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REPORT ID: **14284.00.T063.RP5**

Grand Renewable Wind Farm – Turbine T063 IEC 61400-11 Edition 3.0 Measurement Report

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Revision History

Revision Number	Description	Date
1	Issued draft Edition 2.1 test report	September 9, 2015
2	Issued final Edition 2.1 test report – updated power curve, minor edits	November 13, 2015
3	Issued final Edition 2.1 test report with minor corrections	November 18, 2015
4	Edition 2.1 - Minor changes to Table 1	February 04, 2016
5	Issued Edition 3.0 test report	March 02, 2018

This report in its entirety, including appendices contains 79 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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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 Grand Renewable Wind LP ("GRWLP") to conduct an acoustic measurement of turbine T63 at the Grand Renewable Wind Farm. 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 T63.

2 Wind Turbine Information

2.1 Wind turbine equipment specific information

Wind turbine specific equipment information for turbine T63 was provided by GRWLP and is summarized in Tables 1 – 5.

Table 1 - Wind Turbine Details

Wind Turbine Details	
Manufacturer	Siemens
Model Number	SWT2.3-101
Turbine ID	T63

Table 2 - Operating Details

Operating Details	
Vertical or Horizontal axis wind turbine	Horizontal
Upwind or downwind rotor	Upwind
Hub height	99.5 m
Horizontal distance from rotor centre to tower axis	3.5 m
Diameter of rotor	101 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 Appendix B.01
Rotational speed at each integer standardised wind speed	See Appendix B.02
Rated power output	2.221 MW
Control software version	14.04.30

Table 3 - Rotor Details

Rotor Details	
Rotor control devices	Pitch control
Presence of vortex generators, stall strips, serrated trailing edges	Vortex generators, Dino Tails, Winglet
Blade type	B49
Serial number	Blade A – 4902117501 Blade B – 4902114401 Blade C - 4902119401
Number of blades	3

Table 4 - Gearbox Details

Gearbox Details	
Manufacturer	Winergy
Model number	PEAB4456.8 cold climate 2.3MW
Serial number	4856116-0110-3

Table 5 - Generator Details

Generator Details	
Manufacturer	Loher
Model number	Generator Loher C3, SG V2
Serial number	6013380

2.2 Wind Turbine Location

Turbine T63 is located in the municipality of Haldimand near the town of Dunnville, approximately 760m West of Port Maitland Road, and 1400m North of Kings Row. The area surrounding T63 is flat and consists primarily of 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 T63 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	2369794
Pre-amplifier	B&K 2671	2625416
Acoustic calibrator	B&K 4231	3012380

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 nacelle anemometer located at hub height (10m high) from turbine T63. Data for background measurements was obtained from a 10m high anemometer, which was placed as per guidelines outlined in IEC-61400-11 Edition 2.1.

The meteorological equipment is summarized in Table 7

Table 7 – Meteorological Measurement Equipment

Equipment	Manufacturer Name & Model	Serial Number
Anemometer	VAISALA WXT520	K4250007
Serial to Analog Converter	NOKEVAL 7470	A165164

3.2 Measurement Setup

3.2.1 Microphone Placement

The measurement microphone was setup 150m 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 T63. 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 T10 were taken, the surrounding land was planted with soy beans crop. Any crops in the vicinity of the microphone were flattened such that 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
August 5, 2015	Background	12:31 pm	1:07 pm
	Turbine ON	1:33 pm	2:24 pm
	Background	2:32 pm	3:04 pm
	Turbine ON	3:17 pm	3:48 pm
August 14, 2015	Turbine ON	11:16 am	11:47 am
	Background	11:52 am	12:22 pm
	Turbine ON	12:32 pm	12:50 pm

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 T63's power curve (as per the standard), while wind direction was provided by T63's nacelle yaw position. Background data was obtained from an anemometer located 10m above ground level near T63.

Temperature and pressure readings during the measurement period were provided by the 10m anemometer, located near turbine T63 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 >12.9 dB. 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 recommendations made by the convenor of IEC 61400-11 working group and detailed in Note N6.023.17 and provided in Appendix F.

4.2 Special Notes & Considerations

There were no other turbines in the immediate vicinity of T63.

4.3 Analysis Details

The following section outlines analysis of the measurement data acquired for T63. 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.

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	
7.5	52.5	44	39.0	39	52.3
8	53.7	56	40.7	54	53.5
8.5	54.9	65	40.4	53	54.8
9	55.4	38	40.3	55	55.3
9.5	55.6	47	41.8	69	55.4
10	55.7	11	40.5	49	55.6
10.5	55.8	12	41.0	50	55.6
11	55.9	14	41.1	34	55.7
11.5	55.8	23	41.5	18	55.7
12	55.8	22	40.9	11	55.7
12.5	55.7	20	41.5	12	55.6

4.6 Sound Power Level of Turbine

The calculated sound power level of the turbine T63 (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)
7.5	102.5	0.7
8	103.7	0.7
8.5	105.0	0.7
9	105.5	0.7
9.5	105.6	0.7
10	105.8	0.7
10.5	105.9	0.7
11	106.0	0.7
11.5	105.9	0.7
12	105.9	0.7
12.5	105.8	0.7

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

Wind Speed (m/s)	Apparent L_{WA}, (dBA)	Uncertainty (dB)
5	101.5	0.7
6	104.9	0.7
7	105.7	0.7
8	105.9	0.7
9	105.8	0.7

4.7 Tonality Analysis

The tonality analysis for Turbine T63 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 (%)
7.5	422	-5.2	-3.0	23	44	52%
8	426	-1.7	0.6	16	56	29%
	473	-4.3	-2.0	31	56	55%
8.5	484	-3.2	-1.0	62	65	95%
9	492	-0.1	2.2	33	38	87%
9.5	492	-2.8	-0.5	41	47	87%
10	493	-1.1	1.2	10	11	91%
10.5	500	-4.3	-2.0	10	12	83%
11	518	-0.6	1.7	11	14	79%
11.5	522	-0.3	2.1	13	23	57%
12	519	-1.6	0.7	19	22	86%
12.5	525	-1.5	0.9	13	20	65%

5 Closure

Measurements and analysis were carried on Turbine T63 of the Grand Renewable Wind Farm, located in the municipality of Haldimand as per International IEC 61400-11 (Edition 3.0, released 2012-11), "Wind turbine generator systems – Part 11: Acoustic noise measurement techniques".

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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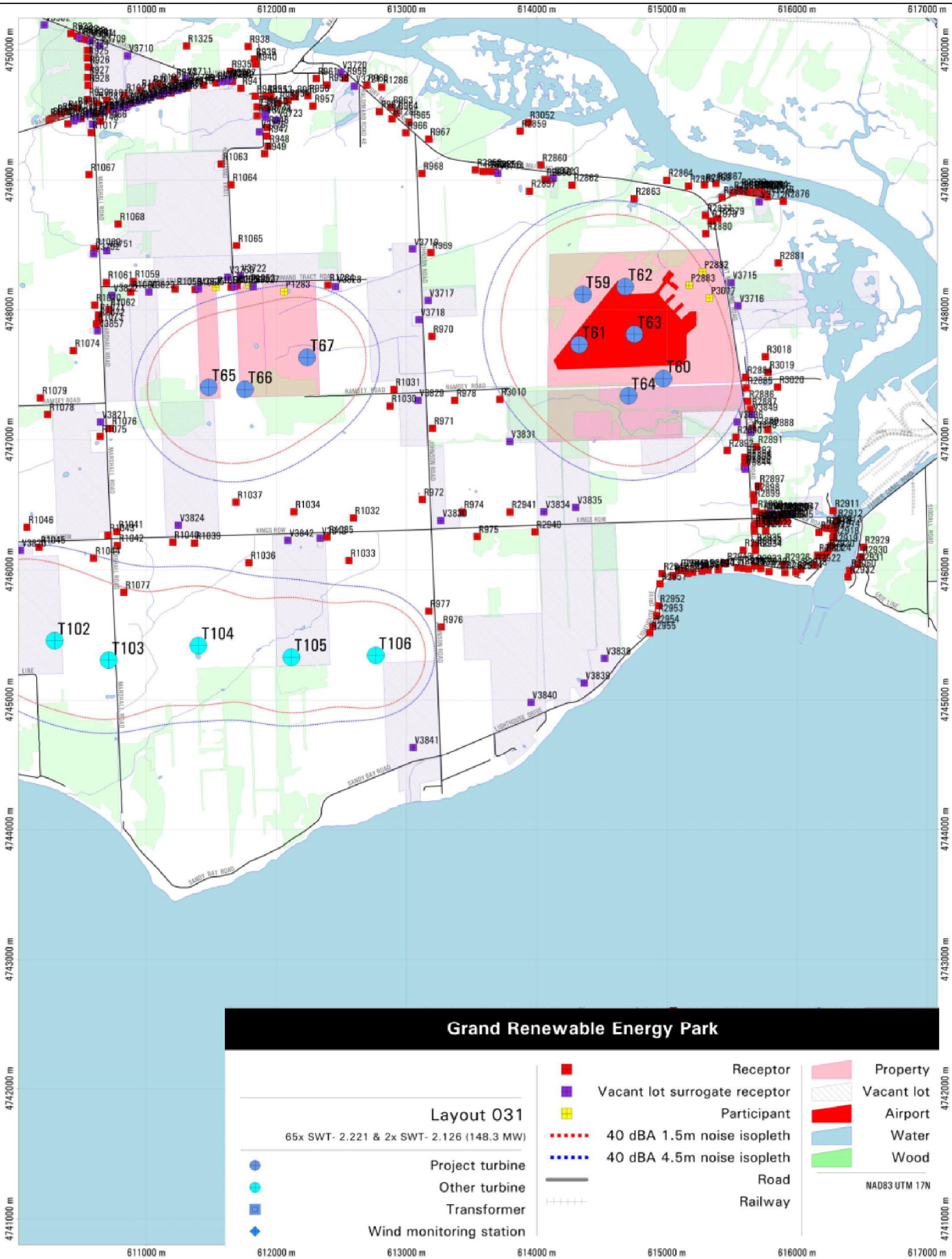

aercoustics	14284.00.T63.RP5 Scale: NTS Drawn by: AM Reviewed by: PA Date: Feb 28,2018 Revision: 1	**Project Name** Grand Renewable Wind - Turbine T63 - IEC61400-11 Edition 3.0 **Figure Title** Site Plan **Figure A.01**

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14284.00.T63.RP5	**Project Name**
Scale: NTS Drawn by: AM Reviewed by: PA Date: Feb 28, 2018 Revision: 1	Grand Renewable Wind - Turbine T63 - IEC61400-11 Edition 3.0
	Figure Title Site Photos

Figure A.02

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Appendix B
Turbine Information

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TM

Wind [m/s]	Power [kW]
0	0
1	0
2	0
3	27
4	116
5	264
6	485
7	792
8	1196
9	1666
10	2031
11	2180
12	2215
13	2220
14	2221
15	2221
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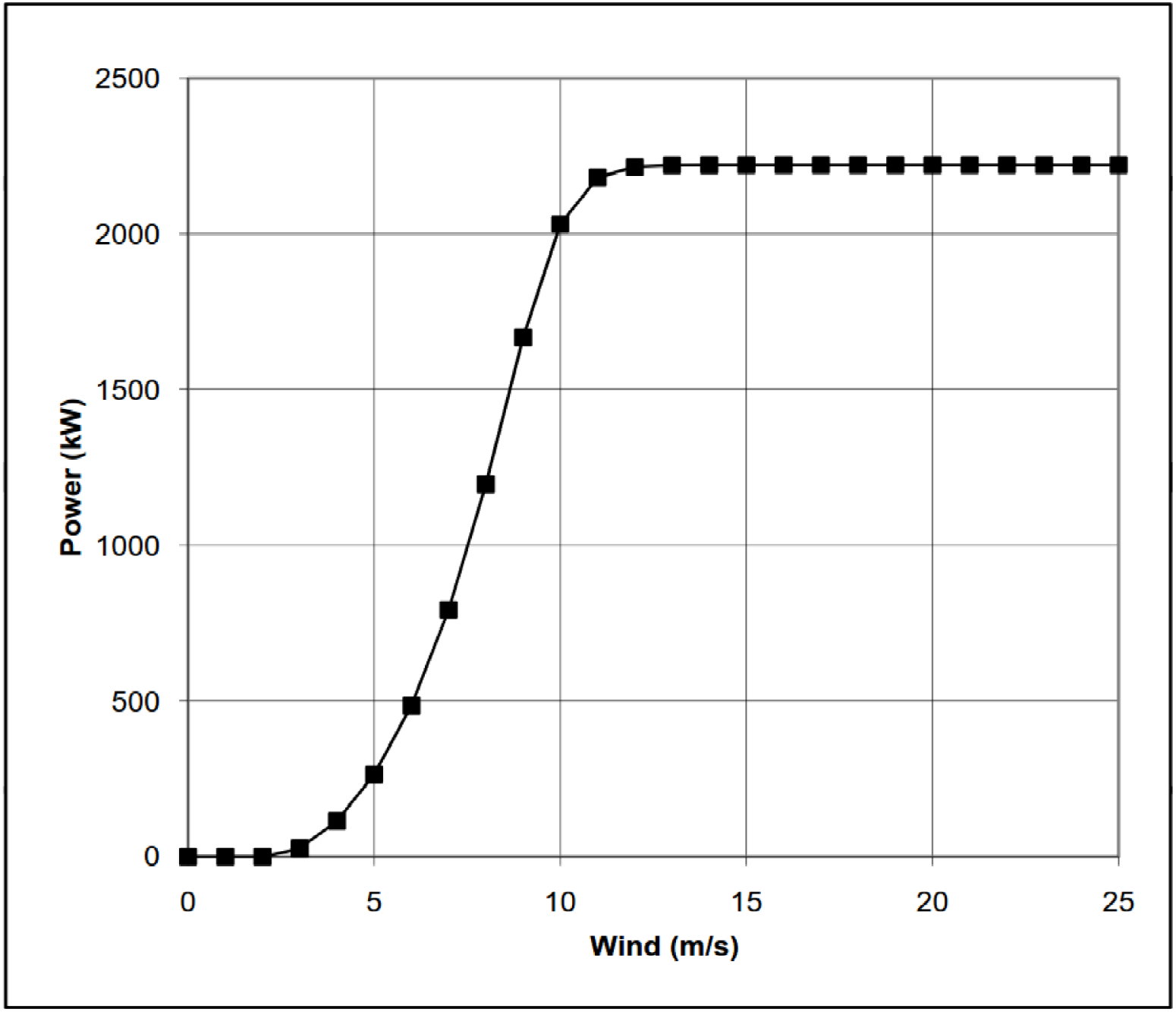

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Revision: 1

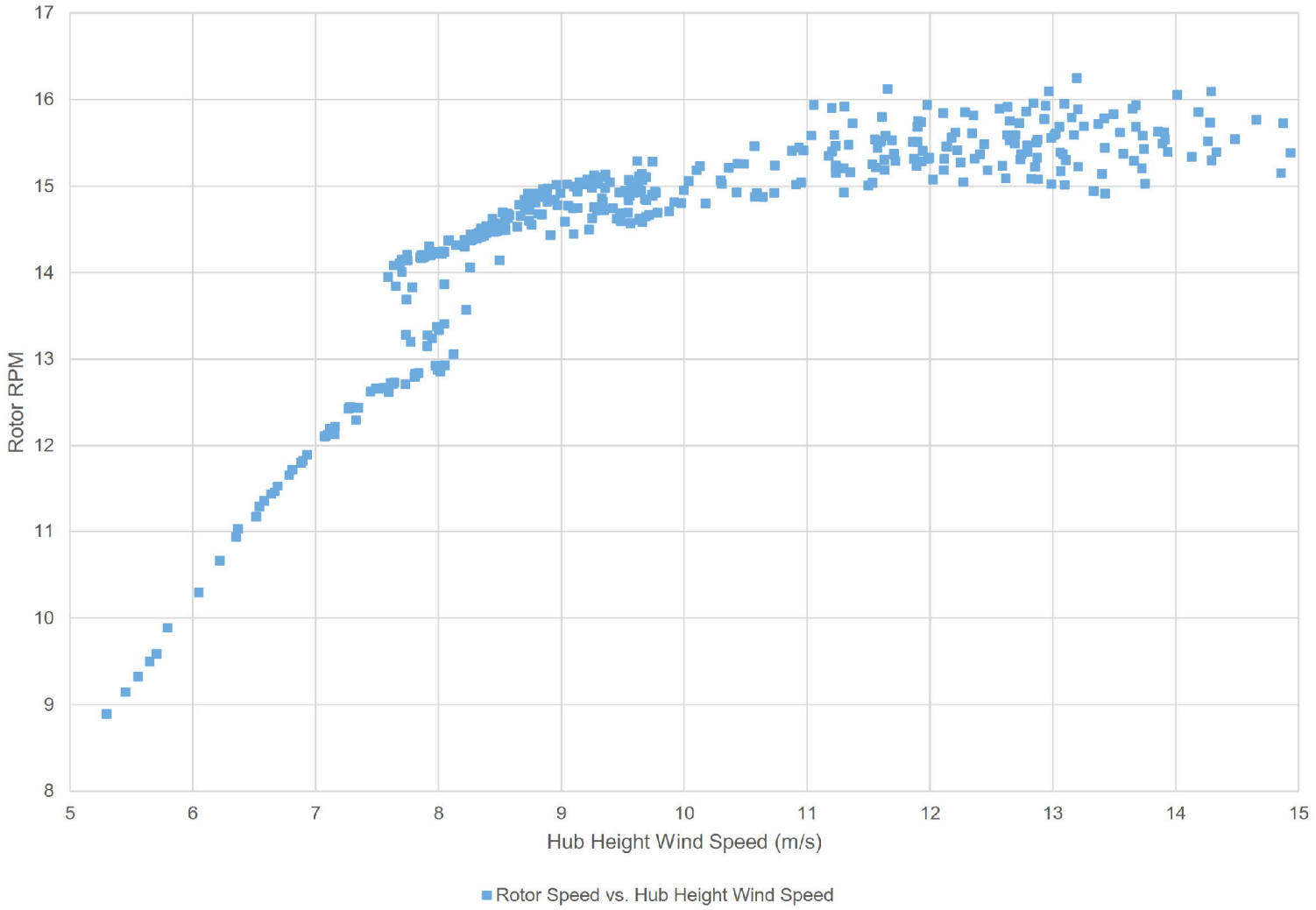
Proj ect Name

Grand Renewable Wind Farm - Turbine T63 - I EC 61400-11 Edit ion 3. 0

Fi gure Ti tl e

Power Curve

Fi gure B. 01



aercoustics	Project ID: 14284.00.T63.RP5 Scale: NTS Drawn by: AM Reviewed by: PA Date: Feb, 28 2018 Revision: 1	**Project Name** Grand Renwable Wind Farm - Turbine T63 - IEC 61400-11 Edition 3.0 **Figure Title** Rotor RPM vs. Wind Speed

Figure B.02

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Appendix C
Apparent Sound Power Level

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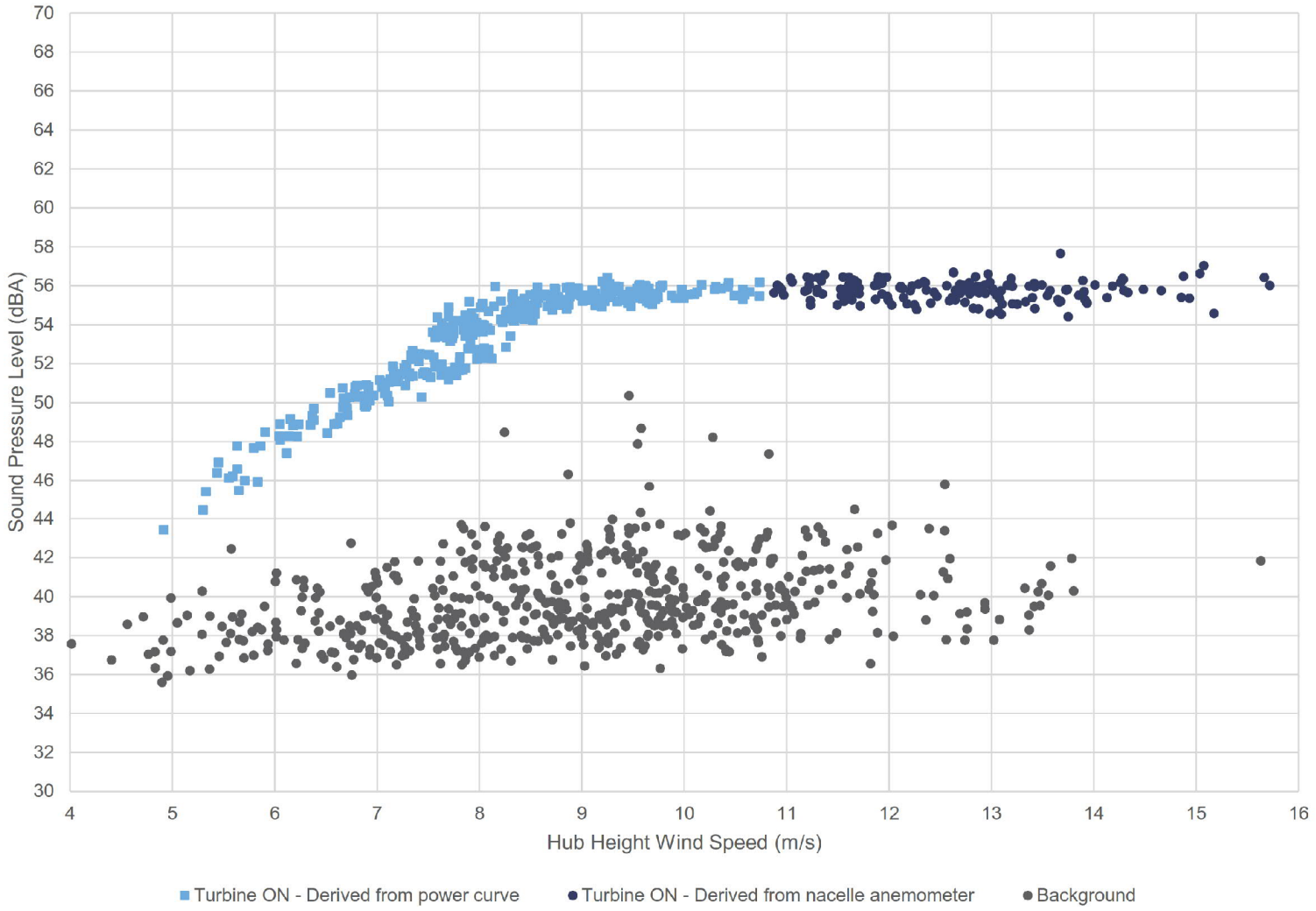
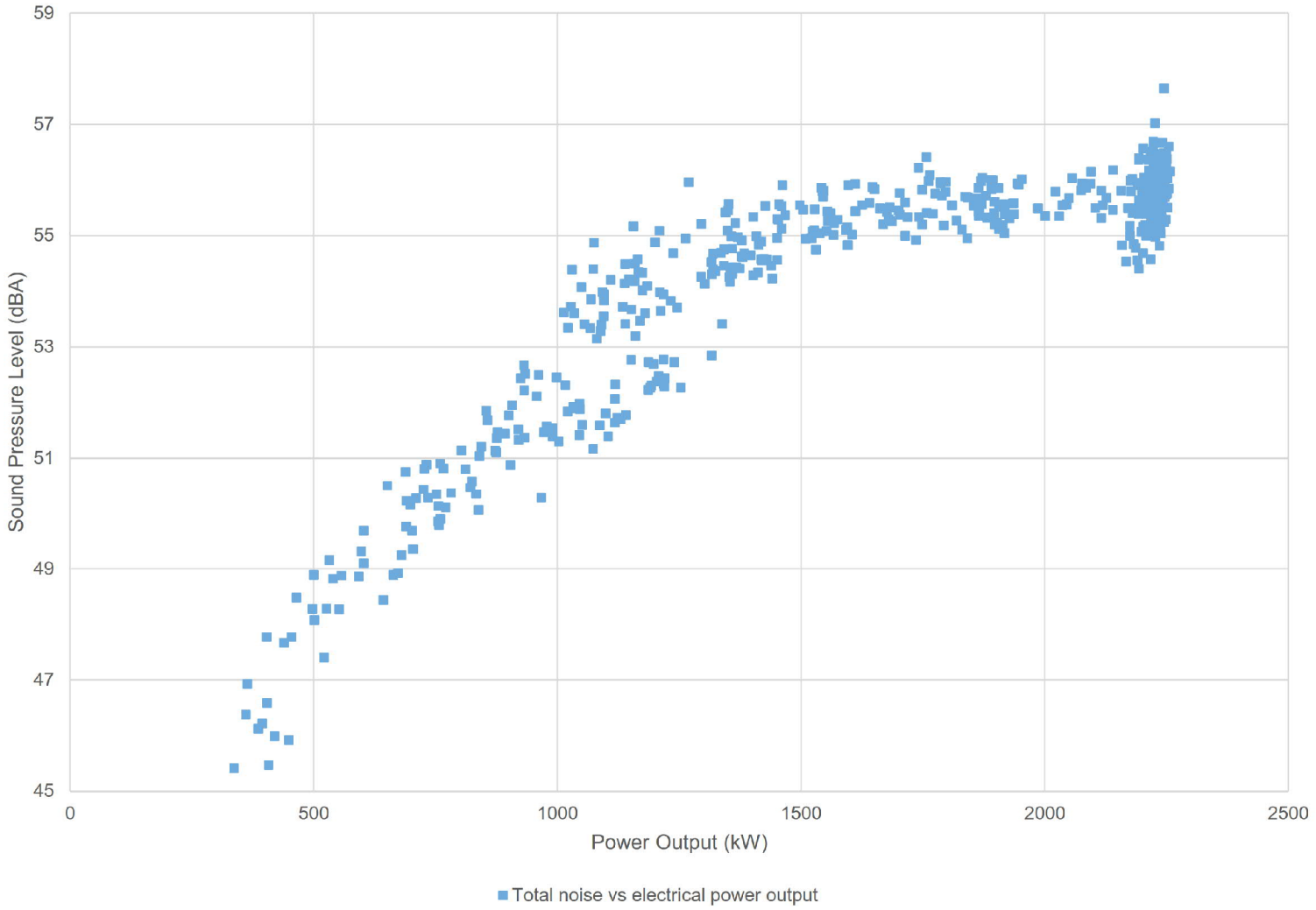


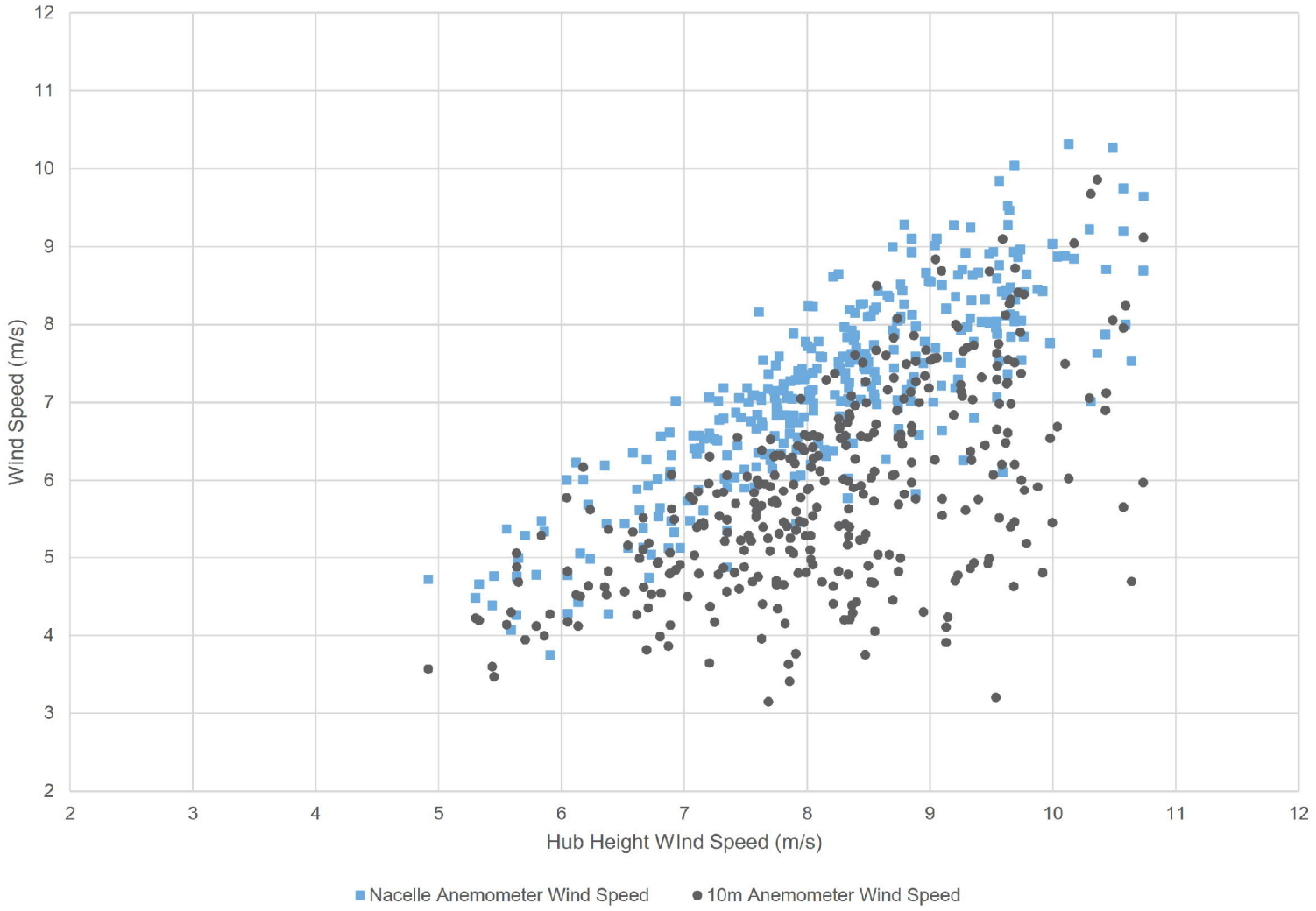
aercoustics	Project ID: 14284.00.T63.RP5 Scale: NTS Drawn by: AM Reviewed by: PA Date: Feb, 28 2018 Revision: 1	**Project Name** Grand Renwable Wind Farm - Turbine T63 - IEC 61400-11 Edition 3.0 **Figure Title** Plot of overall measurement data pairs at Position 1 (Turbine ON &Background)

Figure C.01



aercoustics	Project ID: 14284.00.T63.RP5 Scale: NTS Drawn by: AM Reviewed by: PA Date: Feb, 28 2018 Revision: 1	**Project Name** Grand Renwable Wind Farm - Turbine T63 - IEC 61400-11 Edition 3.0 **Figure Title** Plot of measured total noise vs electrical power output

Figure C.02



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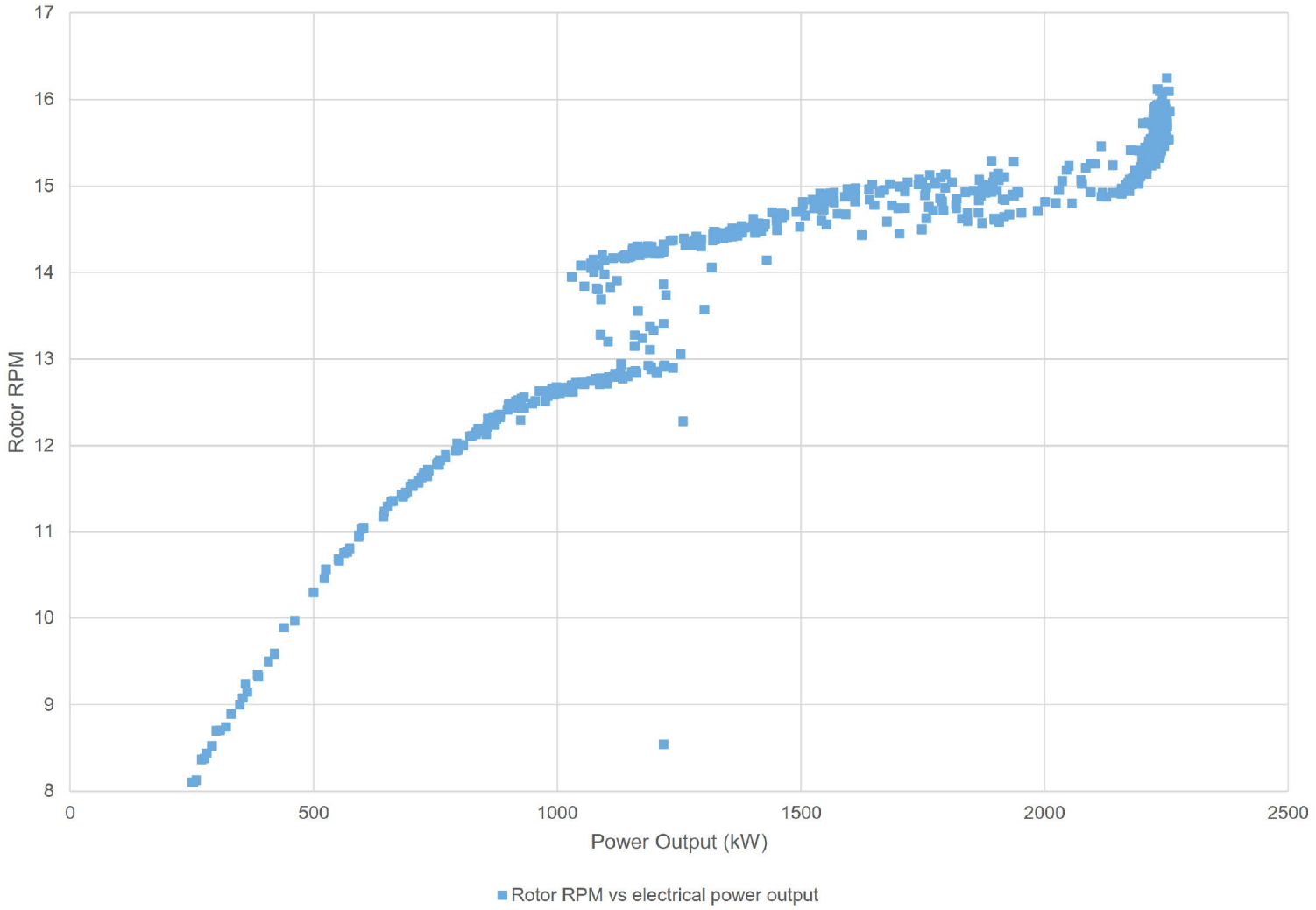
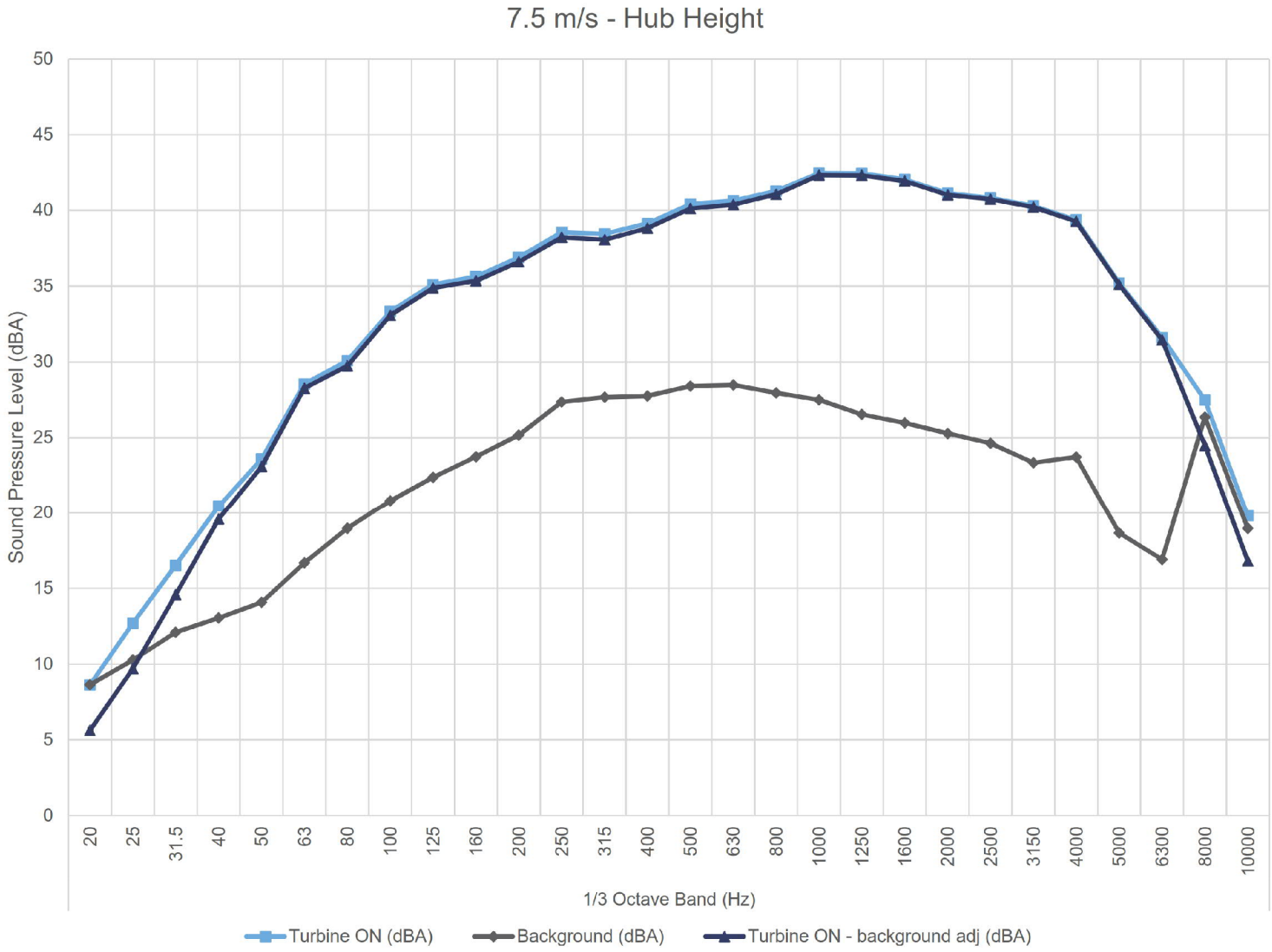
Project ID: 14284.00.T63.RP5	**Project Name**
Scale: NTS Drawn by: AM Reviewed by: PA Date: Feb, 28 2018 Revision: 1	Grand Renwable Wind Farm - Turbine T63 - IEC 61400-11 Edition 3.0
	Figure Title Plot of power curve relative to nacelle anemometer and 10m anemometer

Figure C.03



aercoustics	Project ID: 14284.00.T63.RP5 Scale: NTS Drawn by: AM Reviewed by: PA Date: Feb, 28 2018 Revision: 1	**Project Name** Grand Renwable Wind Farm - Turbine T63 - IEC 61400-11 Edition 3.0 **Figure Title** Plot of rotor RPM vs. electrical power output

