Turku AMK, Kira Circularis -projekti
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DETERMINATION OF AIRBORNE SOUND INSULATION IN LABORATORY CONDITIONS

1 CLIENT

Turku AMK, Kira Circularis -project.

2 DESCRIPTION OF THE COMMISSION

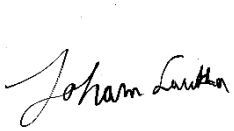
Sound reduction index *R* was measured for four specimens within 100-5000 Hz according to ISO 10140-2:2022. Weighted sound reduction index was determined according to ISO 717-1:2020.

This document SY25-307 Rev1 replaces previous document SY35-307.

3 RESULTS

The test results are presented in Annex 1

4 SIGNATURES



Valtteri Hongisto
Research Group Leader

Johann Laukka
Researcher

Turku University of Applied Sciences
Acoustics laboratory

ANNEXES

Annex 1 – Test results (4 page)
Annex 2 – Structure drawings (5 pages)
Annex 3 – Mounting of specimen (3 pages)
Annex 4 – Measurement arrangements (3 pages)

TURKU AMK
TURKU UNIVERSITY OF APPLIED SCIENCES

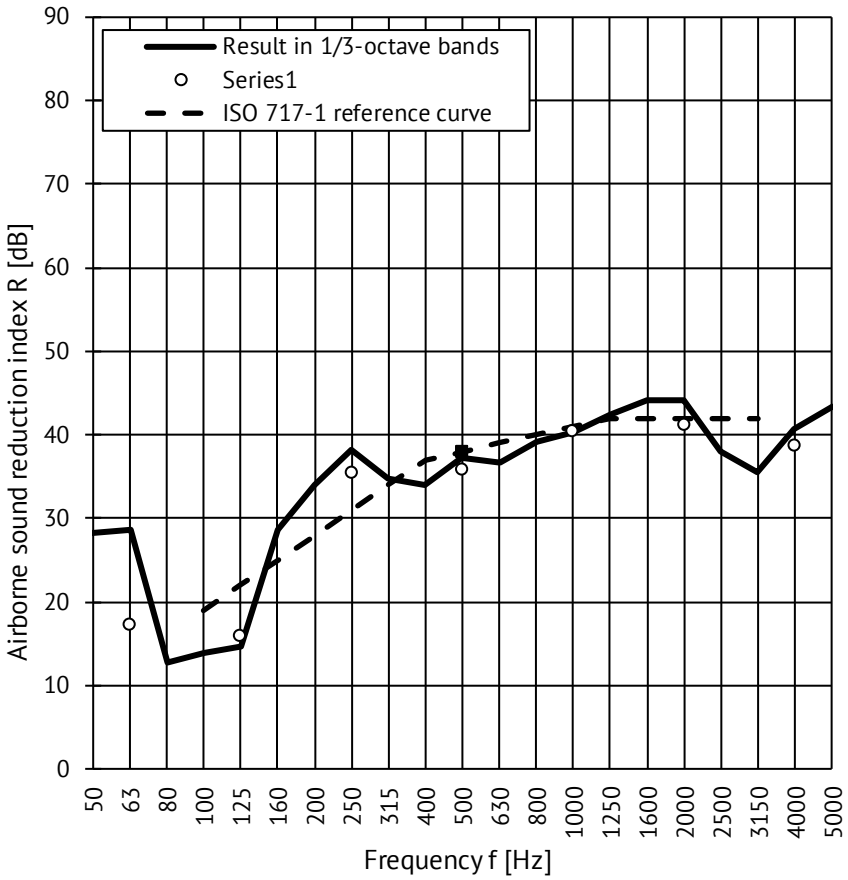
Determination of airborne sound insulation according to ISO 10140-2:2022 in laboratory conditions

Specimen id: **Reference**

Manufacturer: **Oy Meluton AB**
Client: Turun ammattikorkeakoulu, Kira Circularis -tutkimusprojekti
Contact person: Viliam Krištof
Mounting by: Viliam Krištof
Test laboratory: Turku University of Applied Sciences, Acoustics Laboratory
Joukahaisenkatu 7, 20520 Turku, Finland.
https://akustiikka.turkuamk.fi/

Room temperature:	21.9 °C	Area of test element, S:	2.4 m^2
Relative humidity:	41.1 %	Mass per unit area:	22.6 kg/m^2
Source room volume:	200.8 m^3	Test date:	May 23, 2025
Receiving room volume:	71.2 m^3	Test file:	r230525a

	1/3	1/1
f	**R**	**R**
[Hz]	[dB]	[dB]
50	28.2	
63	28.6	17.2
80	12.7	
100	14.0	
125	14.6	16.0
160	28.7	
200	34.0	
250	38.3	35.3
315	34.8	
400	34.0	
500	37.3	35.7
630	36.6	
800	39.1	
1000	40.4	40.4
1250	42.4	
1600	44.2	
2000	44.1	41.1
2500	38.1	
3150	35.5	
4000	40.7	38.6
5000	43.4	



Single-number quantities according to ISO 717-1

R_w	**38 dB**
R_w+C	35 dB
R_w+C_{tr}	30 dB
$R_w+C_{100-5000}$	36 dB
$R_w+C_{50-3150}$	35 dB
$R_w+C_{50-5000}$	36 dB
$R_w+C_{tr,100-5000}$	30 dB
$R_w+C_{tr,50-3150}$	29 dB
$R_w+C_{tr,50-5000}$	29 dB

Signs F and B indicate that the declared result is an underestimate in this frequency band. The true value is larger.

