ANALOG DEVICES
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IEEE P802.3dd 10BASE-T1L Droop and Return Loss

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Introduction

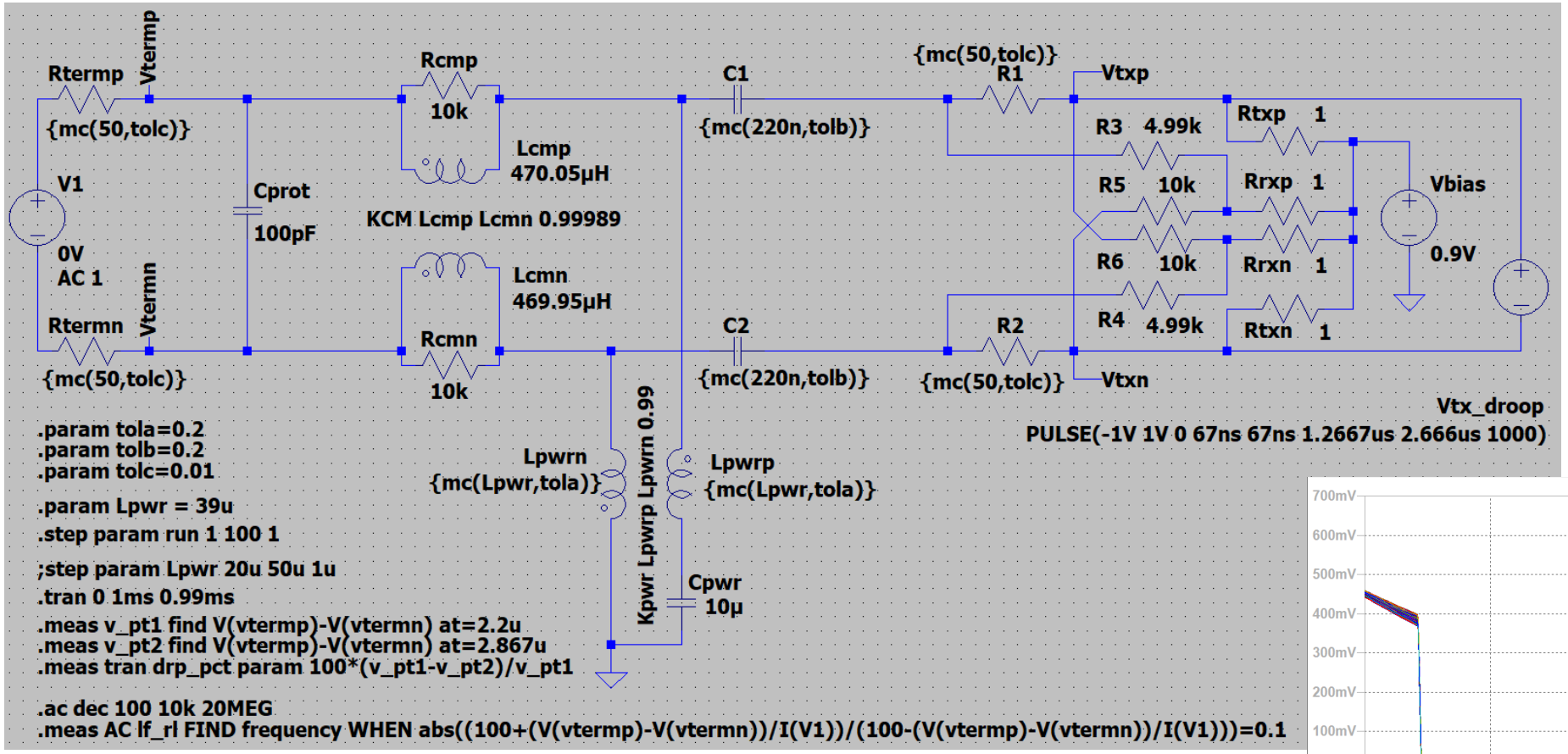
- The task force has voted to change return loss limit to be consistent with the increase of the droop limit from 10% to 25%
- A previous presentation addressed the issue of size and cost of power magnetics and the rational for the increase to 25%

