ERL for .3ck

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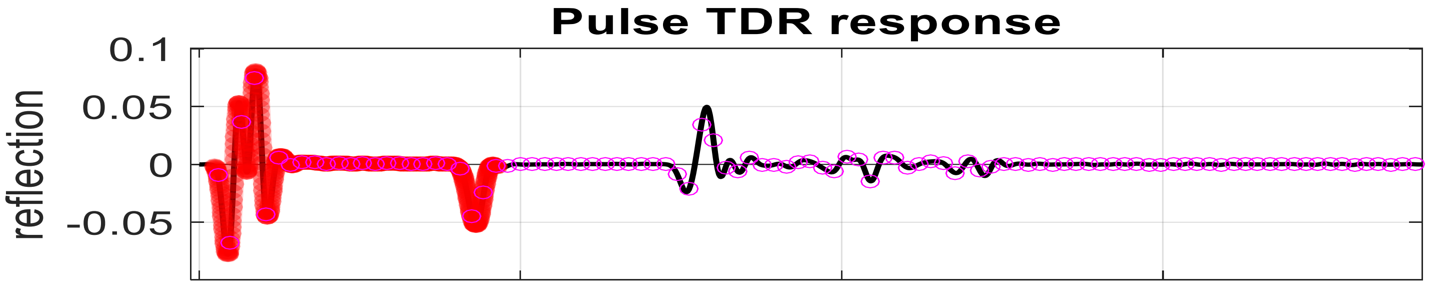
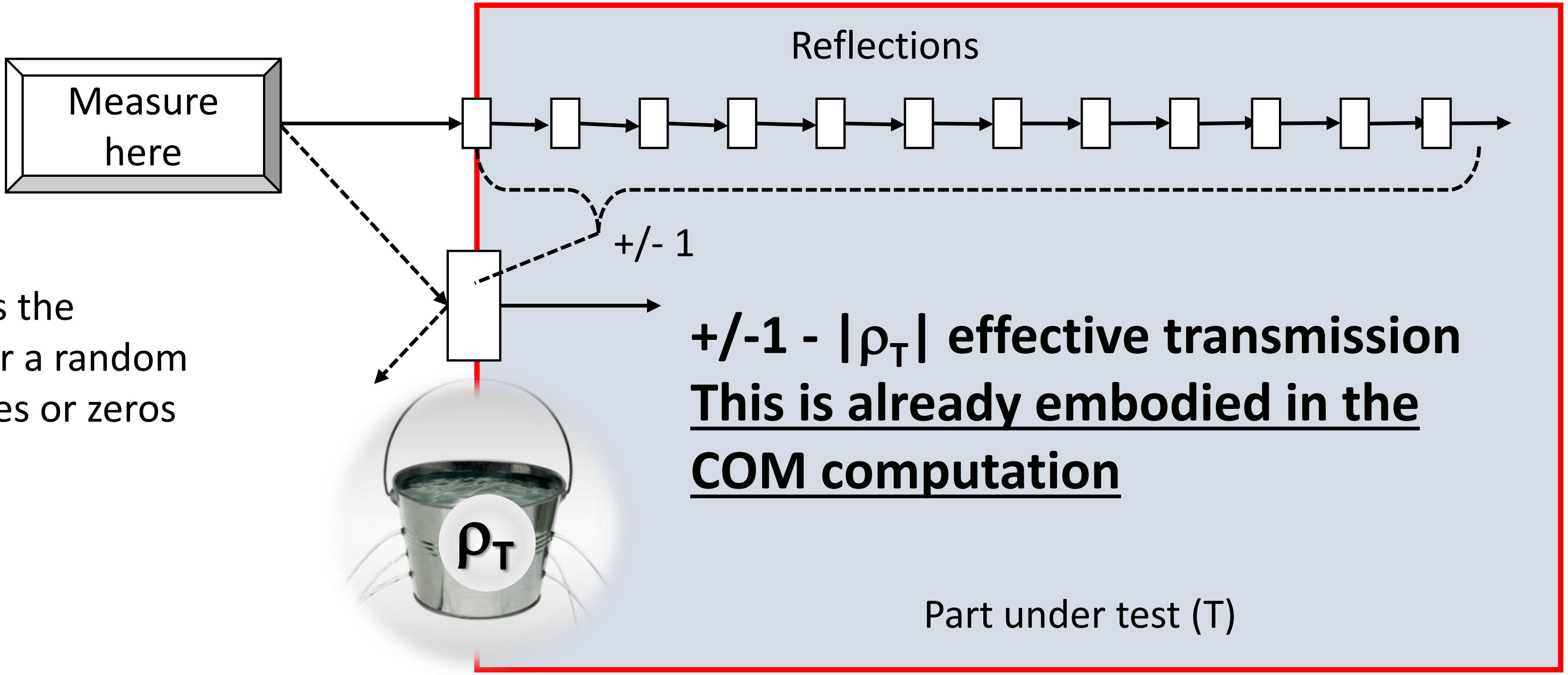
Agenda

