SRL

Technical Report

C/23170/T01

Project

The Laboratory Measurement of the Sound Reduction Index of Various Windows

Prepared for

Smart Architectural Aluminium

Published

7 October 2015

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Project Title	The Laboratory Measurement of the Sound Reduction Index of Various Windows
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Summary

Tests have been done in SRL's Laboratory at Holbrook House, Sudbury, Suffolk, to determine the sound reduction index of various windows in accordance with BS EN ISO 10140-2:2010.

From these measurements the required results have been derived and are presented in both tabular and graphic form in Data Sheets 1 to 6.

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.

George Thomson

For and on behalf of

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Contents

1.0 Details of Measurements

1.1 Location

Sound Research Laboratories
Holbrook House
Little Waldingfield
Sudbury
Suffolk
CO10 0TF

1.2 Test Dates

5 October 2015

1.3 Tester

Allen Smalls of SRL Technical Services Limited

1.4 Instrumentation and Apparatus Used

Make	Description	Type
E D I	Microphone Multiplexer	
	Microphone Power Supply Unit	
Norwegian Electronics	Real Time Analyser	830
	Rotating Microphone Boom	231
Brüel & Kjaer	12mm Condenser Microphones	4166
	Windshields	UA0237
	Pre Amplifiers	2639, 2669C
	Microphone Calibrator	4231
	Omnipower Sound Source	4296
Larson Davis	12mm Condenser Microphone	2560
Celestion	Loudspeakers	100w
Douglas Curtis	Rotating Microphone Boom	
Oregon Scientific	Temperature & Humidity & Probe	THGR810
TOA	Graphic Equalizer	E-1231
QSC Audio	Power Amplifier	RMX 1450

1.5 References

BS EN ISO 717-1:2013	Rating of sound insulation in buildings and of building elements. Airborne Sound Insulation.
BS EN ISO 10140-2:2010	Laboratory measurement of sound insulation for building element – Part 2: Measurement of airborne sound insulation.

2.0 Description of Test

2.1 Description of Sample

Two window frames were tested each with 3 types of glass. See Drawing 1 and Data Sheets for details.

Sampling plan:	Enough for test only
Sample condition:	New
Details supplied by:	Smart Architectural Aluminium
Sample installed by:	Smart Architectural Aluminium

2.2 Sample Delivery date

2 October 2015

2.3 Test Procedures

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

3.0 Results

The results of the measurements and subsequent analysis are given in Data Sheets 1 to 6 and summarised below.

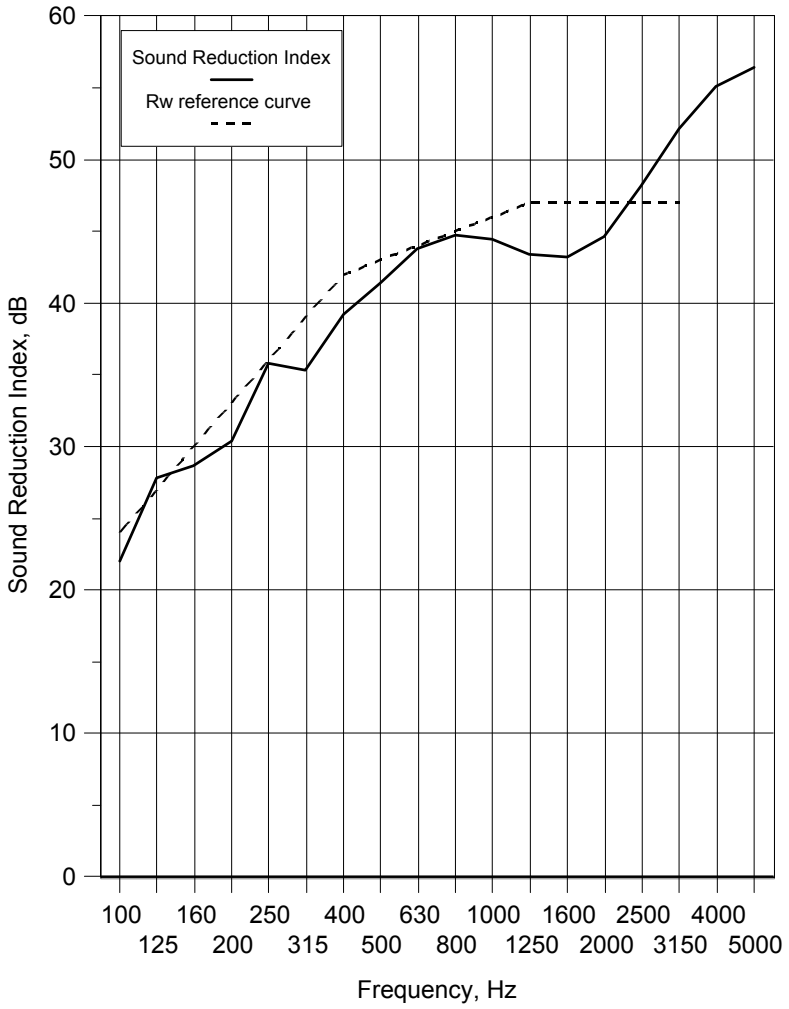
Results relate only to the items tested.

