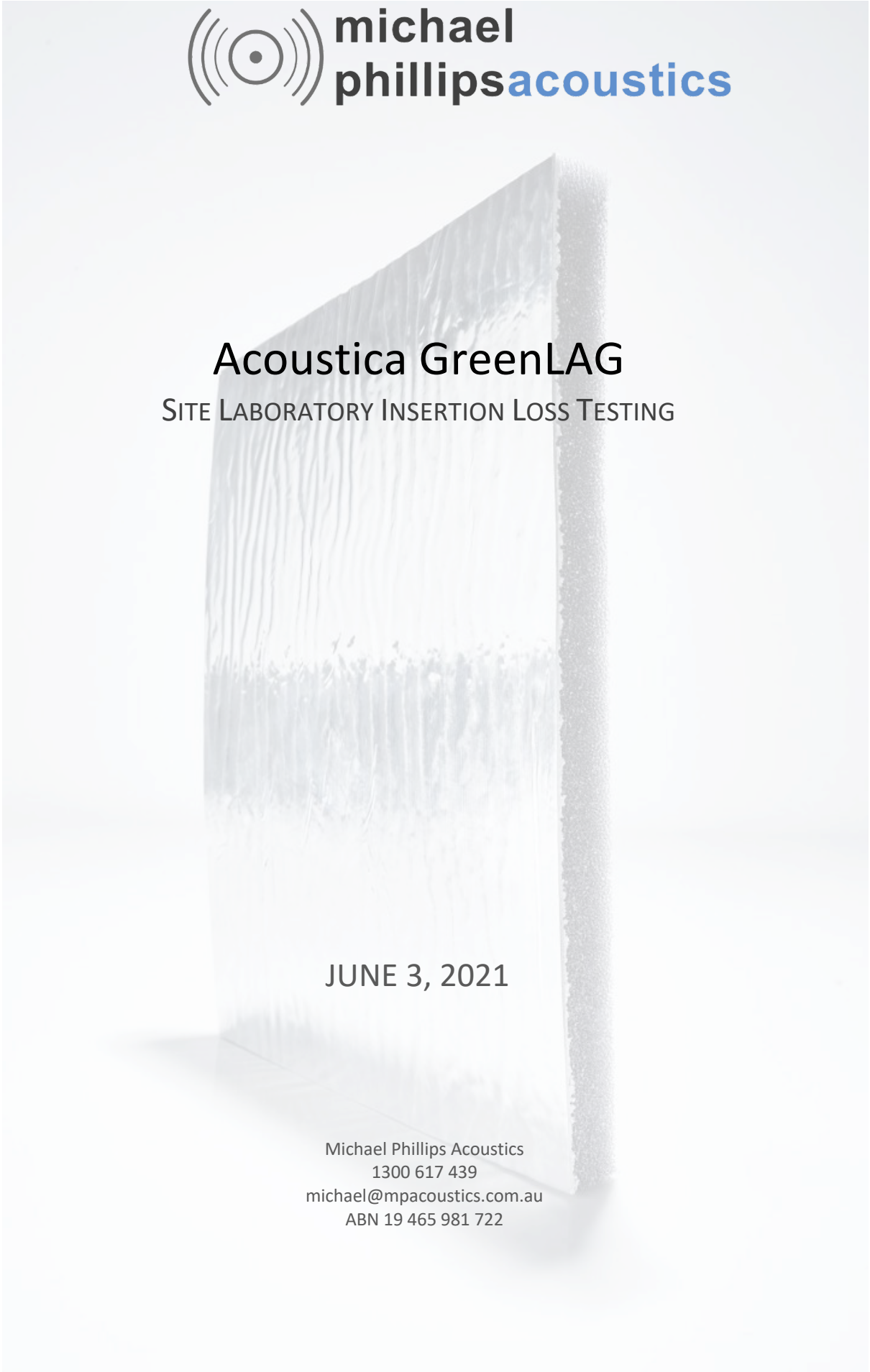
michael phillipsacoustics



Acoustica GreenLAG

SITE LABORATORY INSERTION LOSS TESTING

JUNE 3, 2021

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Project Information

Details	
Report Title:	SITE LABORATORY INSERTION LOSS TESTING
Project:	ACOUSTICA GREENLAG
Client:	Acoustica
Attention:	Daniel Ciric

Document Control

Reference	Issue Date	Details	Revision	Prepared	Reviewed	Authorised
20210603	03/06/2021	Final	0	COBI	MP	MP

SITE LABORTORY INSERTION LOSS TESTING

ACOUSTICA GREENLAG

Product Codes.	GreenLAG 3.6kg flat, GreenLAG 3.6kg convoluted, GreenLAG 5kg flat, GreenLAG 5kg convoluted
Product Description:	Acoustic lagging product with visco-elastic QuietWave noise barrier with micro-cellular acoustic foam
Testing Location:	Acoustica Site Laboratory 25 Plasser Crescent North St Marys NSW 2760
Date of Testing:	15th May, 2021
Date of Report:	3rd June, 2021
Prepared for:	Acoustica Pty Ltd
Testing conducted by:	Michael Phillips Acoustics
Report by:	Michael Phillips Acoustics
NOTES:	Testing has been conducted in general accordance with International Standard ASTM Designation: E1222-90 2016 *"Standard Test Method for Laboratory Measurements of the Insertion Loss of Pipe Lagging Systems"* & BS EN ISO 3741-2010 *"Acoustics-Determination of Sound Power Levels & Sound Energy Levels of Noise Sources Using Sound Pressure-Precision Methods for Reverberation Test Rooms"*

Sincerely

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1 INTRODUCTION

Michael Phillips Acoustics has been engaged by Acoustica Pty Ltd to conduct Site Laboratory Insertion Loss Testing of ACOUSTICA GREENLAG at 25 Plasser Crescent, North St Marys NSW 2760.

This report presents the results of the conducted acoustical measurements of Acoustica GreenLAG and comparative testing of similar available products.

Testing has been carried out with reference to the following standards;

- ASTM Designation: E1222-90 2016 *"Standard Test Method for Laboratory Measurements of the Insertion Loss of Pipe Lagging Systems"*
- BS EN ISO 3741-2010 *"Acoustics-Determination of Sound Power Levels & Sound Energy Levels of Noise Sources Using Sound Pressure-Precision Methods for Reverberation Test Rooms*

2 TEST FACILITIES

The test facility is constructed with a toilet pan installed above the receiving room at the Acoustica Site Laboratory located at 25 Plasser Crescent, North St Marys NSW 2760. The toilet pan outlet is coupled to a 100mm diameter PVC pipe installed into the receiving room via airtight resilient acoustic seals.

The test facility is made up of painted blockwork, tiles and painted rendered compressed fibre cement sheeting. The room measures 3.1m (L) x 1.735m (W) x 2.3m (H), totalling a volume of 12.37m^3. This is below the minimum requirement of 56.6m^3 stated in ASTM Designation: E1222-90 2016 & minimum requirement stated in BS EN ISO 3741-2010. As a result, standard deviations for broadband measurements determining the adequacy of the room have been provided.

2.1 Instrumentation

The following acoustic instruments were used during testing;

Table 1: Instrumentation

Manufacturer	Type	Description
Earthworks	M30	Class 1 Measurement Microphone
	M30	
NTi	M2230WP	
	600 000 388	Class 1 Sound Calibrator
Apogee	Duet	Audio Interface
Sonance	AS38RS	Loudspeaker
Denon	PMA60	Amplifier

3 MEASUREMENT

Both instantaneous and continuous test methods have been applied to validate the performances of the laboratory installed lagging products. These methods have been chosen to ensure accuracy in the comparative performances of the products at each frequency. All products were installed according to the manufacturer guidelines.

Reverberation time measurements were conducted for each lagging installation and the bare pipe. Three microphone positions were measured with two source positions totalling six measurement positions. The Averages were used to determine the reverberation time in the room.

