ASA/ANSI S1.6-2016
(a revision of ANSI/ASA S1.6-1984)
Reaffirmed by ANSI May 28, 2020

AMERICAN NATIONAL STANDARD

Preferred Frequencies and Filter Band Center Frequencies for Acoustical Measurements

Secretariat:

Acoustical Society of America

Approved on August 16, 2016:

American National Standards Institute, Inc.

Abstract

This standard defines preferred frequencies and nominal filter band center frequencies to be used for acoustical measurements. Exact filter center frequencies for constant percent bandwidth filter banks are calculated using ordinal integer band numbers. The differences between the preferred frequencies for pure tone measurements and constant percent bandwidth filter center frequencies are described. ontrolled free sound field for acoustical measurements in a confined space within the facility.

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Accredited Standards Committee S1, Acoustics

Standards Secretariat
Acoustical Society of America
1305 Walt Whitman Road, Suite 300
Melville, NY 11747

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(Revision of ANSI/ASA S1.6-1984 (R2011))

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This standard defines preferred frequencies and nominal filter band center frequencies to be used for acoustical measurements. Exact filter center frequencies for constant percent bandwidth filter banks are calculated using ordinal integer band numbers. The differences between the preferred frequencies for pure tone measurements and constant percent bandwidth filter center frequencies are described.

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Foreword

[*This Foreword is for information only and is not a part of the American National Standard* ANSI/ASA S1.6-2016 American National Standard Preferred Frequencies and Filter Band Center Frequencies for Acoustical Measurements. *As such, this Foreword may contain material that has not been subjected to public review or a consensus process. In addition, it does not contain requirements necessary for conformance to the standard.*]

This standard comprises a part of a group of definitions, standards, and specifications for use in acoustical work. This standard was developed under the jurisdiction of Accredited Standards Committee S1, Acoustics, using the American National Standards Institute (ANSI) Standards Committee Procedure. The Acoustical Society of America holds the Secretariat for Accredited Standards Committee S1. This standard was approved for publication by ANSI.

Accredited Standards Committee S1, Acoustics, has the following scope:

Standards, specifications, methods of measurement and test, and terminology, in the fields of physical acoustics, including architectural acoustics, electroacoustics, sonics and ultrasonics, and underwater sound, but excluding those aspects which pertain to biological safety, tolerance, and comfort.

This standard is a revision of ANSI/ASA S1.6-1984 (R2011) *Preferred Frequencies, Frequency Levels and Band Numbers for Acoustical Measurements*. Revisions include incorporation of a previously issued erratum, the addition of a clause with terms and definitions, and updated references. Preferred frequencies for pure tone testing and constant percent filter band center frequencies are treated separately. The equation for computing the exact center frequency values is generalized and expanded to allow for computation of fractional octave intervals beyond octave and one-third octaves. The term “frequency level” is rarely used and therefore is removed. This standard is comparable to ISO 266-1997 in that it gives preferred frequencies and band numbers for one-third octave and one-octave intervals. However, it also specifies preferred frequencies for other intervals following the preferred series of numbers defined in ISO 3-1973. The formulae for filter band center frequencies are taken directly from ANSI/ASA S1.11-2014/Part 1 / IEC 61260-1:2014.

At the time this standard was submitted to Accredited Standards Committee S1 for approval, the membership was as follows:

R.J. Peppin, *Chair*
A.A. Scharine, *Vice-Chair*

N.B. Stremmel, *Secretary*

3M Personal Safety Division, Detection Solutions ..... P.J. Battenberg
..... M. Wurm (Alt.)

Acoustical Society of America ..... R.J. Peppin
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..... C.M. Walber (Alt.)

Scantek, Inc. ..... S. Marshall
..... V. Buzduga (Alt.)

U.S. Air Force (USAF) ..... R.L. McKinley
..... F. Mobley (Alt.)

U.S. Army Construction Engineering Research Laboratory ..... M. Swearingen
..... M.J. White (Alt.)

U.S. Army Research Laboratory, Human Research and Engineering Directorate ..... A.A. Scharine
..... M.A. Ericson (Alt.)

