Proposed values for TBDs in clauses 136 and 137

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Introduction

- To go to working group ballot (D2.0), we need to be technically complete
  - No TBDs
  - We want no magenta items (although this has no formal meaning)
  - Draft 1.2 still has some of the above
- D2.0 does not need to be final or fully validated
  - There is an ongoing technical discussion that may result in significant changes, but so far it did not result in consensus to change the magenta/TBD items
  - We have several more review cycles and opportunity to change
  - For now, we should make sure that nothing is obviously and outrageously wrong
- This presentation suggests values for the TBDs and magenta items in clauses 136 and 137, to meet the requirements to create D2.0.

What is still TBD/magenta?

- In clause 136
  - Some COM parameters
  - Some TX parameters
  - RX tolerance test channel calibration (injected noise): exceptions from reference procedure 120D.3.1.6
    - This is addressed by comment #103
- In clause 137
  - Same COM parameters as in clause 136.

COM table magenta items

Parameter	Clause 136 value	Clause 137 value	802.3bs (PAM4)	802.3by CA-N (NRZ)	Related Tx parameter
Single-ended device capacitance	1.8E-04	1.8E-04	2.8E-04	2.5E-4	RL
Single-ended package capacitance at package-to-board interface	1.1E-04	1.1E-04	1.1E-04	1.8E-4	RL
Package transmission line characteristic impedance	90	90	85	78.2	RL
Transmitter differential peak output voltage: Victim	0.45	0.45	0.45	0.4	Diff V (min)
Transmitter differential peak output voltage: Far-end aggressor	0.45	0.45	0.45	0.6	Diff V (min)
Transmitter differential peak output voltage: Near-end aggressor	0.63	0.63	0.63	0.6	Diff V (max)
Transmitter signal-to-noise ratio	32.5	32.5	31	29	SNDR
Decision feedback equalizer (DFE) length	12	12	10	14	
Normalized DFE coefficient magnitude limit for n = 1	0.7	0.7	0.5	0.35	
Normalized DFE coefficient magnitude limit for n = 2 to Nb	0.2	0.2	0.2	0.35	
Random jitter, RMS	0.01	0.01	0.01	0.01	J4, JRMS
Dual-Dirac jitter, peak	0.02	0.02	0.02	0.05	J4, JRMS
One-sided noise spectral density	1.64E–8	1.64E–8	2.6E–8	5.2E-8	

Clause 136 TBD/Magenta Tx parameters

Parameter	TX value (Table 136-11)	Corresponding COM value (Table 136-15)	802.3bs value	Notes
Linear fit pulse peak (min.)	0.49*v_f	T_r = 8 ps	0.736*v_f	Also magenta in clause text, 136.9.3.1.2. Both 0.49 and 8 ps are aligned with 802.3by (clause 110). Should not be aligned with 802.3bs since this parameter is at TP2, not TP0a.
Level separation mismatch ratio RLM (min.)	TBD	0.95	0.95	
Signal-to-noise-and-distortion ratio (min.) – value and reference	TBD	SNR_{TX} = 32.5 dB	31	Also TBD in PICS (no reference).
J_{RMS}	TBD	σ_{RJ}=0.01 UI,	0.023	802.3bs values are aligned with COM
J4	TBD	A_{DD}=0.02 UI	0.118	802.3bs values are aligned with COM

Observations – the good

- Some COM and Tx parameters are interrelated and need to be aligned.
- Many magenta values are aligned with 802.3bs (Annex 120D). This is a reasonable default.
- COM receiver parameters are tighter than corresponding 802.3bs parameters.
  - This makes sense; we assume the PMD Rx is more capable.
  - ~~No proposal to change these parameters were received so far.~~
- COM SNR_{TX} is also tighter than in 802.3bs
  - This makes sense too; Tx shares the burden.
  - SNDR should be aligned.

Observations – the bad (ugly?)

- We have magenta values that match neither 802.3bs nor 802.3by, with no apparent justification:
  1. Environment noise spectral density (η_0): 63% of ‘bs and only 32% of ‘by (power ratios)
     - Supposedly improves COM somewhat for channels
     - Are there technology improvements that justify this tightening?
     - However, not obviously wrong
  2. Package model parameters
     - Device capacitance is **180** fF compared to **280** in ‘bs, **250** in ‘by
     - Package-to-board capacitance is 110 fF compared to 180 in ‘by (‘bs also 110)
     - Package Zc assumes dramatic improvement: **90** Ω in D1.2, vs. **85** in ‘bs, **78** in ‘by
     - **We still use Tx/Rx return loss specs from clause 93 with no change** – so no reason to assume this improvement in practical devices. (It seems that we have a Hole In The Budget!)
     - This seems “Obviously And Outrageously Wrong”…

Proposal outline

- **If magenta items are aligned with Annex 120D, and Tx and COM are aligned – make them black**
- **Align Tx SNDR with current COM SNR_{TX} and make them both black**
- **Keep the current COM Rx parameters (in magenta) – make them black**
- **Keep current noise spectral density (η_0) value – make it black**
  - Not OAOW
- **Align package parameters and return loss specifications**
  - To prevent having a HITB and being OAOW
  - Option 1: Change return loss specifications and package model per mellitz_3cd_01_0317
  - Option 2: Revert package model parameters to 802.3bj/by
    - If option 1 is not accepted – we want to move forward without a HITB
    - These parameters are likely to be discussed further in this task force during WGB

Proposal for COM table items
(for both clauses 136 and 137)

Parameter	Current	Proposed	802.3bs (A120D)	802.3by/bj (C92,C110, A93A)	Reasoning
Single-ended device capacitance	1.8E-4	1.8E-4	2.8E-4	2.5E-4	No clear consensus at this point
Single-ended package capacitance at package-to-board interface	1.1E-4	1.1E-4	1.1E-4	1.8E-4	
Package transmission line characteristic impedance	90	90	85	78.2	
Transmitter differential peak output voltage: Victim	0.45	0.45	0.45	0.4	Align with ‘bs (and practically with ‘by too)
Transmitter differential peak output voltage: Far-end aggressor	0.45	0.45	0.45	0.6	
Transmitter differential peak output voltage: Near-end aggressor	0.63	0.63	0.63	0.6	
Transmitter signal-to-noise ratio	32.5	32.5	31	29	Assumed PMD Tx and Rx are improved vs. AUIs
Decision feedback equalizer (DFE) length	12	12	10	14	
Normalized DFE coefficient magnitude limit for n = 1	0.7	0.7	0.5	0.35	
Normalized DFE coefficient magnitude limit for n = 2 to Nb	0.2	0.2	0.2	0.35	
Random jitter, RMS	0.01	0.01	0.01	0.01	Align with ‘bs
Dual-Dirac jitter, peak	0.02	0.02	0.02	0.05	
One-sided noise spectral density	1.64E–8	1.64E–8	2.6E–8	5.2E-8	No clear consensus at this point

Proposal for Clause 136 Tx parameters

Parameter	Current	Proposed	Reasoning
Linear fit pulse peak (min.)	0.49*v_f	0.49*v_f Also change in 136.9.3.1.2 from magenta to black	Align with 802.3by (clause 110)
Signal-to-noise-and-distortion ratio (min.) – value and reference	TBD	30.5 dB, refer to 120D.3.1.2 Also update reference in PICS	Align with COM parameter value (SNR_{TX}) with a 2 dB gap for host measurement (e.g. for crosstalk) Keep as magenta pending confirmation.
J_{RMS}	TBD	0.023	Align with proposed COM parameter values and with 802.3bs
J4	TBD	0.118	