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Report ID: 13350.02.T07.RP2

South Branch Wind Farm / Turbine T07
IEC 61400-11 Edition 3.0 Measurement Report

Prepared for:

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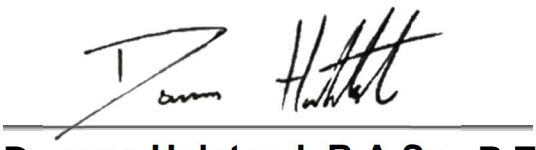

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August 14, 2020

Revision History

Version	Description	Author	Reviewed	Date
RP1	Initial Report	DH	PA	February 14, 2020
RP2	Revisions per regulator comments	DH	PA	August 14, 2020

This report in its entirety, including appendices contains 130 pages.

Statement Qualifications and Limitations

This report was prepared by Aercoustics Engineering Limited in accordance with International Standard IEC 61400-11 (Edition 3.0, released 2012-11), "Wind turbine generator systems – Part 11: Acoustic noise measurement techniques". This report is specific only to the Wind Turbine identified in this report.

Aercoustics Engineering Limited shall not be responsible for any events or circumstances that may have occurred since the date on which the Wind Turbine was tested and/or this report was prepared, or for any inaccuracies contained in information that was provided to Aercoustics Engineering Limited. Further, Aercoustics Engineering Limited agrees that this report represents test data analysed as per the above described standard for the specific Wind Turbine described in this report, but Aercoustics Engineering Limited makes no other representations with respect to this report or any part thereof.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Aercoustics Engineering Limited accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

Any use of this report is subject to this Statement of Qualifications and Limitations. Any damages arising from improper use of this report or parts thereof shall be borne by the party making such use.

This Statement of Qualifications and Limitations is attached to and forms part of this report.

Table of Contents

List of Appendices

1 Introduction

Aercoustics Engineering Limited ("Aercoustics") was retained by EDP Renewables Canada Ltd. to conduct acoustic measurements of the wind turbine T07, located in the South Branch Wind Farm. Measurements were carried out in accordance with IEC 61400-11 (edition 3.0), "*Wind turbine generator systems – Part 11: Acoustic noise measurement techniques*". The IEC 61400-11 (edition 3.0) test standard is referred to in this report by its citation reference, [1]. This report is specific only to turbine T07.

Aercoustics is an ISO/IEC 17025 test laboratory accredited for IEC 61400-11 testing.

2 Wind Turbine Information

2.1 Wind Turbine Equipment Details

Equipment information specific to turbine T07 was provided by the client and is summarized in Table 1 to Table 5.

Table 1 - Wind Turbine Details

Wind Turbine Details	
Manufacturer	Siemens Wind Power A/S
Model Number	SWT-3.0-113
Turbine ID (Serial Number)	T07

Table 2 - Operating Details

Operating Details	
Vertical or Horizontal axis wind turbine	Horizontal
Upwind or downwind rotor	Upwind
Hub height	99.5 m
Horizontal distance from rotor centre to tower axis	5.0 m
Diameter of rotor	113 m
Tower type (lattice or tube)	Tube
Passive stall, active stall, or pitch controlled turbine	Pitch controlled
Constant or variable speed	Variable
Power curve	See Figure B.01 [Appendix B]
Rotational speed at each integer standardised wind speed	See Figure B.02 [Appendix B]
Rated power output	3000 kW
Control software version	128.2.0.1

Table 3 - Rotor Details

Rotor Details	
Rotor control devices	Hydraulic
Presence of aerodynamic add-ons, such as vortex generators, stall strips, serrated trailing edges, etc.	Vortex Generators, Serrated Trailing Edges
Blade type	B55-01
Serial number	550302001, 550301501, 550302601
Number of blades	3

Table 4 - Gearbox Details

Gearbox Details	
Manufacturer	N/A
Model number	N/A
Serial number	N/A

Table 5 - Generator Details

Generator Details	
Manufacturer	SIEMENS LD
Model number	SWP 3.0MW DD22
Serial number	5824135

2.2 Wind Turbine Location / Physical Environment

UTM coordinates of Turbine T07 are 470572 m E and 4980031 m N, Zone 18 T. The area surrounding the test turbine was flat fields, with occasional patches of trees.

A general layout of the test turbine and surrounding area is provided in the site plan (Figure A.01).

3 Measurement Details

3.1 Instrumentation

The instrumentation used to acquire acoustic, meteorological ("MET"), and turbine operational data is detailed in the following sections. All data is acquired synchronously using Aercoustics' data acquisition system unless otherwise noted.

3.1.1 Acoustic Equipment

Acoustic equipment used for the testing is summarized in Table 6. The acoustic equipment used in the test conforms to the traceable calibration requirements prescribed in Section 6.3 of [1]. A field calibration of the measurement chain was performed at the beginning and end of each measurement day.

Table 6 – Acoustic Measurement Equipment

Equipment	Make & Model	Serial Number	Last Calibration Date
Data acquisition system	LMS SCADA Mobile	22143211	2018.06.22
Microphone & Pre-amplifier	B&K 4189	2625416-2369795	2019.08.26
Signal Conditioner	PCB 480E09	34208	2018.01.10
Acoustic calibrator	B&K 4231	3021765	2019.06.19

3.1.2 Meteorological Equipment

Meteorological parameters were measured using an anemometer installed on top of a 10-m AGL[1] mast. The anemometer recorded wind speed, temperature, and atmospheric pressure for the duration of the test. Wind speed at hub-height was recorded from the test turbine. Meteorological equipment utilized and controlled by Aercoustics is summarized in Table 7; this equipment conforms to the traceable calibration requirements prescribed in Section 6.3 of [1]. Equipment used by the test turbine to measure turbine parameters are outside of Aercoustics' control and not reported here.

Table 7 – Meteorological Measurement Equipment

Equipment	Make & Model	Serial Number	Last Calibration Date
Weather anemometer	Vaisala WXT536	R2510790	2019.06.17
Serial to Analog Converter	Nokeval 7470	A198729	2019.03.29

3.1.3 Turbine Operational Information

Turbine operational parameters were acquired from the turbine controller simultaneously with the acoustic and meteorological data using Aercoustics' data acquisition system. Turbine parameters measured include electrical power, yaw angle, rotational speed, and nacelle wind speed. Equipment used by the test turbine to measure turbine parameters are outside of Aercoustics' control and not reported here.

3.1.4 Microphone and MET Tower Placement

The measurement microphone was installed in Position 1, according to Figure 3 of [1]. The horizontal distance from microphone to the centerline of the wind turbine tower was R_0 = 156 m. An elevation difference of 0 metres between the microphone position and the base of the wind turbine was noted by test personnel at the time of the measurements. The slant distance from microphone location to rotor centre was R_1 = 189.3 m (includes the distance from rotor center to tower centreline).

The microphone was placed in a downwind position on the centre of a circular, acoustically reflective board. The downwind direction was determined using the turbine yaw angle output (Section 8.3 of [1]). The microphone position relative to downwind direction was

[1] Above ground level

monitored via the turbine yaw angle and data points were excluded from analysis when the turbine yaw angle exceeded ±15 degrees from the microphone position (reference yaw angle). The microphone board was moved as needed during the measurement to maintain a downwind position from the wind turbine.

The area immediately surrounding the microphone board was flat, snow covered fields. There were no reflecting surfaces in the vicinity of the microphone position during the test.

The 10-m AGL mast was installed in a crosswind position from the turbine tower, according to Figure 5 of [1].

Photos of the 10-m AGL mast and microphone board used during the test are provided in Figure A.02.

3.1.5 Double Windscreen Setup

A double windscreen was utilized, and the measurement data was adjusted to account for the insertion loss of the double windscreen. The insertion loss of the double windscreen has been tested per Annex E of [1].

3.2 Measurement Date and Time

Measurement data collected for this test was acquired during the following times.

Table 8 – Summary of Measurement Periods

Date	Test Type	Start Time	Finish time
November 15, 2019	Turbine ON	9:47 AM	9:56 AM
	Turbine ON	10:02 AM	10:14 AM
	Turbine ON	10:25 AM	10:40 AM
	Turbine ON	10:50 AM	10:57 AM
	Turbine ON	11:04 AM	11:24 AM
	Background	11:39 AM	11:59 AM
	Background	12:10 PM	12:20 PM
	Turbine ON	1:00 PM	1:15 PM
	Turbine ON	1:32 PM	1:43 PM
	Turbine ON	1:55 PM	2:00 PM
	Background	2:06 PM	3:00 PM
	Turbine ON	3:58 PM	4:30 PM
	Background	4:33 PM	4:58 PM

3.3 Determination of Normalized Wind Speed

The normalized hub height wind speed for Turbine ON intervals was determined using one of the following two methods, depending on the hub-height wind speed during the interval:

The power curve method (Section 8.2.1.1 of [1]) is used to determine normalized hub-height wind speed if the power output during the interval falls within the allowable range of the power curve. The allowable range is defined per Equation (3) of [1] as the range of wind bins where the power curve has a positive slope.

The nacelle plus correction method (Section 8.2.1.2 of [1]) is used to determine normalized hub-height wind speed if the power output falls outside the allowable range of the power curve. If the application of this method results in a normalized wind speed that falls back inside the allowable range of the power curve, then that data point is excluded from analysis.

The normalized hub height wind speed for Background intervals is determined using the 10-m AGL anemometer wind speed and applying a correction factor (k_Z) to adjust to hub-height (Section 8.2.2 of [1]).

3.3.1 Wind Speed Correction Factors

Following the methodologies described above, two correction factors are derived from the measurement data and used to determine the normalized hub-height wind speed outside the allowable power curve range.

The first correction factor (k_nac) is used to correct nacelle wind speeds for Turbine ON intervals that fall outside of the allowable power curve range. The second correction factor (k_Z) is used to correct Background 10-m AGL wind speeds to hub-height. The correction factors calculated for this measurement set are provided in Table 9.

Table 9 – Calculated nacelle anemometer (k_nac) and 10 m (k_Z) wind speed k-factor

k_nac	k_Z
1.07	1.53

3.4 Deviations from IEC-61400-11 Edition 3.0

The 10-m AGL anemometer used did not have an ISO 17025 accredited test report available at the time of the test. Date of the factory calibration is within the allowable time frame prescribed in Section 6.3 of [1]. The unit has since been tested per ISO 17025 requirements and found to be in specification. Both the original test report and the ISO 17025 calibration report are attached in Appendix F.01.

3.5 Special Notes & Considerations

Turbine T108 was parked during the measurement period. This turbine, and its position relative to the test turbine, is shown in Figure A.01.

Transient events (such as vehicle traffic, wildlife, air traffic, etc.) are manually excluded from the measurement data set.

During the test, electromagnetic interference ("EMI") was noted in the measured signal by test personnel and found to affect the measured sound levels at higher frequencies (above 4000 Hz). Efforts were made during the test to minimize the impact; however, the EMI was still found to increase the calculated $L_{WA,K}$. This is considered acceptable for the purposes of this test, and the impact of the increased $L_{WA,K}$ is investigated separately in further detail (see Appendix F.02).

4 Measurement Results

Measurement results are summarized in this section. Detailed supporting information is provided in Appendix C (1/3rd octave sound levels and uncertainties), Appendix D (tonality assessment), and Appendix E (measurement dataset).

4.1 Sound Pressure Levels

Average overall sound pressure levels in each wind bin for all Turbine ON and Background periods are summarized in Table 10.

Table 10 – Summary of Sound Pressure Level Measurements

Wind Speed (m/s)	Turbine ON		Background		Turbine ON, Background adjusted L_{eq}, (dBA)
	L_{eq}, (dBA)	# of data pts	L_{eq}, (dBA)	# of data pts	
8.0	53.9	25	43.3	10	53.5
8.5	55.3	19	44.3	17	55.0
9.0	56.1	16	44.9	28	55.8
9.5	56.3	16	42.3	32	56.1
10.0	56.4	22	42.8	49	56.2
10.5	56.4	13	43.3	51	56.1
11.0	55.6	23	44.2	51	55.3
11.5	55.6	28	43.7	64	55.3
12.0	55.7	44	43.3	52	55.4
12.5	55.7	43	44.4	51	55.4

* denotes a 3 to 6 dB difference between Turbine ON and Background
** denotes a less than 3 dB difference between Turbine ON and Background; level not reported

4.2 Apparent Sound Power Level

The calculated apparent sound power levels by hub height wind speed are summarized in Table 11. Corresponding sound power levels by 10 m height wind speed are summarized in Table 12. Wind speeds at 10 m are calculated per Section 9.4 of [1].

Table 11 – $L_{WA,K}$ at each integer wind speed

Wind Speed (m/s)	Apparent L_{WA}, (dBA)	Uncertainty (dB)
8.0	104.0	0.9
8.5	105.5	0.8

Wind Speed (m/s)	Apparent L_{WA}, (dBA)	Uncertainty (dB)
9.0	106.3	0.8
9.5	106.7	0.8
10.0	106.8	1.3
10.5	106.7	1.7
11.0	105.8	0.9
11.5	105.8	1.0
12.0	106.0	0.9
12.5	105.9	0.9

* denotes a 3 to 6 dB difference between Turbine ON and Background
** denotes a less than 3 dB difference between Turbine ON and Background; level not reported

Table 12 – $L_{WA\ 10m,\ K}$ at each integer wind speed

Wind Speed (m/s)	Apparent L_{WA}, (dBA)	Uncertainty (dB)
5	101.1	1.0
6	105.5	0.8
7	106.7	1.1
8	105.9	0.9
9	106.0	0.8

* denotes a 3 to 6 dB difference between Turbine ON and Background
** denotes a less than 3 dB difference between Turbine ON and Background and are not reported

4.3 Uncertainty

The uncertainty of the test result is the combination of Type A and Type B uncertainty. Detailed uncertainties calculated for overall and 1/3rd octave band sound levels are provided in Appendix C.

4.3.1 Type A Uncertainty

Type A measurement uncertainty is calculated based on the distribution of the measured sound levels and wind speeds during the test. Calculation of Type A uncertainy is conducted per Section 9.2 of [1].

4.3.2 Type B Uncertainty

Type B uncertainty is determined using the guidance provided in Annex C of [1] and equipment calibration records. A summary of Type B uncertainties is provided in Table 13.

Table 13 – Summary of Type B uncertainties

Component	Typical (dB)	Used (dB)
Calibration	0.2	0.2
Board	0.3	0.3
Distance & direction	0.1	0.1
Air absorption	0	0

Component	Typical (dB)	Used (dB)
Weather conditions	0.5	0.5
Wind speed measured	0.7	0.7
Wind speed derived	0.2	0.2
Wind speed from power curve	0.2	0.2

4.4 Tonality Analysis

Tonal audibility is determined for each wind speed bin per Section 9.5 of [1]. The results of the tonality analysis are summarized in Table 14. All ΔL_{tn} and ΔL_a values reported represent the energy average of all data points having an identified tone that fall within the same frequency of origin (Section 9.5.8 of [1]).

The average narrow band spectrum measured at each hub-height wind speed are provided in Appendix D.

Table 14 – Tonality Assessment Summary

Wind Speed (m/s)	Frequency (Hz)	Tonality, ΔLtn (dB)	Tonal audibility, ΔLa (dB)	FFT's with tones	Total # of FFT's	Presence (%)
8.0	-	-	No tones	-	-	-
8.5	-	-	No tones	-	-	-
9.0	-	-	No tones	-	-	-
9.5	-	-	No tones	-	-	-
10.0	-	-	No tones	-	-	-
10.5	-	-	No tones	-	-	-
11.0	-	-	No tones	-	-	-
11.5	-	-	No tones	-	-	-
12.0	-	-	No tones	-	-	-
12.5	-	-	No tones	-	-	-

5 Closure

Measurements and analyses per IEC 61400-11 (edition 3.0) were performed on turbine T07 of the South Branch Wind Farm, located in South Dundas, Ontario. The test turbine was found to have a maximum apparent sound power level of 106.8 dBA and no reportable tones.

Supplementary information to address specific local regulatory requirements are attached separately in Appendix F.

6 References

[1] IEC 61400-11 , *Wind Turbines - Part 11: Acoustic noise measurement techniques,* International Electrotechnical Commission, 2012.

[2] A. Nercessian and G. Constantin, “South Branch Wind Farm Noise Impact Assessment,” DNV-GL, Toronto, 2020.

[3] A. Brunskill, “South Branch Wind Farm Ontario, Noise Impact Assessment,” GL Garrad Hassan, Ottawa, 2013.

[4] P. Ashtiani and D. Halstead, “South Branch Wind Farm Transformer Station Acoustic Audit,” Aercoustics Engineering Ltd., Mississauga, 2017.

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Appendix A
Site Details

aercoustics	13350.02.T07.RP2 Scale: NTS Drawn by: DH Reviewed by: PA Date: Aug 2020 Revision: 2	**Project Name** South Branch Wind - IEC 61400-11 Edition 3.0 - Turbine T07 **Figure Title** Site Plan

Figure A.01

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Project Name

South Branch Wind - IEC 61400-11 Edition 3.0 - Turbine T07

Figure Title

Site Photos

Figure A.02

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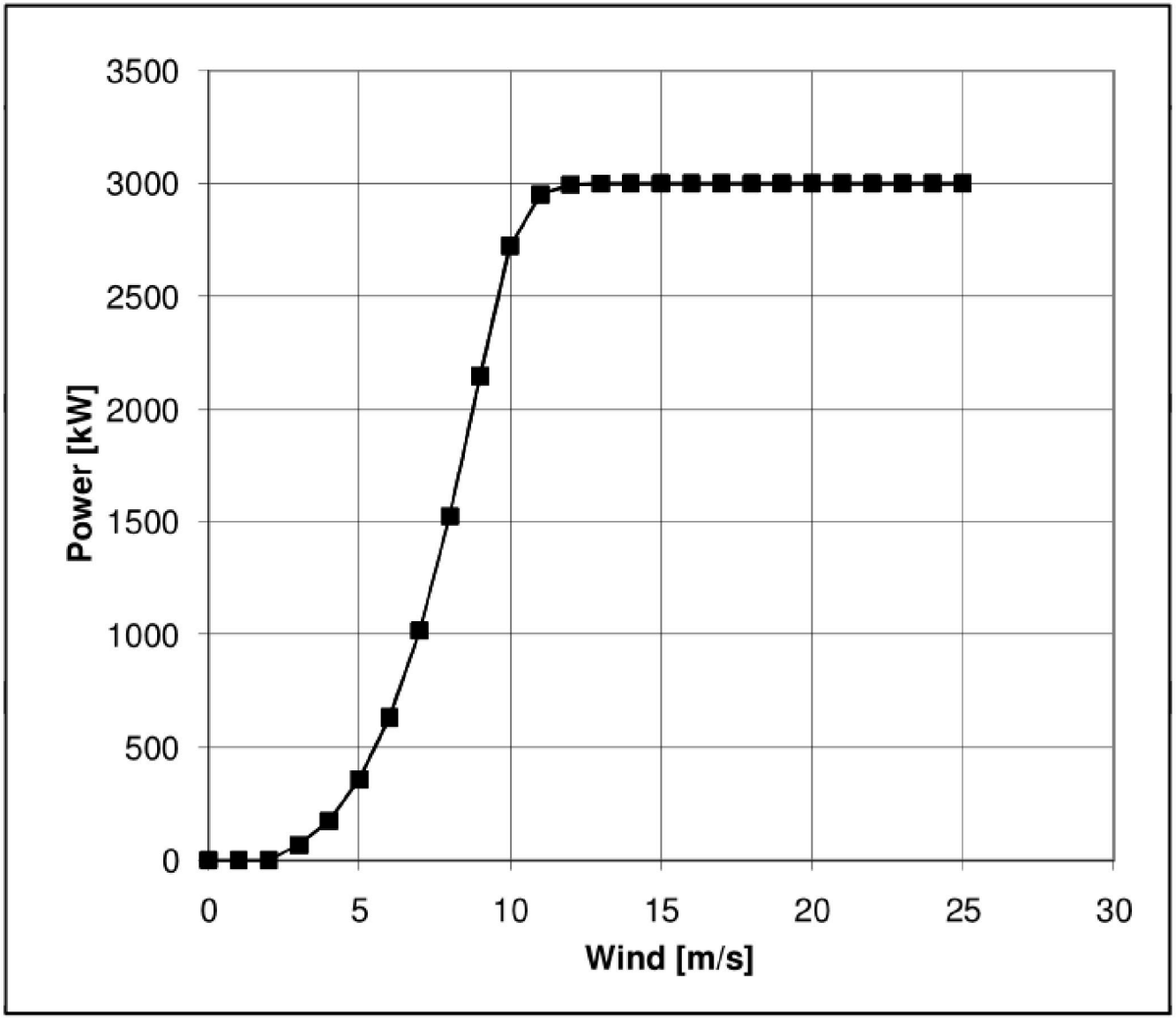
Appendix B
Turbine Information

Wind [m/s]	Power [kW]
0	0
1	0
2	0
3	67
4	174
5	357
6	632
7	1017
8	1524
9	2148
10	2724
11	2952
12	2995
13	3000
14	3000
15	3000
16	3000
17	3000
18	3000
19	3000
20	3000
21	3000
22	3000
23	3000
24	3000
25	3000



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Project Name

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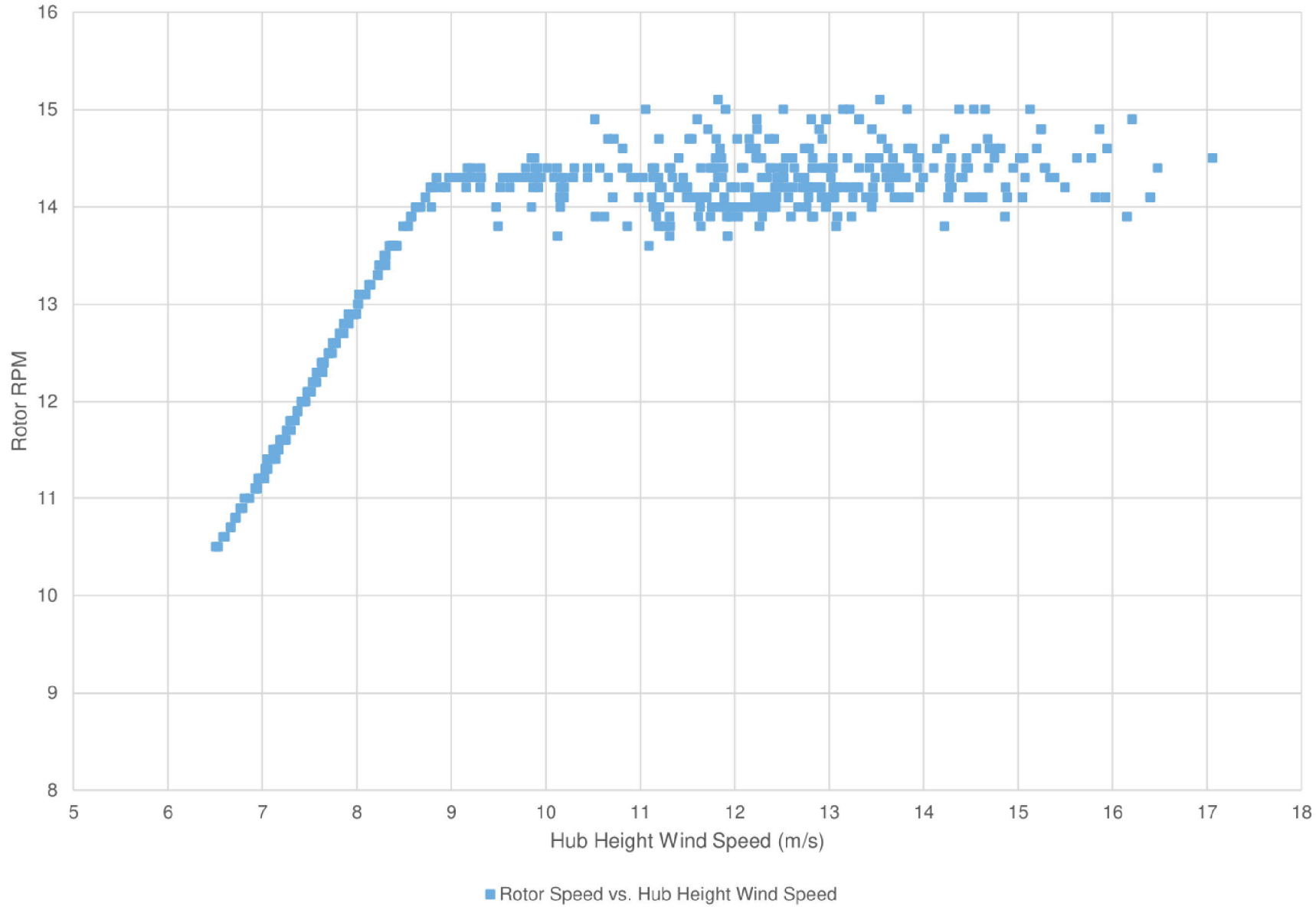
Figure Title

Power Curve

Figure B.01



aercoustics	13350.02.T07.RP2 Scale: NTS Drawn by: DH Reviewed by: PA Date: Jan 2020 Revision: 1	**Project Name** South Branch Wind - IEC 61400-11 Edition 3.0 - Turbine T07 **Figure Title** Rotor RPM vs. Wind Speed

Figure B.02

Table B.01 Allowed power curve range, Secondary wind screen insertion loss

Power Curve & Required Wind Speeds		
Power Curve Tolerance	1%	
Acceptable range min	2	m/s
Acceptable range max	10	m/s
Min allowable range	2	m/s
Max allowable range	10	m/s
Power Output	3000	kW
85% Power	2550	kW
Corresponding wind speed	9.70	m/s
Minimum bin	8.0	m/s
Maximum bin	12.5	m/s

Power Curve (+ value = acceptable)		
Hub Wind Speed (m/s)	Power [kW]	Slope of Power Curve
0	**0**	-60
1	0	-60
2	0	7
3	67	47
4	174	123
5	357	215
6	632	325
7	1017	447
8	1524	564
9	2148	516
10	2724	168
11	2952	-17
12	2995	-55
13	3000	-60
14	3000	-60
15	3000	-60
16	3000	-60
17	3000	-60
18	3000	-60
19	3000	-60
20	3000	-60
21	3000	-60
22	3000	-60
23	3000	-60
24	3000	-60
25	3000	

Secondary windscreen adjustment (dB)	
20	0.0
25	0.0
31.5	0.0
40	0.0
50	0.0
63	0.0
80	0.0
100	0.0
125	0.0
160	0.0
200	0.0
250	-0.1
315	-0.1
400	0.2
500	0.3
630	0.6
800	0.0
1000	0.2
1250	0.5
1600	0.6
2000	0.7
2500	1.0
3150	0.5
4000	0.1
5000	-0.5
6300	0.5
8000	0.9
10000	0.7

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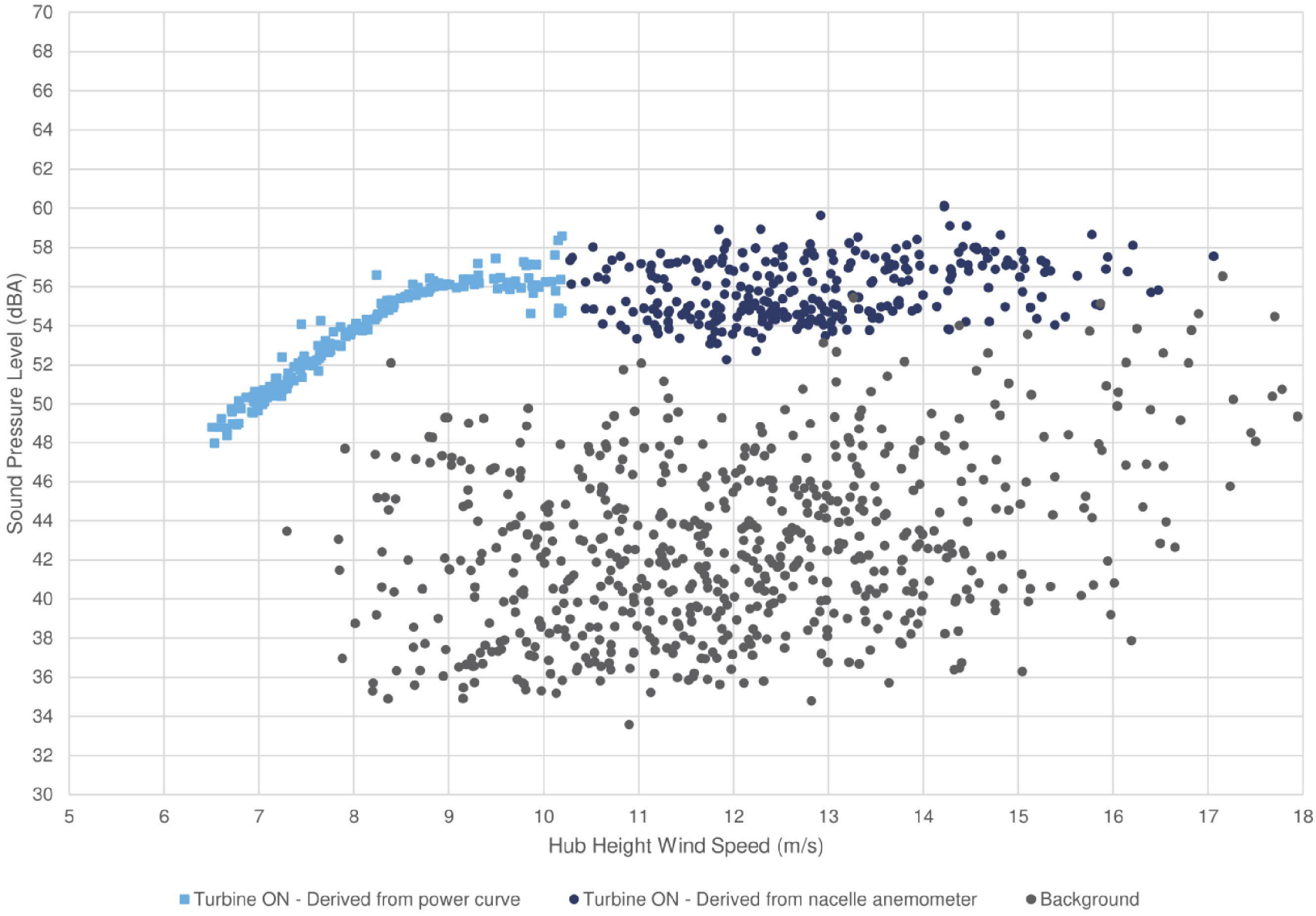
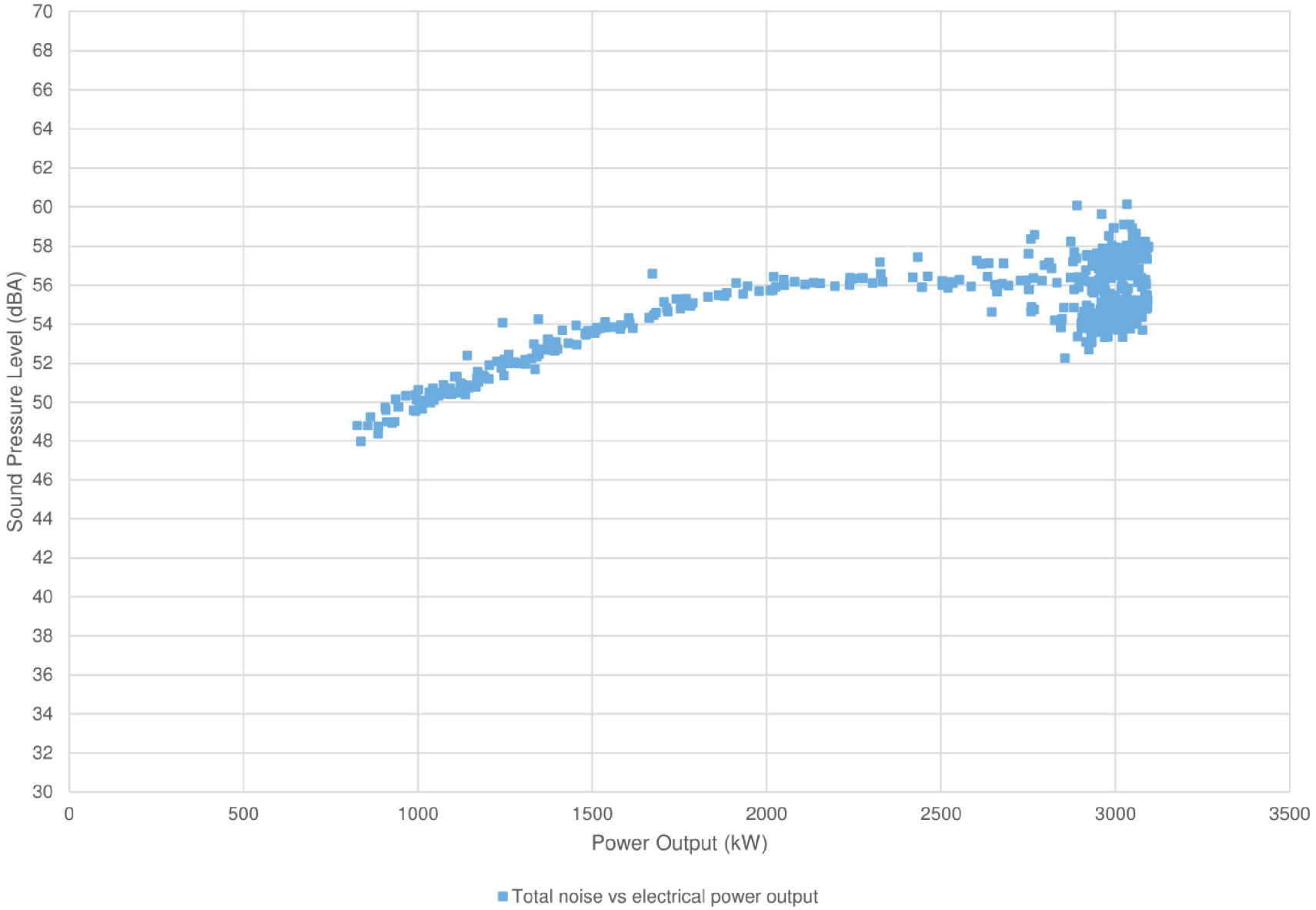
Appendix C
Apparent Sound Power Level



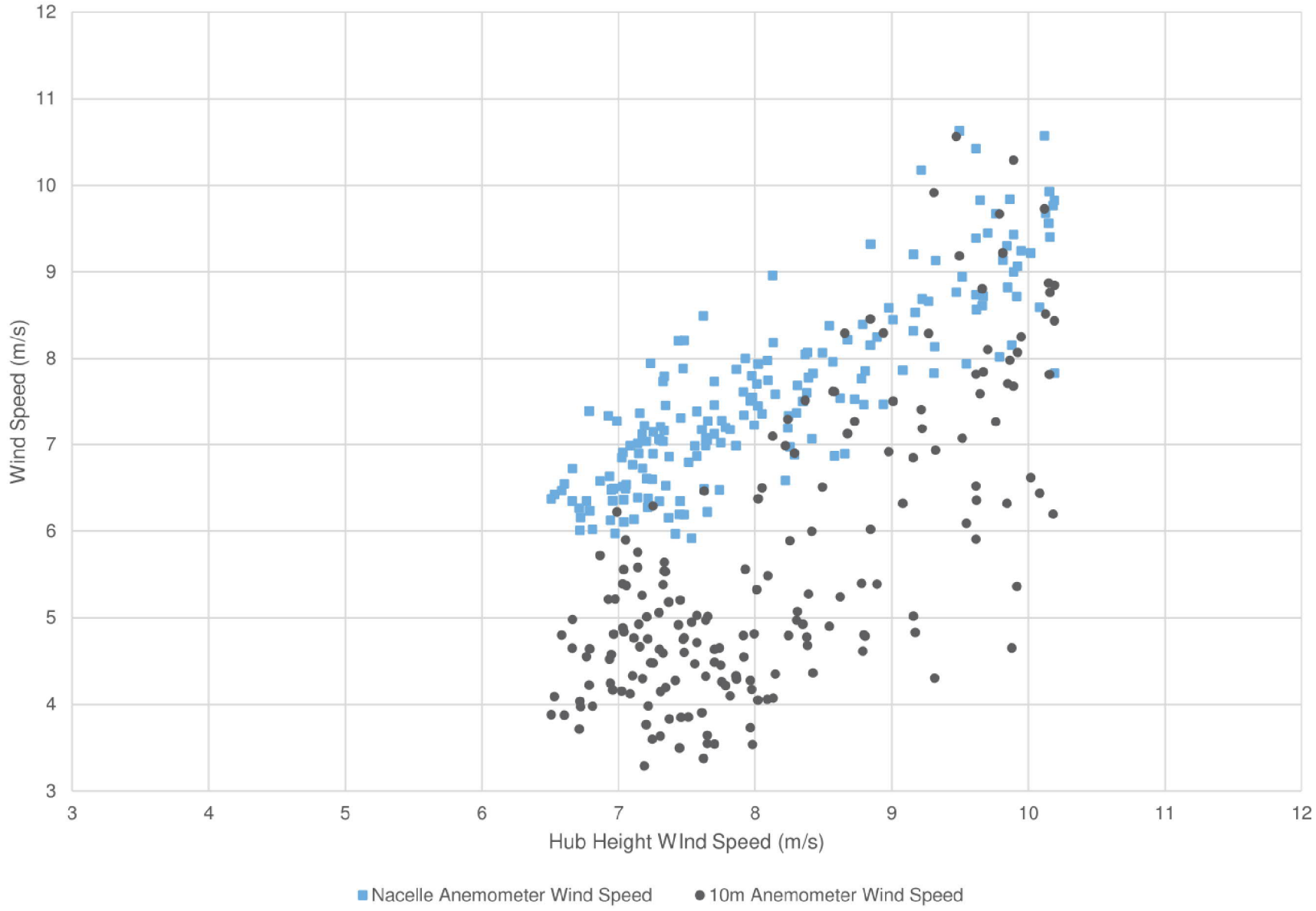
aercoustics	13350.02.T07.RP2 Scale: NTS Drawn by: DH Reviewed by: PA Date: Jan 2020 Revision: 1	**Project Name** South Branch Wind - IEC 61400-11 Edition 3.0 - Turbine T07 **Figure Title** Plot of overall measurement pairs at Position 1 (Turbine ON & Background)

Figure C.01



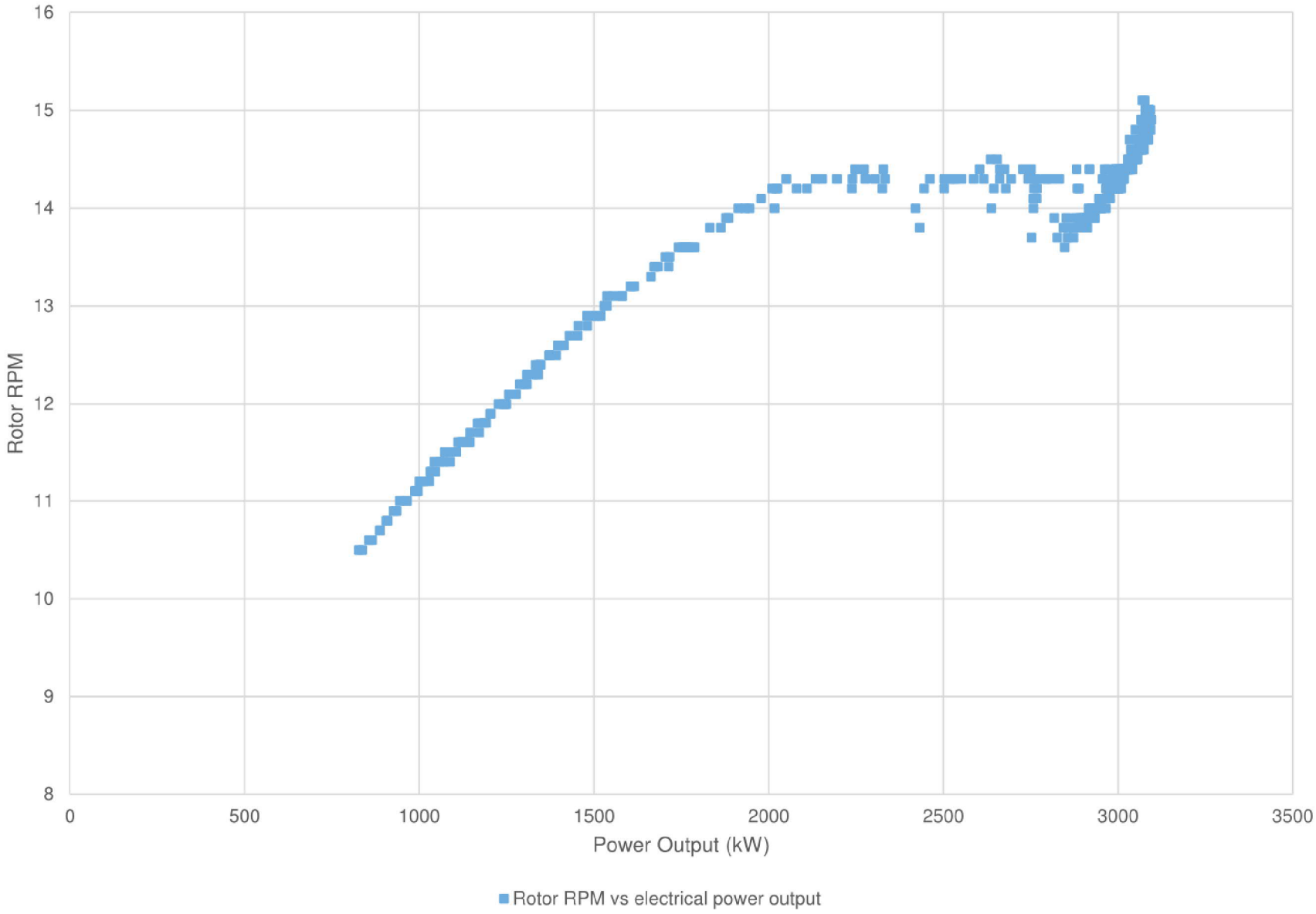
aercoustics	13350.02.T07.RP2 Scale: NTS Drawn by: DH Reviewed by: PA Date: Jan 2020 Revision: 1	**Project Name** South Branch Wind - IEC 61400-11 Edition 3.0 - Turbine T07 **Figure Title** Plot of measured total noise vs. electrical power output

Figure C.02

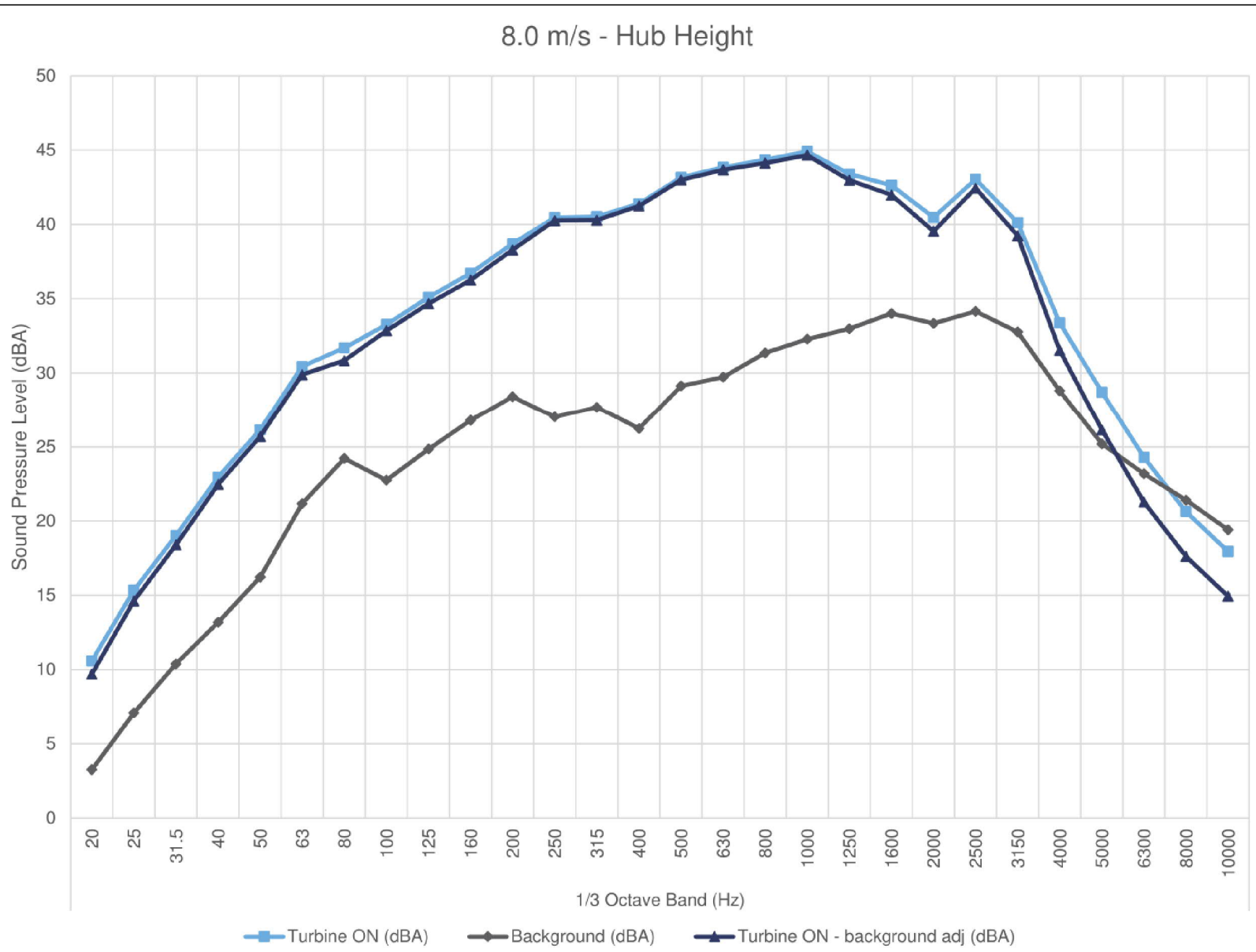


aercoustics	13350.02.T07.RP2 Scale: NTS Drawn by: DH Reviewed by: PA Date: Jan 2020 Revision: 1	**Project Name** South Branch Wind - IEC 61400-11 Edition 3.0 - Turbine T07 **Figure Title** Plot of power curve wind speed relative to nacelle and 10m wind speed

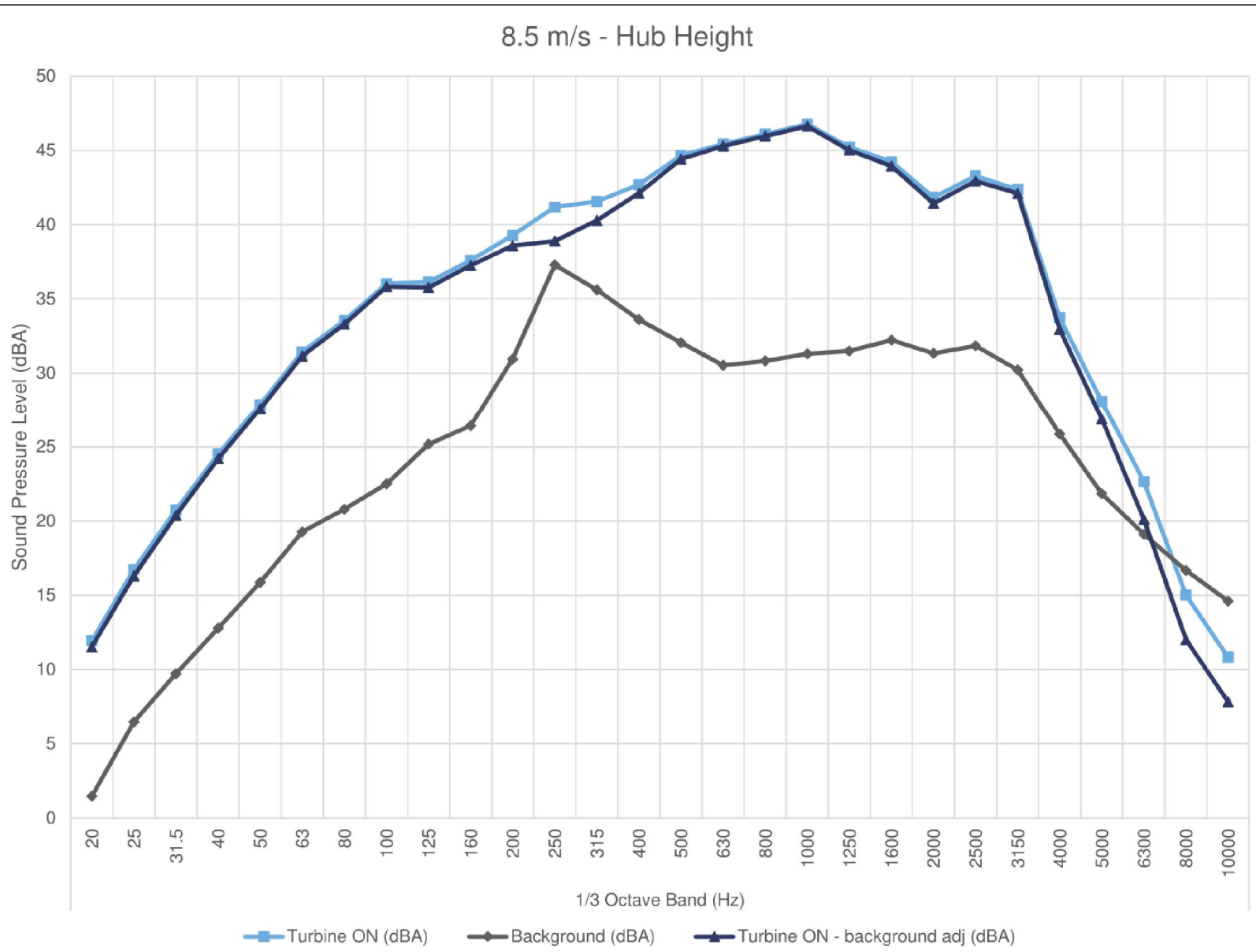
Figure C.03



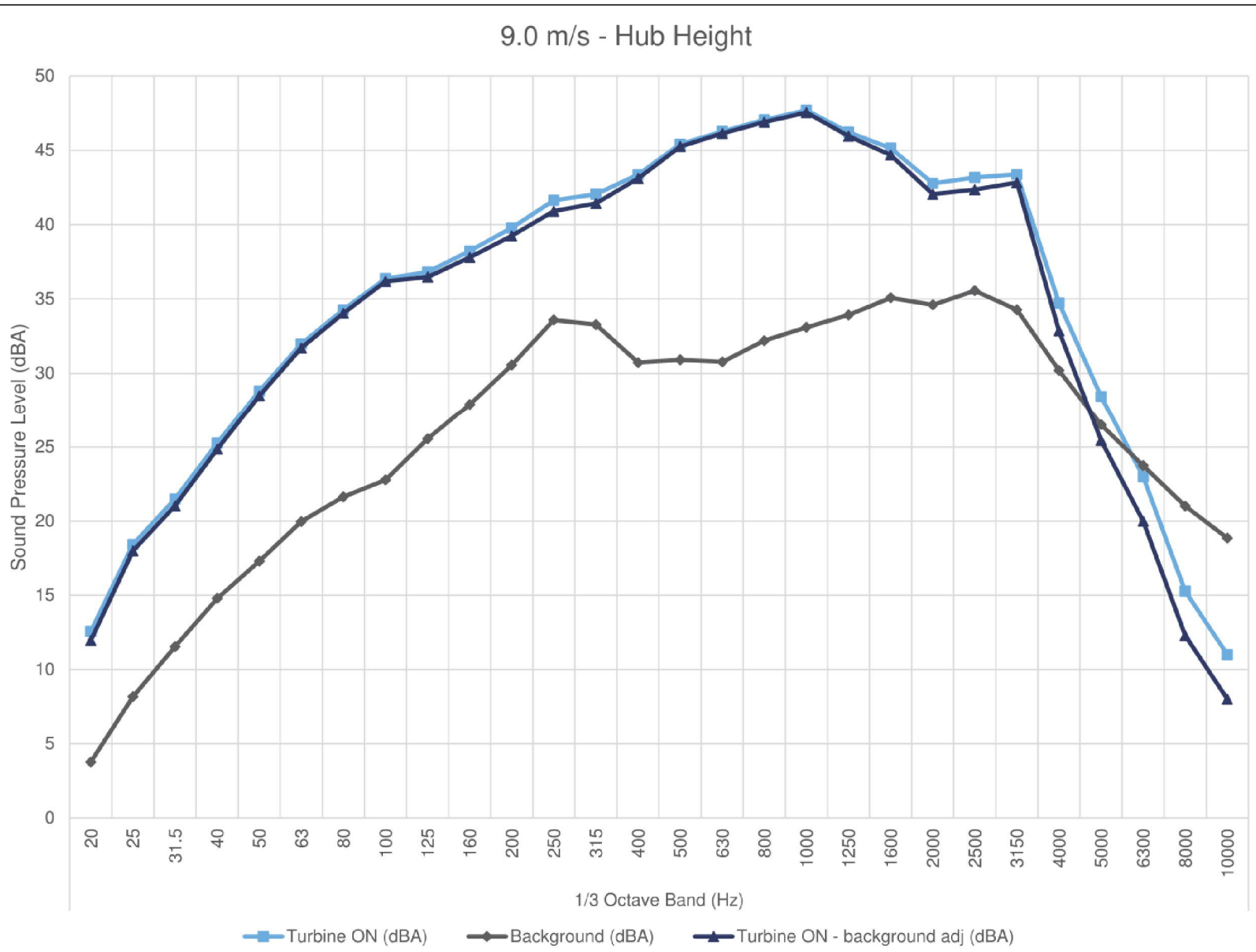
aercoustics	13350.02.T07.RP2 Scale: NTS Drawn by: DH Reviewed by: PA Date: Jan 2020 Revision: 1	**Project Name** South Branch Wind - IEC 61400-11 Edition 3.0 - Turbine T07 **Figure Title** Plot of rotor RPM vs. electrical power output **Figure C.04**



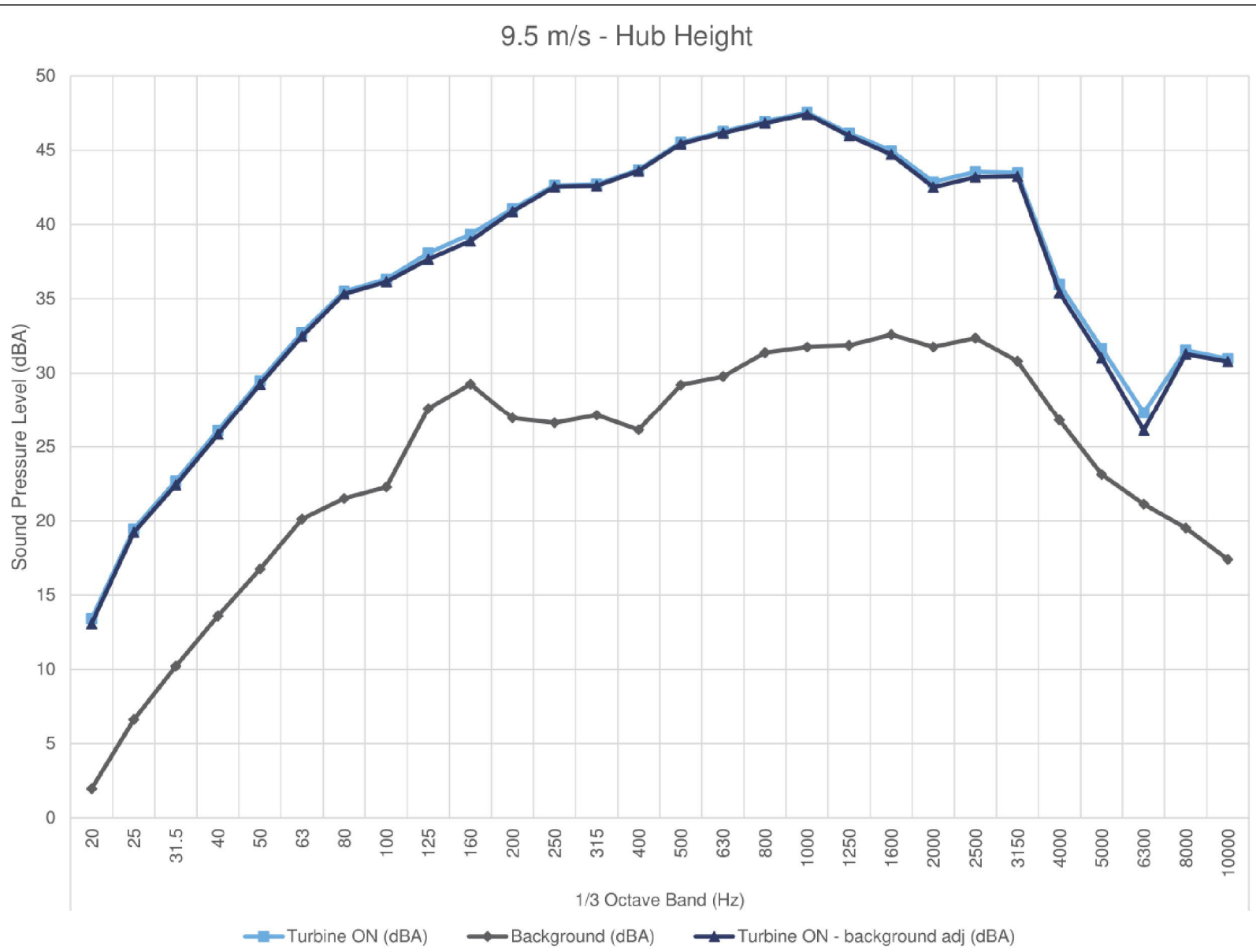
aercoustics	13350.02.T07.RP2 Scale: NTS Drawn by: DH Reviewed by: PA Date: Jan 2020 Revision: 1	**Project Name** South Branch Wind - IEC 61400-11 Edition 3.0 - Turbine T07 **Figure Title** Plot of sound pressure spectrum in 1/3 Octave at 8 m/s **Figure C.05**



