

Ashton Coal

*Environmental Noise Monitoring
September 2018*

*Prepared for
Ashton Coal Operations Pty Ltd*

Global 
Acoustics

Noise and Vibration Analysis and Solutions

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Ashton Coal

Environmental Noise Monitoring September 2018

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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

EXECUTIVE SUMMARY

Global Acoustics was engaged by Ashton Coal Operations to conduct monthly noise monitoring for the Ashton Coal Project (ACP) in accordance with the relevant Project Approval, Environment Protection Licence (EPL), and Noise Management Plan (NMP).

Environmental noise monitoring described in this report was undertaken during the night of 20 September 2018. The survey purpose is to quantify and describe the existing acoustic environment at monitoring locations around the site and compare results with relevant limits.

Activities from ACP complied with the relevant project specific noise limits at all monitoring locations during attended noise monitoring for September 2018. Criteria may not always be applicable due to meteorological conditions at the time of monitoring.

Global Acoustics Pty Ltd

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1 INTRODUCTION

1.1 Background

Global Acoustics was engaged by Ashton Coal Operations to conduct environmental noise monitoring for the Ashton Coal Project (ACP). ACP is an underground mine located to the north-west of Camberwell, off the New England Highway.

Monthly attended noise monitoring is a requirement of the ACP Noise Management Plan (NMP). Monitoring described in this report was undertaken at three locations during the night period of 20 September 2018.

The survey purpose is to quantify and describe the existing acoustic environment at monitoring locations around the site and compare results with relevant limits.

1.2 Attended Noise Monitoring Locations

There were three monitoring locations during this survey as detailed in Table 1.1 and shown on Figure 1. It should be noted that this figure shows the actual monitoring position, not the location of residences.

Table 1.1: ACP ATTENDED NOISE MONITORING LOCATIONS

Report Descriptor	Monitoring Location
N2	Camberwell Village (west)
N3	Camberwell Village (north-east)
N4	South of New England Highway



- Key
- - - - - Ashton Development Consent Boundary
 - - - - - Existing Lease Boundaries
 - N2 - Noise Monitoring - Attended
 - ★ Repeater - Meteorological Station (SX40- meteorological and real time noise)

Figure 1: ACP Attended Noise Monitoring Locations

Source: ACP NMP

1.3 Terminology & Abbreviations

Some definitions of terms and abbreviations, which may be used in this report, are provided in Table 1.2.

Table 1.2: TERMINOLOGY & ABBREVIATIONS

Descriptor	Definition
L _A	The A-weighted root mean squared (RMS) noise level at any instant
L _{Amax}	The maximum A-weighted noise level over a time period or for an event
L _{A1}	The noise level which is exceeded for 1 per cent of the time
L _{A1,1minute}	The noise level which is exceeded for 1 per cent of the specified time period of 1 minute
L _{A10}	The noise level which is exceeded for 10 percent of the time, which is approximately the average of the maximum noise levels
L _{A50}	The noise level which is exceeded for 50 per cent of the time
L _{A90}	The level exceeded for 90 percent of the time, which is approximately the average of the minimum noise levels. The L _{A90} level is often referred to as the “background” noise level and is commonly used to determine noise criteria for assessment purposes
L _{Amin}	The minimum A-weighted noise level over a time period or for an event
L _{Aeq}	The average noise energy during a measurement period
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 micropascals
Hertz (Hz)	Cycles per second, the frequency of fluctuations in pressure, sound is usually a combination of many frequencies together
VTG	Vertical temperature gradient in degrees Celsius per 100 metres altitude
IA	Inaudible. When site only noise is noted as IA, there was no noise from the source of interest audible at the monitoring location
NM	Not Measurable. If site only noise is noted as NM, this means some noise from the source of interest was audible at low-levels, but could not be quantified
Day	This is the period 7:00am to 6:00pm
Evening	This is the period 6:00pm to 10:00pm
Night	This is the period 10:00pm to 7:00am

2 CONSENT & CRITERIA

2.1 Project Approval & Project Specific Criteria

The sections of the Project Approval relating to noise are reproduced in Appendix A. Different noise limits exist for ACP when open cut mining operations are not being undertaken. As this is currently the case, noise impact assessment criteria are outlined in Appendix 6 of the project approval (MOD 5) and are detailed in Table 2.1.

