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Standard ECMA-109

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Declared Noise Emission Values of Information Technology and Telecommunications Equipment

Standard

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Introduction

Information on acoustic noise emission of information technology and telecommunications 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 relating to 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

  ECMA-74 specifies procedures for measuring 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[6].

- 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 gives statistical methods for such determination. ECMA-109 is based upon these basic 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 Ecma Standard specifies that both quantities shall be declared. In the preparation of this Ecma Standard divergences of opinion 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 in decibels re 1 pW and emission sound pressure levels in decibels re 20 μPa, this Ecma Standard expresses sound power level values in bels and emission sound pressure level values in decibels, to alleviate the divergences of opinion 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 gives methods for the verification of a declared noise emission value. In this Ecma Standard the procedure is restricted to verifying declared A-weighted sound power levels, L_{WAd} only.

The reasons for using bels for declared A-weighted sound power levels are:

i) To avoid user confusion

In this Ecma Standard the A-weighted sound power level is the primary descriptor and will be reported in accordance with ISO 4871. Many manufacturers and users of information technology and telecommunications equipment have historically used A-weighted emission sound pressure levels in decibels. Since customers want both sound power and emission sound pressure levels, this Ecma Standard utilises both quantities. Without including reference values (*i.e.* 1 pW and 20 μPa), expressing both declared sound power levels and declared emission sound pressure levels in decibels tend to cause

confusion. To distinguish the two, this Ecma Standard expresses sound power level values in bels where a bel is 10 decibels re 1pW, and expresses emission sound pressure level values in decibels re 20 μPa.

ii) To avoid misapplication of data

If declared A-weighted sound power levels were expressed in decibels, users may mistakenly compare the sound power levels with workplace regulations of immission sound pressure levels. In many information technology and telecommunications equipment applications, the sound power level (in decibels) value of the equipment is significantly larger than the immission sound pressure level (in decibels) value measurable in the workplace. The later, immission value is the level at human ear location in a given environment which changes with the acoustic environment, such as room size, acoustical attenuation property of floor, wall, ceiling, doors, windows and room partitions, etc. while the sound power level value is an intrinsic property of equipment that does not change with the environment it is placed in.

iii) To promote the use of ECMA-109

The purpose of ECMA-109 is to provide uniform methods of presenting declared noise emission values to users. Without using bels, this objective would be lost since there would be an incentive for some manufacturers to report emission sound pressure levels instead of sound power levels. The primary descriptor of information technology and telecommunications equipment noise is the declared A-weighted sound power level L_{WAd}. If ECMA-109 were to use decibels for declared A-weighted sound power levels, manufacturers who do not implement this Ecma Standard would be at a competitive advantage by reporting emission sound pressure levels in decibels which would be lower than the declared sound power levels also in decibels. Not only would the user be confused, and unable to tell the difference, but the manufacturer who followed ECMA-109 would be at an unfair competitive disadvantage. To eliminate this confusion and disadvantage and to promote the uniform reporting of declared noise emission values, the declared A-weighted sound power levels must be reported in bels.

iv) To use a method based on successful experience

For several years, many international companies, members of Ecma, have reported A-weighted sound power levels in bels and A-weighted emission sound pressure levels in decibels without confusion of their customers. Indeed, their customers have been able to distinguish easily between the important difference of sound power level and emission sound pressure level, and the users have not lost the significance of the digit after the decimal mark. Actually they have been less confused: without using bels, they would wonder: "which decibel do I compare to our specification?".

v) To be consistent with other Ecma and ISO standards

The use of bels for declared A-weighted sound power levels is consistent with ISO 4871 "Acoustics - Declaration and verification of noise emission values of machinery and equipment" and with ISO 7574-1 "Acoustics - Statistical methods for determining and verifying stated noise emission values of machinery and equipment - Part 1: General considerations and definitions". The declared A-weighted sound power level, L_{WAd}, is a statistical maximum value and corresponds to the "declared single-number noise emission value" in ISO 4871 and "labelled value" in ISO 7574-1. The definition of "declared single-number noise emission value " in ISO 4871 and "labelled value" in ISO 7574-1 has a note which states that in some cases, the labelled value may be expressed as the numerical value of sound power level in decibels divided by 10, given with one digit after the decimal mark, *i.e.* in bels. ECMA-109 recognizes that the sound power is **determined in decibels**, according to either ECMA-74 which is based upon ISO 3741, ISO 3744 or ISO 3745, and is then reported to the customers as a **declared value in bels**.

