Transmission Channel Basics

TI Precision Labs

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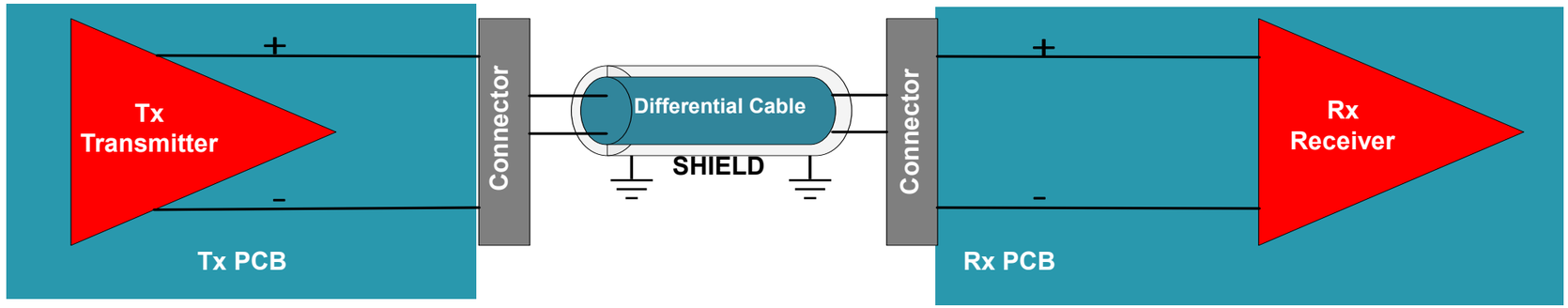
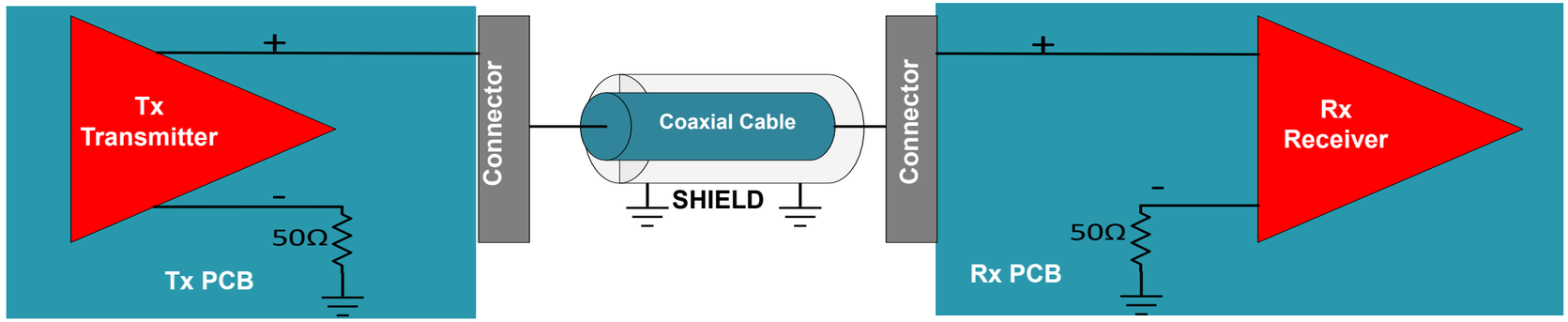
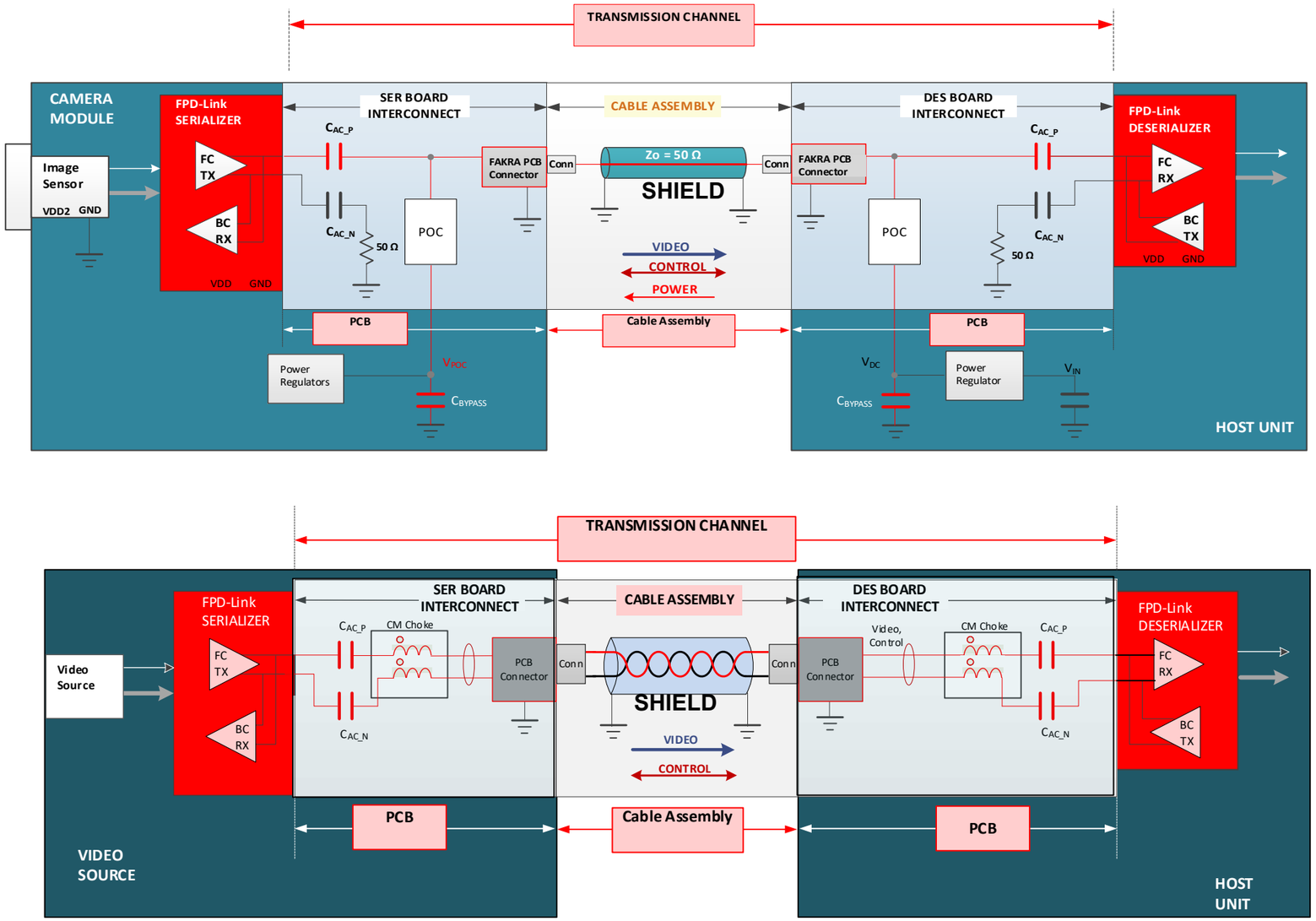
Presented by Casey McCrea

