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Technical Brief 003

Report on the Measurement of Sound Absorption of Planex Linea Storage Units

Introduction

The acoustics of environments that humans share and work in can have sounds that are desirable and may need to be enhanced or emphasized (e.g. music in a room designed for artistic performances; the speakers' voices during a debate; etc.). Other sounds can be undesirable, are known as noise, and need to be reduced or prevented (e.g. noise in a factory workshop or annoying noises such as chatter in a workplace).

Planex's Linea Sliding Door cabinets are designed with several features in mind, including giving an effective degree of noise suppression within the workplace. Linea cabinets can enhance the acoustics of offices and similar environments by attenuating various sound frequencies within the workplace. The reduction of noise will benefit the occupants of the room(s) by promoting collaboration and driving productivity, while providing elegant and aesthetically pleasing office environments.

Planex has conducted tests on the acoustic properties of the Linea storage range in order to make available data that will assist the design of interior workplaces. This report provides the data on those properties.

The data was obtained from tests conducted in the Reverberation Room of the Applied Acoustics Laboratory, School of Applied Sciences, RMIT University, Melbourne, 3000, Australia.

Summary of Our Results

Six tests were conducted to compare the performance of the Linea cabinet against a comparator cabinet that lacked the acoustic components of the Linea. The comparator cabinet was one made with identical dimensions and construction of steel components to Linea's design, but had none of the sound-absorbing qualities incorporated into it that Linea has. Hence, for the purpose of the tests the comparator cabinet is termed as a "standard" cabinet in this technical brief, and in this way, it served as the most appropriate reference for testing.

The test results demonstrate convincingly the superior acoustics that Linea cabinets offer and effective suppression of workplace noise, compared to the comparator (standard) cabinet with its poor sound-absorbing properties. The standard cabinet's poor acoustic properties are an indication of what one can expect from not choosing Linea as the cabinet for the workplace.

The tests were conducted by using 2 cabinets - either 2 Linea or 2 standard - placed side by side. Construction of Linea cabinets include perforations of specific size and spacing in selected panels plus 6mm thick, sound-absorbing material (Echopanel 27) placed in the doors and in the rear panels. Space between the 2 was minimised. The first set of tests (Tests A, B, and C), were on the Linea cabinets.

In the second set of tests (Tests D, E and F), the cabinets had standard construction, as would be found in normal office or storage or filing systems.

Additionally, in tests A, B and C the cabinets were tested with the doors closed, open or half open, respectively. In Tests D, E and F the cabinets were tested with the doors closed, open or half open, respectively.

The configurations are shown in Table 1, below:

Test Number	Door Type	Echopanels	Door Position
A	Linea	✓	Closed
B	Linea	✓	Open
C	Linea	✓	Half open
D	Standard	x	Closed
E	Standard	x	Open
F	Standard	x	Half open

The tests in the reverberation room provided information on the absorption of sounds by cabinets at 18 specific frequencies. The unit of absorption is called the sound absorption coefficient, α_s , which describes the ability of an object to absorb sound. The unit ranges between 0 and 1, where 0 is total reflection and 1 is total absorption. Therefore, 18 values of α_s were determined in each of Tests A - F, and better absorption is indicated by larger values of α_s.

The data emanating from the tests that compared Linea cabinets versus standard cabinets were examined in different ways to produce various units of sound absorption. The units are useful in the design of acoustics appropriate to a room's intended purpose. Details are provided in the Materials and Methods section, below. **Compared to the standard cabinet, conclusions that support Linea's superiority in all positions (i.e., open, closed, half open) are that the Linea has:**

1. **higher absorption values, α_s, at all of the 18 frequencies that were tested**
2. **higher values of α_s at all frequencies with the doors in all 3 positions (closed, open or half open)**
3. **a higher mid-range value, or $\alpha_{i.m.}$ (average of the 18 values of α_s ; see Table 1 below)**
4. **higher weighted sound absorption coefficient, α_w**
5. **higher Practical Sound Absorption Coefficients, α_p**
6. **a higher Noise Reduction Coefficient, NRC**
7. **larger Area Under the Curve or AUC (see explanation below)**

The original RMIT report is provided below as an attachment, as is data and analyses that have been extracted from the report and copied below (Graphs 1 – 6 and Tables 3 – 5). Consideration of the data that lead to the 7 points made above also allows one to see that using the Linea cabinet as tested, could provide several-fold better sound absorption than using a standard cabinet (one with normal construction; i.e., without Linea's unique properties).

