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EMC-Testlab

2007-11-30

submitted by: M. Nagel / D. Giselbrecht
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Report No. 2007-159/1

Shielding effectiveness of the Desk-top cases propacPro 3U 84HP 326D, with shielded rear panel 24576-250, 30MHz-1GHz

Customer: Schroff GmbH
Langenalber Str. 96-100
75334 Straubenhardt

Engineers: Dipl.-Ing. M. Nagel
Dipl. Wi.-Ing. D. Giselbrecht

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1 Subject of this report

This report describes the shielding effectiveness measurements of the Desk-top cases propacPro 3U 84HP 326D.

2 General

Equipment under test:	propacPro 3U 84HP 326D
parts list:	propacPro 3U 84HP 326 depth, rear panel without perforation
EUT received:	2007-11-20
Place of test facility:	EMV-Laboratory Institute of Electrical Energy Systems and High Voltage Engineering (IEH) Universität Karlsruhe (TH) Engesserstrasse 11 76128 Karlsruhe
Test date:	2007-11-20
Environmental conditions:	temperaturer: 20,4 °C humidity: 31 % barometric pressure: 755 Torr
Representative customer:	Mr. R. Benko
Test engineers:	Dipl.-Ing. M. Nagel / Dipl. Wi.-Ing. D. Giselbrecht
Applied standards:	Shielding effectiveness in the frequency range of 30 MHz to 1000 MHz according to VG 95373, Part 15

3 Test setup

The EUT was placed inside a shielded semi anechoic chamber and irradiated on four sides (front, back, right, left). The transmitting antenna was located in a 3m distance and 1,8m above ground. Vertical polarization was used. The basic setup is illustrated in Fig. 1.

The applied test equipment were the signal generator SMH, manufactured by Rohde & Schwarz, the amplifiers BTRA 0122-1000 (9kHz...220MHz) and BLWA 2010-200 (220MHz...1000MHz, manufactured by Bonn GmbH. The logarithmic-periodical antenna UHALP 9108-G, manufactured by Schwarzbeck, was used for emission. The EATON-ALL Tech Probe was used as receiving antenna and connected to the test receiver ESVP manufactured by Rhode & Schwarz.

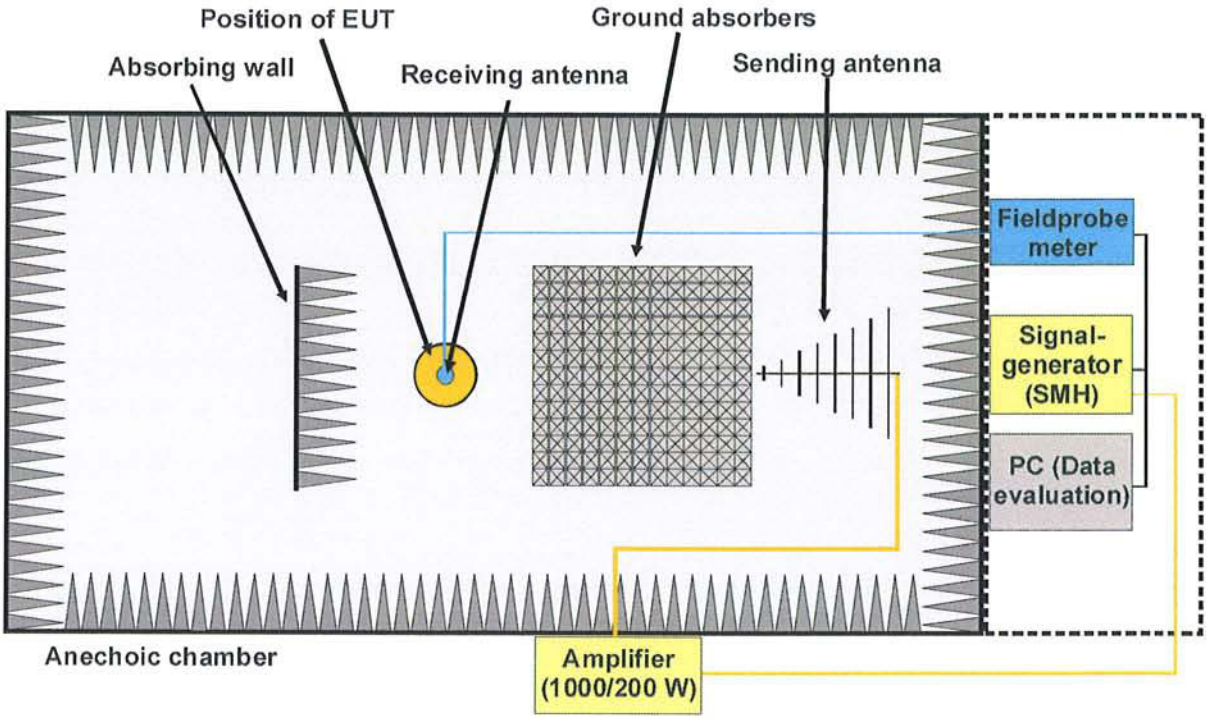

Fig. 1: test setup for shielding effectiveness

The EUT was fixed upon a turntable, 80 cm above ground. The cavities in the turntable were filled with similar absorbers as used at the walls of the semi anechoic chamber (see Fig. 4 for details). The receiving antenna was mounted on a brass tubing and aligned in the center of the EUT. Possible eigenfrequencies of the tubing were suppressed with ferrites.

