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ANSI S3.1-1991)

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American National Standard

# **Maximum Permissible Ambient Noise Levels for Audiometric Test Rooms**

Secretariat

**Acoustical Society of America**

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**American National Standards Institute, Inc.**

## **Abstract**

This Standard specifies maximum permissible ambient noise levels (MPANLs) allowed in an audiometric test room that produce negligible masking ( $\leq 2$  dB) of test signals presented at reference equivalent threshold levels specified in ANSI S3.6-1996 *American National Standard Specification of Audiometers*. The MPANLs are specified from 125 to 8000 Hz in octave and one-third octave band intervals for two audiometric testing conditions (ears covered and ears not covered) and for three test frequency ranges (125 to 8000 Hz, 250 to 8000 Hz, and 500 to 8000 Hz). The Standard is intended for use by all persons testing hearing and for distributors, installers, designers, and manufacturers of audiometric test rooms. This standard is a revision of ANSI S3.1-1991 *American National Standard Maximum Permissible Ambient Noise Levels for Audiometric Test Rooms*.

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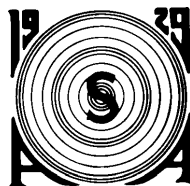
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## Foreword

[This Foreword is for information only and is not an integral part of ANSI S3.1-1999 *American National Standard Maximum Permissible Ambient Noise Levels for Audiometric Test Rooms*.]

This Standard is a revision of ANSI S3.1-1991 *American National Standard Maximum Permissible Ambient Noise Levels for Audiometric Test Rooms*. The 1991 Standard specified maximum permissible ambient noise levels (MPANLs) from 125 to 8000 Hz in octave and one-third octave bands allowed in an audiometric test room that would produce negligible masking of pure tones presented at reference equivalent threshold sound pressure levels specified in ANSI S3.6-1989 for two audiometric conditions (ears covered using a supra-aural earphone and ears not covered) and for three test frequency ranges (125–8000 Hz, 250–8000 Hz, and 500–8000 Hz). The MPANLs were derived using reference equivalent threshold sound pressure levels measured in a NBS 9-A coupler.

This revision also specifies MPANLs from 125 to 8000 Hz in octave and one-third octave bands allowed in an audiometric test room that would produce negligible masking of pure tones for two audiometric conditions and three test frequency ranges. However, the MPANLs specified in this revision were derived using a different computational method based on sound field thresholds, principles of masking for a given threshold shift, power-law summation of masking, and earphone attenuation values. Since the new computational method does not use NBS 9-A coupler based measurements as done in 1991, MPANLs have been specified for an insert as well as for a supra-aural earphone. The present Standard allows slightly more low frequency and slightly less very high frequency ambient noise in an audiometric test room than specified in 1991.

The annexes detail the derivation of the MPANLs and provide information for interim low frequency MPANLs, high frequency ambient noise levels, techniques for physical measurement of ambient noise, supra-aural earphones encased in passive noise-reducing enclosures, and general considerations in planning for an audiometric test room.

Further experimental work concerning the influence of masking on hearing thresholds is encouraged, especially masking of low frequency noise on higher frequency hearing thresholds, very low and high frequency earphone attenuation, and the attenuation provided by passive noise-reducing earphone enclosures. As a result of this research, a more precise specification of permissible ambient noise levels may be developed.

This Standard, a revision of ANSI S3.1-1991 *American National Standard Maximum Permissible Ambient Noise Levels for Audiometric Test Rooms*, was developed under the jurisdiction of Accredited Standards Committee S3, Bioacoustics, which has the following scope:

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

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## American National Standard

# Maximum Permissible Ambient Noise Levels for Audiometric Test Rooms

## 1 Scope, purpose, and applications

### 1.1 Scope

Hearing measurements in an audiometric test room may be conducted for different audiometric purposes over different test frequency ranges. However, if the ambient noise level is excessively high, some hearing threshold levels measured in that environment will be inaccurate. This occurs because excessively high ambient noise will create an elevation of hearing threshold levels. This is a psychoacoustic phenomenon called masking.

Exclusion of all ambient noise from an audiometric test room is not feasible nor practical from structural and cost considerations. However, to ensure that hearing tests are not influenced by excessive ambient noise masking, there is a need to specify maximum permissible ambient noise levels (MPANLs) that can be allowed in an audiometric test room. This is true particularly when testing is done at sound pressure levels for pure tones corresponding to 0 dB hearing level. Further, there is a need to specify MPANLs for different audiometric conditions, test frequency ranges, and earphone types that will permit testing at reference equivalent threshold levels specified in ANSI S3.6-1996 *American National Standard Specification for Audiometers*.

This Standard includes the specification and measurement of MPANLs in an audiometric test room. Within this Standard, MPANLs are specified for octave and one-third octave band intervals from 125 to 8000 Hz for the audiometric conditions of testing with ears covered using a supra-aural and insert earphone and ears not covered for the test frequency ranges 125 to 8000 Hz, 250 to 8000 Hz, and 500 to 8000 Hz.

### 1.2 Purpose

The purpose of this Standard is to specify MPANLs in an audiometric test room and measurement procedures that will produce negligible masking ( $\leq 2$  dB) of pure tones presented at reference equivalent threshold levels as specified in ANSI S3.6-1996 *American National Standard Specifications for Audiometers* for different audiometric conditions and test frequency ranges.

This Standard is intended for use by all persons conducting hearing tests to ensure that ambient noise in an audiometric test room will not have a masking effect or influence on hearing measurements. This Standard is also intended for distributors, installers, designers, and manufacturers so that they can plan and construct appropriate acoustical treatment for the reduction of ambient noise in audiometric test rooms.

### 1.3 Applications

This Standard is a revision of ANSI S3.1-1991 *American National Standard Maximum Permissible Ambient Noise Level for Audiometric Test Rooms*. This Standard pertains to all audiometric testing conditions, particularly to those conditions that require measurement of hearing thresholds. Specifically, the ears covered MPANLs shall apply when both ears are covered by an earphone in a supra-aural cushion or when an insert earphone is placed in each ear canal, as would be the usual case for pure tone air conduction audiometry. The ears not covered MPANLs shall apply when audiometric testing is conducted with one ear not covered by an earphone, as would be typical for pure tone bone conduction audiometry. The ears not covered MPANLs also shall apply when audiometric testing is conducted with both ears not covered, as would be typical for sound field audiometry.

The Standard assumes that ambient noise masking of signals below reference equivalent threshold levels is tolerable. This assumption is not appropriate in applications where hearing thresholds lower than reference equivalent threshold levels must be measured. However, the audibility of all signals presented at levels equal to or greater than reference equivalent threshold levels must be such that the threshold of an average normally hearing listener will be free of any significant effects from ambient noise masking.

This Standard specifies that ambient noise in an audiometric test room shall be measured at octave