Signaling topologies

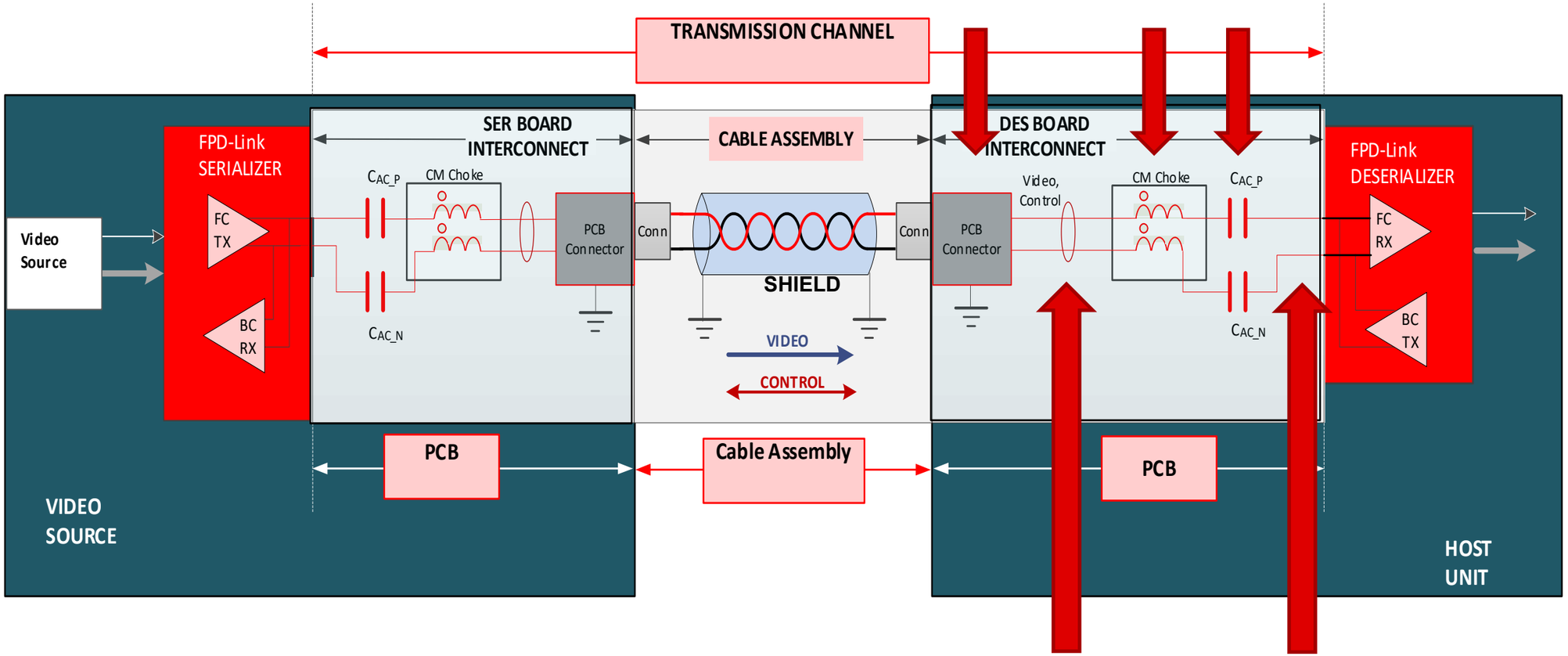




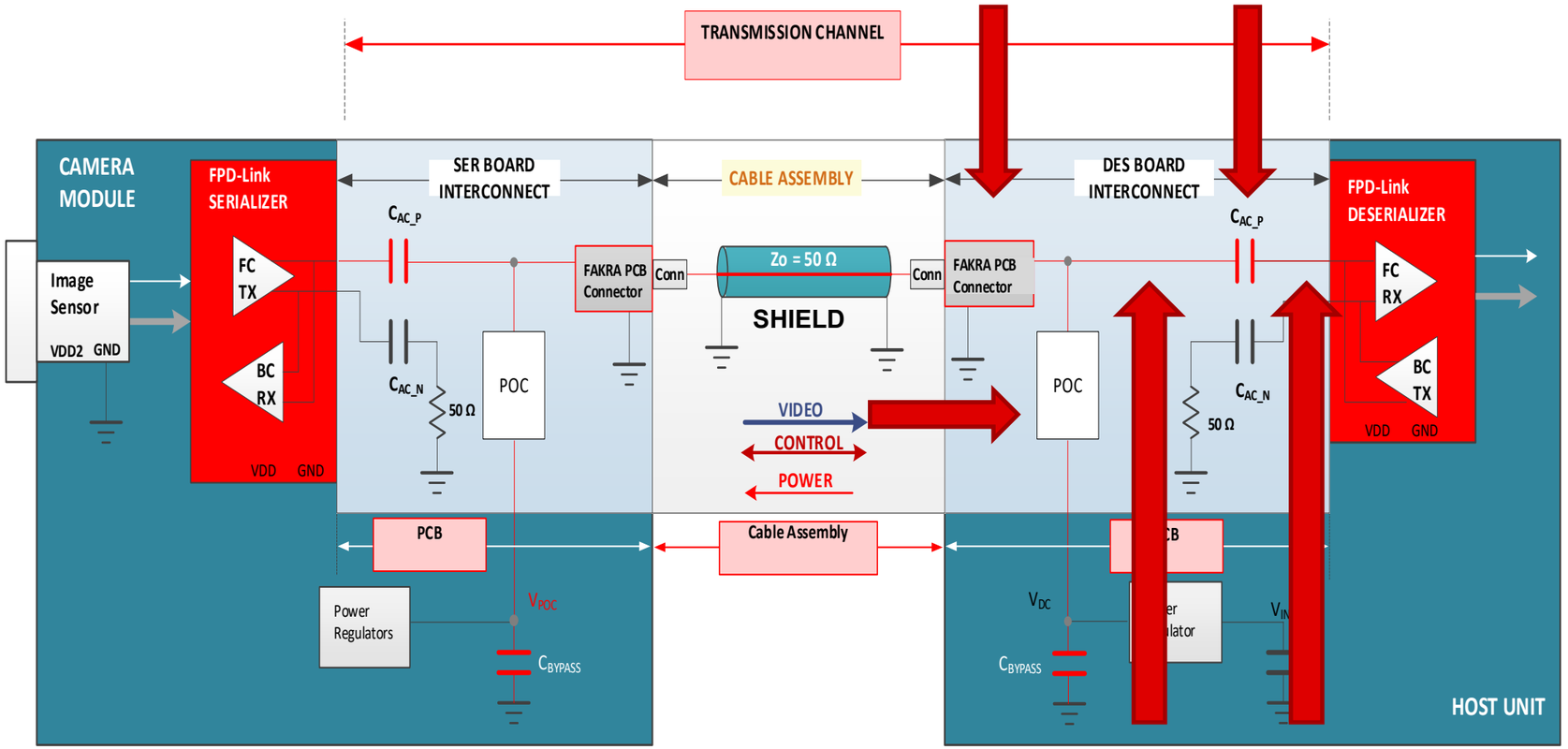
FPD-Link III signaling topologies



Transmission channel – differential signaling

