Working Towards an ERL Baseline

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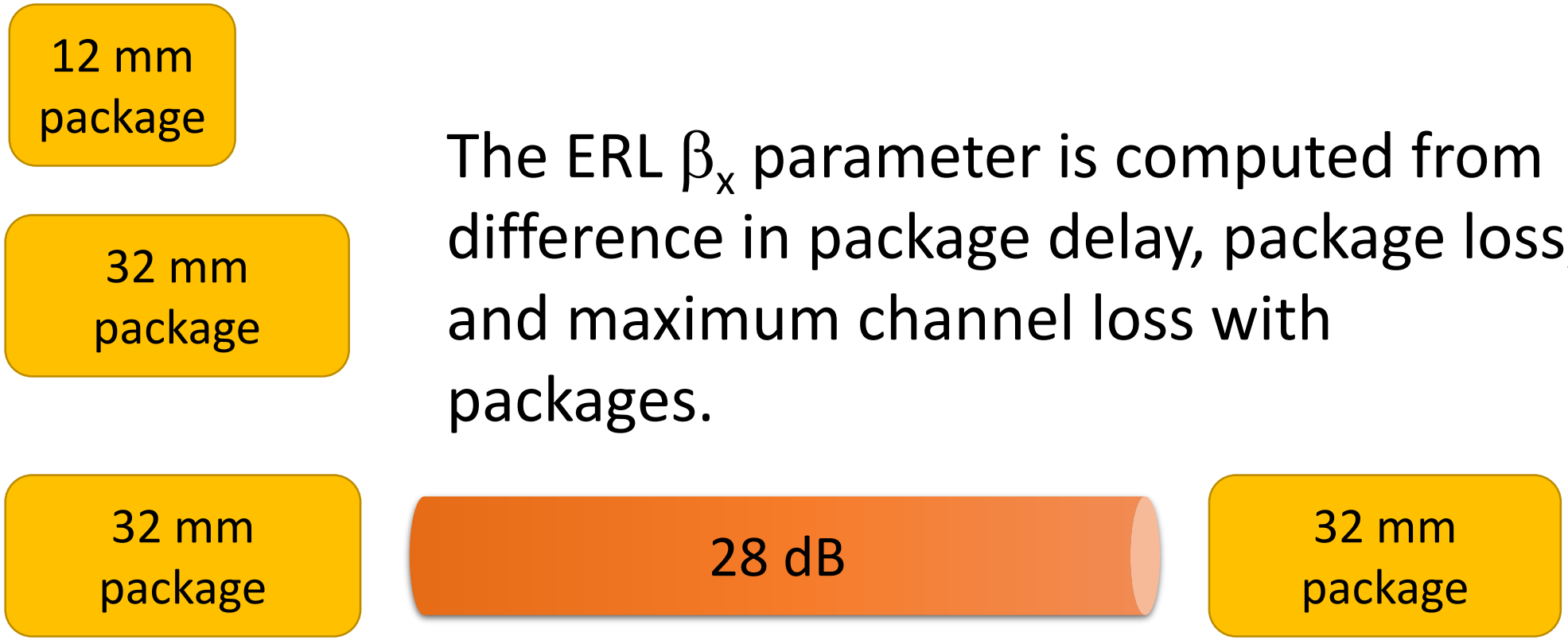
