Stockyard Hill Wind Farm

Post-Construction Testing Report

S3425.2C27

October 2022

sonus.

Chris Turnbull
Principal
Phone: +61 (0) 417 845 720
Email: ct@sonus.com.au
www.sonus.com.au

Document Title	Stockyard Hill Wind Farm
	Post-Construction Testing Report
Client	Goldwind Australia Pty Ltd
Document Reference	S3425.2C27
Date	October 2022
Author	Chris Turnbull, MAAS

CONTENTS

1 INTRODUCTION

In accordance with Condition 26 of Planning Permit No. PL-SP/05/0548/A (the **Planning Permit**) for the Stockyard Hill Wind Farm (the **Wind Farm**), an endorsed Noise Compliance Test Plan (**NCTP**) was prepared by Sonus. The NCTP provides the procedure for the post-construction noise assessment in accordance with the Planning Permit.

The Wind Farm is comprised of 149 Goldwind GW3S turbines, and is required to comply with the noise performance requirements as set out in Condition 21 of the Planning Permit.

Sonus has been engaged by Goldwind Australia Pty Ltd to conduct the post-construction testing in accordance with the NCTP in accordance with Condition 27 of the Planning Permit.

This report, prepared in accordance with Condition 28 of the Planning Permit and Section 8.3 of the New Zealand Standard 6808:2010, *Acoustics – Wind Farm Noise* (the **Standard**), summarises the assessment of operational noise levels at nine residences selected in accordance with the NCTP and sections 7.1.3, 7.2.6, and 7.5.1 of the Standard. Appendix A outlines where the information required in accordance with Section 8.3 of the Standard can be located in this report. The assessment includes analysis of noise monitoring at the residential locations, intermediate locations between the residences and Wind Farm, and nearfield locations around six nominated turbines, consisting of one of each configuration of turbine installed at the Wind Farm. The assessment also includes an assessment of the special audible characteristics of tonality and amplitude modulation in accordance with the NCTP and in accordance with the Standard.

2 NCTP TEST METHOD

The NCTP establishes a methodology to determine compliance in accordance with the Planning Permit Conditions and the Standard. The NCTP provides nine residential logging locations where noise levels from operation of the Wind Farm are to be measured. There were two residential logging locations where access was not granted (B029 and B121) and the noise monitoring was therefore conducted at their respective alternate locations (B328 and B118). The coordinates shown are those of where each logger was placed at the testing location. Where the Wind Farm is shown to be compliant with the noise criteria at the test locations, the Wind Farm is compliant with the Planning Permit Conditions in accordance with the NCTP. The nine locations are shown in Table 1.

Table 1: Testing Locations

Nominated Location	Alternate Test Location	Actual Monitoring Location	Coordinates (WGS 84 Zone 54)	
			Easting	Northing
B006	B113	B006	706600	5851418
B029	B328	B328	712410	5850536
B061(S)	B060	B061(S)	711425	5846996
B065	B099	B065	710655	5841001
B083	B079	B083	712071	5835637
B111	B006	B111	706546	5850423
B114	B113	B114	703299	5849525
B121	B118	B118	698301	5850411
B171	B167	B171	697410	5837887

(S) – This location is understood to be a stakeholder owned by Goldwind

Sonus conducted a pre-construction noise assessment[1] of the Wind Farm that included determining the criteria which apply at residences in the vicinity of the Wind Farm. Table 2 is from the pre-construction noise assessment and summarises the criteria for the compliance monitoring locations.

[1] Summarised in the Sonus report with reference S3425.2C3, dated October 2017.

Table 2: Criteria

Residential Logging Location	Criteria dB(A), at Integer Hub Height Wind Speed, m/s											
	3	4	5	6	7	8	9	10	11	12	13	14
B006	40	40	40	40	40	40	40	40	40	40	40	40
B061(S)	45	45	45	45	45	45	45	45	45	45	48	51
B065	40	40	40	40	40	40	40	42	44	45	47	49
B083	40	40	40	40	40	40	40	40	41	44	46	49
B111	40	40	40	40	40	40	40	40	40	40	42	44
B114	40	40	40	40	40	40	40	40	41	43	45	46
B118	40	40	40	40	40	40	40	40	40	40	43	46
B171	40	40	40	40	40	40	40	40	42	45	47	49
B328	40	40	40	40	40	40	41	42	43	44	45	46

(S) – This location is understood to be a stakeholder owned by Goldwind

In accordance with the NCTP, nearfield and intermediate testing was conducted for the purpose of determining the character of noise (tonality and amplitude modulation) from the turbines 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 is minimised (in comparison to the noise level from wind turbines) and therefore the results can assist in determining compliance at the residential logging locations, when the noise from turbines is masked by other sources.

3 NEARFIELD AND INTERMEDIATE MEASUREMENTS

3.1 NEARFIELD MEASUREMENTS

Nearfield testing has been conducted at six turbines, understood to comprise one of each configuration of turbine installed the site. The testing was done in accordance with the procedure laid out in the NCTP for the purpose of determining the apparent sound power level of the turbines and the presence of tonality or amplitude modulation in the noise profile of the turbine. The table below indicates the turbines tested, the dates the testing was conducted, the configuration of the turbines, the highest sound power level measured, and the report where the results are summarised. The location of the tested turbines, as well as the configuration of the turbines on the site can be seen in Figure 1 below.

Table 3: Nearfield Testing Locations

Turbine	Testing Dates (inclusive)		Turbine Configuration	Maximum Sound Power Level		Report Reference
	Start	End		Sound Power	Wind Speed	
18	10/01/2022	12/01/2022	GW140/3570 V5	111 dB(A)	10m/s	S3425.2C17
22	27/08/2022	29/08/2022	GW140/3570 Only 3/4/5	111 dB(A)	12m/s	S3425.2C25
83	27/08/2022	29/08/2022	GW140/3000 V5	112 dB(A)	14m/s	S3425.2C26
93	07/07/2022	09/07/2022	GW140/3400 V5	111 dB(A)	12m/s	S3425.2C24
141	21/07/2022	22/07/2022	GW140/3570 V4	114 dB(A)	15m/s	S3425.2C21
149	18/07/2022	21/07/2022	GW140/3570 Clean Blades	111 dB(A)	9m/s	S3425.2C23

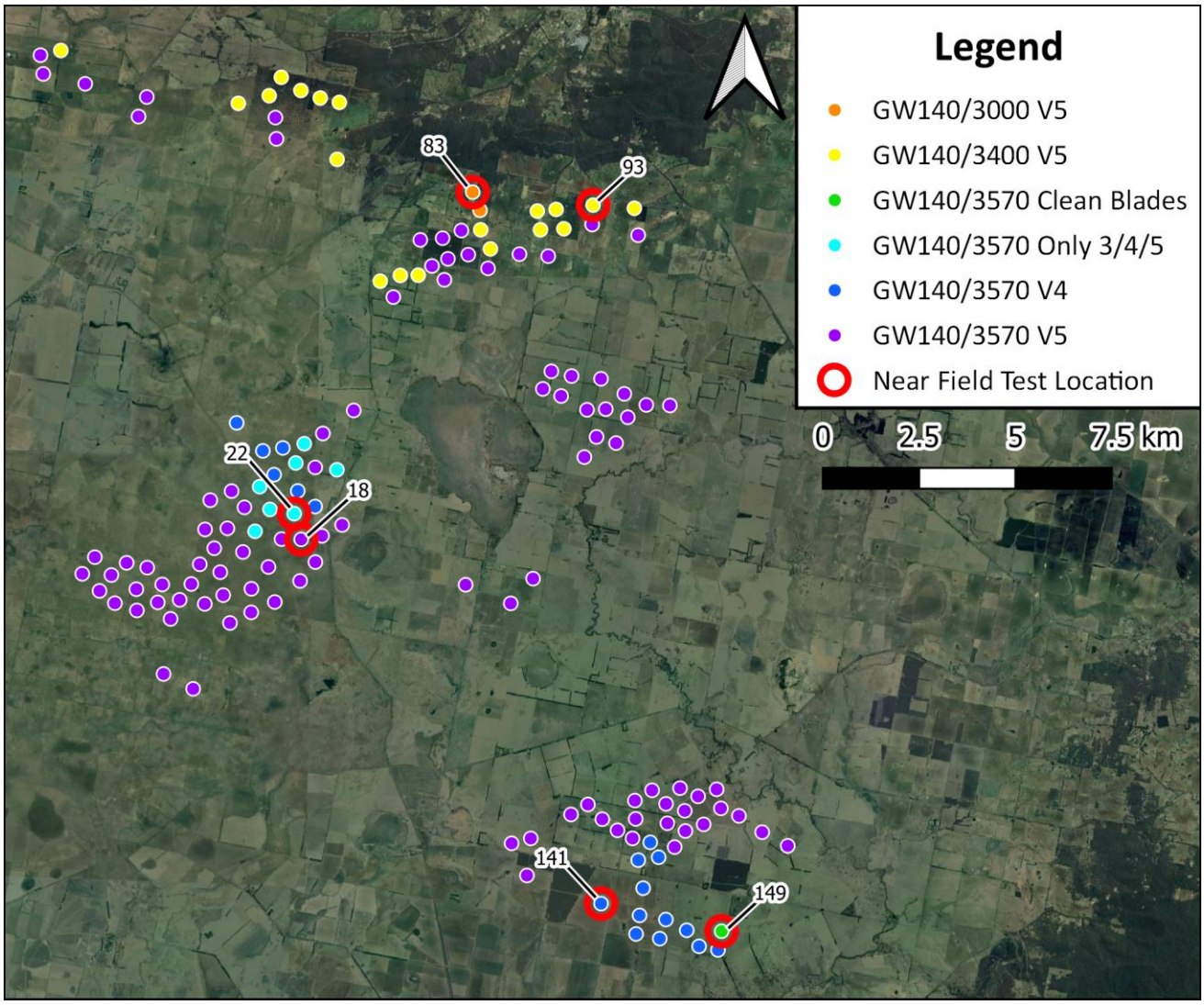


Figure 1: Near Field Test Locations

The near field testing was conducted in general accordance with the procedure outlined in the International Standard *IEC 61400-11: 2012 Wind turbines – Part 11: Acoustic noise measurements techniques* (**IEC 61400**). While it is noted that IEC 61400 requires the sound power level to be determined for every integer and half-integer wind speed, the compliance assessment in accordance with the Standard only requires the integer wind speeds to be considered. As such, the near field analysis was only conducted for the integer wind speeds.

The results of the nearfield testing, conducted in accordance with Section B2 of the Standard, have been used to inform the post-construction analysis summarised in this report. The apparent sound power levels indicate that there is no clear wind speed at which the noise from the turbines reaches a maximum. As a result, the assessment in this report includes all data at high wind speeds. No tonality was identified at any of the nearfield locations, based on the conducted analysis. Likewise, no regular amplitude modulation was

found in the overall A-weighted levels, in accordance with the NCTP. In addition to the objective testing, tonality and amplitude modulation was subjectively assessed close to turbines and at residential locations. The subjective assessments confirmed that the conclusions of the near field special audible characteristic testing was representative of the wind farm overall.

The near field test locations are spread throughout the wind farm, covering all turbine configurations and providing a range of different conditions based on the topography of the area. As the tested turbines represent each of the turbine configurations, are from a variety of locations around the Wind Farm, and do not exhibit any characteristics different from other turbines, it is considered that the six measured turbines are demonstrative of the noise produced at the other turbines not tested.

The sound power level results have been used to update the noise model used for the initial compliance assessment in order to revise the predicted noise levels for locations surrounding the wind farm. It is noted that these predictions do not demonstrate either compliance or non-compliance. They have simply been provided, upon request, for comparison with those produced for the initial compliance report. Figure 2 below shows the predicted noise level contours for the Wind Farm, for a wind speed of 11m/s. It is also noted that the predictions below consider only the noise from the wind farm, which is not the case in practice, where other sources of noise can influence measured results.

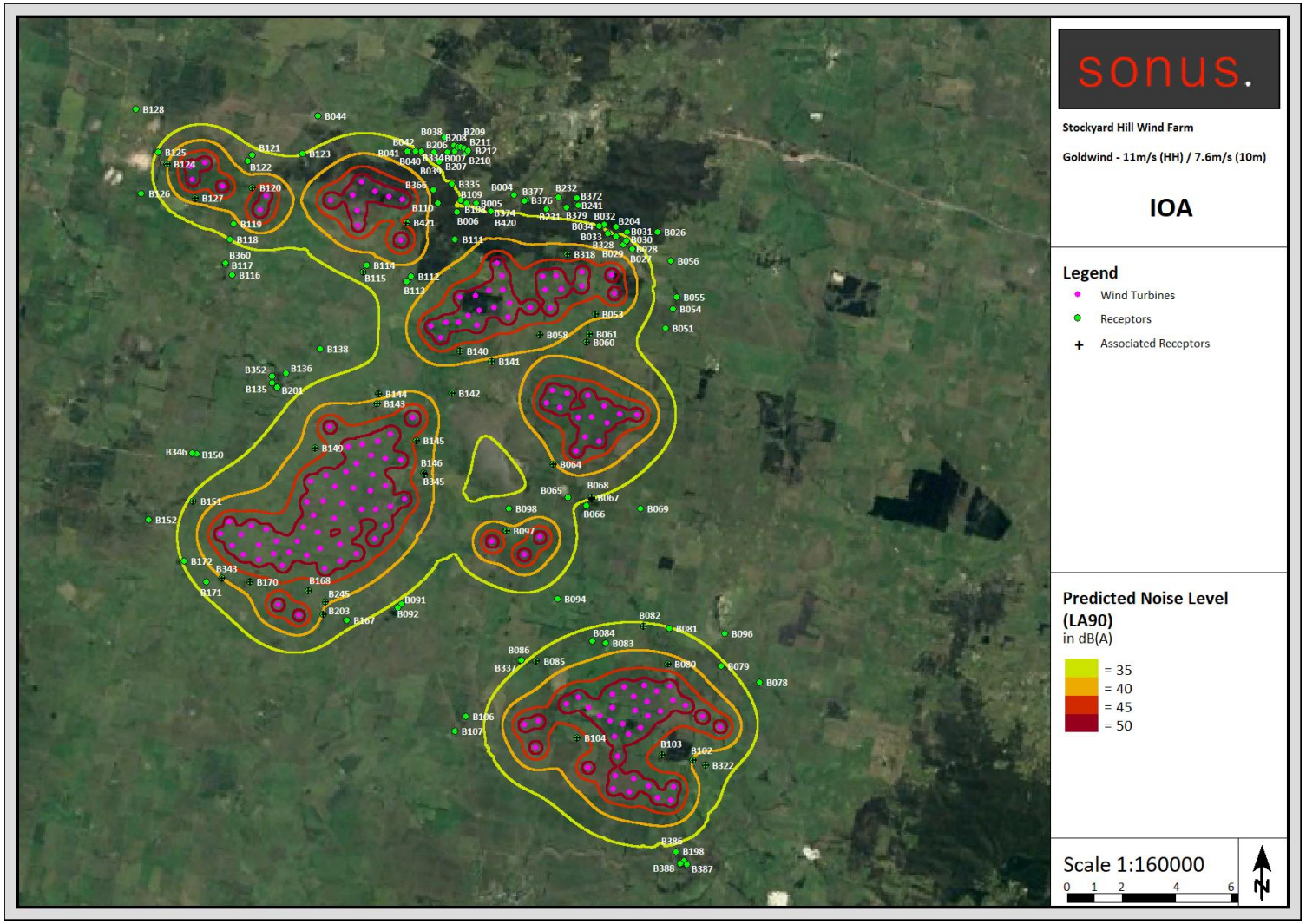


Figure 2: Predicted Noise Level Contours

3.2 INTERMEDIATE MEASUREMENTS

The NCTP recommends that the noise level from the Wind Farm be measured simultaneously at the residential logging locations as well as intermediate locations, which:

- are between the Wind Farm and the residence being assessed; and,
- have a higher Wind Farm noise level to background noise level ratio (the noise level from the Wind Farm is more likely to be measurable above the level of background noise).

Data filtering is permitted to remove time periods where noise data collected at an intermediate position confirms that the source of the noise at a residential logging location is not the wind turbines, and is further outlined in Section 4.1. For example, noise data collected in a particular 10-minute interval at a residential logging location may be removed:

- if the noise measured in the same period at the intermediate position (closer to the turbines) is at a lower level; or
- if the frequency content of the noise at the receptor is not consistent with the frequency content at the Intermediate Position.

The intermediate measurement equipment was located between the residential logging locations and the Wind Farm, in open spaces away from structures and trees. They have also been located such that they can be used as an *alternative monitoring point* in the future, if required, for assessment against the *Environment Protection Amendment (Wind Turbine Noise) Regulations 2022* (the **Regulations**).

The noise level was measured at the intermediate locations using NATA calibrated Rion NL-21 and Rion NL-22 Class 2 sound level meters, in compliance with Section 7.2.2 of the Standard. The coordinates of the intermediate locations and the serial numbers of the sound level meters used are provided in Table 4 and the calibration certificates are attached in Appendix B.

Table 4: Intermediate Logging Locations

Intermediate Logging Location	Coordinates		Sound Level Meter Serial Number
	Easting	Northing	
B006-B111 Intermediate A	706879	5850046	00354109
B006-B111 Intermediate B	705793	5850868	01298933
B061(S) Intermediate	711443	5847469	00709523
B065 Intermediate A	710654	5841416	00877043
B065 Intermediate B	710161	5840479	00683866
B083 Intermediate	711948	5835259	00709526
B114 Intermediate	703294	5849702	01298930
B118 Intermediate	698442	5850531	01298931
B171 Intermediate	697992	5838288	01298928
B328 Intermediate	710988	5849917	01298929

(S) – This location is understood to be a stakeholder owned by Goldwind

An aerial photograph showing the residential logging locations, the turbine layout, meteorological masts, and the intermediate locations is provided below:

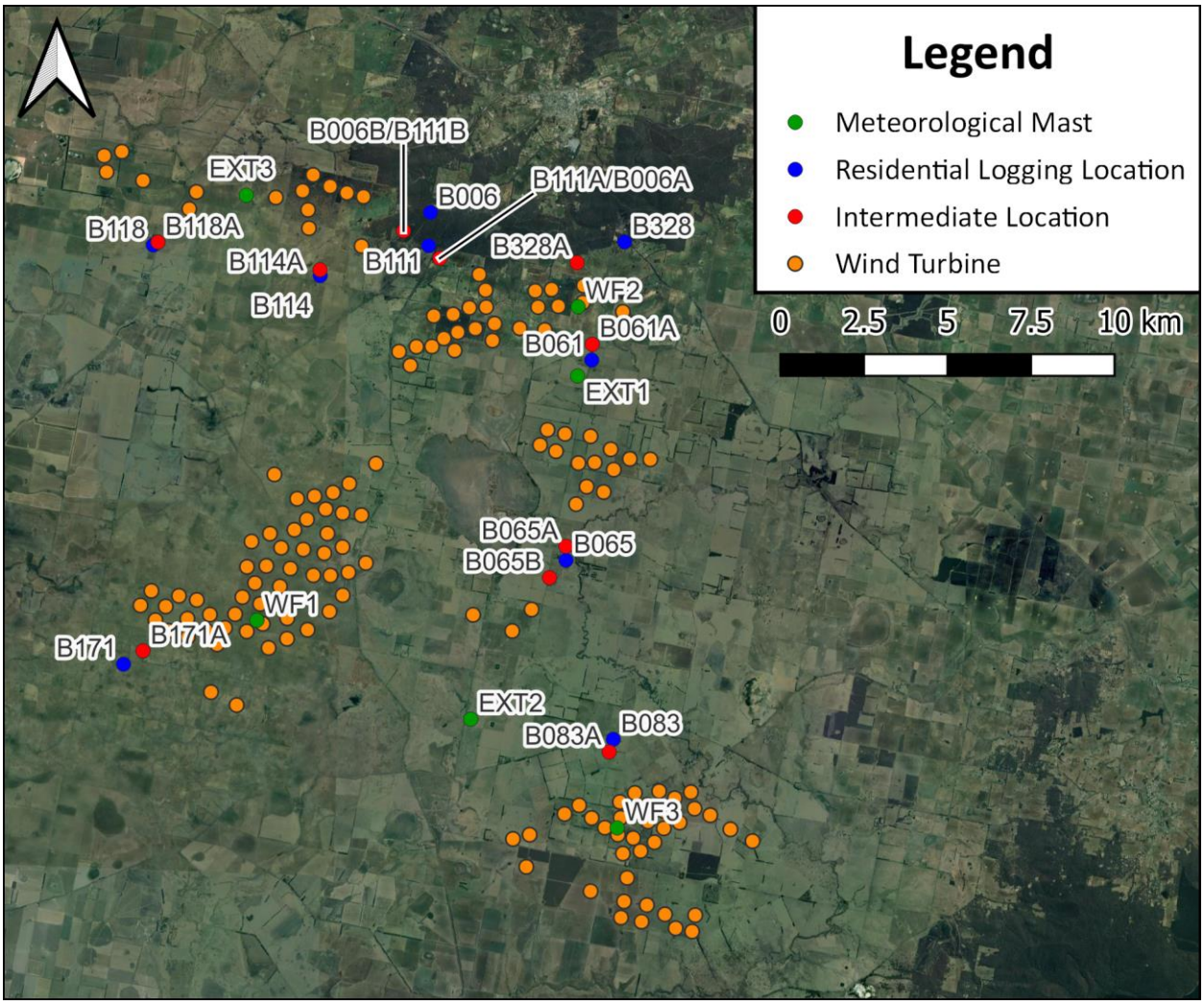


Figure 3: Aerial View of the Site

The use of the intermediate location measurements is discussed further in Section 4.

4 RESIDENTIAL LOGGING

The A-weighted noise levels (L_{A90}) at each of the residential logging locations were measured continuously in 10-minute intervals over a number of periods between 6 July and 8 September 2022, summarised in Table 5, which resulted in at least 6 weeks of data not affected by operational constraints of the Wind Farm.

Table 5: Sound Level Meter Serial Numbers

Residential Logging Location	Noise Monitoring Period		Sound Level Meter Serial Number
	Start Date	End Date	
B006	07/07/2022	25/08/2022	00320657
B061(S)	06/07/2022	25/08/2022	00710394
B065	06/07/2022	24/08/2022	00710391
B083	07/07/2022	25/08/2022	00220543
B111	07/07/2022	25/08/2022	00320648
B114	07/07/2022	25/08/2022	00320647
B118	07/07/2022	25/08/2022	00320649
B171	07/07/2022	08/09/2022	00710393
B328	06/07/2022	25/08/2022	00710427

(S) – This location is understood to be a stakeholder owned by Goldwind

At each of the monitoring locations, Rion NL-52 or NL-42, NATA calibrated, Class 1 or 2 sound level meters with a noise floor of less than 20 dB(A) were deployed, in compliance with Section 7.2.2 of the Standard. The serial numbers of the sound level meters are provided in Table 5 and the calibration certificates are provided in Appendix B.

The sound level meters were calibrated before and after the background noise monitoring regime with either a Class 1 Rion NC-74 calibrator or a Class 1 Rion NC-75 calibrator (with serial numbers 35094478 and 34913547, respectively) and the microphones were fitted with Rion WS-15 all-weather wind shields.

The position of noise loggers, in all instances, were on the Wind Farm side of the dwelling and at least 5m from the building facade, to remove the effects of reflecting surfaces, in accordance with Section 7.1.6 of the Standard. A photograph of the noise logging equipment at each residential logging location is provided in Appendix C.

At each of the residential logging locations, noise monitoring equipment was placed at the equivalent position to the background noise monitoring location, prior to construction of the Wind Farm, with the exception of B114, as required by Section 7.5.1 of the Standard. An air-conditioning unit had been installed near this location since the pre-construction assessment was completed, so the noise monitoring equipment was located away from this unit, while still fulfilling the positioning requirements noted above.

In addition to the noise logging, local wind speed logging was conducted at 3 locations (B061, B114 and B171) using Rainwise wind data loggers. Local rainfall data were collected using a combination of Rainwise and Hobo rain loggers at 2 locations (B114 and B171). The local weather loggers were at B061 and B114 for the duration of the noise logging period and at B171 from 25 August until the end of the monitoring period. The rainfall data and the measured wind speed at the microphone height were used to identify periods when data might have been adversely affected by weather. For locations where the local weather logging equipment was not deployed, data from the closest weather logger has been used in the analysis. A measurable amount of rain was recorded on a number of days, including: 07/07/2022 – 09/07/2022, 11/07/2022 – 13/07/2022, 17/07/2022, 18/07/2022, 23/07/2022, 25/07/2022 – 28/07/2022, 31/07/2022 – 03/08/2022, 06/08/2022, 07/08/2022, 11/08/2022 – 20/08/2022, 22/08/2022 – 27/08/2022, 29/08/2022, 02/09/2022, 04/09/2022, and 07/09/2022 – 09/09/2022, all inclusive.

During the noise monitoring regime, wind speed and direction were monitored at three meteorological masts located around the Wind Farm (Operational Masts). The wind speed data were then referenced back to the additional three locations where masts were previously located during the pre-construction noise monitoring (Development Masts). This was conducted based on correlations between the wind masts when all masts were operating, prior to the operation of the Wind Farm and was completed by GHD. The details of analysis are summarised in the technical memorandum prepared by GHD and titled “Derivation of Wind Reference Data”, dated 7 September 2022. This has been used to provide a hub height (108.5m) data set in 10-minute intervals, free of wake effects at each of the six masts used for the pre-construction noise monitoring. A hub height of 108.5m is the same as that used for the pre-construction assessment. The locations of the meteorological masts are provided in Table 6. It is noted that the location for WF3 in the technical memorandum is incorrect and has been corrected for this report. A wind rose has been prepared for both the noise monitoring period as well as a long-term period preceding the post-construction monitoring. These can be seen in Appendix D and show that the most and least frequent wind directions remain the same between these two periods. This indicates that the wind conditions experienced during the monitoring period are representative of all conditions experienced on the site.

Table 6: Meteorological Mast Locations

Mast Location		Coordinates (WGS 84 Zone 54)		Anemometer Height
		Easting	Northing	
Development Masts	WF1	701402	5839204	82m
	WF2	711017	5848595	82m
	WF3	712188	5832983	82m
Operational Masts	EXT1	711003	5846520	80m
	EXT2	707804	5836241	80m
	EXT3	701085	5851932	80m

4.1 DATA ANALYSIS

The NCTP allows noise from other sources to be removed as follows:

- By filtering out time periods:
  - affected by rain, hail or wind based on a weather logger placed at an equivalent location to one of the noise loggers. Data is adversely affected where precipitation occurs in a 10-minute period, or the period either side, or where a wind speed greater than 5 m/s is exceeded for 90% of a 10-minute period (conducted at all locations);
  - when sufficient WTGs are not operational to influence the measured level during the current 10-minute period (conducted at all locations);
  - where the wind speed is below the cut-in wind speed (conducted at all locations); and
  - considered abnormal, such as during local construction or maintenance activities, or during the setup or collection of equipment (conducted at all locations).
- By filtering out time periods or frequency content where noise data collected at an intermediate location confirms that the source of the noise at a receptor is not the wind turbines (conducted at B111 only).
- The subtraction of the background noise levels from the compliance noise measurements (conducted at all locations, except B111).

It is noted that:

- The wind farm was shut down for select periods during the noise monitoring period. The dates of these periods, as well as the monitoring locations impacted can be seen in Table 7. Data points during these periods have been removed from the analysis. For periods where only some of the wind turbines were off, the predictions have been consulted to determine the contribution that these turbines would have had on the locations used for the compliance assessment. At these locations,

the contribution of the off turbines was no more than 11 dB(A), which is at least 20 dB(A) below the total predicted noise level at these locations, thus indicating that these turbines do not influence the noise level at these locations. Therefore, the wind farm operating at less than full capacity had no impact on the compliance assessment.

Table 7: Wind Farm Shut Down Periods

Start Time	End Time	Shutdown Reason	Affected Locations
22/07/2022 9:30am	03/08/2022 4:30pm	AEMO	B006, B061(S), B111, B114, B118, B328
25/07/2022 6:40am	30/07/2022 4:30pm	AEMO	B065, B171, B083
05/09/2022 4:30am	08/09/2022 12:00pm	HV Maintenance	B171

(S) – This location is understood to be a stakeholder owned by Goldwind

- The NCTP allows for additional data filtering based on the results at the intermediate location. Not filtering for this is a conservative approach as noise from other sources is included in the measured noise levels. The intermediate data have been used for additional filtering at B111 only. Time periods where the noise level at both intermediate locations is lower than the measured level have been filtered out. In addition, a series of audio recordings made during the monitoring period were reviewed to identify the cause of the higher noise level at the residential logging location. It was determined through this review that the noise from frogs and insects was evident in many samples.
- The NCTP also notes that the background noise level will be logarithmically subtracted from the residential logging results where filtering based on intermediate data is not used. This has been done at all locations except for B111, where the intermediate data was used to filter noise from other sources. It is noted that the subtraction of background noise has been limited such that the measured noise level is reduced by no more than 3 dB.

Following the data removal process, the remaining noise data were correlated with the hub height wind speed data for each residential logging location, in line with Section 7.5.2 and the procedure outlined in Section 7.4 of the Standard. The hub height wind speed used for the correlation was taken from the same meteorological mast location as the pre-construction background noise assessments. The following table provides the number of valid data points following the filtering of data and identifies the wind mast location which has been used for the correlations at each residential logging location.

Table 8: Number of Valid Data Pairs and Relevant Wind Mast

Testing Location	Valid Data Points	Relevant Mast
B006	4507	EXT3
B061(S)	5585	WF2
B065	5427	EXT2
B083	5579	WF3
B111	3355	WF2
B114	4516	EXT3
B118	4466	EXT3
B171	5901	WF1
B328	4731	WF2

(S) – This location is understood to be a stakeholder owned by Goldwind

A third order polynomial regression analysis was performed on the correlations to determine the noise levels for comparison with the criteria.

