

## ASSESSMENT REPORT - Project: 15039.00

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### **Cedar Point Wind Power Project** **2<sup>nd</sup> Acoustic Immission Audit** Lambton County, Ontario

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Prepared for:

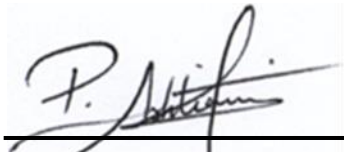
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Revision #4

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## Executive Summary

Aercoustics Engineering Limited (“Aercoustics”) has been retained by Cedar Point II Limited Partnership to complete the acoustic audit outlined in the Renewable Energy Approval (“REA”) for the Cedar Point Wind Power Project (“CPWPP”). CPWPP operates under REA #6914-9L5JBB, issued on August 22, 2014 and amended on August 20, 2015. This report details the second measurement campaign of the CPWPP immission audit.

Noise measurements at M1587, M1395, M1414, M96 and M130 spanned from the following dates, respectively: October 4, 2016 to December 12, 2016; November 15, 2016 to February 3, 2017; November 15, 2016 to 21 December 2016; October 4, 2016 to December 12, 2016; November 15, 2016 to December 18, 2016.

Acoustic and weather data was logged simultaneously for the duration of the measurement campaign. The audit was completed as per the methodology outlined in Part D of the “MOE Compliance Protocol for Wind Turbine Noise – Guideline for Acoustic Assessment and Measurement.”

The turbine-only noise contribution was compared to the Ministry of Environment and Climate Change sound level limits and the facility was found to be in compliance.

## 1 Introduction

Aercoustics Engineering Limited (“Aercoustics”) has been retained by Cedar Point II Limited Partnership to complete the acoustic audit outlined in the Renewable Energy Approval (“REA”) for the Cedar Point Wind Power Project (“CPWPP”) [1]. CPWPP operates under REA #6914-9L5JBB, issued on August 22, 2014 and amended on August 20, 2015. This report details the results of the second measurement campaign (Fall 2016).

The audit was completed as per the methodology outlined in Part D of the “MOE Compliance Protocol for Wind Turbine Noise – Guideline for Acoustic Assessment and Measurement,” [2] as per requirements of Section E, “Acoustic Audit – Immission” of the REA. This report outlines the methodology of the measurements, the results, and a comparison of the sound contribution of the turbines to the Ontario Ministry of Environment Conservation and Parks (“MECP”) sound level limits.

## 2 Facility Description

The CPWPP is comprised of 46 Siemens SWT-2.3-113 wind turbines. Twenty-five (25) turbines have a nameplate capacity of 2.221 MW, nineteen (19) turbines have a nameplate capacity of 2.126 MW and two (2) turbines have a nameplate capacity of 2.030 MW. The 46 Siemens SWT-2.3-113 have a hub height of 99.5 meters, and a rotor diameter of 113 meters. The facility operates 24 hours per day, 7 days per week.

## 3 Audit Details

The acoustic audit was conducted at five (5) receptors: R1587, R1395, R1414, R96 and R130. The acoustic audit at M1587, M1395, M1414, M96 and M130 spanned from the following dates, summarized in Table 1.

Table 1 Monitoring Period for each Receptor

| Location | Monitoring Start Date | Monitoring Ending Date |
|----------|-----------------------|------------------------|
| CP M1587 | October 4, 2016       | December 12, 2016      |
| CP M1395 | November 15, 2016     | February 3, 2017       |
| CP M1414 | November 15, 2016     | December 21, 2016      |
| CP M96   | October 4, 2016       | December 12, 2016      |
| CP M130  | November 15, 2016     | December 18, 2016      |

The following sections detail the test equipment, measurement methodology, measurement locations, and environmental conditions during the audit.

### 3.1 Test Equipment

The following list details the equipment, acoustic and non-acoustic, that was used at each audit location for the measurement campaign.

- One (1) Type 1 sound level meter, with microphone and pre-amplifier that meet the MECP protocol specifications outlined in Part D, Section D2.1 - Acoustic Instrumentation.
- One (1) primary and one (1) secondary windscreen for the microphone. The 1/3 Octave band insertion loss of the secondary windscreen has been tested, and was accounted for in the data analysis.
- One (1) anemometer programmed to sample weather data every 0.5 seconds. The anemometer was located 10m above grade, as defined by Section D3.4. Performance specifications comply with Part D, Section D.2.2 of the MECP protocol.

The following table lists the specific model and serial numbers for the equipment used during the measurement campaign.

Table 2 Equipment Details

| Location | Equipment   | Serial Number                               | Notes   |
|----------|---|---|---|
| M1587    | NI cRIO-9067 controller with NI9234 Data Acquisition card | 1A6C107(controller)<br>30900A7(DAQ card)    |   |
|          | PCB 377B02 Microphone                                     | <b>(122654)</b> 155181                      |   |
|          | PCB 378B02 Pre-amplifier                                  | 122654                                      |   |
|          | Vaisala WXT 520   | K2640013                                    |   |
| M1395    | NI cRIO-9067 controller with NI9234 Data Acquisition card | 1BA43B7 (controller)<br>1B97D62 (DAQ card)  | SLM replaced 18/01/2017<br>B&K 2250 SN: 2630244 |
|          | PCB 377B02 Microphone                                     | <b>(126059)</b> 166109                      | B&K 1489 SN: 2386059                            |
|          | PCB 378B02 Pre-amplifier                                  | 044442                                      | B&K ZC0032 SN: 7946                             |
|          | Vaisala WXT 520   | M0410644                                    | K0640011  |
| M1414    | NI cRIO-9067 controller with NI9234 Data Acquisition card | 1BA43D2 (controller)<br>1B97D6E (DAQ card)  |   |
|          | PCB 377B02 Microphone                                     | <b>(121695)</b> 156314                      |   |
|          | PCB 378B02 Pre-amplifier                                  | 039843                                      |   |
|          | Vaisala WXT 520   | M0410642                                    |   |
| M96      | NI cRIO-9067 controller with NI9234 Data Acquisition card | 1ADD957 (controller)<br>30BD113 (DAQ card)  |   |
|          | PCB 377B02 Microphone                                     | <b>(123030)</b> 148047                      |   |
|          | PCB 378B02 Pre-amplifier                                  | 041166                                      |   |
|          | Vaisala WXT 520   | M0410643                                    |   |
| M130     | NI cRIO-9067 controller with NI9234 Data Acquisition card | 1ADE458C (controller)<br>30BD111 (DAQ card) |   |
|          | PCB 377B02 Microphone                                     | <b>(125630)</b> 165934                      |   |
|          | PCB 378B02 Pre-amplifier                                  | 044003                                      |   |
|          | Vaisala WXT 520   | L3020299                                    |   |

The sound level meter, microphone, and pre-amplifier were calibrated before and after the measurement campaign using a type 4231 Brüel & Kjær acoustic calibrator.

### 3.2 Measurement Methodology

For the duration of the measurement campaign, acoustic and anemometer data was logged simultaneously in one-minute intervals. The measurement equipment was setup to log one-minute equivalent sound levels ( $L_{eq}$ ) in broadband and 1/3 octave bands between 20-10,000 Hz. The microphone was placed at a measurement height of 4.5m above grade, at least 5 meters away from any large reflecting surfaces, in direct line of sight to the nearest turbines, and as far away as practically possible from trees or other foliage. Measurement data was filtered into integer wind bins. Each bin ranged from 0.5m/s below to 0.5m/s above each respective wind bin (i.e. 5 m/s data represents data between 4.5m/s and 5.5m/s).

A one-minute measurement interval was considered valid if:

- The interval occurred between 10pm – 5am
- No precipitation was detected within an hour before or after the interval
- The maximum measured wind speed at 10m was no more than 2m/s higher than the recorded average for that interval
- The temperature was above -20°C
- Either all nearby required turbines were on (for turbine ON measurements), or all nearby required turbines were off (for ambient measurements). Section 3.6 details the operational conditions during turbine on and turbine off measurements. Appendix F details the turbine status during TON and TOFF measurements.
- The measured  $L_{eq}$  was no more than 10 dB greater than the  $L_{90}$  value

These filters were designed to obtain measurement data of the wind project when it is fully operational, as well as reduce the amount of contamination from transient ambient noise sources such as vehicle passbys. These filters also are based on equipment operating limitations, and the filters prescribed in Part D of the Protocol to eliminate noise from precipitation, as well as noise on the microphone from gusty periods where the reliability of the data is reduced.

It should be noted that although the MECF Protocol calls for data points to be excluded if the minimum wind speed at 10m is more than 2m/s less than the recorded average. The effect of this filter significantly reduces the number of samples. Aercoustics has removed this filter in order to increase the amount of data collected so that the audit may be completed in a practical time frame.



In order to justify the removal of this filter Aercoustics reviewed 11 different data sets representing measurements from 3 different wind farms and 10 different receptor locations. Each data set was filtered using both the prescribed and modified methods for wind speed gusting. The results of the analysis shows increases in the number of data points in all wind bins, with a more pronounced effect at high wind speeds, while there is a negligible effect in the measured sound levels; this study is provided in Appendix D.

### 3.3 Sample size requirements

In order to account for the dependence on wind speed of wind turbine noise and ambient noise, the measurement data is sorted into integer wind speed bins according to the measured wind speed. As per Section D3.8 of the MECF protocol, at least 120 data points in each wind bin are required for Turbine ON measurements, and 60 data points for the ambient measurements. For wind speeds where the sufficient number of samples was not achieved, the results are presented and indicated as such.

### 3.4 Measurement Location

Receptors R1587, R1395, R1414, R96 and R130 were chosen to audit the facility. The receptors chosen represent locations with a predicted level of more than 37 dBA and are as close to downwind as possible of the nearest turbine from the prevailing wind direction. The predicted level at R1587, R1395, R1414, R96 and R130 is 38.7 dBA, 37.2dBA, 38.0, 37.8 and 38.2 dBA respectively [3]. The following describes the measurement locations in relation to the above listed receptors:

- M1587: Measurement equipment was placed on the vacant lot R1587, facing the nearest turbine (CP215/WTG15). The ground cover between the monitor and CP215 was an open field. The predicted level based on the acoustic model at M1587 is 38.6 dBA.
- M1395: Measurement equipment was placed on the vacant lot R1395, facing the nearest turbine (CP241/WTG72). The ground cover between the monitor and CP241 was an open field. The predicted level based on the acoustic model at M1395 is 37.2 dBA.
- M1414: Measurement equipment was placed on an adjacent strip of demising land to R1414, facing the nearest turbine (CP228/WTG31). The ground cover between the monitor and CP228 was an open field and a tree lot. The predicted level based on the acoustic model at M1414 is 38.4 dBA.
- M96: Measurement equipment was placed on the adjacent farm land of R96, facing the nearest turbine (CP244/WTG44). The ground cover between the monitor and CP 244 was an open field. The predicted level based on the acoustic model at M96 is 37.7 dBA.
- M130: Measurement equipment was placed on the adjacent farm land of R130, facing the nearest turbine (CP241/WTG72). The ground cover between the

monitor and CP241 was an open field. The predicted level based on the acoustic model at M130 is 38.3 dBA.

Table 2 provides a summary of the receptor locations. Detailed site plans showing the receptor and audit locations are attached in Appendix A.

Table 3 Receptor Measurement Locations

| Audit Receptor ID<br>Nearest Turbine ID |                                | M1587<br>CP215               | M1395<br>CP241               | M1414<br>CP228               | M96<br>CP244                 | M130<br>CP241                |
|---|--------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
| Receptor                                | UTM Coordinates<br>(X,Y)       | 17T<br>420769mE<br>4775052mN | 17T<br>414607mE<br>4766788mN | 17T<br>415148mE<br>4773715mN | 17T<br>409776mE<br>4770010mN | 17T<br>414012mE<br>4767233mN |
|   | Distance to Nearest<br>Turbine | 553m                         | 646m                         | 676m                         | 611m                         | 811m                         |
|   | Predicted Level dBA*           | 38.7                         | 37.2                         | 38.0                         | 37.8                         | 38.2                         |
| Monitor                                 | UTM Coordinates<br>(X,Y)       | 17T<br>420769mE<br>4775052mN | 17T<br>414607mE<br>4766788mN | 17T<br>415091mE<br>4773724mN | 17T<br>409699mE<br>4770000mE | 17T<br>414018mE<br>4767158mN |
|   | Distance to Nearest<br>Turbine | 553m                         | 646m                         | 625m                         | 611m                         | 736m                         |
|   | Predicted Level dBA**          | 38.6                         | 37.2                         | 38.4                         | 37.7                         | 38.3                         |

\* Predicted level from Sound Level Prediction Results, November 25, 2015 As built 46 WTGs – HGC [3]

\*\* Predicted level from Aercoustics' acoustic model

### 3.5 Weather Conditions

Ambient conditions encountered over the measurement campaign were as follows:

- Ambient Humidity: 48% to 97%
- Ambient Temperature: -15°C to 23.5°C
- 10m Wind Speed: 0 m/s to 21 m/s

During the audit period, the predominant wind direction was measured to be from the South West for M1587, M1395, M1414 and M130; East for M96. A wind rose detailing the measured wind direction at the five (5) monitor locations has been provided in Appendix B. Wind directions shown on the wind roses indicate the direction the wind is coming from.

### 3.6 Operational Conditions

Wind turbine SCADA information were logged for the duration of the measurement campaign by CPWPP. Logged parameters included wind speed, wind direction, and power output. The turbines included in this study were chosen such that when they are turned off, the partial impact of the remaining turbines was predicted to be less than 30dBA; 10dB below the lowest sound level limit. Turbine ON measurement data at each receptor was filtered to include only intervals when all turbines in the immediate vicinity were operational.

The turbines were verified by the operator to be running properly during all measurement periods of the campaign using SCADA data and IESO dispatch instructions. Any times where some of the turbines were down for maintenance or otherwise not operating normally were excluded from the measured dataset; see Appendix C for a statement from the operator.

## 4 Sound Level Limits

The purpose of the sound measurements was to confirm whether the sound emitted by the wind facility is in compliance with the MECP allowable sound level limits. The REA identifies the sound level limits in Condition C1 (1), the MECP sound level limits for wind turbines vary with wind speed defined at a 10m height. The details of the sound level limits are presented in Table 3 below.

Table 4 MECP Sound Level Limits for Wind turbines for Class 3 Areas (Rural)

| Wind speed at 10m height [m/s] | MECP Sound level limit [dBA] |
|--------------------------------|------------------------------|
| 4                              | 40.0                         |
| 5                              | 40.0                         |
| 6                              | 40.0                         |
| 7                              | 43.0                         |
| 8                              | 45.0                         |
| 9                              | 49.0                         |
| 10                             | 51.0                         |

## 5 Audit Results

The following tables detail the sound levels measured at the M1587, M1395, M1414, M96 and M130 receptors when all the nearby turbines were on (Turbine ON) and when all the nearby turbines were off (Turbine OFF). Turbine ON measurements are the total sound measured when the turbines were operating and includes all other sound sources that were producing noise during that measurement in addition to the wind turbine.

Three (3) data points were collected at 4 m/s for Turbine OFF at M130. The Turbine ON and background sound level is 38 dBA and is below the 40 dBA sound level limit without a background correction. As such this deviation from the protocol's requirement is considered minor and does not affect the conclusion of the report.

Table 5 M1587 Sound levels measured for Turbine ON and OFF

| Wind speed at 10m height [m/s] |                          | 4    | 5   | 6               | 7               |
|--------------------------------|--------------------------|------|-----|-----------------|-----------------|
| Turbine ON                     | Number of Samples        | 1132 | 960 | 682             | 584             |
|                                | LA <sub>eq</sub> [dBA]   | 38   | 40  | 42              | 46              |
|                                | Standard Deviation [dBA] | 3.4  | 2.5 | 1.7             | 1.7             |
| Turbine OFF                    | Number of Samples        | 103  | 78  | 139             | 67              |
|                                | LA <sub>eq</sub> [dBA]   | 34   | 38  | 42              | 45              |
|                                | Standard Deviation [dBA] | 2.8  | 2.0 | 1.5             | 1.5             |
| Turbine ONLY                   |                          | 37   | 36  | 28 <sup>†</sup> | 33 <sup>†</sup> |

† Higher uncertainty on calculated Turbine ONLY levels in cases where the measured ambient sound level (Turbine OFF) is within 1 dB of the measured Turbine ON level

Table 6 M1395 Sound levels measured for Turbine ON and OFF

| Wind speed at 10m height [m/s] |                          | 4    | 5    | 6   | 7   |
|--------------------------------|--------------------------|------|------|-----|-----|
| Turbine ON                     | Number of Samples        | 1498 | 1111 | 774 | 541 |
|                                | LA <sub>eq</sub> [dBA]   | 37   | 39   | 43  | 47  |
|                                | Standard Deviation [dBA] | 2.2  | 1.9  | 2.2 | 2.1 |
| Turbine OFF                    | Number of Samples        | 149  | 394  | 125 | 80  |
|                                | LA <sub>eq</sub> [dBA]   | 33   | 34   | 40  | 45  |
|                                | Standard Deviation [dBA] | 1.9  | 2.2  | 1.9 | 2.0 |
| Turbine ONLY                   |                          | 35   | 37   | 39  | 42  |

Table 7 M1414 Sound levels measured for Turbine ON and OFF

| Wind speed at 10m height [m/s] |                          | 4   | 5   | 6               | 7   |
|--------------------------------|--------------------------|-----|-----|-----------------|-----|
| Turbine ON                     | Number of Samples        | 509 | 653 | 439             | 226 |
|                                | LA <sub>eq</sub> [dBA]   | 37  | 40  | 42              | 47  |
|                                | Standard Deviation [dBA] | 3.0 | 2.8 | 2.3             | 2.2 |
| Turbine OFF                    | Number of Samples        | 77  | 186 | 151             | 68  |
|                                | LA <sub>eq</sub> [dBA]   | 34  | 38  | 42              | 47  |
|                                | Standard Deviation [dBA] | 2.5 | 2.7 | 2.1             | 1.6 |
| Turbine ONLY                   |                          | 34  | 37  | 32 <sup>†</sup> | *   |

\*measured turbine OFF level equal to or greater Turbine ON level, no Turbine ONLY level could be determined

† Higher uncertainty on calculated Turbine ONLY levels in cases where the measured ambient sound level (Turbine OFF) is within 1 dB of the measured Turbine ON level

Table 8 M96 Sound levels measured for Turbine ON and OFF

| Wind speed at 10m height [m/s] |                          | 4               | 5    | 6   | 7               |
|--------------------------------|--------------------------|-----------------|------|-----|-----------------|
| Turbine ON                     | Number of Samples        | 951             | 1087 | 692 | 276             |
|                                | LA <sub>eq</sub> [dBA]   | 39              | 41   | 44  | 47              |
|                                | Standard Deviation [dBA] | 2.8             | 2.1  | 1.8 | 1.7             |
| Turbine OFF                    | Number of Samples        | 89              | 118  | 167 | 61              |
|                                | LA <sub>eq</sub> [dBA]   | 38              | 39   | 42  | 46              |
|                                | Standard Deviation [dBA] | 4.0             | 1.7  | 1.8 | 1.2             |
| Turbine ONLY                   |                          | 32 <sup>†</sup> | 36   | 40  | 42 <sup>†</sup> |

† Higher uncertainty on calculated Turbine ONLY levels in cases where the measured ambient sound level (Turbine OFF) is within 1 dB of the measured Turbine ON level

Table 9 M130 Sound levels measured for Turbine ON and OFF

| Wind speed at 10m height [m/s] |                          | 4    | 5   | 6               | 7   |
|--------------------------------|--------------------------|------|-----|-----------------|-----|
| Turbine ON                     | Number of Samples        | 753  | 932 | 745             | 547 |
|                                | LA <sub>eq</sub> [dBA]   | 38   | 40  | 43              | 47  |
|                                | Standard Deviation [dBA] | 2.6  | 1.9 | 1.6             | 1.8 |
| Turbine OFF                    | Number of Samples        | 3    | 91  | 299             | 79  |
|                                | LA <sub>eq</sub> [dBA]   | 35   | 40  | 42              | 45  |
|                                | Standard Deviation [dBA] | 1.1  | 1.8 | 1.2             | 1.3 |
| Turbine ONLY                   |                          | 38** | *   | 37 <sup>†</sup> | 43  |

\*measured turbine OFF level equal to or greater Turbine ON level, no Turbine ONLY level could be determined

\*\*No background correction applied

† Higher uncertainty on calculated Turbine ONLY levels in cases where the measured ambient sound level (Turbine OFF) is within 1 dB of the measured Turbine ON level

The following figures are the plots of the measured sound levels at the receptors when all the nearby turbines were on (Turbine ON) and when all the nearby turbines were off (Turbine OFF). Note that all plots include the 95% confidence interval as a dashed line above and below the average value.

Figure 1 M1587 – Measured Turbine ON + Background (Average)

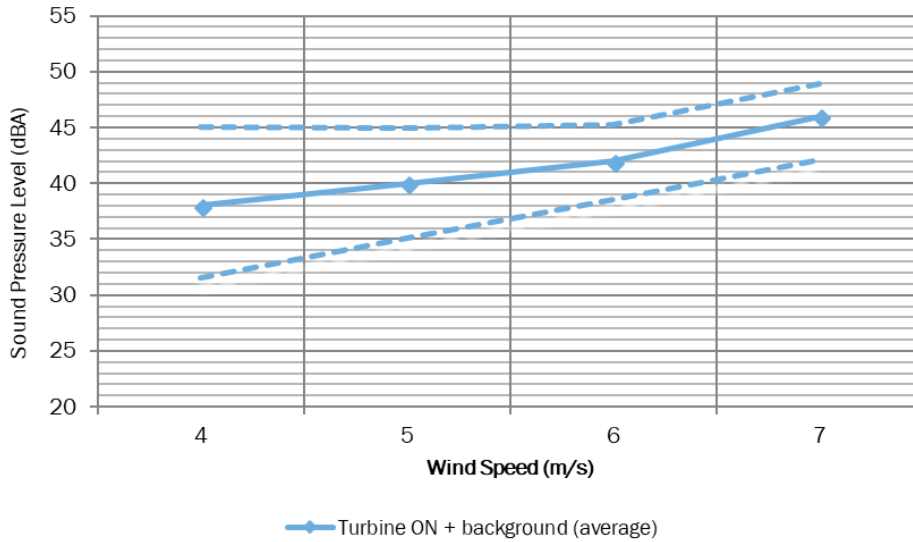


Figure 2 – M1587 - Measured Background (average)

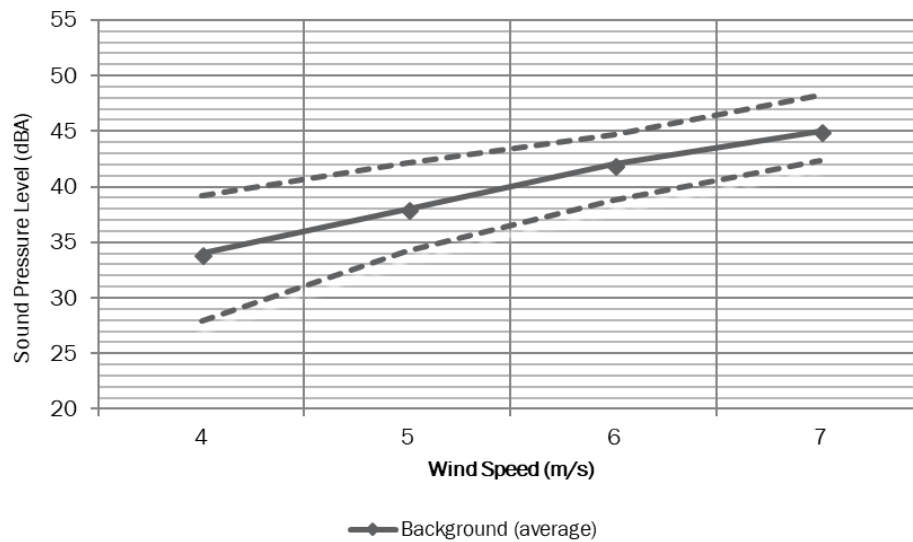


Figure 3 M1395 - Measured Turbine ON + Background (Average)

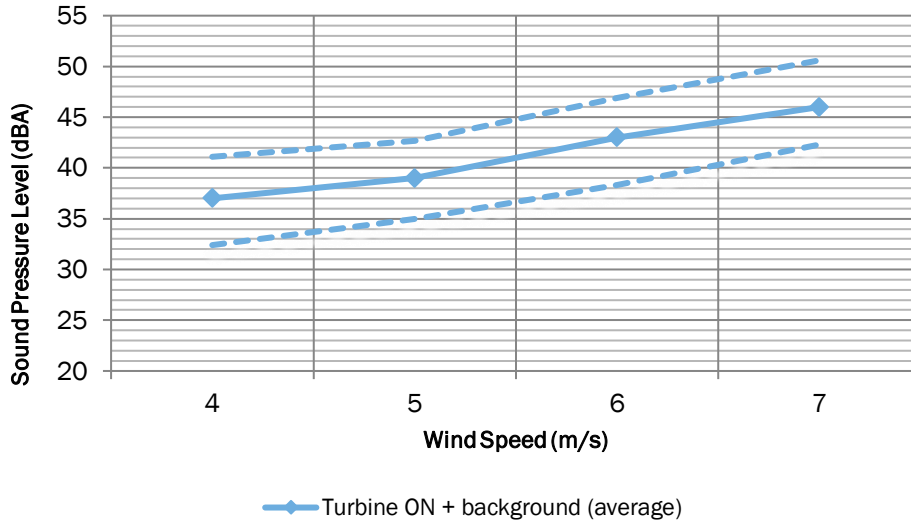


Figure 4 M1395 - Measured Background (Average)

