Bango Wind Farm

Noise Compliance Testing

S3958.1C9

June 2024

sonus.

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GLOSSARY AND ABBREVIATIONS

Term	Definition
A weighting	Frequency adjustment representing the response of the human ear.
Associated Residence	A residential dwelling where the owner has a commercial agreement with the wind farm developer and/or operator.
Background noise level	The noise level represented by the L_{A90} in the absence of intermittent noise such as vehicles and wind gusts.
Bulletin	Wind Energy: Noise Assessment Bulletin for State Significant Wind Energy Development (NSW Department of Planning and Environment, December 2016)
dB	Linear (unweighted) sound pressure or power level in decibels.
dB(A)	A-weighted noise or sound pressure or power level in decibels.
EPA	NSW Environment Protection Authority
L_{A90}	The A-weighted sound pressure level exceeded for 90% of the measurement period.
NCTP	The Noise Compliance Test Plan for the Wind Farm, prepared by Sonus, reference S3958.1C1, dated February 2019
Noise Criteria	The Operational Noise Criteria provided in Condition 9 (WTGs) and Condition 10 (Ancillary Infrastructure) of Schedule 3 Environmental Conditions – General of the Project Approval Conditions
Non-Associated Residence	A residential dwelling where the owner does not have a commercial agreement with the wind farm developer and/or operator.
Project Approval Conditions	The conditions relating to operational noise emissions from the Wind Farm as detailed in Schedules 3 (and associated Appendices) of the Development Consent for SSD 6686 granted by the Land and Environment Court of NSW (appeal 19/149003) on 7 June 2019
Special Noise Characteristics	Tonality or low frequency as defined by the Bulletin
SSD	State Significant Development
WTG	Wind Turbine Generator
Wind Farm	Bango Wind Farm

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1 INTRODUCTION

Under the Development Consent for *State Significant Development* (**SSD**) 6686 for the Bango Wind Farm (the **Wind Farm**), a post-construction assessment of operational noise from the Wind Farm is required. Specifically, Condition 11 of Schedule 3 of the Development Consent for the Wind Farm (the **Project Approval Conditions**) requires the following:

1. *Within 3 months of the commencement of operations (or the commencement of operation of a cluster of turbines, if the development is to be staged), the Applicant must:*
    a. *Undertake noise monitoring to determine whether the development is complying with the relevant conditions of this consent; and*
    b. *Submit a copy of the monitoring results to the Department and the EPA*.

A Noise Compliance Test Plan (the **NCTP**), with Sonus reference S3958.1C1 (dated February 2019), provides the procedure for the post-construction noise assessment, consistent with the Project Approval Conditions, which are in-turn consistent with the *Wind Energy: Noise Assessment Bulletin for State significant wind energy development December 2016* (the **Bulletin**). The Project Approval Conditions relevant to operational noise are detailed in Appendix A.

Sonus has been engaged by GE Vernova to conduct the post-construction assessment in accordance with the NCTP.

This report summarises the assessment of operational noise levels at four residential locations (**Residential Noise Monitoring Locations**) selected in accordance with the NCTP. The assessment includes analysis of noise monitoring at the residential locations, intermediate locations between the residence and the Wind Farm and near-field locations around representative *Wind Turbine Generators* (**WTGs**). The assessment also includes an assessment of the Special Noise Characteristics of tonality and low frequency in accordance with the NCTP, as well as an assessment of the noise produced by ancillary infrastructure on the Wind Farm site.

2 NCTP TEST METHOD

The NCTP establishes a methodology to determine compliance in accordance with the Project Approval Conditions as well as the Bulletin.

As the Bulletin adopts the 2009 South Australian *Wind Farms – Environmental Noise Guidelines* (The **SA Guidelines**) as the basis for the assessment methodology that applies to *State Significant* Wind Farm projects in NSW, the NCTP has been designed to meet the post-construction compliance checking procedures common to both documents (as set out in Section 4 of the SA Guidelines).

The NCTP provides four Residential Noise Monitoring Locations (each at a Non-Associated Residence) where noise levels from operation of the Wind Farm are to be measured. The coordinates of the four residential noise monitoring locations are provided in Table 1 below.

Table 1: Residential noise monitoring locations

Receiver	Type	Associated	Coordinates (GDA94 MGA55)	
			Easting	Northing
BAN152	House	No	674475	6171888
BAN238	House	No	670657	6166162
BAN260	House	No	661449	6169886
BAN282	House	No	666714	6178407

Where the noise levels measured at the above locations demonstrate that the Noise Criteria specified by Condition 9 of the Project Approval Conditions are achieved at each specified wind speed (from 3 m/s to 12 m/s inclusive), the noise from the Wind Farm will be deemed to be in compliance with the Noise Criteria at this location.

Where the Wind Farm is shown to be compliant with the Noise Criteria at the above Residential Noise Monitoring Locations, the Wind Farm is compliant with the Project Approval Conditions and the Bulletin in accordance with the NCTP.

The Noise Criteria that apply at each of the above Residential Noise Monitoring Locations were provided in the *Revised Environmental Noise Assessment* (Sonus Report S3958.1C3, dated May 2019), and are reproduced in Table 2 below. The Noise Criteria for BAN152 and BAN282 are as specified by Condition 9 of the Project Approval Conditions, while the Noise Criteria for BAN238 and BAN260 are based on "*the higher of 35 dB(A) or the existing*

background noise level ($L_{A90\ (10\text{-}minute)}$ plus 5 dB(A)" as specified by the Project Approval Conditions. As background noise monitoring was not conducted at either of these residences, the Noise Criteria have considered the background noise levels measured at the closest monitoring location on the same side of the Wind Farm (BAN060 (for BAN260) and BAN076 (for BAN260)).

Table 2: Noise Criteria (WTGs)

Receiver	Noise Criteria [dB(A)] at integer Hub Height Wind Speeds [m/s]									
	3	4	5	6	7	8	9	10	11	12
BAN152	35	35	36	36	37	37	38	39	40	42
BAN238	35	35	35	35	35	35	35	35	37	39
BAN260	36	36	36	37	37	37	37	38	38	40
BAN282	35	35	35	35	35	35	35	35	35	37

In accordance with the NCTP, near-field and intermediate noise measurements were conducted for the purpose of determining the character of noise (tonality) from the WTGs and enabling noise from other sources to be excluded from the data analysis. The testing was conducted at locations where the noise from other sources in the environment was minimised (in comparison to the noise level from WTGs) and therefore the results can assist in determining compliance at the Residential Noise Monitoring Locations when the noise from WTGs is masked by other sources.

3 NEAR FIELD AND INTERMEDIATE MEASUREMENTS

3.1 Near Field Measurements

Near-field measurements were conducted at two representative WTGs (BAN012 and BAN020) between 13 and 15 December 2023, for the purposes of determining the frequencies of potential tones and the wind speeds at which they occur. The noise measurements were conducted in accordance with the NCTP, which in turn references IEC 61400-11 Edition 3.0 (2012).

It is noted that, although allowed for by the NCTP, high wind speed noise data has not been filtered based on the near-field data. Rather the assessment has been conducted for the full range of wind speeds for which Noise Criteria are specified in the Project Approval Conditions (3 m/s to 12 m/s).

3.1.1 Data Collection

Noise measurements were made using Class 1 Rion NL-52A, NATA calibrated, sound level meters equipped with one-third octave band analysers. The sound level meters were calibrated before and after the measurements using a Class 1 Rion NC-74 calibrator (serial number 35094478), with negligible drift observed.

