WOOD & GRIEVE ENGINEERS

Graythwaite Stage 1- Sydney Church of England Grammar School (Shore)

Noise Compliance Assessment

Angus Gardner, Shore
23/04/2014

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Revision

REVISION	DATE	COMMENT	APPROVED BY
1	17/04/14	For comments	ORFG
2	23/04/14	Following comments	ORFG

Contents

1. INTRODUCTION

Wood & Grieve Engineers has been engaged by Sydney Church of England Grammar School (SHORE) to provide acoustic compliance testing report for the refurbishment of The Graythwaite Stage 1 - Sydney Church of England Grammar School located at Blue Street, North Sydney. This report aims to address condition E1 to comply with the Occupation Certificate requirements.

This assessment has been prepared considering the SLR Consulting Acoustic Impact Assessment (Ref. 10-8964 R1) dated 28th September 2011.

The assessment analyses the noise generated by the new mechanical plants to evaluate whether it complies with the criteria which includes:

- North Sydney Development Control Plan 2002.
- NSW Department of Environmental, Climate Change and Water (DECCW) Industrial Noise Policy (INP).

The report provides:

- A noise assessment for compliance with the aforementioned policies and standards.

This noise assessment is based on noise data collected from short term attended measurements on the ground level nearby the mechanical plants using a type 1 sound level meter on 16th April 2014. The measurements have been conducted in general accordance AS 1055 1997 Acoustics — Description and measurement of environmental noise.

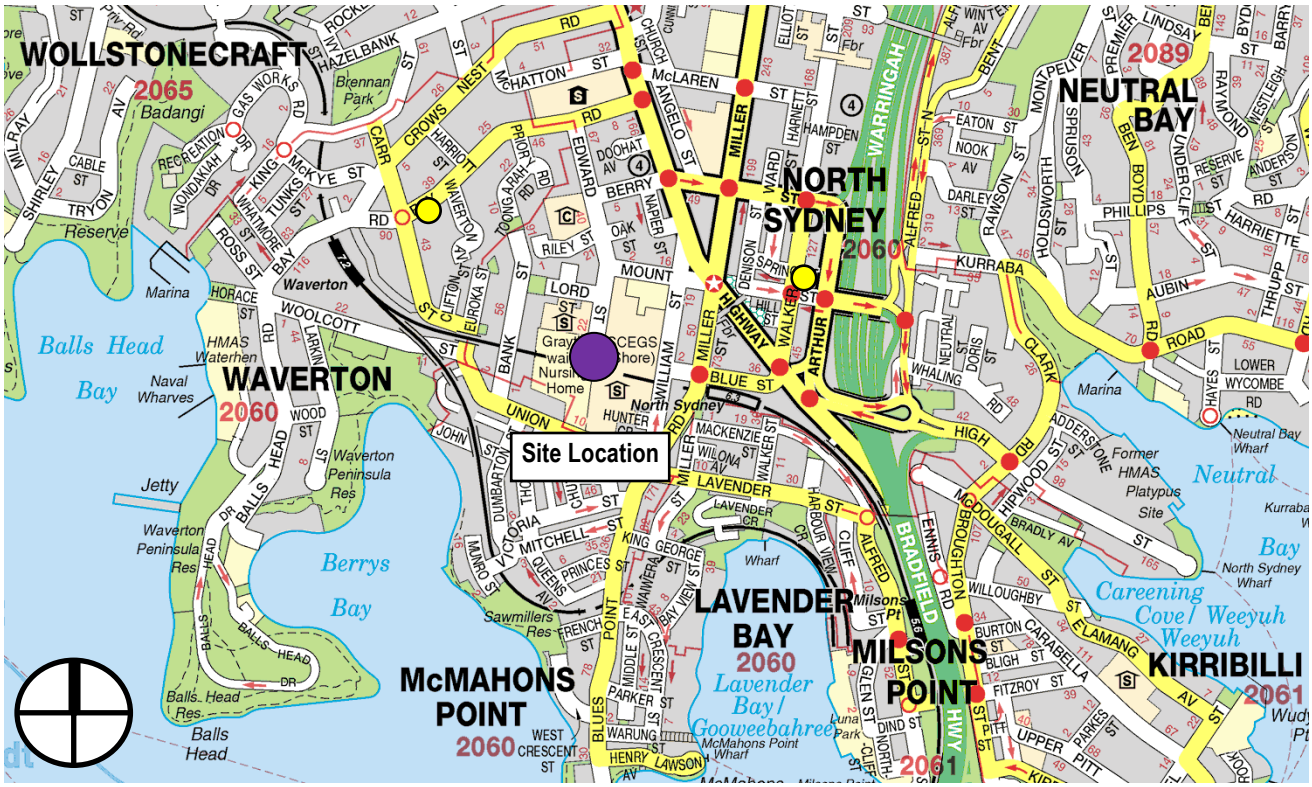
This report is based on our understanding of the proposed project, application of the relevant state guidelines and professional experience within the acoustic field. Therefore this report shall not be relied upon as providing any warranties or guarantees.

