Audiotec
INGENIERÍA ACÚSTICA

LABORATORY
ACOUSTIC TEST REPORT

ABSORBRELLA

ISINAC ACOUSTIC WORLD, S.L
C/ López de Neira, 3, Piso 3, puerta 301
36202 Vigo (Pontevedra)

ABSORBRELLA
Acoustic umbrella

Ref: CAM19030021/REV

Date of issue:
March 14, 2019

AUDIOTEC INGENIERÍA ACÚSTICA S.A.
CENTRO TECNOLÓGICO DE ACÚSTICA
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TEST REPORT

TEST LOCATION	**STANDARDIZED TEST ROOMS IN AUDIOTEC. C/JUANELO TURRIANO, 4. PARQUE TECNOLÓGICO DE BOECILLO. BOECILLO. (VALLADOLID) ESPAÑA**
TEST	Measurement of sound absorption of an acoustic material in a reverberation room.
PRODUCT	**ABSORBRELLA acoustic umbrella, dimensions 2500 x 2500 mm (unfolded), made with sound absorbing material in a sheet distribution, hanging in the inner side of the umbrella panel.** ***Notes: Unfolded umbrella on a pole, at a 2 m height from the floor to the lowest part of the canopy.***
TEST METHOD	**UNE EN ISO 354:2004. Acoustics. Measurement of sound absorption in a reverberation room.**
CUSTOMER	**ISINAC ACOUSTIC WORLD, S.L.**
TEST DATE :	**March 1, 2019**

Reviewed

Signed P.P.

Firmado digitalmente por ARENAZ GOMBAU ANGEL MARIA - 11954820H
Nombre de reconocimiento (DN): c=ES, serialNumber=IDCES-11954820H, givenName=ANGEL MARIA, sn=ARENAZ GOMBAU, cn=ARENAZ GOMBAU ANGEL MARIA - 11954820H

Fdo.: Alvaro Ramos Roncero
Responsable del Laboratorio

Technician

Signed P.P.

Firmado digitalmente por MERILLAS FERNANDEZ MARCOS - 44915713W
Nombre de reconocimiento (DN): c=ES, serialNumber=IDCES-44915713W, givenName=MARCOS, sn=MERILLAS FERNANDEZ, cn=MERILLAS FERNANDEZ MARCOS - 44915713W
Fecha: 2022.03.23 08:54:28 +01'00'

Fdo.: Daniel Bravo Arranz
Técnico del Laboratorio

CONTENT

1.- TEST OBJECT

This report has the object of analyzing sound absorption by obtaining the sound absorption coefficient, α_s, and the weighted sound absorption coefficient, α_w, of a given configuration of objects, and the equivalent sound absorption area per object, **Aobj**, measured in a reverberation room.

Tested sample features were the following:

- **ABSORBRELLA acoustic umbrella**, dimensions 2500 x 2500 mm (unfolded), made with sound absorbing material in a sheet distribution, hanging in the inner side of the umbrella panel.
  Notes: Unfolded umbrella on a pole, at a 2 m height from the floor to the bottom side of the canopy.

This test has been carried out in AUDIOTEC's standardized reverberation room in Boecillo Technology Park (Valladolid).

The test was performed with the product in the following configuration:

- One umbrella configuration, unfolded on a pole, at a 2 m height from the floor (to the lowest part of the umbrella), taking in to account as surface the projection of the umbrella on the floor.

2.- TEST PROCEDURE.

2.1- Procedures and standards used.

The test has been carried out taking into account the following laboratory standards and procedures:

- *UNE-EN ISO 354:2004 (Acoustics. Measurement of sound absorption in a reverberation room.*
- *UNE EN ISO 11654:1998 (Acoustics. Acoustic absorbers for use in buildings. Rating of sound absorption).*
- *Measurement procedure and calculations presented in specific procedure PE-27 of AUDIOTEC's Acoustics Laboratory.*

2.2- Methodology and test parameters

Inside the reverberation room, two source positions were chosen. These positions were placed separated more than 3 m from each other. The source has an omnidirectional radiation pattern.

For each source position, 6 microphone positions were chosen, distributed inside the room, at least 1.5 m apart from each other, 1 m from the walls and 2 m from the sound source. For each microphone position, three measurements of the decay of the sound pressure level were made and reverberation time resulting from the average of the three decays was registered in each frequency band.