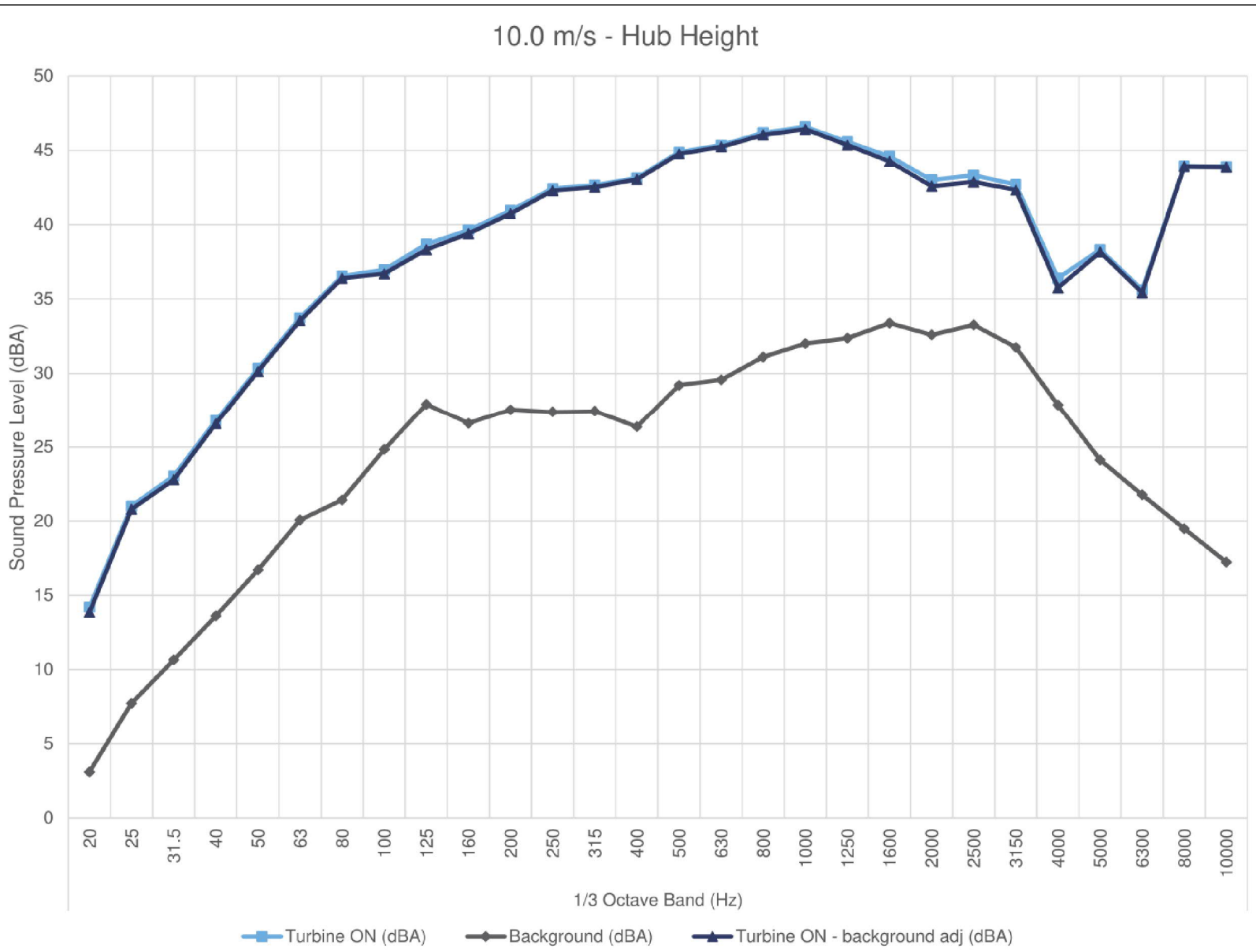
aercoustics	13350.02.T07.RP2 Scale: NTS Drawn by: DH Reviewed by: PA Date: Jan 2020 Revision: 1	**Project Name** South Branch Wind - IEC 61400-11 Edition 3.0 - Turbine T07 **Figure Title** Plot of sound pressure spectrum in 1/3 Octave at 8.5 m/s **Figure C.06**



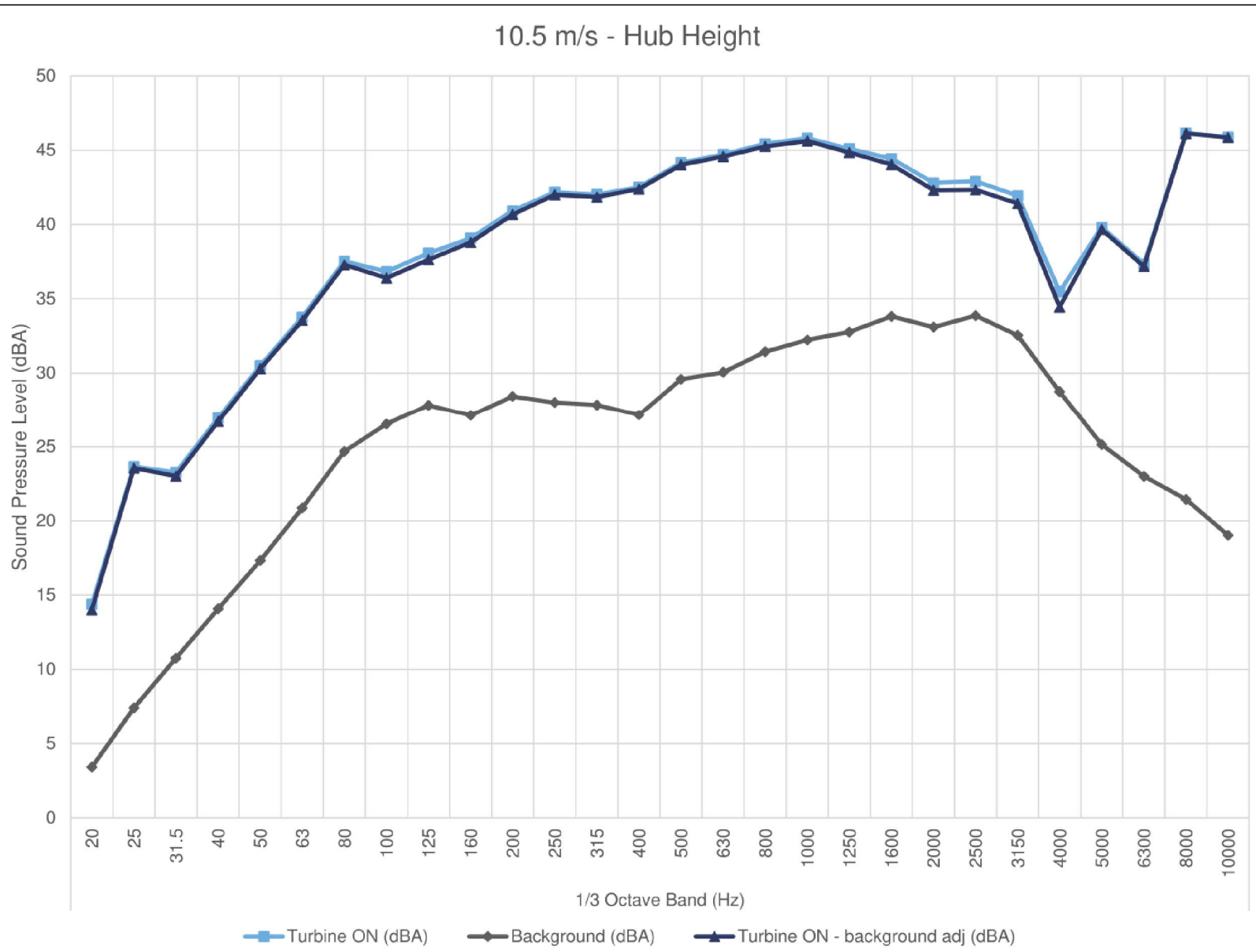
aercoustics	13350.02.T07.RP2 Scale: NTS Drawn by: DH Reviewed by: PA Date: Jan 2020 Revision: 1	**Project Name** South Branch Wind - IEC 61400-11 Edition 3.0 - Turbine T07 **Figure Title** Plot of sound pressure spectrum in 1/3 Octave at 9 m/s **Figure C.07**



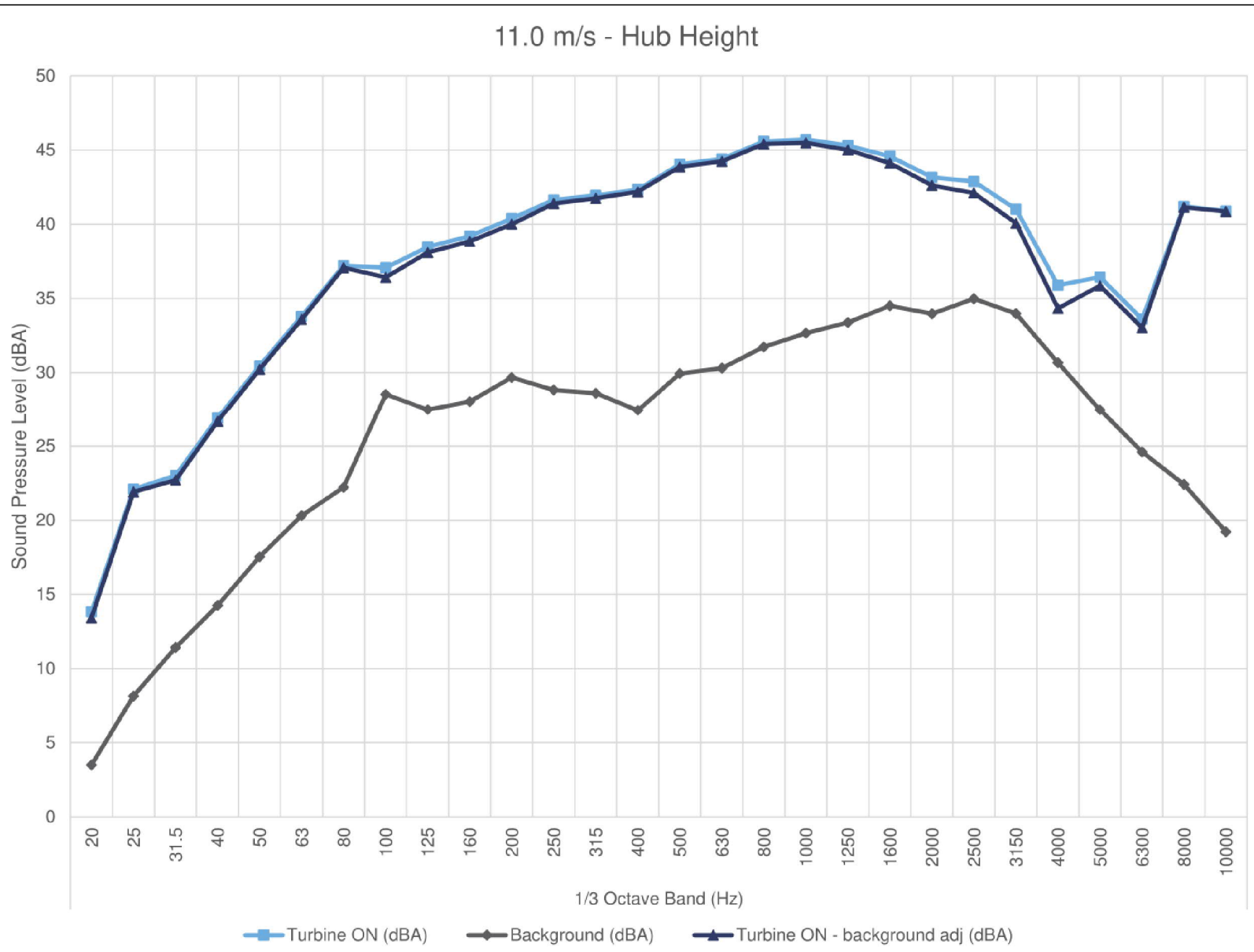
aercoustics	13350.02.T07.RP2 Scale: NTS Drawn by: DH Reviewed by: PA Date: Jan 2020 Revision: 1	**Project Name** South Branch Wind - IEC 61400-11 Edition 3.0 - Turbine T07 **Figure Title** Plot of sound pressure spectrum in 1/3 Octave at 9.5 m/s **Figure C.08**



aercoustics	13350.02.T07.RP2 Scale: NTS Drawn by: DH Reviewed by: PA Date: Jan 2020 Revision: 1	**Project Name** South Branch Wind - IEC 61400-11 Edition 3.0 - Turbine T07 **Figure Title** Plot of sound pressure spectrum in 1/3 Octave at 10 m/s **Figure C.09**

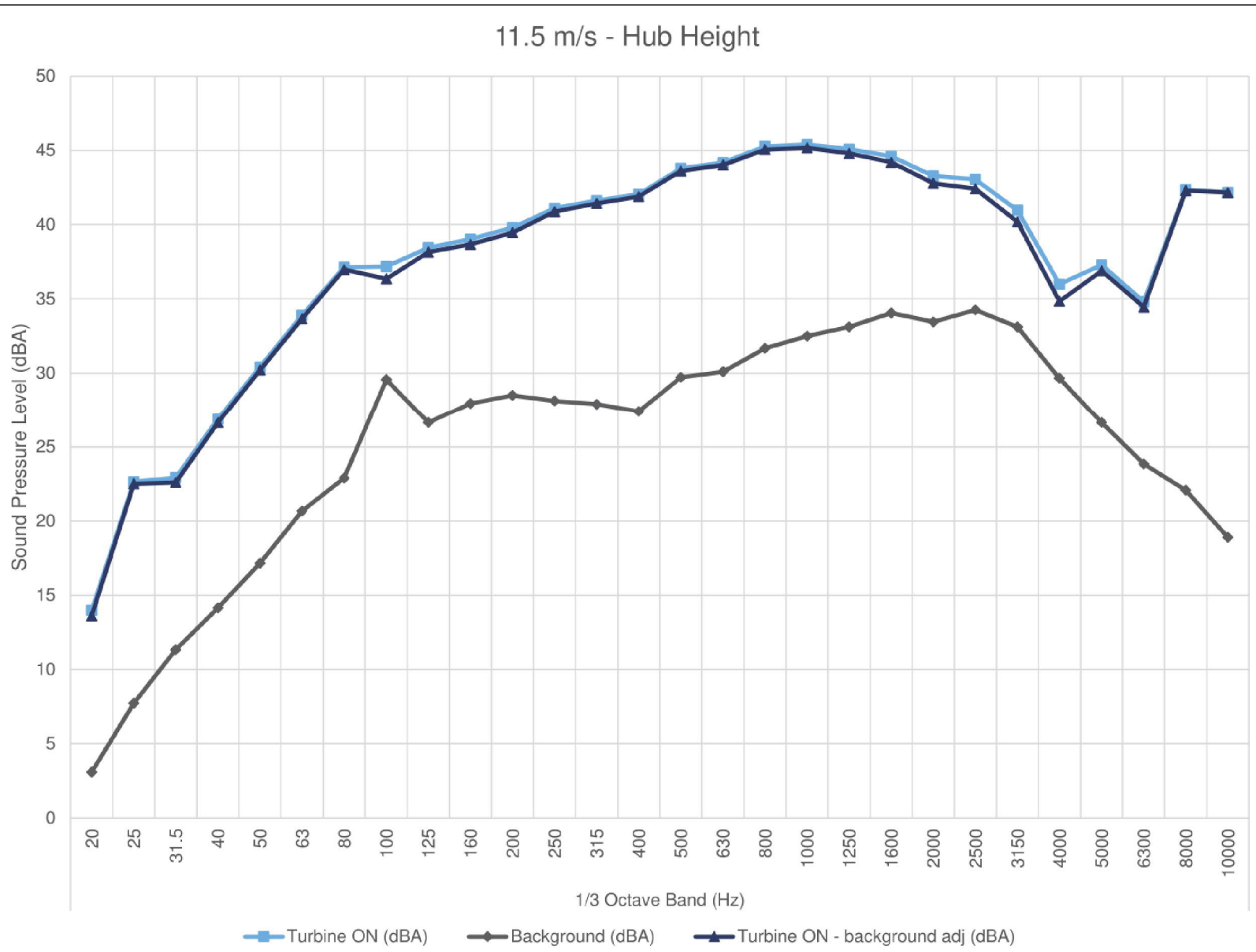


aercoustics	13350.02.T07.RP2 Scale: NTS Drawn by: DH Reviewed by: PA Date: Jan 2020 Revision: 1	**Project Name** South Branch Wind - IEC 61400-11 Edition 3.0 - Turbine T07 **Figure Title** Plot of sound pressure spectrum in 1/3 Octave at 10.5 m/s **Figure C.10**

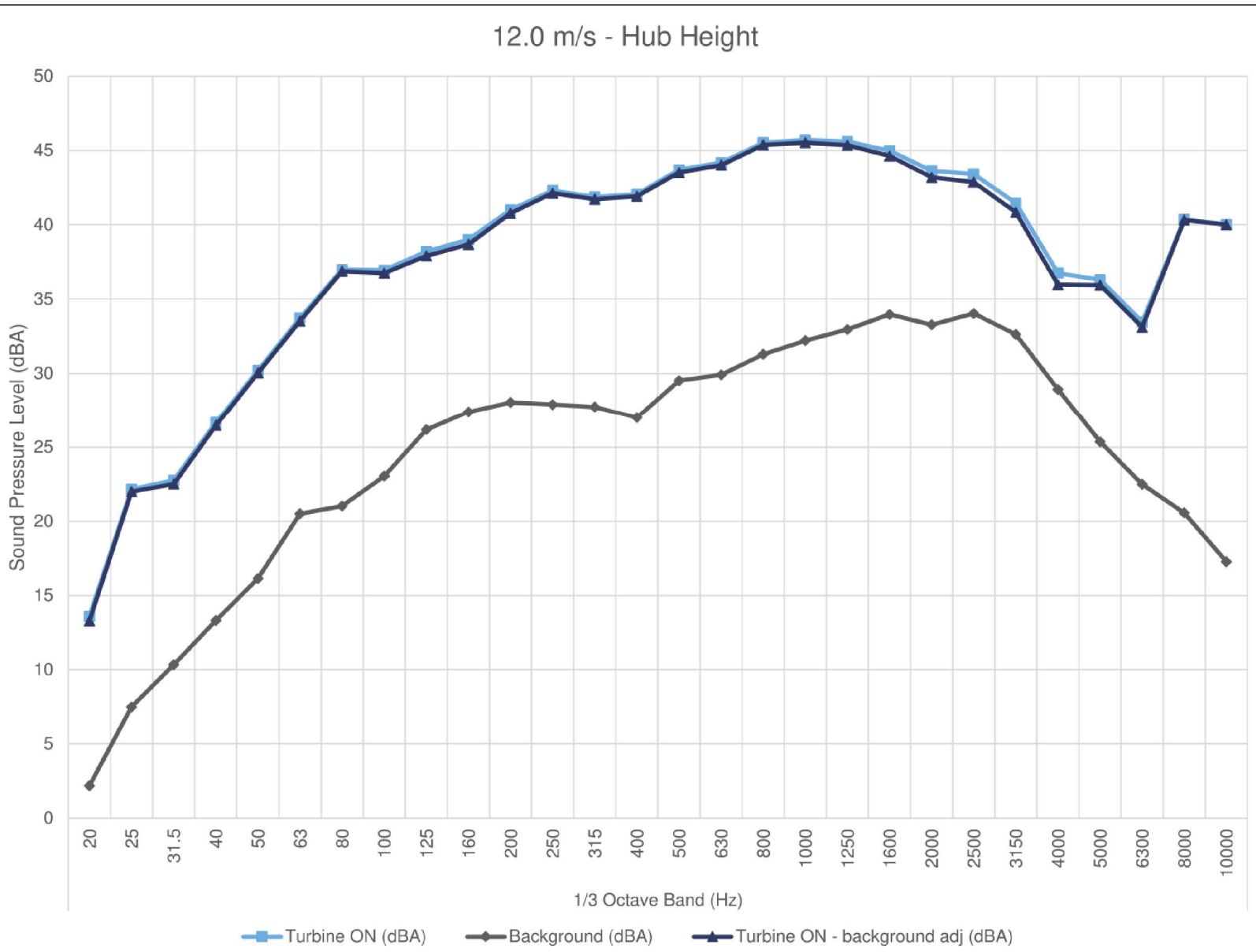


aercoustics	13350.02.T07.RP2 Scale: NTS Drawn by: DH Reviewed by: PA Date: Jan 2020 Revision: 1	**Project Name** South Branch Wind - IEC 61400-11 Edition 3.0 - Turbine T07 **Figure Title** Plot of sound pressure spectrum in 1/3 Octave at 11 m/s

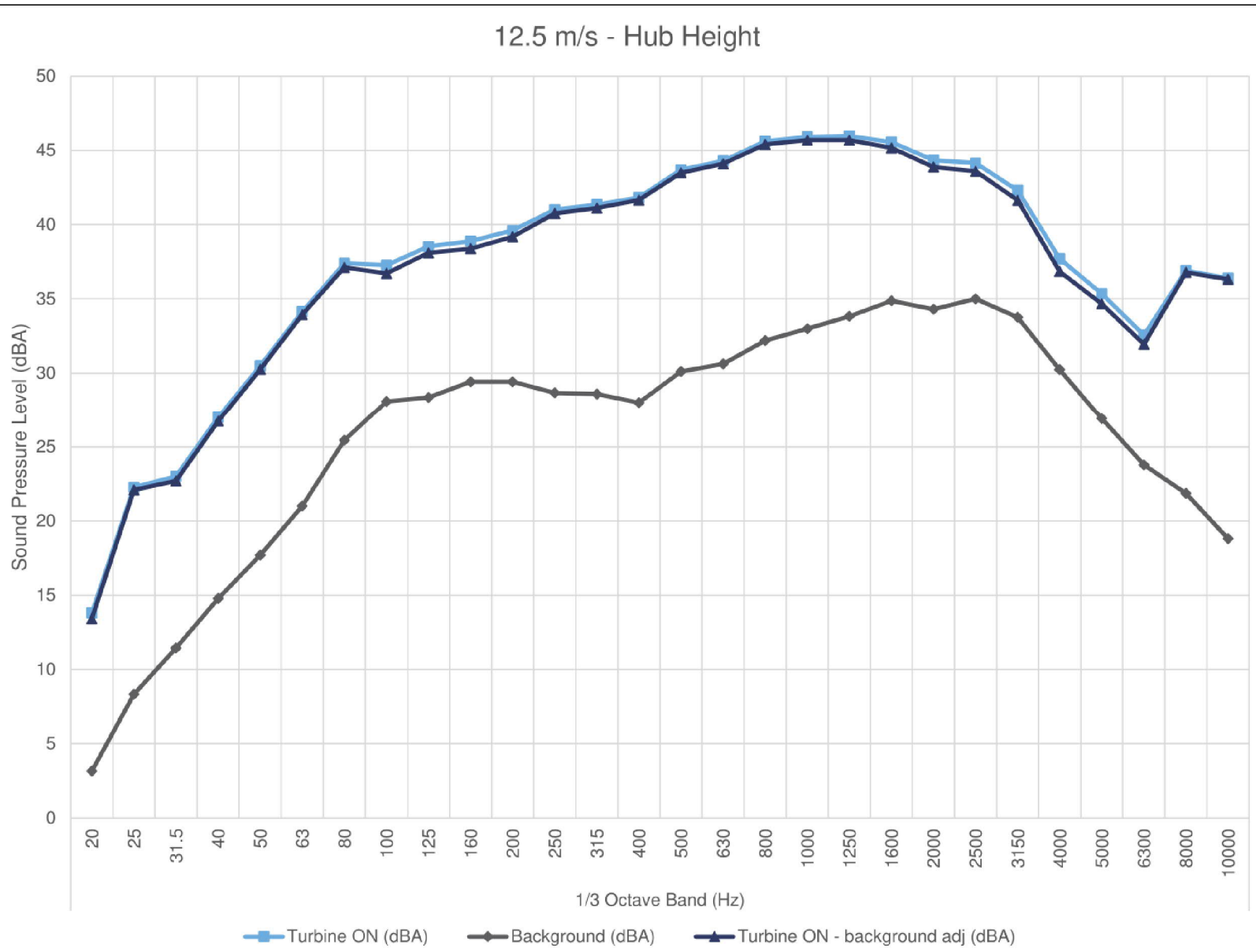
Figure C.11



aercoustics	13350.02.T07.RP2 Scale: NTS Drawn by: DH Reviewed by: PA Date: Jan 2020 Revision: 1	**Project Name** South Branch Wind - IEC 61400-11 Edition 3.0 - Turbine T07 **Figure Title** Plot of sound pressure spectrum in 1/3 Octave at 11.5 m/s **Figure C.12**



aercoustics	13350.02.T07.RP2 Scale: NTS Drawn by: DH Reviewed by: PA Date: Jan 2020 Revision: 1	**Project Name** South Branch Wind - IEC 61400-11 Edition 3.0 - Turbine T07 **Figure Title** Plot of sound pressure spectrum in 1/3 Octave at 12 m/s **Figure C.13**



aercoustics	13350.02.T07.RP2 Scale: NTS Drawn by: DH Reviewed by: PA Date: Jan 2020 Revision: 1	**Project Name** South Branch Wind - IEC 61400-11 Edition 3.0 - Turbine T07 **Figure Title** Plot of sound pressure spectrum in 1/3 Octave at 12.5 m/s **Figure C.14**

Table C.01 Detailed apparent sound power level data at hub height

Project: South Branch Wind Farm - Turbine T07 - IEC 61400-11 Measurement

Report ID: 13350.02.T07.RP2

Created on: 2020-01-29

1/3 Octave values marked with brackets [ ] denote less than 3 dB difference between Turbine ON and Background

Overall levels marked with an asterisk * denote 3 to 6 dB difference between Turbine ON and Background, while Overall values with less than 3 dB difference between Turbine ON and Background are not reported

Wind Bin (m/s)	Parameter	1/3 Octave Band (Hz)																													Overall
		20	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	
8.0	Turbine ON (dBA)	10.6	15.3	19.0	23.0	26.2	30.4	31.7	33.3	35.1	36.7	38.7	40.5	40.5	41.4	43.2	43.8	44.4	44.9	43.4	42.6	40.5	43.0	40.1	33.4	28.7	24.3	20.6	17.9	53.9
	Background (dBA)	3.3	7.1	10.4	13.2	16.2	21.2	24.2	22.7	24.8	26.8	28.4	27.0	27.7	26.2	29.1	29.7	31.3	32.3	33.0	34.0	33.3	34.2	32.8	28.8	25.2	23.2	21.4	19.4	43.3
	Turbine ON - background adj (dBA)	9.7	14.6	18.4	22.5	25.7	29.9	30.8	32.9	34.7	36.3	38.3	40.3	40.3	41.3	43.0	43.7	44.1	44.7	43.0	42.0	39.5	42.4	39.2	31.5	26.1	[21.3]	[17.6]	[14.9]	53.5
	Signal to noise (dB)	7.3	8.2	8.6	9.8	9.9	9.3	7.5	10.5	10.3	9.9	10.3	13.4	12.8	15.2	14.0	14.1	13.0	12.6	10.4	8.6	7.1	8.9	7.3	4.6	3.5	1.1	-0.8	-1.5	10.6
	Uncertainty (dB)	2.5	2.0	1.3	1.7	1.2	1.1	1.2	1.0	1.0	1.0	0.8	0.8	0.8	0.7	0.7	0.8	0.7	0.8	0.9	1.0	1.3	1.2	1.7	2.7	3.4	4.0	5.1	5.9	0.9
	PWL (dBA)	60.2	65.2	68.9	73.0	76.2	80.4	81.4	83.4	85.2	86.8	88.8	90.8	90.8	91.8	93.5	94.2	94.7	95.2	93.5	92.5	90.1	93.0	89.8	82.1	76.7	[71.8]	[68.2]	[65.5]	104.0
8.5	Turbine ON (dBA)	11.9	16.7	20.7	24.5	27.9	31.4	33.5	36.0	36.1	37.6	39.3	41.2	41.6	42.7	44.7	45.4	46.1	46.8	45.2	44.2	41.8	43.3	42.4	33.7	28.1	22.7	15.0	10.8	55.3
	Background (dBA)	1.5	6.5	9.7	12.8	15.9	19.3	20.8	22.5	25.2	26.4	30.9	37.3	35.6	33.6	32.1	30.5	30.8	31.3	31.5	32.2	31.3	31.8	30.2	25.9	21.8	19.1	16.7	14.6	44.3
	Turbine ON - background adj (dBA)	11.5	16.3	20.4	24.2	27.6	31.2	33.3	35.8	35.8	37.3	38.6	38.9	40.3	42.1	44.4	45.3	46.0	46.6	45.0	43.9	41.4	42.9	42.1	33.0	26.9	20.1	[12]	[7.8]	55.0
	Signal to noise (dB)	10.5	10.3	11.0	11.7	12.0	12.2	12.8	13.5	11.0	11.2	8.3	3.9	6.0	9.1	12.6	14.9	15.3	15.5	13.7	12.0	10.5	11.4	12.1	7.9	6.2	3.5	-1.6	-3.8	11.1
	Uncertainty (dB)	2.1	1.7	1.1	1.6	1.1	1.0	0.8	1.0	0.9	0.9	0.8	2.3	1.2	0.8	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.9	1.1	1.3	1.4	2.2	3.2	3.8	0.8
	PWL (dBA)	62.1	66.8	70.9	74.7	78.1	81.7	83.8	86.4	86.3	87.8	89.1	89.4	90.8	92.6	94.9	95.8	96.5	97.2	95.5	94.5	92.0	93.5	92.6	83.5	77.4	70.7	[62.6]	[58.4]	105.5
9.0	Turbine ON (dBA)	12.6	18.4	21.5	25.3	28.8	32.0	34.3	36.4	36.8	38.2	39.8	41.6	42.0	43.4	45.4	46.3	47.0	47.7	46.2	45.1	42.8	43.2	43.4	34.7	28.4	23.0	15.3	11.0	56.1
	Background (dBA)	3.8	8.2	11.5	14.8	17.3	20.0	21.6	22.8	25.6	27.9	30.6	33.6	33.3	30.7	30.9	30.8	32.2	33.1	33.9	35.1	34.6	35.6	34.3	30.2	26.5	23.7	21.0	18.9	44.9
	Turbine ON - background adj (dBA)	12.0	18.0	21.0	24.9	28.5	31.7	34.0	36.2	36.5	37.8	39.2	40.9	41.4	43.1	45.3	46.2	46.9	47.5	46.0	44.7	42.1	42.4	42.8	32.9	[25.4]	[20]	[12.3]	[8]	55.8
	Signal to noise (dB)	8.8	10.2	9.9	10.5	11.5	12.0	12.7	13.6	11.3	10.3	9.2	8.1	8.8	12.6	14.5	15.5	14.8	14.6	12.3	10.1	8.2	7.6	9.1	4.5	1.9	-0.8	-5.7	-7.9	11.2
	Uncertainty (dB)	2.3	1.8	1.2	1.7	1.1	1.0	0.9	1.0	0.9	0.9	0.8	0.9	0.8	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.9	1.1	1.3	2.0	2.7	2.6	3.1	3.8	0.8
	PWL (dBA)	62.5	68.5	71.6	75.4	79.0	82.2	84.6	86.7	87.0	88.3	89.8	91.4	92.0	93.7	95.8	96.7	97.4	98.1	96.5	95.2	92.6	92.9	93.4	83.4	[76]	[70.5]	[62.8]	[58.5]	106.3
9.5	Turbine ON (dBA)	13.4	19.5	22.7	26.1	29.5	32.7	35.5	36.3	38.1	39.3	41.0	42.6	42.7	43.7	45.5	46.3	46.9	47.5	46.1	45.0	42.9	43.5	43.5	36.0	31.7	27.3	31.6	31.0	56.3
	Background (dBA)	2.0	6.6	10.2	13.6	16.8	20.1	21.5	22.3	27.6	29.2	26.9	26.6	27.1	26.1	29.2	29.8	31.4	31.8	31.9	32.6	31.7	32.4	30.8	26.8	23.1	21.1	19.5	17.4	42.3
	Turbine ON - background adj (dBA)	13.1	19.2	22.4	25.8	29.3	32.5	35.3	36.1	37.7	38.9	40.9	42.5	42.6	43.6	45.4	46.2	46.8	47.4	46.0	44.7	42.5	43.2	43.2	35.4	31.0	26.1	31.3	30.8	56.1
	Signal to noise (dB)	11.4	12.8	12.5	12.5	12.7	12.6	14.0	14.0	10.5	10.1	14.1	16.0	15.6	17.5	16.3	16.5	15.6	15.8	14.3	12.4	11.1	11.2	12.7	9.2	8.5	6.2	12.0	13.6	14.0
	Uncertainty (dB)	2.1	1.7	1.1	1.6	1.1	1.0	0.9	0.9	1.0	1.0	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.9	1.1	1.3	1.5	2.1	4.3	5.2	0.8
	PWL (dBA)	63.6	69.8	73.0	76.4	79.8	83.0	85.9	86.7	88.2	89.4	91.4	93.1	93.1	94.1	96.0	96.7	97.4	97.9	96.5	95.2	93.0	93.7	93.8	85.9	81.5	76.6	81.8	81.3	106.7
10.0	Turbine ON (dBA)	14.2	21.0	23.0	26.8	30.3	33.7	36.5	37.0	38.7	39.6	41.0	42.4	42.7	43.1	44.9	45.3	46.2	46.6	45.6	44.6	43.0	43.3	42.7	36.4	38.3	35.6	43.9	43.9	56.4
	Background (dBA)	3.1	7.7	10.6	13.6	16.7	20.1	21.4	24.8	27.9	26.6	27.5	27.4	27.4	26.4	29.2	29.6	31.1	32.0	32.4	33.4	32.6	33.3	31.8	27.9	24.1	21.8	19.5	17.2	42.8
	Turbine ON - background adj (dBA)	13.9	20.8	22.8	26.6	30.1	33.5	36.4	36.7	38.3	39.4	40.8	42.3	42.5	43.1	44.8	45.2	46.0	46.4	45.4	44.2	42.6	42.9	42.3	35.7	38.2	35.4	43.9	43.9	56.2
	Signal to noise (dB)	11.1	13.3	12.4	13.2	13.6	13.7	15.1	12.1	10.8	13.0	13.4	15.0	15.2	16.8	15.7	15.8	15.1	14.6	13.2	11.2	10.4	10.1	10.9	8.5	14.2	13.8	24.4	26.7	13.7
	Uncertainty (dB)	2.1	1.7	1.2	1.6	1.1	1.0	0.9	1.0	1.0	0.9	0.8	0.8	0.8	0.7	0.7	0.8	0.8	0.9	0.9	0.9	0.8	1.0	1.2	1.3	1.8	2.2	4.3	5.0	1.3
	PWL (dBA)	64.4	71.3	73.3	77.1	80.7	84.1	86.9	87.2	88.9	89.9	91.3	92.8	93.1	93.6	95.3	95.8	96.6	96.9	95.9	94.8	93.1	93.4	92.9	86.3	88.7	86.0	94.5	94.4	106.8
10.5	Turbine ON (dBA)	14.4	23.7	23.3	26.9	30.5	33.8	37.5	36.8	38.1	39.1	40.9	42.2	42.0	42.5	44.2	44.7	45.4	45.8	45.1	44.4	42.8	42.9	41.9	35.5	39.8	37.3	46.1	45.9	56.4
	Background (dBA)	3.4	7.4	10.8	14.1	17.3	20.9	24.7	26.5	27.8	27.1	28.4	28.0	27.8	27.1	29.6	30.1	31.4	32.2	32.8	33.8	33.1	33.9	32.5	28.7	25.1	23.0	21.4	19.0	43.3
	Turbine ON - background adj (dBA)	14.0	23.5	23.0	26.7	30.3	33.5	37.3	36.4	37.6	38.8	40.7	42.0	41.8	42.4	44.0	44.6	45.3	45.6	44.8	44.0	42.3	42.3	41.4	34.5	39.7	37.2	46.1	45.9	56.1
	Signal to noise (dB)	11.0	16.3	12.5	12.9	13.2	12.9	12.9	10.3	10.2	12.0	12.5	14.2	14.2	15.4	14.6	14.7	14.0	13.6	12.3	10.6	9.7	9.0	9.4	6.7	14.7	14.3	24.7	26.8	13.0
	Uncertainty (dB)	2.1	1.8	1.2	1.6	1.1	1.0	1.0	1.0	1.0	1.0	1.0	0.9	0.8	0.8	0.8	0.8	0.9	1.0	1.0	0.9	0.9	1.0	1.3	1.5	2.0	2.4	4.5	5.2	1.7
	PWL (dBA)	64.6	74.1	73.5	77.2	80.8	84.1	87.8	86.9	88.2	89.3	91.2	92.5	92.4	92.9	94.5	95.1	95.8	96.1	95.4	94.6	92.8	92.9	91.9	85.0	90.2	87.7	96.7	96.4	106.7
11.0	Turbine ON (dBA)	13.8	22.1	23.0	26.9	30.5	33.8	37.2	37.1	38.5	39.2	40.4	41.6	42.0	42.3	44.0	44.4	45.6	45.7	45.3	44.6	43.2	42.9	41.0	35.9	36.4	33.6	41.2	40.9	55.6
	Background (dBA)	3.5	8.1	11.4	14.3	17.5	20.3	22.2	28.5	27.5	28.0	29.7	28.8	28.6	27.4	29.9	30.3	31.7	32.7	33.4	34.5	34.0	35.0	34.0	30.7	27.5	24.6	22.4	19.2	44.2
	Turbine ON - background adj (dBA)	13.4	21.9	22.7	26.7	30.2	33.6	37.1	36.4	38.1	38.8	40.0	41.4	41.7	42.2	43.9	44.2	45.4	45.5	45.0	44.1	42.6	42.1	40.1	34.3	35.9	33.0	41.1	40.9	55.3
	Signal to noise (dB)	10.3	13.9	11.6	12.7	12.9	13.5	15.0	8.5	11.0	11.1	10.7	12.8	13.3	14.9	14.1	14.1	13.8	13.0	11.9	10.1	9.2	7.9	7.0	5.2	9.0	9.0	18.8	21.7	11.5
	Uncertainty (dB)	2.0	1.6	1.1	1.5	1.0	0.9	0.8	0.9	0.9	0.9	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.8	0.9	0.8	0.8	0.9	1.3	1.6	1.4	1.4	2.1	2.4	0.9
	PWL (dBA)	63.9	72.4	73.2	77.2	80.8	84.1	87.6	87.0	88.6	89.4	90.5	91.9	92.3	92.7	94.4	94.8	95.9	96.0	95.5	94.7	93.1	92.6	90.6	84.9	86.4	83.5	91.7	91.4	105.8
11.5	Turbine ON (dBA)	14.0	22.7	22.9	26.9	30.4	33.9	37.1	37.2	38.4	39.0	39.8	41.1	41.6	42.0	43.8	44.2	45.2	45.4	45.1	44.6	43.3	43.0	41.0	36.0	37.3	34.8	42.3	42.2	55.6
	Background (dBA)	3.1	7.7	11.3	14.1	17.2	20.7	22.9	29.6	26.6	27.9	28.5	28.1	27.9	27.4	29.7	30.1	31.7	32.5	33.1	34.1	33.5	34.3	33.1	29.7	26.7	23.8	22.1	18.9	43.7
	Turbine ON - background adj (dBA)	13.6	22.5	22.6	26.6	30.2	33.7	37.0	36.4	38.2	38.7	39.5	40.9	41.4	41.9	43.6	44.0	45.1	45.2	44.8	44.2	42.8	42.4	40.2	34.8	36.9	34.5	42.3	42.2	55.3
	Signal to noise (dB)	10.9	14.9	11.6	12.7	13.3	13.2	14.2	7.6	11.8	11.1	11.3	13.0	13.7	14.6	14.0	14.1	13.6	12.9	12.0	10.5	9.8	8.8	7.8	6.3	10.6	11.0	20.3	23.3	11.9
	Uncertainty (dB)	2.2	1.8	1.2	1.6	1.1	1.0	0.9	1.1	0.9	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.9	0.9	0.8	1.0	1.3	1.5	1.4	1.5	2.4	2.7	1.0
	PWL (dBA)	64.1	73.0	73.1	77.2	80.8	84.2	87.5	86.9	88.7	89.2	90.0	91.4	92.0	92.4	94.1	94.5	95.6	95.7	95.3	94.7	93.3	93.0	90.7	85.4	87.4	85.0	92.8	92.7	105.8

Table C.01 Detailed apparent sound power level data at hub height

Project: South Branch Wind Farm - Turbine T07 - IEC 61400-11 Measurement

Report ID: 13350.02.T07.RP2

Created on: 2020-01-29

1/3 Octave values marked with brackets [ ] denote less than 3 dB difference between Turbine ON and Background

Overall levels marked with an asterisk * denote 3 to 6 dB difference between Turbine ON and Background, while Overall values with less than 3 dB difference between Turbine ON and Background are not reported

Wind Bin (m/s)	Parameter	1/3 Octave Band (Hz)																													Overall
		20	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	
12.0	Turbine ON (dBA)	13.6	22.2	22.8	26.7	30.2	33.7	37.0	36.9	38.2	39.0	41.0	42.3	41.9	42.1	43.7	44.2	45.5	45.7	45.6	45.0	43.6	43.4	41.5	36.8	36.3	33.5	40.4	40.0	55.7
	Background (dBA)	2.2	7.5	10.3	13.3	16.1	20.5	21.0	23.1	26.2	27.4	28.0	27.9	27.7	27.0	29.5	29.9	31.3	32.2	33.0	34.0	33.3	34.0	32.6	28.9	25.4	22.5	20.6	17.3	43.3
	Turbine ON - background adj (dBA)	13.3	22.0	22.5	26.5	30.0	33.5	36.9	36.8	37.9	38.7	40.8	42.1	41.7	41.9	43.5	44.0	45.4	45.5	45.3	44.6	43.2	42.9	40.8	36.0	35.9	33.1	40.3	40.0	55.4
	Signal to noise (dB)	11.4	14.7	12.4	13.4	14.1	13.2	16.0	13.9	12.0	11.6	13.0	14.4	14.1	15.0	14.2	14.3	14.2	13.5	12.6	11.0	10.3	9.4	8.8	7.8	11.0	11.0	19.8	22.8	12.4
	Uncertainty (dB)	2.1	1.7	1.1	1.6	1.1	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.8	0.7	0.8	0.8	0.8	0.9	0.9	0.8	1.0	1.3	1.4	1.2	1.3	1.9	2.3	0.9
	PWL (dBA)	63.8	72.5	73.0	77.0	80.6	84.1	87.4	87.3	88.4	89.2	91.3	92.7	92.2	92.4	94.1	94.6	95.9	96.1	95.9	95.2	93.7	93.4	91.4	86.5	86.5	83.6	90.9	90.5	106.0
12.5	Turbine ON (dBA)	13.8	22.3	23.0	27.0	30.5	34.2	37.4	37.3	38.5	38.9	39.6	41.0	41.4	41.8	43.7	44.3	45.6	45.9	46.0	45.6	44.3	44.1	42.3	37.7	35.3	32.6	36.9	36.4	55.7
	Background (dBA)	3.2	8.3	11.4	14.8	17.7	21.0	25.4	28.1	28.4	29.4	29.4	28.7	28.6	28.0	30.1	30.6	32.2	33.0	33.8	34.9	34.3	35.0	33.8	30.3	26.9	23.8	21.9	18.8	44.4
	Turbine ON - background adj (dBA)	13.4	22.1	22.7	26.7	30.3	33.9	37.1	36.7	38.1	38.4	39.2	40.7	41.1	41.6	43.5	44.1	45.4	45.7	45.7	45.2	43.9	43.6	41.6	36.8	34.7	32.0	36.8	36.3	55.4
	Signal to noise (dB)	10.7	13.9	11.6	12.2	12.8	13.1	12.0	9.2	10.2	9.5	10.2	12.3	12.8	13.8	13.6	13.7	13.4	12.9	12.1	10.7	10.0	9.1	8.5	7.5	8.4	8.8	15.1	17.6	11.3
	Uncertainty (dB)	2.1	1.7	1.1	1.6	1.1	1.0	0.9	1.0	0.9	0.9	0.8	0.8	0.8	0.8	0.7	0.8	0.8	0.8	0.9	0.8	0.8	1.0	1.3	1.4	1.3	1.4	2.0	2.4	0.9
	PWL (dBA)	64.0	72.6	73.2	77.3	80.8	84.5	87.7	87.2	88.6	88.9	89.7	91.3	91.7	92.2	94.0	94.6	95.9	96.2	96.2	95.7	94.4	94.1	92.2	87.4	85.2	82.5	87.3	86.9	105.9

Table C.02 Detailed apparent sound power level data at 10m height

Project: South Branch Wind Farm - Turbine T07 - IEC 61400-11 Measurement

Report ID: 13350.02.T07.RP2

Created on: 2020-01-29

1/3 Octave values marked with brackets [ ] denote less than 3 dB difference between Turbine ON and Background

Overall levels marked with an asterisk * denote 3 to 6 dB difference between Turbine ON and Background, while Overall values with less than 3 dB difference between Turbine ON and Background are not reported

Wind Bin (m/s)	Parameter	1/3 Octave Band (Hz)																													Overall
		20	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	
5.0	Turbine ON (dBA)	7.0	11.3	15.5	19.0	22.6	29.8	28.0	29.9	32.1	34.1	36.8	38.9	38.7	39.1	40.4	40.7	41.2	41.6	40.1	39.6	38.2	40.7	35.7	29.8	25.5	19.4	21.8	23.2	51.1
	Background (dBA)	2.1	6.4	9.1	11.6	15.3	18.6	19.5	23.6	24.0	25.5	27.4	26.7	28.2	28.7	29.9	30.5	32.1	32.5	32.1	32.2	30.4	30.2	27.6	22.7	18.0	16.1	14.7	12.8	41.9
	Turbine ON - background adj (dBA)	5.3	9.7	14.4	18.1	21.7	29.5	27.3	28.8	31.3	33.5	36.3	38.6	38.3	38.6	40.0	40.3	40.6	41.0	39.4	38.7	37.4	40.3	34.9	28.9	24.7	16.7	20.9	22.8	50.5
	Signal to noise (dB)	4.9	5.0	6.4	7.3	7.3	11.2	8.4	6.3	8.1	8.6	9.4	12.2	10.6	10.4	10.5	10.2	9.1	9.1	8.0	7.3	7.8	10.6	8.0	7.1	7.5	3.3	7.1	10.4	9.2
	Uncertainty (dB)	3.3	2.7	1.5	2.0	1.4	1.1	1.0	1.6	1.1	1.0	0.9	0.8	0.8	0.9	0.8	0.9	0.9	1.0	1.3	1.3	1.2	1.0	1.3	1.3	1.2	1.6	2.0	2.5	1.0
	PWL (dBA)	55.8	60.2	64.9	68.6	72.2	80.0	77.8	79.3	81.9	84.0	86.8	89.2	88.9	89.2	90.6	90.8	91.1	91.5	89.9	89.2	88.0	90.9	85.5	79.4	75.2	67.3	71.4	73.3	101.1
6.0	Turbine ON (dBA)	12.0	17.4	20.8	24.6	28.0	31.6	33.6	35.6	36.4	37.9	39.6	41.4	41.6	42.6	44.5	45.3	46.0	46.6	45.1	44.1	41.9	43.2	42.1	34.3	29.4	24.7	24.7	23.7	55.3
	Background (dBA)	3.1	7.5	10.9	14.1	16.8	20.2	21.9	22.5	25.2	27.2	30.2	34.4	33.4	31.2	30.9	30.4	31.6	32.4	33.0	34.1	33.5	34.4	33.1	29.0	25.3	22.6	20.1	18.0	44.4
	Turbine ON - background adj (dBA)	11.5	17.0	20.3	24.2	27.6	31.3	33.3	35.4	36.1	37.5	39.1	40.4	40.9	42.3	44.4	45.2	45.8	46.4	44.9	43.7	41.2	42.5	41.6	32.7	27.3	[21.7]	22.8	22.3	54.9
	Signal to noise (dB)	9.0	9.9	9.9	10.5	11.1	11.4	11.8	13.1	11.2	10.6	9.4	7.0	8.2	11.4	13.6	14.9	14.4	14.2	12.1	10.0	8.3	8.8	9.1	5.3	4.2	2.1	4.6	5.7	10.9
	Uncertainty (dB)	2.1	1.7	1.1	1.6	1.1	1.0	0.9	0.9	0.9	0.9	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.9	1.2	1.4	1.5	2.4	2.5	2.9	0.8
	PWL (dBA)	62.0	67.5	70.9	74.7	78.2	81.8	83.9	85.9	86.6	88.0	89.6	90.9	91.4	92.9	94.9	95.7	96.4	97.0	95.4	94.2	91.7	93.1	92.1	83.3	77.8	[72.3]	73.3	72.8	105.5
7.0	Turbine ON (dBA)	14.0	21.6	23.0	26.7	30.2	33.5	36.6	36.7	38.3	39.3	40.9	42.3	42.4	43.1	44.9	45.5	46.2	46.6	45.6	44.6	42.9	43.3	42.8	36.1	37.9	35.2	43.6	43.4	56.4
	Background (dBA)	3.0	7.4	10.6	13.8	17.0	20.4	23.2	25.3	27.9	27.7	27.9	27.6	27.6	26.7	29.4	29.8	31.3	32.1	32.5	33.5	32.7	33.4	32.0	28.1	24.5	22.3	20.5	18.2	43.0
	Turbine ON - background adj (dBA)	13.7	21.4	22.7	26.4	29.9	33.2	36.4	36.4	37.9	39.0	40.7	42.2	42.3	43.0	44.7	45.3	46.0	46.5	45.4	44.3	42.5	42.8	42.4	35.3	37.7	34.9	43.6	43.4	56.2
	Signal to noise (dB)	11.0	14.2	12.4	12.8	13.2	13.1	13.4	11.4	10.4	11.6	13.0	14.8	14.9	16.4	15.5	15.6	14.9	14.6	13.1	11.2	10.2	9.9	10.8	7.9	13.4	12.9	23.1	25.2	13.4
	Uncertainty (dB)	2.2	1.7	1.1	1.6	1.1	1.0	0.9	0.9	0.9	0.9	0.8	0.8	0.7	0.7	0.7	0.8	0.8	0.8	0.9	0.8	0.8	0.9	1.2	1.3	1.5	1.7	3.2	3.7	1.1
	PWL (dBA)	64.2	72.0	73.3	77.0	80.5	83.8	86.9	86.9	88.4	89.6	91.2	92.7	92.8	93.5	95.3	95.9	96.6	97.0	95.9	94.8	93.0	93.4	93.0	85.9	88.2	85.5	94.1	93.9	106.7
8.0	Turbine ON (dBA)	13.7	22.2	22.8	26.7	30.3	33.7	37.0	37.0	38.3	39.1	40.6	41.9	41.9	42.2	43.9	44.3	45.5	45.6	45.3	44.7	43.4	43.2	41.3	36.4	36.7	34.0	41.4	41.1	55.7
	Background (dBA)	2.9	7.7	11.0	13.9	16.9	20.4	22.1	28.1	26.7	27.7	28.8	28.3	28.1	27.3	29.7	30.1	31.6	32.5	33.2	34.2	33.6	34.4	33.3	29.8	26.6	23.8	21.8	18.6	43.7
	Turbine ON - background adj (dBA)	13.4	22.0	22.5	26.5	30.1	33.5	36.8	36.4	38.0	38.7	40.3	41.7	41.7	42.0	43.7	44.1	45.3	45.4	45.1	44.3	42.9	42.6	40.6	35.3	36.3	33.6	41.3	41.1	55.4
	Signal to noise (dB)	10.8	14.4	11.8	12.9	13.4	13.3	14.9	8.9	11.5	11.3	11.8	13.6	13.8	14.9	14.1	14.2	13.9	13.2	12.2	10.6	9.8	8.7	8.0	6.5	10.1	10.3	19.6	22.5	11.9
	Uncertainty (dB)	2.0	1.6	1.1	1.5	1.1	0.9	0.8	0.9	0.8	0.9	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.9	1.2	1.3	1.1	1.2	1.6	1.9	0.9
	PWL (dBA)	63.9	72.5	73.1	77.0	80.6	84.0	87.4	86.9	88.5	89.3	90.8	92.2	92.2	92.6	94.2	94.6	95.8	96.0	95.6	94.9	93.4	93.1	91.1	85.8	86.8	84.1	91.9	91.6	105.9
9.0	Turbine ON (dBA)	13.8	22.4	23.0	26.9	30.4	34.0	37.4	37.2	38.5	38.9	39.7	41.1	41.4	41.9	43.8	44.4	45.9	46.2	46.3	45.8	44.6	44.3	42.5	38.0	35.5	32.6	36.9	36.3	55.9
	Background (dBA)	3.9	8.9	12.3	15.8	19.0	22.4	25.3	27.7	30.3	30.2	30.0	30.0	29.6	28.3	30.4	31.1	32.6	33.3	34.3	35.5	35.2	36.2	35.2	31.8	28.2	25.2	22.9	19.4	45.2
	Turbine ON - background adj (dBA)	13.4	22.2	22.6	26.6	30.1	33.7	37.1	36.7	37.7	38.3	39.2	40.7	41.1	41.7	43.6	44.2	45.7	46.0	46.0	45.4	44.0	43.6	41.6	36.8	34.6	31.7	36.7	36.2	55.5
	Signal to noise (dB)	10.0	13.5	10.7	11.1	11.4	11.6	12.0	9.5	8.2	8.8	9.7	11.0	11.8	13.6	13.3	13.3	13.3	12.9	12.0	10.4	9.3	8.2	7.3	6.2	7.3	7.3	14.0	16.9	10.7
	Uncertainty (dB)	2.1	1.6	1.1	1.6	1.1	1.0	0.8	0.9	0.9	0.9	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	1.0	1.3	1.4	1.2	1.3	1.6	1.9	0.8
	PWL (dBA)	63.9	72.7	73.1	77.1	80.6	84.2	87.6	87.3	88.3	88.8	89.7	91.2	91.7	92.2	94.1	94.7	96.2	96.5	96.6	96.0	94.5	94.1	92.1	87.3	85.1	82.2	87.3	86.8	106.0

Table C.03 Type B measurement uncertainty summary

Overall Equipment Uncertainties	Typical values	Used values
Calibration	0.2 dB	0.2 dB
Board	0.3 dB	0.3 dB
Distance	0.1 dB	0.1 dB
Air absorption	0 dB	0 dB
Weather	0.5 dB	0.5 dB

