

The Challenges of the Acoustic Performance Testing on Small Wind Turbines

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Acoustic Sound Testing

- Recording the background (wind turbine not operating)
- Recording the sound emissions from the wind turbine
- Analysis of the recorded background and sound emissions from the wind turbine
- Presenting the results in a report for submission to the SWCC or other sanctioning body



Needed Equipment

- Microphone with a diameter no larger than 13mm that meets the requirements of a type 1 sound level meter (IEC 60804, 61672)
 - Frequency response over at least 20 Hz to 11.2 kHz
 - Class 1 filters (IEC 61260)
- Measurement Board
 - 12 mm Plywood/hard chip board or 2.5 mm metal
 - 1 m diameter or larger



Needed Equipment

- Windscreen
 - Open cell foam sphere 90 mm in diameter
- Acoustical Calibrator
 - Single frequency minimum and meet the requirement of IEC 60942 class 1
- Data recording and playback system
 - Meeting IEC 60651 for type 1 instrumentation



Needed Equipment

- Anemometer
 - 10 m or hub height (preferred)
- Wind Direction
 - 10 m or hub height (preferred)
 - Accurate to within $\pm 6^\circ$
- Electric Power Transducer
 - meet the requirement of IEC 60688 class 1
- Air Temperature and Atmospheric Pressure
 - $\pm 1^\circ\text{C}$ and $\pm 1\text{ kPa}$



Traceable Calibrations

- Acoustic Calibrator
- Microphone
- Sound Level Meter
- Spectrum Analyzer
- Data Recording and Playback System
- Anemometer
- Power Transducer



Data Collection

- Calibration with acoustic calibrator before and after the measurements
- Acoustic signals must be recorded for later analysis
- Collect both background and turbine operating data with the same set-up (20-30 minutes of each)
- Cover a broad range of wind speeds
 - This is perhaps the most challenging



Data Collection ed 2.1

- 30 measurements with turbine operating
- 30 measurements of background
- 10 second averaging
- Microphone allowed ± 15 deg downwind from turbine



Data Collection ed 3

- 180 measurements with turbine operating
- 180 measurements of background
- 10 measurements in each bin
- Wind Speed from cut-in to 11 m/s minimum
- 10 second averaging
- Microphone allowed ± 45 deg downwind from turbine



Data Analysis

- First listen to your data recorded and make notes of any sounds that you hear that should not be there
 - Birds, airplanes, animals, cars/trucks, people, and insects
- Filter your data for wind direction
- Follow the procedures in the edition that you are using to get
 - A weighted sound pressure level
 - 1/3 octave spectrum
 - Tonality
 - Uncertainty
 - AWEA rated sound level



Data Reporting

- Turbine Description
- Location Description
- Environment Description
- Instrumentation
- Acoustic Data
- Non-acoustic Data
- Uncertainty



Thank You!

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