

# *Borg Panels Facility*

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*Construction Noise Monitoring  
Quarter 1 2018*

*Prepared for  
Borg Construction Pty Ltd*

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Noise and Vibration Analysis and Solutions

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## Borg Panels Facility

Quarter 1, 2018

Construction Noise Monitoring

Reference: 18037\_R01\_RevA

Report date: 26 April 2018

### Prepared for

Borg Construction Pty Ltd  
124 Lowes Mount Road  
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### Prepared by

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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*

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## **EXECUTIVE SUMMARY**

Global Acoustics was engaged by Borg Construction Pty Ltd to undertake attended noise monitoring at sites around the Borg panel manufacturing facility (Borg) at Oberon, NSW.

The survey purpose was to quantify and describe the acoustic environment around the site and compare results with limits specified in the Development Consent and Construction Noise Management Plan (CNMP).

Attended environmental noise monitoring described in this report was undertaken during the day period on 27 March 2018. There were 4 attended monitoring locations as listed in Table 1.1 and shown in Figure 1.

Attended monitoring was conducted in general accordance with the EPA 'Noise Policy for Industry' (NPfI) guidelines and Australian Standard AS 1055 'Acoustics, Description and Measurement of Environmental Noise'.

### **Construction Noise Assessment**

Borg operations complied with the relevant noise limits during the Quarter 1, 2018 survey at all monitoring locations.

### **Low Frequency Noise Assessment**

A low frequency noise assessment was carried out in accordance with the EPA's NPfI. Low frequency modifying factors, where applicable, did not result in any exceedances of Borg noise limits during the survey.

### **Global Acoustics Pty Ltd**

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# 1 INTRODUCTION

## 1.1 Background

Global Acoustics was engaged by Borg Construction Pty Ltd to undertake attended noise monitoring at sites around the Borg panel manufacturing facility (Borg) at Oberon, NSW.

The survey purpose was to quantify and describe the acoustic environment around the site and compare results with limits specified in the Development Consent and Construction Noise Management Plan (CNMP).

Attended environmental noise monitoring described in this report was undertaken during the day period on 27 March 2018.

## 1.2 Monitoring Locations

There were 4 attended monitoring locations as listed in Table 1.1 and shown in Figure 1.

*Table 1.1: ATTENDED MONITORING LOCATIONS*

<b>Report Descriptor</b>	<b>Monitoring Location</b>
NM1	Oberon Caravan Park
NM2	Intersection of Pine Street and Herborn Street
NM3	127 Hazelgrove Road
NM4	Intersection of Tasman Street and Earl Street



Figure 1: Attended Noise Monitoring Locations

### 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 <sub>A</sub>	The A-weighted root mean squared (RMS) noise level at any instant
L <sub>Amax</sub>	The maximum A-weighted noise level over a time period or for an event
L <sub>A1</sub>	The noise level which is exceeded for 1 per cent of the time
L <sub>A10</sub>	The noise level which is exceeded for 10 percent of the time, which is approximately the average of the maximum noise levels
L <sub>A50</sub>	The noise level which is exceeded for 50 per cent of the time
L <sub>A90</sub>	The level exceeded for 90 percent of the time, which is approximately the average of the minimum noise levels. The L <sub>A90</sub> level is often referred to as the “background” noise level and is commonly used to determine noise criteria for assessment purposes
L <sub>Amin</sub>	The minimum A-weighted noise level over a time period or for an event
L <sub>Aeq</sub>	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. Estimated from wind speed and sigma theta data
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 AND CRITERIA

All monitoring reported in this document has been carried out in general accordance with the Development Consent (the Consent) dated 29 May 2017 (SSD 7016) and the CNMP.

### 2.1 Development Consent and Project Specific Criteria

The sections of the Consent relating to noise are reproduced in Appendix A.

Table 2 in Schedule B of the Consent outlines the day, evening and night period impact assessment criteria, which have been reproduced in Table 2.1 below.

