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Boggabri Coal Mine

Mobile Plant Sound Power Survey 2022

Prepared for Boggabri Coal Pty Ltd

January 2023

Boggabri Coal Mine

Mobile Plant Sound Power Survey 2022

Boggabri Coal Pty Ltd

E220590 1

January 2023

Version	Date	Prepared by	Approved by	Comments
0.1	18/01/2023	Jonathan Erasmus	Ryan Bruniges	Draft
0.3	23/01/2023	Jonathan Erasmus	Ryan Bruniges	Draft
1.0	27/01/2023	Jonathan Erasmus	Ryan Bruniges	Final

Approved by

Ryan Bruniges
Senior Acoustic Consultant
18/01/2023

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Appendices

Tables

1 Introduction

This report provides sound power (LW) 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 24 August and 20 December 2022.

1.1 Terminology

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

Table 1.1 Terminology and 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.
LW	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
LWA	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 Screening sound power methodology

Sound power measurement and calculation of plant to screening sound power methodology conducted using a reduced scope version of the standards referenced in Section 2.1.

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 detailed test methodology document can be provided upon request.

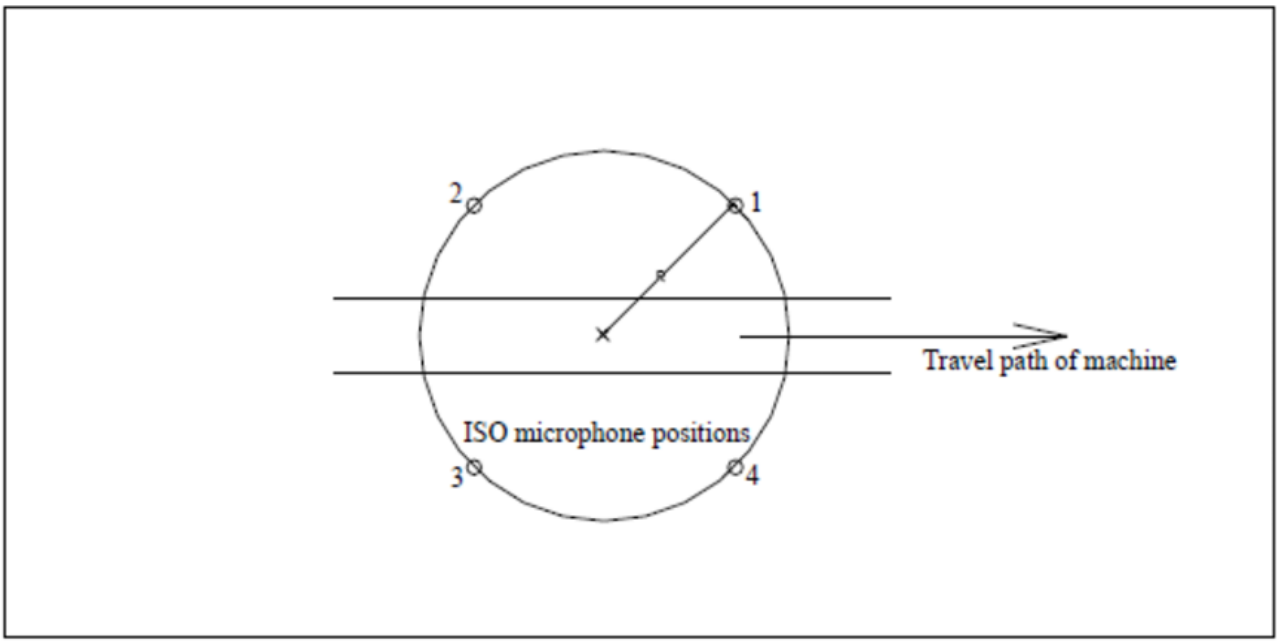

Figure 1 Sound power microphone positions

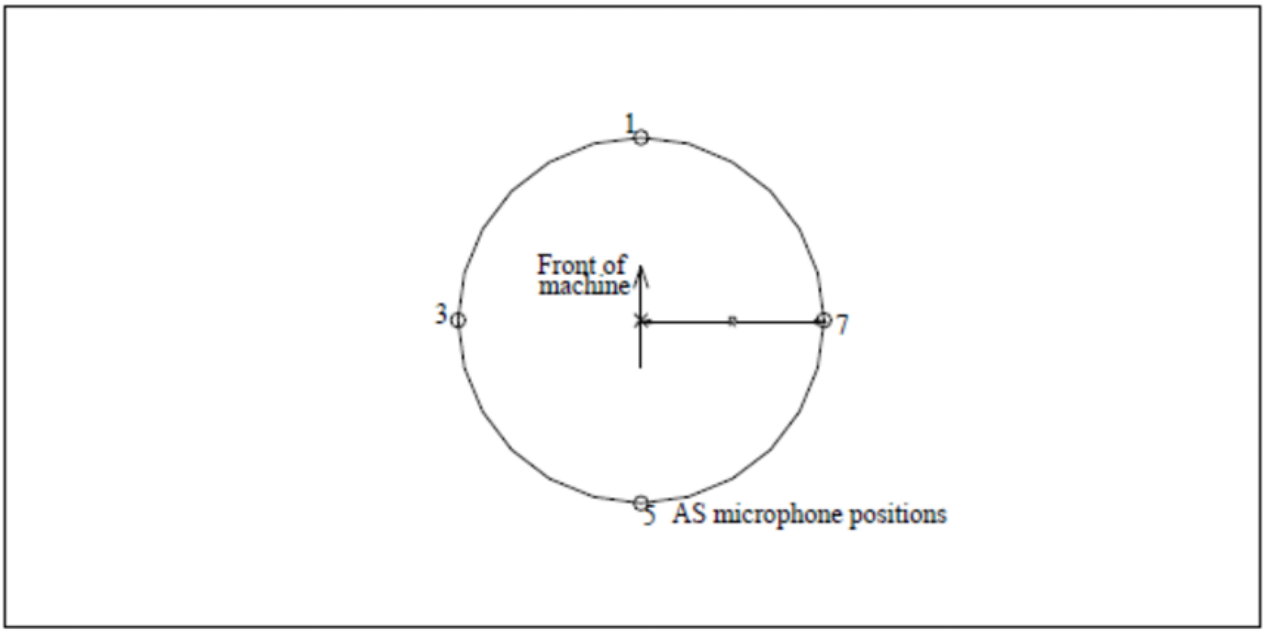

Figure 2 Alternative stationary sound power microphone positions

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 date due
SVAN 958 noise and vibration analyser	20880	06/04/2024
Pulsar 105 acoustic calibrator	96080	07/10/2023
Rion NC-74 acoustic calibrator	34172616	13/09/2024

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)	Relative Humidity (%)
24/08/2022	9	0 – 2	51
20/12/2022	26	1 – 4	45

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

A tonality assessment for each plant item has also been undertaken. 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.

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.

