10G-CX4 Driver Compliance Mask and System Performance Simulation

1. Outline

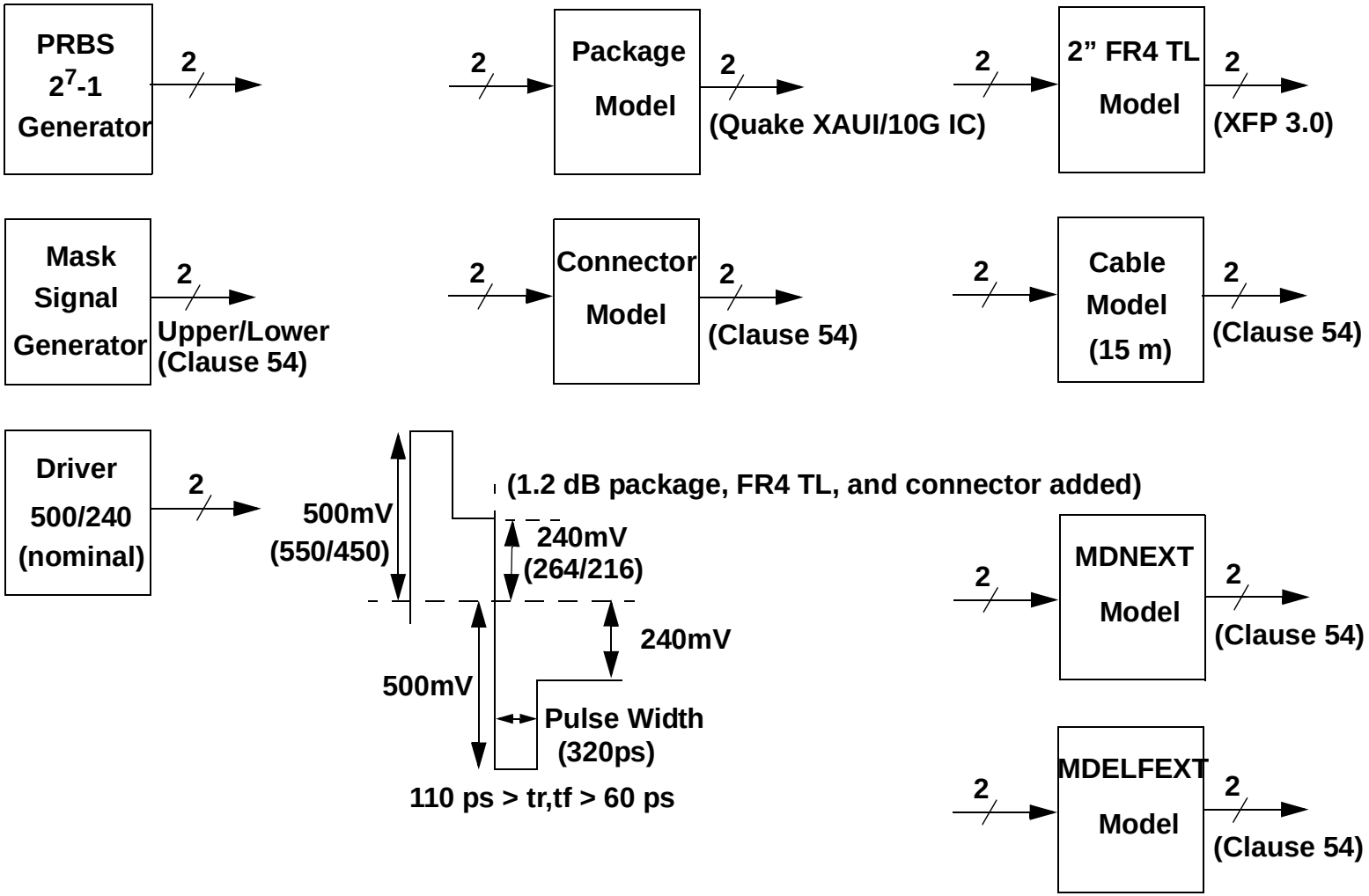
- **Simulation Environment**
- **Cable Model Frequency Response**
- **Compliance Mask Simulation Results**
- **System Performance Simulation**