4.2 SPECIAL AUDIBLE CHARACTERISTICS

4.2.1 Tonality Adjustments

As noted in the nearfield measurement section, conducted in accordance with Section B2 of the Standard, no excessive tonality was identified and therefore the NCTP does not require further assessment at residential logging locations. Nonetheless, a subjective assessment for tonality was also conducted at each residence while placing and collecting the noise monitoring equipment. Excessive tonality was not identified on any of these occasions. No adjustments are therefore made for the special audible characteristic of tonality.

4.2.2 Modulation Adjustments

The nearfield section of this report indicated that no regular amplitude modulation of the overall A-weighted level is present in the noise profile of the turbines. The NCTP therefore does not require any additional assessment at the residential logging locations. Nonetheless, a subjective assessment for amplitude modulation was also conducted at each residence while placing and collecting the noise monitoring equipment. Excessive amplitude modulation was not identified on any of these occasions. For completeness, an additional assessment has been conducted at each non-associated residence in accordance with the Standard.

As per the Standard, the special audible characteristic of amplitude modulation is present when the measured A-weighted peak to trough levels exceed 5 dB on a regularly varying basis or when the one-third octave band peak to trough levels exceed 6 dB on a regular basis in respect of the blade pass frequency.

The overall noise levels at each non-associated residential logging location were analysed for a number of periods covering a large wind speed range. The selected periods to be analysed were based upon the following criteria:

- The residential logging location was downwind of the closest turbine during the period;
- Local weather did not affect the measurement period; and
- The measurement period was generally at night.

A one-third octave band analysis was conducted for one measurement period during the night period for each residence. The measurement period which showed the highest overall A-weighted variation at a regular interval was selected.

The figures in Appendix F show the results for:

- the overall A-weighted level for a range of wind speeds, with horizontal lines at 5 dB(A) intervals for ease of modulation identification; and
- the variation in noise level for each one-third octave band for one example, with horizontal lines at 6 dB(A) intervals for ease of modulation identification.

The analysis found variation greater than 6 dB(A) at low frequencies (25Hz – 63Hz) in almost all cases, as well as variation in some cases in the higher frequency bands.

Low frequency Modulation

Although the analysis found variations in noise level greater than 6 dB(A) at low frequencies (25Hz – 63Hz) in almost all cases, none of these were on a regular basis in respect of the blade pass frequency.

Although the low frequency variation is not on a regular basis at the blade pass frequency, a comparison has been made with the variation in low frequency time traces with the Wind Farm shut off. The comparison is shown in Figure 4. The figure shows no significant difference in the low frequency variation with the Wind Farm on or off. This confirms that the Wind Farm did not result in low frequency one-third octave band peak to trough levels exceeding 6 dB on a regular basis in respect of the blade pass frequency.

High Frequency Modulation

Digital audio files have been analysed to understand the noise sources for the higher frequency variation. Where appropriate, the sources of the noise identified have been labelled on the figures. The presence of noise from insects, frogs, birds, and dogs explains the high frequency variation in one-third octave bands greater than 6 dB.

Periods of variation from the turbines

The analysis found some periods of variation in the one-third octave band levels which were attributable to the Wind Farm. The Standard states that for measured one-third octave band results, the peak to trough levels must "exceed 6 dB on a regular basis in respect of the blade pass frequency" to be considered a special audible characteristic. The periods identified did not exceed 6 dB on a regular basis in respect of the blade pass frequency, and therefore have not been considered special audible characteristics.

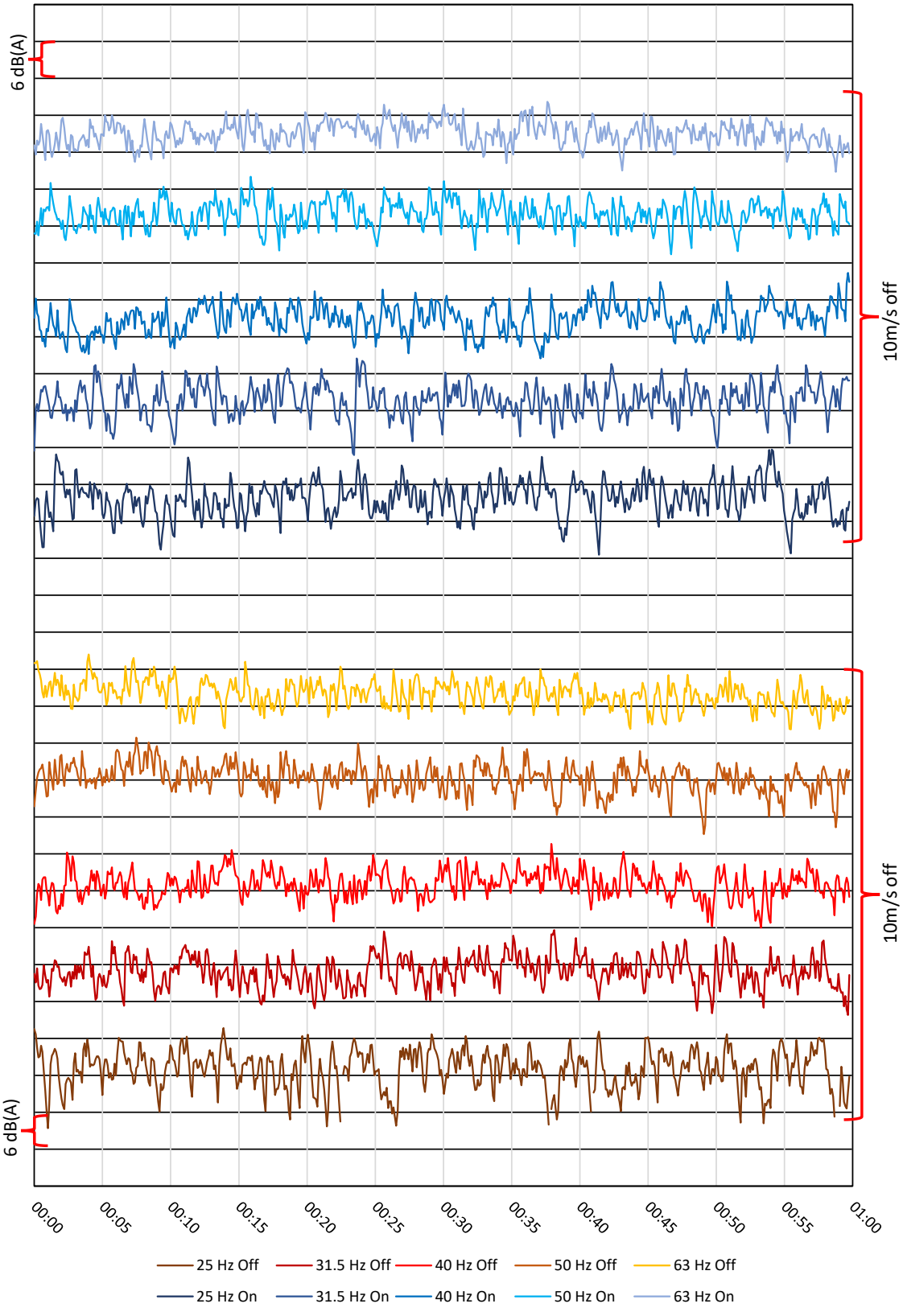


Figure 4: B006 Amplitude Modulation On and Off Comparison

4.3 RESIDENTIAL LOGGING RESULTS

The correlation graphs with the regression curve and criteria are provided in Figure 5 to Figure 13. The measured noise levels and criteria for each integer hub height wind speed from 3m/s to 14m/s have also been tabulated in Table 9.

The results indicate that the noise from the Wind Farm is less than the project criteria, specified in Condition 21 of the Planning Permit, at all integer wind speeds. The criteria for non-participant dwellings are defined as 40 dB(A), except where the background sound level is greater than 35 dB(A), in which case the criteria will be the background sound level plus 5 dB. For example, for B061, where the background sound level at an integer wind speed of 13m/s is 43 dB(A), the criterion for this wind speed will therefore be 48 dB(A), indicating that a measured sound level of 46 dB(A) will be in compliance for this location at this integer wind speed. This has been determined through the subtraction of the pre-construction background noise levels for most locations and the filtering of data points based on the intermediate noise measurements for B111. The correlation graphs for each background noise monitoring location can be seen in Appendix E. As no penalties were required for special audible characteristics, the Wind Farm is therefore compliant with the noise criteria.

Table 9: Resultant Wind Farm Noise Levels (dB(A))

Testing Location	3m/s		4m/s		5m/s		6m/s		7m/s		8m/s		9m/s		10m/s		11m/s		12m/s		13m/s		14m/s	
	Measured	Criterion	Measured	Criterion	Measured	Criterion	Measured	Criterion	Measured	Criterion	Measured	Criterion	Measured	Criterion	Measured	Criterion	Measured	Criterion	Measured	Criterion	Measured	Criterion	Measured	Criterion
B006	19	40	21	40	22	40	24	40	26	40	28	40	30	40	31	40	33	40	34	40	35	40	36	40
B061(S)	25	45	26	45	29	45	31	45	34	45	36	45	39	45	41	45	43	45	45	45	46	48	47	51
B065	25	40	26	40	27	40	29	40	31	40	33	40	35	40	37	42	39	44	41	45	42	47	44	49
B083	24	40	25	40	26	40	28	40	30	40	32	40	33	40	34	40	36	41	37	44	39	46	41	49
B111	26	40	27	40	29	40	31	40	32	40	34	40	36	40	37	40	38	40	39	40	40	42	41	44
B114	28	40	29	40	31	40	32	40	34	40	36	40	37	40	39	40	40	41	42	43	43	45	45	46
B118	21	40	23	40	26	40	28	40	30	40	32	40	33	40	35	40	36	40	36	40	37	43	38	46
B171	25	40	27	40	30	40	32	40	34	40	36	40	37	40	39	40	40	42	41	45	42	47	43	49
B328	25	40	26	40	27	40	29	40	31	40	32	40	34	41	35	42	37	43	38	44	39	45	39	46

(S) – This location is understood to be a stakeholder owned by Goldwind

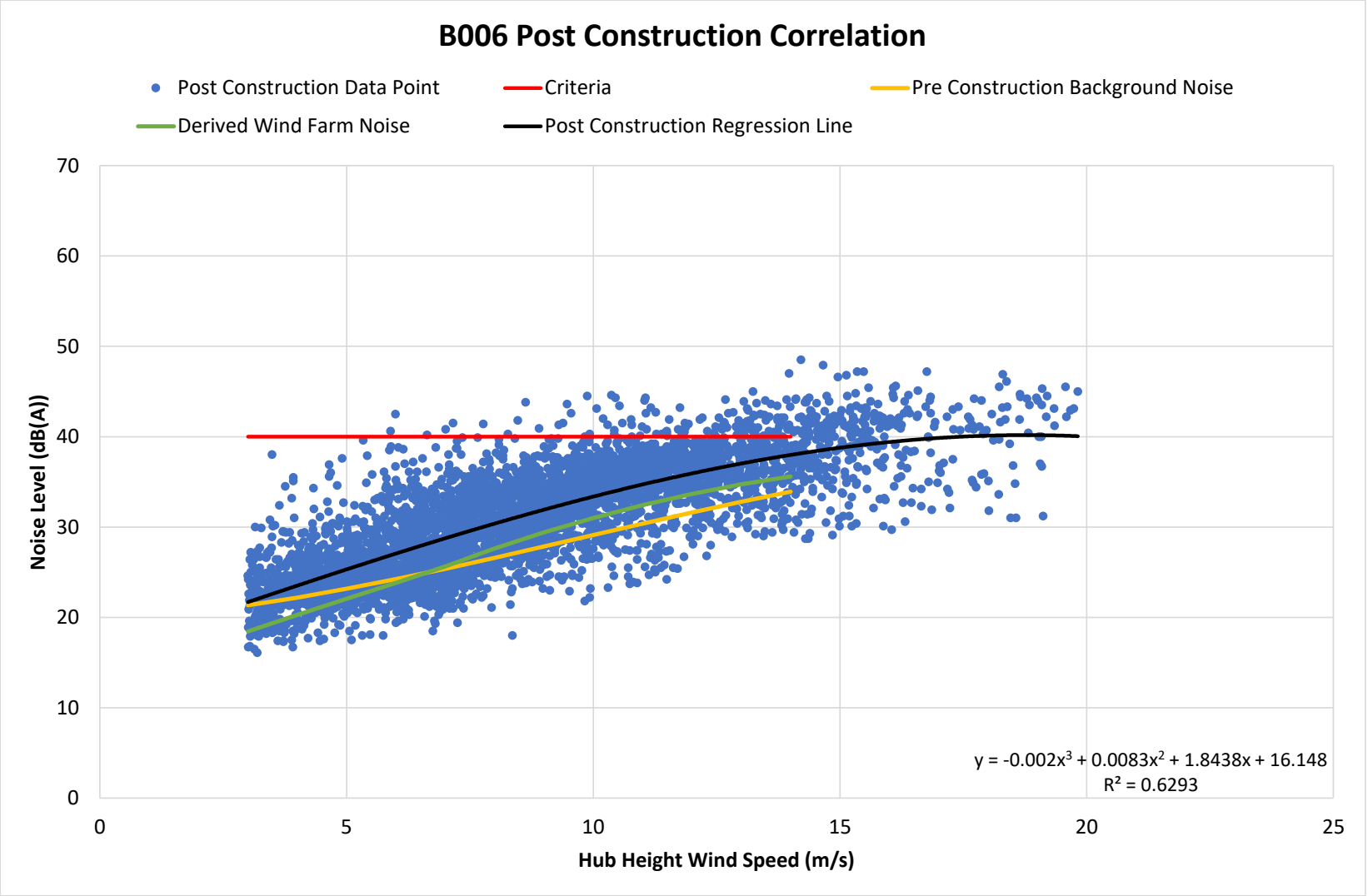


Figure 5: Correlation Between Noise Level and Wind Speed at B006

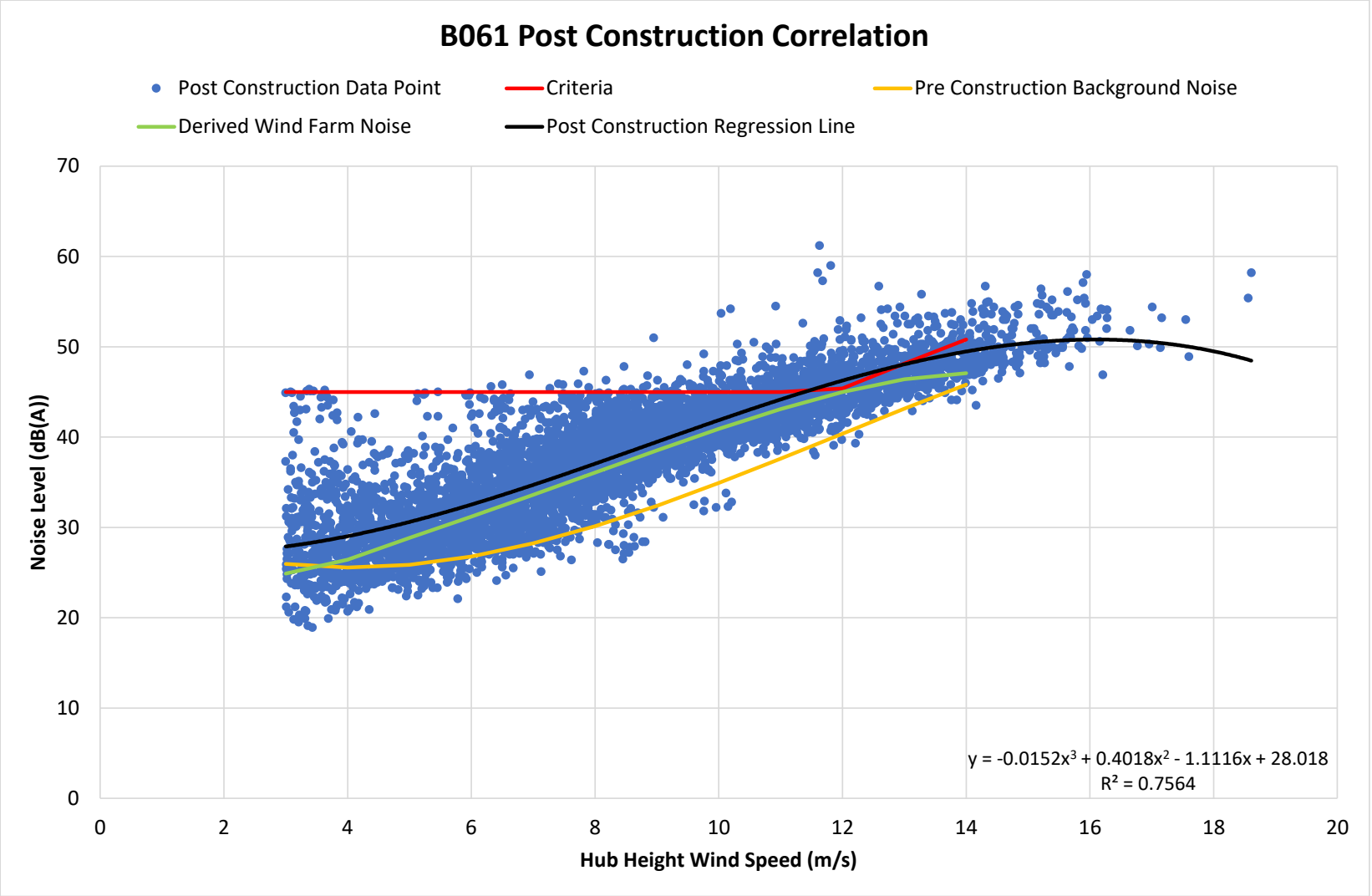


Figure 6: Correlation Between Noise Level and Wind Speed at B061(S)

