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Acoustics — Declared noise emission values of information technology and telecommunications equipment

Acoustique — Valeurs déclarées d'émission acoustique des équipements liés aux technologies de l'information et aux télécommunications

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html

This document was prepared by Technical Committee ISO/TC 43, *Acoustics*, Subcommittee SC 1, *Noise.*

This second edition cancels and replaces the first edition (ISO 9296:1988), which has been technically revised, and in addition contains the following changes:

— the Normative references clause has been updated and certain references moved to the Bibliography;

— a new Annex A has been added;

— a Bibliography has been added.

Introduction

Information on acoustical noise emission of information technology and telecommunications equipment (ITT equipment) is needed by users, planners, manufacturers and authorities. This information is required for comparison of the noise emissions from different products and for installation acoustics planning and may be used for workplace noise immission requirements.

In order for equipment noise emission data to be useful, uniform methods are necessary for the following purposes:

— Measurement of noise emission values

ISO 7779 specifies procedures for determining sound power level based on ISO 3741[1] ISO 3744[2] and ISO 3745[3] (reverberation test room or hemi-anechoic room) and emission sound pressure level based on ISO 11201.[7]

— Determination of the noise emission values to be declared

ISO 4871[4] gives guidelines for the preparation of standards for deriving noise emission values for declaration purposes, and the ISO 7574 series[5,6] gives statistical methods for such determination. This document is based on the above-mentioned International Standards.

— Presentation of declared noise emission values

For the presentation of declared noise emission values, it is of prime importance to declare A-weighted sound power levels, L_{WA}. It is recognized, however, that users still desire information on A-weighted emission sound pressure levels, L_{pA}. Therefore, this document provides methods for declaration of both quantities. In the preparation of this document, divergent opinions have been found between various national and international organisations as to the most useful way of presenting noise emission values. In order to avoid any misunderstanding between presentation of sound power levels (re 1 pW) in decibels and emission sound pressure levels (re 20 μPa) in decibels, this document expresses sound power level values to be declared in bels and emission sound pressure level values in decibels, to alleviate the divergent opinions mentioned.

As an option, methods for determination and presentation of subjective characteristics of noise emission are presented in Annex C.

— Verification of declared noise emission values

ISO 7574-4[6] gives methods for the verification of a declared noise emission value. In this document, the procedure is restricted to verifying the statistical upper limit A-weighted sound power level, $L_{WA,c}$, only.

For continuity with ISO 9296:1988 and current practice, this document specifies bels as the unit for declaring sound power levels. It should be noted, however, that the decision has been made to change the unit to decibels in the next edition, and users of this document should begin to prepare for this transition.

Acoustics — Declared noise emission values of information technology and telecommunications equipment

1 Scope

This document is applicable to information technology and telecommunications equipment.

It specifies:

a) for a batch of equipment, the method for determining the following values:

— the declared mean A-weighted sound power level, $L_{WA,m}$;

— the declared mean A-weighted emission sound pressure level, $L_{pA,m}$;

— the statistical adder for verification, K_v;

— the statistical upper limit A-weighted sound power level, $L_{WA,c}$;

b) how acoustical and product information is to be published electronically or in hard-copy format in technical documents or other product literature supplied to users by the manufacturer or declarer;

c) the method for verifying the noise emission values that are declared by the manufacturer or declarer.

NOTE The terms "manufacturer" and "declarer" are used in this document to represent any entity that provides product noise emission information. For instance, a product supplier or importer who does not manufacture the hardware, but offers noise emissions information, is also referred to a manufacturer or a declarer as applicable, in this document.

The uniform methods in this document use the noise emission data obtained in accordance with ISO 7779, and the declaration and verification procedures detailed in ISO 4871[4] and ISO 7574-4.[6]

The basic noise emission values to be declared are the declared mean A-weighted sound power levels, $L_{WA,m}$. Optionally, the declared mean A-weighted emission sound pressure levels at the operator or bystander positions, $L_{pA,m}$, can be declared. These are arithmetic mean values based upon measurements on a random sample of equipment of the batch, in accordance with ISO 7779.

For verification purposes, an additional quantity is required to be declared: the statistical adder for verification, K_v. This is a quantity that is added to the declared mean A-weighted sound power level, $L_{WA,m}$, and used in the verification section of this document to provide a consistent and predictable probability of acceptance for the batch of equipment.

The declared mean A-weighted sound power level for the batch of equipment permits comparison of noise emissions between different products and permits predictions of installation or work-place noise immission levels, as described in ECMA TR/27.[9]

Although the most useful quantity for calculating immission levels due to one or more noise sources is the A-weighted sound power level of the individual source(s), the A-weighted emission sound pressure level may also be useful in estimating the immission level in the immediate vicinity of an isolated piece of equipment.

