Insertion Loss Limit Analysis

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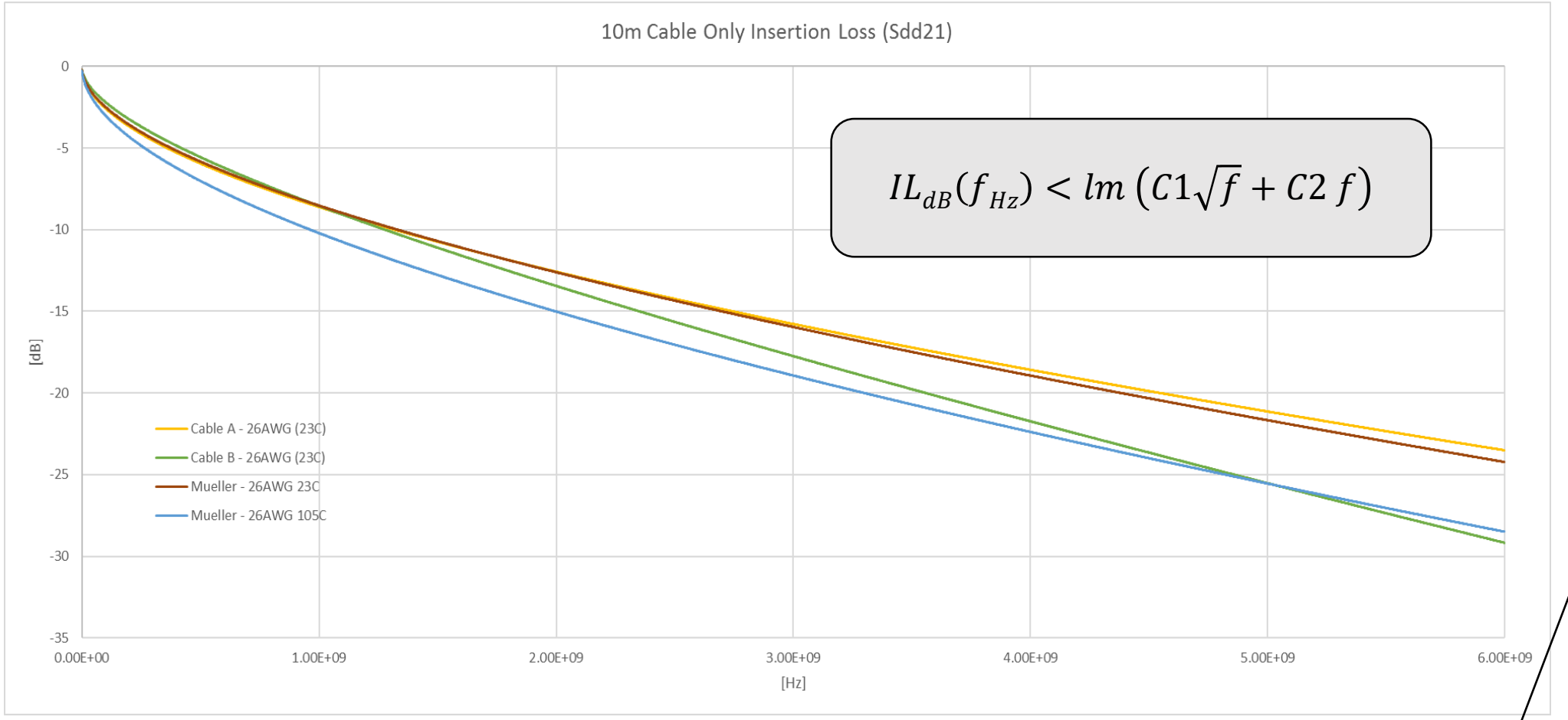
Current Status of Insertion Loss Limit

- Motion proposed in Pittsburgh to modify currently adopted IL limit failed for multiple reasons
  - PHY developers are not concerned about more margin at this time
  - 26 AWG (0.13mm^2) cable is preferred for all applications up to 15m
  - Concerns with offset value in IL limit equation that is not dependent on frequency
- New Frequency Range should be
  - 5MHz to 3GHz
- Violations of the current IL limit still occur at lower frequencies

Cable Modeling Comparison (Diff. Pair)



