Test report of acoustic panels, supplied by PRESTO FURNITURE, in a Reduced-size Reverberation Room

(Megasorber Test Cube AKA Alpha Cabin)

Test Standard:	AS ISO 354 - 2006
Testing Laboratory:	Megasorber Pty. Ltd.
	1/25 Chapman Street
	Blackburn North VIC 3130
Client:	Presto Furniture
Test Officer:	Jonathon Cotterill
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1. Introduction

The material testing detailed in this report was commissioned by Presto Furniture for the purpose of determining the Noise Reduction Coefficients (NRC) of polyester acoustic boards simulating various in-situ applications.

All tests were conducted using Megasorber Test Cube (AKA Alpha Cabin), a reduced-size reverberation chamber at Megasorber Pty Ltd premises in Blackburn North, Victoria, Australia

All testing was conducted in accordance with AS ISO 354–2006 Acoustics: Measurement of sound absorption in a reverberation room, using a calibrated testing apparatus. The test chamber measurement devices are regularly calibrated according to OEM instructions.

Reported results were obtained using a combination of experimental measurements and computer modelling.

2. Test Apparatus

2.1 Testing Facilities

The reduced-size reverberation room has an internal volume of the room is 6.44m^3. None of the walls, floor or ceiling are parallel to one another. Within the room are three loudspeakers, a 5-microphone array and diffusing panels. The whole system was designed, constructed and commissioned by Autoneum.

2.2 Signal Generation

Sound impulses are generated by 3 broadband speakers which are located in the corners. The correct operation of the loudspeakers is periodically checked by the apparatus' operator.

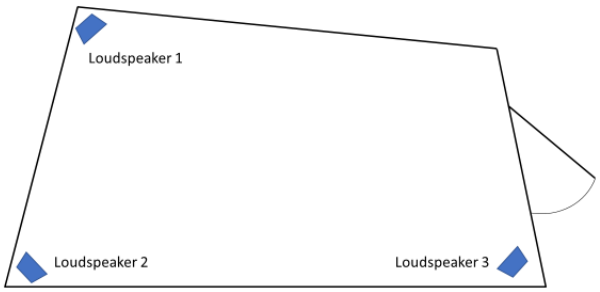


Figure 1. Location of loudspeakers within Test Cube.

2.3 Signal measurement

Measurement of the generated signals occurs individually by five horizontally mounted microphones. These are lowered into position to take measurements after test specimens are loaded into the room.

2.4 Diffusing elements

Diffusing elements within the room consist of 4 convex panels mounted to the walls and a conical section protruding from the ceiling.

Figure 2. Microphone array suspended from the conical diffusing elements with convex diffusers in the background.

3. Test Procedure

3.1 Standard sized test specimens

The test procedure is performed in accordance with AS ISO 354 – 2006. The Test Cube is designed to hold a standard size of test specimen, measuring 1200mm wide x 1000mm long (±1mm). These dimensional boundaries are drawn on the floor of the room to ensure repeatability of measurements. Integrity of results are further assured as all test specimens are contained within a solid frame. Where a suitable frame cannot be used then the edges of test specimens are covered with an adhesive tape. The Absorption Coefficient is calculated for standard size test samples.

3.2 Irregular sized test specimens

Where irregular shaped specimens are tested, the same procedure as above is followed. With the following exceptions: frames are not used; specimens are located within a grid marked on the floor and absorption coefficients are not provided. Regarding the latter, an equivalent absorption area is provided.

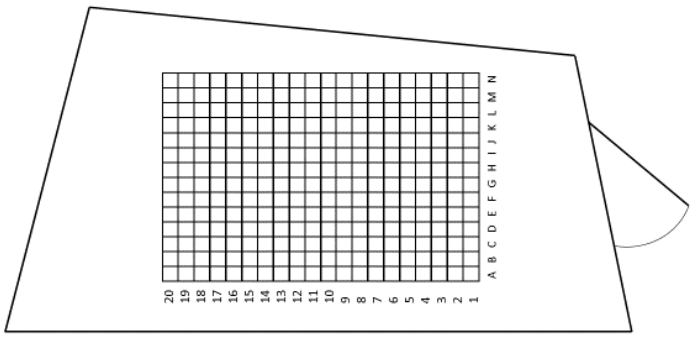


Figure 3.Diagram of the grid pattern of the reduced-size reverberation room floor (Not to scale).

