DRAFT AMENDMENT ISO 7779:1999/DAmd 2.2

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Acoustics — Measurement of airborne noise emitted by information technology and telecommunications equipment

AMENDMENT 2: Revision of measurement surfaces, procedures for equipment installation/operation and detection of prominent discrete tones

Acoustique — Mesurage du bruit aérien émis par les équipements liés aux technologies de l'information et aux télécommunications

AMENDEMENT 2: Révision des surfaces de mesurage, des modes opératoires d'installation/exploitation des équipements et de la détection des composantes tonales discrètes émergentes

ICS 17.140.20; 35.020

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Foreword

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Amendment 2 to ISO 7779:1999 was prepared by Technical Committee ISO/TC 43, *Acoustics*, Subcommittee SC 1, *Noise*.

Acoustics — Measurement of airborne noise emitted by information technology and telecommunications equipment —

AMENDMENT 2: Revision of measurement surfaces, procedures for equipment installation/operation and detection of prominent discrete tones

Page 1: Clause 1 Scope

In the second paragraph, replace “a reverberation room” by “a reverberation test room”

In the third paragraph, replace “the A-weighted sound pressure level measured” by ”the A-weighted emission sound pressure level determined”.

In the eighth paragraph, replace “The sound power and sound pressure levels” by “The sound power and emission sound pressure levels”.

Page 2: Clause 2 Normative references

Replace ISO 3741:1999, ISO 3744:1994, ISO 3745:1977, ISO 6926:1990 and ISO 11201 by:

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

ISO 3744 [2], *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.*

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

ISO 6926, *Acoustics — Requirements for the performance and calibration of reference sound sources used for the determination of sound power levels.*

ISO 11201 [3], *Acoustics — Noise emitted by machinery and equipment — Measurement 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* (Revision of ISO 11201:1995)

Delete the following:

ISO 10302, *Acoustics – Methods for the measurement of airborne noise emitted by small air-moving devices*

IEC 60651, *Sound level meters*

IEC 60804, *Integrating-averaging sound level meters*

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[1] Under preparation (to be published). Revision of ISO 3741:1999

[2] Under preparation (to be published). Revision of ISO 3744:1994

[3] Under preparation (to be published). Revision of ISO 11201:1995.

Add the following:

ISO 266, *Acoustics — Preferred frequencies*.

IEC 61672-1:2002, *Electroacoustics - Sound level meters – Part 1: Specifications* ECMA-74, *Measurement of airborne noise emitted by information technology and telecommunications equipment*

Page 3: Clause 3 Terms and definitions

In NOTE 2 of 3.1.5, delete ":1995".

Insert new 3.1.13 as follows, and renumber the existing 3.1.13 to new 3.1.14:

3.1.13
hand-held equipment
functional unit, generally small and lightweight, intended to be supported by one's hand(s) during operation

Replace 3.2.1 as follows:

3.2.1
sound pressure
p
difference between instantaneous total pressure and static pressure

NOTE 1 Sound pressure is expressed in pascals.

NOTE 2 The symbol, p is often used without modification to represent a root-mean-square sound pressure.

Replace 3.2.2 as follows:

3.2.2
time-averaged sound pressure level
L_{pT}
ten-times the logarithm to the base 10 of the ratio of the time-average of the square of the sound pressure, p, during a stated time interval of duration T (starting at t_1 and ending at t_2), to the square of a reference value, p_0

$$L_{pT} = 10\lg \frac{1}{T}\int_0^T \frac{p^2(t)}{p_0^2}\mathrm{d}t \,\mathrm{dB}$$

where

the reference value, p_0, is 20 μPa

NOTE Time averaged sound pressure levels are expressed in decibels.

Replace 3.2.3 as follows:

3.2.3
emission sound pressure level
L_p
sound pressure level measured at a specified position near a noise source, when the source is in operation under specified operating and mounting conditions on a reflecting plane surface, but excluding the effects of background noise

NOTE Clause 8 specifies the method for determination of emission sound pressure level.

In 3.2.4, replace NOTE 3 as follows:

NOTE 3 In general, the subscripts “eq” and “T” are omitted since time-averaged sound pressure levels are necessarily determined over a certain measurement time interval.

Replace the existing 3.2.9 as follows:

3.2.9
frequency range of interest
one-third-octave bands with centre frequencies specified in ISO 266, from 100 Hz to 10 000 Hz inclusive

NOTE For equipment which emits discrete tone(s) in the 16 kHz octave band, the procedures specified in ISO 9295 are used; see Table 4.

