Boggabri Coal Mine

Mobile Plant Sound Power Survey

2018

Prepared for

Boggabri Coal Pty Limited

Global Acoustics

Noise and Vibration Analysis and Solutions

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Boggabri Coal Mine

Mobile Plant Sound Power Survey 2018

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Report date: 7 February 2019

Prepared for

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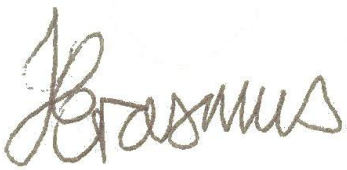

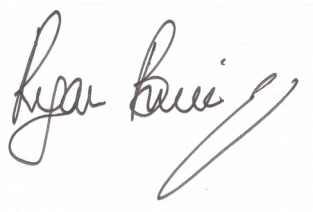

Prepared:	Jonathan Erasmus Consultant	QA Review:	Ryan Bruniges Consultant

Global Acoustics Pty Ltd ~ Environmental noise modelling and impact assessment ~ Sound power testing ~ Noise control advice ~ Noise and vibration monitoring ~ OHS noise monitoring and advice ~ Expert evidence in Land and Environment and Compensation Courts ~ Architectural acoustics ~ Blasting assessments and monitoring ~ Noise management plans (NMP) ~ Sound level meter and noise logger sales and hire

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1 INTRODUCTION

This report provides sound power (L_W) data for mobile equipment operating at Boggabri Coal Mine (BCM). An assessment of tonality for each plant item is also provided.

Sound power testing is undertaken over the course of the calendar year. Plant items identified with elevated sound power levels come under additional investigation. This type of monitoring and action is a form of noise control to ensure that equipment noise levels remain at or near modelled levels, assisting in compliance with off site receptor noise limits.

Noise level measurements in this report were taken on 23 January, 20 and 29 March, 23, 24, and 31 April, 21 and 23 August, 18 September, 15 October and 12 December 2018.

1.1 Terminology

Some definitions of terminology, which may be used in this report, are provided in Table 1.1.

Table 1.1: TERMINOLOGY & ABBREVIATIONS

Descriptor	Definition
dB	Decibels. For sound pressure level this is 10 times the logarithm to the base 10 of the ratio of the mean-square sound pressure to the square of the reference sound pressure (20 micro-pascals)
dB(A)	Noise level measurement units are decibels (dB). The "A" weighting scale is used to describe human response to noise.
SPL	Sound pressure level (SPL), fluctuations in pressure measured as 10 times a logarithmic scale, the reference pressure being 20 micro-pascals.
L_W	Linear sound power level, expressed in decibels, is the logarithmic ratio of the sound power of a source in watts (W) relative to the sound power reference base of 10-12W
L_{WA}	A-weighted sound power level.
L_{Aeq}	The average A-weighted noise energy during a measurement period, in dB

2 METHODOLOGY

2.1 Test Standards

Test standards referenced in this document include:

- AS 2012.1-1990 'Acoustics – Measurement of airborne noise emitted by earth-moving machinery and agricultural tractors – Stationary test condition – Determination of Compliance With Limits for External Noise';
- AS 2012.2-1990 'Acoustics – Measurement of airborne noise emitted by earth-moving machinery and agricultural tractors – Stationary test condition – Operator's Position';
- AS 1269.1-2005 'Occupational Noise Measurement – Part 1 Measurement and assessment of noise immission and exposure';
- ISO 3744-2010 'Acoustics – Determination of sound power levels and sound energy levels of noise sources using sound pressure – Engineering methods for an essentially free field over a reflecting plane';
- ISO 6393:2008(E) 'Earth-moving machinery – Determination of sound power level – Stationary test conditions'; and
- ISO 6395:2008(E) 'Earth-moving machinery – Determination of sound power level – Dynamic test conditions'.

2.2 Test configuration

2.2.1 ISO/AS Sound Power Methodology

Sound power measurement and calculation of plant to ISO/AS level (as shown in Table 3.1) was carried out generally in accordance with Section 2.1 standards. More detail is provided below.