1/3 Octave Band Uncertainties		
Frequency (Hz)	Microphone Uncertainty	Overall (including overall equipment Uncertainties)
20	0.8 dB	2 dB
25	0.8 dB	1.6 dB
31.5	0.5 dB	1.1 dB
40	0.5 dB	1.5 dB
50	0.5 dB	1.1 dB
63	0.5 dB	0.9 dB
80	0.5 dB	0.8 dB
100	0.5 dB	0.8 dB
125	0.5 dB	0.8 dB
160	0.5 dB	0.8 dB
200	0.3 dB	0.7 dB
250	0.3 dB	0.7 dB
315	0.3 dB	0.7 dB
400	0.3 dB	0.7 dB
500	0.3 dB	0.7 dB
630	0.3 dB	0.7 dB
800	0.3 dB	0.7 dB
1000	0.3 dB	0.8 dB
1250	0.3 dB	0.8 dB
1600	0.3 dB	0.8 dB
2000	0.3 dB	0.7 dB
2500	0.5 dB	0.8 dB
3150	0.5 dB	1.1 dB
4000	0.5 dB	1.1 dB
5000	0.5 dB	1 dB
6300	0.5 dB	1.1 dB
8000	0.5 dB	1.4 dB
10000	1.3 dB	1.7 dB

Table C.04 Detailed measurement uncertainty at hub height

Project: South Branch Wind Farm - Turbine T07 - IEC 61400-11 Measurement

Report ID: 13350.02.T07.RP2

Created on: 2020-02-06

Wind Bin (m/s)	Parameter	Average Wind Speed (m/s)	# of data points	Parameter	1/3 Octave Band (Hz)																													Overall
					20	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	
8.0	Turbine ON	8.01	25	Average (dBA)	10.6	15.4	19.1	23.0	26.2	30.5	31.7	33.3	35.1	36.7	38.7	40.5	40.5	41.4	43.2	43.9	44.4	44.9	43.4	42.6	40.5	43.1	40.2	33.4	28.7	24.3	20.6	17.9	53.9
				Uncertainty A (dB)	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.3	0.3	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.4	0.5	0.5	0.9	1.6	1.8	
				Uncertainty B (dB)	2.0	1.6	1.1	1.5	1.1	0.9	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.7	0.8	1.1	1.1	1.0	1.1	1.4	1.7	
				Combined Uncertainty (dB)	2.0	1.7	1.1	1.6	1.1	1.0	0.9	0.9	0.9	0.9	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.7	0.9	1.1	1.2	1.1	1.4	2.1	2.5	
	Background	8.06	10	Average (dBA)	3.0	7.0	10.3	13.1	16.2	20.9	23.8	22.7	24.9	26.7	28.7	28.3	28.7	27.2	29.5	29.8	31.3	32.2	32.8	33.8	33.1	33.9	32.5	28.4	24.8	22.7	20.8	18.8	43.2
				Uncertainty A (dB)	1.4	1.1	1.3	1.3	1.0	1.5	1.9	1.1	0.7	1.5	1.6	1.2	1.0	0.9	0.7	0.8	0.8	1.4	2.6	2.7	3.4	3.5	3.6	3.1	2.9	2.4	2.2	2.2		
				Uncertainty B (dB)	2.0	1.6	1.1	1.5	1.1	0.9	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.7	0.8	1.1	1.1	1.0	1.1	1.4	1.7		
				Combined Uncertainty (dB)	2.4	2.0	1.6	2.0	1.5	1.7	2.0	1.4	1.1	1.7	1.8	1.4	1.2	1.2	1.0	1.1	1.1	1.6	2.7	2.8	3.5	3.6	3.7	3.3	3.0	2.6	2.6	2.8		
8.5	Turbine ON	8.46	19	Average (dBA)	11.9	16.6	20.7	24.4	27.8	31.4	33.5	36.0	36.1	37.5	39.2	41.1	41.5	42.6	44.6	45.4	46.0	46.7	45.1	44.1	41.8	43.3	42.3	33.7	28.1	22.6	15.1	10.9	55.3
				Uncertainty A (dB)	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.5	0.3	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.3	0.2	0.2	0.3	0.5	0.5		
				Uncertainty B (dB)	2.0	1.6	1.1	1.5	1.1	0.9	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.7	0.8	1.1	1.1	1.0	1.1	1.4	1.7		
				Combined Uncertainty (dB)	2.0	1.7	1.1	1.6	1.1	1.0	0.8	1.0	0.9	0.9	0.7	0.8	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.7	0.8	1.1	1.1	1.0	1.1	1.4	1.8		
	Background	8.49	17	Average (dBA)	1.4	6.4	9.7	12.7	15.9	19.3	20.8	22.5	25.2	26.4	31.0	37.4	35.6	33.7	32.1	30.5	30.8	31.3	31.5	32.2	31.3	31.8	30.2	25.8	21.8	19.0	16.6	14.5	44.3
				Uncertainty A (dB)	0.9	0.6	0.8	0.8	0.7	0.6	0.6	0.6	0.6	1.0	1.5	2.7	2.1	2.0	1.1	0.7	0.5	0.9	1.8	1.8	2.3	2.4	2.5	2.1	1.8	1.3	1.0	1.0		
				Uncertainty B (dB)	2.0	1.6	1.1	1.5	1.1	0.9	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.7	0.8	1.1	1.1	1.0	1.1	1.4	1.7		
				Combined Uncertainty (dB)	2.2	1.8	1.3	1.7	1.2	1.1	1.0	1.0	1.0	1.3	1.7	2.8	2.3	2.1	1.3	1.0	0.9	1.2	2.0	1.9	2.4	2.5	2.7	2.4	2.0	1.7	1.7	2.0		
9.0	Turbine ON	8.98	16	Average (dBA)	12.5	18.4	21.4	25.2	28.8	32.0	34.2	36.4	36.8	38.2	39.7	41.6	42.0	43.4	45.4	46.3	47.0	47.7	46.2	45.1	42.8	43.2	43.4	34.7	28.3	22.8	14.7	10.3	56.1
				Uncertainty A (dB)	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.5	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.3	0.1	0.1	0.1	0.2	0.2		
				Uncertainty B (dB)	2.0	1.6	1.1	1.5	1.1	0.9	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.7	0.8	1.1	1.1	1.0	1.1	1.4	1.7		
				Combined Uncertainty (dB)	2.0	1.7	1.1	1.6	1.1	1.0	0.8	1.0	0.9	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.7	0.8	1.1	1.1	1.0	1.1	1.4	1.7		
	Background	9.04	28	Average (dBA)	4.0	8.3	11.7	15.0	17.4	20.0	21.7	22.8	25.6	28.0	30.5	33.3	33.1	30.5	30.8	30.8	32.3	33.3	34.1	35.3	34.9	35.9	34.6	30.6	26.9	24.2	21.4	19.2	45.1
				Uncertainty A (dB)	0.9	0.7	0.7	0.8	0.6	0.6	0.5	0.5	0.5	0.9	1.0	1.3	1.1	0.9	0.5	0.5	0.5	0.8	1.4	1.5	2.0	2.1	2.3	2.0	1.8	1.4	1.1	1.1		
				Uncertainty B (dB)	2.0	1.6	1.1	1.5	1.1	0.9	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.7	0.8	1.1	1.1	1.0	1.1	1.4	1.7		
				Combined Uncertainty (dB)	2.2	1.8	1.3	1.7	1.2	1.1	1.0	1.0	1.0	1.2	1.2	1.5	1.3	1.2	0.9	0.9	0.9	1.1	1.6	1.7	2.1	2.3	2.5	2.3	2.1	1.8	1.8	2.0		
9.5	Turbine ON	9.53	16	Average (dBA)	13.5	19.5	22.7	26.1	29.5	32.8	35.6	36.3	38.1	39.4	41.1	42.7	42.8	43.7	45.5	46.3	46.9	47.5	46.1	45.0	42.9	43.6	43.5	36.0	31.8	27.5	32.4	32.0	56.3
				Uncertainty A (dB)	0.4	0.3	0.3	0.2	0.3	0.3	0.3	0.4	0.4	0.3	0.4	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.4	0.9	1.2	4.0	5.0		
				Uncertainty B (dB)	2.0	1.6	1.1	1.5	1.1	0.9	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.7	0.8	1.1	1.1	1.0	1.1	1.4	1.7		
				Combined Uncertainty (dB)	2.0	1.7	1.1	1.5	1.1	1.0	0.9	0.9	0.9	0.9	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.9	1.1	1.1	1.4	1.6	4.3	5.2		
	Background	9.49	32	Average (dBA)	1.9	6.6	10.2	13.6	16.8	20.1	21.5	22.2	27.6	29.3	26.9	26.6	27.1	26.1	29.2	29.8	31.4	31.8	31.9	32.6	31.7	32.3	30.8	26.8	23.1	21.1	19.5	17.4	42.3
				Uncertainty A (dB)	0.6	0.5	0.5	0.6	0.6	0.6	0.6	0.5	0.9	1.1	0.6	0.4	0.3	0.4	0.3	0.3	0.4	0.6	1.0	1.1	1.4	1.6	1.6	1.5	1.3	1.1	1.1	1.1		
				Uncertainty B (dB)	2.0	1.6	1.1	1.5	1.1	0.9	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.7	0.8	1.1	1.1	1.0	1.1	1.4	1.7		
				Combined Uncertainty (dB)	2.1	1.7	1.2	1.6	1.2	1.1	1.0	1.0	1.2	1.4	0.9	0.8	0.8	0.8	0.8	0.8	0.8	1.0	1.3	1.3	1.6	1.8	2.0	1.8	1.7	1.6	1.7	2.1		
10.0	Turbine ON	9.99	22	Average (dBA)	14.2	21.0	23.0	26.8	30.3	33.7	36.5	37.0	38.7	39.6	41.0	42.4	42.7	43.2	44.9	45.4	46.2	46.6	45.6	44.6	43.0	43.3	42.7	36.4	38.3	35.6	43.9	43.8	56.4
				Uncertainty A (dB)	0.4	0.3	0.3	0.4	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.3	0.2	0.2	0.3	0.4	0.5	0.4	0.3	0.3	0.3	0.5	0.4	1.5	1.9	4.2	4.8		
				Uncertainty B (dB)	2.0	1.6	1.1	1.5	1.1	0.9	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.7	0.8	1.1	1.1	1.0	1.1	1.4	1.7		
				Combined Uncertainty (dB)	2.0	1.7	1.1	1.6	1.1	1.0	0.9	0.9	0.9	0.9	0.8	0.8	0.7	0.7	0.7	0.8	0.8	0.9	0.9	0.8	0.8	0.9	1.2	1.1	1.8	2.1	4.4	5.1		
	Background	9.97	49	Average (dBA)	3.1	7.7	10.6	13.6	16.7	20.0	21.2	24.7	27.9	26.6	27.5	27.4	27.4	26.3	29.2	29.5	31.1	32.0	32.3	33.4	32.6	33.2	31.7	27.8	24.1	21.7	19.4	17.1	42.7
				Uncertainty A (dB)	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.7	0.7	0.6	0.6	0.4	0.3	0.3	0.3	0.3	0.3	0.5	0.9	1.0	1.2	1.3	1.4	1.3	1.2	1.1	1.0	1.0		
				Uncertainty B (dB)	2.0	1.6	1.1	1.5	1.1	0.9	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.7	0.8	1.1	1.1	1.0	1.1	1.4	1.7		
				Combined Uncertainty (dB)	2.1	1.7	1.2	1.6	1.2	1.1	0.9	1.1	1.1	1.0	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.9	1.2	1.2	1.4	1.6	1.8	1.7	1.6	1.5	1.7	2.0		
10.5	Turbine ON	10.52	13	Average (dBA)	14.4	23.8	23.3	26.9	30.5	33.8	37.6	36.8	38.0	39.1	40.9	42.2	42.0	42.5	44.1	44.7	45.4	45.8	45.1	44.4	42.8	42.9	41.9	35.5	39.9	37.4	46.2	45.9	56.4
				Uncertainty A (dB)	0.4	0.7	0.5	0.4	0.4	0.4	0.6	0.4	0.4	0.4	0.7	0.6	0.4	0.4	0.4	0.4	0.5	0.6	0.6	0.5	0.4	0.3	0.5	0.5	1.8	2.2	4.5	5.1		
				Uncertainty B (dB)	2.0	1.6	1.1	1.5	1.1	0.9	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.7	0.8	1.1	1.1	1.0	1.1	1.4	1.7		
				Combined Uncertainty (dB)	2.0	1.8	1.2	1.6	1.1	1.0	1.0	0.9	0.9	0.9	1.0	0.9	0.8	0.8	0.8	0.8	0.8	0.9	1.0	1.0	0.9	0.8	1.2	1.2	2.0	2.4	4.7	5.3		
	Background	10.54	51	Average (dBA)	3.4	7.4	10.8	14.1	17.4	20.9	24.9	26.6	27.8	27.2	28.5	28.1	27.9	27.2	29.6	30.1	31.5	32.2	32.8	33.8	33.1	33.9	32.6	28.8	25.2	23.1	21.6	19.2	43.4
				Uncertainty A (dB)	0.6	0.4	0.5	0.6	0.5	0.6	0.8	0.8	0.7	0.6	0.6	0.4	0.3	0.3	0.3	0.3	0.3	0.5	0.8	0.9	1.2	1.3	1.4	1.4	1.3	1.2	1.1	1.2		
				Uncertainty B (dB)	2.0	1.6	1.1	1.5	1.1	0.9	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.7	0.8	1.1	1.1	1.0	1.1	1.4	1.7		
				Combined Uncertainty (dB)	2.1	1.7	1.2	1.6	1.2	1.1	1.1	1.2	1.1	1.0	0.9	0.8	0.8	0.8	0.7	0.8	0.8	0.9	1.2	1.2	1.4	1.5	1.8	1.7	1.6	1.6	1.8	2.1		
11.0	Turbine ON	11.07	23	Average (dBA)	13.8	21.9	23.0	26.9	30.5	33.8	37.2	37.1	38.5	39.2	40.3	41.5	42.0	42.3	44.0	44.4	45.6	45.7	45.3	44.6	43.2	42.9	40.9	35.9	35.9	33.0	40.5	40.2	55.6
				Uncertainty A (dB)	0.3	0.4	0.3	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.3	0.3	0.2	0.2	0.4	0.8	0.8	1.8	2.0		
				Uncertainty B (dB)	2.0	1.6	1.1	1.5	1.1	0.9	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.7	0.8	1.1	1.1	1.0	1.1	1.4	1.7		
				Combined Uncertainty (dB)	2.0	1.7	1.1	1.6	1.1	1.0	0.9	0.9	0.9	0.9	0.8	0.8	0.8	0.8	0.7	0.8	0.8	0.9	0.9	0.8	0.8	0.9	1.1	1.1	1.3	1.4	2.3	2.6		
	Background	10.99	51	Average (dBA)	3.5	8.2	11.4	14.3	17.5	20.3	22.2	28.5	27.5	28.0	29.7	28.8	28.6	27.4	29.9	30.3	31.7	32.7	33.4	34.5	34.0	35.0	34.0	30.7	27.5	24.6	22.4	19.2	44.2
				Uncertainty A (dB)	0.5	0.4	0.5	0.5	0.5	0.5	0.4	1.0	0.6	0.6	0.7	0.6	0.4	0.4	0.3	0.3	0.4	0.5	0.8	0.9	1.1	1.2	1.4	1.4	1.4	1.2	1.2	1.1		
				Uncertainty B (dB)	2.0	1.6	1.1	1.5	1.1	0.9	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.7	0.8	1.1	1.1	1.0	1.1	1.4	1.7		
				Combined Uncertainty (dB)	2.1	1.7	1.2	1.6	1.2	1.0	0.9	1.3	1.0	1.0	1.0	0.9	0.8	0.8	0.8	0.8	0.8	0.9	1.1	1.2	1.3	1.5	1.7	1.7	1.7	1.6	1.8	2.0		

Table C.04 Detailed measurement uncertainty at hub height

Project: South Branch Wind Farm - Turbine T07 - IEC 61400-11 Measurement

Report ID: 13350.02.T07.RP2

Created on: 2020-02-06

Wind Bin (m/s)	Parameter	Average Wind Speed (m/s)	# of data points	Parameter	1/3 Octave Band (Hz)																													Overall
					20	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	
11.5	Turbine ON	11.50	28	Average (dBA)	14.0	22.7	22.9	26.9	30.4	33.9	37.1	37.2	38.4	39.0	39.8	41.1	41.6	42.0	43.8	44.2	45.2	45.4	45.1	44.6	43.3	43.0	41.0	36.0	37.3	34.8	42.3	42.2	55.6
				Uncertainty A (dB)	0.2	0.5	0.2	0.2	0.3	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.3	0.8	0.8	1.9	2.1	
				Uncertainty B (dB)	2.0	1.6	1.1	1.5	1.1	0.9	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.7	0.8	1.1	1.1	1.0	1.1	1.4	1.7	
				Combined Uncertainty (dB)	2.0	1.7	1.1	1.5	1.1	1.0	0.9	0.9	0.9	0.9	0.8	0.8	0.7	0.8	0.7	0.7	0.8	0.8	0.8	0.8	0.7	0.8	1.1	1.1	1.3	1.3	2.3	2.7	
	Background	11.51	64	Average (dBA)	3.1	7.7	11.3	14.1	17.1	20.7	22.9	29.6	26.6	27.9	28.5	28.1	27.9	27.4	29.7	30.1	31.7	32.5	33.1	34.0	33.4	34.2	33.1	29.6	26.6	23.8	22.1	18.9	43.7
				Uncertainty A (dB)	0.5	0.4	0.5	0.5	0.5	0.5	0.5	1.0	0.4	0.6	0.5	0.4	0.3	0.3	0.3	0.3	0.3	0.4	0.6	0.7	0.9	1.0	1.1	1.2	1.2	1.1	1.1	1.0	
				Uncertainty B (dB)	2.0	1.6	1.1	1.5	1.1	0.9	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.7	0.8	1.1	1.1	1.0	1.1	1.4	1.7	
				Combined Uncertainty (dB)	2.0	1.7	1.2	1.6	1.2	1.1	1.0	1.3	0.9	1.0	0.9	0.8	0.8	0.8	0.7	0.8	0.8	0.9	1.0	1.0	1.2	1.3	1.5	1.6	1.6	1.5	1.7	2.0	
12.0	Turbine ON	11.99	44	Average (dBA)	13.6	22.1	22.8	26.7	30.2	33.7	37.0	36.9	38.2	39.0	41.0	42.3	41.9	42.1	43.7	44.2	45.5	45.7	45.6	45.0	43.6	43.4	41.4	36.7	36.3	33.5	40.5	40.1	55.7
				Uncertainty A (dB)	0.3	0.3	0.3	0.3	0.3	0.2	0.3	0.3	0.3	0.3	0.5	0.5	0.3	0.3	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.5	0.6	1.4	1.6	
				Uncertainty B (dB)	2.0	1.6	1.1	1.5	1.1	0.9	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.7	0.8	1.1	1.1	1.0	1.1	1.4	1.7	
				Combined Uncertainty (dB)	2.0	1.7	1.1	1.6	1.1	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.8	0.7	0.8	0.8	0.8	0.9	0.8	0.8	0.9	1.1	1.1	1.1	1.2	1.9	2.3	
	Background	12.04	52	Average (dBA)	2.1	7.5	10.3	13.3	16.1	20.5	20.9	22.6	26.2	27.4	28.0	27.9	27.7	27.0	29.5	29.9	31.3	32.2	32.9	34.0	33.3	34.0	32.6	28.9	25.3	22.4	20.5	17.2	43.2
				Uncertainty A (dB)	0.5	0.4	0.4	0.5	0.4	0.5	0.3	0.3	0.4	0.6	0.5	0.4	0.3	0.3	0.2	0.3	0.3	0.4	0.7	0.8	1.0	1.1	1.1	1.1	1.1	0.9	0.9	0.8	
				Uncertainty B (dB)	2.0	1.6	1.1	1.5	1.1	0.9	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.7	0.8	1.1	1.1	1.0	1.1	1.4	1.7	
				Combined Uncertainty (dB)	2.0	1.7	1.1	1.6	1.1	1.1	0.9	0.9	0.9	1.0	0.9	0.8	0.7	0.8	0.7	0.8	0.8	0.9	1.1	1.1	1.2	1.3	1.6	1.5	1.5	1.4	1.6	1.9	
12.5	Turbine ON	12.48	43	Average (dBA)	13.8	22.3	23.0	27.0	30.5	34.2	37.4	37.3	38.5	38.9	39.6	41.0	41.4	41.8	43.7	44.3	45.6	45.9	46.0	45.5	44.3	44.1	42.3	37.7	35.4	32.6	36.9	36.4	55.7
				Uncertainty A (dB)	0.3	0.2	0.3	0.3	0.2	0.2	0.2	0.3	0.3	0.2	0.3	0.3	0.2	0.2	0.2	0.2	0.3	0.3	0.2	0.2	0.2	0.2	0.3	0.4	0.5	0.6	1.5	1.8	
				Uncertainty B (dB)	2.0	1.6	1.1	1.5	1.1	0.9	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.7	0.8	1.1	1.1	1.0	1.1	1.4	1.7	
				Combined Uncertainty (dB)	2.0	1.7	1.1	1.5	1.1	1.0	0.9	0.9	0.9	0.9	0.7	0.8	0.7	0.8	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.9	1.1	1.1	1.1	1.2	2.0	2.5	
	Background	12.47	51	Average (dBA)	3.1	8.3	11.4	14.7	17.6	20.9	25.4	28.2	28.1	29.4	29.4	28.6	28.5	28.0	30.1	30.6	32.2	33.0	33.8	34.8	34.2	34.9	33.7	30.1	26.8	23.7	21.8	18.8	44.3
				Uncertainty A (dB)	0.4	0.4	0.4	0.5	0.5	0.5	0.8	0.9	0.5	0.6	0.6	0.4	0.3	0.3	0.2	0.3	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.0	1.0	0.9	
				Uncertainty B (dB)	2.0	1.6	1.1	1.5	1.1	0.9	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.7	0.8	1.1	1.1	1.0	1.1	1.4	1.7	
				Combined Uncertainty (dB)	2.0	1.7	1.1	1.6	1.2	1.1	1.2	1.2	1.0	1.0	0.9	0.8	0.8	0.8	0.7	0.8	0.8	0.8	1.0	1.0	1.0	1.2	1.4	1.5	1.5	1.4	1.7	1.9	

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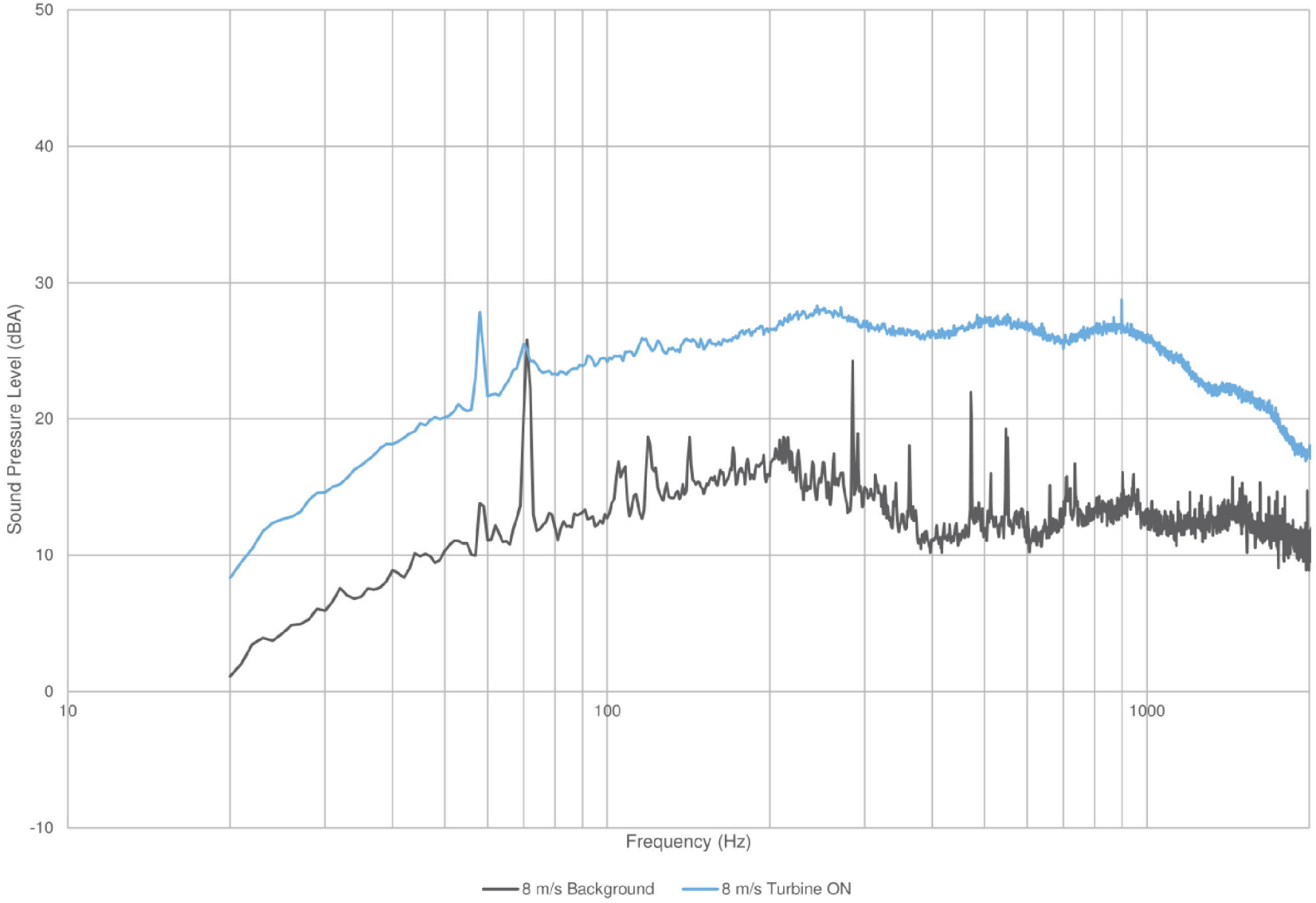
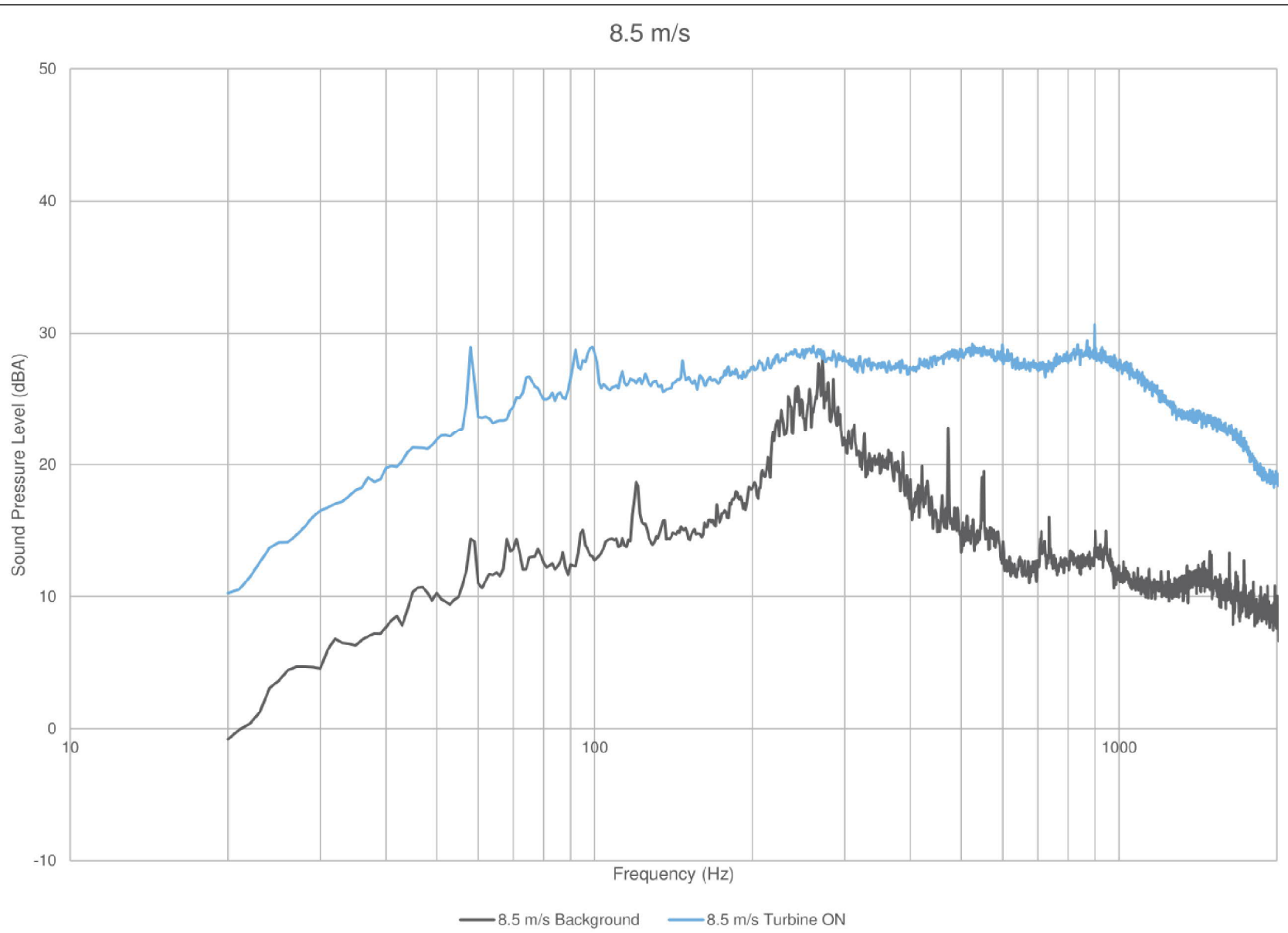
Appendix D
Tonality Assessment

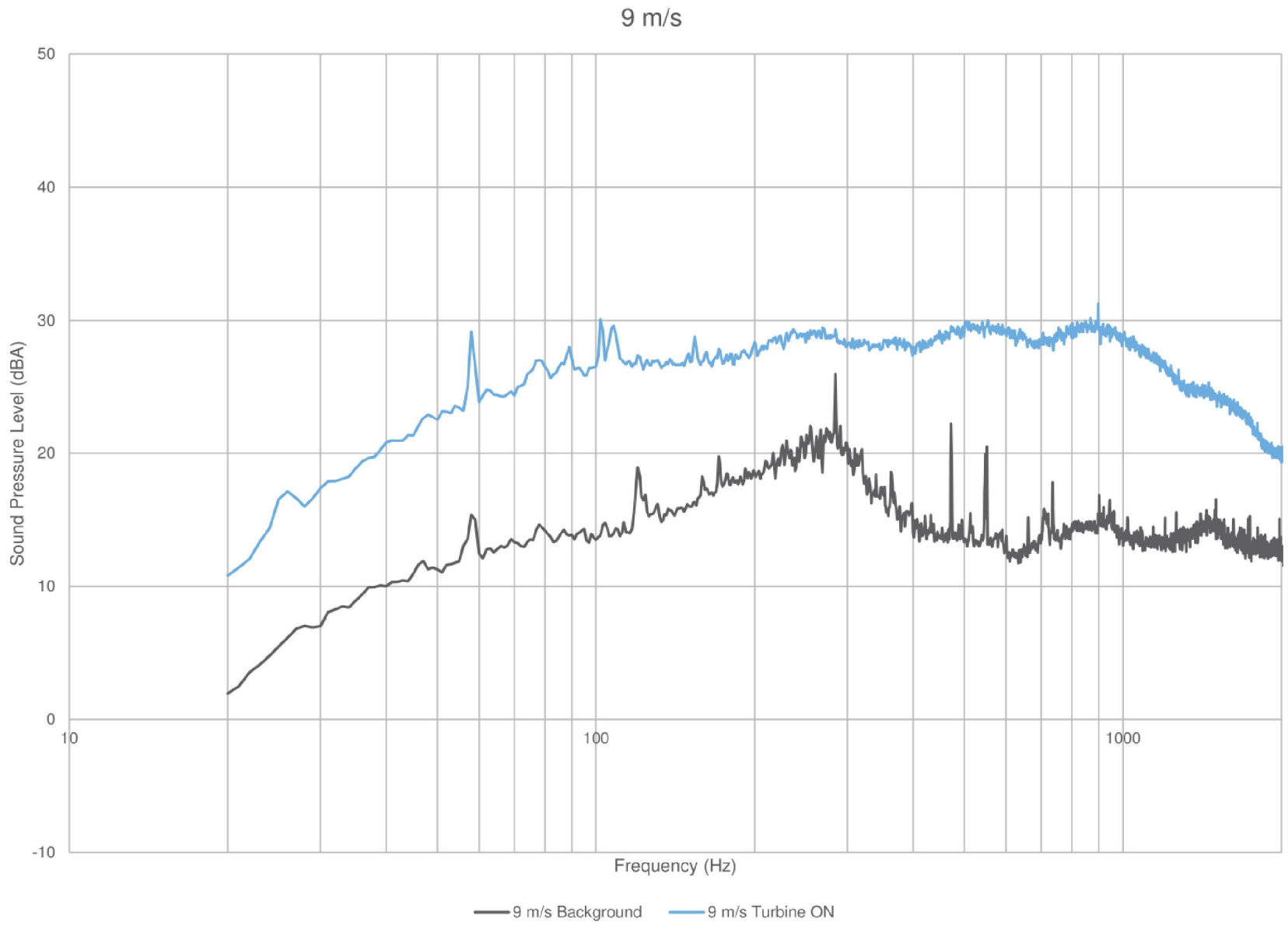


aercoustics	13350.02.T07.RP2 Scale: NTS Drawn by: DH Reviewed by: PA Date: Jan 2020 Revision: 1	**Project Name** South Branch Wind - IEC 61400-11 Edition 3.0 - Turbine T07 **Figure Title** Plot of narrowband spectra - Turbine ON vs. Background at 8 m/s

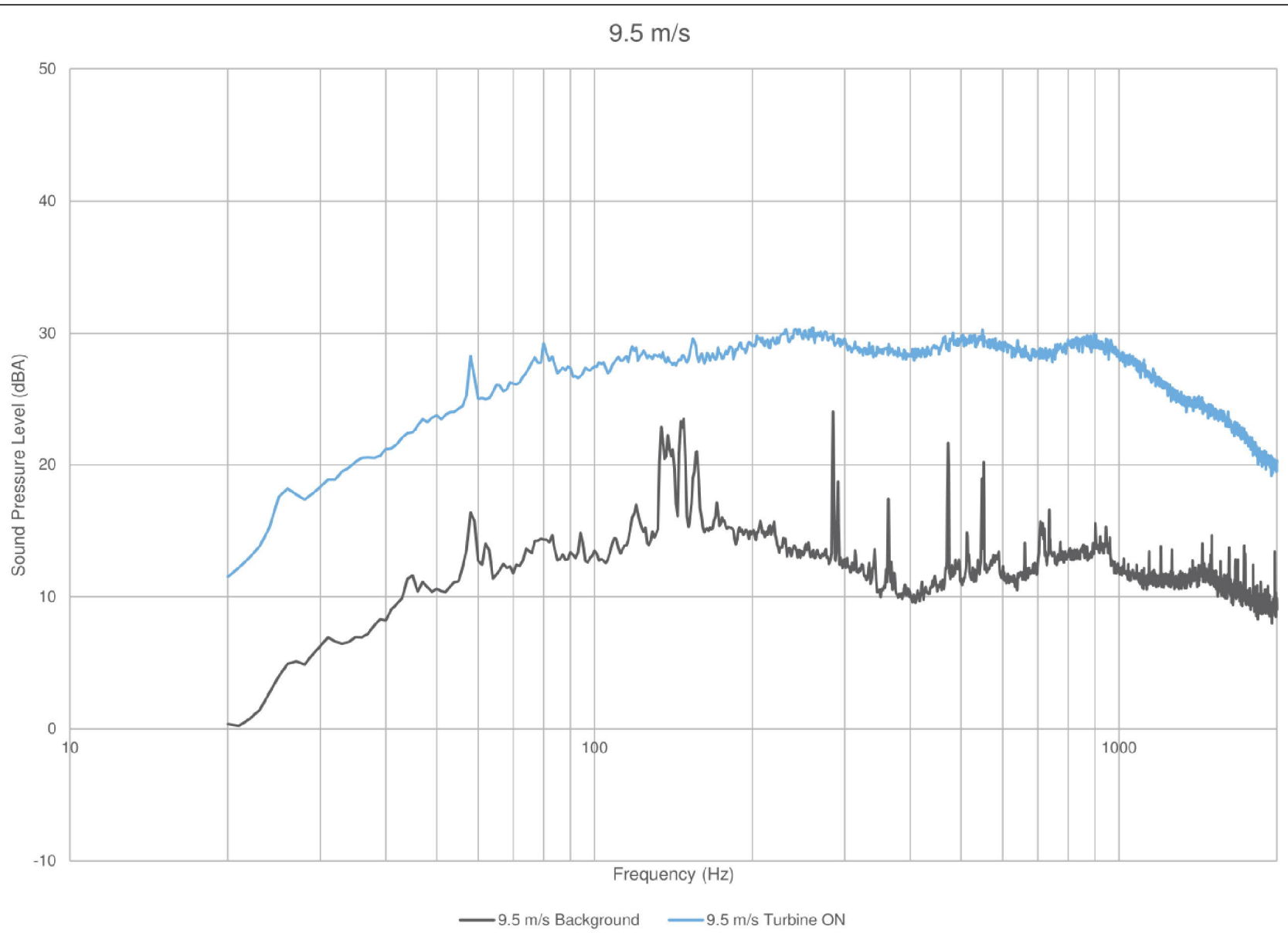
Figure D.01



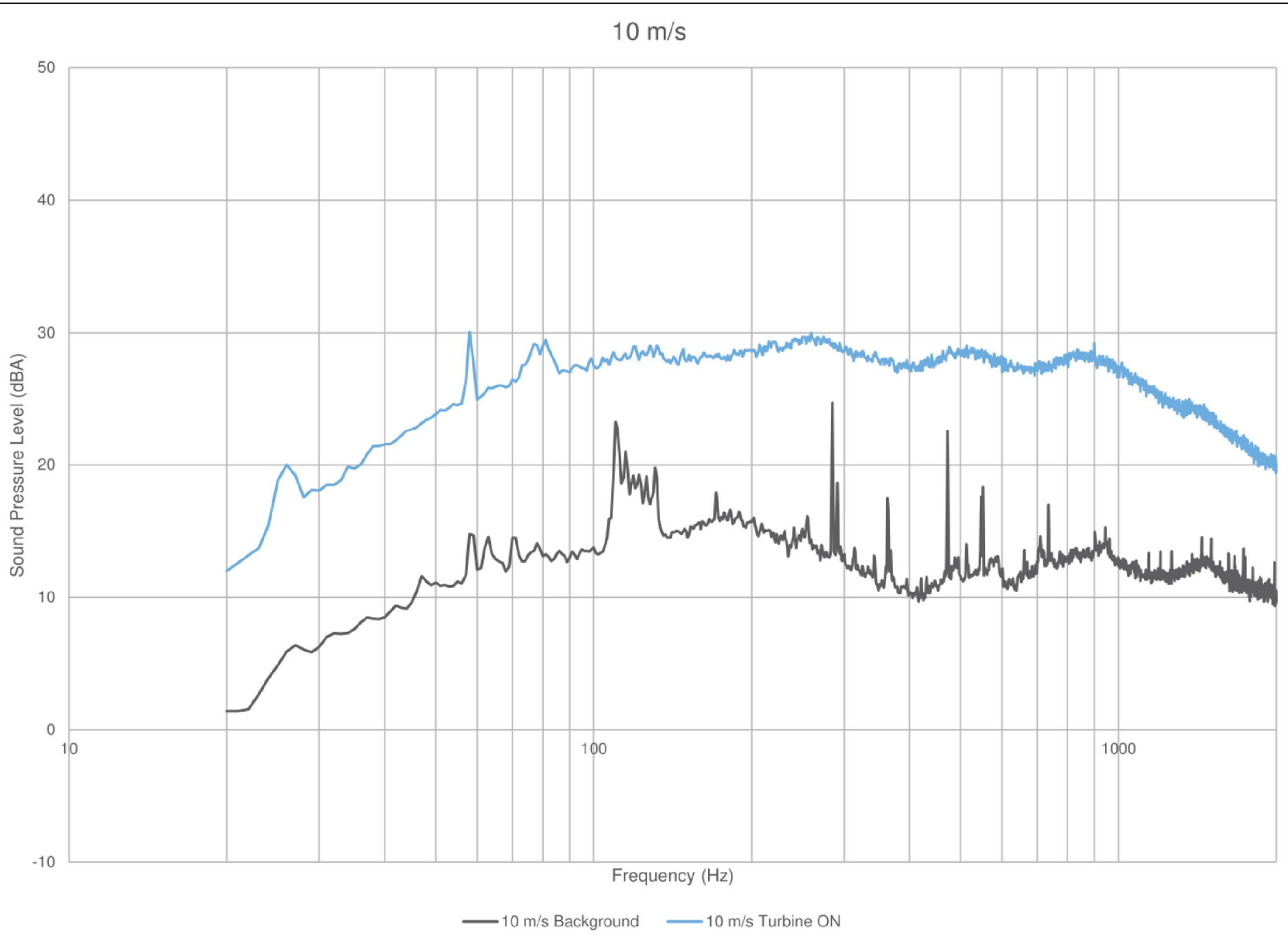
aercoustics	13350.02.T07.RP2 Scale: NTS Drawn by: DH Reviewed by: PA Date: Jan 2020 Revision: 1	**Project Name** South Branch Wind - IEC 61400-11 Edition 3.0 - Turbine T07 **Figure Title** Plot of narrowband spectra - Turbine ON vs. Background at 8.5 m/s **Figure D.02**



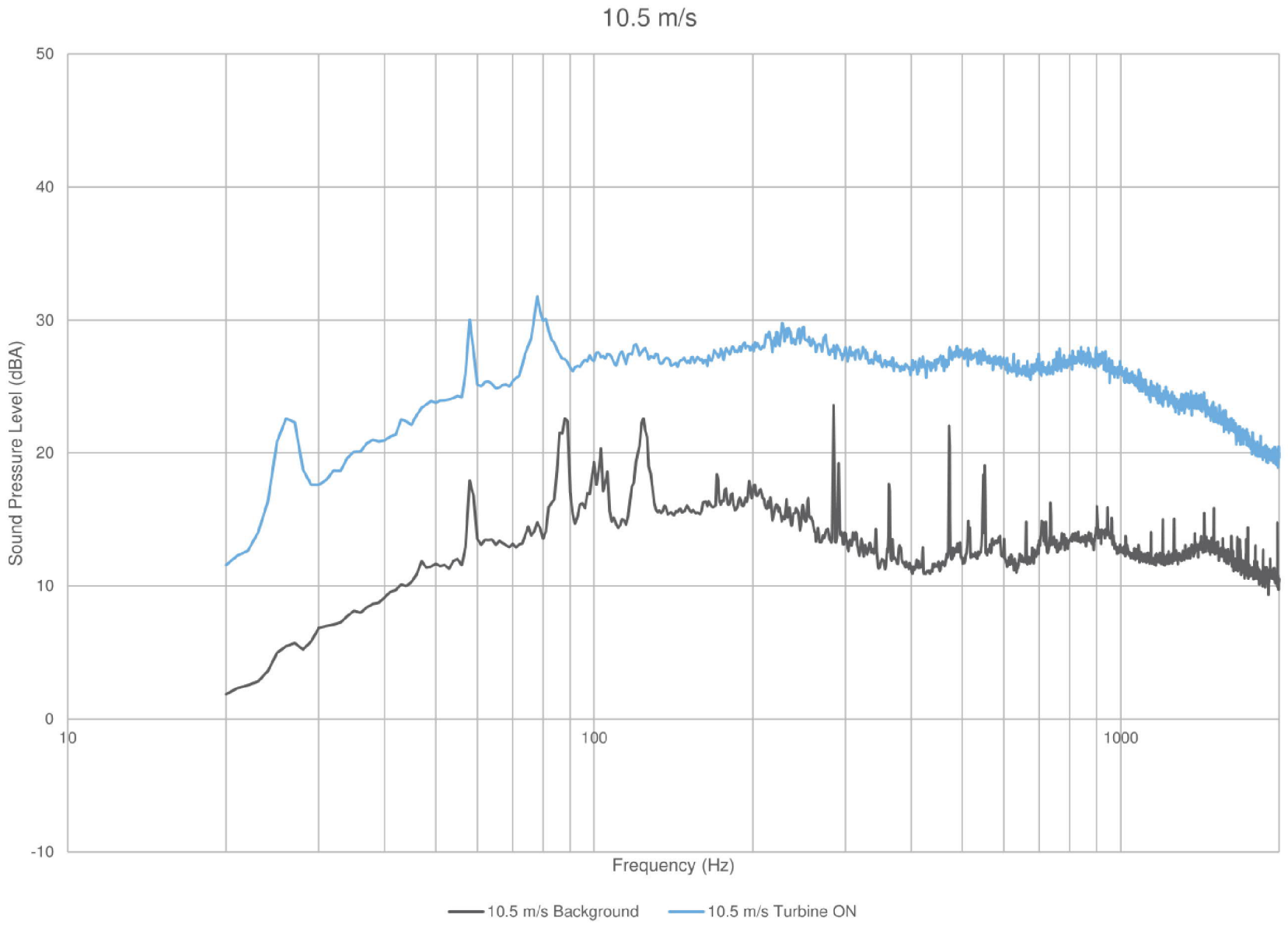
aercoustics	13350.02.T07.RP2 Scale: NTS Drawn by: DH Reviewed by: PA Date: Jan 2020 Revision: 1	**Project Name** South Branch Wind - IEC 61400-11 Edition 3.0 - Turbine T07 **Figure Title** Plot of narrowband spectra - Turbine ON vs. Background at 9 m/s **Figure D.03**



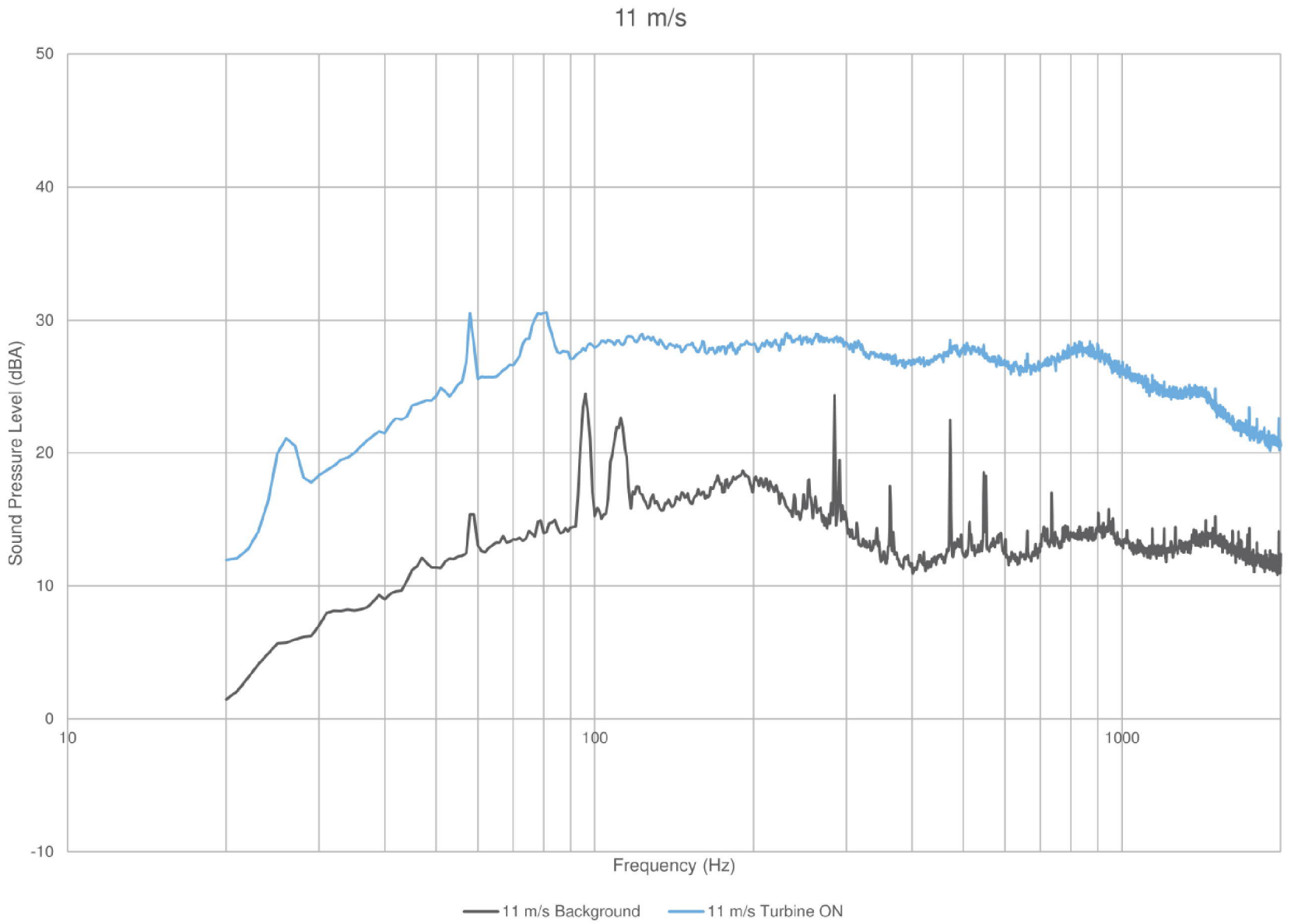
aercoustics	13350.02.T07.RP2 Scale: NTS Drawn by: DH Reviewed by: PA Date: Jan 2020 Revision: 1	**Project Name** South Branch Wind - IEC 61400-11 Edition 3.0 - Turbine T07 **Figure Title** Plot of narrowband spectra - Turbine ON vs. Background at 9.5 m/s **Figure D.04**



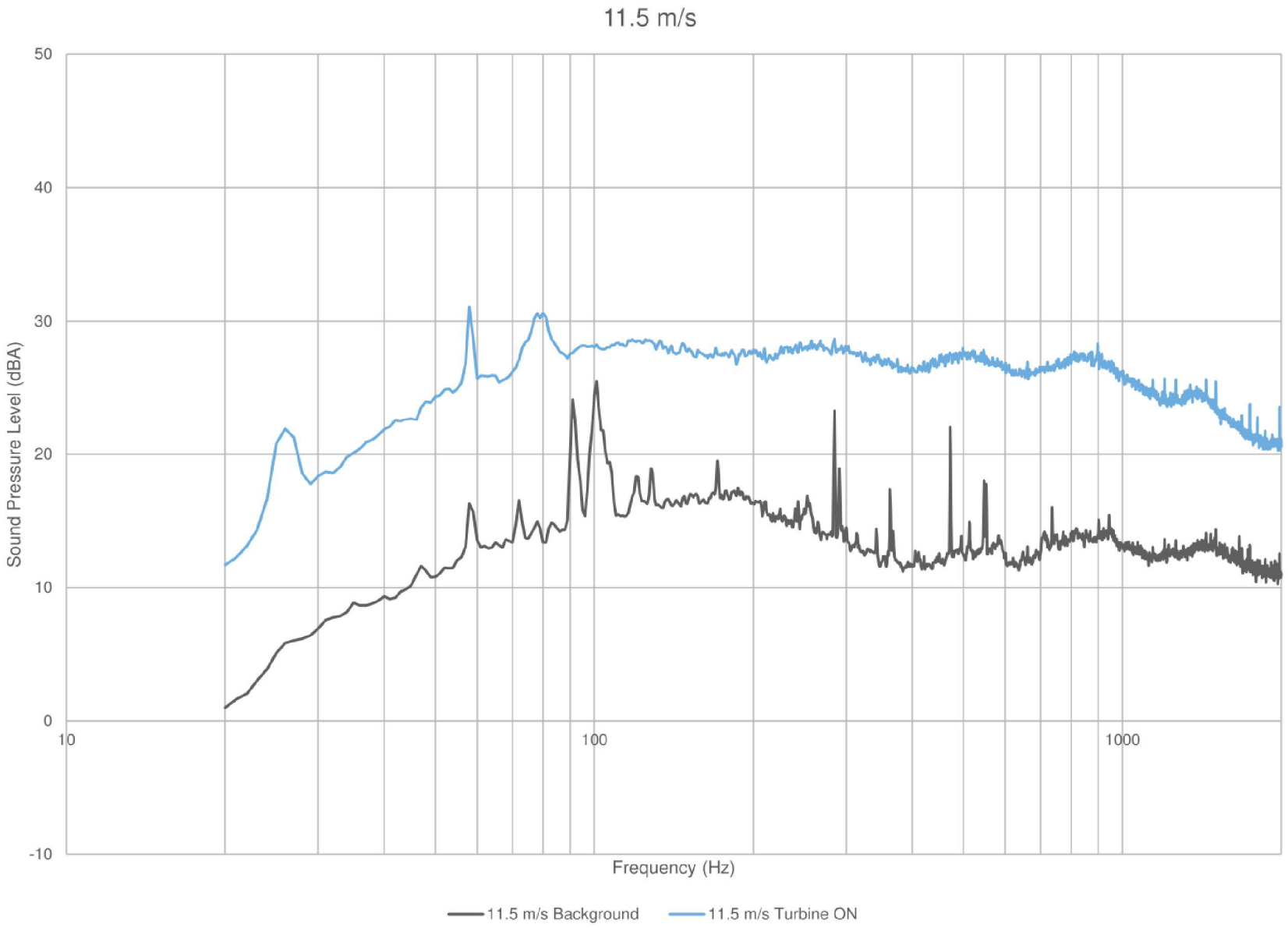
aercoustics	13350.02.T07.RP2 Scale: NTS Drawn by: DH Reviewed by: PA Date: Jan 2020 Revision: 1	**Project Name** South Branch Wind - IEC 61400-11 Edition 3.0 - Turbine T07 **Figure Title** Plot of narrowband spectra - Turbine ON vs. Background at 10 m/s **Figure D.05**



aercoustics	13350.02.T07.RP2 Scale: NTS Drawn by: DH Reviewed by: PA Date: Jan 2020 Revision: 1	**Project Name** South Branch Wind - IEC 61400-11 Edition 3.0 - Turbine T07 **Figure Title** Plot of narrowband spectra - Turbine ON vs. Background at 10.5 m/s **Figure D.06**

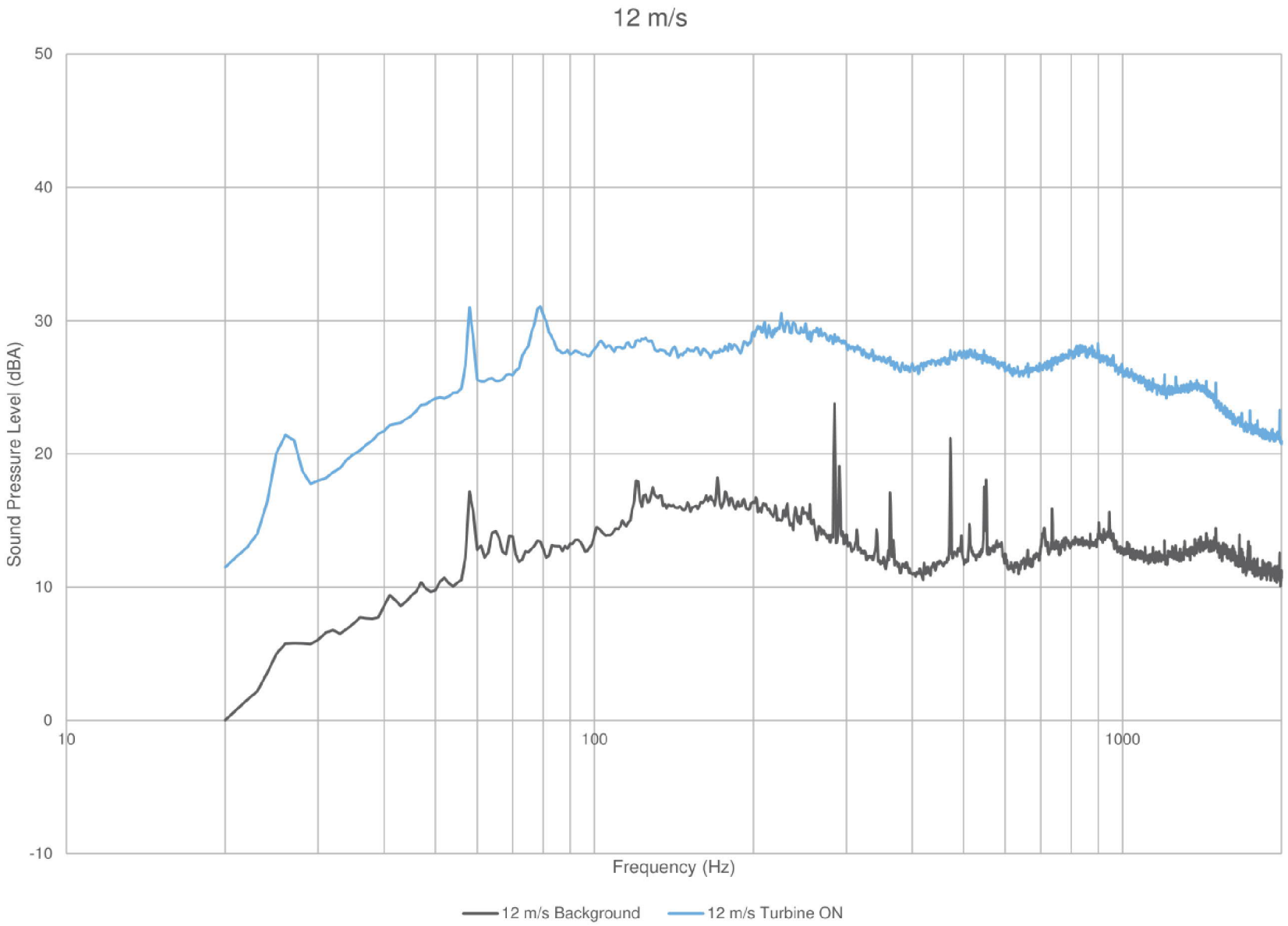


aercoustics	13350.02.T07.RP2 Scale: NTS Drawn by: DH Reviewed by: PA Date: Jan 2020 Revision: 1	**Project Name** South Branch Wind - IEC 61400-11 Edition 3.0 - Turbine T07 **Figure Title** Plot of narrowband spectra - Turbine ON vs. Background at 11 m/s **Figure D.07**

