

Center for Quality Engineering
Test Report No.: T09YPR1P

Order No.:T09Y	Pages: 16	Enclosures: -	Munich, 2005-03-11
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Client: Schroff Sas

Equipment under Test: Schroff EMC - Cabinet "Varistar EMC 2000Hx600Bx600T",
Item No.: 10130-020/20; with Shielding Material Item No.: 60130-028

Manufacturer: Schroff Sas

Task: Shielding effectiveness measurement on basis of:

Test Specification(s) [covered by accreditation]: IEC TS 61587-3:1999-10: Mechanical structures for electronic equipment - Tests for IEC 60917 and IEC 60297 - Part 3: Electromagnetic shielding performance tests for cabinets, racks and subracks

Summary: The Rack was measured with a massive door and a perforated door on basis of IEC TS 61587-3:1999-10, but in the extended frequency range from 30 MHz to 3.0 GHz.

The shielding effectiveness was between 80 dB and 40 dB decreasing with the frequency for the EUT with the massive door and 70 to 30 dB for the EUT with the perforated door.

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

approved by:	Position	Signature / Date
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J. Bauer	Director CQE 13	
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J. Bauer 11/03/2005

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1 Summary:

The EUT was tested according to the applicable specifications as referenced below. The results refer only to the EUT as described in chapter 4. Details of test performance, measurement equipment and Test - results are given in chapter 3 and 5 - 6.

1.1 Table of results:

1.1.1 shielding effectiveness measurement:

Interface:	Test:	Specification	Config.:	Remarks:	Result:
enclosure	shielding effectiveness	IEC TS 61587-3:1999-10	massive door	30 MHz – 3.0 GHz	80 - 40 dB
enclosure	shielding effectiveness	IEC TS 61587-3:1999-10	perforated door	30 MHz – 3.0 GHz	70 - 30 dB

2 References:

2.1 Specifications:

IEC TS 61587-3:1999-10	Mechanical structures for electronic equipment - Tests for IEC 60917 and IEC 60297 - Part 3: Electromagnetic shielding performance tests for cabinets, racks and subracks
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2.2 Glossary of Terms:

CE	Communautés Européennes
CISPR	Comité International Spécial Des Perturbations Radioélectriques
EMC	Electro Magnetic Compatibility
EN	European Standard
ETS	European Telecommunication Standard (defined by ETSI)
ETSI	European Telecommunications Standards Institute
EUT	Equipment Under Test
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronic Engineers
ITE	Information Technology Equipment
prETS	Proposed European Telecommunication Standard (defined by ETSI)
PS	Power Supply
QE	Center for Quality Engineering
SE	Shielding Effectiveness

2.3 Bibliographical Data:

none

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3 General Information:

3.1 Identification of Client:

Schroff Sas
R&D Cabinets and Cases
Mr. Jacques Fischer
Z.I.-4.Rue du Marais
F-67660 Betschdorf
phone: 0033 3 88 90 65 09
fax: 0033 3 88 90 65 00
mail: Jacques_Fischer@schroff.fr

3.2 Test Laboratory:

EMC-Laboratory Com CTO CQE 13
Siemens AG
Hofmannstrasse 51
81359 Munich
Germany
Phone +49 89-722-44387
Fax +49 89-722-43765

3.3 Storage of Records:

The original of the test report is delivered to the client. It is in the responsibility of the client to administer and store the test report for future use. The EUT-documentation has to be kept by the client and must be available for future examinations.

3.4 Time Schedule:

Delivery of EUT:	2005-02-08
Start of Test:	2005-02-08
End of Test:	2005-02-08

3.5 Participants:

Name	Function	Company	Department	Location
Mr. Hudetz	Accredited testing	Siemens AG	Com CTO CQE 13	Mch H
Mr. Marcinkowski	Service and monitoring of the EUT; Eye witnessing	Schroff Sas		Betschdorf
Mr. Meyer	Service and monitoring of the EUT; Eye witnessing	Schroff Sas		Betschdorf

4 Equipment Under Test (EUT):

4.1 Description of Equipment under Test:

Schroff EMC - Cabinet "Varistar EMC 2000Hx600Bx600T",
Item No.: 10130-020/20; with Shielding Material Item No.: 60130-028

Serial No.: none / EMC – prototype

Picture of EUT / Front view:



EMC-Cabinet with massive (left) and perforated (right) steel door

4.2 Configuration of EUT:

The EUT was tested in 2 configurations, with full (massive) steel door and perforated steel door

