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Ort, Datum CH-8600 Dübendorf, 18. Dezember 2015

## **Retrospective documentation of the results of the KTI project 10451 "dukta - Integrated product development based on a new wood cutting technique"**

Dear Mr. Lunin,

You have asked us to document the reverberation chamber measurements, which have been carried out within the framework of a practical work at Empa in connection with the KTI project 10401 "dukta - Integrated Product Development on the Basis of a New Wood Cutting Process". We hereby inform you about the measurement data in the form of tables and diagrams.

On the following pages, firstly the measurement and assessment of the sound absorption coefficient according to international standards in the reverberation chamber of Empa is described. Then descriptions of test setups and data sheets follow.

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### **Information on the measurements**

The measurements, evaluation and determination of the sound absorption coefficient  $\alpha$  of absorbing materials is based on the standard EN ISO 354 (2003). The details of the measuring method, the description of the reverberation chamber, the list of the measuring instruments used and their calibration data are documented in the internal documentation SOP 6 (Empa No. 1059), which is subject to quality control. The measuring accuracy is defined by a standard deviation for  $\alpha$  with the measuring instruments used and is based on previous experience as a function of the frequency: low frequency range 100 - 250 Hz:  $\alpha$  0.1, midrange range 315 - 800 Hz:  $\alpha$  0.05 high frequency range 1000 - 5000 Hz :  $\alpha$  0.02.

### **Installation**

The ducta sound absorbers were placed on the floor of the reverberation chamber for measurement. The description can be found below.

### **Measurement of the sound absorption coefficient $\alpha$ in the reverberation chamber**

#### **Basis**

Standard EN ISO 354 (2003) " Acoustic - Measurement of the sound absorption in reverberation chamber", at which the measuring method is adopted on the basis of the standard EN ISO 18233 (2006) " Acoustics - Application of new measuring methods in building and room acoustics "

#### **Procedure**

The material to be tested is laid on the floor of the reverberation chamber as a joined surface of approx. 12 m<sup>2</sup>. The reverberation times required for absorption are determined by the "Real Time Analyzer" Norsonic 840 and the MLS method. For measurement purposes, the measurements are carried out in two frequency ranges: first in the third octave bands from 100 Hz to 2'500 Hz (MLS sequence length 16 s) and then from 3'150 Hz to 5'000 Hz (MLS sequence length 4 s). The measurements are performed with 6 microphones and 3 loudspeakers. Therefore in every third, the resulting reverberation time T<sub>20</sub> is the arithmetic mean of 18 loudspeaker / microphone combinations.

#### **Calculation of the sound absorption rate $\alpha$ s**

With the aid of the measured reverberation times, the frequency-dependent sound absorption A and the sound absorption degree  $\alpha$  of the sample body are closed:

$$A = \frac{55.3 \cdot V}{c} \left( \frac{1}{T_2} - \frac{1}{T_1} \right) \quad [\text{m}^2]$$

**Equivalent sound absorption area:**

with

V                    Volume of the reverberation chamber V [m<sup>3</sup>]

c                    Sound speed [m / s]

T<sub>1</sub>                  Reverberation time in reverberation room without test material [s]

T<sub>2</sub>                  Reverberation time in reverberation room with text material [s]

The sound absorption coefficient  $\alpha_s$  indicates how much effective sound absorption area A corresponds to a square metre test area S, i.e.

$$\alpha_s = \frac{A}{S}$$

With S test area [m<sup>2</sup>]

The sound absorption coefficient  $\alpha_s$  is determined separately for each third octave band.

For certain applications, it is useful to specify additional arithmetic mean values over certain frequency ranges.

### Meaning

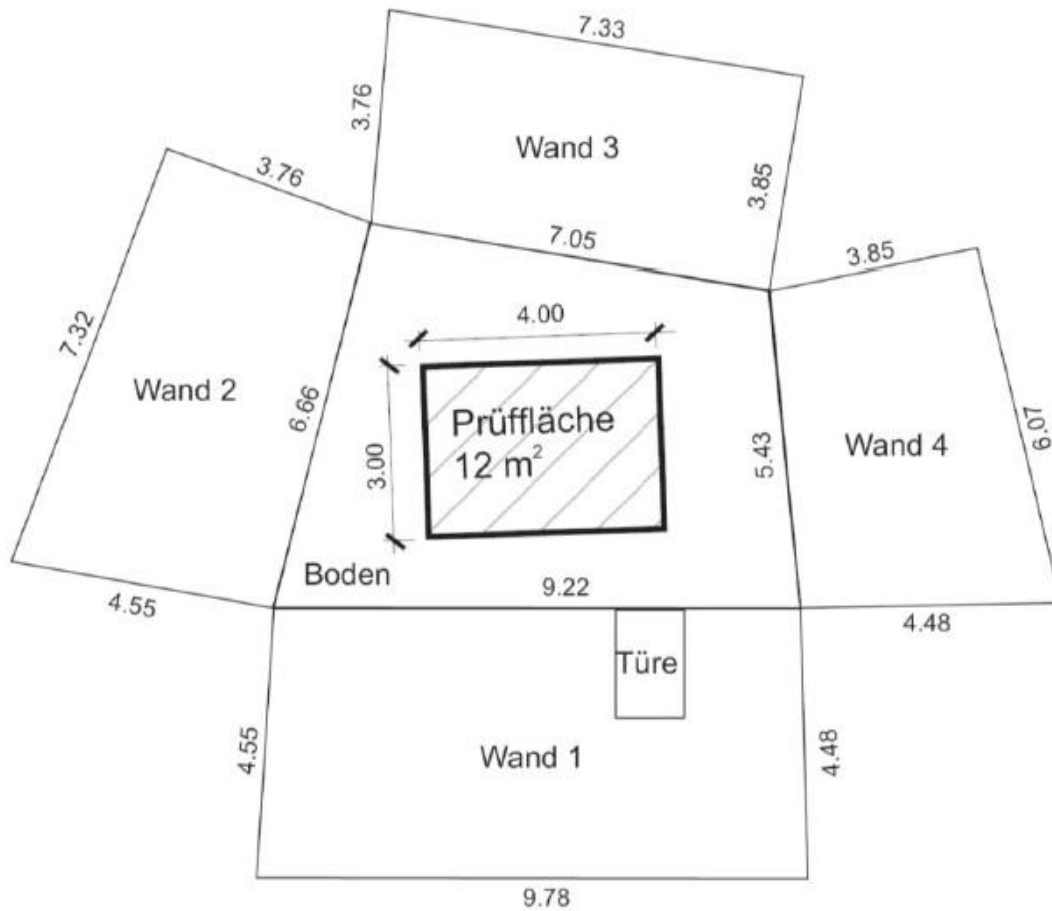
The sound absorption capacity of a material is the better the larger the  $\alpha_s$ . In the reverberation chamber method, the absorption levels may be somewhat greater than 1. It is therefore important to clearly distinguish these variables, identified by the index s (for statistical soundfall), from other variables which are obtained from reflection measurements (for example, in the impedance measuring tube or measurement in situ) and are at most equal to 1.

### Other Calculations

In the standard EN ISO 11'654 (1997) "Acoustic - sound absorbers for use in buildings", a rating method is described for obtaining a single value per octave: the "practical sound absorption coefficient"  $\alpha_p$  as well as the global singular value: the "rated sound absorption coefficient"  $\alpha_w$ .

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## Implementation of the Empa-reverberation room



Prüffläche - Test Area

Wand - Wall

Boden - Floor

Türe - Door

### Measurements

Smallest length measurement : 3.76 m

Largest space diagonal : 11.50 m

Door opening: 1.20 x 2.00 m

Floor: 48.2 m<sup>2</sup>

Ceiling: 56.2 m<sup>2</sup>

Wall 1: 42.8 m<sup>2</sup>

Wall 2: 28.9 m<sup>2</sup>

Wall 3: 27.4 m<sup>2</sup>

Wall 4: 23.6 m<sup>2</sup>

Volume of the reverberation chamber 215 m<sup>3</sup>

Sum of the inner surfaces : 227 m<sup>2</sup>

Plexiglass- reflectors: sum of all one sided surfaces: 31 m<sup>2</sup>

Loudspeakers: 4 , distributed in the room.

Microphones: 6 , irregularly distributed in the room.