*Table 2.1: IMPACT ASSESSMENT CRITERIA*

Location	Day LAeq,15minute dB	Evening LAeq,15minute dB	Night LAeq,15minute dB
All sensitive receivers	55	50	45

As described in the Consent, noise generated by Borg is to be measured in accordance with the relevant procedures and exemptions (including certain meteorological conditions) of the NSW Industrial Noise Policy (INP), as follows:

- during rain and wind speeds greater than 3 metres/second at 10 metres above ground level; or
- stability category F temperature inversion conditions and wind speeds greater than 2 metres/second at 10 metres above ground level; or
- stability category G temperature inversion conditions.

## 2.2 Project Specific Noise Limits

In accordance with the Consent and CNMP, project specific noise criteria for each monitoring location are detailed in Table 2.2 and Table 2.3.

*Table 2.2: GENERAL CONSTRUCTION NOISE LIMITS*

Report Descriptor	Day L <sub>Aeq,15minute</sub> dB	Evening L <sub>Aeq,15minute</sub> dB	Night L <sub>Aeq,15minute</sub> dB
NM1	55	50	45
NM2	55	50	45
NM3	55	50	45
NM4	55	50	45

*Table 2.3: ROCK / CONCRETE BREAKING NOISE LIMITS*

Report Descriptor	Day L <sub>Aeq,15minute</sub> dB
NM1	75
NM2	75
NM3	75
NM4	75

## 2.3 Modifying Factors

The EPA 'Noise Policy for Industry' (NPfI, 2018) was approved for use in NSW in October 2018, 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 Noise Policy for Industry:

*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.*

There were no intermittent noise sources from site during the survey. In addition, there is no equipment on site that is likely to generate tonal noise as defined in the NPfI.

### 2.3.2 Low Frequency Noise

As defined in the Noise Policy for Industry:

*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 and associated notes from 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

All noise monitoring was conducted at locations representative of the nearest residences in accordance with EPA guidelines and Australian Standard AS1055 'Acoustics, Description and Measurement of Environmental Noise' and the Consent and CNMP.

Meteorological data was obtained from the Borg weather station in Oberon. This data allowed correlation of atmospheric parameters and measured noise levels. Atmospheric condition measurement at ground level was also undertaken during attended monitoring.

### 3.2 Attended Noise Monitoring

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 Borg. The duration of each individual measurement was 15 minutes.

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 as per the NPfI (e.g. measure closer and back calculate) to determine a value for reporting.

Therefore, 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.

### 3.3 Modifying Factors

Years of monitoring have indicated that noise levels from the facility, particularly those measured at significant distances from the source are relatively continuous and broad spectrum. Given this, noise levels from Borg 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 Borg 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 Borg 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
- Borg 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.

### 3.4 Monitoring Equipment

The 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	960042	10/10/2019
ND9 acoustic calibrator	N452838	30/06/2019

## 4 RESULTS

### 4.1 Attended Noise Monitoring

Total noise levels measured at each location are provided in Table 4.1.

Table 4.1: MEASURED NOISE LEVELS – QUARTER 1 2018<sup>1</sup>

Location	Start Date and Time	L <sub>Amax</sub> dB	L <sub>A1</sub> dB	L <sub>A10</sub> dB	L <sub>A50</sub> dB	L <sub>Aeq</sub> dB	L <sub>A90</sub> dB	L <sub>Amin</sub> dB
NM1	27/03/2018 10:45	64	54	49	45	47	43	42
NM2	27/03/2018 10:25	61	52	48	46	46	44	41
NM3	27/03/2018 11:45	64	57	45	39	44	36	32
NM4	27/03/2018 11:08	64	55	49	46	48	44	42

Notes: 1. Levels in this table are not necessarily the result of activity at Borg.

Table 4.2 compares measured L<sub>Aeq,15minute</sub> levels from Borg with the Consent and CNMP noise criteria.