4.3 Operating Conditions:

not applicable

4.4 Failure Criteria:

not applicable

4.4.1 Special criteria used for EUT:

not applicable

5 Test Equipment:

5.1 Test Facility:

Chamber	1	2	3	4 / 5	6
Dimensions (net)	17.70*10.85*6.84m	9.63*8.49*5.28m	6.59*5.81*4.78m	4.1*3.53*3.5m	6.4*4.3*4.35m
Max. Door Exit	5.0*3.86m	3.9*4.0m	1.4*2.23m	0.9*2.25m	1.8*3.0mm
Shielding material	Sheet steel (Thickness: 1.5mm on floor, 1.0mm on walls and ceiling)	Sheet steel	Sheet steel	Sheet steel	Sheet steel
Absorbers	<ul style="list-style-type: none"> hybrid absorbers on walls and ceiling (TDK), length 1m 	<ul style="list-style-type: none"> hybrid absorbers on walls and ceiling (E+C), length 0.5m 	<ul style="list-style-type: none"> pyramid absorbers on walls and ceiling (E+C), length 0.76m 	<ul style="list-style-type: none"> without absorbers 	<ul style="list-style-type: none"> without absorbers
Floor	<ul style="list-style-type: none"> metallic ground plane floor load: 12 t/m² 	<ul style="list-style-type: none"> metallic ground plane floor load: 1.5 t/m² 	<ul style="list-style-type: none"> metallic ground plane floor load: 1 t/m² 		
Specials	<ul style="list-style-type: none"> measuring distance of max. 10m turntable Ø 4m/ 6t <p>Test chamber no. 1 complies with: Emission (10m distance and frequency range 30-1000MHz) - EN 55022 / 1998 - CISPR 16, Draft for „Alternative Test Sites“ acc to CISPR/A, Sec 63 / 8.1999 - ANSI C63.4 / 2001 - FCC-listed in June 2003 Reg. Nr.: 90932 Immunity (field uniformity in the frequency range 27-1000MHz) - EN 61000-4-3 / 2001</p>	<ul style="list-style-type: none"> measuring distance of 3m (max 5m) turntable Ø 3.2m/ 1.5t <p>Test chamber no. 2 complies with: Emission (3m distance and frequency range 30-1000MHz) - EN 55022 / 1998 - CISPR 16, Draft for „Alternative Test Sites“ acc to CISPR/A, Sec 63 / 8.1999 - ANSI C63.4 / 2001 - FCC-listed in February 2003 Reg. Nr.: 97242 Immunity (field uniformity in the frequency range 27-1000MHz) - EN 61000-4-3 / 2001</p>	<ul style="list-style-type: none"> measuring distance of max. 3m turntable Ø 1.20m/ 0.5t <p>Test chamber no. 3 complies with: Emission (3m distance and frequency range 80-1000MHz) - EN 55022 / 1998 - CISPR 16, Draft for „Alternative Test Sites“ acc to CISPR/A, Sec 63 / 8.1999 - ANSI C63.4 / 2001 Immunity (field uniformity in the frequency range 27-1000MHz) - EN 61000-4-3 / 2001</p>		

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5.2 Measuring Equipment:

ID-NO	EQUIPMENT	TYPE	MANUF.	SER.-NO.	SPECIFICATION	REMARKS	STA-TUS	L-CAL	N-CAL
P0337	test chamber	-	Siemens	-	11.0 • 10.0 • 6.0 m; 0.5 m pyramid absorbers + ferrite tiles	test chamber 2	chk	2005/01	2006/01
N0772	Network Analyzer	ZVRL Vektoriell	R&S	836941/007	with Calibration Kit ZV-Z21 (Ser.-No.: 101484/014)	with accessories	c	2004/03	2005/11
N0491	Amplifier	7447F Opt. H64	HP	2944A03811	1:9 kHz-50 MHz; 2:0.1-1300 MHz	pre-amplifier	n	-	-
P0680	amplifier	10W1000	AR	128883	1 - 1000 MHz	10 W	cnn	-	-
P0967	preamplifier	AFS44-00101800-25-10P-44	miteq	909363	0.1 - 18GHz	pre-amplifier	cal	2004/03	2006/03
P0029	antenna	3105	Emco	2025	1 - 18 GHz	horn; 300 W	s	2004/03	2006/03
P1072	antenna	-	QE13	-	Cubic Dipole Antenna	8.5x8.5x9.5 cm, SMA, for Shielding Effectiveness Measurements	cnn	-	-
P0127	controller	HD100	Deisel	100/503	for MA240 in Anechoic chamber 2	Emission Set Up 02	i	-	-
P0016	mast	MA240	Deisel	240/445	h = 4.00 m, IEC	Emission Set Up 02	n	-	-
c=calibrated Equipment - L/N-Cal: Last/Next calibration - s=supervised equipment (prior to use / dated) -									
i=for indication only - n=not calibrated Equipment - c(Ref)=Reference standards only									

5.3 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" at ICN TQM QE archives.

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 Ed. 1.0 "Specification for radio disturbance and immunity measuring apparatus and methods - Part 4: Uncertainty in EMC Measurements" for all listed Tests.

5.4 Environmental Conditions:

The EUT was tested under normal test conditions as defined in the European Telecommunication Standard I-ETS 300 609 -1.

Condition	Minimum	Maximum
Barometric pressure	86 kPa	106 kPa
Temperature	15 °C	30 °C
Relative Humidity	20 %	85 %
Power Supply	not applicable	
Vibration	Negligible	

6 Results:

6.1 Shielding effectiveness measurement 30 MHz – 3.0 GHz:

• Test Set - Up:	IEC TS 61587-3:1999-10
• Device:	Enclosure Port

The tests were performed in anechoic **chamber no. 2** using a computer-controlled Test - Set in order to control the test receiver, the turntable, the height and the polarisation of the antenna. The measurement and control equipment was located outside of the chamber.

The EUT was placed on a wooden pallet (10 cm) above a metallic turntable in order to measure the shielding effectiveness (SE) automatically from different sides (0 – 360°) and different heights (1 to 4 m).

The angle step - size was 90° and the height of the receiving antenna was varied from 1 to 4 meters with 1 m step size for the frequency range from 30 MHz to 1 GHz and 45° angle step - size from 1 to 3 GHz.

In order to scan the field strength, a log. per. antenna for 30 MHz to 1 GHz and a horn antenna for 1 to 3 GHz was used. As transmitting antenna a cubical dipole antenna for 30 MHz to 3 GHz was used.

The measurement was performed with horizontal and vertical polarisation of the sending and the receiving antenna for the frequency range from 30 MHz to 3 GHz.

The shielding effectiveness was calculated from the appropriate reference measurement (i. e. the emission of the sending antenna positioned outside the EUT) and one associated measurement with the sending antenna within the EUT.

