# IMPROVEMENTS TO CDAUI8 C2C TX LINEARITY SPECIFICATIONS


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# OVERVIEW

- **TX Linearity Specifications for CDAUI-8 c2c**
  - Measuring Level Mismatch - Current method and Proposed changes
  - $R_{LM}$ and vertical asymmetry

# CDAUI-8 C2C CURRENT METHOD

- **Inherited from Clause 94 (100GBase-KP4) and referenced by TX SNDR & $R_{LM}$**
  - Measure TX Linearity Test Pattern to obtain $V_A$, $V_B$, $V_C$, $V_D$
  - Calculate $ES_1$ & $ES_2$ (to allow for asymmetric inner PAM4 data levels) and $R_{LM}$

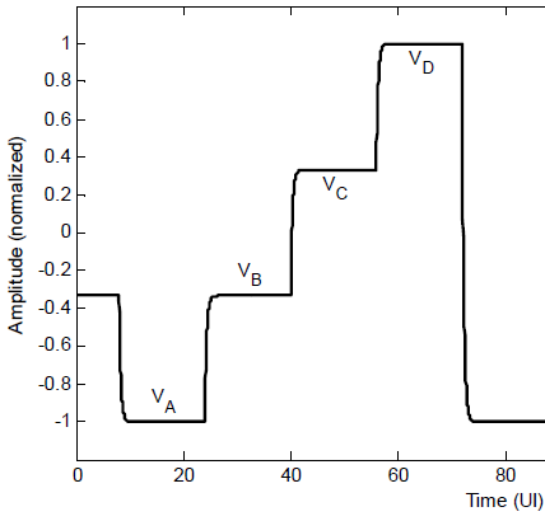
$$S_{min} = \frac{\min(V_D - V_C, V_C - V_B, V_B - V_A)}{2}$$

$$V_{avg} = \frac{V_A + V_B + V_C + V_D}{4}$$

$$ES_1 = \frac{V_B - V_{avg}}{V_A - V_{avg}}$$

$$ES_2 = \frac{V_C - V_{avg}}{V_D - V_{avg}}$$

$$R_{LM} = \frac{6 \cdot S_{min}}{V_D - V_A}$$




  - Measure PRBS13Q
  - Calculate SNDR, p(k) using an assumption that data levels are (-1,-$ES_1$,$ES_2$,1)

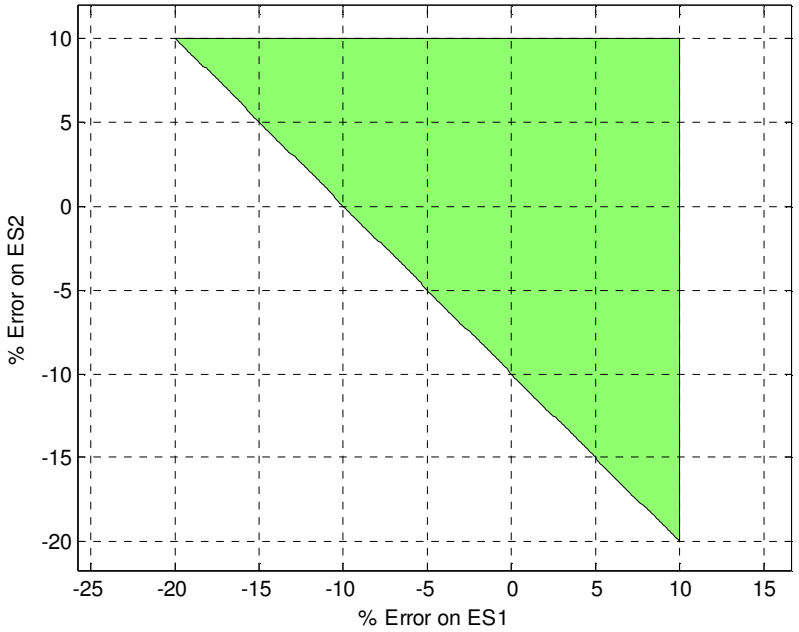
# FINDING ES1 & ES2

- **These equations result in some inaccuracy when $ES_1$!=$ES_2$**
  - The 4 levels are assumed to be [-1,-$ES_1$,$ES_2$,+1]. Starting from there, if you generate $V_A$, $V_B$,$V_C$,$V_D$ and calculate $ES_1$ & $ES_2$, it results in a different answer.
  - $ES_1$ & $ES_2$ definition assumes outer levels are equal, so re-centering should use **$V_{avg} = (V_A+V_D)/2$** to address this

- **A change worth considering is to derive $ES_1$ & $ES_2$ from PRBS13Q instead**
  - Current method focuses only on DC pattern, ignoring transition levels. Including all patterns would provide a more representative average estimate of level asymmetry.
  - All the information needed is present in PRBS13Q measurement, making the test more efficient.
  - **Proposal** : Use a best fit method (least square error criteria) with the PRBS13Q data to estimate ES1 and ES2. The test flow would be like -
    - Measure PRBS13Q waveform
    - Assume symbol values of [-1,-1/3,1/3,+1] and follow procedure in 85.8.3.3.5 to find “P” [equation 85-7]
    - (New step) - Use Y & P to estimate adjusted levels $ES_1$ and $ES_2$ using least square error fit
    - Note for SNDR – Use the new levels [-1, -$ES_1$, $ES_2$, +1] and continue, same as before.

# RLM: ALLOWED VERTICAL ASYMMETRY

- **The current $R_{LM}$ definition allows large asymmetry between -1/3 and +1/3 levels, but was probably not intended**
- **ES1,ES2 @ (-20%, +10%) passes $R_{LM}$, but is considerably tighter on symmetric cases**
  - This is a case where upper and middle eyes are smaller, while lower one is bigger




- **Transmitters shouldn't need such a large allowance, and it ends up adding a burden on RX for potentially hypothetical cases**
- **$R_{LM}$ may be defined to limit the inner levels to +/- margin around their ideal value**
  - $R_{LM}$ = 1-min(Abs(3*$ES_1$-1),Abs(3*$ES_2$-1))