Refining SNDR and COM Computations

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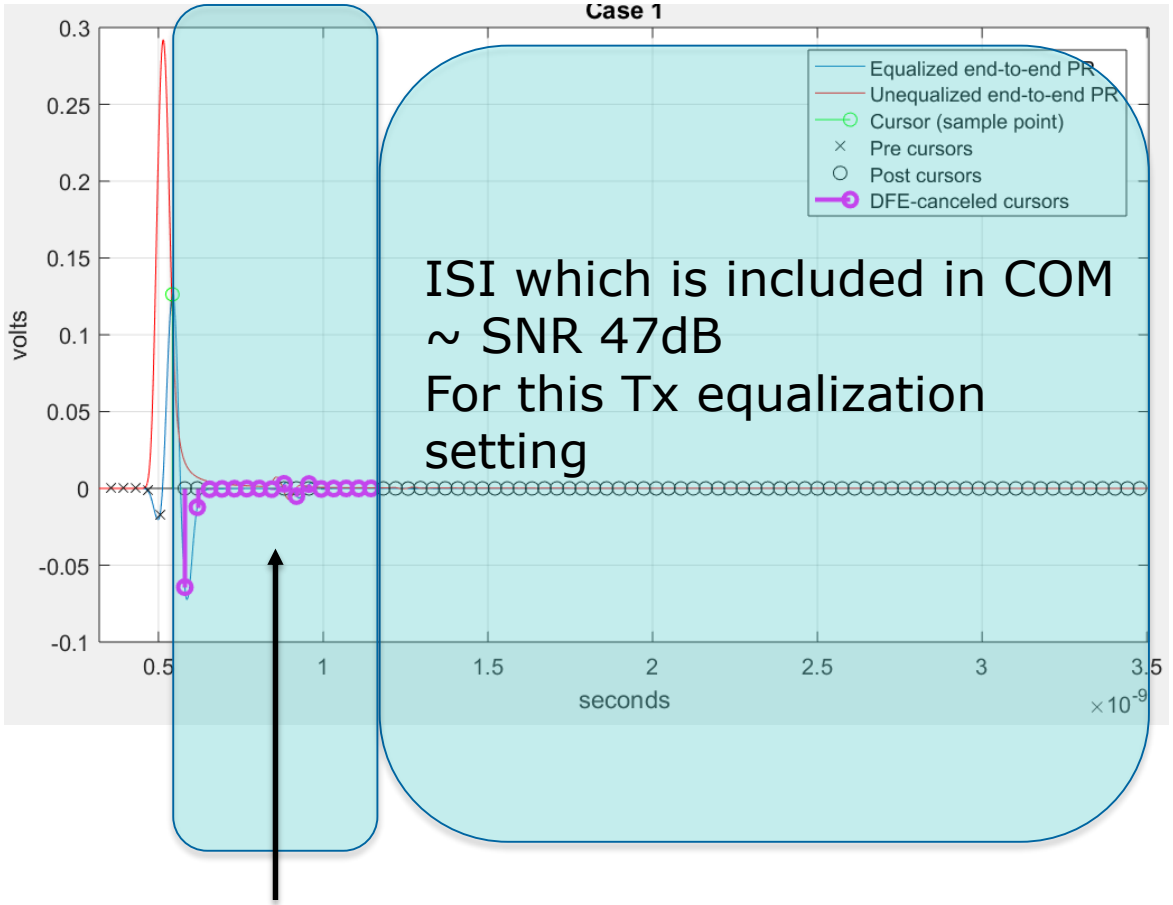
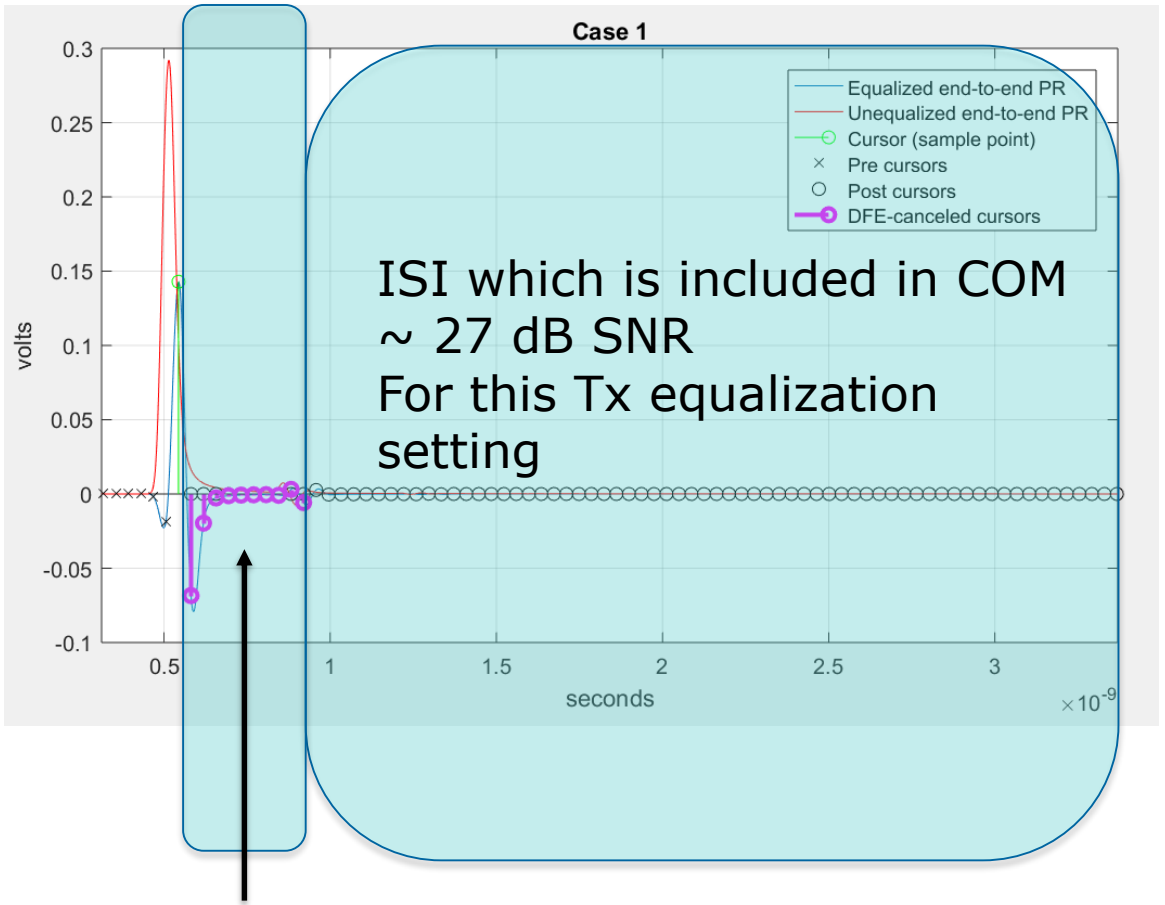
Background