Table 3.1 2022 Sound power results

Plant ID	Make/Model	Test Level	Test Type	Test Date	Result dB	Result dB(A)	Limit dB[1]	Limit dB(A)[1]	Exceedance dB[2]	Exceedance dB (A)[2]	Tonal Hz
Excavators/Loaders											
EX257	Caterpillar 6030	Screening	Dynamic	24/08/2022	123	116	130	120	Nil	Nil	
EX259	Hitachi EX2600-6	Screening	Dynamic	24/08/2022	125	118	130	120	Nil	Nil	
EX262	Hitachi EX3600-6	ISO (100% fan)	Dynamic	21/12/2022	126	116	130	120	Nil	Nil	
EX262	Hitachi EX3600-6	ISO (100% fan)	Stationary	21/12/2022	128	122	130	120	Nil	2	160
Graders											
GR061	Caterpillar 16M	Screening	Dynamic	20/12/2022	113	107	126	115	Nil	Nil	
GR062	Caterpillar 24M	Screening	Dynamic	24/08/2022	115	108	126	115	Nil	Nil	
Trucks											
DT266	Komatsu 730E-7	Screening	Dynamic, Forward	24/08/2022	130	120	126	117	4	3	
DT268	Komatsu 730E-7	Screening	Dynamic, Forward	24/08/2022	129	116	126	117	3	Nil	
DT280	Komatsu 730E-7	Screening	Dynamic, Forward	20/12/2022	125	114	126	117	Nil	Nil	
DT283	Komatsu 730E-7	Screening	Dynamic, Forward	20/12/2022	127	116	126	117	1	Nil	
DT284	Komatsu 730E-7	Screening	Dynamic, Forward	20/12/2022	127	117	126	117	1	Nil	
DT286	Komatsu 730E-7	Screening	Dynamic, Forward	24/08/2022	127	116	126	117	1	Nil	
DT287	Komatsu 730E-7	Screening	Dynamic, Forward	24/08/2022	128	117	126	117	2	Nil	
DT309	Hitachi EH3500ACII	Screening	Dynamic, Forward	20/12/2022	130	116	126	117	4	Nil	
DT316	Hitachi EH3500ACII	Screening	Dynamic, Forward	20/12/2022	131	122	126	117	5	5	5000
DT317	Hitachi EH3500ACII	Screening	Dynamic, Forward	20/12/2022	129	121	126	117	3	4	

Table 3.1 2022 Sound power results

Plant ID	Make/Model	Test Level	Test Type	Test Date	Result dB	Result dB(A)	Limit dB[1]	Limit dB(A) [1]	Exceedance dB [2]	Exceedance dB (A) [2]	Tonal Hz
DT320	Hitachi EH3500ACII	Screening	Dynamic, Forward	20/12/2022	132	122	126	117	6	5	
DT321	Hitachi EH3500ACII	Screening	Dynamic, Forward	20/12/2022	131	122	126	117	5	5	
DT352	Hitachi EH3500ACIII	ISO	Dynamic, Downhill Unloaded	25/05/2022	120	115	125	120	Nil	Nil	
DT352	Hitachi EH3500ACIII	ISO	Dynamic, Uphill Loaded	25/05/2022	121	114	125	120	Nil	Nil	
DT352	Hitachi EH3500ACIII	ISO	Stationary	25/05/2022	117	110	125	120	Nil	Nil	
DT365	Caterpillar 789C	Screening	Dynamic, Forward	20/12/2022	123	116	126	117	Nil	Nil	
DT720	Komatsu 930E-4	Screening	Dynamic, Forward	20/12/2022	128	117	126	117	2	Nil	
DT721	Komatsu 930E-4	Screening	Dynamic, Forward	24/08/2022	131	123	126	117	5	6	
DT721	Komatsu 930E-4	Screening	Dynamic, Forward	20/12/2022	131	122	126	117	5	5	
DT722	Komatsu 930E-4	Screening	Dynamic, Forward	24/08/2022	131	121	126	117	5	4	
DT722	Komatsu 930E-4	Screening	Dynamic, Forward	20/12/2022	131	119	126	117	5	2	
DT723	Komatsu 930E-4	Screening	Dynamic, Forward	24/08/2022	131	122	126	117	5	5	
DT724	Komatsu 930E-4	Screening	Dynamic, Forward	24/08/2022	130	122	126	117	4	5	
DT724	Komatsu 930E-4	Screening	Dynamic, Forward	20/12/2022	129	121	126	117	3	4	
DT725	Komatsu 930E-4	Screening	Dynamic, Forward	24/08/2022	127	119	126	117	1	2	
DT725	Komatsu 930E-4	Screening	Dynamic, Forward	20/12/2022	127	119	126	117	1	2	
DT748	Komatsu 930E-4	Screening	Dynamic, Forward	20/12/2022	135	124	126	117	9	7	
DT750	Komatsu 930E-4	Screening	Dynamic, Forward	24/08/2022	136	124	126	117	10	7	
DT754	Komatsu 930E-4	Screening	Dynamic, Forward	20/12/2022	127	121	126	117	1	4	