To ensure repeatability of measurements the position of specimens is recorded by photograph and/or written description. A distinctive feature of specimens and the reference-grid location (i.e. grid D9) are generally used.

4. Test Samples

4.1 Material description

Material descriptions provided by the client are as follows:

- One sample was supplied
  i) 18mm thick Hush acoustic panel

Figure 4. An image of the 18mm thick Hush panel.

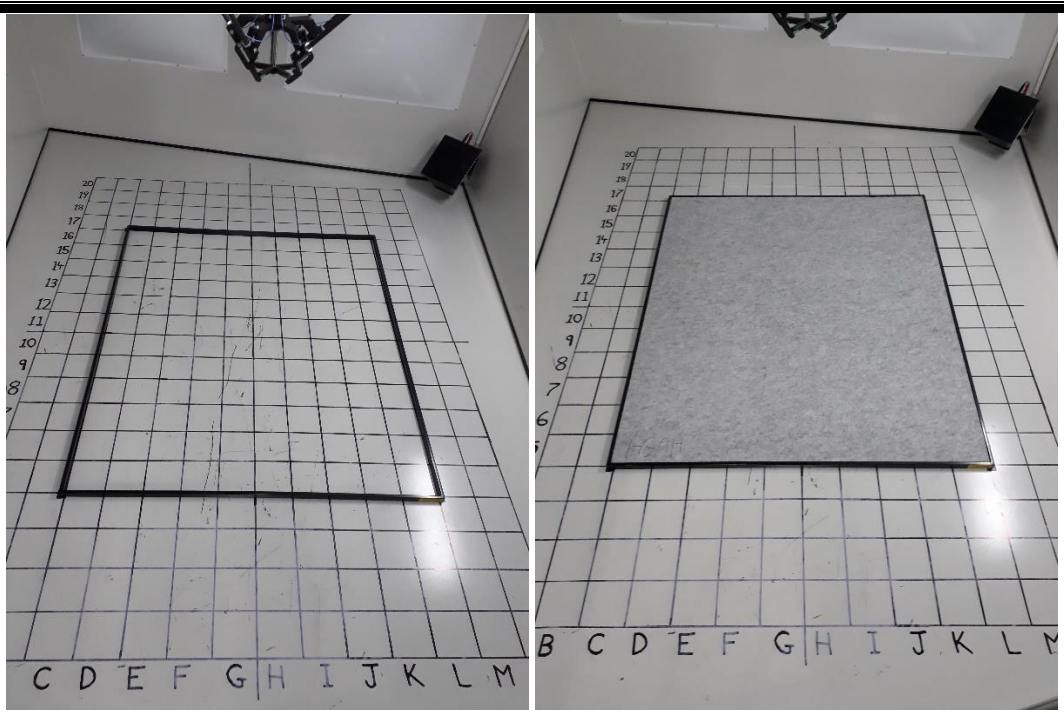
4.2 Material preparation

- Test specimen was provided by the customer wrapped in clear plastic film
- Plastic film packaging was removed several hours before testing to allow specimen to stabilise in temperature and humidity with ambient conditions

4.3 Testing configuration

Three tests were requested by the customer. The Hush panel would be tested with the following air gaps: 0mm, 50mm and 100mm.

Where specimens were tested with an air gap a small number of supports was used to ensure test specimens remained flat. Non-porous aluminium profiles were used for this purpose. The total surface area of these supports was less than 0.5% of the sample area.



Figures 5.1-5.2. Images of the 20mm frame placed on the Alpha Cabin floor and frame containing 18mm 'Hush' panel.