SRL Test No.	Description in Brief	R_w ($C;C_{tr}$)
2	Fixed frame Glass = 10mm clear, 16mm cavity, 8.8mm acoustic glass	43 (-1;-6) dB
3	Fixed frame Glass = 12.8mm lam acoustic, 20mm cavity, 12.8mm lam acoustic glass	45 (-1;-5) dB
4	Fixed frame Glass = 6mm clear, 16mm cavity, 8.8mm acoustic glass	41 (-2;-7) dB
5	Opening frame Glass = 10mm clear, 16mm cavity, 8.8mm acoustic glass	43 (-2;-6) dB
6	Opening frame Glass = 6mm clear, 16mm cavity, 8.8mm acoustic glass	41 (-3;-7) dB
7	Opening frame Glass = 12.8mm lam acoustic, 20mm cavity, 12.8mm lam acoustic glass	43 (-1;-4) dB

Data Sheet 1

Test Number :	2	**Test Room:**	**Source**	**Receiving**
Client:	Smart Architectural Aluminium	**Air temperature:**	15 °C	15.4 °C
Test Date:	05/10/2015	**Air humidity:**	83 %	79 %
Sample height:	1.5 m	**Volume:**	55 m3	300 m3
Sample width:	1.25 m			
Sample weight:	n/a kg/m2		**Air Pressure:**	998 mbar
Product	Fixed frame			
Identification:	Glass = 10mm clear, 16mm cavity, 8.8mm acoustic glass			

Freq f Hz	Sound Reduction Index, dB 1/3 Oct	1/1 Oct
50+	28.8	22.4
63+	26.8	
80+	18.6	
100	22.0	25.1
125	27.8	
160	28.7	
200	30.4	33.1
250	35.8	
315	35.3	
400	39.2	41.1
500	41.4	
630	43.8	
800	44.7	44.2
1000	44.5	
1250	43.4	
1600	43.2	44.9
2000	44.6	
2500	48.2	
3150	52.2	54.2
4000	55.1	
5000	56.4	
6300+	55.4	54.1
8000+	55.6 *	
10000+	52.2 *	
Average 100-3150	39.1	Version v2.1



Rating according to BS EN ISO 717-1:2013

Rw(C;Ctr)= **43 (-1;-6) dB**

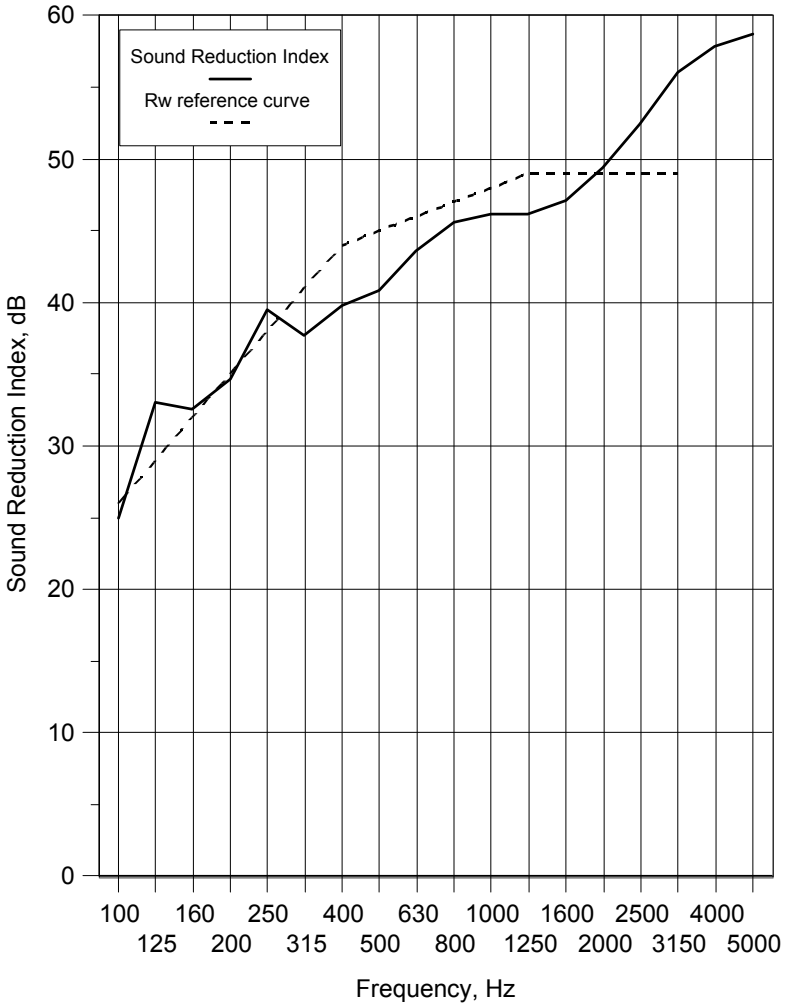
* shows measurement corrected for background