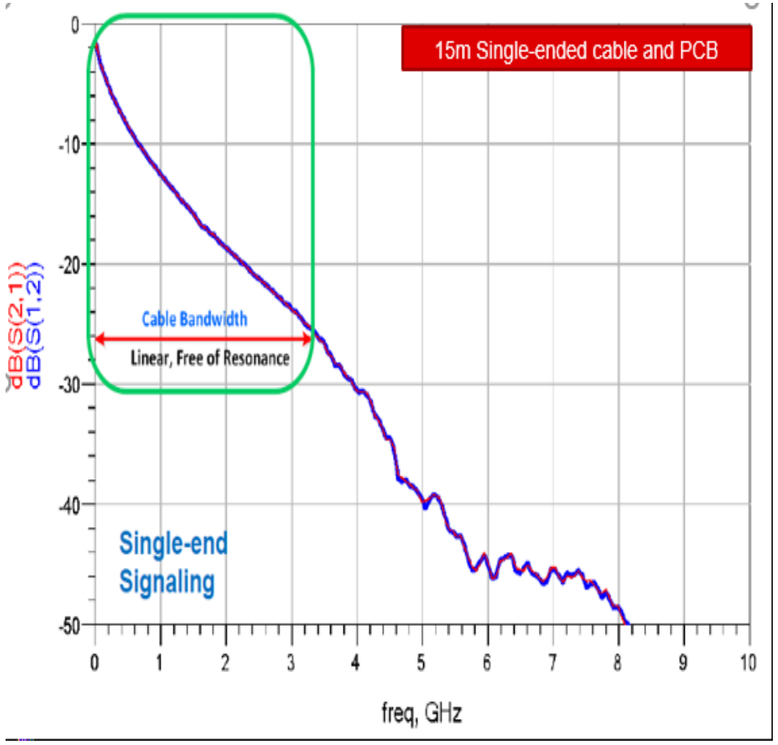


Transmission channel – coaxial signaling

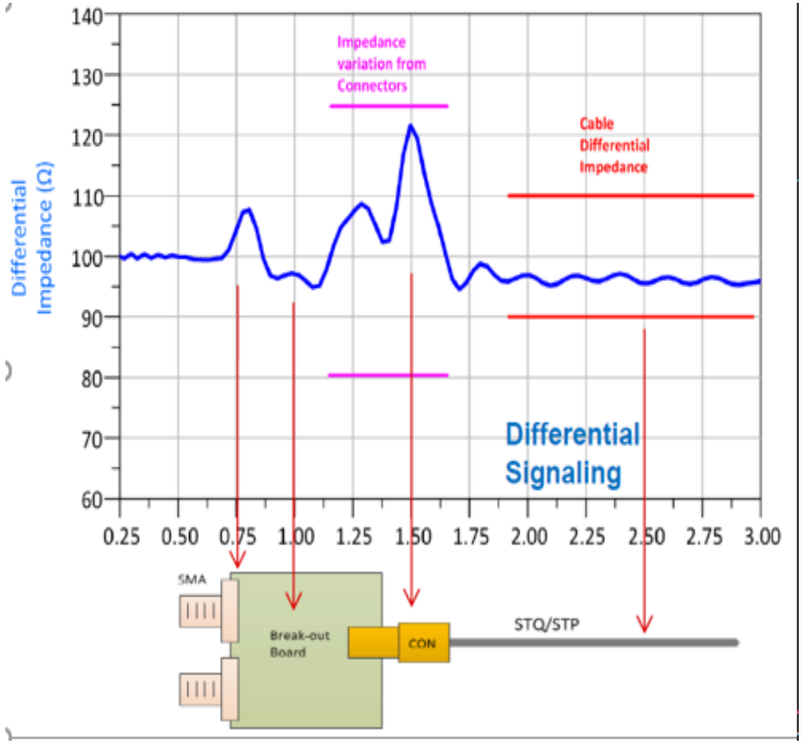


Key transmission channel parameters

