FEHILY TIMONEY

DESIGNING AND DELIVERING
A SUSTAINABLE FUTURE

APPENDIX 7

NOISE & VIBRATION

Appendix 7.1 – Baseline Noise Measurements

Appendix 7.2 – Equipment Calibration Certificates

Appendix 7.3 – Noise Sensitive Location Details

Appendix 7.4 – Sound Power Level Data for Wind

Turbines Appendix 7.5 – Valley Correction

Appendix 7.6 – Predicted Noise Levels from Drehid Wind Farm at Nearby Noise Sensitive Locations

APPENDIX 7.1

BASELINE NOISE MEASUREMENTS

Baseline Noise Measurements

Baseline noise monitoring was undertaken at seven receptor locations, to establish the existing background noise levels at these locations. These locations represent the nearest residential locations to the south and west, north and north-east of the proposed wind farm.

Selection of Monitoring Locations

Section 2.2.5 of the Institute of Acoustics', *A Good Practice Guide to the Application of ETUS-R-97 for the Assessment at Rating of Wind Turbine Noise* (2013) regarding use of proxy locations states "*When choosing a location that will serve as a proxy for others, the basis for selection is that it can reasonably be claimed, from inspection and observation, to be representative of the non-surveyed locations, in line with the criteria of Section 2.5. Measurement locations outside a property's curtilage (such as an adjacent field) may be used when access to a representative property cannot be obtained, provided that such a location can be justified as being representative. No general guidance can therefore be given on the number of measurement locations as this will be site-specific*." Section 2.5 of the GPG is summarised in Table 7.1.1 with the applicability of the proxy locations selected for Drehid Wind Farm.

Table 7.1.1: IOA GPG Section 2.5 Criteria and Applicability to Drehid Wind Farm Monitoring Locations

Requirements of Section 2.5	Drehid Wind Farm Monitoring Locations
2.5.1 *Where possible, measurements should be made in the vicinity of a dwelling in an area frequently used for rest and recreation.*	This was adhered to where possible. In some instances access to the dwellings of interest were denied.
2.5.2 *Equipment should be placed at outdoor positions where noise levels are representative of typical 'low' levels likely to be experienced in the vicinity of a dwelling (or group of dwellings if the measurements are intended to be applied to more than one dwelling). The overriding consideration is that it can reasonably be claimed, from inspection and observation, that there are no other suitable noise-sensitive locations, in the vicinity of any selected location and close to a dwelling, where background noise levels would be expected to be consistently lower than the levels at the selected position.*	This was adhered to where possible. In some instances access to the dwellings of interest were denied.
2.5.3 *Ideally the position should be one which would be exposed to noise from the wind turbines whilst being best screened from other noise sources such as nearby roads or vegetation.*	The locations were in open areas or within the curtilage of a property, set back from local roads and vegetation/ forestry.
2.5.4 *The background surveys provide the basis for setting both daytime and night-time noise limits: the measurement position must therefore reasonably represent external areas (for daytime noise) and also building façades containing windows (for night-time noise).*	The locations being used to derive limits are representative of external areas and façade locations.
2.5.5 *In most locations, background noise levels will be determined by wind in trees and vegetation and noise sources external to the property such as traffic noise. The presence of local noise sources such as boiler flues, garden fountains, domestic drains, watercourses and farm equipment should be identified.*	There were some local noise sources described below. Also there were no watercourses adjacent to some of the monitoring locations.[check this statement]
2.5.6 *Where it is not possible to exclude the influence of variable local noise sources by selection of monitoring position, it is generally possible to identify such data from inspection of noise level time histories and therefore to exclude it from the data set used to derive noise limits*	Attendance at the monitoring location during installation, checks, battery changes and equipment collection did not identify any variable noise sources. Atypical data was removed from data analysis.

Requirements of Section 2.5	Drehid Wind Farm Monitoring Locations
2.5.7 *In all cases, microphones should be supported at a height of 1.2 – 1.5 metres above the ground and no closer than 3.5 metres to any significant reflecting surface (such as a building or fence), except the ground. The position should be within 20 metres of the dwelling unless there are particular reasons for measuring at a more distant position (such as the presence of vegetation or denial of access); if so, the reasons should be explained.*	The microphones were elevated on tripods at approximate height of 1.5 m and no closer than 3.5 m to any significant reflecting surface. Where possible the noise monitors were located within 20 m. When the noise monitors were located at more distant locations this was due to either the refusal of access or presence of vegetation.
2.5.8 *A resident at a selected property may request that measurements are made at a position which is considered inappropriate; perhaps because the preferred location(s) are inconvenient (it might obstruct lawn mowing, for example). In this situation the consultant should clearly explain the reasons why the measurements could be compromised; if no agreement can be reached, an alternative property or location should be sought. The assistance of the EHO may help to resolve these situations.*	This was not an issue.

Monitoring Locations

Seven noise monitoring locations were selected for obtaining a detailed representation of the background noise levels in the area. The chosen noise monitoring locations were representative of the different noise environments in the vicinity of the proposed Drehid Wind Farm development as well as being located at some of the closest dwellings (or their representative proxies) to the proposed wind farm development. Details of the noise monitoring locations are provided in Table 7.1.2 overleaf. The position of the monitoring locations are shown in Figure 7.2.

Table 7.1.2: Details on the Noise Monitoring Locations

Location ID	Easting	Northing	Description	Photograph
N1	673073	733924	Located to the rear of a residential property (R126) approximately 20m from the façade.	Plate 7.1-1
N2	674126	735229	Located in an agricultural field near a residential property (R106) approximately 20m from the side façade.	Plate 7.1-2
N3	673040	735413	Located in an agricultural field near the curtilage of a residential property (R100) approximately 20m from the façade.	Plate 7.1-3
N4	673494	736494	Located to the front of a residential property (R87) approximately 20m from the façade.	Plate 7.1-4
N5	676836	738402	Located to the rear of a residential property (R30) approximately 15m from the façade.	Plate 7.1-5
N6	677260	737573	Located on the southern boundary of garden of receptor R55, off the Dunfierth Park Road (Eircode A83 WP90), approximately 30m from the façade.	Plate 7.1-6
N7	675365	737613	Located in garden of receptor (R53), in Kilwarden townland (Eircode A83 FY68) north of the development. Measurement location is approximately 9m from the side façade.	Plate 7.1-7

Location N1, at receiver R126. This location was chosen as the noise environment is representative of the noise environment present at the proposed wind farm. The noise monitor was located at the rear of the dwelling approximate 20m from the façade. The area is mowed with trees and bushes surrounding the perimeter with a hen coop approximately 8m from the noise meter and c. 40m from the local country road. Rustling of foliage, bird song and distant traffic noise could be heard at this location.

Plate A7.1: Monitoring Location N1

Location N2, at receiver R106. This location was chosen as the noise environment is representative of the noise environment present at the proposed wind farm. The noise monitor was situated in a field adjacent to the residence, 20m from the side of the dwelling. There is Perennial ryegrass (Lolium perenne) with trees and a wooden fence surrounding the perimeter. Livestock, occasional dogs barking, agricultural activities, activity at shed and rustling of foliage could be heard at this location.

Plate A7.2: Monitoring Location N2

Location N3, adjacent to receiver R100. This location was chosen as the noise environment is representative of the noise environment present at the proposed wind farm. The noise monitor was situated in a field, 20m the side of the dwelling. There is Perennial ryegrass (Lolium perenne) and with trees and a wooden fence surrounding the perimeter. The meter is surrounded by sheep wire to protect the meter from the sheep present in the field at the time the metre was installed. Livestock, agricultural activities and rustling of foliage could be heard at this location.


Plate A7.3: Monitoring Location N3

Location N4, at receiver R87. This location was chosen as the noise environment is representative of the noise environment present at the proposed wind farm. The noise monitor was situated in a field, 20m from the front of the dwelling and c. 500m from the R402 regional road. There is Perennial ryegrass (Lolium perenne), with trees and a wooden fence surrounding the perimeter. Livestock, agricultural activities, occasional dogs barking, distance traffic and rustling of foliage could be heard at this location.


Plate A7.4: Monitoring Location N4

Location N5, at receiver R30. This location was chosen as the noise environment is representative of the noise environment present at the proposed wind farm. The noise monitor was situated to the rear of the dwelling approximately 12 m from the façade. Livestock, agricultural activities, rustling of foliage and occasional traffic noise could be heard at this location.


Plate A7.5: Monitoring Location N5

Location N6, at receiver (R55). This location was at the end of the garden, to the south of the property. This location was chosen as the noise environment is representative of the noise environment present at the proposed wind farm. The location has a clear line of sight to the wind farm, not screened by the garage at the property. The noise monitor was located at the southern boundary of the dwelling approximate 30m from the façade. To the south of the noise monitor is a field with livestock. Noise observed at the site included very distant traffic, occasional aircraft and some birdsong.

Plate A7.6: Monitoring Location N6

Location N7, at receiver (R53). The location was in the garden south east of the property, in the direction of the proposed wind farm. This location was chosen as the noise environment is representative of the noise environment present at the proposed wind farm. The noise monitor is approximately 9m from the property. This location was chosen as it was away from trees at the end of the garden. There is a small hedge at the boundary of the garden approximately 4m from the monitor. The main noise sources observed were distant road traffic noise, occasional aircraft and birdsong. The rainfall gauge was also located at this location.

Plate A7.7: Monitoring Location N7

The IOA GPG states "The duration of a background noise survey is determined only by the need to acquire sufficient valid data over the range of wind speeds. It is unlikely that this requirement can be met in less than 2 weeks." If insufficient wind data is collected after two weeks, the monitoring periods will be extended subject to acquiring sufficient valid data over the range of wind speeds. Sufficient data was captured at all monitoring locations with a minimum of two weeks' worth of data captured at all monitoring locations.

Definition of Time Periods

The following periods were analysed for this report:

Daytime hours	07:00 – 23:00
Night-time hours	23:00 – 07:00

Monitoring Equipment

Baseline noise monitoring was carried out using Bruel & Kjaer Type 2238 Class 1 sound level meter, Svantek Svan 977 Class 1 sound level meters. Details of the noise monitoring equipment are presented in Table 6.1.3. The sound level meters were fitted with 1/2" microphones. The microphones connected to the Bruel & Kjaer sound level meter was fitted with B&K UA1404 outdoor microphone assembly. The microphones connected to the Svantek sound level meters were fitted with a UA-0237 type wind shield made from open-pored polyurethane foam with a diameter of 90mm. These were surrounded by a secondary windshield in keeping with ESTU W/13/00386/REP, Noise Measurements in Windy Conditions and IOA Good Practice Guidelines, 2013. Calibration certificates for each sound level meter are provided in Appendix 7.2.

Table 7.1.2: Details of Noise Monitoring Equipment

Monitoring Location	Meter Type	Serial No	Measurement Period
N1	Svan 977	34876	8tth to 22nd November 2017 4th December 2017 to 12th January 2018
N2	Svan 977	34173	8tth to 22nd November 2017 4th December 2017 to 12th January 2018
N3	B&K 2238	2151874	8th to 22nd November 2017 4th December 2017 to 12th January 2018
N4	Svan 977	34875	8th to 22nd November 2017 4th December 2017 to 12th January 2018
N5	Svan 977	34876	8th to 22nd November 2017 4th December 2017 to 12th January 2018
N6	Svan 977	34173	24th May to 11th June 2019
N7	Svan 977	34876	24th May to 11th June 2019

During the first two measurement periods, a CR200 Series data logger was used to record rainfall (ARG 100) and this was located at N2 and N5. This meteorological data was acquired every 10 minutes simultaneously with noise data.

During the 2019 measurement period, a CR200 Series data logger was used to record rainfall (ARG 100) and this was located at monitoring location N7. This meteorological data was acquired every 10 minutes simultaneously with noise data.

Monitoring Protocol

Baseline noise measurements were undertaken at seven locations surrounding the proposed wind farm. Equipment was installed in three lots: 1) from 8th to 22nd November 2017 2) from 4th December 2017 to 12th January 2018 and 3) 24th May to 11th June 2019. These measurements included all seven monitoring locations N1, N2, N3 N4, N5, N6 and N7.

The following monitoring protocol was carried out at each of the monitoring locations:

1. The sound level meters were calibrated on-site and set to log LA90 statistics on a fast time weighted response every ten minutes.
2. Each sound level meter microphone was mounted at 1.5 m above ground level and fitted with an enhanced windshield. Each microphone was placed at least 3.5 m from reflecting surfaces to obtain 'free field' conditions.
3. Wind speed and wind direction measurements were taken from a Lidar Unit installed at noise monitoring location N2 (lot 2) and monitoring location N5 (lot 1). For the measurements at locations N6 and N7, wind speed and wind direction measurements were taken from a Lidar Unit installed at noise monitoring location N5 The standardised 10 m wind speed was obtained from the turbine hub

height wind speed by correcting it to 10 m height using a ground roughness factor of 0.05 m.. Roughness length (or logarithmic) shear profile:

$$U_1 = U_2 \frac{ln\left(^{H_1}/_{z}\right)}{ln\left(^{H_2}/_{z}\right)}$$

where U1 is the wind speed to be calculated, U2 is the measured wind speed, H1 is the height of the measured wind speed to be calculated (10m), H2 is the height of the measured wind speed and z is the ground roughness length (m). A roughness length of 0.05m is used to standardise hub height wind speeds to 10m height in the IEC 61400-11:2012 standard.

4. The LA90 statistic measurements were synchronised with the 10 m standardised wind speeds derived from the on-site meteorological mast data.
5. A logging rain gauge was also installed (at Monitoring Location N5 for lot 1, N2 for lot 2 and N7 for lot 3), and similarly logged rainfall events over successive 10 minute intervals, also synchronised to the noise level and wind speed measurements.
6. After the monitoring was completed, the noise meters were re-tested using the calibration noise source to ensure that the meters had not drifted.

Analysis of the Baseline Data

Following collection of the site data, the following protocol was used to analyse the baseline data:

1. The raw baseline L_{A90} noise data was reviewed to determine whether there are any periods of non-consistent noise level due to equipment malfunction. If there was any data which was inconsistent, these noise level data points were removed from the raw data set and detailed in the report. There was no such data. However, the sound level meter at monitoring location N5 did not capture data for the first two weeks of the noise survey and this sound level meter was replaced as subsequently sufficient data was captured.
2. The raw noise level data was then correlated with the time synchronised wind speed and rainfall data. Preliminary data analysis was used to remove datasets (L_{A90}, wind speed and occurrence of rainfall event) which contain a rainfall event as these data sets are required to be removed from further analysis in line with best practice as outlined in the IOA Good Practice Guide and Supplementary Guidance Note 2 on Data Processing.
3. Early morning periods were also excluded to remove the dawn chorus which is not prevalent through that whole year, with data recorded between 03:00 and 07:00 was removed from further analysis.
4. Once the dawn chorus, rainfall events and snow events have been accounted for, the remaining data was graphed using a wind speed based plot to establish whether there are any remaining data outliers, representing atypical noise sources or events. See Section 7.4.8 'Rainfall, Snow and Outlier Data Removal' for details.
5. Once the remaining data sets were found to be representative of the noise environment, they were analysed to ensure that sufficient data remained to provide sufficient data coverage over the necessary wind speeds. The IOA Good Practice Guide (May 2013) requires, as a minimum, no fewer than five valid data sets across each 1 m/s wind speed from turbine cut-in to rated power. Where integer wind speeds have less than five valid data sets, the prevailing background noise trend will not be extended beyond the range covered by adequate data sets. See Section 'Data Sets Available for Determination of Prevailing Background Noise Levels' for details.

6. A ‘best fit’ trend (not higher than a fourth order polynomial) was then derived to present the assumed prevailing background noise level at each monitoring location. See Section 7.5 ‘Results’ for details.

Measurement Periods

The IOA GPG states “*The duration of a background noise survey is determined only by the need to acquire sufficient valid data over the range of wind speeds. It is unlikely that this requirement can be met in less than 2 weeks.*” If insufficient wind data is collected after two weeks, the monitoring period will be extended subject to acquiring sufficient valid data over the range of wind speeds. Sufficient data was captured at all monitoring locations with a minimum of two and a half weeks’ worth of data captured at all monitoring locations.

