Tx/Rx Channel RL/IL

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Agenda

- IEEE802.3ch RL/IL Equations for Link segment and MDI
- Channel Limit Line Cascade
- Segment Cascade Simulation
- Discussion

IEEE802.3ch Segment Link RL/IL Equation

$$Insertion\ loss(f) \le 0.002\,f + 0.68 f^{0.45} \quad (\mathrm{dB})$$

where

f is the frequency in MHz; $1 \le f \le \mathrm{Fmax}$

$\mathrm{Fmax} = 4000 \times S$

$$2.5G\_Return\_Loss \ge \begin{cases} 20 & 1 \le f < 240 \\ 20 - 10\log_{10}(f/240) & 240 \le f \le 1000 \end{cases} \quad (\mathrm{dB})$$

where

f is the frequency in MHz; $1 \le f \le 1000$

$$5G\_Return\_Loss \ge \begin{cases} 20 & 1 \le f < 480/2^N \\ 20 - 10\log_{10}((2^N \times f)/480) & 480/2^N \le f \le 2000 \end{cases} \quad (\mathrm{dB})$$

where

f is the frequency in MHz; $1 \le f \le 2000$

$$N = \begin{cases} 0 & 15\ \mathrm{dB} < IL\ (1.5\ GHz) \\ 1 & IL\ (1.5\ GHz) \le 15\ \mathrm{dB} \end{cases}$$

$$10G\_Return\_Loss \ge \begin{cases} 20 & 1 \le f < 480/2^N \\ 20 - 10\log_{10}((2^N \times f)/480) & 480/2^N \le f \le 3000 \\ 12 - 3N & 3000 \le f \le 4000 \end{cases} \quad (\mathrm{dB})$$

where

f is the frequency in MHz; $1 \le f \le 4000$

$$N = \begin{cases} 0 & 15\ \mathrm{dB} < IL\ (3\ GHz) \\ 1 & IL\ (3\ GHz) \le 15\ \mathrm{dB} \end{cases}$$

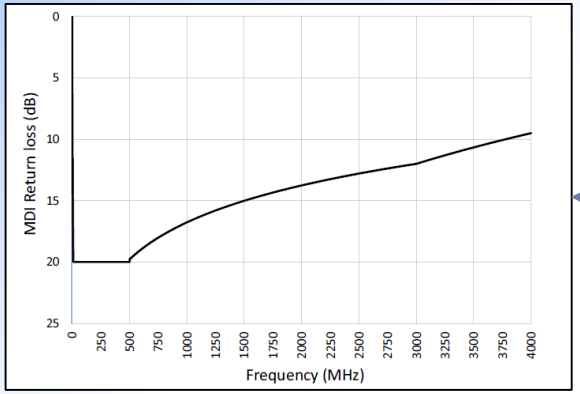
IEEE802.3ch MDI RL Equation

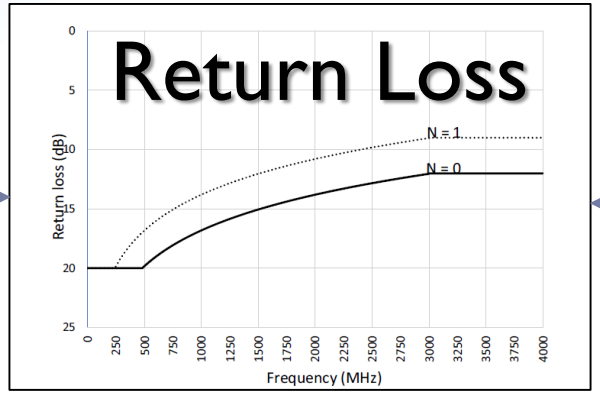
$$MDI\_Return\_Loss(f) \le \begin{cases} 20 - 20\left(\log_{10}\frac{10}{f}\right) & 1 \le f < 10 \\ 20 & 10 \le f \le 500 \\ 12 - 10\log_{10}(f/3000) & 500 \le f \le 3000 \\ 12 - 20\log_{10}(f/3000) & 3000 \le f \le 4000 \end{cases} \quad \text{(dB)}$$