  - Crosstalk Contribution
  - Transmit Jitter Contribution

- **Conclusions**

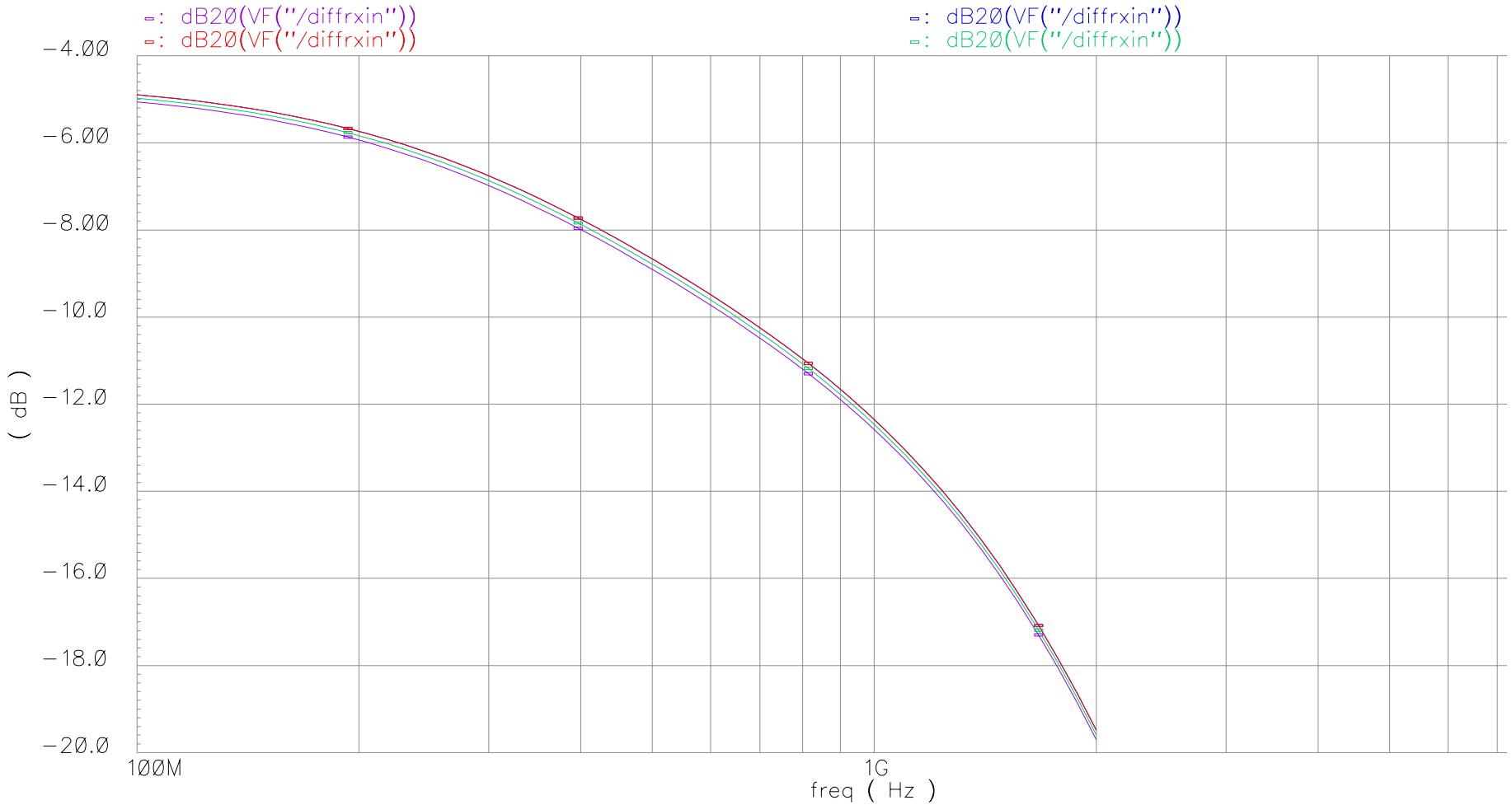
2. Simulation Environment

Figure 1. Simulation Models



3. Cable Model Frequency Response

Figure 2. Frequency Response



The cable assembly attenuation variation with the characteristic impedance (80 to 120 Ohms) is +/- 0.5 dB.

