

## Abschirmender Gardinenstoff

### Shielding sheer curtain

Artikel Nr. / item no. 97431

Verfügbar als

Rollenware

Meterware

fertig genähte Gardine

Available

in rolls

per linear meter

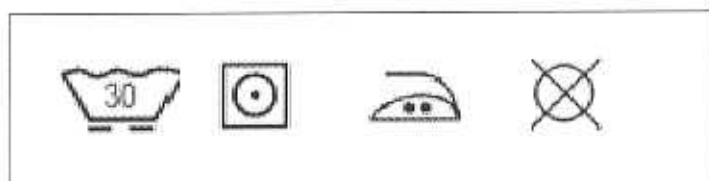
as ready made sheer curtain

#### Technische Daten / technical data

*Gewicht / weight:* 40 g / m<sup>2</sup>

*Breite / width:* 250 cm oder/or 150 cm


*Material (textiler Anteil) /  
material (textile part):* 93 % PES, 7 % PA 6.6



## EXPERT REPORT

- Ordered by:** marburg TECHNIC  
J.B. Schaefer GmbH & Co. KG  
Bertram-Schaefer-Straße 11  
D-35274 Kirchhain  
Germany
- Device under Test :** **Shielding Curtain**  
**(DUT)** item no. 97429 / 97431
- Subject:** Shielding-measurements of electromagnetic waves from  
200 MHz to 10 GHz
- Regulations:** According to MIL-Standard 285 and VG-Standard 95 370-15', KS03
- Date of Measurements:** 23<sup>rd</sup> of September 2002
- Contents:** 4 pages of text, 2 pages with 4 measured diagrams, 1 page explanation of frequency distribution across the diagrams in appendix no. 3
- Results:** This Shielding Curtain, item no. 97429 / 97431 has been measured with vertically and horizontally polarised electromagnetic waves at frequencies between 200 MHz and 10 GHz. The results proved a perfectly equal shielding effectiveness against the two linear polarisations which guarantees the same shielding effectiveness against circular polarised waves.  
At 200 MHz the shielding starts with values of 30 dB which means, that 99.9% of the power-flux density of the wave are shielded, only 0.1% penetrates the DUT.  
At 900 MHz (Cellphone frequencies of the D-Network) the curtain presents a shielding of 23 dB. Here only 0.5 % of the power passes the curtain, 99.5 % are shielded.  
E-Net-, UMTS- or DECT-telephone frequencies (1800 MHz – 2000 MHz) are still reduced by 16 dB shielding (2.5% of power-flux density are transmitted and 97.5% are shielded).  
At 4 GHz the shielding still is about 10 dB and then decreases at higher GHz-frequencies due to the structure of the fabric and physical reasons.

Neubiberg, 1<sup>st</sup> of October 2002



Prof. Dipl.-Ing. P. Pauli

## 1. Introduction

To explain the measured diagrams, it is helpful to use the table at the bottom. You can easily calculate the relation between shielding in "dB" and transmission in "%".

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 %.

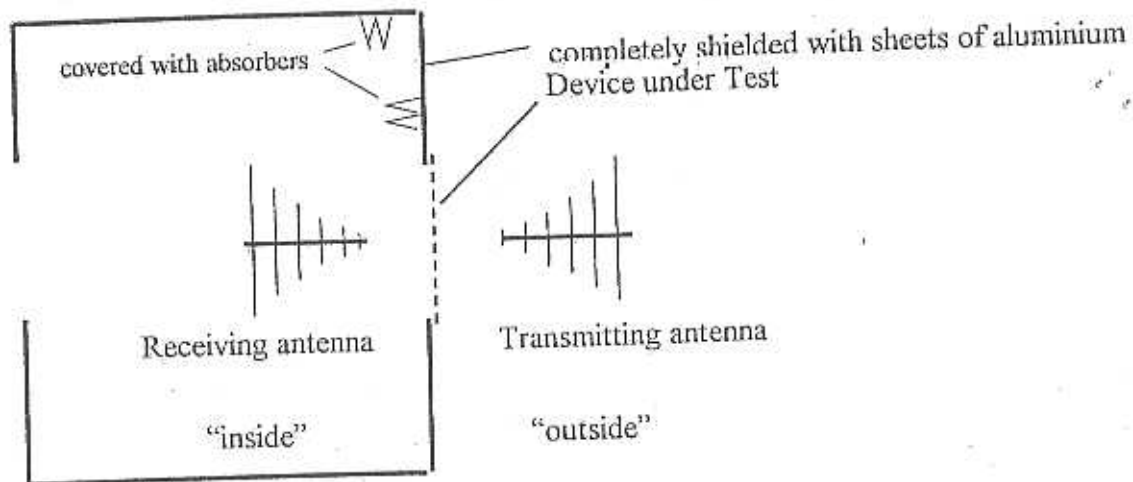
Conversion of Decibel to Percent of transmitted Power			
dB	Power Transmission in %	dB	Power Transmission in %
0	100,00		
1	81,00	21	0,78
2	62,80	22	0,63
3	50,00	23	0,50
4	40,00	24	0,39
5	31,60	25	0,31
6	25,00	26	0,25
7	20,00	27	0,20
8	16,00	28	0,18
9	12,50	29	0,12
10	10,00	30	0,10
11	7,90	31	0,08
12	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

