

TEST REPORT No. 362658

Customer

RODECA GmbH**Freiherr-vom-Stein-Straße, 165 - D-45473 MÜLHEIM AN DER RUHR - Germany**

Item*

panel named "2540-4"

Activity

**laboratory measurements of the airborne sound
insulation in accordance with standards
UNI EN ISO 10140-2:2010 and UNI EN ISO 717-1:2013**

Results

 $R_w (C, C_{tr}) = 20 (-2, -2) \text{ dB}$

Order:

80672

Item origin:

sampled and supplied by the customer

Identification of item received:

2019/1496/C dated 17 June 2019

Activity date:

19 June 2019

Activity site:

Istituto Giordano S.p.A. - Strada Erbosa Uno, 78 -
47043 Gatteo (FC) - Italy

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The results relate only to the item examined, as received, and are valid only in the conditions in which the activity was carried out.

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Geom. Omar Nanni

Head of Acoustics and Vibrations Laboratory:

Dott. Ing. Roberto Baruffa

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Reviewer: Geom. Omar Nanni

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(*) according to that stated by the customer.

Bellaria-Igea Marina - Italy, 28 June 2019

Chief Executive Officer



LAB N° 0021 L

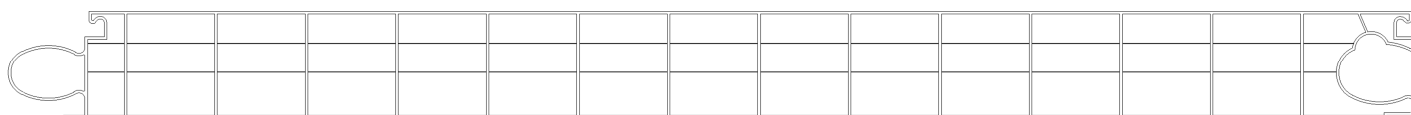
Description of item*

The item under examination consists of No. 3 modular panels, jointed together, having the physical characteristics stated in the following table.

Number of walls	4
Measured width of item	1230 mm
Measured height of item	1480 mm
Measured thickness of item	40 mm
Surface of item (1230 mm × 1480 mm)	1,82 m ²
Measured width of test opening	1250 mm
Measured height of test opening	1500 mm
Effective acoustic surface (1250 mm × 1500 mm)	1,88 m ²
Measured weight	7,35 kg
Measured mass per unit area (7,35 kg / 1,82 m²)	4,05 kg/m ²

More specifically, the item consists of 500 mm wide translucent polycarbonate panel with tongue and groove connection along their longitudinal edges.

SCHEMATIC DRAWINGS OF ITEM (SUPPLIED BY THE CUSTOMER)



PC 2540-4

(*) according to that stated by the customer, apart from characteristics specifically stated to be measurements. Istituto Giordano declines all responsibility for the information and data provided by the customer that may influence the results.



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Photograph of item, receiving room side

Normative references

Standard	Title
UNI EN ISO 10140-2:2010	Acustica - Misurazione in laboratorio dell'isolamento acustico di edifici e di elementi di edificio - Parte 2: Misurazione dell'isolamento acustico per via aerea (<i>Acoustics - Laboratory measurement of sound insulation of building elements - Part 2: Measurement of airborne sound insulation</i>)
UNI EN ISO 717-1:2013	Acustica - Valutazione dell'isolamento acustico in edifici e di elementi di edificio - Parte 1: Isolamento acustico per via aerea (<i>Acoustics - Rating of sound insulation in buildings and of building elements - Part 1: Airborne sound insulation</i>)



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Apparatus

Description
Behringer "EP2000" 2000 W power amplifier
Behringer "DEQ2496" digital 1/3-octave equaliser
portable dodecahedron speaker with line-of-sight path, length 1,6 m and 15° tilt, positioned in the source room
fixed dodecahedron speaker positioned in the receiving room
No. 2 rotating microphone booms with sweep radius 1 m and 30° tilt
No. 2 G.R.A.S. "46AR" 1/2" microphones, with preamplifier
Sinus "Soundbook" 4-channel real-time analyser
Larson Davis "CAL200" acoustic calibrator for microphone calibration
No. 2 Delta Ohm "HD206-1" thermo-hygrometers
Brüel & Kjær "UZ001" barometer
Kern "VB 150 K 50LM" electronic platform scale
Sola "Tri-Matic 5 m/19 mm" metric tape measure
Bosch "DLE 50 Professional" laser range finder