The first edition of Standard ECMA-109 was processed by ISO under the fast-track procedure and led to International Standard ISO 9296 [5]. The second edition has been adapted to the final wording of ISO 9296.

The third edition was adapted to allow for the determination of declared sound power level based on measurements made in accordance with ECMA-160 [7] (using sound intensity) as an alternative to ECMA-74 (reverberation test room or hemi-anechoic room).

This fourth edition corrects minor errors in the third edition, includes re-arrangements of the text, and clarifies the procedure when only a single machine from a batch has been measured and there is no prior knowledge of the standard deviation of production.

This fifth edition changes Annex A to be normative rather than informative, and adds an additional quantity to the declared value when the mean value is based on five or fewer units. It also removes the single equipment sound power level declaration clause due to statistical concerns. In addition, descriptions related to ECMA-160 were removed to align with sound power determination in accordance with ECMA-74.

This Ecma Standard has been adopted by the General Assembly of December 2010.

Declared Noise Emission Values of Information Technology and Telecommunications Equipment

1 Scope

This Ecma Standard applies to information technology and telecommunications equipment.

This Ecma Standard specifies:

- the method of determining the declared noise emission values of a batch of machines,
- acoustical and product information to be given in technical documents supplied to users by the manufacturer,
- the method for verifying the declared noise emission values given by the manufacturers.

The uniform methods in this Ecma Standard use the noise emission data obtained in accordance with ECMA-74, and the procedures specified in ISO 4871 [4] and the ISO 7574 series.

The basic declared noise emission values are the declared A-weighted sound power level L_{WAd} (a statistical maximum value corresponding to L_c in ISO 7574-1) and the declared A-weighted emission sound pressure level L_{pAm} (a mean value) at the operator or bystander positions.

The declared A-weighted sound power level L_{WAd} 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 [8].

Although the most useful quantity for calculating immission levels due to one or more sound sources is usually the declared A-weighted sound power level of the individual source(s), the declared A-weighted emission sound pressure level L_{pAm} may be used to estimate 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 A-weighted sound power level is declared in bels and the A-weighted emission sound pressure level is declared in decibels.

2 Normative references

The following referenced documents are indispensable for the application 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.

ECMA-74, *Measurement of airborne noise emitted by information technology and telecommunications equipment*

ISO 4871 *Acoustics - Declaration and verification of noise emission values of machinery and equipment*

ISO 7574-1 *Acoustics - Statistical methods for determining and verifying stated noise emission values of machinery and equipment*, *Part 1: General considerations and definitions*

ISO 7574-4 *Acoustics - Statistical methods for determining and verifying stated noise emission values of machinery and equipment, Part 4: Methods for stated values for batches of machines*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply. They are grouped in three categories, general definitions, acoustical definitions and statistical definitions.

General definitions

3.1
information technology and telecommunications (ITT) equipment
equipment for information processing, and components thereof, used in homes, offices, sever installations, telecommunications installations or similar environments

3.2
batch (lot) of equipment
a 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 The batch may be either an entire production series or a portion thereof.

3.3
operating mode
condition specified in ECMA-74 in which the equipment being tested is performing its intended function(s)

NOTE When possible to implement for acoustic testing, the conditions specified in the relevant annex of ECMA-74 are considered to be typical of average end use.

3.4
idle mode
one or more steady-state condition specified in ECMA-74, in which the equipment being tested is energized, but is not performing any intended function(s)

Acoustical definitions

3.5
A-weighted sound power level L_{WA} in decibels
the sound power level of the equipment, determined in accordance with ECMA-74, with frequency weighting A

NOTE The reference sound power is 1 pW.

