SLOVENSKI STANDARD
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Inġeniring opreme (EE) - Akustiļ ni ġum, ki ga oddaja telekomunikacijska oprema

Equipment Engineering (EE) - Acoustic noise emitted by telecommunications equipment

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Foreword

This European Standard (Telecommunications series) has been produced by ETSI Technical Committee Environmental Engineering (EE).

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Introduction

Compatibility with the end-use environment is a primary concern for purchasers and manufacturers of telecommunications equipment. An important compatibility issue is the amount of acoustic noise emitted by the equipment. The present document is intended to meet four primary needs of purchasers and manufacturers with regard to this issue:

- specification of acoustic noise emission measurement methods;
- specification of acoustic noise emission limits;
- specification of a method for reporting acoustic noise emission;
- specification of a method for verification of declared noise emission values.

To develop practical specifications and to have the capacity to make fair comparisons between equipment, it is essential to have a single, technically established method for the measurement of acoustic emission. Therefore, the present document specifies the use of sound power measurement and, more specifically, adopts ISO 7779 [1] as the primary measurement document.

Sound power levels can be used for direct comparison of noise emission for functionally similar equipment manufactured by different vendors, and/or in the calculation of estimated sound pressure levels for spaces where the equipment is to be installed. The use of sound *power* level, instead of emission sound *pressure* level, as the specified quantity for product noise emission has clear precedent within the international noise control community.

The acceptability of the acoustic emission from a piece of equipment depends upon a number of details that vary from installation to installation, and the number of possible installations is extensive. Accordingly, the goal of the present document is to specify limits that are applicable to the major installation categories.

The fundamental concern prompting the development of the present document is the potential adverse impact that excessive equipment noise can have on people. For that reason, the impact of noise upon human activities has been carefully considered, and the intent has been to ensure that the acoustic noise emitted is at, or below, generally accepted levels. The perceptual issues considered included task concentration, speech communication, annoyance and other similar parameters. Generally, the relevant noise exposure levels are well below those needed to ensure worker safety and health. Requirements related to worker safety and health (including those related to infrasound and ultrasound) can be found in EC Directive 2003/10/EC [4].

The present document specifies that manufacturers report measured A-weighted sound power values for equipment. Given that it is impractical and unnecessary to measure every manufactured unit, the reported sound power value should be one that all, or nearly all, units of a particular model will not exceed. This means that the reported value needs to take into account both production variation and the precision of the measurement method. ISO 9296 [2] specifies methods that address these issues and is therefore specified in the present document as the method for declaring sound power values. ISO 9296 [2] also specifies a method for verification of declared sound power values.

For further information regarding the motivation for the development of the present document, see annex D.

1 Scope

The present document specifies acoustic noise emission limits for equipment used in telecommunication locations as specified in the EN 300 019-1 [3] series. The present document covers switching, transmission, power, supervisory, as well as tariff and billing equipment.

The present document also specifies methods for measuring, reporting and verifying the noise emission of telecommunications equipment. The details of the methods are found in ISO 7779 [1], ISO 9296 [2] and in the basic standards ISO 3741 [7], ISO 3744 [8] and ISO 3745 [9]. The descriptor used to quantify acoustic noise emission is the declared A-weighted sound power level in units of bels.

The limits contained herein apply only to the airborne acoustic noise generated by equipment during normal operation. That is, the limits do not apply when operating under emergency conditions or when the equipment is being serviced. Also, the limits do not apply to equipment features which produce sound as an intentional aspect of their operation, e.g. alarm signals, attention signals, speech signals and so on. (For more information on that topic, see ETR 116 [5]). Furthermore, the present document does not specify maximum sound pressure level limits in specific environments.

Contained within the present document are 6 annexes. Annex A specifies methods for measuring the acoustic noise emitted from equipment manufactured for open air outdoor locations. Annex B contains tables of recommended A-weighted sound power limits for open air outdoor equipment. Annex C discusses the emission of pure tones from equipment. Annex D reviews the motivation for the creation of the present document. Annex E discusses the relationship between sound power and sound pressure. Annex F briefly summarizes the sound power measurement methods used within the present document.

2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific.

- For a specific reference, subsequent revisions do not apply.
- Non-specific reference may be made only to a complete document or a part thereof and only in the following cases:
  - if it is accepted that it will be possible to use all future changes of the referenced document for the purposes of the referring document;
  - for informative references.

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2.1 Normative references

The following referenced documents are indispensable for the application of the present document. For dated references, only the edition cited applies. For non-specific references, the latest edition of the referenced document (including any amendments) applies.

[1] ISO 7779: "Acoustics - Measurement of airborne noise emitted by information technology and telecommunications equipment".

[2] ISO 9296: "Acoustics - Declared Noise Emission Values of Computer and Business Equipment".

[3] ETSI EN 300 019-1 (1994): "Equipment Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment Part 1: Classification of environmental conditions" (this EN has eight sub-parts).

[4] EC Directive 2003/10/EC: "On the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (noise)" [OJ L 42, 15.02.2003 p.38-44].

[5] ETSI ETR 116 (1994): "Human Factors (HF); Human factors guidelines for ISDN Terminal equipment design".

[6] ECMA TR/27: "Method for prediction of installation noise levels".

[7] ISO 3741 (1999): "Acoustics - Determination of sound power levels of noise sources using sound pressure - Precision methods for reverberation rooms".

[8] ISO 3744 (1994): "Acoustic - Determination of sound power levels of noise sources using sound pressure - Engineering method in an essentially free field over a reflecting plane".

[9] ISO 3745 (2003): "Acoustics - Determination of sound power levels of noise sources using sound pressure - Precision methods for anechoic and hemi-anechoic rooms".

