Technical Report

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Project

The Laboratory Determination of Random Incidence Sound Absorption of an Office Screen

Prepared for

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By

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1.0 Summary

Tests have been done in SRL's Laboratory at Holbrook House, Sudbury, Suffolk, to determine the sound absorption of an office screen in accordance with BS EN ISO 354:2003.

From these measurements the required results have been derived and are presented in both tabular and graphic form in Data Sheet 1.

The results are given in 1/3rd octave bands over the frequency range 50Hz to 10kHz, which is beyond that required by the test standard. Measurements outside the standard frequency range are not UKAS accredited.

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2.0 Details of Measurements

2.1 Location

Sound Research Laboratories Ltd
Holbrook House
Little Waldingfield
Sudbury
Suffolk
CO10 OTH

2.2 Test Date

2 February 2010

2.3 Instrumentation and Apparatus Used

Make	Description	Type
E D I	Microphone Multiplexer Microphone Power Supply Unit	
Norwegian Electronics	Real Time Analyser	830
Brüel & Kjaer	12mm Condenser Microphones Windshields Pre Amplifiers Microphone Calibrator Omnipower Sound Source	4166 UA0237 2639, 2669C 4231 4296
Larson Davis	12mm Condenser Microphone	2560
Thermo Hygro	Temperature & Humidity Probe	
TOA	Graphic Equalizer	E-1231
QSC Audio	Power Amplifier	RMX 1450

2.4 References

BS EN ISO 354:2003	Measurement of sound absorption in a reverberation room

3.0 Description of Test

3.1 Description of Sample

Morton Acoustic Screens. Each Screen 1.8m high by 1.6m wide.

Sampling plan: Enough for test only

Sample condition: New

Details supplied by: Rap Industries

Sample installed by: SRL / RAP Industries

3.2 Sample Delivery date

2 February 2010

3.3 Test Procedures

The sample was mounted/located and tested in accordance with the relevant standard. The method and procedure is described in Appendix 1. The measurement uncertainty is given in Appendix 2.

4.0 Results

The results of the measurements and subsequent analysis are given in Data Sheet 1. The calculated equivalent sound absorption areas are given for one screen.

Results relate only to the items tested.

_____ *End of Text* _____

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Data Sheet 1

The Laboratory Measurement of Random Incidence Sound Absorption to BS EN ISO 354:2003

Client: Rap Industries

Test Date: 02/02/2010

Empty Room:	**Temperature:**	16.8	°C	**Humidity:**	34	%RH	**Pressure:**	1001	mbar
Room with Sample:	**Temperature:**	16.7	°C	**Humidity:**	34	%RH	**Pressure:**	1001	mbar

Sample Description: Morton Acoustic Screen 1.8m high by 1.6m wide

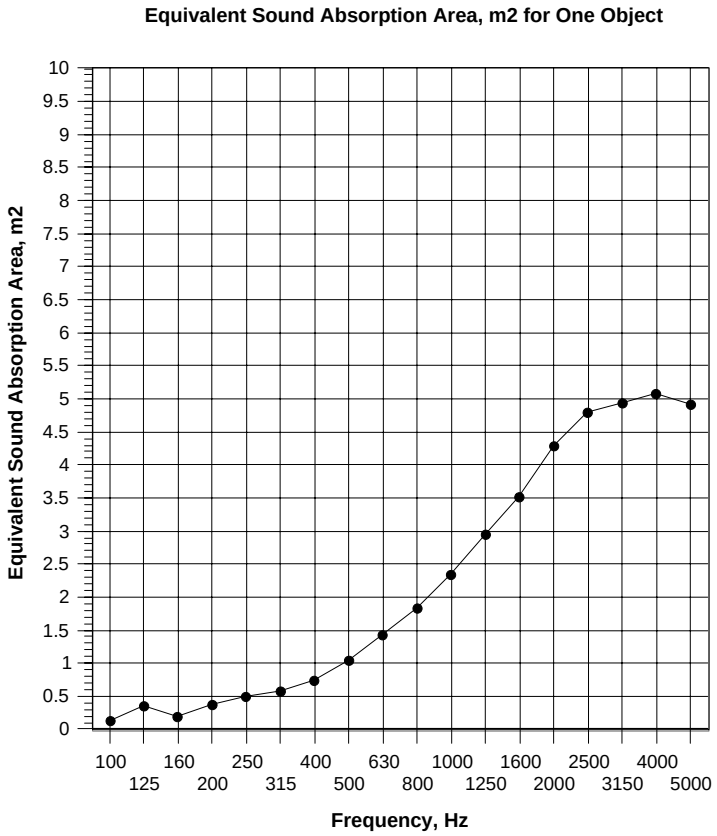
Mounting Method: Free standing office screens (results given for one screen)