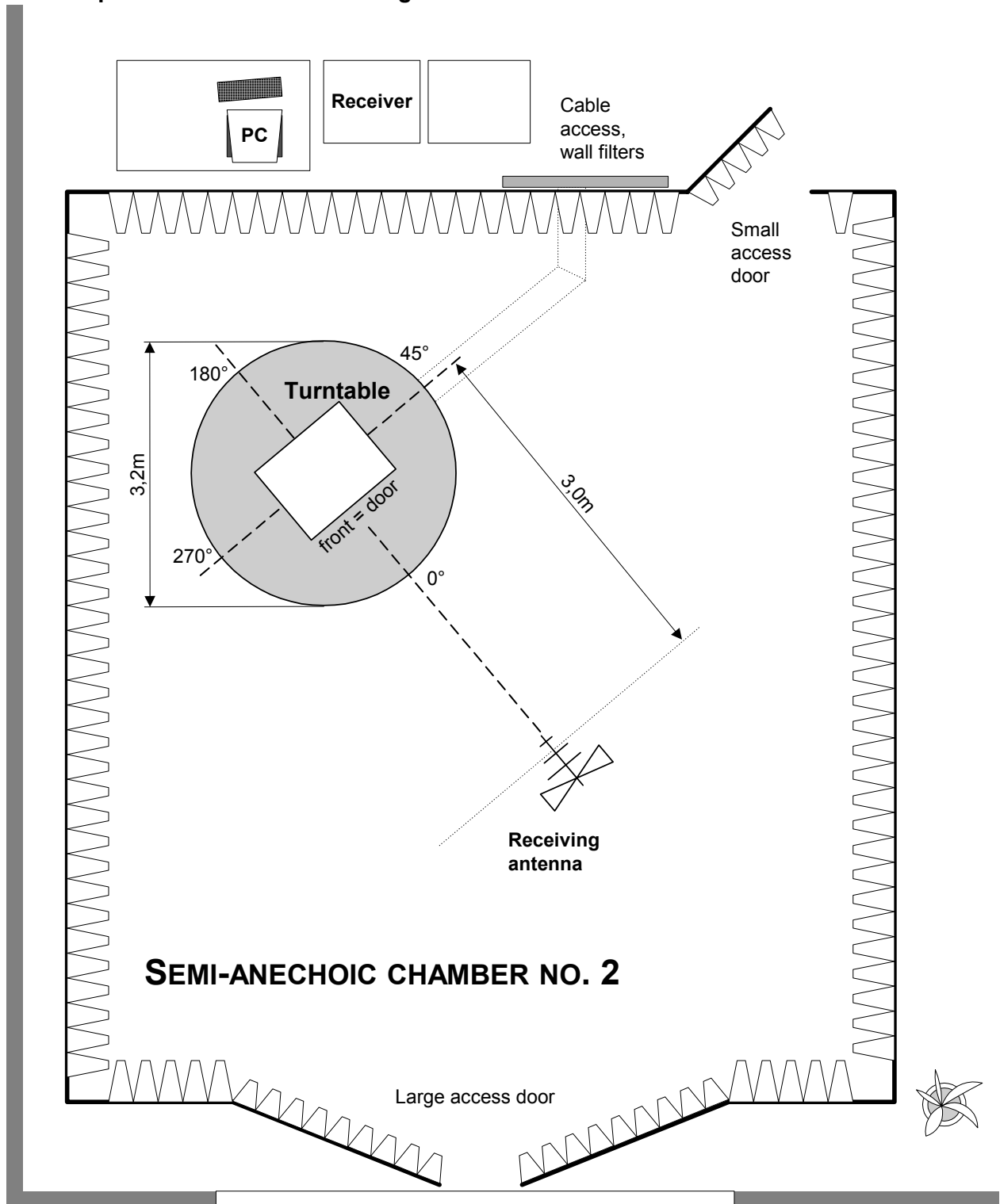
The result is derived as the minimum from $8 \times 4 \times 2 = 64$ measurements for the frequency range 30 MHz – 3 GHz.

Table 1 shows the required shielding effectiveness for the Performance Level 1, 2 and 3.

Performance level	Minimum shielding performance (excluding cavity resonances)	
	Frequency range 30 MHz to 230 MHz	Frequency range 230 MHz to 1000 MHz
1	20 dB	10 dB
2	40 dB	30 dB
3	60 dB	50 dB

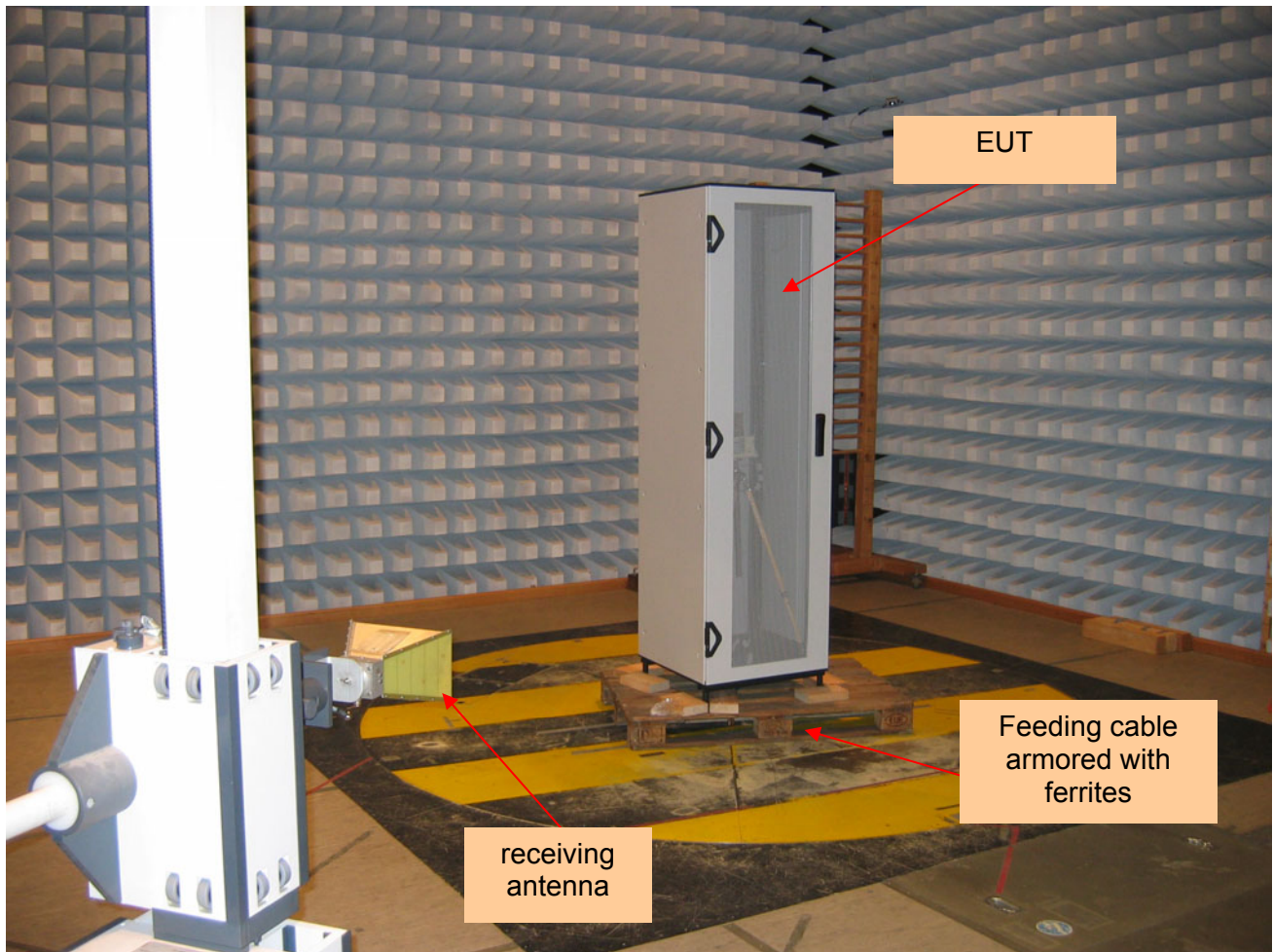
Table 1: Classification of the shielding effectiveness according IEC TS 61587-3:1999-10