2. SITE DESCRIPTION

The Graythwaite Stage 1 - Sydney Church of England Grammar School (SHORE) educational buildings are located on Blue Street, North Sydney. The nearest residential areas are situated along Union St and Bank Street to the South and West of the new mechanical plant on the site, respectively. Figures 1 and 2 provide details of the site, the surrounding area and noise sensitive locations.

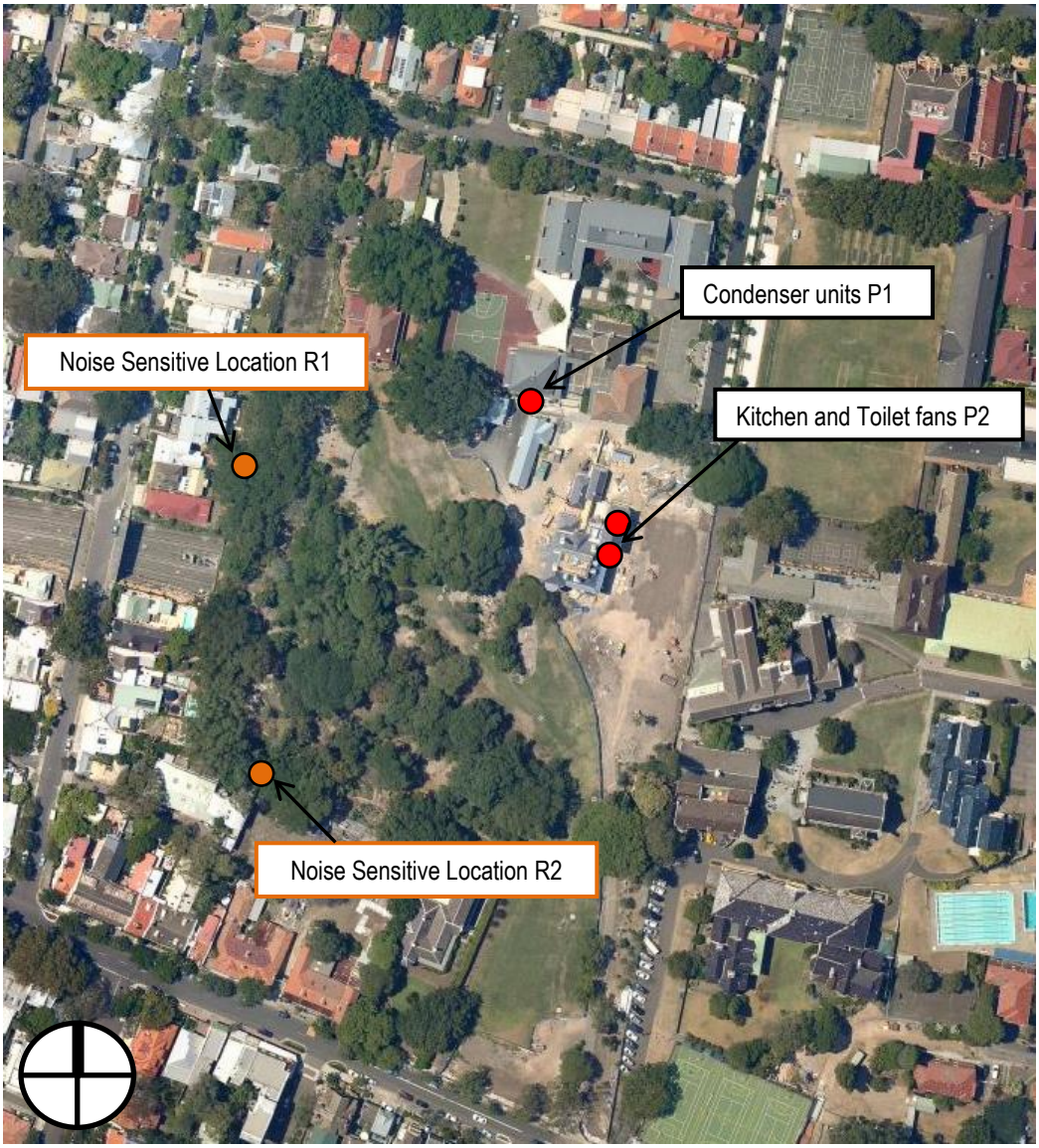
The measurement positions respective to the mechanical plant are illustrated in Figure 2.