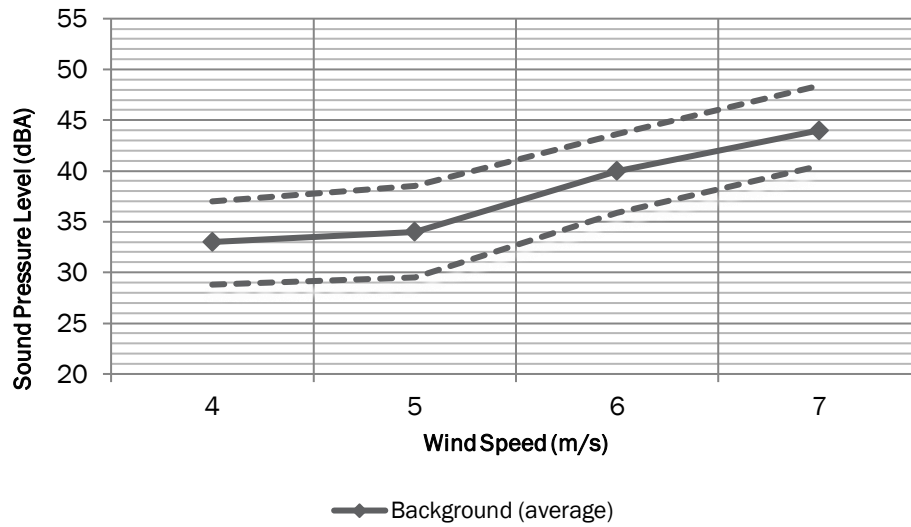


Figure 5 M1414 - Turbine ON + Background (Average)

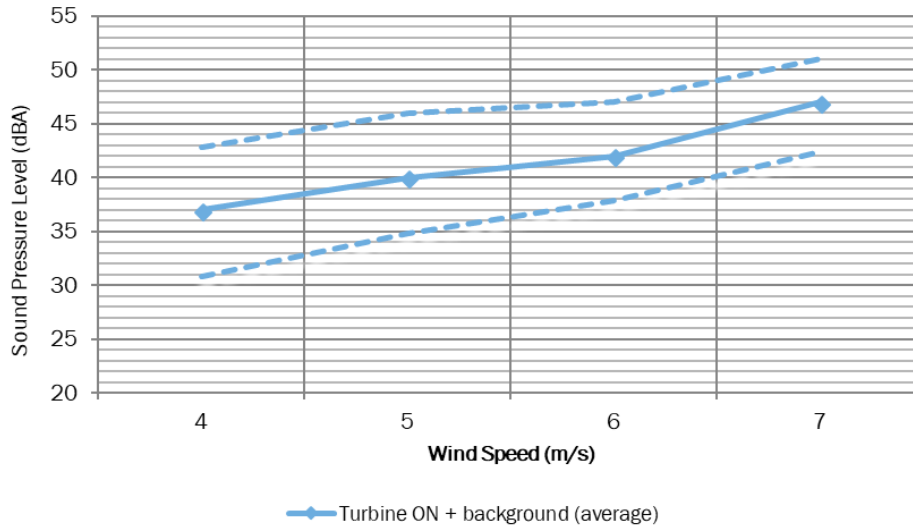


Figure 6 M1414 - Background (Average)

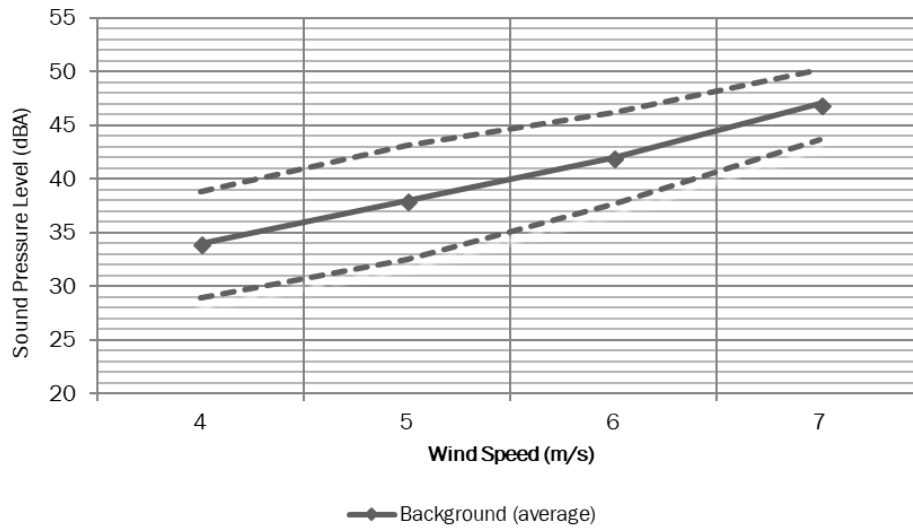




Figure 7 M96 - Turbine ON + Background (Average)

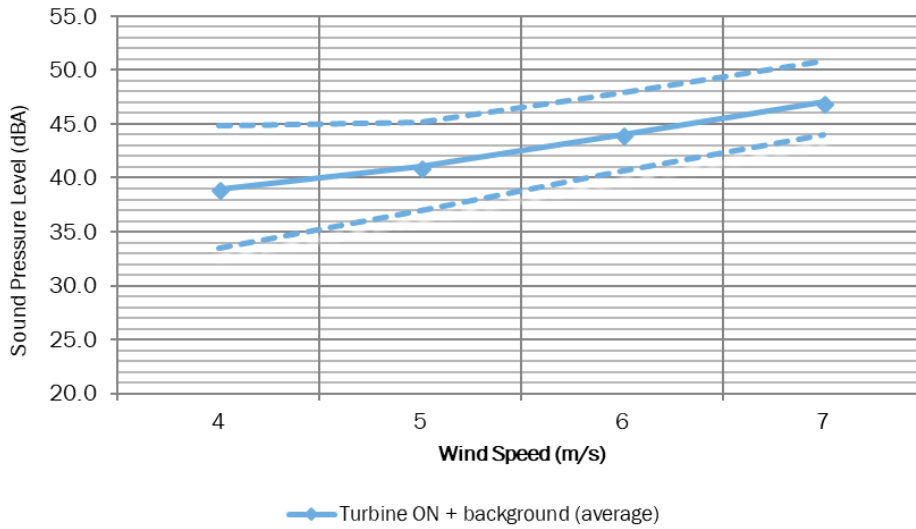


Figure 8 M96 - Measured Background (Average)

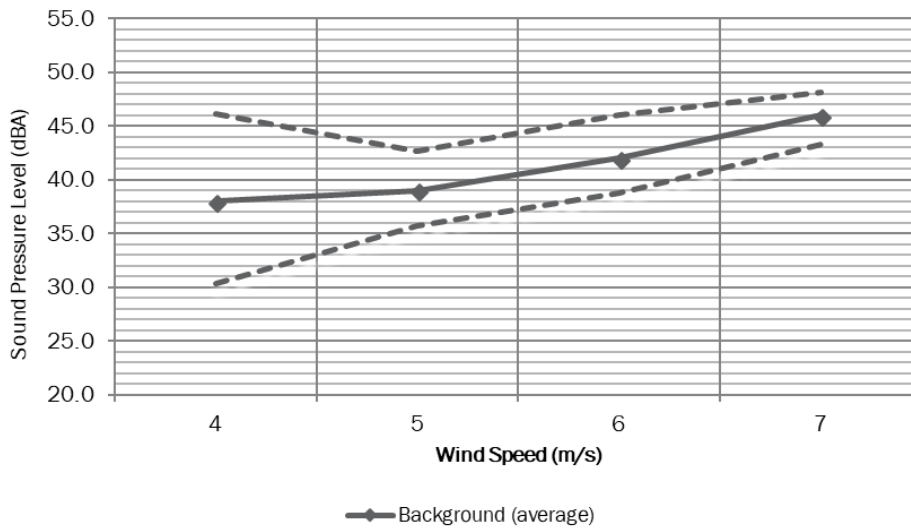


Figure 9 M130 - Measured Turbine ON + Background (Average)

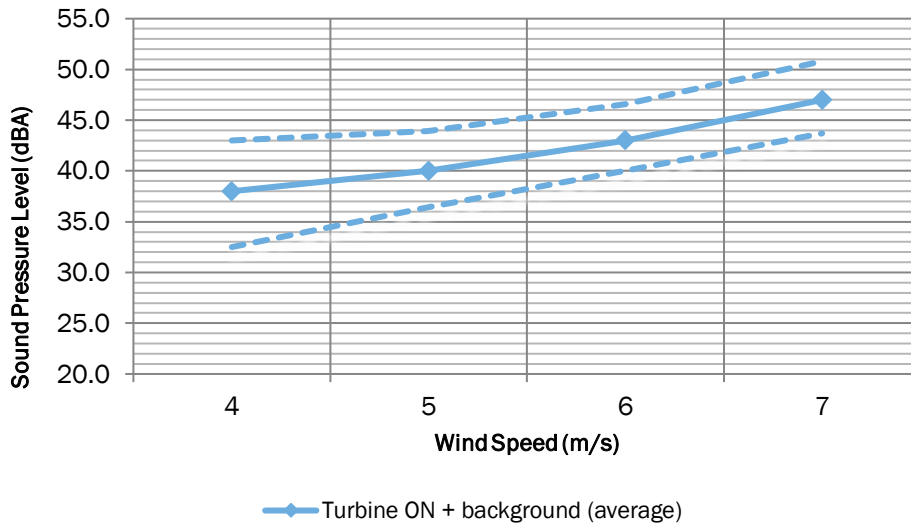
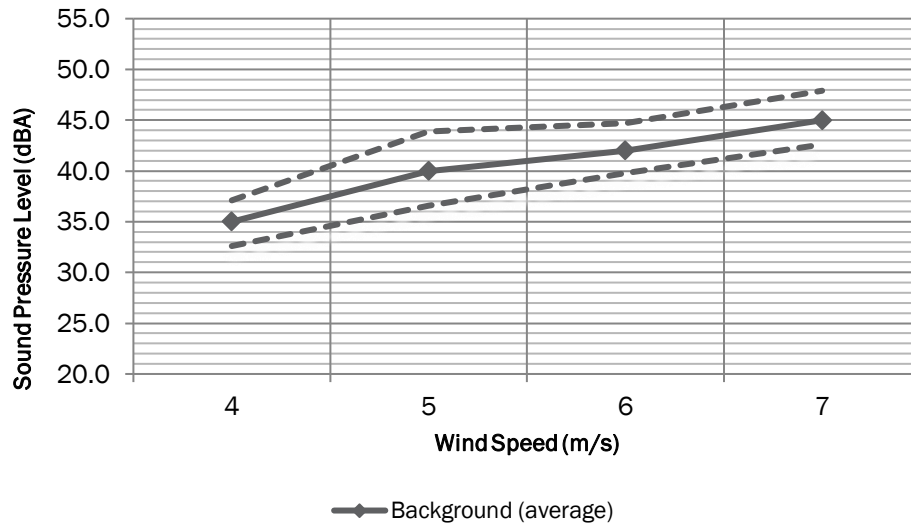


Figure 10 M130- Measured Background (Average)



## 6 Discussion

### 6.1 Overall Sound Level

The turbine component of the sound level was derived by logarithmically subtracting the ambient noise from the turbine on measurements. This calculation represents the noise level attributed to the partial impact of the wind turbine sound on the total measured receptor noise level. The turbine only component of the sound level can be calculated using the formula below, where  $T_{\text{ONLY}}$  is Turbine ONLY,  $T_{\text{ON}}$  is Turbine ON and  $T_{\text{OFF}}$  is Turbine OFF:

$$T_{\text{ONLY}} = 10\log_{10}(\log^{-1}(T_{\text{ON}}/10) - \log^{-1}(T_{\text{OFF}}/10))$$

There were some instances where the measured ambient level was higher than the average measured level when all turbines were operating. This indicates that local ambient noise sources, rather than the turbines, are driving the overall sound level at the receptor.

It should be noted that there is higher uncertainty on the calculated Turbine ONLY levels in cases when the measured ambient sound level is within 1 dB of the measured Turbine ON level.

The audit at M1587, M1395, M96, M1414 and M130 measurement locations are considered representative of the sound levels at Receptors R1587, R1395, R96 and R130 given the placement of the monitoring rigs.

Table 10 to Table 14 presents the Turbine ON, Turbine OFF and calculated Turbine ONLY sound pressure levels at each receptor between 4-7 m/s.

Table 10 Assessment Table - R1587

| Measurement Location   | Wind speed at 10m height [m/s]     | 4  | 5  | 6               | 7               |
|------------------------|------------------------------------|----|----|-----------------|-----------------|
| R1587                  | Turbine ON LAeq [dBA]              | 38 | 40 | 42              | 46              |
|                        | Turbine OFF LAeq [dBA]             | 34 | 38 | 42              | 45              |
|                        | Calculated Turbine ONLY LAeq [dBA] | 37 | 36 | 28 <sup>†</sup> | 33 <sup>†</sup> |
| MECP Sound Level Limit |                                    | 40 | 40 | 40              | 43              |

† Higher uncertainty on calculated Turbine ONLY levels in cases where the measured ambient sound level (Turbine OFF) is within 1 dB of the measured Turbine ON level

Table 11 Assessment Table - R1395

| Measurement Location   | Wind speed at 10m height [m/s]     | 4  | 5  | 6  | 7  |
|------------------------|------------------------------------|----|----|----|----|
| R1395                  | Turbine ON LAeq [dBA]              | 37 | 39 | 43 | 46 |
|                        | Turbine OFF LAeq [dBA]             | 33 | 34 | 40 | 44 |
|                        | Calculated Turbine ONLY LAeq [dBA] | 34 | 37 | 39 | 42 |
| MECP Sound Level Limit |                                    | 40 | 40 | 40 | 43 |

Table 12 Assessment Table - R1414

| Measurement Location   | Wind speed at 10m height [m/s]     | 4  | 5  | 6               | 7  |
|------------------------|------------------------------------|----|----|-----------------|----|
| R1414                  | Turbine ON LAeq [dBA]              | 37 | 40 | 42              | 47 |
|                        | Turbine OFF LAeq [dBA]             | 34 | 38 | 42              | 47 |
|                        | Calculated Turbine ONLY LAeq [dBA] | 34 | 37 | 32 <sup>†</sup> | *  |
| MECP Sound Level Limit |                                    | 40 | 40 | 40              | 43 |

† Higher uncertainty on calculated Turbine ONLY levels in cases where the measured ambient sound level (Turbine OFF) is within 1 dB of the measured Turbine ON level

\*measured turbine OFF level equal to or greater Turbine ON level, no Turbine ONLY level could be determined

Table 13 Assessment Table - R96

| Measurement Location   | Wind speed at 10m height [m/s]     | 4               | 5  | 6  | 7               |
|------------------------|------------------------------------|-----------------|----|----|-----------------|
| R96                    | Turbine ON LAeq [dBA]              | 39              | 41 | 44 | 47              |
|                        | Turbine OFF LAeq [dBA]             | 38              | 39 | 42 | 46              |
|                        | Calculated Turbine ONLY LAeq [dBA] | 32 <sup>†</sup> | 36 | 40 | 42 <sup>†</sup> |
| MECP Sound Level Limit |                                    | 40              | 40 | 40 | 43              |

† Higher uncertainty on calculated Turbine ONLY levels in cases where the measured ambient sound level (Turbine OFF) is within 1 dB of the measured Turbine ON level

Table 14 Assessment Table - R130

| Measurement Location   | Wind speed at 10m height [m/s]     | 4                | 5  | 6               | 7  |
|------------------------|------------------------------------|------------------|----|-----------------|----|
| R130                   | Turbine ON LAeq [dBA]              | 38               | 40 | 43              | 47 |
|                        | Turbine OFF LAeq [dBA]             | 35               | 40 | 42              | 45 |
|                        | Calculated Turbine ONLY LAeq [dBA] | 38 <sup>**</sup> | *  | 37 <sup>†</sup> | 43 |
| MECP Sound Level Limit |                                    | 40               | 40 | 40              | 43 |

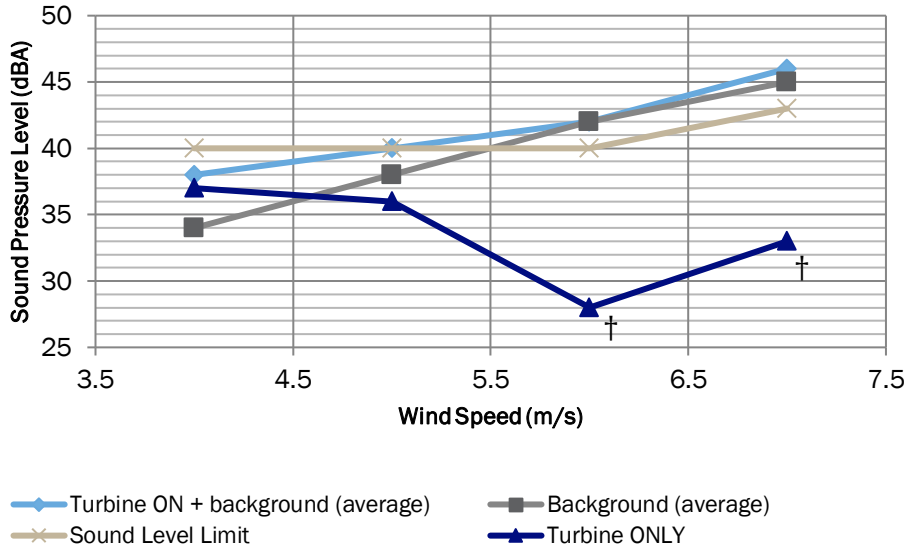
\*measured turbine OFF level equal to or greater Turbine ON level, no Turbine ONLY level could be determined

\*\*No background correction applied

† Higher uncertainty on calculated Turbine ONLY levels in cases where the measured ambient sound level (Turbine OFF) is within 1 dB of the measured Turbine ON level

The data from Table 10-14 is plotted in Figures 11, 12, 13, 14 and 15.

Figure 11 M1587 - Turbine Levels compared to the MECP sound level limits



† Higher uncertainty on calculated Turbine ONLY levels in cases where the measured ambient sound level (Turbine OFF) is within 1 dB of the measured Turbine ON level

Figure 12 M1395 - Turbine Levels compared to the MECP sound level limits

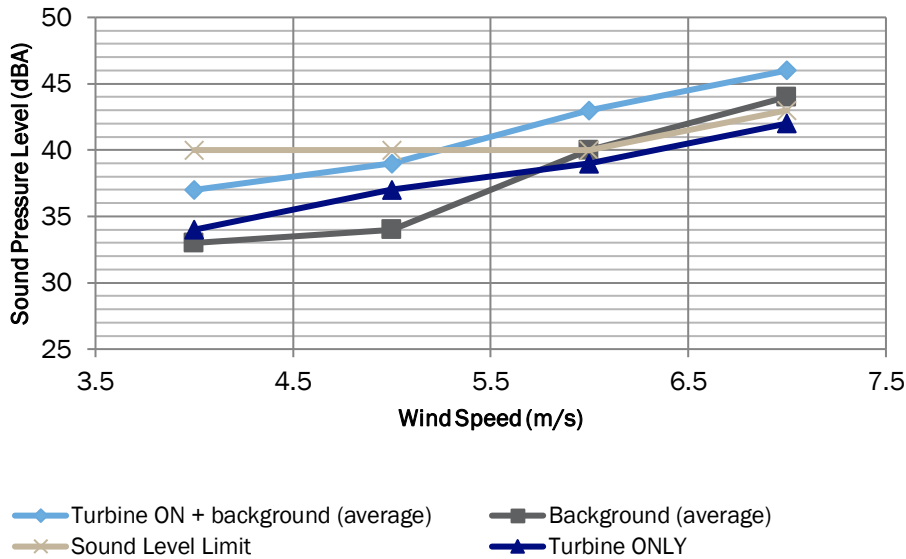
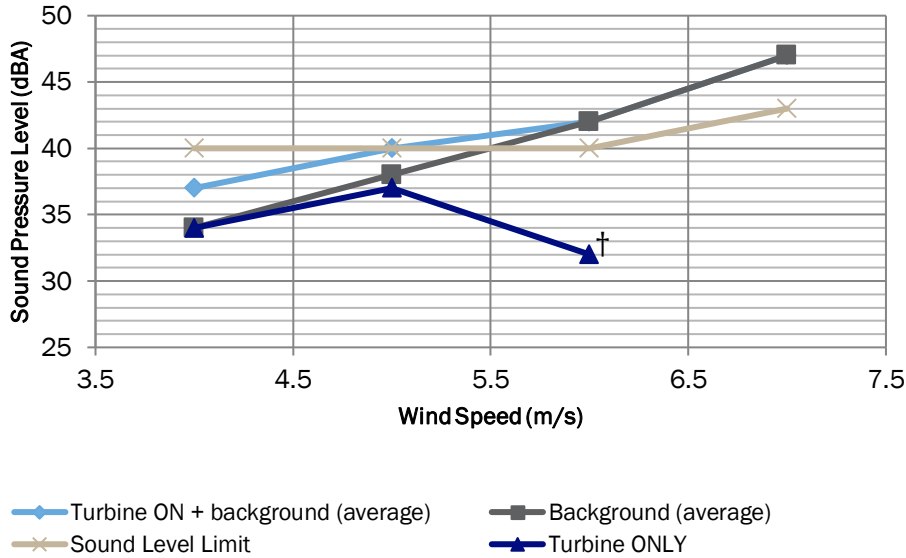
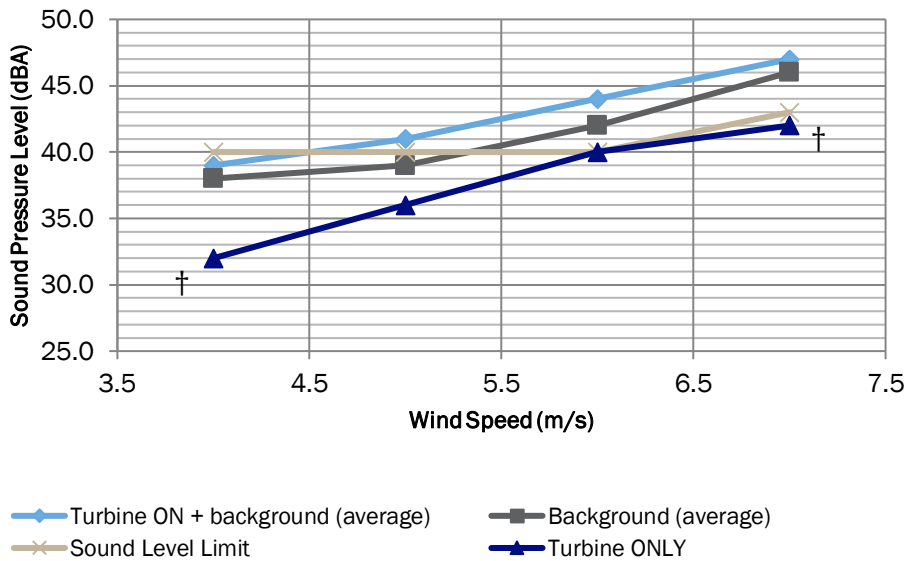


Figure 13 M1414 - Turbine Levels compared to the MECP sound level limits



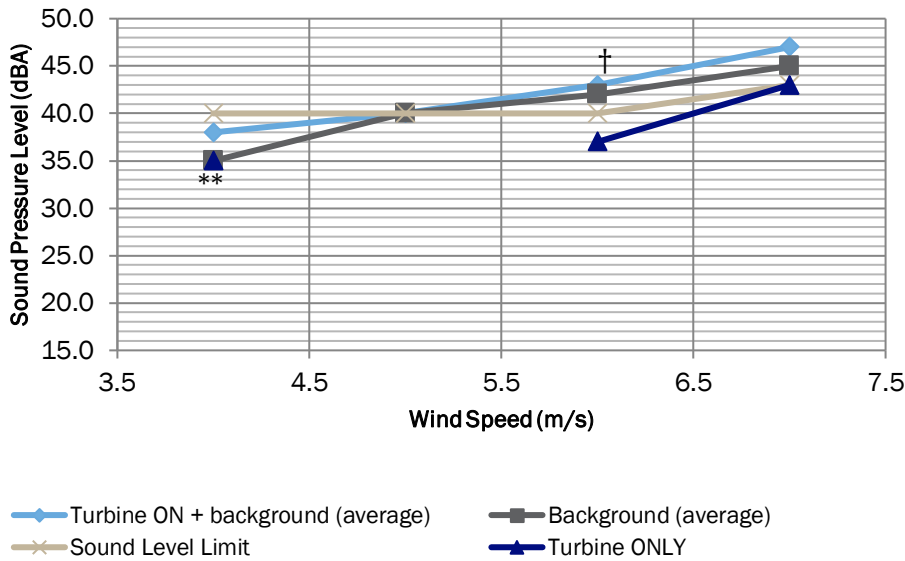
† Higher uncertainty on calculated Turbine ONLY levels in cases where the measured ambient sound level (Turbine OFF) is within 1 dB of the measured Turbine ON level

Figure 14 M96 - Turbine Levels compared to the MECP sound level limits



† Higher uncertainty on calculated Turbine ONLY levels in cases where the measured ambient sound level (Turbine OFF) is within 1 dB of the measured Turbine ON level

Figure 15 M130 - Turbine Levels compared to MECP sound level limits



\*\*No background correction applied

† Higher uncertainty on calculated Turbine ONLY levels in cases where the measured ambient sound level (Turbine OFF) is within 1 dB of the measured Turbine ON level

### 6.2 Tonality

Our site observations qualitatively indicate no presence of distinctly audible tones at the measurement location. The noise from the wind turbines was subjectively assessed not to be tonal.

