802.3CH ACHIEVABLE DATA RATES

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Objective

- Simulate achievable data rates on
  - current baselines of Insertion Loss and Return Loss
  - Assumption on coupling attenuation

- Compare maximum baseline IL with ILs found in DiBiaso_3ch_01_0318.pdf
  in 11m segment defined in
  wienckowski_3ch_01a_022118.pdf

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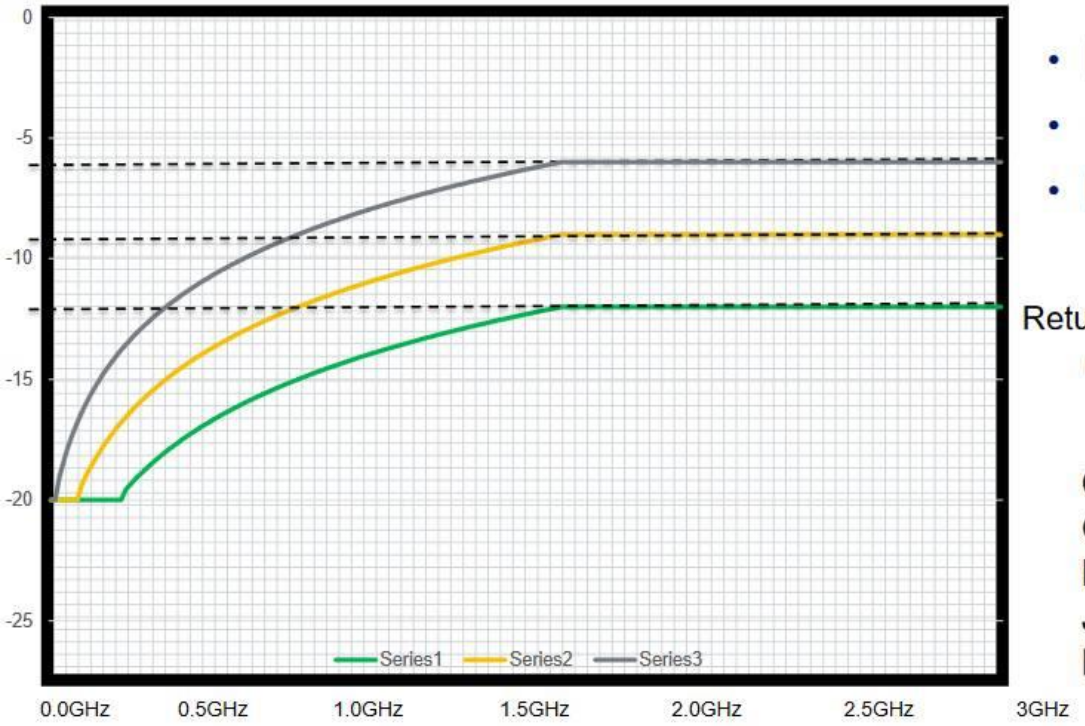
Input Data – Return Loss



- $IL_{3GHz} > 20dB \rightarrow N=0$
- $10dB < IL_{3GHz} < 20dB \rightarrow N=1$
- $IL_{3GHz} < 10dB \rightarrow N=2$

$$\text{Return.Loss(dB)} \le \begin{cases} 20dB & 5 \le f < 500/2^N \\ 12\text{-}3N - 10\log(f/3000) & 500/2^N \le f < 3000 \\ 12\text{-}3N & 3000 \le f < 5500 \end{cases}$$

(f in MHz)