- Original SNDR controlled: (healey_3bs_02_0916.pdf)
  - Correlated (e.g., inter-symbol) interference
  - Non-linear distortion
  - Uncorrelated noise and interference
- The last two are likely to be controlled with the proposed method in healey_3bs_02_0916.pdf
- There first not so much
- The measurement also control signal loss
- It was shown is kareti_3cd_01_0916.pdf and other prior presentations that that SNDR on if the primary limiting factor for 50G PAM4
  - Correlated (e.g., inter-symbol) interference
- "mellitz_3bs_01_0916_adhoc.pdf" suggested that "Correlated (e.g., inter-symbol) interference" in Tx_SNR is already counted in the COM computation.

Some SNR from ISI is already comprehended in COM computation



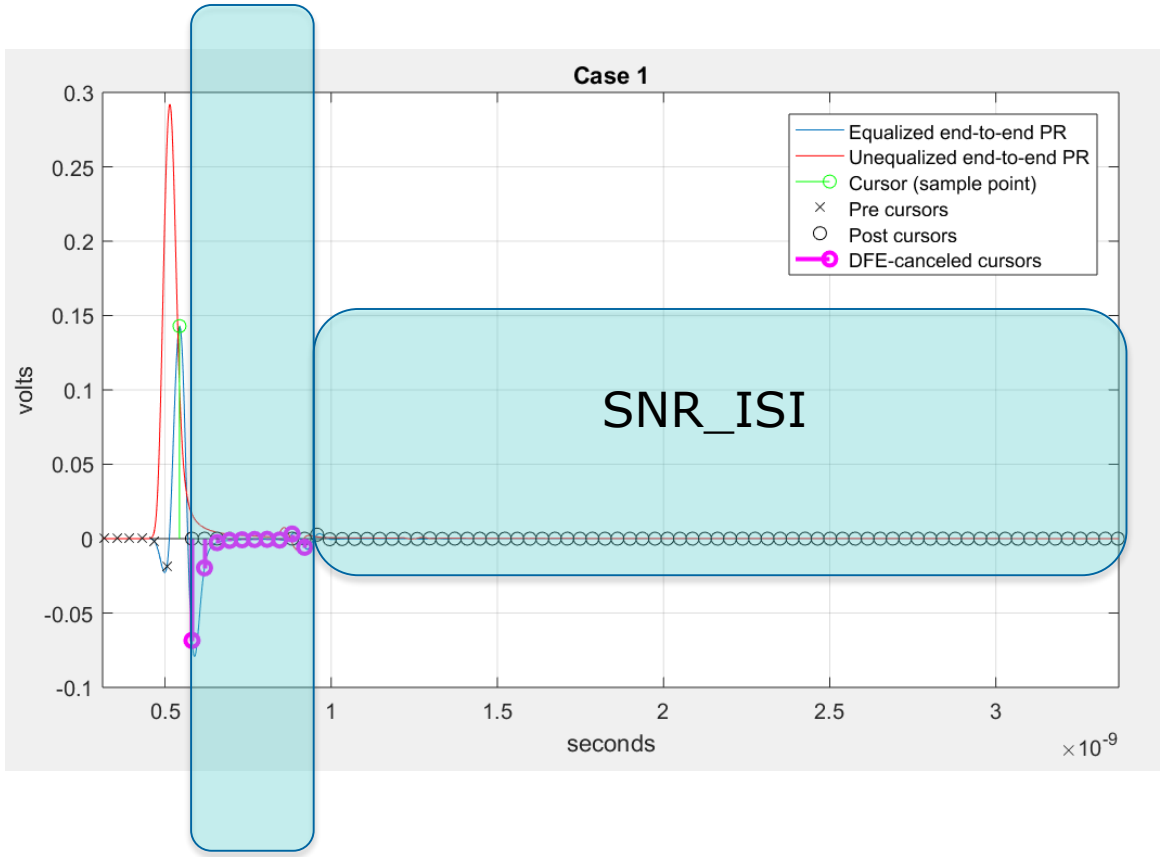
ISI Removed in COM
DFE16



ISI Removed in COM
DFE10

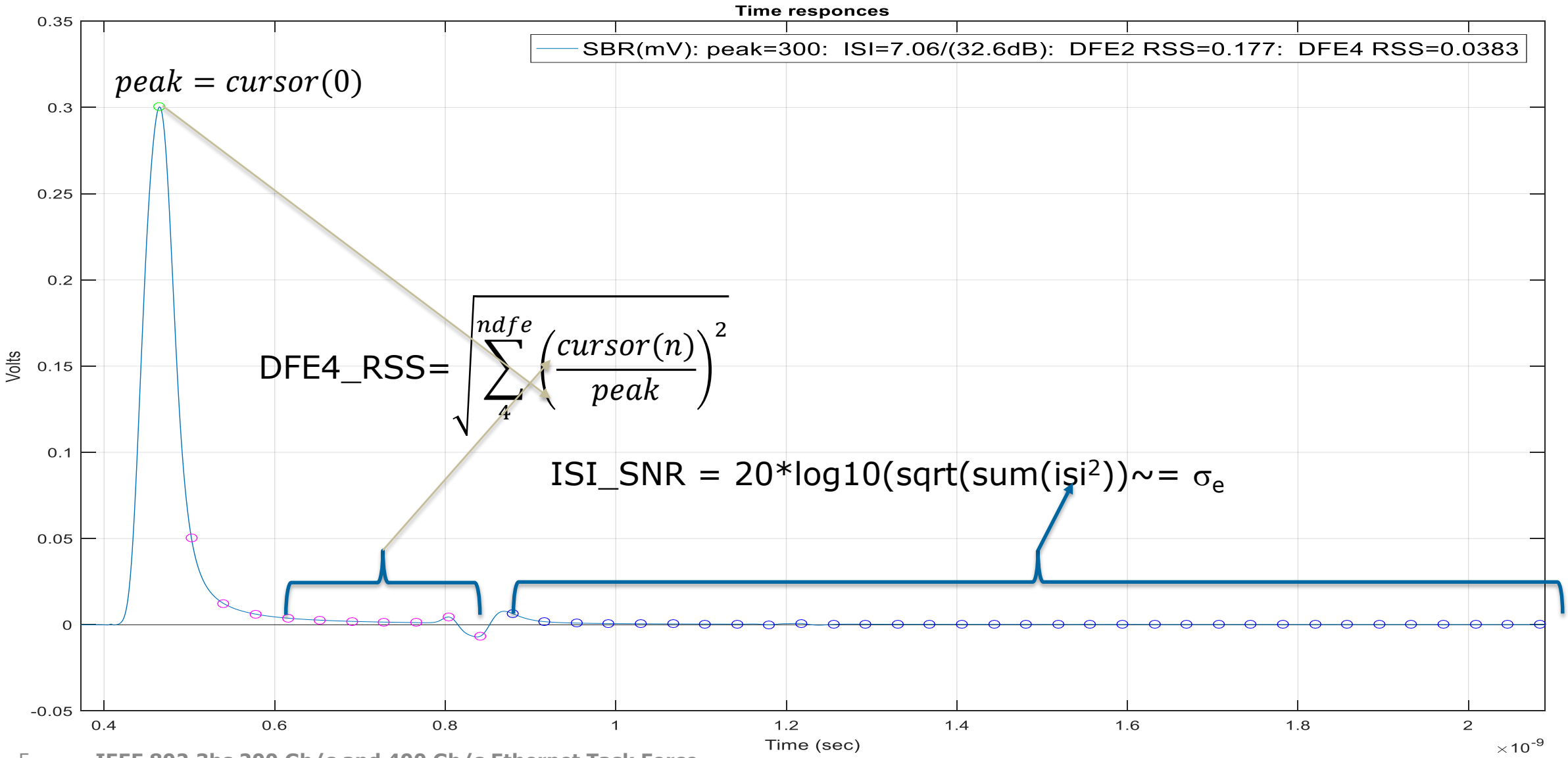
Limit ISI by Specifying Reflections Limits

- Specify DFE4_RSS to limit re-reflections for p(k)
  - Eq 93A.59
- Specify SNR_ISI to be no more than the reference package introduces.
  - For expected impedance load ranges
  - From equation 93A-27 and 93a-31
  - p(k) replaces h_0(t)



DFE2_RSS and DFE4_RSS

Define terms: ISI_SNR and DFE_RSS



Use the CTLE and CTF settings which have the best ISI_SNR results using the linear fit

- Determine Vf and Vf/(Linear fit pulse peak) with a large number for N_p as in healey_3bs_02_0916.pdf or mellitz_cb_01_0516.pdf
- Acquire p(k), the signal bit response with N_p=N_b (number of DFE taps)
- Replace h(0) equation 93A-25, 25, and 27 with p(k) found with the large value of N_p (200)
- Base on equation 93A-27 find $p_{isi}(n)$ and σ_{isi}^2
  - $p_{isi}(n) = \begin{cases} 0 & n \le 0 \\ p(t_s + nT_b) - p(t_s)b_n & 1 \le n \le N_b \\ p(t_s + nT_b) & n > N_b \end{cases}$
  - $\sigma_{isi}^2 = \sigma_x^2 \sum_n p_{isi}^2(n)$