Johann Laukka
researcher
test performer

TURKU AMK
TURKU UNIVERSITY OF APPLIED SCIENCES

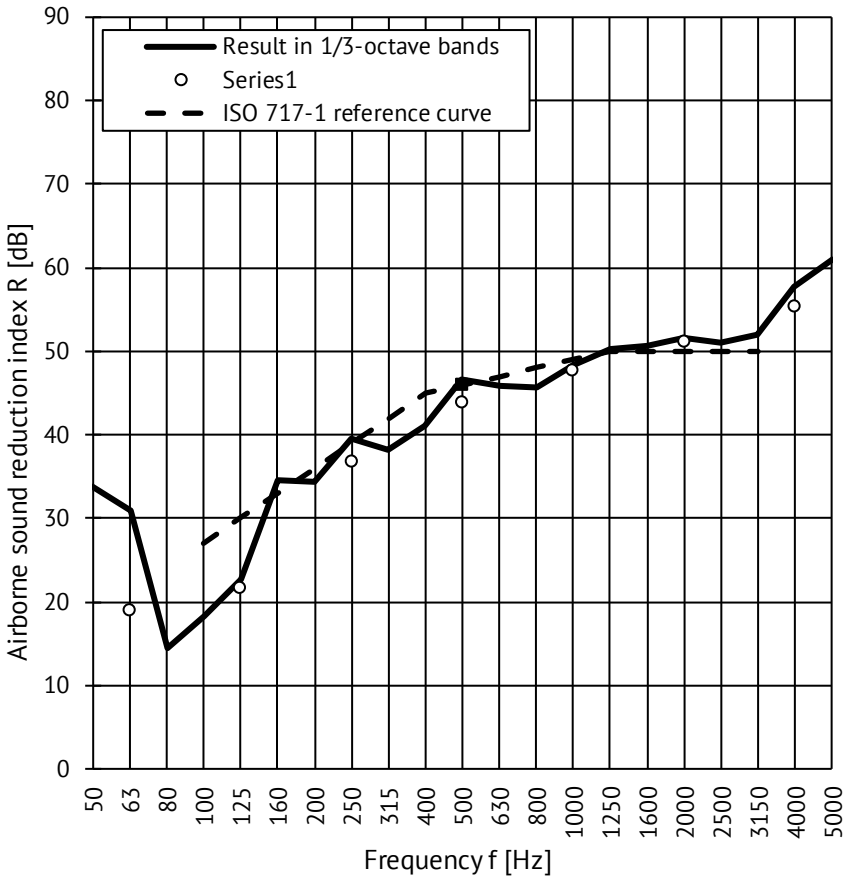
Determination of airborne sound insulation according to ISO 10140-2:2022 in laboratory conditions

Specimen id: **Wall 1**

Manufacturer: **Oy Meluton AB**
Client: Turun ammattikorkeakoulu, Kira Circularis -tutkimusprojekti
Contact person: Viliam Krištof
Mounting by: Viliam Krištof
Test laboratory: Turku University of Applied Sciences, Acoustics Laboratory
Joukahaisenkatu 7, 20520 Turku, Finland.
https://akustiikka.turkuamk.fi/

Room temperature:	22 °C	Area of test element, S:	2.5 m^2
Relative humidity:	40.2 %	Mass per unit area:	34.4 kg/m^2
Source room volume:	200.8 m^3	Test date:	May 23, 2025
Receiving room volume:	71.2 m^3	Test file:	r230525c

	1/3	1/1
f	**R**	**R**
[Hz]	[dB]	[dB]
50	33.9	
63	31.0	19.0
80	14.4	
100	18.3	
125	22.8	21.7
160	34.6	
200	34.4	
250	39.6	36.8
315	38.3	
400	41.1	
500	46.7	43.8
630	45.8	
800	45.7	
1000	48.4	47.7
1250	50.3	
1600	50.7	
2000	51.6	51.1
2500	51.1	
3150	51.9	
4000	57.8	55.3
5000	61.0	



Single-number quantities according to ISO 717-1

R_w	**46 dB**
R_w+C	43 dB
R_w+C_{tr}	36 dB
$R_w+C_{100-5000}$	44 dB
$R_w+C_{50-3150}$	41 dB
$R_w+C_{50-5000}$	42 dB
$R_w+C_{tr,100-5000}$	36 dB
$R_w+C_{tr,50-3150}$	33 dB
$R_w+C_{tr,50-5000}$	33 dB

Signs F and B indicate that the declared result is an underestimate in this frequency band. The true value is larger.