Test Set - Up in Chamber 2 for shielding effectiveness measurement 1 – 3.0 GHz:



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Picture of Test Set - Up in Chamber 2 for shielding effectiveness measurement 1 – 3.0 GHz:

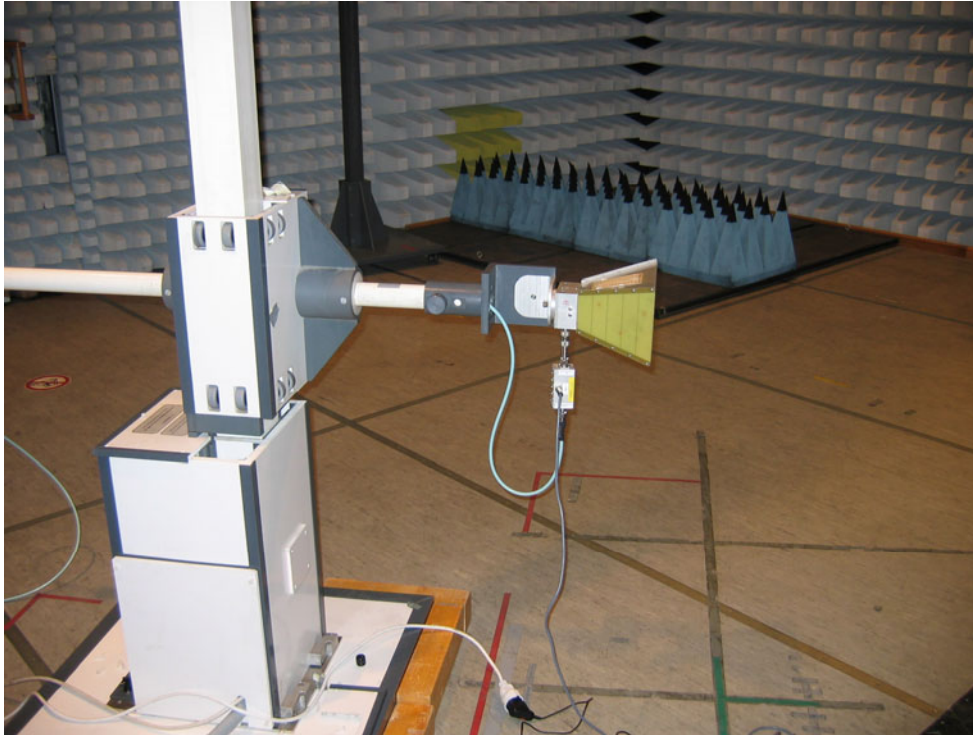


Picture of receiving antenna, horizontal polarization (30 MHz – 1 GHz):