Contributions from :
Garret den Besten
Bert Bergner
James Withey
Masood Shariff

- Baseline as adopted in Geneva January Meeting
  - N = 0, green curve taken

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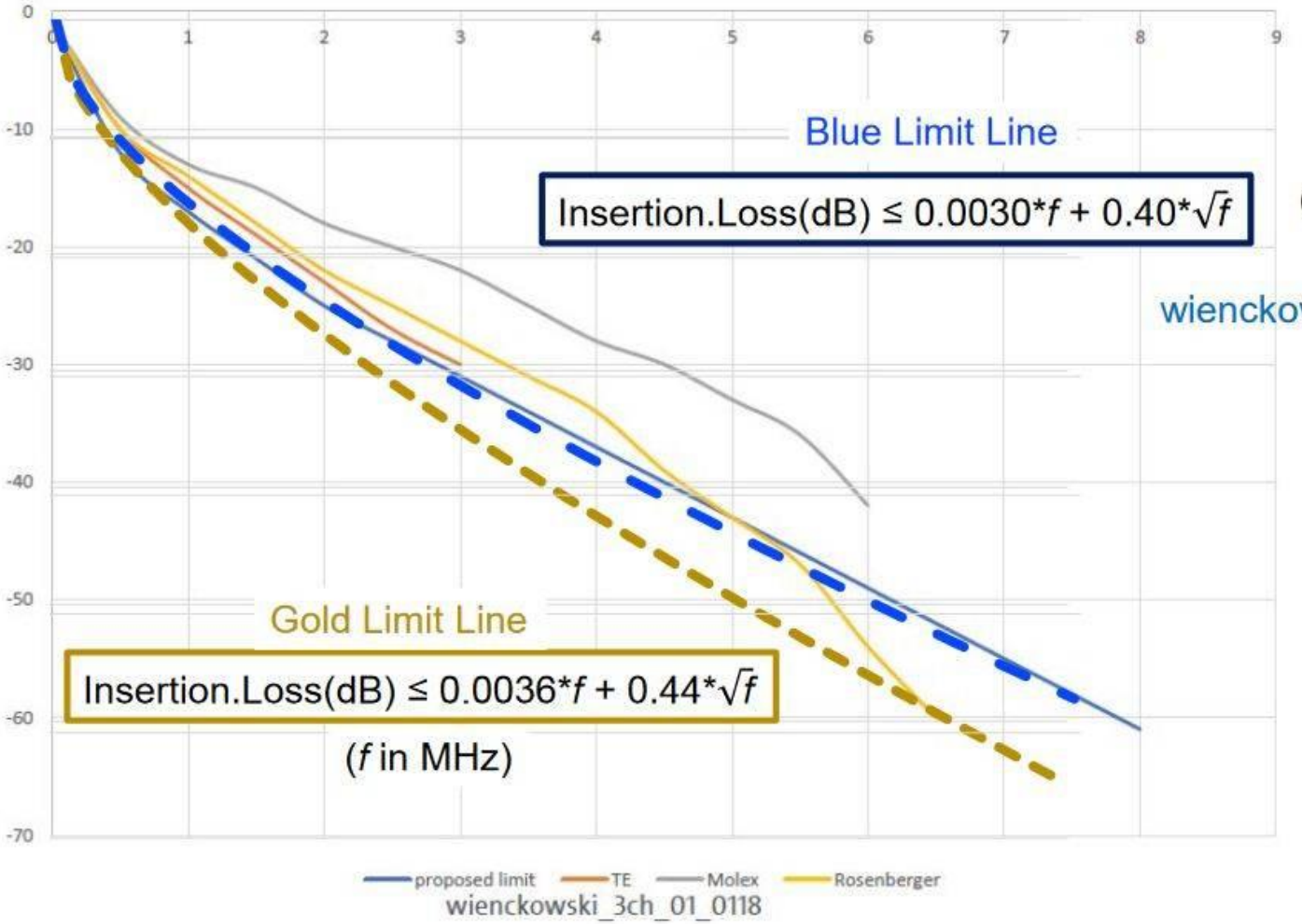
Input Data – Insertion Loss