Cable A (26AWG)
C1 = -2.5898e-5
C2 = -6.7924e-11
Vp = 2.16e8

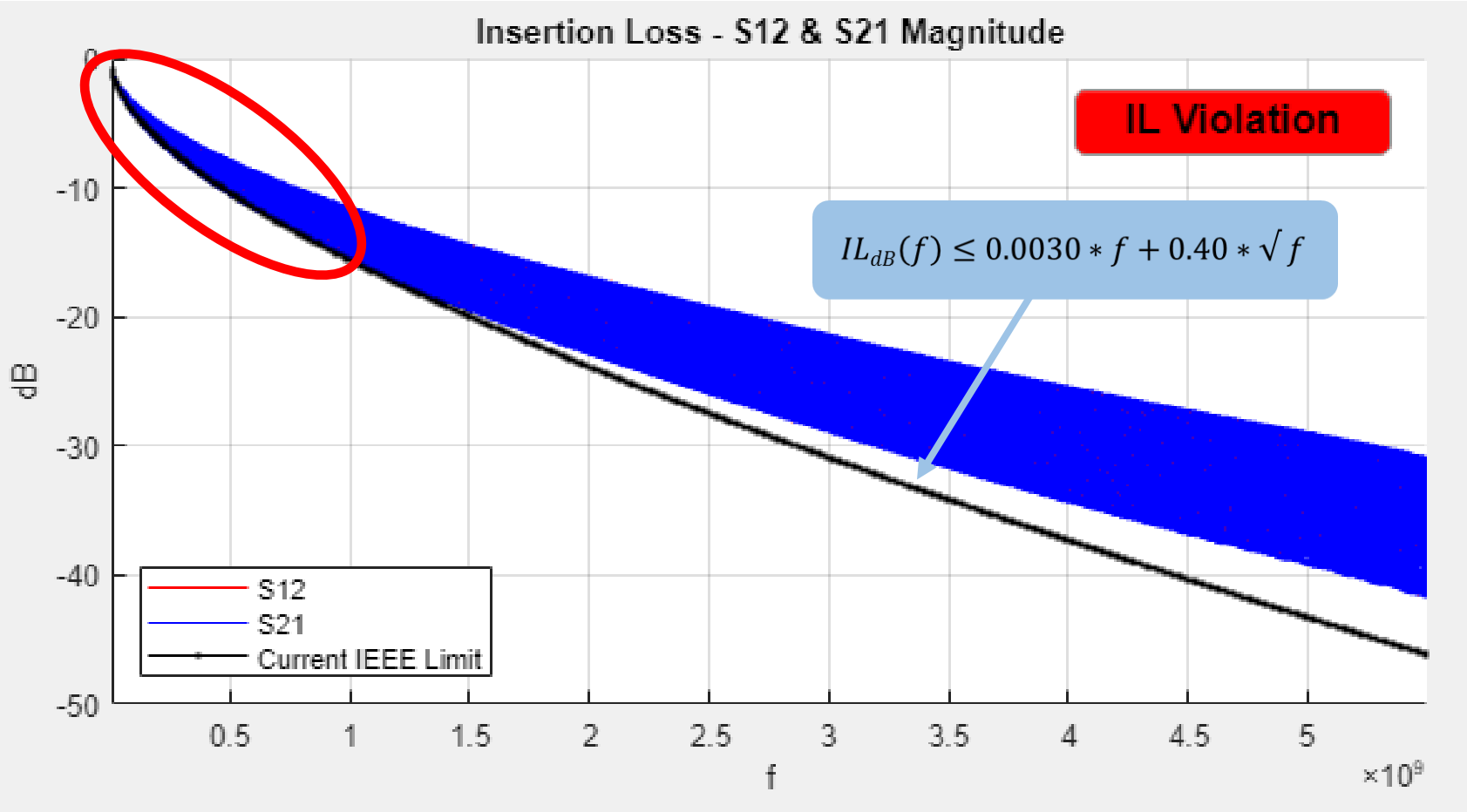
Cable B (26AWG)
C1 = -1.97042e-5
C2 = -2.31881e-10
Vp = 2.16e8

26AWG / 23C
C1 = -2.4e-5
C2 = -9.4e-11
Vp = 2.16e8

26AWG / 105C
C1 = -2.92e-5
C2 = -9.8e-11
Vp = 2.16e8

****** http://www.ieee802.org/3/ch/public/may18/mueller_3ch_01_0518.pdf

3 Segments, 11-15m, Random – 500 iterations



Cable Parameters (26AWG / 105C)

C1 = -2.92e-5

C2 = -9.8e-11

Vp = 2.16e8

Cable Imp: 100Ω mean 1.5 SD

(Gaussian Dist.)

