Return Loss Alternative and COM-like Package RL Data

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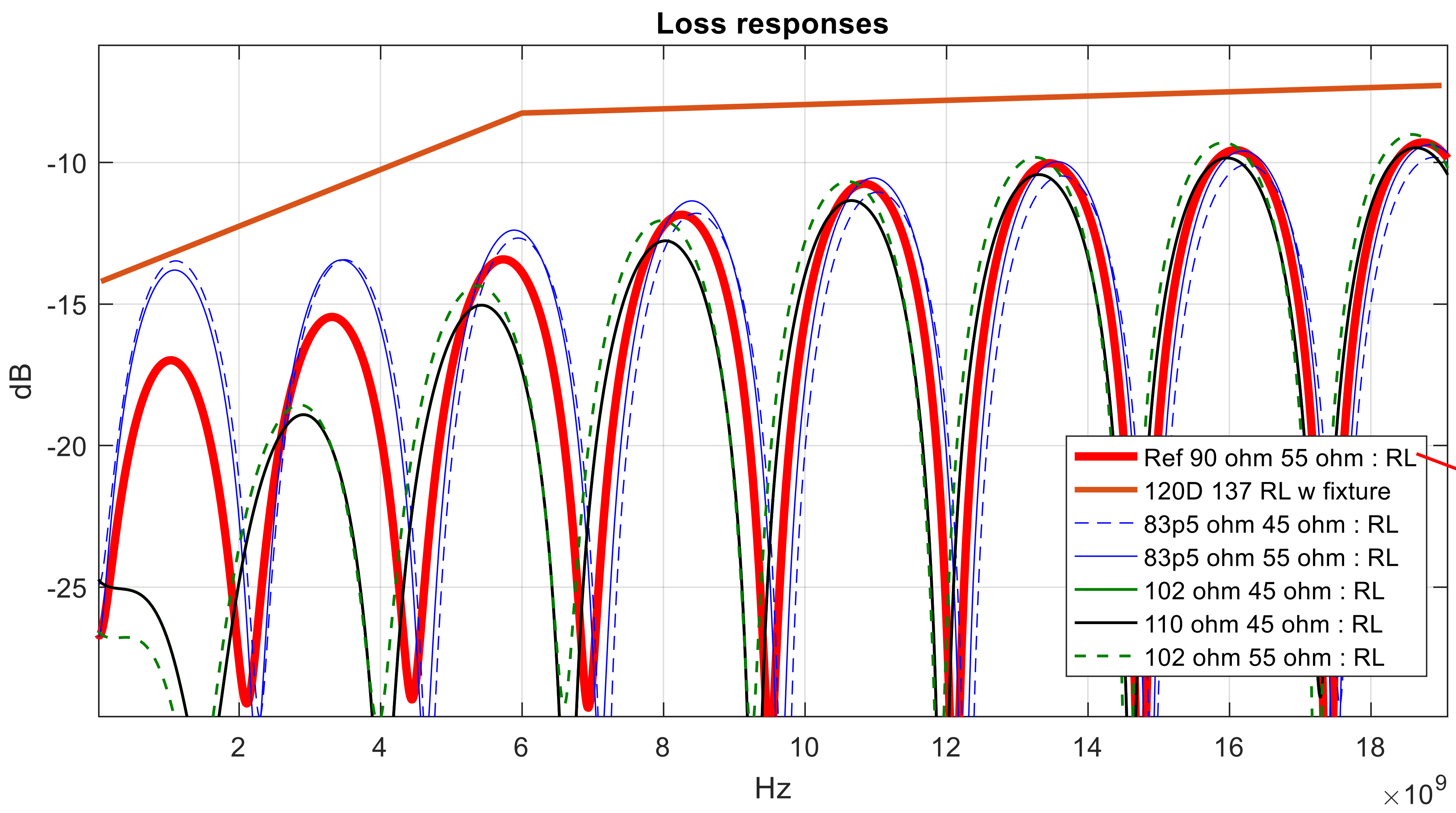
Return Loss Dilemma

