Appendix V

Background Noise Monitoring Report

Tarong West Wind Farm

Background Noise Monitoring

S6000C7A

December 2023

sonus.

Sonus Pty Ltd
17 Ruthven Avenue
Adelaide 5000 SA
Phone: +61 (8) 8231 2100
www.sonus.com.au

Document Title	:	Tarong West Wind Farm Background Noise Monitoring
Client	:	RES Australia Pty Ltd
Document Reference	:	S6000C7A
Date	:	December 2023
Prepared by	:	Chris Turnbull, MAAS

Sonus is a member of the Association of Australian Acoustical Consultants (AAAC).

EXECUTIVE SUMMARY

Background noise monitoring has been conducted in the vicinity of the proposed Tarong West Wind Farm in accordance with the *State code 23: Wind farm development (version 3.0) and State code 23: Wind Farm development – Planning Guidelines (February 2022)* (**State Code 23**).

The background noise monitoring was conducted at seven sensitive land uses (dwellings), in order to:

- determine the background noise levels ($L_{A90,\ 10min}$) which describe the ambient noise of the area surrounding the wind farm during the day and night period; and,
- correlate the measured noise levels with wind speed to determine the relevant noise criteria at the selected representative noise monitoring locations.

In accordance with State Code 23, data have been excluded where they are considered to be adversely affected by weather or are outside the operating wind speeds of cut-in to the approximate rated power for a representative wind turbine.

The data have been correlated to wind speeds measured at the subject site at a height of 166m, representing the hub height of the representative turbine.

Based on the correlations, the following tables summarise the background noise level at integer wind speeds for the day and night periods respectively.

Table: *Daytime Background Noise Levels ($L_{A90,10min}$)*

Location ID	Background Noise Level (dB(A)) at 166m Hub Height Wind Speed (m/s)											
	3	4	5	6	7	8	9	10	11	12	13	14
1	32	33	33	34	34	34	35	35	37	38	41	44
4	24	26	27	28	28	28	29	30	31	34	37	41
6	21	24	26	28	29	30	30	31	32	34	35	38
8	24	26	27	28	29	30	31	32	33	35	37	40
32	24	27	29	31	32	32	33	34	35	38	41	45
43	27	29	30	31	31	32	32	33	34	35	37	40
111	23	25	26	27	28	29	30	32	34	36	39	42

Table: *Night-time Background Noise Levels ($L_{A90,10min}$)*

Location ID	Background Noise Level (dB(A)) at 166m Hub Height Wind Speed (m/s)											
	3	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
1	18	20	21	23	24	25	26	27	29	31	33	37
4	15	16	17	18	19	20	21	22	23	25	27	30
6	15	17	18	19	19	20	21	22	24	26	29	33
8	16	18	19	20	21	22	24	25	27	28	31	33
32	16	19	21	23	24	26	27	28	29	31	33	35
43	20	21	23	24	25	26	26	27	28	30	31	33
111	15	16	18	19	20	22	24	26	28	30	31	33

GLOSSARY AND ABBREVIATIONS

Term	Definition
A weighting	Frequency adjustment representing the response of the human ear.
Background noise level	The noise level represented by the L_{A90} in the absence of intermittent noise such as vehicles and wind gusts.
dB	Linear (unweighted) sound pressure or power level in decibels.
dB(A)	A weighted noise or sound pressure or power level in decibels.
Host Lot	Premises located on the wind farm site.
Non - Host Lot	Premises that do not accommodate any part of a wind farm development and either adjoin or are in close proximity to host lots.
L_{A90}	The A-weighted sound pressure level exceeded for 90% of the measurement period.
$L_{A90,10min}$	The L_{A90} sound pressure level measured over a 10 minute period.
L_{Aeq}	The A-weighted equivalent sound pressure level.
State Code 23	Queensland Government Department of Infrastructure, Government and Planning *State code 23: Wind farm development*, Planning Guideline (July 2017).
Wind Farm	Tarong West Wind Farm
WTG	Wind Turbine Generator

TABLE OF CONTENTS

1 INTRODUCTION

Sonus has been engaged by RES Australia Pty Ltd to conduct background noise monitoring in the vicinity of the proposed Tarong West Wind Farm (the **Wind Farm**).

The background noise monitoring was conducted between 2 May 2019 and 12 June 2019 at seven selected sensitive land uses (dwellings). The purpose of the background noise monitoring was to:

- determine the background noise levels ($L_{A90,\ 10min}$) which describe the ambient noise of the area surrounding the Wind Farm during the day and night period; and,
- correlate the measured noise levels with wind speed to determine the relevant noise criteria at the selected representative noise monitoring locations[1].

The noise monitoring regime and subsequent data analysis have been conducted in accordance with *State code 23: Wind farm development (version 3.0) and State code 23: Wind Farm development - Planning Guidelines (February 2022)* (**State Code 23**).

This report summarises the methodology and results of the background noise monitoring regime.

[1] Criteria are not determined as part of the Background Noise Monitoring Report, but are included in separate Noise Impact Assessment for the Tarong West Wind Farm based on the results of the monitoring.

2 BACKGROUND NOISE MONITORING

2.1 Noise Monitoring Locations

Background noise monitoring was conducted at seven sensitive land uses, which are dwellings on seven non-host lots. The monitoring occurred between 2 May and 12 June 2019.

The background noise monitoring locations were selected to provide data in all directions from the Wind Farm. This resulted in all sensitive land uses (dwellings) having at least one representative background noise monitoring location in a similar direction from the Wind Farm. Where practical the closest dwelling to the Wind Farm in each wind direction was selected but where contact with land owners could not be made, the next closest dwelling was selected.

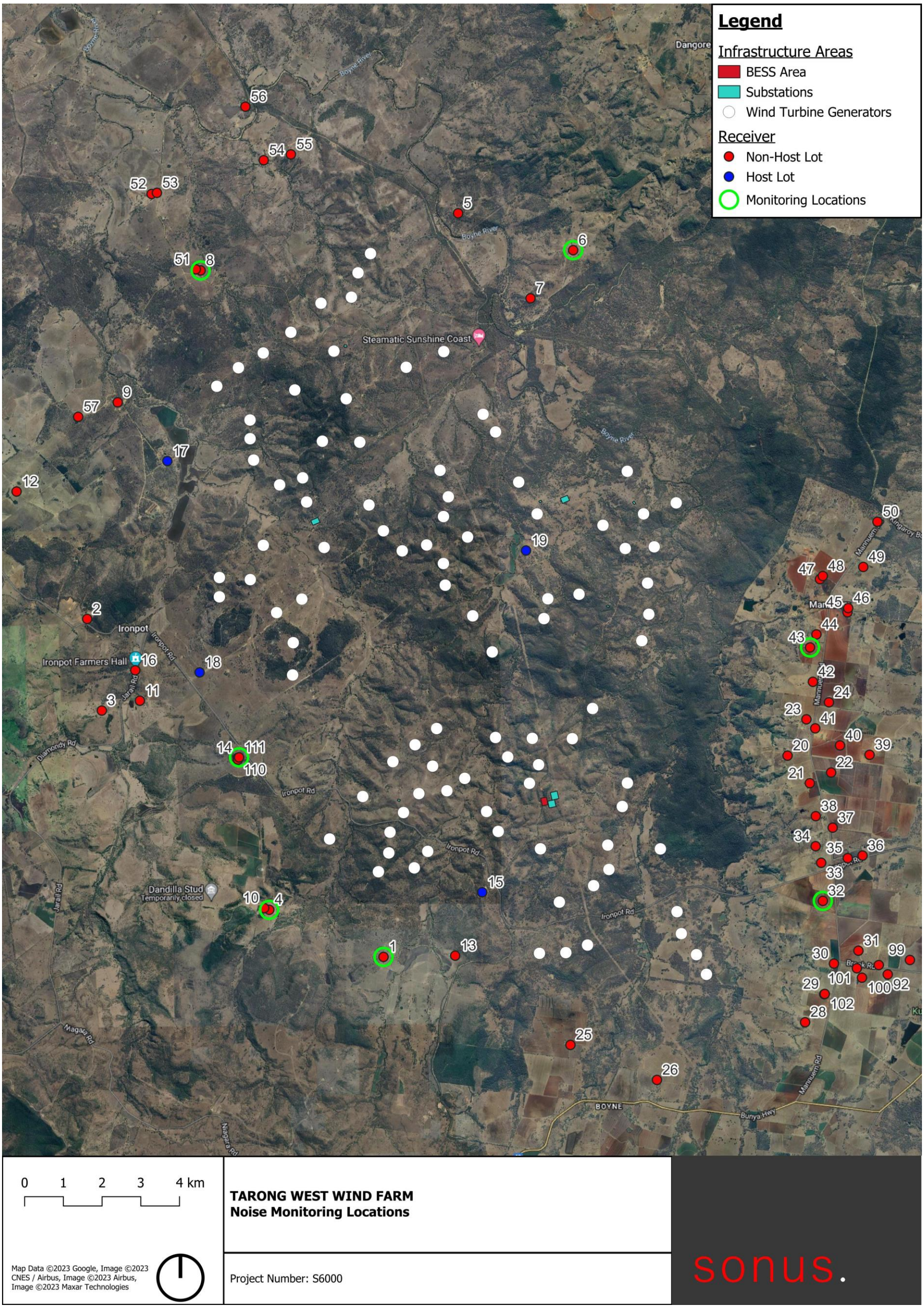
Figure 1 below shows the monitoring locations, the proposed Wind Turbine Generators (**WTGs**) and the surrounding sensitive land uses[2]. Table 1 provides the details of the background noise monitoring locations, including the coordinates, the monitoring period, and the status of the dwelling lot.

Table 1: *Monitoring Locations Coordinates and Periods*

Location		Coordinates (GDA 94 MGA Zone 56)		Monitoring Period
ID	Lot Status	Easting	Northing	
1	Non-host	350033	7048010	3 May -12 June 2019
4	Non-host	347082	7049227	3 May -12 June 2019
6	Non-host	354931	7066259	2 May -12 June 2019
8	Non-Host	345309	7065736	2 May -12 June 2019
32	Non-host	361380	7049457	3 May -12 June 2019
43	Non-host	361049	7056001	2 May -12 June 2019
111	Non-host	346302	7053163	2 May -12 June 2019

[2] Origin of Residence Coordinates: RES Australia Pty Ltd file "DAUSilf001_20200117_5km"
Origin of Turbine Coordinates: RES Australia Pty Ltd file "PAUSilf138"

Figure 1: *Monitoring Locations Aerial Photo*



2.2 Met Mast Monitoring Location

RES Australia Pty Ltd collected wind data at various heights during the background noise monitoring period from the site met mast. The coordinates of the met mast and the measurement heights are provided in Table 2.

Table 2: *Met Mast Monitoring Location*

Coordinates (GDA 94 MGA Zone 56)		Measurement heights
Easting	Northing	
349762	7063665	80m, 100m, 120m

In accordance with State Code 23, RES Australia Pty Ltd has used the following formulae to obtain the wind speed at the hub height of the current representative turbine (166m).

Extrapolated wind speed, $V_{FHH} = \frac{V_1}{\left({}^{H_1}/_{H_{FHH}}\right)^{\propto}}$ **Wind shear factor,** $\propto = \frac{log\ {}^{V_1}/_{V_2}}{log\ {}^{H_1}/_{H_2}}$

Where:

α = wind shear factor

V_1 = wind velocity at measurement height 1 in m/s

V_2 = wind velocity at measurement height 2 in m/s

H_1 = measurement height of V1 in m

H_2 = measurement height of V2 in m/s (H_1 or H_2 to be at least 60% of final hub height)

H_{FHH} = final hub height in m

V_{FHH} = wind velocity at final hub height in m/s.

