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REPORT ID: **15039.00.T226.RP2**

Cedar Point Wind Power Project – Turbine WTG 19 (CP226) IEC 61400-11 Edition 3.0 Measurement Report

Prepared for:

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Revision History

Revision Number	Description	Date
1	Issued Edition 2.1 test report	05/10/2016
2	Issued Edition 3.0 test report	07/11/2017
3	Updated to Edition 3.0 test report Section 3.2.1 and Appendix G Information for Regulator	09/03/2018

This report in its entirety, including appendices contains 114 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.

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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.

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1 Introduction

Aercoustics Engineering Limited (Aercoustics) was retained by Cedar Point II Limited Partnership to conduct an acoustic measurement of turbine WTG 19 (CP226) at the Cedar Point Wind Power Project. The purpose of the measurement was to provide verification of the maximum noise emission of the turbine. The measurement was carried out 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 Turbine WTG 19 (CP226). It should be noted that the turbines

2 Wind Turbine Information

2.1 Wind turbine equipment specific information

Wind turbine specific equipment information for turbine WTG 19 (CP226) was provided by the manufacturer and is summarized in Tables 1 – 5.

Table 1 - Wind Turbine Details

Wind Turbine Details	
Manufacturer	Siemens
Model Number	SWT2.3-113
Turbine ID	2308905

Table 2 - Operating Details

Operating Details	
Vertical or Horizontal axis wind turbine	Horizontal
Upwind or downwind rotor	Upwind rotor
Hub height	99.5 m
Horizontal distance from rotor centre to tower axis	5.5 m
Diameter of rotor	113 m
Tower type (lattice or tube)	Tubular
Passive stall, active stall, or pitch controlled turbine	Pitch controlled turbine
Constant or variable speed	Variable speed
Power curve	See Figure B.01
Rotational speed at each integer standardised wind speed	See Figure B.02
Rated power output	2126 kW
Control software version	128.2.0.1

Table 3 - Rotor Details

Rotor Details	
Rotor control devices	Pitch control
Presence of vortex generators, stall strips, serrated trailing edges	Vortex generators and dino tails
Blade type	B55
Serial number	Blade A: 550326501 Blade B: 550326401 Blade C: 550326101
Number of blades	3

Table 4 - Gearbox Details

Gearbox Details	
Manufacturer	N/A Direct drive turbine
Model number	N/A Direct drive turbine
Serial number	N/A Direct drive turbine

Table 5 - Generator Details

Generator Details	
Manufacturer	Siemens
Model number	DD22_01
Serial number	5100054278

2.2 Wind Turbine Location

Turbine WTG 19 (CP226) is located in the Municipality of Lambton near the town of Forest, Ontario. Specific UTM coordinates for WTG 19 (CP226) are 418499 mE, 4774532 mN, Zone 17T. The area surrounding WTG 19 (CP226) is primarily flat farmland.

A general layout of the area in which the turbine is located is provided in the site plan (Figure A.01).

3 Measurement Details

3.1 Measurement Equipment

3.1.1 Acoustic Measurement Equipment

A summary of acoustic equipment utilized by Aercoustics for the measurement of turbine WTG 19 (CP226) is summarized in Table 6.

Table 6 - Acoustic Measurement Equipment

Equipment	Manufacturer Name & Model	Serial Number
Acoustic Data acquisition system	LMS SCADA Mobile	22143211
Microphone	B&K 4189	2625416
Pre-amplifier	B&K 2671	2369794
Acoustic calibrator	B&K 4231	1807640

Calibration of the measurement setup was carried out before and after Aercoustics set of measurements.

3.1.2 Meteorological Equipment

Wind speed for Turbine ON was derived from the power curve (as per procedures outlined in IEC 61400-11). Wind direction for turbine ON measurements was utilized from the Yaw position from turbine WTG 19 (CP226). Data for background measurements was obtained from a 10m high anemometer, which was placed as per guidelines outlined in IEC-61400-11.

The meteorological equipment is summarized in Table 7

Table 7 – Meteorological Measurement Equipment

Equipment	Manufacturer Name & Model	Serial Number
Anemometer	VAISALA WXT520	K2420011
Serial to Analog Converter	NOKEVAL 7470	A165152

3.2 Measurement Setup

3.2.1 Microphone Placement

The measurement microphone was setup 156m from the base of the turbine in 'Position 1', (i.e. downwind of the turbine, as per IEC 61400-11) at an elevation of 0m relative to the base of WTG 19 (CP226). The slant distance (R_1) from microphone location to rotor centre includes the distance from rotor center (hub) to tower axis (R_1 = 189.7m). The microphone was placed in the centre of a circular, acoustically reflective board.

During the measurement period only data points for which the microphone was within 15 degrees of downwind from the turbine were used. The microphone position relative to downwind of the turbine was monitoring via the yaw angle output provided from the turbine system (discussed further in Section 3.5). During placement of the microphone the turbine was parked and the reference yaw angle for that measurement logged.

When measurements of WTG 19 (CP226) were taken, the surrounding land was planted with short soy beans crop. The crop was short and as such the influence on the measurement was considered negligible. There were no nearby reflecting surfaces

(houses, barns etc.); as such the influence from reflecting surfaces was considered to be negligible.

Photos of the measurement setup are provided in Figure A.02, Appendix A.

3.2.2 Double Windscreen Setup

A double windscreen setup was not utilized.

3.3 Measurement Schedule

Table 8 provides a summary of the test date and times. Data was logged in 10 second intervals for post-processing (as per the measurement standard).

Table 8 - Measurement Schedule Summary

Date	Test Type	Start Time	Finish time
September 1, 2016	Turbine ON	13:02	13:22
	Background	13:23	13:28
	Background	13:49	14:00
	Turbine ON	14:01	14:36
	Turbine ON	14:57	15:02
	Turbine ON	15:19	15:30
	Background	15:34	16:07
	Turbine ON	16:11	16:51
	Background	16:51	17:05
	Background	17:13	17:18
	Turbine ON	17:21	17:35
	Background	17:37	18:42

3.4 Meteorological Conditions

Detailed meteorological data relevant to the measurement is provided in Appendix E.

As previously mentioned, wind speed for Turbine ON was derived from WTG 19 (CP226)'s power curve (as per the standard), while wind direction was provided by WTG 19 (CP226)'s yaw position. Background data was obtained from an anemometer located 10m above ground level near WTG 19 (CP226).

Temperature and pressure readings during the measurement period were provided by the 10m anemometer, located near turbine WTG 19 (CP226) for the duration of Aercoustics measurements.

3.5 Turbine operational information

Output data from the turbine (Power, yaw, RPM, pitch angle, and nacelle wind speed) were obtained as analog output signals that were simultaneously acquired with the acoustic and anemometer measurement data using Aercoustics data acquisition system.

4 Measurement Results

4.1 Deviations from IEC-61400-11 Edition 3.0

Originally, the test contract required measurements in accordance to edition 2.1 of the standard (61400-11) which requires the anemometer to be placed upwind of the turbine. This test report is a reprocessing of the originally acquired data and as such during the test, the anemometer position was erected in an upwind (Ed 2.1), rather than crosswind (Ed 3.0) position relative to the test turbine.

The acoustic signal to noise ratio for the noise levels is >7.1dB. This deviation is therefore considered to be negligible to the assessment of the maximum sound power of this turbine for this test. This method is in accordance with the recommendations made by the convener of the IEC 61400-11 working group and is detailed in Note N6.023.17 and provided in Appendix F.

4.2 Special Notes & Considerations

No special notes and considerations.

4.3 Analysis Details

The following section outlines analysis of the measurement data acquired for WTG 19 (CP226). The data presented is exclusive of transient events such as vehicle traffic, wildlife, air traffic etc. The site has been assessed to have a roughness length of 0.05m, representative of farmland with some vegetation.

4.3.1 Double Windscreen Adjustment

As previously mentioned, no double wind screen was used, as such the measurement data did not require adjustment.

4.3.2 Wind Speed Correction

The wind speed for each measurement data point for Turbine ON was derived through the power curve (as per Section 8.2.1.1 of IEC-61400-11). For data points during Turbine ON that were outside the allowed range of the power curve, the wind speed was derived from the nacelle anemometer wind speed (as specified in Section 8.2.1.2 of IEC-61400-11).

Background wind speed was derived utilizing data acquired with the 10m anemometer and normalizing the wind speed (as per Section 8.2.2 of IEC-61400-11).

4.4 Type B uncertainties

Type B uncertainties were obtained through interpretation of information provided in Annex C of IEC-61400-11, and instrument uncertainties obtained from the calibration certificate. A summary of Type B uncertainties is provided in Table 9, while detailed information (including data in 1/3 octave) is provided in Appendix C.

Table 9 - 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
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

4.5 Sound Pressure Level Measurements

Sound pressure level measurements are summarized in Table 10. Detailed 1/3 Octave band spectrum data, respective uncertainties, and analysis plots are provided in Appendix C. A copy of the measurement data used for analysis is provided in Appendix E and includes meteorological and turbine operational data.

The purpose of this measurement was to verify turbine noise emission, and testing was conducted in conformity with IEC 61400-11-Ed 3.0 Section 5, Paragraph 3. The wind speed range for documentation is related to the specific wind turbine. As a minimum, it is defined as the hub height wind speed from 0,8 to 1,3 times the wind speed at 85% of maximum power rounded to bin centres. For Turbine WTG 19 (CP226) this corresponds to a hub height wind speed of 7 m/s to 11.5 m/s.

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	
7	51.6	35	44.5	37	50.7
7.5	53.2	38	45.0	37	52.5
8	53.3	31	44.5	50	52.7
8.5	53.1	43	44.5	61	52.4
9	53.0	37	44.5	58	52.3
9.5	52.7	38	44.5	63	52.0
10	52.2	49	44.6	59	51.4
10.5	52.2	51	45.1	53	51.3
11	52.1	57	45.1	51	51.1
11.5	52.2	42	45.1	35	51.3

4.6 Sound Power Level of Turbine

The calculated sound power level of the turbine WTG 19 (CP226) (as per IEC 61400-11) is summarized in Table 11 (hub height) and Table 12 (10m height). Detailed 1/3 Octave band spectrum data and respective uncertainties are provided in Appendix C.

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

Wind Speed (m/s)	Apparent L_{WA}, (dBA)	Uncertainty (dB)
7	101.2	1.0
7.5	103.0	0.9
8	103.2	0.9
8.5	103.0	0.9
9	102.9	0.8
9.5	102.5	0.9
10	102.0	0.9
10.5	101.9	0.9
11	101.7	0.9
11.5	101.8	0.9

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

Wind Speed (m/s)	Apparent L_{WA}, (dBA)	Uncertainty (dB)
4	97.3*	1.4
5	101.9	0.9
6	103.0	0.9
7	102.1	0.9
8	101.8	0.9
9	102.4	0.7

Values marked with an asterisk * denote 3 to 6 dB difference between Turbine ON and Background

4.7 Tonality Analysis

The tonality analysis for Turbine WTG 19 (CP226) is summarized in Table 13, while plots of narrow band spectra at each wind speed are provided in Appendix D. The ΔL_{tn} and ΔL_a values reported represent the energy average of all data points with an identified tone that falls within the same frequency origin (as specified in Section 9.5.8 in IEC-61400-11).

The narrow band spectra provided in the plots represents an energy average of all data points in the given wind speed bin for both Turbine ON and Background.

Table 13 - Tonality Assessment Summary

Wind Speed (m/s)	Frequency (Hz)	Tonality, ΔL_{tn} (dB)	Tonal audibility, ΔL_a (dB)	FFT's with tones	Total # of FFT's	Presence (%)
7	58	-4.4	-2.4	9	35	26%
8.5	58	-5.0	-3.0	20	43	47%
9	58	-4.5	-2.5	9	37	24%
9.5	60	-2.3	-0.3	15	38	39%
10	61	-1.9	0.1	20	49	41%
10.5	60	-1.9	0.1	20	51	39%
11	64	-2.4	-0.4	27	57	47%

5 Closure

Measurements and analysis as per International IEC 61400-11 (Edition 3.0, released 2012-11), "Wind turbine generator systems – Part 11: Acoustic noise measurement techniques" were carried out on Turbine WTG 19 (CP226) of the Cedar Point Wind Power Project on September 1st, 2016.

Should you have any questions or comments please do not hesitate to contact the authors of this report.

6 References

1. International Standard IEC 61400-11 (Edition 3.0, released 2012-11), "Wind turbine generator systems – Part 11: Acoustic noise measurement techniques".

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Appendix A
Site Details

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	Scale: NTS Drawn by: AM Reviewed by: PA Date: Sept 15, 2017 Revision: 1	Cedar Point Wind Power Project - Turbine CP226 - IEC61400-11 Edition 3.0
		Figure Title Site Plan
		Figure A.01

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Project Name

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Figure Title

Site photos

Figure A.02

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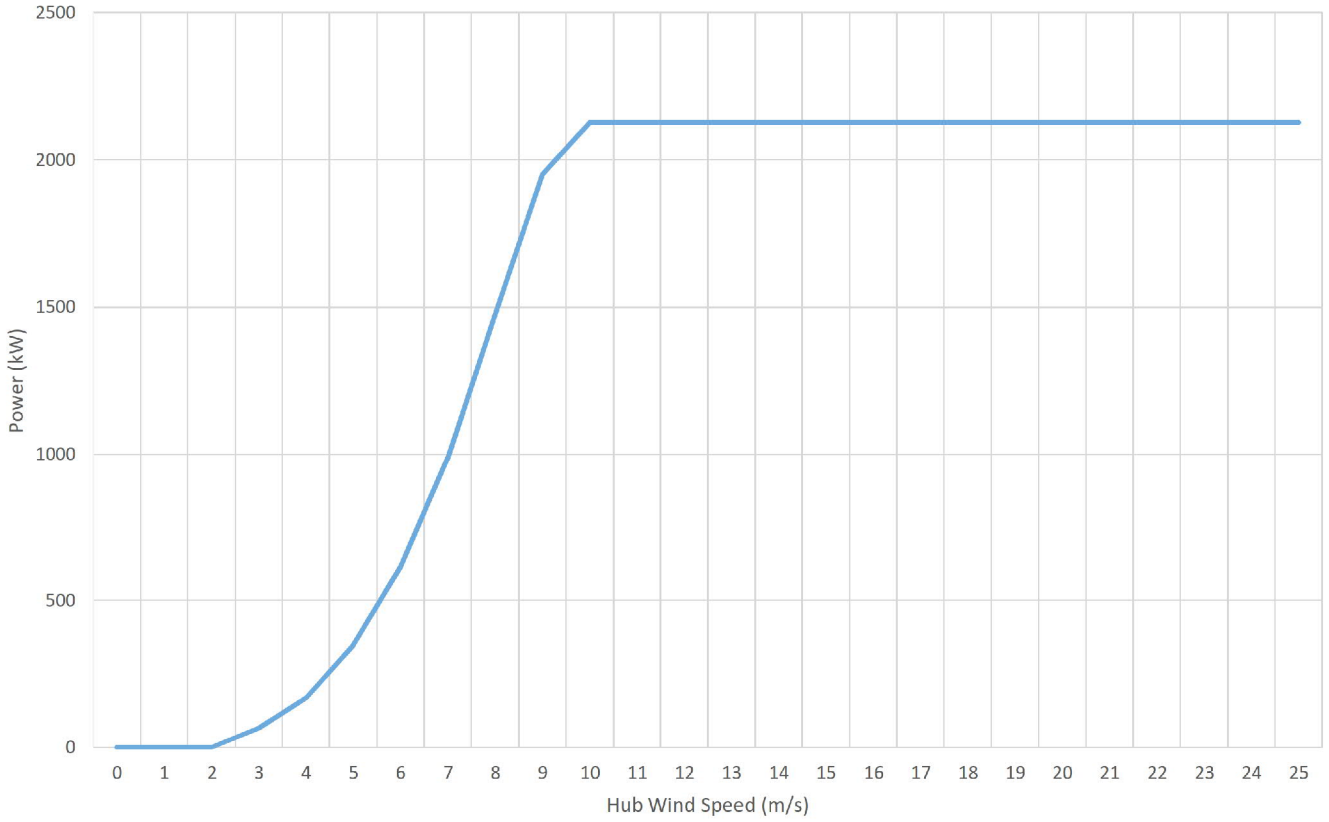
Appendix B
Turbine Information



Power Curve	
Hub Wind Speed (m/s)	Power [kW]
0	0
1	0
2	0
3	65
4	169
5	347
6	615
7	989
8	1471
9	1951
10	2126
11	2126
12	2126
13	2126
14	2126
15	2126
16	2126
17	2126
18	2126
19	2126
20	2126
21	2126
22	2126
23	2126
24	2126
25	2126

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Date: Sept 15, 2017
Revision: 1

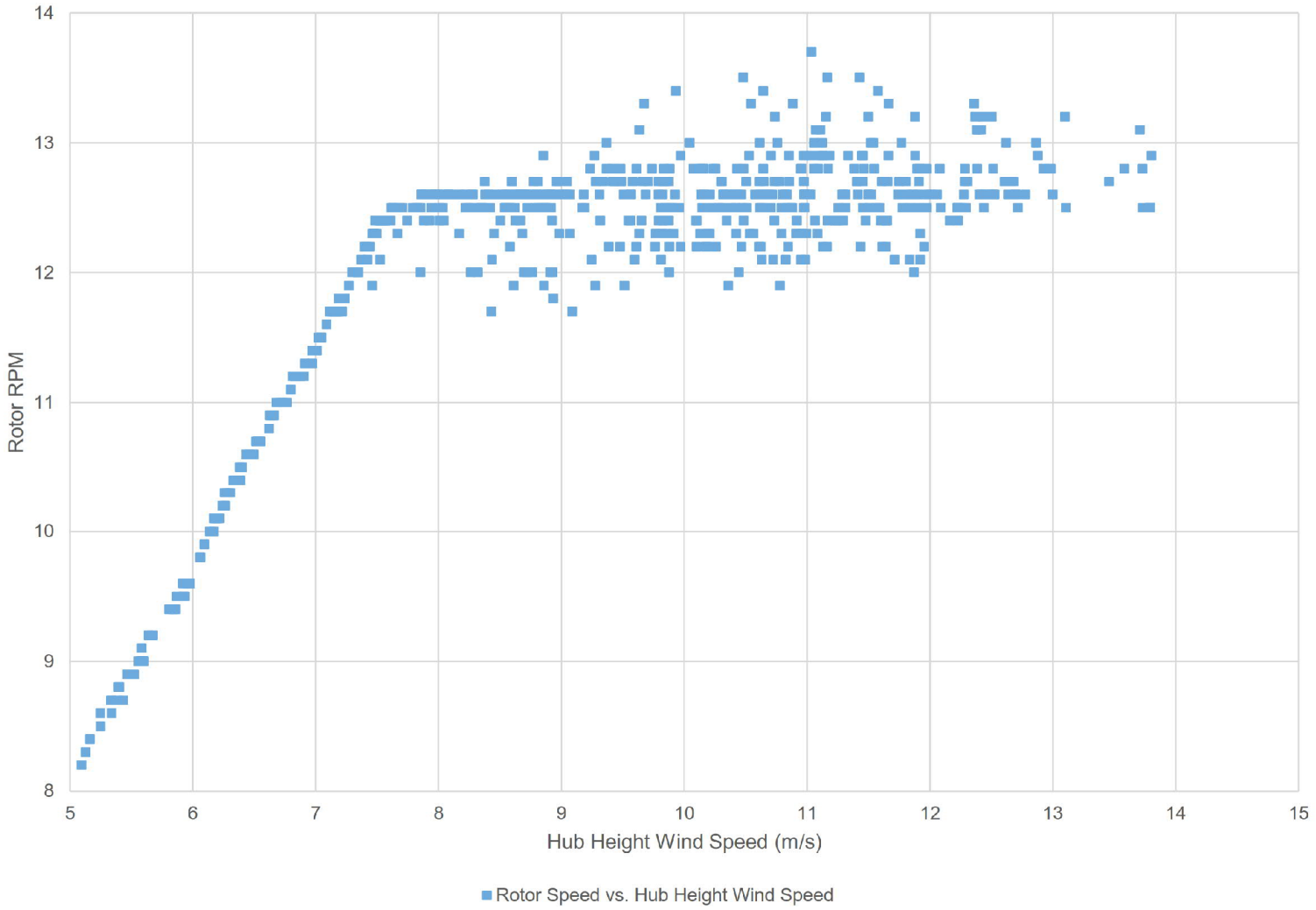
Project Name

Cedar Point Wind Power Project - Turbine CP226 - IEC61400-11 Edition 3.0

Figure Title

Power Curve

Figure B.01



aercoustics	15039.00.T226.RP3 Scale: NTS Drawn by: AM Reviewed by: PA Date: Sept 15, 2017 Revision: 1	**Project Name** Cedar Point Wind Power Project - Turbine CP226 - IEC61400-11 Edition 3.0 **Figure Title** Rotor RPM vs. wind speed

Figure B.02

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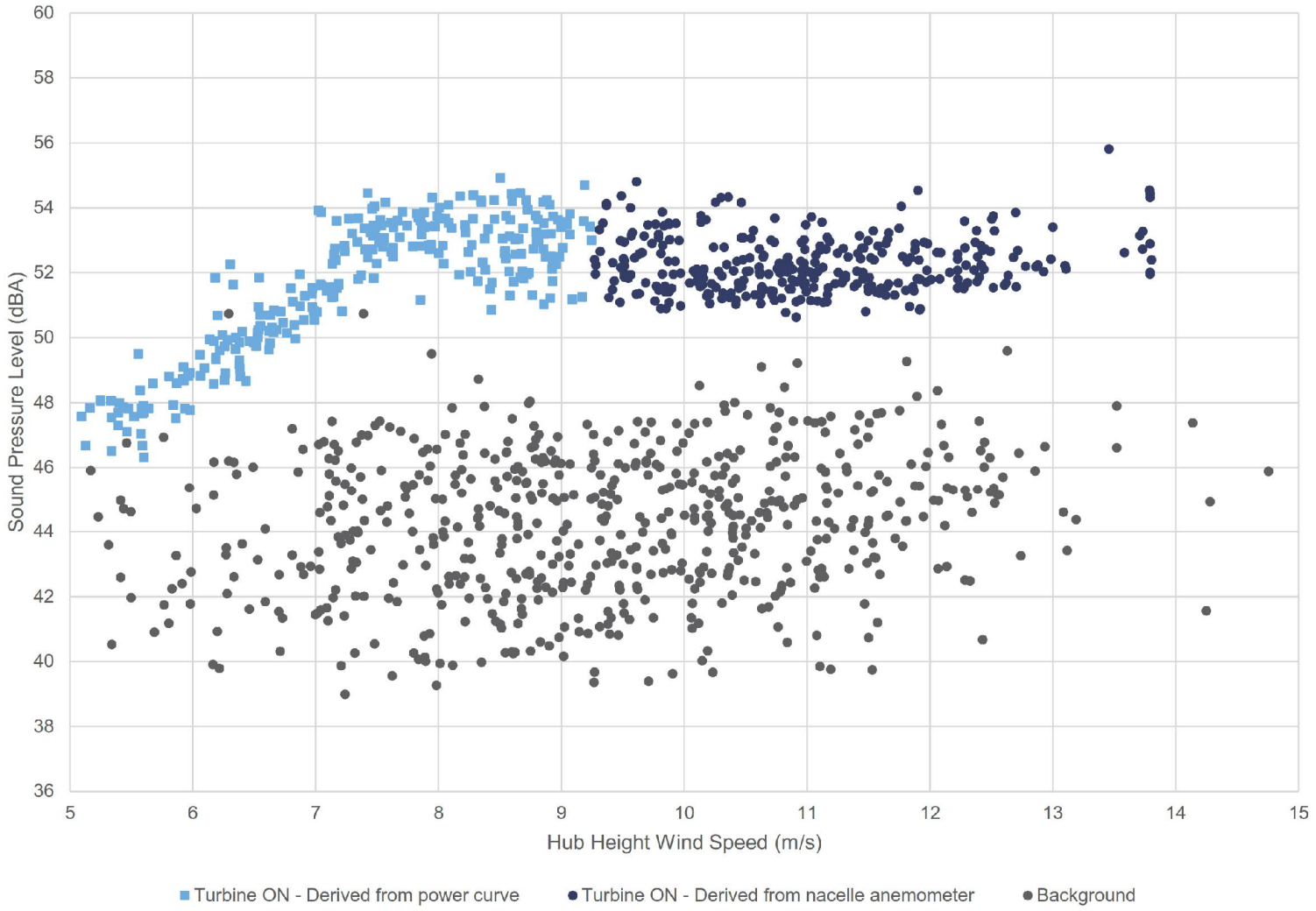
Appendix C
Apparent Sound Power Level

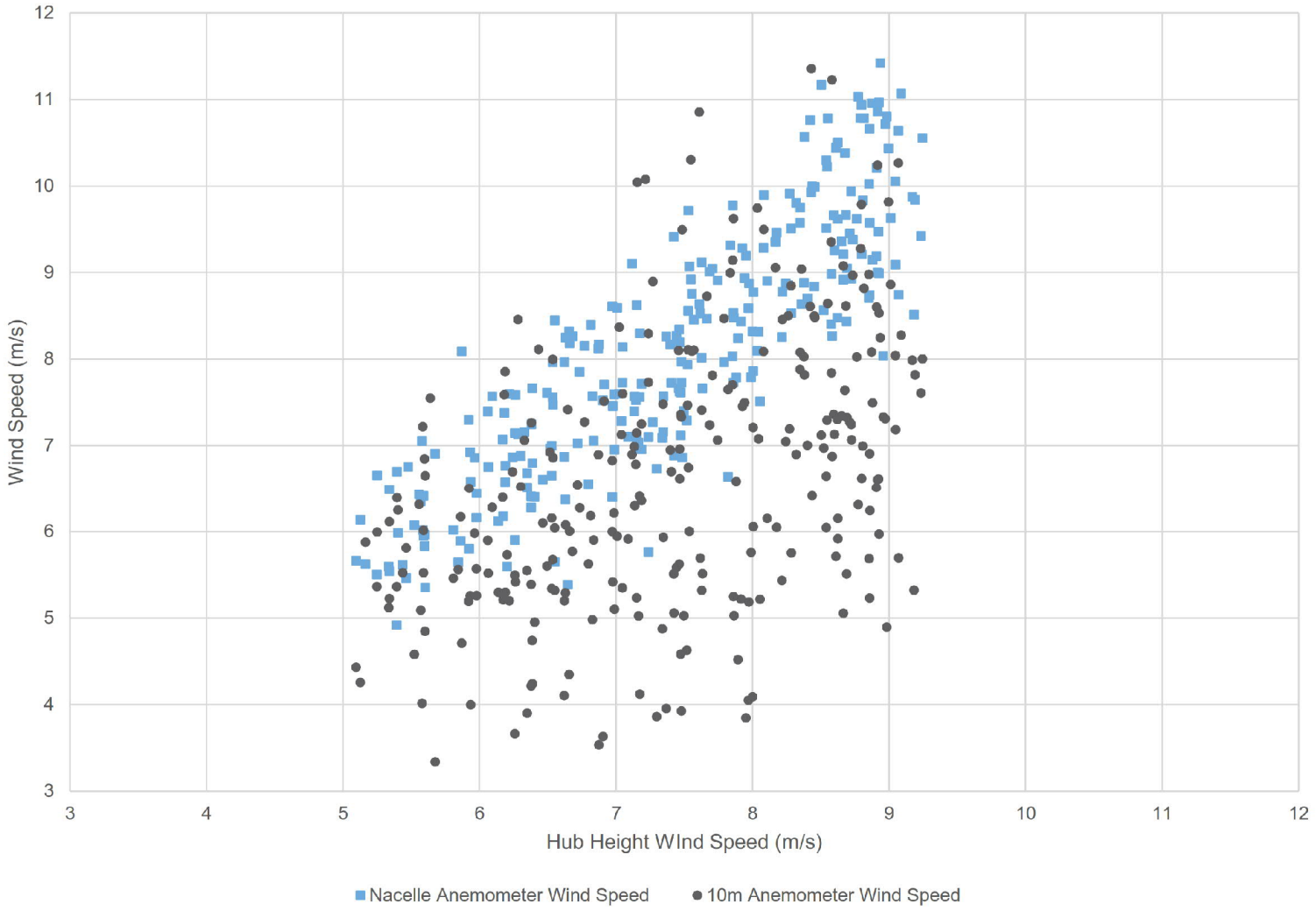


aercoustics	15039.00.T226.RP3 Scale: NTS Drawn by: AM Reviewed by: PA Date: Sept 15, 2017 Revision: 1	**Project Name** Cedar Point Wind Power Project - Turbine CP226 - IEC61400-11 Edition 3.0 **Figure Title** Plot of overall measurement data pairs at Position 1 (Turbine ON & Background)

Figure C.01

aercoustics	15039.00.T226.RP3 Scale: NTS Drawn by: AM Reviewed by: PA Date: Sept 15, 2017 Revision: 1	**Project Name** Cedar Point Wind Power Project - Turbine CP226 - IEC61400-11 Edition 3.0 **Figure Title** Plot of measured total noise vs electrical power output

Figure C.02

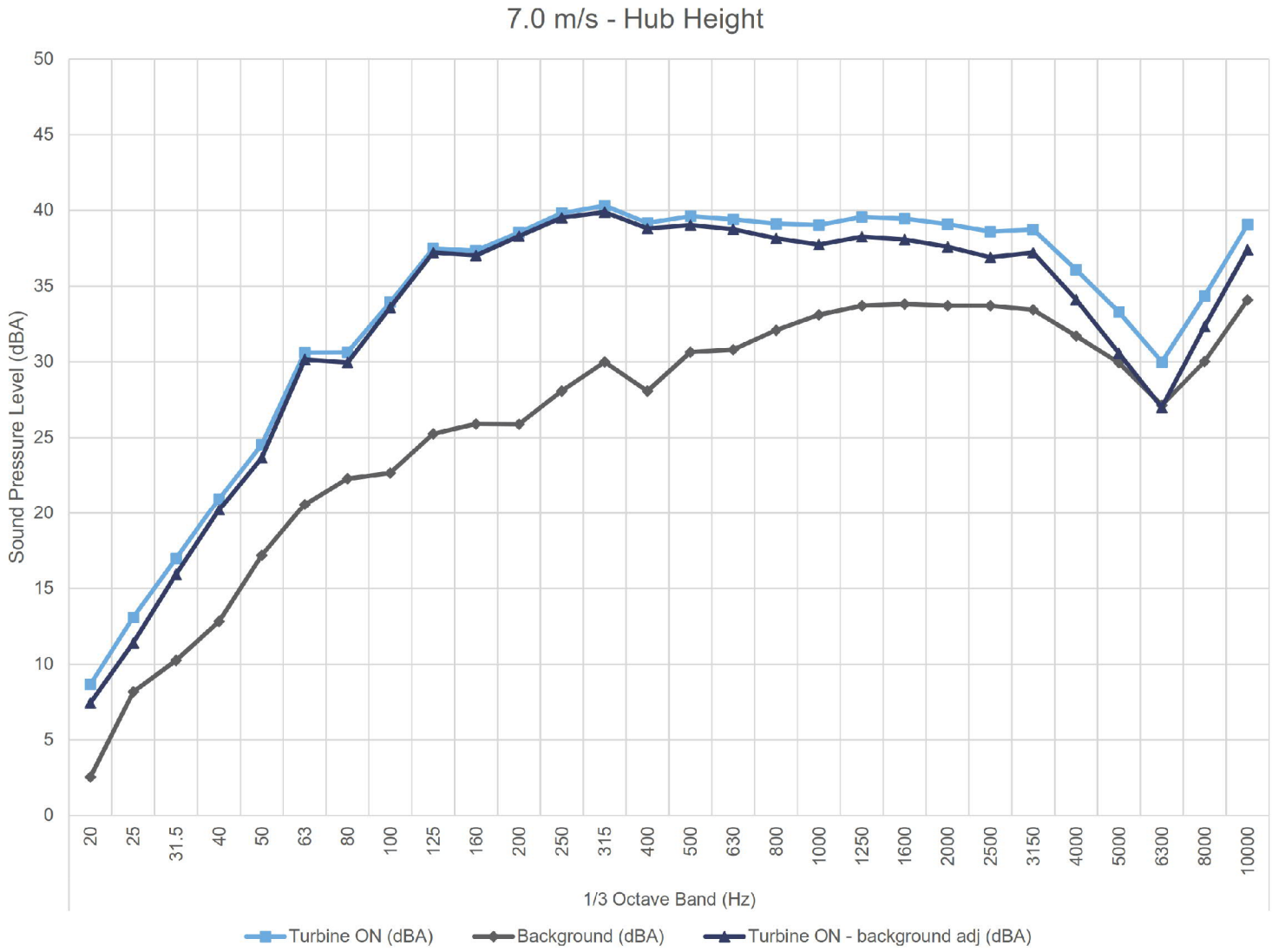


aercoustics	15039.00.T226.RP3 Scale: NTS Drawn by: AM Reviewed by: PA Date: Sept 15, 2017 Revision: 1	**Project Name** Cedar Point Wind Power Project - Turbine CP226 - IEC61400-11 Edition 3.0 **Figure Title** Plot of power curve relative to nacelle anemometer and 10m anemometer

Figure C.03

aercoustics	15039.00.T226.RP3 Scale: NTS Drawn by: AM Reviewed by: PA Date: Sept 15, 2017 Revision: 1	**Project Name** Cedar Point Wind Power Project - Turbine CP226 - IEC61400-11 Edition 3.0 **Figure Title** Plot of rotor RPM vs. electrical power output

Figure C.04



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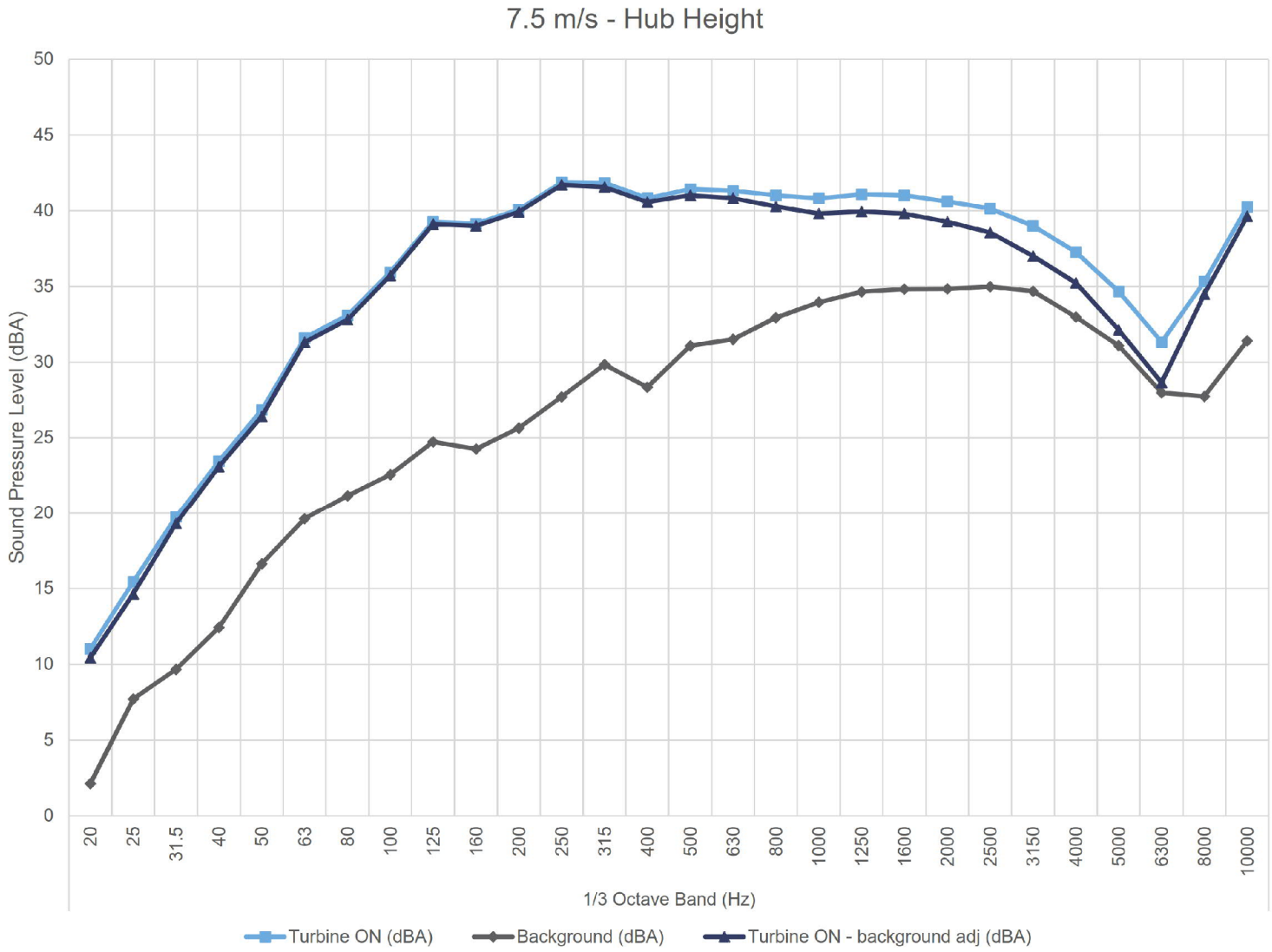
Scale: NTS Drawn by: AM Reviewed by: PA Date: Sept 15, 2017 Revision: 1	Cedar Point Wind Power Project - Turbine CP226 - IEC61400-11 Edition 3.0
	Figure Title Plot of sound pressure spectrum in 1/3 Octave at 7 m/s

Figure C.05



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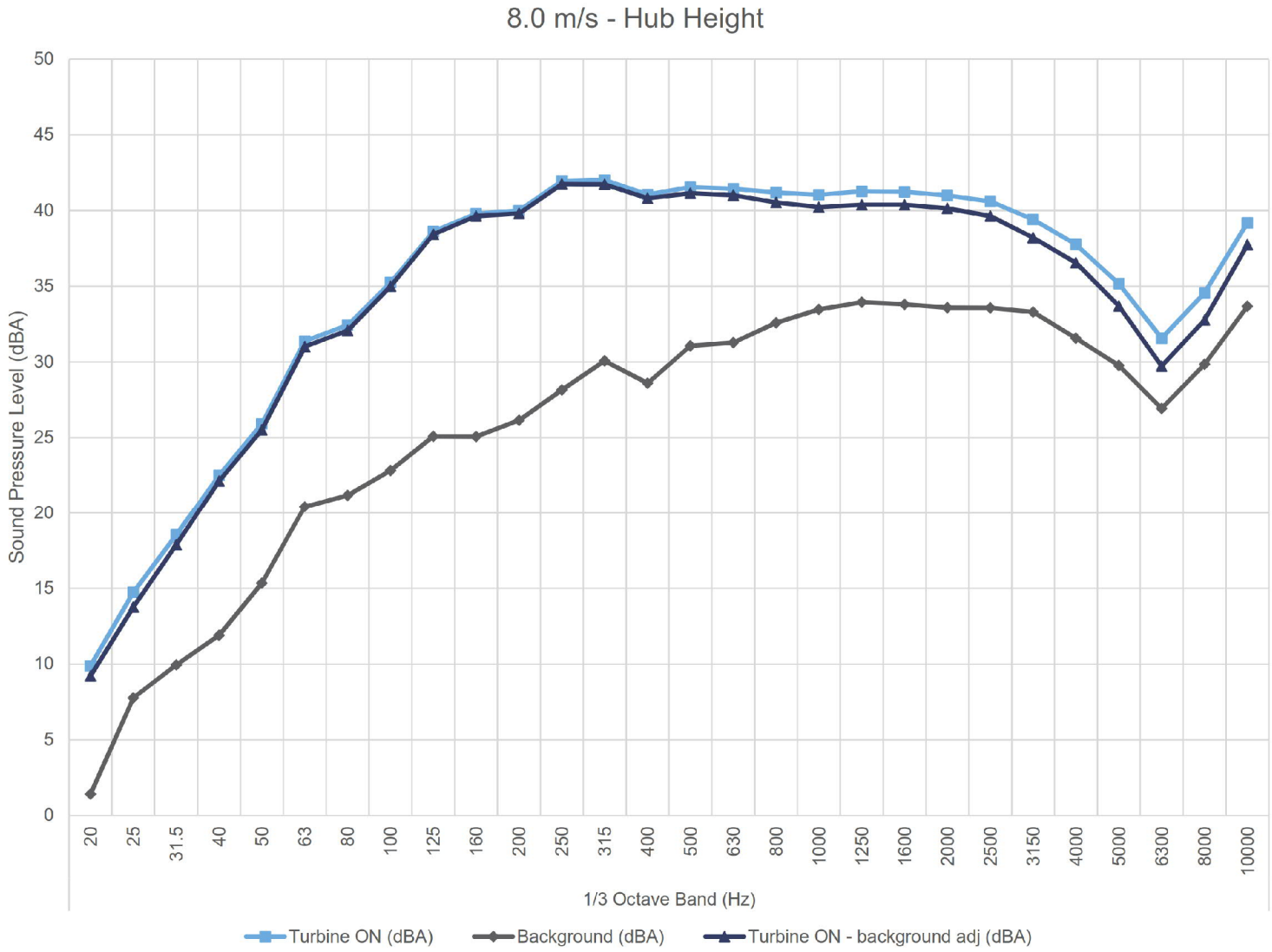
Scale: NTS Drawn by: AM Reviewed by: PA Date: Sept 15, 2017 Revision: 1	Cedar Point Wind Power Project - Turbine CP226 - IEC61400-11 Edition 3.0
	Figure Title Plot of sound pressure spectrum in 1/3 Octave at 7.5 m/s

Figure C.06



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Scale: NTS Drawn by: AM Reviewed by: PA Date: Sept 15, 2017 Revision: 1	Cedar Point Wind Power Project - Turbine CP226 - IEC61400-11 Edition 3.0
	Figure Title Plot of sound pressure spectrum in 1/3 Octave at 8 m/s

Figure C.07

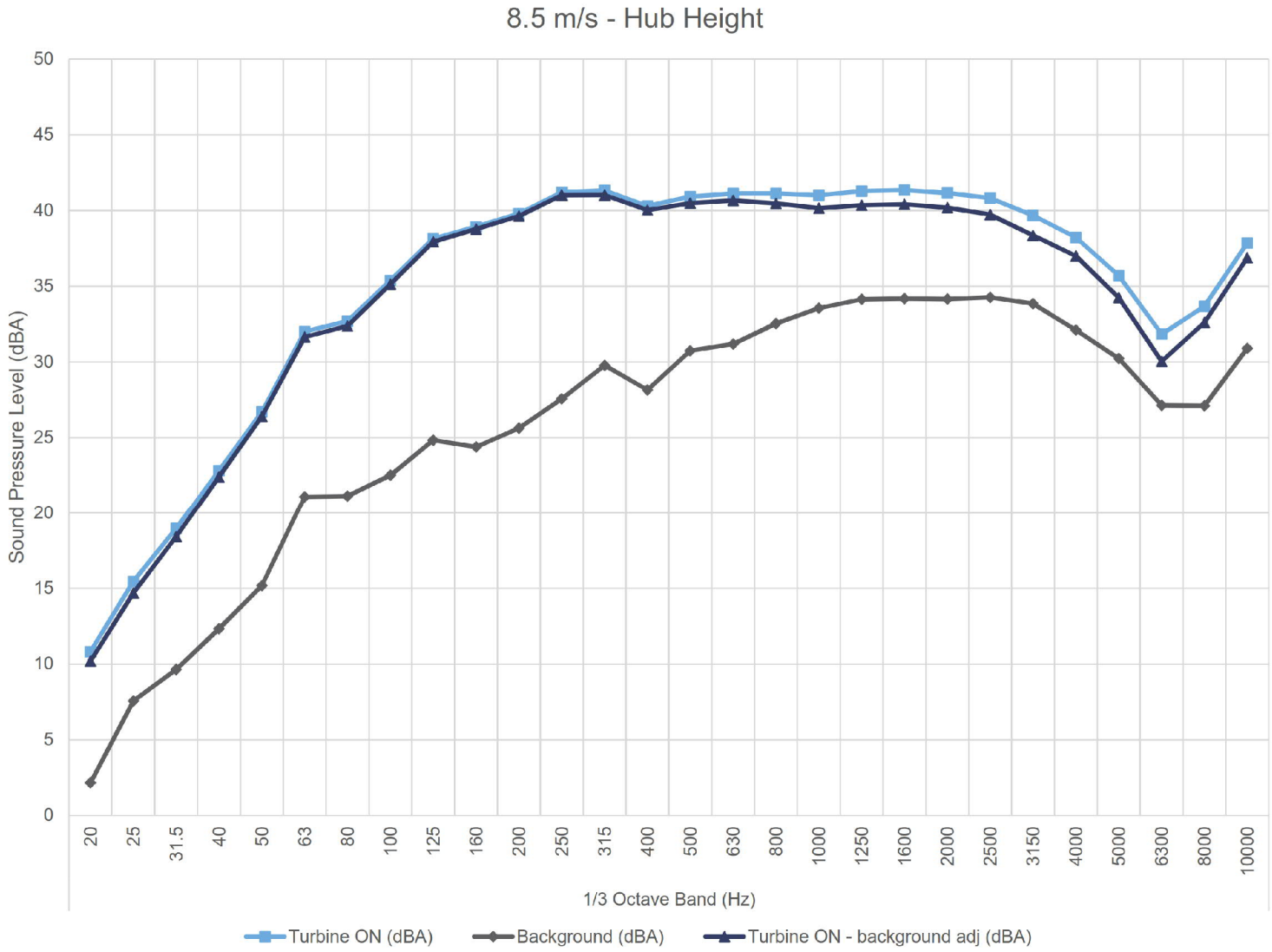

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	Figure Title Plot of sound pressure spectrum in 1/3 Octave at 8.5 m/s

Figure C.08

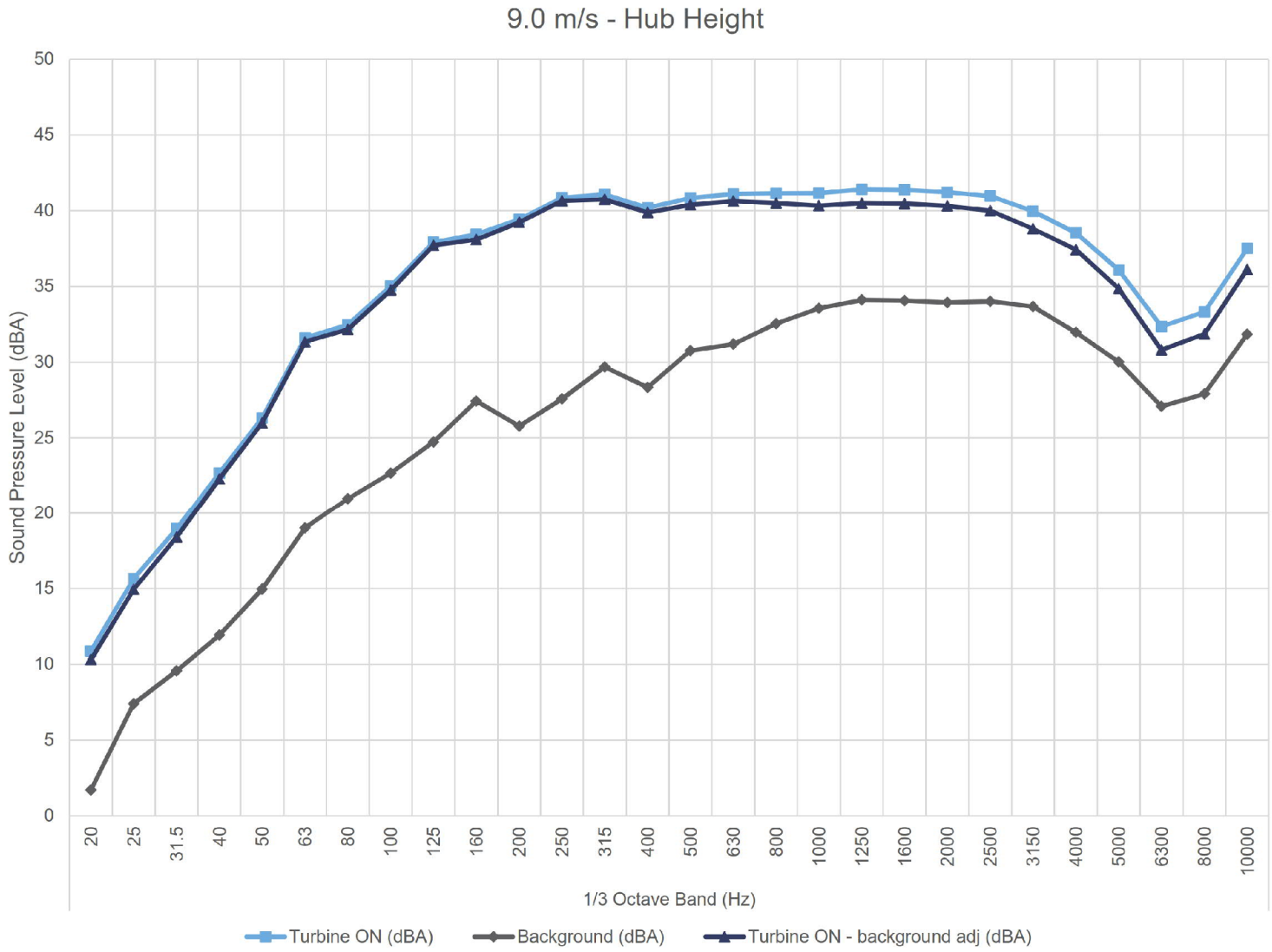

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	Figure Title Plot of sound pressure spectrum in 1/3 Octave at 9 m/s

Figure C.09

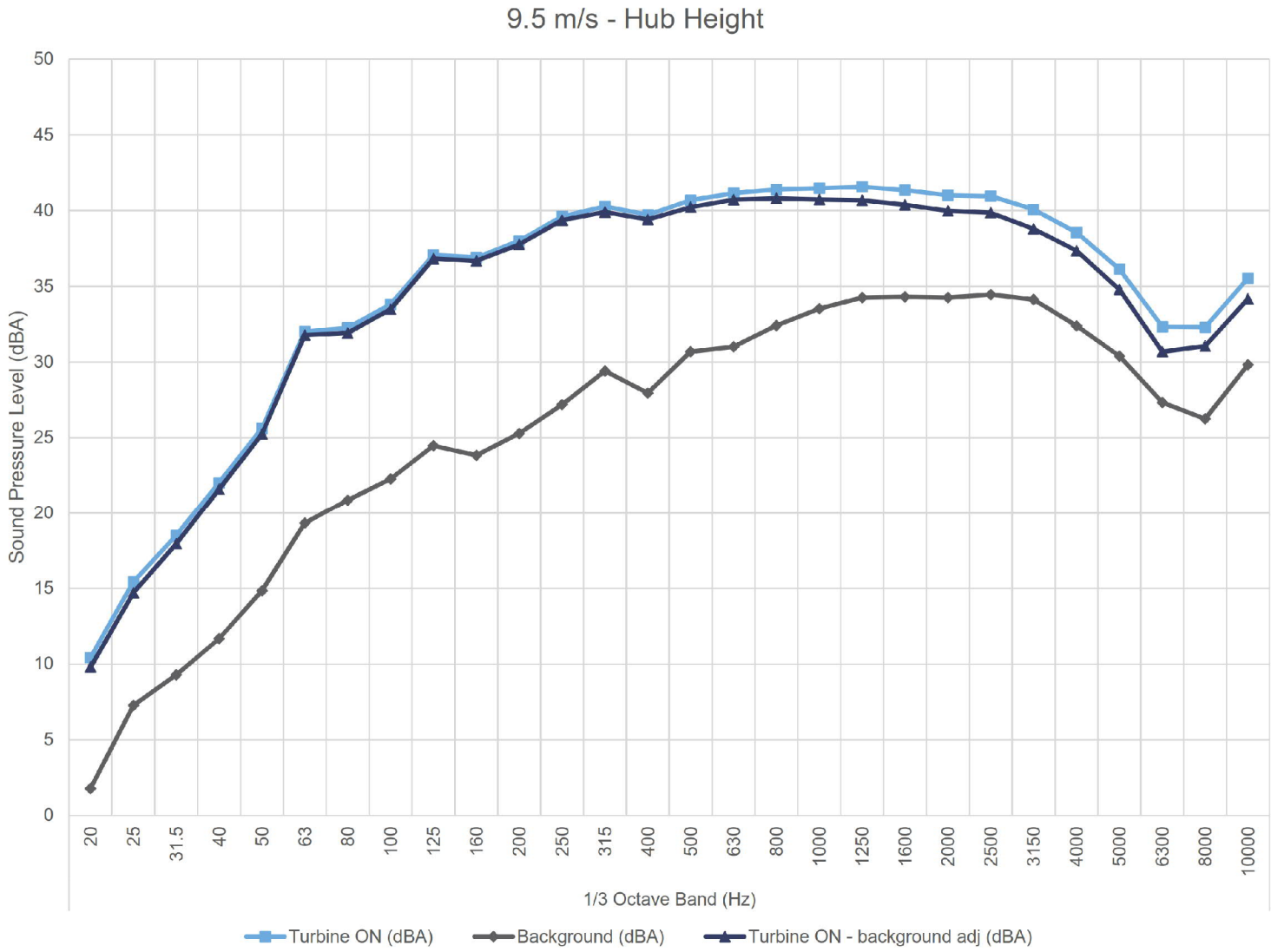

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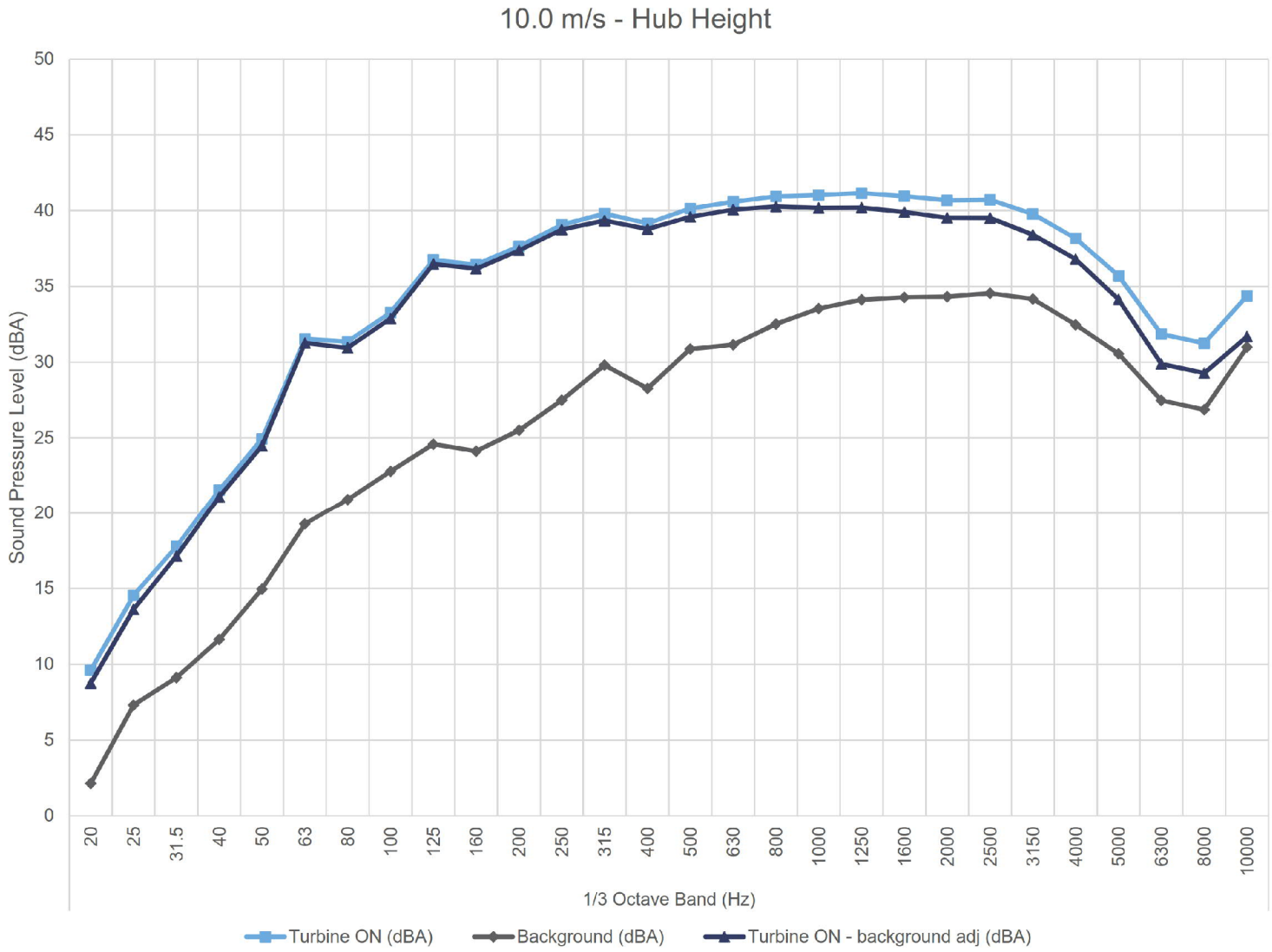
	Figure Title Plot of sound pressure spectrum in 1/3 Octave at 9.5 m/s

