Screening issues CMNR

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History/Summary

- The two presentations:
  - Cibula_3bq_RxCMNR_01_2014
  - Pischl_3bq_01_1014

Showed that we are nearly there, we should define:

- Agree on naming: common mode to differential mode attenuation/reduction
- Where to apply (cable outside to PHY input, what does it include: MDI, PCB, electronics?)
- **Add the missing screening definitions to get the complete picture.**
- It is certainly not a PHY qualification, but could be used for testing

History/Summary

- In the presentations mostly the cable and connector category is used to define the experiment
- The shield quality of the connection is only defined as “shielded”

- To explain the importance of missing information some explanations necessary:

Screening: cables

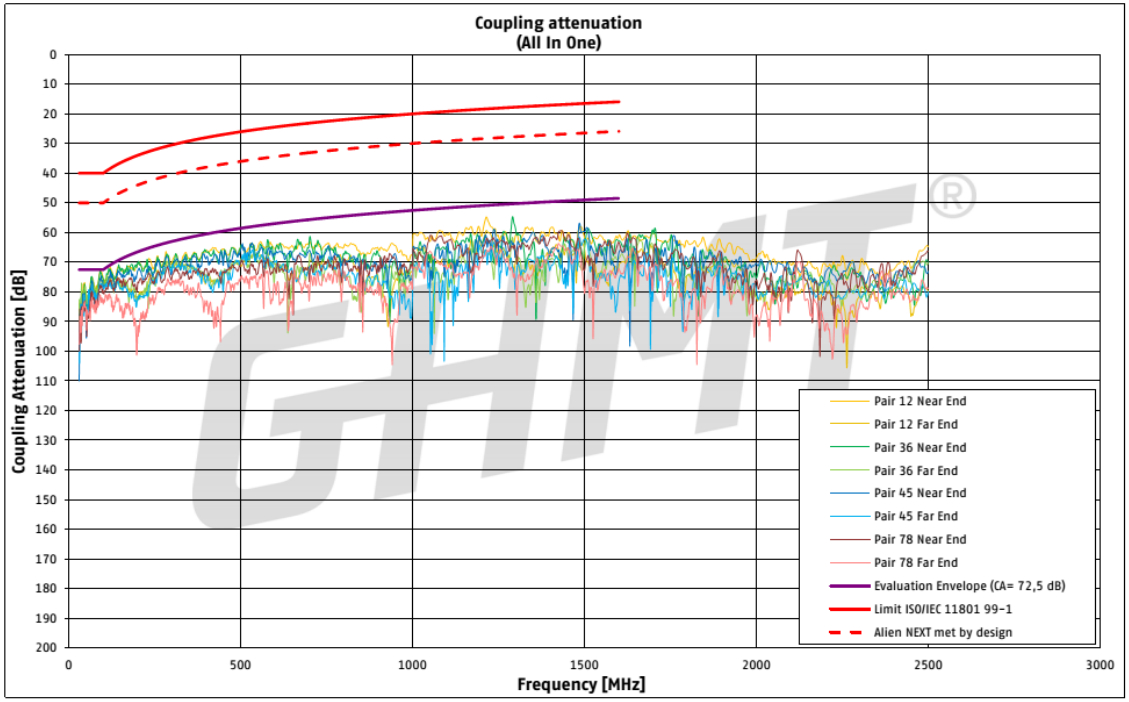
- In IEC cables are specified in 3 types for coupling attenuation
- TIA one value like Type II 55 dB class 8 (cat6A not available to me)

Table 3 – Coupling attenuation

Coupling attenuation type	**Frequency range** MHz	**Coupling attenuation** dB
Type I	30 – 100	≥ 85
	100 – 1 600 (2 000 ffs.)	≥ 85 – 20 $\log_{10}$ (f/100) ; f in MHz
Type Ib	30 – 100	≥ 70
	100 – 1 600 (2 000 ffs.)	≥ 70 – 20 $\log_{10}$ (f/100) ; f in MHz
Type II	30 – 100	≥ 55
	100 – 1 600 (2 000 ffs.)	≥ 55 – 20 $\log_{10}$ (f/100) ; f in MHz

Screening: cables

- IEC definition of coupling attenuation:
  - Differential in, clamp (30 MHz to 1 GHz) out
    - Evaluation of class II ISO channel 30m 2 connections with second clamp from 1000 to 2500 MHz (2013)



Screening: connections

- Connectors are specified by :
  - Transfer impedance up to 80 MHz. This is easy to measure and gives an idea of the quality of the connection/ screen attachment as the latter is up to the manufacturer
  - Coupling attenuation: difficult to measure separate from the channel, therefore mostly measured in a channel configuration.

