
TX Launch Considerations for 10 GbE FDDI Fiber Links

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Constraints on the Conditioned Launch Problem

- Conditioned Launch is Necessary to Achieve Sufficiently High Fiber Bandwidth
 - Seems to Be General Agreement that EDC Improvement Will Range From 2 – 3x
 - Even with Optimistic EDC Assumptions We Need Effective Fiber Bandwidth of:
 - ~ 500 MHz • km for 300m
 - ~ 350 MHz • km for 220m
 - As An Example, Centered Single Mode Launch Would Not Reliably Meet These Needs, As Was the Case in 1000BASE-LX.
- It is a Formal Objective to Operate on Both 50/125 and 62/125 Fiber
- Commercially Viable Solutions Will Require Integrated Conditioned Launch
 - Solutions Must Not Require External Mode Condition Patchcords
 - Practical Implementations are Based on Receptacle Based Transceivers
- **Taken Together These Constraints Will Limit Usable Conditioned Launches Due to Fundamental and Practical Considerations of Receptacle Based Solutions**

Weakness of Integrated Offset Launch

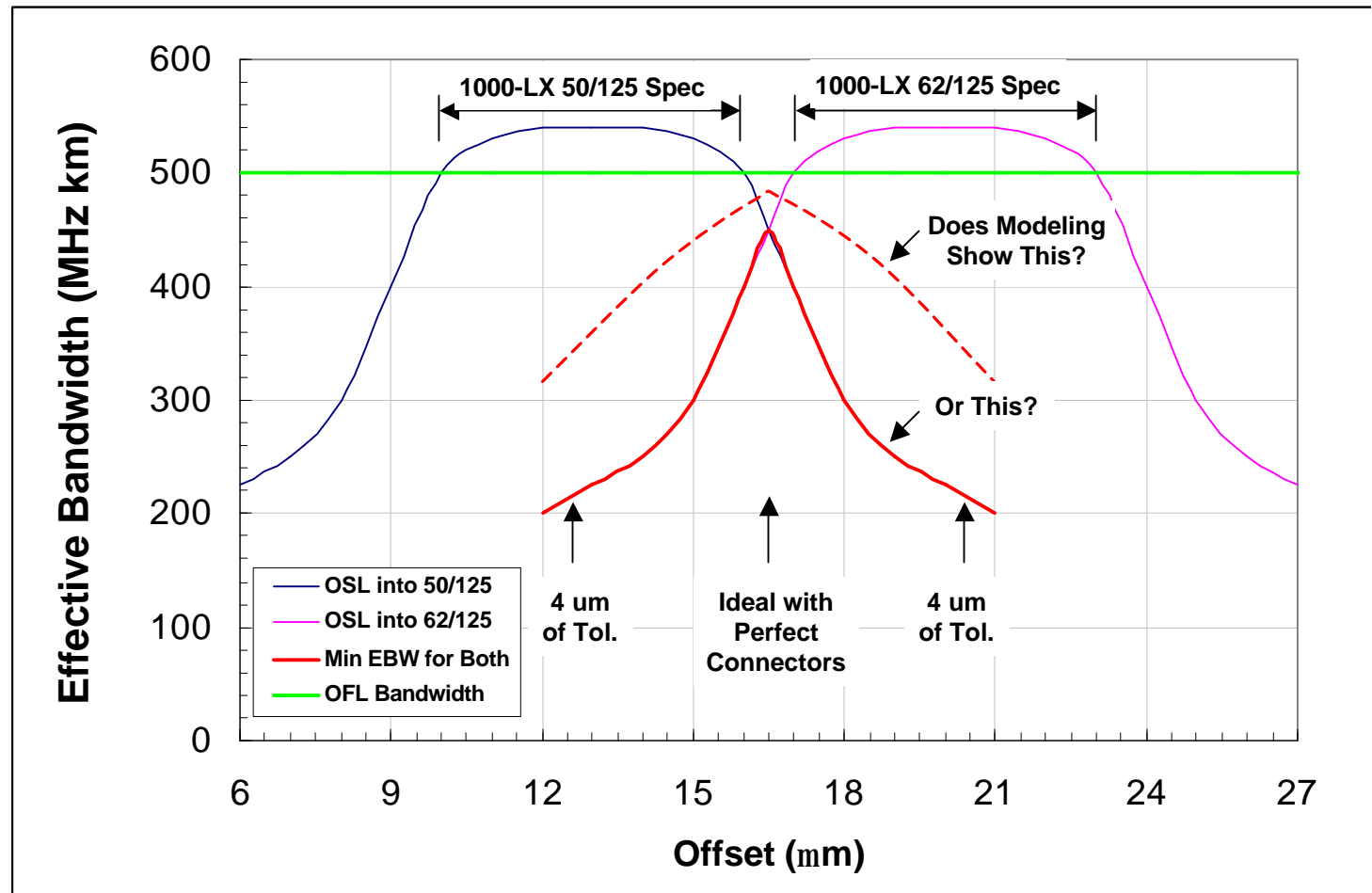
- Offset Launch Was the Ultimate Solution for 1000BASE-LX
 - Achieved Effective Bandwidth Essentially Equal to the OFL Bandwidth of MMF
 - 500 MHz • km for Most Legacy 50/125 and 62/125 Fiber Types
 - 1000BASE-LX Implemented Offset Launch in a Mode Conditioned Patchcord
 - Different Offsets for 50/125 and 62/125 Implemented as Different Patchcords
- Offset Launch in a Receptacle Based Transceiver Poses New Challenges
 - Compromise Offset For Both 50/125 and 62/125 Fiber Must be Chosen
 - Worst Case Offset Must Also Include a Combination of Fundamental and Practical Tolerance Considerations
- **The Requirement for 50/125 and 62/125 Support with Fundamental and Practical Errors in Offset May Lead to Unacceptable Worst Case Effective Bandwidth.**