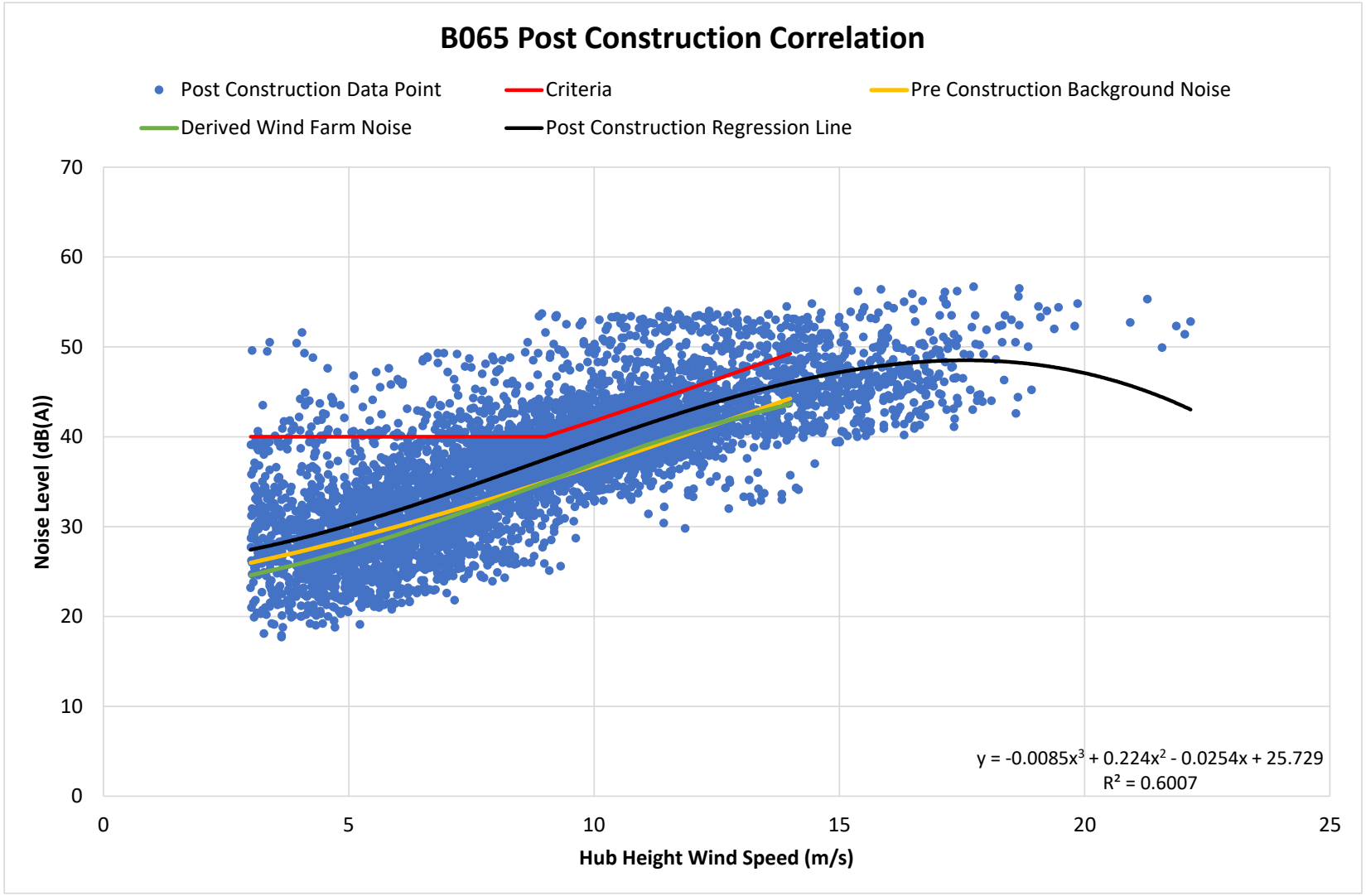


Figure 7: Correlation Between Noise Level and Wind Speed at B065

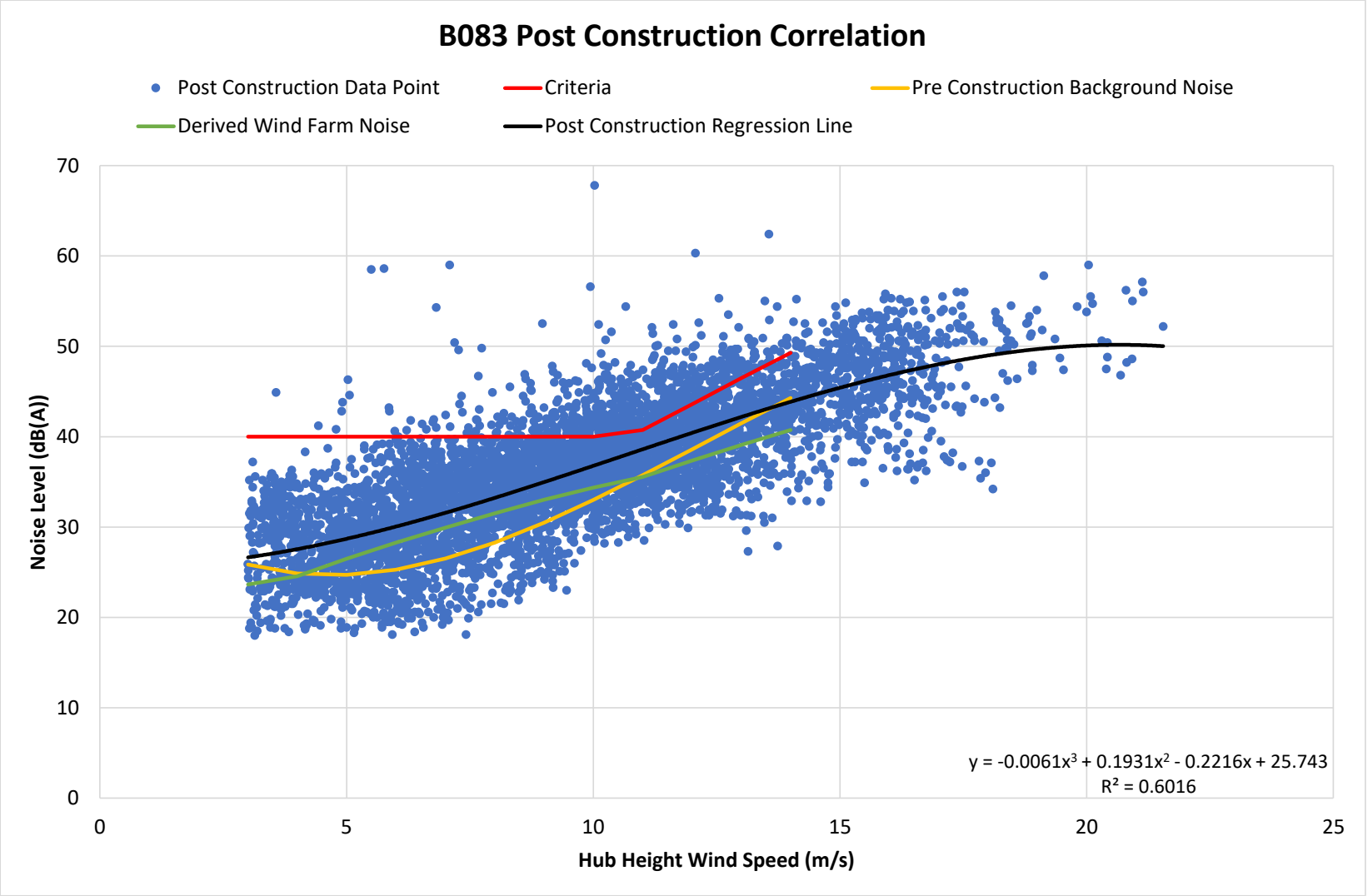


Figure 8: Correlation Between Noise Level and Wind Speed at B083

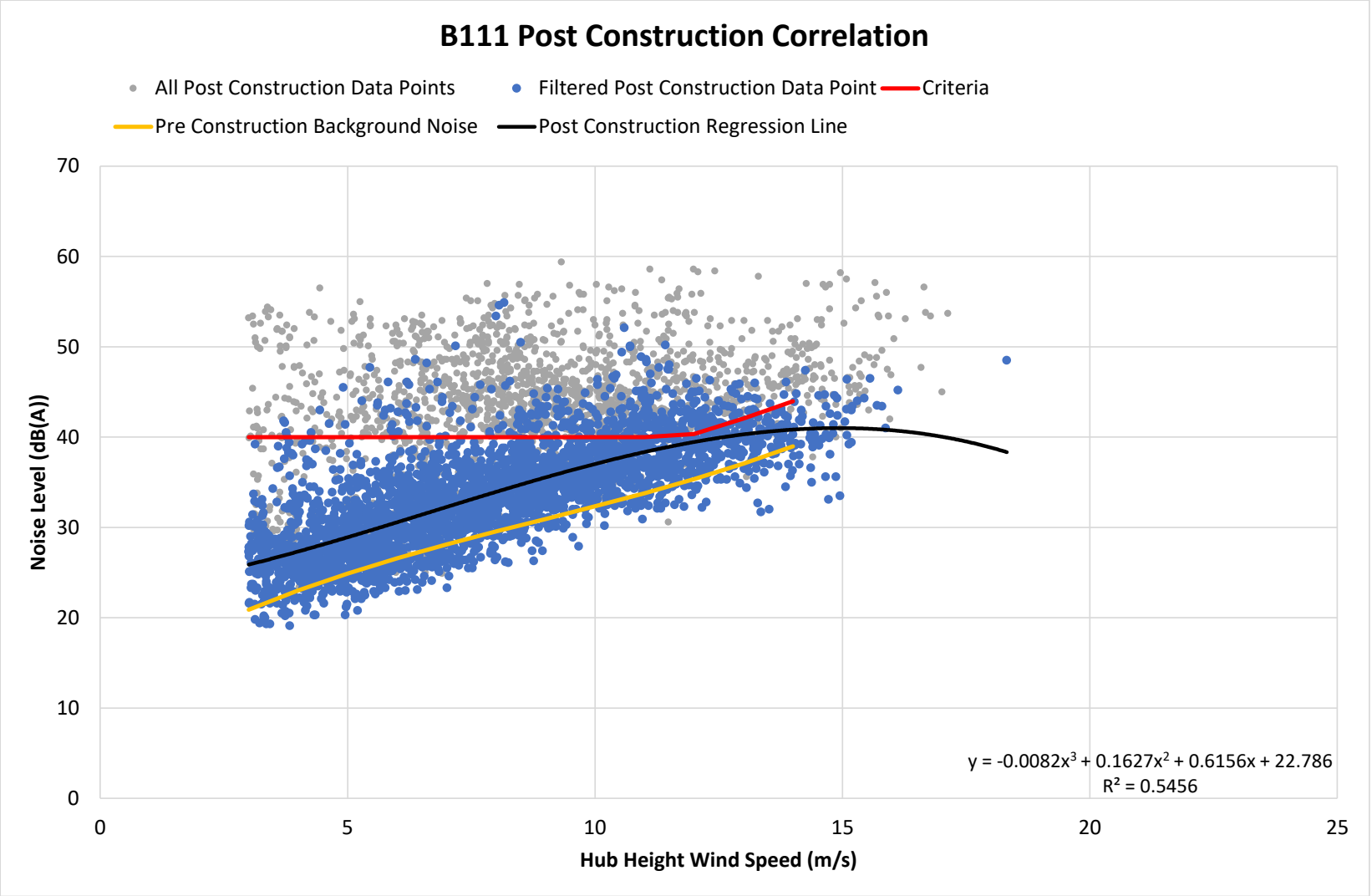


Figure 9: Correlation Between Noise Level and Wind Speed at B111

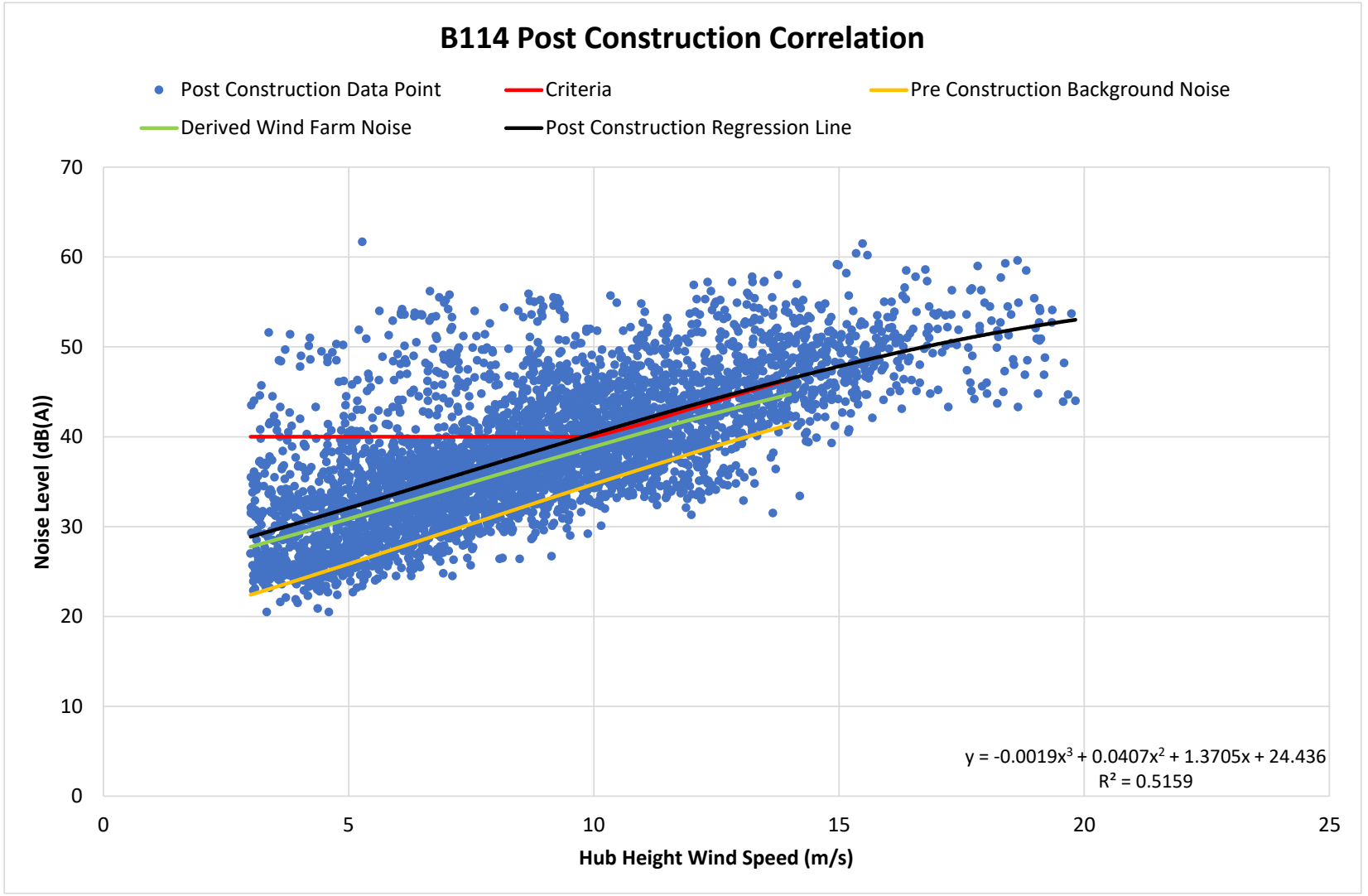


Figure 10: Correlation Between Noise Level and Wind Speed at B114

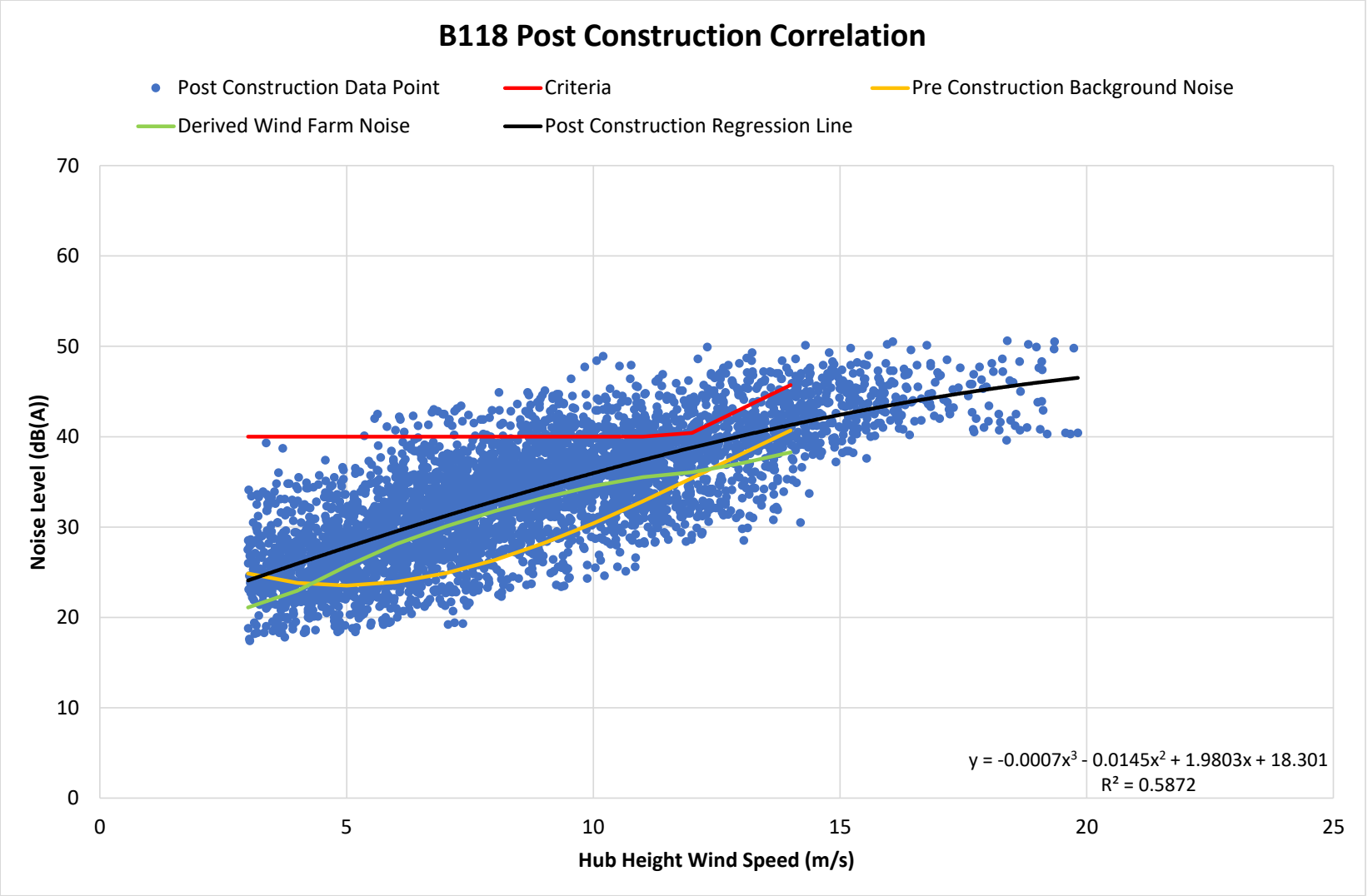


Figure 11: Correlation Between Noise Level and Wind Speed at B118

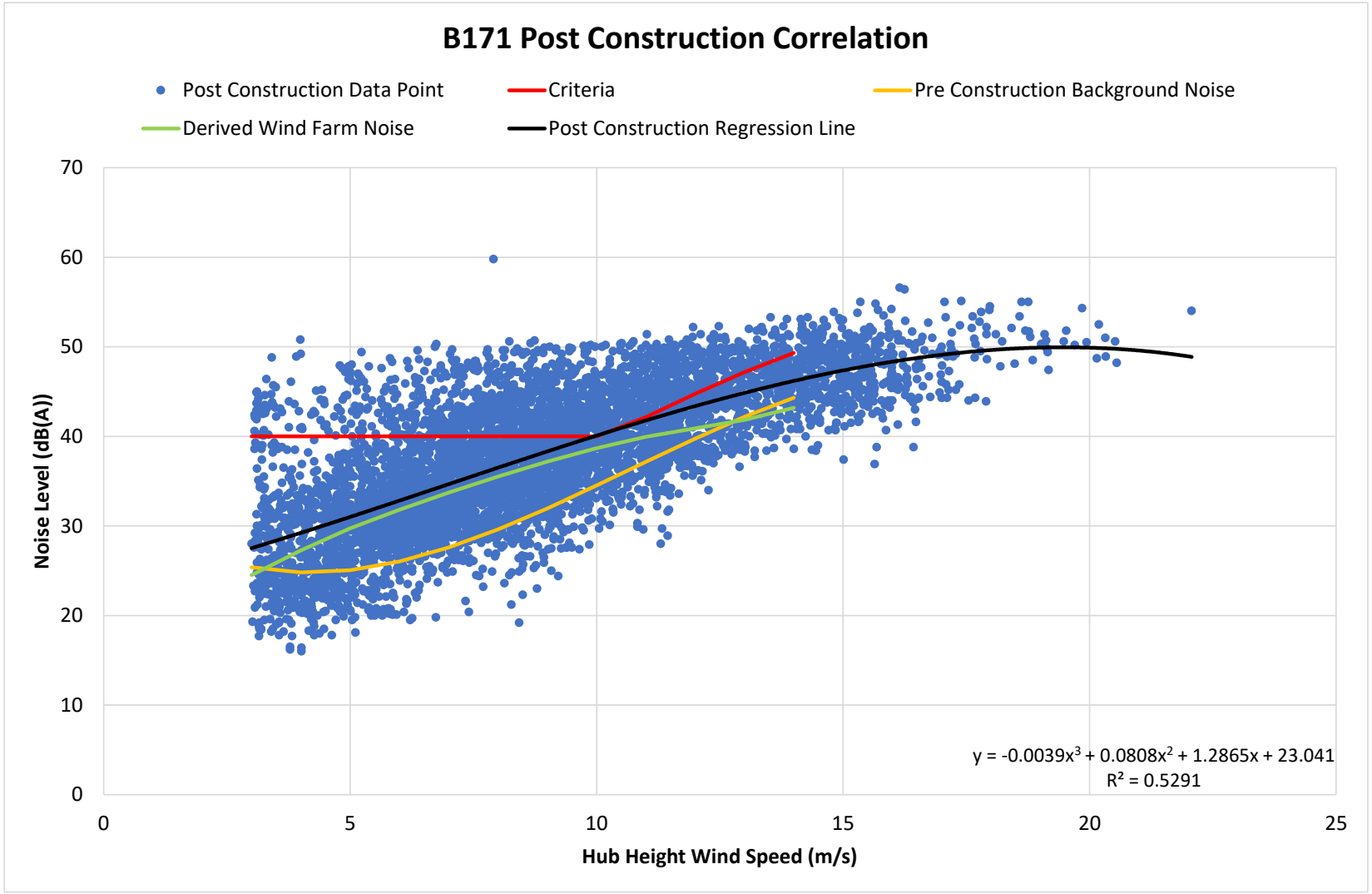


Figure 12: Correlation Between Noise Level and Wind Speed at B171

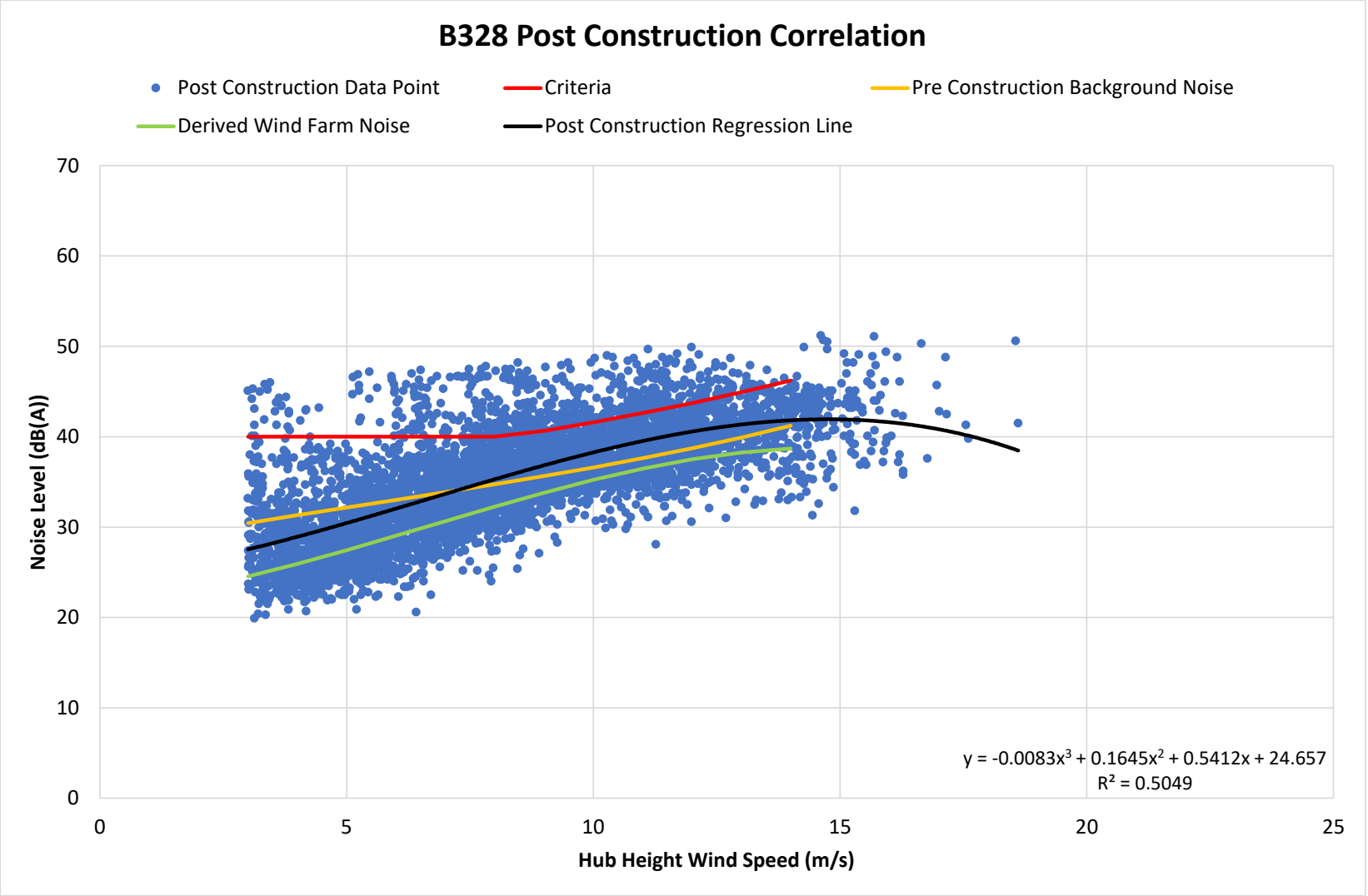


Figure 13: Correlation Between Noise Level and Wind Speed

5 CONCLUSION

Post construction noise testing has been conducted for the Stockyard Hill Wind Farm in accordance with the NCTP.

The testing included noise measurements at nine residential logging locations in the vicinity of the Wind Farm, intermediate locations between these locations and the Wind Farm and in the nearfield of example turbines. The results of these measurements have been used to confirm that the noise from operation of the Wind Farm does not exceed the established noise criteria at all surrounding dwellings and that no penalties are warranted for the special audible characteristics of tonality or amplitude modulation.

The Project therefore complies with the noise performance requirements as set out in Condition 26 of the Planning Permit.

6 APPENDIX A: SECTION 8.3 REQUIREMENTS

Section 8.3 of the Standard provides the following requirements for the report:

Any report of wind farm post-installation sound level measurements and compliance assessment, other than on/off tests, made in accordance with this Standard shall refer to this Standard and provide the following:

(a) Description of the sound monitoring equipment including any ancillary equipment;

(b) A statement confirming the use of A-frequency-weighting;

(c) The location of sound monitoring positions;

(d) Description of the anemometry equipment including the height AGL of the anemometer;

(e) Position of wind speed measurements;

(f) Make and model of the wind turbines;

(g) Number of operational wind turbines;

(h) Time and duration of monitoring period;

(i) Averaging period for both sound and wind speed measurements;

(j) Atmospheric conditions: the wind speed and direction at the wind farm position and rainfall shall be recorded;

(k) Number of data pairs measured (wind speed in m/s, sound in L90);

(l) Description of the regression analysis;

(m) Graphical plots showing the data scatter and the regression lines;

(n) Graphical plots showing the data scatter and the regression lines for both the background and the wind farm in operation;

(o) Assessment of special audible characteristics; and

(p) A statement that the wind farm complies with relevant noise limits – or not – as determined from the results of the measurements.

The location in the report where each of the above points have been addressed can be seen in the below table:

Table 10: Location Where Section 8.3 Requirements are Addressed

Requirement	Section Numbers
(a)	4
(b)	4
(c)	2, 3.2, 8
(d)	4
(e)	3.2, 4
(f)	1
(g)	1
(h)	4
(i)	4
(j)	4, 9
(k)	4.1
(l)	4.1
(m)	4.2
(n)	4.2
(o)	3.1, 4.3, 10
(p)	4.2, 5

7 APPENDIX B: CALIBRATION CERTIFICATES

Acoustic Research Labs Pty Ltd
Unit 36/14 Loyalty Rd
North Rocks NSW AUSTRALIA 2151
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 C20538

Client Details	Sonus Pty Ltd 17 Ruthven Avenue Adelaide SA 5000
Equipment Tested/ Model Number :	Rion NL-52
Instrument Serial Number :	00320657
Microphone Serial Number :	03435
Pre-amplifier Serial Number :	10665

Pre-Test Atmospheric Conditions		Post-Test Atmospheric Conditions	
Ambient Temperature :	21.5°C	**Ambient Temperature :**	21.4°C
Relative Humidity :	49.4%	**Relative Humidity :**	47.4%
Barometric Pressure :	99.92kPa	**Barometric Pressure :**	99.96kPa

Calibration Technician :	Jeff Yu	**Secondary Check:**	Max Moore
Calibration Date :	23 Sep 2020	**Report Issue Date :**	6 Oct 2020

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	
125Hz	*±0.12dB*	*Temperature*	*±0.2°C*
1kHz	*±0.11dB*	*Relative Humidity*	*±2.4%*
8kHz	*±0.13dB*	*Barometric Pressure*	*±0.015kPa*
Electrical Tests	*±0.10dB*		

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.

PAGE 1 OF 1

RION CO., LTD.

3-20-41 Higashimotomachi Kokubunji Tokyo 185-8533
Phone:042(359)7888, Facsimile:042(359)7442

Certificate of Calibration

Name : **Sound Level Meter, Class 1**

Model : **NL-52** **S/No.** : **00710394**

Date of Calibration : **August, 20, 2021**

We hereby certify that the above product was tested and calibrated according to the prescribed Rion procedures, and that it fulfills specification requirements.
The measuring equipment and reference devices used for testing and calibrating this unit are managed under the Rion traceability system and are traceable according to official Japanese standards and official standards of countries belonging to the International Committee of Weights and Measures.

RION CO., LTD.

K. Ikeda

Manager, Quality Control Department

RION CO., LTD.

3-20-41 Higashimotomachi Kokubunji Tokyo 185-8533
Phone:042(359)7888, Facsimile:042(359)7442

Certificate of Calibration

Name : **Sound Level Meter, Class 1**

Model : **NL-52** **S/No.** : **00710391**

Date of Calibration : **August, 25, 2021**

We hereby certify that the above product was tested and calibrated according to the prescribed Rion procedures, and that it fulfills specification requirements.
The measuring equipment and reference devices used for testing and calibrating this unit are managed under the Rion traceability system and are traceable according to official Japanese standards and official standards of countries belonging to the International Committee of Weights and Measures.

RION CO., LTD.

K. Ikeda

Manager, Quality Control Department

Acoustic Research Labs Pty Ltd
Unit 36/14 Loyalty Rd
North Rocks NSW AUSTRALIA 2151
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 C20535

Client Details	Sonus Pty Ltd 17 Ruthven Avenue Adelaide SA 5000
Equipment Tested/ Model Number :	Rion NL-52
Instrument Serial Number :	00220543
Microphone Serial Number :	03377
Pre-amplifier Serial Number :	10543

Pre-Test Atmospheric Conditions		Post-Test Atmospheric Conditions	
Ambient Temperature :	22.4°C	**Ambient Temperature :**	22.1°C
Relative Humidity :	50.1%	**Relative Humidity :**	47%
Barometric Pressure :	99.81kPa	**Barometric Pressure :**	99.87kPa

Calibration Technician : Jeff Yu
Calibration Date : 22 Sep 2020
Secondary Check: Max Moore
Report Issue Date : 6 Oct 2020

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	
125Hz	*±0.12dB*	*Temperature*	*±0.2°C*
1kHz	*±0.11dB*	*Relative Humidity*	*±2.4%*
8kHz	*±0.13dB*	*Barometric Pressure*	*±0.015kPa*
Electrical Tests	*±0.10dB*		

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.

PAGE 1 OF 1

Acoustic Research Labs Pty Ltd
Unit 36/14 Loyalty Rd
North Rocks NSW AUSTRALIA 2151
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 C20537

Client Details	Sonus Pty Ltd 17 Ruthven Avenue Adelaide SA 5000
Equipment Tested/ Model Number :	Rion NL-52
Instrument Serial Number :	00320648
Microphone Serial Number :	03397
Pre-amplifier Serial Number :	10656

Pre-Test Atmospheric Conditions		Post-Test Atmospheric Conditions	
Ambient Temperature :	22.1°C	**Ambient Temperature :**	22.1°C
Relative Humidity :	49.1%	**Relative Humidity :**	49.5%
Barometric Pressure :	99.94kPa	**Barometric Pressure :**	99.93kPa

Calibration Technician :	Jeff Yu	**Secondary Check:**	Max Moore
Calibration Date :	23 Sep 2020	**Report Issue Date :**	6 Oct 2020

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	
125Hz	*±0.12dB*	*Temperature*	*±0.2°C*
1kHz	*±0.11dB*	*Relative Humidity*	*±2.4%*
8kHz	*±0.13dB*	*Barometric Pressure*	*±0.015kPa*
Electrical Tests	*±0.10dB*		

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.

PAGE 1 OF 1

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: SLM32790

EQUIPMENT TESTED: Sound Level Meter

Manufacturer:	Rion		
Type No:	NL-52	**Serial No:**	00320647
Mic. Type:	UC-59	**Serial No:**	03401
Pre-Amp. Type:	NH-25	**Serial No:**	54465

Owner: Sonus Pty Ltd
17 Ruthven Ave
Adelaide SA 5000

Tests Performed: IEC 61672-3:2013

Comments: All Tests passed for Class 1. (See overleaf for details)

CONDITIONS OF TEST:

Ambient Pressure	993	hPa ±1 hPa	**Date of Receipt :**	03/06/2022
Temperature	21	°C ±1° C	**Date of Calibration :**	06/06/2022
Relative Humidity	43	% ±5%	**Date of Issue :**	06/06/2022

Acu-Vib Test Procedure: AVP10 (SLM) based on IEC 61672-3.

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%.

NATA
WORLD RECOGNISED ACCREDITATION
Accredited Lab No. 9262
Acoustic and Vibration Measurements

Acu-Vib Electronics
CALIBRATIONS SALES RENTALS REPAIRS

Head Office & Calibration Laboratory
Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
(02) 9680 8133
www.acu-vib.com.au

Page 1 of 2 Calibration Certificate
AVCERT10.2 Rev 2.0 14/04/2021

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	11/02/2021	Job No	RB856	Operator	AM
Client Name	SONUS PTY LTD				
Client Address	17 RUTHVEN AVE, ADELAIDE SA 5000				

Test Item

Instrument Make	RION	Model	NL-52	Serial No	#00320649
Microphone Make	RION	Model	UC-59	Serial No	#03398
Preamplifier Make	RION	Model	NH-25	Serial No	#20834
Ext'n Cable Make	Nil	Model	N/A	Serial No	N/A
Accessories	Nil			Firmware	2.0

SLM Type	1
Filters Class	N/A

Environmental Conditions	Measured	
	Start	End
Air Temp. (°C)	23.7	23.6
Rel. Humidity (%)	58.7	59.1
Air Pressure (kPa)	100.6	100.5

Applicable Standards:
Periodic tests were performed in accordance with procedures from IEC 61672-3 :2013 and IEC 61260-3 :2016

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:
The results of the tests and measurements included in this document are traceable via the test methods described under each test, and by the use of the above equipment, which has been calibrated by NATA accredited calibration facilities.
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 and IEC 61260-3:2016, 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 IEC 61672-1:2013 and IEC 61260-1:2014 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 1 specifications in IEC 61672-1:2013 and IEC 61260-1:2014 or correction 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 and IEC 61260-3:2016 cover only a limited subset of the specifications in IEC 61672-1:2013 and IEC 61260-1:2014.

NATA
WORLD RECOGNISED ACCREDITATION

NATA Accredited Laboratory Number 14966

Accredited for compliance with ISO/IEC 17025 - Calibration

Authorized Signatory:

Print Name: Ariel Michael Date: 15/02/2021

Template Document Name: RQT-05 (rev 72) SLM ISO Verification

RION CO., LTD.

3-20-41 Higashimotomachi Kokubunji Tokyo 185-8533
Phone:042(359)7888, Facsimile:042(359)7442

Certificate of Calibration

Name : **Sound Level Meter, Class 1**

Model : **NL-52** **S/No.** : **00710393**

Date of Calibration : **August, 20, 2021**

We hereby certify that the above product was tested and calibrated according to the prescribed Rion procedures, and that it fulfills specification requirements.
The measuring equipment and reference devices used for testing and calibrating this unit are managed under the Rion traceability system and are traceable according to official Japanese standards and official standards of countries belonging to the International Committee of Weights and Measures.

RION CO., LTD.

K. Ikeda

Manager, Quality Control Department

RION CO., LTD.

3-20-41 Higashimotomachi Kokubunji Tokyo 185-8533
Phone:042(359)7888, Facsimile:042(359)7442

Certificate of Calibration

Name : **Sound Level Meter, Class 1**

Model : **NL-52** **S/No.** : **00710427**

Date of Calibration : **September, 01, 2021**

We hereby certify that the above product was tested and calibrated according to the prescribed Rion procedures, and that it fulfills specification requirements.
The measuring equipment and reference devices used for testing and calibrating this unit are managed under the Rion traceability system and are traceable according to official Japanese standards and official standards of countries belonging to the International Committee of Weights and Measures.

RION CO., LTD.

K. Ikeda

Manager, Quality Control Department

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: SLM32823

EQUIPMENT TESTED: Sound Level Meter

Manufacturer:	Rion		
Type No:	NL-21	**Serial No:**	00354109
Mic. Type:	UC-52	**Serial No:**	101436
Pre-Amp. Type:	NH-21	**Serial No:**	14744

Owner: Sonus Pty Ltd
17 Ruthven Ave
Adelaide SA 5000

Tests Performed: IEC 61672-3:2013

Comments: All Tests passed for Class 2. (See overleaf for details)

CONDITIONS OF TEST:

Ambient Pressure	1001	hPa ±1 hPa	**Date of Receipt :**	06/06/2022
Temperature	21	°C ±1° C	**Date of Calibration :**	08/06/2022
Relative Humidity	35	% ±5%	**Date of Issue :**	08/06/2022

Acu-Vib Test Procedure: AVP10 (SLM) based on IEC 61672-3

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.

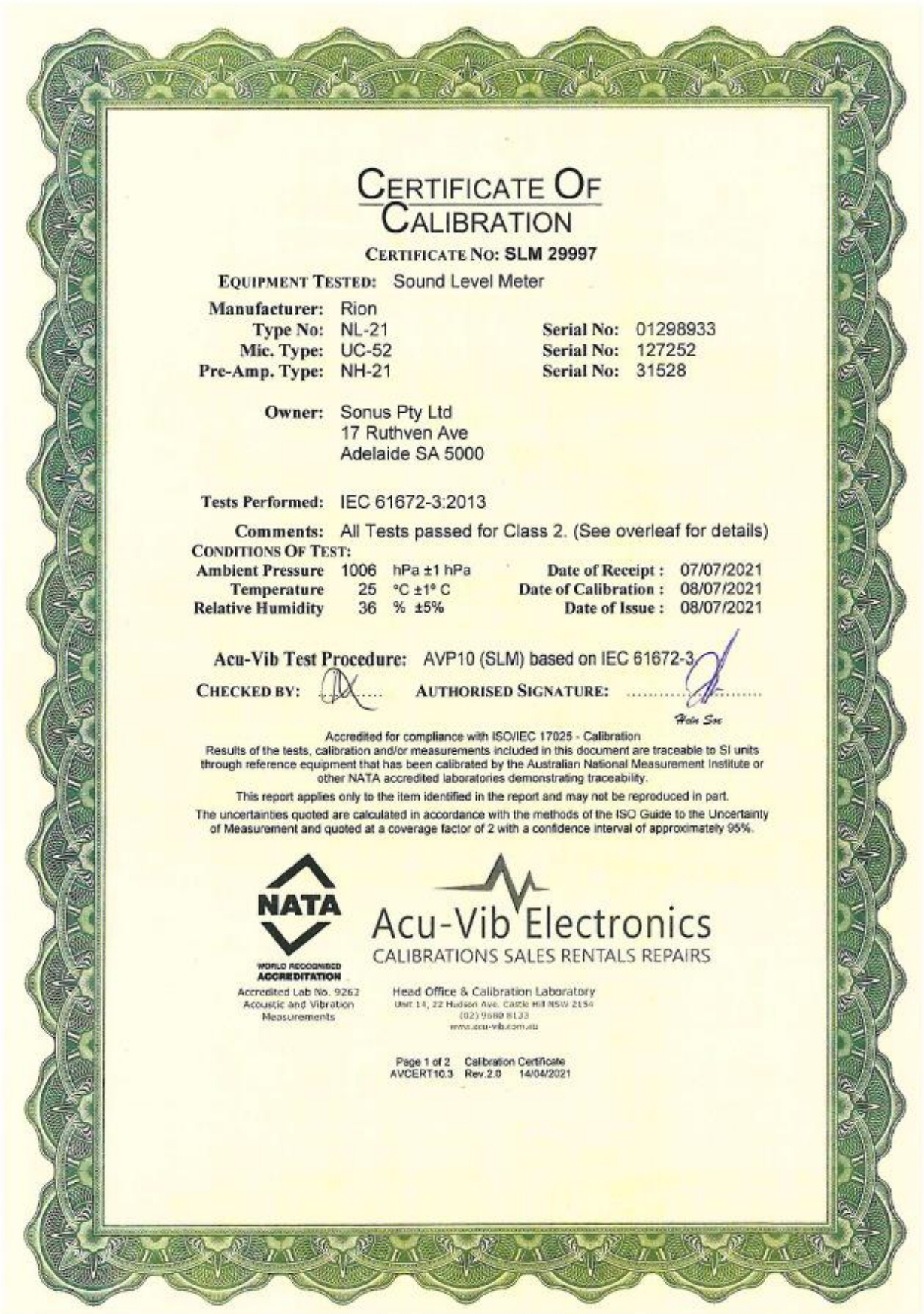
The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

NATA
WORLD RECOGNISED ACCREDITATION
Accredited Lab No. 9262
Acoustic and Vibration Measurements

Acu-Vib Electronics
CALIBRATIONS SALES RENTALS REPAIRS

Head Office & Calibration Laboratory
Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
(02) 9680 8133
www.acu-vib.com.au

Page 1 of 2 Calibration Certificate
AVCERT10.11 Rev.2.0 14/04/2021



CERTIFICATE OF CALIBRATION

CERTIFICATE NO: SLM 29997

EQUIPMENT TESTED: Sound Level Meter

Manufacturer:	Rion		
Type No:	NL-21	**Serial No:**	01298933
Mic. Type:	UC-52	**Serial No:**	127252
Pre-Amp. Type:	NH-21	**Serial No:**	31528

Owner: Sonus Pty Ltd
17 Ruthven Ave
Adelaide SA 5000

Tests Performed: IEC 61672-3:2013

Comments: All Tests passed for Class 2. (See overleaf for details)

CONDITIONS OF TEST:

Ambient Pressure	1006	hPa ±1 hPa	**Date of Receipt :**	07/07/2021
Temperature	25	°C ±1° C	**Date of Calibration :**	08/07/2021
Relative Humidity	36	% ±5%	**Date of Issue :**	08/07/2021

Acu-Vib Test Procedure: AVP10 (SLM) based on IEC 61672-3

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

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.