Figure C.04



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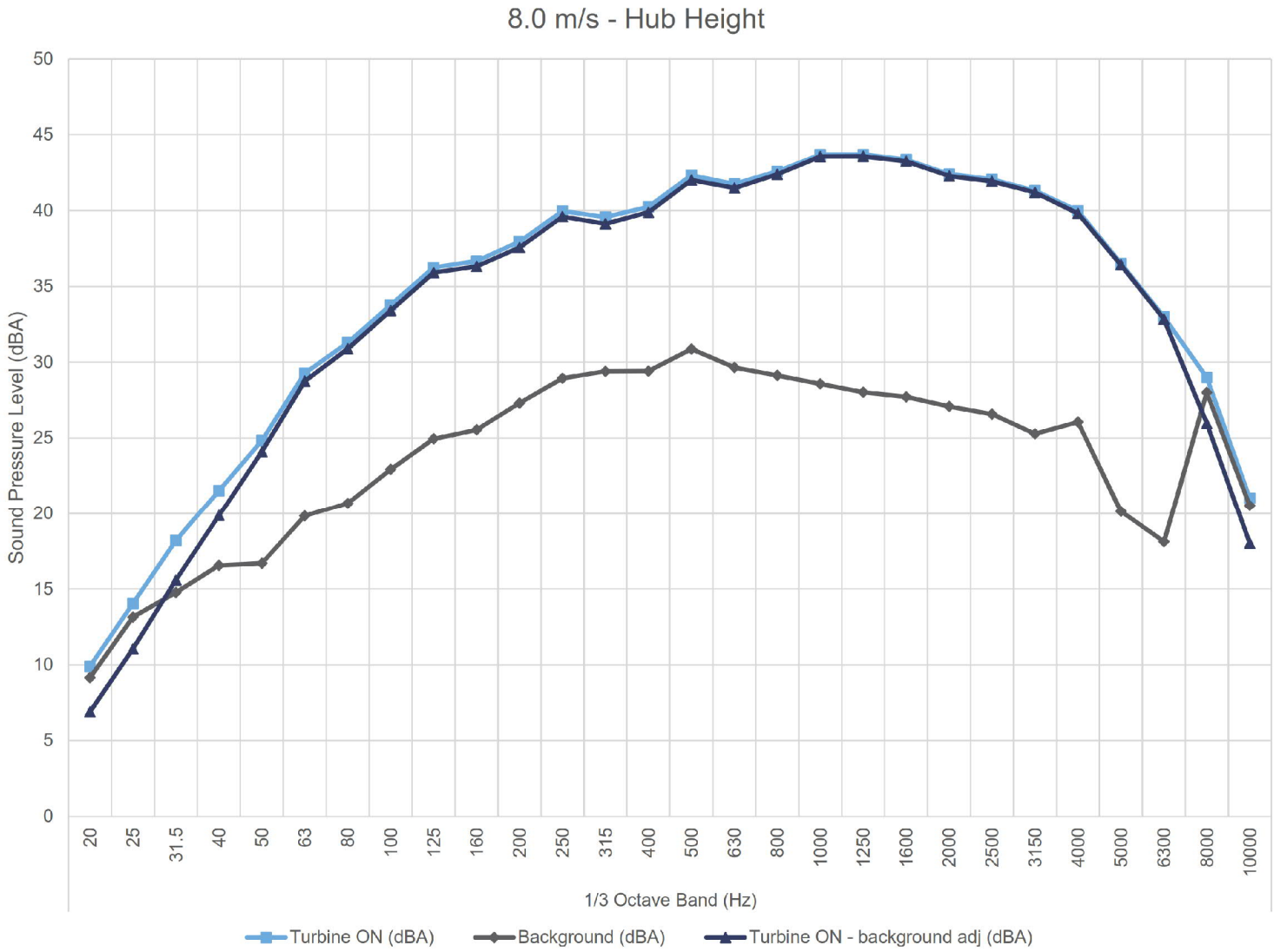
Project ID: 14284.00.T63.RP5	**Project Name**
Scale: NTS Drawn by: AM Reviewed by: PA Date: Feb, 28 2018 Revision: 1	Grand Renwable Wind Farm - Turbine T63 - IEC 61400-11 Edition 3.0
	Figure Title Plot of sound pressure spectrum in 1/3 Octave at 7.5 m/s

Figure C.05



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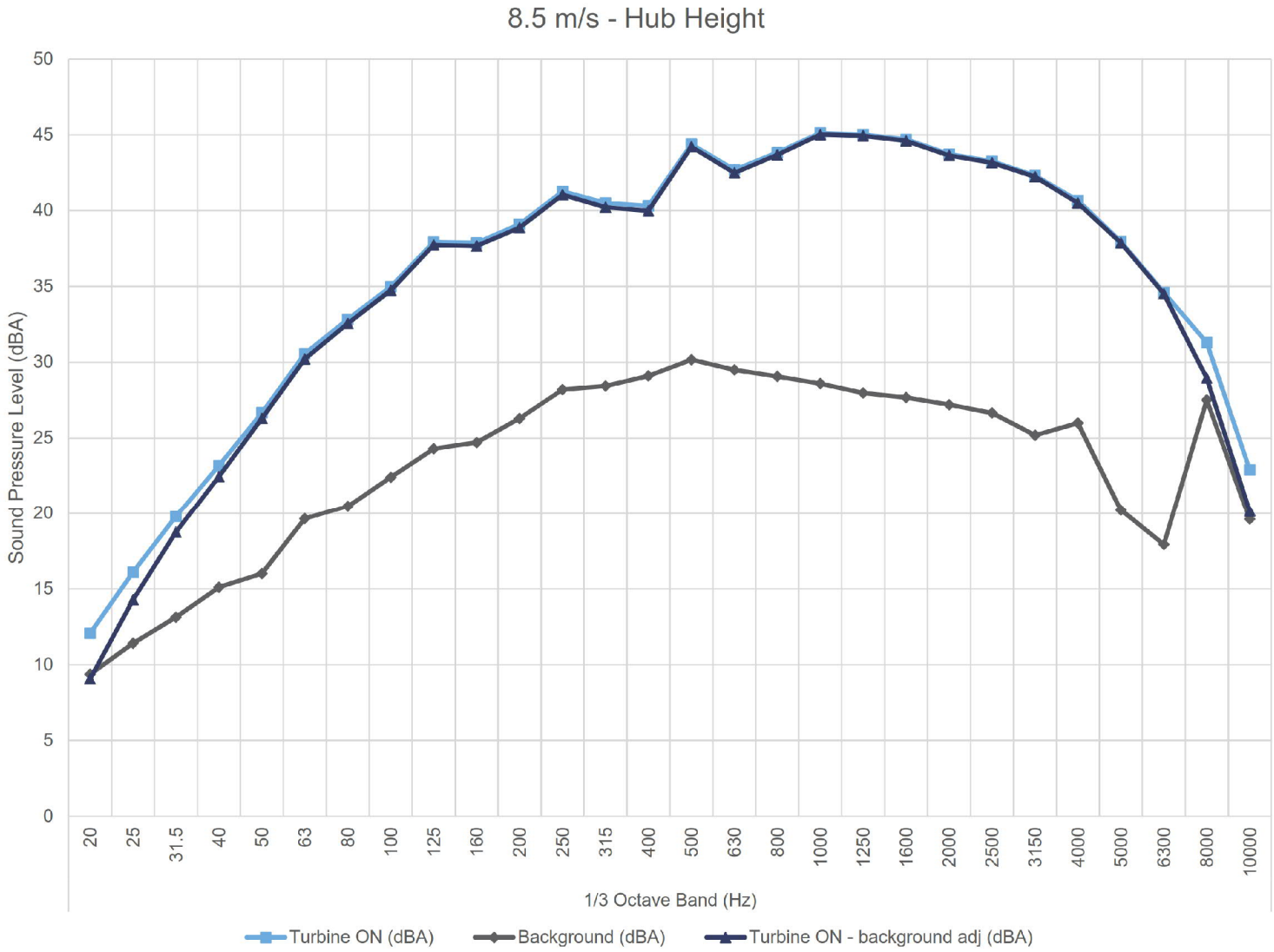
Project ID: 14284.00.T63.RP5	**Project Name**
Scale: NTS Drawn by: AM Reviewed by: PA Date: Feb, 28 2018 Revision: 1	Grand Renwable Wind Farm - Turbine T63 - IEC 61400-11 Edition 3.0
	Figure Title Plot of sound pressure spectrum in 1/3 Octave at 8 m/s

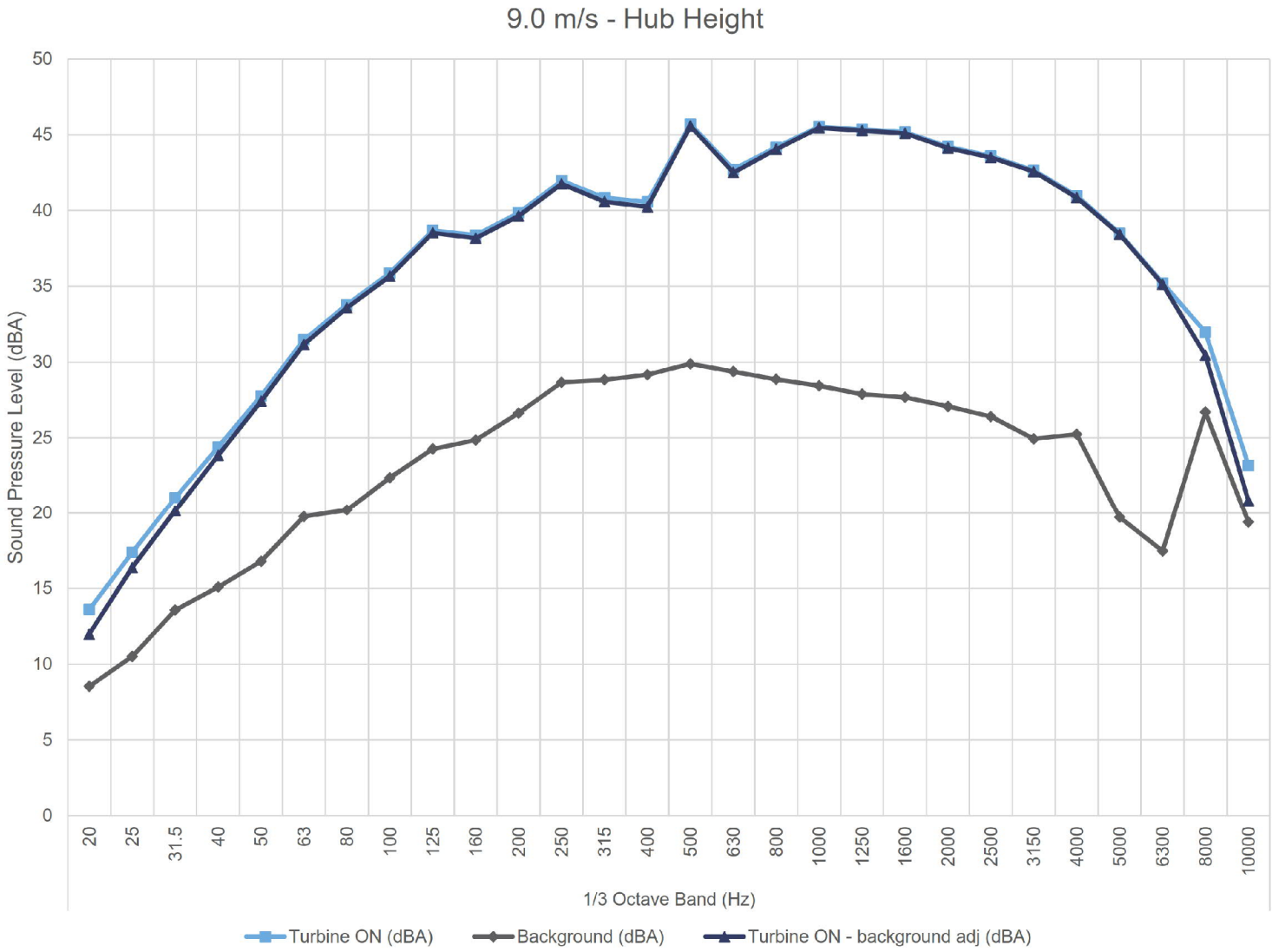
Figure C.06



aercoustics

Project ID: 14284.00.T63.RP5	**Project Name**
Scale: NTS Drawn by: AM Reviewed by: PA Date: Feb, 28 2018 Revision: 1	Grand Renwable Wind Farm - Turbine T63 - IEC 61400-11 Edition 3.0
	Figure Title Plot of sound pressure spectrum in 1/3 Octave at 8.5 m/s

Figure C.07



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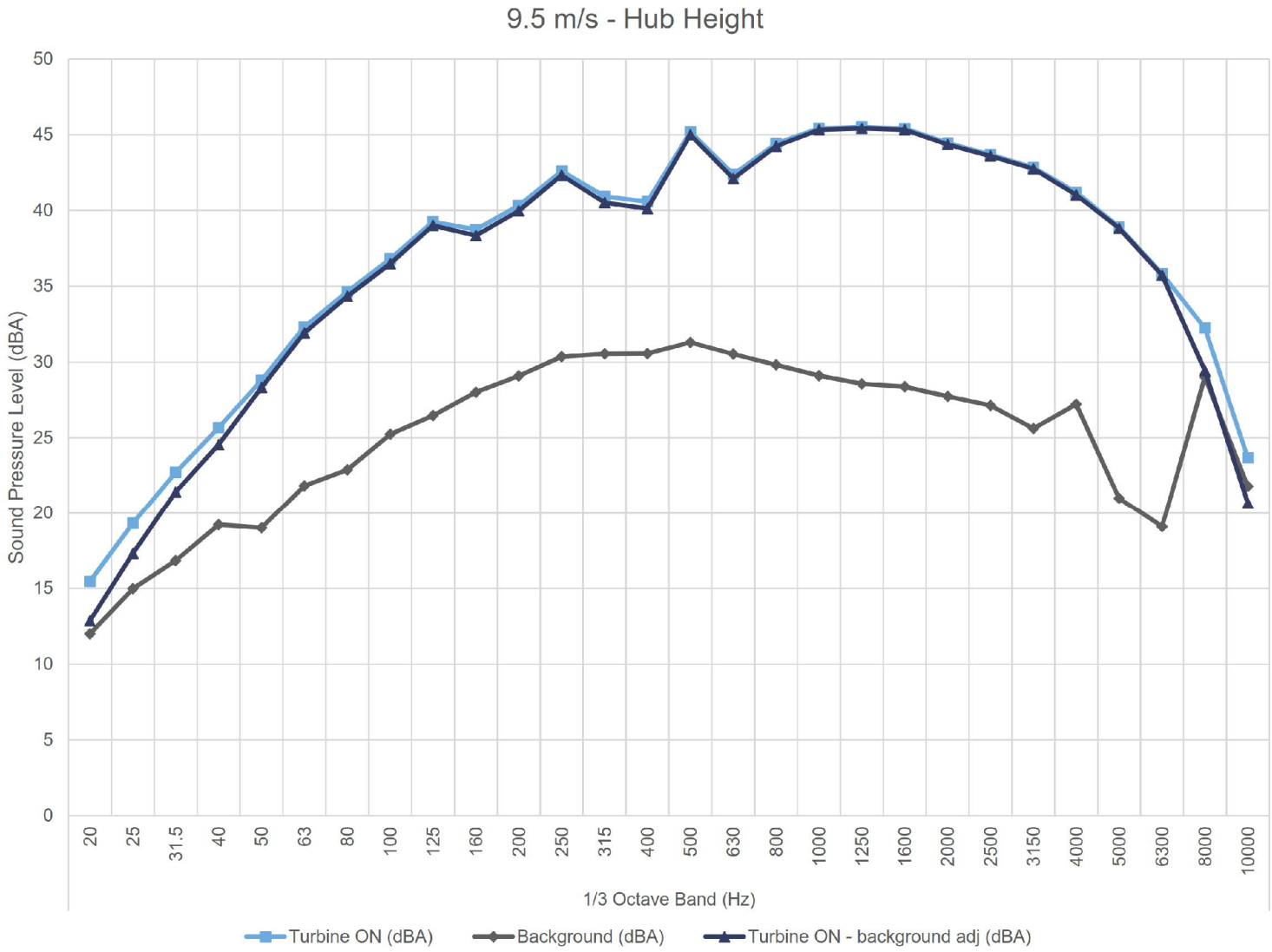
Project ID: 14284.00.T63.RP5	**Project Name**
Scale: NTS Drawn by: AM Reviewed by: PA Date: Feb, 28 2018 Revision: 1	Grand Renwable Wind Farm - Turbine T63 - IEC 61400-11 Edition 3.0
	Figure Title Plot of sound pressure spectrum in 1/3 Octave at 9 m/s

Figure C.08



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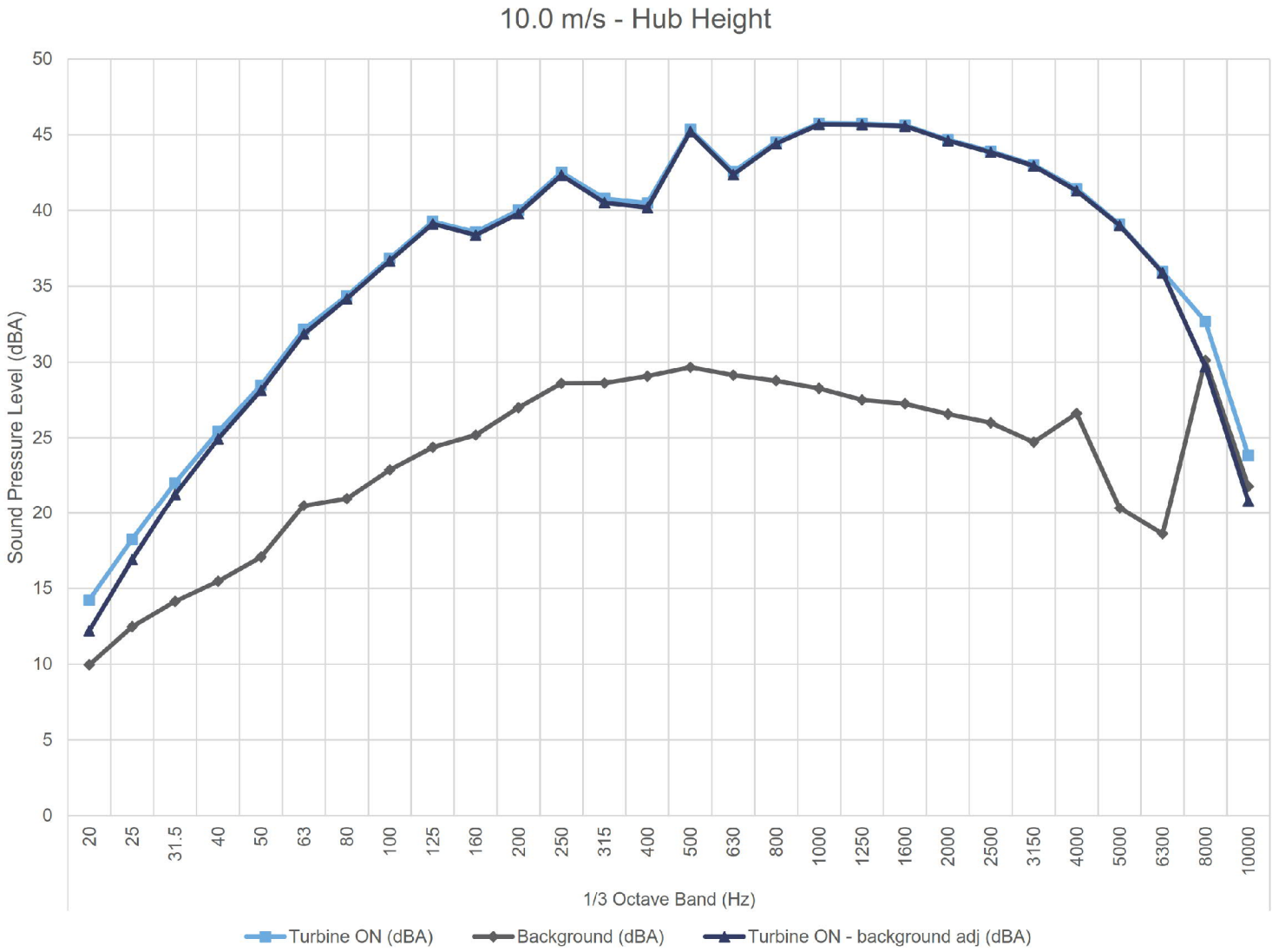
Project ID: 14284.00.T63.RP5	**Project Name**
Scale: NTS Drawn by: AM Reviewed by: PA Date: Feb, 28 2018 Revision: 1	Grand Renwable Wind Farm - Turbine T63 - IEC 61400-11 Edition 3.0
	Figure Title Plot of sound pressure spectrum in 1/3 Octave at 9.5 m/s

Figure C.09



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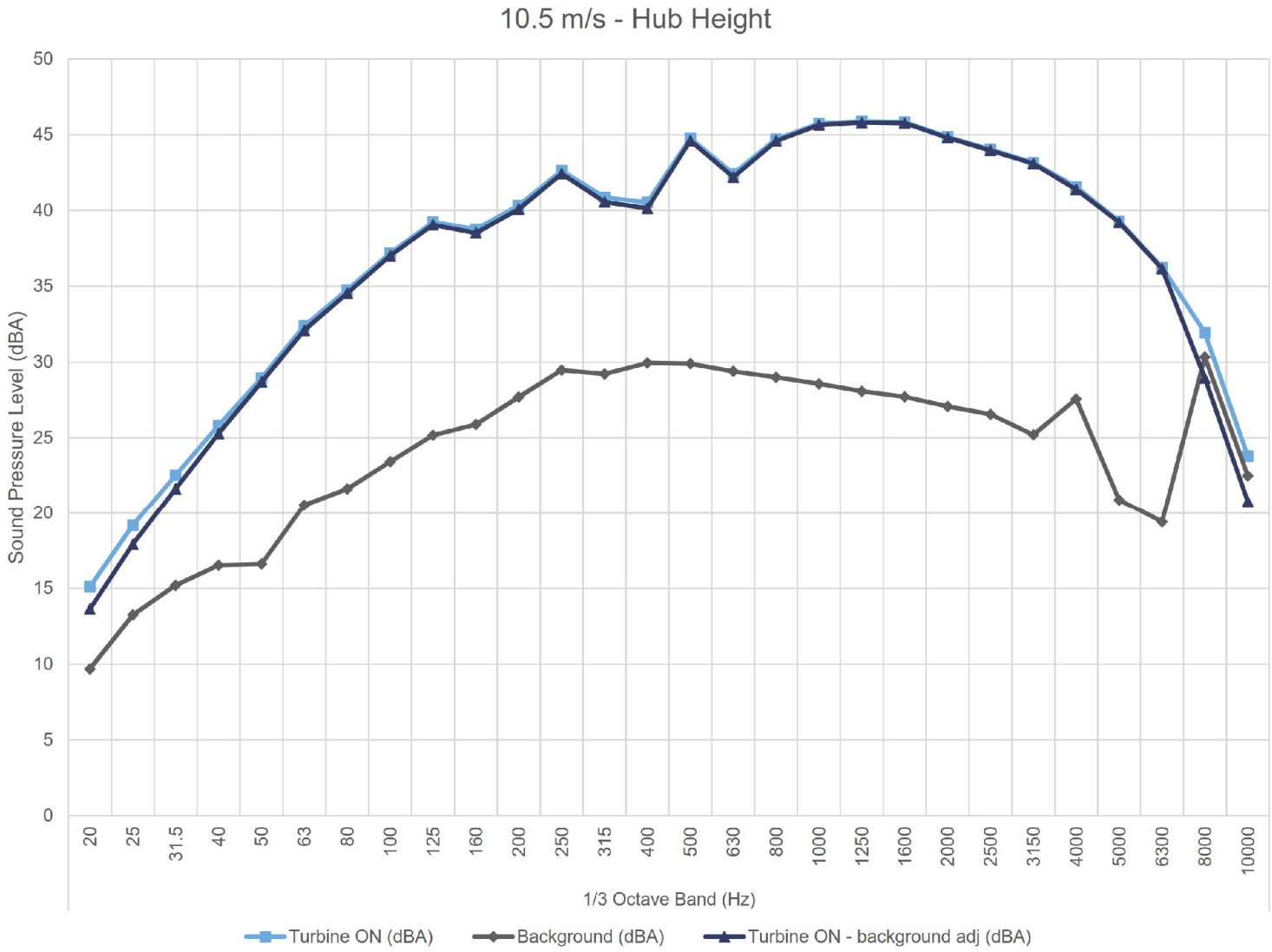
Project ID: 14284.00.T63.RP5	**Project Name**
Scale: NTS Drawn by: AM Reviewed by: PA Date: Feb, 28 2018 Revision: 1	Grand Renwable Wind Farm - Turbine T63 - IEC 61400-11 Edition 3.0
	Figure Title Plot of sound pressure spectrum in 1/3 Octave at 10 m/s

Figure C.10



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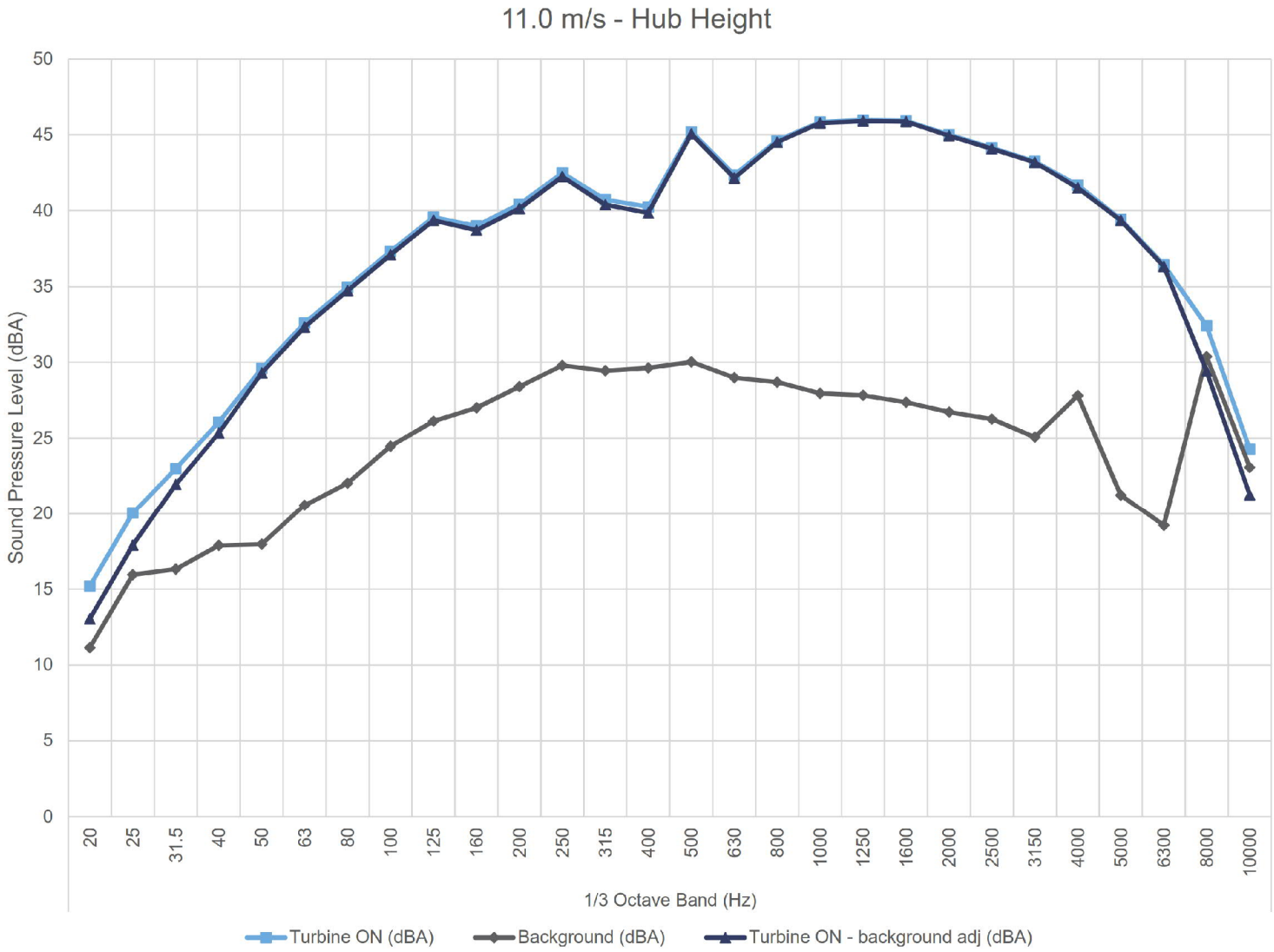
Project ID: 14284.00.T63.RP5	**Project Name**
Scale: NTS Drawn by: AM Reviewed by: PA Date: Feb, 28 2018 Revision: 1	Grand Renwable Wind Farm - Turbine T63 - IEC 61400-11 Edition 3.0
	Figure Title Plot of sound pressure spectrum in 1/3 Octave at 10.5 m/s

Figure C.11



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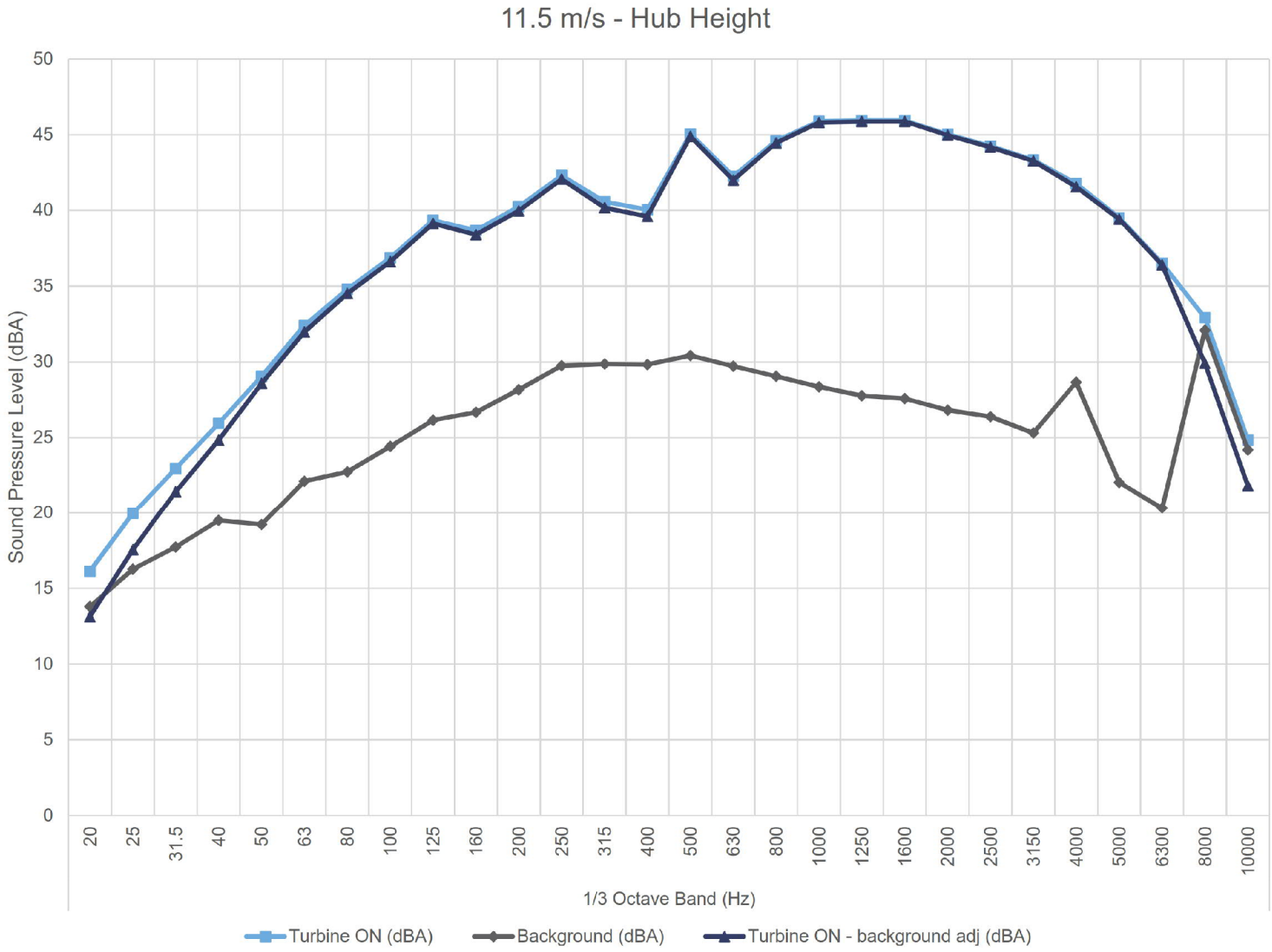
Project ID: 14284.00.T63.RP5	**Project Name**
Scale: NTS Drawn by: AM Reviewed by: PA Date: Feb, 28 2018 Revision: 1	Grand Renwable Wind Farm - Turbine T63 - IEC 61400-11 Edition 3.0
	Figure Title Plot of sound pressure spectrum in 1/3 Octave at 11 m/s

Figure C.12



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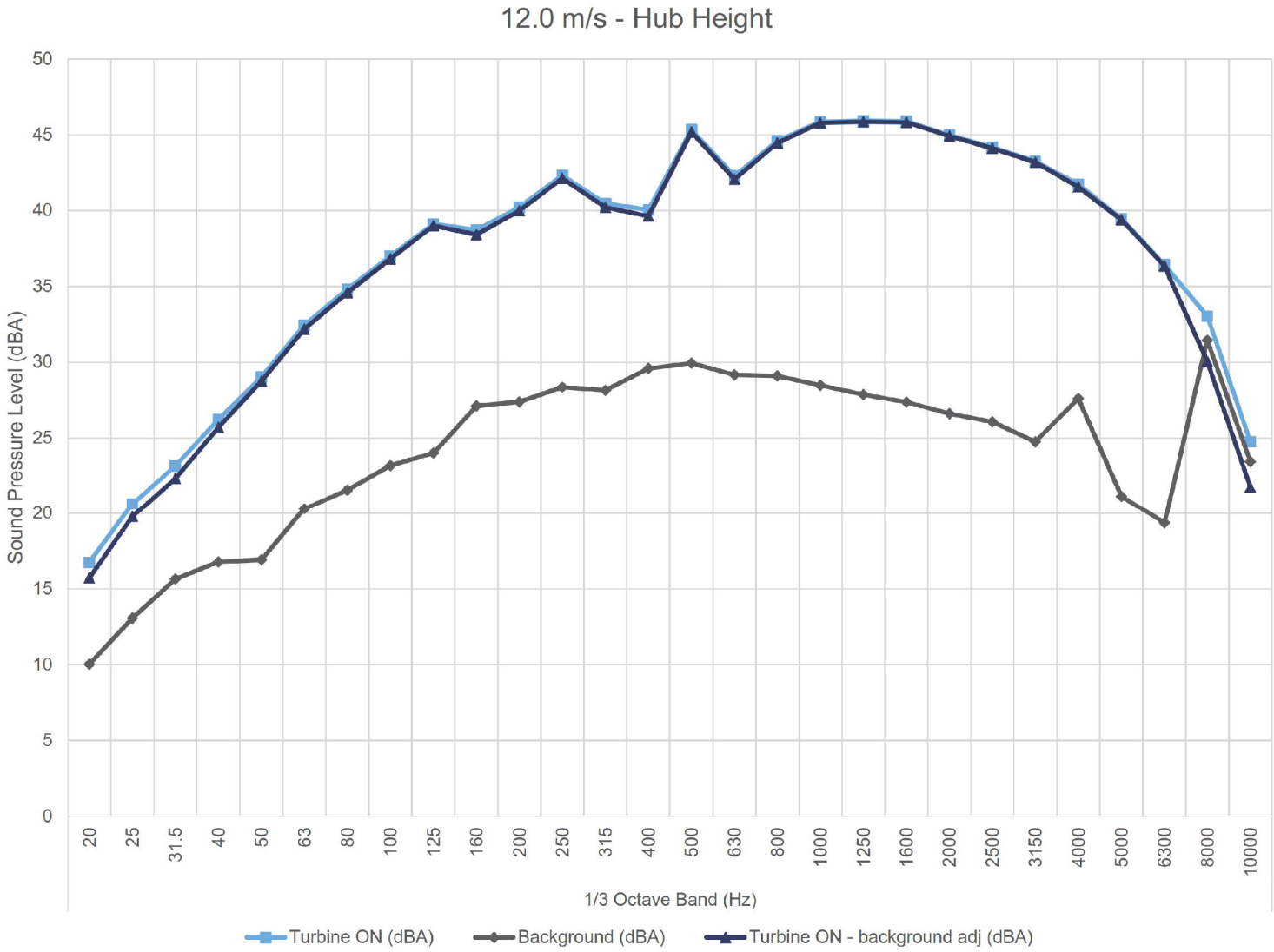
Project ID: 14284.00.T63.RP5	**Project Name**
Scale: NTS Drawn by: AM Reviewed by: PA Date: Feb, 28 2018 Revision: 1	Grand Renwable Wind Farm - Turbine T63 - IEC 61400-11 Edition 3.0
	Figure Title Plot of sound pressure spectrum in 1/3 Octave at 11.5 m/s

Figure C.13



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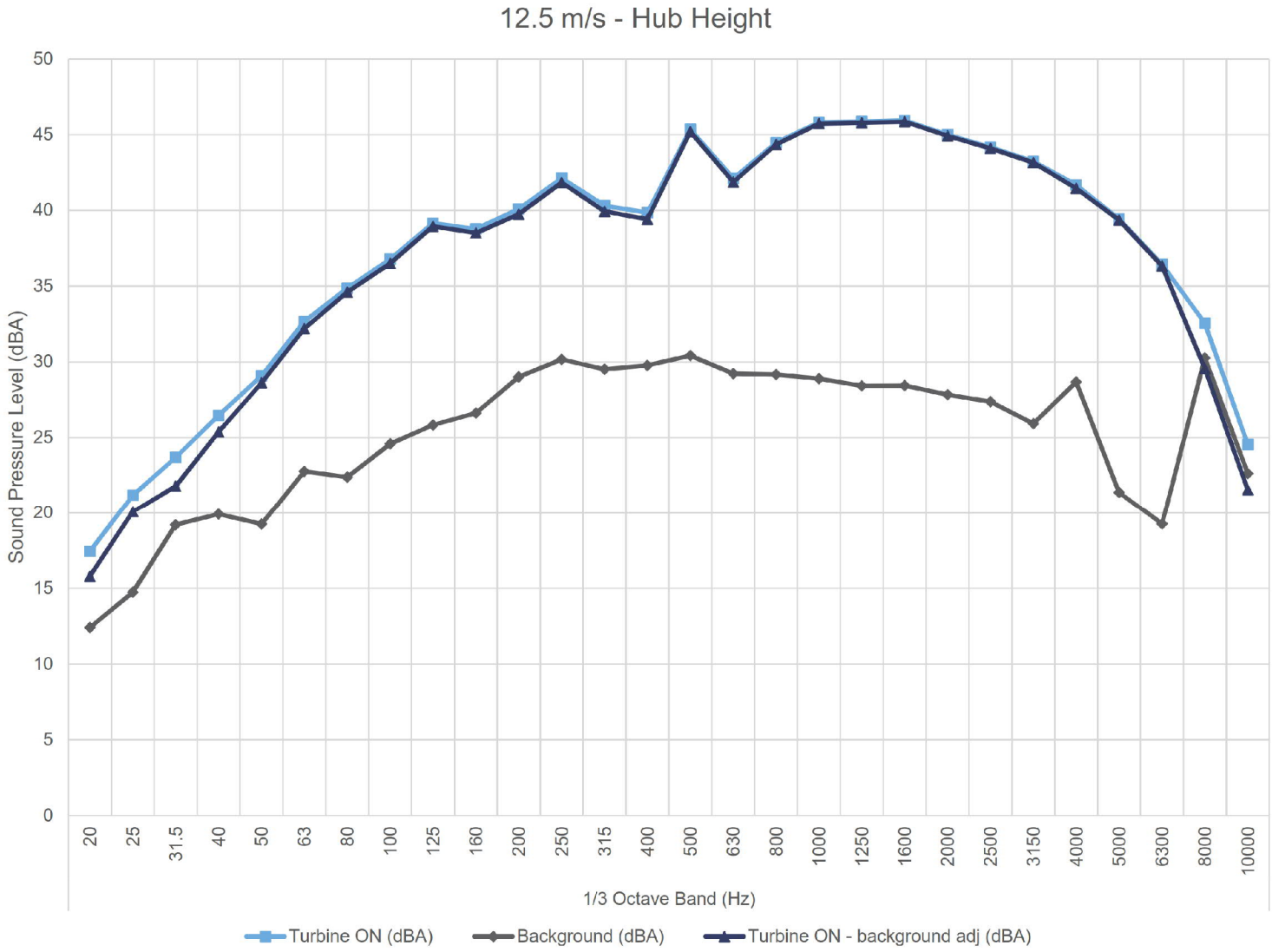
Project ID: 14284.00.T63.RP5	**Project Name**
Scale: NTS Drawn by: AM Reviewed by: PA Date: Feb, 28 2018 Revision: 1	Grand Renwable Wind Farm - Turbine T63 - IEC 61400-11 Edition 3.0
	Figure Title Plot of sound pressure spectrum in 1/3 Octave at 12 m/s