Tolerance Issues for Receptacle Based Transceivers

- **Fundamental Factors in the Installed Base:**
 - Connector Ferrule Diameter Tolerance
 - Easily as large as $+0/-3\mu\text{m}$, Somewhat Less Impact in Split Sleeve Solutions
 - Connector Ferrule and Fiber Core Concentricity
 - Again at least as large as $3\mu\text{m}$ error.
- **Practical Factors in the Transceiver:**
 - Bore Tolerances
 - Manufacturing Alignment Tolerances
 - Tolerances Associated with Implementations of Offset Launch.
- **Taken Together These Could Easily Yield 4 – 5 μm Error in Offset**
- (Note: Various Factors Do Add Statistically with Each Other and the Legacy Distribution of Poor Fibers, But There Is Probably Strong Correlation Between The Older Poorer Bandwidth Fibers and Looser Connector Quality)

Weaknesses of Integrated Offset Launch

- Comments at January Meeting Are That 16.5um Compromise Offset Might Give Only 400 MHz km
- Only 4um for Dia. and Concentricity Tol. in Legacy Cabling Could Lower This Dramatically
 - If This Yields ~ 300 - 350 MHz km, Puts A Lot of Pressure on EDC and May Rule Out 300m
 - If Effective Bandwidth is Much Less (A real possibility with Realistic Tol.), Even 220m is Questionable



Illustrative Curves Only.
Not Based on Modeling.
Shape of Roll-off is Key

Conclusions

- Above Factors Should Be Carefully Analyzed Together for Offset Launch
 - Calculate Impulse Response / EDC Impact for Wide Range of Offsets
 - Agree on Worst Case Fundamental Offset Tolerances (Connector and XCVR)
 - Determine if Integrated Offset Launch is Usable
 - Does it rule out 300m? Is Net Bandwidth So Low that Even 220m Unlikely?
 - If Offset Launch Comes Out Poorly, Make Sure TX Compliance Test Rules it Out
- Consider Performance of All Proposed Launches or TX Compliance Tests with Both Fiber Types and Include Minimum Unavoidable Tolerance Errors
 - Probably Still Are Many Launch Types Which Tolerate These Factors Much Better
 - Approximation of OFL
 - DONUT / Vortex Launches
 - Does an Encircled Flux Requirement Meet These Needs?
 - Does it Still Allow Offset Launch and Other Offset Error Sensitive Launches?