Screening: connections

- IEC or ISO/IEC
  - For details see end
  - 6A not sufficient (personal
  - Not sufficient either
  - (personal opinion)

Table 119 – Informative transfer impedance values (screened connectors only) at key frequencies

Frequency MHz	Maximum transfer impedance Ω						
	Connector category						
	5	6	6_A	7	7_A	8.1	8.2
1	0,10	0,10	0,10	0,05	0,05	0,05	0,05
10	0,20	0,20	0,20	0,10	0,10	0,10	0,10
80	1,60	1,60	1,60	0,80	0,80	0,80	0,80

Table 120 – Coupling attenuation (screened connectors only)

Frequency MHz	Minimum coupling attenuation [a] dB						
	Connector category						
	5	6	6_A	7	7_A	8.1	8.2
$30 \le f \le 100$	≥45,0	≥45,0	≥45,0	≥45,0	≥45,0	ffs	ffs
$100 < f \le$ NOTE	–	85-20 lg(*f*)	85-20 lg(*f*)	85-20 lg(*f*)	85-20 lg(*f*)	ffs	ffs

[a] The applicable test standard is IEC 62153-4-12.

NOTE Coupling attenuation is measured to 1 000 MHz but the limit applies to the upper frequency of the class under test.

- TIA

The shield transfer impedance of screened category 8 connecting hardware, measured in accordance with ANSI/TIA 568-C.2 Annex D shall comply with the requirements of clause 6.8.20 of ANSI/TIA 568-C.2.

Connecting hardware coupling attenuation is assured through compliance with channel coupling attenuation requirements..

Screening: channels up to F_A

class I and II draft (TR equals E_2)

- Mice table in ISO/IEC 11801 defines 3 ambients for the cabling
  - **M**echanical
  - **I**ngress
  - **C**limatic/chemical
  - **E** electromagnetic
- Were to be depends on the planning and installation, mitigation can be applied, not all installations needs to be the same.
- typically the electromagnetic is defined: E1 is commercial, E2 light industry (Data centers, personal opinion) and E3 is heavy industrial

Screening: channels up to F_A

class I and II draft (TR equals E_2)

- Mice table defines 3 ambients for EMC
- TIA one value, cat 8 equals E_2 , 6A (40 ?)

Table 27 – Coupling attenuation for channel for screened systems

Class	Frequency MHz	Environmental classification		
		E_1	E_2	E_3
		Minimum coupling attenuation [a] dB		
D, E, E_A, F, F_A	$30 \le f \le 100$	40	50	60
	$100 \le f \le$ NOTE	$80 - 20\lg(f)$	$90 - 20\lg(f)$	$100 - 20\lg(f)$

TCL for channels: channels up to F_A
class I and II draft

Table 23 – TCL for channel for unscreened systems

Class	Frequency MHz	Environmental classification		
		E_1	E_2	E_3
		Minimum TCL[a] dB		
A	0,1	30	30	30
B	f = 0,1	45	45	45
	f = 1	20	20	20
C	$1 \le f \le 16$	$30 - 5\lg(f)$	$30 - 5\lg(f)$	$30 - 5\lg(f)$
D, E, E_A, F, F_A	$1 \le f < 30$	$53 - 15\lg(f)$	$63 - 15\lg(f)$	$73 - 15\lg(f)$
	$30 \le f \le$ NOTE [b]	$60{,}3 - 20\lg(f)$	$70{,}3 - 20\lg(f)$	$80{,}3 - 20\lg(f)$

[a] Calculated values of greater than 40 dB shall revert to a minimum requirement of 40 dB.

[b] TCL at frequencies above 250 MHz are for information only.

