
802.3da Mixing Segment Update with TX Model

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Purpose

- Mixing segment modeling updated with integration of TX Model
 - Source TX Model:
https://www.ieee802.org/3/da/public/050422/beruto_3da_20220502_tx_model.pdf

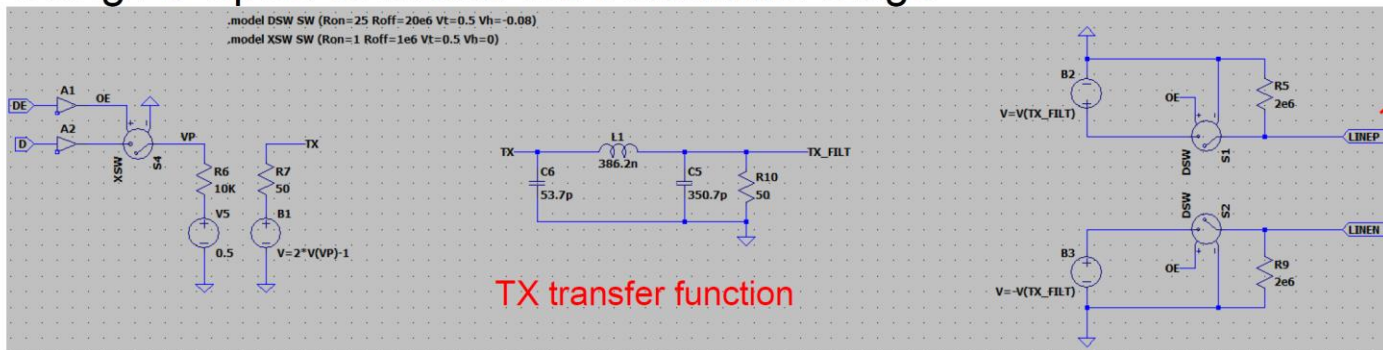
Contributors

- Bob Voss/Paul Wachtel - Panduit
- Piergiorgio Beruto - Onsemi

TX Model

Model description

- Using LT-Spice to model the transmitter stage



- Python script to read LT-Spice data and calculate the PSD / eye diagram
- Change the TX transfer function to get as close as possible to the defined limits
- Many transfer functions are “unreasonable” to implement, but everything that meets the PSD mask is allowed (in principle)

```
147 def run(name, skipsim):
148     if not skipsim:
149         # run LTSPICE simulation
150         run_itsim(name)
151     # get the differential voltage
152     vdiff = get_vdiff(name, fs, noise=25.0)
153     # estimate the PSD using Welch's method
154     # f = frequencies [Hz]
155     # psd = spectral density [V^2/Hz]
156     f, psd = sig.welch(vdiff, fs, nperseg=1024, scaling='density')
157     # convert frequencies to MHz
158     f /= 1e6
159     # convert PSD to dBm/Hz
160     # note: V^2 / R = 1000 = power in mW
161     psd = 10 * np.log10(psd * 1000.0 / Z)
162     # do the plot! ----- #
163     plt.figure()
164     grid = (1, 2)
165     wnd = (
166         plt.subplot2grid(grid, (0, 0), colspan=1, rowspan=1),
167         plt.subplot2grid(grid, (1, 0), colspan=1, rowspan=1),
168         plt.subplot2grid(grid, (1, 1), colspan=1, rowspan=1)
169     )
170     # plot the PSD data ----- #
171     wnd[0].set_title('Power Spectral Density')
172     wnd[1].plot(f, psd)
```



