

802.3ch channel performance at different temperatures

Return Loss, Insertion Loss and investigation of limit line proposals

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Motivation and Agenda

Motivation

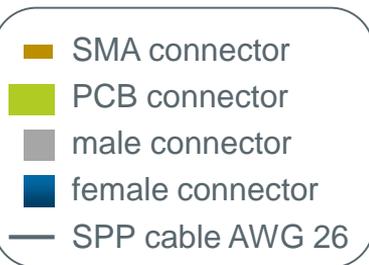
- Supply current Channel measurements at different temperatures
- Investigation of the Insertion limit line at lower frequencies
- Comparing different IL limit line proposals

Agenda

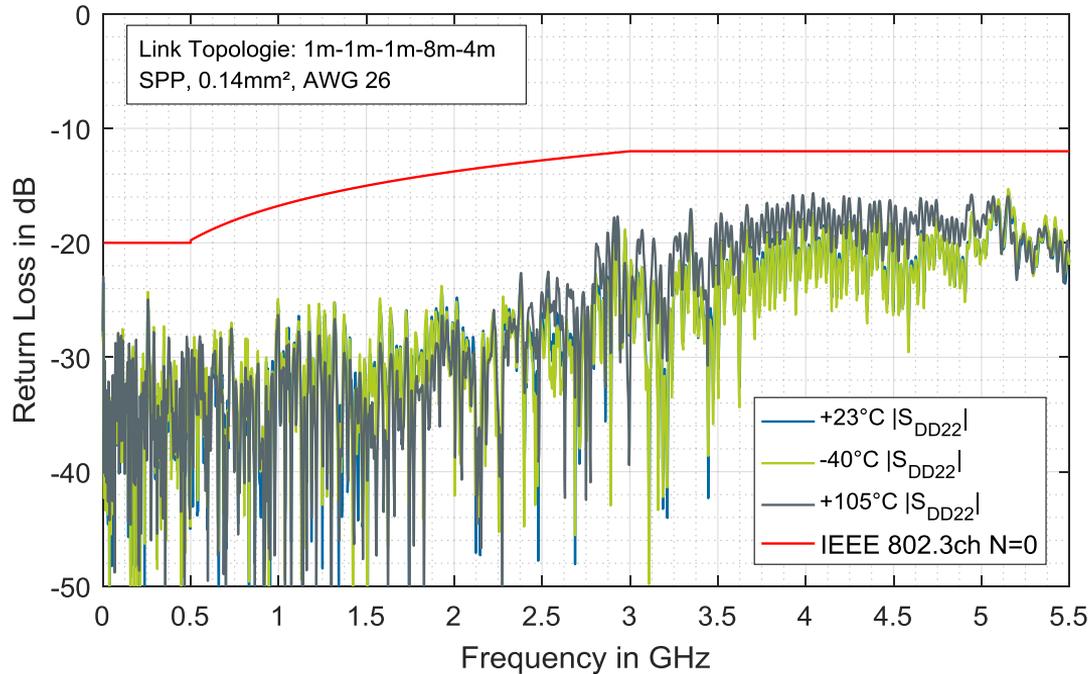
- Test setup and DUT explanation
- Return loss at three different temperatures
- Insertion loss at three different temperatures
- Investigation of IL limit line
- Conclusion

Test setup and DUT

- Shielded Parallel Pair (SPP) Cable 0.14mm² AWG 26
- Channel measurement including the test fixtures on both sides
- Measuring at following temperatures: -40°C, +23°C and +105°C in a climatic chamber