Wide band pink noise was generated with the sound source, at a level at least 45 dB over the background level that was previously measured, in each frequency band inside the evaluated frequency range, and with a sound spectrum such the differences in the sound pressure levels resulting inside the room were smaller than 6 dB between adjacent third octave bands. Interrupted noise method was used.

In each microphone position, reverberation time, TR20, was measured, in the third octave bands comprehended between 100 and 5000 Hz.

This operating method was used both for T1 (empty room) and T2 (sample inside the room) measurements.

T1 was measured with an empty room, with no sample installed.
T2 was measured once the sample was installed inside the reverberation room, with the pole standing on the floor, in the center area of the room. The umbrella was unfolded and standing at a 2 m height from the floor (to the lowest part of the canopy). The projected surface of the umbrella on the floor was 6,25 m^2.

Note: The installation and test setup are described in paragraph 2.4 of this report.

In every moment corrections for sound absorption change in the air due to meteorological conditions variations were applied during T1 and T2 measurements. For this purpose, air sound absorption coefficient was obtained following ISO 9613-1 (Acoustics). Attenuation of sound during propagation outdoors – Part 1: Calculation of the absorption of sound by the atmosphere).

2.3.- Instrumentation used

The instrumentation used for this test was:

- Brüel&KjaerSound source type 4292, serial number 004007.
- Analyzer Brüel&Kjaer type 2250, class 1, serial number 3011733, previously verified.
- Equalizer dbx, model 131, serial number 12000119619.
- B&K Sound calibrator type 4231, class 1, serial number 2136530.
- BARIGO Thermoanemometer, modelnum. 525.

Notes: Measurement and calibration equipment have in force the corresponding periodic verification cerficate which certificates the compliance of the "Orden Ministerial ITC/2845/2007", from September, 25, which moderates metrological control by the State of measurement instruments meant to audible sound measurement and acoustic calibrators (B.O.E. nº 237 del miércoles 3 de octubre de 2007).

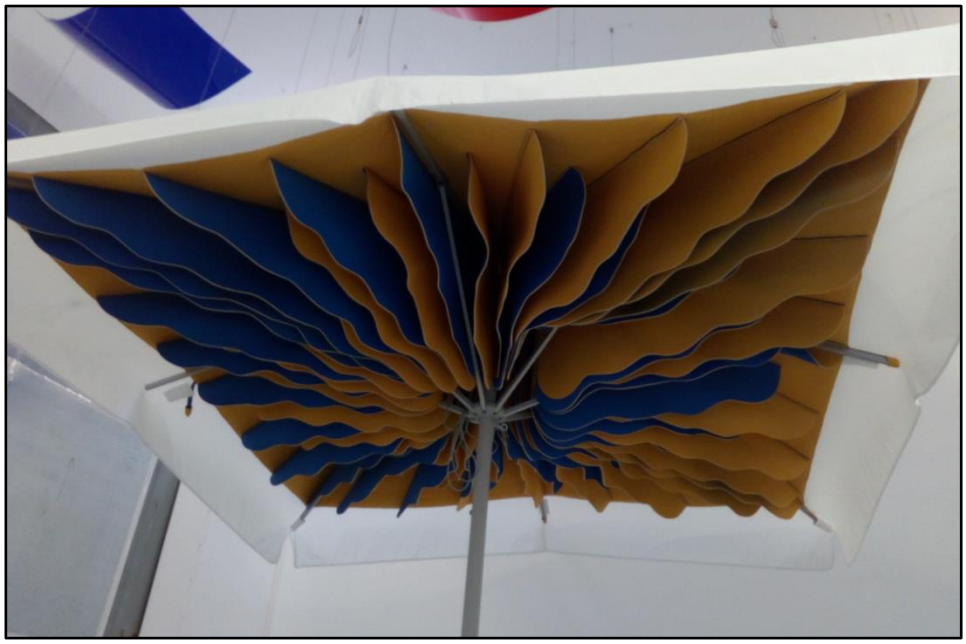
2.4.- Characteristics, description and dimensions of the sample and the room.

- **Tested sample description:**

  The tested sample was a unitary absorbent that consisted in one acoustic umbrella **ABSORBRELLA** with dimensions 2500 x 2500 mm (unfolded umbrella). The inner side of the umbrella was made with sound absorbing material, installed in sheets so it had a greater absorbing surface.

  The sample consisted of only one unfolded umbrella.