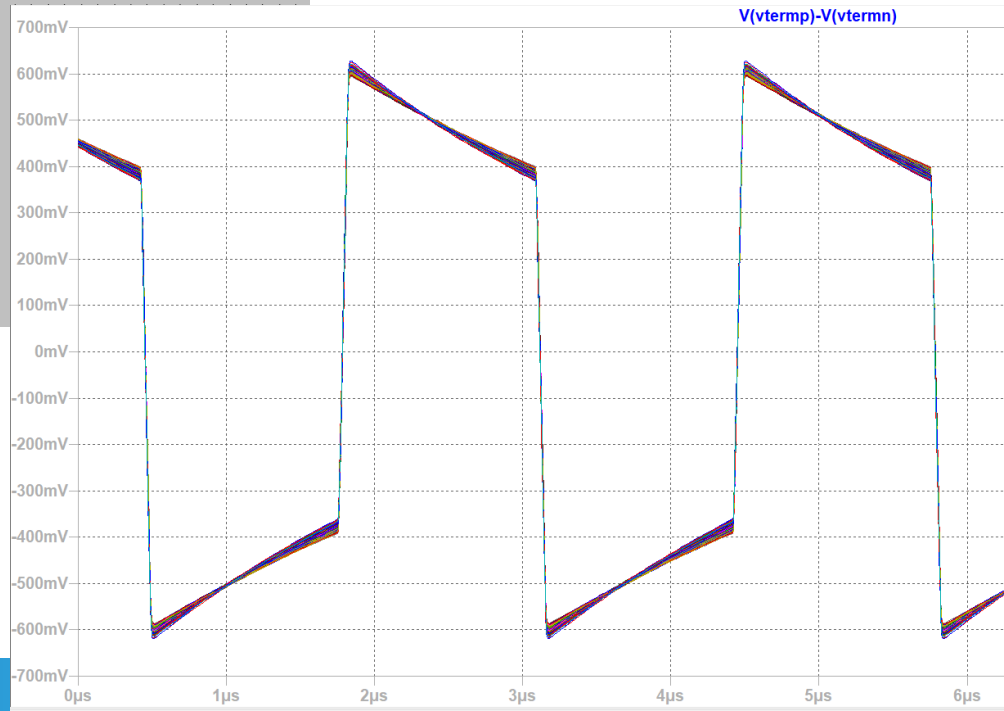
  https://www.ieee802.org/3/dd/public/Stewart_3dd_01_08312021.pdf
- This presentation is in relation to the following comment

Technical	26	146.5.4.2	24	Implementers indicate that receivers are insensitive to droop of 30%, and that it improves economic feasibility for 10BASE-T1L transceivers with inline power.	Change "25%" to "30%" at P26 L24

- We have included some Monte Carlo simulations results for return loss for the case where droop approaches the 25% limit
- We propose a small change to the return loss limit slope of the low frequency section to ensure the return loss limit is consistent with the droop limit of 25%