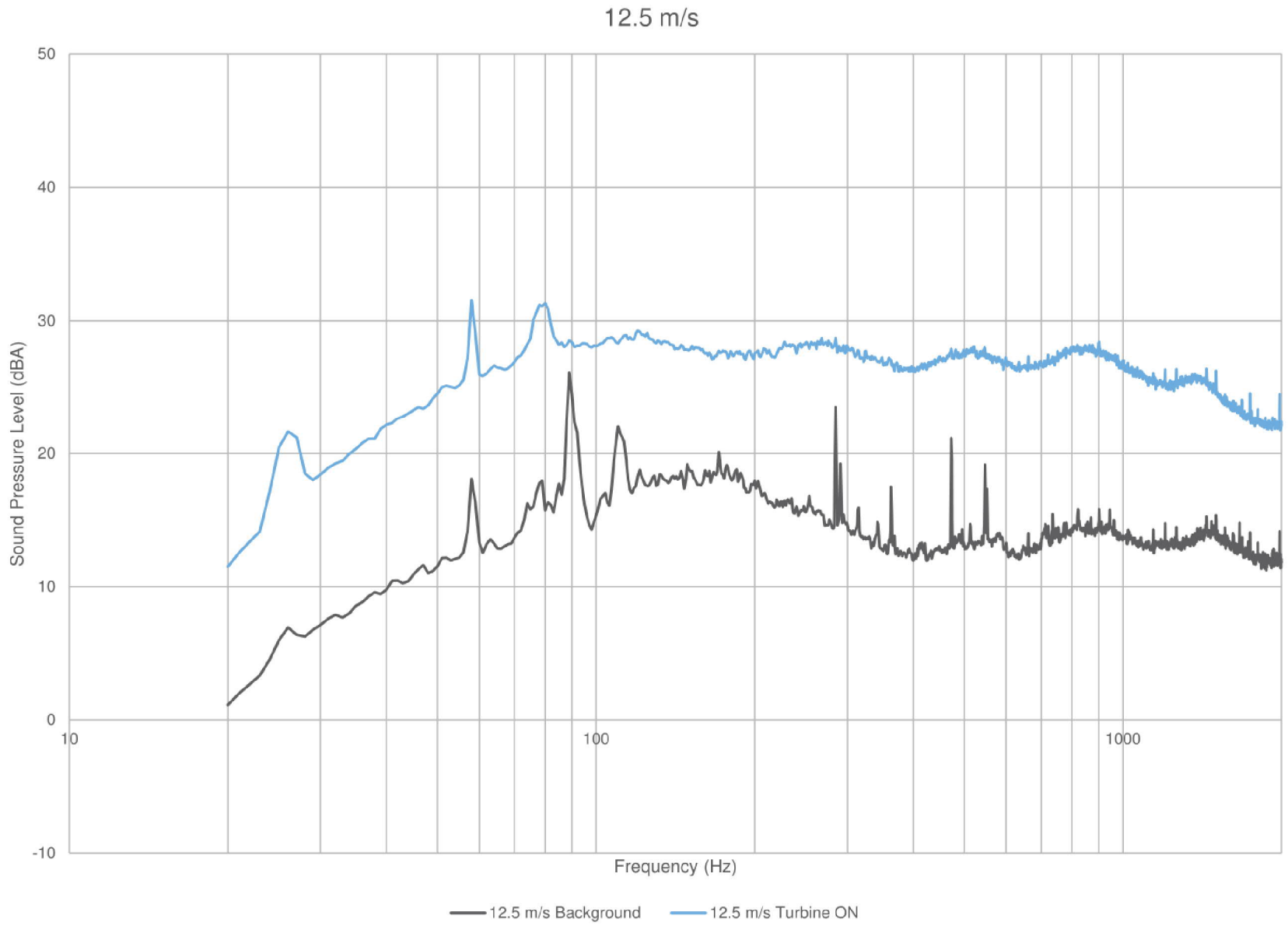


aercoustics	13350.02.T07.RP2 Scale: NTS Drawn by: DH Reviewed by: PA Date: Jan 2020 Revision: 1	**Project Name** South Branch Wind - IEC 61400-11 Edition 3.0 - Turbine T07 **Figure Title** Plot of narrowband spectra - Turbine ON vs. Background at 11.5 m/s

Figure D.08



aercoustics	13350.02.T07.RP2 Scale: NTS Drawn by: DH Reviewed by: PA Date: Jan 2020 Revision: 1	**Project Name** South Branch Wind - IEC 61400-11 Edition 3.0 - Turbine T07 **Figure Title** Plot of narrowband spectra - Turbine ON vs. Background at 12 m/s **Figure D.09**



aercoustics	13350.02.T07.RP2 Scale: NTS Drawn by: DH Reviewed by: PA Date: Jan 2020 Revision: 1	**Project Name** South Branch Wind - IEC 61400-11 Edition 3.0 - Turbine T07 **Figure Title** Plot of narrowband spectra - Turbine ON vs. Background at 12.5 m/s **Figure D.10**

Table D.01 Tonality Assessment Table - 8 m/s

Project: South Branch Wind Farm - Turbine T07 - IEC 61400-11 Measurement

Report ID: 13350.02.T07.RP2

Created on: 2020-01-29

Measurement #	Centre frequency (Hz)	Energy average of all masking lines (dB)	Background (dB)	Background adjusted criterion level (dB)	Masking level (dB)	Tone level (dB)	Determination of tonality (dB)	Frequency dependent audibility criterion (dB)	Tonal Audibility (dB)
Average	-	no reportable tones					-	-	-

Table D.02 Tonality Assessment Table - 8.5 m/s

Project: South Branch Wind Farm - Turbine T07 - IEC 61400-11 Measurement

Report ID: 13350.02.T07.RP2

Created on: 2020-01-29

Measurement #	Centre frequency (Hz)	Energy average of all masking lines (dB)	Background (dB)	Background adjusted criterion level (dB)	Masking level (dB)	Tone level (dB)	Determination of tonality (dB)	Frequency dependent audibility criterion (dB)	Tonal Audibility (dB)
Average	-	no reportable tones					-	-	-

Table D.03 Tonality Assessment Table - 9 m/s

Project: South Branch Wind Farm - Turbine T07 - IEC 61400-11 Measurement

Report ID: 13350.02.T07.RP2

Created on: 2020-01-29

Measurement #	Centre frequency (Hz)	Energy average of all masking lines (dB)	Background (dB)	Background adjusted criterion level (dB)	Masking level (dB)	Tone level (dB)	Determination of tonality (dB)	Frequency dependent audibility criterion (dB)	Tonal Audibility (dB)
Average	-	no reportable tones					-	-	-

Table D.04 Tonality Assessment Table - 9.5 m/s

Project: South Branch Wind Farm - Turbine T07 - IEC 61400-11 Measurement

Report ID: 13350.02.T07.RP2

Created on: 2020-01-29

Measurement #	Centre frequency (Hz)	Energy average of all masking lines (dB)	Background (dB)	Background adjusted criterion level (dB)	Masking level (dB)	Tone level (dB)	Determination of tonality (dB)	Frequency dependent audibility criterion (dB)	Tonal Audibility (dB)
Average	-	no reportable tones					-	-	-

Table D.05 Tonality Assessment Table - 10 m/s

Project: South Branch Wind Farm - Turbine T07 - IEC 61400-11 Measurement

Report ID: 13350.02.T07.RP2

Created on: 2020-01-29

Measurement #	Centre frequency (Hz)	Energy average of all masking lines (dB)	Background (dB)	Background adjusted criterion level (dB)	Masking level (dB)	Tone level (dB)	Determination of tonality (dB)	Frequency dependent audibility criterion (dB)	Tonal Audibility (dB)
Average	-	no reportable tones					-	-	-

Table D.06 Tonality Assessment Table - 10.5 m/s

Project: South Branch Wind Farm - Turbine T07 - IEC 61400-11 Measurement

Report ID: 13350.02.T07.RP2

Created on: 2020-01-29

Measurement #	Centre frequency (Hz)	Energy average of all masking lines (dB)	Background (dB)	Background adjusted criterion level (dB)	Masking level (dB)	Tone level (dB)	Determination of tonality (dB)	Frequency dependent audibility criterion (dB)	Tonal Audibility (dB)
Average	-	no reportable tones					-	-	-

Table D.07 Tonality Assessment Table - 11 m/s

Project: South Branch Wind Farm - Turbine T07 - IEC 61400-11 Measurement

Report ID: 13350.02.T07.RP2

Created on: 2020-01-29

Measurement #	Centre frequency (Hz)	Energy average of all masking lines (dB)	Background (dB)	Background adjusted criterion level (dB)	Masking level (dB)	Tone level (dB)	Determination of tonality (dB)	Frequency dependent audibility criterion (dB)	Tonal Audibility (dB)
Average	-	no reportable tones					-	-	-

Table D.08 Tonality Assessment Table - 11.5 m/s

Project: South Branch Wind Farm - Turbine T07 - IEC 61400-11 Measurement

Report ID: 13350.02.T07.RP2

Created on: 2020-01-29

Measurement #	Centre frequency (Hz)	Energy average of all masking lines (dB)	Background (dB)	Background adjusted criterion level (dB)	Masking level (dB)	Tone level (dB)	Determination of tonality (dB)	Frequency dependent audibility criterion (dB)	Tonal Audibility (dB)
Average	-	no reportable tones					-	-	-

Table D.09 Tonality Assessment Table - 12 m/s

Project: South Branch Wind Farm - Turbine T07 - IEC 61400-11 Measurement

Report ID: 13350.02.T07.RP2

Created on: 2020-01-29

Measurement #	Centre frequency (Hz)	Energy average of all masking lines (dB)	Background (dB)	Background adjusted criterion level (dB)	Masking level (dB)	Tone level (dB)	Determination of tonality (dB)	Frequency dependent audibility criterion (dB)	Tonal Audibility (dB)
Average	-	no reportable tones					-	-	-

Table D.10 Tonality Assessment Table - 12.5 m/s

Project: South Branch Wind Farm - Turbine T07 - IEC 61400-11 Measurement

Report ID: 13350.02.T07.RP2

Created on: 2020-01-29

Measurement #	Centre frequency (Hz)	Energy average of all masking lines (dB)	Background (dB)	Background adjusted criterion level (dB)	Masking level (dB)	Tone level (dB)	Determination of tonality (dB)	Frequency dependent audibility criterion (dB)	Tonal Audibility (dB)
Average	-	no reportable tones					-	-	-

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Appendix E
Measurement Data

Table E.01 Measurement data - Turbine ON

Project: South Branch Wind Farm - Turbine T07 - IEC 61400-11 Measurement

Report ID: 13350.02.T07.RP2

Created on: 2020-01-29

***Blank data denotes values that were omitted in the analysis due to an extraneous event during recording

Data Point #	Standardized Wind Speed	LAeq	Turbine Power Output (kW)	Reference Yaw Angle (°)	Yaw Angle (°)	Pitch Angle (°)	Rotor RPM	Nacelle Anemometer Wind Speed (m/s)	10m Anemometer Wind Speed (m/s)	Air Temperature (-C)	Pressure (kPa)	Relative Humidity (%)
1			3043	236.5	237.0	2.6	14.5	10.6	7.8	1.3	99.3	
2			3076	236.5	237.0	5.5	14.8	11.6	7.2	1.3	99.3	
3			3020	236.5	237.0	5.3	14.4	10.5	5.8	1.3	99.3	
4			2897	236.5	237.0	2.8	13.9	9.4	5.3	1.3	99.3	
5			2958	236.5	237.0	2.3	14.2	10.5	6.2	1.3	99.3	
6			3008	236.5	237.0	3.1	14.3	9.1	7.6	1.3	99.3	
7			2929	236.5	237.0	0.9	14.0	9.0	7.1	1.3	99.3	
8			3073	236.5	237.0	4.4	14.7	10.6	6.3	1.3	99.3	
9			2997	236.5	237.0	3.6	14.3	9.5	6.4	1.3	99.3	
10			2977	236.5	237.0	2.7	14.2	9.8	6.6	1.3	99.3	
11			3071	236.5	237.0	5.4	14.7	11.2	7.1	1.3	99.3	
12			2887	236.5	237.0	3.1	14.0	9.8	6.1	1.3	99.3	
13			2464	236.5	237.0	-0.2	14.0	9.6	7.9	1.3	99.3	
14			2647	236.5	237.0	-0.5	14.3	9.1	7.5	1.3	99.3	
15			2759	236.5	237.0	-0.6	14.4	8.6	8.7	1.3	99.3	
16			3047	236.5	237.0	2.1	14.6	10.1	8.7	1.3	99.3	
17			3053	236.5	237.0	4.2	14.6	11.1	8.8	1.3	99.3	
18			2904	236.5	237.0	2.0	14.1	10.3	7.1	1.3	99.3	
19			2790	236.5	237.0	1.4	14.2	9.5	6.0	1.3	99.3	
20			2950	236.5	237.0	1.9	14.3	9.9	6.6	1.3	99.3	
21			3005	236.5	237.0	2.7	14.5	11.7	5.8	1.3	99.3	
22			3060	236.5	237.0	5.5	14.7	11.4	8.4	1.3	99.3	
23			3033	236.5	237.0	5.5	14.5	11.3	8.1	1.3	99.3	
24			3004	236.5	236.0	5.8	14.4	12.0	7.4	1.3	99.3	
25			2997	236.5	234.1	5.4	14.3	11.4	7.1	1.3	99.3	
26			3000	236.5	234.1	5.9	14.4	10.9	6.6	1.3	99.3	
27			2928	236.5	234.1	4.1	14.0	11.5	6.9	1.3	99.3	
28			2980	236.5	234.1	3.9	14.2	11.1	8.1	1.3	99.3	
29			3050	236.5	234.1	5.7	14.6	11.0	8.0	1.3	99.3	
30			3008	236.5	234.1	5.5	14.4	11.4	8.5	1.3	99.3	
31			3026	236.5	234.1	6.0	14.5	12.3	8.0	1.3	99.3	
32			3039	236.5	234.1	7.1	14.5	12.7	8.1	1.3	99.3	
33			2961	236.5	234.1	5.9	14.1	10.9	7.4	1.3	99.3	
34			2905	236.5	234.1	3.9	13.9	11.0	7.5	1.3	99.3	
35			2956	236.5	234.1	3.3	14.1	11.2	6.5	1.3	99.3	
36			3074	236.5	234.1	6.0	14.8	11.7	6.0	1.3	99.3	
37			2984	236.5	234.1	5.7	14.3	11.2	5.7	1.3	99.3	
38			2911	236.5	234.1	3.0	13.9	9.7	6.3	1.3	99.3	
39			3031	236.5	234.1	4.5	14.5	10.0	6.6	1.3	99.3	
40			3012	236.5	234.1	4.7	14.3	10.2	6.9	1.3	99.3	
41			2828	236.5	235.9	1.1	13.9	9.9	6.1	1.3	99.3	
42			3002	236.5	236.5	2.1	14.3	10.6	7.0	1.3	99.3	
43			2931	236.5	236.5	1.8	14.3	10.0	5.0	1.3	99.3	
44			3070	236.5	236.5	5.4	14.9	11.5	5.0	1.3	99.3	
45			3067	236.5	236.5	6.6	14.6	11.3	5.9	1.3	99.3	
46			2899	236.5	236.5	3.7	13.9	11.2	7.6	1.3	99.3	
47			2963	236.5	236.5	3.0	14.1	10.1	7.4	1.3	99.3	
48			3024	236.5	236.5	4.1	14.4	10.7	6.1	1.3	99.3	
49			3025	236.5	236.5	4.6	14.4	10.5	7.3	1.3	99.3	
50			3035	236.5	236.5	5.1	14.5	11.0	7.1	1.3	99.3	
51			3061	236.5	236.5	7.1	14.6	12.1	7.0	1.3	99.3	
52			3030	236.5	236.5	7.1	14.5	11.4	7.8	1.3	99.3	
53			2982	236.5	236.5	6.9	14.3	11.3	9.0	1.3	99.3	
54			2912	236.5	236.5	4.7	13.9	10.5	8.3	1.3	99.3	
55			3021	236.5	236.5	9.1	14.5	12.0	5.7	1.3	99.3	
56			3068	236.5	236.5	10.8	14.7	13.2	9.0	1.3	99.3	
57			3028	236.5	236.5	10.9	14.5	13.2	9.0	1.3	99.3	
58			2950	236.5	236.5	10.2	14.2	13.9	7.6	1.3	99.3	
59			2913	236.5	236.5	8.6	13.9	12.1	9.4	1.3	99.3	
60			2905	236.5	236.5	7.2	13.9	11.8	8.3	1.3	99.3	
61			2910	236.5	236.5	5.6	13.9	11.0	8.0	1.3	99.3	
62			2960	236.5	236.5	5.4	14.1	10.7	6.8	1.3	99.3	
63			3012	236.5	236.5	5.9	14.5	10.5	6.5	1.3	99.3	
64			3080	236.5	236.5	9.7	15.0	13.6	7.6	1.3	99.3	
65			3077	236.5	236.5	10.7	14.7	14.1	8.0	1.3	99.3	
66			3029	236.5	236.5	10.9	14.5	13.9	7.3	1.3	99.3	
67			2897	236.5	236.5	8.7	13.8	13.2	6.7	1.3	99.3	
68			2921	236.5	236.5	7.4	13.9	12.8	5.5	1.3	99.3	
69			3018	236.5	236.5	8.3	14.4	13.2	6.6	1.3	99.3	
70			3013	236.5	236.5	8.4	14.3	12.5	6.9	1.3	99.3	
71			2949	236.5	236.5	7.2	14.1	12.0	6.5	1.3	99.3	
72			3021	236.5	236.5	7.7	14.4	12.3	6.8	1.3	99.3	
73			3047	236.5	236.5	8.8	14.5	12.7	6.8	1.3	99.3	
74			2979	236.5	236.5	8.0	14.2	12.5	7.4	1.3	99.3	
75			2979	236.5	236.5	7.3	14.2	12.2	8.2	1.3	99.3	
76			3057	236.5	236.5	8.8	14.6	11.6	7.0	1.3	99.3	
77			3041	236.5	236.5	9.3	14.5	12.8	6.0	1.3	99.3	
78			2916	236.5	236.5	7.3	13.9	11.1	5.6	1.3	99.3	
79			2906	236.5	236.5	5.3	13.9	10.1	6.6	1.3	99.3	
80			3007	236.5	236.5	5.9	14.3	10.3	6.0	1.3	99.3	
81			3030	236.5	236.5	6.5	14.4	11.1	6.5	1.3	99.3	
82			2991	236.5	236.5	6.1	14.3	11.7	7.1	1.3	99.3	
83			3033	236.5	236.5	6.6	14.4	11.0	7.4	1.3	99.3	
84			3081	236.5	236.5	8.7	14.8	12.9	7.0	1.3	99.3	
85			3020	236.5	236.5	8.7	14.4	13.5	6.7	1.3	99.3	
86			3022	236.5	236.5	8.8	14.4	13.1	8.1	1.3	99.3	
87			3032	236.5	236.5	9.2	14.4	13.4	7.7	1.3	99.3	
88			3002	236.5	236.5	9.0	14.3	13.7	8.4	1.3	99.3	

***Blank data denotes values that were omitted in the analysis due to an extraneous event during recording

Data Point #	Standardized Wind Speed	LAeq	Turbine Power Output (kW)	Reference Yaw Angle (°)	Yaw Angle (°)	Pitch Angle (°)	Rotor RPM	Nacelle Anemometer Wind Speed (m/s)	10m Anemometer Wind Speed (m/s)	Air Temperature (-C)	Pressure (kPa)	Relative Humidity (%)
89			2976	236.5	236.5	8.6	14.2	13.4	6.7	1.3	99.3	
90			2995	236.5	236.5	8.4	14.3	11.6	8.7	1.3	99.3	
91			2948	236.5	236.5	7.5	14.0	11.3	7.5	1.3	99.3	
92			3012	236.5	236.5	8.2	14.5	13.0	8.0	1.3	99.3	
93			3059	236.5	236.5	9.8	14.6	14.3	6.8	1.3	99.3	
94			3011	236.5	236.5	9.7	14.4	13.4	7.2	1.3	99.3	
95			2989	236.5	236.5	9.4	14.2	13.6	7.3	1.3	99.3	
96			2935	236.5	236.5	8.1	14.0	11.6	6.7	1.3	99.3	
97			2972	236.5	236.5	8.0	14.2	12.0	6.8	1.3	99.3	
98			3002	236.5	236.5	8.0	14.3	11.8	7.1	1.3	99.3	
99			2942	236.5	236.5	6.6	14.0	11.3	7.9	1.3	99.3	
100			2886	236.5	236.5	4.2	13.8	10.2	8.6	1.3	99.3	
101			2944	236.5	236.5	2.9	14.0	10.2	7.5	1.3	99.3	
102			3024	236.5	236.5	3.8	14.4	9.7	8.1	1.3	99.3	
103			2976	236.5	236.5	2.5	14.2	9.7	7.4	1.3	99.3	
104			2981	236.5	236.5	1.9	14.2	10.3	7.6	1.3	99.3	
105			3082	236.5	236.5	5.1	14.8	10.8	9.4	1.3	99.3	
106			3063	236.5	236.5	6.0	14.5	11.6	8.7	1.3	99.3	
107			2959	236.5	236.5	4.1	14.0	10.5	8.8	1.3	99.3	
108			3021	236.5	236.5	4.7	14.4	11.7	9.0	1.3	99.3	
109			3095	236.5	236.5	7.9	14.9	13.4	7.0	1.3	99.3	
110			3033	236.5	236.5	8.6	14.5	13.4	6.9	1.3	99.3	
111			3017	236.5	236.5	8.2	14.4	12.5	7.5	1.3	99.3	
112			2970	236.5	236.5	7.4	14.1	13.5	9.7	1.3	99.3	
113			2971	236.5	236.5	6.9	14.1	12.6	9.1	1.3	99.3	
114			2972	236.5	236.5	6.4	14.1	11.7	8.9	1.3	99.3	
115			2836	236.5	236.5	3.1	13.7	10.0	8.5	1.3	99.3	
116			2930	236.5	236.5	2.1	14.0	8.9	8.1	1.3	99.3	
117			2980	236.5	236.5	1.9	14.1	9.7	7.5	1.3	99.3	
118			2906	236.5	236.5	1.6	14.2	9.8	7.0	1.3	99.3	
119			2895	236.5	236.5	1.6	14.3	9.4	7.6	1.3	99.3	
120			3078	236.5	236.5	4.2	14.7	11.5	8.2	1.3	99.3	
121			3019	236.5	236.5	4.4	14.3	10.7	7.4	1.3	99.3	
122			2750	236.5	236.5	1.5	13.9	9.9	6.6	1.3	99.3	
123			2687	236.5	236.5	1.1	14.2	9.9	8.0	1.3	99.3	
124			2998	236.5	236.5	2.0	14.4	9.1	11.0	1.3	99.3	
125			3042	236.5	236.5	3.0	14.5	9.5	9.4	1.3	99.3	
126			3015	236.5	236.5	2.8	14.3	10.0	7.2	1.3	99.3	
127			2885	236.5	236.5	0.9	14.1	10.2	7.6	1.3	99.3	
128			2928	236.5	239.3	5.8	13.9	10.9	5.7	1.4	99.3	
129			2920	236.5	239.3	4.1	13.9	11.5	6.2	1.4	99.3	
130			2931	236.5	239.3	2.6	13.9	9.6	6.9	1.4	99.3	
131			2979	236.5	239.3	2.5	14.3	10.6	9.1	1.4	99.3	
132			3089	236.5	237.8	6.8	14.9	12.2	8.4	1.4	99.3	
133			3059	236.5	236.9	7.1	14.5	12.1	7.9	1.4	99.3	
134			3038	236.5	236.9	7.4	14.5	11.5	6.8	1.4	99.3	
135			3023	236.5	236.9	7.5	14.4	12.2	7.0	1.4	99.3	
136			3050	236.5	236.9	8.2	14.5	11.3	7.5	1.4	99.3	
137			2934	236.5	236.9	6.9	14.0	11.5	7.2	1.4	99.3	
138			2852	236.5	236.9	3.3	13.7	10.3	7.6	1.4	99.3	
139			2941	236.5	236.9	2.6	14.0	12.4	6.8	1.4	99.3	
140			2976	236.5	236.9	2.2	14.2	11.5	6.7	1.4	99.3	
141			3079	236.5	236.9	5.6	14.8	10.7	9.3	1.4	99.3	
142			3069	236.5	236.9	6.5	14.6	11.3	7.5	1.4	99.3	
143			3049	236.5	236.9	7.1	14.5	11.6	8.8	1.4	99.3	
144			2986	236.5	236.9	6.5	14.2	12.1	8.0	1.4	99.3	
145			2933	236.5	236.9	5.0	14.0	10.9	8.2	1.4	99.3	
146			2963	236.5	236.9	4.3	14.1	10.0	8.1	1.4	99.3	
147			2993	236.5	236.9	4.6	14.3	11.1	7.7	1.4	99.3	
148			2898	236.5	236.9	1.9	13.9	10.4	8.2	1.4	99.3	
149			2971	236.5	236.9	2.0	14.3	11.1	9.5	1.4	99.3	
150			3090	236.5	236.9	4.7	14.7	10.4	8.3	1.4	99.3	
151			3069	236.5	236.9	6.1	14.7	11.8	9.4	1.4	99.3	
152			3032	236.5	236.9	6.3	14.4	11.3	8.5	1.4	99.3	
153			2947	236.5	236.9	4.8	14.1	10.7	6.9	1.4	99.3	
154			2970	236.5	236.9	4.5	14.2	10.0	6.8	1.4	99.3	
155			2801	236.5	236.9	1.4	13.8	9.9	7.0	1.4	99.3	
156			2791	236.5	236.9	1.1	14.3	10.1	4.4	1.4	99.3	
157			2689	236.5	236.9	0.8	14.3	8.8	7.7	1.4	99.3	
158			3067	236.5	236.9	4.5	14.9	11.7	8.7	1.4	99.3	
159			3076	236.5	236.9	7.4	14.8	12.1	7.8	1.4	99.3	
160			3053	236.5	236.9	7.5	14.5	13.3	6.6	1.4	99.3	
161			2997	236.5	236.9	7.1	14.3	12.1	5.5	1.4	99.3	
162			3044	236.5	236.9	8.0	14.5	11.2	5.8	1.4	99.3	
163			3070	236.5	236.9	10.4	14.8	14.2	6.7	1.4	99.3	
164			3004	236.5	236.9	9.8	14.3	14.2	8.7	1.4	99.3	
165			2895	236.5	236.9	7.6	13.8	11.8	9.5	1.4	99.3	
166			2946	236.5	236.9	7.1	14.0	12.3	8.6	1.4	99.3	
167			2929	236.5	236.9	5.6	13.9	10.9	9.1	1.4	99.3	
168			2961	236.5	236.9	3.3	14.2	11.1	9.1	1.4	99.3	
169			3084	236.5	236.9	5.7	14.6	10.8	7.4	1.4	99.3	
170			3077	236.5	236.9	7.9	14.8	12.8	7.9	1.4	99.3	
171			3059	236.5	236.3	8.7	14.6	12.6	9.1	1.4	99.3	
172			3045	236.5	234.6	9.2	14.5	13.3	8.4	1.4	99.3	
173			3034	236.5	234.6	9.6	14.5	13.9	7.5	1.4	99.3	
174			3041	236.5	234.6	10.3	14.5	14.6	7.3	1.4	99.3	
175			2956	236.5	234.6	9.4	14.1	13.8	7.7	1.4	99.3	
176			2889	236.5	234.6	7.2	13.8	13.3	7.4	1.4	99.3	

Table E.01 Measurement data - Turbine ON

Project: South Branch Wind Farm - Turbine T07 - IEC 61400-11 Measurement

Report ID: 13350.02.T07.RP2

Created on: 2020-01-29

***Blank data denotes values that were omitted in the analysis due to an extraneous event during recording

Data Point #	Standardized Wind Speed	LAeq	Turbine Power Output (kW)	Reference Yaw Angle (°)	Yaw Angle (°)	Pitch Angle (°)	Rotor RPM	Nacelle Anemometer Wind Speed (m/s)	10m Anemometer Wind Speed (m/s)	Air Temperature (-C)	Pressure (kPa)	Relative Humidity (%)
177			2918	236.5	234.6	5.9	13.9	11.7	9.9	1.4	99.3	
178			3020	236.5	234.6	6.9	14.5	13.0	9.4	1.4	99.3	
179			3067	236.5	234.6	8.4	14.6	11.4	9.2	1.4	99.3	
180			3010	236.5	234.6	8.2	14.3	11.6	8.2	1.4	99.3	
181			2938	236.5	234.6	6.7	14.0	10.1	8.8	1.4	99.3	
182			2965	236.5	234.6	6.1	14.2	11.8	8.9	1.4	99.3	
183			3022	236.5	234.6	6.8	14.4	11.6	7.8	1.4	99.3	
184			3030	236.5	234.6	7.0	14.4	11.8	7.5	1.4	99.3	
185			3055	236.5	234.6	8.2	14.6	12.2	9.1	1.4	99.3	
186			3022	236.5	234.6	8.3	14.4	12.3	8.2	1.4	99.3	
187			2942	236.5	234.6	6.8	14.0	11.8	7.8	1.4	99.3	
188			2964	236.5	234.6	6.5	14.1	11.8	8.4	1.4	99.3	
189			2973	236.5	234.6	5.5	14.2	11.0	10.7	1.4	99.3	
190			3022	236.5	234.6	6.6	14.4	12.0	9.2	1.4	99.3	
191			3022	236.5	234.6	6.8	14.4	11.9	8.7	1.4	99.3	
192			2965	236.5	234.6	5.6	14.1	10.7	9.4	1.4	99.3	
193			2931	236.5	234.6	4.4	14.0	9.4	7.7	1.4	99.3	
194			2618	236.5	234.6	0.7	13.8	8.8	6.8	1.4	99.3	
195			2976	236.5	233.2	2.6	14.5	10.4	6.4	1.4	99.3	
196			3088	236.5	232.0	6.3	14.9	11.0	6.6	1.4	99.3	
197			3019	236.5	232.0	5.7	14.4	10.2	8.2	1.4	99.3	
198			3064	236.5	232.0	7.0	14.7	11.8	10.0	1.4	99.3	
199			3071	236.5	232.0	8.6	14.7	13.0	8.2	1.4	99.3	
200			3024	236.5	232.0	8.6	14.4	11.6	6.9	1.4	99.3	
201			2995	236.5	232.0	8.3	14.3	12.6	6.3	1.4	99.3	
202			2993	236.5	232.0	8.2	14.2	11.4	7.8	1.4	99.3	
203			2986	236.5	232.0	7.9	14.3	11.1	9.1	1.4	99.3	
204			2984	236.5	232.0	7.6	14.2	11.8	10.2	1.4	99.3	
205			2935	236.5	232.0	6.2	13.9	10.8	8.6	1.4	99.3	
206			2914	236.5	232.0	4.3	13.9	10.9	7.6	1.4	99.3	
207			3005	236.5	232.0	4.9	14.3	10.1	7.8	1.4	99.3	
208			2088	236.5	156.7	4.4	9.9	8.1	8.1	1.4	99.3	
209			0	236.5	-3.2	-0.8	-0.2	0.0	5.9	1.4	99.3	
210			0	236.5	-3.2	-0.8	-0.2	0.0	7.6	1.4	99.3	
211			0	236.5	-3.2	-0.8	-0.2	0.0	7.9	1.4	99.3	
212			0	236.5	-3.2	-0.8	-0.2	0.0	7.5	1.4	99.3	
213			0	236.5	-3.2	-0.8	-0.2	0.0	7.5	1.4	99.3	
214			0	236.5	-3.2	-0.8	-0.2	0.0	10.1	1.4	99.3	
215			0	236.5	-3.2	-0.8	-0.2	0.0	11.0	1.4	99.3	
216	12.2	52.3	2924	236.5	234.5	4.8	14.0	11.4	7.8	1.4	99.3	
217	11.8	52.7	2932	236.5	234.5	3.3	14.0	11.0	7.2	1.4	99.3	
218	11.4	53.0	2979	236.5	235.0	3.5	14.2	10.7	7.6	1.4	99.3	
219	11.8	53.0	3020	236.5	236.9	4.0	14.4	11.0	8.3	1.4	99.3	
220	11.8	53.3	3078	236.5	236.9	6.1	14.7	11.0	6.7	1.4	99.3	
221	12.2	53.3	2952	236.5	236.9	4.4	14.1	11.4	6.0	1.4	99.3	
222			2932	236.5	236.9	2.5	14.1	9.4	7.5	1.4	99.3	
223	13.5	54.0	3077	236.5	236.9	8.6	15.1	12.6	7.0	1.4	99.3	
224	12.8	53.6	3054	236.5	236.9	8.9	14.6	11.9	6.7	1.4	99.3	
225	13.4	53.4	3043	236.5	236.9	9.7	14.5	12.5	8.2	1.4	99.3	
226	12.3	53.0	2893	236.5	236.9	7.2	13.9	11.5	7.2	1.4	99.3	
227	11.1	53.9	2848	236.5	236.9	4.4	13.6	10.3	6.5	1.4	99.3	
228	10.9	53.4	2904	236.5	236.9	2.6	13.8	10.1	6.2	1.4	99.3	
229	10.2	54.3	2759	236.5	236.9	0.6	14.0	9.9	7.8	1.4	99.3	
230	12.1	54.3	2972	236.5	236.9	1.9	14.4	11.3	9.8	1.4	99.3	
231	10.4	54.5	3026	236.5	236.9	2.4	14.4	9.7	9.0	1.4	99.3	
232	9.9	54.3	2646	236.5	236.9	0.8	14.2	9.8	8.0	1.4	99.3	
233			2861	236.5	236.9	1.7	14.5	9.5	6.4	1.4	99.3	
234	11.1	54.5	3083	236.5	236.9	6.1	15.0	10.3	7.2	1.4	99.3	
235	12.0	55.1	3085	236.5	236.9	7.2	14.7	11.2	7.0	1.4	99.3	
236	11.8	53.7	3048	236.5	236.9	8.0	14.5	11.0	7.7	1.4	99.3	
237	11.9	53.3	2930	236.5	236.9	5.8	14.0	11.1	8.5	1.4	99.3	
238	12.4	53.6	2952	236.5	236.9	4.8	14.0	11.5	7.3	1.4	99.3	
239	10.7	54.4	2975	236.5	236.9	4.6	14.1	10.0	6.3	1.4	99.3	
240	11.9	54.0	3003	236.5	236.9	4.7	14.3	11.1	7.2	1.4	99.3	
241	10.5	54.4	2853	236.5	236.9	2.3	13.9	9.8	10.7	1.4	99.3	
242	10.2	54.4	2768	236.5	236.9	1.3	14.1	9.8	8.4	1.4	99.3	
243	10.2	54.5	2760	236.5	236.9	1.3	14.2	9.4	8.8	1.4	99.3	
244	11.1	54.5	2883	236.5	236.9	1.8	14.4	10.4	10.2	1.5	99.3	
245	11.7	55.6	3089	236.5	236.9	4.6	14.8	10.9	8.6	1.5	99.3	
246	11.1	55.4	3038	236.5	236.9	4.8	14.4	10.4	6.7	1.5	99.3	
247	11.6	56.7	2880	236.5	236.9	2.1	13.9	10.8	9.0	1.5	99.3	
248	10.2	57.9	2758	236.5	236.9	1.2	14.1	9.6	8.9	1.5	99.3	
249	9.9	56.7	2680	236.5	236.9	1.1	14.2	9.1	8.1	1.5	99.3	
250	9.9	55.3	2661	236.5	236.9	1.1	14.3	9.4	10.3	1.5	99.3	
251			2839	236.5	236.9	1.4	14.4	8.9	8.9	1.5	99.3	
252			2912	236.5	236.9	1.5	14.3	9.4	7.9	1.5	99.3	
253	11.8	58.8	3048	236.5	236.9	3.4	14.6	11.0	6.8	1.5	99.3	
254	10.7	56.6	3000	236.5	236.9	2.9	14.3	9.9	8.4	1.5	99.3	
255	10.6	56.1	3014	236.5	236.9	2.9	14.4	9.8	8.9	1.5	99.3	
256	11.9	57.1	2976	236.5	236.9	3.2	14.1	11.1	8.1	1.5	99.3	
257	11.3	56.7	2993	236.5	236.9	3.0	14.3	10.6	8.3	1.5	99.3	
258			2967	236.5	236.9	1.9	14.1	9.5	6.9	1.5	99.3	
259	9.9	56.7	2638	236.5	236.9	0.0	14.0	8.8	7.7	1.5	99.3	
260	10.3	57.0	2919	236.5	236.9	1.3	14.4	9.6	8.0	1.5	99.3	
261	10.3	56.9	2956	236.5	236.9	1.3	14.3	9.6	9.3	1.5	99.3	
262	10.7	56.9	3070	236.5	236.9	3.2	14.7	10.0	8.9	1.5	99.3	
263	11.6	55.8	3086	236.5	236.9	6.1	14.9	10.8	6.6	1.5	99.3	
264	12.4	55.7	3066	236.5	236.9	7.4	14.7	11.6	5.9	1.5	99.3	

***Blank data denotes values that were omitted in the analysis due to an extraneous event during recording

Data Point #	Standardized Wind Speed	LAeq	Turbine Power Output (kW)	Reference Yaw Angle (°)	Yaw Angle (°)	Pitch Angle (°)	Rotor RPM	Nacelle Anemometer Wind Speed (m/s)	10m Anemometer Wind Speed (m/s)	Air Temperature (-C)	Pressure (kPa)	Relative Humidity (%)
265	11.3	55.5	2968	236.5	236.9	6.1	14.1	10.5	7.1	1.5	99.3	
266			2782	236.5	236.9	2.5	13.7	9.5	8.5	1.5	99.3	
267	11.9	52.0	2856	236.5	236.1	3.7	13.7	11.1	7.5	1.5	99.3	
268	11.8	52.8	2917	236.5	237.0	2.2	14.0	11.0	5.4	1.5	99.3	
269	10.8	53.7	3062	236.5	237.0	4.6	14.6	10.1	5.0	1.5	99.3	
270	11.2	53.5	2982	236.5	237.0	3.9	14.3	10.4	7.0	1.5	99.3	
271	11.0	53.0	2970	236.5	237.0	3.2	14.1	10.2	6.0	1.5	99.3	
272			2931	236.5	237.0	1.5	14.1	9.4	5.9	1.5	99.3	
273	11.8	54.7	3070	236.5	237.0	6.2	15.1	11.0	8.5	1.5	99.3	
274	13.5	54.3	3069	236.5	237.0	9.1	14.8	12.5	7.9	1.5	99.3	
275	12.7	53.5	3010	236.5	237.1	8.3	14.3	11.8	7.0	1.6	99.3	
276	14.3	53.5	2997	236.5	237.0	8.2	14.3	13.3	7.2	1.5	99.3	
277	13.2	53.5	3036	236.5	237.0	8.9	14.5	12.3	7.4	1.5	99.3	
278	15.2	54.0	3058	236.5	237.0	10.0	14.6	14.2	6.3	1.5	99.3	
279	13.0	53.3	3008	236.5	237.0	10.1	14.4	12.1	7.5	1.5	99.3	
280	13.0	53.1	2931	236.5	237.0	8.5	14.0	12.1	7.3	1.5	99.3	
281	12.8	53.9	2977	236.5	237.0	8.4	14.2	11.9	6.9	1.6	99.3	
282	12.7	53.7	2987	236.5	237.0	8.5	14.3	11.8	7.1	1.5	99.3	
283	12.9	54.0	2973	236.5	237.0	7.8	14.2	12.0	6.8	1.5	99.3	
284	13.0	53.7	2989	236.5	237.0	8.0	14.3	12.1	5.2	1.5	99.3	
285	12.4	54.0	2935	236.5	237.0	6.4	14.0	11.6	4.5	1.5	99.3	
286	13.7	54.4	3046	236.5	237.0	7.8	14.5	12.7	6.7	1.5	99.3	
287	13.1	54.0	2986	236.5	237.0	7.5	14.2	12.2	7.1	1.6	99.3	
288	11.2	53.7	2902	236.5	237.0	4.8	13.9	10.4	8.1	1.5	99.3	
289	11.2	53.3	2947	236.5	237.1	4.2	14.0	10.4	6.5	1.5	99.3	
290	11.8	54.0	2992	236.5	237.0	3.8	14.3	11.0	6.6	1.5	99.3	
291	13.1	54.4	3089	236.5	237.0	7.7	15.0	12.2	6.6	1.5	99.3	
292	15.1	54.6	3081	236.5	237.0	10.7	15.0	14.1	7.6	1.5	99.3	
293	15.9	54.7	3077	236.5	237.0	12.2	14.8	14.8	5.6	1.5	99.3	
294	15.4	53.7	2999	236.5	237.0	11.6	14.3	14.3	5.1	1.5	99.3	
295	15.5	54.1	2975	236.5	237.0	11.0	14.2	14.4	5.9	1.5	99.3	
296	15.8	54.7	2961	236.5	237.0	10.7	14.1	14.7	7.4	1.5	99.3	
297	13.1	55.5	2895	236.5	238.3	8.9	13.8	12.2	6.1	1.5	99.3	
298	12.8	54.0	2906	236.5	239.1	7.4	13.9	11.9	4.6	1.5	99.3	
299	12.7	54.2	3007	236.5	239.1	7.9	14.3	11.8	6.5	1.5	99.3	
300	14.1	54.6	3070	236.5	239.1	9.3	14.6	13.2	8.0	1.5	99.3	
301	14.7	53.9	3057	236.5	239.1	9.9	14.6	13.7	9.4	1.5	99.3	
302	14.4	53.8	3024	236.5	239.2	9.9	14.4	13.5	7.7	1.5	99.3	
303	14.3	53.5	2950	236.5	239.2	8.8	14.1	13.3	7.7	1.5	99.3	
304	13.1	54.7	2979	236.5	239.4	8.5	14.2	12.2	7.7	1.5	99.3	
305	13.3	55.2	2978	236.5	241.6	8.1	14.1	12.3	8.5	1.5	99.3	
306	12.2	53.3	2979	236.5	241.6	7.5	14.2	11.3	9.4	1.5	99.3	
307	12.3	54.9	2971	236.5	241.6	6.5	14.1	11.5	7.8	1.5	99.3	
308	11.6	53.7	2940	236.5	241.6	4.9	14.0	10.8	8.6	1.5	99.3	
309	10.9	54.4	3004	236.5	241.6	5.4	14.3	10.2	7.4	1.5	99.3	
310	11.4	54.9	2992	236.5	241.6	4.7	14.2	10.6	6.5	1.5	99.3	
311	12.2	54.9	3056	236.5	239.7	6.7	14.6	11.3	6.8	1.5	99.3	
312	12.5	54.4	2997	236.5	239.1	5.6	14.2	11.7	7.2	1.5	99.3	
313	12.7	54.8	3066	236.5	239.0	7.0	14.6	11.9	7.7	1.5	99.3	
314	13.0	54.4	3034	236.5	239.0	7.6	14.4	12.1	7.7	1.5	99.3	
315	11.6	54.2	2913	236.5	239.0	4.9	13.8	10.8	6.5	1.5	99.3	
316	13.3	55.1	2999	236.5	239.0	5.2	14.4	12.4	5.5	1.6	99.3	
317	12.9	54.9	3094	236.5	239.0	8.5	14.8	12.0	5.7	1.5	99.3	
318	13.5	54.1	3046	236.5	239.0	8.6	14.5	12.6	6.1	1.5	99.3	
319	12.9	53.9	3015	236.5	239.0	8.7	14.4	12.0	5.4	1.5	99.3	
320	12.7	54.2	2953	236.5	239.0	7.4	14.0	11.8	6.1	1.5	99.3	
321	12.7	53.8	2980	236.5	239.0	7.1	14.2	11.8	5.9	1.5	99.3	
322	12.9	53.7	2960	236.5	239.0	6.4	14.1	12.1	6.8	1.5	99.3	
323	12.6	55.3	2933	236.5	239.0	4.5	13.9	11.7	8.3	1.5	99.3	
324	12.4	55.4	2970	236.5	239.0	4.1	14.1	11.5	8.6	1.5	99.3	
325	11.5	54.7	3058	236.5	239.0	6.2	14.7	10.8	8.4	1.5	99.3	
326	13.3	54.5	3093	236.5	239.0	9.4	14.9	12.4	7.8	1.5	99.3	
327	13.6	54.6	3076	236.5	239.0	10.0	14.7	12.6	7.1	1.5	99.3	
328	13.0	53.4	2983	236.5	239.0	9.3	14.2	12.2	6.7	1.6	99.3	
329	12.6	54.1	2949	236.5	239.0	8.1	14.1	11.7	6.9	1.6	99.3	
330	13.0	54.8	2977	236.5	239.0	7.8	14.1	12.2	6.7	1.6	99.3	
331	12.3	54.1	2942	236.5	239.0	6.4	14.0	11.5	8.1	1.6	99.3	
332	11.5	54.2	2993	236.5	239.0	6.6	14.2	10.7	7.3	1.6	99.3	
333	12.8	53.8	2945	236.5	239.0	5.0	14.0	11.9	8.2	1.6	99.3	
334	12.7	54.3	2977	236.5	239.0	4.5	14.2	11.9	7.5	1.6	99.3	
335	12.8	54.5	3041	236.5	239.0	5.6	14.4	11.9	7.5	1.7	99.3	
336	11.5	54.2	3012	236.5	239.0	5.3	14.3	10.7	8.2	1.7	99.3	
337	11.3	53.5	2845	236.5	239.0	2.2	13.8	10.5	6.7	1.7	99.3	
338	11.2	54.3	2975	236.5	239.0	2.2	14.2	10.4	6.2	1.6	99.3	
339	11.5	54.6	3084	236.5	239.0	4.8	14.7	10.7	7.9	1.6	99.3	
340	12.9	54.7	3072	236.5	239.0	6.9	14.7	12.0	8.1	1.6	99.3	
341	13.0	54.4	3025	236.5	239.0	6.4	14.4	12.1	7.2	1.6	99.3	
342	13.9	54.4	3061	236.5	239.0	7.9	14.6	12.9	6.3	1.6	99.3	
343	12.5	54.1	3042	236.5	239.0	8.3	14.5	11.7	5.6	1.6	99.3	
344	13.9	54.5	3021	236.5	239.0	8.5	14.4	13.0	6.0	1.6	99.3	
345	13.7	54.9	3005	236.5	239.0	8.4	14.3	12.8	5.8	1.6	99.3	
346	12.4	54.6	2967	236.5	239.0	7.6	14.1	11.6	7.3	1.6	99.3	
347	13.5	54.0	2973	236.5	239.0	6.6	14.2	12.5	6.9	1.6	99.3	
348	11.6	54.0	2962	236.5	239.0	5.8	14.1	10.8	6.0	1.6	99.3	
349	11.3	54.3	2911	236.5	239.0	3.5	13.9	10.5	7.1	1.6	99.3	
350	11.5	54.4	2974	236.5	239.0	3.3	14.1	10.7	9.2	1.6	99.3	
351	11.8	54.7	3015	236.5	239.0	3.4	14.3	11.0	9.0	1.7	99.3	
352	12.2	54.4	3070	236.5	239.0	5.2	14.6	11.3	7.9	1.7	99.3	

Table E.01 Measurement data - Turbine ON

Project: South Branch Wind Farm - Turbine T07 - IEC 61400-11 Measurement

Report ID: 13350.02.T07.RP2

Created on: 2020-01-29

***Blank data denotes values that were omitted in the analysis due to an extraneous event during recording

Data Point #	Standardized Wind Speed	LAeq	Turbine Power Output (kW)	Reference Yaw Angle (°)	Yaw Angle (°)	Pitch Angle (°)	Rotor RPM	Nacelle Anemometer Wind Speed (m/s)	10m Anemometer Wind Speed (m/s)	Air Temperature (-C)	Pressure (kPa)	Relative Humidity (%)
353	11.3	54.4	3038	236.5	239.0	5.4	14.4	10.6	9.1	1.7	99.3	
354	12.4	54.3	2987	236.5	239.0	4.8	14.2	11.6	9.6	1.7	99.3	
355	12.6	55.5	3027	236.5	239.0	5.4	14.4	11.8	8.0	1.7	99.3	
356	12.1	54.7	2982	236.5	239.0	4.8	14.2	11.3	7.5	1.7	99.3	
357	12.2	54.7	3041	236.5	239.0	5.6	14.5	11.4	7.7	1.7	99.3	
358	12.8	55.0	3033	236.5	239.0	6.3	14.4	12.0	6.9	1.7	99.3	
359	12.3	54.4	3049	236.5	239.0	7.0	14.5	11.4	6.7	1.7	99.3	
360	13.7	54.8	3007	236.5	239.0	6.9	14.3	12.8	6.4	1.7	99.3	
361	11.3	53.9	2827	236.5	239.0	3.6	13.7	10.5	7.9	1.7	99.3	
362	10.9	54.9	2994	236.5	239.0	4.1	14.4	10.1	8.9	1.7	99.3	
363	13.0	55.5	3076	236.5	239.0	8.4	14.9	12.1	9.9	1.7	99.3	
364	13.4	54.4	3031	236.5	239.0	8.1	14.4	12.5	8.2	1.7	99.3	
365	12.0	53.2	2937	236.5	239.0	6.3	14.0	11.2	9.6	1.7	99.3	
366	12.0	53.6	2937	236.5	239.0	5.3	14.0	11.2	9.1	1.7	99.3	
367	10.6	53.7	2920	236.5	239.0	3.2	13.9	9.9	8.5	1.7	99.3	
368	11.8	54.3	2999	236.5	239.0	3.6	14.4	11.0	7.8	1.7	99.3	
369	12.4	54.3	3034	236.5	239.0	5.2	14.4	11.5	6.0	1.7	99.3	
370	11.6	54.2	2961	236.5	239.0	3.2	14.1	10.9	7.2	1.7	99.3	
371	12.5	55.0	3088	236.5	239.0	7.7	15.0	11.7	7.2	1.7	99.3	
372	12.5	54.4	3027	236.5	239.0	8.0	14.4	11.6	9.5	1.7	99.3	
373	13.0	53.9	2954	236.5	239.0	6.4	14.1	12.1	7.6	1.7	99.3	
374	11.7	54.8	2960	236.5	239.0	5.8	14.1	10.9	7.1	1.7	99.3	
375	11.2	54.5	2927	236.5	239.0	3.8	13.9	10.4	6.8	1.8	99.3	
376	12.2	54.8	3037	236.5	239.0	5.4	14.6	11.4	7.3	1.7	99.3	
377	12.2	55.1	3088	236.5	239.0	7.7	14.7	11.3	6.2	1.7	99.3	
378	11.9	54.5	3050	236.5	239.0	7.8	14.5	11.0	7.7	1.7	99.3	
379	13.7	54.8	3026	236.5	239.0	8.2	14.4	12.8	7.5	1.7	99.3	
380	13.1	54.1	2980	236.5	239.0	7.4	14.2	12.2	5.7	1.7	99.3	
381	12.4	54.4	2957	236.5	239.0	6.4	14.1	11.6	6.4	1.7	99.3	
382	13.7	54.7	3032	236.5	239.0	7.5	14.4	12.8	7.1	1.7	99.3	
383	12.4	54.0	3013	236.5	239.0	7.2	14.3	11.6	7.0	1.7	99.3	
384	13.6	54.7	3075	236.5	239.0	9.0	14.6	12.7	6.2	1.7	99.3	
385	12.0	54.1	2926	236.5	239.0	7.0	13.9	11.2	6.6	1.7	99.3	
386	11.7	53.6	2927	236.5	239.0	5.4	13.9	10.9	7.4	1.7	99.3	
387	11.2	54.8	3058	236.5	239.0	6.6	14.7	10.4	9.6	1.7	99.3	
388	12.4	54.8	3078	236.5	239.0	8.9	14.7	11.5	9.3	1.7	99.3	
389	12.3	53.8	2971	236.5	239.0	7.5	14.1	11.5	8.2	1.7	99.3	
390	12.9	53.9	2966	236.5	239.0	6.9	14.2	12.0	8.2	1.7	99.3	
391	14.7	57.1	3073	236.5	245.8	7.4	14.7	13.7	8.0	2.5	99.3	
392	12.3	56.2	3044	236.5	245.8	7.7	14.5	11.4	8.0	2.5	99.3	
393	13.8	56.0	2967	236.5	245.8	6.4	14.1	12.9	7.5	2.5	99.3	
394	12.6	56.2	2977	236.5	245.8	6.4	14.2	11.8	9.8	2.5	99.3	
395	10.1	55.5	2753	236.5	245.8	2.6	13.7	9.7	8.5	2.5	99.3	
396	11.6	56.6	3014	236.5	245.8	4.0	14.4	10.8	7.1	2.5	99.3	
397	12.6	56.1	3047	236.5	245.8	5.7	14.5	11.7	6.9	2.5	99.3	
398	12.2	55.6	2942	236.5	245.8	3.4	14.0	11.3	7.4	2.5	99.3	
399	12.5	56.0	2988	236.5	245.8	3.3	14.3	11.6	8.9	2.5	99.3	
400	14.4	57.4	3080	236.5	245.8	7.5	15.0	13.4	7.2	2.5	99.3	
401	15.2	57.0	3092	236.5	245.8	9.0	14.8	14.2	7.3	2.5	99.3	
402	14.8	56.5	3052	236.5	245.8	9.8	14.6	13.7	6.3	2.5	99.3	
403	15.3	56.4	3031	236.5	245.8	10.1	14.4	14.2	7.1	2.5	99.3	
404	13.5	55.9	2953	236.5	247.2	8.9	14.1	12.5	7.1	2.5	99.3	
405	14.1	56.5	3027	236.5	248.4	9.7	14.4	13.1	6.8	2.5	99.3	
406	13.3	57.4	2978	236.5	248.4	9.1	14.2	12.4	8.0	2.5	99.3	
407	13.8	56.6	2993	236.5	248.4	9.2	14.3	12.9	8.7	2.5	99.3	
408	14.9	56.7	3023	236.5	248.4	9.5	14.4	13.9	7.2	2.5	99.3	
409	15.1	57.0	3032	236.5	248.4	10.2	14.5	14.0	8.3	2.5	99.3	
410	15.3	56.8	3018	236.5	248.4	10.4	14.4	14.2	8.6	2.5	99.3	
411	12.9	59.2	2961	236.5	248.4	9.5	14.1	12.0	9.5	2.5	99.3	
412	13.1	56.0	2911	236.5	248.4	8.1	13.9	12.2	7.8	2.5	99.3	
413	15.0	56.1	3030	236.5	248.4	9.0	14.5	14.0	8.1	2.5	99.3	
414	15.0	55.4	2972	236.5	248.4	8.3	14.1	14.0	8.7	2.5	99.3	
415	14.0	55.2	2985	236.5	248.4	8.3	14.3	13.0	9.3	2.5	99.3	
416	12.1	55.7	3019	236.5	248.4	8.6	14.4	11.2	9.3	2.5	99.3	
417	12.4	56.2	3021	236.5	248.4	8.8	14.4	11.5	8.0	2.5	99.3	
418	14.3	56.5	3044	236.5	248.4	9.6	14.5	13.3	7.4	2.5	99.3	
419	15.1	56.6	3002	236.5	248.4	9.4	14.3	14.0	6.5	2.5	99.3	
420	13.5	55.9	2930	236.5	248.4	8.0	14.0	12.5	9.5	2.5	99.3	
421	12.3	55.5	2882	236.5	248.4	5.6	13.8	11.4	8.2	2.5	99.3	
422	13.6	56.6	3030	236.5	248.4	7.0	14.4	12.7	6.5	2.5	99.3	
423	12.8	57.5	3029	236.5	248.4	7.2	14.5	11.9	8.0	2.5	99.3	
424	12.3	58.5	2996	236.5	248.4	7.6	14.3	11.4	10.1	2.5	99.3	
425	14.2	59.8	3034	236.5	248.4	8.9	14.7	13.2	8.9	2.5	99.3	
426	16.2	57.8	3081	236.5	248.4	12.3	14.9	15.1	9.1	2.5	99.3	
427	15.9	57.2	3050	236.5	248.4	12.6	14.6	14.9	9.2	2.5	99.3	
428	17.1	57.2	3042	236.5	248.4	13.0	14.5	15.9	7.5	2.5	99.3	
429	15.9	56.6	2954	236.5	248.4	12.1	14.1	14.8	6.7	2.5	99.3	
430	14.9	54.6	2918	236.5	248.4	10.8	13.9	13.8	6.5	2.5	99.3	
431	14.4	57.6	2989	236.5	248.4	10.6	14.3	13.4	8.4	2.5	99.3	
432	11.9	55.8	2925	236.5	248.4	8.9	13.9	11.1	8.3	2.5	99.3	
433	12.7	57.0	2993	236.5	248.4	9.1	14.3	11.9	8.1	2.5	99.3	
434	14.3	58.7	3024	236.5	248.4	9.6	14.4	13.3	7.7	2.5	99.3	
435	14.5	56.7	3041	236.5	248.4	10.1	14.4	13.5	9.3	2.5	99.3	
436	15.8	58.3	3052	236.5	248.4	11.0	14.5	14.7	9.6	2.5	99.3	
437	14.2	59.7	2890	236.5	249.4	8.7	13.8	13.2	11.0	2.5	99.3	
438	14.4	56.8	3015	236.5	251.1	9.3	14.3	13.4	11.3	2.5	99.3	
439	13.6	56.5	3034	236.5	251.1	9.8	14.4	12.7	10.2	2.5	99.3	
440	15.0	57.4	3047	236.5	251.1	10.5	14.5	14.0	9.8	2.5	99.3	