- Return loss (RL) is often used to limit the effects from
  - Specifications done at a particular reference impedance
  - Devices and channel at different impedance targets
- RL is measured in the frequency domain
  - No clear data stream content impact
- Problem: Limit device reflections for all possible load cases
  - For impartments which occur in the time domain
- Potential Solution: Tighter RL limits
- Potential Solution: Include effect of a single bit reflection for all possible impedances
  - Essentially Pulse TDR (PTDR)

Many COM like package models pass return loss



This enables many 30 dB channels to pass COM

Is a tighter RL limit the answer?
The thinking was we need margin for the test fixture impedance. So Maybe not a tighter RL.

Results

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Linear model Poly4:
    f(x) = p1*x^4 + p2*x^3 + p3*x^2 + p4*x + p5
      where x is normalized by mean 1.017e+10 and std 6
Coefficients (with 95% confidence bounds):
      p1 =      0.2547  (0.2128, 0.2966)
      p2 =     0.05012  (0.02252, 0.07772)
      p3 =      -1.572  (-1.666, -1.477)
      p4 =       2.614  (2.571, 2.656)
      p5 =      -10.92  (-10.96, -10.88)

Goodness of fit:
  SSE: 0.4157
  R-square: 0.9994
  Adjusted R-square: 0.9993
  RMSE: 0.07208
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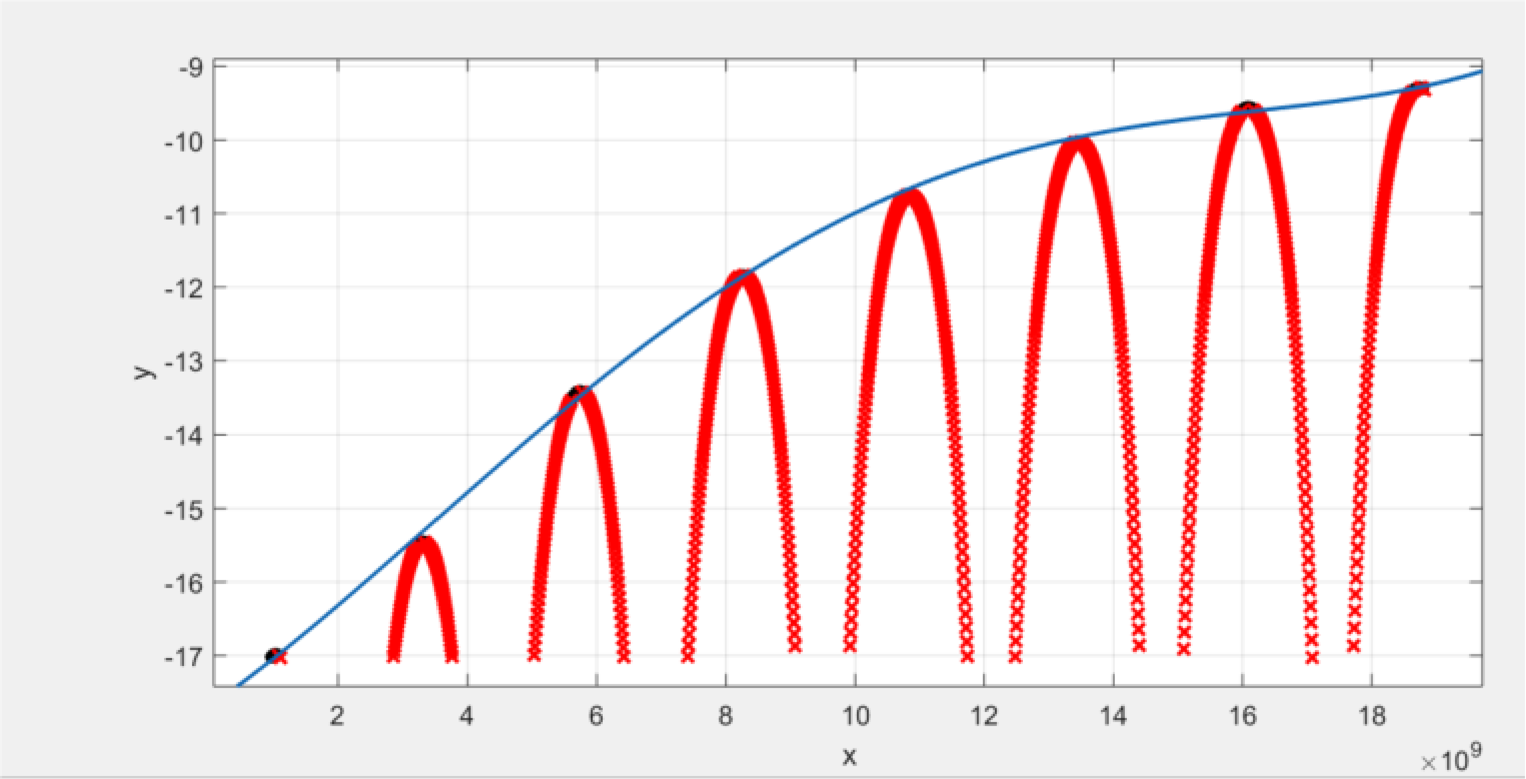
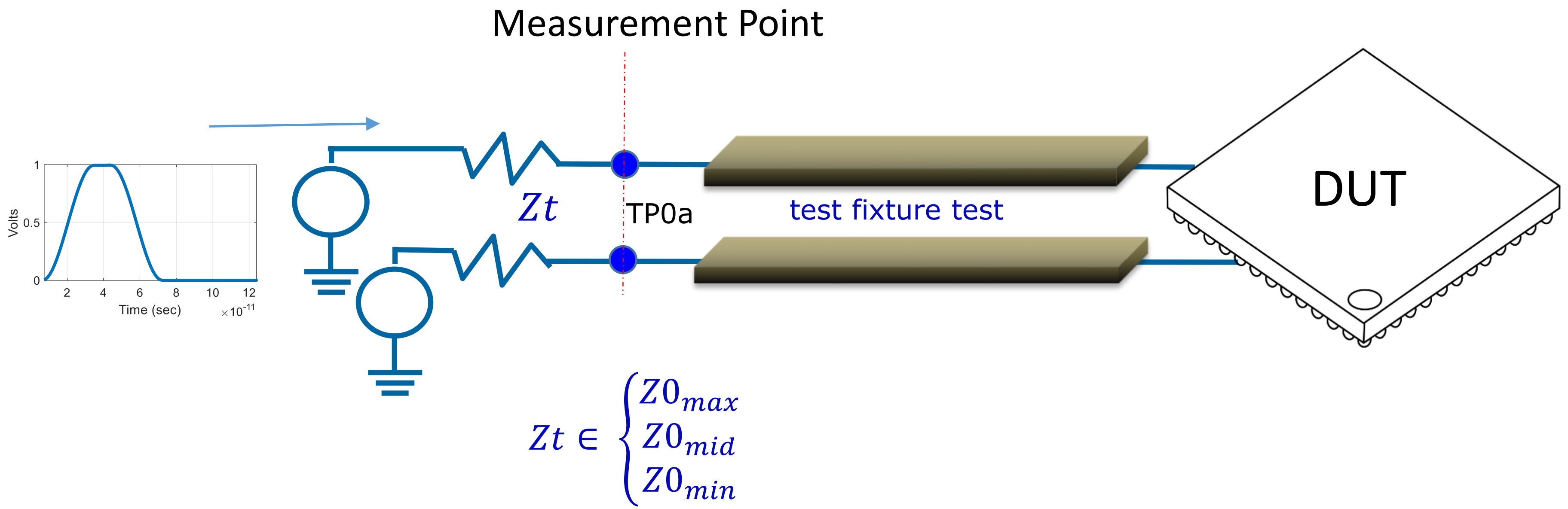
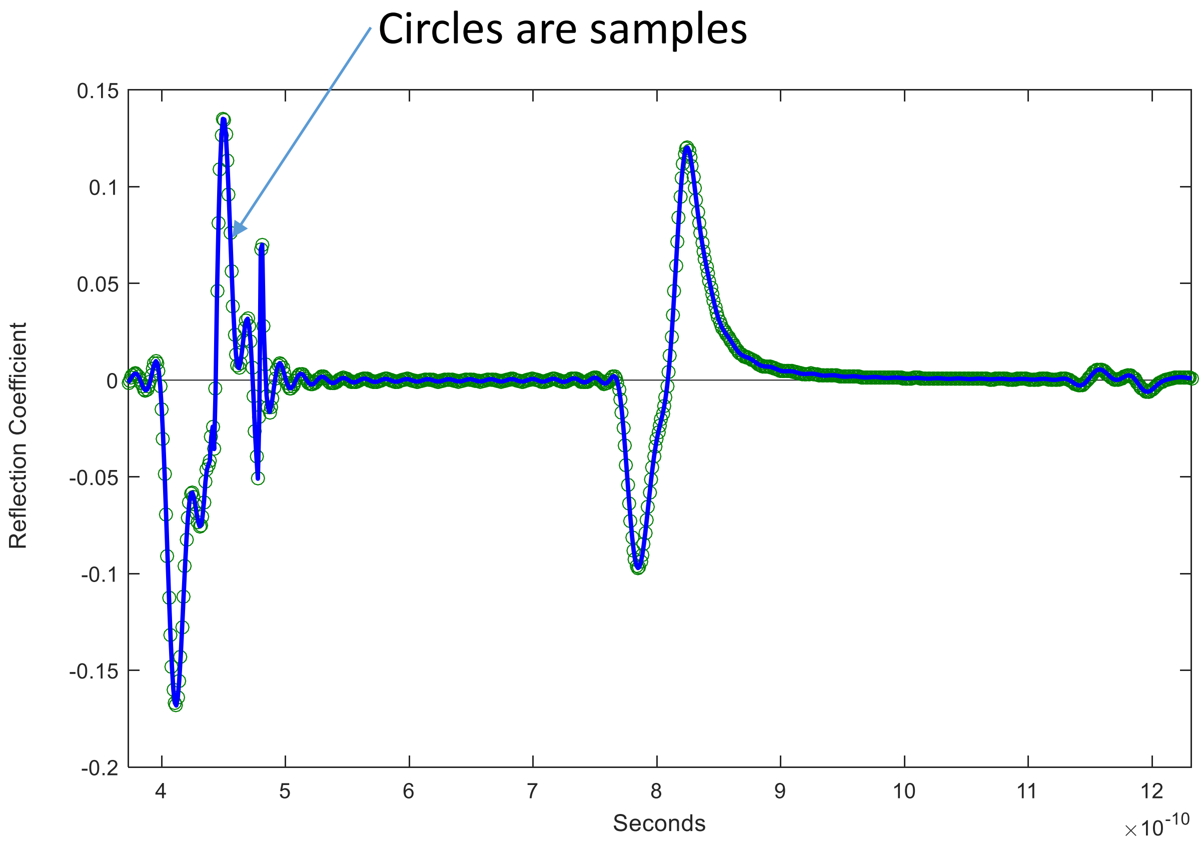