3.1 Instantaneous Noise Test

A toilet pan installed above the receiving room is connected to the receiving room through a 100mm diameter PVC pipe at source position using resilient acoustic mount's between locations. The toilet pan is then filled with water prior to commencement of each measurement. A toilet flush is then used to provide an instantaneous sound and is measured for the duration of each flush using six microphone positions distanced 0.70m away from each other.

The Insertion loss of each lagging system is calculated as the difference in sound pressure levels measured with sound radiating from the bare pipe and the lagged pipe.

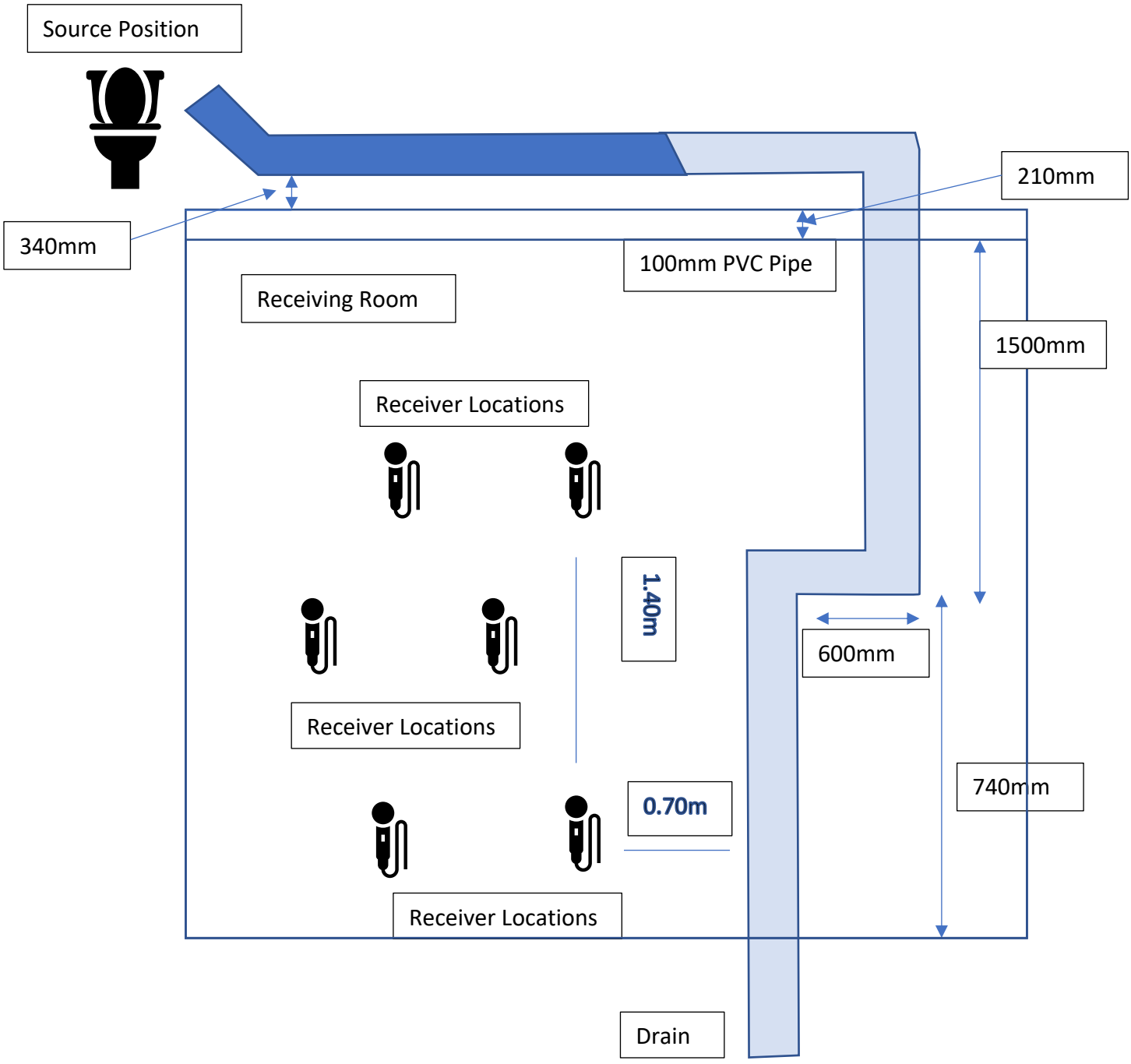


Figure 1: Instantaneous noise test configuration

3.2 Continuous Noise Test

AARAE software was used to generate and record test signals in general accordance with the methods and procedures outlined in ASTM Designation: E1222-90 2016 *"Standard Test Method for Laboratory Measurements of the Insertion Loss of Pipe Lagging Systems"* & BS EN ISO 3741-2010 *"Acoustics-Determination of Sound Power Levels & Sound Energy Levels of Noise Sources Using Sound Pressure-Precision Methods for Reverberation Test Rooms"*

A horn driven loudspeaker is mounted into a 100mm diameter PVC pipe at source position using resilient acoustic mounts, a test signal consisting of 500hz-5kHz band limited white noise is produced inside of the PVC pipe. Average sound pressures levels are measured within the receiving room at three separate locations 0.70m apart for two separate conditions.

One condition with sound radiating from the bare pipe and the other with the same pipe covered with a lagging system of choice. The Insertion loss of each lagging system is the difference in sound pressure levels measured with sound radiating from the bare pipe and the lagged pipe,

$$IL = Lb - Ll - [Lbr - Llr]$$

Where as;

IL = Insertion loss (dB)

Lb, Ll = average sound pressure level measured with sound radiating from the bare pipe and lagged pipe respectively (dB)

Lbr, Llr = average sound pressure level measured with the reference sound source with the bare and lagged pipe respectively (dB)

