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Proposal to modify International Standard IEC 61947-1

"Electronic projection– Measurement and documentation of key performance criteria – Part 1: Fixed resolution projectors"

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DRAFT

Introduction

This document outlines a proposal to modify IEC 61947-1 "Electronic projection – Measurement and documentation of key performance criteria – Part 1: Fixed resolution projectors"

Specifically the proposal is a change to Section 5 "Light output measurement." The current standard measurement for projector brightness is "IEC illuminance" often misrepresented on projector datasheets as "ANSI lumens." The ANSI specification was withdrawn (in 2002) and the international standard IEC 61947-1 replaced it.

The IEC illuminance specification is a key performance metric for the comparison of light output. Consumers use this specification as a primary metric when making purchase decisions. Historically this metric has been clearly indicative of projector performance. Recently new projector technologies have significantly distorted the performance of this metric and depreciated it's utility as a fair comparison of total image brightness.

The current specification samples a grid of test points on a white field and uses an average of those measurements multiplied by the projected area to arrive at the result. Historically projectors used Red, Green and Blue primaries to create the white field, matching the method used in the (RGB) input signal. The measured white field was the sum of the color primaries individual luminance, as such the IEC illuminance specification clearly represented how bright any individual image or scene on one projector would appear compared to another.

Recent development in some projector technologies has seen the addition of more than three primary colors and in some cases the addition of a white primary. In some of these projectors the luminance of the red, green and blue primaries do not add up to the luminance of white. In fact the white of the projector may exceed the luminance of RGB by more than 50%. Because of this discrepancy the IEC illuminance specification no longer represents the overall brightness of the projected color Image. A full color image on a 1500 lumen projector that utilises a white primary may look darker than the same image on a 1000 lumen RGB projector. RGB not suming to white can also create a significant perceptual distortion of color photographic images. [Heckamen, Fairchild - Journal of the SID 14/9, 2006]

The luminance of white continues to be an important metric and no change in the current White Illuminance specification is proposed. When the projector will mostly be used to display black or white text, white luminance is significant. However, if the projector will be used to display color imagery, the existing metric fails to represent actual performance and misleads the consumer.

To remedy this failure an additional metric is proposed. This metric would be called "Color Illuminance." The Color Illuminance specification would be required alongside the White Luminance specification.

IEC White Illuminance 1800 lumens @ 6500K
IEC Color Illuminance 900 lumens @ 6500K

The "Color Illuminance" of a projector is the total illuminance of the maximum red, green, and blue input signal measured independently and then added together. As the input color encoding for all these projectors are based on RGB primaries, this new metric clearly represents the expected perceptual luminance of color images on the subject projector. [Lang, Proceedings of the 15th Color Imaging Conference, 2007]

Section 5, Proposed Modification - IEC 61947-1:

5 Light output measurement and specification

The light output specification shall be stated in lumens for projectors with separate screens, and in candela per square metre (nits) for displays with self-contained screens.

The following conditions shall be met:

- input signals shall be supplied by a standard test signal source, as specified in Annex B;
- the pixel resolution of the input signal for light output measurment shall match the native resolution of the projector. If the projector has digital signal inputs this input and signal type should be used.
- the light meter shall be photopically and cosine corrected, calibrated, and traceable to a national standard;
- a special test pattern (see Figure A.1) shall be used to set the controls for making measurements. The black level (or brightness control) shall be set to the point where the maximum number of signal level blocks on the top line, representing 0 %, 5 %, 10 % and 15 % signal levels, are visible and distinct from the adjacent signal level blocks. The video gain (contrast or picture control) shall be advanced from minimum until the maximum number of signal level blocks in the lower line of the pattern, representing the 85 %, 90 %, 95 %, and 100 % signal levels, are visible and distinct from the adjacent signal level blocks, or until the picture no longer increases in brightness as limited by automatic brightness circuitry.