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## **Appendix**

An overview, the documentation of the tested objects and the data sheets can be found in the appendixes as follows:

Appendix 1 Overview of the measurements

Appendix 2-6 Documentation of the tested elements

Appendix 7 Photos

Appendix 8-22 Data Sheets

With Kind Regards,  
Empa

Kurt Eggenschwiler  
Head of Department of Acoustics noise reduction

Dr. Jean Mare Wunderli  
Deputy Head of acoustic noise reduction

22 Appendixes

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## Appendix 1 Overview of the measurements

(Flach = Flat)

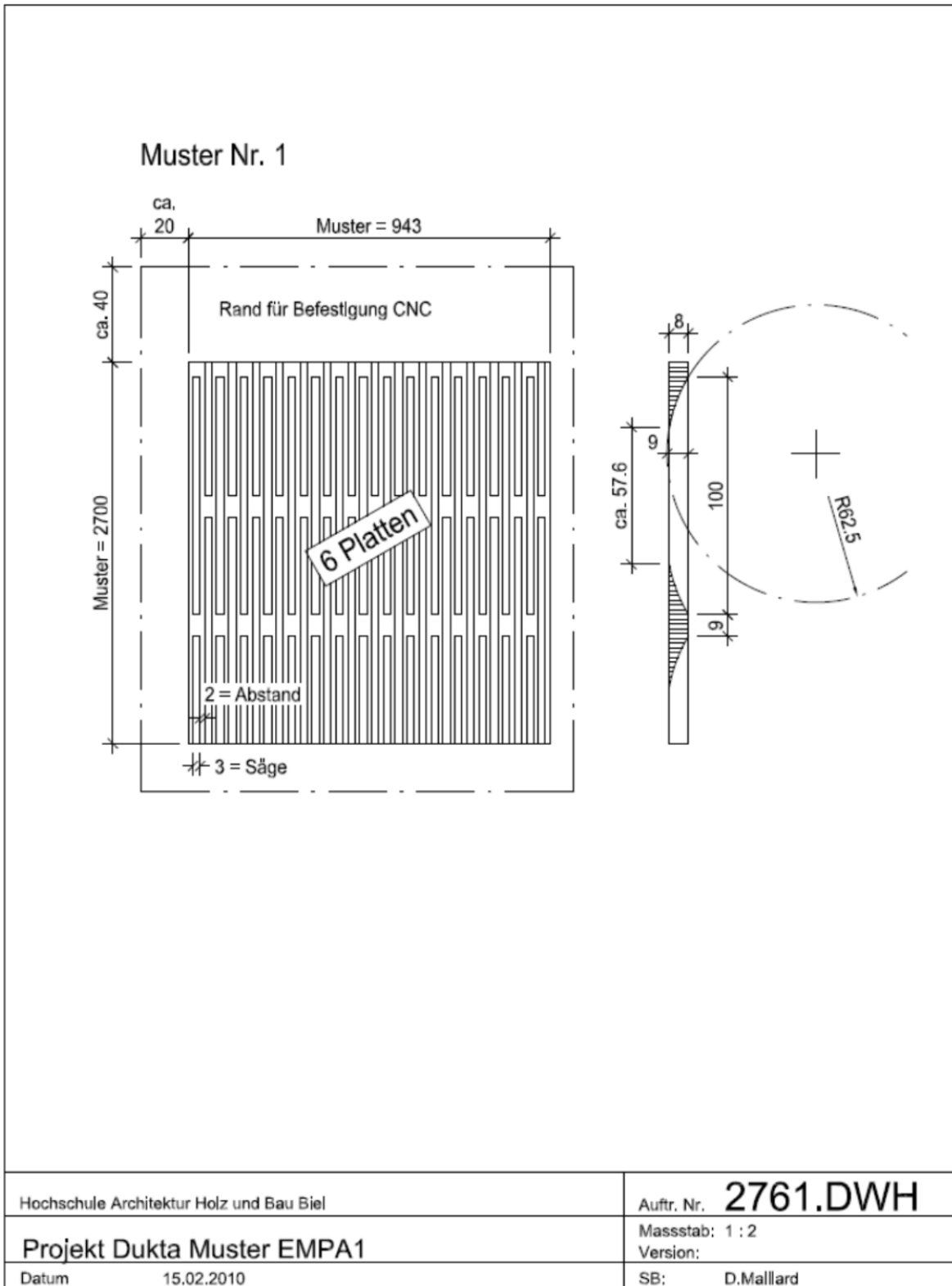
Sample	Frame	Mineral wool	internal numbering	Measurement sheet in appendix
1	Flach		A17	8
2	Flach		A18	9
3	Flach		A19	10
1	A	-	A16	11
2	A	-	A15	12
3	A	-	A14	13
1	A	x	A11	14
2	A	x	A12	15
3	A	x	A13	16
1	B	-	A09	17
2	B	-	A10	18
3	B	-	A03	19
1	B	x	A06	20
2	B	x	A05	21
3	B	x	A04	22

### Notes

- The samples 1, 2 and 3 are found in the appendix 2-4.
- The parameters are found in appendix 5 and 6.
- Flat frame means a "suspension height" of 200 mm, that is, the dukta elements were placed 200 mm from the reverberation chamber floor with a frame.
- The mineral fibre panels of 30 mm were laid on the reverberation chamber floor. The panels are Flumroc Type 3.

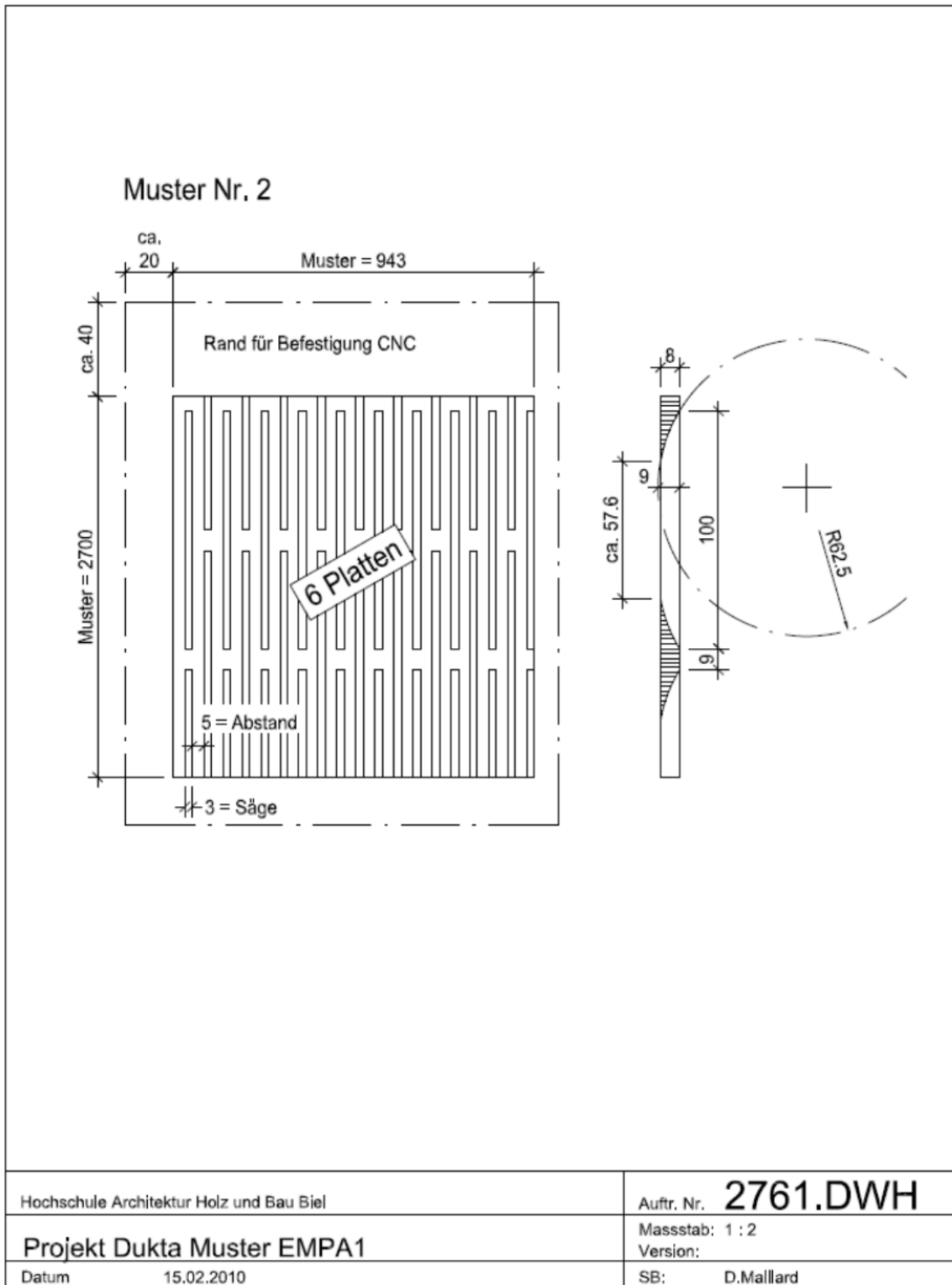
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## Appendix 2 Sample 1