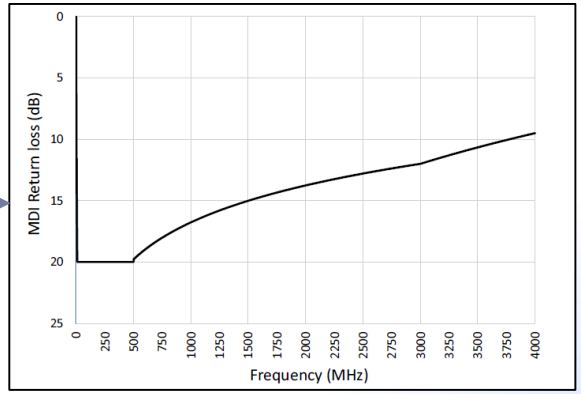
where

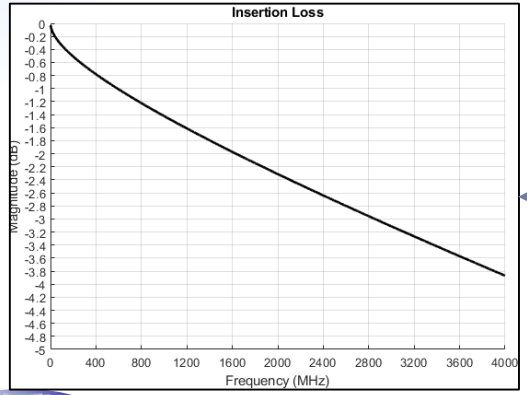
f is the frequency in MHz.