Additionally, measurements carried out in accordance with International Standard IEC 61400-11 (Edition 3.0), “Wind turbine generator systems – Part 11: Acoustic noise measurement techniques” did not show any tonality audibility values of concern at 156m from the turbine. At further distances (>550m) the tonal audibility is expected to be lower.

## 7 Assessment of Compliance

Based on the calculated turbine only component indicated in Tables 10-14 and Figures 11-15, the Cedar Point Wind Power Project is compliant with MECP limits at Receptors R1587, R1395, R1414, R96 and R130.

## 8 Conclusion

Aercoustics Engineering Limited has completed the acoustic audit outlined in the Renewable Energy Approval for the Cedar Point Wind Power Project. The audit was completed as per the methodology outlined in Part D of the “MOE Compliance Protocol

for Wind Turbine Noise.” The levels measured were compared to the MECP limits, and the facility was determined in compliance at the receptors audited.

## 9 References

[1] V. Schroter, “Renewable Energy Approval #8279-9AUP2B”, Ontario Ministry of the Environment, Toronto, ON, June 20, 2013.

[2] Ministry of the Environment, “Compliance Protocol for Wind Turbine Noise – Guideline for Acoustic Assessment and Measurement”, Ontario Ministry of the Environment, Toronto, ON, January, 2011.

[3] “Cedar Point All Acoustic Results 2015-11-25, As built 46 WTGs” Howe Gastmeir Chapnik limited, November 25, 2015.

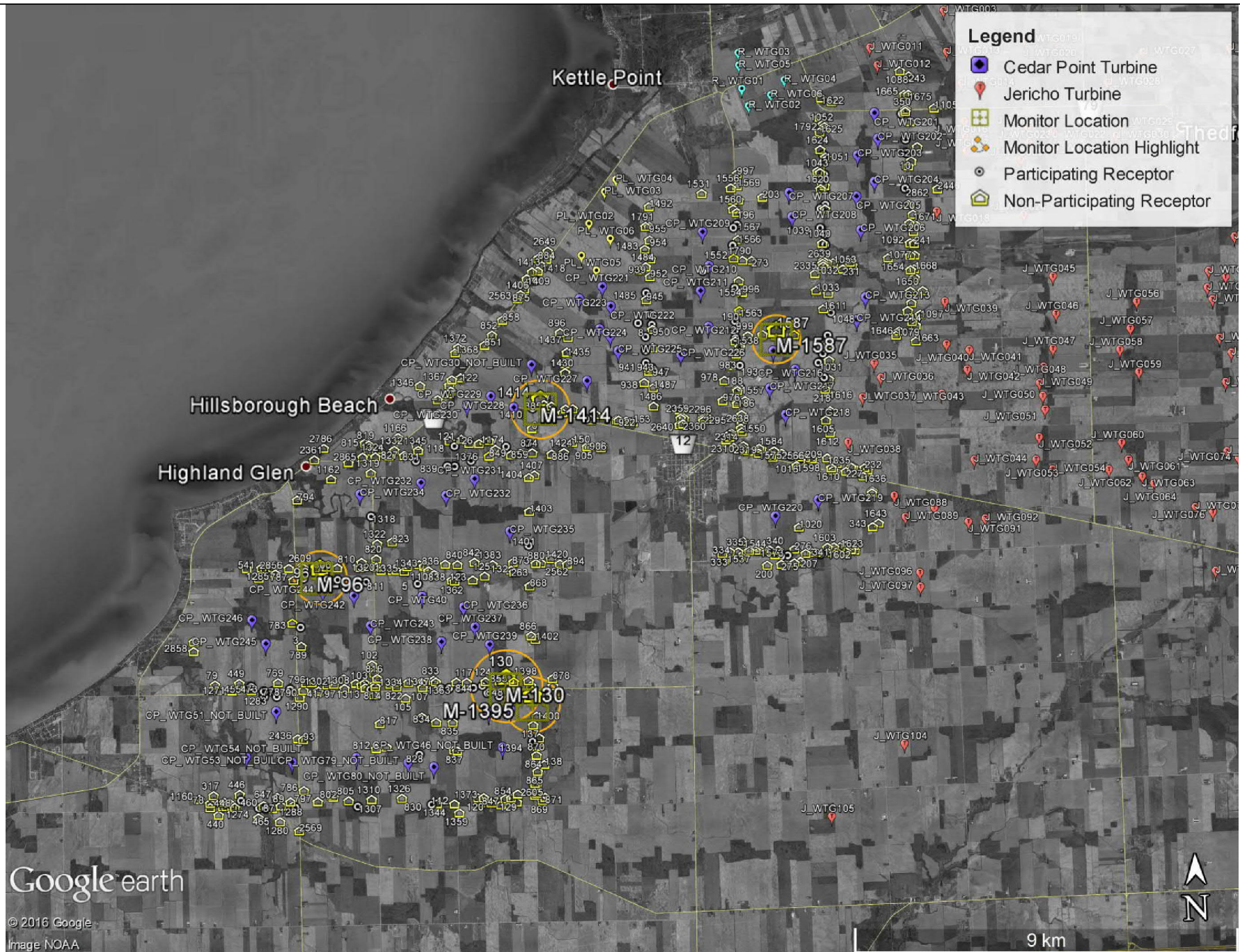


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## **Appendix A**

### **Location Details**

---



15039.00  
 Scale: NTS  
 Drawn by: AM  
 Reviewed by: PA  
 Date: Jul 25, 2016  
 Revision: 1

**Project Name**  
 Cedar Point Wind Power Project - 2nd Acoustic Immission Audit

**Figure Title**  
 Site Plan

**Figure A.01**



Google earth

© 2016 Google  
 Image NOAA



15039.00

**Project Name**

Scale: NTS

Drawn by: AM

Reviewed by: PA

Date: Jul 25, 2016

Revision: 1

Cedar Point Wind Power Project - 2nd Acoustic Immission Audit





**Figure Title**

M1587 - Monitor and Receptor Location Details

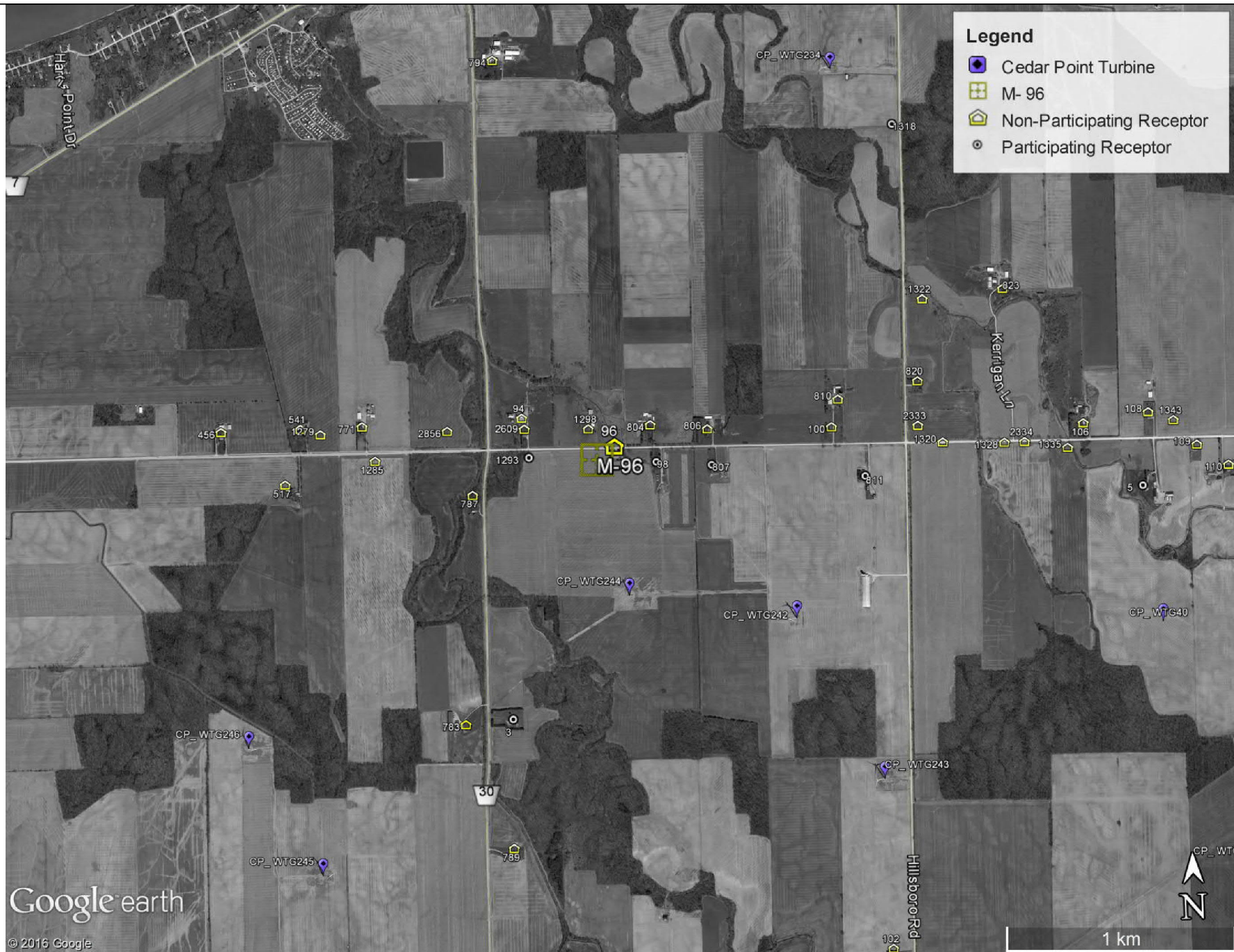
**Figure A.02**




**Legend**

-  Cedar Point Turbine
-  M-1395, M-130
-  Non-Participating Receptor
-  Participating Receptor





|  |   |  |                           |
|--|---|--|---------------------------|
|  | <p>15039.00</p>   | <p><b>Project Name</b></p>   | <p><b>Figure A.05</b></p> |
|  | <p>Scale: NTS<br/>         Drawn by: AM<br/>         Reviewed by: PA<br/>         Date: Jul 25, 2016<br/>         Revision: 1</p> | <p>Cedar Point Wind Power Project - 2nd Acoustic Immission Audit</p> <p><b>Figure Title</b></p> <p>M96 - Monitor and Receptor Location Details</p> |                           |



15039.00

Scale: NTS  
Drawn by: AM  
Reviewed by: PA

Date: Jul 25, 2016  
Revision: 1

**Project Name**

Cedar Point Wind Power Project - 2nd Acoustic Immission Audit

**Figure Title**

M130 - Monitor and Receptor Location Details

**Figure A.06**



15039.00

Scale: NTS  
Drawn by: AM  
Reviewed by: PA  
Date: Jan 30, 2018  
Revision: 1

**Project Name**

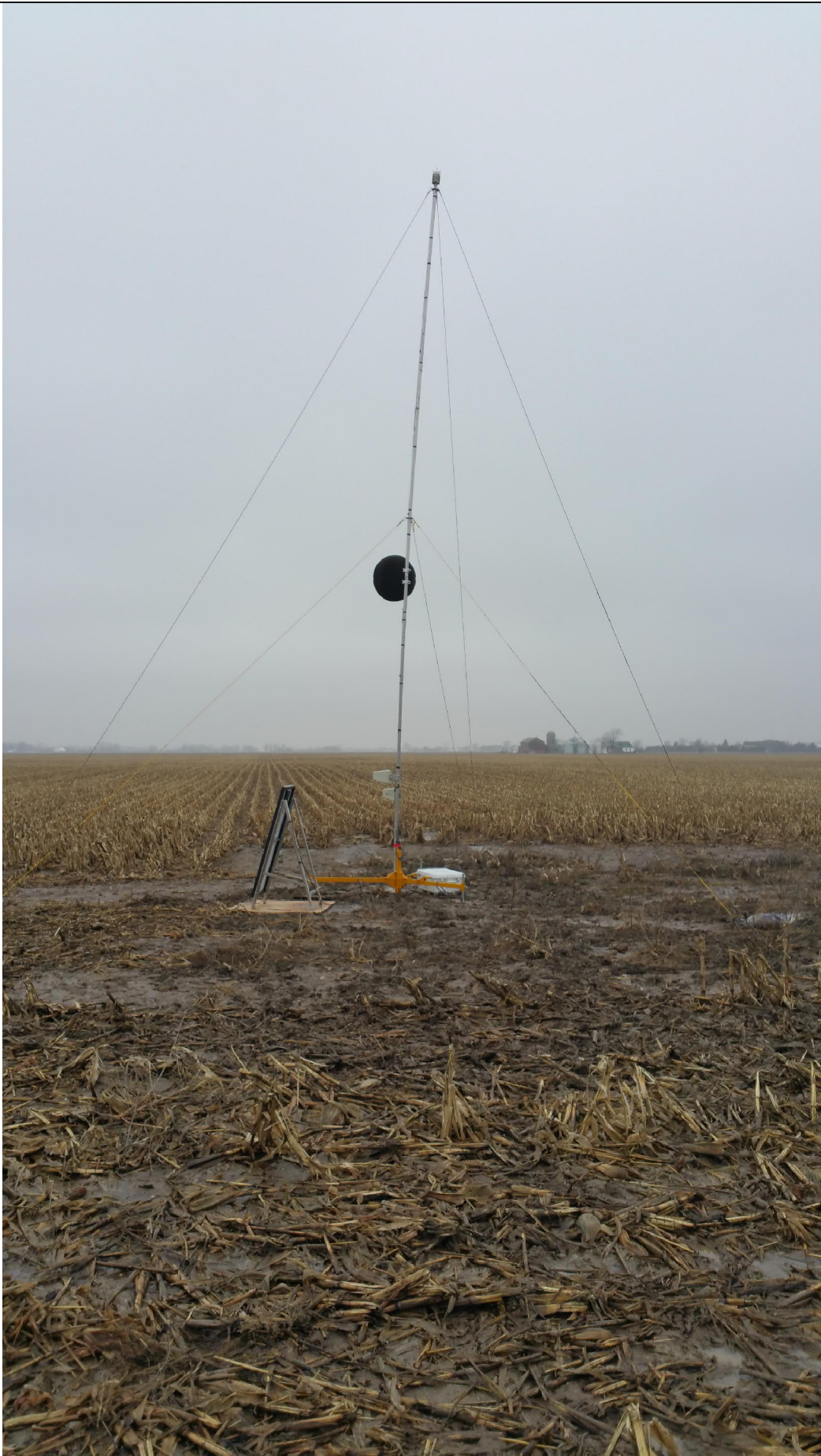
Cedar Point Wind Power Project - 2nd Acoustic Immission Audit

**Figure Title**

Site Photos - M1587

**Figure A.07**





15039.00

**Project Name**



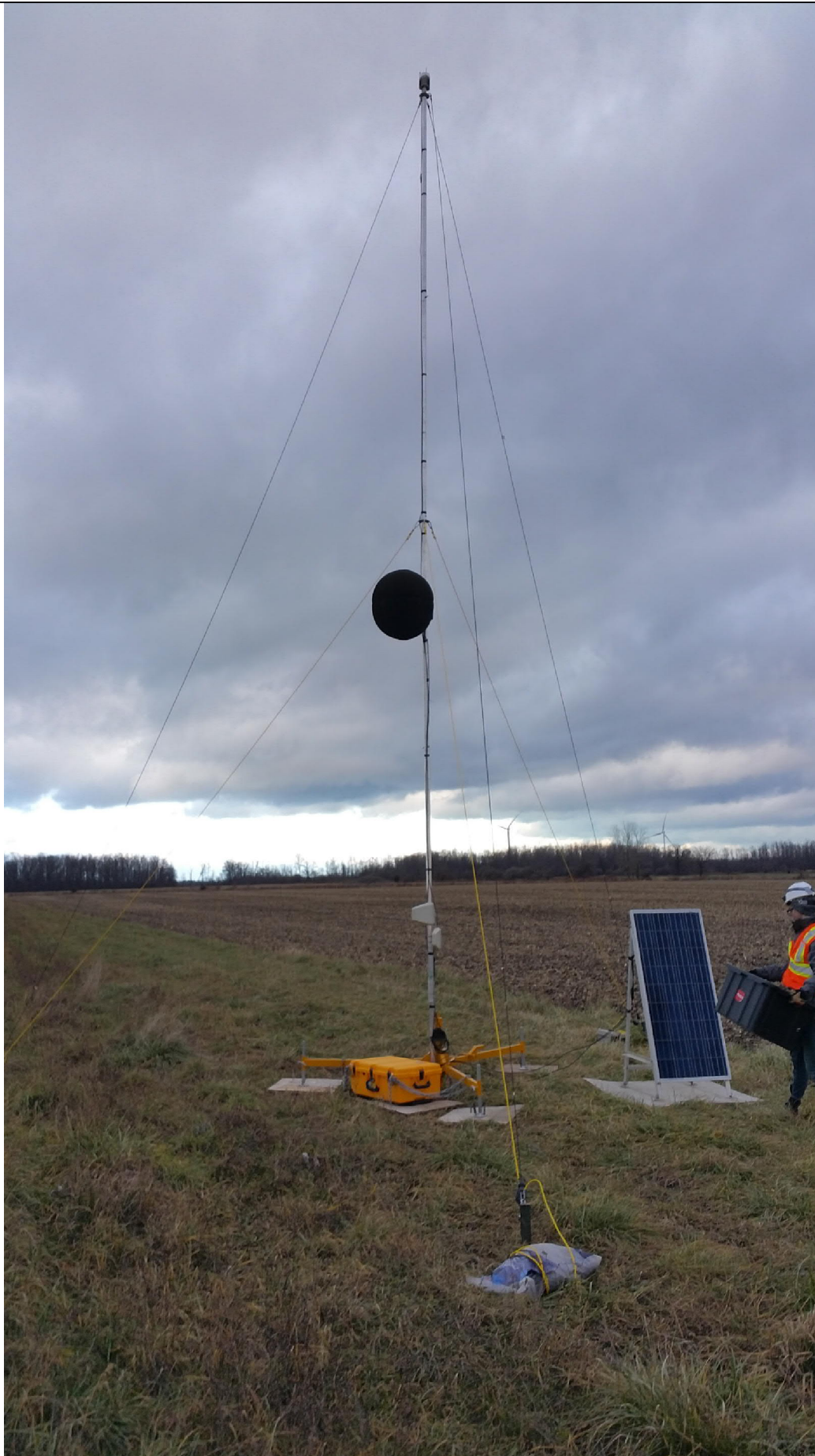
Scale: NTS  
Drawn by: AM  
Reviewed by: PA  
Date: Jan 30, 2018  
Revision: 1

Cedar Point Wind Power Project - 2nd Acoustic Immission Audit

**Figure Title**

Site Photos - M1395

**Figure A.08**





15039.00  
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Drawn by: AM  
Reviewed by: PA  
Date: Jan 30, 2018  
Revision: 1

**Project Name**

Cedar Point Wind Power Project - 2nd Acoustic Immission Audit

**Figure Title**

Site Photos - M96

**Figure A.10**



15039.00

Scale: NTS  
Drawn by: AM  
Reviewed by: PA  
Date: Jan 30, 2018  
Revision: 1

**Project Name**

Cedar Point Wind Power Project - 2nd Acoustic Immission Audit

**Figure Title**

Site Photos - M130

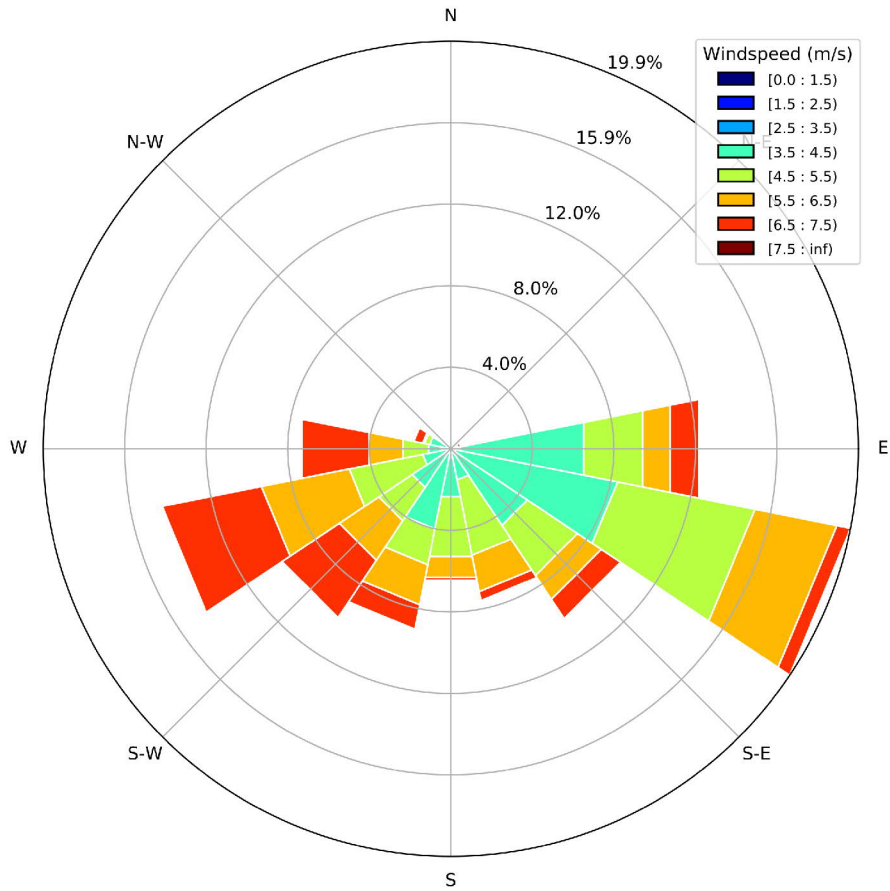
**Figure A.11**

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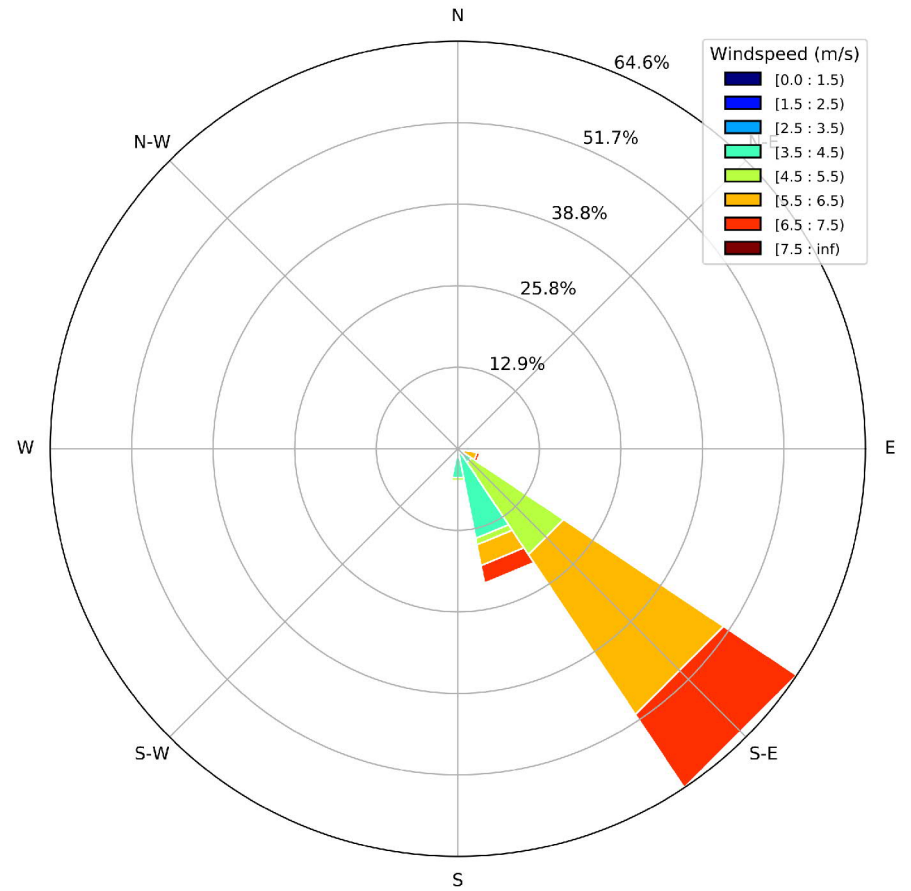
## **Appendix B Wind Roses**

