Options to fix the low frequency jitter (gearbox) issue

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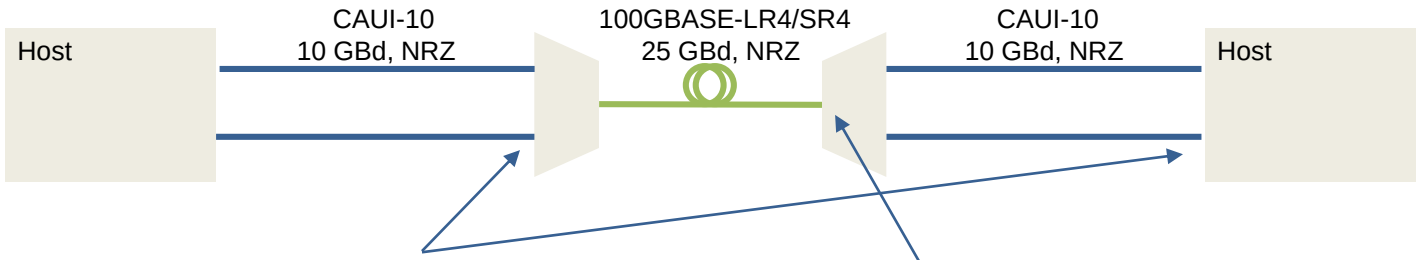
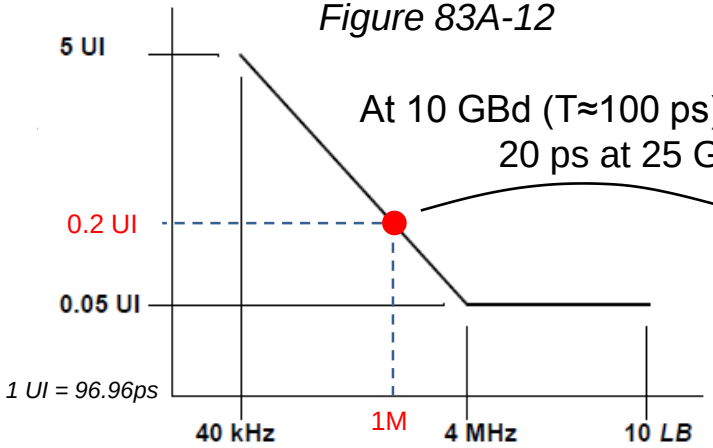
History: IEEE 802.3 CAUI-10 to 100GBASE-LR4 jitter conversion

