ERL KR Baseline Proposal

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

12 mm package

31 mm LC package

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

Update β_x from mellitz_3ck_02_0519

- Tpδ is the timing difference between pulse responses between the 12 mm and 31 mm package
  - Tpδ = 1.1760e-10 for .3ck
- ΔIL is the fit loss difference at the Nyquist frequency between the 12 mm and 31 mm package
  - ΔIL = 2.112 dB for .3ck
- IL_{ref} = 37.098 dB channel for .3ck with the 31 mm package

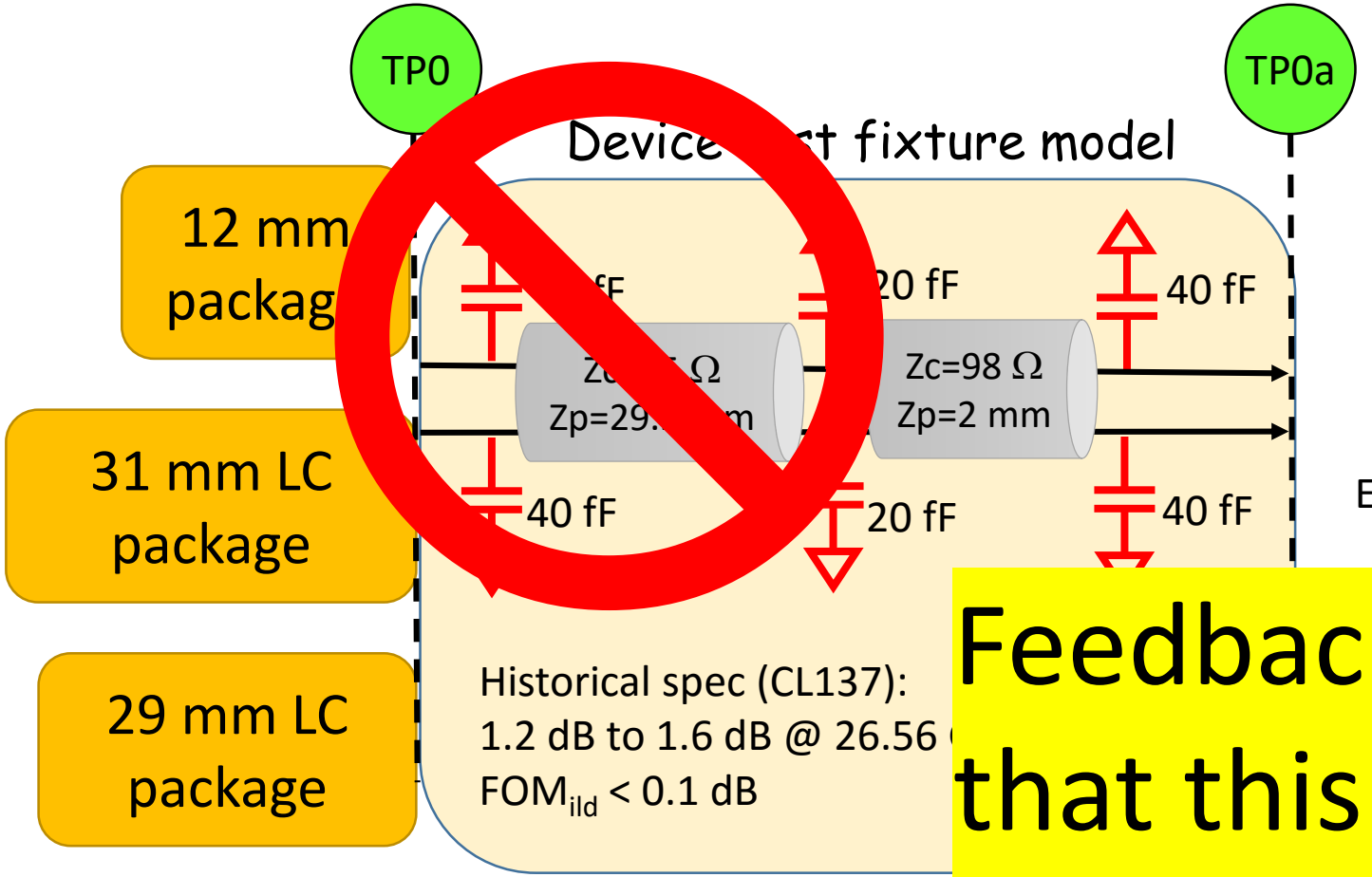
$$\beta_x = \frac{10^{\frac{-(IL_{ref}-\Delta IL)}{20}} - 10^{\frac{-(IL_{ref})}{20}}}{TP\delta \; 10^{\frac{-(IL_{ref})}{20}}}$$