2.3 Equipment

Background noise levels (L_{A90}) were measured in 10 minute intervals with a combination of *Rion Class 1 and 2* sound level meters with certification in accordance with *AS IEC−61672.1-2004 Electroacoustics – Sound level meters.* Appendix A provides the serial numbers of the sound level meters and the associated calibration certificates.

The sound level meters have a noise floor of less than 20 dB(A) and were calibrated at the beginning and end of the measurement period using a Class 1 *Rion NC74* Calibrator, with no significant drift observed in all instances (i.e., a variation of no greater than 1 dB).

The noise logging equipment was positioned with line of sight to the proposed wind farm and set back from any significant structures which could introduce reflections, or domestic noise sources such as air conditioning units. The microphones were positioned approximately 1.5 m above ground level and fitted *Rion WS-15* wind

shields which have an inner and outer wind shield component to minimise any noise from wind on the microphone. A photograph of the typical noise monitoring equipment set up and the location of each noise logger are provided in Appendix B.

Local wind and rain monitoring equipment at the microphone height (approximately 1.5m above ground level) measured the meteorological conditions at dwellings 8 and 32. The loggers and associated sensors measured the wind speed (accurate to ±1m/s), and rainfall (exceeding 0.2mm for any 10 minute interval), as required by State Code 23. The data have been used in the determination of the periods when local weather may have affected the background noise measurements.

3 DATA ANALYSIS

The background noise and wind speed data have been analysed in accordance with the methodology provided in State Code 23.

3.1 Data Removal

Prior to the correlation analysis, the following data were removed:

- data points corresponding to any periods of measured rainfall (detected precipitation exceeding 0.2mm in the 10 minute period) and/or measured wind speed exceeding 5 m/s at the microphone for more than 90% of the measurement period;
- data points corresponding to wind speeds below the cut-in (3 m/s) and above the approximate wind speed of rated power (14 m/s); and,
- data points which were clearly affected by extraneous noise (ie, outliers in the data set).

Table 3 provides the number of data points before and after the filtering process at each monitoring location:

Table 3: *Data Points at each Monitoring Location*

Location ID	Data Points		
	Before Removal	After Removal Day (6am to 10pm)	After Removal Night (10pm to 6am)
1	5761	3287	1674
4	5763	3289	1674
6	5861	3337	1720
8	5859	3331	1720
32	5759	3285	1674
43	5859	3334	1720
111	5858	3331	1720

3.2 Noise and Wind Data Correlations

The background noise data were correlated with the hub height (166m) wind speeds, separately for daytime (between 6am and 10pm) and night-time (between 10pm and 6am) periods.

A best fit, third order regression analysis was undertaken for each of the daytime and night-time data sets. The data sets and resultant regression curves are provided in Appendix D.

Using the regression curves in Appendix D, the background noise level ($L_{A90,10min}$) at each integer hub height wind speed has been determined.

Tables 4 and 5 summarise the background noise levels during the daytime and night-time periods respectively, for each integer hub height wind speed, between 3m/s and 14m/s:

Table 4: *Daytime Background Noise Levels ($L_{A90,10min}$)*

Location ID	Background Noise Level (dB(A)) at 166m Hub Height Wind Speed (m/s)											
	3	4	5	6	7	8	9	10	11	12	13	14
1	32	33	33	34	34	34	35	36	37	39	42	45
4	24	26	27	27	28	29	29	31	32	35	38	43
6	22	24	26	27	29	30	31	32	33	35	36	39
8	24	26	27	28	29	30	31	33	34	36	39	41
32	24	27	29	31	32	32	33	35	36	39	43	48
43	27	29	30	31	31	32	32	33	34	36	38	41
111	23	25	26	27	28	30	31	33	35	37	40	44

Table 5: *Night-time Background Noise Levels ($L_{A90,10min}$)*

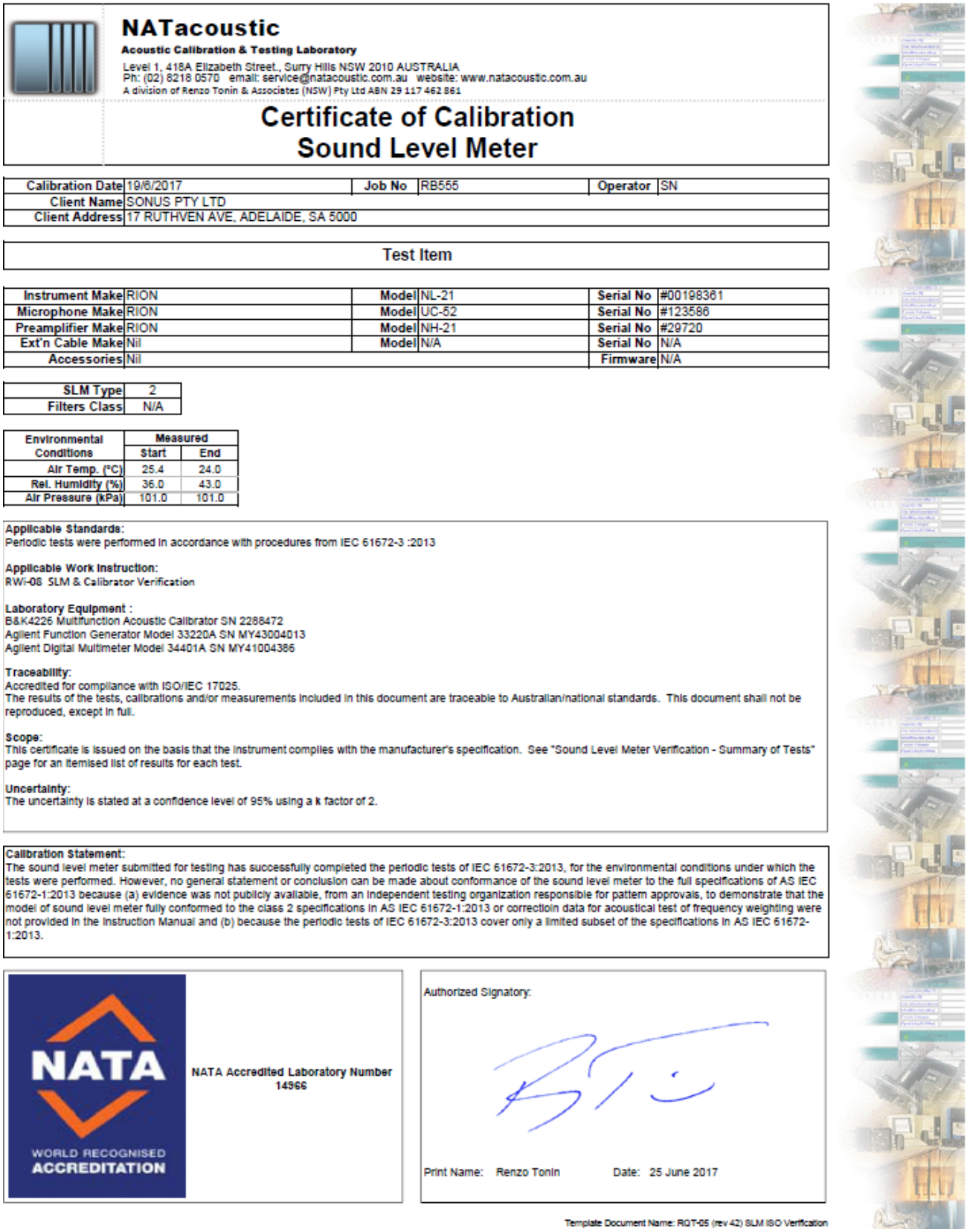
Location ID	Background Noise Level (dB(A)) at 166m Hub Height Wind Speed (m/s)											
	3	4	5	6	7	8	9	10	11	12	13	14
1	19	20	21	23	24	25	26	28	30	32	34	37
4	15	16	17	18	19	20	21	22	24	26	28	31
6	16	17	18	19	19	20	22	23	25	27	30	34
8	17	18	19	20	21	23	24	26	27	29	32	34
32	17	19	21	23	25	26	27	29	30	32	34	36
43	20	21	23	24	25	26	27	28	29	30	32	34
111	16	16	18	19	21	23	25	26	28	30	32	33

APPENDIX A: NOISE MONITORING EQUIPMENT SERIAL NUMBERS AND CALIBRATION CERTIFICATES

Table A1: *Sound level meter type and serial numbers*

Location ID	Make	Model	Serial Number
1	Rion	NL-21	00198361
4	Rion	NL-21	00709523
6	Rion	NL-42	00296499
8	Rion	NL-52	00320649
32	Rion	NL-21	01298928
43	Rion	NL-21	01298931
111	Rion	NL-52	00320653

Figure A1: *Calibration certificate for noise logger at Location 1*



NATacoustic
Acoustic Calibration & Testing Laboratory
Level 1, 418A Elizabeth Street., Surry Hills NSW 2010 AUSTRALIA
Ph: (02) 8218 0570 email: service@natacoustic.com.au website: www.natacoustic.com.au
A division of Renzo Tonin & Associates (NSW) Pty Ltd ABN 29 117 462 861

Certificate of Calibration
Sound Level Meter

Calibration Date	19/6/2017	Job No	RB555	Operator	SN
Client Name	SONUS PTY LTD				
Client Address	17 RUTHVEN AVE, ADELAIDE, SA 5000				

Test Item

Instrument Make	RION	Model	NL-21	Serial No	#00198361
Microphone Make	RION	Model	UC-52	Serial No	#123586
Preamplifier Make	RION	Model	NH-21	Serial No	#29720
Ext'n Cable Make	Nil	Model	N/A	Serial No	N/A
Accessories	Nil			Firmware	N/A

SLM Type	2
Filters Class	N/A

Environmental Conditions	Measured	
	Start	End
Air Temp. (°C)	25.4	24.0
Rel. Humidity (%)	36.0	43.0
Air Pressure (kPa)	101.0	101.0

Applicable Standards:
Periodic tests were performed in accordance with procedures from IEC 61672-3 :2013

Applicable Work Instruction:
RWI-08 SLM & Calibrator Verification

Laboratory Equipment :
B&K4226 Multifunction Acoustic Calibrator SN 2288472
Agilent Function Generator Model 33220A SN MY43004013
Agilent Digital Multimeter Model 34401A SN MY41004386

Traceability:
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. This document shall not be reproduced, except in full.

Scope:
This certificate is issued on the basis that the instrument complies with the manufacturer's specification. See "Sound Level Meter Verification - Summary of Tests" page for an itemised list of results for each test.

Uncertainty:
The uncertainty is stated at a confidence level of 95% using a k factor of 2.

Calibration Statement:
The sound level meter submitted for testing has successfully completed the 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 specifications of AS IEC 61672-1:2013 because (a) evidence was not publicly available, from an independent testing organization responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the class 2 specifications in AS IEC 61672-1:2013 or correctioin data for acoustical test of frequency weighting were not provided in the Instruction Manual and (b) because the periodic tests of IEC 61672-3:2013 cover only a limited subset of the specifications in AS IEC 61672-1:2013.