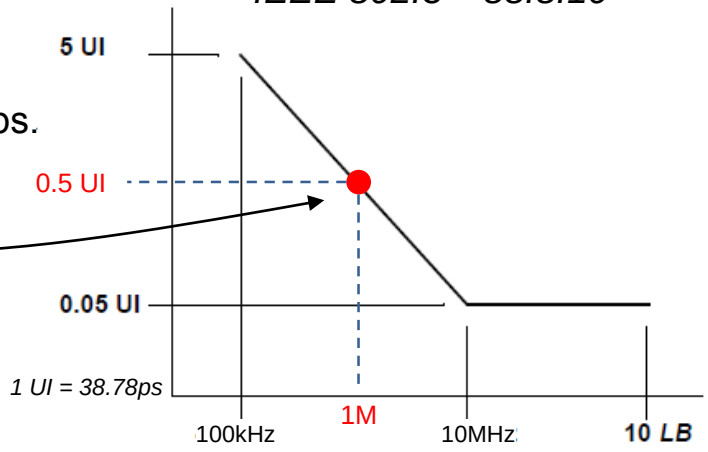


IEEE 802.3 – Clause 83B.2.3→83A.3.4.6
Figure 83A-12



At 10 GBd (T≈100 ps) and 0.2 UI is 20 ps.
20 ps at 25 GBd is 0.5 UI

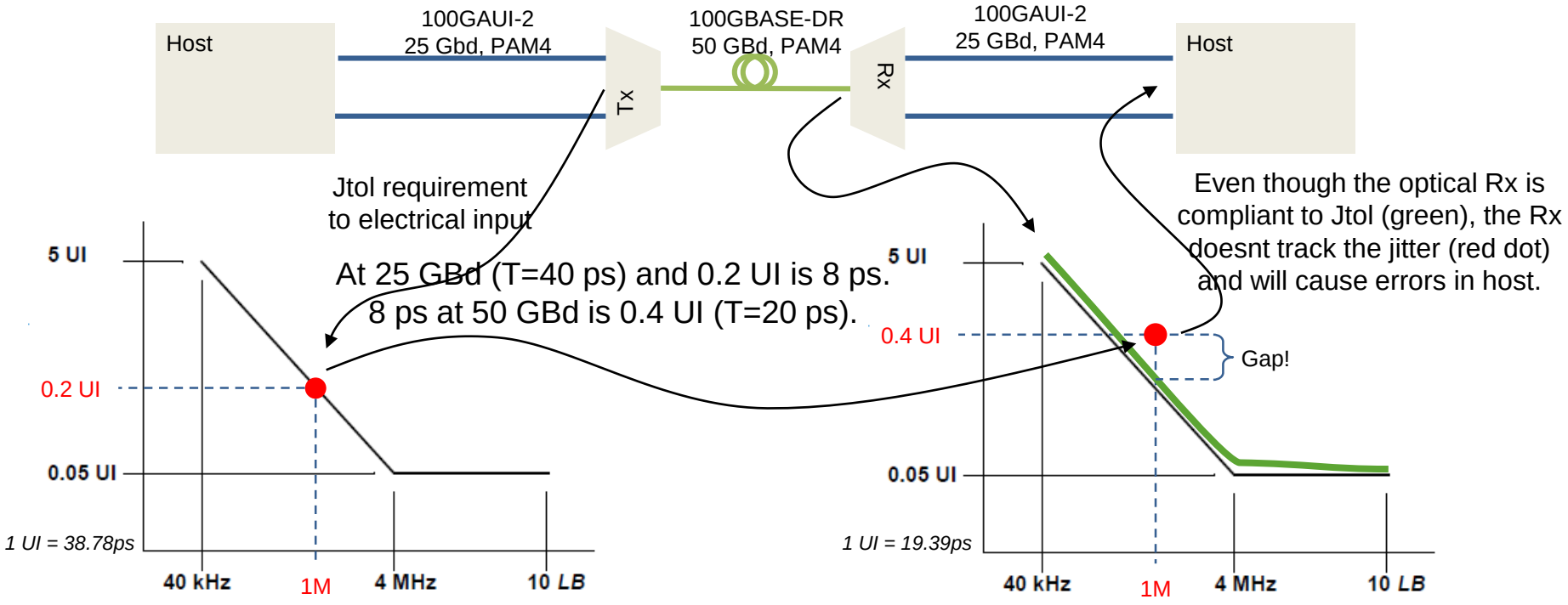
IEEE 802.3 – 88.8.10



This treats a gearbox like a non-gearbox AUI -- OK

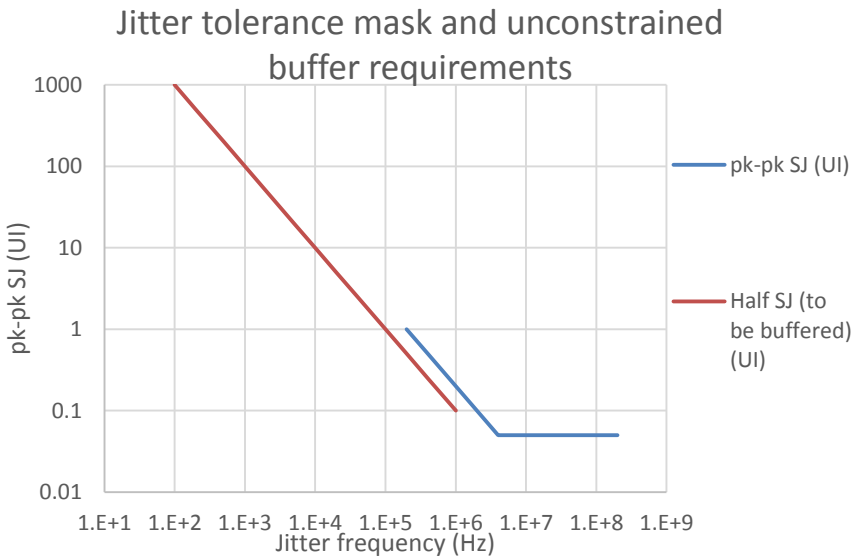
IEEE 802.3cd 100GAUI-2 to 100GBASE-DR Jitter Challenge

