SGS Germany GmbH

Test Report No.: N2AY0001

Order No.: N2AY **Pages:** 14

Client:	MARBURGER TAPETENFABRIK, J. B. Schaefer & Co. KG GmbH
Equipment Under Test:	Shielding Wallpaper
Manufacturer:	MARBURGER TAPETENFABRIK, J. B. Schaefer & Co. KG GmbH
Task:	Measurement of shielding effectiveness according to Specification below:
Test Specification(s):	ASTM D 4935 (2010)
Result:	see chapter 6.

The results relate only to the items tested as described in this test report.

approved by:	**Date**	**Signature**
Bauer Lab Manager EMC	Nov 06, 2018	Josef Bauer

This document was signed electronically.

CONTENTS

1 Summary

1.1 Common

The shielding effectiveness of the a Shielding Wallpaper should be measured in the frequency range 30 MHz to 1.5 (2) GHz:

1.2 Execution of the measurements

The measurements of the shielding effectiveness were performed as described below.

The Test was performed according to ASTM D 4935 – 10.
Two specimens in accordance with Section 6 of ASTM D 4935 – 10 are prepared for the test sample.
The reference specimen is inserted between the two halves of the specimen holder and a reference measurement is performed. Then the reference specimen is replaced by the test specimen and the measurement was repeated.
The difference between these two measurements is the resulting shielding effectiveness.

2 References

2.1 Specifications

- ASTM D 4935 (2010)
  Standard Test Method for Measuring the Electromagnetic Shielding Effectiveness of Planar Materials

2.2 Glossary of Terms

EMC specific Abbreviations

EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
EN	European Standard
EUT	Equipment Under Test
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
SE	Shielding Effectiveness
SW	Software
RX	receive
TX	transmit
VNA	Vectorial Network Analyzer

3 General Information

3.1 Identification of Client

MARBURGER TAPETENFABRIK, J. B. Schaefer & Co. KG GmbH
Bertram-Schaefer-Straße 11
35274 Kirchhain

3.2 Test Laboratory

SGS Germany GmbH
Hofmannstraße 50
81379 München

3.3 Time Schedule

Delivery of EUT: Aug 15, 2018
Start of test: Aug 22, 2018
End of test: Aug 22, 2018

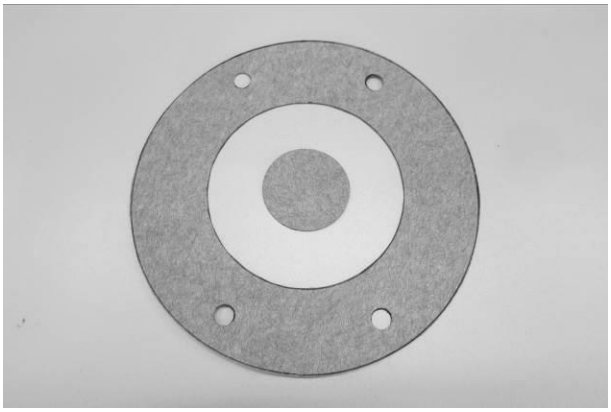
3.4 Participants

Name	Function
Andreas Pauli	Accredited testing, Editor

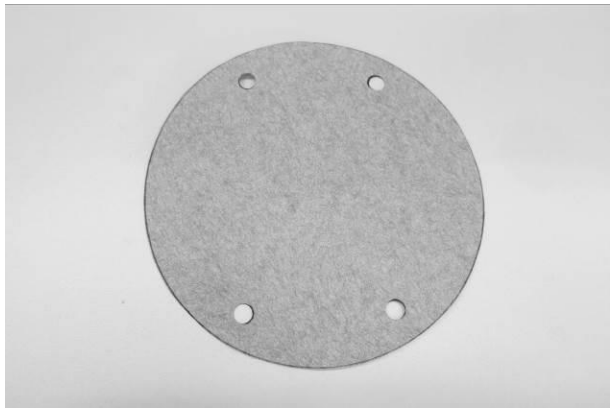
4 Equipment Under Test

4.1 Description

Test item description .....:	Shielding Wallpaper
Manufacturer .....:	MARBURGER TAPETENFABRIK, J. B. Schaefer & Co. KG GmbH
Model/Type .....:	
Number of tested samples..:	1



"Reference"



"Load"

Figure 4-1: Shielding Wallpaper

5 Test Equipment

5.1 Test Facility

The EMC-tests are carried out in the EMC-laboratory (wireless test room) of SGS Germany, Consumer and Retail, Hofmannstraße 50, 81379 München, Germany.

