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Edition 1.0 2009-07

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Plasma display panels –
Part 2-3: Measuring methods – Image quality: defects and degradation

Panneaux d'affichage à plasma –
Partie 2-3: Méthodes de mesure – Qualité d'image: défauts et dégradation

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PLASMA DISPLAY PANELS –

Part 2-3: Measuring methods – Image quality: defects and degradation

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The text of this standard is based on the following documents:

FDIS	Report on voting
110/180/FDIS	110/188/RVD

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

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all the parts in the IEC 61988 series, under the general title *Plasma display panels*, can be found on the IEC website.

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PLASMA DISPLAY PANELS –

Part 2-3: Measuring methods – Image quality: defects and degradation

1 Scope

This part of IEC 61988 determines the measuring methods for defects and degradation of colour plasma display (PDP) module in the following areas:

a) cell defects;

b) image sticking;

c) luminance lifetime.

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 60068-1:1988, *Environmental testing – Part 1: General and guidance*

IEC 60107-1:1997, *Methods of measurement on receivers for television broadcast transmissions – Part 1: General considerations – Measurements at radio and video frequencies*

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

IEC 61988-2-1:2002, *Plasma display panels – Part 2-1: Measuring methods – Optical*

CIE 15:2004, *Colorimetry, 3rd Edition (ISBN 978 3 901906 33 6)*

3 Terms and definitions

For the purposes of this document, most of the terms and definitions used, comply with IEC 61988-1, IEC 60068-1 and IEC 60107-1, and the followings apply.

3.1
cell defect
cell showing a dark defect or a bright defect, or an unstable cell

3.2
defect luminance ratio
percentage of luminance difference from the full screen white-level luminance of each colour

3.3
unstable cell
cell that changes luminance in an uncontrollable way

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4 Standard measuring conditions

4.1 Environmental conditions

Measurements shall be carried out under the standard environmental conditions, e.g. at a temperature of 25 °C ± 3 °C, a relative humidity of 25 % to 85 % and pressure of 86 kPa to 106 kPa. When different environmental conditions are used, it shall be noted on the report.

4.2 Lighting conditions

The following dark-room conditions shall be used for all measurements. Illuminance shall be less than 1 lx anywhere on the screen of the PDP module. When this illuminance significantly affects the measurement of the black level, the background subtraction method shall be used. In case of a different illuminance or if the background subtraction method is used, it shall be noted on the report.

4.3 Set-up conditions

Standard set-up conditions are given below. Each condition shall be noted on the specification form whenever any measurement is carried out under conditions that differ from the standard set-up conditions.

4.3.1 Adjustment of PDP modules

For contrast adjustable PDP module, set the maximum contrast under the standard measuring environmental conditions (see 4.1), measurements shall be started when the PDP module achieves stability.

4.3.2 Warm-up condition of PDP modules

Measurements shall be started after warm-up when the PDP module achieves stability. The warm-up time shall be longer than 30 min with signal input set at 15 % grey level on full screen without gamma correction. Measurements shall be started after the above warm-up when the PDP module achieves stability, unless other specified measuring methods are used. When different warm-up conditions are used, they shall be noted on the report.

4.3.3 Conditions of measuring and driving equipment

a) The light measuring device shall be aligned perpendicular to the area to be measured on the screen of the PDP module.

b) The standard measuring distance ℓ_{X0} is 2,5 *V*, where *V* is the screen height or the short side length of the screen. The measuring distance shall be between 1,6 *V* and 2,8 *V*. The measuring distance shall be noted on the report (see Figure 1).

c) The light measuring device shall be set at a proper aperture angle less than or equal to 2 ° and shall measure an area of at least 500 pixels which has an extent less than 10 % of the screen height. This area corresponds to a circular measurement area of at least 26 lines in diameter in the case of a display panel having a square pixel consisting of 3 subpixels. The measuring distance and the aperture angle may be adjusted to achieve a viewing area greater than 500 pixels which has an extent less than 10 % of the screen height if setting the above aperture angle is difficult. Such deviations from standard conditions shall be noted on the report.

d) The standard field frequency of the driving signal equipment shall be 60 Hz, unless the module is intended to be used at a significantly different frequency. In any case, the field frequency used shall be noted on the report.

e) In case of visual inspection, the inspector shall observe the area to be measured on the screen of the colour plasma display module from the same position of light measuring devices.

