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BSI Standards Publication

Plasma display panels

Part 2-5: Measuring methods —
Acoustic noise (IEC 61988-2-5:2012)

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English version

**Plasma display panels -
Part 2-5: Measuring methods -
Acoustic noise
(IEC 61988-2-5:2012)**

Panneaux d'affichage à plasma -
Partie 2-5 : Méthodes de mesure -
Bruit acoustique
(CEI 61988-2-5:2012)

Plasmabildschirme -
Teil 2-5: Messverfahren - Störgeräusche
(IEC 61988-2-5:2012)

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Foreword

The text of document 110/355/FDIS, future edition 1 of IEC 61988-2-5, prepared by IEC/TC 110 "Electronic display devices" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 61988-2-5:2012.

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- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2013-03-19
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IEC 61988-3-1 NOTE Harmonised as EN 61988-3-1.

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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 60050	Series	International Electrotechnical Vocabulary (IEV)	-	-
IEC 60068-1	-	Environmental testing - Part 1: General and guidance	EN 60068-1	-
IEC 61672-1	-	Electroacoustics - Sound level meters - Part 1: Specifications	EN 61672-1	-
IEC 61988-1	-	Plasma display panels - Part 1: Terminology and letter symbols	EN 61988-1	-
IEC 61988-2-1	-	Plasma display panels - Part 2-1: Measuring methods - Optical and optoelectrical	EN 61988-2-1	-
IEC 61988-4	-	Plasma display Panels - Part 4: Climatic and mechanical testing methods	EN 61988-4	-
ISO 7574-1	-	Acoustics - Statistical methods for determining and verifying stated noise emission values of machinery and equipment - Part 1: General considerations and definitions	EN 27574-1	-

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PLASMA DISPLAY PANELS –

Part 2-5: Measuring methods – Acoustic noise

1 Scope

This part of IEC 61988 determines the following measuring methods for characterizing the performance of PDP modules (plasma display modules):

- Acoustic noise

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050 (all parts), *International Electrotechnical Vocabulary* (available at <http://www.electropedia.org>)

IEC 60068-1, *Environmental testing – Part 1: General and guidance*

IEC 61672-1, *Electroacoustics – Sound level meters – Part 1: Specifications*

IEC 61988-1, *Plasma display panels – Part 1: Terminology and letter symbols*

IEC 61988-2-1, *Plasma display panels – Part 2-1: Measuring methods – Optical and optoelectrical*

IEC 61988-4, *Plasma display panels – Part 4: Climatic and mechanical testing methods*

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-801:1994, IEC 60068-1 and IEC 61988-1 and the following apply.

3.1

acoustic noise

audible noise generated by the driving of PDP module, and caused by the vibrations of panel, electric components, wirings and circuits

Note 1 to entry: The noise depends on the image displayed, module (panel) temperature, environmental pressure and surrounding mechanical (acoustic) conditions.

3.2

acoustic noise level

L

sum of acoustic noise levels that are measured at the individual octave band in the measuring frequency range

3.3 acoustic noise level at f Hz

L_f

noise amplitude that is measured at the centre frequency of individual 1/3 octave bands in the centre frequency range of 250 Hz ~ 20 000 Hz

Note 1 to entry: The centre frequencies of the individual 1/3 octave bands are 250 Hz, 315 Hz, 400 Hz, 500 Hz, ... 20 000 Hz.

4 Structure of measuring equipment

The system diagrams and/or driving conditions of the measuring equipment shall comply with the structure specified in each item.

5 Standard measuring conditions

Measurements shall be carried out under the standard environmental conditions defined in IEC 61988-2-1, i.e. at a temperature of $25\text{ °C} \pm 3\text{ °C}$, a relative humidity of 25 % to 85 %, and a pressure of 98 kPa to 104 kPa, if not otherwise specified in the relevant specifications. When different conditions are used, they shall be noted in the report.

The standard reference atmosphere defined in IEC 61988-4, i.e. 25 °C and 101,3 kPa, is applied.

6 Measuring method

6.1 Purpose

The purpose of this method is to measure the acoustic noise of a PDP module.