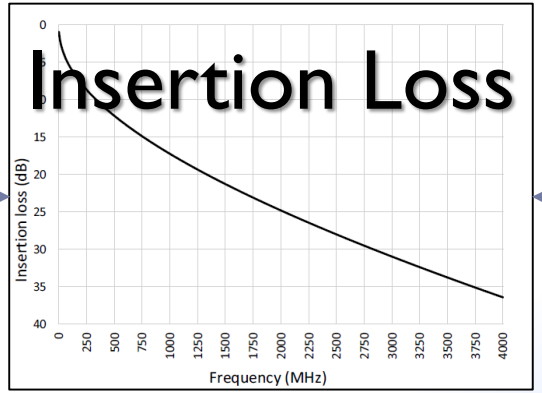
Limit line Cascade

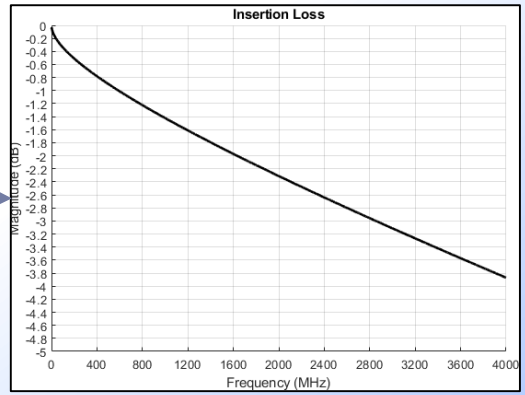




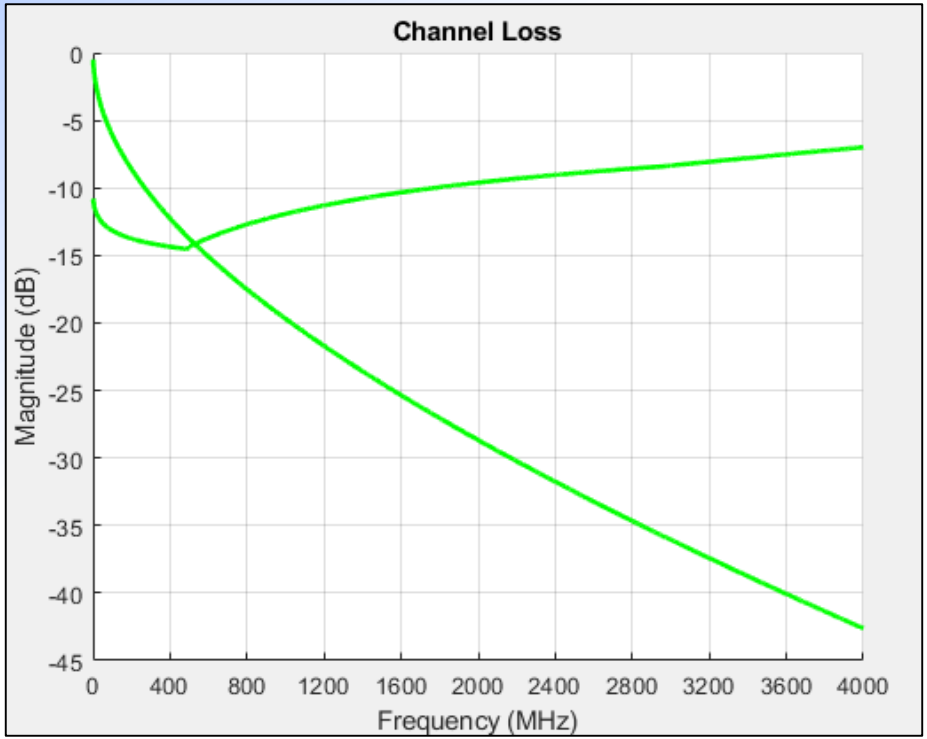






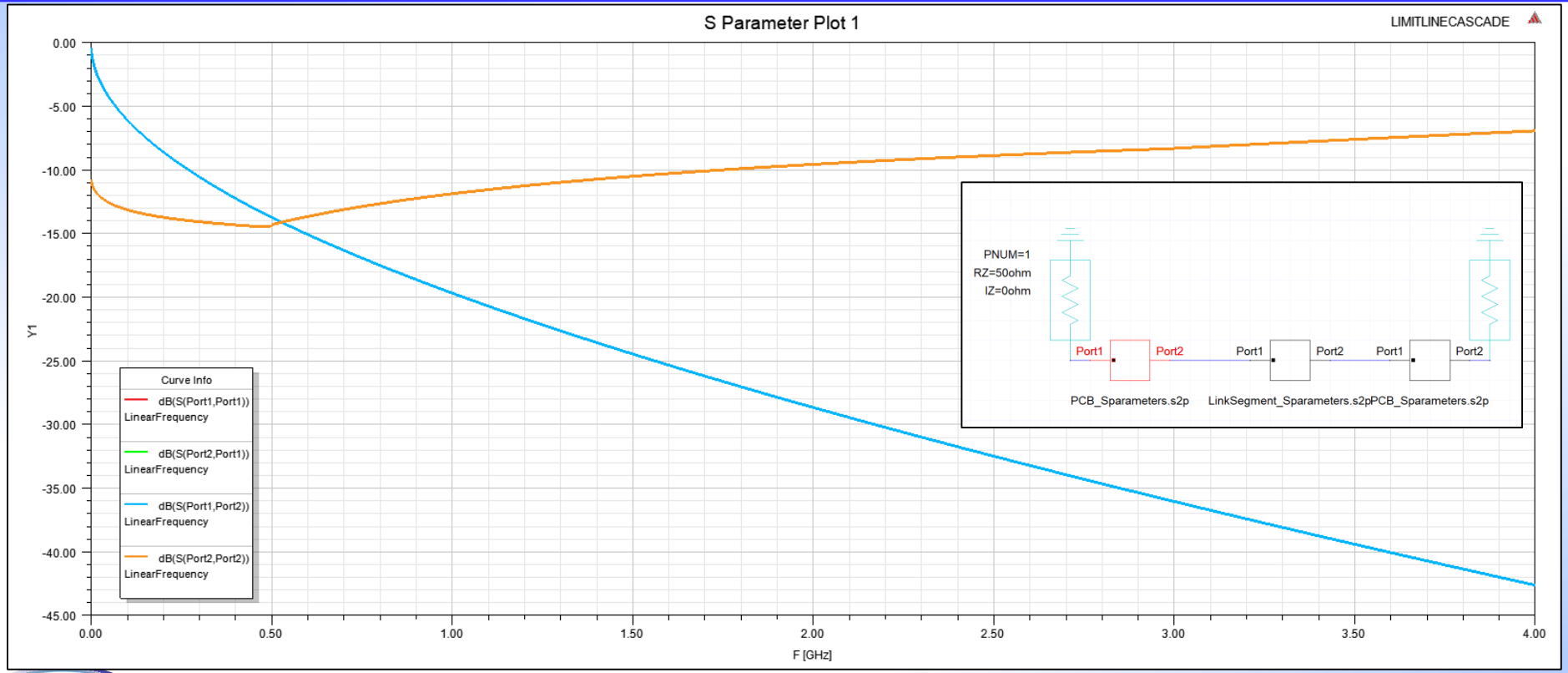


Channel Limit line Cascade Plot