Table 4.2: L<sub>Aeq,15minute</sub> GENERATED BY BORG AGAINST CRITERIA – QUARTER 1 2018

Location	Start Date and Time	Wind Speed m/s <sup>1</sup>	Stability Class <sup>1</sup>	VTG °C per 100m <sup>1</sup>	Criterion dB	Criterion Applies? <sup>2,3</sup>	Borg L <sub>Aeq,15min</sub> dB <sup>4</sup>	Exceedance <sup>5,6</sup>
NM1	27/03/2018 10:45	3.0	B	-1.8	55	Yes	44	Nil
NM2	27/03/2018 10:25	4.2	D	-1.0	55	No	44	NA
NM3	27/03/2018 11:45	3.1	B	-1.8	55	No	<30	NA
NM4	27/03/2018 11:08	3.6	A	-2.0	55	No	<40	NA

Notes:

1. Atmospheric data is sourced from Borg weather station in Oberon;
2. In accordance with EPL and PA, the noise criteria are to apply under all meteorological conditions except the following:
  - Wind speeds greater than 3 m/s at 10 metres above ground level; or
  - Stability class F temperature inversion conditions, and wind speeds greater than 2 m/s at 10 metres above ground level; or
  - Stability class G temperature inversion conditions.
3. Criterion may or may not apply due to rounding of meteorological data values;
4. Estimated or measured L<sub>Aeq,15minute</sub> attributed to the Borg;
5. Bold results in red indicate exceedance of criteria (if applicable); and
6. NA in exceedance column means atmospheric conditions outside conditions specified in development consent and so criterion is not applicable

## 4.2 Low Frequency Noise Assessment

Measured Borg only levels were assessed for the applicability of low frequency modifying factors in accordance with the EPA's NPfL.

None of the measurements satisfied the conditions outlined in Section 3.3. Therefore no further assessment was undertaken.

## 4.3 Atmospheric Conditions

Atmospheric condition data measured by the operator at each location using a Kestrel hand-held weather meter is shown in Table 4.3. Atmospheric condition data is routinely recorded during each measurement to show conditions during the monitoring period. The wind speed, direction and temperature were measured at 1.8 metres.

Table 4.3: MEASURED ATMOSPHERIC CONDITIONS – QUARTER 1 2018<sup>1,2</sup>

Location	Start Date and Time	Temperature (degrees)	Wind Speed (m/s)	Wind Direction	Cloud Cover (1/8s)
NM1	27/03/2018 10:45	20	1.1	60	0
NM2	27/03/2018 10:25	18	0.9	90	90
NM3	27/03/2018 11:45	23	0.8	40	0
NM4	27/03/2018 11:08	20	0.9	120	0

Notes:

1. Wind speed and direction measured at 1.8 metres; and
2. "-" indicates calm conditions at 1.8 metres.

## 5 SUMMARY

The following applies to attended noise monitoring conducted during the day period on 27 March 2018.

### **Construction Noise Assessment**

Borg operations complied with the relevant criteria during the Quarter 1, 2018 survey at all monitoring locations.

### **Low Frequency Noise Assessment**

A low frequency noise assessment was carried out in accordance with the EPA's NPfI. Low frequency modifying factors, where applicable, did not result in any exceedances of Borg noise limits during the survey.

### **Global Acoustics Pty Ltd**

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## APPENDIX

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### A STATUTORY REQUIREMENTS

## A.1 BORG PANELS FACILITY DEVELOPMENT CONSENT

### NOISE

#### Hours of Work

B13. The Applicant must comply with the hours detailed in **Table 1**, unless otherwise agreed in writing by the-Secretary.

**Table 1: Hours of Work**

Activity	Day	Time
Earthworks and Construction	Monday – Friday	7 am to 7 pm
	Saturday	8 am to 1 pm
Operation	Monday – Sunday	24 hours

B14. Works outside of the hours identified in Condition B13 may be undertaken in the following circumstances:

- works that are inaudible at the nearest sensitive receivers;
- works agreed to in writing by the Secretary;
- for the delivery of materials required outside these hours by the NSW Police Force or other authorities for safety reasons; or
- where it is required in an emergency to avoid the loss of lives, property and/or to prevent environmental harm.

