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NBN EN ISO 17025:2017
 EA MLA signatory

NOISE LAB
REPORT Number A-2021LAB-003-I900-44249_E

Customer : CENTEXBEL
 Technologiepark 70
 9052 Zwijnaarde
 Belgium

Contacts : Client : Kristina De Temmerman
 Noise lab : Paul Mees

Tests : Laboratory measurement of the reduction of impact noise by a floating floor system
 on a heavyweight standard floor.
Product name : Rubber tiles T2102135

Normative references:

NBN EN ISO 10140-3:2010 Acoustics - Laboratory measurement of sound insulation of building elements
 - Part 3: Measurements of impact sound insulation

Various other related norms:

NBN EN ISO 10140-3/A1:2015 Acoustics - Laboratory measurement of sound insulation of building elements
 - Part 3: Measurements of impact sound insulation - Amendment 1 (ISO 10140-3:2010/Amd 1:2015)

NBN EN ISO 10140-1:2016 Acoustics - Laboratory measurement of sound insulation of building elements
 - Part 1: Application rules for specific products

NBN EN ISO 10140-4:2010 Acoustics - Laboratory measurement of sound insulation of building elements
 - Part 4: Measurement procedures and requirements

NBN EN ISO 10140-5:2010 Acoustics - Laboratory measurement of sound insulation of building elements
 - Part 5: Requirements for test facilities and equipment

NBN EN ISO 12999-1:2014 Acoustics - Determination and application of measurement uncertainties in building acoustics
 - Part 1: Sound insulation

NBN EN ISO 717-2:2013 Acoustics - Rating of sound insulation in buildings and of building elements
 - Part 2: Impact sound insulation

To perform the above measurements, the laboratory of Daidalos Peutz is accredited by BELAC "The Belgian Accreditation Body"
 BELAC is a signatory of all existing MLAs (multilateral agreements) and MRAs (multilateral recognition agreements) of EA
 (European co-operation for Accreditation), ILAC (International Laboratory Accreditation Cooperation) and IAF
 (International Accreditation Forum).

In this way, reports and certificates issued by BELAC accredited bodies are internationally accredited.

Date and reference of the request:	22/12/2021	2021LAB-003
Date of receipt of the specimen (s):	3/02/2021	SONI900
Date of tests:	22/02/2021	
Date of preparation of the report:	22/02/2021	

This test report together with its annexes contains : 13 pages and must be multiplied only in its entirety.

Technical Manager,

Paul Mees

Laboratory Engineer,

Els Meulemans

NOISE LAB

REPORT Number **A-2021LAB-003-I900-44249_E**

MEASURING EQUIPMENT

Source signal

Brüel & Kjaer - 4292 : Omni Power Sound Source
 Brüel & Kjaer - 2716 : Power amplifier
 Norsonic Nor277 : Tapping machine conform ISO 10140-5 Annex E

Microphone and data acquisition system:

Brüel & Kjaer - 4189 : 1/2" free field microphone, 6Hz to 20kHz, prepolarized
 Brüel & Kjaer - ZC-0032 : 1/2" microphone preamplifier
 Brüel & Kjaer - 4231 : Sound calibrator 94&114dB SPL-1000Hz, Fulfils IEC 60942(2003)Class1
 Brüel & Kjaer - JP 1041 : dual 10-pole adaptor JP-1041
 Brüel & Kjaer - 2270 : Sound level meter - dual channel instrument (measuring both channels simultaneously)
 Conforms with IEC 61672-1 (2002-05) Class 1
 Brüel & Kjaer - 3923 : rotating microphone boom

One rotating microphone system in the receiving room

<i>Number of tapping machine positions:</i>	6
<i>Minimum 0,7m between the different source positions</i>	
<i>Distances to the board of the floor at least 0.5 m</i>	
<i>Random positions and orientation of the tapping machine.</i>	
<i>Number of microphone positions for each tapping machine position:</i>	3
<i>Microphone position with a rotating microphone</i>	
<i>Number of rotations:</i>	3
<i>Rotation speed:</i>	16 s/tr
<i>Minimum rotation time:</i>	30 s
<i>Just not a rotation angle <10 ° to the chamber surfaces</i>	