  Next, a picture of the sample is shown:



- **Sample setup in the test room:**

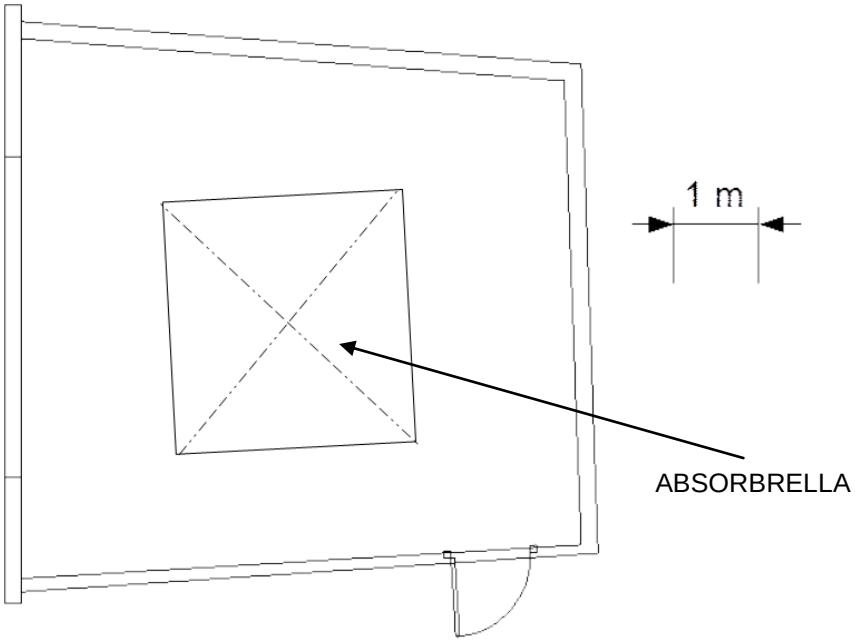
  The tested sample was a unitary absorbent, in this case a ABSORBRELLA umbrella, placed in the center area of the room, standing on the floor and open on its pole, at a 2 m height from the floor (to the lowest part of the canopy), the same way it is installed in practice.

  The distance from any part of the umbrella to any room surface besides the floor on which it is placed, was at least one meter.

The test setup is shown in the next picture:

The umbrella surface projection on the floor was 2500 x 2500 mm, being 6,25 m^2.

Next, a plan view of the sample position in the room is shown:



Plan view showing the sample position in the test room

- **Test room features:**

Standardized reverberation room has the shape of an irregular 6-faced prism with no parallel sides between them, and it has a 202.12 m^3 volume.

The reverberation room has eleven fixed diffusers, slightly curved, suspended from the ceiling in order to obtain the wanted diffusion inside the room.

These diffusers are made of methacrylate sheets and have dimensions of 1 x 1.60 m and 0.80 x 1.20 m, and are distributed in the room, randomly oriented.

Total surface of the room (walls, floor and ceiling), St, is 211.1 m^2.

Temperature in the room during T1 measurements was 17,4º C at the beginning and 17,6º C at the end and relative humidity was 49,7 % at the beginning and 49,9 % at the end.

Temperature in the room during T2 measurements was 18º C at the beginning and 18º C at the end and relative humidity was 50,3 % at the beginning and 49,9 % at the end.

2.5.- Test method deviations

Due to the size of the sample, and being a unitary absorbent, the requirement of making the test in three different positions of the sample with a distance of 2 m between them and having at least 1 m to the room surfaces cannot be met.

2.6.- Pictures during installation and test






3.- RESULTS OF REVERBERATION TIME AND SOUND ABSORPTION COEFFICIENT FOR A GIVEN CONFIGURATION OF OBJECTS AND EQUIVALENT SOUND ABSORPTION AREA PER OBJECT

Next, for each specific configuration of seats (*occupied seats* first and *empty seats* second) three pages are shown with the results obtained in the tests.

The first page contains a chart showing the average reverberation time (with sample, T2 and empty, T1) and the average sound absorption coefficient, α_s, all of it in third octave bands. It also shows a graph comparing T1 and T2.

In the second page there is a chart and a graph of the sound absorption coefficient, α_s, in third octave bands

The third page presents a graph and a chart of the sound absorption coefficient calculated in octave bands, α_p, as well as a global value of the weighted sound absorption coefficient, α_w, calculated according to the standartd UNE EN ISO 11654:1998 together with its shape indicator (if there were such) and the sound absorption class of the absorber according to chart B.1 of Annex B of the same standard.

In addition, in a fourth page, a chart is displayed containing the values, in third octave bands, of the **equivalent sound absorption area per object, A_{obj}**, along with its graphic representation.