To avoid confusion between sound power levels and emission sound pressure levels, the declared mean A-weighted sound power level, $L_{WA,m}$, is expressed in bels (B) and the declared mean A-weighted emission sound pressure level, $L_{pA,m}$, is expressed in decibels (dB).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 7779, *Acoustics — Measurement of airborne noise emitted by information technology and telecommunications equipment*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1 General definitions

3.1.1
information technology and telecommunications equipment
ITT equipment
equipment for information processing, and components thereof, used in homes, offices, server installations, telecommunications installations or similar environments

[SOURCE: ISO 7779:2010, 3.1.3]

3.1.2
batch of equipment
lot of equipment
number of units of information technology or telecommunications equipment intended to perform the same function produced in quantity, manufactured to the same technical specifications and characterized by the same declared noise emission value

Note 1 to entry: The batch may be either an entire production series or a portion thereof.

3.1.3
functional unit
unit of *ITT equipment* (3.1.1), either with or without its own end-use enclosure, that is tested or intended to be tested in accordance with the procedures of ISO 7779

Note 1 to entry: A functional unit can comprise more than one unit of ITT equipment when such units are to be tested together in accordance with the methods of ISO 7779. A functional unit can also comprise one or more units of ITT equipment coupled to one or more units of non-ITT equipment, such as power modules, water pumps, or refrigeration units, when such equipment is necessary for the normal operation of the ITT equipment.

Note 2 to entry: Functional units of ITT equipment can take on a wide range of forms, including commercially available products, prototype units under development, or sub-assemblies and components thereof.

Note 3 to entry: In this document, for simplicity, a functional unit may be expressed as a unit (see 3.2.1 and 3.2.2).

3.1.4
operating mode
condition specified in ISO 7779 in which the equipment being tested is performing its intended function(s)

Note 1 to entry: When possible to implement for acoustic testing, the conditions specified in the relevant annex of ISO 7779 are considered to be typical of average end use.

3.1.5
idle mode
steady-state condition (one or more) specified in ISO 7779, in which the equipment being tested is energized, but is not performing any intended function(s)

3.2 Definitions relating to acoustics

3.2.1
A-weighted sound power level
L_{WA}
sound power level, determined for a particular unit of *ITT equipment* (3.1.1) in accordance with ISO 7779, with A-weighting applied

Note 1 to entry: The A-weighted sound power level, L_{WA} (re 1 pW) is expressed in decibels.

3.2.2
A-weighted emission sound pressure level
L_{pA}
emission sound pressure level, determined for a particular unit of *ITT equipment* (3.1.1) in accordance with ISO 7779, with A-weighting applied, at the operator position(s), or at the bystander positions if no operator position is specified

Note 1 to entry: The A-weighted emission sound pressure level, L_{pA} (re 20 µPa) is expressed in decibels.

3.2.3
sample mean A-weighted sound power level
$\overline{L_{WA}}$
arithmetic average of the *A-weighted sound power levels* (3.2.1) determined for a random sample taken from the *batch of equipment* (3.1.2)

Note 1 to entry: The sample mean A-weighted sound power level, $\overline{L_{WA}}$ (re 1 pW) is expressed in decibels.

Note 2 to entry: This is not a declared noise emission value, but is an interim value to be used for the purpose of computing sample standard deviation of production, s_p for the batch under consideration (see 3.3.3).

3.2.4
declared mean A-weighted sound power level
$L_{WA,m}$
arithmetic average of the *A-weighted sound power levels* (3.2.1) for the *batch of equipment* (3.1.2), used for noise emission declaration

Note 1 to entry: The declared mean A-weighted sound power level, $L_{WA,m}$ (re 1 pW) is expressed in bels.

3.2.5
sample mean A-weighted emission sound pressure level
$\overline{L_{pA}}$
arithmetic average of the A-weighted emission sound pressure levels determined for a random sample taken from the *batch of equipment* (3.1.2)

Note 1 to entry: The sample mean A-weighted emission sound pressure level, $\overline{L_{pA}}$ (re 20 µPa) is expressed in decibels.

Note 2 to entry: This is not a declared value, but is an interim value to be used for the purpose of computing the declared mean A-weighted emission sound pressure level.

3.2.6
declared mean A-weighted emission sound pressure level
$L_{pA,m}$
arithmetic average of the A-weighted emission sound pressure levels for the *batch of equipment* (3.1.2), used for noise emission declaration

Note 1 to entry: The declared mean A-weighted emission sound pressure level, $L_{pA,m}$ (re 20 µPa) is expressed in decibels.

