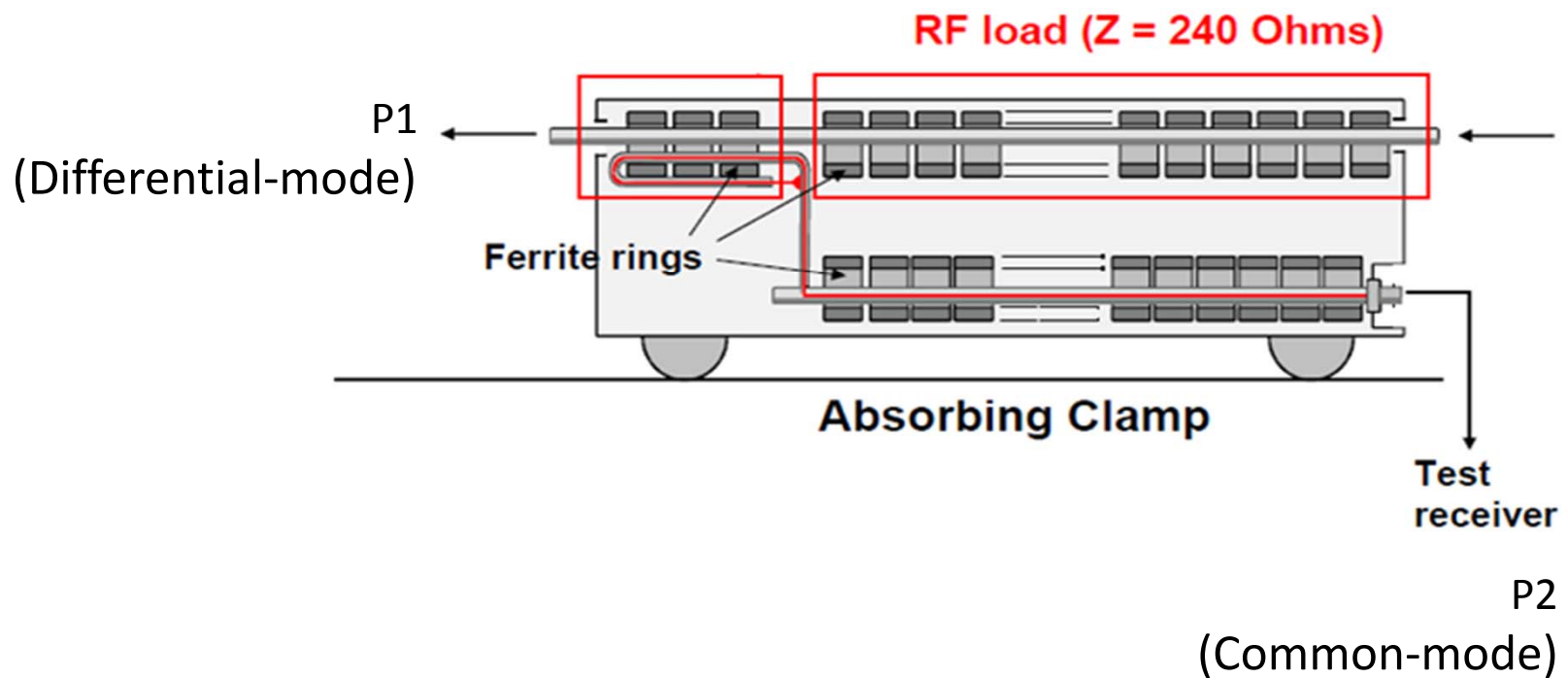


Coupling Attenuation Measurements for Cables & Channels

Paul Kish
Belden

Presented for information to IEEE 802.3bp Task Force 15 May, 2013

Absorbing Clamp



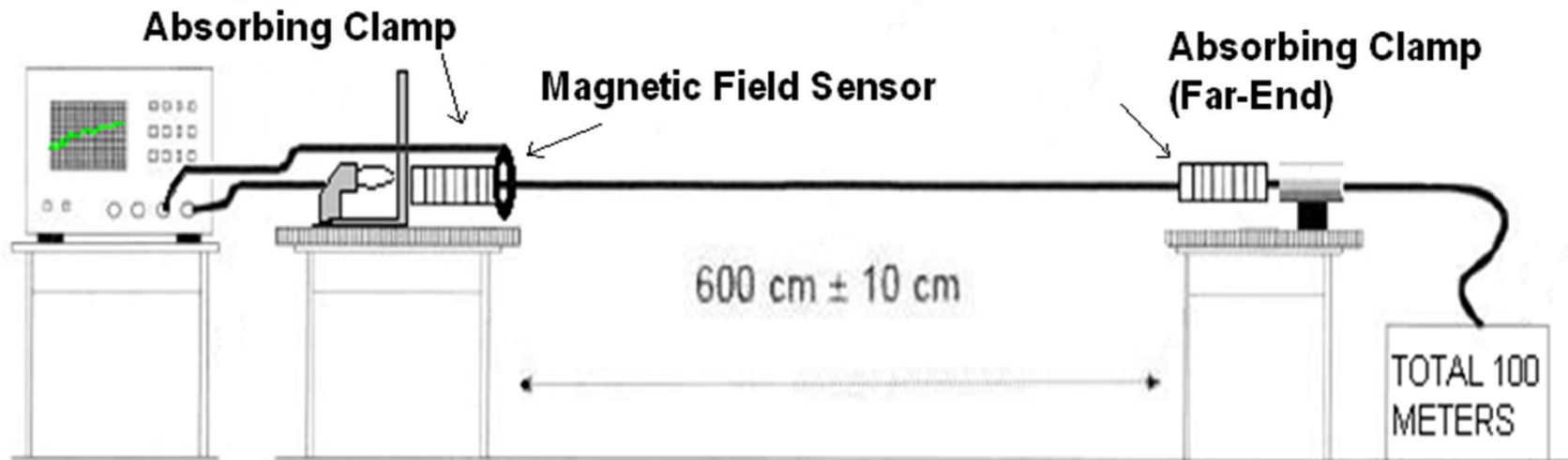
Coupling Attenuation Setup for Cables

Coupling Attenuation