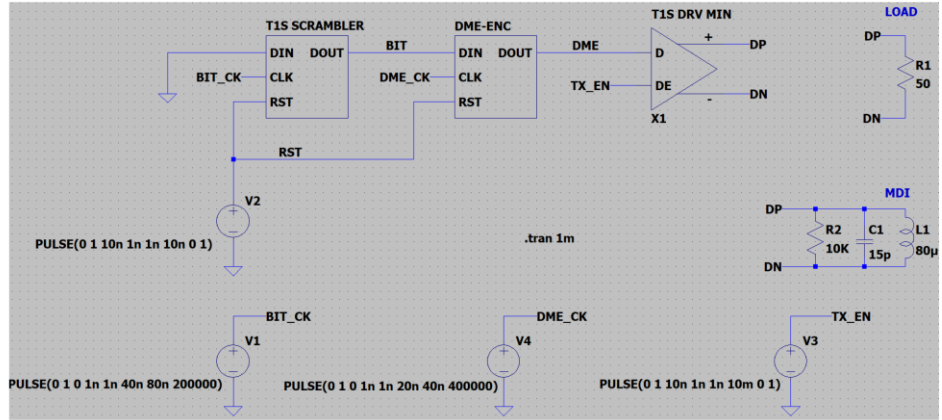
IEEE 802.3 - Public Information

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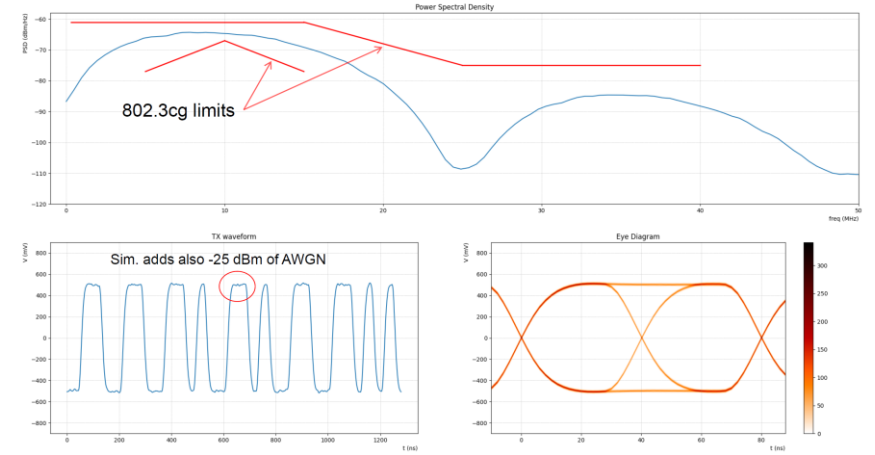
TX Model

Testbench

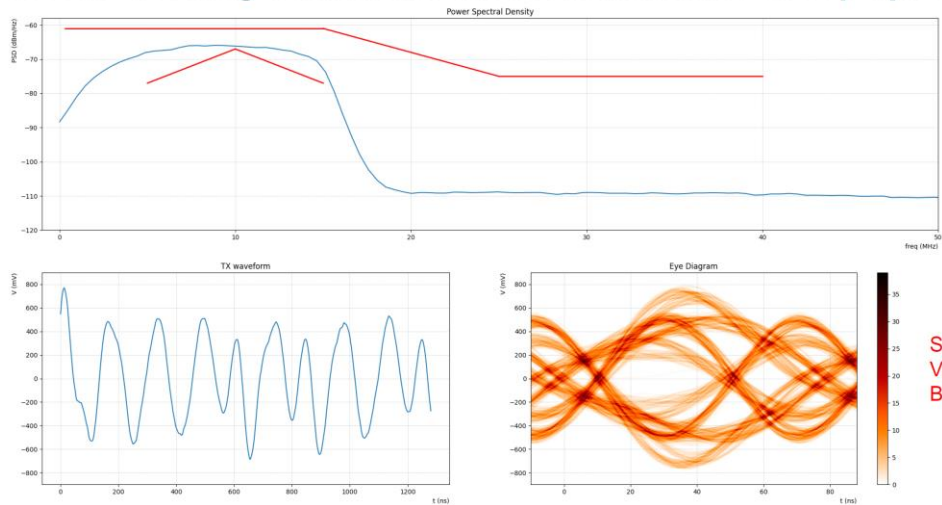


PSD is calculated from $V(DP)-V(DN)$ i.e., differential output voltage on $Z = 50\Omega$

