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# AMERICAN NATIONAL STANDARD

## **Specification of Hearing Aid Characteristics**

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ANSI/ASA S3.22-2014

Accredited Standards Committee S3, Bioacoustics

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

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**ANSI/ASA S3.22-2014**  
**(Revision of ANSI/ASA S3.22-2009)**

AMERICAN NATIONAL STANDARD

# **Specification of Hearing Aid Characteristics**

**Secretariat:**

**Acoustical Society of America**

**Approved on November 10, 2014, by:**

**American National Standards Institute, Inc.**

## **Abstract**

The standard describes air-conduction hearing aid measurement methods that are particularly suitable for specification and tolerance purposes. Among the test methods described are output sound pressure level (SPL) with a 90-dB input SPL, full-on gain, frequency response, harmonic distortion, equivalent input noise, current drain, and induction-coil sensitivity. Specific configurations are given for measuring the input SPL to a hearing aid. Allowable tolerances in relation to values specified by the manufacturer are given for certain parameters. Annexes are provided to describe an equivalent substitution method, characteristics of battery simulators, static and dynamic characteristics of automatic gain control (AGC) hearing aids, and additional tests to characterize more completely the electroacoustic performance of hearing aids.

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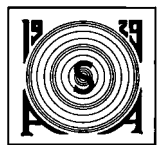
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## Foreword

*[This Foreword is for information only and is not an integral part of ANSI/ASA S3.22-2014 American National Standard Specification of Hearing Aid Characteristics. 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 bioacoustics. It was developed and approved by Accredited Standards Committee S3, Bioacoustics, under its approved operating procedures. Those procedures have been accredited by the American National Standards Institute (ANSI). The Scope of Accredited Standards Committee S3 is as follows:

*Standards, specifications, methods of measurement and test, and terminology in the fields of psychological and physiological acoustics, including aspects of general acoustics which pertain to biological safety, tolerance and comfort.*

The following is a list of the major non-editorial revisions to this edition of the standard:

- added an annex for an optional test of difference frequency distortion;
- moved Annex C.11 Induction Coil Performance With Loops into the main body of the standard;
- deleted the vertical reference angle;
- added a definition of a hearing aid;
- added graphs of attack and release time measurements to annex for Dynamic AGC characteristics;
- added to Annex C optional total harmonic distortion tests at more frequencies;
- the HA-1, HA-2, HA-3 and HA-4 coupler configurations previously defined in ANSI/ASA S3.7 have been updated and included in clause 5.2.3. New figures of these configurations have also been included.

This standard is a revision of ANSI/ASA S3.22-2009, developed originally to establish measurement and specification methods for several definitive hearing aid characteristics and to provide tolerances for some of them. The original purpose of the standard was to provide a means of determining whether a production hearing aid as shipped was as stated by a manufacturer for a particular model, within the tolerances specified in the standard. In the 2009 revision of the standard, considerable effort was made to achieve harmonization with IEC 60118-7.

In the 1996 revision of the standard, the gain control was set to reference test position for automatic gain control (AGC) hearing aids as has been done for all other types of hearing aids. To reduce ambiguity in specifying this procedure, and to reflect common practices in the hearing aid industry at this time, in the 2003 revision of the standard, AGC hearing aids are tested in AGC mode only for tests associated with AGC functions and are operated in non-AGC mode for all other tests. That is, for all hearing aids, for measurements to determine OSPL90, full-on gain, the Reference Test Setting of the gain control (RTS), total harmonic distortion, equivalent input noise, battery current drain, and induction coil sensitivity the hearing aid is set to operate in non-AGC mode. For AGC hearing aids, tests for input-output characteristic and attack and release times are made with the hearing aid operating in AGC mode. In the 2009 revision of the standard, the AGC tests were moved to Annex C and provision was made to use a stationary noise signal as well a sinusoidal signal for some tests.

Although intended for the characterization of air-conduction hearing aids, the methods in this standard can be applied to other systems which have acoustic inputs and outputs, such as personal sound amplification products.