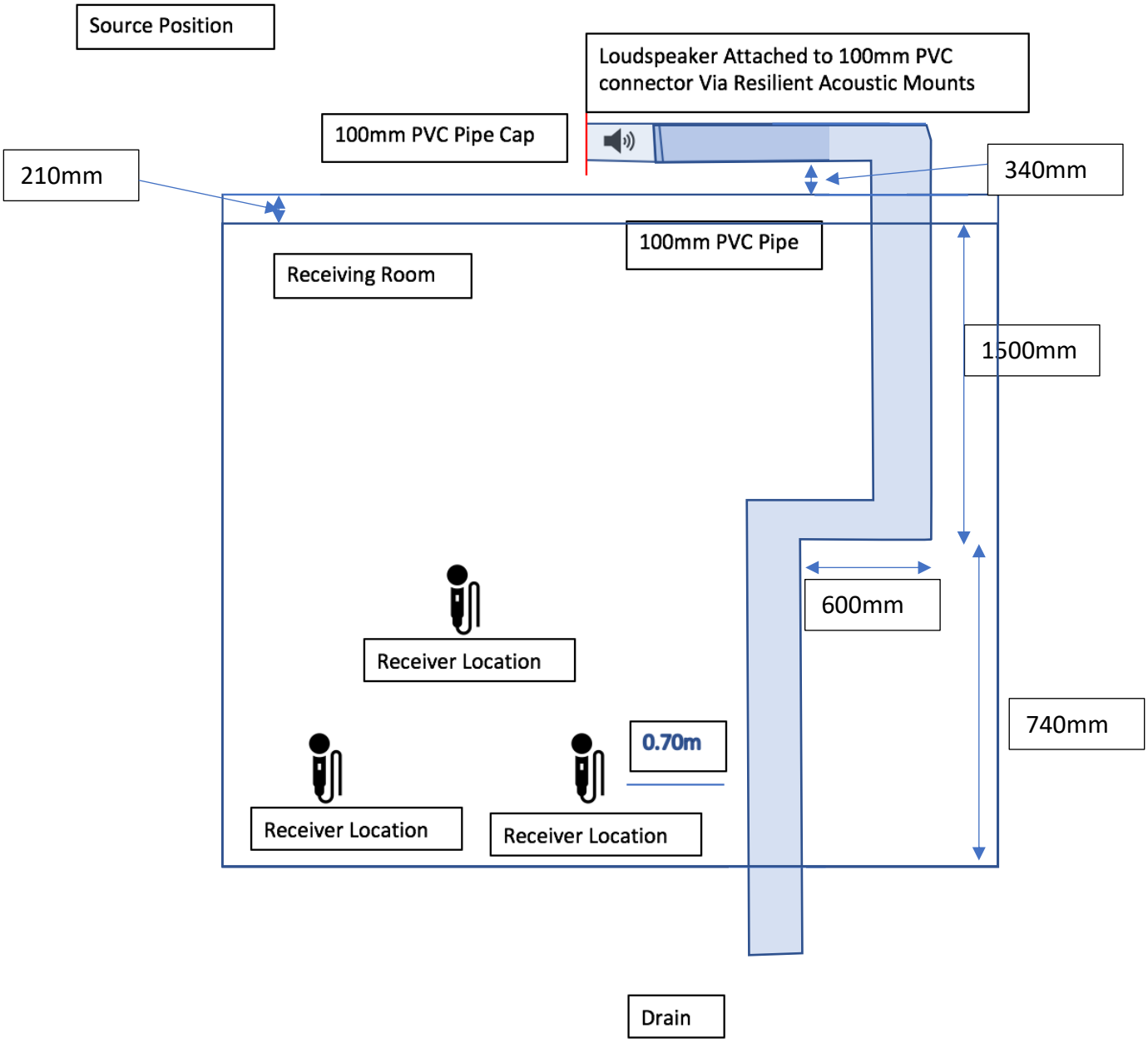


Figure 2: Continuous noise test configuration

3.3 Description of Test Specimens

The 'GreenLAG' samples provided by Acoustica comprised of an acoustic lagging product with visco-elastic QuietWave noise barrier with micro-cellular acoustic foam. Comparative samples were tested to indicate differences in acoustical performance with similar products.

Table 2: Provided Test Specimens

Manufacturer	Product	Density	Description
Acoustica	GreenLAG	3.6kg	Flat
			Convoluted
		5kg	Flat
			Convoluted

Table 3: Provided Comparative Test Specimens

Manufacturer	Product	Density	Description
Pyrotek	4525C	4.5kg	Convoluted
Thermotec	NuWrap 5	5kg	Convoluted
Acoustic Supplies	VIBRALAG	5kg	Convoluted

4 TEST RESULTS

Measurements were completed at the Acoustica Site Laboratory located at 25 Plasser Crescent, North St Marys NSW 2760. Testing was conducted in general accordance with the standards outlined in this report. The results were processed for both instantaneous and continuous noise methods, with the data being further analysed and observed in numerous ways as follows;

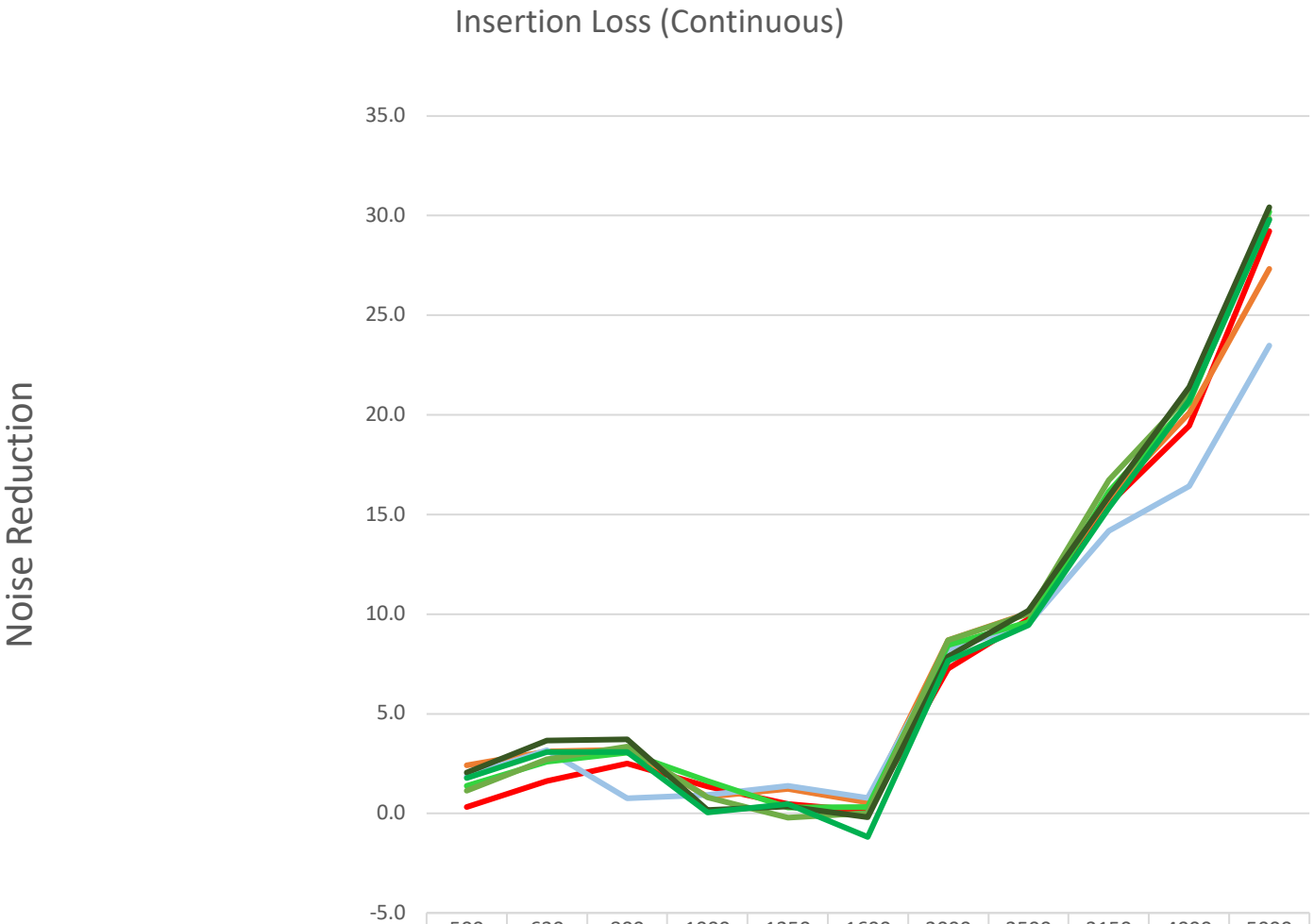
- Insertion loss calculated from the level differences between the bare pipe and lagged pipe at each frequency determined by the relevant standard
- The insertion loss spectrum was summed and expressed as a single digit figure

Further, the following is noted as per ASTM Designation: E1222-90 2016 *"Standard Test Method for Laboratory Measurements of the Insertion Loss of Pipe Lagging Systems"*

"Pipe lagging systems typically have small insertion loss, and sometimes negative insertion loss, at frequencies below 500 Hz. The results obtained at frequencies below 500 Hz may be somewhat erratic. Sound sources used with this test method normally have a low frequency limit in the range from 300 to 500 Hz. For these reasons, the lowest band of frequencies for which results are required is centered at 500 Hz"