Definition of Time Periods

The following periods were analysed for this report:

Amenity/Quiet Daytime hours	18:00 – 23:00 Monday to Friday 13:00 – 18:00 Saturday 07:00 – 18:00 Sunday
Night-time hours	23:00 – 07:00

Data Available for Determination of Prevailing Background Noise Levels

The requirement for the survey duration is dictated by the range of wind speeds to be collected. The IOA Good Practice Guide to the Application of ETSU-R-97[1] for the Assessment and Rating of Wind Turbine Noise, (May 2013) states that “*As a guideline, no fewer than 200 data points should be recorded in each of the amenity hours and night-time periods with no fewer than 5 data points in any 1 m/s wind speed bin.”*

The Wind Energy Development Guidelines (Department of Environment, Heritage and Local Government, 2006) do not provide the specific periods which are represented by daytime and night-time hours, therefore the definitions from ETSU-R-97 are taken as 07:00 to 23:00 hrs for daytime and 23:00 to 07:00 hrs for night-time.

Prevailing background noise levels were derived for daytime and night-time periods. The number of valid datasets are shown in Tables 7.1.4 and 7.1.5 with wind speed ranges greyed out which did not satisfy the criteria of at least 5 data points in any 1 m/s wind speed bin.

[1] Department of Trade and Industry (1996), The Assessment and Rating of Noise from Wind Farms Report ETSU-R-97

Table 7.1.4: Number of Valid Datasets: All Noise Monitoring Locations - Daytime

Wind Speed (at standardised 10 m height), m/s	Valid Datasets						
	N1	N2	N3	N4	N5	N6	N7
0	3	3	1	0	0	0	0
1	49	77	10	45	24	7	26
2	63	76	21	50	74	58	104
3	163	160	78	129	137	112	195
4	277	242	133	183	178	123	234
5	507	434	236	369	241	149	226
6	703	538	327	442	220	132	204
7	564	409	258	318	147	144	172
8	343	294	203	207	32	93	97
9	151	133	89	77	5	46	43
10	108	91	87	40	0	31	31
11	51	43	42	18	0	12	12
12	23	18	17	8	0	0	0
13	11	11	11	5	0	0	0
14	6	6	6	1	0	0	0
15	3	3	3	0	0	0	0
16	1	1	1	0	0	0	0
Total Number of Data Points	3026	2539	1523	1892	1058	907	1344
	Did not satisfy the criteria of at least 5 data points in any 1 m/s wind speed bin						

Table 7.1.5: Number of Valid Datasets: All Noise Monitoring Locations– Night-time

Wind Speed (at standardised 10 m height), m/s	Valid Datasets						
	N1	N2	N3	N4	N5	N6	N7
0	0	0	0	0	0	0	0
1	0	0	0	2	7	0	0
2	6	4	1	6	21	19	29
3	44	31	13	29	7	53	76
4	111	56	63	78	21	35	64
5	290	146	142	204	48	32	81
6	378	168	183	274	69	73	101
7	263	83	133	188	41	38	40
8	160	46	64	92	15	23	23
9	91	38	39	48	18	5	5
10	51	32	37	20	4	0	0
11	16	7	13	7	3	0	0
12	13	5	12	5	0	0	0
13	4	0	4	3	0	0	0
14	3	0	3	2	0	0	0
15	2	0	2	2	0	0	0
16	0	0	0	0	0	0	0
Total Number of Data Points	1432	616	709	960	254	278	419
	Did not satisfy the criteria of at least 5 data points in any 1 m/s wind speed bin						

Results

In this section, the prevailing background noise level in dB L_{A90} relative to standardised 10 m height wind speeds are provided for each monitoring location as per the requirements of the survey. The prevailing background noise level is plotted as a solid line for each daytime and night-time periods at each monitoring location. In all cases, the highest order of polynomial used is a fourth order polynomials provided lines of best fit to the scatter data. Table 7.1.6 presents the derived prevailing background noise for all noise monitoring locations.