4. Compliance Mask Simulation Results

Figure 3. Transmitter Compliance Mask Simulation Environment

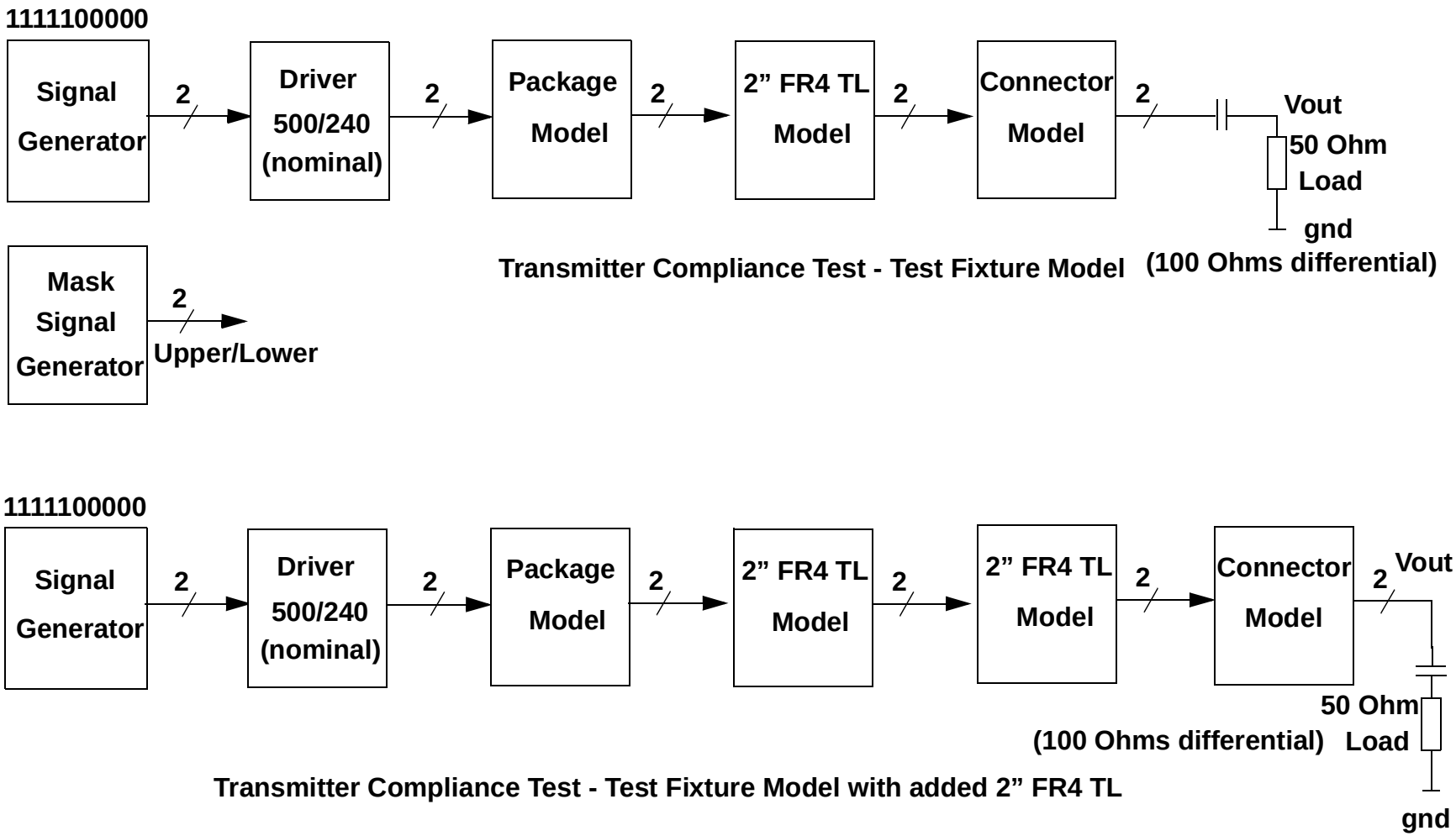
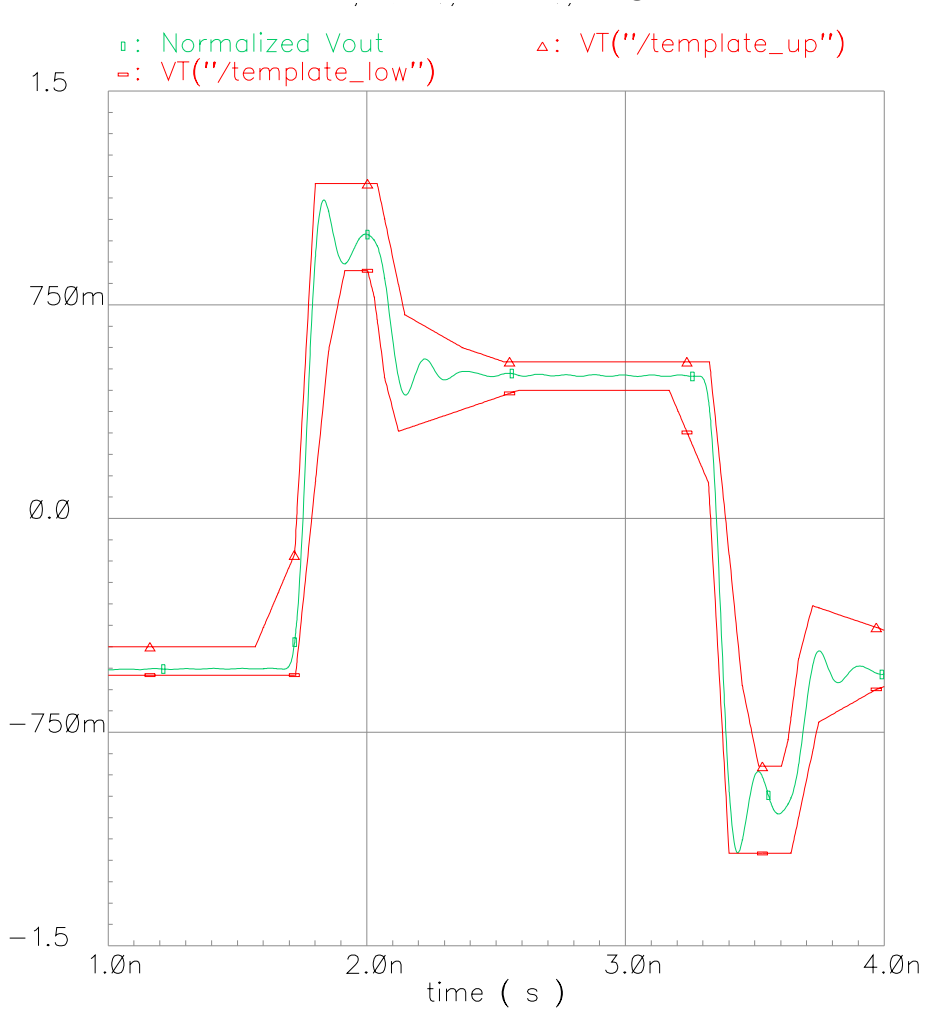
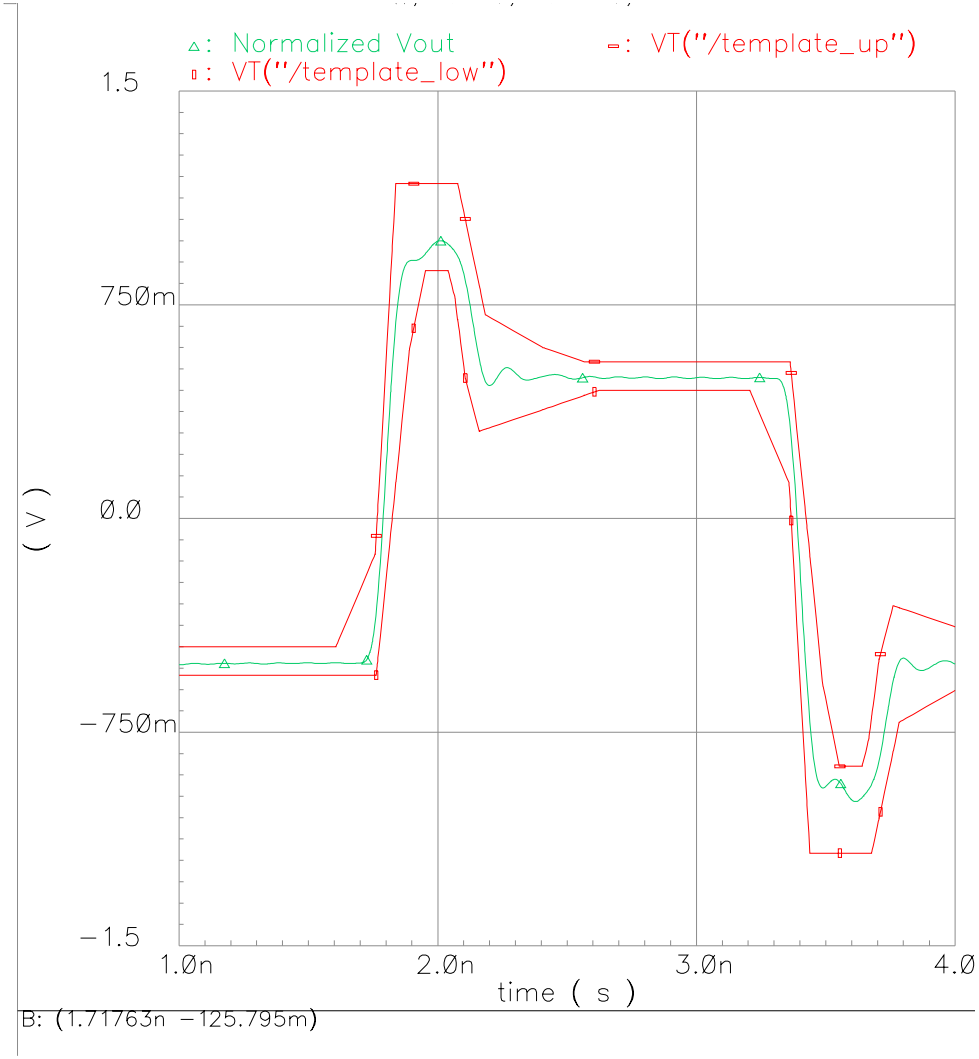