Data processing

Brüel & Kjaer - BZ-5503 : utility software for hand-held analyzers
 Brüel & Kjaer - BZ-7229 : dual-channel building acoustics software
 Brüel & Kjaer - 7830 :Qualifier Software for reporting results
 A computer with proprietary software

<i>Averaging Time per measurement:</i>	48 s
<i>Number of reverberation time measurements (with graphic control):</i>	27

Test chambers

Volume receiving room:	51,4 m ³
Reference floor area:	12,00 m ²
Surface test floor :	3,00 m ²

There are diffusers and absorption material applied in the receiving room.

Standard floor

The base floor used is a 140 mm thick solid reinforced concrete slab.
 According to ISO 10140-5 Annex C this is the "heavyweight standard floor".

NOISE LAB
REPORT Number A-2021LAB-003-I900-44249_E

STANDARD METHOD

The normalised impact sound pressure level L_n and the reduction of sound pressure level (improvement of impact sound insulation) ΔL were measured according to the standard NBN EN ISO 10140-3:2010. A detailed description of the test set up has been given in the figures of annex 1 of this report.

The tests were measured as follows:

- The test sample is mounted onto a heavyweight standard floor, in accordance with the descriptions in the standard NBN EN ISO 10140-1 and 10140-3.
- The standardized (see NBN EN ISO 10140-5:2010 Annex E) tapping machine is positioned in 3 or 4 positions on the test floor (depending on the sample). The impact sound pressure levels are measured in the receiving room below the test floor using a moving microphone. A one-third octave band analyser measured the averaged sound levels in the third octave bands from 100 to 5000 Hz. If required, the levels are corrected to account for the background noise. The individual measurements are then averaged energetically for each one-third octave band and converted with the reverberation time measurements to the normalized impact sound pressure level L_n for a receiving room having 10m² of equivalent sound absorption area.
- The normalized impact sound pressure level of the heavyweight standard floor $L_{n,0}$ is measured using the identical procedure.
- The normalized impact sound pressure level is calculated according to the following equation:

$$L_n = L_i + 10 \log (A/A_0) \quad [\text{dB}]$$

met	L_n	=	The normalized impact sound pressure level, expressed in dB (ref 20μPa)
	L_i	=	the energy average sound pressure level in a one-third octave band in the receiving room when the floor under test is excited by the standardized tapping machine
	A_0	=	the reference equivalent absorption area (= 10m ²)
	A	=	the measured equivalent absorption area

- The temperature, relative humidity and static pressure is also measured in the test rooms.
- The improvement ΔL of the impact sound insulation is calculated from the difference between the weighted impact sound levels of the bare floor without and with the floor covering:

$$\Delta L = L_{n,0} - L_n \quad [\text{dB}]$$

met	ΔL	=	The improvement of the impact sound insulation
	$L_{n,0}$	=	normalized impact sound pressure level of the bare floor
	L_n	=	normalized impact sound pressure level of the bare floor with floor covering

NOISE LAB
REPORT Number A-2021LAB-003-I900-44249_E

STANDARD METHOD

Single rating numbers

Evaluation according to EN ISO 717-2 defines single-number quantities, $L_{n,w}(C_i)$ for the impact sound insulation of floors and $\Delta L_w(C_{i,\Delta})$ for the impact sound reduction of floor coverings and floating floors from the results of measurements carried out in accordance with NBN EN ISO 10140-3. The values obtained in accordance with ISO 10140-3 are compared with reference values at the frequencies of measurement within the range 100Hz to 3150 Hz for measurements in one-third octave bands. The calculation of the single-value indicator can not be summarised in a few lines. See standard NBN EN ISO 717-2 for details.