Figure C.14



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Project ID: 14284.00.T63.RP5	**Project Name**
Scale: NTS Drawn by: AM Reviewed by: PA Date: Feb, 28 2018 Revision: 1	Grand Renwable Wind Farm - Turbine T63 - IEC 61400-11 Edition 3.0
	Figure Title Plot of sound pressure spectrum in 1/3 Octave at 12.5 m/s

Figure C.15

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

Project: Grand Renewables Wind Farm - Turbine T63 - IEC 61400-11 Measurement

Report ID: 14284.00.T63.RP5

Created on: 2/28/2018

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	
7.5	Turbine ON (dBA)	8.6	12.7	16.5	20.5	23.6	28.5	30.1	33.3	35.1	35.6	36.9	38.6	38.4	39.1	40.4	40.7	41.3	42.5	42.4	42.0	41.1	40.9	40.3	39.4	35.2	31.6	27.5	19.8	52.5
	Background (dBA)	8.6	10.3	12.1	13.1	14.1	16.7	19.0	20.8	22.4	23.7	25.2	27.4	27.7	27.8	28.4	28.5	28.0	27.5	26.5	26.0	25.3	24.6	23.3	23.7	18.7	16.9	26.4	19.0	39.0
	Turbine ON - background adj (dBA)	[5.6]	[9.7]	14.6	19.6	23.1	28.3	29.7	33.1	34.9	35.4	36.6	38.2	38.1	38.8	40.1	40.4	41.1	42.3	42.3	41.9	41.0	40.7	40.2	39.3	35.1	31.5	[24.5]	[16.8]	52.3
	Signal to noise (dB)	0.0	2.4	4.4	7.4	9.5	11.9	11.1	12.5	12.7	11.9	11.7	11.2	10.8	11.4	12.0	12.2	13.3	15.0	15.9	16.1	15.9	16.2	17.0	15.7	16.5	14.7	1.1	0.8	13.5
	Uncertainty (dB)	2.7	2.6	1.5	1.0	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	2.2	3.2	0.7
	PWL (dBA)	[55.9]	[59.9]	64.8	69.8	73.3	78.5	80.0	83.3	85.1	85.6	86.8	88.5	88.3	89.1	90.4	90.6	91.3	92.6	92.6	92.2	91.3	91.0	90.5	89.5	85.3	81.7	[74.7]	[67.1]	102.5
8.0	Turbine ON (dBA)	9.9	14.1	18.2	21.5	24.8	29.3	31.3	33.8	36.2	36.7	38.0	40.0	39.6	40.3	42.3	41.8	42.6	43.7	43.7	43.4	42.4	42.1	41.3	40.0	36.5	33.0	29.0	21.0	53.7
	Background (dBA)	9.2	13.2	14.8	16.6	16.7	19.8	20.7	22.9	24.9	25.6	27.3	28.9	29.4	29.4	30.9	29.7	29.1	28.6	28.0	27.7	27.1	26.6	25.3	26.1	20.1	18.1	28.0	20.5	40.7
	Turbine ON - background adj (dBA)	[6.9]	[11.1]	15.6	19.9	24.1	28.8	30.9	33.4	35.9	36.3	37.6	39.6	39.1	39.9	42.0	41.5	42.4	43.6	43.6	43.2	42.3	41.9	41.2	39.8	36.4	32.8	[26]	[18]	53.5
	Signal to noise (dB)	0.8	0.9	3.4	5.0	8.1	9.4	10.6	10.8	11.3	11.1	10.6	11.0	10.2	10.8	11.5	12.1	13.5	15.1	15.7	15.6	15.3	15.5	16.0	13.9	16.4	14.9	1.0	0.5	12.9
	Uncertainty (dB)	2.6	2.7	1.9	1.4	1.0	0.9	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	2.1	3.1	0.7
	PWL (dBA)	[57.1]	[61.3]	65.8	70.1	74.3	79.0	81.1	83.6	86.1	86.6	87.8	89.8	89.4	90.1	92.3	91.7	92.6	93.8	93.8	93.5	92.5	92.2	91.4	90.0	86.7	83.1	[76.2]	[68.3]	103.7
8.5	Turbine ON (dBA)	12.1	16.1	19.8	23.2	26.7	30.6	32.8	35.0	37.9	37.9	39.1	41.3	40.5	40.3	44.4	42.7	43.8	45.1	45.0	44.7	43.7	43.3	42.3	40.7	38.0	34.6	31.3	22.9	54.9
	Background (dBA)	9.4	11.4	13.1	15.1	16.0	19.6	20.5	22.4	24.3	24.7	26.3	28.2	28.4	29.1	30.2	29.5	29.1	28.6	28.0	27.7	27.2	26.7	25.2	26.0	20.2	17.9	27.5	19.6	40.4
	Turbine ON - background adj (dBA)	[9.1]	14.3	18.7	22.5	26.3	30.2	32.6	34.8	37.7	37.7	38.9	41.0	40.2	40.0	44.2	42.5	43.7	45.0	44.9	44.6	43.6	43.2	42.2	40.5	37.9	34.5	29.0	20.2	54.8
	Signal to noise (dB)	2.7	4.7	6.7	8.1	10.7	10.9	12.4	12.6	13.6	13.2	12.8	13.1	12.1	11.2	14.2	13.2	14.7	16.5	17.0	17.0	16.5	16.6	17.1	14.7	17.7	16.7	3.8	3.3	14.6
	Uncertainty (dB)	2.6	1.7	1.1	1.0	0.9	0.9	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	1.7	2.9	0.7
	PWL (dBA)	[59.3]	64.5	69.0	72.7	76.5	80.5	82.8	85.0	88.0	87.9	89.1	91.3	90.5	90.2	94.5	92.7	93.9	95.3	95.2	94.8	93.9	93.4	92.5	90.8	88.1	84.7	79.2	70.4	105.0
9.0	Turbine ON (dBA)	13.6	17.4	21.0	24.4	27.8	31.5	33.8	35.9	38.7	38.4	39.8	42.0	40.9	40.6	45.7	42.7	44.2	45.5	45.4	45.2	44.2	43.6	42.6	41.0	38.5	35.2	32.0	23.2	55.4
	Background (dBA)	8.5	10.5	13.6	15.1	16.8	19.8	20.2	22.4	24.3	24.9	26.6	28.7	28.8	29.2	29.9	29.4	28.9	28.4	27.9	27.7	27.1	26.4	24.9	25.2	19.7	17.5	26.7	19.4	40.3
	Turbine ON - background adj (dBA)	12.0	16.4	20.2	23.8	27.4	31.2	33.6	35.7	38.5	38.2	39.6	41.8	40.6	40.2	45.6	42.5	44.0	45.5	45.3	45.1	44.1	43.5	42.6	40.9	38.4	35.1	30.4	20.8	55.3
	Signal to noise (dB)	5.1	6.9	7.4	9.3	11.0	11.7	13.6	13.5	14.4	13.5	13.2	13.3	12.0	11.4	15.8	13.3	15.3	17.1	17.5	17.5	17.1	17.2	17.7	15.7	18.8	17.7	5.3	3.8	15.2
	Uncertainty (dB)	1.9	1.5	1.2	1.1	1.0	0.9	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	1.4	2.7	0.7
	PWL (dBA)	62.2	66.6	70.4	74.1	77.7	81.4	83.8	85.9	88.8	88.4	89.9	92.0	90.8	90.5	95.8	92.7	94.3	95.7	95.5	95.3	94.4	93.8	92.8	91.1	88.7	85.4	80.7	71.1	105.5
9.5	Turbine ON (dBA)	15.5	19.3	22.7	25.7	28.8	32.3	34.6	36.8	39.3	38.7	40.3	42.6	40.9	40.6	45.2	42.4	44.4	45.4	45.5	45.4	44.5	43.7	42.8	41.2	38.9	35.8	32.2	23.7	55.6
	Background (dBA)	12.0	15.0	16.8	19.2	19.0	21.8	22.9	25.2	26.5	28.0	29.1	30.4	30.5	30.6	31.3	30.5	29.8	29.1	28.6	28.4	27.7	27.1	25.6	27.2	21.0	19.1	29.0	21.8	41.8
	Turbine ON - background adj (dBA)	12.9	17.3	21.4	24.6	28.3	31.9	34.3	36.5	39.0	38.4	40.0	42.3	40.5	40.1	45.0	42.1	44.3	45.3	45.4	45.3	44.4	43.6	42.8	41.0	38.8	35.7	29.4	[20.7]	55.4
	Signal to noise (dB)	3.5	4.3	5.9	6.5	9.8	10.5	11.8	11.6	12.8	10.7	11.2	12.3	10.4	10.0	13.9	11.9	14.6	16.3	17.0	17.1	16.7	16.6	17.2	14.0	17.9	16.7	3.2	1.9	13.8
	Uncertainty (dB)	2.3	1.8	1.2	1.1	0.9	0.9	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	1.9	3.2	0.7
	PWL (dBA)	63.1	67.6	71.7	74.8	78.6	82.2	84.6	86.7	89.3	88.6	90.2	92.6	90.8	90.4	95.2	92.3	94.5	95.6	95.7	95.6	94.6	93.8	93.0	91.3	89.1	86.0	79.7	[70.9]	105.6
10.0	Turbine ON (dBA)	14.2	18.3	22.0	25.4	28.5	32.2	34.4	36.9	39.3	38.6	40.0	42.5	40.8	40.5	45.3	42.6	44.5	45.8	45.7	45.6	44.7	43.9	43.0	41.5	39.1	36.0	32.7	23.8	55.7
	Background (dBA)	10.0	12.5	14.1	15.5	17.1	20.5	21.0	22.9	24.4	25.2	27.0	28.6	28.6	29.1	29.7	29.1	28.8	28.3	27.5	27.2	26.6	26.0	24.7	26.6	20.3	18.6	30.1	21.8	40.5
	Turbine ON - background adj (dBA)	12.2	16.9	21.3	24.9	28.1	31.9	34.2	36.7	39.1	38.4	39.8	42.3	40.5	40.2	45.2	42.4	44.4	45.7	45.7	45.6	44.6	43.8	43.0	41.3	39.0	35.9	[29.7]	[20.8]	55.6
	Signal to noise (dB)	4.3	5.8	7.9	9.9	11.4	11.6	13.4	14.0	14.9	13.4	13.0	13.9	12.2	11.4	15.7	13.5	15.8	17.5	18.2	18.4	18.1	17.9	18.3	14.8	18.8	17.4	2.6	2.0	15.2
	Uncertainty (dB)	2.1	1.6	1.2	1.1	1.0	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	2.5	3.2	0.7
	PWL (dBA)	62.5	67.2	71.5	75.2	78.4	82.1	84.4	86.9	89.4	88.6	90.0	92.6	90.8	90.4	95.5	92.6	94.6	95.9	95.9	95.8	94.9	94.1	93.2	91.5	89.3	86.1	[79.9]	[71.1]	105.8
10.5	Turbine ON (dBA)	15.1	19.2	22.5	25.8	29.0	32.4	34.8	37.2	39.2	38.8	40.3	42.6	40.9	40.5	44.8	42.4	44.7	45.7	45.9	45.8	44.9	44.0	43.2	41.6	39.3	36.3	31.9	23.8	55.8
	Background (dBA)	9.7	13.3	15.2	16.5	16.6	20.5	21.6	23.4	25.2	25.9	27.7	29.5	29.2	29.9	29.9	29.4	29.0	28.6	28.1	27.7	27.1	26.6	25.2	27.6	20.9	19.4	30.3	22.5	41.0
	Turbine ON - background adj (dBA)	13.6	17.9	21.6	25.3	28.7	32.1	34.6	37.0	39.1	38.5	40.1	42.4	40.6	40.1	44.6	42.2	44.6	45.7	45.8	45.8	44.8	44.0	43.1	41.4	39.2	36.2	[28.9]	[20.8]	55.6
	Signal to noise (dB)	5.4	5.9	7.3	9.3	12.3	11.9	13.2	13.8	14.1	12.9	12.6	13.2	11.7	10.6	14.9	13.0	15.7	17.2	17.8	18.1	17.8	17.5	18.0	14.0	18.4	16.8	1.6	1.3	14.8
	Uncertainty (dB)	1.6	1.5	1.1	0.9	0.9	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	2.2	3.2	0.7
	PWL (dBA)	63.9	68.2	71.9	75.5	78.9	82.3	84.8	87.3	89.3	88.8	90.3	92.7	90.8	90.4	94.9	92.4	94.8	95.9	96.0	96.0	95.0	94.2	93.3	91.6	89.5	86.4	[79.2]	[71]	105.9
11.0	Turbine ON (dBA)	15.2	20.0	23.0	26.1	29.6	32.6	35.0	37.3	39.6	39.0	40.4	42.5	40.7	40.2	45.2	42.4	44.6	45.8	46.0	45.9	45.0	44.2	43.3	41.7	39.4	36.4	32.4	24.3	55.9
	Background (dBA)	11.1	16.0	16.3	17.9	18.0	20.6	22.0	24.5	26.1	27.0	28.4	29.8	29.4	29.6	30.0	29.0	28.7	28.0	27.8	27.4	26.7	26.3	25.1	27.8	21.3	19.2	30.4	23.1	41.1
	Turbine ON - background adj (dBA)	13.0	17.9	22.0	25.3	29.3	32.3	34.7	37.1	39.4	38.7	40.2	42.2	40.4	39.9	45.1	42.2	44.5	45.8	45.9	45.9	44.9	44.1	43.2	41.5	39.4	36.3	[29.4]	[21.3]	55.7
	Signal to noise (dB)	4.1	4.1	6.7	8.2	11.6	12.0	12.9	12.9	13.4	12.0	12.0	12.7	11.3	10.6	15.2	13.4	15.9	17.9	18.1	18.6	18.3	17.9	18.2	13.9	18.2	17.2	2.0	1.2	14.8
	Uncertainty (dB)	2.0	2.1	1.1	0.9	0.8	0.8	0.7	0.7	0.7	0.8	0.6	0.6	0.7	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	2.0	2.9	0.7
	PWL (dBA)	63.3	68.1	72.2	75.6	79.5	82.6	85.0	87.3	89.6	89.0	90.4	92.5	90.6	90.1	95.3	92.4	94.8	96.0	96.1	96.1	95.2	94.3	93.4	91.7	89.6	86.6	[79.7]	[71.5]	106.0

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

Project: Grand Renewables Wind Farm - Turbine T63 - IEC 61400-11 Measurement

Report ID: 14284.00.T63.RP5

Created on: 2/28/2018

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	
11.5	Turbine ON (dBA)	16.1	20.0	23.0	25.9	29.1	32.4	34.8	36.9	39.4	38.7	40.3	42.3	40.6	40.0	45.0	42.3	44.6	45.9	45.9	45.9	45.0	44.2	43.3	41.8	39.5	36.5	32.9	24.8	55.8
	Background (dBA)	13.8	16.3	17.7	19.5	19.2	22.1	22.7	24.4	26.2	26.7	28.2	29.8	29.9	29.8	30.4	29.7	29.1	28.4	27.8	27.6	26.8	26.4	25.3	28.7	22.0	20.3	32.1	24.2	41.5
	Turbine ON - background adj (dBA)	[13.1]	17.6	21.4	24.8	28.6	32.0	34.5	36.6	39.1	38.4	40.0	42.1	40.2	39.6	44.9	42.0	44.5	45.8	45.9	45.9	45.0	44.2	43.3	41.6	39.4	36.4	[29.9]	[21.8]	55.7
	Signal to noise (dB)	2.3	3.7	5.2	6.5	9.8	10.3	12.1	12.4	13.2	12.0	12.1	12.6	10.7	10.2	14.6	12.5	15.5	17.5	18.2	18.4	18.2	17.9	18.0	13.1	17.5	16.2	0.8	0.6	14.3
	Uncertainty (dB)	2.9	2.3	1.4	1.1	0.9	0.9	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.7	0.7	0.8	0.8	0.8	2.1	3.1	0.7
	PWL (dBA)	[63.4]	67.8	71.7	75.1	78.8	82.2	84.8	86.9	89.4	88.6	90.2	92.3	90.4	89.8	95.1	92.2	94.7	96.1	96.1	96.1	95.2	94.4	93.5	91.8	89.7	86.6	[80.2]	[72.1]	105.9
12.0	Turbine ON (dBA)	16.8	20.6	23.2	26.2	29.0	32.4	34.8	37.0	39.1	38.7	40.2	42.3	40.5	40.0	45.3	42.3	44.6	45.9	45.9	45.9	45.0	44.2	43.3	41.7	39.5	36.4	33.1	24.8	55.8
	Background (dBA)	10.0	13.1	15.7	16.8	16.9	20.3	21.6	23.2	24.0	27.1	27.4	28.4	28.2	29.6	29.9	29.2	29.1	28.5	27.9	27.4	26.6	26.1	24.8	27.6	21.2	19.4	31.4	23.4	40.9
	Turbine ON - background adj (dBA)	15.7	19.8	22.3	25.7	28.7	32.2	34.6	36.8	39.0	38.4	40.0	42.1	40.2	39.6	45.2	42.1	44.5	45.8	45.9	45.8	44.9	44.1	43.2	41.6	39.4	36.3	[30.1]	[21.8]	55.7
	Signal to noise (dB)	6.7	7.6	7.5	9.5	12.1	12.1	13.2	13.8	15.1	11.6	12.8	14.0	12.3	10.4	15.4	13.1	15.5	17.4	18.1	18.5	18.4	18.1	18.5	14.1	18.3	17.1	1.6	1.3	14.9
	Uncertainty (dB)	1.5	1.3	1.1	1.0	0.9	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	3.0	3.4	0.7
	PWL (dBA)	65.9	70.0	72.6	75.9	79.0	82.4	84.8	87.1	89.2	88.7	90.2	92.4	90.5	89.9	95.4	92.3	94.7	96.0	96.1	96.1	95.2	94.3	93.4	91.8	89.6	86.6	[80.3]	[72]	105.9
12.5	Turbine ON (dBA)	17.4	21.2	23.7	26.5	29.1	32.7	34.9	36.8	39.2	38.8	40.1	42.1	40.3	39.9	45.3	42.1	44.5	45.8	45.9	45.9	45.0	44.2	43.2	41.7	39.4	36.4	32.6	24.5	55.8
	Background (dBA)	12.4	14.8	19.2	19.9	19.3	22.8	22.4	24.6	25.8	26.6	29.0	30.2	29.5	29.8	30.4	29.2	29.2	28.9	28.4	28.4	27.8	27.4	25.9	28.7	21.4	19.3	30.3	22.6	41.5
	Turbine ON - background adj (dBA)	15.8	20.1	21.8	25.4	28.6	32.2	34.6	36.5	38.9	38.5	39.8	41.8	39.9	39.4	45.2	41.9	44.4	45.7	45.8	45.9	44.9	44.1	43.2	41.5	39.4	36.3	[29.6]	[21.5]	55.6
	Signal to noise (dB)	5.0	6.4	4.5	6.5	9.8	9.9	12.5	12.2	13.3	12.2	11.1	12.0	10.8	10.1	14.9	12.9	15.3	16.9	17.4	17.5	17.2	16.8	17.3	13.0	18.1	17.2	2.3	1.9	14.3
	Uncertainty (dB)	2.3	1.7	2.3	1.3	0.9	0.9	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	2.7	3.3	0.7
	PWL (dBA)	66.0	70.3	72.0	75.6	78.8	82.4	84.8	86.7	89.2	88.8	90.0	92.1	90.2	89.7	95.4	92.1	94.6	96.0	96.0	96.1	95.2	94.3	93.4	91.7	89.6	86.6	[79.8]	[71.8]	105.8

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

Project: Grand Renewable Wind Farm - Turbine T63 - IEC 61400-11 Measurement

Report ID: 14284.00.T63.RP5

Created on: 2/28/2018

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

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

Wind Bin (m/s)	Parameter	1/3 Octave Band (Hz)																														Overall
		20	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	
5.0	Turbine ON (dBA)	7.3	11.4	15.5	19.1	22.4	27.7	29.1	32.3	34.1	34.6	36.0	38.0	37.7	38.3	39.4	39.7	40.2	41.4	41.4	41.0	40.1	39.8	39.4	38.7	34.2	30.6	26.9	19.3	51.5
	Background (dBA)	6.4	8.6	10.6	12.1	13.5	17.5	18.6	20.6	22.3	23.4	25.1	27.3	27.5	27.8	28.8	28.8	28.3	27.7	26.8	26.3	25.7	25.1	23.7	23.9	18.7	16.8	25.7	18.5	39.1
	Turbine ON - background adj (dBA)	[4.3]	[8.4]	13.9	18.1	21.9	27.2	28.6	31.9	33.8	34.2	35.6	37.6	37.3	37.9	39.0	39.3	40.0	41.2	41.2	40.8	39.9	39.7	39.3	38.6	34.1	30.5	[23.9]	[16.3]	51.2
	Signal to noise (dB)	1.0	2.7	5.0	7.0	9.0	10.2	10.4	11.6	11.7	11.2	10.9	10.6	10.2	10.4	10.7	10.9	12.0	13.7	14.5	14.6	14.4	14.7	15.7	14.9	15.5	13.8	1.2	0.9	12.4
	Uncertainty (dB)	2.2	2.2	1.2	1.0	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	0.7	0.7	0.8	0.8	1.8	3.0	0.7
	PWL (dBA)	[54.6]	[58.6]	64.1	68.3	72.1	77.5	78.9	82.2	84.0	84.5	85.8	87.8	87.5	88.1	89.3	89.6	90.2	91.5	91.4	91.0	90.1	89.9	89.5	88.8	84.3	80.7	[74.1]	[66.6]	101.5
6.0	Turbine ON (dBA)	12.4	16.4	20.1	23.5	26.9	30.8	33.0	35.2	37.9	37.9	39.2	41.3	40.5	40.5	44.4	42.5	43.7	45.0	44.9	44.6	43.7	43.1	42.2	40.6	37.9	34.6	31.1	22.7	54.9
	Background (dBA)	9.2	11.9	14.1	15.8	16.7	20.0	20.6	22.7	24.6	25.2	26.8	28.7	29.0	29.4	30.4	29.6	29.1	28.7	28.1	27.8	27.3	26.7	25.3	25.9	20.2	18.0	27.4	19.9	40.6
	Turbine ON - background adj (dBA)	9.5	14.4	18.9	22.7	26.5	30.4	32.7	35.0	37.7	37.6	38.9	41.1	40.1	40.1	44.3	42.2	43.6	44.9	44.8	44.5	43.6	43.0	42.2	40.5	37.8	34.5	28.7	[19.7]	54.7
	Signal to noise (dB)	3.2	4.4	6.1	7.7	10.2	10.8	12.4	12.5	13.3	12.7	12.4	12.6	11.4	11.1	14.0	12.9	14.6	16.3	16.8	16.8	16.4	16.4	16.9	14.7	17.7	16.6	3.7	2.8	14.3
	Uncertainty (dB)	2.2	1.7	1.1	1.0	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	1.5	3.1	0.7
	PWL (dBA)	59.8	64.7	69.1	72.9	76.7	80.6	83.0	85.2	88.0	87.9	89.2	91.3	90.4	90.3	94.5	92.5	93.8	95.1	95.0	94.8	93.8	93.3	92.4	90.7	88.1	84.7	79.0	[69.9]	104.9
7.0	Turbine ON (dBA)	15.5	19.4	22.8	25.8	28.9	32.4	34.7	37.0	39.3	38.7	40.3	42.6	40.9	40.5	45.1	42.4	44.5	45.6	45.7	45.6	44.6	43.9	43.0	41.4	39.1	36.0	32.3	23.8	55.6
	Background (dBA)	11.0	14.1	15.9	17.8	18.0	21.1	22.1	24.2	25.6	26.8	28.2	29.7	29.7	30.0	30.4	29.8	29.3	28.7	28.1	27.8	27.1	26.6	25.1	27.1	20.7	19.0	29.7	22.0	41.2
	Turbine ON - background adj (dBA)	13.6	17.9	21.8	25.0	28.5	32.0	34.5	36.7	39.1	38.4	40.0	42.3	40.5	40.1	44.9	42.2	44.4	45.5	45.6	45.5	44.6	43.8	42.9	41.2	39.0	35.9	[29.3]	[20.8]	55.5
	Signal to noise (dB)	4.5	5.4	6.9	8.0	10.9	11.3	12.6	12.7	13.7	11.9	12.0	12.9	11.2	10.5	14.7	12.6	15.2	16.9	17.6	17.8	17.5	17.3	17.8	14.2	18.3	17.0	2.6	1.8	14.5
	Uncertainty (dB)	1.6	1.4	1.0	0.9	0.8	0.8	0.8	0.8	0.7	0.8	0.7	0.6	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.7	1.8	2.9	0.7
	PWL (dBA)	63.9	68.2	72.0	75.3	78.8	82.3	84.7	87.0	89.3	88.7	90.2	92.6	90.7	90.3	95.2	92.4	94.6	95.7	95.8	95.7	94.8	94.0	93.1	91.4	89.2	86.2	[79.6]	[71.1]	105.7
8.0	Turbine ON (dBA)	16.0	20.0	22.9	26.0	29.1	32.4	34.8	37.0	39.3	38.8	40.3	42.4	40.6	40.1	45.2	42.3	44.6	45.9	45.9	45.9	45.0	44.2	43.3	41.7	39.5	36.5	32.8	24.6	55.8
	Background (dBA)	12.0	15.7	16.6	18.2	18.2	21.0	22.2	24.3	25.8	27.0	28.2	29.6	29.4	29.7	30.1	29.2	28.9	28.1	27.8	27.4	26.7	26.2	25.1	28.0	21.5	19.6	31.1	23.5	41.2
	Turbine ON - background adj (dBA)	13.8	18.0	21.8	25.2	28.7	32.1	34.6	36.8	39.1	38.5	40.0	42.1	40.3	39.7	45.1	42.1	44.5	45.8	45.9	45.8	44.9	44.1	43.2	41.5	39.4	36.4	[29.8]	[21.6]	55.7
	Signal to noise (dB)	4.1	4.3	6.3	7.7	10.9	11.5	12.7	12.8	13.5	11.8	12.1	12.8	11.2	10.4	15.1	13.1	15.7	17.7	18.1	18.5	18.3	18.0	18.2	13.7	18.0	16.9	1.6	1.1	14.7
	Uncertainty (dB)	1.9	1.7	1.1	1.0	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	1.9	3.1	0.7
	PWL (dBA)	64.1	68.3	72.0	75.4	79.0	82.4	84.8	87.0	89.4	88.7	90.2	92.4	90.5	89.9	95.3	92.3	94.7	96.0	96.1	96.1	95.2	94.4	93.5	91.8	89.6	86.6	[80]	[71.8]	105.9
9.0	Turbine ON (dBA)	16.8	20.7	23.5	26.4	29.3	32.6	34.9	36.9	39.2	38.8	40.1	42.1	40.3	39.7	45.3	42.0	44.3	45.7	45.8	45.8	44.9	44.1	43.1	41.6	39.4	36.3	32.8	24.7	55.7
	Background (dBA)	11.7	14.7	17.7	18.5	18.3	21.5	22.0	24.1	25.4	27.1	27.9	29.0	28.4	28.1	29.1	27.9	27.8	27.3	26.8	26.6	26.1	25.7	24.6	29.2	21.1	19.2	30.7	23.4	40.6
	Turbine ON - background adj (dBA)	15.2	19.4	22.2	25.6	28.9	32.3	34.6	36.7	39.0	38.5	39.8	41.9	40.0	39.4	45.2	41.8	44.2	45.6	45.7	45.8	44.8	44.0	43.1	41.4	39.3	36.3	[29.8]	[21.7]	55.6
	Signal to noise (dB)	5.1	6.0	5.8	7.8	11.0	11.1	12.9	12.8	13.8	11.7	12.2	13.1	11.8	11.6	16.2	14.0	16.5	18.4	19.0	19.2	18.8	18.4	18.6	12.5	18.3	17.1	2.1	1.4	15.1
	Uncertainty (dB)	1.8	1.5	1.3	1.0	0.9	0.9	0.8	0.8	0.8	0.9	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	2.1	3.3	0.7
	PWL (dBA)	65.4	69.7	72.4	75.8	79.1	82.5	84.9	86.9	89.3	88.7	90.1	92.1	90.2	89.7	95.4	92.0	94.5	95.9	96.0	96.0	95.1	94.3	93.3	91.6	89.5	86.5	[80.1]	[72]	105.8

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 measruement uncertainty at hub height

Project: Grand Renewable Wind Farm - Turbine T63 - IEC 61400-11 Measurement

Report ID: 14284.00.T63.RP5

Created on: 2/28/2018

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	
7.5	Turbine ON	7.54	44	Average (dBA)	8.8	12.9	16.6	20.6	23.7	28.6	30.2	33.4	35.2	35.8	37.0	38.6	38.5	39.2	40.6	40.8	41.4	42.6	42.6	42.2	41.3	41.0	40.4	39.5	35.3	31.7	27.5	19.9	52.6
				Uncertainty A (dB)	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.2	0.2	0.3	0.2	0.2	0.1	0.1	0.3	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		
				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	0.8	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	7.50	39	Average (dBA)	8.7	10.3	12.1	13.1	14.1	16.7	19.0	20.8	22.4	23.7	25.2	27.4	27.7	27.8	28.4	28.5	28.0	27.5	26.5	26.0	25.3	24.6	23.3	23.7	18.7	16.9	26.4	19.0	39.0
				Uncertainty A (dB)	1.5	1.2	1.0	0.8	0.6	0.4	0.3	0.3	0.3	0.3	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.6	0.3	0.2	1.4	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)	1.8	1.6	1.3	1.1	1.0	0.9	0.9	0.9	0.9	0.8	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.9	1.0	0.9	0.8	1.6	1.6		
8.0	Turbine ON	7.96	56	Average (dBA)	9.7	13.9	18.1	21.4	24.7	29.2	31.2	33.7	36.1	36.6	37.9	39.8	39.5	40.3	42.2	41.7	42.5	43.6	43.6	43.2	42.3	41.9	41.2	39.9	36.4	32.8	28.8	20.9	53.6
				Uncertainty A (dB)	0.5	0.5	0.5	0.4	0.5	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.1	0.1	0.2	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.2	0.2	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	1.1	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	7.99	54	Average (dBA)	9.1	13.2	14.8	16.6	16.7	19.8	20.7	22.9	25.0	25.6	27.3	29.0	29.4	29.4	30.9	29.7	29.1	28.6	28.0	27.7	27.1	26.6	25.3	26.1	20.1	18.1	28.0	20.5	40.7
				Uncertainty A (dB)	1.2	1.3	1.1	1.0	0.7	0.6	0.4	0.4	0.5	0.4	0.4	0.4	0.4	0.4	0.5	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.6	0.3	0.3	1.2	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)	1.6	1.6	1.4	1.3	1.0	1.0	0.9	0.9	0.9	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9	1.0	0.9	1.0	0.9	0.9	1.5	1.6		
8.5	Turbine ON	8.47	65	Average (dBA)	12.0	16.0	19.7	23.1	26.6	30.5	32.8	34.9	37.9	37.8	39.1	41.2	40.5	40.3	44.3	42.7	43.8	45.1	45.0	44.7	43.7	43.2	42.3	40.6	37.9	34.6	31.3	22.9	54.9
				Uncertainty A (dB)	0.5	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.2	0.1	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	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	1.1	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	0.9	1.5		
	Background	8.52	53	Average (dBA)	9.4	11.4	13.1	15.1	16.0	19.6	20.5	22.4	24.3	24.7	26.3	28.2	28.4	29.1	30.1	29.5	29.1	28.6	28.0	27.7	27.2	26.7	25.2	26.0	20.2	17.9	27.5	19.6	40.4
				Uncertainty A (dB)	1.2	1.1	0.9	0.8	0.6	0.6	0.4	0.3	0.4	0.3	0.3	0.3	0.3	0.4	0.4	0.3	0.3	0.4	0.4	0.4	0.5	0.4	0.4	0.5	0.3	0.3	1.2	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)	1.6	1.5	1.2	1.2	1.0	1.0	0.9	0.9	0.9	0.9	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.9	1.0	0.9	0.9	1.5	1.6		
9.0	Turbine ON	8.98	38	Average (dBA)	13.5	17.3	21.0	24.3	27.7	31.4	33.7	35.8	38.7	38.4	39.8	41.9	40.9	40.6	45.7	42.7	44.2	45.5	45.3	45.2	44.2	43.6	42.6	41.0	38.5	35.2	32.0	23.2	55.4
				Uncertainty A (dB)	0.7	0.6	0.5	0.6	0.5	0.3	0.4	0.3	0.2	0.2	0.2	0.2	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.4	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)	1.2	1.2	1.0	1.0	1.0	0.9	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	1.5		
	Background	9.00	55	Average (dBA)	8.5	10.5	13.6	15.1	16.8	19.8	20.2	22.4	24.3	24.9	26.6	28.7	28.8	29.2	29.9	29.4	28.9	28.4	27.9	27.7	27.1	26.4	24.9	25.2	19.7	17.5	26.7	19.4	40.3
				Uncertainty A (dB)	1.1	0.9	0.9	0.7	0.7	0.5	0.4	0.3	0.4	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.3	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.3	0.2	1.1	0.6		
				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)	1.5	1.4	1.2	1.1	1.0	1.0	0.9	0.9	0.9	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.9	1.0	0.9	0.8	1.4	1.6		
9.5	Turbine ON	9.53	47	Average (dBA)	15.6	19.4	22.8	25.8	28.9	32.4	34.7	36.9	39.3	38.8	40.4	42.6	41.0	40.6	45.2	42.4	44.4	45.4	45.5	45.4	44.5	43.7	42.9	41.2	38.9	35.9	32.3	23.7	55.6
				Uncertainty A (dB)	0.5	0.4	0.4	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.1		
				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	0.8	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		
	Background	9.51	69	Average (dBA)	12.1	15.1	16.9	19.3	19.0	21.9	22.9	25.3	26.5	28.1	29.1	30.4	30.6	30.6	31.3	30.6	29.8	29.1	28.6	28.4	27.8	27.1	25.6	27.2	21.0	19.1	29.0	21.8	41.8
				Uncertainty A (dB)	1.2	1.1	1.0	1.0	0.7	0.6	0.5	0.5	0.5	0.6	0.5	0.4	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.4	0.5	0.3	0.3	1.1	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)	1.5	1.5	1.3	1.3	1.1	1.0	1.0	1.0	0.9	1.0	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.9	0.9	0.8	0.9	1.3	1.6		
10.0	Turbine ON	9.96	11	Average (dBA)	14.2	18.2	22.0	25.4	28.4	32.1	34.3	36.8	39.3	38.6	40.0	42.5	40.8	40.5	45.4	42.6	44.5	45.8	45.7	45.6	44.7	43.9	43.0	41.4	39.1	35.9	32.7	23.8	55.7
				Uncertainty A (dB)	0.9	0.6	0.7	0.7	0.5	0.4	0.4	0.3	0.3	0.2	0.2	0.3	0.1	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	0.7	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)	1.3	1.2	1.1	1.0	0.9	0.9	0.9	0.9	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	1.1	1.5		
	Background	9.98	49	Average (dBA)	10.0	12.5	14.1	15.4	17.1	20.5	21.0	22.9	24.4	25.2	27.0	28.6	28.6	29.0	29.6	29.1	28.8	28.2	27.5	27.2	26.6	26.0	24.7	26.6	20.3	18.6	30.1	21.8	40.5
				Uncertainty A (dB)	1.1	1.0	0.9	0.7	0.6	0.6	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.5	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.4	0.4	0.5	0.3	0.3	1.3	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)	1.5	1.4	1.2	1.1	1.0	1.0	0.9	0.9	0.9	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.9	0.9	0.8	0.9	1.5	1.6		
10.5	Turbine ON	10.51	12	Average (dBA)	15.1	19.2	22.5	25.8	29.0	32.4	34.8	37.2	39.2	38.8	40.3	42.6	40.9	40.5	44.7	42.4	44.7	45.7	45.9	45.9	44.9	44.0	43.2	41.6	39.3	36.3	31.9	23.8	55.8
				Uncertainty A (dB)	0.5	0.3	0.4	0.2	0.2	0.1	0.2	0.2	0.2	0.1	0.2	0.1	0.1	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.3	0.2		
				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	0.8	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	0.9	1.5		
	Background	10.48	50	Average (dBA)	9.6	13.1	15.2	16.5	16.6	20.5	21.6	23.4	25.1	25.8	27.7	29.5	29.2	30.0	29.9	29.4	29.0	28.6	28.1	27.7	27.1	26.6	25.2	27.6	20.9	19.4	30.3	22.5	41.0
				Uncertainty A (dB)	1.1	1.1	1.0	0.9	0.6	0.6	0.5	0.4	0.5	0.5	0.4	0.4	0.4	0.5	0.4	0.5	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.3	0.3	1.2	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)	1.5	1.5	1.3	1.2	1.0	1.0	1.0	0.9	0.9	0.9	0.8	0.8	0.8	0.9	0.8	0.8	0.8	0.8	0.8	0.9	0.9	0.9	0.9	1.0	0.9	0.9	1.4	1.6		