The measurements were taken in the proximity of two representative turbines, BAN012 and BAN020. The WTGs operated at power outputs ranging from cut-in to rated power during the monitoring period. The measurement locations are provided in Table 3 along with the serial number of the sound level meters used, and the downwind direction to the relevant WTG. The calibration certificates are provided in Appendix B.

Table 3: Near-field measurement locations

WTG	Sound Level Meter Serial Number	Coordinates (GDA 94 MGA 55)		Slant Distance (m)	Downwind Direction (˚)
		Easting	Northing		
BAN012	00331171	663226	6173959	238	285
BANO20	00331170	665328	6172005	235	283

A Rion WS-15 all-weather wind shield was fitted to the microphone at both locations. An example of the near field monitoring installation is shown in Figure 1 below.

Figure 1: Typical near field monitoring installation

3.1.2 Tonality Assessment

An assessment has been made considering the Special Noise Characteristic of tonality at the near-field locations in accordance with ISO 1996-2:2007 Annex D as required by the Bulletin.

The level of tonality for each integer wind speed between 3 m/s and 12 m/s (consistent with the range of wind speeds identified in the Project Approval Conditions) has been determined based on the downwind unweighted one-third octave band energy-average equivalent sound pressure level (L_{eq}) data measured at WTGs BAN012 and BAN020, filtered to exclude data where the WTG did not operate.

Based on the assessment, a tone was identified in the near field noise emissions of the WTGs at a range of wind speeds within the 160 Hz one-third octave band (at BAN020 only), for 10% of the periods within a single integer wind speed bin (at 8 m/s), and a total of 4% of the measured downwind periods. Tonality has therefore been considered at the Residential Noise Monitoring Locations for the 160 Hz one-third octave band. This assessment is detailed in Section 4.9.1.

A tone was also identified within the 2 kHz one-third octave band at both WTGs at a range of wind speeds. The tone was present for 11% of the periods within a single integer wind speed bin (at 12 m/s) but only 2% of all measured downwind periods. Review of the digital audio collected during the measurements identified insect noise within this frequency range which may have contributed to the noise measured. Notwithstanding, a further analysis was conducted of the potential for tonality at this frequency to be audible at residences. A noise model was constructed based on the measured noise level at 2 kHz and the CONCAWE noise propagation model. The predicted noise level at the nearest Non Associated Residence (BAN282) in the 2 kHz one-third octave band is less than 4 dB(A). Any potential tone at this level would not be audible in the overall acoustic environment. Lower noise levels are predicted at Non Associated Residences further from the Wind Farm. Based on this analysis, tonal noise within the 2 kHz one-third octave band not been considered further.

3.2 Intermediate Measurements

Noise monitors were placed at Intermediate Positions between the turbines and Residential Noise Monitoring Locations as recommended by the NCTP for the duration of the monitoring period. The Intermediate Positions were selected within open paddocks between the residential noise monitoring locations and the nearest WTG, and where a higher Wind Farm noise to background noise level ratio is expected to occur (i.e. the noise level from the Wind Farm is likely to be more readily measurable above the level of background noise). The intermediate noise monitors operated simultaneously with those placed at Residential Noise Monitoring Locations throughout the 6-week monitoring period.

The data collected at the Intermediate Positions allowed for periods to be identified where the noise level at the Residential Noise Monitoring Location was higher than at the Intermediate Position (closer to the WTGs), or where the frequency content at the Residential Noise Monitoring Location was inconsistent with that of the Intermediate Position.

The noise level was measured at the Intermediate Locations using Rion NL-42A Class 2, NATA calibrated, sound level meters. The coordinates of the Intermediate Locations and the serial numbers of the sound level meters used are provided in the following table, with the corresponding calibration certificates attached in Appendix B.

Table 4: Intermediate Noise Monitoring Locations

Residence	Sound Level Meter (Serial Number)	Coordinates (GDA 94 MGA zone 55)	
		Easting	Northing
BAN152 Intermediate	Rion NL-42A (00923595)	673957	6171895
BAN238 Intermediate	Rion NL-42A (01224051)	671895	6166402
BAN260 Intermediate	Rion NL-42A (01224052)	661769	6170034
BAN282 Intermediate	Rion NL-42A (01224054)	666455	6178093

3.2.1 Intermediate Validation Point

In accordance with the NCTP, a publicly accessible intermediate point has been identified to allow future validation of the noise model. None of the intermediate locations used for the monitoring were able to be placed within public property, as such an additional location has been identified for this purpose. The intermediate validation point has been selected to be representative of the Non-Associated Residence where the highest noise level is predicted by the noise model (BAN152).

The coordinates of the publicly accessible intermediate point (adjacent to Wargeila Road) are provided in Table 5 below. This location has also been overlaid on a noise contour plan in Figure 2.

Table 5: Publicly accessible intermediate validation point co-ordinates

Location	Coordinates (GDA 94 MGA 55)	
	Easting	Northing
Intermediate validation point	674378	6170278