$L_{n,w}$ = weighted normalized impact sound pressure level
 $L_{n,w}+C_i$ = weighted normalized impact sound pressure level corrected with the adaptation term C_i

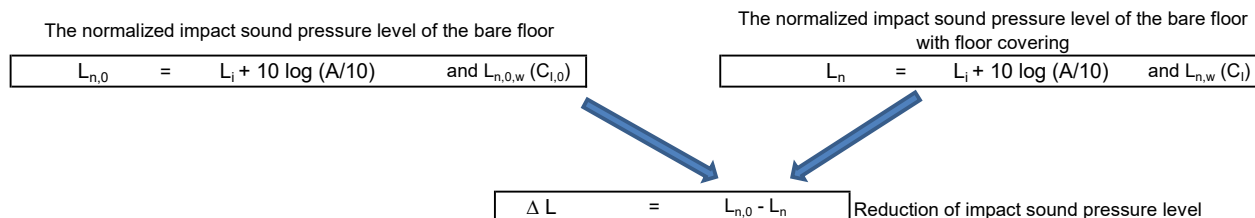
C_i = $L_{n,sum} - 15 - L_{n,w}$ With $L_{n,sum}$ the summation on an energetic basis for the one-third octave bands in the frequency range 100Hz to 2,5kHz

$$L_{n,sum} = 10 \log \sum_{i=1}^k 10^{\frac{L_i}{10}}$$

Calculations of the spectrum adaptation term may additionally be carried out for an enlarged frequency range.

The single-number quantities of impact sound insulation properties of floors, presented as $L_{n,w}(C_i)$

The single-number quantities of the weighted reduction in impact sound pressure level for floorcoverings, is presented as $\Delta L_w(C_{i,\Delta})$ and ΔL_{in}



To compare the measurement results obtained in different test laboratories, the normalized impact sound level L_n is referred to the reference floor defined in ISO 717-2 in the following way. The quantity is designated by the index "r" ("reference floor"): $L_{n,r}$

$$L_{n,r} = L_{n,r,0} - \Delta L \quad \text{and} \quad L_{n,r,w}(C_{i,r})$$

with $L_{n,r,0}$ is the defined normalized impact sound pressure level of the reference floor (see ISO 717-2 point 5.2)

$$\Delta L_w = L_{n,r,0,w} - L_{n,r,w} = 78 - L_{n,r,w} \quad \text{with} \quad C_{i,\Delta} = C_{i,r,0} - C_{i,r} = -11 - C_{i,r}$$

$$\Delta L_{in} = \Delta L_w + C_{i,\Delta}$$

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NOISE LAB
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SPECIAL MEASUREMENT CONDITIONS

/

ACCURACY

The accuracy of the impact sound insulation as calculated can be expressed in terms of repeatability (tests within one laboratory) and reproducibility (between various laboratories)

Repeatability [r]

When: - two tests are performed on identical test material - within a short period of time - by the same person or team - using the same instrumentation - under unchanged environmental conditions - the probability will be 95% that the difference between the two test results will be less than or equal to r

Reproducibility [R]

When: - two tests are performed on identical test material - in different laboratories - by different person(s) - under different environmental conditions - the probability will be 95% that the difference between the two test results will be less than or equal to R

The standard ISO 12999-1:2014 contains a statement on the expected reproducibility R, based on the results of various interlaboratory tests.

The standard deviation for the reduction in impact sound pressure level, ΔL_w , obtained under reproducibility conditions, σ_R , for the single number value, in accordance with ISO 717-2, from table 7 of standard ISO 12999-1:2014 is 1,1dB.

At present, there are no results available for impact sound insulation at reproducibility conditions. Indicated values are estimates.

The standard deviation for impact sound insulation, $L_{n,w}$, obtained under reproducibility conditions, σ_R , for the single number value, in accordance with ISO 717-2, from table 5 of standard ISO 12999-1:2014 is 1,5dB.

For $L_{n,w}$ is σ_R , from table 5 of standard ISO 12999-1:2014 estimated as 1,5dB

ENVIRONMENTAL CONDITIONS during the tests

Temperature :

Atmospheric pressure :

Relative humidity :

	<i>Source room</i>	<i>Receiving room</i>
T =	18,1 °C	18,3 °C
p =	1013,4 hPa	1013,7 hPa
h_r =	59,9 %	57,9 %

NOISE LAB
REPORT Number A-2021LAB-003-I900-44249_E

MEASUREMENT AND CALCULATION DETAILS

The results as presented here relate only to the tested items and laboratory conditions as described in this report.

