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Australian Hearing®
National Acoustic Laboratories

ATF Report 1733

Airborne Sound Transmission Test of a Casement Window with Fixed Light

Commissioned by
Rehau

Test Date: 31st August 2005

AS1191-2002, AS1045-1988
Accredited Lab No: 5472

Airborne Sound Transmission Test of a Casement Window with Fixed Light

1.0 Introduction and test results summary

The National Acoustic Laboratories were commissioned by Rehau to measure the acoustical transmission loss of a casement window with fixed light as described in item 2.0 'Test sample' details

The test sample achieved the following results :

Sound Transmission Class	STC 41
ISO-717 Sound Insulation Rating Rw (C; Ctr)	41 (-2 ; -6)
Outdoor Indoor Transmission Class	OITC 33
Unweighted average transmission loss value (100Hz - 5kHz)	38dB
A-Weighted average transmission loss value (100Hz - 5kHz)	34dB

2.0 Test sample details

Frame Type	Casement Window with fixed light
Frame Material	PVC
Frame Dimensions	1240mm x 1840mm
Glazing	IGU 10.38mm laminated glass on the send side, 16mm air gap then 6.76mm laminated glass on receive side
Glazing Channels	Art 500133
Sash Seals	Art 221866 Casement seal
Lock/Latch Assembly	Roto lock keeper & handle with Friction Stay 16" SS304
Reveal Lining	19mm timber reveal
Installation	Sample screw fixed into the test sample aperture with a 19mm thick timber reveal and all gaps packed and sealed with silicone sealant.
Test Date	31-Aug-2005
Notes	Due to the uncertainty at low frequencies the 63Hz figure was adjusted so that the measured figure didn't appear to have more loss than the original wall. Being as it is such a low frequency it does not affect the value of the Rw or CTR figure.

3.0 Testing rationale

The procedure for testing a small test sample building element such as a door or window requires the construction of a specially designed 'filler wall'. This filler wall is constructed in an aperture between two reverberation rooms and tested for acoustic transmission loss. After testing, an opening which is sufficiently large to accommodate the window or door is made in the filler wall (the size of the opening can be varied to suit a particular sample but normally it is 1850 x 1250mm (W x H) for windows and 1850 x 2150mm (W x H) for doors). The perimeter of this opening is lined with a layer of 16mm thick fire rated gypsum plasterboard, a layer of 12mm thick medium density fibreboard (m.d.f.) and a layer of Barium sulphate impregnated vinyl sheet. The small sample is then fitted into the opening and the acoustical integrity of the installation checked before testing.

The filler wall attenuation characteristics are designed to provide a minimum of 10dB greater attenuation than the test sample at all one-third octave frequencies between 80Hz and 5000Hz. This is to ensure an accurate measurement of the test sample according to standard acoustical practice, and to conform with the measurement requirements of AS1191-2002 *Acoustics - Method for laboratory measurement of airborne sound transmission loss of building partitions* . The transmission loss characteristics of this wall are presented in item **4.1 Sound Transmission Class** of this report.

The second measurement taken is of the test sample fitted within the filler wall as presented in item **4.1 Sound Transmission Class** of this report. The difference between the filler wall and filler wall and test sample measurements provide a means of calculating the Sound Transmission Class (STC) rating of the test sample as presented in item **4.1 Sound Transmission Class** of this report. Other criteria presented in the report are derived from the two sets of measurements.

Signatory............................
Geoff Colin-Thome

Date 14/9/05

4.0 Results

4.1 Sound Transmission Class

A complete set of measurements and calculations for determination of the test sample acoustical transmission loss was calculated and is presented numerically and graphically on the appended spreadsheets. A summation of one-third octave transmission loss results, rounded to the nearest deciBel (as required by AS1191-2002), follows.

Transmission Loss Measurement

1/3 Octave Band Centre Frequency (Hz)	Filler Wall STC 82	Filler Wall and Test Sample STC 47	Test Sample STC 41	STC Criterion Value STC 41	Difference (dB)
80	48	33	27	-	-
100	55	27	21	-	-
125	63	28	22	25	-3
160	64	34	28	28	-
200	66	37	30	31	-1
250	73	38	32	34	-2
315	77	43	37	37	-
400	78	45	38	40	-2
500	82	46	39	41	-2
630	84	47	41	42	-1
800	85	47	41	43	-2
1000	87	48	42	44	-2
1250	90	47	41	45	-4
1600	89	46	40	45	-5
2000	81	46	40	45	-5
2500	81	49	43	45	-2
3150	87	53	46	45	-
4000	92	59	52	45	-
5000	91	64	58	-	-
				SUM	-31

Note 1. The two channel pulse analyser averaging time conforms with the AS1191-2002 requirement of (1/20 the reverberation time of each one-third octave band in the measurement frequency range).

Note 2. Determination of Sound Transmission Class for a test sample requires comparison of the measured sound transmission loss with the value for each transmission class rating listed in the STC tables for each one-third octave band centre frequency, 125Hz to 4000Hz. The STC value, which is expressed as a class rating only (not as deciBels) as determined by these tables, is reached when either or both of the following requirements are met:

(a) The test sample transmission loss at any frequency in the range 125Hz to 4000Hz must not lie more than 8dB below that of the STC reference graph value at the same frequency and

(b) The total sum obtained from the addition of unfavourable deficiencies (as defined in the "Rw determination" description), must not add to more than 32dB. They are listed in the STC table above.

Note 3. Refer to the spreadsheet summaries (attached) for deciBel precision at the 95% confidence level for each attenuation value. The uncertainties have been calculated on the basis of there being not more than five chances in one hundred that any value differs from the true value by more than the stated uncertainty.

4.2 Outdoor-Indoor Transmission Class

The first column of the Summarised **OITC Rating** Table lists centre frequencies of the one-third octave bands measured.

The second column specifies levels of the A-weighted reference spectrum defined by ASTM E1332 which are required to determine OITC. This spectrum has been A-Weighted and then normalised so that its energy summation is 0dB as required by that Standard.

The third column contains transmission loss coefficients for each one-third octave band in the frequency range 80Hz to 4000Hz used to determine test sample OITC rating.

The fourth column represents the difference between column two and three converted to sound energy. The summation of this energy, converted back to deciBels is taken as the OITC value of the test sample.

OITC Rating			
1/3 Octave Band Centre Frequency (Hz)	Normalised A-Weighted Spectrum (dB)	Test Sample Transmission Loss (dB)	Transmitted Sound Energy (Watts)
80	-19.6	27	2.188E-05
100	-17.2	21	1.514E-04
125	-15.2	22	1.905E-04
160	-15.5	28	4.467E-05
200	-14	30	3.981E-05
250	-13.7	32	2.692E-05
315	-12.7	37	1.072E-05
400	-11.9	38	1.023E-05
500	-10.3	39	1.175E-05
630	-11	41	6.310E-06
800	-10.9	41	6.457E-06
1000	-11.1	42	4.898E-06
1250	-10.5	41	7.079E-06
1600	-11.1	40	7.762E-06
2000	-10.9	40	8.128E-06
2500	-11.8	43	3.311E-06
3150	-13.9	46	1.023E-06
4000	-15.1	52	1.950E-07
		Sum of total energy =	5.530E-04
		OITC = -10 * log (Sum of total energy) =	32.57
		OITC	33

4.3 ISO-717 Sound Insulation Rating

Rw Rating	
Rw	41
C_T	-2
C_{TR}	-6
$C_{T\,(50\text{-}5000)}$	-1
$C_{TR\,(50\text{-}5000)}$	-6

Signatory [signature]
Geoff Colin-Thome

Date 14/9/05

5.0 Procedure for measuring test samples

The procedural detail requires reverberation room measurements of the following parameters for the filler wall and then for the filler wall with test sample fitted:

Reverberation time measured in the receive room
Sound pressure level in the send room and
Sound pressure level in the receive room

The receive room reverberation time is measured according to the requirements of AS 1045 - 1985 *"Acoustics - Measurement of Sound Absorption in a Reverberation Room"*. The procedures require twelve measurements of sound pressure levels in the send room and twelve in the receive room for each one-third octave band at different locations in the rooms.