Methods and Results

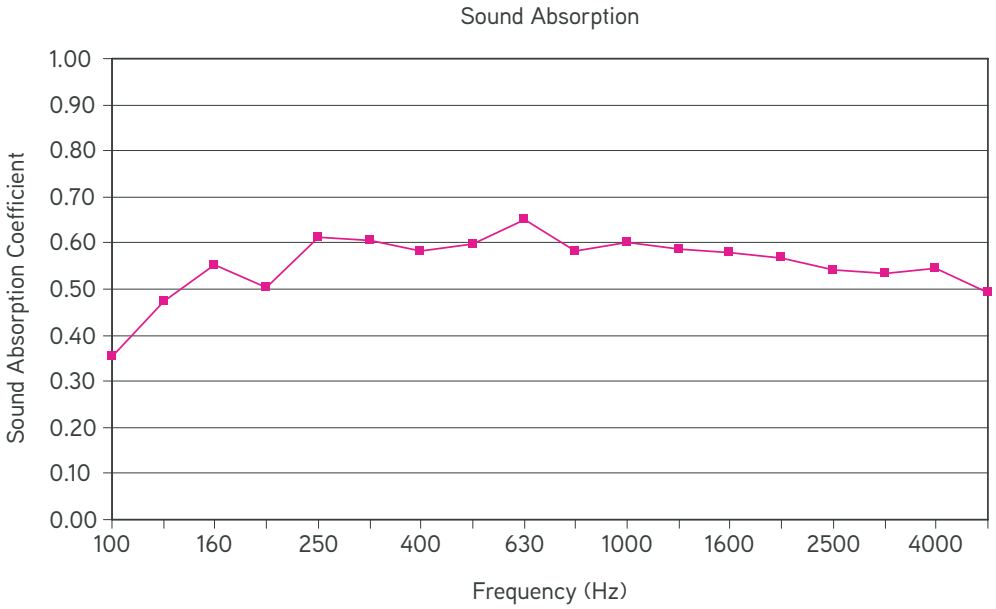
In brief, 2 cabinets each measuring 1900mm H x 1805mm W x 450mm D were placed side by side in a reverberation room. The regularly spaced, circular perforations of the Linea cabinet provided 18.5% of open area. The cabinets were subjected to standardised sound frequencies ranging from 100 to 5000Hz. The reverberation times in seconds coming from the cabinets over each of these frequencies were recorded (see RMIT Report, column 3 in the tables on pages 8, 10, 12, 14, 16, 18) and converted to the corresponding sound absorption coefficient, α_s , (see column 4 of the same tables). In addition, several other units of sound were derived; namely, $\alpha_{i.m.}$, α_w , α_p and NCR.

The data from the RMIT Report is copied below in this Technical Brief in order to allow clearer comparison between the Linea range and standard cabinets.

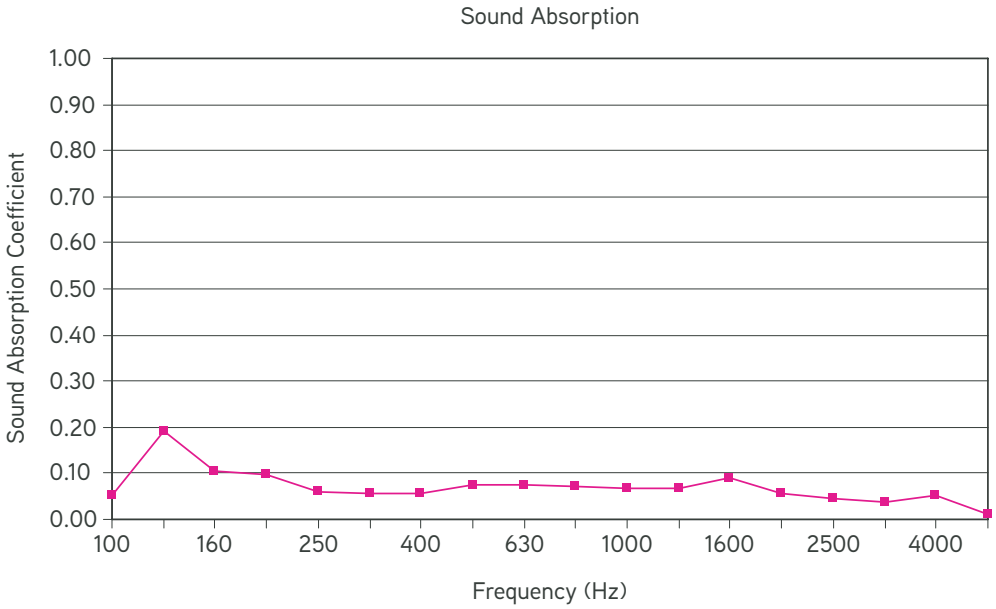
The comparisons begin on pages 4 - 6 below, showing graphs copied from the RMIT Report of α_s versus frequency: see Graphs 1 and 4 with doors closed, Graphs 2 and 5 with doors open, and Graphs 3 and 6 doors with half open. The graphs show higher absorption values, α_s , from Linea cabinets at all of the 18 frequencies that were tested, as well higher values of α_s at all frequencies with the doors in all 3 positions (closed, open or half open). Using the areas under the curves, AUC, is an unconventional parameter for assessing sound absorbance, but comparisons of the data (i.e., Graphs 1 with 4, Graphs 2 with 5, and Graphs 3 with 6) point to larger AUCs, and hence clearly superior performance of the Linea cabinet compared to the standard one.