4.1 Summary of Results

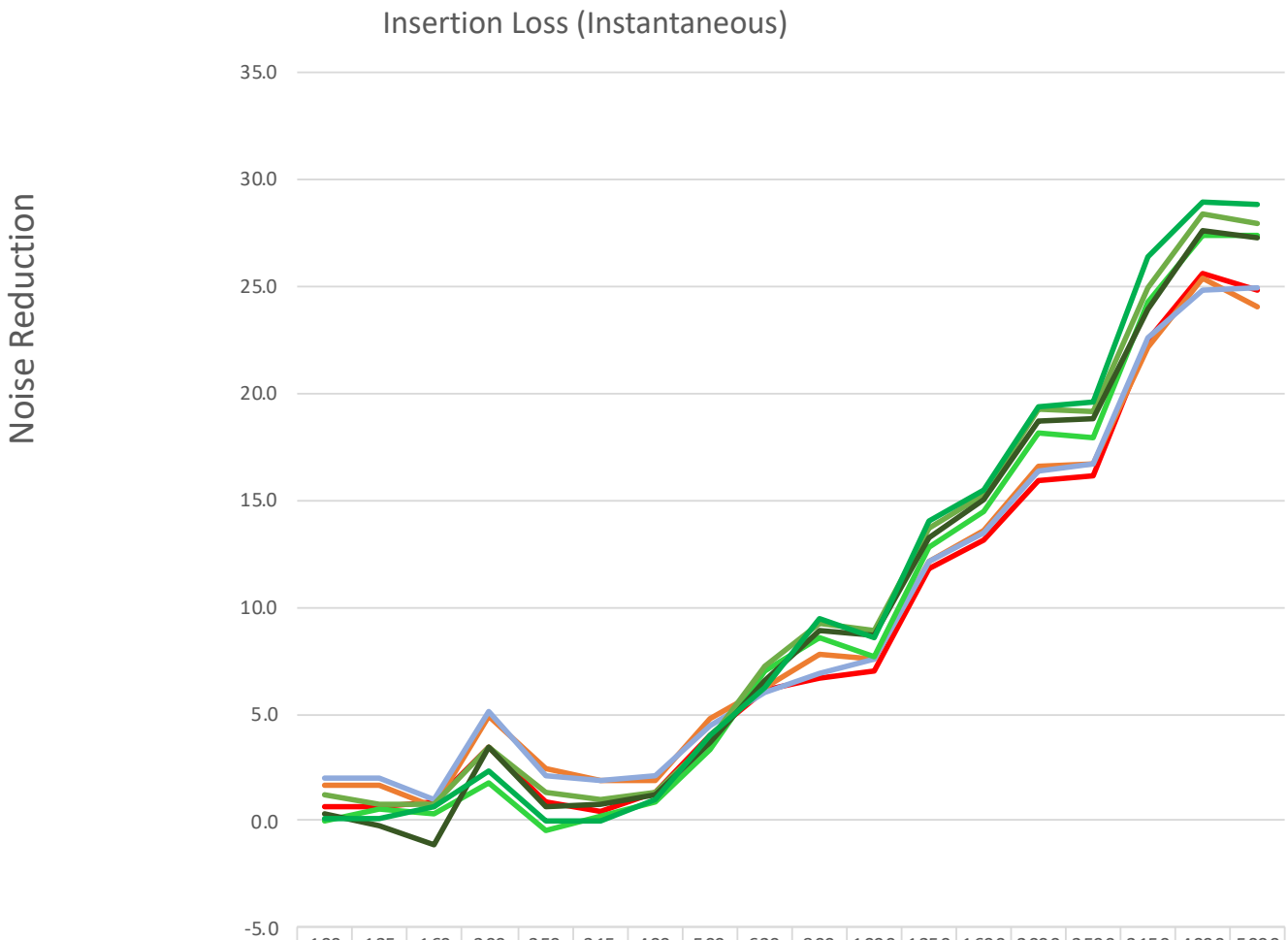
Table 4: Comparison between products using single digit broadband insertion loss values



	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000
Pyrotek 4525C 4.5kg	0.3	1.6	2.5	1.4	0.5	0.1	7.3	9.8	15.5	19.5	29.2
Thermotec NuWrap 5 5kg	2.4	3.1	3.2	0.8	1.2	0.5	8.7	10.1	15.8	20.1	27.3
Acoustic Supplies VIBRALAG 5kg	1.9	3.2	0.8	0.9	1.4	0.8	8.2	9.5	14.2	16.4	23.5
Acoustica GreenLAG 5kg Flat	1.4	2.6	3.0	1.6	0.3	0.3	8.4	9.6	16.2	20.6	30.2
Acoustica GreenLAG 5kg Convoluted	1.1	2.7	3.3	0.8	-0.2	0.0	8.7	10.0	16.7	21.0	29.8
Acoustica GreenLAG 3.6kg Convoluted	2.0	3.6	3.7	0.2	0.3	-0.2	7.9	10.2	15.9	21.4	30.4
Acoustica GreenLAG 3.6kg Flat	1.8	3.1	3.1	0.0	0.5	-1.2	7.7	9.5	15.3	20.7	29.8

1/3rd Octave Insertion Loss values

Table 5: Comparison between products using single digit broadband insertion loss values



	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000
Pyrotek 4525C 4.5kg	0.6	0.7	0.9	3.5	0.9	0.4	1.4	4.1	6.1	6.7	7.0	11.8	13.1	16.0	16.1	22.5	25.6	24.8
Thermotec NuWrap 5 5kg	1.6	1.7	0.7	4.9	2.5	1.8	1.9	4.7	6.2	7.8	7.6	12.1	13.6	16.6	16.7	22.2	25.3	24.1
Acoustic Supplies VIBRALAG 5kg	2.0	2.0	0.9	5.1	2.2	1.9	2.1	4.4	6.0	6.9	7.6	12.1	13.5	16.3	16.7	22.6	24.8	24.9
Acoustica GreenLAG 5kg flat	0.0	0.5	0.4	1.8	-0.4	0.2	0.9	3.3	7.0	8.6	7.7	12.8	14.4	18.1	17.9	24.3	27.4	27.4
Acoustica GreenLAG 5kg convoluted	1.2	0.7	0.8	3.4	1.3	1.0	1.4	3.8	7.2	9.3	9.0	13.6	15.2	19.2	19.1	24.9	28.4	27.9
Acoustica GreenLAG 3.6kg Convoluted	0.4	-0.3	-1.1	3.5	0.7	0.7	1.3	3.7	6.6	8.9	8.6	13.3	15.0	18.7	18.8	23.9	27.6	27.3
Acoustica GreenLAG 3.6kg Flat	0.1	0.1	0.6	2.3	0.0	0.0	1.0	4.0	6.2	9.5	8.6	14.0	15.4	19.4	19.6	26.4	28.9	28.8

1/3rd Octave Insertion Loss values

Table 6: Comparison between products using single digit broadband insertion loss values

Product	Average Broadband Insertion Loss (Continuous 500hz – 5kHz)	Average Broadband Insertion Loss (Instantaneous 100hz – 5kHz)
Pyrotek 4525C	19.5	18.4
Thermotec NuWrap 5	18.1	18.2
Acoustic Supplies VIBRALAG	14.6	18.3
Acoustica Greenlag 5kg Flat	20.5	20.5
Acoustica Greenlag 5kg Convoluted	20.3	21.3
Acoustica Greenlag 3.6kg Convoluted	20.7	20.5
Acoustica Greenlag 3.6kg Flat	20.1	22.0

5 CONCLUSION

Site Laboratory Insertion Loss Testing has been conducted. It is found that all tested Acoustica GreenLAG products provide greater acoustical performance than the comparative products in both instantaneous and continuous noise testing methods.

It is the opinion of the authors of this report that the tested Acoustica GreenLAG 3.6kg or 5kg products can be used as a direct substitute with any of the comparative tested products.

If you have any queries, contact us on the details below to discuss.