To calculate the dB-value from the incident power  $P_1$  and the transmitted power  $P_2$ , one has to use the following equation:

$$a_{\text{Shield}} = 10 \cdot \log \frac{P_2}{P_1}$$

## 2. Measurement Set-up

The measurements were performed according to MIL-Standard 285 in a shielded room of the Radar Laboratories at the German Armed Forces University Munich in Neubiberg at frequencies from 200 MHz to 10 GHz. Linear polarisation was radiated by logperiodic antennas. The device under test, the shielding curtain, was attached to a specific window as shown in the picture below (height 80 cm, width 60 cm). During the measurements neither interferences from external signals nor any creeping waves between DUT and cabin wall could be detected. To test the device in the different planes of linear polarisation (vertically and horizontally), the sample was rotated in 90 degrees.



Setup for Shielding Measurements

The test range was calibrated

1. without any object between the two antennas, to calibrate the zero-dB-transmission-value,
2. with a solid sheet of aluminium, to test the optimum shielding possible.

Due to the antenna specifications, measurements were performed in two frequency bands:

- Range I: 200 MHz to 2200 MHz  
Range II: 1 GHz to 10 GHz

According to MIL-STD 285, both antennas were positioned at a distance of 12 inches in front of the tested fabric and behind it.

Measurement equipment:

- Vector Networkanalyzer Type 360, (40 MHz to 18,6 GHz), Wiltron/Anritsu  
2 Antennas (MHz): Bilog-Antennas, Type CBL 6112A (30 MHz to 2000 MHz), CHASE  
2 Antennas (GHz): LogPer-Antennas Type HL 025 (1 GHz to 18 GHz) Rohde & Schwarz  
Printer: Laserjet 4, Hewlett & Packard

### 3. Results of the measurements and comments

All diagrams present the transmission values in decibels as a function of frequency.

Scale: 10dB/DIV. The 0 dB-Reference line is indicated by this marker ▶.

To find out, how many percent of the incident power is shielded, the table on page 2 presents the conversion between dB and % (of power).

To read the exact frequencies at the horizontal axis, the diagrams of *appendix no. 3* may be helpful.

The **shielding curtain**, item no. 97429 / 97431 has been measured with vertically and horizontally polarised electromagnetic waves at frequencies between 200 MHz and 10 GHz. The results proved no difference in shielding effectiveness against the two polarisations.


At 200 MHz the shielding starts with values of 30 dB which means, that 99.9% of the power-flux density of the wave are shielded, only 0.1% penetrate the DUT.

At 900 MHz ( Cellphone frequencies of the D-Network ) the curtain presents a shielding of 23 dB. Here only 0.5 % of the power passes the curtain, 99.5 % are shielded.

E-Net-, UMTS- or DECT-telephone frequencies (1800 MHz – 2000 MHz) are still reduced by 16 dB shielding (2.5% of power-flux density are transmitted and 97.5% are shielded).

At 4 GHz the shielding still is about 10 dB and then decreases at higher GHz-frequencies due to the structure of the fabric and physical reasons.