+ shows frequency beyond standard and not UKAS accredited

Data Sheet 2

Test Number :	3	**Test Room:**	**Source**	**Receiving**
Client:	Smart Architectural Aluminium	**Air temperature:**	15 °C	15.4 °C
Test Date:	05/10/2015	**Air humidity:**	83 %	79 %
Sample height:	1.5 m	**Volume:**	55 m3	300 m3
Sample width:	1.25 m			
Sample weight:	n/a kg/m2		**Air Pressure:**	998 mbar
Product Identification:	Fixed frame Glass = 12.8mm lam acoustic, 20mm cavity, 12.8mm lam acoustic glass			

Freq f Hz	Sound Reduction Index, dB 1/3 Oct	1/1 Oct
50+	29.9	20.7
63+	27.5	
80+	16.4	
100	25.0	28.5
125	33.0	
160	32.6	
200	34.7	36.8
250	39.5	
315	37.7	
400	39.8	41.1
500	40.8	
630	43.6	
800	45.6	46.0
1000	46.2	
1250	46.2	
1600	47.1	49.1
2000	49.4	
2500	52.4	
3150	56.1	57.4
4000	57.9	
5000	58.7	
6300+	58.3	55.6
8000+	58.0 *	
10000+	52.9 *	
Average 100-3150	41.9	Version v2.1



Rating according to BS EN ISO 717-1:2013	* shows measurement corrected for background
Rw(C;Ctr)= **45 (-1;-5) dB**	+ shows frequency beyond standard and not UKAS accredited

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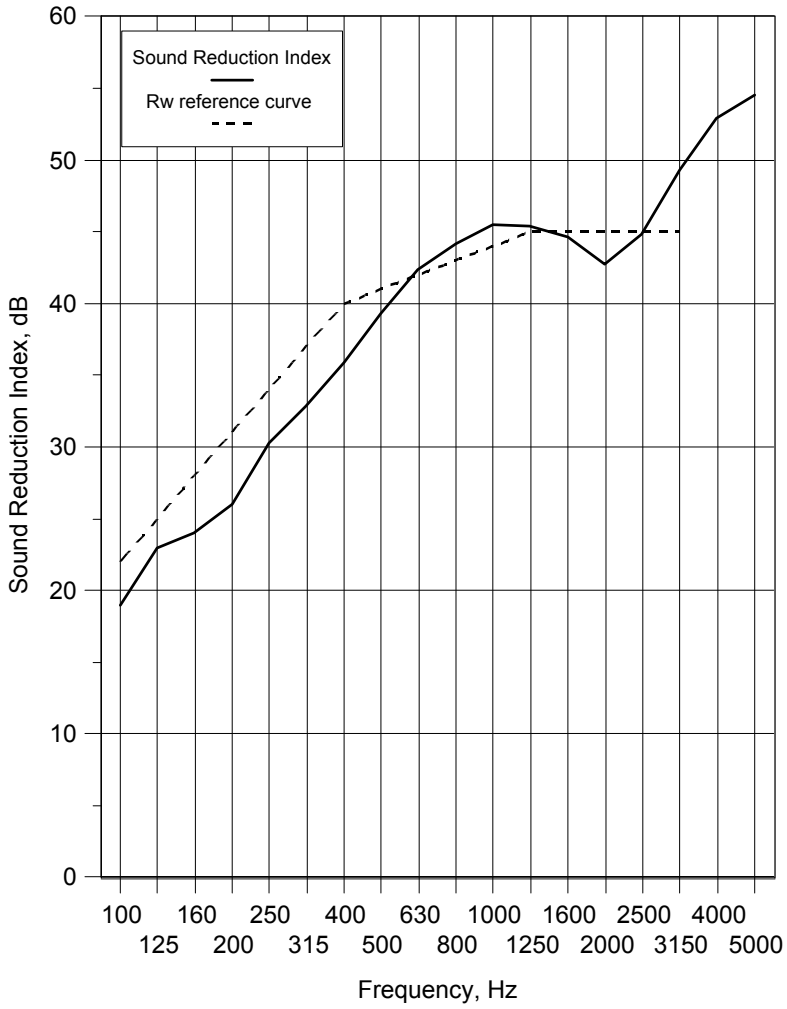
Data Sheet 3

