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EMC-Testlab

2009-08-19

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Report Nr. 2009-75

Shielding effectiveness of the cabinet Multipac Pro (Order Number: 20860126)

Customer:	Schroff GmbH Langenalber Str. 96-100 75334 Straubenhardt
Engineers:	Dipl.-Ing. T. Wenzel Dipl.-Ing. K. Mössner

1 Subject of this report

This report describes the shielding effectiveness measurements of the cabinet Multipac Pro (Order Number: 20860126).

2 General

Equipment under test:	Multipac Pro (Order Number: 20860126)
parts list:	1. Multipac Pro 2 HE (Articlenumber: 20860126)
EUT received:	2009-08-19
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:	2009-08-19
Environmental conditions:	temperature: 24.1 °C humidity: 52.7 % barometric pressure: 1007 mbar
Representative customer:	Mr. R. Benko
Test engineers:	Dipl.-Ing. T. Wenzel / Dipl.-Ing. K. Moessner
Applied standards:	Shielding effectiveness in the frequency range of 30 MHz to 2000 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 emitting antenna was located in a 3 m distance and 1.8 m above ground. Vertical polarization was used. The basic setup is illustrated in Fig. 1.

The applied test equipment for the frequency range between 30 MHz and 1 GHz consisted of the signal generator SMIQ 06 ATE, manufactured by Rohde & Schwarz (Inv.No. 07-100976), the amplifiers BTA 0122-1000 (9 kHz...220 MHz; Inv.No. 950003) and BLWA 2010-200 (220 MHz...1000 MHz; Inv.No. 950004), manufactured by Bonn GmbH. The logarithmic-periodical antenna VULP 9118-G (Inv.No. 050084), manufactured by Schwarzbeck, was used for emission. The EATON-ALL Tech Probe was used as receiving antenna and connected to the test receiver ESVP (Ser.Nr.: 872991/0011) manufactured by Rhode & Schwarz.

The applied test equipment for the frequency range of 1 GHz to 2 GHz was the vector-network-analyzer ZVRE (Inv.Nr.: 272/0074/96), manufactured by Rohde & Schwarz, the amplifier 25S1G4A, manufactured by Amplifier Research (Inv.-Nr.: 990043). The stacked double Log.-Per. antenna STLP 9149, manufactured by Schwarzbeck (Inv.-Nr.: TL2008-28), was used for emission. The EATON-ALL Tech Probe was used as receiving antenna and connected to the network-analyzer ZVRE.

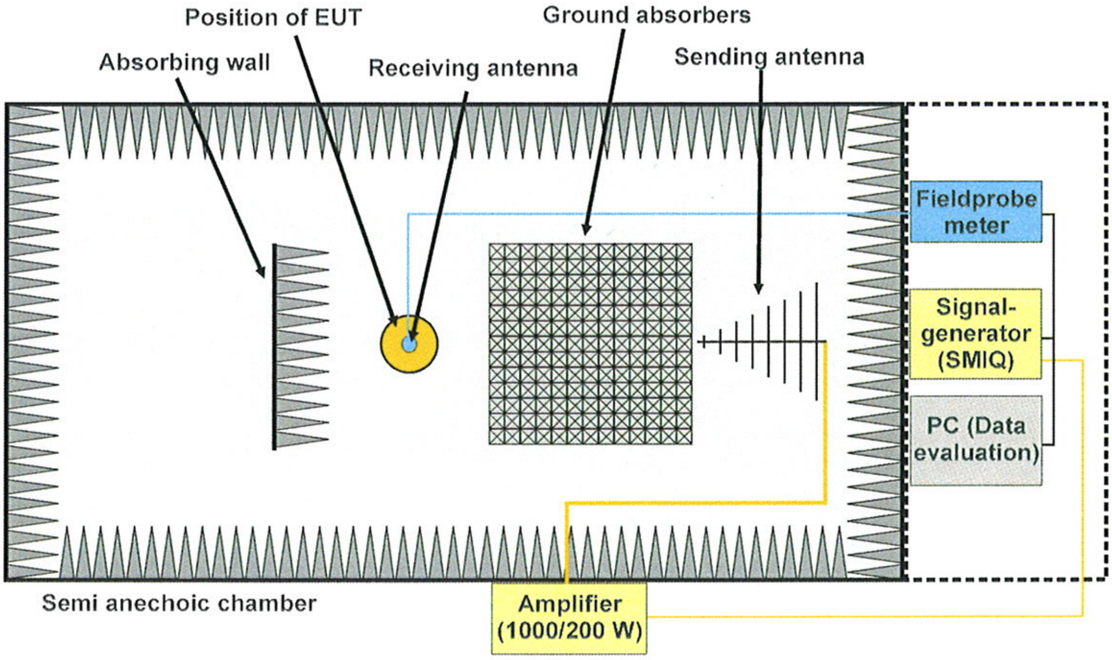

Fig. 1: test setup for shielding effectiveness

The EUT was fixed upon a brass tubing 1.17 m above ground. The receiving antenna was mounted on the 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 insertion loss method.