***Blank data denotes values that were omitted in the analysis due to an extraneous event during recording

Data Point #	Standardized Wind Speed	LAeq	Turbine Power Output (kW)	Reference Yaw Angle (°)	Yaw Angle (°)	Pitch Angle (°)	Rotor RPM	Nacelle Anemometer Wind Speed (m/s)	10m Anemometer Wind Speed (m/s)	Air Temperature (-C)	Pressure (kPa)	Relative Humidity (%)
441	14.3	56.5	3021	236.5	251.1	10.6	14.4	13.3	8.8	2.5	99.3	
442	14.3	56.0	2978	236.5	251.1	10.0	14.2	13.3	8.7	2.5	99.3	
443	14.7	55.6	3023	236.5	251.1	10.5	14.4	13.7	9.3	2.5	99.3	
444	14.3	55.5	2946	236.5	251.1	9.3	14.1	13.3	9.7	2.5	99.3	
445	14.3	56.3	3004	236.5	251.1	9.4	14.2	13.3	9.8	2.5	99.3	
446	14.5	58.7	3042	236.5	251.1	10.2	14.5	13.5	9.7	2.5	99.3	
447	13.7	57.5	2999	236.5	251.3	10.3	14.3	12.8	9.7	2.5	99.3	
448			2880	236.5	253.4	7.7	13.7	11.6	9.7	2.5	99.3	
449			2968	236.5	253.4	7.4	14.2	11.9	8.5	2.5	99.3	
450			3057	236.5	253.4	9.5	14.6	13.4	7.4	2.5	99.3	
451			3043	236.5	253.4	9.6	14.5	13.9	6.2	2.5	99.3	
452			3012	236.5	253.4	9.6	14.3	12.8	7.2	2.5	99.3	
453			3008	236.5	253.5	9.5	14.3	13.5	7.9	2.5	99.3	
454			2891	236.5	253.5	7.3	13.8	11.1	9.9	2.5	99.3	
455			3029	236.5	253.5	8.6	14.6	12.5	10.3	2.5	99.3	
456			3079	236.5	253.5	11.7	14.9	14.2	13.0	2.5	99.3	
457			2875	236.5	253.5	8.4	13.7	12.7	12.9	2.5	99.3	
458			2936	236.5	253.5	7.5	14.0	11.5	9.0	2.5	99.3	
459			2945	236.5	253.5	6.4	14.0	11.7	10.9	2.5	99.3	
460			3046	236.5	253.5	7.5	14.5	12.0	11.7	2.5	99.3	
461			3072	236.5	253.5	8.7	14.6	12.1	11.2	2.5	99.3	
462			3044	236.5	253.5	9.0	14.4	13.2	9.6	2.5	99.3	
463			3009	236.5	253.5	8.8	14.4	13.1	10.3	2.5	99.3	
464			3025	236.5	253.5	9.1	14.4	13.4	9.2	2.5	99.3	
465			2962	236.5	253.5	8.0	14.1	13.5	9.3	2.5	99.3	
466			3024	236.5	253.5	8.6	14.4	13.2	11.4	2.5	99.3	
467			3042	236.5	253.5	9.3	14.4	14.0	11.4	2.5	99.3	
468			2994	236.5	253.5	8.8	14.3	13.8	8.8	2.5	99.3	
469			2935	236.5	254.2	7.4	14.0	12.5	6.2	2.5	99.3	
470			2912	236.5	256.3	5.4	13.9	10.4	8.8	2.5	99.3	
471			2957	236.5	256.3	4.0	14.0	10.4	9.5	2.5	99.3	
472			3002	236.5	256.3	4.0	14.3	11.6	12.0	2.5	99.3	
473			3090	236.5	256.3	6.6	14.7	13.7	11.0	2.5	99.3	
474			3073	236.5	256.3	8.9	14.8	12.9	11.5	2.5	99.3	
475			3073	236.5	256.3	9.2	14.6	13.6	10.9	2.5	99.3	
476			3010	236.5	256.3	9.1	14.4	12.7	10.1	2.5	99.3	
477			2998	236.5	256.3	8.7	14.2	13.0	10.4	2.5	99.3	
478	10.2	58.2	2768	253.0	253.3	1.3	14.2	7.8	8.8	2.3	99.3	
479	12.2	57.6	3050	253.0	253.3	4.2	14.8	11.4	9.0	2.3	99.3	
480	11.9	57.5	3093	253.0	253.3	8.7	15.0	11.1	7.5	2.3	99.3	
481	11.9	56.8	3031	253.0	253.3	8.0	14.4	11.1	6.7	2.3	99.3	
482	12.0	56.4	2975	253.0	253.3	7.3	14.2	11.2	6.9	2.3	99.3	
483	11.9	57.8	2872	253.0	253.3	4.3	13.7	11.1	7.6	2.3	99.3	
484	9.5	57.1	2433	253.0	253.3	0.4	13.8	10.6	9.2	2.3	99.3	
485	10.1	57.3	2751	253.0	253.3	1.4	14.4	10.6	9.7	2.3	99.3	
486	11.2	57.4	2883	253.0	253.3	1.4	14.2	10.5	8.5	2.3	99.3	
487	10.8	57.2	2919	253.0	253.3	1.5	14.4	10.1	9.3	2.3	99.3	
488	11.7	56.9	2996	253.0	253.3	2.2	14.4	10.9	9.6	2.3	99.3	
489	12.1	57.4	2962	253.0	253.3	2.3	14.4	11.3	9.4	2.3	99.3	
490	12.2	57.6	3096	253.0	253.3	5.9	14.9	11.4	10.8	2.3	99.3	
491	14.5	57.6	3089	253.0	253.3	8.6	15.0	13.5	8.6	2.3	99.3	
492	14.6	57.7	3061	253.0	253.3	9.1	14.6	13.6	7.2	2.3	99.3	
493	14.0	57.3	3042	253.0	253.3	9.5	14.5	13.0	7.6	2.3	99.3	
494	15.2	55.1	3092	253.0	253.3	11.4	14.8	14.2	8.5	2.3	99.3	
495			3058	253.0	253.3	12.7	14.7	16.2	8.5	2.3	99.3	
496	16.5	55.5	3017	253.0	253.3	12.5	14.4	15.3	8.5	2.3	99.3	
497	16.4	55.4	2968	253.0	253.3	11.7	14.1	15.3	9.3	2.3	99.3	
498	16.2	56.4	2916	253.0	253.3	10.5	13.9	15.0	9.2	2.3	99.3	
499	14.9	57.0	2959	253.0	254.9	10.1	14.1	13.9	7.1	2.3	99.3	
500	14.6	56.7	2974	253.0	256.3	9.9	14.1	13.6	7.0	2.3	99.3	
501	12.8	55.9	2900	253.0	256.3	7.7	13.9	12.0	7.6	2.3	99.3	
502	11.9	55.3	2939	253.0	256.3	6.5	14.0	11.1	9.7	2.3	99.3	
503	14.7	57.4	3087	253.0	256.3	10.7	15.0	13.7	10.1	2.3	99.3	
504	15.6	56.2	3048	253.0	256.3	10.8	14.5	14.6	10.6	2.3	99.3	
505	13.8	55.9	2970	253.0	256.3	9.7	14.1	12.8	10.8	2.3	99.3	
506	14.9	56.7	2991	253.0	256.3	9.7	14.2	13.9	9.9	2.3	99.3	
507	14.0	56.7	2995	253.0	256.3	9.4	14.2	13.0	9.5	2.3	99.3	
508	13.7	56.8	3005	253.0	256.3	9.4	14.3	12.7	10.0	2.3	99.3	
509	14.8	58.2	3060	253.0	256.3	10.6	14.6	13.8	11.7	2.3	99.3	
510	14.6	57.5	2963	253.0	256.3	9.4	14.1	13.6	13.7	2.3	99.3	
511	13.1	57.0	2950	253.0	256.3	8.6	14.1	12.2	11.6	2.3	99.3	
512	12.4	56.9	2952	253.0	256.3	7.6	14.0	11.6	12.3	2.3	99.3	
513	12.3	56.9	3010	253.0	256.3	7.7	14.3	11.5	12.0	2.3	99.3	
514	13.8	56.5	3069	253.0	256.3	9.5	14.6	12.9	11.5	2.3	99.3	
515	13.0	56.3	2961	253.0	256.3	8.1	14.1	12.1	9.9	2.3	99.3	
516	13.2	56.8	2935	253.0	256.3	6.5	13.9	12.3	8.8	2.3	99.3	
517	13.7	56.1	2961	253.0	256.3	6.0	14.1	12.8	8.7	2.3	99.3	
518	11.1	56.2	2967	253.0	256.3	4.8	14.0	10.4	9.4	2.3	99.3	
519	12.0	56.5	2986	253.0	256.3	4.5	14.2	11.1	8.2	2.3	99.3	
520	11.2	56.1	2893	253.0	256.3	2.1	13.8	10.4	10.5	2.3	99.3	
521	9.5	56.1	2420	253.0	256.3	-0.9	14.0	8.8	10.6	2.3	99.3	
522	9.3	56.9	2326	253.0	256.3	-1.8	14.2	7.8	9.9	2.3	99.3	
523	9.8	57.0	2604	253.0	256.3	-1.2	14.4	8.0	9.7	2.3	99.3	
524	9.8	56.8	2617	253.0	255.0	-1.1	14.3	9.1	9.2	2.3	99.3	
525			2919	253.0	253.9	1.2	14.7	9.5	9.3	2.3	99.3	
526	13.2	57.9	3085	253.0	253.9	7.1	15.0	12.3	8.8	2.3	99.3	
527	12.5	57.6	3010	253.0	252.9	5.7	14.2	11.6	8.3	2.3	99.3	
528	13.9	58.1	3050	253.0	251.1	6.4	14.5	13.0	8.5	2.3	99.3	

Table E.01 Measurement data - Turbine ON

Project: South Branch Wind Farm - Turbine T07 - IEC 61400-11 Measurement

Report ID: 13350.02.T07.RP2

Created on: 2020-01-29

***Blank data denotes values that were omitted in the analysis due to an extraneous event during recording

Data Point #	Standardized Wind Speed	LAeq	Turbine Power Output (kW)	Reference Yaw Angle (°)	Yaw Angle (°)	Pitch Angle (°)	Rotor RPM	Nacelle Anemometer Wind Speed (m/s)	10m Anemometer Wind Speed (m/s)	Air Temperature (-C)	Pressure (kPa)	Relative Humidity (%)
529	12.5	57.7	3033	253.0	251.1	6.6	14.4	11.7	6.7	2.3	99.3	
530	14.8	57.5	3057	253.0	251.1	7.7	14.5	13.7	6.1	2.3	99.3	
531	15.3	56.5	3018	253.0	251.1	7.3	14.3	14.3	5.7	2.3	99.3	
532	14.5	56.5	2963	253.0	251.1	6.1	14.1	13.5	6.3	2.3	99.3	
533	13.3	58.1	2981	253.0	251.1	5.6	14.2	12.4	7.7	2.3	99.3	
534	13.6	56.8	3002	253.0	251.1	5.8	14.2	12.7	8.4	2.3	99.3	
535	12.1	56.7	2942	253.0	251.1	3.6	14.0	11.3	7.9	2.3	99.3	
536	13.2	56.6	3000	253.0	251.1	4.0	14.2	12.3	7.5	2.3	99.3	
537	12.0	56.6	2818	253.0	251.1	0.9	13.9	11.1	8.6	2.3	99.3	
538	12.5	56.7	2797	253.0	251.1	1.2	14.3	11.7	8.2	2.3	99.3	
539	11.0	56.9	2810	253.0	251.3	1.4	14.3	10.3	8.0	2.3	99.3	
540	11.1	56.5	2953	253.0	259.4	1.9	14.1	10.4	7.0	2.1	99.3	
541	10.9	56.6	2997	253.0	259.4	2.1	14.3	10.2	5.7	2.1	99.3	
542	11.3	56.8	3018	253.0	259.4	2.5	14.4	10.5	5.3	2.1	99.3	
543	10.5	57.7	3066	253.0	259.2	5.6	14.9	9.8	6.4	2.1	99.3	
544	13.8	57.7	3079	253.0	256.7	9.4	15.0	12.9	7.2	2.1	99.3	
545	13.5	57.1	2993	253.0	256.7	8.3	14.3	12.6	5.9	2.1	99.3	
546	13.6	57.2	3004	253.0	256.7	8.5	14.3	12.7	6.0	2.1	99.3	
547	13.4	57.3	2947	253.0	256.7	7.2	14.1	12.5	6.1	2.1	99.3	
548	12.8	56.4	2958	253.0	256.7	6.5	14.1	11.9	5.7	2.1	99.3	
549	11.8	57.0	2968	253.0	256.7	6.0	14.2	11.0	7.6	2.0	99.3	
550	11.3	56.1	2871	253.0	256.7	3.3	13.8	10.5	6.9	1.9	99.3	
551			2828	253.0	256.7	1.5	13.9	9.4	8.6	1.9	99.3	
552	11.5	57.1	2889	253.0	256.7	1.6	14.2	10.7	7.7	1.9	99.3	
553	13.0	57.4	3055	253.0	256.7	3.3	14.5	12.1	9.5	1.9	99.3	
554	11.4	56.9	3045	253.0	256.7	3.9	14.5	10.6	8.0	2.0	99.3	
555	11.1	56.8	3001	253.0	256.7	3.6	14.3	10.4	6.5	2.0	99.3	
556	12.9	57.3	2970	253.0	256.7	3.0	14.2	12.0	6.2	1.9	99.3	
557	12.5	57.2	2994	253.0	256.7	2.7	14.4	11.7	7.0	1.9	99.3	
558	12.8	57.8	3075	253.0	256.7	7.7	14.9	11.9	8.0	1.9	99.3	
559	12.8	57.4	2982	253.0	256.7	6.0	14.2	11.9	7.3	1.9	99.3	
560	13.8	57.0	3008	253.0	256.7	6.2	14.3	12.9	7.5	2.0	99.3	
561	13.7	56.7	3021	253.0	256.7	6.7	14.4	12.8	7.1	1.9	99.3	
562	6.7	49.3	909	302.0	299.0	-1.5	10.8	6.0	4.0	-0.9	99.3	
563	6.5	48.4	827	302.0	299.0	-1.5	10.5	6.4	3.9	-0.9	99.3	
564	6.6	48.9	865	302.0	298.9	-1.5	10.6	6.5	3.9	-0.9	99.3	
565	6.7	49.4	906	302.0	299.0	-1.5	10.8	6.3	3.7	-0.8	99.3	
566	6.8	49.4	945	302.0	299.0	-1.5	11.0	6.0	4.0	-0.9	99.3	
567	6.9	50.0	992	302.0	299.0	-1.7	11.1	6.6	4.5	-0.9	99.3	
568	7.2	51.0	1107	302.0	299.0	-2.1	11.5	6.7	4.3	-0.9	99.3	
569	7.4	51.5	1206	302.0	299.0	-2.1	11.9	6.9	3.8	-0.9	99.3	
570	7.5	51.9	1249	302.0	299.0	-2.1	12.0	7.3	3.8	-0.9	99.3	
571	7.3	51.2	1172	302.0	298.9	-2.1	11.7	7.1	3.6	-0.8	99.3	
572	7.2	51.0	1112	302.0	298.9	-2.1	11.6	7.2	3.3	-0.9	99.3	
573	7.6	52.6	1333	302.0	298.9	-2.0	12.4	8.5	3.4	-0.9	99.3	
574	8.0	53.5	1514	302.0	299.0	-1.5	12.9	7.6	3.5	-0.9	99.3	
575	8.0	53.3	1512	302.0	299.0	-1.5	12.9	7.8	4.2	-0.9	99.3	
576	7.8	52.4	1400	302.0	298.8	-1.5	12.6	7.3	4.3	-0.9	99.3	
577	7.7	52.4	1347	302.0	298.9	-1.5	12.4	6.2	3.6	-0.8	99.3	
578	7.7	52.5	1373	302.0	298.9	-1.5	12.5	7.7	3.5	-0.9	99.3	
579	7.7	54.0	1347	302.0	299.0	-1.7	12.4	7.1	3.5	-0.9	99.3	
580	7.4	53.9	1244	302.0	299.0	-2.1	12.0	6.2	3.5	-0.9	99.3	
581	7.2	52.2	1142	302.0	299.0	-2.1	11.6	6.6	3.6	-0.9	99.3	
582	7.0	50.4	1001	302.0	301.4	-2.1	11.2	6.4	4.2	-0.9	99.3	
583	6.8	49.9	936	302.0	301.8	-2.1	10.9	6.2	4.6	-0.9	99.3	
584	6.9	50.1	965	302.0	301.8	-2.1	11.0	6.6	5.7	-0.9	99.3	
585	7.5	52.2	1261	302.0	301.8	-1.9	12.1	8.2	4.6	-0.9	99.3	
586	8.4	54.8	1764	302.0	301.9	-1.4	13.6	8.1	4.7	-0.9	99.3	
587	9.3	56.3	2329	302.0	303.5	-1.1	14.4	8.1	4.3	-0.9	99.3	
588	8.8	55.4	2017	302.0	304.4	-1.5	14.0	8.4	4.6	-0.9	99.3	
589	8.1	53.5	1616	302.0	304.4	-1.5	13.2	7.6	4.4	-0.9	99.3	
590	8.1	53.5	1581	302.0	304.3	-1.5	13.1	8.0	4.1	-0.9	99.3	
591	8.1	53.8	1608	302.0	301.4	-1.6	13.2	8.2	4.1	-0.9	99.3	
592	8.0	53.5	1521	302.0	301.2	-1.8	12.9	7.2	4.8	-0.9	99.3	
593	8.0	53.6	1531	302.0	301.2	-1.8	13.0	7.7	5.3	-0.9	99.3	
594	8.6	55.8	1913	302.0	301.2	-1.8	14.0	7.5	5.2	-0.9	99.3	
595	8.8	56.1	2021	302.0	301.2	-1.8	14.2	7.5	4.8	-0.8	99.3	
596	8.3	54.5	1714	302.0	301.2	-1.8	13.4	7.4	5.0	-0.8	99.3	
597	7.7	52.4	1392	302.0	301.2	-1.9	12.5	6.5	4.7	-0.8	99.3	
598	7.3	51.1	1187	302.0	301.2	-2.1	11.8	7.8	5.6	-0.8	99.3	
599	6.9	49.9	997	302.0	301.2	-2.1	11.1	6.5	4.6	-0.8	99.3	
600	6.6	48.5	857	302.0	301.2	-2.1	10.6	6.5	4.8	-0.8	99.3	
601	7.1	50.4	1044	302.0	301.2	-2.1	11.4	6.5	5.9	-0.8	99.3	
602	7.9	53.4	1488	302.0	301.2	-2.1	12.9	8.0	5.6	-0.8	99.3	
603	7.6	51.7	1301	302.0	301.2	-1.5	12.2	7.0	4.5	-0.8	99.3	
604	7.2	50.1	1137	302.0	301.2	-1.5	11.6	7.9	4.5	-0.8	99.3	
605	7.3	50.5	1146	302.0	301.2	-1.5	11.7	7.1	4.5	-0.8	99.3	
606	7.0	49.7	1029	302.0	301.2	-1.5	11.2	6.8	4.2	-0.8	99.3	
607	6.8	48.6	927	302.0	301.2	-1.5	10.9	6.3	4.6	-0.8	99.3	
608	6.7	48.1	887	302.0	301.2	-1.6	10.7	6.3	4.6	-0.8	99.3	
609	6.5	47.7	837	302.0	301.2	-2.1	10.5	6.4	4.1	-0.8	99.3	
610	6.7	48.7	911	302.0	301.2	-2.1	10.8	6.2	4.0	-0.8	99.3	
611	7.1	50.1	1060	302.0	301.2	-2.1	11.4	7.0	4.1	-0.8	99.3	
612	7.3	50.9	1170	302.0	301.2	-2.1	11.8	6.3	4.6	-0.7	99.3	
613	7.3	50.8	1174	302.0	301.2	-2.1	11.8	7.2	4.1	-0.7	99.3	
614	7.2	50.2	1120	302.0	301.2	-2.1	11.6	7.0	3.8	-0.7	99.3	
615	7.2	50.1	1096	302.0	301.2	-1.5	11.5	7.4	4.7	-0.7	99.3	
616	7.2	50.2	1105	302.0	301.2	-1.5	11.5	7.1	5.3	-0.7	99.3	

***Blank data denotes values that were omitted in the analysis due to an extraneous event during recording

Data Point #	Standardized Wind Speed	LAeq	Turbine Power Output (kW)	Reference Yaw Angle (°)	Yaw Angle (°)	Pitch Angle (°)	Rotor RPM	Nacelle Anemometer Wind Speed (m/s)	10m Anemometer Wind Speed (m/s)	Air Temperature (-C)	Pressure (kPa)	Relative Humidity (%)
617	7.3	50.5	1168	302.0	301.2	-1.5	11.8	7.1	5.1	-0.7	99.3	
618	7.5	51.0	1247	302.0	301.2	-1.5	12.0	6.3	5.2	-0.6	99.3	
619	7.4	50.9	1204	302.0	301.2	-1.5	11.9	6.2	5.2	-0.7	99.3	
620	7.3	51.0	1183	302.0	301.2	-1.6	11.8	7.0	5.4	-0.7	99.3	
621	7.2	50.6	1122	302.0	302.7	-2.1	11.6	6.6	5.0	-0.7	99.3	
622	7.0	49.9	1037	302.0	304.0	-2.1	11.3	6.1	4.8	-0.7	99.3	
623	6.7	48.4	888	302.0	304.1	-2.1	10.7	6.7	5.0	-0.7	99.3	
624	6.8	48.7	934	302.0	304.1	-2.1	10.9	7.4	4.2	-0.7	99.3	
625	7.4	51.5	1240	302.0	304.1	-2.1	12.0	8.2	4.9	-0.7	99.3	
626	7.7	52.9	1374	302.0	304.1	-2.1	12.5	7.5	4.6	-0.7	99.3	
627	7.9	53.6	1454	302.0	304.1	-1.5	12.7	7.0	4.3	-0.7	99.3	
628	7.4	51.8	1228	302.0	304.1	-1.5	12.0	6.0	4.3	-0.7	99.3	
629	7.1	50.1	1089	302.0	304.1	-1.5	11.4	7.0	5.8	-0.7	99.3	
630	7.0	49.3	1013	302.0	304.1	-1.5	11.2	7.3	6.2	-0.7	99.3	
631	6.9	49.3	988	302.0	304.1	-1.5	11.1	7.3	5.2	-0.7	99.3	
632	7.0	50.2	1033	302.0	304.8	-1.6	11.3	6.9	4.9	-0.7	99.3	
633	7.1	49.8	1047	302.0	306.7	-2.1	11.3	6.5	5.4	-0.7	99.3	
634	7.0	49.8	1008	302.0	306.6	-2.1	11.2	6.0	5.2	-0.7	99.3	
635	7.0	49.7	1004	302.0	306.6	-2.1	11.2	6.5	4.8	-0.7	99.3	
636	7.5	51.8	1258	302.0	306.6	-2.1	12.1	7.9	4.7	-0.7	99.3	
637	7.7	52.7	1397	302.0	306.6	-2.1	12.6	7.0	4.5	-0.7	99.3	
638	7.6	51.6	1309	302.0	306.6	-2.1	12.2	7.4	4.7	-0.7	99.3	
639	7.3	50.9	1192	302.0	306.6	-1.5	11.8	6.5	4.2	-0.7	99.3	
640	7.5	51.7	1277	302.0	306.6	-1.5	12.1	6.8	3.9	-0.7	99.3	
641	7.7	52.3	1373	302.0	306.6	-1.5	12.5	7.1	4.5	-0.7	99.3	
642	7.5	51.6	1289	302.0	305.6	-1.5	12.2	5.9	4.9	-0.7	99.3	
643	7.3	51.0	1191	302.0	304.1	-1.5	11.8	7.5	5.5	-0.7	99.3	
644	7.1	50.2	1089	302.0	304.1	-2.1	11.5	6.4	5.6	-0.7	99.3	
645	7.0	49.9	1033	302.0	304.1	-2.1	11.3	6.5	5.4	-0.7	99.3	
646	7.1	50.5	1074	302.0	304.1	-2.1	11.5	6.1	4.8	-0.7	99.3	
647	7.2	50.4	1125	302.0	304.1	-2.1	11.6	6.3	4.8	-0.6	99.3	
648	7.0	49.6	1036	302.0	304.1	-2.1	11.3	6.4	5.6	-0.7	99.3	
649	7.1	50.4	1092	302.0	304.1	-2.1	11.5	6.9	4.9	-0.7	99.3	
650	7.9	53.2	1480	302.0	304.1	-1.6	12.9	7.6	4.8	-0.7	99.3	
651	8.5	55.2	1864	302.0	304.1	-1.5	13.8	8.4	4.9	-0.7	99.3	
652	8.2	54.0	1663	302.0	302.0	-1.5	13.3	6.6	7.0	-0.7	99.3	
653	7.6	51.4	1336	302.0	301.5	-1.5	12.3	6.5	6.5	-0.6	99.3	
654	7.3	50.5	1145	302.0	301.4	-1.5	11.6	6.9	6.3	-0.6	99.3	
655	7.3	51.0	1186	302.0	301.4	-1.5	11.8	7.2	5.5	-0.6	99.3	
656	7.6	52.0	1341	302.0	301.4	-2.1	12.4	7.0	5.0	-0.6	99.3	
657	7.7	52.1	1349	302.0	301.4	-2.1	12.4	7.3	5.0	-0.6	99.3	
658	7.8	53.3	1415	302.0	301.4	-2.1	12.6	7.2	4.2	-0.6	99.3	
659	8.3	54.9	1742	302.0	301.4	-2.1	13.6	7.5	4.9	-0.6	99.3	
660	8.4	55.0	1768	302.0	301.4	-2.1	13.6	7.8	5.3	-0.6	99.3	
661	8.3	54.3	1717	302.0	299.5	-2.1	13.5	7.7	5.1	-0.6	99.3	
662	8.2	54.1	1676	302.0	298.6	-1.6	13.4	7.3	4.8	-0.6	99.3	
663	7.9	53.1	1482	302.0	298.7	-1.5	12.8	7.3	4.5	-0.6	99.3	
664	7.8	52.7	1431	302.0	298.7	-1.5	12.7	7.2	4.1	-0.6	99.3	
665	7.6	52.2	1341	302.0	298.7	-1.5	12.3	7.1	4.3	-0.6	99.3	
666	7.2	50.6	1128	302.0	298.7	-1.5	11.6	6.4	4.0	-0.6	99.3	
667	6.9	49.2	994	302.0	298.7	-1.5	11.1	6.1	4.2	-0.6	99.3	
668	7.1	50.1	1069	302.0	298.7	-2.1	11.4	6.8	4.3	-0.6	99.3	
669	7.5	51.6	1261	302.0	298.7	-2.1	12.1	6.2	4.8	-0.6	99.3	
670	7.6	51.8	1308	302.0	298.7	-2.1	12.3	6.9	5.0	-0.6	99.3	
671	7.9	52.6	1455	302.0	298.7	-2.1	12.8	7.9	4.3	-0.6	99.3	
672	8.0	53.5	1537	302.0	298.7	-2.1	13.0	7.5	4.0	-0.6	99.3	
673	8.0	53.3	1507	302.0	298.7	-2.1	12.9	7.5	3.7	-0.6	99.3	
674	8.4	54.6	1760	302.0	298.7	-1.6	13.6	7.6	4.8	-0.6	99.3	
675	8.4	54.8	1789	302.0	298.7	-1.5	13.6	7.8	4.4	-0.6	99.3	
676			1489	302.0	298.7	-1.5	12.8	7.2	3.5	-0.6	99.3	
677			1347	302.0	298.6	-1.5	12.4	7.1	3.7	-0.6	99.3	
678			1266	302.0	298.6	-1.5	12.1	6.1	3.9	-0.6	99.3	
679			1037	302.0	298.6	-1.5	11.3	6.3	3.9	-0.6	99.3	
680			928	302.0	298.6	-2.1	10.9	6.6	4.2	-0.6	99.3	
681			1036	302.0	298.7	-2.1	11.3	6.7	4.1	-0.6	99.3	
682			1251	302.0	298.7	-2.1	12.1	6.8	3.4	-0.6	99.3	
683			1309	302.0	298.7	-2.1	12.2	7.3	3.5	-0.6	99.3	
684			1179	302.0	298.7	-2.1	11.8	6.9	3.5	-0.6	99.3	
685			1123	302.0	298.7	-2.0	11.6	6.4	3.4	-0.6	99.3	
686			1121	302.0	298.7	-1.5	11.6	6.9	3.2	-0.6	99.3	
687	7.3	50.9	1183	302.0	298.7	-1.5	11.8	7.7	4.6	-0.6	99.3	
688	7.6	51.9	1327	302.0	298.7	-1.5	12.3	7.2	3.9	-0.6	99.3	
689	8.0	53.2	1507	302.0	298.7	-1.5	12.9	7.5	4.3	-0.6	99.3	
690	8.3	54.3	1684	302.0	298.7	-1.5	13.4	7.0	5.9	-0.6	99.3	
691	8.9	55.8	2081	302.0	298.6	-1.3	14.2	8.2	5.4	-0.6	99.3	
692	9.2	56.0	2240	302.0	298.7	-2.1	14.3	9.2	5.0	-0.6	99.3	
693	8.4	54.6	1783	302.0	298.7	-2.1	13.6	7.1	6.0	-0.6	99.3	
694	8.1	53.6	1582	302.0	298.7	-2.1	13.1	7.7	5.5	-0.6	99.3	
695	8.1	53.9	1605	302.0	298.7	-2.1	13.2	9.0	7.1	-0.6	99.3	
696	8.7	55.6	1946	302.0	298.7	-2.0	14.0	8.2	7.1	-0.6	99.3	
697	9.8	56.1	2635	302.0	298.7	-1.0	14.5	9.3	6.3	-0.6	99.3	
698	9.5	56.1	2462	302.0	298.7	-1.5	14.3	7.9	6.1	-0.6	99.3	
699	9.3	55.8	2304	302.0	298.7	-1.8	14.3	8.7	8.3	-0.6	99.3	
700	8.9	55.7	2111	302.0	298.7	-1.8	14.2	7.5	8.3	-0.6	99.3	
701	8.8	56.0	2051	302.0	298.7	-1.8	14.3	8.2	8.5	-0.5	99.3	
702	8.7	55.2	1934	302.0	298.7	-1.8	14.0	6.9	8.3	-0.5	99.3	
703	8.6	55.3	1886	302.0	298.7	-1.8	13.9	6.9	7.6	-0.5	99.3	
704	8.2	56.2	1673	302.0	298.7	-1.9	13.4	7.2	7.3	-0.5	99.3	

Table E.01 Measurement data - Turbine ON

Project: South Branch Wind Farm - Turbine T07 - IEC 61400-11 Measurement

Report ID: 13350.02.T07.RP2

Created on: 2020-01-29

***Blank data denotes values that were omitted in the analysis due to an extraneous event during recording

Data Point #	Standardized Wind Speed	LAeq	Turbine Power Output (kW)	Reference Yaw Angle (°)	Yaw Angle (°)	Pitch Angle (°)	Rotor RPM	Nacelle Anemometer Wind Speed (m/s)	10m Anemometer Wind Speed (m/s)	Air Temperature (-C)	Pressure (kPa)	Relative Humidity (%)
705	8.3	54.8	1705	302.0	298.7	-1.8	13.5	6.9	6.9	-0.5	99.3	
706	8.1	53.5	1556	302.0	298.7	-1.8	13.1	7.4	6.5	-0.5	99.3	
707	8.0	53.8	1538	302.0	298.7	-1.8	13.1	7.9	6.4	-0.4	99.3	
708	8.5	55.1	1832	302.0	298.7	-1.8	13.8	8.1	6.5	-0.4	99.3	
709	9.2	56.0	2273	302.0	298.7	-1.5	14.4	10.2	7.4	-0.4	99.3	
710	9.2	56.0	2277	302.0	298.7	-1.8	14.3	8.7	7.2	-0.4	99.3	
711	8.6	55.1	1879	302.0	298.7	-1.8	13.9	8.0	7.6	-0.4	99.3	
712	8.4	54.5	1753	302.0	298.7	-1.8	13.6	8.1	7.5	-0.4	99.3	
713	8.7	55.4	1979	302.0	298.7	-1.7	14.1	7.5	7.3	-0.4	99.3	
714	9.0	55.8	2154	302.0	298.7	-1.8	14.3	8.5	7.5	-0.4	99.3	
715	9.0	55.8	2134	302.0	298.7	-1.7	14.3	8.6	6.9	-0.4	99.3	
716	9.1	55.6	2196	302.0	299.8	-1.5	14.3	7.9	6.3	-0.4	99.3	
717	8.8	55.7	2052	302.0	301.0	-1.5	14.3	9.3	6.0	-0.4	99.3	
718	8.8	55.4	2010	302.0	301.1	-1.5	14.2	7.8	5.4	-0.4	99.3	
719	8.8	55.6	2027	302.0	301.2	-1.5	14.2	7.9	4.8	-0.4	99.3	
720	9.2	56.0	2248	302.0	301.2	-1.2	14.4	8.5	4.8	-0.4	99.3	
721	9.9	55.7	2655	302.0	301.2	-0.7	14.5	8.2	4.7	-0.4	99.3	
722	9.6	55.7	2504	302.0	301.2	-1.5	14.3	8.7	6.5	-0.4	99.3	
723	10.0	55.9	2728	302.0	301.2	-0.8	14.4	9.2	6.6	-0.4	99.3	
724	9.8	55.6	2587	302.0	301.2	-1.2	14.3	9.7	7.3	-0.4	99.3	
725	9.9	55.6	2695	302.0	302.2	-0.9	14.3	9.2	8.2	-0.4	99.3	
726			2996	302.0	303.8	0.9	14.6	9.1	7.8	-0.4	99.3	
727	10.7	56.0	3075	302.0	303.8	3.9	14.7	9.9	7.6	-0.4	99.3	
728			2860	302.0	303.8	1.8	14.1	9.4	6.4	-0.4	99.3	
729	9.5	55.6	2446	302.0	303.8	-0.4	14.2	8.9	7.1	-0.4	99.3	
730	9.2	55.7	2239	302.0	303.8	-1.8	14.2	8.3	6.8	-0.4	99.3	
731	9.3	55.9	2333	302.0	305.6	-1.8	14.3	9.1	6.9	-0.4	99.3	
732	9.9	55.7	2662	302.0	306.2	-1.0	14.4	9.0	7.7	-0.4	99.3	
733	9.6	55.5	2521	302.0	306.2	-1.4	14.3	9.8	7.6	-0.4	99.3	
734	9.6	55.9	2504	302.0	306.2	-1.5	14.3	9.4	7.8	-0.4	99.3	
735	9.7	55.8	2530	302.0	306.2	-1.4	14.3	8.6	8.8	-0.4	99.3	
736	9.7	55.8	2534	302.0	306.2	-1.4	14.3	8.7	7.8	-0.3	99.3	
737	9.7	55.9	2553	302.0	306.2	-1.3	14.3	9.4	8.1	-0.4	99.3	
738			2857	302.0	306.2	-0.3	14.4	9.3	7.1	-0.4	99.3	
739	10.3	55.8	2833	302.0	306.2	-0.3	14.3	9.6	6.6	-0.4	99.3	
740	10.1	55.9	2743	302.0	306.2	-0.2	14.3	8.6	6.4	-0.4	99.3	
741	10.2	56.0	2766	302.0	304.1	-0.4	14.3	9.8	6.2	-0.4	99.3	
742	10.4	55.9	2791	302.0	303.4	-0.4	14.3	9.7	6.5	-0.4	99.3	
743	9.6	55.9	2503	302.0	303.4	-1.4	14.2	10.4	5.9	-0.4	99.3	
744	9.9	55.7	2676	302.0	303.4	-0.9	14.4	8.7	5.4	-0.4	99.3	
745	9.6	55.7	2506	302.0	303.4	-1.5	14.3	8.6	6.4	-0.4	99.3	
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***Blank data denotes values that were omitted in the analysis due to an extraneous event during recording

Data Point #	Standardized Wind Speed	LAeq	Turbine Power Output (kW)	Reference Yaw Angle (°)	Yaw Angle (°)	Pitch Angle (°)	Rotor RPM	Nacelle Anemometer Wind Speed (m/s)	10m Anemometer Wind Speed (m/s)	Air Temperature (-C)	Pressure (kPa)	Relative Humidity (%)
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Table E.02 Measurement data - Background

Project: South Branch Wind Farm - Turbine T07 - IEC 61400-11 Measurement

Report ID: 13350.02.T07.RP2

Created on: 2020-01-29

***Blank data denotes values that were omitted in the analysis due to an extraneous event during recording

Data Point #	Standardized Wind Speed	LAeq	Rotor RPM	10m Anemometer Wind Speed (m/s)	Air Temperature (-C)	Pressure (kPa)	Relative Humidity (%)
1	12.9	37.2	0.3	8.5	2	100.7	
2	12.1	37.5	0.4	7.9	2	100.7	
3	13.2	39.0	0.5	8.6	2	100.7	
4	10.6	40.6	0.5	6.9	2	100.7	
5	11.5	39.6	0.4	7.6	2	100.7	
6	11.7	37.6	0.3	7.6	2	100.7	
7	11.2	44.2	0.5	7.3	2	100.7	
8	11.3	41.7	0.5	7.4	2	100.7	
9	11.2	42.2	0.4	7.4	2	100.7	
10	12.1	42.1	0.4	7.9	2	100.7	
11	10.8	40.7	0.5	7.1	2	100.7	
12	11.9	40.0	0.5	7.8	2	100.7	
13	15.0	41.3	0.5	9.8	2	100.7	
14	11.3	44.3	0.4	7.4	2	100.7	
15	10.8	43.5	0.6	7.1	2	100.7	
16	11.7	42.4	0.6	7.7	2	100.7	
17	10.1	40.5	0.4	6.6	2	100.7	
18	13.3	36.7	0.4	8.7	2	100.7	
19	12.2	43.6	0.5	8.0	2	100.7	
20	10.9	42.5	0.7	7.1	2	100.7	
21	10.0	44.4	0.6	6.6	2	100.7	
22	9.0	41.5	0.6	5.9	2	100.7	
23	9.3	42.3	0.5	6.1	2	100.7	
24	13.8	42.0	0.5	9.0	2	100.7	
25	10.8	38.6	0.5	7.0	2	100.7	
26	9.9	43.1	0.7	6.5	2	100.7	
27	10.8	44.7	0.5	7.1	2	100.7	
28	12.3	48.5	0.5	8.0	2	100.7	
29	12.1	43.6	0.6	7.9	2	100.7	
30	11.0	52.1	0.8	7.2	2	100.7	
31	9.7	42.1	0.8	6.4	2	100.7	
32	10.5	42.5	0.6	6.9	2	100.7	
33	9.8	48.0	0.6	6.4	2	100.7	
34	13.3	46.8	0.4	8.7	2	100.7	
35	13.0	39.9	0.5	8.5	2	100.7	
36	9.8	46.2	0.6	6.4	2	100.7	
37	10.8	51.8	0.7	7.1	2	100.7	
38	14.2	42.5	0.6	9.3	2	100.7	
39	13.4	44.5	0.5	8.7	2	100.7	
40	12.6	43.4	0.7	8.2	2	100.7	
41	12.6	45.7	0.5	8.3	2	100.7	
42	14.0	45.9	0.4	9.1	2	100.7	
43	16.7	42.6	0.5	10.9	2	100.7	
44	14.0	42.8	0.5	9.1	2	100.7	
45	11.9	40.8	0.3	7.8	2	100.7	
46	12.3	41.2	0.3	8.1	2	100.7	
47	12.7	42.0	0.6	8.3	2	100.7	
48	13.2	44.0	0.7	8.6	2	100.7	
49	12.3	46.0	0.5	8.0	2	100.7	
50	11.9	49.3	0.6	7.8	2	100.7	
51	8.2	39.2	0.5	5.4	2	100.7	
52	10.0	42.4	0.3	6.6	2	100.7	
53	9.2	49.0	0.2	6.0	2	100.7	
54	12.7	45.7	0.5	8.3	2	100.7	
55	13.3	48.7	0.6	8.7	2	100.7	
56	12.4	39.7	0.7	8.1	2	100.7	
57	12.0	38.9	0.5	7.9	2	100.7	
58	11.3	46.4	0.6	7.4	2	100.7	
59	8.4	44.6	0.7	5.5	2	100.7	
60	11.9	46.1	0.7	7.8	2	100.7	
61	7.9	47.7	0.5	5.2	2	100.7	
62	8.8	46.9	0.7	5.8	2	100.7	
63	9.4	49.3	0.5	6.1	2	100.7	
64	12.4	47.7	0.5	8.1	2	100.7	
65	11.6	44.0	0.5	7.6	2	100.7	
66	8.7	47.2	0.6	5.7	2	100.7	
67	11.1	47.7	0.5	7.2	2	100.7	
68	9.8	49.8	0.5	6.4	2	100.7	
69	8.8	48.3	0.5	5.8	2	100.7	
70	9.0	49.3	0.6	5.9	2	100.7	
71	9.9	42.7	0.6	6.5	2	100.7	
72	8.6	42.0	0.6	5.6	2	100.7	
73	9.3	40.6	0.7	6.1	2	100.7	
74	8.3	42.4	0.6	5.4	2	100.7	
75	13.0	40.9	0.8	8.5	2	100.7	
76	11.2	44.4	0.3	7.4	2	100.7	
77	11.3	50.3	0.6	7.4	2	100.7	
78	11.3	51.2	0.7	7.4	2	100.7	
79	9.2	46.6	0.5	6.0	2	100.7	
80	8.2	45.2	0.4	5.4	2	100.7	
81	9.0	41.5	0.5	5.9	2	100.7	
82	10.0	43.7	0.5	6.5	2	100.7	
83	12.6	43.6	0.6	8.3	2	100.7	

***Blank data denotes values that were omitted in the analysis due to an extraneous event during recording

Data Point #	Standardized Wind Speed	LAeq	Rotor RPM	10m Anemometer Wind Speed (m/s)	Air Temperature (-C)	Pressure (kPa)	Relative Humidity (%)
84	12.8	44.9	0.5	8.4	2	100.7	
85	12.4	40.4	0.4	8.1	2	100.7	
86	12.4	41.8	0.4	8.1	2	100.7	
87	12.8	42.6	0.5	8.4	2	100.7	
88	16.2	37.9	0.4	10.6	2	100.7	
89	14.3	36.4	0.4	9.4	2	100.7	
90	12.0	36.4	0.5	7.8	2	100.7	
91	13.2	36.8	0.4	8.6	2	100.7	
92	13.4	37.4	0.5	8.8	2	100.7	
93	11.2	37.4	0.4	7.3	2	100.7	
94	11.3	40.3	0.6	7.4	2	100.7	
95	12.5	42.1	0.5	8.2	2	100.7	
96	11.9	45.0	0.6	7.8	2	100.7	
97	9.8	44.2	0.6	6.4	2	100.7	
98	11.0	41.0	0.6	7.2	2	100.7	
99	11.9	39.4	0.6	7.8	2	100.7	
100	11.2	40.8	0.6	7.4	2	100.7	
101	10.6	38.6	0.7	6.9	2	100.7	
102	10.2	41.9	0.8	6.7	2	100.7	
103	10.3	37.6	0.7	6.8	2	100.7	
104	10.4	46.6	0.8	6.8	2	100.7	
105	9.0	49.3	0.7	5.9	2	100.7	
106	8.3	45.2	0.5	5.4	2	100.7	
107	9.2	44.7	0.5	6.0	2	100.7	
108	10.6	47.3	0.3	6.9	2	100.7	
109	12.1	46.6	0.3	7.9	2	100.7	
110	9.0	42.1	0.7	5.9	2	100.7	
111	13.6	44.4	0.6	8.9	2	100.7	
112	12.1	47.7	0.7	7.9	2	100.7	
113	11.9	44.6	0.4	7.8	2	100.7	
114	12.9	53.1	0.5	8.5	2	100.7	
115	14.4	49.3	0.3	9.4	2	100.7	
116	13.8	52.2	0.4	9.0	2	100.7	
117	14.1	43.5	0.5	9.2	2	100.7	
118	12.4	42.0	0.4	8.1	2	100.7	
119	11.7	42.7	0.6	7.6	2	100.7	
120	11.3	42.5	0.7	7.4	2	100.7	
121	12.0	40.1	0.4	7.9	2	100.7	
122	13.3	46.4	0.4	8.7	2	100.7	
123	10.7	47.9	0.5	7.0	2	100.7	
124	15.0	44.8	0.4	9.8	2	100.7	
125	16.1	46.8	0.4	10.6	2	100.7	
126	11.2	46.0	0.4	7.4	2	100.7	
127	13.6	48.7	0.5	8.9	2	100.7	
128	14.4	47.8	0.5	9.4	2	100.7	
129	13.9	47.4	0.6	9.1	2	100.7	
130	12.7	46.1	0.5	8.3	2	100.7	
131	10.5	45.6	0.5	6.9	2	100.7	
132	10.6	45.7	0.6	6.9	2	100.7	
133	9.2	44.8	0.7	6.0	2	100.7	
134	9.3	41.9	0.6	6.1	2	100.7	
135	13.6	51.4	0.6	8.9	2	100.7	
136	12.7	50.8	0.6	8.3	2	100.7	
137	11.3	46.8	0.5	7.4	2	100.7	
138	8.2	47.4	0.4	5.4	2	100.7	
139	9.8	48.9	0.5	6.4	2	100.7	
140	13.1	51.1	0.6	8.6	2	100.7	
141	14.4	54.0	0.5	9.4	2	100.7	
142	13.1	47.9	0.6	8.5	2	100.7	
143	10.0	44.7	0.6	6.6	2	100.7	
144	10.4	43.0	0.6	6.8	2	100.7	
145	9.5	42.6	0.5	6.2	2	100.7	
146	13.3	42.0	0.5	8.7	2	100.7	
147	11.2	43.3	0.5	7.3	2	100.7	
148	10.6	45.7	0.2	7.0	2	100.7	
149	11.6	43.2	0.5	7.6	2	100.7	
150	14.8	39.4	0.4	9.7	2	100.7	
151	14.1	40.9	0.6	9.2	2	100.7	
152	12.2	38.5	0.4	8.0	2	100.7	
153	13.3	40.5	0.4	8.7	2	100.7	
154	11.6	38.8	0.5	7.6	2	100.7	
155	10.8	44.6	0.5	7.1	2	100.7	
156	14.9	44.5	0.6	9.7	2	100.7	
157	14.0	43.5	0.8	9.1	2	100.7	
158	11.1	39.9	0.9	7.3	2	100.7	
159	10.7	48.9	0.6	7.0	2	100.7	
160	11.9	46.5	0.5	7.8	2	100.7	
161	10.7	47.7	0.3	7.0	2	100.7	
162	9.8	38.3	0.2	6.4	2	100.7	
163	10.0	38.6	0.4	6.5	2	100.7	
164	10.2	39.8	0.4	6.7	2	100.7	
165	9.2	41.4	0.5	6.0	2	100.7	
166	8.3	40.6	0.6	5.4	2	100.7	

***Blank data denotes values that were omitted in the analysis due to an extraneous event during recording

Data Point #	Standardized Wind Speed	LAeq	Rotor RPM	10m Anemometer Wind Speed (m/s)	Air Temperature (-C)	Pressure (kPa)	Relative Humidity (%)
167	7.9	41.5	0.6	5.1	2	100.7	
168	8.8	48.3	0.4	5.8	2	100.7	
169	7.3	43.5	0.5	4.8	2	100.7	
170	9.0	47.2	0.7	5.9	2	100.7	
171	9.2	45.6	0.7	6.0	2	100.7	
172	12.2	42.5	0.6	8.0	2	100.8	
173	10.6	41.9	0.6	6.9	2	100.8	
174	12.8	45.6	0.6	8.4	2	100.8	
175	12.3	47.3	0.7	8.1	2	100.8	
176	11.3	47.4	0.8	7.4	2	100.8	
177	11.7	45.7	0.6	7.7	2	100.8	
178	10.8	44.1	0.6	7.1	2	100.8	
179	11.6	43.8	0.6	7.6	2	100.8	
180	12.4	46.1	0.8	8.1	2	100.8	
181	13.4	45.0	0.5	8.7	2	100.8	
182	13.0	45.0	0.6	8.5	2	100.8	
183	12.8	49.0	0.6	8.4	2	100.8	
184	16.6	43.9	0.5	10.8	2	100.8	
185	16.5	42.8	0.5	10.8	2	100.8	
186	14.9	45.7	0.6	9.7	2	100.8	
187	13.1	42.5	0.5	8.6	2	100.8	
188	11.9	42.3	0.5	7.8	2	100.8	
189	11.9	39.7	0.5	7.8	2	100.8	
190	11.7	41.2	0.6	7.7	2	100.8	
191	10.3	40.9	0.6	6.7	2	100.8	
192	10.3	39.0	0.4	6.7	2	100.8	
193	11.4	38.6	0.4	7.5	2	100.8	
194	13.4	38.9	0.5	8.8	2	100.8	
195	13.3	44.7	0.5	8.7	2	100.8	
196	12.6	41.6	0.6	8.3	2	100.8	
197	11.0	42.5	0.6	7.2	2	100.8	
198	9.8	43.3	0.5	6.4	2	100.8	
199	10.8	40.4	0.5	7.1	2	100.8	
200	11.3	37.5	0.6	7.4	2	100.8	
201	10.8	41.8	0.5	7.1	2	100.8	
202	11.7	47.9	0.6	7.6	2	100.8	
203	10.2	38.4	0.5	6.7	2	100.8	
204	10.0	35.3	0.4	6.5	2	100.8	
205	11.5	35.9	0.6	7.5	2	100.8	
206	10.4	39.8	0.6	6.8	2	100.8	
207	12.3	40.4	0.6	8.1	2	100.8	
208	14.4	36.7	0.6	9.4	2	100.8	
209	15.1	40.5	0.7	9.9	2	100.8	
210	14.4	38.4	0.6	9.4	2	100.8	
211	12.5	40.0	0.7	8.2	2	100.8	
212	12.4	37.9	0.7	8.1	2	100.8	
213	12.3	41.0	0.5	8.1	2	100.8	
214	13.0	45.8	0.6	8.5	2	100.8	
215	11.8	39.1	0.7	7.7	2	100.8	
216	11.4	43.8	0.7	7.4	2	100.8	
217	11.7	45.9	0.6	7.6	2	100.8	
218	13.4	40.5	0.6	8.8	2	100.8	
219	13.3	43.2	0.5	8.7	2	100.8	
220	13.5	45.8	0.5	8.8	2	100.8	
221	13.6	41.4	0.5	8.9	2	100.8	
222	13.0	38.4	0.7	8.5	2	100.8	
223	12.5	41.6	0.6	8.2	2	100.8	
224	10.0	41.8	0.8	6.5	2	100.8	
225	10.1	43.0	0.6	6.6	2	100.8	
226	10.3	41.2	0.7	6.7	2	100.8	
227	11.2	42.4	0.7	7.3	2	100.8	
228	9.3	44.0	0.7	6.1	2	100.8	
229	10.0	42.1	0.5	6.5	2	100.8	
230	9.7	39.3	0.5	6.3	2	100.8	
231	10.0	38.7	0.5	6.5	2	100.8	
232	10.0	38.9	0.6	6.5	2	100.8	
233	10.1	38.5	0.6	6.6	2	100.8	
234	9.6	46.5	0.8	6.3	2	100.8	
235	10.5	47.8	0.8	6.8	2	100.8	
236	14.6	40.8	0.9	9.5	2	100.8	
237	12.9	39.9	0.8	8.5	2	100.8	
238	12.2	39.5	0.5	8.0	2	100.8	
239	11.1	41.8	0.7	7.3	2	100.8	
240	10.8	48.0	0.5	7.1	2	100.8	
241	15.3	40.6	0.6	10.0	2	100.8	
242	14.4	42.5	0.6	9.4	2	100.8	
243	15.1	50.5	0.7	9.9	2	100.8	
244	13.3	55.4	0.6	8.7	2	100.8	
245	10.2	47.9	0.5	6.7	2	100.8	
246	9.6	45.3	0.8	6.3	2	100.8	
247	10.7	49.4	0.8	7.0	2	100.8	
248	10.8	46.6	0.8	7.1	2	100.8	
249	10.6	45.4	0.8	6.9	2	100.8	