The results of the measurements are presented on the next pages (6 till 9)

- on page 7 : the measurement results for the normalized impact sound level for the bare floor (the naked laboratory floor)
- on page 8 : the measurement results for the normalized impact sound level for the bare floor with floor covering, composition of the test element in annex 2
- on page 9 : the calculation of the reduction of impact sound pressure

The results are given at all frequencies of measurement, both in tabular form and in the form of a graph.

The next table present an overview of the measurements and calculations

f	$L_{n,0}$ bare floor	L_n bare floor + floor covering	ΔL $L_{n,0} - L_n$	$L_{n,r,0}$ reference floor according ISO 717-2 / 5.2	$L_{n,r}$ reference floor + floor covering $L_{n,r,0} - \Delta L$	
(Hz)	(dB)	(dB)	(dB)	(dB)	(dB)	
50	44,5	42,2	2,3			
63	59,1	57,7	1,4			
80	67,6	66,4	1,2			
100	63,0	61,0	2,0	67,0	65,0	
125	63,5	61,0	2,5	67,5	65,0	
160	64,9	62,1	2,8	68,0	65,2	
200	65,3	61,1	4,2	68,5	64,3	
250	65,8	59,4	6,4	69,0	62,6	
315	65,7	58,8	6,9	69,5	62,6	
400	66,4	55,4	11,0	70,0	59,0	
500	66,5	48,9	17,6	70,5	52,9	
630	68,1	44,2	23,9	71,0	47,1	
800	69,6	41,4	28,2	71,5	43,3	
1000	70,4	38,3	32,1	72,0	39,9	
1250	70,2	34,7	35,5	72,0	36,5	
1600	70,4	28,2	42,2	72,0	29,8	
2000	69,7	22,8	46,9	72,0	25,1	
2500	69,7	16,9	52,8	72,0	19,2	
3150	68,0	9,6	58,4	72,0	13,6	
4000	64,5	12,9	51,6	/	/	
5000	61,1	10,4	50,7	/	/	
ISO 717-2	$L_{n,0,w}$	$L_{n,w}$		$L_{n,r,0,w}$	$L_{n,r,w}$	$\Delta L_w = 78 - L_{n,r,w}$
	76	54		78	57	21 dB
	$C_{i,0}$	C_i		$C_{i,r,0}$	$C_{i,r}$	$C_{i,\Delta} = C_{i,r,0} - C_{i,r}$
	-11	0		-11	0	-11 dB
$\Delta L_{in} = \Delta L_w + C_{i,\Delta}$						
10 dB						

NOISE LAB
REPORT Number A-2021LAB-003-I900-44249_E

$L_{n,0}$

NORMALIZED IMPACT SOUND PRESSURE LEVEL (of standard floor) in accordance with ISO 10140-3:2010

Client: CENTEXBEL

Date of test: 18/02/2021

Description of the test setup:

The base floor used is a 140 mm thick solid reinforced concrete slab.
 According to ISO 10140-5 Annex C this is the "heavyweight standard floor".

Receiving room volume V: 51,4 m³

Reference floor area : 12,0 m²

Tested floor area : 3,0 m²

Signal : Standard tapping machine with steel-headed hammers.

reference values (according ISO 717-2)

shifted reference values (according ISO 717-2)