Liebherr 9800 (126, 260)

- Stationary L_W test, engine at rated speed (1800 rpm), engine cooling fans operating at approximately 70% (set by pressure), hydraulic cooling fans operating at approximately 70% (set by pressure), all engine compartment doors and hatches were closed; and
- Dynamic L_W test, engine at operational speed (~1900 rpm), engine cooling fans operating at approximately 70% (set by pressure), hydraulic cooling fans operating at approximately 70% (set by pressure), all engine compartment doors and hatches were closed.

Caterpillar 789C (350, 351, 352)

- Stationary L_W, engine at rated speed (1750 rpm), engine cooling fan was direct drive – belt driven, all engine compartment doors and hatches were closed;
- Dynamic uphill loaded L_W 1st gear, engine at operational speed (~1750 rpm), engine cooling fan was direct drive – belt driven, all engine compartment doors and hatches were closed; and
- Dynamic downhill unloaded L_W, 4th gear, 23-25 km/h, all engine compartment doors and hatches were closed.

Komatsu 930E (747, 756, 757, 758, 759, 760)

- Stationary L_W and operator noise exposure test, engine at rated speed (1900 rpm), engine cooling fan operating at 100%, all engine compartment doors and hatches were closed;
- Dynamic uphill loaded L_W test, engine at operational speed (~1900 rpm), engine cooling fan operating at 100%, all engine compartment doors and hatches were closed; and
- Dynamic downhill unloaded L_W test, 20 km/h, all engine compartment doors and hatches were closed.

Komatsu D475A (83, 84, 85, 86, 88, 03, 04)

- Stationary L_W and operator noise exposure test, engine at rated speed (2000 rpm), engine cooling fan operating at 70% of maximum, all engine compartment doors and hatches were closed;
- Dynamic 1st gear forward L_W test, engine at operational speed (~2000 rpm), engine cooling fan operating at 70% of maximum, all engine compartment doors and hatches were closed; and
- Dynamic 1st gear reverse L_W test, engine at operational speed (~2000 rpm), engine cooling fan operating at 70% of maximum, all engine compartment doors and hatches were closed.

Caterpillar 854K (WD001)

- Stationary L_W and operator noise exposure test, engine at rated speed (1750 rpm), engine cooling fan operating at 700 rpm (approximately 70% of standard maximum 960 rpm), all engine compartment doors and hatches were closed;
- Dynamic 1st gear forward L_W test, engine at operational speed (1750 rpm), engine cooling fan operating at 700 rpm (approximately 70% of standard maximum 960 rpm), all engine compartment doors and hatches were closed; and
- Dynamic 1st gear reverse L_W test, engine at operational speed (1750 rpm), engine cooling fan operating at 700 rpm (approximately 70% of standard maximum 960 rpm), all engine compartment doors and hatches were closed.

Caterpillar 24MG (62, 63)

- Stationary L_W test, engine at rated speed (1800 rpm), engine cooling fan operating at 910 rpm

(approximately 70% of standard maximum 1300 rpm), all engine compartment doors and hatches were closed;

- Dynamic 1st gear forward L_W test, engine at operational speed (~ 1800 rpm), engine cooling fan operating at 910 rpm (approximately 70% of standard maximum 1300 rpm), all engine compartment doors and hatches were closed; and
- Dynamic 1st gear reverse L_W test, engine at operational speed (~ 1800 rpm), engine cooling fan operating at 910 rpm (approximately 70% of standard maximum 1300 rpm), all engine compartment doors and hatches were closed.

2.2.2 Screening Sound Power Methodology

Sound power measurement and calculation of plant to screening sound power level (as shown in Table 3.1) conducted using a reduced scope version of Section 2.1 standards.

The reduced scope uses fewer microphone positions than specified in the standards, with only ground positions used. The rationale being to increase mobility of the testing team, provide flexibility in choice of testing location, and to minimise disruption to mining production.

The test is mainly used as a screening tool. A more precise equipment sound power that would result from full adherence to the above standards was not required. A minimum of two test runs were recorded for each plant item with the aim to have less than 1.5 dB difference between results. It is considered that the results are of sufficient accuracy and repeatability for the purpose of this survey.

Typical test areas showing microphone positions are presented in Figure 1 and Figure 2. The majority of tests for mobile plant were undertaken using a dynamic test only, where the plant item passes through the test area shown in Figure 1 under full power on level ground. The measurement is commenced and completed when the plant item (centre of) passes between microphone positions 2 & 3 and 1&4 respectively. In some cases, stationary tests were conducted for dozers, wheel dozers, and loaders in order to determine engine noise in the absence of track noise and reverse alarms.