Table E.02 Measurement data - Background

Project: South Branch Wind Farm - Turbine T07 - IEC 61400-11 Measurement

Report ID: 13350.02.T07.RP2

Created on: 2020-01-29

***Blank data denotes values that were omitted in the analysis due to an extraneous event during recording

Data Point #	Standardized Wind Speed	LAeq	Rotor RPM	10m Anemometer Wind Speed (m/s)	Air Temperature (-C)	Pressure (kPa)	Relative Humidity (%)
250	11.7	46.3	0.7	7.7	2	100.8	
251	12.0	45.5	0.6	7.8	2	100.8	
252	10.8	47.1	0.7	7.1	2	100.8	
253	11.4	41.8	0.6	7.5	2	100.8	
254	10.7	42.3	0.7	7.0	2	100.8	
255	10.6	37.9	0.7	6.9	2	100.8	
256	11.3	42.6	0.5	7.4	2	100.8	
257	10.7	40.9	0.5	7.0	2	100.8	
258	9.8	46.5	0.5	6.4	2	100.8	
259	8.4	45.1	0.5	5.5	2	100.8	
260	9.6	43.4	0.6	6.3	2	100.8	
261	7.8	43.0	0.6	5.1	2	100.8	
262	8.4	40.4	0.6	5.5	2	100.8	
263	9.7	41.3	0.7	6.3	2	100.8	
264	8.6	38.6	0.7	5.6	2	100.8	
265	11.6	37.9	0.7	7.6	2	100.8	
266	10.1	38.2	0.6	6.6	2	100.8	
267	10.1	39.4	0.7	6.6	2	100.8	
268	9.8	40.4	0.7	6.4	2	100.8	
269	9.1	47.0	0.5	6.0	2	100.8	
270	9.4	46.6	0.7	6.2	2	100.8	
271	12.2	47.5	0.5	8.0	2	100.8	
272	13.0	44.1	0.5	8.5	2	100.8	
273	12.1	47.3	0.5	7.9	2	100.8	
274	12.9	39.4	0.5	8.4	2	100.8	
275	11.9	38.5	0.6	7.8	2	100.8	
276	10.9	41.9	0.5	7.1	2	100.8	
277	11.5	38.1	0.6	7.5	2	100.8	
278	13.0	36.8	0.5	8.5	2	100.8	
279	11.5	43.7	0.5	7.5	2	100.8	
280	11.7	39.4	0.5	7.7	2	100.8	
281	11.0	38.6	0.4	7.2	2	100.8	
282	10.3	41.0	0.4	6.7	2	100.8	
283	14.0	40.2	0.4	9.2	2	100.8	
284	15.8	44.2	0.4	10.3	2	100.8	
285	15.1	39.9	0.6	9.9	2	100.8	
286	11.6	41.6	0.6	7.6	2	100.8	
287	11.7	43.7	0.5	7.7	2	100.8	
288	12.6	48.4	0.3	8.3	2	100.8	
289	10.2	44.8	0.3	6.7	2	100.8	
290	10.7	45.1	0.6	7.0	2	100.8	
291	10.8	44.5	0.6	7.0	2	100.8	
292	10.4	46.2	0.5	6.8	2	100.8	
293	10.2	40.5	0.3	6.7	2	100.8	
294	10.9	40.1	0.3	7.2	2	100.8	
295	11.6	39.6	0.3	7.6	2	100.8	
296	10.5	38.6	0.4	6.9	2	100.8	
297	13.4	39.4	0.5	8.8	2	100.8	
298	16.3	44.7	0.8	10.7	2	100.8	
299	16.5	46.8	0.8	10.8	2	100.8	
300	16.3	53.9	0.7	10.6	2	100.8	
301	15.9	55.1	0.9	10.4	2	100.8	
302	17.7	50.4	0.7	11.6	2	100.8	
303	17.3	50.2	0.6	11.3	2	100.8	
304	16.9	54.6	0.7	11.1	2	100.8	
305	16.0	49.9	0.8	10.5	2	100.8	
306	14.5	46.7	0.7	9.5	2	100.8	
307	13.9	45.5	0.6	9.1	2	100.8	
308	13.3	47.2	0.7	8.7	2	100.8	
309	13.4	47.8	0.6	8.7	2	100.8	
310	12.5	49.7	0.6	8.2	1	100.9	
311	14.2	48.4	0.5	9.3	1	100.9	
312	15.7	45.2	0.5	10.3	1	100.9	
313	16.4	46.9	0.3	10.7	1	100.9	
314	13.9	47.6	0.5	9.1	1	100.9	
315	16.1	52.1	0.6	10.6	1	100.9	
316	18.7	48.7	0.6	12.2	0	100.9	
317	16.7	49.2	0.7	10.9	0	100.9	
318	14.6	46.1	0.6	9.6	0	100.9	
319	15.4	46.2	0.6	10.1	0	100.9	
320	15.9	47.9	0.7	10.4	0	100.9	
321	14.8	49.4	0.6	9.7	0	100.9	
322	14.9	51.1	0.6	9.7	0	100.9	
323	17.5	48.5	0.6	11.4	0	100.9	
324	16.8	52.1	0.7	11.0	0	100.9	
325	19.6	46.5	0.5	12.8	0	100.9	
326	17.9	49.4	0.5	11.7	0	100.9	
327	16.4	49.7	0.6	10.7	0	100.9	
328	16.5	52.6	0.7	10.8	0	100.9	
329	17.8	50.7	0.6	11.6	0	100.9	
330	18.9	48.6	0.7	12.4	0	100.9	
331	19.4	53.8	0.7	12.7	0	100.9	
332	22.7	51.1	0.7	14.9	0	100.9	

***Blank data denotes values that were omitted in the analysis due to an extraneous event during recording

Data Point #	Standardized Wind Speed	LAeq	Rotor RPM	10m Anemometer Wind Speed (m/s)	Air Temperature (-C)	Pressure (kPa)	Relative Humidity (%)
333	20.8	52.1	0.7	13.6	0	100.9	
334	20.0	48.1	0.7	13.1	0	100.9	
335	18.8	48.7	0.7	12.3	0	100.9	
336	20.1	51.3	0.7	13.1	0	100.9	
337	19.5	54.0	0.7	12.8	0	100.9	
338	19.6	56.6	0.6	12.8	0	100.9	
339	18.2	58.8	0.5	11.9	0	100.9	
340	17.2	56.5	0.6	11.2	-1	100.9	
341	16.8	53.8	0.7	11.0	-1	100.9	
342	17.7	54.5	0.7	11.6	-1	100.9	
343	15.8	53.7	0.7	10.3	-1	100.9	
344	14.7	52.6	0.6	9.6	-1	100.9	
345	14.6	51.7	0.5	9.5	-1	100.9	
346	13.6	47.4	0.7	8.9	-1	100.9	
347	14.8	50.0	0.7	9.7	-1	100.9	
348	13.1	47.3	0.4	8.6	-1	100.9	
349	13.6	47.8	0.6	8.9	-1	100.9	
350	13.8	46.7	0.6	9.0	-1	100.9	
351	14.1	49.5	0.5	9.2	-1	100.9	
352	13.4	50.6	0.6	8.8	-1	100.9	
353	14.2	47.8	0.6	9.3	-1	100.9	
354	15.5	48.4	0.4	10.2	-1	100.9	
355	15.3	48.3	0.5	10.0	-1	100.9	
356	13.3	49.4	0.5	8.7	-1	100.9	
357	14.4	46.0	0.6	9.4	-1	100.9	
358	14.0	48.1	0.7	9.1	-1	100.9	
359	14.3	42.7	0.5	9.3	-1	100.9	
360	13.8	40.4	0.5	9.0	-1	100.9	
361	13.8	41.4	0.5	9.0	-1	100.9	
362	16.0	39.2	0.5	10.4	-1	100.9	
363	16.0	40.8	0.6	10.5	-1	100.9	
364	13.8	42.0	0.7	9.0	-1	100.9	
365	12.9	38.8	0.7	8.4	-1	100.9	
366	14.3	39.8	0.7	9.4	-1	100.9	
367	14.5	40.5	0.7	9.5	-1	100.9	
368	13.9	38.2	0.6	9.1	-1	100.9	
369	13.8	38.9	0.5	9.0	-1	100.9	
370	12.3	39.6	0.6	8.0	-1	100.9	
371	14.4	40.0	0.6	9.4	-1	100.9	
372	12.5	37.5	0.5	8.2	-1	100.9	
373	11.5	39.2	0.4	7.6	-1	100.9	
374	12.3	40.5	0.4	8.0	-1	100.9	
375	12.4	39.3	0.6	8.1	-1	100.9	
376	12.8	38.4	0.7	8.4	-1	100.9	
377	12.0	41.5	0.6	7.9	-1	100.9	
378	13.8	43.2	0.7	9.0	-1	100.9	
379	12.8	47.2	0.5	8.4	-1	100.9	
380	12.6	43.1	0.6	8.2	-1	100.9	
381	13.0	42.5	0.5	8.5	-1	100.9	
382	11.7	41.5	0.5	7.6	-1	100.9	
383	12.6	43.4	0.5	8.2	-1	100.9	
384	12.5	41.2	0.5	8.2	-1	100.9	
385	12.4	46.0	0.4	8.1	-1	100.9	
386	12.8	44.4	0.4	8.4	-1	100.9	
387	12.2	44.0	0.4	8.0	-1	100.9	
388	12.8	41.6	0.4	8.4	-1	100.9	
389	14.8	44.6	0.4	9.7	-1	100.9	
390	13.9	38.7	0.4	9.1	-1	100.9	
391	13.6	39.2	0.4	8.9	-1	100.9	
392	14.3	42.3	0.4	9.4	-1	100.9	
393	14.5	40.0	0.5	9.5	-1	100.9	
394	13.5	40.3	0.4	8.8	-1	100.9	
395	13.2	45.2	0.3	8.7	-1	100.9	
396	12.2	46.1	0.4	8.0	-1	100.9	
397	10.6	43.1	0.3	7.0	-1	100.9	
398	10.4	43.0	0.4	6.8	-1	100.9	
399	10.5	47.5	0.5	6.9	-1	100.9	
400	11.7	44.7	0.5	7.7	-1	100.9	
401	12.7	45.3	0.5	8.3	-1	100.9	
402	14.8	47.1	0.6	9.7	-1	100.9	
403	12.3	48.8	0.6	8.0	-1	100.9	
404	11.3	49.3	0.6	7.4	-1	100.9	
405	12.5	42.7	0.5	8.2	-1	100.9	
406	11.4	48.1	0.6	7.5	-1	100.9	
407	11.0	49.6	0.6	7.2	-1	100.9	
408	11.4	49.6	0.5	7.5	-1	100.9	
409	11.5	46.7	0.5	7.5	-1	100.9	
410	12.0	45.7	0.5	7.9	-1	100.9	
411	15.1	46.0	0.5	9.9	-1	100.9	
412	15.4	44.3	0.5	10.1	-1	100.9	
413	14.4	45.0	0.4	9.4	-1	100.9	
414	14.8	42.3	0.6	9.7	-1	100.9	
415	14.7	42.2	0.6	9.6	-1	100.9	

***Blank data denotes values that were omitted in the analysis due to an extraneous event during recording

Data Point #	Standardized Wind Speed	LAeq	Rotor RPM	10m Anemometer Wind Speed (m/s)	Air Temperature (-C)	Pressure (kPa)	Relative Humidity (%)
416	14.5	41.4	0.7	9.5	-1	100.9	
417	13.9	40.4	0.7	9.1	-1	100.9	
418	13.8	43.4	0.6	9.0	-1	100.9	
419	12.2	47.7	0.5	8.0	-1	100.9	
420	12.0	46.4	0.5	7.9	-1	100.9	
421	13.3	46.4	0.6	8.7	-1	100.9	
422	14.0	43.3	0.5	9.2	-1	100.9	
423	14.8	40.5	0.5	9.7	-1	100.9	
424	14.0	42.6	0.5	9.2	-1	100.9	
425	12.9	44.6	0.4	8.5	-1	100.9	
426	12.2	43.8	0.4	8.0	-1	100.9	
427	13.2	48.0	0.4	8.7	-1	100.9	
428	12.4	45.7	0.5	8.1	-1	100.9	
429	13.5	41.4	0.5	8.8	-1	100.9	
430	13.9	40.8	0.6	9.1	-1	100.9	
431	13.9	42.6	0.4	9.1	-1	100.9	
432	13.5	44.0	0.5	8.8	-1	100.9	
433	13.3	42.0	0.5	8.7	-1	100.9	
434	13.4	42.3	0.4	8.8	-1	100.9	
435	13.6	40.6	0.4	8.9	-1	100.9	
436	13.5	38.5	0.4	8.8	-1	100.9	
437	12.9	44.2	0.5	8.4	-1	100.9	
438	12.7	43.4	0.6	8.3	-1	100.9	
439	13.1	49.3	0.4	8.5	-1	100.9	
440	14.4	42.3	0.5	9.4	-1	100.9	
441	14.5	43.9	0.5	9.5	-1	100.9	
442	12.3	43.0	0.6	8.0	-1	100.9	
443	12.5	41.7	0.5	8.2	-1	100.9	
444	12.7	41.8	0.3	8.3	-1	100.9	
445	12.1	42.3	0.4	7.9	-1	100.9	
446	12.4	39.8	0.6	8.1	-1	100.9	
447	13.9	39.3	0.5	9.1	-1	100.9	
448	11.9	37.9	0.5	7.8	-2	100.9	
449	11.9	38.1	0.7	7.8	-2	100.9	
450	11.8	41.0	0.5	7.7	-2	100.9	
451	11.5	40.5	0.4	7.5	-2	100.9	
452	12.8	41.0	0.5	8.4	-2	100.9	
453	11.6	39.6	0.5	7.6	-2	100.9	
454	12.2	40.9	0.4	8.0	-2	100.9	
455	11.4	39.3	0.5	7.5	-2	100.9	
456	11.1	39.4	0.4	7.3	-2	100.9	
457	13.4	40.2	0.4	8.8	-2	100.9	
458	13.0	40.8	0.5	8.5	-2	100.9	
459	13.6	42.7	0.6	8.9	-2	100.9	
460	12.4	45.0	0.7	8.1	-2	100.9	
461	12.5	44.5	0.5	8.2	-2	100.9	
462	14.3	42.8	0.5	9.3	-2	100.9	
463	12.3	41.6	0.5	8.0	-2	100.9	
464	11.7	40.6	0.5	7.7	-2	100.9	
465	11.7	40.9	0.4	7.7	-2	100.9	
466	10.7	44.3	0.4	7.0	-2	100.9	
467	12.1	43.7	0.5	7.9	-2	100.9	
468	11.0	43.7	0.5	7.2	-2	100.9	
469	11.5	43.8	0.5	7.5	-2	100.9	
470	10.3	43.8	0.4	6.7	-2	100.9	
471	10.1	43.7	0.4	6.6	-2	100.9	
472	9.7	43.8	0.4	6.3	-2	100.9	
473	9.8	43.3	0.4	6.4	-2	100.9	
474	10.6	39.6	0.5	7.0	-2	100.9	
475	11.3	41.9	0.6	7.4	-2	100.9	
476	13.1	42.9	0.5	8.6	-2	100.9	
477	12.3	40.7	0.4	8.0	-2	100.9	
478	11.2	41.9	0.5	7.3	-2	100.9	
479	11.7	41.7	0.6	7.7	-2	100.9	
480	13.3	40.7	0.6	8.7	-2	100.9	
481	12.7	43.5	0.5	8.3	-2	100.9	
482	11.2	47.8	0.5	7.3	-2	100.9	
483	10.9	46.4	0.6	7.2	-2	100.9	
484	11.5	42.0	0.5	7.5	-2	100.9	
485	10.5	40.0	0.5	6.9	-2	100.9	
486	11.7	43.3	0.5	7.6	-2	100.9	
487	13.5	45.0	0.4	8.8	-2	100.9	
488	12.9	45.3	0.5	8.4	-2	100.9	
489	13.2	44.5	0.5	8.6	-2	100.9	
490	12.1	43.0	0.5	7.9	-2	100.9	
491	10.8	42.1	0.5	7.0	-2	100.9	
492	11.0	40.6	0.4	7.2	0	101.1	
493	11.4	40.4	0.3	7.4	0	101.1	
494	11.1	38.4	0.2	7.3	0	101.1	
495	11.8	37.0	0.3	7.7	0	101.1	
496	11.4	36.0	0.4	7.5	0	101.1	
497	9.8	35.3	0.4	6.4	0	101.1	
498	11.6	36.0	0.5	7.6	0	101.1	

Table E.02 Measurement data - Background

Project: South Branch Wind Farm - Turbine T07 - IEC 61400-11 Measurement

Report ID: 13350.02.T07.RP2

Created on: 2020-01-29

***Blank data denotes values that were omitted in the analysis due to an extraneous event during recording

Data Point #	Standardized Wind Speed	LAeq	Rotor RPM	10m Anemometer Wind Speed (m/s)	Air Temperature (-C)	Pressure (kPa)	Relative Humidity (%)
499	12.0	37.2	0.5	7.8	0	101.1	
500	11.4	37.6	0.5	7.5	0	101.1	
501	13.1	39.3	0.6	8.5	0	101.1	
502	13.3	42.2	0.6	8.7	0	101.1	
503	11.8	40.4	0.6	7.7	0	101.1	
504	10.7	37.3	0.4	7.0	0	101.1	
505	12.2	37.9	0.4	8.0	0	101.1	
506	11.8	37.3	0.5	7.7	0	101.1	
507	10.5	36.8	0.4	6.9	0	101.1	
508	12.2	37.1	0.5	8.0	0	101.1	
509	12.2	38.1	0.6	8.0	0	101.1	
510	12.3	35.8	0.5	8.1	0	101.1	
511	11.4	38.7	0.4	7.5	0	101.1	
512	11.6	36.2	0.3	7.6	0	101.1	
513	10.7	36.4	0.3	7.0	0	101.1	
514	10.5	36.7	0.5	6.9	0	101.1	
515	10.9	39.3	0.6	7.1	0	101.1	
516	10.3	36.3	0.6	6.8	0	101.1	
517	10.6	36.6	0.4	6.9	0	101.1	
518	11.2	36.2	0.4	7.3	0	101.1	
519	10.6	35.8	0.3	6.9	0	101.1	
520	9.0	37.4	0.3	5.9	0	101.1	
521	9.4	37.6	0.5	6.1	0	101.1	
522	9.2	37.0	0.4	6.0	0	101.1	
523	9.1	36.5	0.5	6.0	0	101.1	
524	8.7	36.3	0.6	5.7	0	101.1	
525	9.4	36.7	0.5	6.1	0	101.1	
526	9.7	35.9	0.4	6.4	0	101.1	
527	9.2	35.5	0.3	6.0	0	101.1	
528	10.1	35.2	0.4	6.6	0	101.1	
529	9.8	35.6	0.5	6.4	0	101.1	
530	9.3	36.6	0.3	6.1	0	101.1	
531	8.9	36.1	0.3	5.9	0	101.1	
532	9.8	35.7	0.4	6.4	0	101.1	
533	10.4	37.0	0.4	6.8	0	101.1	
534	10.2	35.8	0.4	6.7	0	101.1	
535	11.7	35.9	0.4	7.7	0	101.1	
536	10.1	36.2	0.4	6.6	0	101.1	
537	8.5	36.3	0.4	5.5	0	101.1	
538	9.5	37.3	0.4	6.2	0	101.1	
539	10.9	37.2	0.5	7.2	0	101.1	
540	11.1	38.0	0.6	7.3	0	101.1	
541	10.4	38.1	0.6	6.8	0	101.1	
542	10.5	37.2	0.6	6.9	0	101.1	
543	14.0	39.4	0.4	9.1	0	101.1	
544	12.2	37.7	0.5	8.0	0	101.1	
545	11.7	37.0	0.4	7.6	0	101.1	
546	11.1	40.7	0.4	7.2	0	101.1	
547	9.7	43.7	0.4	6.3	0	101.1	
548	9.5	46.7	0.3	6.2	0	101.1	
549	10.1	44.8	0.4	6.6	0	101.1	
550	10.6	43.1	0.3	6.9	0	101.1	
551	9.7	39.9	0.3	6.3	0	101.1	
552	8.7	40.5	0.4	5.7	0	101.1	
553	9.8	40.3	0.4	6.4	0	101.1	
554	9.3	40.1	0.4	6.1	0	101.0	
555	9.6	39.9	0.3	6.3	0	101.0	
556	8.9	39.0	0.4	5.8	0	101.1	
557	9.9	37.6	0.5	6.5	0	101.1	
558	8.8	37.7	0.5	5.7	0	101.1	
559	7.9	37.0	0.5	5.2	0	101.1	
560	11.0	39.8	0.3	7.2	0	101.1	
561	10.7	41.4	0.3	7.0	0	101.0	
562	9.8	37.8	0.4	6.4	0	101.0	
563	9.9	37.1	0.3	6.5	0	101.1	
564	9.2	36.6	0.4	6.0	0	101.1	
565	9.5	37.8	0.5	6.2	0	101.1	
566	10.2	38.1	0.5	6.7	0	101.1	
567	10.9	36.4	0.4	7.1	0	101.1	
568	10.7	36.7	0.3	7.0	0	101.0	
569	9.9	37.1	0.5	6.4	0	101.1	
570	11.7	36.9	0.6	7.7	0	101.0	
571	12.1	35.7	0.5	7.9	0	101.0	
572	10.7	36.7	0.4	7.0	0	101.1	
573	10.7	37.7	0.4	7.0	0	101.1	
574	9.6	37.9	0.5	6.3	0	101.0	
575	9.8	40.2	0.5	6.4	0	101.1	
576	8.9	47.3	0.4	5.8	0	101.1	
577	8.4	52.1	0.4	5.5	0	101.1	
578	8.4	47.3	0.4	5.5	0	101.1	
579	9.0	46.8	0.4	5.9	0	101.1	
580	9.1	42.0	0.6	6.0	0	101.1	
581	8.0	38.8	0.6	5.2	0	101.1	

***Blank data denotes values that were omitted in the analysis due to an extraneous event during recording

Data Point #	Standardized Wind Speed	LAeq	Rotor RPM	10m Anemometer Wind Speed (m/s)	Air Temperature (-C)	Pressure (kPa)	Relative Humidity (%)
582	8.6	37.5	0.5	5.6	0	101.1	
583	9.6	37.4	0.4	6.3	0	101.1	
584	9.5	37.3	0.4	6.2	0	101.1	
585	8.6	35.6	0.3	5.7	0	101.1	
586	8.2	35.3	0.3	5.4	0	101.1	
587	9.2	34.9	0.3	6.0	0	101.1	
588	8.4	34.9	0.4	5.5	0	101.1	
589	8.2	35.7	0.5	5.4	0	101.1	
590	9.3	35.7	0.5	6.1	0	101.1	
591	10.4	36.5	0.6	6.8	0	101.1	
592	9.3	37.3	0.6	6.1	0	101.1	
593	9.3	36.6	0.6	6.1	0	101.1	
594	11.1	35.2	0.4	7.3	0	101.1	
595	11.3	38.9	0.5	7.4	0	101.1	
596	12.2	41.9	0.5	8.0	0	101.1	
597	11.2	37.8	0.6	7.3	0	101.1	
598	10.1	36.9	0.4	6.6	0	101.1	
599	11.6	40.8	0.5	7.6	0	101.1	
600	10.8	39.4	0.5	7.1	0	101.1	
601	9.4	38.8	0.5	6.2	0	101.1	
602	11.4	37.2	0.5	7.4	0	101.1	
603	13.8	37.8	0.4	9.0	0	101.1	
604	12.6	38.1	0.4	8.2	0	101.1	
605	14.8	39.7	0.2	9.7	0	101.1	
606	14.2	42.1	0.3	9.3	0	101.1	
607	12.6	40.7	0.4	8.3	0	101.1	
608	13.2	42.8	0.5	8.6	0	101.1	
609	13.3	49.7	0.4	8.7	0	101.1	
610	13.1	45.0	0.5	8.6	0	101.1	
611	13.1	43.9	0.6	8.6	0	101.1	
612	12.8	34.8	0.4	8.4	0	101.1	
613	13.8	37.7	0.4	9.0	0	101.1	
614	14.4	36.5	0.6	9.4	0	101.1	
615	11.9	35.6	0.5	7.8	0	101.1	
616	10.9	33.6	0.5	7.1	0	101.1	
617	14.2	38.2	0.5	9.3	0	101.1	
618	15.8	40.7	0.6	10.3	0	101.1	
619	15.0	36.3	0.5	9.8	0	101.1	
620	13.0	38.1	0.3	8.5	0	101.1	
621	13.6	35.7	0.4	8.9	0	101.1	
622	13.3	45.8	0.5	8.7	0	101.1	
623	13.0	45.3	0.5	8.5	0	101.1	
624	13.6	44.3	0.5	8.9	0	101.1	
625	14.2	47.6	0.6	9.3	0	101.1	
626	12.8	46.0	0.7	8.4	0	101.1	
627	12.8	43.0	0.5	8.4	0	101.1	
628	13.1	52.7	0.6	8.6	0	101.1	
629	13.2	48.2	0.7	8.6	0	101.1	
630	17.2	45.8	0.8	11.3	0	101.1	
631	15.7	40.2	0.4	10.2	0	101.1	
632	14.2	44.4	0.7	9.3	0	101.1	
633	15.7	44.7	0.6	10.3	0	101.1	
634	15.9	47.6	0.6	10.4	0	101.1	
635	15.1	53.6	0.5	9.9	0	101.1	
636	16.1	50.6	0.5	10.5	0	101.1	
637	15.9	50.9	0.6	10.4	0	101.1	
638	17.5	48.0	0.6	11.4	0	101.1	
639	15.9	41.9	0.7	10.4	0	101.1	
640	18.2	46.1	0.6	11.9	0	101.1	
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***Blank data denotes values that were omitted in the analysis due to an extraneous event during recording

Data Point #	Standardized Wind Speed	LAeq	Rotor RPM	10m Anemometer Wind Speed (m/s)	Air Temperature (-C)	Pressure (kPa)	Relative Humidity (%)
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aercoustics

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1004 Middlegate Road, Suite 1100
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Fax 416-249-3613
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Appendix F
Information for the Regulator

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Appendix F.01
Calibration Certificates

ISO17025

As Found RECALIBRATION CERTIFICATE

Sales Region:	Americas
Account:	Aercoustics Engineering Limited
Instrument:	LMS SCADAS
Manufacturer:	Siemens Industry Software B.V.
Type:	SCR202
Serial number(s):	22143211
Calibration method:	Two calibrated external standards (DC voltage and frequency) are used to calibrate the internal LMS SCADAS references: time/frequency accuracy of the internal system clock and amplitude accuracy of the internal signal sources. All input channels are calibrated against the internal references.
Ambient conditions:	The calibrations have been carried out in a controlled environment, at an ambient temperature of 23.5°C ± 0.3°C and a relative humidity of 44% ± 5%.
Calibration date:	June 22, 2018
Results:	The calibration results, together with their associated uncertainties, are included in this calibration certificate. Calibration results within specification.
Uncertainty:	The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with publication EA-4/02.
Traceability:	The measurements have been executed using methods for which the traceability to international standards has been demonstrated towards the Raad voor Accreditatie.

Breda, June 22, 2018

Calibration performed by:

A.v.Aalst Customer Support Engineer

Certificate approved by:

F.Lemmens, Production Manager

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1 Explanation of the factory calibration procedure

The production process of an LMS SCADAS front-end consists of a number of stages.
Every single board or module that will be part of the system is tested extensively on reliability and functionality before it is inserted in the LMS SCADAS frame.
After assembly, the amplitude accuracy and offset errors of all input and output channels are adjusted to a value as close to zero as possible. The adjustment procedure incorporates external measurement equipment, which is documented in the next section of this report.

As a final step, the front-end is submitted to a factory calibration. The factory calibration verifies whether all input and output channels meet their published specifications with respect to amplitude accuracy, offset, and a number of dynamic capabilities such as distortion, signal to noise ratio and inter-channel crosstalk. The measurements that are done as a part of the calibration use an internal reference source, which has been calibrated against an external standard (documented in the next section of this report).
The results of this calibration procedure are documented in the *Calibration Certificate* you have in front of you.

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2 External reference - used equipment

	Type	Serial Number	Cal Certificate	Cal Date
Digital multimeter	Agilent 34401A	MY41040399	201702735.00	21 July 2017
Calibration software	2.14.0002	NA	NA	NA

The external reference (DMM) is calibrated on a yearly basis by a calibration laboratory that is ISO17025:2005 accredited by The Dutch Accreditation Council RvA.

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3 System configuration

Frame	Backplane Module	Conditioner	Unique number	Hardware version	Software version	Option
Master (0)			0022143211			
	V8_E (1)		2013333008	18	0	
	V8_E (2)		2013333032	18	0	
	SYSCON_REC (3)		2013215010	11	0	
		SYSCPB (0)	2013376010	3	0	
	PS12-2 MOB (4)		2014154022	17	11	

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4 V8_E_h18s0

4.1 Gain Accuracy after Adjustment

Description of calibration:
Determination of the amplitude accuracy of the input channels over all input ranges and available ADC bandwidths, by applying an accurate 1kHz -3dBFS (max 4V) sine wave which is generated by the internal reference generator. For charge amplifiers, the reference voltage signal is translated to a reference charge signal.
The reported values represent the deviations from the expected signal amplitude, both absolute (either in Volt or Coulomb, depending on the input channel type) and relative (in %).

AdcBw 102400Hz, Range 0.316V Alternating voltage 100mV < IR <= 316mV Spec: <= ±0.100% Uncertainty: 66µV	
Chan	Value
0,1,x,0	-0.003 mV, -0.001%
0,1,x,1	-0.025 mV, -0.011%
0,1,x,2	-0.037 mV, -0.017%
0,1,x,3	-0.029 mV, -0.013%
0,1,x,4	-0.037 mV, -0.017%
0,1,x,5	-0.064 mV, -0.029%
0,1,x,6	-0.022 mV, -0.010%
0,1,x,7	-0.027 mV, -0.012%
0,2,x,0	-0.035 mV, -0.016%
0,2,x,1	-0.026 mV, -0.011%
0,2,x,2	-0.003 mV, -0.001%
0,2,x,3	-0.031 mV, -0.014%
0,2,x,4	-0.026 mV, -0.012%
0,2,x,5	-0.027 mV, -0.012%
0,2,x,6	-0.030 mV, -0.013%
0,2,x,7	-0.039 mV, -0.018%

AdcBw 102400Hz, Range 1V Alternating voltage 316mV < IR <= 1V Spec: <= ±0.100% Uncertainty: 120µV	
Chan	Value
0,1,x,0	-0.014 mV, -0.002%
0,1,x,1	-0.096 mV, -0.014%
0,1,x,2	-0.076 mV, -0.011%
0,1,x,3	-0.065 mV, -0.009%
0,1,x,4	-0.055 mV, -0.008%
0,1,x,5	-0.154 mV, -0.022%
0,1,x,6	-0.041 mV, -0.006%
0,1,x,7	-0.054 mV, -0.008%
0,2,x,0	-0.118 mV, -0.017%
0,2,x,1	-0.086 mV, -0.012%
0,2,x,2	-0.024 mV, -0.003%
0,2,x,3	-0.078 mV, -0.011%
0,2,x,4	-0.053 mV, -0.007%
0,2,x,5	-0.063 mV, -0.009%
0,2,x,6	-0.089 mV, -0.013%
0,2,x,7	-0.083 mV, -0.012%

AdcBw 102400Hz, Range 3.16V Alternating voltage 1V < IR <= 3.16V Spec: <= ±0.100% Uncertainty: 310µV	
Chan	Value
0,1,x,0	0.200 mV, 0.009%
0,1,x,1	-0.134 mV, -0.006%
0,1,x,2	-0.066 mV, -0.003%
0,1,x,3	-0.067 mV, -0.003%
0,1,x,4	-0.093 mV, -0.004%
0,1,x,5	-0.329 mV, -0.015%
0,1,x,6	0.042 mV, 0.002%
0,1,x,7	-0.077 mV, -0.003%
0,2,x,0	-0.296 mV, -0.013%
0,2,x,1	-0.069 mV, -0.003%
0,2,x,2	0.039 mV, 0.002%
0,2,x,3	-0.215 mV, -0.010%
0,2,x,4	-0.038 mV, -0.002%
0,2,x,5	-0.026 mV, -0.001%
0,2,x,6	-0.184 mV, -0.008%
0,2,x,7	-0.030 mV, -0.001%

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AdcBw 102400Hz, Range 10V Alternating voltage 3.16V < IR <= 10V Spec: <= ±0.100% Uncertainty: 530µV	
Chan	Value
0,1,x,0	0.239 mV, 0.006%
0,1,x,1	-0.025 mV, -0.001%
0,1,x,2	-0.127 mV, -0.003%
0,1,x,3	-0.214 mV, -0.005%
0,1,x,4	-0.201 mV, -0.005%
0,1,x,5	-0.596 mV, -0.015%
0,1,x,6	-0.109 mV, -0.003%
0,1,x,7	-0.149 mV, -0.004%
0,2,x,0	-0.305 mV, -0.008%
0,2,x,1	0.086 mV, 0.002%
0,2,x,2	0.266 mV, 0.007%
0,2,x,3	-0.165 mV, -0.004%
0,2,x,4	-0.174 mV, -0.004%
0,2,x,5	0.002 mV, 0.000%
0,2,x,6	-0.096 mV, -0.002%
0,2,x,7	-0.192 mV, -0.005%

AdcBw 51200Hz, Range 1V Alternating voltage 316mV < IR <= 1V Spec: <= ±0.100% Uncertainty: 120µV	
Chan	Value
0,1,x,0	0.017 mV, 0.002%
0,1,x,1	-0.066 mV, -0.009%
0,1,x,2	-0.046 mV, -0.006%
0,1,x,3	-0.034 mV, -0.005%
0,1,x,4	-0.026 mV, -0.004%
0,1,x,5	-0.125 mV, -0.018%
0,1,x,6	-0.011 mV, -0.002%
0,1,x,7	-0.024 mV, -0.003%
0,2,x,0	-0.090 mV, -0.013%
0,2,x,1	-0.057 mV, -0.008%
0,2,x,2	0.007 mV, 0.001%
0,2,x,3	-0.049 mV, -0.007%
0,2,x,4	-0.023 mV, -0.003%
0,2,x,5	-0.032 mV, -0.005%
0,2,x,6	-0.060 mV, -0.008%
0,2,x,7	-0.054 mV, -0.008%

AdcBw 51200Hz, Range 10V Alternating voltage 3.16V < IR <= 10V Spec: <= ±0.100% Uncertainty: 530µV	
Chan	Value
0,1,x,0	0.397 mV, 0.010%
0,1,x,1	0.134 mV, 0.003%
0,1,x,2	0.033 mV, 0.001%
0,1,x,3	-0.055 mV, -0.001%
0,1,x,4	-0.043 mV, -0.001%
0,1,x,5	-0.436 mV, -0.011%
0,1,x,6	0.045 mV, 0.001%
0,1,x,7	0.007 mV, 0.000%
0,2,x,0	-0.146 mV, -0.004%
0,2,x,1	0.245 mV, 0.006%
0,2,x,2	0.425 mV, 0.011%
0,2,x,3	-0.005 mV, -0.000%
0,2,x,4	-0.015 mV, -0.000%
0,2,x,5	0.161 mV, 0.004%
0,2,x,6	0.056 mV, 0.001%
0,2,x,7	-0.038 mV, -0.001%

AdcBw 51200Hz, Range 0.316V Alternating voltage 100mV < IR <= 316mV Spec: <= ±0.100% Uncertainty: 66µV	
Chan	Value
0,1,x,0	0.009 mV, 0.004%
0,1,x,1	-0.013 mV, -0.006%
0,1,x,2	-0.025 mV, -0.011%
0,1,x,3	-0.017 mV, -0.008%
0,1,x,4	-0.025 mV, -0.011%
0,1,x,5	-0.052 mV, -0.023%
0,1,x,6	-0.010 mV, -0.005%
0,1,x,7	-0.016 mV, -0.007%
0,2,x,0	-0.024 mV, -0.011%
0,2,x,1	-0.014 mV, -0.006%
0,2,x,2	0.009 mV, 0.004%
0,2,x,3	-0.019 mV, -0.009%
0,2,x,4	-0.014 mV, -0.006%
0,2,x,5	-0.015 mV, -0.007%
0,2,x,6	-0.018 mV, -0.008%
0,2,x,7	-0.028 mV, -0.012%

AdcBw 51200Hz, Range 3.16V Alternating voltage 1V < IR <= 3.16V Spec: <= ±0.100% Uncertainty: 310µV	
Chan	Value
0,1,x,0	0.270 mV, 0.012%
0,1,x,1	-0.066 mV, -0.003%
0,1,x,2	0.004 mV, 0.000%
0,1,x,3	0.002 mV, 0.000%
0,1,x,4	-0.029 mV, -0.001%
0,1,x,5	-0.265 mV, -0.012%
0,1,x,6	0.108 mV, 0.005%
0,1,x,7	-0.011 mV, -0.000%
0,2,x,0	-0.228 mV, -0.010%
0,2,x,1	-0.000 mV, -0.000%
0,2,x,2	0.106 mV, 0.005%
0,2,x,3	-0.147 mV, -0.007%
0,2,x,4	0.029 mV, 0.001%
0,2,x,5	0.040 mV, 0.002%
0,2,x,6	-0.119 mV, -0.005%
0,2,x,7	0.033 mV, 0.001%

AdcBw 25600Hz, Range 0.316V Alternating voltage 100mV < IR <= 316mV Spec: <= ±0.100% Uncertainty: 66µV	
Chan	Value
0,1,x,0	0.015 mV, 0.007%
0,1,x,1	-0.007 mV, -0.003%
0,1,x,2	-0.019 mV, -0.009%
0,1,x,3	-0.011 mV, -0.005%
0,1,x,4	-0.019 mV, -0.008%
0,1,x,5	-0.046 mV, -0.021%
0,1,x,6	-0.004 mV, -0.002%
0,1,x,7	-0.009 mV, -0.004%
0,2,x,0	-0.017 mV, -0.008%
0,2,x,1	-0.007 mV, -0.003%
0,2,x,2	0.015 mV, 0.007%
0,2,x,3	-0.013 mV, -0.006%
0,2,x,4	-0.008 mV, -0.004%
0,2,x,5	-0.009 mV, -0.004%
0,2,x,6	-0.012 mV, -0.005%
0,2,x,7	-0.022 mV, -0.010%

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AdcBw 25600Hz, Range 1V Alternating voltage 316mV < IR <= 1V Spec: <= ±0.100% Uncertainty: 120µV	
Chan	Value
0,1,x,0	0.030 mV, 0.004%
0,1,x,1	-0.052 mV, -0.007%
0,1,x,2	-0.032 mV, -0.004%
0,1,x,3	-0.020 mV, -0.003%
0,1,x,4	-0.012 mV, -0.002%
0,1,x,5	-0.110 mV, -0.016%
0,1,x,6	0.003 mV, 0.000%
0,1,x,7	-0.010 mV, -0.001%
0,2,x,0	-0.075 mV, -0.011%
0,2,x,1	-0.042 mV, -0.006%
0,2,x,2	0.021 mV, 0.003%
0,2,x,3	-0.034 mV, -0.005%
0,2,x,4	-0.010 mV, -0.001%
0,2,x,5	-0.019 mV, -0.003%
0,2,x,6	-0.046 mV, -0.007%
0,2,x,7	-0.040 mV, -0.006%

AdcBw 25600Hz, Range 10V Alternating voltage 3.16V < IR <= 10V Spec: <= ±0.100% Uncertainty: 530µV	
Chan	Value
0,1,x,0	0.482 mV, 0.012%
0,1,x,1	0.227 mV, 0.006%
0,1,x,2	0.128 mV, 0.003%
0,1,x,3	0.042 mV, 0.001%
0,1,x,4	0.056 mV, 0.001%
0,1,x,5	-0.332 mV, -0.008%
0,1,x,6	0.144 mV, 0.004%
0,1,x,7	0.104 mV, 0.003%
0,2,x,0	-0.044 mV, -0.001%
0,2,x,1	0.339 mV, 0.008%
0,2,x,2	0.517 mV, 0.013%
0,2,x,3	0.094 mV, 0.002%
0,2,x,4	0.080 mV, 0.002%
0,2,x,5	0.251 mV, 0.006%
0,2,x,6	0.150 mV, 0.004%
0,2,x,7	0.054 mV, 0.001%

AdcBw 25600Hz, Range 3.16V Alternating voltage 1V < IR <= 3.16V Spec: <= ±0.100% Uncertainty: 310µV	
Chan	Value
0,1,x,0	0.330 mV, 0.015%
0,1,x,1	0.000 mV, 0.000%
0,1,x,2	0.069 mV, 0.003%
0,1,x,3	0.068 mV, 0.003%
0,1,x,4	0.037 mV, 0.002%
0,1,x,5	-0.197 mV, -0.009%
0,1,x,6	0.173 mV, 0.008%
0,1,x,7	0.054 mV, 0.002%
0,2,x,0	-0.159 mV, -0.007%
0,2,x,1	0.066 mV, 0.003%
0,2,x,2	0.174 mV, 0.008%
0,2,x,3	-0.078 mV, -0.003%
0,2,x,4	0.095 mV, 0.004%
0,2,x,5	0.105 mV, 0.005%
0,2,x,6	-0.051 mV, -0.002%
0,2,x,7	0.101 mV, 0.005%

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4.2 Residual Offset after Adjustment

Description of calibration:
Determination of the residual input offsets of the input channels over all input ranges and available ADC bandwidths, by internally shorting the input channels to ground.

AdcBw 102400Hz, Range 0.316V Direct voltage IR <= 316mV Spec: <= ±0.316 mV Uncertainty: 4.8µV	
Chan	Value
0,1,x,0	-0.003 mV
0,1,x,1	-0.019 mV
0,1,x,2	0.029 mV
0,1,x,3	0.027 mV
0,1,x,4	0.008 mV
0,1,x,5	0.013 mV
0,1,x,6	-0.035 mV
0,1,x,7	0.063 mV
0,2,x,0	0.027 mV
0,2,x,1	-0.004 mV
0,2,x,2	-0.026 mV
0,2,x,3	0.010 mV
0,2,x,4	-0.023 mV
0,2,x,5	-0.034 mV
0,2,x,6	-0.001 mV
0,2,x,7	-0.016 mV

AdcBw 102400Hz, Range 3.16V Direct voltage 1V < IR <= 3.16V Spec: <= ±3.160 mV Uncertainty: 8µV	
Chan	Value
0,1,x,0	0.052 mV
0,1,x,1	0.099 mV
0,1,x,2	0.145 mV
0,1,x,3	0.190 mV
0,1,x,4	0.177 mV
0,1,x,5	0.148 mV
0,1,x,6	0.061 mV
0,1,x,7	0.258 mV
0,2,x,0	0.136 mV
0,2,x,1	0.100 mV
0,2,x,2	0.019 mV
0,2,x,3	0.085 mV
0,2,x,4	0.151 mV
0,2,x,5	0.052 mV
0,2,x,6	0.075 mV
0,2,x,7	0.123 mV

AdcBw 51200Hz, Range 0.316V Direct voltage IR <= 316mV Spec: <= ±0.316 mV Uncertainty: 4.8µV	
Chan	Value
0,1,x,0	-0.001 mV
0,1,x,1	-0.023 mV
0,1,x,2	0.026 mV
0,1,x,3	0.027 mV
0,1,x,4	0.004 mV
0,1,x,5	0.011 mV
0,1,x,6	-0.037 mV
0,1,x,7	0.057 mV
0,2,x,0	0.025 mV
0,2,x,1	-0.007 mV
0,2,x,2	-0.028 mV
0,2,x,3	0.007 mV
0,2,x,4	-0.023 mV
0,2,x,5	-0.036 mV
0,2,x,6	-0.002 mV
0,2,x,7	-0.018 mV

AdcBw 51200Hz, Range 3.16V Direct voltage 1V < IR <= 3.16V Spec: <= ±3.160 mV Uncertainty: 8µV	
Chan	Value
0,1,x,0	0.057 mV
0,1,x,1	0.096 mV
0,1,x,2	0.141 mV
0,1,x,3	0.196 mV
0,1,x,4	0.171 mV
0,1,x,5	0.140 mV
0,1,x,6	0.061 mV
0,1,x,7	0.256 mV
0,2,x,0	0.122 mV
0,2,x,1	0.087 mV
0,2,x,2	0.019 mV
0,2,x,3	0.082 mV
0,2,x,4	0.158 mV
0,2,x,5	0.059 mV
0,2,x,6	0.092 mV
0,2,x,7	0.117 mV

AdcBw 102400Hz, Range 1V Direct voltage 316mV < IR <= 1V Spec: <= ±1.000 mV Uncertainty: 5.2µV	
Chan	Value
0,1,x,0	0.014 mV
0,1,x,1	0.006 mV
0,1,x,2	0.053 mV
0,1,x,3	0.069 mV
0,1,x,4	0.046 mV
0,1,x,5	0.048 mV
0,1,x,6	-0.014 mV
0,1,x,7	0.109 mV
0,2,x,0	0.049 mV
0,2,x,1	0.017 mV
0,2,x,2	-0.016 mV
0,2,x,3	0.029 mV
0,2,x,4	0.021 mV
0,2,x,5	-0.012 mV
0,2,x,6	0.019 mV
0,2,x,7	0.015 mV

AdcBw 102400Hz, Range 10V Direct voltage 3.16V < IR <= 10V Spec: <= ±10.000 mV Uncertainty: 21µV	
Chan	Value
0,1,x,0	0.183 mV
0,1,x,1	0.373 mV
0,1,x,2	0.424 mV
0,1,x,3	0.579 mV
0,1,x,4	0.576 mV
0,1,x,5	0.428 mV
0,1,x,6	0.291 mV
0,1,x,7	0.727 mV
0,2,x,0	0.377 mV
0,2,x,1	0.326 mV
0,2,x,2	0.132 mV
0,2,x,3	0.286 mV
0,2,x,4	0.551 mV
0,2,x,5	0.278 mV
0,2,x,6	0.279 mV
0,2,x,7	0.465 mV

AdcBw 51200Hz, Range 1V Direct voltage 316mV < IR <= 1V Spec: <= ±1.000 mV Uncertainty: 5.2µV	
Chan	Value
0,1,x,0	0.014 mV
0,1,x,1	0.002 mV
0,1,x,2	0.052 mV
0,1,x,3	0.067 mV
0,1,x,4	0.043 mV
0,1,x,5	0.041 mV
0,1,x,6	-0.013 mV
0,1,x,7	0.104 mV
0,2,x,0	0.049 mV
0,2,x,1	0.016 mV
0,2,x,2	-0.017 mV
0,2,x,3	0.027 mV
0,2,x,4	0.020 mV
0,2,x,5	-0.013 mV
0,2,x,6	0.020 mV
0,2,x,7	0.015 mV

AdcBw 51200Hz, Range 10V Direct voltage 3.16V < IR <= 10V Spec: <= ±10.000 mV Uncertainty: 21µV	
Chan	Value
0,1,x,0	0.198 mV
0,1,x,1	0.396 mV
0,1,x,2	0.426 mV
0,1,x,3	0.611 mV
0,1,x,4	0.563 mV
0,1,x,5	0.448 mV
0,1,x,6	0.295 mV
0,1,x,7	0.749 mV
0,2,x,0	0.375 mV
0,2,x,1	0.327 mV
0,2,x,2	0.149 mV
0,2,x,3	0.278 mV
0,2,x,4	0.567 mV
0,2,x,5	0.255 mV
0,2,x,6	0.322 mV
0,2,x,7	0.434 mV

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AdcBw 25600Hz, Range 0.316V Direct voltage IR <= 316mV Spec: <= ±0.316 mV Uncertainty: 4.8µV	
Chan	Value
0,1,x,0	0.002 mV
0,1,x,1	-0.026 mV
0,1,x,2	0.025 mV
0,1,x,3	0.024 mV
0,1,x,4	0.002 mV
0,1,x,5	0.011 mV
0,1,x,6	-0.039 mV
0,1,x,7	0.055 mV
0,2,x,0	0.024 mV
0,2,x,1	-0.008 mV
0,2,x,2	-0.029 mV
0,2,x,3	0.009 mV
0,2,x,4	-0.020 mV
0,2,x,5	-0.037 mV
0,2,x,6	0.000 mV
0,2,x,7	-0.019 mV

AdcBw 25600Hz, Range 3.16V Direct voltage 1V < IR <= 3.16V Spec: <= ±3.160 mV Uncertainty: 8µV	
Chan	Value
0,1,x,0	0.058 mV
0,1,x,1	0.085 mV
0,1,x,2	0.139 mV
0,1,x,3	0.204 mV
0,1,x,4	0.171 mV
0,1,x,5	0.143 mV
0,1,x,6	0.054 mV
0,1,x,7	0.255 mV
0,2,x,0	0.136 mV
0,2,x,1	0.086 mV
0,2,x,2	0.023 mV
0,2,x,3	0.085 mV
0,2,x,4	0.154 mV
0,2,x,5	0.050 mV
0,2,x,6	0.099 mV
0,2,x,7	0.120 mV

AdcBw 25600Hz, Range 1V Direct voltage 316mV < IR <= 1V Spec: <= ±1.000 mV Uncertainty: 5.2µV	
Chan	Value
0,1,x,0	0.015 mV
0,1,x,1	0.000 mV
0,1,x,2	0.050 mV
0,1,x,3	0.066 mV
0,1,x,4	0.044 mV
0,1,x,5	0.044 mV
0,1,x,6	-0.015 mV
0,1,x,7	0.103 mV
0,2,x,0	0.050 mV
0,2,x,1	0.012 mV
0,2,x,2	-0.018 mV
0,2,x,3	0.030 mV
0,2,x,4	0.021 mV
0,2,x,5	-0.014 mV
0,2,x,6	0.023 mV
0,2,x,7	0.015 mV

AdcBw 25600Hz, Range 10V Direct voltage 3.16V < IR <= 10V Spec: <= ±10.000 mV Uncertainty: 21µV	
Chan	Value
0,1,x,0	0.187 mV
0,1,x,1	0.386 mV
0,1,x,2	0.393 mV
0,1,x,3	0.622 mV
0,1,x,4	0.592 mV
0,1,x,5	0.472 mV
0,1,x,6	0.286 mV
0,1,x,7	0.723 mV
0,2,x,0	0.416 mV
0,2,x,1	0.310 mV
0,2,x,2	0.112 mV
0,2,x,3	0.272 mV
0,2,x,4	0.579 mV
0,2,x,5	0.264 mV
0,2,x,6	0.328 mV
0,2,x,7	0.448 mV

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4.3 Total Harmonic Distortion

Description of calibration:
Determination of the harmonic distortion of the input channels over all input ranges, by applying an accurate 1kHz -3dBFS (max 4V) sine wave which is generated by the internal reference generator. For charge amplifiers, the reference voltage signal is translated to a reference charge signal. Harmonic components 2, 3, 4 and 5 are determined to calculate the harmonic content (either in Volt or Coulomb, depending on the input channel type) and the ratio between the fundamental tone and its harmonics (in dB).

Range 10V
Distortion 3.16V < IR <= 10V
Spec: <= -94.0dB
Uncertainty: 2.6µV

Chan	Value
0,1,x,0	13.829 µV, -109.2dB
0,1,x,1	14.123 µV, -109.0dB
0,1,x,2	13.994 µV, -109.1dB
0,1,x,3	13.999 µV, -109.1dB
0,1,x,4	13.894 µV, -109.2dB
0,1,x,5	14.313 µV, -108.9dB
0,1,x,6	14.466 µV, -108.8dB
0,1,x,7	14.759 µV, -108.7dB
0,2,x,0	14.140 µV, -109.0dB
0,2,x,1	14.634 µV, -108.7dB
0,2,x,2	14.022 µV, -109.1dB
0,2,x,3	14.408 µV, -108.9dB
0,2,x,4	14.116 µV, -109.0dB
0,2,x,5	14.990 µV, -108.5dB
0,2,x,6	13.625 µV, -109.4dB
0,2,x,7	15.063 µV, -108.5dB

Range 1 V
Distortion 316mV < IR <= 1V
Spec: <= -94.0dB
Uncertainty: 290nV

Chan	Value
0,1,x,0	2.727 µV, -108.3dB
0,1,x,1	2.676 µV, -108.4dB
0,1,x,2	2.846 µV, -107.9dB
0,1,x,3	2.556 µV, -108.8dB
0,1,x,4	2.658 µV, -108.5dB
0,1,x,5	2.609 µV, -108.7dB
0,1,x,6	2.982 µV, -107.5dB
0,1,x,7	2.746 µV, -108.2dB
0,2,x,0	2.716 µV, -108.3dB
0,2,x,1	2.804 µV, -108.0dB
0,2,x,2	2.373 µV, -109.5dB
0,2,x,3	2.499 µV, -109.0dB
0,2,x,4	2.870 µV, -107.8dB
0,2,x,5	3.037 µV, -107.3dB
0,2,x,6	3.008 µV, -107.4dB
0,2,x,7	2.988 µV, -107.5dB

Range 3.16V
Distortion 1V < IR <= 3.16V
Spec: <= -94.0dB
Uncertainty: 0.8µV

Chan	Value
0,1,x,0	7.133 µV, -109.9dB
0,1,x,1	7.424 µV, -109.6dB
0,1,x,2	7.168 µV, -109.9dB
0,1,x,3	7.336 µV, -109.7dB
0,1,x,4	7.348 µV, -109.7dB
0,1,x,5	7.416 µV, -109.6dB
0,1,x,6	8.176 µV, -108.7dB
0,1,x,7	8.708 µV, -108.2dB
0,2,x,0	7.512 µV, -109.5dB
0,2,x,1	8.244 µV, -108.7dB
0,2,x,2	6.722 µV, -110.4dB
0,2,x,3	7.172 µV, -109.9dB
0,2,x,4	7.886 µV, -109.0dB
0,2,x,5	8.625 µV, -108.3dB
0,2,x,6	6.798 µV, -110.3dB
0,2,x,7	9.404 µV, -107.5dB

Range 0.316V
Distortion 100mV < IR <= 316mV
Spec: <= -91.0dB
Uncertainty: 140nV

Chan	Value
0,1,x,0	3.035 µV, -97.3dB
0,1,x,1	3.110 µV, -97.1dB
0,1,x,2	3.245 µV, -96.8dB
0,1,x,3	3.091 µV, -97.2dB
0,1,x,4	3.069 µV, -97.2dB
0,1,x,5	3.084 µV, -97.2dB
0,1,x,6	3.336 µV, -96.5dB
0,1,x,7	3.092 µV, -97.2dB
0,2,x,0	3.052 µV, -97.3dB
0,2,x,1	3.256 µV, -96.7dB
0,2,x,2	2.896 µV, -97.7dB
0,2,x,3	3.016 µV, -97.4dB
0,2,x,4	3.199 µV, -96.9dB
0,2,x,5	3.469 µV, -96.2dB
0,2,x,6	3.524 µV, -96.0dB
0,2,x,7	3.210 µV, -96.9dB

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4.4 RMS Noise

Description of calibration:
Determination of the noise contribution of the input channels, by internally shorting the input channels to ground. The reported values are RMS values over the corresponding bandwidth.

Range 10V, Bw 80kHz Not in Scope Spec: < 311.0000µVrms	
Chan	Value
0,1,x,0	218.5553µVrms
0,1,x,1	217.4148µVrms
0,1,x,2	213.0585µVrms
0,1,x,3	211.5176µVrms
0,1,x,4	213.5501µVrms
0,1,x,5	213.7411µVrms
0,1,x,6	215.4583µVrms
0,1,x,7	211.6006µVrms
0,2,x,0	215.9582µVrms
0,2,x,1	228.4073µVrms
0,2,x,2	235.6755µVrms
0,2,x,3	216.7198µVrms
0,2,x,4	214.1678µVrms
0,2,x,5	213.6984µVrms
0,2,x,6	224.1011µVrms
0,2,x,7	214.2931µVrms

Range 10V, Bw 40kHz Not in Scope Spec: < 42.0000µVrms	
Chan	Value
0,1,x,0	30.4525µVrms
0,1,x,1	29.8315µVrms
0,1,x,2	29.4160µVrms
0,1,x,3	29.8817µVrms
0,1,x,4	30.0251µVrms
0,1,x,5	29.5815µVrms
0,1,x,6	30.0026µVrms
0,1,x,7	29.6154µVrms
0,2,x,0	29.8686µVrms
0,2,x,1	32.8724µVrms
0,2,x,2	33.1120µVrms
0,2,x,3	30.5002µVrms
0,2,x,4	30.2669µVrms
0,2,x,5	30.4791µVrms
0,2,x,6	31.8166µVrms
0,2,x,7	30.1322µVrms

Range 10V, Bw 20kHz Noise 3.16V < IR <= 10V Spec: <= 29.000 µV Uncertainty: 3.4nV	
Chan	Value
0,1,x,0	20.656 µV
0,1,x,1	20.234 µV
0,1,x,2	19.799 µV
0,1,x,3	20.140 µV
0,1,x,4	20.207 µV
0,1,x,5	20.055 µV
0,1,x,6	20.437 µV
0,1,x,7	20.067 µV
0,2,x,0	20.321 µV
0,2,x,1	20.314 µV
0,2,x,2	21.076 µV
0,2,x,3	21.723 µV
0,2,x,4	20.682 µV
0,2,x,5	20.930 µV
0,2,x,6	20.446 µV
0,2,x,7	20.746 µV

Range 0.316V, Bw 80kHz Not in Scope Spec: < 10.5000µVrms	
Chan	Value
0,1,x,0	7.2962µVrms
0,1,x,1	7.2710µVrms
0,1,x,2	7.1908µVrms
0,1,x,3	7.1839µVrms
0,1,x,4	7.1553µVrms
0,1,x,5	7.2019µVrms
0,1,x,6	7.2346µVrms
0,1,x,7	7.1261µVrms
0,2,x,0	7.2933µVrms
0,2,x,1	7.6643µVrms
0,2,x,2	7.7992µVrms
0,2,x,3	7.2575µVrms
0,2,x,4	7.1323µVrms
0,2,x,5	7.2573µVrms
0,2,x,6	7.5629µVrms
0,2,x,7	7.1677µVrms

Range 0.316V, Bw 40kHz Not in Scope Spec: < 2.8000µVrms	
Chan	Value
0,1,x,0	2.0798µVrms
0,1,x,1	2.0687µVrms
0,1,x,2	2.0541µVrms
0,1,x,3	2.0628µVrms
0,1,x,4	2.0725µVrms
0,1,x,5	2.0755µVrms
0,1,x,6	2.0743µVrms
0,1,x,7	2.0628µVrms
0,2,x,0	2.0485µVrms
0,2,x,1	2.0942µVrms
0,2,x,2	2.1265µVrms
0,2,x,3	2.0629µVrms
0,2,x,4	2.0425µVrms
0,2,x,5	2.0600µVrms
0,2,x,6	2.0760µVrms
0,2,x,7	2.0477µVrms

Range 0.316V, Bw 20kHz Noise IR <= 316mV Spec: <= 1.980 µV Uncertainty: 2.0nV	
Chan	Value
0,1,x,0	1.465 µV
0,1,x,1	1.470 µV
0,1,x,2	1.458 µV
0,1,x,3	1.452 µV
0,1,x,4	1.463 µV
0,1,x,5	1.457 µV
0,1,x,6	1.467 µV
0,1,x,7	1.459 µV
0,2,x,0	1.452 µV
0,2,x,1	1.450 µV
0,2,x,2	1.493 µV
0,2,x,3	1.449 µV
0,2,x,4	1.453 µV
0,2,x,5	1.451 µV
0,2,x,6	1.452 µV
0,2,x,7	1.448 µV

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4.5 Spurious Free Floor

Description of calibration:
Determination of the peak spurious components generated by the input channels, by internally shorting the input channels to ground. The reported values are peak values over the corresponding bandwidth.