β_x= 2.3407 GHz

Update ρ_x for ERL Computation

- The parameter, ρ_x, uses the ERL of the
  - at the test point where ERL is computed
  - other side
  - For a device this is at TP0 or TP5.
- $\rho_x = 10^{\frac{-ERL}{20}}$
- This caps the re-re-reflection at the test point from the DFE range
- ERL min device ~ 14.5 $\rho_x \cong 0.19$ for channel
- ERL min channel ~ 10.5 $\rho_x \cong 0.30$ for device

ERL for reference package with fixture



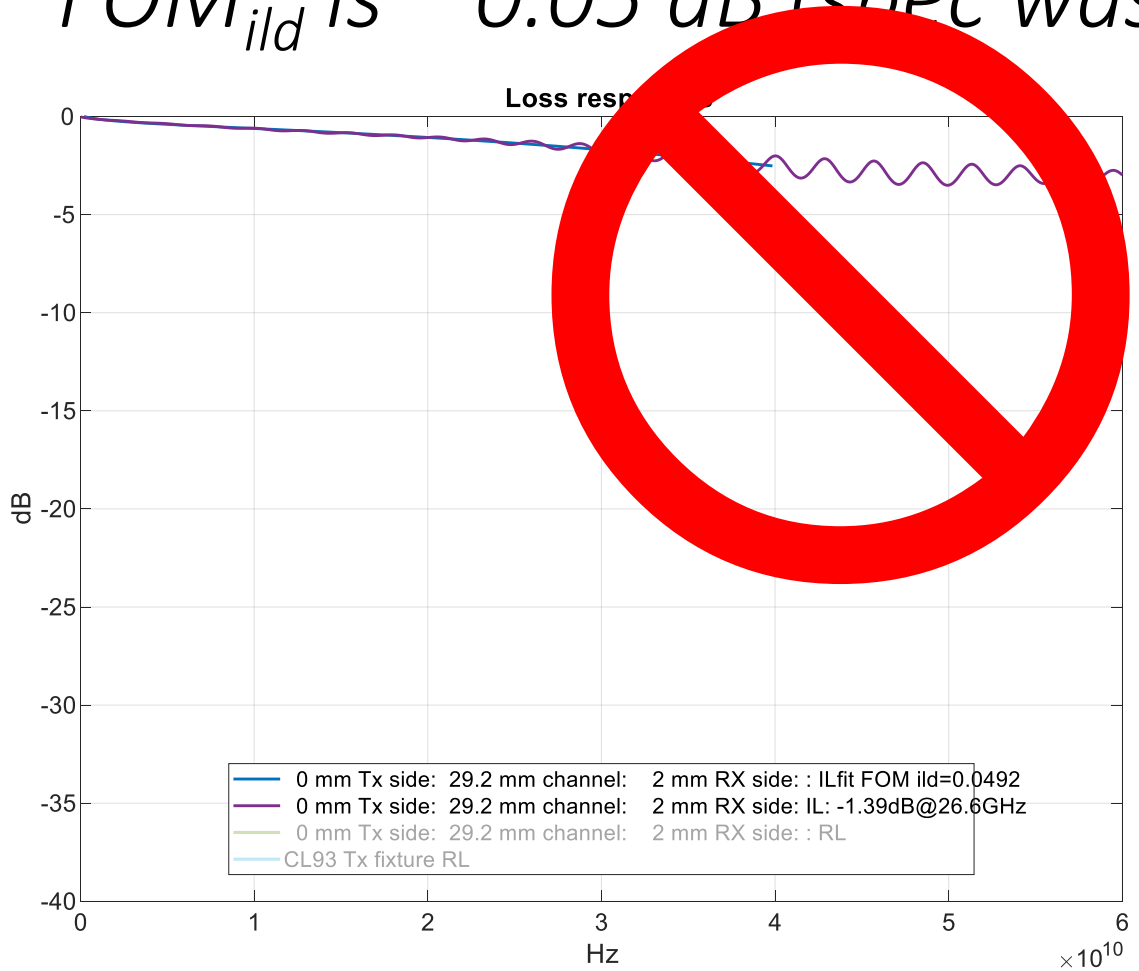
ρ_x= 0.30
β_x = 2.3407 GHz
T_r = 10 ps
N = 200
N_{bx}= 12