Typical 802.3cg transmitter model



“Worst” 802.3cg transmitter model that honors drop spec



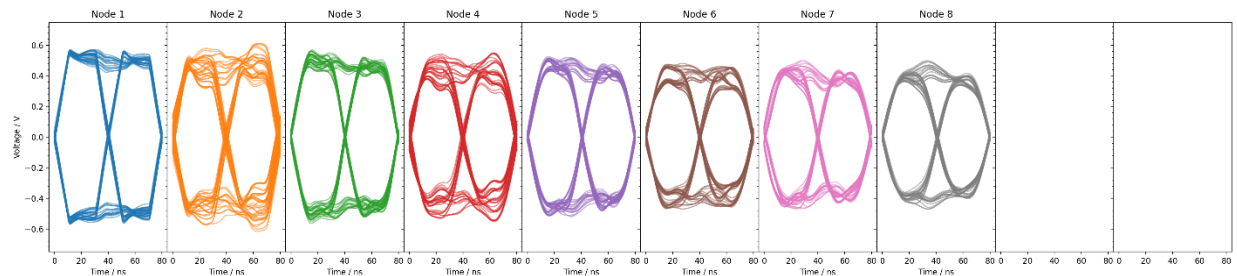
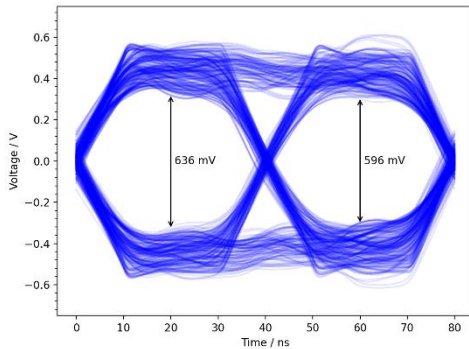
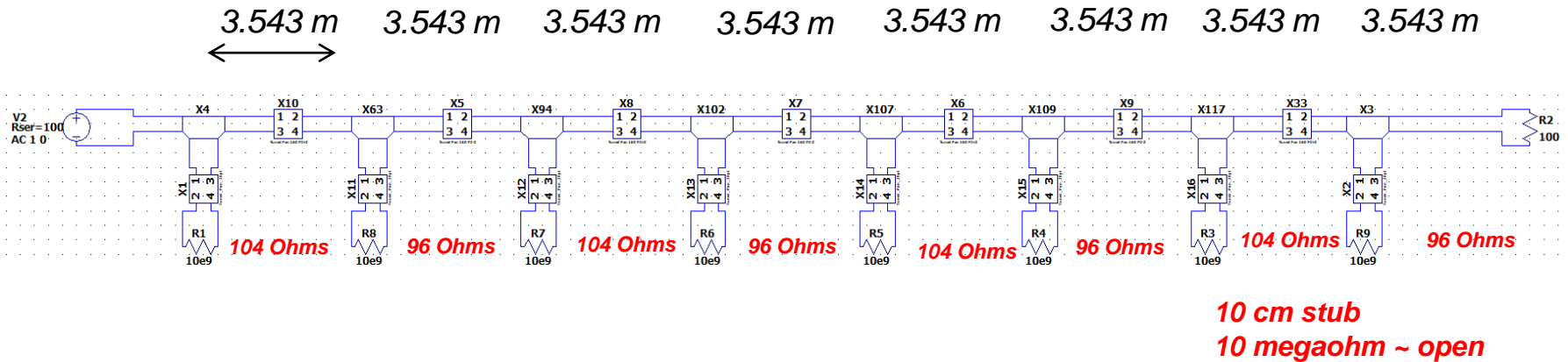
Still not Very good! But allowed

