

IEEE Standard for Wind Turbine Aero Acoustic Noise Measurement Techniques

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**Measurements in Power Systems Committee
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IEEE Instrumentation and Measurement Society**

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Abstract: Techniques to select wind turbine and wind farm aero acoustic noise measurements, including instrumentation standards and metrology technology, measurement set, measurement procedures, data processing, and noise source data analysis are described in this standard. Near-field sound measurement similar to IEC 61400-11 distance and far-field sound measurement both outside and inside concerned houses or buildings are within the scope of this standard. This standard focuses on amplitude modulation noise, however, guidelines for low-frequency noise including infrasound near-field measurement are provided. IEC 61400-11 provides overall wind turbine noise measurement standards, while this standard focuses more on the aero acoustic noise of wind turbines to avoid overlap with IEC 61400-11.

Keywords: aero acoustic noise, amplitude modulation noise, far-field, IEEE 2400™, low-frequency noise including infrasound, near-field, wind farm, wind turbine

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Introduction

This introduction is not part of IEEE Std 2400™-2016, IEEE Standard for Wind Turbine Aero Acoustic Noise Measurement Techniques.

The wind turbine in a wind farm can produce amplitude modulation noise (AMN) caused by rotating airfoil self-noise, particularly trailing edge scattering noise and Doppler effects due to blade motion relative to the observer; it is also recognized as “swish” sound. The envelope of the acoustic wave appears to be blade-passing frequency; therefore, it gives the impression that it is low frequency with blade-passing frequency noise. Meanwhile, the sound pressure pulsation due to blade aerodynamic loading fluctuation and blade tower interaction characterized as low-frequency noise (LFN), including infrasound, were observed from indoor measurement near a wind turbine in operation. The AMN and LFN are both identified as wind turbine aero acoustic noise that has been reported as the most annoying to residents near wind farms, including such complaints as sleep disturbance, nausea, giddiness, etc. The issue becomes a larger public concern as more wind farm projects are built with modern powerful wind turbines deploying larger and longer blades. However, the current IEC 61400-11 noise measurement standard did not address this issue, especially in far-field indoor conditions. To address this issue, IEEE started a standard development project, P2400, in October 2011. This standard establishes standard measurement techniques and methods of analysis to quantify wind turbine and wind farm aero acoustic noise. It can be used to understand wind turbine aero acoustic noise, so-called low-frequency/infrasound and amplitude modulation noise, and potential impacts on surrounding communities. This document provides the standard measurement techniques for wind turbine aero acoustic noise, including instrumentation selection, measurement setup, near-field and far-field outdoor and indoor post-data processing, and noise source data analysis. IEC 61400-11 has provided an overall wind turbine noise-measurement standard, while this standard focuses more on the aero acoustic noise of wind turbines to avoid the overlap with IEC 61400-11. It is advised that users of this document are also familiar with ANSI S1.1–1994 (R2004) Acoustical Terminology.

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