NATA
WORLD RECOGNISED ACCREDITATION

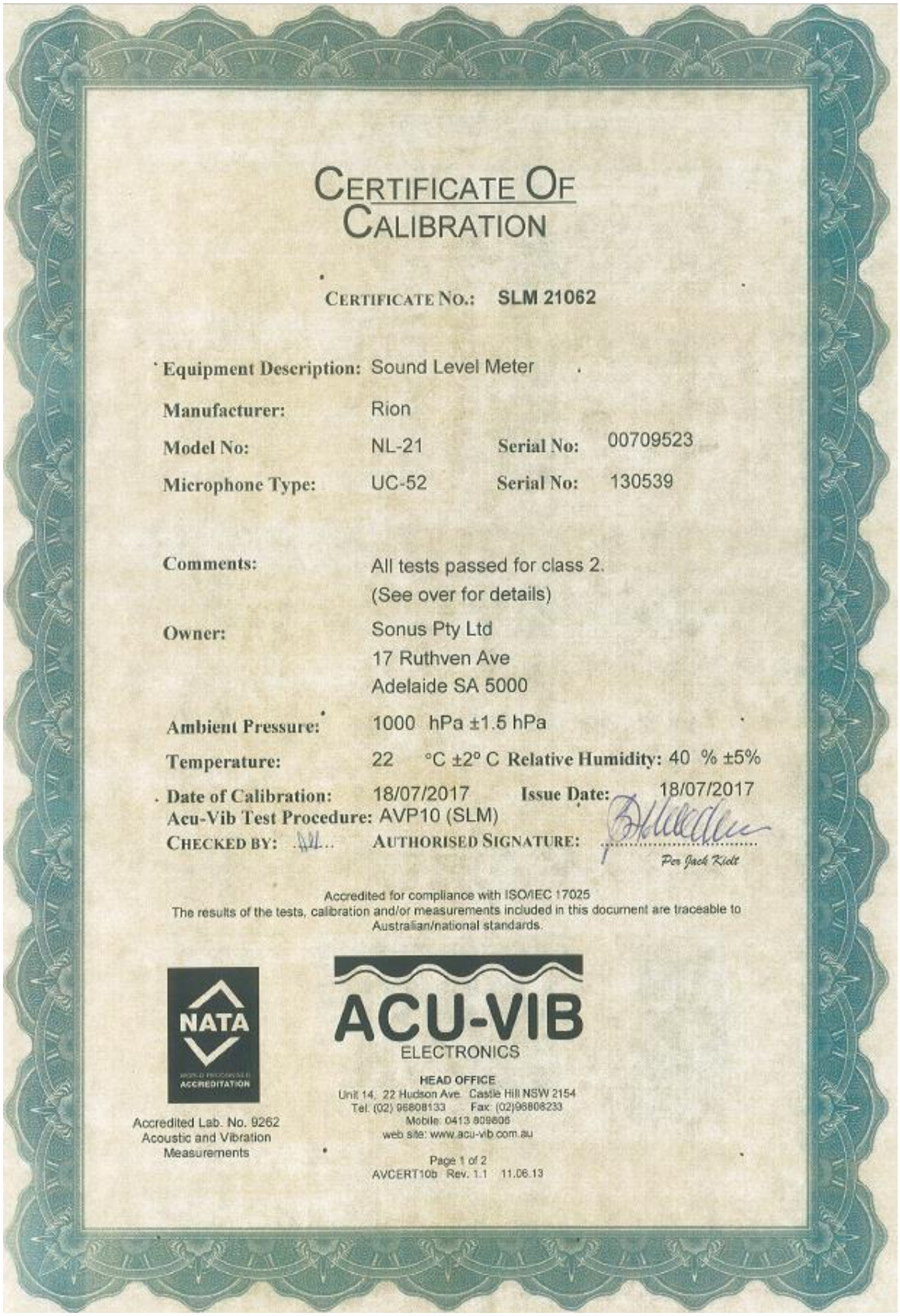
NATA Accredited Laboratory Number 14966

Authorized Signatory:

Print Name: Renzo Tonin Date: 25 June 2017

Template Document Name: RQT-05 (rev 42) SLM ISO Verification

Figure A2: *Calibration certificate for noise logger at Location 4*



CERTIFICATE OF CALIBRATION

CERTIFICATE NO.: **SLM 21062**

Equipment Description:	Sound Level Meter		
Manufacturer:	Rion		
Model No:	NL-21	**Serial No:**	00709523
Microphone Type:	UC-52	**Serial No:**	130539

Comments: All tests passed for class 2.
(See over for details)

Owner: Sonus Pty Ltd
17 Ruthven Ave
Adelaide SA 5000

Ambient Pressure: 1000 hPa ±1.5 hPa

Temperature: 22 °C ±2° C **Relative Humidity:** 40 % ±5%

Date of Calibration: 18/07/2017 **Issue Date:** 18/07/2017

Acu-Vib Test Procedure: AVP10 (SLM)

CHECKED BY: ..... **AUTHORISED SIGNATURE:** .....
Per Jack Riolt

Accredited for compliance with ISO/IEC 17025
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.

NATA
ACCREDITATION

Accredited Lab. No. 9262
Acoustic and Vibration Measurements

ACU-VIB
ELECTRONICS

HEAD OFFICE
Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
Tel: (02) 96808133 Fax: (02)96808233
Mobile: 0413 809806
web site: www.acu-vib.com.au

Page 1 of 2
AVCERT10b Rev. 1.1 11.06.13

Figure A3: *Calibration certificate for noise logger at Location 6*

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

Sound Level Meter
IEC 61672-3.2013
Calibration Certificate

Calibration Number C19151_Reissued

Client Details	Sonus Pty Ltd 17 Ruthven Avenue Adelaide SA 5000
Equipment Tested/ Model Number :	Rion NL-42EX
Instrument Serial Number :	00296499
Microphone Serial Number :	179100
Pre-amplifier Serial Number :	87508

Pre-Test Atmospheric Conditions		Post-Test Atmospheric Conditions	
Ambient Temperature :	22.8°C	**Ambient Temperature :**	24.1°C
Relative Humidity :	51.7%	**Relative Humidity :**	43.9%
Barometric Pressure :	100.09kPa	**Barometric Pressure :**	100kPa

Calibration Technician :	Lucky Jaiswal	**Secondary Check:**	Eloise Burrows
Calibration Date :	8 Mar 2019	**Report Issue Date :**	23 Apr 2019

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 2 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.

Least Uncertainties of Measurement -

Acoustic Tests		Environmental Conditions	
31.5 Hz to 8kHz	*±0.15dB*	*Temperature*	*±0.2°C*
12.5kHz	*±0.2dB*	*Relative Humidity*	*±2.4%*
16kHz	*±0.29dB*	*Barometric Pressure*	*±0.015kPa*
Electrical Tests			
31.5 Hz to 20 kHz	*±0.11dB*		

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.

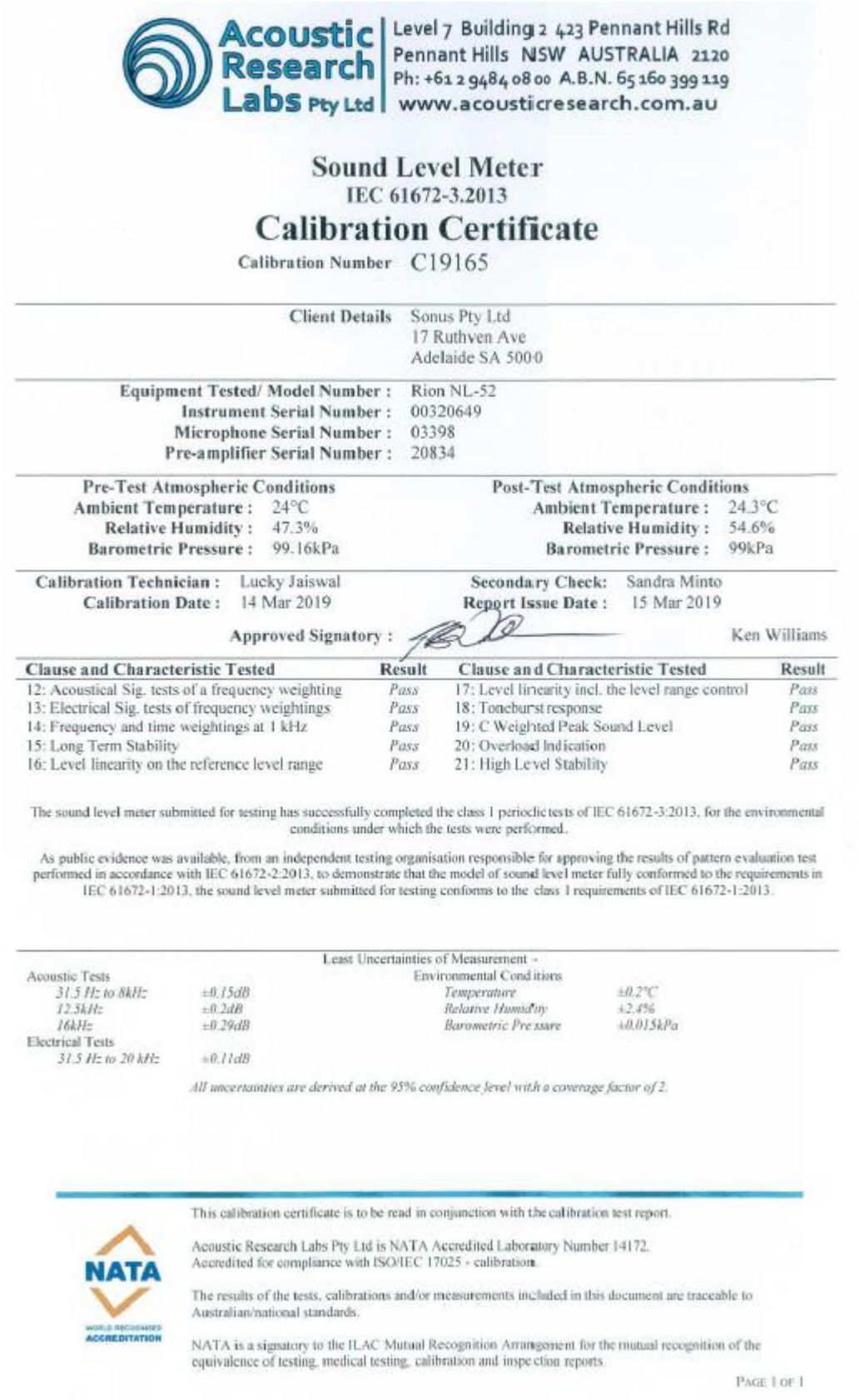
Acoustic Research Labs Pty Ltd is NATA Accredited Laboratory Number 14172.
Accredited for compliance with ISO/IEC 17025 - calibration.

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.

PAGE 1 OF 1

Figure A4: *Calibration certificate for noise logger at Location 8*



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

Sound Level Meter
IEC 61672-3.2013
Calibration Certificate
Calibration Number C19165

Client Details	Sonus Pty Ltd 17 Ruthven Ave Adelaide SA 5000
Equipment Tested/ Model Number :	Rion NL-52
Instrument Serial Number :	00320649
Microphone Serial Number :	03398
Pre-amplifier Serial Number :	20834

Pre-Test Atmospheric Conditions		Post-Test Atmospheric Conditions	
Ambient Temperature :	24°C	Ambient Temperature :	24.3°C
Relative Humidity :	47.3%	Relative Humidity :	54.6%
Barometric Pressure :	99.16kPa	Barometric Pressure :	99kPa

Calibration Technician :	Lucky Jaiswal	Secondary Check:	Sandra Minto
Calibration Date :	14 Mar 2019	Report Issue Date :	15 Mar 2019

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.

