LRM Requires Comprehensive Jitter Tolerance for Interoperability

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Nov 15, 2005

IEEE Meeting

Vancouver, BC

How Do You Build an LRM Module with Serial PMA

- **10GBase-LRM as amended in Orlando 0304_8023aq_Five_Criteria states under Distinct Identity the following "This serial multimode PHY will be the only one that supports a link distance of at least 220m over installed FDDI-grade multimode fiber and that supports compatibility with the 10GBASE-R PMA".**
  - ⇨Initially above statement explicitly referenced XFP.
- **LRM draft 2.4 does not define a comprehensive jitter tolerance test which will cause potential interoperability issues and violates practical serial PMA implementations**
  - ⇨ Current specifications are incompatible with XFPs shipping using XFI /CEI electrical interface and makes X2 implementation very difficult.
- **We want to address known issue in the task force in a timely fashion in order to complete LRM standard quickly**

Potential Interoperability and Field Issue

- **68.6.5 defines a CRU with high frequency corner of 4 MHz.**
  - ⇨Jitter content < 4 MHz will be track with -20 dB /dec slope.
  - ⇨TP2 jitter contents from DC-DC converter, PLL, through XFI channel will be tracked by the CRU and not captured by the measurement equipment.
  - ⇨The above jitter sources are present in operating systems.
- **Now the real issue: LRM receiver + link chain are not tested with the same transmitter jitter the CRU credited.**
- **Implications: This means a perfectly passing transmitter and receiver my not interoperate!**

LRM Current Stress Receiver Test

- **Test the receiver with a set of 3 stressor without any of the transmitter credited low frequency jitter.**

- **In a separate test without the fibre stressor the receiver is tested with the following sinusoidal jitter**
  - ⇨40 KHz with 5 UI and 200 KHz with 1 UI

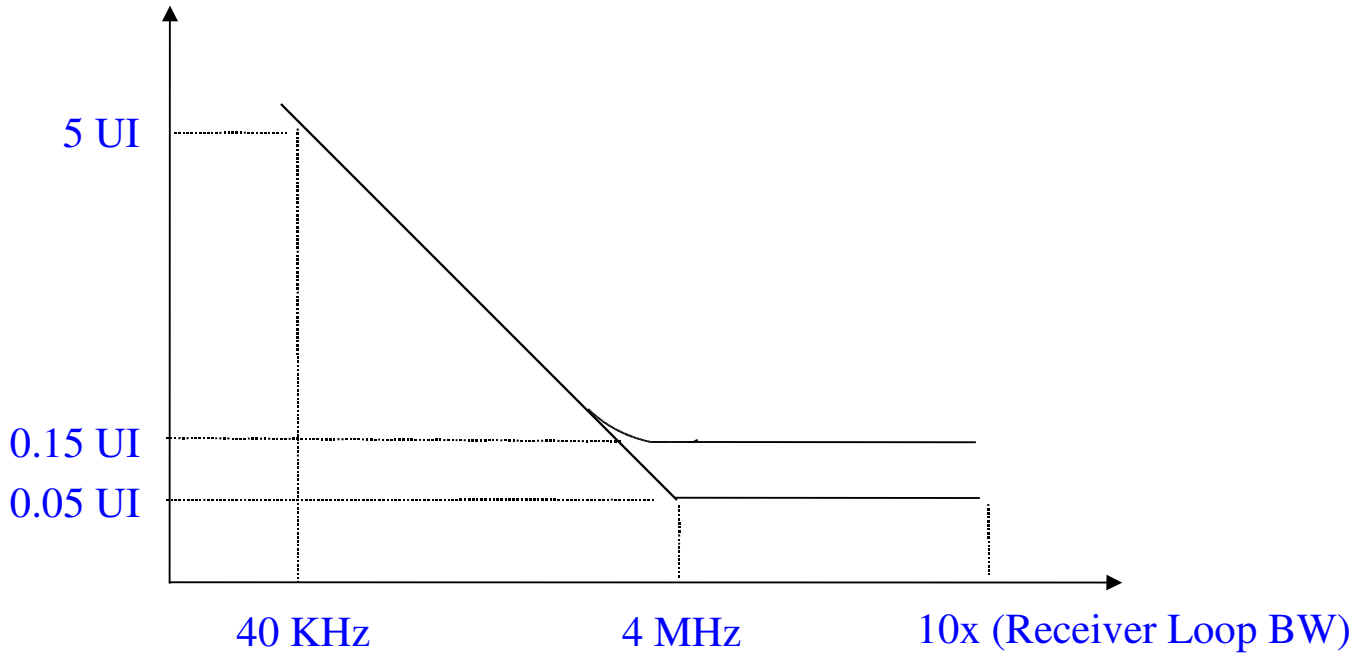
- **Many standards including 802.3ae and FC use MJS jitter methodology:**
  - ⇨MJS, gives credit to the transmitter for the low frequency jitter as some times it is very difficult to eliminate low frequency jitter from the transmitter.
  - ⇨The receiver with sufficient loop BW can track the low frequency jitter.
  - ⇨But then the receiver and channel must be tested at least with the credit low frequency jitter plus some margin.