Range 10V, Bw 80kHz Not in Scope Spec: < 40.0000µV	
Chan	Value
0,1,x,0	20.4671µV
0,1,x,1	19.7447µV
0,1,x,2	21.0808µV
0,1,x,3	22.2612µV
0,1,x,4	20.4832µV
0,1,x,5	20.9375µV
0,1,x,6	19.8179µV
0,1,x,7	19.1502µV
0,2,x,0	20.9806µV
0,2,x,1	20.3204µV
0,2,x,2	19.8305µV
0,2,x,3	19.5816µV
0,2,x,4	21.3277µV
0,2,x,5	20.6013µV
0,2,x,6	20.7131µV
0,2,x,7	20.5438µV

Range 10V, Bw 40kHz Not in Scope Spec: < 3.0000µV	
Chan	Value
0,1,x,0	1.6982µV
0,1,x,1	1.8746µV
0,1,x,2	1.8046µV
0,1,x,3	1.6495µV
0,1,x,4	2.1404µV
0,1,x,5	1.5576µV
0,1,x,6	1.6252µV
0,1,x,7	1.5214µV
0,2,x,0	2.0230µV
0,2,x,1	1.9407µV
0,2,x,2	2.0966µV
0,2,x,3	1.8416µV
0,2,x,4	2.1868µV
0,2,x,5	1.5895µV
0,2,x,6	1.6375µV
0,2,x,7	1.7740µV

Range 10V, Bw 20kHz Spurious 3.16V < IR <= 10V Spec: <= 2.300 µV Uncertainty: 3.4nV	
Chan	Value
0,1,x,0	1.406 µV
0,1,x,1	1.355 µV
0,1,x,2	1.170 µV
0,1,x,3	1.212 µV
0,1,x,4	1.297 µV
0,1,x,5	1.040 µV
0,1,x,6	1.373 µV
0,1,x,7	1.302 µV
0,2,x,0	1.305 µV
0,2,x,1	1.517 µV
0,2,x,2	1.449 µV
0,2,x,3	1.264 µV
0,2,x,4	1.113 µV
0,2,x,5	1.551 µV
0,2,x,6	1.369 µV
0,2,x,7	1.383 µV

ICP Not in Scope Spec: < 0.2600µVp	
Chan	Value
0,1,x,0	0.1003µVp
0,1,x,1	0.0751µVp
0,1,x,2	0.0786µVp
0,1,x,3	0.0782µVp
0,1,x,4	0.0782µVp
0,1,x,5	0.0777µVp
0,1,x,6	0.0812µVp
0,1,x,7	0.0950µVp
0,2,x,0	0.0879µVp
0,2,x,1	0.0806µVp
0,2,x,2	0.1054µVp
0,2,x,3	0.0818µVp
0,2,x,4	0.0897µVp
0,2,x,5	0.0888µVp
0,2,x,6	0.0790µVp
0,2,x,7	0.0882µVp

Range 0.316V, Bw 80kHz Not in Scope Spec: < 1.2000µV	
Chan	Value
0,1,x,0	0.5870µV
0,1,x,1	0.5834µV
0,1,x,2	0.6601µV
0,1,x,3	0.5847µV
0,1,x,4	0.6662µV
0,1,x,5	0.6011µV
0,1,x,6	0.5699µV
0,1,x,7	0.5418µV
0,2,x,0	0.5947µV
0,2,x,1	0.6931µV
0,2,x,2	0.7023µV
0,2,x,3	0.7109µV
0,2,x,4	0.6741µV
0,2,x,5	0.5635µV
0,2,x,6	0.6108µV
0,2,x,7	0.6656µV

Range 0.316V, Bw 40kHz Not in Scope Spec: < 0.1600µV	
Chan	Value
0,1,x,0	0.0795µV
0,1,x,1	0.0804µV
0,1,x,2	0.0834µV
0,1,x,3	0.0911µV
0,1,x,4	0.1061µV
0,1,x,5	0.0834µV
0,1,x,6	0.0822µV
0,1,x,7	0.0819µV
0,2,x,0	0.0873µV
0,2,x,1	0.0965µV
0,2,x,2	0.0919µV
0,2,x,3	0.0910µV
0,2,x,4	0.1030µV
0,2,x,5	0.0783µV
0,2,x,6	0.0948µV
0,2,x,7	0.0920µV

Range 0.316V, Bw 20kHz Spurious IR <= 316mV Spec: <= 0.130 µV Uncertainty: 2.0nV	
Chan	Value
0,1,x,0	0.058 µV
0,1,x,1	0.067 µV
0,1,x,2	0.061 µV
0,1,x,3	0.067 µV
0,1,x,4	0.057 µV
0,1,x,5	0.060 µV
0,1,x,6	0.066 µV
0,1,x,7	0.058 µV
0,2,x,0	0.068 µV
0,2,x,1	0.060 µV
0,2,x,2	0.061 µV
0,2,x,3	0.063 µV
0,2,x,4	0.064 µV
0,2,x,5	0.068 µV
0,2,x,6	0.064 µV
0,2,x,7	0.074 µV

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4.6 Inter-channel Crosstalk

Description of calibration:
Determination of the crosstalk between the input channels in a system. The channel under calibration is internally shorted to ground, while its neighbour channels are fed with a near full scale sine wave signal which is generated by the internal reference generator. This is done for two input range settings of the channel under calibration, and two signal frequencies. The reported results represent the measured crosstalk values in the channels under calibration (either in Volt or Coulomb, depending on the input channel type) and the ratio between the applied signal amplitude and the crosstalk values (in dB).

Range 0.316V, F 1K5 Crosstalk 100mV < IR <= 316mV Spec: <= -120.0dB Uncertainty: 68nV	
Chan	Value
0,1,x,0	0.146 µV, -130.7dB
0,1,x,1	0.118 µV, -132.6dB
0,1,x,2	0.121 µV, -132.3dB
0,1,x,3	0.098 µV, -134.2dB
0,1,x,4	0.101 µV, -133.9dB
0,1,x,5	0.081 µV, -135.8dB
0,1,x,6	0.101 µV, -133.9dB
0,1,x,7	0.105 µV, -133.5dB
0,2,x,0	0.118 µV, -132.6dB
0,2,x,1	0.124 µV, -132.1dB
0,2,x,2	0.135 µV, -131.3dB
0,2,x,3	0.087 µV, -135.1dB
0,2,x,4	0.106 µV, -133.5dB
0,2,x,5	0.086 µV, -135.3dB
0,2,x,6	0.113 µV, -132.9dB
0,2,x,7	0.134 µV, -131.5dB

Range 0.316V, F 15K Crosstalk 100mV < IR <= 316mV Spec: <= -107.0dB Uncertainty: 68nV	
Chan	Value
0,1,x,0	0.814 µV, -115.8dB
0,1,x,1	1.338 µV, -111.5dB
0,1,x,2	1.364 µV, -111.3dB
0,1,x,3	1.382 µV, -111.2dB
0,1,x,4	1.375 µV, -111.2dB
0,1,x,5	1.337 µV, -111.5dB
0,1,x,6	1.198 µV, -112.4dB
0,1,x,7	1.079 µV, -113.3dB
0,2,x,0	0.805 µV, -115.9dB
0,2,x,1	1.343 µV, -111.4dB
0,2,x,2	1.390 µV, -111.1dB
0,2,x,3	1.352 µV, -111.4dB
0,2,x,4	1.355 µV, -111.3dB
0,2,x,5	1.329 µV, -111.5dB
0,2,x,6	1.203 µV, -112.4dB
0,2,x,7	1.081 µV, -113.3dB

Range 10V, F 1K5 Crosstalk 3.16V < IR <= 10V Spec: <= -108.0dB Uncertainty: 1.3µV	
Chan	Value
0,1,x,0	0.304 µV, -124.3dB
0,1,x,1	0.330 µV, -123.6dB
0,1,x,2	0.442 µV, -121.1dB
0,1,x,3	0.497 µV, -120.0dB
0,1,x,4	0.158 µV, -130.0dB
0,1,x,5	0.320 µV, -123.9dB
0,1,x,6	0.493 µV, -120.1dB
0,1,x,7	0.302 µV, -124.4dB
0,2,x,0	0.303 µV, -124.3dB
0,2,x,1	0.282 µV, -125.0dB
0,2,x,2	0.395 µV, -122.0dB
0,2,x,3	0.510 µV, -119.8dB
0,2,x,4	0.185 µV, -128.6dB
0,2,x,5	0.529 µV, -119.5dB
0,2,x,6	0.336 µV, -123.5dB
0,2,x,7	0.318 µV, -123.9dB

Range 10V, F 15K Crosstalk 3.16V < IR <= 10V Spec: <= -105.0dB Uncertainty: 1.3µV	
Chan	Value
0,1,x,0	1.017 µV, -113.8dB
0,1,x,1	1.459 µV, -110.7dB
0,1,x,2	1.727 µV, -109.2dB
0,1,x,3	1.454 µV, -110.7dB
0,1,x,4	1.698 µV, -109.4dB
0,1,x,5	1.543 µV, -110.2dB
0,1,x,6	1.476 µV, -110.6dB
0,1,x,7	1.176 µV, -112.6dB
0,2,x,0	0.975 µV, -114.2dB
0,2,x,1	1.545 µV, -110.2dB
0,2,x,2	1.585 µV, -110.0dB
0,2,x,3	1.458 µV, -110.7dB
0,2,x,4	1.508 µV, -110.4dB
0,2,x,5	1.394 µV, -111.1dB
0,2,x,6	1.586 µV, -110.0dB
0,2,x,7	1.265 µV, -111.9dB

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4.7 Inter-channel Phase Match

Description of calibration:
Determination of the phase difference between the input channels in a system, by applying an accurate -3dBFS (max 4V) sine wave which is generated by the internal reference generator. For charge amplifiers, the reference voltage signal is translated to a reference charge signal. The reported values represent the highest phase differences found between any of the channels in the system. This is done for two input range settings and two signal frequencies.

Range 10V, F 9k9 Not in Scope Spec: < 0.3000°	
Chan	Value
0,1,x,0	0.0174°
0,1,x,1	0.0313°
0,1,x,2	0.0241°
0,1,x,3	0.0174°
0,1,x,4	0.0243°
0,1,x,5	0.0230°
0,1,x,6	0.0161°
0,1,x,7	0.0291°
0,2,x,0	0.0313°
0,2,x,1	0.0194°
0,2,x,2	0.0215°
0,2,x,3	0.0178°
0,2,x,4	0.0159°
0,2,x,5	0.0219°
0,2,x,6	0.0198°
0,2,x,7	0.0282°

Range 10V, F 19k9 Not in Scope Spec: < 0.4000°	
Chan	Value
0,1,x,0	0.0339°
0,1,x,1	0.0619°
0,1,x,2	0.0482°
0,1,x,3	0.0340°
0,1,x,4	0.0476°
0,1,x,5	0.0461°
0,1,x,6	0.0311°
0,1,x,7	0.0590°
0,2,x,0	0.0619°
0,2,x,1	0.0389°
0,2,x,2	0.0425°
0,2,x,3	0.0360°
0,2,x,4	0.0322°
0,2,x,5	0.0438°
0,2,x,6	0.0398°
0,2,x,7	0.0558°

Range 0.316V, F 9k9 Not in Scope Spec: < 0.4500°	
Chan	Value
0,1,x,0	0.0471°
0,1,x,1	0.0655°
0,1,x,2	0.0697°
0,1,x,3	0.0613°
0,1,x,4	0.0664°
0,1,x,5	0.0515°
0,1,x,6	0.0456°
0,1,x,7	0.0448°
0,2,x,0	0.0538°
0,2,x,1	0.0682°
0,2,x,2	0.0508°
0,2,x,3	0.0630°
0,2,x,4	0.0834°
0,2,x,5	0.0711°
0,2,x,6	0.0834°
0,2,x,7	0.0586°

Range 0.316V, F 19k9 Not in Scope Spec: < 0.9000°	
Chan	Value
0,1,x,0	0.0957°
0,1,x,1	0.1321°
0,1,x,2	0.1404°
0,1,x,3	0.1238°
0,1,x,4	0.1343°
0,1,x,5	0.1023°
0,1,x,6	0.0901°
0,1,x,7	0.0906°
0,2,x,0	0.1080°
0,2,x,1	0.1355°
0,2,x,2	0.1015°
0,2,x,3	0.1273°
0,2,x,4	0.1669°
0,2,x,5	0.1421°
0,2,x,6	0.1669°
0,2,x,7	0.1180°

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5 SYSCON_REC_h11s0

5.1 Gain Accuracy after Adjustment

Description of calibration:
Determination of the amplitude accuracy of the input channels over all input ranges and available ADC bandwidths, by applying an accurate 1kHz -3dBFS (max 4V) sine wave which is generated by the internal reference generator. For charge amplifiers, the reference voltage signal is translated to a reference charge signal.
The reported values represent the deviations from the expected signal amplitude, both absolute (either in Volt or Coulomb, depending on the input channel type) and relative (in %).

BW 25k6 **Alternating voltage 3.16V < IR <= 10V** **Spec: <= ±0.100%** **Uncertainty: 530µV**	
Chan	Value
0,x,x,0	-3.293 mV, -0.082%
0,x,x,1	-2.537 mV, -0.063%

BW 51k2 **Alternating voltage 3.16V < IR <= 10V** **Spec: <= ±0.100%** **Uncertainty: 530µV**	
Chan	Value
0,x,x,0	-3.134 mV, -0.078%
0,x,x,1	-2.446 mV, -0.061%

BW 102k4 **Not in Scope** **Spec: 1.00000 ±0.10%**	
Chan	Value
0,x,x,0	999.19951m, -0.08%
0,x,x,1	999.38527m, -0.06%

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ISO17025

As Left RECALIBRATION CERTIFICATE

Sales Region:	Americas
Account:	Aercoustics Engineering Limited
Instrument:	LMS SCADAS
Manufacturer:	Siemens Industry Software B.V.
Type:	SCR202
Serial number(s):	22143211
Calibration method:	Two calibrated external standards (DC voltage and frequency) are used to calibrate the internal LMS SCADAS references: time/frequency accuracy of the internal system clock and amplitude accuracy of the internal signal sources. All input channels are calibrated against the internal references.
Ambient conditions:	The calibrations have been carried out in a controlled environment, at an ambient temperature of 22.9°C ± 0.3°C and a relative humidity of 42% ± 5%.
Calibration date:	June 22, 2018
Results:	The calibration results, together with their associated uncertainties, are included in this calibration certificate. Calibration results within specification.
Uncertainty:	The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with publication EA-4/02.
Traceability:	The measurements have been executed using methods for which the traceability to international standards has been demonstrated towards the Raad voor Accreditatie.

Breda, June 22, 2018

Calibration performed by:

A.v.Aalst Customer Support Engineer

Certificate approved by:

F.Lemmens, Production Manager

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1 Explanation of the factory calibration procedure

The production process of an LMS SCADAS front-end consists of a number of stages.
Every single board or module that will be part of the system is tested extensively on reliability and functionality before it is inserted in the LMS SCADAS frame.
After assembly, the amplitude accuracy and offset errors of all input and output channels are adjusted to a value as close to zero as possible. The adjustment procedure incorporates external measurement equipment, which is documented in the next section of this report.

As a final step, the front-end is submitted to a factory calibration. The factory calibration verifies whether all input and output channels meet their published specifications with respect to amplitude accuracy, offset, and a number of dynamic capabilities such as distortion, signal to noise ratio and inter-channel crosstalk. The measurements that are done as a part of the calibration use an internal reference source, which has been calibrated against an external standard (documented in the next section of this report).
The results of this calibration procedure are documented in the *Calibration Certificate* you have in front of you.

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2 External reference - used equipment

	Type	Serial Number	Cal Certificate	Cal Date
Digital multimeter	Agilent 34401A	MY41040399	201702735.00	21 July 2017
Calibration software	2.14.0002	NA	NA	NA

The external reference (DMM) is calibrated on a yearly basis by a calibration laboratory that is ISO17025:2005 accredited by The Dutch Accreditation Council RvA.

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3 System configuration

Frame	Backplane Module	Conditioner	Unique number	Hardware version	Software version	Option
Master (0)			0022143211			
	V8_E (1)		2013333008	18	0	
	V8_E (2)		2013333032	18	0	
	SYSCON_REC (3)		2013215010	11	0	
		SYSCPB (0)	2013376010	3	0	
	PS12-2 MOB (4)		2014154022	17	11	

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4 V8_E_h18s0

4.1 Gain Accuracy after Adjustment

Description of calibration:
Determination of the amplitude accuracy of the input channels over all input ranges and available ADC bandwidths, by applying an accurate 1kHz -3dBFS (max 4V) sine wave which is generated by the internal reference generator. For charge amplifiers, the reference voltage signal is translated to a reference charge signal.
The reported values represent the deviations from the expected signal amplitude, both absolute (either in Volt or Coulomb, depending on the input channel type) and relative (in %).

AdcBw 102400Hz, Range 0.316V Alternating voltage 100mV < IR <= 316mV Spec: <= ±0.100% Uncertainty: 66µV	
Chan	Value
0,1,x,0	-0.034 mV, -0.015%
0,1,x,1	-0.033 mV, -0.015%
0,1,x,2	-0.033 mV, -0.015%
0,1,x,3	-0.033 mV, -0.015%
0,1,x,4	-0.033 mV, -0.015%
0,1,x,5	-0.032 mV, -0.015%
0,1,x,6	-0.033 mV, -0.015%
0,1,x,7	-0.033 mV, -0.015%
0,2,x,0	-0.033 mV, -0.015%
0,2,x,1	-0.033 mV, -0.015%
0,2,x,2	-0.034 mV, -0.015%
0,2,x,3	-0.033 mV, -0.015%
0,2,x,4	-0.034 mV, -0.015%
0,2,x,5	-0.033 mV, -0.015%
0,2,x,6	-0.033 mV, -0.015%
0,2,x,7	-0.033 mV, -0.015%

AdcBw 102400Hz, Range 1V Alternating voltage 316mV < IR <= 1V Spec: <= ±0.100% Uncertainty: 120µV	
Chan	Value
0,1,x,0	-0.077 mV, -0.011%
0,1,x,1	-0.075 mV, -0.011%
0,1,x,2	-0.075 mV, -0.011%
0,1,x,3	-0.075 mV, -0.011%
0,1,x,4	-0.078 mV, -0.011%
0,1,x,5	-0.075 mV, -0.011%
0,1,x,6	-0.077 mV, -0.011%
0,1,x,7	-0.076 mV, -0.011%
0,2,x,0	-0.074 mV, -0.010%
0,2,x,1	-0.074 mV, -0.011%
0,2,x,2	-0.076 mV, -0.011%
0,2,x,3	-0.075 mV, -0.011%
0,2,x,4	-0.076 mV, -0.011%
0,2,x,5	-0.075 mV, -0.011%
0,2,x,6	-0.075 mV, -0.011%
0,2,x,7	-0.074 mV, -0.010%

AdcBw 102400Hz, Range 3.16V Alternating voltage 1V < IR <= 3.16V Spec: <= ±0.100% Uncertainty: 310µV	
Chan	Value
0,1,x,0	-0.170 mV, -0.008%
0,1,x,1	-0.161 mV, -0.007%
0,1,x,2	-0.164 mV, -0.007%
0,1,x,3	-0.163 mV, -0.007%
0,1,x,4	-0.168 mV, -0.008%
0,1,x,5	-0.162 mV, -0.007%
0,1,x,6	-0.168 mV, -0.008%
0,1,x,7	-0.163 mV, -0.007%
0,2,x,0	-0.160 mV, -0.007%
0,2,x,1	-0.163 mV, -0.007%
0,2,x,2	-0.161 mV, -0.007%
0,2,x,3	-0.159 mV, -0.007%
0,2,x,4	-0.164 mV, -0.007%
0,2,x,5	-0.163 mV, -0.007%
0,2,x,6	-0.160 mV, -0.007%
0,2,x,7	-0.163 mV, -0.007%

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AdcBw 102400Hz, Range 10V
Alternating voltage 3.16V < IR <= 10V
Spec: <= ±0.100%
Uncertainty: 530µV

Chan	Value
0,1,x,0	-0.243 mV, -0.006%
0,1,x,1	-0.241 mV, -0.006%
0,1,x,2	-0.237 mV, -0.006%
0,1,x,3	-0.234 mV, -0.006%
0,1,x,4	-0.244 mV, -0.006%
0,1,x,5	-0.232 mV, -0.006%
0,1,x,6	-0.236 mV, -0.006%
0,1,x,7	-0.233 mV, -0.006%
0,2,x,0	-0.230 mV, -0.006%
0,2,x,1	-0.232 mV, -0.006%
0,2,x,2	-0.234 mV, -0.006%
0,2,x,3	-0.232 mV, -0.006%
0,2,x,4	-0.229 mV, -0.006%
0,2,x,5	-0.232 mV, -0.006%
0,2,x,6	-0.233 mV, -0.006%
0,2,x,7	-0.226 mV, -0.006%

AdcBw 51200Hz, Range 1V
Alternating voltage 316mV < IR <= 1V
Spec: <= ±0.100%
Uncertainty: 120µV

Chan	Value
0,1,x,0	-0.021 mV, -0.003%
0,1,x,1	-0.020 mV, -0.003%
0,1,x,2	-0.021 mV, -0.003%
0,1,x,3	-0.021 mV, -0.003%
0,1,x,4	-0.022 mV, -0.003%
0,1,x,5	-0.020 mV, -0.003%
0,1,x,6	-0.021 mV, -0.003%
0,1,x,7	-0.020 mV, -0.003%
0,2,x,0	-0.020 mV, -0.003%
0,2,x,1	-0.019 mV, -0.003%
0,2,x,2	-0.019 mV, -0.003%
0,2,x,3	-0.020 mV, -0.003%
0,2,x,4	-0.021 mV, -0.003%
0,2,x,5	-0.020 mV, -0.003%
0,2,x,6	-0.020 mV, -0.003%
0,2,x,7	-0.020 mV, -0.003%

AdcBw 51200Hz, Range 10V
Alternating voltage 3.16V < IR <= 10V
Spec: <= ±0.100%
Uncertainty: 530µV

Chan	Value
0,1,x,0	-0.074 mV, -0.002%
0,1,x,1	-0.074 mV, -0.002%
0,1,x,2	-0.068 mV, -0.002%
0,1,x,3	-0.065 mV, -0.002%
0,1,x,4	-0.076 mV, -0.002%
0,1,x,5	-0.066 mV, -0.002%
0,1,x,6	-0.068 mV, -0.002%
0,1,x,7	-0.066 mV, -0.002%
0,2,x,0	-0.065 mV, -0.002%
0,2,x,1	-0.064 mV, -0.002%
0,2,x,2	-0.068 mV, -0.002%
0,2,x,3	-0.068 mV, -0.002%
0,2,x,4	-0.067 mV, -0.002%
0,2,x,5	-0.068 mV, -0.002%
0,2,x,6	-0.073 mV, -0.002%
0,2,x,7	-0.068 mV, -0.002%

AdcBw 51200Hz, Range 0.316V
Alternating voltage 100mV < IR <= 316mV
Spec: <= ±0.100%
Uncertainty: 66µV

Chan	Value
0,1,x,0	-0.010 mV, -0.005%
0,1,x,1	-0.010 mV, -0.005%
0,1,x,2	-0.010 mV, -0.005%
0,1,x,3	-0.010 mV, -0.005%
0,1,x,4	-0.011 mV, -0.005%
0,1,x,5	-0.010 mV, -0.005%
0,1,x,6	-0.011 mV, -0.005%
0,1,x,7	-0.010 mV, -0.005%
0,2,x,0	-0.011 mV, -0.005%
0,2,x,1	-0.010 mV, -0.005%
0,2,x,2	-0.010 mV, -0.005%
0,2,x,3	-0.010 mV, -0.005%
0,2,x,4	-0.011 mV, -0.005%
0,2,x,5	-0.010 mV, -0.005%
0,2,x,6	-0.010 mV, -0.005%
0,2,x,7	-0.010 mV, -0.004%

AdcBw 51200Hz, Range 3.16V
Alternating voltage 1V < IR <= 3.16V
Spec: <= ±0.100%
Uncertainty: 310µV

Chan	Value
0,1,x,0	-0.069 mV, -0.003%
0,1,x,1	-0.065 mV, -0.003%
0,1,x,2	-0.068 mV, -0.003%
0,1,x,3	-0.068 mV, -0.003%
0,1,x,4	-0.072 mV, -0.003%
0,1,x,5	-0.068 mV, -0.003%
0,1,x,6	-0.068 mV, -0.003%
0,1,x,7	-0.065 mV, -0.003%
0,2,x,0	-0.065 mV, -0.003%
0,2,x,1	-0.065 mV, -0.003%
0,2,x,2	-0.065 mV, -0.003%
0,2,x,3	-0.065 mV, -0.003%
0,2,x,4	-0.067 mV, -0.003%
0,2,x,5	-0.066 mV, -0.003%
0,2,x,6	-0.066 mV, -0.003%
0,2,x,7	-0.069 mV, -0.003%

AdcBw 25600Hz, Range 0.316V
Alternating voltage 100mV < IR <= 316mV
Spec: <= ±0.100%
Uncertainty: 66µV

Chan	Value
0,1,x,0	-0.002 mV, -0.001%
0,1,x,1	-0.002 mV, -0.001%
0,1,x,2	-0.002 mV, -0.001%
0,1,x,3	-0.002 mV, -0.001%
0,1,x,4	-0.002 mV, -0.001%
0,1,x,5	-0.002 mV, -0.001%
0,1,x,6	-0.002 mV, -0.001%
0,1,x,7	-0.002 mV, -0.001%
0,2,x,0	-0.002 mV, -0.001%
0,2,x,1	-0.002 mV, -0.001%
0,2,x,2	-0.002 mV, -0.001%
0,2,x,3	-0.002 mV, -0.001%
0,2,x,4	-0.002 mV, -0.001%
0,2,x,5	-0.002 mV, -0.001%
0,2,x,6	-0.002 mV, -0.001%
0,2,x,7	-0.001 mV, -0.001%

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AdcBw 25600Hz, Range 1V Alternating voltage 316mV < IR <= 1V Spec: <= ±0.100% Uncertainty: 120µV	
Chan	Value
0,1,x,0	-0.012 mV, -0.002%
0,1,x,1	-0.012 mV, -0.002%
0,1,x,2	-0.013 mV, -0.002%
0,1,x,3	-0.013 mV, -0.002%
0,1,x,4	-0.013 mV, -0.002%
0,1,x,5	-0.012 mV, -0.002%
0,1,x,6	-0.013 mV, -0.002%
0,1,x,7	-0.012 mV, -0.002%
0,2,x,0	-0.012 mV, -0.002%
0,2,x,1	-0.011 mV, -0.002%
0,2,x,2	-0.012 mV, -0.002%
0,2,x,3	-0.012 mV, -0.002%
0,2,x,4	-0.013 mV, -0.002%
0,2,x,5	-0.012 mV, -0.002%
0,2,x,6	-0.012 mV, -0.002%
0,2,x,7	-0.012 mV, -0.002%

AdcBw 25600Hz, Range 10V Alternating voltage 3.16V < IR <= 10V Spec: <= ±0.100% Uncertainty: 530µV	
Chan	Value
0,1,x,0	-0.053 mV, -0.001%
0,1,x,1	-0.048 mV, -0.001%
0,1,x,2	-0.047 mV, -0.001%
0,1,x,3	-0.046 mV, -0.001%
0,1,x,4	-0.050 mV, -0.001%
0,1,x,5	-0.039 mV, -0.001%
0,1,x,6	-0.049 mV, -0.001%
0,1,x,7	-0.048 mV, -0.001%
0,2,x,0	-0.038 mV, -0.001%
0,2,x,1	-0.045 mV, -0.001%
0,2,x,2	-0.045 mV, -0.001%
0,2,x,3	-0.040 mV, -0.001%
0,2,x,4	-0.042 mV, -0.001%
0,2,x,5	-0.047 mV, -0.001%
0,2,x,6	-0.055 mV, -0.001%
0,2,x,7	-0.051 mV, -0.001%

AdcBw 25600Hz, Range 3.16V Alternating voltage 1V < IR <= 3.16V Spec: <= ±0.100% Uncertainty: 310µV	
Chan	Value
0,1,x,0	-0.030 mV, -0.001%
0,1,x,1	-0.025 mV, -0.001%
0,1,x,2	-0.027 mV, -0.001%
0,1,x,3	-0.027 mV, -0.001%
0,1,x,4	-0.027 mV, -0.001%
0,1,x,5	-0.023 mV, -0.001%
0,1,x,6	-0.028 mV, -0.001%
0,1,x,7	-0.026 mV, -0.001%
0,2,x,0	-0.021 mV, -0.001%
0,2,x,1	-0.022 mV, -0.001%
0,2,x,2	-0.025 mV, -0.001%
0,2,x,3	-0.023 mV, -0.001%
0,2,x,4	-0.028 mV, -0.001%
0,2,x,5	-0.027 mV, -0.001%
0,2,x,6	-0.026 mV, -0.001%
0,2,x,7	-0.029 mV, -0.001%

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4.2 Residual Offset after Adjustment

Description of calibration:
Determination of the residual input offsets of the input channels over all input ranges and available ADC bandwidths, by internally shorting the input channels to ground.

AdcBw 102400Hz, Range 0.316V Direct voltage IR <= 316mV Spec: <= ±0.316 mV Uncertainty: 4.8µV	
Chan	Value
0,1,x,0	0.008 mV
0,1,x,1	0.009 mV
0,1,x,2	0.005 mV
0,1,x,3	-0.001 mV
0,1,x,4	-0.000 mV
0,1,x,5	-0.000 mV
0,1,x,6	0.003 mV
0,1,x,7	-0.001 mV
0,2,x,0	0.005 mV
0,2,x,1	0.009 mV
0,2,x,2	0.008 mV
0,2,x,3	0.004 mV
0,2,x,4	0.005 mV
0,2,x,5	0.005 mV
0,2,x,6	0.005 mV
0,2,x,7	0.008 mV

AdcBw 102400Hz, Range 3.16V Direct voltage 1V < IR <= 3.16V Spec: <= ±3.160 mV Uncertainty: 8µV	
Chan	Value
0,1,x,0	0.003 mV
0,1,x,1	0.006 mV
0,1,x,2	0.007 mV
0,1,x,3	0.001 mV
0,1,x,4	-0.006 mV
0,1,x,5	0.001 mV
0,1,x,6	0.000 mV
0,1,x,7	-0.006 mV
0,2,x,0	0.005 mV
0,2,x,1	0.011 mV
0,2,x,2	0.003 mV
0,2,x,3	-0.005 mV
0,2,x,4	-0.007 mV
0,2,x,5	0.000 mV
0,2,x,6	0.014 mV
0,2,x,7	0.019 mV

AdcBw 51200Hz, Range 0.316V Direct voltage IR <= 316mV Spec: <= ±0.316 mV Uncertainty: 4.8µV	
Chan	Value
0,1,x,0	0.004 mV
0,1,x,1	0.005 mV
0,1,x,2	0.004 mV
0,1,x,3	0.001 mV
0,1,x,4	-0.002 mV
0,1,x,5	0.001 mV
0,1,x,6	0.002 mV
0,1,x,7	-0.002 mV
0,2,x,0	0.003 mV
0,2,x,1	0.004 mV
0,2,x,2	0.001 mV
0,2,x,3	0.001 mV
0,2,x,4	0.001 mV
0,2,x,5	0.004 mV
0,2,x,6	0.003 mV
0,2,x,7	0.005 mV

AdcBw 51200Hz, Range 3.16V Direct voltage 1V < IR <= 3.16V Spec: <= ±3.160 mV Uncertainty: 8µV	
Chan	Value
0,1,x,0	-0.002 mV
0,1,x,1	0.007 mV
0,1,x,2	0.002 mV
0,1,x,3	0.013 mV
0,1,x,4	0.002 mV
0,1,x,5	0.005 mV
0,1,x,6	0.002 mV
0,1,x,7	-0.009 mV
0,2,x,0	0.002 mV
0,2,x,1	0.009 mV
0,2,x,2	-0.001 mV
0,2,x,3	0.002 mV
0,2,x,4	-0.010 mV
0,2,x,5	0.011 mV
0,2,x,6	0.008 mV
0,2,x,7	0.012 mV

AdcBw 102400Hz, Range 1V Direct voltage 316mV < IR <= 1V Spec: <= ±1.000 mV Uncertainty: 5.2µV	
Chan	Value
0,1,x,0	0.006 mV
0,1,x,1	0.008 mV
0,1,x,2	0.003 mV
0,1,x,3	-0.003 mV
0,1,x,4	-0.002 mV
0,1,x,5	-0.000 mV
0,1,x,6	0.001 mV
0,1,x,7	-0.003 mV
0,2,x,0	0.003 mV
0,2,x,1	0.009 mV
0,2,x,2	0.004 mV
0,2,x,3	0.004 mV
0,2,x,4	0.001 mV
0,2,x,5	0.008 mV
0,2,x,6	0.006 mV
0,2,x,7	0.008 mV

AdcBw 102400Hz, Range 10V Direct voltage 3.16V < IR <= 10V Spec: <= ±10.000 mV Uncertainty: 21µV	
Chan	Value
0,1,x,0	0.006 mV
0,1,x,1	-0.009 mV
0,1,x,2	0.011 mV
0,1,x,3	-0.022 mV
0,1,x,4	0.004 mV
0,1,x,5	0.014 mV
0,1,x,6	-0.017 mV
0,1,x,7	-0.051 mV
0,2,x,0	0.010 mV
0,2,x,1	0.023 mV
0,2,x,2	-0.004 mV
0,2,x,3	-0.017 mV
0,2,x,4	-0.050 mV
0,2,x,5	0.019 mV
0,2,x,6	0.036 mV
0,2,x,7	0.048 mV

AdcBw 51200Hz, Range 1V Direct voltage 316mV < IR <= 1V Spec: <= ±1.000 mV Uncertainty: 5.2µV	
Chan	Value
0,1,x,0	0.004 mV
0,1,x,1	0.003 mV
0,1,x,2	0.003 mV
0,1,x,3	0.002 mV
0,1,x,4	-0.001 mV
0,1,x,5	0.001 mV
0,1,x,6	0.001 mV
0,1,x,7	-0.003 mV
0,2,x,0	0.003 mV
0,2,x,1	0.004 mV
0,2,x,2	0.010 mV
0,2,x,3	0.001 mV
0,2,x,4	-0.003 mV
0,2,x,5	0.005 mV
0,2,x,6	0.004 mV
0,2,x,7	0.007 mV

AdcBw 51200Hz, Range 10V Direct voltage 3.16V < IR <= 10V Spec: <= ±10.000 mV Uncertainty: 21µV	
Chan	Value
0,1,x,0	-0.028 mV
0,1,x,1	-0.011 mV
0,1,x,2	0.014 mV
0,1,x,3	0.015 mV
0,1,x,4	-0.030 mV
0,1,x,5	0.018 mV
0,1,x,6	-0.003 mV
0,1,x,7	-0.010 mV
0,2,x,0	0.029 mV
0,2,x,1	0.011 mV
0,2,x,2	-0.013 mV
0,2,x,3	-0.013 mV
0,2,x,4	-0.033 mV
0,2,x,5	0.014 mV
0,2,x,6	-0.005 mV
0,2,x,7	0.033 mV

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AdcBw 25600Hz, Range 0.316V Direct voltage IR <= 316mV Spec: <= ±0.316 mV Uncertainty: 4.8µV	
Chan	Value
0,1,x,0	0.001 mV
0,1,x,1	0.002 mV
0,1,x,2	0.004 mV
0,1,x,3	0.001 mV
0,1,x,4	-0.004 mV
0,1,x,5	0.001 mV
0,1,x,6	0.003 mV
0,1,x,7	-0.002 mV
0,2,x,0	0.003 mV
0,2,x,1	0.003 mV
0,2,x,2	0.002 mV
0,2,x,3	0.000 mV
0,2,x,4	0.001 mV
0,2,x,5	0.002 mV
0,2,x,6	0.004 mV
0,2,x,7	0.003 mV

AdcBw 25600Hz, Range 3.16V Direct voltage 1V < IR <= 3.16V Spec: <= ±3.160 mV Uncertainty: 8µV	
Chan	Value
0,1,x,0	-0.006 mV
0,1,x,1	-0.006 mV
0,1,x,2	0.003 mV
0,1,x,3	0.001 mV
0,1,x,4	-0.008 mV
0,1,x,5	0.001 mV
0,1,x,6	0.012 mV
0,1,x,7	-0.008 mV
0,2,x,0	0.010 mV
0,2,x,1	0.000 mV
0,2,x,2	0.006 mV
0,2,x,3	0.003 mV
0,2,x,4	-0.000 mV
0,2,x,5	0.004 mV
0,2,x,6	-0.003 mV
0,2,x,7	0.005 mV

AdcBw 25600Hz, Range 1V Direct voltage 316mV < IR <= 1V Spec: <= ±1.000 mV Uncertainty: 5.2µV	
Chan	Value
0,1,x,0	0.000 mV
0,1,x,1	-0.001 mV
0,1,x,2	0.004 mV
0,1,x,3	0.002 mV
0,1,x,4	-0.006 mV
0,1,x,5	0.002 mV
0,1,x,6	0.004 mV
0,1,x,7	-0.002 mV
0,2,x,0	0.005 mV
0,2,x,1	-0.001 mV
0,2,x,2	0.001 mV
0,2,x,3	0.000 mV
0,2,x,4	-0.001 mV
0,2,x,5	0.003 mV
0,2,x,6	0.004 mV
0,2,x,7	0.004 mV

AdcBw 25600Hz, Range 10V Direct voltage 3.16V < IR <= 10V Spec: <= ±10.000 mV Uncertainty: 21µV	
Chan	Value
0,1,x,0	-0.024 mV
0,1,x,1	-0.028 mV
0,1,x,2	0.001 mV
0,1,x,3	0.016 mV
0,1,x,4	-0.014 mV
0,1,x,5	-0.002 mV
0,1,x,6	-0.003 mV
0,1,x,7	-0.002 mV
0,2,x,0	0.036 mV
0,2,x,1	-0.015 mV
0,2,x,2	0.020 mV
0,2,x,3	0.020 mV
0,2,x,4	-0.038 mV
0,2,x,5	-0.008 mV
0,2,x,6	0.025 mV
0,2,x,7	0.004 mV

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4.3 Total Harmonic Distortion

Description of calibration:
Determination of the harmonic distortion of the input channels over all input ranges, by applying an accurate 1kHz -3dBFS (max 4V) sine wave which is generated by the internal reference generator. For charge amplifiers, the reference voltage signal is translated to a reference charge signal. Harmonic components 2, 3, 4 and 5 are determined to calculate the harmonic content (either in Volt or Coulomb, depending on the input channel type) and the ratio between the fundamental tone and its harmonics (in dB).

Range 10V
Distortion 3.16V < IR <= 10V
Spec: <= -94.0dB
Uncertainty: 2.6µV

Chan	Value
0,1,x,0	13.337 µV, -109.5dB
0,1,x,1	13.822 µV, -109.2dB
0,1,x,2	13.554 µV, -109.4dB
0,1,x,3	13.677 µV, -109.3dB
0,1,x,4	14.148 µV, -109.0dB
0,1,x,5	14.016 µV, -109.1dB
0,1,x,6	13.985 µV, -109.1dB
0,1,x,7	14.739 µV, -108.7dB
0,2,x,0	13.926 µV, -109.2dB
0,2,x,1	14.379 µV, -108.9dB
0,2,x,2	13.675 µV, -109.3dB
0,2,x,3	14.390 µV, -108.9dB
0,2,x,4	14.053 µV, -109.1dB
0,2,x,5	14.799 µV, -108.6dB
0,2,x,6	13.634 µV, -109.3dB
0,2,x,7	15.140 µV, -108.4dB

Range 1 V
Distortion 316mV < IR <= 1V
Spec: <= -94.0dB
Uncertainty: 290nV

Chan	Value
0,1,x,0	3.313 µV, -106.6dB
0,1,x,1	3.234 µV, -106.8dB
0,1,x,2	3.480 µV, -106.2dB
0,1,x,3	3.130 µV, -107.1dB
0,1,x,4	3.246 µV, -106.8dB
0,1,x,5	3.126 µV, -107.1dB
0,1,x,6	3.622 µV, -105.8dB
0,1,x,7	3.333 µV, -106.5dB
0,2,x,0	3.285 µV, -106.7dB
0,2,x,1	3.383 µV, -106.4dB
0,2,x,2	2.897 µV, -107.7dB
0,2,x,3	3.032 µV, -107.4dB
0,2,x,4	3.458 µV, -106.2dB
0,2,x,5	3.698 µV, -105.6dB
0,2,x,6	3.689 µV, -105.7dB
0,2,x,7	3.572 µV, -105.9dB

Range 3.16V
Distortion 1V < IR <= 3.16V
Spec: <= -94.0dB
Uncertainty: 0.8µV

Chan	Value
0,1,x,0	7.196 µV, -109.8dB
0,1,x,1	7.308 µV, -109.7dB
0,1,x,2	7.072 µV, -110.0dB
0,1,x,3	7.240 µV, -109.8dB
0,1,x,4	7.223 µV, -109.8dB
0,1,x,5	7.389 µV, -109.6dB
0,1,x,6	8.118 µV, -108.8dB
0,1,x,7	8.662 µV, -108.2dB
0,2,x,0	7.395 µV, -109.6dB
0,2,x,1	8.087 µV, -108.8dB
0,2,x,2	6.729 µV, -110.4dB
0,2,x,3	7.082 µV, -110.0dB
0,2,x,4	7.783 µV, -109.2dB
0,2,x,5	8.621 µV, -108.3dB
0,2,x,6	6.749 µV, -110.4dB
0,2,x,7	9.396 µV, -107.5dB

Range 0.316V
Distortion 100mV < IR <= 316mV
Spec: <= -91.0dB
Uncertainty: 140nV

Chan	Value
0,1,x,0	2.917 µV, -97.7dB
0,1,x,1	2.970 µV, -97.5dB
0,1,x,2	3.155 µV, -97.0dB
0,1,x,3	2.997 µV, -97.5dB
0,1,x,4	2.978 µV, -97.5dB
0,1,x,5	2.984 µV, -97.5dB
0,1,x,6	3.242 µV, -96.8dB
0,1,x,7	3.011 µV, -97.4dB
0,2,x,0	2.811 µV, -98.0dB
0,2,x,1	3.024 µV, -97.4dB
0,2,x,2	2.635 µV, -98.6dB
0,2,x,3	2.804 µV, -98.0dB
0,2,x,4	2.946 µV, -97.6dB
0,2,x,5	3.248 µV, -96.8dB
0,2,x,6	3.291 µV, -96.6dB
0,2,x,7	2.980 µV, -97.5dB

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4.4 RMS Noise

Description of calibration:
Determination of the noise contribution of the input channels, by internally shorting the input channels to ground. The reported values are RMS values over the corresponding bandwidth.

Range 10V, Bw 80kHz Not in Scope Spec: < 311.0000µVrms	
Chan	Value
0,1,x,0	219.4912µVrms
0,1,x,1	216.7287µVrms
0,1,x,2	213.5008µVrms
0,1,x,3	211.6015µVrms
0,1,x,4	213.6775µVrms
0,1,x,5	212.5682µVrms
0,1,x,6	214.2083µVrms
0,1,x,7	212.6309µVrms
0,2,x,0	215.2145µVrms
0,2,x,1	230.0707µVrms
0,2,x,2	236.8022µVrms
0,2,x,3	217.6088µVrms
0,2,x,4	213.2856µVrms
0,2,x,5	213.0714µVrms
0,2,x,6	223.8589µVrms
0,2,x,7	213.6467µVrms

Range 10V, Bw 40kHz Not in Scope Spec: < 42.0000µVrms	
Chan	Value
0,1,x,0	30.7155µVrms
0,1,x,1	29.8572µVrms
0,1,x,2	29.4535µVrms
0,1,x,3	29.8768µVrms
0,1,x,4	29.9021µVrms
0,1,x,5	29.6341µVrms
0,1,x,6	30.2264µVrms
0,1,x,7	29.5980µVrms
0,2,x,0	29.8302µVrms
0,2,x,1	32.7797µVrms
0,2,x,2	33.1010µVrms
0,2,x,3	30.6564µVrms
0,2,x,4	30.2540µVrms
0,2,x,5	30.6264µVrms
0,2,x,6	31.5756µVrms
0,2,x,7	30.5333µVrms

Range 10V, Bw 20kHz Noise 3.16V < IR <= 10V Spec: <= 29.000 µV Uncertainty: 3.4nV	
Chan	Value
0,1,x,0	20.634 µV
0,1,x,1	20.484 µV
0,1,x,2	20.603 µV
0,1,x,3	20.016 µV
0,1,x,4	20.425 µV
0,1,x,5	20.417 µV
0,1,x,6	20.417 µV
0,1,x,7	20.169 µV
0,2,x,0	20.185 µV
0,2,x,1	20.663 µV
0,2,x,2	20.523 µV
0,2,x,3	20.854 µV
0,2,x,4	20.663 µV
0,2,x,5	20.753 µV
0,2,x,6	20.665 µV
0,2,x,7	20.714 µV

Range 0.316V, Bw 80kHz Not in Scope Spec: < 10.5000µVrms	
Chan	Value
0,1,x,0	7.3100µVrms
0,1,x,1	7.3283µVrms
0,1,x,2	7.1895µVrms
0,1,x,3	7.2018µVrms
0,1,x,4	7.1340µVrms
0,1,x,5	7.2194µVrms
0,1,x,6	7.2695µVrms
0,1,x,7	7.1547µVrms
0,2,x,0	7.2610µVrms
0,2,x,1	7.6732µVrms
0,2,x,2	7.7941µVrms
0,2,x,3	7.2664µVrms
0,2,x,4	7.1386µVrms
0,2,x,5	7.2384µVrms
0,2,x,6	7.5883µVrms
0,2,x,7	7.1820µVrms

Range 0.316V, Bw 40kHz Not in Scope Spec: < 2.8000µVrms	
Chan	Value
0,1,x,0	2.0805µVrms
0,1,x,1	2.0711µVrms
0,1,x,2	2.0652µVrms
0,1,x,3	2.0675µVrms
0,1,x,4	2.0651µVrms
0,1,x,5	2.0765µVrms
0,1,x,6	2.0759µVrms
0,1,x,7	2.0642µVrms
0,2,x,0	2.0484µVrms
0,2,x,1	2.1001µVrms
0,2,x,2	2.1513µVrms
0,2,x,3	2.0566µVrms
0,2,x,4	2.0533µVrms
0,2,x,5	2.0627µVrms
0,2,x,6	2.0731µVrms
0,2,x,7	2.0493µVrms

Range 0.316V, Bw 20kHz Noise IR <= 316mV Spec: <= 1.980 µV Uncertainty: 2.0nV	
Chan	Value
0,1,x,0	1.472 µV
0,1,x,1	1.479 µV
0,1,x,2	1.470 µV
0,1,x,3	1.471 µV
0,1,x,4	1.462 µV
0,1,x,5	1.466 µV
0,1,x,6	1.479 µV
0,1,x,7	1.467 µV
0,2,x,0	1.456 µV
0,2,x,1	1.459 µV
0,2,x,2	1.492 µV
0,2,x,3	1.466 µV
0,2,x,4	1.456 µV
0,2,x,5	1.455 µV
0,2,x,6	1.457 µV
0,2,x,7	1.450 µV

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4.5 Spurious Free Floor

Description of calibration:
Determination of the peak spurious components generated by the input channels, by internally shorting the input channels to ground. The reported values are peak values over the corresponding bandwidth.

Range 10V, Bw 80kHz
Not in Scope
Spec: < 40.0000µV

Chan	Value
0,1,x,0	20.0249µV
0,1,x,1	20.0868µV
0,1,x,2	20.2110µV
0,1,x,3	19.8084µV
0,1,x,4	19.9002µV
0,1,x,5	17.7317µV
0,1,x,6	17.2711µV
0,1,x,7	23.4957µV
0,2,x,0	19.0752µV
0,2,x,1	20.5292µV
0,2,x,2	21.0525µV
0,2,x,3	20.2035µV
0,2,x,4	18.6087µV
0,2,x,5	18.1188µV
0,2,x,6	21.2995µV
0,2,x,7	18.3366µV

Range 10V, Bw 40kHz
Not in Scope
Spec: < 3.0000µV

Chan	Value
0,1,x,0	1.8141µV
0,1,x,1	1.5600µV
0,1,x,2	1.5992µV
0,1,x,3	1.6127µV
0,1,x,4	1.6059µV
0,1,x,5	1.5218µV
0,1,x,6	2.4156µV
0,1,x,7	2.2373µV
0,2,x,0	1.4688µV
0,2,x,1	1.9192µV
0,2,x,2	2.0544µV
0,2,x,3	1.6560µV
0,2,x,4	1.7163µV
0,2,x,5	1.9976µV
0,2,x,6	2.2116µV
0,2,x,7	1.7323µV

Range 10V, Bw 20kHz
Spurious 3.16V < IR <= 10V
Spec: <= 2.300 µV
Uncertainty: 3.4nV

Chan	Value
0,1,x,0	1.482 µV
0,1,x,1	1.399 µV
0,1,x,2	1.250 µV
0,1,x,3	1.193 µV
0,1,x,4	1.235 µV
0,1,x,5	1.967 µV
0,1,x,6	1.867 µV
0,1,x,7	1.348 µV
0,2,x,0	1.712 µV
0,2,x,1	1.449 µV
0,2,x,2	1.251 µV
0,2,x,3	1.385 µV
0,2,x,4	1.180 µV
0,2,x,5	1.167 µV
0,2,x,6	1.636 µV
0,2,x,7	1.935 µV

ICP
Not in Scope
Spec: < 0.2600µVp

Chan	Value
0,1,x,0	0.0757µVp
0,1,x,1	0.0853µVp
0,1,x,2	0.1011µVp
0,1,x,3	0.0964µVp
0,1,x,4	0.0975µVp
0,1,x,5	0.0963µVp
0,1,x,6	0.0825µVp
0,1,x,7	0.0942µVp
0,2,x,0	0.1036µVp
0,2,x,1	0.0925µVp
0,2,x,2	0.0894µVp
0,2,x,3	0.0997µVp
0,2,x,4	0.0903µVp
0,2,x,5	0.0998µVp
0,2,x,6	0.1001µVp
0,2,x,7	0.1153µVp

Range 0.316V, Bw 80kHz
Not in Scope
Spec: < 1.2000µV

Chan	Value
0,1,x,0	0.5309µV
0,1,x,1	0.6797µV
0,1,x,2	0.6848µV
0,1,x,3	0.6206µV
0,1,x,4	0.5994µV
0,1,x,5	0.6219µV
0,1,x,6	0.7514µV
0,1,x,7	0.7443µV
0,2,x,0	0.6628µV
0,2,x,1	0.7874µV
0,2,x,2	0.6251µV
0,2,x,3	0.6021µV
0,2,x,4	0.5972µV
0,2,x,5	0.7104µV
0,2,x,6	0.6221µV
0,2,x,7	0.7279µV

Range 0.316V, Bw 40kHz
Not in Scope
Spec: < 0.1600µV

Chan	Value
0,1,x,0	0.0870µV
0,1,x,1	0.1009µV
0,1,x,2	0.0819µV
0,1,x,3	0.0939µV
0,1,x,4	0.0780µV
0,1,x,5	0.0822µV
0,1,x,6	0.0876µV
0,1,x,7	0.0818µV
0,2,x,0	0.0929µV
0,2,x,1	0.0884µV
0,2,x,2	0.1121µV
0,2,x,3	0.0809µV
0,2,x,4	0.0931µV
0,2,x,5	0.0947µV
0,2,x,6	0.0896µV
0,2,x,7	0.1212µV

Range 0.316V, Bw 20kHz
Spurious IR <= 316mV
Spec: <= 0.130 µV
Uncertainty: 2.0nV

Chan	Value
0,1,x,0	0.055 µV
0,1,x,1	0.072 µV
0,1,x,2	0.061 µV
0,1,x,3	0.060 µV
0,1,x,4	0.062 µV
0,1,x,5	0.059 µV
0,1,x,6	0.064 µV
0,1,x,7	0.063 µV
0,2,x,0	0.063 µV
0,2,x,1	0.058 µV
0,2,x,2	0.069 µV
0,2,x,3	0.062 µV
0,2,x,4	0.058 µV
0,2,x,5	0.058 µV
0,2,x,6	0.062 µV
0,2,x,7	0.067 µV

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4.6 Inter-channel Crosstalk

Description of calibration:
Determination of the crosstalk between the input channels in a system. The channel under calibration is internally shorted to ground, while its neighbour channels are fed with a near full scale sine wave signal which is generated by the internal reference generator. This is done for two input range settings of the channel under calibration, and two signal frequencies. The reported results represent the measured crosstalk values in the channels under calibration (either in Volt or Coulomb, depending on the input channel type) and the ratio between the applied signal amplitude and the crosstalk values (in dB).