Table 2.1: ACP NOISE IMPACT ASSESSMENT CRITERIA

Descriptor	Day/Evening/Night Impact Assessment Criteria	Night Impact Assessment Criteria
	L _{Aeq,15minute}	L _{A1,1minute}
N2	38/38/36	46
N3	38/38/36	46
N4	38/38/36	46

Appendix 8 of the Project Approval states:

Data collected for the purposes of determining compliance with the relevant conditions of this approval is to be excluded under the following meteorological conditions:

- a) during periods of rain or hail;*
- b) average wind speed at microphone height exceeds 5 m/s;*
- c) wind speeds greater than 3 m/s measures at 10 m above ground level; and*
- d) temperature inversion conditions greater than 3°C/100m.*

This has been interpreted to mean that criteria used for determining compliance are not applicable under the above meteorological conditions.

2.2 Environment Protection Licence

ACP holds Environment Protection Licence (EPL) number 11879. The most recent license revision was issued on 17 August 2017. The relevant sections of the EPL relating to noise are reproduced in Appendix A.

2.3 Modifying Factors

The EPA 'Noise Policy for Industry' (NPfI, 2017) was approved for use in NSW in October 2017, and supersedes the EPA's Industrial Noise Policy (INP, 2000). Assessment and reporting of modifying factors is to be carried out in accordance with Fact Sheet C of the NPfI.

NPfI modifying factors, as they are applicable to mining noise, are described in more detail below.

2.3.1 Tonality and Intermittent Noise

As defined in the NPfI:

Tonal noise contains a prominent frequency and is characterised by a definite pitch.

Intermittent noise is noise where the level suddenly drops/increases several times during the assessment period, with a noticeable change in source noise level of at least 5 dB(A); for example, equipment cycling on and off. The intermittency correction is not intended to be applied to changes in noise level due to meteorology.

2.3.2 Low Frequency Noise

As defined in the NPfI:

Low frequency noise is noise with an unbalanced spectrum and containing major components within the low-frequency range (10 – 160 Hz) of the frequency spectrum.

The NPfI contains the current method of assessing low frequency noise, which is a 2 step process as detailed below:

Measure/assess source contribution C-weighted and A-weighted $L_{eq,T}$ levels over the same time period. The low frequency noise modifying factor correction is to be applied where the C-A level is 15 dB or more and:

- where any of the 1/3 octave noise levels in Table C2 are exceeded by **up to and including** 5 dB and cannot be mitigated, a 2 dBA positive adjustment to measured A weighted levels applies for the evening/night period; and*
- where any of the 1/3 octave noise levels in Table C2 are exceeded by **more than** 5 dB and cannot be mitigated, a 5 dBA positive adjustment to measured A weighted levels applies for the evening/night period and a 2 dBA positive adjustment applies for the daytime period.*

Table C2 of the NPfI is reproduced below:

Table C2: One-third octave low-frequency noise thresholds.

Hz/dB(Z)	One-third octave $L_{Zeq,15min}$ threshold level												
Frequency (Hz)	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160
dB(Z)	92	89	86	77	69	61	54	50	50	48	48	46	44

Notes:

- dB(Z) = decibel (Z frequency weighted).
- For the assessment of low-frequency noise, care should be taken to select a wind screen that can protect the microphone from wind-induced noise characteristics at least 10 dB below the threshold values in Table C2 for

wind speeds up to 5 metres per second. It is likely that high performance larger diameter wind screens (nominally 175 mm) will be required to achieve this performance (Hessler, 2008). In any case, the performance of the wind screen and wind speeds at which data will be excluded needs to be stated.