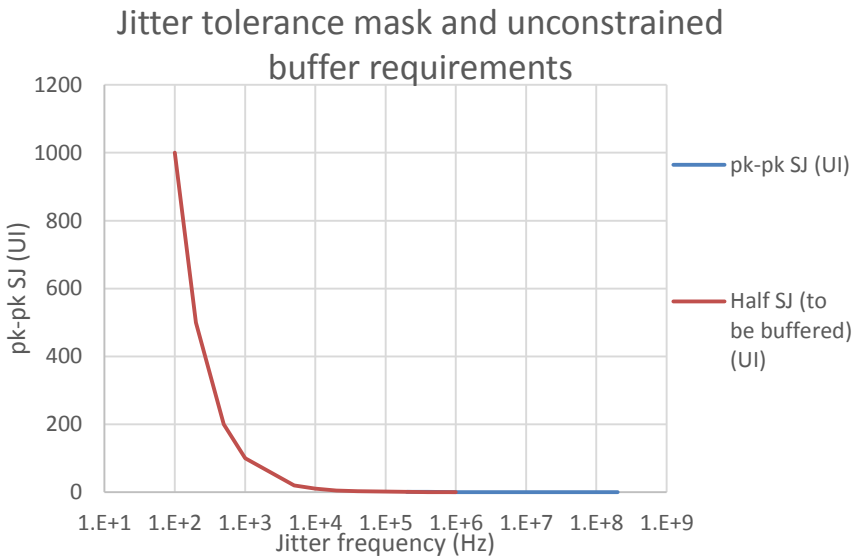
Concern:
The jitter tolerance mask is the same (in UI) for the AUI-8 electrical 25 GBd interface as for the optical 50 GBd receiver. But UI is different.
In the worst case Tx will track the jitter with Jtol mask and the jitter at the optical 50 GBd will be doubled in terms of UI.
An optical receiver Rx marginally compliant will not be able to track this and hence cause bit errors.



This treats a gearbox differently to a non-gearbox AUI -- not OK
The gap at very low frequency (many UI) must be closed

