

# EVEN-ODD JITTER

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Supporting comments 48, 186, 189, 52, 187, 188, 127, 190

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# Goal of this presentation

- Summarize comments
- Propose

# Problem statement(s)

- **Even-Odd Jitter measurement as defined in 120D.3.1.8.2 results in repeatability issues and can show exaggerated values in some cases.**
  - Comments 52, 127, 189, 190
- **Current state-of-the-art test equipment precision is too low for measuring EOJ to the specified values.**
  - Comments 186, 187, 188
- **The limit for even-odd jitter is unnecessarily tight.**
  - Comment 48

# 1. Measurement method

- As shown in recent ad hoc presentation [calvin\\_3ck\\_adhoc\\_01\\_091620](#), the measurement definition in 120D.3.1.8.2 specifically calls for PRBS13Q and a CRU bandwidth of 4 MHz. This combination can result in conversion of low-frequency effects into EOJ (which was supposed to be a very high frequency effect), and subsequently widely distributed and excessive results.
- Proposed remedies:
  1. Allow using CRU bandwidth lower than 4 MHz (#189, #190)
  2. Specify using PRBS9Q instead of PRBS13Q (#127)
  3. Allow using any odd-length pattern which has all required transitions (#52)
- Notes:
  - Using PRBS9Q would solve the issue but may require more text and possibly additional test pattern implementation.
  - Very low CRU bandwidth may degrade the measurement for other reasons. It does not represent the effect on real receivers.
  - Allowing shorter patterns and lower CRU bandwidth would be easier to specify. It would give more flexibility to test engineers (this has upsides and downsides). Some past specifications treated specific patterns as examples of suitable test patterns (e.g. SNDR in 92.8.3.7).
- Suggest a task force discussion and straw poll between these two directions (or do nothing).

## 2. Equipment precision

- The specification of 19 mUI (358 fs) as a maximum of 12 measurements for very challenging measurement precision.
- Proposed remedy: increase spec limit to 25 mUI.
- Notes
  - 19 mUI was specified in 120D too, but with UI twice as large. The measurement challenge is higher in 802.3ck.
  - A specification that cannot be measured at present may effectively become ignored.
  - Equipment limits have been considered in other places (scope noise floor, s-parameter measurement bandwidth).

## 3. Is the limit justified?

- Optical PMDs do not specify EOJ/DCD at all
- For electrical PMDs:
  - For PMDs with NRZ modulation the limit is **0.035 UI** (10G clauses 72, 84, 85; 25G clauses 92, 93, 110, 111)
  - NRZ AUIs and module interfaces do not have this specification except for the PPI (86A, a non-retimed interface) where it is 0.02 UI
  - The value 0.019 UI was first used in clause 94 which had a UI of 73 ps (so the EOJ limit was 1.4 ps); this value was kept for later PAM4 PHYs regardless of the frequency scaling, which now makes it very challenging
  - Annex 120D made an additional requirement of measuring on all 12 transitions and taking the maximum value.
- Notes
  - Unlike other jitter components, EOJ is not part of any budget calculation – the limit seems arbitrary (as well as taking maximum of 12 edges).
  - There is some evidence that real 100G receivers are largely tolerant to higher values of EOJ (e.g. 0.035 UI).
- Question for PMD experts: is this acceptable?