Figure C.10



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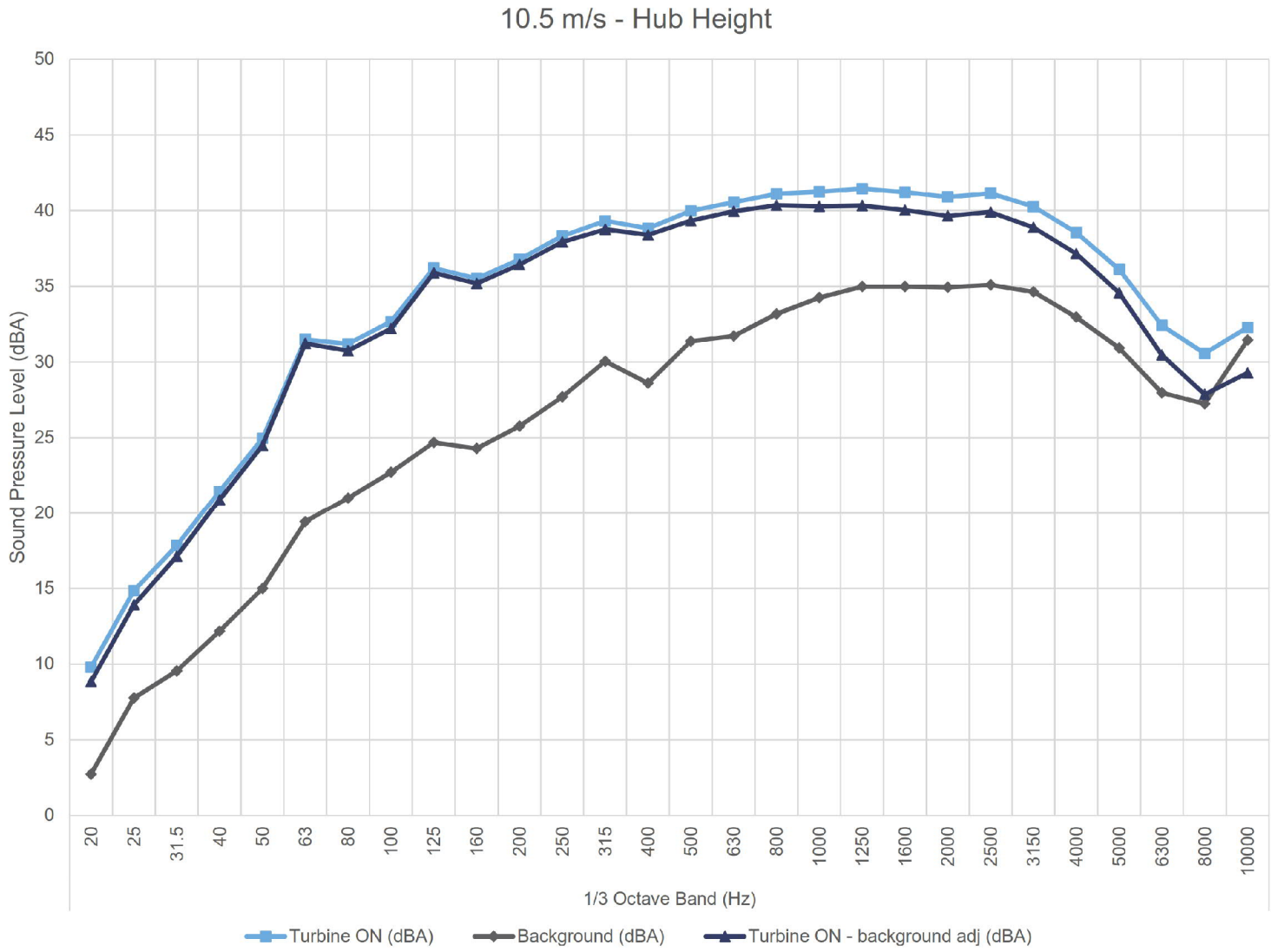
15039.00.T226.RP3	**Project Name**
Scale: NTS Drawn by: AM Reviewed by: PA Date: Sept 15, 2017 Revision: 1	Cedar Point Wind Power Project - Turbine CP226 - IEC61400-11 Edition 3.0
	Figure Title Plot of sound pressure spectrum in 1/3 Octave at 10 m/s

Figure C.11



aercoustics	15039.00.T226.RP3 Scale: NTS Drawn by: AM Reviewed by: PA Date: Sept 15, 2017 Revision: 1	**Project Name** Cedar Point Wind Power Project - Turbine CP226 - IEC61400-11 Edition 3.0 **Figure Title** Plot of sound pressure spectrum in 1/3 Octave at 10.5 m/s

Figure C.12

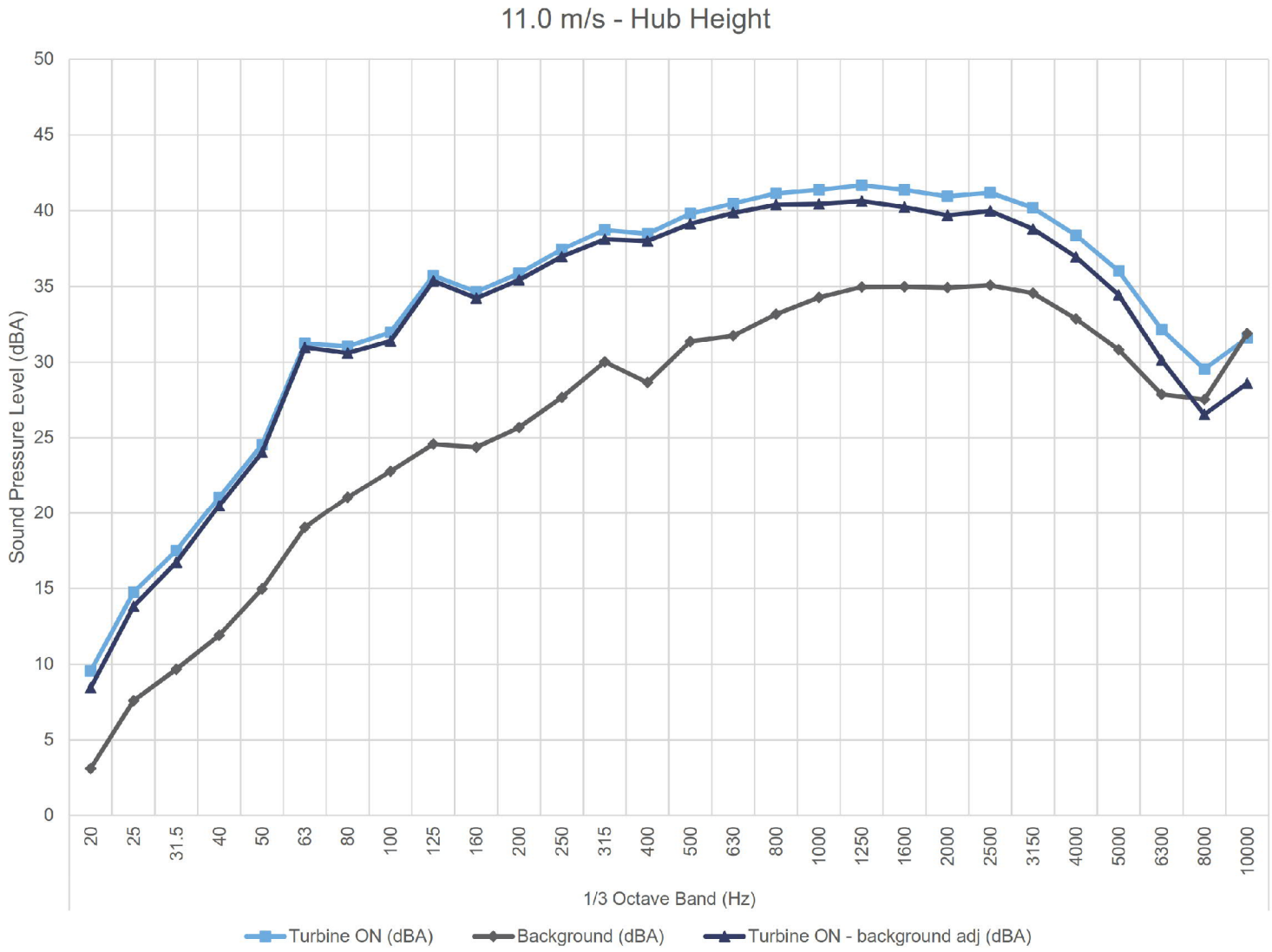


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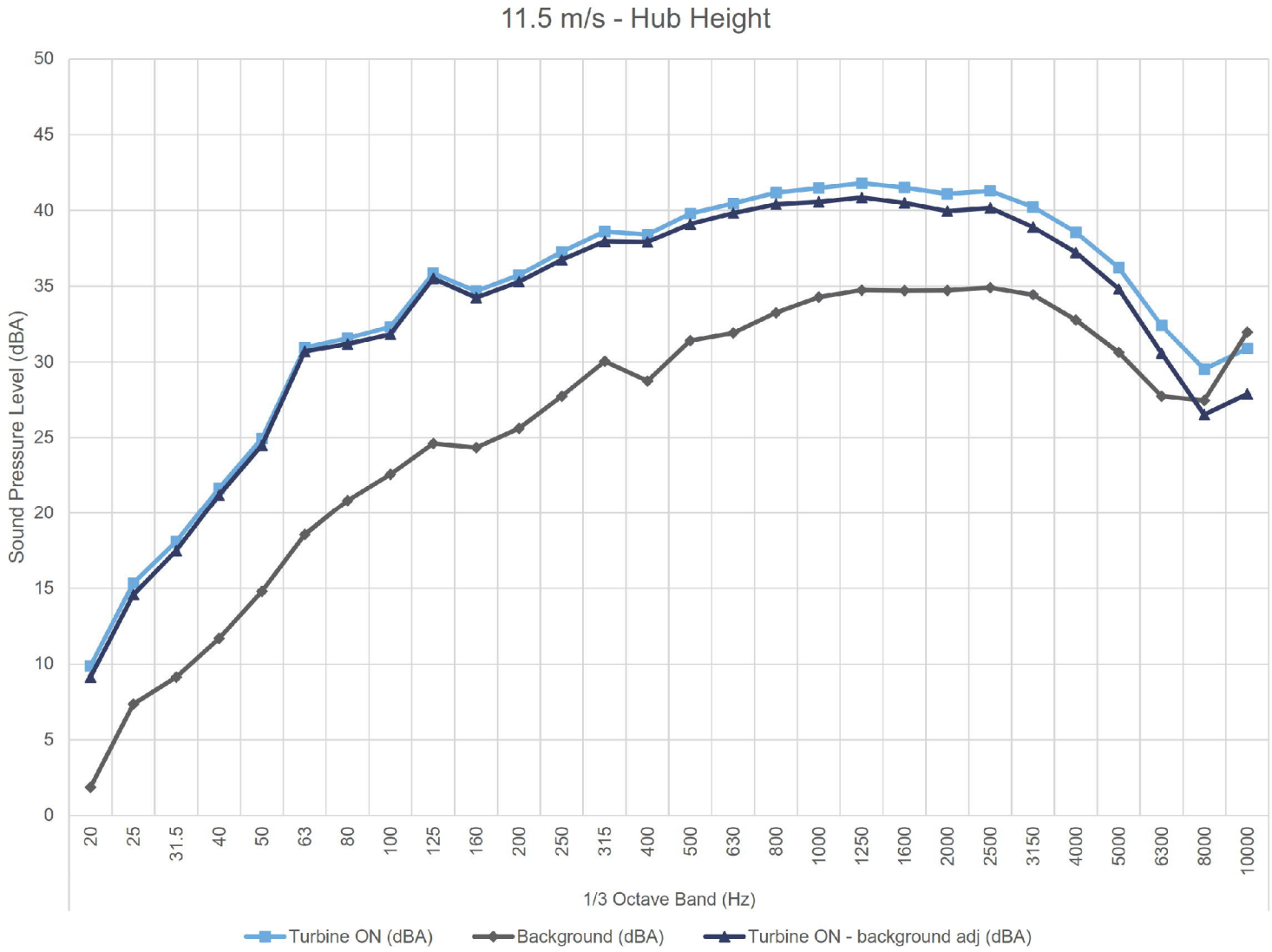
	Figure Title Plot of sound pressure spectrum in 1/3 Octave at 11 m/s

Figure C.13



aercoustics

15039.00.T226.RP3	**Project Name**
Scale: NTS Drawn by: AM Reviewed by: PA Date: Sept 15, 2017 Revision: 1	Cedar Point Wind Power Project - Turbine CP226 - IEC61400-11 Edition 3.0
	Figure Title Plot of sound pressure spectrum in 1/3 Octave at 11.5 m/s

Figure C.14

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

Project: Cedar Point Wind Power Project - Turbine CP226 - IEC 61400-11 Measurement

Report ID: 15039.00.T226.RP3

Created on: 9/14/2017

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	
7.0	Turbine ON (dBA)	8.7	13.1	17.0	20.9	24.6	30.6	30.6	34.0	37.5	37.4	38.5	39.8	40.3	39.2	39.6	39.4	39.1	39.0	39.6	39.5	39.1	38.6	38.8	36.1	33.3	30.0	34.4	39.1	51.6
	Background (dBA)	2.5	8.2	10.3	12.8	17.2	20.6	22.3	22.7	25.3	25.9	25.9	28.1	30.0	28.1	30.7	30.8	32.1	33.1	33.7	33.8	33.7	33.7	33.4	31.7	30.0	27.1	30.0	34.1	44.5
	Turbine ON - background adj (dBA)	7.4	11.4	15.9	20.2	23.7	30.2	30.0	33.6	37.2	37.0	38.3	39.5	39.9	38.8	39.0	38.8	38.2	37.8	38.3	38.1	37.6	36.9	37.2	34.1	30.6	[27]	32.4	37.4	50.7
	Signal to noise (dB)	6.1	4.9	6.7	8.1	7.4	10.0	8.4	11.3	12.2	11.4	12.6	11.7	10.3	11.1	9.0	8.6	7.0	5.9	5.9	5.6	5.4	4.9	5.3	4.4	3.3	2.9	4.3	5.0	7.1
	Uncertainty (dB)	1.4	1.6	1.1	1.0	1.0	0.9	0.9	0.9	0.9	0.8	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.9	0.9	0.9	1.0	1.2	1.3	1.3	1.6	1.8	1.5	2.2	1.0
	PWL (dBA)	58.0	62.0	66.5	70.8	74.2	80.7	80.5	84.2	87.8	87.6	88.9	90.1	90.4	89.4	89.6	89.3	88.7	88.3	88.8	88.6	88.2	87.5	87.8	84.7	81.2	[77.6]	82.9	88.0	101.2
7.5	Turbine ON (dBA)	11.0	15.4	19.7	23.5	26.9	31.6	33.1	35.9	39.3	39.1	40.1	41.9	41.8	40.8	41.4	41.3	41.0	40.8	41.1	41.0	40.6	40.1	39.0	37.3	34.7	31.3	35.3	40.3	53.2
	Background (dBA)	2.1	7.7	9.7	12.4	16.6	19.6	21.2	22.6	24.8	24.3	25.6	27.7	29.8	28.4	31.1	31.5	32.9	34.0	34.6	34.8	34.8	35.0	34.7	33.0	31.1	28.0	27.7	31.4	45.0
	Turbine ON - background adj (dBA)	10.4	14.6	19.3	23.1	26.4	31.3	32.8	35.7	39.1	39.0	39.9	41.7	41.6	40.6	41.0	40.8	40.3	39.8	40.0	39.8	39.3	38.6	37.0	35.2	32.1	28.7	34.5	39.6	52.5
	Signal to noise (dB)	8.9	7.7	10.1	11.0	10.2	12.0	11.9	13.4	14.5	14.9	14.4	14.2	12.0	12.5	10.4	9.8	8.1	6.9	6.4	6.2	5.8	5.2	4.3	4.3	3.6	3.4	7.6	8.8	8.2
	Uncertainty (dB)	1.2	1.3	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.9	0.9	1.0	1.0	1.2	1.4	1.4	1.6	1.7	1.1	1.8	0.9
	PWL (dBA)	61.0	65.2	69.9	73.7	77.0	81.9	83.4	86.3	89.7	89.6	90.5	92.3	92.1	91.1	91.6	91.4	90.8	90.4	90.5	90.4	89.8	89.1	87.6	85.8	82.7	79.2	85.0	90.2	103.0
8.0	Turbine ON (dBA)	9.9	14.7	18.5	22.5	25.9	31.4	32.4	35.2	38.6	39.8	40.0	41.9	42.0	41.1	41.6	41.4	41.2	41.1	41.3	41.2	41.0	40.6	39.4	37.8	35.2	31.6	34.6	39.2	53.3
	Background (dBA)	1.4	7.8	10.0	11.9	15.3	20.4	21.2	22.8	25.1	25.1	26.2	28.2	30.1	28.6	31.1	31.3	32.6	33.5	33.9	33.8	33.6	33.6	33.3	31.6	29.8	26.9	29.9	33.7	44.5
	Turbine ON - background adj (dBA)	9.2	13.8	17.9	22.1	25.5	31.0	32.1	35.0	38.4	39.6	39.8	41.7	41.7	40.8	41.1	41.0	40.5	40.2	40.4	40.4	40.1	39.6	38.2	36.6	33.7	29.7	32.8	37.7	52.7
	Signal to noise (dB)	8.5	7.0	8.6	10.6	10.6	10.9	11.2	12.4	13.5	14.7	13.8	13.8	11.9	12.5	10.5	10.2	8.6	7.6	7.3	7.4	7.4	7.0	6.1	6.2	5.4	4.6	4.7	5.5	8.8
	Uncertainty (dB)	1.3	1.4	1.0	1.0	1.0	0.9	0.9	0.9	0.9	0.9	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.9	0.9	0.9	1.0	1.1	1.1	1.2	1.3	1.6	2.3	0.9
	PWL (dBA)	59.8	64.3	68.4	72.7	76.1	81.6	82.6	85.5	89.0	90.2	90.4	92.3	92.3	91.4	91.7	91.6	91.1	90.8	90.9	90.9	90.7	90.2	88.8	87.1	84.3	80.3	83.3	88.3	103.2
8.5	Turbine ON (dBA)	10.8	15.5	19.0	22.8	26.7	32.0	32.7	35.4	38.1	38.9	39.8	41.2	41.3	40.3	40.9	41.1	41.1	41.0	41.3	41.3	41.2	40.8	39.7	38.2	35.7	31.8	33.7	37.9	53.1
	Background (dBA)	2.2	7.6	9.7	12.3	15.2	21.1	21.1	22.5	24.8	24.4	25.6	27.6	29.8	28.2	30.7	31.2	32.5	33.6	34.1	34.2	34.2	34.3	33.9	32.1	30.2	27.1	27.1	30.9	44.5
	Turbine ON - background adj (dBA)	10.2	14.7	18.4	22.4	26.4	31.7	32.4	35.1	37.9	38.8	39.6	41.0	41.0	40.0	40.5	40.7	40.5	40.2	40.3	40.4	40.2	39.7	38.4	37.0	34.3	30.0	32.6	36.9	52.4
	Signal to noise (dB)	8.7	7.9	9.3	10.5	11.5	10.9	11.6	12.9	13.3	14.5	14.2	13.6	11.6	12.1	10.2	9.9	8.6	7.5	7.1	7.2	7.0	6.5	5.8	6.1	5.5	4.7	6.6	7.0	8.6
	Uncertainty (dB)	1.2	1.2	0.9	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	0.9	0.9	1.0	1.1	1.1	1.1	1.3	1.3	2.0	0.9
	PWL (dBA)	60.7	65.2	69.0	73.0	77.0	82.2	82.9	85.7	88.5	89.3	90.2	91.6	91.6	90.6	91.0	91.2	91.0	90.7	90.9	91.0	90.7	90.3	88.9	87.6	84.8	80.6	83.1	87.4	103.0
9.0	Turbine ON (dBA)	10.9	15.6	18.9	22.7	26.3	31.6	32.5	35.0	37.9	38.4	39.4	40.9	41.1	40.2	40.8	41.1	41.1	41.2	41.4	41.4	41.2	41.0	40.0	38.5	36.1	32.3	33.3	37.5	53.0
	Background (dBA)	1.7	7.4	9.6	11.9	15.0	19.0	21.0	22.7	24.7	27.4	25.8	27.6	29.7	28.3	30.8	31.2	32.5	33.6	34.1	34.1	33.9	34.0	33.7	32.0	30.0	27.1	27.9	31.8	44.5
	Turbine ON - background adj (dBA)	10.3	14.9	18.4	22.3	26.0	31.4	32.2	34.8	37.7	38.1	39.2	40.6	40.7	39.9	40.4	40.6	40.5	40.3	40.5	40.5	40.3	40.0	38.8	37.4	34.9	30.8	31.9	36.1	52.3
	Signal to noise (dB)	9.2	8.3	9.4	10.8	11.4	12.6	11.5	12.4	13.2	11.0	13.7	13.3	11.4	11.8	10.1	9.9	8.6	7.6	7.3	7.3	7.3	7.0	6.3	6.5	6.1	5.3	5.4	5.7	8.5
	Uncertainty (dB)	1.2	1.2	1.0	0.9	0.9	0.8	0.9	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	1.0	1.0	1.0	1.0	1.1	1.4	2.3	0.8
	PWL (dBA)	60.9	65.5	69.0	72.8	76.5	81.9	82.7	85.3	88.3	88.6	89.8	91.2	91.3	90.4	90.9	91.2	91.1	90.9	91.1	91.0	90.9	90.5	89.4	88.0	85.4	81.4	82.4	86.7	102.9
9.5	Turbine ON (dBA)	10.4	15.4	18.5	22.0	25.6	32.0	32.3	33.8	37.1	36.9	38.0	39.6	40.3	39.7	40.7	41.2	41.4	41.5	41.6	41.3	41.0	41.0	40.1	38.6	36.1	32.3	32.3	35.5	52.7
	Background (dBA)	1.8	7.3	9.3	11.7	14.9	19.3	20.9	22.3	24.5	23.8	25.3	27.2	29.4	28.0	30.7	31.0	32.4	33.5	34.2	34.3	34.3	34.5	34.1	32.4	30.4	27.3	26.3	29.8	44.5
	Turbine ON - background adj (dBA)	9.8	14.7	18.0	21.6	25.3	31.8	31.9	33.5	36.8	36.7	37.8	39.4	39.9	39.4	40.2	40.7	40.8	40.7	40.7	40.4	40.0	39.9	38.8	37.4	34.8	30.7	31.1	34.2	52.0
	Signal to noise (dB)	8.7	8.2	9.2	10.3	10.8	12.7	11.4	11.5	12.6	13.1	12.7	12.4	10.9	11.8	10.0	10.1	9.0	8.0	7.3	7.0	6.8	6.5	5.9	6.2	5.7	5.0	6.0	5.7	8.2
	Uncertainty (dB)	1.2	1.3	1.0	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.9	0.9	0.9	1.1	1.1	1.1	1.2	1.3	1.4	2.4	0.9
	PWL (dBA)	60.4	65.3	68.5	72.2	75.8	82.3	82.5	84.0	87.4	87.2	88.3	89.9	90.5	90.0	90.8	91.3	91.4	91.3	91.2	90.9	90.5	90.4	89.4	87.9	85.3	81.2	81.6	84.7	102.5
10.0	Turbine ON (dBA)	9.6	14.5	17.8	21.6	24.9	31.5	31.4	33.3	36.8	36.4	37.6	39.1	39.8	39.2	40.1	40.6	41.0	41.0	41.2	41.0	40.7	40.7	39.8	38.2	35.7	31.9	31.2	34.4	52.2
	Background (dBA)	2.1	7.3	9.1	11.6	15.0	19.3	20.9	22.8	24.6	24.1	25.5	27.5	29.8	28.3	30.9	31.2	32.5	33.5	34.1	34.3	34.3	34.5	34.2	32.5	30.5	27.5	26.9	31.0	44.6
	Turbine ON - background adj (dBA)	8.8	13.6	17.1	21.1	24.5	31.3	31.0	32.9	36.5	36.2	37.4	38.8	39.3	38.8	39.6	40.1	40.3	40.2	40.2	39.9	39.5	39.5	38.4	36.8	34.1	29.9	29.3	31.7	51.4
	Signal to noise (dB)	7.5	7.2	8.7	9.9	10.0	12.3	10.4	10.5	12.2	12.3	12.1	11.6	10.0	10.9	9.3	9.4	8.4	7.5	7.0	6.7	6.4	6.2	5.6	5.7	5.2	4.4	4.4	3.4	7.7
	Uncertainty (dB)	1.3	1.3	1.0	0.9	0.9	0.8	0.9	0.9	0.8	0.9	0.7	0.7	0.8	0.7	0.8	0.8	0.8	0.8	0.9	0.9	0.9	1.1	1.1	1.1	1.2	1.3	1.5	3.0	0.9
	PWL (dBA)	59.3	64.2	67.7	71.6	75.0	81.8	81.5	83.4	87.0	86.7	87.9	89.3	89.9	89.3	90.2	90.6	90.8	90.7	90.7	90.5	90.1	90.1	89.0	87.4	84.7	80.4	79.8	82.3	102.0
10.5	Turbine ON (dBA)	9.8	14.9	17.8	21.4	25.0	31.5	31.2	32.7	36.2	35.5	36.8	38.3	39.3	38.8	40.0	40.6	41.1	41.3	41.4	41.2	40.9	41.1	40.3	38.6	36.1	32.4	30.6	32.3	52.2
	Background (dBA)	2.7	7.8	9.6	12.2	15.0	19.4	21.0	22.7	24.7	24.3	25.8	27.7	30.1	28.6	31.4	31.7	33.2	34.3	35.0	35.0	34.9	35.1	34.6	33.0	30.9	28.0	27.2	31.5	45.1
	Turbine ON - background adj (dBA)	8.8	13.9	17.1	20.9	24.5	31.2	30.8	32.2	35.9	35.2	36.4	37.9	38.8	38.4	39.3	40.0	40.4	40.3	40.3	40.0	39.6	39.9	38.9	37.2	34.6	30.5	27.9	[29.3]	51.3
	Signal to noise (dB)	7.1	7.1	8.3	9.3	10.0	12.1	10.2	9.9	11.5	11.2	11.0	10.6	9.3	10.2	8.6	8.8	7.9	7.0	6.5	6.2	6.0	6.0	5.6	5.6	5.2	4.4	3.3	0.8	7.1
	Uncertainty (dB)	1.3	1.3	1.0	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.9	0.9	1.0	1.1	1.1	1.2	1.2	1.4	1.8	3.3	0.9
	PWL (dBA)	59.4	64.5	67.7	71.5	75.1	81.8	81.3	82.8	86.4	85.7	87.0	88.5	89.3	88.9	89.9	90.5	90.9	90.8	90.9	90.6	90.2	90.4	89.4	87.7	85.1	81.0	78.4	[79.9]	101.9

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

Project: Cedar Point Wind Power Project - Turbine CP226 - IEC 61400-11 Measurement

Report ID: 15039.00.T226.RP3

Created on: 9/14/2017

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	
11.0	Turbine ON (dBA)	9.6	14.7	17.5	21.0	24.6	31.2	31.0	32.0	35.7	34.7	35.9	37.4	38.7	38.5	39.8	40.5	41.1	41.4	41.7	41.4	40.9	41.2	40.2	38.4	36.0	32.1	29.5	31.6	52.1
	Background (dBA)	3.1	7.6	9.7	11.9	15.0	19.0	21.0	22.8	24.6	24.4	25.7	27.7	30.0	28.6	31.4	31.7	33.2	34.3	35.0	35.0	34.9	35.1	34.5	32.9	30.8	27.9	27.5	31.9	45.1
	Turbine ON - background adj (dBA)	8.4	13.8	16.7	20.5	24.0	31.0	30.6	31.4	35.4	34.2	35.4	37.0	38.1	38.0	39.1	39.8	40.4	40.4	40.6	40.2	39.7	40.0	38.8	36.9	34.4	30.1	[26.5]	[28.6]	51.1
	Signal to noise (dB)	6.5	7.2	7.8	9.1	9.6	12.2	10.0	9.2	11.1	10.3	10.2	9.8	8.7	9.8	8.5	8.7	8.0	7.1	6.7	6.4	6.0	6.1	5.6	5.5	5.2	4.3	2.0	-0.3	7.0
	Uncertainty (dB)	1.4	1.3	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.9	0.9	0.9	1.1	1.1	1.2	1.2	1.4	1.8	3.2	0.9
	PWL (dBA)	59.0	64.4	67.3	71.0	74.6	81.5	81.1	82.0	85.9	84.8	86.0	87.5	88.7	88.6	89.7	90.4	90.9	91.0	91.2	90.8	90.3	90.5	89.3	87.5	85.0	80.7	[77.1]	[79.2]	101.7
11.5	Turbine ON (dBA)	9.9	15.3	18.1	21.7	24.9	31.0	31.6	32.3	35.9	34.7	35.7	37.3	38.6	38.4	39.8	40.5	41.2	41.5	41.8	41.5	41.1	41.3	40.2	38.6	36.2	32.4	29.5	30.9	52.2
	Background (dBA)	1.9	7.4	9.1	11.7	14.8	18.6	20.8	22.6	24.6	24.3	25.6	27.7	30.0	28.8	31.4	31.9	33.3	34.3	34.7	34.7	34.7	34.9	34.4	32.8	30.6	27.7	27.5	32.0	45.1
	Turbine ON - background adj (dBA)	9.1	14.6	17.5	21.2	24.5	30.7	31.2	31.8	35.5	34.3	35.3	36.7	38.0	37.9	39.1	39.8	40.4	40.6	40.9	40.5	40.0	40.2	38.9	37.2	34.8	30.6	[26.5]	[27.9]	51.3
	Signal to noise (dB)	8.0	8.0	8.9	10.0	10.1	12.4	10.7	9.7	11.2	10.3	10.1	9.5	8.6	9.7	8.4	8.6	7.9	7.2	7.1	6.8	6.4	6.4	5.8	5.8	5.6	4.7	2.1	-1.1	7.1
	Uncertainty (dB)	1.3	1.3	1.0	1.0	1.0	0.9	0.9	0.9	0.9	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.9	0.9	1.0	1.1	1.2	1.2	1.2	1.4	1.9	3.3	0.9
	PWL (dBA)	59.7	65.1	68.0	71.8	75.1	81.2	81.7	82.4	86.1	84.8	85.9	87.3	88.5	88.5	89.7	90.4	91.0	91.1	91.4	91.1	90.5	90.7	89.5	87.8	85.4	81.1	[77.1]	[78.4]	101.8

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

Project: Cedar Point Wind Power Project - Turbine CP226 - IEC 61400-11 Measurement

Report ID: 15039.00.T226.RP3

Created on: 9/19/2017

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	
4.0	Turbine ON (dBA)	5.1	9.7	13.7	17.7	24.4	30.6	27.8	30.7	33.0	34.2	34.6	35.9	36.3	34.7	35.6	35.4	35.6	36.1	36.5	36.3	35.8	35.3	34.3	33.2	31.0	28.6	35.2	39.3	48.5
	Background (dBA)	1.1	7.3	9.0	11.1	14.6	19.0	21.0	22.7	25.1	26.6	26.0	27.8	29.8	28.1	30.5	30.7	31.9	33.0	33.7	33.9	33.9	34.0	33.7	32.0	30.3	27.4	28.6	32.4	44.4
	Turbine ON - background adj (dBA)	2.9	[6.7]	11.9	16.6	23.9	30.2	26.8	30.0	32.2	33.4	33.9	35.2	35.2	33.6	34.0	33.7	33.2	33.1	[33.5]	[33.3]	[32.8]	[32.3]	[31.3]	[30.2]	[28]	[25.6]	34.1	38.3	46.8*
	Signal to noise (dB)	4.0	2.4	4.6	6.6	9.8	11.5	6.8	8.0	7.9	7.6	8.5	8.1	6.5	6.6	5.1	4.8	3.7	3.0	2.8	2.4	1.8	1.3	0.5	1.2	0.7	1.3	6.6	6.9	4.1
	Uncertainty (dB)	2.0	2.5	1.5	1.2	1.0	1.0	1.2	1.1	1.1	1.1	0.9	0.9	1.0	1.0	1.2	1.2	1.5	1.7	1.7	1.7	1.7	2.0	2.0	2.0	2.0	2.0	1.2	2.0	1.4
	PWL (dBA)	53.5	[57.3]	62.4	67.1	74.5	80.8	77.3	80.5	82.8	83.9	84.5	85.7	85.8	84.2	84.5	84.2	83.8	83.6	[84]	[83.9]	[83.3]	[82.8]	[81.8]	[80.8]	[78.6]	[76.2]	84.7	88.8	97.3*
5.0	Turbine ON (dBA)	9.6	14.1	18.2	22.0	25.6	31.1	31.7	34.8	38.0	38.1	39.1	40.7	40.8	39.7	40.3	40.1	39.9	39.7	40.1	40.1	39.7	39.2	38.5	36.5	33.9	30.6	34.8	39.6	52.2
	Background (dBA)	2.1	7.8	9.9	12.5	16.8	20.2	21.7	22.6	25.0	25.1	25.8	28.0	30.0	28.1	30.8	31.0	32.4	33.4	34.0	34.0	34.0	34.0	33.7	32.0	30.2	27.3	29.7	33.3	44.6
	Turbine ON - background adj (dBA)	8.7	13.0	17.5	21.4	25.0	30.8	31.2	34.5	37.7	37.8	38.9	40.4	40.5	39.4	39.8	39.6	39.0	38.6	39.0	38.8	38.3	37.7	36.8	34.6	31.5	27.9	33.3	38.4	51.4
	Signal to noise (dB)	7.5	6.4	8.3	9.4	8.8	11.0	10.0	12.1	12.9	12.9	13.3	12.7	10.9	11.6	9.5	9.1	7.5	6.4	6.2	6.0	5.7	5.2	4.8	4.5	3.7	3.3	5.1	6.3	7.6
	Uncertainty (dB)	1.3	1.4	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.7	0.7	0.8	0.8	0.8	0.8	0.9	0.9	0.9	0.9	1.0	1.2	1.3	1.3	1.5	1.6	1.2	1.9	0.9
	PWL (dBA)	59.3	63.5	68.0	72.0	75.6	81.3	81.8	85.1	88.3	88.4	89.4	91.0	91.0	90.0	90.3	90.1	89.6	89.2	89.5	89.4	88.9	88.2	87.3	85.2	82.0	78.4	83.8	89.0	101.9
6.0	Turbine ON (dBA)	10.7	15.4	18.9	22.7	26.4	31.7	32.6	35.2	38.2	39.0	39.7	41.2	41.4	40.4	41.0	41.2	41.1	41.1	41.3	41.3	41.1	40.8	39.7	38.3	35.8	32.0	33.7	38.0	53.1
	Background (dBA)	1.9	7.5	9.7	12.1	15.1	20.2	21.0	22.6	24.8	25.9	25.7	27.6	29.8	28.3	30.8	31.2	32.6	33.6	34.1	34.1	34.0	34.1	33.7	32.0	30.1	27.1	27.6	31.7	44.5
	Turbine ON - background adj (dBA)	10.1	14.7	18.3	22.3	26.1	31.4	32.2	34.9	38.0	38.8	39.5	41.0	41.0	40.1	40.6	40.7	40.5	40.2	40.4	40.4	40.2	39.8	38.5	37.1	34.4	30.3	32.5	36.8	52.4
	Signal to noise (dB)	8.9	7.9	9.2	10.6	11.3	11.5	11.5	12.6	13.4	13.1	13.9	13.6	11.6	12.1	10.2	9.9	8.6	7.5	7.2	7.2	7.1	6.7	6.0	6.3	5.7	4.9	6.1	6.3	8.6
	Uncertainty (dB)	1.2	1.2	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.9	0.7	0.7	0.8	0.7	0.8	0.8	0.8	0.9	0.9	0.9	0.9	1.0	1.1	1.1	1.1	1.3	1.2	2.1	0.9
	PWL (dBA)	60.7	65.2	68.9	72.9	76.6	81.9	82.8	85.5	88.5	89.3	90.1	91.6	91.6	90.7	91.1	91.3	91.0	90.8	90.9	91.0	90.8	90.3	89.0	87.7	85.0	80.9	83.0	87.4	103.0
7.0	Turbine ON (dBA)	9.9	14.9	18.0	21.7	25.2	31.7	31.6	33.3	36.7	36.3	37.5	39.0	39.8	39.2	40.3	40.8	41.1	41.2	41.4	41.2	40.9	40.9	40.0	38.4	35.9	32.2	31.4	34.2	52.4
	Background (dBA)	2.3	7.5	9.3	11.8	15.0	19.4	20.9	22.6	24.6	24.1	25.5	27.5	29.8	28.3	31.0	31.3	32.7	33.8	34.5	34.5	34.5	34.7	34.3	32.6	30.7	27.6	26.9	30.9	44.8
	Turbine ON - background adj (dBA)	9.0	14.0	17.4	21.2	24.7	31.4	31.2	32.9	36.4	36.0	37.2	38.7	39.3	38.9	39.7	40.2	40.5	40.4	40.4	40.1	39.7	39.8	38.7	37.0	34.4	30.3	29.5	31.5	51.6
	Signal to noise (dB)	7.6	7.4	8.7	9.8	10.2	12.3	10.6	10.6	12.1	12.2	11.9	11.5	10.0	10.9	9.3	9.5	8.4	7.5	6.9	6.6	6.3	6.2	5.7	5.7	5.3	4.5	4.5	3.3	7.6
	Uncertainty (dB)	1.2	1.3	0.9	0.9	0.9	0.8	0.9	0.9	0.8	0.9	0.7	0.7	0.8	0.7	0.8	0.8	0.8	0.8	0.9	0.9	0.9	1.1	1.1	1.1	1.2	1.3	1.4	3.0	0.9
	PWL (dBA)	59.6	64.5	67.9	71.7	75.3	82.0	81.7	83.4	87.0	86.6	87.8	89.2	89.9	89.4	90.3	90.8	91.0	90.9	90.9	90.7	90.3	90.3	89.2	87.6	85.0	80.8	80.1	82.1	102.1
8.0	Turbine ON (dBA)	9.8	15.1	17.8	21.3	24.7	31.2	31.2	32.1	35.7	34.6	35.7	37.3	38.6	38.4	39.8	40.5	41.2	41.5	41.9	41.6	41.2	41.4	40.4	38.7	36.3	32.5	29.7	31.4	52.2
	Background (dBA)	3.5	7.9	10.1	12.4	15.4	19.4	21.2	22.9	24.7	24.5	25.8	27.8	30.0	28.8	31.5	32.0	33.4	34.4	35.1	35.1	35.1	35.2	34.8	33.1	31.1	28.1	27.7	31.9	45.3
	Turbine ON - background adj (dBA)	8.6	14.1	17.0	20.7	24.2	30.9	30.8	31.5	35.4	34.1	35.2	36.8	37.9	37.9	39.1	39.8	40.4	40.5	40.8	40.5	40.0	40.2	38.9	37.2	34.7	30.5	[26.7]	[28.4]	51.2
	Signal to noise (dB)	6.3	7.2	7.7	8.8	9.3	11.7	10.0	9.2	11.0	10.1	9.9	9.5	8.5	9.5	8.3	8.5	7.8	7.1	6.8	6.5	6.1	6.2	5.6	5.5	5.2	4.4	2.0	-0.5	6.9
	Uncertainty (dB)	1.3	1.2	0.9	0.9	0.9	0.8	0.8	0.9	0.8	0.8	0.7	0.7	0.7	0.7	0.8	0.7	0.8	0.8	0.8	0.8	0.9	1.0	1.1	1.1	1.1	1.3	1.7	3.0	0.9
	PWL (dBA)	59.2	64.7	67.6	71.2	74.7	81.4	81.3	82.1	85.9	84.7	85.8	87.3	88.5	88.4	89.6	90.4	91.0	91.1	91.4	91.0	90.5	90.7	89.5	87.8	85.3	81.0	[77.3]	[79]	101.8
9.0	Turbine ON (dBA)	10.3	15.4	17.9	21.2	24.6	31.0	31.3	31.8	35.5	34.2	35.2	36.9	38.3	38.3	39.9	40.7	41.6	42.1	42.6	42.5	42.1	42.4	41.3	39.7	37.3	33.7	30.7	31.1	52.7
	Background (dBA)	1.9	7.9	9.7	12.0	15.2	20.5	21.7	23.2	25.4	25.0	26.3	28.1	29.9	29.4	31.7	32.4	33.9	35.0	35.5	35.5	35.5	35.6	35.2	33.5	31.5	28.4	28.0	31.5	45.7
	Turbine ON - background adj (dBA)	9.6	14.6	17.2	20.7	24.0	30.6	30.8	31.2	35.0	33.7	34.6	36.3	37.6	37.7	39.2	40.0	40.8	41.1	41.7	41.5	41.1	41.3	40.1	38.6	36.0	32.1	[27.7]	[28.1]	51.8
	Signal to noise (dB)	8.4	7.6	8.2	9.2	9.3	10.6	9.6	8.7	10.1	9.2	8.9	8.9	8.4	9.0	8.2	8.3	7.7	7.1	7.1	7.0	6.7	6.7	6.1	6.2	5.9	5.3	2.7	-0.3	7.1
	Uncertainty (dB)	1.0	1.0	0.8	0.8	0.8	0.7	0.8	0.8	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.7	0.8	0.9	0.9	0.9	1.0	1.6	2.7	0.7
	PWL (dBA)	60.1	65.1	67.7	71.2	74.6	81.2	81.4	81.8	85.6	84.2	85.1	86.9	88.2	88.3	89.7	90.5	91.4	91.7	92.3	92.1	91.7	91.9	90.7	89.1	86.6	82.7	[78.3]	[78.7]	102.4

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	1 dB
25	0.8 dB	1 dB
31.5	0.5 dB	0.8 dB
40	0.5 dB	0.8 dB
50	0.5 dB	0.8 dB
63	0.5 dB	0.8 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	0.7 dB
1250	0.3 dB	0.7 dB
1600	0.3 dB	0.7 dB
2000	0.3 dB	0.7 dB
2500	0.5 dB	0.8 dB
3150	0.5 dB	0.8 dB
4000	0.5 dB	0.8 dB
5000	0.5 dB	0.8 dB
6300	0.5 dB	0.8 dB
8000	0.5 dB	0.8 dB
10000	1.3 dB	1.4 dB

Table C.04 Detailed measurement uncertainty at hub height

Project: Cedar Point Wind Power Project - Turbine T226 - IEC 61400-11 Measurement

Report ID: 15039.00.T226.RP3

Created on: 11/6/2017

Wind Bin (m/s)	Parameter	Average Wind Speed (m/s)	# of data points	Parameter	1/3 Octave Band (Hz) 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	Overall
7.0	Turbine ON	7.04	35	Average (dBA)	8.8	13.2	17.1	21.1	24.6	30.6	30.7	34.0	37.7	37.5	38.7	40.0	40.5	39.3	39.8	39.5	39.2	39.1	39.7	39.6	39.2	38.7	39.0	36.2	33.4	30.1	34.3	39.1	51.7
				Uncertainty A (dB)	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.5	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.5	0.2	0.1	0.2	0.4	0.5		
				Uncertainty B (dB)	1.0	1.0	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	1.4		
				Combined Uncertainty (dB)	1.1	1.1	0.9	0.9	0.9	0.9	0.8	0.8	0.9	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.9	0.8	0.8	0.8	0.9	1.5		
	Background	7.08	37	Average (dBA)	2.7	8.3	10.4	13.1	17.6	20.9	22.5	22.7	25.4	26.2	26.0	28.1	30.0	28.1	30.6	30.8	32.1	33.1	33.7	33.8	33.7	33.7	33.5	31.7	29.9	27.1	30.1	34.1	44.5
				Uncertainty A (dB)	0.6	0.4	0.5	0.5	0.6	0.5	0.4	0.2	0.3	0.5	0.3	0.3	0.2	0.3	0.2	0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.5	0.6	0.5	0.5	0.9	1.0		
				Uncertainty B (dB)	1.0	1.0	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	1.4		
				Combined Uncertainty (dB)	1.2	1.1	0.9	0.9	1.0	1.0	0.9	0.8	0.8	1.0	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.9	1.0	1.0	1.0	1.0	0.9	1.2	1.8		
7.5	Turbine ON	7.50	38	Average (dBA)	11.0	15.5	19.8	23.5	26.9	31.6	33.1	35.9	39.3	39.2	40.1	41.9	41.8	40.8	41.4	41.3	41.0	40.8	41.1	41.0	40.6	40.2	39.0	37.3	34.7	31.3	35.3	40.3	53.2
				Uncertainty A (dB)	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.4	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.5	0.5		
				Uncertainty B (dB)	1.0	1.0	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	1.4		
				Combined Uncertainty (dB)	1.1	1.1	0.9	0.9	0.8	0.8	0.8	0.8	0.9	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.9	1.5		
	Background	7.47	37	Average (dBA)	2.2	7.7	9.7	12.5	16.7	19.6	21.2	22.6	24.7	24.2	25.6	27.7	29.8	28.3	31.1	31.5	33.0	34.0	34.7	34.9	34.9	35.1	34.8	33.1	31.2	28.0	27.6	31.3	45.1
				Uncertainty A (dB)	0.6	0.5	0.3	0.4	0.5	0.4	0.2	0.2	0.3	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.6	0.6	0.6	0.5	0.5	0.7		
				Uncertainty B (dB)	1.0	1.0	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	1.4		
				Combined Uncertainty (dB)	1.2	1.1	0.9	0.9	1.0	0.9	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.8	0.7	0.8	0.8	0.8	0.8	0.9	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.6		
8.0	Turbine ON	7.99	31	Average (dBA)	9.9	14.7	18.5	22.5	25.9	31.4	32.4	35.2	38.6	39.8	40.0	41.9	42.0	41.1	41.6	41.5	41.2	41.1	41.3	41.2	41.0	40.6	39.4	37.7	35.2	31.6	34.6	39.2	53.3
				Uncertainty A (dB)	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.4	0.3	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.6	0.8		
				Uncertainty B (dB)	1.0	1.0	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	1.4		
				Combined Uncertainty (dB)	1.1	1.1	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	1.0	1.6		
	Background	8.01	50	Average (dBA)	1.4	7.8	10.0	11.9	15.3	20.5	21.2	22.8	25.1	25.1	26.2	28.2	30.1	28.6	31.1	31.3	32.6	33.5	33.9	33.8	33.6	33.5	33.3	31.5	29.7	26.9	29.9	33.8	44.5
				Uncertainty A (dB)	0.5	0.4	0.3	0.3	0.3	0.4	0.2	0.2	0.2	0.3	0.3	0.3	0.2	0.3	0.2	0.3	0.3	0.3	0.4	0.5	0.5	0.6	0.6	0.6	0.5	0.5	0.8	0.8		
				Uncertainty B (dB)	1.0	1.0	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	1.4		
				Combined Uncertainty (dB)	1.1	1.1	0.9	0.8	0.9	0.9	0.8	0.8	0.8	0.9	0.8	0.7	0.7	0.7	0.8	0.7	0.7	0.7	0.8	0.8	0.8	0.9	1.0	1.0	1.0	1.0	1.1	1.7		
8.5	Turbine ON	8.53	43	Average (dBA)	10.9	15.5	19.0	22.8	26.8	32.1	32.7	35.4	38.1	38.9	39.8	41.2	41.3	40.3	40.9	41.1	41.1	41.0	41.3	41.4	41.2	40.8	39.7	38.3	35.7	31.9	33.6	37.8	53.0
				Uncertainty A (dB)	0.3	0.3	0.4	0.4	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.2	0.7	0.8		
				Uncertainty B (dB)	1.0	1.0	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	1.4		
				Combined Uncertainty (dB)	1.1	1.1	0.9	0.9	0.9	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	1.1	1.7		
	Background	8.54	61	Average (dBA)	2.2	7.6	9.6	12.4	15.2	21.1	21.1	22.5	24.8	24.3	25.6	27.5	29.8	28.1	30.7	31.2	32.5	33.6	34.2	34.2	34.2	34.3	33.9	32.2	30.3	27.2	26.9	30.7	44.5
				Uncertainty A (dB)	0.5	0.5	0.3	0.3	0.2	0.5	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.4	0.4	0.5	0.5	0.5	0.5	0.4	0.3	0.4		
				Uncertainty B (dB)	1.0	1.0	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	1.4		
				Combined Uncertainty (dB)	1.1	1.1	0.9	0.9	0.8	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	0.8	0.9	0.9	0.9	0.9	0.9	0.9	1.5		
9.0	Turbine ON	8.95	37	Average (dBA)	10.9	15.7	19.0	22.7	26.4	31.6	32.5	35.1	38.0	38.6	39.6	41.0	41.1	40.2	40.9	41.1	41.1	41.1	41.4	41.4	41.2	41.0	40.0	38.5	36.1	32.3	33.4	37.7	53.0
				Uncertainty A (dB)	0.4	0.4	0.5	0.4	0.4	0.3	0.3	0.3	0.2	0.3	0.2	0.3	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.2	0.2	0.2	0.2	0.7	1.0		
				Uncertainty B (dB)	1.0	1.0	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	1.4		
				Combined Uncertainty (dB)	1.1	1.1	0.9	0.9	0.9	0.9	0.9	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	1.0	1.8		
	Background	8.96	58	Average (dBA)	1.7	7.4	9.6	11.9	15.0	19.0	21.0	22.7	24.8	27.7	25.8	27.6	29.7	28.4	30.8	31.2	32.6	33.6	34.1	34.0	33.9	34.0	33.6	31.9	30.0	27.1	28.0	32.0	44.5
				Uncertainty A (dB)	0.5	0.4	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.6	0.3	0.2	0.2	0.2	0.2	0.3	0.2	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5		
				Uncertainty B (dB)	1.0	1.0	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	1.4		
				Combined Uncertainty (dB)	1.1	1.1	0.8	0.8	0.8	0.8	0.8	0.8	0.8	1.0	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.9	0.9	0.9	0.9	0.9	0.9	1.5		
9.5	Turbine ON	9.51	38	Average (dBA)	10.4	15.4	18.5	22.0	25.6	32.0	32.2	33.8	37.1	36.9	38.0	39.6	40.3	39.7	40.7	41.2	41.4	41.5	41.6	41.3	41.0	41.0	40.1	38.6	36.1	32.3	32.3	35.5	52.7
				Uncertainty A (dB)	0.4	0.3	0.4	0.4	0.3	0.2	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.2	0.2	0.2	0.6	0.9		
				Uncertainty B (dB)	1.0	1.0	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	1.4		
				Combined Uncertainty (dB)	1.1	1.1	0.9	0.9	0.9	0.8	0.9	0.9	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	1.0	1.7		
	Background	9.49	63	Average (dBA)	1.8	7.3	9.3	11.7	14.9	19.3	20.9	22.3	24.5	23.8	25.3	27.2	29.4	27.9	30.7	31.0	32.4	33.5	34.3	34.3	34.3	34.5	34.1	32.4	30.4	27.3	26.2	29.8	44.5
				Uncertainty A (dB)	0.4	0.3	0.3	0.2	0.2	0.3	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.4		
				Uncertainty B (dB)	1.0	1.0	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	1.4		
				Combined Uncertainty (dB)	1.1	1.1	0.8	0.8	0.8	0.8	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	0.9	0.9	0.9	0.9	0.9	0.9	1.5		
10.0	Turbine ON	9.97	49	Average (dBA)	9.6	14.5	17.8	21.6	24.9	31.5	31.4	33.3	36.8	36.5	37.7	39.1	39.8	39.2	40.2	40.6	40.9	41.0	41.1	40.9	40.7	40.7	39.8	38.1	35.7	31.8	31.3	34.5	52.2
				Uncertainty A (dB)	0.4	0.3	0.4	0.4	0.3	0.2	0.3	0.3	0.2	0.3	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.5	0.7		
				Uncertainty B (dB)	1.0	1.0	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	1.4		
				Combined Uncertainty (dB)	1.1	1.1	0.9	0.9	0.9	0.8	0.9	0.9	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.9	1.6		
	Background	10.03	59	Average (dBA)	2.2	7.3	9.1	11.6	15.0	19.3	20.9	22.8	24.6	24.2	25.5	27.5	29.8	28.3	30.9	31.2	32.5	33.5	34.1	34.3	34.3	34.6	34.2	32.5	30.6	27.5	26.9	31.1	44.6
				Uncertainty A (dB)	0.5	0.4	0.3	0.2	0.2	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.2	0.2	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.5	0.5	0.4	0.4	0.3	0.4		
				Uncertainty B (dB)	1.0	1.0	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	1.4		
				Combined Uncertainty (dB)	1.1	1.1	0.8	0.8	0.8	0.8	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	0.9	0.9	0.9	0.9	0.9	0.9	1.5		