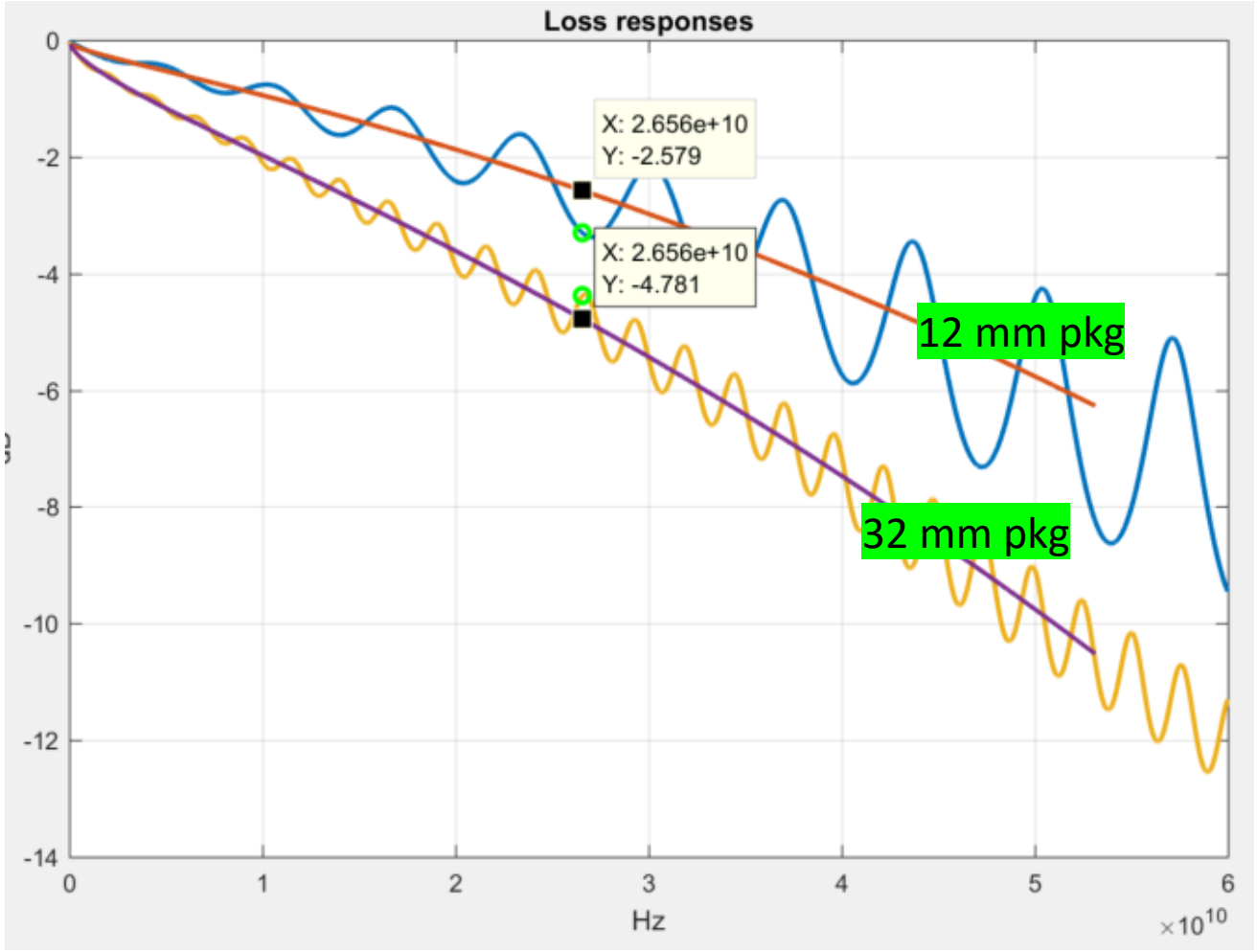
The β_x Parameter for ERL is Derived from Package Loss and Reference Channel Loss



