

© Copyright SEK Svensk Elstandard. Reproduction in any form without permission is prohibited.

Ljudanläggningar – Del 23: TV-apparater och monitorer – Högtalarsystem

*Sound system equipment –
Part 23: TVs and monitors –
Loudspeaker systems*

Som svensk standard gäller europastandarden EN IEC 60268-23:2023. Den svenska standarden innehåller den officiella engelska språkversionen av EN IEC 60268-23:2023.

Nationellt förord

Europastandarden EN IEC 60268-23:2023

består av:

- **europastandardens ikraftsättningsdokument**, utarbetat inom CENELEC
- **IEC 60268-23, First edition, 2023 - Sound system equipment - Part 23: TVs and monitors - Loudspeaker systems**

utarbetad inom International Electrotechnical Commission, IEC.

ICS 33.160.01; 33.160.50

Denna standard är fastställd av SEK Svensk Elstandard, som också kan lämna upplysningar om **sakinnehållet** i standarden.
Postadress: Box 1284, 164 29 KISTA
Telefon: 08 - 444 14 00.
E-post: sek@elstandard.se. Internet: www.elstandard.se

Standarder underlättar utvecklingen och höjer elsäkerheten

Det finns många fördelar med att ha gemensamma tekniska regler för bl a mätning, säkerhet och provning och för utförande, skötsel och dokumentation av elprodukter och elanläggningar.

Genom att utforma sådana standarder blir säkerhetsfordringar tydliga och utvecklingskostnaderna rimliga samtidigt som marknadens acceptans för produkten eller tjänsten ökar.

Många standarder inom elområdet beskriver tekniska lösningar och metoder som åstadkommer den elsäkerhet som föreskrivs av svenska myndigheter och av EU.

SEK är Sveriges röst i standardiseringsarbetet inom elområdet

SEK Svensk Elstandard svarar för standardiseringen inom elområdet i Sverige och samordnar svensk medverkan i internationell och europeisk standardisering. SEK är en ideell organisation med frivilligt deltagande från svenska myndigheter, företag och organisationer som vill medverka till och påverka utformningen av tekniska regler inom elektrotekniken.

SEK samordnar svenska intressenters medverkan i SEKs tekniska kommittéer och stödjer svenska experters medverkan i internationella och europeiska projekt.

Stora delar av arbetet sker internationellt

Utformningen av standarder sker i allt väsentligt i internationellt och europeiskt samarbete. SEK är svensk nationalkommitté av International Electrotechnical Commission (IEC) och Comité Européen de Normalisation Electrotechnique (CENELEC).

Standardiseringsarbetet inom SEK är organiserat i referensgrupper bestående av ett antal tekniska kommittéer som speglar hur arbetet inom IEC och CENELEC är organiserat.

Arbetet i de tekniska kommittéerna är öppet för alla svenska organisationer, företag, institutioner, myndigheter och statliga verk. Den årliga avgiften för deltagandet och intäkter från försäljning finansierar SEKs standardiseringsverksamhet och medlemsavgift till IEC och CENELEC.

Var med och påverka!

Den som deltar i SEKs tekniska kommittéarbete har möjlighet att påverka framtida standarder och får tidig tillgång till information och dokumentation om utvecklingen inom sitt teknikområde. Arbetet och kontakterna med kollegor, kunder och konkurrenter kan gynnsamt påverka enskilda företags affärsutveckling och bidrar till deltagarnas egen kompetensutveckling.

Du som vill dra nytta av dessa möjligheter är välkommen att kontakta SEKs kansli för mer information.

SEK Svensk Elstandard

Box 1284
164 29 Kista
Tel 08-444 14 00
www.elstandard.se

EUROPEAN STANDARD

EN IEC 60268-23

NORME EUROPÉENNE

EUROPÄISCHE NORM

April 2023

ICS 33.160.01; 33.160.50

English Version

**Sound system equipment - Part 23: TVs and monitors -
Loudspeaker systems
(IEC 60268-23:2023)**

Équipements pour systèmes électroacoustiques - Partie 23:
Téléviseurs et moniteurs - Systèmes de haut-parleurs
(IEC 60268-23:2023)

Elektroakustische Geräte - Teil 23: Fernsehgeräte und
Monitore - Lautsprecher Systeme
(IEC 60268-23:2023)

This European Standard was approved by CENELEC on 2023-03-31. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and the United Kingdom.



European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

© 2023 CENELEC All rights of exploitation in any form and by any means reserved worldwide for CENELEC Members.