---

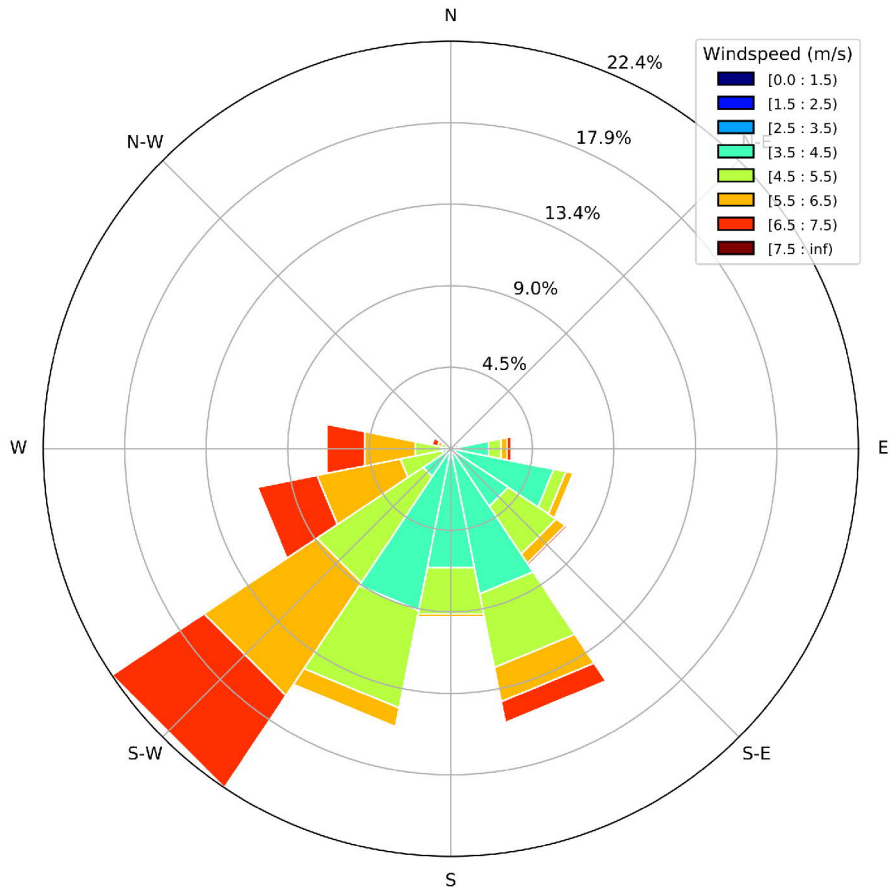
M1587 TON



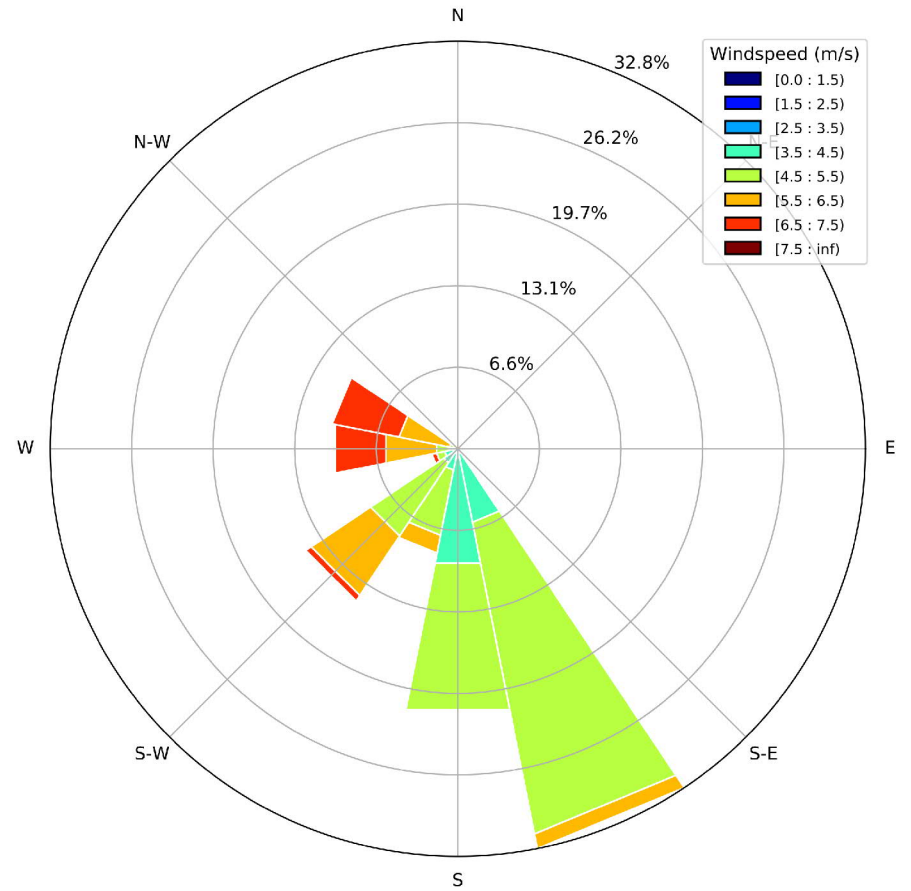
M1587 TOFF



M1395 TON



M1395 TOFF



15039.00

Scale: NTS  
 Drawn by: AM  
 Reviewed by: PA  
 Date: Sept 26, 2018  
 Revision: 1

Project Name

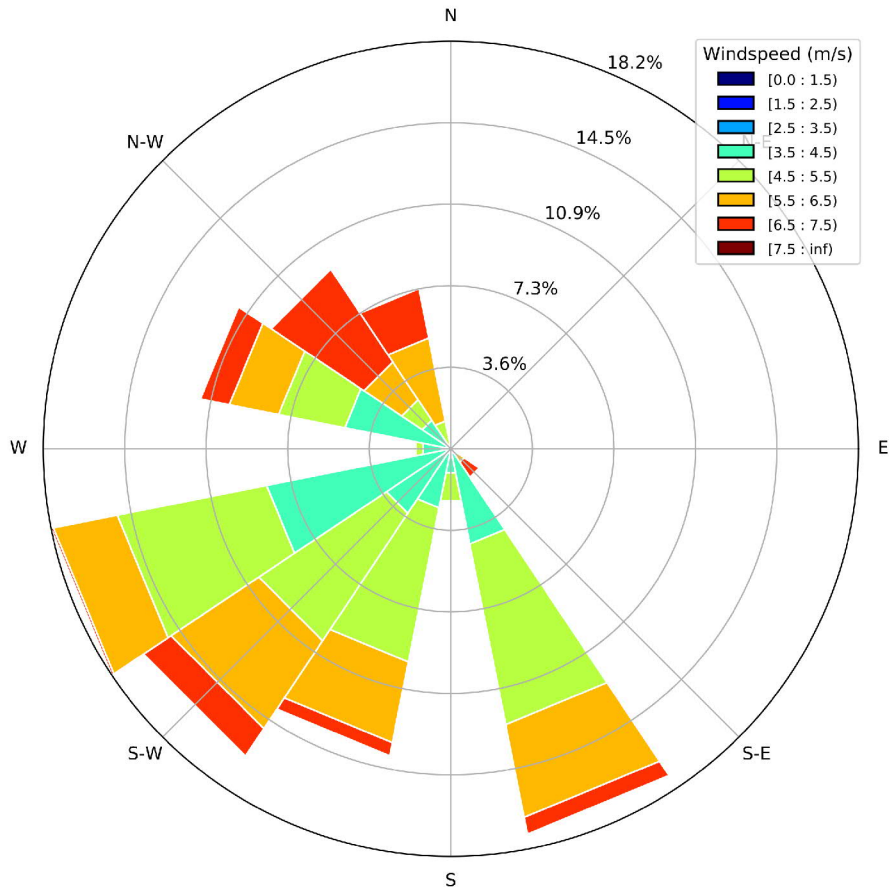
Cedar Point Wind Power Project - 2nd Acoustic Immission Audit

Figure Title

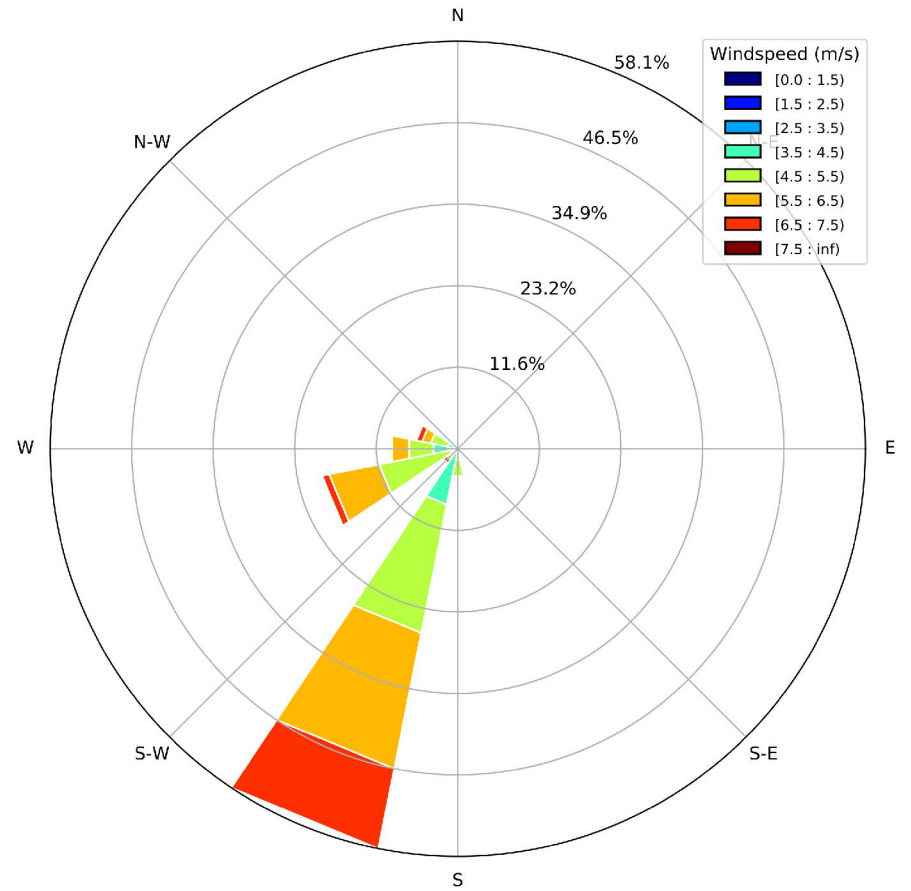
Wind Roses - M1395

Figure B.02

M1414 TON



M1414 TOFF



15039.00

Scale: NTS  
 Drawn by: AM  
 Reviewed by: PA  
 Date: Jan 29, 2018  
 Revision: 1

Project Name

Cedar Point Wind Power Project - 2nd Acoustic Immission Audit

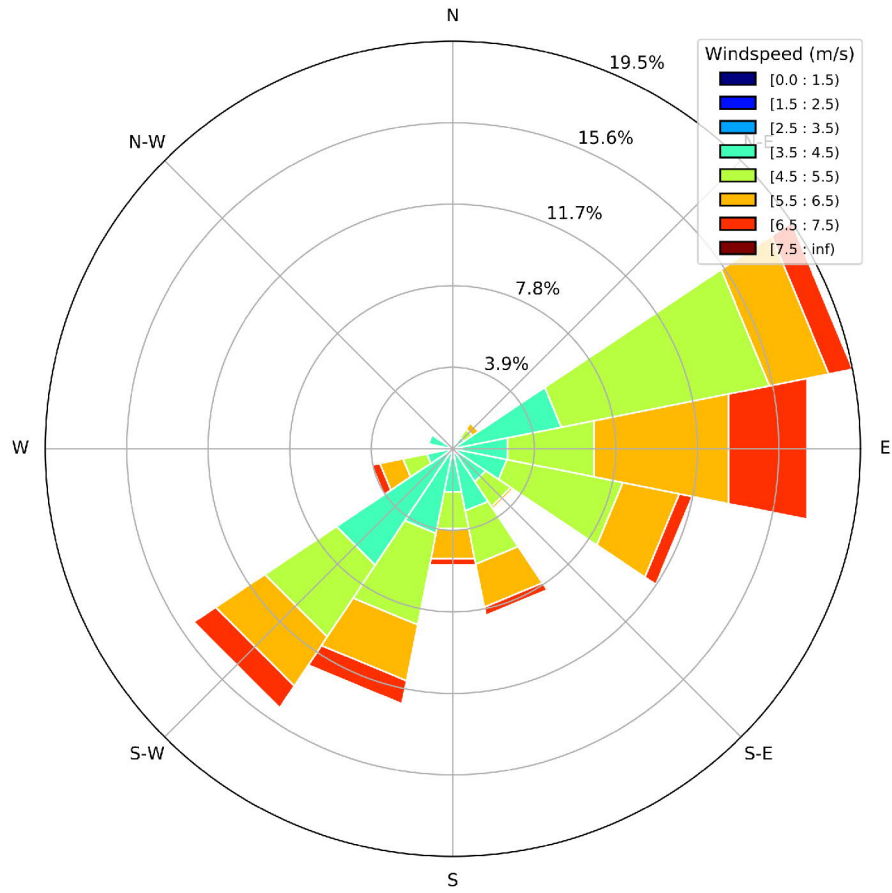
Figure Title

Wind Roses - M1414

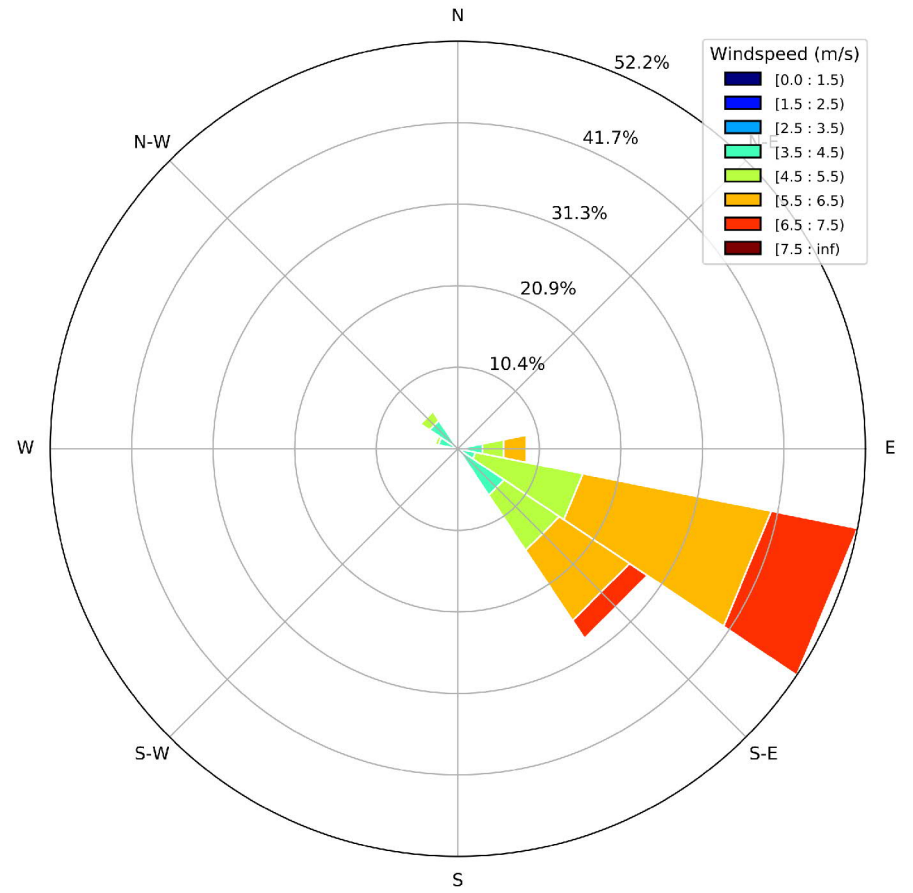
Figure B.03



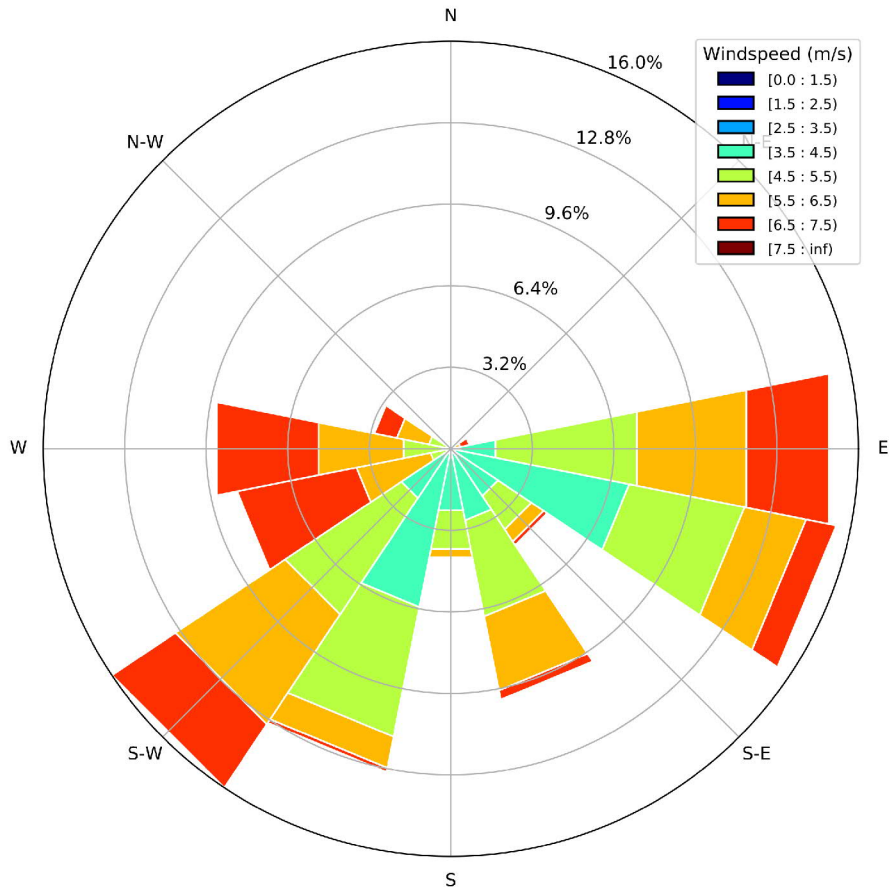
M96 TON



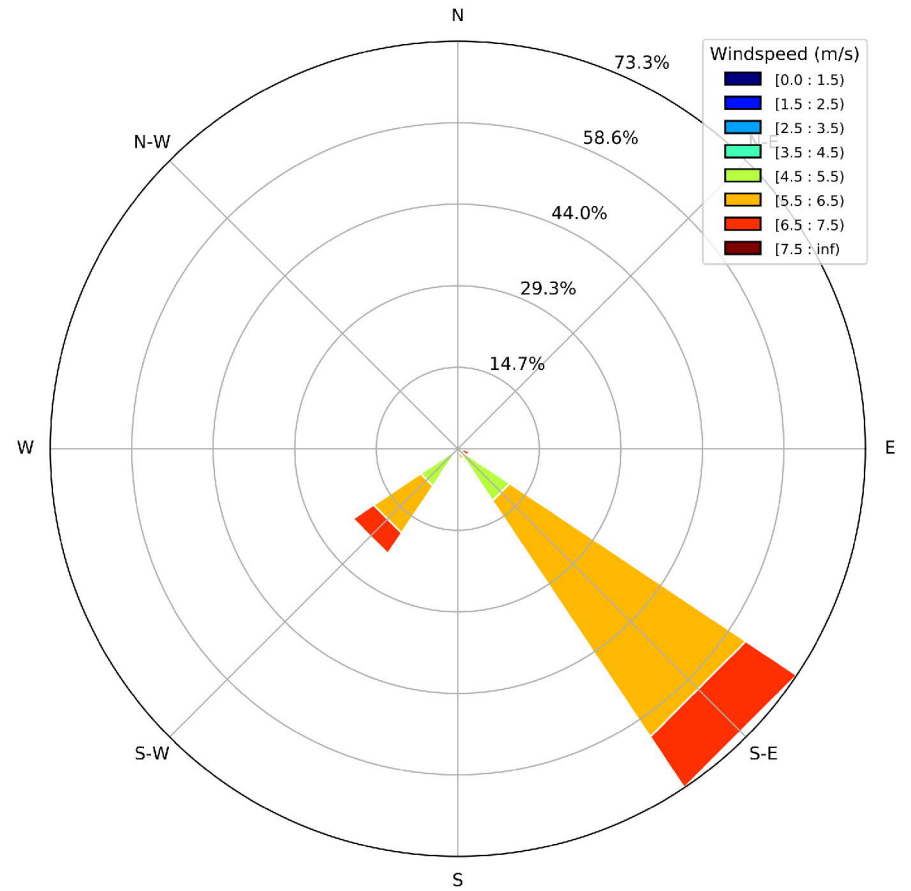
M96 TOFF



M130 TON



M130 TOFF



15039.00

Scale: NTS  
 Drawn by: AM  
 Reviewed by: PA  
 Date: Sept 26, 2018  
 Revision: 1

Project Name

Cedar Point Wind Power Project - 2nd Acoustic Immission Audit

Figure Title

Wind Roses - M130

Figure B.05

---

## **Appendix C**

# **Turbine Operational Statement from Operator**

---

To whom it may concern:

I can confirm on behalf of the Cedar Point II Wind Power Project that the wind turbines were parked for Ambient Measurements during the measurement campaign from October 4, 2016, through February 3, 2017.

**Company Name:**

NextEra Energy Canadian Operating Services


**Name of Company Representative:**

Peter Miller

**Title:**

Regional Windsite Manager-Region 6: Canada&East

**Signature of Company Representative:**



**Date:**

January 26, 2018

To whom it may concern:

I can confirm on behalf of the Cedar Point II wind project that the wind turbines that were included in this Immission report were operating normally for the duration of the measurement campaign from October 4th, 2016 through February 3<sup>rd</sup>, 2017. More specifically, all wind turbines were in operation and operating normally during the valid data time periods indicated in this report.

**Company Name:**

NextEra Energy Canadian Operating Services


**Name of Company Representative:**

Douglas McIntosh

**Title:**

Regional General Manager  
Northeast Wind Operations

**Signature of Company Representative:**

A handwritten signature in black ink, appearing to read 'Douglas McIntosh', written over a horizontal line.

**Date:**

3/7/17

---

## **Appendix D**

### **Gust Filtering Case Study**

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## Wind Gusting Analysis Summary

The purpose of this document is to provide supporting information for wind turbine receptor audits in which the wind speed gusting filter deviates from that prescribed by the Ministry of the Environment and Climate Change (MOECC). The Compliance Protocol for Wind Turbine Noise requires that the maximum and minimum wind speeds be within 2 m/s of the average wind speed in a measurement interval (1-minute average). Any intervals that do not meet this requirement would be excluded from the analysis. Aercoustics examined the possibility of changing this filtering to only exclude intervals where the maximum wind speed is more than 2 m/s above the average without filtering based on minimum wind speed.

Aercoustics reviewed 11 different data sets representing measurements from 3 different wind farms and 10 different receptor locations. Each data set was filtered using both the prescribed and the modified methods for wind speed gusting. The resulting sound pressure levels for Turbine On and Background measurements were computed for each wind bin. The change in number of valid data points and the change in measured sound pressure level were calculated. The increase in number of data points and change in sound pressure from the prescribed filtering method to the proposed method were averaged across the 11 data sets. The mean values by wind speed are presented in Table 1 below.

Table 1: Results

| Wind Bins | Turbine ON       |                 | Background       |                 |
|-----------|------------------|-----------------|------------------|-----------------|
|           | Difference (pts) | Difference (dB) | Difference (pts) | Difference (dB) |
| <b>3</b>  | 2%               | 0.0             | 3%               | 0.0             |
| <b>4</b>  | 6%               | 0.1             | 7%               | 0.0             |
| <b>5</b>  | 10%              | 0.1             | 9%               | 0.1             |
| <b>6</b>  | 11%              | 0.1             | 13%              | 0.1             |
| <b>7</b>  | 21%              | 0.1             | 25%              | 0.1             |

These results clearly show that the proposed modification of the wind speed gusting filter increases the number of data points in all wind bins, with a more pronounced effect at high wind speeds. The over 20% increase in data points in the 7 m/s wind bins is significant as these wind speeds are typically the most difficult to measure and can considerably increase the time required to complete an audit. There are negligible increases in the measured sound levels, which occur during both Turbine On and Background measurements.