Haul trucks, water carts, service carts, front end loaders, graders and dozers were all tested on a flat test area at high idle using the test area shown in Figure 1. Drills were tested in-situ during normal operations using the test area shown in Figure 2. Excavator testing involved measurement at one or more locations at a known distance whilst normal truck loading operations were undertaken. This method provides the most convenient means to test diggers as it presents minimal disruption to production. Excavator testing was performed using some of the positions in Figure 2 (microphone positions being dependant on the excavator immediate working environment). A more accurate and repeatable test would cause significant disruption to production.

A more detailed test methodology document can be provided upon request.

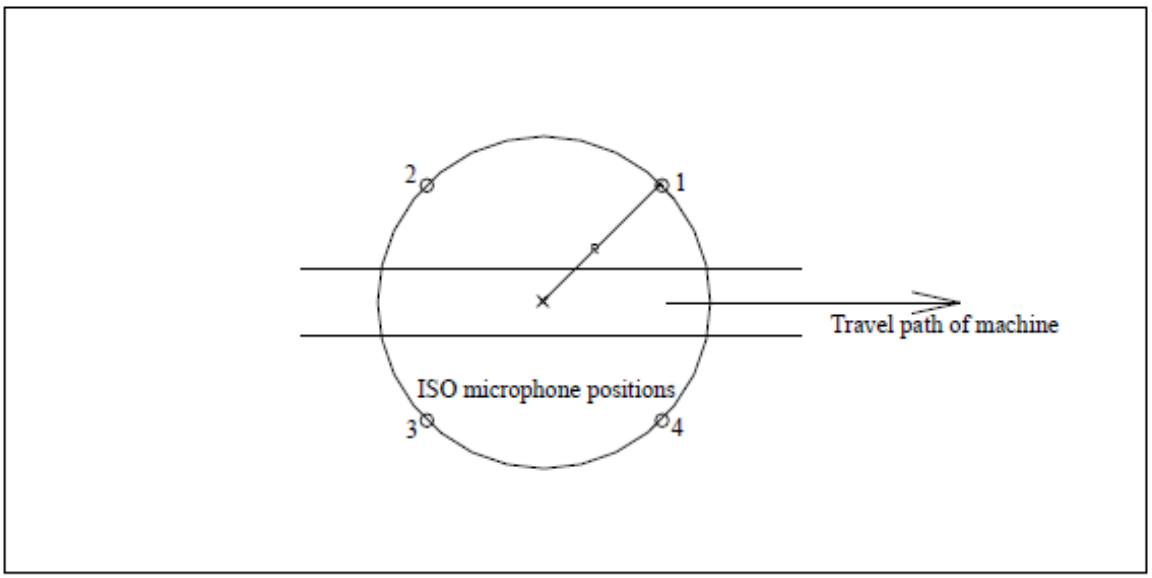

Figure 1 Sound Power Microphone Positions

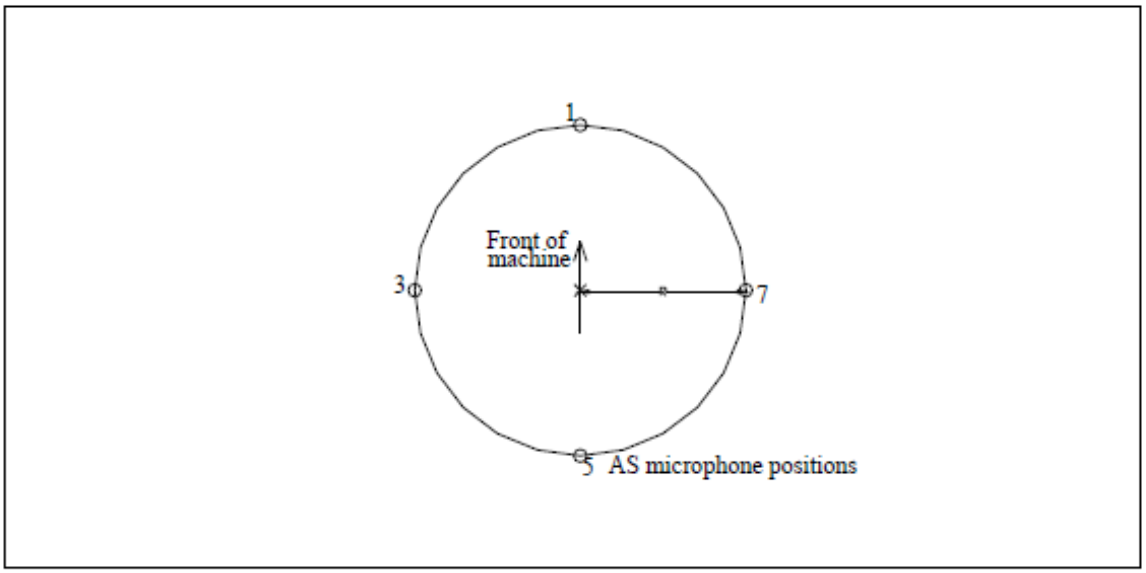

Figure 2 Alternate Stationary Sound Power Microphone Positions

2.3 Equipment Used

Equipment used to measure and record noise levels are listed in Table 2.1. Calibration certificates are provided in Appendix A.

Table 2.1: SOUND LEVEL MEASUREMENT EQUIPMENT

Model	Serial Number	Calibration Due Date
SVAN 958 noise and vibration analyser	20880	10/03/2019
Rion NC74 sound level calibrator	34172616	06/10/2019
SVAN 958 noise and vibration analyser	14216	13/03/2019
Rion NC74 sound level calibrator	50941314	22/11/2018

2.4 Weather Conditions

Weather conditions at the time of testing are presented in Table 2.2.

Table 2.2: ATMOSPHERIC CONDITIONS

Date	Temperature (°C)	Wind Speed (m/s)	Barometric Pressure (hPa)	Relative Humidity (%)
23/01/2018	44	0-1	1013	28
20/03/2018	39	2-3	1014	21
29/03/2018	34	1-3	1013	31
23/05/2018	19	1-3	1024	39
24/05/2018	23	0-1	1024	46
31/05/2018	15	0-1	1023	45
21/08/2018	20	1-3	1019	33
23/08/2018	16	0-1	1020	33
18/09/2018	20	1-2	1022	41
15/10/2018	27	1-3	1022	41
12/12/2018	26	0-2	1014	51

2.5 Criteria

Sound power results in this report have been assessed against sound powers used in modelling for the Continuation of Boggabri Coal Mine Environmental Assessment (EA) (Hansen Bailey, 2010), as advised by Boggabri Coal Mine. Dozers have been assessed against the specified limits for 1st gear operation only.