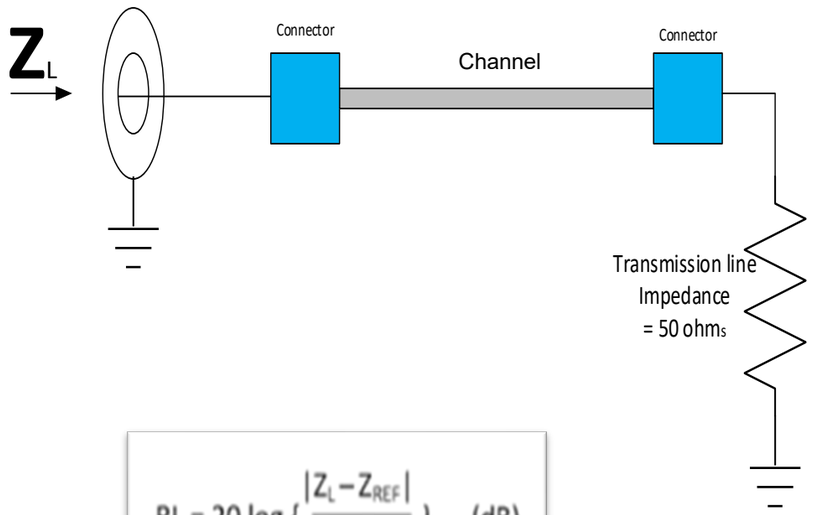
- **Insertion loss**



- **Impedance mismatch**

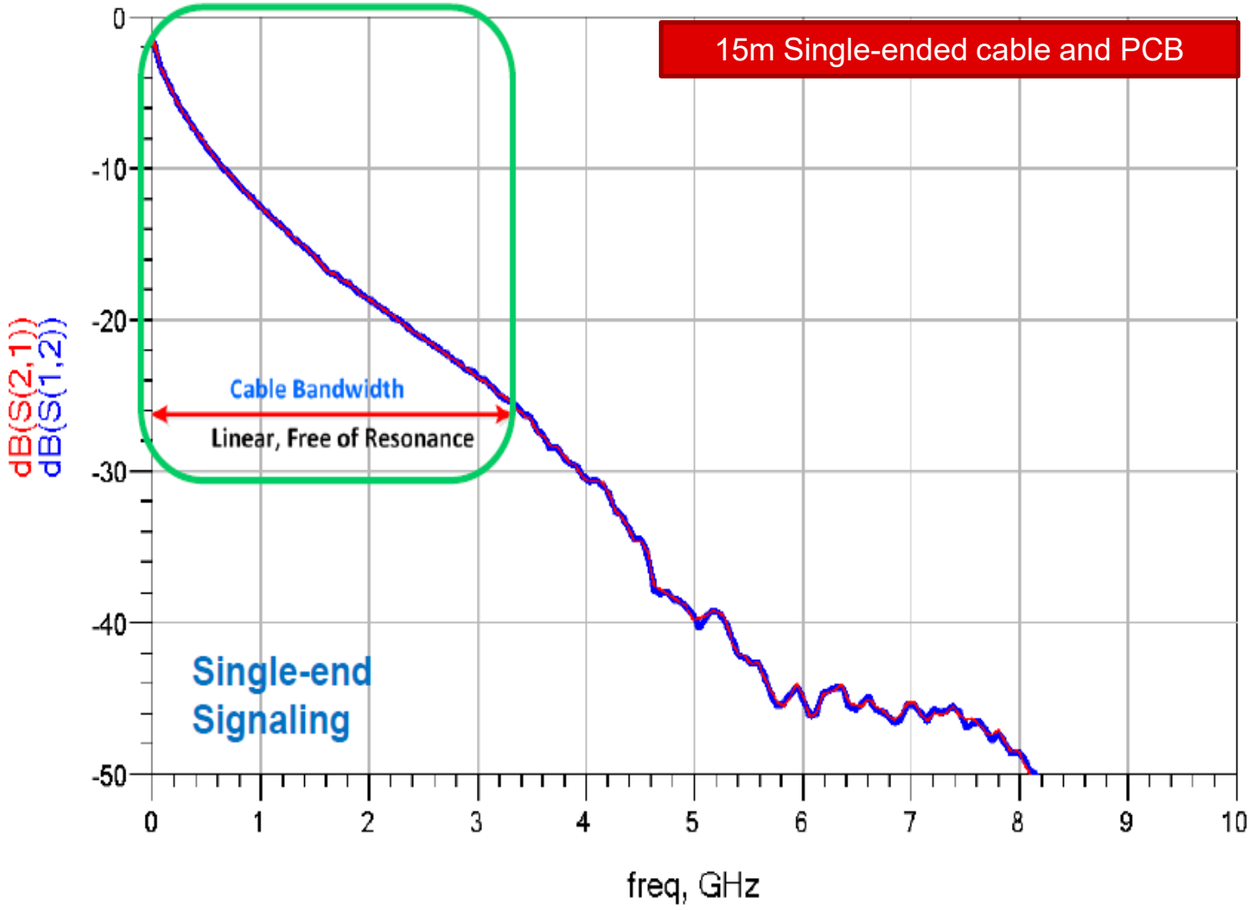