Coupling is first measured without shielding and afterwards the shielding enclosure is inserted. During those measurements the distance between sending and receiving antenna and 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).

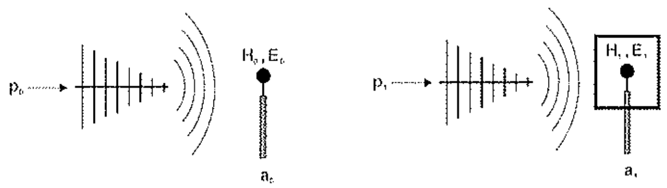

Fig. 2: Illustration of insertion-loss measurement method

The shielding effectiveness is calculated by: $a_s = a_0 - a_1$ in dB.

3.2 Dynamic range

The dynamic range is determined as the difference between reference level a_0 and the measured level when the receiving antenna is replaced by a reflection-free termination of the cable. It is a quantification for the maximum shielding effectiveness, achievable with the used test setup and is depending on the noise level of the equipment (e.g. the shielding effectiveness of the cables) and the intrinsic noise of the receiver. The measured dynamic range is illustrated in the corresponding figures and is predominantly above 80 dB in the required frequency range.

4 Results

4.1 Measured shielding effectiveness

The EUT was irradiated on four sides (front, back, right, left). Up to 1 GHz the antenna was located in a 3 m distance and 1.8 m above ground with vertical polarization. Between 1 GHz and 2 GHz the antenna was located in a 1.5 m distance and at 1 m above ground, set to vertical polarisation.