Figure 1: Site Location and Surrounding Area



Source: *Australian City Streets UBD v6.0*

Figure 2: Aerial Photo of the Area Showing an Overview of the Site and Measurements



***Source**: Nearmap.com*

2.1 Existing Ambient Noise Levels and Noise Criteria

Section 4.2.2 of the Acoustic Impact Assessment (Ref. 10-8964 R1) prepared by SLR Consulting outlines the existing ambient noise levels based on their measurements conducted between 01/09/2010 – 09/09/2010. These measurements have been used as the basis of the proposed noise criteria (outlined in the subsequent section).

3. NOISE CRITERIA

The noise criteria was previously defined in the submitted Acoustic Impact Assessment prepared by SLR Consulting on 28th September 2011 (Document reference 10-8964 R1). The noise criteria has been based on un-attended measurements conducted by SLR Consulting between the dates 01/09/2010 – 09/09/2010.

The noise criteria for the mechanical systems have been based using NSW DECCW Industrial Noise Policy (INP) considering both the amenity and Intrusiveness components. The most stringent criteria from the Amenity and Intrusiveness have been used to define the overall project criteria, these criteria have been summarized below in Table 1 and Table 2.

Table 1: Project Criteria for Bank St Defined in SLR Acoustic Impact Assessment (10-8964 R1)

Period	Descriptor	Criteria dB(A)
Day	$L_{Aeq,15min}$	47
Evening	$L_{Aeq,15min}$	43
Night	$L_{Aeq,15min}$	39

Table 2: Project Criteria for Union St Defined in SLR Acoustic Impact Assessment (10-8964 R1)

Period	Descriptor	Criteria dB(A)
Day	$L_{Aeq,15min}$	47
Evening	$L_{Aeq,15min}$	41
Night	$L_{Aeq,15min}$	39

The noise criteria presented in the tables above have been used as the basis for this noise compliance assessment.

4. NOISE ASSESSMENT

4.1 Overview of installed mechanical plant

The main mechanical sources associated with the development include:

- 4 External Condenser Units located next to the Multi Activity Centre building southern façade (see Figure 2 and Figure 3)
- 1 Kitchen Exhaust Fan (KEF) located on the roof space of the Graythwaite building
- 1 A Toilet Exhaust Fan (TEF) located on the roof space of the Graythwaite building

It should be noted that the External condenser units assessed in this report service the Tom O'Neil Centre, Coach House, Multi-activity centre and the Graythwaite House.

Figure 3: New Mechanical plants (Condensers units in red and TEF and KEF in blue)