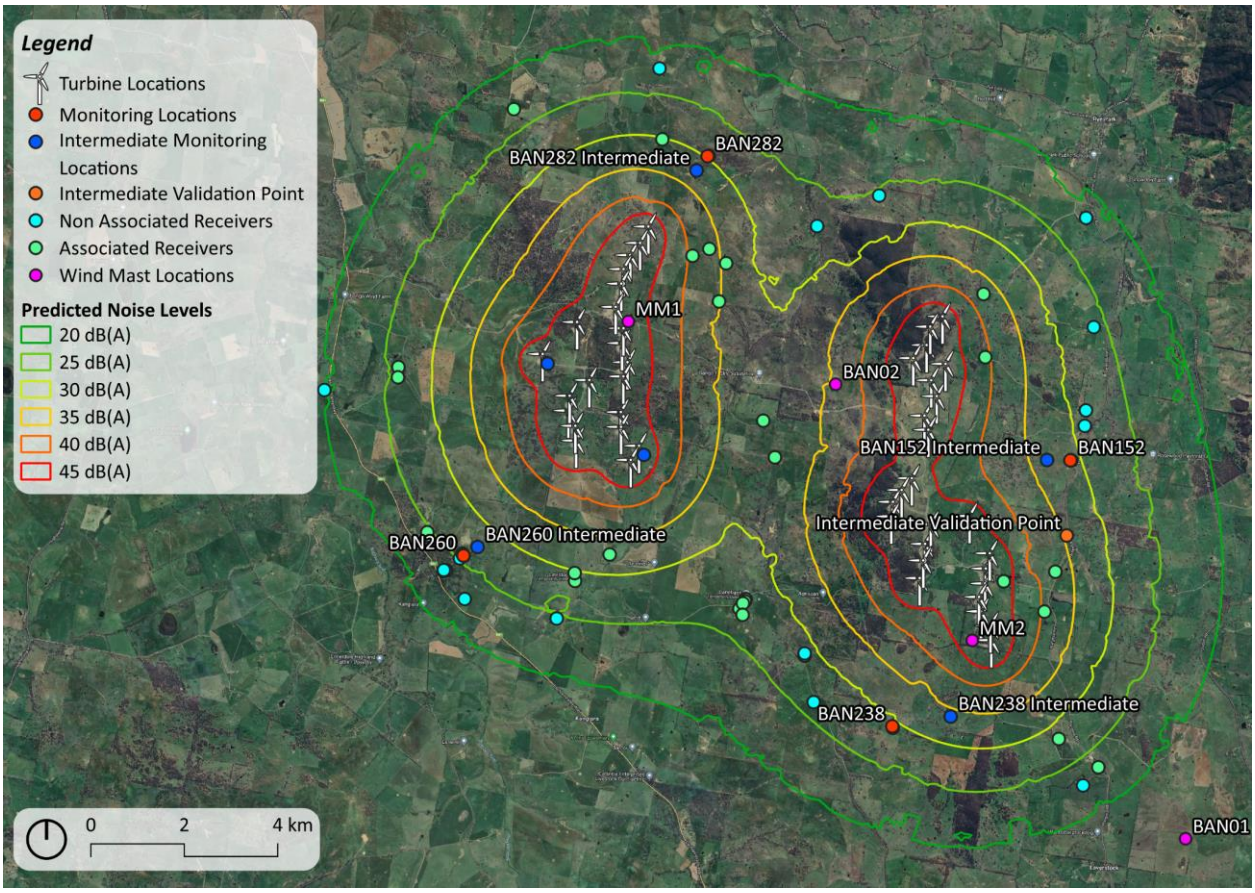

Figure 2: Noise contours and residential noise monitoring locations

4 RESIDENTIAL NOISE MONITORING

4.1 Monitoring Locations

Noise monitoring was conducted at four residences in the vicinity of the Wind Farm continuously over a six week period between 11 December 2023 and 23 January 2024 (inclusive). The residences were selected consistent with those used for the pre-construction background noise monitoring and identified in the NCTP. The coordinates of each Residential Noise Monitoring Location are shown on Figure 2 above.

Table 6: Residential Noise Monitoring Locations

Residence	Sound Level Meter (Serial Number)	Coordinates (GDA 94 MGA 55)	
		Easting	Northing
BAN152	Rion NL-42A (00923782)	674457	6171889
BAN238	Rion NL-42A (00923783)	670645	6166193
BAN260	Rion NL-42A (00923691)	661466	6169848
BAN282	Rion NL-42A (01224053)	666691	6178399

The noise monitoring equipment at each residence was installed at a position equivalent to the background noise monitoring location used prior to construction of the Wind Farm. This position was within 20 metres of the residence and at least 5 metres from building facades (to remove the effects of large reflecting surfaces). The loggers were placed such that buildings at the residence did not block line of sight to the closest turbines. Photographs of the noise monitoring equipment at each residential logging location is provided in Appendix C.

4.2 Equipment

At each monitoring location, sound pressure level data were measured using a NATA calibrated (within the preceding 24 months) Rion NL-42A Class 2 sound level meter (with a noise floor of less than 20 dB(A)). Each sound level meter was fitted with a Rion WS-15 all-weather windshield, and calibrated immediately before and at the conclusion of the monitoring program using a NATA calibrated (within the preceding 12 months) Class 1 Rion NC-74 calibrator (serial number 35094478) with no significant drift observed. The serial numbers of the sound level meters used at each location are provided in Table 1 above, with the corresponding calibration certificates for the calibrator and sound level meters provided in Appendix B.

4.3 Acoustic Data

As required by the Project Approval Conditions, sound pressure level data were gathered at each monitoring location in accordance with the requirements of the Bulletin. Specifically, A-weighted sound pressure level data were gathered in 10-minute intervals ($L_{A90,\ 10\ minute}$) consistent with the compliance checking procedures described in Section 4 of the SA Guidelines.

4.4 Local Weather Data

In addition to the noise monitoring, monitoring of local rainfall and wind speed was conducted at two locations (BAN282 and BAN152). The rainfall data and the measured wind speed at microphone height were used to identify periods where noise data might have been adversely affected by local weather conditions. For locations where local weather monitoring equipment was not installed, data from the closest residence where local weather monitoring was conducted has been used in the analysis.

4.5 Wind Speed and Direction

Prior to the construction of the Wind Farm, there were two meteorological masts installed at the site (BAN01 and BAN02). The Noise Criteria were derived based on the wind speed referenced to BAN02. During the noise monitoring, wind speed and direction were monitored at two permanent meteorological masts (MM1 and MM2) located around the Wind Farm. To facilitate a consistent comparison of the post-construction noise monitoring results with the Noise Criteria, the wind speed and direction data collected at MM1 was used as the basis for modelling wake free wind speed and direction data at the location of pre-construction meteorological mast BAN02 (which has since been decommissioned). The data set at this location was provided by *Wind Pioneers* for a height corresponding to the hub height of the turbines (121 metres) to facilitate this analysis. The locations of the meteorological masts are provided below:

Table 7: Meteorological Mast Locations

	Coordinates (GDA 94 MGA zone 55)	
	Easting	**Northing**
BAN01 (Pre-construction Mast)	676922	6163787
BAN02 (Pre-construction Mast)	669433	6173516
MM1 (Operational Mast)	664995	6174862
MM2 (Operational Mast)	672355	6168033

4.6 Data Analysis

The data measured at the Residential Noise Monitoring Locations was filtered in accordance with the process described in the NCTP. Specifically, data was filtered in the following circumstances:

- Where the relevant period was affected by rain, hail, or wind based on a weather logger placed at an equivalent location to one of the noise loggers. Data is considered to be affected where precipitation occurs in a 10-minute period either side of the period in question or where a wind speed of 5 m/s is exceeded for 90% of a 10-minute period.
- Where the wind direction within a relevant period was more than 45 degrees either side of the direct line between the nearest WTG and the relevant receiver.
- Where the hub height wind speed was outside of the Noise Criteria range specified in the Project Approval Conditions (3 m/s to 12 m/s).

In addition, in accordance with the NCTP, high frequency noise from insects was also filtered as one-third octave band spectra and audio recordings indicated that insects were significant contributors to the overall noise levels. To determine the relative contribution of Wind Farm noise and extraneous noise sources (in particular insects) to residential noise levels within the high frequencies (1.6 kHz one-third octave band and above), the predicted noise level from the WTGs was calculated based on the noise levels measured within these one-third octave bands in the near field. Based on the measured near field data, the highest contribution of the Wind Farm to high frequency noise levels at a Non Associated Residence is 10 dB(A). On this basis, WTG noise within these high frequencies cannot contribute to overall broadband Wind Farm noise levels at Non Associated Residences, and the noise levels measured in these one-third octave bands are unrelated to operation of the Wind Farm and have therefore been filtered from the dataset.

Note that, although the NCTP allows for removal of data where the noise measured in the same period at an intermediate position closer to the WTGs was at a lower level than at the receptor location, no data was removed via this method.

The number of valid data points remaining for each Residential Noise Monitoring Location following filtering of adverse data is summarised in Table 8 below. The relevant wind mast used to conduct the correlations is also provided for each Residential Noise Monitoring Location.

Table 8: Number of valid data pairs and relevant wind mast

Testing Location	Total Data Points Collected	Filtered for:				Total Data Points Removed	Valid Data Points
		Local Wind/Rain	Downwind Only	Wind Speed	Manually Filtered		
BAN152	5993	386	4642	1499	0	4918	1075
BAN238	5996	396	4887	1500	0	5180	815
BAN260	5996	568	4963	1500	7	5331	665
BAN282	5996	565	5056	1499	0	5269	727

Following the removal of data as described above, the remaining noise data were correlated with the hub height wind speed data for each residential logging location.

Second and third order regression analyses were performed on the correlations to determine the noise levels at each wind speed and to facilitate a comparison with the Noise Criteria. In all cases, the coefficient of determination (R2) for the third order regression was higher than that of the corresponding second order regression. The R2 values for the regression analyses at each location are provided in Table 9 below.