And find the best FOM for all CTLE and CTF settings using

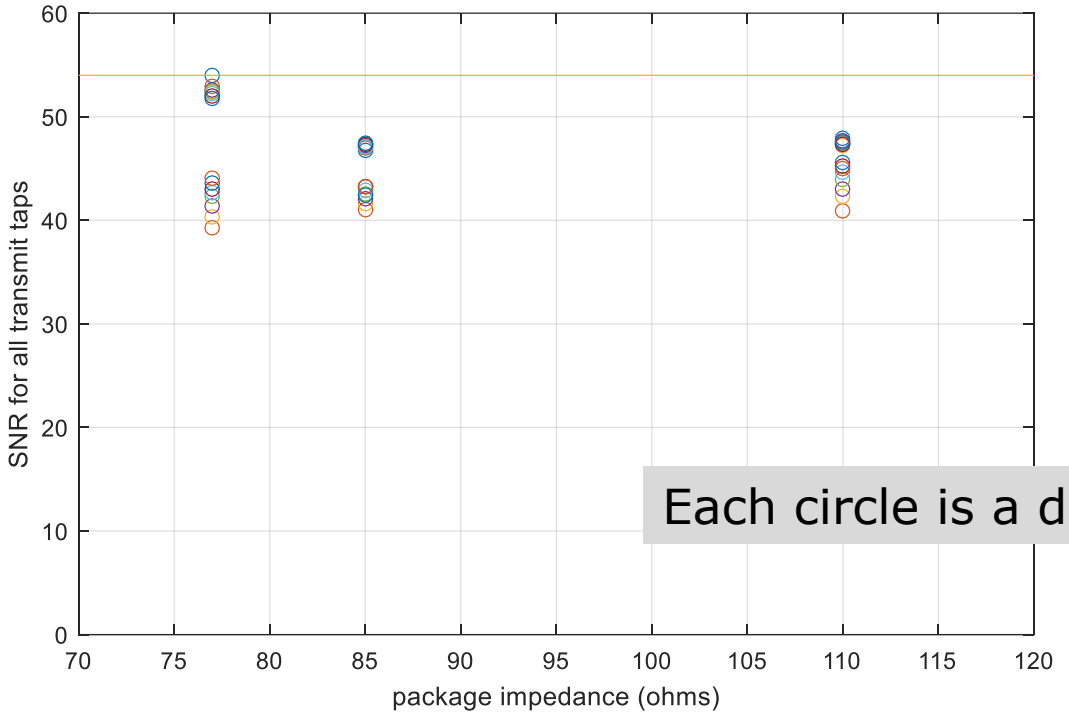
- $FOM_p = 10 * log10\left(\frac{A_s}{\sigma_{isi}^2}\right)$

