



BSI Standards Publication

Sound system equipment

Part 23: TVs and monitors — Loudspeaker systems

National foreword

This British Standard is the UK implementation of EN 60268-23:2023. It is identical to IEC 60268-23:2023.

The UK participation in its preparation was entrusted to Technical Committee EPL/100, Audio-visual equipment.

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

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Date	Text affected
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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)

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European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
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European foreword

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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.cenelec.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	-	-

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

SOUND SYSTEM EQUIPMENT –

Part 23: TVs and monitors – Loudspeaker systems

FOREWORD

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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.

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- withdrawn,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

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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*

3 Terms, definitions and abbreviated terms

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

3.1

equipment under test

EUT

equipment to be measured using the methods described in this document

3.2 Abbreviated terms

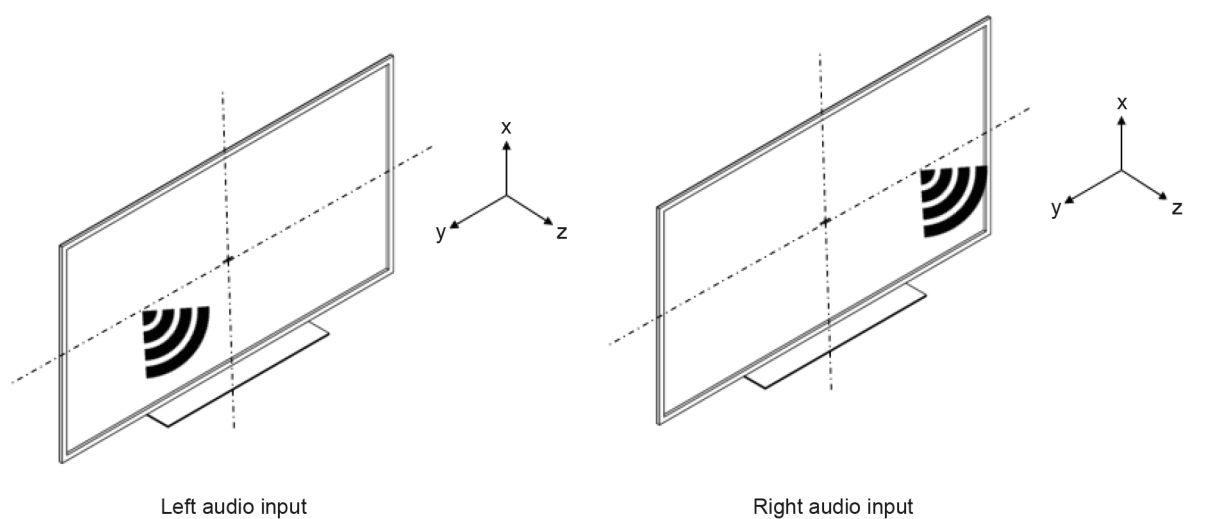
For the purposes of this document, the following abbreviated terms apply.

COG	centre of gravity
dB	decibel
DEF	direct energy fraction
DNR	distortion-to-noise ratio
DSP	digital signal processor
EFR	effective frequency range
EITHD	equivalent input total harmonic distortion
ESP	equivalent sound power
ESPD	equivalent sound power directivity index
EUT	equipment under test
FR	frequency response
Hz	hertz
m	metre
MD	absolute multi-tone distortion
MDS	multi-tone distortion spectrum
NBV	narrow band variation
NF	noise floor
ON	on-axis FR
Pa	pascal
POR	point of rotation
RFR	rated frequency range
RLD	regression line deviation
RMS	root mean square
RMD	relative multi-tone distortion
RNF	relative noise floor
SB	spectral balance
SNR	signal-to-noise ratio
SP	sound power
SPL	sound pressure level
TFA	time-frequency analysis
TH	total harmonic
THD	total harmonic distortion
TMDR	total multi-tone distortion ratio
W	watt

4 Type description

The type description, which includes the following information, shall be provided by the manufacturer.

