spreadsheet maintained at: http://www.ieee802.org/3/av/public/tools/10GEPON-NonLinearEffects_v1.1.xls (current version 1.1)
    - Video overlay is out of scope of IEEE 802.3 and should not be incorporated into generic Ethernet channel link spreadsheet

Activity report [2]

- Completed tasks
  - Account for SBS and SRS due to analog signal transmission at high power levels
    - SRS effect is implemented in both Excel http://www.ieee802.org/3/av/public/tools/10GEPON-NonLinearEffects_v1.1.xls (current version 1.1) and Matlab http://www.ieee802.org/3/av/public/tools/SRS_power_penalty.m (current version 1.0)
    - SRS model is valid only with digital signal located in 1520 – 1540 nm band
    - SRS for digital signal in 1580 – 1600 nm is undefined
      - depends on the video modulation scheme which is out of scope of IEEE 802.3
      - requires complex modeling which cannot be implemented in Excel spreadsheets even in simplified form

Activity report [3]

- Completed tasks
  - Account for SBS and SRS due to analog signal transmission at high power levels
    - SBS model still defies any attempts at its implementation (both in Excel and Matlab)
    - Initial results for simplified SBS model indicate that the expected value significantly underestimates the cross talk caused by the SBS effect in the channel
    - Numerical solution would have to pursued , incompatible with Excel modeling
    - SBS penalty can be ignored if LD dithering is used
    - Group decision: abandond SBS modelling due to extensive work load and inherent SBS mitigation via LD ditherting

Activity report [4]

- Completed tasks
  - Include splitter loss in the overall channel loss figure
    - Last version of the 10GEPON spreadsheet using old cell structure can be found at (includes splitter loss): http://www.ieee802.org/3/av/public/tools/10GEPON-D.0.4.xls
  - Test the feasibility of proposed power budgets:
    - Power budget proposals from 3av_0703_effenberger_5.pdf were incorporated in the 10GEPON spreadsheet: http://www.ieee802.org/3/av/public/tools/10GEPON-D.0.4_with_examples.xls
  - Live session with D.0.4 spreadhseet version
    - Action item: clean the interface, combine all input parameters and derived parameters in predefined locations (**Marek Hajduczenia**, with the aid of **Duane Remein**)

Activity report [5]

- User interface changes to 10GEPON-D.0.4:
  - Rearranged the spreadsheet to combine user input in one block and derived (calculated) parameters in another block
  - G652AB/CD fibre attenuation curves with minimum / maximum values
  - Added min/max/average curves for PSC insertion loss
  - Added a key for every color coding/cell fill option so that
  - the color coding is clear and unambiguous
    - Inconsistent color coding left as artifacts from previous versions has been removed.
  - Spreadsheet is locked but not password protected
  - Changed Extinction Ratio Macro to utilize a user form.

Activity report [6]

- User interface changes to 10GEPON-D.0.4:
  - Added 4 columns (D/E shown, KL hidden) for upper and lower limits used in conditional formatting in User input and Calculated Parameters tables.
  - Added Macro to allow the user to input Extinction Ratio and vary either Tx_Pave_dBm or TxPave_OMA (cell B4 or B5, respectively)
  - Added power budgets from 3av_0703_effenberger_5.pdf
  - Cells B19, B25 and B26 are based on drop down lists to allow only specific parameter values – prevents introduction of unexpected values
  - Added Optical Path Penalty calculation as well as Rx stressed sensitivity

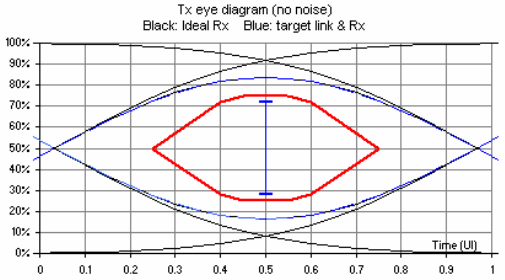
10GEPON-D.1.3.xls

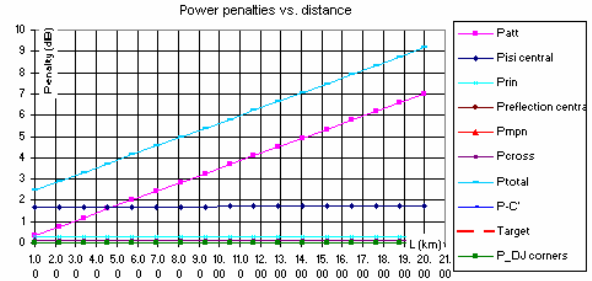
ALL FORMULAS WERE LEFT INTACT – INDIVIDUAL CELLS WERE MERELY REORGANIZED FOR SIMPLIFICATION OF THE USER INTERFACE