History of Comments Related to Lack of Comprehensive Jitter Tolerance

- **Draft 2.0: Comment 247 (Thor) and 414 (Ghiasi)**
- **Draft 2.1: Comment 1171 (Ghiasi) – Open TR**
- **Draft 2.3: Comment 18 (Dawe) – Open TR**
- **Draft 2.4: Comments 1 (Mei) and 11 (Ghiasi)**
- **The problem with jitter tolerance has been known and how to address it is well known since draft 2.0.**

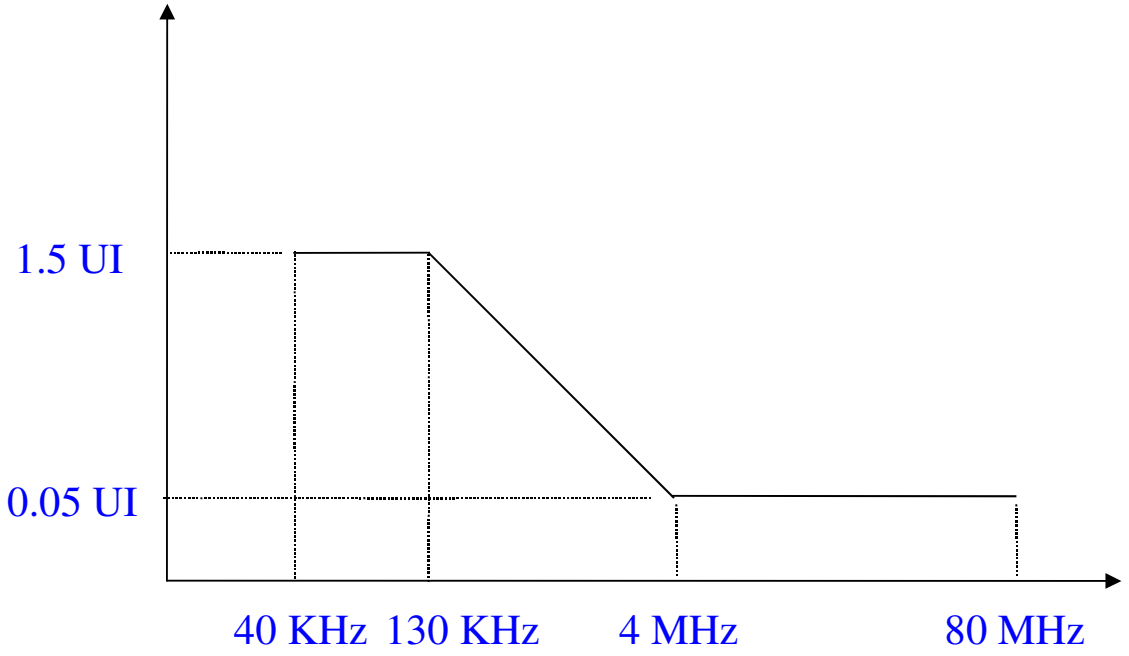
Jitter Tolerance as Defined in 802.3ae

- **LRM is targeted to use the same SerDes transmitter as 802.3ae**
  - ⇨This means jitter corner frequency is 4 MHz.
  - ⇨802.3ae mask shown below and to calibrate stress receiver sensitivity ae allows high frequency SJ be adjusted from 0.05 UI to 0.15 UI.