Johann Laukka
researcher
test performer

TURKU AMK
TURKU UNIVERSITY OF APPLIED SCIENCES

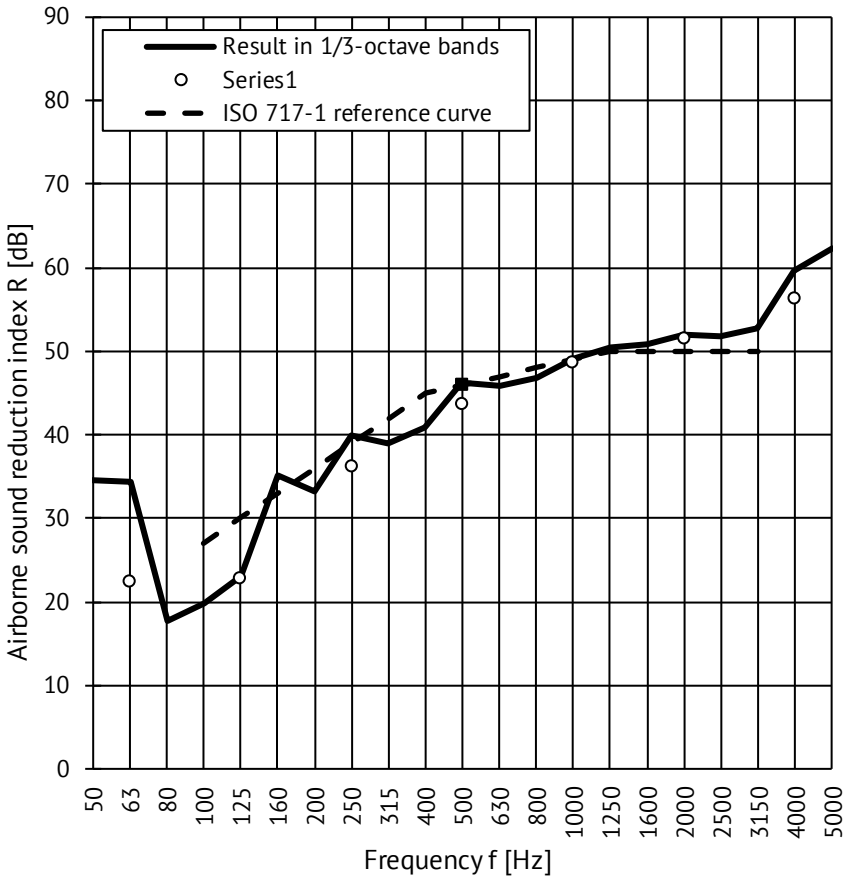
Determination of airborne sound insulation according to ISO 10140-2:2022 in laboratory conditions

Specimen id: **Wall 2**

Manufacturer: **Oy Meluton AB**
Client: Turun ammattikorkeakoulu, Kira Circularis -tutkimusprojekti
Contact person: Viliam Krištof
Mounting by: Viliam Krištof
Test laboratory: Turku University of Applied Sciences, Acoustics Laboratory
Joukahaisenkatu 7, 20520 Turku, Finland.
https://akustiikka.turkuamk.fi/

Room temperature:	22 °C	Area of test element, S:	2.5 m^2
Relative humidity:	40.2 %	Mass per unit area:	41.1 kg/m^2
Source room volume:	200.8 m^3	Test date:	May 23, 2025
Receiving room volume:	71.2 m^3	Test file:	r230525f

	1/3	1/1
f	**R**	**R**
[Hz]	[dB]	[dB]
50	34.6	
63	34.3	22.4
80	17.8	
100	19.8	
125	23.1	22.8
160	35.1	
200	33.2	
250	39.9	36.3
315	39.0	
400	40.9	
500	46.3	43.6
630	45.9	
800	46.9	
1000	49.1	48.6
1250	50.4	
1600	50.8	
2000	51.9	51.5
2500	51.8	
3150	52.7	
4000	59.6	56.3
5000	62.4	



Single-number quantities according to ISO 717-1

R_w	**46 dB**
R_w+C	43 dB
R_w+C_{tr}	37 dB
$R_w+C_{100-5000}$	44 dB
$R_w+C_{50-3150}$	43 dB
$R_w+C_{50-5000}$	44 dB
$R_w+C_{tr,100-5000}$	37 dB
$R_w+C_{tr,50-3150}$	35 dB
$R_w+C_{tr,50-5000}$	35 dB

Signs F and B indicate that the declared result is an underestimate in this frequency band. The true value is larger.

Johann Laukka
researcher
test performer

TURKU AMK
TURKU UNIVERSITY OF APPLIED SCIENCES

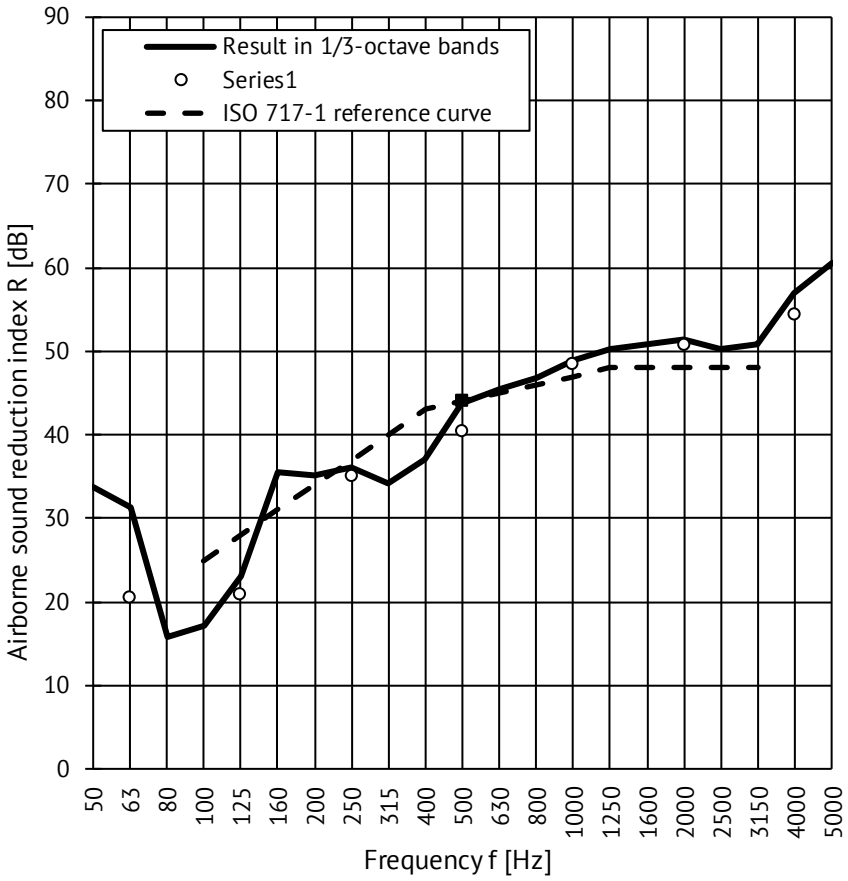
Determination of airborne sound insulation according to ISO 10140-2:2022 in laboratory conditions