Page 5: Clause 4 Conformance requirements

In item c), replace “measurement of emission sound pressure level” by “determination of emission sound pressure level”.

Page 6: 5.1.2

In the title of5.2.2.1, replace “reverberation rooms” by “reverberation test rooms”, and in the first paragraph, replace “reverberation rooms” by “reverberation test room”

Page 6: 5.1.2.2

In the second paragraph of 5.1.2.2, replace “the Note to 7.3.1” by “the NOTE of 7.3.1”.

Page 6: 5.1.2.3

In the second paragraph of 5.1.2.3, replace “the Note in 7.3.1” by “the NOTE of 7.3.1”.

Page 6: 5.1.3

In the title of 5.1.3.1, replace “reverberation rooms” by “reverberation test rooms”.

In the first paragraph of 5.1.3.4, replace “reverberation room” by “reverberation test room”.

Page 6: 5.1.4

In the first paragraph of 5.1.4, replace “reverberation room” by “reverberation test room”.

Page 6: 5.1.6

Replace (correct) “Hand held equipment” by “Hand-held equipment”.

Page 7: 5.1.7

Replace the existing 5.1.7 as follows:**5.1.7 Sub-assemblies**

A sub-assembly shall be supported $0{,}25\ \text{m} \pm 0{,}03\ \text{m}$ above the reflecting plane by vibration-isolating elements. However, if a hemispherical measurement surface is used with a radius less than 1 m (see B.1) but at least 0,5 m, the sub-assembly support height shall be reduced to $0{,}125\ \text{m}^{+0{,}003\ \text{m}}_{-0{,}005\ \text{m}}$. The supports shall not interfere with the propagation of airborne sound.

Page 8: Clause 6

In the title of Clause 6, replace “reverberation rooms” by “reverberation test rooms”.

Page 8: 6.1

In the first paragraph of 6.1, replace “a reverberation room” by “a reverberation test room”.

In the second paragraph of 6.1, replace “ISO 3741:1999, annex A” by “the relevant procedure specified in ISO 3741”.

Page 8: 6.2

In the title of Table 1, replace “reverberation room” by “reverberation test rooms”.

Page 9: 6.4

In the second paragraph of 6.4.1, delete “(see IEC 60804)”.

In the title of Table 1, replace “reverberation room” by “reverberation test rooms”.

Replace the existing 6.4.2 as follows:

6.4.2 The microphone and its associated cable

The instrument system, including the microphone and its associated cable shall meet the requirements of ISO 3741. If the microphone is moved, care shall be exercised to avoid introducing acoustical or electrical noise (e.g. from gears, flexing cables, or sliding contacts) that could interfere with the measurements.

Page 10: 6.4.6

Replace the existing 6.4.6 as follows:

6.4.6 Calibration

During each series of measurements, a class 1 sound calibrator as specified in IEC 60942 shall be applied to the microphone to verify the calibration of the entire measuring system at one or more frequencies over the frequency range of interest. The compliance of the calibrator shall be verified with the requirements of IEC 60942 once a year, and the compliance of the instrumentation system with the requirements of IEC 61672-1 at least every 2-years in a laboratory making calibrations traceable to appropriate standards.

The reference sound source shall be fully calibrated every 2-years according to ISO 6926.

The reference sound source shall be checked annually in accordance with the procedure in ISO 6926 to determine whether or not recalibration of the reference sound source is necessary prior to the 2-year calibration period. If changes in any one-third-octave-band sound pressure level exceed values for recalibration specified in ISO 6926, then the reference sound source shall be fully calibrated according to ISO 6926 before further use.

The date of the last verification of the compliance with the relevant IEC or ISO standards shall be recorded.

Page 10: 6.6

Replace the existing 6.6.1 as follows:

6.6.1 General

The major cause of uncertainty in determining sound power level in a reverberation test room is the spatial irregularity of the sound field. The extent of this irregularity and, hence, the effort required to determine the average sound pressure level accurately is greater for discrete-frequency sound than for broad-band sound.

It is strongly recommended that the room be qualified for the measurement of discrete-frequency components in accordance with the relevant procedures of ISO 3741. This avoids the need to determine the number of microphone positions and equipment locations each time equipment is measured.