Table 24 - TCL for Class I and II channels

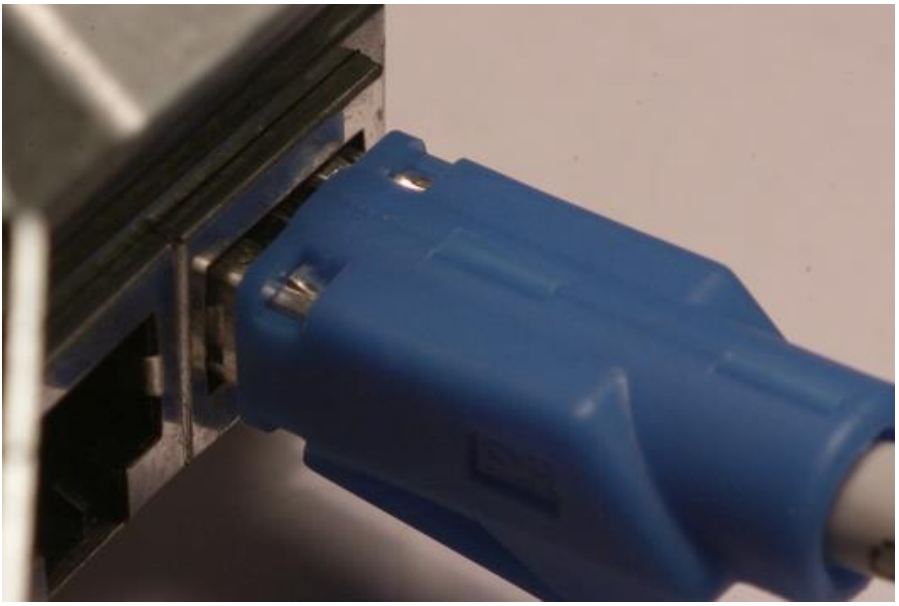
Class	Frequency MHz	Minimum TCL dB	
		Channels using cables with unscreened pairs	Channels using cables with screened pairs
I	$1 \le f \le 2000$	$60{,}0 - 17\lg(f)$ [a]	$50{,}0 - 17\lg(f)$ [b, c]
II	$1 \le f \le 2000$	$60{,}0 - 17\lg(f)$ [a]	$50{,}0 - 17\lg(f)$ [b, c]

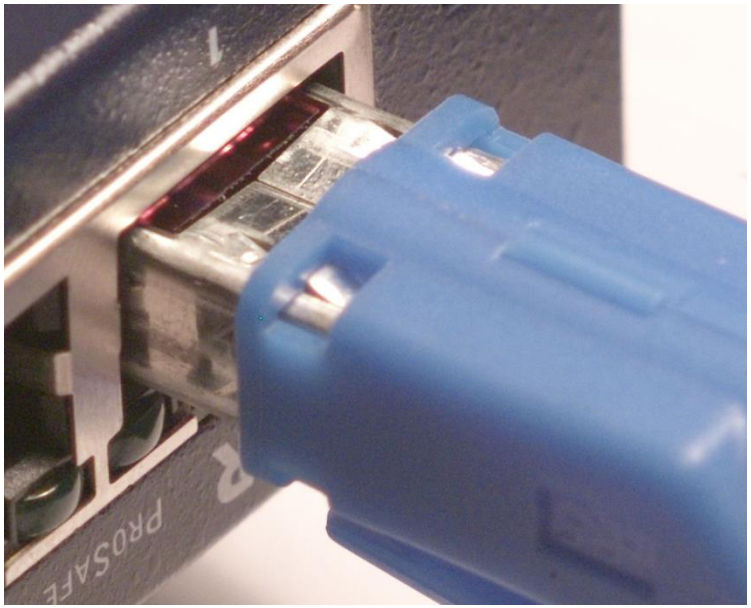
How to define?

- First know the Mice classification
  - 40G will by shure need at least the values of TIA cat8 or ISO/IEC TR 11801-9901(CA Channel 50 dB)
  - Cat 6A set up will be probably lower (CA 40 dB)
  - When doing measurements the cable may be of higher type. 8.2 cables tend to be type 1b (70 dB)
  - The connections in the cabling channel needs to be checked.
  - Especially the equipment connection is critical because not part of the cabling channel but of the eqquipment

Traps with shielded connections

- No remark found on connections in presentations, just “shielded”:
- Issues as only footprint standardized:
  - Same plug, different jacks, both “shielded”