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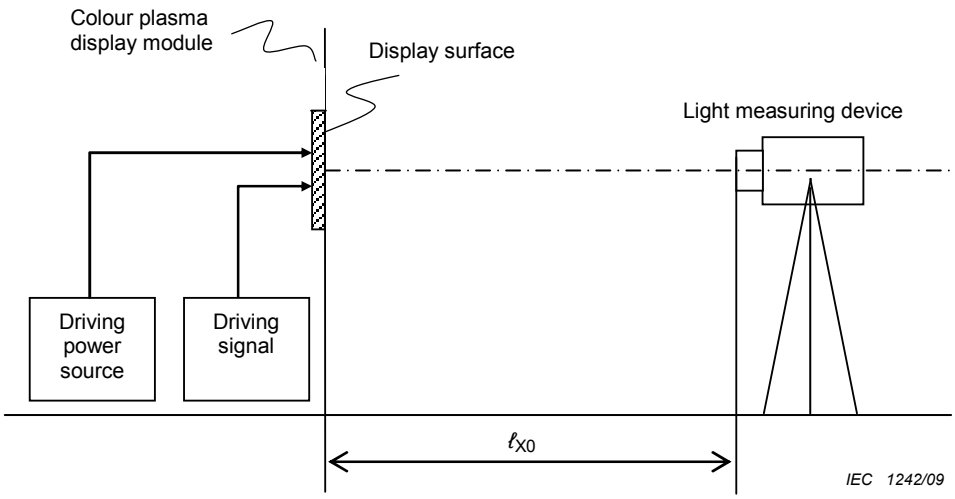

Figure 1 – Measuring system and its arrangement

5 Measuring methods

5.1 Cell defects

5.1.1 Purpose

The purpose of this method is to measure the cell defects of the PDP modules.

5.1.2 Measuring equipment

The following equipment shall be used:

a) Driving power source

b) Driving signal equipment

c) Automatic defect inspection instrument (optional).

5.1.3 Measuring layout

Measurements shall be carried out at the standard measuring layout shown in Figure 1. When a different measuring layout is used, this shall be noted on the report. When visual inspection is used, the inspector should observe the module from the same place as the light measuring equipment which is defined in the standard measuring layout.

5.1.4 Division of display zone

The whole screen is usually divided into two zones during the measurement, as shown in Figure 2.

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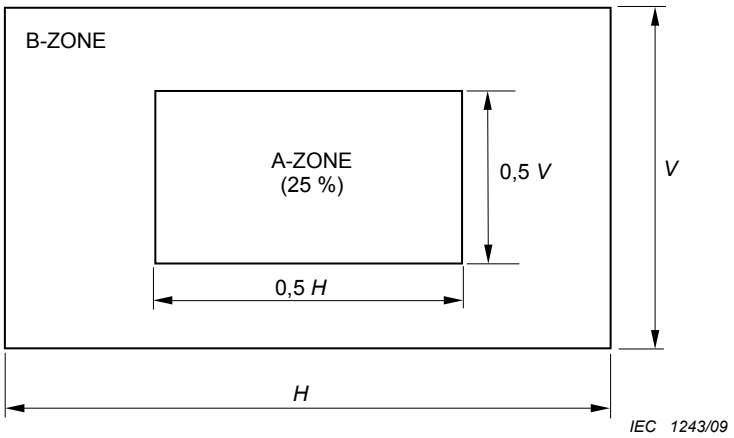

Key

1 A-zone, the 25 % area of inner box

2 B-zone, the remaining 75 % area in the outer box

Figure 2 – Example of display zone

In this example, the centre of A-zone collides to the screen centre and the ratio of the size of A-zone to that of the screen area may be defined. Figure 2 shows an example of 25 % area and the horizontal and vertical ratio are both 0,5.

For the measurement of cell defects, the number of defect cells may be separately observed on each separated screen zone as shown in Figure 2, when required in the relevant specification.

5.1.5 Classification of cell defects

Cell defects are classified as follows: dark defect, bright defect and unstable cell.

For the definitions, see 3.3 of this standard and IEC 61988-1.

5.1.6 Luminance levels of defective cells

The luminance level for each defect on each screen condition is defined as the defect luminance ratio *X*, *Y*, *Z* or *V* as follows:

– A dark defect (R, G, or B) has a luminance which is darker than *X* % of the luminance of full screen R, G or B respectively (see Figure 3).

– A bright defect (R, G, or B) on white, or same colour screen has a luminance which is brighter than *Y* % of the luminance of full screen R, G, or B respectively (see Figure 4).

– A bright defect (R, G, or B) on black screen has a luminance which is brighter than *Z* % of the luminance of full screen R, G or B respectively (see Figure 5).