3.6
A-weighted emission sound pressure level L_{pA} in decibels
the emission sound pressure level of the equipment with frequency weighting A, determined in accordance with ECMA-74 at the operator position(s), or at the bystander positions if no operator position is specified

NOTE The reference sound pressure is 20 μPa.

3.7
measured value
the value of the A-weighted sound power level, L_{WA}, or the A-weighted emission sound pressure level L_{pA}, determined from measurements on an individual machine in accordance with ECMA-74

3.8
declared noise emission values
the value of the declared A-weighted sound power level L_{WAd}, or that of the declared A-weighted emission sound pressure level, L_{pAm}, or both

3.9
declared A-weighted sound power level L_{WAd} in bels
the value of the A-weighted sound power level, L_{WA}, round to the nearest 0,1 B, declared for all equipment in a batch, when new. The declared value is a statistical upper limit and indicates the value below which a specified large proportion (93,5%) of the A-weighted sound power levels of the batch, when new, are expected to lie.

NOTE L_{WAd} corresponds to the labelled value L_c in ISO 7574-1. The assumptions and verification procedures of Clause 6 of ECMA-109 for a batch of equipment result in a 95% probability of acceptance if no more than 6,5% of the equipment in a batch has A-weighted sound power levels greater than the declared noise emission value, L_{WAd}. The mean A-weighted sound power level for the batch is expected to lie approximately 1,5 σ_M below L_{WAd}.

3.10
declared A-weighted emission sound pressure level L_{pAm} in decibels
the value of the A-weighted emission sound pressure level L_{pA}, declared from the arithmetic mean, of the values of the A-weighted sound pressure level, L_{pA}, rounded to the nearest 1 dB, for a batch of equipment, when the machines are new

Statistical definitions

3.11
standard deviation of repeatability σ_r
the 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)

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

3.12
standard deviation of reproducibility σ_R
the standard deviation of sound power level values obtained under reproducibility conditions, that is, the repeated application of the same measurement method on the same equipment at different times and under different conditions (different laboratory, different operator, different apparatus)

NOTE The standard deviation of reproducibility, therefore, includes the standard deviation of repeatability, σ_r.

3.13
standard deviation of production σ_p
the standard deviation of sound power level values obtained on different equipment from a batch of the same family, using the same measurement method under repeatability conditions (same laboratory, same operator, and same apparatus)

3.14
total standard deviation σ_t
the square root of the sum of the squares of the standard deviation of reproducibility, σ_R, and the standard deviation of production, σ_p:

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

3.15
reference standard deviation σ_M
the total standard deviation in sound power level, specified for the family of machines under consideration which is considered typical for batches from this family

NOTE 1 For the purposes of this standard, the reference standard deviation for the family of information technology and telecommunications equipment is 2,0 dB. See 7.1.

NOTE 2 The use of a fixed σ_M enables the application of a statistical method to deal with small sample sizes. If the total standard deviation σ_t is different from the reference standard deviation σ_M the manufacturer may estimate his risk of rejection on the basis of both standard deviations, σ_t and σ_M (see A.1).

4 Conformance requirements

4.1 For declaration

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

a) for acoustical noise measurements, the measurement procedures, the installation and the operating conditions specified by ECMA-74 are taken fully into account in accordance with Clause 5.

b) for the determination and presentation of declared noise emission values, the procedures of Clause 6 are used.

4.2 For verification

Verifications are in conformity with this Ecma Standard if they meet the following requirements:

a) for the verification of declared A-weighted sound power level, L_{WAd}, the procedures of Clause 7 are taken fully into account.

5 Declared noise emission values

5.1 General

The declared noise emission values, L_{WAd} and L_{pAm}, (see 3.9 and 3.10, respectively) shall be determined for one or more idle modes and one or more operating modes as defined in ECMA-74. Noise emission levels used in the determination of declared noise emission values shall be obtained in accordance to ECMA-74. Based on the measured values, declared noise emission values of both L_{WAd} and L_{pAm} shall be determined in accordance with the procedures of Annex A.