Sincerely,

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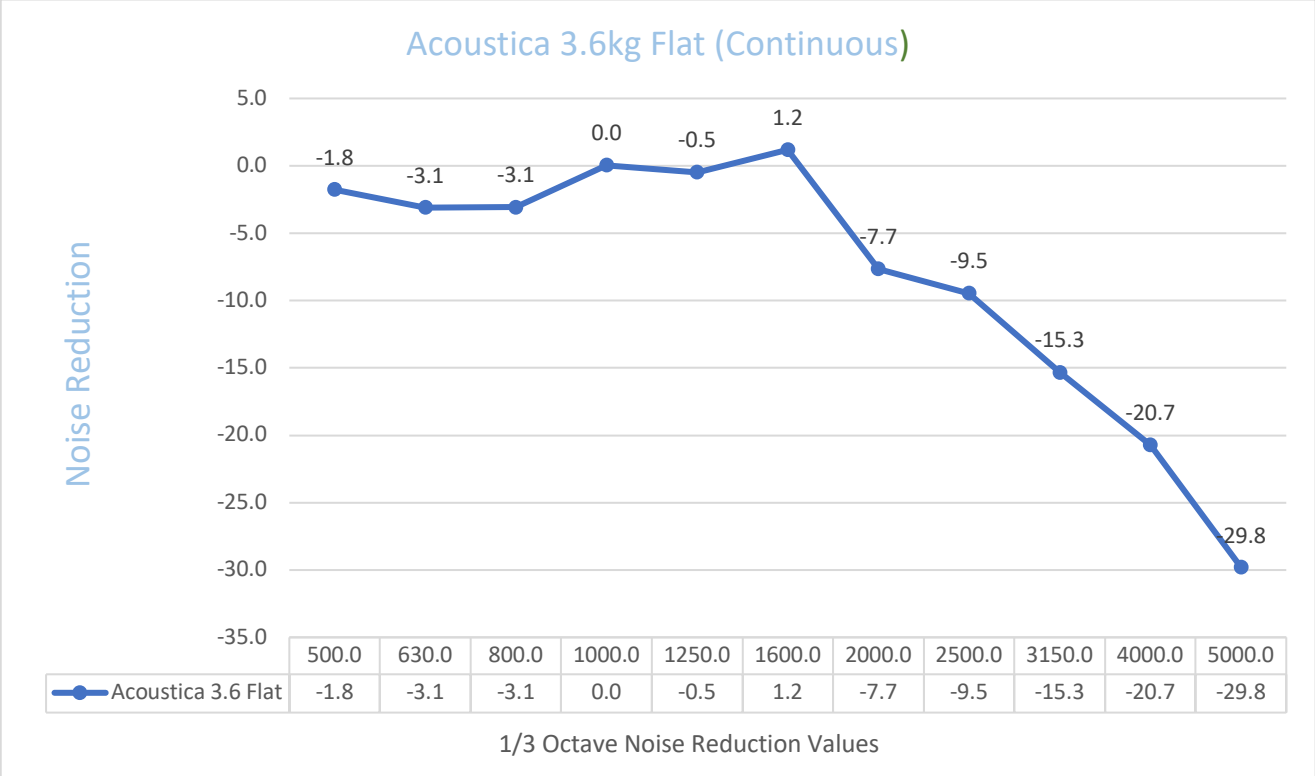
6 APPENDIX – PRESENTATION OF RESULTS

6.1 Acoustica GreenLAG 3.6kg Flat

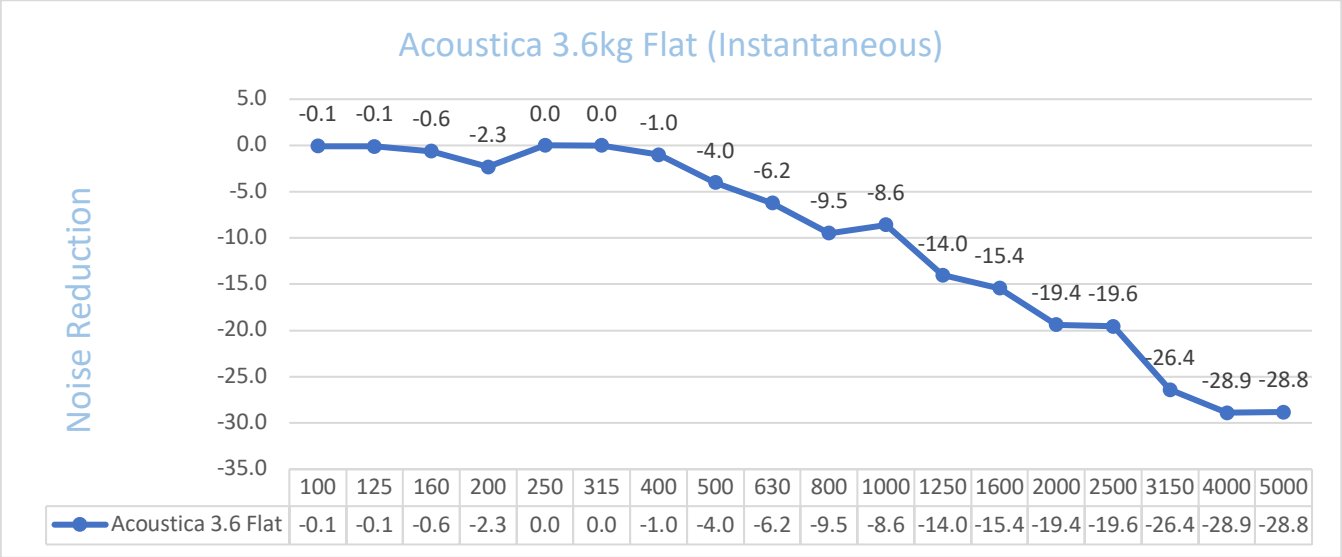
Frequency	Bare Pipe	Bare pipe Ambient	Lagging Ambient	Lagging	IL VALUE
500	64.7908	12.6258	12.2286	63.4201	1.7679
630	56.0287	11.2042	9.0945	55.0502	3.0882
800	54.1543	10.3383	8.601	52.8295	3.0621
1000	61.4489	9.3987	8.8418	62.0463	-0.0405
1250	59.6228	9.2299	9.097	59.2872	0.4685
1600	55.5721	9.606	10.5475	55.8168	-1.1862
2000	56.7697	10.0124	11.378	47.738	7.6661
2500	59.137	10.3462	10.6531	49.3788	9.4513
3150	59.3616	10.6569	11.0429	43.6563	15.3193
4000	58.678	10.9627	11.5013	37.4067	20.7327
5000	59.3467	11.141	11.7203	28.9779	29.7895



Broadband Insertion Loss (Continuous)
20.1 dB

Acoustica GreenLag 3.6kg Flat Noise Reduction values (Instantaneous)

Frequency	Bare Pipe	Lagging	IL VALUE
100	42.05	41.97	0.1
125	42.07	41.95	0.1
160	46.95	46.32	0.6
200	42.27	39.95	2.3
250	44.08	44.10	0.0
315	44.70	44.70	0.0
400	47.78	46.77	1.0
500	45.87	41.85	4.0
630	46.90	40.65	6.2
800	49.73	40.25	9.5
1000	51.82	43.22	8.6
1250	53.08	39.05	14.0
1600	53.12	37.68	15.4
2000	53.75	34.38	19.4
2500	54.97	35.40	19.6
3150	54.88	28.47	26.4
4000	55.13	26.25	28.9
5000	53.95	25.12	28.8