- Number of input channels: typically, the EUT has two input channels that excite at least one transducer on both the left-hand side and the right-hand side, as shown in Figure 1. The configuration shall be clearly specified for EUTs with more input channels.
- Signal input format: for example, analogue, digital and wireless.
- Type, principles, and the number of the transducers used in the TV and monitor audio systems.
- Power amplification of audio.
- DSP (e.g. equalizer, active protection).



IEC

Figure 1 – Test signal scope

5 Physical characteristics

5.1 Dimensions

The outer dimensions of the EUT should be specified.

5.2 Mass

The total mass of the EUT should be specified.

6 Conditions

6.1 Normal measuring conditions

The EUT shall be understood to be under normal measuring conditions if all of the following conditions are met.

- The acoustical environment is specified and selected from those given in Clause 8.
- Unwanted acoustical signals, electrical signals, and noise generated by other sources shall be kept at the lowest levels possible because their presence may obscure low-level signals. Data related to signals, which are less than 20 dB above the noise level in the frequency band being considered, shall be discarded or marked as corrupted by noise.

- c) The EUT is positioned in accordance with Clause 10.
- d) The EUT is supplied with a test signal with specified properties (spectrum, duration, etc.) in accordance with Clause 7 at a specified RMS input value for the rated frequency range in accordance with 6.3.
- e) Attenuators, equalizers, dynamics, or any other active control elements shall be set to their “normal” position as stated by the manufacturer. If other positions are chosen, for example those providing a maximally flat FR or minimum attenuation, they shall be specified.
- f) Measuring equipment suitable for determining the wanted characteristics is connected in accordance with Clause 9.

6.2 Rated conditions

The rated conditions are physical characteristics that constitute the basis for performing the measurements. The following rated conditions shall be taken from the manufacturer's specification:

- rated frequency range defined in 6.3;
- rated maximum sound pressure level defined in 19.9;
- rated maximum input value defined in 19.8.

6.3 Rated frequency range

The rated frequency range corresponds to the intended use of the EUT in the final application as defined in IEC 60268-21. It is specified by the frequencies f_L and f_U of the lower and upper limits of the audio band for which the maximum sound pressure of the EUT is rated in 19.9.

NOTE The RFR can differ from the EUT's effective frequency range (EFR) as defined in 18.3.

6.4 Climatic conditions

IEC 60268-1 states that tests shall be carried out in the following environment to prevent the influence of temperature and humidity that can affect the properties of the drive unit suspensions [1]¹.

- a) ambient temperature: 15 °C to 35 °C;
- b) relative humidity: 25 % to 75 %;
- c) air pressure: 86 kPa to 106 kPa.

7 Test signals

7.1 General

Acoustical measurements shall be made by using one of the stimuli given in 7.2 to 7.9.

7.2 Sinusoidal chirp signal

As defined in IEC 60268-21:2018, 8.2

7.3 Steady-state single-tone signal

As defined in IEC 60268-21:2018, 8.3

¹ Numbers in square brackets refer to the Bibliography.

7.4 Steady-state two-tone signal

As defined in IEC 60268-21:2018, 8.4

7.5 Sparse multi-tone complex

As defined in IEC 60268-21:2018, 8.5

7.6 Broadband noise signal

As defined in IEC 60268-2:1987, 1.4

7.7 Narrow-band noise signal

As defined in IEC 60268-2:1987, 1.4.

7.8 Hann-burst signal

As defined in IEC 60268-21:2018, 8.8

7.9 Impulsive signal

As defined in IEC 60268-2.

8 Acoustical environment

8.1 General

Acoustical measurements shall be made under one of the conditions stated in 8.2 to 8.5. The acoustical environment used for testing shall be stated.

8.2 Free-field conditions

Acoustical conditions that approach those of free space may be used. Any environment shall be considered satisfactory when the reflected sound components are sufficiently suppressed to ensure accuracy of $\pm 0,5$ dB and $\pm 10^\circ$ in the measured sound pressure amplitude and phase values at the specified frequency, respectively. If the environment (e.g. an anechoic room at low frequencies) does not fulfil these free-field conditions over the rated frequency range of the measurement, the manufacturer shall state the valid frequency range.