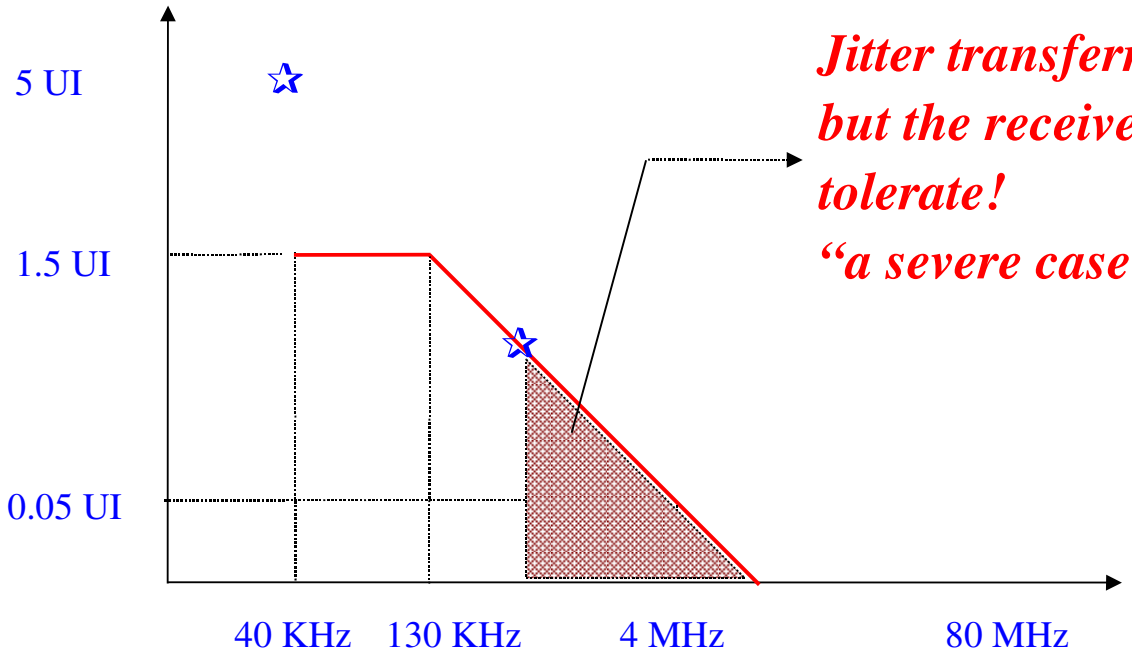
XFP Transmitter Jitter Transfer

- **XFI jitter will transfer to TP2 and TP3**
  - ☺**LRM defined TP2 will pass**
  - ☺**Receiver will pass TP3 defined stressor**
  - ☹**The link may fail !**



XFP Transmitter Driving LRM Receiver

- **Assuming 4 MHz CDR BW in the XFP**
  - ⇨ Currently defined IEEE SJ test frequency are shown ☆ and defined in absence of channel stressor.
  - ⇨The low jitter credited to the transmitter exist regardless of channel.



Jitter transferred by the transmitter but the receiver may not be able to tolerate!
"a severe case for field problems"

Resolving Jitter Tolerance Discrepancy

- First sinusoidal jitter tolerance test must be added on top of the channel stressor.

- Two options exist to resolve jitter tolerance test discrepancy and potential field problems

  - ⇨**Define transmit loop bandwidth of 200 KHz – Not practical**
  - ⇨**Extend the current jitter tolerance from 200 KHz to 4 MHz with the following test frequencies:**
    - **5 UI@40KHz, 0.5 UI@400KHz, 0.05 UI@4MHz, 0.05 UI 40 MHz.**
    - **Also add a note to Table 68-6 saying "above frequency point are provided as reference test point, LRM products must operate error free for all frequencies from 40KHz to 40 MHz when the tolerance points are connected by straight line.**

Conclusion

- **One of the LRM PAR 5 objective was to define an standard with 10GBase-R PMA but our current specification does not support the only serial PMA available today "XFI"**
  - ⇨For example 0.5 UI SJ at 400 KHz coming through the XFI channel may break the LRM receiver.
    - X2 implementation will also be severally difficult.
- **LRM lack of comprehensive jitter tolerance may cause significant interoperability in field and the problem is that passing transmitter and receivers will not work.**
- **We want to address this issue in the task force in a timely fashion in order to complete LRM standard quickly.**