---

## **Appendix E - Turbine Status during TON and TOFF**

---



Cedar Point - Turbine Status Matrix for TON and TOFF

| AAR ID   | CP ID  | Monitor Locations |        |      |       |        |
|----------|--------|-------------------|--------|------|-------|--------|
|          |        | M-1587            | M-1414 | M-96 | M-130 | M-1395 |
| CP_WTG1  | CP 201 |                   |        |      |       |        |
| CP_WTG2  | CP 202 |                   |        |      |       |        |
| CP_WTG4  | CP 203 |                   |        |      |       |        |
| CP_WTG5  | CP 204 |                   |        |      |       |        |
| CP_WTG6  | CP 205 |                   |        |      |       |        |
| CP_WTG8  | CP 206 |                   |        |      |       |        |
| CP_WTG7  | CP 207 |                   |        |      |       |        |
| CP_WTG82 | CP 208 |                   |        |      |       |        |
| CP_WTG10 | CP 209 |                   |        |      |       |        |
| CP_WTG13 | CP 210 | 1                 |        |      |       |        |
| CP_WTG14 | CP 211 | 1                 |        |      |       |        |
| CP_WTG17 | CP 212 | 1                 |        |      |       |        |
| CP_WTG9  | CP 213 | 1                 |        |      |       |        |
| CP_WTG11 | CP 214 | 1                 |        |      |       |        |
| CP_WTG15 | CP 215 | 1                 |        |      |       |        |
| CP_WTG16 | CP 216 | 1                 |        |      |       |        |
| CP_WTG18 | CP 217 | 1                 |        |      |       |        |
| CP_WTG20 | CP 218 | 1                 |        |      |       |        |
| CP_WTG26 | CP 219 |                   |        |      |       |        |
| CP_WTG29 | CP 220 |                   |        |      |       |        |
| CP_WTG21 | CP 221 |                   |        |      |       |        |
| CP_WTG22 | CP 222 |                   |        |      |       |        |
| CP_WTG23 | CP 223 |                   |        |      |       |        |
| CP_WTG24 | CP 224 |                   |        |      |       |        |
| CP_WTG25 | CP 225 |                   |        |      |       |        |
| CP_WTG19 | CP 226 | 1                 |        |      |       |        |
| CP_WTG27 | CP 227 |                   | 1      |      |       |        |
| CP_WTG31 | CP 228 |                   | 1      |      |       |        |
| CP_WTG32 | CP 229 |                   | 1      |      |       |        |
| CP_WTG34 | CP 230 |                   | 1      |      |       |        |
| CP_WTG35 | CP 231 |                   |        |      |       |        |
| CP_WTG36 | CP 232 |                   |        |      |       |        |
| CP_WTG37 | CP 233 |                   |        |      |       |        |
| CP_WTG39 | CP 234 |                   |        |      |       |        |
| CP_WTG71 | CP 235 |                   |        |      |       |        |
| CP_WTG81 | CP 236 |                   |        |      |       |        |
| CP_WTG76 | CP 237 |                   |        |      |       |        |
| CP_WTG69 | CP 238 |                   |        |      |       |        |
| CP_WTG70 | CP 239 |                   |        |      | 1     |        |
| CP_WTG42 | CP 240 |                   |        |      | 1     | 1      |
| CP_WTG72 | CP 241 |                   |        |      | 1     | 1      |
| CP_WTG41 | CP 242 |                   |        | 1    |       |        |
| CP_WTG43 | CP 243 |                   |        | 1    |       |        |
| CP_WTG44 | CP 244 |                   |        | 1    |       |        |
| CP_WTG48 | CP 245 |                   |        |      |       |        |
| CP_WTG47 | CP 246 |                   |        |      |       |        |

1- Turbine ON/OFF

Turbines Turned off such that predicted impact at monitor/receptor location is 30 dBA or less

---

## **Appendix F**

# **Receptor Selection Rationale**

---

# Appendix F - Receptor Selection Summary

Project: Cedar Point Wind Power Project

| Receptor ID | Description                  | Modelled Sound Level (dBA) | Receptor Height (m) | Distance to Closest Turbine (m) | Closest Turbine ID | Rationale  |
|-------------|------------------------------|----------------------------|---------------------|---------------------------------|--------------------|--|
| 1437        | Non-Participating Vacant Lot | 39.5                       | 4.5                 | 746                             | Suncor WTG24       | Not in Prevailing Wind Direction   |
| 1489        | Non-Participating Vacant Lot | 39.4                       | 4.5                 | 728                             | Suncor WTG19       | Not in Prevailing Wind Direction   |
| 1630        | Non-Participating Vacant Lot | 39.4                       | 4.5                 | 749                             | Suncor WTG6        | Not in Prevailing Wind Direction   |
| 1020        | Non-Participating Receptor   | 39.3                       | 4.5                 | 567                             | Suncor WTG29       | Not in Prevailing Wind Direction   |
| 945         | Non-Participating Receptor   | 39.1                       | 4.5                 | 900                             | Suncor WTG22       | In Proximity to ProofLine Wind Farm (impact above 30dBA), cannot reach below 30 dBA even if all Cedar Point Turbines Parked              |
| 950         | Non-Participating Receptor   | 39.0                       | 4.5                 | 990                             | Suncor WTG19       | Not in Prevailing Wind Direction   |
| 1620        | Non-Participating Vacant Lot | 38.9                       | 4.5                 | 780                             | Suncor WTG7        | In Proximity to ProofLine Wind Farm (impact above 30dBA), cannot reach below 30 dBA even if all Cedar Point Turbines Parked              |
| 943         | Non-Participating Receptor   | 38.9                       | 4.5                 | 762                             | Suncor WTG25       | Not in Prevailing Wind Direction   |
| 6           | Non-Participating Receptor   | 38.9                       | 4.5                 | 550                             | Suncor WTG31       | Not in Prevailing Wind Direction   |
| 224         | Non-Participating Receptor   | 38.9                       | 4.5                 | 844                             | Suncor WTG6        | Not in Prevailing Wind Direction   |
| 952         | Non-Participating Receptor   | 38.9                       | 4.5                 | 1192                            | Suncor WTG21       | In Proximity to ProofLine Wind Farm (impact above 30dBA), cannot reach below 30 dBA even if all Cedar Point Turbines Parked              |
| 1430        | Non-Participating Vacant Lot | 38.8                       | 4.5                 | 613                             | Suncor WTG27       | Not in Prevailing Wind Direction   |
| 1538        | Non-Participating Vacant Lot | 38.8                       | 4.5                 | 662                             | Suncor WTG17       | Not in Prevailing Wind Direction   |
| 222         | Non-Participating Receptor   | 38.7                       | 4.5                 | 853                             | Suncor WTG7        | In Proximity to ProofLine Wind Farm (impact above 30dBA), cannot reach below 30 dBA even if all Cedar Point Turbines Parked              |
| 896         | Non-Participating Receptor   | 38.7                       | 4.5                 | 781                             | Suncor WTG23       | Not in Prevailing Wind Direction   |
| 124         | Non-Participating Receptor   | 38.7                       | 4.5                 | 728                             | Suncor WTG70       | Not in Prevailing Wind Direction   |
| 994         | Non-Participating Receptor   | 38.7                       | 4.5                 | 599                             | Suncor WTG18       | Not in Prevailing Wind Direction   |
| 1587        | Non-Participating Vacant Lot | 38.7                       | 4.5                 | 554                             | Suncor WTG15       | Selected Monitoring Location   |
| 1100        | Non-Participating Receptor   | 38.7                       | 7.5                 | 923                             | Suncor WTG2        | Not in Prevailing Wind Direction   |
| 850         | Non-Participating Receptor   | 38.6                       | 4.5                 | 842                             | Suncor WTG34       | Not in Prevailing Wind Direction   |
| 846         | Non-Participating Receptor   | 38.6                       | 4.5                 | 781                             | Suncor WTG34       | Not in Prevailing Wind Direction   |
| 947         | Non-Participating Receptor   | 38.6                       | 4.5                 | 696                             | Suncor WTG19       | Not in Prevailing Wind Direction   |
| 1384        | Non-Participating Vacant Lot | 38.6                       | 4.5                 | 741                             | Suncor WTG70       | Not in Prevailing Wind Direction   |
| 203         | Non-Participating Receptor   | 38.5                       | 4.5                 | 624                             | Suncor WTG7        | Not in Prevailing Wind Direction   |
| 1480        | Non-Participating Vacant Lot | 38.5                       | 4.5                 | 787                             | Suncor WTG19       | Not in Prevailing Wind Direction   |
| 1002        | Non-Participating Receptor   | 38.5                       | 4.5                 | 588                             | Suncor WTG15       | Not in Prevailing Wind Direction   |
| 121         | Non-Participating Receptor   | 38.5                       | 4.5                 | 651                             | Suncor WTG34       | Not in Prevailing Wind Direction   |
| 1435        | Non-Participating Vacant Lot | 38.5                       | 4.5                 | 866                             | Suncor WTG24       | Not in Prevailing Wind Direction   |
| 350         | Non-Participating Receptor   | 38.5                       | 4.5                 | 751                             | Suncor WTG1        | Not in Prevailing Wind Direction   |
| 1051        | Non-Participating Receptor   | 38.4                       | 4.5                 | 757                             | Suncor WTG4        | Not in Prevailing Wind Direction   |
| 218         | Non-Participating Receptor   | 38.4                       | 4.5                 | 775                             | Suncor WTG16       | Not in Prevailing Wind Direction   |
| 240         | Non-Participating Receptor   | 38.4                       | 4.5                 | 762                             | Suncor WTG1        | Not in Prevailing Wind Direction   |
| 1673        | Non-Participating Vacant Lot | 38.4                       | 4.5                 | 836                             | Suncor WTG1        | Not in Prevailing Wind Direction   |
| 10          | Non-Participating Receptor   | 38.4                       | 4.5                 | 867                             | Suncor WTG2        | Not in Prevailing Wind Direction   |
| 1617        | Non-Participating Vacant Lot | 38.4                       | 4.5                 | 795                             | Suncor WTG16       | Not in Prevailing Wind Direction   |
| 1634        | Non-Participating Vacant Lot | 38.3                       | 4.5                 | 1087                            | Suncor WTG1        | Not in Prevailing Wind Direction   |
| 126         | Non-Participating Receptor   | 38.3                       | 4.5                 | 790                             | Suncor WTG34       | Not in Prevailing Wind Direction   |
| 843         | Non-Participating Receptor   | 38.3                       | 4.5                 | 735                             | Suncor WTG34       | Not in Prevailing Wind Direction   |
| 1043        | Non-Participating Receptor   | 38.3                       | 4.5                 | 918                             | Suncor WTG4        | Not in Prevailing Wind Direction   |
| 192         | Non-Participating Receptor   | 38.3                       | 4.5                 | 805                             | Suncor WTG17       | Not in Prevailing Wind Direction   |
| 270         | Non-Participating Receptor   | 38.3                       | 4.5                 | 795                             | Suncor WTG17       | Not in Prevailing Wind Direction   |
| 1431        | Non-Participating Vacant Lot | 38.3                       | 4.5                 | 751                             | Suncor WTG27       | Not in Prevailing Wind Direction   |
| 1792        | Non-Participating Vacant Lot | 38.3                       | 4.5                 | 1185                            | Suncor WTG4        | Not in Prevailing Wind Direction   |
| 1552        | Non-Participating Vacant Lot | 38.3                       | 4.5                 | 665                             | Suncor WTG13       | In Proximity to ProofLine Wind Farm (impact above 30dBA), cannot reach below 30 dBA even if all Cedar Point Turbines Parked              |
| 1672        | Non-Participating Vacant Lot | 38.2                       | 4.5                 | 866                             | Suncor WTG2        | Not in Prevailing Wind Direction   |
| 130         | Non-Participating Receptor   | 38.2                       | 4.5                 | 811                             | Suncor WTG72       | Selected Monitoring Location   |
| 1052        | Non-Participating Receptor   | 38.2                       | 4.5                 | 1119                            | Suncor WTG4        | Not in Prevailing Wind Direction   |
| 189         | Non-Participating Receptor   | 38.2                       | 4.5                 | 820                             | Suncor WTG17       | Not in Prevailing Wind Direction   |
| 985         | Non-Participating Receptor   | 38.2                       | 4.5                 | 801                             | Suncor WTG17       | Not in Prevailing Wind Direction   |
| 1044        | Non-Participating Receptor   | 38.1                       | 4.5                 | 893                             | Suncor WTG4        | Not in Prevailing Wind Direction   |
| 1625        | Non-Participating Vacant Lot | 38.1                       | 4.5                 | 1121                            | Suncor WTG4        | Not in Prevailing Wind Direction   |
| 219         | Non-Participating Receptor   | 38.1                       | 4.5                 | 931                             | Suncor WTG7        | In Proximity to Ravenswood and Jericho Wind Farm (impact above 30dBA), cannot reach below 30 dBA even if all Cedar Point Turbines Parked |
| 152         | Non-Participating Receptor   | 38.1                       | 4.5                 | 603                             | Suncor WTG27       | Not in Prevailing Wind Direction   |
| 1041        | Non-Participating Receptor   | 38.0                       | 4.5                 | 875                             | Suncor WTG16       | In Proximity to Jericho Wind Farm (impact above 30dBA), cannot reach below 30 dBA even if all Cedar Point Turbines Parked                |
| 1624        | Non-Participating Vacant Lot | 38.0                       | 4.5                 | 918                             | Suncor WTG4        | Not in Prevailing Wind Direction   |
| 1414        | Non-Participating Vacant Lot | 38.0                       | 4.5                 | 676                             | Suncor WTG31       | Selected Monitoring Location   |
| 114         | Non-Participating Receptor   | 37.9                       | 4.5                 | 608                             | Suncor WTG34       | Not in Prevailing Wind Direction   |
| 1646        | Non-Participating Vacant Lot | 37.9                       | 4.5                 | 1007                            | Suncor WTG11       | Not in Prevailing Wind Direction   |
| 1057        | Non-Participating Receptor   | 37.9                       | 4.5                 | 659                             | Suncor WTG8        | Not in Prevailing Wind Direction   |
| 999         | Non-Participating Receptor   | 37.9                       | 4.5                 | 778                             | Suncor WTG15       | Not in Prevailing Wind Direction   |
| 137         | Non-Participating Receptor   | 37.9                       | 4.5                 | 574                             | Suncor WTG72       | Not in Prevailing Wind Direction   |
| 1365        | Non-Participating Vacant Lot | 37.8                       | 4.5                 | 621                             | Suncor WTG34       | Not in Prevailing Wind Direction   |
| 1621        | Non-Participating Vacant Lot | 37.8                       | 4.5                 | 780                             | Suncor WTG11       | Not in Prevailing Wind Direction   |
| 849         | Non-Participating Receptor   | 37.8                       | 4.5                 | 765                             | Suncor WTG35       | Permission not Granted   |
| 96          | Non-Participating Receptor   | 37.8                       | 4.5                 | 611                             | Suncor WTG44       | Selected Monitoring Location   |
| 1040        | Non-Participating Receptor   | 37.8                       | 4.5                 | 851                             | Suncor WTG82       | Not in Prevailing Wind Direction   |
| 1565        | Non-Participating Vacant Lot | 37.8                       | 4.5                 | 728                             | Suncor WTG13       | Not in Prevailing Wind Direction   |
| 1058        | Non-Participating Receptor   | 37.8                       | 4.5                 | 708                             | Suncor WTG8        | Not in Prevailing Wind Direction   |
| 117         | Non-Participating Receptor   | 37.7                       | 4.5                 | 911                             | Suncor WTG70       | Not in Prevailing Wind Direction   |

## Appendix F - Receptor Selection Summary

Project: Cedar Point Wind Power Project

| Receptor ID | Description                  | Modelled Sound Level (dBA) | Receptor Height (m) | Distance to Closest Turbine (m) | Closest Turbine ID | Rationale   |
|-------------|------------------------------|----------------------------|---------------------|---------------------------------|--------------------|---|
| 857         | Non-Participating Receptor   | 37.7                       | 4.5                 | 582                             | Suncor WTG71       | Not in Prevailing Wind Direction                                    |
| 1174        | Non-Participating Vacant Lot | 37.6                       | 4.5                 | 934                             | Suncor WTG31       | Not in Prevailing Wind Direction                                    |
| 1025        | Non-Participating Receptor   | 37.6                       | 4.5                 | 725                             | Suncor WTG15       | Receptor location 400m away from selected monitoring location M1587 |
| 983         | Non-Participating Receptor   | 37.6                       | 4.5                 | 926                             | Suncor WTG17       | Not in Prevailing Wind Direction                                    |
| 188         | Non-Participating Receptor   | 37.5                       | 4.5                 | 765                             | Suncor WTG18       | Not in Prevailing Wind Direction                                    |
| 984         | Non-Participating Receptor   | 37.5                       | 4.5                 | 772                             | Suncor WTG18       | Not in Prevailing Wind Direction                                    |
| 938         | Non-Participating Receptor   | 37.5                       | 4.5                 | 856                             | Suncor WTG25       | Not in Prevailing Wind Direction                                    |
| 1563        | Non-Participating Vacant Lot | 37.5                       | 4.5                 | 895                             | Suncor WTG17       | Permission not Granted  |
| 855         | Non-Participating Receptor   | 37.5                       | 4.5                 | 797                             | Suncor WTG72       | Receptor location 175m away from selected monitoring location M130  |
| 881         | Non-Participating Receptor   | 37.5                       | 4.5                 | 747                             | Suncor WTG31       | Not in Prevailing Wind Direction                                    |
| 1449        | Non-Participating Vacant Lot | 37.4                       | 4.5                 | 666                             | Suncor WTG27       | Not in Prevailing Wind Direction                                    |
| 1364        | Non-Participating Vacant Lot | 37.3                       | 4.5                 | 792                             | Suncor WTG34       | Not in Prevailing Wind Direction                                    |
| 1400        | Non-Participating Vacant Lot | 37.3                       | 4.5                 | 612                             | Suncor WTG72       | Not in Prevailing Wind Direction                                    |
| 2353        | Non-Participating Vacant Lot | 37.3                       | 4.5                 | 861                             | Suncor WTG69       | Not in Prevailing Wind Direction                                    |
| 783         | Non-Participating Receptor   | 37.2                       | 4.5                 | 889                             | Suncor WTG48       | Poor monitoring location: low point surrounded by trees             |
| 1395        | Non-Participating Vacant Lot | 37.2                       | 4.5                 | 646                             | Suncor WTG72       | Selected Monitoring Location  |

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## **Appendix G**

### **Calibration Certificates**

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# ~ Certificate of Calibration and Compliance ~

Model: 378B02 Serial Number: 123030  
Microphone Model: 377B02 Serial Number: 148047 Manufacturer: PCB  
Preamplifier Model: 426E01 Serial Number: 041166 Manufacturer: PCB

## Calibration Environmental Conditions

Environmental test conditions as printed on microphone calibration chart.

## Reference Equipment

| Manufacturer         | Model #  | Serial # | PCB Control # | Cal Date     | Due Date     |
|----------------------|----------|----------|---------------|--------------|--------------|
| Larson Davis         | PRM915   | 122      | CA865         | 10/26/15     | 10/26/16     |
| Larson Davis         | PRM916   | 104      | LD015         | 3/10/15      | 3/10/16      |
| Larson Davis         | CAL250   | 5025     | CA1277        | 5/14/15      | 5/13/16      |
| Larson Davis         | 2201     | 102      | LD022         | 3/2/15       | 3/2/16       |
| Larson Davis         | PRA951-4 | 241      | CA1449        | 9/29/15      | 9/29/16      |
| Larson Davis         | PRM902   | 5352     | CA1247        | 3/10/15      | 3/10/16      |
| Larson Davis         | GPRM902  | 4923     | CA2237        | 8/6/15       | 8/5/16       |
| Bruel & Kjaer        | 4192     | 2764626  | CA1636        | 6/15/15      | 6/15/16      |
| Larson Davis         | ADP005   | 0        | 0             | not required | not required |
| Newport              | BTH-W/N  | 8410668  | CA1187        | not required | not required |
| National Instruments | PCI-6251 | 1162ED1  | CA1740        | 7/29/15      | 7/29/16      |
| 0                    | 0        | 0        | 0             | not required | not required |
| 0                    | 0        | 0        | 0             | not required | not required |
| 0                    | 0        | 0        | 0             | not required | not required |
| 0                    | 0        | 0        | 0             | not required | not required |

Frequency sweep performed with B&K UA0033 electrostatic actuator.

## Condition of Unit

As Found: n/a

As Left: New Unit, In Tolerance

## Notes

1. Calibration of reference equipment is traceable to one or more of the following National Labs; NIST, PTB or DFM.
2. This certificate shall not be reproduced, except in full, without written approval from PCB Piezotronics, Inc.
3. Calibration is performed in compliance with ISO 9001, ISO 10012-1, ANSI/NCSL Z540.3 and ISO 17025.
4. See Manufacturer's Specification Sheet for a detailed listing of performance specifications.
5. System Sensitivity is measured following procedure AT603-5.
6. Measurement uncertainty (95% confidence level with coverage factor of 2) for sensitivity is +/-0.20 dB.
7. Unit calibrated per ACS-63.

Technician: Nicholas Herdlein NH

Date: January 7, 2016



3425 Walden Avenue, Depew, New York, 14043

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ID CAL61-3535018123 439

# ~ Calibration Report ~

Model: 378B02  
 Microphone Model: 377B02  
 Preamp Model: 426E01

Serial Number: 123030  
 Serial Number: 148047  
 Serial Number: 041166

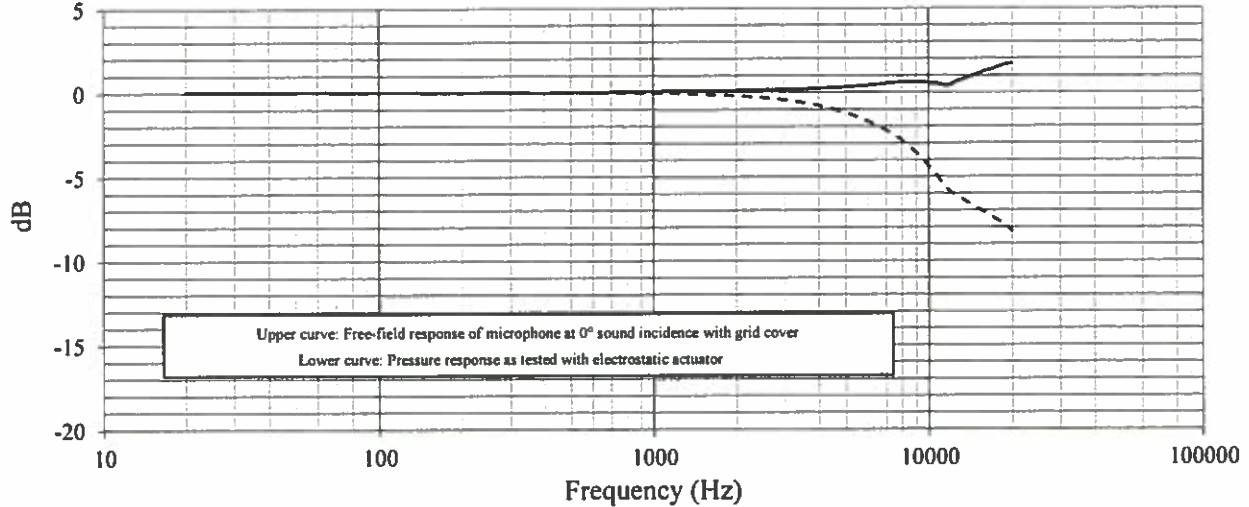
Description: 1/2" Free-Field Microphone  
 and Preamp

## Calibration Data

System Sensitivity @ 251.2 Hz: 49.32 mV/Pa      Polarization Voltage, External: 0 V  
 -26.14 dB re 1V/Pa

Temperature: 72 °F (22°C)      Ambient Pressure: 999 mbar      Relative Humidity: 24 %

Frequency Response (0 dB @ 251.2 Hz)



| Freq (Hz) | Lower (dB) | Upper (dB) | Freq (Hz) | Lower (dB) | Upper (dB) | Freq (Hz) | Lower (dB) | Upper (dB) | Freq (Hz) | Lower (dB) | Upper (dB) |
|-----------|------------|------------|-----------|------------|------------|-----------|------------|------------|-----------|------------|------------|
| 20.0      | 0.05       | 0.05       | 1679      | -0.15      | 0.08       | 7499      | -2.51      | 0.56       | -         | -          | -          |
| 25.1      | 0.04       | 0.04       | 1778      | -0.16      | 0.09       | 7943      | -2.79      | 0.60       | -         | -          | -          |
| 31.6      | 0.04       | 0.04       | 1884      | -0.18      | 0.10       | 8414      | -3.14      | 0.59       | -         | -          | -          |
| 39.8      | 0.05       | 0.05       | 1995      | -0.20      | 0.11       | 8913      | -3.51      | 0.60       | -         | -          | -          |
| 50.1      | 0.04       | 0.04       | 2114      | -0.23      | 0.11       | 9441      | -3.92      | 0.60       | -         | -          | -          |
| 63.1      | 0.04       | 0.04       | 2239      | -0.25      | 0.12       | 10000     | -4.39      | 0.56       | -         | -          | -          |
| 79.4      | 0.03       | 0.03       | 2371      | -0.28      | 0.13       | 10593     | -4.86      | 0.54       | -         | -          | -          |
| 100.0     | 0.03       | 0.03       | 2512      | -0.31      | 0.15       | 11220     | -5.41      | 0.45       | -         | -          | -          |
| 125.9     | 0.02       | 0.02       | 2661      | -0.35      | 0.16       | 11885     | -5.88      | 0.44       | -         | -          | -          |
| 158.5     | 0.01       | 0.01       | 2818      | -0.40      | 0.16       | 12589     | -6.12      | 0.65       | -         | -          | -          |
| 199.5     | 0.01       | 0.01       | 2985      | -0.44      | 0.18       | 13335     | -6.39      | 0.80       | -         | -          | -          |
| 251.2     | 0.00       | 0.00       | 3162      | -0.49      | 0.19       | 14125     | -6.63      | 0.96       | -         | -          | -          |
| 316.2     | -0.01      | 0.00       | 3350      | -0.56      | 0.18       | 14962     | -6.89      | 1.08       | -         | -          | -          |
| 398.1     | -0.01      | -0.01      | 3548      | -0.62      | 0.20       | 15849     | -7.10      | 1.25       | -         | -          | -          |
| 501.2     | -0.02      | 0.02       | 3758      | -0.69      | 0.21       | 16788     | -7.37      | 1.35       | -         | -          | -          |
| 631.0     | -0.03      | 0.02       | 3981      | -0.77      | 0.23       | 17783     | -7.61      | 1.50       | -         | -          | -          |
| 794.3     | -0.03      | 0.06       | 4217      | -0.86      | 0.25       | 18837     | -7.87      | 1.64       | -         | -          | -          |
| 1000.0    | -0.05      | 0.07       | 4467      | -0.96      | 0.28       | 19953     | -8.23      | 1.70       | -         | -          | -          |
| 1059.3    | -0.06      | 0.07       | 4732      | -1.09      | 0.28       | -         | -          | -          | -         | -          | -          |
| 1122.0    | -0.07      | 0.07       | 5012      | -1.21      | 0.32       | -         | -          | -          | -         | -          | -          |
| 1188.5    | -0.07      | 0.08       | 5309      | -1.35      | 0.35       | -         | -          | -          | -         | -          | -          |
| 1258.9    | -0.08      | 0.08       | 5623      | -1.51      | 0.38       | -         | -          | -          | -         | -          | -          |
| 1333.5    | -0.09      | 0.09       | 5957      | -1.67      | 0.40       | -         | -          | -          | -         | -          | -          |
| 1412.5    | -0.10      | 0.09       | 6310      | -1.85      | 0.44       | -         | -          | -          | -         | -          | -          |
| 1496.2    | -0.12      | 0.08       | 6683      | -2.05      | 0.47       | -         | -          | -          | -         | -          | -          |
| 1584.9    | -0.13      | 0.08       | 7080      | -2.26      | 0.52       | -         | -          | -          | -         | -          | -          |

