Phase Delay Distortion

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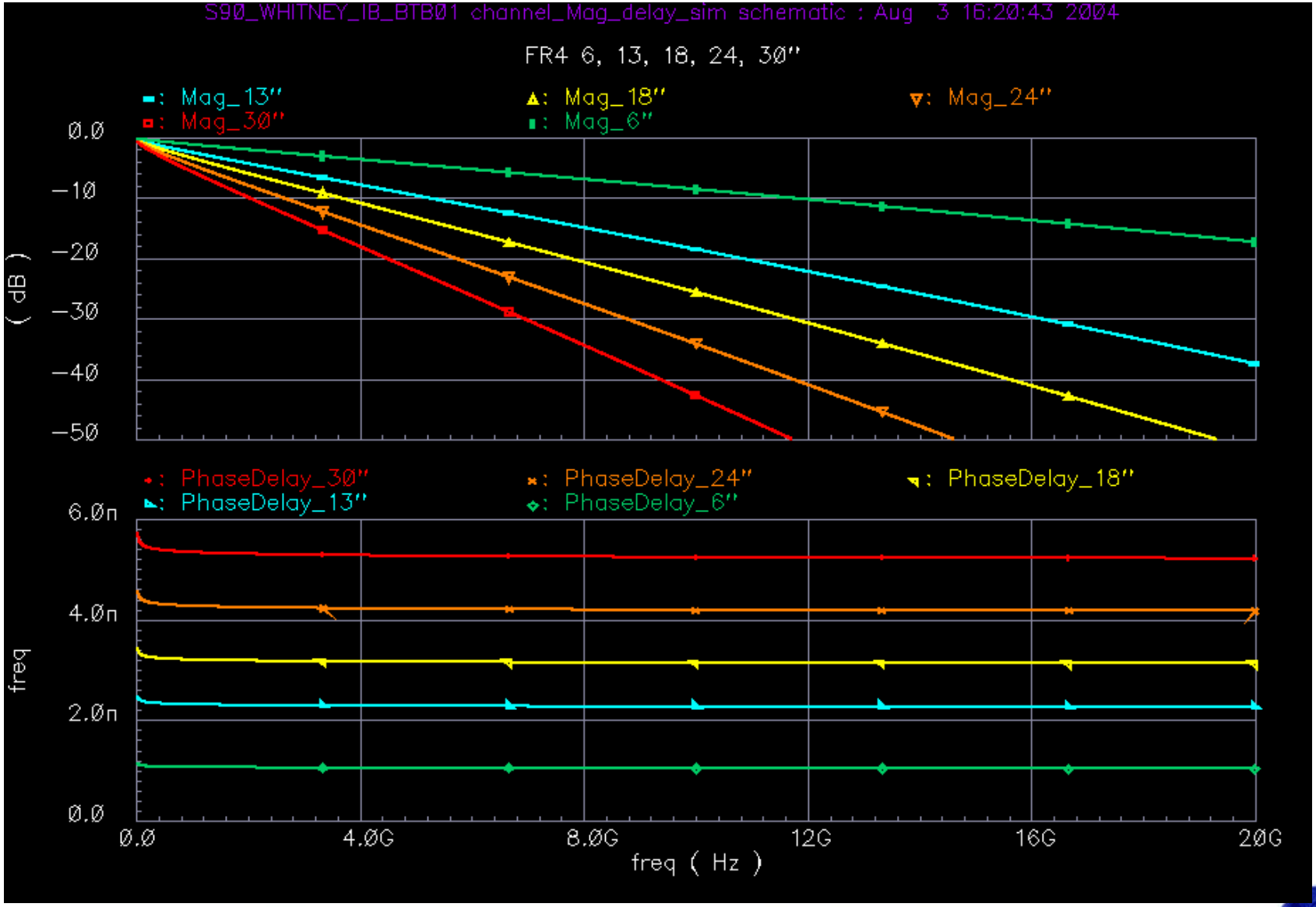
Phase Delay

- It appears the quantity of interest should be “Phase Delay” rather than “Group Delay”.