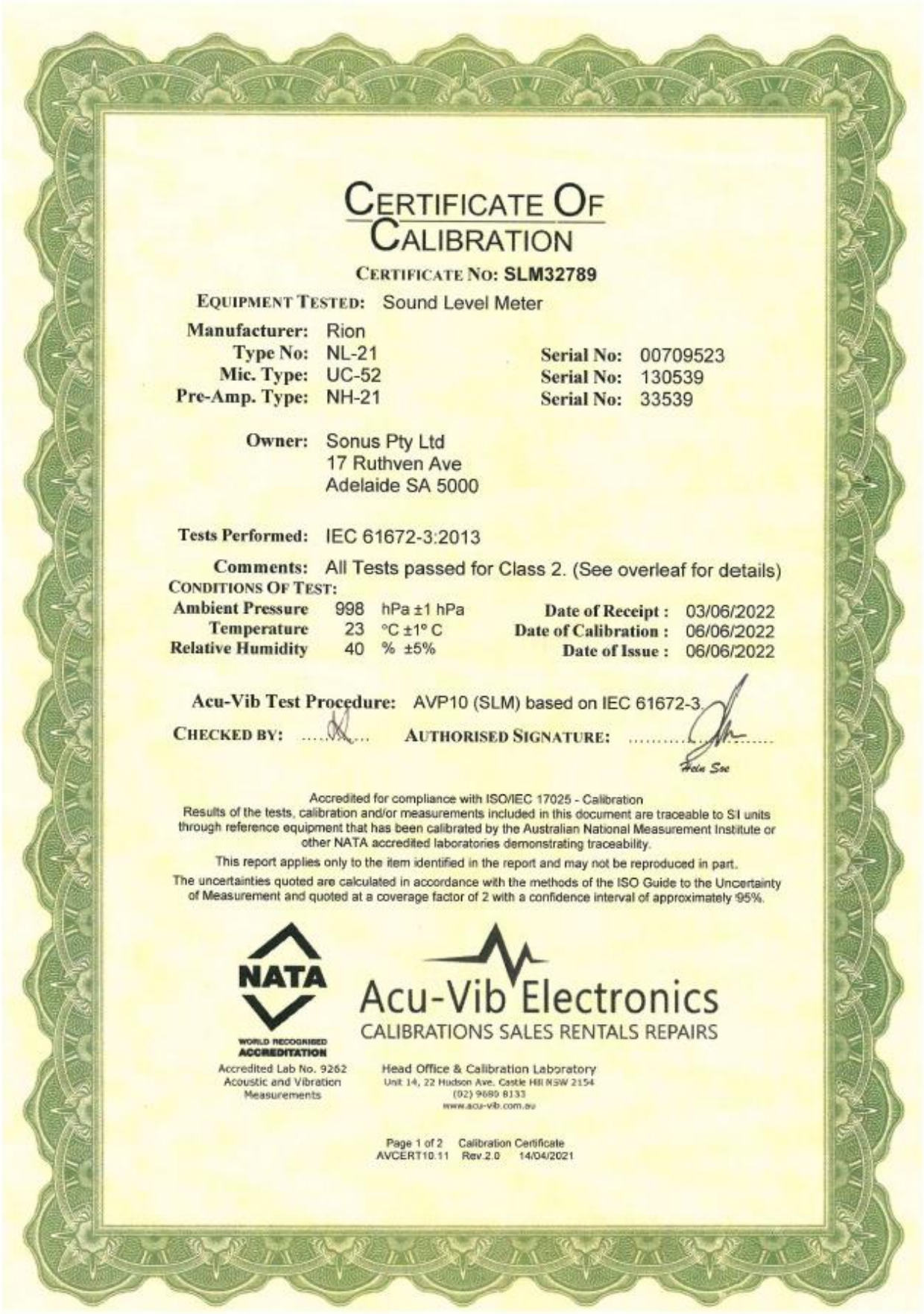
The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

NATA
WORLD RECOGNISED ACCREDITATION
Accredited Lab No. 9262
Acoustic and Vibration Measurements

Acu-Vib Electronics
CALIBRATIONS SALES RENTALS REPAIRS

Head Office & Calibration Laboratory
Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
(02) 9680 8133
www.acu-vib.com.au

Page 1 of 2 Calibration Certificate
AVCERT10.3 Rev.2.0 14/04/2021



CERTIFICATE OF CALIBRATION

CERTIFICATE NO: SLM32789

EQUIPMENT TESTED: Sound Level Meter

Manufacturer:	Rion		
Type No:	NL-21	**Serial No:**	00709523
Mic. Type:	UC-52	**Serial No:**	130539
Pre-Amp. Type:	NH-21	**Serial No:**	33539

Owner: Sonus Pty Ltd
17 Ruthven Ave
Adelaide SA 5000

Tests Performed: IEC 61672-3:2013

Comments: All Tests passed for Class 2. (See overleaf for details)

CONDITIONS OF TEST:

Ambient Pressure	998	hPa ±1 hPa	**Date of Receipt :**	03/06/2022
Temperature	23	°C ±1° C	**Date of Calibration :**	06/06/2022
Relative Humidity	40	% ±5%	**Date of Issue :**	06/06/2022

Acu-Vib Test Procedure: AVP10 (SLM) based on IEC 61672-3

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

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%.

NATA
WORLD RECOGNISED ACCREDITATION
Accredited Lab No. 9262
Acoustic and Vibration Measurements

Acu-Vib Electronics
CALIBRATIONS SALES RENTALS REPAIRS

Head Office & Calibration Laboratory
Unit 14, 22 Hudson Ave, Castle Hill NSW 2154
(02) 9680 8133
www.acu-vib.com.au

Page 1 of 2 Calibration Certificate
AVCERT10.11 Rev.2.0 14/04/2021

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: SLM32821

EQUIPMENT TESTED: Sound Level Meter

Manufacturer:	Rion		
Type No:	NL-21	**Serial No:**	00877043
Mic. Type:	UC-52	**Serial No:**	116416
Pre-Amp. Type:	NH-21	**Serial No:**	24441

Owner: Sonus Pty Ltd
17 Ruthven Ave
Adelaide SA 5000

Tests Performed: IEC 61672-3:2013

Comments: All Tests passed for Class 2. (See overleaf for details)

CONDITIONS OF TEST:

Ambient Pressure	995	hPa ±1 hPa	**Date of Receipt :**	06/06/2022
Temperature	24	°C ±1° C	**Date of Calibration :**	07/06/2022
Relative Humidity	37	% ±5%	**Date of Issue :**	08/06/2022

Acu-Vib Test Procedure: AVP10 (SLM) based on IEC 61672-3

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.

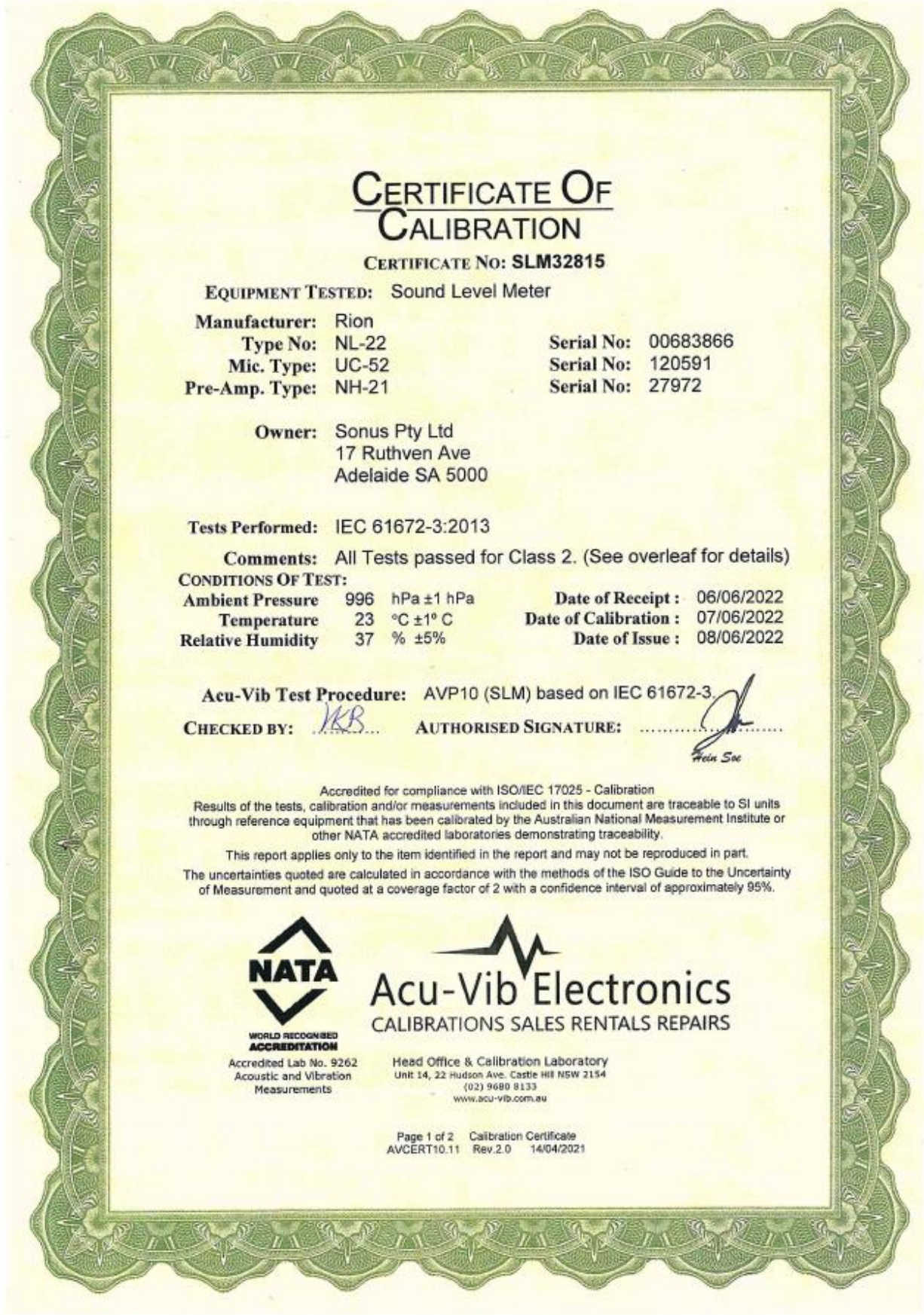
The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

NATA
WORLD RECOGNISED ACCREDITATION
Accredited Lab No. 9262
Acoustic and Vibration Measurements

Acu-Vib Electronics
CALIBRATIONS SALES RENTALS REPAIRS

Head Office & Calibration Laboratory
Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
(02) 9680 8133
www.acu-vib.com.au

Page 1 of 2 Calibration Certificate
AVCERT10.11 Rev.2.0 14/04/2021



CERTIFICATE OF CALIBRATION

CERTIFICATE NO: SLM32815

EQUIPMENT TESTED: Sound Level Meter

Manufacturer:	Rion		
Type No:	NL-22	**Serial No:**	00683866
Mic. Type:	UC-52	**Serial No:**	120591
Pre-Amp. Type:	NH-21	**Serial No:**	27972

Owner: Sonus Pty Ltd
17 Ruthven Ave
Adelaide SA 5000

Tests Performed: IEC 61672-3:2013

Comments: All Tests passed for Class 2. (See overleaf for details)

CONDITIONS OF TEST:

Ambient Pressure	996	hPa ±1 hPa	**Date of Receipt :**	06/06/2022
Temperature	23	°C ±1° C	**Date of Calibration :**	07/06/2022
Relative Humidity	37	% ±5%	**Date of Issue :**	08/06/2022

Acu-Vib Test Procedure: AVP10 (SLM) based on IEC 61672-3

CHECKED BY: MKB **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.

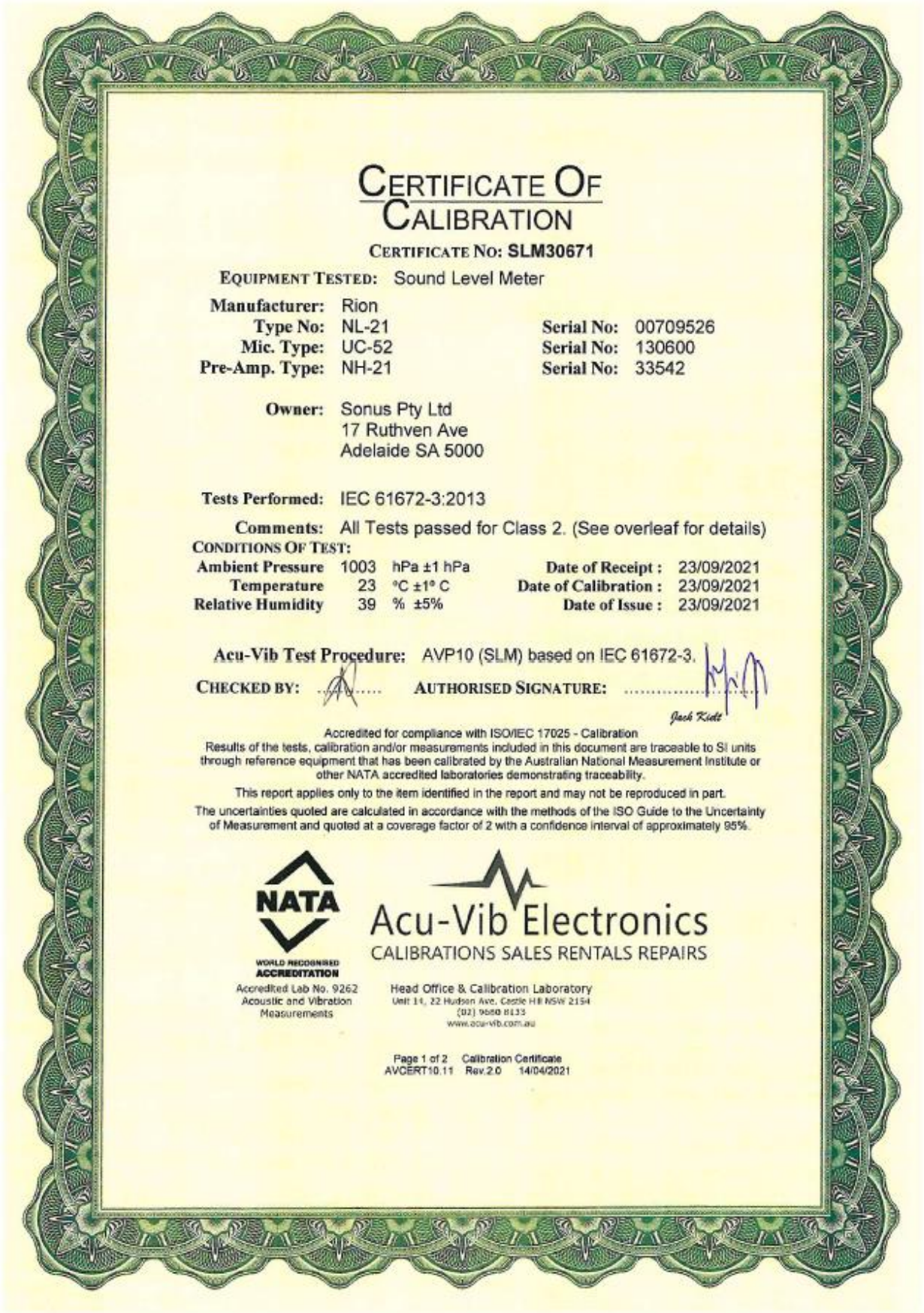
The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

NATA
WORLD RECOGNISED ACCREDITATION
Accredited Lab No. 9262
Acoustic and Vibration Measurements

Acu-Vib Electronics
CALIBRATIONS SALES RENTALS REPAIRS

Head Office & Calibration Laboratory
Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
(02) 9680 8133
www.acu-vib.com.au

Page 1 of 2 Calibration Certificate
AVCERT10.11 Rev.2.0 14/04/2021



CERTIFICATE OF CALIBRATION

CERTIFICATE NO: SLM30671

EQUIPMENT TESTED: Sound Level Meter

Manufacturer:	Rion		
Type No:	NL-21	**Serial No:**	00709526
Mic. Type:	UC-52	**Serial No:**	130600
Pre-Amp. Type:	NH-21	**Serial No:**	33542

Owner: Sonus Pty Ltd
17 Ruthven Ave
Adelaide SA 5000

Tests Performed: IEC 61672-3:2013

Comments: All Tests passed for Class 2. (See overleaf for details)

CONDITIONS OF TEST:

Ambient Pressure	1003	hPa ±1 hPa	**Date of Receipt :**	23/09/2021
Temperature	23	°C ±1° C	**Date of Calibration :**	23/09/2021
Relative Humidity	39	% ±5%	**Date of Issue :**	23/09/2021

Acu-Vib Test Procedure: AVP10 (SLM) based on IEC 61672-3.

CHECKED BY: ..... **AUTHORISED SIGNATURE:** .....
Jack Kidd

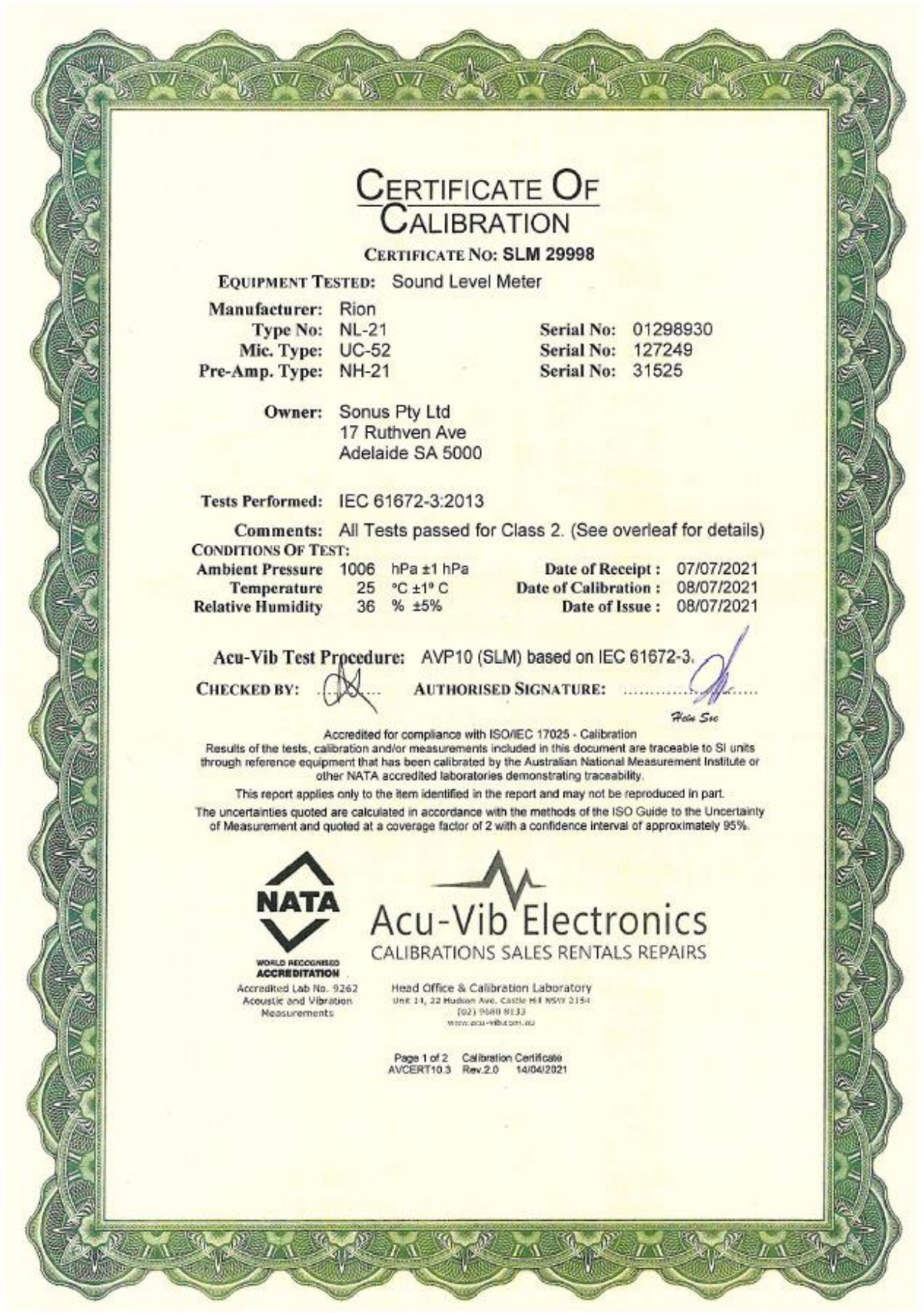
Accredited for compliance with ISO/IEC 17025 - Calibration
Results of the tests, calibration and/or measurements included in this document are traceable to SI units through reference equipment that has been calibrated by the Australian National Measurement Institute or other NATA accredited laboratories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

NATA
WORLD RECOGNISED ACCREDITATION
Accredited Lab No. 9262
Acoustic and Vibration Measurements

Acu-Vib Electronics
CALIBRATIONS SALES RENTALS REPAIRS

Head Office & Calibration Laboratory
Unit 14, 22 Hudson Ave, Castle Hill NSW 2154
(02) 9680 8133
www.acu-vib.com.au

Page 1 of 2 Calibration Certificate
AVCERT10.11 Rev.2.0 14/04/2021



CERTIFICATE OF CALIBRATION

CERTIFICATE NO: SLM 29998

EQUIPMENT TESTED: Sound Level Meter

Manufacturer:	Rion		
Type No:	NL-21	**Serial No:**	01298930
Mic. Type:	UC-52	**Serial No:**	127249
Pre-Amp. Type:	NH-21	**Serial No:**	31525

Owner: Sonus Pty Ltd
17 Ruthven Ave
Adelaide SA 5000

Tests Performed: IEC 61672-3:2013

Comments: All Tests passed for Class 2. (See overleaf for details)

CONDITIONS OF TEST:

Ambient Pressure	1006	hPa ±1 hPa	**Date of Receipt :**	07/07/2021
Temperature	25	°C ±1° C	**Date of Calibration :**	08/07/2021
Relative Humidity	36	% ±5%	**Date of Issue :**	08/07/2021

Acu-Vib Test Procedure: AVP10 (SLM) based on IEC 61672-3.

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

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.

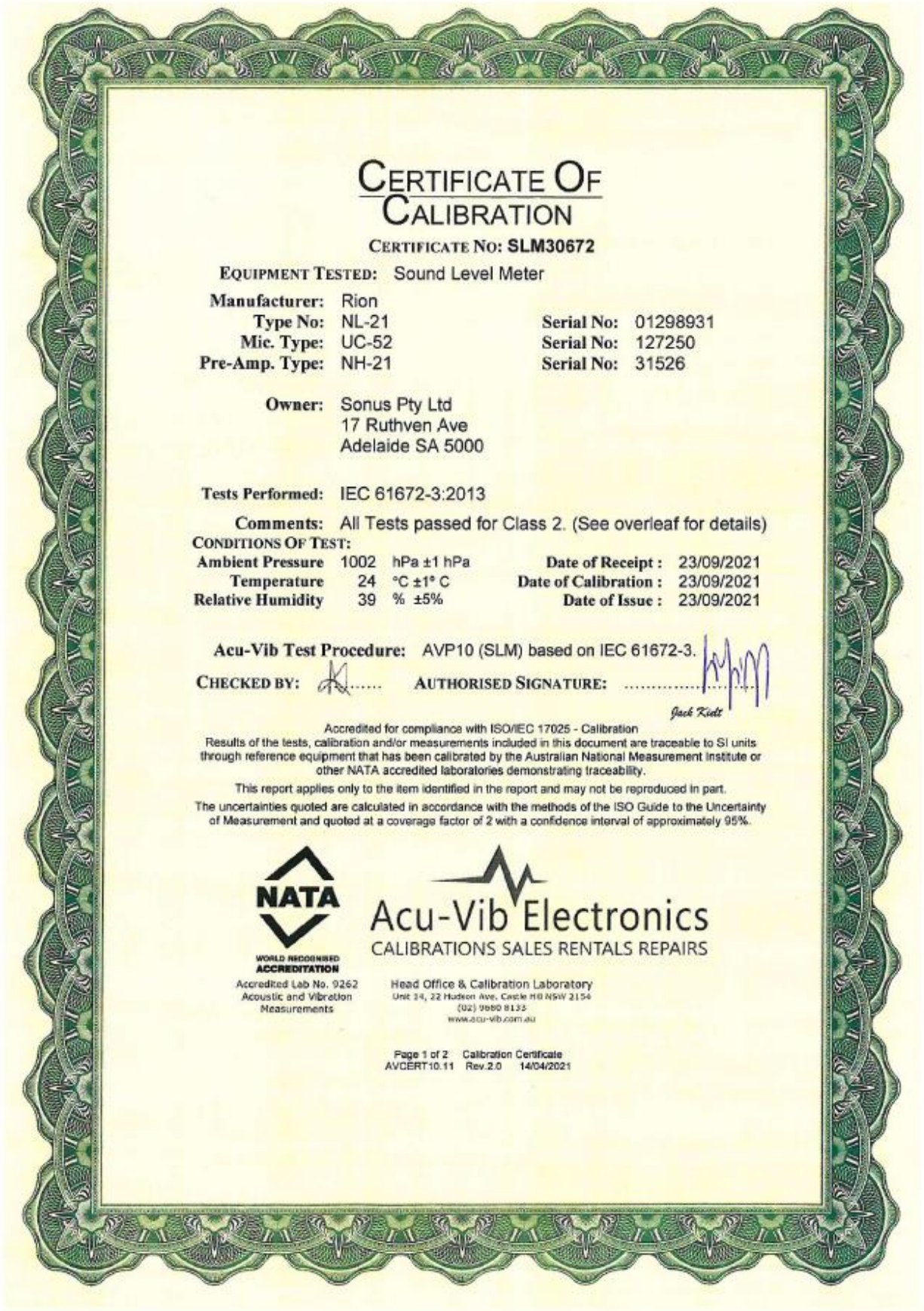
The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

NATA
WORLD RECOGNISED ACCREDITATION
Accredited Lab No. 9262
Acoustic and Vibration Measurements

Acu-Vib Electronics
CALIBRATIONS SALES RENTALS REPAIRS

Head Office & Calibration Laboratory
Unit 11, 22 Hudson Ave, Castle Hill NSW 2154
(02) 9680 8133
www.acu-vib.com.au

Page 1 of 2 Calibration Certificate
AVCERT10.3 Rev.2.0 14/04/2021



CERTIFICATE OF CALIBRATION

CERTIFICATE NO: SLM30672

EQUIPMENT TESTED: Sound Level Meter

Manufacturer:	Rion		
Type No:	NL-21	**Serial No:**	01298931
Mic. Type:	UC-52	**Serial No:**	127250
Pre-Amp. Type:	NH-21	**Serial No:**	31526

Owner: Sonus Pty Ltd
17 Ruthven Ave
Adelaide SA 5000

Tests Performed: IEC 61672-3:2013

Comments: All Tests passed for Class 2. (See overleaf for details)

CONDITIONS OF TEST:

Ambient Pressure	1002	hPa ±1 hPa	**Date of Receipt :**	23/09/2021
Temperature	24	°C ±1° C	**Date of Calibration :**	23/09/2021
Relative Humidity	39	% ±5%	**Date of Issue :**	23/09/2021

Acu-Vib Test Procedure: AVP10 (SLM) based on IEC 61672-3.

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

Jack Kidd

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.

