Akustikverkstan Lab AB
Kinnegatan 23, 531 33 Lidköping, Sweden, +46 510 - 911 44

carl.nyqvist@akustikverkstan.se
Direct: +46 70 938 00 45

SOUND ABSORPTION MEASUREMENTS FOR LANDSCAPE FROM GÖTESSONS

The sound absorption for the product Landscape from Götessons has been measured according to the reverberation room method (SS-EN ISO 354:2003) for sound absorption coefficient and sound absorption area. The sound absorption coefficient has been evaluated according to SS-EN ISO 11654:1997. The sound absorption area has been evaluated according to ISO 20189:2018.

The measured sound absorption area is presented in the measurement protocols. The N_{10}-values as defined by Kammarkollegiet (described in section 6) are presented in the table below.

Measurement protocol	Test object	N_{10}
M1	Landscape 1000 x 700 mm	21
M2	Landscape 500 x 700 mm	37

The results as weighted sound absorption coefficient and sound absorption class are presented in the table below.

Measurement protocol	Test object	α_w	Sound absorption class
M3	Landscape, 10 m^2	0.60(H)	C

1 CLIENT

Götessons Industri AB, Box 56, 523 22 Ulricehamn, Sweden
Contact: Nina Cronholm, nina@gotessons.se, +46 321 68 77 67

2 ASSIGNMENT

To measure the sound absorption for Landscape wall absorber in two sizes and as 10 m^2 surface according to SS-EN ISO 354:2003 and evaluate according to ISO 20189:2018 and SS-EN ISO 11654:1997.

3 TEST OBJECTS

Landscape – Wall absorber

Landscape is a decorative wall absorber with a wooden frame (depth 60 mm, thickness 12 mm) inside are EcoSUND absorbers in various thicknesses (8, 20, 40 and 50 mm). Landscape comes in two sizes; 1024 x 724 mm and 524 x 724 mm (incl. frame).
Figure 1-3 below shows measurement setups for the three measurements.

Figure 1: Landscape 1000 x 700 measured as single objects.

Figure 2: Landscape 500 x 700 measured as single objects.

Figure 3: Landscape measured as surface (10 m^2).

4 MEASUREMENT PROCEDURE

The absorption measurements were performed according to the standard SS-EN ISO 354:2003. The measurements were made with three speaker positions and four microphone positions. The results for sound absorption area were evaluated according to ISO 20189:2018. The results for sound absorption coefficient were evaluated according to SS-EN ISO 11654:1997. The test specimen area fulfils the requirements in SS-EN ISO 354:2003.

The measurements were performed by Carl Nyqvist 2023-09-14 in Akustikverkstan's reverberation room in Skultorp, Skövde, Sweden. More information on the test facilities can be found in Appendix 2.

The equipment used is presented in Appendix 3.

5 RESULTS

Detailed measurement results are available in the measurement protocols belonging to this report, 3035-M1 to M3. The results are only valid for the tested sample. The measurement accuracy is described in Appendix 4.

This report should always be used in its complete context, even though the measurement protocols may be used independently.

6 COMMENTS AND INTERPRETATIONS

6.1 N_{10}-value

Kammarkollegiet, the Swedish authority dealing with public purchasing, has published advice regarding purchasing of sound absorbers. They define the value N_{10} according to the formula:

$$N_{10} = \frac{10}{A_{500}}$$

A_{500} is the sound absorption area at the 500 Hz octave band for the sound absorber. The N_{10} value is developed to be a single value metric for speech sound absorption and describes how many objects are needed to obtain 10 m^2 of sound absorption area in the 500 Hz octave band. If the sound absorption is lower in any octave above 500 Hz, the lower value will be used instead.

7 DEVIATIONS FROM THE STANDARD

The total measured sound absorption area at lower frequencies is below 1 m^2. According to ISO 20189:2018, the total sound absorption should exceed 1 m^2 in each frequency band.