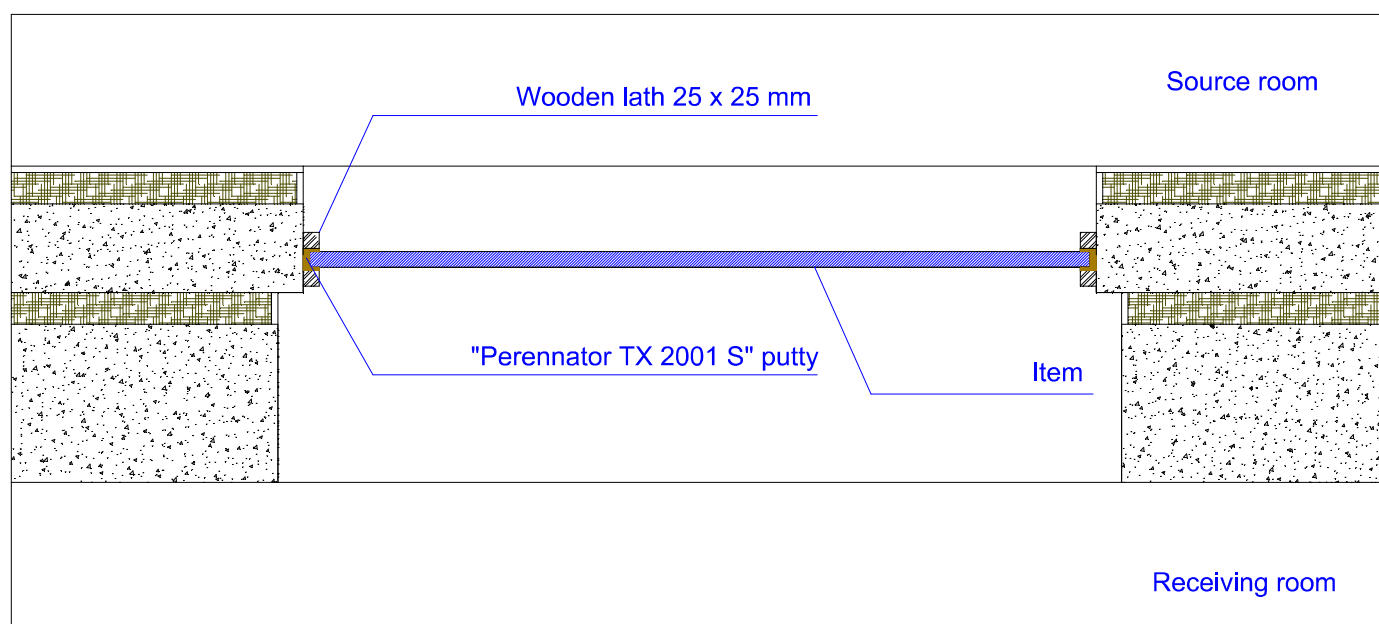
Method

The test was carried out using detailed internal procedure PP017 in its current revision at testing date.

The test environment consists of:

- "source room", containing the noise source and with volume " V_s ";
- "receiving room", characterised acoustically by the equivalent sound absorption area and with volume " V ".

The item, after being conditioned for at least 24 h inside measurement environment, was installed in the test opening between the two rooms, as shown in the following drawing.