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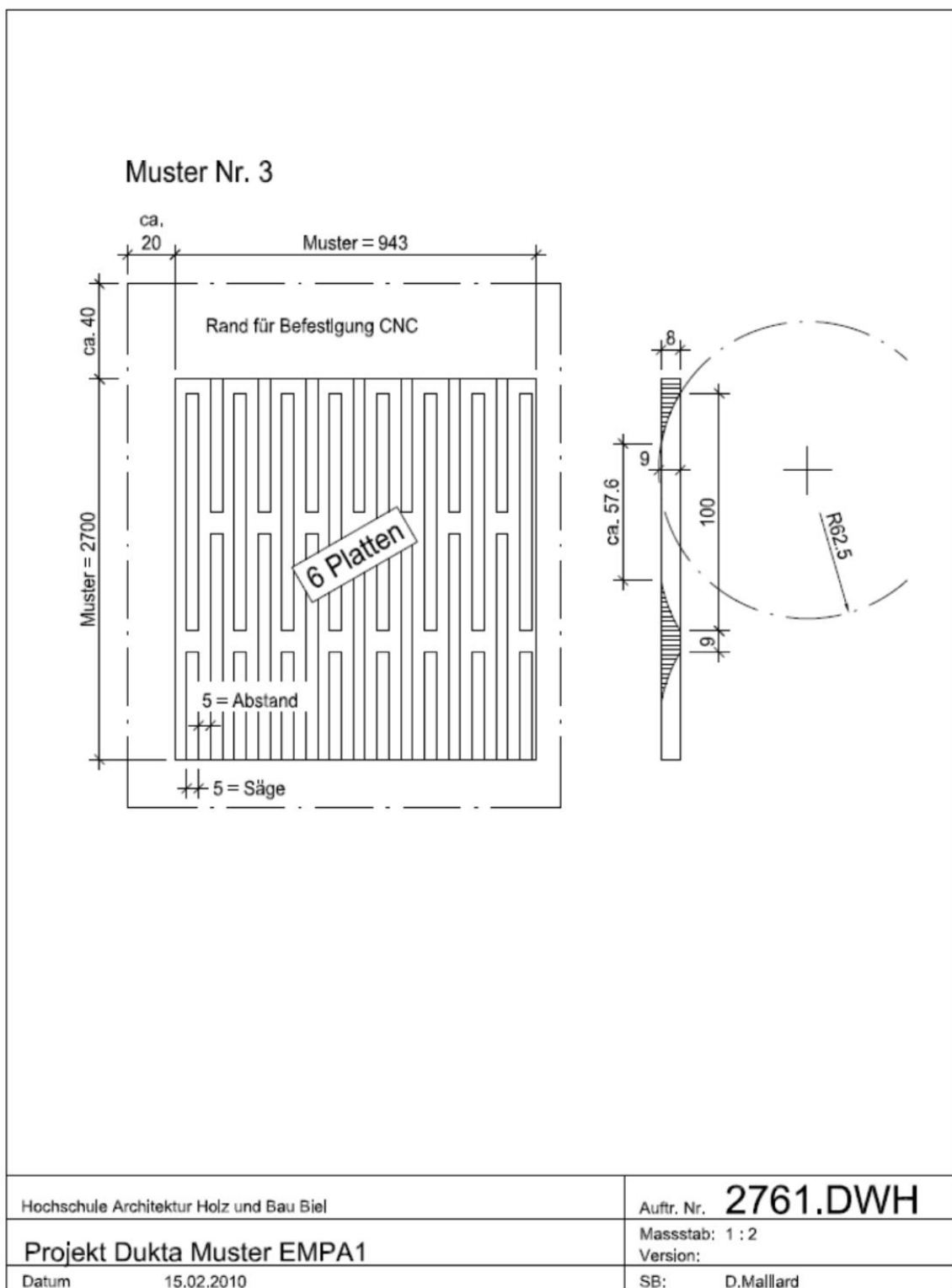
### Appendix 3 Sample No.2



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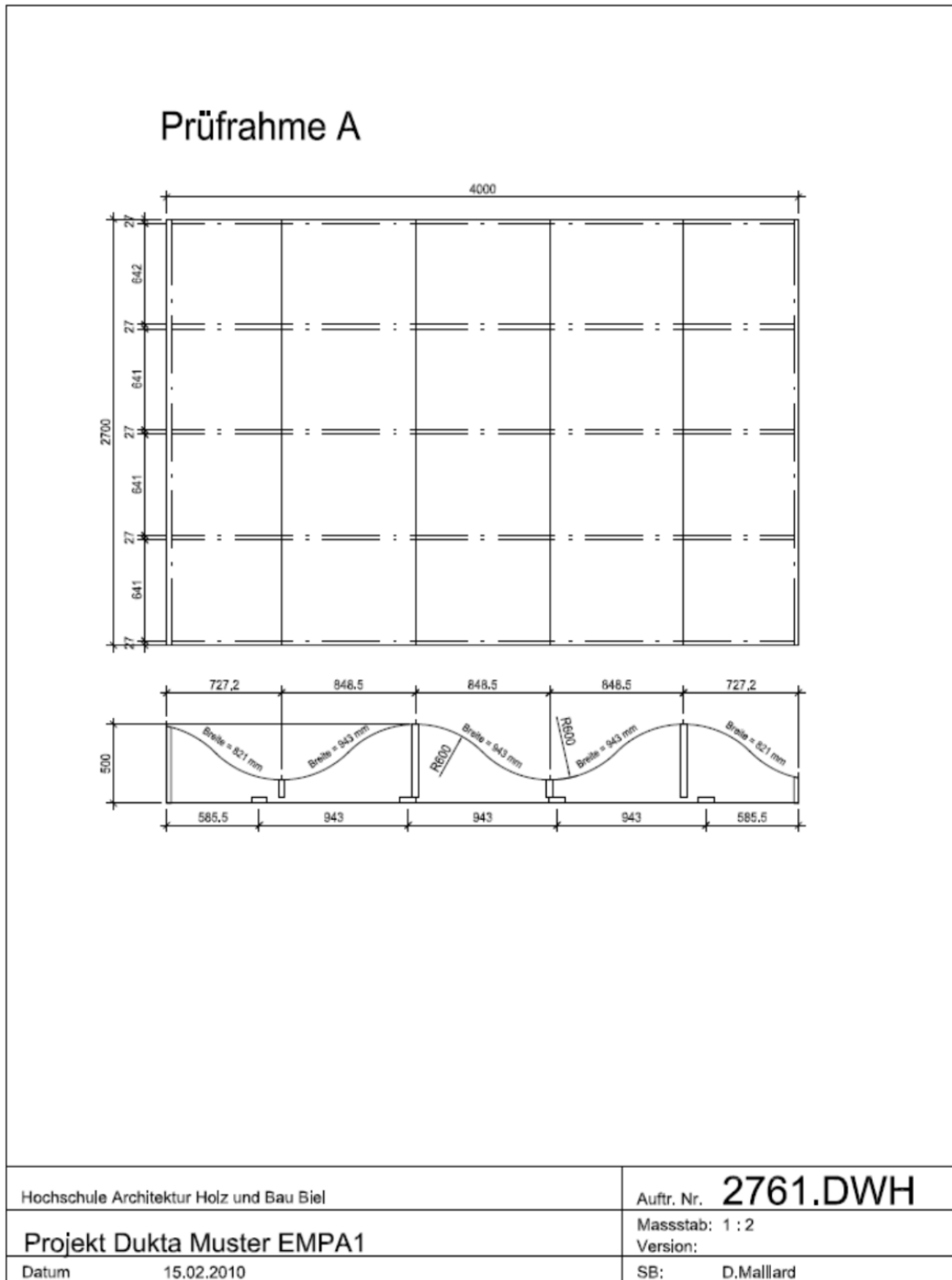


## Appendix 4 Sample No.3



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## Appendix 5 Frame A



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**Appendix 7 – photos**



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## Appendix 8 - Sound absorption coefficient (reverberation chamber method)

Article: dukta flat

Sample 1

Flat frame

200mm distance from floor

Mineral fibre panels on floor

Measurement at reverberation chamber Empa Dübendorf, Volume V: 215 m<sup>3</sup> Date: 22.4.10

temperature: 21.6°C, relative air humidity: 57 %

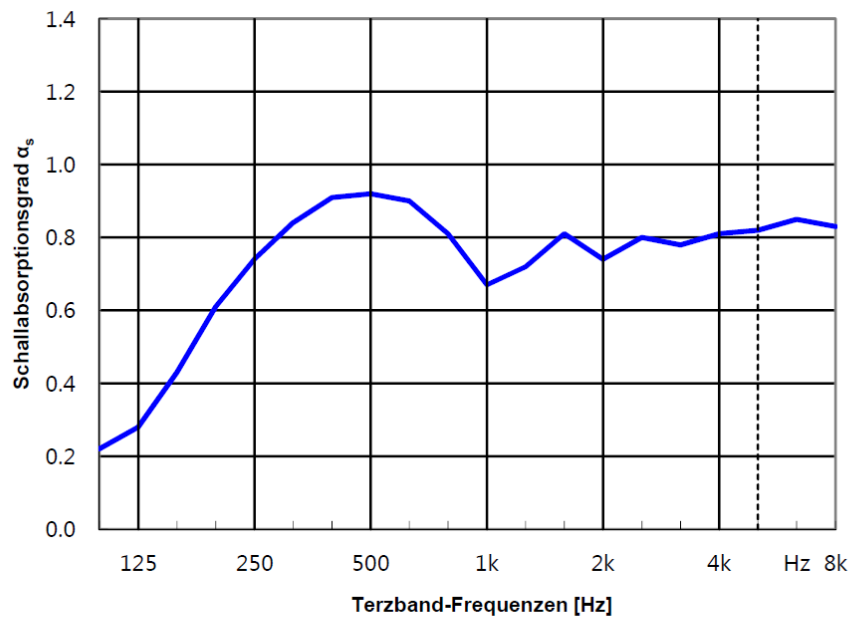
sample size: 2680 x 3760 mm Test Area S: m<sup>2</sup>