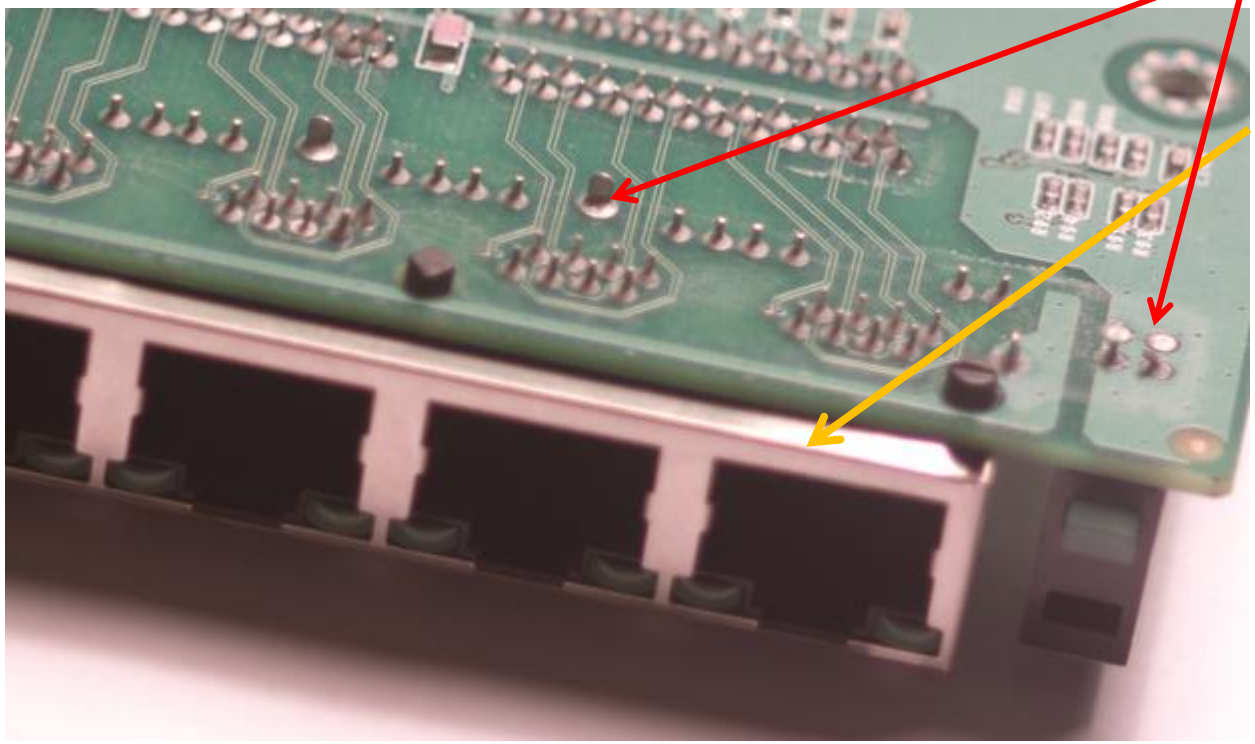


Home 1G switch

- Shield connection only trough fingers, in this case they hit metal but no force any more

Home 1G switch

- Lower side no ground contact (painted and no forced contact)
  - Would have never passed a transfer impedance test
  - Bad results expected even if cabling is very good