2.2 Informative references

The following referenced documents are not essential to the use of the present document but they assist the user with regard to a particular subject area**.** For non-specific references, the latest version of the referenced document (including any amendments) applies.

Not applicable.

3 Definitions and symbols

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

A-weighting filter: response characteristic of a filter used in acoustic measurement systems which attenuates low frequency and high frequency acoustic energy

NOTE: This filter is used to provide a frequency response characteristic similar to that of the human auditory system.

business area: area where the principal activity is office / clerical work or similar activities

NOTE: These areas typically contain multiple single-person work areas. Sound levels should be low enough to provide good conditions for task concentration and speech communication.

daytime: part of the day considered to extend over normal waking hours

NOTE: Typically, the period during which people are most likely to be engaged in activities related to business, education, active recreation, etc.

declared A-weighted sound power level (L_{WAd}): statistical maximum A-weighted sound power level for manufactured units, taking into account tolerances of production and measurement variance, described in ISO 9296 [2]

NOTE: Typically, L_{WAd} is 0,3 bels higher than the A-weighted sound power level measured on an average manufactured unit. L_{WAd} is used for all equipment classes and in the specification of noise emission limits. Units: bels.

free field over a reflecting plane: sound field in a homogeneous, isotropic medium in the half-space above an infinite, rigid plane surface on which the source is located

hemi-anechoic room: room in which a free field over a reflecting plane is obtained

high temperature A-weighted sound power level (HL_{WAd}): statistical maximum A-weighted sound power level for manufactured units, taking into account tolerances of production and measurement variance

NOTE: The method for determining the high temperature A-weighted sound power level is similar to that used in the determination of declared sound power values, as described in ISO 9296 [2]. HL_{WAd} is used for equipment whose operational noise varies with temperature. Units: bels.

high temperature limit: maximum temperature specified for the stated environmental class of the equipment under test according to the relevant subpart of EN 300 019-1 [3]

industrial: relating to areas, typically, of transient population and heavy manufacturing activity

night-time: part of the day considered to be normal sleeping hours

NOTE: This period includes evening and early morning hours when people are likely to be awake but not yet fully involved in typical daytime activities.

office: area where individuals are primarily engaged in individual or small group intellectual tasks which require excellent conditions for task concentration and speech communication

NOTE: A typical example would be a single-person closed office.

power room: area designed to house heavy equipment including, but not limited to, power generation equipment, heating equipment, and ventilation equipment

NOTE: Typically occupied only for short periods during servicing.

protected area: location intended to be used for rest, recuperation and contemplation

NOTE: There is no IEC description for this class but there is a requirement of some European countries for this special category. These areas could be adjacent to hospitals, churches, libraries, etc.

rural: areas, typically, in the countryside with low population density

sound power level (L_W): logarithm (base 10) of the ratio of a given sound power to the reference sound power

NOTE: The weighting network (A-weighting) or the width of the frequency band used needs to be indicated. The reference sound power is 1 pW. Units: bels.

sound pressure level (L_P): ten times the logarithm (base 10) of the ratio of the time-mean-square sound pressure to the square of the reference sound pressure

NOTE: The weighting network (A-weighting) or the width of the frequency band used needs to be indicated. The reference sound pressure is 20 μPa. Units: decibels.

telecommunication equipment room: area dedicated to large telecommunication systems

NOTE: Unattended rooms are typically occupied only for service and maintenance activities. These activities may last for periods of time greater than one hour.

underground vault: sealed underground enclosure which is large enough to be entered for servicing equipment contained therein

NOTE: Typically occupied only for service and maintenance activities. These activities may last for periods of time greater than one hour.

urban: relating to areas, typically, in towns and cities with high population density

3.2 Symbols

For the purposes of the present document, the following symbols apply:

L_W	sound power level
L_{WAd}	declared A-weighted sound power level
L_p	sound pressure level
HLWAd	high temperature declared A-weighted sound power level

4 Measurement methodology

The measurement methods specified in ISO 7779 [1] and in the basic standards ISO 3741 [7], ISO 3744 [8] and ISO 3745 [9]. shall be used for determining the sound power of products. Annex A contains additional methods and measurements relating to open air outdoor equipment.

5 Installation and operation of equipment

The installation and operation conditions specified in ISO 7779 [1] shall be used for determining the sound power of products. Where there are differences between the present document and ISO 7779 [1], the requirements contained herein shall be followed.

The equipment shall be configured and operated according to its normal intended use. Within that constraint and the constraints specified below, the equipment shall be configured and operated to ensure worst case acoustic noise emission.

5.1 Equipment installation

The specific installation will depend upon the sound power measurement technique being used (reverberation room or free-field over a reflecting plane), and upon the normal installation requirements of the equipment being measured.

5.2 Equipment operation "in-use"

For telecommunication equipment whose operational noise varies with functional load, the electrical input and load conditions of the equipment shall be chosen to obtain full functional utilization of the equipment under test. Dissipation shall be maximized by selection of supply power and load conditions.

Only the sound power of continuous, steady-state noise sources shall be measured. Therefore, the equipment is to be operated such that intermittent sources are not active. Such sources include (but are not restricted to) alarms, attention signals, printing mechanisms, disk-drive seeking mechanisms and so on.

For telecommunication equipment whose operational noise varies with temperature (e.g. equipment using variable speed air moving devices), the sound power will be measured with the equipment operating under the two conditions specified in clauses 5.2.1 and 5.2.2.

5.2.1 Variable emissions - standard temperature test

For the first test, the ambient temperature in the test environment shall be 23 °C ± 2 °C, in accordance with ISO 7779 [1]. Data obtained from testing as specified in this clause is to be used in the determination of the declared A-weighted sound power level (L_{WAd}) for the equipment.