Data from the RMIT Report is also tabulated in the present Technical Brief on pages 8 and 9 below. The four tables show the data expressed in various units of sound absorption. All four sets of data support the 7 conclusions made on the previous page. Lastly, the data also show a trend for the best sound absorbance coming from the doors being closed compared to open or half open.

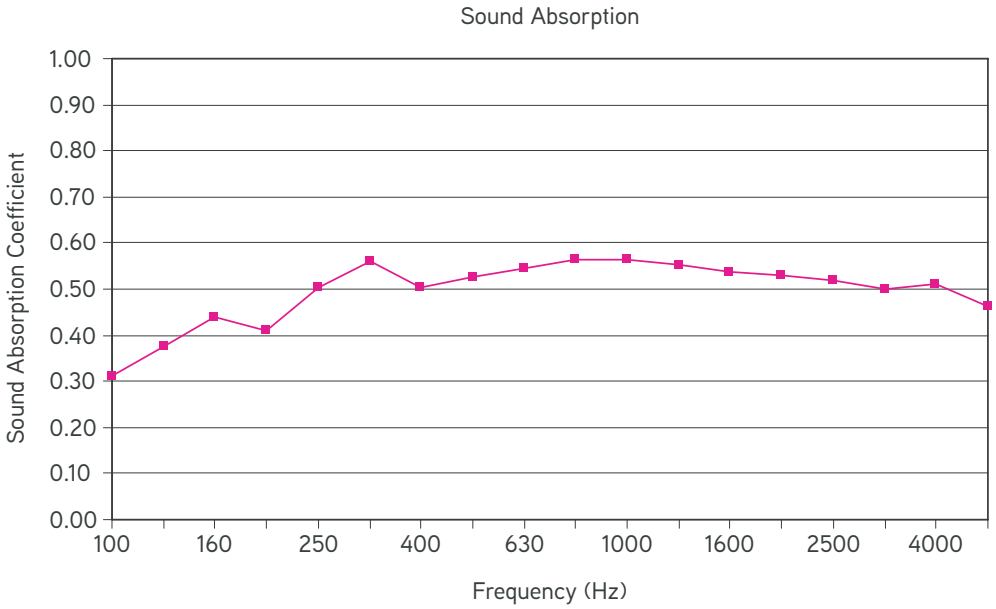
Graph 1. Results from Test A.
Sound absorption coefficient of the Linea cabinet with doors closed