Neubiberg, 1<sup>st</sup> of October 2002

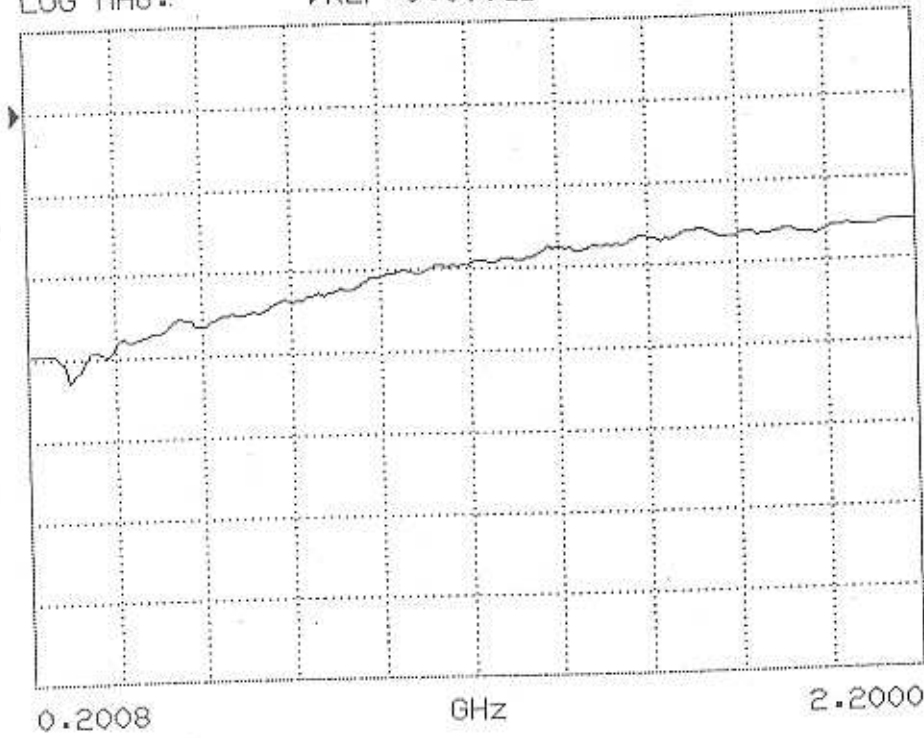
  
Prof. Dipl.-Ing. P. Pauli

**Device under test: Shielding Curtain, item no. 97429 / 97431**

(upper trace: MHz, lower trace: GHz)

