

LM-79-08 TEST REPORT

for

GREEN CREATIVE LTD

Room 3603, Level 36, Tower 1, Enterprise Square Five, 38 Wang Chiu Road, Kowloon Bay, KL,
Hong Kong

LED Lamp

Model: 13BR40DIM/927

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

3rd Floor, Bld. 2, NO. 96 Longchuanwu Rd Qianjiang Economy Dev. Zone, YuhangDist,
Hangzhou, Zhejiang Province, China 311100

Tel: +86571 86376106

www.ledtestlab.com

Report No.: HZ21120007m

The laboratory that conducted the testing detailed in this report has been accredited for SSL by NVLAP.

Review by:



Engineer: April Zou

Dec. 15, 2021

Approved by:



Manager: Jim Zhang

Dec. 15, 2021

Note: This report does not imply product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

TEST SUMMARY

Sample Tested: 13BR40DIM/927

| Luminous Efficacy (Lumens /Watt) | Total Luminous Flux (Lumens) | Power (Watts) | Power Factor |
|-------------------------------------|---------------------------------|---------------------------------------|--------------|
| 118.5 | 1435.1 | 12.11 | 0.9506 |
| CCT (K) | CRI | Stabilization Time (Light & Power) | |
| 2766 | 94.6 | 60 | |

Table 1: Executive Data Summary

Note: The above results are recorded/ derived from measurements made using an Integrating Sphere.

Test specifications:

| | |
|---------------------------|---|
| Date of Receipt | : Dec. 03, 2021 |
| Date of Test | : Dec. 09, 2021 |
| Test item | : Total Luminous Flux, Luminous Distribution Intensity, Luminous Efficacy, Correlated Color Temperature, Color Rendering Index, Chromaticity Coordinate, Electrical parameters |
| Reference Standard | : IESNA LM-79-2008 Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products ANSI/IES TM-30-18 IES Method for Evaluating Light Source Color Rendition |

TABLE OF CONTENT

| | |
|---|----|
| LM-79-08 TEST REPORT | 1 |
| TEST SUMMARY | 2 |
| SAMPLE PHOTO | 4 |
| TEST RESULTS | 5 |
| Sphere-Spectroradiometer Method..... | 5 |
| Goniophotometer Method | 6 |
| Spectral Power Distribution - Sphere Spectroradiometer Method | 7 |
| Chromaticity Diagram - Sphere Spectroradiometer Method..... | 8 |
| Nominal CCT Quadrangles – Sphere Spectroradiometer Method | 9 |
| Color Rendition Report – Sphere Spectroradiometer Method | 10 |
| Zonal Lumen Tabulation- Goniophotometer Method | 11 |
| Illuminance Plots- Goniophotometer Method | 12 |
| Luminous Intensity Distribution Plots- Goniophotometer Method..... | 13 |
| Luminous Intensity Data- Goniophotometer Method | 14 |
| EQUIPMENT LIST | 16 |
| TEST METHODS | 16 |
| Seasoning of SSL Product..... | 16 |
| Sphere-Spectroradiometer Method- Photometric and Electrical Measurements..... | 16 |
| Goniophotometer Method | 17 |
| Photometric and Electrical Measurements | 17 |
| Color Characteristics Measurements..... | 17 |
| Color Spatial Uniformity | 17 |

SAMPLE PHOTO



Figure 1- Overview of the sample

Equipment Under Test(EUT)

| | |
|----------------------------|---|
| Name | : LED Lamp |
| Model | : 13BR40DIM/927 |
| Electrical Ratings | : 120V, 60Hz, 13W |
| Product Description | : 2700K |
| Manufacturer | : GREEN CREATIVE LTD |
| Address | : Room 3603, Level 36, Tower 1, Enterprise Square Five, 38 Wang Chiu Road, Kowloon Bay, KL, Hong Kong |

TEST RESULTS

Test ambient temperature was 26.0 °C.

Base orientation was horizontal. Test was conducted without a dimmer in the circuit.

The stabilization time of the sample was 60 minutes, and the total operating time including stabilization was 65 minutes.

Sphere-Spectroradiometer Method

| Parameter | Result |
|---------------------------------------|--------|
| Test Voltage (V) | 120.0 |
| Voltage frequency (Hz) | 60 |
| Test Current (A) | 0.106 |
| Power Factor | 0.9506 |
| Test Power (W) | 12.11 |
| THD A% | 18.32 |
| Luminous Efficacy (lm/W) | 118.5 |
| Total Luminous Flux (lm) | 1435.1 |
| Color Rendering Index (CRI) | 94.6 |
| R9 | 62.7 |
| Correlated Color Temperature (CCT)(K) | 2766 |
| Chromaticity Chroma x | 0.4551 |
| Chromaticity Chroma y | 0.4106 |
| Chromaticity Chroma u | 0.2594 |
| Chromaticity Chroma v | 0.3511 |
| Duv | 0.0004 |
| Chromaticity Chroma u' | 0.2594 |
| Chromaticity Chroma v' | 0.5266 |

| Special Color Rendering Indices | |
|---------------------------------|------|
| R1 | 96.3 |
| R2 | 98 |
| R3 | 97.9 |
| R4 | 96.4 |
| R5 | 95.8 |
| R6 | 97 |
| R7 | 92.1 |
| R8 | 83.6 |
| R9 | 62.7 |
| R10 | 93.1 |
| R11 | 98.1 |
| R12 | 84.1 |
| R13 | 96.8 |
| R14 | 97.3 |

Table 2: Test data per Sphere-Spectroradiometer Method

Note: According to CIE 1976 (u', v') diagram, $u' = u = 4x/(-2x+12y+3)$, $v' = 3v/2 = 9y/(-2x+12y+3)$.

Goniophotometer Method

Test ambient temperature was 25.1 °C.

The photometric distance is 2.47 m.

Luminous data was taken at 0.5 vertical intervals and 10 horizontal intervals.

| Parameter | Result |
|-------------------------------------|------------------------------------|
| Test Voltage (V) | 120.0 |
| Voltage frequency (Hz) | 60 |
| Test Current (A) | 0.106 |
| Power Factor | 0.9509 |
| Power (W) | 12.14 |
| Luminous Efficacy (lm/W) | 121.3 |
| Total Luminous Flux (lm) | 1472.1 |
| Beam Angle (°) | 106.8 (0°-180°) / 106.6 (90°-270°) |
| Center Beam Candle Power (cd) | 488 |
| Maximum Beam Candle Power (cd) | 488.4 (At: C=250.0, Gamma=1.5) |
| Spacing Criteria | 1.20 (0°-180°) / 1.23 (90°-270°) |
| Zonal Lumens in the 0 °-60 °Zone | 70.19% |
| Zonal Lumens in the 60 °-90 °Zone | 24.37% |
| Zonal Lumens in the 90 °-120 °Zone | 4.73% |
| Zonal Lumens in the 120 °-180 °Zone | 0.71% |