Chamber Volume: 300 m3

	Test 2		
Freq Hz	**T1 sec**	**T2 sec**	**Equivalent Sound Absorption Area m2**
*50**	*4.42*	*4.64*	*-0.1*
*63**	*4.82*	*3.68*	*0.8*
*80**	*5.73*	*4.84*	*0.4*
100	7.02	6.52	*0.1*
125	8.36	6.73	*0.4*
160	7.16	6.41	*0.2*
200	7.38	5.99	*0.4*
250	8.36	6.26	*0.5*
315	8.27	5.91	*0.6*
400	7.27	5.04	*0.7*
500	5.88	3.90	*1.1*
630	5.38	3.30	*1.4*
800	5.81	3.10	*1.8*
1000	6.29	2.84	*2.3*
1250	5.93	2.43	*3.0*
1600	5.18	2.07	*3.5*
2000	4.39	1.72	*4.3*
2500	3.75	1.51	*4.8*
3150	2.95	1.34	*4.9*
4000	2.18	1.14	*5.1*
5000	1.60	0.97	*4.9*
*6300**	*1.12*	*0.78*	*4.7*
*8000**	*0.88*	*0.66*	*4.6*
*10000**	*0.62*	*0.50*	*4.7*

** Denotes frequencies outside the range covered by BS EN ISO 354:2003*

T1, empty room reverberation time
T2, room reverberation time with sample



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Appendix 1

Test Procedure

Measurements of The Equivalent Sound Absorption Area
To BS EN ISO 354:2003 - TP14 (Discrete objects or arrays)

In the laboratory, the equivalent sound absorption area of a sample is determined from the rate of decay of a sound field in a reverberation room, with and without a test sample installed. The rate of decay is described by the time a sound field takes to decay by 60dB, known as the reverberation time.

The reverberation room is constructed from 215mm brick, which is internally plastered with a reinforced concrete roof and floor. The room is rectangular and has a volume of 300 cubic metres and a total surface area of 275m2. From the ceiling hang 10 randomly positioned diffusers, each measuring 1.2m x 2.14m. The room is isolated from the surrounding structure by the use of resilient mountings and seals, ensuring good acoustic isolation.

Using at least two omnidirectional loudspeaker positions, broad band random noise is produced in the room using an electronic generator and power amplifier. When the amplification system is switched off, the decay of sound is filtered into one-third octave band widths and the reverberation times measured. This process is repeated for each of six microphone positions and the values arithmetically averaged to obtain a final value for each frequency.

The sample, is then at an appropriate height above the floor of the reverberation room so that no part of it is closer than one metre from any edge of the boundaries. The procedure of measuring the reverberation times then repeated.

The equivalent sound absorption area is calculated from the difference in decay rates for each frequency according to the formula:

where

$$A_{obj} = \frac{A_T}{n}$$

A_{obj} is the equivalent sound absorption area

A_T is the increase in equivalent sound absorption area of the test specimen (m^2)

n is the number of objects (n=1 for an array)

The equivalent absorption area of the test specimen is further defined as:

$$A_T = 55.3V\left(\frac{1}{c_2T_2} - \frac{1}{c_1T_1}\right) - 4V(m_2 - m_1)$$

where

V is the volume of the empty reverberation room (m^3)

c_1 is the speed of sound in the empty room (m/sec)

T_1 is the reverberation time in the empty room (sec)

m_1 is the power attenuation coefficient calculated according to ISO 9613-1 using the climatic conditions that have been present in the empty room during the measurement.

c_2, T_2 and m_2 have the same meanings as c_1, T_1 and m_1 but with the test specimen in the room.

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Appendix 2

Measurement Uncertainty
BS EN ISO 354 - TP14

1. Introduction

The estimated values of uncertainty are based on a standard uncertainty multiplied by a coverage factor of K = 2, which provides a level of confidence of approximately 95%.

Table 1: Uncertainty For Equivalent Absorption Area Measurement

Frequency, Hz	Expanded uncertainty K = 2, 95% % of A_1 or A_2
100	9.0
125	8.1
160	5.6
200	6.7
250	4.3
315	8.1
400	4.6
500	5.0
630	5.3
800	3.2
1000	3.5
1250	3.1
1600	2.8
2000	2.7
2500	2.2
3150	1.8
4000	1.6
5000	1.6

2. Estimation of Expanded Uncertainty For Sample Equivalent Sound Absorption Area

The expanded uncertainty U_A, m^2 is estimated by using the following formulae:-

$$U_A = \sqrt{\left(\frac{uA_1}{100}\right)^2 + \left(\frac{uA_2}{100}\right)^2}$$

where

U_A is the expanded uncertainty for the sample equivalent sound absorption area, for K = 2, 95%, m^2

u is the estimated expanded uncertainty for the equivalent sound absorption area, taken from Table 1 above, K = 2, 95%, % of A_1 or A_2

A_1 is the equivalent sound absorption area of the empty room, m^2

A_2 is the equivalent sound absorption area of the room with the sample, m^2

3. Estimation of expanded Uncertainty For Sound Absorption Coefficients

The expanded uncertainty for sound absorption coefficients, U_{α_s} , is estimated using the following formulae:-

$$U_{\alpha_s} = \frac{\alpha_s U_A}{A}$$

where

U_{α_s} is the expanded uncertainty for sound absorption coefficients, K=2, 95%

α_s is the sound absorption coefficient

U_A is the expanded uncertainty for the sample equivalent sound absorption area, K=2, 95%, m^2

A is the sample equivalent sound absorption area, m^2

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SRL's Laboratory is accredited for testing under UKAS Number 0444

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