Table C.04 Detailed measurement uncertainty at hub height

Project: Cedar Point Wind Power Project - Turbine T226 - IEC 61400-11 Measurement

Report ID: 15039.00.T226.RP3

Created on: 11/6/2017

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	
10.5	Turbine ON	10.52	51	Average (dBA)	9.8	14.9	17.8	21.4	25.0	31.5	31.2	32.6	36.2	35.5	36.8	38.3	39.3	38.8	40.0	40.6	41.1	41.3	41.5	41.2	40.9	41.2	40.3	38.6	36.1	32.4	30.6	32.2	52.2
				Uncertainty A (dB)	0.4	0.3	0.4	0.4	0.3	0.2	0.3	0.3	0.2	0.3	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.3	0.4	0.5		
				Uncertainty B (dB)	1.0	1.0	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	1.4		
				Combined Uncertainty (dB)	1.1	1.1	0.9	0.9	0.9	0.8	0.9	0.9	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.9	0.9	1.5		
	Background	10.48	53	Average (dBA)	2.7	7.8	9.6	12.2	15.0	19.4	21.0	22.7	24.7	24.3	25.8	27.7	30.1	28.6	31.4	31.7	33.2	34.3	35.0	35.0	34.9	35.1	34.6	33.0	30.9	28.0	27.2	31.4	45.1
				Uncertainty A (dB)	0.5	0.4	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.3	0.5		
				Uncertainty B (dB)	1.0	1.0	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	1.4		
				Combined Uncertainty (dB)	1.1	1.1	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.9	0.9	0.9	0.9	0.9	1.5		
11.0	Turbine ON	10.99	57	Average (dBA)	9.5	14.7	17.5	21.0	24.5	31.2	31.0	31.9	35.7	34.6	35.9	37.4	38.7	38.5	39.8	40.5	41.1	41.4	41.7	41.4	40.9	41.2	40.2	38.4	36.0	32.1	29.5	31.6	52.1
				Uncertainty A (dB)	0.3	0.2	0.3	0.3	0.3	0.2	0.3	0.2	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.3		
				Uncertainty B (dB)	1.0	1.0	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	1.4		
				Combined Uncertainty (dB)	1.1	1.0	0.8	0.8	0.8	0.8	0.9	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	1.5		
	Background	10.98	51	Average (dBA)	3.2	7.6	9.7	11.9	15.0	19.1	21.1	22.8	24.6	24.4	25.7	27.7	30.0	28.6	31.3	31.7	33.1	34.3	35.0	35.0	34.9	35.1	34.5	32.9	30.8	27.9	27.5	31.9	45.1
				Uncertainty A (dB)	0.6	0.4	0.3	0.3	0.2	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.2	0.3	0.3	0.3	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.4		
				Uncertainty B (dB)	1.0	1.0	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	1.4		
				Combined Uncertainty (dB)	1.2	1.1	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.9	1.0	0.9	0.9	0.9	1.5		
11.5	Turbine ON	11.50	42	Average (dBA)	9.9	15.3	18.1	21.7	24.9	30.9	31.6	32.3	35.9	34.7	35.7	37.3	38.6	38.4	39.8	40.5	41.2	41.5	41.8	41.5	41.1	41.3	40.2	38.6	36.2	32.4	29.5	30.9	52.2
				Uncertainty A (dB)	0.3	0.3	0.3	0.4	0.3	0.2	0.3	0.3	0.1	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3		
				Uncertainty B (dB)	1.0	1.0	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	1.4		
				Combined Uncertainty (dB)	1.1	1.0	0.9	0.9	0.9	0.8	0.9	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	1.5		
	Background	11.49	35	Average (dBA)	1.8	7.3	9.1	11.6	14.8	18.5	20.8	22.6	24.6	24.3	25.6	27.7	30.0	28.7	31.4	31.9	33.2	34.3	34.7	34.7	34.7	34.9	34.4	32.7	30.6	27.7	27.4	32.0	45.0
				Uncertainty A (dB)	0.6	0.5	0.3	0.3	0.3	0.3	0.2	0.2	0.3	0.3	0.3	0.2	0.2	0.3	0.2	0.3	0.3	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.3	0.5		
				Uncertainty B (dB)	1.0	1.0	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	1.4		
				Combined Uncertainty (dB)	1.2	1.1	0.9	0.9	0.8	0.8	0.8	0.8	0.8	0.9	0.7	0.7	0.7	0.8	0.7	0.8	0.8	0.8	0.8	0.8	0.9	1.0	1.0	1.0	0.9	0.9	0.9	1.5		

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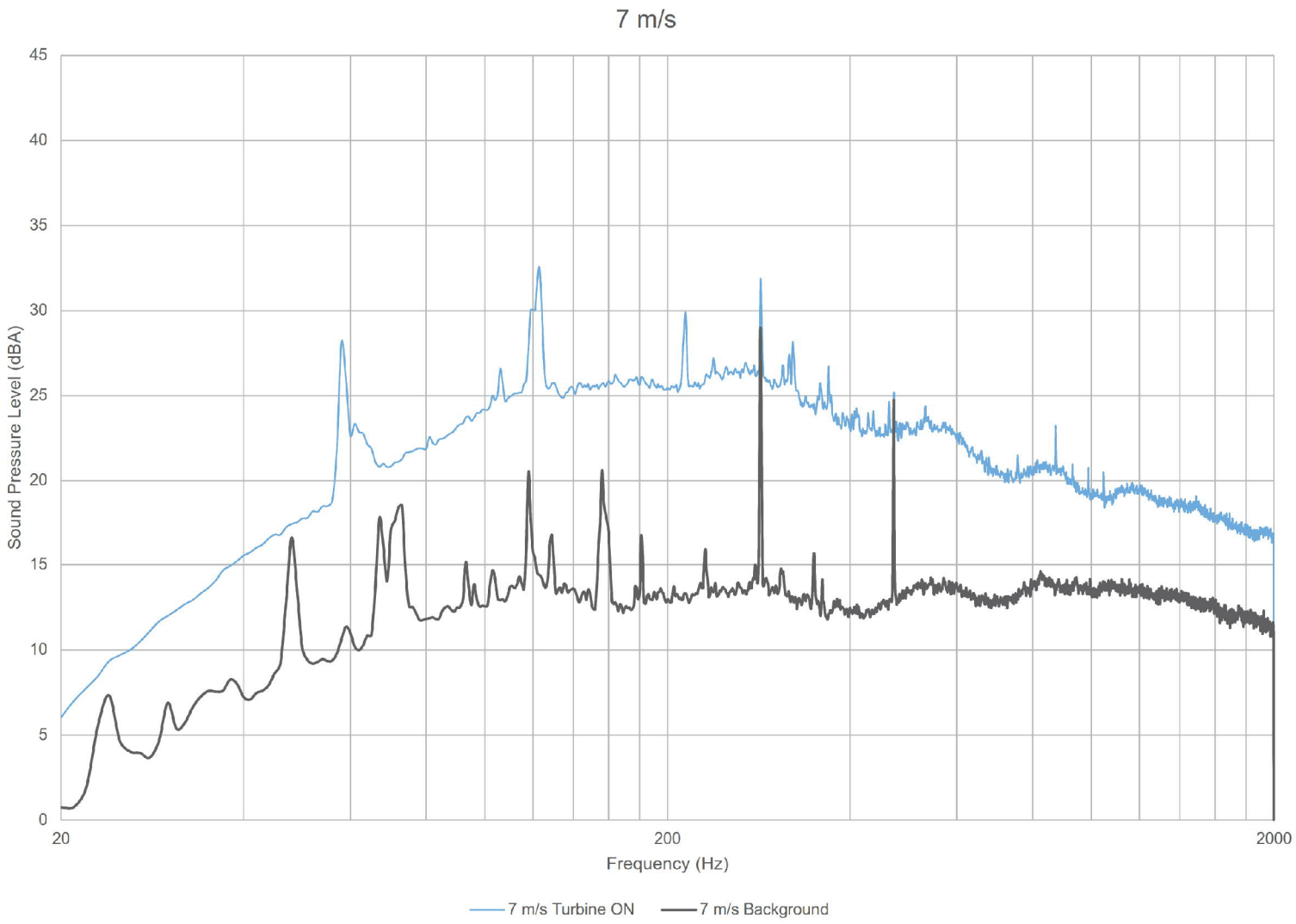
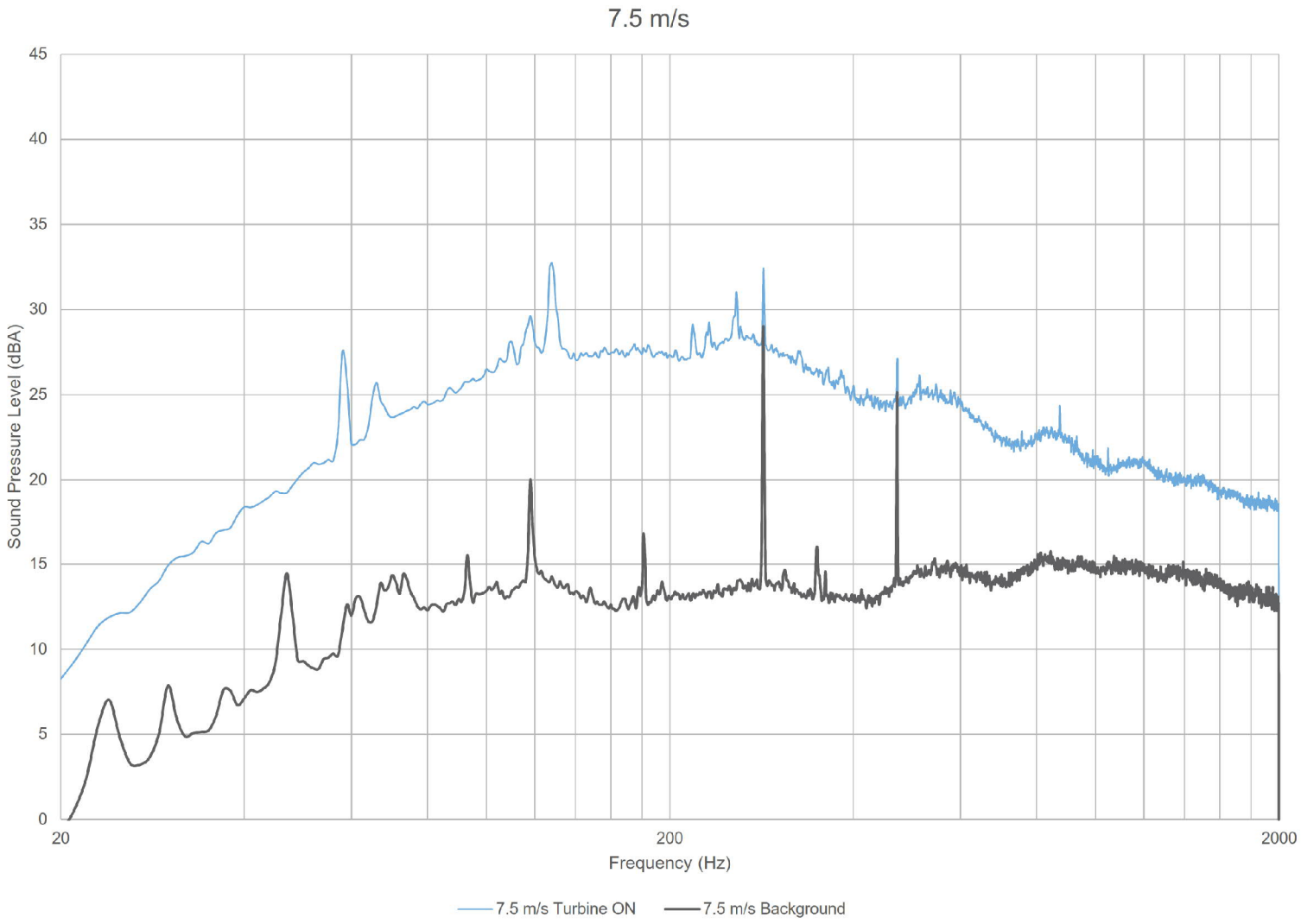
Appendix D
Tonality Assessment

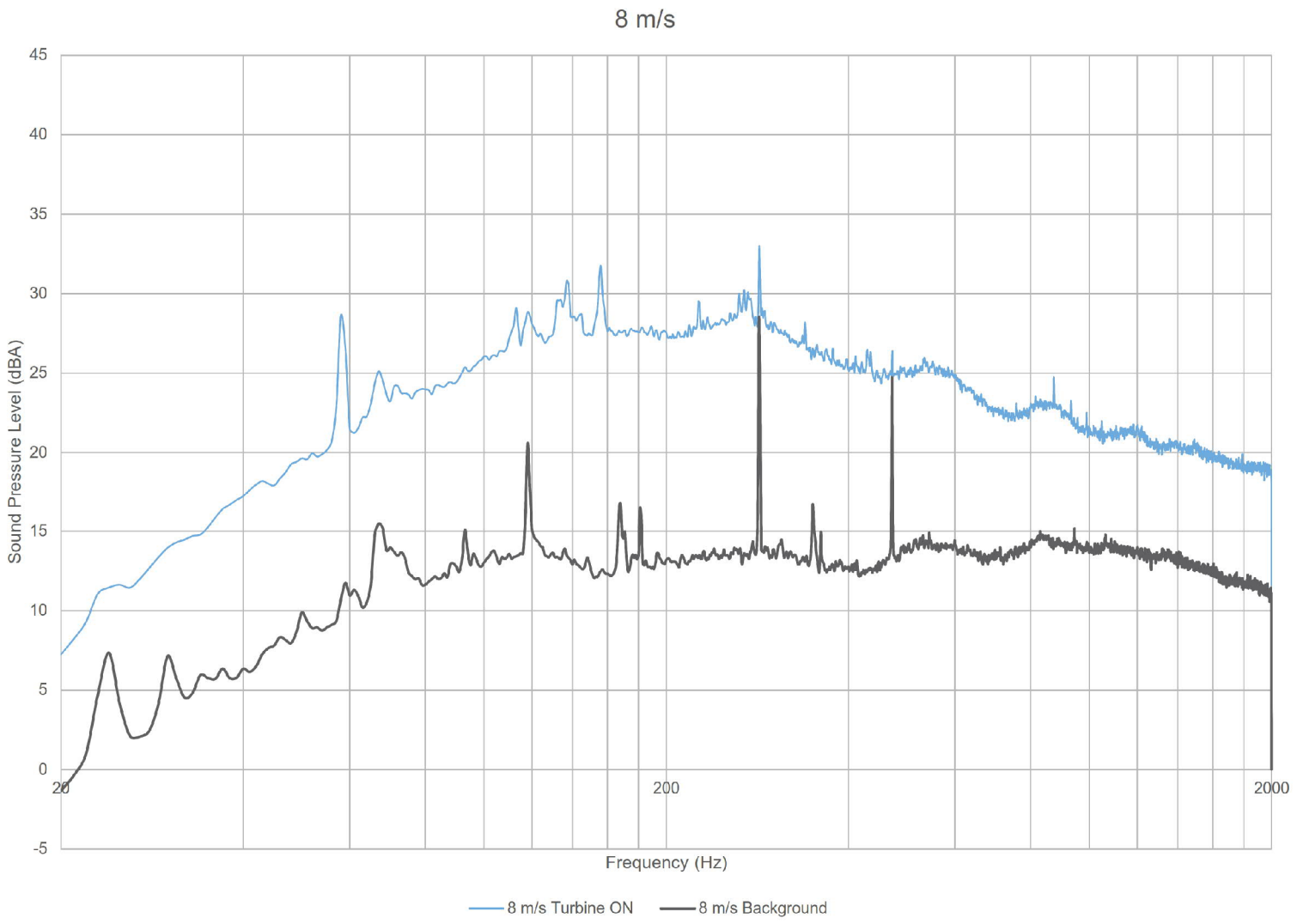


aercoustics	15039.00.T226.RP3	**Project Name**
	Scale: NTS Drawn by: AM Reviewed by: PA Date: Sept 15, 2017 Revision: 1	Cedar Point Wind Power Project - Turbine CP226 - IEC61400-11 Edition 3.0
		Figure Title Plot of narrow band spectra – Turbine ON vs. Background at 7 m/s
		Figure D.01



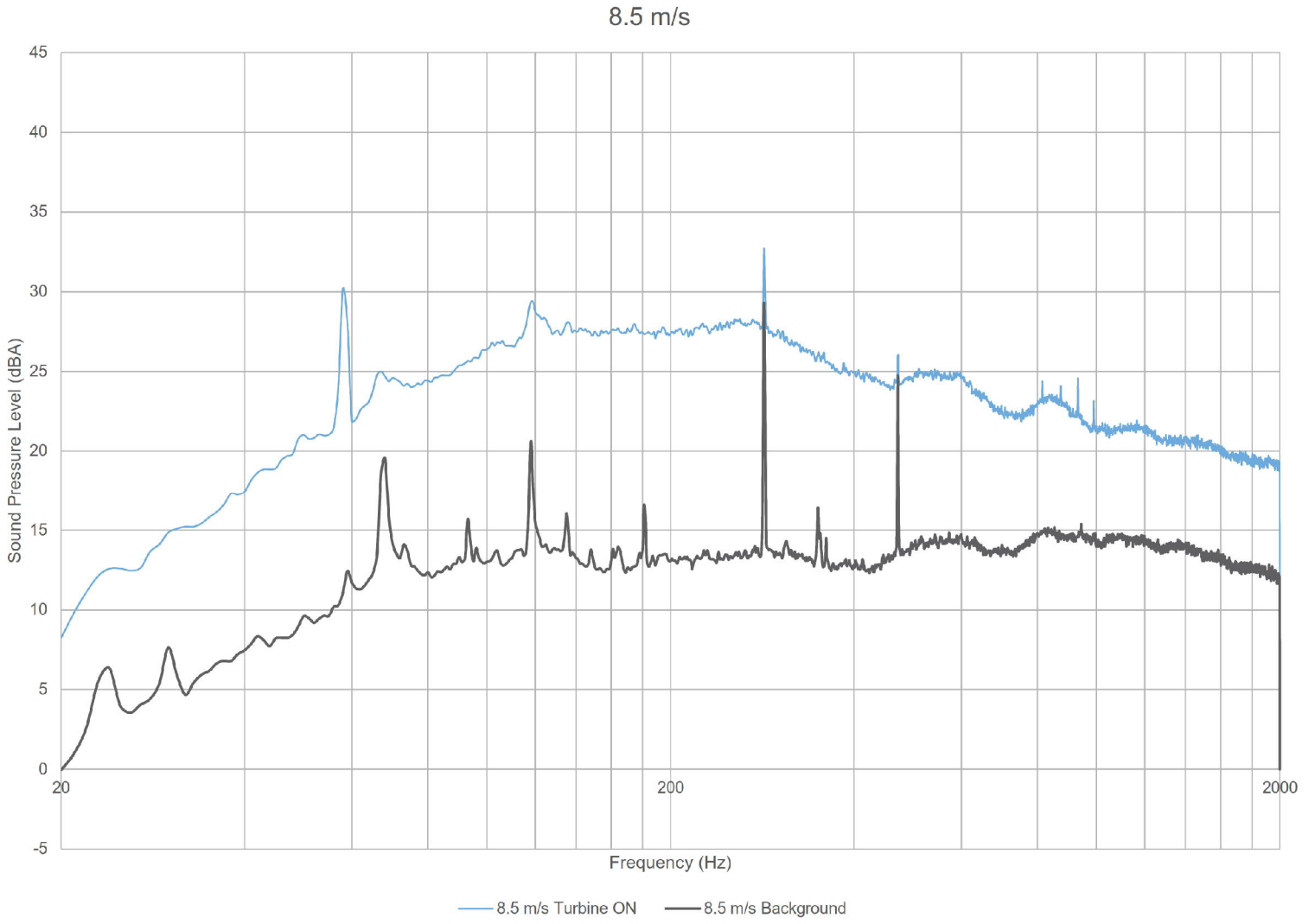
aercoustics	15039.00.T226.RP3 Scale: NTS Drawn by: AM Reviewed by: PA Date: Sept 15, 2017 Revision: 1	**Project Name** Cedar Point Wind Power Project - Turbine CP226 - IEC61400-11 Edition 3.0 **Figure Title** Plot of narrow band spectra – Turbine ON vs. Background at 7.5 m/s

Figure D.02



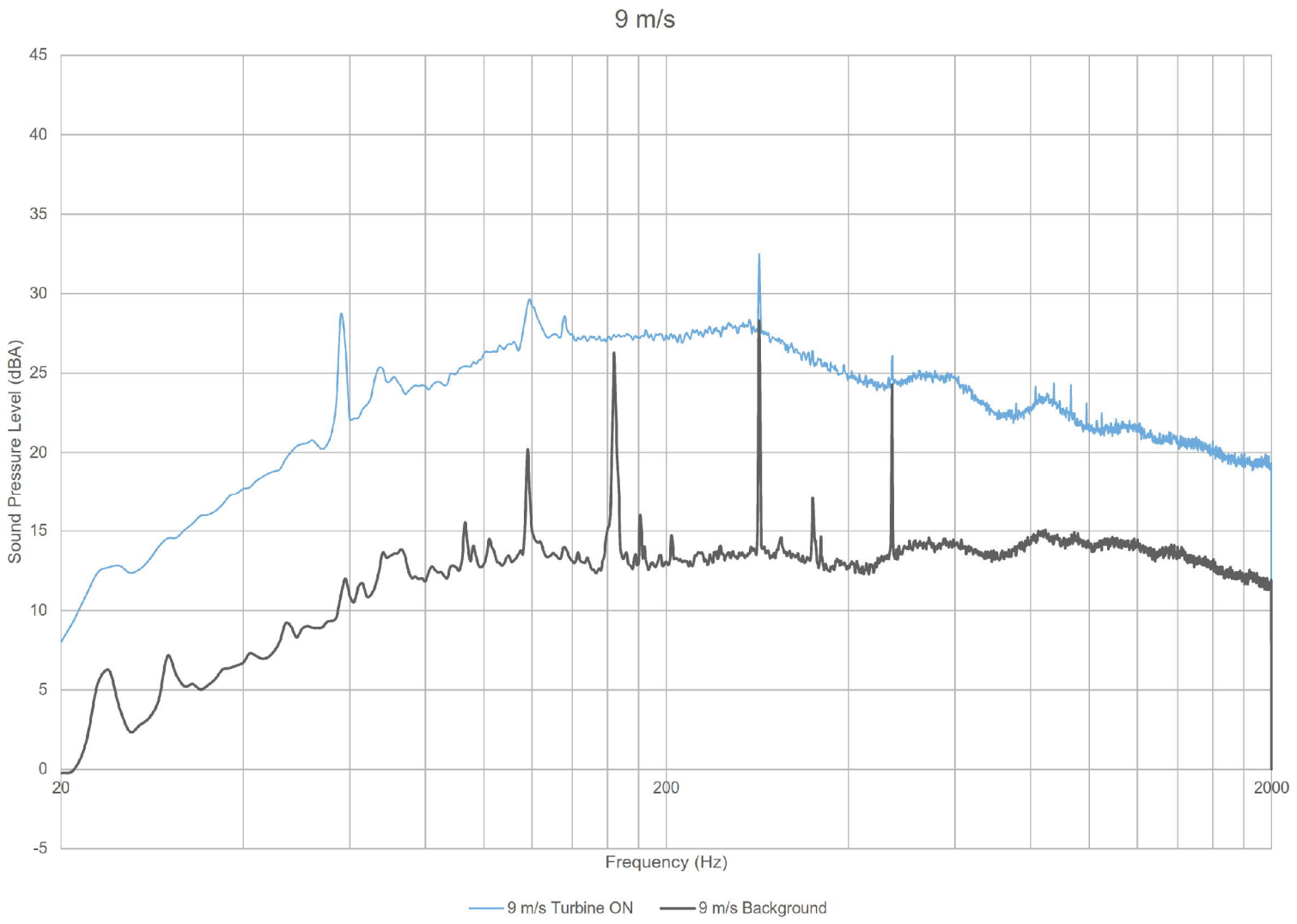
aercoustics	15039.00.T226.RP3 Scale: NTS Drawn by: AM Reviewed by: PA Date: Sept 15, 2017 Revision: 1	**Project Name** Cedar Point Wind Power Project - Turbine CP226 - IEC61400-11 Edition 3.0 **Figure Title** Plot of narrow band spectra – Turbine ON vs. Background at 8 m/s

Figure D.03



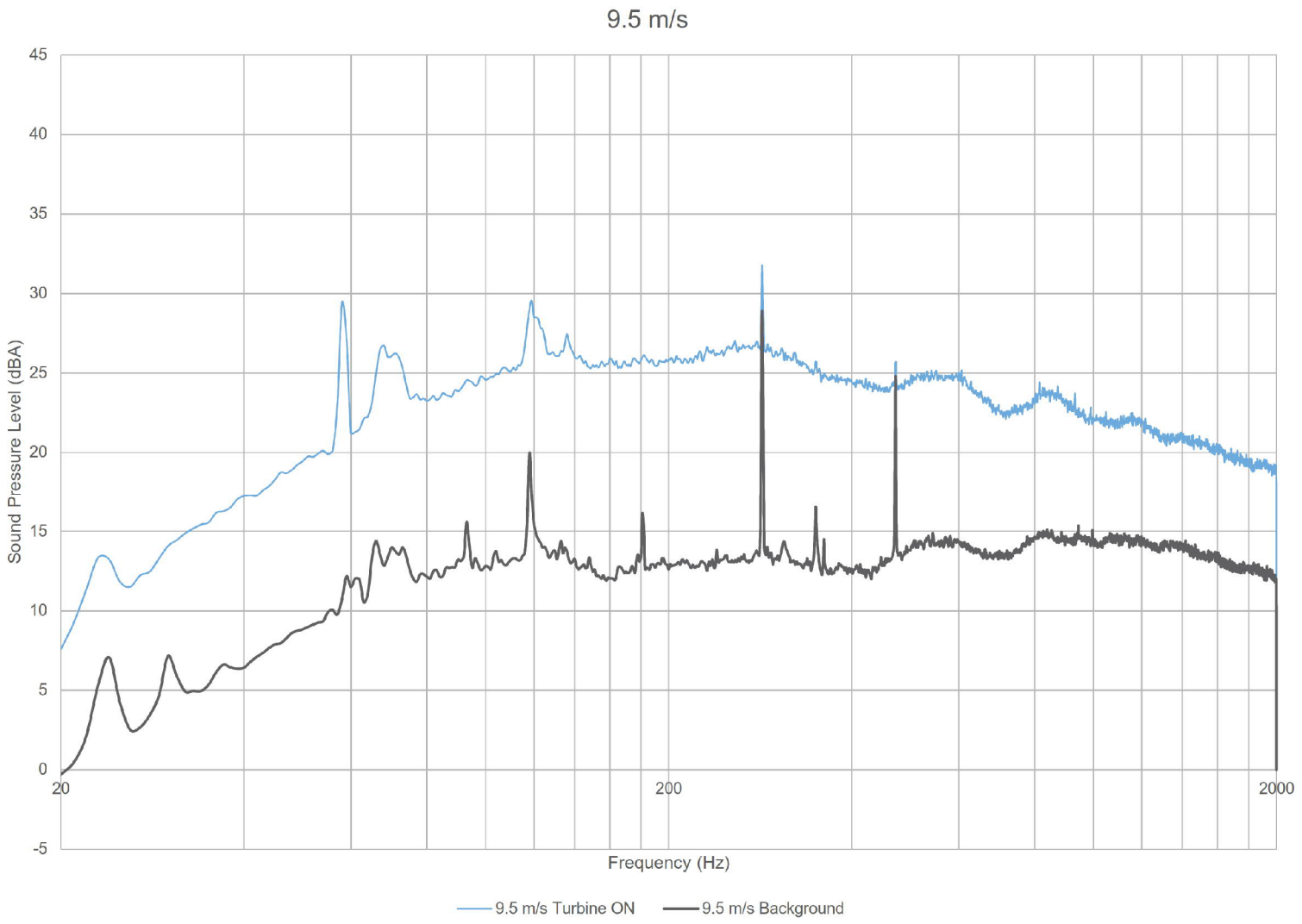
aercoustics	15039.00.T226.RP3 Scale: NTS Drawn by: AM Reviewed by: PA Date: Sept 15, 2017 Revision: 1	**Project Name** Cedar Point Wind Power Project - Turbine CP226 - IEC61400-11 Edition 3.0 **Figure Title** Plot of narrow band spectra – Turbine ON vs. Background at 8.5 m/s

Figure D.04



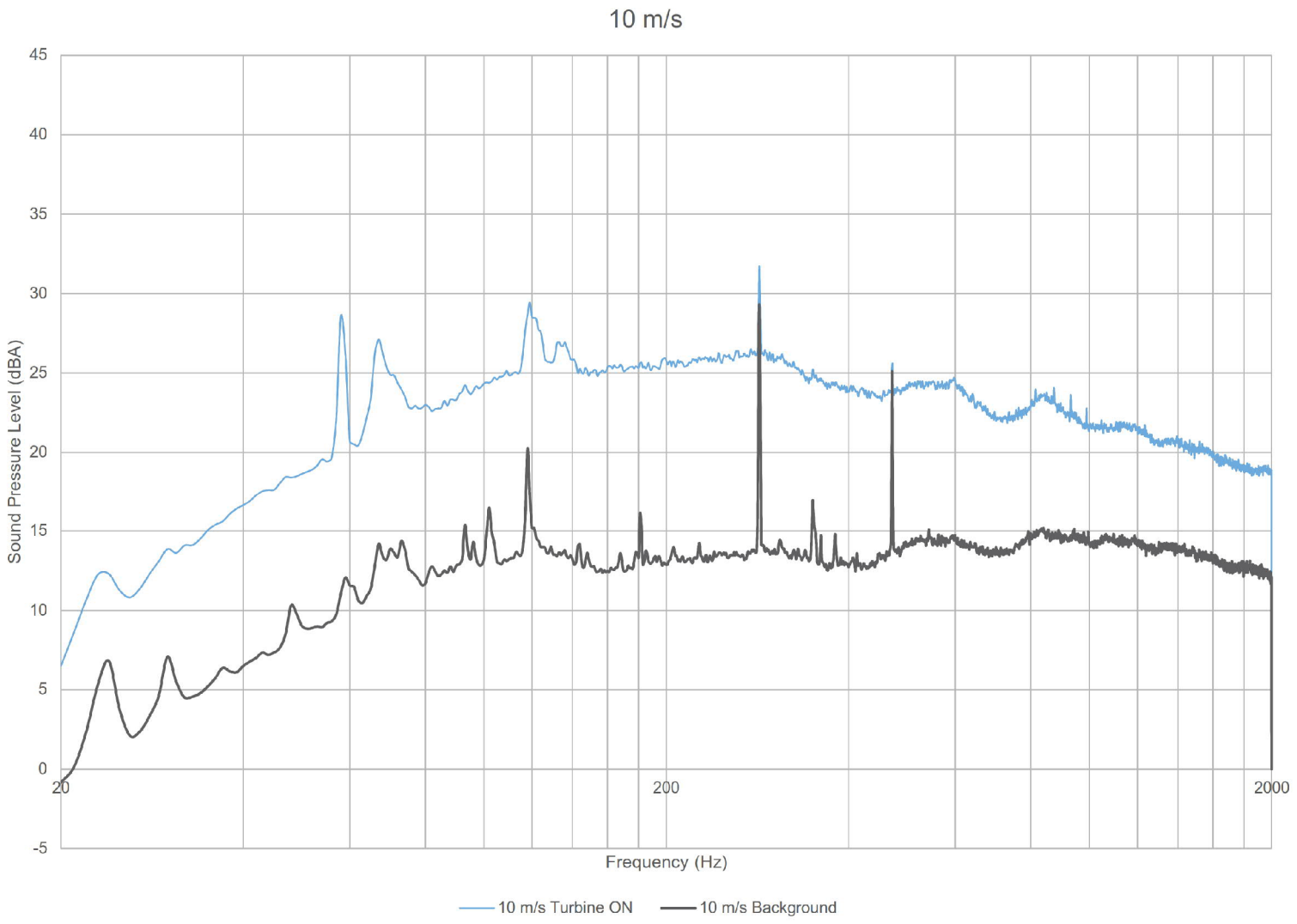
aercoustics	15039.00.T226.RP3 Scale: NTS Drawn by: AM Reviewed by: PA Date: Sept 15, 2017 Revision: 1	**Project Name** Cedar Point Wind Power Project - Turbine CP226 - IEC61400-11 Edition 3.0 **Figure Title** Plot of narrow band spectra – Turbine ON vs. Background at 9 m/s

Figure D.05

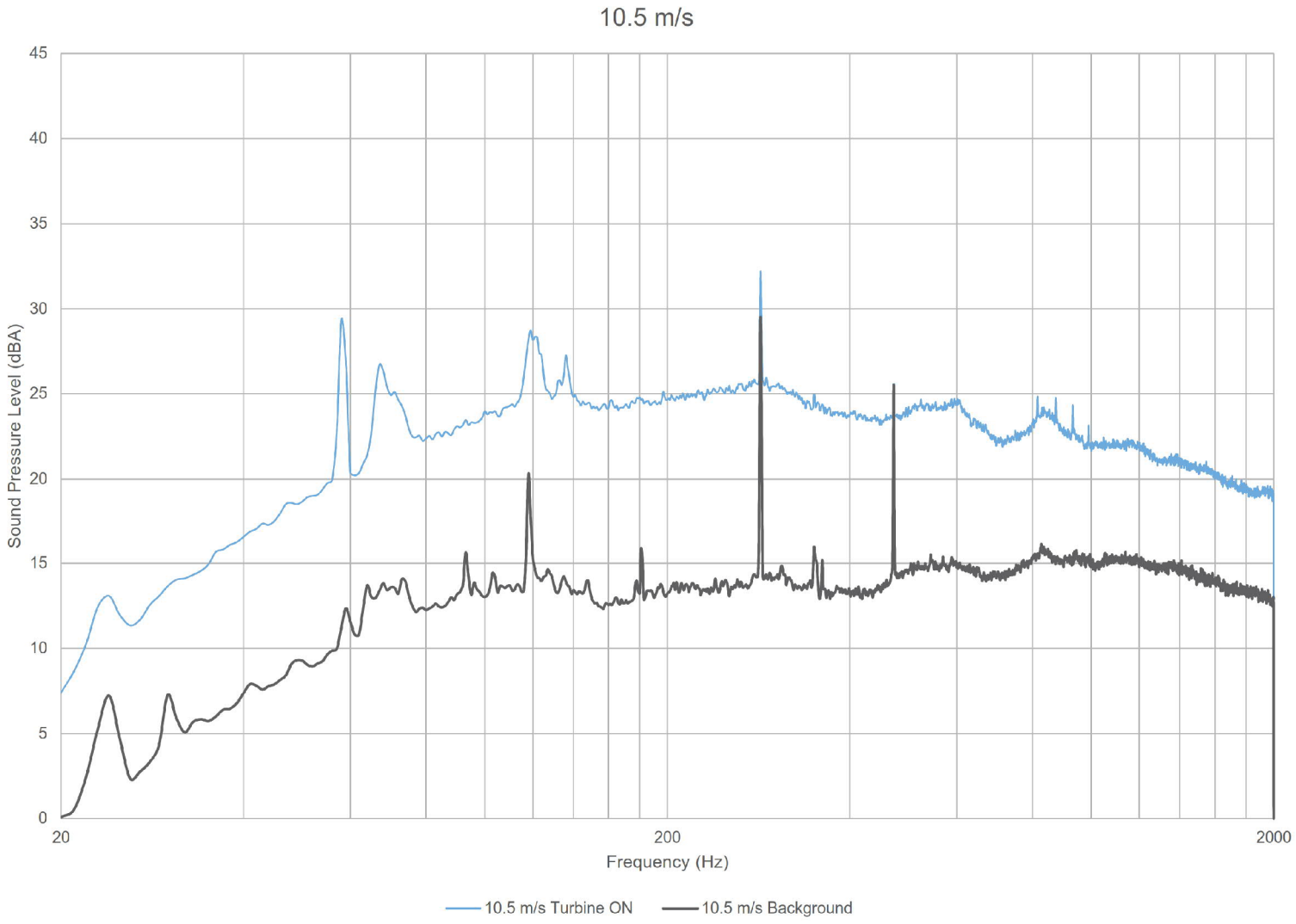


aercoustics	15039.00.T226.RP3 Scale: NTS Drawn by: AM Reviewed by: PA Date: Sept 15, 2017 Revision: 1	**Project Name** Cedar Point Wind Power Project - Turbine CP226 - IEC61400-11 Edition 3.0 **Figure Title** Plot of narrow band spectra – Turbine ON vs. Background at 9.5 m/s

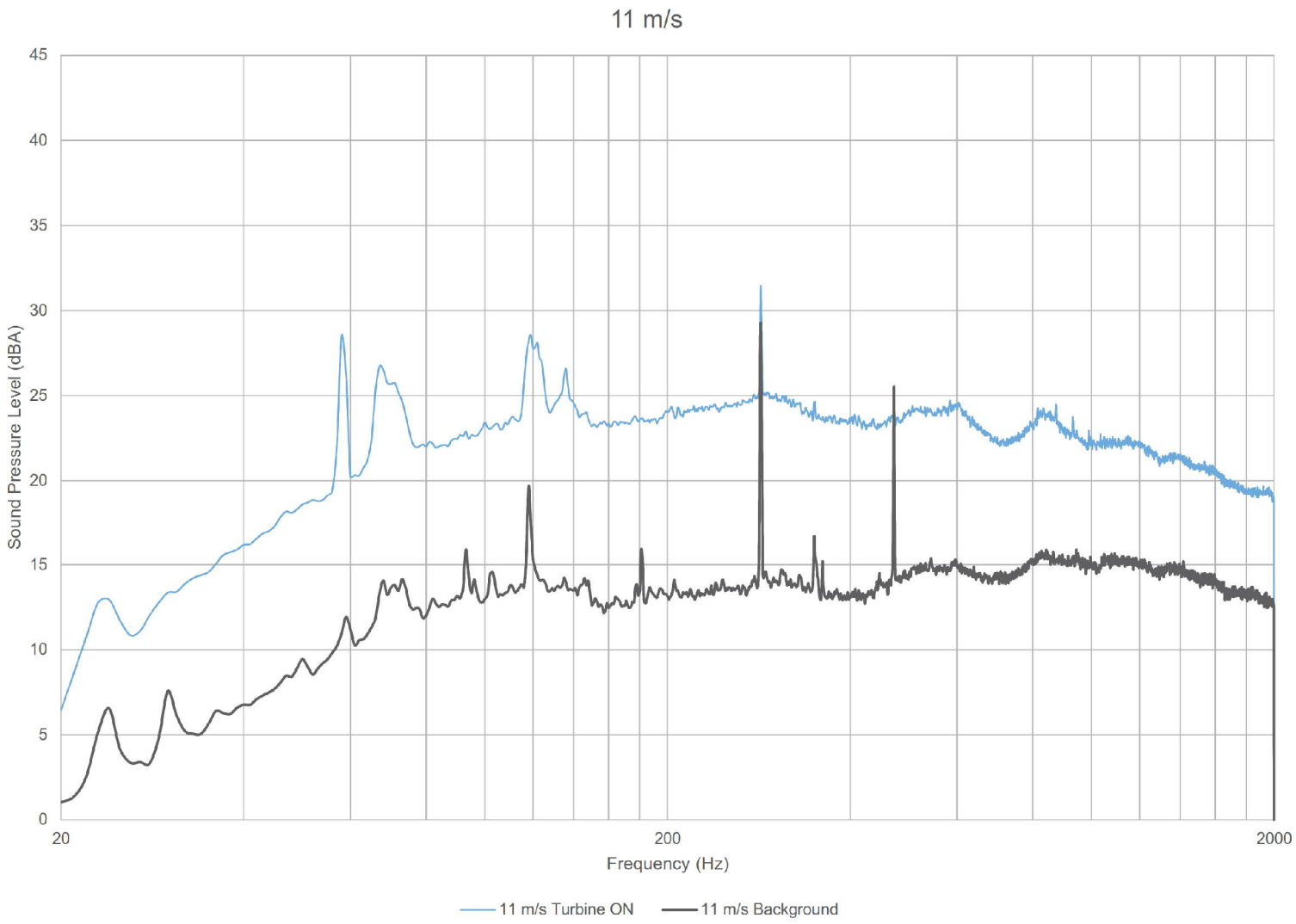
Figure D.06



aercoustics	15039.00.T226.RP3	**Project Name**
	Scale: NTS Drawn by: AM Reviewed by: PA Date: Sept 15, 2017 Revision: 1	Cedar Point Wind Power Project - Turbine CP226 - IEC61400-11 Edition 3.0
		Figure Title Plot of narrow band spectra – Turbine ON vs. Background at 10 m/s
		Figure D.07

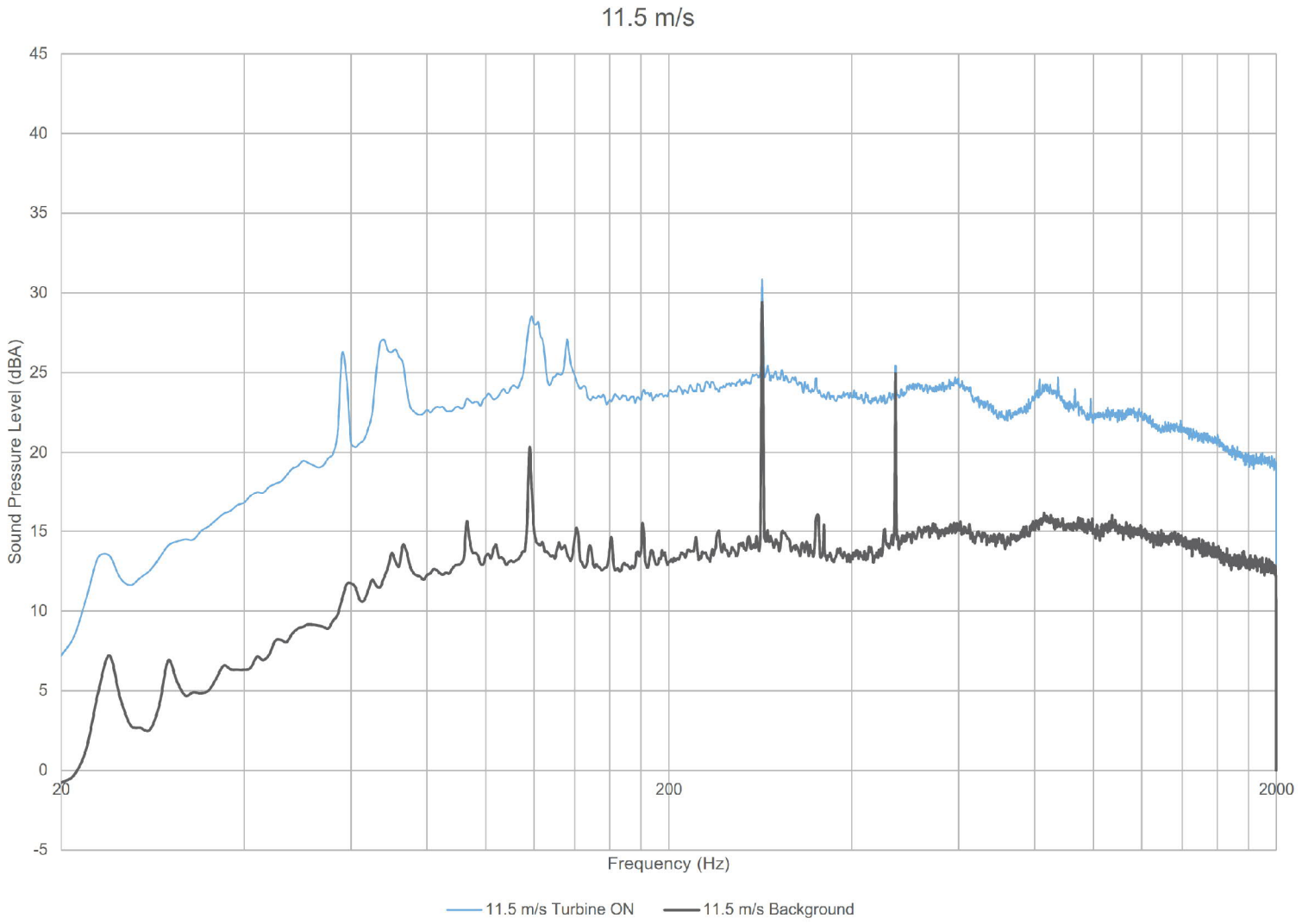


aercoustics	15039.00.T226.RP3	**Project Name**
	Scale: NTS Drawn by: AM Reviewed by: PA Date: Sept 15, 2017 Revision: 1	Cedar Point Wind Power Project - Turbine CP226 - IEC61400-11 Edition 3.0
		Figure Title Plot of narrow band spectra – Turbine ON vs. Background at 10.5 m/s
		Figure D.08



aercoustics	15039.00.T226.RP3 Scale: NTS Drawn by: AM Reviewed by: PA Date: Sept 15, 2017 Revision: 1	**Project Name** Cedar Point Wind Power Project - Turbine CP226 - IEC61400-11 Edition 3.0 **Figure Title** Plot of narrow band spectra – Turbine ON vs. Background at 11 m/s

Figure D.09



aercoustics	15039.00.T226.RP3 Scale: NTS Drawn by: AM Reviewed by: PA Date: Sept 15, 2017 Revision: 1	**Project Name** Cedar Point Wind Power Project - Turbine CP226 - IEC61400-11 Edition 3.0 **Figure Title** Plot of narrow band spectra – Turbine ON vs. Background at 11.5 m/s

Figure D.10

Table D.01 Tonality Assessment Table - 7 m/s

Project: Cedar Point Wind Power Project- Turbine CP226 - IEC 61400-11 Measurement

Report ID: 15039.00.T226.RP3

Created on: 10/26/2017

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)
294	58			22.2	40.4	34.1	-6.4	-2.0	-4.4
679	58			22.2	40.4	32.9	-7.5	-2.0	-5.5
18	58			20.9	39.2	34.7	-4.5	-2.0	-2.5
21	58			20.2	38.5	33.3	-5.1	-2.0	-3.1
300	58			22.3	40.5	34.2	-6.4	-2.0	-4.4
71	58			18.7	37.0	32.6	-4.3	-2.0	-2.3
70	58			19.0	37.3	34.0	-3.3	-2.0	-1.3
293	58			23.9	42.2	33.6	-8.6	-2.0	-6.6
69	58			17.4	35.6	35.7	0.0	-2.0	2.0
Average	58						-4.4	-2.0	-2.4

Table D.02 Tonality Assessment Table - 7.5 m/s

Project: Cedar Point Wind Power Project- Turbine CP226 - IEC 61400-11 Measurement

Report ID: 15039.00.T226.RP3

Created on: 10/26/2017

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)
No Reportable Tones									

Table D.03 Tonality Assessment Table - 8 m/s

Project: Cedar Point Wind Power Project- Turbine CP226 - IEC 61400-11 Measurement

Report ID: 15039.00.T226.RP3

Created on: 10/26/2017

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)
No Reportable Tones									

Table D.04 Tonality Assessment Table - 8.5 m/s

Project: Cedar Point Wind Power Project- Turbine CP226 - IEC 61400-11 Measurement

Report ID: 15039.00.T226.RP3

Created on: 10/26/2017

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)
457	58			23.2	41.4	35.7	-5.7	-2.0	-3.7
290	58			24.7	42.9	32.4	-10.5	-2.0	-8.5
445	58			24.4	42.6	35.0	-7.6	-2.0	-5.6
277	58			20.6	38.8	36.9	-2.0	-2.0	0.0
460	58			23.7	41.9	33.7	-8.1	-2.0	-6.1
291	58			25.3	43.5	33.8	-9.7	-2.0	-7.7
191	58			19.4	37.7	37.3	-0.3	-2.0	1.7
680	58			21.5	39.7	33.3	-6.5	-2.0	-4.5
276	58			20.8	39.0	37.0	-2.1	-2.0	-0.1
443	58			24.5	42.7	34.1	-8.5	-2.0	-6.5
442	58			23.7	41.9	34.0	-7.9	-2.0	-5.9
763	58			23.5	41.7	36.1	-5.6	-2.0	-3.6
458	58			22.9	41.1	33.9	-7.3	-2.0	-5.3
193	58			20.8	39.0	36.8	-2.2	-2.0	-0.2
192	58			21.4	39.7	35.5	-4.2	-2.0	-2.2
444	58			24.2	42.5	33.9	-8.6	-2.0	-6.6
128	58			21.3	39.5	35.9	-3.6	-2.0	-1.6
278	58			22.9	41.1	36.8	-4.3	-2.0	-2.3
282	58			24.6	42.8	34.3	-8.5	-2.0	-6.5
459	58			22.7	41.0	36.1	-4.9	-2.0	-2.9
Average	58						-5.0	-2.0	-3.0

Table D.05 Tonality Assessment Table - 9 m/s

Project: Cedar Point Wind Power Project- Turbine CP226 - IEC 61400-11 Measurement

Report ID: 15039.00.T226.RP3

Created on: 10/26/2017

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)
456	58			21.4	39.7	36.1	-3.6	-2.0	-1.6
764	58			26.6	44.8	33.2	-11.6	-2.0	-9.6
136	58			24.0	42.2	37.1	-5.1	-2.0	-3.1
461	58			24.1	42.3	33.1	-9.2	-2.0	-7.2
284	58			22.6	40.9	36.2	-4.7	-2.0	-2.7
137	58			21.4	39.6	36.9	-2.7	-2.0	-0.7
279	58			23.0	41.2	34.9	-6.4	-2.0	-4.4
190	58			18.4	36.6	36.7	0.1	-2.0	2.1
289	58			24.5	42.7	32.4	-10.3	-2.0	-8.3
Average	58						-4.5	-2.0	-2.5

Table D.06 Tonality Assessment Table - 9.5 m/s

Project: Cedar Point Wind Power Project- Turbine T226 - IEC 61400-11 Measurement

Report ID: 15039.00.T226.RP3

Created on: 10/26/2017

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)
177	58			19.0	37.2	36.5	-0.7	-2.0	1.3
145	58			22.4	40.6	35.8	-4.8	-2.0	-2.8
186	58			19.5	37.8	36.0	-1.8	-2.0	0.2
139	58			23.7	41.9	35.0	-6.9	-2.0	-4.9
387	58			17.8	36.0	36.1	0.1	-2.0	2.1
189	58			17.5	35.7	36.4	0.7	-2.0	2.7
388	58			19.2	37.4	35.0	-2.4	-2.0	-0.4
396	58			18.6	36.9	36.9	0.0	-2.0	2.0
178	58			20.3	38.6	35.7	-2.9	-2.0	-0.9
176	58			19.1	37.3	37.1	-0.2	-2.0	1.8
146	58			22.5	40.7	37.8	-2.9	-2.0	-0.9
140	58			22.4	40.7	35.7	-5.0	-2.0	-3.0
390	58			21.7	39.9	32.7	-7.2	-2.0	-5.2
649	68			23.0	41.3	30.9	-10.3	-2.0	-8.3
174	71			22.9	41.2	37.6	-3.6	-2.0	-1.6
	60						-2.3	-2.0	-0.3

Table D.07 Tonality Assessment Table - 10 m/s

Project: Cedar Point Wind Power Project- Turbine CP226 - IEC 61400-11 Measurement

Report ID: 15039.00.T226.RP3

Created on: 10/26/2017

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)
403	58			18.4	36.6	36.2	-0.4	-2.0	1.6
452	58			21.2	39.4	35.2	-4.2	-2.0	-2.2
188	58			18.4	36.6	37.6	1.0	-2.0	3.0
392	58			19.8	38.0	36.4	-1.6	-2.0	0.4
393	58			19.8	38.1	35.8	-2.2	-2.0	-0.2
385	58			19.1	37.3	35.6	-1.8	-2.0	0.2
386	58			17.7	36.0	35.6	-0.4	-2.0	1.6
454	58			20.8	39.1	35.8	-3.3	-2.0	-1.3
181	58			20.0	38.2	38.9	0.7	-2.0	2.7
144	58			20.0	38.2	37.3	-0.9	-2.0	1.1
397	58			17.5	35.7	36.7	1.0	-2.0	3.0
180	58			20.5	38.7	36.3	-2.4	-2.0	-0.4
182	58			20.4	38.6	36.5	-2.1	-2.0	-0.1
462	58			23.0	41.3	35.6	-5.6	-2.0	-3.6
407	67			20.7	38.9	31.0	-7.9	-2.0	-5.9
423	67			18.4	36.6	33.0	-3.6	-2.0	-1.6
421	67			18.2	36.5	33.6	-2.9	-2.0	-0.9
540	67			20.5	38.8	34.6	-4.1	-2.0	-2.1
572	68			22.0	40.3	35.8	-4.4	-2.0	-2.4
411	73			20.6	38.9	35.9	-3.0	-2.0	-1.0
Average	61						-1.9	-2.0	0.1

Table D.08 Tonality Assessment Table - 10.5 m/s

Project: Cedar Point Wind Power Project- Turbine CP226 - IEC 61400-11 Measurement