Frequenz f [Hz]	$\alpha_s$ Terzen
100	0.22
125	0.28
160	0.43
200	0.61
250	0.74
315	0.84
400	0.91
500	0.92
630	0.90
800	0.81
1000	0.67
1250	0.72
1600	0.81
2000	0.74
2500	0.80
3150	0.78
4000	0.81
5000	0.82
6300	0.85
8000	0.83

**Messung** Hallraum Empa Dübendorf, Volumen V: 215 m<sup>3</sup> **Datum:** 22.4.10

Temperatur: 21.6°C, relative Luftfeuchtigkeit: 57 %

Probengrösse: 2680 x 3760 mm Prüffläche S: 10.1 m<sup>2</sup>



Auswertung nach EN ISO 11'654 (1997):  $\alpha_w$ : **0.80**  
 $\alpha_p$ : 250 Hz: 0.75 500 Hz: 0.90 1000Hz: 0.75 2000Hz: 0.80 4000Hz: 0.80

Messung: EN ISO 354 (2003)

MLS-Messung; Terzbandfilter; T20 aus integrierter Impulsantwort

Evaluation according to EN ISO 11'654 (1997)

Messung: EN ISO 354 (2003) = Measurement EN ISO 354 (2003)

MLS-Messung; Terzbandfilter; T20 aus integrierter Impulsantwort = MLS- measurement;  
 third octave filter; T20 from integrated impulse response

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## Appendix 9 - Sound absorption coefficient (reverberation chamber method)

Article: dukta flat

Sample 2

Flat frame

200mm distance from floor

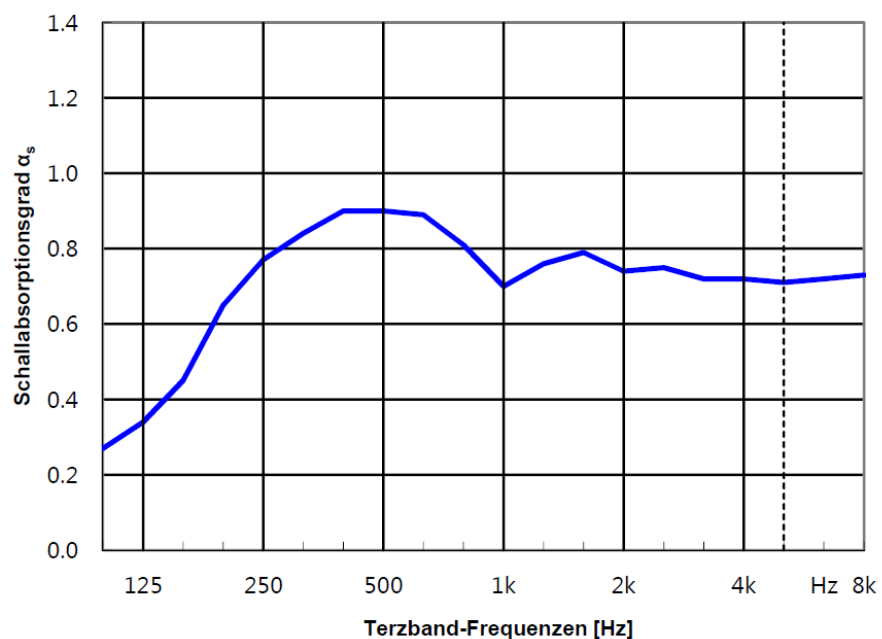
Mineral fibre panels on floor

Frequenz f [Hz]	$\alpha_s$ Terzen
100	0.27
125	0.34
160	0.45
200	0.65
250	0.77
315	0.84
400	0.90
500	0.90
630	0.89
800	0.81
1000	0.70
1250	0.76
1600	0.79
2000	0.74
2500	0.75
3150	0.72
4000	0.72
5000	0.71
6300	0.72
8000	0.73

**Messung** Hallraum Empa Dübendorf, Volumen V: 215 m<sup>3</sup> **Datum:** 22.4.10

Temperatur: 21.7°C, relative Luftfeuchtigkeit: 59.3 %

Probengrösse: 2680 x 3760 mm Prüffläche S: 10.1 m<sup>2</sup>



Auswertung nach EN ISO 11'654 (1997):  $\alpha_w$ : **0.80**  
 $\alpha_p$ : 250 Hz: 0.75 500 Hz: 0.90 1000Hz: 0.75 2000Hz: 0.75 4000Hz: 0.70

Messung: EN ISO 354 (2003)

MLS-Messung; Terzbandfilter; T20 aus integrierter Impulsantwort

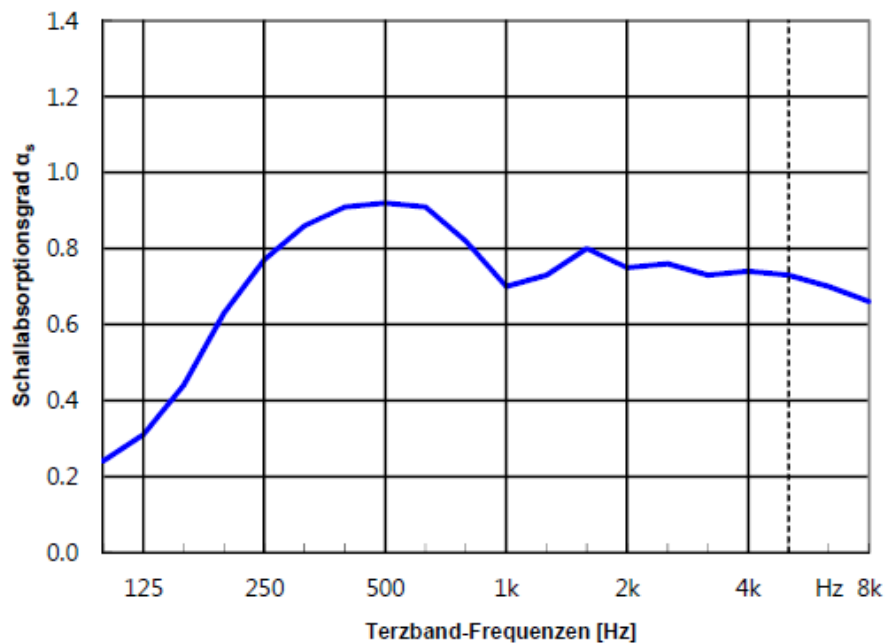
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## Appendix 10 - Sound absorption coefficient (reverberation chamber method)

Sample 3  
 Flat frame  
 200mm distance from floor  
 Mineral fibre panels on floor

Frequenz f [Hz]	$\alpha_s$ Terzen
100	0.24
125	0.31
160	0.44
200	0.63
250	0.77
315	0.86
400	0.91
500	0.92
630	0.91
800	0.82
1000	0.70
1250	0.73
1600	0.80
2000	0.75
2500	0.76
3150	0.73
4000	0.74
5000	0.73
6300	0.70
8000	0.66

**Messung** Hallraum Empa Dübendorf, Volumen V: 215 m<sup>3</sup>    **Datum:** 22.4.10  
 Temperatur: 21.7°C, relative Luftfeuchtigkeit: 58.8 %  
 Probengrösse: 2680 x 3760 mm    Prüffläche S: 10.1 m<sup>2</sup>



Auswertung nach EN ISO 11'654 (1997):  $\alpha_w$ : **0.80**  
 $\alpha_p$ : 250 Hz: 0.75    500 Hz: 0.90    1000Hz: 0.75    2000Hz: 0.75    4000Hz: 0.75

Messung: EN ISO 354 (2003)  
 MLS-Messung; Terzbandfilter; T20 aus integrierter Impulsantwort

