

EXPERT REPORT

- Ordered by:** Spoerry 1866 AG
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- Device under Test:** Shielding fabric *Swiss Shield Evolution*
- Subject:** Measurement of the shielding efficiency (SE) against electromagnetic waves from 800 MHz to 12 GHz
- Regulations:** IEEE 299-2006 (similar to MILSTD 285)
- Date of Measurements:** 5th of September 2017
- Content:** 4 pages of text, 2 diagrams in the appendix
- Results:** The measurements proved that the shielding of the fabric *Swiss Shield Evolution* is almost independent of the polarisation of the incident waves.
The shielding against frequencies in the mobile communication is between 22dB and 28dB.
This means, that 99,37% to 99,82% of the incident power flux density is removed by the fabric.

1 Introduction

To explain the measured diagrams, it is helpful to use this table. You can easily find the relation between shielding in „dB“ and transmitted power in „%“.

To calculate the dB-value from the incident power P_1 respectively field strength E_1 and the transmitted power P_2 or field strength E_2 , one has to use the following

equation:
$$a_{Shield} = 10 \cdot \log \frac{P_2}{P_1} = 20 \cdot \log \frac{E_2}{E_1} \text{ in decibel (dB)}$$

The network analyzer presents the results of the shielding measurements in „Decibel“ (dB). The mode of measurement is a typical transmission measurement (S_{21} -measurement). This dB value describes, how much the level of an incident power or power flux density has decreased, passing the device under test.

It describes values of field-strengths as well. But the calculation of the percent-values in the table at the right refers to the power-relationships.

So it tells - for example - that 20 dB shielding reduces the penetrating power to 1%.

Conversion of Decibel to Percent of transmitted Power			
dB	Power Transmission in %	dB	Power Transmission in %
0	100,00		
1	81,00	21	0,78
2	62,80	22	0,63
3	50,00	23	0,50
4	40,00	24	0,39
5	31,60	25	0,31
6	25,00	26	0,25
7	20,00	27	0,20
8	16,00	28	0,18
9	12,50	29	0,12
10	10,00	30	0,10
11	7,90	31	0,08
12	6,25	32	0,06
13	5,00	33	0,05
14	4,00	34	0,04
15	3,13	35	0,03
16	2,50	36	0,02
17	2,00	37	0,02
18	1,56	38	0,02
19	1,20	39	0,02
20	1,00	40	0,01
		43	0,005

Table 1: Conversion of SE-values, given in dB, to percent values of transmitted power

2 Shielding measurements according to IEEE 299-2006 from 800MHz to 12GHz

The measurements were performed according to IEEE 299 on 5th of September 2017 at the EMC-test site of the Radar Laboratories at the German Armed Forces University Munich in Neubiberg at frequencies from 800 MHz to 12 GHz. Linear polarisation was radiated and received by double ridged exponential horn antennas. The device under test was attached to a specific aperture (height 40 cm, width 40 cm as shown in the picture below) in a metallic shelter wall with the front dimensions of 210cm x 200cm.

During the measurements neither interferences from external signals nor any creeping waves between DUT and cabin wall could be detected.

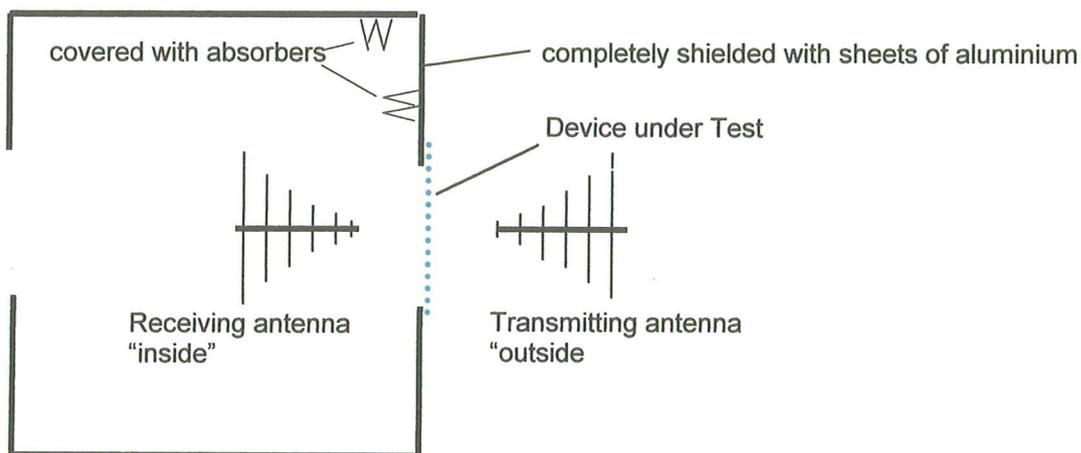


Fig. 1 Setup for Shielding Measurements according to IEEE299 (schematically)

The test range was calibrated without any object between the two antennas, to adjust the zero-dB-transmission-value. The horn antennas were positioned at a distance of 84cm in front of the DUT and 30cm behind it.