5.2 Determination of the A-weighted sound power level L_{WA}

The A-weighted sound power level, L_{WA}, shall be determined in accordance with ECMA-74. Measured values shall not be rounded.

5.3 Determination of the A-weighted emission sound pressure level L_{pA} at the operator (bystander) position(s)

The A-weighted emission sound pressure level, L_{pA}, at the applicable operator or bystander positions shall be measured in accordance with ECMA-74. Measured values shall not be rounded.

6 Presentation of declared noise emission values

6.1 Required information

The declared noise emission values, L_{WAd} and L_{pAm}, shall be presented or “declared” for at least one configuration or variation of the product deemed to be typical of that marketed to, or purchased by, customers. It is recommended that other representative configurations or variations also be declared, especially for those products available in multiple configurations or with various options that result in different noise emission levels.

The presentation of noise emission values for a product, determined according to this Ecma Standard, shall contain the following information.

- identification of the product and description of the product configuration or variation with sufficient detail to determine the applicability of the declared noise emission values. If such information is not given, the declared noise emission values apply to all configurations or variations of the listed product;

- the words "Declared Noise Emission Values in accordance with ECMA-109" followed by L_{WAd} and L_{pAm} in conformance with Clause 5;

- identification of whether L_{pAm} as defined in ECMA-74 refers to the operator position or average of the bystander positions;

- if more than one operating mode according to ECMA-74 is possible, sufficient information to determine unambiguously the mode(s) used for declaration.

NOTE Declared noise emission values should be given in technical documents or other literature supplied to the user (see Annex B).

6.2 Additional information

Annex C provides optional information on describing the character of the noise emissions.

7 Verification of the declared noise emission values

7.1 General

The procedures for verifying the declared noise emission values are applicable only to declared A-weighted sound power levels L_{WAd} and are not applicable to declared A-weighted emission sound pressure level L_{pAm}.

Verification shall be made with noise measurements and equipment operation in accordance with ECMA-74. Furthermore, the installation and operating conditions for verification shall be as specified in Clause 5 and stated by the manufacturer as specified in Clause 6.

The procedure for verifying the L_{WAd} of the batch is consistent with ISO 7574-4, using the single sampling inspection procedure with a sample size of n = 3 and with the reference standard deviation σ_M specified as 2,0 dB for the family of ITT equipment.

7.2 Verification of L_{WAd} for a batch of equipment

The following procedure is designed for inspection under reproducibility conditions (see 3.12). It may be applied for inspection under repeatability conditions (see 3.11) if there is confidence that there is no significant systematic error of measurement connected with the relevant test laboratory.

Take a random sample of three from the batch of new equipment under consideration. The measured values are L_{WA1}, L_{WA2}, and L_{WA3} in dB, and their arithmetic mean value $\bar{L}$ in dB is given by:

$$\bar{L} = \frac{1}{3}\left(L_{WA1} + L_{WA2} + L_{WA3}\right)$$

Decide on the acceptability of the declared noise emission value L_{WAd} using the following rules:

- if $\bar{L}$ /10 ≤ (L_{WAd} - 0,11), L_{WAd} is confirmed as verified for the batch,

- if $\bar{L}$ /10 > (L_{WAd} - 0,11), L_{WAd} is not confirmed as verified for the batch.

Annex A
(normative)

Procedure for determining declared noise emission values

A.1 General

The procedures in A.2 and A.3 shall be followed for the determination of the declared values of both L_{WAd} and L_{pAm}. These procedures are given in order to provide uniform noise declarations for the ITT equipment industry and also to provide a predictable probability of acceptance (see 3.25 of ISO 7574-4) for the declarer.