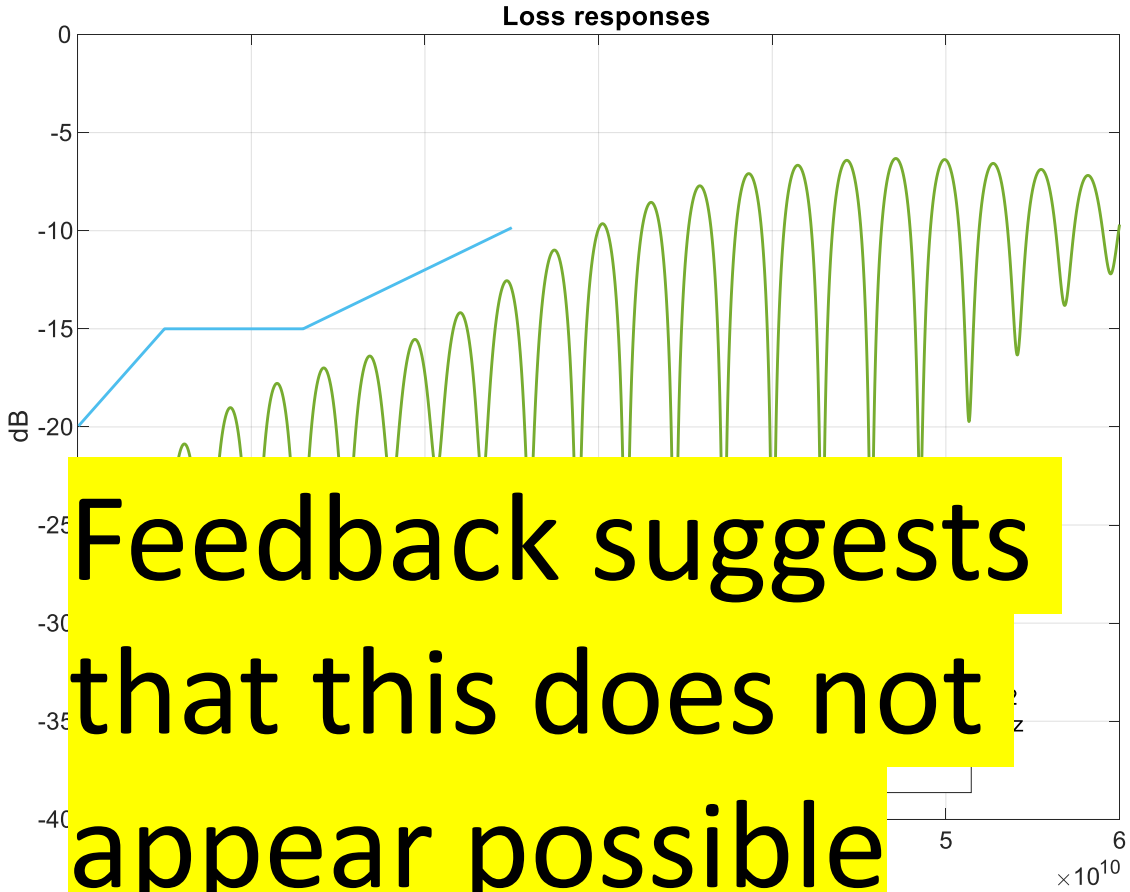
ERL Range 16 dB to 22 dB

Feedback suggests that this does not appear possible

This Test fixture IL and RL are better compared to .3cd specifications

FOM_{ild} is ~ 0.05 dB (spec was 0.1 dB)