Report ID: 15039.00.T226.RP3

Created on: 10/26/2017

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)
183	58			19.1	37.4	37.9	0.6	-2.0	2.6
381	58			18.4	36.6	37.3	0.6	-2.0	2.6
395	58			22.5	40.7	35.4	-5.3	-2.0	-3.3
379	58			18.4	36.6	36.6	0.0	-2.0	2.0
400	58			18.2	36.5	37.5	1.0	-2.0	3.0
447	58			22.3	40.6	35.5	-5.0	-2.0	-3.0
455	58			20.4	38.6	37.9	-0.7	-2.0	1.3
382	58			20.7	38.9	36.7	-2.2	-2.0	-0.2
690	58			20.7	39.0	35.2	-3.8	-2.0	-1.8
394	58			20.0	38.2	36.4	-1.8	-2.0	0.2
141	58			21.6	39.8	37.1	-2.7	-2.0	-0.7
402	58			18.6	36.8	36.2	-0.6	-2.0	1.4
446	58			24.8	43.0	31.8	-11.3	-2.0	-9.3
449	58			18.1	36.3	36.8	0.4	-2.0	2.4
283	58			23.1	41.4	38.1	-3.3	-2.0	-1.3
398	58			18.8	37.1	36.8	-0.3	-2.0	1.7
546	67			21.3	39.6	35.0	-4.6	-2.0	-2.6
560	67			21.1	39.3	33.2	-6.2	-2.0	-4.2
501	67			19.5	37.7	33.8	-4.0	-2.0	-2.0
558	73			22.2	40.4	36.3	-4.1	-2.0	-2.1
Average	60						-1.9	-2.0	0.1

Table D.09 Tonality Assessment Table - 11 m/s

Project: Cedar Point Wind Power Project- Turbine CP226 - IEC 61400-11 Measurement

Report ID: 15039.00.T226.RP3

Created on: 10/26/2017

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)
694	58			21.7	40.0	36.0	-4.0	-2.0	-2.0
448	58			20.0	38.3	38.6	0.3	-2.0	2.3
380	58			18.3	36.6	37.2	0.7	-2.0	2.7
693	58			22.4	40.6	32.9	-7.8	-2.0	-5.8
401	58			18.1	36.3	37.0	0.6	-2.0	2.6
696	58			19.6	37.8	37.4	-0.4	-2.0	1.6
399	58			17.9	36.2	38.5	2.4	-2.0	4.4
695	58			22.4	40.7	34.4	-6.3	-2.0	-4.3
389	58			22.7	40.9	33.8	-7.1	-2.0	-5.1
697	58			20.7	39.0	37.1	-1.9	-2.0	0.1
142	58			20.5	38.8	35.9	-2.9	-2.0	-0.9
384	58			20.3	38.5	36.7	-1.8	-2.0	0.2
383	58			19.0	37.3	37.1	-0.2	-2.0	1.8
619	66			21.6	39.8	32.0	-7.8	-2.0	-5.8
428	67			19.0	37.2	33.6	-3.6	-2.0	-1.6
538	67			19.6	37.8	35.3	-2.5	-2.0	-0.5
377	67			18.4	36.6	32.8	-3.9	-2.0	-1.9
375	67			20.3	38.6	32.9	-5.7	-2.0	-3.7
730	67			20.8	39.1	35.9	-3.2	-2.0	-1.2
517	67			17.2	35.5	34.8	-0.7	-2.0	1.3
561	68			20.5	38.8	35.9	-2.9	-2.0	-0.9
563	69			19.9	38.1	35.0	-3.1	-2.0	-1.1
743	71			21.8	40.1	34.5	-5.6	-2.0	-3.6
410	71			21.6	39.8	34.8	-5.1	-2.0	-3.1
720	71			22.9	41.2	35.6	-5.5	-2.0	-3.5
506	71			21.9	40.1	36.0	-4.1	-2.0	-2.1
425	73			21.6	39.8	36.1	-3.8	-2.0	-1.8
Average	64						-2.4	-2.0	-0.4

Table D.10 Tonality Assessment Table - 11.5 m/s

Project: Cedar Point Wind Power Project- Turbine CP226 - IEC 61400-11 Measurement

Report ID: 15039.00.T226.RP3

Created on: 10/26/2017

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)
No Reportable Tones									

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Appendix E
Measurement Data

Table E.01 Measurement data - Turbine ON

Project: Cedar Point Wind Power Project - Turbine CP226 - IEC 61400-11 Measurement

Report ID: 15039.00.T226.RP3

Created on: 9/14/2017

***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 (Pa)	Relative Humidity (%)
1			1257	29.0	23.7	-1.8	12.5	8.0	4.8	20	90152	79
2	7.5	51.8	1218	29.0	23.7	-1.8	12.3	7.6	4.6	20	90152	79
3	8.0	52.6	1472	29.0	23.7	-1.8	12.6	8.3	4.1	20	90152	79
4	7.9	53.4	1419	29.0	22.9	-1.3	12.6	8.2	4.5	20	91785	79
5	7.9	52.8	1430	29.0	20.8	0.0	12.6	8.4	5.2	20	92152	79
6	7.9	52.8	1404	29.0	20.8	-0.1	12.6	7.7	5.2	20	92152	79
7	8.0	53.4	1457	29.0	20.7	0.0	12.6	8.6	4.0	20	92152	79
8	8.0	54.3	1448	29.0	18.2	-0.8	12.6	9.2	3.8	20	92152	79
9	7.4	54.4	1194	29.0	18.0	-1.5	12.1	6.9	5.1	20	92152	79
10	7.0	53.9	1012	29.0	18.0	-1.6	11.5	7.7	5.3	20	90933	79
11	7.5	53.3	1212	29.0	18.0	-1.8	12.3	8.3	5.6	20	90650	79
12	7.9	53.5	1406	29.0	18.1	-1.8	12.6	8.5	5.0	20	90650	79
13	7.5	53.2	1220	29.0	18.1	-1.8	12.3	8.0	3.9	20	90651	79
14	7.2	52.4	1069	29.0	18.1	-1.8	11.7	7.0	5.0	20	90651	79
15	6.8	51.5	914	29.0	18.0	-1.8	11.1	6.6	5.6	20	90650	79
16	6.5	49.9	788	29.0	18.0	-1.9	10.6	6.6	6.1	20	90563	79
17	6.5	50.2	816	29.0	18.0	-2.1	10.7	7.6	5.7	20	90543	79
18	7.0	51.4	979	29.0	18.0	-2.1	11.4	8.6	6.0	20	90543	79
19	7.4	52.5	1193	29.0	18.0	-2.1	12.2	9.4	5.5	20	90543	79
20	7.4	51.9	1167	29.0	18.0	-2.1	12.1	8.3	4.0	20	90543	79
21	6.9	50.5	954	29.0	18.0	-2.1	11.2	7.5	3.6	20	90543	79
22	6.4	49.2	757	29.0	18.0	-1.9	10.4	6.3	4.2	20	91574	79
23	6.0	47.8	610	29.0	18.0	-1.5	9.6	6.4	5.3	20	91808	79
24	5.4	47.3	453	29.0	19.4	-1.5	8.7	4.9	5.4	20	91808	79
25	5.3	46.5	438	29.0	21.4	-1.5	8.7	5.5	5.2	20	91808	79
26	5.6	46.7	505	29.0	21.4	-1.5	9.0	5.9	6.0	20	91805	79
27	5.6	46.3	508	29.0	21.4	-1.5	9.0	6.0	4.8	20	91783	79
28	5.5	47.6	487	29.0	21.4	-1.7	8.9	6.1	4.6	20	90628	79
29	5.6	48.4	500	29.0	21.4	-2.1	9.0	6.3	5.1	20	90365	79
30	5.6	47.0	502	29.0	21.4	-2.1	9.0	7.1	4.0	20	90366	79
31	5.5	47.8	475	29.0	22.4	-2.1	8.9	6.8	2.7	20	90365	79
32	5.7	48.6	528	29.0	24.3	-2.1	9.2	6.9	3.3	20	90365	79
33	6.3	49.7	712	29.0	26.5	-2.1	10.3	7.1	3.7	20	90365	79
34	6.7	50.2	861	29.0	28.4	-1.9	10.9	8.3	4.3	20	91636	79
35	6.4	48.8	760	29.0	29.8	-1.5	10.4	6.8	4.2	19	91918	79
36	5.9	47.8	598	29.0	31.3	-1.5	9.5	6.6	4.0	19	91919	79
37	5.4	47.9	464	29.0	31.3	-1.5	8.7	5.6	5.5	19	91919	79
38	5.1	47.6	373	29.0	31.3	-1.5	8.2	5.7	4.4	19	91919	79
39	5.1	46.7	381	29.0	31.3	-1.5	8.3	6.1	4.3	19	91918	79
40	5.9	48.6	580	29.0	31.3	-1.7	9.5	8.1	4.7	19	92496	79
41	6.5	49.7	808	29.0	33.4	-2.1	10.7	7.0	6.9	19	92628	79
42	6.7	50.5	890	29.0	34.0	-2.1	11.0	7.9	6.3	19	92627	79
43	6.6	50.2	848	29.0	34.0	-2.1	10.8	8.0	5.2	19	92628	79
44	6.8	51.1	920	29.0	34.0	-2.1	11.2	8.4	6.2	19	92628	79
45	7.1	51.6	1046	29.0	34.0	-2.1	11.7	9.1	6.9	19	92628	79
46	7.6	52.5	1292	29.0	35.4	-1.9	12.5	9.1	5.3	19	89495	79
47	7.6	52.6	1287	29.0	36.8	-1.5	12.5	8.5	5.7	19	88784	79
48	7.5	52.3	1229	29.0	36.8	-1.5	12.3	7.4	5.0	19	88784	79
49	7.2	51.5	1073	29.0	36.8	-1.5	11.7	8.3	4.1	19	88785	79
50	6.9	51.0	942	29.0	36.8	-1.5	11.2	8.2	3.5	19	88784	79
51	6.5	49.9	800	29.0	39.0	-1.5	10.6	7.6	5.6	19	88785	79
52	6.1	48.8	639	29.0	39.7	-1.7	9.8	6.8	5.5	19	89671	79
53	5.6	47.7	509	29.0	39.7	-2.1	9.0	5.4	6.7	19	89866	79
54	5.5	47.1	471	29.0	39.7	-2.1	8.9	5.5	5.8	19	89866	79
55	6.1	49.1	650	29.0	37.9	-2.1	9.9	7.6	6.3	19	89865	79
56	6.6	50.4	822	29.0	36.8	-2.1	10.7	8.4	5.3	19	89870	79
57	6.6	50.7	851	29.0	36.8	-2.1	10.9	8.2	6.1	20	89887	79
58	6.7	50.2	870	29.0	36.9	-1.9	11.0	8.3	5.8	20	90516	79
59	7.0	50.8	994	29.0	37.0	-1.5	11.4	8.6	5.9	20	90650	79
60	7.0	50.5	985	29.0	37.0	-1.5	11.4	7.0	5.1	20	90650	79
61	6.6	49.6	847	29.0	36.9	-1.5	10.8	6.9	4.1	20	90650	79
62	6.3	50.0	746	29.0	36.9	-1.5	10.4	6.5	3.9	20	90651	79
63	6.4	49.0	759	29.0	37.0	-1.5	10.4	7.7	4.7	20	90650	79
64	6.3	48.7	712	29.0	37.0	-1.7	10.2	5.9	5.5	20	90862	79
65	5.9	47.5	578	29.0	37.0	-2.1	9.4	5.9	6.2	20	90887	79
66	5.8	48.8	564	29.0	36.9	-2.1	9.4	6.0	5.5	20	90888	79
67	6.3	48.9	714	29.0	36.9	-2.1	10.2	7.6	5.4	20	90887	79
68	6.6	49.8	850	29.0	37.0	-2.1	10.9	6.4	5.3	20	90887	79
69	6.8	50.4	924	29.0	37.0	-2.1	11.2	7.6	5.0	20	90887	79
70	7.0	50.8	984	29.0	37.0	-1.9	11.4	7.6	6.2	20	90458	79
71	6.8	50.0	928	29.0	36.9	-1.5	11.2	7.1	5.9	20	90360	79
72	6.5	50.2	813	29.0	36.6	-1.5	10.7	6.7	5.3	20	90360	79
73	6.4	49.8	756	29.0	33.8	-1.5	10.4	6.4	5.4	20	90360	79
74	6.4	50.2	766	29.0	32.8	-1.5	10.5	6.4	5.0	20	90360	79
75	6.3	49.6	745	29.0	31.4	-1.5	10.4	6.7	5.5	20	90360	79
76	6.1	49.9	667	29.0	30.6	-1.7	10.0	6.1	5.3	20	90558	79
77	5.9	49.1	595	29.0	28.5	-2.1	9.5	5.8	6.5	20	90600	79
78	5.6	47.9	507	29.0	28.5	-2.1	9.0	5.8	6.8	20	90600	79
79	5.4	48.0	455	29.0	28.5	-2.1	8.8	6.0	6.2	20	90600	79
80	5.6	49.5	496	29.0	28.6	-2.1	9.0	6.4	6.3	20	90600	79
81	6.0	48.8	606	29.0	28.6	-2.1	9.6	6.9	6.0	20	90600	79
82	6.2	49.6	697	29.0	28.6	-1.9	10.1	7.6	5.2	20	91590	79
83	6.2	49.3	686	29.0	28.6	-1.5	10.1	6.8	5.3	20	91808	79
84	6.0	48.9	609	29.0	28.6	-1.5	9.6	6.2	5.6	20	91808	79
85	5.9	48.7	594	29.0	28.6	-1.5	9.6	7.3	5.2	20	91808	79
86	5.8	47.9	573	29.0	28.5	-1.5	9.4	5.6	5.6	20	91808	79
87	5.6	47.7	505	29.0	28.6	-1.5	9.0	6.4	5.5	20	91808	79
88	5.3	47.5	438	29.0	28.6	-1.7	8.6	6.5	6.1	20	91779	79

***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 (Pa)	Relative Humidity (%)
89	5.3	48.0	414	29.0	28.5	-2.1	8.5	6.7	6.0	20	91756	79
90	5.4	47.7	453	29.0	28.5	-2.1	8.8	6.7	6.4	20	91756	79
91	5.3	48.0	437	29.0	28.5	-2.1	8.7	5.6	5.1	20	91756	79
92	5.2	47.8	391	29.0	28.5	-2.1	8.4	5.6	5.9	20	91756	79
93	5.2	48.1	414	29.0	30.4	-2.1	8.6	5.5	5.4	20	91756	79
94	5.6	47.8	504	29.0	31.3	-2.0	9.1	6.0	7.2	20	91627	79
95	6.2	48.6	679	29.0	31.3	-1.5	10.1	7.1	6.4	20	91598	79
96	6.7	50.8	862	29.0	31.1	-1.5	10.9	8.2	6.0	20	91598	79
97	7.0	51.5	980	29.0	28.2	-1.5	11.4	7.5	5.4	20	91598	79
98	7.1	51.4	1032	29.0	27.9	-1.5	11.6	7.1	5.9	20	91598	79
99	7.1	51.2	1054	29.0	27.1	-1.5	11.7	7.4	7.0	20	91598	79
100	7.2	51.6	1079	29.0	25.6	-1.7	11.8	7.0	7.2	20	90786	79
101	7.1	51.3	1059	29.0	24.6	-2.1	11.7	7.5	6.8	20	90600	79
102	7.2	51.7	1079	29.0	23.1	-2.1	11.7	7.7	6.4	20	90600	79
103	7.2	51.6	1061	29.0	23.1	-2.1	11.7	7.1	7.1	20	90600	79
104	7.0	50.9	979	29.0	23.1	-2.1	11.3	6.4	6.8	20	90600	79
105	6.5	50.0	813	29.0	23.1	-2.1	10.7	7.0	6.2	20	90600	79
106	6.2	49.9	680	29.0	23.3	-2.0	10.0	6.2	5.2	20	90278	79
107	5.9	48.7	597	29.0	25.8	-1.5	9.6	6.9	5.3	20	90204	79
108	6.1	49.5	638	29.0	25.9	-1.5	9.8	7.4	5.9	20	90204	79
109	6.4	49.3	757	29.0	25.9	-1.5	10.5	7.2	7.3	20	90204	79
110	6.9	51.3	957	29.0	25.8	-1.5	11.3	7.7	7.5	20	90204	79
111	7.9	52.9	1444	29.0	25.8	-0.4	12.5	8.9	7.5	20	90204	79
112	8.7	53.0	1785	29.0	25.8	-1.0	12.6	9.4	7.3	20	90252	79
113	8.2	53.2	1576	29.0	23.7	-1.8	12.5	8.8	8.5	20	90256	79
114	8.4	53.3	1665	29.0	22.4	-1.8	12.6	8.7	7.0	20	90256	79
115	8.7	53.4	1802	29.0	22.4	-1.7	12.6	8.4	5.5	20	90256	79
116	8.8	53.0	1855	29.0	22.4	-1.7	12.6	9.2	6.6	20	90256	79
117	9.0	53.6	1960	29.0	22.4	-1.6	12.6	9.1	7.2	20	90256	79
118	8.9	53.2	1911	29.0	22.4	-1.6	12.6	9.0	6.6	20	91189	79
119	9.3	53.3	2013	29.0	22.4	-0.8	12.6	10.1	8.5	20	91387	79
120			1671	29.0	22.4	8.3	11.7	9.6	10.7	20	91386	79
121			135	29.0	22.4	47.2	5.9	9.1	8.8	20	91387	79
122			0	29.0	22.4	81.6	1.6	8.1	7.7	20	91387	79
123			0	29.0	22.4	82.0	0.5	9.0	7.1	20	91387	79
124			527	29.0	33.0	13.2	9.2	10.3	8.7	20	90600	79
125			705	29.0	33.0	8.6	10.2	10.0	8.7	20	90600	79
126			1327	29.0	33.0	4.3	11.9	10.1	8.4	20	90600	79
127			1777	29.0	33.0	3.2	12.1	10.0	7.3	20	90600	79
128	8.3	51.7	1625	29.0	33.0	0.6	12.0	9.8	6.9	20	90600	79
129	7.9	52.7	1436	29.0	32.9	-0.4	12.4	9.3	7.5	20	90798	79
130	7.6	52.8	1292	29.0	33.0	-1.3	12.5	8.0	7.4	20	90836	79
131	7.3	51.8	1156	29.0	33.0	-1.8	12.0	7.2	7.5	20	90836	79
132	6.6	50.7	821	29.0	33.0	-1.8	10.7	5.6	6.0	20	90836	79
133	6.2	50.1	706	29.0	32.9	-1.8	10.2	6.9	6.7	20	90836	79
134	6.2	51.8	684	29.0	31.7	-1.8	10.1	7.4	7.6	20	90836	79
135	7.5	54.0	1211	29.0	27.3	-0.2	11.9	7.7	8.1	19	91301	79
136	9.0	52.8	1953	29.0	25.7	1.8	12.6	9.6	8.9	19	91387	79
137	8.9	52.1	1914	29.0	25.1	0.7	12.4	9.5	6.6	19	91387	79
138			2010	29.0	24.9	0.6	12.5	8.7	6.0	19	91387	79
139	9.5	53.0	2164	29.0	22.4	2.1	12.8	10.3	5.9	19	76931	61
140	9.6	52.6	2213	29.0	22.0	4.5	13.1	10.5	7.3	19	60006	5
141	10.5	52.0	2189	29.0	19.3	5.7	12.9	11.5	7.1	20	84887	64
142	11.0	52.7	2116	29.0	19.2	4.8	12.5	12.0	6.8	20	99423	64
143			2056	29.0	19.3	2.7	12.2	9.8	7.5	20	99422	64
144	9.9	53.5	2065	29.0	17.6	1.0	12.2	10.8	7.7	20	99423	64
145	9.7	53.5	2152	29.0	16.2	2.5	12.7	10.6	7.4	20	99423	64
146	9.3	53.5	2150	29.0	15.6	3.5	12.7	10.2	8.3	20	99423	64
147			1999	29.0	13.4	0.5	12.1	9.3	7.4	20	99422	63
148			1805	29.0	12.0	-1.0	12.4	8.3	7.1	20	99423	63
149			2082	29.0	10.3	0.3	12.6	10.2	6.2	20	99422	63
150			2102	29.0	10.4	0.3	12.6	10.0	6.6	20	99423	63
151			1960	29.0	10.4	0.1	12.6	9.8	6.2	20	99422	63
152			2059	29.0	10.4	0.4	12.6	9.5	6.4	20	99422	63
153			1996	29.0	10.4	0.2	12.5	10.5	7.4	20	99423	64
154			1825	29.0	10.4	-0.7	12.5	9.6	7.1	20	99422	64
155			1987	29.0	10.4	-0.2	12.6	9.9	7.4	20	99423	64
156			1883	29.0	10.4	-0.9	12.6	9.4	8.0	20	99422	64
157			2093	29.0	10.4	-0.2	12.6	9.4	7.2	20	99423	64
158			2026	29.0	11.6	-0.5	12.5	11.5	7.2	20	99422	64
159			1903	29.0	12.8	-0.8	12.5	9.9	6.7	20	99423	65
160			2049	29.0	12.8	-0.4	12.6	10.3	7.4	20	99423	65
161			1997	29.0	12.8	-0.6	12.6	10.0	7.3	20	99422	65
162			1974	29.0	12.8	-0.6	12.5	10.7	7.5	20	99422	65
163			1723	29.0	13.0	-1.5	12.5	9.3	6.8	20	99422	65
164	7.7	53.4	1348	29.0	15.6	-1.8	12.4	8.9	7.1	20	99423	65
165	7.6	54.2	1264	29.0	15.7	-1.8	12.4	8.5	8.1	19	99423	65
166	7.2	52.7	1104	29.0	16.0	-1.8	11.8	5.8	7.7	19	99422	65
167	7.0	53.9	1001	29.0	18.9	-1.7	11.5	7.6	8.4	19	99422	65
168	8.1	53.5	1511	29.0	19.1	-0.5	12.6	9.9	9.5	19	99422	65
169	7.6	53.5	1284	29.0	19.6	-1.8	12.4	8.6	10.9	19	99422	65
170	7.2	52.7	1064	29.0	21.9	-1.8	11.7	7.0	10.0	19	99423	65
171	7.3	53.7	1119	29.0	21.9	-1.8	11.9	7.3	8.9	19	99422	64
172	7.5	53.4	1223	29.0	21.8	-1.8	12.4	6.9	9.5	19	99423	64
173	8.9	54.2	1881	29.0	21.8	-0.4	12.9	8.7	9.0	19	99422	64
174	9.4	54.1	2200	29.0	21.8	2.7	13.0	10.2	9.7	19	99422	64
175			2142	29.0	20.7	2.6	12.7	9.7	11.0	19	99422	64
176	9.4	54.1	2159	29.0	19.1	3.5	12.8	10.2	9.2	19	99423	64

Table E.01 Measurement data - Turbine ON

Project: Cedar Point Wind Power Project - Turbine CP226 - IEC 61400-11 Measurement

Report ID: 15039.00.T226.RP3

Created on: 9/14/2017

***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 (Pa)	Relative Humidity (%)
177	9.5	54.4	2150	29.0	19.1	4.0	12.7	10.3	9.4	19	99422	64
178	9.6	54.0	2110	29.0	19.1	3.2	12.4	10.4	8.7	19	99423	64
179			2105	29.0	19.1	2.7	12.4	10.0	8.0	19	99422	64
180	9.8	53.5	2083	29.0	19.0	1.2	12.3	10.6	8.3	19	99422	64
181	9.8	53.9	2080	29.0	19.0	-0.1	12.3	10.7	8.4	19	99422	64
182	9.8	53.2	2121	29.0	19.1	0.5	12.6	10.7	7.3	19	99422	64
183	10.3	54.2	2166	29.0	19.1	1.8	12.8	11.2	7.0	19	99422	63
184			2170	29.0	19.1	2.8	12.8	9.8	6.2	19	99422	63
185			2132	29.0	19.1	2.6	12.6	9.4	6.1	19	99422	63
186	9.6	53.2	2138	29.0	18.8	3.0	12.7	10.4	5.8	19	99422	63
187	9.8	53.4	2167	29.0	16.8	4.1	12.8	10.7	5.6	19	99423	63
188	10.1	53.6	2168	29.0	16.8	5.0	12.8	11.0	6.6	19	99422	63
189	9.6	53.1	2131	29.0	16.8	4.9	12.6	10.4	6.1	19	99422	64
190	9.2	53.0	1994	29.0	16.8	2.0	12.1	10.6	8.0	19	99422	64
191	8.5	54.2	1688	29.0	16.8	-0.2	12.3	8.8	8.5	19	99422	64
192	8.3	54.2	1638	29.0	16.8	-1.6	12.5	9.6	7.9	19	99422	64
193	8.3	54.2	1639	29.0	16.8	-1.8	12.5	9.8	8.1	19	99422	64
194	8.0	53.7	1473	29.0	16.7	-1.8	12.5	7.9	7.2	19	99422	64
195	7.9	53.6	1401	29.0	16.7	-1.8	12.5	8.0	7.7	19	99422	63
196	8.2	54.4	1556	29.0	16.7	-1.8	12.6	9.5	6.0	19	99422	63
197	8.1	53.7	1497	29.0	18.8	-1.8	12.6	7.5	5.2	19	99422	63
198	7.8	53.8	1385	29.0	20.1	-1.8	12.5	6.6	7.6	19	99422	63
199	7.5	53.1	1214	29.0	20.1	-1.8	12.3	8.2	7.0	19	99422	63
200	7.4	53.2	1203	29.0	20.3	-1.8	12.2	8.3	5.6	19	99422	63
201	7.3	53.2	1132	29.0	22.7	-1.8	12.0	6.7	3.9	20	99422	63
202	7.2	53.6	1072	29.0	22.9	-2.0	11.7	7.6	6.4	20	99422	63
203	7.4	53.4	1181	29.0	22.8	-2.1	12.2	8.2	6.9	20	99422	63
204	7.5	53.4	1248	29.0	22.8	-2.1	12.4	9.1	6.0	20	99422	63
205	7.3	53.7	1156	29.0	22.8	-2.1	12.0	7.6	5.9	20	99422	63
206	7.2	52.6	1061	29.0	22.8	-2.1	11.7	8.6	5.2	20	99422	63
207	6.5	51.8	817	29.0	22.8	-2.1	10.7	7.5	6.9	20	99422	62
208	6.3	52.3	728	29.0	22.8	-1.7	10.3	6.9	6.5	20	99422	62
209	6.2	50.7	691	29.0	22.8	-1.5	10.1	5.6	5.7	20	99422	62
210	6.3	51.6	739	29.0	22.8	-1.5	10.4	7.2	7.1	20	99422	62
211	7.5	53.5	1242	29.0	21.4	-0.5	12.1	7.9	7.5	20	99422	62
212	8.6	54.2	1759	29.0	19.8	-0.3	12.7	9.3	7.1	20	99422	62
213	8.3	54.4	1607	29.0	19.7	-1.5	12.5	8.5	5.8	20	99422	61
214	8.7	54.5	1790	29.0	18.2	-1.6	12.6	8.9	5.1	20	99422	61
215			2044	29.0	17.4	-1.2	12.7	9.4	4.2	20	99422	61
216			2096	29.0	14.9	-0.4	12.6	9.8	3.5	20	99422	61
217			2031	29.0	14.6	-0.6	12.5	8.9	3.3	20	99422	61
218			2088	29.0	11.9	-0.4	12.6	9.5	4.4	20	99422	61
219			2151	29.0	11.7	0.4	12.7	9.8	5.6	20	99423	63
220			2163	29.0	11.6	1.7	12.8	10.1	6.5	20	99422	63
221			2129	29.0	10.3	1.6	12.6	10.8	6.4	20	99422	63
222			2179	29.0	9.4	3.2	12.9	11.6	6.2	20	99423	63
223			2148	29.0	9.5	3.8	12.7	10.4	5.2	20	99422	63
224			2110	29.0	9.5	3.0	12.5	10.6	6.7	20	99422	63
225			2116	29.0	9.5	2.7	12.6	10.0	6.8	20	99422	65
226			2199	29.0	9.5	5.0	13.0	11.4	7.6	20	99422	65
227			2075	29.0	9.5	4.3	12.5	10.3	7.4	20	99422	65
228			2028	29.0	9.5	2.3	12.4	11.3	7.5	20	99422	65
229			2154	29.0	9.5	4.2	12.8	11.3	7.7	20	99422	65
230			2127	29.0	9.4	4.0	12.6	10.9	8.1	20	99422	65
231			2110	29.0	10.3	3.9	12.5	10.8	9.0	20	99422	63
232			2144	29.0	12.2	4.6	12.7	11.2	7.6	20	99422	62
233			2115	29.0	12.2	4.3	12.5	10.0	6.5	20	99422	62
234			2090	29.0	12.2	3.4	12.4	9.2	6.7	20	99422	62
235			2055	29.0	12.2	1.0	12.2	10.3	6.6	20	99422	62
236			2098	29.0	12.1	0.7	12.4	11.3	7.3	20	99422	62
237			2074	29.0	12.1	-0.3	12.4	10.0	7.4	20	99421	61
238			1784	29.0	12.1	-1.2	12.4	10.1	6.5	20	99422	61
239			1615	29.0	12.1	-1.8	12.5	8.8	6.6	20	99422	61
240			1718	29.0	12.1	-1.8	12.6	9.9	6.9	20	99422	61
241			2029	29.0	12.1	-1.1	12.8	10.3	6.9	20	99422	61
242			1849	29.0	12.1	-1.4	12.4	8.9	6.2	20	99422	61
243			1693	29.0	12.2	-1.4	12.6	9.7	6.0	20	99422	61
244			1904	29.0	12.2	-0.9	12.6	9.5	5.2	20	99422	61
245			2059	29.0	12.1	-0.2	12.6	10.2	4.4	20	99422	61
246			1967	29.0	12.2	-0.6	12.5	10.2	6.0	20	99422	61
247			1690	29.0	12.1	-1.6	12.5	9.4	6.5	20	99422	61
248			2100	29.0	12.1	0.1	12.7	9.7	7.3	20	99423	61
249			2114	29.0	12.1	0.4	12.6	10.0	7.5	20	99422	63
250			2088	29.0	12.1	0.2	12.6	9.3	8.8	20	99422	63
251			2148	29.0	9.9	1.3	12.7	9.2	7.4	20	99422	63
252			1995	29.0	9.2	0.0	12.4	9.5	8.0	20	99422	63
253			1807	29.0	9.2	-0.6	12.5	9.1	9.0	20	99422	63
254			1789	29.0	9.2	-1.7	12.6	8.2	8.5	20	99422	63
255			1879	29.0	9.1	-1.6	12.6	8.6	8.8	20	99423	60
256			1456	29.0	9.1	-1.8	12.4	7.4	8.2	20	99423	60
257			1467	29.0	9.1	-1.8	12.6	8.0	8.1	20	99422	60
258			1797	29.0	9.1	-1.7	12.7	9.0	8.0	20	99422	60
259			1680	29.0	9.1	-1.8	12.5	8.9	7.1	20	99423	60
260			1503	29.0	9.1	-1.8	12.5	8.1	6.3	20	99422	60
261			1522	29.0	9.1	-1.8	12.6	9.8	6.3	20	99422	61
262			1905	29.0	9.1	-1.7	12.7	9.7	7.4	20	99422	61
263			1812	29.0	9.1	-2.0	12.5	9.9	7.4	20	99422	61
264			1334	29.0	9.1	-2.1	12.3	7.1	5.9	20	99423	61

***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 (Pa)	Relative Humidity (%)
265			1195	29.0	9.1	-2.1	12.2	8.4	5.7	20	99422	61
266			1135	29.0	9.1	-2.1	12.0	8.0	7.2	20	99422	61
267			991	29.0	9.1	-2.1	11.4	7.3	7.5	20	99422	61
268	7.0	51.6	1008	29.0	16.9	-1.7	11.5	7.3	7.1	20	99422	61
269	8.4	53.0	1652	29.0	17.0	0.1	12.7	8.9	8.0	20	99422	61
270	8.9	53.2	1883	29.0	17.0	-0.6	12.6	8.7	6.9	20	99422	61
271	9.1	53.8	1963	29.0	16.9	-0.9	12.6	8.7	5.7	20	99422	61
272	8.9	53.5	1884	29.0	14.6	-0.8	12.5	9.6	6.2	20	99422	61
273	8.9	54.1	1907	29.0	14.4	-0.7	12.6	9.2	6.5	20	99422	61
274	9.2	53.6	1983	29.0	14.4	-0.5	12.6	8.5	5.3	20	99422	61
275	8.7	53.9	1819	29.0	14.4	-1.2	12.5	8.9	7.1	20	99423	61
276	8.6	53.6	1752	29.0	14.4	-1.8	12.5	8.3	6.9	20	99422	61
277	8.5	53.0	1722	29.0	14.4	-1.8	12.6	8.6	7.0	20	99422	61
278	8.7	54.2	1813	29.0	14.4	-1.8	12.6	9.5	7.3	20	99422	61
279	8.9	54.2	1893	29.0	14.4	-1.7	12.6	9.1	7.5	20	99422	61
280	7.9	53.9	1414	29.0	14.3	-1.8	12.4	7.8	6.6	20	99422	61
281	7.5	54.0	1220	29.0	14.4	-1.7	12.3	7.7	7.3	20	99422	61
282	8.6	54.4	1756	29.0	14.4	-1.2	12.7	9.7	7.4	20	99422	63
283	10.3	54.3	2045	29.0	16.2	-1.3	12.7	11.2	8.7	20	99423	63
284	9.2	54.7	1984	29.0	17.4	-0.8	12.5	9.8	7.8	20	99422	63
285	8.0	54.0	1474	29.0	17.4	-1.8	12.4	8.8	6.1	20	99422	63
286	7.7	53.9	1330	29.0	19.0	-1.8	12.5	9.0	7.8	20	99422	63
287	8.1	54.1	1510	29.0	20.8	-1.7	12.6	9.3	8.1	20	99421	63
288	9.0	53.6	1938	29.0	21.0	-1.5	12.7	10.7	7.3	20	99422	60
289	8.8	53.8	1852	29.0	23.3	-1.7	12.5	10.8	9.3	20	99422	59
290	8.6	53.8	1736	29.0	23.4	-1.8	12.5	10.8	8.6	20	99422	59
291	8.5	53.6	1690	29.0	23.4	-1.8	12.6	10.0	8.5	20	99422	59
292	7.7	53.6	1311	29.0	24.9	-1.8	12.3	8.5	8.7	20	99422	59
293	7.2	52.8	1103	29.0	25.8	-1.8	11.8	7.1	8.3	20	99422	59
294	6.8	50.1	903	29.0	25.8	-1.8	11.0	8.2	7.3	20	99422	61
295	6.3	49.9	720	29.0	22.5	-1.6	10.3	7.1	8.5	20	99422	62
296	6.2	49.4	685	29.0	21.5	-1.5	10.1	6.6	7.9	20	99422	62
297	6.5	50.9	816	29.0	21.5	-1.5	10.7	8.0	8.0	20	99421	62
298	6.6	50.3	857	29.0	21.4	-1.5	10.9	5.4	7.4	20	99423	62
299	6.7	50.8	884	29.0	19.0	-1.5	11.0	7.0	6.5	20	99422	62
300	6.9	51.9	941	29.0	18.8	-1.5	11.2	8.1	6.9	20	99422	62
301	7.0	51.6	1012	29.0	18.8	-1.9	11.5	8.1	7.6	20	99422	63
302	7.8	52.8	1371	29.0	18.7	-1.9	12.5	8.0	8.5	20	99422	63
303	8.3	53.7	1607	29.0	16.1	-2.1	12.6	9.5	8.8	20	99422	63
304	7.8	53.7	1392	29.0	15.8	-2.1	12.5	9.3	9.0	20	99422	63
305	7.6	53.1	1257	29.0	15.8	-2.1	12.4	8.8	8.1	20	99422	63
306	7.4	52.7	1184	29.0	15.9	-2.1	12.2	7.7	6.7	20	99422	62
307	7.5	53.6	1244	29.0	16.0	-1.7	12.4	8.6	8.1	20	99422	62
308	8.1	53.4	1523	29.0	18.5	-1.5	12.6	8.9	6.2	20	99422	62
309	7.6	53.4	1294	29.0	18.7	-1.5	12.5	7.7	5.5	20	99422	62
310	7.5	52.9	1239	29.0	18.7	-1.5	12.4	7.3	4.6	20	99422	62
311	8.0	53.4	1458	29.0	18.7	-1.4	12.6	8.9	5.2	20	99422	62
312	8.2	53.5	1574	29.0	18.7	-1.5	12.6	8.3	5.4	20	99422	62
313	7.3	53.0	1152	29.0	18.7	-1.9	12.0	7.1	4.9	20	99422	63
314	7.1	52.3	1056	29.0	18.6	-2.1	11.7	7.6	6.3	20	99422	63
315	7.5	53.1	1245	29.0	18.7	-2.0	12.4	9.7	6.7	20	99422	63
316	7.7	53.1	1320	29.0	18.7	-2.1	12.5	9.0	7.2	20	99422	63
317	7.5	53.5	1217	29.0	18.6	-2.1	12.3	7.1	7.4	20	99422	63
318	7.5	52.7	1214	29.0	18.6	-2.1	12.3	7.6	6.6	20	99422	63
319	8.0	53.7	1466	29.0	17.9	-1.7	12.6	7.8	5.8	20	99422	63
320	8.8	53.6	1859	29.0	15.1	-1.2	12.7	9.8	7.0	20	99422	63
321	9.9	53.5	2116	29.0	15.1	-0.4	12.7	10.8	7.4	20	99422	63
322	9.6	54.8	2165	29.0	15.1	1.1	12.8	10.5	6.7	20	99422	63
323			2186	29.0	15.1	2.8	12.9	9.8	8.1	20	99422	63
324	10.1	53.8	2126	29.0	15.1	2.3	12.6	11.0	9.7	20	99422	61
325			2112	29.0	13.7	1.8	12.5	9.8	9.8	20	99422	60
326			2139	29.0	12.8	2.5	12.6	10.0	8.6	20	99422	60
327			1205	12.0	9.9	-1.8	12.3	8.0	6.6	20	99400	61
328			1090	12.0	10.3	-2.0	11.8	7.5	6.2	20	99401	61
329			1214	12.0	12.7	-1.8	12.2	8.7	5.8	20	99400	61
330			1411	12.0	12.7	-2.0	12.5	8.8	5.6	20	99401	61
331			1195	12.0	12.7	-2.1	12.2	9.1	7.1	20	99401	61
332			1343	12.0	12.7	-2.0	12.5	8.3	7.2	20	99401	61
333			1714	12.0	12.7	-2.1	12.7	8.9	7.6	20	99400	60
334			1865	12.0	12.6	-1.8	12.6	10.8	6.6	20	99401	60
335			1885	12.0	14.1	-1.4	12.6	9.5	7.1	20	99401	60
336			2152	12.0	14.9	0.2	12.8	9.6	7.2	20	99401	60
337			2170	12.0	15.0	2.0	12.8	10.0	10.3	20	99401	60
338			2048	12.0	15.0	0.3	12.4	9.1	10.0	20	99406	60
339			2151	12.0	15.0	1.5	12.8	9.9	10.0	20	99422	60
340			2109	12.0	15.0	2.1	12.5	9.3	7.1	20	99423	60
341			1221	12.0	9.6	3.9	12.3	8.1	7.8	20	99422	63
342			1124	12.0	9.6	5.9	13.0	9.9	6.9	20	99422	63
343			1257	12.0	9.6	9.3	13.3	10.5	6.9	20	99422	63
344			1352	12.0	9.6	10.1	13.0	11.1	5.4	20	99422	65
345			1349	12.0	9.7	9.0	12.4	10.2	4.7	20	99422	65
346			1334	12.0	9.7	7.0	12.1	10.1	5.3	20	99422	65
347			1322	12.0	9.7	5.4	12.1	10.0	5.9	20	99422	65
348			1310	12.0	9.7	5.8	12.6	10.5	6.5	20	99422	65
349			1377	12.0	9.6	7.8	12.9	10.6	6.0	20	99422	65
350			1370	12.0	9.7	7.1	12.5	10.1	7.1	20	99422	62
351			1405	12.0	9.7	7.1	12.6	9.8	7.4	20	99422	62
352			1391	12.0	9.7	6.4	12.4	9.9	7.1	20	99421	62

Table E.01 Measurement data - Turbine ON

Project: Cedar Point Wind Power Project - Turbine CP226 - IEC 61400-11 Measurement

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Created on: 9/14/2017

***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 (Pa)	Relative Humidity (%)
353			1343	12.0	9.7	4.6	12.2	9.3	5.8	20	99422	62
354			1216	12.0	9.7	3.7	12.3	9.3	5.1	20	99422	62
355			1064	12.0	9.7	4.2	12.6	7.8	5.9	20	99422	62
356			990	12.0	9.7	6.0	13.0	8.7	8.2	20	99422	62
357			1132	12.0	9.7	8.9	13.3	10.3	6.3	20	99422	63
358			1249	12.0	9.7	8.5	12.7	10.1	5.7	20	99422	63
359			1302	12.0	9.7	7.2	12.3	9.8	5.8	20	99422	63
360			1288	12.0	9.7	5.5	12.1	9.5	5.9	20	99422	63
361			1202	12.0	9.7	4.7	12.3	9.2	4.7	20	99421	63
362			1055	12.0	9.7	5.3	12.7	7.8	4.7	20	99422	65
363			994	12.0	12.3	6.6	12.8	7.7	7.0	20	99422	65
364			839	12.0	14.4	5.0	12.3	7.9	7.6	20	99422	65
365			573	12.0	15.9	5.4	12.7	7.0	6.8	20	99422	65
366			399	12.0	16.2	8.0	13.2	6.0	5.1	20	99422	65
367			507	12.0	18.6	10.0	13.2	7.7	5.7	20	99422	65
368			644	12.0	18.7	9.2	12.6	7.7	5.9	20	99445	65
369			538	12.0	18.6	7.9	12.3	7.2	6.4	20	99451	65
370			406	12.0	18.6	9.8	13.0	8.4	8.0	20	99452	65
371	11.2	51.5	2165	12.0	12.8	7.6	12.8	12.2	10.1	20	99426	65
372	10.5	53.1	2132	12.0	12.8	7.4	12.6	11.4	7.2	20	99425	65
373	11.3	51.9	2127	12.0	12.8	7.2	12.5	12.3	9.7	20	99425	65
374	11.5	51.6	2124	12.0	13.5	7.5	12.6	12.5	9.8	20	99426	65
375	10.8	52.5	2112	12.0	15.4	6.8	12.5	11.8	9.1	20	99425	65
376	11.5	51.4	2128	12.0	15.4	7.1	12.6	12.5	10.4	20	99425	65
377	10.9	51.1	2092	12.0	15.4	6.0	12.3	11.9	10.1	20	99425	64
378	10.4	51.0	2123	12.0	15.4	5.9	12.5	11.3	8.8	20	99425	63
379	10.7	51.4	2120	12.0	15.4	6.0	12.5	11.7	7.0	20	99424	63
380	10.9	51.8	2129	12.0	15.4	5.8	12.5	11.8	5.6	20	99424	63
381	10.7	51.3	2131	12.0	15.4	5.9	12.6	11.7	7.5	20	99424	63
382	10.6	51.6	2131	12.0	15.4	5.9	12.5	11.6	8.5	20	99424	63
383	11.0	52.0	2130	12.0	15.6	5.9	12.6	12.0	8.8	20	99424	63
384	11.1	51.5	2170	12.0	17.7	7.1	12.8	12.0	7.7	20	99423	63
385	10.1	51.6	2088	12.0	17.8	5.5	12.3	11.0	7.1	20	99424	63
386	9.8	51.4	2144	12.0	17.8	6.3	12.7	10.7	7.0	20	99423	63
387	9.5	51.1	2074	12.0	17.8	4.4	12.2	10.3	8.0	20	99423	63
388	9.6	51.3	2061	12.0	17.8	2.5	12.2	10.5	7.1	20	99424	63
389	11.1	52.0	2167	12.0	17.8	4.1	12.8	12.1	7.2	20	99423	63
390	9.3	52.2	2147	12.0	17.8	4.6	12.7	10.1	6.8	20	99424	63
391	10.6	52.7	2161	12.0	17.8	5.0	12.7	11.6	6.3	20	99424	63
392	10.1	51.6	2177	12.0	17.8	6.4	12.8	11.1	8.0	20	99424	63
393	9.9	50.9	2074	12.0	15.8	4.4	12.3	10.7	7.7	20	99424	63
394	10.6	51.9	2117	12.0	14.9	4.2	12.5	11.6	5.6	20	99423	63
395	10.7	53.0	2189	12.0	15.0	6.1	12.9	11.7	4.7	20	99423	64
396	9.4	51.5	2184	12.0	15.0	7.2	12.8	10.3	4.7	20	99423	65
397	10.2	51.3	2074	12.0	15.0	5.2	12.3	11.1	4.8	20	99423	65
398	10.3	52.0	2124	12.0	15.0	5.1	12.5	11.2	5.8	20	99423	65
399	10.9	52.3	2185	12.0	15.0	6.9	12.9	11.8	9.6	20	99423	65
400	10.6	52.5	2153	12.0	15.0	7.1	12.7	11.6	8.2	20	99423	65
401	10.9	51.7	2097	12.0	15.0	6.1	12.4	11.9	7.4	20	99423	64
402	10.5	51.6	2118	12.0	15.0	6.1	12.5	11.4	8.6	20	99423	62
403	9.8	51.1	2075	12.0	15.0	4.5	12.2	10.6	9.6	20	99423	62
404	10.0	51.0	2067	12.0	15.0	2.9	12.2	10.9	8.6	20	99423	62
405	9.9	51.5	2113	12.0	15.0	2.8	12.5	10.8	7.9	20	99423	62
406			2135	12.0	15.0	3.2	12.6	9.9	7.0	20	99424	62
407	9.8	51.5	2105	12.0	15.0	2.1	12.4	10.7	7.4	20	99424	63
408			2109	12.0	14.9	1.6	12.4	9.7	6.3	20	99424	63
409	10.2	51.8	2138	12.0	14.9	1.9	12.6	11.1	6.4	20	99423	63
410	11.0	52.3	2190	12.0	14.2	4.0	12.9	12.0	6.6	20	99424	63
411	10.0	51.7	2201	12.0	11.9	5.7	13.0	10.9	6.9	20	99424	63
412	10.4	51.2	2135	12.0	11.9	5.0	12.6	11.3	7.2	20	99424	63
413	10.9	51.5	2140	12.0	11.9	5.6	12.7	11.8	7.3	20	99424	63
414	10.6	51.3	2136	12.0	11.9	5.6	12.6	11.6	8.0	20	99424	63
415	10.5	51.3	2142	12.0	11.9	5.9	12.7	11.4	7.9	20	99424	63
416	9.5	51.8	2105	12.0	11.9	5.4	12.4	10.4	9.8	20	99424	63
417	10.7	52.0	2133	12.0	11.9	5.4	12.6	11.6	8.4	20	99424	63
418	10.7	51.1	2147	12.0	11.9	6.1	12.7	11.7	8.1	20	99424	63
419	10.2	51.0	2142	12.0	11.9	6.3	12.6	11.1	8.4	20	99424	63
420	10.3	51.2	2120	12.0	11.9	6.1	12.5	11.2	8.7	20	99424	63
421	10.2	51.4	2087	12.0	11.9	5.0	12.3	11.1	6.7	20	99424	63
422	9.6	51.4	2084	12.0	11.9	3.7	12.3	10.5	6.5	20	99424	63
423	9.8	50.9	2108	12.0	11.9	3.7	12.5	10.7	7.8	20	99424	63
424	10.3	51.9	2142	12.0	11.9	4.1	12.7	11.2	10.3	20	99424	63
425	10.8	52.1	2195	12.0	11.9	6.0	13.0	11.7	8.9	20	99424	63
426	11.4	51.6	2150	12.0	11.9	6.2	12.7	12.4	7.3	20	99424	63
427	11.0	51.6	2124	12.0	11.9	5.8	12.5	12.0	5.8	20	99424	63
428	11.2	51.7	2101	12.0	11.9	5.2	12.4	12.2	5.7	20	99424	63
429	10.8	51.7	2134	12.0	11.9	5.5	12.6	11.8	6.4	20	99424	63
430	11.7	51.7	2137	12.0	13.3	6.0	12.6	12.8	7.0	20	99424	63
431	10.3	51.5	2073	12.0	14.5	4.3	12.2	11.2	6.8	20	99424	63
432	8.7	51.8	1804	12.0	14.5	0.6	12.0	9.0	7.3	20	99423	64
433	8.6	52.6	1771	12.0	14.6	0.2	12.4	9.6	6.2	20	99423	64
434	8.5	52.6	1730	12.0	14.6	-0.6	12.5	9.5	6.0	20	99423	64
435	9.0	52.3	1931	12.0	14.6	-0.2	12.7	8.0	7.3	20	99423	64
436	9.9	52.3	2029	12.0	14.6	0.3	12.6	10.8	8.5	20	99424	64
437	9.7	52.6	2020	12.0	14.6	1.1	12.7	10.5	10.4	20	99418	63
438			2087	12.0	14.6	1.6	12.8	10.0	9.2	20	99396	62
439			2180	12.0	14.6	4.7	13.1	9.9	8.1	20	99397	62
440	9.2	51.3	1981	12.0	14.6	3.7	12.5	9.9	8.0	20	99396	62

***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 (Pa)	Relative Humidity (%)
441	7.9	51.2	1401	12.0	15.2	1.6	12.0	9.8	9.1	20	99418	62
442	8.4	51.5	1674	12.0	15.1	-0.5	12.5	10.8	8.6	20	99424	62
443	8.4	52.1	1654	12.0	15.1	-1.8	12.6	10.6	7.8	20	99423	62
444	8.7	52.6	1795	12.0	15.2	-1.7	12.6	10.4	7.6	20	99423	62
445	8.5	52.4	1733	12.0	15.2	-1.6	12.6	10.2	7.3	20	99423	62
446	10.5	53.1	2246	12.0	15.1	3.0	13.3	11.5	8.4	20	99423	62
447	10.6	52.5	2261	12.0	15.1	7.2	13.4	11.6	7.2	20	99424	64
448	11.1	51.8	2204	12.0	15.1	7.9	13.0	12.0	5.2	20	99423	64
449	10.3	51.4	2127	12.0	15.1	7.4	12.6	11.2	7.1	20	99423	64
450	11.0	51.1	2127	12.0	15.1	7.3	12.6	12.0	7.7	20	99423	64
451	11.1	51.1	2078	12.0	15.1	6.1	12.2	12.1	6.8	20	99424	64
452	9.9	51.1	2034	12.0	15.1	3.2	12.0	10.8	9.9	20	99423	64
453	11.5	51.8	2179	12.0	15.1	5.5	12.9	12.5	8.3	20	99423	62
454	9.8	51.5	2157	12.0	15.1	6.2	12.7	10.7	7.8	20	99423	62
455	10.6	51.5	2162	12.0	15.1	6.8	12.8	11.6	8.2	20	99423	62
456	8.8	51.3	1837	12.0	15.1	3.1	12.0	9.6	8.0	20	99423	62
457	8.3	52.0	1597	12.0	13.8	0.2	12.0	8.9	8.5	20	99423	62
458	8.4	52.3	1643	12.0	12.4	0.1	12.5	8.6	9.0	20	99423	62
459	8.6	52.0	1748	12.0	12.4	0.4	12.6	8.4	9.4	20	99423	62
460	8.7	52.0	1823	12.0	12.4	0.2	12.6	9.4	9.0	20	99423	62
461	8.9	52.3	1916	12.0	12.4	0.3	12.6	9.0	6.0	20	99423	62
462	9.8	52.0	2060	12.0	12.4	0.6	12.6	10.7	7.9	20	99423	62
463	9.5	52.2	2161	12.0	12.4	1.7	12.7	10.3	6.5	20	99423	62
464	9.3	52.7	2014	12.0	12.4	0.4	12.4	10.1	6.1	20	99423	62
465	8.9	52.7	1881	12.0	12.4	0.3	12.5	10.0	5.7	20	99423	64
466	10.4	52.3	2037	12.0	12.4	1.2	12.8	11.4	6.6	20	99423	64
467	10.5	52.4	2280	12.0	12.5	6.3	13.5	11.4	5.7	20	99423	64
468	10.9	52.1	2249	12.0	12.5	8.3	13.3	11.9	5.6	20	99423	64
469	12.5	53.6	2237	12.0	12.5	10.1	13.2	13.6	5.7	20	99423	64
470	11.6	51.4	2115	12.0	12.5	9.3	12.5	12.6	6.9	20	99423	64
471	10.6	52.2	2065	12.0	12.5	7.7	12.2	11.6	6.9	20	99423	63
472	11.0	51.9	2075	12.0	12.5	6.8	12.3	11.9	5.9	20	99423	63
473	10.7	52.9	2098	12.0	12.5	6.4	12.4	11.7	7.9	20	99423	63
474	10.8	52.2	2122	12.0	12.5	6.5	12.5	11.8	10.2	20	99423	63
475	11.9	51.6	2139	12.0	12.5	6.8	12.6	12.9	8.6	20	99423	63
476	11.7	51.7	2185	12.0	12.4	8.2	12.9	12.7	7.5	20	99423	63
477	12.6	51.7	2189	12.0	12.5	9.4	13.0	13.7	8.4	20	99423	63
478	11.4	52.1	2143	12.0	12.5	9.4	12.7	12.4	8.1	20	99423	63
479	12.0	51.7	2168	12.0	12.5	10.3	12.8	13.0	8.1	20	99424	63
480	12.6	51.6	2150	12.0	12.5	10.8	12.7	13.7	9.9	20	99423	63
481	12.4	52.7	2129	12.0	12.5	10.7	12.6	13.6	10.0	20	99424	63
482	12.5	53.3	2116	12.0	12.5	10.5	12.6	13.6	12.9	20	99424	63
483	13.6	52.6	2154	12.0	12.5	11.3	12.8	14.8	13.1	20	99424	62
484	12.2	51.8	2101	12.0	12.5	10.7	12.4	13.3	11.9	20	99424	62
485	11.0	52.4	2034	12.0	12.5	8.6	12.1	11.9	10.4	20	99424	62
486	11.0	52.9	2085	12.0	12.5	8.2	12.3	11.9	10.1	20	99424	62
487	10.9	51.5	2108	12.0	12.5	8.3	12.5	11.8	9.7	20	99424	62
488	11.5	51.6	2126	12.0	12.5	8.2	12.6	12.6	8.8	20	99424	62
489	11.8	51.5	2142	12.0	12.4	8.8	12.7	12.9	8.9	20	99424	62
490	11.4	51.6	2165	12.0	12.5	9.7	12.8	12.4	9.7	20	99424	63
491	11.5	51.8	2114	12.0	12.5	9.1	12.5	12.5	9.8	20	99423	63
492	11.5	52.0	2141	12.0	12.5	9.5	12.7	12.5	8.0	20	99424	63
493	11.3	51.7	2140	12.0	12.5	9.9	12.6	12.3	6.4	20	99424	63
494	11.0	51.7	2046	12.0	12.5	7.9	12.1	12.0	5.7	20	99424	63
495	11.2	51.3	2107	12.0	12.5	8.0	12.4	12.2	5.9	20	99424	65
496	10.1	52.1	2088	12.0	12.5	7.0	12.4	11.0	5.7	20	99424	65
497	11.5	52.5	2191	12.0	12.5	8.9	13.0	12.5	7.5	20	99423	65
498	11.5	53.3	2199	12.0	12.5	10.3	13.0	12.6	6.9	20	99423	65
499	11.9	54.5	2135	12.0	12.5	10.0	12.6	13.0	6.6	20	99424	65
500	10.8	52.2	2125	12.0	13.1	10.2	12.6	11.8	8.7	20	99424	65
501	10.6	51.0	2071	12.0	15.0	8.9	12.2	11.6	7.3	20	99423	63
502	10.8	52.0	2020	12.0	15.0	6.3	11.9	11.7	7.3	20	99424	63
503	8.9	53.7	1920	12.0	15.0	2.7	11.8	11.4	8.2	20	99424	63
504	10.1	52.0	2094	12.0	15.0	2.9	12.4	11.0	7.8	20	99424	63
505	9.7	52.9	2169	12.0	15.0	4.6	12.8	10.6	7.7	20	99424	63
506	11.1	53.6	2204	12.0	15.0	6.6	13.0	12.1	7.6	20	99424	63
507	8.9	51.7	1916	12.0	16.3	2.8	12.0	11.0	8.5	20	99424	63
508	8.2	51.9	1552	12.0	17.2	-0.3	12.3	9.4	9.1	20	99424	63
509	8.0	52.8	1488	12.0	18.0	-1.7	12.5	8.1	9.7	20	99424	63
510	7.5	52.8	1254	12.0	20.8	-1.8	12.4	8.9	10.3	20	99424	63
511	7.9	53.2	1404	12.0	22.4	-1.5	12.6	8.5	9.6	20	99424	63
512			2021	12.0	24.1	-0.1	13.0	8.5	9.6	20	99424	63
513	11.0	53.7	2309	12.0	24.1	7.2	13.7	12.0	8.5	20	99424	63
514	11.7	53.2	2252	12.0	24.2	9.2	13.3	12.7	7.2	20	99424	63
515	12.4	52.8	2214	12.0	24.2	10.2	13.1	13.5	8.0	20	99424	63
516	11.9	50.8	2160	12.0	24.2	10.4	12.8	13.0	8.8	20	99424	63
517	10.9	50.6	2085	12.0	24.2	9.3	12.3	11.9	10.7	20	99424	63
518	12.0	51.8	2115	12.0	23.5	9.2	12.6	13.1	11.7	20	99424	63
519	11.9	52.9	2174	12.0	21.6	10.6	12.9	12.9	10.1	20	99424	62
520	12.1	52.6	2132	12.0	21.6	10.5	12.6	13.1	10.1	20	99424	62
521	12.4	52.1	2116	12.0	21.6	10.2	12.5	13.5	8.4	20	99424	62
522	12.3	51.6	2112	12.0	21.6	10.0	12.5	13.3	8.7	20	99424	62
523	11.9	52.4	2142	12.0	21.6	10.5	12.7	13.0	9.5	20	99424	62
524	12.3	52.2	2122	12.0	21.6	10.4	12.5	13.4	9.5	20	99424	62
525	12.0	52.1	2114	12.0	21.6	10.1	12.5	13.0	7.5	20	99424	62
526	13.0	52.4	2169	12.0	21.6	11.2	12.8	14.1	8.2	20	99424	62
527	12.5	52.7	2129	12.0	21.6	11.1	12.6	13.6	10.3	20	99424	62
528	12.6	51.9	2131	12.0	21.6	11.3	12.6	13.8	11.2	20	99425	62