A.2 Determination of the declared A-weighted sound power level for a batch of equipment, L_{WAd}

A.2.1 Initial considerations

To obtain the declared A-weighted sound power level L_{WAd} for a batch of equipment the manufacturer shall take into account the following:

i) The standard deviation of reproducibility, σ_R, for sound power level determinations carried out in accordance with ECMA-74: The standard deviation of reproducibility for the A-weighted sound power level is estimated to be 1,5 dB in ECMA-74 for most ITT equipment, and this value is used below for the purposes of this Standard.

ii) The standard deviation of production, σ_p: This is the standard deviation of the A-weighted sound power levels determined from different machines in the batch carried out in accordance with ECMA-74 under repeatability conditions (same laboratory, same operator, same apparatus).

NOTE In principle, each A-weighted sound power level value may represent the arithmetic mean of several repeated measurements on the same machine (see ISO 7574-4, Annex B).

iii) The total standard deviation σ_t: This is a combination of the standard deviation of reproducibility σ_R and the standard deviation of production σ_p (see 3.14).

iv) The procedure for verifying the declared sound power level values: This is given in Clause 7 and is consistent with ISO 7574-4 using the single sampling inspection procedure with a verification sample size $n = 3$ and a reference standard deviation $\sigma_M = 2{,}0$ dB for the family of ITT equipment. When the verification procedure of Clause 7 is used in conjunction with the determination procedure given in this annex, the declarer will have a known and predictable probability of acceptance; that is, the batch will be accepted (the declared value will be verified) with a probability of 95%, and the mean value will lie approximately $1{,}5\sigma_M$ below the declared value.

A.2.2 Determination of the sample mean and sample total standard deviation of the batch

The declaration and verification procedures of ISO 7574-4 upon which the procedures in this standard are based assume that the measured values (see 3.7) of A-weighted sound power levels of the machines in the batch are normally distributed and that the true mean, μ, and true total standard deviation, σ_t, are known or closely approximated. These true values are approximated by the sample mean, L_{WAm}, and sample total standard deviation, s_t, respectively, as defined in this annex.

The sample mean is determined by taking a reasonably large random sample from the batch of new equipment under consideration, and determining the A-weighted sound power level, L_{WAi}, for each machine in the sample in accordance with ECMA-74. The arithmetic mean A-weighted sound power level, L_{WAm} is then calculated as follows:

$$L_{WAm} = \frac{1}{M}\sum_{i=1}^{M} L_{WAi} \quad \text{(A.1)}$$

where M is the number of machines in the sample.

The sample total standard deviation is determined by the following two-step procedure.

First, the sample standard deviation of production s_p for the measured values L_{WAi} of the machines in the sample is computed as follows:

$$s_p = \sqrt{\frac{1}{M-1}\sum_{i=1}^{M}\left(L_{WAi} - L_{WAm}\right)^2} \quad \text{(A.2)}$$

Second, the sample total standard deviation s_t is computed from the sample standard deviation of production s_p and the standard deviation of reproducibility $s_R=\sigma_R$ which is assigned here the value of 1,5 dB based on ECMA-74:

$$s_t = \sqrt{s_p^2 + s_R^2} = \sqrt{s_p^2 + 1{,}5^2} \quad \text{(A.3)}$$

The values of L_{WAm} and s_t are estimates of the true mean value μ and the true total standard deviation σ_t of the batch, respectively. The differences between these estimates and the true values are expected to be small when the sample size M is relatively large. When the sample size is small, an additional guard band (described below) is to be added to partially offset the uncertainty in the estimates.

The standard deviation of production s_p may alternatively be estimated by the manufacturer from prior experience with similar equipment. If the noise from fewer than three machines of a production series has been measured, and there is no prior knowledge of the standard deviation of production, then the manufacturer shall set a minimum value of s_p = 1,32 dB (such that the total standard deviation will equal the reference standard deviation). Higher values may be warranted when the product emits prominent discrete tones, there is significant structure-borne noise, or there is fan speed control that is sensitive to the test temperature.

A.2.3 Determination of the value to declare

Once the mean and standard deviation have been determined or estimated for the batch, the declared A-weighted sound power level, L_{WAd}, shall be calculated from one of the following equations, in bels. The calculated value shall be rounded to the nearest 0,1 bel.