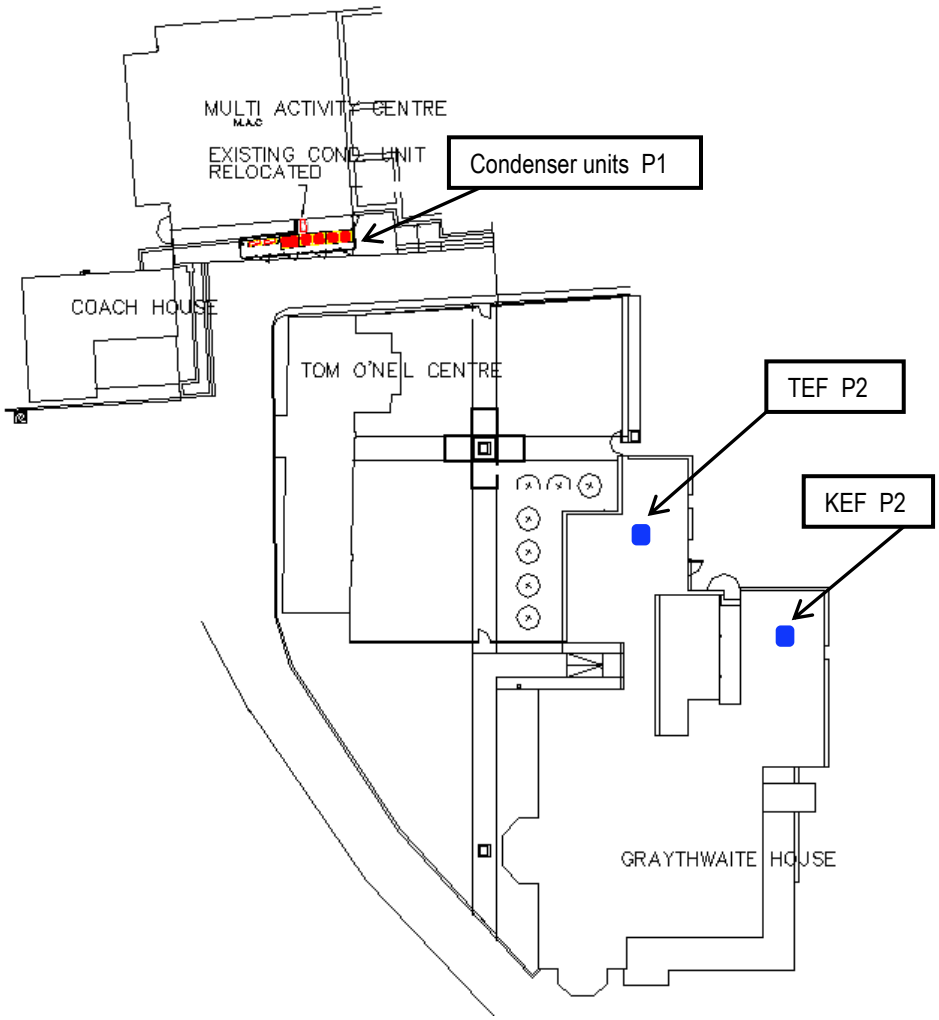
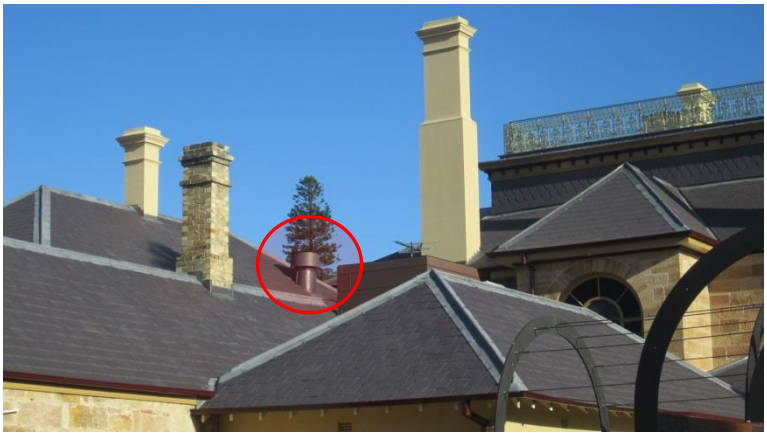


Figure 4: New Mechanical plant (Condensers units next to the multi activity centre) during the noise measurements

Figure 5: New toilet exhaust fan within the red circle (Graythwaite building)

Figure 6: New kitchen exhaust fan within the red circle (Graythwaite building)



4.2 Compliance testing

In order to assess the noise from the installed mechanical plant, compliance measurements were conducted on the 16th April 2014. As the site overall background was noisy because of the construction works occurring on site noise measurements were conducted next to the mechanical units to be able to calculate at the nearest residential receivers the potential noise impact (R1 and R2 shown in Figure 2).

In total, 7 measurements were performed in the specified locations with all the mechanical plant switched ON in a heating mode from the condensers and full speed for the fans (worst case scenario) according to the builder (Daniel Bacic, Carfax).