## Appendix 11 - Sound absorption coefficient (reverberation chamber method)

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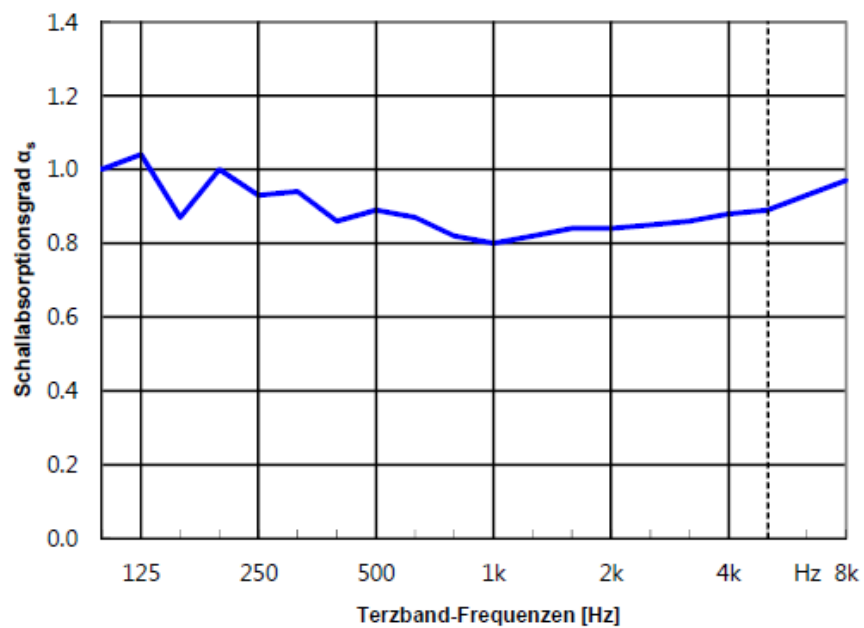
sample 1

frame A

without mineral fibre panels on floor

Frequenz f [Hz]	$\alpha_s$ Terzen
100	1.00
125	1.04
160	0.87
200	1.00
250	0.93
315	0.94
400	0.86
500	0.89
630	0.87
800	0.82
1000	0.80
1250	0.82
1600	0.84
2000	0.84
2500	0.85
3150	0.86
4000	0.88
5000	0.89
6300	0.93
8000	0.97

**Messung** Hallraum Empa Dübendorf, Volumen V: 215 m<sup>3</sup>    **Datum:** 20.4.10  
 Temperatur: 21.7°C, relative Luftfeuchtigkeit: 57 %  
 Probengrösse: 2700 x 4000 mm    Prüffläche S: 10.8 m<sup>2</sup>



Auswertung nach EN ISO 11'654 (1997):  $\alpha_w$ : **0.85 (L)**  
 $\alpha_p$ : 250 Hz: 0.95    500 Hz: 0.85    1000Hz: 0.80    2000Hz: 0.85    4000Hz: 0.90

Messung: EN ISO 354 (2003)

MLS-Messung; Terzbandfilter; T20 aus integrierter Impulsantwort

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## Appendix 12 - Sound absorption coefficient (reverberation chamber method)

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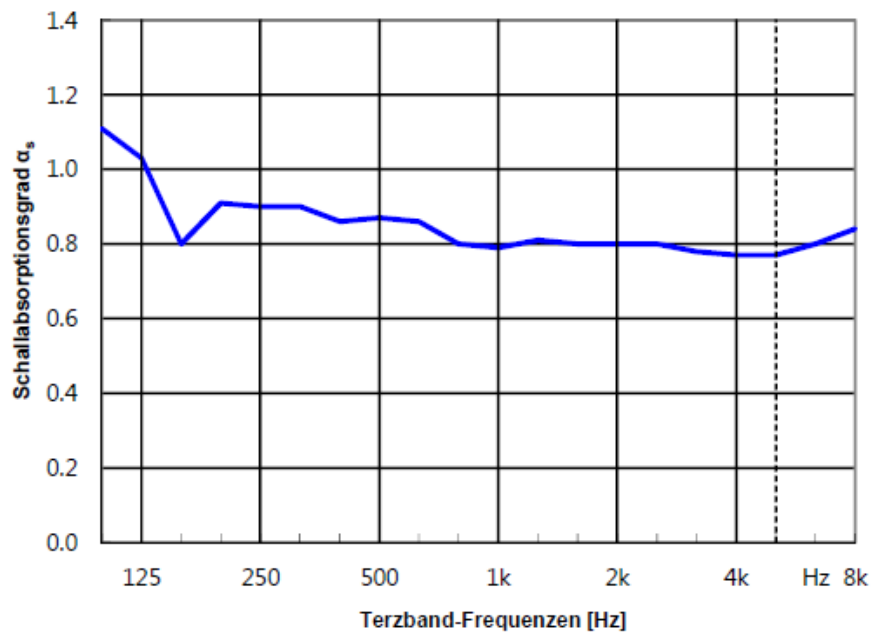
sample 2

frame A

without mineral fibre panels on floor

Frequenz f [Hz]	$\alpha_s$ Terzen
100	1.11
125	1.03
160	0.80
200	0.91
250	0.90
315	0.90
400	0.86
500	0.87
630	0.86
800	0.80
1000	0.79
1250	0.81
1600	0.80
2000	0.80
2500	0.80
3150	0.78
4000	0.77
5000	0.77
6300	0.80
8000	0.84

**Messung** Hallraum Empa Dübendorf, Volumen V: 215 m<sup>3</sup> **Datum:** 16.4.10  
 Temperatur: 21.9°C, relative Luftfeuchtigkeit: 58 %  
 Probengrösse: 2700 x 4000 mm Prüffläche S: 10.8 m<sup>2</sup>



Auswertung nach EN ISO 11'654 (1997):  $\alpha_w$ : 0.85  
 $\alpha_p$ : 250 Hz: 0.90 500 Hz: 0.85 1000Hz: 0.80 2000Hz: 0.80 4000Hz: 0.75

Messung: EN ISO 354 (2003)

MLS-Messung; Terzbandfilter; T20 aus integrierter Impulsantwort

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## Appendix 13 - Sound absorption coefficient (reverberation chamber method)

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sample 3

frame A

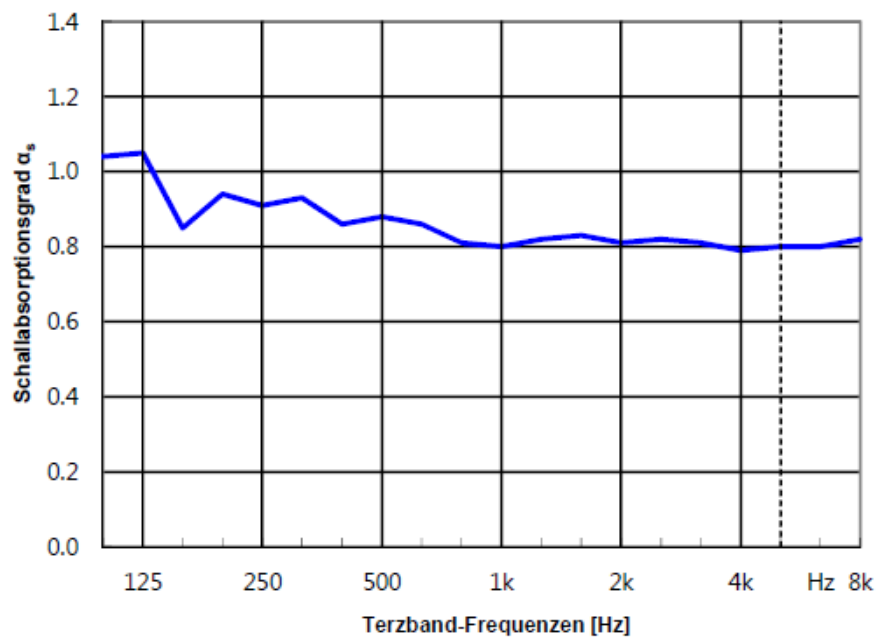
without mineral fibre panels on floor

Frequenz f [Hz]	$\alpha_s$ Terzen
100	1.04
125	1.05
160	0.85
200	0.94
250	0.91
315	0.93
400	0.86
500	0.88
630	0.86
800	0.81
1000	0.80
1250	0.82
1600	0.83
2000	0.81
2500	0.82
3150	0.81
4000	0.79
5000	0.80
6300	0.80
8000	0.82

**Messung** Hallraum Empa Dübendorf, Volumen V: 215 m<sup>3</sup> **Datum:** 16.4.10

Temperatur: 21.9°C, relative Luftfeuchtigkeit: 57 %

Probengrösse: 2700 x 4000 mm Prüffläche S: 10.8 m<sup>2</sup>



Auswertung nach EN ISO 11'654 (1997):  $\alpha_w$ : **0.85 (L)**  
 $\alpha_p$ : 250 Hz: 0.95 500 Hz: 0.85 1000Hz: 0.80 2000Hz: 0.80 4000Hz: 0.80

Messung: EN ISO 354 (2003)

MLS-Messung; Terzbandfilter; T20 aus integrierter Impulsantwort

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## Appendix 14 - Sound absorption coefficient (reverberation chamber method)