Carl Nyqvist

Reviewed by Johan Jernstedt, 2023-09-25

APPENDIX 1: MEASURED REVERBERATION TIMES

f(Hz)	Empty	Landscape 1000x700	Landscape 500x700	Landscape (surface)
50	7.94	7.79	7.96	7.62
63	8.28	7.80	7.94	7.39
80	7.61	7.09	7.26	6.74
100	6.98	6.55	6.66	6.12
125	6.77	5.72	5.95	5.03
160	5.16	4.49	4.62	3.87
200	5.16	4.38	4.48	3.66
250	5.11	4.10	4.29	3.53
315	5.13	3.84	4.10	3.10
400	5.02	3.65	3.97	3.08
500	4.67	3.35	3.53	2.65
630	4.38	3.03	3.23	2.40
800	4.69	3.08	3.29	2.34
1000	4.68	3.08	3.29	2.27
1250	4.19	2.81	3.02	2.12
1600	3.90	2.71	2.93	2.06
2000	3.56	2.53	2.70	1.93
2500	3.27	2.33	2.54	1.86
3150	2.85	2.13	2.30	1.68
4000	2.46	1.88	2.02	1.51
5000	2.00	1.58	1.68	1.30

Number of objects / area (m^2)	0	6	8	9.66
Temperature (°C)	17.4	17.4	17.5	17.5
RH (%)	71	70	70	70

APPENDIX 2: INFORMATION ABOUT THE REVERBERATION ROOM

The reverberation room is rectangular, measuring Length x Width x Height = 5.85 x 4.65 x 7.35 m. The room volume is 200 m^3 and the total area of the walls, ceiling and floor is 209 m^2. There are 22 diffusors (size 0.775 x 1.25 m) randomly installed in the room. The reverberation time between 50 and 200 Hz is controlled with membrane absorbers on the walls.
The test specimen is put on the floor on the mounting area (10 m^2, 2.6 x 3.85 m) according to figure A2.1. The mounting area consists of a concrete slab that can be lowered up to 700 mm below the floor.

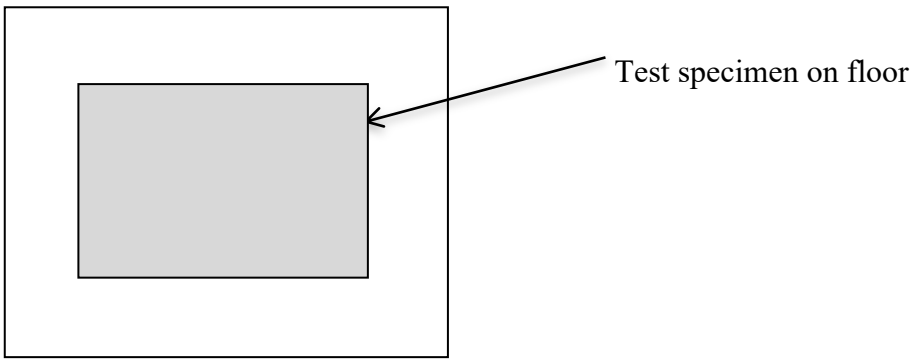


Figure A2.1: Plane drawing of the reverberation room with the positions of the test specimens.

APPENDIX 3: MEASUREMENT EQUIPMENT

Table A3.1 lists the equipment used during the measurements. The equipment fulfils class 1 according to SS-EN 61672-1, 60942 and 61260. Date for the latest calibration is available in the instrument journal of Akustikverkstan.

Instrument	Manufacture and type	Serial number	Internal designation
Measurement computer	HP Zbook		DA02
Front end	National Instruments NI 9234	1918620/190DB0B	AN05
Microphone	Roga MI-17	592	MI04
Microphone	Roga MI-17	593	MI05
Microphone	Roga MI-17	594	MI06
Microphone	Roga MI-17	595	MI07
Speaker	IMA Kub 1	8	HÖ7
Speaker	IMA Kub 1	9	HÖ8
Speaker	IMA Kub 1	10	HÖ9
Equalizer	Monacor MEQ-2152	-	Lab
Amplifier	Denon POA-2200	-	Lab

Table A3.1: Equipment used during the measurements.

APPENDIX 4: MEASUREMENT UNCERTAINTY

The uncertainties in the measured sound absorption coefficients have been estimated to the values in table A4.1. The uncertainty for sound absorption area is deduced from the test object area multiplied with the sound absorption coefficient uncertainty. The uncertainty corresponds to one standard deviation.