If the room has not been qualified for the measurement of discrete-frequency components, the procedures specified in ISO 3741 shall be used to determine the minimum number of microphone positions and to evaluate the need for additional noise source locations prior to each measurement. The results of these procedures depend on the presence or absence of significant discrete-frequency components or narrow bands of noise in the sound emitted by the source. When these are present, the number of microphone positions and equipment locations may be large.

In the title of 6.6.2, replace (correct) “reference source” by “reference sound source”.

In 6.6.2, replace “ISO 3741:1999, clause 8,” by “ISO 3741”.

In 6.6.3, replace “ISO 3741:1999, clause 8,” by “ISO 3741”.

Page 11: 6.7.3

At the end of 6.7.3, add the following NOTE.

NOTE When the levels of the background noise in the test room are extremely low and very controlled, the environment may satisfy the absolute and/or relative criteria for background noise in accordance with ISO 3741. In such cases, A-weighted level for low noise level sources may be calculated by omitting some bands according the procedure of ISO 3741. Care should be taken to use the latest version of ISO 3741; Versions such as the third edition (1999-08-01), and earlier, did not use the concept of absolute and relative criteria for background noise.

Page 11: 6.8

In the second paragraph, replace “reverberant rooms” by “reverberation test rooms”.

Page 11: 6.10

Replace the existing 6.10 (including Tables 2, 3 and 4) as follows:

6.10 Determination of sound power level

6.10.1 Calculation of band sound power levels

The sound power level, under reference meteorological conditions, of the equipment, in each one-third octave band within the frequency range of interest (see 3.2.9) is obtained by using the comparison method of ISO 3741.

NOTE The procedures in ISO 3741 are used to determine the sound power level under reference meteorological conditions (barometric pressure 1,01325 × 10^5 Pa, temperature 23,0 °C, relative humidity 50 %). Care should be taken to use the latest version of ISO 3741; Versions such as the third edition (1999-08-01), and earlier versions, did not use the concept of reference meteorological conditions.

The sound power level in the k-th octave band, $L_{W\mathrm{oct},\,k}$ in decibels, if needed, shall be based on one-third octave band data, and calculated from the following equation:

$$L_{W\mathrm{oct},k} = 10\lg \sum_{j=3k-2}^{3k} 10^{0{,}1L_{W1/3,j}} \text{ dB} \qquad (1)$$

where

k is an identification number of octave band within the frequency range of interest (see Table 2);

$L_{W1/3,\,j}$ is the sound power level in the j-th one-third-octave band, in decibels (see Table 3);

j is an identification number lying within the range of ($3k$ – 2) and $3k$, and which identifies the three one-third-octave bands which make up the k-th octave band.

6.10.2 Calculation of A-weighted sound power level

The A-weighted sound power level, $L_{W\mathrm{A}}$ in decibels shall be based on the frequency range of interest, and calculated from the following equation:

$$L_{W\mathrm{A}} = 10\lg \sum_{j=j_{\min}}^{j_{\max}} 10^{0{,}1(L_{W1/3,\,j}+\mathrm{A}_j)} \text{ dB} \qquad (2)$$

where

$L_{W1/3,\,j}$ is the sound power level in the j-th one-third-octave band, in decibels;

A_j is the A-weighting value corresponding to j-th one-third-octave band (see Table 3);

j is an identification number of one-third octave-band within the frequency range of interest (see Table 3);

j_{min}, j_{max} are the values of j corresponding, respectively, to the lowest and highest frequency range of intest (Usually j_{min}=1 and j_{max} = 21 respectively, but, occasionally either or both may be changed. See NOTE of 6.7.3.).

NOTE Equation (2), as well as Tables 2 and 3, is intended for common use for not only Clause 6, but also Clauses 7 and 8.

Table 1 — Identification number k for octave bands

k	**Octave-band centre frequency** in Hz
1	125
2	250
3	500
4	1 000
5	2 000
6	4 000
7	8 000

Table 2 — Values of A-weighting, A_j, for one-third-octave bands

j	**One-third-octave-band centre frequency** in Hz	**A-weighting** A_j in dB
1	100	– 19,1
2	125	– 16,1
3	160	– 13,4
4	200	– 10,9
5	250	– 8,6
6	315	– 6,6
7	400	– 4,8
8	500	– 3,2
9	630	– 1,9
10	800	– 0,8
11	1 000	0,0
12	1 250	0,6
13	1 600	1,0
14	2 000	1,2
15	2 500	1,3
16	3 150	1,2
17	4 000	1,0
18	5 000	0,5
19	6 300	– 0,1
20	8 000	– 1,1
21	10 000	– 2,5

Some information technology and telecommunications equipment emits high-frequency noise in 16 kHz octave band. Depending upon the nature of noise emissions, Table 4 shows how to handle each situation.