Figure 4. Test Fixture Model Simulation Results

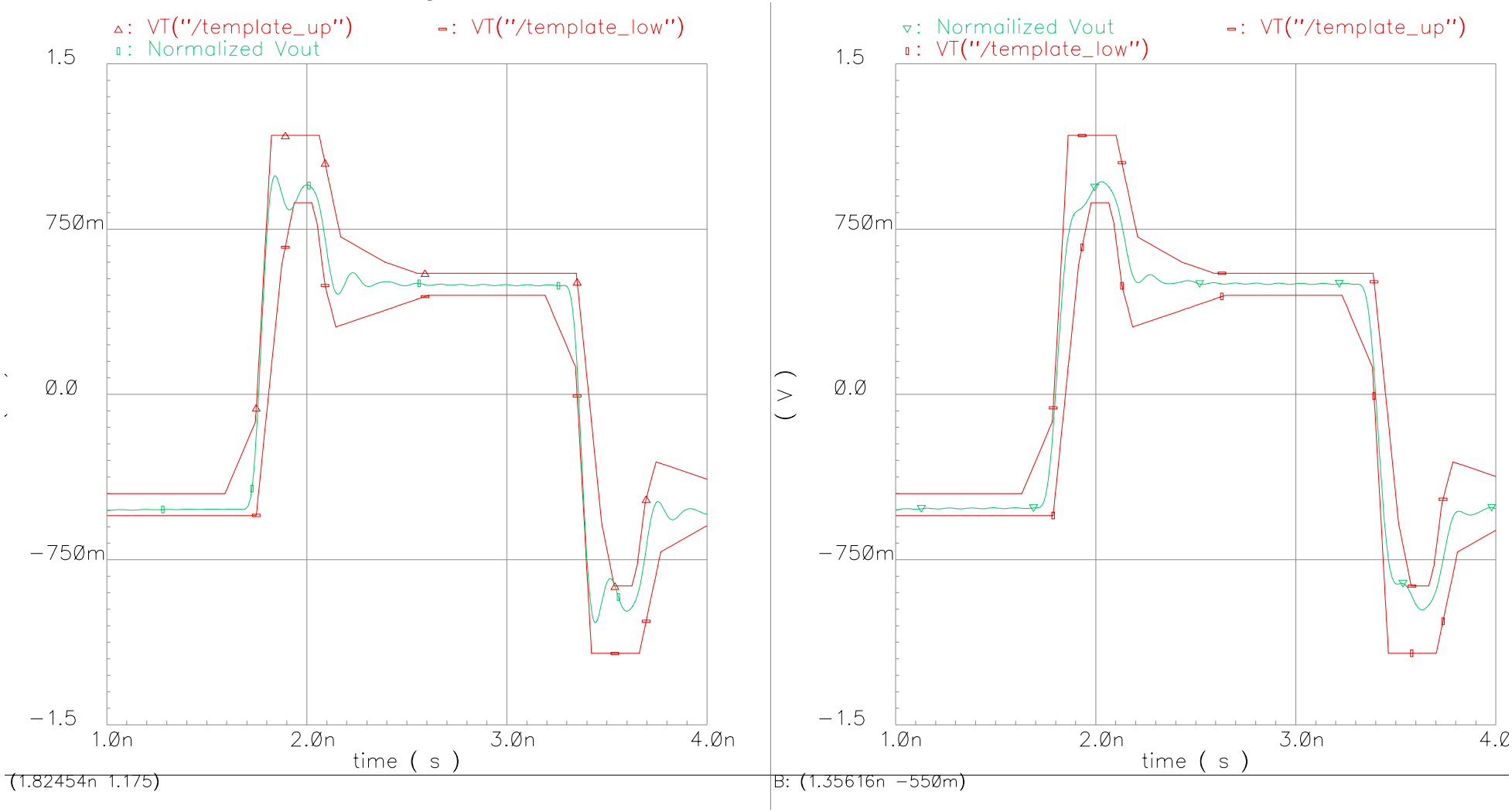


Fast (ff) process, supply voltage +5%, 0 deg. C



Slow (ss) process, supply voltage -5%, 125 deg. C

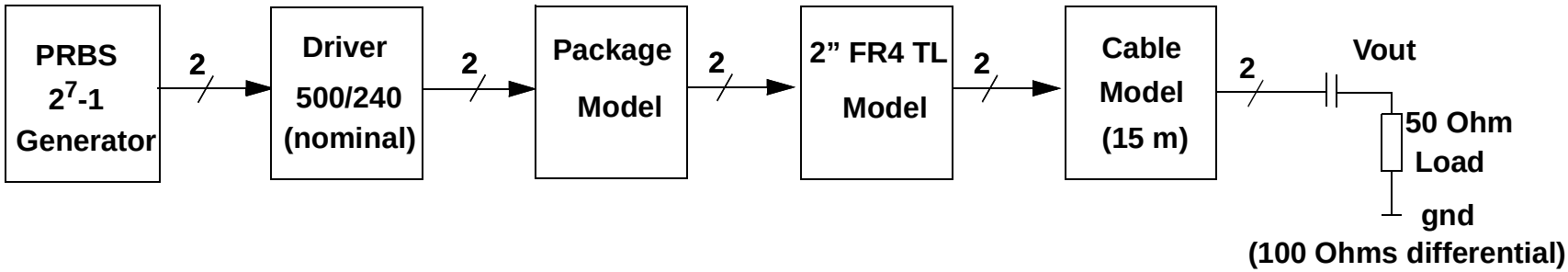
Figure 5. 4" FR4 TL Test Fixture Model Simulation Results



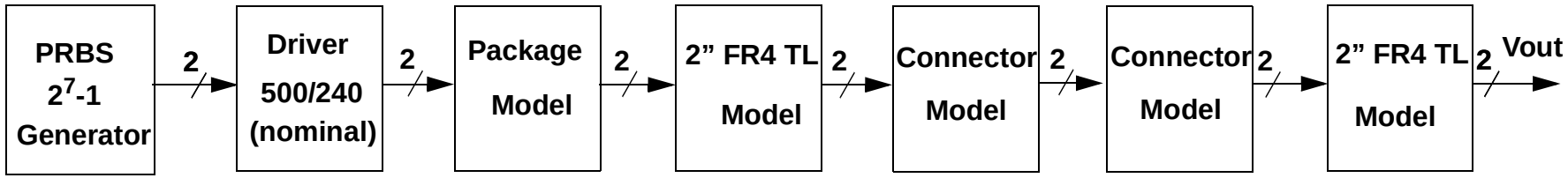
Fast (ff) process, supply voltage +5%, 0 deg. C