Measurements were performed during the daytime period as we have been advised the building is not expected to be operating during night time. A summary of the results is shown in Table 3.

Table 3: Noise Measurements Results L_{eq} – L_{90} dB(A)

Measurement Position (see Figure 2)	Period (Day)	$L_{Aeq\ (1min)}$	$L_{90\ (1min)}$	Notes
P1 (@ 2m)	Day	61.3	59.1	(1) As the condensers units are located in the middle of the educational buildings mostly of the noise from there to the boundaries will be sheltered by them acting like noise barriers.
		60.5	58.5	
		59.7	58.9	
		59.2	58.3	
		60.7	59.6	
		58.4	57.9	
		59.8	58.5	
P2		Inaudible	Inaudible	(2) The noise from the fans is sheltered by the Graythwaite roof
R1		Inaudible	Inaudible	(1) and (2)
R2		Inaudible	Inaudible	

4.3 Predicted Noise Levels

As the project is an educational building, we have been advised its normal operation hours will be from 7am until 10pm, therefore, only day and evening period times are considered in this assessment.

Table 4 below is presented with the predicted noise levels at the boundary of the nearest receiver.

Table 4: Predicted noise levels LAeq – dB(A)

Location See Figure 1	Period	Noise Criteria	Predicted Noise Levels – dB(A)	Complies (Yes/No)
Noise Sensitive Location R1	Day (7:00am – 6:00pm)	47	< 24	Yes
	Evening (6:00pm – 10:00pm)	43		Yes
Noise Sensitive Location R2	Day (7:00am – 6:00pm)	47	< 22	Yes
	Evening (6:00pm – 10:00pm)	41		Yes

The results presented in Table 4 show that both the day and evening time criteria are to be met at the boundary of the potentially most affected receivers. The predicted expected noise levels are very low due large proximity between the mechanical units and the nearest affected receivers.

5. CONCLUSION

This report presents a noise impact assessment associated with the new installed mechanical units located within the Graythwaite Stage 1 - Sydney Church of England Grammar School (Shore) at Blue Street, North Sydney. These installed mechanical units service the Tom O'Neil Centre, Coach House, Multi-activity centre and the Graythwaite House within the school.

This report has provided a noise assessment for the external mechanical plants of the new refurbishment in compliance with the North Sydney DCP 2002 and NSW DECCW Industrial Noise Policy. The noise levels for the external mechanical plant showed that the most stringent noise criteria (day, evening and night time criteria) shall be met at the boundary of the potentially most affected receivers.

We conclude therefore that the development, as described in this report, complies with the required Council conditions to issue the Occupation Certificate for the building.

Appendix 1 – Glossary of Terms

NOISE

Acceptable Noise Level: The acceptable L_{Aeq} noise level from industrial sources, recommended by the EPA (Table 2.1, INP). Note that this noise level refers to all industrial sources at the receiver location, and not only noise due to a specific project under consideration.

Adverse Weather: Weather conditions that affect noise (wind and temperature inversions) that occur at a particular site for a significant period of time. The previous conditions are for wind occurring more than 30% of the time in any assessment period in any season and/or for temperature inversions occurring more than 30% of the nights in winter).

Acoustic Barrier: Solid walls or partitions, solid fences, earth mounds, earth berms, buildings, etc used to reduce noise, without eliminating it.

Ambient Noise: The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.

Assessment Period: The period in a day over which assessments are made.

Assessment Location: The position at which noise measurements are undertaken or estimated.

Background Noise: Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the $\mathbf{L_{90}}$ noise level.

Decibel [dB]: The units of sound pressure level.

dB(A): A-weighted decibels. Noise measured using the A filter.

Extraneous Noise: Noise resulting from activities that are not typical of the area. Atypical activities include construction, and traffic generated by holidays period and by special events such as concert or sporting events. Normal daily traffic is not considered to be extraneous.

Free Field: An environment in which there are no acoustic reflective surfaces. Free field noise measurements are carried out outdoors at least 3.5m from any acoustic reflecting structures other than the ground.

Frequency: Frequency is synonymous to pitch. Frequency or pitch can be measured on a scale in units of Hertz (Hz).

Impulsive Noise: Noise having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.