For the determination of A-weighted sound power levels from band levels, this International Standard does not extend the frequency range of interest to include the 16 kHz octave band.

For equipment which emits discrete tone(s) in the 16 kHz octave band, each frequency and level of the tone(s) that is (are) within 10 dB of the highest tone level in the band shall be determined according to the procedures specified in ISO 9295, (see Table 4). The derived levels are not frequency-weighted.

CAUTION In any case, for determining A-weighted level, 16 kHz octave-band contribution is not included.

Table 3 — Type of noise and determination of sound power levels

Type of noise in the frequency range of the octave bands centred at		Sound power level to be determined
125 Hz to 8 kHz	16 kHz	
Broad-band or narrow-band noise †	No significant noise	A-weighted level (125 Hz to 8 kHz octave bands) according to this International Standard.
	Broad-band noise	A-weighted level (125 Hz to 8 kHz octave bands) according to this International Standard, and one-third-octave-band levels in 16 kHz octave band according to the procedure of ISO 9295.
Broad-band or narrow-band noise †	Discrete tone	A-weighted level (125 Hz to 8 kHz octave bands) according to this International Standard and the level and frequency of the discrete tone according to ISO 9295.
	Multiple tones	A-weighted level (125 Hz to 8 kHz octave bands) according to this International Standard and the levels and frequencies of all tones in the 16 kHz octave band that are within 10 dB of the highest tone level in the band according to ISO 9295.
No significant noise ††	Discrete tone	Level and frequency of the discrete tone in the 16 kHz octave band according to ISO 9295.
	Multiple tones	Levels and frequencies of all tones in the 16 kHz octave band that are within 10 dB of the highest tone level in the band according to ISO 9295.

NOTES

† For noise in 125 Hz to 8 kHz octave bands, sound power level in one-third-octave bands and in octave bands may also be reported.

†† When there is no significant noise contribution from 125 Hz to 8 000 Hz octave band, it is out of scope of this International Standard, only ISO 9295 is applicable.

Page 14: 7.3.1

At the end of the first paragraph of 7.3.1, add the following sentence:

However, for the purpose of this International Standard, the environmental correction, K_2 in accordance with ISO 3744 or ISO 3745, as applicable, shall be equal to or less than 2 dB.

Page 14: 7.3.2

Delete “or 3745”.

Page 14: 7.4

Replace the existing 7.4 as follows:

7.4 Instrumentation

7.4.1 General

The requirements of 7.4, as well as the instrumentation requirements of ISO 3744 or ISO 3745, shall be followed.

Digital integration is the preferred method of averaging.

7.4.2 The microphone and its associated cable

The instrument system, including the microphone and its associated cable shall meet the requirements of ISO 3744 or ISO 3745 as applicable. If the microphone is moved, care shall be exercised to avoid introducing acoustical or electrical noise (e.g. from wind, gears, flexing cables or sliding contacts) that could interfere with the measurements.

7.4.3 Frequency response of the instrumentation system

The requirements of ISO 3744 or ISO 3745, as applicable, shall be followed.

7.4.4 Reference sound source

The reference sound source shall meet the requirements specified in ISO 6926 over the frequency range of interest.

7.4.5 Filter characteristics

The requirements of a class 1 instrument specified in IEC 61260 shall be followed.

7.4.6 Calibration

During each series of measurements, a class 1 sound calibrator as specified in IEC 60942 shall be applied to the microphone to verify the calibration of the entire measuring system at one or more frequencies over the frequency range of interest. The compliance of the calibrator shall be verified with the requirements of IEC 60942 once a year, and the compliance of the instrumentation system with the requirements of IEC 61672-1 at least every 2-years in a laboratory making calibrations traceable to appropriate standards.

The reference sound source, if used for determining environmental correction K_2, shall be fully calibrated every 2-years according to ISO 6926.

The reference sound source shall be checked annually in accordance with ISO 6926 to determine whether or not recalibration of the reference sound source is necessary prior to the 2-year calibration period. If changes in any one-third-octave band space/time averaged sound pressure level exceed the limits specified in ISO 6926, then the reference sound source shall be fully calibrated according to ISO 6926 before further use.

The date of the last verification of the compliance with the relevant IEC or ISO standards shall be recorded.