Technician: Nicholas Herdlein *NH*      Date: January 7, 2016



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## TEST REPORT


**Instrument** WXT520 AAB1BE30B0  
**Serial number** M0410646  
**Manufacturer** Vaisala Oyj, Finland  
**Test date** 28th January 2016

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

### Test results

| Test                         | Result    | Limit          | Passed |
|------------------------------|-----------|----------------|--------|
| Rain response                | 426.0 mV  | (345...575) mV | OK     |
| Zero wind speed              | 0.00 m/s  | (0...0.4) m/s  | OK     |
| Pressure                     | 978.5 hPa | PASS/FAIL      | OK     |
| Temperature                  | 22.3 °C   | PASS/FAIL      | OK     |
| Humidity                     | 29.3 %RH  | PASS/FAIL      | OK     |
| Heating                      | PASS      | PASS/FAIL      | OK     |
| Current (service port)       | 0.57      | (0.2...0.7) mA | OK     |
| Communication (service port) | PASS      | PASS/FAIL      | OK     |
| Current (main port)          | 0.32      | (0.1...0.4) mA | OK     |
| Communication (main port)    | PASS      | PASS/FAIL      | OK     |

Signature

  
 \_\_\_\_\_  
 Technician

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## CALIBRATION SHEET

**Instrument** WXTPTU  
**Serial number** L5040044  
**Manufacturer** Vaisala Oyj, Finland  
**Test date** 28th January 2016

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

### Calibration results

| Test phase of calibration process | Reference value | Observed value | Error*  | Uncertainty** |
|-----------------------------------|-----------------|----------------|---------|---------------|
| Pressure                          | 1078.7 hPa      | 1078.7 hPa     | 0.0 hPa | ± 0.4 hPa     |
| Pressure                          | 896.5 hPa       | 896.6 hPa      | 0.1 hPa | ± 0.4 hPa     |
| Pressure                          | 798.1 hPa       | 798.1 hPa      | 0.0 hPa | ± 0.4 hPa     |
| Pressure                          | 596.5 hPa       | 596.5 hPa      | 0.0 hPa | ± 0.4 hPa     |
| Temperature                       | 59.7 °C         | 59.7 °C        | 0.0 °C  | ± 0.2 °C      |
| Temperature                       | 24.8 °C         | 24.9 °C        | 0.1 °C  | ± 0.2 °C      |
| Temperature                       | -5.7 °C         | -5.7 °C        | 0.0 °C  | ± 0.2 °C      |
| Temperature                       | -32.8 °C        | -32.7 °C       | 0.1 °C  | ± 0.2 °C      |
| Temperature                       | -52.0 °C        | -52.0 °C       | 0.0 °C  | ± 0.2 °C      |
| Relative humidity                 | 29.9 %RH        | 29.9 %RH       | 0.0 %RH | ± 2 %RH       |
| Relative humidity                 | 58.4 %RH        | 58.4 %RH       | 0.0 %RH | ± 2 %RH       |
| Relative humidity                 | 91.5 %RH        | 91.5 %RH       | 0.0 %RH | ± 3 %RH       |

\*The test points for error values are polynomial fitting curve fitting points.

\*\*The calibration uncertainty given at 95 % confidence level, k = 2

### Traceability

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

Signature



Technician

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Doc218938-A

# ~ Certificate of Calibration and Compliance ~

Model: 378B02      Serial Number: 123031  
Microphone Model: 377B02      Serial Number: 158828      Manufacturer: PCB  
Preamplifier Model: 426E01      Serial Number: 041165      Manufacturer: PCB

## Calibration Environmental Conditions

Environmental test conditions as printed on microphone calibration chart.

## Reference Equipment

| Manufacturer         | Model #  | Serial # | PCB Control # | Cal Date     | Due Date     |
|----------------------|----------|----------|---------------|--------------|--------------|
| Larson Davis         | PRM915   | 122      | CA865         | 10/26/15     | 10/26/16     |
| Larson Davis         | PRM916   | 104      | LD015         | 3/10/15      | 3/10/16      |
| Larson Davis         | CAL250   | 5025     | CA1277        | 5/14/15      | 5/13/16      |
| Larson Davis         | 2201     | 102      | LD022         | 3/2/15       | 3/2/16       |
| Larson Davis         | PRA951-4 | 241      | CA1449        | 9/29/15      | 9/29/16      |
| Larson Davis         | PRM902   | 5352     | CA1247        | 3/10/15      | 3/10/16      |
| Larson Davis         | GPRM902  | 4923     | CA2237        | 8/6/15       | 8/5/16       |
| Bruel & Kjaer        | 4192     | 2764626  | CA1636        | 6/15/15      | 6/15/16      |
| Larson Davis         | ADP005   | 0        | 0             | not required | not required |
| Newport              | BTH-W/N  | 8410668  | CA1187        | not required | not required |
| National Instruments | PCI-6251 | 1162ED1  | CA1740        | 7/29/15      | 7/29/16      |
| 0                    | 0        | 0        | 0             | not required | not required |
| 0                    | 0        | 0        | 0             | not required | not required |
| 0                    | 0        | 0        | 0             | not required | not required |
| 0                    | 0        | 0        | 0             | not required | not required |

Frequency sweep performed with B&K UA0033 electrostatic actuator.

## Condition of Unit

As Found: n/a

As Left: New Unit, In Tolerance

## Notes

1. Calibration of reference equipment is traceable to one or more of the following National Labs; NIST, PTB or DFM.
2. This certificate shall not be reproduced, except in full, without written approval from PCB Piezotronics, Inc.
3. Calibration is performed in compliance with ISO 9001, ISO 10012-1, ANSI/NC SL Z540.3 and ISO 17025.
4. See Manufacturer's Specification Sheet for a detailed listing of performance specifications.
5. System Sensitivity is measured following procedure AT603-5.
6. Measurement uncertainty (95% confidence level with coverage factor of 2) for sensitivity is +/-0.20 dB.
7. Unit calibrated per ACS-63.

Technician: Nicholas Herdlein *NH*

Date: January 7, 2016



3425 Walden Avenue, Depew, New York, 14043

TEL: 888-684-0013      FAX: 716-685-3886      www.pcb.com

ID: CAL01-3535010778.100

# ~ Calibration Report ~

Model: 378B02  
 Microphone Model: 377B02  
 Preamplifier Model: 426E01

Serial Number: **123031**  
 Serial Number: 158828  
 Serial Number: 041165

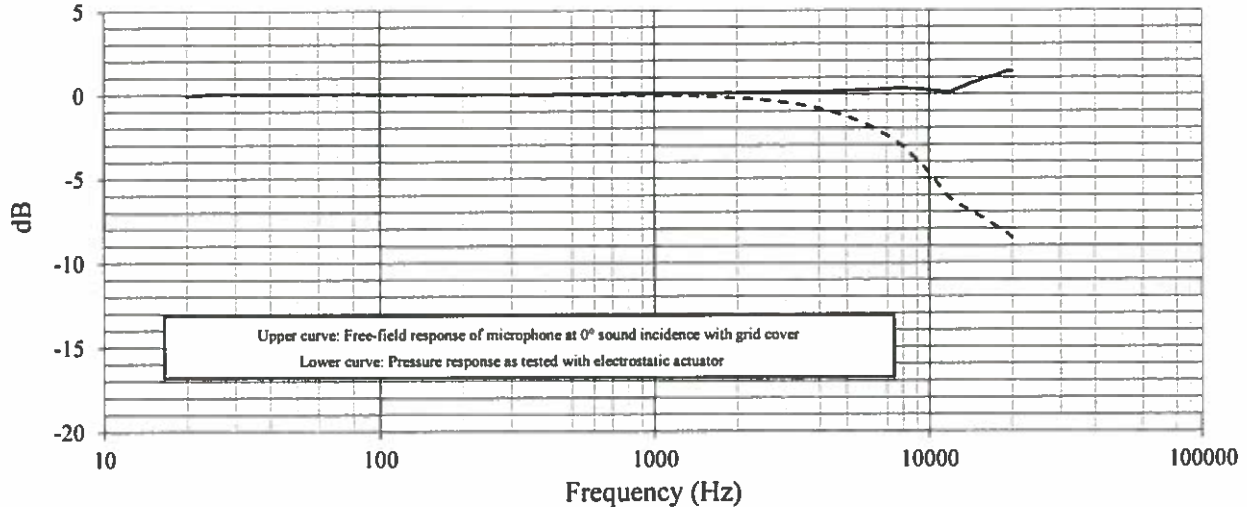
Description: 1/2" Free-Field Microphone  
 and Preamplifier

## Calibration Data

System Sensitivity @ 251.2 Hz: 49.16 mV/Pa      Polarization Voltage, External: 0 V  
 -26.17 dB re 1V/Pa

Temperature: 72 °F (22°C)      Ambient Pressure: 999 mbar      Relative Humidity: 24 %

Frequency Response (0 dB @ 251.2 Hz)



Upper curve: Free-field response of microphone at 0° sound incidence with grid cover  
 Lower curve: Pressure response as tested with electrostatic actuator

| Freq (Hz) | Lower (dB) | Upper (dB) | Freq (Hz) | Lower (dB) | Upper (dB) | Freq (Hz) | Lower (dB) | Upper (dB) | Freq (Hz) | Lower (dB) | Upper (dB) |
|-----------|------------|------------|-----------|------------|------------|-----------|------------|------------|-----------|------------|------------|
| 20.0      | -0.05      | -0.05      | 1679      | -0.16      | 0.07       | 7499      | -2.73      | 0.34       | -         | -          | -          |
| 25.1      | 0.05       | 0.05       | 1778      | -0.18      | 0.07       | 7943      | -3.04      | 0.35       | -         | -          | -          |
| 31.6      | 0.05       | 0.05       | 1884      | -0.20      | 0.08       | 8414      | -3.41      | 0.32       | -         | -          | -          |
| 39.8      | 0.05       | 0.05       | 1995      | -0.22      | 0.09       | 8913      | -3.80      | 0.31       | -         | -          | -          |
| 50.1      | 0.05       | 0.05       | 2114      | -0.25      | 0.09       | 9441      | -4.23      | 0.29       | -         | -          | -          |
| 63.1      | 0.04       | 0.04       | 2239      | -0.28      | 0.09       | 10000     | -4.74      | 0.21       | -         | -          | -          |
| 79.4      | 0.04       | 0.04       | 2371      | -0.30      | 0.11       | 10593     | -5.21      | 0.19       | -         | -          | -          |
| 100.0     | 0.03       | 0.03       | 2512      | -0.35      | 0.12       | 11220     | -5.74      | 0.12       | -         | -          | -          |
| 125.9     | 0.02       | 0.02       | 2661      | -0.39      | 0.12       | 11885     | -6.21      | 0.12       | -         | -          | -          |
| 158.5     | 0.01       | 0.01       | 2818      | -0.44      | 0.12       | 12589     | -6.48      | 0.29       | -         | -          | -          |
| 199.5     | 0.00       | 0.00       | 2985      | -0.49      | 0.13       | 13335     | -6.74      | 0.45       | -         | -          | -          |
| 251.2     | 0.00       | 0.00       | 3162      | -0.55      | 0.13       | 14125     | -6.96      | 0.63       | -         | -          | -          |
| 316.2     | -0.01      | 0.00       | 3350      | -0.61      | 0.13       | 14962     | -7.20      | 0.77       | -         | -          | -          |
| 398.1     | -0.01      | -0.01      | 3548      | -0.68      | 0.14       | 15849     | -7.42      | 0.93       | -         | -          | -          |
| 501.2     | -0.02      | 0.02       | 3758      | -0.76      | 0.15       | 16788     | -7.70      | 1.02       | -         | -          | -          |
| 631.0     | -0.03      | 0.01       | 3981      | -0.85      | 0.15       | 17783     | -7.96      | 1.15       | -         | -          | -          |
| 794.3     | -0.03      | 0.06       | 4217      | -0.96      | 0.15       | 18837     | -8.19      | 1.32       | -         | -          | -          |
| 1000.0    | -0.06      | 0.06       | 4467      | -1.07      | 0.16       | 19953     | -8.57      | 1.37       | -         | -          | -          |
| 1059.3    | -0.07      | 0.07       | 4732      | -1.19      | 0.18       | -         | -          | -          | -         | -          | -          |
| 1122.0    | -0.07      | 0.07       | 5012      | -1.33      | 0.20       | -         | -          | -          | -         | -          | -          |
| 1188.5    | -0.08      | 0.07       | 5309      | -1.48      | 0.22       | -         | -          | -          | -         | -          | -          |
| 1258.9    | -0.09      | 0.07       | 5623      | -1.65      | 0.23       | -         | -          | -          | -         | -          | -          |
| 1333.5    | -0.10      | 0.08       | 5957      | -1.83      | 0.25       | -         | -          | -          | -         | -          | -          |
| 1412.5    | -0.11      | 0.08       | 6310      | -2.03      | 0.26       | -         | -          | -          | -         | -          | -          |
| 1496.2    | -0.13      | 0.07       | 6683      | -2.24      | 0.28       | -         | -          | -          | -         | -          | -          |
| 1584.9    | -0.14      | 0.07       | 7080      | -2.48      | 0.30       | -         | -          | -          | -         | -          | -          |

Technician: Nicholas Herdlein NH      Date: January 7, 2016



3425 Walden Avenue, Depew, New York, 14043  
 TEL: 888-684-0013      FAX: 716-685-3886      www.pcb.com

# TEST REPORT

**Instrument** WXT520 AAB1BE30B0  
**Serial number** M0410647  
**Manufacturer** Vaisala Oyj, Finland  
**Test date** 28th January 2016

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

## Test results

| Test                         | Result    | Limit          | Passed |
|------------------------------|-----------|----------------|--------|
| Rain response                | 435.0 mV  | (345...575) mV | OK     |
| Zero wind speed              | 0.00 m/s  | (0...0.4) m/s  | OK     |
| Pressure                     | 978.2 hPa | PASS/FAIL      | OK     |
| Temperature                  | 22.3 °C   | PASS/FAIL      | OK     |
| Humidity                     | 28.3 %RH  | PASS/FAIL      | OK     |
| Heating                      | PASS      | PASS/FAIL      | OK     |
| Current (service port)       | 0.56      | (0.2...0.7) mA | OK     |
| Communication (service port) | PASS      | PASS/FAIL      | OK     |
| Current (main port)          | 0.31      | (0.1...0.4) mA | OK     |
| Communication (main port)    | PASS      | PASS/FAIL      | OK     |

Signature

**COPY**

\_\_\_\_\_  
Technician

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# ~ Certificate of Calibration and Compliance ~

Model: 378B02 Serial Number: 123028  
Microphone Model: 377B02 Serial Number: 158980 Manufacturer: PCB  
Preamplifier Model: 426E01 Serial Number: 041181 Manufacturer: PCB

## Calibration Environmental Conditions

Environmental test conditions as printed on microphone calibration chart.

## Reference Equipment

| Manufacturer         | Model #  | Serial # | PCB Control # | Cal Date     | Due Date     |
|----------------------|----------|----------|---------------|--------------|--------------|
| Larson Davis         | PRM915   | 122      | CA865         | 10/26/15     | 10/26/16     |
| Larson Davis         | PRM916   | 104      | LD015         | 3/10/15      | 3/10/16      |
| Larson Davis         | CAL250   | 5025     | CA1277        | 5/14/15      | 5/13/16      |
| Larson Davis         | 2201     | 102      | LD022         | 3/2/15       | 3/2/16       |
| Larson Davis         | PRA951-4 | 241      | CA1449        | 9/29/15      | 9/29/16      |
| Larson Davis         | PRM902   | 5352     | CA1247        | 3/10/15      | 3/10/16      |
| Larson Davis         | GPRM902  | 4923     | CA2237        | 8/6/15       | 8/5/16       |
| Bruel & Kjaer        | 4192     | 2764626  | CA1636        | 6/15/15      | 6/15/16      |
| Larson Davis         | ADP005   | 0        | 0             | not required | not required |
| Newport              | BTH-W/N  | 8410668  | CA1187        | not required | not required |
| National Instruments | PCI-6251 | 1162ED1  | CA1740        | 7/29/15      | 7/29/16      |
| 0                    | 0        | 0        | 0             | not required | not required |
| 0                    | 0        | 0        | 0             | not required | not required |
| 0                    | 0        | 0        | 0             | not required | not required |
| 0                    | 0        | 0        | 0             | not required | not required |

Frequency sweep performed with B&K UA0033 electrostatic actuator.

## Condition of Unit

As Found: n/a

As Left: New Unit, In Tolerance

## Notes

1. Calibration of reference equipment is traceable to one or more of the following National Labs; NIST, PTB or DFM.
2. This certificate shall not be reproduced, except in full, without written approval from PCB Piezotronics, Inc.
3. Calibration is performed in compliance with ISO 9001, ISO 10012-1, ANSI/NCSL Z540.3 and ISO 17025.
4. See Manufacturer's Specification Sheet for a detailed listing of performance specifications.
5. System Sensitivity is measured following procedure AT603-5.
6. Measurement uncertainty (95% confidence level with coverage factor of 2) for sensitivity is +/-0.20 dB.
7. Unit calibrated per ACS-63.

Technician: Nicholas Herdlein NH

Date: January 7, 2016



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TEL: 888-684-0013 FAX: 716-685-3886 www.pcb.com

ID CAL61-3525019245.704

# ~ Calibration Report ~

Model: 378B02  
 Microphone Model: 377B02  
 Preamplifier Model: 426E01

Serial Number: **123028**  
 Serial Number: 158980  
 Serial Number: 041181

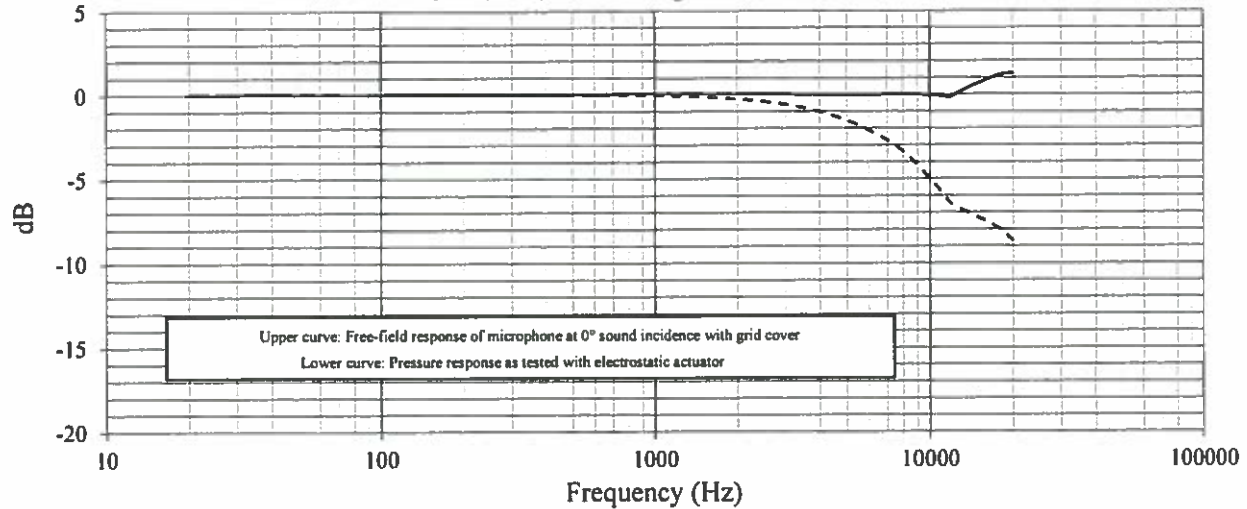
Description: 1/2" Free-Field Microphone  
 and Preamplifier

## Calibration Data

System Sensitivity @ 251.2 Hz: 47.67 mV/Pa      Polarization Voltage, External: 0 V  
 -26.43 dB re 1V/Pa

Temperature: 72 °F (22°C)      Ambient Pressure: 999 mbar      Relative Humidity: 24 %

Frequency Response (0 dB @ 251.2 Hz)



| Freq (Hz) | Lower (dB) | Upper (dB) | Freq (Hz) | Lower (dB) | Upper (dB) | Freq (Hz) | Lower (dB) | Upper (dB) | Freq (Hz) | Lower (dB) | Upper (dB) |
|-----------|------------|------------|-----------|------------|------------|-----------|------------|------------|-----------|------------|------------|
| 20.0      | 0.02       | 0.02       | 1679      | -0.19      | 0.04       | 7499      | -3.04      | 0.04       | -         | -          | -          |
| 25.1      | 0.02       | 0.02       | 1778      | -0.21      | 0.04       | 7943      | -3.35      | 0.04       | -         | -          | -          |
| 31.6      | 0.05       | 0.05       | 1884      | -0.24      | 0.04       | 8414      | -3.71      | 0.02       | -         | -          | -          |
| 39.8      | 0.07       | 0.07       | 1995      | -0.27      | 0.04       | 8913      | -4.10      | 0.02       | -         | -          | -          |
| 50.1      | 0.05       | 0.05       | 2114      | -0.30      | 0.04       | 9441      | -4.54      | -0.02      | -         | -          | -          |
| 63.1      | 0.04       | 0.04       | 2239      | -0.33      | 0.04       | 10000     | -5.03      | -0.08      | -         | -          | -          |
| 79.4      | 0.03       | 0.03       | 2371      | -0.37      | 0.04       | 10593     | -5.47      | -0.07      | -         | -          | -          |
| 100.0     | 0.03       | 0.03       | 2512      | -0.41      | 0.05       | 11220     | -5.99      | -0.13      | -         | -          | -          |
| 125.9     | 0.02       | 0.02       | 2661      | -0.47      | 0.04       | 11885     | -6.47      | -0.15      | -         | -          | -          |
| 158.5     | 0.02       | 0.02       | 2818      | -0.52      | 0.04       | 12589     | -6.70      | 0.07       | -         | -          | -          |
| 199.5     | 0.01       | 0.01       | 2985      | -0.58      | 0.04       | 13335     | -6.92      | 0.27       | -         | -          | -          |
| 251.2     | 0.00       | 0.00       | 3162      | -0.66      | 0.02       | 14125     | -7.09      | 0.50       | -         | -          | -          |
| 316.2     | 0.00       | 0.01       | 3350      | -0.73      | 0.01       | 14962     | -7.32      | 0.65       | -         | -          | -          |
| 398.1     | -0.01      | -0.01      | 3548      | -0.81      | 0.01       | 15849     | -7.50      | 0.85       | -         | -          | -          |
| 501.2     | -0.02      | 0.02       | 3758      | -0.90      | 0.00       | 16788     | -7.73      | 1.00       | -         | -          | -          |
| 631.0     | -0.03      | 0.01       | 3981      | -1.00      | 0.00       | 17783     | -7.97      | 1.14       | -         | -          | -          |
| 794.3     | -0.04      | 0.06       | 4217      | -1.13      | -0.02      | 18837     | -8.29      | 1.22       | -         | -          | -          |
| 1000.0    | -0.06      | 0.06       | 4467      | -1.26      | -0.03      | 19953     | -8.69      | 1.24       | -         | -          | -          |
| 1059.3    | -0.07      | 0.06       | 4732      | -1.40      | -0.03      | -         | -          | -          | -         | -          | -          |
| 1122.0    | -0.08      | 0.06       | 5012      | -1.55      | -0.02      | -         | -          | -          | -         | -          | -          |
| 1188.5    | -0.09      | 0.06       | 5309      | -1.71      | -0.01      | -         | -          | -          | -         | -          | -          |
| 1258.9    | -0.10      | 0.06       | 5623      | -1.90      | -0.02      | -         | -          | -          | -         | -          | -          |
| 1333.5    | -0.12      | 0.06       | 5957      | -2.09      | -0.02      | -         | -          | -          | -         | -          | -          |
| 1412.5    | -0.13      | 0.06       | 6310      | -2.30      | -0.01      | -         | -          | -          | -         | -          | -          |
| 1496.2    | -0.15      | 0.05       | 6683      | -2.52      | 0.00       | -         | -          | -          | -         | -          | -          |
| 1584.9    | -0.17      | 0.04       | 7080      | -2.77      | 0.01       | -         | -          | -          | -         | -          | -          |

Technician: Nicholas Herdlein *NH*      Date: January 7, 2016



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ID: CAL61-3525010243.704

## TEST REPORT

**Instrument** WXT520 AAB1BE30B0  
**Serial number** M0410645  
**Manufacturer** Vaisala Oyj, Finland  
**Test date** 28th January 2016

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

### Test results

| Test                         | Result    | Limit          | Passed |
|------------------------------|-----------|----------------|--------|
| Rain response                | 441.0 mV  | (345...575) mV | OK     |
| Zero wind speed              | 0.00 m/s  | (0...0.4) m/s  | OK     |
| Pressure                     | 978.6 hPa | PASS/FAIL      | OK     |
| Temperature                  | 22.4 °C   | PASS/FAIL      | OK     |
| Humidity                     | 29.3 %RH  | PASS/FAIL      | OK     |
| Heating                      | PASS      | PASS/FAIL      | OK     |
| Current (service port)       | 0.57      | (0.2...0.7) mA | OK     |
| Communication (service port) | PASS      | PASS/FAIL      | OK     |
| Current (main port)          | 0.32      | (0.1...0.4) mA | OK     |
| Communication (main port)    | PASS      | PASS/FAIL      | OK     |

Signature



Technician

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## CALIBRATION SHEET

**Instrument** WXTPTU  
**Serial number** L5040043  
**Manufacturer** Vaisala Oyj, Finland  
**Test date** 28th January 2016

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

### Calibration results

| Test phase of calibration process | Reference value | Observed value | Error*  | Uncertainty** |
|-----------------------------------|-----------------|----------------|---------|---------------|
| Pressure                          | 1078.7 hPa      | 1078.7 hPa     | 0.0 hPa | ± 0.4 hPa     |
| Pressure                          | 896.5 hPa       | 896.6 hPa      | 0.1 hPa | ± 0.4 hPa     |
| Pressure                          | 798.1 hPa       | 798.1 hPa      | 0.0 hPa | ± 0.4 hPa     |
| Pressure                          | 596.5 hPa       | 596.5 hPa      | 0.0 hPa | ± 0.4 hPa     |
| Temperature                       | 59.7 °C         | 59.7 °C        | 0.0 °C  | ± 0.2 °C      |
| Temperature                       | 24.8 °C         | 24.9 °C        | 0.1 °C  | ± 0.2 °C      |
| Temperature                       | -5.7 °C         | -5.7 °C        | 0.0 °C  | ± 0.2 °C      |
| Temperature                       | -32.8 °C        | -32.8 °C       | 0.0 °C  | ± 0.2 °C      |
| Temperature                       | -52.0 °C        | -52.0 °C       | 0.0 °C  | ± 0.2 °C      |
| Relative humidity                 | 30.0 %RH        | 30.0 %RH       | 0.0 %RH | ± 2 %RH       |
| Relative humidity                 | 58.4 %RH        | 58.4 %RH       | 0.0 %RH | ± 2 %RH       |
| Relative humidity                 | 91.5 %RH        | 91.5 %RH       | 0.0 %RH | ± 3 %RH       |


\*The test points for error values are polynomial fitting curve fitting points.