2.6 Tonality

The NPfI states that a noise is determined to be tonal when the level of an individual one-third octave band exceeds the level of the adjacent bands on both sides by:

- 5 dB or more if the centre frequency of the band containing the tone is above 400Hz;
- 8 dB or more if the centre frequency of the band containing the tone is 160 Hz to 400 Hz inclusive;
- 15 dB or more if the centre frequency of the band containing the tone is below 160 Hz.

Tonal plant (Y/N) is listed in Table 3.1.

3 Overall Sound Power Results

Overall A-weighted sound power levels determined from measured SPL are shown in Table 3.1. Overall sound power screening results which exceeded the relevant criterion by 2 dB or less are considered minor and not significant enough to require additional investigation. Overall sound power screening results which exceeded the relevant criterion by 3 dB or more are considered significant and require additional investigation. Any difference in screening results for the same plant between consecutive years of +3 dB or more would also trigger a more detailed analysis of results (third octave band results analysis) and potentially follow-up machine inspection and/or additional testing.

This approach has been developed in consideration of a number of uncertainty factors and has been adopted and approved by the Department of Planning and Environment (DPE) in other annual noise testing regimes of mobile plant in NSW. These factors include, but are not limited to:

- As described in the Methodology section of this report, the acceptable repeatability for screening is up to 1.5 dB between measured results;
- Due to the mobile nature of screening testing, additional variables such as other mobile plant operating nearby, hard-packed and/or uneven testing surfaces, varying skill of operators, and certain modes of operations being undertaken during testing (in the case of excavators and drills) can result in measured noise levels that are slightly higher than they would be under full scope noise testing;

Single and one-third-octave graphs for equipment tested can be useful in identifying noise sources or differences between like machines. These graphs have not been included in this report but are available upon request.