Table 9: Second order and third order R2 values

Testing Location	Coefficients of Determination (R^2)	
	Second Order	Third Order
BAN152	0.5326	0.5353
BAN238	0.36	0.3641
BAN260	0.0995	0.1049
BAN282	0.4573	0.4815

4.7 Wind Farm Availability

During the monitoring period, the average WTG availability across the Wind Farm was 92%, exceeding the long-term average of 90%. The individual WTGs closest to each of the respective 4 receptors had comparatively high availability across the test period. Operation of the wind farm during the noise test data collection period can therefore be considered as typical.

4.8 Residential Noise Monitoring Results

The correlation graphs with the regression curve and Noise Criteria are provided in Figure 3 to Figure 6 below. The measured noise levels and Noise Criteria for each integer hub height wind speed from 3m/s to 12m/s have also been tabulated below.

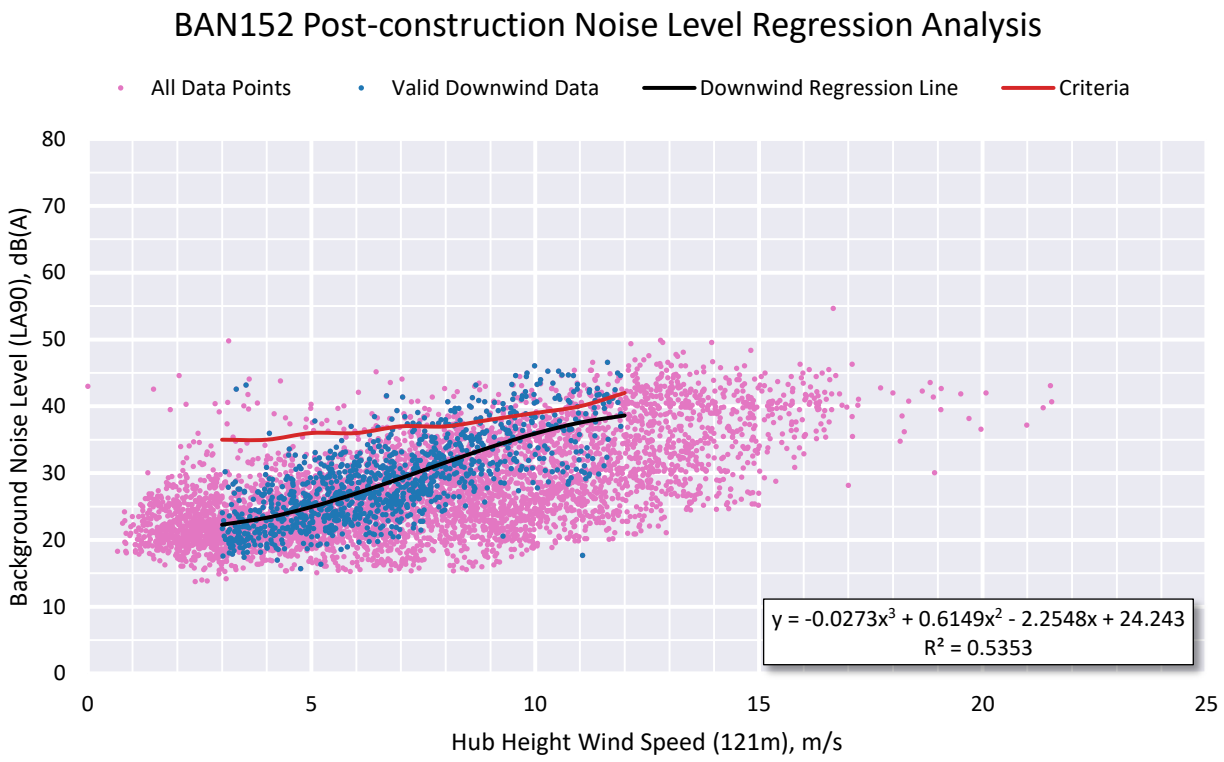

Figure 3: Noise Criteria and post construction regression curve for BAN152 (Downwind +/- 45°)

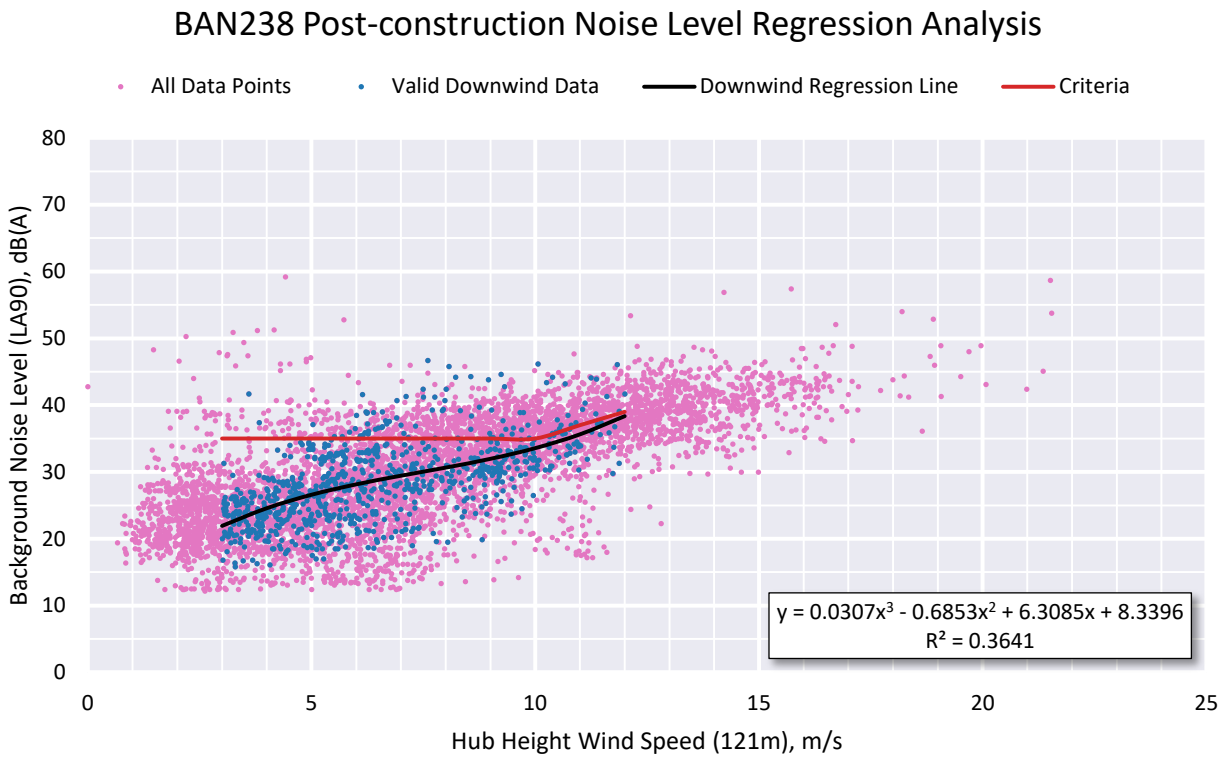

Figure 4: Noise Criteria and post construction regression curve for BAN238 (Downwind +/- 45°)