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

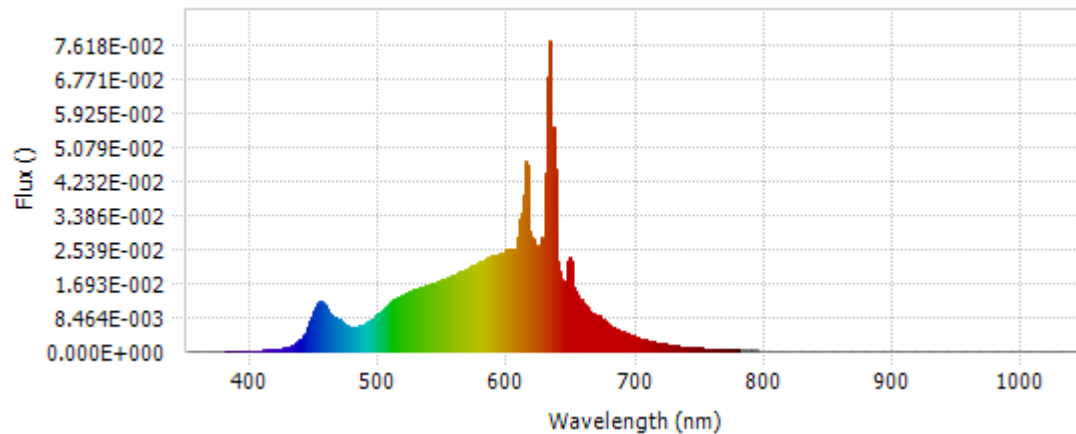
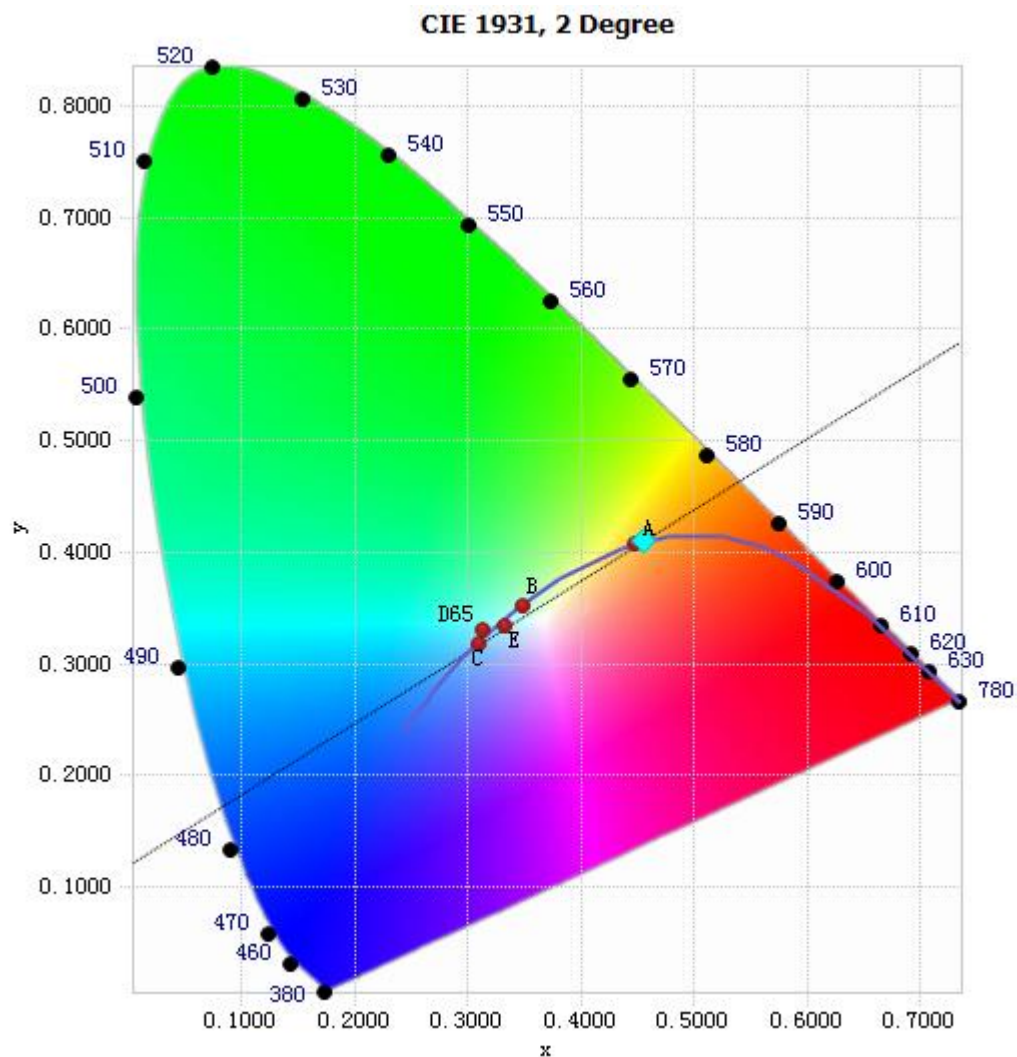


Chart 1: Spectral Power Distribution

| Spectral Distribution over Visible Wavelength | | | | | | | |
|---|----------------|--------|----------------|--------|----------------|--------|----------------|
| WL(nm) | Radiant(Watts) | WL(nm) | Radiant(Watts) | WL(nm) | Radiant(Watts) | WL(nm) | Radiant(Watts) |
| 380 | 8.92E-05 | 485 | 6.20E-03 | 590 | 2.38E-02 | 695 | 4.06E-03 |
| 385 | 8.20E-05 | 490 | 7.02E-03 | 595 | 2.41E-02 | 700 | 3.47E-03 |
| 390 | 8.78E-05 | 495 | 8.13E-03 | 600 | 2.54E-02 | 705 | 2.94E-03 |
| 395 | 1.10E-04 | 500 | 9.59E-03 | 605 | 2.52E-02 | 710 | 2.53E-03 |
| 400 | 8.31E-05 | 505 | 1.11E-02 | 610 | 3.44E-02 | 715 | 2.17E-03 |
| 405 | 1.05E-04 | 510 | 1.23E-02 | 615 | 4.61E-02 | 720 | 1.85E-03 |
| 410 | 1.31E-04 | 515 | 1.34E-02 | 620 | 2.80E-02 | 725 | 1.60E-03 |
| 415 | 2.67E-04 | 520 | 1.44E-02 | 625 | 2.65E-02 | 730 | 1.36E-03 |
| 420 | 4.52E-04 | 525 | 1.50E-02 | 630 | 4.41E-02 | 735 | 1.14E-03 |
| 425 | 7.21E-04 | 530 | 1.56E-02 | 635 | 5.02E-02 | 740 | 9.77E-04 |
| 430 | 1.17E-03 | 535 | 1.61E-02 | 640 | 1.99E-02 | 745 | 8.35E-04 |
| 435 | 2.02E-03 | 540 | 1.66E-02 | 645 | 1.73E-02 | 750 | 7.10E-04 |
| 440 | 3.54E-03 | 545 | 1.72E-02 | 650 | 1.86E-02 | 755 | 6.13E-04 |
| 445 | 6.64E-03 | 550 | 1.78E-02 | 655 | 1.34E-02 | 760 | 5.25E-04 |
| 450 | 1.09E-02 | 555 | 1.85E-02 | 660 | 1.13E-02 | 765 | 4.39E-04 |
| 455 | 1.21E-02 | 560 | 1.91E-02 | 665 | 9.56E-03 | 770 | 3.82E-04 |
| 460 | 9.80E-03 | 565 | 1.99E-02 | 670 | 8.88E-03 | 775 | 3.21E-04 |
| 465 | 8.46E-03 | 570 | 2.07E-02 | 675 | 7.44E-03 | 780 | 2.80E-04 |
| 470 | 7.41E-03 | 575 | 2.16E-02 | 680 | 6.29E-03 | | |
| 475 | 6.25E-03 | 580 | 2.24E-02 | 685 | 5.48E-03 | | |
| 480 | 5.91E-03 | 585 | 2.33E-02 | 690 | 4.72E-03 | | |