Droop – Simulation

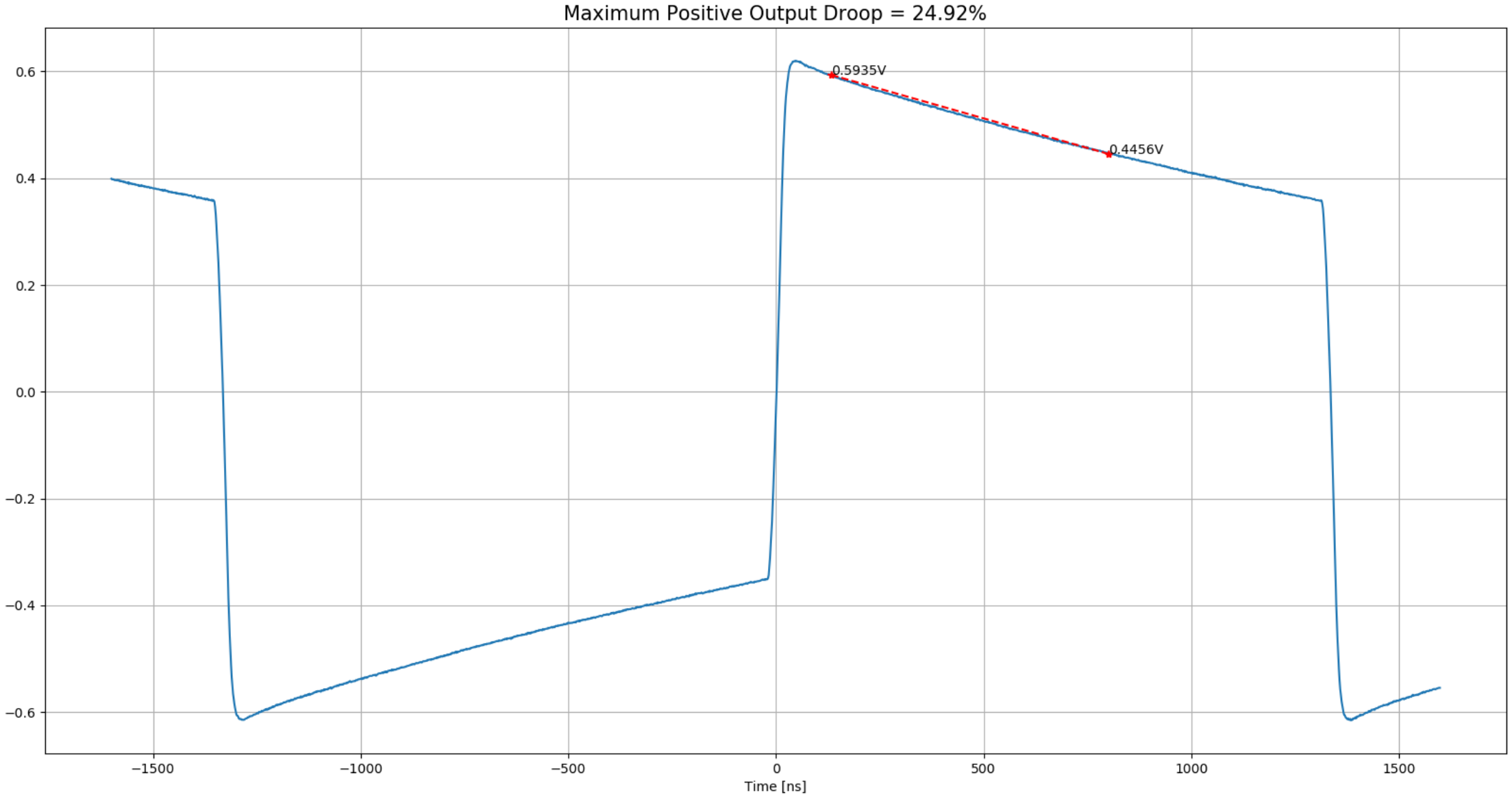




- LT Spice, Monte Carlo, Inductors ±20%, Capacitors ±20%
- Maximum droop over 100 runs of 24.9%
- Average droop 21.9%