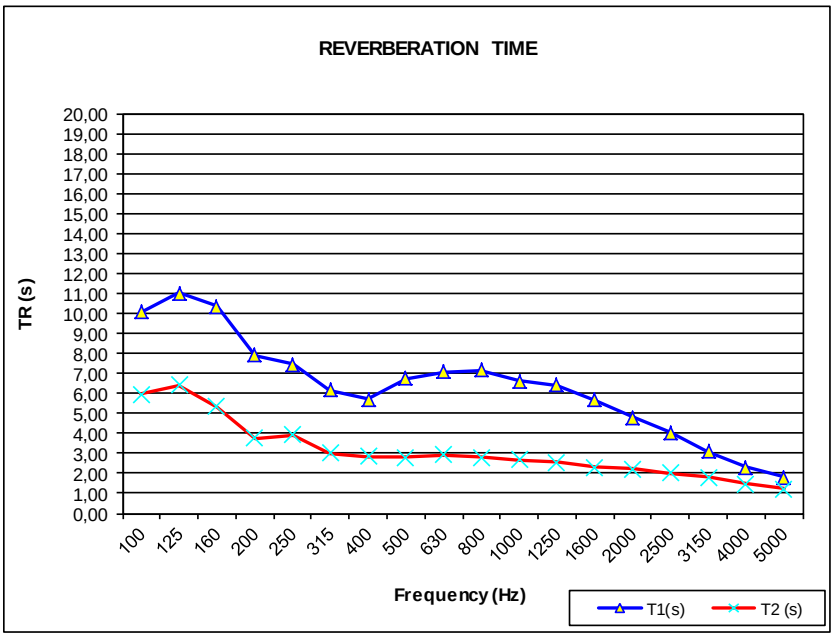
Notes:

- The results of this test only concern the objects presented for testing and at the time and conditions in which the measurements were made.
- Measurement uncertainty is available to all customers in the AUDIOTEC Acoustics Laboratory.
- This report should not be reproduced by any means unless it is done entirely and with the authorization of the Acoustics Laboratory of AUDIOTEC S.A.

Test location: AUDIOTEC standardized reverberation room, placed in C/ Juanelo Turriano, nº 4, Parque Tecnológico de Boecillo,Valladolid, España.
Test: Measurement of sound absorption of an acoustic material in a reverberation room. Absorption coefficient for a given configuration of objects.
Customer: ISINAC ACOUSTIC WORLD, S.L **Test date:** 01 de marzo de 2019.
Sample identification: ABSORBRELLA acoustic umbrella, dimensions 2500 x 2500 mm (unfolded), made with sound absorbing material in a sheet distribution, hanging in the inner side o the umbrella panel. *Notes: Unfolded umbrella on a pole, at a 2 m height from the floor to the lowest part of the canopy*.

Sample surface: 6,25 m². **Room volume:** 202,12 m³. **Standard:** UNE-EN ISO 354:2004.

Freq(Hz)	T1(s)	T2 (s)	A_1 (m^2)	A_2 (m^2)	A_T (m^2)	α_s
100	10,06	5,94	3,2	5,4	2,2	0,36
125	11,01	6,41	2,9	5,0	2,1	0,34
160	10,36	5,33	3,0	6,0	3,0	0,48
200	7,91	3,75	4,0	8,6	4,6	0,73
250	7,43	3,92	4,2	8,1	3,9	0,63
315	6,17	2,99	5,0	10,6	5,6	0,90
400	5,71	2,83	5,4	11,2	5,8	0,93
500	6,73	2,82	4,4	11,1	6,7	1,08
630	7,08	2,91	4,1	10,7	6,6	1,06
800	7,14	2,78	3,9	11,1	7,2	1,14
1000	6,63	2,66	4,1	11,5	7,3	1,17
1250	6,43	2,57	4,1	11,7	7,6	1,22
1600	5,65	2,31	4,4	12,8	8,3	1,34
2000	4,80	2,23	4,9	12,8	7,9	1,26
2500	4,05	2,02	5,4	13,6	8,2	1,31
3150	3,11	1,79	6,6	14,4	7,9	1,26
4000	2,30	1,47	8,1	16,3	8,2	1,31
5000	1,79	1,24	9,1	17,4	8,3	1,33