Table 4: Spectral Power Distribution Numerical Data per Sphere - Spectroradiometer Method

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4551, 0.4106)

Chart 2: Chromaticity Diagram per Sphere - Spectroradiometer Method

Note: The location on the diagram of the tristimulus coordinates are indicated by the blue diamond.

Nominal CCT Quadrangles – Sphere Spectroradiometer Method

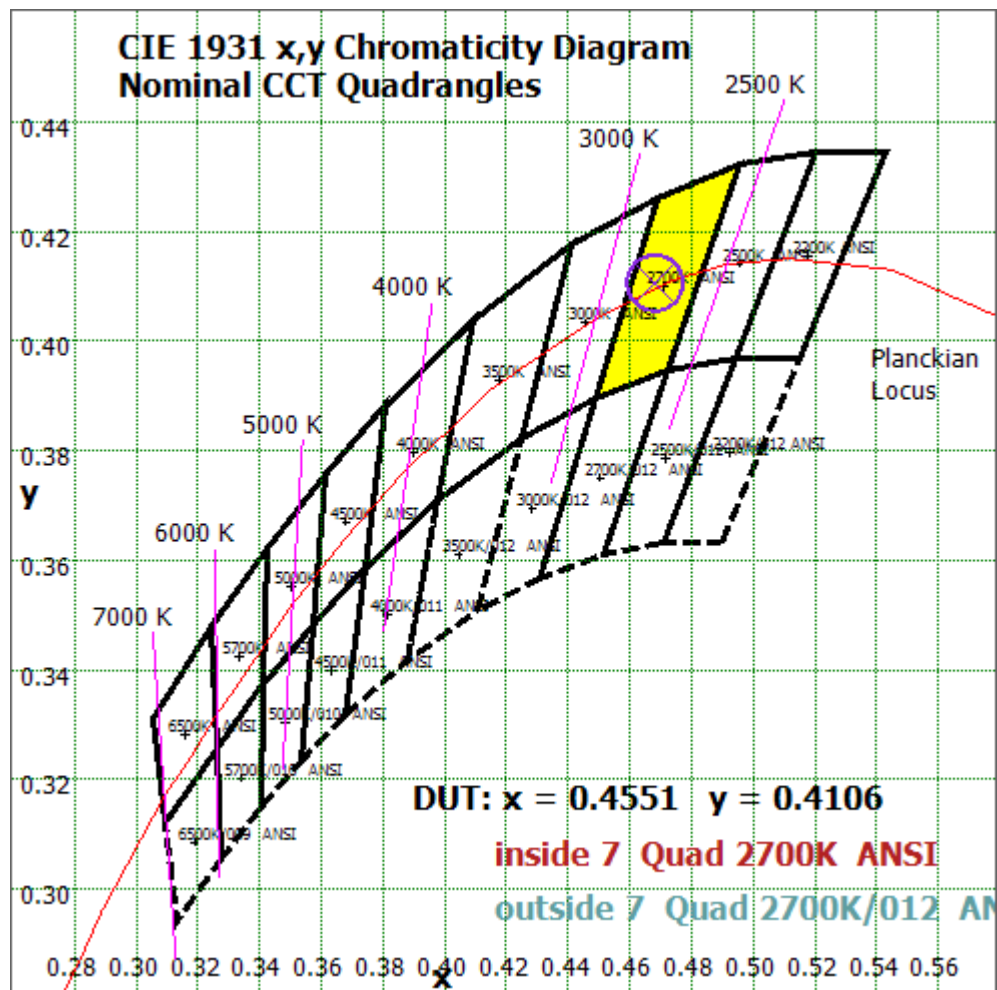


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method

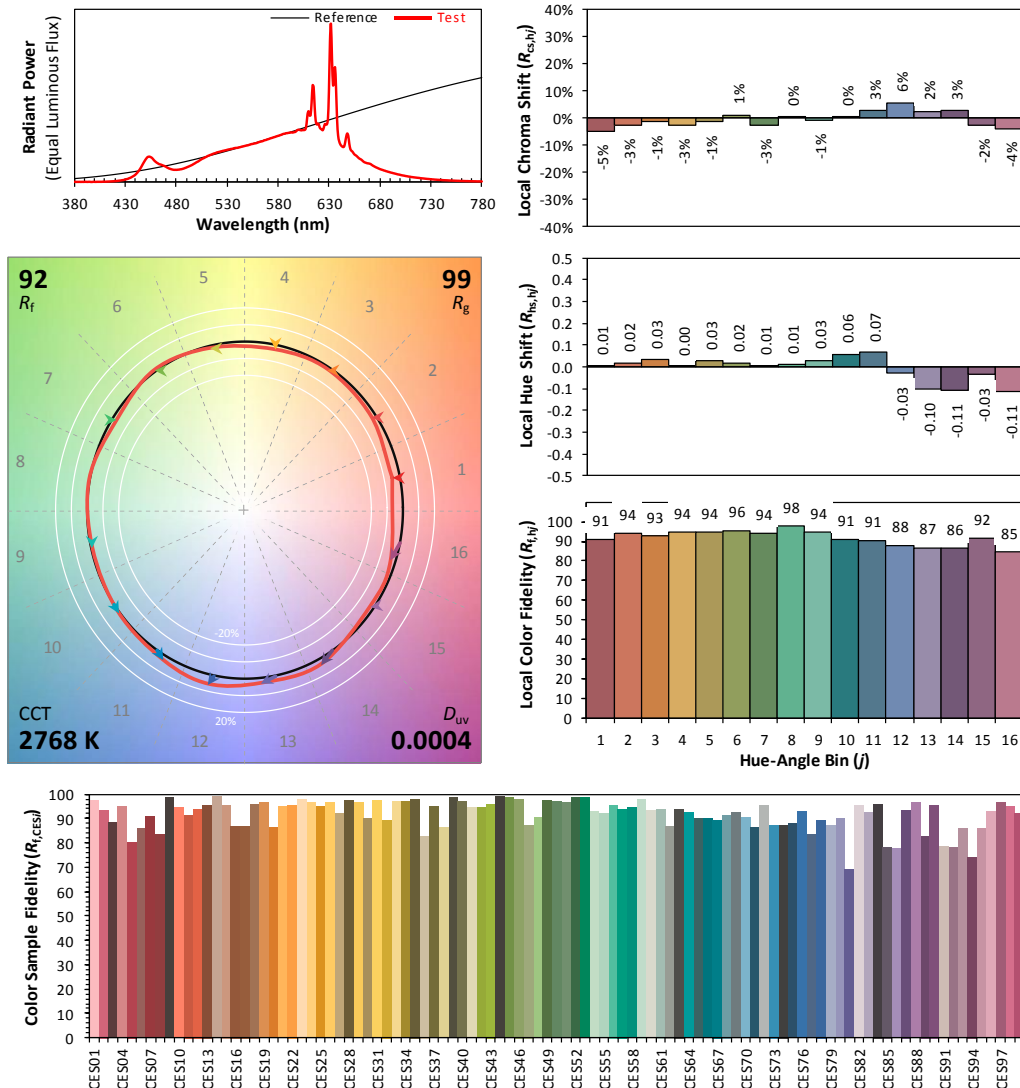
ANSI/IES TM-30-18 Color Rendition Report