Table C.04 Detailed measruement uncertainty at hub height

Project: Grand Renewable Wind Farm - Turbine T63 - IEC 61400-11 Measurement

Report ID: 14284.00.T63.RP5

Created on: 2/28/2018

Wind Bin (m/s)	Parameter	Average Wind Speed (m/s)	# of data points	Parameter	1/3 Octave Band (Hz)																													Overall
					20	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	
11.0	Turbine ON	11.09	14	Average (dBA)	15.2	20.2	23.1	26.1	29.7	32.6	35.0	37.3	39.6	39.1	40.4	42.5	40.7	40.2	45.3	42.3	44.6	45.9	46.0	45.9	45.0	44.2	43.3	41.7	39.5	36.4	32.5	24.4	55.9
				Uncertainty A (dB)	0.6	0.6	0.5	0.2	0.3	0.2	0.2	0.2	0.1	0.2	0.1	0.2	0.2	0.2	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.3	0.2	
				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	1.2	1.0	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.8	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	34	Average (dBA)	11.0	15.9	16.2	17.8	17.9	20.5	22.0	24.5	26.1	27.0	28.4	29.8	29.4	29.6	30.0	28.9	28.7	27.9	27.8	27.4	26.7	26.3	25.1	27.8	21.2	19.2	30.3	23.0	41.0
				Uncertainty A (dB)	1.4	1.7	1.3	1.2	0.9	0.7	0.6	0.6	0.7	0.7	0.6	0.5	0.5	0.6	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.3	0.3	1.2	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)	1.7	2.0	1.5	1.4	1.2	1.1	1.0	1.0	1.0	1.1	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1.0	0.9	0.9	0.9	0.9	1.4	1.6	
11.5	Turbine ON	11.54	23	Average (dBA)	16.2	20.0	23.0	25.9	29.0	32.4	34.8	36.8	39.3	38.6	40.2	42.3	40.6	40.0	45.0	42.2	44.6	45.9	45.9	45.9	45.0	44.3	43.3	41.8	39.5	36.5	33.0	24.9	55.8
				Uncertainty A (dB)	0.7	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.2	0.2	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	0.1	0.3	0.2	
				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	0.9	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	0.9	1.5	
	Background	11.47	18	Average (dBA)	14.1	16.5	17.9	19.7	19.4	22.3	22.8	24.5	26.3	26.6	28.3	29.9	30.0	29.9	30.5	29.8	29.1	28.4	27.8	27.6	26.9	26.4	25.4	28.8	22.1	20.4	32.1	24.2	41.6
				Uncertainty A (dB)	1.8	1.8	1.6	1.5	1.1	0.8	0.7	0.7	0.8	0.8	0.8	0.7	0.7	0.8	0.6	0.6	0.5	0.5	0.6	0.7	0.7	0.7	0.6	0.4	0.3	0.4	1.3	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)	2.1	2.1	1.7	1.7	1.4	1.1	1.1	1.1	1.1	1.1	1.0	1.0	1.0	1.0	0.9	0.9	0.8	0.9	0.9	1.0	1.0	1.0	1.0	0.9	0.9	0.9	1.5	1.6	
12.0	Turbine ON	12.03	22	Average (dBA)	16.8	20.7	23.2	26.2	29.0	32.5	34.8	37.0	39.1	38.7	40.2	42.3	40.5	40.0	45.3	42.3	44.6	45.9	45.9	45.9	45.0	44.2	43.3	41.7	39.5	36.4	33.1	24.8	55.8
				Uncertainty A (dB)	0.6	0.5	0.4	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.3	0.2	
				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	0.9	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	0.9	1.5	
	Background	11.89	11	Average (dBA)	9.5	12.7	14.9	16.1	16.4	19.8	21.4	22.9	23.6	27.2	27.0	28.0	27.9	29.6	29.8	29.2	29.1	28.4	27.7	27.1	26.3	25.8	24.5	27.4	21.1	19.4	31.7	23.6	40.8
				Uncertainty A (dB)	2.0	1.9	1.8	1.6	1.3	1.3	1.1	0.9	0.9	1.5	1.0	0.8	0.9	1.5	1.2	1.4	1.3	1.3	1.2	1.2	1.1	1.0	0.9	0.8	0.6	0.8	2.8	1.8	
				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)	2.3	2.1	2.0	1.8	1.5	1.5	1.3	1.2	1.2	1.7	1.2	1.1	1.1	1.6	1.4	1.5	1.5	1.5	1.4	1.4	1.3	1.3	1.2	1.1	1.0	1.1	2.9	2.3	
12.5	Turbine ON	12.54	20	Average (dBA)	17.5	21.2	23.7	26.5	29.1	32.7	34.9	36.8	39.2	38.8	40.1	42.1	40.3	39.8	45.4	42.1	44.5	45.8	45.9	45.9	45.0	44.2	43.2	41.7	39.4	36.4	32.5	24.5	55.8
				Uncertainty A (dB)	0.9	0.6	0.6	0.4	0.3	0.2	0.3	0.2	0.2	0.2	0.2	0.1	0.1	0.2	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.3	0.2	
				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)	1.3	1.2	1.0	0.9	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	1.5	
	Background	12.52	12	Average (dBA)	12.5	14.8	19.4	20.1	19.4	22.9	22.4	24.7	25.9	26.6	29.1	30.2	29.6	29.8	30.4	29.2	29.2	28.9	28.5	28.5	27.9	27.4	26.0	28.7	21.4	19.3	30.2	22.6	41.5
				Uncertainty A (dB)	3.2	3.0	3.4	2.9	1.9	1.4	1.1	1.1	0.9	1.1	1.1	0.9	0.8	1.0	1.0	1.0	1.0	1.2	1.1	1.2	1.2	1.1	0.9	0.8	0.5	0.5	2.2	1.3	
				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)	3.4	3.2	3.5	3.0	2.1	1.6	1.4	1.4	1.2	1.3	1.3	1.2	1.1	1.2	1.2	1.2	1.2	1.4	1.3	1.4	1.4	1.4	1.2	1.1	0.9	1.0	2.3	2.0	

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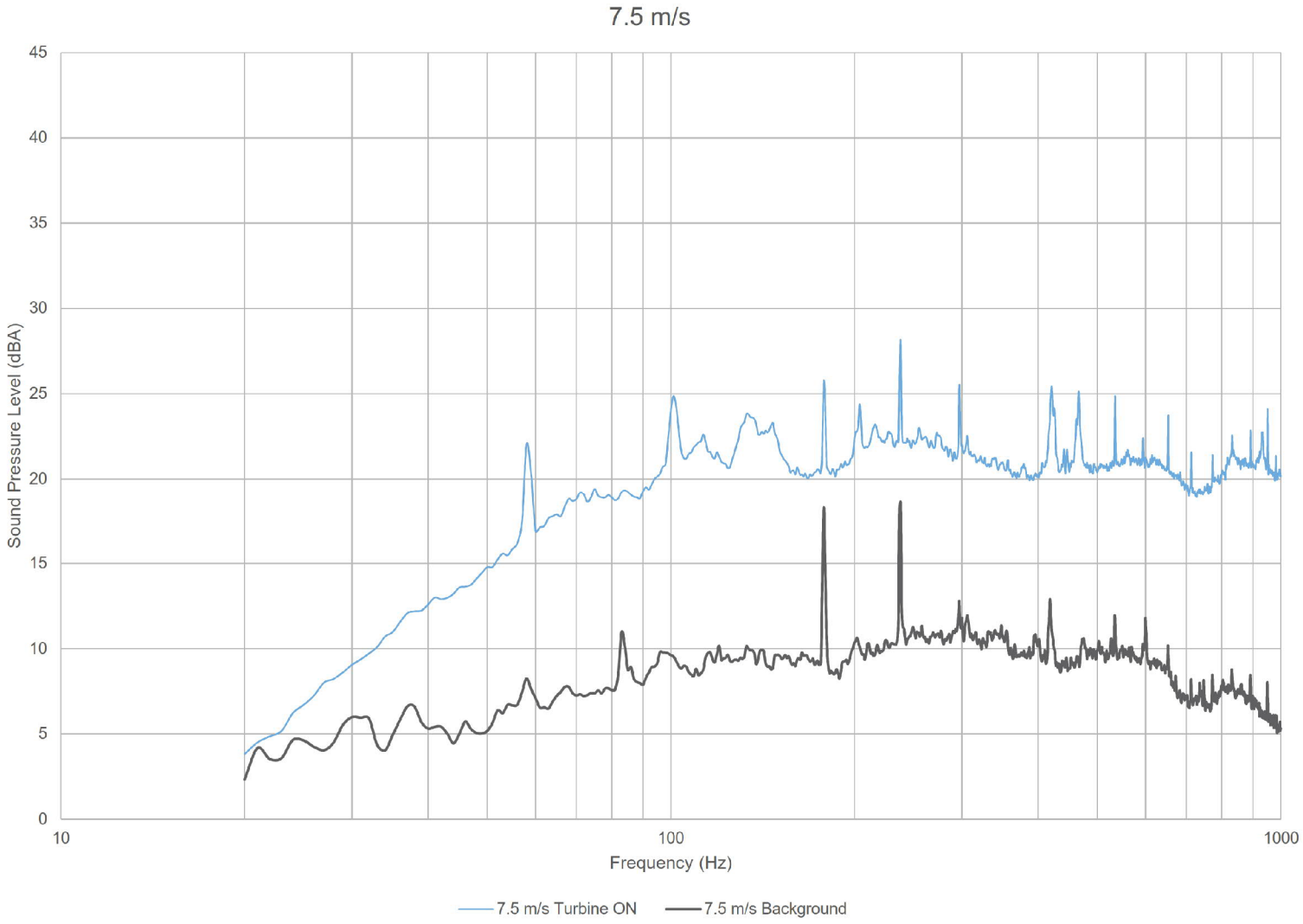
Appendix D
Tonality Assessment

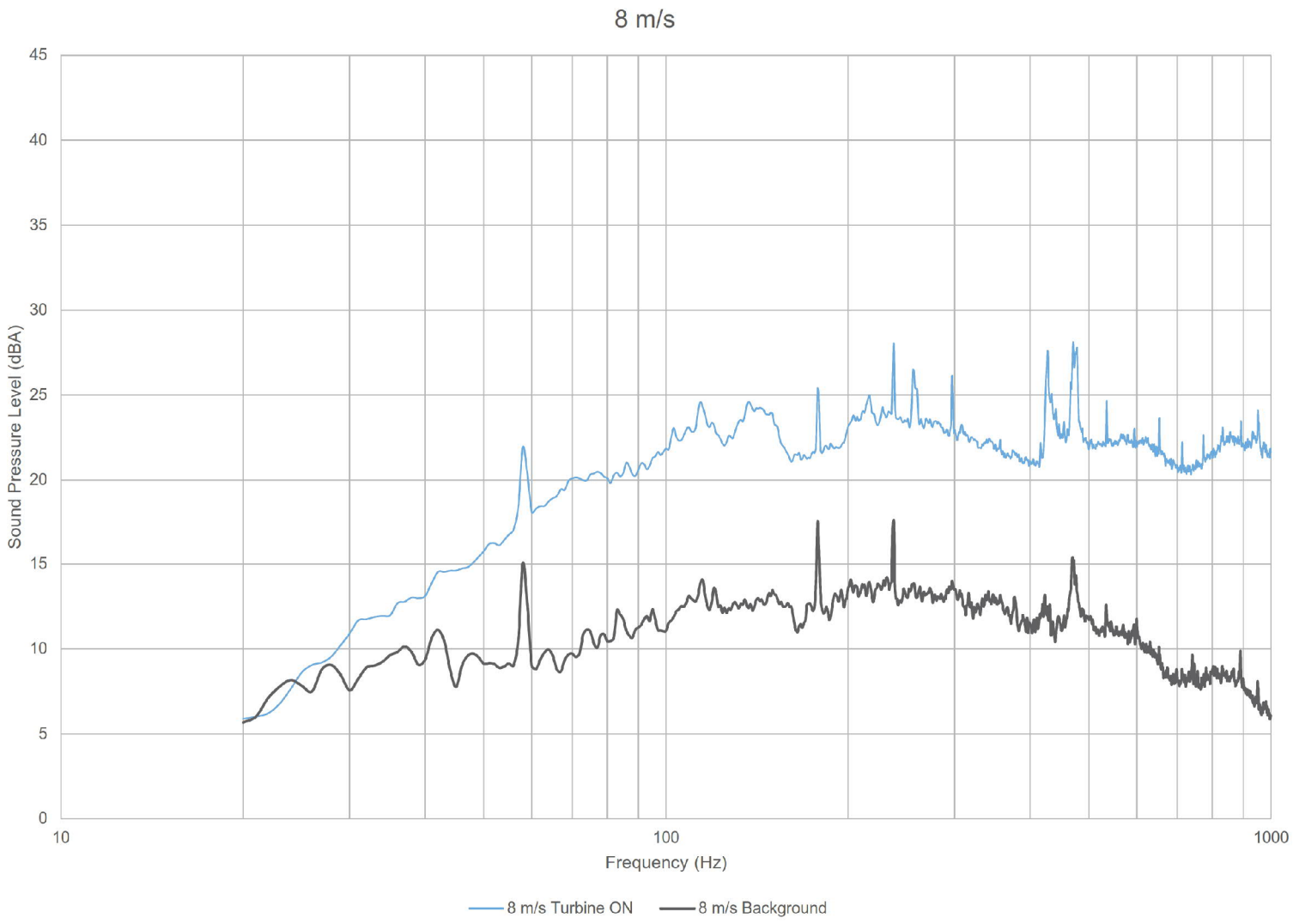
ilac-MRA

SCC Accredited
CB-P/S
OCPS
Accrédité CCN

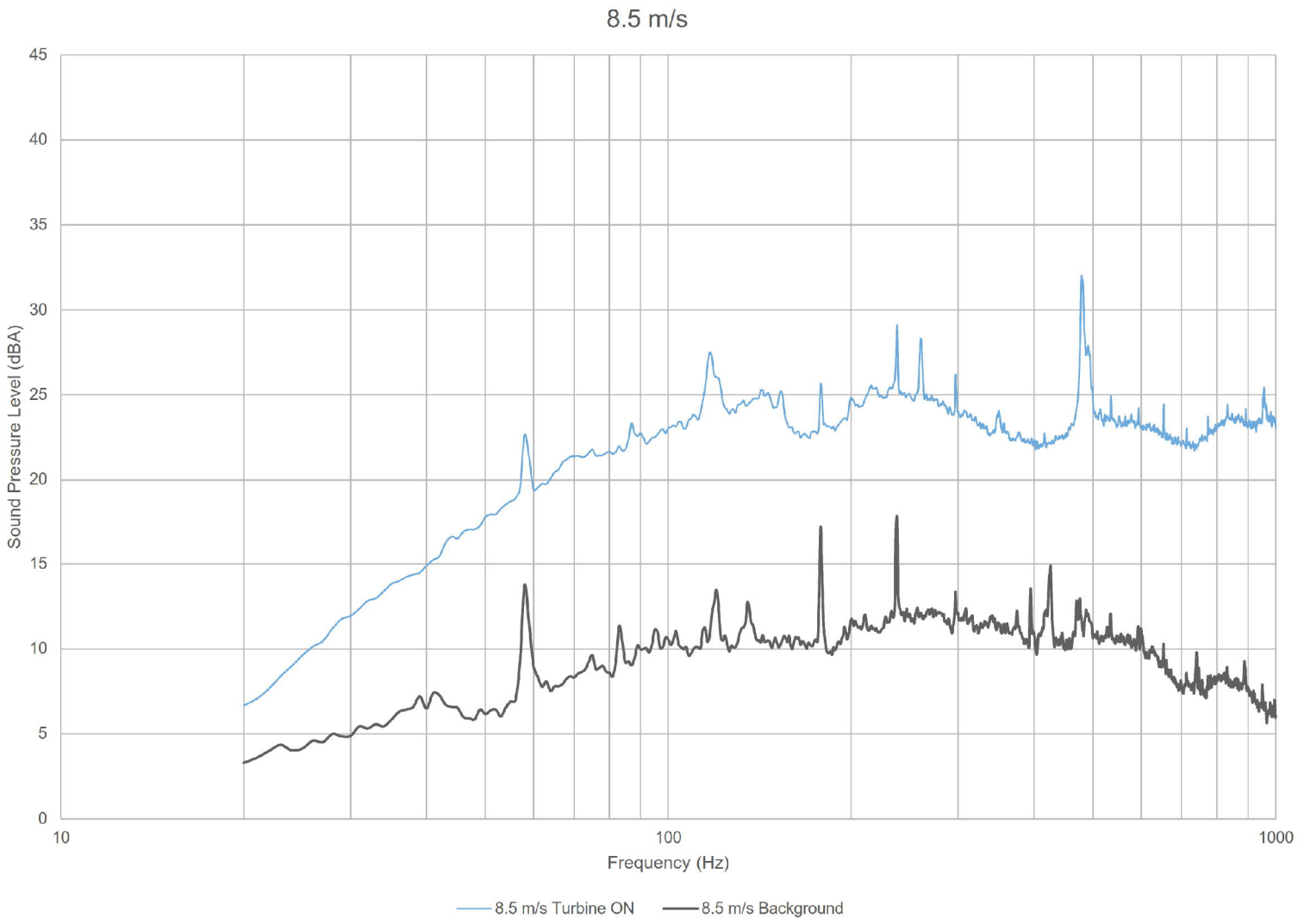


aercoustics	Project ID: 14284.00.T63.RP5 Scale: NTS Drawn by: AM Reviewed by: PA Date: Feb, 28 2018 Revision: 1	**Project Name** Grand Renwable Wind Farm - Turbine T63 - IEC 61400-11 Edition 3.0 **Figure Title** Plot of narrow band spectra – Turbine ON vs. Background at 7.5 m/s

Figure D.01

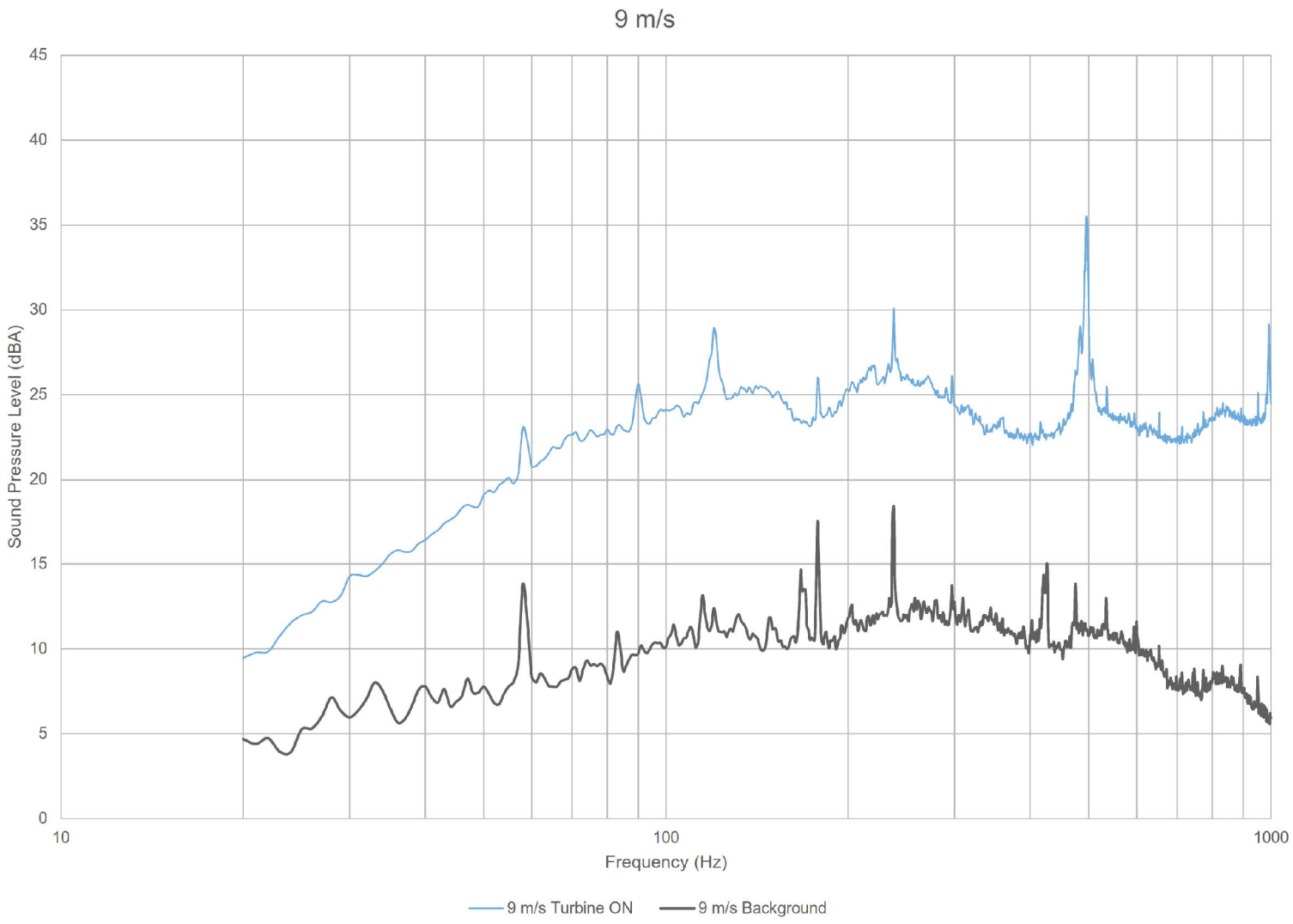


aercoustics	Project ID: 14284.00.T63.RP5	**Project Name**
	Scale: NTS Drawn by: AM Reviewed by: PA Date: Feb, 28 2018 Revision: 1	Grand Renwable Wind Farm - Turbine T63 - IEC 61400-11 Edition 3.0
		Figure Title Plot of narrow band spectra – Turbine ON vs. Background at 8 m/s
		Figure D.02



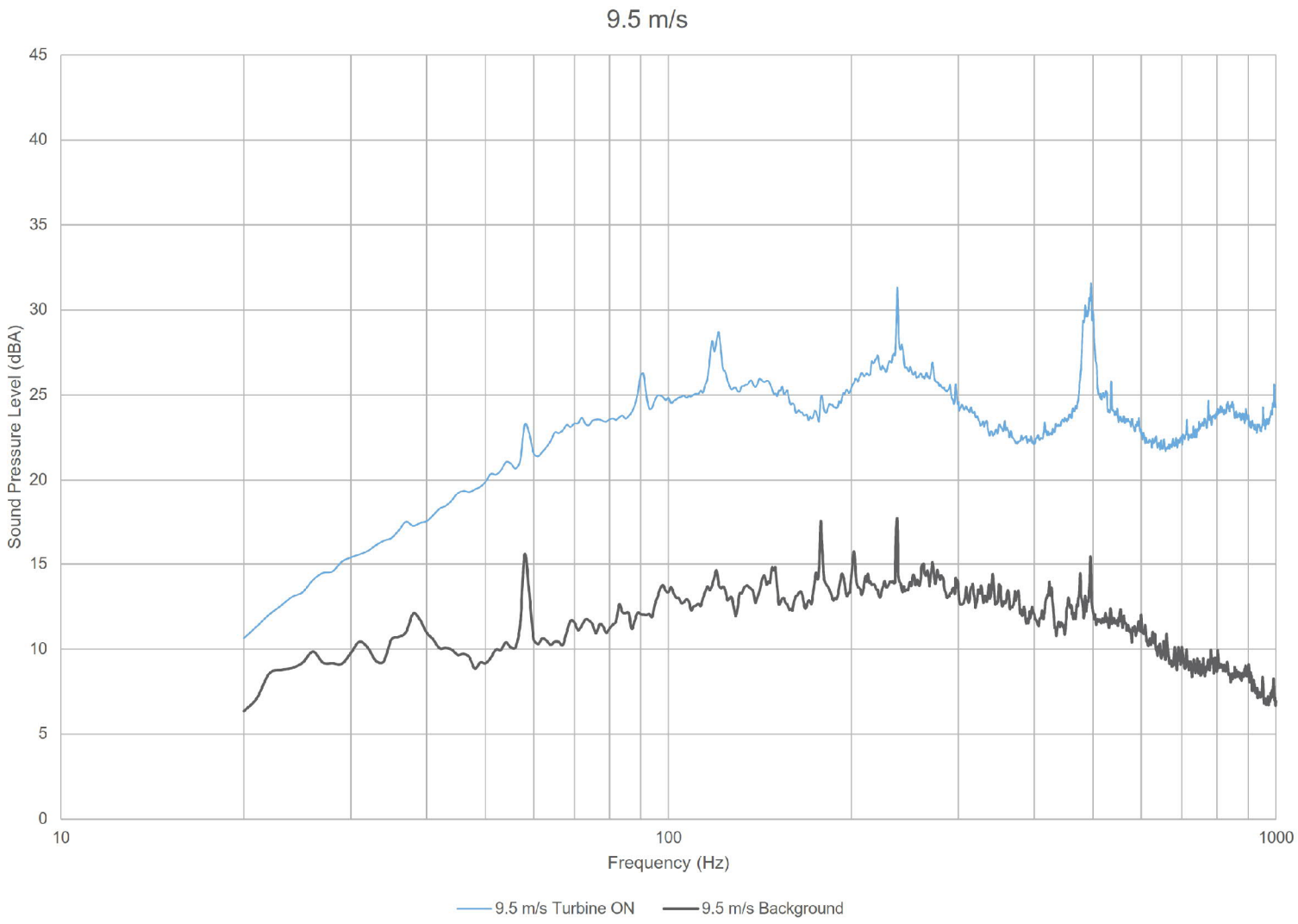
aercoustics	Project ID: 14284.00.T63.RP5 Scale: NTS Drawn by: AM Reviewed by: PA Date: Feb, 28 2018 Revision: 1	**Project Name** Grand Renwable Wind Farm - Turbine T63 - IEC 61400-11 Edition 3.0 **Figure Title** Plot of narrow band spectra – Turbine ON vs. Background at 8.5 m/s

Figure D.03



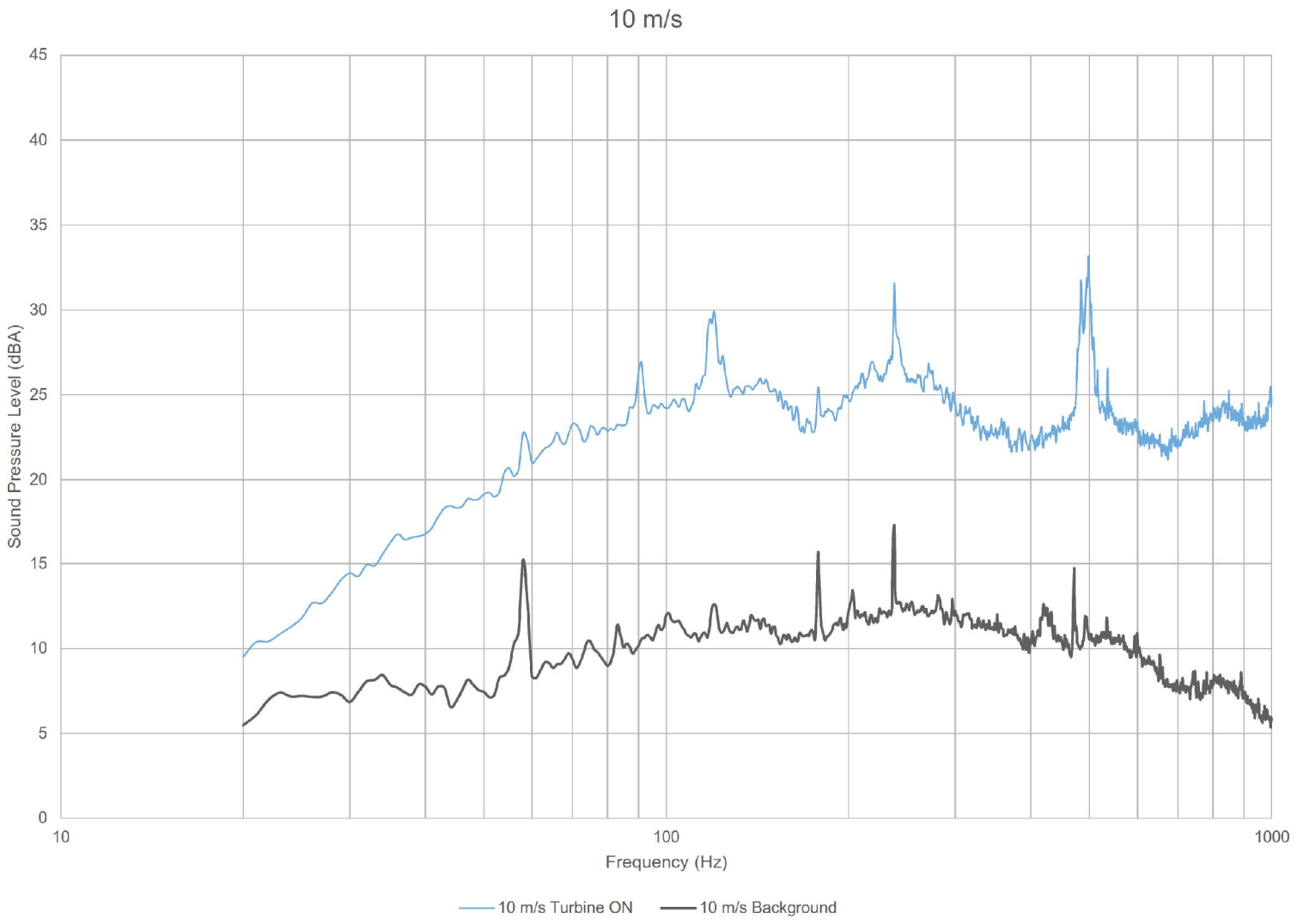
aercoustics	Project ID: 14284.00.T63.RP5 Scale: NTS Drawn by: AM Reviewed by: PA Date: Feb, 28 2018 Revision: 1	**Project Name** Grand Renwable Wind Farm - Turbine T63 - IEC 61400-11 Edition 3.0 **Figure Title** Plot of narrow band spectra – Turbine ON vs. Background at 9 m/s

Figure D.04



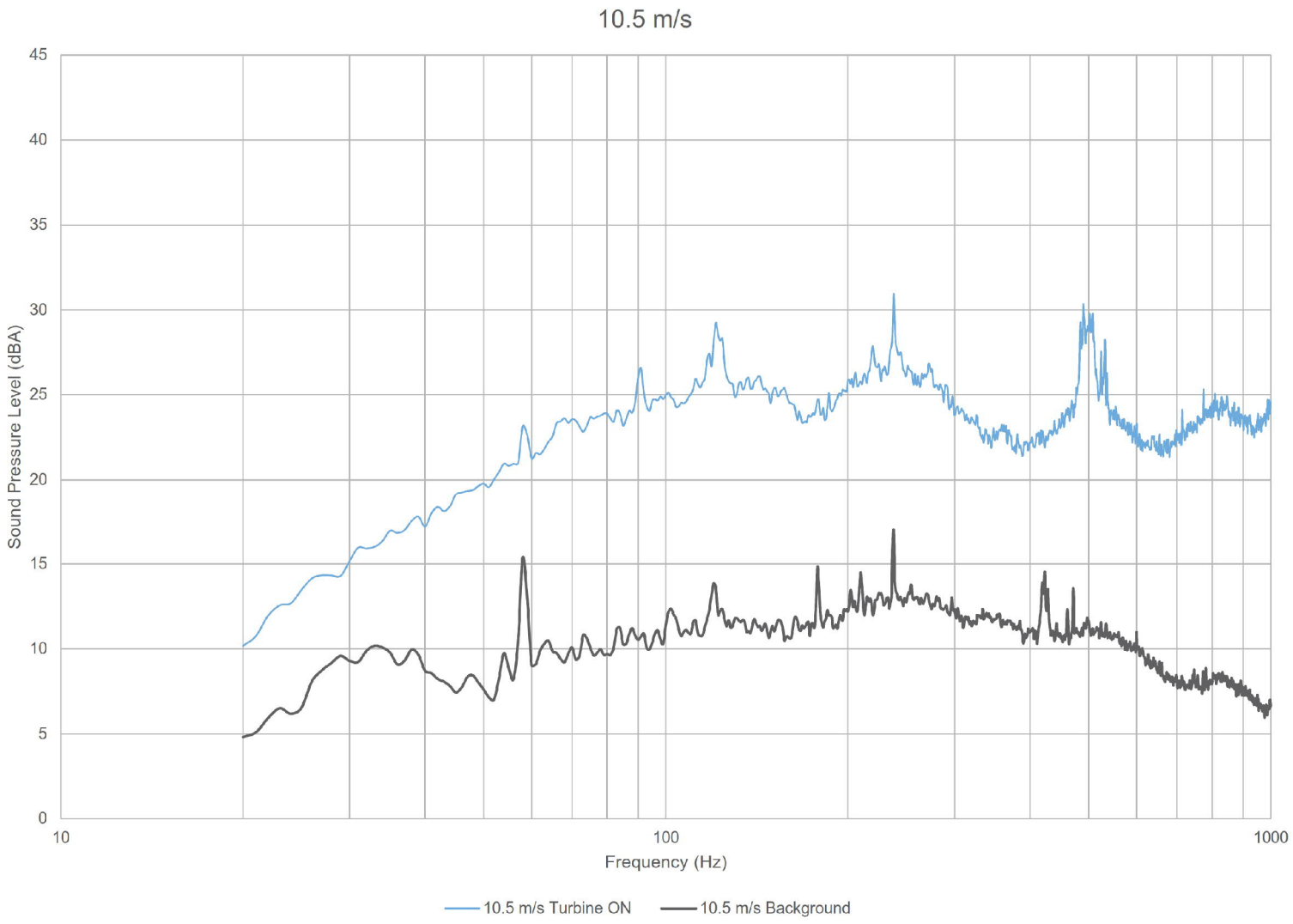
aercoustics	Project ID: 14284.00.T63.RP5 Scale: NTS Drawn by: AM Reviewed by: PA Date: Feb, 28 2018 Revision: 1	**Project Name** Grand Renwable Wind Farm - Turbine T63 - IEC 61400-11 Edition 3.0 **Figure Title** Plot of narrow band spectra – Turbine ON vs. Background at 9.5 m/s

Figure D.05



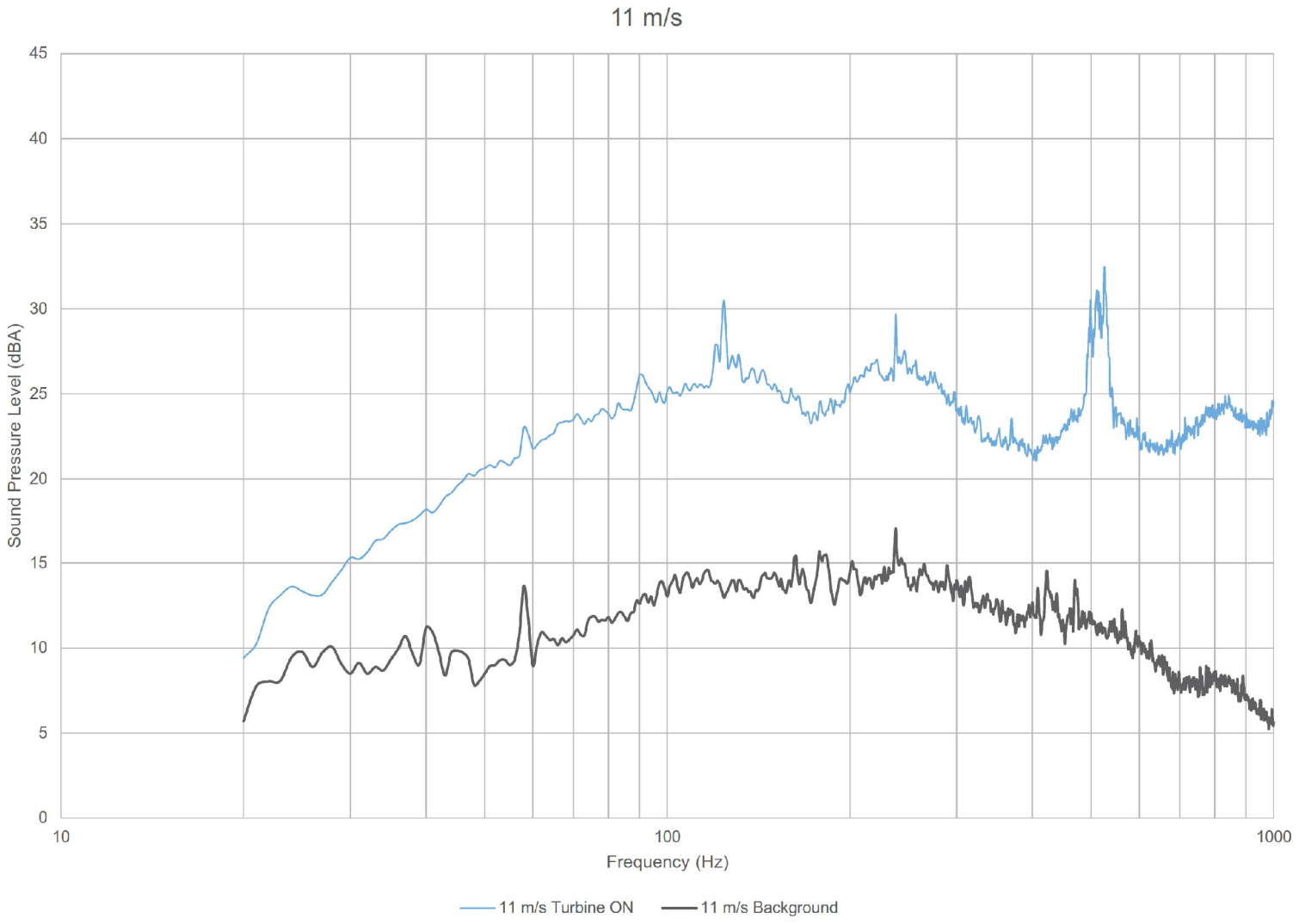
aercoustics	Project ID: 14284.00.T63.RP5 Scale: NTS Drawn by: AM Reviewed by: PA Date: Feb, 28 2018 Revision: 1	**Project Name** Grand Renwable Wind Farm - Turbine T63 - IEC 61400-11 Edition 3.0 **Figure Title** Plot of narrow band spectra – Turbine ON vs. Background at 10 m/s

Figure D.06



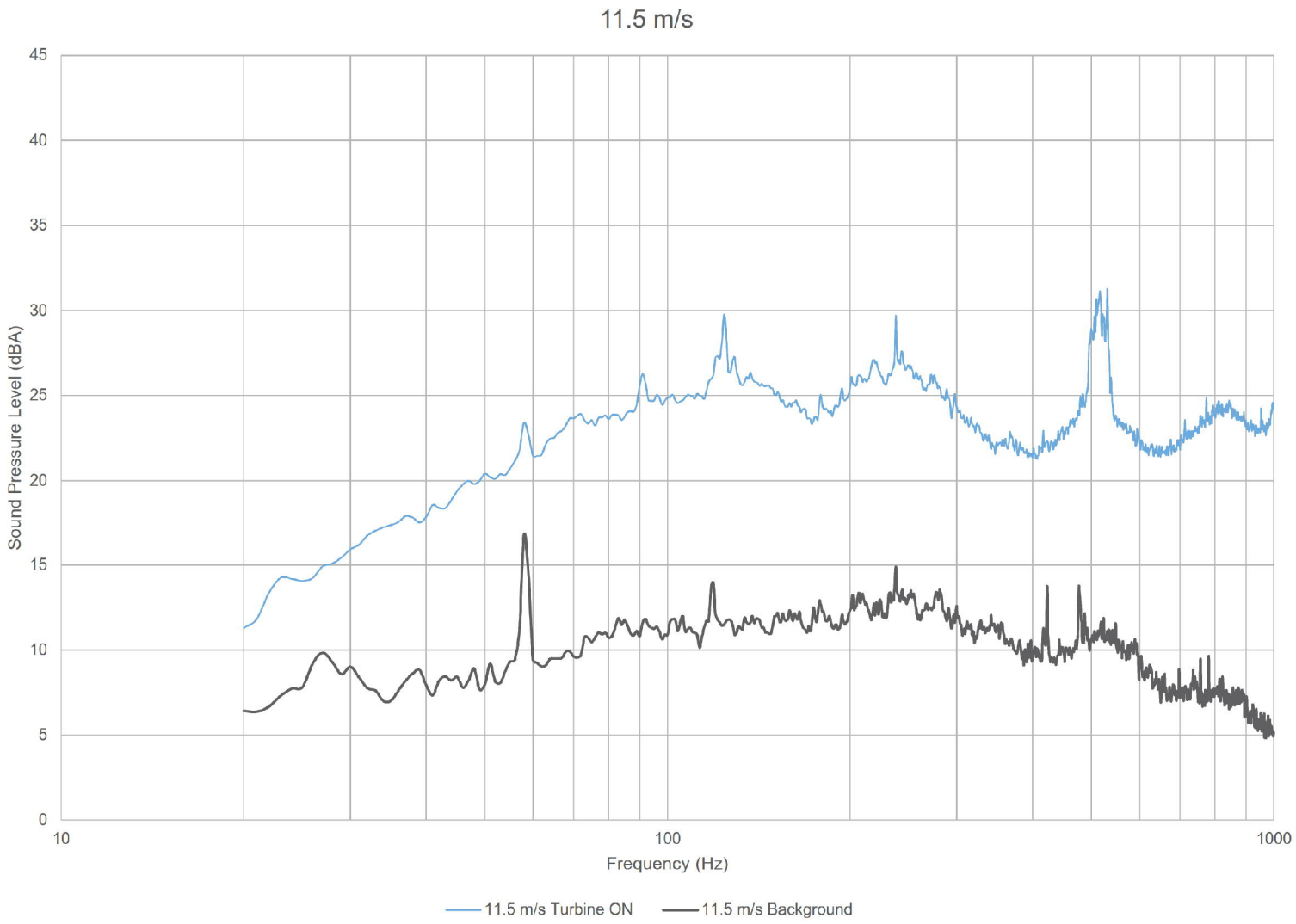
aercoustics	Project ID: 14284.00.T63.RP5 Scale: NTS Drawn by: AM Reviewed by: PA Date: Feb, 28 2018 Revision: 1	**Project Name** Grand Renwable Wind Farm - Turbine T63 - IEC 61400-11 Edition 3.0 **Figure Title** Plot of narrow band spectra – Turbine ON vs. Background at 10.5 m/s