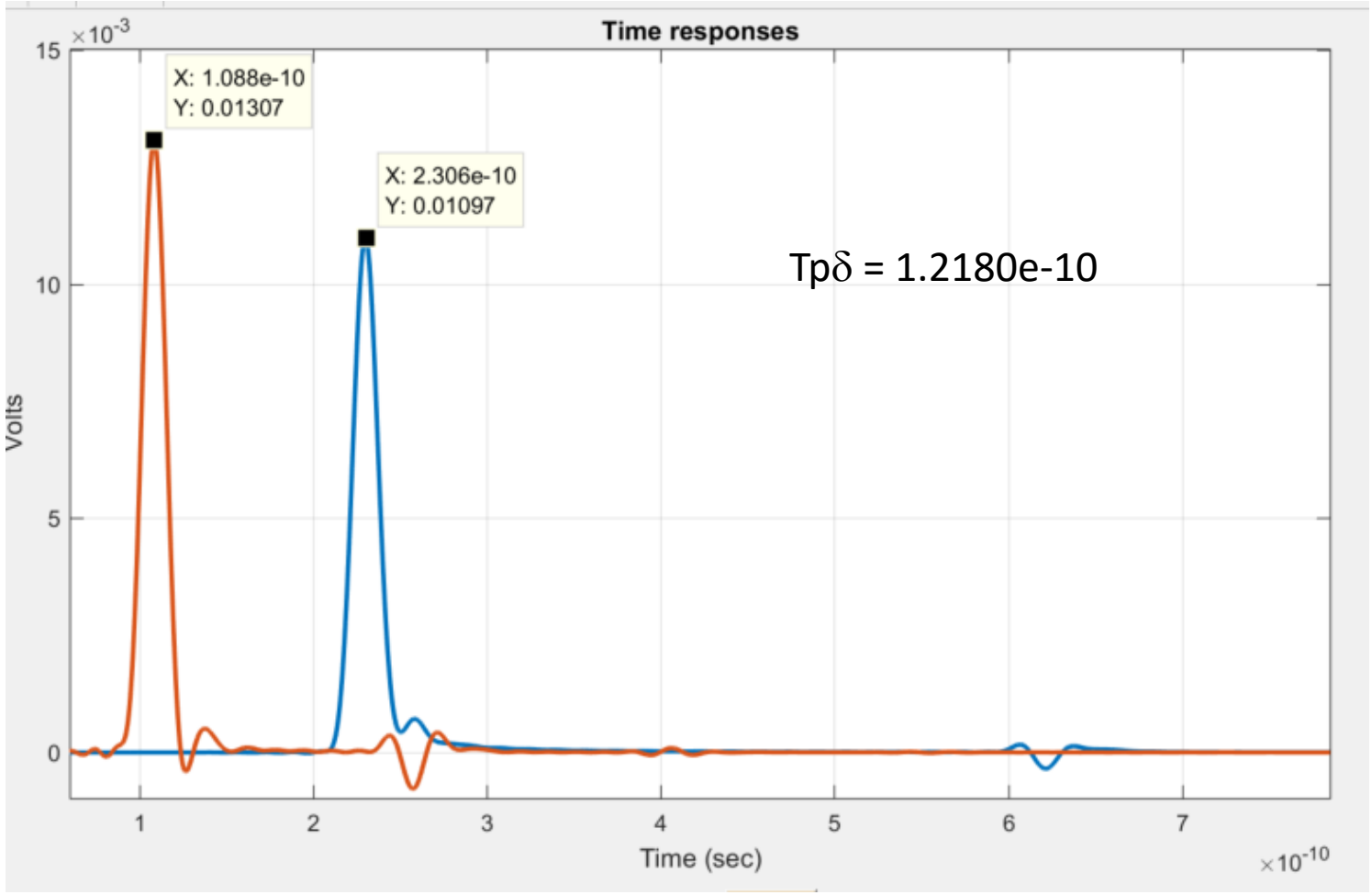
The ERL β_x parameter is computed from difference in package delay, package loss, and maximum channel loss with packages.