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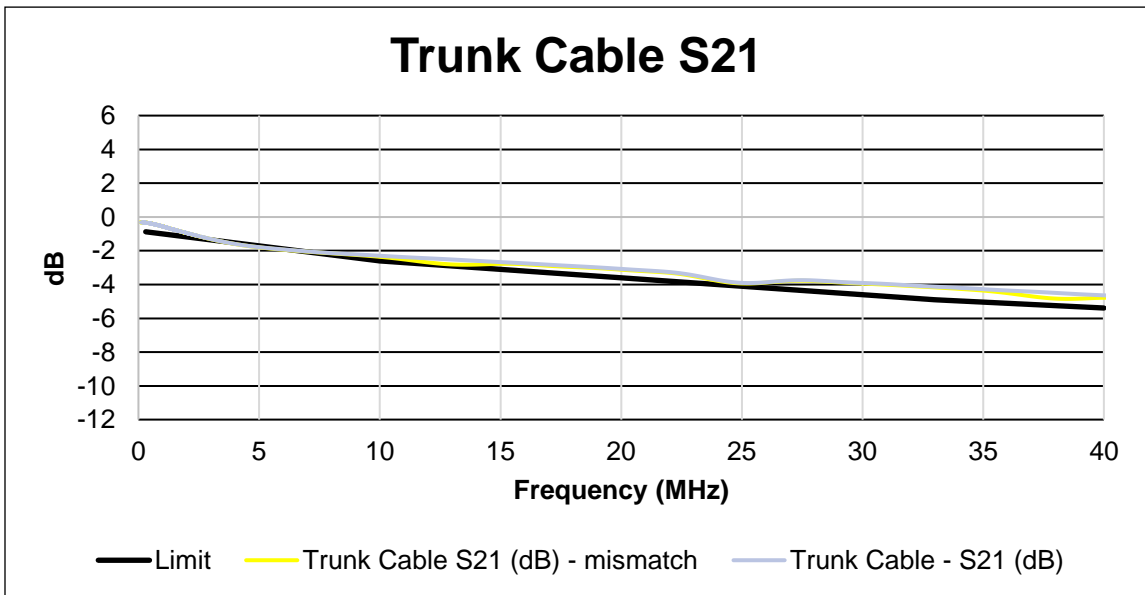
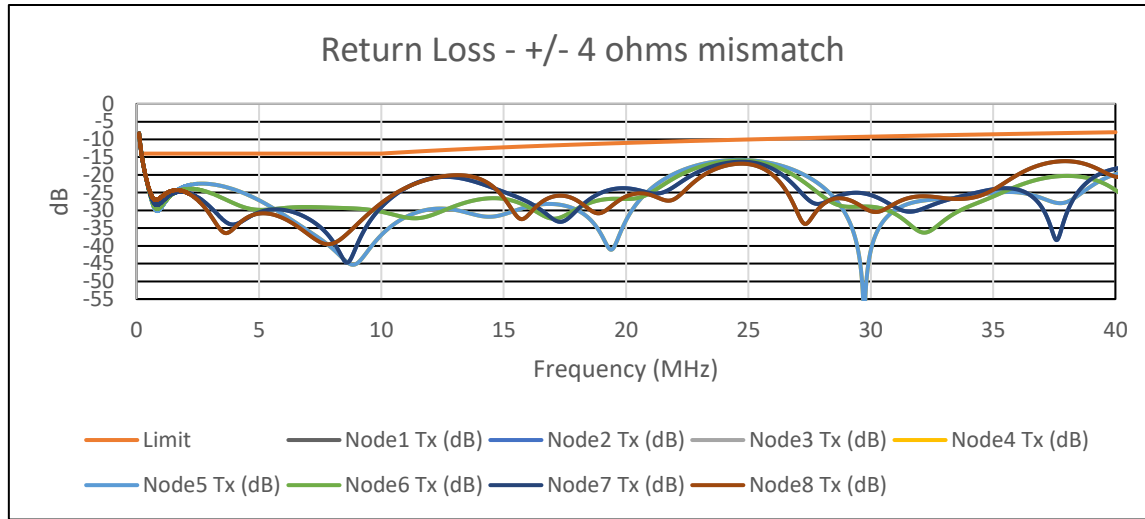
Mixing segment topologies - LT-spice model

- Mixing segment considered consisting of cable sections between MDIs with variation on cable impedances of 4 ohms; 8 nodes equally spaced 3.543 m; open circuit (without MDI or tuning inductors attached).