Test Number :	4	**Test Room:**	**Source**	**Receiving**
Client:	Smart Architectural Aluminium	**Air temperature:**	15 °C	15.4 °C
Test Date:	05/10/2015	**Air humidity:**	83 %	80 %
Sample height:	1.5 m	**Volume:**	55 m3	300 m3
Sample width:	1.25 m			
Sample weight:	n/a kg/m2		**Air Pressure:**	998 mbar
Product	Fixed frame			
Identification:	Glass = 6mm clear, 16mm cavity, 8.8mm acoustic glass			

Freq f Hz	Sound Reduction Index, dB 1/3 Oct	1/1 Oct
50+	26.1	22.3
63+	24.7	
80+	19.3	
100	19.0	21.4
125	23.0	
160	24.0	
200	26.0	28.8
250	30.3	
315	32.9	
400	35.9	38.4
500	39.3	
630	42.4	
800	44.2	45.0
1000	45.5	
1250	45.4	
1600	44.6	43.9
2000	42.7	
2500	44.8	
3150	49.3	51.7
4000	52.9	
5000	54.5	
6300+	55.4	54.2
8000+	55.9 *	
10000+	52.3 *	
Average 100-3150	36.8	Version v2.1



Rating according to BS EN ISO 717-1:2013

Rw(C;Ctr)= **41 (-2;-7) dB**

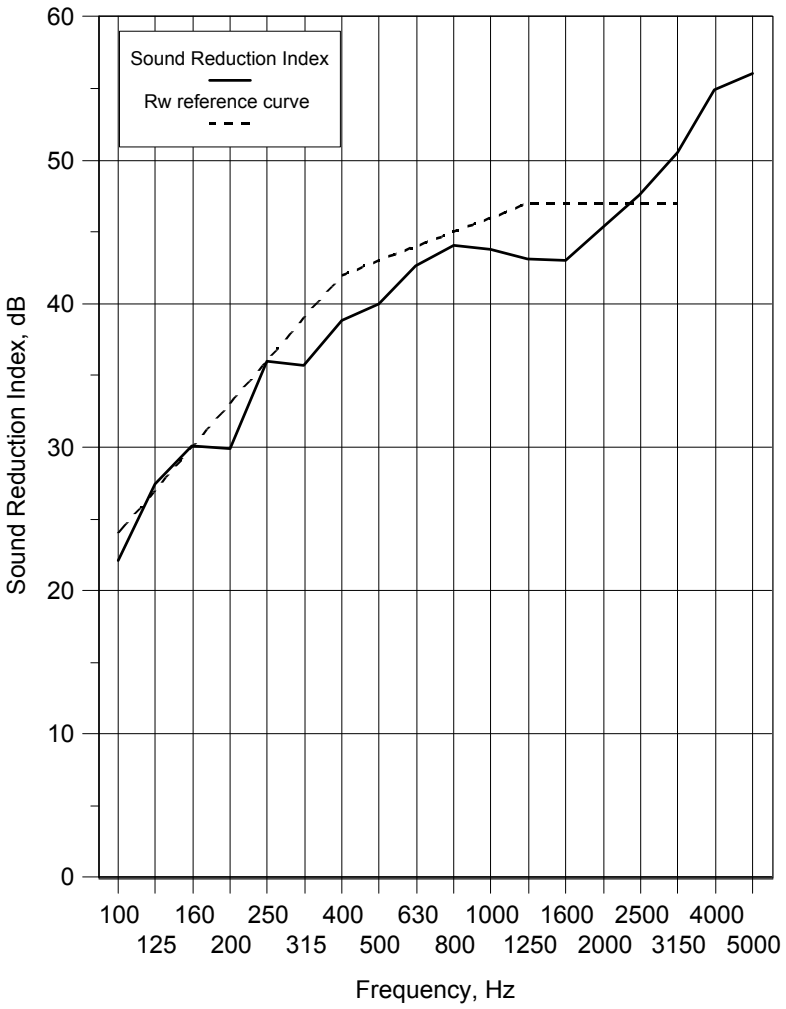
* shows measurement corrected for background