- Baseline (blue limit line) as adopted in Geneva January Meeting

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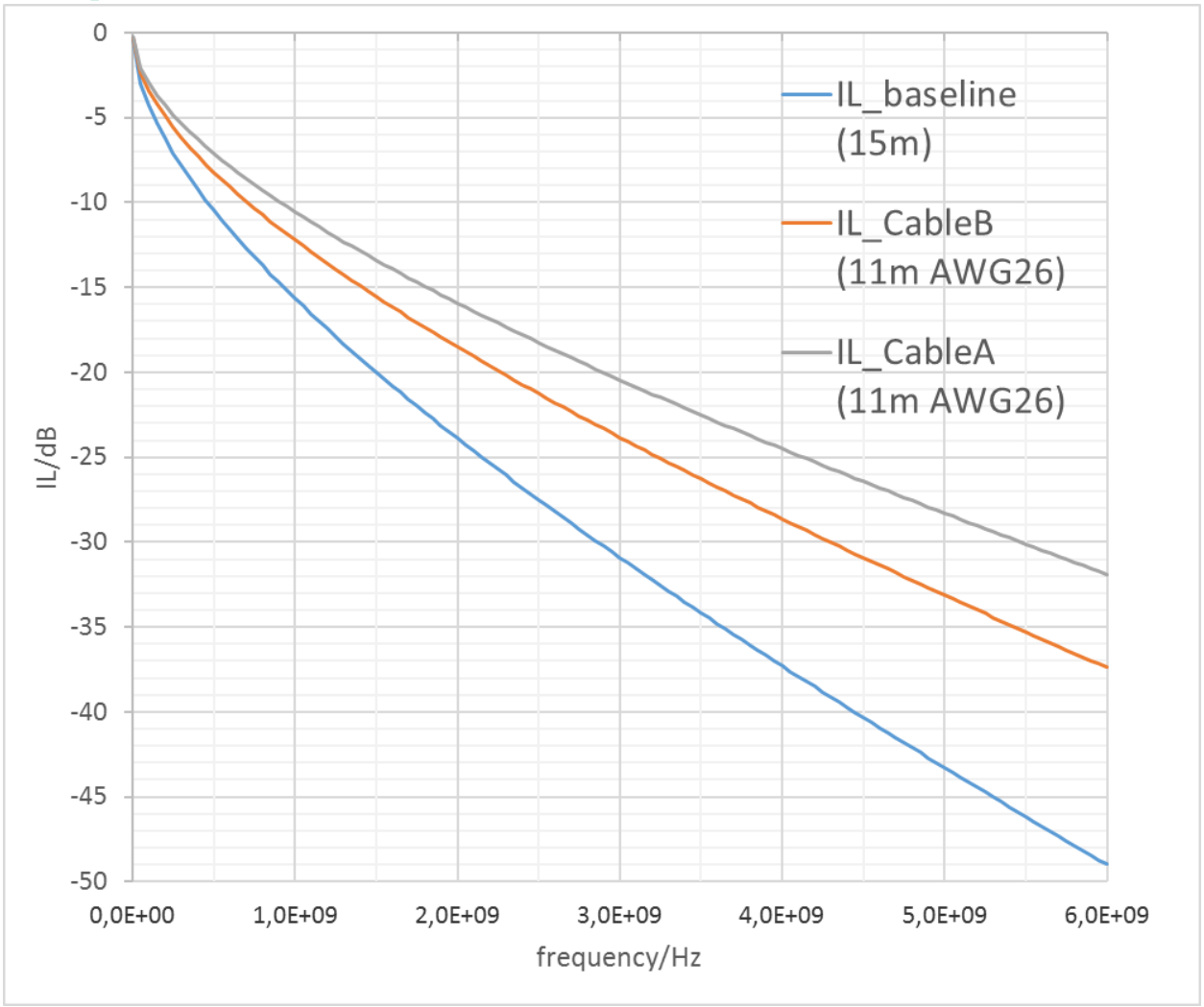
Input Data – Insertion Loss



- topologies with 3 segments and 11m max as defined in wienckowski_3ch_01a_022118.pdf
- Harness simulation as in DiBiaso_3ch_01_0318.pdf slide 9 (cable A) and slide 11 (cable B) enables new IL limit lines