3.1 Measurement procedures

The measurement of the shielding effectiveness was performed according to the "middle point method" in the frequency range of 30 MHz to 1 GHz which describes an isertion-loss method.

Coupling is first measured with no enclosure present an afterwards with one inserted. During those measurements the distance between sending- and receiving antenna, as well as the orientation are kept constant.

The enclosure shielding effectiveness is the difference between the reference level a_0 without, and the level a_1 with applied shielding (Fig. 2).

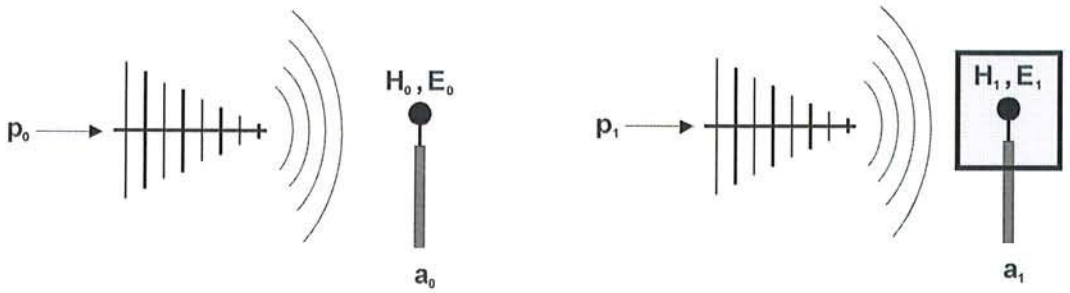

Fig. 2: Illustration of insertion-loss measurement method

The shielding effectiveness is calculated by:

$$a_s = a_0 - a_1 \text{ in dB.}$$

3.2 Dynamic range

The dynamic range is determined as the difference between reference level a_0 and the level without the receiving antenna. It is a quantification for the maximum shielding effectiveness, achievable with the used test setup and is dependable on the noise level of the epuipment (e.g., the shielding efeciveness of the cables) and the intrinsic noise of the receiver. The measured dynamic range is illustrated in Fig. 3, which is predominantly above 80 dB in the required frequency range.

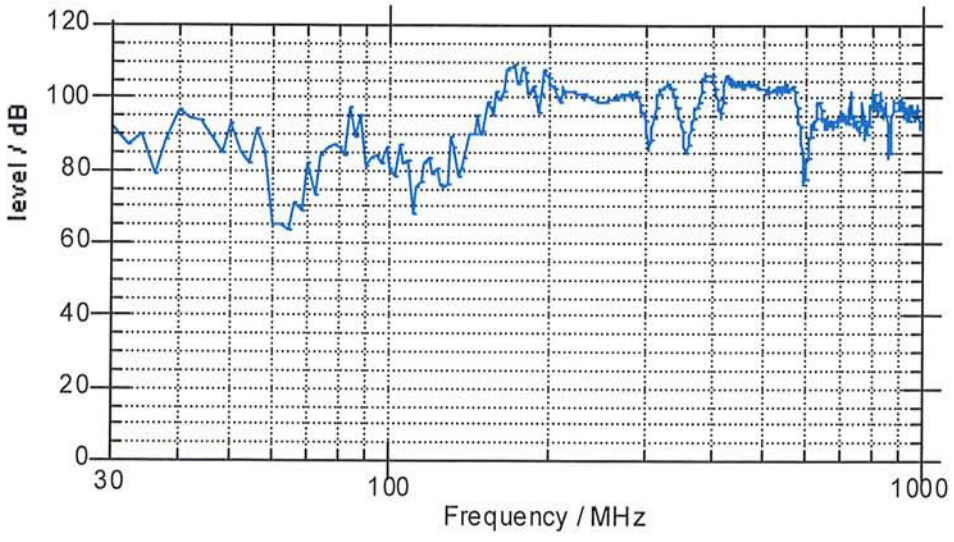

Fig. 3: Measured dynamic range

4 Results

4.1 Measurement of shielding effectiveness

The EUT was irradiated on four sides (top, bottom, right and left). The antenna was located in a 3m distance and 1,8 m above ground with a vertical polarization.