+ shows frequency beyond standard and not UKAS accredited

Data Sheet 4

Test Number :	5	**Test Room:**	**Source**	**Receiving**
Client:	Smart Architectural Aluminium	**Air temperature:**	15.1 °C	15.5 °C
Test Date:	05/10/2015	**Air humidity:**	87 %	82 %
Sample height:	1.5 m	**Volume:**	55 m3	300 m3
Sample width:	1.25 m			
Sample weight:	n/a kg/m2		**Air Pressure:**	998 mbar
Product	Opening frame			
Identification:	Glass = 10mm clear, 16mm cavity, 8.8mm acoustic glass			

Freq f Hz	Sound Reduction Index, dB 1/3 Oct	1/1 Oct
50+	28.8	23.3
63+	26.5	
80+	19.8	
100	22.1	25.2
125	27.4	
160	30.1	
200	29.9	32.9
250	36.0	
315	35.7	
400	38.8	40.2
500	40.0	
630	42.6	
800	44.1	43.7
1000	43.8	
1250	43.1	
1600	43.0	44.9
2000	45.3	
2500	47.6	
3150	50.5	53.1
4000	54.9	
5000	56.1	
6300+	54.4	54.2
8000+	54.9	
10000+	53.5 *	
Average 100-3150	38.8	Version v2.1



Rating according to BS EN ISO 717-1:2013

Rw(C;Ctr)= **43 (-2;-6) dB**

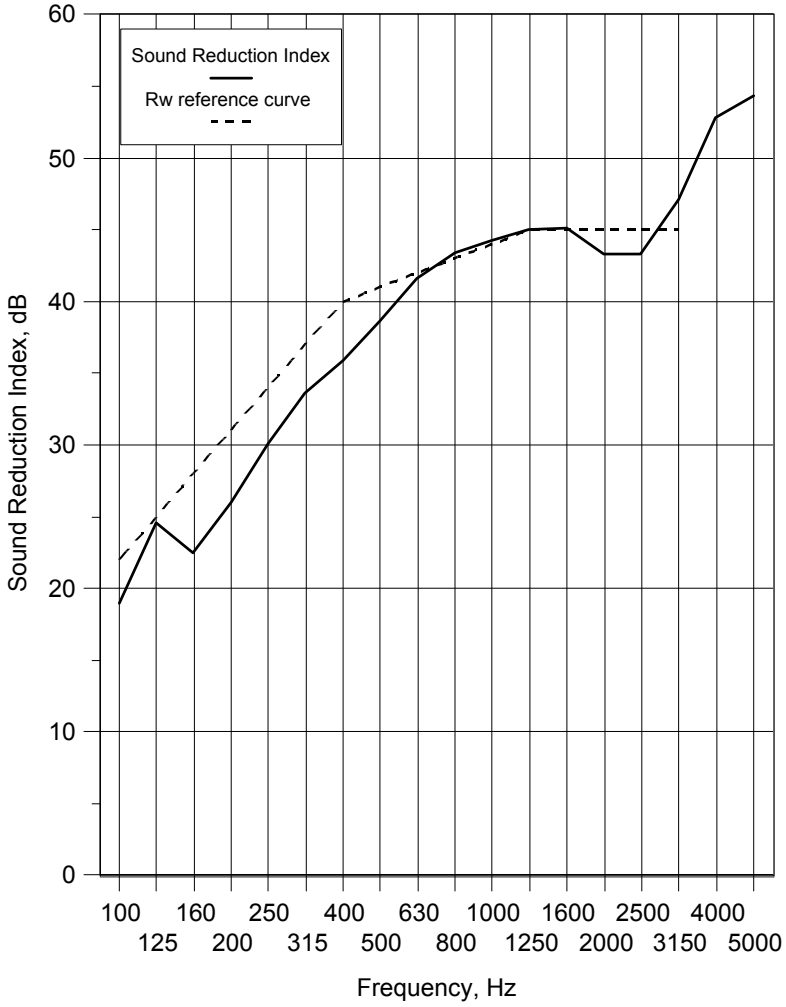
* shows measurement corrected for background

+ shows frequency beyond standard and not UKAS accredited

Data Sheet 5

Test Number :	6	**Test Room:**	**Source**	**Receiving**
Client:	Smart Architectural Aluminium	**Air temperature:**	15.1 °C	15.5 °C
Test Date:	05/10/2015	**Air humidity:**	87 %	83 %
Sample height:	1.5 m	**Volume:**	55 m3	300 m3
Sample width:	1.25 m			
Sample weight:	n/a kg/m2		**Air Pressure:**	998 mbar
Product	Opening frame			
Identification:	Glass = 6mm clear, 16mm cavity, 8.8mm acoustic glass			