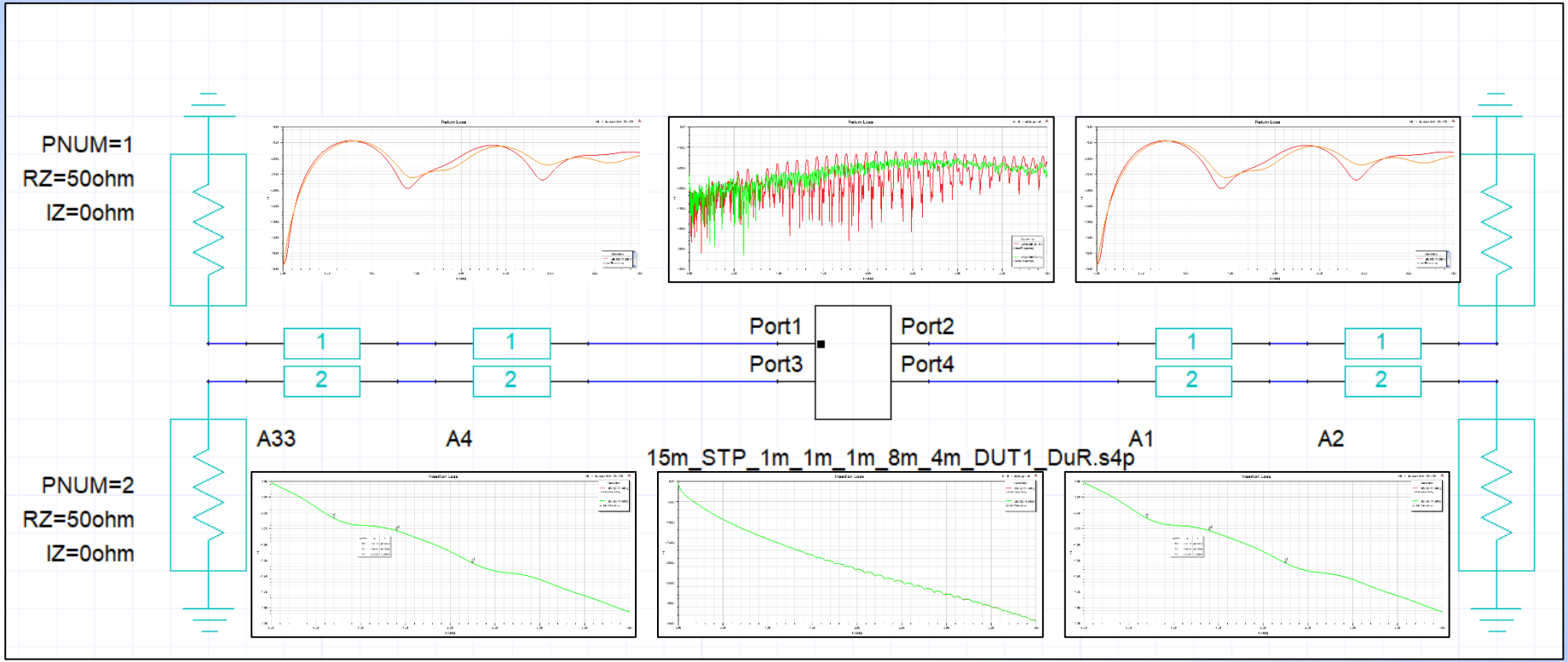


- S-Parameter files generated using IEEE802.3ch equations in MATLAB
- S-Parameter data file are cascaded in MATLAB to display worst case limit line
- Data was verified in Ansys