Specimen id: **Wall 3**

Manufacturer: **Oy Meluton AB**
Client: Turun ammattikorkeakoulu, Kira Circularis -tutkimusprojekti
Contact person: Viliam Krištof
Mounting by: Viliam Krištof
Test laboratory: Turku University of Applied Sciences, Acoustics Laboratory
Joukahaisenkatu 7, 20520 Turku, Finland.
https://akustiikka.turkuamk.fi/

Room temperature:	22 °C	Area of test element, S:	2.5 m^2
Relative humidity:	40.2 %	Mass per unit area:	34.7 kg/m^2
Source room volume:	200.8 m^3	Test date:	May 23, 2025
Receiving room volume:	71.2 m^3	Test file:	r230525d

	1/3	1/1
f	**R**	**R**
[Hz]	[dB]	[dB]
50	33.9	
63	31.4	20.5
80	15.9	
100	17.2	
125	23.0	20.9
160	35.5	
200	35.2	
250	36.1	35.1
315	34.1	
400	37.0	
500	43.7	40.4
630	45.4	
800	46.9	
1000	49.0	48.5
1250	50.2	
1600	50.8	
2000	51.4	50.8
2500	50.3	
3150	50.9	
4000	57.0	54.4
5000	60.6	



Single-number quantities according to ISO 717-1

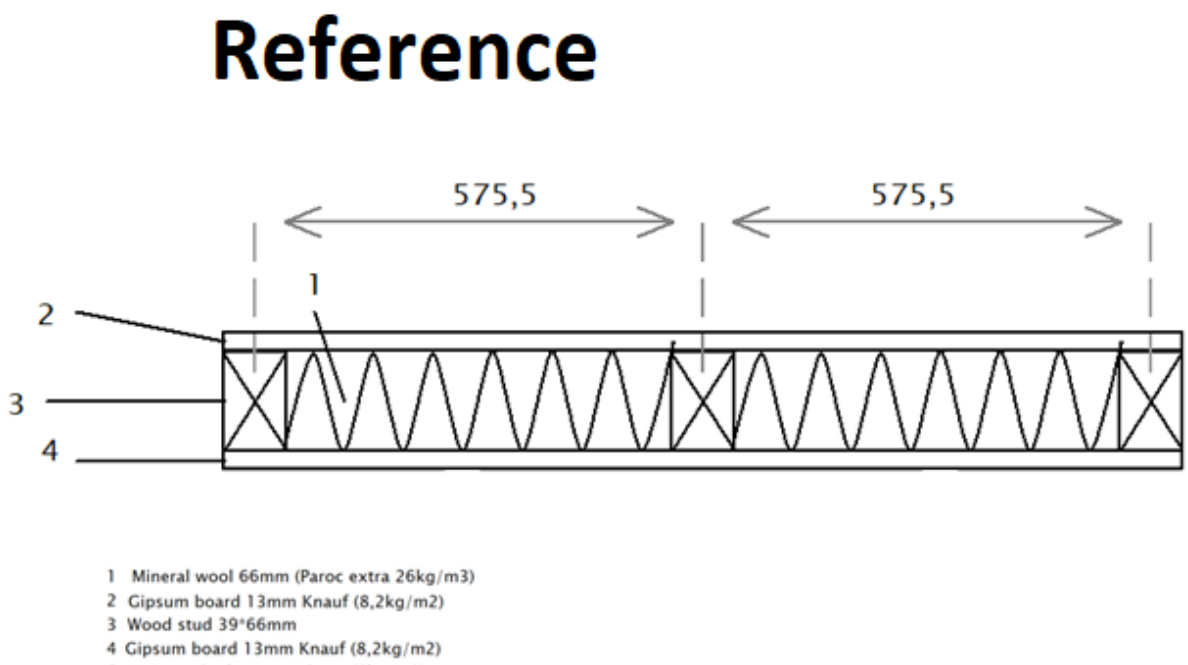
R_w	**44 dB**
R_w+C	42 dB
R_w+C_{tr}	35 dB
$R_w+C_{100-5000}$	43 dB
$R_w+C_{50-3150}$	41 dB
$R_w+C_{50-5000}$	42 dB
$R_w+C_{tr,100-5000}$	35 dB
$R_w+C_{tr,50-3150}$	33 dB
$R_w+C_{tr,50-5000}$	33 dB

Signs F and B indicate that the declared result is an underestimate in this frequency band. The true value is larger.

