Proposed Link Segment for short –reach objective

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Introduction

- Define a link segment for the short-reach objective
- Do not preclude use in non-industrial use cases.

Assumptions

- Used 802.3bw link segment for simulations.
- Standard FR4 used for loss characteristics.
- No connectors/cables in the simulations. Simulations underway showing potential cable solutions between chassis.
- Signals routed on FR4 at basic HS design guidelines (100MHz)
- To make this feasible for this non-industrial use case a minimum 24” of trace length is required.

Electrical Specification of 802.3bw

$$\text{Insertion loss}(f) < \begin{cases} 1.0 + 1.6 \times \frac{f-1}{9} \text{ dB} & \text{for } 1 \text{ MHz} \le f < 10 \text{ MHz} \\ 2.6 + 2.3 \times \frac{f-10}{23} \text{ dB} & \text{for } 10 \text{ MHz} \le f < 33 \text{ MHz} \\ 4.9 + 2.3 \times \frac{f-33}{33} \text{ dB} & \text{for } 33 \text{ MHz} \le f \le 66 \text{ MHz} \end{cases}$$

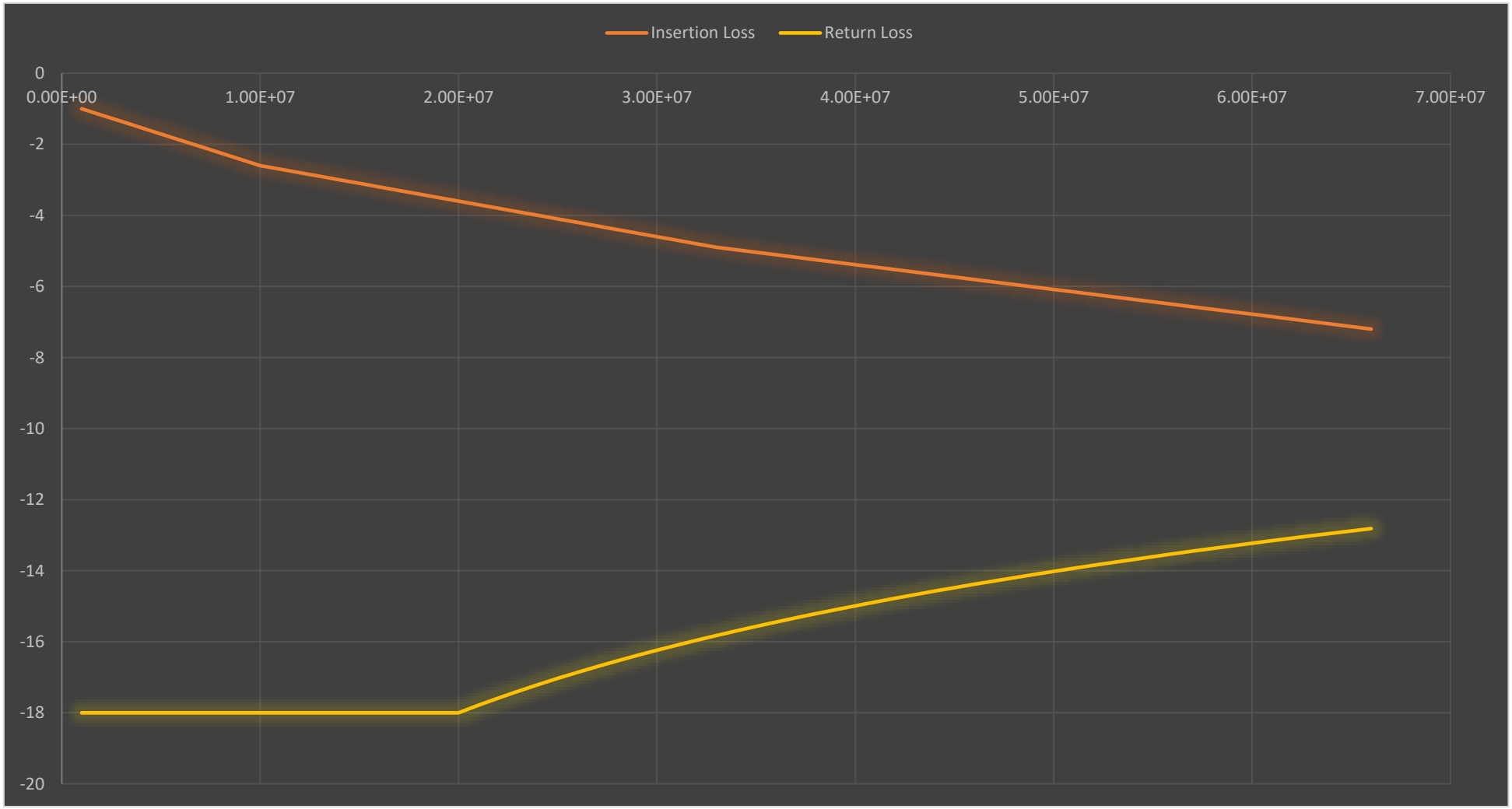
where

Insertion loss(f)	is the Insertion loss of the link segment at frequency f
f	is the frequency in MHz

$$\text{Return loss}(f) \ge \begin{cases} 18 \text{ dB} & \text{for } 1 \text{ MHz} \le f \le 20 \text{ MHz} \\ 18 - 10 \times \log_{10}\left(\frac{f}{20}\right) \text{ dB} & \text{for } 20 \text{ MHz} \le f \le 66 \text{ MHz} \end{cases}$$

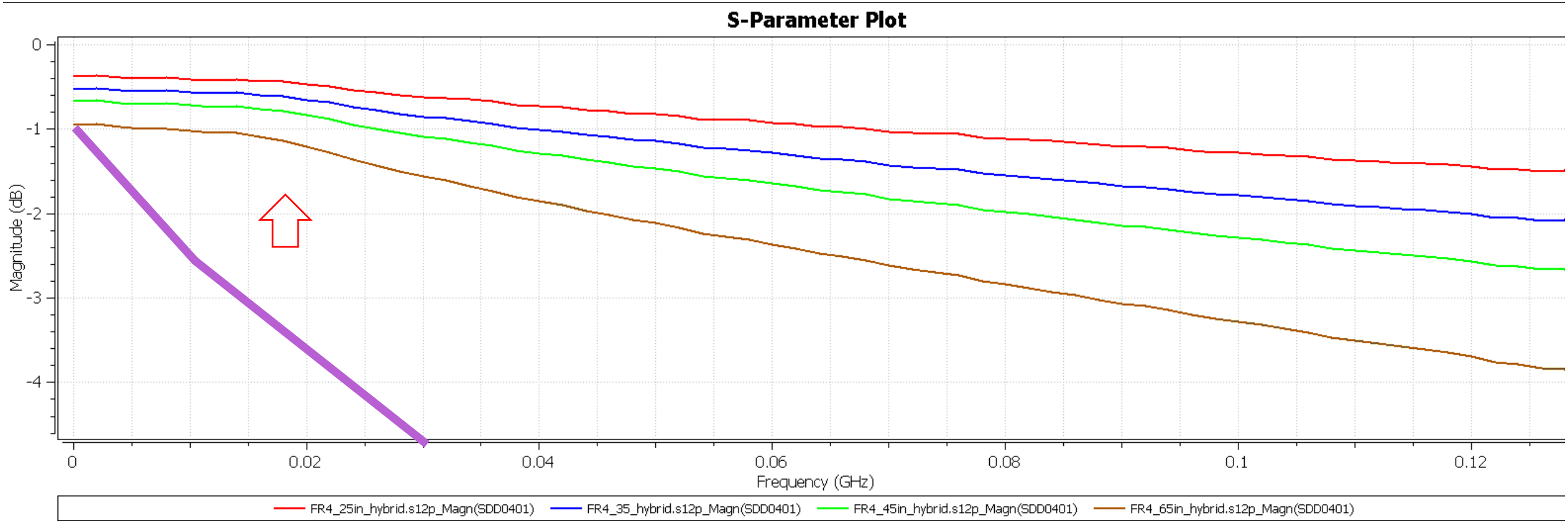
$$\text{Mode conversion loss}(f) \ge \begin{cases} 43 \text{ dB} & \text{for } 1 \text{ MHz} \le f \le 33 \text{ MHz} \\ 43 - 20 \times \log_{10}\left(\frac{f}{33}\right) \text{ dB} & \text{for } 33 \text{ MHz} \le f \le 200 \text{ MHz} \end{cases}$$