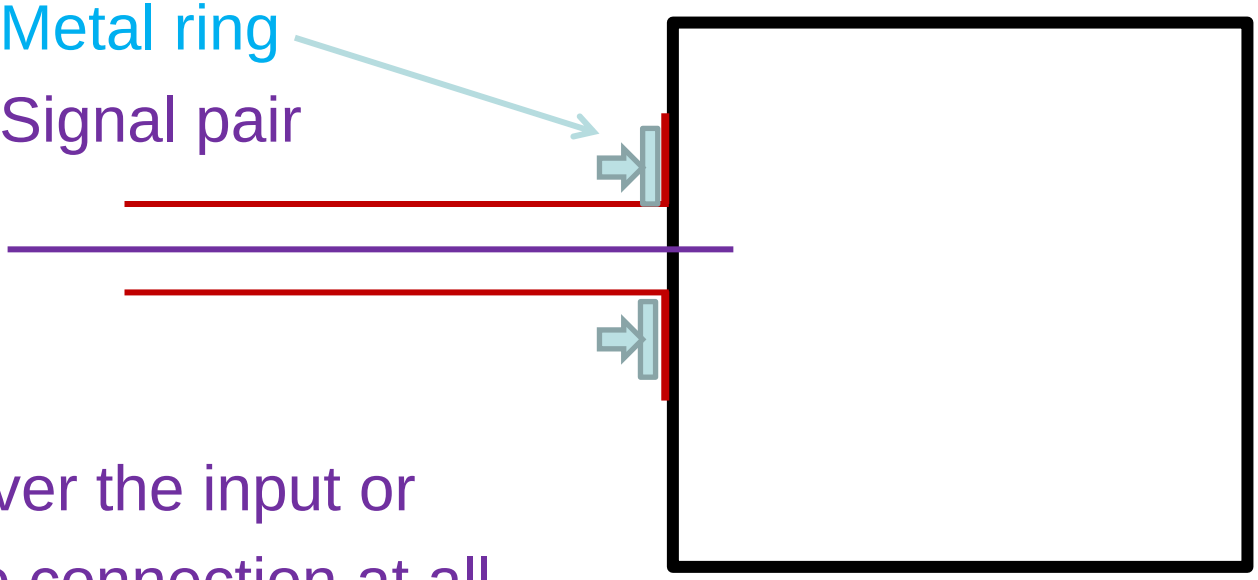


As shield connection fair, ground connection with a lot of coupling to signal path

Metal should be connecting too

Proposal to check receiver connection

- Receiver
  - Braid over cable also over connection if there
  - Metal ring
  - Signal pair



