

EECS240 – Spring 2010

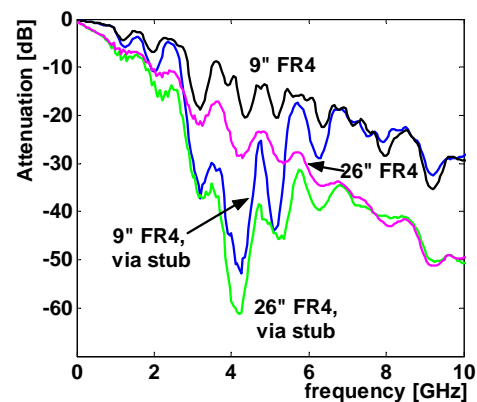
Lecture 19: High-Speed Filter Design



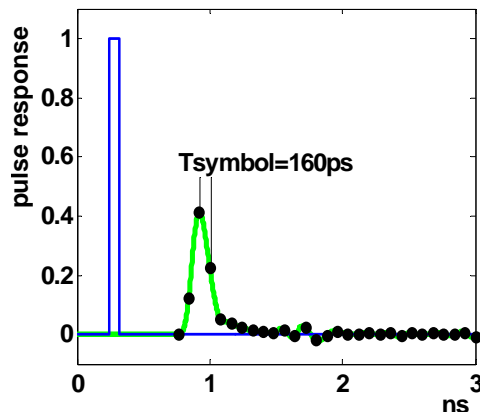
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Link Channels and ISI

- 20-30dB loss at 3GHz
- How bad is that?
- Two related issues:
 - (1) Noise and min. signal amplitude
 - (2) Intersymbol interference

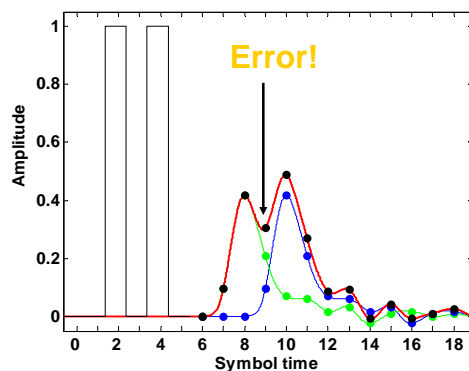


Inter-symbol interference (ISI)



- Channel is low pass
 - Short TX pulses get spread out

Impact of ISI



- Middle sample is corrupted by 0.2 trailing ISI (from previous symbol) and 0.1 leading ISI (from next symbol)
- Total ISI: 0.3 total ISI
 - Middle symbol incorrectly detected

Equalization

- **ISI is proportional to TX swing**
 - Generally can't just boost signal to overcome it
- **Solution: Equalization**
 - If channel applies filter $H(s)$
 - Pass the signal through another filter $H^{-1}(s)$

Equalization cont'd

- **Link channel basically low-pass**
 - Equalizer boosts high frequency, attenuates low frequency

Equalizer Requirements

Equalizer Requirements cont'd

Equalizer Options and Limitations

RX Equalizer

RX Equalizer Implementations

RX Equalizer Implementations

RX Equalizer Implementations

RX Equalizer Implementations

Programmability

Aside: Switched Cap. Resistor

Aside: Switched Cap Low-Pass Filter