Figure D.07



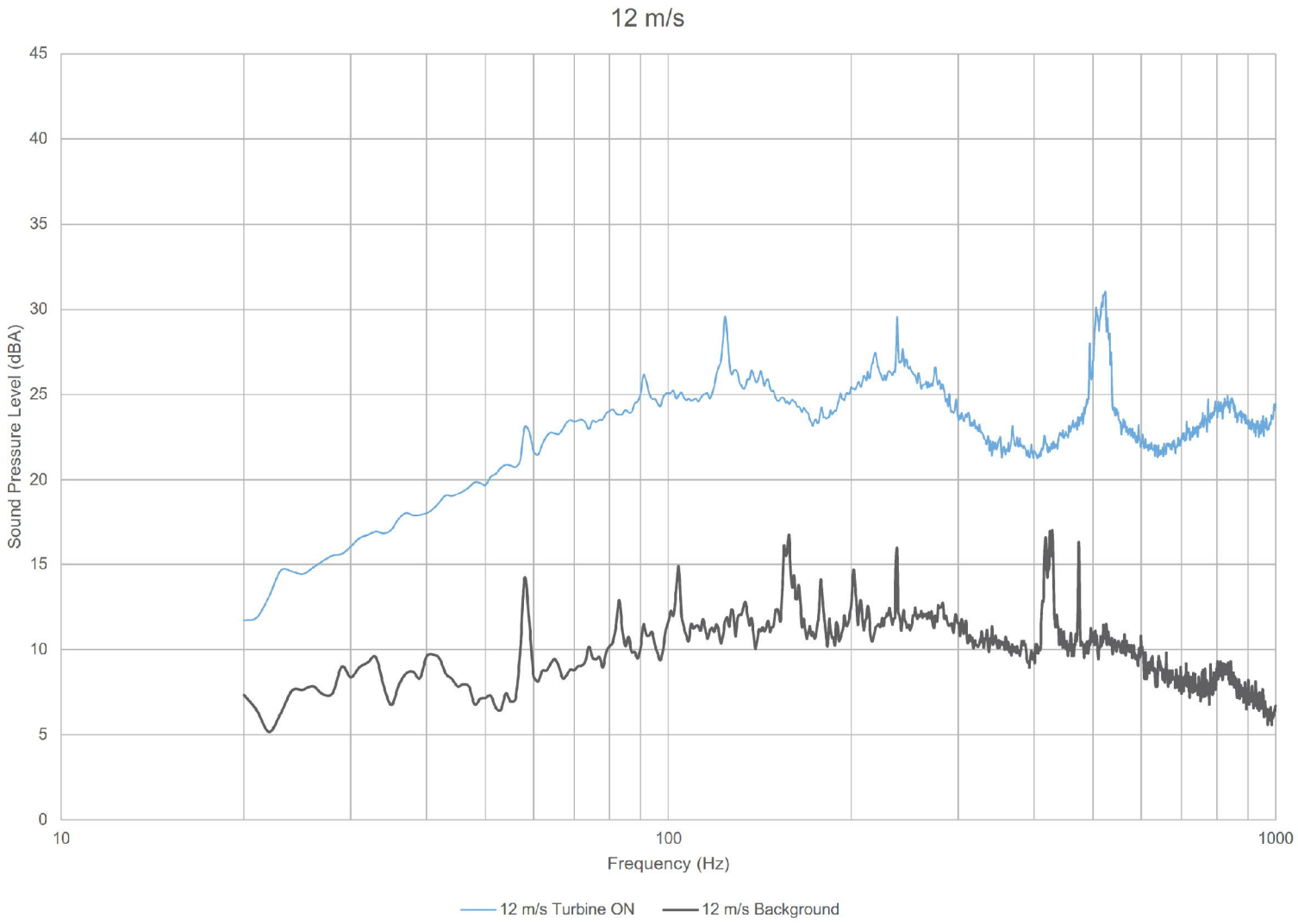
aercoustics	Project ID: 14284.00.T63.RP5 Scale: NTS Drawn by: AM Reviewed by: PA Date: Feb, 28 2018 Revision: 1	**Project Name** Grand Renwable Wind Farm - Turbine T63 - IEC 61400-11 Edition 3.0 **Figure Title** Plot of narrow band spectra – Turbine ON vs. Background at 11 m/s

Figure D.08



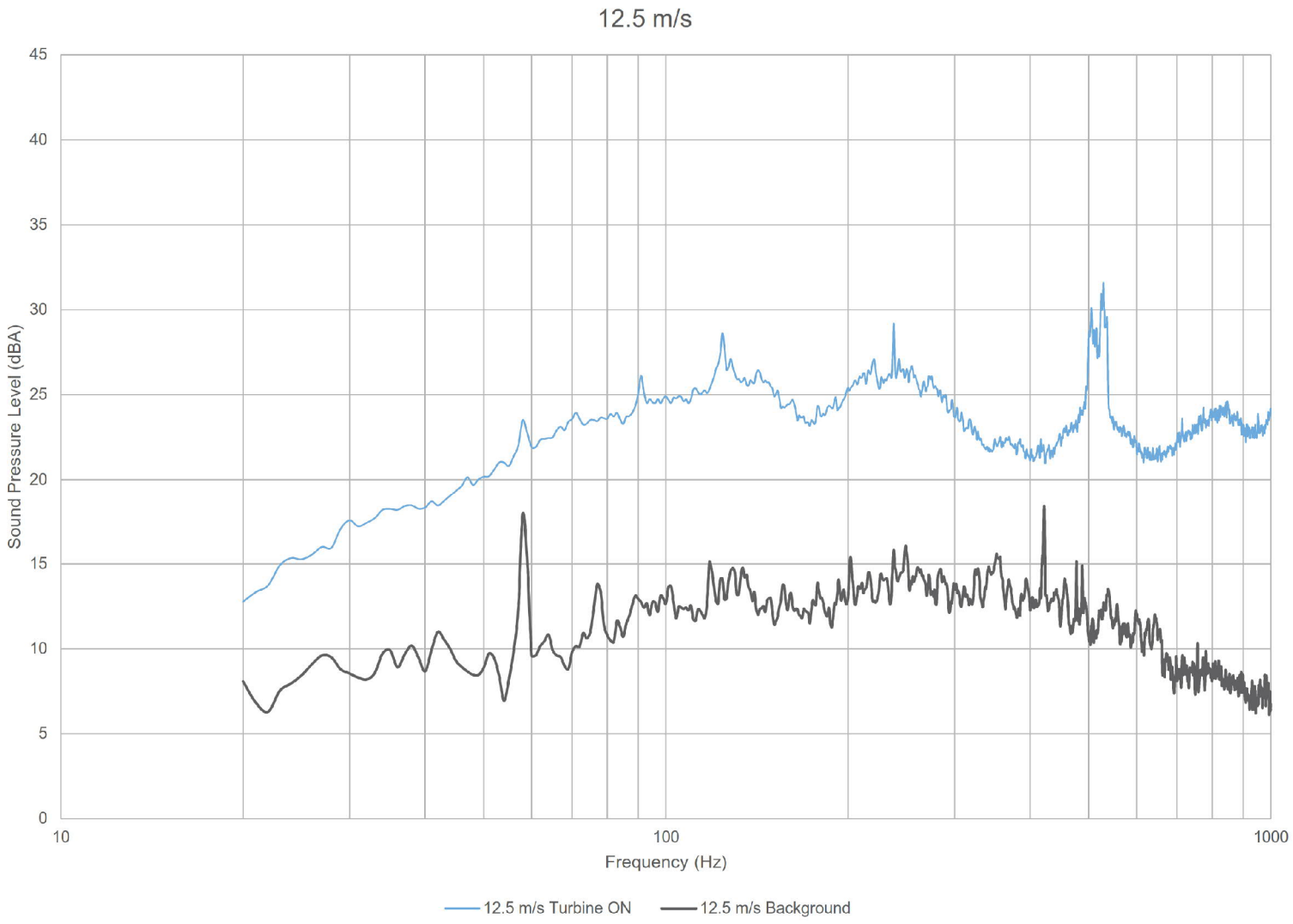
aercoustics	Project ID: 14284.00.T63.RP5 Scale: NTS Drawn by: AM Reviewed by: PA Date: Feb, 28 2018 Revision: 1	**Project Name** Grand Renwable Wind Farm - Turbine T63 - IEC 61400-11 Edition 3.0 **Figure Title** Plot of narrow band spectra – Turbine ON vs. Background at 11.5 m/s

Figure D.09



aercoustics	Project ID: 14284.00.T63.RP5 Scale: NTS Drawn by: AM Reviewed by: PA Date: Feb, 28 2018 Revision: 1	**Project Name** Grand Renwable Wind Farm - Turbine T63 - IEC 61400-11 Edition 3.0 **Figure Title** Plot of narrow band spectra – Turbine ON vs. Background at 12 m/s

Figure D.10



aercoustics	Project ID: 14284.00.T63.RP5 Scale: NTS Drawn by: AM Reviewed by: PA Date: Feb, 28 2018 Revision: 1	**Project Name** Grand Renwable Wind Farm - Turbine T63 - IEC 61400-11 Edition 3.0 **Figure Title** Plot of narrow band spectra – Turbine ON vs. Background at 12.5 m/s

Figure D.11

Table D.01 Tonality Assessment Table - 7.5m/s

Project: Grand Renewable Wind Farm - Turbine T63 - IEC 61400-11 Measurement

Report ID: 14284.00.T63.RP5

Created on: 2/28/2018

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)
118	412			19.4	38.1	27.2	-10.9	-2.2	-8.7
208	414			19.8	38.5	29.6	-8.9	-2.2	-6.7
207	417			20.2	39.0	30.1	-8.9	-2.2	-6.7
348	419			19.8	38.6	33.4	-5.2	-2.2	-3.0
55	419			19.1	37.8	34.0	-3.8	-2.2	-1.6
54	419			19.5	38.2	25.8	-12.4	-2.2	-10.2
56	420			19.3	38.0	35.0	-3.0	-2.2	-0.8
57	420			19.4	38.2	32.9	-5.2	-2.2	-3.0
321	420			21.5	40.3	30.5	-9.7	-2.2	-7.5
117	421			20.2	38.9	31.6	-7.3	-2.2	-5.1
347	421			20.5	39.2	31.4	-7.8	-2.2	-5.6
65	421			20.3	39.0	31.1	-8.0	-2.2	-5.7
78	421			19.5	38.2	32.1	-6.1	-2.2	-3.9
439	422			20.0	38.8	33.9	-4.9	-2.2	-2.7
83	423			19.4	38.2	32.3	-5.9	-2.2	-3.7
79	423			19.4	38.2	33.7	-4.5	-2.2	-2.2
367	424			19.8	38.5	35.6	-2.9	-2.2	-0.7
86	424			19.6	38.4	34.8	-3.6	-2.2	-1.4
368	425			19.4	38.1	31.3	-6.8	-2.2	-4.6
59	426			20.2	39.0	34.6	-4.4	-2.2	-2.2
189	427			19.7	38.5	39.1	0.7	-2.2	2.9
195	428			20.4	39.2	32.1	-7.1	-2.2	-4.8
194	441			22.1	40.9	36.7	-4.2	-2.2	-2.0
Average	422						-5.2	-2.2	-3.0

Table D.02 Tonality Assessment Table - 8.0 m/s

Project: Grand Renewable Wind Farm - Turbine T63 - IEC 61400-11 Measurement

Report ID: 14284.00.T63.RP5

Created on: 2/28/2018

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)
339	405			21.4	40.1	28.2	-11.9	-2.2	-9.7
441	423			19.5	38.2	33.0	-5.2	-2.2	-3.0
324	424			21.1	39.8	35.8	-4.0	-2.2	-1.8
440	425			19.8	38.6	35.2	-3.4	-2.2	-1.2
123	426			23.6	42.4	32.8	-9.5	-2.2	-7.3
84	426			19.5	38.3	37.2	-1.1	-2.2	1.2
87	427			20.2	39.0	40.4	1.4	-2.2	3.6
58	427			19.8	38.6	39.0	0.4	-2.2	2.7
245	427			20.8	39.6	36.8	-2.8	-2.2	-0.5
322	427			21.5	40.2	37.2	-3.1	-2.2	-0.8
82	428			19.1	37.9	37.1	-0.8	-2.2	1.5
80	428			19.8	38.5	40.3	1.8	-2.2	4.0
85	428			20.4	39.1	39.8	0.6	-2.2	2.9
325	428			21.1	39.9	38.7	-1.2	-2.2	1.1
153	428			21.3	40.1	34.2	-5.9	-2.2	-3.7
143	431			20.5	39.2	38.0	-1.3	-2.2	1.0
Average	426						-1.7	-2.2	0.6

Table D.02 Tonality Assessment Table - 8.0 m/s

Project: Grand Renewable Wind Farm - Turbine T63 - IEC 61400-11 Measurement

Report ID: 14284.00.T63.RP5

Created on: 2/28/2018

206	455			22.2	41.0	33.2	-7.8	-2.3	-5.6
251	467			22.1	41.0	34.6	-6.4	-2.3	-4.1
339	467			21.3	40.1	38.6	-1.5	-2.3	0.7
583	468			24.5	43.3	32.6	-10.7	-2.3	-8.4
183	468			22.0	40.8	36.4	-4.4	-2.3	-2.2
343	470			21.5	40.3	34.5	-5.8	-2.3	-3.6
193	470			21.5	40.3	33.9	-6.4	-2.3	-4.2
311	470			22.4	41.2	33.3	-7.9	-2.3	-5.6
181	471			21.8	40.6	36.0	-4.7	-2.3	-2.4
174	471			22.0	40.9	38.6	-2.3	-2.3	0.0
314	471			22.0	40.9	35.0	-5.9	-2.3	-3.7
297	471			22.6	41.5	39.2	-2.3	-2.3	-0.1
288	472			23.0	41.9	34.5	-7.4	-2.3	-5.1
313	472			22.7	41.6	32.7	-8.8	-2.3	-6.6
256	472			23.2	42.1	36.6	-5.5	-2.3	-3.3
180	472			21.6	40.5	38.4	-2.1	-2.3	0.1
298	472			22.5	41.3	37.1	-4.3	-2.3	-2.0
110	473			22.5	41.4	39.7	-1.7	-2.3	0.5
663	473			23.7	42.6	37.0	-5.5	-2.3	-3.3
182	474			22.3	41.1	34.5	-6.6	-2.3	-4.3
218	475			22.7	41.5	40.2	-1.4	-2.3	0.9
312	476			22.3	41.2	37.1	-4.1	-2.3	-1.8
664	477			23.9	42.8	40.1	-2.6	-2.3	-0.3
301	477			23.0	41.9	33.3	-8.6	-2.3	-6.4
100	477			22.9	41.8	41.7	0.0	-2.3	2.2
549	477			24.5	43.3	35.8	-7.5	-2.3	-5.3
305	479			22.6	41.5	41.1	-0.4	-2.3	1.9
92	479			22.2	41.1	37.8	-3.3	-2.3	-1.0
254	479			22.6	41.5	31.3	-10.2	-2.3	-7.9
211	483			23.5	42.4	36.2	-6.2	-2.3	-3.9
89	484			24.1	43.0	35.5	-7.5	-2.3	-5.3
Average	473						-4.3	-2.3	-2.0

Table D.03 Tonality Assessment Table - 8.5 m/s

Project: Grand Renewable Wind Farm - Turbine T63 - IEC 61400-11 Measurement

Report ID: 14284.00.T63.RP5

Created on: 2/28/2018

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)
648	477			25.8	44.7	33.4	-11.3	-2.3	-9.0
647	477			24.5	43.4	35.3	-8.0	-2.3	-5.7
335	478			22.7	41.6	41.2	-0.4	-2.3	1.9
338	478			22.6	41.5	39.6	-1.9	-2.3	0.3
269	478			23.5	42.3	37.9	-4.4	-2.3	-2.1
587	478			23.9	42.8	39.5	-3.3	-2.3	-1.0
219	478			23.1	41.9	42.2	0.3	-2.3	2.6
306	479			22.4	41.3	41.4	0.1	-2.3	2.4
216	479			22.5	41.4	41.1	-0.2	-2.3	2.0
270	479			23.2	42.1	38.6	-3.5	-2.3	-1.2
177	479			22.1	40.9	38.1	-2.8	-2.3	-0.5
215	479			22.9	41.7	40.4	-1.3	-2.3	0.9
176	479			22.5	41.4	40.5	-0.9	-2.3	1.3
307	480			23.0	41.9	38.9	-3.0	-2.3	-0.7
271	480			23.3	42.2	39.9	-2.3	-2.3	0.0
263	480			23.1	42.0	38.3	-3.7	-2.3	-1.4
336	480			23.0	41.9	40.9	-1.0	-2.3	1.3
334	480			22.9	41.8	39.4	-2.4	-2.3	-0.1
175	480			22.6	41.5	39.1	-2.4	-2.3	-0.1
588	480			24.7	43.6	35.9	-7.6	-2.3	-5.4
337	480			22.6	41.5	38.0	-3.5	-2.3	-1.2
272	481			23.7	42.5	39.9	-2.7	-2.3	-0.4
310	481			23.0	41.8	36.7	-5.1	-2.3	-2.8
97	481			23.5	42.4	38.6	-3.8	-2.3	-1.5
521	481			24.1	42.9	40.9	-2.0	-2.3	0.3
250	481			22.7	41.6	36.7	-4.8	-2.3	-2.6
273	481			23.3	42.1	41.7	-0.5	-2.3	1.8
191	481			22.6	41.5	40.8	-0.7	-2.3	1.6
309	482			22.9	41.8	40.0	-1.8	-2.3	0.5
160	482			23.1	42.0	36.1	-5.9	-2.3	-3.6
657	482			25.3	44.2	42.7	-1.5	-2.3	0.8
548	482			24.6	43.5	39.9	-3.6	-2.3	-1.3
101	482			23.6	42.4	37.9	-4.5	-2.3	-2.2
333	482			23.2	42.0	37.3	-4.7	-2.3	-2.5
582	482			24.6	43.5	40.3	-3.1	-2.3	-0.9
220	482			22.9	41.8	40.2	-1.6	-2.3	0.7
96	482			22.5	41.3	35.4	-5.9	-2.3	-3.7
98	482			23.8	42.7	38.6	-4.0	-2.3	-1.7
327	483			22.9	41.8	36.2	-5.6	-2.3	-3.3
553	483			24.7	43.6	36.5	-7.0	-2.3	-4.8
192	483			22.3	41.2	36.5	-4.7	-2.3	-2.4
255	483			23.3	42.2	41.1	-1.1	-2.3	1.2
491	484			24.8	43.6	37.8	-5.8	-2.3	-3.6
275	484			24.1	43.0	34.9	-8.1	-2.3	-5.8
492	485			24.9	43.8	36.2	-7.5	-2.3	-5.3
550	485			25.0	43.9	36.4	-7.5	-2.3	-5.2
274	486			23.7	42.6	36.8	-5.8	-2.3	-3.5
308	486			22.9	41.8	34.8	-7.1	-2.3	-4.8
555	487			24.9	43.8	38.6	-5.2	-2.3	-2.9
282	489			23.7	42.6	42.2	-0.4	-2.3	1.9
581	489			24.9	43.8	42.1	-1.7	-2.3	0.6
557	489			25.2	44.1	35.3	-8.8	-2.3	-6.6
296	490			23.6	42.5	30.3	-12.3	-2.3	-10.0
91	490			22.7	41.6	30.5	-11.2	-2.3	-8.9
102	491			23.9	42.8	37.5	-5.4	-2.3	-3.1
155	492			23.5	42.4	36.9	-5.5	-2.3	-3.2
332	492			23.1	42.0	38.0	-4.0	-2.3	-1.7
266	494			23.4	42.3	43.6	1.3	-2.3	3.6
90	495			23.6	42.5	38.6	-3.9	-2.3	-1.6
670	495			25.7	44.6	35.3	-9.2	-2.3	-7.0
328	498			23.7	42.6	40.2	-2.4	-2.3	-0.1
248	500			24.2	43.2	35.7	-7.4	-2.3	-5.1
Average	484						-3.2	-2.3	-1.0

Table D.04 Tonality Assessment Table - 9.0 m/s

Project: Grand Renewable Wind Farm - Turbine T63 - IEC 61400-11 Measurement

Report ID: 14284.00.T63.RP5

Created on: 2/28/2018

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)
580	475			24.7	43.6	38.6	-5.0	-2.3	-2.7
529	475			24.2	43.1	43.3	0.2	-2.3	2.5
669	478			24.9	43.8	38.3	-5.5	-2.3	-3.2
512	482			25.8	44.7	36.4	-8.3	-2.3	-6.0
642	484			24.4	43.3	41.9	-1.3	-2.3	0.9
493	484			25.1	44.0	36.3	-7.7	-2.3	-5.5
678	485			24.1	43.0	41.1	-1.8	-2.3	0.5
674	488			24.2	43.1	35.6	-7.5	-2.3	-5.2
490	491			24.5	43.4	39.4	-4.0	-2.3	-1.7
577	491			24.6	43.5	35.4	-8.2	-2.3	-5.9
225	492			23.8	42.7	44.4	1.7	-2.3	4.0
489	493			24.2	43.1	38.3	-4.8	-2.3	-2.5
265	494			23.1	42.1	43.8	1.7	-2.3	4.0
227	494			23.4	42.3	44.9	2.7	-2.3	5.0
280	495			23.7	42.6	43.7	1.1	-2.3	3.4
592	495			25.6	44.5	36.5	-8.0	-2.3	-5.7
226	495			23.4	42.4	46.4	4.0	-2.3	6.3
330	495			23.2	42.1	43.0	1.0	-2.3	3.3
278	495			23.9	42.8	44.8	2.0	-2.3	4.3
646	495			24.5	43.4	43.2	-0.2	-2.3	2.1
552	495			24.8	43.7	42.5	-1.1	-2.3	1.2
331	496			22.5	41.4	42.5	1.0	-2.3	3.3
276	496			24.1	43.0	46.4	3.4	-2.3	5.7
156	496			23.4	42.3	38.4	-3.9	-2.3	-1.6
213	497			23.1	42.1	44.7	2.7	-2.3	5.0
591	497			26.1	45.0	34.0	-11.0	-2.3	-8.7
277	497			23.7	42.6	45.1	2.5	-2.3	4.8
618	497			25.5	44.4	36.9	-7.5	-2.3	-5.2
279	497			23.3	42.3	45.7	3.4	-2.3	5.7
264	498			23.6	42.6	43.5	1.0	-2.3	3.3
329	499			22.9	41.9	43.9	2.0	-2.3	4.3
551	499			25.2	44.1	39.6	-4.5	-2.3	-2.2
228	500			23.4	42.3	43.1	0.8	-2.3	3.1
Average	492						-0.1	-2.3	2.2

Table D.05 Tonality Assessment Table - 9.5 m/s

Project: Grand Renewable Wind Farm - Turbine T63 - IEC 61400-11 Measurement

Report ID: 14284.00.T63.RP5

Created on: 2/28/2018

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)
586	480			24.8	43.7	39.1	-4.7	-2.3	-2.4
673	481			23.9	42.8	38.7	-4.1	-2.3	-1.8
712	481			25.6	44.5	36.1	-8.4	-2.3	-6.1
544	481			25.4	44.3	41.4	-2.9	-2.3	-0.6
617	481			24.5	43.4	42.0	-1.4	-2.3	0.9
576	481			24.2	43.1	41.9	-1.2	-2.3	1.0
518	481			24.1	43.0	41.7	-1.3	-2.3	1.0
598	484			24.6	43.4	40.4	-3.0	-2.3	-0.7
606	485			24.3	43.2	39.7	-3.4	-2.3	-1.2
656	485			24.9	43.8	43.2	-0.6	-2.3	1.7
682	486			24.5	43.4	41.5	-2.0	-2.3	0.3
662	486			23.8	42.7	43.6	0.9	-2.3	3.2
224	488			23.5	42.4	41.0	-1.5	-2.3	0.8
545	488			23.8	42.7	42.4	-0.3	-2.3	2.0
707	488			24.0	42.9	41.5	-1.4	-2.3	0.9
509	489			24.4	43.3	41.7	-1.6	-2.3	0.7
501	489			25.4	44.3	32.4	-11.8	-2.3	-9.5
561	490			25.0	43.9	41.6	-2.2	-2.3	0.0
634	490			24.6	43.5	40.5	-3.1	-2.3	-0.8
530	492			24.9	43.8	33.8	-10.0	-2.3	-7.7
524	492			24.0	43.0	35.4	-7.6	-2.3	-5.3
658	493			26.2	45.1	40.7	-4.4	-2.3	-2.1
511	493			24.8	43.7	42.6	-1.1	-2.3	1.2
623	495			24.9	43.9	40.5	-3.4	-2.3	-1.1
525	495			23.7	42.6	33.9	-8.7	-2.3	-6.4
621	495			24.6	43.5	43.3	-0.2	-2.3	2.1
590	495			24.9	43.8	43.0	-0.8	-2.3	1.5
488	496			24.3	43.2	37.3	-5.9	-2.3	-3.6
292	496			23.5	42.4	43.9	1.5	-2.3	3.8
547	496			24.6	43.5	38.8	-4.7	-2.3	-2.4
291	497			23.3	42.2	42.3	0.1	-2.3	2.4
559	499			24.3	43.2	34.2	-8.9	-2.3	-6.6
620	499			25.2	44.1	37.7	-6.4	-2.3	-4.1
546	500			24.6	43.5	42.7	-0.8	-2.3	1.5
683	500			25.5	44.4	39.1	-5.3	-2.3	-3.0
619	500			24.9	43.8	39.8	-4.0	-2.3	-1.7
249	500			23.7	42.6	40.5	-2.1	-2.3	0.2
558	501			24.6	43.5	39.6	-4.0	-2.3	-1.7
599	503			25.2	44.1	36.2	-7.9	-2.3	-5.6
607	505			25.5	44.4	35.8	-8.7	-2.3	-6.4
487	507			24.9	43.8	37.7	-6.2	-2.3	-3.9
Average	492						-2.8	-2.3	-0.5

Table D.06 Tonality Assessment Table - 10.0 m/s

Project: Grand Renewable Wind Farm - Turbine T63 - IEC 61400-11 Measurement

Report ID: 14284.00.T63.RP5

Created on: 2/28/2018

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)
677	478			24.2	43.1	44.1	1.0	-2.3	3.3
535	484			24.7	43.6	41.7	-1.8	-2.3	0.5
597	484			24.4	43.3	43.1	-0.2	-2.3	2.1
641	486			24.6	43.5	41.5	-2.0	-2.3	0.3
681	492			24.6	43.5	31.4	-12.1	-2.3	-9.8
622	497			25.1	44.0	42.3	-1.7	-2.3	0.6
510	498			24.5	43.4	43.7	0.3	-2.3	2.6
223	499			23.5	42.4	41.9	-0.5	-2.3	1.8
562	503			24.3	43.2	40.7	-2.5	-2.3	-0.2
222	508			23.7	42.6	42.8	0.2	-2.3	2.5
Average	493						-1.1	-2.3	1.2

Table D.07 Tonality Assessment Table - 10.5 m/s

Project: Grand Renewable Wind Farm - Turbine T63 - IEC 61400-11 Measurement

Report ID: 14284.00.T63.RP5

Created on: 2/28/2018

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)
543	484			24.3	43.2	38.2	-5.0	-2.3	-2.7
706	485			24.4	43.3	40.3	-3.0	-2.3	-0.7
508	490			24.4	43.3	36.9	-6.5	-2.3	-4.2
560	492			24.0	42.9	43.3	0.4	-2.3	2.7
498	496			25.1	44.1	37.9	-6.1	-2.3	-3.8
502	502			25.2	44.2	36.3	-7.9	-2.3	-5.6
709	506			25.2	44.2	31.7	-12.5	-2.3	-10.2
500	508			25.5	44.5	34.0	-10.4	-2.3	-8.1
639	508			24.7	43.6	39.7	-3.9	-2.3	-1.6
536	532			25.8	44.8	42.8	-2.1	-2.3	0.3
Average	500						-4.3	-2.3	-2.0

Table D.08 Tonality Assessment Table - 11.0 m/s

Project: Grand Renewable Wind Farm - Turbine T63 - IEC 61400-11 Measurement

Report ID: 14284.00.T63.RP5

Created on: 2/28/2018

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)
750	505			24.4	43.3	43.7	0.4	-2.3	2.7
516	509			23.4	42.3	40.2	-2.1	-2.3	0.2
738	510			24.4	43.4	35.7	-7.7	-2.3	-5.4
746	514			23.9	42.9	40.4	-2.5	-2.3	-0.2
734	515			23.2	42.2	39.8	-2.5	-2.3	-0.1
494	518			24.7	43.7	36.3	-7.3	-2.3	-5.0
499	518			24.3	43.3	42.6	-0.7	-2.3	1.6
653	525			24.4	43.4	45.7	2.3	-2.3	4.6
755	526			23.7	42.7	45.9	3.2	-2.3	5.5
715	526			24.9	43.9	44.8	0.8	-2.3	3.1
514	532			25.0	44.0	40.6	-3.3	-2.3	-1.0
Average	518						-0.6	-2.3	1.7

Table D.09 Tonality Assessment Table - 11.5m/s

Project: Grand Renewable Wind Farm - Turbine T63 - IEC 61400-11 Measurement

Report ID: 14284.00.T63.RP3

Created on: 2/28/2018

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)
747	513			24.6	43.5	38.7	-4.8	-2.3	-2.5
676	513			24.1	43.1	41.4	-1.7	-2.3	0.6
745	514			23.2	42.2	40.8	-1.4	-2.3	0.9
593	515			25.2	44.2	41.4	-2.8	-2.3	-0.5
770	516			23.5	42.5	45.2	2.8	-2.3	5.1
495	517			24.8	43.8	41.1	-2.7	-2.3	-0.4
640	518			24.6	43.6	41.5	-2.1	-2.3	0.2
567	522			23.3	42.3	45.8	3.5	-2.3	5.9
497	525			24.3	43.3	39.1	-4.2	-2.3	-1.9
624	531			25.3	44.3	43.1	-1.2	-2.3	1.2
713	531			24.7	43.7	43.6	-0.1	-2.3	2.3
609	531			24.4	43.4	45.5	2.1	-2.3	4.5
659	540			24.3	43.4	42.9	-0.4	-2.3	1.9
Average	522						-0.3	-2.3	2.1

Table D.10 Tonality Assessment Table - 12.0 m/s

Project: Grand Renewable Wind Farm - Turbine T63 - IEC 61400-11 Measurement

Report ID: 14284.00.T63.RP5

Created on: 2/28/2018

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)
608	504			24.9	43.8	37.3	-6.5	-2.3	-4.2
710	506			24.5	43.5	38.6	-4.9	-2.3	-2.5
702	507			24.6	43.6	34.3	-9.3	-2.3	-7.0
769	508			23.1	42.1	40.8	-1.2	-2.3	1.1
541	510			23.9	42.8	39.7	-3.1	-2.3	-0.8
631	513			23.4	42.3	43.1	0.7	-2.3	3.1
692	516			22.7	41.7	43.0	1.3	-2.3	3.6
513	517			25.1	44.1	38.9	-5.2	-2.3	-2.9
735	518			24.1	43.1	42.7	-0.4	-2.3	1.9
757	520			23.5	42.5	42.1	-0.3	-2.3	2.0
496	521			24.2	43.2	42.5	-0.7	-2.3	1.7
716	522			24.1	43.1	40.7	-2.4	-2.3	-0.1
649	524			26.0	44.9	39.2	-5.7	-2.3	-3.4
532	524			24.5	43.5	43.1	-0.4	-2.3	1.9
629	525			24.1	43.1	44.1	1.0	-2.3	3.3
722	528			24.6	43.6	42.8	-0.8	-2.3	1.5
732	528			25.7	44.7	38.9	-5.8	-2.3	-3.5
537	531			24.1	43.1	43.3	0.2	-2.3	2.5
627	533			25.8	44.8	42.4	-2.4	-2.3	-0.1
Average	519						-1.6	-2.3	0.7

Table D.11 Tonality Assessment Table - 12.5 m/s

Project: Grand Renewable Wind Farm - Turbine T63 - IEC 61400-11 Measurement

Report ID: 14284.00.T63.RP5

Created on: 2/28/2018

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)
690	510			23.0	41.9	39.7	-2.2	-2.3	0.1
744	515			24.1	43.0	38.9	-4.1	-2.3	-1.8
540	518			23.5	42.5	34.8	-7.7	-2.3	-5.4
575	523			25.1	44.1	38.2	-5.9	-2.3	-3.6
686	524			23.4	42.4	41.3	-1.0	-2.3	1.3
504	527			23.1	42.1	43.1	0.9	-2.3	3.3
736	528			23.7	42.7	41.3	-1.4	-2.3	1.0
602	528			23.8	42.8	43.4	0.6	-2.3	3.0
628	529			24.8	43.8	43.1	-0.7	-2.3	1.6
733	529			24.4	43.4	43.7	0.3	-2.3	2.6
730	531			24.0	43.0	41.1	-1.9	-2.3	0.4
749	531			25.6	44.6	37.3	-7.3	-2.3	-4.9
600	536			25.0	44.0	44.7	0.7	-2.3	3.0
Average	525						-1.5	-2.3	0.9

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Appendix E
Measurement Data

ilac-MRA

SCC Accredited
CB-P/S
OCPS
Accrédité CCN
TM

Table E.01 Measurement data - Turbine ON

Project: Grand Renewable Wind Farm - Turbine T63 - IEC 61400-11 Measurement

Report ID: 14284.00.T63.RP5

Created on: 2/28/2018

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

Data Point #	Standardized Wind Speed	LAeq	Turbine Power Output (kW)	Reference Yaw Angle (°)	Yaw Angle (°)	Pitch Angle (°)	Rotor RPM	Nacelle Anemometer Wind Speed (m/s)	10m Anemometer Wind Speed (m/s)	Air Temperature (-C)	Pressure (kPa)	Relative Humidity (%)
1	7.1	50.1	839	233.0	233.5	-2.1	12.2	5.9	5.8	19.8	99.4	67
2			932	233.0	236.5	-2.3	12.6	6.9	6.3	19.8	99.4	67
3			911	233.0	236.4	-2.4	12.5	7.0	6.4	19.8	99.4	68
4			792	233.0	236.4	-2.6	11.9	6.6	6.2	19.8	99.4	68
5			692	233.0	236.4	-2.6	11.5	6.4	6.5	19.8	99.4	68
6			684	233.0	236.4	-2.0	11.4	5.6	6.3	19.8	99.4	68
7			603	233.0	236.0	-1.8	11.0	5.1	6.3	19.8	99.4	68
8			551	233.0	232.4	-1.8	10.7	5.3	6.6	19.8	99.4	68
9			523	233.0	231.3	-1.8	10.5	5.0	7.0	19.8	99.4	68
10			525	233.0	232.3	-1.9	10.6	5.4	6.7	19.8	99.4	68
11			570	233.0	234.7	-1.9	10.8	5.7	6.0	19.8	99.4	68
12			575	233.0	234.7	-2.6	10.8	5.9	5.3	19.8	99.4	68
13	6.4	48.9	593	233.0	234.8	-2.9	10.9	6.2	4.6	19.8	99.4	68
14	6.2	48.3	553	233.0	234.9	-2.9	10.7	5.7	4.6	19.9	99.4	68
15	5.8	47.7	440	233.0	236.5	-2.9	9.9	4.8	4.1	19.9	99.4	69
16			349	233.0	237.7	-2.8	9.0	4.8	4.5	19.9	99.4	69
17			276	233.0	237.7	-2.8	8.4	4.3	5.2	19.9	99.4	69
18			202	233.0	236.1	-2.1	7.6	4.0	7.0	19.9	99.4	69
19			163	233.0	233.9	-1.7	7.0	3.3	7.5	19.9	99.4	69
20			173	233.0	233.9	-1.7	7.1	4.1	7.5	20.0	99.4	68
21			200	233.0	233.9	-1.7	7.4	4.8	6.9	20.0	99.4	68
22			213	233.0	235.4	-1.7	7.6	4.5	5.6	20.0	99.4	68
23			259	233.0	239.6	-1.8	8.1	5.3	5.3	20.0	99.4	68
24			280	233.0	240.4	-2.4	8.4	4.1	5.6	20.0	99.4	68
25			301	233.0	239.3	-2.8	8.7	4.3	4.8	20.0	99.4	68
26	5.3	44.4	331	233.0	235.1	-2.8	8.9	4.5	4.2	20.1	99.4	67
27			355	233.0	234.2	-2.8	9.1	4.6	4.8	20.1	99.4	66
28	5.7	45.5	408	233.0	234.2	-3.0	9.5	5.0	4.7	20.1	99.4	66
29	5.7	46.0	420	233.0	234.2	-3.0	9.6	5.3	3.9	20.1	99.4	66
30	5.6	46.1	387	233.0	234.2	-2.5	9.3	5.4	4.1	20.1	99.4	66
31			321	233.0	234.2	-1.9	8.7	4.5	4.6	20.1	99.4	66
32			253	233.0	234.2	-1.9	8.1	3.6	5.1	20.2	99.4	66
33			236	233.0	234.2	-1.8	7.8	3.7	4.4	20.2	99.4	67
34			234	233.0	234.1	-1.8	7.8	4.4	4.5	20.2	99.4	67
35			241	233.0	231.9	-1.8	7.8	4.5	4.4	20.2	99.4	67
36	4.9	43.4	252	233.0	230.7	-2.4	8.1	4.7	3.6	20.2	99.4	67
37			271	233.0	233.2	-2.9	8.4	4.4	5.4	20.2	99.4	67
38			292	233.0	237.5	-2.9	8.5	4.7	5.1	20.3	99.4	68
39			386	233.0	238.0	-3.0	9.3	5.8	5.1	20.4	99.4	68
40			462	233.0	238.0	-3.0	10.0	6.0	5.6	20.4	99.4	68
41			562	233.0	238.0	-3.0	10.7	6.2	5.8	20.4	99.4	68
42			645	233.0	238.0	-2.6	11.2	6.4	5.5	20.4	99.4	68
43	6.6	48.9	664	233.0	238.0	-2.0	11.4	6.4	5.3	20.4	99.4	68
44	6.6	49.2	680	233.0	236.1	-2.0	11.4	5.6	5.0	20.5	99.4	68
45	6.9	49.9	760	233.0	232.8	-2.0	11.8	6.3	5.6	20.5	99.4	69
46	7.1	50.4	833	233.0	232.7	-2.0	12.1	6.3	5.4	20.5	99.4	69
47	6.9	50.1	771	233.0	233.3	-2.0	11.9	7.0	4.8	20.5	99.4	69
48			704	233.0	236.8	-2.3	11.6	6.0	5.6	20.5	99.4	69
49			737	233.0	237.2	-3.0	11.7	6.0	6.5	20.5	99.4	69
50			795	233.0	235.5	-3.0	12.0	6.3	6.2	20.5	99.4	68
51	7.1	50.5	822	233.0	233.3	-3.0	12.1	6.6	5.7	20.5	99.4	66
52	7.1	50.6	825	233.0	233.3	-3.0	12.1	6.4	5.0	20.5	99.4	66
53	7.1	51.0	840	233.0	233.3	-3.0	12.2	6.6	4.8	20.5	99.4	66
54	7.3	50.9	904	233.0	233.3	-2.7	12.4	7.0	4.8	20.5	99.4	66
55	7.4	51.5	973	233.0	233.3	-2.0	12.6	7.1	4.6	20.5	99.4	66
56	7.5	51.4	990	233.0	233.3	-2.0	12.7	6.1	4.9	20.5	99.4	67
57	7.5	51.5	990	233.0	233.2	-2.0	12.7	5.9	5.1	20.4	99.4	68
58	7.8	51.7	1130	233.0	233.2	-2.0	12.8	7.1	5.4	20.4	99.4	68
59	7.6	52.3	1017	233.0	236.2	-2.0	12.7	7.1	4.7	20.4	99.4	68
60	7.1	51.2	844	233.0	239.3	-2.3	12.2	6.4	5.4	20.4	99.4	68
61			807	233.0	239.4	-3.0	12.0	6.2	6.6	20.4	99.4	68
62			727	233.0	239.4	-3.0	11.7	6.6	6.8	20.4	99.4	67
63			715	233.0	239.4	-3.0	11.6	6.4	6.1	20.4	99.4	66
64	6.9	50.1	756	233.0	239.4	-3.0	11.9	6.1	5.1	20.4	99.4	66
65	7.3	51.3	921	233.0	239.4	-3.0	12.4	7.2	5.8	20.4	99.4	66
66			1089	233.0	239.4	-2.8	12.8	7.1	7.8	20.4	99.4	66
67			1105	233.0	239.5	-2.0	12.8	7.0	8.3	20.4	99.4	66
68			1030	233.0	239.5	-2.0	12.7	7.5	7.9	20.4	99.4	66
69			921	233.0	239.5	-2.0	12.5	6.5	8.3	20.3	99.4	65
70			1056	233.0	239.5	-2.0	12.7	6.4	7.1	20.3	99.4	65
71			1070	233.0	239.3	-2.0	12.7	6.9	6.8	20.3	99.4	65
72			964	233.0	235.8	-2.1	12.6	6.5	6.5	20.3	99.4	65
73			922	233.0	234.2	-3.0	12.5	7.2	6.4	20.3	99.4	65
74			882	233.0	234.2	-3.0	12.3	6.8	6.9	20.3	99.4	65
75			796	233.0	234.2	-3.0	12.0	6.4	6.2	20.2	99.4	65
76			845	233.0	234.2	-3.0	12.2	7.0	7.4	20.2	99.4	65
77			927	233.0	234.2	-3.0	12.5	7.0	6.3	20.2	99.4	65
78	7.6	51.9	1038	233.0	234.2	-2.9	12.7	8.2	5.9	20.2	99.4	65
79	7.6	51.6	1051	233.0	234.2	-2.0	12.7	7.5	5.4	20.2	99.4	65
80	8.0	52.2	1187	233.0	234.2	-2.0	12.9	7.3	6.4	20.2	99.4	66
81			1218	233.0	234.2	-2.0	12.9	7.3	6.8	20.1	99.4	66
82	7.8	52.1	1118	233.0	234.2	-2.0	12.8	7.2	5.9	20.1	99.4	66
83	7.6	51.4	1046	233.0	234.2	-2.0	12.7	7.1	5.7	20.1	99.4	66
84	7.8	51.6	1119	233.0	234.2	-2.0	12.8	7.2	5.5	20.1	99.4	66
85	8.0	52.3	1193	233.0	234.2	-3.0	12.9	7.4	4.8	20.1	99.4	66
86	7.6	52.0	1046	233.0	234.2	-2.9	12.7	7.0	4.0	20.1	99.4	66
87	7.8	51.7	1124	233.0	232.1	-3.0	12.8	6.8	4.1	20.0	99.4	68
88	8.1	52.3	1253	233.0	230.7	-3.0	13.1	7.6	4.7	20.0	99.4	68