Channel Envelopes



FR4 Channel with Vias (Insertion Loss)

Can meet the loss budget till 65” of FR4 trace



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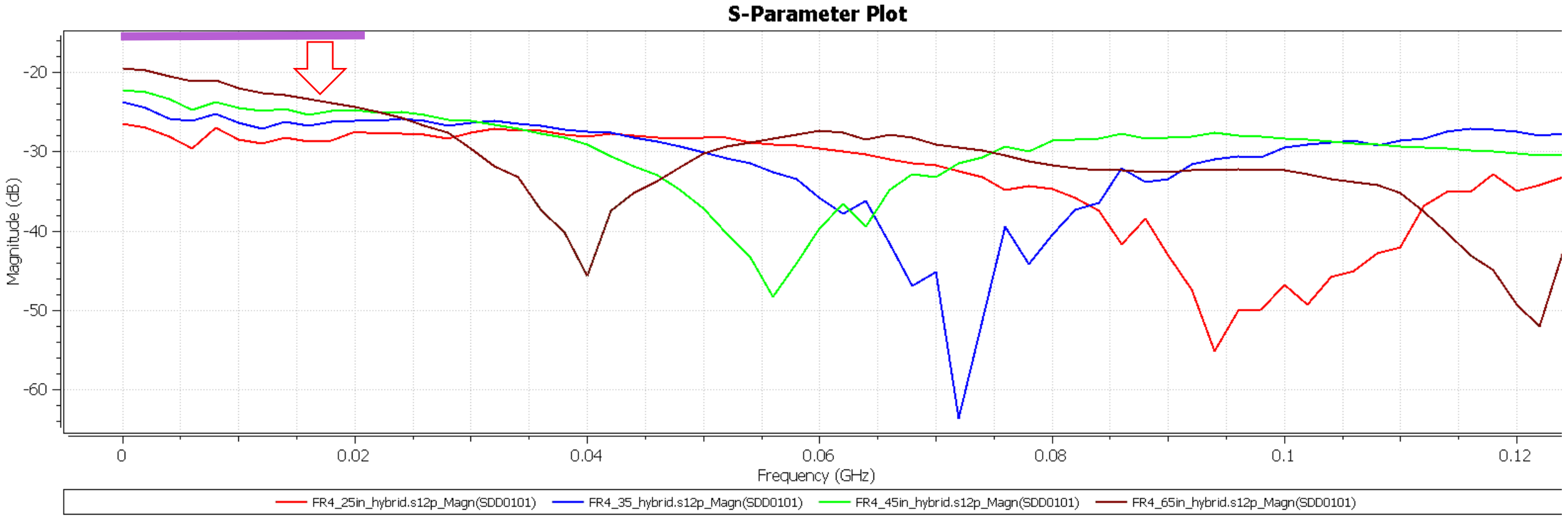
FR4 channel with Vias (Return Loss)

Can meet the return loss budget till 65” of FR4 trace



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Summary

- Adopt link segment from IEEE Std 802.3bw-2015
- Easy to meet the channel specification for Point to point topologies
  - Multi-drop topologies would be challenging.
- Insertion loss and return loss violation happens beyond 65” of FR4 PCB trace length.
  - Exceeds the required 24” trace length.
- Simulations were done out past 100 MHz intentionally!
  - Potential for autoneg to 100M
  - Future-proofing as technology advances