Fitted Loss* Difference Between 12 mm and 32 mm Package is 2.29 dB



*C_d included

Time Delay Difference Estimate Between 12 mm and 32 mm Package is 121.8 ps



Total Ref Loss for a 28 dB Channel (@ 26.56 GHz)

- 32 mm fitted package loss = 4.781 dB
- 2 x package loss + 28 dB = 38.56 dB
- For β_x computation, Il_{ref} = 38.562 dB

Determine β_x

- Tpδ is the timing difference between pulse responses
  - Tpδ = 1.2180e-10 for .3ck
- ΔIL is the loss difference a the Nyquist frequency
  - ΔIL =2.125 dB for .3ck
- Define IL_{ref} as a required insertion loss
  - IL_{ref} = 38.562 dB for .3ck
- Define the loss weight, β_x, as:

$$\beta_x = \frac{10^{\frac{-(IL_{ref}-\Delta IL)}{20}} - 10^{\frac{-(IL_{ref})}{20}}}{TP\delta \; 10^{\frac{-(IL_{ref})}{20}}}$$

- β_x= 2.2756 GHz

Recap of ρ_x for ERL Computation

- The parameter, ρ_x, uses the ERL
  - at the test point where ERL is computed
  - other side
- $\rho_x = 10^{\frac{-ERL}{20}}$
- This caps the re-re-reflection at the test point from the DFE range

"mellitz_3ck_adhoc_01_032719" Proposed a Change to ERL Computation

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

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

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

- The idea was to make it easier to explain.
- However. since there is little difference in the ERL results the recommendation is not to change at this point in time

ERL Parameters for KR

KR Tx and Rx device

- ρ_x= 0.32
- β_x = 2.2756 GHz
- T_r = 10 ps
- N = 200
- N_{bx}=N_b
- ERL_{min} = 12 dB
  - Includes the impact for a worst case fixture

KR channel

- ρ_x= 0.25
- β_x = GHz
- T_r = 10 ps
- N = 3000
- N_{bx}=N_b
- ERL_{min} = 10 dB