Test equipment:

Vector Network Analyzer type 360, (40 MHz – 18.6 GHz), Wiltron
2 Double-ridged exponential horn antennas type HF 906, (1 – 18 GHz), R & S
Printer: Kyocera Ecosys, FS – 1020D

3 Results of the Measurements

The diagrams in the appendices present the transmission values i.e. the shielding efficiency (SE) of the shielding fabric in decibels as a function of frequency.

At the right of the diagrams, some dB-values are printed for some typical marked frequencies.

For a quick overview the following table presents the **shielding efficiency** in Decibel (dB) at some interesting frequencies:

Measurement acc. to IEEE 299		
Name of the DUT:		Evolution
D-Netz, GSM 900,	900 MHz	28dB / 27dB
E-Netz, GSM 1800,	1800 MHz	26dB / 25dB
Blue-Tooth, WLAN	2450 MHz	24dB / 22dB
W-LAN new generation	5.8 GHz	19dB / 17dB
X-Band Radar	9.5 GHz	12dB / 10dB

Table 2: Shielding at different frequencies

Values before the slash: E-Field perpendicular to the weft thread

Values behind the slash: E-Field parallel to the weft thread

4. Final conclusions

The measurements proved that the shielding of the fabric **Swiss Shield Evolution** is almost independent of the polarisation of the incident waves.

The shielding against frequencies, used at the mobile communications (i.e. GSM 900, GSM 1800, UMTS and LTE) is between 22dB and 28dB. This means, that 99,37% to 99,82% of the incident power flux density is removed by the fabric.

The reduction of the shielding values is physically determined by the material and the width of the mesh. This is quite normal for all types of fabric or mesh-structures.



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Pflegeanleitung für Swiss Shield® Abschirmgewebe

Mit dem Swiss Shield® Abschirmgewebe haben Sie ein exklusives, hochwertiges technisches Gewebe mit textilen Eigenschaften erstanden. Damit Sie möglichst lange Freude an Ihren Abschirmtextilien haben befolgen Sie unsere Waschanleitung bitte sorgfältig.

Waschen Sie Ihre Swiss Shield® Gewebe bitte nur im Schonwaschgang, oder im Wollwaschgang oder Handwaschzyklus, welche noch gewebeschonender sind. Bitte verwenden Sie nur milde, ökologische Waschmittel. Bitte verwenden Sie KEINE BLEICHMITTEL! Swiss Shield® Gewebe gehören NICHT IN DEN WÄSCHETROCKNER! Gewebe bitte zügig hängetrocknen.

Diese Massnahmen sind wichtig, da die Drähtchen und die schützende Lackschicht äusserst fein sind und durch mechanische oder chemische Stressfaktoren beschädigt werden könnten.

Wenn Sie obige Anleitung beachten, und Ihre Swiss Shield® Gewebe vor chemischen und mechanischen Belastungen schützen, dann werden Sie lange Freude an Ihren Abschirmstoffen haben.

Swiss Shield® - Fabric Care Instructions

Congratulations on your new Swiss Shield® shielding fabrics. In order to enjoy the full protective shielding properties of your Swiss Shield® fabrics for many years please follow these instructions carefully.

Please wash your Swiss Shield® fabrics in gentle cycle, or in wool cycle or hand wash cycle only, as those programs are even more gentle on the fabric. Do not use aggressive detergents, only use mild biological / ecological detergents.

ABSOLUTELY NO BLEACHING OF FABRICS! NO TUMBLE DRYING! The fabrics must be line dried (hang dried). Best use front loading washing machines only.

If you follow the above instructions, and protect the fabrics from undue chemical and mechanical stress, then the Swiss Shield® fabrics will practically keep forever. A life span of more than 15 years without loss of shielding power - this is how long we have been producing Swiss Shield® fabrics - is absolutely no problem.

Please keep those instructions for future reference.



In case of questions please write us an email to info@swiss-shield.eu or visit www.swiss-shield.ch.