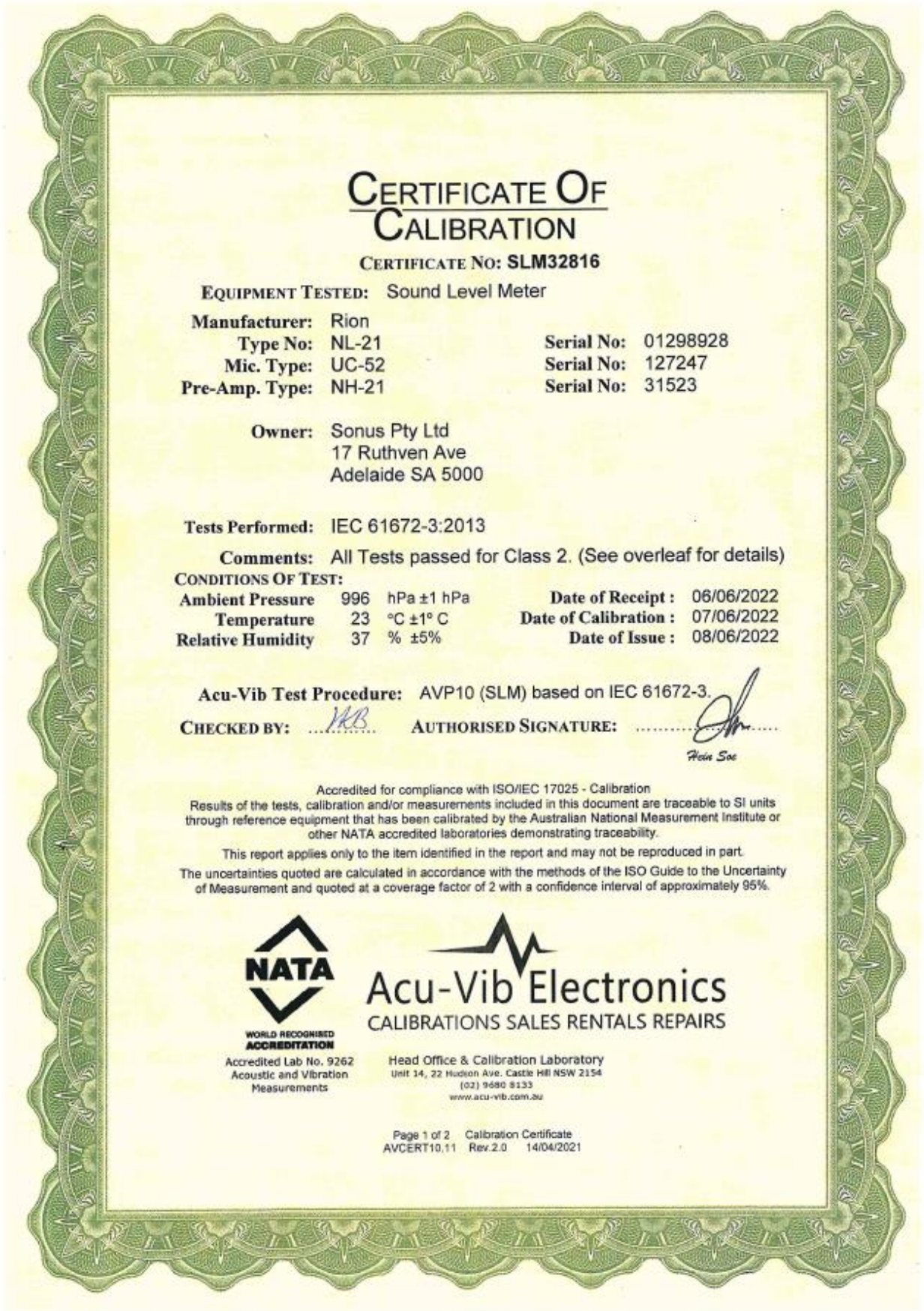
The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

NATA
WORLD RECOGNISED ACCREDITATION
Accredited Lab No. 9262
Acoustic and Vibration Measurements

Acu-Vib Electronics
CALIBRATIONS SALES RENTALS REPAIRS

Head Office & Calibration Laboratory
Unit 14, 22 Hudson Ave, Castle Hill NSW 2154
(02) 9680 8133
www.acu-vib.com.au

Page 1 of 2 Calibration Certificate
AVCERT10.11 Rev.2.0 14/04/2021



CERTIFICATE OF CALIBRATION

CERTIFICATE NO: SLM32816

EQUIPMENT TESTED: Sound Level Meter

Manufacturer:	Rion		
Type No:	NL-21	**Serial No:**	01298928
Mic. Type:	UC-52	**Serial No:**	127247
Pre-Amp. Type:	NH-21	**Serial No:**	31523

Owner: Sonus Pty Ltd
17 Ruthven Ave
Adelaide SA 5000

Tests Performed: IEC 61672-3:2013

Comments: All Tests passed for Class 2. (See overleaf for details)

CONDITIONS OF TEST:

Ambient Pressure	996	hPa ±1 hPa	**Date of Receipt :**	06/06/2022
Temperature	23	°C ±1° C	**Date of Calibration :**	07/06/2022
Relative Humidity	37	% ±5%	**Date of Issue :**	08/06/2022

Acu-Vib Test Procedure: AVP10 (SLM) based on IEC 61672-3.

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.

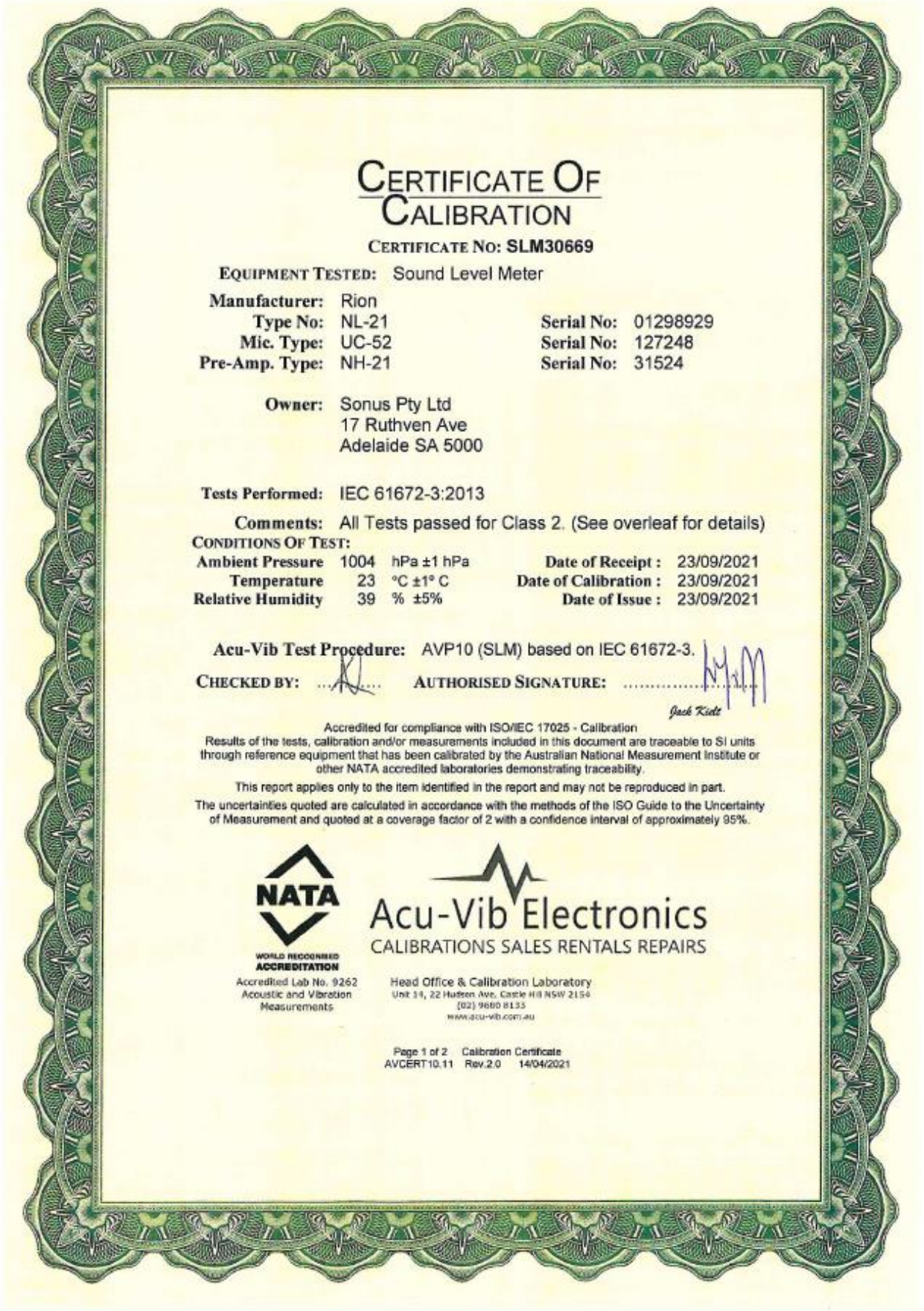
The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

NATA
WORLD RECOGNISED ACCREDITATION
Accredited Lab No. 9262
Acoustic and Vibration Measurements

Acu-Vib Electronics
CALIBRATIONS SALES RENTALS REPAIRS

Head Office & Calibration Laboratory
Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
(02) 9680 8133
www.acu-vib.com.au

Page 1 of 2 Calibration Certificate
AVCERT10.11 Rev.2.0 14/04/2021



CERTIFICATE OF CALIBRATION

CERTIFICATE NO: SLM30669

EQUIPMENT TESTED: Sound Level Meter

Manufacturer:	Rion		
Type No:	NL-21	**Serial No:**	01298929
Mic. Type:	UC-52	**Serial No:**	127248
Pre-Amp. Type:	NH-21	**Serial No:**	31524

Owner: Sonus Pty Ltd
17 Ruthven Ave
Adelaide SA 5000

Tests Performed: IEC 61672-3:2013

Comments: All Tests passed for Class 2. (See overleaf for details)

CONDITIONS OF TEST:

Ambient Pressure	1004	hPa ±1 hPa	**Date of Receipt :**	23/09/2021
Temperature	23	°C ±1° C	**Date of Calibration :**	23/09/2021
Relative Humidity	39	% ±5%	**Date of Issue :**	23/09/2021

Acu-Vib Test Procedure: AVP10 (SLM) based on IEC 61672-3.

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

Jack Kiely

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.

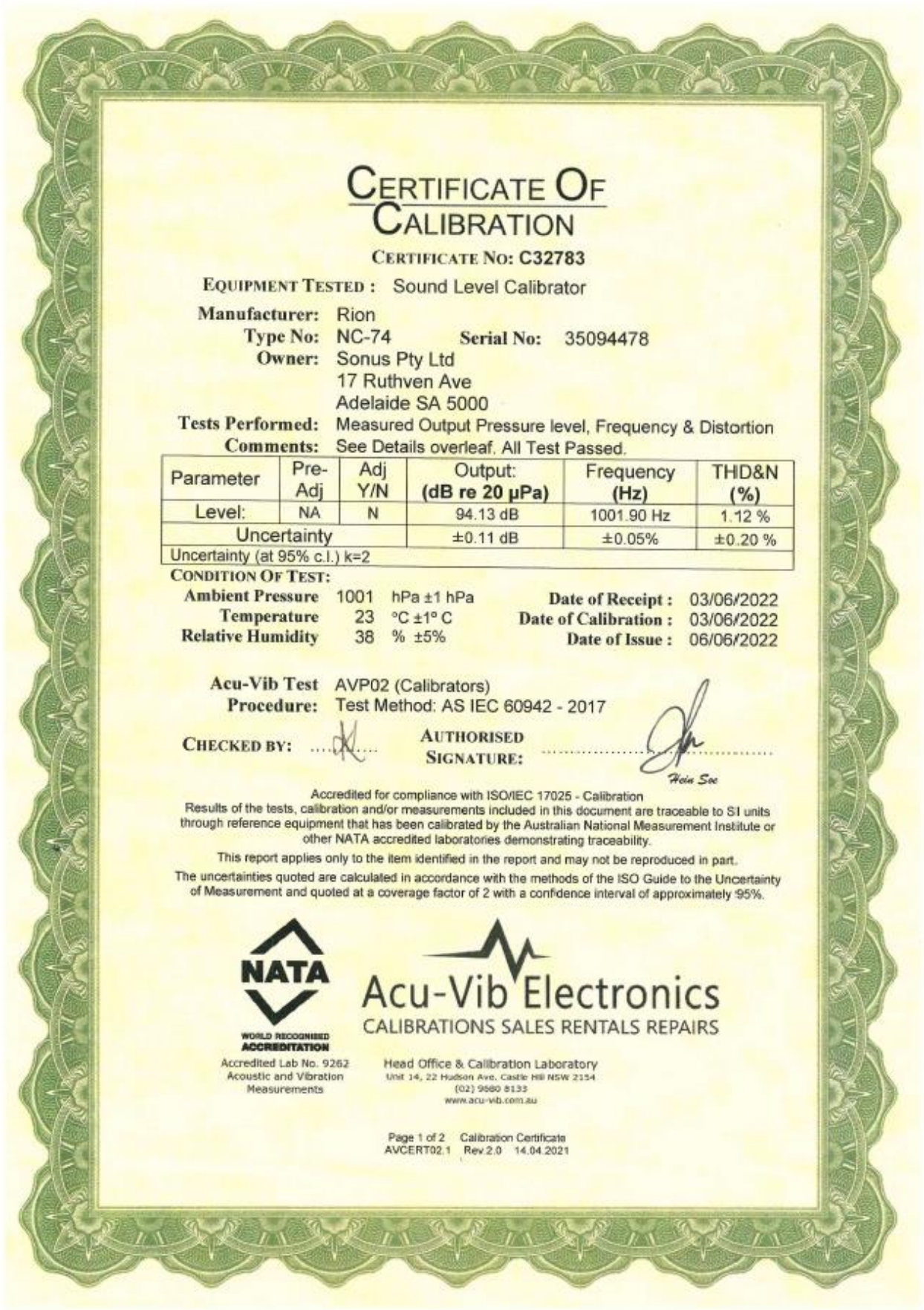
The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

NATA
WORLD RECOGNISED ACCREDITATION
Accredited Lab No. 9262
Acoustic and Vibration Measurements

Acu-Vib Electronics
CALIBRATIONS SALES RENTALS REPAIRS

Head Office & Calibration Laboratory
Unit 14, 22 Hudson Ave, Castle Hill NSW 2154
(02) 9680 8133
www.acu-vib.com.au

Page 1 of 2 Calibration Certificate
AVCERT10.11 Rev.2.0 14/04/2021



CERTIFICATE OF CALIBRATION

CERTIFICATE NO: C32783

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	94.13 dB	1001.90 Hz	1.12 %
Uncertainty			±0.11 dB	±0.05%	±0.20 %
Uncertainty (at 95% c.l.) k=2					

CONDITION OF TEST:

Ambient Pressure	1001	hPa ±1 hPa	**Date of Receipt :**	03/06/2022
Temperature	23	°C ±1° C	**Date of Calibration :**	03/06/2022
Relative Humidity	38	% ±5%	**Date of Issue :**	06/06/2022

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

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

Hein See

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%.

NATA
WORLD RECOGNISED ACCREDITATION
Accredited Lab No. 9262
Acoustic and Vibration Measurements

Acu-Vib Electronics
CALIBRATIONS SALES RENTALS REPAIRS

Head Office & Calibration Laboratory
Unit 14, 22 Hudson Ave, Castle Hill NSW 2154
(02) 9680 8133
www.acu-vib.com.au

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

Certificate No. D213662E

JCSS 0197

CALIBRATION CERTIFICATE

Product	:	SOUND CALIBRATOR
Type	:	NC-75
Serial number	:	34913547
Manufacturer	:	RION CO., LTD.
Calibration quantities	:	Sound pressure level (with reference standard microphone)
Calibration method	:	Measured by specified secondary standard microphone according to JCSS calibration procedure specified by RION.
Ambient conditions	:	Temperature 22.3 ℃, Relative humidity 55 %, Static pressure 100.1 kPa
Calibration date	:	03/09/2021 (DD/MM/YYYY)
Calibration location	:	3-20-41 Higashimotomachi, Kokubunji, Tokyo 185-8533, Japan RION CO., LTD. Calibration Room

We hereby certify that the results of this calibration were as follows.

Issue date : 08/09/2021 (DD/MM/YYYY)

Junichi Kawamura
Manager
Quality Assurance Section,
Quality Assurance Department,
Environmental Instrument Division,
RION CO., LTD.
3-20-41 Higashimotomachi, Kokubunji,
Tokyo 185-8533, Japan

This certificate is based on article 144 of the Measurement Law and indicates the result of calibration in accordance with measurement standards traceable to Primary Measurement Standards (National Standards) which realizes the physical units of measurement according to the International System of Units (SI).
The accreditation symbol is attestation of which the result of calibration is traceable to Primary Measurement Standards (National Standards).
The certificate shall not be reproduced except in full, without the written approval of the issuing laboratory.
The calibration laboratory who issued this calibration certificate conforms to ISO/IEC 17025:2017.
This calibration certificate was issued by the calibration laboratory accredited by IAJapan who is a signatory to the Mutual Recognition Arrangement (MRA) of International Laboratory Accreditation Cooperation (ILAC) and Asia Pacific Accreditation Cooperation (APAC). This (These) calibration result(s) may be accepted internationally through ILAC/APAC MRA.