Source: LED

Manufacturer: GREEN CREATIVE LTD

Date: 2021/12/09

Model: 13BR40DIM/927



Notes: This is a recommended method for displaying ANSI/IES TM-30-18 information.

x 0.4551
 y 0.4106
 u' 0.2594
 v' 0.5266

CIE 13.3-1995
(CRI)
 R_a 95
 R_g 63

Colors are for visual orientation purposes only. Created with the ANSI/IES TM-30-18 Calculator Version 2.00.

Chart 4: Full Report Created with the IES TM-30 Calculator

Note: The values in this diagram might be a little different from the values in Table 2 due to rounding.

Zonal Lumen Tabulation- Goniophotometer Method

| $\gamma(^{\circ})$ | Lumens | % Total |
|--------------------|---------|---------|
| 0- 10 | 45.98 | 3.12% |
| 10- 20 | 129.98 | 8.83% |
| 20- 30 | 192.5 | 13.08% |
| 30- 40 | 226.023 | 15.35% |
| 40- 50 | 230.077 | 15.63% |
| 50- 60 | 208.7 | 14.18% |
| 60- 70 | 168.179 | 11.42% |
| 70- 80 | 118.539 | 8.05% |
| 80- 90 | 71.981 | 4.89% |
| 90-100 | 38.619 | 2.62% |
| 100-110 | 20.31 | 1.38% |
| 110-120 | 10.744 | 0.73% |
| 120-130 | 5.583 | 0.38% |
| 130-140 | 2.83 | 0.19% |
| 140-150 | 1.297 | 0.09% |
| 150-160 | 0.493 | 0.03% |
| 160-170 | 0.163 | 0.01% |
| 170-180 | 0.049 | 0.00% |
| Total | 1472.0 | 100% |

| $\gamma(^{\circ})$ | Lumens | % Total |
|--------------------|---------|---------|
| 0- 60 | 1033.26 | 70.19% |
| 60- 90 | 358.699 | 24.37% |
| 0-90 | 1391.96 | 94.56% |
| 90- 180 | 80.088 | 5.44% |
| 0- 180 | 1472.0 | 100% |