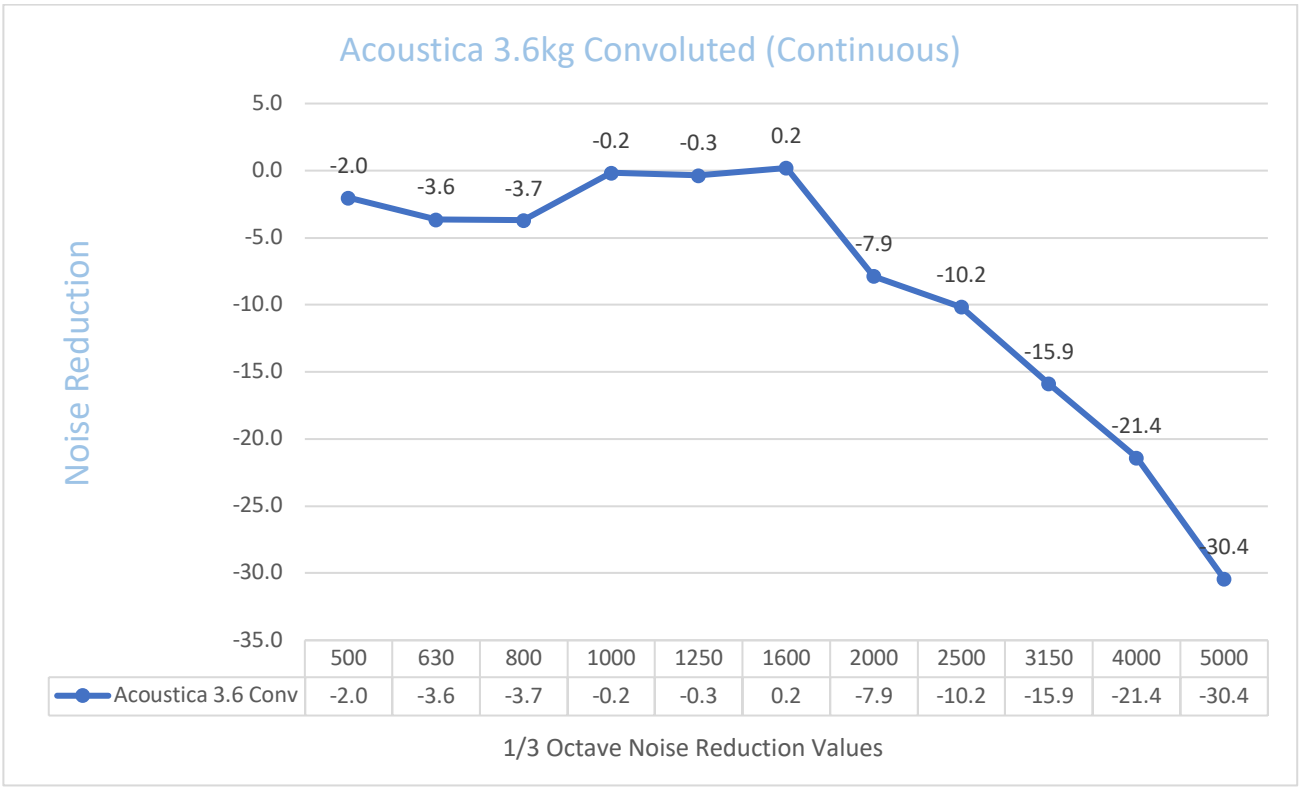


Standard Deviation																	
100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000
2.43	1.51	0.89	1.62	1.59	1.60	1.67	1.30	1.23	0.55	0.59	0.43	0.58	0.59	0.47	0.64	0.60	0.78

Broadband Insertion Loss *(Instantaneous)*
22 dB

6.2 Acoustica GreenLAG 3.6kg Convoluted

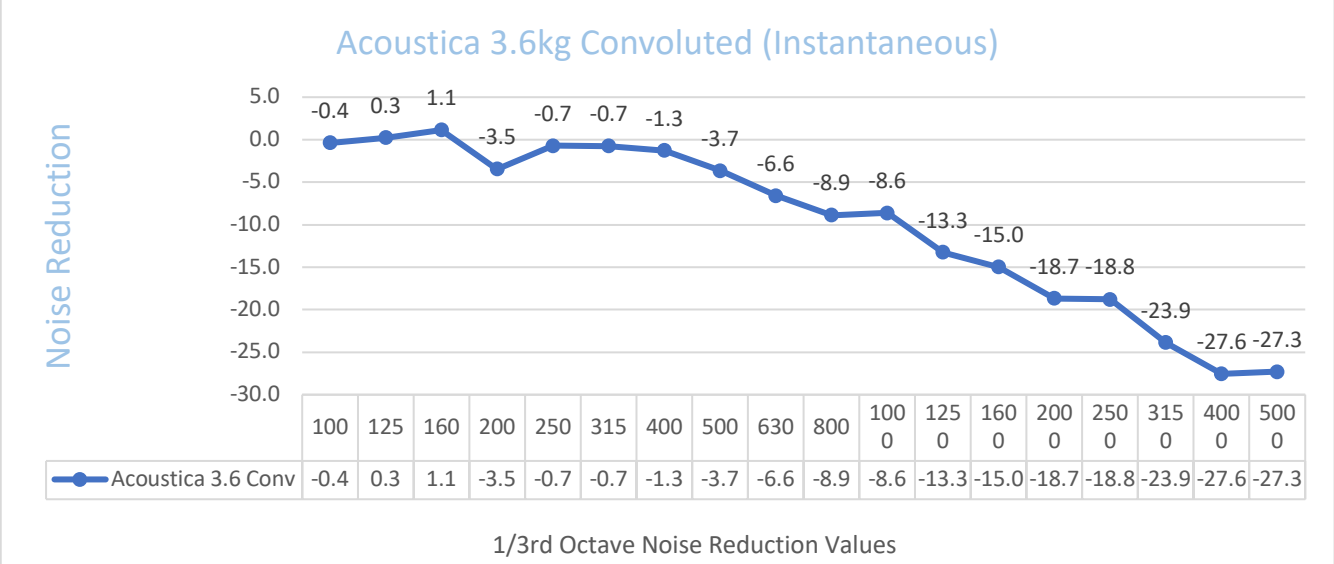
Frequency	Bare Pipe	Bare pipe Ambient	Lagging Ambient	Lagging	IL VALUE
500	64.7908	12.6258	11.5974	63.7833	2.0359
630	56.0287	11.2042	8.5323	55.0511	3.6495
800	54.1543	10.3383	8.2084	52.576	3.7082
1000	61.4489	9.3987	8.3945	62.2898	0.1633
1250	59.6228	9.2299	8.8436	59.6614	0.3477
1600	55.5721	9.606	9.3861	55.9881	-0.1961
2000	56.7697	10.0124	9.9913	48.9182	7.8726
2500	59.137	10.3462	10.4754	48.8452	10.1626
3150	59.3616	10.6569	10.9972	43.1293	15.892
4000	58.678	10.9627	11.4219	36.8252	21.3936
5000	59.3467	11.141	11.581	28.4863	30.4204



Broadband Insertion Loss (Continuous)
20.7 dB

Acoustica GreenLag 3.6kg Convoluted Noise Reduction values (Instantaneous)

Frequency	Bare Pipe	Lagging	IL VALUE
100	42.05	41.67	0.4
125	42.07	42.32	-0.3
160	46.95	48.08	-1.1
200	42.27	38.80	3.5
250	44.08	43.38	0.7
315	44.70	43.97	0.7
400	47.78	46.52	1.3
500	45.87	42.20	3.7
630	46.90	40.32	6.6
800	49.73	40.83	8.9
1000	51.82	43.18	8.6
1250	53.08	39.83	13.3
1600	53.12	38.12	15.0
2000	53.75	35.07	18.7
2500	54.97	36.18	18.8
3150	54.88	31.00	23.9
4000	55.13	27.58	27.6
5000	53.95	26.65	27.3