$$a_c = 10 \text{ Log}_{10} \left(\frac{P_1}{\max[P_2]} \right)$$

P_1 = Input Power (Differential-mode) injected on Individual Pairs

P_2 = Peak Power (Common-mode) measured by the Magnetic Field Sensor



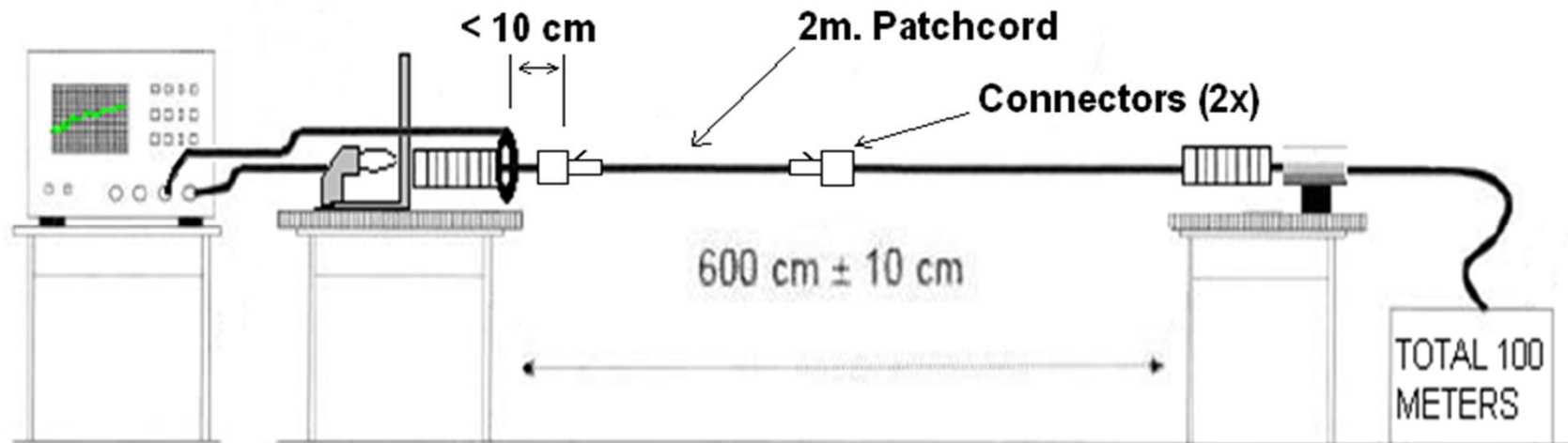
Coupling Attenuation Setup for Channels (EN50289-1-15)

