

# SG-Bauakustik

Institut für schalltechnische Produktoptimierung

## Test Report

Nr. 1370-001-12 dated 16.02.2012

### Sound Absorption Coefficient in the Reverberation Room

**Customer:**

Abstracta AB  
Lammengatan 2  
SE-360 30 Lammhult  
Sweden

**Test Object:**

Arrangement of Acoustic Panels Abstracta Bits Wall

**Contract:**

Determination of the Sound Absorption Coefficient in the  
Reverberation Room according to DIN EN ISO 354

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This report comprises of 6 pages and 5 annexes. Duplication is only permissible when carried out unabridged and with prior consent of the issuer.

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## 1. Definition of Project and General Details

### 1.1 Definition of Project

The Sound Absorption Coefficient  $\alpha_S$  in the reverberation room is to be determined in accordance with DIN EN ISO 354 from a test arrangement of Acoustic Panels Abstracta Bits Wall, single dimensions length x width = 510 mm x 580 mm (equilateral triangles, each side length 580 mm). The Acoustic Panels are built of thermally and mechanically compressed absorber panels Soundfelt REC, Manufacturer Formfiber i Nybro AB, Sweden, with textile cover Europost, Manufacturer Gabriel A/S, Denmark. The Wall Panels uses hidden metal angles with Velcro tape to be hung at ceiling or wall.

From the determined Sound Absorption Coefficients  $\alpha_S$  in 1/3 octave intervals, the practical Absorption Coefficient  $\alpha_P$  is to be calculated in accordance with DIN EN ISO 11 654 and the weighted Absorption Coefficient  $\alpha_w$  is deduced.

The measurements are to be carried out on a trapezoidal test arrangement consisting of 72 butt jointed single elements having the dimensions length x width = 5,220 mm x 2,040 mm (height h = 45 to 95 mm). The test surface is S = 10.65 m<sup>2</sup>.

### 1.2 Measurement Standards

The tests will be carried out in the reverberation room by our specialist staff in accordance with the following standards and guidelines

- DIN EN ISO 354 "Acoustic; measurement of sound absorption in reverberation rooms (ISO 354:2003); German Version EN ISO 354:2003", Edition December 2003
- DIN EN ISO 11 654 "Acoustic – Sound absorber for application in buildings - Evaluation of sound absorption (ISO 11 654:1997)", Edition July 1997.

### 1.3 Manufacturer of Test Objects

Abstracta AB  
Lammengatan 2  
SE-360 30 Lammhult  
Sweden

## 1.4 Customer

Abstracta AB  
Lammengatan 2  
SE-360 30 Lammhult  
Sweden

## 2. Set-up of Test Objects and Test Arrangement

### 2.1 Set-up of Test Objects

The Wall Panels Bits Wall are built of thermally and mechanical compressed absorber panels Soundfelt REC, Manufacturer Formfiber i Nybro AB, Sweden. The Material Soundfelt REC is manufactured from industrial textile remnants and contains polyester- and bicomponent-fibres.

The elements are equipped with textile covers, Type Europost, Manufacturer Gabriel A/S, Denmark.

### 2.2 Test Arrangement

The test surface was built of 72 single elements having the dimensions length x width = 510 mm x 580 mm (h = 45 mm to 95 mm) with the measurements:

Length	l	=	5,220 mm
Width	w	=	2,040 mm

in the test stand. The entire test surface therefore amounted to:

$$S = 10.65 \text{ m}^2$$

The arrangement was laid directly on the floor of the test stand and was framed with gypsum plasterboards in accordance to DIN EN ISO 354.

The reverberation room has a volume of  $V = 161.4 \text{ m}^3$ .

### 3. Measurement Results

#### 3.1 Reverberation periods T and Sound Absorption Coefficient $\alpha_S$

The reverberation periods were determined according to the measurement and evaluation regulation DIN EN ISO 354. From the measured values the Absorption Coefficient  $\alpha_S$  was calculated taking the room parameter and conditions as well as the test area into consideration.

##### 3.1.1 Reverberation period with and without test object

The reverberation periods for the empty reverberation room as well as the reverberation periods for the reverberation room with test object are illustrated in table 1.