- Low-frequency noise corrections only apply under the standard and/or noise-enhancing meteorological conditions.
- Where a receiver location has had architectural acoustic treatment applied (including alternative means of mechanical ventilation satisfying the Building Code of Australia) by a proponent, as part of consent requirements or as a private negotiated agreement, alternative external low-frequency noise assessment criteria may be proposed to account for the higher transmission loss of the building façade.
- Measurements should be made between 1.2 and 1.5 metres above ground level unless otherwise approved through a planning instrument (consent/approval) or environment protection licence, and at locations nominated in the development consent or licence.

3 METHODOLOGY

3.1 Overview

Noise monitoring was conducted at the monitoring locations in accordance with Australian Standard AS1055 'Acoustics, Description and Measurement of Environmental Noise' and relevant NSW EPA requirements. Meteorological data was obtained from ACP's weather stations; 'Repeater Weather Station' (M2) and 'Site 1 Weather Station' (M1). This allowed correlation of atmospheric parameters and measured noise levels. See Section 3.3 for further details on calculation method. Atmospheric condition measurement at ground level was also undertaken.

3.2 Attended Noise Monitoring

During this survey, attended monitoring was undertaken at three locations during night period, once at each location, where the duration of each measurement was 15 minutes.

Attended monitoring is preferred to the use of noise loggers when determining compliance with prescribed limits as it allows the most accurate determination of the contribution, if any, to measured noise levels by the source of interest, in this case ACP.

If the exact contribution of the source of interest cannot be established, due to masking by other noise sources in a similar frequency range, but site noise levels are observed to be well below (more than 5 dB lower than) any relevant criterion, a maximum estimate of the potential contribution of the site might be made based on other measured site-only noise levels, for example L_{A10} , L_{A50} or L_{A90} . This is generally expressed as a 'less than' quantity, such as <20 dB or <30 dB.

The terms 'Inaudible' (IA) or 'Not Measurable' (NM) may also be used in this report. When site noise is noted as IA, no site noise was audible at the monitoring location. When site noise is noted as NM, this means some noise was audible but could not be quantified. If site noise was NM due to masking but estimated to be significant in relation to a relevant criterion, we would employ methods (e.g. measure closer and back calculate) to determine a value for reporting.

All sites noted as NM in this report are due to one or more of the following reasons:

- site noise levels were extremely low and unlikely, in many cases, to be even noticed;
- site noise levels were masked by another relatively loud noise source that is characteristic of the environment (e.g. breeze in foliage or continuous road traffic noise) that cannot be eliminated by moving closer; and/or
- it was not feasible or reasonable to employ methods such as move closer and back calculate. Cases may include, but are not limited to, rough terrain preventing closer measurement, addition/removal of significant source to receiver shielding caused by moving closer, and meteorological conditions where back calculation may not be accurate.

A measurement of $L_{A1,1\text{minute}}$ corresponds to the highest noise level generated for 0.6 second during one minute. In practical terms this is the highest noise level, or $L_{A\text{max}}$, received from the site during the entire measurement period (i.e. the highest level of the worst minute during the 15 minute measurement).

To avoid disturbance to residents, particularly during the night period, monitoring locations have been used to represent multiple residences. Suitable monitoring locations where noise levels are likely to be higher than those measured at the residence are chosen to take a conservative approach, as the direct measurement of noise 1 metre from the dwelling facades or within 30 metres of the residence is often impractical due to access requirements and the presence of dogs, air conditioners and other noise sources at the residences.

Received levels from various noise sources were noted during attended monitoring and particular attention was paid to the extent of ACP's contribution, if any, to measured levels. At each receptor location, the $L_{A\text{eq},15\text{minute}}$ for ACP (in the absence of any other noise) was measured directly, where possible, or determined by frequency analysis. Time variations of noise sources in each measurement, their temporal characteristics, are taken into account via statistical descriptors.

3.3 Vertical Temperature Gradient Estimation

Temperature inversion conditions have been determined using the direct measurement method outlined in Fact Sheet D of the NPfI.

Inversion strength based on the temperature differential between the two weather stations was calculated using the following formula:

Inversion strength = (upper height temp – lower height temp) × (100/[upper height – lower height]),

Where:

- Upper height temperature is the temperature measured at 10 metres above ground level at M2;
- Lower height temperature is the temperature measured at 10 metres above ground level at M1; and
- Upper height – lower height is the vertical difference between M2 and M1 (which is 73 metres).