U.S. Department of Labor – Mine Safety and Health Administration ..... J. Novakovich

Individual Experts of Accredited Standards Committee S1, Acoustics, were:

V. Buzduga	T.R. Letwoski	C.M. Walber
P. Hanes	P.D. Schomer	L. Wu

Working Group S1/WG 29, Preferred Frequencies, Frequency Levels, and Band Numbers for Acoustical Measurements, which assisted Accredited Standards Committee S1, Acoustics, in the development of this standard, had the following membership.

A.A. Scharine, Chair

R.J. Peppin
C.J. Struck

Suggestions for improvements to this standard will be welcomed. They should be sent to Accredited Standards Committee S1, Acoustics, in care of the Standards Secretariat of the Acoustical Society of America, 1305 Walt Whitman Road, Suite 300, Melville, New York 11747. Telephone: 631-390-0215; FAX: 631-923-2875; E-mail: asastds@acousticalsociety.org.

Introduction

Comparison of data in different frequency formats is inconvenient. Some of the difficulties arise from use of different frequency intervals in, or different starting frequencies for, a series. The purpose of this standard, therefore, is to specify preferred frequencies, a reference frequency, and filter center frequencies and band numbers for constant percentage filter banks in such a way as to afford a maximum number of frequencies common to the various series. The resulting simplification thus reduces the number of frequencies at which acoustical data need to be measured or computed. This also enables acoustical test instruments to be designed to use a uniform set of frequencies, allowing improved exchange of information and standardized methodology.

Both preferred frequencies for pure-tone measurements and filter band center frequencies appear together in this standard in order to illustrate the differences for intervals other than octaves and one-third octaves. This information is useful not only for simplifying data exchange using a common format, but also for use in providing lookup data in tabular form (e.g., weighting tables, conversion or translation data, tolerances, reference responses, etc.) that may be required in both formats, depending upon how a particular measurement is performed.

American National Standard

Preferred Frequencies and Filter Band Center Frequencies for Acoustical Measurements

1 Scope

For certain acoustical measurements, a constant-frequency increment is a suitable spacing. More commonly, however, a constant-percentage increment is adopted and the frequencies then form a geometric series. This is useful as acoustical data is commonly plotted on a logarithmic frequency axis (see IEC 60263). This standard deals with the geometric series.

The present standard is not concerned with specification of preferred frequencies for music or musical instruments, or with the calculation of band-edge frequencies for bandpass filters.

2 Normative references

The following referenced documents are indispensable for the application of this standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ANSI/ASA S1.1-2013 *American National Standard Acoustical Terminology*

ISO 3:1973, *Preferred numbers – Series of preferred numbers*

ISO 17:1973, *Guide to the use of preferred numbers and of series of preferred numbers*

ISO 497:1973, *Guide to the choice of series of preferred numbers and of series containing more rounded values of preferred numbers*

3 Terms and definitions

3.1 band number. Ordinal integer *N*, denoting the index of the center frequency of a specific constant percentage band fractional octave filter.

3.2 decade. A multiplicative factor of 10 in frequency; e.g., 20,000 Hz is three decades above 20 Hz.

3.3 fractional decade. Frequency ratio less than 1:10 or bandwidth comprised within lower and upper limit frequencies having a ratio less than 1:10, respectively, expressed as a reciprocal; e.g., 1/10 decade (one-tenth-decade), 1/40 decade (one-fortieth-decade), 1/80 decade (one-eightieth-decade), etc.

3.4 fractional octave. Frequency ratio less than or equal to 1:2 or bandwidth comprised within lower and upper limit frequencies having a ratio less than or equal to 1:2, respectively, expressed as the reciprocal of *B,* where *B* is the fractional octave bandwidth; e.g., 1/3 octave (one-third-octave), 1/12 octave (one-twelfth-octave), 1/24 octave (one-twenty-fourth-octave), etc.

NOTE The base-ten system is preferred in acoustics. The fractional octave is computed from the fractional decade, $10^{\frac{3}{10B}}$, where *B* is the fractional octave bandwidth. Therefore, using the base-10 system, 1/3 octave equals 1/10 decade; 1/6 octave equals 1/20 decade; 1/12 octave equals 1/40 decade; 1/24 octave equals 1/80 decade, etc.