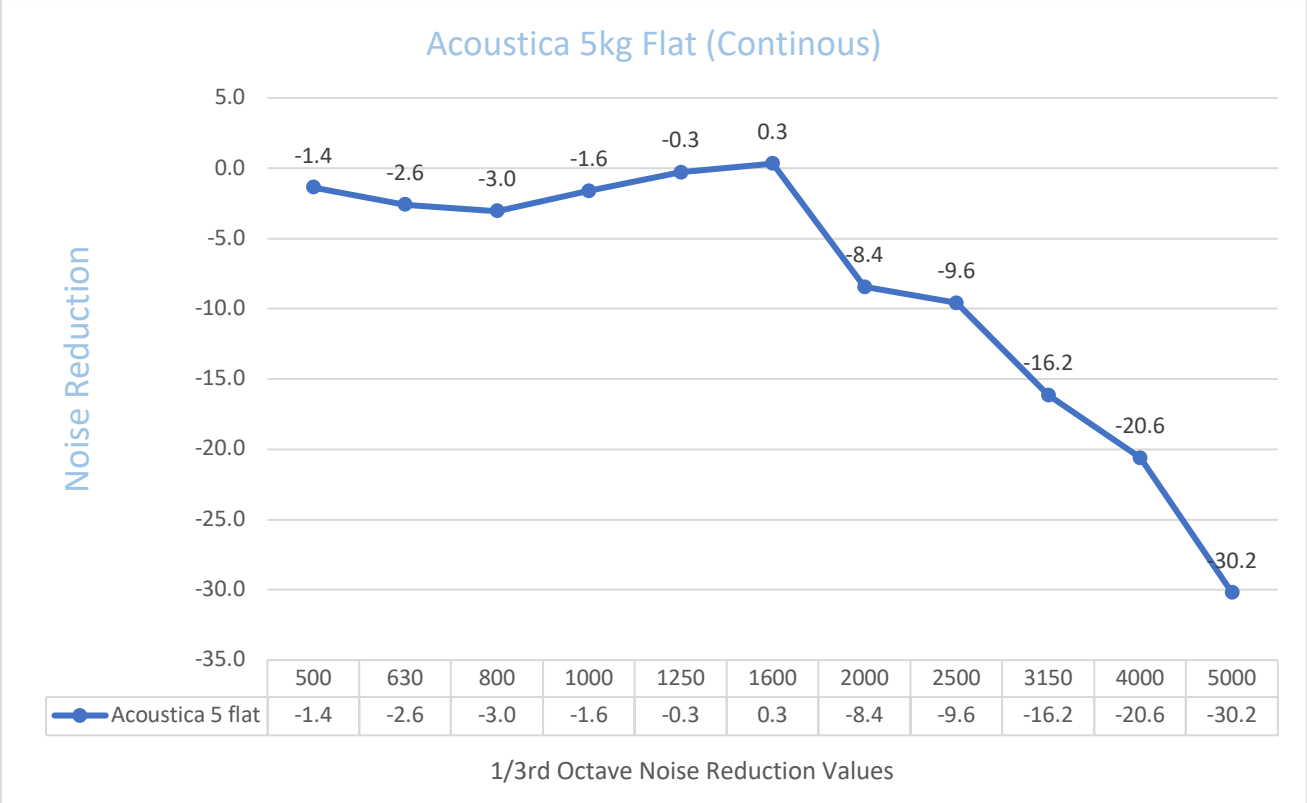


Standard Deviation																
100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000
3.36	1.94	1.12	1.43	1.01	1.28	0.69	1.22	0.66	0.49	0.49	0.78	0.34	0.22	0.57	0.48	0.58	0.80

Broadband Insertion Loss *(Instantaneous)*
20.5 dB

6.3 Acoustica GreenLAG 5kg Flat

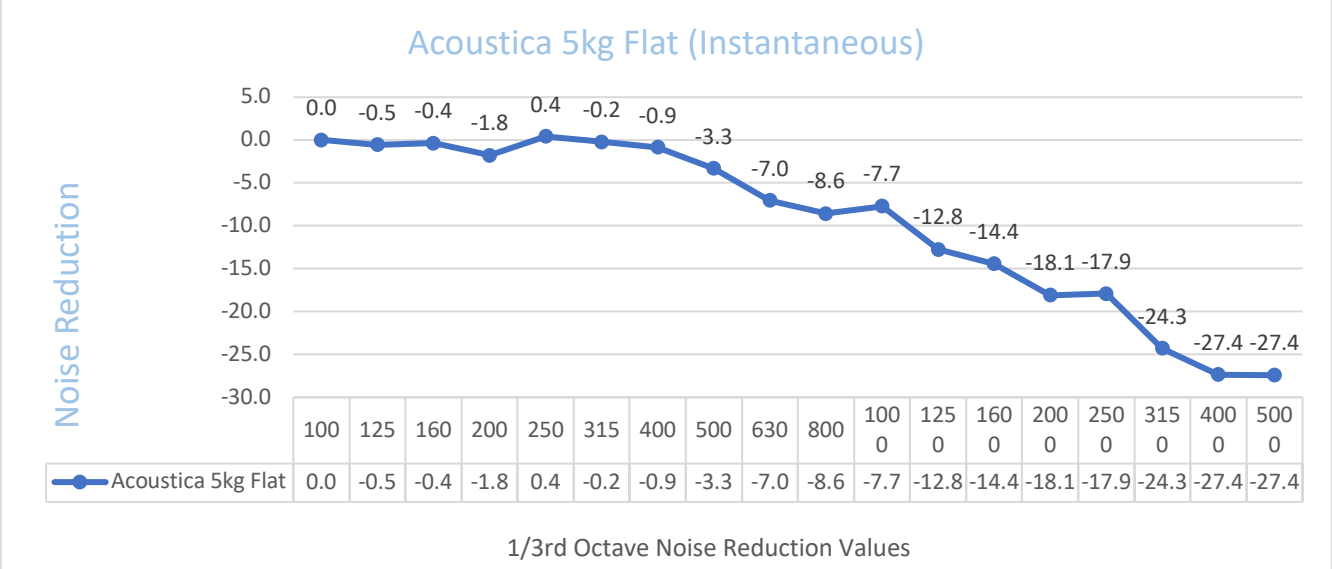
Frequency	Bare Pipe	Bare pipe Ambient	Lagging Ambient	Lagging	IL VALUE
500	64.7908	12.6258	11.332	64.7152	1.3694
630	56.0287	11.2042	8.3389	56.2999	2.5941
800	54.1543	10.3383	8.013	53.4336	3.046
1000	61.4489	9.3987	8.3307	60.8935	1.6234
1250	59.6228	9.2299	8.9025	59.6586	0.2916
1600	55.5721	9.606	9.4008	56.1038	-0.3265
2000	56.7697	10.0124	9.9904	48.353	8.4387
2500	59.137	10.3462	10.5837	49.3011	9.5984
3150	59.3616	10.6569	11.0786	42.788	16.1519
4000	58.678	10.9627	11.4889	37.5353	20.6165
5000	59.3467	11.141	11.7106	28.5808	30.1963



Broadband Insertion Loss (Continuous)
20.5 dB

Acoustica GreenLag 5kg Flat Noise Reduction values (Instantaneous)

Frequency	Bare Pipe	Lagging	IL VALUE
100	42.05	41.67	0.4
125	42.07	42.32	-0.3
160	46.95	48.08	-1.1
200	42.27	38.80	3.5
250	44.08	43.38	0.7
315	44.70	43.97	0.7
400	47.78	46.52	1.3
500	45.87	42.20	3.7
630	46.90	40.32	6.6
800	49.73	40.83	8.9
1000	51.82	43.18	8.6
1250	53.08	39.83	13.3
1600	53.12	38.12	15.0
2000	53.75	35.07	18.7
2500	54.97	36.18	18.8
3150	54.88	31.00	23.9
4000	55.13	27.58	27.6
5000	53.95	26.65	27.3