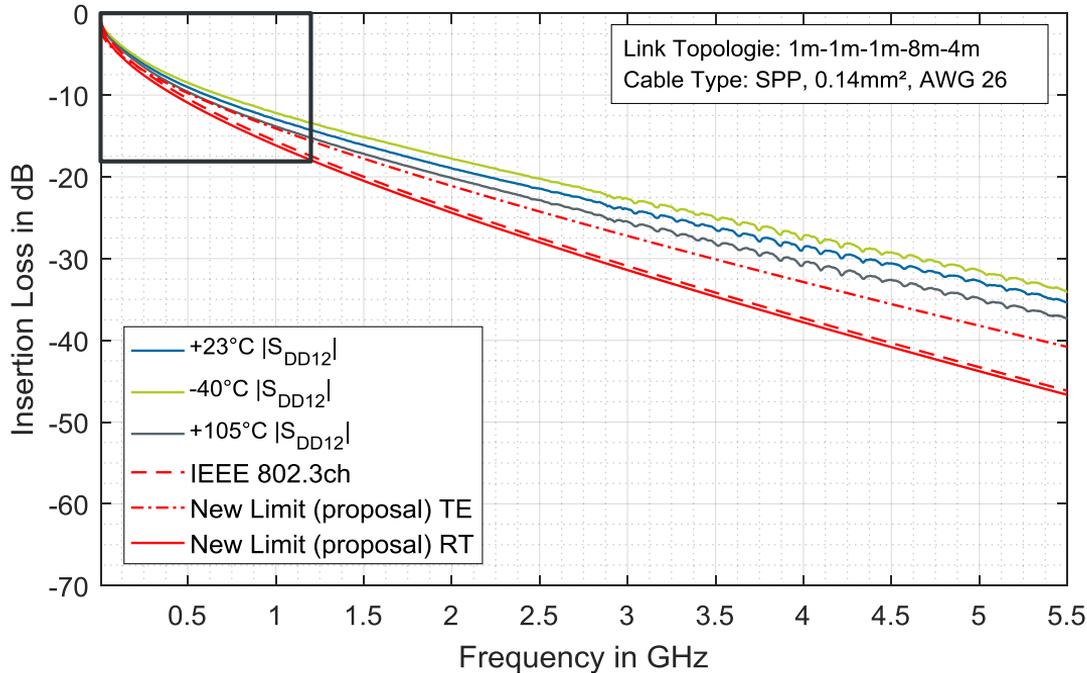
Return Loss at three different temperatures



- Return loss meets the limit line at all three temperatures
- Margin is large enough



Insertion Loss at three different temperatures



- Violation of the current limit line at the lower frequencies (black rectangle)
- Insertion loss meets **only** the limit line **proposals** at all three temperatures

IEEE 802.3ch (Current limit)

*Farjad_3ch_01b_0118.pdf

$$IL_{DB}(f) \leq 0.003 \cdot f + 0.4 \cdot \sqrt{f} \quad \text{with } f \text{ in MHz; } 5 \leq f \leq 5500$$

New Limit (proposal) TE

*Bergner_DiBiasco_Mandel_3ch_01_0418.pdf

$$IL_{DB}(f) \leq 0.0031 \cdot f + 0.3 \cdot \sqrt{f} + 1.5 \quad \text{with } f \text{ in MHz; } 5 \leq f \leq 5500$$

