

RTPGE

Channel Requirements Proposal for 1-Pair Ethernet

CommScope

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- Insertion Loss Calculations with Variables
 - Temperature
 - Connector Count
 - Frequency
 - Conduction size (AWG & Area)
 - ILD Addition
- Return Loss
- PSANEXT
- PSAACRF
 - Connector Count
 - Frequency
 - Length
- Summary and Recommendation

Temperature and Wire Cross-Sectional Area in mm²

For conductor size in cross-sectional area, mm²

$$IL := [1 + .004 \cdot (T - 20)] \cdot \left(1.2 \cdot \frac{15}{100}\right) \cdot \left[1.82 \cdot \left(\frac{.508}{\sqrt{A}}\right) \cdot \sqrt{f} + .0091 \cdot f + \frac{.25}{\sqrt{f}}\right] + 4 \cdot .02 \cdot \sqrt{f} + .018 \cdot \sqrt{f}$$

where

$$A := \text{conductor_cross_sectional_area_mm}^2$$

Temperature and Wire Gauge

For any temperature above 20 degrees C and for any conductor size

$$IL := [1 + .004(T - 20)] \left(1.2 \frac{15}{100} \right) \left[\frac{1.82}{92 \left(\frac{23-n}{39} \right)} \sqrt{f} + .0091f + \frac{.25}{\sqrt{f}} \right] + 4 \times .02 \sqrt{f} + .018 \sqrt{f}$$

where

T := Temperature in degrees_C

n := conductor_size_in_AWG

equations for insertion loss of 1-pair Ethernet channel

For 20 degrees C and AWG 23

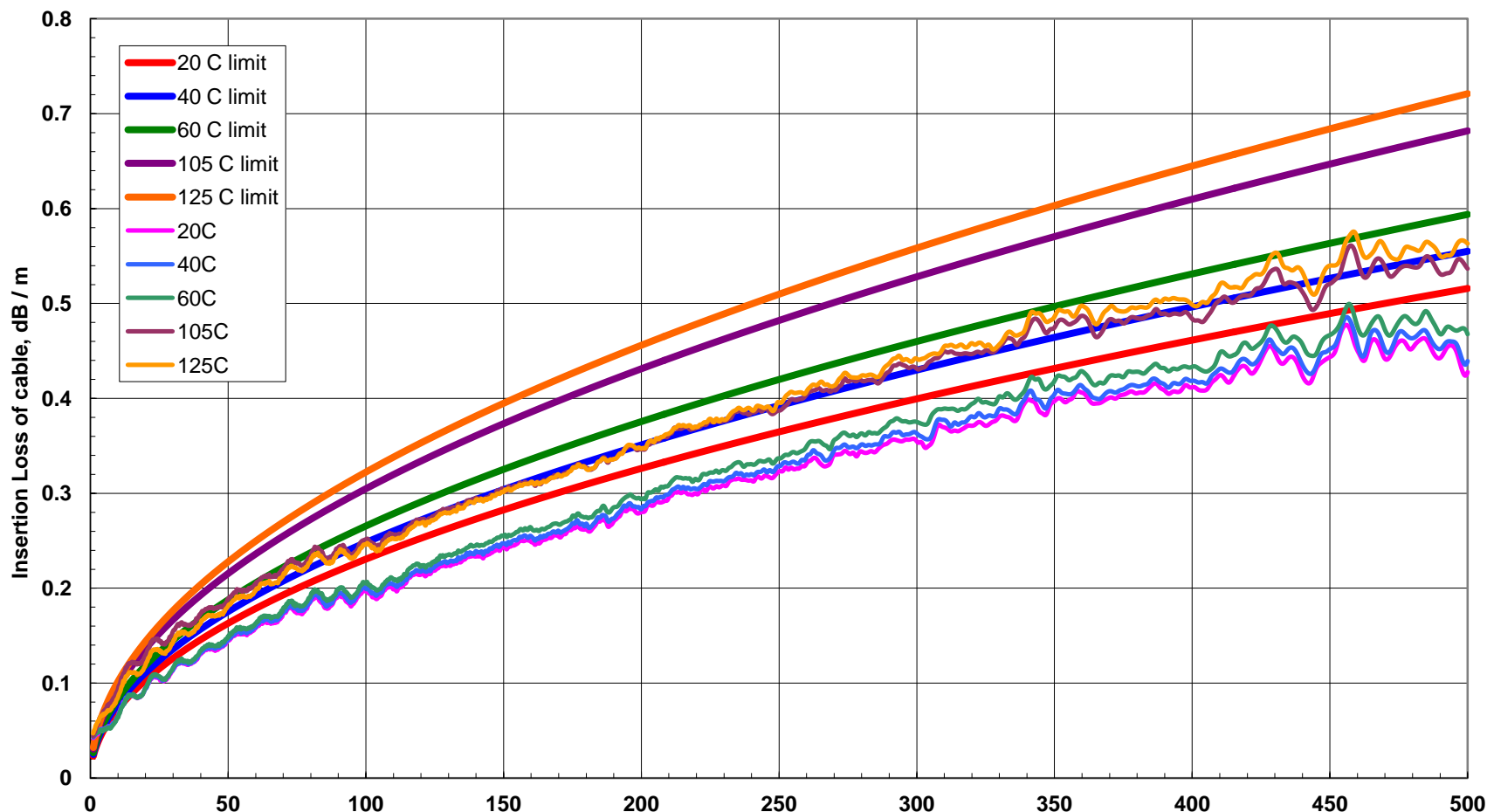
$$IL := \left(1.2 \cdot \frac{15}{100}\right) \cdot \left(1.82 \cdot \sqrt{f} + .0091 \cdot f + \frac{.25}{\sqrt{f}}\right) + 4 \cdot .02 \cdot \sqrt{f} + .018 \cdot \sqrt{f}$$