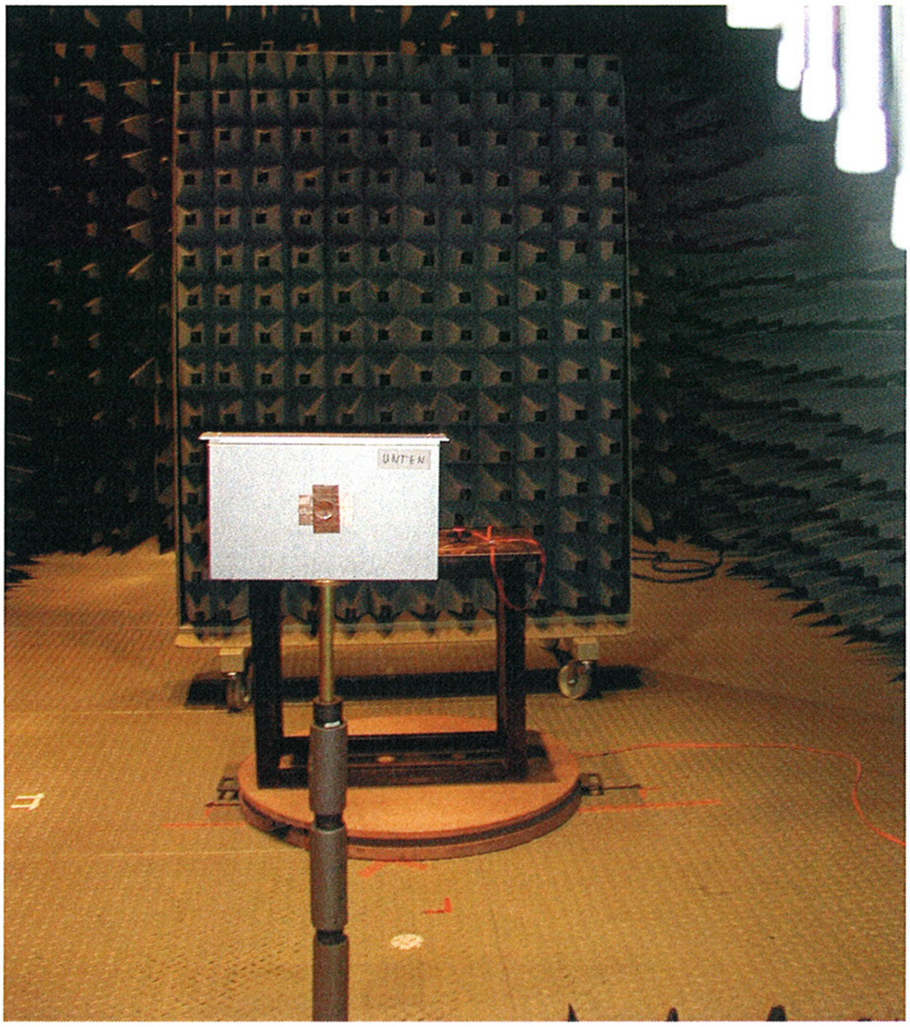

Fig. 3: EUT at the measurement position inside the anechoic chamber

4.1.1 30 MHz - 1 GHz: top side of EUT towards antenna

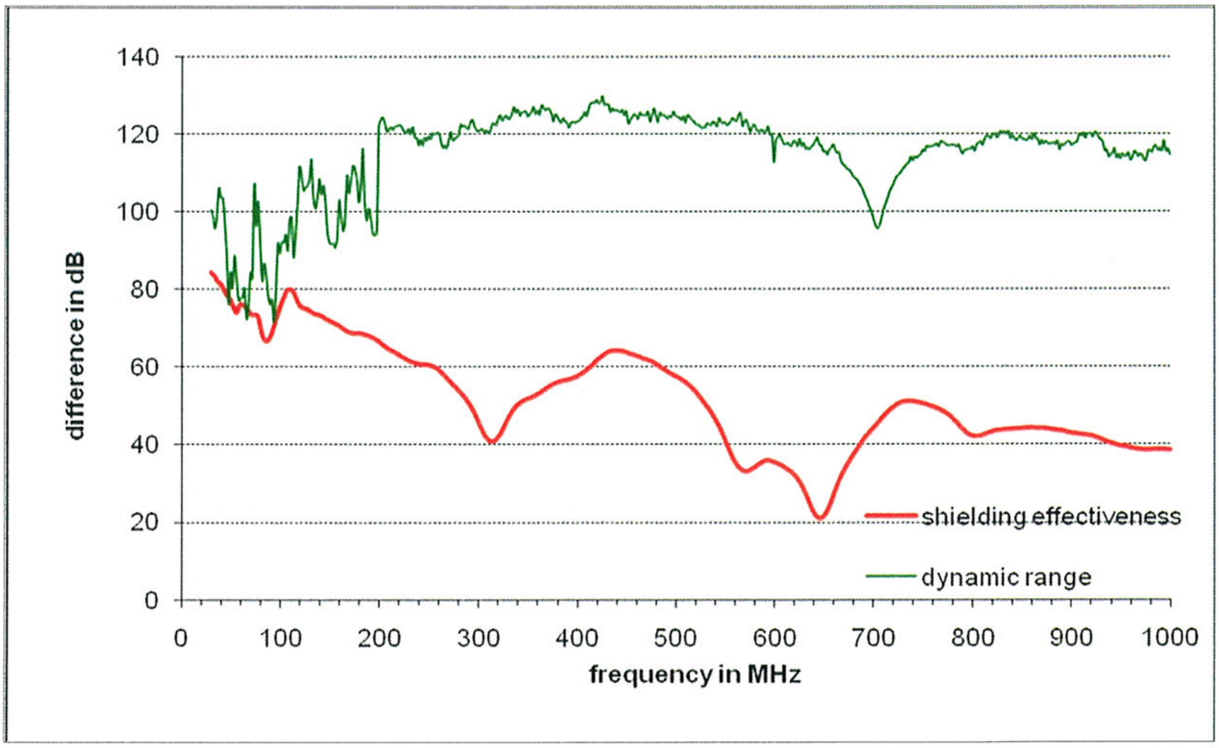

Fig. 4: Measurement results for direct radiation on top side of the EUT

4.1.2 30 MHz - 1 GHz: left side of EUT towards antenna

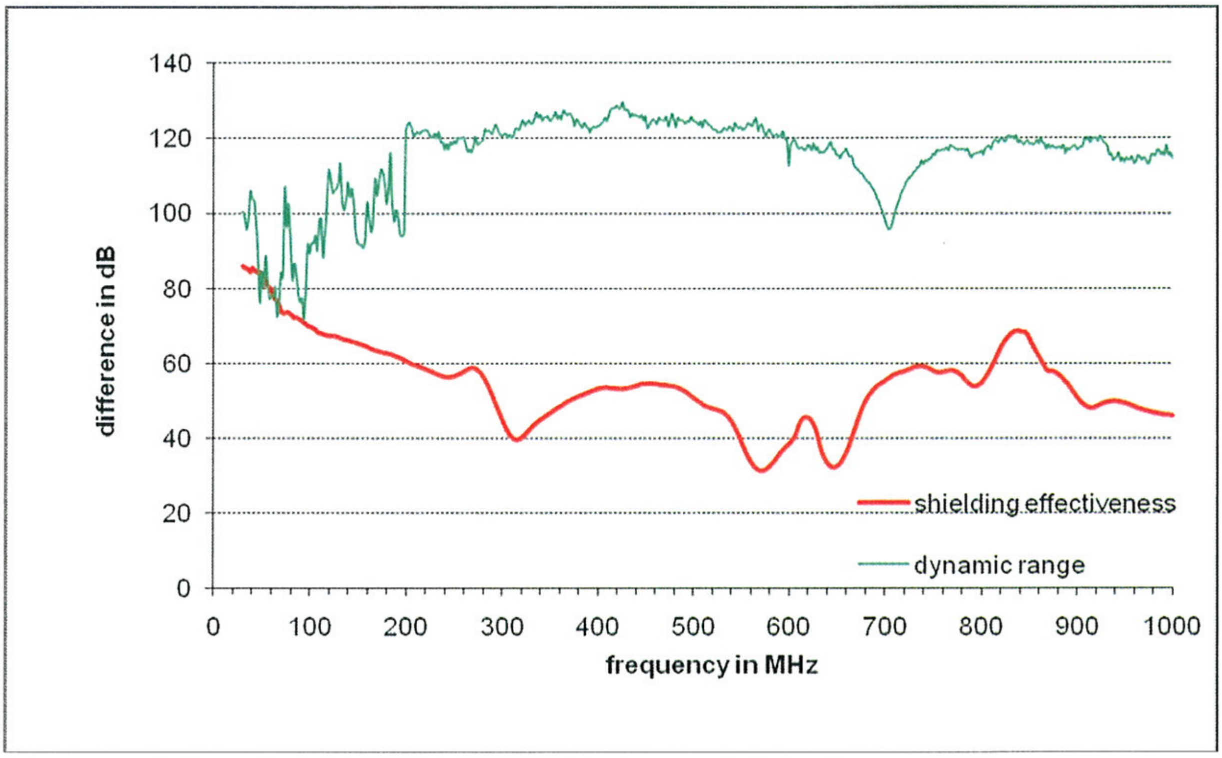