- ❑ Review ERL
- ❑ Proposal

ERL reduces all reflections to single bucket, ρ_T, at the measurement (test) point

- Every circle to the right is a UI reflection
- The red represent 24 UI or time





ERL evaluates the reflections for a random stream of ones or zeros (i.e. +/- 1)

+/-1 - |ρ_T| effective transmission

<u>This is already embodied in the COM computation</u>

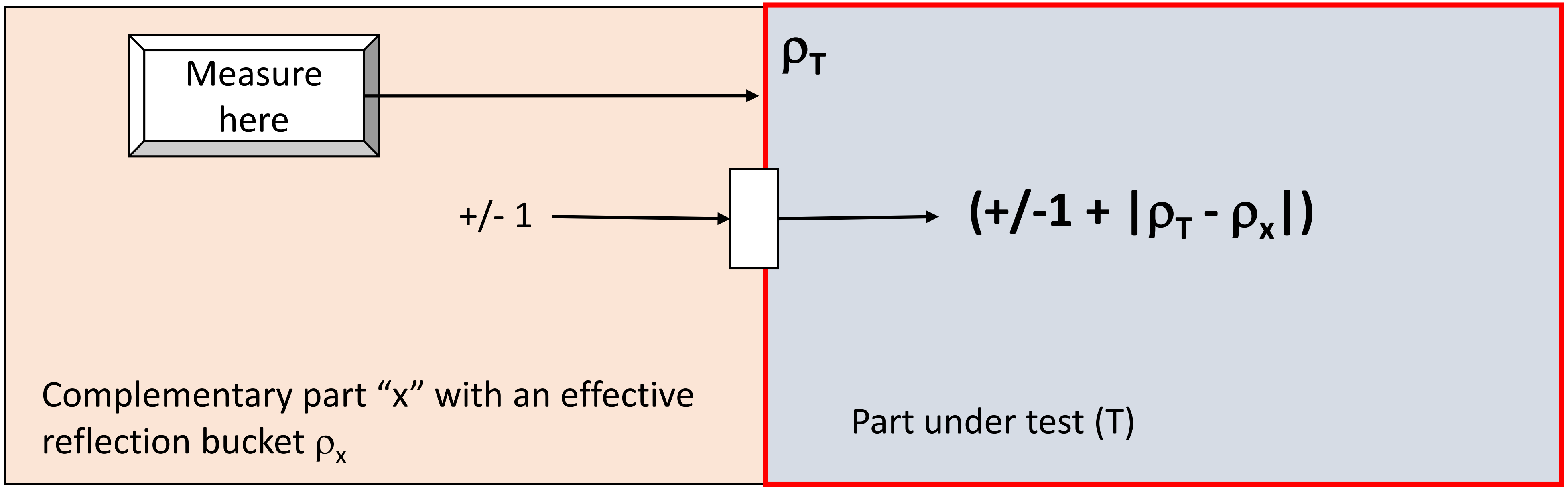
RL or ERL addresses interoperability

Between

- ❑ At part “T” under test

and

- ❑ Any complementary part “x” connecting to “T”