Table E.01 Measurement data - Turbine ON

Project: Cedar Point Wind Power Project - Turbine CP226 - IEC 61400-11 Measurement

Report ID: 15039.00.T226.RP3

Created on: 9/14/2017

***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 (Pa)	Relative Humidity (%)
529	11.6	52.6	2062	12.0	21.6	9.8	12.2	12.6	10.7	20	99424	62
530	11.8	52.5	2107	12.0	21.6	9.9	12.5	12.9	9.6	20	99424	62
531	11.7	53.4	2146	12.0	21.4	10.5	12.7	12.8	8.3	20	99416	63
532	12.5	53.7	2157	12.0	19.4	11.3	12.8	13.6	7.4	20	99403	63
533	12.2	52.0	2104	12.0	19.3	10.5	12.4	13.2	6.7	20	99405	63
534	11.4	52.4	2065	12.0	19.3	9.3	12.2	12.5	6.8	20	99405	63
535	11.6	51.3	2066	12.0	19.3	8.2	12.2	12.7	7.3	20	99405	63
536	9.8	51.6	2088	12.0	19.3	7.5	12.3	10.6	7.4	20	99404	63
537	11.0	53.5	2128	12.0	19.3	8.0	12.6	12.0	6.8	20	99405	64
538	11.2	52.6	2098	12.0	19.3	7.3	12.4	12.3	5.8	20	99405	64
539	9.9	51.4	2046	12.0	19.2	4.9	12.0	10.8	6.8	20	99405	64
540	9.8	51.6	2110	12.0	19.2	5.0	12.5	10.7	7.0	20	99405	64
541	9.6	51.9	2135	12.0	18.8	5.6	12.6	10.4	6.7	20	99405	64
542			2108	12.0	16.9	4.6	12.4	9.4	6.1	20	99405	64
543	9.8	52.8	2107	12.0	17.0	3.8	12.4	10.7	7.4	20	99405	65
544	11.5	53.0	2228	12.0	17.0	7.2	13.2	12.5	7.6	20	99405	66
545	10.0	53.0	2132	12.0	17.0	6.4	12.5	10.8	5.4	20	99405	66
546	10.3	52.2	2092	12.0	17.0	5.2	12.4	11.3	6.8	20	99405	66
547	10.4	52.1	2141	12.0	17.0	5.7	12.6	11.3	6.5	20	99406	66
548	11.5	51.8	2114	12.0	17.0	5.3	12.5	12.5	6.2	20	99405	66
549	10.4	51.5	1998	12.0	17.0	2.2	12.0	11.4	4.9	20	99406	65
550	9.0	52.5	1944	12.0	17.0	0.7	12.3	10.8	4.9	20	99405	65
551	10.5	52.5	1997	12.0	17.0	0.1	12.3	11.5	7.8	20	99405	65
552	8.9	52.5	1890	12.0	17.0	-0.2	12.5	11.0	8.1	20	99405	65
553	8.6	53.1	1749	12.0	17.5	-1.2	12.5	9.0	7.8	20	99405	65
554	9.2	53.4	1992	12.0	20.9	-0.4	12.8	9.4	7.6	20	99405	65
555	9.7	53.1	2250	12.0	21.1	3.7	13.3	10.5	7.3	20	99406	63
556	10.2	52.1	2180	12.0	21.0	4.3	12.8	11.1	6.4	20	99406	62
557	11.4	52.6	2128	12.0	21.0	3.6	12.6	12.4	6.6	20	99406	62
558	10.6	52.0	2214	12.0	21.1	6.1	13.0	11.6	5.7	20	99406	62
559			2126	12.0	21.0	5.2	12.5	10.0	6.0	20	99405	62
560	10.4	51.4	2127	12.0	21.0	4.8	12.5	11.3	6.0	20	99405	62
561	11.0	52.1	2176	12.0	21.1	6.2	12.8	11.9	7.2	20	99413	64
562	11.4	52.8	2190	12.0	21.1	7.3	12.9	12.5	7.2	20	99425	64
563	10.9	51.2	2166	12.0	21.1	8.0	12.8	11.9	6.3	20	99425	64
564	11.0	51.4	2089	12.0	20.9	6.8	12.3	12.0	5.8	20	99425	64
565	9.8	52.6	2053	12.0	18.8	4.6	12.1	10.7	5.7	20	99425	64
566	8.6	51.7	1765	12.0	18.3	1.1	11.9	10.4	5.7	20	99425	64
567	9.9	52.3	2004	12.0	15.7	0.9	12.4	10.8	6.5	20	99425	65
568	11.9	52.7	2227	12.0	15.6	4.5	13.2	12.9	6.0	20	99425	65
569	9.7	51.7	2150	12.0	15.6	4.4	12.6	10.6	7.2	20	99425	65
570	8.4	51.7	1680	12.0	15.6	-0.4	12.1	10.0	6.4	20	99425	65
571	10.1	52.1	2147	12.0	15.7	2.2	12.8	11.0	6.7	20	99425	65
572	10.0	52.0	2195	12.0	15.7	4.2	12.9	10.9	7.8	20	99425	65
573	9.9	51.5	2117	12.0	15.7	3.0	12.5	10.8	6.4	20	99425	64
574	8.7	51.9	1819	12.0	15.7	-0.5	12.0	9.9	7.2	20	99425	64
575	8.0	52.3	1492	12.0	15.6	-1.4	12.4	8.3	7.1	20	99425	64
576	8.8	52.7	1843	12.0	15.6	-1.0	12.7	11.0	6.3	20	99425	64
577	8.5	52.7	1731	12.0	15.6	-1.3	12.5	10.3	6.6	20	99425	64
578	8.2	52.6	1588	12.0	15.6	-1.6	12.5	8.9	7.0	20	99425	64
579	8.3	52.9	1601	12.0	15.6	-1.8	12.6	9.9	7.2	20	99425	64
580	8.6	53.0	1771	12.0	15.7	-1.7	12.6	10.5	5.9	20	99425	64
581	9.9	53.0	2087	12.0	17.1	-0.3	12.8	10.8	5.9	20	99425	64
582			2050	12.0	18.5	0.6	12.6	9.9	4.9	20	99425	64
583	10.2	52.8	2127	12.0	18.5	1.7	12.8	11.2	5.2	20	99425	64
584			2159	12.0	18.5	2.3	12.7	9.1	6.2	20	99425	64
585	10.6	53.3	2042	12.0	18.4	0.3	12.3	11.5	7.6	20	99425	65
586	8.5	54.9	1713	12.0	18.6	-0.8	12.4	11.2	7.1	20	99425	65
587	10.3	52.8	1996	12.0	21.1	0.3	12.6	11.2	8.5	20	99425	65
588	8.9	52.5	1911	12.0	21.3	0.0	12.5	10.9	10.2	20	99425	65
589	8.8	53.2	1854	12.0	21.4	-0.6	12.6	10.9	9.8	20	99425	65
590	9.0	53.4	1950	12.0	24.1	-0.2	12.6	10.4	9.8	20	99425	65
591	9.9	53.5	2259	12.0	24.6	4.5	13.4	10.8	8.4	20	99425	63
592			2170	12.0	24.6	4.5	12.7	9.1	8.2	20	99425	63
593	9.8	53.1	2159	12.0	24.6	5.0	12.7	10.7	8.0	20	99425	63
594	9.4	51.2	2017	12.0	24.6	2.6	12.2	10.2	7.8	20	99426	63
595			2094	12.0	24.6	1.7	12.4	9.6	9.0	20	99426	63
596	11.5	52.4	2183	12.0	24.7	3.8	12.8	12.6	8.5	20	99426	63
597	9.3	52.4	2191	12.0	24.7	4.9	12.9	10.1	7.8	20	99426	64
598	11.6	52.8	2251	12.0	23.2	8.4	13.4	12.6	9.1	20	99427	64
599	10.5	53.1	2177	12.0	21.9	8.7	12.8	11.4	9.8	20	99427	64
600	11.6	52.9	2083	12.0	21.6	7.1	12.4	12.7	9.8	20	99426	64
601	12.4	52.9	2230	12.0	19.6	10.0	13.2	13.5	8.7	20	99425	64
602	13.8	52.4	2190	12.0	19.5	11.0	12.9	15.0	11.0	20	99425	64
603	12.9	52.0	2162	12.0	19.5	11.2	12.8	14.1	10.2	20	99425	63
604	12.7	53.9	2123	12.0	19.6	11.2	12.6	13.8	9.3	20	99424	63
605	13.0	53.4	2133	12.0	19.6	11.3	12.6	14.2	8.9	20	99424	63
606	12.7	52.7	2107	12.0	19.6	11.0	12.5	13.8	8.1	20	99425	63
607	12.4	51.9	2130	12.0	19.5	11.3	12.6	13.5	9.1	20	99425	63
608	11.8	51.0	2046	12.0	19.5	9.5	12.1	12.9	9.0	20	99425	63
609	9.1	51.2	1967	12.0	21.9	5.5	11.7	11.1	8.3	20	99425	63
610	11.9	51.8	2110	12.0	22.7	6.1	12.5	13.0	7.3	20	99424	63
611	11.6	51.5	2152	12.0	22.7	7.2	12.7	12.6	7.2	20	99425	63
612	11.9	51.8	2164	12.0	22.7	7.9	12.8	13.0	8.9	20	99425	63
613	10.5	52.0	2121	12.0	22.7	7.5	12.5	11.4	8.8	20	99425	63
614	11.3	51.8	2128	12.0	22.7	7.5	12.6	12.3	9.5	20	99425	63
615	11.3	51.8	2131	12.0	22.7	7.6	12.6	12.3	8.5	20	99428	63
616	12.4	51.7	2170	12.0	22.7	8.7	12.8	13.5	9.4	20	99425	63

***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 (Pa)	Relative Humidity (%)
617	12.7	51.6	2142	12.0	22.7	8.6	12.6	13.8	8.4	20	99425	63
618	10.6	51.3	2139	12.0	22.7	8.9	12.6	11.5	8.3	20	99424	63
619	11.1	51.1	2083	12.0	22.7	7.9	12.3	12.1	10.4	20	99425	63
620	11.6	51.5	2108	12.0	22.7	7.5	12.4	12.6	9.8	20	99424	63
621	10.4	51.2	2073	12.0	22.7	6.2	12.3	11.4	7.3	20	99424	63
622	11.1	52.2	2181	12.0	22.7	7.9	12.9	12.1	5.8	20	99425	63
623	11.2	53.0	2180	12.0	22.7	8.9	12.9	12.2	8.5	20	99425	63
624	11.3	52.5	2192	12.0	22.7	10.2	12.9	12.3	7.6	20	99425	63
625	11.5	50.8	2104	12.0	22.7	9.2	12.4	12.5	7.2	20	99425	63
626	12.4	52.2	2121	12.0	22.7	9.0	12.6	13.5	8.6	20	99425	63
627	11.5	52.8	2167	12.0	22.7	10.2	12.8	12.5	10.8	20	99451	64
628	11.7	51.6	2096	12.0	22.7	9.3	12.4	12.7	10.9	20	99453	64
629	12.5	51.5	2116	12.0	24.0	9.2	12.6	13.6	9.3	20	99453	64
630	12.4	52.5	2213	12.0	25.3	11.4	13.1	13.5	11.2	20	99454	64
631	13.7	53.1	2205	12.0	25.3	12.6	13.1	14.9	11.8	20	99454	64
632	13.7	52.7	2162	12.0	25.2	13.0	12.8	15.0	11.7	20	99453	64
633	13.7	53.3	2108	12.0	25.3	12.5	12.5	15.0	9.7	20	99430	60
634	13.5	55.8	2136	12.0	25.3	12.8	12.7	14.7	7.6	20	99425	60
635	13.8	54.5	2106	12.0	25.3	12.5	12.5	15.0	7.8	20	99424	60
636	13.8	54.4	2108	12.0	25.3	12.5	12.5	15.0	9.7	20	99424	60
637	13.8	54.3	2108	12.0	25.3	12.5	12.5	15.0	8.7	20	99424	60
638	13.8	52.9	2108	12.0	25.3	12.5	12.5	15.0	9.8	20	99424	60
639	13.8	52.0	2108	12.0	25.3	12.5	12.5	15.0	9.2	20	99424	60
640	13.8	52.0	2108	12.0	25.3	12.5	12.5	15.0	9.1	20	99425	61
641	12.0	52.9	2078	12.0	25.3	8.7	12.2	13.0	8.8	20	99425	61
642	11.9	51.4	2029	12.0	25.3	5.6	12.0	12.9	8.6	20	99424	61
643	10.4	51.7	2124	12.0	25.2	6.0	12.6	11.4	7.2	20	99424	61
644	10.6	51.5	2133	12.0	25.2	6.4	12.6	11.6	6.4	20	99436	61
645	8.9	51.2	1908	12.0	25.3	2.9	12.0	10.2	8.6	20	99453	62
646			2075	12.0	25.2	1.8	12.3	8.9	8.5	20	99453	62
647	10.1	52.0	2111	12.0	25.2	1.6	12.5	11.1	9.0	20	99452	62
648	9.4	51.7	2153	12.0	25.3	2.9	12.7	10.3	8.2	20	99453	62
649	9.5	52.4	2144	12.0	25.2	3.0	12.6	10.4	7.7	20	99452	62
650	10.2	51.7	2120	12.0	25.3	2.5	12.5	11.1	7.3	20	99453	62
651	10.2	51.3	2020	12.0	25.2	0.1	12.2	11.1	9.4	20	99452	61
652	8.7	51.9	1790	12.0	27.0	-0.6	12.4	9.2	9.1	20	99452	61
653			1829	12.0	27.8	-1.1	12.6	10.0	8.7	20	99453	61
654			1950	12.0	27.8	-0.9	12.6	9.4	8.0	20	99453	61
655			2013	12.0	27.8	-0.6	12.6	9.5	8.1	20	99452	61
656			2024	12.0	27.8	-0.6	12.5	10.2	9.0	20	99443	61
657			1666	12.0	27.8	-1.7	12.4	10.2	8.7	20	99423	62
658			1378	12.0	27.8	-1.8	12.4	8.5	7.3	20	99423	62
659			1321	12.0	27.8	-1.8	12.5	8.3	8.3	20	99424	62
660			1297	12.0	29.7	-1.8	12.5	8.3	7.6	20	99423	62
661			1130	12.0	31.0	-1.8	11.9	8.1	6.3	20	99423	62
662			1289	12.0	31.0	-1.2	12.3	8.2	6.6	20	99429	62
663			2148	12.0	31.0	1.1	12.9	9.3	6.4	20	99424	63
664			2249	12.0	30.9	5.2	13.3	12.0	6.1	20	99424	63
665			2211	12.0	30.9	6.4	13.0	10.6	5.6	20	99424	63
666			2167	12.0	28.6	6.8	12.8	11.7	7.0	20	99423	63
667			2176	12.0	28.3	7.5	12.9	12.1	8.5	20	99424	63
668			2207	12.0	28.4	9.4	13.0	13.8	8.9	20	99423	63
669			2085	12.0	28.4	7.8	12.3	12.6	7.6	20	99423	63
670			2101	12.0	28.3	7.1	12.5	11.8	5.8	20	99423	63
671			2206	12.0	28.3	9.6	13.0	13.9	6.3	20	99424	63
672			2133	12.0	28.3	9.1	12.6	12.3	7.8	20	99423	63
673			2160	12.0	28.3	9.9	12.8	14.0	6.3	20	99424	63
674			2178	12.0	28.4	10.9	12.9	13.9	6.5	20	99437	64
675			2159	12.0	28.4	11.4	12.8	13.3	7.0	20	99453	64
676			1639	12.0	28.4	17.8	11.4	13.7	9.6	20	99453	64
677	5.6	47.8	519	12.0	25.9	19.5	9.2	14.1	7.5	20	99435	63
678	6.4	48.7	777	12.0	25.9	16.2	10.6	13.5	8.1	20	99451	64
679	7.2	50.8	1093	12.0	25.8	12.5	11.7	13.0	10.1	20	99452	64
680	8.6	51.3	1750	12.0	25.8	10.1	12.2	12.1	11.2	20	99451	64
681	12.7	52.5	2150	12.0	25.9	11.5	12.7	13.8	11.4	20	99451	64
682	12.8	52.2	2124	12.0	25.9	11.7	12.6	13.9	8.8	20	99451	64
683	12.2	52.1	2120	12.0	25.9	11.6	12.5	13.3	7.1	20	99451	62
684	12.2	52.6	2120	12.0	25.9	11.6	12.5	13.3	8.0	20	99451	62
685	12.2	52.4	2120	12.0	25.9	11.6	12.5	13.3	8.1	20	99451	62
686	12.2	51.5	2120	12.0	25.9	11.6	12.5	13.3	10.8	20	99451	62
687	12.2	51.5	2120	12.0	25.9	11.6	12.5	13.3	9.0	20	99451	62
688	11.9	51.8	2074	12.0	25.9	10.7	12.3	13.0	9.0	20	99451	62
689	10.7	51.4	2042	12.0	25.9	8.8	12.1	11.7	8.4	20	99452	62
690	10.6	51.5	2036	12.0	25.0	7.5	12.1	11.6	8.5	20	99451	63
691	11.8	52.3	2134	12.0	23.5	7.8	12.6	12.9	9.0	20	99451	63
692	12.4	52.1	2240	12.0	23.5	10.7	13.3	13.5	10.6	20	99451	63
693	11.0	52.2	2163	12.0	23.4	10.7	12.7	12.0	10.4	20	99451	63
694	11.0	51.6	2145	12.0	23.4	10.4	12.6	12.0	9.7	20	99451	63
695	11.0	53.0	2145	12.0	23.4	10.4	12.6	12.0	8.5	20	99452	62
696	11.0	52.0	2145	12.0	23.4	10.4	12.6	12.0	9.8	20	99452	62
697	10.8	52.0	2147	12.0	22.8	10.0	12.6	11.8	8.3	20	99451	62
698	11.8	52.5	2116	12.0	21.3	8.6	12.5	12.8	7.0	20	99452	62
699	11.7	53.0	2147	12.0	21.2	9.0	12.7	12.7	8.2	20	99451	62
700	12.0	52.9	2141	12.0	21.2	9.3	12.6	13.1	6.9	20	99451	62
701	12.1	52.6	2124	12.0	21.3	9.1	12.5	13.2	7.2	20	99475	63
702	10.8	50.8	2052	12.0	21.3	7.2	12.1	11.8	6.0	20	99477	63
703	11.2	51.1	2066	12.0	21.2	6.0	12.2	12.2	5.7	20	99477	63
704	8.9	51.0	1883	12.0	21.2	2.4	11.9	10.7	5.2	20	99477	63

Table E.01 Measurement data - Turbine ON

Project: Cedar Point Wind Power Project - Turbine CP226 - IEC 61400-11 Measurement

Report ID: 15039.00.T226.RP3

Created on: 9/14/2017

***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 (Pa)	Relative Humidity (%)
705	10.1	51.7	2014	12.0	21.2	0.8	12.2	11.0	6.1	20	99477	63
706	11.1	52.5	2215	12.0	21.2	4.2	13.1	12.1	5.9	20	99477	63
707	12.4	53.3	2224	12.0	21.2	6.6	13.1	13.5	8.0	20	99477	65
708	11.8	54.0	2201	12.0	21.3	7.5	13.0	12.8	6.7	20	99477	65
709	10.8	52.3	2146	12.0	21.3	7.5	12.7	11.7	8.1	20	99477	65
710	12.4	52.7	2224	12.0	21.3	9.8	13.2	13.5	8.8	20	99477	65
711	12.9	52.2	2179	12.0	21.3	10.7	12.9	14.0	7.9	20	99477	65
712	10.8	51.2	2070	12.0	21.2	8.9	12.3	11.8	9.5	20	99477	65
713	12.3	51.7	2142	12.0	21.2	9.7	12.7	13.4	9.0	20	99478	64
714	11.6	51.4	2108	12.0	21.2	9.4	12.5	12.6	8.3	20	99477	64
715	11.9	50.9	2051	12.0	21.2	7.6	12.1	13.0	8.6	20	99477	64
716	8.4	50.8	1678	12.0	21.2	3.1	11.7	9.9	11.4	20	99477	64
717	8.7	52.0	1799	12.0	21.3	0.3	12.3	9.7	8.6	20	99477	64
718			2097	12.0	21.3	1.6	12.7	8.8	9.6	20	99464	64
719	11.2	53.1	2279	12.0	21.3	6.7	13.5	12.2	9.8	20	99451	64
720	11.1	52.7	2219	12.0	21.3	8.2	13.1	12.1	8.6	20	99451	64
721	12.1	51.8	2163	12.0	21.3	8.3	12.8	13.2	7.5	20	99451	64
722	13.1	52.2	2222	12.0	21.3	10.2	13.2	14.3	7.8	20	99451	64
723	12.9	52.2	2198	12.0	21.3	11.5	13.0	14.0	12.2	20	99451	64
724	12.3	51.5	2136	12.0	21.3	11.3	12.6	13.4	11.4	20	99451	64
725	11.7	51.3	2045	12.0	21.3	9.4	12.1	12.8	10.6	20	99451	64
726	12.3	52.8	2153	12.0	21.3	10.4	12.8	13.4	10.5	20	99452	64
727	13.1	52.1	2108	12.0	21.3	10.3	12.5	14.3	9.6	20	99452	64
728	11.3	52.7	2091	12.0	21.3	9.5	12.4	12.3	8.2	20	99452	64
729	10.2	53.6	2054	12.0	21.3	7.9	12.2	11.1	8.4	20	99451	64
730	11.1	52.3	2096	12.0	21.0	7.8	12.4	12.1	8.6	20	99453	65
731	10.5	51.8	2102	12.0	18.3	7.6	12.4	11.4	7.8	20	99451	65
732	9.3	52.0	2018	12.0	18.2	4.5	11.9	10.1	7.7	20	99451	65
733	9.5	52.9	1999	12.0	18.2	3.3	11.9	10.4	8.1	20	99451	65
734	9.5	51.9	1999	12.0	18.2	3.3	11.9	10.4	9.5	20	99451	65
735	9.5	52.2	1999	12.0	18.2	3.3	11.9	10.4	9.9	20	99451	65
736	9.5	52.0	1999	12.0	18.2	3.3	11.9	10.4	7.9	20	99454	66
737	9.5	52.4	1999	12.0	18.2	3.3	11.9	10.4	9.6	20	99451	66
738	9.6	52.5	2041	12.0	17.4	2.3	12.1	10.5	9.4	20	99452	66
739	9.4	52.3	2156	12.0	16.1	1.9	12.7	10.3	9.2	20	99451	66
740	11.1	52.8	2184	12.0	16.0	3.4	12.9	12.1	8.5	20	99451	66
741	10.7	53.7	2228	12.0	16.3	5.8	13.2	11.7	8.8	20	99452	66
742	11.2	52.7	2231	12.0	19.0	8.3	13.2	12.2	9.3	20	99451	65
743	11.0	52.0	2189	12.0	19.1	8.8	12.9	12.0	8.2	20	99451	65
744	12.3	53.6	2122	12.0	21.0	8.7	12.7	13.4	8.1	20	99452	65
745	11.3	52.0	2119	12.0	22.3	8.5	12.5	12.3	10.4	20	99451	65
746	10.8	52.5	2059	12.0	24.7	7.0	12.2	11.8	8.6	20	99451	65
747	10.4	54.3	2013	12.0	25.7	4.0	11.9	11.3	8.5	20	99451	65
748	10.5	54.2	2063	12.0	25.7	2.7	12.2	11.4	8.3	20	99467	64
749	9.7	52.6	2097	12.0	25.7	2.4	12.4	10.5	9.6	20	99477	64
750	9.9	51.9	2091	12.0	25.7	1.3	12.3	10.8	9.0	20	99477	64
751	9.1	53.2	1963	12.0	25.7	-0.1	12.3	10.6	10.3	20	99477	64
752	8.8	53.0	1863	12.0	26.4	0.1	12.5	10.8	8.8	20	99477	64
753			1329	12.0	28.3	-1.7	12.3	9.0	10.5	20	99477	64
754			1228	12.0	28.2	-1.8	12.3	7.2	11.0	20	99461	64
755			1214	12.0	28.2	-1.8	12.3	6.6	10.2	20	99452	63
756			1327	12.0	28.2	-1.8	12.5	7.8	10.3	20	99451	63
757			1219	12.0	28.2	-1.8	12.3	8.9	8.1	20	99451	63
758			1599	12.0	28.2	-1.7	12.7	7.8	7.0	20	99451	63
759			1881	12.0	28.2	-1.6	12.7	8.0	7.2	20	99462	64
760			2021	12.0	28.2	-1.1	12.6	8.1	6.4	20	99477	65
761			2118	12.0	28.2	0.0	12.7	10.3	6.4	20	99477	65
762			1982	12.0	27.1	-0.2	12.5	10.3	7.5	20	99477	65
763	8.6	53.1	1770	12.0	25.6	-1.4	12.5	8.5	7.3	20	99476	65
764	9.0	53.5	1959	12.0	25.7	-0.6	12.7	10.1	8.0	20	99477	65
765	11.4	53.1	2291	12.0	25.7	5.4	13.5	12.4	9.3	20	99477	64
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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 (Pa)	Relative Humidity (%)
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Table E.02 Measurement data - Background

Project: Cedar Point Wind Power Project - Turbine CP226 - IEC 61400-11 Measurement

Report ID: 15039.00.T226.RP3

Created on: 9/14/2017

***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 (Pa)	Relative Humidity (%)
1	7.8	46.9	0.3	6.7	20	90739	79
2	8.8	46.7	0.4	7.6	20	90754	79
3	8.1	45.8	0.3	7.0	20	90754	79
4	6.2	46.2	0.3	5.3	20	90754	79
5	7.1	46.3	0.4	6.1	20	90754	79
6	11.2	45.3	0.5	9.6	20	90754	79
7	11.8	44.3	0.6	10.2	20	90306	79
8	10.2	44.0	0.6	8.8	20	90204	79
9	12.5	45.4	0.6	10.8	20	90204	79
10	12.4	46.0	0.6	10.7	20	90204	79
11			0.4	10.0	20	90204	79
12			0.3	8.7	20	90204	79
13			0.3	7.7	20	90437	79
14			0.4	6.4	20	90490	79
15			0.3	5.8	20	90491	79
16			0.2	4.9	20	90491	79
17	6.5	46.0	0.2	5.6	20	90491	79
18	8.0	45.0	0.3	6.9	20	90491	79
19	5.9	43.3	0.4	5.1	20	91348	79
20	7.8	44.6	0.4	6.7	20	91544	79
21	8.3	44.5	0.4	7.2	20	91544	79
22	8.1	45.5	0.5	7.0	20	91545	79
23	8.6	45.7	0.7	7.4	20	91545	79
24			0.4	8.8	20	91545	79
25	10.7	46.8	0.5	9.2	20	91566	79
26			0.5	8.6	20	91545	79
27			0.6	7.7	20	91545	79
28	7.2	46.2	0.5	6.2	20	91545	79
29	7.2	45.6	0.4	6.2	20	91544	79
30	7.3	44.0	0.3	6.3	20	91545	79
31	8.2	42.4	0.4	7.0	20	92335	79
32	8.5	41.8	0.4	7.3	20	92496	79
33	9.9	47.3	0.3	8.6	19	92055	79
34	9.0	44.2	0.3	7.8	19	92047	79
35	8.8	45.0	0.3	7.5	19	92047	79
36	11.5	44.0	0.3	9.9	19	92047	79
37	11.2	47.6	0.2	9.6	19	92047	79
38			0.3	8.2	20	91836	79
39			0.3	8.6	20	91836	79
40			0.4	9.6	20	91836	79
41			0.6	9.2	20	91483	79
42			0.7	8.9	20	90702	79
43			0.4	8.1	20	90702	79
44			0.4	9.1	20	90702	79
45			0.7	9.2	20	90702	79
46			0.4	11.3	20	90702	79
47			0.3	9.6	20	90594	79
48			0.4	9.1	20	90361	79
49			0.5	7.3	20	90361	79
50			0.5	8.5	20	90361	79
51			0.4	8.7	20	90361	79
52			0.4	7.5	20	90361	79
53			0.5	7.4	20	90646	79
54			0.5	7.0	20	91204	79
55	8.9	46.1	0.5	7.7	20	91204	79
56	8.5	46.3	0.4	7.3	20	91204	79
57	7.2	45.5	0.4	6.2	20	91204	79
58			0.6	6.0	20	91204	79
59			0.6	5.9	20	91448	79
60	9.1	46.1	0.5	7.8	20	91943	79
61	8.8	46.2	0.5	7.6	20	91943	79
62			0.6	8.3	20	91942	79
63			0.6	8.6	20	91942	79
64			0.5	7.3	20	91942	79
65			0.6	7.0	20	91800	79
66			0.6	8.3	20	91443	79
67			0.4	7.8	20	91443	79
68			0.5	7.6	20	91443	79
69			0.6	6.5	20	91443	79
70			0.5	8.7	20	91444	79
71			0.3	10.2	20	91324	79
72			0.4	10.4	20	91048	79
73			0.6	10.5	20	91048	79
74			0.6	9.3	20	91048	79
75			0.6	8.7	20	91048	79
76			0.5	9.3	20	91048	79
77			0.7	10.6	20	90765	79
78			0.5	9.6	20	90153	79
79			0.5	9.1	20	90153	79
80			0.6	8.6	20	90153	79
81			0.7	8.1	20	90153	79
82			0.6	9.0	20	90151	79
83			0.4	9.4	20	90425	79

***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 (Pa)	Relative Humidity (%)
84			0.4	9.8	20	91027	79
85			0.3	8.6	20	91027	79
86			0.4	8.3	20	91027	79
87			0.4	8.0	20	91027	79
88			0.4	8.4	20	91027	79
89	8.9	45.5	0.5	7.6	20	91123	79
90	6.9	45.9	0.5	5.9	20	91314	79
91	7.5	45.9	0.3	6.5	20	91313	79
92	8.2	46.8	0.2	7.0	20	91314	79
93			0.3	6.4	20	91314	79
94			0.4	5.3	20	91314	79
95			0.2	5.2	20	91324	79
96			0.2	7.2	20	91314	79
97			0.3	6.6	20	91314	79
98			0.3	5.6	20	91314	79
99	8.2	46.4	0.1	7.1	20	91314	79
100	7.1	47.4	0.4	6.1	20	91314	79
101	7.9	46.5	0.7	6.8	20	91256	79
102	7.0	46.7	0.8	6.1	20	91131	79
103	10.3	46.3	1.3	8.9	20	91130	79
104	7.4	47.0	2.0	6.4	20	91130	79
105	6.3	50.7	3.2	5.4	20	91130	79
106	7.3	43.7	0.3	6.3	20	99424	64
107	7.4	42.0	0.3	6.4	20	99424	64
108	7.0	41.6	0.3	6.1	20	99424	64
109	6.7	41.5	0.5	5.8	20	99424	64
110	8.6	40.2	0.5	7.4	20	99424	64
111	10.1	41.3	0.4	8.7	20	99424	64
112	11.2	44.3	0.6	9.6	20	99424	64
113	10.9	42.4	0.5	9.4	20	99424	63
114	10.1	42.2	0.4	8.7	20	99424	63
115	10.8	42.3	0.3	9.3	20	99424	63
116	11.6	45.8	0.3	10.0	20	99424	63
117	9.7	44.3	0.5	8.3	20	99423	63
118	11.7	43.8	0.4	10.1	20	99424	63
119	10.7	44.9	0.3	9.2	20	99408	61
120	9.0	45.8	0.2	7.7	20	99402	61
121	8.2	45.2	0.5	7.1	20	99403	61
122	8.1	47.8	0.8	7.0	20	99403	61
123	10.3	47.9	0.6	8.9	20	99403	61
124	9.6	46.7	0.4	8.3	20	99403	61
125	8.8	47.3	0.3	7.6	20	99403	62
126	7.6	44.8	0.1	6.5	20	99403	63
127	8.4	41.5	0.2	7.3	20	99403	63
128	8.8	40.6	0.7	7.6	20	99403	63
129	11.6	42.7	0.5	10.0	20	99404	63
130	10.0	42.5	0.5	8.6	20	99403	63
131	9.5	42.2	0.6	8.2	20	99403	62
132	8.0	41.7	0.6	6.9	20	99403	62
133	8.6	43.8	0.6	7.4	20	99403	62
134	9.3	45.2	0.4	8.0	20	99403	62
135	10.8	44.2	0.4	9.3	20	99403	62
136	10.4	43.3	0.3	9.0	20	99403	62
137	8.7	41.9	0.3	7.5	20	99403	62
138	7.5	40.5	0.1	6.4	20	99403	62
139	8.1	39.9	0.1	7.0	20	99404	62
140	8.8	42.6	0.1	7.6	20	99403	62
141	8.0	42.1	0.2	6.9	20	99403	62
142	8.8	44.3	0.3	7.6	20	99403	62
143	9.0	43.2	0.5	7.7	20	99403	64
144	9.7	42.7	0.6	8.4	20	99403	64
145	10.1	41.2	0.4	8.7	20	99403	64
146	11.1	42.8	0.3	9.6	20	99403	64
147	10.9	44.8	0.3	9.4	20	99404	64
148	10.3	44.8	0.5	8.9	20	99403	64
149	10.4	44.9	0.5	8.9	20	99419	62
150	10.7	45.3	0.4	9.2	20	99424	62
151	10.7	47.2	0.4	9.3	20	99423	62
152	11.1	43.8	0.5	9.5	20	99423	62
153	11.5	43.2	0.6	9.9	20	99423	62
154	10.8	45.0	0.5	9.3	20	99424	62
155	9.7	46.1	0.3	8.4	20	99423	64
156	10.5	43.5	0.3	9.0	20	99423	65
157	11.5	43.0	0.5	9.9	20	99423	65
158	12.1	48.4	0.5	10.4	20	99423	65
159	10.9	49.2	0.3	9.4	20	99423	65
160	11.9	45.4	0.3	10.2	20	99423	65
161	10.8	46.2	0.4	9.3	20	99423	63
162	10.8	42.9	0.7	9.3	20	99423	63
163	9.0	42.4	0.5	7.8	20	99423	63
164	9.7	41.9	0.5	8.3	20	99424	63
165	11.7	44.5	0.7	10.0	20	99423	63
166	12.1	45.4	0.5	10.5	20	99424	63

***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 (Pa)	Relative Humidity (%)
167	10.7	42.0	0.5	9.3	20	99424	62
168	10.3	41.8	0.3	8.9	20	99424	62
169	9.5	43.0	0.3	8.2	20	99423	62
170	8.3	42.6	0.5	7.2	20	99423	62
171	11.4	44.1	0.6	9.8	20	99423	62
172	10.6	44.1	0.5	9.1	20	99424	62
173	9.5	43.9	0.5	8.2	20	99424	63
174	11.2	45.4	0.5	9.6	20	99423	64
175	10.8	48.5	0.5	9.3	20	99423	64
176	8.6	45.6	0.5	7.4	20	99423	64
177	10.1	45.8	0.5	8.7	20	99423	64
178			0.5	8.8	20	99424	64
179			0.4	9.5	20	99401	62
180			0.4	9.1	20	99395	62
181			0.4	8.5	20	99395	62
182	10.1	44.5	0.5	8.7	20	99396	62
183	10.6	43.3	0.5	9.1	20	99396	62
184	11.3	46.0	0.5	9.8	20	99396	62
185			0.5	8.3	20	99396	63
186			0.4	11.3	20	99395	63
187	11.5	47.4	0.5	9.9	20	99396	63
188	11.5	45.2	0.4	9.9	20	99396	63
189	10.7	44.9	0.4	9.2	20	99396	63
190	12.0	45.0	0.4	10.4	20	99396	63
191	10.6	44.6	0.4	9.1	20	99418	63
192	13.5	46.6	0.4	11.6	20	99423	63
193	11.3	45.2	0.4	9.7	20	99424	63
194	9.9	45.8	0.5	8.6	20	99424	63
195	10.9	47.4	0.4	9.4	20	99423	63
196	9.5	47.1	0.5	8.2	20	99423	63
197	9.3	45.8	0.4	8.0	20	99423	64
198	9.4	44.8	0.3	8.1	20	99424	64
199	7.9	45.6	0.4	6.8	20	99423	64
200	7.3	45.3	0.5	6.3	20	99423	64
201	7.3	42.9	0.6	6.3	20	99424	64
202	6.0	42.8	0.6	5.2	20	99424	64
203	7.2	43.6	0.6	6.2	20	99423	66
204			0.6	6.9	20	99423	66
205			0.5	7.6	20	99424	66
206	9.9	45.4	0.4	8.5	20	99424	66
207	11.3	42.9	0.4	9.8	20	99424	66
208	10.8	46.7	0.2	9.3	20	99424	66
209	10.8	44.9	0.2	9.3	20	99424	64
210	9.4	43.0	0.4	8.1	20	99424	63
211	8.3	43.2	0.4	7.1	20	99424	63
212	8.6	45.9	0.3	7.4	20	99424	63
213	10.2	42.7	0.3	8.8	20	99423	63
214	8.9	42.1	0.4	7.7	20	99424	63
215	9.0	40.2	0.4	7.8	20	99424	64
216	9.3	39.7	0.6	8.0	20	99424	64
217	8.6	40.3	0.4	7.4	20	99424	64
218	8.0	39.9	0.3	6.9	20	99423	64
219	10.2	40.3	0.3	8.8	20	99424	64
220	9.3	43.0	0.5	8.0	20	99424	64
221	8.6	44.5	0.5	7.4	20	99423	65
222	8.7	42.8	0.4	7.5	20	99423	65
223	8.2	41.2	0.5	7.1	20	99424	65
224	8.5	41.2	0.5	7.3	20	99423	65
225	8.5	43.8	0.4	7.3	20	99424	65
226	11.1	42.3	0.2	9.5	20	99424	65
227	9.1	41.3	0.2	7.9	20	99424	65
228	9.0	41.1	0.5	7.8	20	99423	65
229	9.9	39.6	0.4	8.5	20	99424	65
230	11.5	39.7	0.5	9.9	20	99423	65
231	11.6	41.2	0.4	10.0	20	99423	65
232	10.1	40.0	0.4	8.7	20	99424	65
233	8.9	40.5	0.4	7.7	20	99424	65
234	8.7	41.5	0.5	7.5	20	99424	65
235	7.9	40.9	0.4	6.8	20	99424	65
236	8.4	40.0	0.4	7.2	20	99423	65
237	8.1	42.4	0.4	7.0	20	99423	65
238	9.3	47.0	0.5	8.0	20	99424	65
239	11.1	42.6	0.6	9.6	20	99401	65
240	8.5	42.1	0.5	7.4	20	99396	65
241	9.9	43.9	0.5	8.5	20	99396	65
242			0.7	10.9	20	99396	65
243			0.5	11.0	20	99396	65
244	12.5	45.2	0.4	10.8	20	99396	65
245	10.7	46.0	0.5	9.2	20	99396	66
246			0.7	8.6	20	99396	66
247			0.4	8.6	20	99395	66
248			0.5	8.6	20	99396	66
249			0.6	9.6	20	99396	66

Table E.02 Measurement data - Background

Project: Cedar Point Wind Power Project - Turbine CP226 - IEC 61400-11 Measurement

Report ID: 15039.00.T226.RP3

Created on: 9/14/2017

***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 (Pa)	Relative Humidity (%)
250			0.6	9.2	20	99396	66
251			0.6	8.8	20	99396	65
252			0.4	8.5	20	99395	65
253	8.8	46.3	0.4	7.6	20	99395	65
254	9.7	47.1	0.4	8.3	20	99395	65
255	11.1	44.3	0.4	9.5	20	99395	65
256	10.3	45.3	0.4	8.9	20	99395	65
257	9.8	46.1	0.4	8.4	20	99395	65
258	10.0	42.8	0.4	8.6	20	99395	65
259	10.4	44.0	0.5	9.0	20	99395	65
260	10.4	44.2	0.4	9.0	20	99396	65
261	10.4	42.9	0.3	8.9	20	99396	65
262	10.4	42.8	0.4	8.9	20	99396	65
263	9.6	42.3	0.7	8.3	20	99396	66
264	9.8	45.3	0.5	8.5	20	99396	67
265	8.0	43.6	0.6	6.9	20	99396	67
266	7.3	46.0	0.5	6.3	20	99396	67
267	7.1	44.3	0.4	6.1	20	99396	67
268	9.3	46.2	0.4	8.0	20	99396	67
269	10.2	44.8	0.4	8.8	20	99396	65
270	9.2	45.0	0.5	8.0	20	99396	64
271	8.5	45.6	0.6	7.3	20	99396	64
272			0.6	8.2	20	99396	64
273	9.3	46.4	0.5	8.0	20	99396	64
274	10.2	44.5	0.5	8.8	20	99395	64
275	11.6	47.7	0.7	10.0	20	99396	64
276	13.5	47.9	0.6	11.6	20	99396	64
277	15.0	43.6	0.5	12.9	20	99396	64
278	12.4	45.3	0.6	10.7	20	99396	64
279	11.4	46.7	0.6	9.8	20	99396	64
280	14.8	45.9	0.6	12.7	20	99395	64
281	14.1	47.4	0.6	12.2	20	99396	62
282	11.3	46.4	0.6	9.7	20	99396	62
283	11.5	45.3	0.6	9.9	20	99396	62
284	8.6	46.8	0.4	7.4	20	99396	62
285	9.8	46.0	0.3	8.4	20	99395	62
286	10.4	43.1	0.4	9.0	20	99396	62
287	11.5	44.3	0.6	9.9	20	99395	63
288	10.2	44.3	0.5	8.8	20	99395	63
289	10.1	42.8	0.5	8.7	20	99396	63
290	10.4	45.0	0.7	9.0	20	99395	63
291	9.0	46.9	0.5	7.7	20	99395	63
292	7.5	47.4	0.5	6.5	20	99396	63
293			0.7	5.4	20	99396	66
294			0.6	9.5	20	99395	66
295	12.2	46.3	0.5	10.5	20	99396	66
296	11.2	44.1	0.6	9.7	20	99396	66
297	11.4	43.4	0.5	9.8	20	99395	66
298	9.7	43.4	0.4	8.4	20	99396	66
299			0.4	7.8	20	99396	65
300	9.8	46.8	0.3	8.4	20	99396	64
301	9.0	46.2	0.4	7.7	20	99396	64
302	7.8	45.5	0.6	6.7	20	99396	64
303	8.0	45.0	0.6	6.9	20	99396	64
304	9.5	41.5	0.5	8.2	20	99396	64
305	8.7	43.9	0.5	7.5	20	99418	65
306			8.6	9.4	20	99396	61
307			0.5	8.1	20	99452	64
308			0.5	9.8	20	99452	63
309	10.5	46.5	0.4	9.0	20	99453	63
310	9.4	45.2	0.4	8.1	20	99452	63
311	10.3	45.1	0.2	8.9	20	99452	63
312	10.8	46.3	0.4	9.3	20	99452	63
313	11.8	47.8	0.5	10.1	20	99443	62
314			0.5	9.6	20	99423	62
315			0.6	9.0	20	99423	62
316	8.9	46.3	0.6	7.6	20	99423	62
317	10.7	47.8	0.5	9.2	20	99423	62
318	12.4	47.4	0.8	10.7	20	99423	62
319	10.4	44.5	0.6	9.0	20	99423	61
320			0.7	10.8	20	99423	60
321			0.6	10.8	20	99423	60
322			0.5	9.4	20	99423	60
323	9.4	45.4	0.6	8.1	20	99423	60
324	11.2	45.9	0.5	9.6	20	99423	60
325			0.6	8.4	20	99438	61
326			0.7	7.4	20	99452	61
327			0.5	9.5	20	99452	61
328			0.5	12.6	20	99452	61
329			0.3	9.9	20	99452	61
330	12.1	47.3	0.4	10.4	20	99452	61
331	13.1	44.6	0.4	11.3	20	99440	61
332	10.4	44.1	0.4	9.0	20	99423	61

***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 (Pa)	Relative Humidity (%)
333	12.3	42.5	0.6	10.6	20	99423	61
334	11.3	45.9	0.4	9.8	20	99423	61
335			0.6	8.5	20	99423	61
336			0.7	10.0	20	99423	61
337			0.5	10.7	20	99423	61
338			0.6	10.0	20	99423	61
339	12.4	46.8	0.5	10.7	20	99423	61
340	11.9	48.2	0.6	10.2	20	99423	61
341			0.5	10.0	20	99423	61
342			0.4	9.1	20	99423	61
343			0.5	9.8	20	99438	61
344			0.6	12.0	20	99453	62
345			0.5	11.4	20	99452	62
346			0.5	9.7	20	99452	62
347	10.8	45.7	0.4	9.3	20	99452	62
348	12.1	42.9	0.5	10.4	20	99452	62
349	12.6	45.7	0.5	10.9	20	99440	62
350	10.0	45.5	0.5	8.6	20	99423	62
351			0.6	7.0	20	99422	62
352			0.5	9.1	20	99422	62
353			0.7	7.3	20	99423	62
354	8.6	47.5	0.6	7.4	20	99423	62
355	12.3	44.6	0.6	10.6	20	99423	62
356	12.5	44.9	0.5	10.8	20	99423	63
357			0.4	8.8	20	99423	63
358	9.2	47.3	0.2	7.9	20	99423	63
359	7.8	45.8	0.2	6.8	20	99423	63
360			0.2	8.1	20	99423	63
361			0.2	9.0	20	99423	64
362			0.2	9.8	20	99423	64
363			0.2	9.9	20	99423	64
364			0.2	8.6	20	99423	64
365			0.2	8.5	20	99423	64
366			0.5	8.5	20	99423	64
367	7.9	46.6	0.6	6.8	20	99438	65
368	8.5	43.6	0.5	7.3	20	99452	65
369	10.4	46.4	0.4	8.9	20	99452	65
370	11.5	46.9	0.4	9.9	20	99452	65
371	12.1	45.0	0.6	10.4	20	99452	65
372	10.3	46.0	0.6	8.9	20	99452	65
373	10.3	47.7	0.6	8.9	20	99452	65
374	11.6	47.7	0.7	10.0	20	99452	64
375	10.1	48.5	0.5	8.7	20	99452	64
376	10.8	47.7	0.5	9.3	20	99452	64
377	12.2	45.3	0.6	10.5	20	99452	64
378			0.6	11.5	20	99452	64
379			0.5	9.2	20	99452	64
380			0.4	8.6	20	99452	63
381			0.5	8.9	20	99452	63
382	9.6	47.4	0.6	8.3	20	99452	63
383	10.5	42.5	0.3	9.0	20	99452	63
384	8.6	46.5	0.3	7.4	20	99452	63
385	8.8	45.2	0.4	7.6	20	99452	64
386	8.0	44.0	0.5	6.9	20	99452	65
387	8.9	46.2	0.5	7.6	20	99452	65
388			0.4	10.0	20	99452	65
389			0.5	8.5	20	99452	65
390			0.7	6.7	20	99451	64
391			0.5	7.5	20	99451	64
392	8.1	47.0	0.5	6.9	20	99451	64
393	7.1	45.1	0.6	6.1	20	99451	65
394	7.7	47.1	0.7	6.6	20	99451	66
395	10.9	45.0	0.5	9.4	20	99451	66
396	8.7	48.0	0.3	7.5	20	99451	66
397	12.0	46.5	0.6	10.3	20	99452	66
398	10.4	45.6	0.7	9.0	20	99451	66
399	12.7	43.3	0.5	11.0	20	99451	65
400	10.0	46.8	0.6	8.6	20	99452	63
401	11.1	47.4	0.7	9.6	20	99451	63
402			0.5	9.3	20	99452	63
403			0.5	11.1	20	99452	63
404	11.1	47.1	0.8	9.6	20	99451	63
405	9.3	44.4	0.6	8.0	20	99451	63
406	11.8	44.9	0.4	10.1	20	99451	63
407	11.7	45.6	0.4	10.0	20	99451	63
408	13.2	44.4	0.6	11.4	20	99451	63
409	11.1	46.0	0.6	9.6	20	99451	63
410	8.4	47.9	0.5	7.2	20	99451	63
411	9.1	43.6	0.7	7.9	20	99451	63
412	8.9	45.0	0.8	7.7	20	99439	64
413	9.0	45.0	0.5	7.8	20	99431	64
414	8.3	44.2	0.6	7.2	20	99432	64
415	10.5	47.6	0.8	9.1	20	99432	64