In the event of controls interacting, they shall be readjusted in sequence in order to achieve the described conditions on the screen. The controls shall remain at these settings for all measurements. The total number of signal level blocks distinguishable in this pattern shall be stated in the specification.

A 100 % full white image shall be used for the correlated colour temperature (CCT) and white screen illuminance measurements, immediately following with no changes to the projector settings, the color illuminance measurment shall be performed using test targets 4, 5 and 6 in annex A.

For display devices where the screen is not an integral part of the viewing system, the CCT shall be measured by placing a cosine corrected colorimeter in the plane of the focused image. For display devices the screen of which is an integral part of the projection device, the CCT shall be measured by focusing a colorimeter at the centre of the screen. The measurement field shall be at least 3 pixels by 3 pixels. The projection system shall be adjusted until the desired CCT is obtained.

The equipment shall be stabilized without further adjustment for at least 15 min before making any colour or other measurement. All measurements shall be made in a darkened room. Light from the projector shall be measured with a photopically corrected, cosine corrected light-meter, the calibration of which is traceable to a national standard.

Note: Meters may suffer from errors due to such problems as spectral mismatch of tristimulus filters. Also, scanning or pulsed source displays may saturate the meter. For diagnostics, solutions, and further information concerning light meters, see Annex H.

For display devices where the screen is not an integral part of the viewing system, the white illuminance shall be measured with a light meter, the sensor of which is placed in and parallel to the plane of the focused image at the centre of each of nine equal rectangles and four corners (see Figure A.2) or the detector can be placed at the viewing space design centre.

The measurement field shall be at least 3 pixels by 3 pixels. The average of the nine white field readings in lux (lumens per square metre) shall be multiplied by the number of square metres covered by the image at the plane of the meter readings. The result shall be taken as the white light output of the projector, in lumens.

For display devices where the screen is not an integral part of the viewing system, the color illuminance shall be measured with a light meter, the sensor of which is placed in and parallel to the plane of the focused image at the centre of each of nine equal rectangles (see Figure A.2) or the detector can be placed at the viewing space design centre. The nine measurerment points shall be sampled for each of the three color illuminance test targets (see Figure A.4, A.5, and A.6)

The average of the 9 red measurements in lux plus the average of the 9 green measurements in lux plus the average of the 9 blue measurements in lux shall be multiplied by the number of square meters covered by the image at the plane of the meter readings. The result shall be taken as the projectors color light output, in lumens.

The light output specification shall also state the aspect ratio of the display, horizontal and vertical scan rates, CCT and the lens throw distance ratio and type.

For display devices where the screen is an integral part of the projection device, the white luminance of the screen is measured in candela per square metre (nits) at the centre of each of the nine equal rectangles (see Figure A.2) or the detector can be placed at the designed viewing distance.

The standard viewing distance shall be four times the screen height and the standard viewing angle shall be selected as the peak angle in order to obtain the maximum luminance of the white picture at the centre of the screen.

White Luminance shall be measured for nine zones. The measurement field shall be at least 3 pixels by 3 pixels. An average of the nine readings shall be taken in order to calculate the light output specification, in candela per square metre (nits).

For display devices where the screen is an integral part of the viewing system, the color luminance of the screen is measured in candela per square metre (nits) at the centre of each of the nine equal rectangles (see Figure A.2) or the detector can be placed at the designed viewing distance. The nine measurerment points shall be sampled for each of the three color illuminance test targets (see Figure A.4, A.5, and A.6)

The average of the 9 red measurements in cd/m^2 plus the average of the 9 green measurements in cd/m^2 plus the average of the 9 blue measurements in cd/m^2 shall be taken as the projectors color light output, in cd/m^2.

5.1 Light output specifications

5.1.1 Light output specification for projectors with a separate screen

White illuminance and color illuminance specificatiions shall always be provided together.

EXAMPLE

Light output measurement conditions: 6500 K CCT, 4:3 aspect ratio, and a 2:1 lens;

- IEC White illuminance 1800 lumens
- IEC Color illuminance 900 lumens

5.1.2 Full black light level specification

Measurements shall be made at the same signal level as the black rectangles for contrast ratio measurement (see Figure A.3).

