Coupling attenuation and EMC considerations

Draft 1.2 Comments #363 and #364

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- Due to measurement implications CISPR divided the frequency range in:
  - Below 80 MHz conductive measurements e.g.
    - Strip lines
    - Current clamps
    - Impedance stabilization networks
  - Higher than 80 MHz radiated measurements e.g.
    - Antennas
    - Clamp coupling
    -

Transient IEC 61000 series

- are specified in clause 146.9.2.2 for system integrators
  - Does it include the link?
- Different Transient testing e.g.
  - ESD
  - EFT
  - sourge
  - conducted immunity (less then 80MHz)
  - Magnetic field

Table 146-7

- As above 20 MHz the line Radiated RF-AM should be deleted
- The original , now missing lines of the MICE table should be added again in the link section

Electromagnetic	**E_1**	**E_2**	**E_3**
Electrostatic discharge – Contact (0,667 μC)	4 kV	4 kV	4 kV
Electrostatic discharge – Air (0,132 μC)	8 kV	8 kV	8 kV
Conducted radio frequency (RF)	3 V at 150 kHz to 80 MHz	3 V at 150 kHz to 80 MHz	10 V at 150 kHz to 80 MHz
Electrical fast transient/Burst (EFT/B) AC mains power including the protective earth	1 000 V	1 000 V	2 000 V
Electrical fast transient/Burst (EFT/B) I/O (signal/data/control)	500 V	500 V	1 000 V
Surge (transient ground potential difference) - signal, line to earth	500 V	1 000 V	1 000 V
Magnetic Field (50/60 Hz)	1 A/m	3 A/m	30 A/m

Coupling attenuation

- Defined because of measurement considerations, similar to CISPR from 100 MHz on with a plateau down to 30MHz. The limitation is the absorber clamp as defined in IEC62153-4-13
- Why was it never defined for lower frequencies?
  - There was no need for it, ISO/IEC 11801-1 refers to IEC cables and connectors which specify the low frequencies with:
    - Screening effectiveness
    - Transfer impedance

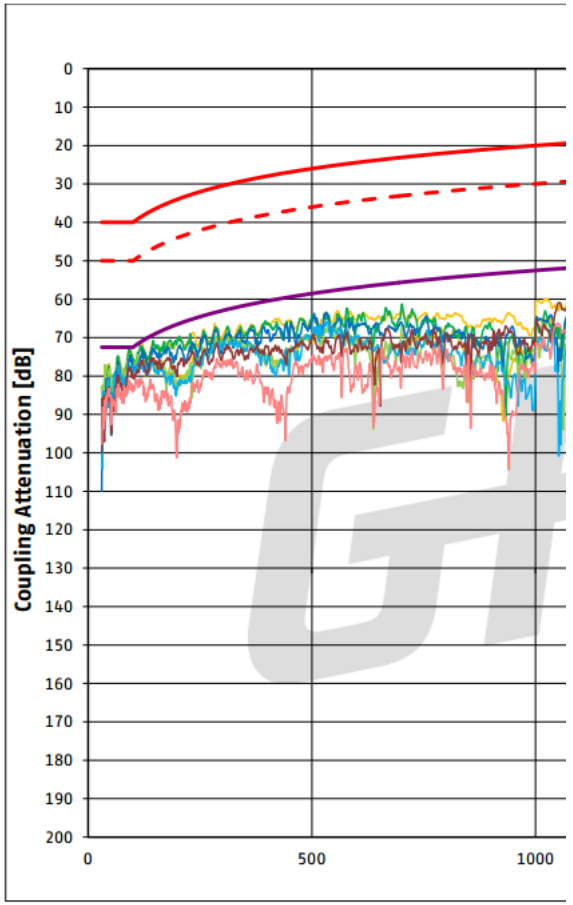
Typical measurement

source: GHMT AG Germany

The graph was created using IEC 62135-4-13 and shows the typical slope of 20dB/decade.
It can be seen that it shows this behaviour below 100 MHz but the standard neglects this.
Therefore the formula is for this case:

CA= 112-20log(f) 72 dB max 30< f< 1000 MHz

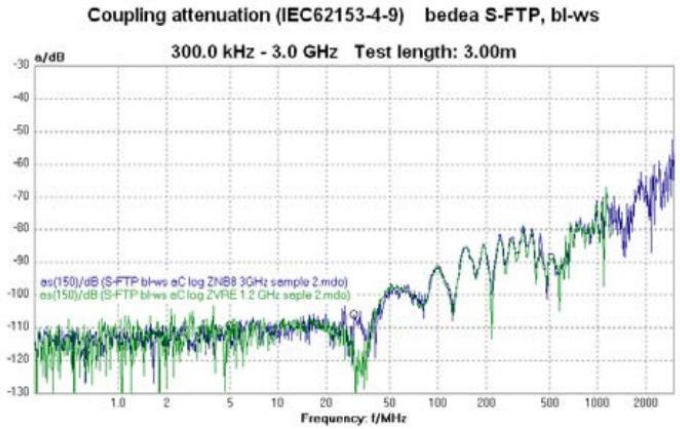
But the measured maximum is 78 dB at 30 MHz.

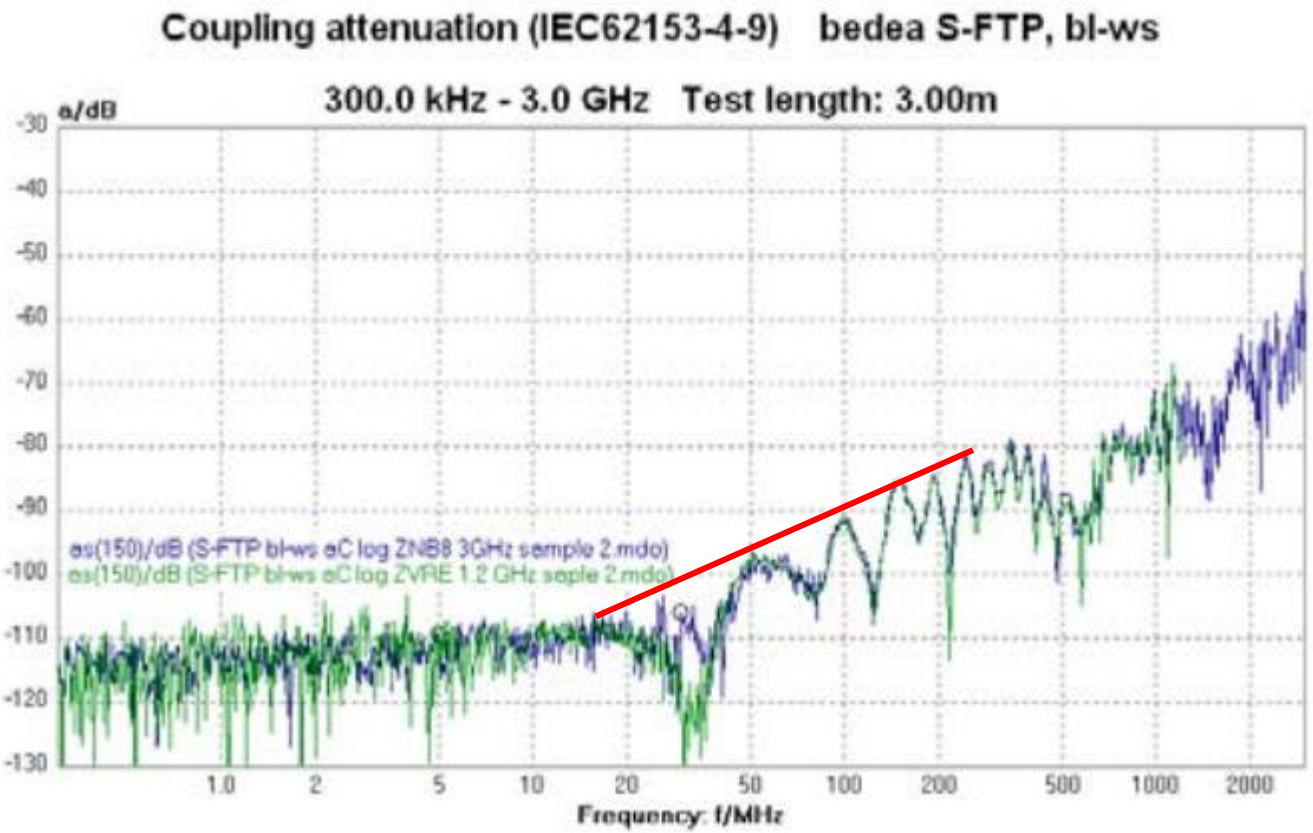


- There are various IEC standards to measure coupling attenuation down to less than 1 MHz, but not referenced by cabling and component standards.
- A list can be seen after page 12. Coupling attenuation not always mentioned in the title

Example of a measurement down to 150 kHz

- Reference:
  - http://www.bedea.com/images/PDF/Messtechnik/english/IWCS%20-%20Halme_Mund%20-%20EMC%20of%20Cables,%20Connectors.pdf
  - **EMC of Cables, Connectors and Components with Triaxial Test set-up**
  - **New and revised IEC 62153-4 standards to measure Transfer Impedance and screening or Coupling Attenuation**





Is a 20 dB/dec line showing that till 15 MHz it follows this slope .
It is therefore save to use the 100 MHz value for coupling attenuation from 150 Khz to 20 MHz for the T1L link.

IEC SC46C WG7

- On Monday April 23 this group decided to start a project 61156-13 to specify the T1L cable including coupling attenuation. The frequency range would start at 100 KHz.
- It should be referenceable by September 2018.
  - Several options to specify coupling attenuation were discussed.

Proposal

- Therefore values of coupling attenuation using the actual 30 MHz values should be used.
- Table 146-6 would then be:
- Reference: TBD

Frequency (MHz)	E_1 dB	E_2 dB	E_3 dB
0.1< f ≤ 20	40	50	60

Thank you