**Table 1: Measurement on 14.02.2012, humidity 53.2%, temperature 20.3°C**

<b>f<sub>terz</sub> in Hz</b>	<b>50</b>	<b>63</b>	<b>80</b>	<b>100</b>	<b>125</b>	<b>160</b>	<b>200</b>	<b>250</b>	<b>315</b>	<b>400</b>	<b>500</b>
T <sub>empty</sub> in s	4.57	4.89	5.19	4.73	5.01	4.92	4.86	4.83	4.76	4.11	3.96
T <sub>with Obj.</sub> in s	4.51	4.60	4.58	3.66	3.53	2.80	2.56	2.22	2.04	1.68	1.61

<b>f<sub>terz</sub> in Hz</b>	<b>630</b>	<b>800</b>	<b>1,000</b>	<b>1,250</b>	<b>1,600</b>	<b>2,000</b>	<b>2,500</b>	<b>3,150</b>	<b>4,000</b>	<b>5,000</b>
T <sub>empty</sub> in s	3.90	3.85	3.65	3.55	3.41	3.32	3.19	3.01	2.76	2.32
T <sub>with Obj.</sub> in s	1.52	1.55	1.44	1.51	1.47	1.48	1.45	1.42	1.38	1.27

##### 3.1.2 Sound Absorption Coefficient $\alpha_S$

The Sound Absorption Coefficient  $\alpha_S$  is illustrated in table 2.

**Table 2: Measurement on 14.02.2012, humidity 53.2%, temperature 20.3°C**

<b>f<sub>terz</sub> in Hz</b>	<b>50</b>	<b>63</b>	<b>80</b>	<b>100</b>	<b>125</b>	<b>160</b>	<b>200</b>	<b>250</b>	<b>315</b>	<b>400</b>	<b>500</b>
$\alpha_S$	0.01	0.03	0.06	0.15	0.20	0.38	0.46	0.59	0.69	0.85	0.91

<b>f<sub>terz</sub> in Hz</b>	<b>630</b>	<b>800</b>	<b>1,000</b>	<b>1,250</b>	<b>1,600</b>	<b>2,000</b>	<b>2,500</b>	<b>3,150</b>	<b>4,000</b>	<b>5,000</b>
$\alpha_S$	0.99	0.95	1.02	0.94	0.95	0.92	0.92	0.91	0.88	0.87

### 3.2 Practical Absorption Coefficient $\alpha_P$ , weighted Absorption Coefficient $\alpha_w$

The determination of the practical Sound Absorption Coefficient  $\alpha_P$  was carried out in accordance with DIN EN ISO 11 654 from the arithmetic average values for each octav-step. The average value is calculated to the 2<sup>nd</sup> decimal point and rounded in steps of 0.05.

To determine the evaluated Sound Absorption Coefficient  $\alpha_w$  the reference curve from DIN EN ISO 11 654 is shifted in steps of 0.05 until the sum of the unfavorable deviations between reference curve and the  $\alpha_P$ -values is smaller than or equals 0.10. The weighted Sound Absorption Coefficient  $\alpha_w$  is defined as the value of the shifted reference curve at  $f = 500$  Hz.

The following values were found:

**Table 3:** Practical Sound Absorption Coefficient  $\alpha_P$

<b>F<sub>Octavo</sub> in Hz</b>	<b>125</b>	<b>250</b>	<b>500</b>	<b>1000</b>	<b>2000</b>	<b>4000</b>
$\alpha_S$ (Average value)	0.24	0.58	0.92	0.97	0.93	0.89
Shifted reference curve	--	0.70	<b>0.90</b>	0.90	0.90	0.80
$\alpha_P$	0.25	0.60	0.90	0.95	0.95	0.90

The weighted Sound Absorption Coefficient  $\alpha_w$  is:

$$\alpha_w = 0.90$$

The test set-up is classified in **sound absorption class A**.