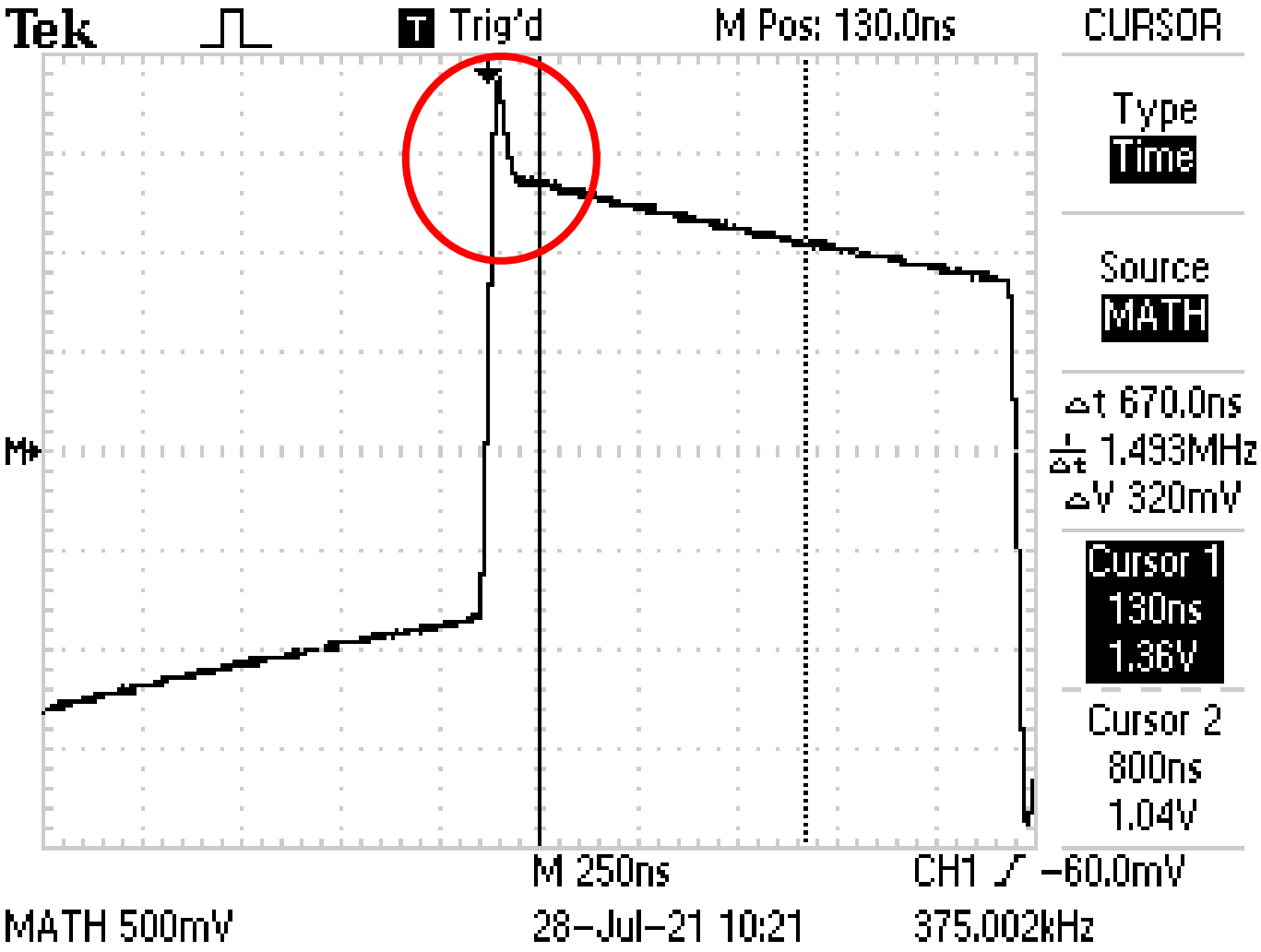
Droop Measured

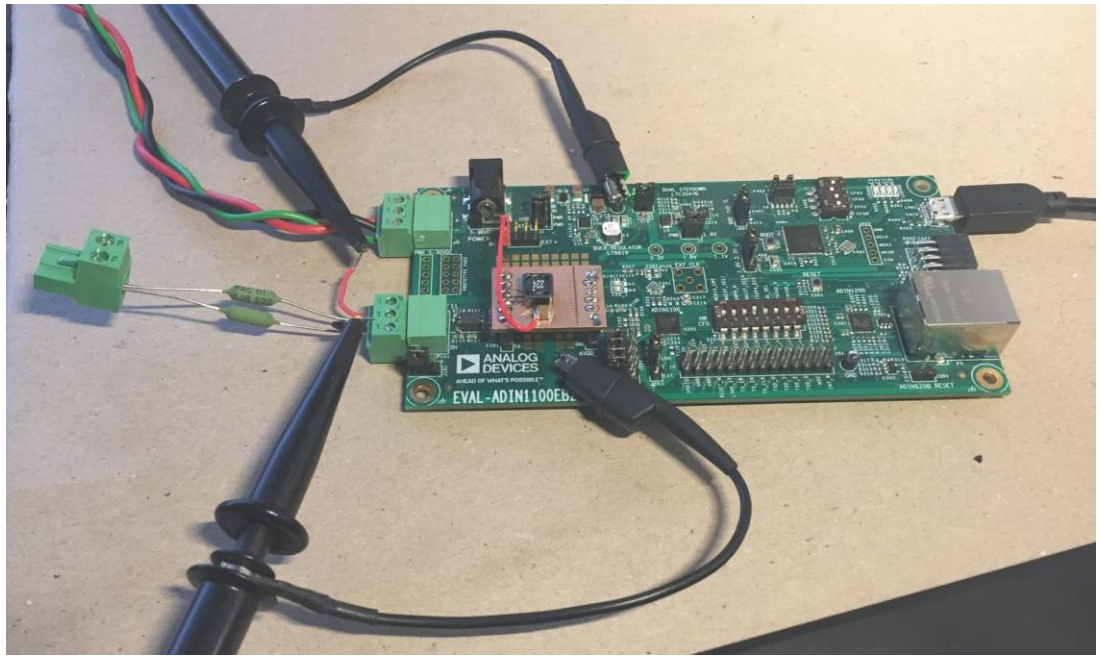
EVAL-ADIN1100EBZ, MSD7342-393MLC, 2x 39uH, coupled, 156uH Diff.