ERL Parameters for CR

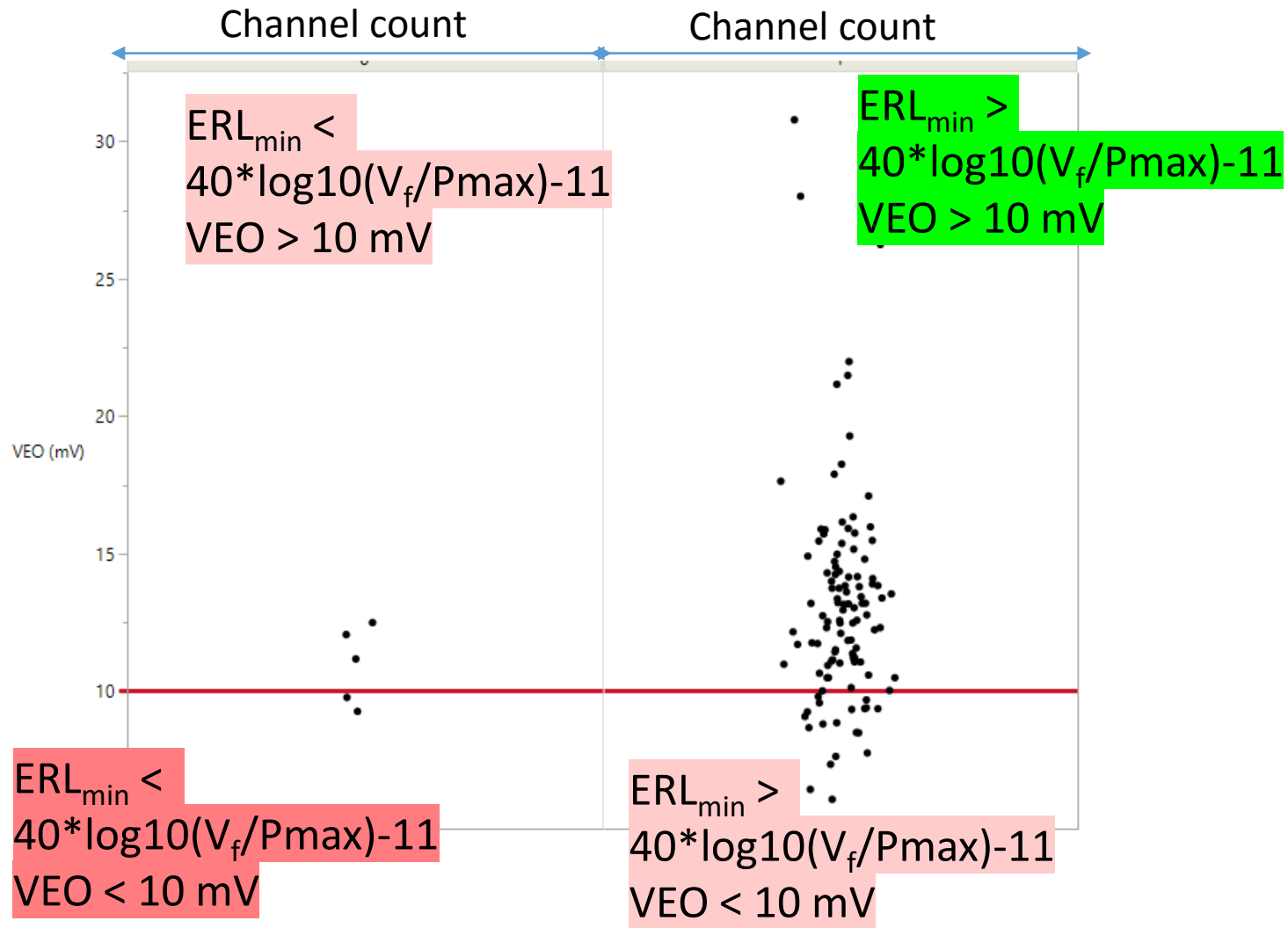
CR host

- ρ_x= 0.32
- β_x = 2.2756 GHz
- T_r = 10 ps
- N = 600
- N_{bx}=N_b
- ERL_{min}= 10 dB

Cable assembly

- ρ_x= 0.32
- β_x = 2.2756 GHz
- T_r = 10 ps
- N = 2000
- N_{bx}=N_b
- ERL_{min}= 10 dB

"mellitz_3ck_adhoc_01a_042419" Suggests Host to Module Output ERL Limits Based on Channel Acceptance and VEO



ERL Parameters for AUI C2M

AUI Host Output

- ρ_x= 0.25
- β_x = 2.2756 GHz
- T_r = 10 ps
- N = 800
- N_{bx} = 4
- ERL_{min} = 40*log10(V_f/Pmax)-11
  - For fitting with N_p=200

AUI Host Input

- ρ_x= 0.25
- β_x = 2.2756 GHz
- T_r = 10 ps
- N = 800
- N_{bx} = 4
- ERL_{min} = 10 dB

AUI module

- ρ_x= 0.32
- β_x = 2.2756 GHz
- T_r = 10 ps
- N = 200
- N_{bx}= 4
- ERL_{min} = 12 dB
  - Should the fixture delay be on the module side if the connector?

ERL Parameters for AUI C2C

AUI C2C Tx/Rx Device

- ρ_x= 0.32
- β_x = 2.2756 GHz
- T_r = 10 ps
- N = 200
- N_{bx}=N_b
- ERL_{min} = 12 dB
  - Includes the impact for a worst case fixture

AUI C2C Channel

- ρ_x= 0.25
- β_x = 2.2756 GHz
- T_r = 10 ps
- N = 2000
- N_{bx}=N_b
- ERL_{min} = 12 dB

Action

- Uses this document as a baseline for ERL
- IEEE802.3ck participants to verify these make sense for their affiliates
  - Most any COM version 2.52 and higher may be used to compute ERL.
  - For C2M hosts, use COM versions later than 2.60
    - The package is included in the ERL computation.

Thank You!