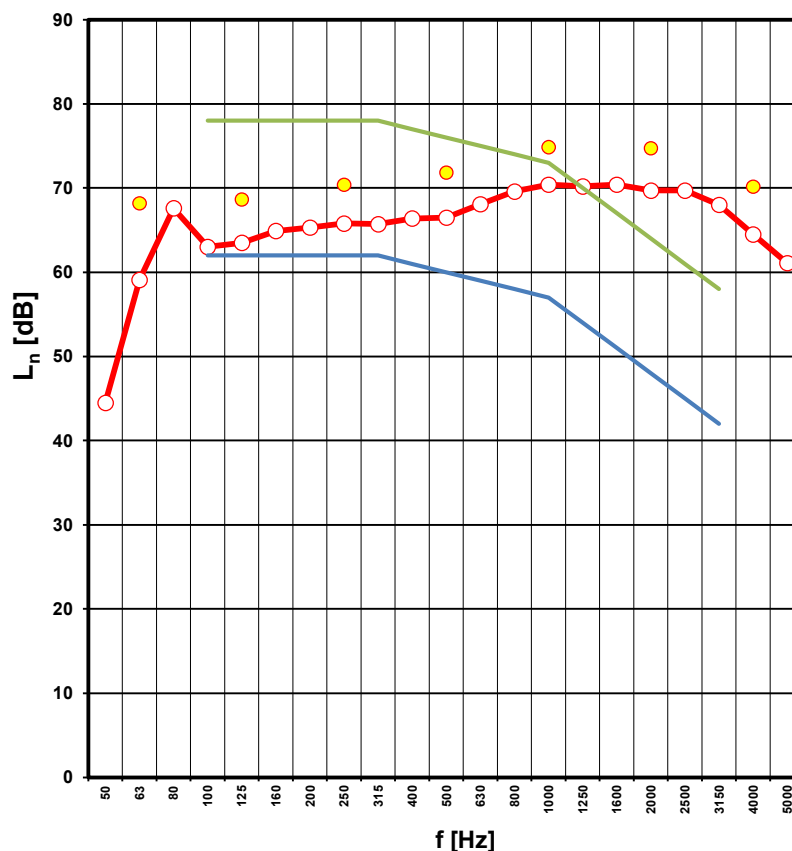
f	$L_{n,0}$	(*)
(Hz)	(dB)	
1/3 octave bands : —		
50	44,5	
63	59,1	
80	67,6	
100	63,0	
125	63,5	
160	64,9	
200	65,3	
250	65,8	
315	65,7	
400	66,4	
500	66,5	
630	68,1	
800	69,6	
1000	70,4	
1250	70,2	
1600	70,4	
2000	69,7	
2500	69,7	
3150	68,0	
4000	64,5	
5000	61,1	

octave bands : ●	
63	68,2
125	68,6
250	70,4
500	71,8
1000	74,9
2000	74,7
4000	70,2

B: $L_n = <$ value shown

(*) b : background noise correction used

B : Maximum background noise correction used



Rating according to ISO 717-2

$L_{n,0,w} (C_{i,0}) = 76 (-11)$ dB

Evaluation based on laboratory measurement results obtained in one-third-octave bands by an engineering method

No. of test report: SONI893
 Date: 18/02/2021

Name of test institute: Daidalos Peutz
 Signature: Paul Mees

NOISE LAB
REPORT Number A-2021LAB-003-I900-44249_E

L_n

NORMALIZED IMPACT SOUND PRESSURE LEVEL in accordance with ISO 10140-3:2010

Client: CENTEXBEL

Date of test: 22/02/2021

Description of the test setup:

20 mm Rubber tiles T2102135
 140 mm heavyweight standard floor = solid reinforced concrete slab

Receiving room volume V: 51,4 m³

Reference floor area : 12,0 m²

Tested floor area : 3,0 m²

Signal : Standard tapping machine with steel-headed hammers.

reference values (according ISO 717-2)

shifted reference values (according ISO 717-2)