Coupling Attenuation

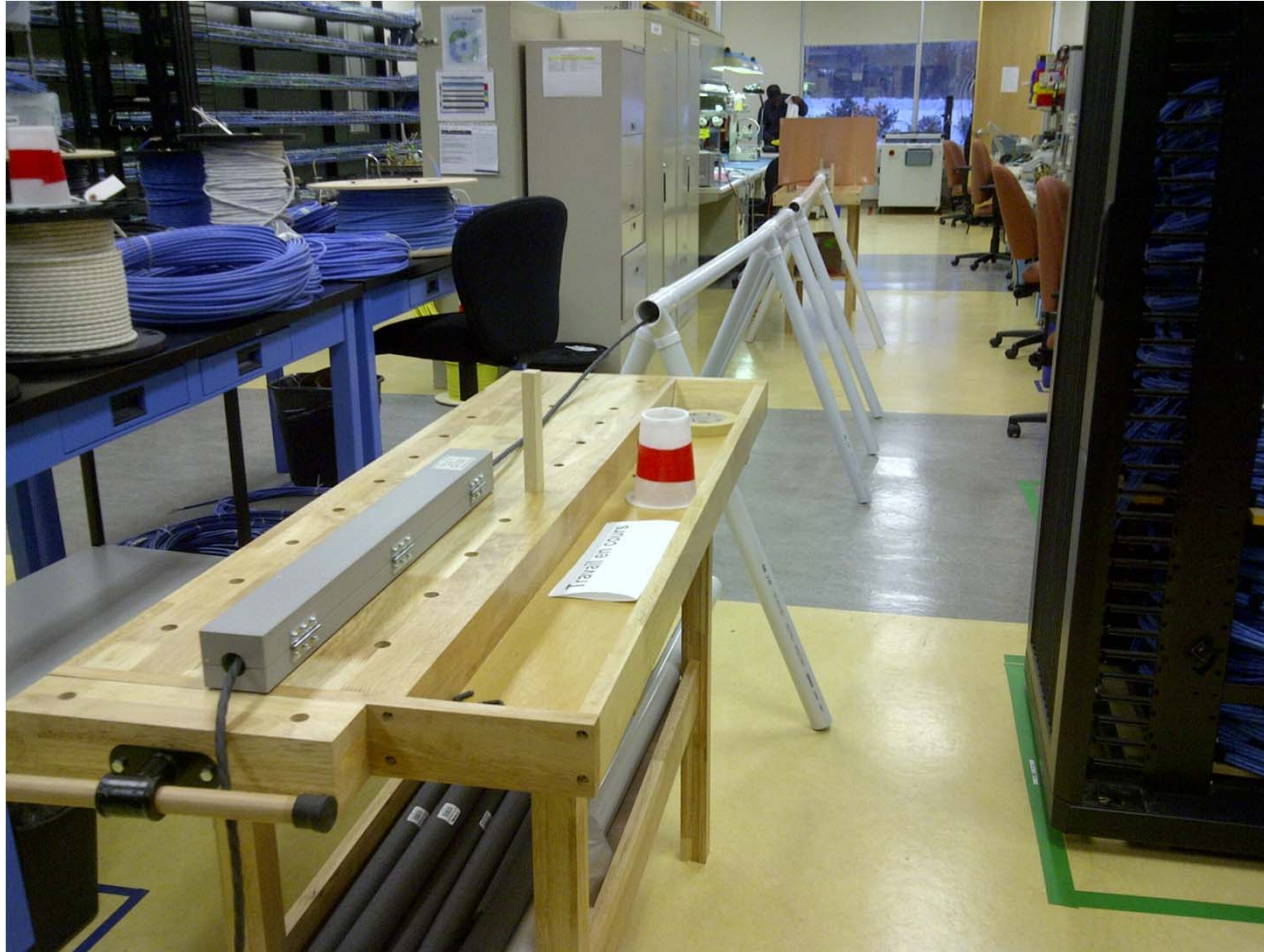
$$a_c = 10 \text{ Log}_{10} \left(\frac{P_1}{\max[P_2]} \right)$$

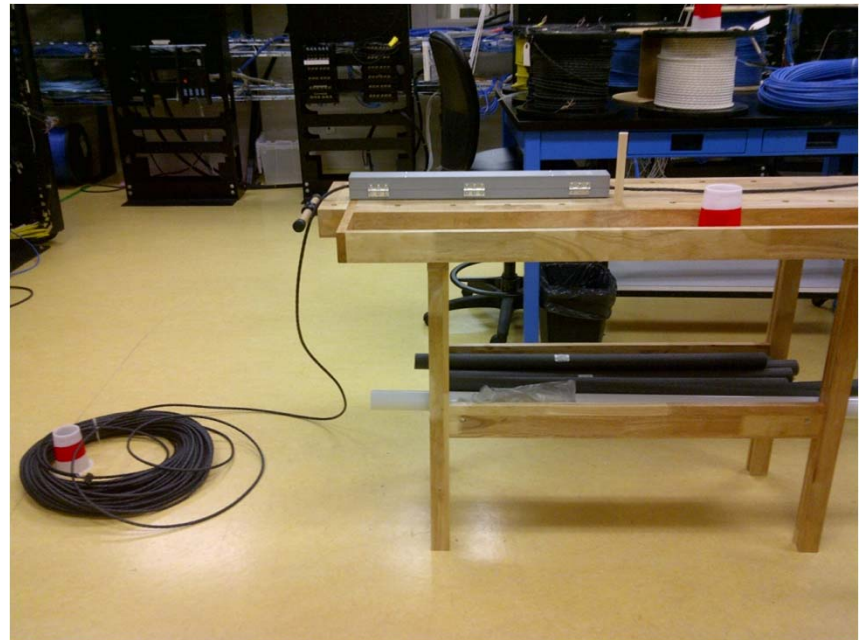
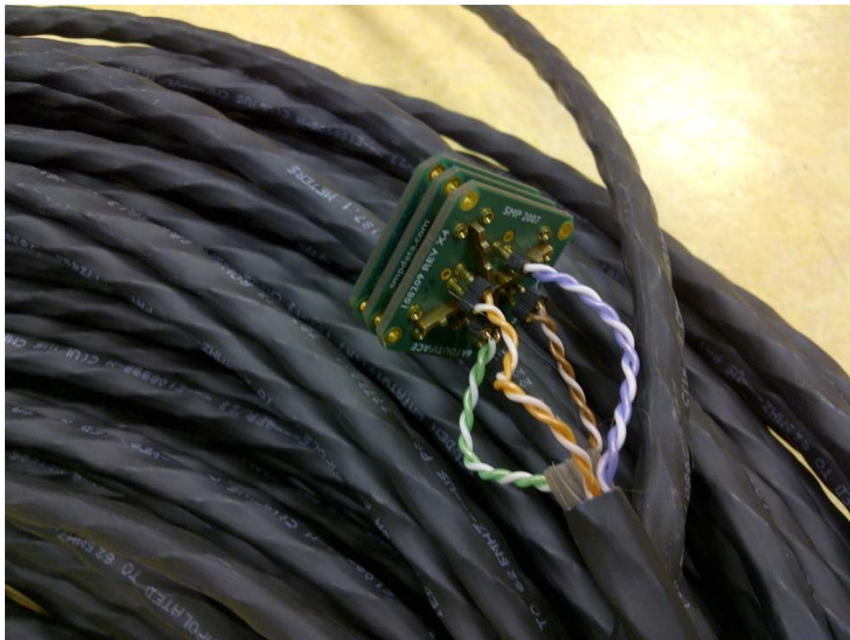
P_1 = Input Power (Differential-mode) injected on Individual Pairs