Chamber	1	2	3	4 / 5	6
Dimen-sions (net)	17.7 * 10.8 * 6.8 m	9.6 * 8.5 * 5.3 m	7.4 * 6.6 * 5.2 m	4.1 * 3.5 * 3.5m	6.4 * 4.3 * 4.3m
Max. Door Exit (w x h)	2.9 * 3.86 m	3.9 * 4.0 m	2.0 * 2.7 m	0.9 * 2.25 m	1.8 * 3.0 m
Shielding material	Sheet steel (Thick-ness:1.5mm on floor, 1.0 mm on walls and ceiling)	Sheet steel	Sheet steel	Sheet steel	Sheet steel
Absorbers	Hybrid absorbers on walls and ceiling (TDK), length 1 m	Hybrid absorbers on walls and ceiling (E+C), length 0.5 m	Hybrid absorbers on walls and ceiling (E+C), length 0.3 m	Without absorbers	Without absorbers
Floor	Metallic ground plane floor load: 12 t/m²	Metallic ground plane floor load: 1.5 t/m²	Metallic ground plane floor load: 1 t/m²	Metallic ground plane	Metallic ground plane
Turntable	∅ 4 m / 7 t	∅ 3.2 m / 1.5 t	∅ 2.0 m / 1 t		
Listings	FCC-listed until Nov. 2017, Reg. No.: 90932 Industry Canada listed until June 2018 Reg. No. 9058A-1	FCC-listed until Nov. 2017, Reg. No.: 97242 Industry Canada listed until June 2018 Reg. No. 9058A-2 VCCI-listed until Oct. 2016, Reg. No. R-2623, G-266	FCC-listed until Nov. 2017, Reg. No.: 299569 Industry Canada listed until June 2018 Reg. No. 9058A-3		VCCI-listed until Oct. 2016, Reg. No. C-2866 & No. T-1942
Specials	***Emission*:** ***30 – 1000 MHz (d = 10 m)*** - NSA acc. to: · EN 55022 · CISPR 16-1-4 · ANSI C63.4 ***1 – 18 GHz (d = 3 m)*** Site VSWR 1 – 18 GHz acc. to CISPR 16-1-4	***Emission*:** ***30 – 1000 MHz (d = 3 m)*** - NSA acc. to: · EN 55022 · CISPR 16-1-4 · ANSI C63.4 ***1 – 18 GHz (d = 3 m)*** Site VSWR 1 – 18 GHz acc. to CISPR 16-1-4	***Emission*:** ***30 – 1000 MHz (d = 3 m)*** - NSA acc. to: · EN 55022 · CISPR 16-1-4 · ANSI C63.4 ***1 – 18 GHz (d = 3 m)*** Site VSWR 1 – 18 GHz acc. to CISPR 16-1-4		
	Immunity: Field uniformity 27 – 6000 MHz acc. EN 61000-4-3	***Immunity:*** Field uniformity 80 – 6000 MHz acc. EN 61000-4-3	***Immunity:*** Field uniformity 80 – 6000 MHz acc. EN 61000-4-3		

FCC (Federal Communication Commission): Accreditation by Bundesministerium für Wirtschaft und Arbeit (BMWA; BNetzA-CAB-14/21-09) and Designation as **CAB (Conformity Assessment Body):** Designation Number DE0013; Test firm Registration #: 366296

Designation **KBA** (**Kraftfahrt-Bundesamt**) as Technical Service Category A and D. Registration Number: KBA-P 00083-97

CB Testing Laboratory under the responsibility of SGS CEBEC as National Certification Body and to carry out testing within the **IECEE CB Scheme.**