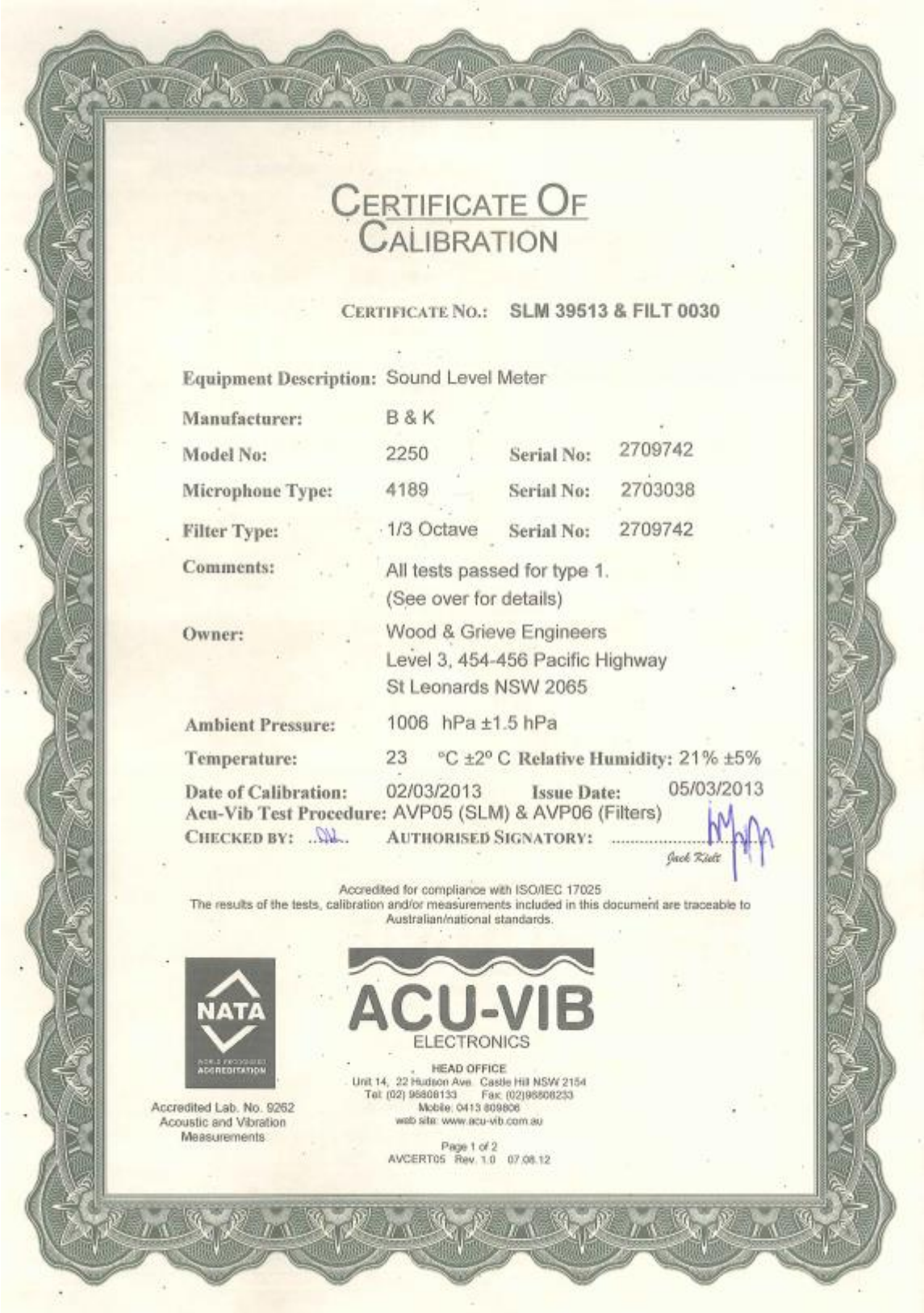
Intermittent Noise: Level that drops to the background noise level several times during the period of observation.

$\mathbf{L_{Amax}}$ The maximum sound pressure level measured over a period.

$\mathbf{L_{Amin}}$ The minimum sound pressure level measured over a period.

