Alignment of Tx jitter specifications, COM, and Rx interference/jitter tolerance tests

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Baseline

- In clauses/annexes that use COM for channel specifications, there are 3 coupled elements:
  - Transmitter specification
  - Receiver tolerance tests
  - COM parameters
- If these elements match, then a combination of Tx+channel+Rx (all compliant) should perform as expected
- Otherwise… there is either a hole in the budget or margin left on the table
  - E.g. compliant Tx, COM parameters match, but understressed Rx tolerance test: system performance not guaranteed
  - E.g. compliant Tx, compliant Rx, but COM overestimates jitter effect: channels that fail COM would still work

Comment #15

- There seems to be a mismatch SJ in the jitter tolerance test and the A_DD parameter.
- Looking at the precedence in 83D:
  - The channel is specified with COM parameter A_DD=0.05 (Table 83D–6), corresponding to 0.1 UI PtP. The transmitter specification has the same value allowed for effective DJ.
  - The SJ stress at high frequencies is 0.05 UI PtP (from Table 88–13).
  - This means the SJ stress is 50% lower than the maximum allowed for the transmitter; the test in 83D is understressed (unless the transmitter has intrinsic DJ of 0.05 UI PtP).
- In the current annex
  - The channel is specified with COM paremeter A_DD=0.02 corresponding to 0.04 UI PtP (the transmitter specification may not match this value; as noted in another comment)
  - The SJ stress at high frequencies is 0.05 UI PtP (Table 120D-7)
  - This means the SJ stress is 25% higher than the maximum allowed for the transmitter; the test is overtstressed (even if the transmitter has no intrinsic DJ).
- The SJ stress is supposedly based on the CRU bandwidth so all frequencies should be scaled similarly."

- From Table 120D-7

Table 120D–7—200GAUI-4 and 400GAUI-8 receiver jitter tolerance parameters

Parameter	Case A	Case B	Case C	Case D	Case E	Units
PCS FEC Symbol error ratio	10^{-4}	10^{-4}	10^{-4}	10^{-4}	10^{-4}	—
Jitter frequency	0.04	1.333	4	12	40	MHz
Jitter amplitude (pk-pk)	5	0.15	0.05	0.05	0.05	UI

- From Table 120D-8

Random jitter, RMS	σ_{RJ}	0.01	UI
Dual-Dirac jitter, peak	A_{DD}	0.02	UI

Comment #15 = cont.

- Suggested remedy:
  - Change table 120D-7 so that the SJ is 0.04 UI PtP at high frequencies (cases C, D and E) , 0.12 UI for case B, and 4 UI for case A.

- Suggested Table 120D-7 change

~~Table 120D–7—200GAUI-4 and 400GAUI-8 receiver jitter tolerance parameters~~

Parameter	Case A	Case B	Case C	Case D	Case E	Units
~~PCS FEC Symbol error ratio~~	~~10^{-4}~~	~~10^{-4}~~	~~10^{-4}~~	~~10^{-4}~~	~~10^{-4}~~	~~—~~
~~Jitter frequency~~	~~0.04~~	~~1.333~~	~~4~~	~~12~~	~~40~~	~~MHz~~
~~Jitter amplitude (pk-pk)~~	~~5~~	~~0.15~~	~~0.05~~	~~0.05~~	~~0.05~~	~~UI~~

Table 120D–7—200GAUI-4 and 400GAUI-8 receiver jitter tolerance parameters

Parameter	Case A	Case B	Case C	Case D	Case E	Units
PCS FEC Symbol error ratio	10^{-4}	10^{-4}	10^{-4}	10^{-4}	10^{-4}	—
Jitter frequency	0.04	1.333	4	12	40	MHz
Jitter amplitude (pk-pk)	4	0.12	0.04	0.04	0.04	UI

Comment #29

- There seems to be a mismatch between the transmitter jitter specifications and the A_DD parameter.
- Looking at the precedence in 83D:
  - The maximum effective DJ allowance for the transmitter is 0.1 UI PtP (Table 83D–1)
  - The channel is specified with COM parameter A_DD=0.05 (Table 83D–6), corresponding to 0.1 UI PtP.
- In the current annex:
  - Transmitter DJ is not specified directly, but using equations 120D-9 and 120D-10 with the maximum specified J4 (0.118 UI) and JRMS (0.019 UI) yields A_DD=0.015 and sigma_RJ=0.011
  - The channel is specified with COM paremeter A_DD=0.02 and sigma_RJ=0.01.
- If the equations are correct, this means the channel specification assumes a significantly worse transmitter than what is actually allowed, and the transmitter specification may be relaxed.

Comment #29 – cont.

- Assuming the channels are an (informal) objective, we should not change the COM parameters.
- Suggested remedy: change the Tx jitter specifications.
  - ➔Find J4, J_{RMS} and equations that would yield the same A_{DD}, σ_{RJ} used in COM
  - I am actively looking for such a combination…
- Can we assume that J4 and J_{RMS} cannot be at the maximum together?
  - If so – this should be stated
  - I still don't have an example of values that yield the target A_{DD}, σ_{RJ}

Comment #30

- As a sanity check, I calculated what would happen with
  - A purely dual-dirac jitter (no RJ) causing the specified J4, and
  - A purely random jitter (no DD) causing the specified J_{RMS} (0.023 UI).
- In the first case, J4=0.0118 and J_{RMS} would be sqrt(0.0118)=0.109 (more than allowed…)
  - Plugging these values to equations 120D-9 and 120D-10 yields A_{DD}=0.1059 and σ_{RJ}=0.1917
  - Instead of the expected A_{DD}=0.0059 (J4/2) and σ_{RJ}=0
- In the second case, JRMS is 0.023 and J4 would be 2*0.023*Q(1e-4/2)=0.18
  - plugging these values to equations 120D-9 and 120D-10 yields A_{DD}=0.0106 and σ_{RJ}=0.004; instead of the expected A_{DD}=0 and σ_{RJ}=0.023.

Q4	3.8906	
Input values		
J_4	0.0118	
J_{RMS}	0.109	
Calcualted values		
A_{DD}	0.1059	120D–7
σ_{RJ}	0.1917	120D–8

Q4	3.8906	
Input values		
J_4	0.18	
J_{RMS}	0.023	
Calcualted values		
A_{DD}	0.0106	120D–7
σ_{RJ}	0.004	120D–8

Comment #30 – cont.

- The equations originated from comment #25 against D2.0 which has very little explanation.
- I have not found any further analysis and suspect that the equations may be incorrect…
- Looking for alternative calculation