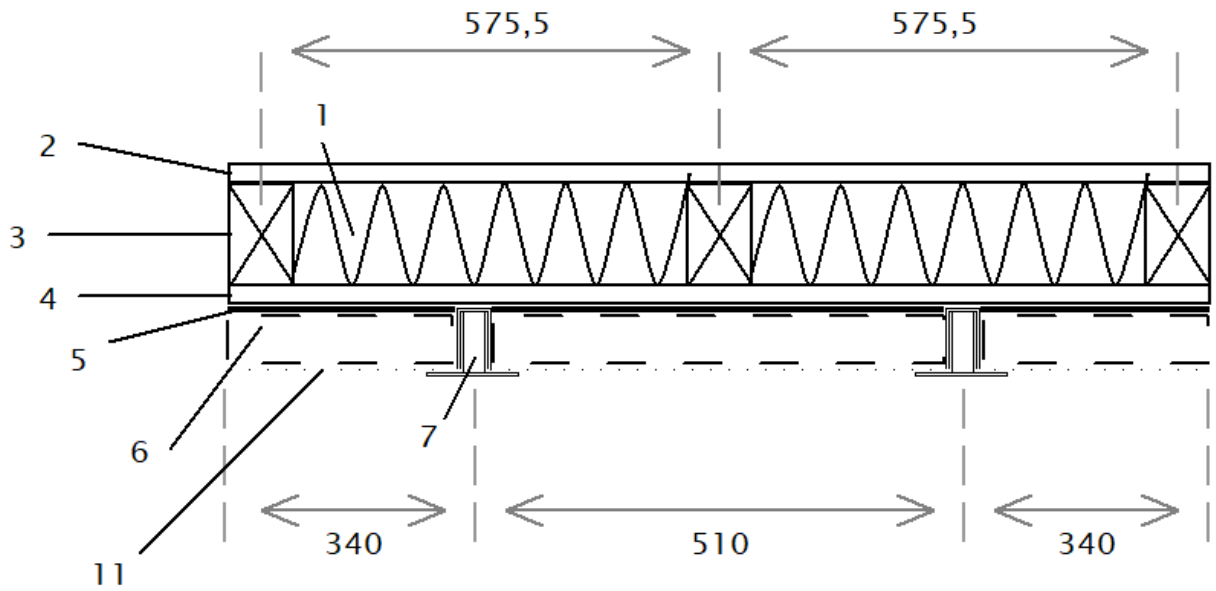
Johann Laukka
researcher
test performer

ANNEX 2 – STRUCTURE DRAWINGS

The structure drawing was provided by the client. TUAS has not verified the structure.

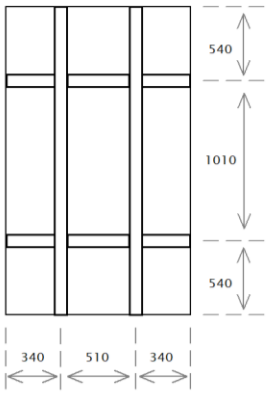


Wall 1

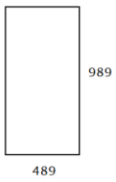


1 Mineral wool 66mm (Paroc extra 26kg/m3)
2 Gipsum board 13mm Knauf (8,2kg/m2)
3 Wood stud 39*66mm
4 Gipsum board 13mm Knauf (8,2kg/m2)
5 Hajuton Raskasmatto 3mm (6kg/m2)
6 PES-vanu 50 mm (60kg/m3)
7 Aluminium U and T profile holding acoustical panel
8 Hajuton Raskasmatto 3mm (6kg/m2)
9 Rouhe 30mm (90kg/m3)
10 PES-vanu 15 mm (60kg/m3)
11 Huopa (400 g/m2)