Freq f Hz	Sound Reduction Index, dB 1/3 Oct	1/1 Oct
50+	23.4	
63+	25.0	22.1
80+	19.7	
100	19.0	
125	24.6	21.4
160	22.5	
200	26.0	
250	30.1	28.8
315	33.6	
400	35.9	
500	38.7	38.1
630	41.6	
800	43.4	
1000	44.3	44.2
1250	45.0	
1600	45.1	
2000	43.3	43.8
2500	43.3	
3150	47.1	
4000	52.8	50.2
5000	54.3	
6300+	53.2	
8000+	54.5	52.3
10000+	50.3 *	
Average 100-3150	36.5	Version v2.1



Rating according to BS EN ISO 717-1:2013

Rw(C;Ctr)= **41 (-3;-7) dB**

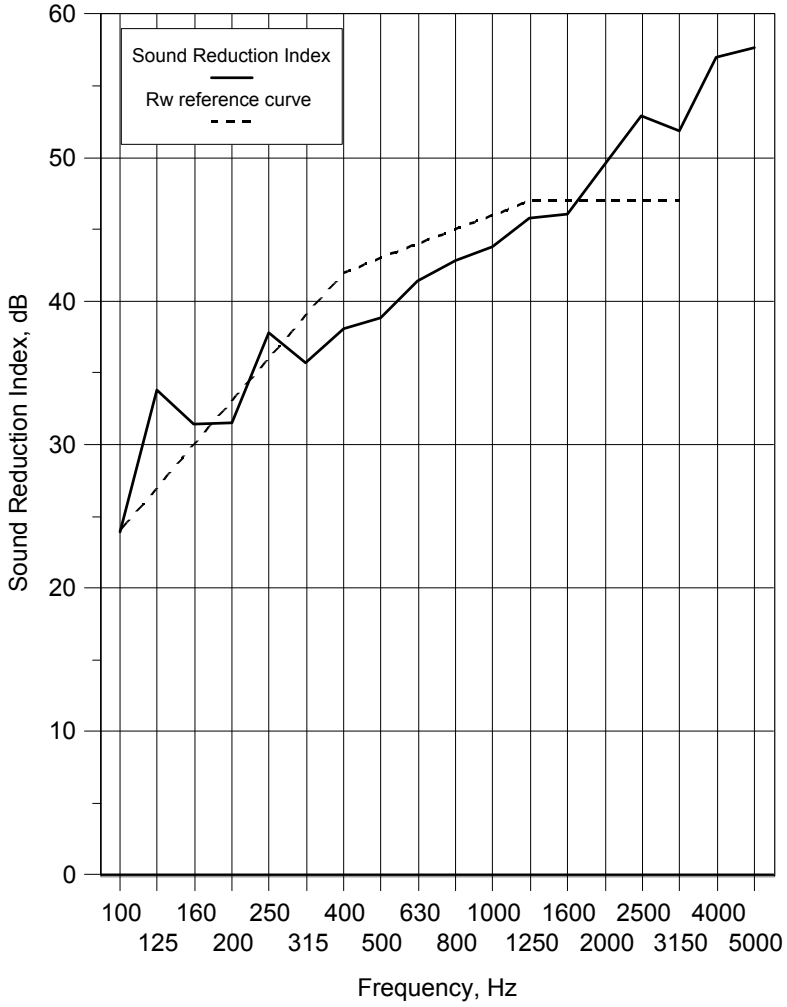
* shows measurement corrected for background

+ shows frequency beyond standard and not UKAS accredited

Data Sheet 6

Test Number :	7	**Test Room:**	**Source**	**Receiving**
Client:	Smart Architectural Aluminium	**Air temperature:**	15.1 °C	15.5 °C
Test Date:	05/10/2015	**Air humidity:**	86 %	83 %
Sample height:	1.5 m	**Volume:**	55 m3	300 m3
Sample width:	1.25 m			
Sample weight:	n/a kg/m2		**Air Pressure:**	997 mbar
Product	Opening frame			
Identification:	Glass = 12.8mm lam acoustic, 20mm cavity, 12.8mm lam acoustic glass			

Freq f Hz	Sound Reduction Index, dB 1/3 Oct	1/1 Oct
50+	30.1	
63+	27.7	21.2
80+	17.0	
100	23.9	
125	33.8	27.6
160	31.4	
200	31.5	
250	37.8	34.2
315	35.7	
400	38.1	
500	38.8	39.2
630	41.4	
800	42.8	
1000	43.8	43.9
1250	45.8	
1600	46.1	
2000	49.5	48.6
2500	52.9	
3150	51.9	
4000	57.0	54.7
5000	57.7	
6300+	57.7	
8000+	56.5 *	53.7
10000+	50.5 *	
Average 100-3150	40.3	Version v2.1