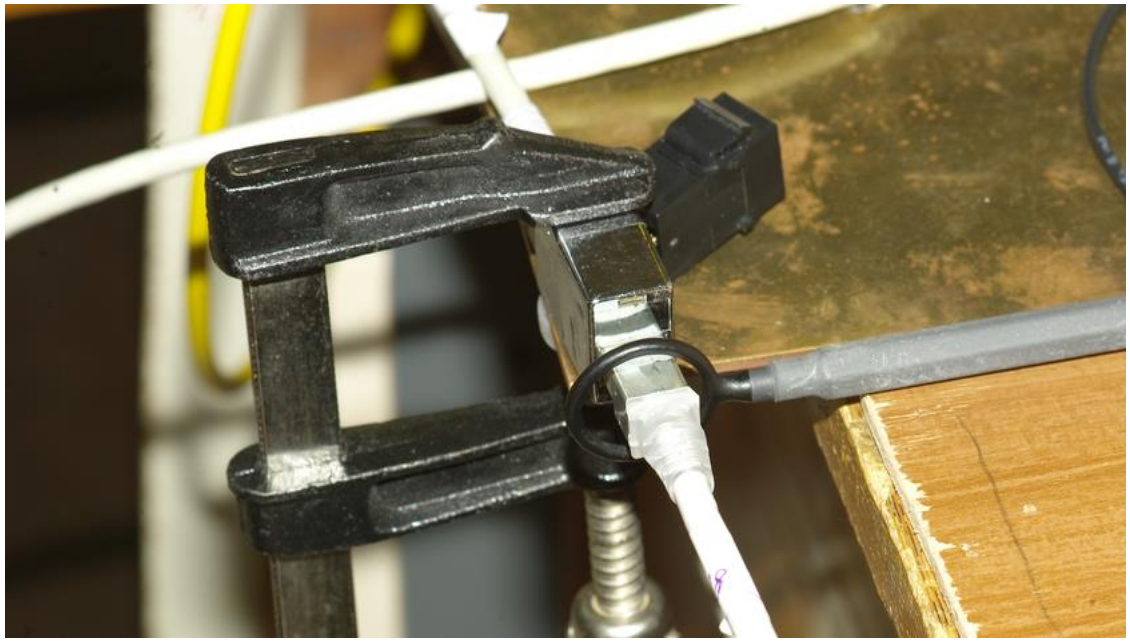
Over the input or

no connection at all

Remove cable jacket of course

Mini clamp for tests /comparison

- Not standardized, but insufficient set ups easily seen



Summary

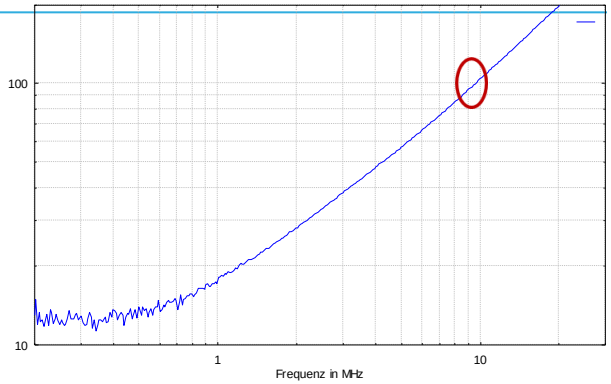
- It is therefore not sufficient to name just the Class/Category
- Additionally the connections to the equipment is usually the weak part because not part of the cabling channel and therefore not defined nor tested separately.

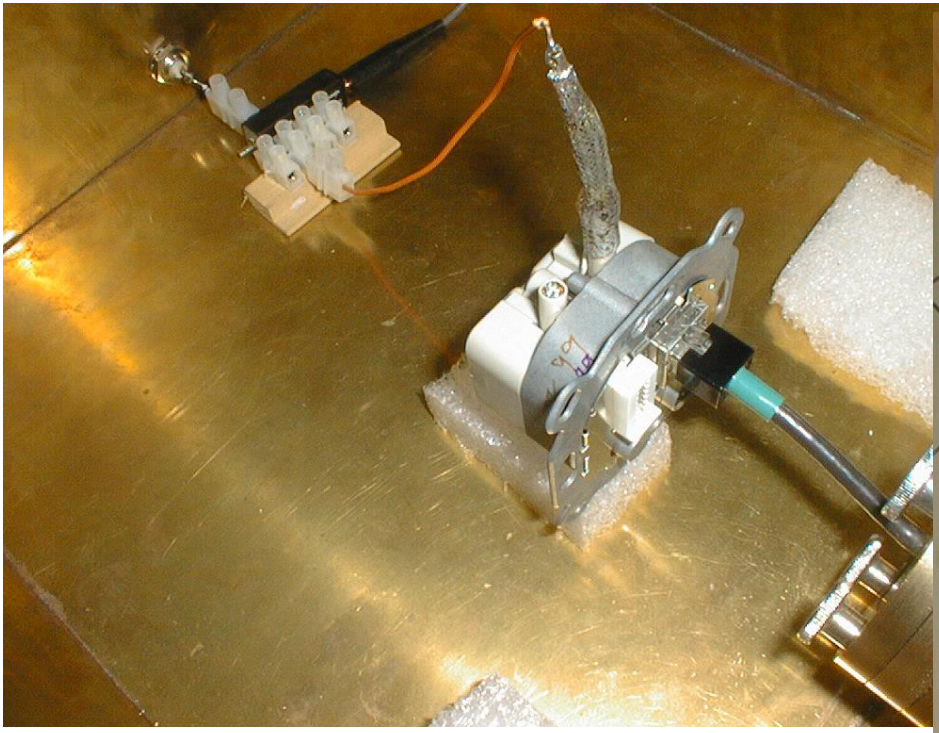
Thank You!