Measurement of twenty four sets of sound decay data in the receive room requires the use of two sound sources, each positioned at a different location in the room and by moving the microphone through three positions, one for each measurement. A measurement is repeated four times for each combination of microphone and sound source location.

The total number of measurements required to evaluate sound pressure performance of the small test sample therefore comprises forty eight one-third octave sets of recordings in the send and receive rooms for the filler wall and forty eight sets for the filler wall with test sample installed. A set of recordings contains a measurement of the sound pressure level in each one-third octave frequency band between 100Hz and 5000Hz (eighteen in total), 80Hz is added to this for the calculation of OITC. These multiple measurements provide a means of calculating the sound field space-time variation within each room and establishes a basis for determining an estimation of the measurement precision to a confidence level of 95%.

Before testing commences, the measurement microphone in each reverberation room is acoustically calibrated and the acoustical noise floor measured. Acoustical calibration of each microphone is repeated at completion of the testing programme to ensure accuracy of results.

AS1191-2002 and the equivalent standards ISO140-1 and ISO140-3 describe procedures which allow measurement of transmission loss of 10 square metre samples or of smaller size samples such as windows, doors, partitions etc. The procedure for 10 square metre test samples is straightforward and requires only the aforementioned three sets of measurements. The procedure for measurement of smaller test samples, which is discussed in appendix A of AS1191-2002, requires construction and transmission loss measurement of a 10 square metre test wall which has at least 5dB and preferably 10dB more attenuation at each one-third octave band centre frequency in the frequency range to be measured than that of the smaller test sample to be evaluated and a calculation based on relative sizes of the 10 square metre test wall and the small test sample.

OITC is then calculated as required by ASTM E1332-90 by assuming the previously specified spectra and using the transmission loss coefficients obtained in the calculation procedure (refer spreadsheets) and Rw (C; Ctr) calculated according to requirements of ISO 717-1:1996 "Acoustics - Rating of sound insulation in buildings and of building elements - Part 1: Airborne Sound Insulation".

6.0 Test sample performance assessment

Several criteria are presented in this report to evaluate the acoustical transmission loss of the test sample to satisfy building industry requirements in Australia. Each evaluation is made on an analysis of the calculated difference between the filler wall and the filler wall with test sample fitted.

a. The Internationally used rating of Sound Transmission Class as required by Australian Standard AS1191-2002.

b. The Weighted Sound Reduction Index, Rw rating with spectral corrections C and Ctr as discussed in International Standards Organisation document ISO717-1:1996 *"Acoustics - Rating of sound insulation in buildings and of building elements - Part 1: Airborne Sound Insulation"*. The ISO Rw rating is relevant where the spectra has low frequency energy content and is similar in application to the American OITC criteria. They differ however in the frequency range of application. Each compares a standardised reference curve with the measured data over one-third octave bands. The Rw evaluation is carried out using the one-third octave band with centre frequencies ranging from 100Hz to 3150Hz, and the OITC evaluation is carried out using the one-third octave bands in the frequency range 80Hz to 4000Hz. The Rw criteria is now largely favoured as a replacement for STC. The OITC evaluation is included in our reports for clients who wish to market their products overseas.

c. Other ratings presented are an evaluation of linear and A-weighted sound transmission loss averaged over the frequency range 100Hz to 5kHz. These are often required for marketing in New Zealand.

7.0 Sound Transmission Class (STC) rating

The first criterion presented, Sound Transmission Class (STC), has been an internationally standardised criterion for many years for evaluating noise reducing characteristics of building elements. The test procedure provides a single number which has been considered sufficient to determine transmission loss of building elements such as walls, windows, doors and other small test samples fitted into the walls of buildings.

This STC rating criterion was originally developed for acoustical performance evaluation of internal walls and doors in buildings and is based on noise spectra with an energy distribution typical of music and speech. It is now considered to be unsuitable for use where the building element under evaluation is likely to be exposed to low frequency components of noise generated by transportation movement.

Determination of Sound Transmission Class for a test sample requires comparison of the measured sound transmission loss with the value for each transmission class rating listed in the STC tables for each one-third octave band centre frequency, 125Hz to 4000Hz. The STC value, which is expressed as a class rating only (not as deciBels) as determined by these tables, is reached when either or both of the following requirements are met:

(a) The test sample transmission loss at any frequency in the range 125Hz to 4000Hz must not lie more than 8dB below that of the STC reference graph value at the same frequency and

(b) The total sum obtained from the addition of unfavourable deficiencies (as defined in the "Rw determination" description), must not add to more than 32dB.

8.0 Outdoor - Indoor Transmission Class (OITC), and Rw (C; Ctr) Weighted Sound Reduction Ratings

Alternative single number criterion, the American Outdoor - Indoor Transmission Class (OITC) rating and the European International Organisation for Standardisation Document ISO 717-1:1996, specification for the Weighted Sound Reduction Index (Rw) associated with relevant spectrum corrections C and Ctr, have been developed in order to more closely rank transmission loss performance of building elements with a listener's subjective reaction to transportation and living activity type noise spectra. Each criterion is intended for use in situations where the relevant spectra can be transmitted through the element.

The OITC and Rw (C; Ctr) criterion are not considered to be suitable for use where the noise has a predominantly low frequency component such as produced by some industrial activities. More information on the OITC test procedure can be obtained in ASTM Standard Test Procedure E1332, *"Standard Classification for Determination of Outdoor-Indoor Transmission Class"* and the Weighted Sound Reduction Index, C and Ctr criteria are fully explained in ISO 717-1:1996, *"Acoustics - Rating of sound insulation in buildings and of building elements - Part 1: Airborne Sound Insulation"*.

8.1 OITC determination

The OITC value for a test sample, as detailed in ASTM E 1332, is obtained by A-Weighting a noise spectrum which was obtained as an average of multiple measurements of aircraft take-off, freeway and railroad passby activities. This standardised noise spectrum is assumed to be in the send room during measurement of transmission loss.

The noise energy from this assumed noise spectra is (theoretically) transmitted through the small test sample, reduced by the transmission loss of the test sample at each one-third octave centre frequency (each transmission loss obtained from the STC measurement) and then summed as the total energy in the receive room.

The total energy is then determined as sound power (deciBels re 1 pW) and the resulting numerical value expressed as the OITC value of the sample under test. It should be noted that the OITC rating is considered as a class evaluation and stated numerically in a similar way to the STC value which is also a class evaluation (that is, stated numerically and not as deciBels as is sometimes found in literature).

