



# CSIRO ACOUSTIC MEASUREMENT REPORT

Commonwealth Scientific and Industrial Research Organisation, Infrastructure Technologies  
Acoustics Testing Laboratory, Gate 5, 2 Normanby Road, Clayton, Vic 3168 Australia

Report No:  
**AC254-02-1**

**Client:** Woven Image Pty Ltd  
37-39 Chard Road, Brookvale, NSW 2766 Australia

## Measurement Type: Sound Absorption

AS ISO 354-2006 "Acoustics-Measurement of sound absorption in a reverberation room"  
AS ISO 11654-2002 (ISO 11654:1997) "Acoustics-Rating of sound absorption-Materials and systems"

### Test Specimen [Specimen area: 3.6 x 2.8 m (10.07 m<sup>2</sup>)]

Description: Woven Image 'EchoPanel® 12 mm',  
spaced 20 mm from the room surface.

#### EchoPanel® Details<sup>3</sup>

- Product designation: EchoPanel® 12 mm
- Construction: non woven polymer fibre (PET, 60% recycled)
- Physical characteristics: panel size 2800 x 1200 mm, x 12 mm thick, area density 2400 gsm.

#### Installation

- The reverberation chamber was swept and vacuumed.
- An array of solid timber (pine) spacers, 20 mm high was arranged on the floor of the chamber. Spacers were arranged by hand, typically about 500 mm apart, endeavouring to minimise their effect on the acoustics of the cavity whilst also ensuring minimal sag of the panels.
- Three panels (as described above) were laid directly on the spacers, arranged in a rectangle 11° off parallel with the walls of the chamber.
- The three panels were carefully aligned with each other and pushed tightly together. The panels were observed to mate well against each other and present a smooth flat surface to the airspace of the room.
- A skirt of folded steel angle (1 mm thick, 35 mm high) was arranged around the perimeter of the installed panels to mask the edges.
- Specimen installation was carried out by laboratory staff.



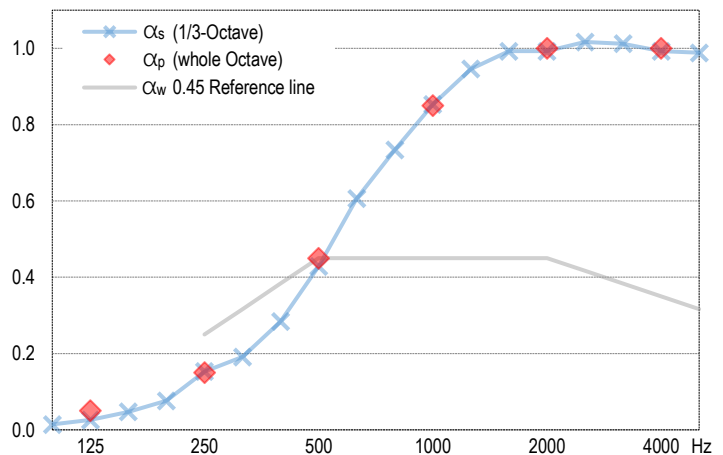
Test specimen installed for testing



Close-up showing face and cut edge of panel (edge covered by steel skirt during test)

## Measurement Details & Results

Freq Hz	Absorption coefficients <sup>4</sup>			Reverberation times, T <sub>60</sub> (sec)	
	α <sub>s</sub>	α <sub>p</sub>	95% Conf (δ)	Empty room	with Specimen
100	0.01		0.06	6.13	5.97
125	0.03	0.05	0.04	6.66	6.33
160	0.05		0.03	6.72	6.12
200	0.08		0.03	6.24	5.45
250	0.15	0.15	0.04	5.98	4.67
315	0.19		0.03	6.63	4.78
400	0.28		0.03	6.80	4.27
500	0.43	0.45	0.04	6.49	3.51
630	0.61		0.04	6.01	2.84
800	0.73		0.05	5.57	2.48
1000	0.85	0.85	0.04	5.41	2.24
1250	0.95		0.05	4.80	2.01
1600	0.99		0.04	4.19	1.84
2000	0.99	1.00	0.03	3.67	1.74
2500	1.02		0.03	3.28	1.62
3150	1.01		0.05	2.83	1.51
4000	0.99	1.00	0.04	2.32	1.36
5000	0.99		0.05	1.86	1.19



#### Performance Indices<sup>1,2</sup>

α<sub>w</sub> = 0.45 (MH)

SAA = 0.61

NRC = 0.60

The required 12 spatially independent decay curves came from ensemble averaging 10 successive decays with each of 3 different source loudspeaker positions, all sampled by 4 fixed microphones, using linear averaging.

#### Measurement Conditions

	Empty room	with Test Specimen
Date of measurement:	18 Aug 2019	18 Aug 2019
Temperature & humidity:	14 °C, 60 % R.H.	14 °C, 59 % R.H.
Atmospheric pressure:	993 mBar	993 mBar

## Notes, Deviations etc

- Shape indicators (L, M, and H), if any, following the α<sub>w</sub> index, indicate α<sub>p</sub> values above the reference contour by ≥ 0.25 in the Low, Medium or High frequency ranges respectively; it is strongly recommended to use this single number rating in combination with the complete sound absorption coefficient curve.
- SAA and NRC are defined in ASTM C423; laboratory requirements for which differ from AS ISO 354.
- Physical characteristics of materials may be as per client or supplier's advice; not necessarily verified by CSIRO.
- Calculation of absorption coefficients is based on actual specimen area measured: 10.073 m<sup>2</sup> (3.600 x 2.798 m).

## Issuing Authority

Signed:

David Truett

Date:

23 August 2019

## Instrumentation

Real time analyser: Brüel & Kjær PULSE LAN-XI type 3160-A/4/2  
Microphones/preamps: 2 x GRAS type 40AP and 2 x B&K type 4134 microphones, all on B&K type 2669 preamps, in 4 fixed positions as per AS ISO 354  
Noise source: Room populated with three decahedron loudspeakers; 2 Norsonic NOR276 & 1 x B&K 4296, driven in turn by a Norsonic NOR280 power amplifier.  
Calibration: • Analyser: July 2018 (NATA cal)

## Laboratory Construction

Reverb room: • 300 mm thick concrete (closed off from the adjoining room by an MDF Wall) • parallelepiped with dimensional proportions 1:1.3:1.6 for distribution of room modes • approx 202 m<sup>3</sup> total room volume • approx 215 m<sup>2</sup> surface area excluding diffusers  
Diffusers: • 20 stationary diffusers, approx 40 m<sup>2</sup> total surface area  
Absorption area: • in accordance with AS ISO 354, unless noted otherwise