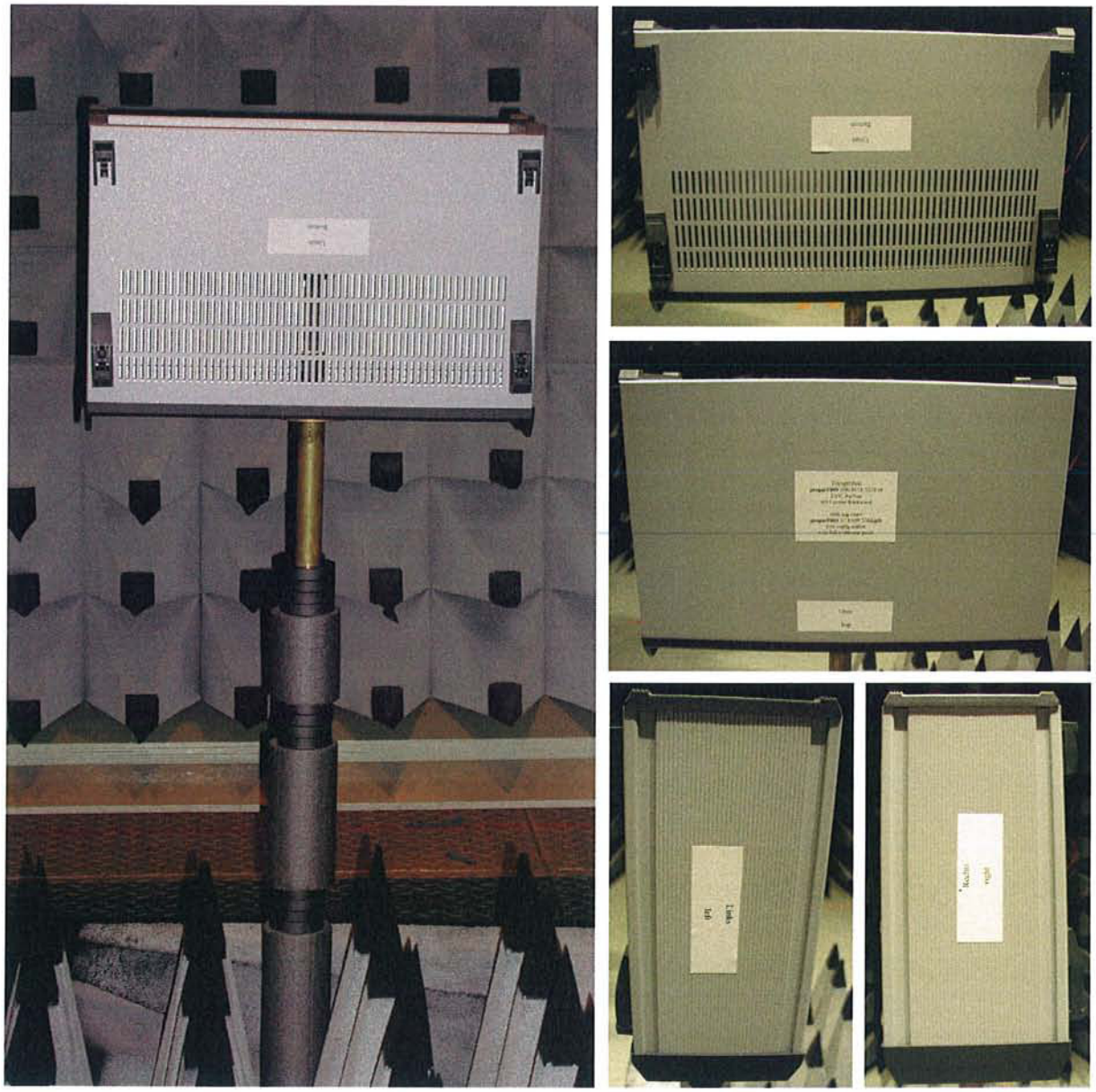

Fig. 4: EUT at the measurement position inside the anechoic chamber

4.1.1 TOP-side of EUT towards antenna

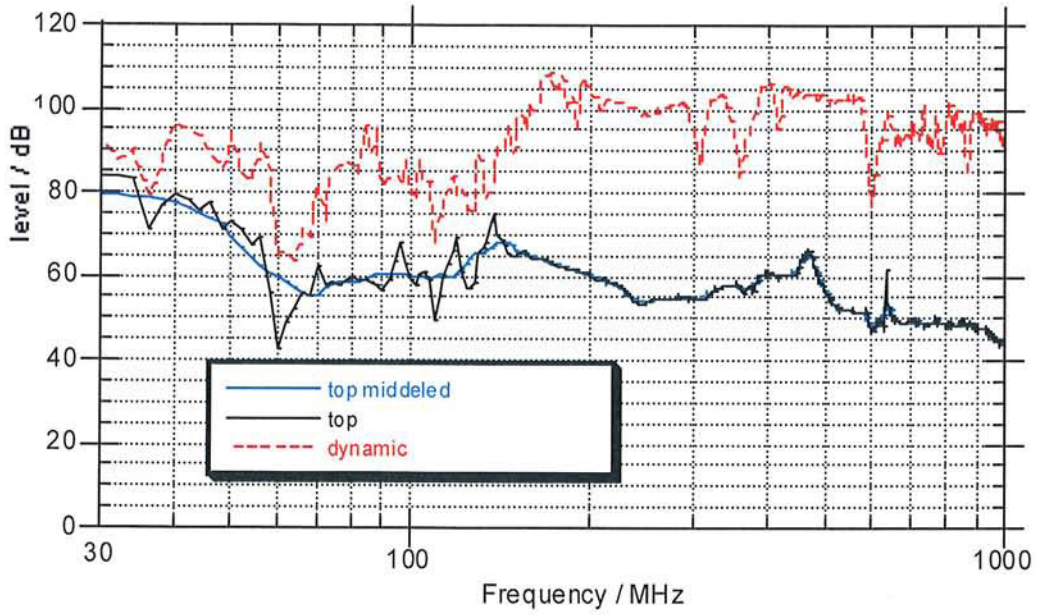

Fig. 5: Measurement results for direct radiation on TOP-side of the EUT

4.1.2 LEFT-side of EUT towards antenna

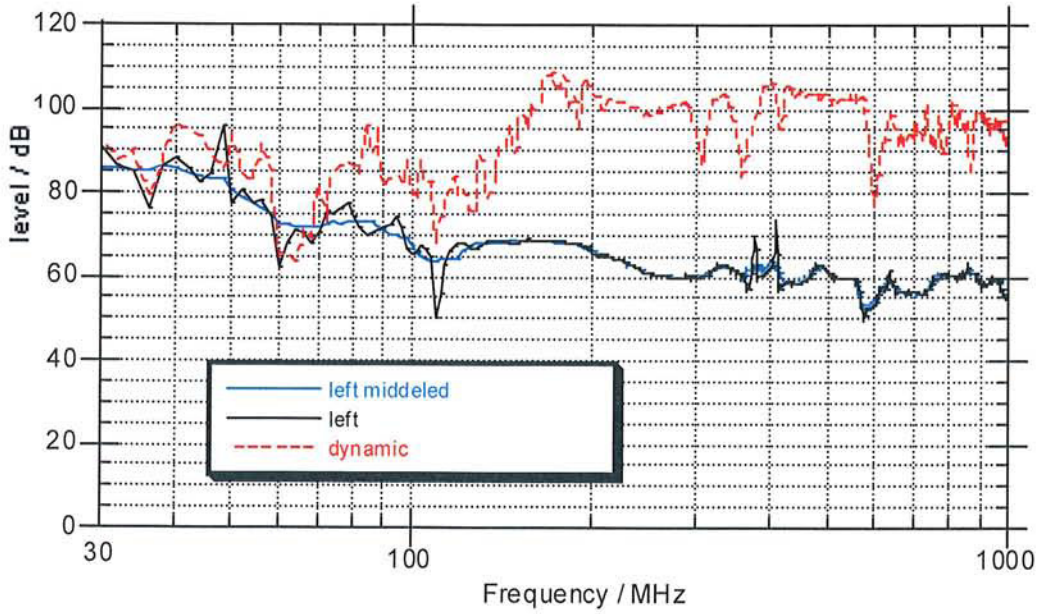

Fig. 6: Measurement results for direct radiation on LEFT-side of the EUT

4.1.3 BUTTOM-side of EUT towards antenna

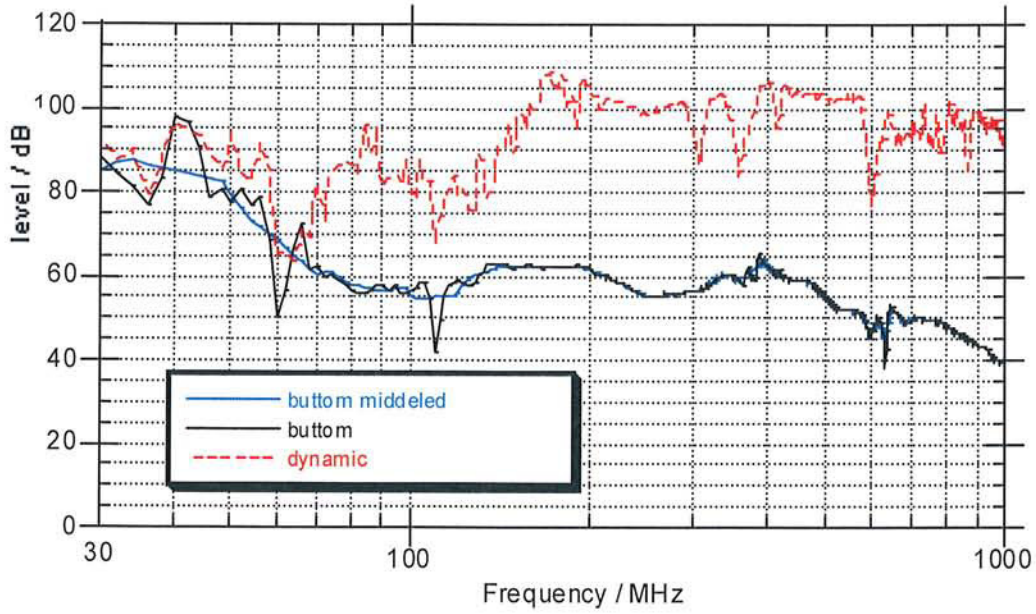