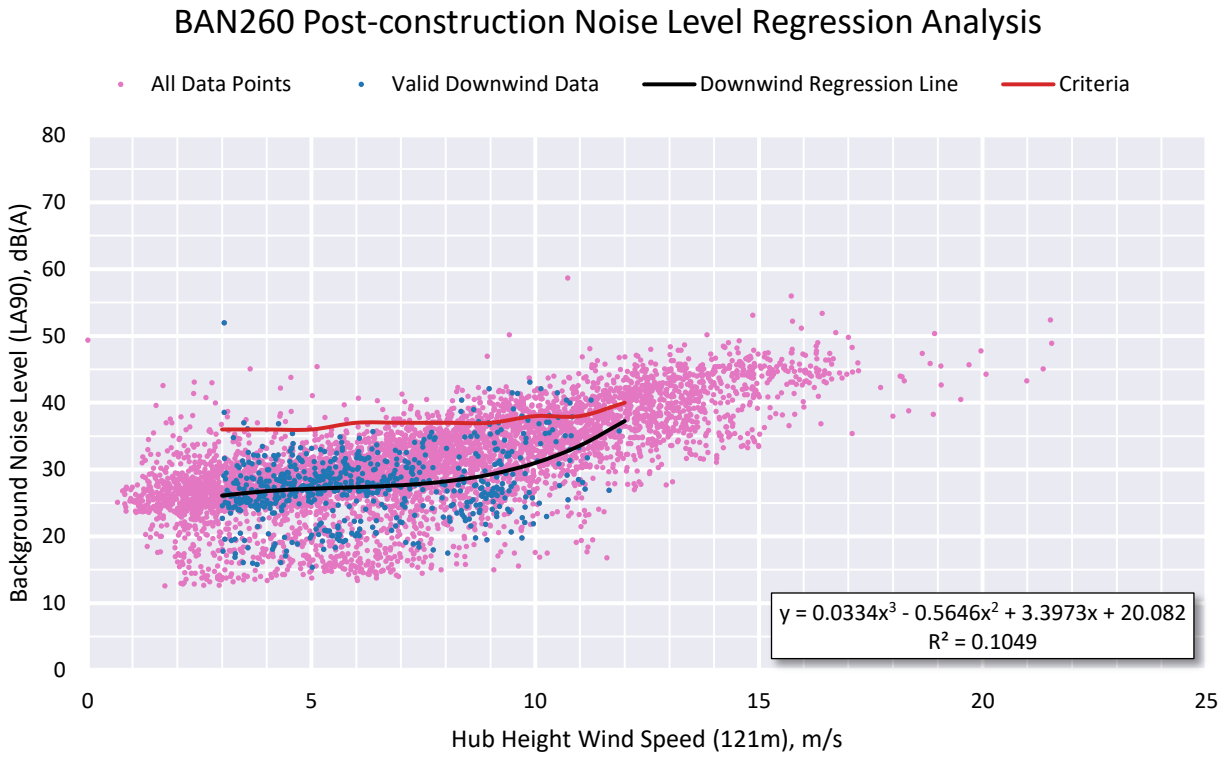

Figure 5: Noise Criteria and post construction regression curve for BAN260 (Downwind +/- 45°)

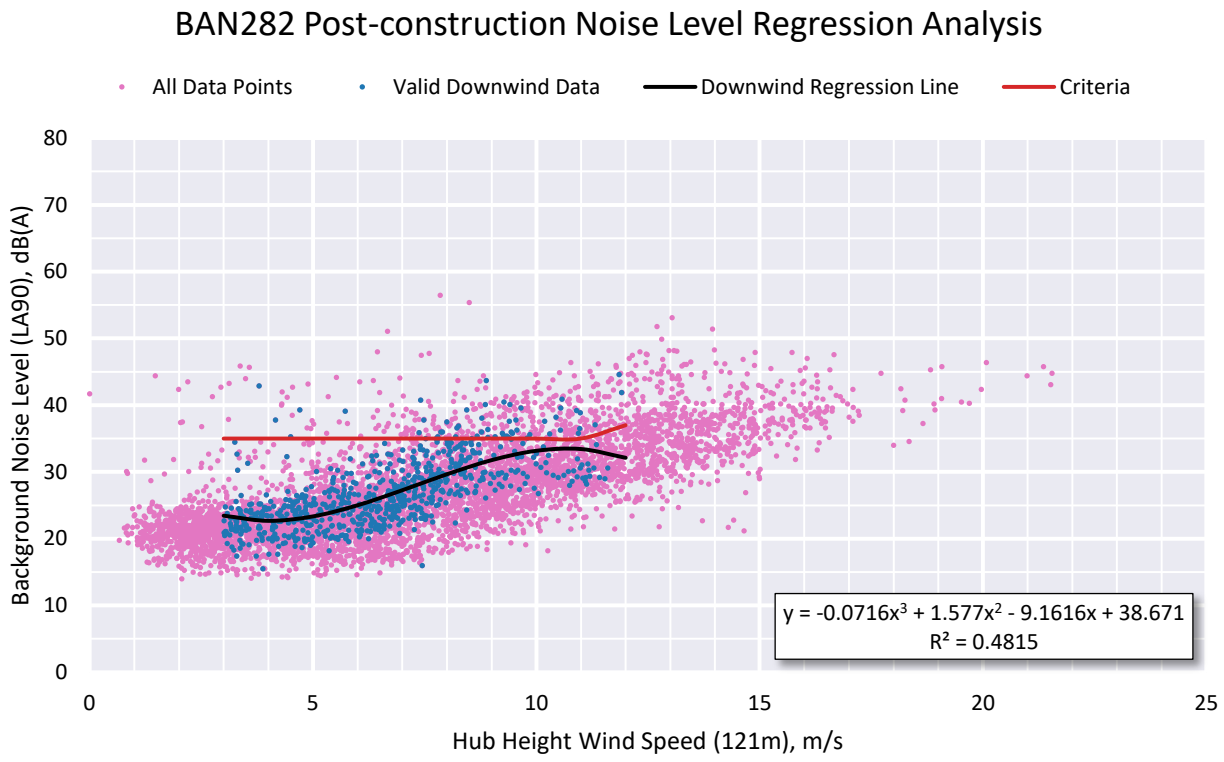

Figure 6: Noise Criteria and post construction regression curve for BAN282 (Downwind +/- 45°)

Table 10: Noise Criteria and measured levels

Receiver		Criteria and Measured Levels at integer Hub Height Wind Speeds [$L_{A90,\ 10\ minute}$, dB(A)]									
		3	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
BAN152	Noise Criteria	35	35	36	36	37	37	38	39	40	42
	Measured	22	23	25	27	29	32	34	36	38	39
BAN238	Noise Criteria	35	35	35	35	35	35	35	35	37	39
	Measured	22	25	27	28	29	31	32	34	36	38
BAN260	Noise Criteria	36	36	36	37	37	37	37	38	38	40
	Measured	26	27	27	27	28	28	29	31	34	37
BAN282	Noise Criteria	35	35	35	35	35	35	35	36	37	40
	Measured	23	23	23	25	27	30	32	33	33	32

Based on the above, the regression demonstrates that the Noise Criteria are achieved at all integer wind speeds for each Residential Noise Monitoring Location. As such, the noise from the Wind Farm is deemed to comply with the Noise Criteria in accordance with the NCTP, subject to the assessment of Special Noise Characteristics.

Note that although the NCTP allows for subtraction of the pre-construction background noise data where an intermediate position has not been used to remove data points, compliance is achieved without subtracting the background noise levels.

4.9 Special Noise Characteristics

4.9.1 Tonality

As part of the near field testing, a tone with the potential to be audible at Non Associated residences was identified in the noise profile of the WTG at in the 160 Hz one-third octave band. As such, further testing for tonality was undertaken as part of the residential noise monitoring regime.

As per the NCTP, an analysis of the tonality was undertaken at the closest residential monitoring location, being BAN282. Based on the analysis, a tone within the 160 Hz one-third octave band was not identified in any valid period (irrespective of wind speed or direction).

On this basis, in accordance with the NCTP, repeated and excessive tonality was not identified at the nearest Non Associated Residence, and a penalty for tonality is therefore not warranted.