Other meteorological data, such as wind speed, was sourced from M2.

3.4 Modifying Factors

Years of monitoring have indicated that noise levels from mining operations, particularly those measured at significant distances from the source are relatively continuous and broad spectrum. Given this, noise levels from ACP at the monitoring locations are unlikely to be intermittent or tonal.

Assessment of low-frequency modifying factors is necessary when application of the maximum correction could potentially result in an exceedance of the relevant site-only L_{Aeq} criterion. Low-frequency analysis is therefore undertaken for measurements in this report where:

- meteorological conditions resulted in criteria being applicable;
- contributions from ACP were audible and directly measurable, such that the site-only L_{Aeq} was not “NM” or less than a maximum cut off value (e.g. “<20 dB” or “<30dB”);
- contributions from ACP were within 5 dB of the relevant L_{Aeq} criterion, as 5 dB is the maximum penalty that can be applied by low-frequency modifying factors; and
- ACP was the dominant low-frequency noise source.

All measurements meeting these conditions were evaluated for possible low frequency penalty applicability in accordance with the NPfI.

3.5 Noise Monitoring Equipment

Equipment used to measure environmental noise levels is detailed in Table 3.1. Calibration certificates are provided in Appendix B.

Table 3.1: ATTENDED NOISE MONITORING EQUIPMENT

Model	Serial Number	Calibration Due Date
Rion NA-28 sound level analyser	1070590	25/06/2020
Rion NA-28 sound level analyser	30131882	15/03/2019
Pulsar 106 acoustic calibrator	81334	18/12/2019
Pulsar 105 acoustic calibrator	78226	14/03/2019

4 RESULTS

4.1 Modifying factors

Measured ACP only levels were assessed for the applicability of modifying factors in accordance with the EPA's NPfI.

There were no intermittent or tonal noise sources, as defined in the NPfI, audible from site during the survey. None of the measurements satisfied the conditions outlined in Section 3.4 when assessing low frequency noise.

Therefore no further assessment of modifying factors was undertaken.

4.2 Attended Noise Monitoring

Noise levels measured at each location during attended surveys are provided in Table 4.1. These noise levels are the result of many sounds reaching the sound level meter microphone during monitoring.

Table 4.1: MEASURED NOISE LEVELS – SEPTEMBER 2018

Location	Start Date and Time	L _{Amax} dB	L _{A1} dB	L _{A10} dB	L _{A50} dB	L _{Aeq} dB	L _{A90} dB	L _{Amin} dB	L _{Ceq} dB
N2	20/09/2018 23:37	62	59	54	44	49	34	29	57
N3	20/09/2018 22:55	68	61	55	47	51	38	32	56
N4	20/09/2018 22:42	48	45	43	40	41	38	36	56

Notes:

1. Levels in this table are not necessarily the result of activity at ACP.

Table 4.2 compares measured L_{Aeq,15minute} levels from ACP with impact assessment criteria.

Table 4.2: L_{Aeq,15minute} GENERATED BY ACP AGAINST IMPACT ASSESSMENT CRITERIA – SEPTEMBER 2018

Location	Start Date and Time	Wind Speed m/s	VTG °C/100m	Criterion dB	Criterion Applies? ^{1,2}	ACP L _{Aeq} dB ³	Exceedance ⁴
N2	20/09/2018 23:37	1.9	4.1	36	No	IA	NA
N3	20/09/2018 22:55	2.2	3.4	36	No	IA	NA
N4	20/09/2018 22:42	1.7	2.9	36	Yes	IA	Nil

Notes:

1. Criterion may or may not apply due to rounding of meteorological data values;
2. Noise emission limits do not apply during the following meteorological conditions: periods of rain or hail, wind speeds greater than 3 metres per second (at a height of 10 metres); or temperature inversion conditions greater than 3°C/100m;
3. Estimated or measured L_{Aeq,15minute} attributed to ACP; and
4. NA in exceedance column means atmospheric conditions outside conditions specified in development consent and so criterion is not applicable.