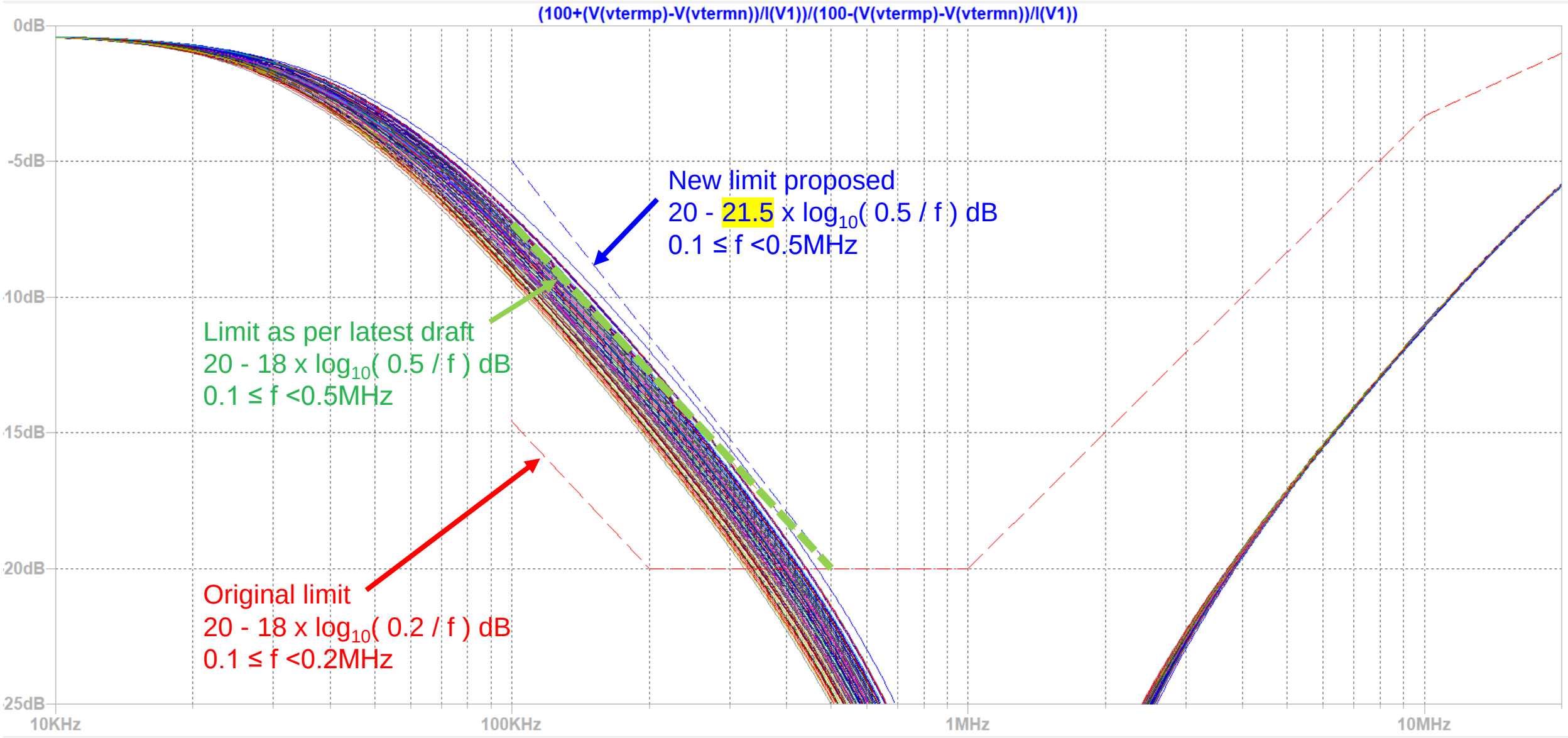
Droop Measured

EVAL-ADIN1100EBZ, MSD7342-393MLC, 2x 39uH, coupled, 156uH Diff.