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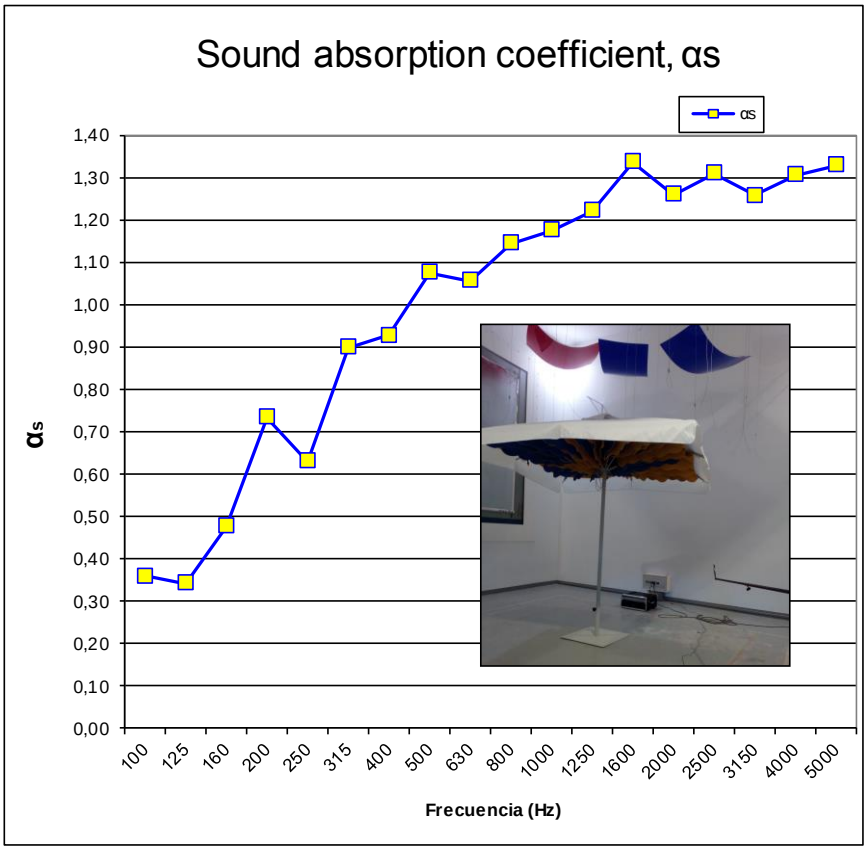
Freq(Hz	α_s
100	0,36
125	0,34
160	0,48
200	0,73
250	0,63
315	0,90
400	0,93
500	1,08
630	1,06
800	1,14
1k	1,17
1,25k	1,22
1,6k	1,34
2k	1,26
2,5k	1,31
3,15k	1,26
4k	1,31
5k	1,33



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Signed: Daniel Bravo	Signed: Álvaro Ramos

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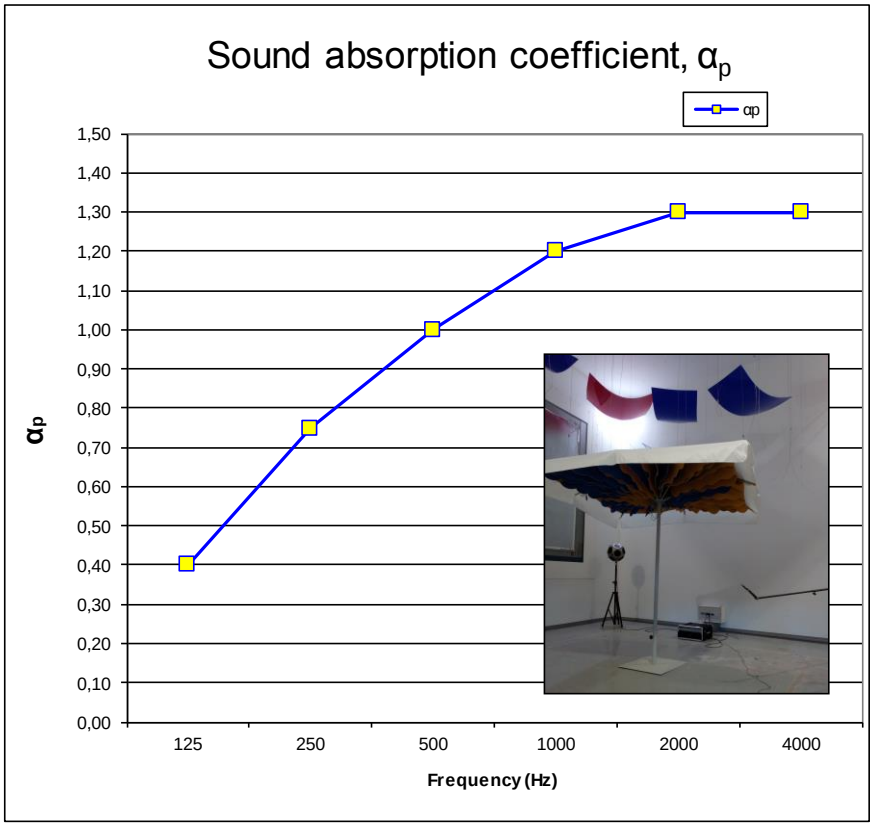
Sample surface: 6,25 m². **Room volume:** 202,12 m³. **Standard:** UNE-EN ISO 354:2004.