RION

8 APPENDIX C: LOGGER LOCATION PHOTOS

Figure 14: B006 – First View

Figure 15: B006 – Second View

Figure 16: B006 – Third View

Figure 17: B006 – Fourth View

Figure 18: B061(S) – First View

Figure 19: B061(S) – Second View

Figure 20: B061(S) – Third View

Figure 21: B061(S) – Fourth View

Figure 22: B065 – First View

Figure 23: B065 – Second View

Figure 24: B065 – Third View

Figure 25: B065 – Fourth View

Figure 26: B083 – First View

Figure 27: B083 – Second View

Figure 28: B083 – Third View

Figure 29: B083 – Fourth View

Figure 30: B111 – First View

Figure 31: B111 – Second View

Figure 32: B111 – Third View

Figure 33: B111 – Fourth View

Figure 34: B114 – First View

Figure 35: B114 – Second View

Figure 36: B114 – Third View

Figure 37: B114 – Fourth View

Figure 38: B118 – First View

Figure 39: B118 – Second View

Figure 40: B118 – Third View

Figure 41: B118 – Fourth View

Figure 42: B171 – First View

Figure 43: B171 – Second View

Figure 44: B171 – Third View

Figure 45: B171 – Fourth View

Figure 46: B328 – First View

Figure 47: B328 – Second View

Figure 48: B328 – Third View

Figure 49: B328 – Fourth View

9 APPENDIX D: WIND ROSES

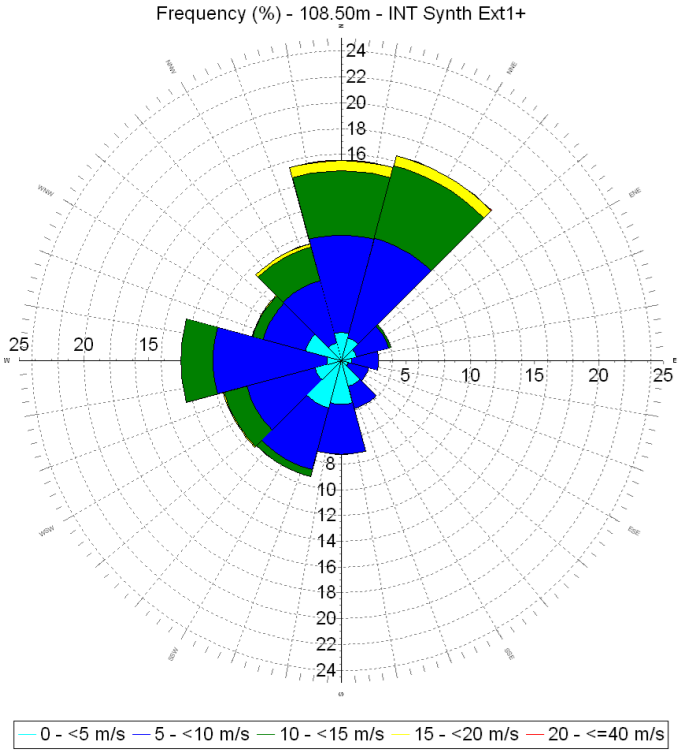


Figure 50: EXT1 – Hub Height Monitoring Period Wind Rose

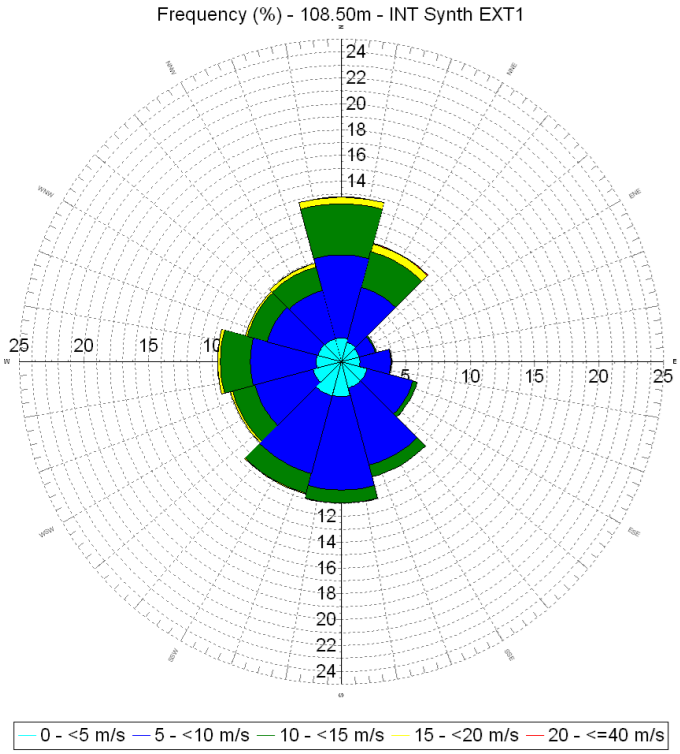


Figure 51: EXT1 – Hub Height Long Term Wind Rose