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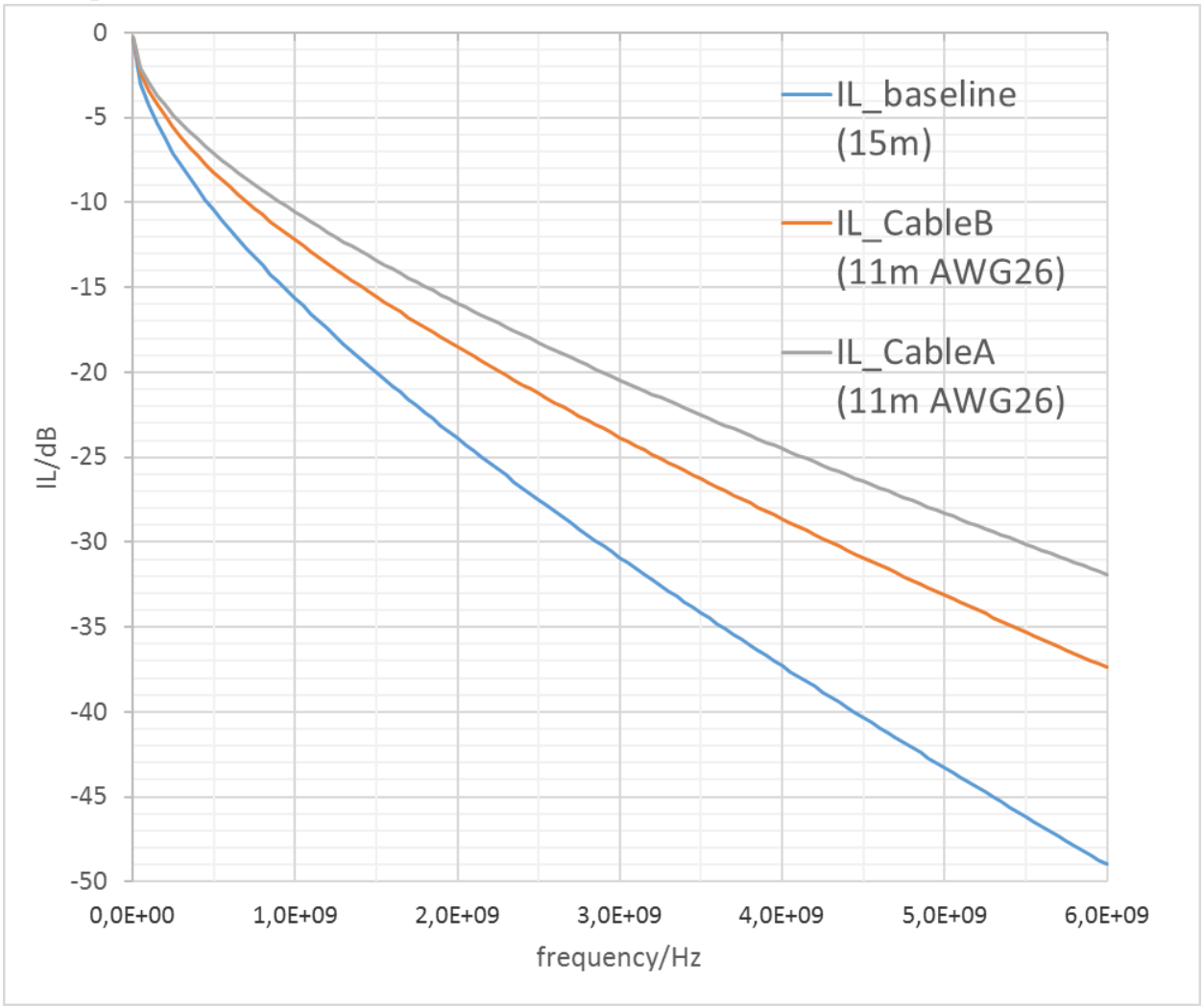
Input Data – Insertion Loss



- IL_baseline <= 0.003 * f + 0.4 * sqrt(f)
- IL_11m_CableB <= 0.0021 * f + 0.32 * sqrt(f)
- IL_11m_CableA <= 0.0017 * f + 0.28 * sqrt(f)
- f in MHz
- Curves keep 3-4dB margin at high frequencies to simulation results in DiBiaso_3ch_01_0318.pdf