***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 (Pa)	Relative Humidity (%)
416			0.8	9.7	20	99432	64
417			0.6	10.3	20	99432	63
418			0.3	9.9	20	99432	61
419	10.9	46.3	0.2	9.4	20	99432	61
420			0.3	8.4	20	99432	61
421			0.6	8.2	20	99477	64
422			0.5	9.3	20	99477	64
423			0.5	9.1	20	99478	64
424	12.0	46.0	0.6	10.3	20	99477	64
425	10.7	44.6	0.6	9.2	20	99477	64
426			0.5	8.6	20	99477	64
427			0.5	7.7	20	99477	64
428			0.5	6.5	20	99477	64
429	7.6	47.2	0.5	6.6	20	99476	64
430	8.2	43.7	0.6	7.1	20	99477	64
431	8.7	45.9	0.7	7.5	20	99477	64
432	8.9	46.5	0.6	7.7	20	99477	65
433			0.6	7.1	20	99477	65
434			0.6	8.3	20	99477	65
435	12.9	46.6	0.6	11.1	20	99477	65
436	12.4	46.5	0.5	10.7	20	99476	65
437	12.5	46.3	0.5	10.8	20	99477	64
438	9.3	45.1	0.4	8.0	20	99477	64
439	10.2	47.4	0.4	8.8	20	99477	64
440	9.7	47.4	0.5	8.4	20	99477	64
441	11.8	46.1	0.4	10.2	20	99477	64
442			0.5	8.6	20	99477	64
443			0.5	7.4	20	99477	65
444			0.5	7.2	19	99477	66
445			0.5	7.4	19	99477	66
446	10.8	46.7	0.5	9.3	19	99477	66
447	9.6	46.1	0.4	8.3	19	99477	66
448	10.2	45.7	0.4	8.8	19	99477	66
449	9.4	43.1	0.4	8.1	19	99477	66
450	11.6	44.5	0.4	10.0	19	99477	66
451	10.4	48.0	0.5	9.0	19	99477	66
452	10.5	44.1	0.5	9.0	19	99477	66
453	14.2	41.6	0.3	12.3	19	99477	66
454	13.1	43.4	0.3	11.3	19	99477	66
455	14.3	44.9	0.6	12.3	19	99478	65
456	11.8	44.3	0.7	10.2	19	99477	64
457	12.5	45.2	0.6	10.8	19	99477	64
458	12.6	49.6	0.6	10.9	19	99477	64
459	12.9	45.9	0.5	11.1	19	99477	64
460			0.5	11.4	19	99477	64
461			0.5	10.6	19	99477	64
462			0.4	10.0	19	99477	65
463			0.3	10.8	19	99477	65
464	9.6	43.5	0.7	8.3	19	99477	65
465	11.4	44.4	0.6	9.8	19	99477	65
466	11.9	44.5	0.6	10.3	19	99477	65
467	11.0	47.4	0.6	9.5	19	99477	65
468	12.7	46.4	0.4	11.0	19	99477	66
469	11.2	44.9	0.3	9.6	19	99477	66
470	9.5	46.0	0.3	8.2	19	99477	66
471			0.3	8.3	19	99477	66
472			0.7	8.5	19	99477	66
473			0.8	8.0	19	99477	66
474	8.3	44.4	0.4	7.2	19	99477	66
475	6.9	42.9	0.5	5.9	19	99477	66
476	9.1	42.4	0.6	7.8	19	99477	66
477	9.8	43.6	0.6	8.5	19	99477	66
478	8.3	48.7	0.5	7.2	19	99477	66
479			0.7	7.9	19	99477	66
480			0.8	7.0	19	99477	67
481			0.7	6.7	19	99477	67
482			0.7	6.6	19	99477	67
483			0.6	5.8	19	99477	67
484			0.5	6.9	19	99477	67
485			0.5	8.6	19	99477	67
486	8.6	46.0	0.6	7.5	19	99477	67
487	7.3	46.8	0.6	6.3	19	99477	67
488	7.7	45.4	0.3	6.7	19	99477	67
489	7.8	44.0	0.5	6.7	19	99477	67
490	9.5	45.0	0.8	8.1	19	99477	67
491			0.7	7.7	19	99477	67
492			0.5	6.6	19	99477	67
493			0.6	8.8	19	99477	67
494			0.5	8.0	19	99477	67
495			0.4	6.9	19	99477	67
496	8.1	42.6	0.4	7.0	19	99477	67
497	8.0	42.2	0.4	6.9	19	99477	67
498	7.3	44.0	0.4	6.3	19	99477	67

Table E.02 Measurement data - Background

Project: Cedar Point Wind Power Project - Turbine CP226 - IEC 61400-11 Measurement

Report ID: 15039.00.T226.RP3

Created on: 9/14/2017

***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 (Pa)	Relative Humidity (%)
499	7.2	46.7	0.4	6.2	19	99477	67
500	8.8	46.6	0.4	7.5	19	99477	67
501	8.0	43.8	0.4	6.9	19	99478	67
502	8.5	43.3	0.4	7.3	19	99477	67
503	9.0	44.0	0.4	7.8	19	99477	66
504	10.1	44.7	0.4	8.7	19	99477	66
505	10.4	44.6	0.3	8.9	19	99477	66
506	11.5	44.2	0.4	9.9	19	99477	66
507	12.3	42.5	0.4	10.6	19	99477	66
508	9.4	40.8	0.4	8.1	19	99477	66
509	8.5	41.1	0.2	7.3	19	99477	66
510	9.8	43.5	0.2	8.5	19	99477	65
511	9.6	42.2	0.3	8.3	19	99477	65
512	9.0	40.7	0.4	7.7	19	99477	65
513	9.8	41.3	0.6	8.4	19	99477	65
514	10.2	39.7	0.5	8.8	19	99477	65
515	10.6	41.6	0.4	9.2	19	99477	64
516	10.1	41.8	0.3	8.7	19	99477	64
517	9.7	39.4	0.4	8.4	19	99477	64
518	11.1	39.8	0.4	9.6	19	99477	64
519	11.5	43.6	0.4	9.9	19	99477	64
520	12.4	40.7	0.4	10.7	19	99477	64
521	12.1	42.9	0.3	10.5	19	99477	63
522	9.2	42.4	0.3	7.9	19	99477	60
523	8.7	42.7	0.4	7.5	19	99477	60
524	8.6	42.5	0.5	7.4	19	99477	60
525	8.1	44.3	0.5	6.9	19	99477	60
526	8.8	45.1	0.5	7.5	19	99477	60
527	6.3	46.2	0.4	5.5	19	99477	62
528	6.4	43.6	0.3	5.5	19	99477	65
529	6.9	46.6	0.3	5.9	19	99477	65
530	8.3	45.6	0.4	7.1	19	99477	65
531	10.8	44.8	0.4	9.3	19	99477	65
532	9.4	44.5	0.4	8.1	19	99477	65
533	10.4	45.5	0.6	9.0	19	99477	64
534	12.3	45.1	0.4	10.6	20	99477	64
535	11.5	41.8	0.4	9.9	20	99477	64
536	11.1	42.9	0.4	9.6	20	99477	64
537	10.6	42.5	0.3	9.1	20	99477	64
538	10.7	41.7	0.4	9.2	20	99477	64
539	11.6	43.2	0.4	10.0	20	99477	63
540	11.0	43.4	0.3	9.5	20	99477	63
541	9.6	44.5	0.5	8.3	20	99477	63
542	10.3	45.8	0.5	8.9	20	99477	63
543	10.6	49.1	0.5	9.2	20	99477	63
544	11.4	47.6	0.6	9.8	20	99477	63
545			0.6	10.0	20	99477	63
546			0.5	9.9	19	99479	63
547			0.5	9.3	19	99478	63
548			0.3	11.5	19	99479	63
549			0.2	9.1	19	99478	63
550	12.1	44.2	0.4	10.4	19	99478	63
551	11.4	47.2	0.6	9.8	19	99478	63
552	9.3	44.8	0.5	8.0	19	99478	63
553	8.2	43.2	0.6	7.1	19	99478	63
554			0.7	7.1	19	99478	63
555			0.7	8.3	19	99478	63
556	10.7	44.4	0.6	9.2	19	99478	63
557	8.8	47.0	0.7	7.6	19	99478	64
558	9.3	44.3	0.6	8.1	19	99478	65
559	8.4	44.8	0.5	7.3	19	99478	65
560	8.6	45.0	0.7	7.4	19	99478	65
561			0.6	7.4	19	99478	65
562	7.2	46.5	0.5	6.2	19	99478	65
563	7.1	44.8	0.7	6.1	19	99478	65
564	8.0	43.8	0.7	6.9	19	99478	66
565	8.8	43.3	0.5	7.6	19	99478	66
566	9.4	45.6	0.5	8.1	19	99478	66
567	7.9	49.5	0.5	6.8	19	99478	66
568	6.8	47.2	0.6	5.9	19	99478	66
569	7.4	44.3	0.7	6.4	19	99478	66
570	10.0	43.0	0.9	8.6	20	99478	65
571	9.3	41.1	1.0	8.0	20	99478	65
572	6.5	43.1	0.7	5.6	20	99478	65
573			0.3	4.7	20	99478	65
574			0.6	4.8	20	99478	65
575			0.4	6.1	20	99478	65
576	6.0	45.4	0.4	5.1	20	99478	65
577	6.3	43.3	0.7	5.4	20	99478	65
578	5.8	42.2	0.7	5.0	20	99478	65
579	7.6	42.4	0.4	6.6	20	99478	65
580	10.1	47.3	0.4	8.7	20	99478	65
581	9.5	43.3	0.3	8.1	20	99478	65

***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 (Pa)	Relative Humidity (%)
582	7.7	43.0	0.3	6.6	20	99478	64
583	7.9	40.8	0.3	6.8	20	99478	64
584	6.5	41.6	0.1	5.6	20	99478	64
585	6.3	42.1	0.1	5.4	20	99478	64
586	7.3	42.0	0.2	6.3	20	99478	64
587	9.1	40.9	0.3	7.9	20	99478	64
588	10.8	41.1	0.3	9.3	20	99478	65
589	9.0	42.3	0.2	7.8	20	99477	65
590	7.0	42.9	0.3	6.0	20	99478	65
591	7.1	41.2	0.6	6.1	20	99478	65
592	9.2	40.9	0.5	7.9	20	99478	65
593	9.5	42.3	0.3	8.2	20	99478	65
594	9.5	41.8	0.3	8.2	20	99475	65
595	9.6	41.3	0.3	8.2	20	99457	65
596	9.9	42.8	0.5	8.5	20	99458	65
597	8.9	43.0	0.4	7.7	20	99458	65
598	9.2	42.6	0.3	8.0	20	99458	65
599	9.4	41.1	0.2	8.1	20	99458	65
600	8.3	44.7	0.2	7.2	20	99458	65
601	7.4	47.0	0.3	6.4	20	99458	65
602	8.2	44.1	0.3	7.0	20	99458	65
603	10.1	42.4	0.2	8.7	20	99458	65
604	8.4	41.9	0.2	7.2	20	99459	65
605	7.9	43.0	0.4	6.8	20	99459	65
606	7.3	43.1	0.3	6.3	20	99459	66
607	7.4	45.7	0.5	6.3	20	99459	66
608			0.4	6.8	20	99459	66
609			0.3	6.9	20	99459	66
610	6.2	45.1	0.4	5.3	20	99459	66
611	5.4	42.6	0.3	4.7	20	99459	67
612	6.3	43.5	0.4	5.4	20	99459	67
613	7.8	43.4	0.4	6.8	20	99459	67
614			0.5	7.5	20	99459	67
615	7.1	45.8	0.5	6.1	20	99459	67
616	8.0	46.6	0.5	6.9	20	99459	67
617	9.1	45.1	0.5	7.8	20	99459	67
618	11.1	42.6	0.5	9.6	20	99459	65
619	11.9	45.4	0.5	10.3	20	99459	65
620	11.4	45.4	0.6	9.8	20	99459	65
621	9.8	42.7	0.6	8.5	20	99459	65
622	9.8	44.4	0.6	8.5	20	99459	65
623	10.5	43.9	0.6	9.0	20	99459	65
624			0.7	9.8	20	99461	64
625			0.6	7.3	20	99478	64
626			0.8	7.8	20	99478	64
627			0.8	7.3	20	99478	64
628			0.7	5.8	20	99478	64
629			0.7	6.7	20	99478	65
630	8.6	44.2	0.6	7.4	19	99478	66
631	10.2	44.5	0.4	8.8	19	99478	66
632	8.4	46.4	0.4	7.2	19	99478	66
633	8.2	42.6	0.5	7.1	19	99478	66
634	9.6	42.8	0.4	8.3	19	99478	66
635	10.8	42.3	0.3	9.3	19	99478	65
636	9.4	41.3	0.5	8.1	19	99478	64
637	8.8	41.9	0.3	7.6	19	99478	64
638	8.7	45.5	0.4	7.5	19	99478	64
639	10.2	44.3	0.3	8.8	19	99478	64
640	11.5	40.7	0.4	9.9	19	99478	64
641	11.2	39.8	0.3	9.6	19	99478	64
642	11.0	43.1	0.3	9.5	19	99478	65
643	10.8	40.6	0.4	9.3	19	99478	65
644	12.6	45.1	0.2	10.8	19	99478	65
645	12.1	46.7	0.1	10.4	19	99478	65
646	8.9	42.3	0.4	7.6	19	99478	65
647	9.7	46.4	0.6	8.4	19	99486	65
648	10.8	47.2	0.5	9.3	19	99503	66
649	10.5	44.5	0.4	9.0	19	99504	66
650	10.2	43.4	0.5	8.8	19	99503	66
651	9.2	42.2	0.4	7.9	19	99504	66
652	8.5	44.6	0.5	7.4	19	99504	66
653	8.3	41.9	0.5	7.1	19	99496	66
654	7.0	43.4	0.3	6.1	19	99479	66
655	5.9	42.4	0.4	5.1	19	99479	66
656			0.4	6.7	19	99478	66
657			0.4	6.8	19	99478	66
658			0.4	7.2	19	99478	66
659			0.6	6.7	19	99486	66
660			0.5	6.7	19	99504	67
661			0.2	5.9	19	99503	67
662			0.3	5.7	19	99503	67
663	7.0	42.8	0.4	6.1	19	99503	67
664	8.6	44.3	0.5	7.4	19	99504	67

***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 (Pa)	Relative Humidity (%)
665	9.4	41.5	0.3	8.1	19	99496	66
666	10.4	42.0	0.4	9.0	19	99479	66
667	8.8	46.9	0.5	7.6	19	99478	66
668	9.6	46.2	0.6	8.3	19	99478	66
669	10.1	44.3	0.5	8.7	19	99478	66
670	11.8	49.3	0.6	10.2	19	99479	66
671	11.1	47.4	0.5	9.5	19	99486	65
672			0.3	6.8	19	99503	63
673			0.4	7.0	19	99504	63
674	11.2	43.8	0.4	9.6	19	99503	63
675	11.1	40.8	0.4	9.5	19	99504	63
676	9.1	43.3	0.4	7.8	19	99503	63
677	9.0	44.9	0.4	7.7	19	99503	64
678	8.6	41.2	0.4	7.4	19	99504	65
679	9.5	40.8	0.3	8.2	19	99504	65
680	9.6	43.4	0.4	8.2	19	99503	65
681	9.2	46.0	0.4	8.0	19	99504	65
682	8.2	47.0	0.4	7.1	19	99504	65
683			0.2	6.4	19	99504	65
684	7.7	45.3	0.1	6.7	19	99504	66
685	6.0	44.7	0.3	5.2	19	99504	66
686	9.7	45.8	0.4	8.4	19	99504	66
687	10.1	45.5	0.4	8.7	19	99504	66
688	9.5	46.1	0.4	8.2	19	99504	66
689			0.3	8.3	19	99503	66
690			0.2	9.5	19	99504	65
691	9.8	45.3	0.4	8.5	19	99503	65
692	8.8	42.2	0.4	7.6	19	99504	65
693	7.4	45.0	0.5	6.4	19	99504	65
694	6.8	43.3	0.4	5.9	19	99504	65
695	7.0	44.6	0.4	6.1	19	99504	66
696	7.3	44.0	0.4	6.3	19	99504	66
697	7.3	43.0	0.4	6.3	19	99504	66
698	6.6	41.8	0.4	5.7	19	99504	66
699	6.2	39.9	0.4	5.3	19	99503	66
700	6.2	39.8	0.4	5.4	19	99503	66
701	5.3	40.5	0.4	4.6	19	99503	67
702	6.0	41.8	0.4	5.2	19	99503	68
703	5.2	44.4	0.4	4.5	19	99504	68
704	4.4	44.6	0.4	3.7	19	99504	68
705	5.4	45.0	0.4	4.7	19	99504	68
706	5.3	43.6	0.4	4.6	19	99504	68
707	6.3	46.2	0.4	5.4	19	99503	68
708	6.4	45.8	0.4	5.5	19	99503	67
709			0.4	7.6	19	99503	67
710			0.7	7.8	19	99504	67
711			0.6	7.0	19	99503	67
712	9.7	46.2	0.3	8.3	19	99503	67
713	9.4	46.8	0.6	8.1	19	99503	67
714			0.6	7.4	19	99504	66
715	7.7	45.1	0.5	6.7	19	99504	66
716	9.0	46.1	0.3	7.7	19	99503	66
717	7.6	44.3	0.4	6.5	19	99504	66
718	7.2	43.9	0.5	6.2	19	99503	66
719	10.1	42.7	0.3	8.7	19	99495	66
720	11.8	43.6	0.3	10.1	19	99478	66
721	11.1	42.8	0.4	9.6	19	99478	66
722	10.2	46.2	0.4	8.8	19	99478	66
723	10.2	45.3	0.3	8.7	19	99478	66
724	10.0	44.5	0.4	8.6	19	99478	66
725	10.0	47.1	0.4	8.6	19	99486	66
726	10.5	44.3	0.2	9.1	19	99503	65
727	10.4	43.8	0.2	9.0	19	99504	65
728	12.3	45.3	0.2	10.6	19	99503	65
729	9.9	44.6	0.2	8.5	19	99504	65
730			0.2	7.5	19	99503	65
731	9.3	43.7	0.2	8.0	19	99503	65
732	9.6	42.9	0.1	8.3	19	99504	65
733	8.4	42.3	0.4	7.2	19	99504	65
734	7.5	43.4	0.6	6.4	19	99504	65
735	6.6	44.1	0.4	5.7	19	99504	65
736	8.1	42.6	0.3	7.0	19	99504	65
737	8.6	40.3	0.2	7.4	19	99504	65
738	7.9	40.0	0.3	6.8	19	99504	65
739	8.0	39.3	0.3	6.9	19	99504	65
740	7.1	42.0	0.3	6.2	19	99504	65
741	7.1	41.6	0.4	6.1	19	99504	65
742	10.2	42.9	0.4	8.8	19	99505	65
743	10.1	41.0	0.2	8.7	19	99496	65
744	9.3	39.4	0.1	8.0	19	99479	64
745	7.0	41.4	0.3	6.0	19	99479	64
746	7.0	41.5	0.4	6.0	19	99478	64
747	6.3	42.6	0.4	5.5	19	99478	64

Table E.02 Measurement data - Background

Project: Cedar Point Wind Power Project - Turbine CP226 - IEC 61400-11 Measurement

Report ID: 15039.00.T226.RP3

Created on: 9/14/2017

***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 (Pa)	Relative Humidity (%)
748	5.5	42.0	0.3	4.7	19	99479	64
749	6.2	40.9	0.4	5.3	19	99487	65
750	6.7	42.7	0.4	5.8	19	99505	66
751	7.2	41.4	0.3	6.2	19	99504	66
752	7.7	41.8	0.3	6.6	19	99504	66
753	7.8	40.3	0.4	6.7	19	99504	66
754	7.2	39.9	0.4	6.2	19	99504	66
755	7.2	39.0	0.6	6.2	19	99504	66
756	7.9	40.1	0.3	6.8	19	99504	66
757	7.2	43.8	0.3	6.2	19	99504	66
758			0.3	5.9	19	99504	66
759	8.5	44.6	0.5	7.3	19	99504	66
760	8.5	45.4	0.4	7.3	19	99504	66
761	8.7	45.5	0.4	7.5	19	99504	66
762	7.2	44.8	0.4	6.2	19	99504	65
763	9.1	43.0	0.3	7.8	19	99504	65
764	9.9	43.9	0.3	8.5	19	99504	65
765	8.6	42.7	0.4	7.4	19	99504	65
766	7.2	42.2	0.5	6.2	19	99504	65
767	8.8	42.5	0.4	7.6	19	99504	65
768			0.4	7.0	19	99504	65
769			0.4	7.2	19	99504	65
770			0.4	6.7	19	99505	65
771	5.5	46.8	0.5	4.7	19	99505	65
772	5.8	46.9	0.4	5.0	19	99504	65
773	5.5	44.6	0.3	4.7	19	99504	66
774	5.2	45.9	0.4	4.5	19	99504	66
775	5.4	44.7	0.4	4.7	19	99504	66
776	5.8	41.7	0.3	5.0	19	99504	66
777	6.9	42.7	0.2	5.9	19	99504	66
778	9.4	43.3	0.2	8.1	19	99504	66
779	8.7	41.6	0.2	7.5	19	99504	66
780	8.5	40.3	0.2	7.4	19	99504	66
781	7.6	39.6	0.3	6.6	19	99504	66
782	7.8	40.1	0.4	6.8	19	99504	66
783	6.7	40.3	0.4	5.8	19	99504	66
784	7.3	40.3	0.3	6.3	19	99504	66
785	6.7	41.3	0.4	5.8	19	99504	66
786	5.8	41.2	0.5	5.0	19	99504	66
787	5.7	40.9	0.5	4.9	19	99504	66
788	8.8	40.3	0.5	7.5	19	99504	66
789	8.5	41.0	0.6	7.3	19	99504	66
790	7.5	44.6	0.7	6.5	19	99504	66
791	7.4	50.7	0.5	6.4	19	99504	66
792	8.7	48.0	0.3	7.5	19	99504	66
793	10.2	45.2	0.3	8.8	19	99504	66
794	10.4	46.3	0.5	9.0	19	99504	66
795			0.5	7.3	19	99504	66
796			0.5	6.7	19	99504	66
797			0.4	6.2	19	99504	66
798	7.9	46.0	0.5	6.8	19	99504	67
799	8.6	46.5	0.4	7.4	19	99504	67
800	8.7	42.7	0.4	7.5	19	99504	67
801	10.8	42.1	0.5	9.3	19	99504	67
802			0.4	8.3	19	99504	67
803			0.4	8.8	19	99504	66
804			0.3	9.4	19	99504	65
805	10.0	45.5	0.3	8.6	19	99504	65
806	11.0	45.0	0.4	9.4	19	99504	65
807	9.0	43.7	0.6	7.7	19	99504	65
808	10.4	42.6	0.6	8.9	19	99504	65
809	9.7	44.0	0.5	8.3	19	99504	65
810	7.6	41.9	0.4	6.5	19	99504	65
811	7.1	46.8	0.6	6.1	19	99504	65
812			0.8	6.5	19	99504	65
813			0.6	7.7	19	99503	65
814	9.9	46.5	0.5	8.6	19	99504	65
815	8.2	45.9	0.5	7.1	19	99504	65
816	7.5	47.3	0.5	6.4	19	99504	66
817							
818							
819							
820							
821							
822							
823							
824							
825							
826							
827							
828							
829							
830							

***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 (Pa)	Relative Humidity (%)
831							
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912							
913							

***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 (Pa)	Relative Humidity (%)
914							
915							
916							
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Appendi xF
Note on anemometer position with IEC 61400-11 Ed 2.1 and Ed 3.0

Note N6.040.17

Note on anemometer position with IEC 61400-11 editions 2.1 and 3.0

Author: Bo Søndergaard

Project number: 35.6539.01
Date: 7/11/2017
Project manager: Bo Søndergaard
Controlled by: -

To : Aercoustics Engineering Limited
Att.: Payam Ashtiani

From : Bo Søndergaard

1. Purpose

In the capacity of convenor for Maintenance Team 11, the workgroup in charge of IEC 61400-11, since 2006, I have been asked to provide background information, and comment on the consequences of changing the anemometer position when going from edition 2.1 to edition 3, and the recommended method for using measurements based on edition 2.1 for an analysis with edition 3.

2. Comment

There are several differences between IEC 61400-11 standard edition 2.1 (November 2006) and edition 3.0 (November 2012). In particular, the general data treatment procedures for noise levels, and the tonality assessment were changed to keep up with the changes in wind turbine design at the time.

However, since edition 1.0 (1998), very few changes have been made to the IEC 61400-11 standard with respect to the measurement setup. In edition 1.0 the prescribed position of the anemometer was upwind (2 to 4 rotor diameters) as it was allowed to use the anemometer for determination of the standardized wind speed with the wind turbine running. At that time the distances were smaller and this setup is maintained in Annex F on small wind turbines in edition 3. Editions 2.0 and 2.1, still allowed such use of the anemometer

In Germany, modified versions of IEC 61400-11 edition 2 were introduced by the FGW. In revision 15 (from 2004), using the power for determination of the standardized wind speed was mandatory. In revision 16 (from 2005), it was stated that the position of the anemometer can deviate from the requirements in IEC 61400-11 edition 2, without specifying position requirements. Germany has had a strong influence on the development of the IEC 61400-11 standard through the experience from several measuring companies and German authorities. The decision to allow alternative positions for the anemometer is very representative of the situation. It is difficult to set up general requirements for the position of the anemometer that works at all sites. As such, it makes sense to allow for an expert

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judgement on the anemometer position in a given situation. In the Danish regulations, it is stated that the anemometer has to be close to the wind turbine in a position where neither the wind turbine nor objects in the terrain is expected to influence the wind speed measurements.

The German and Danish considerations on the position of the anemometer is based on the fact that the dominating background noise at the microphone position can be more or less dependent on wind speed; and can be generated by vegetation upwind, downwind or to the side of the wind turbine. This is often reflected in background noise with a weak dependence on wind speed.

Maintenance Team 11, responsible for revising IEC 61400-11, discussed this issue and there was a strong support from the measurement institutes for using the nacelle anemometer for background noise measurements. In most cases, this would give a reasonable correlation between wind speed and background noise. The nacelle anemometer is not influenced by terrain and represents, to a reasonable degree, the wind in the surroundings. However, the manufacturers argued that the nacelle anemometer might not be a part of future designs and could not be guaranteed. There was a general agreement that it was difficult to decide on an optimum position, but in most cases, downwind and to the side would make sense, resulting in Figure 5 of edition 3.0. The position of the anemometer is not considered an important issue and the wording is “guidance” and “acceptable” and not a stronger wording like “shall”. This is a deliberate decision by the Maintenance Team 11 to ensure flexibility when other choices make more sense.

The recommended method when using measurements made according to IEC 61400-11 edition 2.1 for analysis with IEC 61400-11 edition 3.0 is to use the nacelle anemometer for the background noise. This will work well in most cases. Alternatively, to use the measured wind speed at 10 m height if there is no strong influence from the background noise (e.g. when signal to noise ratio is better than 6 dB).

SWECO Danmark A/S

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Appendix G
Information for Regulator

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E-Audit Checklist

(2017 Compliance Protocol AF5): E-Audit checklist

Wind Energy Project – Screening Document – Acoustic Audit Report – Emmission IEC61400-11 Standard

Information Required in the Acoustic Audit Report – Immission

Item #	Description	Complete?	Comment
1	Characterization of the wind turbine Items 1 to 26; IEC61400-11:2013, Section 10.2	✓	
2	Physical environment Items 27 to 33; IEC61400-11:2013, Section 10.3, Physical Environment	✓	
3	Measurement instrumentation Items 34 to 39; IEC61400-11:2013, Section 10.4, Instrumentation	✓	
4	Acoustic data Items 40 to 52; IEC61400-11:2013, Section 10.5, Acoustic Data	✓	
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	✓	
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	✓	
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	✓	All data Excel sheet provided
8	Items 68 to 72; IEC61400-11:2013, Section 10.5, Acoustic Data	⊘	Items 68 to 72 acoustic data as per IEC 61400-11 standard are optional; low frequency noise, infrasound, impulsivity, amplitude modulation not reported
9	Non-acoustic data Items 73 to 74 are from IEC61400-11:2013, Section 10.6, Non-Acoustic Data	⊘	Items 73 to 74 non-acoustic data as per IEC 64100-11 standard are optional; turbulence intensity during acoustic meeasurements not reported

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Sample Calculation

Allowed Range from Power Curve and Required Wind Speeds

Sample Calculation: Allowed range of power curve and required wind speeds

Power Curve & Required Wind Speeds		
Power Curve Tolerance	1%	
Min allowable range	2	m/s
Max allowable range	9	m/s
Power Output	2126	kW
85% Power	1807.1	kW
Corresponding wind speed	8.70	m/s
Minimum bin	7.0	m/s
Maximum bin	11.5	m/s

Power Curve Hub Wind Speed (m/s)	Power [kW]	+ value = acceptable slope of power curve
0	**0**	-42.52
1	0	-42.52
2	0	22.48
3	65	61.48
4	169	135.48
5	347	225.48
6	615	331.48
7	989	439.48
8	1471	437.48
9	1951	132.48
10	2126	-42.52
11	2126	-42.52
12	2126	-42.52
13	2126	-42.52
14	2126	-42.52
15	2126	-42.52
16	2126	-42.52
17	2126	-42.52
18	2126	-42.52
19	2126	-42.52
20	2126	-42.52
21	2126	-42.52
22	2126	-42.52
23	2126	-42.52
24	2126	-42.52
25	2126	

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Sample Calculation

K_{nac} and K_z

[as per IEC 61400-11 Edition 3.0 Section 8.2.1.2 and Section 8.2.2]

SAMPLE CALCULATION

This calculation example demonstrates the calculation of nacelle k-factor as per IEC 61400-11 Edition 3.0 section 8.2.1.2

Sample calculations have been based on measurement data collected and reported for Cedar Point Wind Power Project (Report ID: 15039.00.CP226.R3)

For all data points with power levels from the allowed range of the power curve, the average value of the ratio of the wind speed derived from the power curve $V_{P,n}$ and the measured nacelle wind speed $V_{nac,m}$, k_{nac}, is derived as per equation (1). Information to calculate k_{nac} is provided in Table 1.

$$k_{nac} = \frac{1}{n}\left(\sum_{i=1}^{n}\left(\frac{v_{p,n}}{v_{nac,m}}\right)_i\right) \quad (1)$$

where

$V_{nac,m}$ is measured nacelle wind speed

K_{nac} is nacelle k-factor

$V_{P,n}$ is wind speed derived from the power curve

k_{nac} = 0.9182

SAMPLE CALCULATION

This calculation example demonstrates the calculation of nacelle k-factor as per IEC 61400-11 Edition 3.0 section 8.2.1.2

Table 1 - Information to calculate K_{nac}

Data ID#	Data Point Excluded 1=yes, 0=no	Power (kW)	Hub Height Wind Speed (m/s) from power curve	Hub Wind speed in acceptable range 1=yes, 0=no	wind speed from acceptable range $V_{p,n}$ (m/s)	Nacelle Anemometer Wind Speed, $V_{nac,m}$ (m/s)	$V_{P,n}/V_{nac,m}$
1	1	1257	7.56	1		8.01	
2	0	1218	7.47	1	7.47	7.61	0.98
3	0	1472	8.00	1	8.00	8.32	0.96
4	0	1419	7.89	1	7.89	8.24	0.96
5	0	1430	7.92	1	7.92	8.43	0.94
6	0	1404	7.86	1	7.86	7.73	1.02
7	0	1457	7.97	1	7.97	8.59	0.93
8	0	1448	7.95	1	7.95	9.19	0.87
9	0	1194	7.43	1	7.43	6.88	1.08
10	0	1012	7.05	1	7.05	7.73	0.91
11	0	1212	7.46	1	7.46	8.34	0.89
12	0	1406	7.86	1	7.86	8.48	0.93
13	0	1220	7.48	1	7.48	7.97	0.94
14	0	1069	7.17	1	7.17	7.04	1.02
15	0	914	6.80	1	6.80	6.55	1.04
16	0	788	6.46	1	6.46	6.61	0.98
17	0	816	6.54	1	6.54	7.56	0.86
18	0	979	6.97	1	6.97	8.61	0.81
19	0	1193	7.42	1	7.42	9.41	0.79
20	0	1167	7.37	1	7.37	8.26	0.89
21	0	954	6.91	1	6.91	7.52	0.92
22	0	757	6.38	1	6.38	6.28	1.02
23	0	610	5.98	1	5.98	6.44	0.93
24	0	453	5.39	1	5.39	4.92	1.10
25	0	438	5.34	1	5.34	5.54	0.96
26	0	505	5.59	1	5.59	5.95	0.94
27	0	508	5.60	1	5.60	5.96	0.94
28	0	487	5.52	1	5.52	6.07	0.91
29	0	500	5.57	1	5.57	6.35	0.88
30	0	502	5.58	1	5.58	7.05	0.79
31	0	475	5.48	1	5.48	6.75	0.81
32	0	528	5.68	1	5.68	6.91	0.82
33	0	712	6.26	1	6.26	7.15	0.88
34	0	861	6.66	1	6.66	8.32	0.80
35	0	760	6.39	1	6.39	6.80	0.94
36	0	598	5.94	1	5.94	6.58	0.90
37	0	464	5.44	1	5.44	5.61	0.97
38	0	373	5.10	1	5.10	5.66	0.90
39	0	381	5.13	1	5.13	6.14	0.84
40	0	580	5.87	1	5.87	8.09	0.73
41	0	808	6.52	1	6.52	6.97	0.94
42	0	890	6.74	1	6.74	7.85	0.86
43	0	848	6.62	1	6.62	7.96	0.83
44	0	920	6.81	1	6.81	8.39	0.81
45	0	1046	7.12	1	7.12	9.10	0.78
46	0	1292	7.63	1	7.63	9.12	0.84
47	0	1287	7.62	1	7.62	8.53	0.89
48	0	1229	7.50	1	7.50	7.40	1.01
49	0	1073	7.17	1	7.17	8.30	0.86
50	0	942	6.87	1	6.87	8.17	0.84
51	0	800	6.50	1	6.50	7.61	0.85
52	0	639	6.06	1	6.06	6.75	0.90
53	0	509	5.60	1	5.60	5.35	1.05
54	0	471	5.46	1	5.46	5.46	1.00
55	0	650	6.09	1	6.09	7.57	0.81
56	0	822	6.55	1	6.55	8.45	0.78
57	0	851	6.63	1	6.63	8.25	0.80
58	0	870	6.68	1	6.68	8.26	0.81
59	0	994	7.01	1	7.01	8.59	0.82
60	0	985	6.99	1	6.99	6.95	1.01
61	0	847	6.62	1	6.62	6.87	0.96
62	0	746	6.35	1	6.35	6.51	0.98
63	0	759	6.39	1	6.39	7.66	0.83
64	0	712	6.26	1	6.26	5.90	1.06
65	0	578	5.86	1	5.86	5.89	1.00
66	0	564	5.81	1	5.81	6.02	0.97
67	0	714	6.26	1	6.26	7.59	0.83
68	0	850	6.63	1	6.63	6.37	1.04
69	0	924	6.83	1	6.83	7.57	0.90
70	0	984	6.99	1	6.99	7.59	0.92
71	0	928	6.84	1	6.84	7.05	0.97
72	0	813	6.53	1	6.53	6.65	0.98
73	0	756	6.38	1	6.38	6.41	1.00
74	0	766	6.40	1	6.40	6.40	1.00
75	0	745	6.35	1	6.35	6.68	0.95
76	0	667	6.14	1	6.14	6.12	1.00
77	0	595	5.92	1	5.92	5.80	1.02
78	0	507	5.60	1	5.60	5.83	0.96
79	0	455	5.40	1	5.40	5.98	0.90
80	0	496	5.56	1	5.56	6.43	0.86
81	0	606	5.96	1	5.96	6.86	0.87
82	0	697	6.22	1	6.22	7.60	0.82
83	0	686	6.19	1	6.19	6.77	0.91
84	0	609	5.98	1	5.98	6.16	0.97
85	0	594	5.92	1	5.92	7.30	0.81
86	0	573	5.84	1	5.84	5.64	1.04
87	0	505	5.59	1	5.59	6.41	0.87
88	0	438	5.34	1	5.34	6.49	0.82
89	0	414	5.25	1	5.25	6.65	0.79
90	0	453	5.40	1	5.40	6.70	0.81
91	0	437	5.34	1	5.34	5.59	0.95
92	0	391	5.16	1	5.16	5.62	0.92
93	0	414	5.25	1	5.25	5.50	0.95
94	0	504	5.58	1	5.58	6.02	0.93
95	0	679	6.17	1	6.17	7.07	0.87
96	0	862	6.66	1	6.66	8.19	0.81
97	0	980	6.98	1	6.98	7.46	0.94
98	0	1032	7.09	1	7.09	7.11	1.00
99	0	1054	7.13	1	7.13	7.40	0.96
100	0	1079	7.19	1	7.19	6.96	1.03
101	0	1059	7.15	1	7.15	7.52	0.95
102	0	1079	7.19	1	7.19	7.72	0.93
103	0	1061	7.15	1	7.15	7.07	1.01
104	0	979	6.97	1	6.97	6.40	1.09
105	0	813	6.53	1	6.53	7.00	0.93
106	0	680	6.17	1	6.17	6.17	1.00
107	0	597	5.93	1	5.93	6.92	0.86
108	0	638	6.06	1	6.06	7.39	0.82
109	0	757	6.38	1	6.38	7.25	0.88
110	0	957	6.91	1	6.91	7.71	0.90
111	0	1444	7.94	1	7.94	8.93	0.89
112	0	1785	8.65	1	8.65	9.36	0.92
113	0	1576	8.22	1	8.22	8.78	0.94
114	0	1665	8.40	1	8.40	8.70	0.97
115	0	1802	8.69	1	8.69	8.43	1.03
116	0	1855	8.80	1	8.80	9.21	0.96
117	0	1960	9.05	1	9.05	9.09	1.00
118	0	1911	8.92	1	8.92	9.00	0.99
119	0	2013	9.36	0	9.31	10.14	
120	1	1671	8.42	1		9.65	
121	1	135	3.67	1		9.08	
122	1	0	2.00	0		8.13	
123	1	0	2.00	0		9.04	
124	1	527	5.67	1		10.26	
125	1	705	6.24	1		9.96	
126	1	1327	7.70	1		10.10	
127	1	1777	8.64	1		9.99	
128	0	1625	8.32	1	8.32	9.80	0.85
129	0	1436	7.93	1	7.93	9.28	0.85
130	0	1292	7.63	1	7.63	8.02	0.95
131	0	1156	7.35	1	7.35	7.16	1.03
132	0	821	6.55	1	6.55	5.65	1.16
133	0	706	6.24	1	6.24	6.87	0.91
134	0	684	6.18	1	6.18	7.38	0.84
135	0	1211	7.46	1	7.46	7.66	0.97
136	0	1953	9.01	1	9.01	9.63	0.94
137	0	1914	8.92	1	8.92	9.47	0.94
138	0	2010	9.34	0		8.71	
139	0	2164		0	9.48	10.33	
140	0	2213		0	9.64	10.49	
141	0	2189		0	10.53	11.47	
142	0	2116	9.94	0	10.98	11.96	
143	0	2056	9.60	0		9.82	
144	0	2065	9.65	0	9.88	10.76	
145	0	2152		0	9.71	10.57	
146	0	2150		0	9.34	10.17	
147	0	1999	9.28	0		9.28	
148	0	1805	8.70	1	8.70	8.30	1.05
149	0	2082	9.75	0	9.38	10.22	
150	0	2102	9.86	0		10.04	
151	0	1960	9.05	1	9.05	9.79	0.92
152	0	2059	9.62	0		9.54	
153	0	1996	9.26	0	9.62	10.48	
154	0	1825	8.74	1	8.74	9.63	0.91
155	0	1987	9.21	1	9.21	9.94	0.93
156	0	1883	8.86	1	8.86	9.43	0.94
157	0	2093	9.81	0		9.41	
158	0	2026	9.43	0	10.55	11.49	
159	0	1903	8.90	1	8.90	9.94	0.90
160	0	2049	9.56	0	9.42	10.26	
161	0	1997	9.26	0		9.97	
162	0	1974	9.13	1	9.13	10.74	0.85
163	0	1723	8.53	1	8.53	9.29	0.92
164	0	1348	7.75	1	7.75	8.91	0.87
165	0	1264	7.57	1	7.57	8.45	0.90
166	0	1104	7.24	1	7.24	5.76	1.26
167	0	1001	7.02	1	7.02	7.60	0.92
168	0	1511	8.08	1	8.08	9.90	0.82
169	0	1284	7.61	1	7.61	8.63	0.88
170	0	1064	7.16	1	7.16	6.98	1.03
171	0	1119	7.27	1	7.27	7.27	1.00
172	0	1223	7.49	1	7.49	6.86	1.09
173	0	1881	8.85	1	8.85	8.71	1.02
174	0	2200		0	9.37	10.20	
175	0	2142		0		9.69	
176	0	2159		0	9.37	10.20	
177	0	2150		0	9.49	10.33	
178	0	2110	9.91	0	9.56	10.42	
179	0	2105	9.88	0		9.97	
180	0	2083	9.75	0	9.77	10.64	
181	0	2080	9.73	0	9.82	10.70	
182	0	2121	9.97	0	9.79	10.66	
183	0	2166		0	10.26	11.17	
184	0	2170		0		9.82	
185	0	2132		0		9.35	
186	0	2138		0	9.58	10.43	
187	0	2167		0	9.84	10.71	
188	0	2168		0	10.14	11.04	
189	0	2131		0	9.57	10.42	
190	0	1994	9.25	1	9.25	10.55	0.88
191	0	1688	8.45	1	8.45	8.84	0.96
192	0	1638	8.35	1	8.35	9.57	0.87
193	0	1639	8.35	1	8.35	9.75	0.86
194	0	1473	8.00	1	8.00	7.86	1.02
195	0	1401	7.85	1	7.85	8.03	0.98
196	0	1556	8.18	1	8.18	9.46	0.86
197	0	1497	8.05	1	8.05	7.51	1.07
198	0	1385	7.82	1	7.82	6.64	1.18
199	0	1214	7.47	1	7.47	8.19	0.91
200	0	1203	7.44	1	7.44	8.27	0.90
201	0	1132	7.30	1	7.30	6.73	1.08
202	0	1072	7.17	1	7.17	7.56	0.95
203	0	1181	7.40	1	7.40	8.17	0.91
204	0	1248	7.54	1	7.54	9.07	0.83
205	0	1156	7.35	1	7.35	7.57	0.97
206	0	1061	7.15	1	7.15	8.62	0.83
207	0	817	6.54	1	6.54	7.47	0.87
208	0	728	6.30	1	6.30	6.88	0.92
209	0	691	6.20	1	6.20	5.59	1.11
210	0	739	6.33	1	6.33	7.16	0.88
211	0	1242	7.53	1	7.53	7.94	0.95
212	0	1759	8.60	1	8.60	9.26	0.93
213	0	1607	8.28	1	8.28	8.53	0.97
214	0	1790	8.66	1	8.66	8.92	0.97
215	0	2044	9.53	0		9.35	
216	1	2096	9.83	0		9.82	
217	0	2031	9.46	0		8.87	
218	0	2088	9.79	0		9.48	
219	0	2151		0		9.80	
220	0	2163		0	9.29	10.12	
221	0	2129		0	9.91	10.79	
222	0	2179		0	10.63	11.58	
223	0	2148		0	9.56	10.42	
224	0	2110	9.91	0	9.74	10.61	
225	0	2116	9.94	0		9.97	
226	0	2199		0	10.45	11.38	
227	0	2075	9.71	0	9.45	10.29	
228	0	2028	9.44	0	10.33	11.26	
229	0	2154		0	10.37	11.30	
230	0	2127		0	9.97	10.86	
231	0	2110	9.91	0	9.91	10.79	
232	0	2144		0	10.24	11.15	
233	0	2115	9.94	0		10.04	
234	0	2090	9.80	0		9.15	
235	0	2055	9.60	0	9.45	10.29	
236	0	2098	9.84	0	10.35	11.28	
237	0	2074	9.70	0		10.01	
238	0	1784	8.65	1	8.65	10.10	0.86
239	0	1615	8.30	1	8.30	8.82	0.94
240	0	1718	8.51	1	8.51	9.88	0.86
241	0	2029	9.45	0	9.42	10.26	
242	0	1849	8.79	1	8.79	8.93	0.98
243	0	1693	8.46	1	8.46	9.66	0.88
244	0	1904	8.90	1	8.90	9.53	0.93
245	0	2059	9.62	0	9.38	10.21	
246	0	1967	9.09	1	9.09	10.24	0.89
247	0	1690	8.46	1	8.46	9.35	0.90
248	0	2100	9.85	0		9.67	
249	0	2114	9.93	0		9.96	
250	0	2088	9.78	0		9.31	
251	0	2148		0		9.22	
252	0	1995	9.25	0		9.52	
253	0	1807	8.70	1	8.70	9.07	0.96
254	0	1789	8.66	1	8.66	8.19	1.06
255	0	1879	8.85	1	8.85	8.59	1.03
256	0	1456	7.97	1	7.97	7.36	1.08
257	0	1467	7.99	1	7.99	8.01	1.00
258	0	1797	8.68	1	8.68	9.03	0.96
259	0	1680	8.44	1	8.44	8.92	0.95
260	0	1503	8.07	1	8.07	8.11	0.99
261	0	1522	8.11	1	8.11	9.76	0.83
262	0	1905	8.90	1	8.90	9.69	0.92
263	0	1812	8.71	1	8.71	9.89	0.88
264	0	1334	7.72	1	7.72	7.12	1.08

SAMPLE CALCULATION

This calculation example demonstrates the calculation of nacelle k-factor as per IEC 61400-11 Edition 3.0 section 8.2.1.2

Data ID#	Data Point Excluded 1=yes, 0=no	Power (kW)	Hub Height Wind Speed (m/s) from power curve	Hub Wind speed In acceptable range 1=yes, 0=no	wind speed from acceptable range $V_{p,n}$ (m/s)	Nacelle Anemometer Wind Speed, $V_{nac,m}$ (m/s)	$V_{P,n}/V_{nac,m}$
265	0	1195	7.43	1	7.43	8.40	0.88
266	0	1135	7.30	1	7.30	7.99	0.91
267	0	991	7.00	1	7.00	7.28	0.96
268	0	1008	7.04	1	7.04	7.28	0.97
269	0	1652	8.38	1	8.38	8.88	0.94
270	0	1883	8.86	1	8.86	8.74	1.01
271	0	1963	9.07	1	9.07	8.74	1.04
272	0	1884	8.86	1	8.86	9.57	0.93
273	0	1907	8.91	1	8.91	9.19	0.97
274	0	1983	9.18	1	9.18	8.51	1.08
275	0	1819	8.73	1	8.73	8.93	0.98
276	0	1752	8.58	1	8.58	8.27	1.04
277	0	1722	8.52	1	8.52	8.56	1.00
278	0	1813	8.71	1	8.71	9.45	0.92
279	0	1893	8.88	1	8.88	9.15	0.97
280	0	1414	7.88	1	7.88	7.79	1.01
281	0	1220	7.48	1	7.48	7.73	0.97
282	0	1756	8.59	1	8.59	9.66	0.89
283	0	2045	9.54	0	10.30	11.22	
284	0	1984	9.19	1	9.19	9.84	0.93
285	0	1474	8.01	1	8.01	8.77	0.91
286	0	1330	7.71	1	7.71	9.05	0.85
287	0	1510	8.08	1	8.08	9.29	0.87
288	0	1938	8.97	1	8.97	10.71	0.84
289	0	1852	8.79	1	8.79	10.78	0.82
290	0	1736	8.55	1	8.55	10.78	0.79
291	0	1690	8.46	1	8.46	9.99	0.85
292	0	1311	7.67	1	7.67	8.46	0.91
293	0	1103	7.24	1	7.24	7.10	1.02
294	0	903	6.77	1	6.77	8.15	0.83
295	0	720	6.28	1	6.28	7.13	0.88
296	0	685	6.19	1	6.19	6.58	0.94
297	0	816	6.54	1	6.54	7.96	0.82
298	0	857	6.65	1	6.65	5.38	1.23
299	0	884	6.72	1	6.72	7.03	0.96
300	0	941	6.87	1	6.87	8.12	0.85
301	0	1012	7.05	1	7.05	8.14	0.87
302	0	1371	7.79	1	7.79	7.96	0.98
303	0	1607	8.28	1	8.28	9.51	0.87
304	0	1392	7.84	1	7.84	9.31	0.84
305	0	1257	7.56	1	7.56	8.75	0.86
306	0	1184	7.40	1	7.40	7.72	0.96
307	0	1244	7.53	1	7.53	8.56	0.88
308	0	1523	8.11	1	8.11	8.90	0.91
309	0	1294	7.63	1	7.63	7.66	1.00
310	0	1239	7.52	1	7.52	7.29	1.03
311	0	1458	7.97	1	7.97	8.87	0.90
312	0	1574	8.22	1	8.22	8.25	1.00
313	0	1152	7.34	1	7.34	7.09	1.04
314	0	1056	7.14	1	7.14	7.57	0.94
315	0	1245	7.53	1	7.53	9.71	0.78
316	0	1320	7.69	1	7.69	9.01	0.85
317	0	1217	7.47	1	7.47	7.12	1.05
318	0	1214	7.47	1	7.47	7.62	0.98
319	0	1466	7.99	1	7.99	7.79	1.03
320	0	1859	8.81	1	8.81	9.83	0.90
321	0	2116	9.94	0	9.87	10.75	
322	0	2165		0	9.61	10.47	
323	0	2186		0		9.83	
324	0	2126	10.00	0	10.14	11.04	
325	0	2112	9.92	0		9.78	
326	0	2139		0		10.05	
327	1	1205	7.45	1		7.98	
328	1	1090	7.21	1		7.50	
329	1	1214	7.47	1		8.67	
330	1	1411	7.88	1		8.83	
331	1	1195	7.43	1		9.14	
332	1	1343	7.73	1		8.27	
333	1	1714	8.51	1		8.89	
334	1	1865	8.82	1		10.80	
335	1	1885	8.86	1		9.49	
336	1	2152		0		9.62	
337	1	2170		0		9.98	
338	1	2048	9.55	0		9.11	
339	1	2151		0		9.95	
340	1	2109	9.90	0		9.28	
341	1	1221	7.48	1		8.13	
342	1	1124	7.28	1		9.86	
343	1	1257	7.56	1		10.53	
344	1	1352	7.75	1		11.06	
345	1	1349	7.75	1		10.21	
346	1	1334	7.72	1		10.06	
347	1	1322	7.69	1		9.97	
348	1	1310	7.67	1		10.53	
349	1	1377	7.81	1		10.56	
350	1	1370	7.79	1		10.09	
351	1	1405	7.86	1		9.83	
352	1	1391	7.83	1		9.95	

Data ID#	Data Point Excluded 1=yes, 0=no	Power (kW)	Hub Height Wind Speed (m/s) from power curve	Hub Wind speed In acceptable range 1=yes, 0=no	wind speed from acceptable range $V_{p,n}$ (m/s)	Nacelle Anemometer Wind Speed, $V_{nac,m}$ (m/s)	$V_{P,n}/V_{nac,m}$
353	1	1343	7.73	1		9.33	
354	1	1216	7.47	1		9.28	
355	1	1064	7.16	1		7.85	
356	1	990	7.00	1		8.70	
357	1	1132	7.30	1		10.27	
358	1	1249	7.54	1		10.10	
359	1	1302	7.65	1		9.81	
360	1	1288	7.62	1		9.52	
361	1	1202	7.44	1		9.25	
362	1	1055	7.14	1		7.80	
363	1	994	7.01	1		7.66	
364	1	839	6.60	1		7.88	
365	1	573	5.84	1		6.96	
366	1	399	5.19	1		6.02	
367	1	507	5.60	1		7.74	
368	1	644	6.08	1		7.68	
369	1	538	5.71	1		7.23	
370	1	406	5.22	1		8.38	
371	0	2165		0	11.17	12.17	
372	0	2132		0	10.46	11.40	
373	0	2127		0	11.31	12.32	
374	0	2124	9.99	0	11.50	12.52	
375	0	2112	9.92	0	10.84	11.81	
376	0	2128		0	11.50	12.52	
377	0	2092	9.80	0	10.91	11.88	
378	0	2123	9.98	0	10.42	11.35	
379	0	2120	9.97	0	10.71	11.66	
380	0	2129		0	10.88	11.85	
381	0	2131		0	10.72	11.67	
382	0	2131		0	10.63	11.58	
383	0	2130		0	11.02	12.00	
384	0	2170		0	11.05	12.04	
385	0	2088	9.78	0	10.13	11.03	
386	0	2144		0	9.85	10.72	
387	0	2074	9.70	0	9.48	10.32	
388	0	2061	9.63	0	9.61	10.47	
389	0	2167		0	11.09	12.08	
390	0	2147		0	9.28	10.11	
391	0	2161		0	10.61	11.56	
392	0	2177		0	10.15	11.05	
393	0	2074	9.70	0	9.85	10.73	
394	0	2117	9.95	0	10.62	11.56	
395	0	2189		0	10.71	11.66	
396	0	2184		0	9.42	10.25	
397	0	2074	9.70	0	10.21	11.12	
398	0	2124	9.99	0	10.28	11.20	
399	0	2185		0	10.85	11.82	
400	0	2153		0	10.65	11.60	
401	0	2097	9.83	0	10.92	11.89	
402	0	2118	9.95	0	10.47	11.40	
403	0	2075	9.71	0	9.76	10.63	
404	0	2067	9.66	0	9.97	10.86	
405	0	2113	9.92	0	9.88	10.76	
406	0	2135		0		9.86	
407	0	2105	9.88	0	9.79	10.67	
408	0	2109	9.90	0		9.69	
409	0	2138		0	10.15	11.06	
410	0	2190		0	10.98	11.95	
411	0	2201		0	10.05	10.94	
412	0	2135		0	10.37	11.29	
413	0	2140		0	10.85	11.82	
414	0	2136		0	10.62	11.57	
415	0	2142		0	10.50	11.44	
416	0	2105	9.88	0	9.54	10.40	
417	0	2133		0	10.69	11.64	
418	0	2147		0	10.74	11.69	
419	0	2142		0	10.21	11.12	
420	0	2120	9.96	0	10.31	11.23	
421	0	2087	9.78	0	10.19	11.10	
422	0	2084	9.76	0	9.63	10.49	
423	0	2108	9.90	0	9.81	10.68	
424	0	2142		0	10.31	11.23	
425	0	2195		0	10.76	11.72	
426	0	2150		0	11.41	12.42	
427	0	2124	9.99	0	10.97	11.95	
428	0	2101	9.86	0	11.23	12.23	
429	0	2134		0	10.80	11.76	
430	0	2137		0	11.74	12.79	
431	0	2073	9.70	0	10.26	11.17	
432	0	1804	8.69	1	8.69	9.05	0.96
433	0	1771	8.63	1	8.63	9.62	0.90
434	0	1730	8.54	1	8.54	9.51	0.90
435	0	1931	8.96	1	8.96	8.04	1.11
436	0	2029	9.44	0	9.93	10.81	
437	0	2020	9.39	0	9.66	10.52	
438	0	2087	9.78	0		9.98	
439	0	2180		0		9.86	
440	0	1981	9.17	1	9.17	9.87	0.93