#### Construction Noise Management Plan

B15. The Applicant must prepare a Construction Noise Management Plan (CNMP) for the Project to manage construction noise. The plan must form part of the CEMP required by Condition C1 and must:

- be prepared by a suitably qualified and experienced noise expert;
- be approved by the Secretary prior to the commencement of construction of the Project;
- describe procedures for achieving the noise limits in **Table 2**;
- describe the measures to be implemented to manage noisy works such as rock/concrete breaking activities, in close proximity to sensitive receivers;
- include strategies that have been developed with the community for managing noisy works;
- describe the community consultation undertaken to develop the strategies in e) above; and
- include a complaints management system that would be implemented for the duration of the Project.

#### Operational Noise Limits

B16. The Applicant must ensure that noise generated by the Development does not exceed the noise limits in **Table 2**.

**Table 2: Noise Limits dB(A)**

Location	Day	Evening	Night
	L <sub>Aeq</sub> (15 minute)	L <sub>Aeq</sub> (15 minute)	L <sub>Aeq</sub> (15 minute)
All sensitive receivers	55	50	45

**Note:** Noise generated by the Development is to be measured in accordance with the relevant procedures and exemptions (including certain meteorological conditions) of the NSW Industrial Noise Policy.

## Noise Mitigation

B17. The Applicant must ensure all noise attenuation measures already installed for the Existing Development are maintained in good working order for the life of the Development.

## Operational Noise Management Plan

B18. Within 6 months of the date of this consent, the Applicant must prepare an Operational Noise Management Plan (ONMP) for the Existing Development, to manage operational noise to the satisfaction of the Secretary. The ONMP must form part of the OEMP required by Condition C4 and be prepared in accordance with Condition C9. The ONMP must:

- (a) be prepared by a suitably qualified and experienced noise expert;
- (b) describe the measures that will be implemented to minimise noise from the Existing Development including:
  - (i) all reasonable and feasible measures being employed on site;
  - (ii) maintain equipment to ensure it is in good order;
  - (iii) traffic noise is effectively managed;
  - (iv) the noise impacts of the Existing Development are minimised during any meteorological conditions when the noise criteria in this consent do not apply;
  - (v) compliance with the relevant conditions of this consent;
- (c) includes a noise monitoring program that:
  - (i) must be carried out until otherwise agreed to in writing by the Secretary;
  - (ii) is capable of evaluating the performance of the Existing Development; and
  - (iii) includes a protocol for determining exceedances of the relevant conditions of this consent and responding to complaints; and
- (d) include a procedure for implementing noise mitigation measures, should the Applicant be directed by the EPA or the Secretary, or should non-compliances be detected.

B19. Prior to the commencement of operation of the Project, the Applicant must update the ONMP required under Condition B18, to incorporate the Project and its management, to the satisfaction of the Secretary. The updated plan must be prepared in accordance with the requirements of Condition B18, and must incorporate the following:

- (a) description of the noise monitoring program to measure the performance of the Development against this consent and the EPL; and
- (b) description of any additional measures that would be implemented for the Development to ensure compliance with the noise limits in Condition B16 and the EPL.

## Noise Verification

B20. Within 3 months of commencement of operation of the Project, the Applicant must undertake a noise verification study for the Development to the satisfaction of the Secretary. The study must:

- (a) be undertaken by a suitably qualified expert;
- (b) include an analysis of compliance with noise limits specified in Condition B16;
- (c) demonstrate achievement of the sound power levels in Table 12 of the *Borg Panels Timber Panel Processing Facility Noise and Vibration Impact Assessment*, dated May 2016 and prepared by Global Acoustics;
- (d) include an outline of management actions to be taken to address any exceedances of the limits specified in Condition B16; and
- (e) describe the contingency measures in the event management actions are not effective in reducing noise levels to an acceptable level.

Within 1 month of completing the study, the Applicant must submit a report outlining the findings of the study to the Secretary and the EPA.

B21. Should the noise verification study indicate the Development has not complied with the noise limits in Condition B16 and applicable EPL requirements, or where the verification indicates that greater impacts than predicted in the EIS may arise, a detailed investigation and an outline of any management measures necessary to prevent exceedances must be submitted to the Secretary and the EPA, as part of the study.

Borg will implement reasonable and practical measures to avoid or minimise impacts to the environment that may arise as a result of the project.

Borg will carry out the proposed works in accordance with the EIS, RTS and the approval conditions.