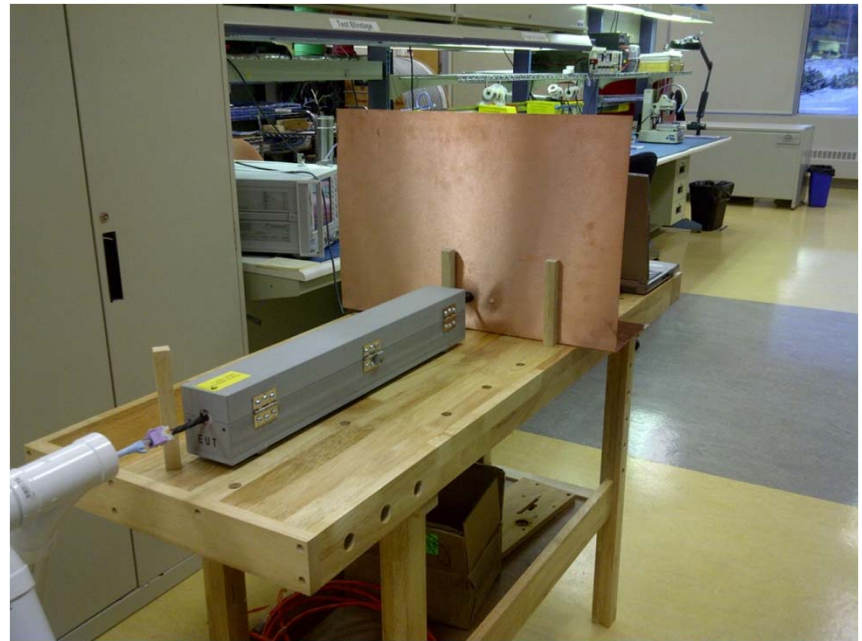
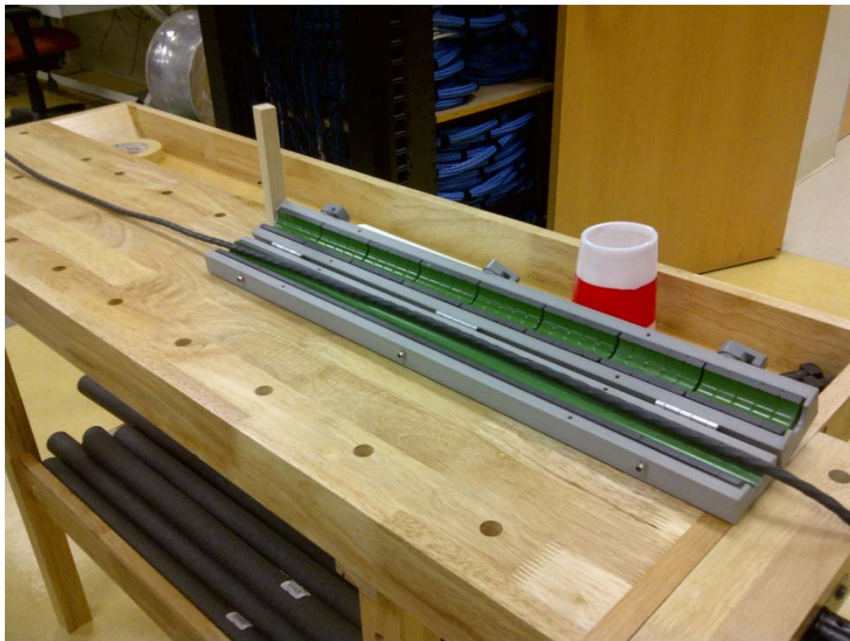
P_2 = Peak Power (Common-mode) measured by the Magnetic Field Sensor