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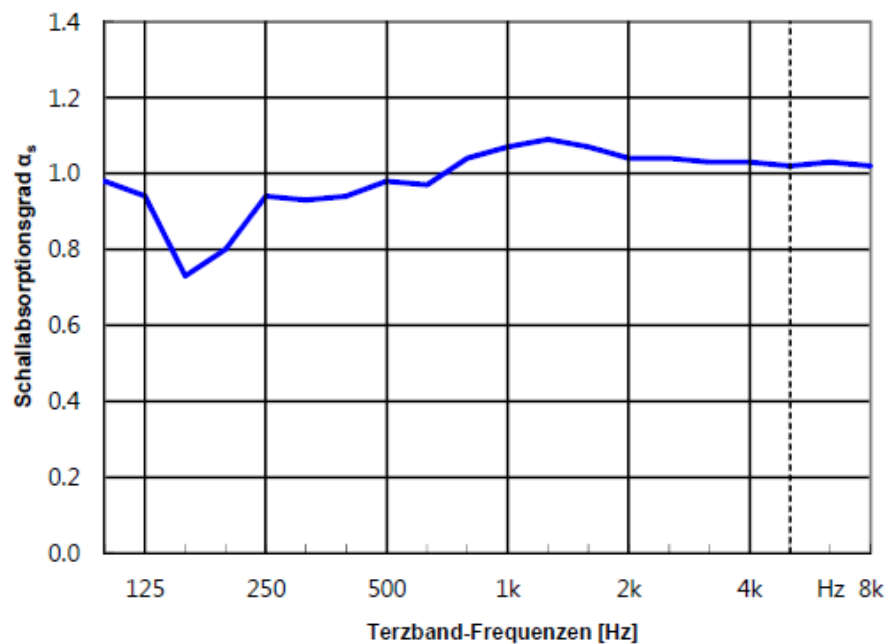
sample 1

frame A

mineral fibre panels on floor

Frequenz f [Hz]	$\alpha_s$ Terzen
100	0.98
125	0.94
160	0.73
200	0.80
250	0.94
315	0.93
400	0.94
500	0.98
630	0.97
800	1.04
1000	1.07
1250	1.09
1600	1.07
2000	1.04
2500	1.04
3150	1.03
4000	1.03
5000	1.02
6300	1.03
8000	1.02

**Messung** Hallraum Empa Dübendorf, Volumen V: 215 m<sup>3</sup>    **Datum:** 15.4.10  
 Temperatur: 21.9°C, relative Luftfeuchtigkeit: 57.1 %  
 Probengrösse: 2700 x 4000 mm    Prüffläche S: 10.8 m<sup>2</sup>



Auswertung nach EN ISO 11'654 (1997):     $\alpha_w$ : 1.00  
 $\alpha_p$ : 250 Hz: 0.90    500 Hz: 0.95    1000Hz: 1.00    2000Hz: 1.00    4000Hz: 1.00

Messung: EN ISO 354 (2003)

MLS-Messung; Terzbandfilter; T20 aus integrierter Impulsantwort

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## Appendix 15 - Sound absorption coefficient (reverberation chamber method)

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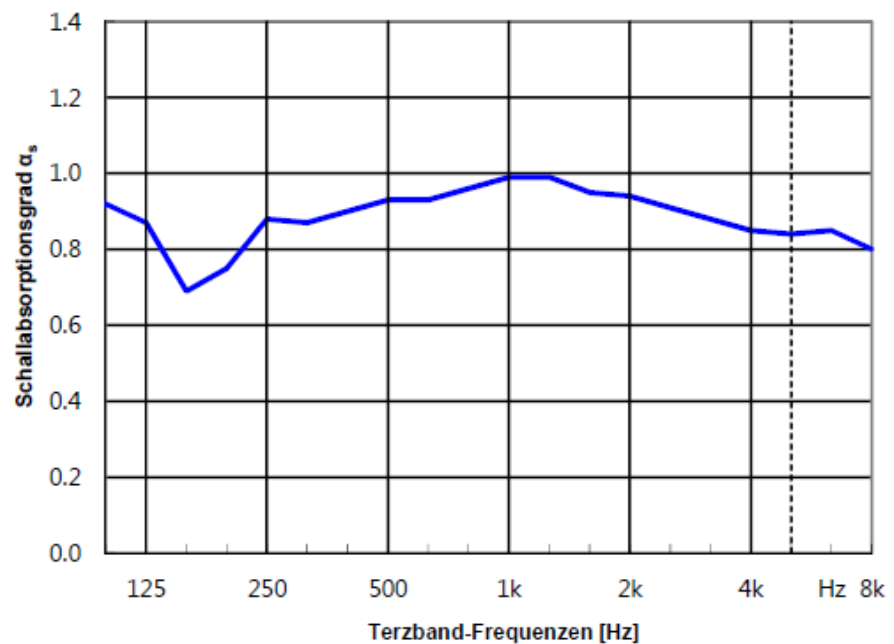
sample 2

frame A

mineral fibre panels on floor

Frequenz f [Hz]	$\alpha_s$ Terzen
100	0.92
125	0.87
160	0.69
200	0.75
250	0.88
315	0.87
400	0.90
500	0.93
630	0.93
800	0.96
1000	0.99
1250	0.99
1600	0.95
2000	0.94
2500	0.91
3150	0.88
4000	0.85
5000	0.84
6300	0.85
8000	0.80

**Messung** Hallraum Empa Dübendorf, Volumen V: 215 m<sup>3</sup> **Datum:** 15.4.10  
 Temperatur: 21.9°C, relative Luftfeuchtigkeit: 55.4 %  
 Probengrösse: 2700 x 4000 mm Prüffläche S: 10.8 m<sup>2</sup>



Auswertung nach EN ISO 11'654 (1997):  $\alpha_w$ : 0.95  
 $\alpha_p$ : 250 Hz: 0.85 500 Hz: 0.90 1000Hz: 1.00 2000Hz: 0.95 4000Hz: 0.85

Messung: EN ISO 354 (2003)

MLS-Messung; Terzbandfilter; T20 aus integrierter Impulsantwort

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## Appendix 16 - Sound absorption coefficient (reverberation chamber method)

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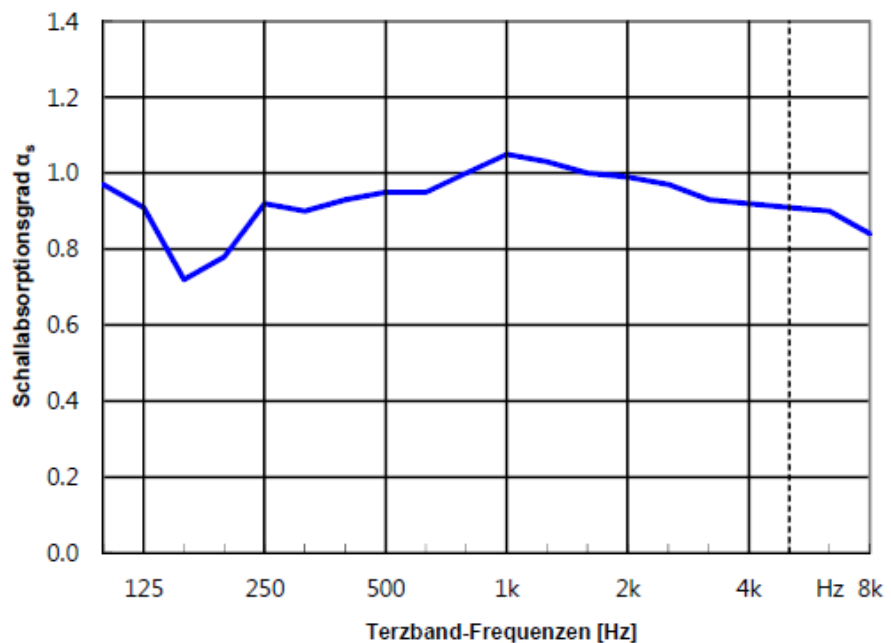
sample 3

frame A

mineral fibre panels on floor

Frequenz f [Hz]	$\alpha_s$ Terzen
100	0.97
125	0.91
160	0.72
200	0.78
250	0.92
315	0.90
400	0.93
500	0.95
630	0.95
800	1.00
1000	1.05
1250	1.03
1600	1.00
2000	0.99
2500	0.97
3150	0.93
4000	0.92
5000	0.91
6300	0.90
8000	0.84

**Messung** Hallraum Empa Dübendorf, Volumen V: 215 m<sup>3</sup>    **Datum:** 15.4.10  
 Temperatur: 21.9°C, relative Luftfeuchtigkeit: 57 %  
 Probengrösse: 2700 x 4000 mm    Prüffläche S: 10.8 m<sup>2</sup>



Auswertung nach EN ISO 11'654 (1997):  $\alpha_w$ : **1.00**  
 $\alpha_p$ : 250 Hz: 0.85    500 Hz: 0.95    1000Hz: 1.00    2000Hz: 1.00    4000Hz: 0.90

Messung: EN ISO 354 (2003)

MLS-Messung; Terzbandfilter; T20 aus integrierter Impulsantwort

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## Appendix 17 - Sound absorption coefficient (reverberation chamber method)