As public evidence was available, from an independent testing organisation responsible for approving the results of pattern evaluation test performed in accordance with IEC 61672-2:2013, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2013.

Least Uncertainties of Measurement -

Acoustic Tests		Environmental Conditions	
31.5 Hz to 8kHz	*±0.15dB*	*Temperature*	*±0.2°C*
12.5kHz	*±0.2dB*	*Relative Humidity*	*±2.4%*
16kHz	*±0.29dB*	*Barometric Pressure*	*±0.015kPa*
Electrical Tests			
31.5 Hz to 20 kHz	*±0.11dB*		

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.

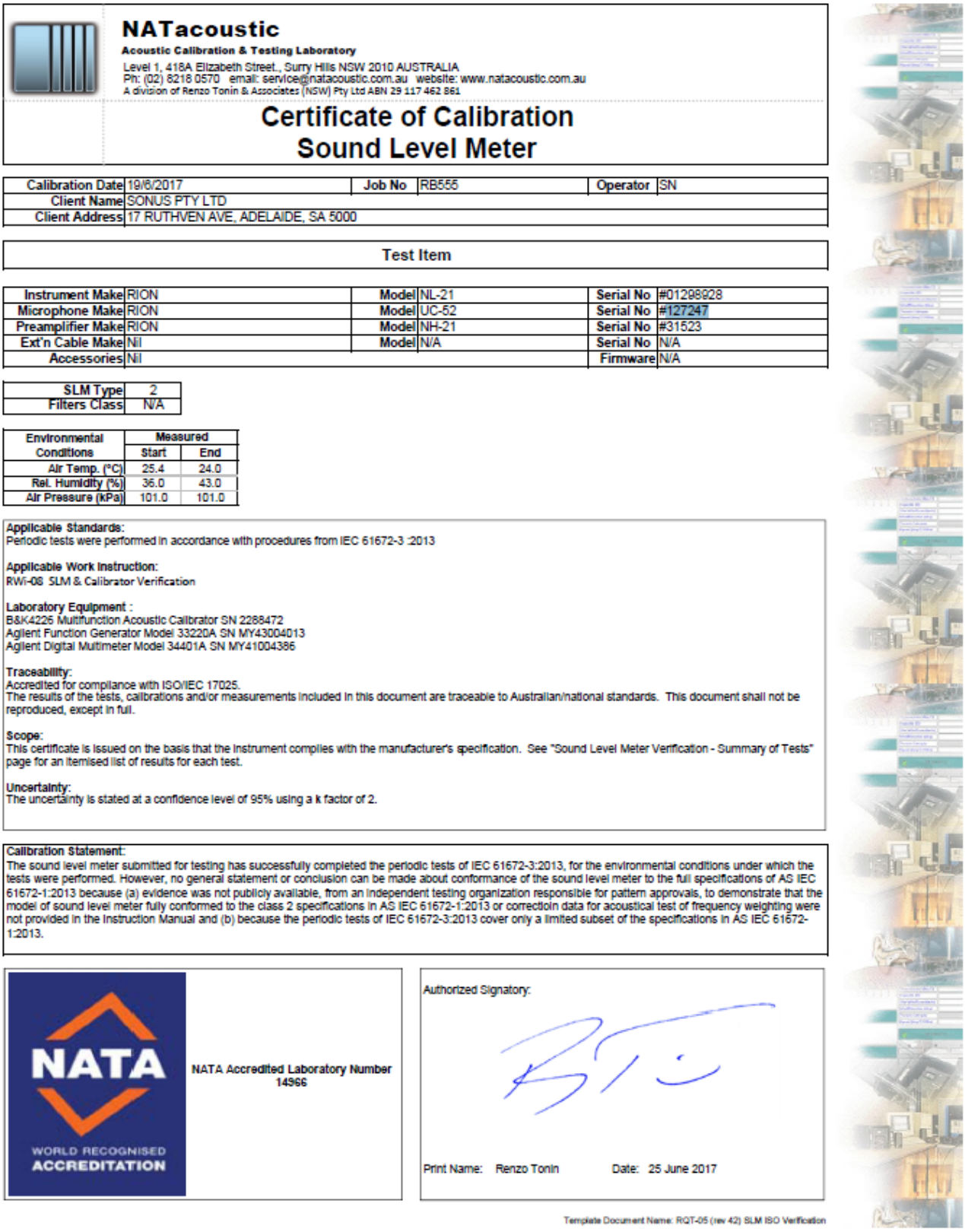
Acoustic Research Labs Pty Ltd is NATA Accredited Laboratory Number 14172.
Accredited for compliance with ISO/IEC 17025 - calibration.

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.

PAGE 1 OF 1

Figure A5: *Calibration certificate for noise logger at Location 32*



NATacoustic
Acoustic Calibration & Testing Laboratory
Level 1, 416A Elizabeth Street., Surry Hills NSW 2010 AUSTRALIA
Ph: (02) 8218 0570 email: service@natacoustic.com.au website: www.natacoustic.com.au
A division of Renzo Tonin & Associates (NSW) Pty Ltd ABN 29 117 462 861

Certificate of Calibration
Sound Level Meter

Calibration Date	19/6/2017	Job No	RB555	Operator	SN
Client Name	SONUS PTY LTD				
Client Address	17 RUTHVEN AVE, ADELAIDE, SA 5000				

Test Item

Instrument Make	RION	Model	NL-21	Serial No	#01298928
Microphone Make	RION	Model	UC-52	Serial No	#127247
Preamplifier Make	RION	Model	NH-21	Serial No	#31523
Ext'n Cable Make	Nil	Model	N/A	Serial No	N/A
Accessories	Nil			Firmware	N/A

SLM Type	2
Filters Class	N/A

Environmental Conditions	Measured Start	End
Air Temp. (°C)	25.4	24.0
Rel. Humidity (%)	36.0	43.0
Air Pressure (kPa)	101.0	101.0

Applicable Standards:
Periodic tests were performed in accordance with procedures from IEC 61672-3 :2013

Applicable Work Instruction:
RWi-08 SLM & Calibrator Verification

Laboratory Equipment :
B&K4226 Multifunction Acoustic Calibrator SN 2288472
Agilent Function Generator Model 33220A SN MY43004013
Agilent Digital Multimeter Model 34401A SN MY41004386

Traceability:
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. This document shall not be reproduced, except in full.

Scope:
This certificate is issued on the basis that the instrument complies with the manufacturer's specification. See "Sound Level Meter Verification - Summary of Tests" page for an itemised list of results for each test.

Uncertainty:
The uncertainty is stated at a confidence level of 95% using a k factor of 2.

Calibration Statement:
The sound level meter submitted for testing has successfully completed the 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 specifications of AS IEC 61672-1:2013 because (a) evidence was not publicly available, from an independent testing organization responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the class 2 specifications in AS IEC 61672-1:2013 or correctioin data for acoustical test of frequency weighting were not provided in the Instruction Manual and (b) because the periodic tests of IEC 61672-3:2013 cover only a limited subset of the specifications in AS IEC 61672-1:2013.

NATA
WORLD RECOGNISED ACCREDITATION

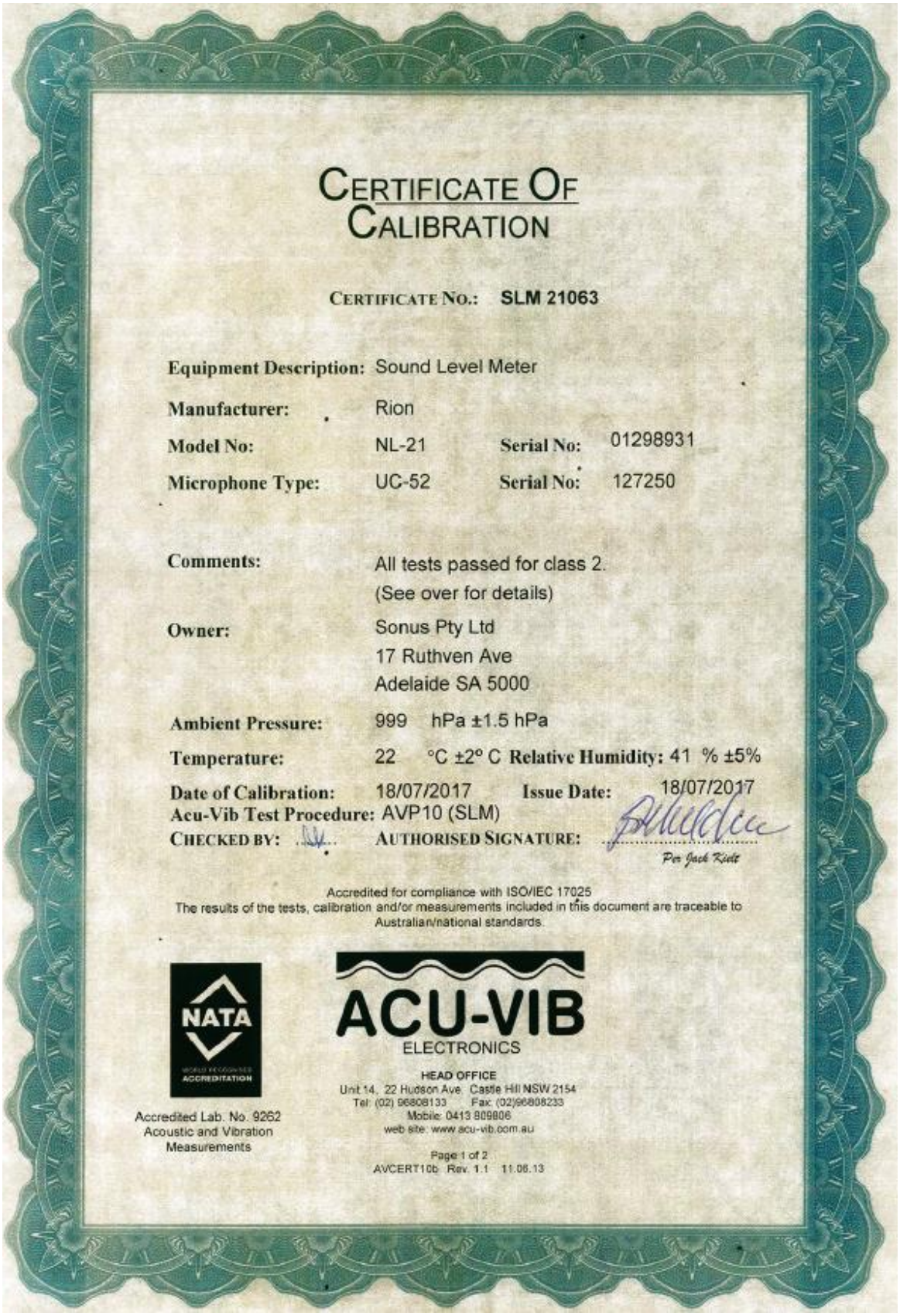
NATA Accredited Laboratory Number 14966

Authorized Signatory:

Print Name: Renzo Tonin Date: 25 June 2017

Template Document Name: RQT-05 (rev 42) SLM ISO Verification

Figure A6: *Calibration certificate for noise logger at Location 43*



CERTIFICATE OF CALIBRATION

CERTIFICATE NO.: SLM 21063

Equipment Description:	Sound Level Meter		
Manufacturer:	Rion		
Model No:	NL-21	**Serial No:**	01298931
Microphone Type:	UC-52	**Serial No:**	127250

Comments: All tests passed for class 2.
(See over for details)

Owner: Sonus Pty Ltd
17 Ruthven Ave
Adelaide SA 5000

Ambient Pressure: 999 hPa ±1.5 hPa

Temperature: 22 °C ±2° C **Relative Humidity:** 41 % ±5%

Date of Calibration: 18/07/2017 **Issue Date:** 18/07/2017

Acu-Vib Test Procedure: AVP10 (SLM)

CHECKED BY: ..... **AUTHORISED SIGNATURE:** .....
Per Jack Riede

Accredited for compliance with ISO/IEC 17025
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.