Single bit reflection concept: I.e. Pulse TDR (PTDR)

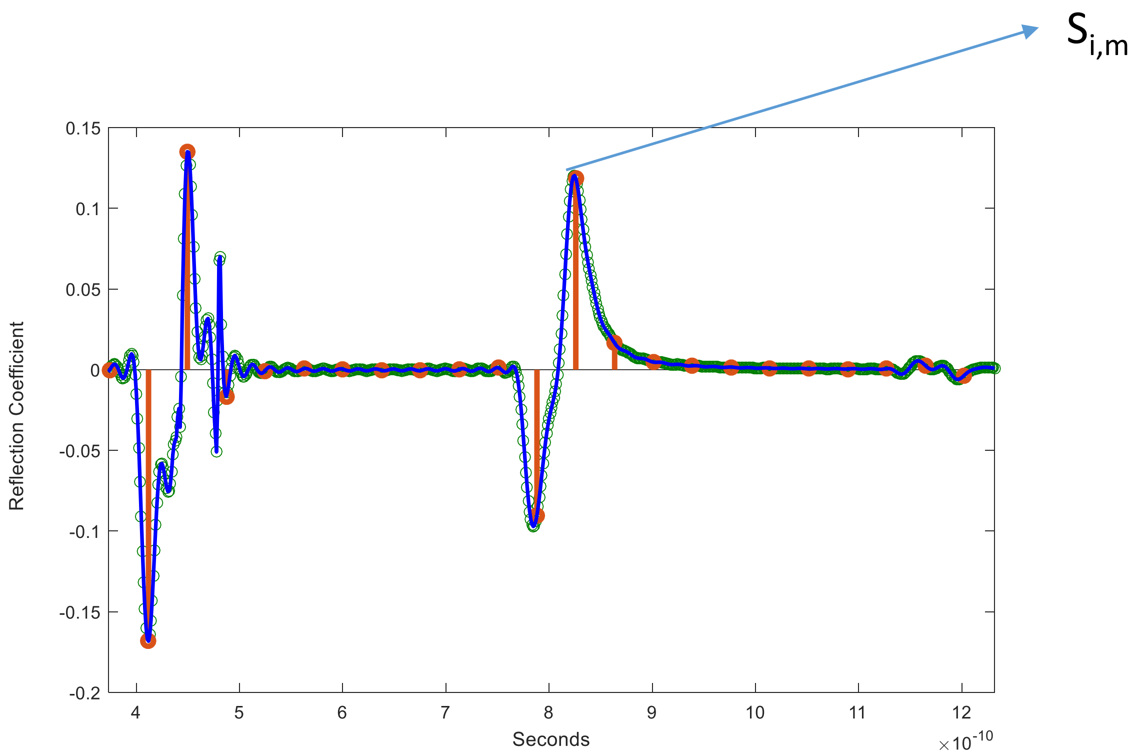


Determine PTDR response for each Zt

Example of PTDR for 30mm COM package



Determine effective reflection coefficient for each sample in a unit interval



where i = 1 to numbers samples per UI
and m = 1 to number of UI's in response

Reflection Test Metric (RTM)

- Greatest [1]RSS($S_{i,1:m}$) for any Zt

  Or Bit stream convolution
- Greatest CDF(PDF($S_{i,1:m} \otimes$ [2]Constellation)) @BER for any Zt
- Converting RTM to dB makes this somewhat similar to RL in the frequency domain

[1]*RSS is root of the sum of squares*

[2]*Constellation for PAM-4 = [-1 -1/3 1/3 1]*

Sound like an interesting idea but data has not been correlated to COM performance

- Method: bit stream convolution
- All but 1 package would have more return loss than the reference COM package
- Maybe this method could be used to qualify the RITT test channels
- It appears the idea needs some work to correlate to COM results

Zt (ohms)						
45	**50**	**55**	**PDF RL**	**Zc (ohms)**	**Rd(ohms)**	
-4.91	**-4.35**	**-4.71**	**dB**	**90**	**55**	**reference**
-5.38	-4.65	-4.33	dB	83.5	55	**fail**
-4.83	-4.6	-3.73	dB	102	55	**fail**
-5.67	-4.99	-4.62	dB	83.5	50	**fail**
-5.09	-4.89	-3.98	dB	102	50	**fail**
-5.97	-5.67	-5.38	dB	83.5	45	**pass**
-5.36	-5.2	-4.26	dB	102	45	**fail**

Conclusion

- ❑ More work is required.
  - Do we need a better definition for impedance targets?
- ❑ Reexamine the context of package reelections
- ❑ Investigate if PTDR to could be used qualify a test fixture or RITT channel
  - Measurement could quantify or minimize test fixture errors