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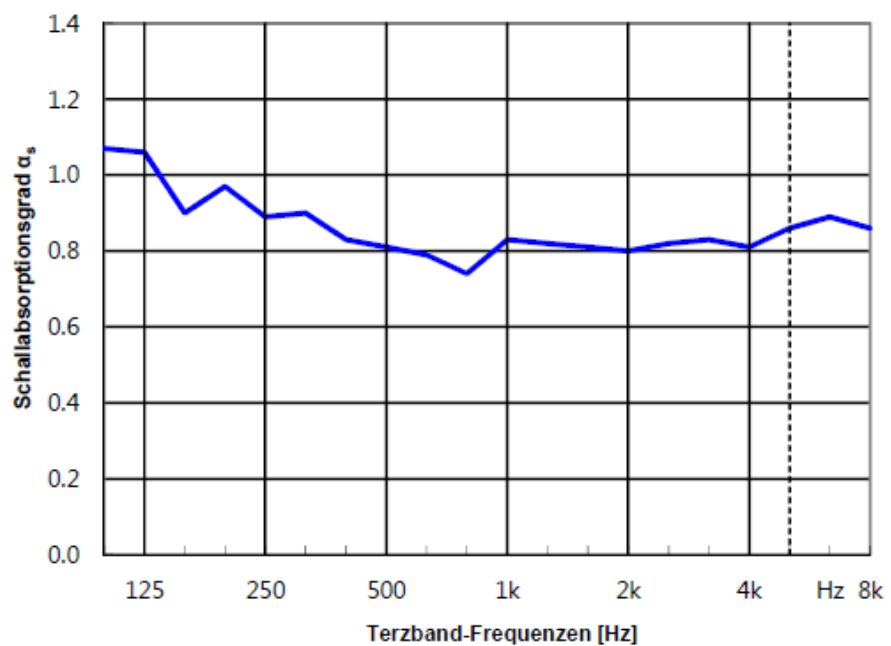
sample 1

frame B

without mineral fibre panels on floor

Frequenz f [Hz]	$\alpha_s$ Terzen
100	1.07
125	1.06
160	0.90
200	0.97
250	0.89
315	0.90
400	0.83
500	0.81
630	0.79
800	0.74
1000	0.83
1250	0.82
1600	0.81
2000	0.80
2500	0.82
3150	0.83
4000	0.81
5000	0.86
6300	0.89
8000	0.86

**Messung** Hallraum Empa Dübendorf, Volumen V: 215 m<sup>3</sup>    **Datum:** 12.4.10  
 Temperatur: 21.9°C, relative Luftfeuchtigkeit: 57.7 %  
 Probengrösse: 2700 x 4000 mm    Prüffläche S: 10.8 m<sup>2</sup>



Auswertung nach EN ISO 11'654 (1997):  $\alpha_w$ : **0.80 (L)**  
 $\alpha_p$ : 250 Hz: 0.90    500 Hz: 0.80    1000Hz: 0.80    2000Hz: 0.80    4000Hz: 0.85

Messung: EN ISO 354 (2003)

MLS-Messung; Terzbandfilter; T20 aus integrierter Impulsantwort

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## Appendix 18 - Sound absorption coefficient (reverberation chamber method)

Corrugated dukta®

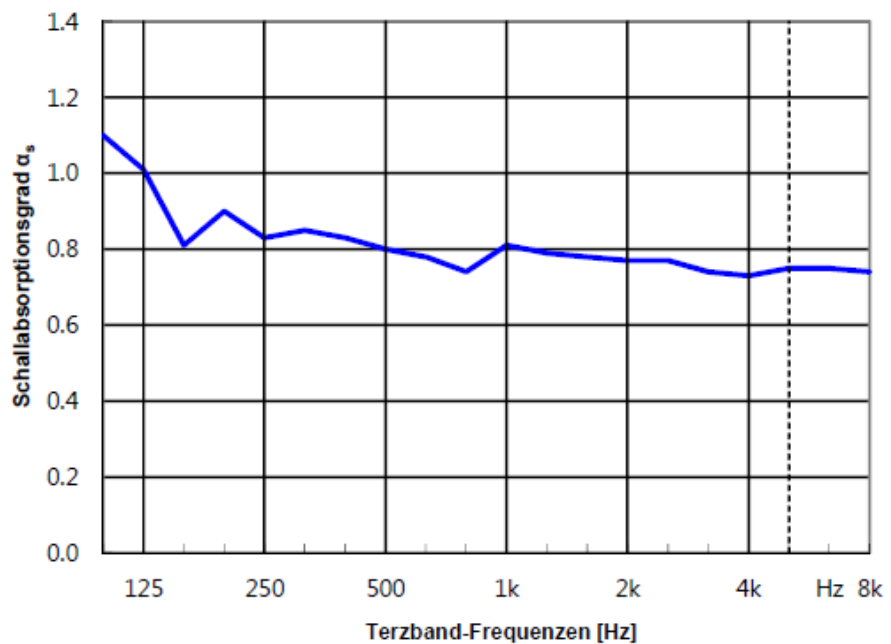
sample 2

frame B

without mineral fibre panels on floor

Frequenz f [Hz]	$\alpha_s$ Terzen
100	1.10
125	1.01
160	0.81
200	0.90
250	0.83
315	0.85
400	0.83
500	0.80
630	0.78
800	0.74
1000	0.81
1250	0.79
1600	0.78
2000	0.77
2500	0.77
3150	0.74
4000	0.73
5000	0.75
6300	0.75
8000	0.74

**Messung** Hallraum Empa Dübendorf, Volumen V: 215 m<sup>3</sup> **Datum:** 13.4.10  
 Temperatur: 21.8°C, relative Luftfeuchtigkeit: 56.2 %  
 Probengrösse: 2700 x 4000 mm Prüffläche S: 10.8 m<sup>2</sup>



Auswertung nach EN ISO 11'654 (1997):  $\alpha_w$ : 0.80  
 $\alpha_p$ : 250 Hz: 0.85 500 Hz: 0.80 1000Hz: 0.80 2000Hz: 0.75 4000Hz: 0.75

Messung: EN ISO 354 (2003)

MLS-Messung; Terzbandfilter; T20 aus integrierter Impulsantwort

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 Translation and typing errors excepted.

## Appendix 19 - Sound absorption coefficient (reverberation chamber method)

Corrugated dukta®

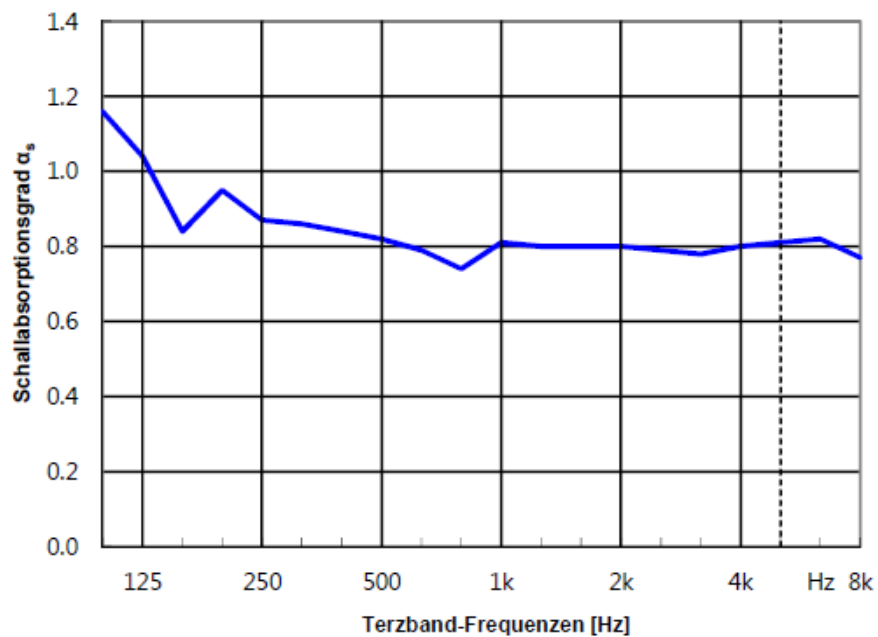
sample 3

frame B

without mineral fibre panels on floor

Frequenz f [Hz]	$\alpha_s$ Terzen
100	1.16
125	1.04
160	0.84
200	0.95
250	0.87
315	0.86
400	0.84
500	0.82
630	0.79
800	0.74
1000	0.81
1250	0.80
1600	0.80
2000	0.80
2500	0.79
3150	0.78
4000	0.80
5000	0.81
6300	0.82
8000	0.77

**Messung** Hallraum Empa Dübendorf, Volumen V: 215 m<sup>3</sup> **Datum:** 29.3.10  
 Temperatur: 21.7°C, relative Luftfeuchtigkeit: 58.4 %  
 Probengröße: 2700 x 4000 mm Prüffläche S: 10.8 m<sup>2</sup>



Auswertung nach EN ISO 11'654 (1997):  $\alpha_w$ : **0.80 (L)**  
 $\alpha_p$ : 250 Hz: 0.90 500 Hz: 0.80 1000Hz: 0.80 2000Hz: 0.80 4000Hz: 0.80

Messung: EN ISO 354 (2003)

MLS-Messung; Terzbandfilter; T20 aus integrierter Impulsantwort

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## Appendix 20 - Sound absorption coefficient (reverberation chamber method)