8.2 Rw determination

The Rw criterion is obtained by comparing the set of test sample transmission loss against a set of reference data specified on table 3 on page 4 of ISO 717-1: 1996 (the comparison is made between values specified for each set at each one-third octave band centre frequency over the frequency range 100Hz to 3150Hz).

The reference data must then be amplitude shifted by the same amount (in single deciBel steps) until the sum of unfavourable readings, determined from the data difference at each frequency, is as large as possible but not more than 32dB. The 500Hz value of the reference data minus the number of deciBels the reference data set has been shifted is then referred to as the Rw value for the test sample.

Note 1. An unfavourable difference (deficiency) at any frequency occurs when the test sample transmission loss is less than the value specified for the shifted reference data at the same frequency.

Note 2. The STC rating determination criterion has failure modes of -8dB at any one frequency and/or a deficiency sum of -32dB, whereas Rw has only a single failure mode, this being a -32dB deficiency summation over the pass band consisting of 100Hz to 3150Hz one-third octave bands. As a result of this, the Rw rating usually has the same numerical value as the STC rating unless the STC evaluation is a consequence of one or more -8dB deficiencies and any deficiency at 100Hz does not contribute to the Rw failure or at 4kHz to the STC failure.

8.3 C and Ctr determination

Rw corrections are accommodated in ISO 717-1:1996 to account for the type of spectra incident on the high noise side of a test sample. The correction C is applied to Rw spectra which is generated by sources such as transportation which are located close to the building element under test. Such noise sources have a wide energy distribution in their noise spectra. The correction Ctr is applied to pink noise or to spectra which is generated by sources such as transportation, located at a distance. This correction is applied to Rw where spectral energy is mostly concentrated in the low frequency end of the measurement frequency range.

Relevant Spectrum "correction" for different types of noise source
(table A.1 of ISO717-1:1996)

Type of Noise Source	Relevant Spectrum "Correction" Term
Living activities (talking, music, radio, TV) Children playing Railway traffic at medium and high speed Highway road traffic > 80km/hour Jet aircraft, short distance Factories emitting mainly medium and high frequency noise	C
Urban road traffic Railway traffic at low speeds Aircraft, propeller driven Jet aircraft, large distance Disco music Factories emitting mainly low and medium frequency noise	Ctr

9.0 Test environment

Transmission loss measurement according to the requirements of AS1191 requires the use of two reverberation rooms which conform to the acoustical performance requirements of Annex D, guidelines for the design of reverberation rooms, ISO 3741-1999 "*Acoustics - Determination of sound power levels of noise sources - Precision methods for broad-band sources in reverberation rooms*".

Each test room, designated Reverberation (send) Room and Diffuse Field (receive) Room has a volume of approximately 200 cubic metres and is individually air conditioned by a special purpose acoustically attenuated air conditioning system. During testing, the supply and return air ducts are closed off via both pneumatically and manually operated dampers. The floors have different dimensions and are pentagonally shaped. The ceilings are inclined to the plane of the floor, opposite wall surfaces are different dimensions and inclined at an angle to each other to avoid acoustical coupling between rooms and to minimise the possibility of resonance in each room.

Additional sound diffusion within each of the rooms, to meet diffusivity requirements of ISO 354 - 1985 "*Acoustics - Measurement of sound absorption in a reverberation room*" is achieved by non-parallel room surfaces together with careful placing of eight 2400mm x 1200mm randomly oriented, freely suspended panels (19mm thick plywood sheets) with a total surface area of 40 square metres. These surfaces are heavily coated with epoxy resin to minimise acoustical absorption. The panels in each room are suspended in accordance with the tuning detail of ISO 354-1985 and therefore fully comply with the requirements of Australian Standard AS1045-1988.

Acoustical absorption coefficients in each octave band for each room and its diffusers do not exceed the maximum AS1191 requirement of 0.06 and are as follows:

Acoustical Absorption Coefficients						
Frequency	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz
Reverberation Room	0.02	0.01	0.02	0.03	0.04	0.06
Diffuse Field Room	0.02	0.02	0.02	0.03	0.04	0.06

Both reverberation rooms are inside separate isolating rooms, which serve as plenum chambers. This construction ensures freedom from flanking noise transmission problems even when very high acoustical sound pressure levels are generated inside either reverberation room.

The 300mm thick walls, floor and ceiling of all three rooms and plenum chambers are made from a heavily reinforced, high density concrete. The reverberation rooms are vibrationally suspended on damped, high tensile springs resting on neoprene rubber. The entire suspension assembly forms a two pole resonant suspension system, which is tuned below 5Hz.

The complete mounting system of springs, dampers and high compliance acoustical seals around the test aperture ensures negligible vibrational coupling between the reverberation rooms or interference from outside vibrational sources for all frequencies within the operating range of the two reverberation rooms. Entry to both reverberation rooms and plenum chambers is by means of double doors.

Each room size, geometry and suspended diffusers ensures that the acoustical performance characteristics fully meet requirements of Australian Standard AS1191-2002.

A sample testing space of approximately 10 square metres is located within an opening in the common wall between the plenum chambers. This wall is part of the external sound shell construction, it is not a component of either test room and effectively isolates the sample from any vibrational energy, which may be generated inside either reverberation test room.

Exposure of either side of any test sample in this test space to a sound field is achieved via apertures in each reverberation room wall which align with the opening in the common wall of the plenum chambers. Acoustical sealing at the location of the openings between the reverberation rooms and the wall holding the test sample is achieved by means of compliant, high transmission loss and vibration isolation gaskets installed between the reverberation rooms and the common wall between the plenum chambers.

When testing small samples a filler wall is constructed in the 10 square metre opening in the testing space. An aperture is made in the filler wall, the test sample is then fitted and sealed in the opening. The acoustical integrity of the fitting is then tested.

10.0 Formulae

(A) Receive room acoustical absorption

Sound absorption coefficients at each frequency band for the test specimen alpha (A) is determined from the reverberation time measurements according to the following equation:

$$A = \frac{0.16V}{T_{60}} \qquad \text{........(1)}$$

Where

A	=	the equivalent absorption area in the receiving room
V	=	the receive room volume (in m^3)
T_{60}	=	the receive room reverberation time (RT60)

(B) Average sound pressure level

Average sound pressure level (Lp) is determined for each frequency band as follows:

$$L_p = 10 Log\left[\frac{p_1^2 + p_2^2 + p_3^2 .... + p_n^2}{np_o^2}\right] \qquad \text{........(2)}$$

Where

L_p	=	Average sound pressure level (dB)
p_n	=	sound pressure of the n^{th} measurement (Pascals)
p_o	=	reference sound pressure (Pascals)
n	=	number of measurements

(C) Transmission Loss

Since the sound fields in both rooms are diffuse and the environment is free of flanking transmission, sound transmission loss (R) of a test sample for each frequency band is calculated according to the following equation:

$$R = L_{ps} - L_{pr} + 10 Log\left[\frac{S}{A}\right] \qquad \text{........(3)}$$

Where

R	=	the sound transmission loss of the test sample
L_{ps}	=	the average SPL in the source room
L_{pr}	=	the average SPL in the receiving room
S	=	the area of the specimen under test
A	=	the equivalent absorption area in the receiving room

(D) Small Test Samples

Test objects comprising a small size test sample mounted in a filler wall are measured according to the small sample method discussed in standard AS1191-2002. The equations used to calculate results are as follows:

Transmission loss coefficients for the small test sample (τ_s) are determined from the difference between the filler wall transmission loss (τ_f) and the composite wall transmission loss (τ_χ) according to the following equations:

$$\tau_f = 10^{\frac{R_f}{10}} \quad \text{...........(4)}$$

$$\tau_c = 10^{\frac{R_c}{10}} \quad \text{...........(5)}$$

Rearranging the equations produces the transmission loss coefficient for each frequency band as follows:

$$\tau_s = \frac{\tau_c S_c - \tau_f S_f}{S_s} \quad \text{...........(6)}$$

Transmission loss for each frequency band (R_s) is determined from this result according to the following equation:

$$R_s = 10Log\left[\frac{1}{\tau_s}\right] \quad \text{...........(7)}$$

Where

τ_c	=	the transmission loss coefficient of the filler wall and the small test sample
τ_f	=	the transmission loss coefficient of the filler wall
τ_s	=	the transmission loss coefficient of the small test sample for each frequency band
R_c	=	the transmission loss of the filler wall and the small test sample
R_f	=	the transmission loss of the filler wall
R_s	=	the transmission loss of the small test sample for each frequency band
S_c	=	the surface area of the composite wall
S_f	=	the surface area of the filler wall
S_s	=	the surface area of the wall mounted small test sample

(E) Errors

Errors (95% confidence level) are determined for each frequency band by means of the following equation:

$$Error(95\%confidence) = \frac{t.sd}{\sqrt{n}} \quad \text{...........(8)}$$

Where

n	=	the number of microphone positions sampled
t	=	the students t factor
sd	=	the standard deviation obtained from the measurement spreadsheet

11.0 Instrumentation

The following instrumentation is used for acoustical transmission loss measurements. Instrumentation calibration where appropriate has been calibrated according to NATA requirements.

Brüel and Kjaer Two Channel Pulse Analyser (assembly 2825, 7521, 2 x 3015), S/N 2005502
Brüel and Kjaer Real Time Frequency Analyser type 2123, S/N 1446593
Brüel and Kjaer Cathode Follower type 2639, S/N 1448239 & S/N 1391974
Brüel and Kjaer Cathode Follower type 2660, S/N 1337994 & S/N 1338051
Brüel and Kjaer Cathode Follower type 2669, S/N 1888716 & S/N 1834203
Brüel and Kjaer Microphone type 4144, S/N 563123, S/N 1138528, S/N 439142 & S/N 2118354
Brüel and Kjaer Microphone type 4179, S/N 2245299, S/N 2245300 & S/N 2245154
Brüel and Kjaer Sound Level Calibrator type 4231, S/N 2095393
Yamaha Professional Sound Sources type S500, S/N 1068 and S/N 1069
Murray 100 Watt Amplifier type MA534, S/N 15
Vaisala Digital Barometer type PTB201AD, S/N R3330001
Testo Temperature/Humidity Logger, type 177-H1, S/N 00886924

checked : JSmith

Test Conditions:

Total Area Under Test (Sq m):	9.97	Barometric Air Pressure (hPa)	1017
Temperature (C):	18.1	Relative Humidity SR (%)	64.5
Receive Room Volume (Cu m):	200	Relative Humidity RR (%)	64.5
Speed of Sound (m/s):	341.98		

Date Of Test: 29-Aug-2004

Testing Officer: P. Alway.

FILLER WALL ONLY

ATF Report 1730

Client Name: Rehau

Frequency	Mean SEND Room SPL (dB)	Std Dev	Mean RECEIVE Room SPL (dB)	Std Dev	Difference with Mic Response Corrections	Mean Receive Room Reverb RT_{60} (seconds)	Receive Room Absorption	10*log (S/A)	Std Dev	Frequency	Calculated 1/3 Octave Transmission Loss (dB)	Precision 95% Confidence Interval (dB)	Frequency	Calculated 1/1 Octave Transmission Loss (dB)
50 Hz	90.88	2.47	52.25	2.85	38.63	6.12	5.23	2.80	0.61	50 Hz	41.431	2.43		
63 Hz	89.65	3.85	56.25	4.18	33.40	3.90	8.20	0.85	0.86	63 Hz	34.243	3.65	63 Hz	40.192
80 Hz	90.73	1.99	42.47	1.52	48.26	3.01	10.63	-0.28	0.46	80 Hz	47.980	1.62		
100 Hz	94.58	1.44	39.35	1.69	55.23	3.39	9.43	0.24	0.42	100 Hz	55.470	1.43		
125 Hz	95.12	1.78	33.15	1.49	61.98	3.67	8.71	0.59	0.33	125 Hz	62.561	1.49	125 Hz	60.603
160 Hz	92.77	0.97	31.27	1.53	61.50	5.53	5.79	2.36	0.40	160 Hz	63.857	1.18		
200 Hz	94.63	0.79	31.35	0.66	63.28	5.77	5.55	2.55	0.22	200 Hz	65.823	0.67		
250 Hz	94.38	0.67	24.02	0.77	70.36	6.56	4.88	3.10	0.25	250 Hz	73.467	0.67	250 Hz	70.210
315 Hz	94.39	0.41	20.78	0.53	73.62	6.97	4.59	3.37	0.17	315 Hz	76.985	0.44		
400 Hz	95.38	0.36	20.39	0.64	74.99	6.92	4.62	3.34	0.16	400 Hz	78.325	0.48		
500 Hz	94.93	0.27	16.71	0.84	78.22	7.27	4.40	3.55	0.12	500 Hz	81.772	0.56	500 Hz	80.595
630 Hz	93.55	0.22	12.57	0.92	80.98	6.48	4.94	3.05	0.15	630 Hz	84.033	0.61		
800 Hz	92.30	0.31	9.68	1.65	82.62	5.94	5.38	2.68	0.09	800 Hz	85.296	1.07		
1000 Hz	94.49	0.17	9.53	0.40	84.96	5.65	5.66	2.46	0.13	1000 Hz	87.419	0.33	1000 Hz	88.288
1250 Hz	96.71	0.31	8.46	0.29	87.86	5.31	6.03	2.19	0.02	1250 Hz	90.050	0.30		
1600 Hz	97.96	0.38	9.88	0.35	87.56	4.37	7.33	1.34	0.07	1600 Hz	88.901	0.35		
2000 Hz	95.98	0.29	14.59	0.30	80.54	3.82	8.37	0.76	0.15	2000 Hz	81.301	0.32	2000 Hz	84.983
2500 Hz	94.69	0.36	12.63	0.35	80.73	3.34	9.57	0.18	0.10	2500 Hz	80.907	0.39		
3150 Hz	93.39	0.39	4.05	0.24	87.10	2.96	10.81	-0.35	0.05	3150 Hz	86.749	0.31		
4000 Hz	93.38	0.54	-2.92	0.16	92.91	2.50	12.79	-1.08	0.09	4000 Hz	91.827	0.41	4000 Hz	92.203
5000 Hz	92.45	0.64	-4.61	0.18	92.41	2.07	15.44	-1.90	0.08	5000 Hz	90.509	0.51		
6300 Hz	90.20	0.73	-6.92	0.22	90.62	1.69	18.93	-2.78	0.09	6300 Hz	87.837	0.60		
8000 Hz	89.76	0.75	-6.63	0.09	89.18	1.35	23.72	-3.76	0.24	8000 Hz	85.417	0.70	8000 Hz	92.237
10000 Hz	81.69	1.01	-5.96	0.20	82.83	1.31	24.41	-3.89	0.29	10000 Hz	78.937	0.94		