Table 3.1 2022 Sound power results

Plant ID	Make/Model	Test Level	Test Type	Test Date	Result dB	Result dB(A)	Limit dB[1]	Limit dB(A) [1]	Exceedance dB [2]	Exceedance dB (A) [2]	Tonal Hz
Dozers											
TD03	Komatsu D475A-5EO	Screening	Dynamic, 1st Gear Forward	24/08/2022	118	107	126	116	Nil	Nil	
TD03	Komatsu D475A-5EO	Screening	Dynamic, 1st Gear Reverse	24/08/2022	120	111	126	116	Nil	Nil	
TD03	Komatsu D475A-5EO	Screening	Stationary	24/08/2022	117	103	126	116	Nil	Nil	
TD06	Caterpillar D11T	Screening	Dynamic, 1st Gear Forward	24/08/2022	123	114	126	116	Nil	Nil	
TD06	Caterpillar D11T	Screening	Dynamic, 1st Gear Reverse	24/08/2022	124	116	126	116	Nil	Nil	
TD06	Caterpillar D11T	Screening	Stationary	24/08/2022	121	109	126	116	Nil	Nil	
TD07	Caterpillar D11T	Screening	Dynamic, 1st Gear Forward	20/12/2022	127	119	126	116	1	**3**	160
TD07	Caterpillar D11T	Screening	Dynamic, 1st Gear Reverse	20/12/2022	128	122	126	116	2	**6**	
TD07	Caterpillar D11T	Screening	Dynamic, 2nd Gear Forward	20/12/2022	130	126	NA[3]	NA[3]	NA[3]	NA[3]	
TD07	Caterpillar D11T	Screening	Dynamic, 2nd Gear Reverse	20/12/2022	131	127	NA[3]	NA[3]	NA[3]	NA[3]	
TD07	Caterpillar D11T	Screening	Stationary	20/12/2022	126	117	126	116	Nil	1	160
TD080	Komatsu D475A-5EO	Screening	Dynamic, 1st Gear Forward	24/08/2022	118	108	126	116	Nil	Nil	
TD080	Komatsu D475A-5EO	Screening	Dynamic, 1st Gear Reverse	24/08/2022	119	111	126	116	Nil	Nil	
TD080	Komatsu D475A-5EO	Screening	Stationary	24/08/2022	116	104	126	116	Nil	Nil	
TD091	Komatsu D375A-8	Screening	Dynamic, 1st Gear Forward	24/08/2022	116	109	126	116	Nil	Nil	
TD091	Komatsu D375A-8	Screening	Dynamic, 1st Gear Reverse	24/08/2022	117	112	126	116	Nil	Nil	
TD091	Komatsu D375A-8	Screening	Stationary	24/08/2022	114	106	126	116	Nil	Nil	
WD001	Caterpillar 854K	Screening	Dynamic, 1st Gear Forward	24/08/2022	124	111	126	116	Nil	Nil	630

1. Results in bold and red are greater than or equal to 3 dB over the relevant sound power target.
2. Limits in this table are sourced from Table 6 of Bridges Acoustics, Continuation of Boggabri Coal Mine – Acoustic Impact Assessment 12 October 2010, Ref J0130-30-R2
3. Only 1st gear for dozers has been compared to criteria.

3.1 Komatsu 930-E-4 attenuation comparison

As part of an attenuation trial of Komatsu930E-4 haul trucks Boggabri Coal engaged Global Acoustics (2016) and EMM (2022) to perform sound power testing on a sample of attenuated trucks.

To assess the performance of this attenuation two measurements on trucks DT721, DT722, DT724, and DT725 were made during the 2022 sound power screening campaign on 24 August and 20 December 2022. Results from trucks DT723, DT748, and DT750 have been included to show performance of trucks without attenuation.