Fig. 7: Measurement results for direct radiation on BUTTOM-side of the EUT

4.1.4 RIGHT-side of EUT towards antenna

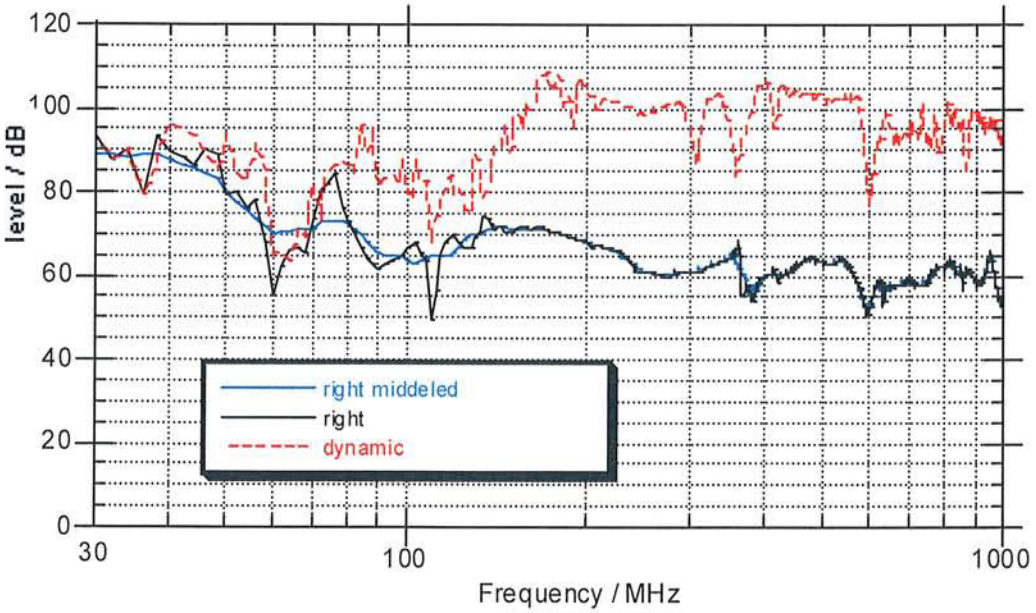

Fig. 8: Measurement results for direct radiation on RIGHT-side of the EUT

4.2 Typical shielding effectiveness and worst-case scenario

Additionally to the above measurements with direct radiation on one side of the EUT an overall worst-case scenario was calculated, using the total minimum shielding effectiveness of the previously recorded values. Combined with an inserted smoothing of the resonance frequencies results a typical shielding effectiveness of the EUT as shown in Fig. 9.