Mülheim an der Ruhr, 16.02.2012

Stefan Grill

Figure 1: Arrangement of Acoustic Panels Abstracta Bits Wall, 72 single elements



Figure 2: Arrangement of Acoustic Panels Abstracta Bits Wall, 72 single elements





Figure 3: Arrangement of Acoustic Panels Abstracta Bits Wall, 72 single elements, detailed view

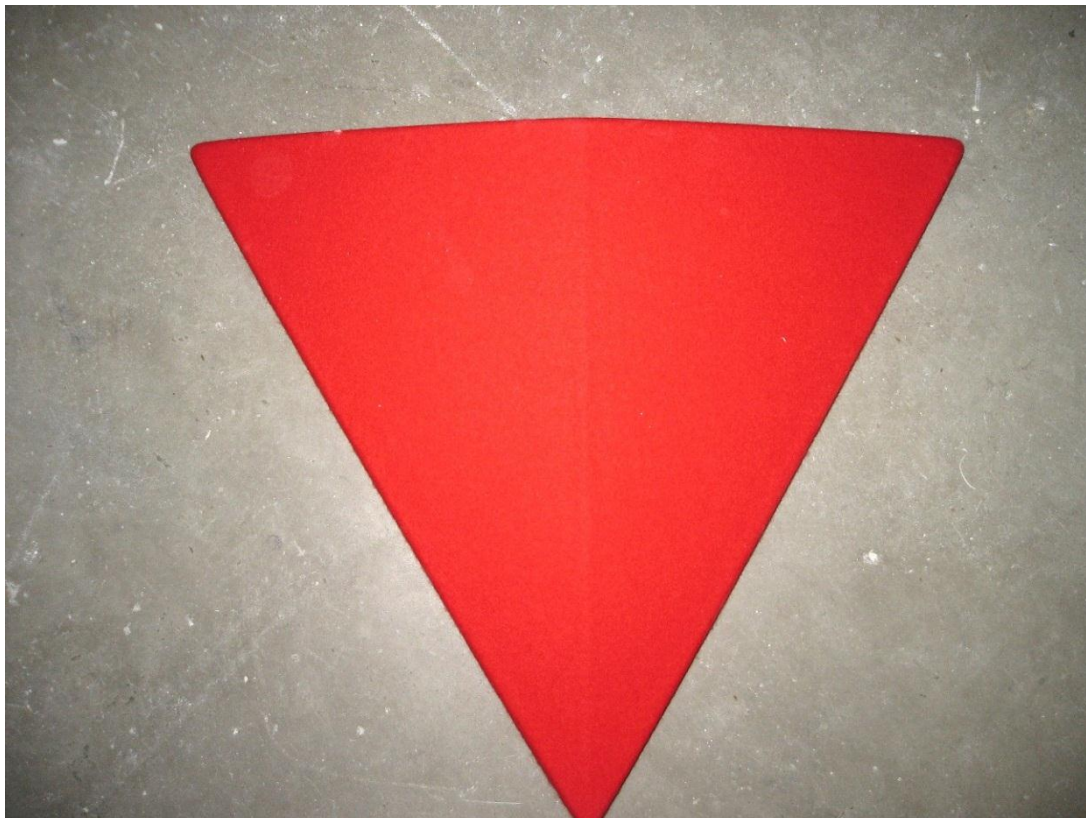
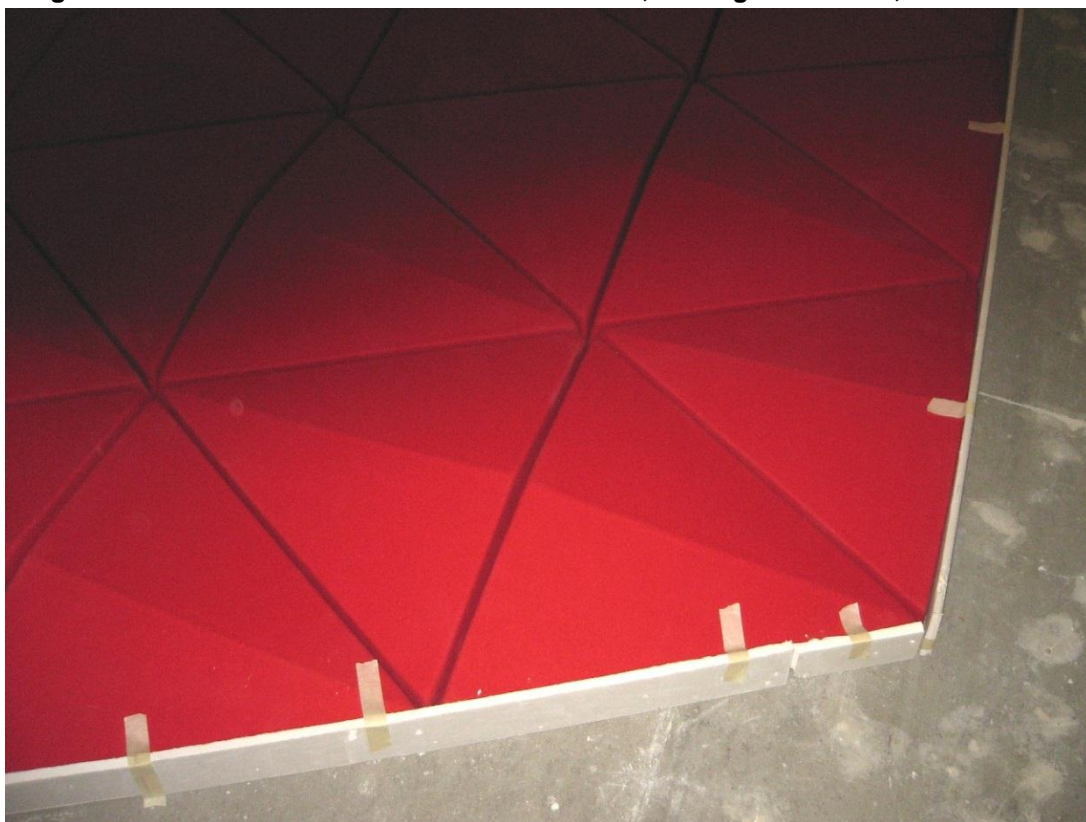