L_{A1}	The sound pressure level that is exceeded for 1% of the time for which the sound is measured.
L_{A10}	The sound pressure level that is exceeded for 10% of the time for which the sound is measured.
L_{A90}	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L_{90} noise level expressed in units of dB(A).
L_{Aeq}	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.
Reflection:	Sound wave changed in direction of propagation due to a solid object meets on its path.
R-w:	The Sound Insulation Rating R-w is a measure of the noise reduction performance of the partition.
SEL:	Sound Exposure Level is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain Leq sound levels over any period of time and can be used for predicting noise at various locations.
Sound Absorption:	The ability of a material to absorb sound energy through its conversion into thermal energy.
Sound Level Meter:	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound Pressure Level:	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound Power Level:	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
Tonal noise:	Containing a prominent frequency and characterised by a definite pitch.

Appendix 2 – Calibration Certificates



CERTIFICATE OF CALIBRATION

CERTIFICATE NO.: SLM 39513 & FILT 0030

Equipment Description:	Sound Level Meter		
Manufacturer:	B & K		
Model No:	2250	**Serial No:**	2709742
Microphone Type:	4189	**Serial No:**	2703038
Filter Type:	1/3 Octave	**Serial No:**	2709742
Comments:	All tests passed for type 1. (See over for details)		
Owner:	Wood & Grieve Engineers Level 3, 454-456 Pacific Highway St Leonards NSW 2065		
Ambient Pressure:	1006 hPa ±1.5 hPa		
Temperature:	23 °C ±2° C	**Relative Humidity:**	21% ±5%
Date of Calibration:	02/03/2013	**Issue Date:**	05/03/2013
Acu-Vib Test Procedure:	AVP05 (SLM) & AVP06 (Filters)		

CHECKED BY: ..... **AUTHORISED SIGNATORY:** .....
Jack Kielt

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

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CERTIFICATE NO.: SLM 39513 & FILT 0030

The performance characteristics listed below were tested. The tests are based on the relevant clauses of A.S. 1259.1 and A.S. 1259.2 - 1990

1.	RMS Performance	clause 10.4.5
2.	Time Weighting Response, F&S	clause 10.4.2
3.	Time Weighting I	clause 10.4.3
4.	Time Weighting P	clause 10.4.4
5.	Input-Attenuator Accuracy	clause 10.3.3
6.	Detector & Differential Linearity	clause 10.4.1
7.	Weighting Networks & Linearity	clause 10.2.3
8.	Overload Indication	clause 10.3.2
9.	AC Output & Weighted Noise Level	clause 11. (c). (ii) 10.3.4
10.	Time Averaging	clause 9.3.2
11.	Absolute Sensitivity	clause 10.2.2

Note: Absolute Sensitivity as found was 93.8 dB and adjusted to 94.1 dB
Least Uncertainty: ±0.13dB (at 95% c.l.) k=2

This Sound Level Meter included an Octave Filter Set. Tests were based on IEC 1260: 1995 and AS/NZS 4476 - 1997 and were conducted to test the following performance characteristics:

1.	Relative attenuation	clause 5.3

Least uncertainty for relative attenuation (at 95% c.l.) k=2:
±0.1 dB for attenuation equal to an less than 6 dB
±0.3 dB for RA from above 6 dB to 18 dB
±0.6 dB for RA from above 18 dB to 80 dB

Date of Calibration: 02/03/2013 **Issue Date:** 05/03/2013

Checked by:

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.