Material Under Test:
Description
Filler Wall For ATF Test Program August 2005

Arithmetic Average of Transmission Loss From 100hz to 5kHz

Unweighted Average	A-Weighted Average
79	75

Results (Incorporating AS1191-1985 Compliant Measurements)

Frequency		Rounded 1/3 octave Transmission Loss Values (dB)	STC 82 Curve	Transmission Loss to STC Difference
50		41		
63		34		
80		48		
100	(AS1191)	55		
125	(AS1191)	63	66	-3
160	(AS1191)	64	69	-5
200	(AS1191)	66	72	-6
250	(AS1191)	73	75	-2
315	(AS1191)	77	78	-1
400	(AS1191)	78	81	-3
500	(AS1191)	82	82	-
630	(AS1191)	84	83	-
800	(AS1191)	85	84	-
1000	(AS1191)	87	85	-
1250	(AS1191)	90	86	-
1600	(AS1191)	89	86	-
2000	(AS1191)	81	86	-5
2500	(AS1191)	81	86	-5
3150	(AS1191)	87	86	-
4000	(AS1191)	92	86	-
5000	(AS1191)	91		Sum
6300		88		-30
8000		85		
10000		79		

The Sound Transmission Class Of This Sample is:

STC 82

OITC Rating

Frequency	Normalised A-Weighted Reference Noise Spectrum (dB)	Sound Energy (W/m2)
80 Hz	-19.6	1.738E-07
100 Hz	-17.2	6.026E-08
125 Hz	-15.2	1.514E-08
160 Hz	-15.5	1.122E-08
200 Hz	-14	1.000E-08
250 Hz	-13.7	2.138E-09
315 Hz	-12.7	1.072E-09
400 Hz	-11.9	1.023E-09
500 Hz	-10.3	5.888E-10
630 Hz	-11	3.162E-10
800 Hz	-10.9	2.570E-10
1000 Hz	-11.1	1.549E-10
1250 Hz	-10.5	8.913E-11
1600 Hz	-11.1	9.772E-11
2000 Hz	-10.9	6.457E-10
2500 Hz	-11.8	5.248E-10
3150 Hz	-13.9	8.128E-11
4000 Hz	-15.1	1.950E-11
	Sum	2.774E-07
	-10*LOG(Sum)	65.57

The Outdoor Indoor Transmission Class is:

OITC 66

1/1 Octave

Frequency	Rounded 1/1 octave Transmission Loss Values (dB)
63 Hz	40
125 Hz	61
250 Hz	70
500 Hz	81
1000 Hz	88
2000 Hz	85
4000 Hz	92
8000 Hz	92

R_w Rating

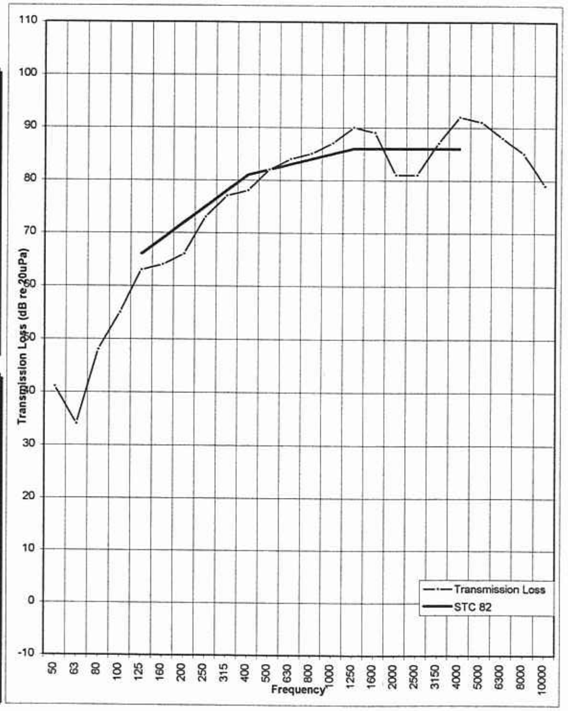
$R_W =$	81
$C_T =$	-2
$C_{TR} =$	-8
$C_{T\ (50\text{-}5000)} =$	-11
$C_{TR\ (50\text{-}5000)} =$	-25

$R_W(C_T; C_{TR})$ is

81 (-2 ; -8)

$R_W(C_T; C_{TR}; C_{(50\text{-}5000)}; C_{TR\ (50\text{-}5000)})$ is:

81 (-2 ; -8 ; -11 ; -25)



Signatory: ....
Geoff Colin-Thome

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Date: 19/9/05

Signatory: ....

Geoff Colin-Thome

Date Of Test
31-Aug-2005

Test Conditions:

Total Area Under Test (Sq m):	9.95	Barometric Air Pressure (hPa)	1005
Temperature (C):	18.3	Relative Humidity SR (%)	67.7
Receive Room Volume (Cu m):	200	Relative Humidity RR (%)	67.7
Speed of Sound (m/s):	341.98		

Testing Officer: G. Colin-Thome'

FILLER WALL + SAMPLE

ATF Report 1733

Client Name: Rehau

Frequency	Mean SEND Room SPL (dB)	Std Dev	Mean RECEIVE Room SPL (dB)	Std Dev	Difference with Mic Response Corrections	Mean Receive Room Reverb RT_{60} (seconds)	Receive Room Absorption	10*log (S/A)	Std Dev	Frequency	Calculated 1/3 Octave Transmission Loss (dB)	Precision 95% Confidence Interval (dB)	Frequency	Calculated 1/1 Octave Transmission Loss (dB)
50 Hz	86.52	2.70	48.94	2.89	37.59	3.72	8.61	0.63	0.61	50 Hz	38.215	2.54		
63 Hz	84.36	3.64	47.30	3.35	37.06	2.82	11.33	-0.56	0.86	63 Hz	36.493	3.19	63 Hz	36.251
80 Hz	85.96	2.35	52.40	2.81	33.56	2.98	10.74	-0.33	0.46	80 Hz	33.225	2.34		
100 Hz	87.62	1.63	59.47	3.32	28.15	2.63	12.16	-0.87	0.42	100 Hz	27.278	2.37		
125 Hz	90.23	1.81	62.17	2.57	28.06	3.39	9.44	0.23	0.33	125 Hz	28.292	2.01	125 Hz	30.373
160 Hz	88.30	1.18	55.12	1.28	33.18	4.34	7.38	1.30	0.40	160 Hz	34.476	1.13		
200 Hz	89.21	0.97	54.72	1.17	34.49	5.18	6.18	2.07	0.22	200 Hz	36.559	0.97		
250 Hz	89.38	0.70	53.79	0.78	35.59	6.08	5.26	2.77	0.25	250 Hz	38.357	0.68	250 Hz	38.976
315 Hz	88.50	0.46	48.55	0.44	39.95	6.41	5.00	2.99	0.17	315 Hz	42.944	0.42		
400 Hz	88.92	0.50	47.34	0.37	41.58	6.39	5.01	2.98	0.16	400 Hz	44.561	0.41		
500 Hz	89.30	0.37	46.84	0.56	42.45	6.63	4.82	3.14	0.12	500 Hz	45.597	0.44	500 Hz	45.687
630 Hz	87.87	0.42	43.49	0.34	44.38	6.24	5.13	2.88	0.15	630 Hz	47.258	0.36		
800 Hz	86.45	0.38	41.61	0.35	44.84	5.64	5.68	2.44	0.09	800 Hz	47.279	0.33		
1000 Hz	88.73	0.42	42.63	0.31	46.09	5.56	5.75	2.38	0.13	1000 Hz	48.474	0.37	1000 Hz	47.936
1250 Hz	90.76	0.27	45.35	0.24	45.03	5.23	6.12	2.11	0.02	1250 Hz	47.136	0.26		
1600 Hz	91.85	0.24	46.63	0.37	44.71	4.43	7.22	1.39	0.07	1600 Hz	46.105	0.32		
2000 Hz	90.13	0.33	43.54	0.29	45.73	3.76	8.51	0.68	0.15	2000 Hz	46.413	0.33	2000 Hz	47.800
2500 Hz	88.59	0.39	38.12	0.33	49.14	3.22	9.95	0.00	0.10	2500 Hz	49.143	0.40		
3150 Hz	86.72	0.34	31.49	0.30	52.99	2.90	11.05	-0.46	0.05	3150 Hz	52.535	0.31		
4000 Hz	86.65	0.55	23.57	0.44	59.69	2.56	12.52	-1.00	0.09	4000 Hz	58.694	0.49	4000 Hz	58.688
5000 Hz	86.48	0.47	16.01	0.32	65.81	2.11	15.16	-1.83	0.08	5000 Hz	63.982	0.46		
6300 Hz	83.02	0.78	7.33	0.54	69.20	1.75	18.31	-2.65	0.09	6300 Hz	66.546	0.70		
8000 Hz	81.73	1.14	2.27	0.87	72.24	1.41	22.68	-3.58	0.24	8000 Hz	68.666	1.04	8000 Hz	74.208
10000 Hz	73.63	1.04	-2.32	0.26	71.12	1.32	24.19	-3.86	0.29	10000 Hz	67.258	0.96		