Corrugated dukta®

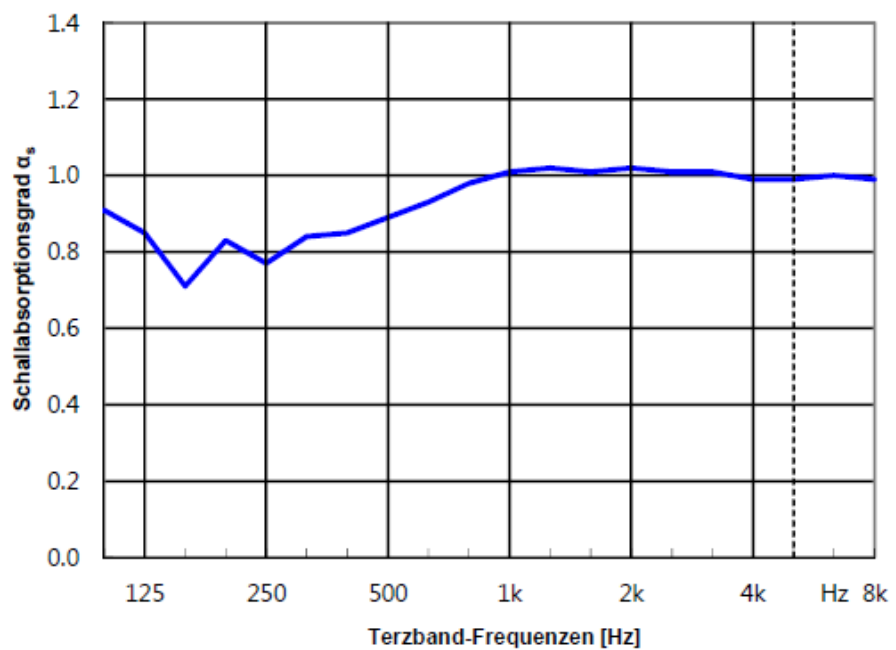
sample 1

frame B

mineral fibre panels on floor

Frequenz f [Hz]	$\alpha_s$ Terzen
100	0.91
125	0.85
160	0.71
200	0.83
250	0.77
315	0.84
400	0.85
500	0.89
630	0.93
800	0.98
1000	1.01
1250	1.02
1600	1.01
2000	1.02
2500	1.01
3150	1.01
4000	0.99
5000	0.99
6300	1.00
8000	0.99

**Messung** Hallraum Empa Dübendorf, Volumen V: 215 m<sup>3</sup>    **Datum:** 09.4.10  
 Temperatur: 22°C,    relative Luftfeuchtigkeit: 57 %  
 Probengröße: 2700 x 4000 mm    Prüffläche S: 10.8 m<sup>2</sup>



Auswertung nach EN ISO 11'654 (1997):     $\alpha_w$ : **1.00**  
 $\alpha_p$ : 250 Hz: 0.80    500 Hz: 0.90    1000Hz: 1.00    2000Hz: 1.00    4000Hz: 1.00

Messung: EN ISO 354 (2003)

MLS-Messung; Terzbandfilter; T20 aus integrierter Impulsantwort

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## Appendix 21 - Sound absorption coefficient (reverberation chamber method)

Corrugated dukta®

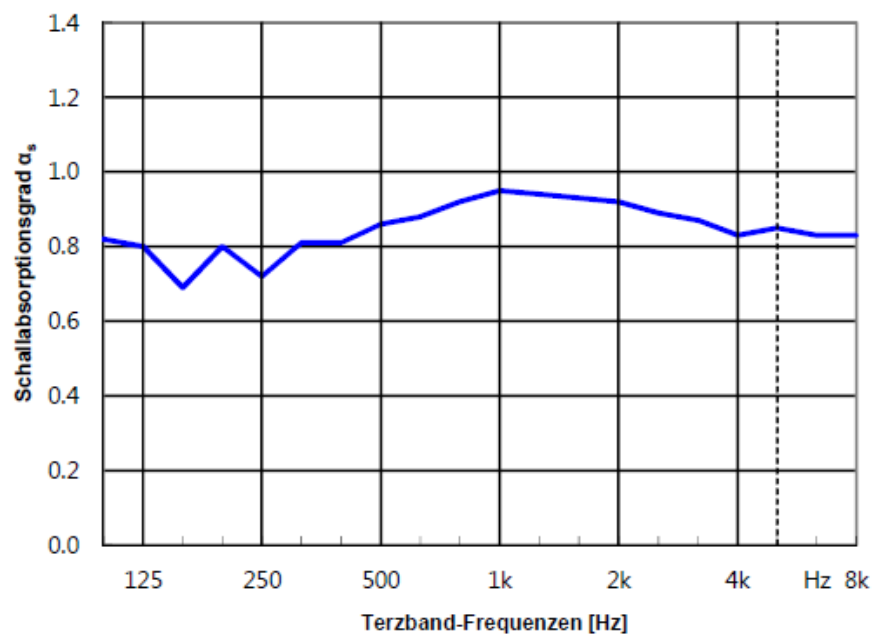
sample 2

frame B

mineral fibre panels on floor

Frequenz f [Hz]	$\alpha_s$ Terzen
100	0.82
125	0.80
160	0.69
200	0.80
250	0.72
315	0.81
400	0.81
500	0.86
630	0.88
800	0.92
1000	0.95
1250	0.94
1600	0.93
2000	0.92
2500	0.89
3150	0.87
4000	0.83
5000	0.85
6300	0.83
8000	0.83

**Messung** Hallraum Empa Dübendorf, Volumen V: 215 m<sup>3</sup> **Datum:** 09.4.10  
 Temperatur: 21.7°C, relative Luftfeuchtigkeit: 57 %  
 Probengröße: 2700 x 4000 mm Prüffläche S: 10.8 m<sup>2</sup>



Auswertung nach EN ISO 11'654 (1997):  $\alpha_w$ : 0.90  
 $\alpha_p$ : 250 Hz: 0.80 500 Hz: 0.85 1000Hz: 0.95 2000Hz: 0.90 4000Hz: 0.85

Messung: EN ISO 354 (2003)

MLS-Messung; Terzbandfilter; T20 aus integrierter Impulsantwort

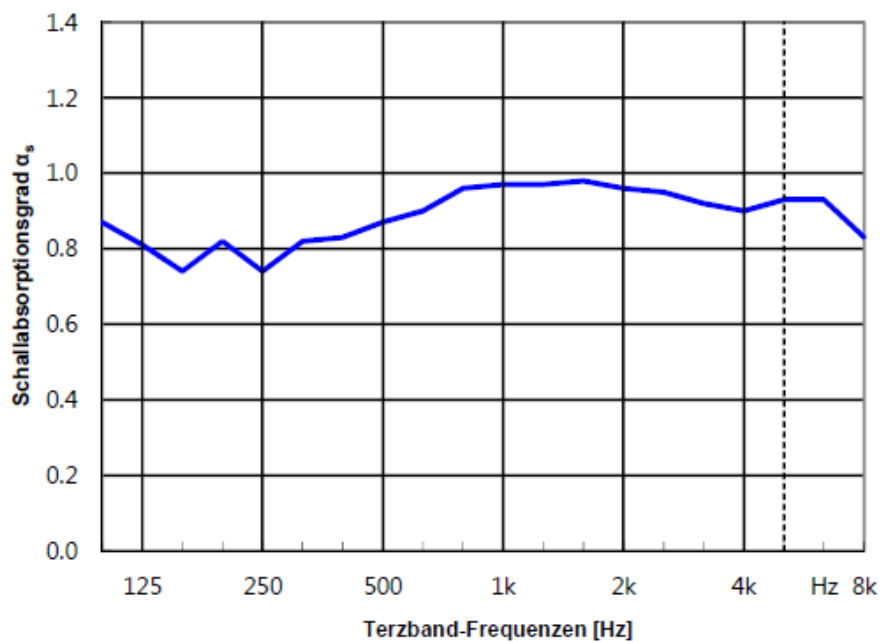
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 Translation and typing errors excepted.

## Appendix 22 - Sound absorption coefficient (reverberation chamber method)

Corrugated dukta®  
 sample 3  
 frame B  
 mineral fibre panels on floor

Frequenz f [Hz]	$\alpha_s$ Terzen
100	0.87
125	0.81
160	0.74
200	0.82
250	0.74
315	0.82
400	0.83
500	0.87
630	0.90
800	0.96
1000	0.97
1250	0.97
1600	0.98
2000	0.96
2500	0.95
3150	0.92
4000	0.90
5000	0.93
6300	0.93
8000	0.83

**Messung** Hallraum Empa Dübendorf, Volumen V: 215 m<sup>3</sup> **Datum:** 09.4.10  
 Temperatur: 21.7°C, relative Luftfeuchtigkeit: 58 %  
 Probengröße: 2700 x 4000 mm Prüffläche S: 10.8 m<sup>2</sup>



Auswertung nach EN ISO 11'654 (1997):  $\alpha_w$ : 0.95  
 $\alpha_p$ : 250 Hz: 0.80 500 Hz: 0.85 1000Hz: 0.95 2000Hz: 0.95 4000Hz: 0.90

Messung: EN ISO 354 (2003)  
 MLS-Messung; Terzbandfilter; T20 aus integrierter Impulsantwort