Close-up of item positioning in the opening between the two rooms of the test environment



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In the 1/3-octave frequency range 100 Hz to 5000 Hz, the sound reduction index “R” was calculated using the following equation:

$$R = L_1 - L_2 + 10 \cdot \log \frac{S}{A}$$

where: L_1 = average sound pressure level in the source room, in dB, generated by pink noise;

L_2 = average sound pressure level in the receiving room, in dB, adjusted for background noise and calculated using the following equation:

$$L_2 = 10 \cdot \log \left[10^{\frac{L_{2b}}{10}} - 10^{\frac{L_b}{10}} \right]$$

where: L_{2b} = combined average sound pressure level of signal and background noise, in dB;

L_b = average background noise level, in dB;

if the difference between the levels [$L_{2b} - L_b$] is less than 6 dB, a maximum correction of 1,3 dB is applied and the corresponding value of “R” shall be considered a measurement limit value;

S = effective measuring surface of test item, in m^2 ;

A = equivalent sound absorption area in the receiving room, in m^2 , in turn calculated using the following equation:

$$A = \frac{0,16 \cdot V}{T}$$

where: V = receiving room volume, in m^3 ;

T = reverberation time, in s.

In accordance with the method specified by standard UNI EN ISO 717-1 were calculated:

- single-number quantity “ R_w ” of the sound reduction index “R”, in dB, equal to the value of the reference curve at 500 Hz;
- adaptation term “C” to be added to “ R_w ” with source spectrum for A-weighted pink noise;
- adaptation term “ C_{tr} ” to be added to “ R_w ” with source spectrum for A-weighted traffic noise.

The test was carried out immediately after completion of item preparation.

Uncertainty of measurement

Uncertainty of measurement was determined in accordance with guide JCGM 100:2008 dated September 2008 “Evaluation of measurement data - Guide to the expression of uncertainty in measurement”, by calculating for each frequency the number of effective degrees of freedom “ ν_{eff} ” and expanded uncertainty “U” of the sound reduction index “R”, using a coverage factor “k” representing a confidence level of 95 %. Uncertainty of measurement of the single-number quantity “ $U(R_w)$ ” is calculated with a coverage factor $k = 2$ representing a confidence level of 95 % using the calculation procedure stated in the Annex B standard UNI EN ISO 12999-1:2014 dated 26/06/2014 “Acustica - Determinazione e applicazione dell’incertezza di misurazione nell’acustica in edilizia - Parte 1: Isolamento acustico” (“Acoustics - Determination and application of measurement uncertainties in building acoustics - Part 1: Sound insulation”).



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Environmental conditions

	Source room	Receiving room
Atmospheric pressure "p"	(101500 ± 50) Pa	(101500 ± 50) Pa
Average temperature "t"	(28 ± 1) °C	(27 ± 1) °C
Average relative humidity "RH"	(57 ± 5) %	(59 ± 5) %

Results

Frequency [Hz]	R [dB]	R _{rif} [dB]	v _{eff}	k	U [dB]
100	14,1	1,0	7	2,36	2,6
125	14,2	4,0	8	2,31	2,0
160	14,2	7,0	12	2,00	1,0
200	14,6	10,0	11	2,00	0,8
250	17,1	13,0	12	2,00	0,8
315	17,7	16,0	10	2,23	0,8
400	19,4	19,0	18	2,00	0,5
500	19,3	20,0	19	2,00	0,5
630	20,0	21,0	14	2,00	0,5
800	20,6	22,0	19	2,00	0,5
1000	19,6	23,0	26	2,00	0,4
1250	13,8	24,0	19	2,00	0,4
1600	14,6	24,0	16	2,00	0,4
2000	27,4	24,0	21	2,00	0,4
2500	32,5	24,0	15	2,00	0,4
3150	29,7	24,0	15	2,00	0,4
4000	35,8	//	15	2,00	0,4
5000	38,0	//	16	2,00	0,4

Note: evaluation based on laboratory measurement results obtained by an engineering method.