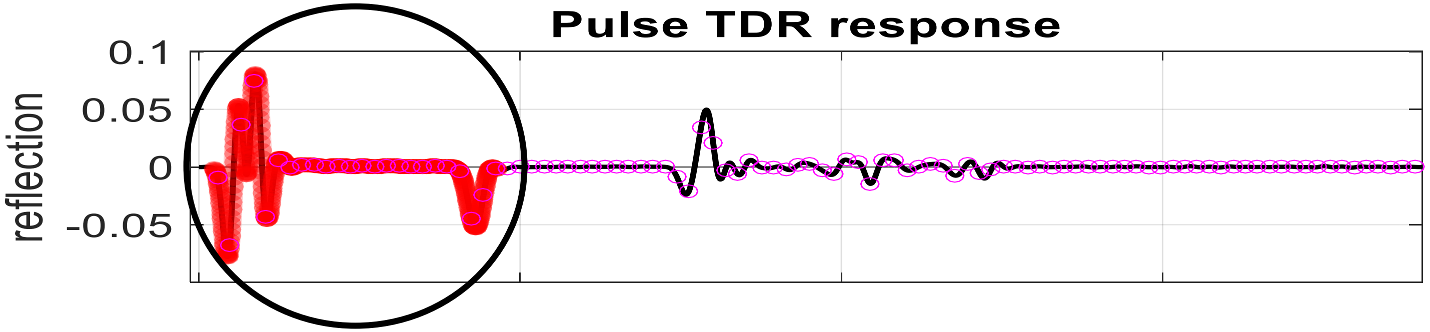


- ❑ The control is specifying the limits on the reflection bucket ρ
  - Such that $\rho = 10^{-ERL/20}$

ERL/COM Caveats

- The ERL test limit is relative to the variations of COM computation for different parts excepted to pass
- A loss dominated system is sort of like a “self-fulling prophecy”
  - Reflection can’t be very great for system to work
  - So we would see little ERL correlation to COM
- In a reflection dominated system ERL should be better correlated to COM
- Reflections in the middle of channel don’t tend to re-reflect at the ports
- Reflections at the end tend to re-reflect with the complementary part “x”

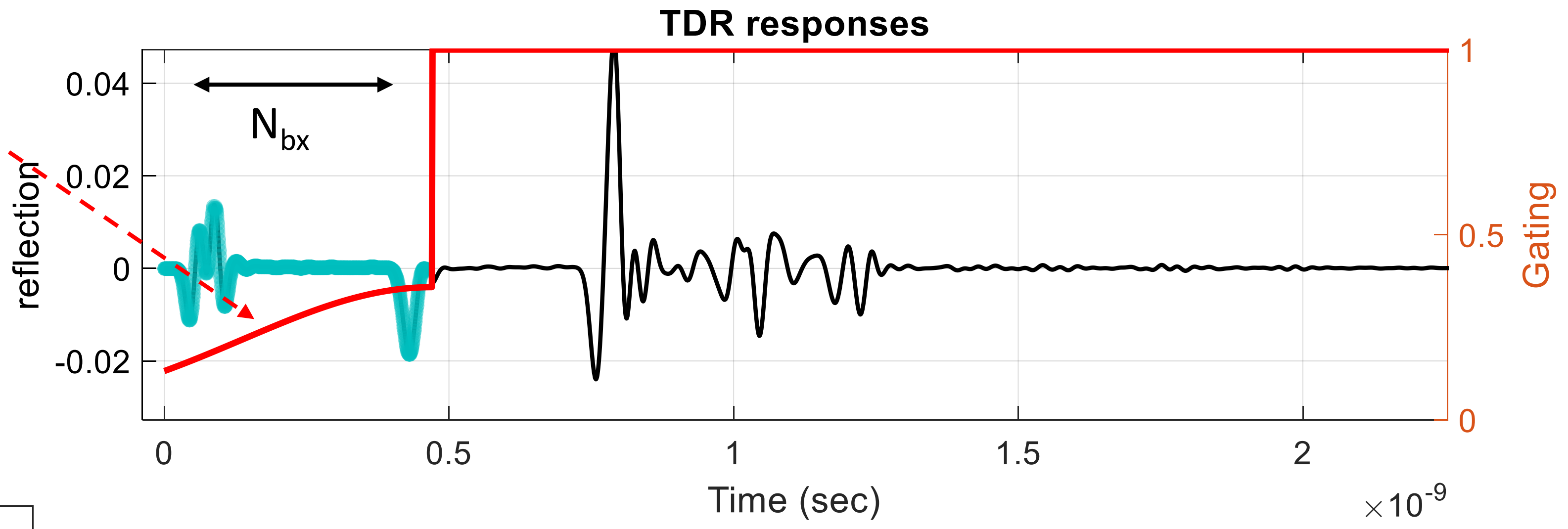
The Complication: DFE (or equivalent)