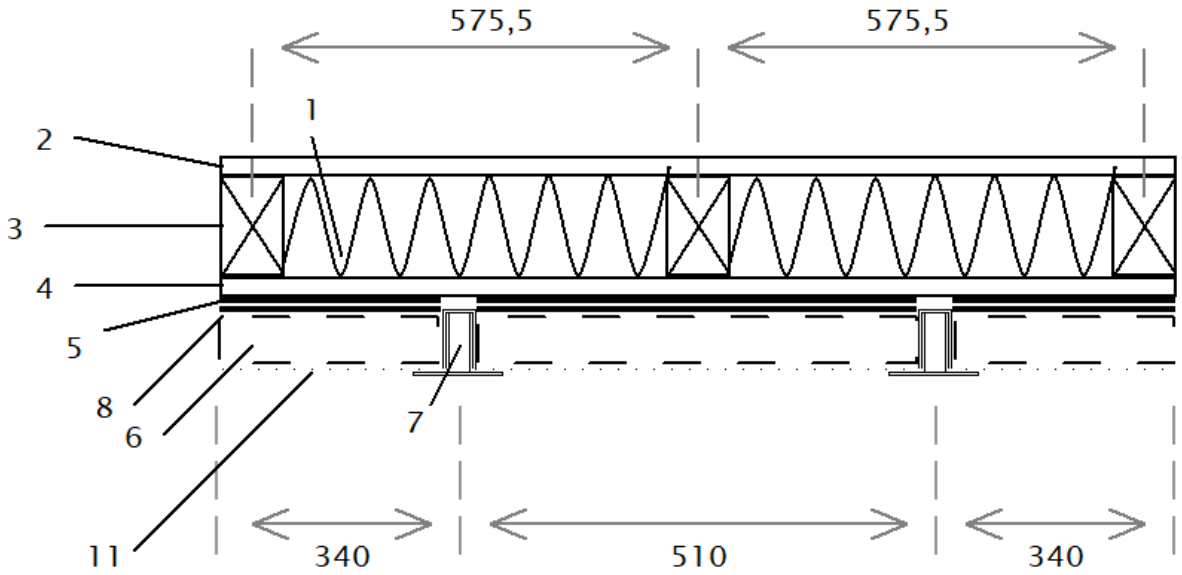
Walls from the front



Acoustical panel

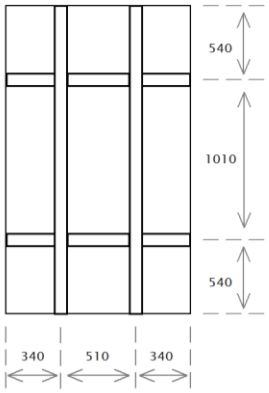


Wall 2

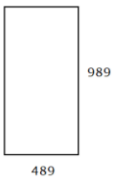


1 Mineral wool 66mm (Paroc extra 26kg/m3)
2 Gipsum board 13mm Knauf (8,2kg/m2)
3 Wood stud 39*66mm
4 Gipsum board 13mm Knauf (8,2kg/m2)
5 Hajuton Raskasmatto 3mm (6kg/m2)
6 PES-vanu 50 mm (60kg/m3)
7 Aluminium U and T profile holding acoustical panel
8 Hajuton Raskasmatto 3mm (6kg/m2)
9 Rouhe 30mm (90kg/m3)
10 PES-vanu 15 mm (60kg/m3)
11 Huopa (400 g/m2)