Material Under Test:

PVC Casement window with fixed light.
Glazing - Insulating Glass Unit 10.38mm Lam (Send Side)/ 16mm air gap/ 6.76mm Laminated Glass (Receive Side)
EPDM interior and exterior perimeter seals.
5mm Self-adhesive foam on interior stile.

Arithmetic Average of Transmission Loss From 100hz to 5kHz

Unweighted Average	A-Weighted Average
45	40

Results (Incorporating AS1191-1985 Compliant Measurements)

Frequency		Rounded 1/3 octave Transmission Loss Values (dB)	STC 47 Curve	Transmission Loss to STC Difference
50		38		
63		36		
80		33		
100	(AS1191)	27		
125	(AS1191)	28	31	-3
160	(AS1191)	34	34	-
200	(AS1191)	37	37	-
250	(AS1191)	38	40	-2
315	(AS1191)	43	43	-
400	(AS1191)	45	46	-1
500	(AS1191)	46	47	-1
630	(AS1191)	47	48	-1
800	(AS1191)	47	49	-2
1000	(AS1191)	48	50	-2
1250	(AS1191)	47	51	-4
1600	(AS1191)	46	51	-5
2000	(AS1191)	46	51	-5
2500	(AS1191)	49	51	-2
3150	(AS1191)	53	51	-
4000	(AS1191)	59	51	-
5000	(AS1191)	64		Sum
6300		67		-28
8000		69		
10000		67		

The Sound Transmission Class Of This Sample is:

STC 47

OITC Rating

Frequency	Normalised A-Weighted Reference Noise Spectrum (dB)	Sound Energy (W/m2)
80 Hz	-19.6	5.495E-06
100 Hz	-17.2	3.802E-05
125 Hz	-15.2	4.786E-05
160 Hz	-15.5	1.122E-05
200 Hz	-14	7.943E-06
250 Hz	-13.7	6.761E-06
315 Hz	-12.7	2.692E-06
400 Hz	-11.9	2.042E-06
500 Hz	-10.3	2.344E-06
630 Hz	-11	1.585E-06
800 Hz	-10.9	1.622E-06
1000 Hz	-11.1	1.230E-06
1250 Hz	-10.5	1.778E-06
1600 Hz	-11.1	1.950E-06
2000 Hz	-10.9	2.042E-06
2500 Hz	-11.8	8.318E-07
3150 Hz	-13.9	2.042E-07
4000 Hz	-15.1	3.890E-08
	Sum	1.357E-04
	-10*LOG(Sum)	38.68

The Outdoor Indoor Transmission Class is:

OITC 39

1/1 Octave

Frequency	Rounded 1/1 octave Transmission Loss Values (dB)
63 Hz	36
125 Hz	30
250 Hz	39
500 Hz	46
1000 Hz	48
2000 Hz	48
4000 Hz	59
8000 Hz	74

R_w Rating

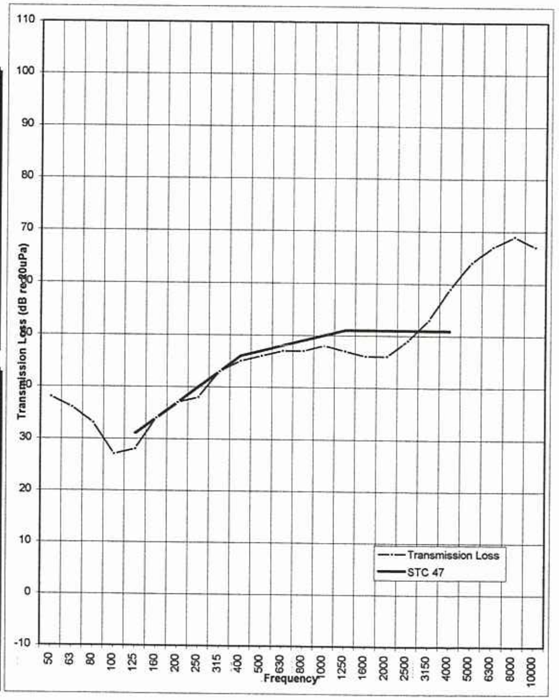
R_W =	47
C_T =	-2
C_{TR} =	-5
$C_{T\ (50\text{-}5000)}$ =	-1
$C_{TR\ (50\text{-}5000)}$ =	-6

R_W(C_T ; C_{TR}) is

47 (-2 ; -5)

R_W(C_T; C_{TR}; $C_{T(50\text{-}5000)}$; $C_{TR(50\text{-}5000)}$) is:

47 (-2 ; -5 ; -1 ; -6)



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Date: 14/9/05

Signatory: [signature] Geoff Colin-Thome

Date Of Test 31-Aug-2005

Test Conditions:

Surface Area Of Test Sample (Sq m): 2.3436
Surface Area Of Remaining Filler Wall: 7.6264
Total Surface Area Of Test Aperture: 9.97