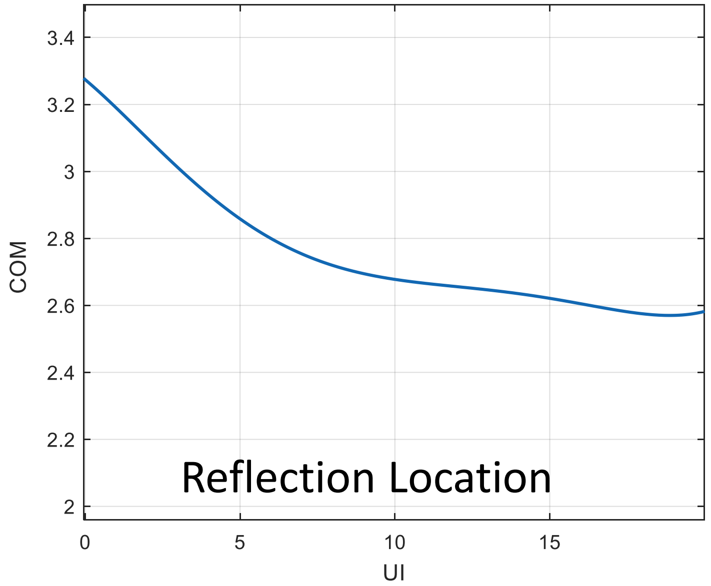


- ❑ The DFE is like a leaky bucket
- ❑ Ideally the DFE should remove this reflection at the receiver
- ❑ The problem gets complicated by the fact that even if "DFE" reflections are removed
  - They will be re-reflected and become part of the reflection bucket
- ❑ We overcame this by applying a time domain gating filter for span of the DFE
- ❑ This filter was somewhat complicated
  - It was intend to be model scattering near the interface

The Grr “DFE” reflection filter

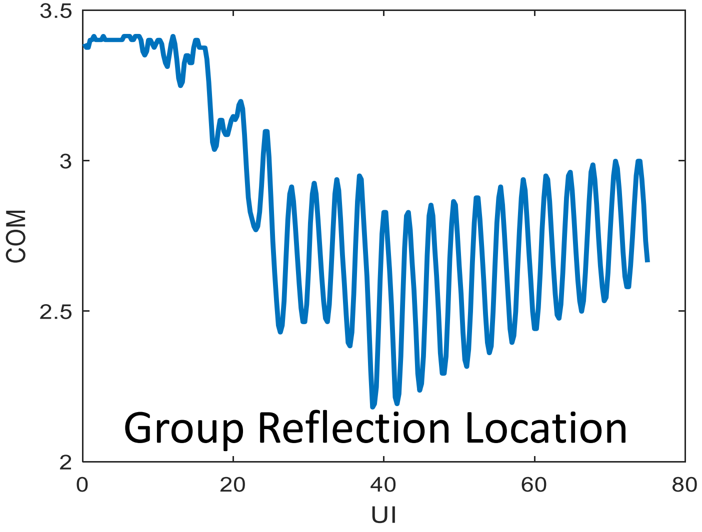
$$\rho_x\,(1+\rho_x)e^{-\frac{\left(\frac{t-T_{fx}}{T_b}-(N_{bx}+1)\right)^2}{(N_{bx}+1)^2}}$$





This filter is somewhat more complicated

- ❑ It was intend to be model scattering near the interface
- ❑ The left represented the one set of results of COM vs reflection placement for a KR channel with a 14 tap DFE and 30 mm pkg for 50Gb/s PAM4 with 2 UI precision
- ❑ When more reflection and more precision are added the impact of reflection are smeared
- ❑ The proposal is to use single average value, ρ_x for Grr in this DFE region