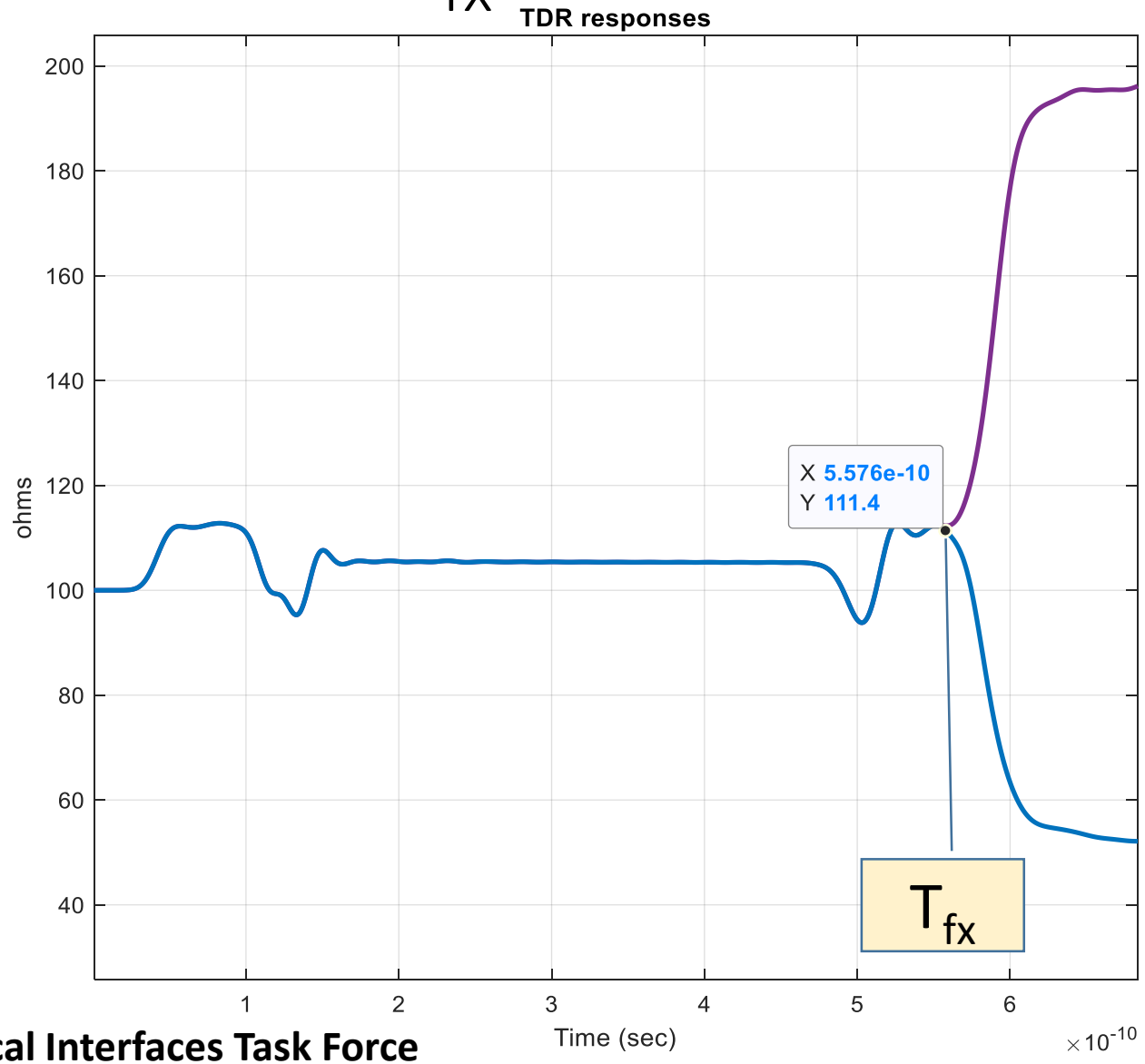




Feedback suggests that this does not appear possible

Suggested method to determine T_{fx}

- Acquire test fixture TDR response from TP0(TP5) to TP0a(TP5a)
  - Use same Gaussian filter as for required for ERL
  - Use same receiver filter as required for ERL
  - Do this for two single ended terminations
    - 25 ohms and 100 ohms
- Determine the time when the waveforms diverge.
- Suggest a 1 ohm or less divergence
  - Use this time for T_{fx}.
  - May be used for CR fixtures as well