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

Data Point #	Standardized Wind Speed	LAeq	Turbine Power Output (kW)	Reference Yaw Angle (°)	Yaw Angle (°)	Pitch Angle (°)	Rotor RPM	Nacelle Anemometer Wind Speed (m/s)	10m Anemometer Wind Speed (m/s)	Air Temperature (-C)	Pressure (kPa)	Relative Humidity (%)
89	8.2	54.3	1296	233.0	230.7	-3.0	14.3	8.6	4.4	20.0	99.4	68
90	8.7	55.1	1524	233.0	230.7	-2.9	14.8	9.0	4.5	20.0	99.4	68
91	8.3	54.8	1359	233.0	230.7	-2.0	14.5	8.2	4.2	20.0	99.4	68
92	8.1	53.8	1233	233.0	230.7	-2.0	14.4	7.4	5.6	20.0	99.4	68
93			1155	233.0	230.7	-2.0	14.3	7.2	6.7	20.0	99.4	69
94			1085	233.0	230.7	-2.0	14.1	7.3	7.3	20.0	99.4	69
95			1327	233.0	230.7	-2.0	14.5	7.5	8.8	20.0	99.4	69
96	8.3	54.5	1342	233.0	230.6	-2.0	14.4	7.4	6.6	20.0	99.4	69
97	8.3	54.7	1319	233.0	230.6	-2.9	14.4	6.8	6.7	20.0	99.4	69
98	8.4	54.9	1379	233.0	230.6	-3.0	14.5	8.1	7.0	20.1	99.4	69
99			1268	233.0	230.6	-3.0	14.4	7.0	7.1	20.1	99.4	69
100	8.1	54.7	1238	233.0	230.6	-2.9	14.4	6.5	6.3	20.1	99.4	69
101	8.5	54.8	1413	233.0	230.6	-2.9	14.6	7.5	5.2	20.1	99.4	69
102	8.6	55.4	1468	233.0	230.6	-3.0	14.7	8.4	5.0	20.1	99.4	69
103			1286	233.0	230.6	-2.2	14.4	7.9	6.9	20.1	99.4	69
104			1178	233.0	232.7	-2.0	14.3	7.0	7.9	20.2	99.4	68
105			1218	233.0	236.6	-1.9	14.3	7.2	6.8	20.3	99.4	68
106			1354	233.0	236.8	-1.9	14.5	7.4	7.0	20.3	99.4	68
107			1568	233.0	236.8	-1.7	14.9	7.7	7.9	20.3	99.4	68
108			1561	233.0	236.8	-1.6	14.8	8.0	8.2	20.3	99.4	68
109			1296	233.0	236.8	-2.8	14.4	7.3	7.9	20.3	99.4	68
110	7.9	54.6	1165	233.0	239.6	-3.0	14.3	6.6	6.4	20.4	99.4	67
111	7.8	54.2	1110	233.0	241.1	-3.0	13.8	6.3	6.3	20.4	99.4	67
112			1191	233.0	241.1	-3.0	13.1	6.7	8.2	20.4	99.4	67
113			916	233.0	238.7	-3.0	12.5	5.9	7.9	20.4	99.4	67
114			922	233.0	235.4	-3.0	12.5	6.5	7.4	20.4	99.4	67
115			900	233.0	235.3	-2.3	12.5	6.6	6.9	20.4	99.4	67
116			899	233.0	235.3	-2.0	12.4	6.9	6.4	20.5	99.4	67
117	7.5	52.5	999	233.0	235.3	-2.0	12.7	7.2	6.0	20.5	99.4	67
118	7.3	52.0	908	233.0	235.3	-2.0	12.4	6.8	5.5	20.5	99.4	67
119	7.2	51.7	857	233.0	235.3	-2.0	12.2	6.5	5.4	20.5	99.4	67
120	6.5	50.5	652	233.0	233.0	-2.0	11.3	5.1	5.2	20.5	99.4	67
121			594	233.0	230.8	-2.7	11.0	5.4	5.4	20.5	99.4	67
122	6.9	49.8	756	233.0	230.7	-3.0	11.8	6.6	4.8	20.6	99.4	68
123	8.0	52.7	1197	233.0	233.7	-3.0	13.3	7.7	5.9	20.6	99.4	70
124	7.7	54.4	1074	233.0	237.3	-3.0	14.2	6.3	5.9	20.6	99.4	70
125			1081	233.0	236.3	-3.0	13.8	6.2	7.6	20.6	99.3	70
126			1123	233.0	233.3	-3.0	13.9	6.6	8.1	20.6	99.3	70
127			1097	233.0	233.1	-2.4	14.0	6.9	8.3	20.6	99.3	70
128			1131	233.0	233.1	-2.0	12.9	6.6	8.7	20.7	99.3	68
129			903	233.0	235.1	-2.0	12.5	6.3	7.8	20.7	99.3	66
130			801	233.0	239.8	-2.0	12.0	6.3	8.2	20.7	99.3	66
131			753	233.0	240.9	-2.0	11.8	5.7	9.1	20.7	99.3	66
132			834	233.0	241.0	-2.0	12.1	5.5	7.5	20.7	99.3	66
133			858	233.0	239.3	-2.6	12.3	6.1	7.7	20.7	99.3	66
134			1079	233.0	237.5	-3.0	12.8	6.9	7.8	20.8	99.3	66
135			998	233.0	237.5	-3.0	12.7	5.8	7.1	20.8	99.3	65
136			1193	233.0	237.5	-3.0	12.9	7.0	7.9	20.8	99.3	65
137			1162	233.0	237.5	-3.0	12.8	7.3	8.6	20.8	99.3	65
138			1153	233.0	237.5	-3.0	12.8	7.3	8.1	20.8	99.3	65
139			1159	233.0	237.4	-2.5	12.8	7.1	6.8	20.8	99.3	65
140			1102	233.0	237.4	-2.0	12.8	7.9	7.3	20.8	99.3	65
141			1104	233.0	237.4	-2.0	12.8	7.4	8.0	20.7	99.3	65
142			1161	233.0	237.5	-2.0	12.9	7.0	7.6	20.7	99.3	65
143	8.1	52.3	1220	233.0	237.5	-2.0	12.9	6.9	6.3	20.7	99.3	65
144			949	233.0	237.4	-2.0	12.5	6.3	7.3	20.7	99.3	65
145			798	233.0	237.4	-2.5	12.0	5.4	7.2	20.7	99.3	65
146			688	233.0	237.4	-3.0	11.4	5.4	5.7	20.8	99.3	65
147	6.4	49.3	598	233.0	238.1	-3.0	11.0	5.4	4.5	20.8	99.3	63
148	6.1	48.9	500	233.0	240.9	-3.0	10.3	4.8	4.8	20.8	99.3	63
149	5.5	46.9	364	233.0	241.1	-2.9	9.1	4.8	3.5	20.8	99.3	63
150			308	233.0	241.2	-2.9	8.7	4.2	4.8	20.8	99.3	63
151			361	233.0	243.4	-2.5	9.2	4.3	5.5	20.8	99.3	63
152	6.5	48.4	643	233.0	246.0	-2.0	11.2	5.4	4.6	20.9	99.3	63
153	7.8	52.3	1119	233.0	245.8	-2.0	12.8	6.5	4.6	20.9	99.3	63
154	8.0	52.3	1219	233.0	242.5	-2.0	13.4	7.2	4.9	20.9	99.3	63
155	8.5	54.2	1441	233.0	240.6	-1.9	14.7	7.2	6.0	21.0	99.4	63
156	8.9	54.8	1596	233.0	240.5	-1.5	15.0	7.2	6.2	21.0	99.4	63
157			1322	233.0	240.5	-2.3	14.5	6.5	8.1	21.0	99.4	63
158			1186	233.0	240.5	-3.0	14.3	7.3	7.1	21.0	99.4	63
159			1261	233.0	240.5	-2.9	14.4	7.6	6.9	21.2	99.4	63
160	8.4	54.3	1402	233.0	240.5	-2.9	14.5	8.3	6.6	21.2	99.4	63
161			1385	233.0	240.5	-2.9	14.5	8.1	8.2	21.2	99.4	63
162			1195	233.0	240.5	-2.8	14.3	7.3	8.0	21.2	99.4	63
163			1156	233.0	240.5	-2.5	14.3	6.8	7.5	21.2	99.4	63
164	7.7	54.0	1093	233.0	240.5	-1.9	14.2	7.5	6.3	21.1	99.4	64
165	7.7	53.3	1089	233.0	240.5	-2.0	13.3	6.6	6.1	21.0	99.4	66
166			757	233.0	240.5	-2.0	11.8	6.2	6.6	21.0	99.4	66
167			660	233.0	240.5	-2.0	11.3	5.9	7.4	21.0	99.4	66
168			684	233.0	240.5	-2.0	11.4	6.1	6.8	21.0	99.4	66
169			772	233.0	240.5	-2.3	11.9	5.9	6.8	21.0	99.4	66
170			880	233.0	240.5	-3.0	12.4	6.3	7.2	21.0	99.4	65
171			733	233.0	240.5	-3.0	11.6	5.2	6.9	21.0	99.4	64
172	6.7	49.8	690	233.0	240.5	-3.0	11.5	5.4	5.5	21.0	99.4	64
173	7.8	51.4	1105	233.0	240.5	-3.0	13.2	7.6	5.3	21.0	99.4	64
174	8.0	53.6	1180	233.0	240.5	-3.0	14.2	7.4	6.4	21.0	99.4	64
175	8.3	54.2	1354	233.0	240.5	-2.8	14.4	7.2	5.6	21.0	99.4	64
176	8.4	54.4	1374	233.0	240.5	-2.0	14.5	7.8	5.9	21.0	99.4	64

Table E.01 Measurement data - Turbine ON

Project: Grand Renewable Wind Farm - Turbine T63 - IEC 61400-11 Measurement

Report ID: 14284.00.T63.RP5

Created on: 2/28/2018

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

Data Point #	Standardized Wind Speed	LAeq	Turbine Power Output (kW)	Reference Yaw Angle (°)	Yaw Angle (°)	Pitch Angle (°)	Rotor RPM	Nacelle Anemometer Wind Speed (m/s)	10m Anemometer Wind Speed (m/s)	Air Temperature (-C)	Pressure (kPa)	Relative Humidity (%)
177	8.3	54.3	1360	233.0	239.4	-2.0	14.4	7.0	6.8	21.0	99.4	63
178			1337	233.0	236.5	-2.0	14.4	7.0	7.0	21.0	99.4	63
179			1183	233.0	236.4	-2.0	14.2	7.1	7.1	21.0	99.4	63
180	7.9	53.7	1152	233.0	236.4	-2.0	14.2	6.8	5.9	21.0	99.4	63
181	7.9	53.4	1140	233.0	236.4	-2.1	14.2	7.3	6.3	21.0	99.4	63
182	8.0	53.6	1212	233.0	236.4	-3.0	14.2	7.7	6.2	21.0	99.4	63
183	7.8	53.8	1096	233.0	234.0	-3.0	14.1	6.8	5.7	21.0	99.4	63
184	7.7	53.4	1090	233.0	232.2	-3.0	13.7	7.1	5.7	21.0	99.4	63
185	7.2	51.9	854	233.0	232.2	-3.0	12.1	5.6	5.4	21.0	99.4	63
186			704	233.0	231.9	-3.0	11.5	5.4	6.4	21.0	99.4	63
187			841	233.0	228.5	-2.9	12.2	6.4	6.9	21.0	99.4	63
188			1005	233.0	227.2	-2.0	12.6	7.3	6.3	20.9	99.4	64
189	7.7	51.6	1088	233.0	227.2	-2.0	12.7	7.1	6.3	20.8	99.4	64
190	8.0	52.3	1191	233.0	227.2	-2.0	13.4	7.8	5.3	20.8	99.4	64
191	8.3	53.4	1338	233.0	227.2	-2.0	14.4	8.0	4.2	20.8	99.4	64
192	8.5	54.6	1451	233.0	227.2	-2.0	14.6	8.2	4.7	20.8	99.4	64
193	8.0	53.9	1218	233.0	227.2	-2.1	14.2	7.4	5.5	20.8	99.4	64
194	7.7	53.4	1056	233.0	227.2	-3.0	13.8	6.3	6.0	20.8	99.4	64
195	7.3	52.4	925	233.0	227.2	-3.0	12.3	6.0	5.2	20.8	99.4	64
196	6.8	50.4	726	233.0	227.2	-3.0	11.7	6.0	4.9	20.7	99.4	64
197	6.8	50.3	734	233.0	227.2	-3.0	11.7	6.6	4.5	20.8	99.4	64
198	6.7	50.1	698	233.0	229.4	-3.0	11.5	6.3	3.8	20.8	99.4	64
199			715	233.0	231.3	-3.0	11.6	6.3	6.0	20.8	99.4	64
200			722	233.0	231.3	-2.0	11.6	5.9	5.7	20.7	99.4	64
201			873	233.0	231.3	-2.0	12.2	6.5	7.8	20.7	99.4	64
202			1238	233.0	231.3	-2.0	12.9	7.7	8.6	20.7	99.4	64
203			1166	233.0	231.5	-2.0	13.6	8.3	8.2	20.7	99.4	64
204			1278	233.0	234.6	-2.0	14.3	7.5	8.0	20.7	99.4	64
205			1069	233.0	235.2	-2.0	14.1	6.7	6.6	20.7	99.4	64
206	7.9	53.2	1160	233.0	235.2	-2.9	13.3	6.4	5.6	20.7	99.4	64
207	7.6	51.9	1032	233.0	235.2	-3.0	12.6	6.8	6.0	20.6	99.4	65
208	7.3	51.8	900	233.0	235.2	-3.0	12.4	6.5	5.8	20.6	99.4	65
209			875	233.0	235.2	-3.0	12.3	6.0	6.6	20.6	99.4	65
210			1145	233.0	235.2	-3.0	12.8	7.0	6.7	20.6	99.4	65
211	8.0	52.8	1218	233.0	234.4	-3.0	13.9	8.2	6.4	20.6	99.4	65
212			1505	233.0	231.2	-2.1	14.8	8.6	7.6	20.6	99.4	64
213	8.8	55.0	1567	233.0	230.9	-1.7	14.9	8.3	7.0	20.5	99.4	64
214			1502	233.0	230.9	-1.8	14.7	8.2	7.5	20.5	99.4	64
215	8.3	54.7	1336	233.0	230.9	-2.0	14.4	7.6	6.0	20.5	99.4	64
216	8.3	54.4	1320	233.0	230.9	-2.0	14.4	7.4	6.7	20.5	99.4	64
217			1098	233.0	230.9	-2.0	14.1	6.5	6.6	20.5	99.4	64
218	7.9	53.5	1170	233.0	230.9	-2.8	14.2	6.7	5.5	20.5	99.4	64
219	8.3	54.8	1342	233.0	230.6	-3.0	14.4	7.3	5.4	20.4	99.4	65
220	8.4	54.6	1380	233.0	227.5	-3.0	14.5	7.5	6.3	20.4	99.4	65
221	8.8	55.1	1595	233.0	226.7	-2.6	14.9	8.9	6.7	20.4	99.4	65
222	10.1	55.7	2050	233.0	226.7	-0.4	15.2	10.3	6.0	20.4	99.4	65
223	10.0	55.3	2030	233.0	226.9	-0.3	15.0	9.0	5.4	20.4	99.4	65
224	9.7	55.2	1915	233.0	229.8	-0.7	14.8	8.9	4.6	20.4	99.4	65
225	9.1	55.0	1714	233.0	231.6	-1.9	14.7	8.2	4.1	20.3	99.4	66
226	9.1	55.6	1714	233.0	231.6	-1.9	14.9	8.2	3.9	20.3	99.4	66
227	8.9	55.6	1641	233.0	231.6	-2.2	14.8	7.5	4.3	20.3	99.4	66
228	9.1	55.4	1703	233.0	231.6	-2.1	15.0	8.5	5.5	20.3	99.4	66
229			1540	233.0	231.7	-2.6	14.7	7.4	8.6	20.3	99.4	66
230			1450	233.0	231.7	-3.0	14.6	7.3	7.7	20.4	99.4	65
231			1219	233.0	231.7	-3.0	14.3	7.0	8.9	20.4	99.4	64
232			1151	233.0	231.7	-3.0	14.2	7.1	8.6	20.4	99.4	64
233			1115	233.0	232.3	-3.0	14.2	6.7	7.8	20.4	99.4	64
234			1177	233.0	235.9	-3.0	14.2	7.9	9.1	20.4	99.4	64
235			1219	233.0	236.6	-3.0	14.2	7.0	8.2	20.4	99.4	64
236			1084	233.0	236.6	-2.3	13.8	6.2	7.9	20.4	99.4	64
237			955	233.0	236.6	-2.0	12.5	5.6	8.1	20.4	99.4	64
238			1102	233.0	236.6	-2.0	12.7	6.9	7.7	20.4	99.4	64
239			1204	233.0	236.7	-2.0	12.8	7.8	8.3	20.4	99.4	64
240			1024	233.0	236.7	-2.0	12.6	7.7	8.8	20.4	99.4	64
241			882	233.0	236.7	-2.0	12.4	5.9	9.1	20.4	99.4	64
242			869	233.0	236.7	-2.7	12.3	6.0	9.1	20.4	99.4	65
243			981	233.0	236.7	-3.0	12.6	7.2	8.5	20.4	99.4	65
244			994	233.0	236.7	-3.0	12.6	7.1	7.4	20.4	99.4	65
245	8.0	52.4	1204	233.0	236.7	-3.0	12.9	7.1	5.9	20.4	99.4	65
246	7.3	52.2	933	233.0	236.7	-3.0	12.4	6.3	6.1	20.4	99.4	65
247			976	233.0	236.7	-3.0	12.5	5.6	6.7	20.4	99.4	65
248	8.3	52.8	1317	233.0	236.7	-2.0	14.1	8.6	6.8	20.4	99.4	66
249	9.4	55.5	1810	233.0	236.7	-0.5	15.0	8.7	5.7	20.4	99.4	67
250	8.7	54.9	1510	233.0	236.7	-1.7	14.7	8.3	5.0	20.4	99.4	67
251	7.9	54.5	1139	233.0	236.7	-2.0	14.2	6.7	5.1	20.4	99.4	67
252	7.6	54.1	1049	233.0	236.7	-2.0	14.1	6.7	4.4	20.4	99.4	67
253	7.7	53.9	1069	233.0	234.9	-2.0	14.1	7.4	3.1	20.4	99.4	67
254	7.8	53.7	1135	233.0	233.0	-2.5	14.2	7.1	3.6	20.4	99.4	68
255	8.5	54.6	1423	233.0	233.1	-3.0	14.5	7.6	7.0	20.4	99.4	69
256	8.0	54.9	1201	233.0	233.1	-3.0	14.2	8.2	6.6	20.4	99.4	69
257	7.6	54.4	1030	233.0	233.0	-3.0	14.0	6.7	5.6	20.4	99.4	69
258	7.9	54.0	1175	233.0	233.0	-3.0	13.2	6.1	5.8	20.4	99.4	69
259			1135	233.0	233.0	-3.0	12.8	6.6	7.3	20.4	99.4	69
260			1224	233.0	233.0	-2.5	13.7	8.5	7.0	20.5	99.4	68
261			1205	233.0	233.0	-2.0	14.2	6.6	7.3	20.6	99.4	66
262			1138	233.0	233.0	-2.0	14.2	8.0	6.8	20.6	99.4	66
263	8.3	54.4	1325	233.0	233.0	-1.9	14.4	7.0	6.5	20.6	99.4	66
264	8.9	54.8	1596	233.0	233.0	-1.6	15.0	9.1	6.0	20.6	99.4	66

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

Data Point #	Standardized Wind Speed	LAeq	Turbine Power Output (kW)	Reference Yaw Angle (°)	Yaw Angle (°)	Pitch Angle (°)	Rotor RPM	Nacelle Anemometer Wind Speed (m/s)	10m Anemometer Wind Speed (m/s)	Air Temperature (-C)	Pressure (kPa)	Relative Humidity (%)
265	8.8	55.3	1555	233.0	233.0	-1.7	14.9	8.1	6.6	20.6	99.4	66
266	8.7	55.0	1540	233.0	233.0	-2.3	14.9	8.0	6.9	20.6	99.4	66
267			1548	233.0	233.0	-2.8	14.9	7.8	7.8	20.6	99.4	67
268			1591	233.0	233.0	-2.5	14.9	8.9	7.9	20.6	99.4	67
269	8.3	55.0	1357	233.0	233.0	-3.0	14.4	7.3	6.9	20.6	99.4	67
270	8.3	55.1	1350	233.0	233.0	-3.0	14.4	7.8	6.7	20.6	99.4	67
271	8.4	54.6	1379	233.0	233.0	-2.9	14.5	7.9	7.6	20.6	99.4	67
272	8.5	55.0	1409	233.0	234.3	-3.0	14.5	7.6	7.5	20.6	99.4	66
273	8.5	54.9	1419	233.0	236.4	-3.0	14.5	7.4	7.3	20.6	99.4	65
274	8.6	55.1	1461	233.0	236.4	-3.0	14.6	8.2	6.7	20.6	99.4	65
275	8.5	55.0	1451	233.0	236.4	-3.0	14.6	7.7	5.7	20.5	99.4	65
276	8.8	55.4	1560	233.0	236.4	-2.7	14.9	8.4	6.5	20.6	99.4	65
277	8.9	55.9	1597	233.0	236.4	-2.5	14.9	8.1	6.6	20.6	99.4	65
278	8.9	55.4	1613	233.0	236.4	-2.2	15.0	8.0	7.3	20.6	99.4	65
279	9.0	55.5	1662	233.0	236.4	-1.2	14.9	8.6	7.2	20.6	99.4	65
280	9.2	55.3	1743	233.0	236.2	-0.9	15.1	8.4	8.0	20.6	99.4	65
281			1755	233.0	233.5	-0.6	14.9	7.6	8.8	20.6	99.4	65
282	8.7	55.1	1528	233.0	232.9	-1.8	14.7	7.7	7.8	20.6	99.4	65
283			1553	233.0	232.9	-1.8	14.9	7.9	8.6	20.6	99.4	65
284			1543	233.0	232.9	-2.1	14.9	8.4	8.6	20.6	99.4	65
285			1640	233.0	232.9	-2.3	15.0	8.6	9.2	20.6	99.4	65
286			1545	233.0	235.0	-2.7	14.9	7.8	9.4	20.6	99.4	65
287			1282	233.0	237.9	-3.0	14.4	7.0	8.2	20.6	99.4	65
288	7.9	54.3	1175	233.0	237.9	-3.0	14.2	7.3	7.0	20.6	99.4	65
289			1279	233.0	237.9	-3.0	14.3	7.4	8.3	20.6	99.4	65
290			1662	233.0	238.0	-2.2	14.9	9.4	8.8	20.6	99.4	64
291	9.7	55.4	1918	233.0	238.0	-0.9	15.1	10.0	7.5	20.6	99.4	63
292	9.6	55.2	1903	233.0	238.0	-1.1	14.9	9.5	8.3	20.6	99.4	63
293			1820	233.0	238.0	-1.3	14.9	9.1	8.9	20.6	99.4	63
294			1547	233.0	238.0	-2.7	14.7	8.9	9.1	20.6	99.4	63
295			1545	233.0	238.0	-2.8	14.9	8.3	8.4	20.6	99.4	63
296	8.4	55.2	1365	233.0	238.5	-3.0	14.5	7.6	7.1	20.7	99.4	63
297	7.9	54.2	1147	233.0	241.0	-3.0	14.2	7.0	6.3	20.8	99.4	62
298	8.0	54.1	1185	233.0	241.1	-3.0	14.2	6.8	5.4	20.8	99.4	62
299			1259	233.0	239.9	-3.1	12.3	7.1	7.8	20.8	99.4	62
300			1218	233.0	236.0	-3.2	8.5	6.8	8.2	20.8	99.4	62
301	8.2	54.1	1303	233.0	236.8	-2.9	13.6	7.1	7.4	20.8	99.4	62
302			1083	233.0	235.6	-3.1	7.8	6.1	7.4	20.8	99.4	63
303	7.4	52.5	935	233.0	235.5	-2.4	6.2	5.9	5.3	21.0	99.4	64
304	7.2	51.4	876	233.0	235.6	-2.4	7.0	7.1	6.3	21.0	99.4	64
305	8.1	53.7	1246	233.0	230.3	-2.4	0.7	7.6	6.1	20.8	99.3	65
306	8.3	54.4	1355	233.0	230.5	-2.6	1.6	7.2	5.3	20.8	99.3	65
307	8.4	54.6	1397	233.0	230.2	-2.9	0.4	7.6	5.2	20.8	99.3	65
308	8.5	54.5	1439	233.0	230.2	-3.0	0.4	8.1	4.7	20.8	99.3	65
309	8.5	54.6	1419	233.0	227.5	-3.2	0.4	7.6	3.7	20.8	99.3	65
310	8.4	54.7	1384	233.0	226.5	-3.3	0.4	7.7	4.4	20.8	99.3	65
311	7.9	54.2	1159	233.0	226.5	-3.4	0.4	7.3	3.8	21.0	99.3	67
312	8.0	54.0	1210	233.0	226.5	-3.4	0.5	7.1	5.0	21.0	99.3	67
313	7.9	54.3	1167	233.0	226.5	-3.5	0.6	7.4	4.8	21.0	99.3	67
314	7.9	54.1	1138	233.0	226.5	-3.4	0.6	6.6	3.4	21.0	99.3	67
315	7.6	53.7	1029	233.0	227.7	-2.5	0.6	6.2	5.5	21.0	99.3	67
316	7.7	53.1	1081	233.0	232.0	-2.6	0.7	6.2	5.7	21.0	99.3	67
317	7.4	52.1	958	233.0	233.0	-2.6	0.6	6.0	4.8	21.3	99.3	66
318	6.8	50.9	732	233.0	233.0	-2.6	0.6	5.6	4.0	21.3	99.3	65
319	6.7	50.3	710	233.0	233.0	-2.6	0.6	5.0	4.5	21.3	99.3	65
320	6.9	50.9	760	233.0	233.2	-2.6	0.6	5.5	6.1	21.3	99.3	65
321	7.3	51.4	933	233.0	233.1	-3.6	0.6	4.9	5.5	21.3	99.3	65
322	8.1	52.4	1220	233.0	233.1	-3.6	0.4	7.0	6.6	21.3	99.3	65
323	8.1	52.7	1240	233.0	233.1	-3.6	0.4	7.8	6.6	21.4	99.3	64
324	8.0	52.7	1187	233.0	233.1	-3.6	0.4	7.0	6.6	21.4	99.3	64
325	8.0	52.5	1208	233.0	233.1	-3.6	0.5	7.1	5.1	21.4	99.3	64
326	7.9	52.8	1152	233.0	233.1	-3.6	0.6	7.9	5.1	21.4	99.3	64
327	8.5	54.3	1411	233.0	233.2	-2.6	0.6	8.3	5.8	21.4	99.3	64
328	8.7	54.7	1531	233.0	233.2	-2.4	0.6	7.9	6.1	21.4	99.3	64
329	9.0	55.3	1680	233.0	233.2	-1.6	0.5	9.0	6.3	21.4	99.3	63
330	9.0	55.2	1669	233.0	233.2	-1.7	0.5	8.5	7.5	21.4	99.3	63
331	9.2	54.9	1737	233.0	233.2	-1.3	0.4	9.3	6.8	21.4	99.3	63
332	8.7	55.0	1522	233.0	233.2	-2.3	0.5	7.9	6.1	21.4	99.3	63
333	8.5	54.5	1420	233.0	233.2	-3.5	0.5	7.3	5.3	21.4	99.3	63
334	8.4	54.4	1388	233.0	233.2	-3.6	0.4	7.9	4.4	21.4	99.3	63
335	8.3	54.5	1317	233.0	233.2	-3.7	0.5	7.5	4.8	21.3	99.3	65
336	8.3	54.3	1353	233.0	233.2	-3.7	0.5	7.0	4.8	21.2	99.3	65
337	8.3	54.3	1358	233.0	233.2	-3.7	0.5	7.5	5.4	21.2	99.3	65
338	8.3	54.3	1318	233.0	233.2	-3.6	0.5	7.4	5.4	21.2	99.3	65
339	7.8	53.9	1096	233.0	233.2	-2.8	0.5	7.0	4.6	21.2	99.3	65
340	7.5	53.6	1013	233.0	233.2	-2.6	0.6	6.8	5.2	21.2	99.3	65
341	7.6	53.3	1022	233.0	233.2	-2.7	0.6	5.9	5.7	21.2	99.3	66
342	7.7	53.3	1068	233.0	233.2	-2.7	0.6	7.2	5.2	21.1	99.3	66
343	7.8	53.5	1095	233.0	233.2	-2.7	0.6	6.9	4.7	21.1	99.3	66
344	7.6	53.6	1035	233.0	233.2	-2.7	0.6	6.4	4.8	21.1	99.3	66
345	7.3	52.7	932	233.0	231.7	-3.5	0.7	5.3	4.6	21.1	99.3	66
346	6.9	50.8	767	233.0	228.3	-3.7	0.6	5.3	5.5	21.1	99.3	66
347	7.5	51.3	1003	233.0	228.3	-3.6	1.5	7.0	5.3	21.2	99.3	65
348	7.6	51.8	1022	233.0	228.2	-3.6	1.4	7.1	5.8	21.2	99.3	65
349	7.2	51.1	873	233.0	228.0	-3.7	0.7	7.1	6.0	21.2	99.3	65
350			698	233.0	228.1	-3.7	0.7	5.8	7.0	21.2	99.3	65
351			580	233.0	229.7	-2.9	0.8	5.3	6.6	21.2	99.3	65
352			561	233.0	234.6	-2.7	0.6	5.6	7.4	21.2	99.3	65

Table E.01 Measurement data - Turbine ON

Project: Grand Renewable Wind Farm - Turbine T63 - IEC 61400-11 Measurement

Report ID: 14284.00.T63.RP5

Created on: 2/28/2018

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

Data Point #	Standardized Wind Speed	LAeq	Turbine Power Output (kW)	Reference Yaw Angle (°)	Yaw Angle (°)	Pitch Angle (°)	Rotor RPM	Nacelle Anemometer Wind Speed (m/s)	10m Anemometer Wind Speed (m/s)	Air Temperature (-C)	Pressure (kPa)	Relative Humidity (%)
353			592	233.0	237.6	-2.6	0.6	5.6	7.5	21.2	99.3	63
354			561	233.0	237.6	-2.6	0.7	4.8	6.6	21.2	99.3	62
355			546	233.0	237.6	-2.6	0.9	5.1	6.2	21.2	99.3	62
356			486	233.0	234.5	-2.6	0.9	5.6	5.6	21.2	99.3	62
357			434	233.0	233.1	-3.4	0.8	5.0	6.9	21.2	99.3	62
358			455	233.0	233.1	-3.7	1.0	4.7	6.5	21.2	99.3	62
359			468	233.0	233.0	-3.7	0.7	4.9	6.3	21.2	99.3	64
360			460	233.0	233.0	-3.7	0.7	5.5	5.9	21.2	99.3	64
361			455	233.0	233.0	-3.7	0.7	5.6	5.7	21.2	99.3	64
362	5.6	46.6	405	233.0	233.0	-3.7	0.5	4.8	4.9	21.2	99.3	64
363	5.3	45.4	337	233.0	233.0	-3.0	0.6	4.7	4.2	21.2	99.3	64
364			329	233.0	233.0	-2.6	0.7	4.9	4.8	21.2	99.3	64
365	5.8	45.9	449	233.0	234.8	-2.7	0.8	5.5	5.3	21.2	99.3	65
366			625	233.0	238.9	-2.7	0.8	6.1	6.4	21.2	99.3	65
367	7.4	50.3	967	233.0	239.4	-2.6	0.6	6.4	6.6	21.2	99.3	65
368	7.6	51.9	1047	233.0	239.4	-2.6	0.7	6.7	6.4	21.2	99.3	65
369	7.0	50.8	812	233.0	239.4	-3.2	0.6	5.5	5.8	21.2	99.3	65
370	6.7	49.4	704	233.0	239.4	-3.7	0.6	4.7	5.2	21.2	99.3	65
371	6.4	49.1	603	233.0	239.8	-3.7	0.8	4.3	4.8	21.2	99.3	65
372	6.1	48.1	501	233.0	243.5	-3.7	0.9	4.3	4.2	21.2	99.3	65
373	5.6	47.8	404	233.0	247.5	-3.7	0.9	4.3	5.1	21.2	99.3	65
374			281	233.0	248.1	-3.6	0.9	4.4	5.2	21.2	99.3	65
375			214	233.0	251.4	-3.0	0.9	4.1	4.9	21.2	99.3	65
376			225	233.0	254.5	-2.6	1.0	3.4	5.4	21.2	99.3	65
377			255	233.0	254.5	-2.6	0.8	3.5	4.8	21.2	99.3	65
378			338	233.0	254.5	-2.6	0.6	4.8	5.0	21.2	99.3	65
379			443	233.0	253.8	-2.6	1.2	5.3	5.8	21.2	99.3	65
380			507	233.0	250.0	-2.6	0.6	6.1	4.6	21.2	99.3	65
381			471	233.0	249.4	-3.1	0.6	4.7	3.8	21.2	99.3	65
382			429	233.0	249.4	-3.6	0.6	5.0	4.0	21.2	99.3	65
383			467	233.0	249.4	-3.6	0.4	5.4	3.8	21.3	99.3	65
384			548	233.0	249.2	-3.6	0.2	6.1	5.2	21.3	99.3	65
385	6.2	48.9	557	233.0	246.0	-3.6	0.5	5.0	5.6	21.3	99.3	65
386	6.2	48.8	540	233.0	245.3	-3.6	0.6	6.0	6.2	21.3	99.3	65
387	6.0	48.3	498	233.0	246.3	-3.3	0.6	6.0	5.8	21.3	99.3	65
388			481	233.0	249.1	-2.6	0.4	4.8	7.5	21.3	99.3	65
389			449	233.0	249.2	-2.6	0.3	4.9	7.1	21.4	99.3	61
390			367	233.0	249.2	-2.6	0.5	4.0	6.3	21.4	99.3	60
391			311	233.0	249.2	-2.6	0.4	3.5	6.2	21.4	99.3	60
392			345	233.0	249.2	-2.6	0.5	4.5	6.0	21.4	99.3	60
393			388	233.0	249.2	-3.0	0.5	4.2	5.3	21.4	99.3	60
394			374	233.0	252.5	-3.6	0.4	4.4	4.7	21.4	99.3	60
395			344	233.0	256.1	-3.6	0.4	4.2	4.5	21.4	99.3	60
396			324	233.0	256.3	-3.6	0.3	3.9	4.6	21.4	99.3	60
397			418	233.0	256.1	-3.6	0.5	4.5	3.3	21.4	99.3	60
398			441	233.0	254.1	-3.6	0.5	4.2	4.6	21.4	99.3	60
399			383	233.0	255.4	-3.4	0.6	4.4	6.4	21.4	99.3	60
400			301	233.0	260.1	-2.6	0.6	4.3	6.0	21.4	99.3	60
401			229	233.0	263.7	-2.5	0.4	4.1	5.8	21.5	99.3	62
402			167	233.0	263.9	-2.5	0.3	3.0	5.8	21.5	99.3	63
403			135	233.0	262.4	-2.5	0.7	3.7	6.0	21.5	99.3	63
404			156	233.0	258.3	-2.5	0.6	5.0	4.7	21.5	99.3	63
405			233	233.0	257.8	-2.7	0.3	4.5	5.5	21.5	99.3	63
406			336	233.0	257.7	-3.6	0.3	5.0	5.5	21.5	99.3	63
407			410	233.0	257.7	-3.7	0.2	4.2	6.9	21.5	99.3	63
408			462	233.0	255.7	-3.7	0.2	4.3	6.4	21.5	99.3	63
409			544	233.0	252.8	-3.7	0.3	5.2	6.8	21.5	99.3	63
410			649	233.0	252.8	-3.6	0.3	5.2	6.9	21.5	99.3	63
411			671	233.0	252.7	-3.5	0.3	5.6	6.4	21.5	99.3	63
412			540	233.0	252.0	-2.6	0.3	4.1	8.0	21.5	99.3	63
413			498	233.0	249.3	-2.6	0.3	5.0	8.6	21.5	99.3	64
414			578	233.0	249.2	-2.6	0.4	5.6	7.2	21.5	99.3	64
415			706	233.0	249.2	-2.6	0.4	5.8	6.7	21.5	99.3	64
416			871	233.0	249.2	-2.6	0.5	6.3	5.1	21.5	99.3	64
417			809	233.0	249.2	-2.8	0.5	5.9	4.6	21.5	99.3	64
418			688	233.0	249.2	-3.7	0.4	5.2	4.2	21.5	99.3	64
419			726	233.0	249.2	-3.6	0.3	6.1	4.1	21.4	99.3	59
420			742	233.0	249.2	-3.6	0.4	5.9	5.2	21.4	99.3	57
421			685	233.0	248.3	-3.7	0.4	5.0	4.6	21.4	99.3	57
422	6.7	50.2	691	233.0	244.1	-3.6	0.4	5.1	4.6	21.4	99.3	57
423	6.4	49.7	603	233.0	242.3	-3.6	0.3	4.3	5.4	21.4	99.3	57
424	6.6	48.9	673	233.0	245.5	-2.6	0.4	5.9	4.3	21.4	99.3	57
425	6.9	49.8	757	233.0	247.8	-2.6	0.4	6.1	4.1	21.5	99.3	62
426	7.0	50.4	782	233.0	247.9	-2.6	0.4	5.1	4.9	21.5	99.3	64
427	7.7	51.2	1074	233.0	246.9	-2.6	0.5	6.3	5.1	21.5	99.3	64
428	7.4	52.5	962	233.0	242.8	-2.6	0.5	6.9	5.7	21.5	99.3	64
429	6.8	50.8	727	233.0	242.1	-2.7	0.6	5.5	4.9	21.5	99.3	64
430	6.2	49.2	532	233.0	242.1	-3.6	0.5	5.0	4.5	21.5	99.3	64
431	5.9	47.8	454	233.0	242.1	-3.7	0.6	5.3	4.0	21.4	99.3	63
432	6.1	47.4	521	233.0	242.0	-3.7	0.5	6.2	4.5	21.4	99.3	63
433	6.7	49.7	702	233.0	242.0	-3.6	0.5	5.9	4.4	21.4	99.3	63
434	7.2	51.4	892	233.0	241.9	-3.7	0.6	6.5	4.2	21.4	99.3	63
435	7.0	51.1	803	233.0	241.9	-3.7	0.6	5.7	4.5	21.4	99.3	63
436	6.9	50.3	752	233.0	242.0	-2.7	0.5	5.1	3.9	21.4	99.3	63
437	7.2	51.1	875	233.0	243.6	-2.6	0.5	6.6	3.6	21.4	99.3	64
438	7.2	51.5	877	233.0	245.9	-2.6	0.5	6.5	4.4	21.3	99.3	65
439	7.5	51.6	978	233.0	245.9	-2.6	0.5	6.8	5.2	21.3	99.3	65
440	7.9	51.8	1141	233.0	245.9	-2.6	0.5	6.8	5.2	21.3	99.3	65