Case 1: For $M > 5$

$$L_{WAd} = \frac{1}{10}\left[L_{WAm} + 1{,}514 s_t + 0{,}564\left(2{,}0 - s_t\right)\right] \quad \text{(A.4)}$$

NOTE This equation is based on ISO 7574-4 with a probability of acceptance of 95%.

Case 2: For $M \leq 5$

$$L_{WAd} = \frac{1}{10}\left[L_{WAm} + 1{,}514 s_t + 0{,}564\left(2{,}0 - s_t\right) + G\right] \quad \text{(A.5)}$$

NOTE The term G is a guard band as given in Table A.1 as a function of the sample size M. Reference [9] provides the basis for derivation of the guard band values. The guard band is intended to restore a 95% probability of acceptance

across a large population of declarers and verifiers when the sample size is small, but any individual declaration made based on a small sample size is not guaranteed to have a 95% probability of acceptance.

Table A.1 Guard band value, G

Sample size, M	**Guard band, G (dB)**
1	1,00
2	0,75
3	0,50
4	0,40
5	0,35

A.3 Determination of the declared A-weighted emission sound pressure level L_{pAm} for a batch of equipment

The declared A-weighted emission sound pressure level L_{pAm} shall be determined by calculating the arithmetic mean, using equation A.6, of the A-weighted emission sound pressure level L_{pA} of each machine in the sample measured in accordance with ECMA-74. The value of L_{pAm} shall be rounded to the nearest 1 dB.

$$L_{pAm} = \frac{1}{M}\sum_{i=1}^{M} L_{pAi} \qquad \text{(A.6)}$$

where M is the number of machines in the sample.

Annex B
(informative)

Examples of noise emission declarations

Example 1

Where multiple variations of a product exist and no operator position is specified.

Declared Noise Emission Values in accordance with ECMA-109				
Product Configuration or Variation	**Declared A-Weighted Sound Power Level, L_{WAd} (B)**		**Declared A-Weighted Emission Sound Pressure Level, L_{pAm} (dB)**	
	Operating	**idle**	**Operating**	**Idle**
Server Model XYZ, 4.2-GHz, Typical configuration with acoustical door set: Five processor nodes (40-core), two I/O drawers, and bulk power assembly. Air-moving devices at nominal speeds.	7,1	7,1	52	52
Server Model XYZ 4.2-GHz, Typical configuration with standard, non-acoustical door set: Five processor nodes (40-core), two I/O drawers, and bulk power assembly. Air-moving devices at nominal speeds.	7,9	7,9	61	61
Server Model XYZ, 4.2-GHz, Maximum configuration with acoustical door set: Eight processor nodes (40-core), four I/O drawers, and bulk power assembly. Air-moving devices at nominal speeds.	7,7	7,7	60	60
Server Model XYZ 4.2-GHz, Maximum configuration with standard, non-acoustical door set: Eight processor nodes (40-core), four I/O drawers, and bulk power assembly. Air-moving devices at nominal speeds.	8,5	8,5	68	68

Notes:
1. Declared level L_{WAd} is the statistical upper-limit A-weighted sound power level.
2. Declared level L_{pAm} is the mean A-weighted emission sound pressure level measured at the 1-meter bystander positions.
3. All measurements made in conformance with ECMA-74 and declared in conformance with ECMA-109.
4. 'B' and 'dB' are abbreviations for bels and decibels, respectively.

Example 2

Where declared noise emission values apply to all variations of a product, no operator position is specified, and several printing speeds are available, of which 20 pages per minute is the most frequently used.