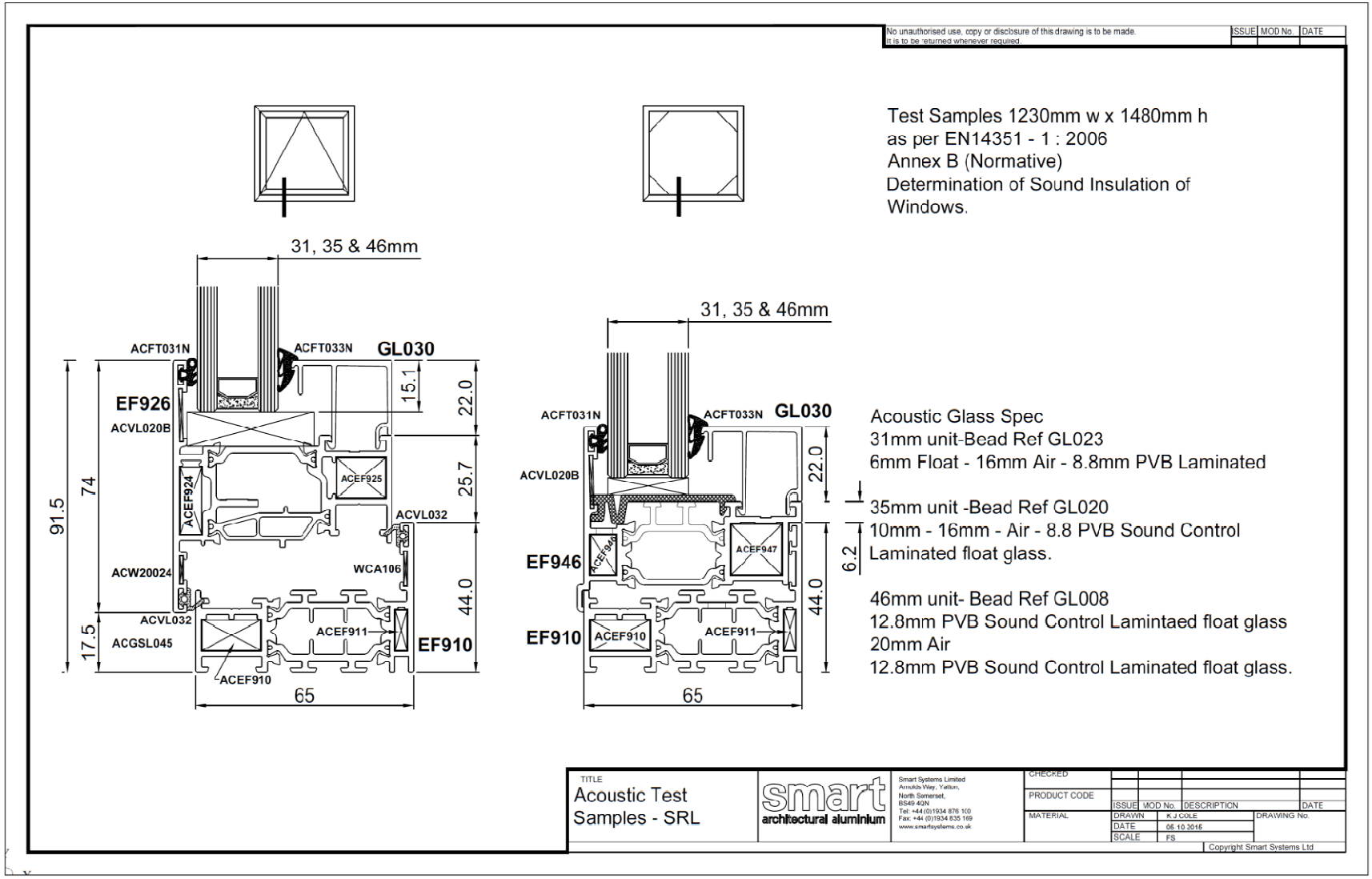


Rating according to BS EN ISO 717-1:2013

Rw(C;Ctr)= **43 (-1;-4) dB**

* shows measurement corrected for background

+ shows frequency beyond standard and not UKAS accredited


No unauthorised use, copy or disclosure of this drawing is to be made.
It is to be returned whenever required.
ISSUE
MOD No.
DATE
Test Samples 1230mm w x 1480mm h
as per EN14351 - 1 : 2006
Annex B (Normative)
Determination of Sound Insulation of
Windows.
31, 35 & 46mm
ACFT031N
ACFT033N
GL030
EF926
ACVL020B
ACEF924
ACEF925
ACVL032
ACW20024
WCA106
ACVL032
ACGSL045
ACEF911
EF910
ACEF910
91.5
74
17.5
15.1
22.0
25.7
44.0
65
31, 35 & 46mm
ACFT031N
ACFT033N
GL030
ACVL020B
EF946
ACEF946
ACEF947
EF910
ACEF910
ACEF911
22.0
6.2
44.0
65
Acoustic Glass Spec
31mm unit-Bead Ref GL023
6mm Float - 16mm Air - 8.8mm PVB Laminated
35mm unit -Bead Ref GL020
10mm - 16mm - Air - 8.8 PVB Sound Control
Laminated float glass.
46mm unit- Bead Ref GL008
12.8mm PVB Sound Control Lamintaed float glass
20mm Air
12.8mm PVB Sound Control Laminated float glass.
TITLE
Acoustic Test
Samples - SRL
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architectural aluminium
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North Somerset,
BS49 4QN
Tel: +44 (0)1934 876 100
Fax: +44 (0)1934 835 169
www.smartsystems.co.uk
CHECKED
PRODUCT CODE
ISSUE
MOD No.
DESCRIPTION
DATE
MATERIAL
DRAWN
K J COLE
DATE
06 10 2015
SCALE
FS
DRAWING No.
Copyright Smart Systems Ltd

Appendix A – Test Procedure

Measurement of Sound Transmission in accordance with

BS EN ISO 10140-2: 2010 – TP33

In the laboratory, airborne sound transmission is determined from the difference in sound pressure levels measured across a test sample installed between two reverberant rooms. The difference in measured sound pressure levels is corrected for the amount of absorption in the receiving room. The test is done under conditions which restrict the transmission of sound by paths other than directly through the sample. The source sound field is randomly incident on the sample.

The test sample is located and sealed in an aperture within the brick dividing wall between the two rectangular reverberant (i.e. acoustically "live") room, both of which are constructed from 215mm brick with reinforced concrete floors and roofs. The brick wall has dimensions of 4.8m wide x 3.1m high and 550mm nominal thickness and forms the whole of the common area between the two rooms.

One of the rooms is used as the receiving room and has a volume of 300 cubic metres. It is isolated from the surrounding structure and the adjoining room by the use of resilient mountings and seals ensuring good acoustic isolation. The adjoining source room has a volume of 55 cubic metres.