Fig. 5: Measurement results for direct radiation on left side of the EUT

4.1.3 30 MHz - 1 GHz: bottom side of EUT towards antenna

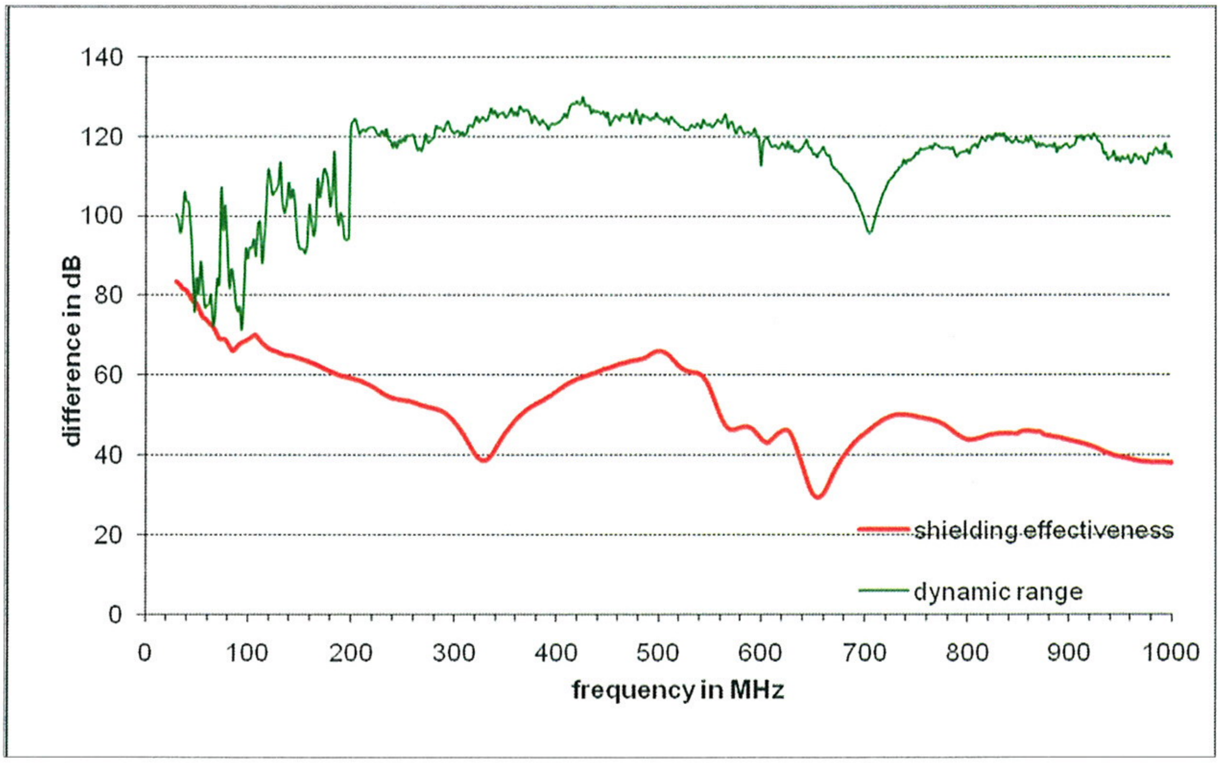

Fig. 6: Measurement results for direct radiation on bottom side of the EUT

4.1.4 30 MHz - 1 GHz: right side of EUT towards antenna

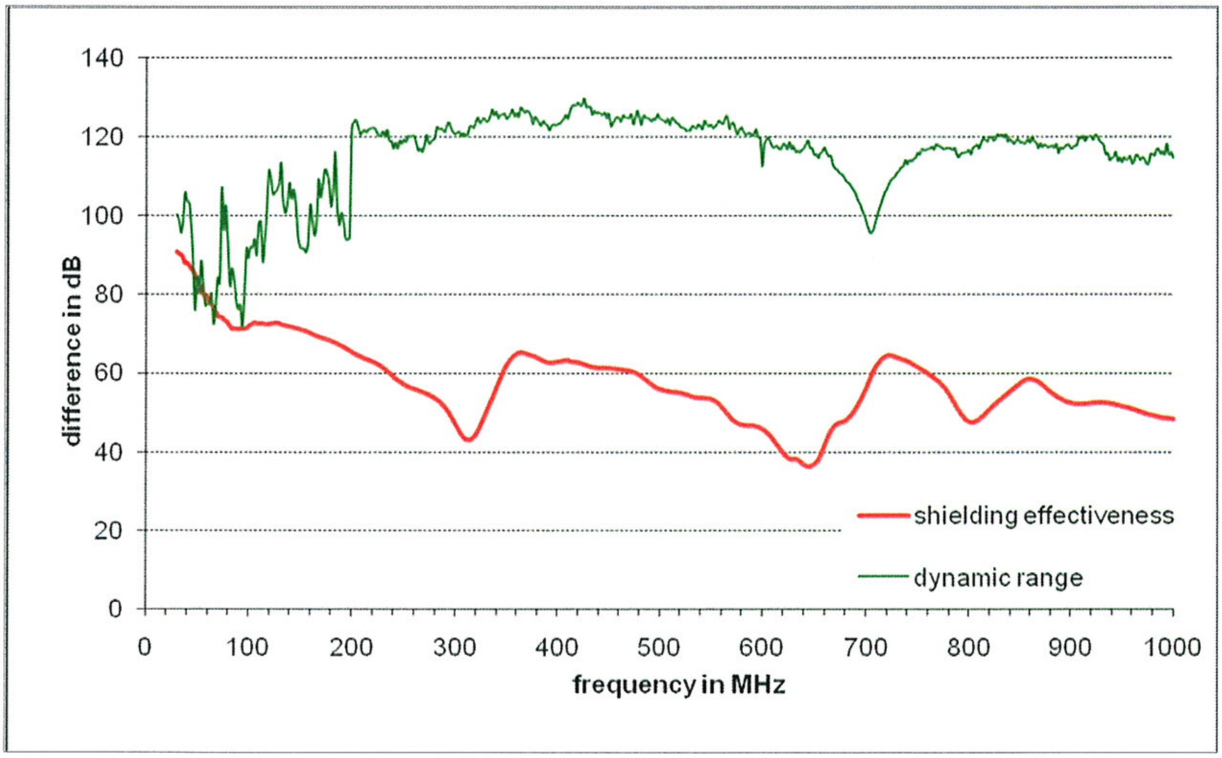

Fig. 7: Measurement results for direct radiation on right side of the EUT