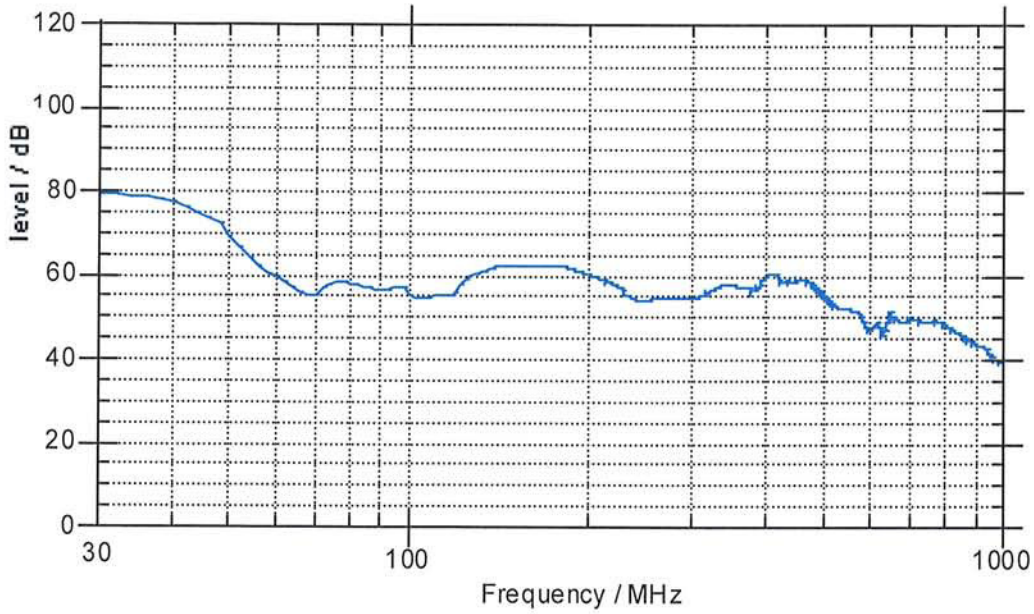

Fig. 9: Typical shielding effectiveness and worst case scenarion of the EUT

5 Conclusion

Shielding effectiveness measurements of the Desk-top cases propacPro 3U 84HP 326D were performed in the frequency range of 30MHz to 1GHz according to VG 95 373, Part 15.

The results of those measurements are displayed in Fig. 5, Fig. 6, Fig. 7 and Fig. 8. The additionally calculated worst-case scenario resulted in Fig. 9.