Suggestion: Do not include ISI in SNDR

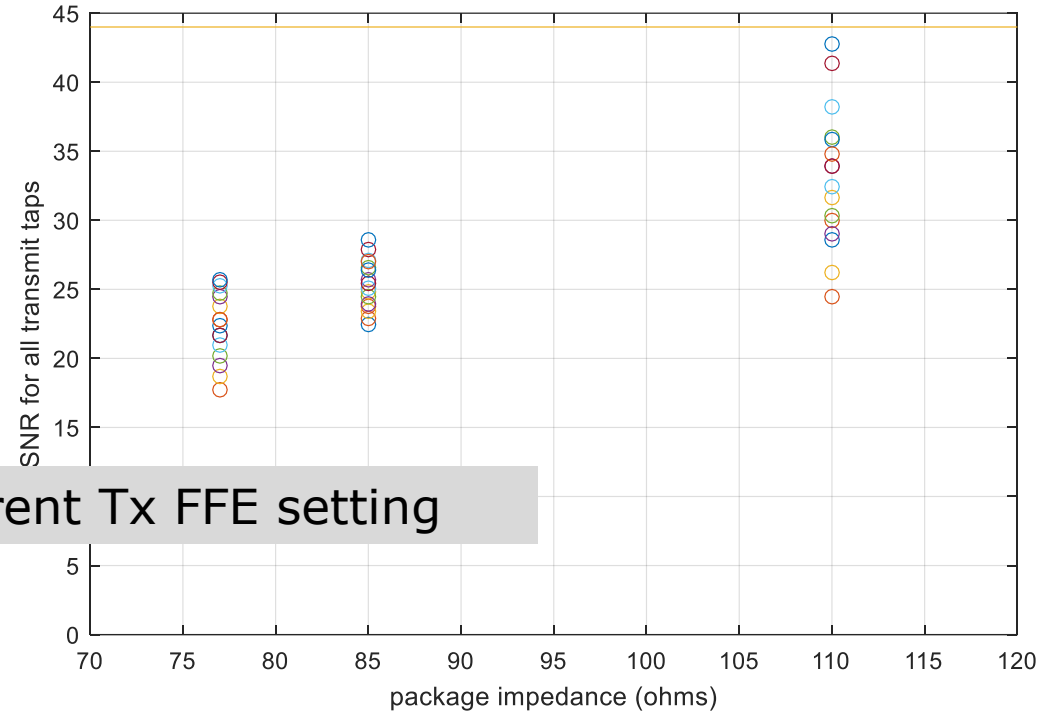
- Instead specify max SNR_ISI for all legal transmitter equalization settings.
- Replaces return loss mask.
  - E.g. a time domain context sensitive return loss specification
- Data for impedance variation explored next
- Experiment demonstrate package impedances of 77 ohms, 85 ohms, and 110 ohms