Changes to Annex 93A … a simplification

Change 93A-61 to

$$TG_{rr}(t) = \begin{cases} 0, & t < T_{fx} \\ \rho_x G_x, & T_{fx} \le t < T_{fx} + \frac{N_{bx}+1}{f_b} \\ 1, & t \ge T_{fx} + \frac{N_{bx}+1}{f_b} \end{cases}$$

Annex 93A

$$G_{rr}(t) = \begin{cases} 0 & t < T_{fx} \\ \rho_x(1+\rho_x)\exp\left(-\frac{[(t-T_{fx})f_b-(N_{bx}+1)]^2}{(N_{bx}+1)^2}\right) & T_{fx} \le t < T_{fx} + \frac{N_{bx}+1}{f_b} \\ 1 & t \ge T_{fx} + \frac{N_b+1}{f_b} \end{cases} \quad (93A\text{–}61)$$

Where

G_x= is defined in the calling clause

Normally set **G_x =1** in .3ck

If not set in the calling clause G_x is defined as such

$$G_x = (1+\rho_x)e^{-\frac{\left(\frac{t-T_{fx}}{T_b}-(N_b+1)\right)^2}{(N_b+1)^2}}$$

i.e the case for .3cd

Determine the Loss Weighting for a Signaling Architecture in Relation to Expected Packages

- Assuming a package context for signaling of a short and long package
- Tpδ is the timing difference between pulse responses
  - Tpδ = 1.2180e-10 for .3ck
- ΔIL is the loss difference a the Nyquist frequency
  - ΔIL =1.85 dB for .3ck
- Define IL_{ref} as a required insertion loss
  - IL_{ref} = 28 dB for .3ck
- Define the loss weight, β_x, as:
  - $\beta_x = \dfrac{10^{\frac{-(IL_{ref}-\Delta IL)}{20}} - 10^{\frac{-(IL_{ref})}{20}}}{TP\delta\, 10^{\frac{-(IL_{ref})}{20}}}$
  - β_x= 1.95 GHz