EXAMPLE

- Full black light level: 1.2 lumens

5.1.3 Luminance specification for devices with an integral screen

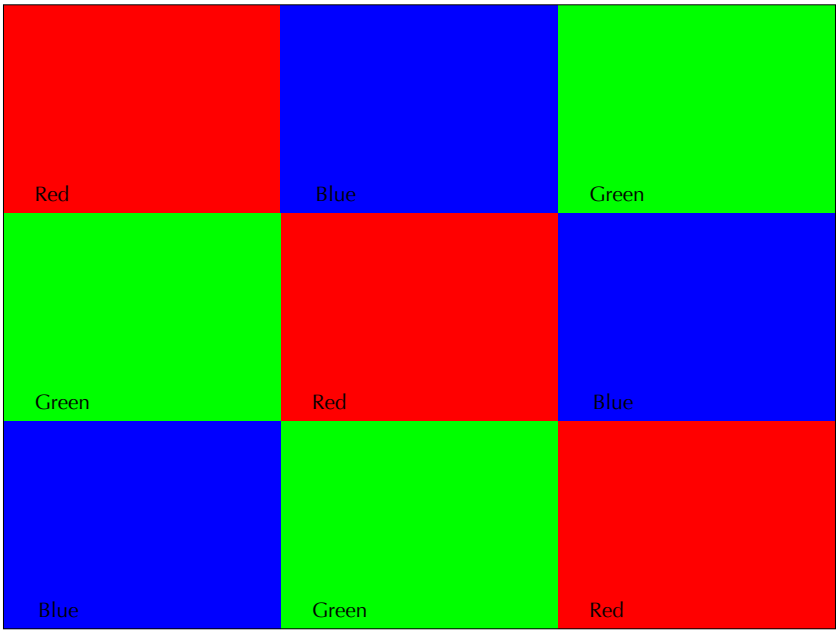
EXAMPLE

Luminance measurement conditions: 9300 K CCT, 4:3 aspect ratio, and a total screen viewing angle of 60° horizontal, 20° vertical (higher luminance values are better):

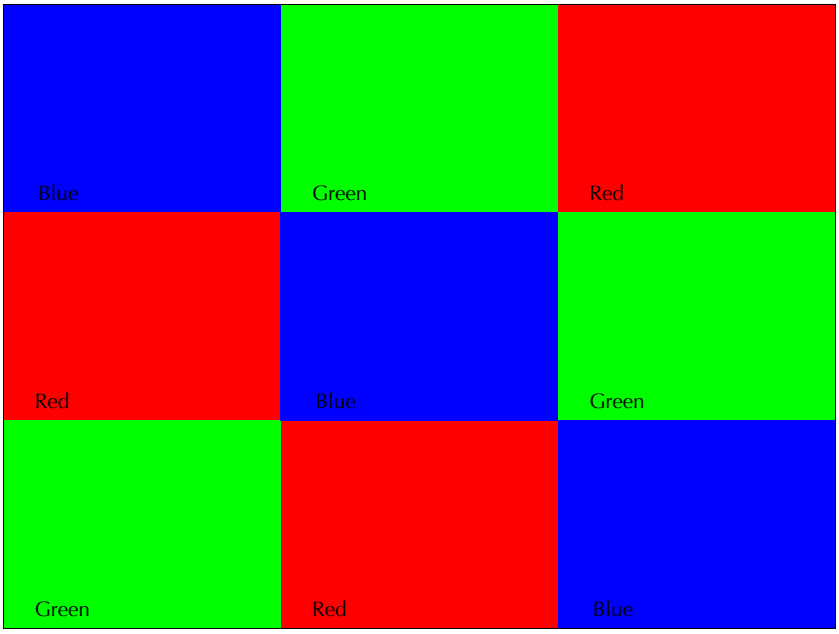
- IEC White luminance 175 cd/m^2
- IEC Color luminance 120 cd/m^2

Note: Direct comparisons can be made between displays with and without integral screens using candela per square metre, if both screens have the same horizontal and vertical angles of view. If this is not the case, mathematical conversions may be made, but will result in unreliable data of questionable value.