- *IEC 62153-4*-6: Standard | Metallic cables and other passive components test methods - Part 4-6: Electromagnetic compatibility (EMC) - Surface transfer impedance - line injection method.
- *IEC 62153-4*-3: determines the screening effectiveness of a cable shield by applying a well-defined current and voltage to the screen of the cable and measuring the induced voltage in order to determine the surface transfer impedance. This test measures only the magnetic component.

- *IEC 62153-4-7*: Metallic communication cable test methods - Part 4-7: Electromagnetic compatibility (EMC) - Test method for measuring of transfer impedance ZT and screening attenuation and or **coupling attenuation** of connectors and assemblies up to and above 3 GHz - Triaxial tube in tube method.

- DIN *IEC 62153-4*-9:2007-01 - Entwurf [ACHTUNG: DOKUMENT ZURÜCKGEZOGEN]. Titel (Deutsch): Prüfverfahren für metallische Kommunikationskabel - Teil 4-9: Elektromagnetische Verträglichkeit (EMV) - Kopplungsdämpfung geschirmter symmetrischer Kabel - Triaxialverfahren (IEC 46/190/CDV:2006)

- *IEC 62153-4-2*: electromagnetic compatibility, EMC, smart city | Metallic communication cable test methods - Part 4-2: Electromagnetic compatibility (EMC) - Screening and **coupling attenuation** - Injection clamp method.

- The present technical report describes how to extrapolate the test results of transfer impedance to higher frequencies and the test results of screening attenuation to lower frequencies when measured with the triaxial set-up according to IEC 62153-4-3 (method B) respectively IEC 62153-4-4