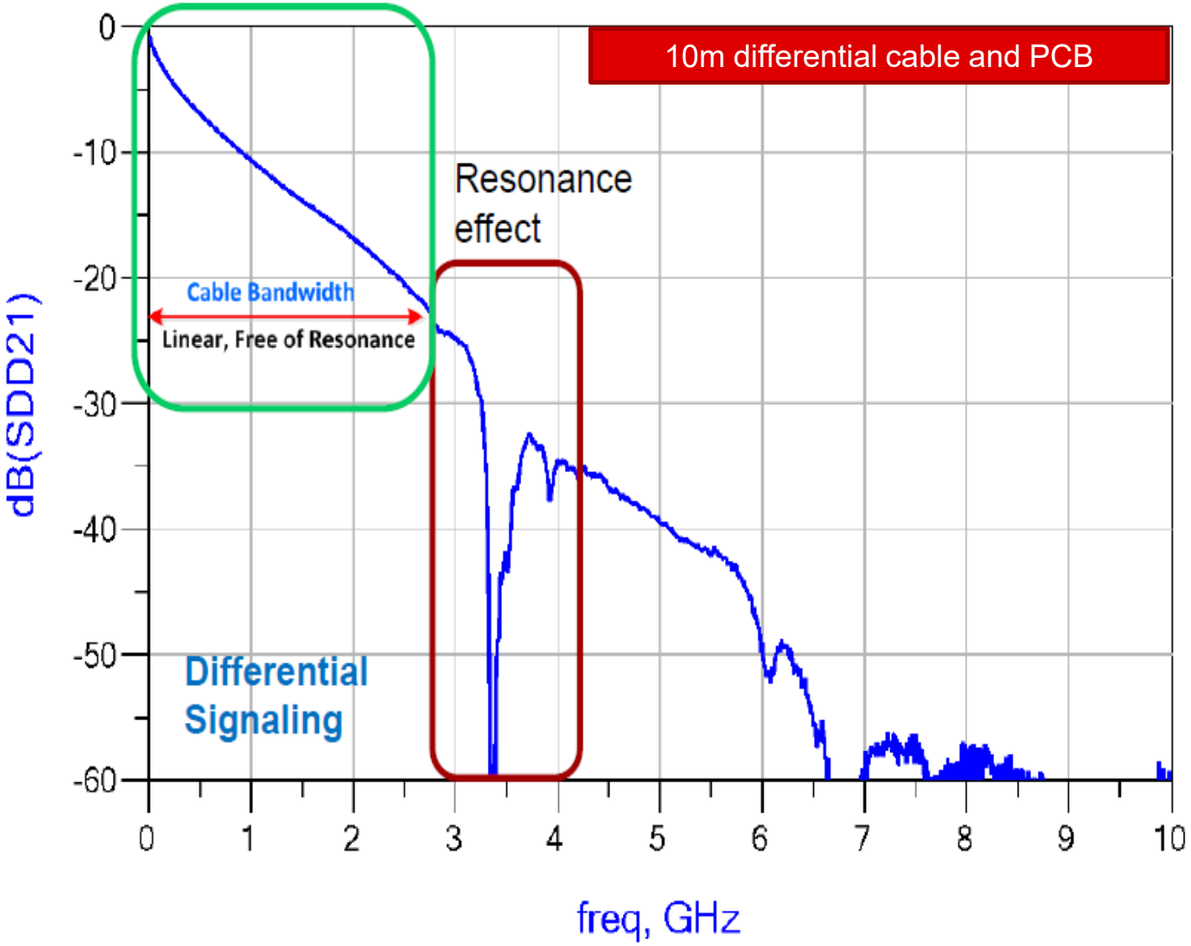
- **Return loss**



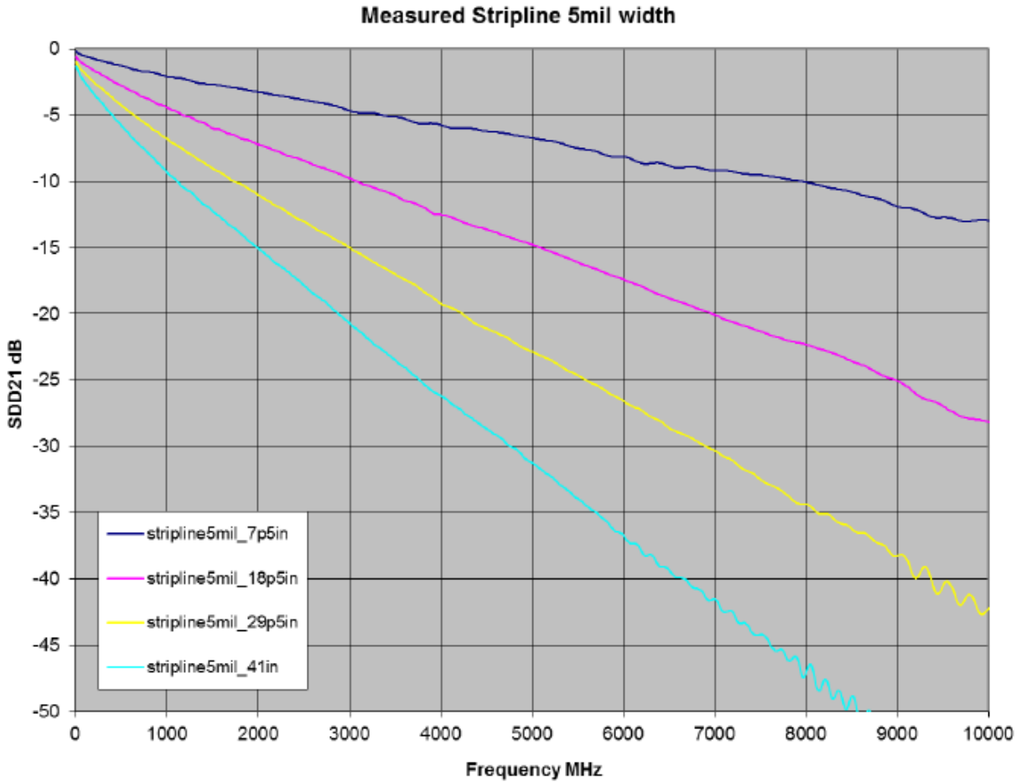
$$RL = 20 \log \left\{ \frac{|Z_L - Z_{REF}|}{Z_L + Z_{REF}} \right\} \ldots (dB)$$