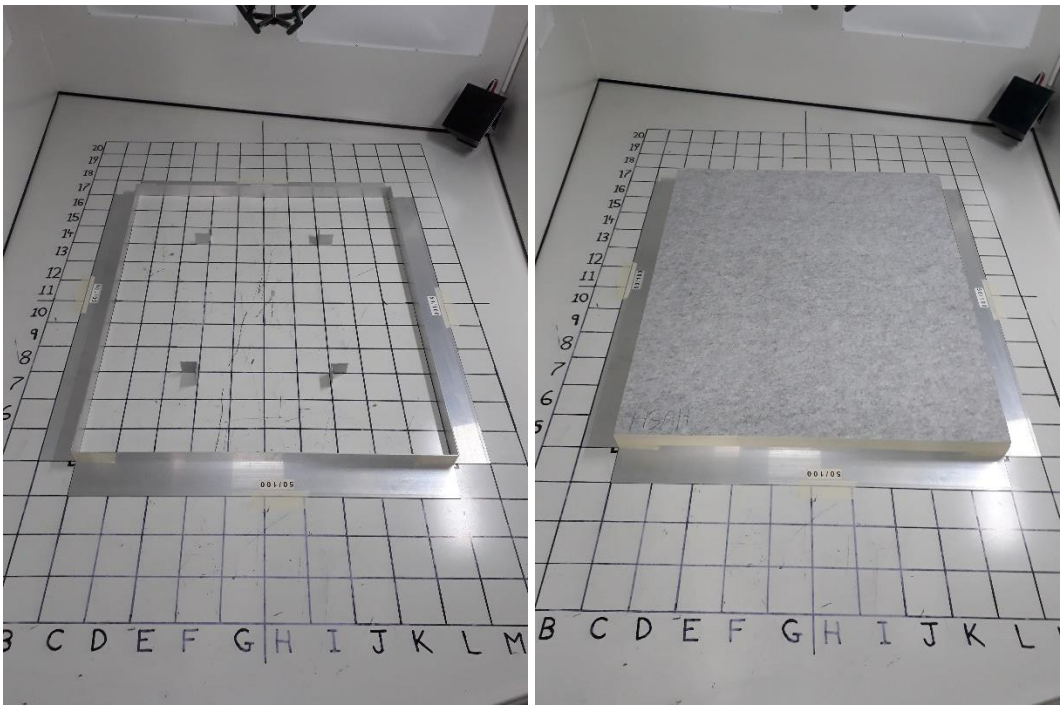


Figure 6.1-6.2. Images of the 50mm frame and supports placed on the Alpha Cabin floor and 'Hush' panel mounted on supports and frame.