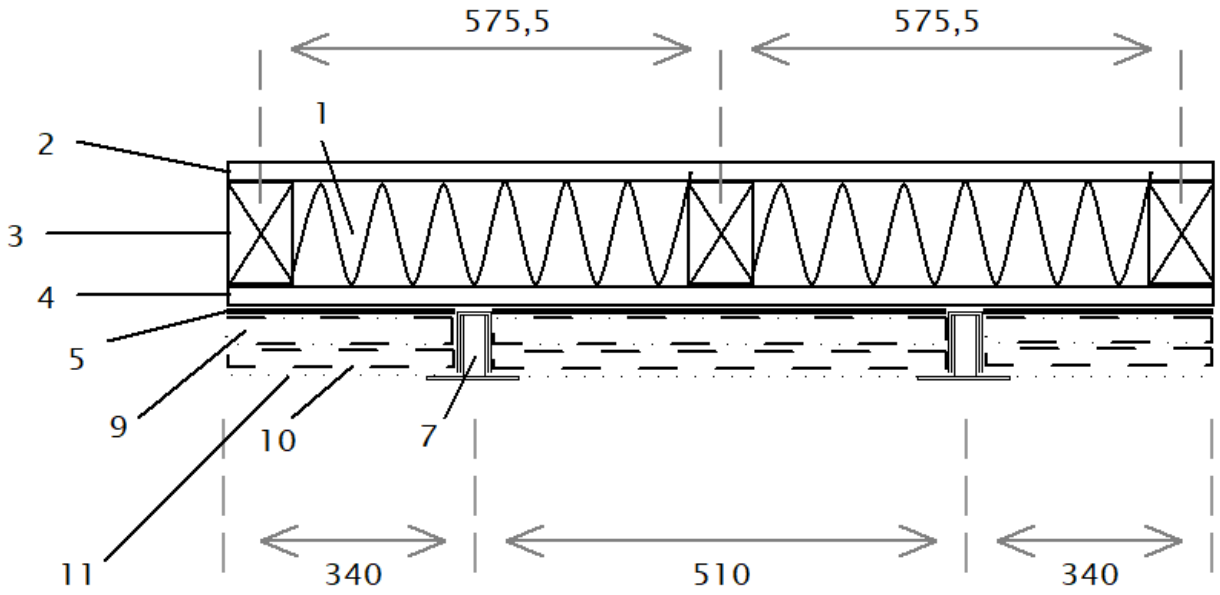
Walls from the front



Acoustical panel

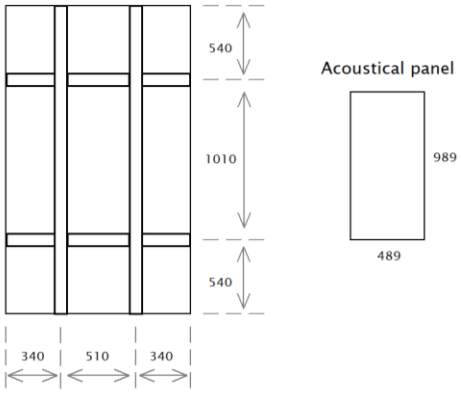


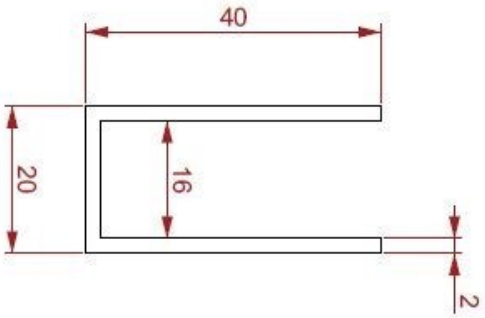
Wall 3

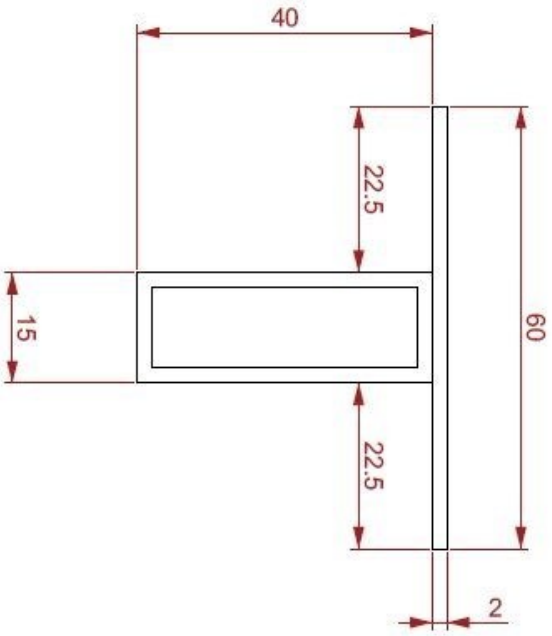


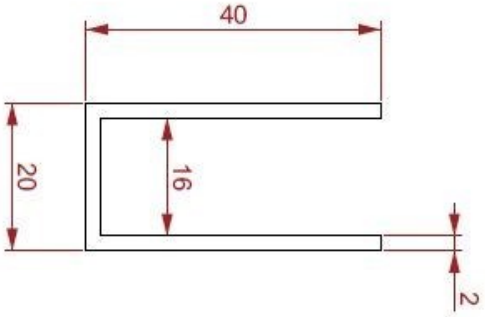
1 Mineral wool 66mm (Paroc extra 26kg/m3)
2 Gipsum board 13mm Knauf (8,2kg/m2)
3 Wood stud 39*66mm
4 Gipsum board 13mm Knauf (8,2kg/m2)
5 Hajuton Raskasmatto 3mm (6kg/m2)
6 PES-vanu 50 mm (60kg/m3)
7 Aluminium U and T profile holding acoustical panel
8 Hajuton Raskasmatto 3mm (6kg/m2)
9 Rouhe 30mm (90kg/m3)
10 PES-vanu 15 mm (60kg/m3)
11 Huopa (400 g/m2)

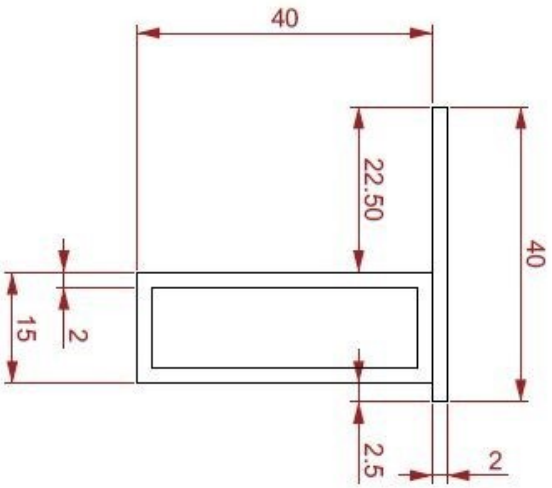
Walls from the front











ANNEX 3 – MOUNTING OF SPECIMEN

The Reference wall was installed in a small test opening (H2100 x W1215). The perimeters between the sample and the test opening were sealed with mineral wool and further sealed with 20 x 20 mm wooden strips and acrylic sealant.

Figure A3.1. Reference wall installation into the test opening. The image on the left is viewed from the source room. The image on the right is viewed from the receiving room.

The Walls 1 to 3 were installed in a small test opening (H2100 x W1215), with one side against to the test opening. Any gaps on this side were sealed with mineral wool. From the source room side the other horizontal perimeter between the sample and the test opening was sealed with mineral wool and 20 x 20 mm wooden slath. The top edge was sealed with a 15 x 40 mm wooden slath. All perimeters between the sample and the test opening were sealed with acrylic sealant. From the receiving room side the perimeters between the sample and the test opening were sealed with 20 x 20 mm wooden strips and acrylic sealant.

Figure A3.2. The Wall 1 installation into the test opening. The image on the left is viewed from the source room. The image on the right is viewed from the receiving room.

Figure A3.3. The Wall 2 installation into the test opening. The image on the left is viewed from the source room. The image on the right is viewed from the receiving room.).

Figure A3.4. The Wall 3 installation into the test opening. The image on the left is viewed from the source room. The image on the right is viewed from the receiving room.).