Responsible for the proper execution of the measurements in accordance with acknowledged rules of technology

Karlsruhe, 2007-11-30

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(Head of EMC-testing)

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Appendix of the Report No. 2007-159/1

Shielding effectiveness of the Desk-top cases propacPro 3U 84HP 326D, with shielded rearpanel 24576-250, 1GHz-2GHz

Customer: Schroff GmbH
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1 Results

1.1 Measurement of shielding effectiveness

The EUT was irradiated on four sides (top, bottom, right and left). The antenna was located in a 1.2m distance and 1,1 m above ground with a vertical polarization.

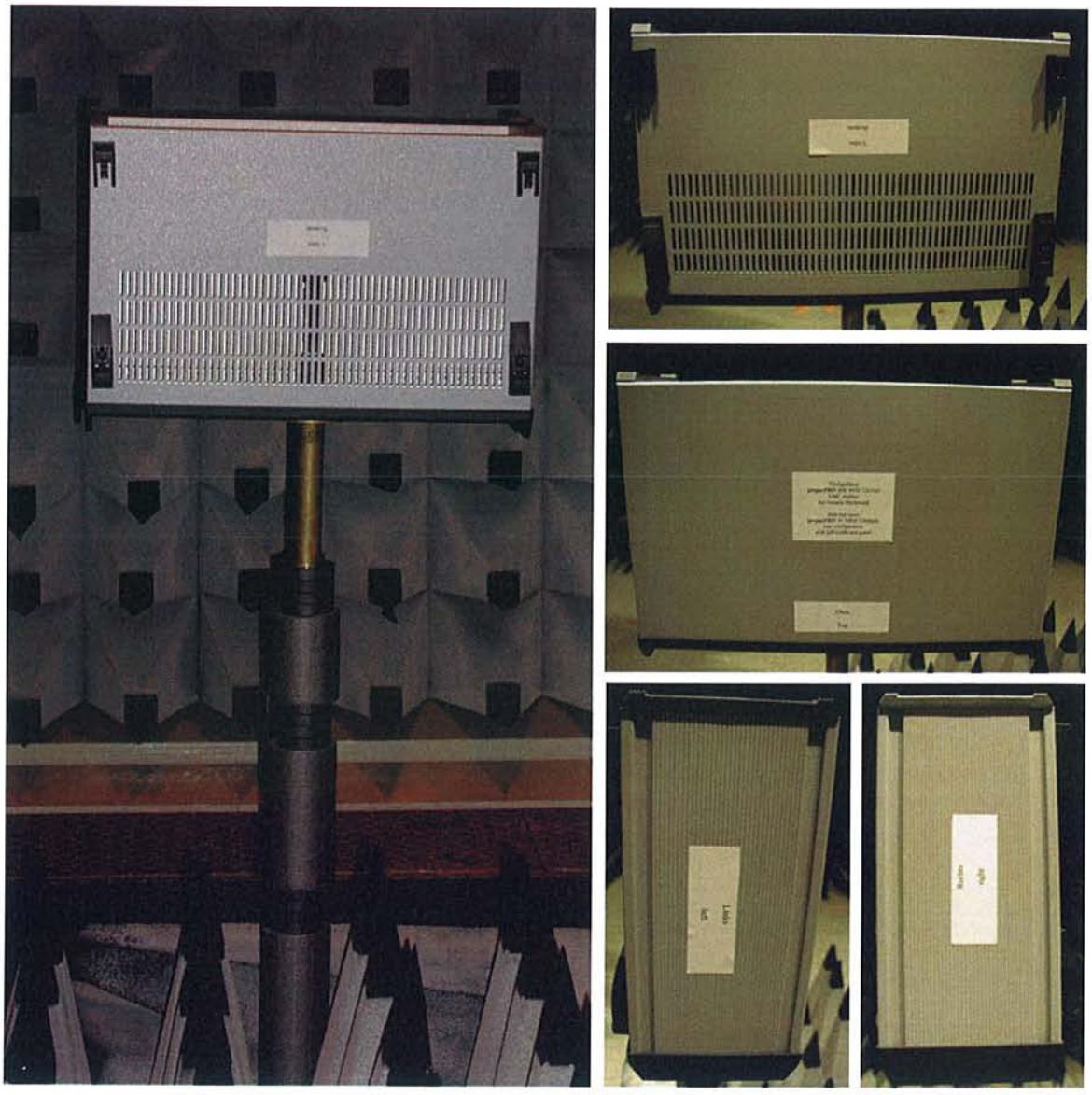

Fig. 1: EUT at the measurement position inside the anechoic chamber

1.1.1 TOP-side of EUT towards antenna

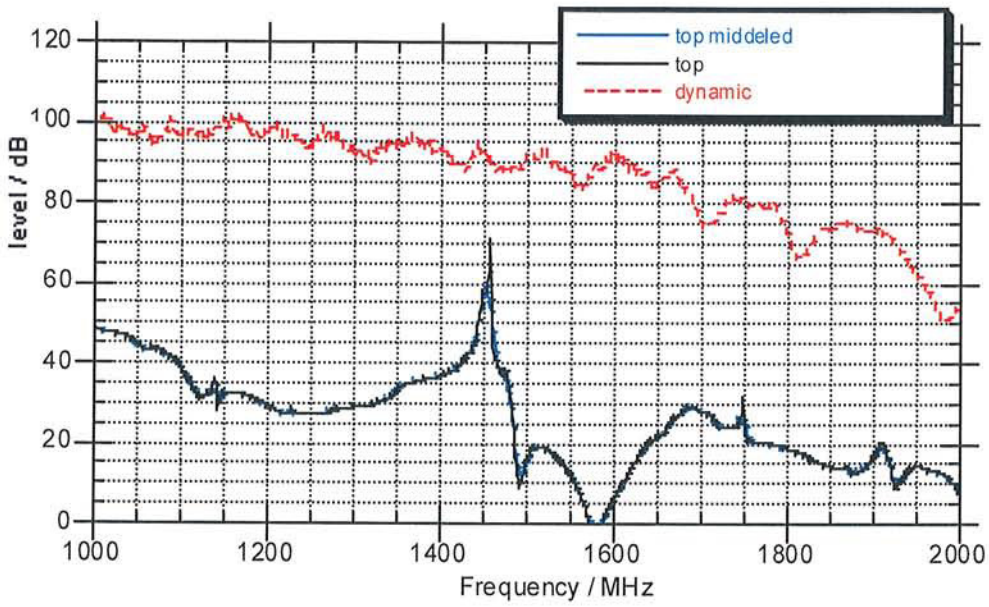

Fig. 2: Measurement results for direct radiation on TOP-side of the EUT

1.1.2 LEFT-side of EUT towards antenna

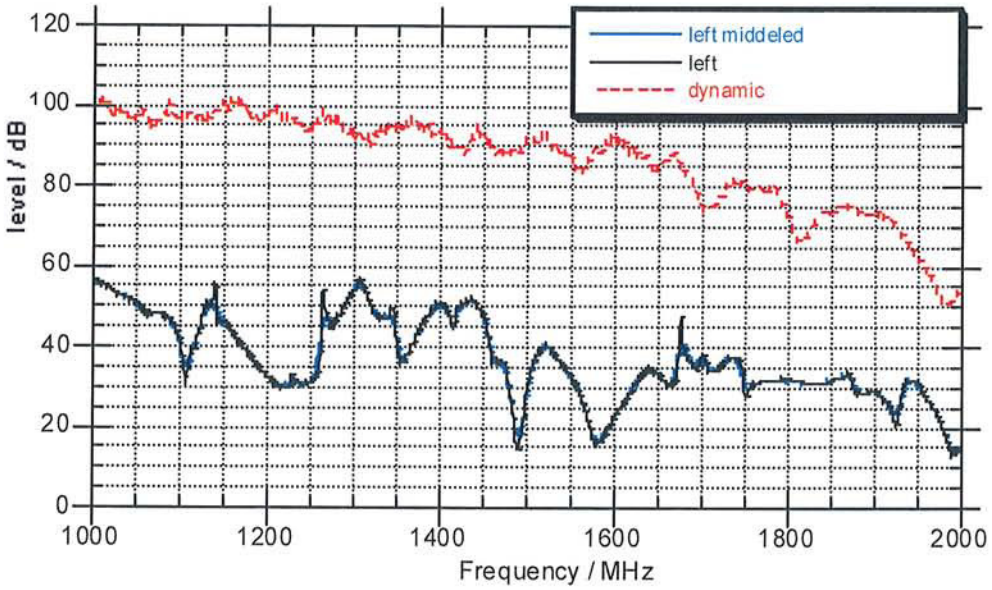

Fig. 3: Measurement results for direct radiation on LEFT-side of the EUT

1.1.3 BUTTOM-side of EUT towards antenna

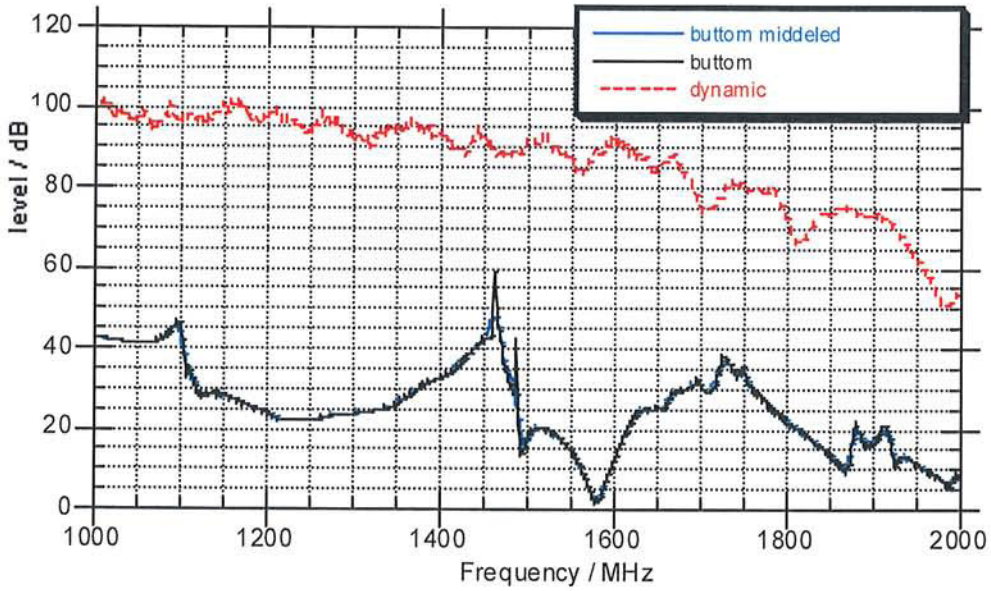

Fig. 4: Measurement results for direct radiation on Buttom-side of the EUT

1.1.4 RIGHT-side of EUT towards antenna