Channel parameter – insertion loss

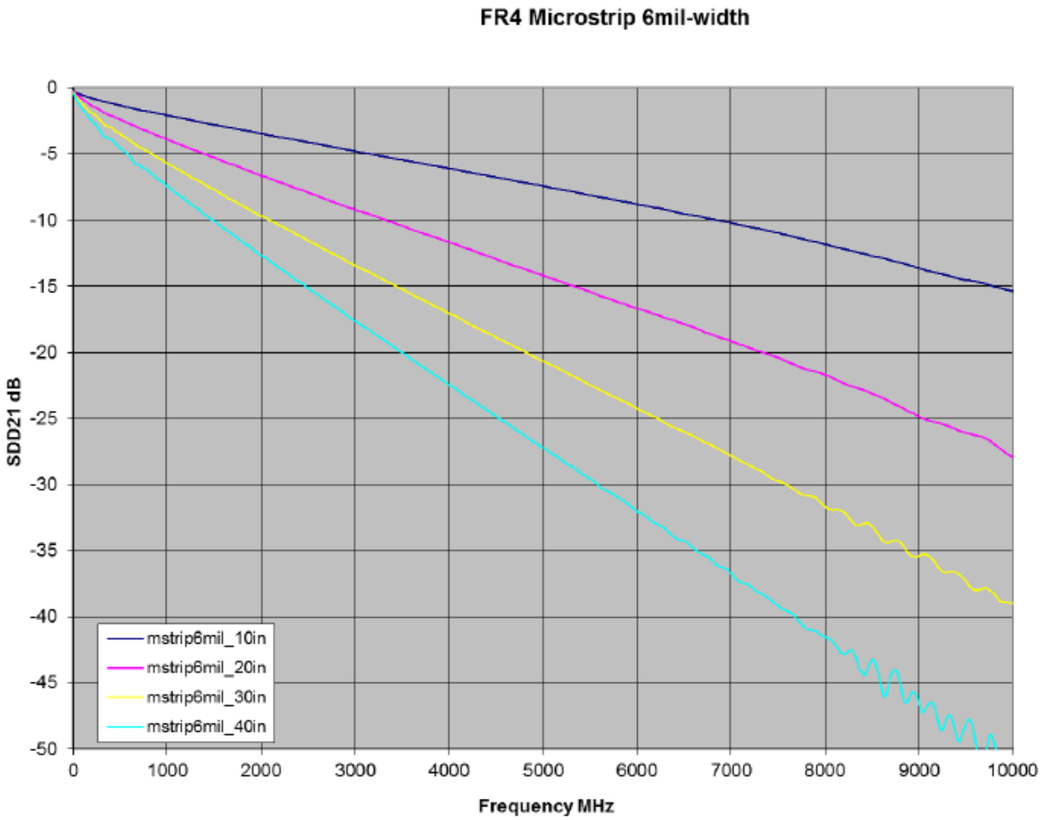




Insertion loss from PCB traces

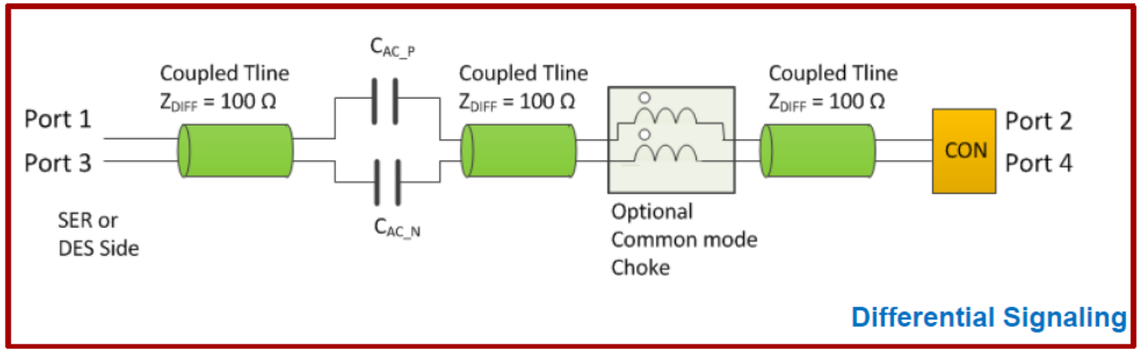


- A 5-mil FR4 stripline has about 0.37 dB/inch insertion loss at 2 GHz

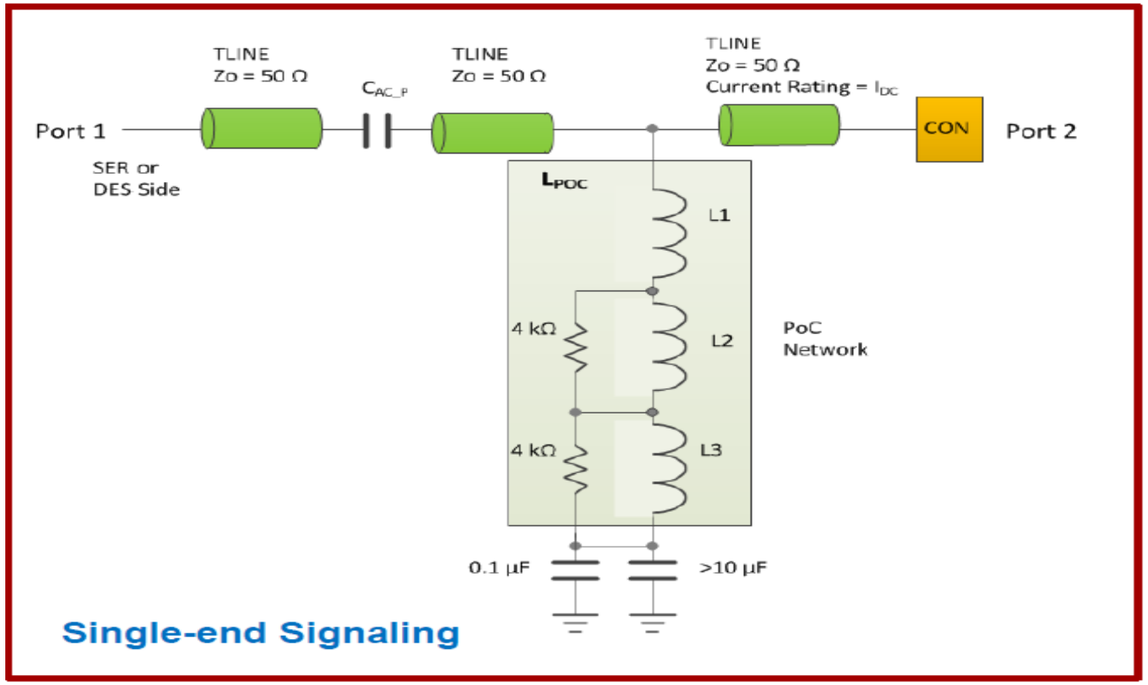


- A 6-mil FR4 stripline has about 0.31 dB/inch insertion loss at 2 GHz

SER-board and DES-board elements



transmission loss due to SER-board
+ transmission loss due to cable
+ transmission loss due to DES-board
total channel transmission loss