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

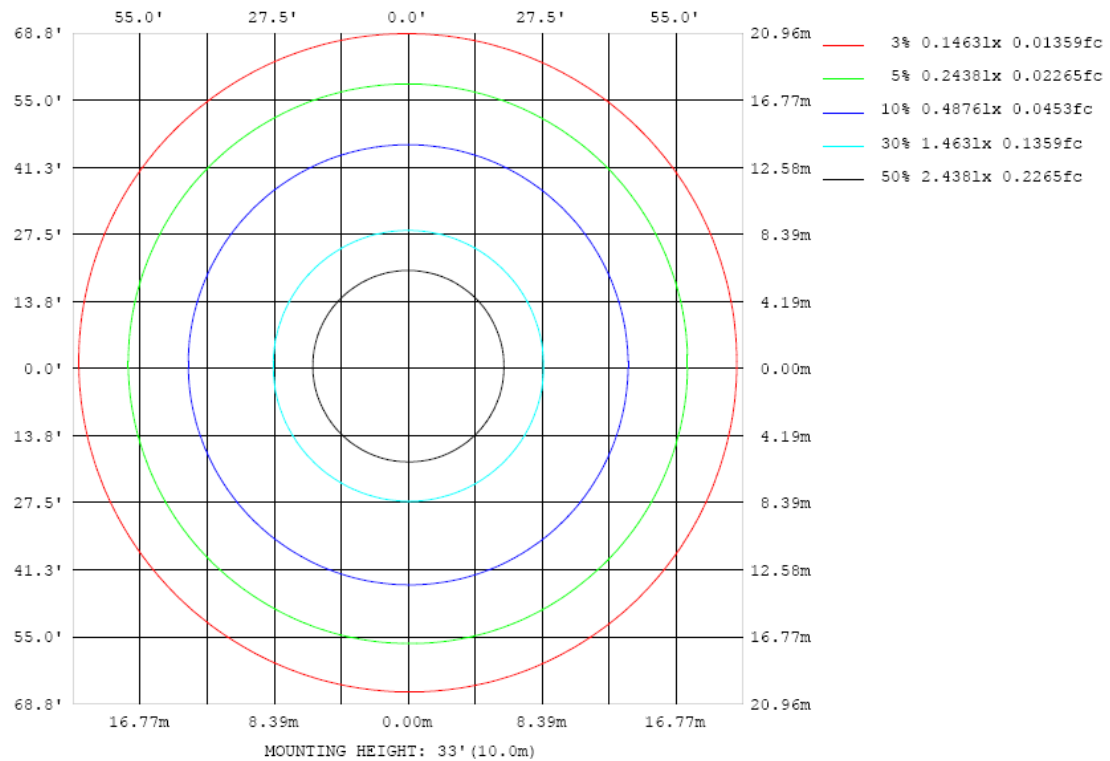


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

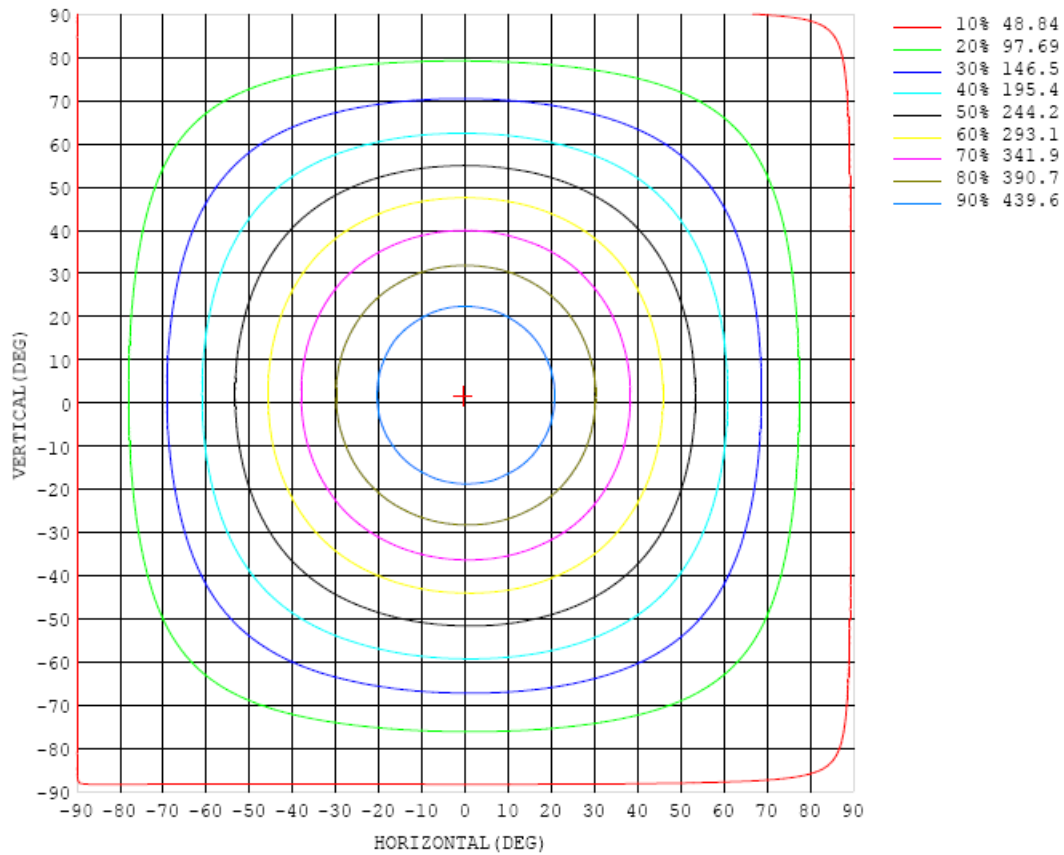


Chart 6: Isocandela Plot

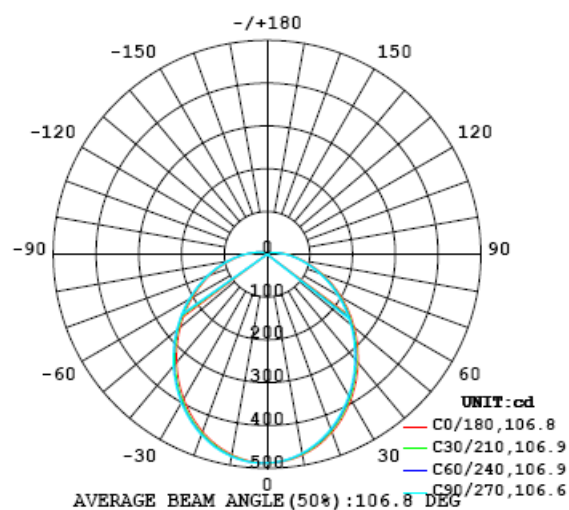


Chart 7: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1

UNIT: cd

| C (DEG) γ (DEG) | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 140 | 150 | 160 | 170 | 180 |
|--------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 0 | 488 | 488 | 488 | 488 | 488 | 488 | 488 | 488 | 488 | 488 | 488 | 488 | 488 | 488 | 488 | 488 | 488 | 488 | 488 |
| 5 | 485 | 484 | 484 | 484 | 483 | 483 | 483 | 483 | 483 | 482 | 482 | 483 | 483 | 483 | 483 | 483 | 483 | 484 | 485 |
| 10 | 476 | 475 | 475 | 474 | 473 | 473 | 472 | 472 | 472 | 471 | 471 | 472 | 472 | 472 | 472 | 473 | 474 | 474 | 475 |
| 15 | 461 | 461 | 460 | 458 | 457 | 457 | 456 | 456 | 455 | 455 | 455 | 455 | 456 | 456 | 456 | 457 | 459 | 459 | 461 |
| 20 | 442 | 441 | 440 | 439 | 437 | 437 | 436 | 436 | 434 | 434 | 434 | 434 | 435 | 435 | 435 | 437 | 439 | 440 | 441 |
| 25 | 419 | 417 | 416 | 415 | 413 | 412 | 411 | 410 | 409 | 409 | 409 | 408 | 410 | 410 | 411 | 412 | 415 | 416 | 417 |
| 30 | 392 | 390 | 389 | 388 | 386 | 385 | 384 | 383 | 381 | 381 | 380 | 380 | 381 | 382 | 383 | 384 | 387 | 388 | 390 |
| 35 | 362 | 360 | 359 | 357 | 356 | 354 | 353 | 352 | 351 | 351 | 350 | 350 | 351 | 352 | 353 | 354 | 357 | 358 | 360 |
| 40 | 331 | 329 | 328 | 326 | 324 | 323 | 322 | 321 | 320 | 319 | 319 | 319 | 319 | 320 | 321 | 323 | 326 | 327 | 329 |
| 45 | 299 | 297 | 295 | 294 | 292 | 291 | 290 | 289 | 288 | 287 | 287 | 287 | 287 | 288 | 289 | 291 | 294 | 296 | 297 |
| 50 | 266 | 264 | 263 | 261 | 260 | 259 | 258 | 257 | 256 | 255 | 254 | 254 | 255 | 256 | 257 | 259 | 261 | 263 | 265 |
| 55 | 233 | 231 | 230 | 229 | 227 | 226 | 225 | 224 | 223 | 223 | 222 | 222 | 223 | 224 | 225 | 227 | 229 | 231 | 233 |
| 60 | 201 | 199 | 198 | 196 | 195 | 194 | 193 | 193 | 192 | 191 | 190 | 190 | 191 | 192 | 193 | 195 | 197 | 199 | 202 |
| 65 | 169 | 168 | 166 | 165 | 164 | 163 | 162 | 161 | 161 | 160 | 160 | 160 | 160 | 161 | 162 | 164 | 166 | 168 | 171 |
| 70 | 139 | 137 | 136 | 135 | 134 | 133 | 132 | 132 | 131 | 130 | 130 | 130 | 131 | 132 | 133 | 135 | 137 | 138 | 142 |
| 75 | 111 | 109 | 108 | 107 | 106 | 105 | 105 | 104 | 104 | 104 | 103 | 104 | 104 | 105 | 106 | 107 | 109 | 111 | 113 |
| 80 | 85.4 | 84.2 | 83.3 | 82.4 | 81.7 | 81.0 | 80.6 | 80.2 | 79.8 | 79.5 | 79.5 | 79.7 | 80.1 | 80.9 | 81.7 | 83.0 | 84.5 | 85.7 | 88.2 |
| 85 | 64.5 | 63.7 | 62.9 | 62.3 | 61.7 | 61.1 | 60.8 | 60.5 | 60.2 | 60.2 | 60.2 | 60.3 | 60.7 | 61.2 | 62.0 | 62.9 | 64.1 | 65.1 | 66.5 |