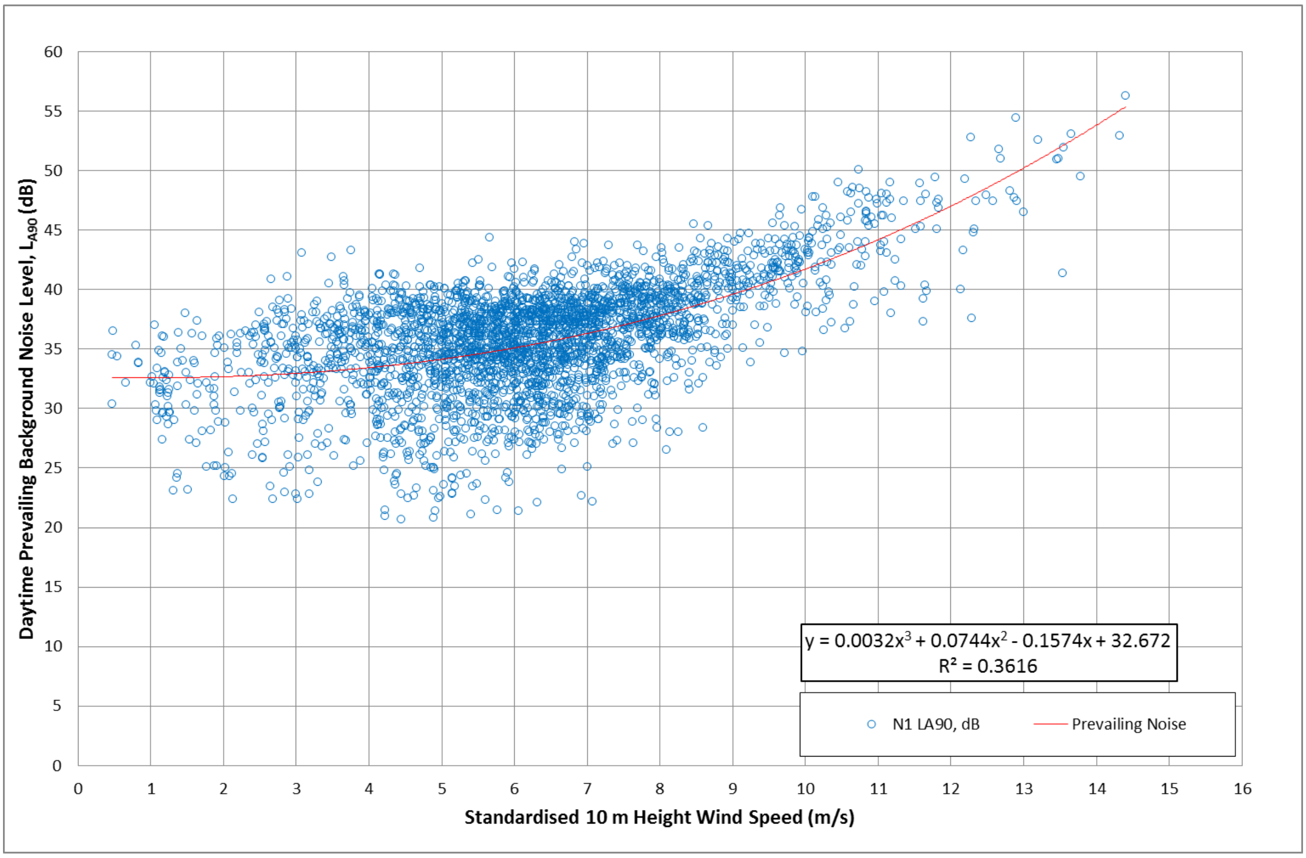


Figure A7.1: Prevailing Amenity/Daytime Background (L_{A90}) Noise Levels at N1

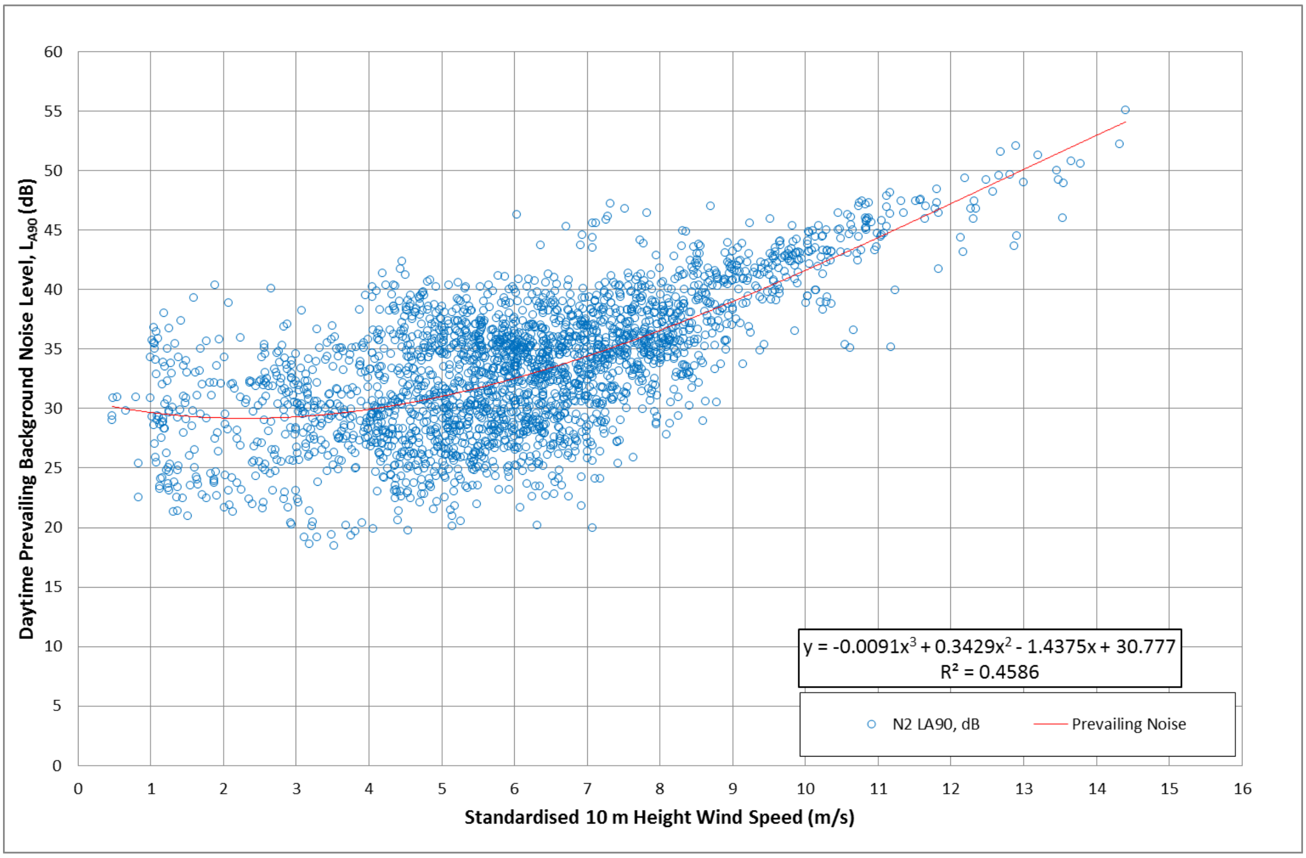


Figure A7.2: Prevailing Amenity/Daytime Background (L_{A90}) Noise Levels at N2

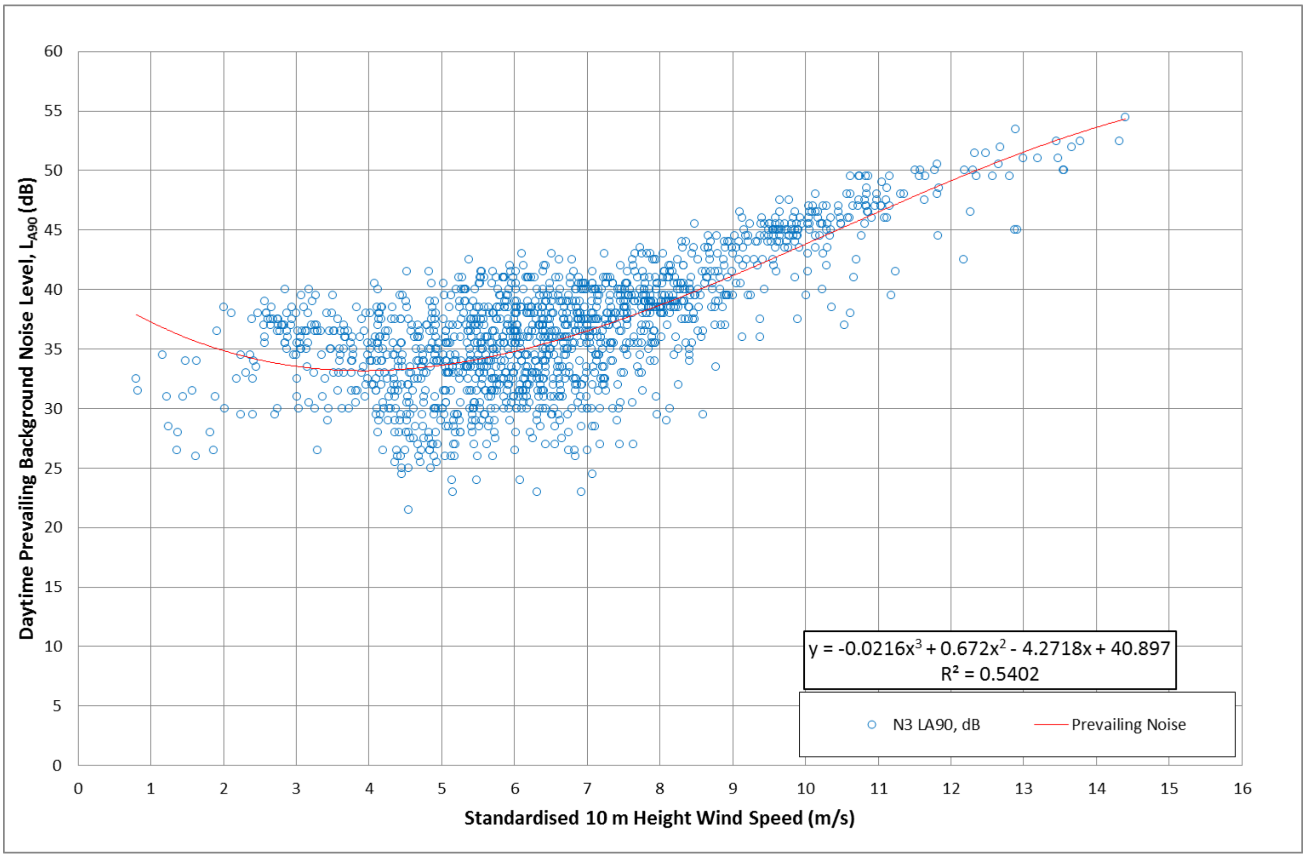


Figure A7.3: Prevailing Amenity/Daytime Background (L_{A90}) Noise Levels at N3

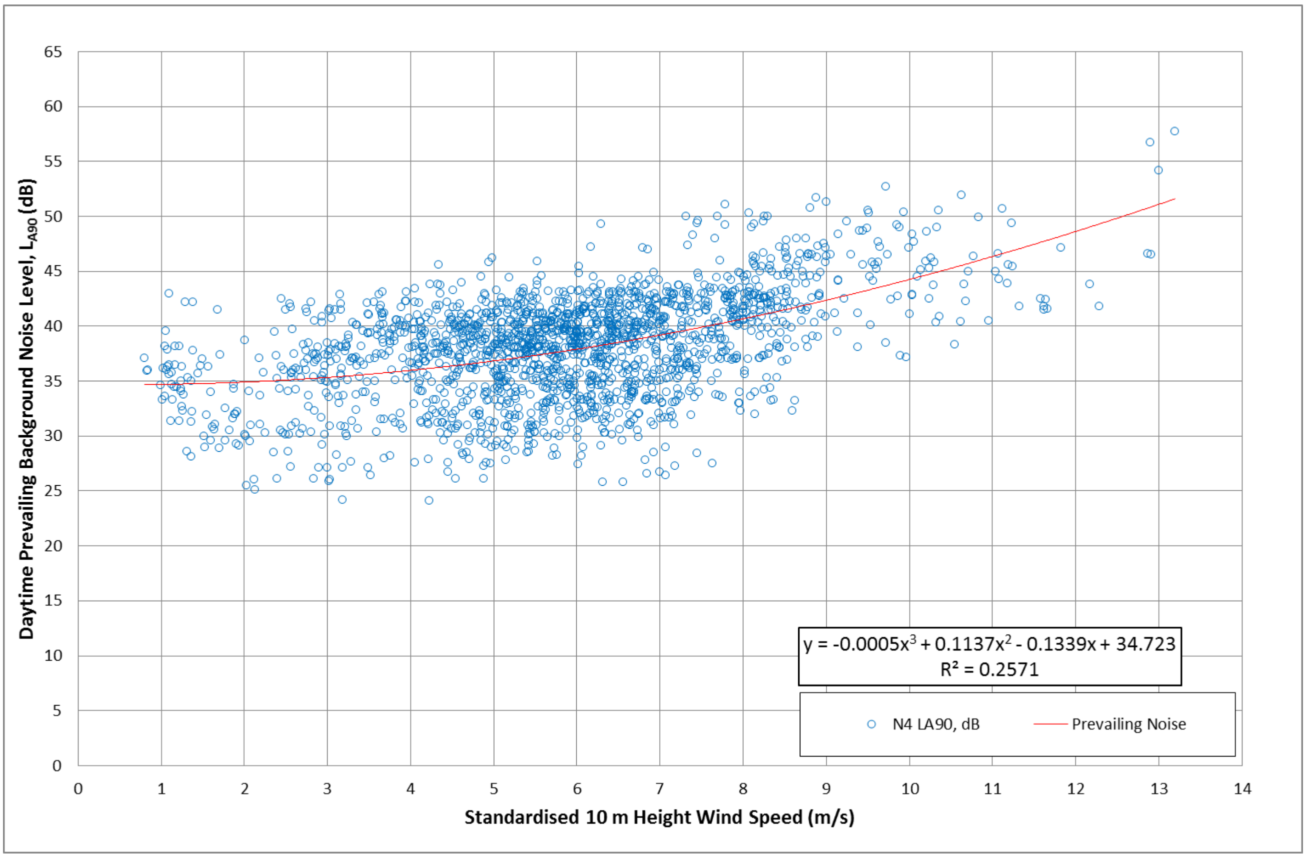


Figure A7.4: Prevailing Amenity/Daytime Background (L_{A90}) Noise Levels at N4

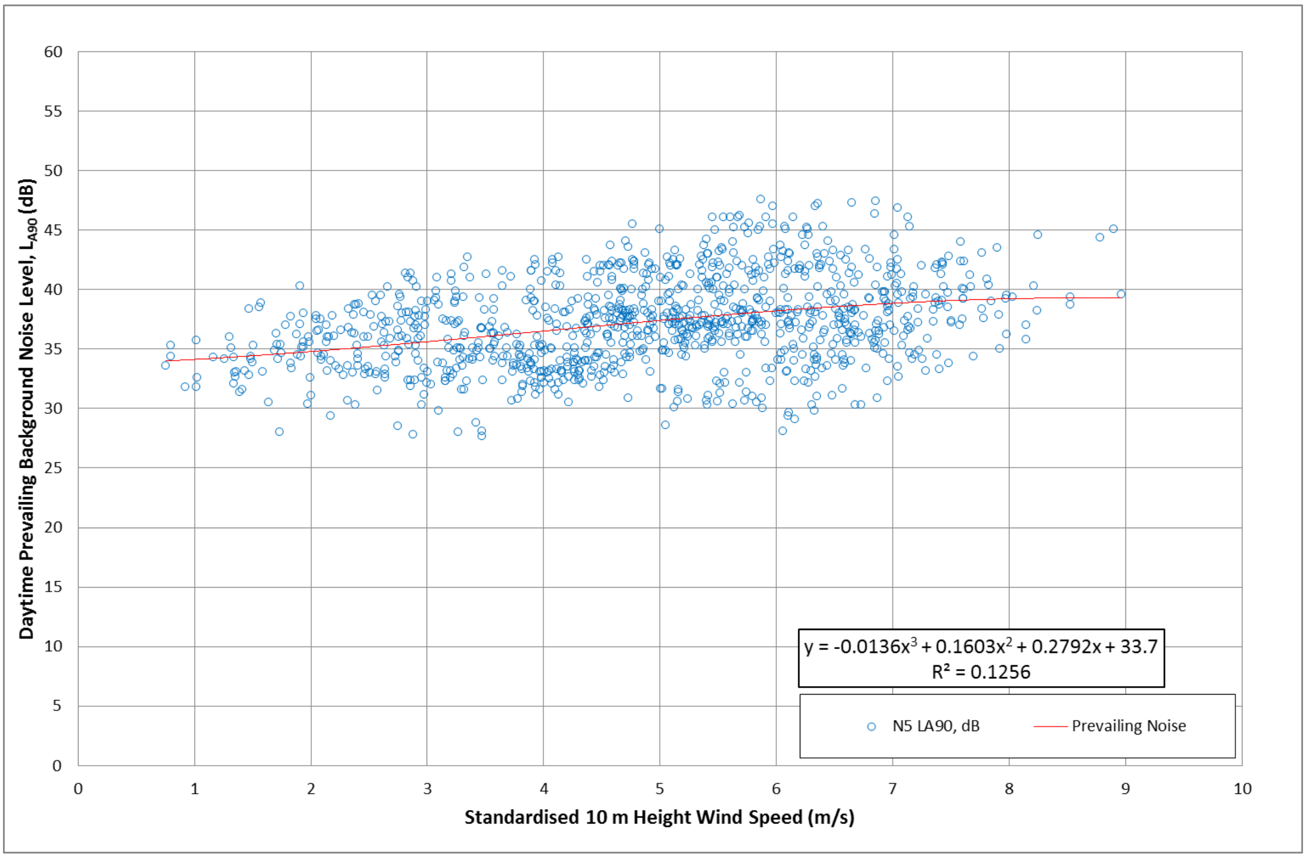


Figure A7.5: Prevailing Amenity/Daytime Background (L_{A90}) Noise Levels at N5

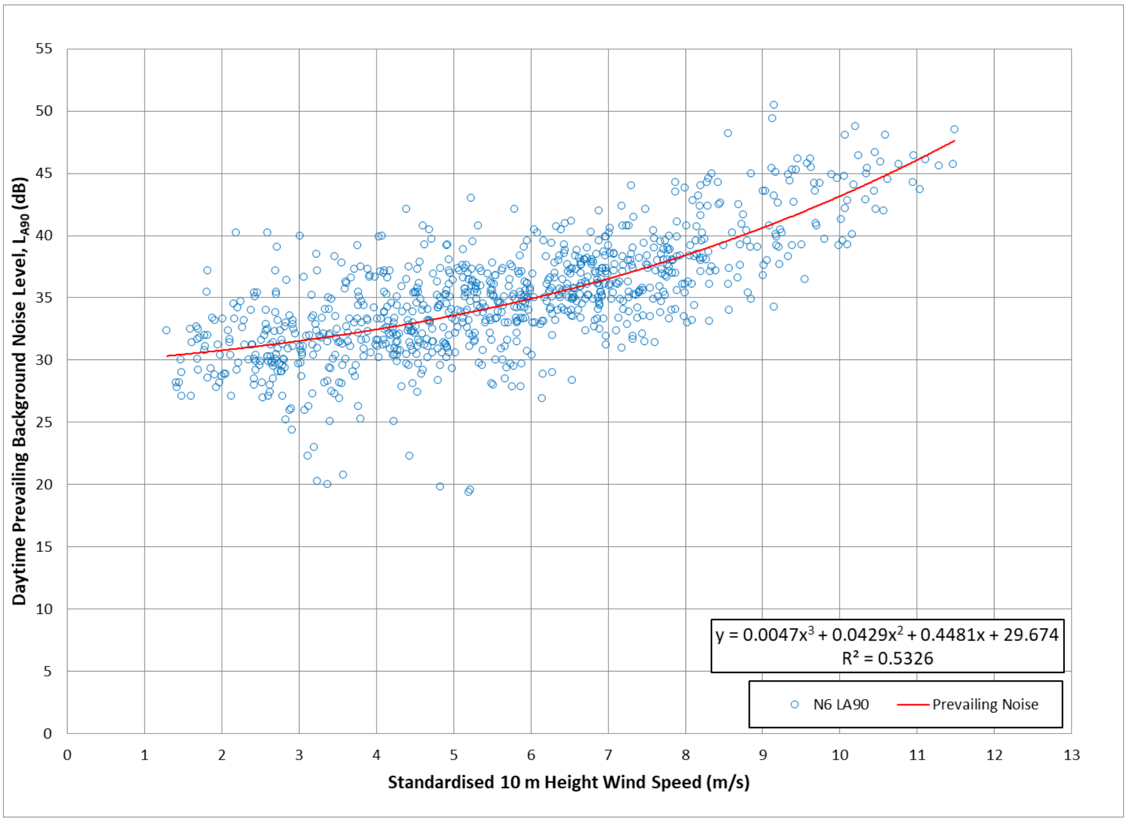


Figure A7.6: Prevailing Amenity/Daytime Background (L_{A90}) Noise Levels at N6

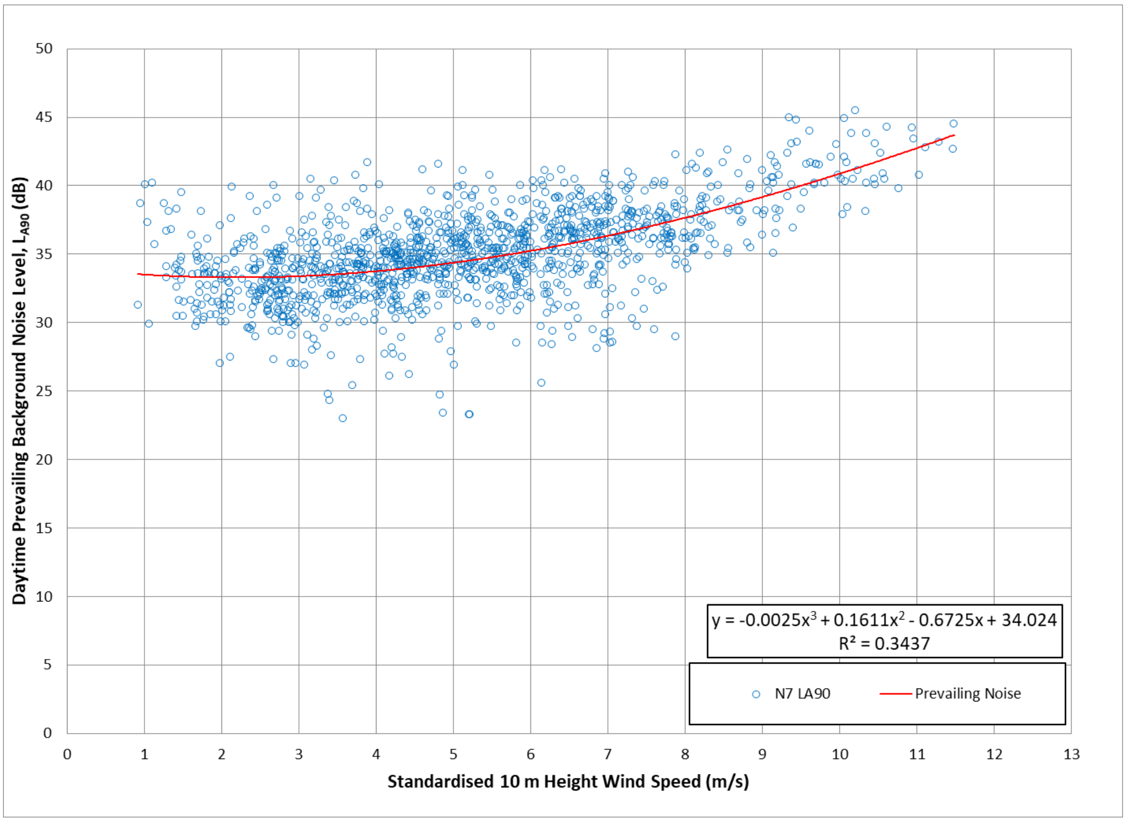


Figure A7.6: Prevailing Amenity/Daytime Background (L_{A90}) Noise Levels at N7

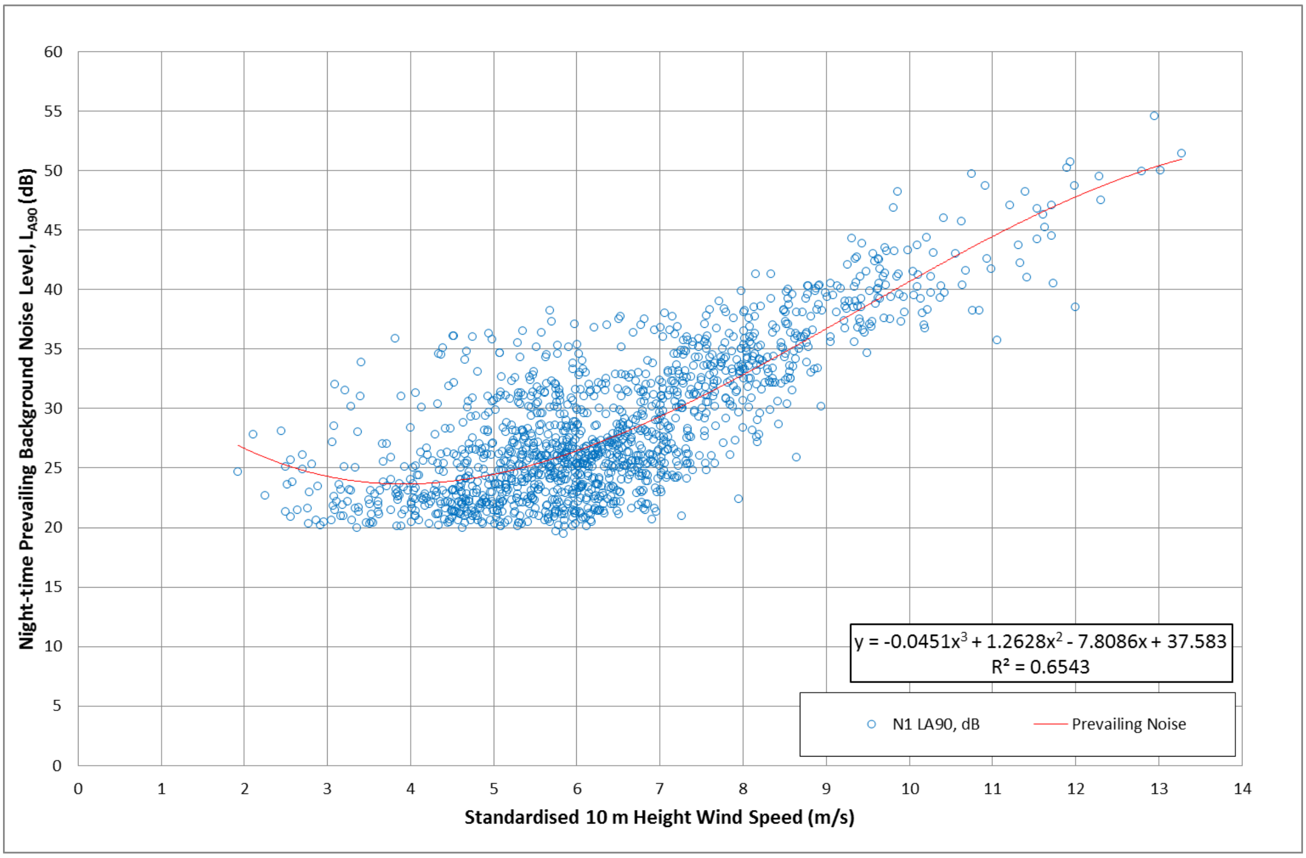


Figure A7.10: Prevailing Night-time Background (L_{A90}) Noise Levels at N1

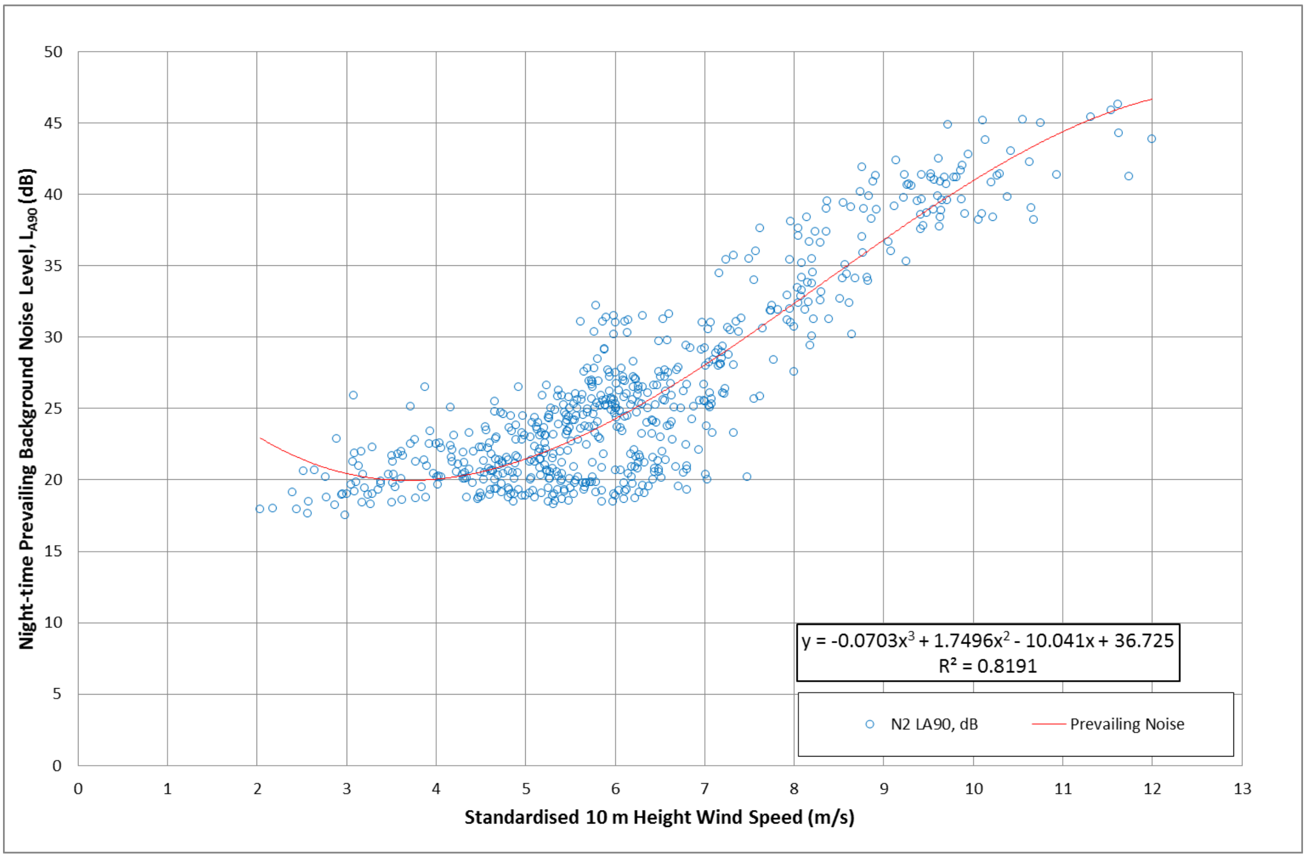


Figure A7.11: Prevailing Night-time Background (L_{A90}) Noise Levels at N2

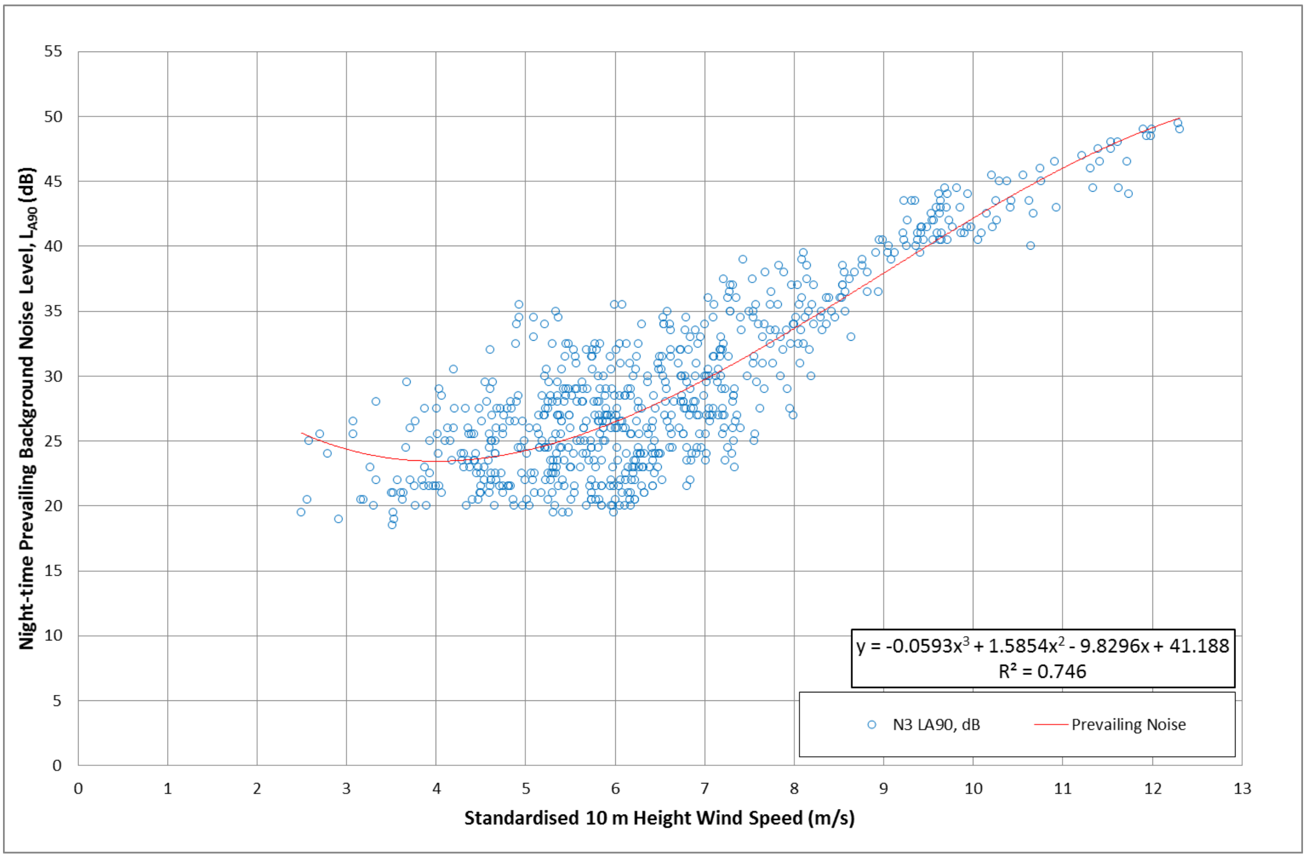


Figure A7.12: Prevailing Night-time Background (L_{A90}) Noise Levels at N3

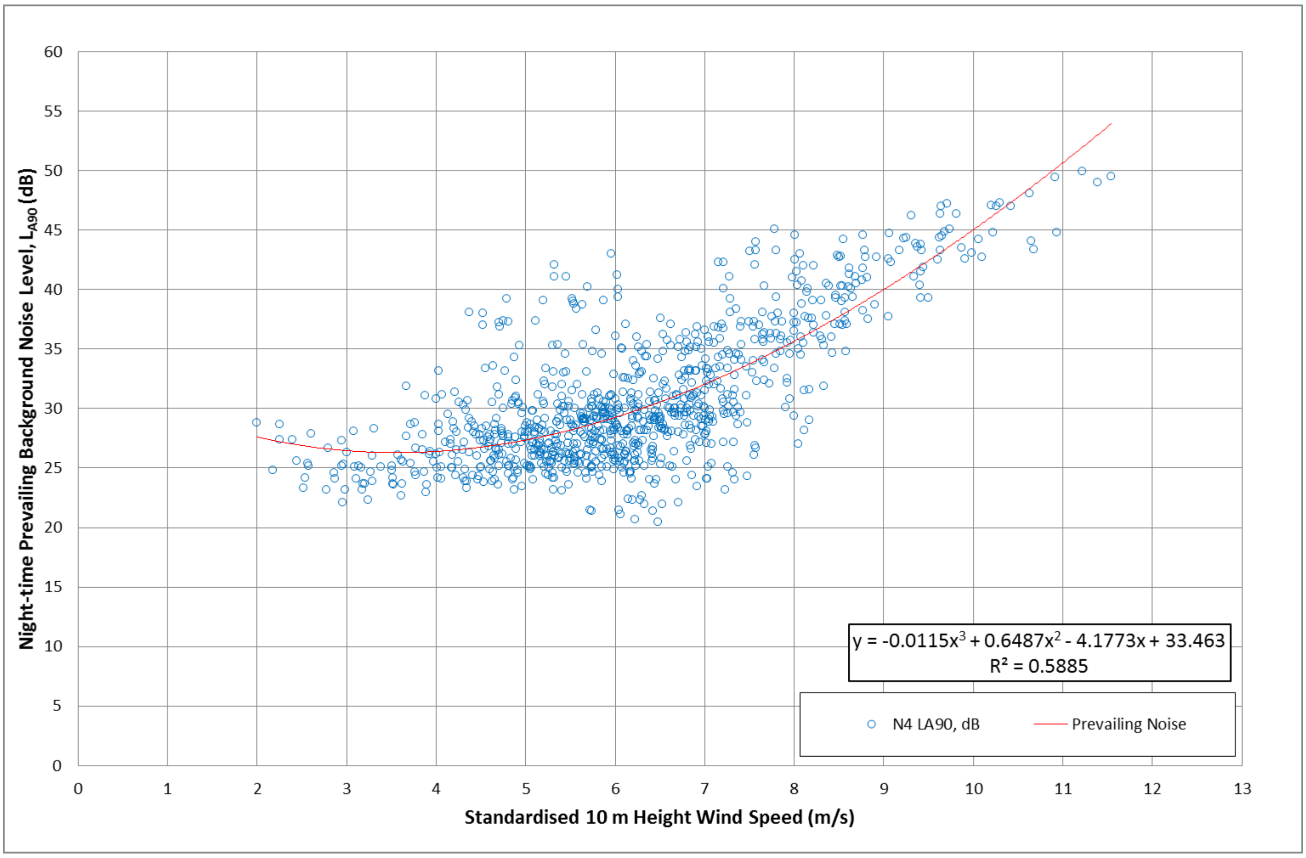


Figure A7.13: Prevailing Night-time Background (L_{A90}) Noise Levels at N4

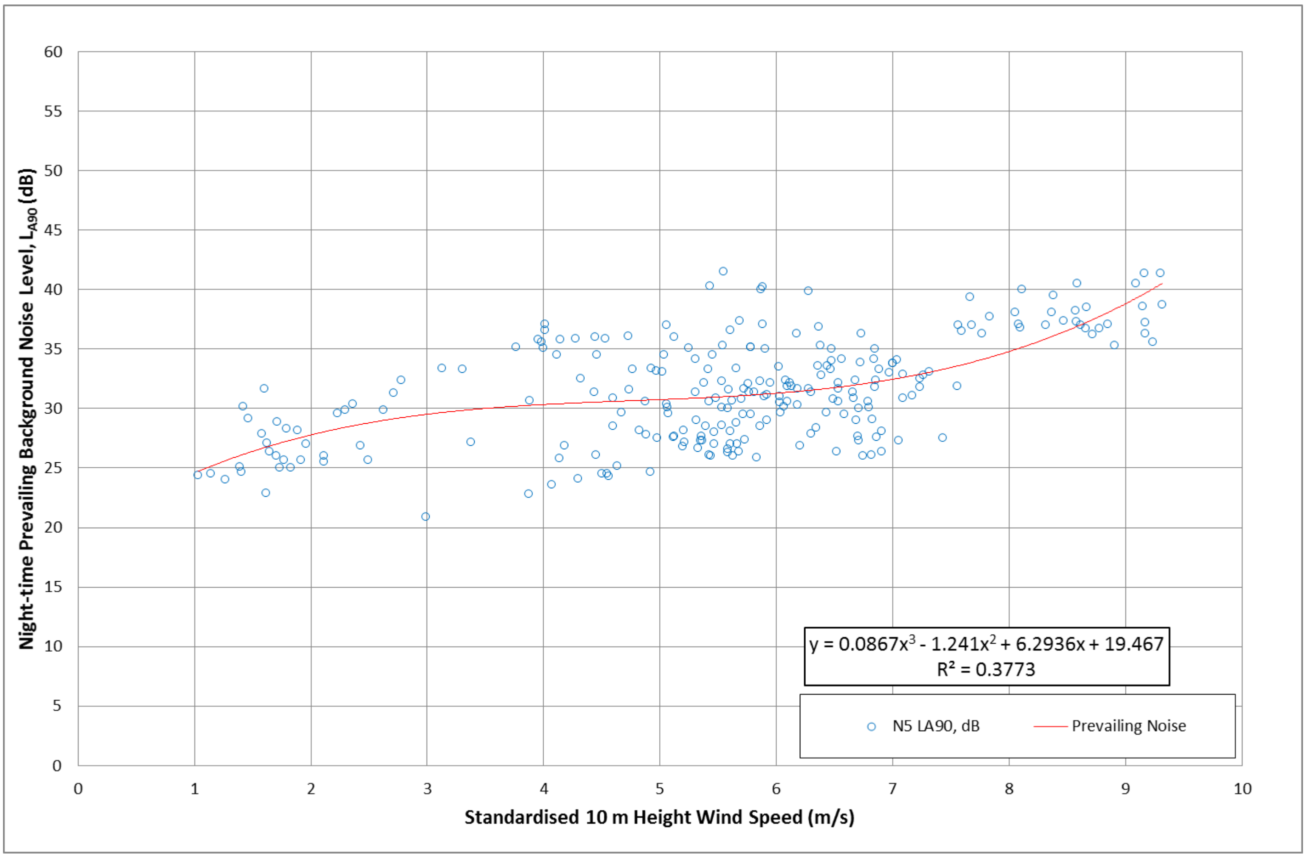


Figure A7.14: Prevailing Night-time Background (L_{A90}) Noise Levels at N5

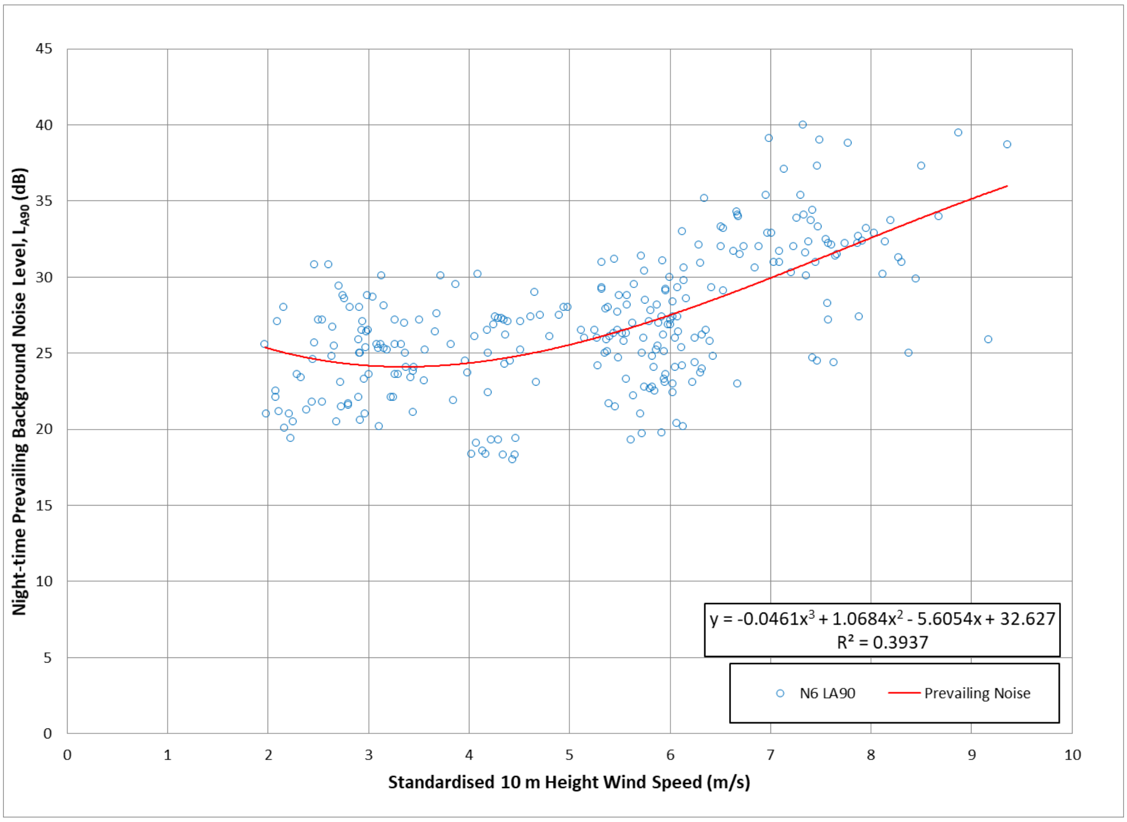


Figure A7.15: Prevailing Night-time Background (L_{A90}) Noise Levels at N6

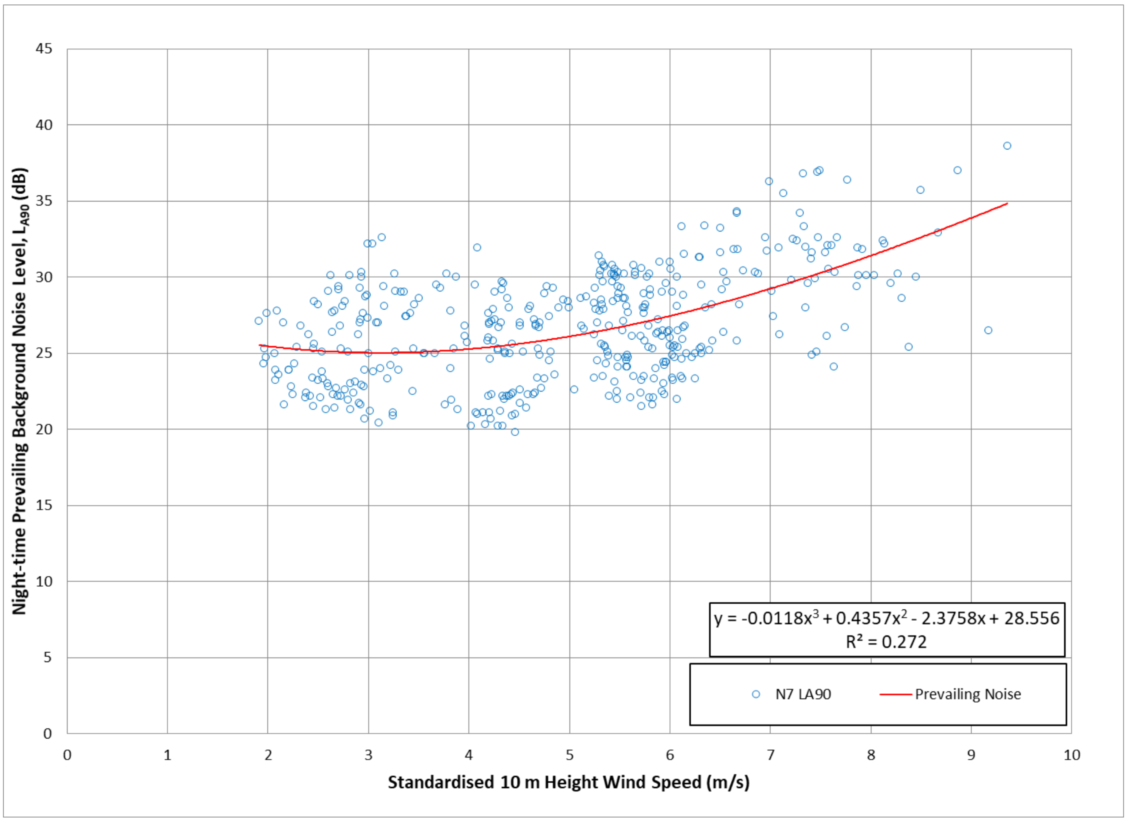


Figure A7.16: Prevailing Night-time Background (L_{A90}) Noise Levels at N7

Table 7.1.6: Prevailing Background Noise

Location	Period	Prevailing Background Noise $L_{A90,10min}$ (dB) at Standardised 10 m Height Wind Speed (m/s)									
		3	4	5	6	7	8	9	10	11	12
N1	Daytime	33.0	33.4	34.1	35.1	36.3	37.8	39.6	41.7	44.2	47.0
	Night time	23.7*	23.7	24.5	26.5	29.3	32.8	36.7	40.7	44.5	47.8
N2	Daytime	29.3	29.9	31.0	32.5	34.4	36.6	39.0	41.6	44.3	47.2
	Night time	20.1*	20.1	21.5	24.3	28.1	32.4	36.8	41.0	44.4	46.7
N3	Daytime	33.2*	33.2	33.6	34.8	36.5	38.7	41.1	43.8	46.5	49.1
	Night time	23.4*	23.4	24.3	26.5	29.7	33.7	37.9	42.1	46.0	49.1
N4	Daytime	35.3	36.0	36.8	37.9	39.2	40.7	42.4	44.3	46.3	48.6
	Night time	26.4*	26.4	27.4	29.3	32.1	35.7	40.0	45.1	50.7	56.9
N5	Daytime	35.6	36.5	37.4	38.2	38.8	39.2	39.3	39.3	39.3	39.3
	Night time	29.5	30.3	30.7	31.3	32.5	34.8	38.8	38.8§	38.8§	38.8§
N6	Daytime	31.5	32.5	33.6	34.9	36.5	38.4	40.6	43.1	46.0	46.0§
	Night time	24.2	24.3	25.5	27.5	29.9	32.6	35.1	35.1§	35.1§	35.1§
N7	Daytime	33.4	33.8	34.4	35.2	36.4	37.7	39.2	40.9	42.8	42.8§
	Night time	25.0	25.3	26.1	27.4	29.2	31.4	33.9	33.9§	33.9§	33.9§

* - lowest derived background noise level is adopted for all wind speeds below where this derived minimum occurs. For example, at monitoring location N1 the lowest derived background noise level occurs at a wind speed of 4 m/s. The trend line fitted to noise data showed a higher noise level at 3 m/s. Therefore, using this criterion, the noise level at 3 m/s has been assumed to be equal to that of the noise level at 4 m/s.

§ - noise level restricted to the highest derived point

APPENDIX 7.2

EQUIPMENT CALIBRATION CERTIFICATES

NSAI

National Metrology Laboratory

Certificate of Calibration

Issued to	Fehily Timoney & Company J5 Plaza North Business Park North Road Dublin 11