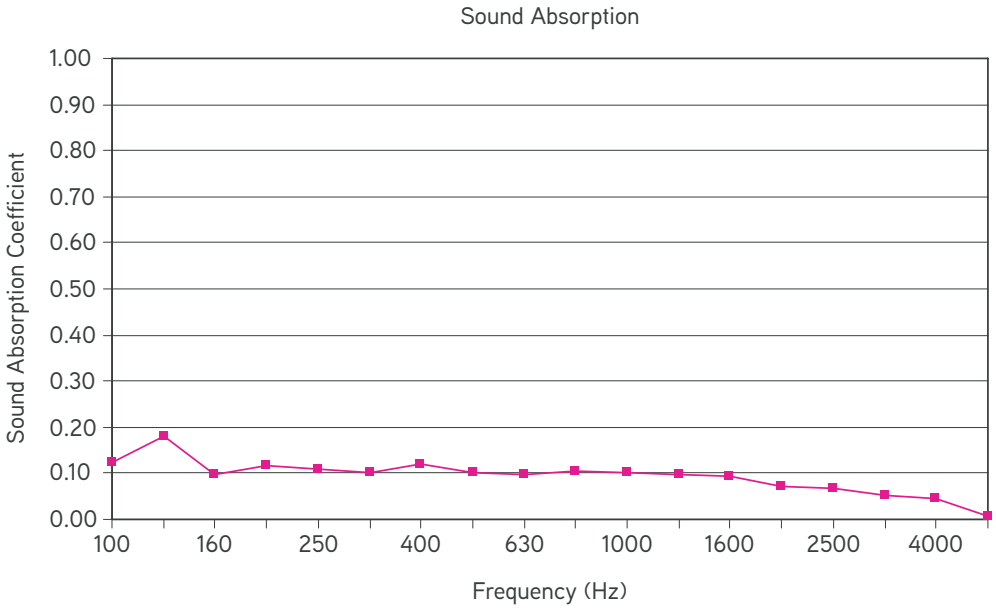
Graph 4. Results from Test D.
Sound absorption coefficient of the standard cabinet with doors closed



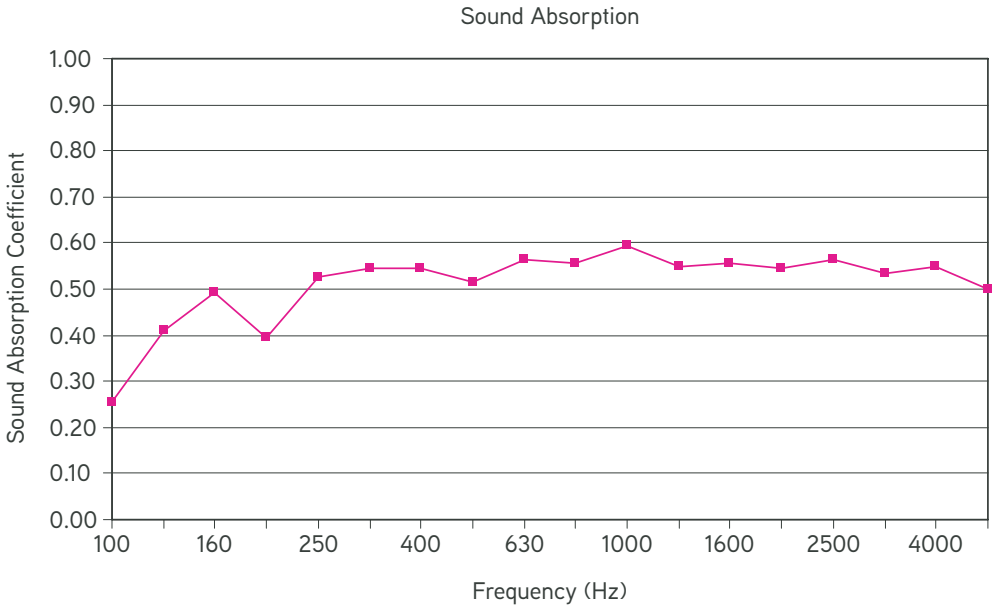
Graph 2. Results from Test B.
Sound absorption coefficient of the Linea cabinet with doors open



Graph 5. Results from Test E.
Sound absorption coefficient of the standard cabinet with doors open



Graph 3. Results from Test C.
Sound absorption coefficient of the Linea cabinet with doors half open



Graph 6. Results from Test F.
Sound absorption coefficient of the standard cabinet with doors half open