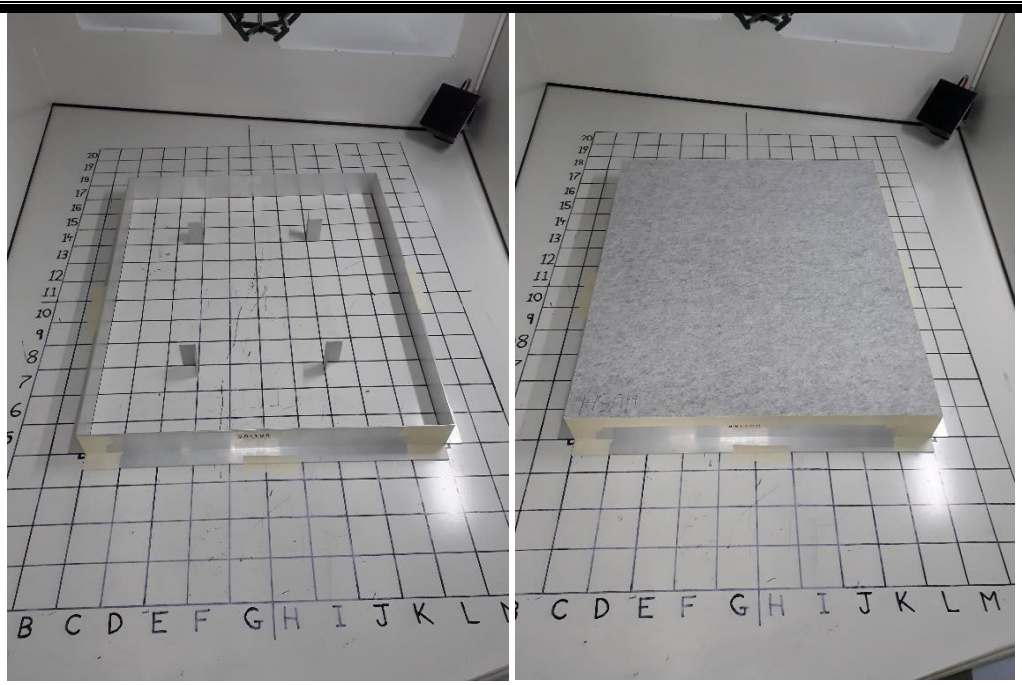


Figure 7.1-7.2. Image of the 100mm frame and supports placed on the Alpha Cabin and 'Hush' panel mounted on supports and frame.

5. Results

5.1 Alpha Cabin Measurements

- Measured data from the test is tabulated and presented below in Table 1

Frequency [Hz]	Hush Panel Absorption Coefficient [-]		
	Air cavity - 0mm	Air cavity - 50mm	Air cavity - 100m
400	0.210	0.507	0.688
500	0.367	0.711	0.820
630	0.491	0.821	0.867
800	0.677	0.995	0.994
1,000	0.851	1.005	0.959
1,250	1.005	1.026	0.917
1,600	1.016	1.024	0.832
2,000	1.055	0.993	0.949
2,500	1.055	0.931	1.005
3,150	1.033	0.978	0.959
4,000	1.000	1.024	1.010
5,000	0.998	1.038	1.019
6,300	0.969	0.991	1.027
8,000	0.974	0.985	1.062
10,000	1.002	1.076	1.060

Table 1. Experimentally determined third octave data for all test configurations.

- A comparison of the absorption spectra for all test configurations is presented below

