

PWDAS-19**LUMINANCE MEASUREMENT OF HP LEDS AND
PHOTOBIOLOGICAL SAFETY RISK EVALUATION OF THEM**

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Recently, light output from HP LEDs (High Power Light Emitting Diodes) are improved much more and now widely expected to be used for general illumination.

As is well-known, light (optical radiation) from light sources is playing an important role to support human vision however, it is also photobiologically affecting to humans (and other living bodies) accessing there, other than supporting vision. Among these photobiological effects, some of them are regarded as to be hazardous. In order to specify and evaluate degree of these hazardous risk, measuring and risk evaluation system of optical radiation have been investigated, and in 2007, CIE/IEC Standard of photobiological safety for lamps and lamp systems was authorized and published [1].

To evaluate safety risks according to this CIE/IEC Standard, it is necessary to measure optical characteristics of relating light sources precisely. Measuring procedure and method of optical properties of conventional light sources have been developed and completed [2]-[4]. However concerning to LEDs, as they are largely different in shape and construction from those of conventional light sources, new peculiar investigative points have been recognized for applying the new photobiological safety Standard.

This paper describes some considerations about luminance measurement of LED, especially of HP LEDs, relating to safety risk evaluation of human retinal hazards. Luminance of light sources can be usually measured with a luminance meter [5] however, as the source size of LEDs is much smaller comparing with conventional sources, general luminance meters can not be directly applied to measuring of LED luminance.

To give a proper solution to this point, there can be considered following two processes. One is to convert from luminous intensity value. Luminance value of a small sized source can be calculated from its luminous intensity according to the following formula [6].

$$L = d\Phi / (dA * d\omega) = I / A$$

L: luminance of source [cd· m⁻²]

I : luminous intensity [cd]

A : area of LED chip [m²]

The other is to attach a suitably and specially designed close-up lens to a conventional luminance meter. Optional close-up lens was experimentally investigated and several types of close-up lenses were prepared for trial measurement. By combining with the suitable close-up lens, average luminance value of almost all light-radiating surface of LED chips (including HP LEDs) could have been measured. This average luminance was proposed to be called as "LED luminance".

Some examples of measured luminance value of recent commercially available LEDs (including HP LEDs) are shown in Table 1.

Table 1 Example of measured values of LED luminance for commercial LEDs

color	LED luminance [$\text{cd} \cdot \text{m}^{-2}$]	
	oval	HP
white	958,800	9,830,700
blue	363,100	2,909,800

In this test, forward current was kept to the each rated value designated by the manufacturers.

Actual measured area was properly adjusted according to the size of LED chip by the close-up lens, and luminance measuring target area should be adjusted to cover almost all radiating area on LED chip surface respectively.

By using measured luminance value shown in Table 1, photobiological safety risk of test LEDs could be evaluated. Results of this risk evaluation will be introduced at the Conference.

References

1. CIE DS 009.2/E/IEC 62471-1: Photobiological safety of lamps and lamp systems, 2007
2. CIE 18.2: The basis of physical photometry, 2nd edi., 1983
3. CIE 70: The measurement of absolute luminous intensity distribution, 1987
4. CIE 84: Measurement of luminous flux, 1989
5. CIE 69: Methods of characterizing illuminance meters and luminance meters, 1987
6. Hans-Jurgen Hentschel : Licht und Beleuchtung - Theorie und Praxis der Lichttechnik, 4., neubearbeitete Auflage, Huethig Buch Verlag Heidelberg, 1997