| 90 | 47.4 | 46.6 | 46.0 | 45.5 | 45.0 | 44.6 | 44.4 | 44.1 | 43.9 | 43.9 | 43.9 | 44.1 | 44.4 | 44.9 | 45.4 | 46.2 | 47.1 | 47.9 | 48.8 |
| 95 | 34.2 | 33.6 | 33.2 | 32.8 | 32.4 | 32.1 | 31.9 | 31.8 | 31.7 | 31.7 | 31.7 | 31.8 | 32.1 | 32.5 | 32.9 | 33.4 | 34.1 | 34.7 | 35.4 |
| 100 | 24.9 | 24.6 | 24.2 | 24.0 | 23.7 | 23.5 | 23.4 | 23.3 | 23.2 | 23.2 | 23.2 | 23.3 | 23.5 | 23.7 | 24.0 | 24.4 | 24.9 | 25.3 | 25.8 |
| 105 | 18.6 | 18.3 | 18.1 | 17.9 | 17.7 | 17.6 | 17.5 | 17.4 | 17.4 | 17.4 | 17.4 | 17.4 | 17.6 | 17.8 | 18.0 | 18.3 | 18.6 | 18.9 | 19.3 |
| 110 | 13.9 | 13.7 | 13.6 | 13.4 | 13.3 | 13.2 | 13.1 | 13.1 | 13.0 | 13.0 | 13.1 | 13.1 | 13.2 | 13.4 | 13.5 | 13.8 | 14.0 | 14.3 | 14.5 |
| 115 | 10.5 | 10.3 | 10.2 | 10.1 | 9.97 | 9.89 | 9.86 | 9.81 | 9.80 | 9.81 | 9.84 | 9.89 | 9.98 | 10.1 | 10.2 | 10.4 | 10.6 | 10.8 | 10.9 |
| 120 | 7.89 | 7.78 | 7.68 | 7.60 | 7.52 | 7.46 | 7.43 | 7.41 | 7.39 | 7.40 | 7.44 | 7.49 | 7.54 | 7.63 | 7.74 | 7.87 | 8.02 | 8.13 | 8.27 |
| 125 | 5.95 | 5.88 | 5.81 | 5.75 | 5.69 | 5.64 | 5.62 | 5.61 | 5.60 | 5.61 | 5.64 | 5.67 | 5.73 | 5.80 | 5.87 | 5.97 | 6.08 | 6.18 | 6.31 |
| 130 | 4.54 | 4.48 | 4.43 | 4.38 | 4.34 | 4.30 | 4.29 | 4.28 | 4.27 | 4.28 | 4.31 | 4.35 | 4.40 | 4.44 | 4.50 | 4.58 | 4.67 | 4.74 | 4.85 |
| 135 | 3.46 | 3.41 | 3.37 | 3.34 | 3.30 | 3.27 | 3.25 | 3.24 | 3.24 | 3.26 | 3.28 | 3.31 | 3.36 | 3.40 | 3.44 | 3.51 | 3.58 | 3.64 | 3.75 |
| 140 | 2.59 | 2.55 | 2.52 | 2.49 | 2.47 | 2.43 | 2.41 | 2.40 | 2.40 | 2.42 | 2.45 | 2.48 | 2.52 | 2.56 | 2.59 | 2.64 | 2.70 | 2.75 | 2.86 |
| 145 | 1.89 | 1.86 | 1.84 | 1.82 | 1.80 | 1.78 | 1.76 | 1.74 | 1.74 | 1.75 | 1.78 | 1.81 | 1.84 | 1.88 | 1.91 | 1.95 | 1.99 | 2.04 | 2.15 |
| 150 | 1.33 | 1.31 | 1.30 | 1.29 | 1.27 | 1.25 | 1.23 | 1.22 | 1.21 | 1.22 | 1.25 | 1.27 | 1.30 | 1.33 | 1.35 | 1.38 | 1.42 | 1.46 | 1.57 |
| 155 | 0.92 | 0.91 | 0.90 | 0.89 | 0.88 | 0.86 | 0.85 | 0.83 | 0.82 | 0.82 | 0.84 | 0.86 | 0.88 | 0.90 | 0.92 | 0.95 | 0.98 | 1.02 | 1.12 |
| 160 | 0.63 | 0.62 | 0.62 | 0.61 | 0.60 | 0.59 | 0.58 | 0.58 | 0.57 | 0.56 | 0.55 | 0.55 | 0.57 | 0.59 | 0.61 | 0.63 | 0.67 | 0.70 | 0.80 |
| 165 | 0.48 | 0.47 | 0.46 | 0.45 | 0.45 | 0.45 | 0.45 | 0.45 | 0.45 | 0.45 | 0.44 | 0.44 | 0.44 | 0.45 | 0.46 | 0.48 | 0.49 | 0.51 | 0.61 |
| 170 | 0.46 | 0.46 | 0.46 | 0.46 | 0.46 | 0.46 | 0.46 | 0.46 | 0.46 | 0.47 | 0.46 | 0.46 | 0.46 | 0.46 | 0.46 | 0.46 | 0.46 | 0.46 | 0.54 |
| 175 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.55 |
| 180 | 0.53 | 0.54 | 0.54 | 0.54 | 0.53 | 0.53 | 0.54 | 0.54 | 0.53 | 0.53 | 0.53 | 0.53 | 0.54 | 0.54 | 0.53 | 0.53 | 0.53 | 0.52 | 0.53 |