Attention of	Maureen Marsden

Certificate Number	**220034**
Item Calibrated	Svantek SVAN 977 Sound Level Meter with ACO 7052E Microphone
Serial Number	34173 (SLM) and 54691 (Microphone)
ID Number	None
Order Number	7018
Date Received	06 Jan 2022
NML Procedure Number	AP-NM-09

Method

The above sound level meter was allowed to stabilise for a suitable period in laboratory conditions. It was then calibrated by carrying out the verification tests detailed in IEC 61672-3 (2006), *Periodic tests, specification for the verification of sound level meters*. This standard specifies a procedure for the periodic verification of conformance of a sound level meter or integrating-averaging meter to IEC 61672-1 (2003).

Calibration Standards

Norsonic 1504A Calibration System incorporating:
SR DS360 Signal Generator, No. 0735 [Cal Due Date: 10 Jun 2022]
Agilent 34401A Digital Multimeter, No. 0736 [Cal Due Date: 10 Jun 2022]
B&K 4134 Measuring Microphone, No. 0744 [Cal Due Date: 03 Jun 2023]
B&K 4228 Pistonphone, No. 0740 [Cal Due Date: 04 Jun 2023]
B&K 4226 Acoustical Calibrator, No. 0150 [Cal Due Date: 07 Oct 2022]

Calibrated by	David Fleming	**Approved by**	Paul Hetherington
Date of Calibration	17 Jan 2022	**Date of Issue**	17 Jan 2022

CIPM MRA

This certificate is consistent with Calibration and Measurement Capabilities (CMC's) that are included in Appendix C of the Mutual Recognition Arrangement (MRA) drawn up by the International Committee for Weights and Measures. Under the MRA, all participating institutes recognize the validity of each other's calibration certificates and measurement reports for quantities, ranges and measurement uncertainties specified in Appendix C (for details see www.bipm.org)

NSAI

National Metrology Laboratory

Certificate of Calibration

Issued to	Fehily Timoney & Company J5 Plaza North Business Park North Road Dublin 11
Attention of	Maureen Marsden

Certificate Number	**220035**
Item Calibrated	Svantek SVAN 977 Sound Level Meter with ACO 7052E Microphone
Serial Number	34876 (SLM) and 56429 (Microphone)
ID Number	None
Order Number	7018
Date Received	06 Jan 2022
NML Procedure Number	AP-NM-09

Method

The above sound level meter was allowed to stabilise for a suitable period in laboratory conditions. It was then calibrated by carrying out the verification tests detailed in IEC 61672-3 (2006), *Periodic tests, specification for the verification of sound level meters*. This standard specifies a procedure for the periodic verification of conformance of a sound level meter or integrating-averaging meter to IEC 61672-1 (2003).

Calibration Standards

Norsonic 1504A Calibration System incorporating:
SR DS360 Signal Generator, No. 0735 [Cal Due Date: 10 Jun 2022]
Agilent 34401A Digital Multimeter, No. 0736 [Cal Due Date: 10 Jun 2022]
B&K 4134 Measuring Microphone, No. 0744 [Cal Due Date: 03 Jun 2023]
B&K 4228 Pistonphone, No. 0740 [Cal Due Date: 04 Jun 2023]
B&K 4226 Acoustical Calibrator, No. 0150 [Cal Due Date: 07 Oct 2022]

Calibrated by	David Fleming	**Approved by**	Paul Hetherington
Date of Calibration	18 Jan 2022	**Date of Issue**	18 Jan 2022

CIPM MRA

This certificate is consistent with Calibration and Measurement Capabilities (CMC's) that are included in Appendix C of the Mutual Recognition Arrangement (MRA) drawn up by the International Committee for Weights and Measures. Under the MRA, all participating institutes recognize the validity of each other's calibration certificates and measurement reports for quantities, ranges and measurement uncertainties specified in Appendix C (for details see www.bipm.org)