NOTE Half-space, free-field conditions are usually not helpful for the acoustical evaluation of monitors, TVs, and other EUTs of similar shape used in applications where the EUT is not operated within a wall of sufficient size.

8.3 Simulated free-field conditions

Acoustical conditions of any environment (e.g., reverberant room) shall be satisfied if the direct sound radiated by the EUT is separated from the room reflections by using measurement techniques such as gating of the impulse response [2], wave separation [3], or acoustical holography [4]. These measurement techniques shall ensure accuracy of $\pm 0,5$ dB and $\pm 10^\circ$ in the measured sound pressure amplitude and phase values at the specified frequency. The frequency resolution $\Delta f = 1 / T$, where T is the effective or truncated impulse response length where the simulated free-field conditions are fulfilled, and any other limitations that impair the measurement results shall be stated.

The condition will be met in any environment (e.g. large rooms with no obstructions) where sound emitted by the TV or monitor speaker reflected from any surface or object in the environment does not reach the measuring microphone before completing the direct sound measurement.

8.4 In-situ environment

There is also a need in product development, manufacturing, installation, maintenance, and service to perform additional measurements in an in-situ environment that does not comply with free-field conditions. For example, an in-situ environment is generated using the wall-mounted, stand-type mounting techniques defined in Clause 12. Test results depend on the particular properties of the in-situ environment and are not comparable with measurements under other conditions.

8.5 Listening room

A listening room representing the typical in-situ environment used by a customer in the final target application is valuable for combining perceptual and physical testing. In order to create a meaningful listening room, the following criteria shall be specified:

- the volume of the room;
- the shape of the room;
- reverberation time $R_{60}(f)$ of the room versus frequency measured in octaves;
- positioning of the EUT in accordance with Clause 10;
- listening position and acoustical zone in accordance with Clause 17;
- mounting conditions in accordance with Clause 12.

NOTE A perceptual and physical listening room reflects essential properties of the speaker-room interaction and provides repeatable and reproducible data in this room. However, the data measured in different listening rooms have limited comparability.

9 Measurement equipment

Measurements in free-field conditions shall be made using a WS2F or WS3F free-field microphone in accordance with IEC 61094-4.

10 Positioning of the EUT

10.1 Reference plane and normal vector

The normal vector $\mathbf{n}_{\text{ref}}$ should be used to specify the direction of the reference plane. The reference plane of EUT should be set parallel to the display screen, as shown in Figure 2. For other EUTs, the manufacturer shall specify the normal vector $\mathbf{n}_{\text{ref}}$ with the results.

The reference plane with the normal vector $\mathbf{n}_{\text{ref}}$ should be used to define the reference axis and reference point $\mathbf{r}_{\text{ref}}$. The pole of the spherical coordinate system in accordance with ISO 80000-2 shall be on the reference axis pointing in the direction of the normal vector $\mathbf{n}_{\text{ref}}$. The azimuthal angle ϕ should rotate according to the right-hand rule around the normal vector $\mathbf{n}_{\text{ref}}$.

10.2 Reference point

The manufacture shall define the reference point $\mathbf{r}_{\text{ref}}$ within the reference plane and provide this information with the measured results. For an EUT with symmetrical geometry, the reference point $\mathbf{r}_{\text{ref}}$ shall be placed at the axis of reflectional symmetries or at the point of rotational symmetry. The directional properties of the EUT shall be described in a spherical coordinate system. The origin of the Cartesian and spherical coordinate system shall be placed at the reference point, as shown in Figure 2.

NOTE For directional measurements performing a rotation of the EUT, the reference point is identical to the point of rotation (POR) and usually chosen close to or identical to the centre of gravity (COG) of the EUT.

10.3 Reference axis

The reference axis is the line that passes through the reference plane at the reference point r_{ref} in the direction of the normal vector n_{ref} as shown in Figure 2. The pole of the spherical coordinate system shall be placed on the reference axis, and the polar angle θ describes the declination of the observation point r from the reference axis. The on-axis measurements defined in 15.2 shall be performed on the reference axis with a polar angle $\theta=0$. The reference axis shall be used as the reference axis for directional measurements.