A comparison of sound power levels of these attenuated trucks from 2016 to 2022 are shown in Table 3.2.

Table 3.2 Komatsu 930E-4 sound power results, dB[1]

Plant ID	Make/ model	Test type and level	2016 Lw dB[2]	2016 LwA dB[2]	2022 Lw dB	2022 LwA dB	L_W diff	L_{WA} diff	Comments
DT720	Komatsu 930E-4	Screening, forward	133	123	128	117	-5	-6	Exhaust and grid box attenuation.
DT721	Komatsu 930E-4	Screening, forward	132	123	131	123	-1	0	Exhaust and grid box attenuation.
DT722	Komatsu 930E-4	Screening, forward	134	124	131	121	-3	-3	Exhaust and grid box attenuation.
DT723	Komatsu 930E-4	Screening, forward	134	123	131	122	-3	-1	Standard truck. No attenuation.
DT724	Komatsu 930E-4	Screening, forward	133	124	129	121	-4	-3	Exhaust and grid box attenuation.
DT725	Komatsu 930E-4	Screening, forward	133	123	127	119	-6	-4	Exhaust and grid box attenuation.
DT748	Komatsu 930E-4	Screening, forward	132	123	135	124	3	1	Standard truck. No attenuation.
DT750	Komatsu 930E-4	Screening, forward	134	123	136	124	2	1	Standard truck. No attenuation.
DT754	Komatsu 930E-4	Screening, forward	133	125	127	121	-6	-4	Exhaust and grid box attenuation.

1. Sound power results in this table have been measured using sound power screening methodology described in section 2.2.1.
2. Pre-attenuation sound power results.

4 Summary

This report provides sound power (LW) data for mobile equipment tested during 2022 at Boggabri Coal Mine (BCM).

Results in Table 3.1 show that:

- Komatsu 730E-7 rear-dump truck 266 and 268 exceeded the linear target by 3 dB or more and dump truck 266 exceeded the A-weighted target by 3 dB; and
- Hitachi EH3500ACII rear-dump trucks 309, 316, 317, 320, and 321 exceeded A-weighted or linear targets by 3 or more dB;
- Komatsu 930E-4 rear-dump trucks 721, 722, 723, 724, 748, 750, and 754 exceeded A-weighted or linear targets by 3 or more dB; and
- Caterpillar D11T 07 exceeded the A-weighted target by 3 dB and 6 dB for the 1st gear forward and reverse tests respectively.

Results in Table 3.2 show that:

- 2022 linear sound power levels are between 1 to 6 dB lower than pre-attenuation 2016 levels.; and
- 2022 A-weighted sound power levels are up to 6 dB lower than pre-attenuated 2016 levels. As with the linear results.

EMM 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.

Appendix A
Calibration Certificates

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www.acousticresearch.com.au

Sound Level Meter
IEC 61672-3:2013
Calibration Certificate

Calibration Number C22209

Client Details	Global Acoustics Pty Ltd 12/16 Huntingdale Drive Thornton NSW 2322
Equipment Tested/ Model Number :	SVANTEK SVAN 958
Instrument Serial Number :	20880
Microphone Serial Number :	17132
Pre-amplifier Serial Number :	24298

Pre-Test Atmospheric Conditions		Post-Test Atmospheric Conditions	
Ambient Temperature :	24.9°C	**Ambient Temperature :**	23.8°C
Relative Humidity :	59.4%	**Relative Humidity :**	53.7%
Barometric Pressure :	100.8kPa	**Barometric Pressure :**	100.78kPa

Calibration Technician :	Lucky Jaiswal	**Secondary Check:**	Shaheen Boaz
Calibration Date :	6 Apr 2022	**Report Issue Date :**	6 Apr 2022

Approved Signatory : Ken Williams

Clause and Characteristic Tested	Result	Clause and Characteristic Tested	Result
12: Acoustical Sig. tests of a frequency weighting	*Pass*	17: Level linearity incl. the level range control	*Pass*
13: Electrical Sig. tests of frequency weightings	*Pass*	18: Toneburst response	*Pass*
14: Frequency and time weightings at 1 kHz	*Pass*	19: C Weighted Peak Sound Level	*Pass*
15: Long Term Stability	*Pass*	20: Overload Indication	*Pass*
16: Level linearity on the reference level range	*Pass*	21: High Level Stability	*Pass*

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed.