Ref. No. EN IEC 60268-23:2023 E

SEK Svensk Elstandard

SS-EN IEC 60268-23, utg 1:2023

European foreword

The text of document 100/3774/CDV, future edition 1 of IEC 60268-23, prepared by Technical Area 20 "Analogue and digital audio" of IEC/TC 100 "Audio, video and multimedia systems and equipment" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 60268-23:2023.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2023-12-31
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2026-03-31

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

Any feedback and questions on this document should be directed to the users' national committee. A complete listing of these bodies can be found on the CENELEC website.

Endorsement notice

The text of the International Standard IEC 60268-23:2023 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 standard indicated:

IEC 63034	NOTE	Approved as EN IEC 63034
IEC 60263	NOTE	Approved as EN IEC 60263
ISO 3382-1	NOTE	Approved as EN ISO 3382-1

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

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.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cencenelec.eu.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60268-2	1987	Sound system equipment. Part 2: Explanation of general terms and calculation methods	-	-
IEC 60268-21	2018	Sound system equipment - Part 21: Acoustical (output-based) measurements	EN IEC 60268-21	2018
IEC 61094-4	-	Measurement microphones - Part 4: Specifications for working standard microphones	EN 61094-4	-
IEC 61260-1	2014	Electroacoustics - Octave-band and fractional-octave-band filters - Part 1: Specifications	EN 61260-1	2014
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	EN ISO 3744	-
ISO 3745	-	Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Precision methods for anechoic rooms and hemi-anechoic rooms	EN ISO 3745	-
ISO 80000-2	-	Quantities and units - Part 2: Mathematics	EN ISO 80000-2	-
ANSI/CTA 2034-A	2015	Standard Method of Measurement for In-Home Loudspeakers	-	-

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Sound system equipment –
Part 23: TVs and monitors – Loudspeaker systems**

**Équipements pour systèmes électroacoustiques –
Partie 23: Téléviseurs et moniteurs – Systèmes de haut-parleurs**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 33.160.01; 33.160.50

ISBN 978-2-8322-6548-2

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

CONTENTS

FOREWORD.....	7
INTRODUCTION.....	9
1 Scope.....	10
2 Normative references	10
3 Terms, definitions and abbreviated terms	10
3.2 Abbreviated terms.....	11
4 Type description	12
5 Physical characteristics	12
5.1 Dimensions	12
5.2 Mass.....	12
6 Conditions	12
6.1 Normal measuring conditions	12
6.2 Rated conditions	13
6.3 Rated frequency range.....	13
6.4 Climatic conditions.....	13
7 Test signals.....	13
7.1 General.....	13
7.2 Sinusoidal chirp signal	13
7.3 Steady-state single-tone signal	13
7.4 Steady-state two-tone signal.....	14
7.5 Sparse multi-tone complex.....	14
7.6 Broadband noise signal.....	14
7.7 Narrow-band noise signal	14
7.8 Hann-burst signal.....	14
7.9 Impulsive signal	14
8 Acoustical environment.....	14
8.1 General.....	14
8.2 Free-field conditions	14
8.3 Simulated free-field conditions	14
8.4 In-situ environment	15
8.5 Listening room	15
9 Measurement equipment	15
10 Positioning of the EUT	15
10.1 Reference plane and normal vector.....	15
10.2 Reference point	15
10.3 Reference axis.....	16
10.4 Orientation vector	16
10.5 Horizontal and Vertical Trajectories	18
11 Measuring distance between EUT and microphone.....	18
11.1 Far-field conditions	18
11.2 Near-field conditions.....	18
12 Mounting of the EUT.....	19
12.1 General.....	19
12.2 Mounting methods	19
12.2.1 Stand-type.....	19

12.2.2	Wall mount-type.....	19
12.3	Mounting for free-field conditions	20
12.3.1	General	20
12.3.2	EUT rotating condition	20
12.3.3	Microphone rotating condition.....	20
13	Rated ambient conditions	20
13.1	Temperature ranges.....	20
13.1.1	Performance limited temperature range	20
13.1.2	Damage limited temperature range	21
13.2	Humidity ranges.....	21
13.2.1	Relative humidity range	21
13.2.2	Damage limited humidity range.....	21
14	Evaluation point and distance	21
14.1	Evaluation point	21
14.2	Evaluation distance.....	21
15	Free-field measurements	22
15.1	General.....	22
15.2	On-axis SPL FR	22
15.2.1	Definition	22
15.2.2	Measurement methods	22
15.2.3	Reporting.....	22
15.3	Spatial transfer function	23
15.3.1	Definition	23
15.3.2	Measurement method	23
15.3.3	Reporting.....	24
15.4	Sound power response	24
15.4.1	Definition	24
15.4.2	Measurement methods	25
15.4.3	Reporting.....	25
15.5	Directional characteristics	26
15.5.1	General	26
15.5.2	Measurement methods	27
15.5.3	Post-processing.....	27
15.5.4	Reporting.....	30
16	In-situ testing.....	30
16.1	General.....	30
16.2	In-situ transfer function	31
16.2.1	Definition	31
16.2.2	Measurement method	32
16.2.3	Reporting.....	33
16.3	Room transfer function.....	33
16.3.1	Definition	33
16.3.2	Measurement method	33
16.4	Reflected sound SPL response	34
16.4.1	Definition	34
16.4.2	Measurement method	34
16.4.3	Reporting.....	35
16.5	In-situ SPL FR	35