4.1.5 1 GHz – 2 GHz: top side of EUT towards antenna

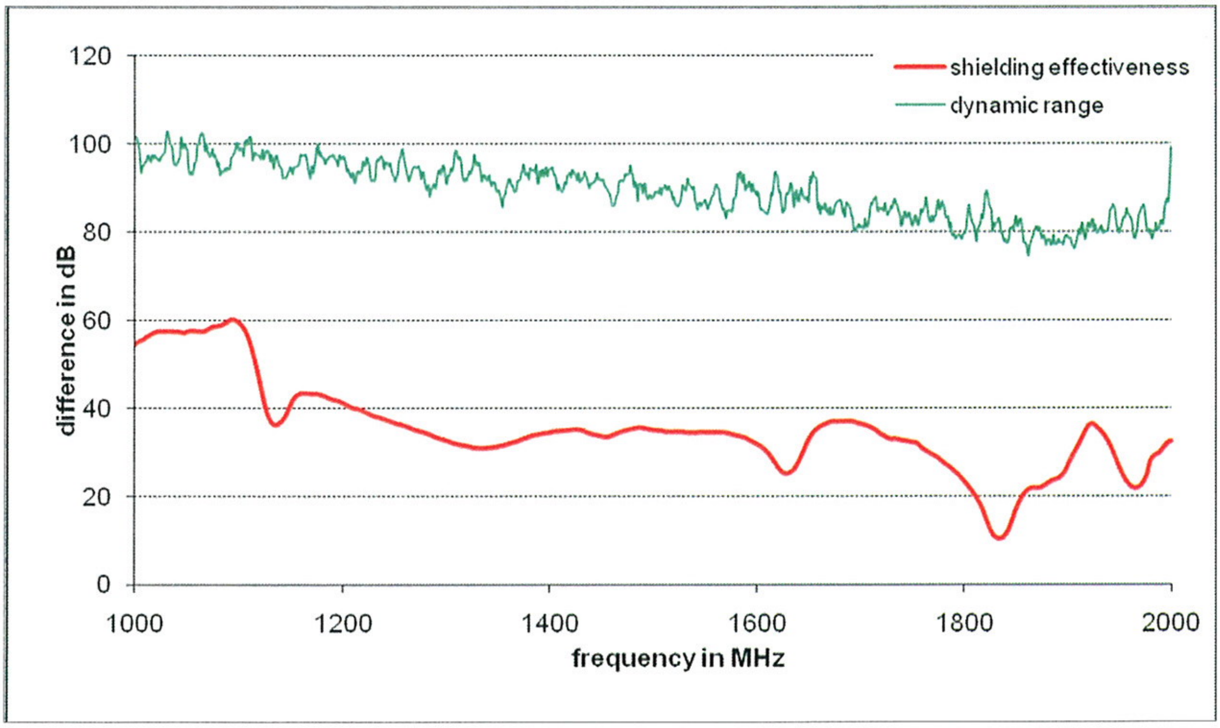

Fig. 8: Measurement results for direct radiation on top side of the EUT

4.1.6 1 GHz – 2 GHz: left side of EUT towards antenna

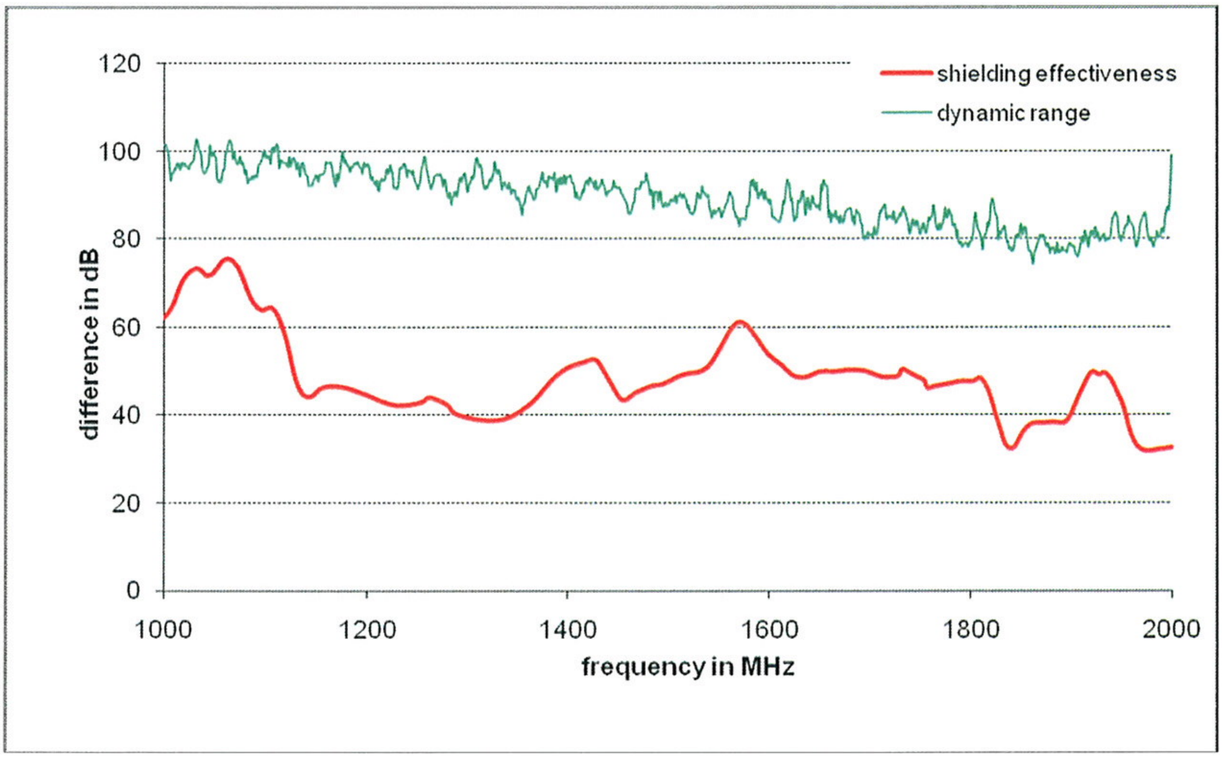

Fig. 9: Measurement results for direct radiation on left side of the EUT

4.1.7 1 GHz – 2 GHz: bottom side of EUT towards antenna

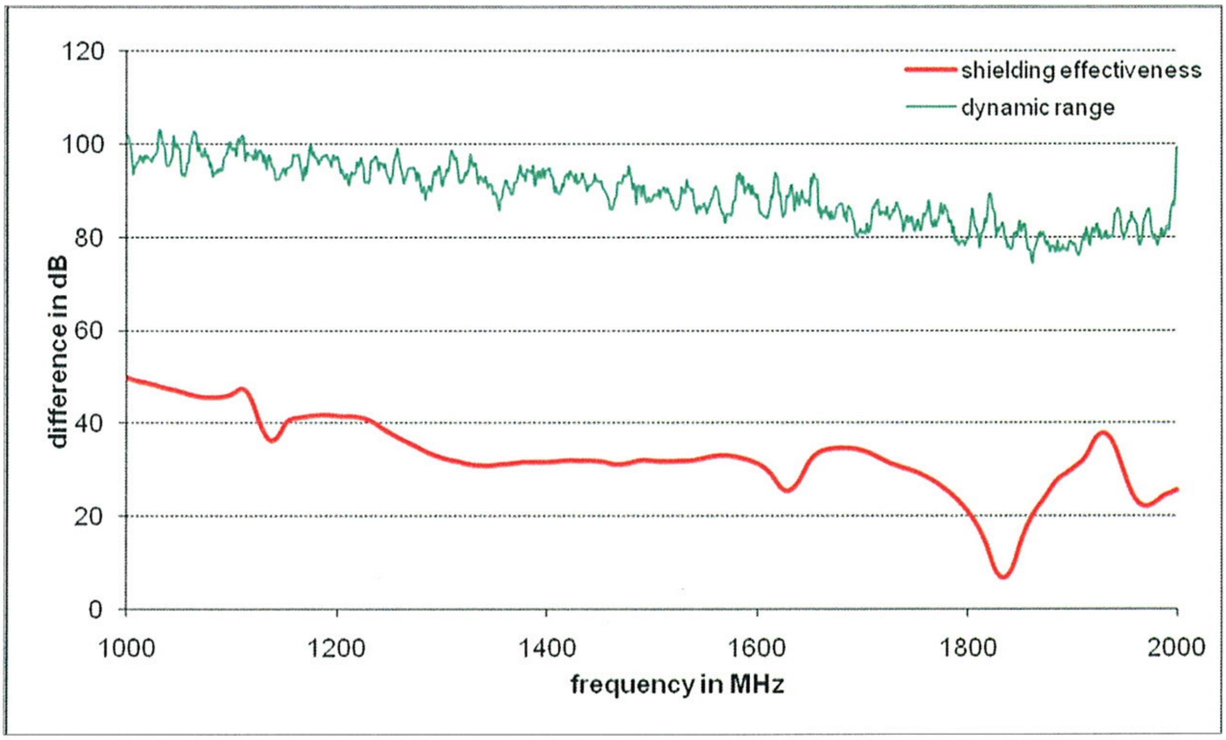