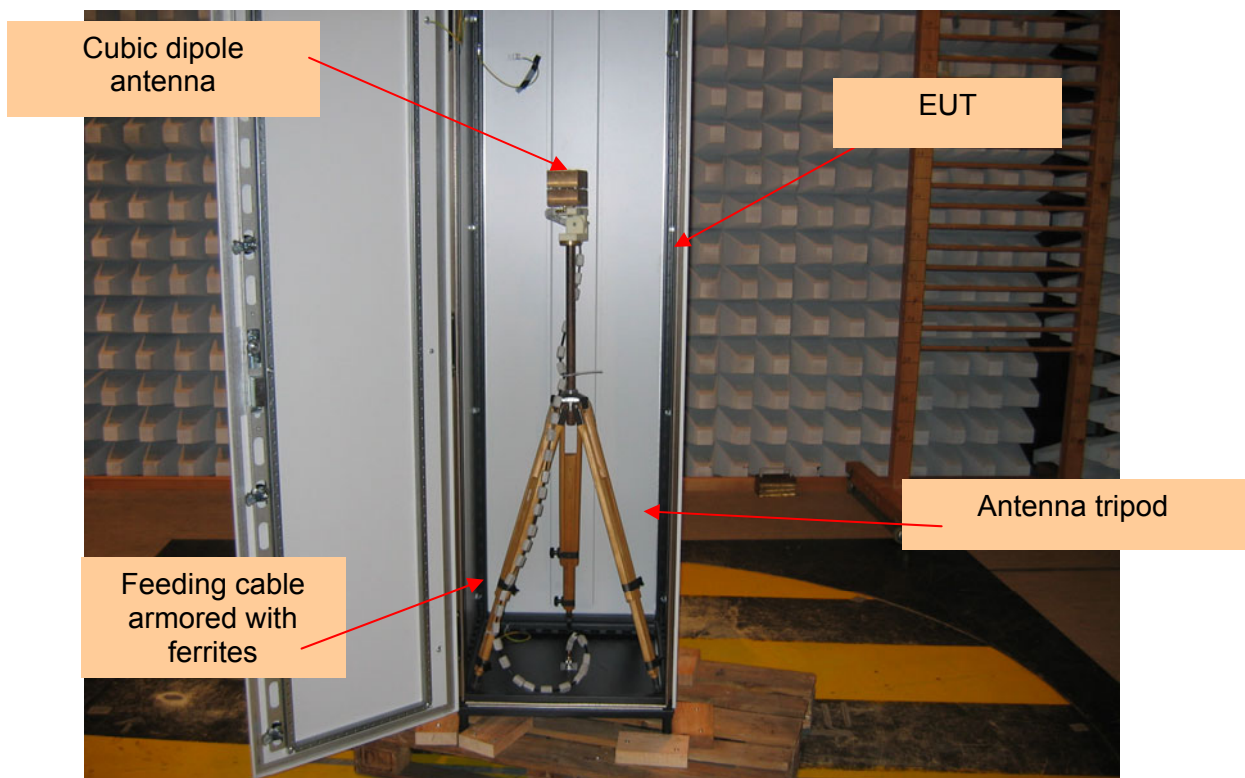


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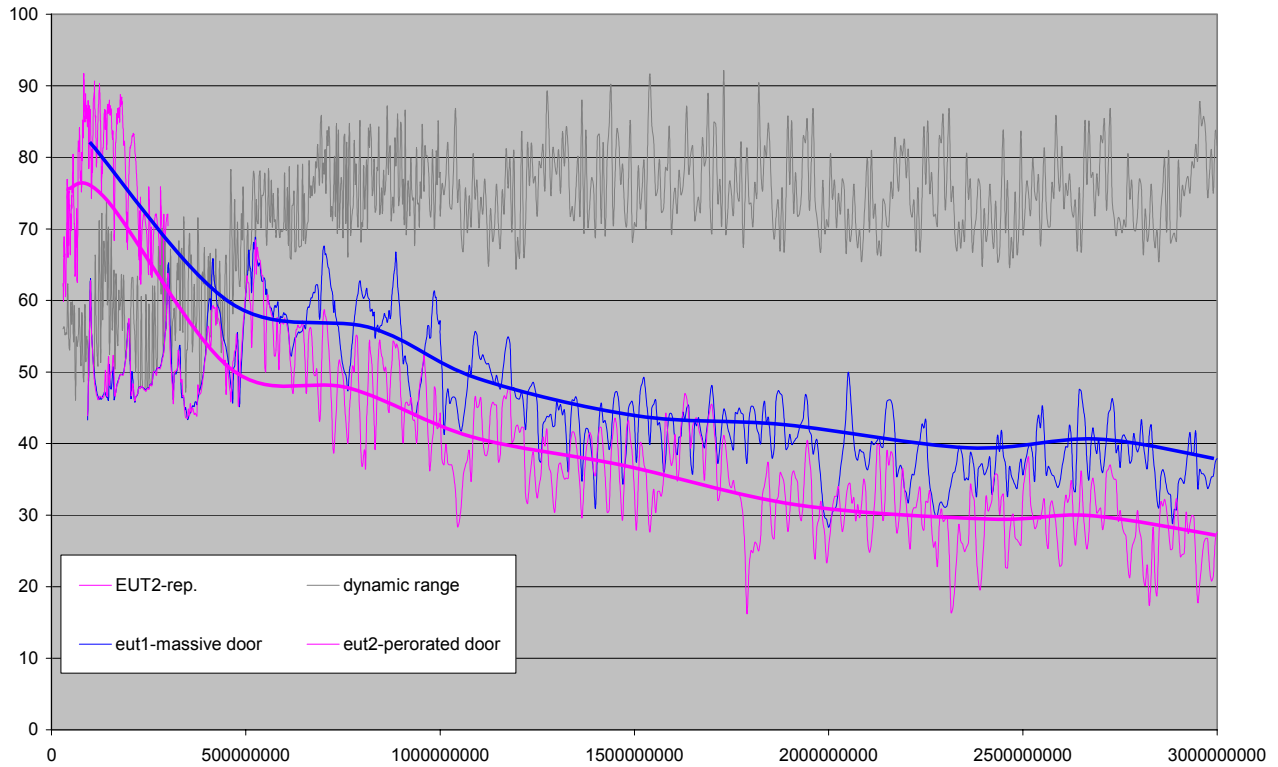
Picture of receiving antenna, vertical polarization (1 GHz – 3 GHz) with pre-amplifier:



Picture of Transmitting antenna inside the EUT, horizontal polarization (30 MHz – 3 GHz):
The transmitting antenna was located in the middle of the equipment under test (EUT) in 110 cm height.