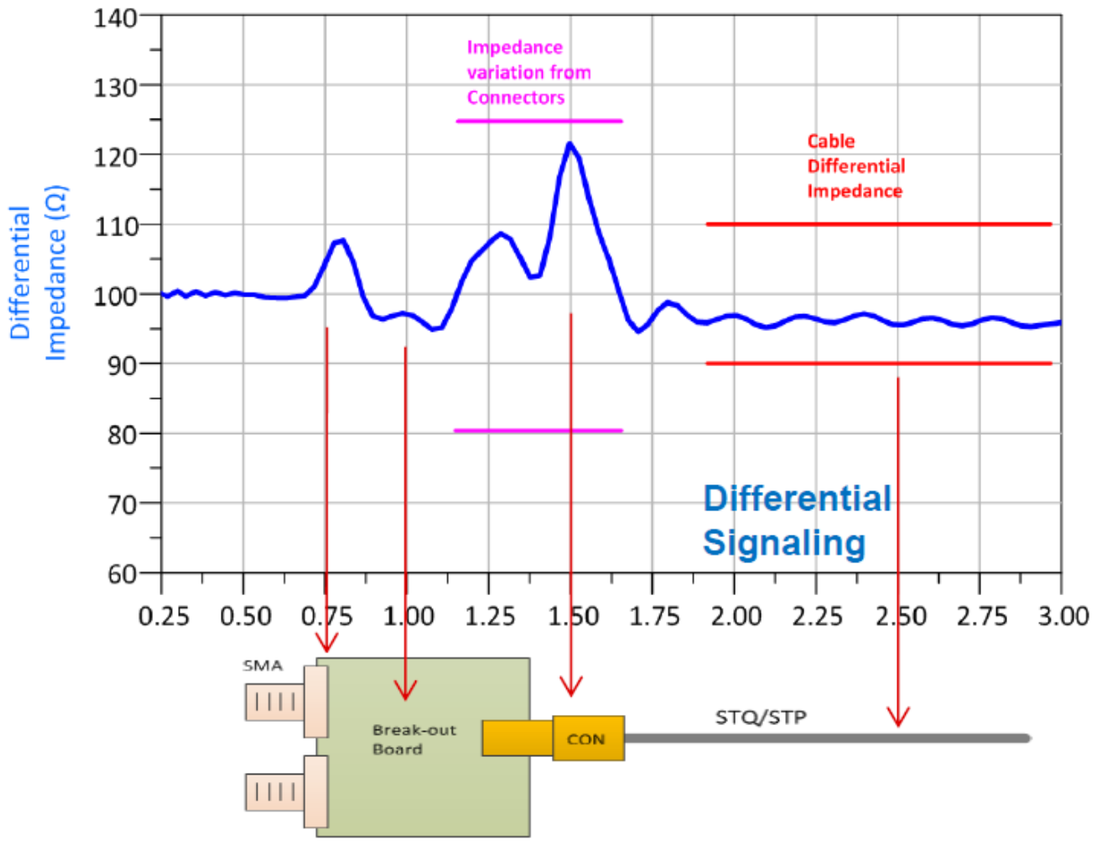
- Transmission loss of SER-board and DES-board are usually small compared with that of the cable

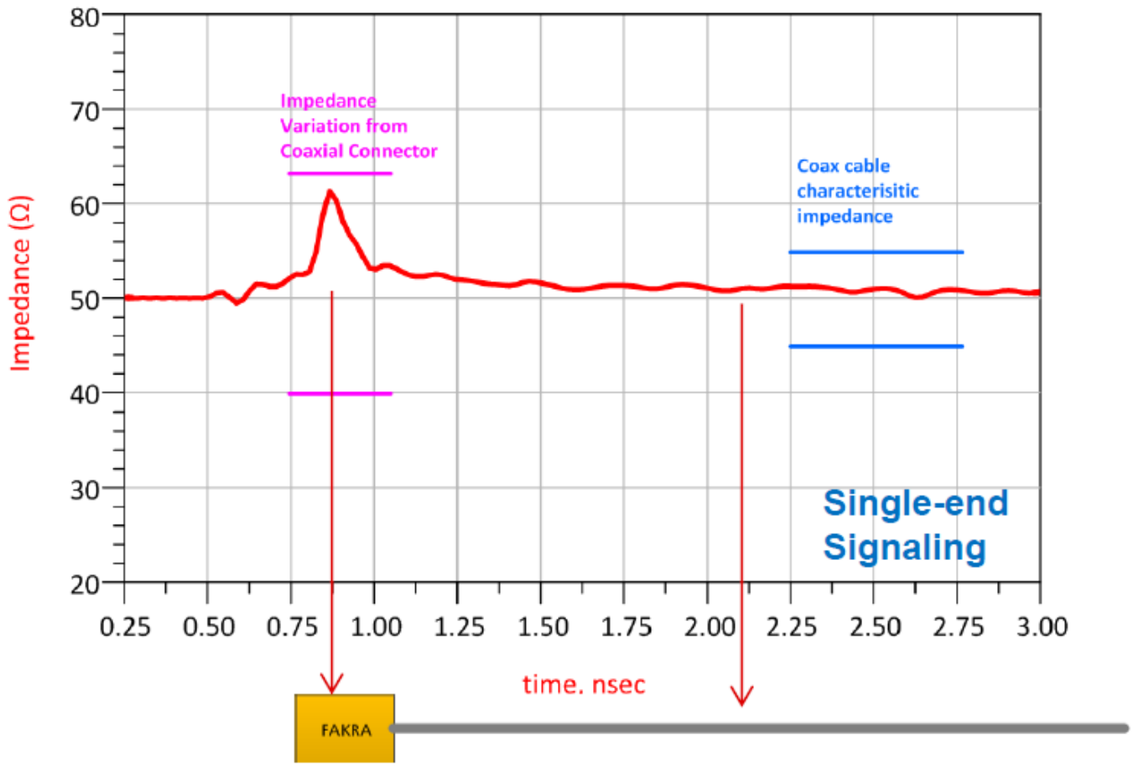
Estimating channel budget

Compare the Total Transmission Channel loss with the Channel Requirement Specifications of FPD-Link III SER-DES chipset.

Parameters	Description	Insertion Loss at 1.5 GHz (3 Gbps)
Common mode choke	DLW21SZ900HQ2.s4p	0.4 dB
FR4 board trace 2-inch, 6-mil width	0.26 dB/inch 6-mil 100-Ω coupled microstrip	0.52 dB
Channel-SER		***0.92 dB***
Channel-DES	Assume same as Channel-SER	***0.92 dB***
Channel-Cable	10m STQ w/HSD connector on both ends, measured	***14 dB***
Total Channel	Channel-SER + Channel-Cable + Channel-DES	**15.84 dB**

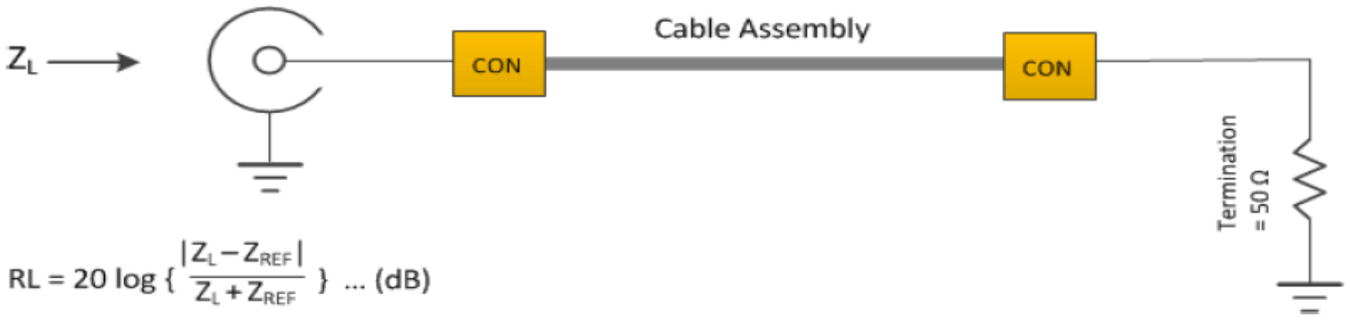
Channel parameter – characteristic impedance