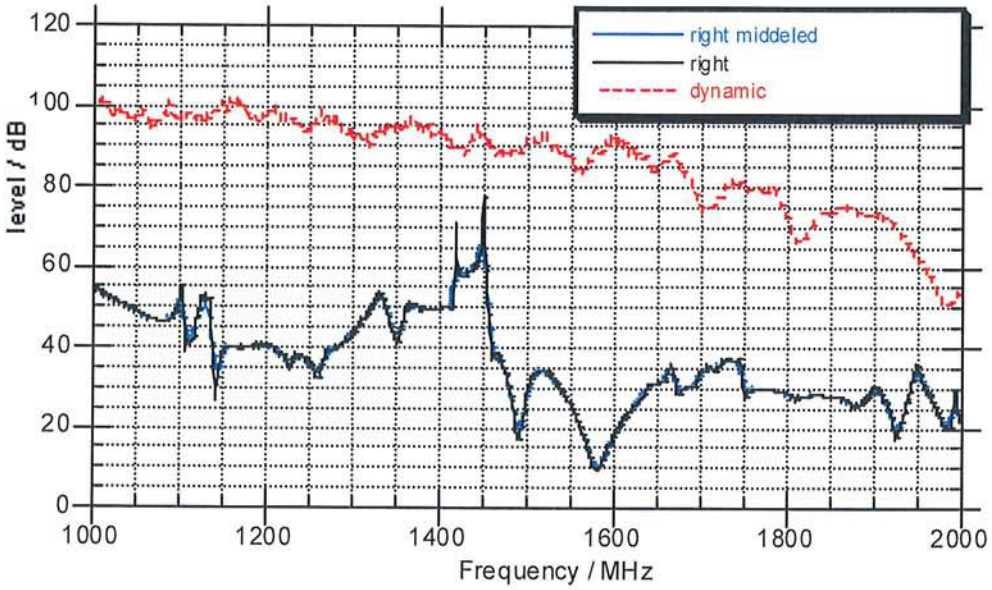

Fig. 5: Measurement results for direct radiation on RIGHT-side of the EUT

1.2 Typical shielding effectiveness and worst-case scenario

Additionally to the above measurements with direct radiation on one side of the EUT an overall worst-case scenario was calculated, using the total minimum shielding effectiveness of the previously recorded values. Combined with an inserted smoothing of the resonance frequencies results a typical shielding effectiveness of the EUT as shown in Fig. 6.

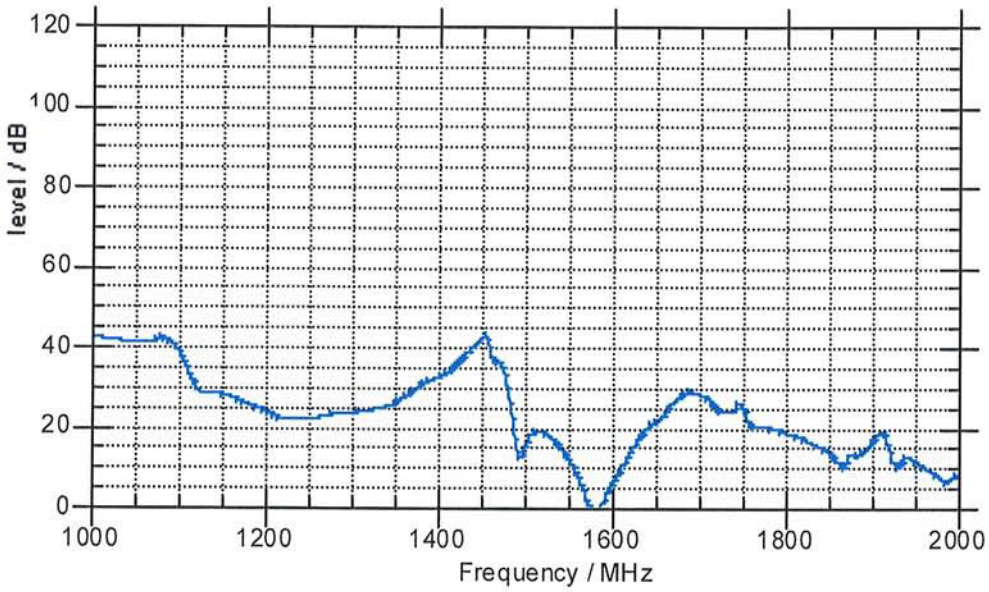

Fig. 6: Typical shielding effectiveness and worst case scenarion of the EUT