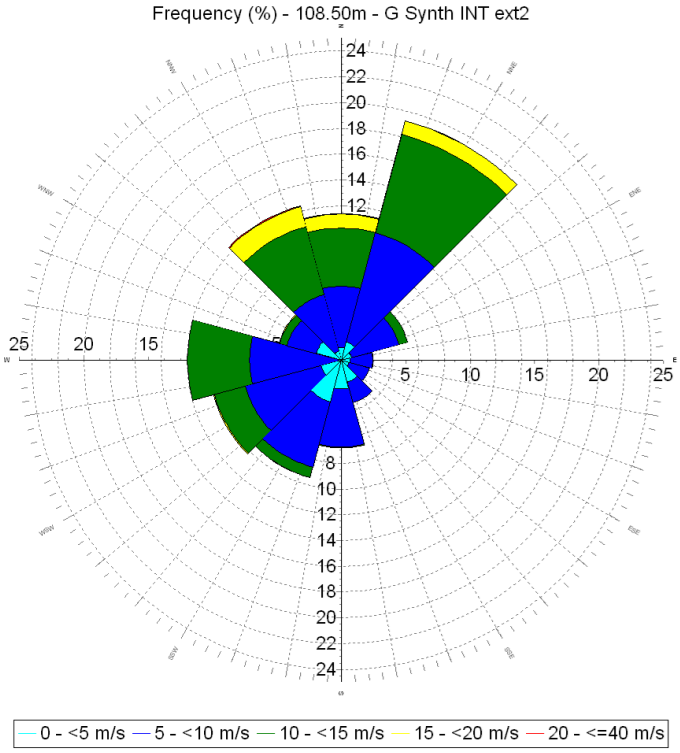


Figure 52: EXT2 – Hub Height Monitoring Period Wind Rose

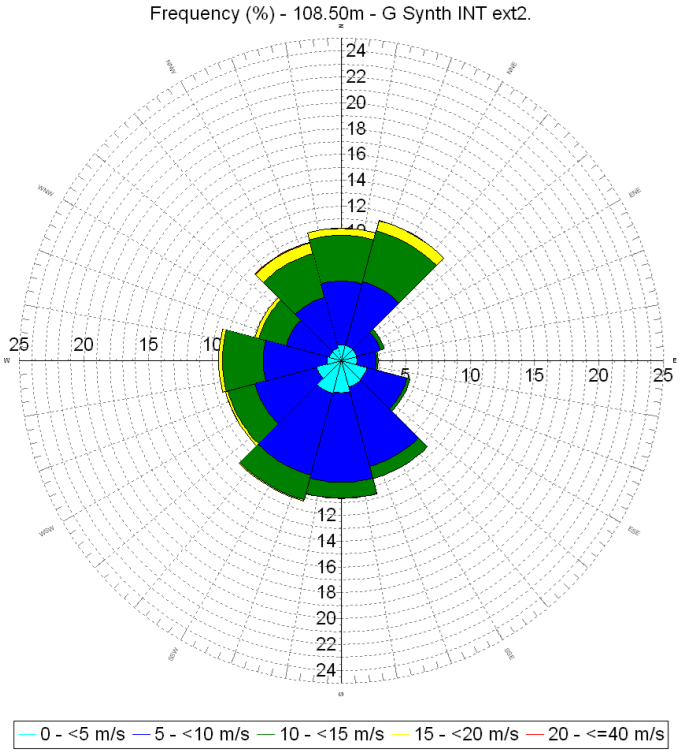


Figure 53: EXT2 – Hub Height Long Term Wind Rose

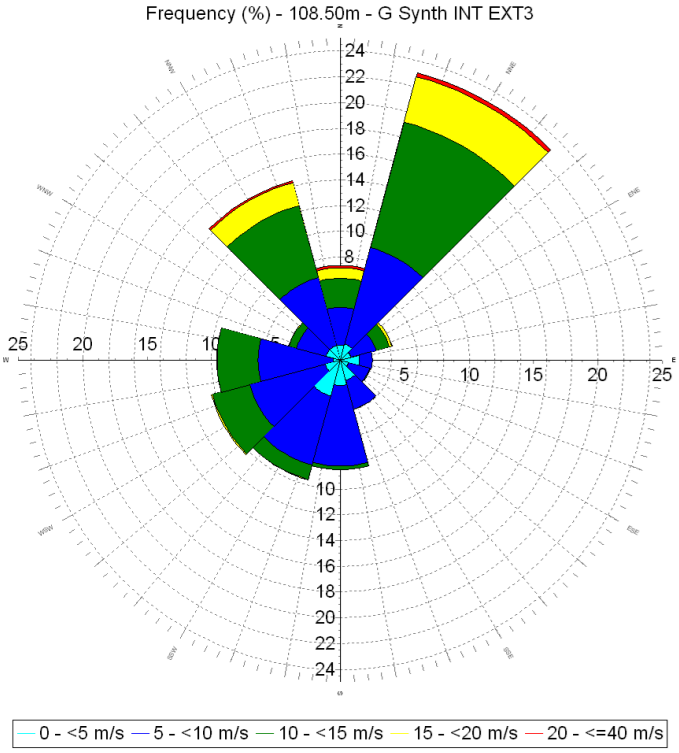


Figure 54: EXT3 – Hub Height Monitoring Period Wind Rose

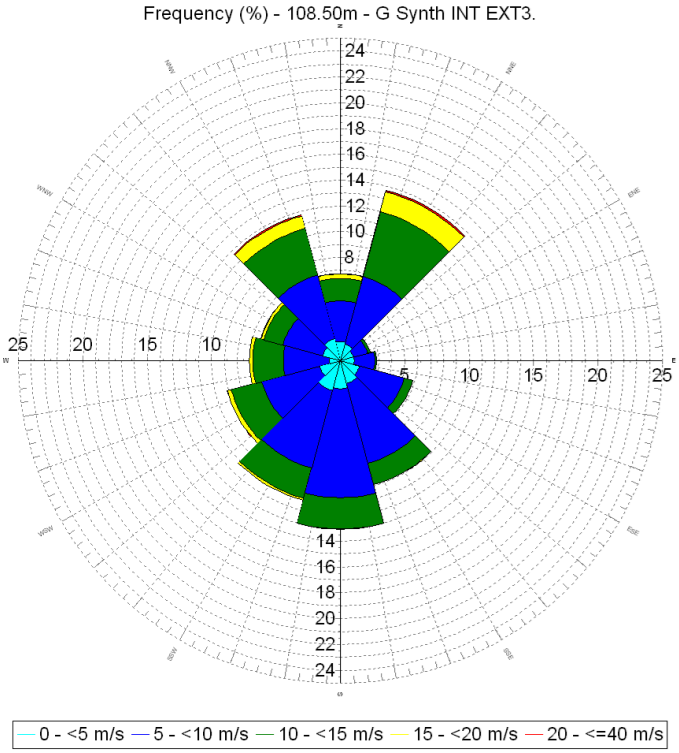


Figure 55: EXT3 – Hub Height Long Term Wind Rose

10 APPENDIX E: BACKGROUND NOISE CORRELATIONS

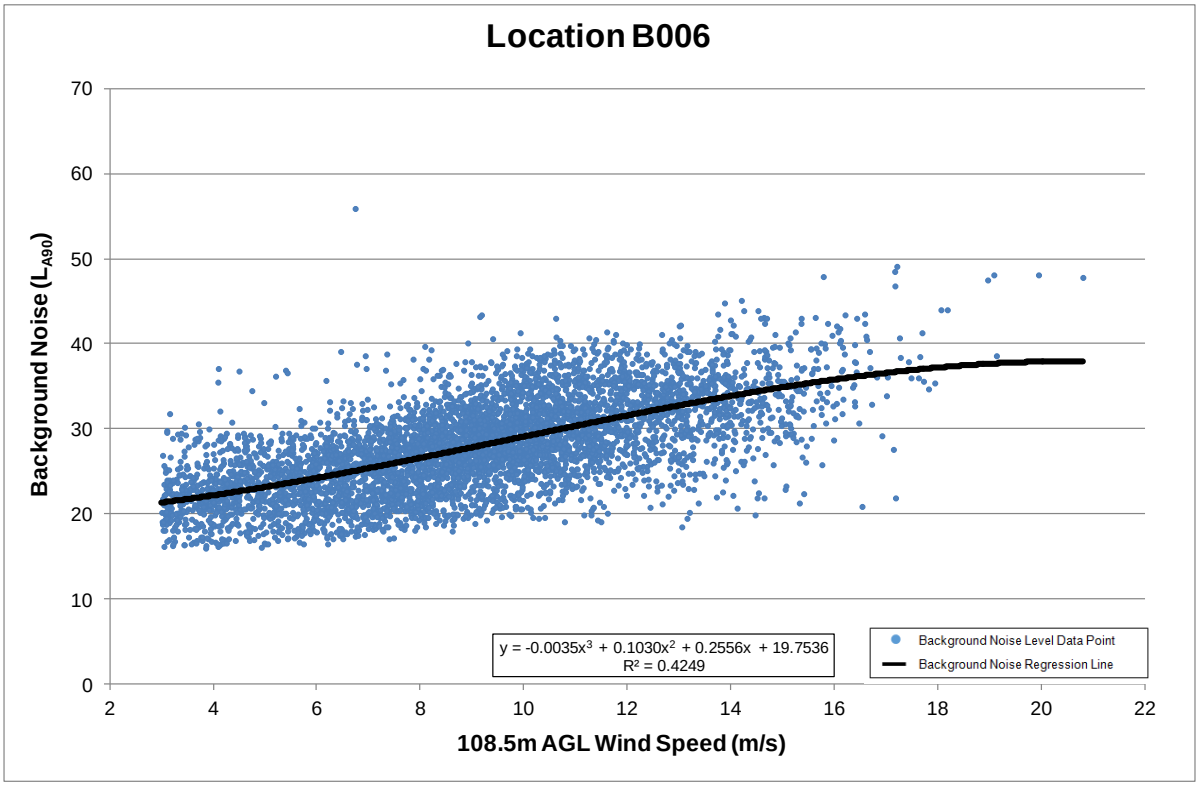


Figure 56: B006 Background Noise Correlation Graph

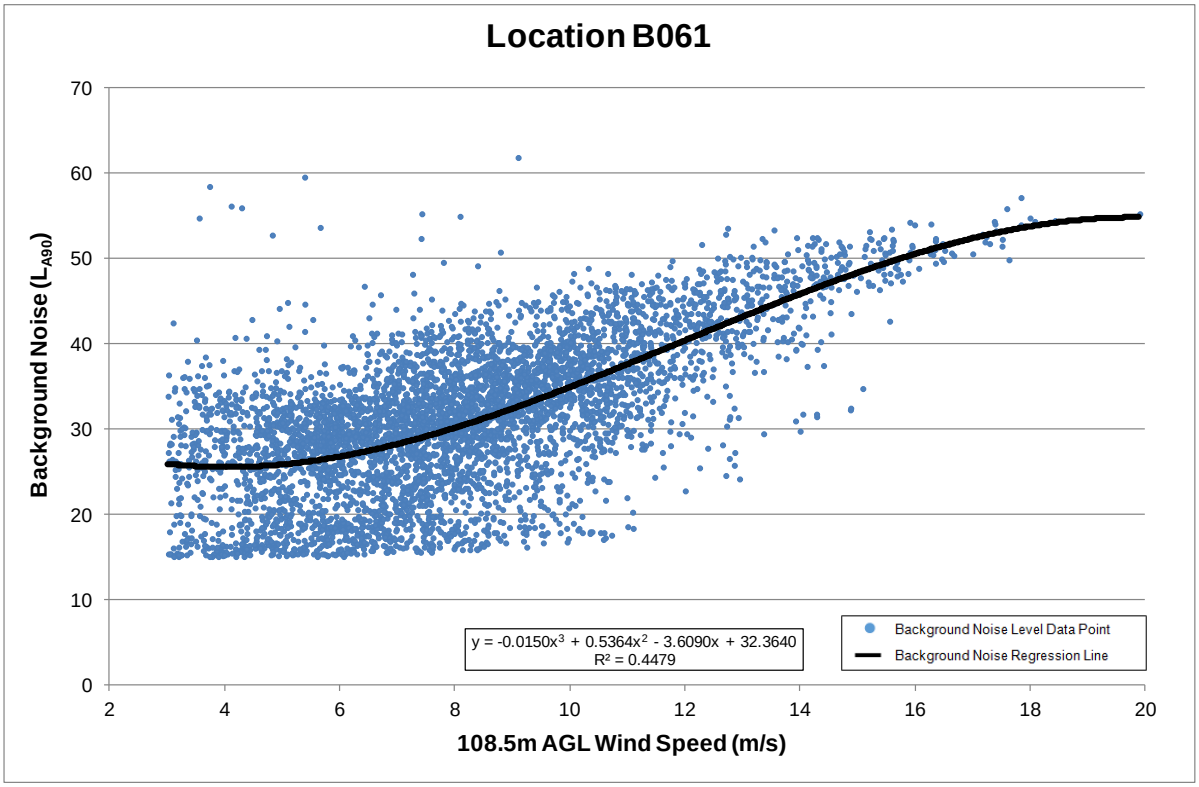


Figure 57: B061 Background Noise Correlation Graph

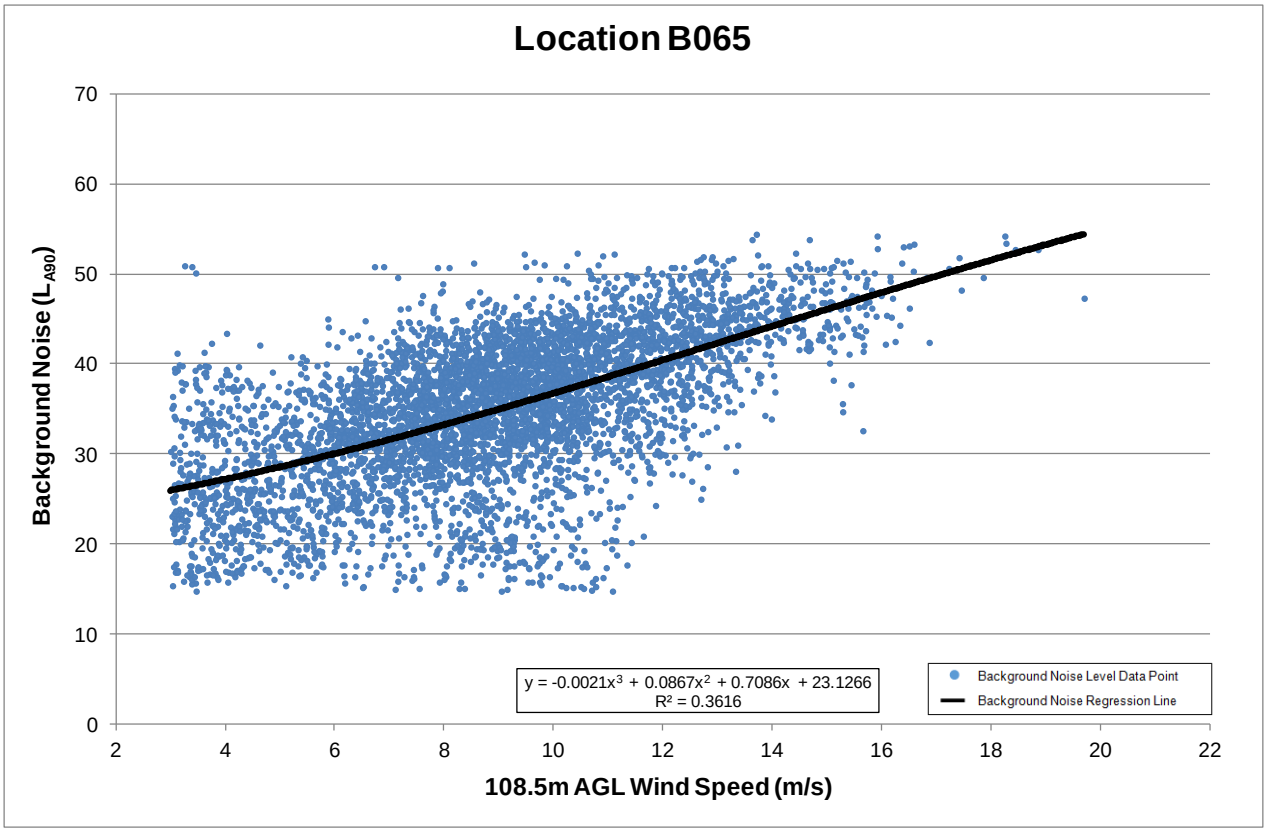


Figure 58: B065 Background Noise Correlation Graph

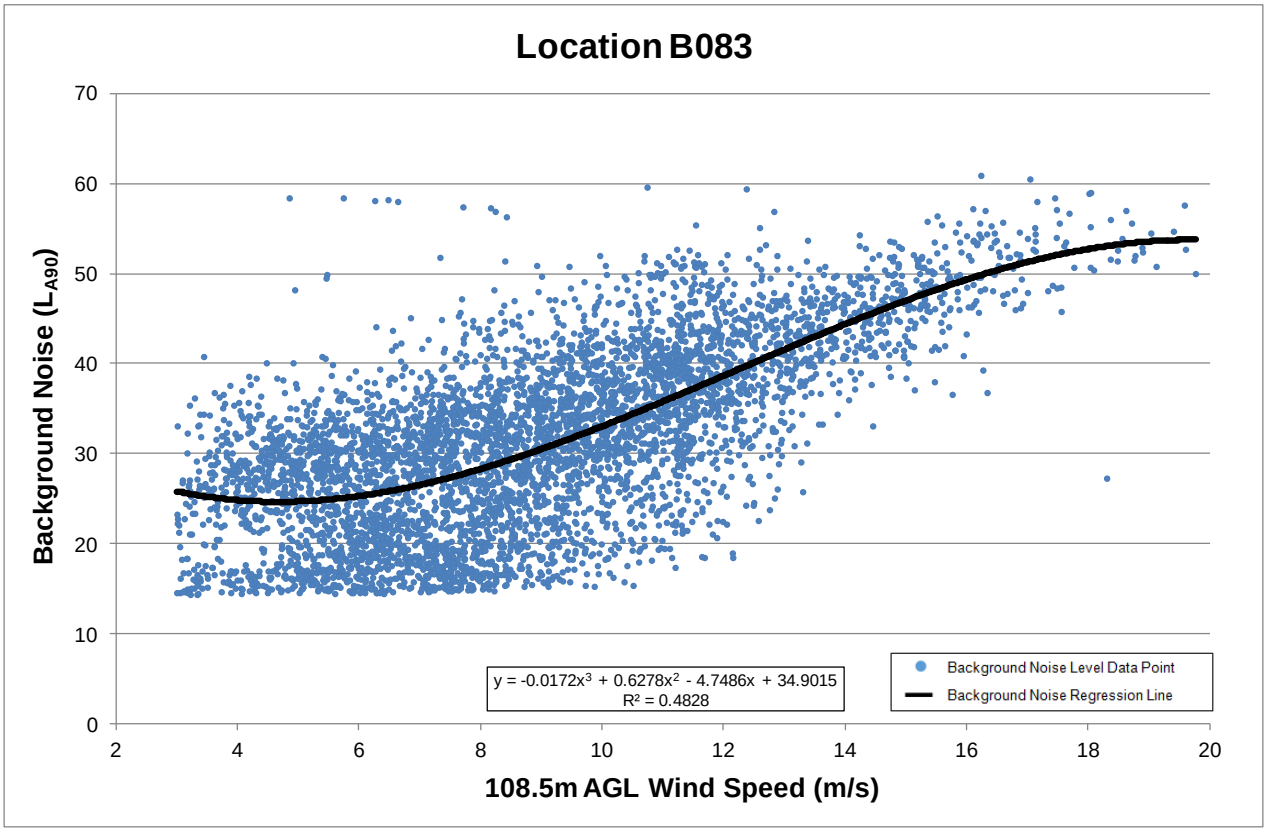


Figure 59: B083 Background Noise Correlation Graph

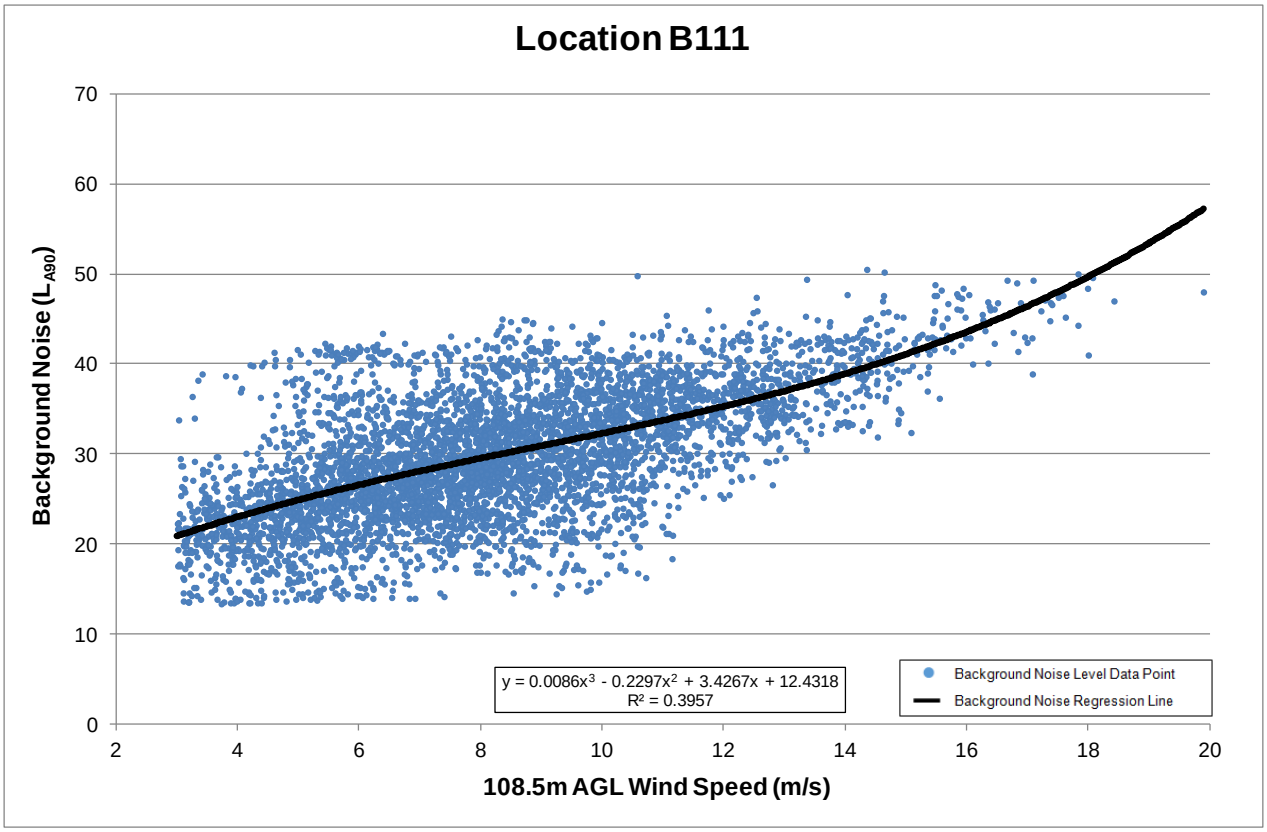


Figure 60: B111 Background Noise Correlation Graph

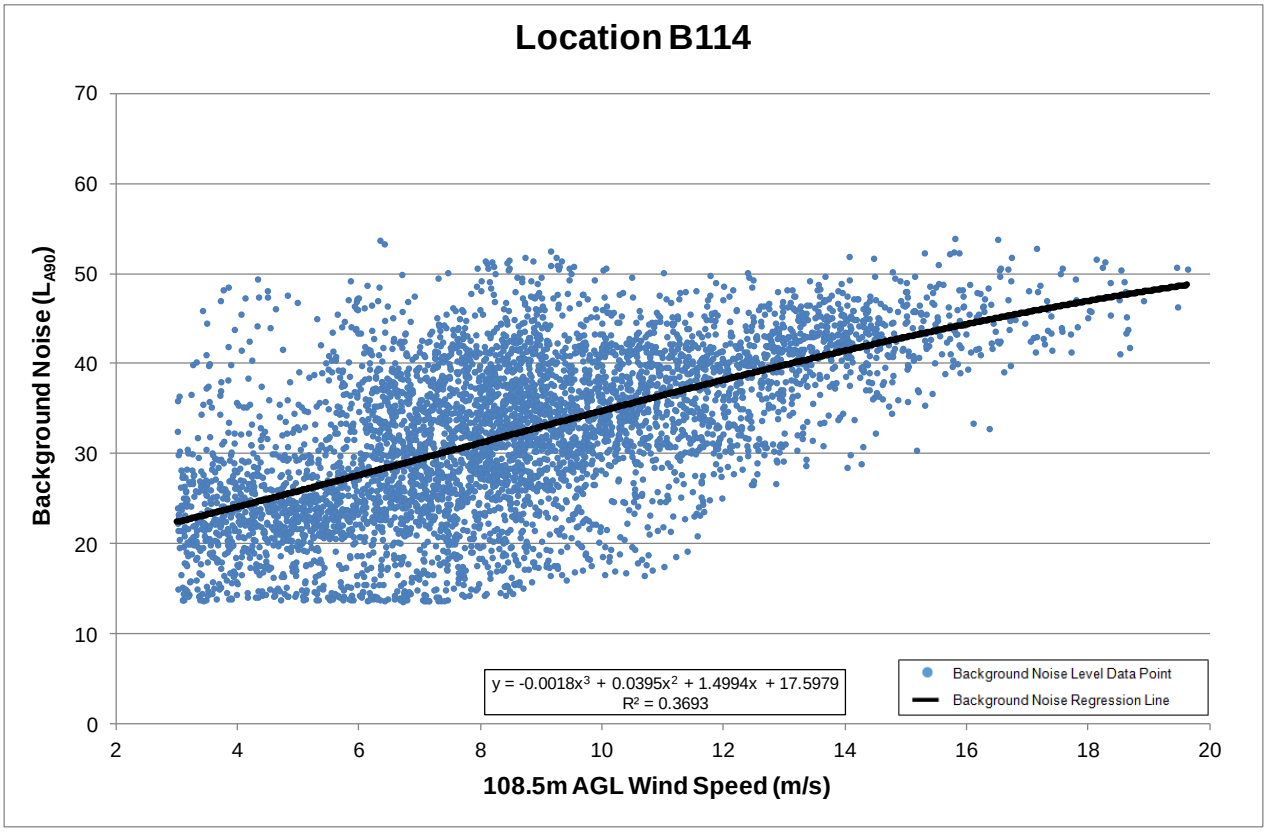


Figure 61: B114 Background Noise Correlation Graph

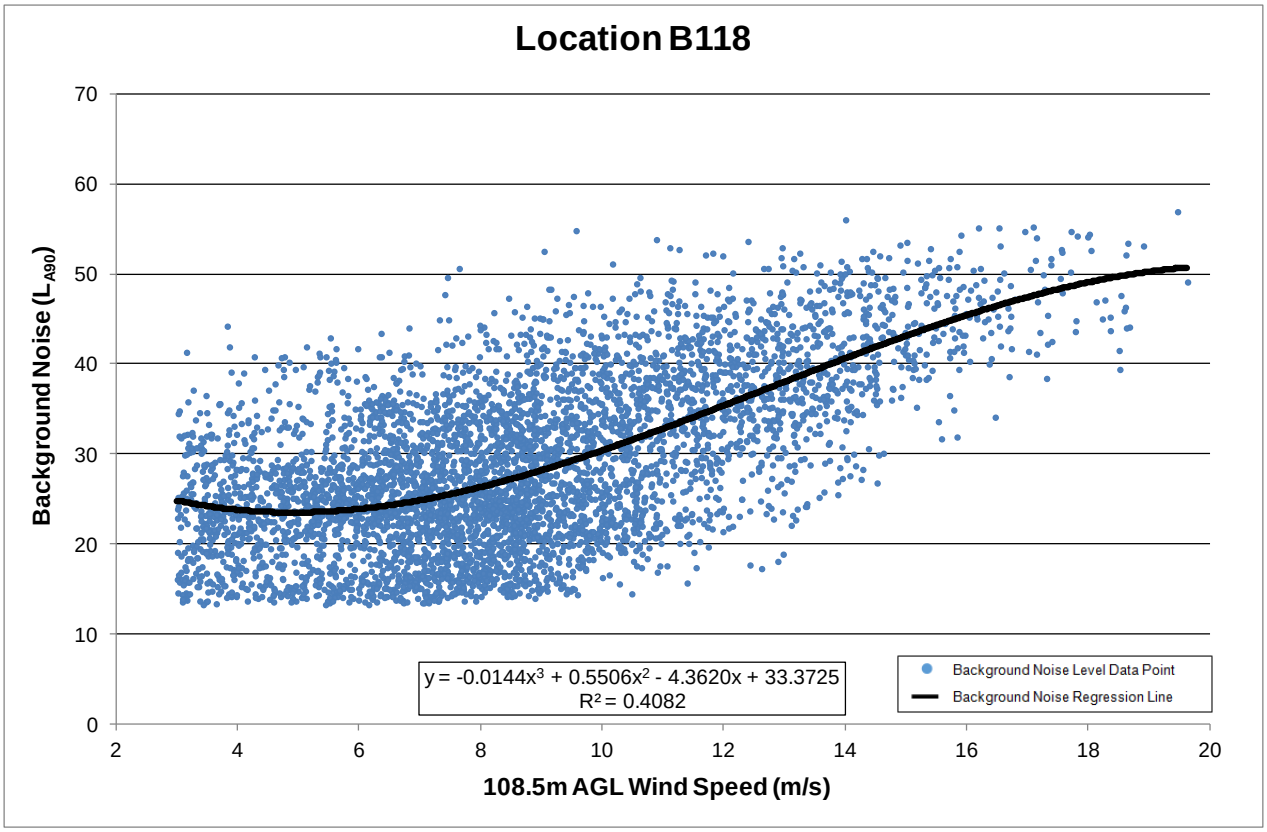


Figure 62: B118 Background Noise Correlation Graph

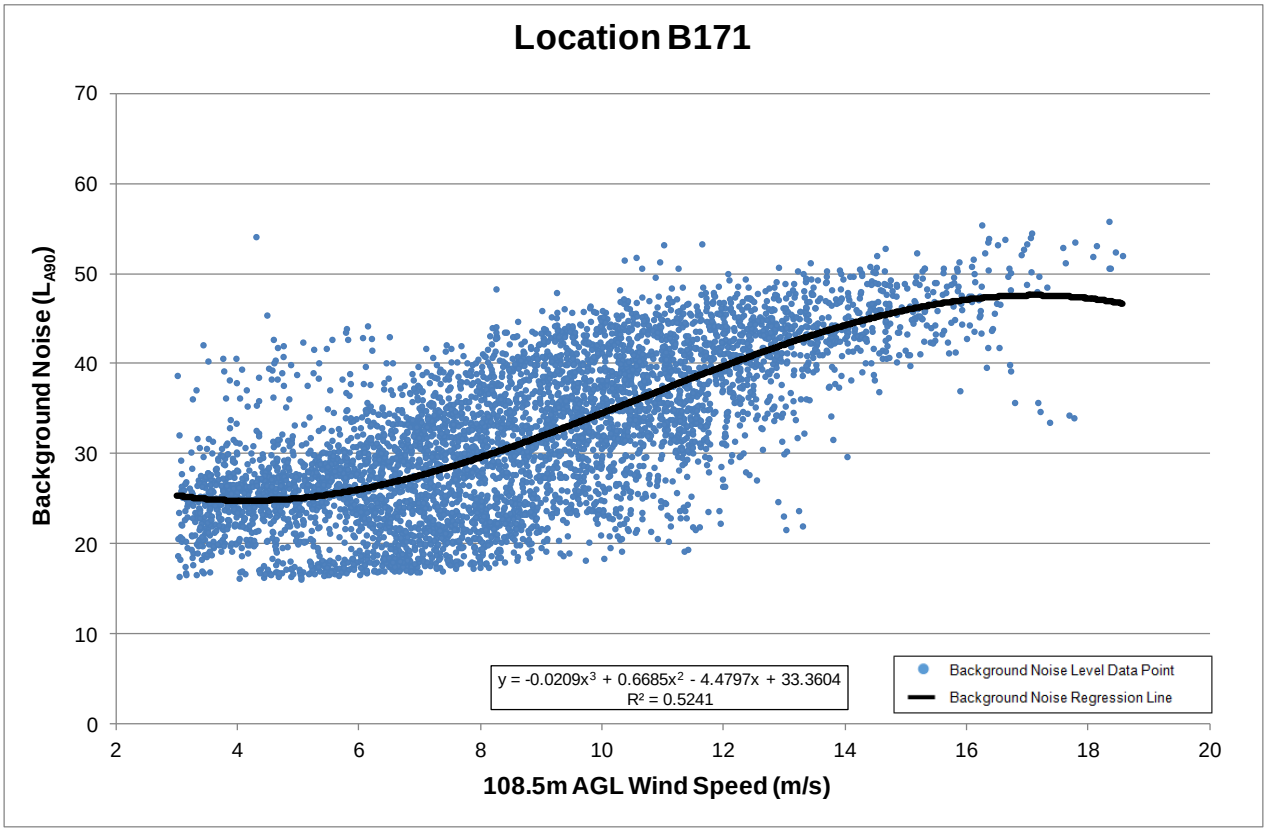


Figure 63: B171 Background Noise Correlation Graph

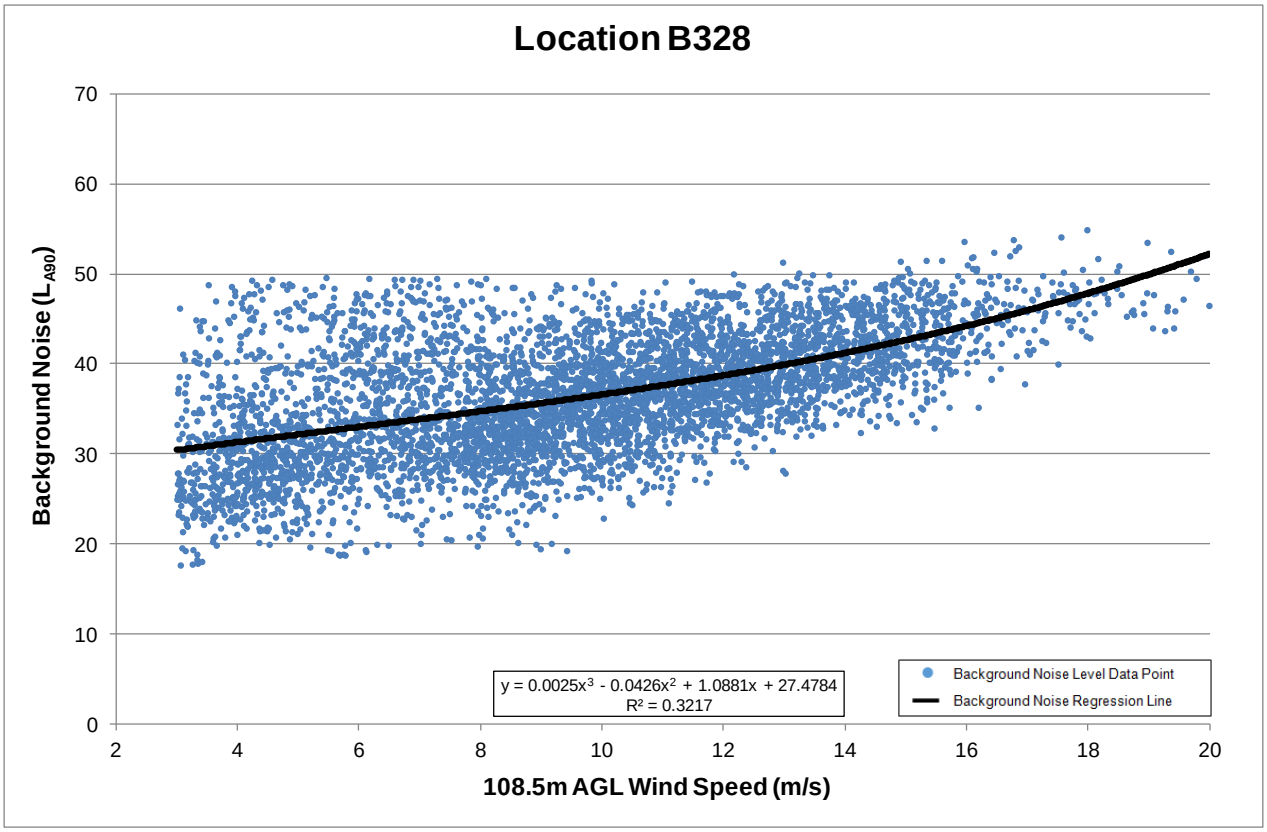


Figure 64: B328 Background Noise Correlation Graph

11 APPENDIX F: AMPLITUDE MODULATION GRAPHS

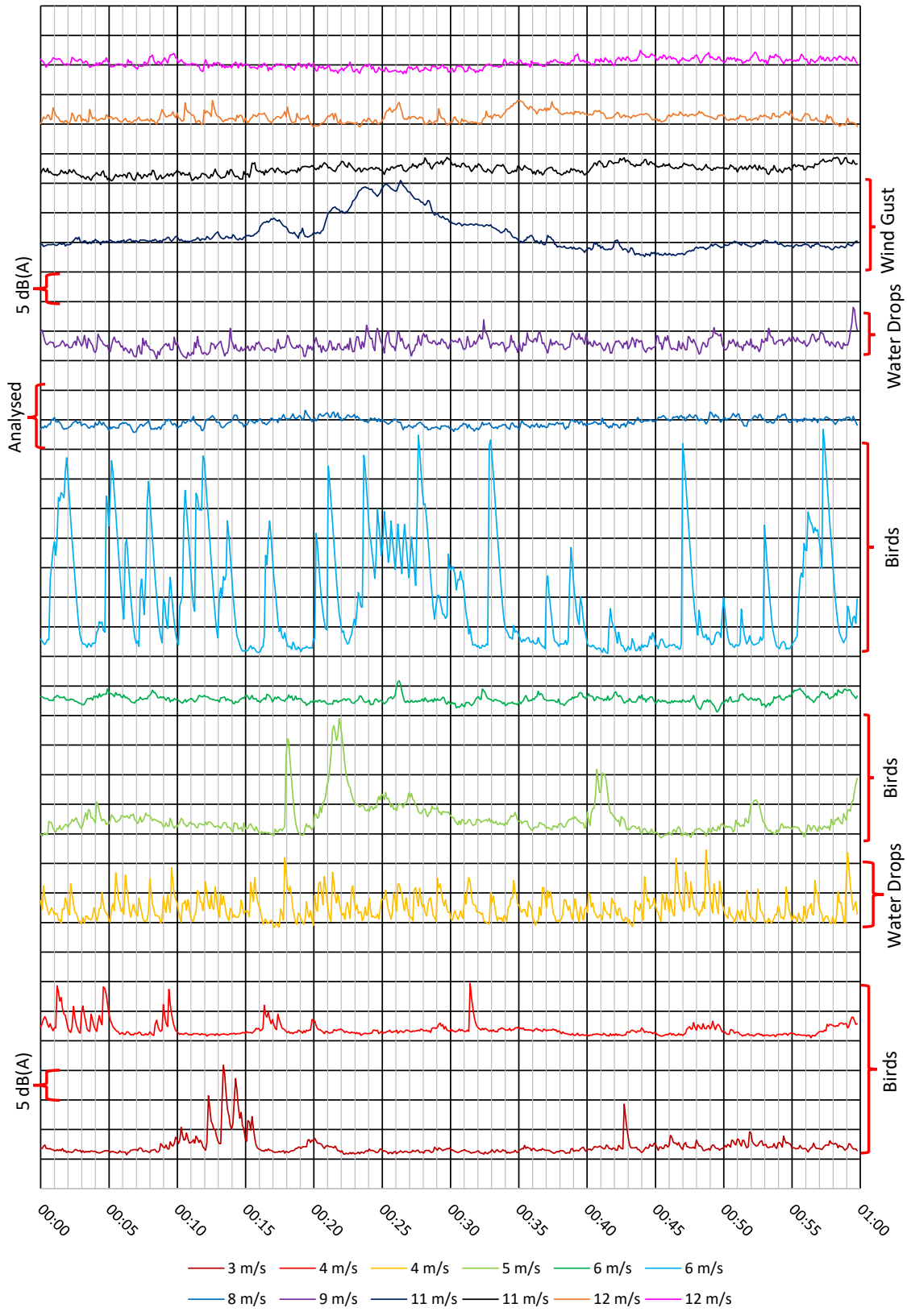