Data ID#	Data Point Excluded 1=yes, 0=no	Power (kW)	Hub Height Wind Speed (m/s) from power curve	Hub Wind speed In acceptable range 1=yes, 0=no	wind speed from acceptable range $V_{p,n}$ (m/s)	Nacelle Anemometer Wind Speed, $V_{nac,m}$ (m/s)	$V_{P,n}/V_{nac,m}$
441	0	1401	7.85	1	7.85	9.77	0.80
442	0	1674	8.42	1	8.42	10.76	0.78
443	0	1654	8.38	1	8.38	10.57	0.79
444	0	1795	8.68	1	8.68	10.38	0.84
445	0	1733	8.55	1	8.55	10.22	0.84
446	0	2246		0	10.55	11.48	
447	0	2261		0	10.64	11.59	
448	0	2204		0	11.06	12.04	
449	0	2127		0	10.32	11.24	
450	0	2127		0	11.03	12.01	
451	0	2078	9.72	0	11.13	12.12	
452	0	2034	9.47	0	9.88	10.76	
453	0	2179		0	11.46	12.48	
454	0	2157		0	9.83	10.70	
455	0	2162		0	10.64	11.59	
456	0	1837	8.76	1	8.76	9.62	0.91
457	0	1597	8.26	1	8.26	8.86	0.93
458	0	1643	8.36	1	8.36	8.64	0.97
459	0	1748	8.58	1	8.58	8.40	1.02
460	0	1823	8.73	1	8.73	9.38	0.93
461	0	1916	8.93	1	8.93	8.99	0.99
462	0	2060	9.62	0	9.82	10.70	
463	0	2161		0	9.48	10.33	
464	0	2014	9.36	0	9.32	10.15	
465	0	1881	8.86	1	8.86	10.02	0.88
466	0	2037	9.49	0	10.43	11.36	
467	0	2280		0	10.48	11.41	
468	0	2249		0	10.88	11.85	
469	0	2237		0	12.50	13.62	
470	0	2115	9.94	0	11.57	12.60	
471	0	2065	9.65	0	10.61	11.56	
472	0	2075	9.71	0	10.96	11.94	
473	0	2098	9.84	0	10.73	11.69	
474	0	2122	9.97	0	10.79	11.76	
475	0	2139		0	11.86	12.92	
476	0	2185		0	11.66	12.70	
477	0	2189		0	12.62	13.75	
478	0	2143		0	11.41	12.42	
479	0	2168		0	11.97	13.04	
480	0	2150		0	12.61	13.73	
481	0	2129		0	12.45	13.56	
482	0	2116	9.94	0	12.53	13.64	
483	0	2154		0	13.58	14.79	
484	0	2101	9.86	0	12.23	13.32	
485	0	2034	9.48	0	10.95	11.93	
486	0	2085	9.76	0	10.95	11.93	
487	0	2108	9.90	0	10.87	11.84	
488	0	2126	10.00	0	11.53	12.55	
489	0	2142		0	11.80	12.86	
490	0	2165		0	11.38	12.40	
491	0	2114	9.93	0	11.46	12.48	
492	0	2141		0	11.46	12.48	
493	0	2140		0	11.28	12.29	
494	0	2046	9.54	0	10.99	11.96	
495	0	2107	9.89	0	11.17	12.16	
496	0	2088	9.78	0	10.10	11.00	
497	0	2191		0	11.52	12.55	
498	0	2199		0	11.54	12.57	
499	0	2135		0	11.90	12.96	
500	0	2125	9.99	0	10.82	11.79	
501	0	2071	9.69	0	10.62	11.57	
502	0	2020	9.40	0	10.78	11.74	
503	0	1920	8.94	1	8.94	11.42	0.78
504	0	2094	9.82	0	10.10	11.00	
505	0	2169		0	9.74	10.61	
506	0	2204		0	11.12	12.11	
507	0	1916	8.93	1	8.93	10.96	0.81
508	0	1552	8.17	1	8.17	9.35	0.87
509	0	1488	8.04	1	8.04	8.09	0.99
510	0	1254	7.55	1	7.55	8.92	0.85
511	0	1404	7.86	1	7.86	8.54	0.92
512	0	2021	9.40	0		8.53	
513	0	2309		0	11.04	12.02	
514	0	2252		0	11.67	12.70	
515	0	2214		0	12.42	13.52	
516	0	2160		0	11.92	12.98	
517	0	2085	9.77	0	10.91	11.88	
518	0	2115	9.94	0	12.01	13.08	
519	0	2174		0	11.88	12.94	
520	0	2132		0	12.06	13.13	
521	0	2116	9.94	0	12.44	13.55	
522	0	2112	9.92	0	12.26	13.35	
523	0	2142		0	11.91	12.97	
524	0	2122	9.97	0	12.29	13.39	
525	0	2114	9.93	0	11.98	13.04	
526	0	2169		0	12.98	14.14	
527	0	2129		0	12.49	13.61	
528	0	2131		0	12.64	13.76	

SAMPLE CALCULATION

This calculation example demonstrates the calculation of nacelle k-factor as per IEC 61400-11 Edition 3.0 section 8.2.1.2

Data ID#	Data Point Excluded 1=yes, 0=no	Power (kW)	Hub Height Wind Speed (m/s) from power curve	Hub Wind speed in acceptable range 1=yes, 0=no	wind speed from acceptable range $V_{p,n}$ (m/s)	Nacelle Anemometer Wind Speed, $V_{nac,m}$ (m/s)	$V_{P,n}/V_{nac,m}$
529	0	2062	9.64	0	11.61	12.65	
530	0	2107	9.89	0	11.84	12.90	
531	0	2146		0	11.75	12.80	
532	0	2157		0	12.52	13.63	
533	0	2104	9.87	0	12.16	13.24	
534	0	2065	9.65	0	11.44	12.46	
535	0	2066	9.65	0	11.64	12.68	
536	0	2088	9.78	0	9.77	10.64	
537	0	2128		0	10.99	11.97	
538	0	2098	9.84	0	11.25	12.25	
539	0	2046	9.54	0	9.87	10.75	
540	0	2110	9.91	0	9.84	10.72	
541	0	2135		0	9.57	10.42	
542	0	2108	9.90	0		9.43	
543	0	2107	9.89	0	9.83	10.70	
544	0	2228		0	11.50	12.52	
545	0	2132		0	9.96	10.85	
546	0	2092	9.81	0	10.35	11.27	
547	0	2141		0	10.40	11.33	
548	0	2114	9.93	0	11.51	12.53	
549	0	1998	9.27	0	10.45	11.38	
550	0	1944	8.98	1	8.98	10.80	0.83
551	0	1997	9.26	0	10.53	11.47	
552	0	1890	8.87	1	8.87	10.96	0.81
553	0	1749	8.58	1	8.58	8.98	0.95
554	0	1992	9.23	1	9.23	9.42	0.98
555	0	2250		0	9.67	10.54	
556	0	2180		0	10.16	11.07	
557	0	2128		0	11.41	12.43	
558	0	2214		0	10.61	11.56	
559	0	2126	10.00	0		10.04	
560	0	2127		0	10.38	11.31	
561	0	2176		0	10.96	11.93	
562	0	2190		0	11.45	12.47	
563	0	2166		0	10.95	11.92	
564	0	2089	9.79	0	10.99	11.97	
565	0	2053	9.58	0	9.81	10.69	
566	0	1765	8.61	1	8.61	10.44	0.82
567	0	2004	9.30	0	9.87	10.75	
568	0	2227		0	11.88	12.94	
569	0	2150		0	9.69	10.55	
570	0	1680	8.44	1	8.44	10.00	0.84
571	0	2147		0	10.08	10.97	
572	0	2195		0	9.97	10.86	
573	0	2117	9.95	0	9.90	10.78	
574	0	1819	8.72	1	8.72	9.94	0.88
575	0	1492	8.04	1	8.04	8.32	0.97
576	0	1843	8.77	1	8.77	11.03	0.80
577	0	1731	8.54	1	8.54	10.30	0.83
578	0	1588	8.24	1	8.24	8.88	0.93
579	0	1601	8.27	1	8.27	9.91	0.83
580	0	1771	8.63	1	8.63	10.50	0.82
581	0	2087	9.78	0	9.88	10.76	
582	0	2050	9.57	0		9.90	
583	0	2127		0	10.24	11.15	
584	0	2159		0		9.15	
585	0	2042	9.52	0	10.56	11.51	
586	0	1713	8.50	1	8.50	11.17	0.76
587	0	1996	9.26	0	10.33	11.25	
588	0	1911	8.92	1	8.92	10.86	0.82
589	0	1854	8.80	1	8.80	10.94	0.80
590	0	1950	9.00	1	9.00	10.44	0.86
591	0	2259		0	9.93	10.82	
592	0	2170		0		9.14	
593	0	2159		0	9.79	10.66	
594	0	2017	9.38	0	9.39	10.23	
595	0	2094	9.82	0		9.64	
596	0	2183		0	11.55	12.57	
597	0	2191		0	9.27	10.10	
598	0	2251		0	11.58	12.61	
599	0	2177		0	10.48	11.42	
600	0	2083	9.75	0	11.4	12.68	
601	0	2230		0	12.37	13.47	
602	0	2190		0	13.80	15.03	
603	0	2162		0	12.93	14.08	
604	0	2123	9.99	0	12.70	13.83	
605	0	2133		0	13.00	14.16	
606	0	2107	9.89	0	12.72	13.85	
607	0	2130		0	12.40	13.51	
608	0	2046	9.54	0	11.83	12.89	
609	0	1967	9.09	1	9.09	11.07	0.82
610	0	2110	9.91	0	11.91	12.97	
611	0	2152		0	11.61	12.64	
612	0	2164		0	11.90	12.96	
613	0	2121	9.97	0	10.51	11.44	
614	0	2128		0	11.30	12.30	
615	0	2131		0	11.31	12.32	
616	0	2170		0	12.39	13.49	

Data ID#	Data Point Excluded 1=yes, 0=no	Power (kW)	Hub Height Wind Speed (m/s) from power curve	Hub Wind speed in acceptable range 1=yes, 0=no	wind speed from acceptable range $V_{p,n}$ (m/s)	Nacelle Anemometer Wind Speed, $V_{nac,m}$ (m/s)	$V_{P,n}/V_{nac,m}$
617	0	2142		0	12.70	13.83	
618	0	2139		0	10.58	11.52	
619	0	2083	9.75	0	11.08	12.07	
620	0	2108	9.90	0	11.60	12.63	
621	0	2073	9.70	0	10.42	11.35	
622	0	2181		0	11.13	12.12	
623	0	2180		0	11.18	12.18	
624	0	2192		0	11.33	12.34	
625	0	2104	9.87	0	11.48	12.50	
626	0	2121	9.97	0	12.42	13.52	
627	0	2167		0	11.46	12.48	
628	0	2096	9.83	0	11.65	12.69	
629	0	2116	9.94	0	12.52	13.63	
630	0	2213		0	12.39	13.49	
631	0	2205		0	13.71	14.93	
632	0	2162		0	13.73	14.96	
633	0	2108	9.90	0	13.73	14.96	
634	0	2136		0	13.46	14.66	
635	0	2106	9.89	0	13.79	15.02	
636	0	2108	9.90	0	13.79	15.02	
637	0	2108	9.90	0	13.79	15.02	
638	0	2108	9.90	0	13.79	15.02	
639	0	2108	9.90	0	13.79	15.02	
640	0	2108	9.90	0	13.79	15.02	
641	0	2078	9.72	0	11.95	13.02	
642	0	2029	9.45	0	11.87	12.93	
643	0	2124	9.99	0	10.44	11.37	
644	0	2133		0	10.65	11.60	
645	0	1908	8.91	1	8.91	10.21	0.87
646	0	2075	9.71	0		8.85	
647	0	2111	9.92	0	10.15	11.05	
648	0	2153		0	9.43	10.27	
649	0	2144		0	9.51	10.36	
650	0	2120	9.97	0	10.22	11.14	
651	0	2020	9.39	0	10.18	11.09	
652	0	1790	8.67	1	8.67	9.21	0.94
653	0	1829	8.75	1	8.75	9.98	0.88
654	0	1950	9.00	1	9.00	9.45	0.95
655	0	2013	9.35	0		9.55	
656	0	2024	9.42	0	9.33	10.16	
657	0	1666	8.41	1	8.41	10.17	0.83
658	0	1378	7.81	1	7.81	8.54	0.91
659	0	1321	7.69	1	7.69	8.32	0.92
660	0	1297	7.64	1	7.64	8.28	0.92
661	0	1130	7.29	1	7.29	8.10	0.90
662	0	1289	7.62	1	7.62	8.16	0.93
663	0	2148		0		9.33	
664	0	2249		0	10.99	11.97	
665	0	2211		0	9.76	10.63	
666	0	2167		0	10.72	11.67	
667	0	2176		0	11.10	12.09	
668	0	2207		0	12.65	13.77	
669	0	2085	9.76	0	11.52	12.55	
670	0	2101	9.86	0	10.84	11.81	
671	0	2206		0	12.79	13.93	
672	0	2133		0	11.27	12.28	
673	0	2160		0	12.81	13.95	
674	0	2178		0	12.80	13.95	
675	0	2159		0	12.21	13.30	
676	0	1639	8.35	1	8.35	13.72	0.61
677	0	519	5.64	1	5.64	14.15	0.40
678	0	777	6.43	1	6.43	13.51	0.48
679	0	1093	7.22	1	7.22	12.98	0.56
680	0	1750	8.58	1	8.58	12.09	0.71
681	0	2150		0	12.68	13.81	
682	0	2124	9.99	0	12.78	13.92	
683	0	2120	9.97	0	12.23	13.32	
684	0	2120	9.97	0	12.23	13.32	
685	0	2120	9.97	0	12.23	13.32	
686	0	2120	9.97	0	12.23	13.32	
687	0	2120	9.97	0	12.23	13.32	
688	0	2074	9.70	0	11.92	12.98	
689	0	2042	9.52	0	10.72	11.68	
690	0	2036	9.48	0	10.63	11.58	
691	0	2134		0	11.82	12.87	
692	0	2240		0	12.36	13.46	
693	0	2163		0	10.97	11.95	
694	0	2145		0	10.98	11.95	
695	0	2145		0	10.98	11.95	
696	0	2145		0	10.98	11.95	
697	0	2147		0	10.84	11.80	
698	0	2116	9.95	0	11.78	12.83	
699	0	2147		0	11.66	12.70	
700	0	2141		0	11.98	13.05	
701	0	2124	9.99	0	12.09	13.17	
702	0	2052	9.58	0	10.83	11.79	
703	0	2066	9.65	0	11.16	12.16	
704	0	1883	8.86	1	8.86	10.66	0.83

Data ID#	Data Point Excluded 1=yes, 0=no	Power (kW)	Hub Height Wind Speed (m/s) from power curve	Hub Wind speed in acceptable range 1=yes, 0=no	wind speed from acceptable range $V_{p,n}$ (m/s)	Nacelle Anemometer Wind Speed, $V_{nac,m}$ (m/s)	$V_{P,n}/V_{nac,m}$
705	0	2014	9.36	0	10.10	11.00	
706	0	2215		0	11.07	12.06	
707	0	2224		0	12.38	13.49	
708	0	2201		0	11.77	12.82	
709	0	2146		0	10.78	11.74	
710	0	2224		0	12.43	13.54	
711	0	2179		0	12.88	14.03	
712	0	2070	9.68	0	10.79	11.75	
713	0	2142		0	12.31	13.40	
714	0	2108	9.90	0	11.59	12.62	
715	0	2051	9.57	0	11.92	12.98	
716	0	1678	8.43	1	8.43	9.93	0.85
717	0	1799	8.68	1	8.68	9.66	0.90
718	0	2097	9.83	0		8.78	
719	0	2279		0	11.16	12.16	
720	0	2219		0	11.11	12.10	
721	0	2163		0	12.08	13.16	
722	0	2222		0	13.10	14.27	
723	0	2198		0	12.86	14.01	
724	0	2136		0	12.28	13.37	
725	0	2045	9.53	0	11.71	12.76	
726	0	2153		0	12.29	13.38	
727	0	2108	9.90	0	13.11	14.27	
728	0	2091	9.80	0	11.29	12.30	
729	0	2054	9.59	0	10.18	11.08	
730	0	2096	9.83	0	11.06	12.05	
731	0	2102	9.86	0	10.48	11.42	
732	0	2018	9.38	0	9.28	10.10	
733	0	1999	9.27	0	9.51	10.36	
734	0	1999	9.27	0	9.51	10.36	
735	0	1999	9.27	0	9.51	10.36	
736	0	1999	9.27	0	9.51	10.36	
737	0	1999	9.27	0	9.51	10.36	
738	0	2041	9.51	0	9.60	10.45	
739	0	2156		0	9.42	10.26	
740	0	2184		0	11.11	12.10	
741	0	2228		0	10.74	11.70	
742	0	2231		0	11.16	12.15	
743	0	2189		0	11.03	12.02	
744	0	2122	9.98	0	12.28	13.38	
745	0	2119	9.96	0	11.26	12.26	
746	0	2059	9.61	0	10.85	11.81	
747	0	2013	9.36	0	10.36	11.28	
748	0	2063	9.64	0	10.47	11.40	
749	0	2097	9.83	0	9.65	10.51	
750	0	2091	9.80	0	9.91	10.80	
751	0	1963	9.07	1	9.07	10.64	0.85
752	0	1863	8.82	1	8.82	10.78	0.82
753	0	1329	7.71	1	7.71	9.05	0.85
754	0	1228	7.50	1	7.50	7.22	1.04
755	0	1214	7.47	1	7.47	6.64	1.13
756	0	1327	7.70	1	7.70	7.83	0.98
757	0	1219	7.48	1	7.48	8.91	0.84
758	0	1599	8.27	1	8.27	7.85	1.05
759	0	1881	8.85	1	8.85	8.00	1.11
760	0	2021	9.40	0		8.10	
761	0	2118	9.95	0	9.50	10.35	
762	0	1982	9.18	1	9.18	10.35	0.89
763	0	1770	8.62	1	8.62	8.48	1.02
764	0	1959	9.05	1	9.05	10.05	0.90
765	0	2291		0	11.43	12.44	

SAMPLE CALCULATION

This calculation example demonstrates the calculation of nacelle k-factor as per IEC 61400-11 Edition 3.0 section 8.2.1.2

Sample calculations have been based on measurement data collected and reported for Cedar Point Wind Power Project (Report ID: 15039.00.CP226.R3)

For all data points with power levels from the allowed range of the power curve, the average value of the ratio of the wind speed derived from the power curve VP,n and the measured wind speed $V_{Z,m}$, k_Z, is derived as per equation (1) Information to calculate k_Z is provided in Table 1.

$$k_Z = \frac{1}{n}\left(\sum_{i=1}^{n}\left(\frac{v_{p,n}}{v_{Z,m}}\right)_i\right) \quad (1)$$

where

$V_{P,n}$ is wind speed derived from power curve

K_Z is Background k-factor

$V_{Z,n}$ is measured 10m wind speed

k_Z = 1.1608

SAMPLE CALCULATION

This calculation example demonstrates the calculation of nacelle k-factor as per IEC 61400-11 Edition 3.0 section 8.2.1.2

Table 1 - Information to calculate K_z

Data ID#	Data Point Excluded 1=yes, 0=no	Power (kW)	Hub Height Wind Speed (m/s) from power curve	Hub Wind speed in acceptable range 1=yes, 0=no	wind speed from acceptable range $V_{z,n}$ (m/s)	10m Anemometer Wind Speed, $V_{z,m}$ (m/s)	$V_{P,n}/V_{Z,m}$
1	1	1257	7.56	1		4.83	
2	0	1218	7.47	1	7.47	4.58	1.63
3	0	1472	8.00	1	8.00	4.09	1.96
4	0	1419	7.89	1	7.89	4.52	1.75
5	0	1430	7.92	1	7.92	5.22	1.52
6	0	1404	7.86	1	7.86	5.25	1.50
7	0	1457	7.97	1	7.97	4.05	1.97
8	0	1448	7.95	1	7.95	3.85	2.07
9	0	1194	7.43	1	7.43	5.06	1.47
10	0	1012	7.05	1	7.05	5.35	1.32
11	0	1212	7.46	1	7.46	5.62	1.33
12	0	1406	7.86	1	7.86	5.03	1.56
13	0	1220	7.48	1	7.48	3.92	1.91
14	0	1069	7.17	1	7.17	5.02	1.43
15	0	914	6.80	1	6.80	5.62	1.21
16	0	788	6.46	1	6.46	6.10	1.06
17	0	816	6.54	1	6.54	5.67	1.15
18	0	979	6.97	1	6.97	6.00	1.16
19	0	1193	7.42	1	7.42	5.51	1.35
20	0	1167	7.37	1	7.37	3.95	1.86
21	0	954	6.91	1	6.91	3.63	1.90
22	0	757	6.38	1	6.38	4.21	1.51
23	0	610	5.98	1	5.98	5.26	1.14
24	0	453	5.39	1	5.39	5.36	1.01
25	0	438	5.34	1	5.34	5.22	1.02
26	0	505	5.59	1	5.59	6.01	0.93
27	0	508	5.60	1	5.60	4.85	1.16
28	0	487	5.52	1	5.52	4.58	1.21
29	0	500	5.57	1	5.57	5.09	1.09
30	0	502	5.58	1	5.58	4.02	1.39
31	0	475	5.48	1	5.48	2.75	1.99
32	0	528	5.68	1	5.68	3.34	1.70
33	0	712	6.26	1	6.26	3.66	1.71
34	0	861	6.66	1	6.66	4.35	1.53
35	0	760	6.39	1	6.39	4.24	1.51
36	0	598	5.94	1	5.94	4.00	1.49
37	0	464	5.44	1	5.44	5.52	0.98
38	0	373	5.10	1	5.10	4.43	1.15
39	0	381	5.13	1	5.13	4.26	1.20
40	0	580	5.87	1	5.87	4.71	1.25
41	0	808	6.52	1	6.52	6.92	0.94
42	0	890	6.74	1	6.74	6.27	1.07
43	0	848	6.62	1	6.62	5.20	1.27
44	0	920	6.81	1	6.81	6.18	1.10
45	0	1046	7.12	1	7.12	6.90	1.03
46	0	1292	7.63	1	7.63	5.32	1.43
47	0	1287	7.62	1	7.62	5.69	1.34
48	0	1229	7.50	1	7.50	5.03	1.49
49	0	1073	7.17	1	7.17	4.12	1.74
50	0	942	6.87	1	6.87	3.53	1.95
51	0	800	6.50	1	6.50	5.60	1.16
52	0	639	6.06	1	6.06	5.52	1.10
53	0	509	5.60	1	5.60	6.65	0.84
54	0	471	5.46	1	5.46	5.81	0.94
55	0	650	6.09	1	6.09	6.28	0.97
56	0	822	6.55	1	6.55	5.32	1.23
57	0	851	6.63	1	6.63	6.07	1.09
58	0	870	6.68	1	6.68	5.77	1.16
59	0	994	7.01	1	7.01	5.94	1.18
60	0	985	6.99	1	6.99	5.10	1.37
61	0	847	6.62	1	6.62	4.10	1.61
62	0	746	6.35	1	6.35	3.90	1.63
63	0	759	6.39	1	6.39	4.74	1.35
64	0	712	6.26	1	6.26	5.49	1.14
65	0	578	5.86	1	5.86	6.17	0.95
66	0	564	5.81	1	5.81	5.46	1.06
67	0	714	6.26	1	6.26	5.42	1.16
68	0	850	6.63	1	6.63	5.29	1.25
69	0	924	6.83	1	6.83	4.98	1.37
70	0	984	6.99	1	6.99	6.21	1.12
71	0	928	6.84	1	6.84	5.90	1.16
72	0	813	6.53	1	6.53	5.34	1.22
73	0	756	6.38	1	6.38	5.39	1.18
74	0	766	6.40	1	6.40	4.95	1.29
75	0	745	6.35	1	6.35	5.55	1.14
76	0	667	6.14	1	6.14	5.30	1.16
77	0	595	5.92	1	5.92	6.50	0.91
78	0	507	5.60	1	5.60	6.85	0.82
79	0	455	5.40	1	5.40	6.25	0.87
80	0	496	5.56	1	5.56	6.31	0.88
81	0	606	5.96	1	5.96	5.98	1.00
82	0	697	6.22	1	6.22	5.20	1.20
83	0	686	6.19	1	6.19	5.30	1.17
84	0	609	5.98	1	5.98	5.57	1.07
85	0	594	5.92	1	5.92	5.19	1.14
86	0	573	5.84	1	5.84	5.56	1.05
87	0	505	5.59	1	5.59	5.52	1.01
88	0	438	5.34	1	5.34	6.11	0.87
89	0	414	5.25	1	5.25	5.99	0.88
90	0	453	5.40	1	5.40	6.39	0.84
91	0	437	5.34	1	5.34	5.12	1.04
92	0	391	5.16	1	5.16	5.87	0.88
93	0	414	5.25	1	5.25	5.36	0.98
94	0	504	5.58	1	5.58	7.22	0.77
95	0	679	6.17	1	6.17	6.40	0.96
96	0	862	6.66	1	6.66	6.00	1.11
97	0	880	6.98	1	6.98	5.41	1.29
98	0	1032	7.09	1	7.09	5.91	1.20
99	0	1054	7.13	1	7.13	6.99	1.02
100	0	1079	7.19	1	7.19	7.25	0.99
101	0	1059	7.15	1	7.15	6.78	1.05
102	0	1079	7.19	1	7.19	6.36	1.13
103	0	1061	7.15	1	7.15	7.15	1.00
104	0	979	6.97	1	6.97	6.83	1.02
105	0	813	6.53	1	6.53	6.16	1.06
106	0	680	6.17	1	6.17	5.21	1.19
107	0	597	5.93	1	5.93	5.26	1.13
108	0	638	6.06	1	6.06	5.90	1.03
109	0	757	6.38	1	6.38	7.26	0.88
110	0	957	6.91	1	6.91	7.51	0.92
111	0	1444	7.94	1	7.94	7.50	1.06
112	0	1785	8.65	1	8.65	7.35	1.18
113	0	1576	8.22	1	8.22	8.46	0.97
114	0	1665	8.40	1	8.40	7.00	1.20
115	0	1802	8.69	1	8.69	5.51	1.58
116	0	1855	8.80	1	8.80	6.62	1.33
117	0	1960	9.05	1	9.05	7.18	1.26
118	0	1911	8.92	1	8.92	6.61	1.35
119	0	2013	9.36	0	9.31	8.53	
120	1	1671	8.42	1		10.73	
121	1	135	3.67	1		8.80	
122	1	0	2.00	0		7.74	
123	1	0	2.00	0		7.06	
124	1	527	5.67	1		8.70	
125	1	705	6.24	1		8.74	
126	1	1327	7.70	1		8.37	
127	1	1777	8.64	1		7.33	
128	0	1625	8.32	1	8.32	6.90	1.21
129	0	1436	7.93	1	7.93	7.45	1.06
130	0	1292	7.63	1	7.63	7.41	1.03
131	0	1156	7.35	1	7.35	7.48	0.98
132	0	821	6.55	1	6.55	6.04	1.08
133	0	706	6.24	1	6.24	6.70	0.93
134	0	684	6.18	1	6.18	7.59	0.81
135	0	1211	7.46	1	7.46	8.10	0.92
136	0	1953	9.01	1	9.01	8.86	1.02
137	0	1914	8.92	1	8.92	6.61	1.35
138	0	2010	9.34	0		6.05	
139	0	2164		0	9.48	5.91	
140	0	2213		0	9.64	7.35	
141	0	2189		0	10.53	7.13	
142	0	2116	9.94	0	10.98	6.78	
143	0	2056	9.60	0		7.55	
144	0	2065	9.65	0	9.88	7.75	
145	0	2152		0	9.71	7.40	
146	0	2150		0	9.34	8.26	
147	0	1999	9.28	0		7.39	
148	0	1805	8.70	1	8.70	7.05	1.23
149	0	2082	9.75	0	9.38	6.24	
150	0	2102	9.86	0		6.65	
151	0	1960	9.05	1	9.05	6.19	1.46
152	0	2059	9.62	0		6.42	
153	0	1996	9.26	0	9.62	7.35	
154	0	1825	8.74	1	8.74	7.05	1.24
155	0	1987	9.21	1	9.21	7.37	1.25
156	0	1883	8.86	1	8.86	7.97	1.11
157	0	2093	9.81	0		7.22	
158	0	2026	9.43	0	10.55	7.16	
159	0	1903	8.90	1	8.90	6.66	1.34
160	0	2049	9.56	0	9.42	7.43	
161	0	1997	9.26	0		7.30	
162	0	1974	9.13	1	9.13	7.48	1.22
163	0	1723	8.53	1	8.53	6.81	1.25
164	0	1348	7.75	1	7.75	7.06	1.10
165	0	1264	7.57	1	7.57	8.10	0.93
166	0	1104	7.24	1	7.24	7.73	0.94
167	0	1001	7.02	1	7.02	8.37	0.84
168	0	1511	8.08	1	8.08	9.50	0.85
169	0	1284	7.61	1	7.61	10.85	0.70
170	0	1064	7.16	1	7.16	10.04	0.71
171	0	1119	7.27	1	7.27	8.89	0.82
172	0	1223	7.49	1	7.49	9.49	0.79
173	0	1881	8.85	1	8.85	8.98	0.99
174	0	2200		0	9.37	9.73	
175	0	2142		0		10.98	
176	0	2159		0	9.37	9.24	
177	0	2150		0	9.49	9.43	
178	0	2110	9.91	0	9.56	8.75	
179	0	2105	9.88	0		7.99	
180	0	2083	9.75	0	9.77	8.35	
181	0	2080	9.73	0	9.82	8.43	
182	0	2121	9.97	0	9.79	7.27	
183	0	2166		0	10.26	6.95	
184	0	2170		0		6.20	
185	0	2132		0		6.06	
186	0	2138		0	9.58	5.75	
187	0	2167		0	9.84	5.60	
188	0	2168		0	10.14	6.56	
189	0	2131		0	9.57	6.09	
190	0	1994	9.25	1	9.25	8.00	1.16
191	0	1688	8.45	1	8.45	8.50	0.99
192	0	1638	8.35	1	8.35	7.88	1.06
193	0	1639	8.35	1	8.35	8.08	1.03
194	0	1473	8.00	1	8.00	7.21	1.11
195	0	1401	7.85	1	7.85	7.70	1.02
196	0	1556	8.18	1	8.18	6.05	1.35
197	0	1497	8.05	1	8.05	5.22	1.54
198	0	1385	7.82	1	7.82	7.65	1.02
199	0	1214	7.47	1	7.47	6.96	1.07
200	0	1203	7.44	1	7.44	5.58	1.33
201	0	1132	7.30	1	7.30	3.86	1.89
202	0	1072	7.17	1	7.17	6.41	1.12
203	0	1181	7.40	1	7.40	6.95	1.06
204	0	1248	7.54	1	7.54	6.00	1.26
205	0	1156	7.35	1	7.35	5.93	1.24
206	0	1061	7.15	1	7.15	5.23	1.37
207	0	817	6.54	1	6.54	6.86	0.95
208	0	728	6.30	1	6.30	6.52	0.97
209	0	691	6.20	1	6.20	5.73	1.08
210	0	739	6.33	1	6.33	7.06	0.90
211	0	1242	7.53	1	7.53	7.47	1.01
212	0	1759	8.60	1	8.60	7.13	1.21
213	0	1607	8.28	1	8.28	5.75	1.44
214	0	1790	8.66	1	8.66	5.06	1.71
215	0	2044	9.53	0		4.21	
216	1	2096	9.83	0		3.46	
217	0	2031	9.46	0		3.30	
218	0	2088	9.79	0		4.45	
219	0	2151		0		5.61	
220	0	2163		0	9.29	6.49	
221	0	2129		0	9.91	6.44	
222	0	2179		0	10.63	6.23	
223	0	2148		0	9.56	5.25	
224	0	2110	9.91	0	9.74	6.68	
225	0	2116	9.94	0		6.85	
226	0	2199		0	10.45	7.57	
227	0	2075	9.71	0	9.45	7.42	
228	0	2028	9.44	0	10.33	7.55	
229	0	2154		0	10.37	7.66	
230	0	2127		0	9.97	8.09	
231	0	2110	9.91	0	9.91	9.03	
232	0	2144		0	10.24	7.56	
233	0	2115	9.94	0		6.47	
234	0	2090	9.80	0		6.70	
235	0	2055	9.60	0	9.45	6.58	
236	0	2098	9.84	0	10.35	7.29	
237	0	2074	9.70	0		7.44	
238	0	1784	8.65	1	8.65	6.52	1.33
239	0	1615	8.30	1	8.30	6.57	1.26
240	0	1718	8.51	1	8.51	6.88	1.24
241	0	2029	9.45	0	9.42	6.94	
242	0	1849	8.79	1	8.79	6.22	1.41
243	0	1693	8.46	1	8.46	5.97	1.42
244	0	1904	8.90	1	8.90	5.20	1.71
245	0	2059	9.62	0	9.38	4.40	
246	0	1967	9.09	1	9.09	6.04	1.51
247	0	1690	8.46	1	8.46	6.46	1.31
248	0	2100	9.85	0		7.31	
249	0	2114	9.93	0		7.54	
250	0	2088	9.78	0		8.82	
251	0	2148		0		7.43	
252	0	1995	9.25	0		8.03	
253	0	1807	8.70	1	8.70	9.02	0.96
254	0	1789	8.66	1	8.66	8.53	1.02
255	0	1879	8.85	1	8.85	8.78	1.01
256	0	1456	7.97	1	7.97	8.21	0.97
257	0	1467	7.99	1	7.99	8.07	0.99
258	0	1797	8.68	1	8.68	7.99	1.09
259	0	1680	8.44	1	8.44	7.05	1.20
260	0	1503	8.07	1	8.07	6.33	1.27
261	0	1522	8.11	1	8.11	6.35	1.28
262	0	1905	8.90	1	8.90	7.41	1.20
263	0	1812	8.71	1	8.71	7.36	1.18
264	0	1334	7.72	1	7.72	5.91	1.31

SAMPLE CALCULATION

This calculation example demonstrates the calculation of nacelle k-factor as per IEC 61400-11 Edition 3.0 section 8.2.1.2

Data ID#	Data Point Excluded 1=yes, 0=no	Power (kW)	Hub Height Wind Speed (m/s) from power curve	Hub Wind speed in acceptable range 1=yes, 0=no	wind speed from acceptable range $V_{p,n}$ (m/s)	10m Anemometer Wind Speed, $V_{z,m}$ (m/s)	$V_{p,n}/V_{z,m}$
265	0	1195	7.43	1	7.43	5.71	1.30
266	0	1135	7.30	1	7.30	7.22	1.01
267	0	991	7.00	1	7.00	7.47	0.94
268	0	1008	7.04	1	7.04	7.13	0.99
269	0	1652	8.38	1	8.38	8.03	1.04
270	0	1883	8.86	1	8.86	6.91	1.28
271	0	1963	9.07	1	9.07	5.69	1.59
272	0	1884	8.86	1	8.86	6.24	1.42
273	0	1907	8.91	1	8.91	6.51	1.37
274	0	1983	9.18	1	9.18	5.32	1.73
275	0	1819	8.73	1	8.73	7.07	1.23
276	0	1752	8.58	1	8.58	6.88	1.25
277	0	1722	8.52	1	8.52	6.97	1.22
278	0	1813	8.71	1	8.71	7.27	1.20
279	0	1893	8.88	1	8.88	7.49	1.19
280	0	1414	7.88	1	7.88	6.59	1.20
281	0	1220	7.48	1	7.48	7.33	1.02
282	0	1756	8.59	1	8.59	7.36	1.17
283	0	2045	9.54	0	10.30	8.71	
284	0	1984	9.19	1	9.19	7.82	1.18
285	0	1474	8.01	1	8.01	6.06	1.32
286	0	1330	7.71	1	7.71	7.81	0.99
287	0	1510	8.08	1	8.08	8.09	1.00
288	0	1938	8.97	1	8.97	7.31	1.23
289	0	1852	8.79	1	8.79	9.28	0.95
290	0	1736	8.55	1	8.55	8.64	0.99
291	0	1690	8.46	1	8.46	8.48	1.00
292	0	1311	7.67	1	7.67	8.73	0.88
293	0	1103	7.24	1	7.24	8.29	0.87
294	0	903	6.77	1	6.77	7.27	0.93
295	0	720	6.28	1	6.28	8.46	0.74
296	0	685	6.19	1	6.19	7.85	0.79
297	0	816	6.54	1	6.54	7.99	0.82
298	0	857	6.65	1	6.65	7.42	0.90
299	0	884	6.72	1	6.72	6.55	1.03
300	0	941	6.87	1	6.87	6.90	1.00
301	0	1012	7.05	1	7.05	7.60	0.93
302	0	1371	7.79	1	7.79	8.47	0.92
303	0	1607	8.28	1	8.28	8.85	0.94
304	0	1392	7.84	1	7.84	8.99	0.87
305	0	1257	7.56	1	7.56	8.09	0.93
306	0	1184	7.40	1	7.40	6.70	1.11
307	0	1244	7.53	1	7.53	8.11	0.93
308	0	1523	8.11	1	8.11	6.15	1.32
309	0	1294	7.63	1	7.63	5.51	1.39
310	0	1239	7.52	1	7.52	4.63	1.62
311	0	1458	7.97	1	7.97	5.18	1.54
312	0	1574	8.22	1	8.22	5.43	1.51
313	0	1152	7.34	1	7.34	4.87	1.51
314	0	1056	7.14	1	7.14	6.30	1.13
315	0	1245	7.53	1	7.53	6.75	1.12
316	0	1320	7.69	1	7.69	7.24	1.06
317	0	1217	7.47	1	7.47	7.36	1.02
318	0	1214	7.47	1	7.47	6.62	1.13
319	0	1466	7.99	1	7.99	5.76	1.39
320	0	1859	8.81	1	8.81	6.99	1.26
321	0	2116	9.94	0	9.87	7.37	
322	0	2165		0	9.61	6.67	
323	0	2186		0		8.08	
324	0	2126	10.00	0	10.14	9.69	
325	0	2112	9.92	0		9.83	
326	0	2139		0		8.62	
327	1	1205	7.45	1		6.59	
328	1	1090	7.21	1		6.22	
329	1	1214	7.47	1		5.76	
330	1	1411	7.88	1		5.60	
331	1	1195	7.43	1		7.07	
332	1	1343	7.73	1		7.23	
333	1	1714	8.51	1		7.62	
334	1	1865	8.82	1		6.62	
335	1	1885	8.86	1		7.09	
336	1	2152		0		7.19	
337	1	2170		0		10.31	
338	1	2048	9.55	0		10.03	
339	1	2151		0		10.00	
340	1	2109	9.90	0		7.14	
341	1	1221	7.48	1		7.80	
342	1	1124	7.28	1		6.86	
343	1	1257	7.56	1		6.92	
344	1	1352	7.75	1		5.38	
345	1	1349	7.75	1		4.68	
346	1	1334	7.72	1		5.32	
347	1	1322	7.69	1		5.91	
348	1	1310	7.67	1		6.49	
349	1	1377	7.81	1		6.02	
350	1	1370	7.79	1		7.10	
351	1	1405	7.86	1		7.44	
352	1	1391	7.83	1		7.05	

Data ID#	Data Point Excluded 1=yes, 0=no	Power (kW)	Hub Height Wind Speed (m/s) from power curve	Hub Wind speed in acceptable range 1=yes, 0=no	wind speed from acceptable range $V_{p,n}$ (m/s)	10m Anemometer Wind Speed, $V_{z,m}$ (m/s)	$V_{p,n}/V_{z,m}$
353	1	1343	7.73	1		5.75	
354	1	1216	7.47	1		5.09	
355	1	1064	7.16	1		5.85	
356	1	990	7.00	1		8.17	
357	1	1132	7.30	1		6.26	
358	1	1249	7.54	1		5.75	
359	1	1302	7.65	1		5.83	
360	1	1288	7.62	1		5.95	
361	1	1202	7.44	1		4.68	
362	1	1055	7.14	1		4.66	
363	1	994	7.01	1		6.97	
364	1	839	6.60	1		7.62	
365	1	573	5.84	1		6.75	
366	1	399	5.19	1		5.13	
367	1	507	5.60	1		5.65	
368	1	644	6.08	1		5.91	
369	1	538	5.71	1		6.40	
370	1	406	5.22	1		8.04	
371	0	2165		0	11.17	10.07	
372	0	2132		0	10.46	7.18	
373	0	2127		0	11.31	9.70	
374	0	2124	9.99	0	11.50	9.78	
375	0	2112	9.92	0	10.84	9.12	
376	0	2128		0	11.50	10.41	
377	0	2092	9.80	0	10.91	10.07	
378	0	2123	9.98	0	10.42	8.84	
379	0	2120	9.97	0	10.71	7.02	
380	0	2129		0	10.88	5.63	
381	0	2131		0	10.72	7.54	
382	0	2131		0	10.63	8.52	
383	0	2130		0	11.02	8.77	
384	0	2170		0	11.05	7.75	
385	0	2088	9.78	0	10.13	7.13	
386	0	2144		0	9.85	6.98	
387	0	2074	9.70	0	9.48	8.04	
388	0	2061	9.63	0	9.61	7.10	
389	0	2167		0	11.09	7.20	
390	0	2147		0	9.28	6.77	
391	0	2161		0	10.61	6.32	
392	0	2177		0	10.15	7.97	
393	0	2074	9.70	0	9.85	7.67	
394	0	2117	9.95	0	10.62	5.57	
395	0	2189		0	10.71	4.65	
396	0	2184		0	9.42	4.69	
397	0	2074	9.70	0	10.21	4.82	
398	0	2124	9.99	0	10.28	5.84	
399	0	2185		0	10.85	9.58	
400	0	2153		0	10.65	8.16	
401	0	2097	9.83	0	10.92	7.37	
402	0	2118	9.95	0	10.47	8.64	
403	0	2075	9.71	0	9.76	9.62	
404	0	2067	9.66	0	9.97	8.58	
405	0	2113	9.92	0	9.88	7.95	
406	0	2135		0		6.99	
407	0	2105	9.88	0	9.79	7.38	
408	0	2109	9.90	0		6.32	
409	0	2138		0	10.15	6.39	
410	0	2190		0	10.98	6.57	
411	0	2201		0	10.05	6.86	
412	0	2135		0	10.37	7.19	
413	0	2140		0	10.85	7.31	
414	0	2136		0	10.62	7.96	
415	0	2142		0	10.50	7.89	
416	0	2105	9.88	0	9.54	9.77	
417	0	2133		0	10.69	8.37	
418	0	2147		0	10.74	8.12	
419	0	2142		0	10.21	8.44	
420	0	2120	9.96	0	10.31	8.68	
421	0	2087	9.78	0	10.19	6.74	
422	0	2084	9.76	0	9.63	6.49	
423	0	2108	9.90	0	9.81	7.83	
424	0	2142		0	10.31	10.27	
425	0	2195		0	10.76	8.90	
426	0	2150		0	11.41	7.35	
427	0	2124	9.99	0	10.97	5.82	
428	0	2101	9.86	0	11.23	5.73	
429	0	2134		0	10.80	6.37	
430	0	2137		0	11.74	7.04	
431	0	2073	9.70	0	10.26	6.84	
432	0	1804	8.69	1	8.69	7.32	1.19
433	0	1771	8.63	1	8.63	6.15	1.40
434	0	1730	8.54	1	8.54	6.04	1.41
435	0	1931	8.96	1	8.96	7.33	1.22
436	0	2029	9.44	0	9.93	8.52	
437	0	2020	9.39	0	9.66	10.43	
438	0	2087	9.78	0		9.20	
439	0	2180		0		8.06	
440	0	1981	9.17	1	9.17	7.99	1.15

Data ID#	Data Point Excluded 1=yes, 0=no	Power (kW)	Hub Height Wind Speed (m/s) from power curve	Hub Wind speed in acceptable range 1=yes, 0=no	wind speed from acceptable range $V_{p,n}$ (m/s)	10m Anemometer Wind Speed, $V_{z,m}$ (m/s)	$V_{p,n}/V_{z,m}$
441	0	1401	7.85	1	7.85	9.14	0.86
442	0	1674	8.42	1	8.42	8.61	0.98
443	0	1654	8.38	1	8.38	7.82	1.07
444	0	1795	8.68	1	8.68	7.64	1.14
445	0	1733	8.55	1	8.55	7.29	1.17
446	0	2246		0	10.55	8.41	
447	0	2261		0	10.64	7.24	
448	0	2204		0	11.06	5.15	
449	0	2127		0	10.32	7.08	
450	0	2127		0	11.03	7.71	
451	0	2078	9.72	0	11.13	6.80	
452	0	2034	9.47	0	9.88	9.87	
453	0	2179		0	11.46	8.28	
454	0	2157		0	9.83	7.78	
455	0	2162		0	10.64	8.18	
456	0	1837	8.76	1	8.76	8.02	1.09
457	0	1597	8.26	1	8.26	8.50	0.97
458	0	1643	8.36	1	8.36	9.04	0.92
459	0	1748	8.58	1	8.58	9.35	0.92
460	0	1823	8.73	1	8.73	8.97	0.97
461	0	1916	8.93	1	8.93	5.97	1.50
462	0	2060	9.62	0	9.82	7.90	
463	0	2161		0	9.48	6.47	
464	0	2014	9.36	0	9.32	6.15	
465	0	1881	8.86	1	8.86	5.68	1.56
466	0	2037	9.49	0	10.43	6.64	
467	0	2280		0	10.48	5.75	
468	0	2249		0	10.88	5.56	
469	0	2237		0	12.50	5.70	
470	0	2115	9.94	0	11.57	6.89	
471	0	2065	9.65	0	10.61	6.92	
472	0	2075	9.71	0	10.96	5.93	
473	0	2098	9.84	0	10.73	7.94	
474	0	2122	9.97	0	10.79	10.21	
475	0	2139		0	11.86	8.58	
476	0	2185		0	11.66	7.46	
477	0	2189		0	12.62	8.36	
478	0	2143		0	11.41	8.12	
479	0	2168		0	11.97	8.12	
480	0	2150		0	12.61	9.92	
481	0	2129		0	12.45	9.98	
482	0	2116	9.94	0	12.53	12.86	
483	0	2154		0	13.58	13.12	
484	0	2101	9.86	0	12.23	11.94	
485	0	2034	9.48	0	10.95	10.44	
486	0	2085	9.76	0	10.95	10.14	
487	0	2108	9.90	0	10.87	9.66	
488	0	2126	10.00	0	11.53	8.77	
489	0	2142		0	11.80	8.92	
490	0	2165		0	11.38	9.71	
491	0	2114	9.93	0	11.46	9.85	
492	0	2141		0	11.46	8.02	
493	0	2140		0	11.28	6.39	
494	0	2046	9.54	0	10.99	5.69	
495	0	2107	9.89	0	11.17	5.89	
496	0	2088	9.78	0	10.10	5.70	
497	0	2191		0	11.52	7.54	
498	0	2199		0	11.54	6.89	
499	0	2135		0	11.90	6.64	
500	0	2125	9.99	0	10.82	8.74	
501	0	2071	9.69	0	10.62	7.30	
502	0	2020	9.40	0	10.78	7.29	
503	0	1920	8.94	1	8.94	8.25	1.08
504	0	2094	9.82	0	10.10	7.79	
505	0	2169		0	9.74	7.72	
506	0	2204		0	11.12	7.65	
507	0	1916	8.93	1	8.93	8.53	1.05
508	0	1552	8.17	1	8.17	9.05	0.90
509	0	1488	8.04	1	8.04	9.74	0.82
510	0	1254	7.55	1	7.55	10.30	0.73
511	0	1404	7.86	1	7.86	9.62	0.82
512	0	2021	9.40	0		9.63	
513	0	2309		0	11.04	8.46	
514	0	2252		0	11.67	7.25	
515	0	2214		0	12.42	7.97	
516	0	2160		0	11.92	8.82	
517	0	2085	9.77	0	10.91	10.75	
518	0	2115	9.94	0	12.01	11.66	
519	0	2174		0	11.88	10.10	
520	0	2132		0	12.06	10.07	
521	0	2116	9.94	0	12.44	8.37	
522	0	2112	9.92	0	12.26	8.72	
523	0	2142		0	11.91	9.53	
524	0	2122	9.97	0	12.29	9.53	
525	0	2114	9.93	0	11.98	7.55	
526	0	2169		0	12.98	8.20	
527	0	2129		0	12.49	10.27	
528	0	2131		0	12.64	11.23	

SAMPLE CALCULATION

This calculation example demonstrates the calculation of nacelle k-factor as per IEC 61400-11 Edition 3.0 section 8.2.1.2

Data ID#	Data Point Excluded 1=yes, 0=no	Power (kW)	Hub Height Wind Speed (m/s) from power curve	Hub Wind speed in acceptable range 1=yes, 0=no	wind speed from acceptable range $V_{p,n}$ (m/s)	10m Anemometer Wind Speed, $V_{z,m}$ (m/s)	$V_{P,n}/V_{Z,m}$
529	0	2062	9.64	0	11.61	10.65	
530	0	2107	9.89	0	11.84	9.59	
531	0	2146		0	11.75	8.27	
532	0	2157		0	12.52	7.37	
533	0	2104	9.87	0	12.16	6.70	
534	0	2065	9.65	0	11.44	6.83	
535	0	2066	9.65	0	11.64	7.29	
536	0	2088	9.78	0	9.77	7.37	
537	0	2128		0	10.99	6.78	
538	0	2098	9.84	0	11.25	5.79	
539	0	2046	9.54	0	9.87	6.80	
540	0	2110	9.91	0	9.84	6.99	
541	0	2135		0	9.57	6.72	
542	0	2108	9.90	0		6.12	
543	0	2107	9.89	0	9.83	7.44	
544	0	2228		0	11.50	7.58	
545	0	2132		0	9.96	5.37	
546	0	2092	9.81	0	10.35	6.82	
547	0	2141		0	10.40	6.53	
548	0	2114	9.93	0	11.51	6.25	
549	0	1998	9.27	0	10.45	4.86	
550	0	1944	8.98	1	8.98	4.90	1.84
551	0	1997	9.26	0	10.53	7.83	
552	0	1890	8.87	1	8.87	8.08	1.10
553	0	1749	8.58	1	8.58	7.84	1.09
554	0	1992	9.23	1	9.23	7.61	1.21
555	0	2250		0	9.67	7.25	
556	0	2180		0	10.16	6.38	
557	0	2128		0	11.41	6.56	
558	0	2214		0	10.61	5.68	
559	0	2126	10.00	0		6.04	
560	0	2127		0	10.38	5.99	
561	0	2176		0	10.96	7.17	
562	0	2190		0	11.45	7.18	
563	0	2166		0	10.95	6.28	
564	0	2089	9.79	0	10.99	5.81	
565	0	2053	9.58	0	9.81	5.66	
566	0	1765	8.61	1	8.61	5.71	1.51
567	0	2004	9.30	0	9.87	6.47	
568	0	2227		0	11.88	5.99	
569	0	2150		0	9.69	7.19	
570	0	1680	8.44	1	8.44	6.41	1.32
571	0	2147		0	10.08	6.66	
572	0	2195		0	9.97	7.81	
573	0	2117	9.95	0	9.90	6.43	
574	0	1819	8.72	1	8.72	7.25	1.20
575	0	1492	8.04	1	8.04	7.08	1.14
576	0	1843	8.77	1	8.77	6.31	1.39
577	0	1731	8.54	1	8.54	6.64	1.29
578	0	1588	8.24	1	8.24	7.05	1.17
579	0	1601	8.27	1	8.27	7.19	1.15
580	0	1771	8.63	1	8.63	5.91	1.46
581	0	2087	9.78	0	9.88	5.89	
582	0	2050	9.57	0		4.89	
583	0	2127		0	10.24	5.19	
584	0	2159		0		6.22	
585	0	2042	9.52	0	10.56	7.58	
586	0	1713	8.50	1	8.50	7.12	1.19
587	0	1996	9.26	0	10.33	8.46	
588	0	1911	8.92	1	8.92	10.24	0.87
589	0	1854	8.80	1	8.80	9.79	0.90
590	0	1950	9.00	1	9.00	9.82	0.92
591	0	2259		0	9.93	8.41	
592	0	2170		0		8.15	
593	0	2159		0	9.79	8.00	
594	0	2017	9.38	0	9.39	7.79	
595	0	2094	9.82	0		9.03	
596	0	2183		0	11.55	8.52	
597	0	2191		0	9.27	7.77	
598	0	2251		0	11.58	9.11	
599	0	2177		0	10.48	9.82	
600	0	2083	9.75	0	11.64	9.79	
601	0	2230		0	12.37	8.71	
602	0	2190		0	13.80	11.03	
603	0	2162		0	12.93	10.17	
604	0	2123	9.99	0	12.70	9.26	
605	0	2133		0	13.00	8.88	
606	0	2107	9.89	0	12.72	8.11	
607	0	2130		0	12.40	9.14	
608	0	2046	9.54	0	11.83	8.97	
609	0	1967	9.09	1	9.09	8.27	1.10
610	0	2110	9.91	0	11.91	7.33	
611	0	2152		0	11.61	7.24	
612	0	2164		0	11.90	8.85	
613	0	2121	9.97	0	10.51	8.78	
614	0	2128		0	11.30	9.54	
615	0	2131		0	11.31	8.51	
616	0	2170		0	12.39	9.42	
617	0	2142		0	12.70	8.42	
618	0	2139		0	10.58	8.31	
619	0	2083	9.75	0	11.08	10.37	
620	0	2108	9.90	0	11.60	9.79	
621	0	2073	9.70	0	10.42	7.33	
622	0	2181		0	11.13	5.78	
623	0	2180		0	11.18	8.46	
624	0	2192		0	11.33	7.62	
625	0	2104	9.87	0	11.48	7.19	
626	0	2121	9.97	0	12.42	8.59	
627	0	2167		0	11.46	10.81	
628	0	2096	9.83	0	11.65	10.92	
629	0	2116	9.94	0	12.52	9.31	
630	0	2213		0	12.39	11.22	
631	0	2205		0	13.71	11.78	
632	0	2162		0	13.73	11.69	
633	0	2108	9.90	0	13.73	9.73	
634	0	2136		0	13.46	7.56	
635	0	2106	9.89	0	13.79	7.81	
636	0	2108	9.90	0	13.79	9.70	
637	0	2108	9.90	0	13.79	8.74	
638	0	2108	9.90	0	13.79	9.81	
639	0	2108	9.90	0	13.79	9.19	
640	0	2108	9.90	0	13.79	9.11	
641	0	2078	9.72	0	11.95	8.83	
642	0	2029	9.45	0	11.87	8.56	
643	0	2124	9.99	0	10.44	7.24	
644	0	2133		0	10.65	6.44	
645	0	1908	8.91	1	8.91	8.60	1.04
646	0	2075	9.71	0		8.46	
647	0	2111	9.92	0	10.15	8.97	
648	0	2153		0	9.43	8.20	
649	0	2144		0	9.51	7.72	
650	0	2120	9.97	0	10.22	7.26	
651	0	2020	9.39	0	10.18	9.44	
652	0	1790	8.67	1	8.67	9.07	0.95
653	0	1829	8.75	1	8.75	8.70	1.01
654	0	1950	9.00	1	9.00	7.96	1.13
655	0	2013	9.35	0		8.15	
656	0	2024	9.42	0	9.33	8.98	
657	0	1666	8.41	1	8.41	8.74	0.96
658	0	1378	7.81	1	7.81	7.27	1.07
659	0	1321	7.69	1	7.69	8.28	0.93
660	0	1297	7.64	1	7.64	7.65	1.00
661	0	1130	7.29	1	7.29	6.26	1.17
662	0	1289	7.62	1	7.62	6.57	1.16
663	0	2148		0		6.45	
664	0	2249		0	10.99	6.05	
665	0	2211		0	9.76	5.63	
666	0	2167		0	10.72	6.97	
667	0	2176		0	11.10	8.49	
668	0	2207		0	12.65	8.94	
669	0	2085	9.76	0	11.52	7.59	
670	0	2101	9.86	0	10.84	5.81	
671	0	2206		0	12.79	6.34	
672	0	2133		0	11.27	7.75	
673	0	2160		0	12.81	6.32	
674	0	2178		0	12.80	6.49	
675	0	2159		0	12.21	7.05	
676	0	1639	8.35	1	8.35	9.57	0.87
677	0	519	5.64	1	5.64	7.55	0.75
678	0	777	6.43	1	6.43	8.11	0.79
679	0	1093	7.22	1	7.22	10.08	0.72
680	0	1750	8.58	1	8.58	11.22	0.76
681	0	2150		0	12.68	11.44	
682	0	2124	9.99	0	12.78	8.80	
683	0	2120	9.97	0	12.23	7.13	
684	0	2120	9.97	0	12.23	8.02	
685	0	2120	9.97	0	12.23	8.13	
686	0	2120	9.97	0	12.23	10.83	
687	0	2120	9.97	0	12.23	9.04	
688	0	2074	9.70	0	11.92	9.02	
689	0	2042	9.52	0	10.72	8.36	
690	0	2036	9.48	0	10.63	8.47	
691	0	2134		0	11.82	9.05	
692	0	2240		0	12.36	10.61	
693	0	2163		0	10.97	10.37	
694	0	2145		0	10.98	9.72	
695	0	2145		0	10.98	8.48	
696	0	2145		0	10.98	9.78	
697	0	2147		0	10.84	8.29	
698	0	2116	9.95	0	11.78	7.04	
699	0	2147		0	11.66	8.23	
700	0	2141		0	11.98	6.90	
701	0	2124	9.99	0	12.09	7.16	
702	0	2052	9.58	0	10.83	6.00	
703	0	2066	9.65	0	11.16	5.65	
704	0	1883	8.86	1	8.86	5.23	1.69
705	0	2014	9.36	0	10.10	6.05	
706	0	2215		0	11.07	5.86	
707	0	2224		0	12.38	8.04	
708	0	2201		0	11.77	6.67	
709	0	2146		0	10.78	8.06	
710	0	2224		0	12.43	8.77	
711	0	2179		0	12.88	7.86	
712	0	2070	9.68	0	10.79	9.53	
713	0	2142		0	12.31	9.05	
714	0	2108	9.90	0	11.59	8.31	
715	0	2051	9.57	0	11.92	8.63	
716	0	1678	8.43	1	8.43	11.35	0.74
717	0	1799	8.68	1	8.68	8.61	1.01
718	0	2097	9.83	0		9.57	
719	0	2279		0	11.16	9.80	
720	0	2219		0	11.11	8.61	
721	0	2163		0	12.08	7.54	
722	0	2222		0	13.10	7.82	
723	0	2198		0	12.86	12.20	
724	0	2136		0	12.28	11.41	
725	0	2045	9.53	0	11.71	10.62	
726	0	2153		0	12.29	10.55	
727	0	2108	9.90	0	13.11	9.55	
728	0	2091	9.80	0	11.29	8.15	
729	0	2054	9.59	0	10.18	8.44	
730	0	2096	9.83	0	11.06	8.63	
731	0	2102	9.86	0	10.48	7.82	
732	0	2018	9.38	0	9.28	7.73	
733	0	1999	9.27	0	9.51	8.13	
734	0	1999	9.27	0	9.51	9.45	
735	0	1999	9.27	0	9.51	9.89	
736	0	1999	9.27	0	9.51	7.92	
737	0	1999	9.27	0	9.51	9.61	
738	0	2041	9.51	0	9.60	9.43	
739	0	2156		0	9.42	9.18	
740	0	2184		0	11.11	8.53	
741	0	2228		0	10.74	8.81	
742	0	2231		0	11.16	9.31	
743	0	2189		0	11.03	8.23	
744	0	2122	9.98	0	12.28	8.08	
745	0	2119	9.96	0	11.26	10.43	
746	0	2059	9.61	0	10.85	8.58	
747	0	2013	9.36	0	10.36	8.50	
748	0	2063	9.64	0	10.47	8.32	
749	0	2097	9.83	0	9.65	9.65	
750	0	2091	9.80	0	9.91	8.99	
751	0	1963	9.07	1	9.07	10.27	0.88
752	0	1863	8.82	1	8.82	8.82	1.00
753	0	1329	7.71	1	7.71	10.50	0.73
754	0	1228	7.50	1	7.50	11.01	0.68
755	0	1214	7.47	1	7.47	10.20	0.73
756	0	1327	7.70	1	7.70	10.29	0.75
757	0	1219	7.48	1	7.48	8.11	0.92
758	0	1599	8.27	1	8.27	6.99	1.18
759	0	1881	8.85	1	8.85	7.21	1.23
760	0	2021	9.40	0		6.38	
761	0	2118	9.95	0	9.50	6.39	
762	0	1982	9.18	1	9.18	7.49	1.23
763	0	1770	8.62	1	8.62	7.30	1.18
764	0	1959	9.05	1	9.05	8.04	1.13
765	0	2291		0	11.43	9.30	

aercoustics

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Tel: 416-249-3361
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Sample Calculation

Standardized Wind Speed Through Power Curve
Standardized Wind Speed with Nacelle Anemometer
[as per IEC 61400-11 Edition 3.0 Section 8.2.1.1 and Section 8.2.1.2]

SAMPLE CALCULATION

This calculation example demonstrates the calculation of standardized wind speed through power curve and the calculation of standardized wind speed with Nacelle anemometer as per IEC 61400-11 Edition 3.0 section 8.2.1.1 and section 8.2.1.2

Sample calculations have been based on measurement data collected and reported for Cedar Point Wind Power Project (Report ID: 15039.00.T226.R3) for data points collected during Turbine ON measurements [Data point #1 and #119]

8.2.1.1 Determination of Wind Speed through power curve (m/s)

Step 1: Determine Acceptable Range of Power Curve
The power curve relates the power to the wind speed at hub height. The wind speed is determined from the measured electric power. Correlation between measured sound level and measured electric power is very high for the allowed intervals of the power curve, see Equation (3).
The intervals on the power curve that can be used are all intervals where no duplicated values exist and the slope of the power curve including the uncertainty is positive. The demand on the slope of the power curve is satisfied for any interval on the power curve, where the following is fulfilled:

$$(P_{k+1} - P_{tol}) - (P_k + P_{tol}) > 0 \qquad (3)$$

where
k is the wind speed bin number of the power curve;
P_k is the power curve value at wind bin k;
P_{tol} is the tolerance on the power reading, typical values for Ptol are 1 to 5% of maximum value

The Acceptable Range of the power curve based on the slope of the power curve is highlighted in table 1.