Declared Noise Emission Values in accordance with ECMA-109				
Product Configuration or Variation	**Declared A-Weighted Sound Power Level, L_{WAd} (B)**		**Declared A-Weighted Emission Sound Pressure Level, L_{pAm} (dB)**	
	Printing (20 ppm)	**Idle**	**Printing (20 ppm)**	**Idle**
Printer model XYZ	7,4	5,2	62	40

Notes:
1. Declared level L_{WAd} is the statistical upper-limit A-weighted sound power level.
2. Declared level L_{pAm} is the mean A-weighted emission sound pressure level measured at the 1-meter bystander positions.
3. All measurements made in conformance with ECMA-74 and declared in conformance with ECMA-109.
4. 'B' and 'dB' are abbreviations for bels and decibels, respectively.
5. 'ppm' is the abbreviation for pages per minute.

Example 3

Where different declared noise emission values apply to variations of the product manufactured in different years and an operator position is specified.

Declared Noise Emission Values in accordance with ECMA-109				
Product Configuration or Variation	**Declared A-Weighted Sound Power Level, L_{WAd} (B)**		**Declared A-Weighted Emission Sound Pressure Level, L_{pAm} (dB)**	
Personal Computer Model XYZ	**Operating**	**Idle**	**Operating**	**Idle**
Year of manufacture 2009-2010	5,2	4,8	41	37
Year of manufacture prior to 2009	5,5	5,1	44	40

Notes:
1. Declared level L_{WAd} is the statistical upper-limit A-weighted sound power level.
2. Declared level L_{pAm} is the A-weighted emission sound pressure level measured at the operator position.
3. All measurements made in conformance with ECMA-74 and declared in conformance with ECMA-109.
4. 'B' and 'dB' are abbreviations for bels and decibels, respectively
5. Operating mode: HDD operating mode per ECMA-74, Annex C, C.15.

Annex C
(informative)

Character of noise

C.1 General

This annex presents optional information which may be provided in addition to the declared noise emission values. Information on the character of the noise, that is, whether the noise is considered to be impulsive noise or whether it contains prominent discrete tones, may be of interest to the user of the equipment.

National and international organisations have been working on objective methods for rating the subjective character of noise, however a final consensus on the procedure to be applied has not yet been reached. Furthermore, statistical procedures have to be specified for determining a single description for the character of the noise of batches of equipment.

C.2 Annex status

Although this annex is informative, it contains requirements for fulfilment when the manufacturer has decided declaring characters of noise. These requirements are generally identified through the use of the prescriptive word “shall”.

C.3 Determination of the character of noise

For the specified operator or bystander position(s) it shall be determined whether the equipment emits impulsive noise and/or prominent discrete tones.

C.3.1 Impulsive noise parameter

ECMA-74 shall be used to determine whether the noise is impulsive.

C.3.2 Prominent discrete tones

ECMA-74 shall be used to determine whether a prominent discrete tone is present.

C.4 Information on impulsive noise and prominent discrete tones

The declared noise emission values may be supplemented by one of the following statements, which describe the character of the noise as determined according to C.3:

- no prominent discrete tones, no impulsive noise,
- no prominent discrete tones, impulsive noise,
- prominent discrete tones, no impulsive noise,
- prominent discrete tones and impulsive noise.

Bibliography

[1] ISO 3741, *Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Precision methods for reverberation test rooms*

[2] ISO 3744, *Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Engineering methods for an essentially free field over a reflecting plane*

[3] ISO 3745, *Acoustics — Determination of sound power levels of noise sources using sound pressure — Precision methods for anechoic and hemi-anechoic rooms*

[4] ISO 4871, *Acoustics — Declaration and verification of noise emission values of machinery and equipment*

[5] ISO 9296, *Acoustics — Declared noise emission values of computer and business equipment*

[6] ISO 11201, *Acoustics — Noise emitted by machinery and equipment — Determination of emission sound pressure levels at a work station and at other specified positions in an essentially free field over a reflecting plane with negligible environmental corrections*

[7] ECMA-160, *Determination of Sound Power Levels of Computer and Business Equipment using Sound Intensity Measurements; Scanning Method in Controlled Rooms*

[8] ECMA TR/27, *Method for the prediction of installation noise levels*

[9] Eric Baugh, Brian Kluge, and Kaleen Man, “Declared sound power level based on small sample size”, *Noise-Con Proc*. **218**, 2645, 2009.