– A bright defect (R, G, or B) on other colours (for an example, red bright defect on full screen green, or phosphor contamination) has a luminance which is brighter than *V* % of the luminance of full screen R, G or B respectively (see Figure 6).

The *X*, *Y*, *Z* or *V* values can be different for each colour defect. The values chosen for *X*, *Y*, *Z* and *V* shall be given in the report.

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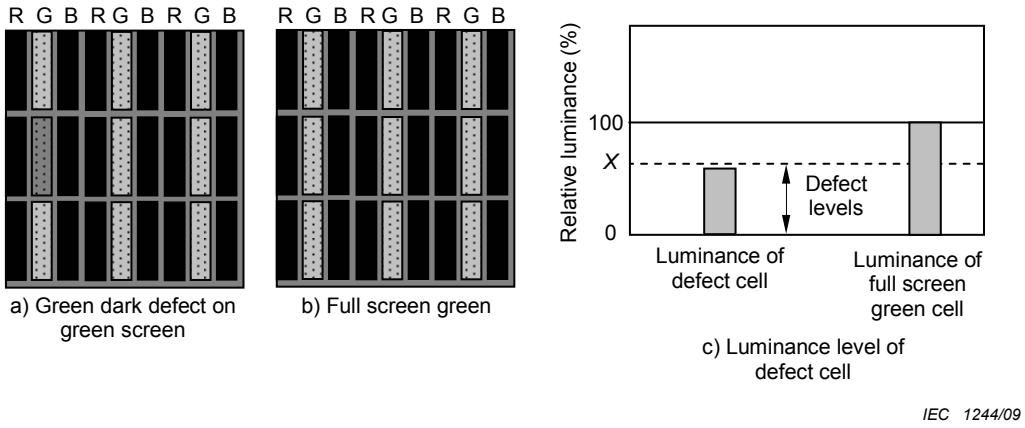