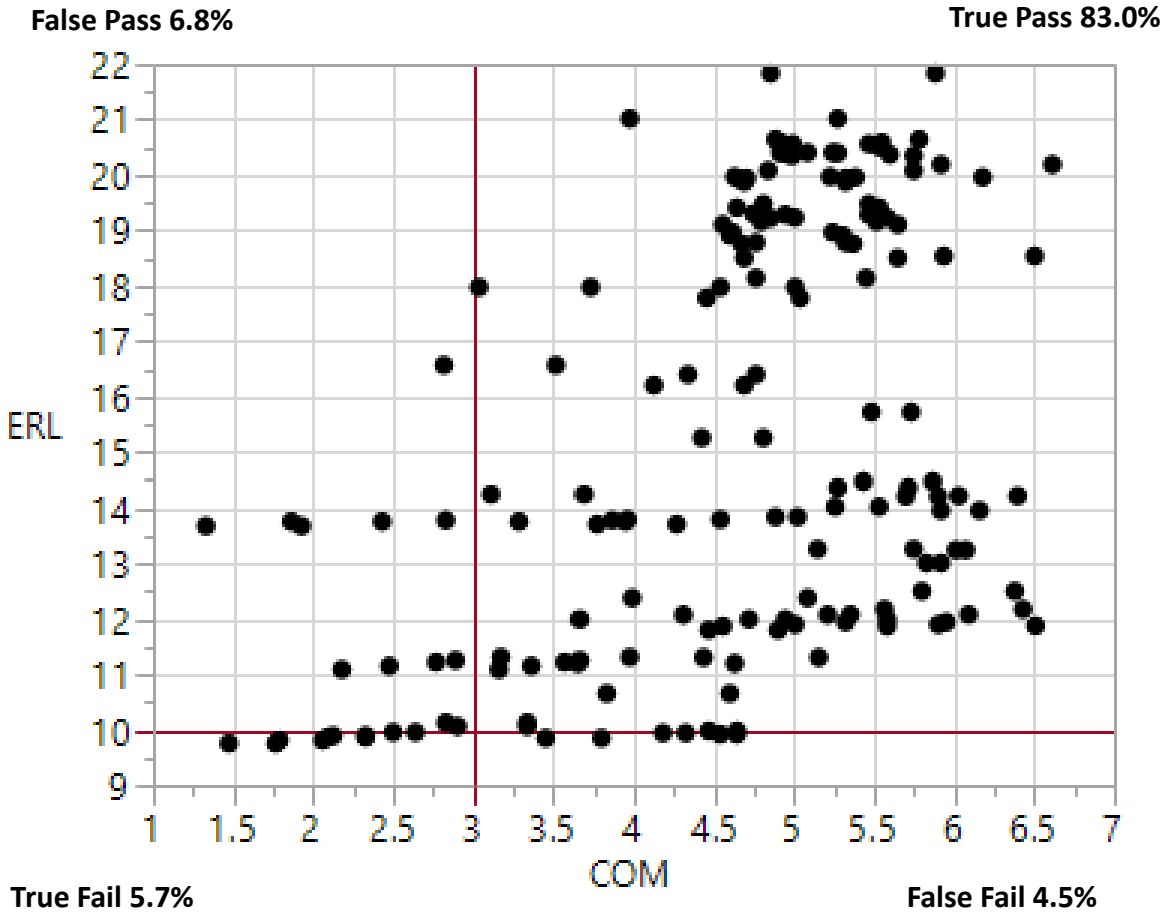
ERL results for different package lengths without a test fixture

- ERL 31 mm LC package = 16.1 dB
- ERL 30 mm LC package = 14.8 dB
- ERL 29 mm LC package = 15.3 dB
- ERL 20 mm LC package = 15.0 dB
- ERL 12 mm LC package = 20.0 dB
- Allowing for ~0.3 dB for margin, 14.5 dB seems like a good limit
  - Note: Physical device data has not been published yet

Data From Version 2.75 with Corrections for ERL/TDR Adam Healey
Will be available at ad Hock following the Sept'19 interim.