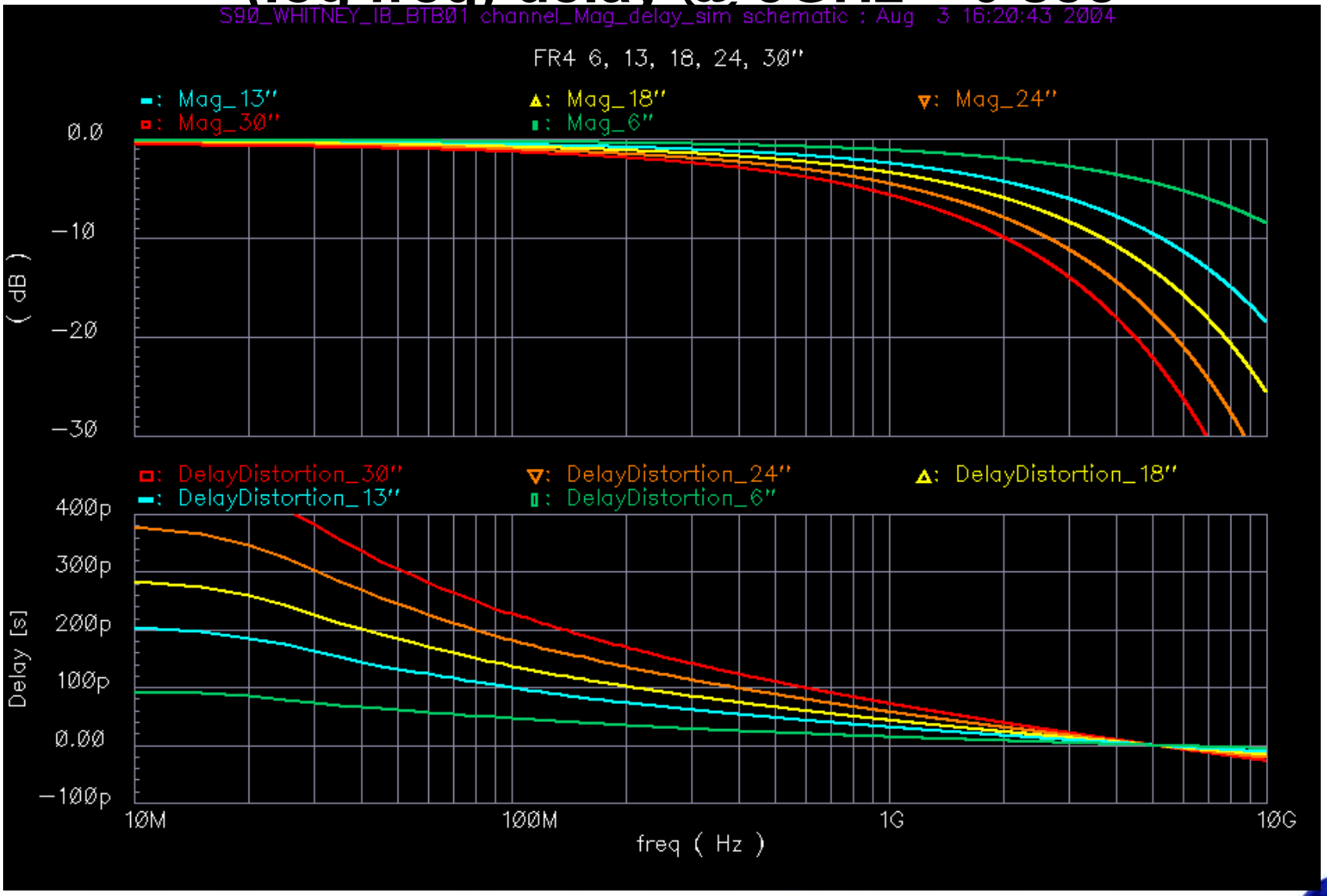
$$\text{PhaseDelay} := \frac{-\theta}{\omega} \qquad \text{GroupDelay} := -\left(\frac{d}{d\omega}\theta\right)$$

- Phase Delay is the delay of each frequency component [units sec].
- Group Delay is the delay of an envelope formed by narrow-band modulation [units sec].
- Phase Delay requires unwrapped phase, which we can get. Phase Delay may require less measurement averaging.
- Group Delay is very sensitive to frequency variation in materials and has numerical issues with derivative. Group Delay has more noise the finer the measurement resolution. Can measure Group Delay needing only wrapped phase.

FR-4 Mag and PhaseDelay (linear freq)



FR-4 Mag and PhaseDelayDistortion (log freq) delay @ 5GHz = 0 sec



PhaseDelayDistortion 109ps 500MHz to 5GHz