Note that overall linear sound power levels are a better indicator of low frequency noise content of plant than overall A-weighted sound power levels. Low frequency noise can propagate further than high frequency noise, and so can indicate items with higher potential for off-site noise impacts.

Where plant has been tested to ISO/AS level, any exceedance of the relevant criterion is considered significant, and requires further investigation.

Table 3.1: 2018 SOUND POWER LEVELS

Plant No	Make/Model	Test Level	Test Type	Results dB	Results dB(A)	Limit dB	Limit dB(A)	Exceedance dB	Exceedance dB(A)	Comments	Tonal
Excavators/Loaders											
EX124	CAT 6060	Screening	Stationary	129	121	130	120	0	1	Minetek Kit No fan covers	No
EX126	LIE R9800	ISO/AS	Stationary	122	112	130	120	0	0		No
			Dynamic	126	117	130	120	0	0		No
EX129	LIE R9400 BH	Screening	Dynamic	123	115	130	120	0	0		No
EX260	LIE R9800	ISO/AS	Stationary	122	113	130	120	0	0		No
			Dynamic	126	117	130	120	0	0		No
WL190	KOM WA600-6	Screening	Stationary	123	110	126	117	0	0	Stock Standard	No
WL02	CAT 992K	Screening	Stationary	128	111	126	117	2	0	Lined engine bay	No
Trucks											
DT268	KOM 730E	Screening	Forward	127	113	126	117	1	0	Minetek kit	No
DT280	KOM 730E	Screening	Forward	126	113	126	117	0	0	Minetek kit	No
DT283	KOM 730E	Screening	Forward	126	114	126	117	0	0		No
DT286	KOM 730E	Screening	Forward	127	115	126	117	1	0	Minetek kit	No
DT287	KOM 730E	Screening	Forward	126	114	126	117	0	0	Minetek kit	No
DT350	CAT 789C	ISO/AS	Stationary	121	116	125	119	0	0	Stock Standard	No
			Uphill Loaded	124	119	125	119	0	0		No

Plant No	Make/Model	Test Level	Test Type	Results dB	Results dB(A)	Limit dB	Limit dB(A)	Exceedance dB	Exceedance dB(A)	Comments	Tonal
			Downhill Unloaded	120	114	125	119	0	0		No
DT351	CAT 789C	ISO/AS	Stationary	122	118	125	119	0	0	Stock Standard	No
			Uphill Loaded	124	118	125	119	0	0		No
			Downhill Unloaded	122	116	125	119	0	0		No
DT352	CAT 789C	ISO/AS	Stationary	120	116	125	119	0	0	Stock Standard	No
			Uphill Loaded	123	118	125	119	0	0		No
			Downhill Unloaded	120	114	125	119	0	0		No
Trucks											
DT266	KOM 930E-4	Screening	Forward	129	117	126	117	3	0	Minetek Kit	No
DT723	KOM 930E-4	Screening	Forward	129	121	126	117	3	4	Exhaust upgrade	No
DT724	KOM 930E-4	Screening	Forward	131	124	126	117	5	7	Stock Standard	No
DT725	KOM 930E-4	Screening	Forward	131	121	126	117	5	4	Stock Standard	No
DT747	KOM 930E-4	ISO/AS	Stationary	127	120	125	119	2	1	Exhaust upgrade	No
			Uphill Loaded	129	122	125	119	4	3		No
			Downhill Unloaded	125	122	125	119	0	3		No
DT753	KOM 930E-4	Screening	Forward	131	123	126	117	5	6	Stock Standard	No
DT756	KOM 930E-4	ISO/AS	Stationary	128	122	125	119	3	3	Exhaust upgrade	No