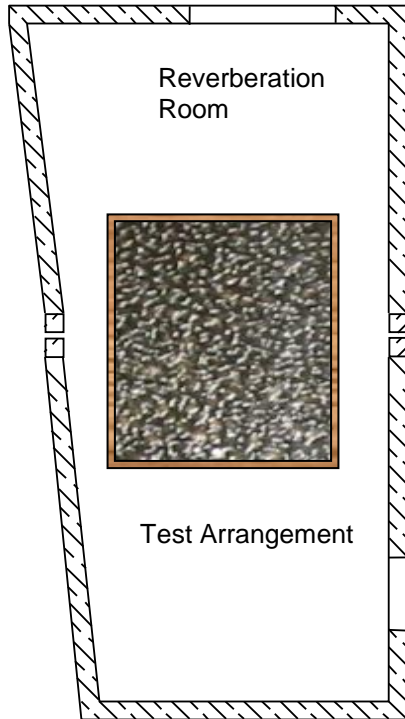
Figure 4: Arrangement of Acoustic Panels Abstracta Bits Wall, 72 single elements, detailed view



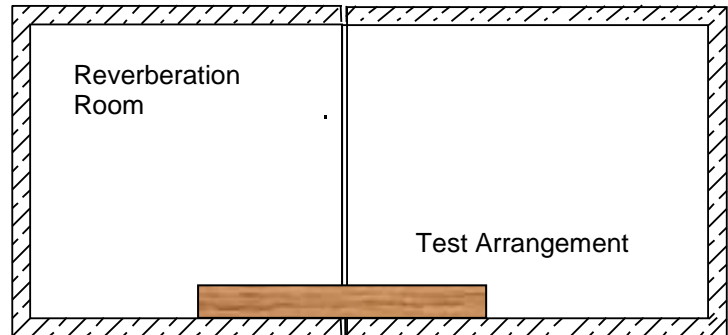


Principle Diagram: Arrangement of Test Facilities

Ground View



Vertical Section



- Mountings:**
- Ceiling - Reinforced concrete ceiling  $t_1 = 14$  cm and  $t_2 = 20$  cm, latex paintwork inside the room, site related mass  $m_{F1} = 322$  kg/m<sup>2</sup> and  $m_{F21} = 460$  kg/m<sup>2</sup>
  - Floor - Reinforced concrete plate  $t = 20$  cm, flanks straightened, site related mass  $m_F = 460$  kg/m<sup>2</sup>
  - Walls - Brickwork  $t = 24$  cm, site related mass  $m_F = 384$  kg/m<sup>2</sup>