Figure 65: B006 Overall Amplitude Modulation

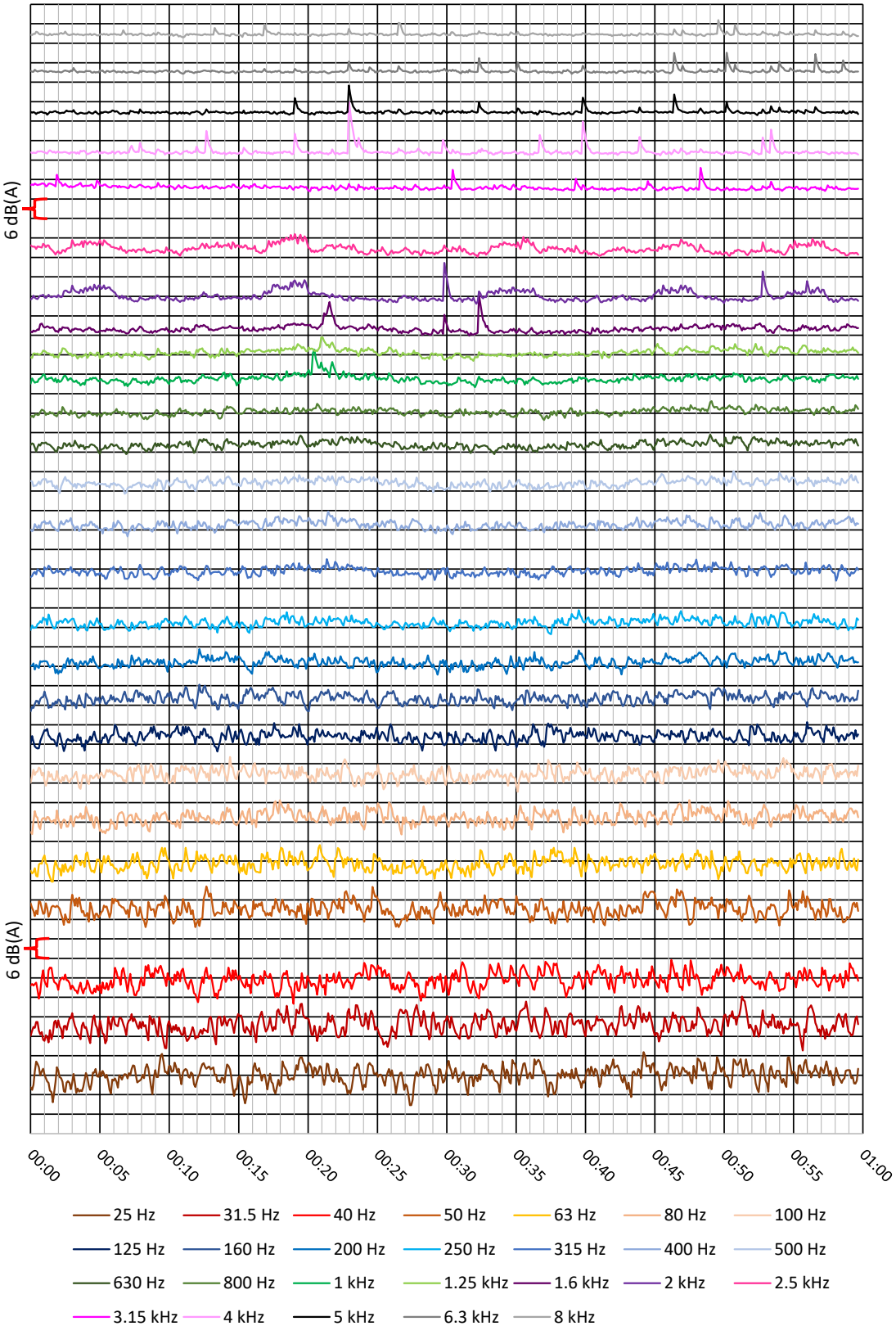


Figure 66: B006 8m/s Amplitude Modulation

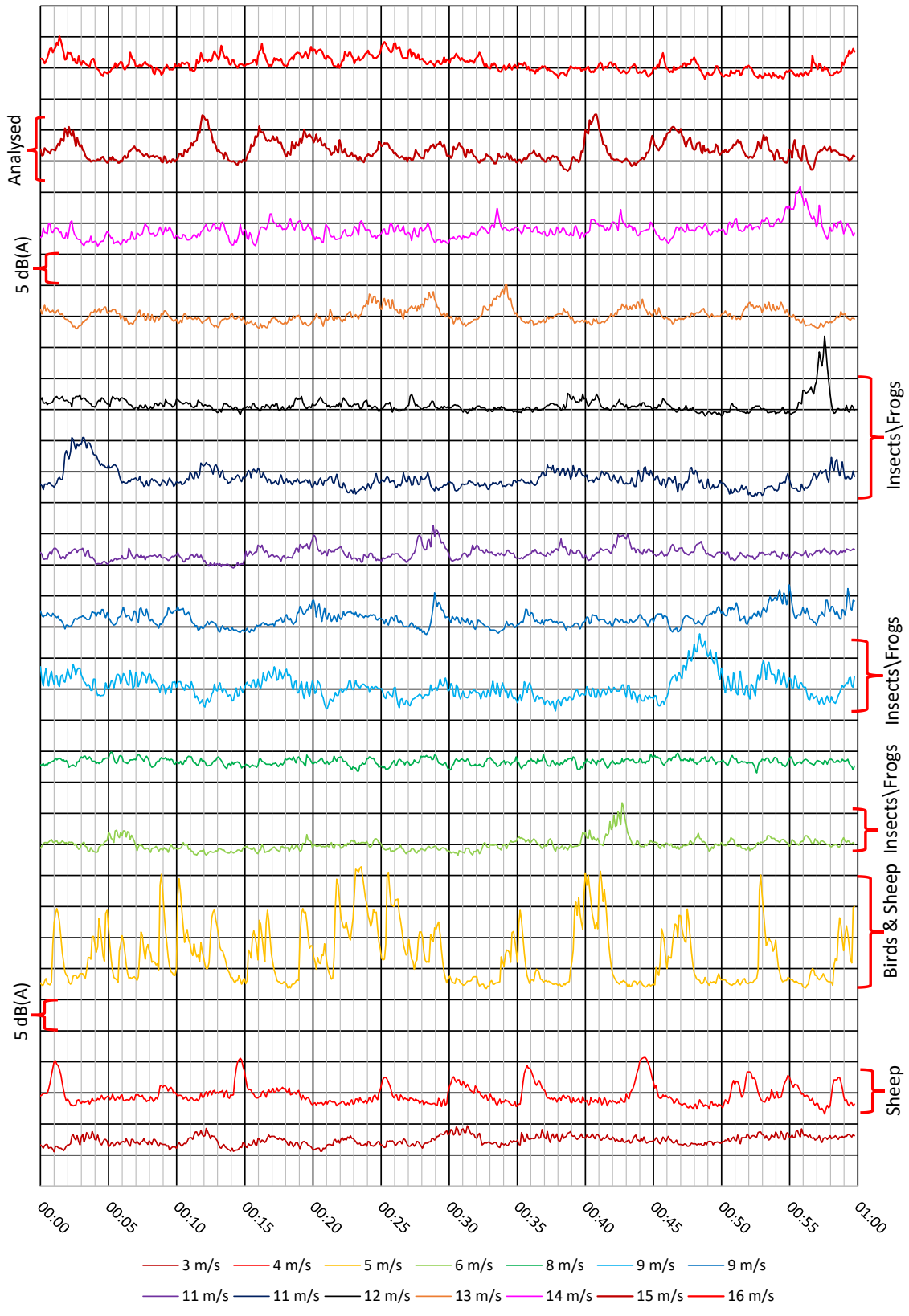


Figure 67: B065 Overall Amplitude Modulation

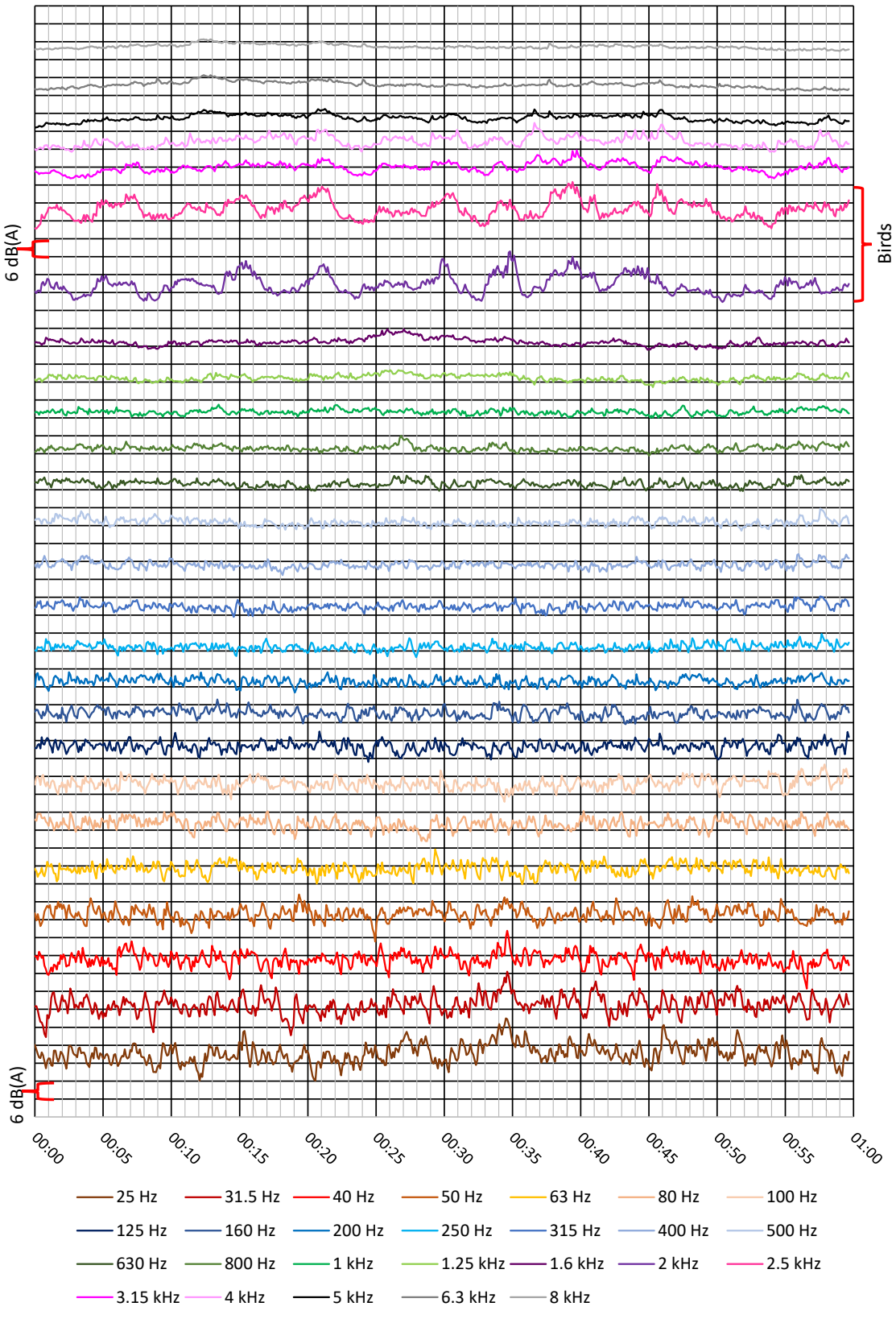


Figure 68: B065 15m/s Amplitude Modulation

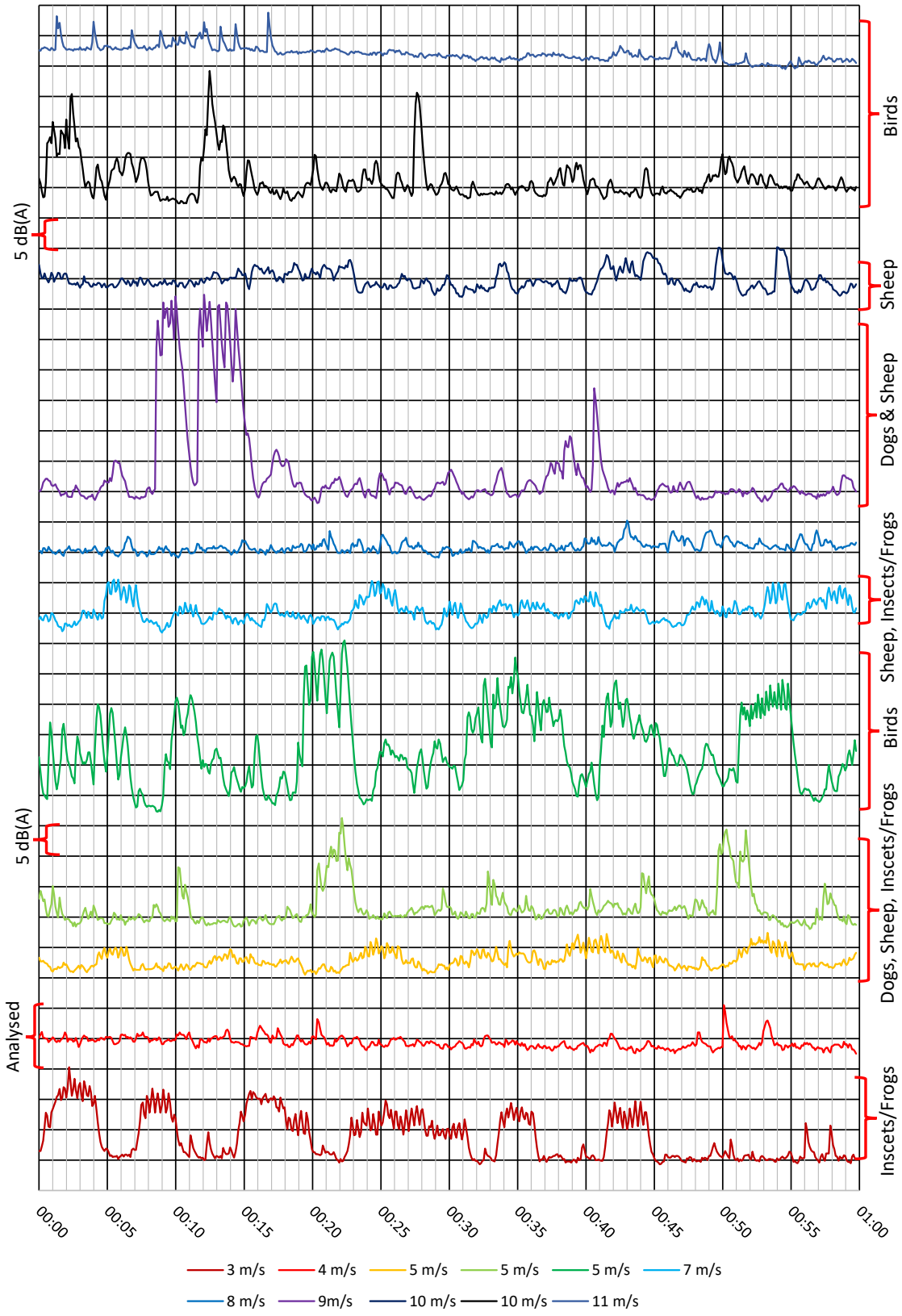


Figure 69: B083 Overall Amplitude Modulation

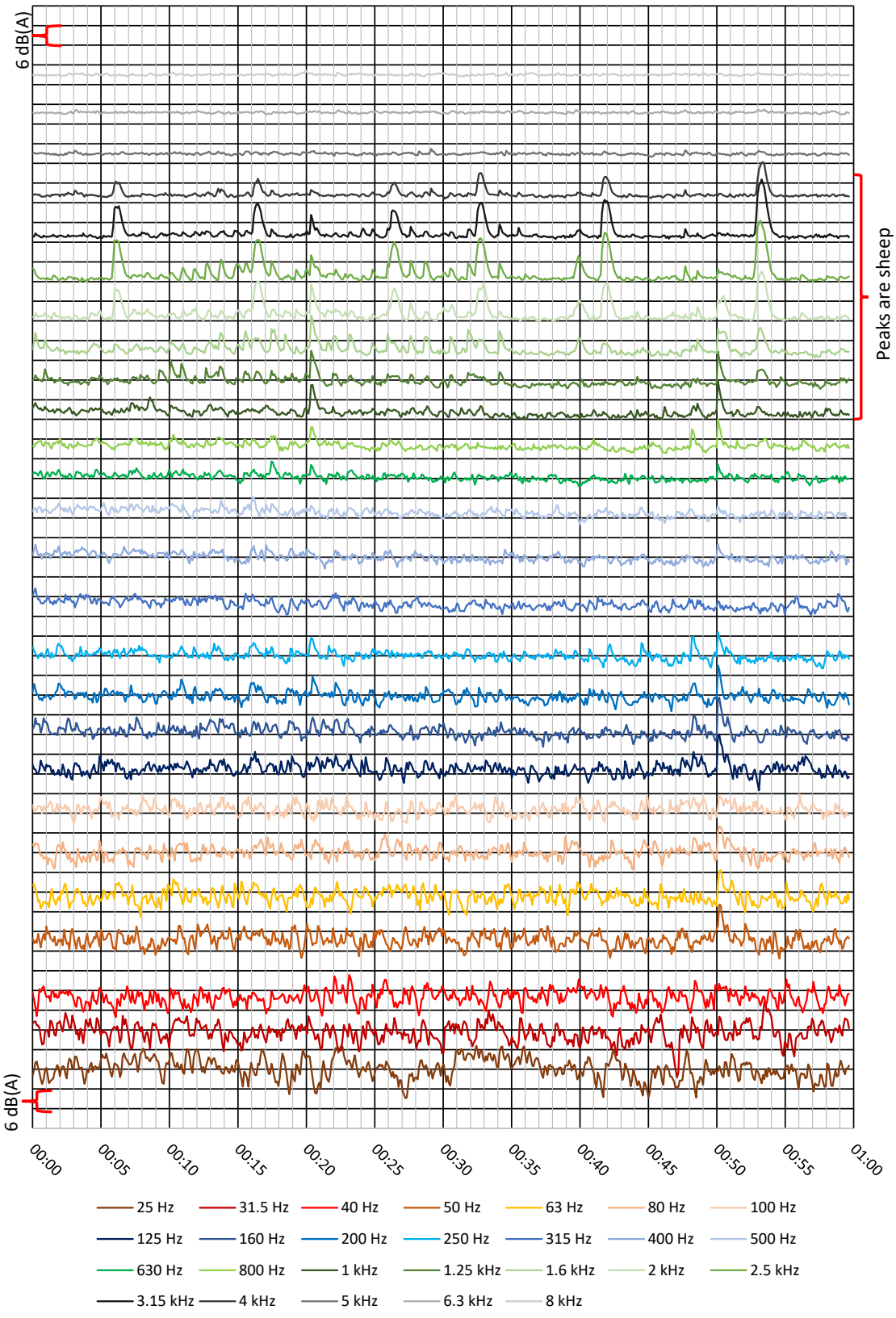


Figure 70: B083 4m/s Amplitude Modulation

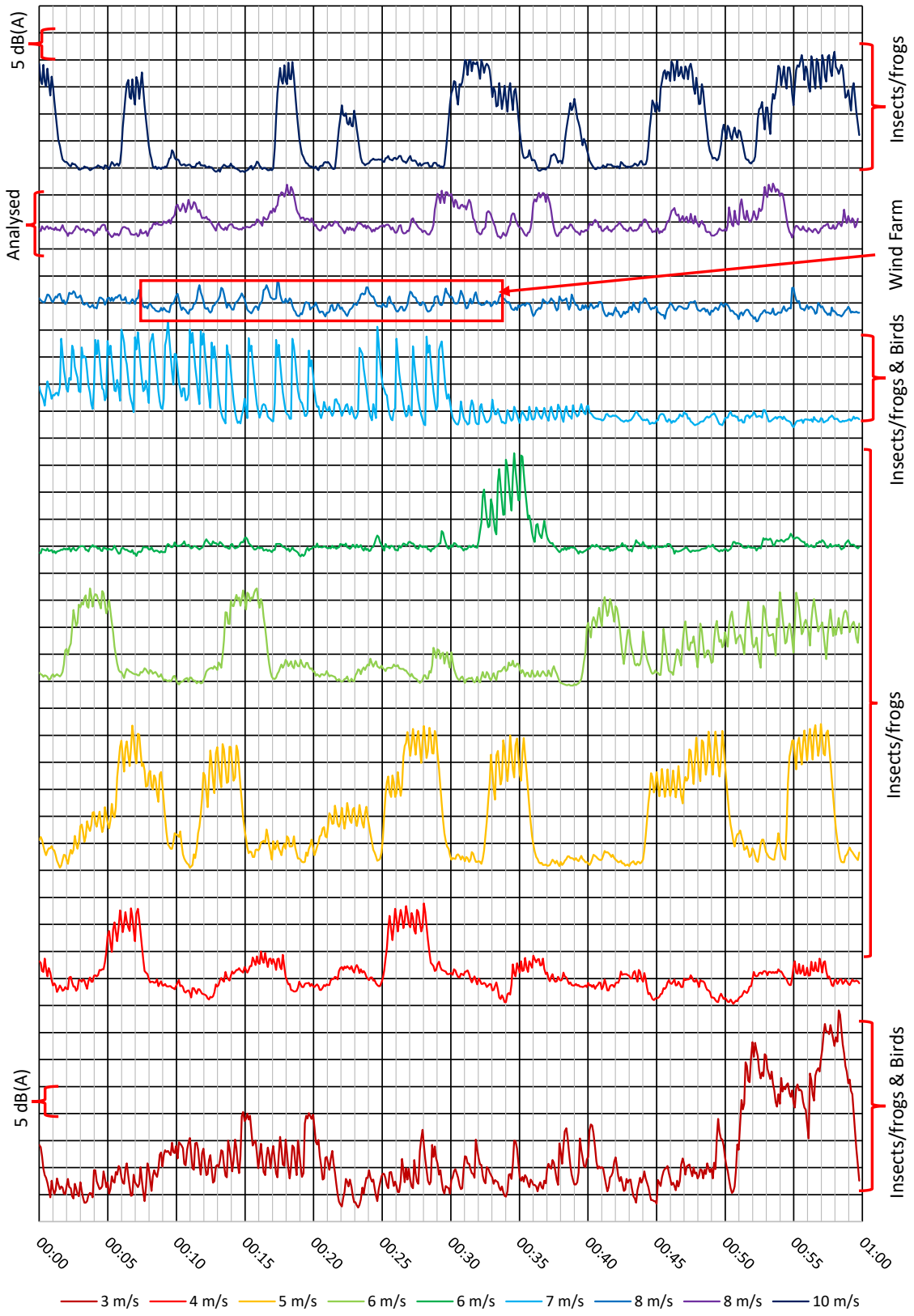


Figure 71: B111 Overall Amplitude Modulation

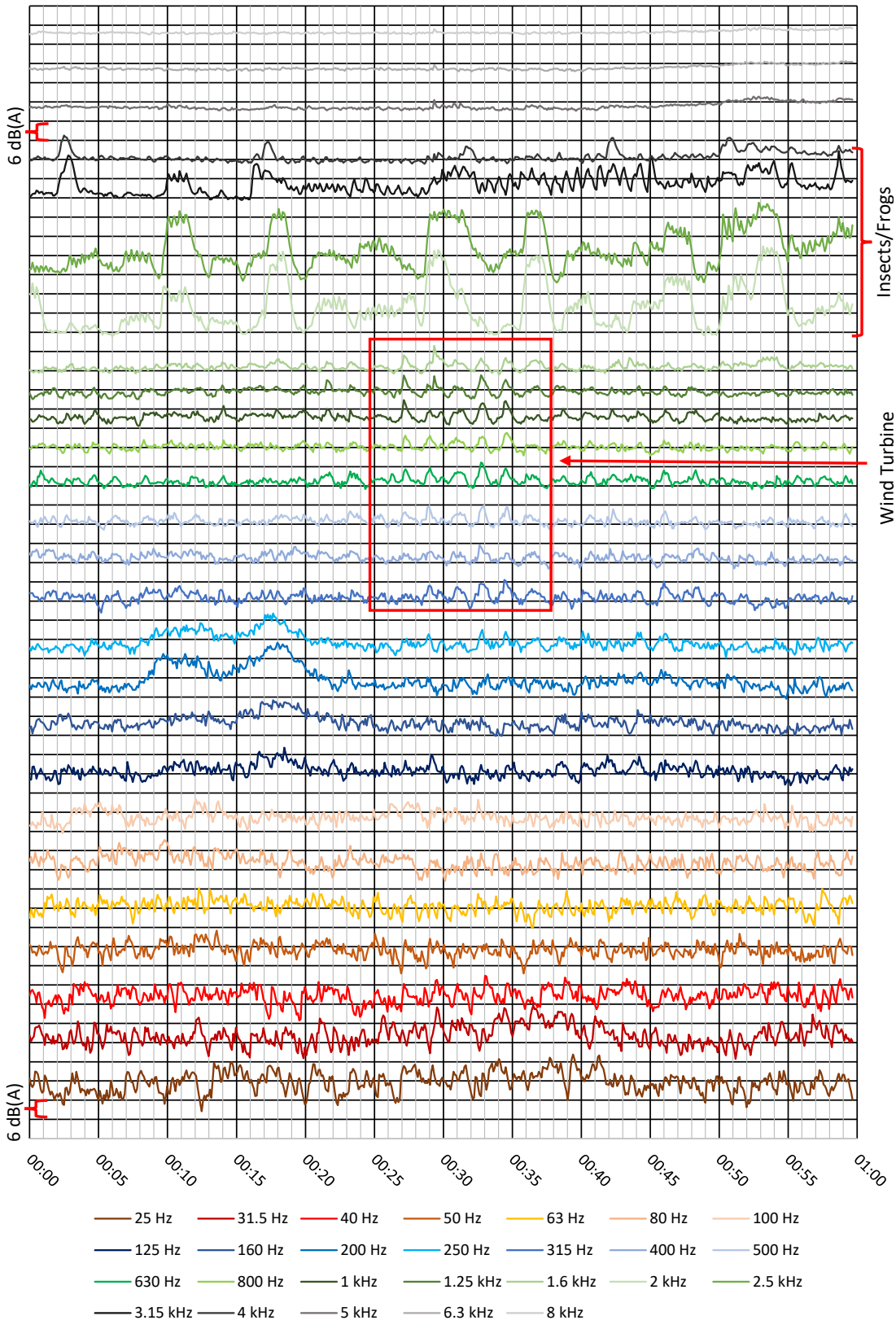


Figure 72: B111 8m/s Amplitude Modulation

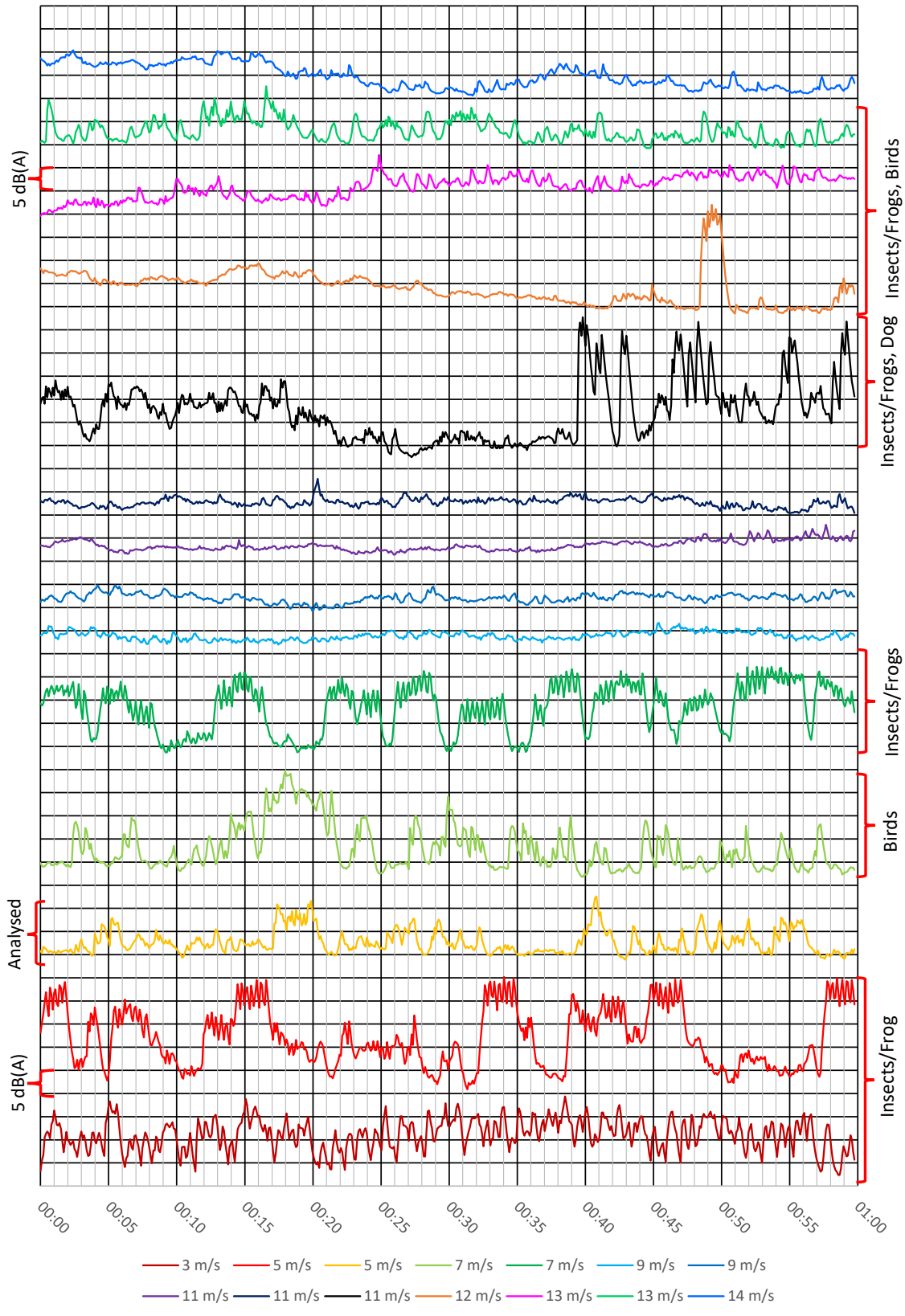


Figure 73: B114 Overall Amplitude Modulation

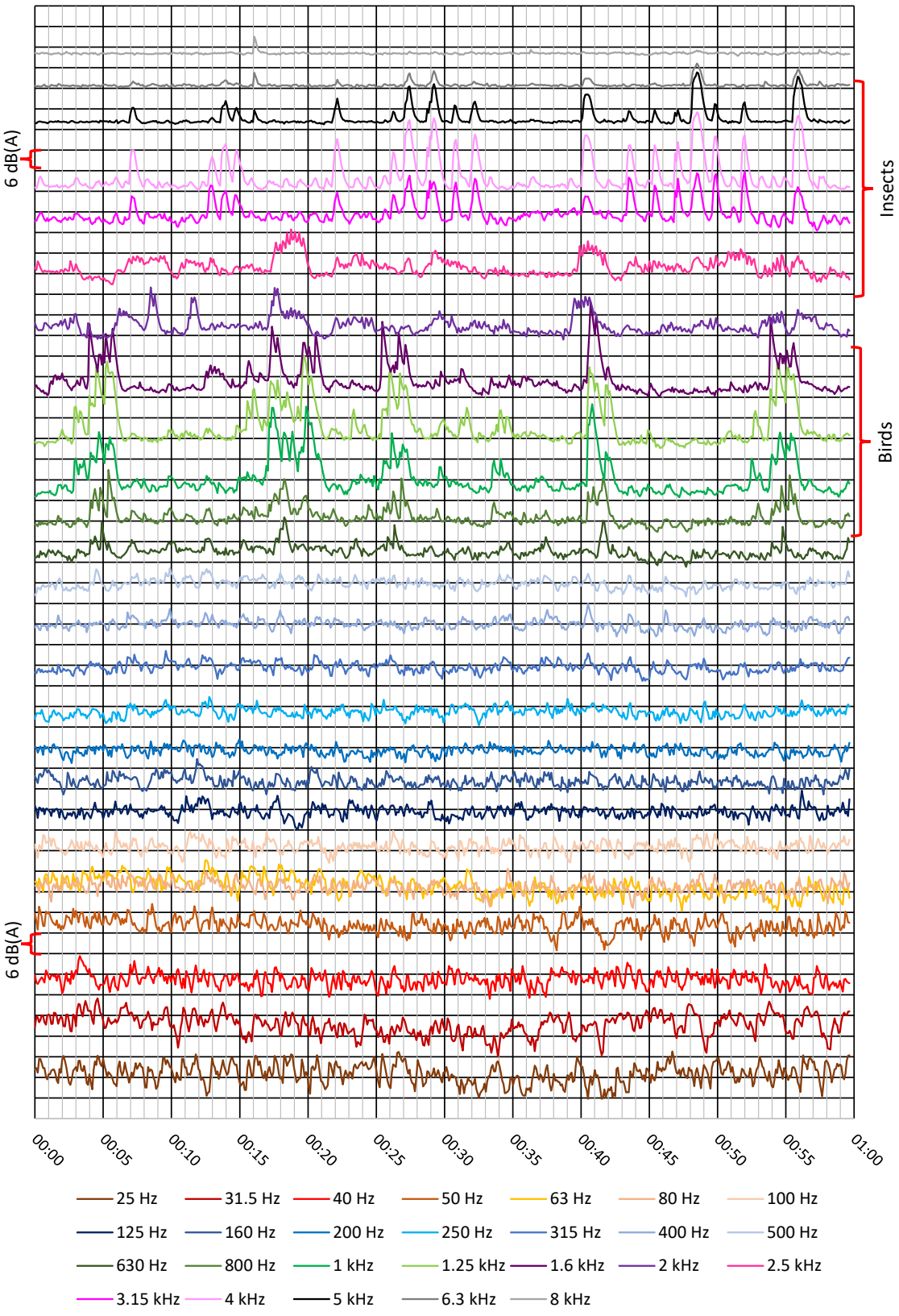


Figure 74: B114 5m/s Amplitude Modulation

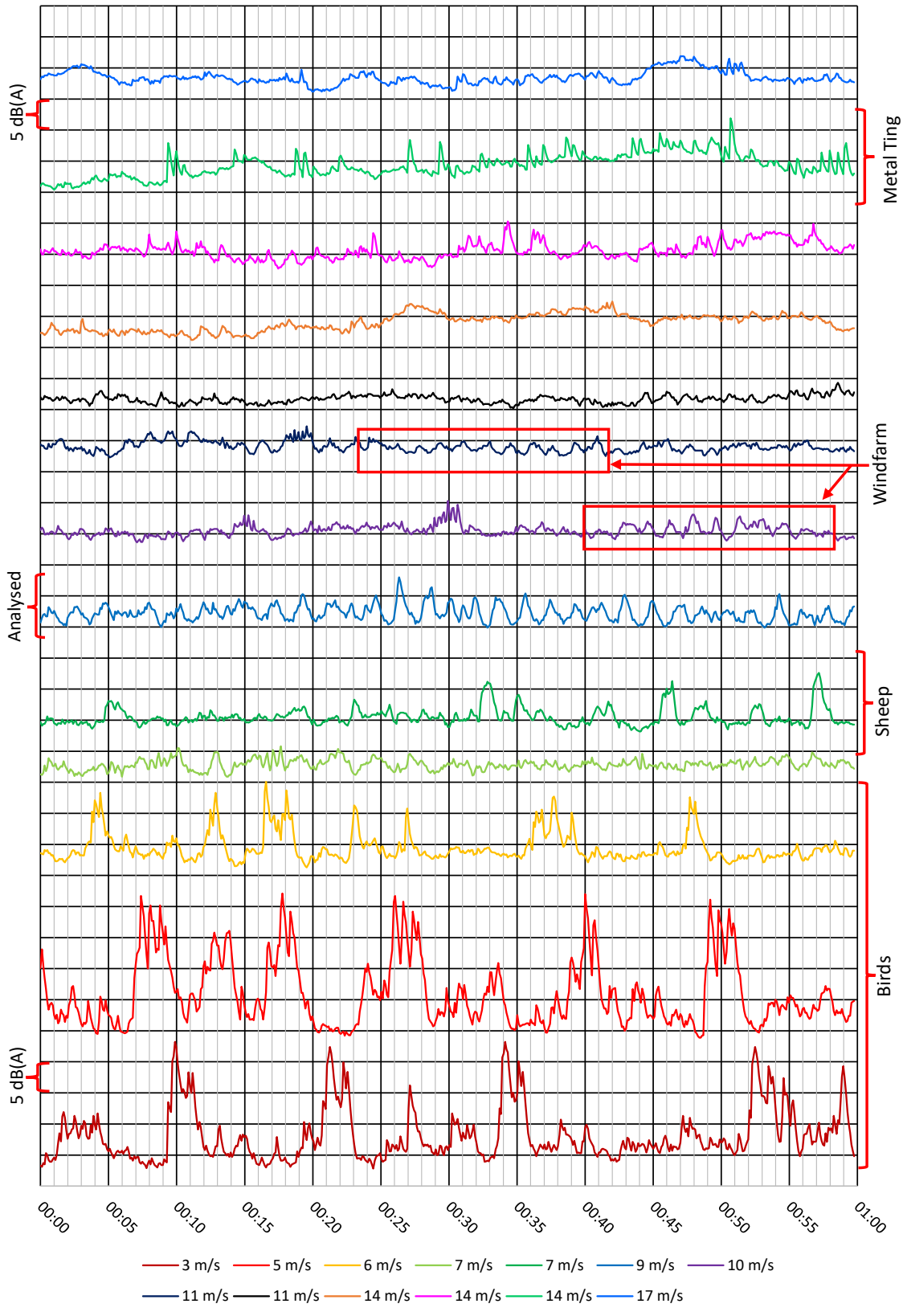


Figure 75: B118 Overall Amplitude Modulation

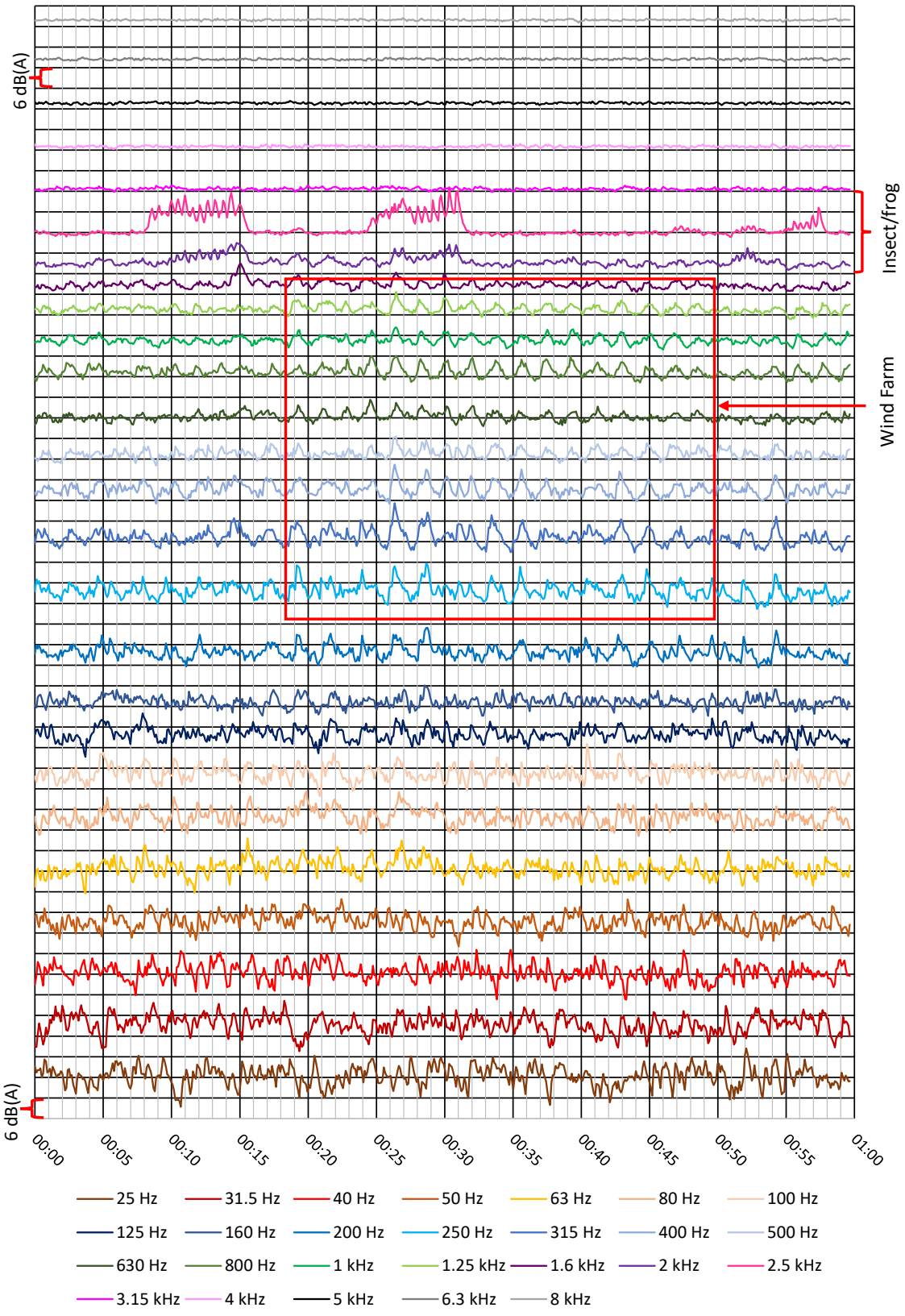


Figure 76: B118 9m/s Amplitude Modulation

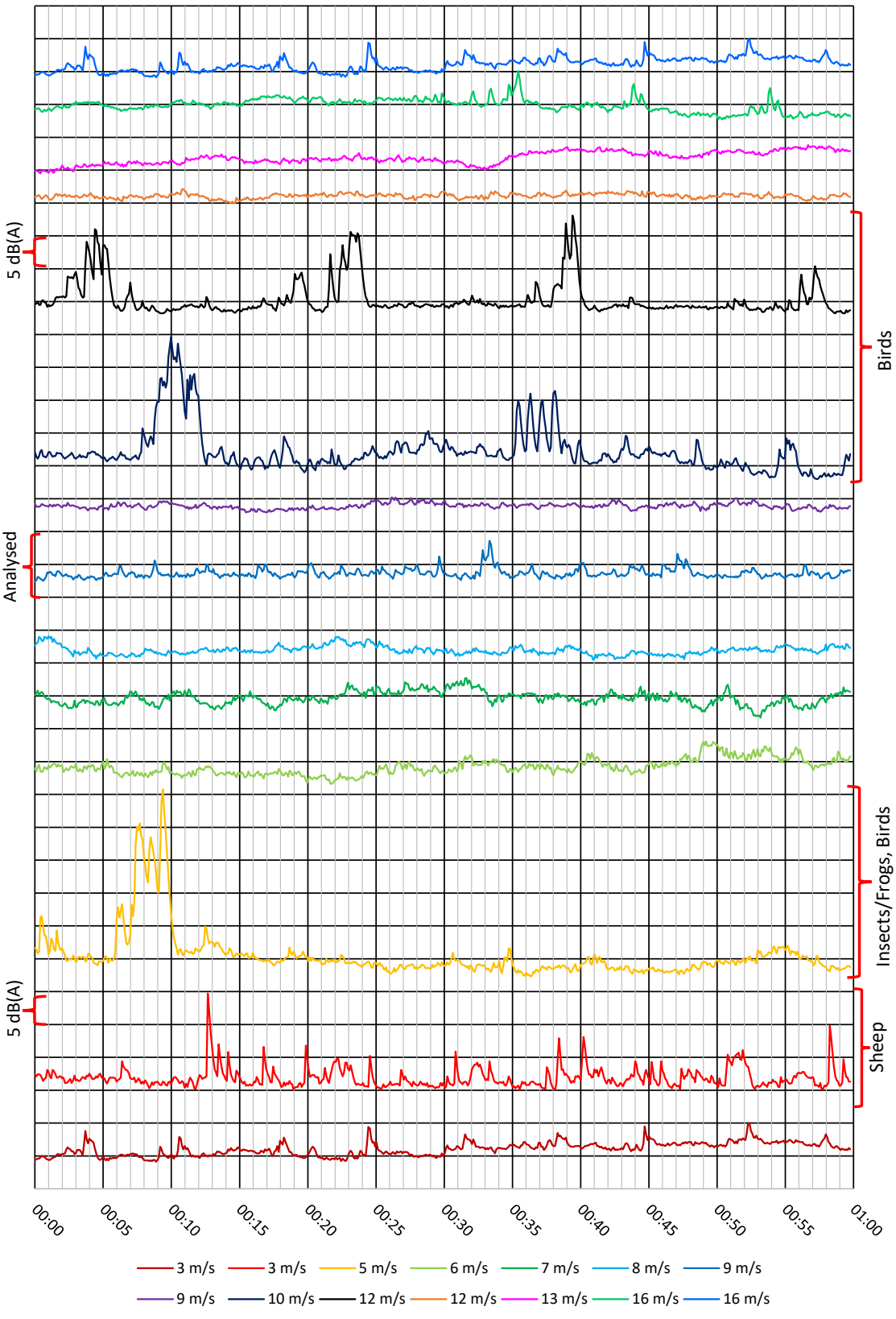


Figure 77: B171 Overall Amplitude Modulation

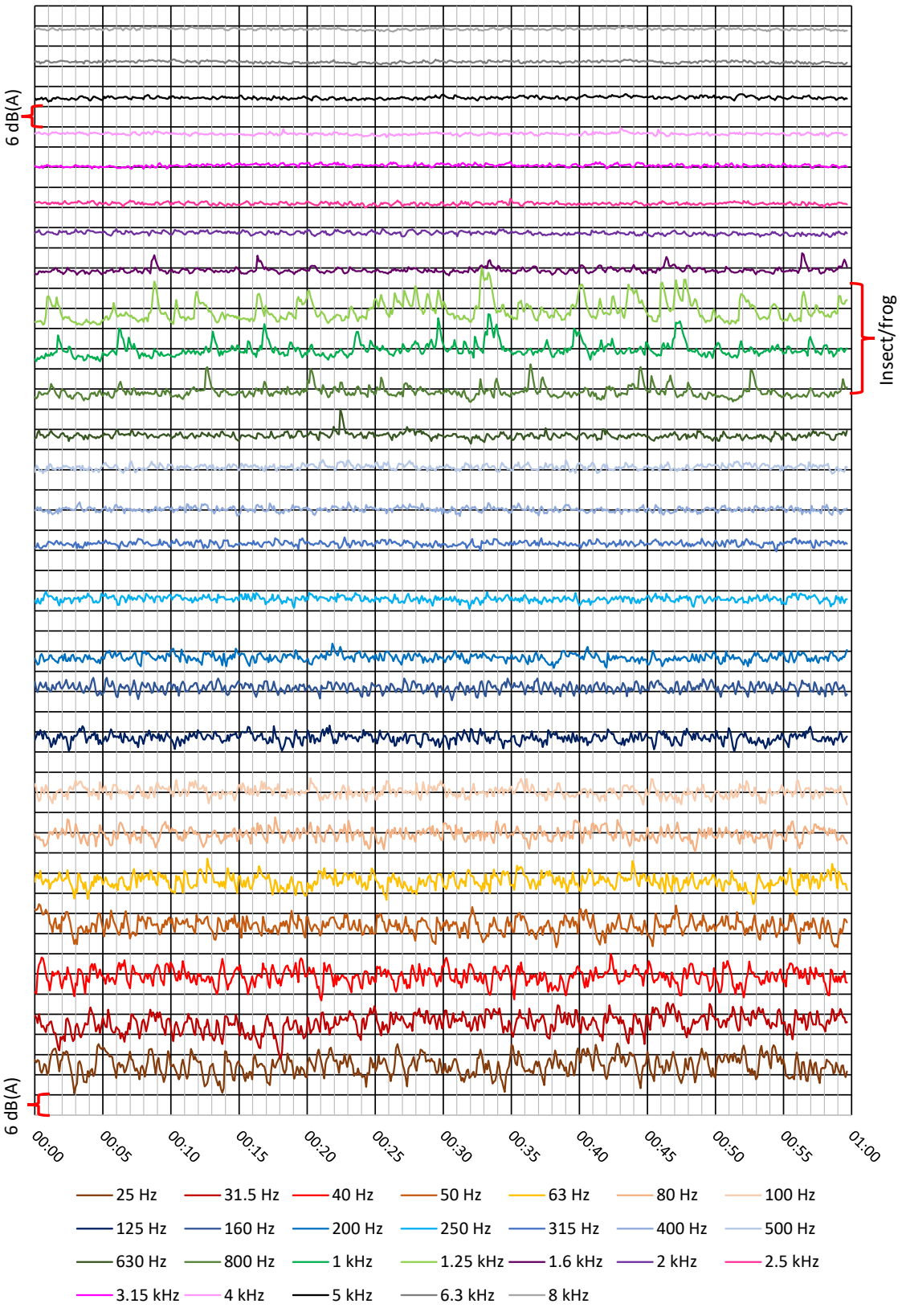


Figure 78: B171 9m/s Amplitude Modulation

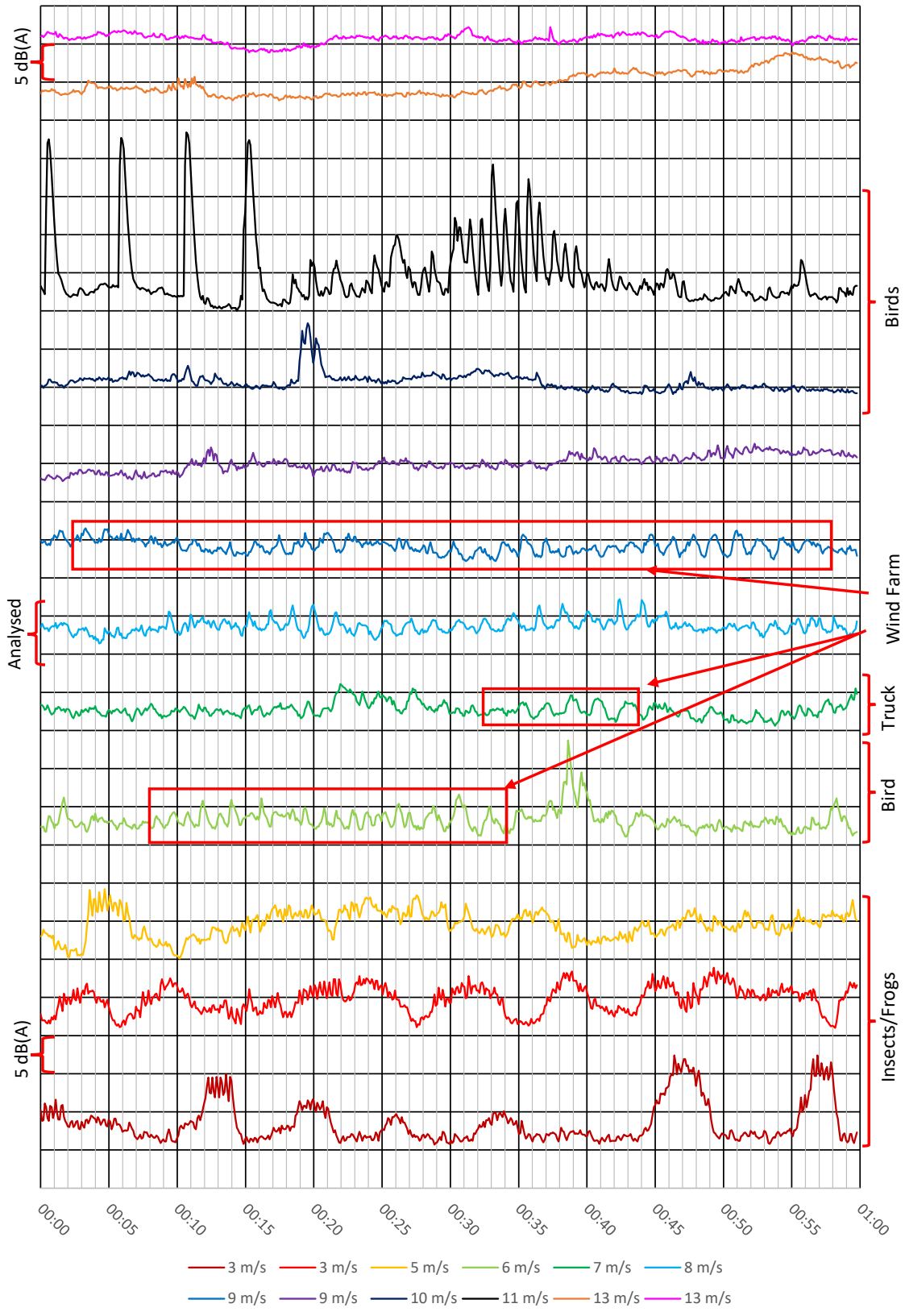


Figure 79: B328 Overall Amplitude Modulation

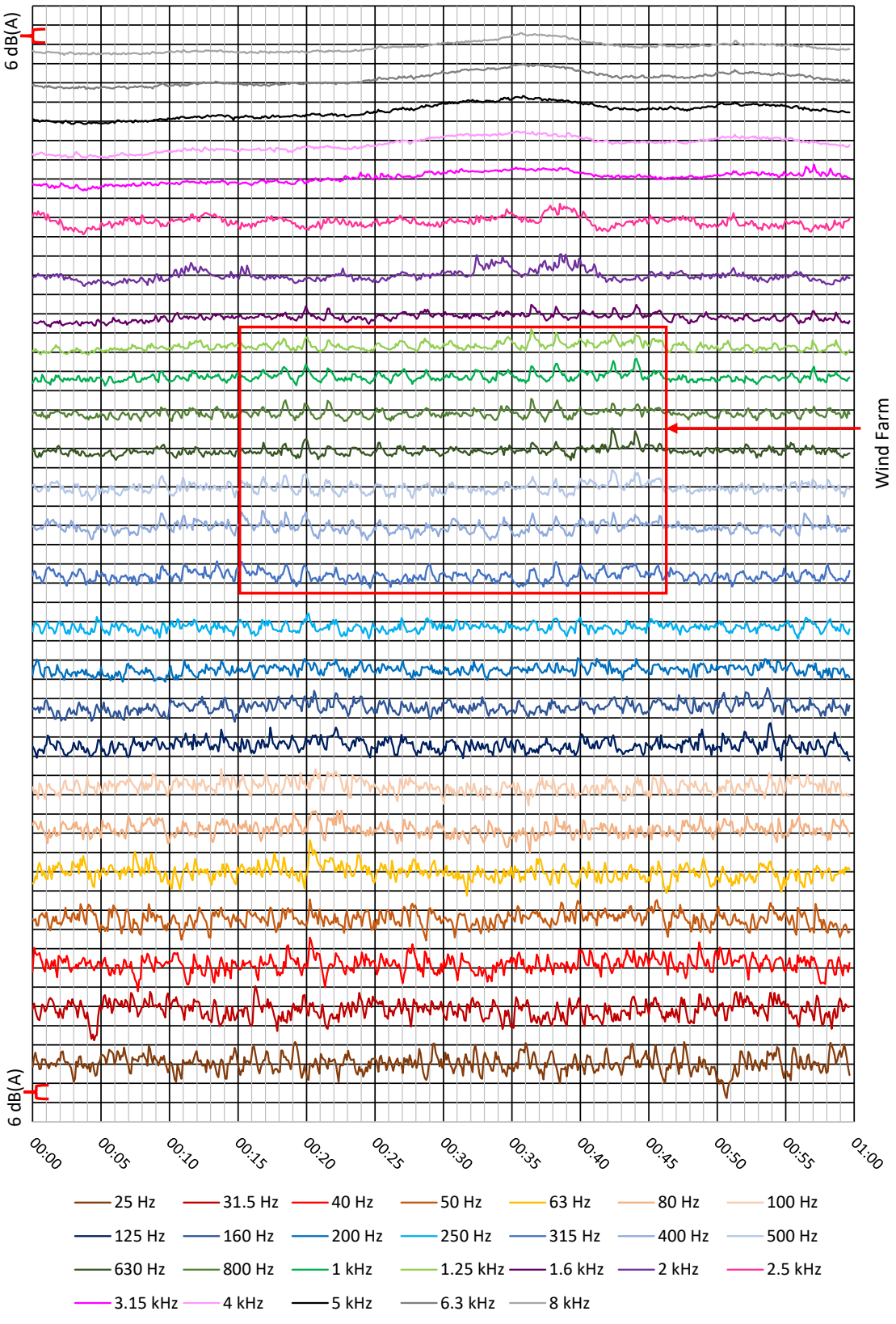


Figure 80: B328 8m/s Amplitude Modulation