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### Noise

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Attenuation, as detailed in the NIA, will be implemented as follows:

- Conti 1 Dryer Fan air intake redesigned and the fan speed reduced to minimise noise generated. A sound power reduction from LAeq 121 dB to 114 dB or better is required.
- Booster fan will receive additional insulation and a reduction in fan speed. A sound power reduction from LAeq 116 dB to 109 dB or better is required.
- Main fibre transport fan will have a concrete enclosure constructed around it. A sound power reduction from LAeq 110 dB to 104 dB or better is required.

In short, the approach taken by Borg to mitigate noise is based on a number of factors:

1. Continuation of the use of mobile chippers (that is, not to enclose the mobile chippers). However, these are backup items (only to be used when enclosed, electric chippers are not operational), and will not be used in enhancing met conditions.
2. Implementation of additional noise mitigation measures to minimise noise generated by equipment, as detailed above.
3. Provision of sound attenuation structures and enclosures to other equipment where appropriate.

Irrespective of the above, Borg undertakes to meet the existing plant sound power reductions specified in the NIA. If the proposed attenuation measures to the existing plant are found to be insufficient in achieving these reductions, additional works will be undertaken.

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## APPENDIX

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### ***B CALIBRATION CERTIFICATES***



**Acoustic  
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Pennant Hills NSW AUSTRALIA 2120  
Ph: +61 2 9484 0800 A.B.N. 65 160 399 119  
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**Sound Level Meter**  
IEC 61672-3:2013

**Calibration Certificate**

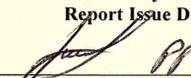
Calibration Number C17510

**Client Details** Acoustic Research Labs Pty Ltd  
Level 7, Bld 2, 423 Pennant Hills Road  
Pennant Hills NSW 2120

**Equipment Tested/ Model Number :** Rion NA-28  
**Instrument Serial Number :** 00960042  
**Microphone Serial Number :** 07714  
**Pre-amplifier Serial Number :** 60062

<b>Pre-Test Atmospheric Conditions</b>	<b>Post-Test Atmospheric Conditions</b>
<b>Ambient Temperature :</b> 22.4°C	<b>Ambient Temperature :</b> 22.8°C
<b>Relative Humidity :</b> 50.7%	<b>Relative Humidity :</b> 50.1%
<b>Barometric Pressure :</b> 99.7kPa	<b>Barometric Pressure :</b> 99.67kPa

**Calibration Technician :** Jason Gomes  
**Calibration Date :** 10/10/2017  
**Secondary Check:** Riley Cooper  
**Report Issue Date :** 11/10/2017

**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 61672-3:2006, for the environmental conditions under which the tests were performed.

As public evidence was available, from an independent testing organisation responsible for approving the results of pattern evaluation test performed in accordance with IEC 61672-2:2003, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2002.

Least Uncertainties of Measurement -			
Acoustic Tests		Environmental Conditions	
31.5 Hz to 8kHz	±0.16dB	Temperature	±0.05°C
12.5kHz	±0.2dB	Relative Humidity	±0.46%
16kHz	±0.29dB	Barometric Pressure	±0.017kPa
Electrical Tests			
31.5 Hz to 20 kHz	±0.12dB		

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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Research  
Labs Pty Ltd**

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**Sound Calibrator  
IEC 60942-2004**

**Calibration Certificate**

Calibration Number C17306

<b>Client Details</b>	Acoustic Research Labs Pty Ltd Level 7, Bld 2, 423 Pennant Hills Road Pennant Hills NSW 2120
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<b>Equipment Tested/ Model Number :</b>	ARL ND9
<b>Instrument Serial Number :</b>	N452838

<b>Atmospheric Conditions</b>	
<b>Ambient Temperature :</b>	22.5°C
<b>Relative Humidity :</b>	37.4%
<b>Barometric Pressure :</b>	100.27kPa

<b>Calibration Technician :</b>	Lucky Jaiswal	<b>Secondary Check:</b>	Riley Cooper
<b>Calibration Date :</b>	30/06/2017	<b>Report Issue Date :</b>	03/07/2017

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	94.0	1000.12

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 - Environmental Conditions			
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.

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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