Slow (ss) process, supply voltage -5%, 125 deg. C

Figure 6. System Performance Simulation Environment

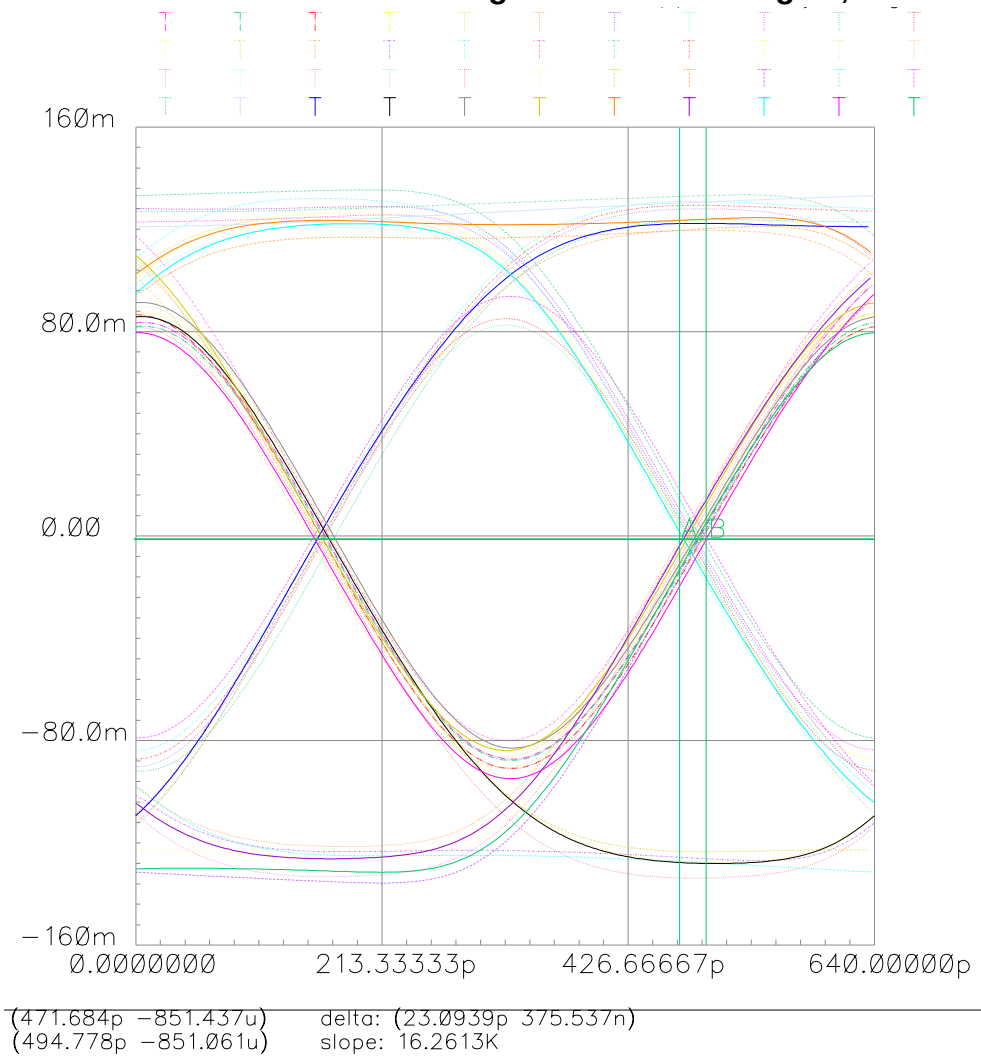


System performance simulation, 15 m worst case cable assembly model

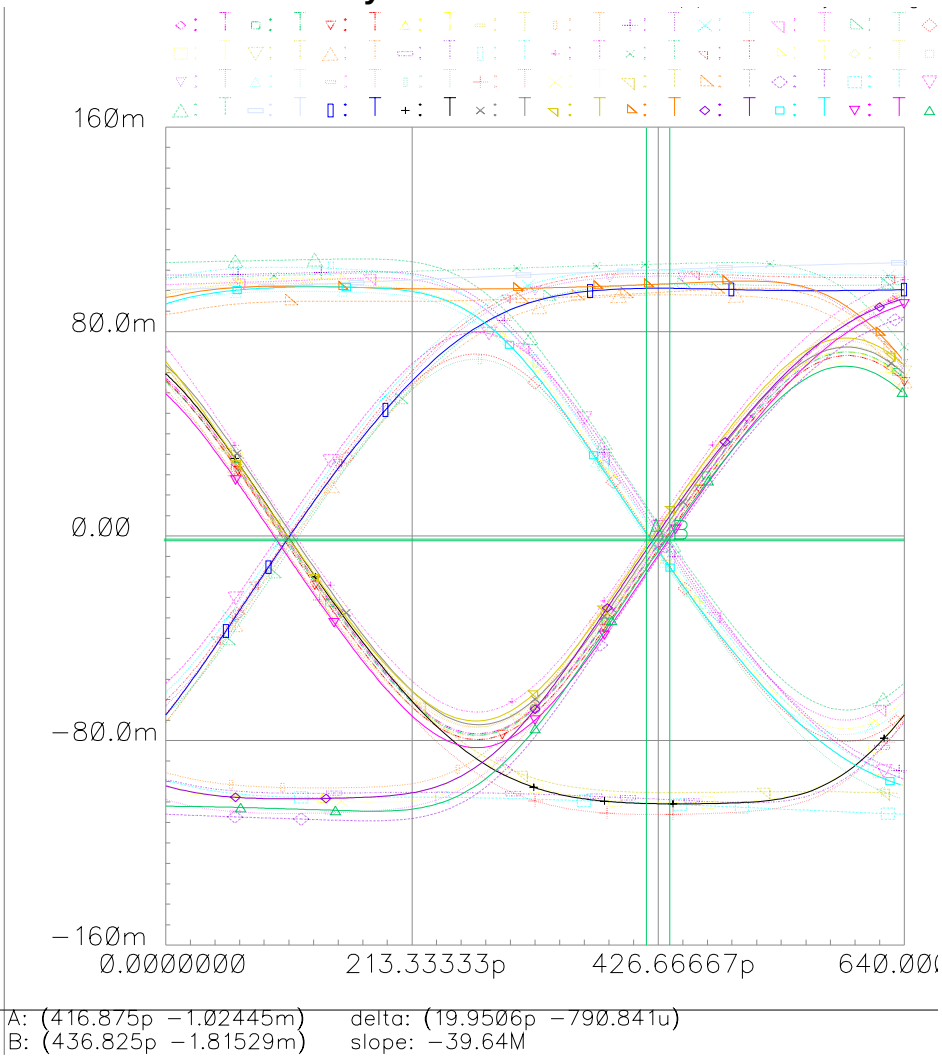


System performance "0" m cable, simulation model

Figure 7. Receiver Signal, 15 m Worst Case Cable Assembly

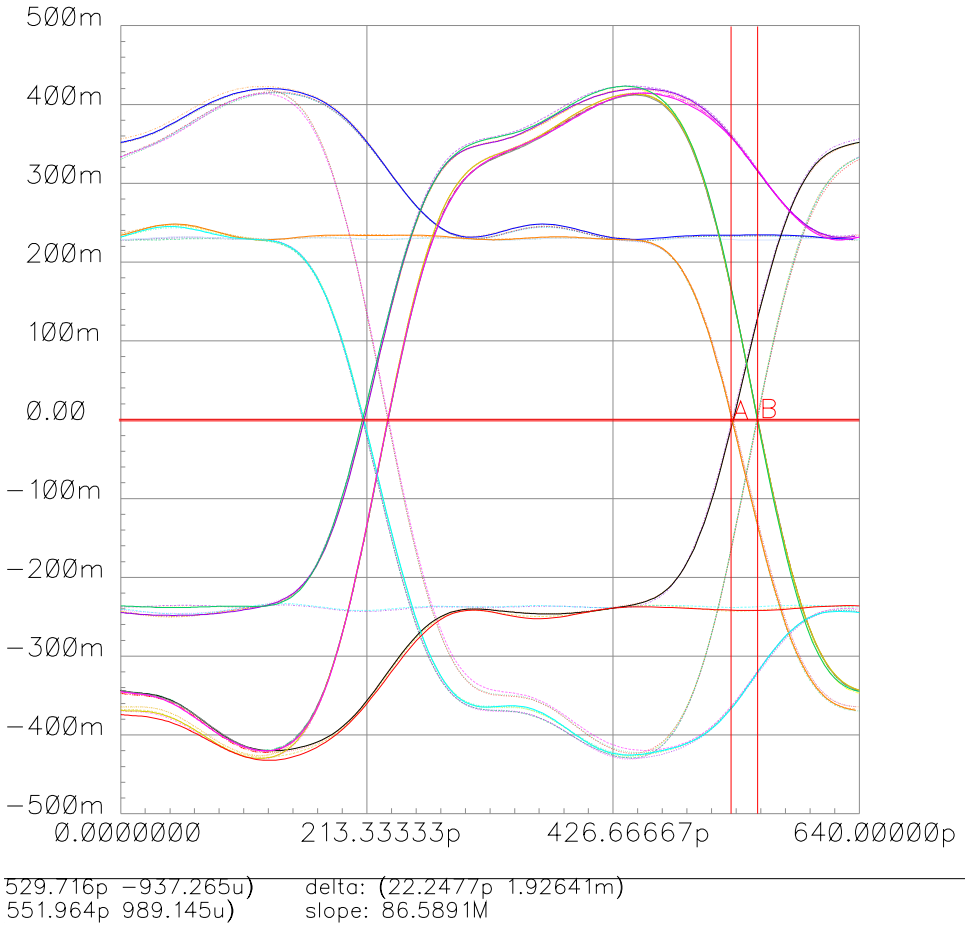


Slow (ss) process, supply voltage -5%, 125 deg. C

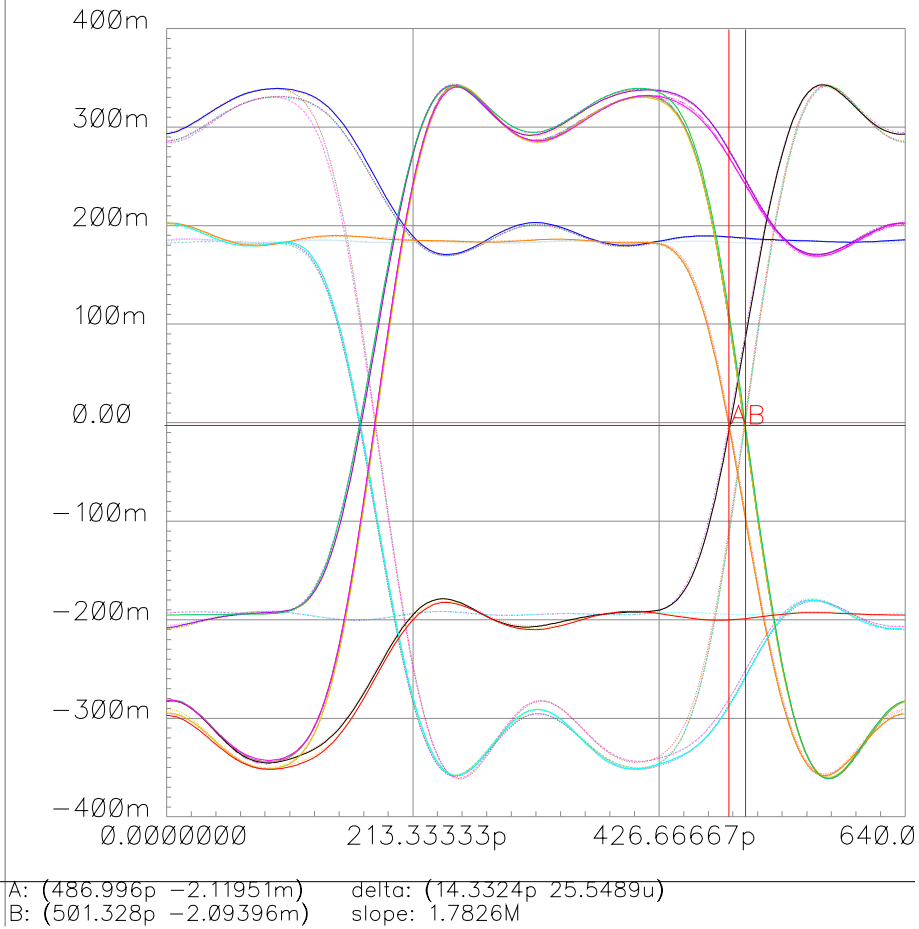


Fast (ff) process, supply voltage +5%, 0 deg. C