	Input parameters					
2	**Parameter name**	**Value**	**Units**	**Lower Lim**	**Upper Lim**	**Comments/Observations**
3			**Transmitter parameters**			
4	**Tx_Pave_dBm**	**3.09**	dBm	-5	12	Worst case average power for Tx
5	**Tx_Pave_OMA**	**5.00**	dBm	-99	99	Minimum Tx power OMA
6						**Set Extinction Ratio**
7	**Tx_Uc**	**1310**	nm	1260	1660	Central wavelength of Tx
8	**Tx_Uw**	**0.10**	nm	0.01	1	Spectral width of Tx
9	**Q factor**	**7.037**		0	99	Q factor for waveforms
10	**Data_rate**	**10313**	MBd	1000	11000	Effective data rate in Mbaud
11	**Ts(20-80)**	**47.1**	ps	0	75	Tx rise time (20%-80%)
12	**Ts(10-90)**	**71.50**	ps	0	100	Tx rise time (10%-90%)
13			**Receiver parameters**			
14	**Rx_sensitivity_dBm**	**-20.0**	dBm	-35	-5	Receiver sensitivity floor in dBm
15	**Rx_bandwidth**	**7725**	MHz	100	11000	Receiver bandwidth
16	**Rx_burst_penalty**	**0.50**	dBm	0	2	Rx burst mode operation penalty
17			**Power budget**			
18	**PSC_split_count**	**16**	-	16	32	Number of splitter ports (powers of 2)
19	**PSC_loss_curve**	**average**	-			[min,max,average]
20	**Fibre_length**	**20**	km	0.002	30	Target distance between OLT and ONUs
21	**Fibre_length_min**	**1.000**	km	0.002	30	Minimum fibre length
22	**Nonlinear_penalties**	**0.00**	dB	-3	0	Minimum fibre length
23	**Fibre_plant**	**2.00**	dB	-0.1	22.59	Connector/Splice related loss
24			**Fibre plant parameters**			
25	**Fibre attenuation curve**	**lambda^-4**	-			[lambda^-4,G652AB,G652CD]
26	**Curve type**	**min**	-	min	max	[min/max]
27	**Att_base_lambda^-4**	**1310**	dB/km			Base fibre attenuation wavelength (for lambda^-4 model)
28	**Att_base**	**0.35**	dB/km	0	1	Base fibre attenuation (for lambda^-4 model)
29						
30			**Calculated parameters**			
31	**Parameter name**	**Value**	**Units**	**Lower Lim**	**Upper Lim**	**Comments/Observations**
32			**Transmitter parameters**			
33	Tx_Pave_uW	2036.63	uW			Worst case average power for Tx
34	Tx_Pave_OMA	3162.28	uW			Minimum Tx power OMA
35	Tx_Extinction	9.00	dB	5	15	Tx extinction ratio
36	Tx_Extinction_Penalty	1.10	dBo			Tx extinction ratio penalty
37			**Receiver parameters**			
38	Rx_Psens_OMA	-18.09	dB			Normalized Rx sensitivity in OMA
39	Rx_Psens_OMA_burst	-17.59	dB			Normalized Rx sensitivity in OMA in burst mode
40			**Power budget**			
41	PSC_loss	14.00	dB			PSC induced CHIL
42	Fibre_loss	7.00	dB			Fibre (no connectors) CHIL @ Tx_Uc
43	Other_penalties	2.00	dB			Other system penalties
44	Budget_available	22.59	dB			Available power budget (Tx_Pave_OMA - Rx_Psens_OMA_burst)
45	Budget_used	23.01	dB			Currently allocated power budget in the system
46	Budget_margin	**-0.42**	dB	0	10	Available power budget margin
47			**Fibre plant parameters**			
48	Dispersion_Uo	1324.00	nm			Dispersion minimum wavelength (Uo)
49	Dispersion_So	0.09	ps/nm^2·km			
50	Dispersion_D1	-1.32	ps/(nm·km)			
51	Dispersion_Epsilon	-0.03				
52	Base wavelength	1310.00	nm			Base wavelength for fibre attenuation estimation
53	Fiber attenuation	0.35	dB/km			Fibre attenuation estimated at base wavelength

Colour code

	Calculated value
	Incorrect value/Error
	Description
Text bold	User entry fields
	Limit (normally hidden)





Targets for the next 2 months

- Ad hoc tasks left open ...
  - None identified as for now
- Provide ongoing support for current version of the 10GEPON spreadsheet document via email reflector