Figure 3 – Dark defect on green screen and its luminance level

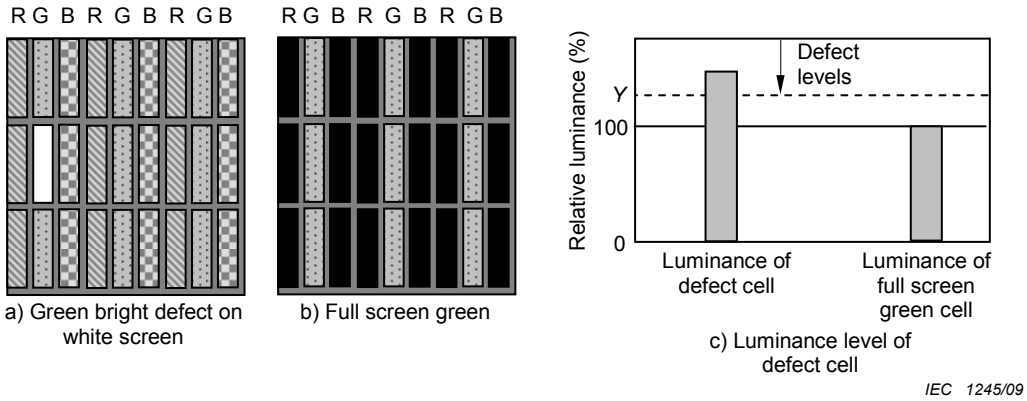

Figure 4 – Bright defect on white screen and its luminance level

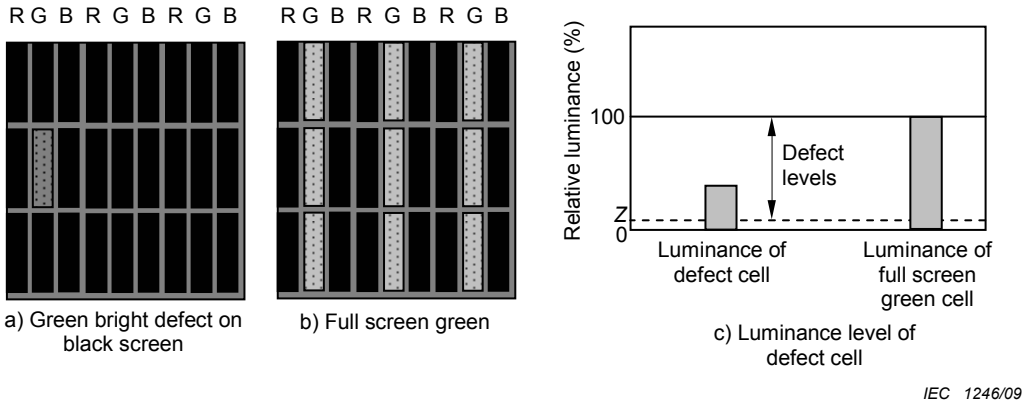

Figure 5 – Bright defect on black screen and its luminance level

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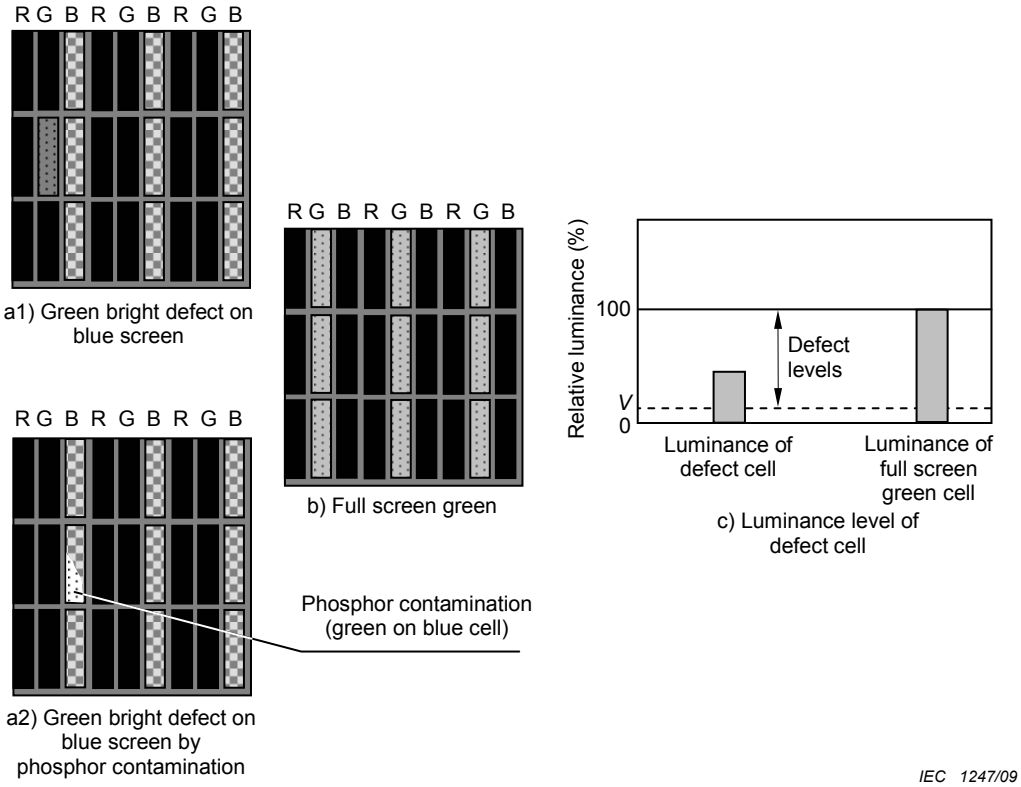

Figure 6 – Bright defect on other colour screen and its luminance level

Peak to peak luminance variation ratio of unstable cell, W_R W_G W_B: The peak to peak luminance variation of an unstable cell is greater than W % of the full screen R, G and B respectively.

The judgment whether a cell is a defect cell or not, is specified on the relevant specification.

5.1.7 Measuring procedure

Warm up the PDP module according to the procedure described in 4.3.2. The measurement shall be performed under dark-room conditions (see 4.2.1).

Applied input signals are full screen black, full screen white, full screen red, full screen green, and full screen blue. When different screen condition(s) are applied, they shall be reported.

Observed defect types on each screen are as follows:

– dark defect, bright defect and unstable cell on full screen white,
– bright defect and unstable cell on full screen black,
– bright defect, red dark defect and unstable cell on full screen red,
– bright defect, green dark defect and unstable cell on full screen green, and
– bright defect, blue dark defect and unstable cell on full screen blue.

Applied signal conditions and observed defect types are summarized in Table 1.

Input one of a full screen black, white, red, green and blue signals to the module. Each signal is described in Table 1. Observe cell defects and classify them to three types of cell defects. Record the number of three type cell defects. Observation area on the screen may be divided into two zones as shown in Figure 2. An input signal is changed to another signal after the observation of the cell defects of one signal is completed.

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After the measurement of all input signals, record the total number of the defects and finish the measurement.

The record of cell defects may be summarized as Table 2.