SONITUS SYSTEMS

Statement of Calibration

Issued to:

Fehily Timoney
J5 Plaza
North Park Business Park
North Road
Dublin 11

Calibration Reference
SLM200096

Test Date: 03/06/2020
Procedure: TP-SLM-1

Equipment

Item Calibrated:	Sound Level Meter	**Model**	977
Make:	Svantek	**Serial Number:**	69556

Calibration Procedure

The sound level meter was allowed to stabilize for a suitable period, as described in the manufacturer's instruction manual, in laboratory conditions. The sound level meter was calibrated by carrying out the verification tests detailed in IEC 61672-3 (2006), Periodic tests, specification of sound level meters. Tolerances for verification procedures are specified in IEC 61672-1 (2003).

Calibration Standards

Description	Serial Number
National Instruments PXI-4461	19C91D2
Stanford Research DS360	123803

The standards used in this calibration are traceable to NIST and/or other National Measurement Institutes (NMI's) that are signatories of the International Committee of Weights and Measures (CIPM) mutual recognition agreement (MRA).

Signed on behalf of Sonitus Systems:

Calibration Report

Equipment Description

Model:	Svantek	**Serial Number:**	69556
Model:	977	**Microphone Model:**	ACO 7052E

Ambient Conditions

Measurement conditions were within the tolerances defined in IEC 61672-1 and IEC 60942.

Barometric Pressure:	1030 hPa
Temperature:	22.5 °C
Relative Humidity:	39 %

Results Summary

IEC 61672 Test #	Test Description	Result
10	Self-generated noise	-
11	Frequency weighting (acoustical)	PASS
12	Frequency weighting (electrical)	PASS
13	Frequency and time weighting (1kHz)	PASS
14	Level linearity on reference level range	PASS
15	Level linearity with level range control	-
16	Toneburst response	PASS
17	Peak C sound level	PASS
18	Overload indication	PASS

As public evidence was available, from a testing organization responsible for approving the results of pattern evaluation tests, to demonstrate that the model of sound level meter fully conformed to the requirements for pattern evaluation described in IEC 61672:2003, the sound level meter tested is considered to conform to all the Class 1 requirements of IEC 61672:2003.

The manufacturer's guidelines concerning appropriate set up for measurement under various conditions should be observed during usage.

Prior to carrying out the verification tests the sound level meter was adjusted to read correctly using the acoustic calibrator held by the testing lab (Cirrus CR511ES, Serial number: 60871). The calibration procedure is described in the manufacturer's instruction manual.

Self-generated noise - IEC 61672-3 Test #10
SLM Measuring Mode: Leq

SLM Configuration	Freq. Weighting Network	SLM Reading
Microphone Installed	A	21.2
Microphone replaced by electrical input device fitted with short circuit	A	8.7
	C	8.7
	Z	8.7

Acoustical signal test of a frequency weighting - IEC 61672-3 Test #11
Range: reference level range
Frequency Weighting: C
Time Weighting: Slow

Input	Freq	Expected Level	Deviation	Tol +/-
94 dB	1000 Hz	94.0	0.0	1.0
	125 Hz	93.7	0.2	1.0
	4000 Hz	92.3	0.1	1.0

The frequency response was tested using an electrostatic actuator. Appropriate correction factors were applied where available from the manufacturer's instruction manual.