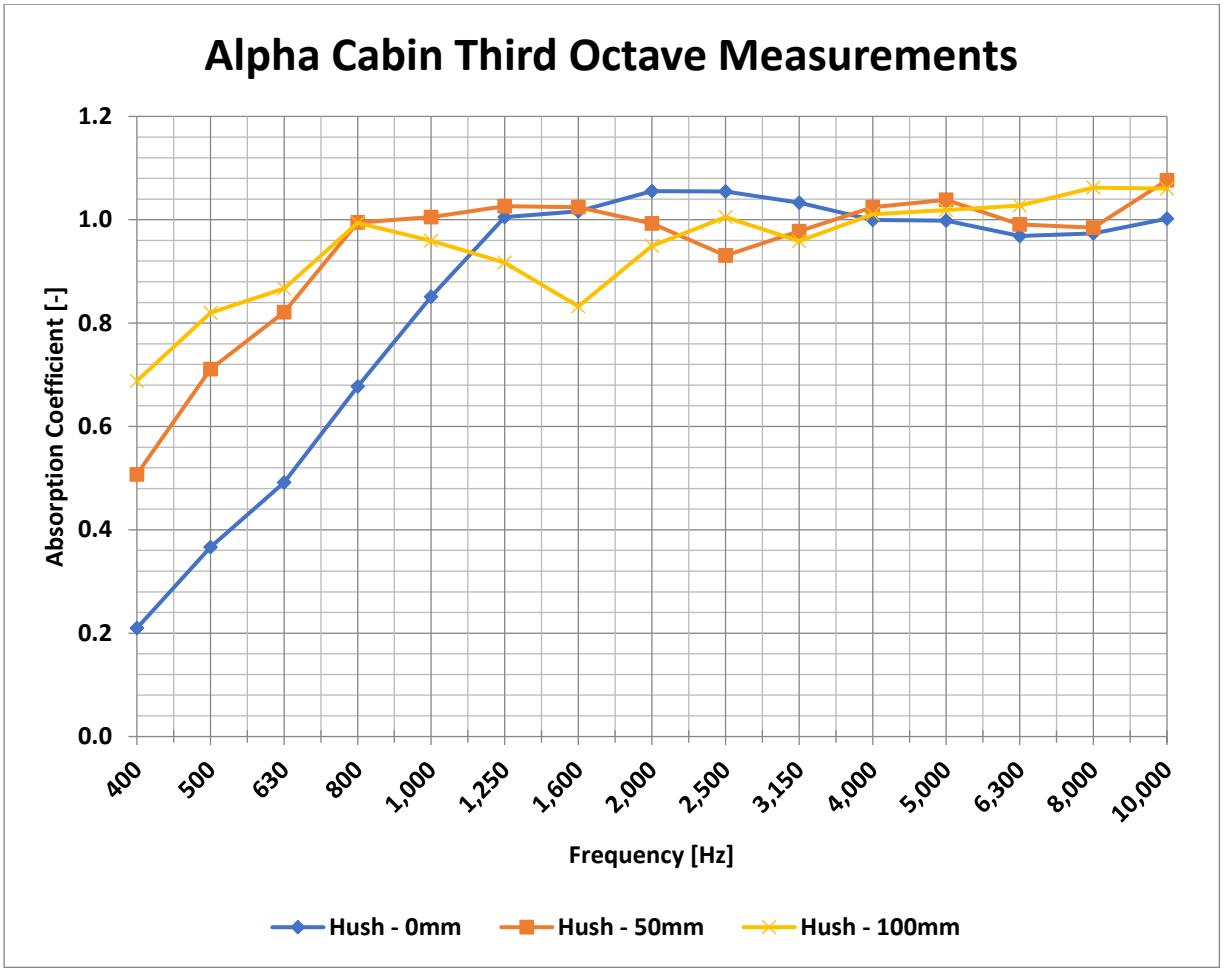


Figure 8. Comparison graph of experimentally determined absorption spectra of all test configurations.

5.2 Computer Modelling

- Computer modelled data for low frequency absorption coefficients is presented below:

Frequency (Hz)	Hush Panel Absorption Coefficient [-]		
	Air cavity - 0mm	Air cavity - 50mm	Air cavity - 100m
100	0.000	0.028	0.078
125	0.000	0.057	0.121
160	0.000	0.114	0.197
200	0.019	0.197	0.296
250	0.055	0.314	0.423
315	0.113	0.456	0.563

Table 2. Computer modelled third octave data for all test configurations.

5.3 Combined results

- Computer modelled and measured absorption coefficients are presented in Table 3, below.

Frequency [Hz]	Hush Panel Absorption Coefficient [-]		
	Air cavity - 0mm	Air cavity - 50mm	Air cavity - 100m
100	0.000	0.028	0.078
125	0.000	0.057	0.121
160	0.000	0.114	0.197
200	0.019	0.197	0.296
250	0.055	0.314	0.423
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1,250	1.005	1.026	0.917
1,600	1.016	1.024	0.832
2,000	1.055	0.993	0.949
2,500	1.055	0.931	1.005
3,150	1.033	0.978	0.959
4,000	1.000	1.024	1.010
5,000	0.998	1.038	1.019
6,300	0.969	0.991	1.027
8,000	0.974	0.985	1.062
10,000	1.002	1.076	1.060

Table 3. Computer modelled and measured data of absorption coefficients for all test configurations.

- A comparison of the modelled and measured absorption spectra for all test configurations is presented below