Plant No	Make/Model	Test Level	Test Type	Results dB	Results dB(A)	Limit dB	Limit dB(A)	Exceedance dB	Exceedance dB(A)	Comments	Tonal
			Uphill Loaded	130	123	125	119	5	4		No
			Downhill Unloaded	126	124	125	119	1	5		No
DT757	KOM 930E-4	ISO/AS	Stationary	127	122	125	119	2	3	Exhaust upgrade	No
			Uphill Loaded	129	122	125	119	4	3		No
			Downhill Unloaded	124	119	125	119	0	0		No
DT758	KOM 930E-4	ISO/AS	Stationary	125	113	125	119	0	0	Komatsu Kit	No
			Uphill Loaded	128	115	125	119	3	0		No
			Downhill Unloaded	124	123	125	119	0	4		No
DT759	KOM 930E-4	ISO/AS	Stationary	124	113	125	119	0	0	Komatsu Kit	No
			Uphill Loaded	128	115	125	119	3	0		No
			Downhill Unloaded	124	123	125	119	0	4		No
DT760	KOM 930E-4	ISO/AS	Stationary	123	115	125	119	0	0	Komatsu Kit	No
			Uphill Loaded	127	115	125	119	2	0		No
			Downhill Unloaded	124	123	125	119	0	4		No
Dozers											
TD083	KOM D475A-5E0	ISO/AS	Stationary	117	108	126	116	0	0	Stock Standard	No

Plant No	Make/Model	Test Level	Test Type	Results dB	Results dB(A)	Limit dB	Limit dB(A)	Exceedance dB	Exceedance dB(A)	Comments	Tonal
			1st gear forward/reverse	119/119	111/112	126	116	0/0	0/0	Stock Standard	No
TD084	KOM D475A-5SE0	ISO/AS	Stationary	115	105	126	116	0	0	Stock Standard	No
			1st gear forward/reverse	117/118	110/111	126	116	0/0	0/0	Stock Standard	No
TD085	KOM D475A-5E0 SD	ISO/AS	Stationary	114	104	126	116	0	0	Stock Standard	No
			1st gear forward/reverse	117/117	110/111	126	116	0/0	0/0	Stock Standard	No
TD086	KOM D475A-5E0 SD	ISO/AS	Stationary	117	106	126	116	0	0	Stock Standard	No
			1st gear forward/reverse	118/119	110/111	126	116	0/0	0/0	Stock Standard	No
TD088	KOM D375	ISO/AS	Stationary	117	109	126	116	0	0	Stock Standard	No
			1st gear forward/reverse	118/119	110/112	126	116	0/0	0/0	Stock Standard	No
Dozers											
TD03	KOM D475A-5E0 SD	ISO/AS	Stationary	114	104	126	116	0	0	Stock Standard	No
			1st gear forward/reverse	116/117	107/109	126	116	0/0	0/0		No
TD04	KOM D475A-5E0 SD	ISO/AS	Stationary	114	105	126	116	0	0	Stock Standard	No
			1st gear forward/reverse	117/118	108/110	126	116	0/0	0/0		No
Wheel Dozers											
WD001	CAT 854K	ISO/AS	Stationary	121	108	126	116	0	0	Westrac Kit	No

Plant No	Make/Model	Test Level	Test Type	Results dB	Results dB(A)	Limit dB	Limit dB(A)	Exceedance dB	Exceedance dB(A)	Comments	Tonal
			1st gear forward/reverse	117/121	108/110	126	116	0/0	0/0	Westrac Kit	No
Graders											
GR062	CAT 24MG	ISO/AS	Stationary	116	109	126	115	0	0	Westrac Kit	No
			1st gear forward/reverse	117/117	108/108	126	115	0/0	0/0	Westrac Kit	No
GR063	CAT 24MG	ISO/AS	Stationary	117	109	126	115	0	0	Westrac Kit	No
			1st gear forward/reverse	117/117	108/108	126	115	0/0	0/0	Westrac Kit	No
Water Trucks											
WC044	KOM 730E	Screening	Forward	125	113	128	117	0	0	Minetek Kit	No
Drills											
661	ReichDrill C700D	Screening	Stationary	128	117	129	117	0	0	Stock Standard	No
663	ReichDrill C700D	Screening	Stationary	130	119	129	117	1	2	Stock Standard	No

4 SUMMARY

This report provides sound power (L_W) data for mobile equipment operating at Boggabri Coal Mine (BCM).

Results in Table 3.1 show that:

- Komatsu 930-E trucks 266, 723, 724, 725, 747, 753, 756, 757, 758, 759, 760 exceeded A-weighted and/or linear limits by 3 or more dB.