Data for specifying ISI_SNR depending on DFE for all Tx FFE settings

DFE16



DFE10

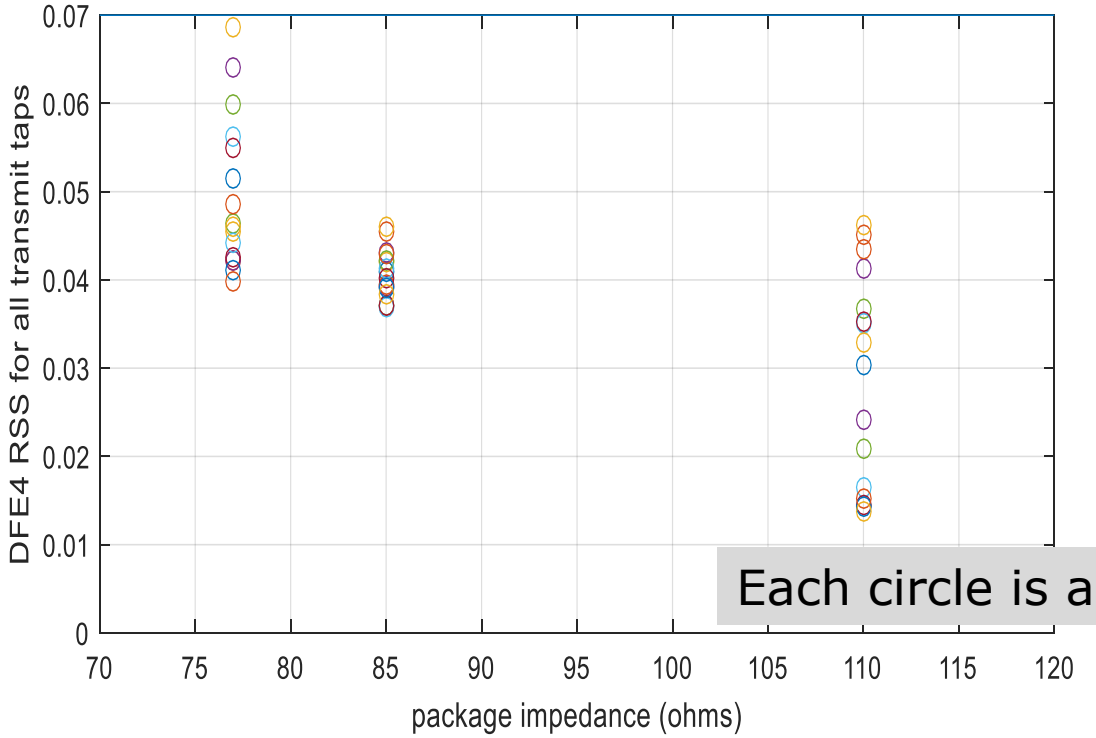


Each circle is a different Tx FFE setting

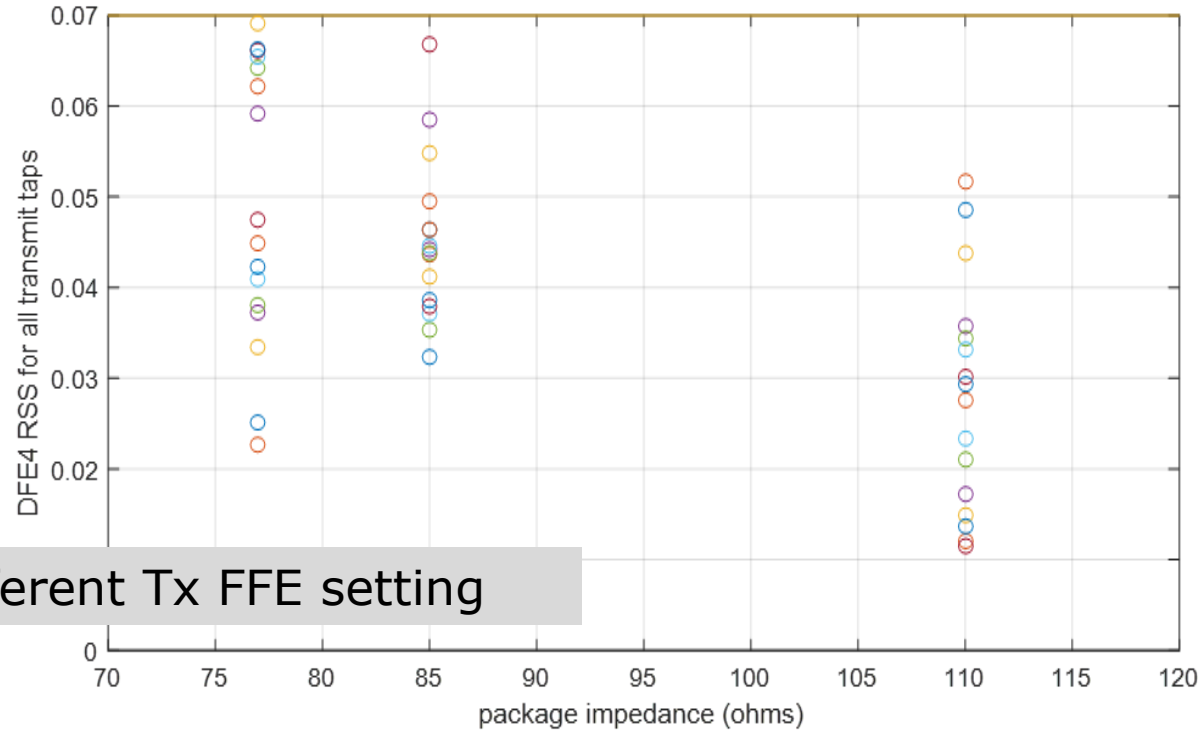
Collection of package impedances

Data for specifying DFE4_RSS

DFE16



DFE10



Each circle is a different Tx FFE setting

Collection of package impedances

Recommendations

- TX_SNR could be ≥ 34 dB
  - budgeting for 2 mv RMS of crosstalk and no ISI
- We could keep package impedance at 78.2 ohms
  - Comprehends board a worst case condition
- Specify ISI_SNR and DFE4_RSS for any legal Tx equalization setting
  - for DFE16
  - for DFE10
- A little more work needed with channel data and measured fits.
- Use ISI_SNR and DFE_RSS to specify test fixture reflections