SAMPLE ONLY

ATF Report 1733

Client Name: Rehau

Frequency	Filler Wall Transmission Loss (dB)	Std Dev	Filler Wall + Sample Transmission Loss	Std Dev	Transmission Coefficient of Filler Wall (τ_f)	Transmission Coefficient of Filler Wall + Sample (τ_c)	Transmission Coefficient of Sample (τ_s)	$1/\tau_s$
50 Hz	41.43	2.43	38.22	2.54	7.19263E-05	0.000150831	0.000407599	2453.39
63 Hz	34.24	3.65	34.24	3.19	0.000376449	0.000376704	0.000377533	2648.77
80 Hz	47.98	1.62	33.23	2.34	1.59239E-05	0.000475864	0.001972572	506.95
100 Hz	55.47	1.43	27.28	2.37	2.8379E-06	0.001871705	0.007953257	125.73
125 Hz	62.56	1.49	28.29	2.01	5.54451E-07	0.001481859	0.006302229	158.67
160 Hz	63.86	1.18	34.48	1.13	4.11387E-07	0.000356772	0.001516419	659.45
200 Hz	65.82	0.67	36.56	0.97	2.61648E-07	0.000220852	0.000938684	1065.32
250 Hz	73.47	0.67	38.36	0.68	4.50142E-08	0.000145985	0.000620895	1610.58
315 Hz	76.98	0.44	42.94	0.42	2.00226E-08	5.07725E-05	0.000215928	4631.17
400 Hz	78.33	0.48	44.56	0.41	1.47047E-08	3.49844E-05	0.000148781	6721.30
500 Hz	81.77	0.56	45.60	0.44	6.64928E-09	2.7564E-05	0.00011724	8529.55
630 Hz	84.03	0.61	47.26	0.36	3.95093E-09	1.88031E-05	7.99782E-05	12503.41
800 Hz	85.30	1.07	47.28	0.33	2.95414E-09	1.87132E-05	7.95989E-05	12562.98
1000 Hz	87.42	0.33	48.47	0.37	1.81196E-09	1.42114E-05	6.04516E-05	16542.17
1250 Hz	90.05	0.30	47.14	0.26	9.88626E-10	1.93379E-05	8.22629E-05	12156.14
1600 Hz	88.90	0.35	46.11	0.32	1.28791E-09	2.45167E-05	0.000104293	9588.33
2000 Hz	81.30	0.32	46.41	0.33	7.4106E-09	2.28376E-05	9.71304E-05	10295.44
2500 Hz	80.91	0.39	49.14	0.40	8.11451E-09	1.21826E-05	5.18002E-05	19304.95
3150 Hz	86.75	0.31	52.54	0.31	2.11402E-09	5.57768E-06	2.37213E-05	42156.14
4000 Hz	91.83	0.41	58.69	0.49	6.56673E-10	1.35077E-06	5.74424E-06	174087.55
5000 Hz	90.51	0.51	63.98	0.46	8.89363E-10	3.99785E-07	1.69785E-06	588981.54
6300 Hz	87.84	0.60	66.55	0.70	1.64538E-09	2.21529E-07	9.37063E-07	1067164.27
8000 Hz	85.42	0.70	68.67	1.04	2.87253E-09	1.35966E-07	5.69071E-07	1757248.58
10000 Hz	78.94	0.94	67.26	0.96	1.2772E-08	1.88015E-07	7.5828E-07	1318774.49

Frequency	Calculated 1/3 Octave Transmission Loss (dB)	Precision 95% Confidence Interval (dB)	Frequency	Calculated 1/1 Octave Transmission Loss (dB)
50 Hz	33.898	3.51		
63 Hz	34.230	4.85	63 Hz	31.566
80 Hz	27.050	2.85		
100 Hz	20.995	2.77		
125 Hz	22.005	2.50	125 Hz	24.088
160 Hz	28.192	1.64		
200 Hz	30.275	1.18		
250 Hz	32.070	0.96	250 Hz	32.690
315 Hz	36.657	0.61		
400 Hz	38.275	0.63		
500 Hz	39.309	0.71	500 Hz	39.400
630 Hz	40.970	0.71		
800 Hz	40.991	1.12		
1000 Hz	42.186	0.50	1000 Hz	41.649
1250 Hz	40.848	0.40		
1600 Hz	39.817	0.47		
2000 Hz	40.126	0.46	2000 Hz	41.513
2500 Hz	42.857	0.56		
3150 Hz	46.249	0.44		
4000 Hz	52.408	0.64	4000 Hz	52.401
5000 Hz	57.701	0.68		
6300 Hz	60.282	0.92		
8000 Hz	62.448	1.26	8000 Hz	67.972
10000 Hz	61.202	1.35		

Sample Under Test:
PVC Casement window with fixed light.
Glazing - Insulating Glass Unit 10.38mm Lam (Send Side)/ 16mm air gap/ 6.76mm Laminated Glass (Receive Side)
EPDM interior and exterior perimeter seals.
5mm Self-adhesive foam on interior stile.

Arithmetic Average of Transmission Loss From 100hz to 5kHz

Unweighted Average	A-Weighted Average
38	34

Results (Incorporating AS1191-1985 Compliant Measurements)

Frequency		Rounded 1/3 octave Transmission Loss Values (dB)	STC 41 Curve	Transmission Loss to STC Difference
50		34		
63		34		
80		27		
100	(AS1191)	21		
125	(AS1191)	22	25	-3
160	(AS1191)	28	28	-
200	(AS1191)	30	31	-1
250	(AS1191)	32	34	-2
315	(AS1191)	37	37	-
400	(AS1191)	38	40	-2
500	(AS1191)	39	41	-2
630	(AS1191)	41	42	-1
800	(AS1191)	41	43	-2
1000	(AS1191)	42	44	-2
1250	(AS1191)	41	45	-4
1600	(AS1191)	40	45	-5
2000	(AS1191)	40	45	-5
2500	(AS1191)	43	45	-2
3150	(AS1191)	46	45	-
4000	(AS1191)	52	45	-
5000	(AS1191)	58		Sum
6300		60		-31
8000		62		
10000		61		

The Sound Transmission Class Of This Sample is:

STC 41

OITC Rating

Frequency	Normalised A-Weighted Reference Noise Spectrum (dB)	Sound Energy (W/m2)
80 Hz	-19.6	2.188E-05
100 Hz	-17.2	1.514E-04
125 Hz	-15.2	1.905E-04
160 Hz	-15.5	4.467E-05
200 Hz	-14	3.981E-05
250 Hz	-13.7	2.692E-05
315 Hz	-12.7	1.072E-05
400 Hz	-11.9	1.023E-05
500 Hz	-10.3	1.175E-05
630 Hz	-11	6.310E-06
800 Hz	-10.9	6.457E-06
1000 Hz	-11.1	4.898E-06
1250 Hz	-10.5	7.079E-06
1600 Hz	-11.1	7.762E-06
2000 Hz	-10.9	8.128E-06
2500 Hz	-11.8	3.311E-06
3150 Hz	-13.9	1.023E-06
4000 Hz	-15.1	1.950E-07
	Sum	5.530E-04
	-10*LOG(Sum)	32.57

The Outdoor Indoor Transmission Class is:

OITC 33

1/1 Octave

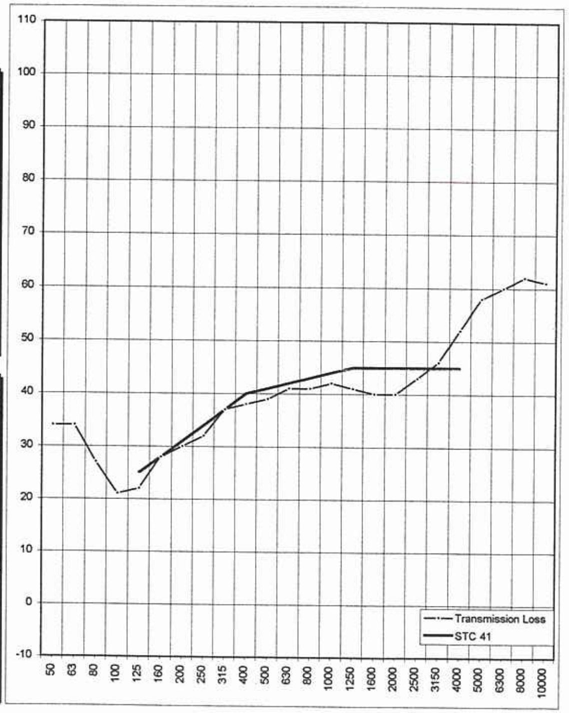
Frequency	Rounded 1/1 octave Transmission Loss Values (dB)
63 Hz	32
125 Hz	24
250 Hz	33
500 Hz	39
1000 Hz	42
2000 Hz	42
4000 Hz	52
8000 Hz	68