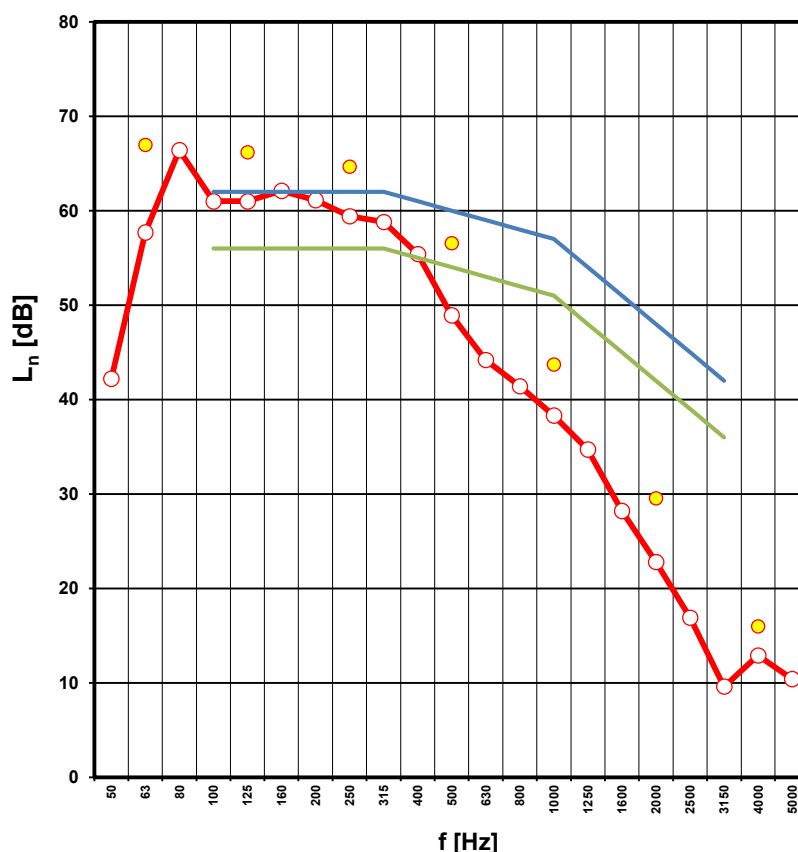
f	L _n	(*)
(Hz)	(dB)	
1/3 octave bands : —		
50	42,2	
63	57,7	
80	66,4	
100	61,0	
125	61,0	
160	62,1	
200	61,1	
250	59,4	
315	58,8	
400	55,4	
500	48,9	
630	44,2	
800	41,4	
1000	38,3	
1250	34,7	
1600	28,2	
2000	22,8	
2500	16,9	
3150	9,6	B
4000	12,9	B
5000	10,4	B

octave bands : ●	
63	67,0
125	66,2
250	64,7
500	56,5
1000	43,7
2000	29,5
4000	16,0

B: L_n < value shown

(*) b : background noise correction used

B : Maximum background noise correction used



Rating according to ISO 717-2

L_{n,w} (C_i) = 54 (0) dB

Evaluation based on laboratory measurement results obtained in one-third-octave bands by an engineering method

No. of test report: SONI900
 Date: 22/02/2021

Name of test institute: Daidalos Peutz
 Signature: Paul Mees

NOISE LAB
REPORT Number A-2021LAB-003-I900-44249_E



REDUCTION OF IMPACT SOUND PRESSURE LEVEL BY FLOOR COVERINGS in accordance with ISO 10140-3

Client: CENTEXBEL

Date of test: 22/02/2021

Description of the test setup:

20 mm Rubber tiles T2102135
 140 mm heavyweight standard floor = solid reinforced concrete slab