Table 6: Luminous Intensity Data

| Table--2 | | UNIT: cd | | | | | | | | | | | | | | | | | |
|----------------|---------|----------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|--|
| γ (DEG) | C (DEG) | 190 | 200 | 210 | 220 | 230 | 240 | 250 | 260 | 270 | 280 | 290 | 300 | 310 | 320 | 330 | 340 | 350 | |
| 0 | | 488 | 488 | 488 | 488 | 488 | 488 | 488 | 488 | 488 | 488 | 488 | 488 | 488 | 488 | 488 | 488 | 488 | |
| 5 | | 485 | 485 | 486 | 486 | 486 | 487 | 487 | 486 | 487 | 487 | 487 | 487 | 487 | 486 | 486 | 486 | 485 | |
| 10 | | 476 | 476 | 477 | 478 | 478 | 479 | 479 | 480 | 480 | 480 | 480 | 480 | 479 | 479 | 478 | 478 | 477 | |
| 15 | | 461 | 463 | 464 | 465 | 465 | 467 | 467 | 467 | 467 | 468 | 467 | 467 | 466 | 465 | 464 | 464 | 462 | |
| 20 | | 442 | 443 | 445 | 446 | 447 | 448 | 449 | 449 | 450 | 449 | 449 | 449 | 448 | 447 | 446 | 445 | 444 | |
| 25 | | 418 | 420 | 422 | 423 | 424 | 426 | 426 | 427 | 427 | 426 | 427 | 427 | 425 | 424 | 423 | 422 | 420 | |
| 30 | | 391 | 394 | 395 | 397 | 398 | 399 | 400 | 401 | 401 | 401 | 401 | 400 | 399 | 397 | 396 | 395 | 394 | |
| 35 | | 362 | 364 | 366 | 368 | 369 | 370 | 371 | 372 | 372 | 372 | 371 | 371 | 370 | 368 | 367 | 366 | 364 | |
| 40 | | 331 | 333 | 335 | 337 | 338 | 340 | 341 | 341 | 341 | 341 | 340 | 340 | 339 | 338 | 336 | 335 | 333 | |
| 45 | | 299 | 302 | 303 | 305 | 306 | 307 | 308 | 309 | 309 | 309 | 308 | 308 | 307 | 305 | 304 | 303 | 301 | |
| 50 | | 268 | 270 | 271 | 273 | 274 | 275 | 276 | 277 | 277 | 276 | 276 | 276 | 274 | 273 | 271 | 270 | 268 | |
| 55 | | 235 | 237 | 239 | 240 | 242 | 243 | 243 | 244 | 244 | 243 | 243 | 242 | 241 | 240 | 238 | 237 | 235 | |
| 60 | | 204 | 206 | 207 | 208 | 209 | 210 | 211 | 211 | 211 | 211 | 210 | 210 | 208 | 207 | 206 | 204 | 203 | |
| 65 | | 172 | 174 | 176 | 177 | 178 | 179 | 179 | 179 | 179 | 179 | 178 | 177 | 176 | 175 | 174 | 173 | 171 | |
| 70 | | 143 | 145 | 146 | 147 | 148 | 149 | 149 | 149 | 149 | 149 | 148 | 147 | 146 | 145 | 144 | 143 | 141 | |
| 75 | | 115 | 117 | 118 | 119 | 119 | 120 | 120 | 120 | 120 | 119 | 119 | 118 | 117 | 116 | 115 | 114 | 113 | |
| 80 | | 89.5 | 90.7 | 91.8 | 92.6 | 93.2 | 93.6 | 93.8 | 93.8 | 93.6 | 93.1 | 92.6 | 91.9 | 91.1 | 90.3 | 89.3 | 88.5 | 87.3 | |
| 85 | | 67.6 | 68.6 | 69.3 | 70.0 | 70.4 | 70.8 | 71.0 | 71.0 | 70.7 | 70.4 | 69.9 | 69.4 | 68.7 | 68.0 | 67.3 | 66.5 | 65.5 | |
| 90 | | 49.7 | 50.5 | 51.2 | 51.6 | 52.0 | 52.2 | 52.2 | 52.2 | 52.1 | 51.8 | 51.5 | 51.0 | 50.5 | 49.9 | 49.3 | 48.7 | 48.0 | |
| 95 | | 36.0 | 36.6 | 37.1 | 37.3 | 37.7 | 37.8 | 37.9 | 37.8 | 37.7 | 37.5 | 37.2 | 36.9 | 36.5 | 36.0 | 35.5 | 35.1 | 34.6 | |
| 100 | | 26.2 | 26.6 | 27.0 | 27.2 | 27.4 | 27.5 | 27.5 | 27.5 | 27.4 | 27.2 | 27.0 | 26.8 | 26.5 | 26.2 | 25.9 | 25.6 | 25.3 | |
| 105 | | 19.6 | 19.8 | 20.1 | 20.2 | 20.3 | 20.4 | 20.4 | 20.4 | 20.3 | 20.2 | 20.1 | 19.9 | 19.7 | 19.5 | 19.3 | 19.1 | 18.8 | |
| 110 | | 14.7 | 14.9 | 15.1 | 15.2 | 15.3 | 15.4 | 15.4 | 15.3 | 15.3 | 15.2 | 15.1 | 15.0 | 14.8 | 14.6 | 14.4 | 14.2 | 14.1 | |
| 115 | | 11.0 | 11.2 | 11.3 | 11.4 | 11.4 | 11.5 | 11.5 | 11.5 | 11.4 | 11.3 | 11.3 | 11.2 | 11.0 | 10.9 | 10.8 | 10.7 | 10.5 | |
| 120 | | 8.38 | 8.48 | 8.56 | 8.62 | 8.67 | 8.70 | 8.70 | 8.67 | 8.63 | 8.57 | 8.51 | 8.42 | 8.32 | 8.23 | 8.14 | 8.05 | 7.94 | |
| 125 | | 6.40 | 6.48 | 6.54 | 6.59 | 6.62 | 6.64 | 6.63 | 6.61 | 6.58 | 6.52 | 6.46 | 6.41 | 6.33 | 6.24 | 6.18 | 6.11 | 6.03 | |
| 130 | | 4.93 | 4.99 | 5.05 | 5.08 | 5.10 | 5.11 | 5.11 | 5.08 | 5.05 | 5.01 | 4.96 | 4.91 | 4.85 | 4.79 | 4.73 | 4.68 | 4.61 | |
| 135 | | 3.81 | 3.86 | 3.91 | 3.93 | 3.95 | 3.95 | 3.95 | 3.93 | 3.90 | 3.87 | 3.83 | 3.79 | 3.73 | 3.68 | 3.62 | 3.58 | 3.52 | |
| 140 | | 2.92 | 2.97 | 3.00 | 3.03 | 3.03 | 3.03 | 3.02 | 3.00 | 2.99 | 2.96 | 2.93 | 2.89 | 2.85 | 2.80 | 2.75 | 2.71 | 2.66 | |
| 145 | | 2.20 | 2.24 | 2.28 | 2.29 | 2.30 | 2.29 | 2.28 | 2.27 | 2.25 | 2.23 | 2.20 | 2.17 | 2.14 | 2.09 | 2.05 | 2.01 | 1.97 | |
| 150 | | 1.62 | 1.66 | 1.69 | 1.70 | 1.70 | 1.70 | 1.68 | 1.67 | 1.66 | 1.64 | 1.62 | 1.60 | 1.56 | 1.53 | 1.49 | 1.45 | 1.41 | |
| 155 | | 1.16 | 1.20 | 1.22 | 1.23 | 1.23 | 1.23 | 1.22 | 1.20 | 1.19 | 1.18 | 1.16 | 1.14 | 1.12 | 1.09 | 1.05 | 1.02 | 0.98 | |
| 160 | | 0.82 | 0.86 | 0.87 | 0.88 | 0.88 | 0.88 | 0.88 | 0.87 | 0.86 | 0.85 | 0.83 | 0.82 | 0.79 | 0.77 | 0.74 | 0.72 | 0.69 | |
| 165 | | 0.62 | 0.64 | 0.65 | 0.66 | 0.66 | 0.67 | 0.67 | 0.67 | 0.66 | 0.64 | 0.62 | 0.61 | 0.59 | 0.57 | 0.56 | 0.55 | 0.55 | |
| 170 | | 0.54 | 0.55 | 0.55 | 0.56 | 0.57 | 0.57 | 0.57 | 0.57 | 0.57 | 0.57 | 0.56 | 0.55 | 0.54 | 0.53 | 0.53 | 0.53 | 0.53 | |
| 175 | | 0.55 | 0.55 | 0.55 | 0.55 | 0.55 | 0.55 | 0.55 | 0.55 | 0.55 | 0.55 | 0.55 | 0.55 | 0.55 | 0.55 | 0.55 | 0.54 | 0.54 | |
| 180 | | 0.53 | 0.53 | 0.53 | 0.53 | 0.53 | 0.53 | 0.53 | 0.53 | 0.53 | 0.53 | 0.53 | 0.53 | 0.53 | 0.53 | 0.53 | 0.53 | 0.53 | |