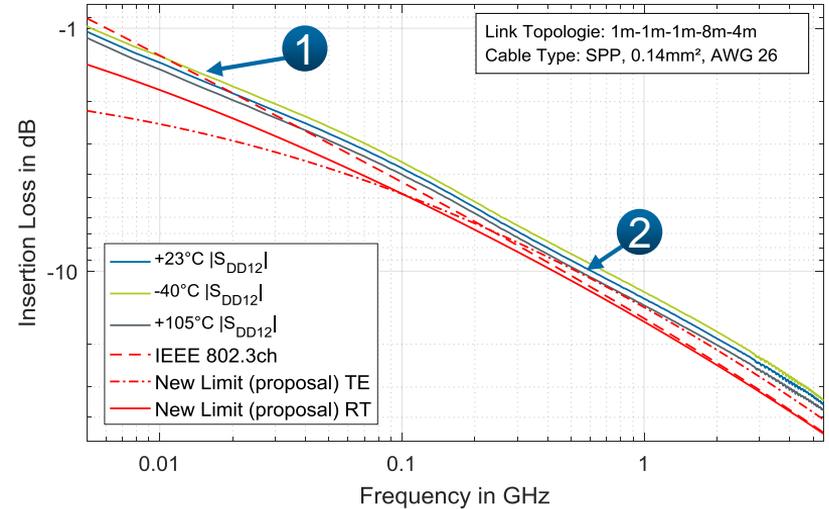
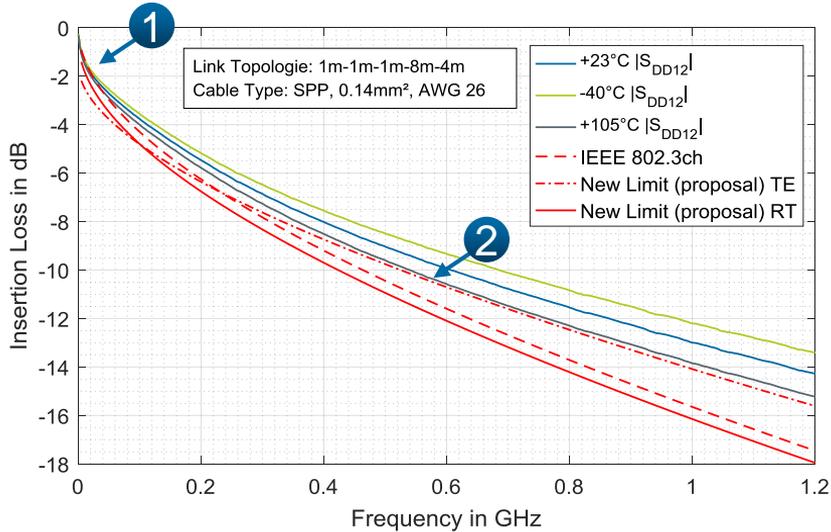
New Limit (proposal) RT

*mueller_3ch_01_0318.pdf

$$IL_{DB}(f) \leq 0.003 \cdot f + 0.4 \cdot \sqrt{f} + 0.5 \quad \text{with } f \text{ in MHz; } 5 \leq f \leq 5500$$



IL limit line investigation at lower frequencies



1 Current Limit is violated at lower frequencies <0.2 GHz
The problem is also shown by [*mueller_3ch_01_0318.pdf](#)

2 New limit line (proposal) TE have a small margin at frequencies of 0.6 GHz ±0.2 GHz
Insertion loss meets both new limit line proposals of RT and TE at all three temperatures

IEEE 802.3ch (Current limit)
[*Farjad_3ch_01b_0118.pdf](#)
 $IL_{DB}(f) \leq 0.003 \cdot f + 0.4 \cdot \sqrt{f}$ with f in MHz; $5 \leq f \leq 5500$

New Limit (proposal) TE
[*Bergner_DiBiaso_Mandel_3ch_01_0418.pdf](#)
 $IL_{DB}(f) \leq 0.0031 \cdot f + 0.3 \cdot \sqrt{f} + 1.5$ with f in MHz; $5 \leq f \leq 5500$

New Limit (proposal) RT
[*mueller_3ch_01_0318.pdf](#)
 $IL_{DB}(f) \leq 0.003 \cdot f + 0.4 \cdot \sqrt{f} + 0.5$ with f in MHz; $5 \leq f \leq 5500$

Conclusion

- The insertion loss have a **low** temperature dependency
Approximately 3-4 dB @ 5.5 GHz
- The return loss have **no** temperature dependency
- The IEEE 802.3 channel (1m-1m-1m-8m-4m) with the SPP cables (AWG 26, 0.14mm²)
 - **Doesn't** fulfill the **current** insertion loss limit line
 - **Fulfills** the two insertion loss limit line **proposals** from
 - RT *mueller_3ch_01_0318.pdf
 - TE *Bergner_DiBiaso_Mandel_3ch_01_0418.pdfat room temperature (+23°C), -40°C and +105°C