4.9.2 Low Frequency

An assessment of the low frequency content has been conducted in accordance with the procedure outlined in the NCTP as follows:

- At the residential logging location where the highest noise level is predicted;
- At the integer wind speed where the difference between the predicted noise level and the Noise Criteria is the least;
- Conducted under a downwind condition at night;
- Over a 10-minute interval with the wind farm operational;
- Collecting at least 5 measurement intervals where the wind farm is audible;
- Comparing the C-weighted L_{90} noise level with the criterion of 60 dB(C);

It is noted that the C-weighted L_{eq} descriptor was used in lieu of the C-weighted L_{90} noise level for the purpose of this assessment. The L_{90} value will always be lower than the L_{eq} value and is more likely to include noise from intermittent low frequency noise sources such as vehicles. Where the criterion is met when considering the L_{eq} value, it will always be met when considering the L_{90} value.

The residential noise monitoring location with the highest predicted noise level is BAN152. The smallest difference between the predicted level and the Noise Criteria occurs at a wind speed of 9m/s, where the difference is 7 dB(A). The assessment has therefore considered this wind speed further under downwind conditions.

Under downwind conditions at night when the wind farm was operating at a wind speed of 9 m/s, noise measurement data were collected for 15 periods at BAN152. Of these periods, the highest measured C-weighted L_{eq} sound pressure level was 62 dB(C), with levels below 60 dB(C) being measured during each of the remaining periods.

Given the small number of data points available under downwind conditions for a 9 m/s wind speed at night, the analysis was expanded to include all night-time downwind periods with wind speeds between 3 and 12 m/s.

During the 6-week monitoring period, the above conditions occurred during 364 periods. Of these periods, C-weighted noise levels greater than 60 dB(C) were measured during only five periods, or approximately 1% of downwind periods between 3 and 12 m/s. It is noted that these are likely to have been as a result of sources other than the Wind Farm.

Notwithstanding, C-weighted noise levels at BAN152 exceeded the 60 dB(C) criterion for less than 10 % of the measured periods, meeting the criterion described in the NCTP. There is therefore no repeated and excessive low frequency component to the noise from the WTGs. As such, no penalty is warranted for a low frequency Special Noise Characteristic.

4.10 Ancillary Infrastructure

Unattended noise monitoring was conducted at an intermediate position between the substation and nearby residences over a six week period between 11 December 2023 and 23 January 2024 (inclusive) using a Rion NL-42A Class 2 sound level meter (with serial number 01224053). The intermediate location was a comparable distance from the Wind Farm, and in a comparable direction to the nearest Non-Associated Residence (BAN170, 3,400 metres from the nearest WTG).

During the monitoring period, a number of periods were identified where conditions were most conducive to noise propagation from the substation to the monitoring location, and noise from the substation had the potential to be audible, being during the early hours of the morning (before 5:00 am, with light winds blowing from the substation to the monitoring location (in the order of 2-3 m/s).

Based on the above, a number of periods were identified where noise from the substation was most likely to influence noise levels at the nearest Non-Associated Residence. Audio recordings collected during each identified period were reviewed to exclude any periods or data affected extraneous noise sources not related to operation of the Wind Farm (such as rain, domestic animals or human activity in the vicinity of the noise monitor). It is noted that the ancillary equipment was not identified as a significant contributor.

As noted in Section 4.6, noise levels at the monitoring locations were significantly influenced by noise from insects and other fauna in the 1.6 kHz one-third octave bands and above and have therefore been removed (consistent with the methodology employed for the Residential Noise Monitoring Locations described in Section 4.6 above). Noise levels from the substation within these frequency bands are predicted to be below the threshold of hearing at the nearest Non-Associated Residence and therefore cannot contribute to noise levels within these frequency bands.

If it is assumed that all of the remaining noise was from the ancillary infrastructure (a very conservative assessment), a noise level in the order of 30 dB(A) is predicted at the nearest Non-Associated Residence based on the highest noise level measured at the intermediate position within one of the periods identified above.

As the measured level includes the influence of the WTGs and other ambient noise sources which contribute to noise in the 1.25 kHz one-third octave band and below, the actual noise level from the sub-station would likely be much lower. The noise level at the nearest noise sensitive receiver therefore comfortably achieves the 35 dB(A) criterion nominated in the Project Approval Conditions. On this basis, noise from the substation is therefore deemed to be in compliance with the Project Approval Conditions.

5 CONCLUSION

Post-construction monitoring and assessment of operational noise from the Bango Wind Farm has been completed in accordance with the Project Approval Conditions and the Noise Compliance Test Plan.

This report has been prepared to summarise the results of this analysis and to provide further information regarding the methodology behind the assessment.

The results of the analysis show that operational noise from the Wind Farm meets the Noise Criteria specified by the Project Approval Conditions when assessed in accordance with the NCTP. Based on the assessment, the noise from the WTGs is compliant with the Project Approval Conditions and the Bulletin.

An assessment of Special Noise Characteristics has also been completed, indicating that there is no repeated or excessive component of tonality or low frequency to the noise profile of the WTGs and no penalty is therefore warranted for such characteristics.

The noise produced by the ancillary infrastructure on the site has also been assessed and achieves the criterion required as per the Project Approval Conditions.

It can therefore be determined that the Bango Wind Farm complies with all noise related provisions of the Project Approval, as indicated by the assessment contained within this report.

APPENDIX A: PROJECT APPROVAL CONDITIONS

NOISE

Construction & Decommissioning Noise

5. The Applicant must:
   (a) minimise the construction or decommissioning noise of the development, including any associated traffic noise; and
   (b) ensure that the noise generated by any construction or decommissioning activities is managed in accordance with the best practice requirements outlined in the *Interim Construction Noise Guideline* (DECC, 2009), or its latest version.

6. Unless the Secretary agrees otherwise, the Applicant must only undertake construction or decommissioning activities between:
   (a) 7.00 am to 6.00 pm Monday to Friday;
   (b) 8.00 am to 1.00 pm Saturdays; and
   (c) at no time on Sundays and NSW public holidays.

   The following construction activities may be undertaken outside these hours without the approval of the Secretary:
   - activities that are inaudible at non-associated residences;
   - the delivery of materials requested by the NSW Police Force or other authorities for safety reasons; or
   - emergency work to avoid the loss of life, property and/or material harm to the environment.

Blasting

7. The Applicant may only carry out blasting on site between 9.00 am and 5.00 pm Monday to Friday and between 8.00 am to 1.00 pm on Saturday. No blasting is allowed on Sundays or public holidays.

8. The Applicant must ensure that any blasting carried out on site does not exceed the criteria in Table 1.

Table 1: Blasting criteria

Location	*Airblast overpressure (dB(Lin Peak))*	*Ground vibration (mm/s)*	*Allowable exceedance*
Any non-associated residence	120	10	0%
	115	5	5% of the total number of blasts or events over a rolling period of 12 months

Operational Noise Criteria – Wind Turbines

9. The Applicant must ensure that the noise generated by the operation of wind turbines does not exceed the relevant criteria in Table 2 at any non-associated residence.