Table 4.3 compares measured $L_{A1,1\text{minute}}$ levels from ACP with impact assessment criteria.

Table 4.3: $L_{A1,1\text{minute}}$ GENERATED BY ACP AGAINST IMPACT ASSESSMENT CRITERIA – SEPTEMBER 2018

Location	Start Date and Time	Wind Speed m/s	VTG °C/100m	Criterion dB	Criterion Applies? ^{1,2}	ACP $L_{A1,1\text{min}}$ dB ³	Exceedance ⁴
N2	20/09/2018 23:37	1.9	4.1	46	No	IA	NA
N3	20/09/2018 22:55	2.2	3.4	46	No	IA	NA
N4	20/09/2018 22:42	1.7	2.9	46	Yes	IA	Nil

Notes:

1. Criterion may or may not apply due to rounding of meteorological data values;
2. Noise emission limits do not apply during the following meteorological conditions: periods of rain or hail, wind speeds greater than 3 metres per second (at a height of 10 metres); or temperature inversion conditions greater than 3°C/100m;
3. Estimated or measured $L_{A1,1\text{minute}}$ attributed to ACP; and
4. NA in exceedance column means atmospheric conditions outside conditions specified in development consent and so criterion is not applicable.

4.3 Atmospheric Conditions

Atmospheric condition data measured by the operator during each measurement using a Kestrel hand-held weather meter is shown in Table 4.4. The wind speed, direction and temperature were measured at approximately 1.8 metres. Attended noise monitoring is not undertaken during rain or hail.

Table 4.4: MEASURED ATMOSPHERIC CONDITIONS – SEPTEMBER 2018

Location	Start Date and Time	Temperature Degrees	Wind Speed m/s	Wind Direction Degrees ¹	Cloud Cover Eighths
N2	20/09/2018 23:37	10	0.0	-	0
N3	20/09/2018 22:55	8	0.0	-	0
N4	20/09/2018 22:42	6	0.6	95	0

Notes:

1. "-" indicates calm conditions at 1.8 metres.

Meteorological data sourced from both ACP weather stations was used to determine compliance with specified noise criteria.

5 SUMMARY OF COMPLIANCE

Global Acoustics was engaged by Ashton Coal Operations to conduct noise monitoring for the Ashton Coal Project in accordance with Project Approval, EPL and NMP.

The following summaries apply to attended noise monitoring conducted during the night period on 20 September 2018.

Activities from ACP complied with the relevant development consent noise limits during attended noise monitoring for September 2018 at all monitoring locations. Criteria may not always be applicable due to meteorological conditions at the time of monitoring.

Global Acoustics Pty Ltd

APPENDIX

A STATUTORY REQUIREMENTS

A.1 ASHTON COAL OPERATIONS PROJECT APPROVAL

Relevant sections of Project Approval (modification 5) are reproduced below.

APPENDIX 6 ALTERNATE NOISE CONDITIONS

NOISE

Application

1. Conditions 2 to 3 below have effect during times when open cut mining operations are not being undertaken at the Ashton Mine Complex, in the opinion of the Secretary.

Noise Criteria

2. Except for the noise-affected land in Table 1 of Schedule 3, the Applicant must ensure that the noise generated by the development does not exceed the criteria in Table 1 at any residence on privately-owned land or on more than 25 per cent of any privately-owned land.

Table 1: Noise Criteria dB(A)

Receiver No.	Receiver	Day ($L_{Aeq}(15min)$)	Evening ($L_{Aeq}(15min)$)	Night ($L_{Aeq}(15min)$)	Night ($L_{A1}(1min)$)
-	All privately-owned land	38	38	36	46

Noise generated by the development is to be measured in accordance with the relevant requirements of the *NSW Industrial Noise Policy*. Appendix 8 sets out the requirements for evaluating compliance with these criteria.

However, these noise criteria do not apply if the Applicant has an agreement with the relevant owner/s of the residence/land to generate higher noise levels, and the Applicant has advised the Department in writing of the terms of this agreement.