- Differential signaling: 100 Ω ± tolerance
- Single-end signaling: 50 Ω ± tolerance

Channel parameter – return loss



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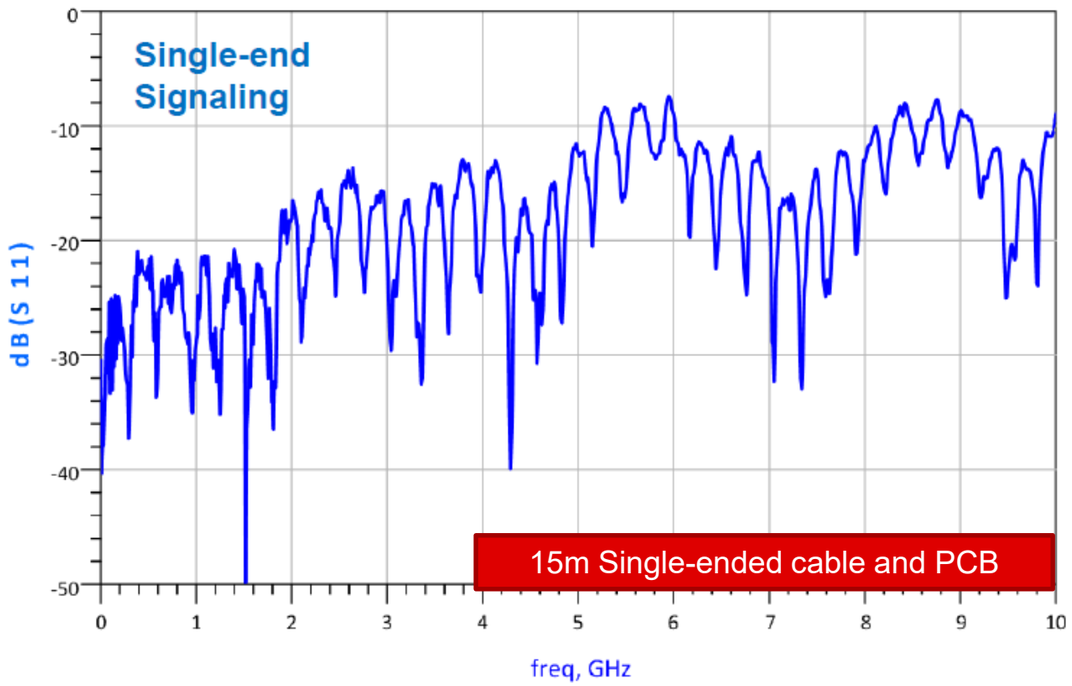

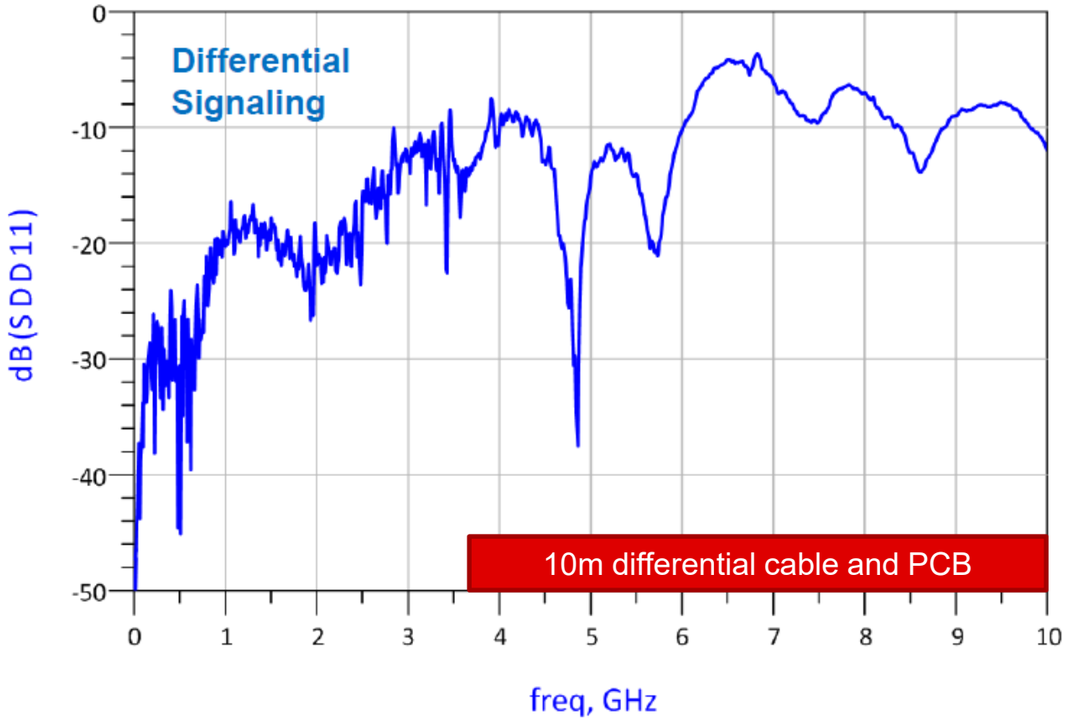

Summary of FPD-Link transmission channel basics

- FPD-Link signaling topologies
  - Differential
  - Single-ended

- Transmission channel parameters
  - Insertion loss
  - Characteristic Impedance
  - Return Loss

Quiz

- How can you compensate for the insertion loss effect of a transmission channel
  a) Low-pass filter with gain
  b) High-pass filter with gain √
  c) Insertion loss due to transmission channel cannot be compensated

- What return-loss measurements shown below corresponds with the ideal performance criteria?
  a) Return loss of 0 dB
  b) Return loss of negative 10dB
  c) Return loss of negative infinity √

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