Electrical tests of frequency weighting - IEC 61672-3 Test #12
Range: reference level range

A-weighting

Freq	Expected Level	SLM Reading	Deviation	Tol +	Tol -
63	95.0	95.0	0.0	1.5	-1.5
125	95.0	95.0	0.0	1.5	-1.5
250	95.0	94.9	-0.1	1.4	-1.4
500	95.0	95.0	0.0	1.4	-1.4
1000	95.0	95.0	0.0	1.1	-1.1
2000	95.0	94.9	-0.1	1.6	-1.6
4000	95.0	95.1	0.1	1.6	-1.6
8000	95.0	95.1	0.1	2.1	-3.1
16000	95.0	94.7	-0.3	3.5	-17.0

C-weighting

Freq	Expected Level	SLM Reading	Deviation	Tol +	Tol -
63	95.0	94.9	-0.1	1.5	-1.5
125	95.0	95.3	0.3	1.5	-1.5
250	95.0	95.0	0.0	1.4	-1.4
500	95.0	95.0	0.0	1.4	-1.4
1000	95.0	95.0	0.0	1.1	-1.1
2000	95.0	95.1	0.1	1.6	-1.6
4000	95.0	95.1	0.1	1.6	-1.6
8000	95.0	95.1	0.1	2.1	-3.1
16000	95.0	94.7	-0.3	3.5	-17.0

Linear

Freq	Expected Level	SLM Reading	Deviation	Tol +	Tol -
63	95.0	95.0	0.0	1.5	-1.5
125	95.0	95.0	0.0	1.5	-1.5
250	95.0	95.0	0.0	1.4	-1.4
500	95.0	95.0	0.0	1.4	-1.4
1000	95.0	95.0	0.0	1.1	-1.1
2000	95.0	95.0	0.0	1.6	-1.6
4000	95.0	95.0	0.0	1.6	-1.6
8000	95.0	95.0	0.0	2.1	-3.1
16000	95.0	95.0	0.0	3.5	-17.0

Frequency and Time Weightings at 1 kHz IEC 61672-3 Test #13
Range: reference level range

Time Weighting	Freq. Weighting	Expected Level	Deviation	Tol +/-
Fast	A	94.0	ref	
	C	94.0	0.0	0.2
Slow	A	94.0	0.0	0.2
LEQ	A	94.0	0.0	0.2

Linearity level on reference range - IEC 61672-3 Test #14
Input frequency: 8 kHz
SLM Measuring Mode: SPL

Range	Expected Level	SLM Reading	Deviation	Tol +/-
123 dB	94.0	94.0	0.0	1.1
	99.0	99.0	0.0	1.1
	104.0	104.0	0.0	1.1
	109.0	109.0	0.0	1.1
	114.0	114.0	0.0	1.1
	119.0	119.0	0.0	1.1
	124.0	124.0	0.0	1.1
	129.0	129.0	0.0	1.1
	134.0	134.1	0.1	1.1
	135.0	135.1	0.1	1.1
	136.0	136.1	0.1	1.1
	137.0	137.1	0.1	1.1
	89.0	89.0	0.0	1.1
	84.0	84.0	0.0	1.1
	79.0	79.0	0.0	1.1
	74.0	74.0	0.0	1.1
	69.0	69.0	0.0	1.1
	64.0	64.0	0.0	1.1
	59.0	59.0	0.0	1.1
	54.0	54.0	0.0	1.1
	49.0	49.1	0.1	1.1
	44.0	44.1	0.1	1.1
	43.0	43.2	0.2	1.1
	42.0	42.2	0.2	1.1
	41.0	41.2	0.2	1.1
	40.0	40.3	0.3	1.1
	39.0	39.4	0.4	1.1

Toneburst response - IEC 61672-3 Test #16
Range: reference level range

Burst Type	Response	Expected Level	SLM Reading	Deviation	Tol +	Tol -
0.25 ms	LAFMAX	111.0	110.8	-0.2	0.8	-0.8
2.0 ms	LAFMAX	120.0	119.9	-0.1	1.3	-1.3
200 ms	LAFMAX	137.0	137.0	0.0	1.3	-3.3
2.0 ms	LASMAX	111.0	111.3	0.3	0.8	-0.8
200 ms	LASMAX	130.6	130.6	0.0	1.3	-3.3

Peak C sound level - IEC 61672-3 Test #17
Range: reference level range

Pulse Type	Freq	Expected Level	SLM Reading	Deviation	Tol +/-
1 cycle	8 kHz	135.4	135.2	-0.2	2.4
Pos ½ cycle	500 Hz	137.4	137.3	-0.1	1.4
Neg ½ cycle	500 Hz	137.4	137.3	-0.1	1.4

Overload indication IEC 61672-3 Test #18

Test Description	Overload at	Meas. Diff. (Pos – Neg)	Tol +/-
Pos. ½ cycle at 4 kHz	140.6		
Neg. ½ cycle at 4 kHz	140.7		
Level difference		-0.1	1.8

Calibration Notes

1. The manufacturer's instruction manual was accessed through the manufacturer's website.
2. The sound level meter was powered by a regulated 9V power supply provided by the testing laboratory.

Calibration Certificate

Certificate Number 2020009751

Customer:

Environmental Measurement
Unit 12 Tallaght Business Centre
Whitestown Business Park
Dublin, 24, Ireland

Model Number	LxT SE	***Procedure Number***	D0001.8378			
Serial Number	0006241	***Technician***	Ron Harris			
Test Results	**Pass**	***Calibration Date***	4 Sep 2020			
Initial Condition	As Manufactured	***Calibration Due***				
		Temperature	23.69	°C	± 0.25 °C	
Description	Sound Expert LxT Class 1 Sound Level Meter Firmware Revision: 2.404	***Humidity***	50.5	%RH	± 2.0 %RH	
		Static Pressure	86.75	kPa	± 0.13 kPa	

Evaluation Method Tested electrically using Larson Davis PRMLxT1L S/N 069977 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 μPa assuming a microphone sensitivity of 23.6 mV/Pa.

Compliance Standards Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8384:

IEC 60651:2001 Type 1	ANSI S1.4-2014 Class 1
IEC 60804:2000 Type 1	ANSI S1.4 (R2006) Type 1
IEC 61252:2002	ANSI S1.25 (R2007)
IEC 61672:2013 Class 1	ANSI S1.43 (R2007) Type 1
IEC 61260:2001 Class 1	ANSI S1.11 (R2009) Class 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017. **Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.**

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

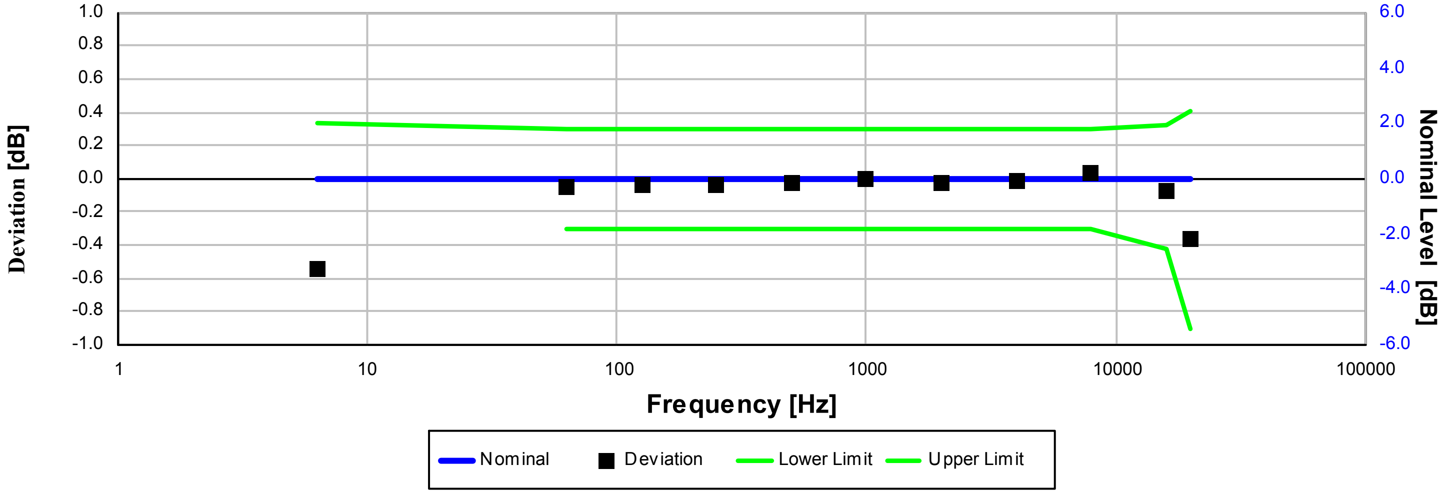
This report may not be reproduced, except in full, unless permission for the publication of an approved abstract is obtained in writing from the organization issuing this report.

Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert Lxt, I770.01 Rev O Supporting Firmware Version 4.0.5, 2019-09-10

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 μPa

Standards Used			
Description	**Cal Date**	**Cal Due**	**Cal Standard**
Hart Scientific 2626-S Humidity/Temperature Sensor	2020-05-12	2021-05-12	006943
SRS DS360 Ultra Low Distortion Generator	2020-01-17	2021-01-17	007118

Z-weight Filter Response



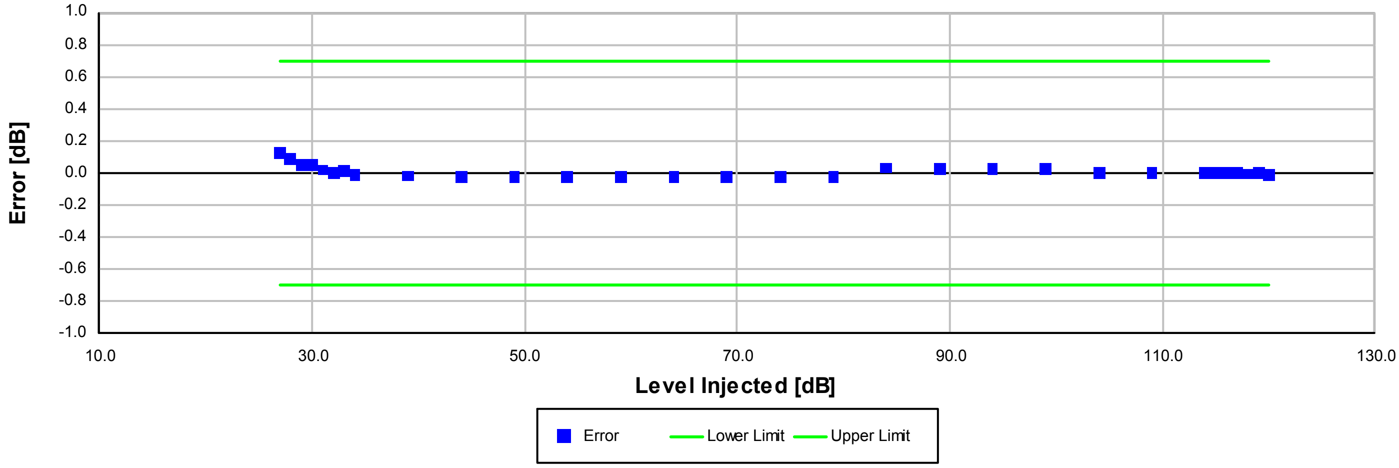
Electrical signal test of frequency weighting performed according to IEC 61672-3:2013 13 and ANSI S1.4-2014 Part 3: 13 for compliance to IEC 61672-1:2013 5.5; IEC 60651:2001 6.1 and 9.2.2; IEC 60804:2000 5; ANSI S1.4:1983 (R2006) 5.1 and 8.2.1; ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Deviation [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
6.31	-0.54	-0.54	-1.11	0.33	0.15	Pass
63.10	-0.05	-0.05	-0.30	0.30	0.15	Pass
125.89	-0.04	-0.04	-0.30	0.30	0.15	Pass
251.19	-0.04	-0.04	-0.30	0.30	0.15	Pass
501.19	-0.02	-0.02	-0.30	0.30	0.15	Pass
1,000.00	0.00	0.00	-0.30	0.30	0.15	Pass
1,995.26	-0.02	-0.02	-0.30	0.30	0.15	Pass
3,981.07	-0.01	-0.01	-0.30	0.30	0.15	Pass
7,943.28	0.03	0.03	-0.30	0.30	0.15	Pass
15,848.93	-0.07	-0.07	-0.42	0.32	0.15	Pass
19,952.62	-0.36	-0.36	-0.91	0.41	0.15	Pass

-- End of measurement results--

LARSON DAVIS - A PCB PIEZOTRONICS DIV.
1681 West 820 North
Provo, UT 84601, United States
716-684-0001

A-weighted Broadband Log Linearity: 8,000.00 Hz



Broadband level linearity performed according to IEC 61672-3:2013 16 and ANSI S1.4-2014 Part 3: 16 for compliance to IEC 61672-1:2013 5.6, IEC 60804:2000 6.2, IEC 61252:2002 8, ANSI S1.4 (R2006) 6.9, ANSI S1.4-2014 Part 1: 5.6, ANSI S1.43 (R2007) 6.2

Level [dB]	Error [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
27.00	0.12	-0.70	0.70	0.16	Pass
28.00	0.09	-0.70	0.70	0.17	Pass
29.00	0.05	-0.70	0.70	0.16	Pass
30.00	0.05	-0.70	0.70	0.35	Pass
31.00	0.02	-0.70	0.70	0.16	Pass
32.00	0.00	-0.70	0.70	0.16	Pass
33.00	0.01	-0.70	0.70	0.16	Pass
34.00	-0.01	-0.70	0.70	0.16	Pass
39.00	-0.02	-0.70	0.70	0.16	Pass
44.00	-0.03	-0.70	0.70	0.16	Pass
49.00	-0.03	-0.70	0.70	0.16	Pass
54.00	-0.03	-0.70	0.70	0.16	Pass
59.00	-0.03	-0.70	0.70	0.16	Pass
64.00	-0.03	-0.70	0.70	0.16	Pass
69.00	-0.03	-0.70	0.70	0.16	Pass
74.00	-0.03	-0.70	0.70	0.16	Pass
79.00	-0.03	-0.70	0.70	0.16	Pass
84.00	0.03	-0.70	0.70	0.16	Pass
89.00	0.03	-0.70	0.70	0.16	Pass
94.00	0.02	-0.70	0.70	0.16	Pass
99.00	0.02	-0.70	0.70	0.16	Pass
104.00	0.00	-0.70	0.70	0.15	Pass
109.00	0.00	-0.70	0.70	0.15	Pass
114.00	0.00	-0.70	0.70	0.15	Pass
115.00	0.00	-0.70	0.70	0.15	Pass
116.00	0.00	-0.70	0.70	0.15	Pass
117.00	0.00	-0.70	0.70	0.15	Pass
118.00	-0.01	-0.70	0.70	0.15	Pass
119.00	0.00	-0.70	0.70	0.15	Pass
120.00	-0.02	-0.70	0.70	0.15	Pass

-- End of measurement results--

LARSON DAVIS - A PCB PIEZOTRONICS DIV.
1681 West 820 North
Provo, UT 84601, United States
716-684-0001

Peak Rise Time

Peak rise time performed according to IEC 60651:2001 9.4.4 and ANSI S1.4:1983 (R2006) 8.4.4

Amplitude [dB]	Duration [µs]		Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
116.15	40	Negative Pulse	117.52	116.05	118.05	0.15	Pass
		Positive Pulse	117.49	116.01	118.01	0.15	Pass
	30	Negative Pulse	116.59	116.05	118.05	0.15	Pass
		Positive Pulse	116.55	116.01	118.01	0.15	Pass

-- End of measurement results--

Positive Pulse Crest Factor

200 µs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60651:2001 9.4.2 and ANSI S1.4:1983 (R2006) 8.4.2

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
114.15	3	OVLD	± 0.50	0.15 ‡	Pass
	5	OVLD	± 1.00	0.15 ‡	Pass
	10	OVLD	± 1.50	0.15 ‡	Pass
104.15	3	-0.16	± 0.50	0.15 ‡	Pass
	5	-0.17	± 1.00	0.16 ‡	Pass
	10	OVLD	± 1.50	0.15 ‡	Pass
94.15	3	-0.13	± 0.50	0.15 ‡	Pass
	5	-0.12	± 1.00	0.15 ‡	Pass
	10	-0.01	± 1.50	0.15 ‡	Pass
84.15	3	-0.14	± 0.50	0.15 ‡	Pass
	5	-0.15	± 1.00	0.15 ‡	Pass
	10	-0.09	± 1.50	0.15 ‡	Pass

-- End of measurement results--

Negative Pulse Crest Factor

200 µs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60651:2001 9.4.2 and ANSI S1.4:1983 (R2006) 8.4.2

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
114.15	3	OVLD	± 0.50	0.15 ‡	Pass
	5	OVLD	± 1.00	0.15 ‡	Pass
	10	OVLD	± 1.50	0.15 ‡	Pass
104.15	3	-0.14	± 0.50	0.15 ‡	Pass
	5	-0.12	± 1.00	0.15 ‡	Pass
	10	OVLD	± 1.50	0.15 ‡	Pass
94.15	3	-0.13	± 0.50	0.15 ‡	Pass
	5	-0.12	± 1.00	0.15 ‡	Pass
	10	0.02	± 1.50	0.15 ‡	Pass
84.15	3	-0.14	± 0.50	0.15 ‡	Pass
	5	-0.14	± 1.00	0.15 ‡	Pass
	10	-0.04	± 1.50	0.15 ‡	Pass

-- End of measurement results--

Gain

Gain measured according to IEC 61672-3:2013 17.3 and 17.4 and ANSI S1.4-2014 Part 3: 17.3 and 17.4

Measurement	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
0 dB Gain	84.01	83.90	84.10	0.15	Pass
0 dB Gain, Linearity	21.16	20.30	21.70	0.16	Pass
OBA Low Range	84.00	83.90	84.10	0.15	Pass
OBA Normal Range	84.00	83.20	84.80	0.15	Pass

-- End of measurement results--

Broadband Noise Floor

Self-generated noise measured according to IEC 61672-3:2013 11.2 and ANSI S1.4-2014 Part 3: 11.2

Measurement	Test Result [dB]	Upper limit [dB]	Result
A-weight Noise Floor	7.62	16.00	Pass
C-weight Noise Floor	12.10	18.00	Pass
Z-weight Noise Floor	19.88	25.00	Pass

-- End of measurement results--

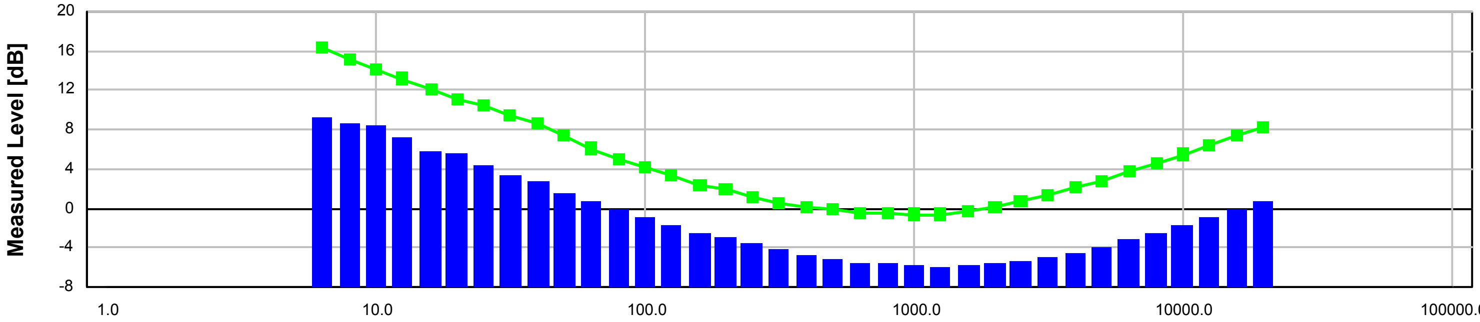
Total Harmonic Distortion

Measured using 1/3-Octave filters

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
10 Hz Signal	113.16	112.35	113.95	0.15	Pass
THD	-58.05		-50.00	0.01 ‡	Pass
THD+N	-56.28		-50.00	0.01 ‡	Pass

-- End of measurement results--

1/3-Octave Self-Generated Noise



The SLM is set to low range.