Additional Noise Mitigation Measures

3. Upon receiving a written request from the owner of any residence on any privately-owned land where subsequent operational noise monitoring shows the noise generated by the development exceeds the noise limits in Table 2, the Applicant must implement additional reasonable and feasible noise mitigation measures (such as double glazing, insulation, and/or air conditioning) at the residence in consultation with the owner.

If within 3 months of receiving this request from the landowner, the Applicant and the landowner cannot agree on the measures to be implemented, or there is a dispute about the implementation of these measures, then either party may refer the matter to the Secretary for resolution.

Table 2: Additional Noise Mitigation Criteria dB(A) $L_{Aeq}(15min)$

Receiver No.	Receiver	Day ($L_{Aeq}(15min)$)	Evening ($L_{Aeq}(15min)$)	Night ($L_{Aeq}(15min)$)
-	All privately-owned land	38	38	38

Notes:

- Noise generated by the development is to be measured in accordance with the relevant requirements of the *NSW Industrial Noise Policy*. Appendix 8 sets out the requirements for evaluating compliance with these criteria.
- For this condition to apply, the exceedance of the criteria must be systemic.

APPENDIX 8 NOISE COMPLIANCE ASSESSMENT

Compliance Monitoring

1. Attended monitoring is to be used to evaluate compliance with the relevant conditions of this approval.
2. Data collected for the purposes of determining compliance with the relevant conditions of this approval is to be excluded under the following meteorological conditions:
 - a) during periods of rain or hail;
 - b) average wind speed at microphone height exceeds 5 m/s;
 - c) wind speeds greater than 3 m/s measured at 10 m above ground level; and
 - d) temperature inversion conditions greater than 3°C/100m.
3. Unless otherwise agreed with the Secretary, this monitoring is to be carried out in accordance with the relevant requirements relating to reviewing performance set out in the NSW Industrial Noise Policy (as amended from time to time), in particular the requirements relating to:
 - a) monitoring locations for the collection of representative noise data;
 - b) equipment used to collect noise data, and conformity with Australian Standards relevant to such equipment; and
 - c) modifications to noise data collected, including for the exclusion of extraneous noise and/or penalties for modifying factors apart from adjustments for duration.
4. To the extent that there is any inconsistency between the Industrial Noise Policy and the requirements set out in this Appendix, the Appendix prevails to the extent of the inconsistency.

Determination of Meteorological Conditions

5. Except for wind speed at microphone height, the data to be used for determining meteorological conditions shall be that recorded by the meteorological station located in the vicinity of the site (as required by condition 18 of Schedule 3).

A.2 ASHTON COAL OPERATIONS ENVIRONMENT PROTECTION LICENCE

Relevant sections of EPL 11879 are reproduced below.

L2 Noise limits

L2.1 Noise from the premises must not exceed the limits specified in the table below:

Location	Day LAeq(15 minute)	Evening LAeq(15 minute)	Night LAeq(15 minute)	Night LAeq(1 minute)
Any residence not owned by the licensee or not subject to an agreement between the licensee and the residence owner as to an alternative noise limit.	38	38	36	46

L2.2 For the purpose of Condition L2.1:

- a) Day is defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays,
- b) Evening is defined as the period from 6pm to 10pm, and
- c) Night is defined as the period from 10pm to 7am Monday to Saturday and 10pm to 8am Sundays and Public Holidays

L2.3 Noise from the premises must be measured at the most affected point on or within the residential boundary or at the most affected point within 30m of the dwelling where the dwelling is more than 30m from boundary to determine compliance with the LAeq(15 minute) noise limits in condition L2.1. Where it can be demonstrated that direct measurement of noise from the premises is impractical, the EPA may accept alternative means of determining compliance. See Chapter 11 of the NSW Industrial Noise Policy. The modification factors presented in Section 4 of the NSW Industrial Noise Policy shall also be applied to the measured noise level where applicable.