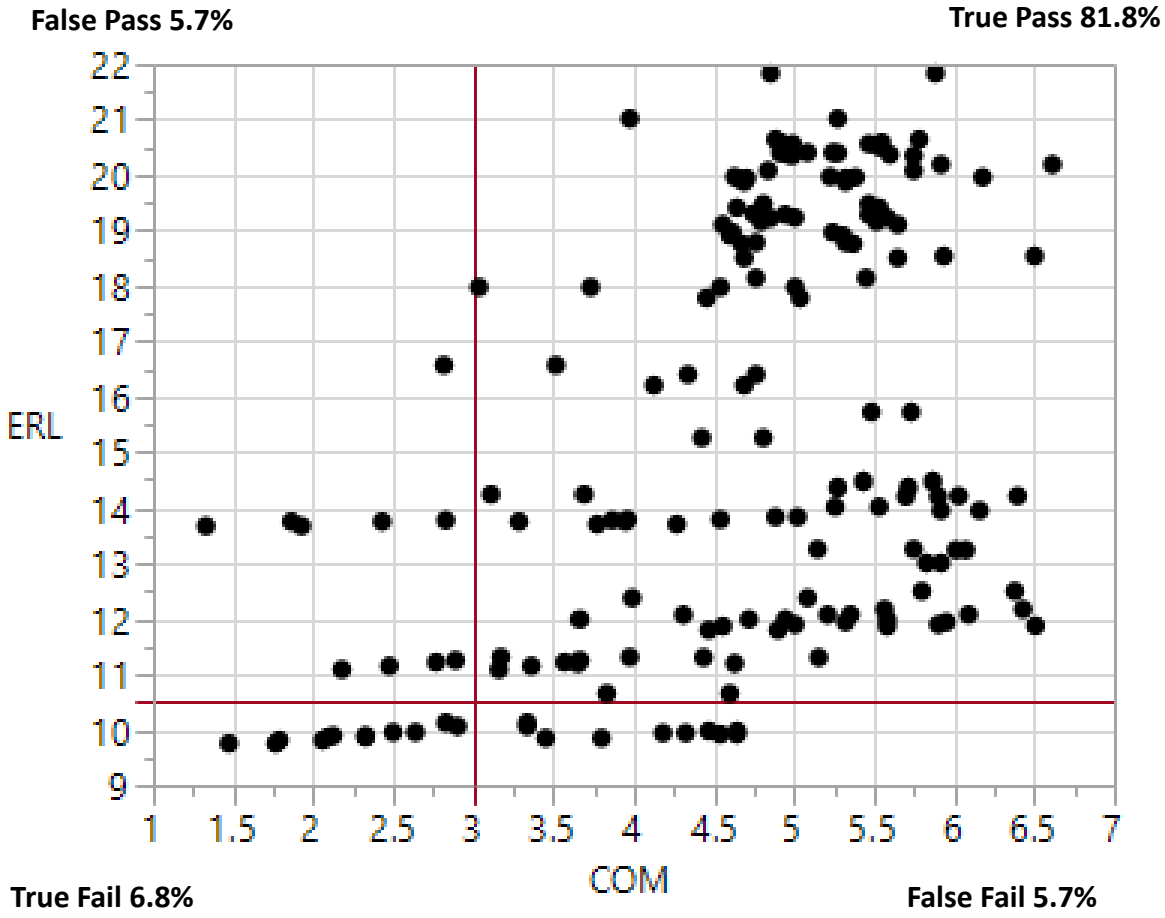
“Dialing in” ERL 10 dB

12 fixed taps
3 banks of 3 floating taps
40UI span
bmax(1)=0.85
bmax(2..n)=0.2



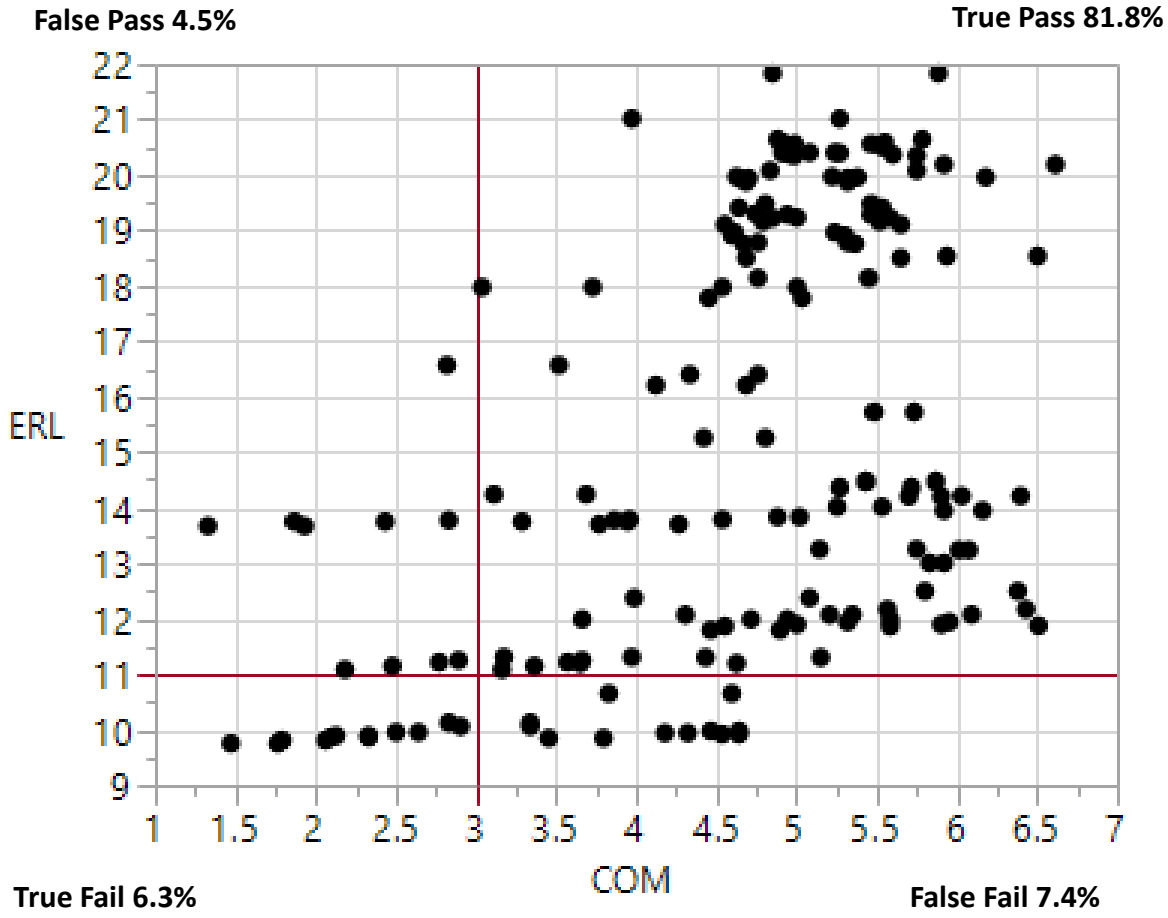
Dialing in” ERL 10.5 dB

12 fixed taps
3 banks of 3 floating taps
40UI span
bmax(1)=0.85
bmax(2..n)=0.2

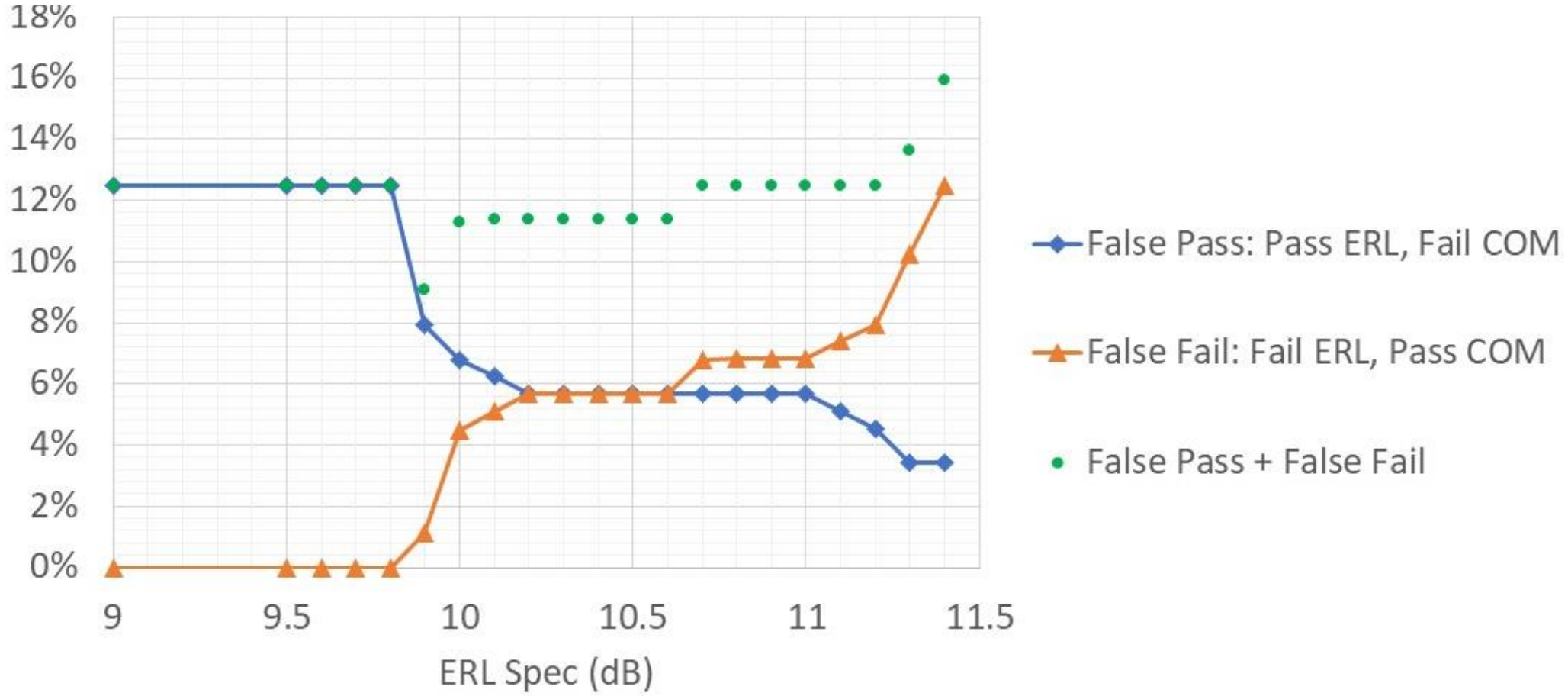


“Dialing in” ERL 11 dB

12 fixed taps
3 banks of 3 floating taps
40UI span
bmax(1)=0.85
bmax(2..n)=0.2



Results: False Pass/False Fail



ERL Parameters for KR

KR Tx and Rx device w/o test fixture

- ρ_x= 0.30
- β_x = 2.3407 GHz
- T_r = 10 ps
- N = 200
- N_{bx}= 12
- ERL_{min} = 14 dB
- Test fixture is an open issue