where

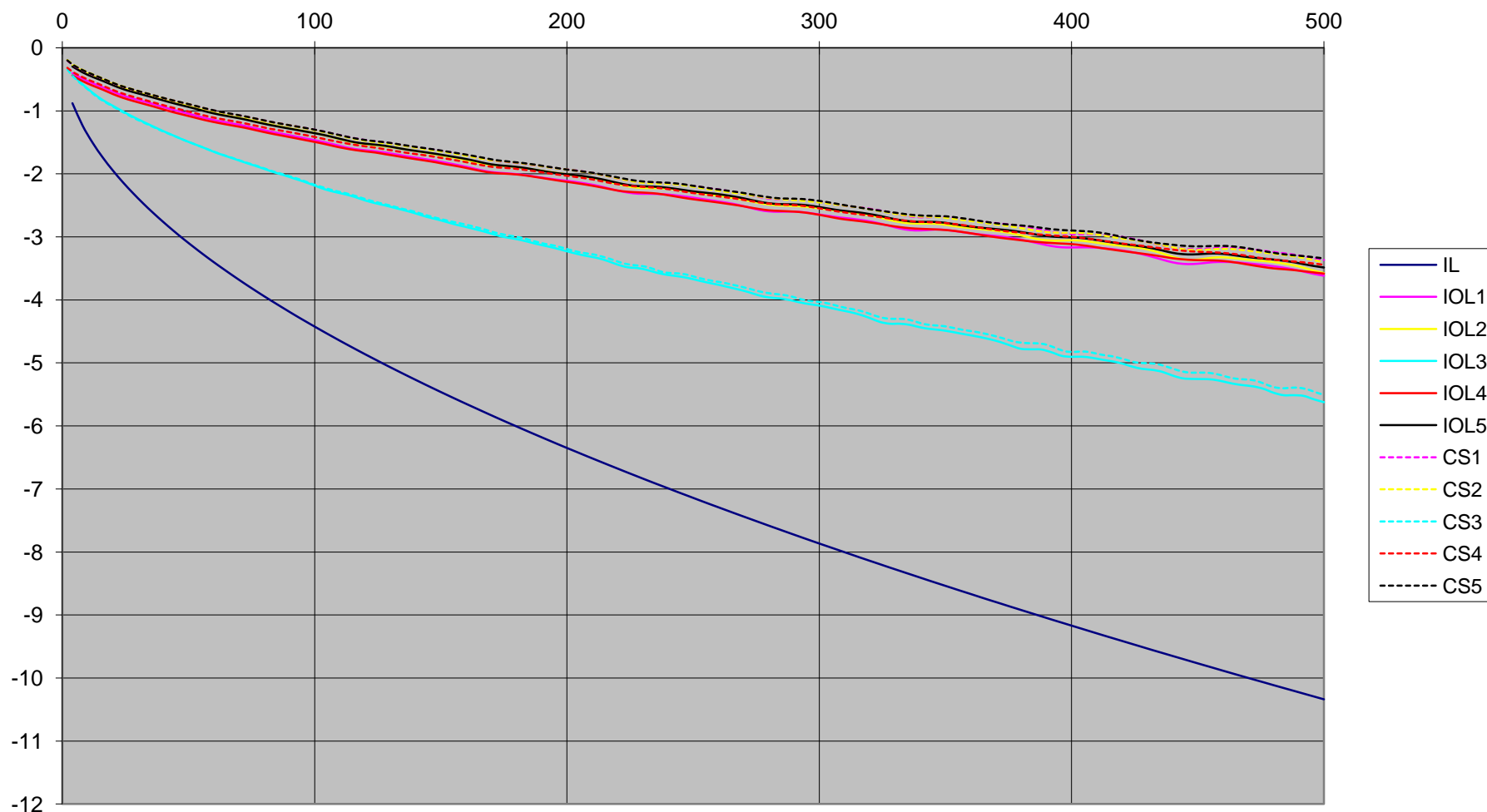
$f :=$ frequency_MHz

This equation is based on a 15 meter channel with four connectors.