Specimen	**Weight [kg]**
Reference	54.4
Wall 1	85.5
Wall 2	102.1
Wall 3	86.2

ANNEX 4 – MEASUREMENT ARRANGEMENTS

1 Acoustical measurements

The sound was produced in the source room using five different sound sources and with five uncorrelated pink noise generators (Behringer Ultra curve DEQ 2496). The loudspeaker signals were amplified with three terminal amplifiers (QSC RMX 850, 850, 2450). The sound pressure level in the source room was measured using the rotating microphone boom (Brüel&Kjær 3923, serialnr. 1357240), the condenser microphone and the preamplifier (Brüel&Kjær 4165 and Brüel&Kjær 2669, serialnr. 1829762). The sound pressure level in the receiving room was measured using the rotating microphone boom (Brüel&Kjær 3923, serialnr. 2036590), the condenser microphone (Brüel&Kjær 4165, serialnr. 1867292) and the preamplifier (Brüel&Kjær 2669, serialnr. 1866352). The radius of rotation was 100 cm in both rooms. The averaging time was 64 seconds. The level measurements were made simultaneously. The microphones and the measurement channels were calibrated before the measurements with the sound level calibrator (Brüel&Kjær 4231, serialnr. 2376479).

For the reverberation time measurement in the receiving room, the pink noise test signal was produced with the real time analyzer and amplified with the terminal amplifier (QSC 900 W USA). Two fixed loudspeaker positions were used, and the microphone was placed in three positions. The reverberation time was determined in conformance with ISO 3382-2:2008 using 2 averaged decay signals from the decay range of −5 to -25 dB in each measurement. The sound analysis was made with the two-channel real time analyzer (Norsonic 121, serialnr. 31416).

The acoustical measurement equipment does not fulfil the requirements of IEC 61672, because the manufacturer has not tested the real time analyzer in conformance with IEC 61672-1 and 2.
The acoustical measurement equipment fulfilled the following IEC standards and grades of accuracy:

IEC 60651	Sound level meters (replaced by IEC 61672)	**type 1**
IEC 60804	Integrating sound level meters (replaced by IEC 61672)	**type 1**
IEC 61260	Octave-band and fractional-octave-band filters	**class 1**
IEC 60942	Sound level calibrators	**class 1**

2 Other measurements

The temperature and the relative humidity of the measurement rooms were measured using an environmental measurement device (Thermo Recorder TR-73U, serialnr. E00009). The specimen was weighed with a weighing machine (Vetek TI-500 SL, serialnr. 47359). The dimensions of the specimen were measured with a roll meter (Stanley Fat Max).

3 The uncertainty of sound insulation measurement

The uncertainty of reproducibility expresses the differences between the laboratories. The procedure to determine uncertainty of sound insulation in laboratory tests is defined in standard ISO 12999-1:2014. According to ISO 12999-1 the standard uncertainty for reproducibility of R varies within the measured frequency range (Figure below). The standard uncertainty for reproducibility of the weighted sound reduction index R_w is 1.2 dB.

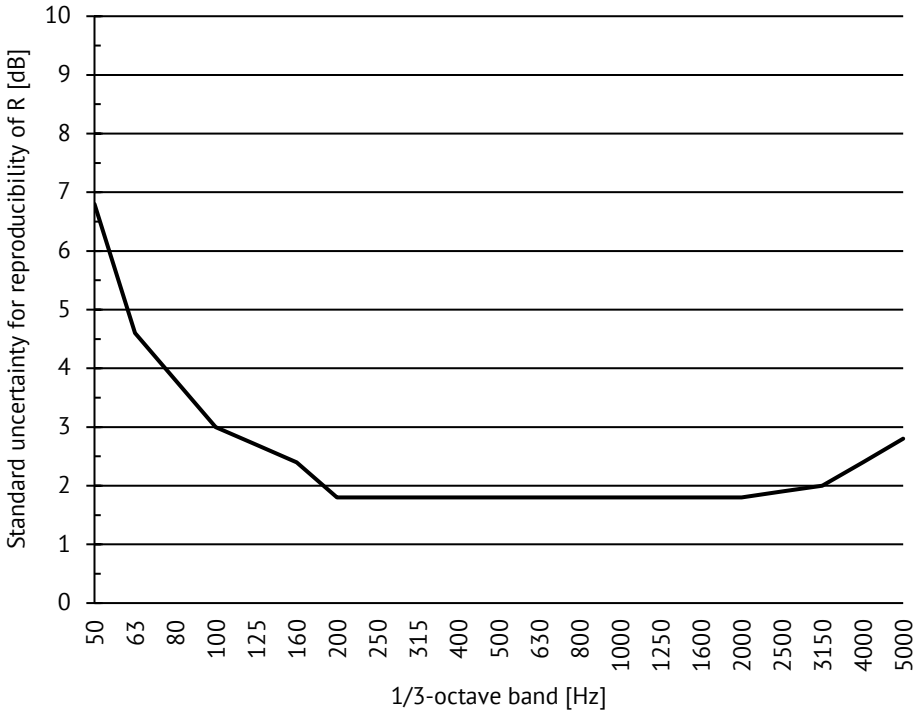


Figure. Standard uncertainty for reproducibility of sound reduction index R within 50–5000 Hz according to ISO 12999-1:2014.

4 References to the ISO standards

ISO 10140-2:2022 (E) Acoustics – Laboratory measurement of sound insulation of building elements – Part 2: Measurement of airborne sound insulation

ISO 717-1:2020 (E) Acoustics – Rating of sound insulation of building elements - Part 1: Airborne sound insulation

ISO 3382-2:2008 (E) Acoustics – Measurement of room acoustic parameters - Part 2: Reverberation time in ordinary rooms

ISO 12999-1:2014 (E) Acoustics – Determination and application of measurement uncertainties in building acoustics – Part 1: Sound insulation.