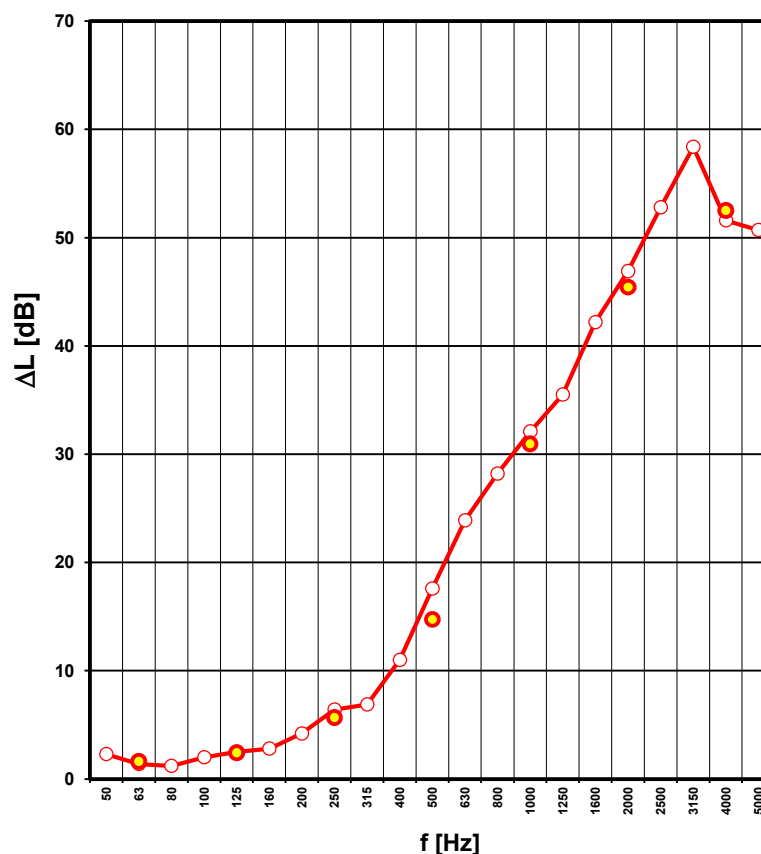
Receiving room volume V: 51,4 m³

Reference floor area : 12,0 m²

Tested floor area : 3,0 m²

Signal : Standard tapping machine with steel-headed hammers.

f (Hz)	ΔL = $L_{n,0} - L_n$ (dB)
1/3 octave bands : —	
50	2,3
63	1,4
80	1,2
100	2,0
125	2,5
160	2,8
200	4,2
250	6,4
315	6,9
400	11,0
500	17,6
630	23,9
800	28,2
1000	32,1
1250	35,5
1600	42,2
2000	46,9
2500	52,8
3150	58,4
4000	51,6
5000	50,7
octave bands : ●	
63	1,6
125	2,4
250	5,7
500	14,7
1000	30,9
2000	45,4
4000	52,5



Rating according to ISO 717-2

$\Delta L_w (C_{1,\Delta}) = 21 \quad (-11) \quad \text{dB}$

$\Delta L_{in} = 10 \quad \text{dB}$

Evaluation based on laboratory measurement results obtained in one-third-octave bands by an engineering method