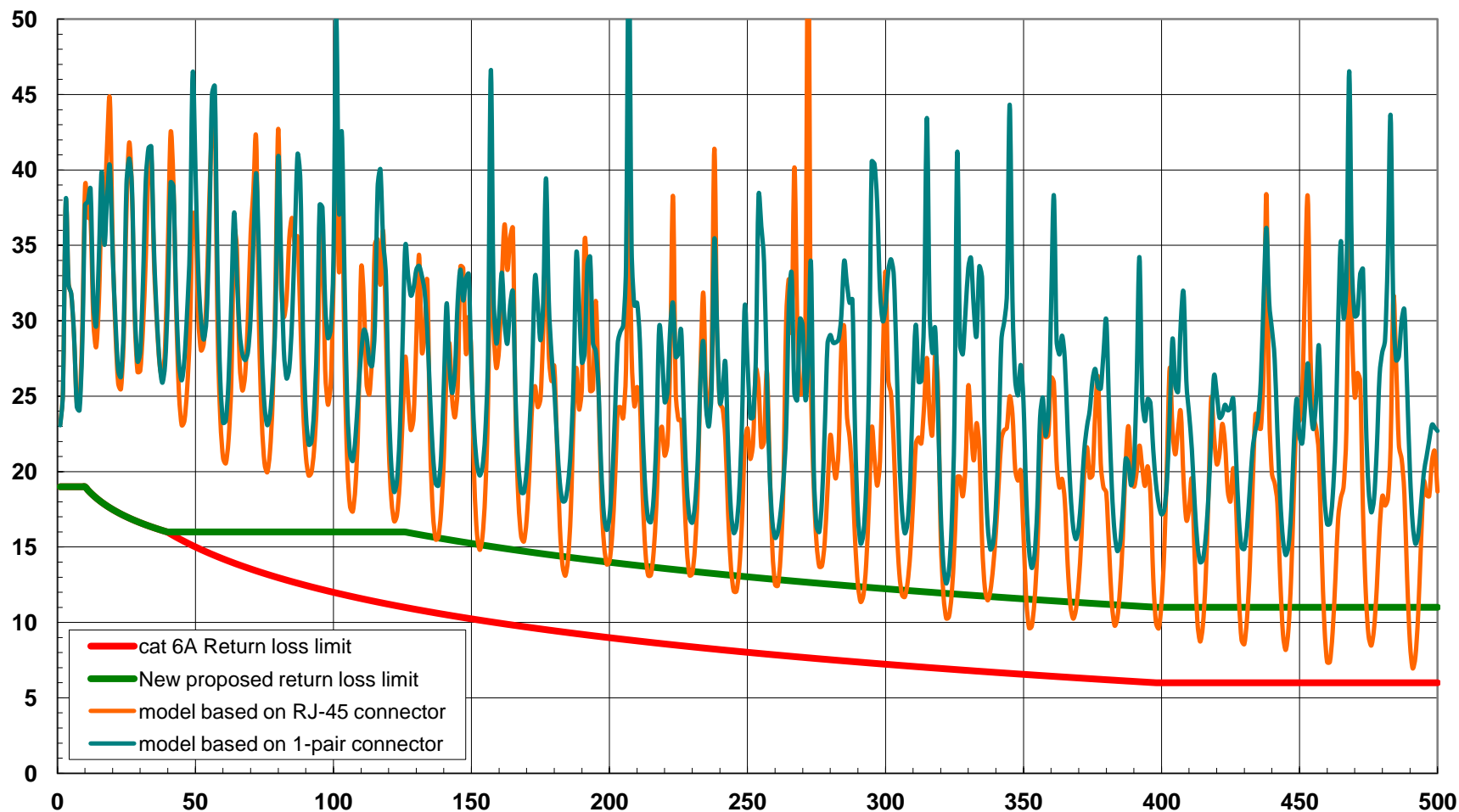
Insertion Loss Requirements and Measured Data
Versus Temperature