5.2 Measuring Equipment

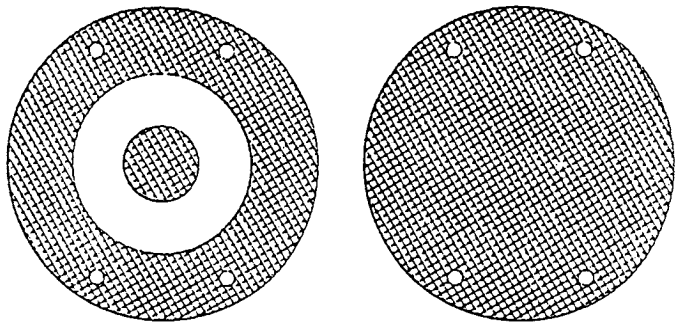
ID	Measuring Instrument	Specification	Status	Calibration due
N0467	EMI Test Speciment Holder	30 MHz - 1.5 GHz; 80-120 dB	cnn	
P2105	Network analyzer	10 MHz - 20 GHz, 4 Channels incl. active test set	cal	Mar 2020
P2292	attenuator	Type N, 6 dB, 5 Watt/ dc to 18.0 GHz	chk	Sep 2018
P1420	attenuator 6dB	6dB; 50 Ohm; DC - 4 GHz	chk	Jul 2019
P2233	Coax cable 3m	50 Ohm, 3G	cnn	
P2226	Coax cable 2m	50 Ohm, 3G	cnn	

cal = Calibration, car = Calibration restricted use, chk = Check, chr = Check restricted use, cpu = Check prior to use, calchk = Calibration and check, ind = for indication only, cnn = Calibration not necessary, man = Maintenance

5.3 Test Setup

To perform the tests, a vectorial network analyzer (VNA) is used which is controlled via a software “Schirmdämpfung” based on Labview.
The software version is v2.1.3.01.

The test is performed using a specimen holder according to ASTM D 4935 – 10. The specimen holder is an enlarged, coaxial transmission line with special taper sections and notched matching grooves to maintain a characteristic impedance of 50 Ω throughout the entire length of the holder.
Reference and load specimens in accordance with Section 6 of ASTM D 4935 – 10 are prepared for each textile. The reference and load specimens shall be of the same material and thickness. Both are shown below:



First the reference specimen is inserted between the two halves of the specimen holder and a reference measurement is performed. Then the reference specimen is replaced by the test specimen and the measurement is repeated.
The difference between these two measurements is the resulting shielding effectiveness.

5.4 Measurement Uncertainty

As far as the underlying standards include requirements concerning the uncertainty of measuring instruments or measuring methods, they are met.

The expanded measurement uncertainty of the measuring chain was calculated for all tests according to the “ISO Guide to the expression of uncertainty in measurement (GUM)”. The results are documented in an “internal controlled document”.

The measuring accuracy for all measuring devices is given in their technical description. The measuring instruments, including any accessories, are calibrated respectively verified to ensure the necessary accuracy. Depending on the kind of measuring equipment it is checked within regular intervals or directly before the measurement is performed. Adjustments are made and correction factors applied to measured data in accordance with the specifications of the specific instrument.

The expanded measurement instrumentation uncertainty of our Test Laboratory meets the requirements of IEC CISPR 16-4-2 “Specification for radio disturbance and immunity measuring apparatus and methods – Part 4-2: Uncertainties, statistics and limit modeling – Uncertainty in EMC measurements” for all listed tests.

6 Results

The test results in the report refer exclusively to the test object described in section 4 and the test period in section 3.3.

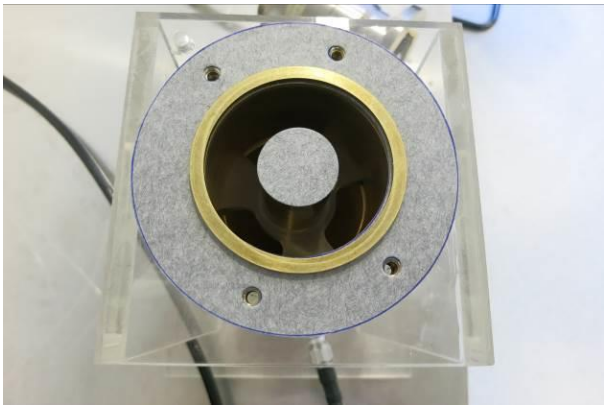
Note:

The tested materials are rather flexible. Therefore, it is difficult to position them exactly in the ASTM specimen holder. To verify the influence of setup accuracy each sample was removed from the specimen holder after the test and inserted again. Then the test was repeated.