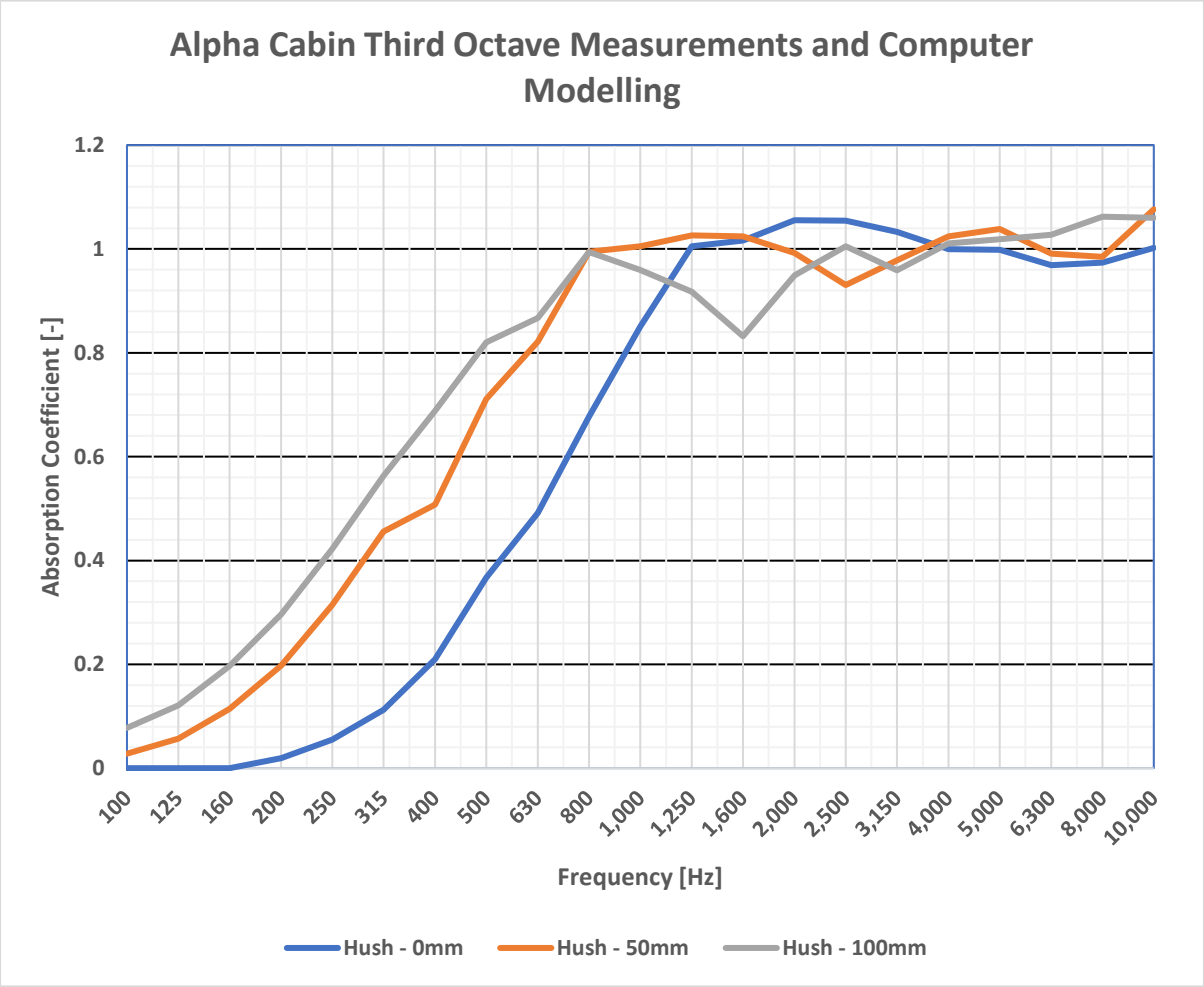

Figure 5. Comparison of modelled and measured absorption spectra for all test configurations.

5.4 Noise Reduction Coefficients

- Noise reduction coefficients, for all test configurations, using computer modelled data and experimental measurements, are presented below in Table 4.

Frequency (Hz)	Hush Panel Noise Reduction Coefficient (NRC)		
	Air cavity - 0mm	Air cavity - 50mm	Air cavity - 100m
250	0.05	0.31	0.42
500	0.37	0.71	0.82
1000	0.85	1.01	0.96
2000	1.06	0.99	0.95
NRC	**0.55**	**0.75**	**0.75**

Table 4. Noise reduction coefficients computed using computer modelled and experimentally determined absorption coefficients.

6. Analysis

- Test specimen is a poor low-frequency sound absorber – it does perform well across the 'speech frequencies' (300-3400Hz)
- An increase in the low- to mid-frequency absorption is observed with an increase in the depth of the air-cavity

7. Recommendations

- Modelling of low-frequency absorption coefficients generally yields lower values than those observed in full scale reverberation chambers – for greater accuracy of low frequency results, testing should be performed using full scale reverberation chambers
- Confidence in test results can be improved by testing more product samples to account for variations in materials during manufacturing
- Low- to mid-frequency absorption could be improved with the addition of a flow resistive membrane on the exposed face of both panels