Global Acoustics recommend that any plant with a sound power level change between test periods of greater than 2 dB and/or an exceedance of a sound power limit by more than 2 dB, be initially inspected for damaged or missing sound attenuation, further action to be determined from the outcomes of said inspection.

We trust this information is per your requirements. Please contact us if you require further details or advice.

Global Acoustics Pty Ltd

APPENDIX

A CALIBRATION CERTIFICATES

Acoustic Research Labs Pty Ltd
Level 7 Building 2 423 Pennant Hills Rd
Pennant Hills NSW AUSTRALIA 2120
Ph: +61 2 9484 0800 A.B.N. 65 160 399 119
www.acousticresearch.com.au

Octave Band Filter
AS 4476:1997
Calibration Certificate

Calibration Number C17109A

Client Details	Global Acoustics Pty Ltd 12/16 Huntingdale Drive Thornton NSW 2322
Filter Model Number :	SvanTek 958
Filter Serial Number :	N/A
Instrument Serial Number :	20880
Microphone Serial Number :	2662995
Pre-amplifier Serial Number :	17124

Atmospheric Conditions

Ambient Temperature :	22.2°C
Relative Humidity :	50.1%
Barometric Pressure :	99.47kPa

Calibration Technician : Vicky Jaiswal
Calibration Date : 10/03/2017
Secondary Check: Riley Cooper
Report Issue Date : 13/03/2017

Approved Signatory : Juan Aguero

Clause and Characteristic Tested	Result	Clause and Characteristic Tested	Result
4.4 & 5.3: 1/1 Octave relative attenuation	*Pass*	4.6 & 5.5: Linear operating range	*Pass*
4.4 & 5.3: 1/3 Octave relative attenuation	*Pass*	4.8 & 5.7: Anti-alias filters	*Pass*
		4.10 & 5.9: Flat frequency response	*Pass*

The fractional octave band meter under test has been shown to conform to the class 1 requirements for periodic testing as described in AS 4476:1997 for the tests stated above.

Least Uncertainties of Measurement -

Electrical Tests		Environmental Conditions	
< 16Hz	*±0.19dB*	*Temperature*	*±0.05°C*
16Hz-100Hz	*±0.11dB*	*Relative Humidity*	*±0.46%*
100Hz-1000Hz	*±0.09dB*	*Barometric Pressure*	*±0.017kPa*
1000Hz-10kHz	*±0.09dB*		
>10kHz	*±0.16dB*		

All uncertainties are derived at the 95% confidence level with a coverage factor of 2.

This calibration certificate is to be read in conjunction with the calibration test report.

Acoustic Research Labs Pty Ltd is NATA Accredited Laboratory Number 14172.
Accredited for compliance with ISO/IEC 17025.

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration and inspection reports.

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Sound Calibrator

IEC 60942-2004

Calibration Certificate

Calibration Number C17526

Client Details Global Acoustics Pty Ltd
12/16 Huntingdale Drive
Thornton NSW 2322

Equipment Tested/ Model Number : Rion NC-74
Instrument Serial Number : 34172616

Atmospheric Conditions
Ambient Temperature : 21.6°C
Relative Humidity : 42.4%
Barometric Pressure : 99.43kPa

Calibration Technician : Jason Gomes
Calibration Date : 06/10/2017
Secondary Check: Riley Cooper
Report Issue Date : 10/10/2017

Approved Signatory : Ken Williams

Clause and Characteristic Tested	Result	Clause and Characteristic Tested	Result
5.2.2: Generated Sound Pressure Level	*Pass*	5.3.2: Frequency Generated	*Pass*
5.2.3: Short Term Fluctuation	*Pass*	5.5: Total Distortion	*Pass*

Nominal Level	Nominal Frequency	Measured Level	Measured Frequency
94.0	1000.0	94.1	1002.31

The sound calibrator has been shown to conform to the class 1 requirements for periodic testing, described in Annex B of IEC 60942:2004 for the sound pressure level(s) and frequency(ies) stated, for the environmental conditions under which the tests were performed..