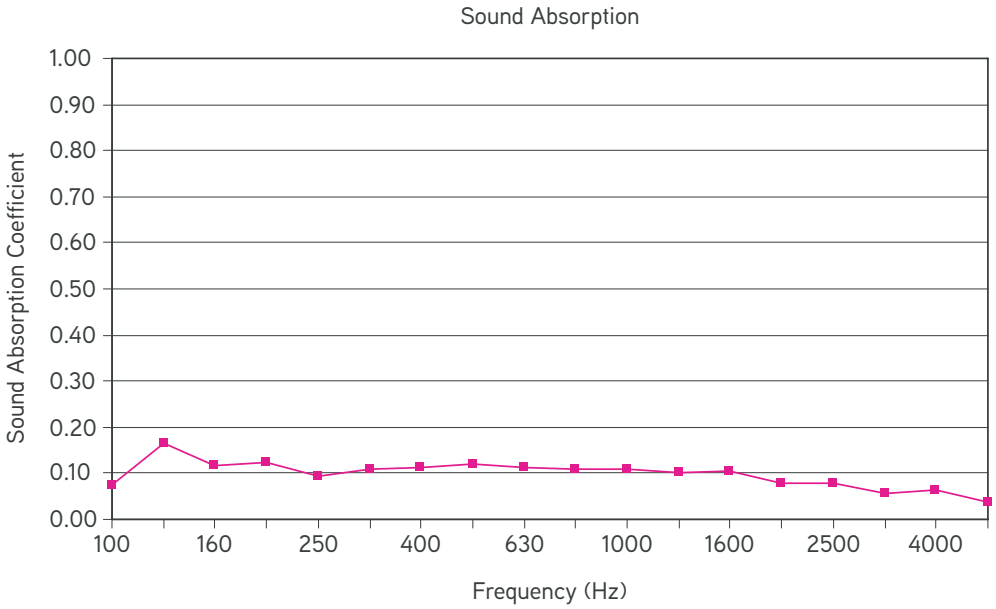


Table 2. Comparison of the Linea cabinet's acoustics versus those of the standard cabinet using the single mid-range value of the sound absorption coefficient, $\alpha_{i.m.}$

Test Number	Doors Closed	Doors Open	Doors Half Open
1. $\alpha_{i.m.}$ of the Linea cabinet	0.55	0.50	0.54
2. $\alpha_{i.m.}$ of the Standard cabinet	0.07	0.09	0.10

The numbers are averages of the 18 values of sound absorption coefficient, α_s , from each test.

Table 3. Comparison of the Linea cabinet's acoustics versus those of the standard cabinet using the weighted sound absorption coefficient, α_w

Test Number	Doors Closed	Doors Open	Doors Half Open
1. $\alpha_{i.m.}$ of the Linea cabinet	0.60	0.55	0.55
2. $\alpha_{i.m.}$ of the Standard cabinet	0.05	0.10	0.10

Table 4. Comparison of the Linea cabinet's acoustics versus those of the standard cabinet using the Practical Sound Absorption Coefficients, α_p

Frequency (Hertz; Hz)		125	250	500	1000	2000	4000
α_p with doors closed	Linea	0.45	0.55	0.60	0.60	0.55	0.55
	Standard	0.45	0.55	0.60	0.60	0.55	0.55
α_p with doors open	Linea	0.40	0.50	0.55	0.55	0.55	0.50
	Standard	0.15	0.10	0.10	0.10	0.10	0.05
α_p with doors half open	Linea	0.40	0.50	0.55	0.55	0.55	0.55
	Standard	0.10	0.10	0.10	0.10	0.10	0.05

Table 5. Comparison of the Linea cabinet's acoustics versus those of the standard cabinet using the Noise Reduction Coefficients, NRC

Test Number	Doors Closed	Doors Open	Doors Half Open
5. NRC (noise reduction coefficient) of the Linea cabinet	0.60	0.55	0.55
6. NRC (noise reduction coefficient) of the Standard cabinet	0.05	0.1	0.1

Method for calculating NRC: $\dfrac{(\alpha_{250Hz} + \alpha_{500Hz} + \alpha_{1000Hz} + \alpha_{2000Hz})}{4}$

Sample calculation of NRC for the Linea cabinet with doors closed: (0.61 + 0.60 + 0.60 + 0.57) ÷ 4 = 0.60

Head Office / Manufacturing
191 Princes Highway Hallam
VIC Australia 3803
PO Box 125 Hallam 3803
Tel: +61 3 8795 1100
Fax: +61 3 8795 1122
Email Head Office: info@planex.com.au

National Sales and Distribution
Adelaide
Brisbane
Canberra
Hobart
Perth
Sydney
Tel: +61 3 8795 1100
Email: info@planex.com.au

www.planex.com.au