50 Hz	**63 Hz**	**80 Hz**	**100 Hz**	**125 Hz**	**160 Hz**	**200 Hz**
± 0.10	± 0.08	± 0.07	± 0.06	± 0.05	± 0.04	± 0.03
250 Hz	**315 Hz**	**400 Hz**	**500 Hz**	**630 Hz**	**800 Hz**	**1 kHz**
± 0.03	± 0.03	± 0.03	± 0.03	± 0.03	± 0.03	± 0.03
1.25 kHz	**1.6 kHz**	**2 kHz**	**2.5 kHz**	**3.15 kHz**	**4 kHz**	**5 kHz**
± 0.03	± 0.03	± 0.03	± 0.03	± 0.03	± 0.03	± 0.03

Table A4.1: Measurement uncertainty for each third octave.

Landscape 1000 x 700 mm (single object)

SOUND ABSORPTION AREA ACCORDING TO SS-EN ISO 354:2003 and ISO 20189:2018

Measurement of sound absorption area in a reverberation room

Ackred. nr. 10445
Provning
ISO/IEC 17025

Report number:
3035-M1
Date
2023-09-21

Frequency f [Hz]	Sound absorption area per object [m^2 Sabine]	
50	0.01	
63	0.04	0.03
80	0.05	
100	0.05	
125	0.15	0.12
160	0.16	
200	0.19	
250	0.26	0.27
315	0.35	
400	0.41	
500	0.46	0.47
630	0.55	
800	0.60	
1000	0.60	0.61
1250	0.63	
1600	0.61	
2000	0.62	0.63
2500	0.66	
3150	0.63	
4000	0.66	0.66
5000	0.70	

N_{10} = 21

Client: Götessons Industri AB

Manufacturer: Götessons Industri AB

Product identification: Landscape 1000 x 700

Description of test specimen: Wall absorber in wooden frame. Core material EcoSUND with thickness 8, 20, 40 and 50 mm. Frame depth 60 mm.
Size incl. frame: 1024 x 724 x 60 mm.
Measured directly on floor.

Reverberation room volume: 200 m^3

Temperature: 17.4 °C (empty: 17.4 °C)

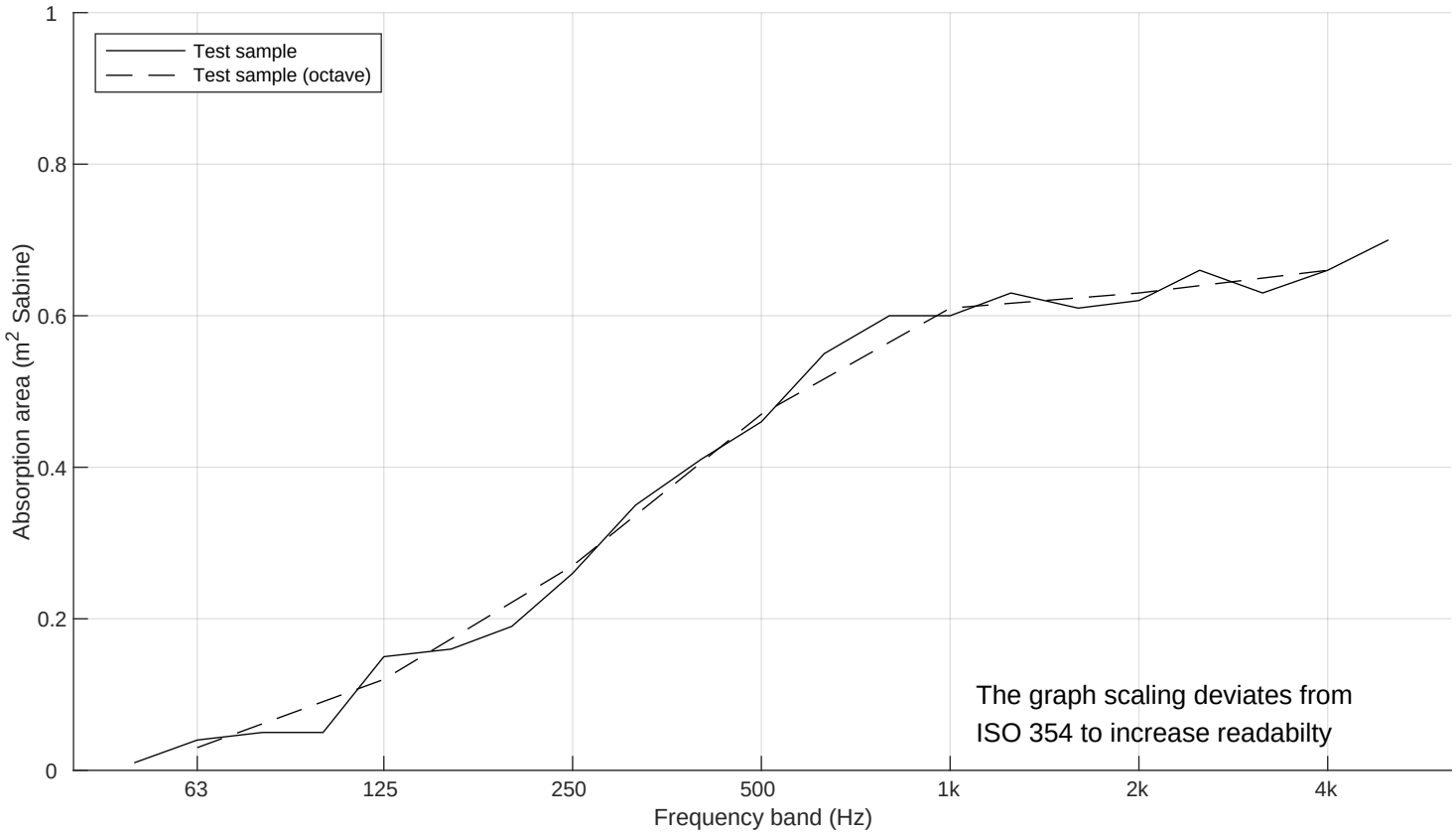
Air humidity: 70 % (empty: 71 %)