Least Uncertainties of Measurement -

Specific Tests		Environmental Conditions	
Generated SPL	*±0.11dB*	*Temperature*	*±0.05°C*
Short Term Fluct.	*±0.02dB*	*Relative Humidity*	*±0.46%*
Frequency	*±0.01%*	*Barometric Pressure*	*±0.017kPa*
Distortion	*±0.5%*		

All uncertainties are derived at the 95% confidence level with a coverage factor of 2.

This calibration certificate is to be read in conjunction with the calibration test report.

NATA
WORLD RECOGNISED ACCREDITATION

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Octave Band Filter
AS 4476:1997
Calibration Certificate

Calibration Number C17110A

Client Details Global Acoustics Pty Ltd
12/16 Huntingdale Drive
Thornton NSW 2322

Filter Model Number : SVANTEK 958
Filter Serial Number : N/A
Instrument Serial Number : 14216
Microphone Serial Number : 4012617
Pre-amplifier Serial Number : 49884

Atmospheric Conditions
Ambient Temperature : 22.2°C
Relative Humidity : 51.8%
Barometric Pressure : 99.14kPa

Calibration Technician : Vicky Jaiswal
Calibration Date : 13/03/2017
Secondary Check: Riley Cooper
Report Issue Date : 13/03/2017
Approved Signatory : Juan Aguero

Clause and Characteristic Tested	Result	Clause and Characteristic Tested	Result
4.4 & 5.3: 1/1 Octave relative attenuation	*Pass*	4.6 & 5.5: Linear operating range	*Pass*
4.4 & 5.3: 1/3 Octave relative attenuation	*Pass*	4.8 & 5.7: Anti-alias filters	*Pass*
		4.10 & 5.9: Flat frequency response	*Pass*

The fractional octave band meter under test has been shown to conform to the class 1 requirements for periodic testing as described in AS 4476:1997 for the tests stated above.

Least Uncertainties of Measurement -

Electrical Tests

< 16Hz	*±0.19dB*
16Hz-100Hz	*±0.11dB*
100Hz-1000Hz	*±0.09dB*
1000Hz-10kHz	*±0.09dB*
>10kHz	*±0.16dB*

Environmental Conditions

Temperature	*±0.05°C*
Relative Humidity	*±0.46%*
Barometric Pressure	*±0.017kPa*

All uncertainties are derived at the 95% confidence level with a coverage factor of 2.

This calibration certificate is to be read in conjunction with the calibration test report.

Acoustic Research Labs Pty Ltd is NATA Accredited Laboratory Number 14172.
Accredited for compliance with ISO/IEC 17025.

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration and inspection reports.

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Sound Calibrator
IEC 60942-2004

Calibration Certificate

Calibration Number C16646

Client Details Global Acoustics Pty Ltd
12/16 Huntingdale Drive
Thornton NSW 2322

Equipment Tested/ Model Number : Rion NC-74
Instrument Serial Number : 50941314

Atmospheric Conditions
Ambient Temperature : 21.9°C
Relative Humidity : 43.3%
Barometric Pressure : 99.08kPa

Calibration Technician : Vicky Jaiswal
Calibration Date : 22/11/2016
Secondary Check: Riley Cooper
Report Issue Date : 22/11/2016
Approved Signatory : Ken Williams

Clause and Characteristic Tested	Result	Clause and Characteristic Tested	Result
5.2.2: Generated Sound Pressure Level	*Pass*	5.3.2: Frequency Generated	*Pass*
5.2.3: Short Term Fluctuation	*Pass*	5.5: Total Distortion	*Pass*

	Nominal Level	Nominal Frequency	Measured Level	Measured Frequency
Measured Output	94.0	1000.0	93.9	1002.91

The sound calibrator has been shown to conform to the class 1 requirements for periodic testing, described in Annex B of IEC 60942:2004 for the sound pressure level(s) and frequency(ies) stated, for the environmental conditions under which the tests were performed..

Least Uncertainties of Measurement -

Specific Tests

Generated SPL	*±0.09dB*
Short Term Fluct.	*±0.02dB*
Frequency	*±0.01%*
Distortion	*±0.5%*

Environmental Conditions

Temperature	*±0.05°C*
Relative Humidity	*±0.46%*
Barometric Pressure	*±0.017kPa*

All uncertainties are derived at the 95% confidence level with a coverage factor of 2.

This calibration certificate is to be read in conjunction with the calibration test report.

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