NATA
ACCREDITATION

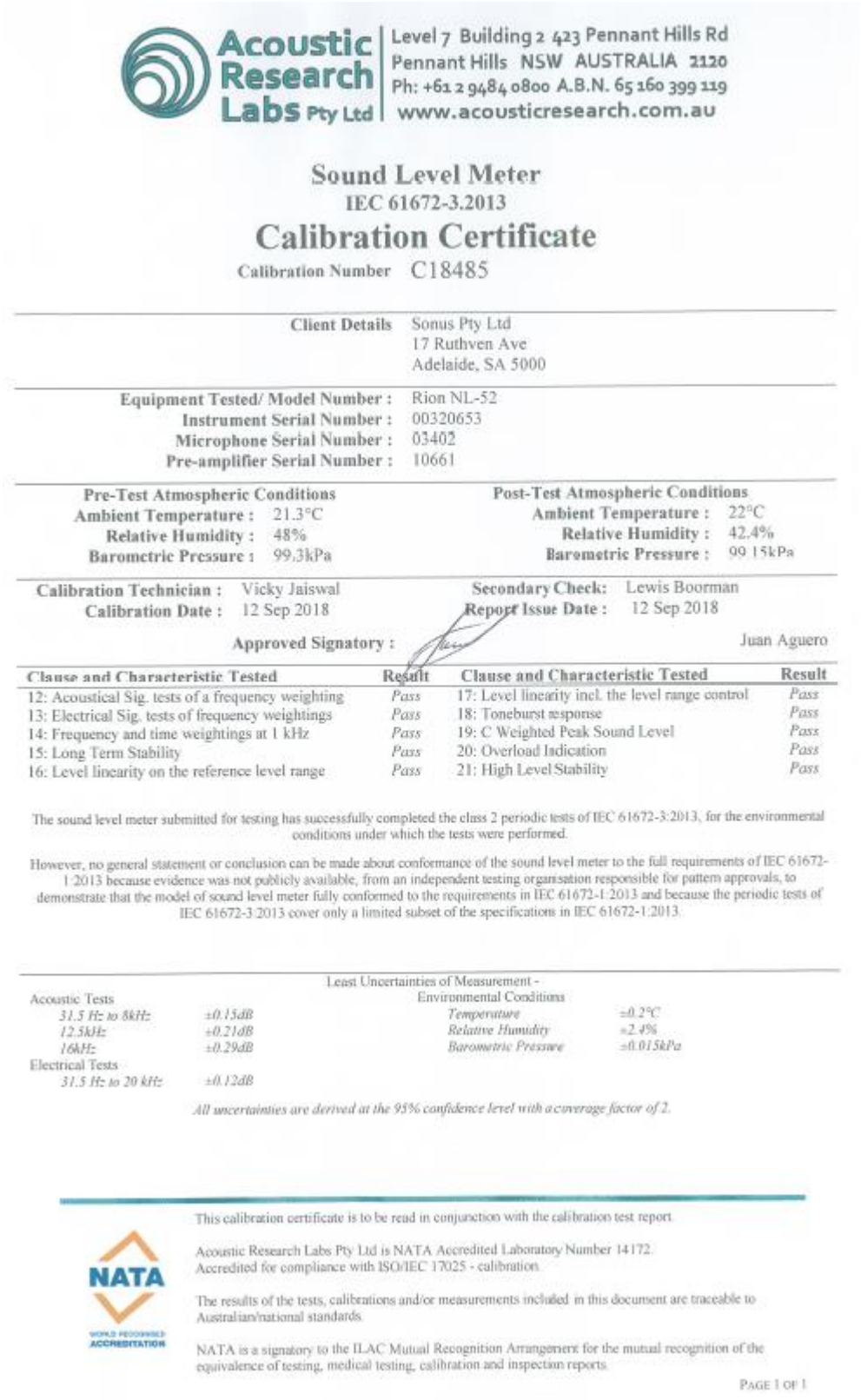
Accredited Lab. No. 9262
Acoustic and Vibration Measurements

ACU-VIB
ELECTRONICS

HEAD OFFICE
Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
Tel: (02) 96808133 Fax: (02)96808233
Mobile: 0413 809806
web site: www.acu-vib.com.au

Page 1 of 2
AVCERT10b Rev. 1.1 11.06.13

Figure A7: *Calibration certificate for noise logger at Location 111*



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

Sound Level Meter
IEC 61672-3:2013
Calibration Certificate
Calibration Number C18485

Client Details	Sonus Pty Ltd 17 Ruthven Ave Adelaide, SA 5000
Equipment Tested/ Model Number :	Rion NL-52
Instrument Serial Number :	00320653
Microphone Serial Number :	03402
Pre-amplifier Serial Number :	10661

Pre-Test Atmospheric Conditions		Post-Test Atmospheric Conditions	
Ambient Temperature :	21.3°C	**Ambient Temperature :**	22°C
Relative Humidity :	48%	**Relative Humidity :**	42.4%
Barometric Pressure :	99.3kPa	**Barometric Pressure :**	99.15kPa

Calibration Technician : Vicky Jaiswal
Calibration Date : 12 Sep 2018
Secondary Check: Lewis Boorman
Report Issue Date : 12 Sep 2018
Approved Signatory : Juan Aguero

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 2 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.

Least Uncertainties of Measurement -

Acoustic Tests		Environmental Conditions	
31.5 Hz to 8kHz	*±0.15dB*	*Temperature*	*±0.2°C*
12.5kHz	*±0.21dB*	*Relative Humidity*	*±2.4%*
16kHz	*±0.29dB*	*Barometric Pressure*	*±0.015kPa*
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.

Accredited for compliance with ISO/IEC 17025 - calibration.

Acoustic Research Labs Pty Ltd is NATA Accredited Laboratory Number 14172.

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.

PAGE 1 OF 1

APPENDIX B: MONITORING EQUIPMENT SETUP AND LOCATIONS

Figure B1: *Example of noise monitoring equipment set-up*

Figure B2: *Monitoring at Location 1*

Figure B3: *Monitoring at Location 4*

Figure B4: *Monitoring at Location 6*

Figure B5: *Monitoring at Location 8*

Figure B6: *Monitoring at Location 32*

Figure B7: *Monitoring at Location 43*

Figure B8: *Monitoring at Location 111*

APPENDIX D: BACKGROUND NOISE AND WIND SPEED CORRELATIONS

Figure D1: *Location 1 Background Noise Level Correlations Daytime (6am to 10pm)*

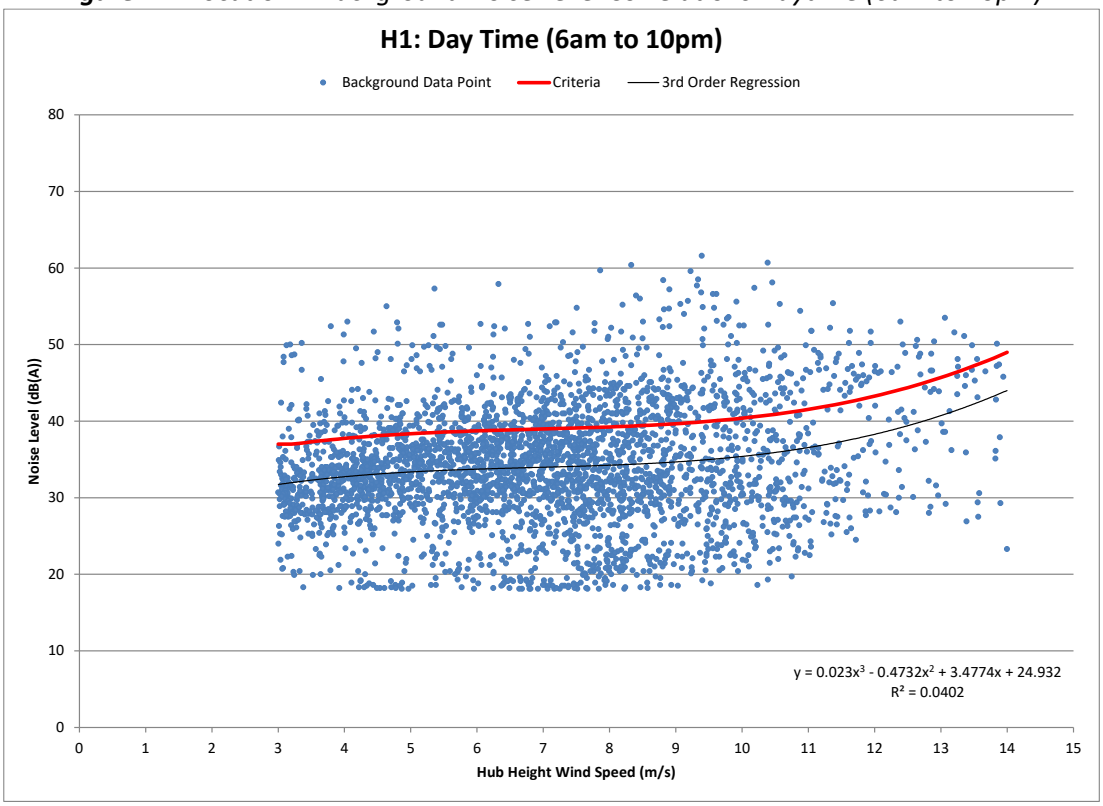


Figure D2: *Location 1 Background Noise Level Correlations Night-time (10pm to 6am)*

