# Round Robin LED Photometric Test in Japan

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## 1. Introduction

International Standardization of LED photometry is now proceeded in the CIE [1] – [3] however, it is not yet finally concluded because of several difficulties. Each LED makers are now measuring optical characteristics of LEDs by their own individual method. Under these present circumstances, it seems to be effective to proceed round robin LED photometry test for establishing the International standard of proper LED photometry.

Recently, among Japanese LED makers, a round robin measuring test of luminous intensity and total luminous flux of LEDs have been proceeded, as one of activities in the Photometry Sub-committee of the Standardizing Committee of white LEDs for General Lighting. Some results are reported hereinafter.

## 2. Participating Organizations

Following 7 Japanese LED makers joined to this round robin test.

(1) Toshiba Lighting & Technology Corporation
(2) Nichia Corporation
(3) Stanley Electric Corporation
(4) Agilent Technology Japan
(5) Sharp Corporation
(6) Mitsubishi Electric Lighting Fixture Corp.
(7) Matsushita Electronics Corporation

## 3. Test Samples

Applied LED test samples are as follows;

- Type: T1$^3/_4$ oval type LED lamp
- Color: blue, blue-green, green, yellow, red, white
- Number of Test Samples: 3 pieces for each color
- Manufacturer: Japanese makers

## 4. Testing Condition and Items

Common designated testing condition (operating current) and comparative measuring items are as follows, and other conditions (such as ambient temperature, measuring instruments and so on) are following ordinary process of each manufacturers;

- Testing Current: DC 20 mA (regulated)
- Measuring Items
  (1) luminous intensity (compulsory)
  (2) tal luminous flux (optional)

Each test LED samples were aged for suitable period before testing for optical characteristics to become stable.

## 5. Comparison of Measuring Processes of LED Luminous Intensity

Comparison of measuring processes of LED luminous intensity of 7 organizations is shown in Table 1 (next page).

## 6. Results

In case that total average value of all organizations will be a reference, ranges (difference between maximum value and minimum value) of all measured values to the reference are shown in Table 2.

Table 2 Range of all measured values

| LED color | luminous intensity | luminous flux |
|---|---|---|
| white | 24 % | 17 % |
| blue | 74 % | 43 % |
| blue-green | 56 % | 33 % |
| green | 56 % | 16 % |
| yellow | 46 % | 14 % |
| red | 38 % | 23 % |

## 7. Comments

Judging from measured results of both luminous intensity and total luminous flux of LEDs at 7 organizations, ranges of measured values were larger and difference among organizations might be rather larger.

Reasons of this difference may be considered as coming from followings;

(1) Standard LED lamp is not available.
(2) Insufficient heterochromatic correction
(3) Insufficient correction of variation of detecting condition
(4) Variation of LED setting

7. Conclusion

Round robin testing of LED photometry have been proceeded among 7 Japanese LED Manufacturers. It can be concluded that ranges of measured values between organizations were rather larger. As it can be considered as these ranges must be much smaller for photometry of conventional light sources for general lighting, it would be necessary that well-reproductive measuring method and traceability for LED photometry shall be established in future.

References

[1] CIE Technical report CIE 127: Measurements of LEDs, 1997
[2] CIE/ISO Standard: CIE/ISO Standard of Measuring the Intensity of Light Emitting Diodes (LEDs), 2nd Draft, 1999
[3] CIE TC2-45 Report: Total Flux Measurement of LEDs using integrating sphere, 1st Draft, 1999

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Table 1 Comparison of Measuring Condition of Luminous Intensity for each Organizations

| items | laboratory | | | | | | |
|---|---|---|---|---|---|---|---|
| | Pilot | A | B | C | D | E | F |
| measuring instrument | goniophoto -meter (color corrected) | photometer (color corrected) | photometer | photometer | photometer | photometer | goniophoto -meter |
| acceptance area [$m^2$] | 50.2 | 314 | 100 | 56.6 | 100 | 100 | 491 |
| measureme nt distance [mm] | 600 | 1000 | 305 | 75.2 | 100 | 316 | 500 |
| angular subtense [°] | 0.8 | 1.1 | 2.1 | 6.5 | 6.5 | 2.0 | 2.9 |
| distance basis | luminous part (chip) | luminous part (chip) | top of package | luminous part (chip) | luminous part (chip) | top of package | luminous part (chip) |
| applicable axis | peak intensity axis | mechanical axis | mechanical axis | mechanical axis | mechanical axis | mechanical axis | mechanical axis |
| photometri cstandard | luminous intensity standard lamp | luminous intensity standard lamp | spectral irradiance standard lamp and standard LED | corrected photometer | luminous intensity standard lamp | standard photo detector (NIST traceable) | corrected illuminance meter |