- Ambient Air:** Ambient air conditions during the measurement on 14.02.2012
- Air temperature  $T_L = 20.3^\circ\text{C}$
  - relative humidity  $r_F = 53.2\%$

Room Parameter	Reverberation Room
Width $w$ [m]	4.10 – 5.32
Length $l$ [m]	9.41
Height $h$ [m]	3.76
Volume $V$ [m <sup>3</sup> ]	161.4

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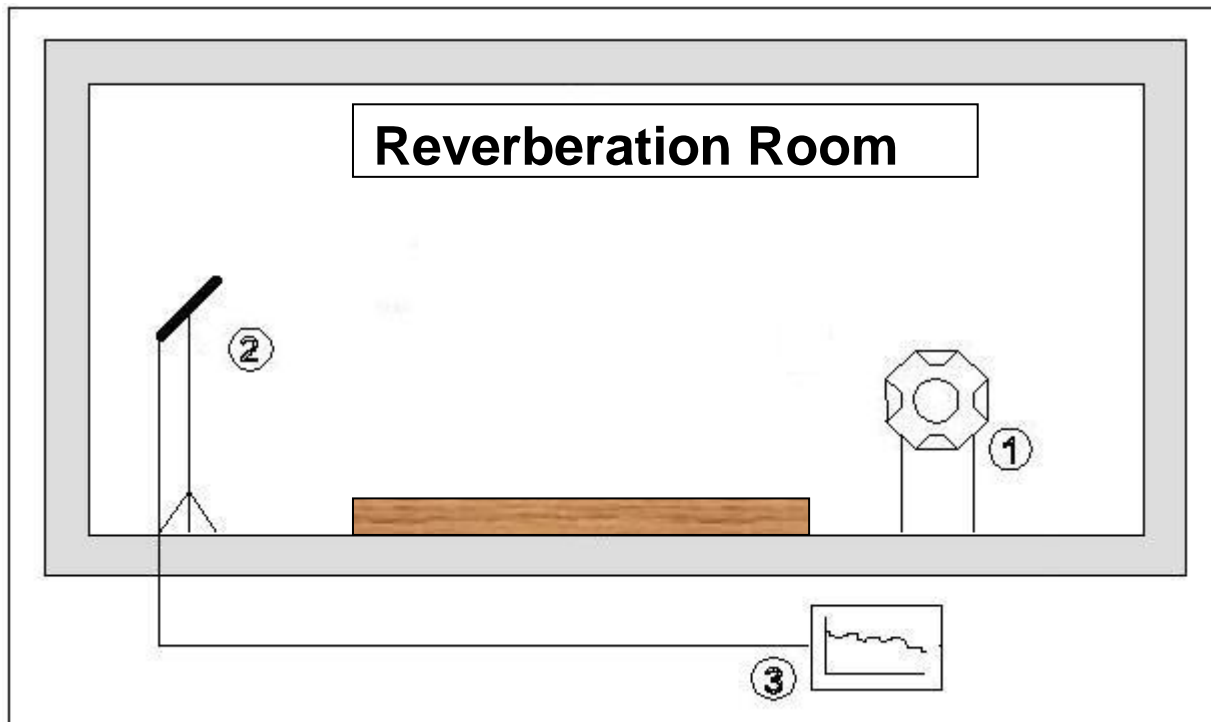
Stefan Gröll

Description of the Principles for the Execution of Measuring the Sound Absorption Coefficient, evaluated through a Measuring Device with Process Computer

**Customer:** Abstracta AB, Lammengatan 2, SE-360 30 Lammhult, Sweden

**Object:** Arrangement of Acoustic Panels Abstracta Bits Wall

1. Measurement Set-up



	Device Designation/ Type	Serial Number	Date of the last Inspection/calibrated until	Last Calibration
1	Dodecahedron speaker for radiating omni directional sounds	DL 1	04.06.2009/-	-
2	Condenser microphone: M1: Norsonic, Type 1220 V1: Norsonic, Type 1201	14761 17598	20.01.2010/31.12.2012 20.01.2010/31.12.2012	14.02.2012 14.02.2012
3	Sound level analyser: Norsonic, Type 121	29837	20.01.2010/31.12.2012	14.02.2012