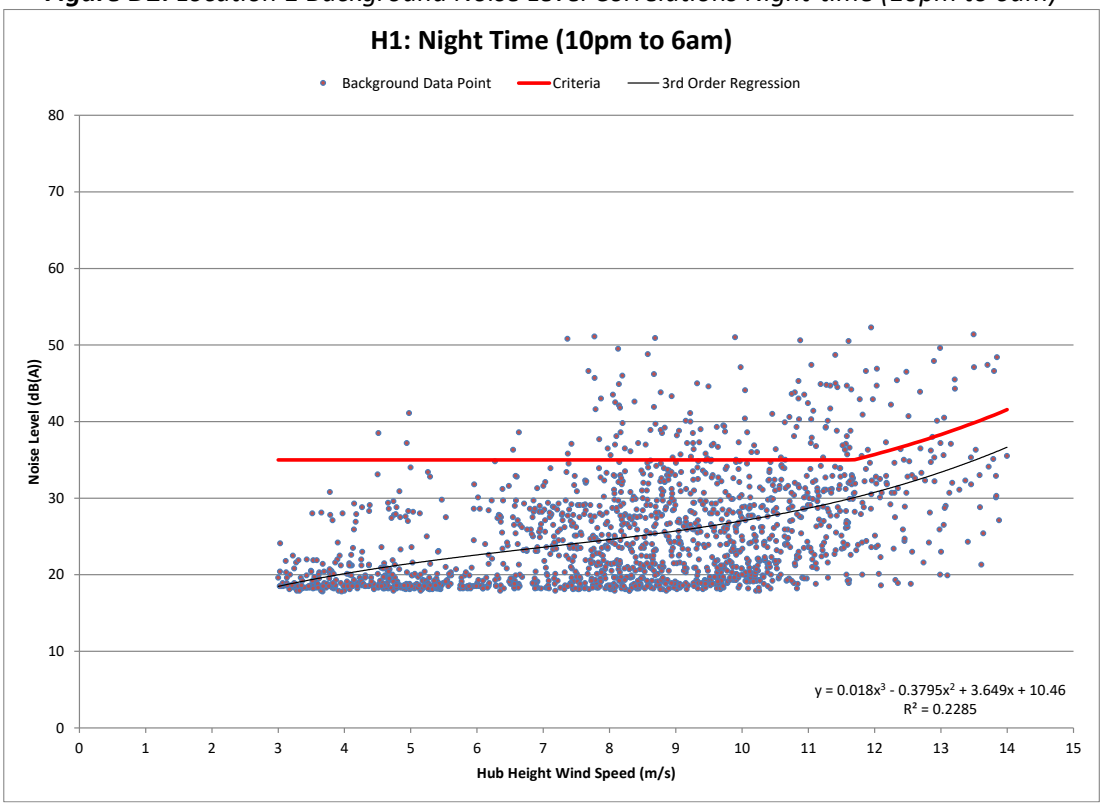


Figure D3: *Location 4 Background Noise Level Correlations Daytime (6am to 10pm)*

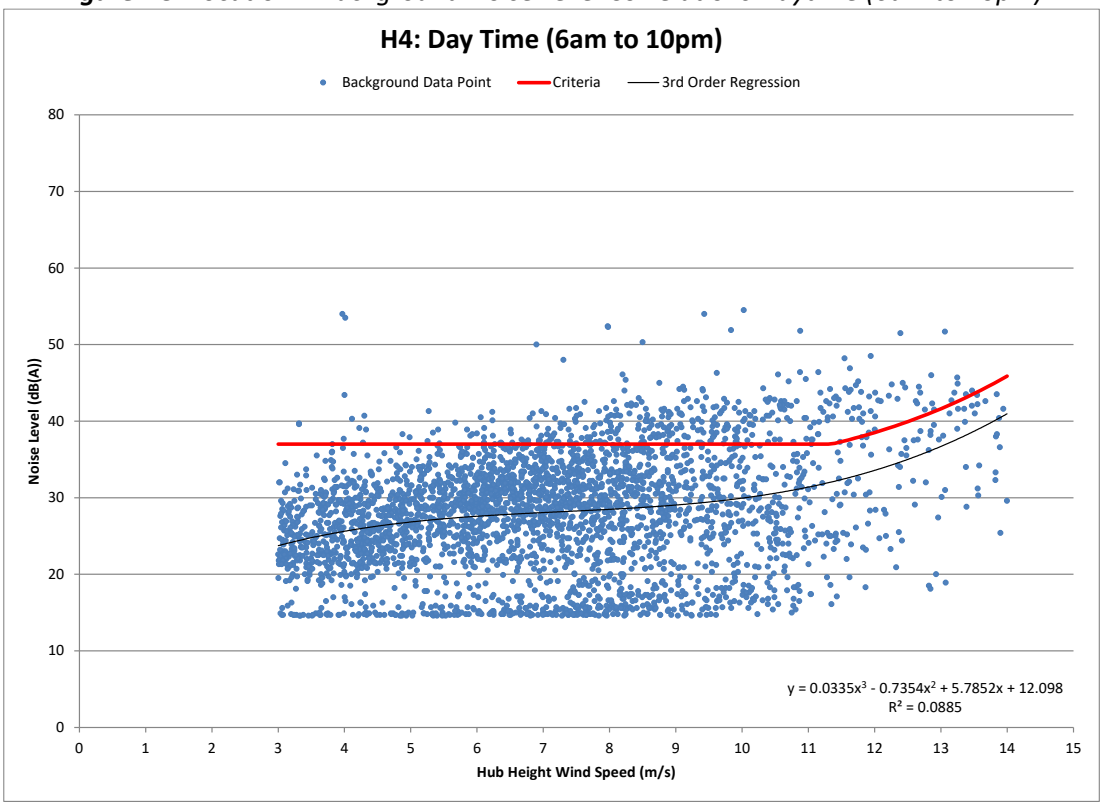


Figure D4: *Location 4 Background Noise Level Correlations Night-time (before 6am or after 10pm)*

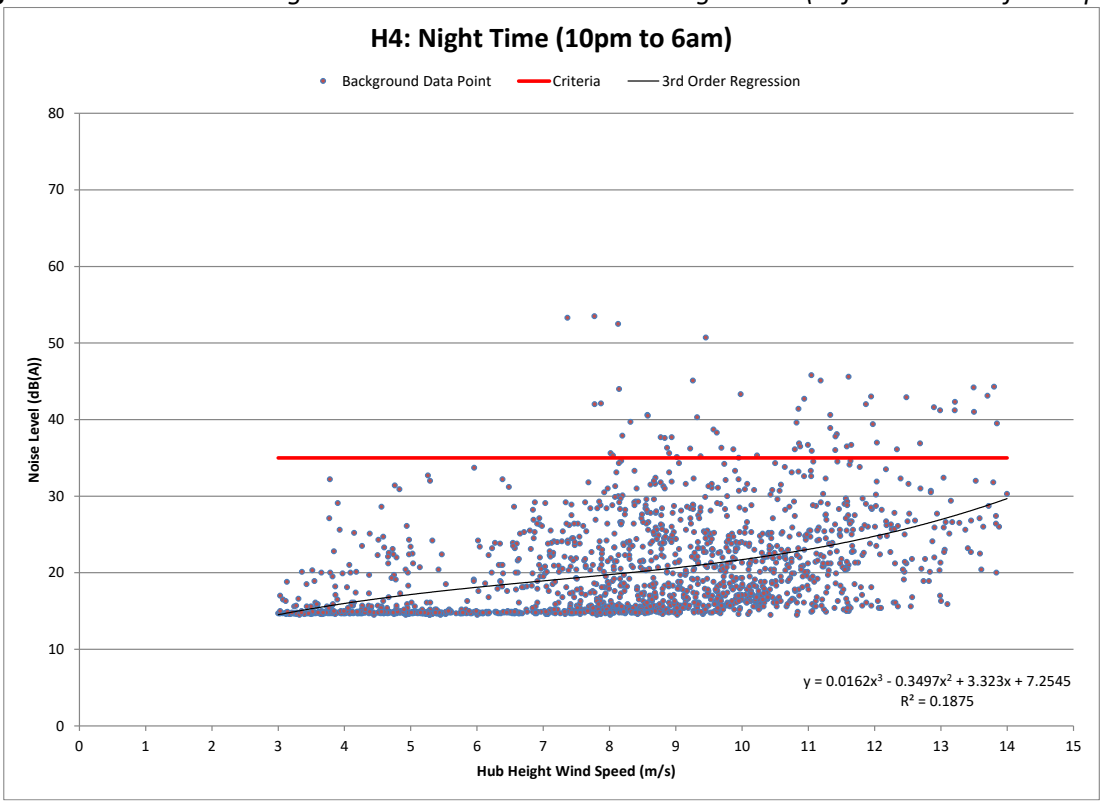


Figure D5: *Location 6 Background Noise Level Correlations Daytime (6am to 10pm)*

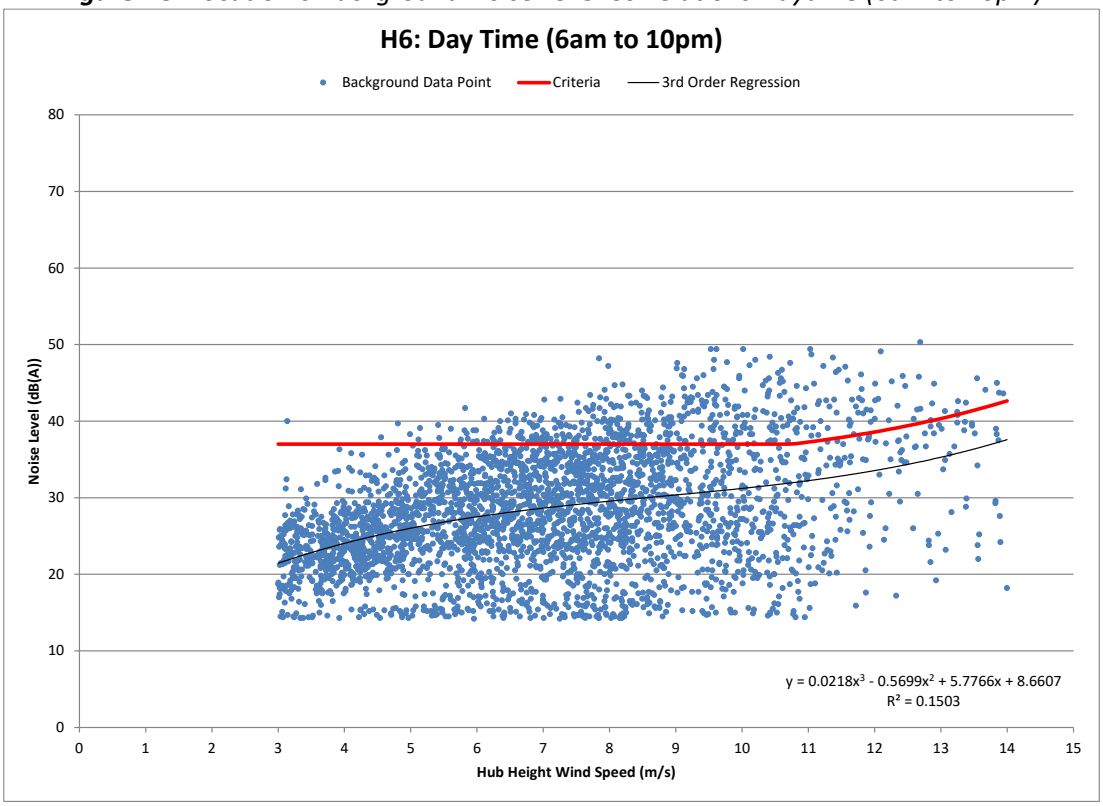


Figure D6: *Location 6 Background Noise Level Correlations Night-time (before 6am or after 10pm)*