Table 2: Noise criteria dB(A)

Residence	*Criteria (dB(A)) with Reference to Hub Height Wind Speed (m/s)*									
	3	4	5	6	7	8	9	10	11	12
26, 166	35	35	35	35	35	35	36	38	39	42
60	35	35	35	35	35	35	35	35	37	39
62, 76, 179, 235, 260	36	36	36	37	37	37	37	38	38	40
106, 152, 243	35	35	36	36	37	37	38	39	40	42
144, 276	35	35	35	35	35	35	35	36	37	40
165	35	35	35	35	35	35	36	38	39	42
170	35	35	35	35	35	35	35	35	36	38
282	35	35	35	35	35	35	35	35	35	37
43	35	35	36	37	37	37	37	38	39	40
48	35	35	37	38	39	40	40	41	42	43
138	36	36	36	36	37	37	38	39	40	42
All other non-associated residences	The higher of 35 dB(A) or the existing background noise level ($L_{A90\ (10\text{-minute})}$) plus 5 dB(A)									

Note: To identify the residences referred to in Table 2, see the applicable figures in APPENDIX 2.

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Noise generated by the operation of the wind turbines is to be measured in accordance with the relevant requirements of the Department's *Wind Energy: Noise Assessment Bulletin* (2016) (or its latest version), and the provisions in Appendix 5.

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

Operational Noise Criteria – Ancillary Infrastructure

10. The Applicant must ensure that the noise generated by the operation of ancillary infrastructure does not exceed 35 dB(A) $L_{Aeq(15\ minute)}$ at any non-associated residence.

    Noise generated by the operation of ancillary infrastructure is to be measured in accordance with the relevant requirements of the *NSW Noise Policy for Industry* (or its equivalent) as modified by the provisions in Appendix 5.

Operational Noise Monitoring

11. Within 3 months of the commencement of operations (or the commencement of operation of a cluster of turbines, if the development is to be staged), the Applicant must:
    (a) undertake noise monitoring to determine whether the development is complying with the relevant conditions of this consent; and
    (b) submit a copy of the monitoring results to the Department and the EPA.

12. The Applicant must undertake further noise monitoring of the development if required by the Secretary.

APPENDIX 5
NOISE COMPLIANCE ASSESSMENT

Applicable Meteorological Conditions – Wind Turbines

1. The noise criteria in Table 2 of condition 9, Schedule 3, are to apply under all meteorological conditions.

Applicable Meteorological Conditions – Other Facilities

2. The noise criteria in condition 10, Schedule 3, are to apply under all meteorological conditions except the following:
    a) wind speeds greater than 3 m/s at 10 m above ground level; or
    b) temperature inversion conditions between 1.5 °C and 3°C/100m and wind speeds greater than 2 m/s at 10 m above ground level; or
    c) temperature inversion conditions greater than 3°C/100m.

APPENDIX B: CALIBRATION CERTIFICATES

Acoustic Research Labs Pty Ltd
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www.acousticresearch.com.au

Sound Level Meter
IEC 61672-3:2013

Calibration Certificate

Calibration Number C23348

Client Details	Sonus Pty Ltd 17 Ruthven Ave Adelaide SA 5000
Equipment Tested/ Model Number :	NL-42AEX
Instrument Serial Number :	00923782
Microphone Serial Number :	199680
Pre-amplifier Serial Number :	26825
Firmware Version :	2.0

Pre-Test Atmospheric Conditions		**Post-Test Atmospheric Conditions**	
Ambient Temperature :	22.6°C	**Ambient Temperature :**	22.9°C
Relative Humidity :	52.2%	**Relative Humidity :**	51.2%
Barometric Pressure :	101.2kPa	**Barometric Pressure :**	101.3kPa

Calibration Technician :	Ken Williams	**Secondary Check:**	Megan Williams
Calibration Date :	3 Jun 2023	**Report Issue Date :**	5 Jun 2023

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	*N/A*
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.

Uncertainties of Measurement -

Acoustic Tests		Environmental Conditions	
125Hz	*±0.13dB*	*Temperature*	*±0.1°C*
1kHz	*±0.13dB*	*Relative Humidity*	*±1.9%*
8kHz	*±0.14dB*	*Barometric Pressure*	*±0.014kPa*
Electrical Tests	*±0.13dB*		

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

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

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

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

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Sound Level Meter
IEC 61672-3:2013
Calibration Certificate

Calibration Number C23347

Client Details	Sonus Pty Ltd 17 Ruthven Ave Adelaide SA 5000
Equipment Tested/ Model Number :	NL-42AEX
Instrument Serial Number :	00923783
Microphone Serial Number :	199681
Pre-amplifier Serial Number :	26826
Firmware Version :	2.0

Pre-Test Atmospheric Conditions		**Post-Test Atmospheric Conditions**	
Ambient Temperature :	22.8°C	**Ambient Temperature :**	22.6°C
Relative Humidity :	51.9%	**Relative Humidity :**	52.2%
Barometric Pressure :	101.3kPa	**Barometric Pressure :**	101.3kPa

Calibration Technician :	Ken Williams	**Secondary Check:**	Megan Williams
Calibration Date :	3 Jun 2023	**Report Issue Date :**	5 Jun 2023

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	*N/A*
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.

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Uncertainties of Measurement -

Acoustic Tests		Environmental Conditions	
125Hz	*±0.13dB*	*Temperature*	*±0.1°C*
1kHz	*±0.13dB*	*Relative Humidity*	*±1.9%*
8kHz	*±0.14dB*	*Barometric Pressure*	*±0.014kPa*
Electrical Tests	*±0.13dB*		

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Sound Level Meter
IEC 61672-3:2013
Calibration Certificate

Calibration Number C23349

Client Details	Sonus Pty Ltd 17 Ruthven Ave Adelaide SA 5000
Equipment Tested/ Model Number :	NL-42AEX
Instrument Serial Number :	00923691
Microphone Serial Number :	199585
Pre-amplifier Serial Number :	26734
Firmware Version :	2.0

Pre-Test Atmospheric Conditions		**Post-Test Atmospheric Conditions**	
Ambient Temperature :	22.4°C	**Ambient Temperature :**	22.6°C
Relative Humidity :	52.4%	**Relative Humidity :**	52.3%
Barometric Pressure :	101.2kPa	**Barometric Pressure :**	101.2kPa

Calibration Technician :	Ken Williams	**Secondary Check:**	Megan Williams
Calibration Date :	3 Jun 2023	**Report Issue Date :**	5 Jun 2023

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	*N/A*
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.

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Uncertainties of Measurement -

Acoustic Tests		Environmental Conditions	
125Hz	*±0.13dB*	*Temperature*	*±0.1°C*
1kHz	*±0.13dB*	*Relative Humidity*	*±1.9%*
8kHz	*±0.14dB*	*Barometric Pressure*	*±0.014kPa*
Electrical Tests	*±0.13dB*		

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Sound Level Meter
IEC 61672-3:2013
Calibration Certificate

Calibration Number C23355

Client Details	Sonus Pty Ltd 17 Ruthven Ave Adelaide SA 5000
Equipment Tested/ Model Number :	NL-42AEX
Instrument Serial Number :	01224053
Microphone Serial Number :	200734
Pre-amplifier Serial Number :	27272
Firmware Version :	2.0

Pre-Test Atmospheric Conditions		Post-Test Atmospheric Conditions	
Ambient Temperature :	20.4°C	**Ambient Temperature :**	21.3°C
Relative Humidity :	56.4%	**Relative Humidity :**	54%
Barometric Pressure :	101.4kPa	**Barometric Pressure :**	101.5kPa

Calibration Technician :	Ken Williams	**Secondary Check:**	Megan Williams
Calibration Date :	3 Jun 2023	**Report Issue Date :**	5 Jun 2023

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	*N/A*
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.

