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AMERICAN NATIONAL STANDARD

METHOD FOR MEASURING THE PERFORMANCE OF NOISE DISCRIMINATING AND NOISE CANCELING MICROPHONES

ANSI S1.16-2000

Accredited Standards Committee S1, Acoustics

Standards Secretariat
Acoustical Society of America
120 Wall Street, 32nd Floor
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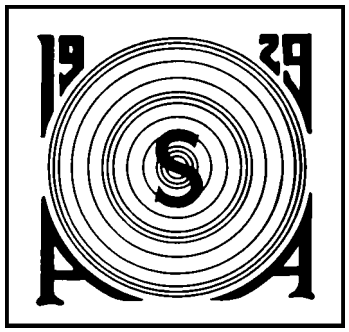

American National Standard

Method for Measuring the Performance of Noise Discriminating and Noise Canceling Microphones

Secretariat

Acoustical Society of America

Approved 19 May 2000

American National Standards Institute, Inc.

Abstract

This American National Standard describes procedures for measuring the performance of noise discriminating and noise canceling microphones. The signal-to-noise ratio is measured at 1/3 octave band intervals with the desired test source in a diffuse noise field. The noise canceling performance of the microphone is defined as the noise canceling index (NCI), a weighted summation of the signal-to-noise ratios. The NCI of the microphone under test can be compared to the required baseline NCI of a laboratory standard pressure microphone.

AMERICAN NATIONAL STANDARDS ON ACOUSTICS

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Foreword

[This Foreword is for information only and is not an integral part of *American National Standard Method for Measuring the Performance of Noise Discriminating and Noise Canceling Microphones*, ANSI S1.16-2000.]

Noise canceling microphones are used in numerous applications where improved signal-to-noise ratios are important for speech communication and/or other audio applications. Arrays of microphones connected together by hardware and/or software can also improve the signal-to-noise ratio. This Standard addresses the need to have a standard methodology to measure the performance of these types of devices.

This Standard was developed under the jurisdiction of Accredited Standards Committee S1, Acoustics, which 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.*

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

G. S. K. Wong, *Chair*
T. J. Kuemmel, *Vice Chair*
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L. Letowski (*Alt.*)
U.S. Army Primary Standards Laboratory (APSL) of the TMDE Support Group ..... J. R. Arrington

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

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S. L. Ehrlich	D. L. Johnson	P. D. Schomer
K. M. Eldred	W. W. Lang	H. E. von Gierke
W. J. Galloway	A. H. Marsh	G. S. K. Wong
		R. W. Young

Working Group S1/WG15, Noise Canceling Microphones, which assisted Accredited Standards Committee S1, Acoustics, in the development of this Standard, had the following membership:

R. L. McKinley, *Chair*

J. Bareham	J. J. Earshen	R. J. Peppin
A. Campanella	T. A. Heline	G. S. K. Wong
R. Campbell	A. H. Marsh	R. W. Young

Suggestions for improvement of this Standard will be welcomed. Send suggestions for improvement to Accredited Standards Committee S1, Acoustics, in care of the ASA Standards Secretariat, 120 Wall Street, 32nd Floor, New York, NY 10005-3993, USA.

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American National Standard

Method for Measuring the Performance of Noise Discriminating and Noise Canceling Microphones

1 Scope, purpose, and applications

1.1 Scope

This Standard specifies the laboratory physical measurement procedure, calculation, and results reporting for quantifying the performance of noise canceling and noise discriminating microphones in a diffuse noise field.

1.2 Purpose

The purpose of this Standard is to describe procedures designed to measure the noise canceling performance of noise canceling and noise discrimination microphones in a diffuse sound field. This method provides a measure of merit, the Noise Canceling Index, which can be used to quantify the overall performance of a microphone in canceling or discriminating noise when compared to a laboratory quality pressure microphone meeting ANSI S1.12-1967 (R 1997).

1.3 Applications

The test method used in this Standard applies to measuring the noise canceling performance of noise canceling microphones, such as first and second order pressure gradient microphones, noise discriminating microphones, such as cardioid or shotgun microphones, and microphone systems, such as array microphones.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this American National Standard. At the time of approval by the American National Standards Institute, Inc. (ANSI), the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this American National Standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed below. Information on the recent editions is available from the ASA Standards Secretariat.

ANSI S1.1-1995 (R 1999), *American National Standard, Acoustical Terminology*

ANSI S1.15-1997/Part 1, *American National Standard Measurement Microphones*, Part 1: Specifications for Laboratory Standard Microphones

3 Definitions

3.1 A **Noise canceling microphone** uses a pressure gradient transducer to differentiate a signal having a high pressure gradient from noise having a low pressure gradient.

3.2 A **Noise discriminating microphone** uses only its directional polar response to differentiate a signal arriving on the axis of greatest sensitivity from a noise arriving from all directions.

3.3 Microphone system. A system consisting of one or more microphones, elements interconnected to perform a specific response function as an integrated physical transducer.

3.4 Test volume. A volume, as in figure 1, where a microphone device under test (DUT or LS1P) can be placed to determine its noise discriminating characteristics. This volume must be free of reflections and must furnish a uniform and diffuse acoustical noise field over the range of audio frequencies at which the DUT will be evaluated. This volume should be large enough to allow positioning and securing of the microphone device under test as well as an LS1P microphone, to determine the test sound level. Test sound field gradient and noise field should be present.

3.4.1 rho (radius vector). The radius vector from the source center, usually assumed to be at the center of the lip ring, to the measurement position in the test volume.

3.4.2 theta (azimuthal angle). The horizontal angle from the normal to the lip ring plane to the plane containing the measurement position and the source position.

3.4.3 phi (elevation angle). The vertical angle from the normal to the lip ring plane to the plane containing the measurement position and a horizontal line through the source.

3.4.4 test fixture. An apparatus or jig which maintains the relative positions of the source, the