S21 FORWARD TRANSMISSION

LOG MAG.      ▶REF=0.000dB      10.000dB/DIV



▶START  
0.2008 GHz

STOP  
2.2000 GHz

169 DATA PTS,  
12.0 MHz  
STEP SIZE

C.W. MODE OFF

MARKER SWEEP

DISCRETE FILL

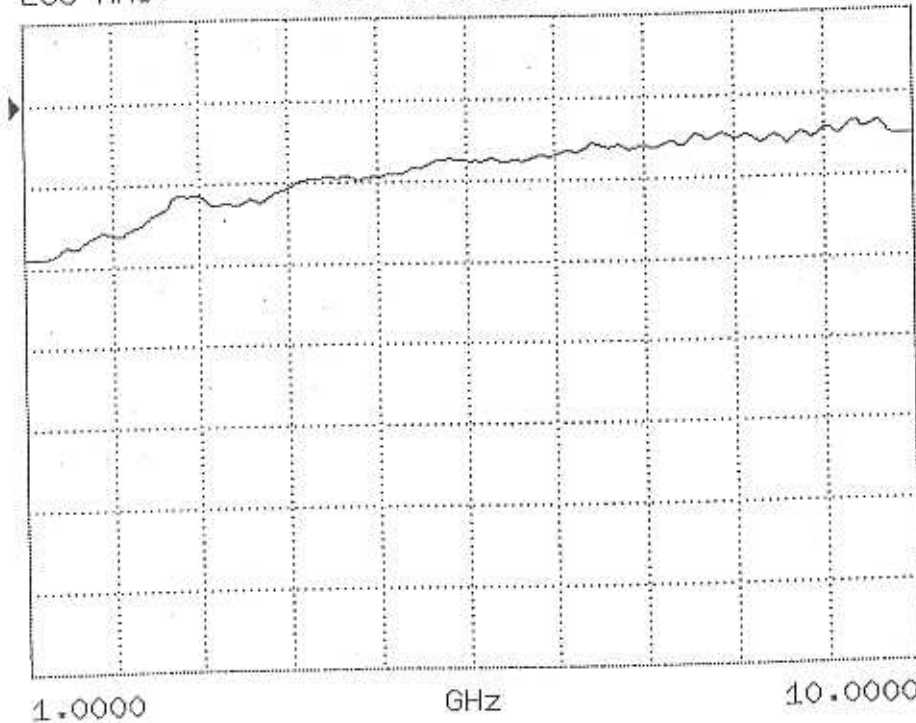
HOLD BUTTON  
FUNCTION

REDUCED TEST  
SIGNALS

PRESS ◀ENTER▶  
TO SELECT  
OR TURN ON/OFF

S21 FORWARD TRANSMISSION

LOG MAG.      ▶REF=0.000dB      10.000dB/DIV



▶START  
1.0000 GHz

STOP  
10.0000 GHz

169 DATA PTS,  
54.0 MHz  
STEP SIZE

C.W. MODE OFF

MARKER SWEEP

DISCRETE FILL

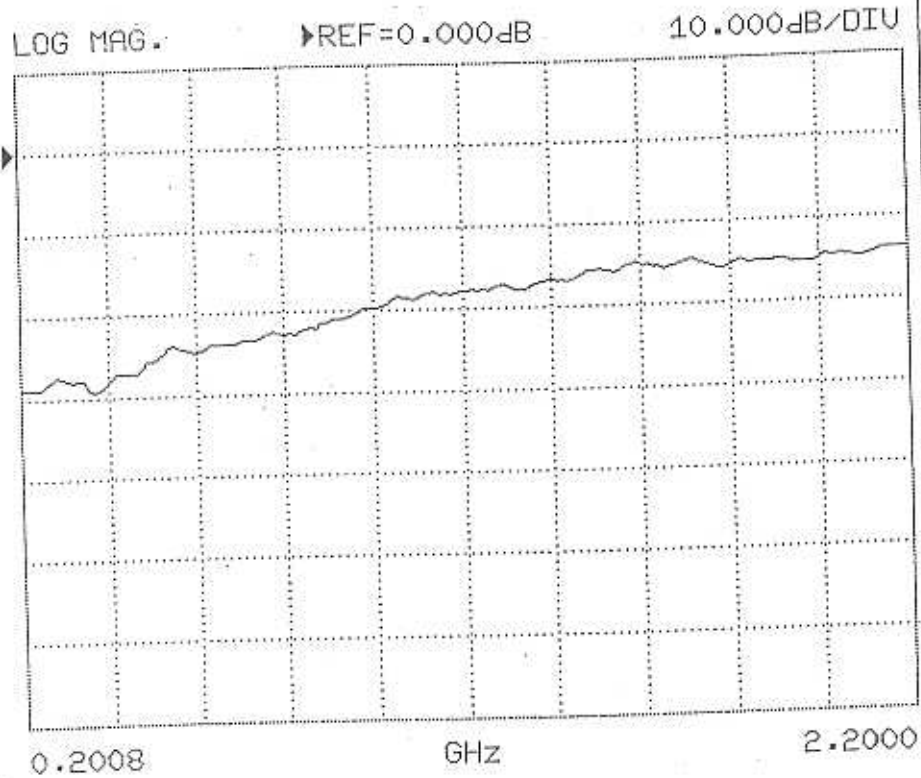
HOLD BUTTON  
FUNCTION

REDUCED TEST  
SIGNALS

PRESS ◀ENTER▶  
TO SELECT  
OR TURN ON/OFF

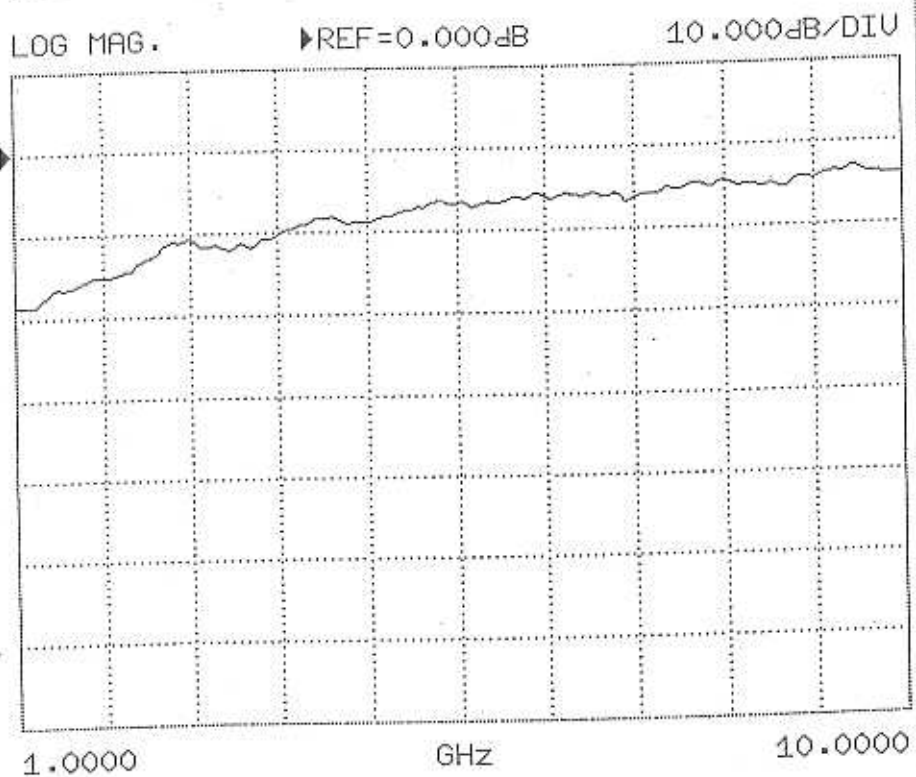
Device under test: Shielding Curtain, item no. 97429 / 97431  
(upper trace: MHz, lower trace: GHz)