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Uncertainties of Measurement -

Acoustic Tests		Environmental Conditions	
125Hz	*±0.13dB*	*Temperature*	*±0.1°C*
1kHz	*±0.13dB*	*Relative Humidity*	*±1.9%*
8kHz	*±0.14dB*	*Barometric Pressure*	*±0.014kPa*
Electrical Tests	*±0.13dB*		

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

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Sound Level Meter
IEC 61672-3:2013
Calibration Certificate

Calibration Number C23352

Client Details	Sonus Pty Ltd Ruthven Ave Adelaide SA 5000
Equipment Tested/ Model Number :	NL-42AEX
Instrument Serial Number :	00923595
Microphone Serial Number :	197283
Pre-amplifier Serial Number :	26638
Firmware Version :	2.0

Pre-Test Atmospheric Conditions		Post-Test Atmospheric Conditions	
Ambient Temperature :	21.5°C	**Ambient Temperature :**	21.8°C
Relative Humidity :	54%	**Relative Humidity :**	53.6%
Barometric Pressure :	101.5kPa	**Barometric Pressure :**	101.4kPa

Calibration Technician : Ken Williams
Calibration Date : 3 Jun 2023
Secondary Check: Megan Williams
Report Issue Date : 5 Jun 2023

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	*N/A*
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.

Uncertainties of Measurement -

Acoustic Tests		Environmental Conditions	
125Hz	*±0.13dB*	*Temperature*	*±0.1°C*
1kHz	*±0.13dB*	*Relative Humidity*	*±1.9%*
8kHz	*±0.14dB*	*Barometric Pressure*	*±0.014kPa*
Electrical Tests	*±0.13dB*		

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

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Sound Level Meter
IEC 61672-3:2013
Calibration Certificate

Calibration Number C23344

Client Details	Sonus Pty Ltd 17 Ruthven Ave Adelaide SA 5000
Equipment Tested/ Model Number :	NL-42AEX
Instrument Serial Number :	01224051
Microphone Serial Number :	200732
Pre-amplifier Serial Number :	27270
Firmware Version :	1.1

Pre-Test Atmospheric Conditions		**Post-Test Atmospheric Conditions**	
Ambient Temperature :	20.1°C	**Ambient Temperature :**	23°C
Relative Humidity :	55.3%	**Relative Humidity :**	50%
Barometric Pressure :	101.4kPa	**Barometric Pressure :**	101.5kPa

Calibration Technician :	Ken Williams	**Secondary Check:**	Megan Williams
Calibration Date :	2 Jun 2023	**Report Issue Date:**	5 Jun 2023

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	*N/A*
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.

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Uncertainties of Measurement -

Acoustic Tests		Environmental Conditions	
125Hz	*±0.13dB*	*Temperature*	*±0.1°C*
1kHz	*±0.13dB*	*Relative Humidity*	*±1.9%*
8kHz	*±0.14dB*	*Barometric Pressure*	*±0.014kPa*
Electrical Tests	*±0.13dB*		

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Sound Level Meter
IEC 61672-3:2013
Calibration Certificate

Calibration Number C23351

Client Details	Sonus Pty Ltd 17 Ruthven Ave Adelaide SA 5000
Equipment Tested/ Model Number :	NL-42AEX
Instrument Serial Number :	01224052
Microphone Serial Number :	200733
Pre-amplifier Serial Number :	27271
Firmware Version :	2.0

Pre-Test Atmospheric Conditions		Post-Test Atmospheric Conditions	
Ambient Temperature :	21.8°C	**Ambient Temperature :**	22.4°C
Relative Humidity :	54.2%	**Relative Humidity :**	52.2%
Barometric Pressure :	101.4kPa	**Barometric Pressure :**	101.2kPa

Calibration Technician : Ken Williams
Secondary Check: Megan Williams
Calibration Date : 3 Jun 2023
Report Issue Date : 5 Jun 2023

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	*N/A*
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.

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Uncertainties of Measurement -

Acoustic Tests		Environmental Conditions	
125Hz	*±0.13dB*	*Temperature*	*±0.1°C*
1kHz	*±0.13dB*	*Relative Humidity*	*±1.9%*
8kHz	*±0.14dB*	*Barometric Pressure*	*±0.014kPa*
Electrical Tests	*±0.13dB*		

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Sound Level Meter
IEC 61672-3:2013
Calibration Certificate

Calibration Number C23350

Client Details	Sonus Pty Ltd 17 Ruthven Ave Adelaide SA 5000
Equipment Tested/ Model Number :	NL-42AEX
Instrument Serial Number :	01224054
Microphone Serial Number :	200735
Pre-amplifier Serial Number :	27273
Firmware Version :	2.0

Pre-Test Atmospheric Conditions		Post-Test Atmospheric Conditions	
Ambient Temperature :	21.9°C	**Ambient Temperature :**	22.6°C
Relative Humidity :	53.8%	**Relative Humidity :**	53.2%
Barometric Pressure :	101.4kPa	**Barometric Pressure :**	101.3kPa

Calibration Technician :	Ken Williams	**Secondary Check:**	Megan Williams
Calibration Date :	3 Jun 2023	**Report Issue Date :**	5 Jun 2023

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	*N/A*
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.

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Uncertainties of Measurement -

Acoustic Tests		Environmental Conditions	
125Hz	*±0.13dB*	*Temperature*	*±0.1°C*
1kHz	*±0.13dB*	*Relative Humidity*	*±1.9%*
8kHz	*±0.14dB*	*Barometric Pressure*	*±0.014kPa*
Electrical Tests	*±0.13dB*		

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

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

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

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

NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration and inspection reports.

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CERTIFICATE OF CALIBRATION

CERTIFICATE NO: C36132

EQUIPMENT TESTED : Sound Level Calibrator

Manufacturer: Rion
Type No: NC-74 **Serial No:** 35094478
Owner: Sonus Pty Ltd
17 Ruthven Ave
Adelaide SA 5000
Tests Performed: Measured Output Pressure level, Frequency & Distortion
Comments: See Details overleaf. All Test Passed.

Parameter	Pre-Adj	Adj Y/N	Output: (dB re 20 µPa)	Frequency (Hz)	THD&N (%)
Level:	NA	N	94.06 dB	1001.75 Hz	1.26 %
Uncertainty			±0.11 dB	±0.05%	±0.20 %
Uncertainty (at 95% c.l.) k=2					

CONDITION OF TEST:

Ambient Pressure 1009 hPa ±1 hPa
Temperature 22 °C ±1° C
Relative Humidity 49 % ±5%

Date of Receipt : 11/05/2023
Date of Calibration : 17/05/2023
Date of Issue : 17/05/2023

Acu-Vib Test Procedure: AVP02 (Calibrators)
Test Method: AS IEC 60942 - 2017

CHECKED BY: ..... **AUTHORISED SIGNATURE:** .....

Hein Soe

Accredited for compliance with ISO/IEC 17025 - Calibration
Results of the tests, calibration and/or measurements included in this document are traceable to SI units through reference equipment that has been calibrated by the Australian National Measurement Institute or other NATA accredited laboratories demonstrating traceability.

This report applies only to the item identified in the report and may not be reproduced in part.

The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

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Acoustic and Vibration Measurements

Acu-Vib Electronics
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Head Office & Calibration Laboratory
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www.acu-vib.com.au

Page 1 of 2 Calibration Certificate
AVCERT02.1 Rev.2.0 14.04.2021

APPENDIX C: RESIDENTIAL NOISE MONITORING LOCATION PHOTOS

(a)

(b)

(c)

(d)

Figure 7: BAN152 Noise Monitor

(a) *(b)*

(c) *(d)*

Figure 8: BAN238 Noise Monitor

(a)

(b)

(c)

(d)

Figure 9: BAN260 Noise Monitor

(a)

(b)

(c)

(d)

Figure 10: BAN282 Noise Monitor