Range 0.316V, F 1K5 Crosstalk 100mV < IR <= 316mV Spec: <= -120.0dB Uncertainty: 68nV	
Chan	Value
0,1,x,0	0.134 µV, -131.4dB
0,1,x,1	0.130 µV, -131.7dB
0,1,x,2	0.124 µV, -132.1dB
0,1,x,3	0.093 µV, -134.7dB
0,1,x,4	0.093 µV, -134.6dB
0,1,x,5	0.087 µV, -135.1dB
0,1,x,6	0.096 µV, -134.4dB
0,1,x,7	0.115 µV, -132.8dB
0,2,x,0	0.128 µV, -131.9dB
0,2,x,1	0.115 µV, -132.8dB
0,2,x,2	0.131 µV, -131.7dB
0,2,x,3	0.105 µV, -133.6dB
0,2,x,4	0.105 µV, -133.5dB
0,2,x,5	0.075 µV, -136.5dB
0,2,x,6	0.113 µV, -132.9dB
0,2,x,7	0.133 µV, -131.5dB

Range 0.316V, F 15K Crosstalk 100mV < IR <= 316mV Spec: <= -107.0dB Uncertainty: 68nV	
Chan	Value
0,1,x,0	0.815 µV, -115.8dB
0,1,x,1	1.335 µV, -111.5dB
0,1,x,2	1.348 µV, -111.4dB
0,1,x,3	1.390 µV, -111.1dB
0,1,x,4	1.373 µV, -111.2dB
0,1,x,5	1.346 µV, -111.4dB
0,1,x,6	1.161 µV, -112.7dB
0,1,x,7	1.099 µV, -113.2dB
0,2,x,0	0.802 µV, -115.9dB
0,2,x,1	1.341 µV, -111.4dB
0,2,x,2	1.393 µV, -111.1dB
0,2,x,3	1.354 µV, -111.3dB
0,2,x,4	1.337 µV, -111.5dB
0,2,x,5	1.321 µV, -111.6dB
0,2,x,6	1.217 µV, -112.3dB
0,2,x,7	1.063 µV, -113.4dB

Range 10V, F 1K5 Crosstalk 3.16V < IR <= 10V Spec: <= -108.0dB Uncertainty: 1.3µV	
Chan	Value
0,1,x,0	0.188 µV, -128.5dB
0,1,x,1	0.331 µV, -123.6dB
0,1,x,2	0.263 µV, -125.6dB
0,1,x,3	0.457 µV, -120.8dB
0,1,x,4	0.063 µV, -137.9dB
0,1,x,5	0.330 µV, -123.6dB
0,1,x,6	0.550 µV, -119.2dB
0,1,x,7	0.478 µV, -120.4dB
0,2,x,0	0.399 µV, -122.0dB
0,2,x,1	0.580 µV, -118.7dB
0,2,x,2	0.474 µV, -120.5dB
0,2,x,3	0.518 µV, -119.7dB
0,2,x,4	0.523 µV, -119.6dB
0,2,x,5	0.422 µV, -121.5dB
0,2,x,6	0.314 µV, -124.0dB
0,2,x,7	0.415 µV, -121.6dB

Range 10V, F 15K Crosstalk 3.16V < IR <= 10V Spec: <= -105.0dB Uncertainty: 1.3µV	
Chan	Value
0,1,x,0	0.995 µV, -114.0dB
0,1,x,1	1.324 µV, -111.5dB
0,1,x,2	1.675 µV, -109.5dB
0,1,x,3	1.559 µV, -110.1dB
0,1,x,4	1.887 µV, -108.5dB
0,1,x,5	1.436 µV, -110.8dB
0,1,x,6	1.511 µV, -110.4dB
0,1,x,7	1.215 µV, -112.3dB
0,2,x,0	0.869 µV, -115.2dB
0,2,x,1	1.436 µV, -110.8dB
0,2,x,2	1.687 µV, -109.4dB
0,2,x,3	1.528 µV, -110.3dB
0,2,x,4	1.583 µV, -110.0dB
0,2,x,5	1.671 µV, -109.5dB
0,2,x,6	1.659 µV, -109.6dB
0,2,x,7	1.174 µV, -112.6dB

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4.7 Inter-channel Phase Match

Description of calibration:
Determination of the phase difference between the input channels in a system, by applying an accurate -3dBFS (max 4V) sine wave which is generated by the internal reference generator. For charge amplifiers, the reference voltage signal is translated to a reference charge signal. The reported values represent the highest phase differences found between any of the channels in the system. This is done for two input range settings and two signal frequencies.

Range 10V, F 9k9 Not in Scope Spec: < 0.3000°	
Chan	Value
0,1,x,0	0.0171°
0,1,x,1	0.0310°
0,1,x,2	0.0241°
0,1,x,3	0.0175°
0,1,x,4	0.0240°
0,1,x,5	0.0228°
0,1,x,6	0.0159°
0,1,x,7	0.0291°
0,2,x,0	0.0310°
0,2,x,1	0.0195°
0,2,x,2	0.0212°
0,2,x,3	0.0177°
0,2,x,4	0.0161°
0,2,x,5	0.0220°
0,2,x,6	0.0196°
0,2,x,7	0.0281°

Range 10V, F 19k9 Not in Scope Spec: < 0.4000°	
Chan	Value
0,1,x,0	0.0342°
0,1,x,1	0.0619°
0,1,x,2	0.0485°
0,1,x,3	0.0339°
0,1,x,4	0.0473°
0,1,x,5	0.0461°
0,1,x,6	0.0311°
0,1,x,7	0.0590°
0,2,x,0	0.0619°
0,2,x,1	0.0391°
0,2,x,2	0.0424°
0,2,x,3	0.0361°
0,2,x,4	0.0322°
0,2,x,5	0.0438°
0,2,x,6	0.0398°
0,2,x,7	0.0557°

Range 0.316V, F 9k9 Not in Scope Spec: < 0.4500°	
Chan	Value
0,1,x,0	0.0469°
0,1,x,1	0.0646°
0,1,x,2	0.0682°
0,1,x,3	0.0606°
0,1,x,4	0.0656°
0,1,x,5	0.0526°
0,1,x,6	0.0466°
0,1,x,7	0.0449°
0,2,x,0	0.0540°
0,2,x,1	0.0684°
0,2,x,2	0.0511°
0,2,x,3	0.0631°
0,2,x,4	0.0834°
0,2,x,5	0.0710°
0,2,x,6	0.0834°
0,2,x,7	0.0588°

Range 0.316V, F 19k9 Not in Scope Spec: < 0.9000°	
Chan	Value
0,1,x,0	0.0920°
0,1,x,1	0.1274°
0,1,x,2	0.1355°
0,1,x,3	0.1188°
0,1,x,4	0.1292°
0,1,x,5	0.1079°
0,1,x,6	0.0957°
0,1,x,7	0.0870°
0,2,x,0	0.1082°
0,2,x,1	0.1360°
0,2,x,2	0.1020°
0,2,x,3	0.1269°
0,2,x,4	0.1675°
0,2,x,5	0.1429°
0,2,x,6	0.1675°
0,2,x,7	0.1186°

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5 SYSCON_REC_h11s0

5.1 Gain Accuracy after Adjustment

Description of calibration:
Determination of the amplitude accuracy of the input channels over all input ranges and available ADC bandwidths, by applying an accurate 1kHz -3dBFS (max 4V) sine wave which is generated by the internal reference generator. For charge amplifiers, the reference voltage signal is translated to a reference charge signal.
The reported values represent the deviations from the expected signal amplitude, both absolute (either in Volt or Coulomb, depending on the input channel type) and relative (in %).

BW 25k6 **Alternating voltage 3.16V < IR <= 10V** **Spec: <= ±0.100%** **Uncertainty: 530µV**	
Chan	Value
0,x,x,0	0.362 mV, 0.009%
0,x,x,1	0.469 mV, 0.012%

BW 51k2 **Alternating voltage 3.16V < IR <= 10V** **Spec: <= ±0.100%** **Uncertainty: 530µV**	
Chan	Value
0,x,x,0	0.462 mV, 0.012%
0,x,x,1	0.607 mV, 0.015%

BW 102k4 **Not in Scope** **Spec: 1.00000 ±0.10%**	
Chan	Value
0,x,x,0	1.00011, 0.01%
0,x,x,1	1.00015, 0.02%

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West Caldwell Calibration Laboratories Inc.

Certificate of Calibration

for

MICROPHONE & PREAMPLIFIER

Manufactured by:	**BRUEL & KJAER**
Model No:	**4189-2671 (ID#00366)**
Serial No:	**2625416-2369794**
Calibration Recall No:	**30268**

Submitted By:

Customer:	**Iwona Stasiewicz**
Company:	**Aercoustics Engineering Ltd**
Address:	**1004 Middlegate Road**
	Mississauga, ON.Cana L4Y0G1

The subject instrument was calibrated to the indicated specification using standards traceable to the National Institute of Standards and Technology or to accepted values of natural physical constants. This document certifies that the instrument met the following specification upon its return to the submitter.

West Caldwell Calibration Laboratories Procedure No. 4189-2671 (BRUE

Upon receipt for Calibration, the instrument was found to be:

Within (X)

tolerance of the indicated specification. See attached Report of Calibration.
The information supplied relates to the calibrated item listed above.
West Caldwell Calibration Laboratories' calibration control system meets the following requirements, ISO 10012-1 MIL STD 45662A, ANSI/NCSL Z540-1, IEC Guide 25, ISO 9001:2015 and ISO 17025

Note: With this Certificate, Report of Calibration is included.

Calibration Date: 26-Aug-19

Certificate No: 30268 -4

Approved by:

James Zhu

Quality Manager
ISO/IEC 17025:2005

ACCREDITED

Calibration Lab. Cert. # 1533.01

uncompromised calibration
West Caldwell Calibration Laboratories, Inc.
1575 State Route 96, Victor, NY 14564, U.S.A.

West Caldwell Calibration Laboratories Inc.

Certificate of Calibration

for

ICP SIGNAL CONDITIONER

Manufactured by:	PCB PIEZOTRONICS
Model No:	480E09
Serial No:	34208
Calibration Recall No:	28351

Submitted By:

Customer:

Company: Aercoustics Engineering Ltd.
Address:

The subject instrument was calibrated to the indicated specification using standards traceable to the National Institute of Standards and Technology or to accepted values of natural physical constants. This document certifies that the instrument met the following specification upon its return to the submitter.

West Caldwell Calibration Laboratories Procedure No. 480E09 PCB PI

Upon receipt for Calibration, the instrument was found to be:

Within (X)

tolerance of the indicated specification. See attached Report of Calibration.
The information supplied relates to the calibrated item listed above.
West Caldwell Calibration Laboratories' calibration control system meets the requirements, ISO 10012-1 MIL-STD-45662A, ANSI/NCSL Z540-1, IEC Guide 25, ISO 9001:2008 and ISO 17025.

Note: With this Certificate, Report of Calibration is included.

Approved by: FC

Calibration Date: 10-Jan-18

Felix Christopher (QA Mgr.)

Certificate No: 28351 - 8

ISO/IEC 17025:2005

ACCREDITED

Calibration Lab. Cert. # 1533.01

West Caldwell Calibration Laboratories, Inc.
uncompromised calibration
1575 State Route 96, Victor, NY 14564, U.S.A.

Brüel & Kjær
North America Inc.

The Bruel and Kjaer Calibration Laboratory
3079 Premiere Parkway Suite 120
Duluth, GA 30097
Telephone: 770-209-6907
Fax: 770-447-4033
Web site address: http://www.bksv.com

ACCREDITED

Calibration Certificate # 1568.01

CERTIFICATE OF CALIBRATION

No.: CAS-388620-J0R7K6-402

CALIBRATION OF:

Calibrator:	Brüel & Kjær	Type	4231	Serial No.:	3021765
		IEC Class:	1		

CUSTOMER:

Aercoustics Engineering
1004 Middlegate Rd
Suite 1100
Mississauga, ON L4Y 0G1
Canada

CALIBRATION CONDITIONS:

Environment conditions:	Air temperature:	23	°C
	Air pressure:	97.47	kPa
	Relative Humidity:	54.7	%RH

SPECIFICATIONS:

This document certifies that the acoustic calibrator as listed under "Type" has been calibrated and unless otherwise indicated under "Final Data", meets acceptance criteria as prescribed by the referenced Procedure. Statements of compliance, where applicable, are based on calibration results falling within specified criteria with no reduction by the uncertainty of the measurements. The calibration of the listed transducer was accomplished using a test system which conforms to the requirements of ISO/IEC 17025, ANSI/NCSL Z540-1, and guidelines of ISO 10012-1. For "as received" and "final" data, see the attached page(s). Items marked with one asterisk (*) are not covered by the scope of the current A2LA accreditation. This Certificate and attached data pages shall not be reproduced, except in full, without written approval of the Bruel and Kjaer Calibration Laboratory-Duluth, GA. Results relate only to the items tested. The transducer has been calibrated using Measurement Standards with values traceable to the National Institute of Standards and Technology, National Measurement Institutes or derived from natural physical constants. The acoustic calibrator has been calibrated in accordance with the requirements as specified in IEC60942.

PROCEDURE:

The measurements have been performed with the assistance of Brüel & Kjær acoustic calibrator calibration application Software version 2.3.4 Type 7794 using calibration procedure 4231 Complete

RESULTS:

- [X] "As Received" Data: Within Acceptance Criteria
- [ ] "As Received" Data: Outside Acceptance Criteria
- [X] "Final" Data : Within Acceptance Criteria
- [ ] "Final" Data : Outside Acceptance Criteria

The reported expanded uncertainty is based on the standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with EA-4/02from elements originating from the standards, calibration method, effect of environmental conditions and any short time contribution from the calibrator under calibration.

Date of Calibration: June 19, 2019

Certificate issued: June 19, 2019

Meshaun Hobbs

Calibration Technician

Harold Williams

Quality Representative

Sound Pressure Levels

All stated values are valid at environmental reference conditions

Nominal Level [dB]	Accept Limit Lower [dB]	Accept Limit Upper [dB]	Measured Level [dB]	Measurement Uncertainty [dB]
94	93.80	94.20	94.02	0.12
114	113.80	114.20	113.99	0.12

Frequency

Nominal Frequency [Hz]	Accept Limit Lower [Hz]	Accept Limit Upper [Hz]	Measured Frequency [Hz]	Measurement Uncertainty [Hz]
1000	999.00	1001.00	1000.02	0.10

Total Distortion*

Distortion mode: [X] **TD*** [ ] **THD***

Calibration Level [dB]*	Accept Limit [%]*	Measured Distortion [%]*	Measurement Uncertainty [%]*
94	1.00	0.65	0.13
114	1.00	0.12	0.13

Environmental Reference Conditions:

Pressure: 101.3 kPa, Temperature: 23 °C, Relative Humidity: 50%

Instrument List

Type	Description	Serial no	Cal. date	Due date	Calibrated by	Trace number
3560	PULSE Analyzer	2723320	2018-10-22	2019-10-31	KC	CAS-335103-K3P9T8-301
9545	Transfer Microphone	3	2018-11-29	2019-11-30	WS	CAS-341143-N8H3J4-701
4228	Reference Sound Source	1610502	2019-04-05	2021-04-30	W.Shipman	CAS-375162-C8J4Z3-705

During the calibration the calibrator has been loaded by the load volume of the Transfer Microphone. The load volumes for a number of different types of Transfer Microphones are listed in the table below.
For Brüel & Kjær Pistonphones types 4220 and 4228 the result of the SPL calibration has been corrected to be valid for a load volume of 1333 mm^3 . For all other types the result is valid with the actual load volume.

Transfer Microphone Type	Fulfils standard IEC 61094-1 LS	Fulfils standard IEC 61094-4 WS	Load Volume 1" (1/2" mic including DP-0776)	Load Volume 1/2"
4180	yes	yes	1126 mm^3	43 mm^3
4192	-	yes	1273 mm^3	190 mm^3
9545	-	-	1333 mm^3	-

Condition "As Received":

Good

Comments

Test report no. H31-19250031

TEST REPORT

Product family	WXT530 series
Product type	WXT536
Order code	6C1B2A4B1A1B
Serial number	R2510790
Manufacturer	Vaisala Oyj, Finland
Test date	17 June 2019

This test report certifies that the product was thoroughly tested and inspected, and found to meet its published test limits when it was shipped from Vaisala.

Test results

Test	Result	Lower limit	Upper limit	Unit
Rain response	430	345	575	mV
Zero wind speed	0	0	0.4	m/s
Pressure difference	-0.19	-1	1	hPa
Temperature difference	0.42	-2	2	°C
Humidity difference	0.14	-10	10	%RH
Heating current	0.71	0.6	0.8	A
Current (service port)	1.18	0.5	2	mA
Communication (service port)	pass	PASS	PASS	-
Current (main port)	0.84	0.5	2	mA
Communication (main port)	pass	PASS	PASS	-

Ambient conditions / Humidity 50.04 ±5 %RH, Temperature 23.14 ±1 °C, Pressure 1008.53 ±1 hPa.

Signature

Technician

 DOC233154-A.doc

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Email firstname.lastname@vaisala.com | www.vaisala.com
Domicile Vantaa, Finland | VAT FI01244162 | Business ID 0124416-2

VAISALA

Calibration sheet no. H31-19250032

CALIBRATION SHEET

Instrument	WXTPTU
Serial number	R1530068
Manufacturer	Vaisala Oyj, Finland
Test date	24 May 2019

This test report certifies that the instrument was thoroughly tested and inspected, and found to meet its published test limits when it was shipped from Vaisala.

Calibration results

Test phase of calibration process	Reference value	Observed value	Difference*	Uncertainty**
Pressure	1083.6	1083.6	0	± 0.4 hPa
Pressure	898.8	898.9	0.1	± 0.4 hPa
Pressure	796.5	796.5	0	± 0.4 hPa
Pressure	595.4	595.5	0.1	± 0.4 hPa
Temperature	59.7	59.7	0	± 0.2 °C
Temperature	-5.9	-5.9	0	± 0.2 °C
Temperature	-33	-33	0	± 0.2 °C
Temperature	25.1	25.1	0	± 0.2 °C
Temperature	-52.1	-52.1	0	± 0.2 °C
Relative humidity	29.6	29.6	0	± 2 %RH
Relative humidity	57.7	57.7	0	± 2 %RH
Relative humidity	92.1	92.1	0	± 3 %RH

*The test points for error values are polynomial fitting curve fitting points.
**The calibration uncertainty given at 95 % confidence level, k = 2

Traceability
The working standards for pressure and temperature are calibrated at Vaisala Measurement Standards Laboratory (MSL) by using MSL working standards traceable to National Institute of Standards and Technology (NIST, USA). The relative humidity values are calculated from measured temperature and dew-point temperature values. The dew-point working standards are traceable to the Finnish National Humidity Laboratory (MIKES).

Signature

Technician

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SOH Wind Engineering LLC
141 Leroy Road · Williston, VT 05495 · USA
Tel 802.316.4368 · Fax 802.735.9106 · www.sohwind.com

CERTIFICATE FOR CALIBRATION OF SONIC ANEMOMETER

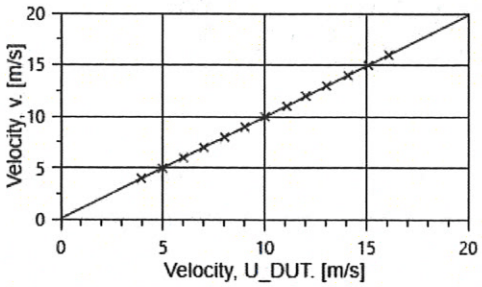
Certificate number: 20.US1.00288 **Date of issue:** February 04, 2020
Type: Vaisala Weather Transmitter, WXT536 **Serial number:** R2510790
Manufacturer: Vaisala, Oyj, Pl 26, FIN-00421 Helsinki, Finland
Client: Aercoustics Engineering Ltd., 1004 Middlegate RD, Suite 1100, S.Tower, Mississauga, ON L4Y 1M4, Canada

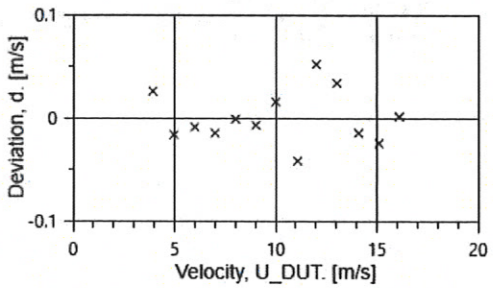
Anemometer received: January 30, 2020 **Anemometer calibrated:** February 04, 2020
Calibrated by: MEJ **Procedure:** MEASNET, IEC 61400-12-1:2017 Annex F
Certificate prepared by: EJF **Approved by:** Calibration engineer, EJF

Calibration equation obtained: v [m/s] = 0.98766 · U [m/s] + 0.07507

Standard uncertainty, slope: 0.00199 **Standard uncertainty, offset:** 0.28086
Covariance: -0.0000388 (m/s)²/m/s **Coefficient of correlation:** ρ = 0.999978
Absolute maximum deviation: 0.052 m/s at 11.995 m/s
Barometric pressure: 996.3 hPa **Relative humidity:** 21.4%

Succession	Velocity pressure, q. [Pa]	Temperature in wind tunnel [°C]	d.p. box [°C]	Wind velocity, v. [m/s]	Anemometer Output, U. [m/s]	Deviation, d. [m/s]	Uncertainty u_c (k=2) [m/s]
1-first	9.45	18.6	24.7	3.989	3.9367	0.026	0.023
13-last	14.68	18.9	24.8	4.974	4.9767	-0.016	0.026
2	21.30	18.6	24.7	5.989	5.9967	-0.009	0.030
12	28.88	18.9	24.7	6.977	7.0033	-0.015	0.034
3	37.96	18.6	24.7	7.995	8.0200	-0.001	0.038
11	47.86	19.0	24.7	8.983	9.0267	-0.007	0.042
4	59.19	18.6	24.7	9.984	10.0167	0.016	0.047
10	71.62	19.0	24.7	10.990	11.0933	-0.042	0.051
5	85.42	18.7	24.7	11.995	12.0167	0.052	0.055
9	99.87	19.0	24.7	12.978	13.0300	0.034	0.059
6	116.04	18.7	24.7	13.983	14.0967	-0.014	0.064
8	132.84	18.9	24.7	14.968	15.1033	-0.024	0.068
7	151.36	18.8	24.7	15.974	16.0967	0.001	0.072





AC-1746

EQUIPMENT USED

Serial Number	Description
Njord1	Wind tunnel, blockage factor = 1.0035
2254	Control cup anemometer
-	Mounting tube, D = 19 mm
TT004	Summit Electronics, 1XPT100, 0-10V Output, wind tunnel temp.
TP001	PR Electronics 5102, 0-10V Output, differential pressure box temp.
DP005	Setra Model 239, 0-1inWC, differential pressure transducer
HY004	Dwyer RHP-2D20, 0-10V Output, humidity transmitter
BP001	Setra Model 278, barometer
PL8	Pitot tube
XB002	Computer Board. 16 bit A/D data acquisition board
Njord1-PC	PC dedicated to data acquisition

The accuracies of all measurements were traceable to the SI through NIST or CIPM recognized NMI's.

Photo of the wind tunnel setup. The cross-sectional area is 2.5m x 2.5m.

UNCERTAINTIES

The documented uncertainty is the total combined uncertainty at 95% confidence level (k=2) in accordance with EA-4/02. The uncertainty at 10 m/s comply with the requirements in the IEC 61400-12-1:2005 procedure. See Document US.12.01.004 for further details.

COMMENTS

This sensor was oriented in the 90° position during calibration.

Certificate number: 20.US1.00288

SOH Wind Engineering LLC
141 Leroy Road · Williston, VT 05495 · USA
Tel 802.316.4368 · Fax 802.735.9106 · www.sohwind.com

CERTIFICATE FOR CALIBRATION OF SONIC ANEMOMETER

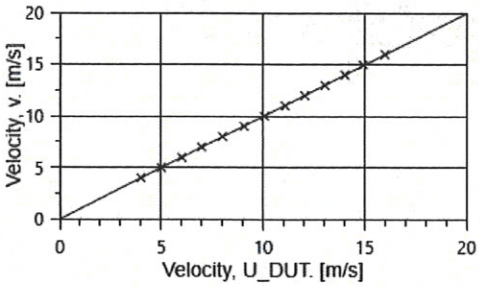
Certificate number: 20.US1.00287 **Date of issue:** February 04, 2020
Type: Vaisala Weather Transmitter, WXT536 **Serial number:** R2510790
Manufacturer: Vaisala, Oyj, Pl 26, FIN-00421 Helsinki, Finland
Client: Aercoustics Engineering Ltd., 1004 Middlegate RD, Suite 1100, S.Tower, Mississauga, ON L4Y 1M4, Canada

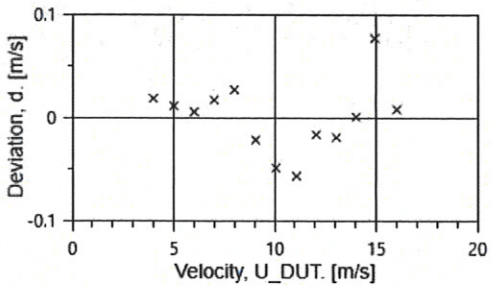
Anemometer received: January 30, 2020 **Anemometer calibrated:** February 04, 2020
Calibrated by: MEJ **Procedure:** MEASNET, IEC 61400-12-1:2017 Annex F
Certificate prepared by: EJF **Approved by:** Calibration engineer, EJF

Calibration equation obtained: v [m/s] = 0.99806 · U [m/s] + -0.02018

Standard uncertainty, slope: 0.00267 **Standard uncertainty, offset:** -1.41229
Covariance: -0.0000711 (m/s)²/m/s **Coefficient of correlation:** ρ = 0.999961
Absolute maximum deviation: 0.077 m/s at 14.964 m/s
Barometric pressure: 996.2 hPa **Relative humidity:** 21.6%

Succession	Velocity pressure, q. [Pa]	Temperature in wind tunnel [°C]	d.p. box [°C]	Wind velocity, v. [m/s]	Anemometer Output, U. [m/s]	Deviation, d. [m/s]	Uncertainty u_c (k=2) [m/s]
1-first	9.45	18.4	24.6	3.987	3.9967	0.018	0.023
13-last	14.73	18.7	24.7	4.981	5.0000	0.011	0.026
2	21.23	18.3	24.6	5.977	6.0033	0.005	0.030
12	28.92	18.7	24.7	6.980	6.9967	0.017	0.034
3	37.98	18.3	24.6	7.995	8.0033	0.027	0.038
11	48.08	18.7	24.7	9.000	9.0600	-0.022	0.042
4	59.20	18.4	24.6	9.981	10.0700	-0.049	0.047
10	71.57	18.8	24.7	10.981	11.0800	-0.057	0.051
5	85.40	18.4	24.6	11.990	12.0500	-0.017	0.055
9	100.00	18.7	24.7	12.982	13.0467	-0.019	0.059
6	116.12	18.5	24.6	13.983	14.0300	0.001	0.064
8	132.89	18.7	24.6	14.964	14.9367	0.077	0.068
7	151.26	18.6	24.7	15.963	16.0067	0.008	0.072





AC-1746

EQUIPMENT USED

Serial Number	Description
Njord1	Wind tunnel, blockage factor = 1.0035
2254	Control cup anemometer
-	Mounting tube, D = 19 mm
TT004	Summit Electronics, 1XPT100, 0-10V Output, wind tunnel temp.
TP001	PR Electronics 5102, 0-10V Output, differential pressure box temp.
DP005	Setra Model 239, 0-1inWC, differential pressure transducer
HY004	Dwyer RHP-2D20, 0-10V Output, humidity transmitter
BP001	Setra Model 278, barometer
PL8	Pitot tube
XB002	Computer Board. 16 bit A/D data acquisition board
Njord1-PC	PC dedicated to data acquisition

The accuracies of all measurements were traceable to the SI through NIST or CIPM recognized NMI's.

Photo of the wind tunnel setup. The cross-sectional area is 2.5m x 2.5m.

UNCERTAINTIES

The documented uncertainty is the total combined uncertainty at 95% confidence level (k=2) in accordance with EA-4/02. The uncertainty at 10 m/s comply with the requirements in the IEC 61400-12-1:2005 procedure. See Document US.12.01.004 for further details.

COMMENTS

This sensor was oriented in the 0° position during calibration.

Certificate number: 20.US1.00287

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CERTIFICATE OF CALIBRATION

SCC Accredited LAB — LAB Accrédité CCN — SCC Lab No 22
CLAS NRC·CNRC CLAS 2000-03
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Customer: AERCOUSTICS ENGINEERING LTD
1004 MIDDLEGATE ROAD
SUITE 1100
MISSISSAUGA, ON L4Y 0G1
PO Number: TR2019.03.22_875FT-00

Certificate/SO Number: 9-Q1F7P-20-1 Revision 0

Manufacturer: Nokeval
Model Number: 7470
Description: Serial to Analog Converter
Serial Number: A198729
ID: NONE

As-Found: In Tolerance
As-Left: In Tolerance

Calibration Date: Mar 29, 2019
Due Date: Mar 29, 2021

Calibrated To: Manufacturer Specification
Calibration Procedure: 1-AC58014-0

Transcat Calibration Laboratories have been audited and found in compliance with ISO/IEC 17025:2005. Accredited calibrations performed within the Lab's Scope of Accreditation are indicated by the presence of the Accrediting Body's Logo and Certificate Number. Any measurements on an accredited calibration not covered by that Lab's Scope of Accreditation are listed in the notes section of the certificate. SCC, NRC, CLAS or ANAB do not guarantee the accuracy of an individual calibration by accredited laboratories.

Transcat calibrations, as applicable, are performed in compliance with the requirements of the Transcat Quality Manual QAC-P01-000 Revision 2.0, the customer's Purchase Order and/or Quality Agreement requirements, ISO 9001:2008, ANSI/NCSL Z540.1-1994 (R2002) or NQA-1, as applicable. Complete records of work performed are maintained by Transcat and are available for inspection. Laboratory standards used in the performance of this calibration are listed on this certificate.

Transcat documents the traceability of measurements to the SI units through the National Institute of Standards and Technology (NIST), or the National Research Council of Canada (NRC), or other national measurement institutes (NMI) that are signatories to the CIPM Mutual Recognition Arrangement, or accepted fundamental and/or natural physical constants, or by the use of specified methods, consensus standards or ratio type measurements. Documentation supporting traceability information is available for review upon written request at a Transcat facility. The measured quantity and the measurement uncertainty are required for further dissemination of traceability.

A binary decision rule, utilizing simple acceptance, and simple rejection criteria is used for the determination of compliance. When compliance statements are present, they are reported without factoring in the effects of uncertainty and comply with the guidelines established by ASME B89.7.3.1-2001 (R2011) as follows:
-The acceptance zone is defined as: less than or equal to the high limit, and/or greater than or equal to the low limit. The rejection zones are defined as greater than the high limit and/or less than the low limit.
-Single measurement results in the acceptance zone are be identified as in-tolerance. Single measurement results in the rejection zone are identified as out-of-tolerance (OOT).
-When all measurement results are in the acceptance zone for repeated measurements, for the same characteristic, the test is identified as in-tolerance. For repeated characteristic measurements, a single measurement result in the rejection zone, will cause the test to be identified as out-of-tolerance (OOT).

Uncertainties are reported with a coverage factor k=2, providing a level of confidence of approximately 95%. All calibrations have been performed using processes having a TUR of 4:1 or better (3:1 for mass calibrations), unless otherwise noted. The Test Uncertainty Ratio (TUR) is calculated in accordance with NCSL International RP-18. For mass calibrations: Conventional mass referenced to 8.0 g/cm³.

The results in this report relate only to the item calibrated or tested. Recorded calibration data is valid at the time of calibration within the stated uncertainties at the environmental conditions noted. The determination of compliance to the specification is specific to the model/serial no./ID no. referenced above based on the tolerances shown; these tolerances are either the original equipment manufacturers (OEM's) warranted specifications or the client's requested specifications. This certificate may not be reproduced except in full, without the written approval of Transcat. Additional information, if applicable may be included on separate report(s).

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CERTIFICATE OF CALIBRATION

Customer: AERCOUSTICS ENGINEERING LTD
1004 MIDDLEGATE ROAD
SUITE 1100
MISSISSAUGA, ON L4Y 0G1
PO Number: TR2019.03.22_875FT-00

SCC Accredited LAB — LAB Accrédité CCN — SCC Lab No 22
CLAS NRC·CNRC — CLAS 2000-03
ilac-MRA

Certificate/SO Number: 9-Q1F7P-20-1 Revision 0

As Found/As Left Data

Description	Setpoints	Accuracy	Low Limit	High Limit	As Found / As Left	OOT	Cal Process Uncertainty (k=2; ±)	Measurement Uncertainty (k=2; ±)	Units	TUR
DC Current % Source - 4-20mA Ch #1										
4 - 20mA	0%	±(0.1% Span)	3.984	4.016	4.003 mA		1.6e-004	1.9e-003	mA	100.0 : 1
	25%	±(0.1% Span)	7.984	8.016	8.001 mA		2.6e-004	1.9e-003	mA	61.5 : 1
	50%	±(0.1% Span)	11.984	12.016	12.002 mA		1.1e-003	2.2e-003	mA	14.5 : 1
	75%	±(0.1% Span)	15.984	16.016	16.000 mA		1.3e-003	2.3e-003	mA	12.3 : 1
	100%	±(0.1% Span)	19.984	20.016	19.998 mA		1.4e-003	2.3e-003	mA	11.4 : 1
DC Current % Source - 4-20mA Ch #2										
4 - 20mA	0%	±(0.1% Span)	3.984	4.016	3.999 mA		1.6e-004	1.9e-003	mA	100.0 : 1
	25%	±(0.1% Span)	7.984	8.016	7.998 mA		2.6e-004	1.9e-003	mA	61.5 : 1
	50%	±(0.1% Span)	11.984	12.016	11.999 mA		1.1e-003	2.2e-003	mA	14.5 : 1
	75%	±(0.1% Span)	15.984	16.016	15.998 mA		1.3e-003	2.3e-003	mA	12.3 : 1
	100%	±(0.1% Span)	19.984	20.016	19.997 mA		1.4e-003	2.3e-003	mA	11.4 : 1
DC Current % Source - 4-20mA Ch #3										
4 - 20mA	0%	±(0.1% Span)	3.984	4.016	3.999 mA		1.6e-004	1.9e-003	mA	100.0 : 1
	25%	±(0.1% Span)	7.984	8.016	7.998 mA		2.6e-004	1.9e-003	mA	61.5 : 1
	50%	±(0.1% Span)	11.984	12.016	12.003 mA		1.1e-003	2.2e-003	mA	14.5 : 1
	75%	±(0.1% Span)	15.984	16.016	16.001 mA		1.3e-003	2.3e-003	mA	12.3 : 1
	100%	±(0.1% Span)	19.984	20.016	19.999 mA		1.4e-003	2.3e-003	mA	11.4 : 1
DC Current % Source - 4-20mA Ch #4										
4 - 20mA	0%	±(0.1% Span)	3.984	4.016	4.001 mA		1.6e-004	1.9e-003	mA	100.0 : 1
	25%	±(0.1% Span)	7.984	8.016	7.998 mA		2.6e-004	1.9e-003	mA	61.5 : 1
	50%	±(0.1% Span)	11.984	12.016	12.002 mA		1.1e-003	2.2e-003	mA	14.5 : 1
	75%	±(0.1% Span)	15.984	16.016	15.999 mA		1.3e-003	2.3e-003	mA	12.3 : 1
	100%	±(0.1% Span)	19.984	20.016	19.996 mA		1.4e-003	2.3e-003	mA	11.4 : 1

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CERTIFICATE OF CALIBRATION

Customer: AERCOUSTICS ENGINEERING LTD
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SCC Lab No 22

CLAS MRC·CNRC
CLAS 2000-03

ilac-MRA

Certificate/SO Number: 9-Q1F7P-20-1 Revision 0

As Found/As Left Data

Description	Setpoints	Accuracy	Low Limit	High Limit	As Found / As Left	OOT	Cal Process Uncertainty (k=2; ±)	Measurement Uncertainty (k=2; ±)	Units	TUR
DC Current % Source - 0-20mA Ch #1										
0 - 20mA	0%	±(0.1% Span)	-0.020	0.020	0.004 mA		9.2e-007	2.3e-003	mA	100.0 : 1
	25%	±(0.1% Span)	4.980	5.020	4.999 mA		1.9e-004	2.3e-003	mA	100.0 : 1
	50%	±(0.1% Span)	9.980	10.020	9.999 mA		3.1e-004	2.3e-003	mA	64.5 : 1
	75%	±(0.1% Span)	14.980	15.020	15.000 mA		1.2e-003	2.6e-003	mA	16.7 : 1
	100%	±(0.1% Span)	19.980	20.020	19.998 mA		1.4e-003	2.7e-003	mA	14.3 : 1
DC Current % Source - 0-20mA Ch #2										
0 - 20mA	0%	±(0.1% Span)	-0.020	0.020	0.001 mA		9.2e-007	2.3e-003	mA	100.0 : 1
	25%	±(0.1% Span)	4.980	5.020	5.001 mA		1.9e-004	2.3e-003	mA	100.0 : 1
	50%	±(0.1% Span)	9.980	10.020	10.002 mA		3.1e-004	2.3e-003	mA	64.5 : 1
	75%	±(0.1% Span)	14.980	15.020	15.003 mA		1.2e-003	2.6e-003	mA	16.7 : 1
	100%	±(0.1% Span)	19.980	20.020	19.997 mA		1.4e-003	2.7e-003	mA	14.3 : 1
DC Current % Source - 0-20mA Ch #3										
0 - 20mA	0%	±(0.1% Span)	-0.020	0.020	0.002 mA		9.2e-007	2.3e-003	mA	100.0 : 1
	25%	±(0.1% Span)	4.980	5.020	5.001 mA		1.9e-004	2.3e-003	mA	100.0 : 1
	50%	±(0.1% Span)	9.980	10.020	10.001 mA		3.1e-004	2.3e-003	mA	64.5 : 1
	75%	±(0.1% Span)	14.980	15.020	15.000 mA		1.2e-003	2.6e-003	mA	16.7 : 1
	100%	±(0.1% Span)	19.980	20.020	19.999 mA		1.4e-003	2.7e-003	mA	14.3 : 1
DC Current % Source - 0-20mA Ch #4										
0 - 20mA	0%	±(0.1% Span)	-0.020	0.020	0.000 mA		9.2e-007	2.3e-003	mA	100.0 : 1
	25%	±(0.1% Span)	4.980	5.020	5.002 mA		1.9e-004	2.3e-003	mA	100.0 : 1
	50%	±(0.1% Span)	9.980	10.020	10.000 mA		3.1e-004	2.3e-003	mA	64.5 : 1
	75%	±(0.1% Span)	14.980	15.020	14.999 mA		1.2e-003	2.6e-003	mA	16.7 : 1
	100%	±(0.1% Span)	19.980	20.020	19.996 mA		1.4e-003	2.7e-003	mA	14.3 : 1

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CERTIFICATE OF CALIBRATION

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SCC Lab No 22

CLAS MRC·CNRC
CLAS 2000-03

ilac-MRA

Certificate/SO Number: 9-Q1F7P-20-1 Revision 0

As Found/As Left Data

Description	Setpoints	Accuracy	Low Limit	High Limit	As Found / As Left	OOT	Cal Process Uncertainty (k=2; ±)	Measurement Uncertainty (k=2; ±)	Units	TUR
DC Voltage % Source - 0-5V Ch#1										
0 -5V	0%	±(0.1% Span)	-0.0050	0.0050	0.0018 V		5.8e-007	5.8e-004	V	100.0 : 1
	20%	±(0.1% Span)	0.9950	1.0050	1.0009 V		5.6e-006	5.8e-004	V	100.0 : 1
	40%	±(0.1% Span)	1.9950	2.0050	2.0000 V		1.1e-005	5.8e-004	V	100.0 : 1
	60%	±(0.1% Span)	2.9950	3.0050	3.0010 V		1.6e-005	5.8e-004	V	100.0 : 1
	80%	±(0.1% Span)	3.9950	4.0050	4.0005 V		2.1e-005	5.8e-004	V	100.0 : 1
	100%	±(0.1% Span)	4.9950	5.0050	4.9997 V		2.6e-005	5.8e-004	V	100.0 : 1
DC Voltage % Source - 0-5V Ch#2										
0 -5V	0%	±(0.1% Span)	-0.0050	0.0050	0.0006 V		5.8e-007	5.8e-004	V	100.0 : 1
	20%	±(0.1% Span)	0.9950	1.0050	1.0002 V		5.6e-006	5.8e-004	V	100.0 : 1
	40%	±(0.1% Span)	1.9950	2.0050	2.0004 V		1.1e-005	5.8e-004	V	100.0 : 1
	60%	±(0.1% Span)	2.9950	3.0050	3.0006 V		1.6e-005	5.8e-004	V	100.0 : 1
	80%	±(0.1% Span)	3.9950	4.0050	4.0007 V		2.1e-005	5.8e-004	V	100.0 : 1
	100%	±(0.1% Span)	4.9950	5.0050	5.0014 V		2.6e-005	5.8e-004	V	100.0 : 1
DC Voltage % Source - 0-5V Ch#3										
0 -5V	0%	±(0.1% Span)	-0.0050	0.0050	0.0008 V		5.8e-007	5.8e-004	V	100.0 : 1
	20%	±(0.1% Span)	0.9950	1.0050	1.0002 V		5.6e-006	5.8e-004	V	100.0 : 1
	40%	±(0.1% Span)	1.9950	2.0050	1.9997 V		1.1e-005	5.8e-004	V	100.0 : 1
	60%	±(0.1% Span)	2.9950	3.0050	2.9988 V		1.6e-005	5.8e-004	V	100.0 : 1
	80%	±(0.1% Span)	3.9950	4.0050	4.0012 V		2.1e-005	5.8e-004	V	100.0 : 1
	100%	±(0.1% Span)	4.9950	5.0050	5.0015 V		2.6e-005	5.8e-004	V	100.0 : 1
DC Voltage % Source - 0-5V Ch#4										
0 -5V	0%	±(0.1% Span)	-0.0050	0.0050	0.0007 V		5.8e-007	5.8e-004	V	100.0 : 1
	20%	±(0.1% Span)	0.9950	1.0050	1.0018 V		5.6e-006	5.8e-004	V	100.0 : 1
	40%	±(0.1% Span)	1.9950	2.0050	2.0008 V		1.1e-005	5.8e-004	V	100.0 : 1
	60%	±(0.1% Span)	2.9950	3.0050	2.9993 V		1.6e-005	5.8e-004	V	100.0 : 1
	80%	±(0.1% Span)	3.9950	4.0050	3.9988 V		2.1e-005	5.8e-004	V	100.0 : 1
	100%	±(0.1% Span)	4.9950	5.0050	5.0009 V		2.6e-005	5.8e-004	V	100.0 : 1

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CERTIFICATE OF CALIBRATION

Customer: AERCOUSTICS ENGINEERING LTD
1004 MIDDLEGATE ROAD
SUITE 1100
MISSISSAUGA, ON L4Y 0G1
PO Number: TR2019.03.22_875FT-00

SCC Accredited LAB — LAB Accrédité CCN — SCC Lab No 22
CLAS NRC·CNRC — CLAS 2000-03
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Certificate/SO Number: 9-Q1F7P-20-1 Revision 0

As Found/As Left Data

Description	Setpoints	Accuracy	Low Limit	High Limit	As Found / As Left	OOT	Cal Process Uncertainty (k=2; ±)	Measurement Uncertainty (k=2; ±)	Units	TUR
DC Voltage % Source - 0-10V Ch#1										
0 - 10V	0%	±(0.1% Span)	-0.010	0.010	0.002 V		5.8e-007	1.2e-003	V	100.0 : 1
	20%	±(0.1% Span)	1.990	2.010	2.000 V		1.1e-005	1.2e-003	V	100.0 : 1
	40%	±(0.1% Span)	3.990	4.010	4.000 V		2.1e-005	1.2e-003	V	100.0 : 1
	60%	±(0.1% Span)	5.990	6.010	6.002 V		3.1e-005	1.2e-003	V	100.0 : 1
	80%	±(0.1% Span)	7.990	8.010	8.000 V		4.1e-005	1.2e-003	V	100.0 : 1
	100%	±(0.1% Span)	9.990	10.010	10.000 V		5.2e-005	1.2e-003	V	100.0 : 1
DC Voltage % Source - 0-10V Ch#2										
0 - 10V	0%	±(0.1% Span)	-0.010	0.010	0.001 V		5.8e-007	1.2e-003	V	100.0 : 1
	20%	±(0.1% Span)	1.990	2.010	2.000 V		1.1e-005	1.2e-003	V	100.0 : 1
	40%	±(0.1% Span)	3.990	4.010	4.001 V		2.1e-005	1.2e-003	V	100.0 : 1
	60%	±(0.1% Span)	5.990	6.010	6.002 V		3.1e-005	1.2e-003	V	100.0 : 1
	80%	±(0.1% Span)	7.990	8.010	8.000 V		4.1e-005	1.2e-003	V	100.0 : 1
	100%	±(0.1% Span)	9.990	10.010	10.000 V		5.2e-005	1.2e-003	V	100.0 : 1
DC Voltage % Source - 0-10V Ch#3										
0 - 10V	0%	±(0.1% Span)	-0.010	0.010	0.001 V		5.8e-007	1.2e-003	V	100.0 : 1
	20%	±(0.1% Span)	1.990	2.010	2.000 V		1.1e-005	1.2e-003	V	100.0 : 1
	40%	±(0.1% Span)	3.990	4.010	4.001 V		2.1e-005	1.2e-003	V	100.0 : 1
	60%	±(0.1% Span)	5.990	6.010	6.001 V		3.1e-005	1.2e-003	V	100.0 : 1
	80%	±(0.1% Span)	7.990	8.010	8.000 V		4.1e-005	1.2e-003	V	100.0 : 1
	100%	±(0.1% Span)	9.990	10.010	9.999 V		5.2e-005	1.2e-003	V	100.0 : 1
DC Voltage % Source - 0-10V Ch#4										
0 - 10V	0%	±(0.1% Span)	-0.010	0.010	0.001 V		5.8e-007	1.2e-003	V	100.0 : 1
	20%	±(0.1% Span)	1.990	2.010	2.001 V		1.1e-005	1.2e-003	V	100.0 : 1
	40%	±(0.1% Span)	3.990	4.010	3.999 V		2.1e-005	1.2e-003	V	100.0 : 1
	60%	±(0.1% Span)	5.990	6.010	6.000 V		3.1e-005	1.2e-003	V	100.0 : 1
	80%	±(0.1% Span)	7.990	8.010	8.001 V		4.1e-005	1.2e-003	V	100.0 : 1
	100%	±(0.1% Span)	9.990	10.010	9.999 V		5.2e-005	1.2e-003	V	100.0 : 1

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Certificate/SO Number: 9-Q1F7P-20-1 Revision 0

Traceable Standards

Asset	Manufacturer	Model Number	Description	Cal Date	Due Date	Traceability Number	Use
ED-0050	HP	3458A Opt 002	Digital Multimeter, 8.5 Digit	6-Jul-18	31-Jul-19	9-&ED-0050-12-1	AF/AL

The use of the standard is defined as: AF - used for as-found readings, AL - used for as-left readings.

Environmental Data

Temperature	Relative Humidity	Temp / RH Asset
74.75°F /23.75°C	18.40%	LEM-0003

Calibrated At:
916 Gateway
Burlington, ON L7L 5K7

Facility Responsible:
916 Gateway
Burlington, ON L7L 5K7
800-828-1470

Calibrated By:
Electronically Signed By:
Lawrence Loi
Lawrence Loi — Calibration Technician — Mar 29, 2019 15:33:38 -04:00

Reviewed By:
Electronically Signed By:
Tony Ghanbari
Tony Ghanbari — Lab Manager — Mar 29, 2019 15:39:53 -04:00

Unit Barcode: 900B0177370

Date Received: March 26, 2019
Service Level : R9

Customer Number: 9-322110-00C

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Appendix F.02
Compliance Statement

The following provides a summary of the compliance assessment for the Ontario Ministry of the Environment, Conservation and Parks ("MECP") with respect to the South Branch turbine sound emissions.

In short, the tested turbine emission sound levels in this report are acceptable and compliance has been demonstrated for South Branch despite the overall apparent sound levels testing higher than the levels outlined in the South Branch Renewable Energy Approval ("REA") #8279-974KHK. The approach detailed here follows Section E3.1.1 and E3.1.3 of the MECP Compliance Protocol for Wind Turbine Noise ("Compliance Protocol").

1 Summary of Measurement Results

The emission test of South Branch turbine T07[2] was conducted in November 2019; the CAN/CSA-IEC 61400-11:13 test report detailing the results of that test is 13350.02.T07.RP2. Sound power and tonal audibility levels from the test are summarized in Table F15 and Table F16. The measured sound power levels are compared to the allowable sound power levels in the South Branch Renewable Energy Approval ("REA").

Table F15: Apparent Sound Power values from Table 11 of 13350.02.T07.RP2

Wind Speed (m/s)	Apparent L_{WA}, (dBA)	Maximum Sound Power Level (dBA)* REA # 8992-9TVSKD
8.0	104.0	106.0
8.5	105.5	106.0
9.0	106.3	106.0
9.5	106.7	106.0
10.0	106.8	106.0
10.5	106.7	106.0
11.0	105.8	106.0
11.5	105.8	106.0
12.0	106.0	106.0
12.5	105.9	106.0

* Includes +0.5 dB allowance, per Section E3.1 of the MECP Compliance Protocol for Wind Turbine Noise

[2] Turbine ID per REA nomenclature

Table F16: Tonal Audibility values from Table 14 of 13350.02.T07.RP2

Wind Speed (m/s)	Frequency (Hz)	Tonal audibility, ΔL_a (dB)
8.0	-	No tones
8.5	-	No tones
9.0	-	No tones
9.5	-	No tones
10.0	-	No tones
10.5	-	No tones
11.0	-	No tones
11.5	-	No tones
12.0	-	No tones
12.5	-	No tones

2 Evaluation of Measured Sound Power Level

Based on the results presented in Table F15, the maximum apparent sound power level of T07 exceeds the sound level in REA #8279-974KHK by up to 0.8 dB. Therefore, in order to assess whether this higher sound power level is acceptable, additional analysis is required. To that end, "*Option 1: re-modelling*" per Section E3.1.1 of the Compliance Protocol has been used to determine if the predicted sound levels at the surrounding receptors to South Branch are compliant with the applicable sound level limits.

An updated Noise Impact Assessment ("NIA") has been prepared [2] based on the measured sound power level of T07, and the surrounding receptors have been verified to be in compliance using the measured sound power level.

2.1 Comparison of Sound Power Spectrum

The spectrum in the wind bin having the maximum calculated L_{WA} (10 m/s) is compared to the spectrum used in the original facility NIA [3] in Figure F1. Elevated levels in the 8000 Hz band have been attributed to Electromagnetic Interference ("EMI") measured during the test. It is noted that EMI is electrical, not acoustic, contamination and the elevated levels from EMI are not the result of acoustic emission from the turbine. For more details see Section 3.5 of 13350.02.T07.RP2. Elevated levels are also visible in the 500 Hz and 1000 Hz octave bands, albeit a much smaller difference than at 8000 Hz. The levels at these frequencies are not attributed to EMI.

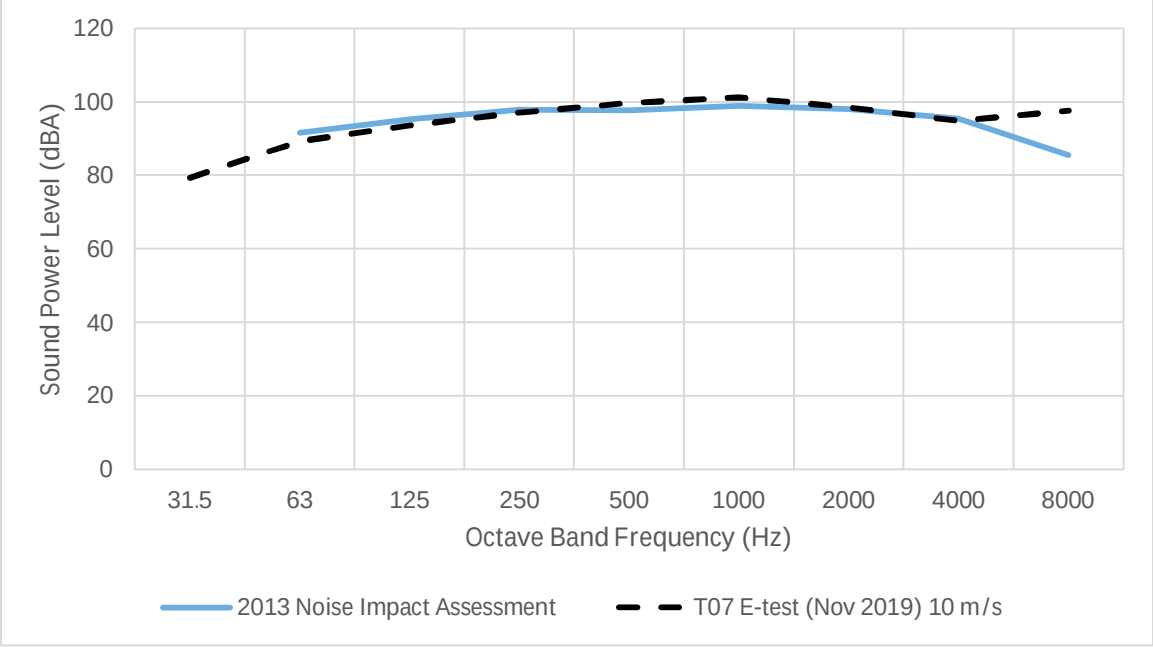

Figure F1: Maximum measured sound power spectrum (10 m/s) compared with manufacturer sound power spectrum from 2013 NIA.

Note that the worst-case spectrum considered in the updated NIA is 9.5 m/s and was determined by assessing the spectrum that results in the highest noise impact at the receptor, rather than the highest measured turbine sound power level. See Section 5.2 of the revised NIA [2] for details.

2.2 Option 1: Re-modelling

The impact of the elevated L_{WA} on the predicted receptor sound levels is calculated using the acoustic modelling parameters from the original NIA for South Branch, prepared in 2013. The results of this remodelling are provided in detail in a revised NIA prepared by DNV-GL and dated August 13, 2020 [2].

For information, the predicted sound levels at the five highest non-participating receptors are presented below, sorted first according to the original 2013 NIA sound levels (Table F17) and then according to new revised 2020 NIA sound levels (Table F18). The sound levels at all worst-case receptors remain in compliance.

Table F17: Five highest non-participating receptor sound levels, original 2013 NIA

Non-Participating Receptor ID	Predicted Sound Level (2013 NIA spectrum)	Closest Noise Source
R_139	39.5	Sub
V_278	39.1	Sub
R_137	38.9	Sub
R_138	38.9	Sub
V_260	38.8	T05

Table F18: Five highest non-participating receptor sound levels, updated 2020 NIA

Non-Participating Receptor ID	Predicted Sound Level (13350.02.T07.RP2, 9.5 m/s spectrum*)	Closest Noise Source
V_260	40.0	T05
V_251	39.8	T05
R_202	39.7	T12
V_298	39.4	T12
R_76	39.3	T07

* Per Table 5-3 of the revised NIA, the 9.5 m/s spectrum results in the highest predicted receptor levels.

Note that many of the receptors having high predicted sound levels in the 2013 NIA have the substation transformer as the closest noise source. The transformer sound power utilized in the 2013 NIA model was determined using a prediction method based on the transformer size and rating (see Section 5.2 of [3]), as the actual transformer model had not yet been selected at the time. The actual substation transformer sound level was tested to be 4 dBA quieter (see Table 4 and Section 8 of [4]) than the predicted sound level assumed in the original NIA, which has resulted in reduced sound levels at the receptors near the transformer.

2.3 Statement of Compliance

Based on the results summarized in this letter and detailed in the revised Noise Impact Study, the sound levels at all South Branch receptors remain compliant with the applicable MECP limits. Therefore, based on the guidance in Section E3.1.1 and E3.1.3 of the Compliance Protocol, the measured sound power levels of South Branch Turbine T07 are considered acceptable and the facility remains in compliance despite the exceedance of the tested sound power level above the allowable turbine emission levels in REA #8279-974KHK.

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Appendix F.03
E-audit Checklist

Appendix F.03 - (2017 Compliance Protocol Appendix F6): E-Audit checklist for IEC 61400-11:2013
Wind Energy Project – Screening Document – Acoustic Audit Report – Emission IEC61400-11:2013 Standard
Information Required in the Acoustic Audit Report – Emission

Item #	Description	Complete?	Comment
1	Characterization of the wind turbine Items 1 to 26; IEC61400-11:2013, Section 10.2	✓	Report Section 2.1
2	Physical environment Items 27 to 33; IEC61400-11:2013, Section 10.3, Physical Environment	✓	Report Section 2.2, 3.1.4, 3.5, Appendix A
3	Measurement instrumentation Items 34 to 39; IEC61400-11:2013, Section 10.4, Instrumentation	✓	Report Section 3.1, Appendix F.01
4	Acoustic data Items 40 to 52; IEC61400-11:2013, Section 10.5, Acoustic Data	✓	Report Section 4, 3.3, Appendix C, Appendix D,
5	Non-acoustic data Items 50 to 53, and 56; IEC61400-11:2003 Section 10.6, Non-Acoustic Data Items 59 and 60; NPC-233, Section 12.3, Acoustic Audit – Acoustical Data, bullet point number 8, All necessary and supporting calculations	✓	Report Section 3.3, Appendix C, Appendix E
6	Uncertainty the apparent sound power level at integer wind speeds one-third octave band spectrum of the noise at the reference position at each integer wind speed the Tonality of the sound emissions of the wind turbine measured at the reference position	✓	Report Section 4.3, Appendix C
7	Additional information Item 60; NPC-233, Section 10, Report Format, bullet point number 4, Conclusions and Recommendations Item 61; NPC-233, Section 12.3, Acoustic Audit – Acoustical Data, bullet point number 8, All necessary and supporting calculations Item 62; NPC-233, Section 12.3, Acoustic Audit – Acoustical Data, bullet point number 3, Details of measurement procedure	✓	Report Section 3 and Section 5, Appendix F, data in Excel provided separately
8	Items 68 to 72; IEC61400-11:2013, Section 10.5, Acoustic Data	⊘	Optional information, not provided in this report
9	Non-acoustic data Items 73 to 74 are from IEC61400-11:2013, Section 10.6, Non-Acoustic Data	⊘	Optional information, not provided in this report

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End of Report