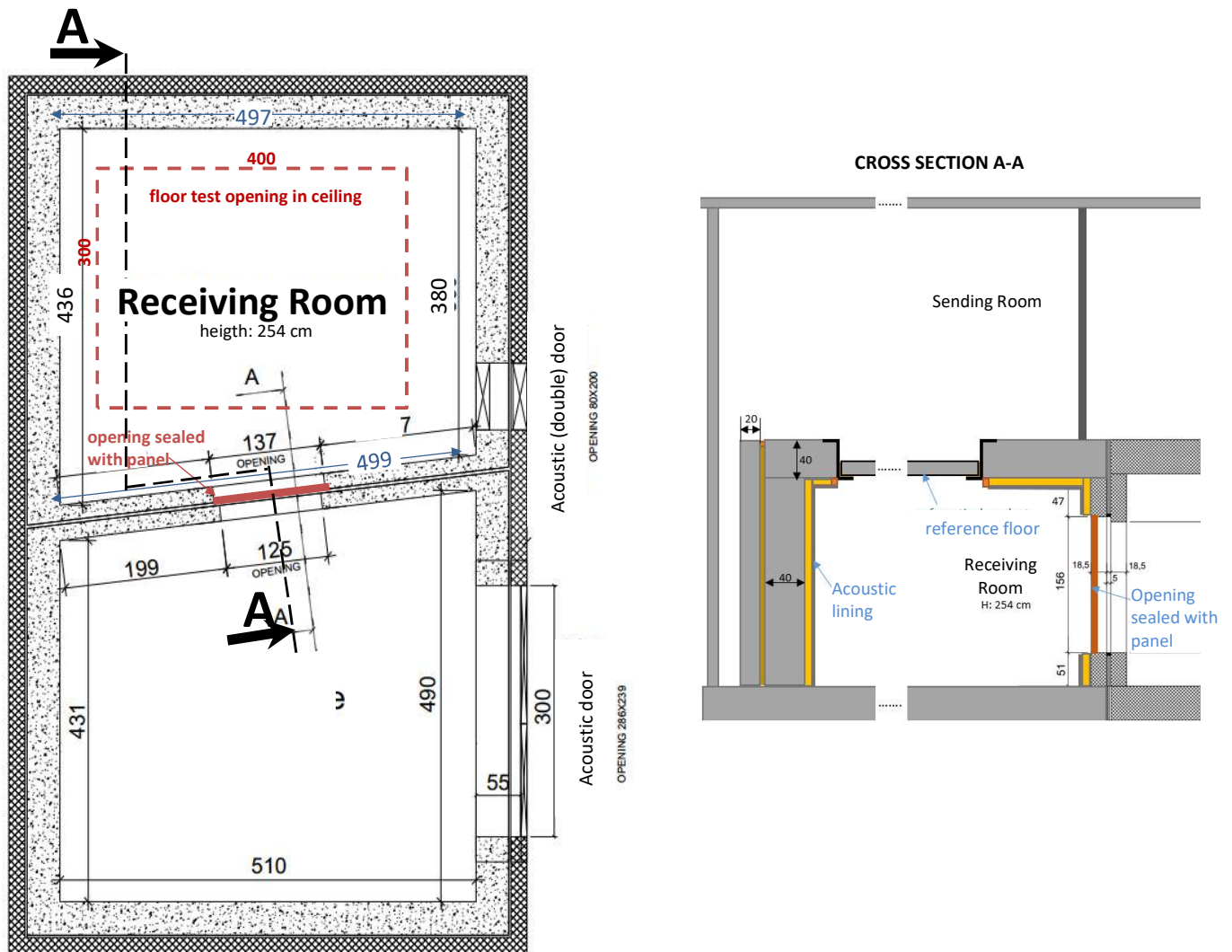
No. of test report: SONI900
 Date: 22/02/2021

Name of test institute: Daidalos Peutz
 Signature: Paul Mees

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REPORT Number A-2021LAB-003-I900-44249_E

ANNEX 1 : Sound insulation test facilities

The test rooms meet the requirements of ISO 10140-5
 Both rooms are isolated for vibrations by using a so called room-in-room construction.



NOISE LAB
REPORT Number A-2021LAB-003-I900-44249_E

ANNEX 2: Description test items by manufacturer

*The test sample description given by manufacturer is checked visually as good as possible by the laboratory.
 The correspondence between the test element and the commercialized product is the sole responsibility of the manufacturer*

Description of the test element as a layered structure

	Thickness (mm)	ρ (kg/m ³)	m'' (kg/m ²)	Description of the layer
1	20			Rubber tiles T2102135
2	140	2300	322	heavyweight standard floor = solid reinforced concrete slab
3				
4				
5				
6				
7				
8				
9				
10				

Rubber tiles T2102135

Rubber tiles

the top side completely flat and a waffled pattern on the base
 thickness : 20 mm (as verified on the samples)
 dimensions : 1000mmx1000mm
 weight : 18,9 kg (verified on one sample)



photo: front side



photo: back side



photo : cross section

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ANNEX 3: Technical sheet

*The test sample description given by manufacturer is checked visually as good as possible by the laboratory.
The correspondence between the test element and the commercialized product is the sole responsibility of the manufacturer*

On request at supplier

NOISE LAB
REPORT Number A-2021LAB-003-I900-44249_E

ANNEX 4: photographs of the test element or the test arrangement

Description of the assembly or drawing or photo

The rubber tiles were classified as a 'category I' material, as mentioned in part H2.2.1 of the standard ISO10140-1.
This category includes flexible coverings.
One sample large enough to support the whole tapping machine was loosely laid on three different positions on the concrete reference floor.



photo : total test setup



photo: detail with the tapping machine on one rubber tile