Although the purpose of this standard is quality measurements using the 2 cm<sup>3</sup> coupler, the methods described herein may also be used for design, research, or product development using the 2 cm<sup>3</sup> coupler, occluded ear simulator, or other specialized couplers or ear simulators. Additional advanced methods are found in the annexes.

This standard contains several informative annexes which are not considered to be part of this standard.

Since 1976, earlier versions of this standard have been incorporated into regulations of the United States Food and Drug Administration and have given guidance to manufacturers and consumers of hearing aids and to those who serve the hearing-impaired population.

At the time this Standard was submitted to Accredited Standards Committee S3, Bioacoustics for approval, the membership was as follows:

C.J. Struck, *Chair*  
P. Nelson, *Vice-Chair*

S.B. Blaeser, *Secretary*

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Working group S3/WG48, Hearing Aids, which assisted Accredited Standards Committee, S3, Bioacoustics, in the preparation of this standard, had the following membership who worked actively on this revision:

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William Cole, S3.22 Sub-group Chair  
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Suggestions for improvements to this standard will be welcomed. They should be sent to Accredited Standards Committee S3, Bioacoustics, 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](mailto:asastds@acousticalsociety.org).

## Introduction

This standard describes hearing aid measurements that are particularly suitable for specification and tolerance purposes.

The procedures of this standard employ a reference test setting of the gain control (see 6.6) to which the hearing aid is adjusted for certain measurements such as frequency response, harmonic distortion, and equivalent input noise level. The rationale underlying the use of the reference test setting is that the gain control setting for certain tests should be related to the saturation output capability of the hearing aid. Among the advantages of the gain control setting specified herein are (1) the gain control is set fairly close to a typical "use" setting, and (2) harmonic distortion measurements are made with a setting appropriately related to the maximum output capability of the hearing aid.

**NOTE** The concept of using a gain control setting related to the output capability of a hearing aid was originally put into practice by the National Bureau of Standards in their work for the Veterans Administration. This standard uses similar principles.

An important feature of the procedures described in this standard is the method of determining the input SPL at the microphone opening(s) of the hearing aid (see 3.2.2 and 4.2).

## American National Standard

# Specification of Hearing Aid Characteristics

## 1 Scope, applications and purpose

### 1.1 Scope

This standard describes certain hearing aid measurements and parameters that are deemed useful in determining the electroacoustic performance of an air-conduction hearing aid. Some of these lend themselves to setting of tolerances for the purpose of maintaining product uniformity and for compliance with the performance specified for a model.

It is not the intent of this document to restrict the variety of hearing aid performance available nor to inhibit in any way advances in the state of the art.

This standard is limited to the specification of certain electroacoustic characteristics based on sinusoidal and other steady-state test signals. Measurements described in this standard are not intended to reflect *in situ* performance of hearing aids, directional performance of directional hearing aids, or certain performance properties of digital hearing aids, such as processing delay.

Notes in the standard are not considered to be part of the standard.

### 1.2 Applications

Tolerances are given relative to specified characteristics supplied by a manufacturer. In the case of "custom" or "made-to-order" hearing aids, individual test data are to be supplied. The tolerances specified in the standard will apply to the individual test data supplied.

### 1.3 Purpose

This standard is intended to meet the need for specifications of air-conduction hearing aid performance parameters and their tolerances. The quantities suggested for specifications and tolerances are considered to be useful for comparing performance characteristics of different hearing aids or for comparing performance characteristics of a hearing aid with published specifications.

## 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.

[1] ANSI/ASA S1.1 *American National Standard Acoustical Terminology*

[2] ANSI/ASA S1.6 *American National Standard Preferred Frequencies, Frequency Levels, and Band Numbers for Acoustical Measurements*

[3] ANSI/ASA S3.42-1992/Part 1 (R 2012) *American National Standard Testing Hearing Aids with a Broad-Band Noise Signal*