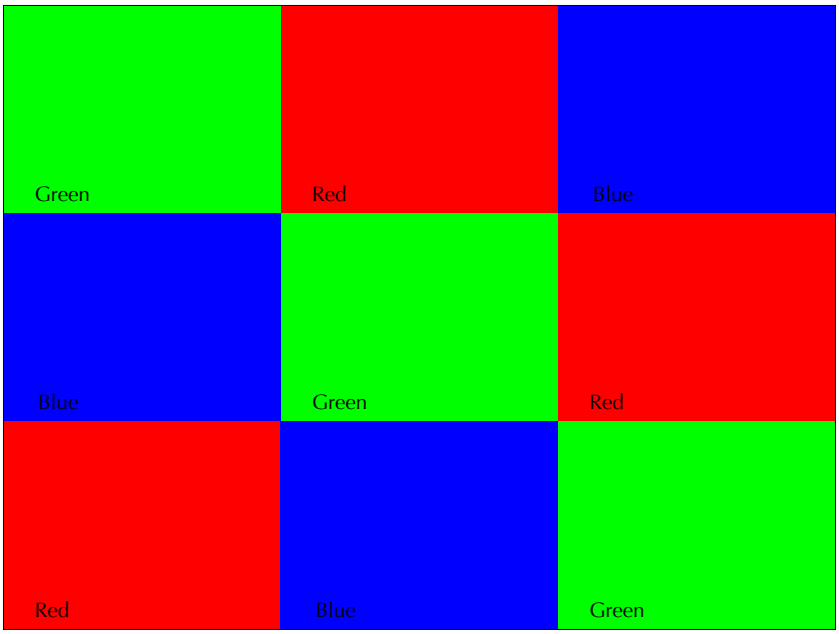
Additions to Annex A:



Test Pattern A.4



Test Pattern A.5



Test Pattern A.6

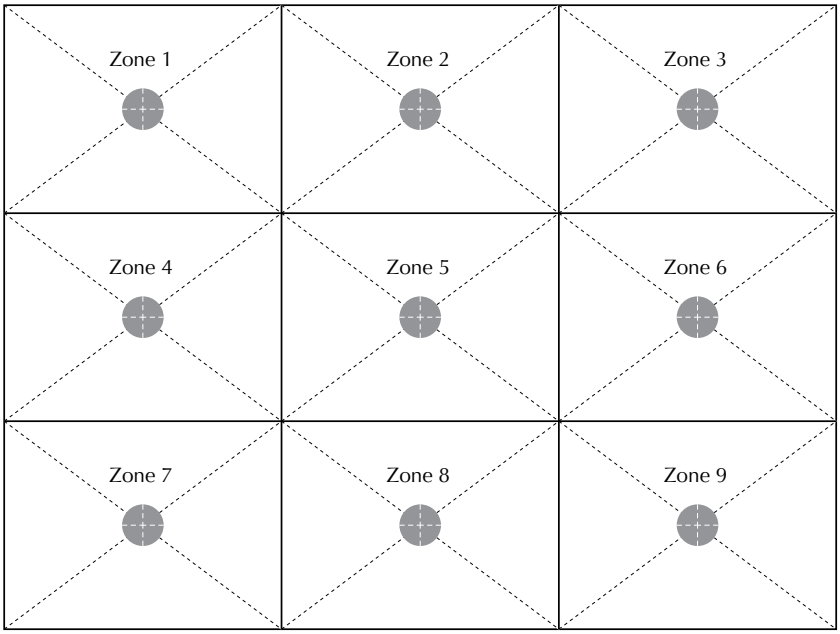


Figure A.7 - 9 point measurement grid for illuminance testing.