Implication for a jitter clean-up buffer

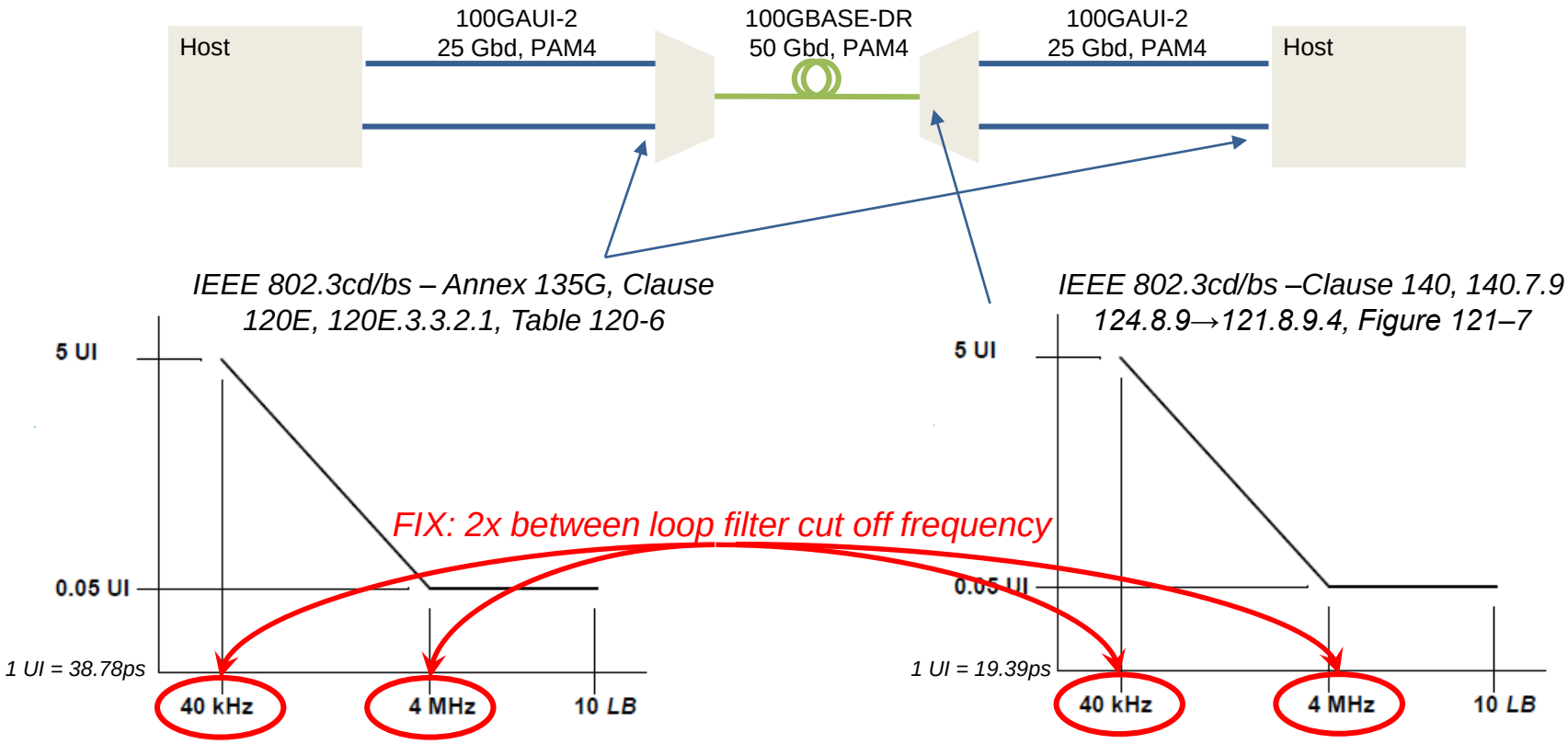




- Log-log plot
- The jitter tolerance mask (blue) and the half of that that has to be handled somehow

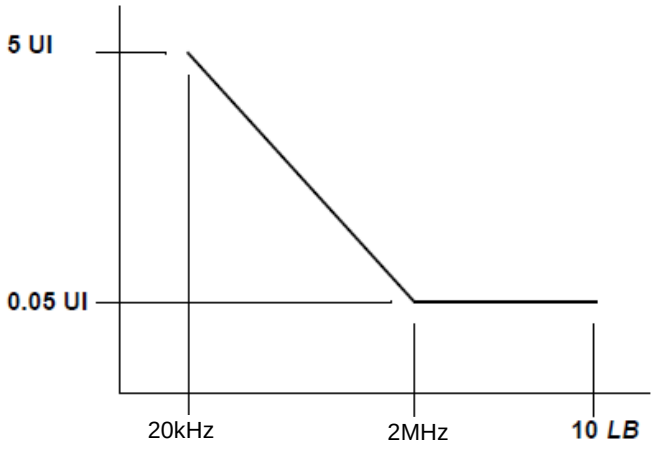
- Log-lin plot
- Showing that the discrepancy in the spec is not bounded