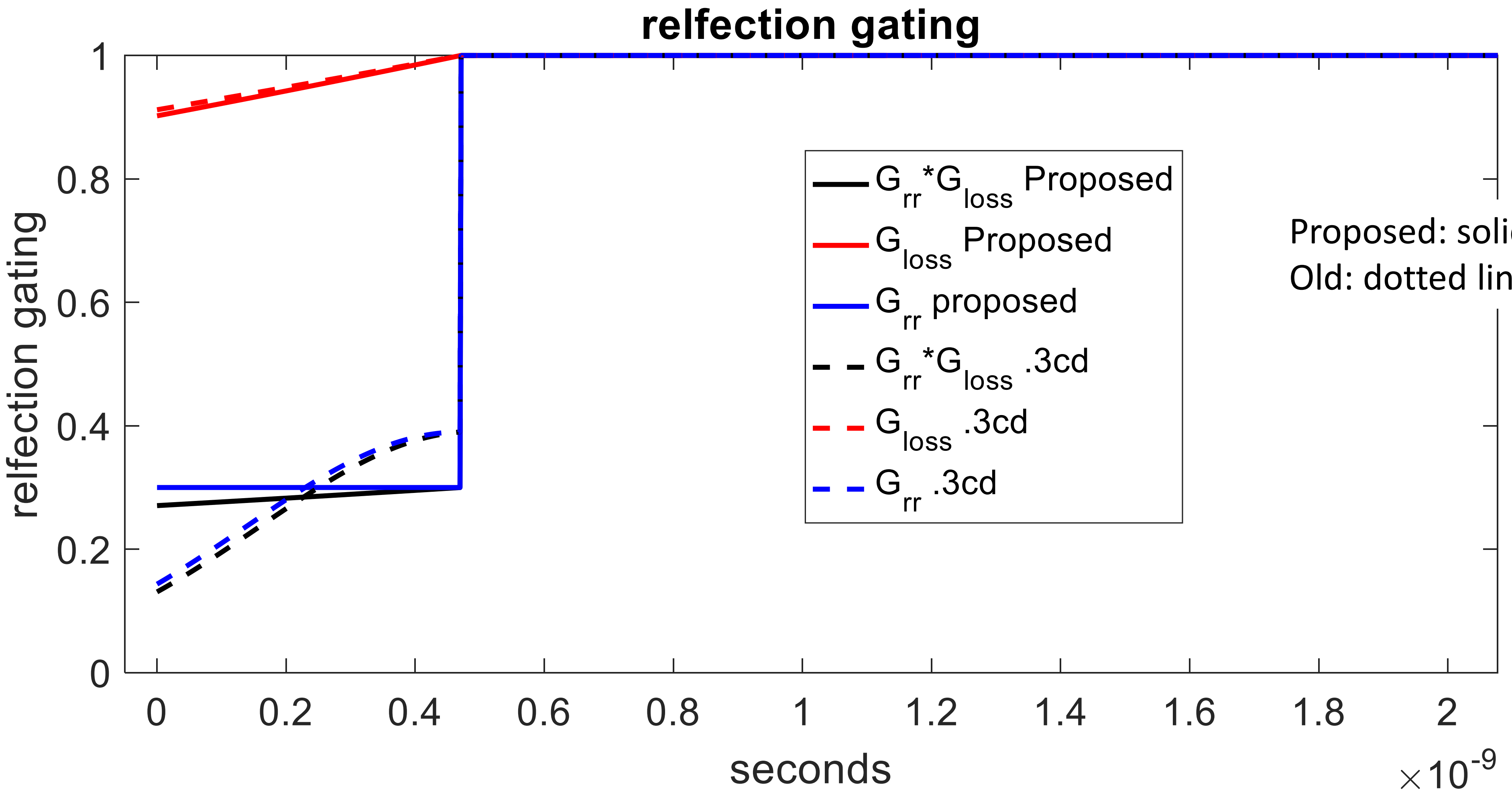
β_x only for packages

- Package loss should only be use for package testing
- It is to compensate for short packages
- For channel, cable assemblies, and hosts $\beta_x = 0$

Ties Between Package and Channel ERL: ρ_x

- ❑ Define either ERL for a channel or package
- ❑ The parameter, ρ_x, uses the ERL of the other side at the test point in the computation of ERL
  - $\rho_x = 10^{\frac{-ERL}{20}}$
  - This caps the re-reflection at the test point

Proposal Looks Like Averaging in the Gated Region



Proposed: solid lines
Old: dotted lines

Parameters for KR

KR Tx and Rx device

- ❑ ρ_x= 0.32
- ❑ G_x = 1
- ❑ β_x = 1.95 GHz
- ❑ Tr = 10 ps
- ❑ N = 200
- ❑ Nbx=Nb (unless rxFFE)
- ❑ ERL limit - TBD

KR channel

- ❑ ρ_x= 0.15
- ❑ G_x = 1
- ❑ β_x = 0
- ❑ Tr = 10 ps
- ❑ N = 2000
- ❑ Nbx=Nb (unless rxFFE)
- ❑ ERL limit - TBD

Parameters for CR

CR host

- ❑ ρ_x= 0.3
- ❑ G_x = 1
- ❑ β_x = 0
- ❑ Tr = 10 ps
- ❑ N = 600
- ❑ Nbx=Nb (unless rxFFE)
- ❑ ERL limit - TBD

Cable assembly

- ❑ ρ_x= 0.25
- ❑ G_x = 1
- ❑ β_x = 0
- ❑ Tr = 10 ps
- ❑ N = 2000
- ❑ Nbx=Nb (unless rxFFE)
- ❑ ERL limit - TBD

Parameters for AUI

AUI Host

- ρ_x= 0.15
- G_x = 1
- β_x = 0
- Tr = 10 ps
- N = 800
- Nbx = 4
- ERL limit - TBD

AUI module

- ρ_x= 0.3
- G_x = 1
- β_x = 0
- Tr = 10 ps
- N = 200
- Nbx= 4
- ERL limit - TBD

Moving forward

- ❑ Discussion