6.2 Measuring equipment

6.2.1 Equipment list

The following equipment shall be used:

- a) anechoic chamber or silent room;
- b) sound level meter; and
- c) pattern generator.

NOTE Microphone and FFT (Fast Fourier Transformation) analyser with control PC can be used when calibrated against a calibrated sound level meter.

6.2.2 Anechoic chamber

An anechoic chamber with an enough size for the measurement should be used. The details of the anechoic chamber shall be noted on the report. The conditions of the anechoic chamber defined in ISO 7574-1 shall be applied, if not otherwise defined in this measurement method. The background noise level of the anechoic chamber shall be measured and noted in the report.

6.2.3 Silent room

When any proper anechoic chamber is not available, a silent room where the background sound level is small enough for the measurement can be used. In the case of using a silent room, the size of the room should be large enough and the sound reflection from the wall, ceiling and floor shall not affect the measurement result. The background noise level of the silent room shall be measured and noted in the report.

6.2.4 Sound level meter

A well calibrated sound level meter shall be used. The details are defined in IEC 61672-1.

NOTE Microphone and FFT analyser with control PC can be used when calibrated against a calibrated sound level meter.

6.3 Measuring conditions

6.3.1 Layout

The PDP module shall be set in the anechoic chamber or the silent room as shown in Figure 1. The driving power source, control PC and pattern generator should be set outside the room. The power and signal lines shall be arranged in order to be free from any unwanted vibrations. The microphone shall be aligned perpendicular to the screen centre. The details of the measuring layout applied shall be noted in the report.

6.3.2 Standard measuring distance

The standard measuring distance is 1 m. When other measuring distance is applied, this shall be noted on the report.

6.3.3 Measuring point

The measurement shall be carried out at the centre of the screen area as shown in Figure 2. The acoustic noise levels of front and rear sides of PDP module shall be measured. When different points are measured, this shall be noted in the report.

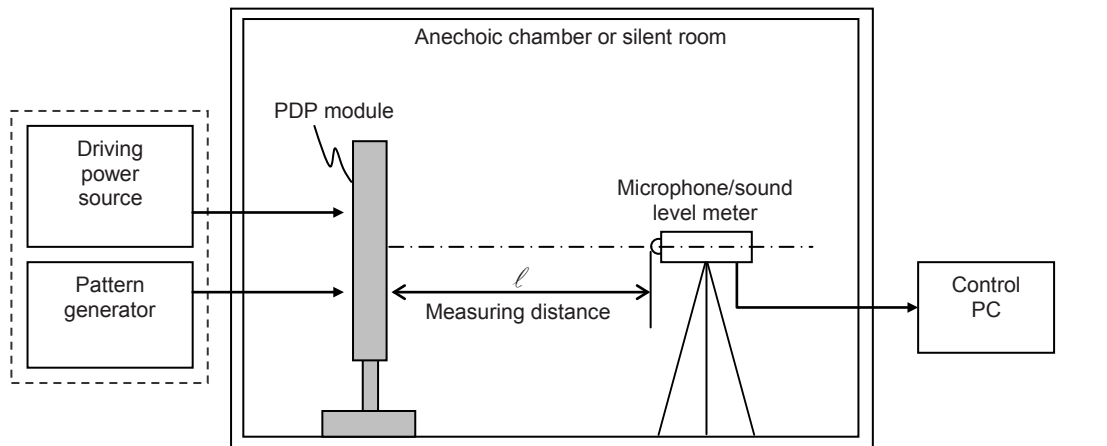
6.3.4 Input video signal

Full screen white at the level of 100 %, full screen black and other signals defined in the relevant specification shall be applied. The applied signals shall be noted in the report.

6.3.5 Warm-up conditions

The PDP module shall be warmed up for 30 minutes or longer under the condition of full screen white to stabilize the panel at around the highest operating temperature in the standard environmental conditions. When another warm-up condition is applied, it shall be noted in the report.

NOTE Gas pressure in a PDP panel becomes higher with the increase of panel temperature. The acoustic noise of the panel usually changes with gas pressure.