Air pressure: 101.5 kPa (empty:101.5 kPa)

Number of objects: 6

Measurement date: 2023-09-14

Measured by: Carl Nyqvist



AKUSTIKVERKSTAN

Landscape 500 x 700 mm (single object)

SOUND ABSORPTION AREA ACCORDING TO SS-EN ISO 354:2003 and ISO 20189:2018

Measurement of sound absorption area in a reverberation room

Ackred. nr. 10445
Provning
ISO/IEC 17025

Report number:
3035-M2
Date
2023-09-25

Frequency f [Hz]	Sound absorption area per object [m^2 Sabine]	
50	0.00	
63	0.02	0.02
80	0.03	
100	0.03	
125	0.08	0.07
160	0.09	
200	0.12	
250	0.15	0.16
315	0.20	
400	0.21	
500	0.28	0.27
630	0.33	
800	0.37	
1000	0.37	0.37
1250	0.37	
1600	0.34	
2000	0.36	0.35
2500	0.35	
3150	0.34	
4000	0.36	0.36
5000	0.37	

N_{10} = 37

Client: Götessons Industri AB

Manufacturer: Götessons Industri AB

Product identification: Landscape 500 x 700

Description of test specimen: Wall absorber in wooden frame. Core material EcoSUND with thickness 8, 20, 40 and 50 mm. Frame depth 60 mm.
Size incl. frame: 524 x 724 x 60 mm.
Measured directly on floor.

Reverberation room volume: 200 m^3

Temperature: 17.5 °C (empty: 17.4 °C)