16.5.1	Definition	35
16.5.2	Measurement methods	35
16.5.3	Reporting.....	36
17	Mean SPL in an acoustical zone	37
17.1	General.....	37
17.2	Definition	37
17.3	Measurement.....	38
17.4	Numerical prediction	38
17.5	Reporting	38
18	FR characteristics.....	38
18.1	General.....	38
18.2	Mean value of SPL in a rated frequency range	39
18.2.1	Definition and unit.....	39
18.2.2	Setup.....	39
18.2.3	Procedure.....	39
18.2.4	Analysis.....	39
18.2.5	Reporting.....	40
18.3	Effective frequency range (EFR)	40
18.3.1	Definition and unit.....	40
18.3.2	Setup.....	40
18.3.3	Procedure.....	40
18.3.4	Analysis.....	41
18.3.5	Reporting.....	41
18.4	Spectral balance (SB).....	42
18.4.1	Definition and unit.....	42
18.4.2	Setup.....	42
18.4.3	Procedure.....	42
18.4.4	Analysis.....	42
18.4.5	Reporting.....	43
18.5	Regression line deviation (RLD).....	43
18.5.1	Definition and unit.....	43
18.5.2	Setup.....	43
18.5.3	Procedure.....	43
18.5.4	Analysis.....	44
18.5.5	Reporting.....	44
18.6	Narrow band variation (NBV)	45
18.6.1	Definition and unit.....	45
18.6.2	Setup.....	45
18.6.3	Procedure.....	45
18.6.4	Analysis.....	45
18.6.5	Reporting.....	46
19	Large-signal characteristics	46
19.1	Modelling at high amplitudes.....	46
19.2	Noise spectrum.....	47
19.2.1	Definition and measurement	47
19.2.2	Reporting.....	47
19.3	Short-term amplitude compression.....	47
19.3.1	Definition and unit.....	47
19.3.2	Setup.....	47

19.3.3	Procedure.....	47
19.3.4	Analysis.....	48
19.3.5	Reporting.....	48
19.4	Multi-tone distortion	48
19.4.1	Multi-tone distortion spectrum.....	48
19.4.2	Absolute multi-tone distortion	50
19.4.3	Relative multi-tone distortion	51
19.4.4	Total multi-tone distortion ratio	52
19.5	Harmonic distortion in sound pressure output	53
19.5.1	Definition and unit.....	53
19.5.2	Setup.....	54
19.5.3	Procedure and analysis	54
19.5.4	Reporting.....	55
19.6	Equivalent input total harmonic distortion.....	56
19.6.1	Definition and unit.....	56
19.6.2	Setup.....	57
19.6.3	Procedure.....	57
19.6.4	Analysis.....	57
19.6.5	Reporting.....	58
19.7	Impulsive distortion.....	59
19.7.1	Definition and unit.....	59
19.7.2	Setup.....	59
19.7.3	Procedure.....	59
19.7.4	Analysis.....	59
19.7.5	Reporting.....	60
19.8	Rated maximum input value	60
19.8.1	Definition and unit.....	60
19.8.2	Setup.....	60
19.8.3	Procedure.....	61
19.8.4	Analysis.....	62
19.8.5	Reporting.....	62
19.9	Rated maximum SPL	62
19.9.1	Definition and unit.....	62
19.9.2	Setup.....	62
19.9.3	Procedure.....	62
19.9.4	Reporting.....	63
Bibliography.....		64
Figure 1 –Test signal scope		12
Figure 2 –Recommended position and orientation of the EUT		16
Figure 3 – Measuring the horizontal directivity in spherical coordinates by rotating the EUT (e.g., OLED TV) in upright position.....		17
Figure 4 – Measuring the vertical directivity in spherical coordinates by rotating the tilted EUT (e.g. OLED TV).....		17
Figure 5 – Example for stand-type		19
Figure 6 – Example for wall mount-type.		20
Figure 7 – Evaluation point and distance (centre)		21
Figure 8 – SPL distribution of the direct sound represented in colour in 3D		24