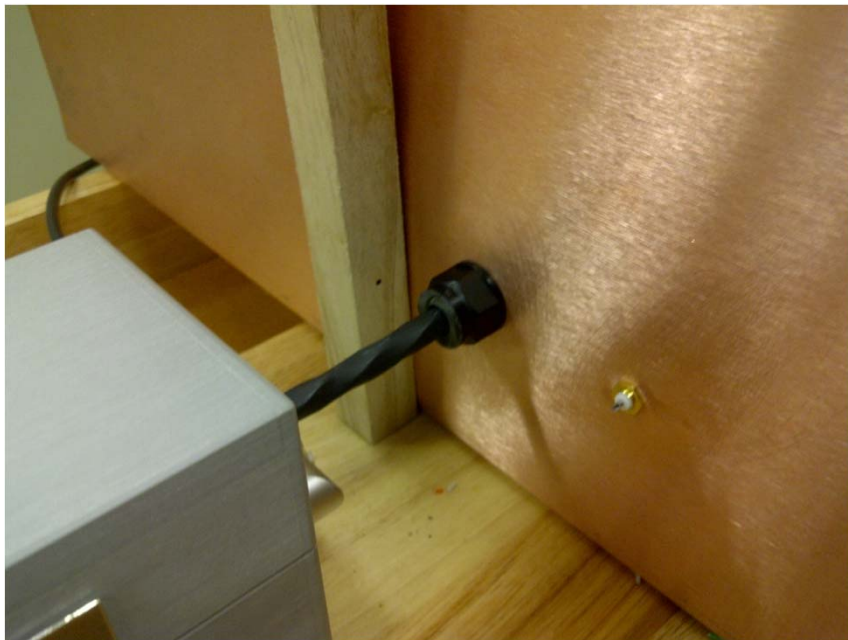


PICTURES OF TEST SETUP



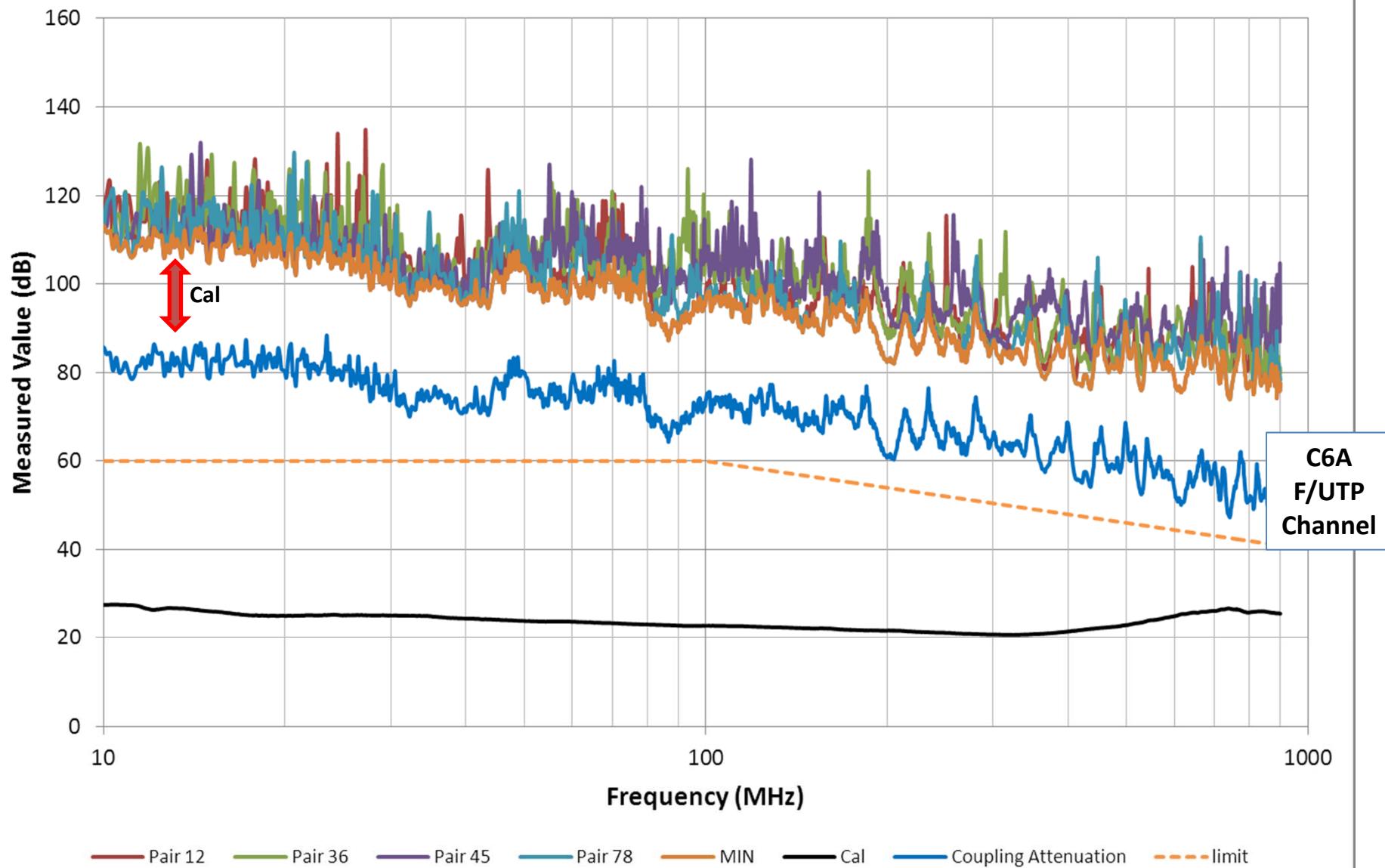






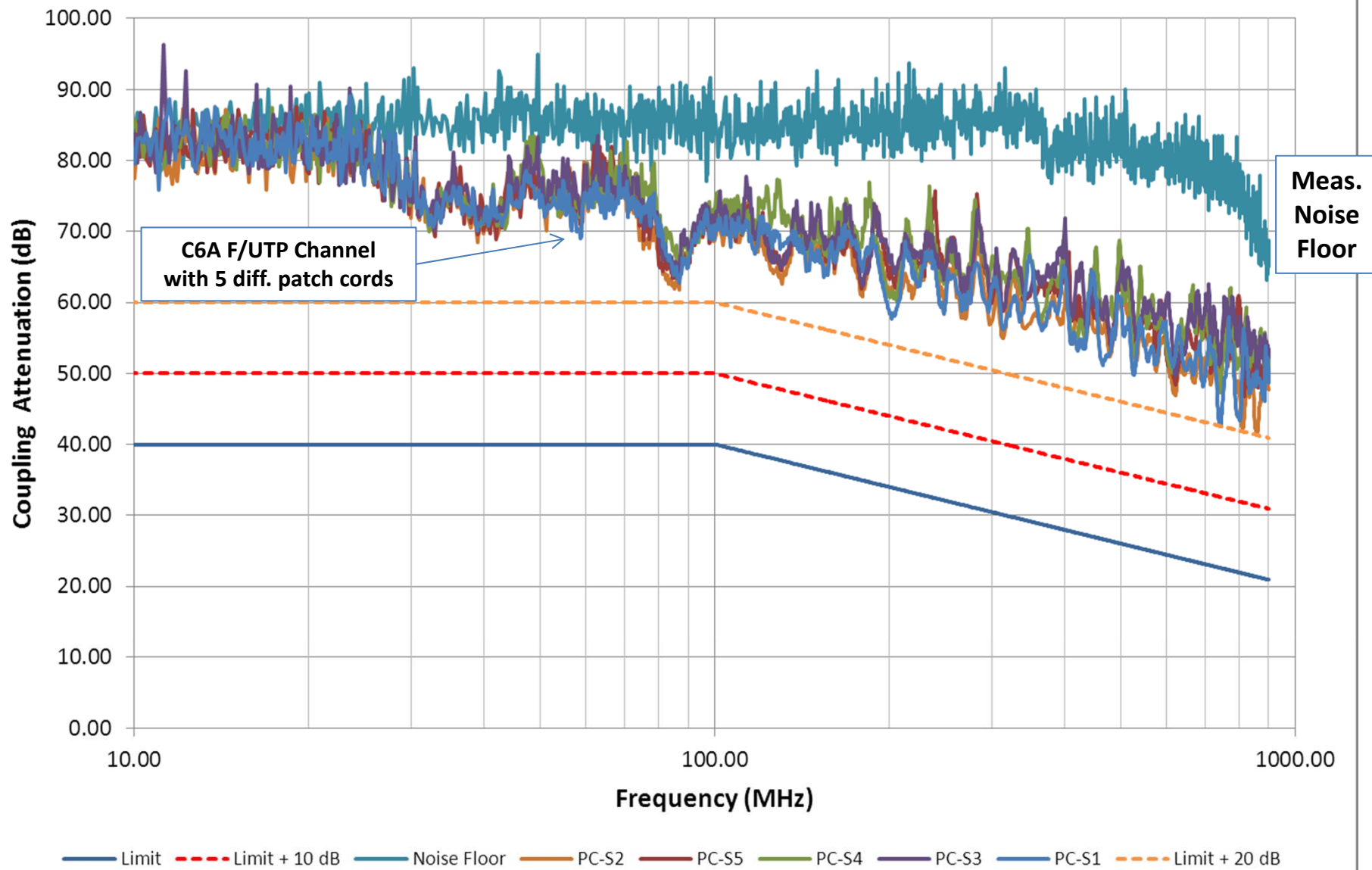
COUPLING ATTENUATION MEASUREMENTS

Example Coupling Attenuation Measurements F/UTP Channel



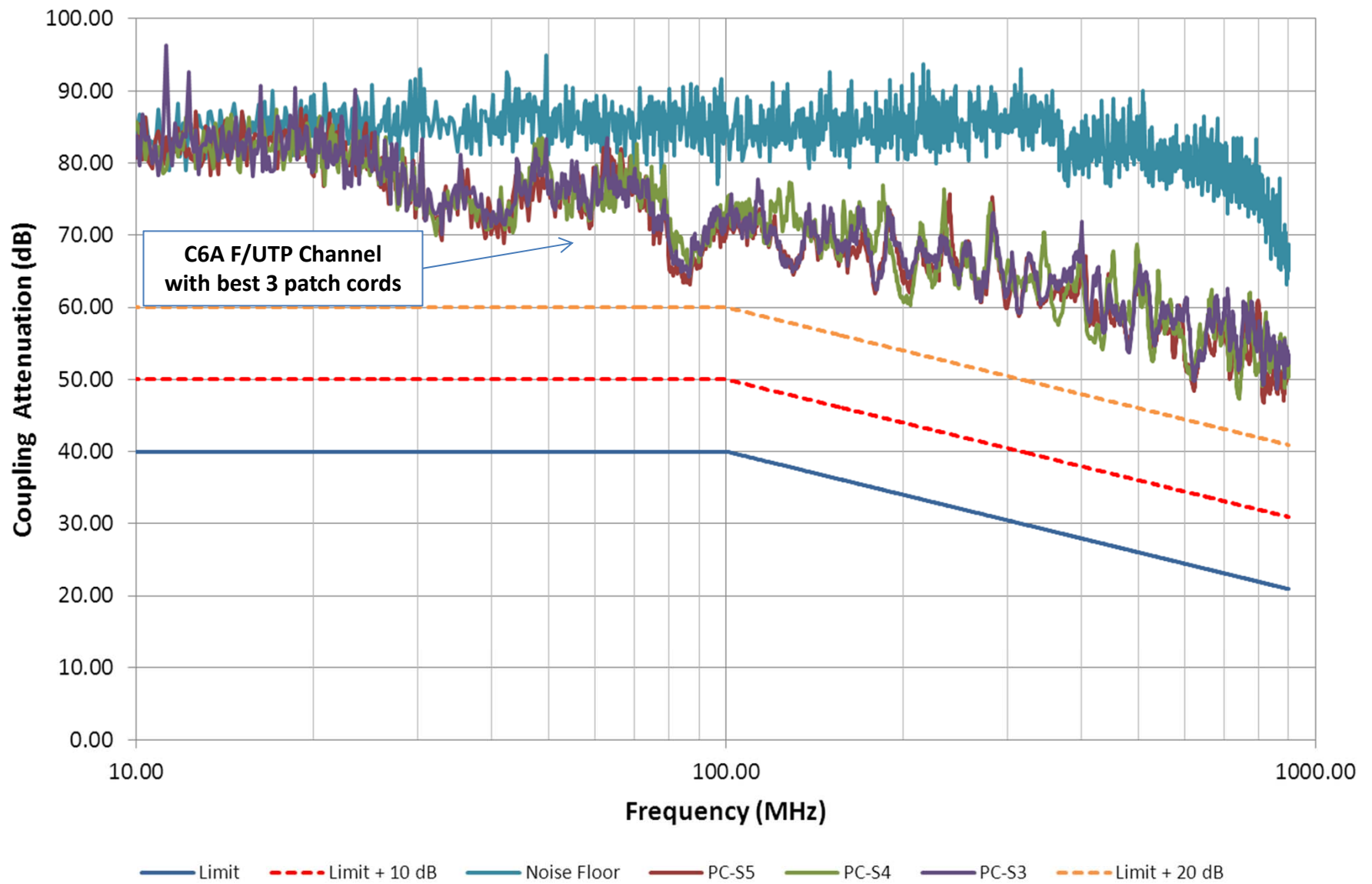
Coupling Attenuation

Channel Test with 2 m Cords (F/UTP), Noise Floor

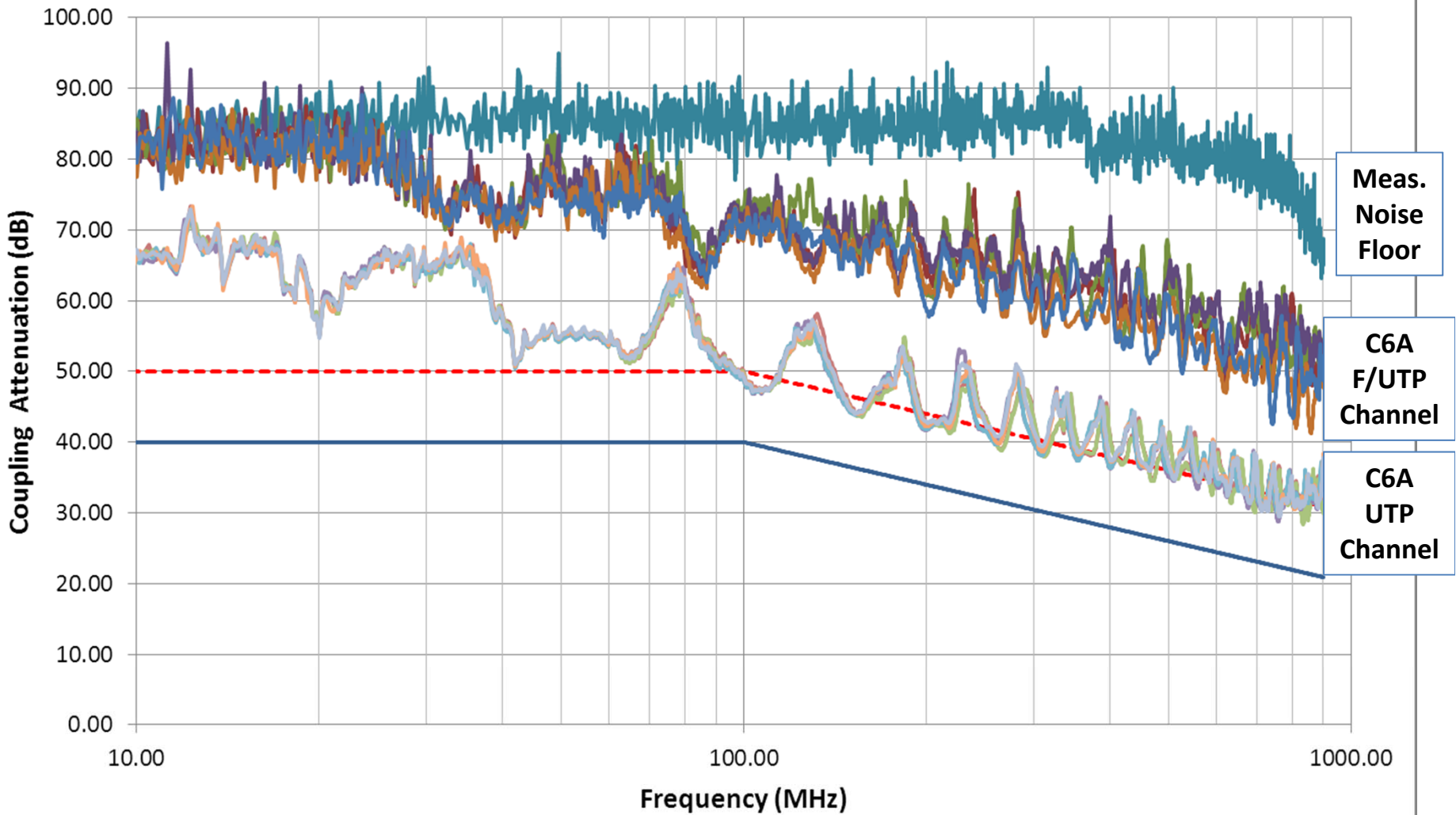