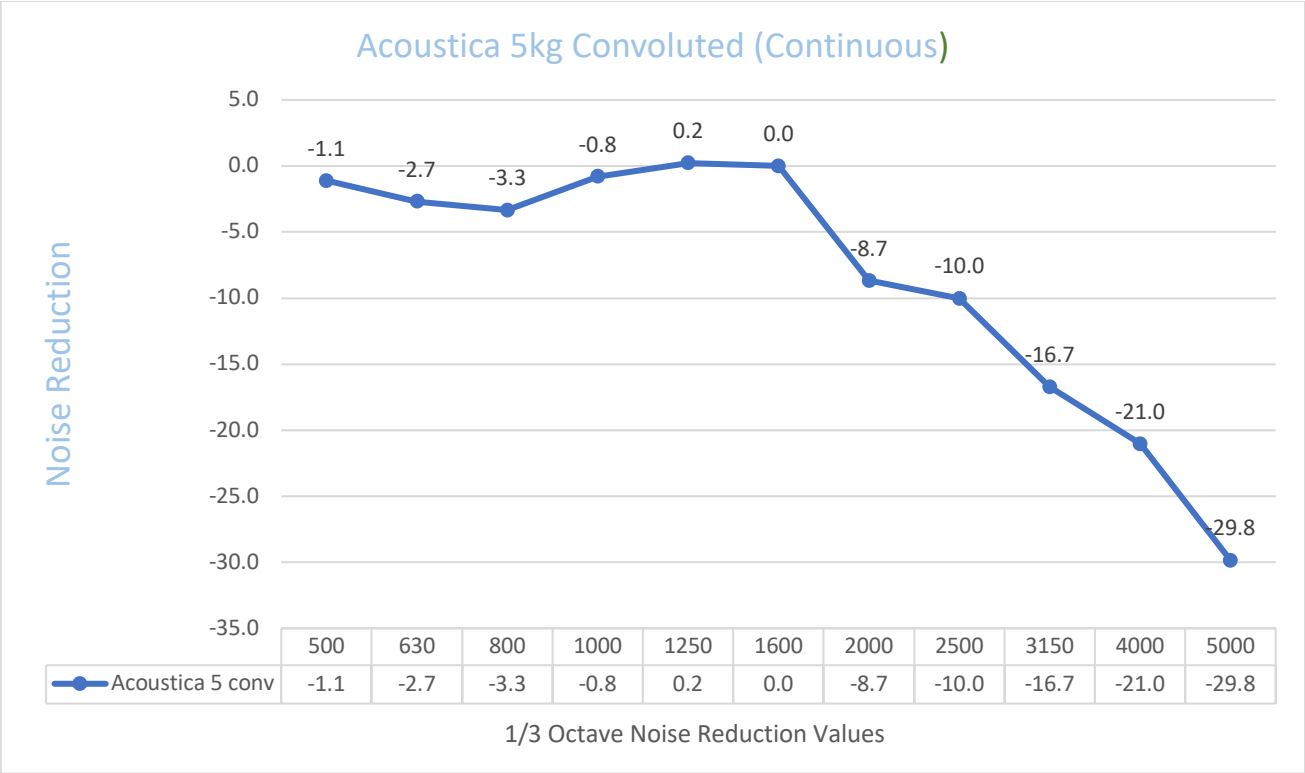


Standard Deviation																
100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000
3.74	1.96	1.15	1.81	1.44	1.42	0.60	1.39	1.21	0.68	0.32	0.51	0.42	0.31	0.75	0.42	0.56	0.71

Broadband Insertion Loss *(Instantaneous)*
20.5 dB

6.4 Acoustica GreenLAG 5kg Convoluted

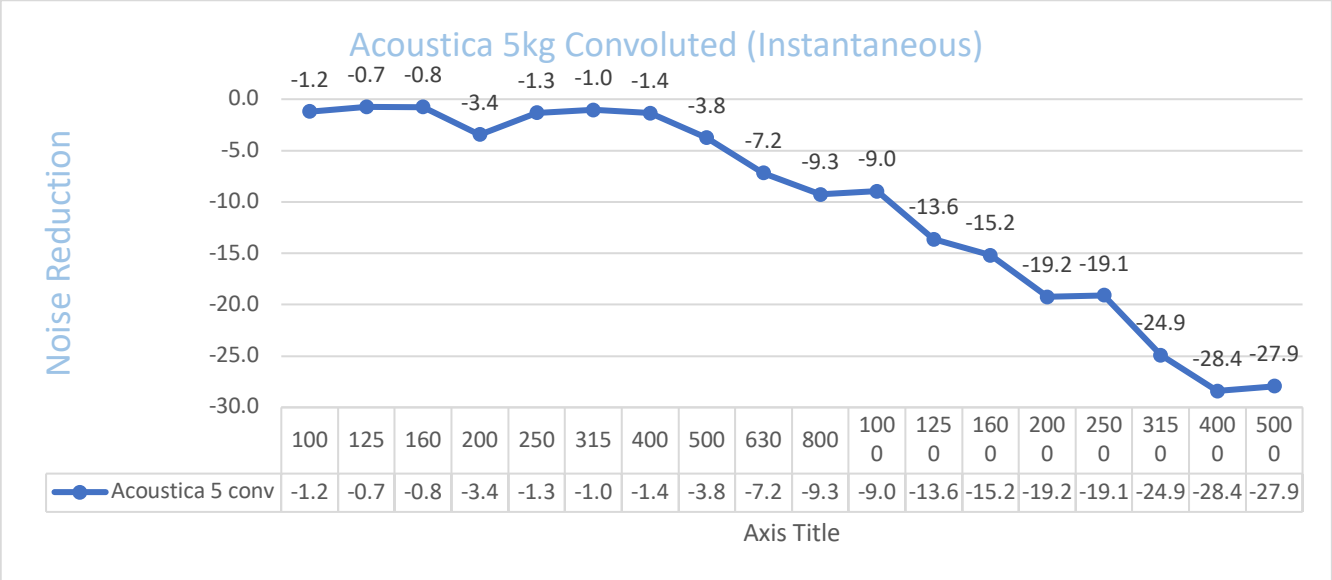
Frequency	Bare Pipe	Bare pipe Ambient	Lagging Ambient	Lagging	IL VALUE
500	64.7908	12.6258	11.7472	64.5452	1.1242
630	56.0287	11.2042	8.5675	55.9655	2.6999
800	54.1543	10.3383	8.513	52.6453	3.3343
1000	61.4489	9.3987	8.6599	61.3879	0.7998
1250	59.6228	9.2299	9.1201	59.9503	-0.2177
1600	55.5721	9.606	9.6841	55.5022	-0.0082
2000	56.7697	10.0124	10.0137	48.0921	8.6763
2500	59.137	10.3462	10.5846	48.8727	10.0259
3150	59.3616	10.6569	11.0379	42.2475	16.7331
4000	58.678	10.9627	11.4344	37.1728	21.0335
5000	59.3467	11.141	11.688	28.95	29.8497



Broadband Insertion Loss (Continuous)
20.3 dB

Acoustica GreenLag 5kg Convoluted Noise Reduction values (Instantaneous)

Frequency	Bare Pipe	Lagging	IL VALUE
100	42.05	40.83	1.2
125	42.07	41.32	0.7
160	46.95	46.18	0.8
200	42.27	38.83	3.4
250	44.08	42.77	1.3
315	44.70	43.65	1.0
400	47.78	46.42	1.4
500	45.87	42.12	3.8
630	46.90	39.70	7.2
800	49.73	40.47	9.3
1000	51.82	42.87	9.0
1250	53.08	39.45	13.6
1600	53.12	37.92	15.2
2000	53.75	34.52	19.2
2500	54.97	35.88	19.1
3150	54.88	29.97	24.9
4000	55.13	26.73	28.4
5000	53.95	26.02	27.9



Standard Deviation																	
100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000
3.72	2.17	1.24	1.25	1.38	1.41	0.78	1.35	0.98	0.51	0.58	0.42	0.41	0.35	0.61	0.52	0.52	0.75

Broadband Insertion Loss *(Instantaneous)*
20.5 dB