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

Data Point #	Standardized Wind Speed	LAeq	Turbine Power Output (kW)	Reference Yaw Angle (°)	Yaw Angle (°)	Pitch Angle (°)	Rotor RPM	Nacelle Anemometer Wind Speed (m/s)	10m Anemometer Wind Speed (m/s)	Air Temperature (-C)	Pressure (kPa)	Relative Humidity (%)
441	7.8	51.8	1100	233.0	245.0	-2.6	0.5	6.9	4.3	21.3	99.3	65
442	7.3	51.5	921	233.0	241.9	-3.6	0.5	6.8	4.9	21.3	99.3	65
443	6.7	50.8	689	233.0	241.7	-3.6	0.5	5.1	5.1	21.2	99.3	63
444	5.9	48.5	465	233.0	242.2	-3.6	0.6	3.7	4.3	21.2	99.3	62
445	5.4	46.4	361	233.0	246.2	-3.6	0.5	4.4	3.6	21.2	99.3	62
446			328	233.0	250.6	-3.5	0.5	4.4	3.5	21.2	99.3	62
447			383	233.0	251.6	-3.6	0.5	4.9	3.8	21.2	99.3	62
448			416	233.0	251.6	-2.8	0.5	5.0	6.0	21.2	99.3	62
449			420	233.0	251.7	-2.6	0.5	4.8	5.5	21.2	99.3	60
450			387	233.0	251.8	-2.6	0.5	4.2	4.3	21.2	99.3	59
451			300	233.0	251.8	-2.6	0.6	3.4	3.8	21.2	99.3	59
452			264	233.0	251.7	-2.6	0.6	3.5	4.2	21.2	99.3	59
453			237	233.0	251.7	-2.6	0.7	3.4	5.1	21.2	99.3	59
454			240	233.0	251.2	-3.4	0.6	4.0	5.8	21.2	99.3	59
455			294	233.0	247.4	-3.5	0.5	4.3	5.1	21.3	99.3	63
456			310	233.0	246.4	-3.5	0.5	4.3	6.0	21.3	99.3	65
457	5.6	46.2	394	233.0	246.3	-3.6	0.5	4.1	4.3	21.3	99.3	65
458	6.1	48.3	527	233.0	246.3	-3.6	0.6	4.4	4.1	21.3	99.3	65
459			536	233.0	246.3	-3.7	0.6	4.2	5.6	21.3	99.3	65
460			536	233.0	246.8	-2.9	0.6	4.8	5.4	21.3	99.3	65
461			511	233.0	249.6	-2.6	0.6	5.3	4.6	21.3	99.3	60
462			433	233.0	249.8	-2.6	0.6	4.7	4.6	21.3	99.3	59
463			394	233.0	249.8	-2.7	0.4	4.9	4.5	21.3	99.3	59
464			349	233.0	249.8	-2.6	0.4	5.0	4.2	21.3	99.3	59
465			273	233.0	249.8	-2.6	0.5	3.8	3.9	21.3	99.3	59
466			223	233.0	249.8	-3.2	0.5	4.1	3.6	21.3	99.3	59
467			203	233.0	250.6	-3.5	0.6	4.1	3.5	21.3	99.3	59
468			240	233.0	253.8	-3.5	0.6	4.4	4.7	21.3	99.3	59
469			277	233.0	254.0	-3.6	0.6	4.3	4.6	21.3	99.3	59
470			287	233.0	254.0	-3.6	0.5	3.9	3.8	21.3	99.3	59
471			297	233.0	250.9	-3.6	0.6	4.5	4.9	21.3	99.3	59
472			264	233.0	249.8	-3.0	0.6	4.3	4.4	21.3	99.3	59
473			204	233.0	250.7	-2.5	0.6	3.6	3.2	21.4	99.3	58
474			212	233.0	255.1	-2.5	0.6	4.3	3.2	21.4	99.3	58
475			224	233.0	259.3	-2.5	0.6	4.4	3.8	21.4	99.3	58
476			185	233.0	259.9	-2.5	0.6	4.3	4.9	21.4	99.3	58
477			172	233.0	260.5	-2.5	0.5	4.2	4.8	21.4	99.3	58
478			187	233.0	264.4	-3.0	0.5	4.6	4.6	21.4	99.3	58
479			186	233.0	266.7	-3.5	0.5	4.9	4.5	21.4	99.3	55
480			159	233.0	266.6	-3.5	0.6	4.5	4.0	21.4	99.3	55
481			104	233.0	266.7	-3.4	0.6	4.0	3.5	21.4	99.3	55
482			75	233.0	266.7	-3.4	0.7	3.2	4.4	21.4	99.3	55
483			86	233.0	266.7	-3.3	0.6	2.7	4.3	21.4	99.3	55
484			80	233.0	267.7	-2.8	0.6	2.5	3.4	21.4	99.3	55
485			52	233.0	272.1	-2.3	0.7	3.3	3.1	21.5	99.3	53
486			67	233.0	274.5	-2.3	0.6	2.0	3.8	21.5	99.3	53
487	9.7	55.9	1905	222.0	228.1	-1.1	15.1	8.5	5.4	22.7	99.7	80
488	9.5	55.5	1855	222.0	228.1	-1.2	14.9	8.9	6.1	22.7	99.7	80
489	9.1	55.3	1687	222.0	228.1	-2.0	14.8	9.1	7.6	22.7	99.7	80
490	8.8	55.2	1569	222.0	228.1	-2.5	14.8	9.3	5.8	22.7	99.7	80
491	8.6	55.6	1455	222.0	230.0	-2.9	14.6	7.1	4.0	22.7	99.7	80
492	8.7	55.7	1546	222.0	232.7	-2.7	14.8	6.6	4.8	22.7	99.7	80
493	8.9	55.4	1611	222.0	232.7	-2.2	14.9	5.8	7.5	22.7	99.7	80
494	10.9	55.9	2223	222.0	230.7	0.7	15.4	9.4	6.1	22.7	99.7	80
495	11.7	55.6	2214	222.0	227.9	0.8	15.4	10.1	5.8	22.7	99.7	80
496	11.9	56.1	2243	222.0	227.9	2.8	15.7	10.3	5.4	22.7	99.7	80
497	11.6	55.6	2219	222.0	227.9	3.3	15.4	10.0	4.7	22.7	99.7	80
498	10.6	55.7	2126	222.0	227.9	0.0	14.9	7.5	4.7	22.8	99.7	79
499	11.2	55.8	2219	222.0	227.9	1.2	15.4	9.6	6.0	22.9	99.7	79
500	10.4	55.9	2095	222.0	227.9	0.0	14.9	7.9	6.9	22.9	99.7	79
501	9.4	55.3	1819	222.0	227.9	-1.4	14.7	8.0	7.3	22.9	99.7	79
502	10.4	55.9	2085	222.0	227.9	-0.2	15.2	7.6	9.9	22.9	99.7	79
503	12.9	56.0	2243	222.0	227.9	3.0	15.8	11.1	9.3	22.9	99.7	79
504	12.4	56.2	2230	222.0	227.9	5.3	15.8	10.6	7.5	22.9	99.7	79
505	13.7	55.2	2236	222.0	227.9	6.3	15.7	11.8	7.6	22.9	99.7	78
506	13.7	55.2	2203	222.0	228.1	5.7	15.3	11.8	6.2	22.9	99.7	78
507	12.6	55.4	2180	222.0	231.5	1.9	15.1	10.9	6.6	22.9	99.7	78
508	10.7	55.5	2140	222.0	232.4	0.1	14.9	8.7	6.0	22.9	99.7	78
509	9.5	55.0	1842	222.0	232.4	-1.3	14.7	8.9	5.0	22.9	99.7	78
510	9.8	55.9	1947	222.0	232.4	-0.8	14.9	8.4	5.9	22.9	99.7	78
511	9.3	56.0	1762	222.0	232.4	-1.5	14.8	8.7	7.1	22.9	99.7	78
512	8.8	55.4	1554	222.0	232.4	-2.7	14.8	8.5	6.5	22.9	99.7	78
513	11.9	56.4	2194	222.0	232.4	0.3	15.4	10.3	7.0	22.9	99.7	78
514	11.1	56.2	2239	222.0	232.4	3.2	15.9	9.5	6.1	22.9	99.7	78
515	15.0	56.6	2223	222.0	232.4	5.8	15.6	12.9	6.1	22.9	99.7	78
516	11.2	55.0	2209	222.0	232.4	3.3	15.2	9.7	6.1	23.0	99.7	78
517	11.6	55.5	2186	222.0	232.1	1.8	15.2	10.0	6.9	23.1	99.7	79
518	9.5	55.1	1830	222.0	230.0	-1.2	14.6	8.3	6.4	23.1	99.7	79
519	9.5	55.7	1862	222.0	229.9	-1.2	14.9	8.0	3.2	23.1	99.7	79
520	9.7	55.4	1938	222.0	229.9	-0.8	14.9	7.5	6.0	23.1	99.7	79
521	8.5	55.3	1452	222.0	229.9	-2.7	14.5	7.1	6.6	23.1	99.7	79
522	8.9	55.0	1605	222.0	229.9	-2.4	14.9	7.3	7.9	23.1	99.7	78
523	10.7	56.2	2141	222.0	229.9	0.1	15.2	9.6	9.1	23.1	99.7	77
524	9.7	55.5	1919	222.0	229.9	-0.9	14.8	8.3	8.7	23.1	99.7	77
525	9.5	55.4	1865	222.0	229.9	-1.1	14.9	8.0	7.6	23.1	99.7	77
526	10.5	55.5	2104	222.0	229.9	-0.1	15.3	10.3	8.1	23.1	99.7	77
527			2234	222.0	229.9	1.1	15.5	9.0	9.6	23.1	99.7	77
528			2220	222.0	229.9	2.7	15.5	8.8	8.2	23.1	99.7	77

Table E.01 Measurement data - Turbine ON

Project: Grand Renewable Wind Farm - Turbine T63 - IEC 61400-11 Measurement

Report ID: 14284.00.T63.RP5

Created on: 2/28/2018

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

Data Point #	Standardized Wind Speed	LAeq	Turbine Power Output (kW)	Reference Yaw Angle (°)	Yaw Angle (°)	Pitch Angle (°)	Rotor RPM	Nacelle Anemometer Wind Speed (m/s)	10m Anemometer Wind Speed (m/s)	Air Temperature (-C)	Pressure (kPa)	Relative Humidity (%)
529	9.2	55.8	1749	222.0	229.9	-1.5	14.5	7.3	8.0	23.1	99.7	78
530	9.4	55.8	1797	222.0	229.9	-1.7	15.0	7.8	7.7	23.1	99.7	78
531	10.1	55.6	2046	222.0	231.1	-0.3	15.2	8.9	7.5	23.1	99.7	78
532	11.9	56.3	2250	222.0	233.0	2.5	15.7	10.2	6.4	23.1	99.7	78
533	13.0	56.2	2234	222.0	233.0	3.5	15.6	11.2	7.1	23.1	99.7	78
534			2157	222.0	233.1	0.3	14.9	8.7	5.9	23.0	99.7	78
535	9.8	56.0	1953	222.0	232.9	-0.6	14.7	8.6	5.2	23.0	99.7	78
536	10.6	55.8	2116	222.0	229.9	0.7	15.5	9.7	5.6	23.0	99.7	78
537	11.9	56.5	2234	222.0	228.0	3.7	15.7	10.2	6.0	23.0	99.7	78
538			2210	222.0	228.0	1.5	15.3	8.9	6.8	23.0	99.7	78
539	13.5	56.0	2243	222.0	228.0	3.6	15.8	11.6	6.7	23.0	99.7	78
540	12.6	55.3	2242	222.0	228.0	4.3	15.5	10.9	6.4	23.0	99.7	78
541	11.9	55.3	2222	222.0	228.0	2.9	15.3	10.2	6.9	23.1	99.7	78
542			2205	222.0	228.0	0.9	15.2	9.2	7.4	23.1	99.7	78
543	10.6	55.3	2117	222.0	228.8	0.0	14.9	9.2	8.0	23.1	99.7	78
544	9.3	55.2	1793	222.0	231.7	-1.5	14.7	8.6	7.0	23.1	99.7	78
545	9.3	55.7	1790	222.0	231.7	-1.4	14.8	8.3	6.3	23.1	99.7	78
546	9.7	55.5	1906	222.0	231.7	-1.1	15.1	8.1	8.3	23.1	99.7	78
547	9.7	55.6	1935	222.0	231.9	-0.8	14.9	9.0	7.9	23.1	99.7	77
548	8.6	55.5	1498	222.0	232.0	-2.5	14.5	6.3	7.6	23.1	99.7	77
549	8.2	55.2	1296	222.0	231.7	-2.9	14.4	6.4	4.6	23.1	99.7	77
550	8.3	55.6	1352	222.0	229.3	-2.8	14.5	6.0	6.0	23.1	99.7	77
551	9.0	55.9	1647	222.0	228.7	-2.3	15.0	7.8	7.3	23.1	99.7	77
552	9.2	56.4	1757	222.0	228.7	-1.6	15.0	7.5	7.2	23.1	99.7	78
553	8.7	55.8	1544	222.0	229.1	-2.4	14.7	6.9	6.6	23.1	99.7	79
554	8.3	55.4	1345	222.0	233.3	-2.9	14.4	6.5	6.4	23.1	99.7	79
555	8.7	55.5	1505	222.0	234.6	-2.8	14.8	8.4	7.2	23.1	99.7	79
556			1491	222.0	234.6	-2.8	14.7	8.6	9.1	23.1	99.7	79
557	8.7	55.5	1529	222.0	234.6	-2.8	14.8	7.4	7.3	23.1	99.7	79
558	9.3	55.9	1787	222.0	234.6	-1.5	15.1	9.2	6.4	23.1	99.7	78
559	9.5	55.5	1866	222.0	234.6	-1.1	15.1	7.9	7.5	23.1	99.7	78
560	10.3	55.8	2075	222.0	234.6	-0.1	15.1	9.2	7.1	23.1	99.7	78
561	9.5	55.9	1865	222.0	233.8	-1.0	14.8	7.1	6.7	23.1	99.7	78
562	10.0	55.5	2036	222.0	229.4	-0.3	15.1	8.9	6.7	23.1	99.7	78
563	13.2	56.0	2240	222.0	228.7	2.9	15.8	11.3	7.5	23.1	99.7	78
564	14.3	56.2	2215	222.0	228.6	4.9	15.5	12.3	8.2	23.1	99.7	78
565	13.9	55.3	2231	222.0	228.6	4.1	15.5	12.0	7.9	23.1	99.7	78
566	12.9	56.0	2237	222.0	228.6	4.9	15.5	11.1	7.4	23.1	99.7	78
567	11.6	55.3	2245	222.0	228.6	4.7	15.6	10.0	6.7	23.1	99.7	78
568	13.7	55.8	2242	222.0	228.6	5.8	15.6	11.8	7.3	23.1	99.7	78
569	13.2	55.1	2199	222.0	228.6	4.0	15.2	11.4	8.3	23.1	99.7	78
570	13.4	56.1	2230	222.0	228.6	4.8	15.8	11.5	7.0	23.1	99.7	78
571	13.1	55.5	2231	222.0	228.6	5.1	15.4	11.2	6.2	23.1	99.7	77
572	12.5	55.5	2203	222.0	228.6	2.6	15.2	10.7	6.1	23.1	99.7	77
573	11.4	55.6	2200	222.0	228.6	0.4	15.2	9.8	6.2	23.1	99.7	77
574	11.0	55.8	2178	222.0	228.6	0.4	15.0	9.4	6.1	23.1	99.7	77
575	12.7	56.1	2223	222.0	228.6	2.1	15.5	10.9	6.9	23.1	99.7	77
576	9.5	55.7	1843	222.0	228.6	-1.2	14.6	8.0	8.7	23.1	99.7	77
577	9.1	55.5	1701	222.0	228.6	-1.9	14.7	7.2	8.7	23.1	99.7	77
578	9.6	55.8	1891	222.0	228.6	-0.9	15.3	8.4	6.5	23.1	99.7	77
579			2207	222.0	229.0	1.8	15.4	8.6	7.1	23.1	99.7	77
580	8.9	55.5	1625	222.0	231.5	-2.0	14.4	6.6	7.0	23.1	99.7	77
581	8.6	55.9	1462	222.0	231.7	-2.9	14.6	7.0	8.5	23.1	99.7	77
582	8.6	55.5	1460	222.0	231.2	-2.9	14.7	7.3	7.7	23.1	99.7	77
583	7.9	55.2	1156	222.0	228.3	-2.9	14.2	6.0	6.2	23.1	99.7	78
584	8.4	55.3	1402	222.0	228.1	-2.9	14.6	7.0	5.9	23.1	99.7	78
585	9.4	56.0	1797	222.0	228.2	-1.6	15.1	6.8	4.9	23.1	99.7	78
586	9.3	56.0	1786	222.0	228.2	-1.3	14.9	8.1	4.9	23.1	99.7	78
587	8.3	55.4	1351	222.0	228.1	-2.9	14.4	5.8	5.2	23.1	99.7	78
588	8.4	55.0	1370	222.0	228.1	-2.9	14.4	6.5	4.3	23.1	99.7	78
589	9.1	55.3	1719	222.0	228.1	-1.8	15.0	7.6	4.2	23.1	99.7	79
590	9.5	55.7	1838	222.0	228.1	-1.2	14.9	8.0	4.9	23.1	99.7	79
591	8.9	55.9	1612	222.0	228.1	-2.4	14.8	7.6	5.8	23.1	99.7	79
592	9.2	56.2	1741	222.0	228.1	-1.7	15.0	7.2	4.7	23.1	99.7	79
593	11.6	56.4	2217	222.0	228.7	0.8	15.5	9.9	6.0	23.1	99.7	79
594	11.2	56.4	2193	222.0	231.2	0.3	15.1	9.7	6.6	23.1	99.7	79
595			2240	222.0	231.4	1.2	15.5	9.0	6.8	23.3	99.7	78
596			2227	222.0	231.4	0.6	15.4	8.3	6.3	23.3	99.7	78
597	10.0	55.8	2023	222.0	231.4	-0.3	14.8	7.8	6.5	23.3	99.7	78
598	9.3	55.4	1758	222.0	229.2	-1.5	14.6	7.9	7.1	23.3	99.7	78
599	9.6	55.4	1897	222.0	227.2	-1.1	15.1	7.4	7.3	23.3	99.7	78
600	12.6	56.0	2224	222.0	228.2	3.0	15.9	10.8	6.2	23.3	99.7	78
601	11.6	56.0	2224	222.0	230.2	4.1	15.5	10.0	7.5	23.3	99.7	77
602	12.7	55.6	2243	222.0	230.3	4.1	15.6	10.9	10.5	23.3	99.7	77
603	13.0	55.7	2227	222.0	230.1	5.5	15.6	11.2	8.6	23.3	99.7	77
604	13.4	55.4	2192	222.0	227.7	2.8	15.1	11.5	7.5	23.3	99.7	77
605	11.3	55.8	2157	222.0	227.3	0.2	14.9	9.7	7.2	23.3	99.7	77
606	9.7	55.3	1928	222.0	227.2	-0.8	14.7	8.9	8.4	23.2	99.7	77
607	9.6	55.7	1880	222.0	227.2	-1.2	14.9	8.4	6.2	23.2	99.7	76
608	11.9	56.0	2204	222.0	227.2	0.4	15.2	10.2	4.8	23.2	99.7	76
609	11.3	56.4	2244	222.0	227.2	3.5	15.9	9.7	5.1	23.2	99.7	76
610	14.3	56.3	2237	222.0	227.2	6.8	16.1	12.3	5.3	23.2	99.7	76
611	14.5	55.8	2236	222.0	227.2	7.6	15.5	12.5	4.5	23.2	99.7	76
612	13.1	54.7	2202	222.0	227.2	5.5	15.2	11.2	4.4	23.2	99.7	77
613	14.7	55.7	2250	222.0	227.2	6.4	15.8	12.6	5.3	23.2	99.7	79
614	14.3	55.8	2211	222.0	227.2	6.3	15.3	12.3	7.2	23.2	99.7	79
615	14.9	55.4	2219	222.0	227.2	4.9	15.4	12.9	7.8	23.2	99.7	79
616	12.9	55.6	2194	222.0	227.2	2.5	15.1	11.1	6.7	23.2	99.7	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 (kPa)	Relative Humidity (%)
617	9.6	55.2	1898	222.0	227.2	-0.9	14.6	9.3	7.5	23.2	99.7	79
618	8.8	55.3	1576	222.0	227.2	-2.6	14.7	7.2	7.5	23.3	99.7	79
619	9.3	55.7	1775	222.0	227.2	-1.6	15.0	8.0	7.7	23.3	99.7	77
620	9.6	56.0	1872	222.0	227.2	-1.0	15.0	8.8	7.0	23.3	99.7	77
621	9.6	56.0	1891	222.0	227.2	-1.0	14.9	8.1	8.1	23.3	99.7	77
622	9.8	55.9	1945	222.0	227.2	-0.8	14.9	7.8	8.4	23.3	99.7	77
623	9.6	56.0	1870	222.0	227.2	-1.0	14.9	7.5	7.8	23.3	99.7	77
624	11.4	56.6	2202	222.0	227.2	2.0	15.7	9.8	8.1	23.3	99.7	76
625	12.8	56.5	2239	222.0	227.2	5.7	16.0	11.1	9.9	23.3	99.6	76
626			2159	222.0	227.2	2.6	15.0	8.5	7.9	23.3	99.6	76
627	12.2	56.0	2177	222.0	227.2	1.4	15.4	10.5	8.0	23.3	99.6	76
628	12.6	56.7	2223	222.0	227.2	4.0	15.6	10.9	8.6	23.3	99.6	76
629	12.1	55.9	2245	222.0	227.2	4.8	15.8	10.4	6.9	23.3	99.6	76
630	12.4	55.7	2223	222.0	227.2	5.6	15.5	10.7	6.0	23.3	99.6	76
631	12.0	55.3	2226	222.0	227.2	4.3	15.3	10.3	4.2	23.2	99.7	78
632	11.5	55.5	2172	222.0	227.2	0.6	15.0	9.9	6.3	23.2	99.7	78
633	10.9	56.0	2180	222.0	227.2	0.2	15.0	9.4	6.5	23.2	99.7	78
634	9.6	55.6	1898	222.0	227.2	-0.9	14.6	9.5	6.6	23.2	99.7	78
635			1818	222.0	227.2	-1.3	14.8	8.3	9.4	23.2	99.7	78
636			1406	222.0	227.2	-2.8	14.5	7.3	9.5	23.3	99.7	77
637			1191	222.0	228.0	-2.9	14.3	6.4	9.8	23.3	99.7	76
638	9.0	55.5	1683	222.0	232.0	-2.0	15.0	7.7	8.8	23.3	99.7	76
639	10.4	56.1	2096	222.0	232.8	-0.2	15.3	8.7	7.1	23.3	99.7	76
640	11.3	56.2	2245	222.0	232.9	1.5	15.5	9.8	9.9	23.3	99.7	76
641	10.2	56.0	2057	222.0	232.9	-0.2	14.8	8.8	9.0	23.3	99.7	76
642	9.0	55.4	1677	222.0	232.9	-1.9	14.6	7.0	7.6	23.2	99.7	77
643			1344	222.0	231.7	-2.8	14.5	5.8	8.7	23.1	99.7	77
644			1671	222.0	227.8	-2.1	15.0	7.2	10.4	23.1	99.7	77
645			1777	222.0	227.1	-1.6	15.0	7.9	10.1	23.1	99.7	77
646	9.0	55.8	1651	222.0	227.1	-2.0	14.8	8.7	7.7	23.1	99.7	77
647	8.5	55.5	1427	222.0	227.1	-2.9	14.6	8.1	6.5	23.1	99.7	77
648	8.5	55.3	1454	222.0	227.1	-2.6	14.6	7.4	6.1	23.1	99.7	77
649	12.0	56.4	2232	222.0	226.3	2.6	15.9	10.3	5.2	23.1	99.7	78
650	15.1	57.0	2227	222.0	224.0	7.3	15.9	13.0	5.7	23.1	99.7	78
651	13.7	55.8	2226	222.0	224.0	6.1	15.4	11.8	5.7	23.1	99.7	78
652	13.7	55.8	2211	222.0	223.9	5.4	15.2	11.8	5.7	23.1	99.7	78
653	11.0	55.5	2222	222.0	223.9	3.7	15.4	9.4	5.7	23.1	99.7	78
654	13.9	56.3	2224	222.0	223.9	4.7	15.5	12.0	6.1	23.1	99.7	78
655	12.0	55.0	2175	222.0	223.9	1.3	15.1	10.3	4.8	23.1	99.7	78
656	9.7	55.6	1918	222.0	224.1	-0.8	14.6	8.1	5.5	23.1	99.7	78
657	8.7	55.9	1542	222.0	226.6	-2.6	14.6	7.0	8.1	23.1	99.7	78
658	9.3	56.1	1765	222.0	227.0	-1.7	15.1	6.3	7.7	23.1	99.7	78
659	11.7	56.3	2232	222.0	226.6	4.4	16.1	10.0	6.2	23.1	99.7	78
660	13.4	55.9	2207	222.0	223.5	5.9	15.4	11.6	6.4	23.2	99.7	78
661	13.0	54.6	2191	222.0	222.9	2.1	15.0	11.2	6.5	23.1	99.7	78
662	9.6	55.6	1872	222.0	222.9	-0.9	14.6	9.8	5.5	23.1	99.7	78
663	8.0	55.1	1210	222.0	222.9	-2.9	14.2	6.2	5.3	23.1	99.7	78
664	8.1	54.9	1263	222.0	222.8	-2.9	14.3	6.4	6.0	23.1	99.7	78
665	7.7	54.9	1076	222.0	222.8	-3.0	14.0	6.3	6.5	23.1	99.7	78
666	7.9	54.5	1159	222.0	222.7	-3.0	13.1	5.4	5.3	23.2	99.7	78
667	8.5	54.6	1430	222.0	222.7	-1.7	14.1	7.5	4.9	23.3	99.7	78
668			2236	222.0	223.0	1.3	15.5	8.9	5.4	23.3	99.7	78
669	9.1	55.8	1703	222.0	225.3	-1.4	14.4	6.6	5.8	23.3	99.7	78
670	8.7	55.8	1547	222.0	224.9	-2.6	14.8	6.7	5.7	23.3	99.7	78
671	8.2	56.0	1269	222.0	221.4	-2.9	14.3	6.3	7.3	23.3	99.7	78
672	12.9	54.8	2236	222.0	233.1	3.3	15.3	11.1	6.5	23.4	99.7	79
673	9.7	55.1	1906	222.0	233.1	-0.7	14.6	7.8	7.0	23.4	99.7	79
674	8.8	55.1	1593	222.0	233.1	-2.2	14.7	7.0	7.1	23.4	99.7	78
675	9.7	55.6	1937	222.0	233.0	-0.8	15.3	8.0	7.4	23.4	99.7	78
676	11.7	56.2	2248	222.0	230.1	1.1	15.5	10.1	6.3	23.4	99.7	78
677	9.9	55.5	1986	222.0	228.2	-0.4	14.7	8.5	5.9	23.4	99.7	78
678	8.8	55.1	1553	222.0	228.2	-2.4	14.6	8.1	5.0	23.4	99.7	78
679	9.2	55.2	1749	222.0	228.1	-1.7	15.0	8.6	4.8	23.4	99.7	78
680	12.9	55.9	2197	222.0	228.1	0.3	15.2	11.1	4.6	23.4	99.7	79
681	9.9	55.3	2001	222.0	228.1	-0.5	14.8	8.4	4.8	23.4	99.7	79
682	9.3	55.4	1772	222.0	228.4	-1.5	14.7	8.9	5.6	23.4	99.7	79
683	9.6	56.0	1894	222.0	231.3	-1.1	15.0	8.4	7.2	23.4	99.7	79
684	13.0	55.8	2229	222.0	231.8	1.4	15.6	11.2	5.7	23.4	99.7	79
685	13.2	56.0	2244	222.0	231.9	2.8	15.6	11.3	6.5	23.3	99.7	79
686	12.7	56.0	2252	222.0	232.0	4.4	15.7	10.9	4.5	23.4	99.7	79
687			2210	222.0	232.0	1.2	15.1	9.2	4.5	23.5	99.7	79
688			2247	222.0	232.0	1.6	15.6	8.8	5.4	23.5	99.7	79
689	14.0	56.0	2242	222.0	232.0	6.4	16.1	12.1	9.1	23.5	99.7	79
690	12.7	55.1	2238	222.0	232.0	5.7	15.4	11.0	8.0	23.5	99.7	79
691	11.7	55.0	2227	222.0	232.0	4.5	15.3	10.1	6.3	23.5	99.7	79
692	12.1	55.4	2241	222.0	232.0	4.4	15.5	10.4	6.0	23.5	99.7	78
693	11.6	55.2	2206	222.0	230.8	1.9	15.2	9.9	6.7	23.5	99.7	78
694			2233	222.0	227.4	1.3	15.4	8.8	6.7	23.5	99.7	78
695			2195	222.0	227.3	0.3	15.1	8.5	5.6	23.5	99.7	78
696	11.5	55.8	2229	222.0	227.3	0.5	15.3	9.9	4.8	23.5	99.7	78
697	13.0	56.6	2255	222.0	227.3	4.2	16.1	11.2	6.3	23.5	99.7	78
698	14.3	56.4	2214	222.0	227.3	8.9	15.7	12.3	7.4	23.5	99.7	78
699	15.2	54.6	2218	222.0	227.5	7.4	15.3	13.1	9.1	23.5	99.7	78
700	12.3	54.8	2187	222.0	230.9	4.6	15.0	10.6	6.8	23.5	99.7	78
701			2197	222.0	232.1	1.8	15.1	9.0	5.6	23.5	99.7	78
702	11.9	55.6	2212	222.0	232.1	0.6	15.3	10.3	6.9	23.5	99.7	78
703	12.9	55.8	2256	222.0	232.1	1.5	15.5	11.1	8.0	23.5	99.7	78
704	13.1	55.5	2252	222.0	232.2	3.0	15.7	11.2	7.4	23.5	99.7	78

Table E.01 Measurement data - Turbine ON

Project: Grand Renewable Wind Farm - Turbine T63 - IEC 61400-11 Measurement

Report ID: 14284.00.T63.RP5

Created on: 2/28/2018

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

Data Point #	Standardized Wind Speed	LAeq	Turbine Power Output (kW)	Reference Yaw Angle (°)	Yaw Angle (°)	Pitch Angle (°)	Rotor RPM	Nacelle Anemometer Wind Speed (m/s)	10m Anemometer Wind Speed (m/s)	Air Temperature (-C)	Pressure (kPa)	Relative Humidity (%)
705	12.6	55.2	2220	222.0	232.1	1.5	15.2	10.8	7.5	23.5	99.7	78
706	10.6	55.5	2119	222.0	232.1	0.0	14.9	8.0	8.2	23.5	99.7	78
707	9.5	55.4	1865	222.0	232.1	-1.1	14.7	8.6	7.3	23.5	99.7	78
708	9.6	55.3	1882	222.0	232.1	-1.3	15.0	6.1	9.1	23.5	99.7	78
709	10.3	55.9	2077	222.0	232.1	-0.2	15.0	7.0	9.7	23.5	99.7	78
710	12.1	56.0	2227	222.0	232.1	0.6	15.3	10.4	8.8	23.4	99.7	78
711	11.3	55.7	2202	222.0	232.2	0.8	15.2	9.7	7.4	23.4	99.7	78
712	9.7	55.0	1918	222.0	232.1	-1.0	14.8	8.0	6.2	23.4	99.7	78
713	11.6	56.4	2250	222.0	232.1	3.1	15.8	10.0	4.7	23.4	99.7	78
714			2199	222.0	232.2	0.8	15.1	8.4	4.9	23.4	99.7	78
715	11.2	56.0	2245	222.0	232.1	1.6	15.6	9.7	5.0	23.4	99.7	78
716	11.9	56.3	2231	222.0	232.1	2.8	15.5	10.2	6.3	23.3	99.7	79
717			2205	222.0	232.1	0.4	15.1	9.2	6.1	23.3	99.7	80
718			2233	222.0	232.1	0.5	15.3	8.7	6.2	23.3	99.7	80
719			2221	222.0	232.1	0.4	15.3	8.0	6.5	23.3	99.7	80
720	12.8	56.1	2257	222.0	232.1	3.1	15.9	11.0	6.0	23.3	99.7	80
721	12.1	55.9	2212	222.0	232.1	4.2	15.5	10.4	6.0	23.3	99.7	80
722	12.2	55.1	2232	222.0	232.1	3.0	15.6	10.5	5.7	23.3	99.7	80
723	13.2	56.0	2241	222.0	231.7	6.3	15.9	11.4	5.1	23.3	99.7	79
724	13.1	55.1	2226	222.0	228.8	4.9	15.3	11.3	6.2	23.3	99.7	79
725	13.6	55.3	2249	222.0	228.6	6.4	15.9	11.7	6.1	23.3	99.7	79
726	13.9	55.1	2218	222.0	228.6	6.7	15.4	12.0	5.6	23.3	99.7	79
727	13.8	54.4	2194	222.0	228.6	3.6	15.0	11.8	5.7	23.3	99.7	79
728	12.8	54.8	2183	222.0	228.6	0.5	15.1	11.0	4.1	23.3	99.7	80
729	13.7	57.6	2245	222.0	228.6	4.2	15.9	11.8	5.1	23.3	99.7	80
730	12.3	56.2	2233	222.0	228.6	5.5	15.6	10.6	5.6	23.3	99.7	80
731			2173	222.0	228.6	1.2	15.0	9.1	6.4	23.3	99.7	80
732	12.0	55.4	2225	222.0	228.6	0.8	15.3	10.3	6.0	23.3	99.7	80
733	12.6	56.7	2242	222.0	228.6	4.2	15.9	10.9	6.2	23.3	99.7	80
734	11.2	55.2	2245	222.0	228.6	3.8	15.5	9.7	7.5	23.3	99.7	79
735	12.2	55.7	2248	222.0	228.6	4.7	15.6	10.5	8.9	23.3	99.7	78
736	12.7	55.8	2251	222.0	228.6	6.2	15.8	10.9	10.1	23.3	99.7	78
737	11.5	55.0	2175	222.0	228.6	2.4	15.0	9.9	9.8	23.3	99.7	78
738	11.2	55.7	2220	222.0	231.7	1.0	15.3	9.6	9.4	23.3	99.7	78
739			2250	222.0	233.7	1.4	15.6	8.1	7.5	23.3	99.7	78
740	13.2	56.4	2251	222.0	233.7	6.5	16.2	11.4	6.9	23.2	99.7	79
741	12.8	55.8	2222	222.0	233.7	6.7	15.4	11.0	7.8	23.1	99.7	79
742	14.1	55.4	2209	222.0	232.3	5.5	15.3	12.2	8.0	23.1	99.7	79
743	14.3	55.6	2238	222.0	230.0	5.2	15.4	12.3	7.1	23.1	99.7	79
744	12.4	55.1	2231	222.0	230.0	4.0	15.4	10.7	5.2	23.1	99.7	79
745	11.7	55.9	2227	222.0	230.1	3.5	15.4	10.1	6.8	23.1	99.7	79
746	10.9	55.6	2231	222.0	230.1	2.7	15.4	9.4	10.5	23.1	99.7	79
747	11.6	55.9	2209	222.0	230.1	1.8	15.3	10.0	8.4	23.1	99.7	79
748			2187	222.0	230.0	0.3	15.0	8.3	6.5	23.1	99.7	79
749	12.3	56.1	2251	222.0	230.0	3.2	15.8	10.6	5.7	23.1	99.7	79
750	11.0	56.4	2237	222.0	230.0	5.0	15.6	9.5	5.3	23.1	99.7	79
751			2227	222.0	230.0	4.2	15.5	8.5	5.2	23.1	99.7	79
752	12.7	55.8	2200	222.0	230.4	3.1	15.3	11.0	6.4	23.1	99.7	80
753	12.4	55.8	2228	222.0	233.5	1.1	15.3	10.6	6.2	23.1	99.7	80
754			2243	222.0	234.2	1.0	15.5	8.8	5.5	23.1	99.7	80
755	11.2	56.4	2238	222.0	234.2	4.3	15.9	9.6	4.6	23.1	99.7	80
756	13.4	56.0	2247	222.0	234.2	5.5	15.7	11.5	6.1	23.1	99.7	80
757	11.9	56.0	2240	222.0	234.2	5.9	15.5	10.2	6.3	23.1	99.7	80
758	13.1	55.3	2230	222.0	231.4	5.3	15.4	11.3	7.4	23.1	99.7	79
759	12.8	55.6	2242	222.0	230.4	4.9	15.5	11.0	6.0	23.1	99.7	79
760			2240	222.0	230.4	4.8	15.4	9.2	5.5	23.1	99.7	79
761	12.9	55.6	2231	222.0	230.4	6.0	15.9	11.1	5.3	23.1	99.7	79
762	14.9	56.5	2245	222.0	230.4	8.6	15.7	12.8	5.2	23.1	99.7	79
763	15.7	56.4	2238	222.0	230.4	8.5	15.5	13.5	5.5	23.1	99.7	79
764	15.7	56.0	2225	222.0	230.4	7.8	15.4	13.5	8.8	23.1	99.7	79
765	14.9	55.4	2194	222.0	230.4	6.3	15.1	12.8	8.7	23.1	99.7	79
766	13.5	55.5	2233	222.0	232.8	6.6	15.6	11.7	9.7	23.1	99.7	79
767	13.9	55.7	2247	222.0	233.8	7.3	15.6	12.0	8.1	23.1	99.7	79
768	13.6	55.7	2226	222.0	233.8	6.9	15.4	11.7	7.3	23.1	99.7	79
769	12.2	55.0	2220	222.0	233.7	5.8	15.3	10.5	8.1	23.1	99.7	79
770	11.6	55.3	2241	222.0	233.7	5.6	15.5	10.0	7.9	23.1	99.7	79
771	13.9	55.5	2232	222.0	231.8	6.6	15.6	11.9	7.1	23.1	99.7	78
772	16.0	55.6	2223	222.0	229.9	7.0	15.8	13.8	8.5	23.1	99.7	78
773	16.8	56.5	2221	222.0	229.9	9.6	15.7	14.5	8.2	23.1	99.7	78
774	13.4	54.8	2159	222.0	229.9	6.3	14.9	11.6	6.9	23.1	99.7	78
775	13.3	55.0	2238	222.0	232.0	6.9	15.7	11.4	7.6	23.1	99.7	78
776	12.1	55.9	2191	222.0	232.8	6.0	15.2	10.4	6.0	23.1	99.7	79
777	13.1	55.7	2241	222.0	232.8	7.1	15.9	11.3	7.8	23.1	99.7	79
778	16.0	56.5	2248	222.0	232.9	9.5	15.9	13.8	9.6	23.1	99.7	79
779	13.3	55.2	2175	222.0	232.9	7.5	14.9	11.5	7.1	23.1	99.7	79
780	13.1	54.5	2167	222.0	232.9	3.2	15.0	11.3	6.1	23.1	99.7	79
781	14.2	56.0	2243	222.0	232.9	5.1	15.9	12.2	7.5	23.1	99.7	79
782												
783												
784												
785												
786												
787												
788												
789												
790												
791												
792												