Freq(Hz)	125	250	500	1000	2000	4000	α_w= 1
α_p	0,40	0,75	1,00	1,20	1,30	1,30	



SOUND ABSORPTION CLASS	A

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Freq(Hz)	T1(s)	T2 (s)	A_1 (m^2)	A_2 (m^2)	A_T(m^2)	A_{obj} (m^2)
100	10,06	5,94	3,2	5,4	2,2	**2,2**
125	11,01	6,41	2,9	5,0	2,1	**2,1**
160	10,36	5,33	3,0	6,0	3,0	**3,0**
200	7,91	3,75	4,0	8,6	4,6	**4,6**
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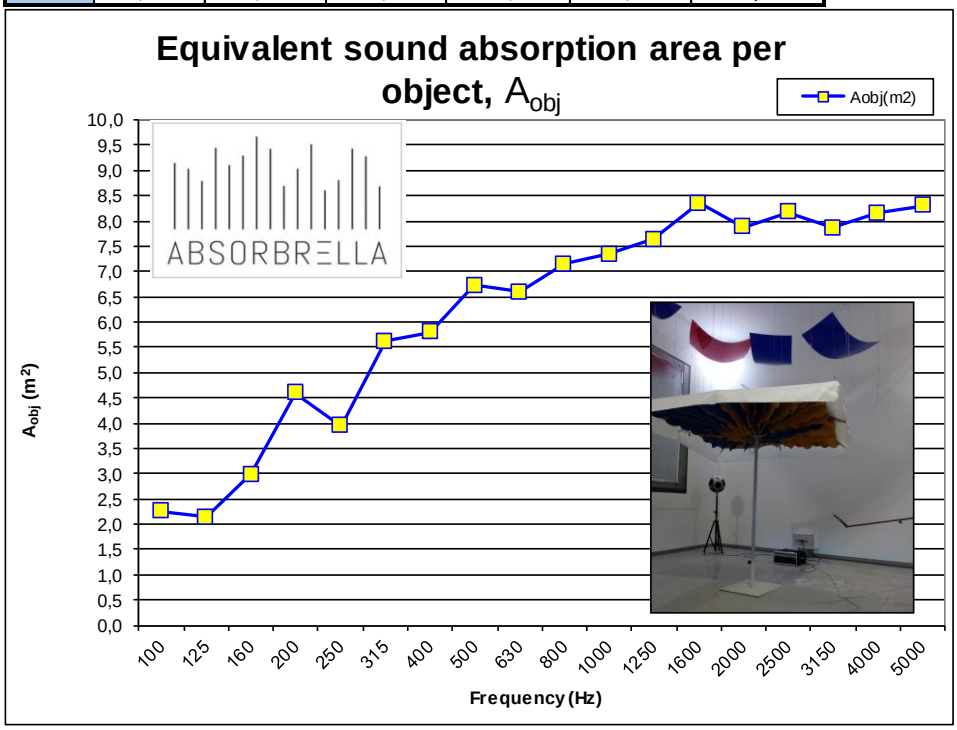
800	7,14	2,78	3,9	11,1	7,2	**7,2**
1000	6,63	2,66	4,1	11,5	7,3	**7,3**
1250	6,43	2,57	4,1	11,7	7,6	**7,6**
1600	5,65	2,31	4,4	12,8	8,3	**8,3**
2000	4,80	2,23	4,9	12,8	7,9	**7,9**
2500	4,05	2,02	5,4	13,6	8,2	**8,2**
3150	3,11	1,79	6,6	14,4	7,9	**7,9**
4000	2,30	1,47	8,1	16,3	8,2	**8,2**
5000	1,79	1,24	9,1	17,4	8,3	**8,3**



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