2. Execution of Measurement

Electro-acoustically generated omni directional sounds in a frequency ranging from 50 Hz to 5,000 Hz are radiated from a dodecahedron speaker in the reverberation room and measured and recorded by a condenser microphone in order to ascertain the reverberation period. After reaching a stationary sound pressure level in the reverberation room the test sound is switched off and the reverberation period is calculated in terz steps by the integrated process computer of the acoustic measuring system from the slope of the decay curve. A total of twelve measurements are selected which result from three microphone positions at two speaker settings.

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**Sound Absorption Coefficient according to DIN EN ISO 354****Determination of the Sound Absorption Coefficient in Test Stand****Annex 5**

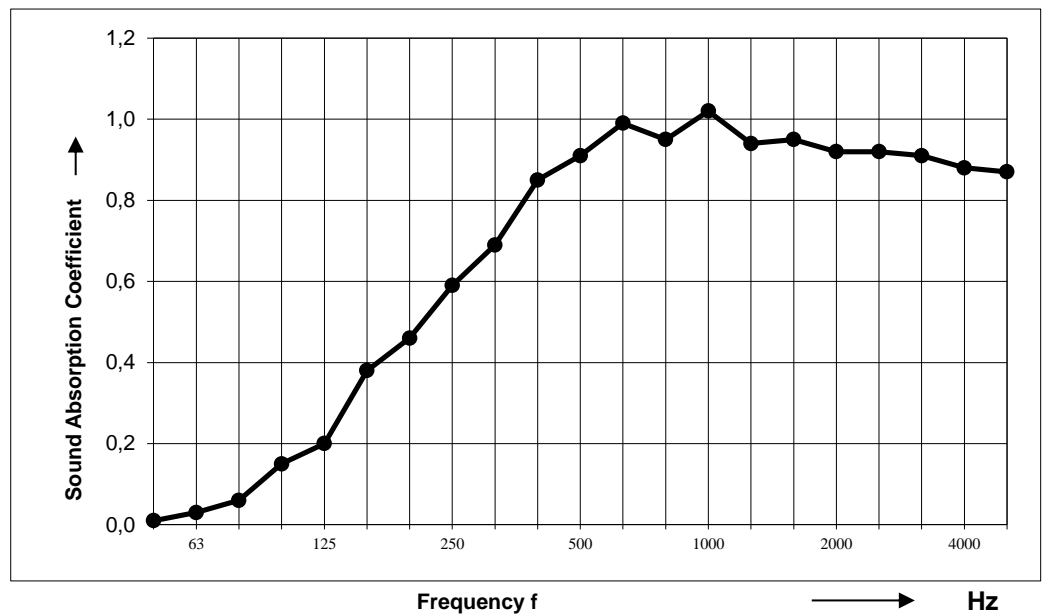
Manufacturer: Abstracta AB, Sweden  
 Customer: Abstracta AB, Sweden  
 Test Object installed by: Test institute

Product designation: Abstracta Bits Wall  
 ID of Test Rooms: Reverberation Room  
 Test Date: 14.02.2012

**Description of Test Object:**

Acoustic Panels Abstracta Bits Wall, Arrangement of 72 single elements, dimensions length x width = 510 mm x 580 mm, height h = 45 mm to 95 mm, Total surface length x width = 5,220 mm x 2,040 mm, S = 10.65 m<sup>2</sup>, with perimeter frame of gypsum plasterboard.

Frequency f Hz	Absorption Coefficient $\alpha$
50	0,01
63	0,03
80	0,06
100	0,15
125	0,20
160	0,38
200	0,46
250	0,59
315	0,69
400	0,85
500	0,91
630	0,99
800	0,95
1000	1,02
1250	0,94
1600	0,95
2000	0,92
2500	0,92
3150	0,91
4000	0,88
5000	0,87



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