IEEE 802.3cd 100GAUI-2 PLL Two possible solutions



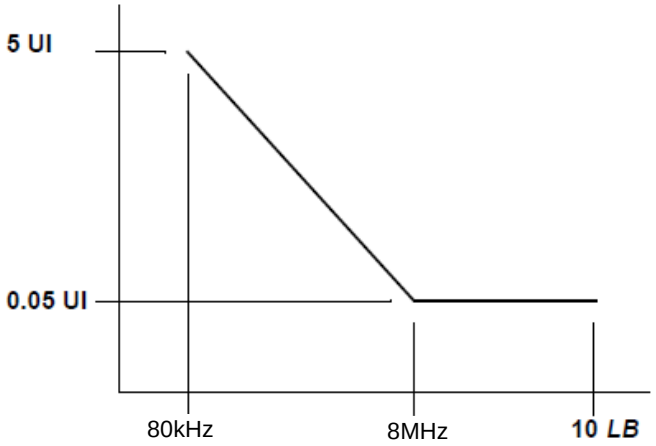
Fix options, 2 of many

IEEE 802.3cd/bs – Annex 135G, Clause 120E, 120E.3.3.2.1, Table 120-6



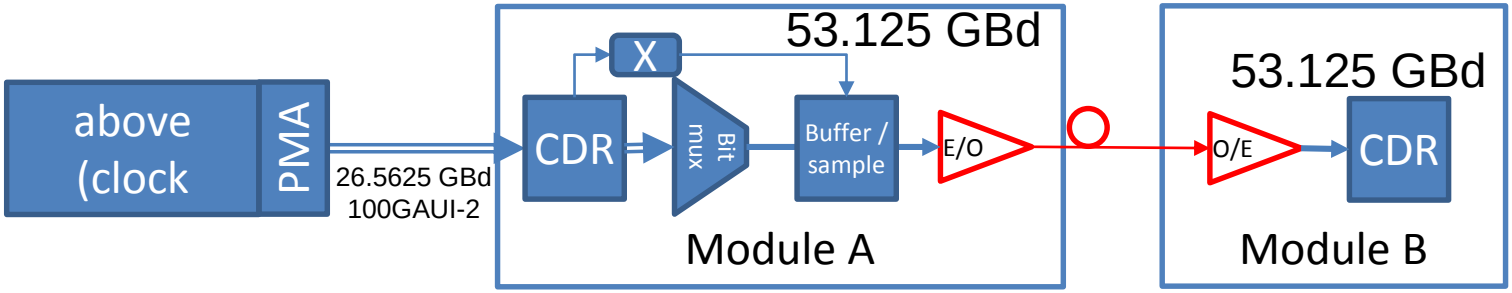
- Change the 100GCAUI-2 down in frequency

IEEE 802.3cd/bs –Clause 140, 140.7.9 124.8.9→121.8.9.4, Figure 121–7



- Change the 100GBASE-DR4 up in frequency

Jitter buffer



Two cases:

1. Module A has a simple “clock forward” in box X – no buffering, optical samples have the same LF jitter as electrical samples
2. Module A has a “cleaning PLL” in box X that reduces LF jitter on optical signal; jitter in electrical signal is tracked; frequency difference handled by buffering

Based on ran_011718_3cd_adhoc slide 4

Options to close the gap

Option		Effect on 50G host o/p	Effect on 2n:1n gearbox in a module	Effect on 100G i/p	Changed or extra specs	Reference
1	Make 50G source better at LF	Yes	Protected	No	Jitter tolerance corner and CRU BW 4 > 2 MHz	802.3ba 10:4 gearbox D3.0 comments, ran_011718_3cd_adhoc
2	Make 50G source better at VLF	Yes	Protected, needs jitter buffer and better gearbox VCO	Yes	New VLF jitter spec for 50G host o/p, compound jitter tolerance for 100G i/p	
3	Make 100G input better at LF	No	Protected	Yes	Jitter tolerance corner and CRU BW 4 > 8 MHz	802.3ba 10:4 gearbox
4	Make 100G input better at VLF	No	Protected, needs jitter buffer and better gearbox VCO	Yes	Compound jitter tolerance for 100G i/p	dawe_3cd_03_0717 slide 11
5	No change to public spec	In practice, yes	In practice, yes	In practice, yes	In practice, burden on all three	

Conclusion

- Use option 1
  - Make it a recommendation because most 50G/lane hosts will never have 100G/lane optics plugged into them
- Note that option 4 is the next least complicated

Thanks