Some additional slides for your information attached

Spare: Transfer impedance

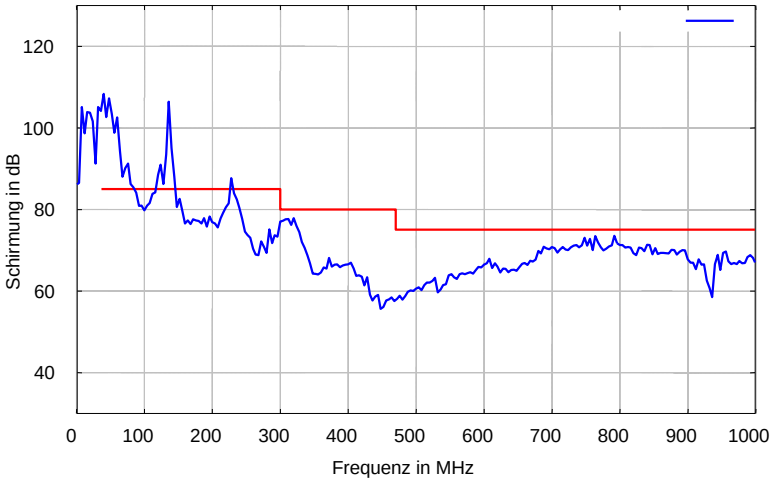
- One practical set up

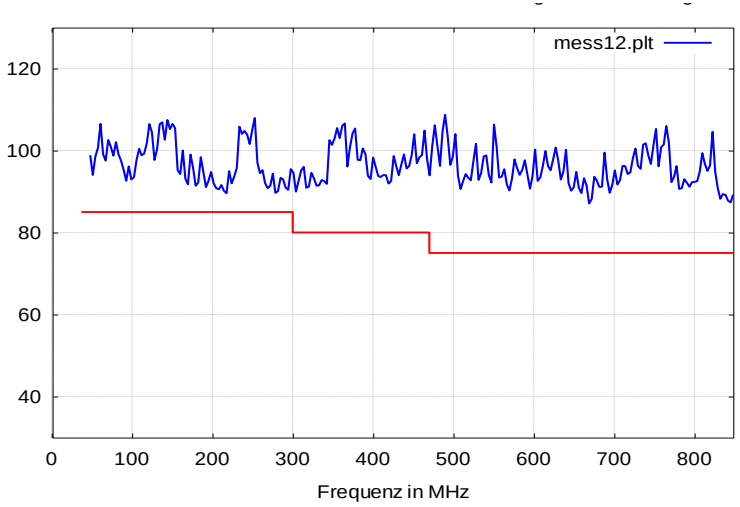




Spare: coupling attenuation

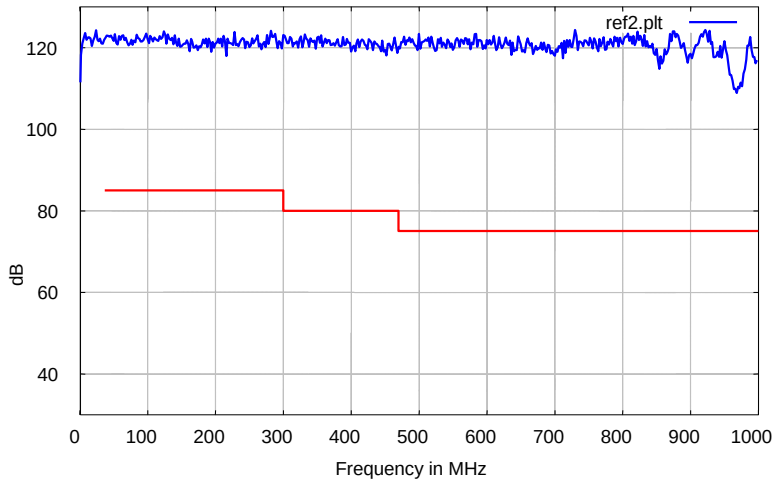
Tera connection example:
Top: manufacturer mounted (sufficient)
Below: Laboratory optimized by using copper tape and additional pressure.
20-30 dB improvement
Limit line TV transmission



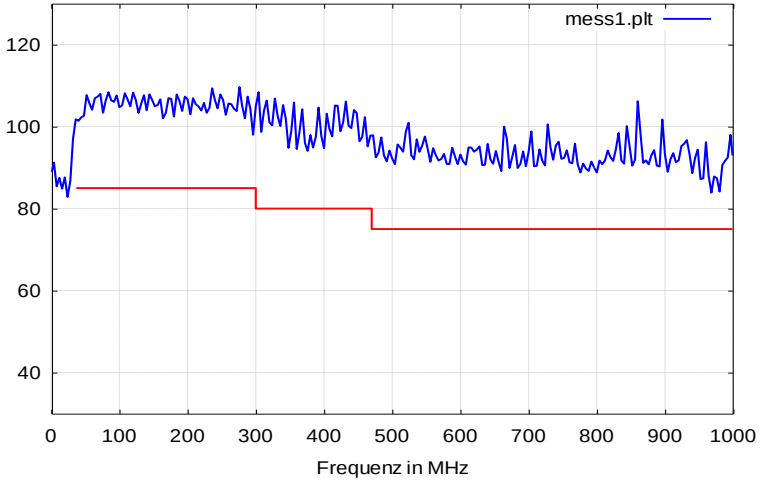


Type 1 cable coupling attenuation

- Noise level



- Cable type 1
  - Red lines are TV limit lines



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