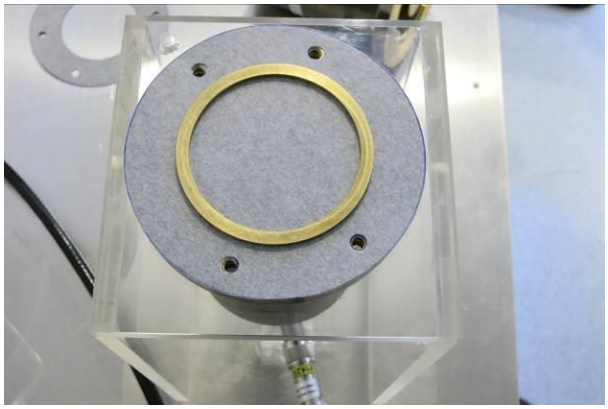
6.1 Test Setup

- ASTM Holder
- no preamp in RX path
- no preamp in TX path
- 6dB attenuator in RX path
- 6dB attenuator in RX path
- measuring bandwidth = 30Hz

Photo documentation of the test set-up:



ASTM holder with REFERENCE



ASTM holder with LOAD

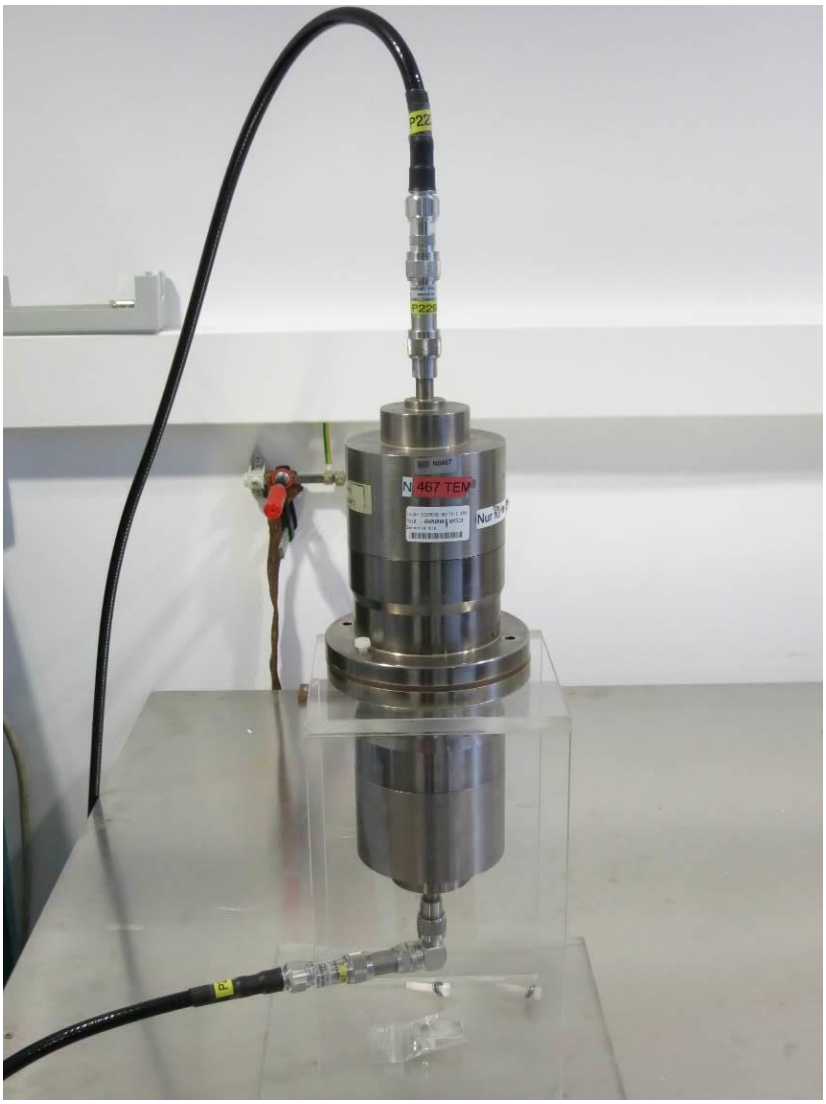
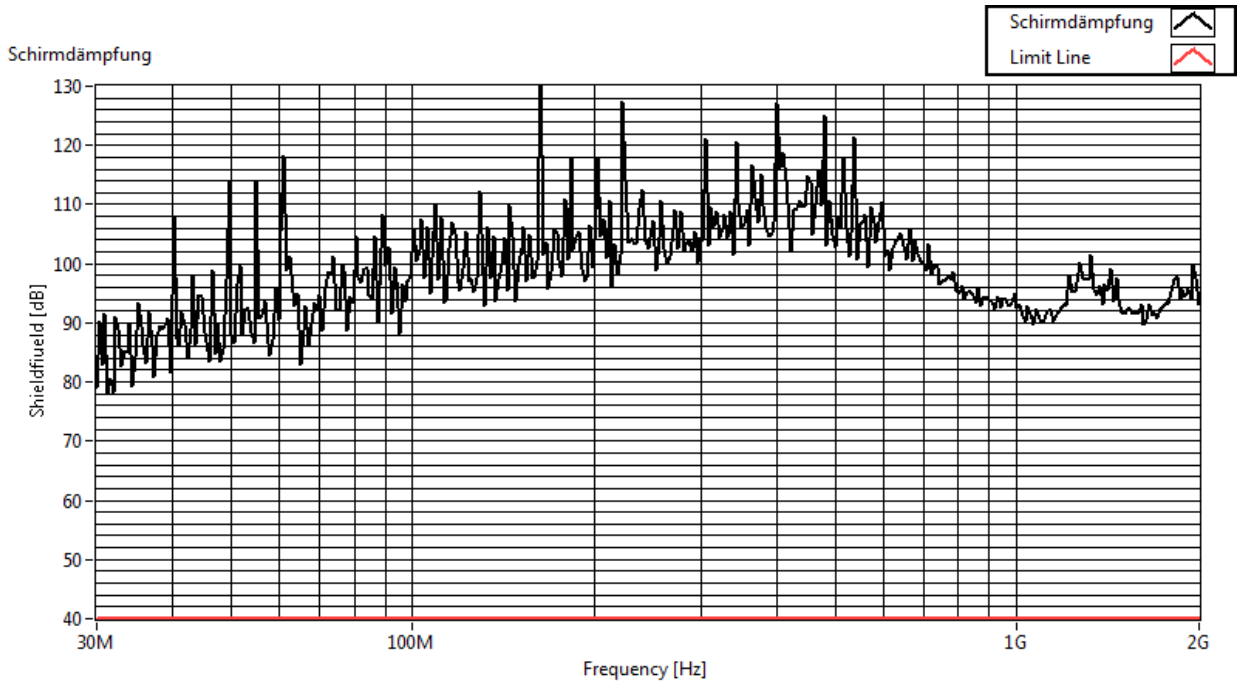


Figure 6-1: test setup, 30 – 1500 (2000) MHz

6.2 Dynamic Range

Dynamic Range means the maximum of shielding effectiveness, which can be reached with the used measuring equipment and test setup decribed above.