Frequency [Hz]	Test Result [dB]	Upper limit [dB]	Result
6.30	9.30	16.30	Pass
8.00	8.68	15.20	Pass
10.00	8.49	14.20	Pass
12.50	7.16	13.20	Pass
16.00	5.76	12.10	Pass
20.00	5.65	11.10	Pass
25.00	4.37	10.40	Pass
31.50	3.40	9.40	Pass
40.00	2.67	8.60	Pass
50.00	1.63	7.40	Pass
63.00	0.78	6.10	Pass
80.00	-0.17	5.00	Pass
100.00	-0.86	4.20	Pass
125.00	-1.64	3.30	Pass
160.00	-2.48	2.40	Pass
200.00	-2.97	1.90	Pass
250.00	-3.59	1.20	Pass
315.00	-4.18	0.60	Pass
400.00	-4.72	0.20	Pass
500.00	-5.22	-0.10	Pass
630.00	-5.49	-0.50	Pass
800.00	-5.65	-0.50	Pass
1,000.00	-5.84	-0.60	Pass
1,250.00	-5.91	-0.60	Pass
1,600.00	-5.83	-0.20	Pass
2,000.00	-5.62	0.20	Pass
2,500.00	-5.36	0.70	Pass
3,150.00	-4.93	1.40	Pass
4,000.00	-4.50	2.10	Pass
5,000.00	-3.89	2.80	Pass
6,300.00	-3.18	3.70	Pass
8,000.00	-2.48	4.60	Pass
10,000.00	-1.71	5.50	Pass
12,500.00	-0.88	6.40	Pass
16,000.00	-0.07	7.40	Pass
20,000.00	0.79	8.30	Pass

-- End of measurement results--

-- End of Report--

Signatory: Ron Harris

LARSON DAVIS - A PCB PIEZOTRONICS DIV.
1681 West 820 North
Provo, UT 84601, United States
716-684-0001

ACCREDITED
Cert. #3622.01

Calibration Certificate

Certificate Number 2019015629
Customer:

Environmental Measurement
Unit 12 Tallaght Business Centre
Whitestown Business Park
Dublin, 24, Ireland

Model Number	LxT SE	***Procedure Number***	D0001.8378		
Serial Number	0005835	***Technician***	Ron Harris		
Test Results	**Pass**	***Calibration Date***	20 Dec 2019		
Initial Condition	Inoperable	***Calibration Due***	20 Dec 2021		
		Temperature	23.7	°C	± 0.25 °C
Description	Sound Expert LxT Class 1 Sound Level Meter Firmware Revision: 2.402	***Humidity***	50.6	%RH	± 2.0 %RH
		Static Pressure	87.39	kPa	± 0.13 kPa

Evaluation Method Tested electrically using Larson Davis PRMLxT1L S/N 069953 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 μPa assuming a microphone sensitivity of 23.6 mV/Pa.

Compliance Standards Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8384:

IEC 60651:2001 Type 1	ANSI S1.4-2014 Class 1
IEC 60804:2000 Type 1	ANSI S1.4 (R2006) Type 1
IEC 61252:2002	ANSI S1.11 (R2009) Class 1
IEC 61260:2001 Class 1	ANSI S1.25 (R2007)
IEC 61672:2013 Class 1	ANSI S1.43 (R2007) Type 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2005. **Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.**

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert Lxt, I770.01 Rev O Supporting Firmware Version 4.0.5, 2019-09-10

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 μPa

CERTIFICATE OF CALIBRATION

Issued by: **MTS Calibration Ltd.**
Laboratory address: 17 Elvington Close
Billingham TS23 3YS
England
Telephone: +44 (0)1642 876 410

Please note delivery address below

Date of Issue:	**26 April 2019**	**Certificate Number:**	**33234**

Third-Octave Band Digital Filter

Third-Octave Band Filter verification to BS EN 61260:1996

Client: Environmental Measurements
Unit 12, Tallaght Business Centre
Whitestown Business Park
Co.Dublin 24, Ireland
0

Instrument Make: **Larson Davis**
Instrument Model: **LxT1**
Serial Number: **0004642**

The centre frequency sequence of this filter set follows the exact base 10 midband frequency sequence of IEC 61260 and measurements have been made accordingly

Associated Preamplifier:	***- Make :***	Larson Davis	***Calibrated by:***	MTS
	- Model :	PRMLxT1L	***Certificate Number:***	33234
	- Serial Number :	036048	***Date:***	26 April 2019
Associated Sound Level Meter	***- Make:***	Larson Davis	***Calibrated by:***	MTS
	- Model:	LxT1	***Certificate Number:***	33234
	- Serial Number:	0004642	***Date:***	26 April 2019

This is to certify that this instrument, whose calibration records are enclosed in this file, has been tested in accordance with MTS Calibration Ltd. Work Procedures. The instrument as configured above has been found to be in compliance with attenuation and frequency characteristics as specified by BS EN 61260: 1996 and the results are reported in the following pages and summarised below. The results obtained are only for limited tests and do not indicate conformance to the full requirements of the standard, and are only applicable to those filter bands tested. The measurements were carried out using equipment whose calibrations are traceable to UK National Standards. The management controls of MTS Calibration Ltd. are registered in the current issue of its Quality Manual, which are designed to be in conformity with BS EN ISO/IEC 17025: 2005. Test procedures and test results and details of the traceability of test equipment to National Standards are filed with MTS Calibration Ltd. and relevant extracts are available on request.

Because a digital filter will have the same amplitude characteristic relative to its centre frequency, only three filters were measured at each of the test frequencies specified by BS EN 61260:1996 for BASE-10 distribution. The measurements made were relative to the attenuation of the 1kHz filter at 1kHz input frequency and input level 1V. Because the measurements include a linearity contribution from the sound level meter, and could be variable with frequency, the assessment is valid only for this pairing. The sound level meter was set for "Linear" frequency response on the lowest range setting which did not give overload at any test frequency or test level. Its compliance with the standard was assessed by referring the measurements to the tolerances specified.

Third-Octave Band Filter — **Compliance with BS EN 61260: 1996 Class 1**

125 Hz complies
1000 Hz complies
8kHz complies

Uncertainties of measurements:
Within Passband (0.89 to 1.12 of centre frequency) dB: 0.42
Outside Passband dB: 2.40

Test Equipment:

Equipment	Manufacturer	Model	Serial No.	Traceability Ref.	Cal. Due
Signal Generator (set 3)	HP	33120A	US34007158	TE 163	Oct-19

Authorised signatory:

Tony Sherris

Date of Receipt:	**17 April 2019**
Date of Calibration:	**26 April 2019**
Date of Certificate:	**26 April 2019**

Page: 1
of: 4

CERTIFICATE OF CALIBRATION

Issued by: **MTS Calibration Ltd.**
Laboratory address: 17 Elvington Close, Billingham TS23 3YS, England
Telephone: +44 (0)1642 876 410
Please note delivery address below

Date of Issue:	26 April 2019	**Certificate Number:**	33234

Third-Octave Band Digital Filter

Third-Octave Band Filter verification to BS EN 61260:1996

Client: Environmental Measurements
Unit 12, Tallaght Business Centre
Whitestown Business Park
Co.Dublin 24, Ireland
0

Instrument Make: **Larson Davis**
Instrument Model: **LxT1**
Serial Number: **0004642**

The centre frequency sequence of this filter set follows the exact base 10 midband frequency sequence of IEC 61260 and measurements have been made accordingly

Associated Preamplifier:	***- Make :*** Larson Davis	***- Model :*** PRMLxT1L	***- Serial Number :*** 036048	***Calibrated by:*** MTS; ***Certificate Number:*** 33234; ***Date:*** 26 April 2019
Associated Sound Level Meter	***- Make:*** Larson Davis	***- Model:*** LxT1	***- Serial Number:*** 0004642	***Calibrated by:*** MTS; ***Certificate Number:*** 33234; ***Date:*** 26 April 2019

This is to certify that this instrument, whose calibration records are enclosed in this file, has been tested in accordance with MTS Calibration Ltd. Work Procedures. The instrument as configured above has been found to be in compliance with attenuation and frequency characteristics as specified by BS EN 61260: 1996 and the results are reported in the following pages and summarised below. The results obtained are only for limited tests and do not indicate conformance to the full requirements of the standard, and are only applicable to those filter bands tested. The measurements were carried out using equipment whose calibrations are traceable to UK National Standards. The management controls of MTS Calibration Ltd. are registered in the current issue of its Quality Manual, which are designed to be in conformity with BS EN ISO/IEC 17025: 2005. Test procedures and test results and details of the traceability of test equipment to National Standards are filed with MTS Calibration Ltd. and relevant extracts are available on request.

Because a digital filter will have the same amplitude characteristic relative to its centre frequency, only three filters were measured at each of the test frequencies specified by BS EN 61260:1996 for BASE-10 distribution. The measurements made were relative to the attenuation of the 1kHz filter at 1kHz input frequency and input level 1V. Because the measurements include a linearity contribution from the sound level meter, and could be variable with frequency, the assessment is valid only for this pairing. The sound level meter was set for "Linear" frequency response on the lowest range setting which did not give overload at any test frequency or test level. Its compliance with the standard was assessed by referring the measurements to the tolerances specified.

Third-Octave Band Filter — **Compliance with BS EN 61260: 1996 Class 1**

125 Hz complies
1000 Hz complies
8kHz complies

Uncertainties of measurements:
Within Passband (0.89 to 1.12 of centre frequency) dB: 0.42
Outside Passband dB: 2.40

Test Equipment:

Equipment	Manufacturer	Model	Serial No.	Traceability Ref.	Cal. Due
Signal Generator (set 3)	HP	33120A	US34007158	TE 163	Oct-19

Authorised signatory:
Tony Sherris

Date of Receipt: 17 April 2019
Date of Calibration: 26 April 2019
Date of Certificate: 26 April 2019

APPENDIX 7.3

NOISE SENSITIVE LOCATION DETAILS

Table 7.3.1: Noise Sensitive Location Details (based on L_{Aeq} 35 dB without Valley correction and no cumulative noise from adjacent windfarms.) [To be updated]

Receptor ID	Description	ITM (X)	ITM (Y)
1	Residential	676530	738604
6	Residential	676499	738585
8	Residential	676597	738555
9	Residential	676367	738549
10	Residential	676566	738545
11	Residential	676302	738541
12	Residential	676689	738534
13	Residential	676265	738529
14	Residential	676256	738527
15	Residential	676189	738514
16	Residential	676466	738509
17	Residential	676167	738509
18	Residential	676031	738507
19	Residential	676135	738502
20	Residential	676369	738497
21	Residential	676115	738495
23	Residential	676739	738481
24	Residential	676228	738475
25	Residential	676786	738465
26	Residential	676186	738455
27	Residential	676139	738451
28	Residential	676085	738431
30	Residential	676842	738427
31	Residential	675929	738396
32	Residential	675789	738376
34	Residential	675634	738301
35	Residential	676045	738300
37	Residential	675545	738285
38	Residential	675521	738277
39	Residential	675485	738252
40	Residential	675452	738237
41	Residential	675405	738229
45	Residential	675138	737851
46	Residential	675160	737751
47	Residential	677209	737706
49	Residential	675175	737678
51	Residential	677385	737650
52	Residential	677321	737631
53	Residential	675352	737623

Receptor ID	Description	ITM (X)	ITM (Y)
54	Residential	677283	737622
55	Residential	677254	737608
56	Residential	676966	737567
57	Residential	677025	737480
58	Residential	675352	737472
59	Residential	673866	737466
60	Residential	673810	737457
61	Residential	675303	737455
62	Residential	673770	737393
63	Residential	674108	737386
64	Residential	673848	737380
65	Residential	676970	737370
66	Residential	673829	737357
67	Residential	673811	737338
68	Residential	674162	737327
69	Residential	673798	737316
70	Residential	673772	737304
71	Residential	673645	737272
72	Residential	673757	737236
73	Residential	673660	737208
74	Residential	673648	737180
75	Residential	673620	737175
76	Residential	673957	737137
77	Residential	673556	737135
78	Residential	673958	737094
79	Residential	673325	736912
80	Residential and Commercial	673200	736910
82	Residential	673461	736805
83	Residential and Commercial	677152	736770
83A	Residential	677213	736711
83B	Residential	677277	736530
86	Residential and Commercial	677063	736582
87	Residential and Commercial	673497	736488
89	Residential	672799	735976
92	Residential	672753	735858
93	Residential	672820	735850
94	Residential	672759	735750
98	Residential	672816	735488
99	Residential and Commercial	673274	735416
100	Residential	673063	735408
101	Residential	673104	735405

Receptor ID	Description	ITM (X)	ITM (Y)
102	Residential	672874	735398
103	Residential	672901	735379
104	Residential	673100	735309
105	Residential	673494	735298
106	Residential and Commercial	674154	735244
107	Residential and Commercial	673229	734530
118	Residential	672931	734086
122	Residential	673010	734039
125	Residential	673196	733960
126	Residential	673088	733938
127	Residential	672999	733933
128	Residential	673133	733931
129	Residential	673227	733922
131	Residential	673019	733891
132	Residential	674229	733318
132	Residential	673094	733888
134	Residential and Commercial	673338	733870
135	Residential	673046	733865
136	Residential	673456	733840
138	Residential and Commercial	673064	733801
140	Residential	673535	733767
204	Residential	673398	737260
233	Residential	675072	738201
237	Residential	674086	737607
238	Residential	677356	737652
239	Residential	673806	737519
240	Residential	675099	738201
241	Residential	675140	738249
242	Residential	674087	737656
243	Residential	675355	738219
244	Residential	673915	737607
245	Residential	674110	737402
246	Residential	673970	737623
247	Residential	674093	737629
248	Residential	675271	738278
249	Residential	673762	737481
250	Residential	675140	738199
251	Residential	673913	737592
252	Residential	673712	737373
253	Residential	673600	737338
254	Residential	673532	736945

Receptor ID	Description	ITM (X)	ITM (Y)
255	Residential	673914	737695
256	Residential	674038	737696
257	Residential	673946	737578
258	Commercial (school)	673878	737576
259	Residential	674077	737672
260	Residential	675210	737781
261	Residential	673792	737422
262	Residential	674021	737707
263	Residential	674067	737591
264	Residential	674013	737605
265	Residential	673732	737437
266	Residential	675109	738202
267	Residential	675227	738269
268	Residential	673942	737710
269	Residential	674001	737591
270	Residential	674052	737577
271	Commercial (school)	673815	737557
272	Residential	673596	736942
273	Residential	675290	738164
274	Residential	675583	738292
275	Residential	674053	737687
276	Residential	674029	737628
277	Residential	673885	733540
278	Residential	673828	733558
279	Residential	673557	733756
280	Residential	674105	733473
281	Residential and Commercial	673479	733745
282	Residential	674181	733414
283	Residential	674221	733407
284	Residential	674026	733568
285	Residential	675253	737559
286	Residential	674075	737404
287	Residential	675191	737802
288	Residential	673026	734027
289	Residential	675585	738295

APPENDIX 7.4

SOUND POWER LEVEL DATA FOR WIND TURBINES

Table 7. 4.1: Wind Turbine (Nordex N133) – Manufacturers Sound Power Data at standardised wind speeds (83m hub height

Wind Speed (m/s)	3	4	5	6	7	8	9	10	11	12	Up to cut-out
Mode 0	93.0	94.2	99.7	103.9	104.5	104.5	104.5	104.5	104.5	104.5	104.5

Table 7.4.2: Wind Turbine Nordex 133 – Manufacturers typical 1/1 octave band spectrum for 63 Hz to 8 kHz, at standardised wind speeds (83m hub height).

