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ANSI S1.22-1992
(ASA 100-1992)

AMERICAN NATIONAL STANDARD

SCALES AND SIZES FOR FREQUENCY CHARACTERISTICS AND POLAR DIAGRAMS IN ACOUSTICS

Accredited Standards Committee S1, Acoustics

Standards Secretariat
c/o Acoustical Society of America
335 East 45th Street
New York, New York 10017-3483

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AMERICAN NATIONAL STANDARD
Scales and Sizes for Frequency Characteristics and Polar Diagrams in Acoustics

ACCREDITED STANDARDS COMMITTEE S1, ACOUSTICS

ABSTRACT

For rectangular cartesian graphs in which a level (in decibels) of an acoustical quantity is plotted against frequency on a logarithmic scale, the scale proportions shall be those for which the length for a 10·1 frequency ratio on the abscissa is equal to the length for a level difference of 25, 50, or 10 decibels (dB) on the ordinate For polar diagrams in which an absolute or relative level (in decibels) is shown increasing outward along a radius on a linear scale, a reference circle shall be identified whose radius is a difference in level of 50 dB (alternatively, 25 dB), and such that maximum level is preferably plotted within 5 dB (alternatively, 2 5 dB) of the reference circle. For polar diagrams of relative level, the level assigned to the reference circle is preferably 0 dB, the angle assigned to the reference direction is preferably zero degrees. The preferred size for one decibel is 2, 1, or 5 mm.

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AMERICAN NATIONAL STANDARDS ON ACOUSTICS

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These standards are developed and published as a public service to provide standards useful to the public, industry, and consumers, and to Federal, State, and local governments.

This standard was approved by the American National Standards Institute as ANSI S1.22-1992 on 7 February 1992.

An American National Standard implies a consensus of those substantially concerned with its scope and provisions An American National Standard is intended as a guide to aid the manufacturer, the consumer, and the general public The existence of an American National Standard does not in any respect preclude anyone, whether he has approved the standard or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the standard American National Standards are subject to periodic review and users are cautioned to obtain the latest editions

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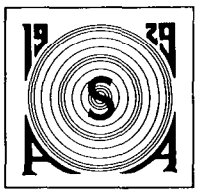

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FOREWORD

[This Foreword is for information only and is not a part of the American National Standard Scales and Sizes for Frequency Characteristics and Polar Diagrams in Acoustics, ANSI S1 22–1992 (ASA Catalog No 100-1992)]

American National Standard Scales and Sizes for Frequency Characteristics and Polar Diagrams in Acoustics, ANSI S1.22-1992, in essence is the same as International Electrotechnical Commission Standard Scales and Sizes for Plotting Frequency Characteristics and Polar Diagrams, IEC Publication 263 (1982). The text of ANSI S1.22-1992 has been rearranged to clarify instructions for preparation of polar diagrams. Appendix A of ANSI S1.22-1992 differs from that of IEC 263 (1982) in that spectra of sound exposure level are shown in the first illustrative graph rather than spectra of sound pressure level; polar diagrams are printed 0.5 times original size instead of 0.8 times original size, to illustrate a preferable reduction; the height of lettering is 1/40 to 1/50 the narrow dimension of a figure, rather than 1/70 as in IEC 263 (1982), to yield transparencies or slides which, when projected, can be easily read from a typical viewing distance.

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, Acoustics.

Accredited Standards Committee S1, Acoustics, under whose jurisdiction this standard was developed, 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 safety, tolerance, and comfort

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

D. L. Johnson, *Chair*
E. H Toothman, *Vice-Chairman*
A. Brenig, *Secretary*

Acoustical Society of America ● T F W Embleton, D L Johnson (*Alt*)
Air-Conditioning and Refrigeration Institute ● R Harold, H C Skarbek (*Alt*)
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U.S. Army Construction Engineering, Research Laboratory ● P D Schomer, R Raspet (*Alt*)

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

L Batchelder
S L Ehrlich
K M Eldred
D R Flynn
R S Gales
W J Galloway
E E Gross, Jr
R M Guernsey
R K Hillquist
R Huntley
W W Lang
G C Maling, Jr
A H Marsh
A P G Peterson
L W Sepmeyer
W R Thornton
H E von Gierke
G S K Wong
R W Young