However, no general statement or conclusion can be made about conformance of the sound level meter to the full requirements of IEC 61672-1:2013 because evidence was not publicly available, from an independent testing organisation responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013 and because the periodic tests of IEC 61672-3:2013 cover only a limited subset of the specifications in IEC 61672-1:2013.

Uncertainties of Measurement -

Acoustic Tests		Environmental Conditions	
125Hz	*±0.13dB*	*Temperature*	*±0.2°C*
1kHz	*±0.13dB*	*Relative Humidity*	*±2.4%*
8kHz	*±0.14dB*	*Barometric Pressure*	*±0.015kPa*
Electrical Tests	*±0.10dB*		

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 - Calibration.

The results of the tests, calibrations and/or measurements included in this document are traceable to SI units.

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 60942-2017

Calibration Certificate

Calibration Number C21661

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

Equipment Tested/ Model Number : Pulsar Model 105
Instrument Serial Number : 96080

Atmospheric Conditions
Ambient Temperature : 22.7°C
Relative Humidity : 40.4%
Barometric Pressure : 99.8kPa

Calibration Technician : Lucky Jaiswal
Calibration Date : 07 Oct 2021
Secondary Check: Matthew Calleja
Report Issue Date : 7 Oct 2021

Approved Signatory : Ken Williams

Characteristic Tested	Result
Generated Sound Pressure Level	*Pass*
Frequency Generated	*Pass*
Total Distortion	*Pass*

Nominal Level	Nominal Frequency	Measured Level	Measured Frequency
94	1000	93.85	1000.30

The sound calibrator has been shown to conform to the class 1 requirements for periodic testing, described in Annex B of IEC 60942:2017 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*	*±0.2°C*
Frequency	*±0.18%*	*Relative Humidity*	*±2.4%*
Distortion	*±0.50%*	*Barometric Pressure*	*±0.015kPa*

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

* The tests <1000 kHz are not covered by Acoustic Research Labs Pty Ltd NATA accreditation.

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

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The results of the tests, calibrations and/or measurements included in this document are traceable to SI units.

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Sound Calibrator
IEC 60942:2017
Calibration Certificate

Calibration Number C22553

Client Details	EMM Consulting Level 3/175 Scott Street Newcastle NSW 2300
Equipment Tested/ Model Number :	Rion NC-74
Instrument Serial Number :	34172616

Atmospheric Conditions

Ambient Temperature :	24.4°C
Relative Humidity :	44.2%
Barometric Pressure :	101.48kPa

Calibration Technician :	Lucky Jaiswal	**Secondary Check:**	Dylan Selge
Calibration Date :	13 Sep 2022	**Report Issue Date :**	13 Sep 2022

Approved Signatory : Ken Williams

Characteristic Tested	Result
Generated Sound Pressure Level	*Pass*
Frequency Generated	*Pass*
Total Distortion	*Pass*

Nominal Level	Nominal Frequency	Measured Level	Measured Frequency
94	1000	94.07	1002.40

The sound calibrator has been shown to conform to the class 1 requirements for periodic testing, described in Annex B of IEC 60942:2017 for the sound pressure level(s) and frequency(ies) stated, for the environmental conditions under which the tests were performed..

Uncertainties of Measurement -

Specific Tests		Environmental Conditions	
Generated SPL	*±0.10dB*	*Temperature*	*±0.1°C*
Frequency	*±0.13%*	*Relative Humidity*	*±1.9%*
Distortion	*±0.20%*	*Barometric Pressure*	*±0.014kPa*

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 - Calibration.

The results of the tests, calibrations and/or measurements included in this document are traceable to SI units.

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