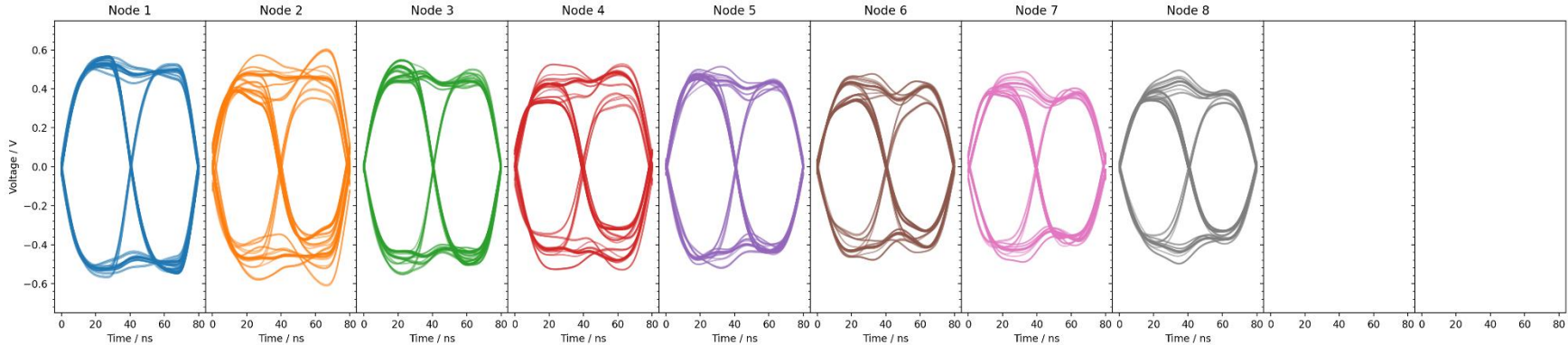
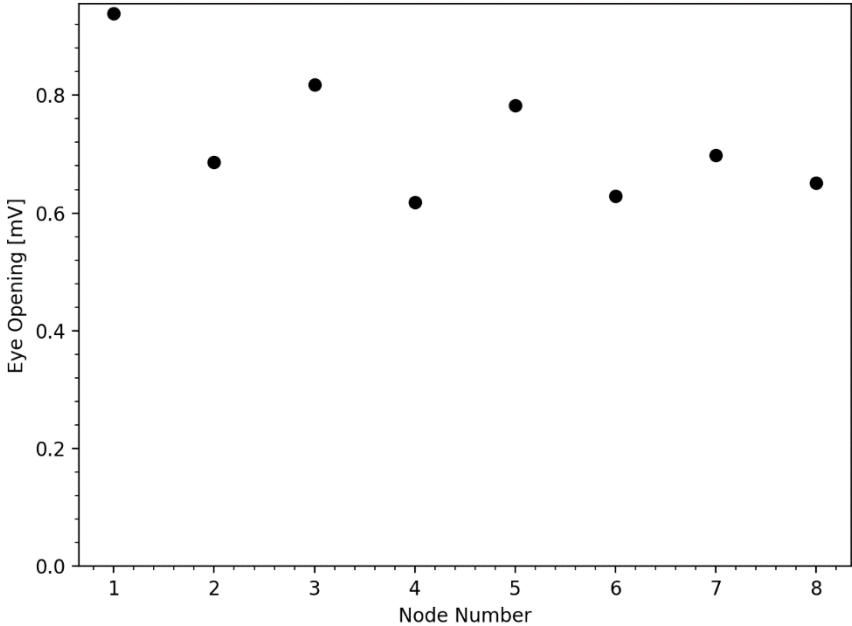
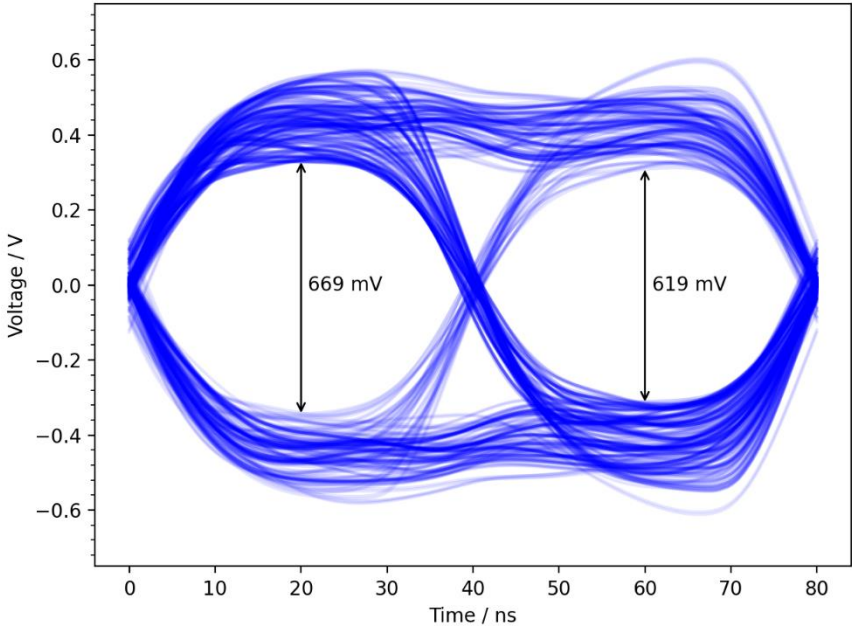