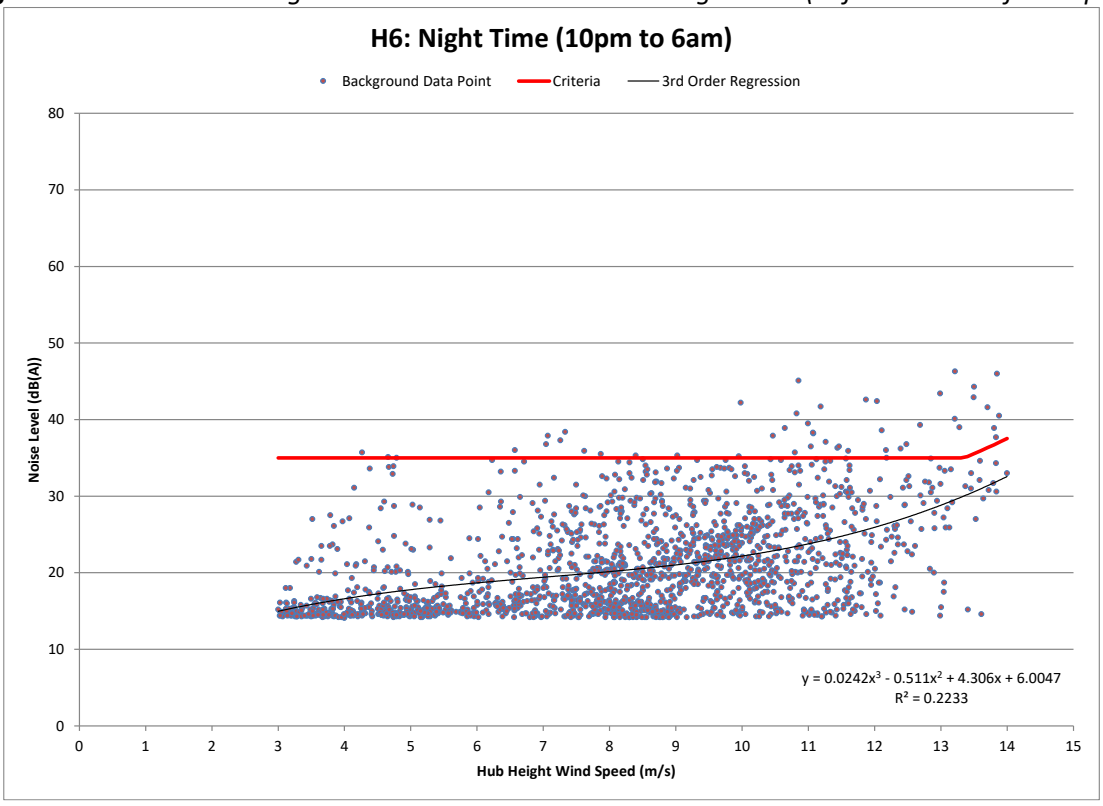


Figure D7: *Location 8 Background Noise Level Correlations Daytime (6am to 10pm)*

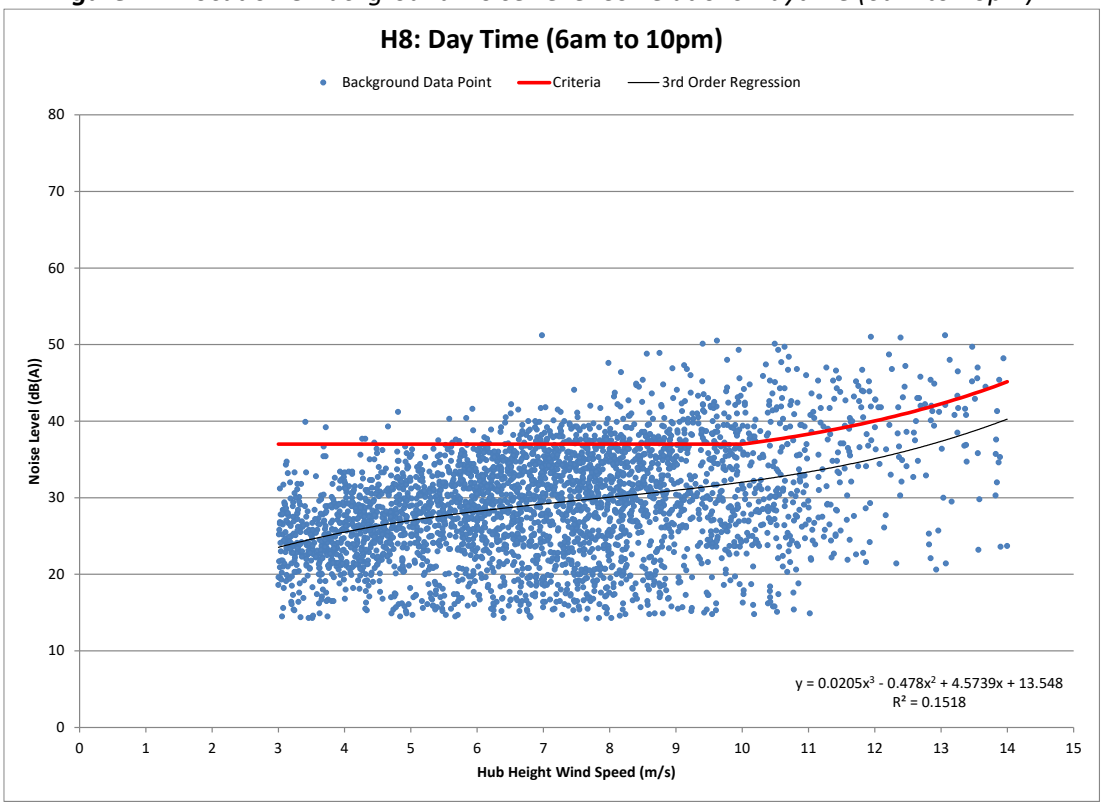


Figure D8: *Location 8 Background Noise Level Correlations Night-time (before 6am or after 10pm)*

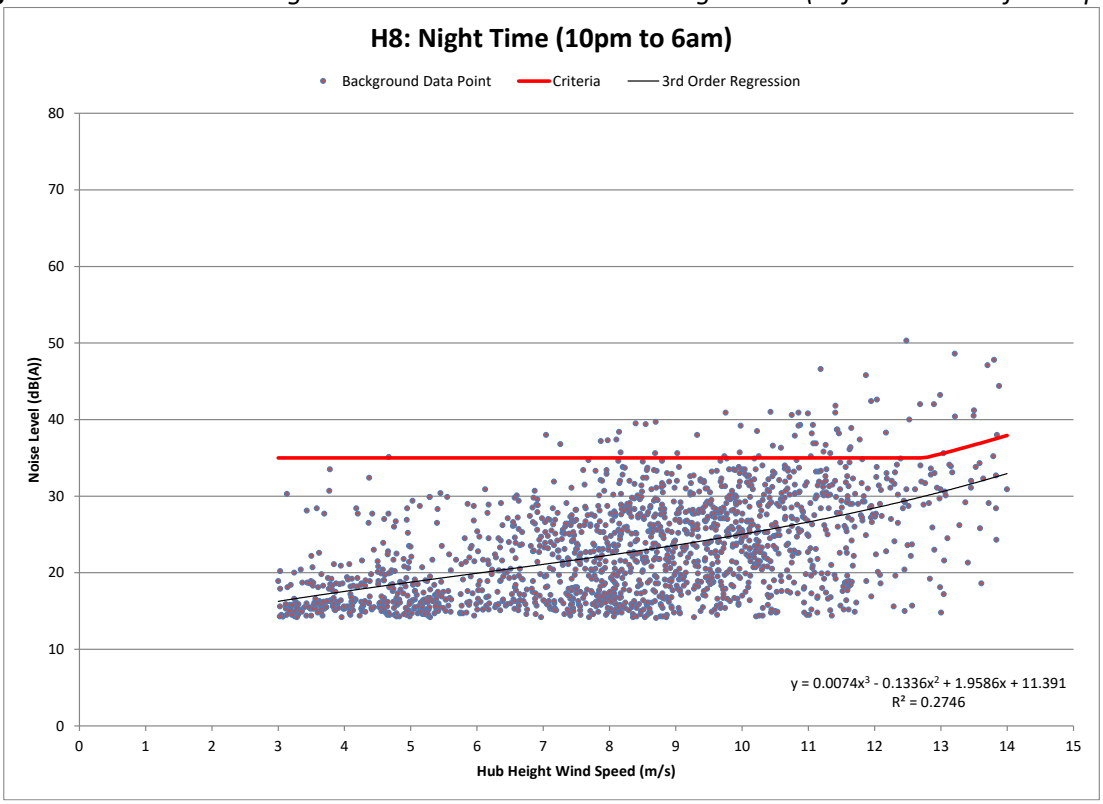


Figure D9: *Location 32 Background Noise Level Correlations Daytime (6am to 10pm)*

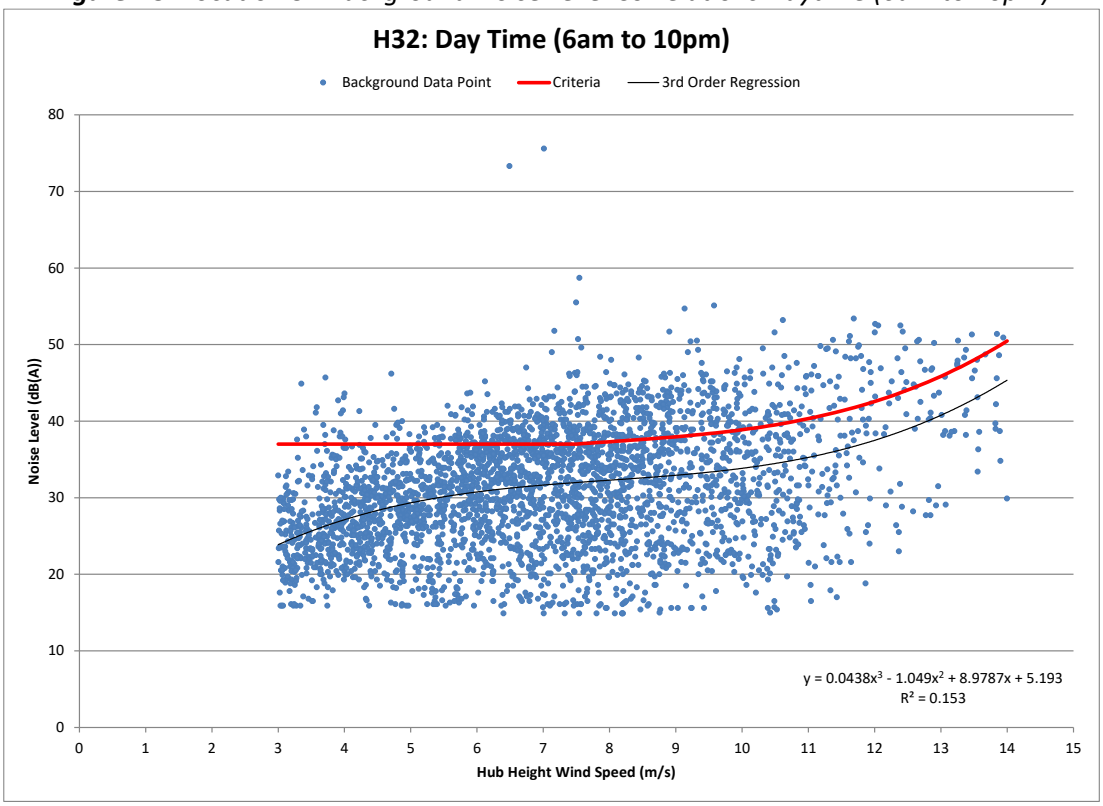


Figure D10: *Location 32 Background Noise Level Correlations Night-time (before 6am or after 10pm)*