Fig. 10: Measurement results for direct radiation on bottom side of the EUT

4.1.8 1 GHz – 2 GHz: right side of EUT towards antenna

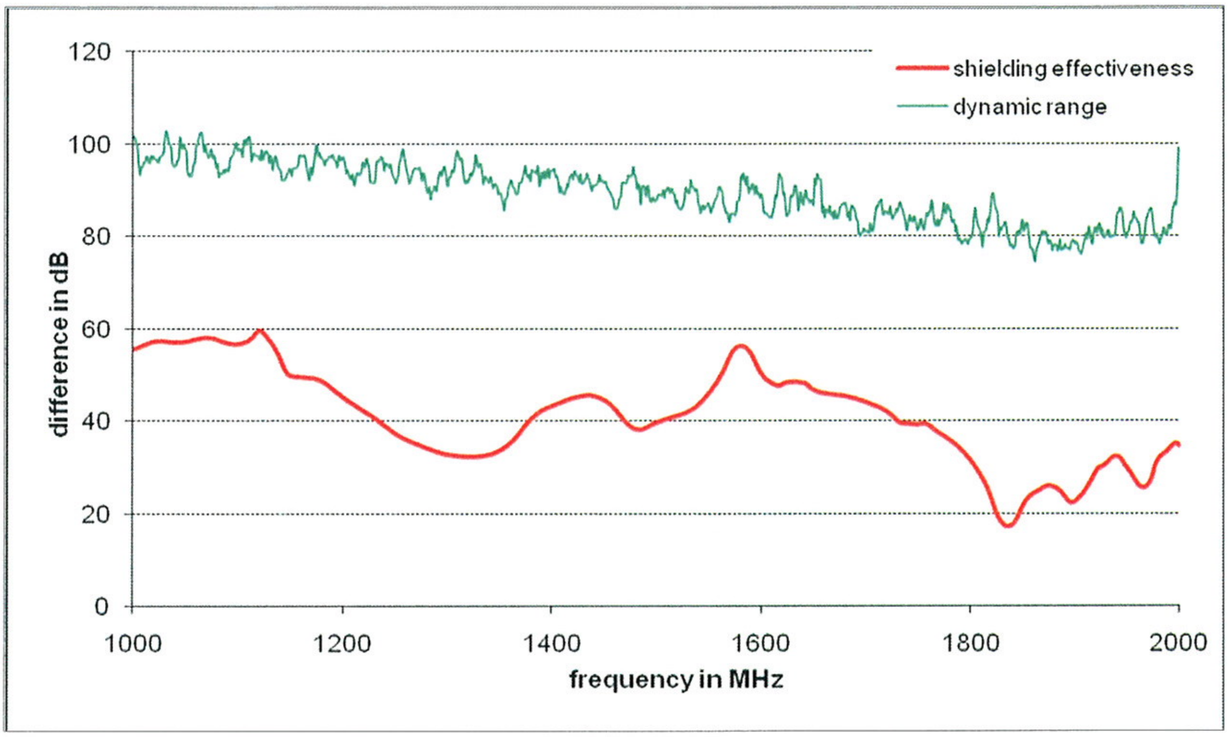

Fig. 11: Measurement results for direct radiation on right side of the EUT

4.2 Typical shielding effectiveness and worst-case scenario

Additionally to the measurements displayed above with direct radiation to 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, a