5/8 METER CHANNEL IL COMPARISON

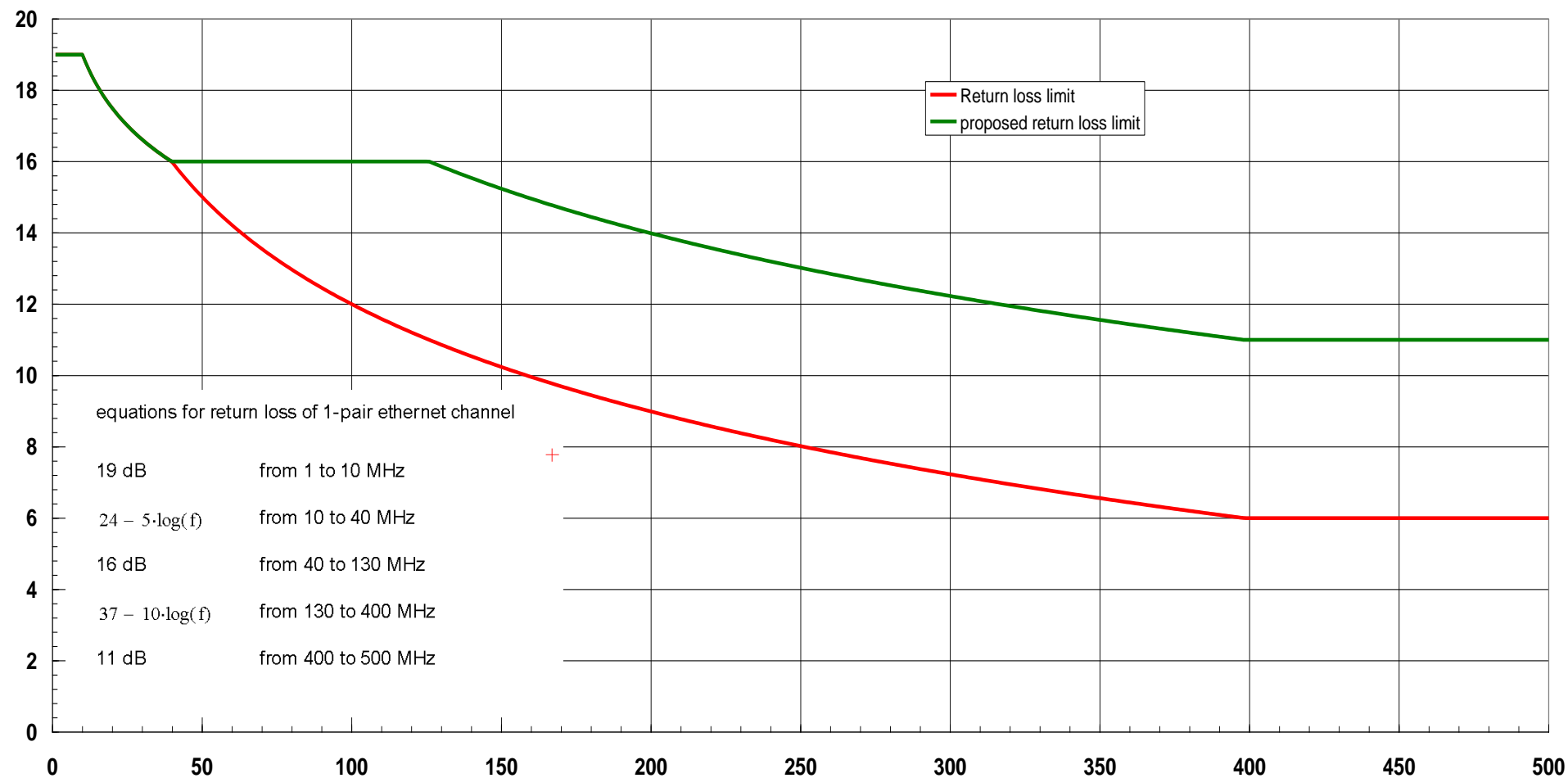


Return Loss Limit Proposal and Supporting Model



Return Loss

return loss limit proposal



PSANEXT

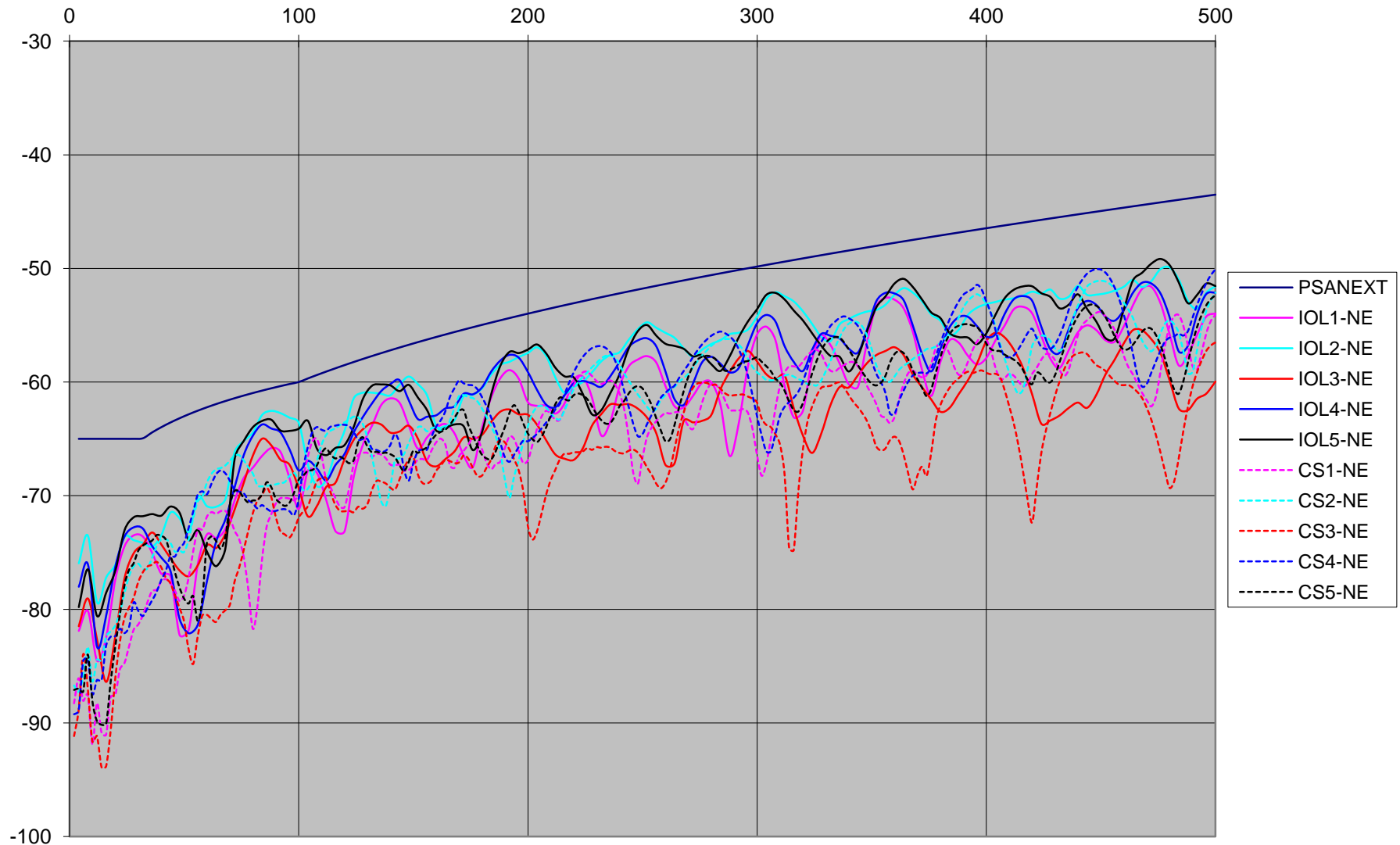
from 1 to 100 MHz

$$\text{PSANEXT} := 60 - 10 \cdot \log\left(\frac{f}{100}\right)$$

from 100 to 500 MHz

$$\text{PSANEXT} := 60 - 15 \cdot \log\left(\frac{f}{100}\right) - 6 \cdot \left[\frac{(f - 100)}{400} \right]$$

This equation implements the maximum relaxation from category 6A, ISO Class E_A, for short lengths.