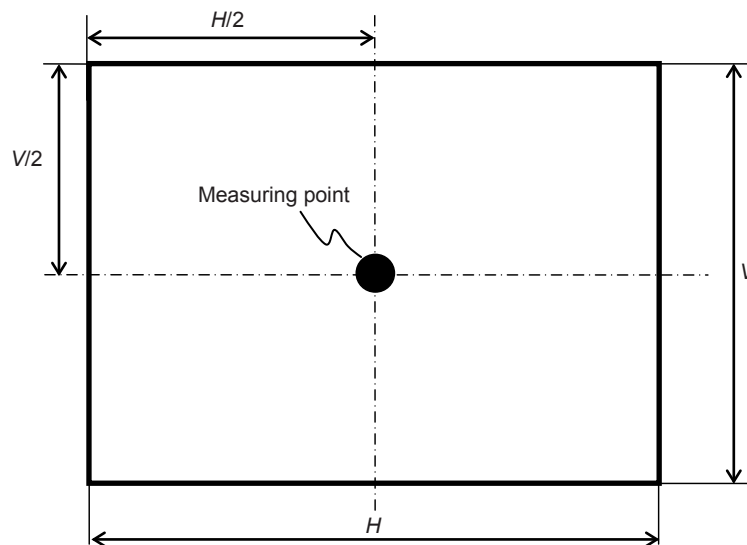
IEC 905/12

Front and rear sides of PDP module are measured.

The microphone is aligned perpendicular to screen.

The power and signal lines are set free from any unexpected vibrations.

Figure 1 – Setting of measuring equipment



IEC 906/12

Figure 2 – Measuring point

6.3.6 Measuring frequency range

The standard measuring frequency range is 250 Hz ~ 20 000 Hz. When another measuring frequency is applied, it shall be noted on the report.

NOTE The lowest bound of measuring frequency range depends on the cut-off frequency of anechoic chamber. The cut-off frequency of anechoic chamber is defined as follows:

$$\text{Cut-off frequency} = \frac{v_s}{4\ell_w}$$

where, v_s is the velocity of sound and ℓ_w is the length of wedge foam (shape of sound absorber) in anechoic chamber. If ℓ_w is 340 mm, the cut-off frequency is about 250 Hz and the results for frequencies less than 250 Hz are meaningless.

6.3.7 Measuring bandwidth

The standard measuring bandwidth is 1/3 octave band.

6.3.8 Weighting filter

The acoustic weighting of FFT analyser should be A-weighted (dBA). A-weighting filter is used to emphasize frequencies around 3 kHz ~ 6 kHz where the human ear is most sensitive, while attenuating very high and very low frequencies to which the ear is insensitive.

NOTE The unit, A-weighted decibel, is abbreviated dBA or dB(A). The decibel (dB) can be used for convenience.

6.4 Calculation of overall acoustic noise level

When an FFT analyser is used, overall acoustic noise level L is calculated as follows;

$$L \text{ (dB)} = 10 \log_{10} \left(\sum_f 10^{\frac{L_f}{10}} \right)$$

where L_f is the acoustic noise level at the frequency f and f is the centre frequency of each 1/3 octave band.

6.5 Measurement procedure

The following procedure shall be carried out:

- a) Set the sound level meter toward front side of PDP module;
- b) Measure the background noise level;
- c) Turn on the PDP module;
- d) Warm-up the PDP module with an input signal of full screen white;
- e) Measure the sound pressure level with the signal of full screen white;
- f) Turn the signal to full screen black;
- g) Measure the sound level with the signal of full screen black;
- h) Calculate and record the measurement result as shown in Table 1, and
- i) Repeat the measurement from e) for rear side of PDP module.

If a procedure different from above is used, it shall be described in detail in the measurement report.

6.6 Measurement report

The measurement report shall include the detailed measurement conditions and results (see Table 1).

Table 1 – Example of acoustic noise measurement result

	Acoustic noise level L dBA			
	Front	Max.	Rear	Max.
Input signal				
Full screen white	25,5	x	29,2	
Full screen black	24,7		29,3	x
Background	15		15	
Maximum acoustic noise	29,3 dBA / Rear side / Full screen black			

Bibliography

IEC 61988-3-1, *Plasma display panels – Part 3-1: Mechanical interface*

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