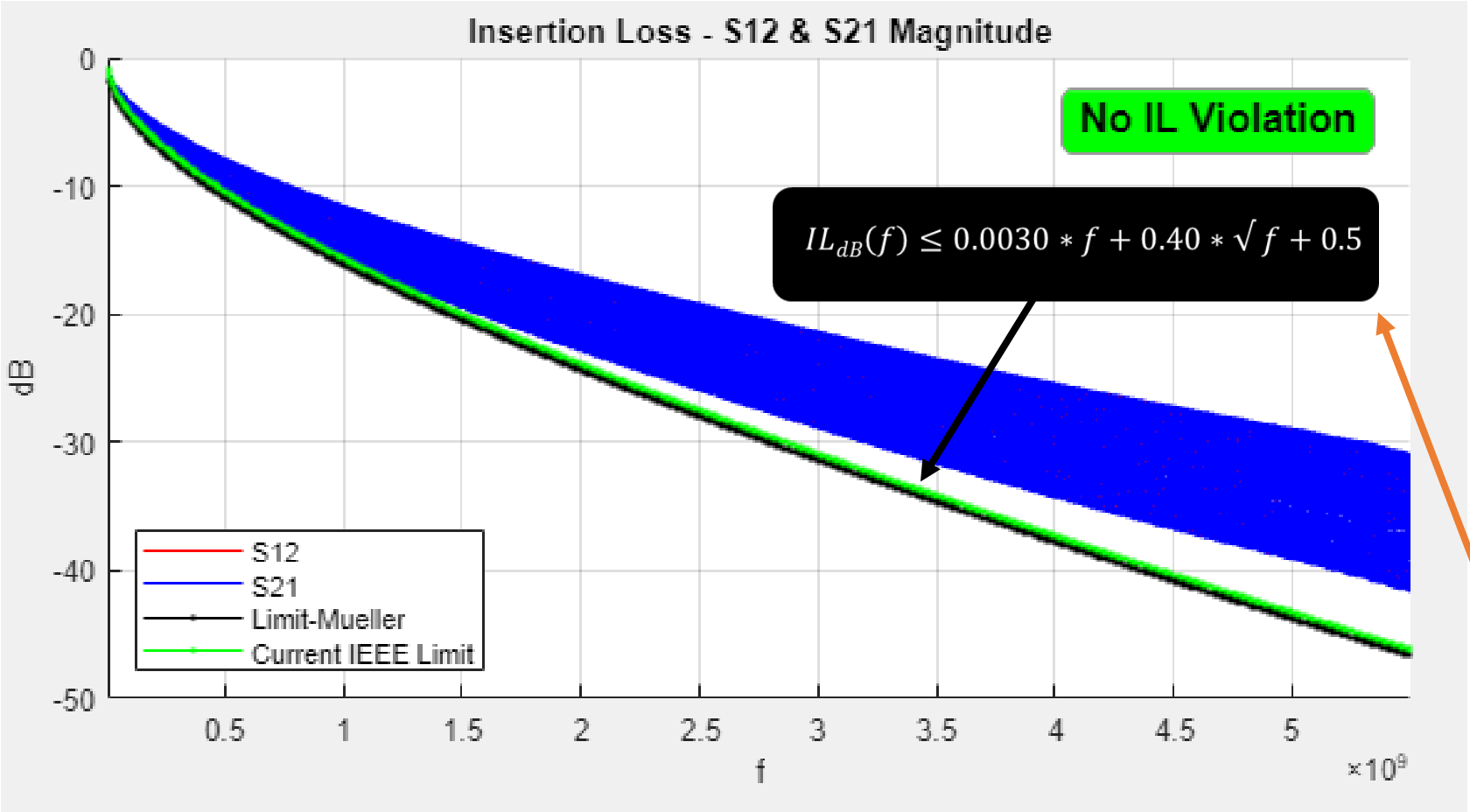
187 iterations with IL Violations

S21/S12 errors between

3.75 MHz & 911 MHz

(Max error: 0.3dB)

3 Segments, 11-15m, Random – 500 iterations



Cable Parameters (26AWG / 105C)