Table 7: Luminous Intensity Data

EQUIPMENT LIST

| Test Equipment | Model | Equipment No. | Calibration Date | Calibration Due date |
|-----------------------------------|----------|---------------|------------------|----------------------|
| Goniophotometer system | GO-R5000 | HZTE011-01 | Aug. 05, 2021 | Aug. 04, 2022 |
| Digital Power Meter | PF2010A | HZTE028-01 | Aug. 05, 2021 | Aug. 04, 2022 |
| AC Power Supply | DPS1060 | HZTE001-06 | Aug. 05, 2021 | Aug. 04, 2022 |
| DC Power Supply | WY12010 | HZTE004-03 | Aug. 05, 2021 | Aug. 04, 2022 |
| Temperature recorder | JM624U | HZTE018-08 | Aug. 05, 2021 | Aug. 04, 2022 |
| Temperature and humidity recorder | JR900 | HZTE018-01 | Aug. 05, 2021 | Aug. 04, 2022 |
| Standard source | D908 | HZTE012-01 | Aug. 05, 2021 | Aug. 04, 2022 |
| Integrate Sphere system | 3M | HZTE015-04 | Aug. 05, 2021 | Aug. 04, 2022 |
| Digital Power Meter | WT210 | HZTE008-01 | Aug. 05, 2021 | Aug. 04, 2022 |
| AC Power Supply | PCR 500L | HZTE001-07 | Aug. 05, 2021 | Aug. 04, 2022 |
| DC Power Supply | IT6154 | HZTE004-04 | Aug. 05, 2021 | Aug. 04, 2022 |
| Standard source | SCL-1400 | HZTE012-02 | Aug. 05, 2021 | Aug. 04, 2022 |
| Temperature and humidity recorder | JR900 | HZTE018-02 | Aug. 05, 2021 | Aug. 04, 2022 |
| Temperature Meter | TES1310 | HZTE017-01 | Aug. 05, 2021 | Aug. 04, 2022 |

Table 8: Test Equipment List

TEST METHODS

Seasoning of SSL Product

For the purpose of rating new SSL products, SSL products shall be tested with no seasoning. Therefore, no seasoning was performed.

Sphere-Spectroradiometer Method- Photometric and Electrical Measurements

A Labsphere Model CDS 2100 Spectroradiometer and Two Meter Sphere was used to measure correlated color temperature, chromaticity coordinates, and the color rendering index for each SSL unit. The coating reflectance of each sphere is 98%. The measure geometry is 4π . Self-absorption correction is conducted in testing. Bandwidth of spectroradiometer is 350nm-1050nm.

Ambient temperature was measured at a position inside the sphere. Each SSL unit was operated on the client provided driver at the rated input voltage in its designated orientation.

The stabilization time typically ranges from 30 min (small integrated LED lamps) to 2 or more hours for large SSL luminaires). It can be judged that stability is reached when the variation (maximum – minimum) of at least 3 readings of the light output and electrical power over a period of 30 min, taken 15 minutes apart, is less than 0.5 %.

Electrical measurements including voltage, current, and power were measured using the Yokogawa Power Analyzer.

The standard reference of the integrated sphere system is halogen incandescent lamp, the intensity distribution type is omni-directional, and is traceable to the National Institute of Standards and Technology.

The uncertainty of integrating sphere system reported in this document is expanded uncertainty is 2.1% with a coverage factor $k=2$.

Goniophotometer Method

Photometric and Electrical Measurements

An EVERFINE Type C Model GO-R5000 Goniophotometer was used to measure the intensity at each angle of distribution for each sample. The photometric distance is 2.475m for near-field measurement or 30m for far-field measurement. Bandwidth of spectroradiometer is 380nm-780nm.

Ambient temperature was measured at the same height of the sample mounted on the Goniophotometer equipment. Each SSL unit was operated on the client provided driver at the rated input voltage in its designated orientation.

The stabilization time typically ranges from 30 min (small integrated LED lamps) to 2 or more hours for large SSL luminaires). It can be judged that stability is reached when the variation (maximum – minimum) of at least 3 readings of the light output and electrical power over a period of 30 min, taken 15 minutes apart, is less than 0.5 %.

Electrical measurements including voltage, current, and power were measured using the Everfine Digital Power Meter.

Some graphics were created with Photometric Plus software.

The standard reference of the Goniophotometer system is halogen incandescent lamp, the intensity distribution type is omni-directional, and is traceable to the National Institute of Metrology P.R. China.

The uncertainty of goniophotometer system reported in this document is expanded uncertainty is 2.3% with a coverage factor $k=2$.

Color Characteristics Measurements

The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as values that are spatially average, weighted to intensity, over the angular range where light is intentionally emitted from the SSL product. The color characteristics measurements are using gonio-spectroradiometer.

Color Spatial Uniformity

The characteristics of SSL products may be spatially non-uniform, the chromaticity coordinate shall be measured at two vertical planes ($C=0^\circ/180^\circ$ and $C=90^\circ/270^\circ$) and at 10° or less intervals for vertical angle until the light output dropped to below 10% of the peak intensity. The averaged weighted chromaticity coordinate

was calculated from these points. The data was then analyzed to check for delta color differences of the u' , v' chromaticity coordinates. The spatial non-uniformity of chromaticity, $\Delta u'v'$, is determined as the maximum deviation (distance on the CIE (u' , v') diagram) among all measured points from the spatially averaged chromaticity coordinate.

The geometry for the chromaticity measurement using gonio-spectroradiometer is shown as following.



*** End of Report ***

This report is considered invalidated without the Special Seal for Inspection of the LTL. This report shall not be altered, increased or deleted. The results shown in this test report refer only to the sample(s) tested. Without written approval of LTL, this test report shall not be copied except in full and published as advertisement.