Broad band noise is produced in the source room from an electronic generator, power amplifier and loudspeaker. The resulting sound pressure levels in both rooms are sampled using a microphone mounted on an oscillating boom and connected to a real time analyser. The signal is filtered into one third octave band widths, integrated and averaged. The value obtained at each frequency is known as the average sound pressure level for either the source or the receiving room. The change in level across the test sample is termed the sound pressure level difference, i.e.

$$D = L_1 - L_2$$

where

D is the equivalent Sound Pressure level difference in dB

L_1 is the equivalent Sound Pressure level in the source room in dB

L_2 is the equivalent Sound Pressure level in the receiving room in dB

The Sound Reduction Index (R), also known by the American terminology Sound Transmission Loss, is defined as the number of decibels by which sound energy randomly incident on the test sample is reduced in transmitting through it and is given by the formula:

$R = D + 10\log_{10} \frac{S}{A}$..... in decibels

Where

S is the area of the sample

A is the total absorption in the receiving room

both dimensions being in consistent units

The Sound Reduction Index is an expression of the laboratory sound transmission performance of a particular element or construction. It is a function of the mass, thickness, sealing, method of mounting etc. and is independent of the overall area of the sample.

However, when an example of this construction is installed on site, the sound insulation obtained will depend upon its surface area, as well as the absorption in the receiving room. The larger the area the greater the sound energy transmitted. Also, the overall sound insulation is affected by the sound transmission through other building elements, some of which may have an inferior performance to the sample tested. In practice, therefore, the potential sound reduction index of a construction is not fully realised on site. Furthermore, the sound reduction index of a particular sample of that construction can only be measured accurately in a laboratory, because only under such controlled conditions can the sound transmission path be limited to the sample under test.

R_w, C and C_{tr} have been calculated in accordance with the relevant section of

BS EN ISO 717-1:1997 from the results of laboratory tests carried out in accordance with

BS EN ISO 10140-2:2010.

Appendix B – Measurement Uncertainty

BS EN ISO 10140-2: 2010 – TP33

The following 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%.

Frequency, Hz	Uncertainty, ± dB
100	3.2
125	2.9
160	2.5
200	2.5
250	1.8
315	1.8
400	1.5
500	1.5
630	1.2
800	1.2
1000	1.2
1250	1.2
1600	1.2
2000	1.2
2500	1.2
3150	1.2

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