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6.1.1 Test results:**Total shielding effectiveness / with trend plot:****Remarks:**

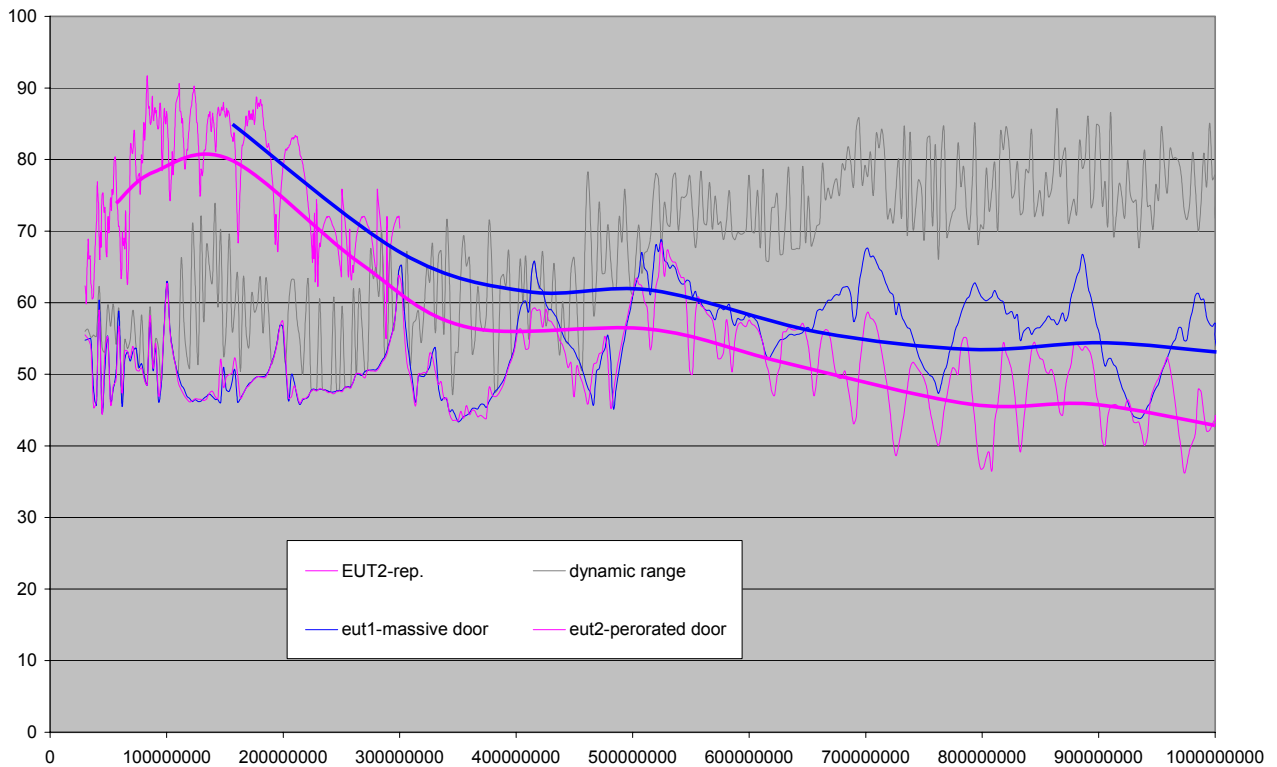
In the frequency range from 30 to 300 MHz the measurement was repeated with a smaller bandwidth of 100 Hz instead of 10 kHz to increase the dynamic range of the test set up, because the shielding effectiveness was better than the dynamic range (upper purple curve: EUT2-rep.).

It is obvious that the shielding effectiveness would increase as in the upper frequency range as well with approximately 20 dB / decade.

	EUT with perforated door	EUT with massive door
30 MHz	≈ 70 dB	≈ 80 dB
300 MHz	≈ 50 dB	≈ 60 dB
3GHz	≈ 30 dB	≈ 40 dB

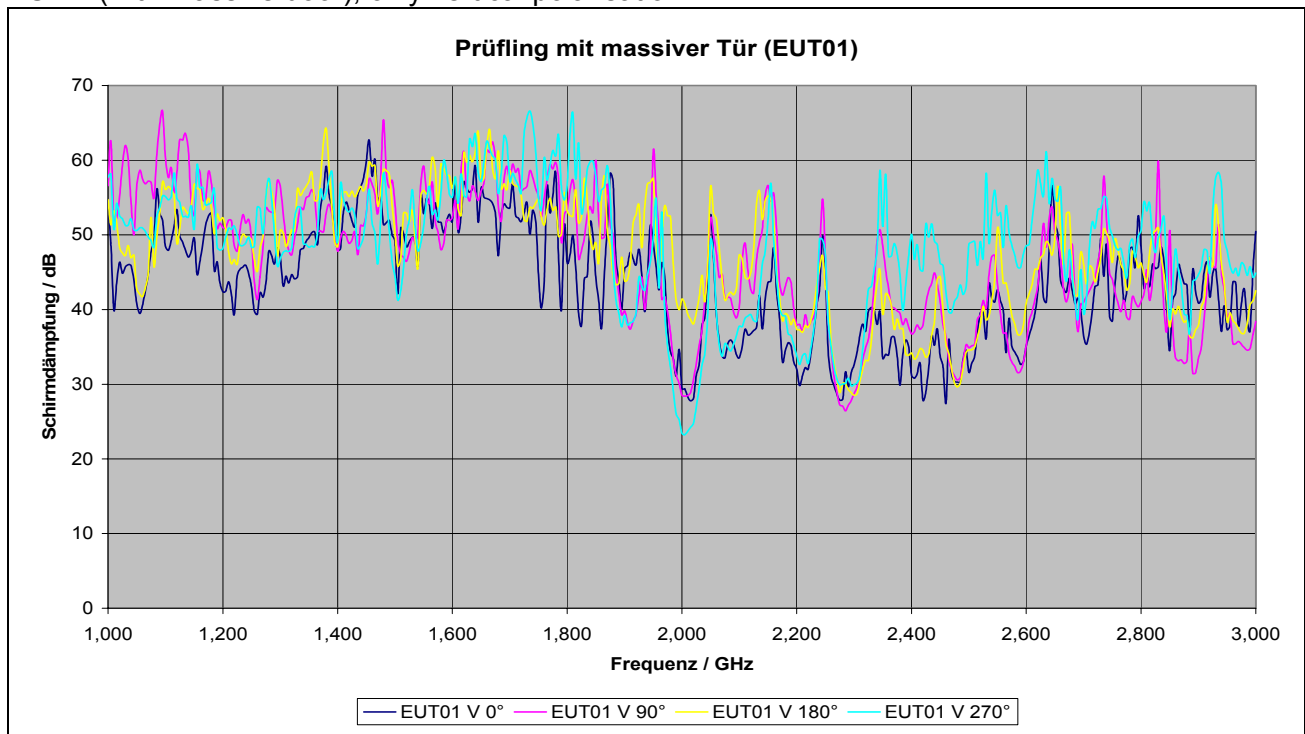
Details:

Only Frequency range up to 1000 MHz:

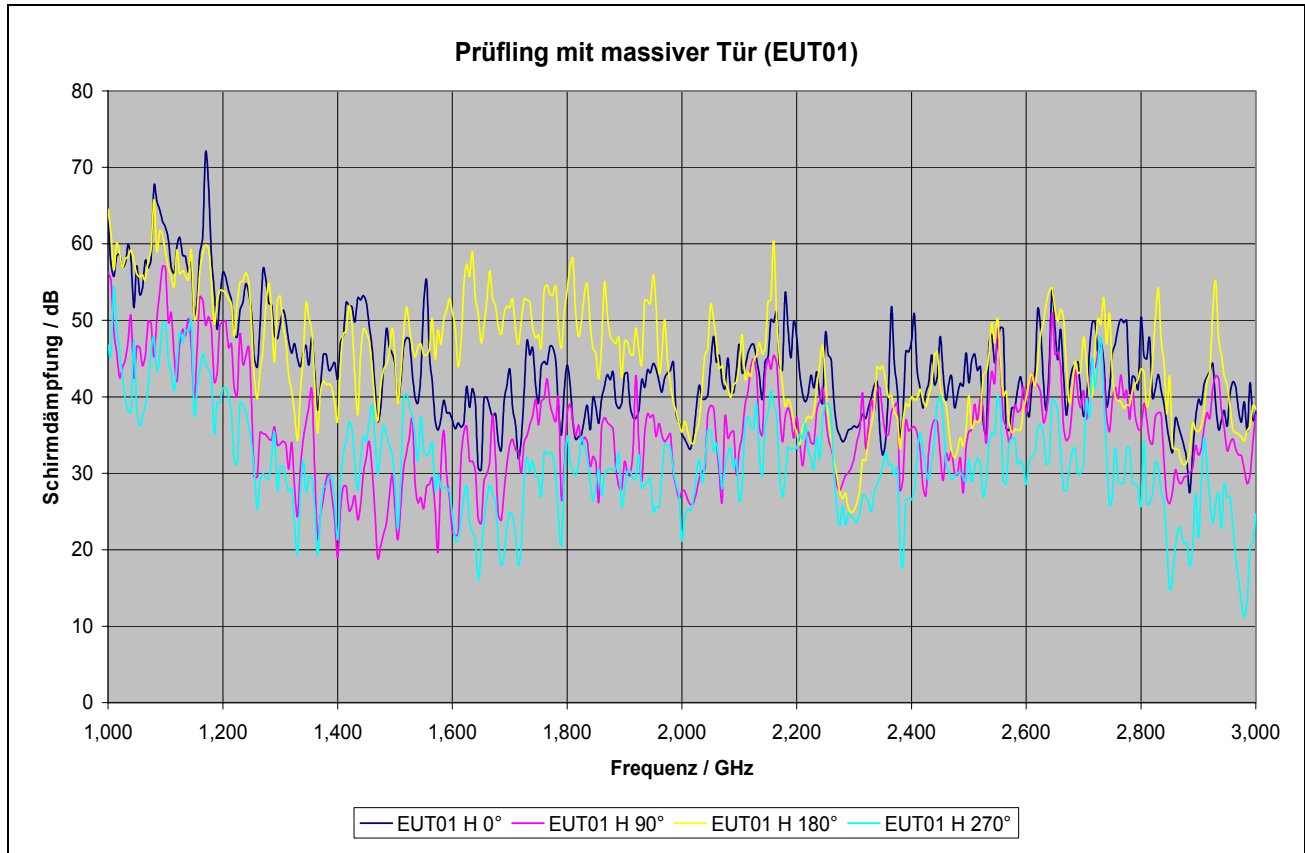


Separate curves for front (0°), left (45°), right (270°), back (180°), horizontal & vertical view with 1 - 4 m:

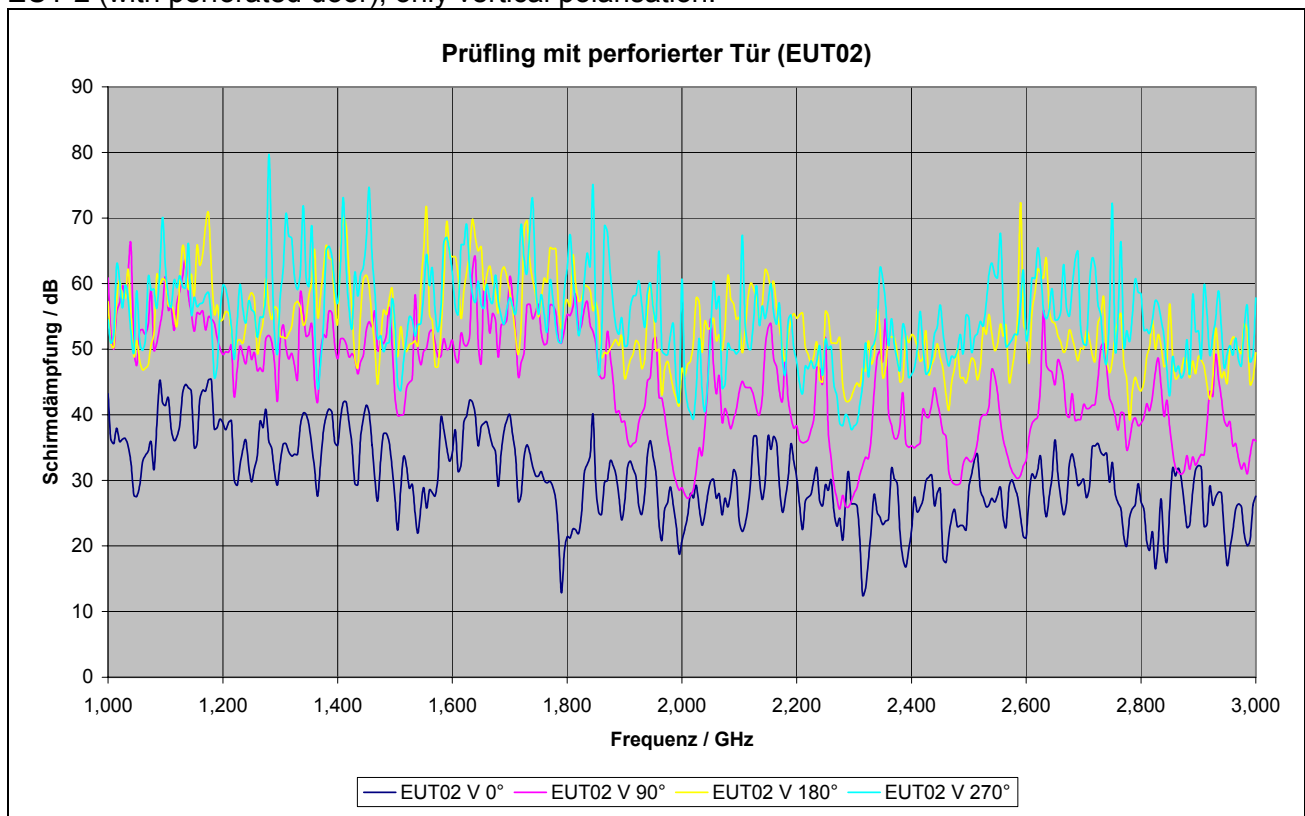
EUT 1 (with massive door), only vertical polarisation:



EUT 1 (with massive door), only horizontal polarisation:

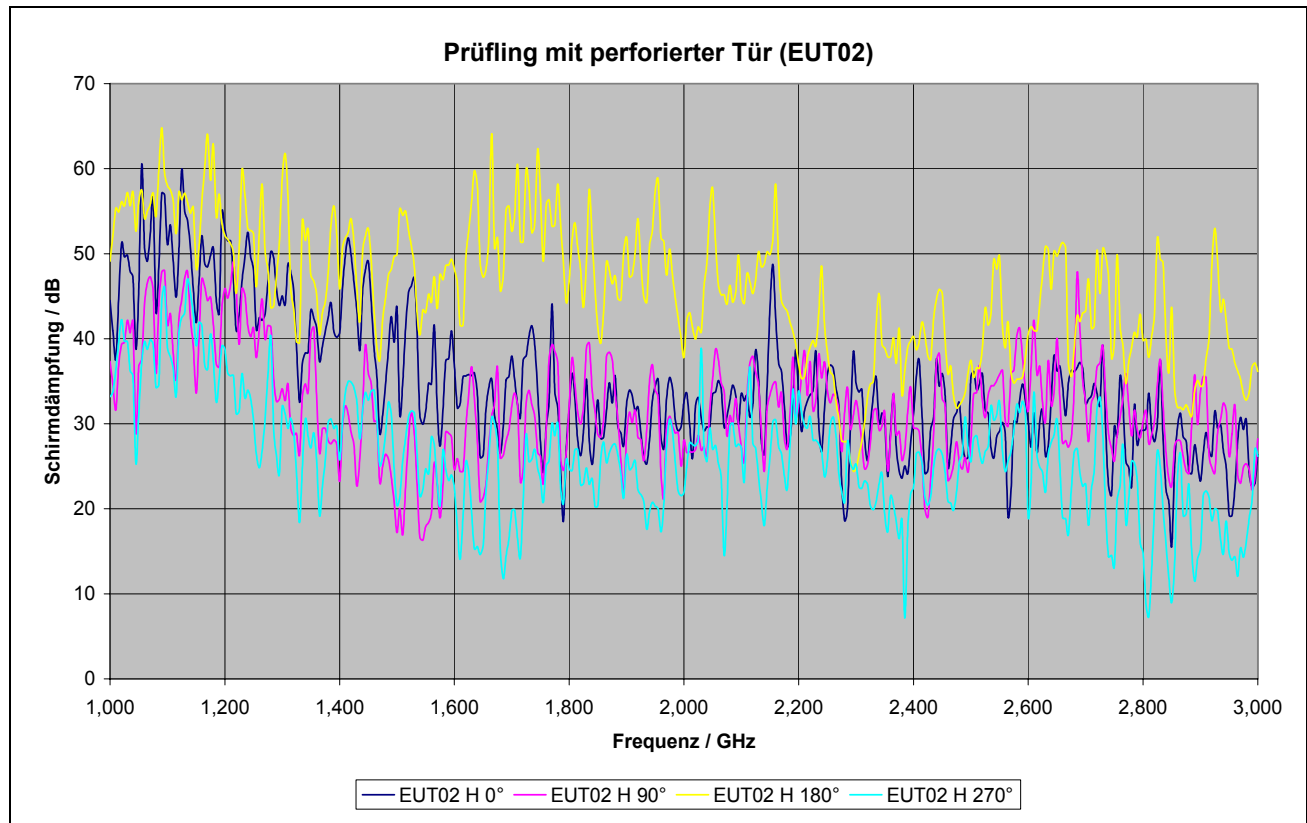


EUT 2 (with perforated door), only vertical polarisation:



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EUT 2 (with perforated door), only horizontal polarisation:



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Schroff EMC - Cabinet "Varistar EMC 2000Hx600Bx600T",
Item No.: 10130-020/20; with Shielding Material Item No.: 60130-028

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Item No.: 10130-020/20; with Shielding Material Item No.: 60130-028

In the following document please find the Test Report T09YPR1P.

With Best Regards

Armin Hudetz

Depart.: Com CTO CQE 13
Author: Armin Hudetz

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