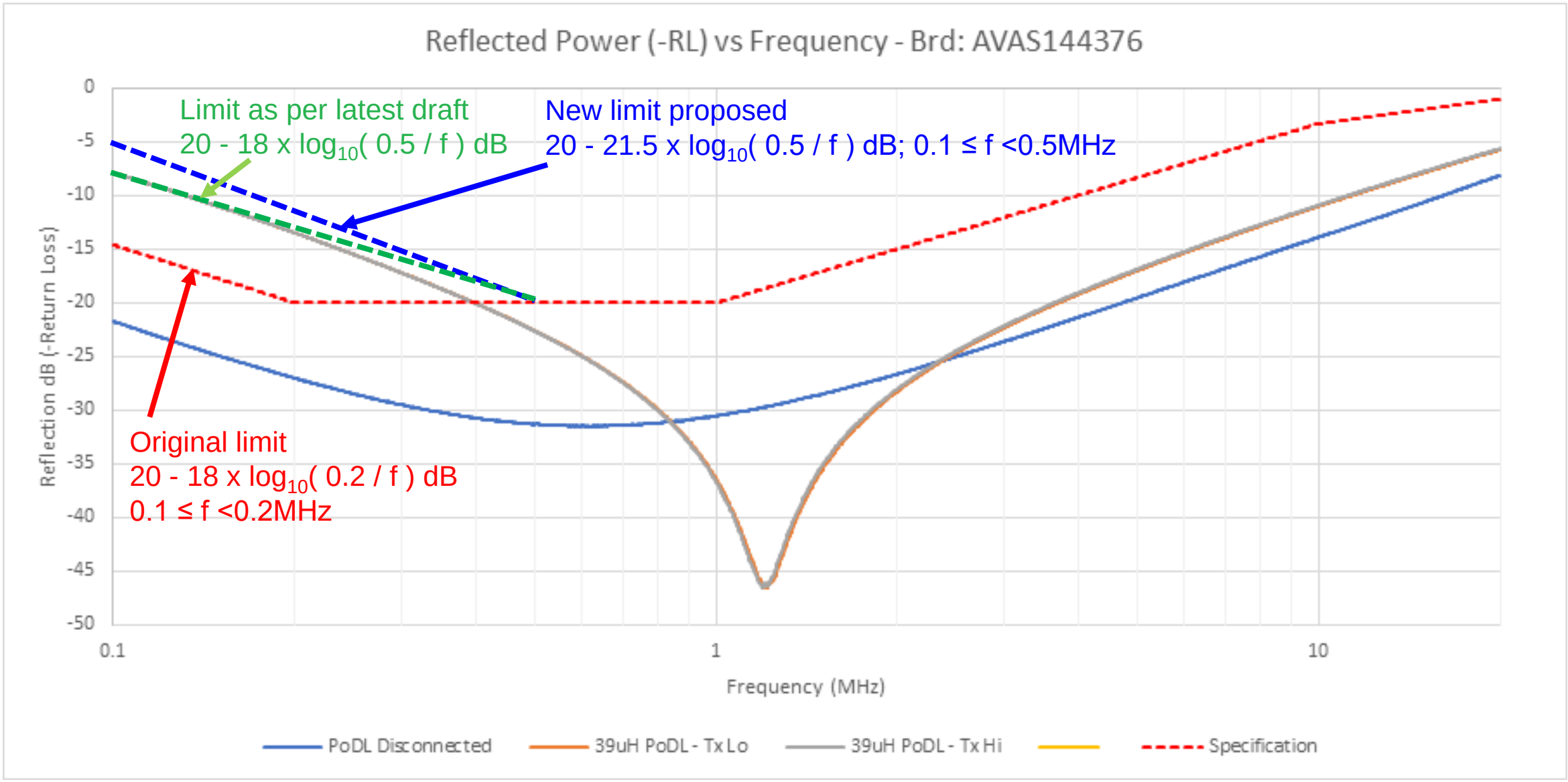




Return Loss – Simulation (Circuit as previously presented)



Return Loss Measured,
EVAL-ADIN1100EBZ, MSD7342-393MLC, 2x 39uH, coupled, 156uH Diff.



Summary and Suggested Remedy

- Summary:
  - A small change to the return loss limit slope and initial value @100kHz from 7.42dB to ~5dB is required to be consistent with the 25% droop limit
    - Keeping the same intercept of 500kHz at -20 dB already agreed
- Suggested Remedy: Change 146.8.3, including additional equation 146-17a to read (yellow highlight shows changes):

When a Clause 104 Type E PSE or PD PI is encompassed within the MDI, the MDI return loss (RL) shall meet or exceed Equation (146–17a) for all frequencies from 100 kHz to 20 MHz (with 100 Ω ± 0.1% reference impedance) at all times when the PHY is transmitting data or idle symbols.

$$\text{Return Loss}\,(f) \geq \begin{cases} 20 - 21.5 \times \log_{10}\left(\frac{0.5}{f}\right)\ \text{dB} & 0.1 \leq f < 0.5\ \text{MHz} \\ 20\ \text{dB} & 0.5 \leq f \leq 1\ \text{MHz} \\ 20 - 16.7 \times \log_{10}(f)\ \text{dB} & 1 < f \leq 10\ \text{MHz} \\ 3.3 - 7.6 \times \log_{10}\left(\frac{f}{10}\right)\ \text{dB} & 10 < f \leq 20\ \text{MHz} \end{cases} \qquad \text{(146–17a)}$$

where f is the frequency in MHz.

Thank you