Figure 9 – Measurement locations at vertical and horizontal trajectories at distance r_d	26
Figure 10 – Measurement locations at listening window	28
Figure 11 – Measurement locations at equivalent sound power.....	29
Figure 12 – Example for reporting the directional characteristics measured at distance r_d	30
Figure 13 – Modelling the sound reproduction under in-situ conditions.....	32
Figure 14 – Example of time-frequency analysis (spectrogram) applied to reflected sound impulse response $h_{REFL}(t,r)$ measured at a distance $r = 1,5$ m from the EUT in an office room.....	33
Figure 15 – SPL FR of the in-situ condition.	36
Figure 16 – Mean value of SPL at rated frequency range	40
Figure 17 – Effective Frequency Range at Frequency Response.....	41
Figure 18 – Regression line deviation at rated frequency range	44
Figure 19 – Loudspeaker model considering the dominant signal distortion at high amplitudes	46
Figure 20 – SPL spectrum of the reproduced multi-tone stimulus (MDS) at full FFT resolution comprising the fundamental components at the excited tones and the distortion components at other frequencies	49
Figure 21 – SPL of the fundamental, multi-tone distortion and noise floor integrated into frequency bands at the excitation frequencies of the multi-tone stimulus	51
Figure 22 – Relative multi-tone distortion $L_{RMD}(f_i)$ and relative noise floor $L_{RNF}(f_i)$ in decibel versus excitation frequencies f_i	52
Figure 23 – Total harmonic distortion (THD) referred to the fundamental component measured at three distances on the reference axis	55
Figure 24 – SPL FR of the fundamental component, total harmonic components ($L_{TH}(f,r_e)$), and the noise floor $L_{NFTH}(f,r_e)$	56
Figure 25 – Signal flow chart illustrating the generation of the equivalent input distortion by inverse filtering the sound pressure signal measured at three different points in an in-situ environment (office).....	57
Figure 26 – Equivalent input total harmonic distortion (EITHD) in percent versus excitation frequency measured at three distances on the reference axis in an in-situ environment.....	58
Table 1 – Recommended coordinates of the trajectories at distance r_D	18
Table 2 – Evaluation distance reference standard	22
Table 3 – Weights for polar angle θ at 10° Increments	29
Table 4 – Worked example for mean value of SPL	40
Table 5 – Worked example for effective frequency range	41
Table 6 – Worked example for spectral balance	43
Table 7 – Worked example for RLD.....	44
Table 8 – Worked example for NBV	46
Table 9 – Worked example for rated maximum input value.....	62
Table 10 – A Worked example for Rated maximum SPL.....	63

INTERNATIONAL ELECTROTECHNICAL COMMISSION

SOUND SYSTEM EQUIPMENT –

Part 23: TVs and monitors – Loudspeaker systems

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 60268-23 has been prepared by technical area 20: Analogue and digital audio, of IEC technical committee 100: Audio, video and multimedia systems and equipment. It is an International Standard.

The text of this International Standard is based on the following documents:

Draft	Report on voting
100/3774/CDV	100/3831/RVC

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

A list of all parts in the IEC 60268 series, published under the general title *Sound system equipment*, can be found on the IEC website.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The "colour inside" logo on the cover page of this document indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

IEC TC 100 has already standardized loudspeaker measurement methods. However, the locations of the loudspeakers of TVs and monitors vary (e.g. front, bottom, back, side), and TVs and monitors are used on stands or wall-mounted, and methods used for their installation continue to evolve. Since the sound characteristics change according to the installation type and position of the loudspeaker, it is necessary to develop new measurement methods for loudspeakers of TVs and monitors. This document provides measurement methods for the audio system of TVs and monitors that take into account the listening environment.

SOUND SYSTEM EQUIPMENT –

Part 23: TVs and monitors – Loudspeaker systems

1 Scope

This part of IEC 60268 specifies acoustical measurement methods that apply to TV sets, monitors with built-in loudspeakers, and other audio devices having similar acoustical properties (e.g. flat-panel loudspeakers). The acoustical measurements are performed under free-field conditions and in-situ.

This document does not assess the perception and cognitive evaluation of the reproduced sound, nor the impact of perceived sound quality.

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.

IEC 60268-2:1987, *Sound system equipment – Part 2: Explanation of general terms and calculation methods*

IEC 60268-21:2018, *Sound system equipment – Part 21 Acoustical (output-based) measurements*

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

IEC 61260-1:2014, *Electroacoustics – Octave-band and fractional-octave-band filters – Part 1: Specifications*

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*

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

ISO 80000-2, *Quantities and units – Part 2: Mathematics*

ANSI/CTA 2034-A:2015, *Standard Method of Measurement for In-Home Loudspeakers*