Table 1 – Input signal for cell defect observation

Signal	Input signal level %			Observed defect of each colour (R, G, B)[a]			Display area
	Red	Green	Blue	Bright defect	Dark defect	Unstable cell	
Full screen black	0	0	0	R, G, B	-	R, G, B	Full screen
Full screen white	100	100	100	R, G, B	R, G, B	R, G, B	Full screen
Full screen red	100	0	0	R, G, B	R	R, G, B	Full screen
Full screen green	0	100	0	R, G, B	G	R, G, B	Full screen
Full screen blue	0	0	100	R, G, B	B	R, G, B	Full screen
[a] On black screen a dark defect (R, G, or B) is not observed, and a red dark defect is not observed on other colour (G or B) screen for an example.							

Table 2 – An example record of cell defects

Signal	Bright defect			Dark defect			Unstable cell		
	Red	Green	Blue	Red	Green	Blue	Red	Green	Blue
Full screen black	1	0	2	-	-	-	0	0	1
Full screen white	0	0	0	2	1	3	2	2	(1)
Full screen red	0	1	0	(2)	-	-	0	0	1+(1)
Full screen green	0	0	0	-	2+(1)	-	(1)	(1)	(2)
Full screen blue	1	(1)	0	-	-	2+(3)	(2)	0	(1)
Total	2	1	2	2	3	5	2	2	2
NOTE The number in brackets is the count of previously measured same defects.									

5.2 Image sticking

5.2.1 Purpose

The purpose of this method is to measure the image sticking of the PDP modules. We shall consider both the luminance and colour change during the measurement.

5.2.2 Measuring equipment

The following equipment shall be used:

a) driving power source;

b) driving signal equipment;

c) light measuring device.

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5.2.3 Specification of image sticking

Image sticking is a general term that refers to a burned-in image, a ghost image or an image that decays slowly over time. This is measured after operating the PDP module for 1 h with a full white screen. See IEC 61988-1.

NOTE The 1h full white screen operation avoids confusion between image sticking and short term image retention that disappears quickly.

5.2.4 Measuring procedure

The PDP module shall be set in the standard measuring conditions and in the dark-room conditions. The layout diagram is shown in Figure 1.

Apply full screen white signal of level 100 % to the PDP module for 1 h, measure the initial luminance values and the initial chromaticity values at the measuring points P_0 to P_4 as shown in Figure 8, and then change to full screen red, green and blue in turn to measure the initial luminance values and the initial chromaticity values at the measuring points P_0 to P_4 as shown in Figure 8. Warm-up of the PDP module is not required here.

Apply white signal (*H*/5 . *V*/5) of level 100 % to the PDP module and maintain for the following selected time (8, 12, 24, 36, 48) hours (should be noted) in the standard measuring condition, the display pattern is shown in Figure 7. Afterwards, turn the PDP module power off and maintain for 1 h in the standard measuring condition.

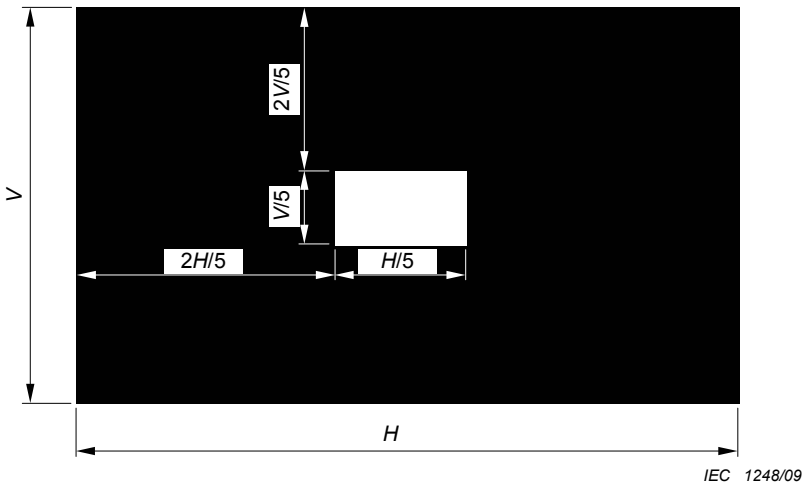

Figure 7 – Image sticking pattern

Apply full white signal of level 100 % to the PDP module for 1 h in the standard measuring condition, measure the final luminance values and the final chromaticity values at the measuring points P_0 to P_4 as shown in Figure 8, and then change to full screen red, green and blue in turn to measure the final luminance values and the final chromaticity values at the measuring points P_0 to P_4 as shown in Figure 8.

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