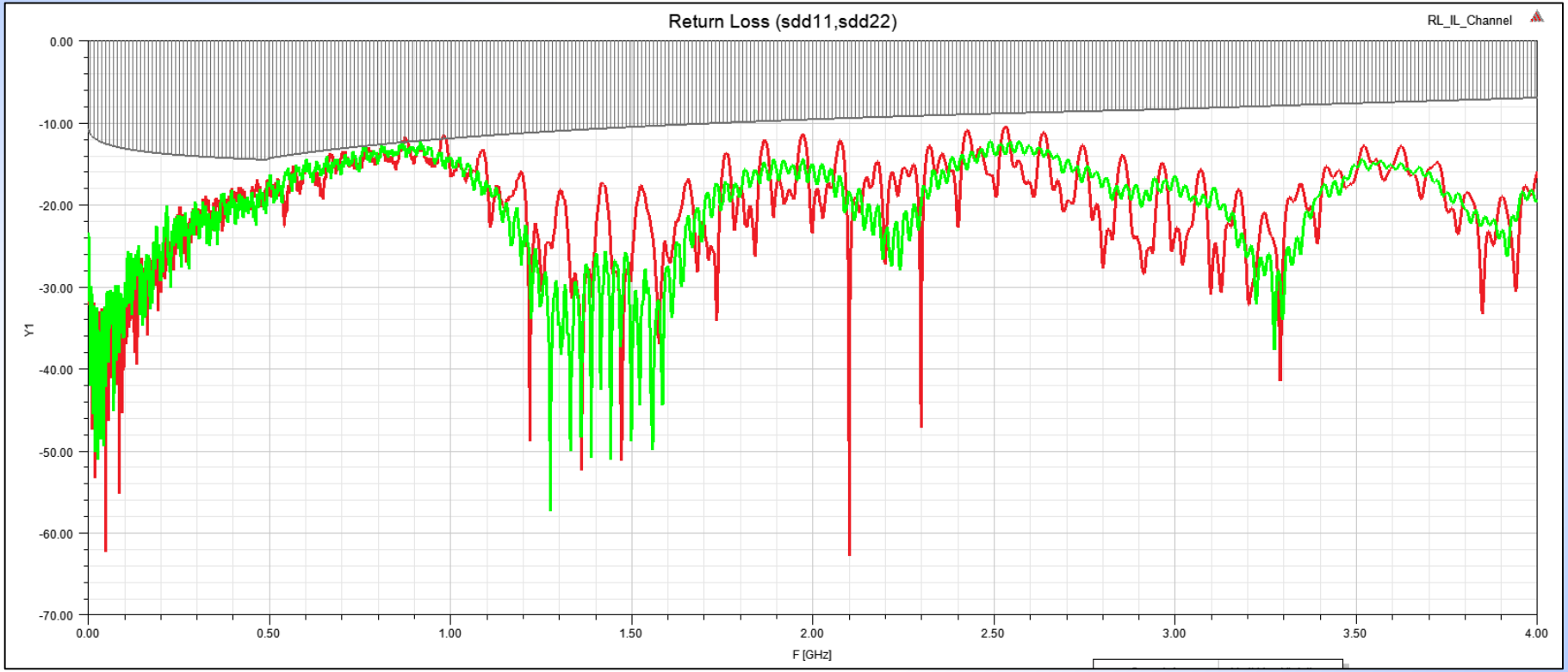
Channel Limit line Cascade Plot Ansys



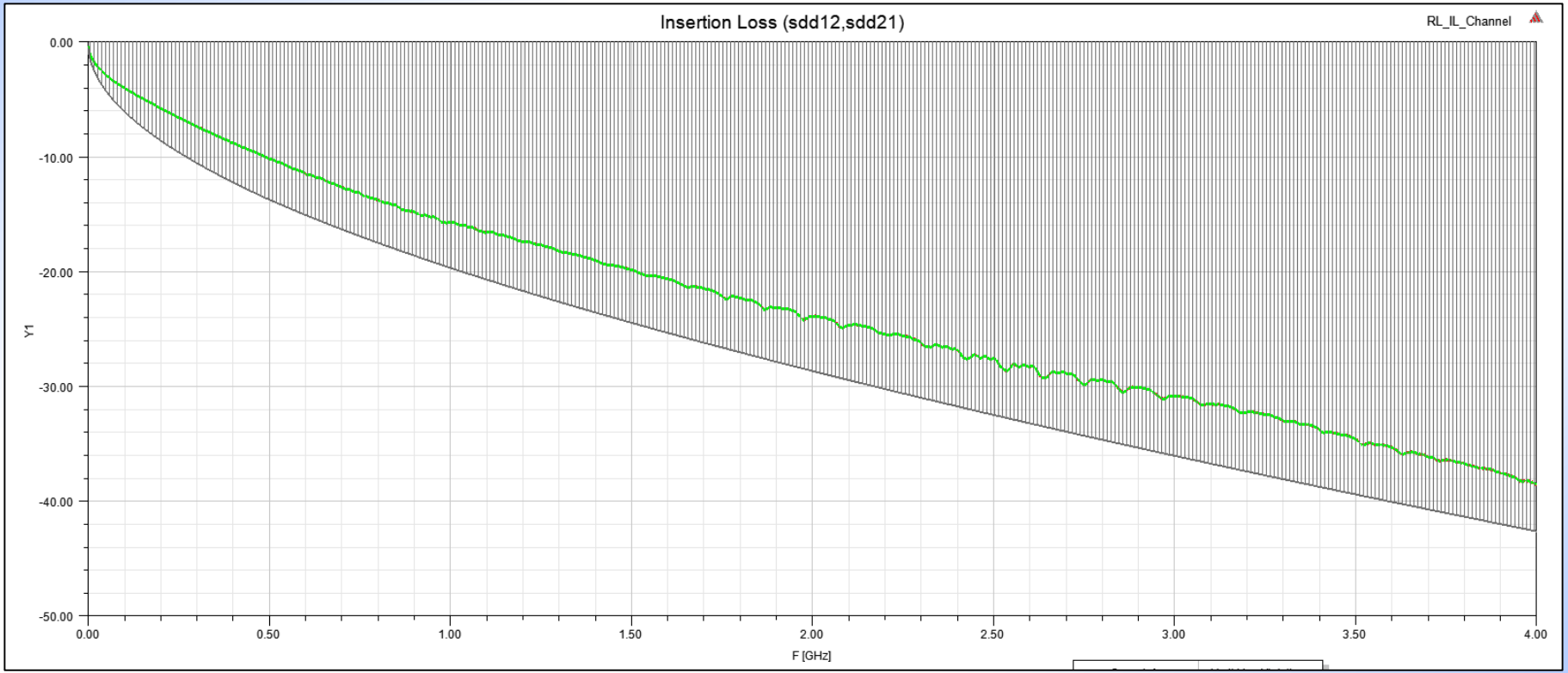
Segment(s) Cascade



Return Loss


Return Loss (sdd11,sdd22)
RL_IL_Channel
0.00
-10.00
-20.00
-30.00
-40.00
-50.00
-60.00
-70.00
Y1
0.00
0.50
1.00
1.50
2.00
2.50
3.00
3.50
4.00
F [GHz]

Insertion Loss



Questions / Discussion

1. Channel return loss is very tight considering no components have been included

2. Insertion loss close to line considering no components are included and temperature consideration

3. Next step to finalize the annex