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Item effective measuring surface:
1,88 m²

Volume of test rooms:

$V_s = 98,6 \text{ m}^3$

$V = 86,1 \text{ m}^3$

Weighted sound reduction index and adaptation terms:

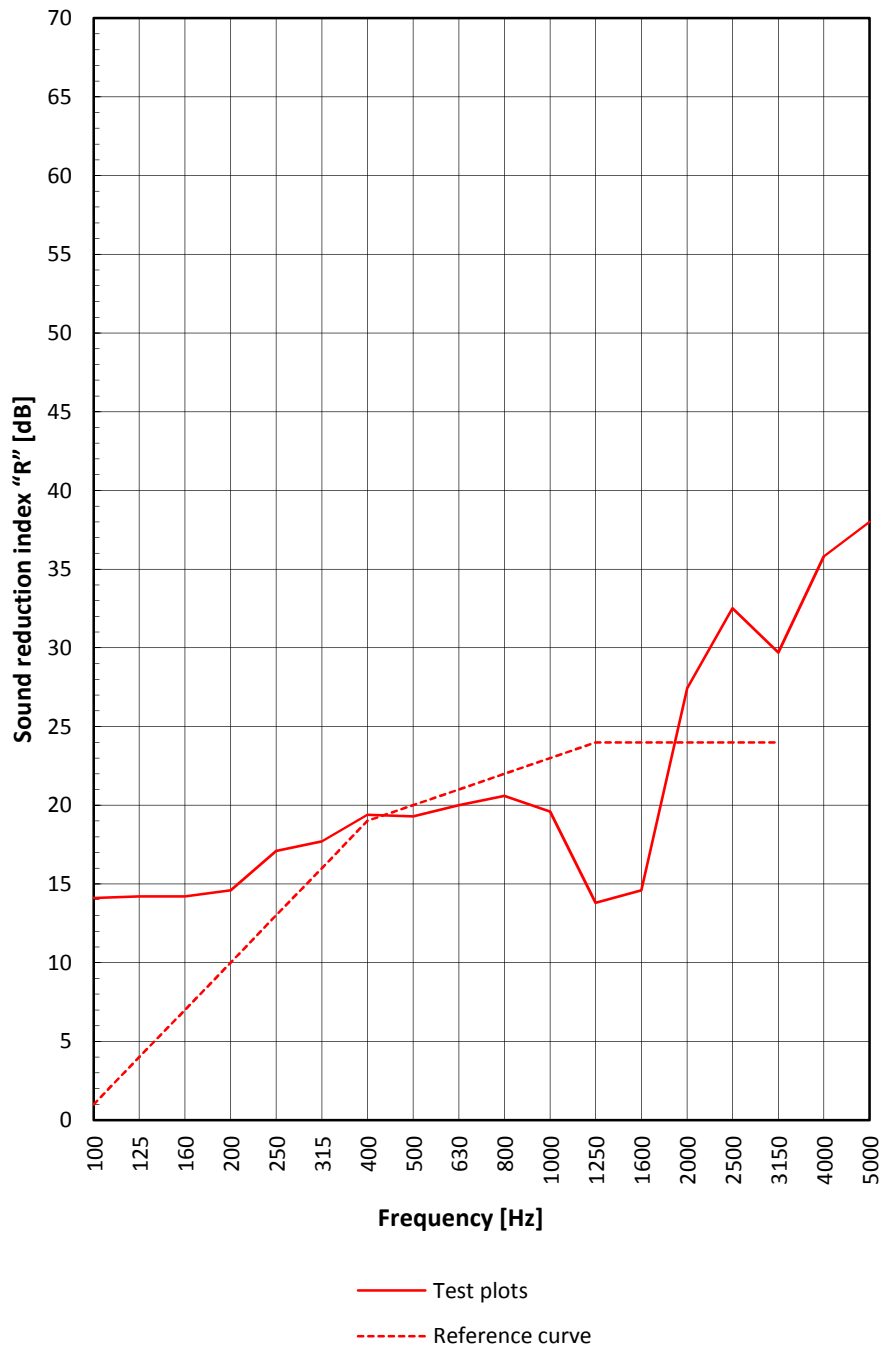
$R_w (C, C_{tr}) = 20 (-2, -2) \text{ dB}^*$

(*) weighted sound reduction index " R_w " measured in steps of 0,1 dB and its uncertainty of measurement " $U(R_w)$ ":

$R_w = (20,9 \pm 0,5) \text{ dB}$

$R_w + C = (18,4 \pm 0,5) \text{ dB}$

$R_w + C_{tr} = (17,6 \pm 0,6) \text{ dB}$



Chief Test Technician
(Geom. Omar Nanni)

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