Figure 8. Receiver Signal "0" m Cable Assembly

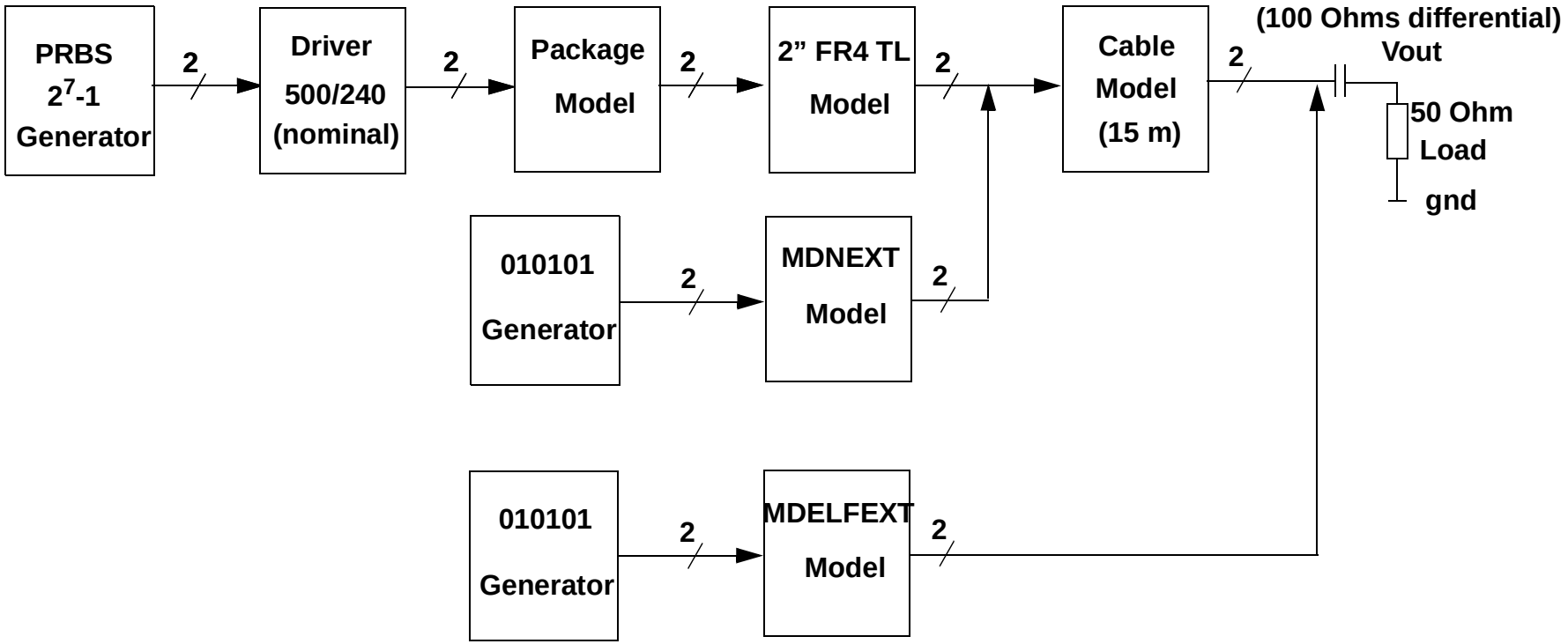


Slow (ss) process, supply voltage -5%, 125 deg. C



Fast (ff) process, supply voltage +5%, 0 deg. C

Figure 9. Simulation Environment for Crosstalk Impact



System performance simulation, 15 m worst case cable assembly model

5. Conclusions

- Models have be generated for connectors, cable assembly, and FR4 transmission lines.
- The cable assembly attenuation variation with the characteristic impedance is +/- 0.5 dB.
- The transmitter mask compliance test has small sensitivity to the length of transmission line (between 2” and 4”).
- The minimum receiver input amplitude is 140 mV pp, not including crosstalk, and 94 mV pp including MDNEXT.
- The model for MDELFEXT needs more work.
- Summary of signal degradation

Source	Worst Case Signal Amplitude [mV pp]	Worst Case Jitter [ps-pp]	Worst Case Jitter [UI]
Transmitter	450/216	112*	0.35*
Cable Assembly Attenuation and TL	140	20	0.07
MDNEXT	94	12	0.04
MDELFEXT			
Total	94	144	0.45

*Worst case total jitter at the driver input.