Step2: Determine Standardized Wind Speed from linear interpolation from power curve for Data Point # 1

Average Active Power measured for Data Point #1 (x) = 1257 kW

$$y = y_0 + (x - x_0)\frac{y_1 - y_0}{x_1 - x_0} = \frac{y_0(x_1 - x) + y_1(x - x_0)}{x_1 - x_0},$$

y_0 =	7	m/s
x_0 =	989	kW
y_1 =	8	m/s
x_1 =	1471	kW
x =	1257	kW
y =	7.56	m/s

8.2.1.2 Determination of Wind Speed with Nacelle Anemometer

For all data points with power levels from the allowed range of the power curve, the average value of the ratio of the wind speed derived from the power curve $V_{P,n}$ and the measured nacelle wind speed $V_{nac,m}$,k_{nac}, is derived. This value is applied to the measured nacelle wind speed for the data points with power levels outside the allowed range of the power curve to derive the normalised wind speed using Equation (4).

$$V_{nac,n} = \kappa_{nac} V_{nac,m} \qquad (4)$$

$V_{nac,m}$ is the wind speed measured with the nacelle anemometer;
$V_{nac,n}$ is the normalised wind speed from the nacelle anemometer, corrected to hub height

Determine Standardized Wind Speed using eq(4) for Data Point #119

K_{nac} =	0.9182	
$V_{nac,m}$ =	10.14	m/s
$V_{nac,n}$ =	9.31	m/s

Table 1 - Power Curve and Acceptable Range of Power Curve

Power Curve		+ value = acceptable
Hub Wind Speed (m/s)	Power [kW]	slope of power curve
0	0	-42.52
1	0	-42.52
2	0	22.48
3	65	61.48
4	169	135.48
5	347	225.48
6	615	331.48
7	989	439.48
8	1471	437.48
9	1951	132.48
10	2126	-42.52
11	2126	-42.52
12	2126	-42.52
13	2126	-42.52
14	2126	-42.52
15	2126	-42.52
16	2126	-42.52
17	2126	-42.52
18	2126	-42.52
19	2126	-42.52
20	2126	-42.52
21	2126	-42.52
22	2126	-42.52
23	2126	-42.52
24	2126	-42.52
25	2126	

Table 2 - Power Curve & Required Wind Speeds

Power Curve & Required Wind Speeds		
Power Curve Tolerance	1%	
Acceptable range min	2	m/s
Acceptable range max	9	m/s
Min allowable range	2	m/s
Max allowable range	9	m/s
Power Output	2126	kW
85% Power	1807.1	kW
Corresponding wind speed	8.70	m/s
Minimum bin	7.0	m/s
Maximum bin	11.5	m/s

Table 3 - Nacelle K-factor and Bacground K-factor

Environmental Details		
k_nac	0.9182	
k_Z	1.1608	

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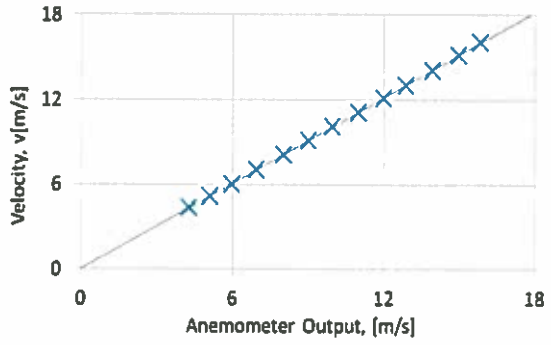
Calibration Certificates

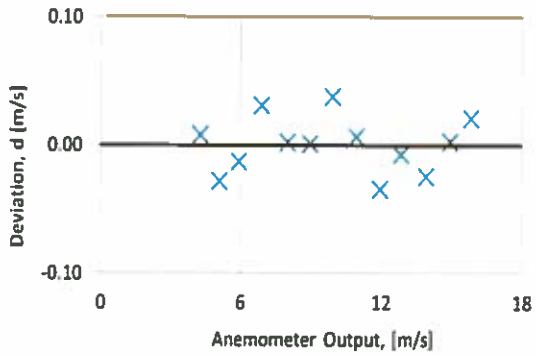
SOH Wind Engineering LLC
141 Leroy Road · Williston, VT 05495 · USA
Tel 802.316.4368 · Fax 802.735.9106 · www.sohwind.com

CERTIFICATE FOR CALIBRATION OF SONIC ANEMOMETER

Certificate number: 16.US1.06097 **Date of issue:** July 5, 2016
Type: Vaisala Weather Transmitter, WXT520 **Serial number:** K2420011.0deg
Manufacturer: VAISALA Oyj, Pl 26, FIN-00421 Helsinki, Finland
Client: Aercoustics Engineering Ltd., 50 Ronson Dr, Suite 165, Toronto, ON M9W 1B3, Canada
Anemometer received: June 28, 2016 **Anemometer calibrated:** 10:48 July 5, 2016
Calibrated by: mej **Procedure:** MEASNET, IEC 61400-12-1:2005(E) Annex F
Certificate prepared by: ejf **Approved by:** Calibration engineer, rds
Calibration equation obtained: v [m/s] = 1.01362 · f [m/s] + -0.00805
Standard uncertainty, slope: 0.00170 **Standard uncertainty, offset:** -2.27147
Covariance: -0.0000296 (m/s)²/m/s **Coefficient of correlation:** ρ = 0.999984
Absolute maximum deviation: 0.037 m/s at 10.080 m/s
Barometric pressure: 995.5 hPa **Relative humidity:** 40.4%

Succession	Velocity pressure, q. [Pa]	Temperature in wind tunnel [°C]	d.p. box [°C]	Wind velocity, v. [m/s]	Anemometer Output, f. [m/s]	Deviation, d. [m/s]	Uncertainty u_c (k=2) [m/s]
2	10.39	28.4	27.9	4.309	4.252	0.008	0.025
4	14.78	28.5	28.0	5.133	5.100	-0.028	0.025
6	20.54	28.5	28.0	6.008	5.948	-0.013	0.027
8	27.78	28.5	28.0	7.033	6.916	0.030	0.030
10	36.94	28.5	28.0	8.103	8.000	0.002	0.033
12	46.48	28.5	28.0	9.099	8.984	0.001	0.036
13-last	57.18	28.5	28.0	10.080	9.916	0.037	0.039
11	69.26	28.5	28.0	11.099	10.952	0.007	0.042
9	82.18	28.5	28.0	12.071	11.952	-0.035	0.046
7	95.15	28.5	28.0	12.995	12.835	-0.007	0.049
5	110.58	28.5	28.0	14.040	13.884	-0.024	0.052
3	128.53	28.5	28.0	15.117	14.919	0.003	0.056
1-first	144.29	28.4	27.9	16.024	15.797	0.020	0.059





AC-1746

EQUIPMENT USED

Serial Number	Description
Njord 1	Wind tunnel, blockage factor = 1.004
2254	Control cup anemometer
-	Mounting tube, D = 30 mm
TT004	Summit RT-AUI, wind tunnel
TP001	Summit RT-AUI, differential pressure box
DP006	Setra Model 239 pressure transducer
HY003	Dwyer Instruments RHP-2D20 humidity transmitter
BP002	Setra Model 278 barometer
PL8	Pitot tube
XB002	Computer Board. 16 bit A/D data acquisition board
9PRZRW1	PC dedicated to data acquisition

Traceable calibrations of the equipment are carried out by external accredited institutions: Atlantic Scale, Essco Calibration Labs & Furness Controls. A real-time analysis module within the data acquisition software detects pulse frequency.

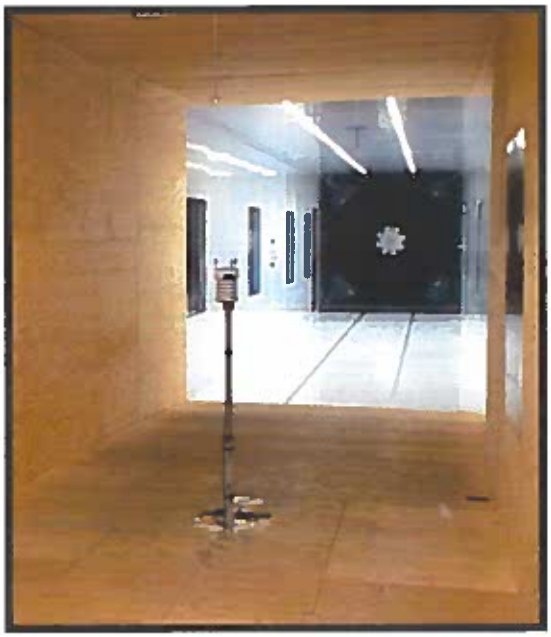


Photo of the wind tunnel setup. The cross-sectional area is 2.5 x 2.5 m.

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.

Certificate number: 16.US1.06097

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: 16.US1.06098 **Date of issue:** July 5, 2016

Type: Vaisala Weather Transmitter, WXT520 **Serial number:** K2420011.90deg

Manufacturer: VAISALA Oyj, Pl 26, FIN-00421 Helsinki, Finland

Client: Aercoustics Engineering Ltd., 50 Ronson Dr, Suite 165, Toronto, ON M9W IB3, Canada

Anemometer received: June 28, 2016 **Anemometer calibrated:** 11:08 July 5, 2016

Calibrated by: mej **Procedure:** MEASNET, IEC 61400-12-1:2005(E) Annex F

Certificate prepared by: ejf **Approved by:** Calibration engineer, rds

Calibration equation obtained: v [m/s] = 0.99840 · f [m/s] + 0.23389

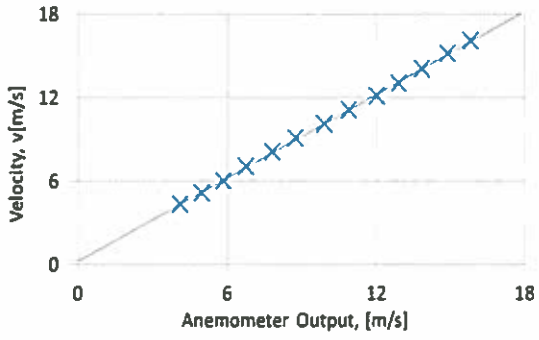
Standard uncertainty, slope: 0.00605 **Standard uncertainty, offset:** 0.27227

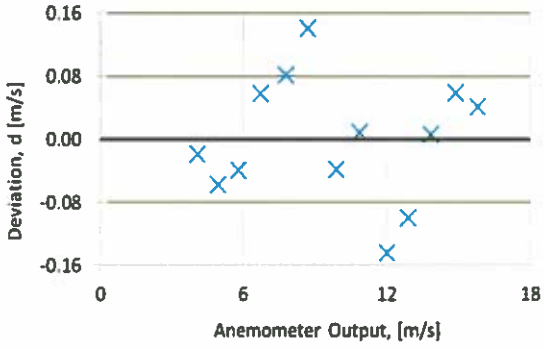
Covariance: -0.0003601 (m/s)²/m/s **Coefficient of correlation:** ρ = 0.999799

Absolute maximum deviation: 0.143 m/s at 12.071 m/s

Barometric pressure: 995.3 hPa **Relative humidity:** 40.2%

Succession	Velocity pressure, q. [Pa]	Temperature in wind tunnel [°C]	d.p. box [°C]	Wind velocity, v. [m/s]	Anemometer Output, f. [m/s]	Deviation, d. [m/s]	Uncertainty u_c (k=2) [m/s]
2	10.48	28.6	28.0	4.309	4.100	-0.018	0.025
4	14.88	28.6	28.0	5.133	4.965	-0.057	0.026
6	20.41	28.6	28.0	6.008	5.823	-0.039	0.027
8	27.86	28.6	28.0	7.033	6.752	0.058	0.030
10	36.96	28.6	28.0	8.103	7.800	0.082	0.033
12	46.52	28.6	28.0	9.099	8.739	0.140	0.036
13-last	57.08	28.6	28.0	10.080	9.900	-0.038	0.039
11	69.14	28.6	28.0	11.099	10.874	0.009	0.042
9	82.16	28.6	28.0	12.071	12.000	-0.143	0.046
7	94.99	28.6	28.0	12.995	12.881	-0.099	0.049
5	110.48	28.6	28.0	14.040	13.823	0.006	0.052
3	128.65	28.6	28.0	15.117	14.848	0.059	0.056
1-first	144.01	28.5	28.0	16.024	15.774	0.041	0.058





AC-1746

EQUIPMENT USED

Serial Number	Description
Njord 1	Wind tunnel, blockage factor = 1.004
2254	Control cup anemometer
-	Mounting tube, D = 30 mm
TT004	Summit RT-AUI, wind tunnel
TP001	Summit RT-AUI, differential pressure box
DP006	Setra Model 239 pressure transducer
HY003	Dwyer Instruments RHP-2D20 humidity transmitter
BP002	Setra Model 278 barometer
PL8	Pitot tube
XB002	Computer Board. 16 bit A/D data acquisition board
9PRZRW1	PC dedicated to data acquisition

Traceable calibrations of the equipment are carried out by external accredited institutions: Atlantic Scale, Esseo Calibration Labs & Furness Controls. A real-time analysis module within the data acquisition software detects pulse frequency.

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

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.

Certificate number: 16.US1.06098

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CERTIFICATE OF CALIBRATION

SCC Accredited LAB — LAB Accrédité CCN
CLAS NRC·CNRC
CLAS 2000-03

Customer: AEROCOUSTICS ENGINEERING LTD
50 RONSON DRIVE
SUITE 165
TORONTO, ON M9W 1B3

PO Number: 2016.06.27C

Certificate/SO Number: 9-Q0G8J-20-1 Revision 0

Manufacturer: Nokeval
Model Number: 7470
Description: Serial to Analog Converter
Serial Number: A165152
ID: NONE

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

Calibration Date: July 11, 2016
Due Date: July 11, 2018

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 on this Certificate of Calibration. Any measurements on an accredited calibration not covered by that Lab's Scope of Accreditation are listed in the notes section of the certificate. This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, SCC, NRC, CLAS, ANAB or any agency of the Federal Government. NVLAP, NIST, 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 Revision I, ISO 9001:2008, ANSI/NCSL Z540.1-1994 (R2002), and ISO 10012:2003. When specified contractually, the requirements of ISO TS16949:2009, 10CFR21, 10CFR50 App. B and ASME NQA-1:2012 are also covered. Complete records of work performed are maintained by Transcat and are available for inspection. Laboratory standards used in the performance of this calibration are shown on the Supplemental Report.

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 recognized 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 at a Transcat facility. The measured quantity and the measurement uncertainty are required for further dissemination of traceability.

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 on the Supplemental Report. 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, and the determination of in or out of tolerance is specific to the model/serial no. referenced above based on the tolerances shown on the supplemental report; these tolerances are either the original equipment manufacturer's (OEM's) warranted specifications or the client's requested specifications. Any number of factors can cause a unit to drift out of tolerance at any time following its calibration. Limitations on the uses of this instrument are detailed in the OEM's operating instructions. 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).

Notes:

Calibrated At:
916 Gateway
Burlington, ON L7L 5K7

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

Calibrated By:
Digitally Signed By
Lawrence Loi
Date: July 11, 2016
Lawrence Loi
Calibration Technician

Reviewed By:
Digitally Signed By
Robert Whittaker
Date: July 11, 2016
Robert Whittaker
Lab Manager

Unit Barcode: 901B0165859
Date Received: June 27, 2016

Customer Number: 9-322110-000

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SUPPLEMENTAL REPORT

CALIBRATION LAB DATA AS FOUND / AS LEFT

Customer: AEROCOUSTICS ENGINEERING LTD
PO Number: 2016.06.27C

Certificate/SO Number: 9-Q0G8J-20-1 Revision 0

Manufacturer: Nokeval
Model Number: 7470
Description: Serial to Analog Converter
Serial Number: A165152
ID: NONE

Service Type: R9

Calibration Date: Jul 11, 2016
Date Due: Jul 11, 2018

Calibration Procedure: 1-AC58014-0

Description	Setpoints	Accuracy	Low Limit	High Limit	As Found / As Left	OOT	Cal Process Uncertainty	Measurement Uncertainty	Units	TUR
DC Current % Source - 4-20mA Ch #1										
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	16.000 mA		1.3e-003	2.3e-003	mA	12.3 : 1
	100%	±(0.1% Span)	19.984	20.016	20.001 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	3.996 mA		1.6e-004	1.9e-003	mA	100.0 : 1
	25%	±(0.1% Span)	7.984	8.016	7.996 mA		2.6e-004	1.9e-003	mA	61.5 : 1
	50%	±(0.1% Span)	11.984	12.016	11.997 mA		1.1e-003	2.2e-003	mA	14.5 : 1
	75%	±(0.1% Span)	15.984	16.016	16.003 mA		1.3e-003	2.3e-003	mA	12.3 : 1
	100%	±(0.1% Span)	19.984	20.016	20.001 mA		1.4e-003	2.3e-003	mA	11.4 : 1

The column labeled Cal Process Uncertainty (CPU) does not include the short term component of the UUT. The column labeled Measurement Uncertainty includes both CPU and the short term component of the UUT. TUR is calculated using CPU.
Note: Reported resolution of the UUT does not represent calibration uncertainty or accuracy of the UUT.

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SUPPLEMENTAL REPORT

CALIBRATION LAB DATA AS FOUND / AS LEFT

Customer: AEROCOUSTICS ENGINEERING LTD

PO Number: 2016.06.27C

Certificate/SO Number: 9-Q0G8J-20-1 Revision 0

Description	Setpoints	Accuracy	Low Limit	High Limit	As Found / As Left	OOT	Cal Process Uncertainty	Measurement Uncertainty	Units	TUR
DC Current % Source - 4-20mA Ch #3										
4 - 20mA	0%	±(0.1% Span)	3.984	4.016	3.997 mA		1.6e-004	1.9e-003	mA	100.0 : 1
	25%	±(0.1% Span)	7.984	8.016	8.000 mA		2.6e-004	1.9e-003	mA	61.5 : 1
	50%	±(0.1% Span)	11.984	12.016	12.000 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	20.001 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	4.002 mA		1.6e-004	1.9e-003	mA	100.0 : 1
	25%	±(0.1% Span)	7.984	8.016	8.000 mA		2.6e-004	1.9e-003	mA	61.5 : 1
	50%	±(0.1% Span)	11.984	12.016	12.000 mA		1.1e-003	2.2e-003	mA	14.5 : 1
	75%	±(0.1% Span)	15.984	16.016	16.004 mA		1.3e-003	2.3e-003	mA	12.3 : 1
	100%	±(0.1% Span)	19.984	20.016	20.001 mA		1.4e-003	2.3e-003	mA	11.4 : 1
DC Current % Source - 0-20mA Ch #1										
0 - 20mA	0%	±(0.1% Span)	-0.020	0.020	0.003 mA		9.2e-007	2.3e-003	mA	100.0 : 1
	25%	±(0.1% Span)	4.980	5.020	5.000 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	20.001 mA		1.4e-003	2.7e-003	mA	14.3 : 1

The column labeled Cal Process Uncertainty (CPU) does not include the short term component of the UUT. The column labeled Measurement Uncertainty includes both CPU and the short term component of the UUT. TUR is calculated using CPU

Note: Reported resolution of the UUT does not represent calibration uncertainty or accuracy of the UUT.

TRANSCAT CANADA
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SUPPLEMENTAL REPORT

CALIBRATION LAB DATA AS FOUND / AS LEFT

Customer: AEROCOUSTICS ENGINEERING LTD
PO Number: 2016.06.27C

Certificate/SO Number: 9-Q0G8J-20-1 Revision 0

Description	Setpoints	Accuracy	Low Limit	High Limit	As Found / As Left	OOT	Cal Process Uncertainty	Measurement Uncertainty	Units	TUR
DC Current % Source - 0-20mA Ch #2										
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	4.998 mA		1.9e-004	2.3e-003	mA	100.0 : 1
	50%	±(0.1% Span)	9.980	10.020	9.996 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	20.001 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	0.000 mA		9.2e-007	2.3e-003	mA	100.0 : 1
	25%	±(0.1% Span)	4.980	5.020	4.998 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	15.001 mA		1.2e-003	2.6e-003	mA	16.7 : 1
	100%	±(0.1% Span)	19.980	20.020	20.001 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	5.000 mA		1.9e-004	2.3e-003	mA	100.0 : 1
	50%	±(0.1% Span)	9.980	10.020	10.003 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	20.001 mA		1.4e-003	2.7e-003	mA	14.3 : 1

The column labeled Cal Process Uncertainty (CPU) does not include the short term component of the UUT. The column labeled Measurement Uncertainty includes both CPU and the short term component of the UUT. TUR is calculated using CPU.
Note: Reported resolution of the UUT does not represent calibration uncertainty or accuracy of the UUT.

TRANSCAT CANADA
Trust in every measure

SUPPLEMENTAL REPORT

CALIBRATION LAB DATA AS FOUND / AS LEFT

Customer: AEROCOUSTICS ENGINEERING LTD

PO Number: 2016.06.27C

Certificate/SO Number: 9-Q0G8J-20-1 Revision 0

Description	Setpoints	Accuracy	Low Limit	High Limit	As Found / As Left	OOT	Cal Process Uncertainty	Measurement Uncertainty	Units	TUR
DC Voltage % Source - 0-5V Ch#1										
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	0.9996 V		5.6e-006	5.8e-004	V	100.0 : 1
	40%	±(0.1% Span)	1.9950	2.0050	1.9987 V		1.1e-005	5.8e-004	V	100.0 : 1
	60%	±(0.1% Span)	2.9950	3.0050	3.0009 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	5.0003 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	0.0011 V		5.8e-007	5.8e-004	V	100.0 : 1
	20%	±(0.1% Span)	0.9950	1.0050	1.0001 V		5.6e-006	5.8e-004	V	100.0 : 1
	40%	±(0.1% Span)	1.9950	2.0050	1.9989 V		1.1e-005	5.8e-004	V	100.0 : 1
	60%	±(0.1% Span)	2.9950	3.0050	3.0009 V		1.6e-005	5.8e-004	V	100.0 : 1
	80%	±(0.1% Span)	3.9950	4.0050	4.0003 V		2.1e-005	5.8e-004	V	100.0 : 1
	100%	±(0.1% Span)	4.9950	5.0050	4.9998 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	0.0016 V		5.8e-007	5.8e-004	V	100.0 : 1
	20%	±(0.1% Span)	0.9950	1.0050	0.9994 V		5.6e-006	5.8e-004	V	100.0 : 1
	40%	±(0.1% Span)	1.9950	2.0050	1.9994 V		1.1e-005	5.8e-004	V	100.0 : 1
	60%	±(0.1% Span)	2.9950	3.0050	3.0000 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

The column labeled Cal Process Uncertainty (CPU) does not include the short term component of the UUT. The column labeled Measurement Uncertainty includes both CPU and the short term component of the UUT. TUR is calculated using CPU.

Note: Reported resolution of the UUT does not represent calibration uncertainty or accuracy of the UUT.

TRANSCAT CANADA
Trust in every measure

SUPPLEMENTAL REPORT

CALIBRATION LAB DATA AS FOUND / AS LEFT

Customer: AEROCOUSTICS ENGINEERING LTD
PO Number: 2016.06.27C

Certificate/SO Number: 9-Q0G8J-20-1 Revision 0

Description	Setpoints	Accuracy	Low Limit	High Limit	As Found / As Left	OOT	Cal Process Uncertainty	Measurement Uncertainty	Units	TUR
DC Voltage % Source - 0-5V Ch#4										
0 -5V	0%	±(0.1% Span)	-0.0050	0.0050	0.0005 V		5.8e-007	5.8e-004	V	100.0 : 1
	20%	±(0.1% Span)	0.9950	1.0050	1.0013 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	3.0001 V		1.6e-005	5.8e-004	V	100.0 : 1
	80%	±(0.1% Span)	3.9950	4.0050	4.0001 V		2.1e-005	5.8e-004	V	100.0 : 1
	100%	±(0.1% Span)	4.9950	5.0050	4.9999 V		2.6e-005	5.8e-004	V	100.0 : 1
DC Voltage % Source - 0-10V Ch#1										
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	1.999 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	6.000 V		3.1e-005	1.2e-003	V	100.0 : 1
	80%	±(0.1% Span)	7.990	8.010	8.002 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	1.999 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

The column labeled Cal Process Uncertainty (CPU) does not include the short term component of the UUT. The column labeled Measurement Uncertainty includes both CPU and the short term component of the UUT. TUR is calculated using CPU
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TRANSCAT CANADA
Trust in every measure

SUPPLEMENTAL REPORT

CALIBRATION LAB DATA AS FOUND / AS LEFT

Customer: AEROCOUSTICS ENGINEERING LTD
PO Number: 2016.06.27C

Certificate/SO Number: 9-Q0G8J-20-1 Revision 0

Description	Setpoints	Accuracy	Low Limit	High Limit	As Found / As Left	OOT	Cal Process Uncertainty	Measurement Uncertainty	Units	TUR
DC Voltage % Source - 0-10V Ch#3										
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	1.999 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	8.001 V		4.1e-005	1.2e-003	V	100.0 : 1
	100%	±(0.1% Span)	9.990	10.010	10.001 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	2.000 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	6.000 V		3.1e-005	1.2e-003	V	100.0 : 1
	80%	±(0.1% Span)	7.990	8.010	8.002 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

As Found and As Left Data recorded on July 11, 2016

Temperature 75.0°F / 23.9°C Relative Humidity 39% Temp/RH Asset LEM-0005

Asset	Manufacturer	Model	Description	Cal Date	Due Date	Traceability Numbers
NT0339	HP	3458A Opt 002	Digital Multimeter, 8.5 Digit	Nov 21, 2015	Nov 30, 2016	1-7363155174-1

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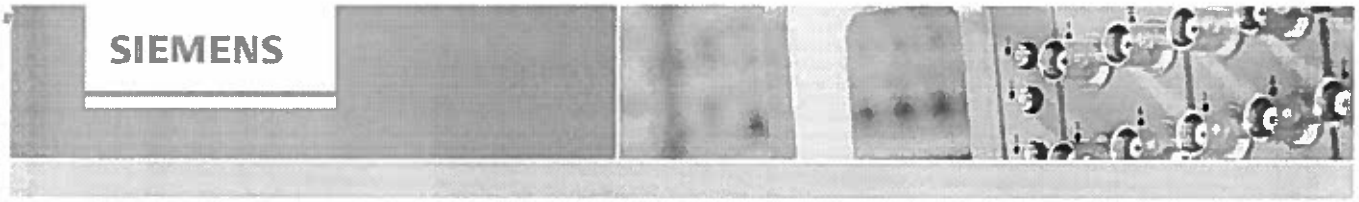


ISO17025

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 22,8°C and a relative humidity of 50,2%.
Calibration date:	August 17, 2016
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, August 17, 2016

Calibration performed by:

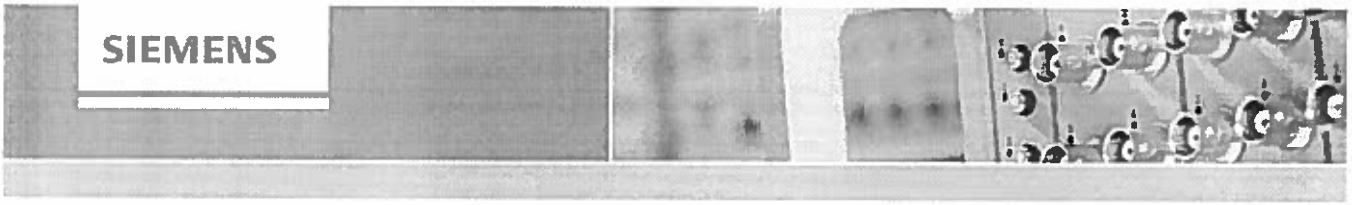
H. Dam

Certificate approved by:

M.C.A.G. Damen

The Raad voor Accreditatie is one of the signatories of the Multilateral Agreement of the European Cooperation for Accreditation (EA) for the mutual recognition of calibration certificates.

Siemens Industry Software B.V.
Druivenstraat 47
4816 KB Breda
The Netherlands
Phone: +31 76 573 6363



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 22.7°C and a relative humidity of 50.8%.
Calibration date:	August 17, 2016
Results:	The calibration results, together with their associated uncertainties, are included in this calibration certificate. *One or more channels failed to meet their specifications.*
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, August 17, 2016

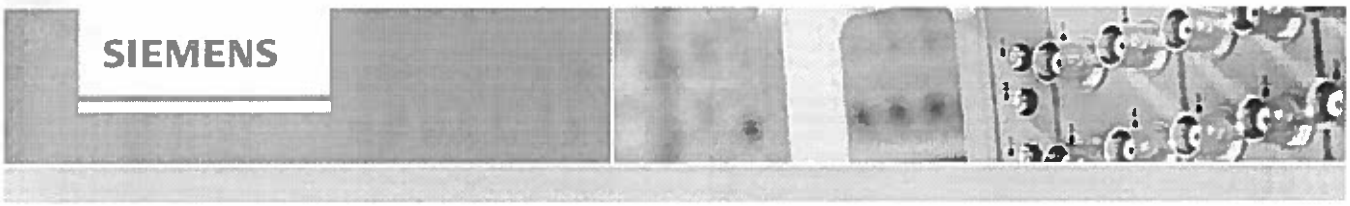
Calibration performed by:

H. Dam

Certificate approved by:

M.C.A.G. Damen

Siemens Industry Software B.V.
Druivenstraat 47
4816 KB Breda
The Netherlands
Phone: +31 76 573 6363



Certificate number: **2016-22143211**

Adjustment report

Product type: LMS SCADAS

Calibration Suite: **Calibration Software**
Calibration Suite Version: **2.10.0001**

Customer:

Company name	: Aercoustics Enigneering Limited
Location (city / country)	: Toronto/Canada
Contact person	: Tim Preager

System:

System type(s)	: SCR202
Serial number(s)	: 22143211

Adjustment conditions:

TAC reference number	: 7508254
Location (factory, office or on-site)	: Office
Date	: 17 August, 2016
Ambient temperature	: 22,8 °C
Previous adjustment / calibration date	: August 2014

Adjustment results (refer to page 2 for details) :

Adjustment successful	: YES
Within published specification	: YES
Within test specification	: NO

Report approved by:

Name : Mr. H. Dam

(Signature)..... .....

.....

Siemens Industry Software
Druivenstraat 47
4816 KB Breda
The Netherlands
Phone: +31 76 573 6363

Siemens Industry Software
222-0033 Kanagawa
Shin-Yokohama, Kohoku-ku
Japan
Phone: + +81 454 784 800

Siemens Industry Software
13 avenue Morane Saulnier
78140 Vélizy Villacoublay
France
Phone :+33 1 3452 1740

Siemens PLM Software
5755 New King Street
Troy, MI 48098
USA
Phone: +1 248 952 5664

West Caldwell Calibration Laboratories Inc.

Certificate of Calibration

for

ACOUSTICAL CALIBRATOR

Manufactured by:	BRUEL & KJAER
Model No:	4231
Serial No:	1807640
Calibration Recall No:	26810

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. 4231 BRUE

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

Within (X)

tolerance of the indicated specification. See attached Report of Calibration.

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.

Calibration Date: 06-Sep-16

Certificate No: 26810 - 4

Approved by:

FC

Felix Christopher (QA Mgr.)
ISO/IEC 17025:2005

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

ACCREDITED

Calibration Lab. Cert. # 1533.01

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

ISO/IEC 17025: 2005
ACCREDITED
Calibration Lab. Cert. # 1533.01

REPORT OF CALIBRATION

for

Brüel & Kjær Acoustical Calibrator **Model No.: 4231** **Serial No.: 1807640**
Company: Aercoustics Engineering LTD **I. D. No.: XXXX**

Calibration results:

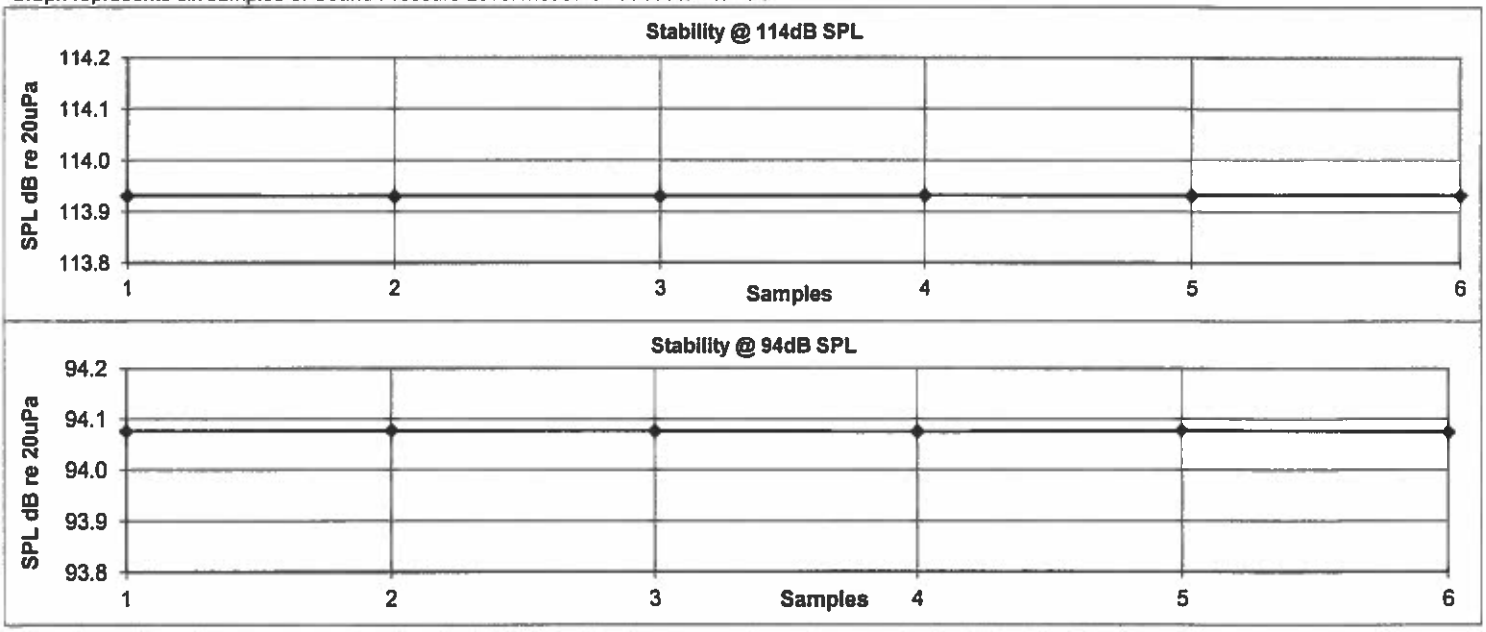
Before data: ..... **After data:** .....
Before & after data same: ...X...
Sound Pressure Level at 999.9 **Hz and pressure of 1013 hPa (mbar)**
was 113.9 **dB re 20µPa**
(Calibrator tested with ½" adaptor UC 0210)
IEC 1094-4 Type WS 2 P Microphone was used for measurement.

	114dB	94dB
Sound Pressure Level:	Pass	Pass
Frequency:	Pass	Pass
Distortion:	Pass	Pass
Stability:	Pass	Pass
All tested parameters:		Pass

Laboratory Environment:		
Ambient Temperature:	20.3	°C
Ambient Humidity:	48.7	% RH
Ambient Pressure:	99.776	kPa
Calibration Date:	6-Sep-2016	
Re-calibration Due:	6-Sep-2017	
Report Number:	26810 -4	
Control Number:	26810	

The above listed instrument meets or exceeds the tested manufacturer's specifications
The IEC 942:1988 Class 1 specifications, passed.
The ANSI S1.4-1984 specifications, passed.
This Calibration is traceable through NIST test numbers: 683/284413-14
The expanded uncertainty of calibration: 0.09dB at 95% confidence level with a coverage factor of k=2.

Graph represents six samples of Sound Pressure Level measured at 5sec. interval.



The above listed instrument was checked using calibration procedure documented in West Caldwell Calibration Laboratories Inc. procedure : **Rev. 7.0 Jan. 24, 2014 Doc. # 1038 4231B&K**

Calibration was performed by West Caldwell Calibration Laboratories Inc. under Operating Procedures intended to implement the requirements of ISO10012-1, IEC Guide 25, ANSI/NCSL Z540-1, (MIL-STD-45662A) and ISO 9001:2008, ISO 17025

Cal. Date: 6-Sep-2016 Measurements performed by: .....
James Zhu

Calibrated on WCCL system type 9700

West Caldwell Calibration Laboratories Inc.
1575 State Route 96, Victor NY 14564
Tel. (585) 586-3900 FAX (585) 586-4327

Calibration Data Record

for

Brüel & Kjær Acoustical Calibrator **Model No.: 4231** **Serial No.: 1807640**
Company: Aercoustics Engineering LTD

All tested parameters: Pass

Measured Sound Pressure Level (Six samples measured at 5 sec. interval)

Sample	1	113.93 dB re 20µPa	94.08 dB re 20µPa	
	2	113.93	94.08	
	3	113.93	94.08	
	4	113.93	94.07	
	5	113.93	94.08	
	6	113.93	94.07	
	Average	**113.9** Spec. 114dB ± 0.2dB	**94.1**	Spec. 94dB ± 0.2dB

Frequency measured (Three samples at 30 sec. Interval)

Sample	1	999.86 Hz	999.88 Hz	
	2	999.86	999.86	
	3	999.86	999.86	
	Average	**999.86**	**999.87**	Spec. 1000Hz ±0.1%

The Frequency expanded uncertainty of calibration:45µHz/Hz at 95% confidence level with a coverage factor of k=2.

Distortion measured	-54.0 dB	-51.6 dB	Spec. ≤-40dB

Instruments used for calibration:			Date of Cal.	Traceability No.	Re-cal. Due Date
Brüel & Kjær	4231	S/N 2205492	6-Oct-2015	683/284413-14	6-Oct-2016
Brüel & Kjær	4134	S/N 173494	1-Oct-2015	683/284413-14	1-Oct-2016
Brüel & Kjær	2669	S/N 1835080	7-Oct-2015	683/284413-14	7-Oct-2016
HP	34401A	S/N MY440029	5-Oct-2015	,287708	5-Oct-2016
Brüel & Kjær	2636	S/N 1487493	1-Oct-2015	683/284413-14	1-Oct-2016
HP	33120A	S/N SG400116	3-Oct-2015	,287708	3-Oct-2016

Cal. Date: 6-Sep-2016 **Tested by: James Zhu**

Calibrated on WCCL system type 9700

West Caldwell Calibration Laboratories Inc.

Certificate of Calibration

for

MICROPHONE & PREAMPLIFIER

Manufactured by:	BRUEL & KJAER
Model No:	4189-2671
Serial No:	2625416-2369794
Calibration Recall No:	27267

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. 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.

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.

Calibration Date: 25-Jan-17

Certificate No: 27267 - 4

Approved by:

FC

Felix Christopher (QA Mgr.)

ISO/IEC 17025:2005

West Caldwell Calibration Laboratories, Inc.

uncompromised calibration

1575 State Route 96, Victor, NY 14564, U.S.A.

ACCREDITED

Calibration Lab. Cert. # 1533.01

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

ISO/IEC 17025: 2005
ACCREDITED
Calibration Lab. Cert. # 1533.01

REPORT OF CALIBRATION

for

Brüel & Kjær Microphone & Preamplifier Model No.: 4189&2671 Serial No.: 2625416-2369794
Mic. Model No.: 4189 Serial No.: 2625416
Preamp Model No.: 2671 Serial No.: 2369794
Company: Aercoustics Engineering Ltd I. D. No.: XXXX

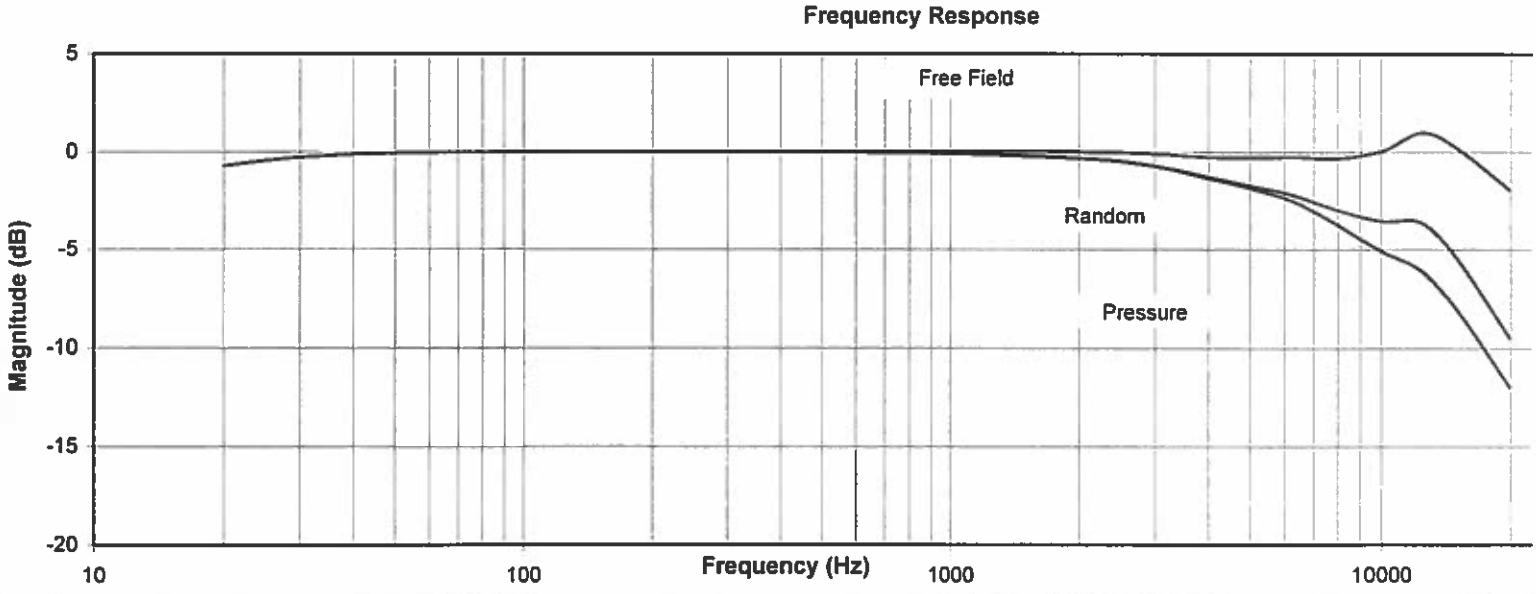
Calibration results:

Before & after data same: ...X...

Combined Sensitivity @ 250 Hz and pressure of 98.236 kPa
(Sens. with mic. and preamp.) 0 Volts Polarization voltage (External):
-26.34 dB re.1V/Pascal
48.18 mV/Pascal
0.34 Ko (- dB re 50 mV/Pascal)
Sensitivity: Pass
Freq. Response: Pass
All tests: Pass

Ambient Temperature:	20.3	°C
Ambient Humidity:	30.1	% RH
Ambient Pressure:	98.236	kPa
Calibration Date:	25-Jan-2017	
Re-calibration Due:	25-Jan-2018	
Report Number:	27267	-4
Control Number:	27267	

The above listed instrument meets or exceeds the tested manufacturer's specifications.
The IEC 651:1979 & 1993 Type 1 and ANSI S1.4 1983 Type 2 specification passed.
This Calibration is traceable through NIST test numbers: 683/284413-14
The expanded uncertainty of calibration: 0.094dB at 95% confidence level with a coverage factor of k=2.
The pressure response recorded with electroacoustic method.



The above listed instrument was checked using calibration procedure documented in West Caldwell Calibration Laboratories Inc. procedure : **Rev. 7.0 Jan. 24, 2014 Doc. # 1038 P4189&2671B&K**
Calibration was performed by West Caldwell Calibration Laboratories Inc. under Operating Procedures intended to implement the requirements of ISO10012-1, IEC Guide 25, ANSI/NCSL Z540-1, (MIL-STD-45662A) and ISO 9001:2008, ISO 17025

Measurements performed by: .....
Kent Zeng

Calibrated on WCCL system type 9700

West Caldwell Calibration Laboratories Inc.
1575 State Route 96, Victor NY 14564
Tel. (585) 586-3900 FAX (585) 586-4327

Calibration Data Record

for

Brüel & Kjær Microphone & Preamplifier **Model No.: 4189&2671** **Serial No.: 2625416-2369794**
Company: Aercoustics Engineering Ltd **I. D. No.: XXXX**

Frequency Response (Reference = 0 dB @ 250Hz)

Frequency [Hz]	Pressure [dB]	Free Field (dB)	Random (dB)
19.95	-0.70	-0.70	-0.70
25.12	-0.42	-0.42	-0.42
31.62	-0.23	-0.23	-0.23
39.81	-0.11	-0.11	-0.11
50.12	-0.05	-0.05	-0.05
63.10	-0.02	-0.02	-0.02
79.43	-0.01	-0.01	-0.01
100.00	0.00	0.00	0.00
125.89	0.00	0.00	0.00
158.49	-0.01	-0.01	-0.01
199.53	0.00	0.00	0.00
251.19	0.00	0.00	0.00
316.23	0.00	0.00	0.00
398.11	0.00	0.01	0.00
501.19	-0.01	0.01	-0.01
630.96	-0.02	0.02	-0.02
794.33	-0.03	0.03	-0.03
1000.00	-0.07	0.03	-0.09
1258.93	-0.10	0.05	-0.14
1584.89	-0.18	0.04	-0.24
1995.26	-0.31	0.01	-0.32
2511.89	-0.48	-0.01	-0.45
3162.28	-0.82	-0.10	-0.78
3981.07	-1.33	-0.26	-1.24
5011.87	-1.86	-0.28	-1.72
6309.57	-2.52	-0.24	-2.21
7943.28	-3.71	-0.33	-2.96
10000.00	-5.07	0.05	-3.54
12589.25	-6.20	0.99	-3.69
15848.93	-8.76	-0.17	-6.18
19952.62	-11.98	-1.93	-9.50

Freq. response: Expanded Uncertainty (dB) with coverage factor K = 2
20 to 63Hz 0.1dB, 63 to 12.5kHz 0.094dB, 12.5k to 16kHz 0.10dB, 16k to 20kHz 0.5dB.

Instruments used for calibration:			Date of Cal.	Traceability No.	Re-cal. Due Date
Brüel & Kjær	4226	S/N 1445428	10-Nov-2016	683/284413-14	10-Nov-2017
Brüel & Kjær	3560	S/N 2202374	10-Nov-2016	683/284413-14	10-Nov-2017
HP	33120A	S/N 36043716	1-Oct-2016	,287708	1-Oct-2017
HP	34401A	S/N 36064102	1-Oct-2016	,287708	1-Oct-2017

Cal. Date: 25-Jan-2017 **Tested by: Kent Zeng**

Calibrated on WCCL system type 9700

Rev. 7.0 Jan. 24, 2014 Doc. # 1038 P4189&2671B&K

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End of Report