Working Group S1/WG10 on Scales and Ratios for Plotting, which assisted Accredited Standards Committee S1, Acoustics, in the preparation of this standard, had the following membership:

R W Young, *Chair*

Suggestions for improvements in this standard will be welcomed. They should be sent to **Accredited Standards Committee S1, Acoustics, at the Standards Secretariat, in care of the Acoustical Society of America, 335 East 45th Street, New York, NY 10017-3483. Telephone: (212) 661-9404.**

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American National Standard
Scales and Sizes for Frequency Characteristics and Polar Diagrams in Acoustics

0. INTRODUCTION

0.1 For displaying response-frequency characteristics, different ranges and orders of accuracy are needed. Thus, a range of 10 decibels (dB) may suffice for the response of a standard microphone, but a range of more than 80 dB may be required for the attenuation response of a filter. Although such requirements illustrate the need for different scale sizes, to facilitate comparisons the number of proportions should be kept to a minimum.

0.2 When identical scale sizes are used, rectangular cartesian curves on translucent paper may be laid over one another for easy comparison. Although graphs for publication may be reduced to fit the printed page, the use of a standard proportion makes it feasible to compare graphs from different publications by direct superposition of suitable enlargements.

0.3 A visual appraisal of a polar diagram is affected by the magnitude of the level being plotted radially, as well as the scale of the level. Radial scale-length ratios are here standardized to facilitate comparison of polar diagrams. Such standardization of proportion is intended to insure that the visual impression of how far the major lobe extends from the center is relatively independent of the length for one decibel.

1. SCOPE

1.1 This Standard specifies standard proportions and preferred sizes of scales for plotting acoustical frequency characteristics and polar level diagrams.

1.2 This Standard is not a requirement for audiograms.

2. PURPOSE

2.1 A purpose of this Standard is to provide a minimum number of standard proportions of scales for graphs on which the level (in decibels) of an acoustical quantity is plotted against frequency on a logarithmic scale, or against polar angle.

2.2 Another purpose of this Standard is to specify preferred sizes for the level (or level difference) scale on rectangular cartesian plots and for the level difference corresponding to the radius of a reference circle on polar level diagrams.

3. APPLICATIONS

3.1 For many applications ultimate interest is in the spectrum that results from the combination of an input signal and the responses of several individual elements such as a microphone, amplifier, loudspeaker, and a transmission loss possibly due to a filter, a structure, or the atmosphere. Instruments such as a hearing aid, a recorder, and a vibration measuring apparatus may be involved. The contribution of each element to the final result is more readily understood if the response-frequency characteristic of each element is plotted to scales at least having a standard proportion.

4. LOGARITHMIC FREQUENCY SCALES

4.1 For a rectangular cartesian graph in which a level of stated kind (in decibels) is plotted against frequency (or frequency ratio) on a logarithmic scale, the scale proportions shall be those for which the length for a 10:1 frequency ratio on the abscissa is equal to the length for a level difference of 25, 50, or 10 dB on the ordinate.

4.2 The three standard proportions can be attained respectively by use of a length of 50 mm for the 10:1 frequency ratio on the logarithmic frequency scale, and 2, 1, or 5 mm for one decibel. Also, the standard proportions can be attained by use of a length of 2.5 inches for the 10:1 frequency ratio, and 0.1, 0.05, or 0.25 inch for one decibel.

4.3 The preferred size for one decibel is 2, 1, or 5 mm.

5. POLAR LEVEL DIAGRAMS

5.1 For a radial plot of absolute level at a given distance versus polar angle from a stated reference direction preferably upward on the page, the radius of the reference circle from the center of the circle shall be a difference in level of 50 dB (alternatively, 25 dB). The absolute level associated with the reference circle shall be a multiple of 10 dB if the radius of the reference circle is a level difference 50 dB; the absolute level of the reference circle should be such that maximum absolute level can be plotted within 5 dB of the reference circle. Alternatively, the absolute level associated with

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