1/1 oct. band, center freq.	63	125	250	500	1000	2000	4000	8000
3 m/s	74.7	81.7	85.5	86.4	86.9	85.6	81.3	72.1
4 m/s	75.9	82.9	86.7	87.6	88.1	86.8	82.5	73.3
5 m/s	81.4	88.4	92.2	93.1	93.6	92.3	88	78.8
6 m/s	85.6	92.6	96.4	97.3	97.8	96.5	92.2	83
7 m/s	86.3	93.3	97.1	98	98.4	97.2	92.9	83.7
8 m/s	86.2	93.2	97	97.9	98.4	97.1	92.8	83.7
9 m/s	86.2	93.2	97	97.9	98.4	97.1	92.8	83.6
10 m/s	86.2	93.2	97	97.9	98.4	97.1	92.8	83.6
11 m/s	86.2	93.2	97	97.9	98.4	97.1	92.8	83.6
12 m/s	86.2	93.2	97	97.9	98.4	97.1	92.8	83.6

APPENDIX 7.6

PREDICTED NOISE LEVELS FROM DREHID WIND FARM AT NEARBY NOISE SENSITIVE LOCATIONS

Table 7.6.1: Predicted noise levels (L_{A90}) from Drehid Wind Farm at Noise Sensitive Locations for Standardised 10m Wind Speeds of 3 m/s to 9 m/s, hub height 103m. Locations are within the 35 dB L_{A90} noise contour

Receptor ID	Description	Predicted Noise Level (dB L_{A90}) at Standardised 10m Height Wind Speeds (m/s)						
		3	4	5	6	7	8	9
1	Residential	23.2	24.4	29.9	34.1	34.8	34.7	34.7
6	Residential	23.5	24.7	30.2	34.4	35	35	35
8	Residential	23.4	24.6	30.1	34.3	35	34.9	34.9
9	Residential	24	25.2	30.7	34.9	35.6	35.5	35.5
10	Residential	23.6	24.8	30.3	34.5	35.2	35.1	35.1
11	Residential	24.2	25.4	30.9	35.1	35.7	35.7	35.7
12	Residential	23.3	24.5	30	34.2	34.9	34.8	34.8
13	Residential	24.3	25.5	31	35.2	35.9	35.8	35.8
14	Residential	24.3	25.5	31	35.2	35.9	35.8	35.8
15	Residential	24.5	25.7	31.2	35.4	36	36	36
16	Residential	24.2	25.4	30.9	35.1	35.8	35.7	35.7
17	Residential	24.5	25.7	31.2	35.4	36.1	36	36
18	Residential	24.4	25.6	31.1	35.3	35.9	35.9	35.9
19	Residential	24.5	25.7	31.2	35.4	36.1	36	36
20	Residential	24.5	25.7	31.2	35.4	36.1	36	36
21	Residential	24.6	25.8	31.3	35.5	36.2	36.1	36.1
23	Residential	23.5	24.7	30.2	34.4	35.1	35	35
24	Residential	24.9	26.1	31.6	35.8	36.4	36.4	36.4
25	Residential	23.4	24.6	30.1	34.3	35	34.9	34.9
26	Residential	25.1	26.3	31.8	36	36.6	36.6	36.6
27	Residential	25.1	26.3	31.8	36	36.6	36.6	36.6
28	Residential	25.2	26.4	31.9	36.1	36.8	36.7	36.7
30	Residential	23.5	24.7	30.2	34.4	35	35	35
31	Residential	25.2	26.4	31.9	36.1	36.8	36.7	36.7
32	Residential	24.9	26.1	31.6	35.8	36.5	36.4	36.4
34	Residential	24.9	26.1	31.6	35.8	36.5	36.4	36.4
35	Residential	26.5	27.7	33.2	37.4	38.1	38	38
37	Residential	24.7	25.9	31.4	35.6	36.2	36.2	36.2
38	Residential	24.6	25.8	31.3	35.5	36.2	36.1	36.1
39	Residential	24.6	25.8	31.3	35.5	36.2	36.1	36.1
40	Residential	24.6	25.8	31.3	35.5	36.2	36.1	36.1
41	Residential	24.5	25.7	31.2	35.4	36	36	36

Receptor ID	Description	Predicted Noise Level (dB L_{A90}) at Standardised 10m Height Wind Speeds (m/s)						
		3	4	5	6	7	8	9
45	Residential	25.7	26.9	32.4	36.6	37.2	37.2	37.2
46	Residential	26.3	27.5	33	37.2	37.9	37.8	37.8
47	Residential	24.7	25.9	31.4	35.6	36.2	36.2	36.2
49	Residential	26.9	28.1	33.6	37.8	38.4	38.4	38.4
51	Residential	23.3	24.5	30	34.2	34.9	34.8	34.8
52	Residential	23.9	25.1	30.6	34.8	35.4	35.4	35.4
53	Residential	27.9	29.1	34.6	38.8	39.5	39.4	39.4
54	Residential	24.2	25.4	30.9	35.1	35.8	35.7	35.7
55	Residential	24.5	25.7	31.2	35.4	36.1	36	36
56	Residential	27.5	28.7	34.2	38.4	39.1	39	39
57	Residential	27	28.2	33.7	37.9	38.6	38.5	38.5
58	Residential	28.8	30	35.5	39.7	40.4	40.3	40.3
59	Residential	24.2	25.4	30.9	35.1	35.7	35.7	35.7
60	Residential	24	25.2	30.7	34.9	35.6	35.5	35.5
61	Residential	28.8	30	35.5	39.7	40.3	40.3	40.3
62	Residential	24.2	25.4	30.9	35.1	35.8	35.7	35.7
63	Residential	25.6	26.8	32.3	36.5	37.1	37.1	37.1
64	Residential	24.6	25.8	31.3	35.5	36.2	36.1	36.1
65	Residential	27.8	29	34.5	38.7	39.4	39.3	39.3
66	Residential	24.7	25.9	31.4	35.6	36.3	36.2	36.2
67	Residential	24.7	25.9	31.4	35.6	36.3	36.2	36.2
68	Residential	26.2	27.4	32.9	37.1	37.8	37.7	37.7
69	Residential	24.8	26	31.5	35.7	36.4	36.3	36.3
70	Residential	24.8	26	31.5	35.7	36.3	36.3	36.3
71	Residential	24.4	25.6	31.1	35.3	36	35.9	35.9
72	Residential	25.1	26.3	31.8	36	36.7	36.6	36.6
73	Residential	24.8	26	31.5	35.7	36.4	36.3	36.3
74	Residential	25	26.2	31.7	35.9	36.5	36.5	36.5
75	Residential	24.8	26	31.5	35.7	36.4	36.3	36.3
76	Residential	26.8	28	33.5	37.7	38.4	38.3	38.3
77	Residential	24.7	25.9	31.4	35.6	36.3	36.2	36.2
78	Residential	27.2	28.4	33.9	38.1	38.7	38.7	38.7
79	Residential	24.5	25.7	31.2	35.4	36.1	36	36
80	Residential and Commercial	23.8	25	30.5	34.7	35.4	35.3	35.3
82	Residential	26	27.2	32.7	36.9	37.6	37.5	37.5

Receptor ID	Description	Predicted Noise Level (dB L_{A90}) at Standardised 10m Height Wind Speeds (m/s)						
		3	4	5	6	7	8	9
83	Residential and Commercial	25.2	26.4	31.9	36.1	36.8	36.7	36.7
83A	Residential	24.4	25.9	31.1	35.3	36	35.9	35.9
83B	Residential	23.3	25.6	30	34.2	34.9	34.8	34.8
86	Residential and Commercial	25.1	26.3	31.8	36	36.7	36.6	36.6
87	Residential and Commercial	27.9	29.1	34.6	38.8	39.5	39.4	39.4
89	Residential	23.3	24.5	30	34.2	34.8	34.8	34.8
92	Residential	23	24.2	29.7	33.9	34.6	34.5	34.5
93	Residential	23.4	24.6	30.1	34.3	35	34.9	34.9
94	Residential	23.1	24.3	29.8	34	34.6	34.6	34.6
98	Residential	23.4	24.6	30.1	34.3	35	34.9	34.9
99	Residential and Commercial	26.4	27.6	33.1	37.3	38	37.9	37.9
100	Residential	24.9	26.1	31.6	35.8	36.5	36.4	36.4
101	Residential	25.2	26.4	31.9	36.1	36.8	36.7	36.7
102	Residential	23.7	24.9	30.4	34.6	35.3	35.2	35.2
103	Residential	23.9	25.1	30.6	34.8	35.4	35.4	35.4
104	Residential	25.1	26.3	31.8	36	36.7	36.6	36.6
105	Residential	27.8	29	34.5	38.7	39.3	39.3	39.3
106	Residential and Commercial	31.7	32.9	38.4	42.6	43.3	43.2	43.2
107	Residential and Commercial	26.9	28.1	33.6	37.8	38.5	38.4	38.4
118	Residential	23.5	24.7	30.2	34.4	35.1	35	35
122	Residential	24	25.2	30.7	34.9	35.6	35.5	35.5
125	Residential	25.3	26.5	32	36.2	36.9	36.8	36.8
126	Residential	24.2	25.4	30.9	35.1	35.8	35.7	35.7
127	Residential	23.5	24.7	30.2	34.4	35.1	35	35
128	Residential	24.6	25.8	31.3	35.5	36.2	36.1	36.1
129	Residential	25.3	26.5	32	36.2	36.9	36.8	36.8
131	Residential	23.5	24.7	30.2	34.4	35	35	35
132	Residential	24.7	25.9	31.4	35.6	36.3	36.2	36.2
132	Residential	24.1	25.3	30.8	35	35.6	35.6	35.6
134	Residential and Commercial	26	27.2	32.7	36.9	37.6	37.5	37.5

Receptor ID	Description	Predicted Noise Level (dB L_{A90}) at Standardised 10m Height Wind Speeds (m/s)						
		3	4	5	6	7	8	9
135	Residential	23.6	24.8	30.3	34.5	35.1	35.1	35.1
136	Residential	26.8	28	33.5	37.7	38.3	38.3	38.3
138	Residential and Commercial	23.4	24.6	30.1	34.3	35	34.9	34.9
140	Residential	26.7	27.9	33.4	37.6	38.3	38.2	38.2
204	Residential	23.3	24.5	30	34.2	34.8	34.8	34.8
233	Residential	23.5	24.7	30.2	34.4	35	35	35
237	Residential	24.1	25.3	30.8	35	35.7	35.6	35.6
238	Residential	23.5	24.7	30.2	34.4	35.1	35	35
239	Residential	23.6	24.8	30.3	34.5	35.2	35.1	35.1
240	Residential	23.6	24.8	30.3	34.5	35.1	35.1	35.1
241	Residential	23.4	24.6	30.1	34.3	35	34.9	34.9
242	Residential	23.8	25	30.5	34.7	35.4	35.3	35.3
243	Residential	24.3	25.5	31	35.2	35.9	35.8	35.8
244	Residential	23.5	24.7	30.2	34.4	35.1	35	35
245	Residential	25.5	26.7	32.2	36.4	37	37	37
246	Residential	23.6	24.8	30.3	34.5	35.2	35.1	35.1
247	Residential	24	25.2	30.7	34.9	35.5	35.5	35.5
248	Residential	23.7	24.9	30.4	34.6	35.3	35.2	35.2
249	Residential	23.7	24.9	30.4	34.6	35.3	35.2	35.2
250	Residential	23.7	24.9	30.4	34.6	35.3	35.2	35.2
251	Residential	23.6	24.8	30.3	34.5	35.2	35.1	35.1
252	Residential	24.1	25.3	30.8	35	35.7	35.6	35.6
253	Residential	23.8	25	30.5	34.7	35.4	35.3	35.3
254	Residential	25.7	26.9	32.4	36.6	37.3	37.2	37.2
255	Residential	23	24.2	29.7	33.9	34.6	34.5	34.5
256	Residential	23.4	24.6	30.1	34.3	35	34.9	34.9
257	Residential	23.8	25	30.5	34.7	35.4	35.3	35.3
258	Commercial (school)	23.6	24.8	30.3	34.5	35.1	35.1	35.1
259	Residential	23.7	24.9	30.4	34.6	35.3	35.2	35.2
260	Residential	26.4	27.6	33.1	37.3	37.9	37.9	37.9
261	Residential	24.1	25.3	30.8	35	35.7	35.6	35.6
262	Residential	23.3	24.5	30	34.2	34.9	34.8	34.8
263	Residential	24.1	25.3	30.8	35	35.7	35.6	35.6
264	Residential	23.9	25.1	30.6	34.8	35.4	35.4	35.4
265	Residential	23.8	25	30.5	34.7	35.4	35.3	35.3

Receptor ID	Description	Predicted Noise Level (dB L_{A90}) at Standardised 10m Height Wind Speeds (m/s)						
		3	4	5	6	7	8	9
266	Residential	23.6	24.8	30.3	34.5	35.2	35.1	35.1
267	Residential	23.6	24.8	30.3	34.5	35.2	35.1	35.1
268	Residential	23	24.2	29.7	33.9	34.6	34.5	34.5
269	Residential	23.9	25.1	30.6	34.8	35.5	35.4	35.4
270	Residential	24.1	25.3	30.8	35	35.7	35.6	35.6
271	Commercial (school)	23.4	24.6	30.1	34.3	35	34.9	34.9
272	Residential	26.2	27.4	32.9	37.1	37.7	37.7	37.7
273	Residential	24.4	25.6	31.1	35.3	36	35.9	35.9
274	Residential	24.8	26	31.5	35.7	36.3	36.3	36.3
275	Residential	23.5	24.7	30.2	34.4	35.1	35	35
276	Residential	23.8	25	30.5	34.7	35.4	35.3	35.3
277	Residential	26.1	27.3	32.8	37	37.7	37.6	37.6
278	Residential	26.1	27.3	32.8	37	37.7	37.6	37.6
279	Residential	26.7	27.9	33.4	37.6	38.3	38.2	38.2
280	Residential	26.1	27.3	32.8	37	37.6	37.6	37.6
281	Residential and Commercial	26.1	27.3	32.8	37	37.7	37.6	37.6
282	Residential	25.6	26.8	32.3	36.5	37.2	37.1	37.1
283	Residential	25.6	26.8	32.3	36.5	37.2	37.1	37.1
284	Residential	26.9	28.1	33.6	37.8	38.4	38.4	38.4
285	Residential	27.9	29.1	34.6	38.8	39.5	39.4	39.4
286	Residential	25.3	24.5	32	36.2	36.9	36.8	36.8
287	Residential	26.2	26.5	32.9	37.1	37.7	37.7	37.7
288	Residential	24.1	27.4	30.8	35	35.7	35.6	35.6
289	Residential	24.7	25.3	31.4	35.6	36.3	36.2	36.2