C1 = -2.92e-5

C2 = -9.8e-11

Vp = 2.16e8

Cable Imp: 100Ω mean 1.5 SD

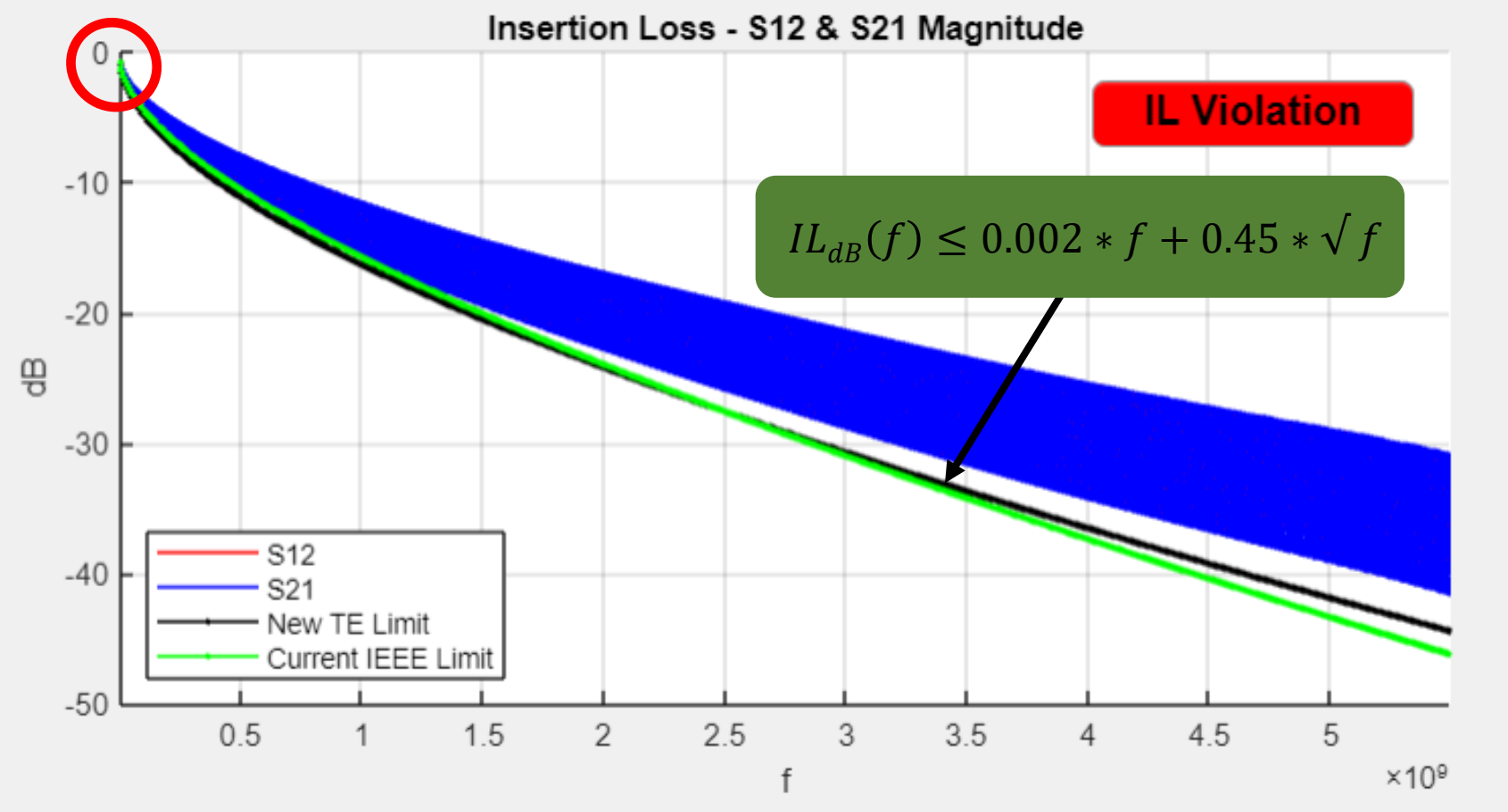
(Gaussian Dist.)

0 IL Violations

Mueller IL Limit Recommendation

****** http://www.ieee802.org/3/ch/public/mar18/mueller_3ch_01_0318.pdf

3 Segments, 11-15m, Random – 500 iterations



Cable Parameters (26AWG / 105C)

C1 = -2.92e-5

C2 = -9.8e-11

Vp = 2.16e8

Cable Imp: 100Ω mean 1.5 SD

(Gaussian Dist.)