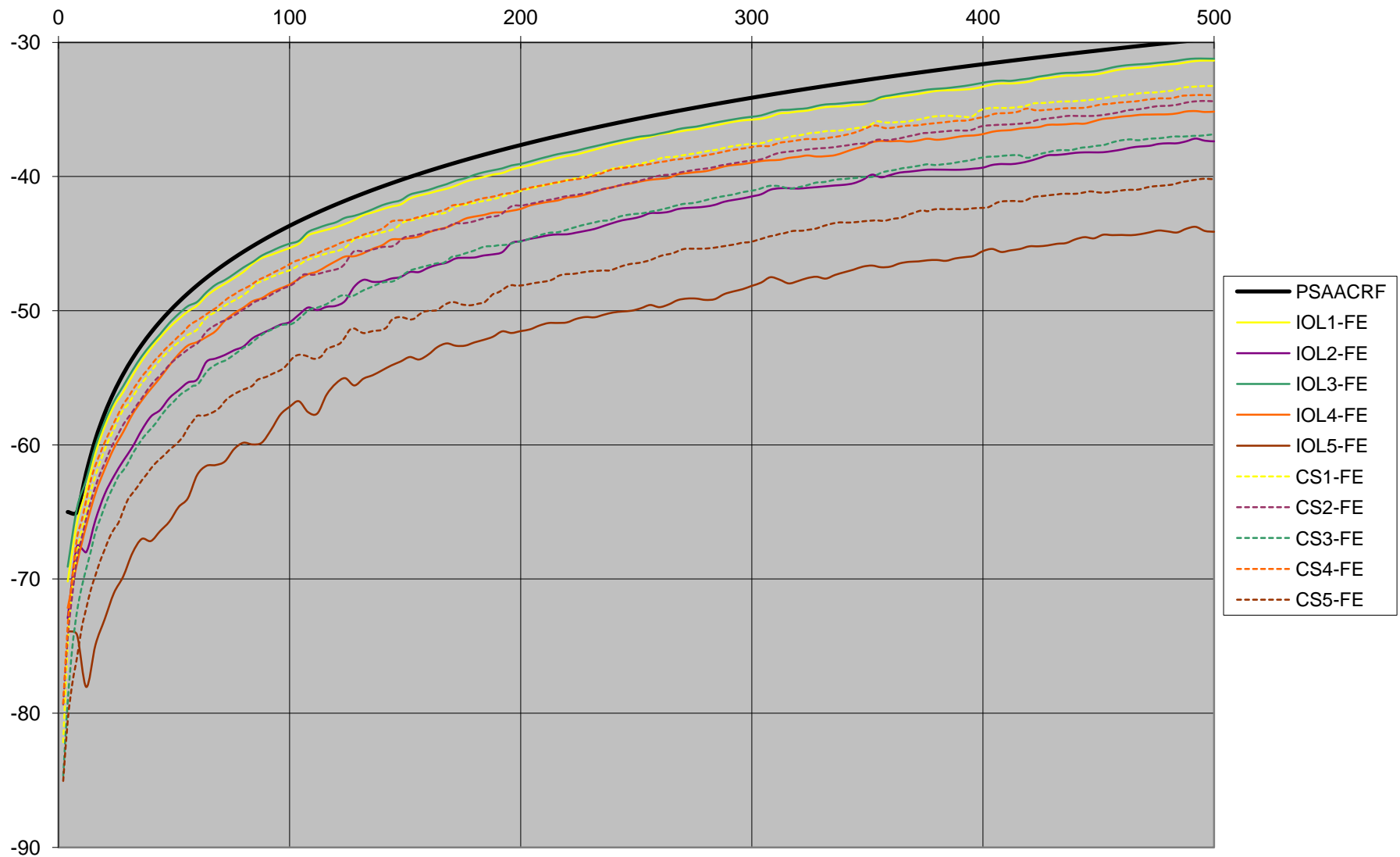
PSAACRF

$$\text{PSAACRF} := -20 \cdot \log \left(10^{\left(\frac{-10 \cdot \log \left(\frac{15}{100} \right) + 38.2 - 20 \cdot \log \left(\frac{f}{100} \right)}{-20} + 4 \cdot 10^{\frac{67 - 20 \cdot \log \left(\frac{f}{100} \right)}{-20}} \right)} \right)$$

where

$f :=$ frequency_in_MHz

This equation is based on a 15 meter channel with four connectors.



- ILD component was added based on the channel modeling and measurements of actual connectors
- Insertion Loss is a function temperature and wire size
 - Feasibility of this temperature dependent limit has been demonstrated by measurements of cable up to 125C
- The Insertion loss and PSAACRF limits are based on the Cat 6A limit, but have been adjusted to a 15 meter length to improve performance.
 - In the previous proposal, these parameters were functions of length and number of connectors.
- The new improved proposed Return Loss limit is based on a 1-pair connector, not the compensated RJ-45 connector.
- Data from testing multiple channel bundles in two different labs show both the feasibility of compliance to these limits and reproducibility.
- The PSANEXT limit is based on the category 6A limit.

Thank You

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