L2.4 Noise from the premises is to be measured or computed at 1m from the dwelling facade to determine compliance with condition L2.1 (LA1 (1 minute) noise limit).

L2.5 The noise emission limits identified in condition L2.1 apply under the following meteorological conditions:

- a) wind speeds up to 3m/s at 10m above ground level; and
- b) temperature inversion conditions up to 30C/100m.

L2.6 Open cut mining activities must only be carried out between the hours of 0700 and 2200 Monday to Saturday, and 0800 and 2200 on Sundays and Public Holidays.

APPENDIX

B CALIBRATION CERTIFICATES



Level 7 Building 2 423 Pennant Hills Rd
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Octave Band Filter AS 4476:1997 Calibration Certificate

Calibration Number C18363A

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

Filter Model Number : Rion NA-28
Filter Serial Number : N/A
Instrument Serial Number : 01070590
Microphone Serial Number : 08184
Pre-amplifier Serial Number : 52329

Atmospheric Conditions

Ambient Temperature : 22.8°C
Relative Humidity : 37.7%
Barometric Pressure : 100.82kPa

Calibration Technician : Lucky jaiswal
Calibration Date : 25 Jun 2018
Secondary Check: Lewis Boorman
Report Issue Date : 25 Jun 2018

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.

Electrical Tests

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

Least Uncertainties of Measurement -

Environmental Conditions
Temperature ±0.03°C
Relative Humidity ±2.3%
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 - calibration.

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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Octave Band Filter
AS 4476:1997
Calibration Certificate

Calibration Number C17126A_Reissued


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

Filter Model Number : Rion NA-28
Filter Serial Number : N/A
Instrument Serial Number : 30131882
Microphone Serial Number : 04739
Pre-amplifier Serial Number : 11942

Atmospheric Conditions
Ambient Temperature : 22.3°C
Relative Humidity : 54.4%
Barometric Pressure : 99.83kPa

Calibration Technician : Vicky Jaiswal
Calibration Date : 15/03/2017

Secondary Check: Riley Cooper
Report Issue Date : 28/06/2018

Approved Signatory : 

Ken Williams

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.

Electrical Tests		Least Uncertainties of Measurement - Environmental Conditions	
< 16Hz	±0.19dB	Temperature	±0.3°C
16Hz-100Hz	±0.11dB	Relative Humidity	±2.5%
100Hz-1000Hz	±0.1dB	Barometric Pressure	±0.017kPa
1000Hz-10kHz	±0.1dB		
> 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 - calibration.

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

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Sound Calibrator
IEC 60942-2004
Calibration Certificate

Calibration Number C17682_Reissued

Client Details	Global Acoustics Pty Ltd 12/16 Huntingdale Drive Thornton NSW 2322
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Equipment Tested/ Model Number :	Pulsar 106
Instrument Serial Number :	81334

Atmospheric Conditions	
Ambient Temperature :	23.5°C
Relative Humidity :	49.8%
Barometric Pressure :	98.79kPa

Calibration Technician :	Vicky Jaiswal	Secondary Check:	Riley Cooper
Calibration Date :	18 Dec 2017	Report Issue Date :	27 Mar 2018

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	94.1	1000.36

The sound calibrator has been shown to conform to the class 2 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 - Environmental Conditions			
Specific Tests		Environmental Conditions	
Generated SPL	±0.1dB	Temperature	±°C
Short Term Fluct.	±0.02dB	Relative Humidity	±%
Frequency	±0.01%	Barometric Pressure	±kPa
Distortion	±0.5%		

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



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**Sound Calibrator
IEC 60942-2004**

Calibration Certificate

Calibration Number C17127

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

Equipment Tested/ Model Number : Pulsar 105
Instrument Serial Number : 78226

Atmospheric Conditions

Ambient Temperature : 22.3°C
Relative Humidity : 55.6%
Barometric Pressure : 99.9kPa

Calibration Technician : Vicky Jaiswal
Calibration Date : 14/03/2017
Secondary Check: Riley Cooper
Report Issue Date : 15/03/2017

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
Measured Output	94.0	1000.0	94.1	1000.32

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.

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