\*\*The calibration uncertainty given at 95 % confidence level, k = 2

### Traceability

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

Signature



Technician

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Doc218938-A



# ~ Certificate of Calibration and Compliance ~

Model: 378B02  
Microphone Model: 377B02  
Preamplifier Model: 426E01

Serial Number: 121695  
Serial Number: 156314  
Serial Number: 039843

Manufacturer: PCB  
Manufacturer: PCB

## Calibration Environmental Conditions

Environmental test conditions as printed on microphone calibration chart.

## Reference Equipment

| Manufacturer         | Model #   | Serial # | PCB Control # | Cal Date     | Due Date     |
|----------------------|-----------|----------|---------------|--------------|--------------|
| National Instruments | PC1c-6351 | 1896F08  | CA1918        | 11/3/14      | 11/3/15      |
| Larson Davis         | PRM915    | 122      | CA865         | 10/21/14     | 10/21/15     |
| Larson Davis         | PRM902    | 4943     | CA1162        | 10/27/14     | 10/27/15     |
| Larson Davis         | PRM916    | 125      | TA469         | 6/9/15       | 6/9/16       |
| Larson Davis         | CAL250    | 5374     | CA2068        | 5/27/15      | 5/27/16      |
| Larson Davis         | 2201      | 144      | CA1409        | 3/12/15      | 3/11/16      |
| Bruel & Kjaer        | 4192      | 2764626  | CA1636        | 6/15/15      | 6/15/16      |
| Larson Davis         | GPRM902   | 5337     | CA2063        | 1/5/15       | 1/5/16       |
| Newport              | iTHX-SD/N | 1080002  | CA1511        | not required | not required |
| Larson Davis         | PRA951-4  | 242      | CA1456        | 11/10/14     | 11/10/15     |
| Larson Davis         | ADP005    | 0        | 0             | not required | not required |
| 0                    | 0         | 0        | 0             | not required | not required |
| 0                    | 0         | 0        | 0             | not required | not required |
| 0                    | 0         | 0        | 0             | not required | not required |
| 0                    | 0         | 0        | 0             | not required | not required |

Frequency sweep performed with B&K UA0033 electrostatic actuator.

## Condition of Unit

As Found: n/a

As Left: New Unit, In Tolerance

## Notes

1. Calibration of reference equipment is traceable to one or more of the following National Labs; NIST, PTB or DFM.
2. This certificate shall not be reproduced, except in full, without written approval from PCB Piezotronics, Inc.
3. Calibration is performed in compliance with ISO 9001, ISO 10012-1, ANSI/NC SL Z540.3 and ISO 17025.
4. See Manufacturer's Specification Sheet for a detailed listing of performance specifications.
5. System Sensitivity is measured following procedure AT603-5.
6. Measurement uncertainty (95% confidence level with coverage factor of 2) for sensitivity is +/-0.20 dB.
7. Unit calibrated per ACS-63.

Technician: Leonard Lukasik

Date: September 16, 2015



3425 Walden Avenue, Depew, New York, 14043

TEL: 888-684-0013 FAX: 716-685-3886 www.pcb.com

ID CAL 112-352529790 503

# ~ Calibration Report ~

Model: 378B02  
 Microphone Model: 377B02  
 Preamplifier Model: 426E01

Serial Number: 121695  
 Serial Number: 156314  
 Serial Number: 039843

Description: 1/2" Free-Field Microphone  
 and Preamplifier

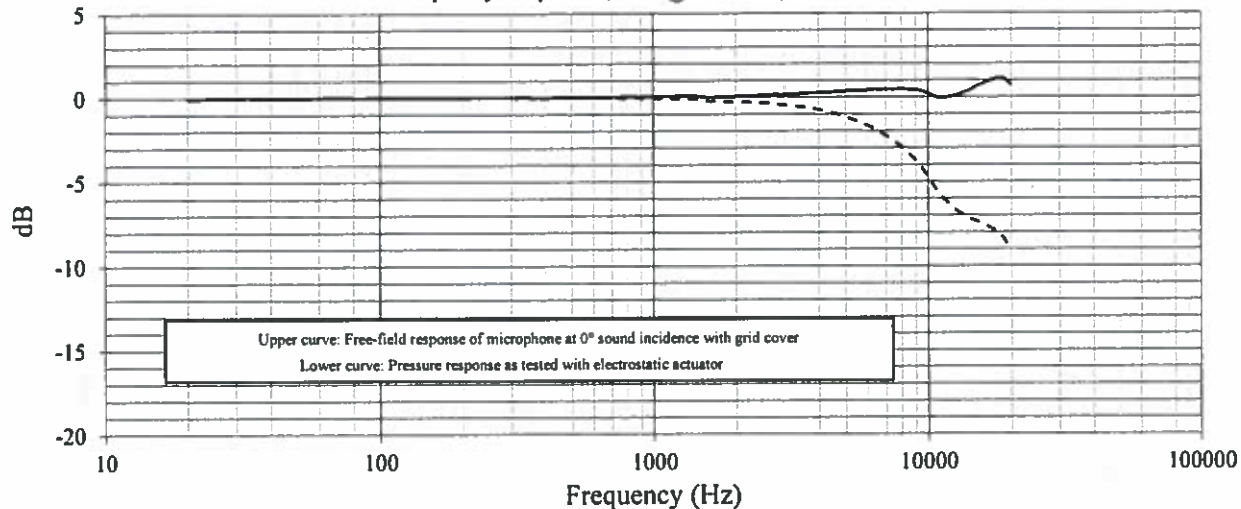
## Calibration Data

System Sensitivity @ 251.2 Hz: 51.27 mV/Pa  
 -25.8 dB re 1V/Pa

Polarization Voltage, External: 0 V

Temperature: 70 °F (21°C)      Ambient Pressure: 1002 mbar      Relative Humidity: 48 %

Frequency Response (0 dB @ 251.2 Hz)



| Freq (Hz) | Lower (dB) | Upper (dB) | Freq (Hz) | Lower (dB) | Upper (dB) | Freq (Hz) | Lower (dB) | Upper (dB) | Freq (Hz) | Lower (dB) | Upper (dB) |
|-----------|------------|------------|-----------|------------|------------|-----------|------------|------------|-----------|------------|------------|
| 20.0      | -0.08      | -0.08      | 1679      | -0.23      | 0.00       | 7499      | -2.62      | 0.45       | -         | -          | -          |
| 25.1      | -0.01      | -0.01      | 1778      | -0.23      | 0.02       | 7943      | -2.91      | 0.48       | -         | -          | -          |
| 31.6      | 0.00       | 0.00       | 1884      | -0.28      | 0.01       | 8414      | -3.28      | 0.45       | -         | -          | -          |
| 39.8      | -0.01      | -0.01      | 1995      | -0.26      | 0.05       | 8913      | -3.68      | 0.43       | -         | -          | -          |
| 50.1      | -0.03      | -0.03      | 2114      | -0.27      | 0.07       | 9441      | -4.15      | 0.37       | -         | -          | -          |
| 63.1      | 0.01       | 0.01       | 2239      | -0.29      | 0.08       | 10000     | -4.76      | 0.20       | -         | -          | -          |
| 79.4      | 0.00       | 0.00       | 2371      | -0.31      | 0.10       | 10593     | -5.39      | 0.01       | -         | -          | -          |
| 100.0     | 0.00       | 0.00       | 2512      | -0.33      | 0.14       | 11220     | -5.92      | -0.06      | -         | -          | -          |
| 125.9     | 0.00       | 0.00       | 2661      | -0.36      | 0.15       | 11885     | -6.31      | 0.01       | -         | -          | -          |
| 158.5     | 0.00       | 0.00       | 2818      | -0.40      | 0.16       | 12589     | -6.69      | 0.08       | -         | -          | -          |
| 199.5     | 0.00       | 0.00       | 2985      | -0.45      | 0.17       | 13335     | -6.96      | 0.23       | -         | -          | -          |
| 251.2     | 0.00       | 0.00       | 3162      | -0.49      | 0.19       | 14125     | -7.20      | 0.40       | -         | -          | -          |
| 316.2     | -0.01      | 0.00       | 3350      | -0.54      | 0.20       | 14962     | -7.35      | 0.62       | -         | -          | -          |
| 398.1     | -0.01      | -0.01      | 3548      | -0.59      | 0.23       | 15849     | -7.54      | 0.81       | -         | -          | -          |
| 501.2     | -0.02      | 0.02       | 3758      | -0.67      | 0.23       | 16788     | -7.76      | 0.96       | -         | -          | -          |
| 631.0     | -0.03      | 0.01       | 3981      | -0.73      | 0.27       | 17783     | -8.01      | 1.10       | -         | -          | -          |
| 794.3     | -0.05      | 0.04       | 4217      | -0.84      | 0.27       | 18837     | -8.44      | 1.07       | -         | -          | -          |
| 1000.0    | -0.07      | 0.05       | 4467      | -0.94      | 0.30       | 19953     | -9.20      | 0.73       | -         | -          | -          |
| 1059.3    | -0.07      | 0.06       | 4732      | -1.03      | 0.34       | -         | -          | -          | -         | -          | -          |
| 1122.0    | -0.08      | 0.06       | 5012      | -1.17      | 0.36       | -         | -          | -          | -         | -          | -          |
| 1188.5    | -0.08      | 0.07       | 5309      | -1.33      | 0.37       | -         | -          | -          | -         | -          | -          |
| 1258.9    | -0.09      | 0.07       | 5623      | -1.49      | 0.39       | -         | -          | -          | -         | -          | -          |
| 1333.5    | -0.10      | 0.08       | 5957      | -1.66      | 0.41       | -         | -          | -          | -         | -          | -          |
| 1412.5    | -0.11      | 0.08       | 6310      | -1.83      | 0.46       | -         | -          | -          | -         | -          | -          |
| 1496.2    | -0.17      | 0.04       | 6683      | -2.07      | 0.45       | -         | -          | -          | -         | -          | -          |
| 1584.9    | -0.23      | -0.02      | 7080      | -2.32      | 0.46       | -         | -          | -          | -         | -          | -          |

Technician: Leonard Lukasik      Date: September 16, 2015



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ID CALL 13-352529/PRO 800



# SOH Wind Engineering LLC

141 Leroy Road · Williston, VT 05495 · USA

Tel 802.316.4368 · Fax 802.735.9106 · www.sohwind.com

## CERTIFICATE FOR CALIBRATION OF SONIC ANEMOMETER

Certificate number: 16.US1.01908

Date of issue: February 18, 2016

Type: Vaisala Weather Transmitter, WXT520

Serial number: K0630017.0deg

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

Client: Aercoustics Engineering Ltd., 50 Ronson Dr, Suite 165, Toronto, ON M9W 1B3, Canada

Anemometer received: February 18, 2016

Anemometer calibrated: 11:48 February 18, 2016

Calibrated by: mej

Procedure: MEASNET, IEC 61400-12-1:2005(E) Annex F

Certificate prepared by: ejf

Approved by: Calibration engineer, rds

Calibration equation obtained:  $v [m/s] = 0.98953 \cdot f [m/s] + 0.09392$

Standard uncertainty, slope: 0.00190

Standard uncertainty, offset: 0.21429

Covariance: -0.0000355 (m/s)<sup>2</sup>/m/s

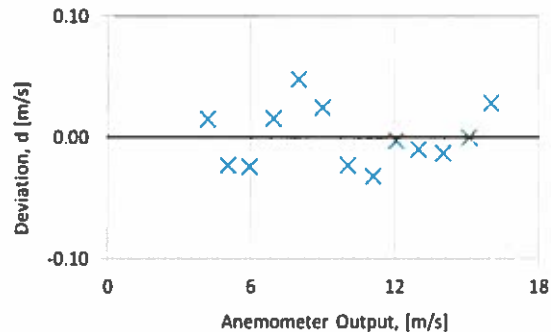
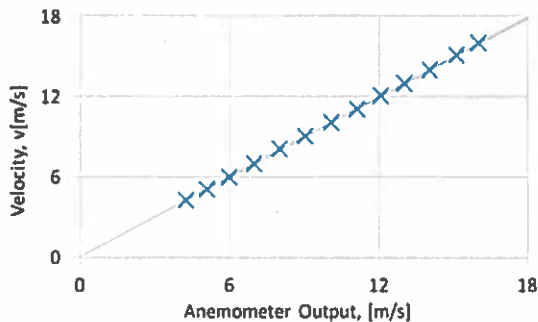
Coefficient of correlation:  $\rho = 0.999980$

Absolute maximum deviation: 0.047 m/s at 8.060 m/s

Barometric pressure: 1020.9 hPa

Relative humidity: 9.7%

| Succession | Velocity pressure, q, [Pa] | Temperature in wind tunnel [°C] | d.p. box [°C] | Wind velocity, v, [m/s] | Anemometer Output, f, [m/s] | Deviation, d, [m/s] | Uncertainty $u_c (k=2)$ [m/s] |
|------------|----------------------------|---------------------------------|---------------|-------------------------|-----------------------------|---------------------|-------------------------------|
| 2          | 11.01                      | 24.4                            | 27.5          | 4.293                   | 4.229                       | 0.015               | 0.048                         |
| 4          | 15.52                      | 24.4                            | 27.5          | 5.098                   | 5.081                       | -0.023              | 0.043                         |
| 6          | 21.38                      | 24.4                            | 27.5          | 5.985                   | 5.977                       | -0.024              | 0.041                         |
| 8          | 29.18                      | 24.4                            | 27.5          | 6.991                   | 6.955                       | 0.015               | 0.039                         |
| 10         | 38.79                      | 24.4                            | 27.5          | 8.060                   | 8.003                       | 0.047               | 0.040                         |
| 12         | 48.71                      | 24.4                            | 27.5          | 9.034                   | 9.010                       | 0.024               | 0.041                         |
| 13-last    | 59.98                      | 24.4                            | 27.5          | 10.024                  | 10.058                      | -0.023              | 0.043                         |
| 11         | 72.79                      | 24.4                            | 27.5          | 11.042                  | 11.097                      | -0.032              | 0.045                         |
| 9          | 86.28                      | 24.4                            | 27.5          | 12.023                  | 12.058                      | -0.003              | 0.048                         |
| 7          | 99.86                      | 24.4                            | 27.5          | 12.935                  | 12.987                      | -0.010              | 0.051                         |
| 5          | 116.09                     | 24.4                            | 27.5          | 13.947                  | 14.013                      | -0.013              | 0.054                         |
| 3          | 134.98                     | 24.4                            | 27.5          | 15.039                  | 15.103                      | 0.000               | 0.057                         |
| 1-first    | 151.76                     | 24.3                            | 27.5          | 15.945                  | 15.990                      | 0.028               | 0.060                         |



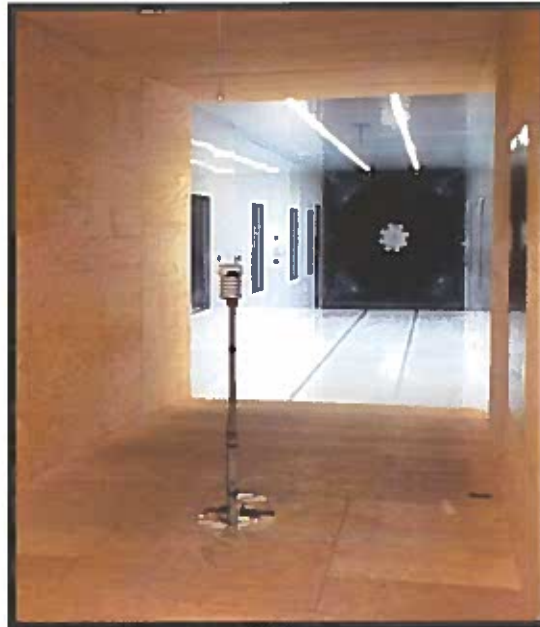
AC-1746



## EQUIPMENT USED

| Serial Number | Description                                       |
|---------------|---|
| Njord 1       | Wind tunnel, blockage factor = 1.004              |
| 2254          | Control cup anemometer                            |
| -             | Mounting tube, D = 30 mm                          |
| TT003         | Summit RT-AUI, wind tunnel                        |
| TP001         | Summit RT-AUI, differential pressure box          |
| DP004         | Setra Model 239 pressure transducer               |
| HY003         | Dwyer Instruments RHP-2D20 humidity transmitter   |
| BP002         | Setra Model 278 barometer                         |
| PL8           | Pitot tube  |
| XB002         | Computer Board. 16 bit A/D data acquisition board |
| 9PRZRW1       | PC dedicated to data acquisition                  |

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



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

## UNCERTAINTIES

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

**Certificate number: 16.US1.01908**



# SOH Wind Engineering LLC

141 Leroy Road · Williston, VT 05495 · USA

Tel 802.316.4368 · Fax 802.735.9106 · www.sohwind.com

## CERTIFICATE FOR CALIBRATION OF SONIC ANEMOMETER

Certificate number: 16.US1.01909

Date of issue: February 18, 2016

Type: Vaisala Weather Transmitter, WXT520

Serial number: K0630017.90deg

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

Client: Aercoustics Engineering Ltd., 50 Ronson Dr, Suite 165, Toronto, ON M9W 1B3, Canada

Anemometer received: February 18, 2016

Anemometer calibrated: 12:07 February 18, 2016

Calibrated by: mej

Procedure: MEASNET, IEC 61400-12-1:2005(E) Annex F

Certificate prepared by: ejf

Approved by: Calibration engineer, rds

Calibration equation obtained:  $v [m/s] = 1.01610 \cdot f [m/s] + 0.08636$

Standard uncertainty, slope: 0.00150

Standard uncertainty, offset: 0.18401

Covariance:  $-0.0000227 (m/s)^2/m/s$

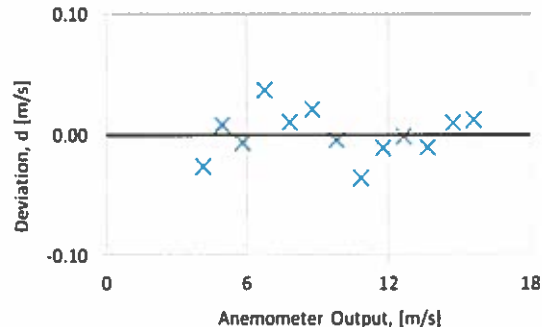
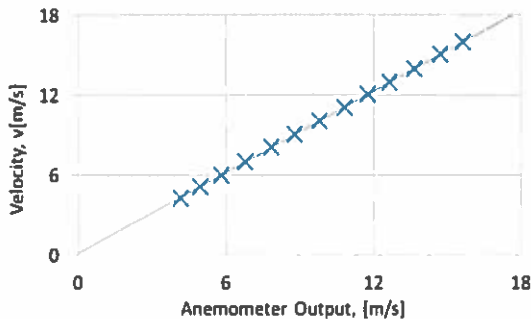
Coefficient of correlation:  $\rho = 0.999988$

Absolute maximum deviation: 0.036 m/s at 6.993 m/s

Barometric pressure: 1020.8 hPa

Relative humidity: 9.7%

| Succession | Velocity pressure, q [Pa] | Temperature in wind tunnel [°C] | d.p. box [°C] | Wind velocity, v [m/s] | Anemometer Output, f [m/s] | Deviation, d [m/s] | Uncertainty $u_c (k=2)$ [m/s] |
|------------|---------------------------|---------------------------------|---------------|------------------------|----------------------------|--------------------|-------------------------------|
| 2          | 10.93                     | 24.5                            | 27.5          | 4.279                  | 4.152                      | -0.026             | 0.049                         |
| 4          | 15.62                     | 24.6                            | 27.5          | 5.116                  | 4.942                      | 0.008              | 0.043                         |
| 6          | 21.41                     | 24.6                            | 27.5          | 5.989                  | 5.816                      | -0.007             | 0.041                         |
| 8          | 29.18                     | 24.5                            | 27.5          | 6.993                  | 6.761                      | 0.036              | 0.039                         |
| 10         | 38.75                     | 24.5                            | 27.5          | 8.058                  | 7.835                      | 0.010              | 0.040                         |
| 12         | 48.65                     | 24.5                            | 27.5          | 9.029                  | 8.781                      | 0.021              | 0.041                         |
| 13-last    | 59.99                     | 24.5                            | 27.5          | 10.026                 | 9.787                      | -0.005             | 0.043                         |
| 11         | 72.74                     | 24.5                            | 27.5          | 11.041                 | 10.816                     | -0.035             | 0.045                         |
| 9          | 86.24                     | 24.5                            | 27.5          | 12.022                 | 11.758                     | -0.011             | 0.048                         |
| 7          | 99.80                     | 24.5                            | 27.5          | 12.934                 | 12.645                     | -0.001             | 0.051                         |
| 5          | 116.10                    | 24.5                            | 27.5          | 13.951                 | 13.655                     | -0.010             | 0.054                         |
| 3          | 135.09                    | 24.5                            | 27.5          | 15.049                 | 14.716                     | 0.009              | 0.057                         |
| 1-first    | 151.82                    | 24.5                            | 27.5          | 15.953                 | 15.603                     | 0.012              | 0.060                         |



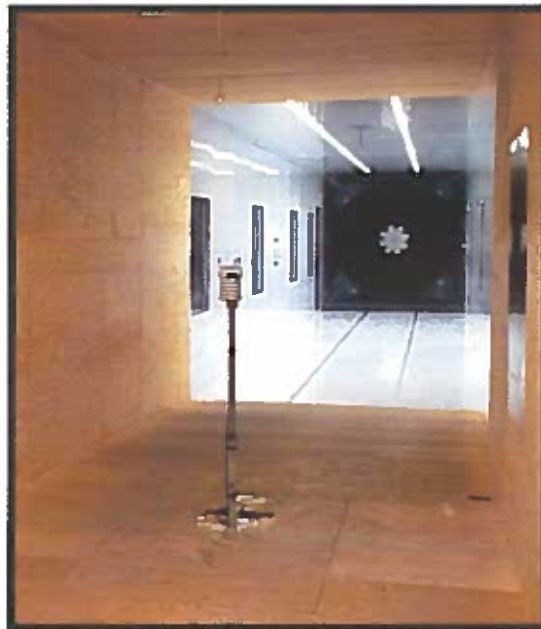
AC-1746



## EQUIPMENT USED

| Serial Number | Description                                       |
|---------------|---|
| Njord 1       | Wind tunnel, blockage factor = 1.004              |
| 2254          | Control cup anemometer                            |
| -             | Mounting tube, D = 30 mm                          |
| TT003         | Summit RT-AUI, wind tunnel                        |
| TP001         | Summit RT-AUI, differential pressure box          |
| DP004         | Setra Model 239 pressure transducer               |
| HY003         | Dwyer Instruments RHP-2D20 humidity transmitter   |
| BP002         | Setra Model 278 barometer                         |
| PL8           | Pitot tube  |
| XB002         | Computer Board. 16 bit A/D data acquisition board |
| 9PRZRW1       | PC dedicated to data acquisition                  |

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



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

## UNCERTAINTIES

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

**Certificate number: 16.USI.01909**

# ~ Certificate of Calibration and Compliance ~

Model: 378B02      Serial Number: 123029  
Microphone Model: 377B02      Serial Number: 158838      Manufacturer: PCB  
Preamplifier Model: 426E01      Serial Number: 041180      Manufacturer: PCB

## Calibration Environmental Conditions

Environmental test conditions as printed on microphone calibration chart.