typical shielding effectiveness of the EUT results as shown in Fig. 12.

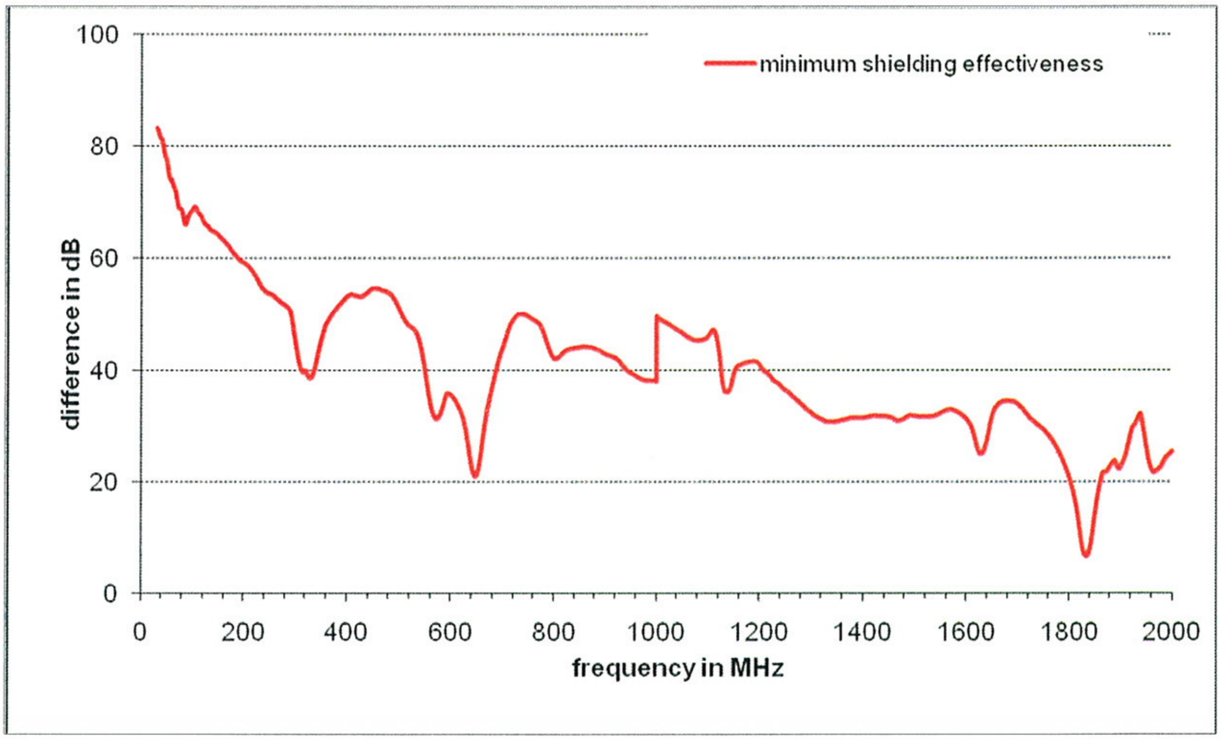

Fig. 12: Minimum shielding effectiveness of the EUT

5 Conclusion

Shielding effectiveness measurements of the Multipac Pro (Order Number: 20860126) were performed in the frequency range of 30 MHz to 1 GHz according to VG 95 373, Part 15.

The results of those measurements are displayed in Fig. 4, Fig. 5, Fig. 6 and Fig. 7.

Measurements were also done in the frequency range of 1 GHz to 2 GHz. The results of those measurements are displayed in Fig. 8, Fig. 9, Fig. 10 and Fig. 11

The additionally calculated worst-case scenario is shown in Fig. 12.

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

Karlsruhe, 2009-08-19

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