3.2.7
declared noise emission values
value of the declared *mean A-weighted sound power level* (3.2.1), $L_{WA,m}$, or the declared mean *A-weighted emission sound pressure level* (3.2.2), $L_{pA,m}$, or both, and *statistical adder for verification* (3.3.6), K_v, declared for the batch of new equipment

Note 1 to entry: Based on $L_{WA,m}$ and K_v, the statistical upper limit A-weighted sound power level, $L_{WA,c}$, can be computed in accordance with Clause 7.

3.2.8
statistical upper limit A-weighted sound power level
$L_{WA,c}$
limit below which 93,5 % of the *A-weighted sound power levels* (3.2.1) of the batch of new equipment are expected to lie

Note 1 to entry: The statistical upper limit A-weighted sound power level, $L_{WA,c}$ (re 1 pW) is expressed in bels.

Note 2 to entry: According to ISO 7574-4:1985[6] Clause 7, a 95 % probability of acceptance can be assumed if no more than 6,5 % of the equipment in a batch has A-weighted sound power levels greater than $L_{WA,c}$, and the verification procedures therein are used.

Note 3 to entry: The statistical upper limit A-weighted sound power level, $L_{WA,c}$, was called the declared A-weighted sound power level, L_{WAd} in ISO 9296:1988.

3.3 Definitions relating to statistics

NOTE In this document, the symbol σ is used for a standard deviation of a population and the symbol s for a standard deviation of a sample.

3.3.1
standard deviation of repeatability
σ_r
standard deviation of sound power level values obtained under repeatability conditions, that is, the repeated application of the same measurement method on the same equipment within a short interval of time under the same conditions (same laboratory, same operator, and same apparatus)

3.3.2
standard deviation of reproducibility
σ_R
standard deviation of sound power level values obtained under reproducibility conditions, that is, the repeated application of the same measurement method on the same unit of *ITT equipment* (3.1.1) at different times and under different conditions (different laboratory, different operator, different apparatus)

Note 1 to entry: The standard deviation of reproducibility, σ_R, therefore, includes the standard deviation of repeatability, σ_r.

3.3.3
standard deviation of production
σ_p
standard deviation of sound power level values obtained on different units from a batch of *ITT equipment* (3.1.1) of the same family, using the same measurement method under repeatability conditions (same laboratory, same operator, and same apparatus)

3.3.4
total standard deviation
σ_t
square root of the sum of the squares of the standard deviation of reproducibility, σ_R, and the standard deviation of production, σ_p for the equipment in the batch

$$\sigma_t = \sqrt{\sigma_R^2 + \sigma_p^2}$$

3.3.5
reference standard deviation
σ_M
total standard deviation (3.3.4) in sound power level values, specified for the family of *ITT equipment* (3.1.1) under consideration which is considered typical for batches from this family

Note 1 to entry: For the purposes of this document, the reference standard deviation for any family of ITT equipment is fixed to 2,0 dB. See 7.1.

Note 2 to entry: The use of a fixed value of σ_M enables the application of a statistical method to deal with small verification sample sizes. If the total standard deviation, σ_t is different from the reference standard deviation, σ_M, the manufacturer can estimate his risk of rejection on the basis of both standard deviations, σ_t and σ_M (see ISO 7574–4[6]).

3.3.6
statistical adder for verification
K_v
quantity to be added to the declared *mean A-weighted sound power level* (3.2.1), $L_{WA,m}$, such that there will be a 95 % probability of acceptance, when using the verification procedures of this document, if no more than 6,5 % of the batch of new equipment has A-weighted sound power levels greater than ($L_{WA,m}$ + K_v)

Note 1 to entry: The statistical adder for verification, K_v, is expressed in bels.

Note 2 to entry: K_v is determined by the procedures in Annex A.

Note 3 to entry: The statistical adder for verification, K_v, should not be confused with a type of uncertainty[8]. Uncertainty is usually well-documented in the underlying measurement standards and generally represents a plus-or-minus variation around the measured value. Here, K_v is a positive adder only and is used to arrive at a consistent and predictable probability of acceptance when using the statistical verification procedure in Clause 7.

4 Conformity requirements

4.1 For declaration

Declarations are in conformity with this document if they meet the following requirements:

a) for the acoustical noise measurements, the measurement procedures and the installation and operating conditions are in full conformance with ISO 7779;

b) for the determination and presentation of declared noise emission values, the procedures of Clauses 5 and 6 are followed and the requirements therein are met.