S21 FORWARD TRANSMISSION

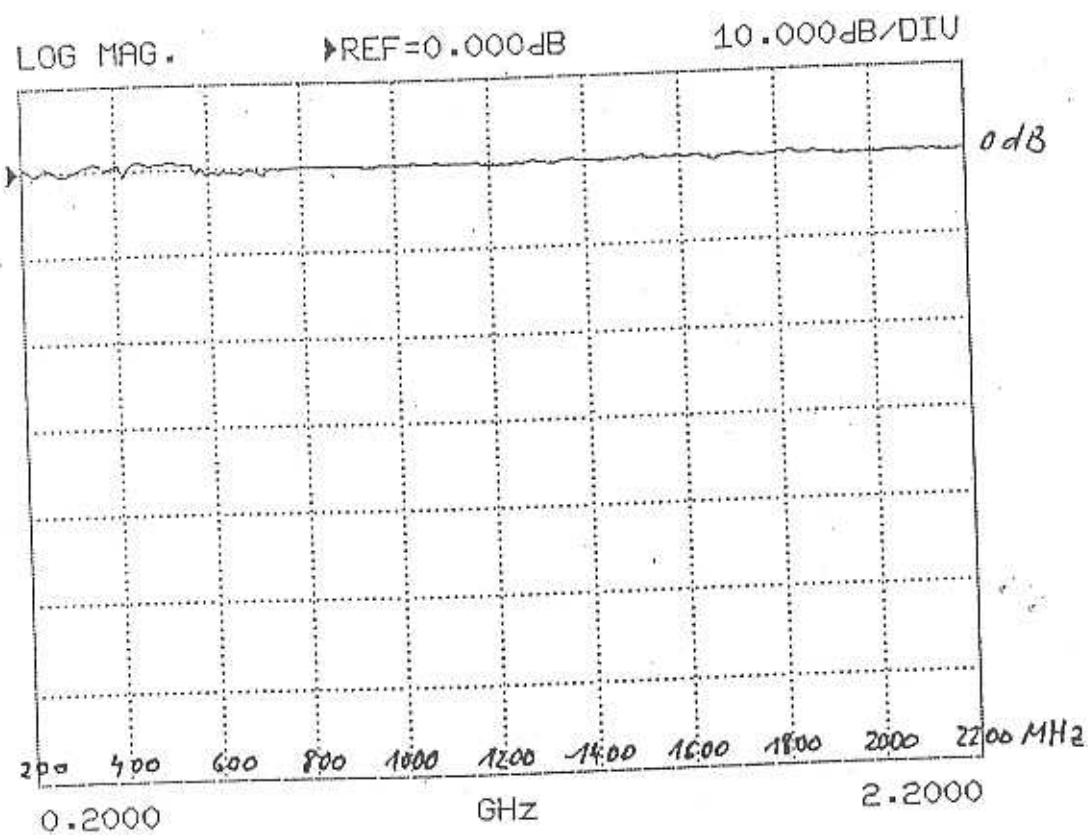


▶START  
0.2008 GHz  
STOP  
2.2000 GHz  
169 DATA PTS,  
12.0 MHz  
STEP SIZE  
C.W. MODE OFF  
MARKER SWEEP  
DISCRETE FILL  
HOLD BUTTON  
FUNCTION  
REDUCED TEST  
SIGNALS  
PRESS ◀ENTER▶  
TO SELECT  
OR TURN ON/OFF

S21 FORWARD TRANSMISSION



▶START  
1.0000 GHz  
STOP  
10.0000 GHz  
169 DATA PTS,  
54.0 MHz  
STEP SIZE  
C.W. MODE OFF  
MARKER SWEEP  
DISCRETE FILL  
HOLD BUTTON  
FUNCTION  
REDUCED TEST  
SIGNALS  
PRESS ◀ENTER▶  
TO SELECT  
OR TURN ON/OFF



S21 FORWARD TRANSMISSION