Coupling Attenuation

Channel Test with 2 m Cords (F/UTP), Noise Floor



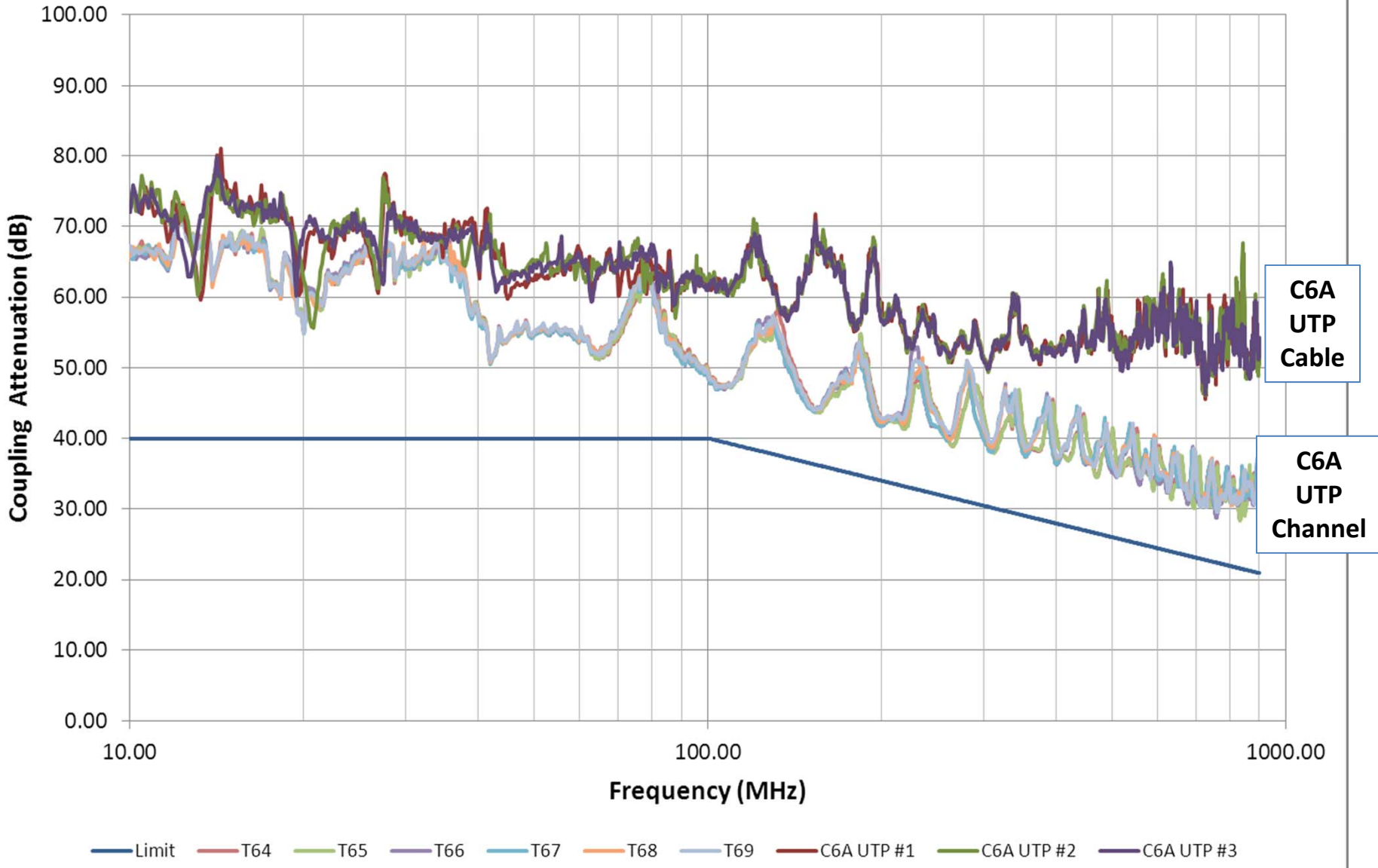
Coupling Attenuation Channel Test with 2 m Cords (F/UTP vs. UTP), Noise Floor



- Limit
- - - Limit + 10 dB
- Noise Floor
- T64
- T65
- T66
- T67
- T68
- T69
- PC-S5
- PC-S4
- PC-S3
- PC-S2
- PC-S1

Coupling Attenuation

Channel Test with 2 m Cords, Cable Test Category 6A UTP, Noise Floor



Summary

- Coupling attenuation measurements have been performed on cables and channels
- Coupling attenuation is considered as the figure of merit of the electromagnetic immunity:
 - For UTP channels
 - Category 6A UTP channels that we tested generally meet the requirements of $80 - 20 \cdot \log(f)$ currently specified in ISO 11801 ed 2.1, where f is the frequency in MHz
 - Once the setup is established, most of the variability in coupling attenuation measurements is related to the patch cord
 - For FTP channels
 - Category 6A FTP channels generally meet the requirements from 10 dB to 20 dB higher than the coupling attenuation limits specified in ISO 11801, ed 2.1
 - If the shield is properly terminated at the connectors, most of the variability in coupling attenuation measurement is related to the patch cord