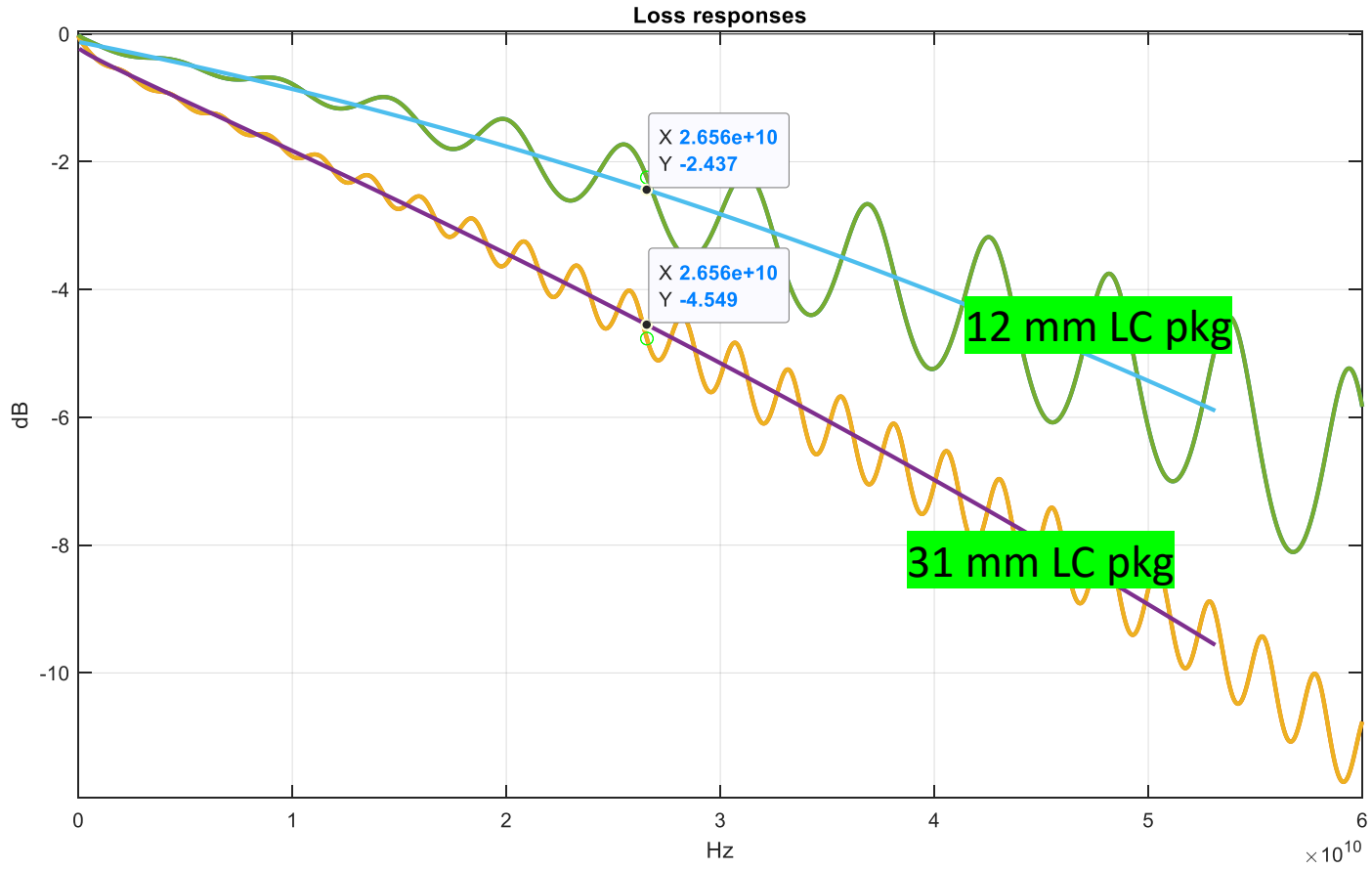
KR channel

- ρ_x= 0.19
- β_x = 2.3407 GHz
- T_r = 10 ps
- N = 3000
- N_{bx}= 12
- ERL_{min} = 10.5 dB

Thank You!

Back up data

Fitted Loss* Difference Between 12 mm and 31 mm Package is 2.112 dB



*C_d included

Time Delay Difference Estimate Between 12 mm and 31 mm LC Package is 117.6 ps