R_w Rating

R_W = 41
C_T = -2
C_{TR} = -6
$C_{T\,(50\text{-}5000)}$ = -1
$C_{TR\,(50\text{-}5000)}$ = -6

$R_W(C_T ; C_{TR})$ is
41 (-2 ; -6)

$R_W(C_T ; C_{TR} ; C_{(50\text{-}5000)} ; C_{TR(50\text{-}5000)})$ is:
41 (-2 ; -6 ; -1 ; -6)



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Date: 14 / 9 / 05

ATF Report	1733

Date Of Test	31-Aug-2005

R_W Calculation Spreadsheet

R_W = 41

Frequency (Hz)	Transmission Loss R_i (Rounded down to 1 significant figure)	Rw 41 Curve	Transmission Loss to R_W Difference
100	21	22	-1
125	22	25	-3
160	28.2	28	-
200	30.3	31	-0.7
250	32.1	34	-1.9
315	36.7	37	-0.3
400	38.3	40	-1.7
500	39.3	41	-1.7
630	41	42	-1
800	41	43	-2
1000	42.2	44	-1.8
1250	40.8	45	-4.2
1600	39.8	45	-5.2
2000	40.1	45	-4.9
2500	42.9	45	-2.1
3150	46.2	45	-
		SUM	-31.5

Determination Of Correction C

C spectrum (ISO 717-P7) L_{i1}	L_{i1}-R_i	10^((L_{i1}-R_i)/10)
-29	-50.00	1.000E-05
-26	-48.00	1.585E-05
-23	-51.20	7.586E-06
-21	-51.30	7.413E-06
-19	-51.10	7.762E-06
-17	-53.70	4.266E-06
-15	-53.30	4.677E-06
-13	-52.30	5.888E-06
-12	-53.00	5.012E-06
-11	-52.00	6.310E-06
-10	-52.20	6.026E-06
-9	-49.80	1.047E-05
-9	-48.80	1.318E-05
-9	-49.10	1.230E-05
-9	-51.90	6.457E-06
-9	-55.20	3.020E-06
	SUM	1.262E-04
	10*Log (SUM)	38.99

C = -2

Determination Of Correction CTR

C_{TR} spectrum (ISO717-P7) L_{i2}	L_{i2}-R_i	10^((L_{i2}-R_i)/10)
-20	-41.00	7.943E-05
-20	-42.00	6.310E-05
-18	-46.20	2.399E-05
-16	-46.30	2.344E-05
-15	-47.10	1.950E-05
-14	-50.70	8.511E-06
-13	-51.30	7.413E-06
-12	-51.30	7.413E-06
-11	-52.00	6.310E-06
-9	-50.00	1.000E-05
-8	-50.20	9.550E-06
-9	-49.80	1.047E-05
-10	-49.80	1.047E-05
-11	-51.10	7.762E-06
-13	-55.90	2.570E-06
-15	-61.20	7.586E-07
	SUM	2.907E-04
	10*Log (SUM)	35.37

C_{TR}= -6

Determination Of Correction $C_{50\text{-}5000}$

Frequency (Hz)	Transmission Loss R_i (Rounded down to 1 significant figure)	C spectrum (ISO 717-P11) L_{i1}	L_{i1}-R_i	10^((L_{i1}-R_i)/10)
50	33.9	-41	-74.90	3.236E-08
63	34.2	-37	-71.20	7.586E-08
80	27.0	-34	-61.00	7.943E-07
100	21.0	-30	-51.00	7.943E-06
125	22.0	-27	-49.00	1.259E-05
160	28.2	-24	-52.20	6.026E-06
200	30.3	-22	-52.30	5.888E-06
250	32.1	-20	-52.10	6.166E-06
315	36.7	-18	-54.70	3.388E-06
400	38.3	-16	-54.30	3.715E-06
500	39.3	-14	-53.30	4.677E-06
630	41.0	-13	-54.00	3.981E-06
800	41.0	-12	-53.00	5.012E-06
1000	42.2	-11	-53.20	4.786E-06
1250	40.8	-10	-50.80	8.318E-06
1600	39.8	-10	-49.80	1.047E-05
2000	40.1	-10	-50.10	9.772E-06
2500	42.9	-10	-52.90	5.129E-06
3150	46.2	-10	-56.20	2.399E-06
4000	52.4	-10	-62.40	5.754E-07
5000	57.7	-10	-67.70	1.698E-07
			SUM	1.019E-04
			10*Log (SUM)	39.92

$C_{50\text{-}5000}$ = -1

Determination Of Correction $C_{TR\ 50\text{-}5000}$

C_{TR} spectrum (ISO717-P11) L_{i2}	L_{i2}-R_i	10^((L_{i2}-R_i)/10)
-25	-58.90	1.288E-06
-23	-57.20	1.905E-06
-21	-48.00	1.585E-05
-20	-41.00	7.943E-05
-20	-42.00	6.310E-05
-18	-46.20	2.399E-05
-16	-46.30	2.344E-05
-15	-47.10	1.950E-05
-14	-50.70	8.511E-06
-13	-51.30	7.413E-06
-12	-51.30	7.413E-06
-11	-52.00	6.310E-06
-9	-50.00	1.000E-05
-8	-50.20	9.550E-06
-9	-49.80	1.047E-05
-10	-49.80	1.047E-05
-11	-51.10	7.762E-06
-13	-55.90	2.570E-06
-15	-61.20	7.586E-07
-16	-68.40	1.445E-07
-18	-75.70	2.692E-08
	SUM	3.099E-04
	10*Log (SUM)	35.09

$C_{TR,\ 50\text{-}5000}$ = -6

Determination Of Arithmetic Average Of Transmission Loss

Frequency (Hz)	Calculated Transmission Loss	A-Weighting Correction	A-weighted Transmission Loss
100	20.995	-19.1	1.895
125	22.005	-16.1	5.905
160	28.192	-13.4	14.792
200	30.275	-10.9	19.375
250	32.070	-8.6	23.470
315	36.657	-6.6	30.057
400	38.275	-4.8	33.475
500	39.309	-3.2	36.109
630	40.970	-1.9	39.070
800	40.991	-0.8	40.191
1000	42.186	0	42.186
1250	40.848	0.6	41.448
1600	39.817	1	40.817
2000	40.126	1.2	41.326
2500	42.857	1.3	44.157
3150	46.249	1.2	47.449
4000	52.408	1	53.408
5000	57.701	0.5	58.201
Average =	38.441	A-weighted Average =	34.074
Rounded	38	Rounded	34

Signatory: ....
Geoff Colin-Thome

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Date: 1/9/05