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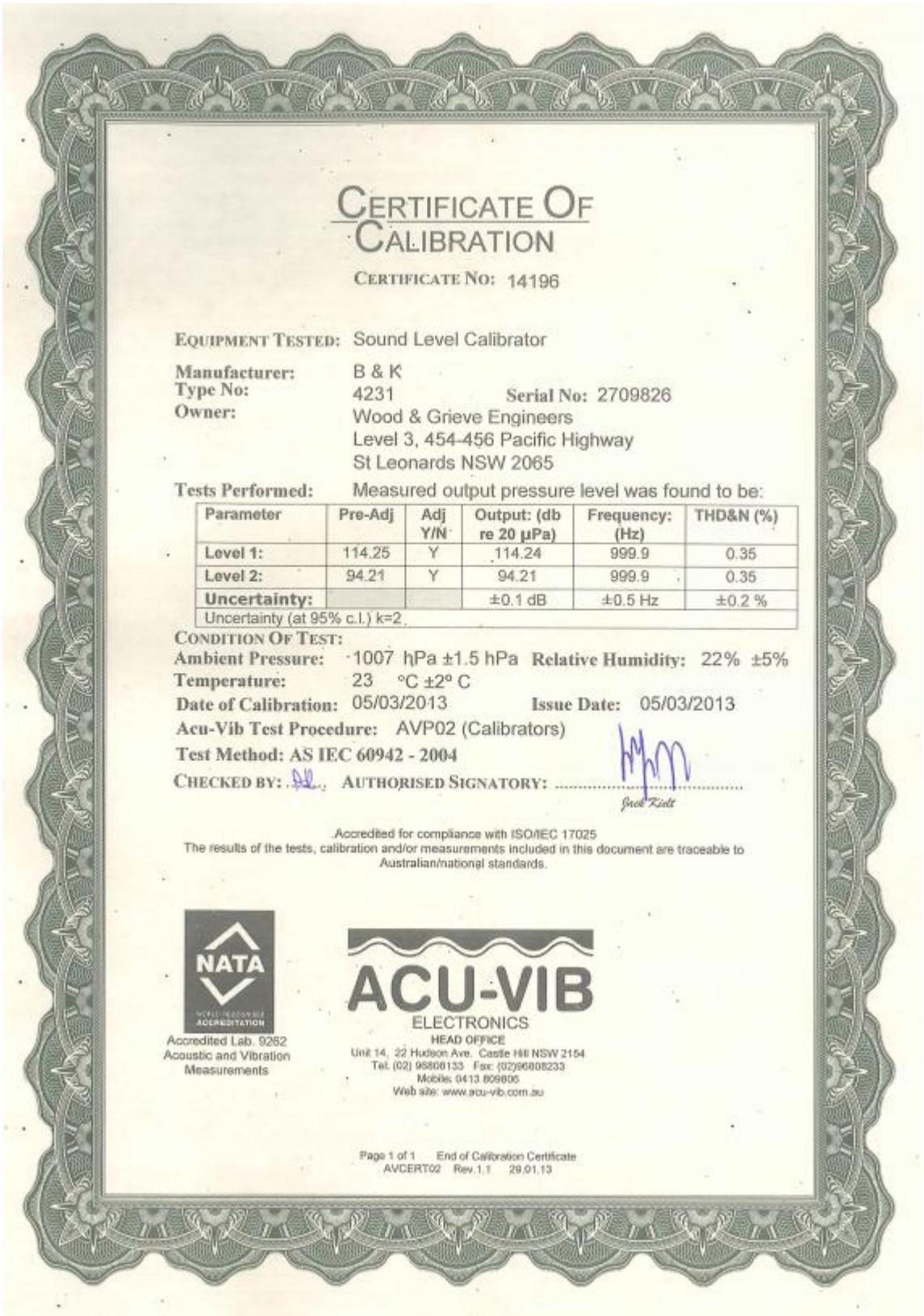
AVCERT05



CERTIFICATE OF CALIBRATION

CERTIFICATE NO: 14196

EQUIPMENT TESTED: Sound Level Calibrator

Manufacturer: B & K
Type No: 4231 **Serial No:** 2709826
Owner: Wood & Grieve Engineers
Level 3, 454-456 Pacific Highway
St Leonards NSW 2065

Tests Performed: Measured output pressure level was found to be:

Parameter	Pre-Adj	Adj Y/N	Output: (db re 20 µPa)	Frequency: (Hz)	THD&N (%)
Level 1:	114.25	Y	114.24	999.9	0.35
Level 2:	94.21	Y	94.21	999.9	0.35
Uncertainty:			±0.1 dB	±0.5 Hz	±0.2 %
Uncertainty (at 95% c.l.) k=2					

CONDITION OF TEST:
Ambient Pressure: 1007 hPa ±1.5 hPa **Relative Humidity:** 22% ±5%
Temperature: 23 °C ±2° C
Date of Calibration: 05/03/2013 **Issue Date:** 05/03/2013
Acu-Vib Test Procedure: AVP02 (Calibrators)
Test Method: AS IEC 60942 - 2004
CHECKED BY: .... **AUTHORISED SIGNATORY:** .....
Jack Kidd

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.

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