6.3 Results of EUT

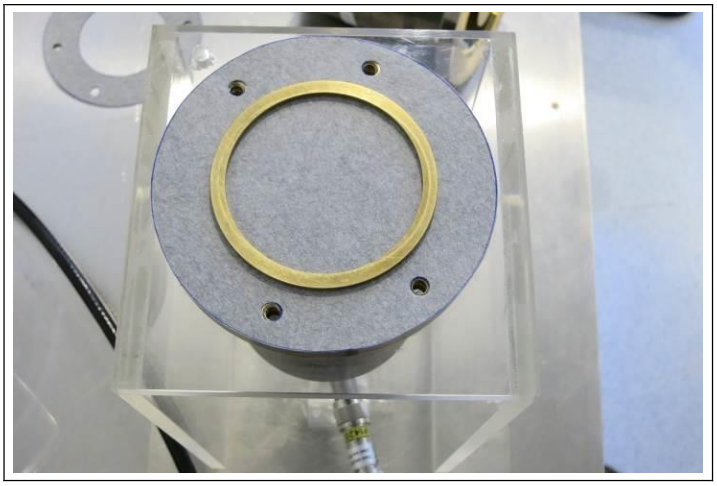


Figure 6-2: test setup for 1st measurement (coated side up)

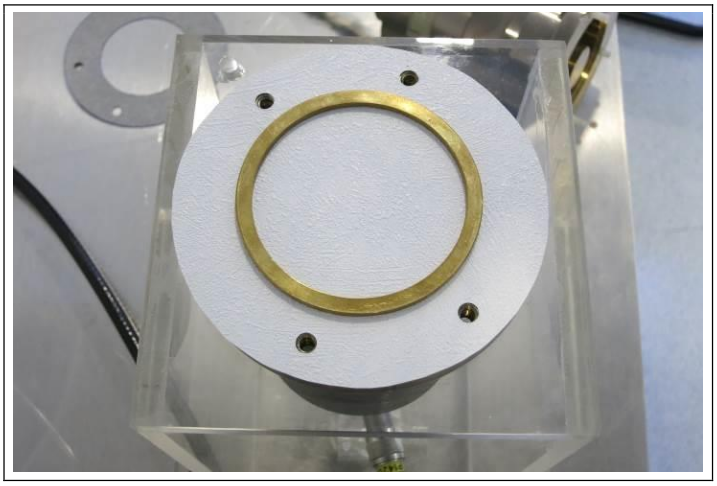


Figure 6-3: test setup for 2nd measurement (coated side down)

Shielding effectiveness, numeric:

Shielding effectiveness (dB)	Frequency (MHz)			
	30	100	300	1000
1st Measurement	25.2	22.1	21.0	20.6
2nd Measurement	26.0	22.5	21.1	20.9

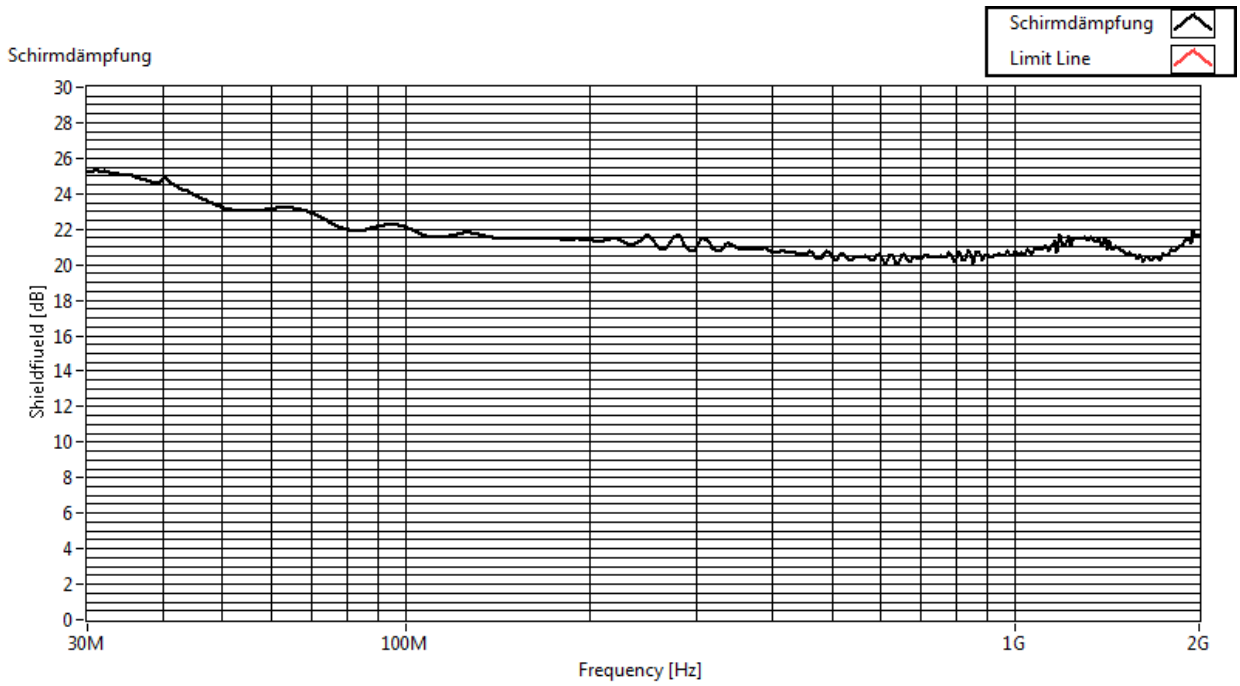
Note:

A shielding effectiveness of 20 dB as it was measured at 1000 MHz means, that electromagnetic fields can be reduced by a factor of 10. Therefore, especially atGSM 900, 90% of the ingressing field is inhibited.

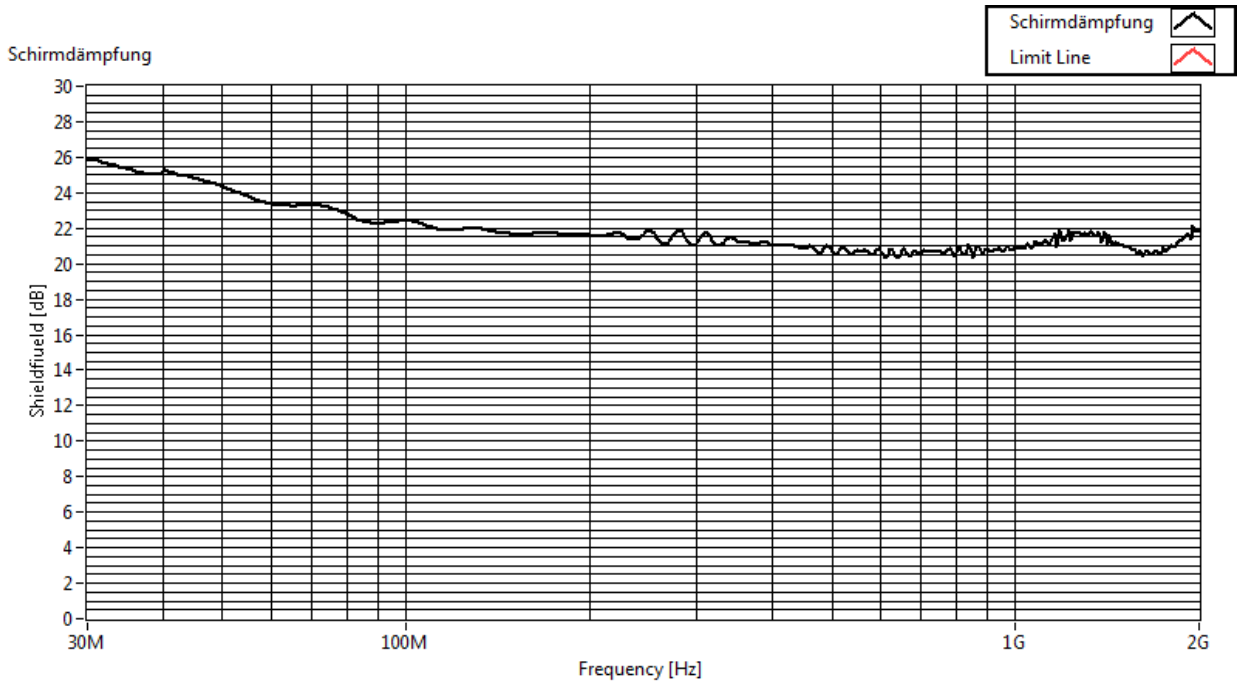
However, this is only ensured under the condition that an all-side closed casing made from this material[1] is provided and all parts are connected to each other electrically conductive.

[1] or a combination with other materials having at least the same shielding effectiveness.

1st measurement result:



2nd measurement result:



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