10.4 Orientation vector

The orientation vector O_{ref} defines the orientation of the EUT and the azimuthal angle $\phi = 0$ within the reference plane shown in Figure 2. The orientation vector O_{ref} should typically point upwards to the top of the EUT if not stated otherwise. The azimuthal angle should have a positive sign if measured anticlockwise from the orientation vector O_{ref} on the reference plane, as seen from the zenith side of the plane.

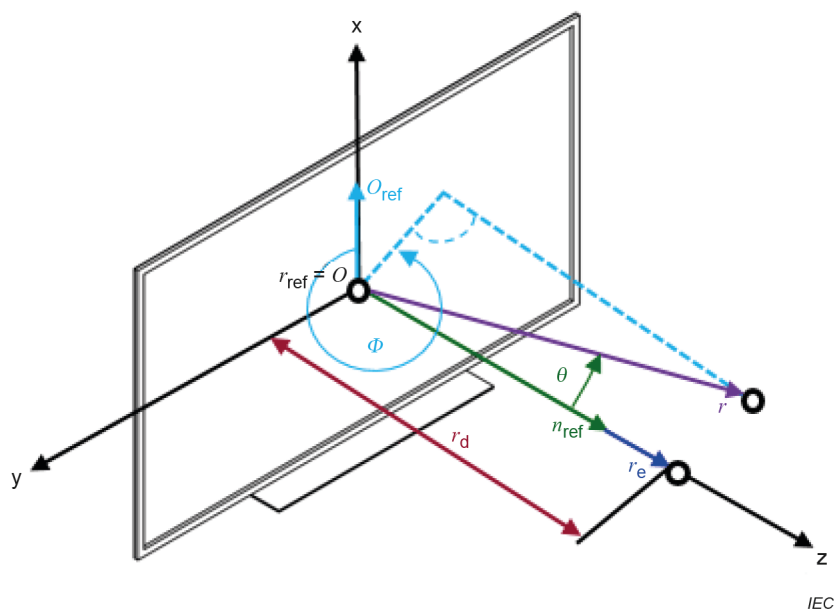


Figure 2 –Recommended position and orientation of the EUT

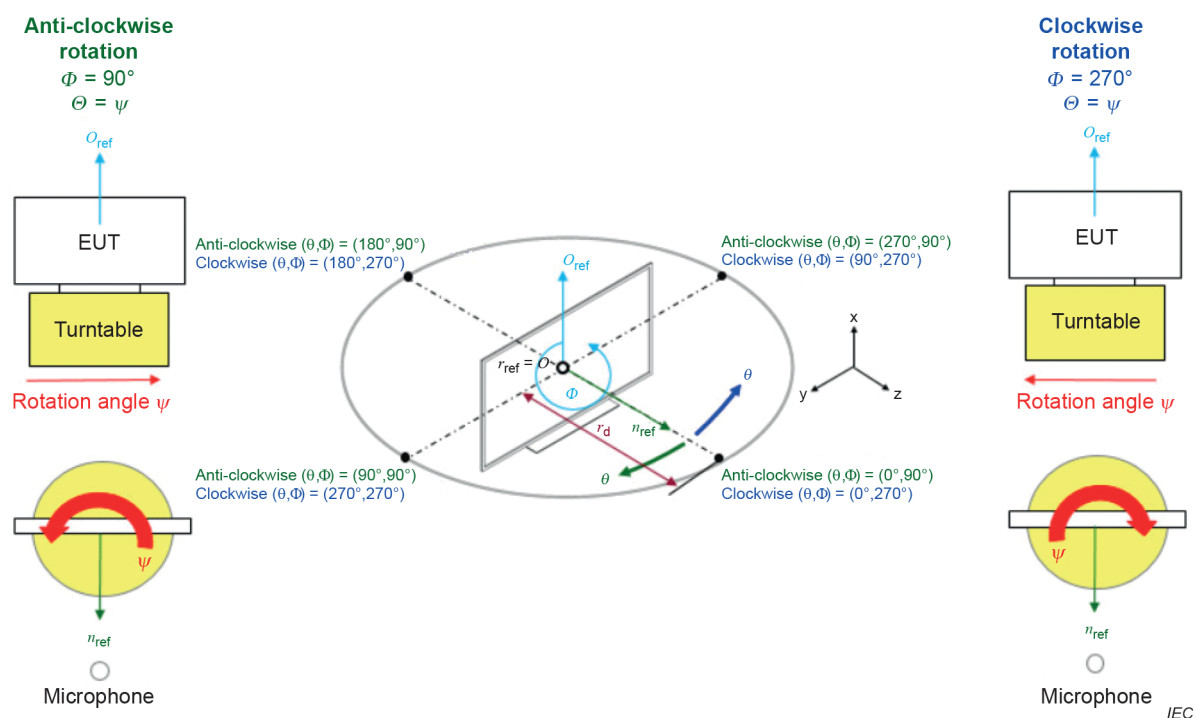


Figure 3 – Measuring the horizontal directivity in spherical coordinates by rotating the EUT (e.g., OLED TV) in upright position

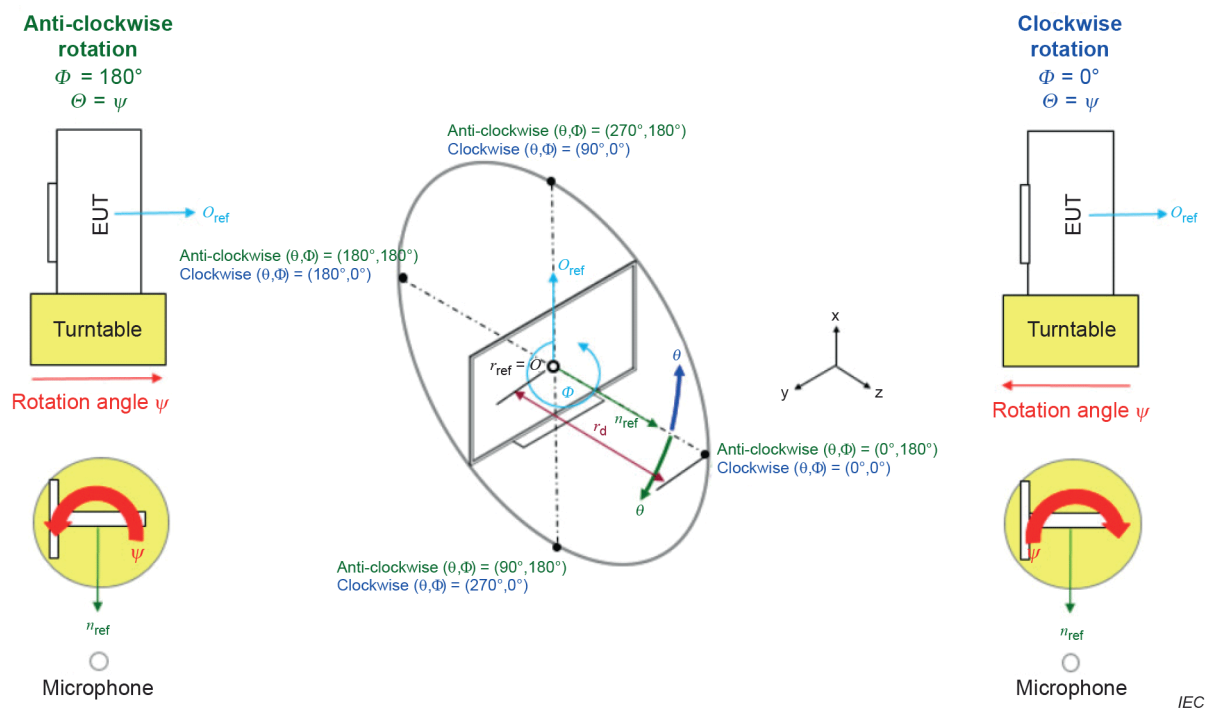


Figure 4 – Measuring the vertical directivity in spherical coordinates by rotating the tilted EUT (e.g., OLED TV)