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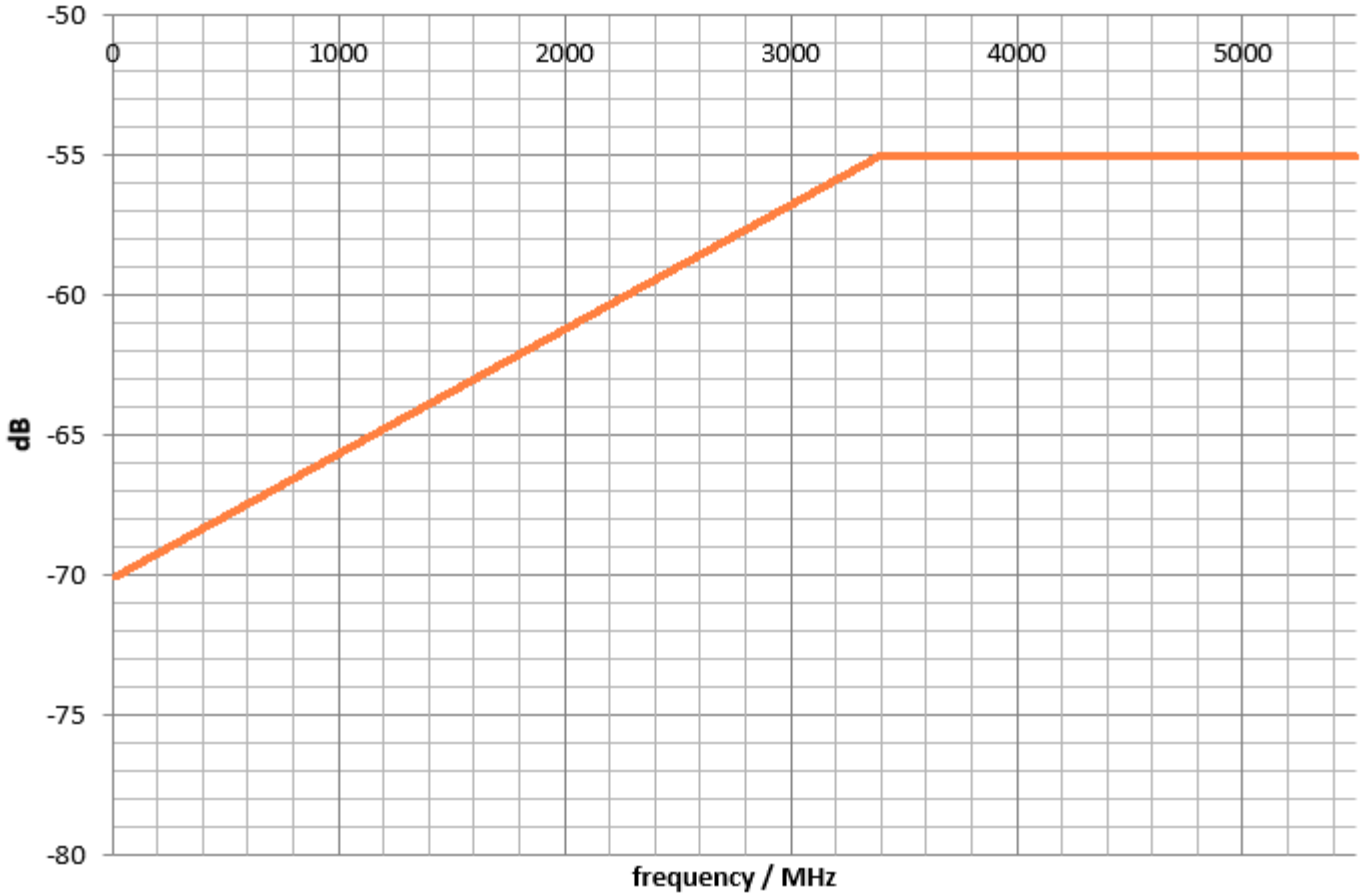
Input Data – Assumption on Coupling Attenuation



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Input Data – Assumption on Analysis

- Full-duplex communication
- Limited ENOB available (CMOS implementation of ADC and oscillator)
- Limited effectivness of echo cancellation (25dB)
- Transmit power limited
  - Emission considerations
  - CMOS and low power considerations
  - Full-duplex operation
- Thermal noise + noise factor
- Automotive alien crosstalk

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Results Overview

- Analysis gives
  - Maximum achievable data rate for given input conditions
  - Maximum usable frequency
- Several implementation non-idealities included
  - But not all … there is some margin needed
- Absolute values change with inputs/assumptions, but comparison/trend will hold

	IL_baseline	IL_11m_cableB	IL_11m_cableA
IL @ 3GHz [dB]	-30.6	-23.6	-20.2
Data rate [Gbps]	9.2	11.5	13.05
Used BW [GHz]	2.2	2.95	3.4

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Achievable Data Rates - Conclusion

- → Baseline IL limit will likely demand a very laborious PHY implementation
- → New IL limits from new link topology definition would enable significantly higher data rate or much more economic PHY implementation
- → cableB at 11m would still be a quite challenging PHY implementation
- → Thicker gauges could produce same IL at lengths above 11m
- → Coupling attenuation is just an assumption, not a baseline …