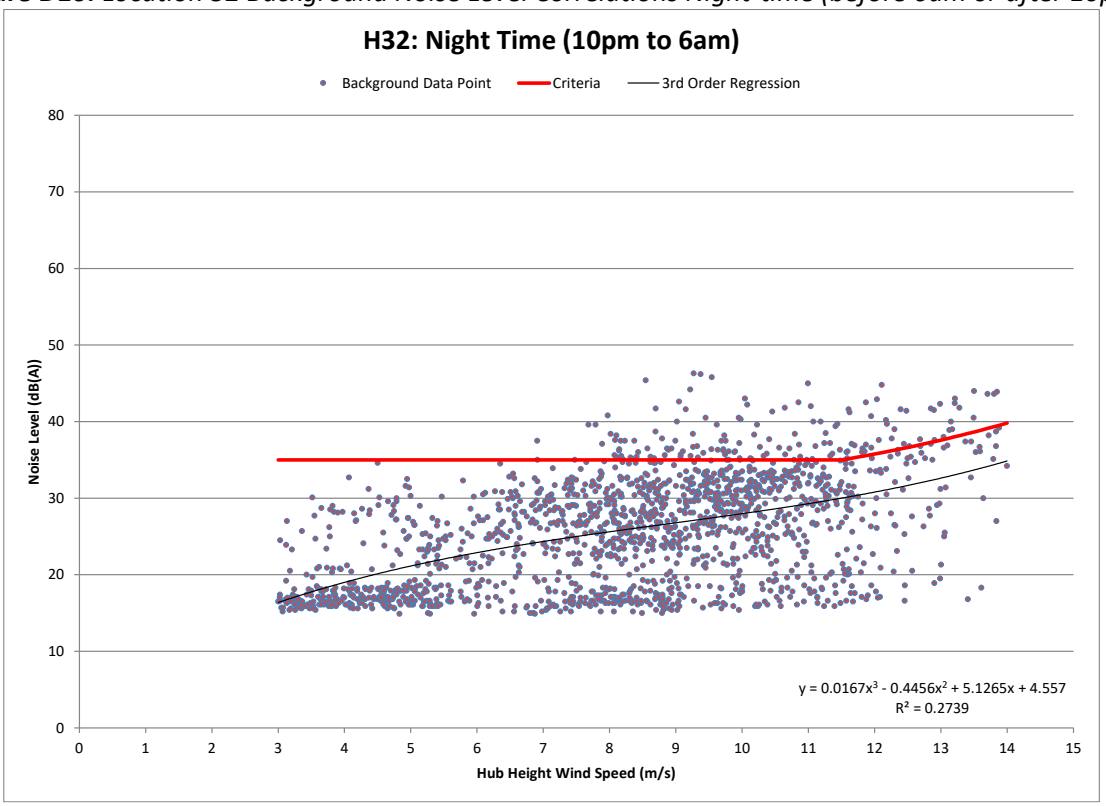


Figure D11: *Location 43 Background Noise Level Correlations Daytime (6am to 10pm)*

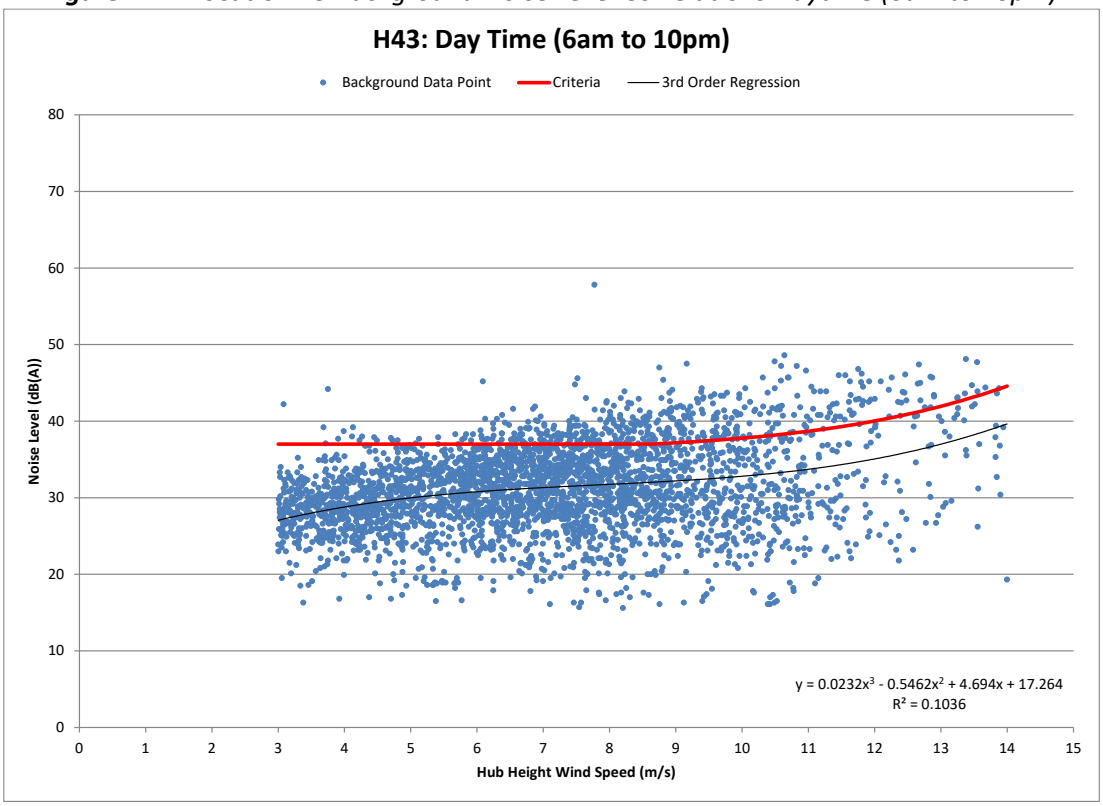


Figure D12: *Location 43 Background Noise Level Correlations Night-time (before 6am or after 10pm)*

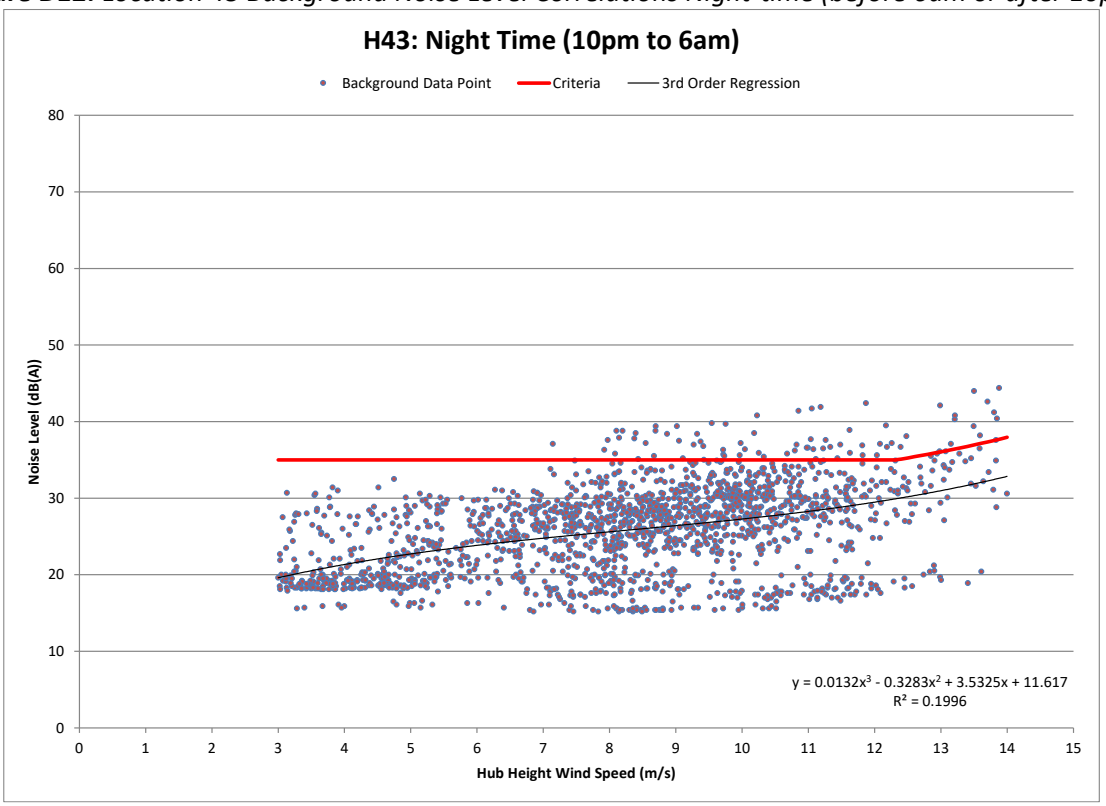


Figure D13: *Location 111 Background Noise Level Correlations Daytime (6am to 10pm)*

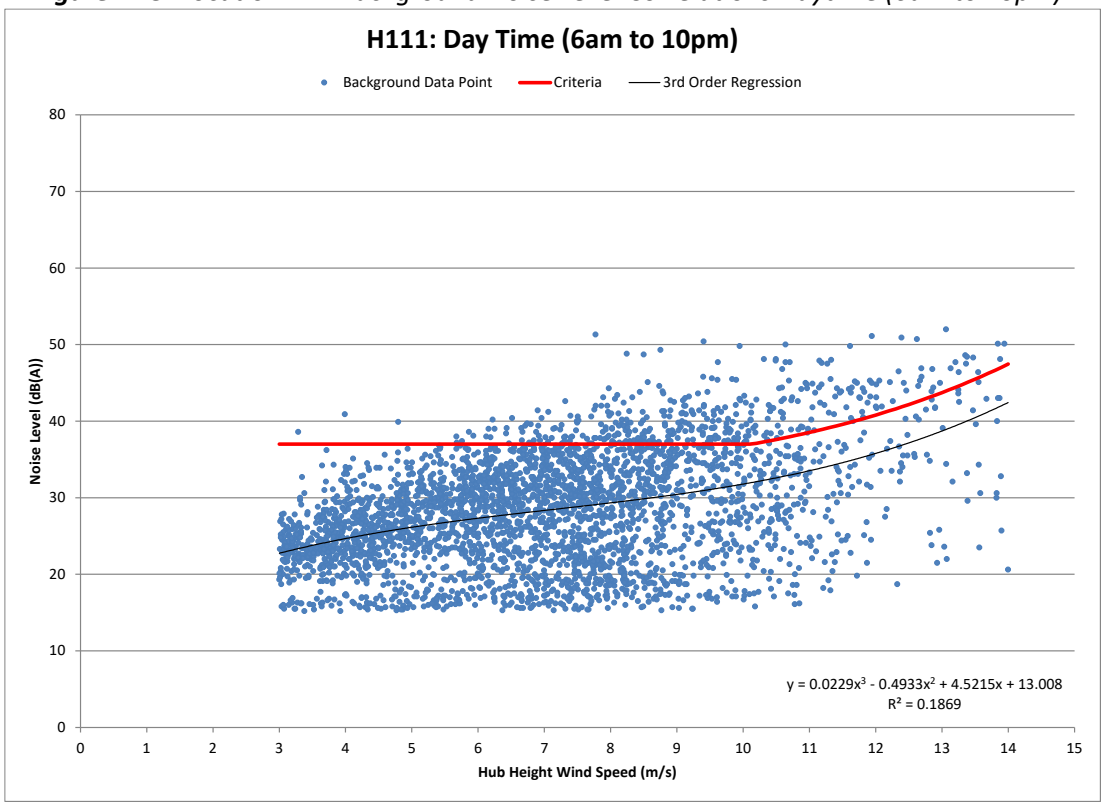


Figure D14: *Location 111 Background Noise Level Correlations Night-time (before 6am or after 10pm)*