## Reference Equipment

| Manufacturer         | Model #  | Serial # | PCB Control # | Cal Date     | Due Date     |
|----------------------|----------|----------|---------------|--------------|--------------|
| Larson Davis         | PRM915   | 122      | CA865         | 10/26/15     | 10/26/16     |
| Larson Davis         | PRM916   | 104      | LD015         | 3/10/15      | 3/10/16      |
| Larson Davis         | CAL250   | 5025     | CA1277        | 5/14/15      | 5/13/16      |
| Larson Davis         | 2201     | 102      | LD022         | 3/2/15       | 3/2/16       |
| Larson Davis         | PRA951-4 | 241      | CA1449        | 9/29/15      | 9/29/16      |
| Larson Davis         | PRM902   | 5352     | CA1247        | 3/10/15      | 3/10/16      |
| Larson Davis         | GPRM902  | 4923     | CA2237        | 8/6/15       | 8/5/16       |
| Bruel & Kjaer        | 4192     | 2764626  | CA1636        | 6/15/15      | 6/15/16      |
| Larson Davis         | ADP005   | 0        | 0             | not required | not required |
| Newport              | BTH-W/N  | 8410668  | CA1187        | not required | not required |
| National Instruments | PCI-6251 | 1162ED1  | CA1740        | 7/29/15      | 7/29/16      |
| 0                    | 0        | 0        | 0             | not required | not required |
| 0                    | 0        | 0        | 0             | not required | not required |
| 0                    | 0        | 0        | 0             | not required | not required |
| 0                    | 0        | 0        | 0             | not required | not required |

Frequency sweep performed with B&K UA0033 electrostatic actuator.

## Condition of Unit

As Found: n/a

As Left: New Unit, In Tolerance

## Notes

1. Calibration of reference equipment is traceable to one or more of the following National Labs; NIST, PTB or DFM.
2. This certificate shall not be reproduced, except in full, without written approval from PCB Piezotronics, Inc.
3. Calibration is performed in compliance with ISO 9001, ISO 10012-1, ANSI/NC SL Z540.3 and ISO 17025.
4. See Manufacturer's Specification Sheet for a detailed listing of performance specifications.
5. System Sensitivity is measured following procedure AT603-5.
6. Measurement uncertainty (95% confidence level with coverage factor of 2) for sensitivity is +/-0.20 dB.
7. Unit calibrated per ACS-63.

Technician: Nicholas Herdlein <sup>NH</sup>

Date: January 7, 2016



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ID CAL81-3535018081.228

# ~ Calibration Report ~

Model: 378B02  
 Microphone Model: 377B02  
 Preamplifier Model: 426E01

Serial Number: 123029  
 Serial Number: 158838  
 Serial Number: 041180

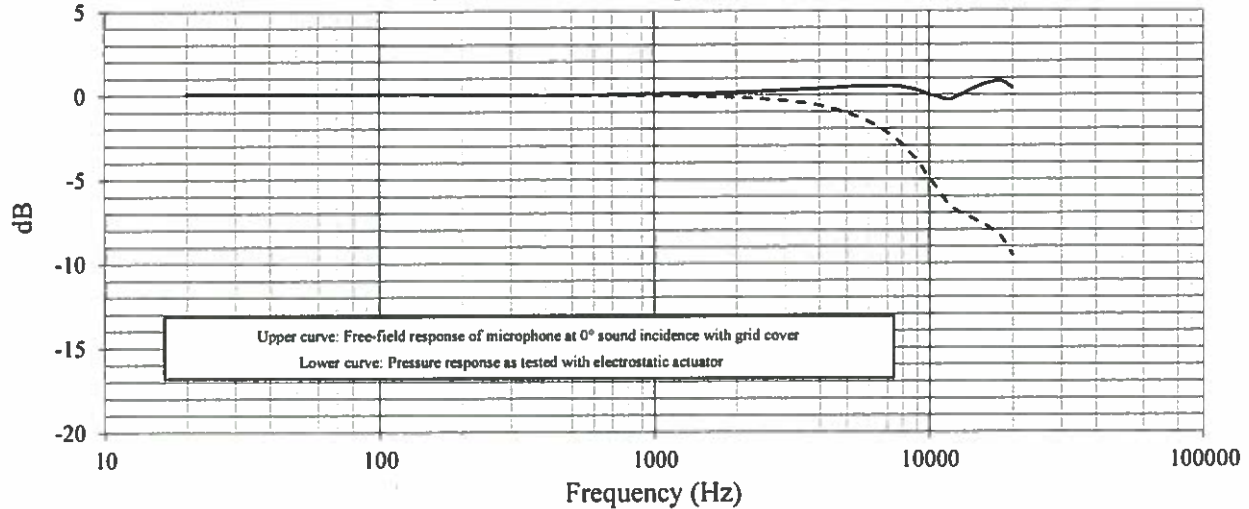
Description: 1/2" Free-Field Microphone  
 and Preamplifier

## Calibration Data

System Sensitivity @ 251.2 Hz: 55.72 mV/Pa      Polarization Voltage, External: 0 V  
 -25.08 dB re 1V/Pa

Temperature: 72 °F (22°C)      Ambient Pressure: 999 mbar      Relative Humidity: 24 %

Frequency Response (0 dB @ 251.2 Hz)



| Freq (Hz) | Lower (dB) | Upper (dB) | Freq (Hz) | Lower (dB) | Upper (dB) | Freq (Hz) | Lower (dB) | Upper (dB) | Freq (Hz) | Lower (dB) | Upper (dB) |
|-----------|------------|------------|-----------|------------|------------|-----------|------------|------------|-----------|------------|------------|
| 20.0      | 0.13       | 0.13       | 1679      | -0.11      | 0.12       | 7499      | -2.56      | 0.51       | -         | -          | -          |
| 25.1      | 0.07       | 0.07       | 1778      | -0.12      | 0.13       | 7943      | -2.92      | 0.47       | -         | -          | -          |
| 31.6      | 0.09       | 0.09       | 1884      | -0.13      | 0.15       | 8414      | -3.35      | 0.38       | -         | -          | -          |
| 39.8      | 0.08       | 0.08       | 1995      | -0.15      | 0.16       | 8913      | -3.81      | 0.30       | -         | -          | -          |
| 50.1      | 0.08       | 0.08       | 2114      | -0.17      | 0.17       | 9441      | -4.36      | 0.16       | -         | -          | -          |
| 63.1      | 0.07       | 0.07       | 2239      | -0.19      | 0.18       | 10000     | -4.97      | -0.02      | -         | -          | -          |
| 79.4      | 0.07       | 0.07       | 2371      | -0.21      | 0.20       | 10593     | -5.50      | -0.10      | -         | -          | -          |
| 100.0     | 0.06       | 0.06       | 2512      | -0.23      | 0.23       | 11220     | -6.09      | -0.23      | -         | -          | -          |
| 125.9     | 0.06       | 0.06       | 2661      | -0.27      | 0.24       | 11885     | -6.61      | -0.29      | -         | -          | -          |
| 158.5     | 0.05       | 0.05       | 2818      | -0.30      | 0.26       | 12589     | -6.88      | -0.11      | -         | -          | -          |
| 199.5     | 0.04       | 0.04       | 2985      | -0.33      | 0.29       | 13335     | -7.11      | 0.08       | -         | -          | -          |
| 251.2     | 0.00       | 0.00       | 3162      | -0.38      | 0.30       | 14125     | -7.29      | 0.30       | -         | -          | -          |
| 316.2     | -0.01      | 0.00       | 3350      | -0.43      | 0.31       | 14962     | -7.51      | 0.46       | -         | -          | -          |
| 398.1     | -0.02      | -0.02      | 3548      | -0.48      | 0.34       | 15849     | -7.71      | 0.64       | -         | -          | -          |
| 501.2     | -0.02      | 0.02       | 3758      | -0.55      | 0.35       | 16788     | -7.98      | 0.74       | -         | -          | -          |
| 631.0     | -0.02      | 0.02       | 3981      | -0.62      | 0.38       | 17783     | -8.27      | 0.84       | -         | -          | -          |
| 794.3     | -0.03      | 0.07       | 4217      | -0.73      | 0.39       | 18837     | -8.80      | 0.72       | -         | -          | -          |
| 1000.0    | -0.04      | 0.08       | 4467      | -0.82      | 0.41       | 19953     | -9.52      | 0.41       | -         | -          | -          |
| 1059.3    | -0.05      | 0.08       | 4732      | -0.93      | 0.44       | -         | -          | -          | -         | -          | -          |
| 1122.0    | -0.05      | 0.09       | 5012      | -1.07      | 0.46       | -         | -          | -          | -         | -          | -          |
| 1188.5    | -0.06      | 0.09       | 5309      | -1.21      | 0.49       | -         | -          | -          | -         | -          | -          |
| 1258.9    | -0.06      | 0.10       | 5623      | -1.37      | 0.51       | -         | -          | -          | -         | -          | -          |
| 1333.5    | -0.07      | 0.11       | 5957      | -1.56      | 0.51       | -         | -          | -          | -         | -          | -          |
| 1412.5    | -0.08      | 0.11       | 6310      | -1.77      | 0.52       | -         | -          | -          | -         | -          | -          |
| 1496.2    | -0.09      | 0.11       | 6683      | -2.00      | 0.52       | -         | -          | -          | -         | -          | -          |
| 1584.9    | -0.10      | 0.11       | 7080      | -2.26      | 0.52       | -         | -          | -          | -         | -          | -          |

Technician: Nicholas Herdlein *NH*      Date: January 7, 2016



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ID CAL81-353501001.228



## TEST REPORT

Instrument WXT520 AAB1BE30B0  
 Serial number M0410643  
 Manufacturer Vaisala Oyj, Finland  
 Test date 28th January 2016

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

### Test results

| Test                         | Result    | Limit          | Passed |
|------------------------------|-----------|----------------|--------|
| Rain response                | 438.0 mV  | (345...575) mV | OK     |
| Zero wind speed              | 0.00 m/s  | (0...0.4) m/s  | OK     |
| Pressure                     | 979.8 hPa | PASS/FAIL      | OK     |
| Temperature                  | 22.3 °C   | PASS/FAIL      | OK     |
| Humidity                     | 30 %RH    | PASS/FAIL      | OK     |
| Heating                      | PASS      | PASS/FAIL      | OK     |
| Current (service port)       | 0.57      | (0.2...0.7) mA | OK     |
| Communication (service port) | PASS      | PASS/FAIL      | OK     |
| Current (main port)          | 0.33      | (0.1...0.4) mA | OK     |
| Communication (main port)    | PASS      | PASS/FAIL      | OK     |

Signature



Technician

*This report shall not be reproduced except in full, without the written approval of Vaisala. DOC216638.doc*

## CALIBRATION SHEET

**Instrument** WXTPTU  
**Serial number** L5040041  
**Manufacturer** Vaisala Oyj, Finland  
**Test date** 28th January 2016

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

### Calibration results

| Test phase of calibration process | Reference value | Observed value | Error*  | Uncertainty** |
|-----------------------------------|-----------------|----------------|---------|---------------|
| Pressure                          | 1078.7 hPa      | 1078.7 hPa     | 0.0 hPa | ± 0.4 hPa     |
| Pressure                          | 896.5 hPa       | 896.5 hPa      | 0.0 hPa | ± 0.4 hPa     |
| Pressure                          | 798.1 hPa       | 798.1 hPa      | 0.0 hPa | ± 0.4 hPa     |
| Pressure                          | 596.5 hPa       | 596.5 hPa      | 0.0 hPa | ± 0.4 hPa     |
| Temperature                       | 59.8 °C         | 59.8 °C        | 0.0 °C  | ± 0.2 °C      |
| Temperature                       | 24.8 °C         | 24.9 °C        | 0.1 °C  | ± 0.2 °C      |
| Temperature                       | -5.7 °C         | -5.7 °C        | 0.0 °C  | ± 0.2 °C      |
| Temperature                       | -32.8 °C        | -32.8 °C       | 0.0 °C  | ± 0.2 °C      |
| Temperature                       | -52.0 °C        | -52.1 °C       | -0.1 °C | ± 0.2 °C      |
| Relative humidity                 | 30.0 %RH        | 30.0 %RH       | 0.0 %RH | ± 2 %RH       |
| Relative humidity                 | 58.4 %RH        | 58.4 %RH       | 0.0 %RH | ± 2 %RH       |
| Relative humidity                 | 91.5 %RH        | 91.5 %RH       | 0.0 %RH | ± 3 %RH       |

\*The test points for error values are polynomial fitting curve fitting points.

\*\*The calibration uncertainty given at 95 % confidence level, k = 2

### Traceability

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

Signature



Technician

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Doc218938-A

**West Caldwell Calibration Laboratories Inc.**

# Certificate of Calibration

for

**MICROPHONE UNIT**

**Manufactured by:** PCB PIEZOTRONCS  
**Model No:** 378B02  
**Serial No:** 121695  
**Calibration Recall No:** 27880

**Submitted By:**

**Customer:**

**Company:** Aercoustics Engineering LTD  
**Address:**

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

West Caldwell Calibration Laboratories Procedure No. 378B02 PCB P

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

Within ( X )

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

West Caldwell Calibration Laboratories' calibration control system meets the requirements, ISO 10012-1 MIL-STD-45662A, ANSI/NCSL Z540-1, IEC Guide 25, ISO 9001:2008 and ISO 17025.

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

Approved by: *FC*

Calibration Date: 25-Jul-17

Felix Christopher (QA Mgr.)

Certificate No: 27880 - 6

QA Doc. #1051 Rev. 2.0 10/1/01

Certificate Page 1 of 1

ISO/IEC 17025:2005

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



Calibration Lab. Cert. # 1533.01

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



Calibration Lab. Cert. # 1533.01

# REPORT OF CALIBRATION

for

PCB Piezotronics Microphone Unit

Model No.: 378B02

Serial No.: 121695

Mic Model No.: 377B02

Serial No.: 156314

Preamp Model No.: 426E01

Serial No.: 039843

Company: Aercoustics Engineering LTD

ID No.: XXXX

**Calibration results:**

|                                   |  |                      |             |      |
|-----------------------------------|--|----------------------|-------------|------|
| Before & after data same: ...X... |  | Ambient Temperature: | 22.6        | °C   |
| Combined Sensitivity @            | 250 Hz                                   | and pressure of      | 99.611      | kPa  |
| (Sens. with mic. and preamp.)     | 0 Volts Polarization voltage (External): | Ambient Humidity:    | 54.8        | % RH |
|                                   | -26.34 dB re.1V/Pascal                   | Ambient Pressure:    | 99.611      | kPa  |
|                                   | 48.20 mV/Pascal                          | Calibration Date:    | 25-Jul-2017 |      |
|                                   | 0.34 Ko ( - dB re 50 mV/Pascal)          | Calibration Due:     | 25-Jul-2019 |      |
| Sensitivity:                      | Pass                                     | Report Number:       | 27880 -6    |      |
| Freq. Response:                   | Pass                                     | Control Number:      | 27880       |      |
| All tests:                        | Pass                                     |                      |             |      |

The above listed instrument meets or exceeds the tested manufacturer's specifications.

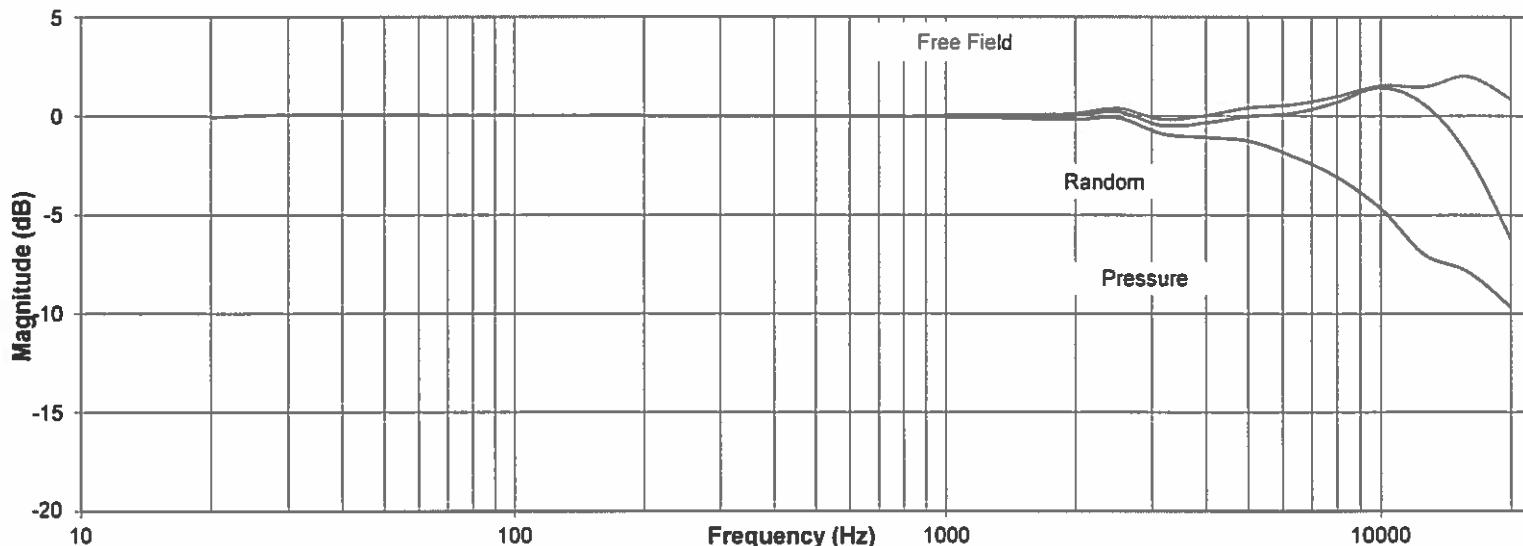
The IEC 651:type 1 and ANSI S1.4 1983 specification passed.

This Calibration is traceable through NIST test numbers: 683/284413-14

The expanded uncertainty of calibration: 0.079dB at 95% confidence level with a coverage factor of k=2.

The pressure response recorded with electroacoustic method.

**Frequency Response**



The above listed instrument was checked using calibration procedure documented in West Caldwell

Calibration Laboratories Inc. procedure :

Rev. 7.0 Jan. 24, 2014 Doc. # 1038 P378B02PCB

Calibration was performed by West Caldwell Calibration Laboratories Inc. under Operating Procedures

intended to implement the requirements of ISO10012-1, IEC Guide 25, ANSI/NCSL Z540-1, (MIL-STD-45662A) and ISO 9001:2008, ISO 17025

Measurements performed by: *James Zhu*

**James Zhu**

Calibrated on WCCL system type 9700

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Rev. 7.0 Jan. 24, 2014 Doc. # 1038 P378B02PCB

## West Caldwell Calibration Laboratories Inc.

1575 State Route 96, Victor NY 14564  
Tel. (585) 586-3900 FAX (585) 586-4327

*Calibration Data Record*

for

PCB Piezotronics Microphone Unit  
Company: Aercoustics Engineering LTD

Model No.: 378B02

Serial No.: 121695  
ID No.: XXXX

## Frequency Response ( Reference = 0 dB @ 250Hz )

| Frequency<br>[Hz] | Pressure<br>[dB] | Free Field<br>[dB] | Random<br>[dB] |
|-------------------|------------------|--------------------|----------------|
| 19.95             | -0.07            | -0.07              | -0.07          |
| 25.12             | 0.03             | 0.03               | 0.03           |
| 31.62             | 0.07             | 0.07               | 0.07           |
| 39.81             | 0.07             | 0.07               | 0.07           |
| 50.12             | 0.06             | 0.06               | 0.06           |
| 63.10             | 0.05             | 0.05               | 0.05           |
| 79.43             | 0.03             | 0.03               | 0.03           |
| 100.00            | 0.03             | 0.03               | 0.03           |
| 125.89            | 0.02             | 0.02               | 0.02           |
| 158.49            | 0.01             | 0.01               | 0.01           |
| 199.53            | 0.01             | 0.01               | 0.01           |
| 251.19            | 0.00             | 0.00               | 0.00           |
| 316.23            | 0.00             | 0.00               | 0.00           |
| 398.11            | -0.01            | -0.01              | -0.01          |
| 501.19            | -0.01            | -0.01              | -0.01          |
| 630.96            | -0.02            | -0.02              | -0.02          |
| 794.33            | -0.04            | -0.04              | -0.04          |
| 1000.00           | -0.06            | 0.05               | -0.06          |
| 1258.93           | -0.08            | 0.08               | -0.04          |
| 1584.89           | -0.15            | 0.08               | -0.07          |
| 1995.26           | -0.18            | 0.15               | 0.02           |
| 2511.89           | -0.10            | 0.38               | 0.21           |
| 3162.28           | -0.89            | -0.17              | -0.48          |
| 3981.07           | -1.08            | 0.02               | -0.35          |
| 5011.87           | -1.26            | 0.42               | -0.02          |
| 6309.57           | -2.00            | 0.58               | 0.15           |
| 7943.28           | -3.03            | 0.97               | 0.68           |
| 10000.00          | -4.66            | 1.55               | 1.43           |
| 12589.25          | -6.96            | 1.47               | 0.58           |
| 15848.93          | -7.83            | 1.99               | -1.95          |
| 19952.62          | -9.63            | 0.87               | -6.13          |

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

| Instruments used for calibration: | Date of Cal. | Traceability No. | Re-cal. Due Date |
|-----------------------------------|--------------|------------------|------------------|
| Brüel & Kjær 4226 S/N 1445428     | 3-Nov-2016   | 683/284413-14    | 3-Nov-2017       |
| Brüel & Kjær 3560 S/N 2202374     | 3-Nov-2016   | 683/284413-14    | 3-Nov-2017       |
| HP 33120A S/N 36043716            | 1-Oct-2016   | ,287708          | 1-Oct-2017       |
| HP 34401A S/N 36064102            | 1-Oct-2016   | ,287708          | 1-Oct-2017       |

Cal. Date: 25-Jul-2017

Tested by: James Zhu

Calibrated on WCCL system type 9700

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## **Appendix H**

### **I-Audit Checklist**

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**Appendix H - (2017 Compliance Protocol AF7): I-Audit checklist**  
**Wind Energy Project – Screening Document – Acoustic Audit Report – Immission**  
**Information Required in the Acoustic Audit Report – Immission**

| Item # | Description   | Complete? | Comment  |
|--------|---|-----------|--|
| 1      | Did the Sound level Meter meet the Type 1 Sound level meter requirements according to the IEC standard 61672-1 Sound level Meters, Part 1: Specifications? Section D2.1.1   | ✓         |  |
| 2      | Was the complete sound measurement system, including any recording, data logging or computing systems calibrated immediately before and after the measurement session at one or more frequencies using an acoustic calibrator on the microphone (must not exceed $\pm 0.5\text{dB}$ )? Section D2.1.3 | ✓         |  |
| 3      | Are valid calibration certificate(s) of the noise monitoring equipment and calibration traceable to a qualified laboratory? Is the validity duration of the calibration stated for each item of equipment? Section D2.3   | ✓         |  |
| 4      | Was the predictable worst case parameters such as high wind shear and wind direction toward the Receptor considered? Section D3.2   | ✓         | Assessment performed to available Wind Turbine Noise Compliance Protocol at the time of measurements (2011 Wind Turbine Noise Compliance Protocol) as per Section A4.4.2 Transition rules for I-Audits of the 2017 WTNCP. All valid data with varying wind shear and wind directions included in the analysis. |
| 5      | Is there a Wind Rose showing the wind directions at the site? Section D7 (1e)   | ✓         |  |
| 6      | Did the results cover a wind speed range of at least 4-7 m/s as outlined in section D 3.8.?   | ✓         |  |
| 7      | Was the weather report during the measurement campaign included in the report? Section D7 (1c)  | ✓         |  |
| 8      | Did the audit state there was compliance with the limits at each wind speed category? Section D6  | ✓         |  |
| 9      | Are pictures of the noise measurement setup near Point of reception provided? Section D3.3.2 & D3.4   | ✓         |  |
| 10     | Was there justification of the Receptor location choice(s) prior to commencement of the I-Audit? Section D4.1   | ✓         |  |
| 11     | Was there sufficient valid data for different wind speeds? Section D5.2 # 3   | ✓         |  |
| 12     | Was the turbine (operational) specific information during the measurement campaign in tabular form (i.e. wind speed at hub height, anemometer wind speed at 10 m height, air temperature and pressure and relative humidity) Section D3.7   | ✓         | Provided separately in excel format. See Point 15.   |
| 13     | Were all the calculated standard deviations at all relevant integer wind speeds provided? Section D7 (2d)   | ✓         |  |
| 14     | Compliance statement  | ✓         |  |
| 15     | All data included in an Excel spreadsheet   | ✓         |  |
| 16     | If deviations from standard; was justification of the deviations provided   | ✓         | Assessment performed to available Wind Turbine Noise Compliance Protocol at the time of measurements (2011 Wind Turbine Noise Compliance Protocol) as per Section A4.4.2 Transition rules for I-Audits of the 2017 WTNCP, No deviations from 2011 protocol   |