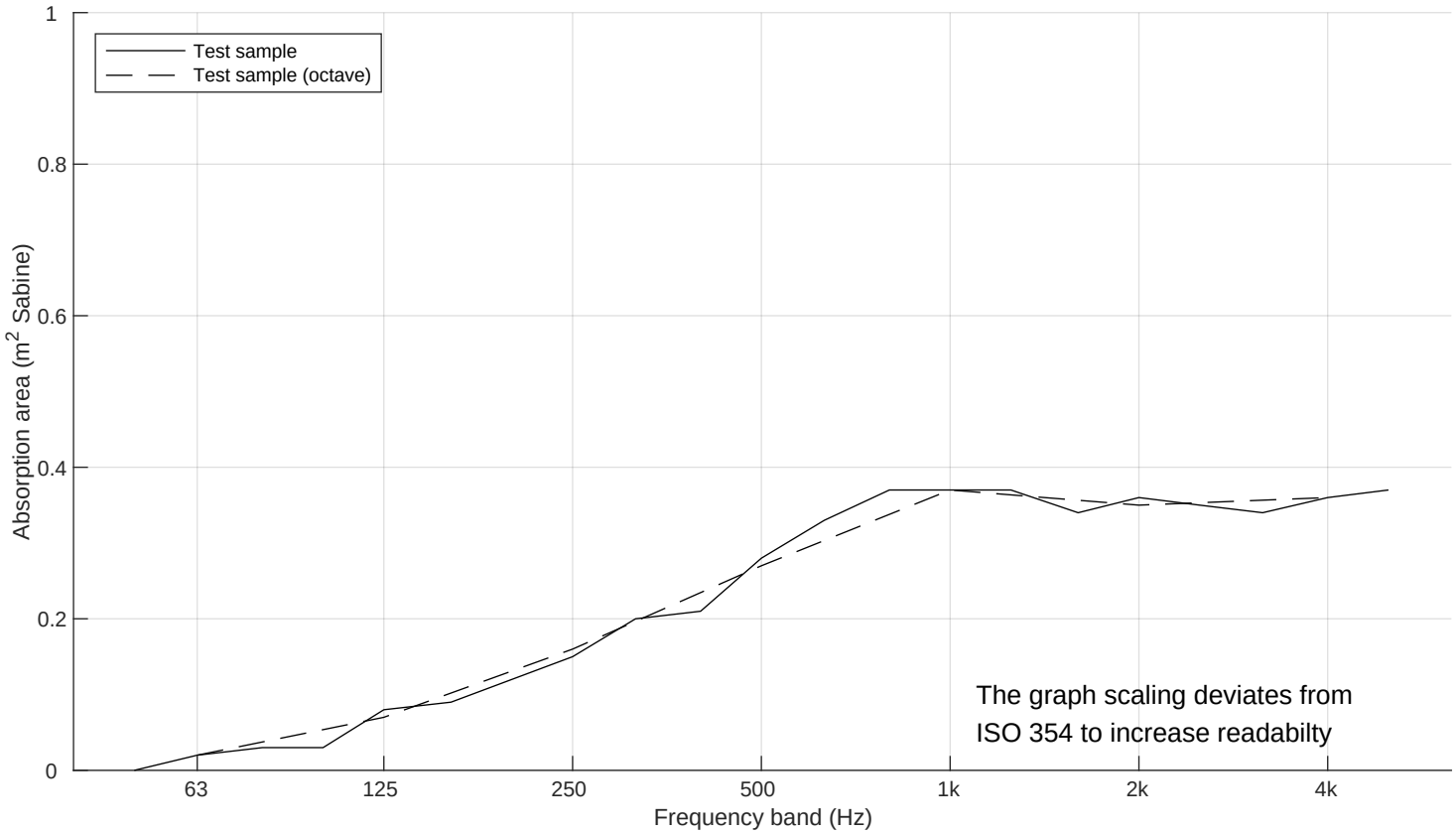
Air humidity: 70 % (empty: 71 %)

Air pressure: 101.5 kPa (empty:101.5 kPa)

Number of objects: 8

Measurement date: 2023-09-14

Measured by: Carl Nyqvist



AKUSTIKVERKSTAN

Landscape (surface)