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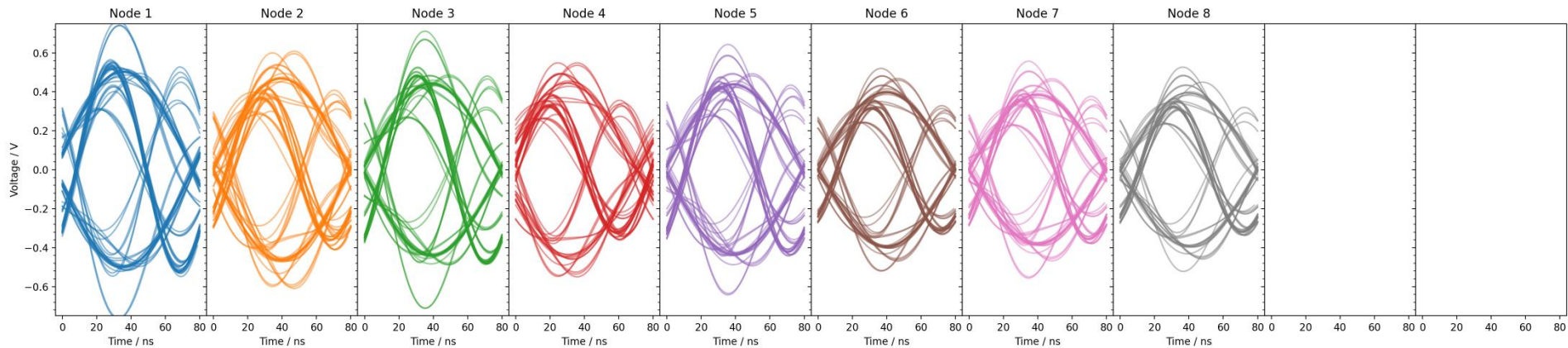
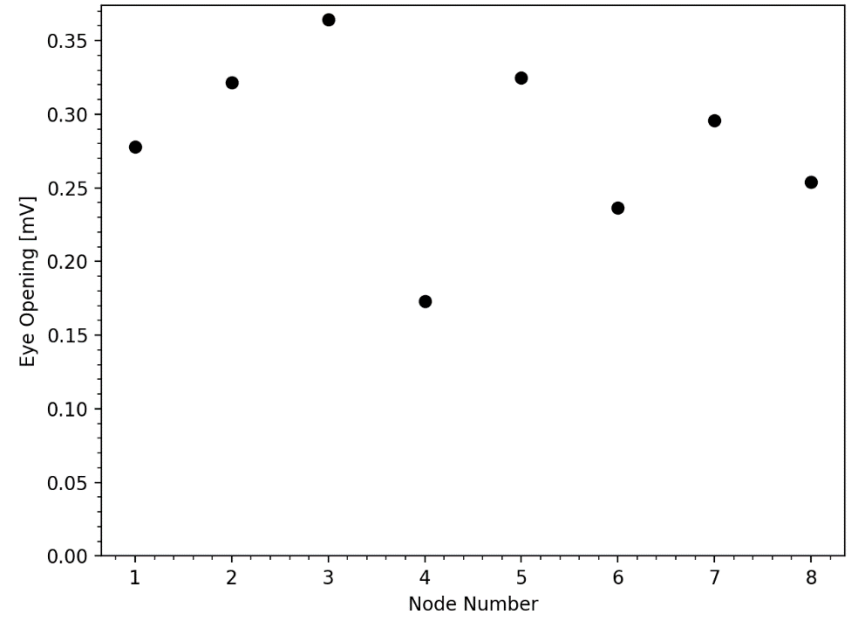
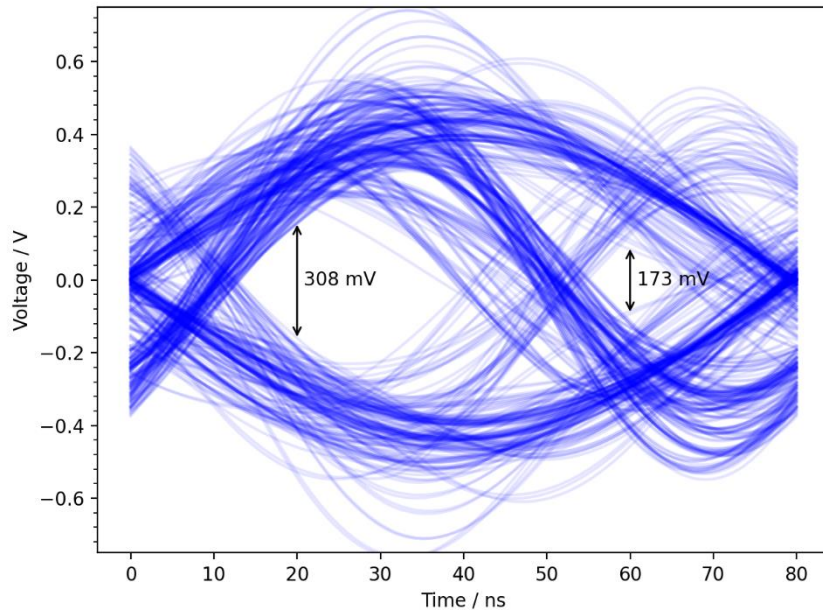
Mixing segment topologies - LT-spice model



Mixing Segment with TX Model - Typical



Mixing Segment with TX Model - Minimally Compliant



Summary

- Mixing segment modeling updated with integration of TX Model
 - Source TX Model:
https://www.ieee802.org/3/da/public/050422/beruto_3da_20220502_tx_model.pdf
- Next Steps: Mixing segment modeling updated with integration of RX Model
 - Source RX Model:
https://www.ieee802.org/3/da/public/0722/beruto_3da_20220711_rx_model.pdf