

BS EN 60318-1:2009



BSI Standards Publication

Electroacoustics — Simulators of human head and ear

Part 1: Ear simulator for the measurement of supra-aural and circumaural earphones

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This British Standard is the UK implementation of EN 60318-1:2009. It is identical to IEC 60318-1:2009. It supersedes BS EN 60318-1:1998 and BS EN 60318-2:1998, which are withdrawn.

The UK participation in its preparation was entrusted to Technical Committee EPL/29, Electroacoustics.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Compliance with a British Standard cannot confer immunity from legal obligations.

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English version

**Electroacoustics -
Simulators of human head and ear -
Part 1: Ear simulator for the measurement of supra-aural
and circumaural earphones
(IEC 60318-1:2009)**

Electroacoustique -
Simulateurs de tête et d'oreille humaines -
Partie 1: Simulateur d'oreille
pour la mesure des écouteurs
supra-auraux et circumauraux
(CEI 60318-1:2009)

Akustik -
Simulatoren des menschlichen Kopfes
und Ohres -
Teil 1: Ohrsimulator zur Kalibrierung
von supra-auralen und circumauralen
Kopfhörern
(IEC 60318-1:2009)

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European Committee for Electrotechnical Standardization
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Foreword

The text of document 29/683/FDIS, future edition 2 of IEC 60318-1, prepared by IEC TC 29, Electroacoustics, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60318-1 on 2009-11-01.

This European Standard supersedes EN 60318-1:1998 and EN 60318-2:1998.

This European Standard includes the following significant technical changes with respect to EN 60318-1:1998:

- an extension of the frequency range to 16 kHz;
- a revised specification for the acoustical transfer impedance, including tolerances;
- a method for measuring the acoustical transfer impedance;
- expanded measurement uncertainties.

The following dates were fixed:

- latest date by which the EN has to be implemented
at national level by publication of an identical
national standard or by endorsement (dop) 2010-08-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2012-11-01

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60318-1:2009 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 61094-1	NOTE	Harmonized as EN 61094-1:2000 (not modified).
IEC 61094-2	NOTE	Harmonized as EN 61094-2:2009 (not modified).
IEC 61094-6	NOTE	Harmonized as EN 61094-6:2005 (not modified).
ISO 389-1	NOTE	Harmonized as EN ISO 389-1:2000 (not modified).
ISO 389-5	NOTE	Harmonized as EN ISO 389-5:2005 (not modified).
ISO 389-8	NOTE	Harmonized as EN ISO 389-8:2004 (not modified).

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

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.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 61094-4	- ¹⁾	Measurement microphones - Part 4: Specifications for working standard microphones	EN 61094-4	1995 ²⁾
ISO/IEC Guide 98-3	- ¹⁾	Uncertainty of measurement - Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)	-	-

¹⁾ Undated reference.

²⁾ Valid edition at date of issue.

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ELECTROACOUSTICS – SIMULATORS OF HUMAN HEAD AND EAR –

Part 1: Ear simulator for the measurement of supra-aural and circumaural earphones

1 Scope

This part of IEC 60318 specifies an ear simulator for the measurement of supra-aural and circumaural earphones (used for example in audiometry and telephonometry) applied to the ear without acoustical leakage, in the frequency range from 20 Hz to 10 kHz. The same device can be used as an acoustic coupler at additional frequencies up to 16 kHz.

NOTE 1 This device has alternative configurations for supra-aural earphones and different types of circumaural earphones. In practice, the alternative configurations can be realised through the use of adapters where necessary.

NOTE 2 Repeatability for supra-aural and circumaural earphones may get significantly worse above 10 kHz.

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.

IEC 61094-4, *Measurement microphones – Part 4: Specifications for working standard microphones*

ISO/IEC Guide 98-3, *Uncertainty of measurement – Part 3: Guide to the expression of uncertainty in measurement (GUM: 1995)*

3 Terms and definitions

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

3.1

ear simulator

device for measuring the acoustic output of sound sources where the sound pressure is measured by a calibrated microphone coupled to the source so that the overall acoustic impedance of the device approximates that of the normal human ear at a given location and in a given frequency band

3.2

acoustic coupler

device for measuring the acoustic output of sound sources where the sound pressure is measured by a calibrated microphone coupled to the source by a cavity of predetermined shape and volume which does not necessarily approximate the acoustical impedance of the normal human ear

3.3

supra-aural earphone

earphone applied externally to the outer ear and intended to rest on the pinna

3.4**circumaural earphone**

earphone which encloses the pinna and rests on the surrounding surface of the head

NOTE Contact with the head is normally maintained by compliant cushions. Circumaural earphones may touch but not significantly compress the pinna.

3.5**acoustic impedance**

at a specified surface, quotient of the sound pressure by volume velocity through the surface

NOTE Unit: $\text{Pa}\cdot\text{s}\cdot\text{m}^{-3}$.

3.6**acoustic transfer impedance of the ear simulator**

quotient of the sound pressure acting on the diaphragm of the microphone by volume velocity through the planar surface bounded by the upper rim of the ear simulator

NOTE Unit: $\text{Pa}\cdot\text{s}\cdot\text{m}^{-3}$.

3.7**level of acoustic transfer impedance**

ten times the logarithm to the base of ten of the quotient of the absolute value (modulus) of the squared acoustic transfer impedance of the ear simulator by the squared reference acoustic transfer impedance of one pascal second per cubic meter ($\text{Pa}\cdot\text{s}\cdot\text{m}^{-3}$)

NOTE Unit: decibel (dB).

4 Construction**4.1 General**

The measurements of supra-aural and circumaural earphones each require the ear simulator to have a different external configuration. Apart from this, the remaining specifications apply to both types of earphone.

For supra-aural earphones the coupling surface of the ear simulator has sloped sides to match the shape of the earphone cushions. For circumaural earphones, a flat coupling surface is specified to suit the variety of earphone designs that may be encountered. Figure 1 shows the ear simulator configuration for supra-aural earphones and Figure 2 shows that for circumaural earphones.

Internally, the ear simulator is composed of three acoustically coupled cavities. The primary cavity is conical in shape and houses the microphone at its lower surface. The key dimensions of the primary cavity and the acoustical compliances of each cavity are specified in Figure 1 (and replicated in Figure 2). The secondary cavities are coupled to the primary cavity by elements having acoustical mass and resistance. The lumped-parameter values of the coupling elements shall be as follows:

$$M_{a2} = 4,5 \times 10^2 \text{ Pa}\cdot\text{s}^2\cdot\text{m}^{-3}$$

$$M_{a3} = 1,06 \times 10^4 \text{ Pa}\cdot\text{s}^2\cdot\text{m}^{-3}$$

$$R_{a2} = 6,05 \times 10^6 \text{ Pa}\cdot\text{s}\cdot\text{m}^{-3}$$

$$R_{a3} = 2 \times 10^7 \text{ Pa}\cdot\text{s}\cdot\text{m}^{-3}$$

M_{a2} and M_{a3} represent acoustic masses, R_{a2} and R_{a3} represent acoustic resistances. These values are applicable for the reference environment conditions and are subject to the tolerances of 4.2.