SOUND ABSORPTION COEFFICIENT ACCORDING TO SS-EN ISO 354:2003 AND SS-EN ISO 11654:1997

Measurement of sound absorption coefficient in a reverberation room

Ackred. nr. 10445 Provning ISO/IEC 17025

Report number: 3035-M3

Date 2023-09-21

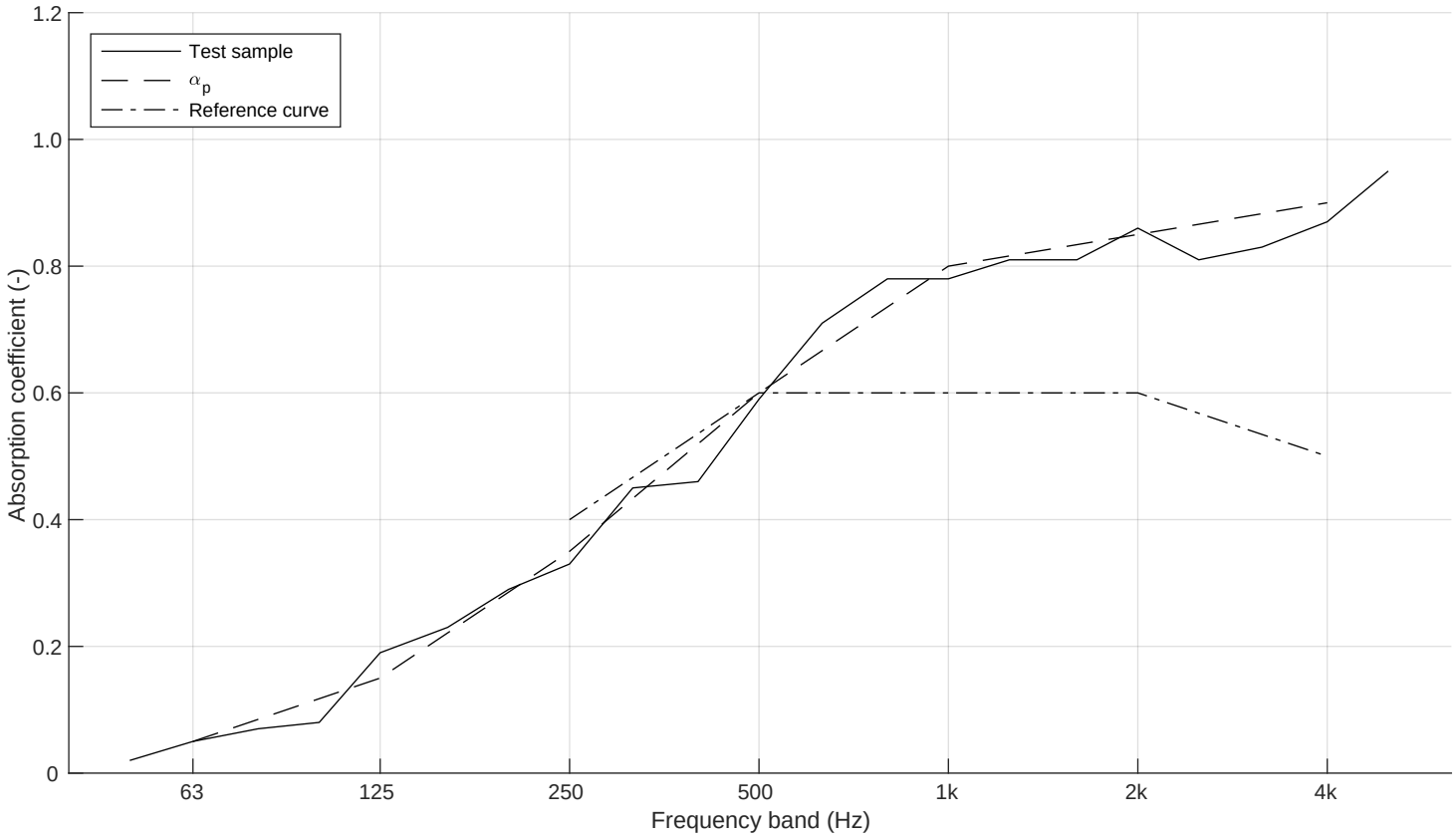
Frequency f [Hz]	Sound absorption coefficient α_s	α_p
50	0.02	
63	0.05	0.05
80	0.07	
100	0.08	
125	0.19	0.15
160	0.23	
200	0.29	
250	0.33	0.35
315	0.45	
400	0.46	
500	0.59	0.60
630	0.71	
800	0.78	
1000	0.78	0.80
1250	0.81	
1600	0.81	
2000	0.86	0.85
2500	0.81	
3150	0.83	
4000	0.87	0.90
5000	0.95	

α_w = 0.60(H)

Absorption class = C

Client:	Götessons Industri AB
Manufacturer:	Götessons Industri AB
Product identification:	Landscape
Description of test specimen:	Wall absorber in wooden frame. Core material EcoSUND with thickness 8, 20, 40 and 50 mm. Frame depth 60 mm. Measurement with 13 panels. Size per panel incl. frame: 1024 x 724 x 60 mm. Type A mounting.

Reverberation room volume:	200 m^3	
Temperature:	17.5 °C	(empty: 17.4 °C)
Air humidity:	71 %	(empty: 71 %)
Air pressure:	101.5 kPa	(empty:101.5 kPa)
Size of specimen:	9.9 m^2	
Measurement date:	2023-09-14	
Measured by:	Carl Nyqvist	



AKUSTIKVERKSTAN