



Designation: E1503 – 22

Standard Test Method for Conducting Outdoor Sound Measurements Using a Statistical Sound Analysis System¹

This standard is issued under the fixed designation E1503; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

INTRODUCTION

This is one of a series of standards on the measurement and evaluation of community noise. Others in the series include Guide E1014 which covers manual measurement, using a simple meter, and analysis of the resulting data, and Guide E1780, which covers measurement of sound received from a nearby fixed source.

1. Scope

1.1 This test method covers the measurement of outdoor sound levels at specific locations using a digital statistical sound analysis system and a formal measurement plan.

1.1.1 This test method provides basic requirements for obtaining either a single set of data or multiple sets of related data. However, because there are numerous circumstances and varied objectives requiring multiple sets of data, the test method does not address planning of the measurement program.

1.2 The use of results of measurements performed using this test method include, but are not limited to, the following:

1.2.1 To characterize the acoustical environment of a site,

1.2.2 To characterize the sound emissions of a specific sound source which exhibits a temporal variation in sound output, and

1.2.3 To monitor the effectiveness of a noise impact mitigation plan.

1.3 This test method is intended to be used in conjunction with a measurement plan that references this test method. Changes or additions to the provisions of this test method shall be clearly stated in the plan.

1.3.1 In the event it is necessary, for example, because of time constraints, to conduct measurements without first formalizing a plan, this test method can be used if an operator/observer whose qualifications are satisfactory to both the performing organization and the client is present at all times during the measurements and who complies, to the extent

possible, with all the applicable requirements of this test method, including record keeping.

1.4 The data obtained using this test method enable comparison of sound level data with appropriate criteria.

1.4.1 The data obtained with this test method can be used in the derivation of loudness levels provided the necessary requirements regarding sample duration and signal bandwidth are observed in collecting the data. It is recommended that a specialist in the area of loudness evaluation be consulted in preparing a plan for measurements intended to produce data which will be used for this purpose.

1.5 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.7 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:²

C634 Terminology Relating to Building and Environmental Acoustics

¹ This test method is under the jurisdiction of ASTM Committee E33 on Building and Environmental Acoustics and is the direct responsibility of Subcommittee E33.09 on Community Noise.

Current edition approved Oct. 1, 2022. Published November 2022. Originally approved in 1992. Last previous edition approved in 2014 as E1503 – 14. DOI: 10.1520/E1503-22.

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

E1014 Guide for Measurement of Outdoor A-Weighted Sound Levels

E1686 Guide for Applying Environmental Noise Measurement Methods and Criteria

E1780 Guide for Measuring Outdoor Sound Received from a Nearby Fixed Source

2.2 *ANSI Standards*:³

S1.11 Specifications for Octave-band and Fractional Octave-band Analog and Digital Filters³

S1.13 Measurement of Sound Pressure Levels in Air

S1.17 Microphone Windscreens - Part 1: Measurements and Specification of Insertion Loss in Still or Slightly Moving Air

S1.40 Specification for Verification Procedures for Sound Calibrators³

S1.43 Specifications of Integrating-Averaging Sound Level Meters

S12.9 Standard Quantities and Procedures for Description and Measurement of Environmental Sound, Part 2: Measurement of Long-Term, Wide-Area Sound and Part 3: Short-term Measurements with an Observer Present

2.3 *IEC Standards*

61672-1 Electroacoustics - Sound Level Meters - Part 1: Specifications

3. Terminology

3.1 For definitions of terms, including the following used in this test method, see Terminology **C634**: dummy microphone, interference, impulsive sound, measurement plan, measurement set, percentile level, self noise and time-average sound level.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *digital statistical sound analysis system*—combination of a sound level meter, either analog or digital, interfaced with a digital data storage device, and a digital statistical analyzer, for sampling environmental sound levels over a specified timed interval.

3.2.1.1 *Discussion*—For the purposes of this test method, a generic analyzer having the necessary features for the intended measurement and meeting the requirements of ANSI S1.11, and ANSI S1.43 is assumed.

4. Significance and Use

4.1 This test method deals with methods and techniques which are well defined and which are understood by a trained acoustical professional. This test method has been prepared to provide a standard methodology which, when followed, will produce results which are consistent with requirements of government and industry, and which can be validated using information gathered and documented in the course of the measurement program.

4.2 There are numerous situations for which outdoor sound level data are required. These include, but are not limited to the following:

4.2.1 Documentation of sound levels before the introduction of a new sound source as a reference for assessment of the noise impact caused by a proposed facility and associated activities,

4.2.2 Comparison of sound levels with and without a specific source (for example, assessment of the impact of an existing source), and

4.2.3 Comparison of sound levels with criteria or regulatory limits (for example, indication of exceedance of criteria or non-compliance with laws).

4.3 This test method provides a means for operating a sound analysis system which incorporates digital circuits for processing and storing sound level data, documenting conditions under which the measurements were performed, and reporting the results.

4.4 This test method provides the user with information to (1) perform and document statistical analysis of outdoor sound level over specific time periods at specified places, and (2) make and document the physical observations necessary to qualify the measurements.

4.5 This test method can be used by individuals, regulatory agencies, or others as a measurement method to collect acoustical data for many common situations. The data are collected in a format determined by the capabilities of the equipment, equipment operational options selected, and by post-processing options available.

4.6 The user is cautioned that there are many factors that can strongly influence the results obtained during measurement of outdoor sound levels and that this test method is not intended to supplant the experience and judgment of experts in the field of acoustics. This test method is intended to facilitate communication between sound measurement professionals and individuals who are responsible for administering regulations, or are otherwise involved in decisions involving sound measurements. Measurements shall be performed only under the direction of people who are experienced in the measurement and analysis of outdoor sound, and who are thoroughly familiar with the use of the equipment and techniques involved.

4.7 This test method is only a measurement procedure and, as such, does not address the methods of comparison of the acquired data with specific criteria. No procedures are provided within this test method for estimating the influences of two or more simultaneously measured sounds. This test method can be used, with an appropriate plan, in establishing compliance when the measured data are below a specified limit, or conversely, establishing noncompliance when any of the data are above a specified limit.

5. Interferences

5.1 Measurements intended to provide detailed spectral and temporal sound level data are subject to interferences from a number of sources. The most significant of these are mentioned briefly in paragraphs 5.1 – 5.8.

5.2 *Effects of Wind:*

5.2.1 Wind may influence sound level measurements, even with a windscreen in place. The windscreen recommended by

³ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.