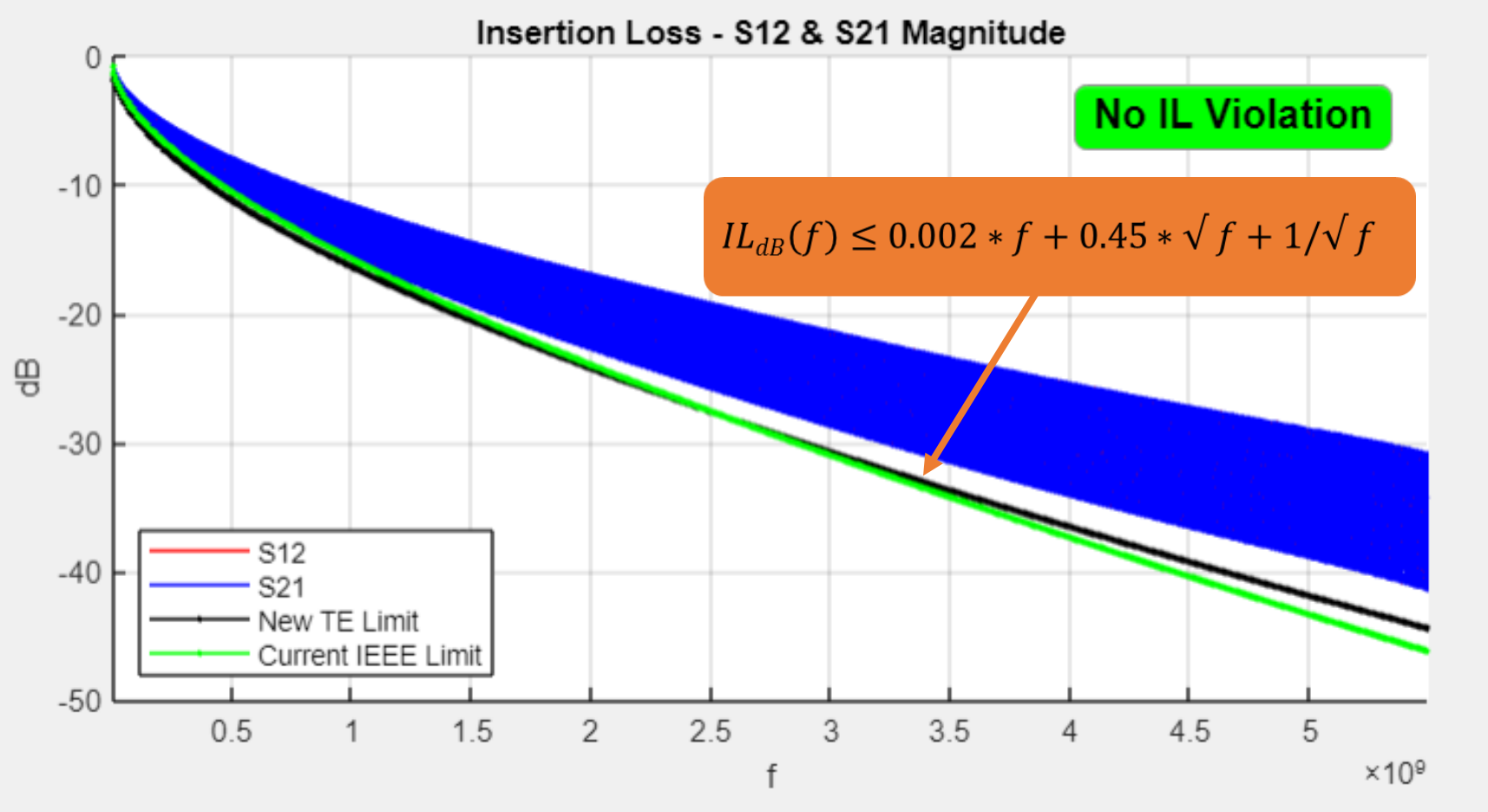
23 iterations with IL Violations

S21/S12 errors between

3.75 MHz & 7.5 MHz

(Max error: 0.016dB)

3 Segments, 11-15m, Random – 500 iterations



Cable Parameters (26AWG / 105C)

C1 = -2.92e-5

C2 = -9.8e-11

Vp = 2.16e8

Cable Imp: 100Ω mean 1.5 SD

(Gaussian Dist.)

0 IL Violations

Conclusions

- New IL Limits were investigated using 26AWG (0.13mm^2) cables @ 105C
- Mueller IL Limit proposed in March meeting had 0 violations after 500 iterations
- Another IL Limit is proposed which had 0 violations and removed the 0.5 offset term from the equation

$$Insertion\ Loss(f) \leq 0.002 * f + 0.45 * \sqrt{f} + 1/\sqrt{f} \quad \text{(dB)}$$

where

f is the frequency in MHz: $5 \leq f \leq 3000$

Thank You!!!