Proposed values for TBDs in clauses 136 and 137

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Supporters

- (You can be listed here)

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 parameters
  - Some TX parameters
  - RX tolerance test channel calibration (injected noise): exceptions from reference procedure 120D.3.1.6.
- 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). Need 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	0.018	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 150 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 back to 802.3bj/by**
  - To prevent having a HITB and being OAOW
  - This is faster than creating new RL specs – and we want to move forward
  - These parameters are likely to by under scrutiny in this task force…
- **Finally, remove the empty "exceptions" list from the RX ITT calibration**
  - Until we find that we need any

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	2.5E-4	2.8E-4	2.5E-4	Align with 'by/'bj and with RL specs
Single-ended package capacitance at package-to-board interface	1.1E-4	1.5E-4	1.1E-4	1.8E-4	
Package transmission line characteristic impedance	90	78	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	Not OAOW

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)
Level separation mismatch ratio R_{LM} (min.)	TBD	0.95	Align with COM parameter value and with 802.3bs
Signal-to-noise-and-distortion ratio (min.) – value and reference	TBD	32.5 dB, refer to 120D.3.1.2 Also update reference in PICS	Align with COM parameter value (SNR_{TX})
J_{RMS}	TBD	0.023	Align with proposed COM parameter values and with 802.3bs
J4	TBD	0.018	

Proposal for Rx specs

- In 136.9.4.2.3, remove the text “with the following exceptions: 1. TBD”