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

Data Point #	Standardized Wind Speed	LAeq	Turbine Power Output (kW)	Reference Yaw Angle (°)	Yaw Angle (°)	Pitch Angle (°)	Rotor RPM	Nacelle Anemometer Wind Speed (m/s)	10m Anemometer Wind Speed (m/s)	Air Temperature (-C)	Pressure (kPa)	Relative Humidity (%)
793												
794												
795												
796												
797												
798												
799												
800												
801												
802												
803												
804												
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Table E.02 Measurement data - Background

Project: Grand Renewable Wind Farm - Turbine T63 - IEC 61400-11 Measurement

Report ID: 14284.00.T63.RP5

Created on: 2/28/2018

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

Data Point #	Standardized Wind Speed	LAeq	Rotor RPM	10m Anemometer Wind Speed (m/s)	Air Temperature (·C)	Pressure (kPa)	Relative Humidity (%)
1	5.9	38.3	0.3	4.2	20	99.4	59
2	6.8	38.5	0.2	4.9	20	99.4	59
3	6.7	38.1	0.2	4.8	20	99.4	58
4	5.7	37.7	0.3	4.1	20	99.4	57
5	6.7	38.1	0.2	4.8	20	99.4	57
6	7.8	38.5	0.2	5.6	20	99.4	57
7	7.8	40.0	0.2	5.5	20	99.4	57
8	7.1	39.0	0.2	5.1	20	99.4	57
9	8.3	40.4	0.2	6.0	20	99.4	59
10	9.0	39.4	0.2	6.5	20	99.4	59
11	9.8	38.5	0.2	7.0	20	99.4	59
12	8.6	37.7	0.2	6.1	20	99.4	59
13	6.3	37.3	0.2	4.5	20	99.4	59
14	8.0	37.3	0.3	5.7	20	99.4	59
15	6.3	37.6	0.3	4.5	20	99.4	59
16	7.4	37.8	0.3	5.3	20	99.4	59
17	7.3	37.9	0.2	5.2	20	99.4	59
18	6.5	38.5	0.2	4.7	20	99.4	59
19	7.3	37.0	0.2	5.2	20	99.4	59
20	5.8	37.0	0.1	4.1	20	99.4	59
21	6.2	40.9	0.2	4.4	20	99.4	56
22	7.0	39.9	0.2	5.0	20	99.4	56
23	5.4	39.0	0.1	3.8	20	99.4	56
24	4.6	38.6	0.1	3.3	20	99.4	56
25	3.4	38.7	0.1	2.5	20	99.4	56
26	3.4	38.6	0.1	2.5	20	99.4	56
27	6.9	39.0	0.1	4.9	20	99.4	57
28	7.1	38.0	0.1	5.1	20	99.4	57
29	6.6	37.1	0.0	4.7	20	99.4	57
30	5.7	37.8	0.0	4.0	20	99.4	57
31	5.0	35.9	0.2	3.5	20	99.4	57
32	4.9	35.6	0.5	3.5	20	99.4	57
33	5.2	36.2	0.5	3.7	21	99.4	56
34	4.4	36.7	0.4	3.1	21	99.4	56
35	4.8	36.3	0.3	3.5	21	99.4	56
36	5.7	36.8	0.3	4.1	21	99.4	56
37	5.3	38.0	0.3	3.8	21	99.4	56
38	5.0	38.6	0.3	3.6	21	99.4	56
39	4.0	37.6	0.3	2.9	21	99.4	57
40	4.8	37.0	0.3	3.4	21	99.4	58
41	6.2	37.8	0.2	4.5	21	99.4	58
42	6.8	36.8	0.3	4.8	21	99.4	58
43	6.9	37.3	0.3	5.0	21	99.4	58
44	6.0	37.9	0.4	4.3	21	99.4	58
45	7.9	36.9	0.3	5.6	21	99.4	58
46	10.4	37.2	0.3	7.4	21	99.4	59
47	10.0	39.1	0.3	7.2	21	99.4	59
48	10.4	38.2	0.3	7.4	21	99.4	59
49	9.0	36.4	0.3	6.5	21	99.4	59
50	7.6	36.5	0.1	5.4	21	99.4	59
51	6.4	38.7	0.3	4.6	21	99.4	57
52	6.7	38.5	0.3	4.8	21	99.4	57
53	8.2	39.3	0.4	5.9	21	99.4	57
54	8.6	40.0	0.3	6.1	21	99.4	57
55	9.2	38.6	0.3	6.6	21	99.4	57
56	9.3	37.6	0.4	6.6	21	99.4	57
57	6.7	37.9	0.4	4.8	21	99.4	57
58	7.4	38.1	0.3	5.3	21	99.4	57
59	9.3	38.1	0.3	6.7	21	99.4	57
60	9.9	39.2	0.2	7.1	21	99.4	57
61	10.9	39.6	0.1	7.8	21	99.4	57
62	9.7	40.7	0.1	6.9	21	99.4	57
63	8.7	38.8	0.1	6.2	21	99.4	56
64	7.6	38.0	0.1	5.5	21	99.4	56
65	8.1	38.9	0.2	5.8	21	99.4	56
66	8.1	39.9	0.1	5.8	21	99.4	56
67	7.0	40.7	0.1	5.0	21	99.4	56
68	7.9	38.9	0.2	5.7	21	99.4	56
69	10.5	38.1	0.1	7.5	21	99.4	56
70	9.0	38.3	0.2	6.4	21	99.4	56
71	7.6	37.3	0.3	5.4	21	99.4	56
72	8.7	37.8	0.3	6.2	21	99.4	56
73	7.9	38.1	0.4	5.6	21	99.4	56
74	9.2	38.0	0.3	6.5	21	99.4	56
75	9.0	37.9	0.3	6.4	21	99.4	57
76	7.7	37.9	0.2	5.5	21	99.4	57
77	7.6	37.9	0.4	5.4	21	99.4	57
78	7.3	37.3	0.3	5.2	21	99.4	57
79	7.3	37.4	0.3	5.2	21	99.4	57
80	7.2	37.8	0.3	5.2	21	99.4	57
81	6.1	37.8	0.3	4.4	21	99.4	58
82	5.8	38.4	0.3	4.2	21	99.4	58
83	5.6	38.1	0.2	4.0	21	99.4	58

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

Data Point #	Standardized Wind Speed	LAeq	Rotor RPM	10m Anemometer Wind Speed (m/s)	Air Temperature (·C)	Pressure (kPa)	Relative Humidity (%)
84	6.3	39.3	0.2	4.5	21	99.4	58
85	6.9	37.0	0.2	5.0	21	99.4	58
86	6.6	37.1	0.3	4.7	21	99.4	58
87	6.8	37.5	0.4	4.9	21	99.4	58
88	8.0	37.6	0.3	5.7	21	99.4	58
89	8.1	38.0	0.2	5.8	21	99.4	58
90	8.2	37.3	0.2	5.9	21	99.4	58
91	7.1	38.3	0.1	5.1	21	99.4	58
92	5.1	39.0	0.3	3.7	21	99.4	58
93	5.0	39.9	0.2	3.6	21	99.4	59
94	6.3	40.0	0.3	4.5	21	99.4	60
95	6.4	40.4	0.2	4.6	21	99.4	60
96	8.4	39.5	0.3	6.0	21	99.4	60
97	9.0	38.2	0.4	6.4	21	99.4	60
98	8.8	38.0	0.3	6.3	21	99.4	60
99	7.7	38.9	0.2	5.5	21	99.4	57
100	6.8	38.3	0.3	4.9	21	99.4	57
101	7.7	38.6	0.2	5.5	21	99.4	57
102	7.1	39.1	0.2	5.1	21	99.4	57
103	8.8	39.3	0.3	6.3	21	99.4	57
104	8.5	39.1	0.4	6.1	21	99.4	57
105	7.8	39.1	0.4	5.6	21	99.4	57
106	7.3	39.3	0.2	5.2	21	99.4	57
107	7.1	39.4	0.4	5.0	21	99.4	57
108	8.4	39.9	0.4	6.0	21	99.4	57
109	5.9	39.5	0.3	4.2	21	99.4	57
110	6.9	39.0	0.4	4.9	21	99.4	57
111	9.2	39.1	0.3	6.6	21	99.4	57
112	9.4	39.3	0.5	6.7	21	99.4	57
113	9.9	39.2	0.5	7.1	21	99.4	57
114	9.9	41.0	0.5	7.0	21	99.4	57
115	8.4	40.2	0.5	6.0	21	99.4	57
116	9.7	41.1	0.4	6.9	21	99.4	57
117	10.2	40.1	0.3	7.3	21	99.4	56
118	8.8	38.9	0.3	6.3	21	99.4	56
119	7.4	37.4	0.4	5.3	21	99.4	56
120	5.5	37.6	0.4	4.0	21	99.4	56
121	7.1	37.5	0.3	5.0	21	99.4	56
122	8.8	39.4	0.3	6.3	21	99.4	56
123	8.6	38.3	0.3	6.2	21	99.4	55
124	9.0	38.8	0.3	6.5	21	99.4	55
125	7.0	37.6	0.3	5.0	21	99.4	55
126	7.7	41.0	0.4	5.5	21	99.4	55
127	8.6	41.6	0.3	6.1	21	99.4	55
128	9.6	39.5	0.5	6.8	21	99.4	55
129	9.1	38.7	0.6	6.5	21	99.4	54
130	10.0	38.9	0.5	7.1	21	99.4	54
131	9.7	39.6	0.5	6.9	21	99.4	54
132	8.6	39.7	0.5	6.2	21	99.4	54
133	8.9	38.7	0.3	6.3	21	99.4	54
134	7.8	37.4	0.2	5.6	21	99.4	54
135	9.3	37.0	0.3	6.7	21	99.4	60
136	9.6	37.3	0.3	6.9	21	99.4	61
137	10.2	37.8	0.2	7.3	21	99.4	61
138	8.1	37.0	0.1	5.8	21	99.4	61
139	7.7	38.0	0.4	5.5	21	99.4	61
140	9.1	38.6	0.3	6.5	21	99.4	61
141	9.2	37.4	0.3	6.6	21	99.4	66
142	9.7	38.0	0.2	7.0	20	99.4	66
143	10.0	37.3	0.2	7.1	20	99.4	66
144	7.8	37.1	0.3	5.6	20	99.4	66
145	8.3	37.9	0.2	5.9	20	99.4	66
146	9.7	38.1	0.3	6.9	20	99.4	66
147	9.8	36.3	0.2	7.0	20	99.4	68
148	9.2	37.7	0.2	6.6	20	99.4	68
149	7.0	38.9	0.3	5.0	20	99.4	68
150	7.1	38.3	0.2	5.1	20	99.4	68
151	7.4	38.2	0.1	5.3	20	99.4	68
152	6.4	38.2	0.1	4.6	20	99.4	68
153	5.5	36.9	0.3	3.9	20	99.4	69
154	5.4	36.3	0.3	3.8	20	99.4	70
155	6.8	36.0	0.4	4.8	20	99.4	70
156	5.9	37.2	0.3	4.2	20	99.4	70
157	6.5	37.0	0.3	4.6	20	99.4	70
158	6.8	37.3	0.4	4.9	20	99.4	70
159	7.1	37.2	0.3	5.1	20	99.4	70
160	8.7	36.8	0.3	6.2	20	99.4	70
161	9.0	39.9	0.4	6.5	20	99.4	70
162	7.7	37.7	0.4	5.5	20	99.4	70
163	8.0	38.6	0.5	5.7	20	99.4	70
164	7.1	38.7	0.5	5.0	20	99.4	70
165	6.0	38.3	0.5	4.3	20	99.4	72
166	5.5	38.5	0.3	3.9	20	99.4	72

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

Data Point #	Standardized Wind Speed	LAeq	Rotor RPM	10m Anemometer Wind Speed (m/s)	Air Temperature (·C)	Pressure (kPa)	Relative Humidity (%)
167	5.1	38.7	0.3	3.6	20	99.4	72
168	4.9	37.8	0.3	3.5	20	99.4	72
169	4.8	37.2	0.4	3.5	20	99.4	72
170	6.7	38.1	0.4	4.8	20	99.4	72
171	7.4	38.5	0.4	5.3	20	99.4	71
172	7.6	38.8	0.4	5.4	20	99.4	71
173	10.5	38.8	0.4	7.5	20	99.4	71
174	9.7	38.6	0.5	6.9	20	99.4	71
175	8.8	39.7	0.4	6.3	20	99.4	71
176	7.7	39.4	0.4	5.5	20	99.4	71
177	8.3	42.5	0.3	5.9	20	99.4	68
178	8.7	40.6	0.2	6.2	20	99.4	67
179	9.5	40.2	0.2	6.8	20	99.4	67
180	10.6	38.2	0.3	7.6	20	99.4	67
181	10.9	38.0	0.2	7.8	20	99.4	67
182	10.7	38.5	0.2	7.6	20	99.4	67
183	9.7	40.2	0.5	6.9	20	99.4	67
184	8.9	38.7	0.3	6.4	20	99.4	67
185	9.9	40.8	0.1	7.1	20	99.4	67
186	10.6	40.0	0.1	7.6	20	99.4	67
187	10.8	41.7	0.2	7.7	20	99.4	67
188	12.0	41.9	0.2	8.6	20	99.4	67
189	12.6	40.9	0.2	9.0	20	99.4	67
190	11.8	41.2	0.4	8.5	20	99.4	67
191	10.5	41.7	0.4	7.5	20	99.4	67
192	8.3	41.4	0.3	5.9	20	99.4	67
193	9.0	41.6	0.3	6.4	20	99.4	67
194	9.0	41.9	0.3	6.5	20	99.4	67
195	10.7	41.8	0.3	7.6	20	99.4	69
196	11.8	40.7	0.3	8.4	20	99.4	69
197	10.4	42.3	0.4	7.5	20	99.4	69
198	9.5	41.9	0.4	6.8	20	99.4	69
199	10.2	42.7	0.3	7.3	20	99.4	69
200	9.4	42.6	0.2	6.7	20	99.4	69
201	8.6	42.6	0.2	6.1	20	99.4	70
202	8.2	43.1	0.3	5.9	20	99.4	70
203	7.9	43.2	0.4	5.7	20	99.4	70
204	8.2	42.4	0.4	5.9	20	99.4	70
205	6.9	40.5	0.3	4.9	20	99.4	70
206	8.5	39.5	0.2	6.1	20	99.4	70
207	9.7	38.8	0.2	7.0	20	99.4	69
208	9.1	38.5	0.2	6.5	20	99.4	69
209	9.8	38.5	0.3	7.0	20	99.4	69
210	8.5	37.7	0.3	6.1	20	99.4	69
211	9.4	37.3	0.3	6.7	20	99.4	69
212	8.4	38.7	0.4	6.0	20	99.4	69
213	8.4	38.0	0.4	6.0	20	99.4	69
214	9.0	38.3	0.3	6.4	20	99.4	69
215	9.4	39.7	0.3	6.7	20	99.4	69
216	8.7	39.1	0.3	6.2	20	99.4	69
217	9.4	38.6	0.2	6.7	20	99.4	69
218	9.3	42.9	0.4	6.6	21	99.3	60
219	9.1	41.8	0.4	6.5	21	99.3	60
220	12.3	40.1	0.4	8.8	21	99.3	60
221	12.4	40.1	0.3	8.9	21	99.3	59
222	11.4	40.6	0.2	8.2	21	99.3	59
223	10.0	40.0	0.3	7.1	21	99.3	59
224	9.5	40.1	0.3	6.8	21	99.3	59
225	10.4	40.9	0.3	7.4	21	99.3	59
226	9.5	41.2	0.2	6.8	21	99.3	59
227	7.9	41.9	0.3	5.7	21	99.3	61
228	8.0	40.5	0.4	5.7	21	99.3	62
229	9.9	41.0	0.3	7.0	21	99.3	62
230	10.9	41.9	0.4	7.8	21	99.3	62
231	8.5	43.2	0.4	6.1	21	99.3	62
232	8.5	43.1	0.4	6.0	21	99.3	62
233	9.8	43.7	0.3	7.0	21	99.3	62
234	8.1	43.6	0.2	5.8	21	99.3	61
235	9.5	43.2	0.5	6.8	21	99.3	61
236	9.6	43.6	0.4	6.9	21	99.3	61
237	11.2	43.4	0.4	8.0	21	99.3	61
238	11.9	43.2	0.4	8.5	21	99.3	61
239	10.8	41.9	0.3	7.8	22	99.3	60
240	9.9	41.3	0.3	7.1	22	99.3	58
241	10.7	40.6	0.3	7.7	22	99.3	58
242	10.2	41.1	0.4	7.3	22	99.3	58
243	9.7	41.0	0.3	6.9	22	99.3	58
244	9.2	41.2	0.2	6.6	22	99.3	58
245	8.7	40.4	0.2	6.2	21	99.3	59
246	8.1	41.4	0.2	5.8	21	99.3	60
247	7.9	41.4	0.3	5.7	21	99.3	60
248	7.2	41.0	0.3	5.1	21	99.3	60
249	5.6	42.4	0.3	4.0	21	99.3	60

Table E.02 Measurement data - Background

Project: Grand Renewable Wind Farm - Turbine T63 - IEC 61400-11 Measurement

Report ID: 14284.00.T63.RP5

Created on: 2/28/2018

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

Data Point #	Standardized Wind Speed	LAeq	Rotor RPM	10m Anemometer Wind Speed (m/s)	Air Temperature (-C)	Pressure (kPa)	Relative Humidity (%)
250	6.7	42.7	0.5	4.8	21	99.3	60
251	8.3	42.0	0.5	5.9	21	99.4	62
252	8.2	42.8	0.5	5.8	21	99.4	63
253	8.4	42.6	0.6	6.0	21	99.4	63
254	8.8	42.1	0.5	6.3	21	99.4	63
255	10.4	43.6	0.4	7.4	21	99.4	63
256	9.3	44.0	0.5	6.6	21	99.4	63
257	10.0	43.1	0.5	7.1	21	99.4	62
258	10.4	43.2	0.5	7.4	21	99.4	61
259	9.9	43.2	0.4	7.1	21	99.4	61
260	9.3	43.5	0.5	6.6	21	99.4	61
261	8.9	43.8	0.5	6.4	21	99.4	61
262	9.3	43.2	0.5	6.6	21	99.4	61
263	9.7	45.7	0.4	6.9	21	99.4	62
264	12.5	43.4	0.3	9.0	21	99.4	62
265	12.4	43.5	0.4	8.9	21	99.4	62
266	11.3	43.6	0.3	8.1	21	99.4	62
267	10.3	42.9	0.4	7.4	21	99.4	62
268	9.0	42.7	0.4	6.5	21	99.4	62
269	7.8	43.5	0.3	5.6	21	99.4	62
270	7.8	43.7	0.3	5.6	21	99.4	63
271	10.3	43.0	0.3	7.4	21	99.4	63
272	10.3	44.4	0.3	7.3	21	99.4	63
273	9.5	43.5	0.3	6.8	21	99.4	63
274	8.5	42.6	0.4	6.1	21	99.4	63
275	10.7	42.4	0.4	7.7	21	99.4	61
276	10.0	43.2	0.3	7.2	21	99.4	60
277	9.6	42.3	0.3	6.9	21	99.4	60
278	9.2	42.2	0.3	6.6	21	99.4	60
279	9.2	42.3	0.3	6.6	21	99.4	60
280	9.0	41.4	0.3	6.4	21	99.4	60
281	8.3	41.1	0.1	6.0	21	99.4	61
282	7.6	40.9	0.3	5.4	21	99.4	62
283	9.4	40.1	0.2	6.7	21	99.4	62
284	8.7	39.7	0.2	6.2	21	99.4	62
285	11.0	40.2	0.2	7.9	21	99.4	62
286	9.9	39.9	0.4	7.0	21	99.4	62
287	10.4	39.6	0.4	7.4	21	99.4	61
288	10.0	40.4	0.3	7.1	21	99.4	60
289	10.2	39.8	0.4	7.3	21	99.4	60
290	9.2	39.1	0.3	6.6	21	99.4	60
291	9.4	38.5	0.3	6.7	21	99.4	60
292	10.4	37.2	0.5	7.5	21	99.4	60
293	10.7	37.8	0.4	7.7	21	99.4	59
294	9.3	37.9	0.2	6.6	21	99.4	59
295	7.9	37.1	0.2	5.6	21	99.4	59
296	7.2	37.0	0.2	5.2	21	99.4	59
297	7.2	36.5	0.2	5.1	21	99.4	59
298	7.3	37.2	0.2	5.2	21	99.4	59
299	7.7	37.4	0.3	5.5	21	99.4	60
300	6.5	36.8	0.4	4.6	21	99.4	61
301	8.3	36.7	0.3	5.9	21	99.4	61
302	8.0	36.9	0.3	5.7	21	99.4	61
303	7.1	37.0	0.2	5.1	21	99.4	61
304	7.3	37.2	0.3	5.2	21	99.4	61
305	5.9	37.6	0.2	4.2	21	99.3	62
306	6.7	37.5	0.2	4.8	21	99.3	63
307	5.7	39.1	0.2	4.1	21	99.3	63
308	4.7	39.0	0.3	3.4	21	99.3	63
309	5.8	38.2	0.2	4.1	21	99.3	63
310	6.0	38.7	0.3	4.3	21	99.3	63
311	7.4	39.0	0.3	5.3	21	99.3	62
312	5.7	38.7	0.3	4.0	21	99.3	61
313	5.6	38.9	0.3	4.0	21	99.3	61
314	7.5	40.4	0.4	5.4	21	99.3	61
315	8.4	41.3	0.3	6.0	21	99.3	61
316	8.9	40.7	0.5	6.3	21	99.3	61
317	10.8	40.5	0.5	7.7	21	99.3	61
318	10.8	40.1	0.4	7.7	21	99.3	61
319	11.0	41.0	0.3	7.9	21	99.3	61
320	9.3	41.9	0.4	6.7	21	99.3	61
321	8.8	40.3	0.4	6.3	21	99.3	61
322	7.9	39.9	0.3	5.6	21	99.3	61
323	8.7	39.7	0.2	6.2	21	99.3	61
324	10.4	39.7	0.2	7.4	21	99.3	62
325	10.3	39.4	0.2	7.4	21	99.3	62
326	8.6	39.9	0.3	6.1	21	99.3	62
327	10.0	39.9	0.2	7.1	21	99.3	62
328	10.9	40.5	0.3	7.8	21	99.3	62
329	11.0	39.9	0.3	7.9	21	99.3	59
330	9.0	40.8	0.3	6.4	21	99.3	57
331	9.7	41.6	0.2	6.9	21	99.3	57
332	10.6	41.5	0.3	7.6	21	99.3	57

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

Data Point #	Standardized Wind Speed	LAeq	Rotor RPM	10m Anemometer Wind Speed (m/s)	Air Temperature (-C)	Pressure (kPa)	Relative Humidity (%)
333	11.4	41.4	0.3	8.2	21	99.3	57
334	11.3	41.4	0.3	8.1	21	99.3	57
335	11.2	41.3	0.5	8.0	21	99.3	59
336	9.7	41.4	0.4	6.9	21	99.3	60
337	10.9	40.5	0.4	7.8	21	99.3	60
338	10.4	40.5	0.3	7.4	21	99.3	60
339	10.5	41.6	0.4	7.5	21	99.3	60
340	10.1	41.4	0.4	7.3	21	99.3	60
341	9.0	40.8	0.4	6.4	21	99.3	60
342	8.1	41.0	0.3	5.8	21	99.3	61
343	8.7	42.0	0.3	6.2	21	99.3	61
344	8.3	41.0	0.4	5.9	21	99.3	61
345	7.6	40.0	0.4	5.4	21	99.3	61
346	7.0	41.2	0.4	5.0	21	99.3	61
347	7.4	39.9	0.3	5.3	21	99.4	61
348	6.9	40.2	0.2	4.9	21	99.4	62
349	7.0	41.0	0.3	5.0	21	99.4	62
350	6.0	40.8	0.4	4.3	21	99.4	62
351	6.3	40.4	0.3	4.5	21	99.4	62
352	7.2	40.8	0.4	5.1	21	99.4	62
353	7.6	42.7	0.4	5.5	21	99.4	62
354	7.6	41.8	0.3	5.4	21	99.4	62
355	7.2	41.8	0.3	5.1	21	99.4	62
356	9.0	42.1	0.5	6.4	21	99.4	62
357	9.5	41.6	0.5	6.8	21	99.4	62
358	8.2	41.8	0.4	5.8	21	99.4	62
359	8.8	43.2	0.4	6.3	21	99.4	62
360	9.1	42.4	0.2	6.5	21	99.3	62
361	9.5	42.3	0.2	6.8	21	99.3	62
362	10.8	43.3	0.3	7.7	21	99.3	62
363	8.5	42.5	0.4	6.1	21	99.3	62
364	8.0	41.7	0.4	5.7	21	99.3	62
365	7.9	41.9	0.4	5.7	21	99.4	63
366	7.9	41.7	0.3	5.6	21	99.4	64
367	8.6	42.1	0.3	6.1	21	99.4	64
368	9.1	42.1	0.3	6.5	21	99.4	64
369	9.5	41.9	0.4	6.8	21	99.4	64
370	8.2	42.3	0.4	5.9	21	99.4	64
371	7.1	41.5	0.3	5.1	21	99.4	64
372	6.3	40.8	0.4	4.5	21	99.4	63
373	7.6	40.3	0.5	5.5	21	99.4	63
374	7.2	41.1	0.4	5.1	21	99.4	63
375	6.9	40.5	0.4	5.0	21	99.4	63
376	7.0	39.3	0.3	5.0	21	99.4	63
377	9.3	39.2	0.3	6.6	21	99.4	64
378	9.2	38.7	0.3	6.6	21	99.4	64
379	8.8	38.8	0.3	6.3	21	99.4	64
380	8.6	38.0	0.2	6.2	21	99.4	64
381	9.9	38.5	0.2	7.1	21	99.4	64
382	8.7	38.9	0.2	6.2	21	99.4	64
383	6.2	36.6	0.3	4.4	21	99.4	65
384	7.3	37.1	0.3	5.2	21	99.4	65
385	7.9	36.7	0.3	5.6	21	99.4	65
386	6.6	36.4	0.3	4.7	21	99.4	65
387	7.0	36.8	0.2	5.0	21	99.4	65
388	8.0	37.9	0.3	5.8	21	99.4	65
389	9.0	37.5	0.3	6.4	21	99.4	65
390	7.8	36.5	0.3	5.6	21	99.4	64
391	7.8	37.2	0.3	5.6	21	99.4	64
392	7.2	38.0	0.3	5.1	21	99.4	64
393	9.8	38.5	0.3	7.0	21	99.4	64
394	11.1	39.4	0.2	7.9	21	99.4	64
395	9.9	39.8	0.2	7.1	21	99.4	64
396	9.9	39.2	0.4	7.1	21	99.4	63
397	9.6	40.1	0.5	6.8	21	99.4	63
398			0.3	7.6	21	99.4	63
399			0.2	7.9	21	99.4	63
400			0.2	7.4	21	99.4	63
401			0.2	5.3	21	99.4	63
402			0.4	5.8	21	99.4	63
403			0.4	5.3	21	99.4	63
404			0.5	6.0	21	99.4	63
405			0.4	6.4	21	99.4	63
406			0.3	6.3	21	99.4	63
407			0.2	5.9	21	99.4	63
408			0.2	6.3	21	99.4	63
409	8.2	39.5	0.5	5.8	23	99.7	77
410	8.2	48.5	0.4	5.9	23	99.7	77
411	9.8	39.0	0.5	7.0	23	99.7	77
412	10.5	39.6	0.5	7.5	23	99.7	77
413	8.6	40.2	0.4	6.1	23	99.7	77
414	8.6	39.1	0.6	6.1	23	99.7	77
415	12.5	41.3	0.6	9.0	23	99.7	77

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

Data Point #	Standardized Wind Speed	LAeq	Rotor RPM	10m Anemometer Wind Speed (m/s)	Air Temperature (-C)	Pressure (kPa)	Relative Humidity (%)
416	13.3	40.4	0.5	9.5	23	99.7	77
417	12.9	39.7	0.4	9.2	23	99.7	77
418	10.1	39.7	0.5	7.2	23	99.7	77
419	11.2	42.1	0.5	8.0	23	99.7	77
420	12.6	41.9	0.3	9.0	23	99.7	77
421	11.3	41.3	0.2	8.1	23	99.7	76
422	10.4	41.8	0.3	7.4	23	99.7	76
423	11.6	41.5	0.4	8.3	23	99.7	76
424	11.6	41.2	0.6	8.3	23	99.7	76
425	9.3	40.1	0.7	6.6	23	99.7	76
426	8.4	40.3	0.5	6.0	23	99.7	76
427	10.6	40.5	0.5	7.5	23	99.7	77
428	11.7	40.1	0.5	8.4	23	99.7	77
429	9.5	43.5	0.6	6.8	23	99.7	77
430	6.0	41.2	0.6	4.3	23	99.7	77
431	9.6	39.5	0.5	6.8	23	99.7	77
432	10.2	39.7	0.5	7.3	23	99.7	77
433	9.7	40.3	0.6	6.9	23	99.7	76
434	6.4	40.2	0.6	4.6	23	99.7	76
435	5.3	40.3	0.6	3.8	23	99.7	76
436	7.8	42.3	0.5	5.6	23	99.7	76
437	8.9	46.3	0.6	6.3	23	99.7	76
438	11.4	42.8	0.7	8.1	23	99.7	76
439	12.0	43.7	0.4	8.6	23	99.7	76
440	10.2	43.3	0.4	7.3	23	99.7	76
441	10.3	39.5	0.4	7.4	23	99.7	76
442	9.4	39.2	0.4	6.7	23	99.7	76
443	8.9	39.3	0.6	6.3	23	99.7	76
444	6.4	39.9	0.6	4.6	23	99.7	76
445	8.0	42.6	0.4	5.7	23	99.7	78
446	9.2	39.0	0.7	6.6	23	99.7	78
447	10.4	39.2	0.6	7.4	23	99.7	78
448	8.8	39.6	0.4	6.3	23	99.7	78
449	13.8	41.9	0.3	9.9	23	99.7	78
450	13.5	40.2	0.1	9.6	23	99.7	78
451	13.8	40.3	0.5	9.9	23	99.7	77
452	15.6	41.8	0.7	11.2	23	99.7	77
453	13.6	41.6	0.5	9.7	23	99.7	77
454	12.9	39.4	0.4	9.2	23	99.7	77
455	11.1	40.8	0.5	8.0	23	99.7	77
456	10.7	38.9	0.6	7.6	23	99.7	77
457	11.2	43.1	0.6	8.0	23	99.7	76
458	8.7	38.6	0.6	6.2	23	99.7	76
459	8.2	38.7	0.7	5.9	23	99.7	76
460	9.4	42.1	0.4	6.7	23	99.7	76
461	10.7	42.9	0.3	7.7	23	99.7	76
462	9.6	39.7	0.5	6.8	23	99.7	76
463	9.7	39.5	0.6	7.0	23	99.7	76
464	9.3	42.3	0.5	6.7	23	99.7	76
465	10.4	41.0	0.5	7.4	23	99.7	76
466	10.2	43.5	0.6	7.3	23	99.7	76
467	12.7	39.1	0.4	9.1	23	99.7	76
468	11.7	44.5	0.4	8.3	23	99.7	76
469	13.4	39.5	0.5	9.6	23	99.7	77
470	12.8	38.3	0.5	9.1	23	99.7	77
471	10.7	37.6	0.4	7.7	23	99.7	77
472	12.6	37.8	0.4	9.0	23	99.7	77
473	13.6	40.1	0.6	9.7	23	99.7	77
474	11.7	42.5	0.4	8.4	23	99.7	77
475	11.3	40.3	0.7	8.1	23	99.7	77
476	10.3	39.5	0.5	7.4	23	99.7	77
477	10.2	42.5	0.3	7.3	23	99.7	77
478	10.2	42.5	0.4	7.3	23	99.7	77
479	10.3	38.6	0.5	7.4	23	99.7	77
480	11.1	38.1	0.4	8.0	23	99.7	77
481	10.3	38.0	0.7	7.3	23	99.7	78
482	10.4	37.5	0.6	7.4	23	99.7	78
483	9.6	37.5	0.5	6.9	23	99.7	78
484	8.1	38.0	0.5	5.8	23	99.7	78
485	9.7	38.5	0.4	6.9	23	99.7	78
486	11.0	38.8	0.4	7.9	23	99.7	78
487	8.4	37.9	0.4	6.0	23	99.7	77
488	12.7	37.8	0.3	9.1	23	99.7	77
489	11.2	39.6	0.3	8.0	23	99.7	77
490	13.4	39.0	0.5	9.6	23	99.7	77
491	13.4	38.3	0.6	9.6	23	99.7	77
492	10.8	39.0	0.5	7.7	23	99.7	77
493	9.6	39.2	0.3	6.8	23	99.7	77
494	10.6	39.1	0.5	7.6	23	99.7	77
495	12.5	45.8	0.7	9.0	23	99.7	77
496	13.1	38.8	0.4	9.3	23	99.7	77
497	10.2	38.9	0.4	7.3	23	99.7	77
498	11.1	40.2	0.5	7.9	23	99.7	77

Table E.02 Measurement data - Background

Project: Grand Renewable Wind Farm - Turbine T63 - IEC 61400-11 Measurement

Report ID: 14284.00.T63.RP5

Created on: 2/28/2018

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

Data Point #	Standardized Wind Speed	LAeq	Rotor RPM	10m Anemometer Wind Speed (m/s)	Air Temperature (-C)	Pressure (kPa)	Relative Humidity (%)
499	9.2	38.8	0.5	6.6	23	99.7	77
500	11.9	40.1	0.3	8.5	23	99.7	77
501	13.5	40.7	0.4	9.6	23	99.7	77
502	9.8	40.2	0.6	7.0	23	99.7	77
503	8.7	41.1	0.4	6.2	23	99.7	77
504	10.3	42.6	0.3	7.4	23	99.7	77
505	8.1	41.5	0.2	5.8	23	99.7	77
506	11.8	40.4	0.3	8.4	23	99.7	77
507	9.3	39.4	0.6	6.6	23	99.7	77
508	9.6	38.8	0.6	6.9	23	99.7	77
509	10.7	38.6	0.5	7.6	23	99.7	77
510	10.1	38.6	0.5	7.2	23	99.7	77
511	8.9	38.4	0.6	6.3	23	99.7	78
512	7.3	38.7	0.5	5.2	23	99.7	78
513	8.4	40.4	0.6	6.0	23	99.7	78
514	7.6	39.4	0.3	5.4	23	99.7	78
515	8.6	38.3	0.4	6.2	23	99.7	78
516	9.9	38.1	0.6	7.1	23	99.7	78
517	9.9	38.7	0.9	7.1	23	99.7	77
518	11.1	39.1	0.6	7.9	23	99.7	77
519	10.7	38.3	0.4	7.7	23	99.7	77
520	8.9	37.5	0.3	6.4	23	99.7	77
521	11.8	36.5	0.6	8.4	23	99.7	77
522	10.8	36.9	0.5	7.7	23	99.7	77
523	9.6	38.0	0.7	6.9	23	99.7	77
524	7.4	41.8	0.5	5.3	23	99.7	77
525	11.6	42.4	0.5	8.3	23	99.7	77
526	9.8	40.4	0.5	7.0	23	99.7	77
527	9.5	39.7	0.5	6.8	23	99.7	77
528	9.0	38.9	0.4	6.4	23	99.7	77
529	10.4	39.5	0.5	7.4	23	99.7	78
530	11.3	39.7	0.4	8.1	23	99.7	78
531	10.1	39.3	0.5	7.2	23	99.7	78
532	11.8	39.2	0.5	8.5	23	99.7	78
533	13.5	39.5	0.6	9.6	23	99.7	78
534	9.9	39.5	0.7	7.0	23	99.7	78
535	8.4	41.7	0.6	6.0	23	99.7	77
536	9.6	48.7	0.4	6.8	23	99.7	77
537	10.3	48.2	0.5	7.3	23	99.7	77
538	10.9	40.4	0.5	7.8	23	99.7	77
539	11.0	39.5	0.6	7.9	23	99.7	77
540	7.4	38.9	0.7	5.3	23	99.7	77
541	6.6	38.8	0.4	4.7	23	99.7	78
542	10.1	38.5	0.6	7.2	23	99.7	78
543	9.9	39.6	0.5	7.1	23	99.7	78
544	7.8	38.9	0.5	5.5	23	99.7	78
545	8.2	39.2	0.4	5.9	23	99.7	78
546	9.5	50.4	0.6	6.8	23	99.7	78
547	10.5	41.8	0.4	7.5	23	99.7	77
548	10.4	39.5	0.4	7.4	23	99.7	77
549	10.8	39.5	0.5	7.7	23	99.7	77
550	9.8	39.3	0.4	7.0	23	99.7	77
551	7.8	39.9	0.7	5.6	23	99.7	77
552	6.4	39.2	0.5	4.6	23	99.7	77
553	7.8	39.1	0.4	5.6	23	99.7	78
554	9.3	39.3	0.2	6.7	23	99.7	78
555	10.7	42.6	0.4	7.7	23	99.7	78
556	12.4	38.8	0.5	8.8	23	99.7	78
557	11.0	39.5	0.5	7.8	23	99.7	78
558	9.5	37.5	0.6	6.8	23	99.7	78
559	7.5	38.4	0.6	5.4	23	99.7	77
560	5.0	37.2	0.7	3.6	23	99.7	77
561	9.6	41.5	0.5	6.9	23	99.7	77
562	10.8	43.1	0.5	7.7	23	99.7	77
563	10.4	37.3	0.4	7.4	23	99.7	77
564	9.2	37.0	0.4	6.6	23	99.7	77
565	8.5	37.3	0.5	6.1	23	99.7	77
566	8.9	38.7	0.6	6.3	23	99.7	77
567	8.0	40.0	0.8	5.7	23	99.7	77
568	9.6	39.1	0.7	6.9	23	99.7	77
569	8.1	37.8	0.5	5.8	23	99.7	77
570	8.4	42.5	0.6	6.0	23	99.7	78
571	8.5	37.9	0.4	6.0	23	99.7	78
572	10.0	39.4	0.2	7.2	23	99.7	78
573	9.6	44.3	0.4	6.8	23	99.7	78
574	10.7	40.3	0.4	7.7	23	99.7	78
575	11.1	37.9	0.5	8.0	23	99.7	78
576	12.0	38.0	0.5	8.6	23	99.7	78
577	11.5	38.1	0.8	8.2	23	99.7	77
578	13.0	37.8	0.4	9.3	23	99.7	77
579	11.4	37.8	0.3	8.2	23	99.7	77
580	9.4	39.4	0.5	6.7	23	99.7	77
581	11.9	38.1	0.5	8.5	23	99.7	77

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

Data Point #	Standardized Wind Speed	LAeq	Rotor RPM	10m Anemometer Wind Speed (m/s)	Air Temperature (-C)	Pressure (kPa)	Relative Humidity (%)
582	10.9	38.7	0.5	7.8	23	99.7	77
583	9.5	47.9	0.4	6.8	23	99.7	77
584	10.8	47.4	0.3	7.7	23	99.7	77
585	11.4	43.2	0.5	8.1	23	99.7	77
586	12.8	39.2	0.4	9.1	23	99.7	77
587	11.6	39.9	0.5	8.3	23	99.7	77
588	9.6	37.7	0.3	6.8	23	99.7	77
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***Blank data denotes values that were omitted in the analysis due to an extraneous event during recording

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

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End of Report

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