

LM-79-19 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: 4.5FSG40DIM/821

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

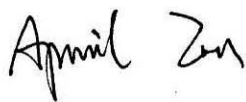
Tel: +86571 86376106

www.ltlqa.com

Report No.: HZ23020012b

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

Review by:



Engineer: April Zou
Feb. 22, 2023

Approved by:



Manager: Jim Zhang
Feb. 22, 2023

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: 4.5FSG40DIM/821

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
97.2	379.2	3.90	0.7380
CCT (K)	CRI	Stabilization Time (Light & Power)	
2079	84.8	50	

Table 1: Executive Data Summary

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

Test specifications:

Date of Receipt	: Feb. 09, 2023
Date of Test	: Feb. 14, 2023
Test item	: Total Luminous Flux, Luminous Distribution Intensity, Luminous Efficacy, Correlated Color Temperature, Color Rendering Index, Chromaticity Coordinate, Electrical parameters
Reference Standard	: IESNA LM-79-2019 Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products ANSI/IES TM-30-18 IES Method for Evaluating Light Source Color Rendition

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SAMPLE PHOTO

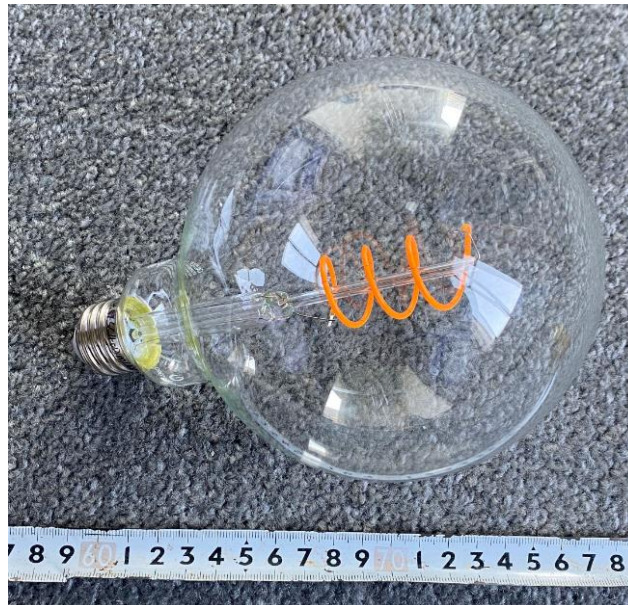


Figure 1- Overview of the sample

Equipment Under Test(EUT)

Name	: LED Lamp
Model	: 4.5FSG40DIM/821
Electrical Ratings	: 120V, 60Hz, 4.5W
Product Description	: 2100K
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 base up. Test was conducted without a dimmer in the circuit.

The stabilization time of the sample was 50 minutes, and the total operating time including stabilization was 55 minutes.

Sphere-Spectroradiometer Method

Parameter	Result
Test Voltage (V)	120.0
Voltage frequency (Hz)	60
Test Current (A)	0.044
Power Factor	0.7380
Test Power (W)	3.90
THD A%	66.63
Luminous Efficacy (lm/W)	97.2
Total Luminous Flux (lm)	379.2
Color Rendering Index (CRI)	84.8
R9	17.1
Correlated Color Temperature (CCT)(K)	2079
Chromaticity Chroma x	0.5193
Chromaticity Chroma y	0.4161
Chromaticity Chroma u	0.2987
Chromaticity Chroma v	0.3590
Duv	0.0006
Chromaticity Chroma u'	0.2987
Chromaticity Chroma v'	0.5385

Special Color Rendering Indices	
R1	85
R2	95.7
R3	91.5
R4	84.9
R5	86.6
R6	97.1
R7	79.5
R8	57.6
R9	17.1
R10	92.1
R11	89.4
R12	94.8
R13	88
R14	96.2

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 24.8 °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)	0.044
Power Factor	0.7480
Power (W)	3.91
Luminous Efficacy (lm/W)	98.7
Total Luminous Flux (lm)	386.0
Beam Angle (°)	337.1 (0°-180°) / 337.6 (90°-270°)
Center Beam Candle Power (cd)	17.3
Maximum Beam Candle Power (cd)	36.36 (At: C=292.5, Gamma=48.5)
Spacing Criteria	2.36 (0°-180°) / 2.38 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	27.07%
Zonal Lumens in the 60 °-90 °Zone	24.16%
Zonal Lumens in the 90 °-120 °Zone	24.00%
Zonal Lumens in the 120 °-180 °Zone	24.77%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

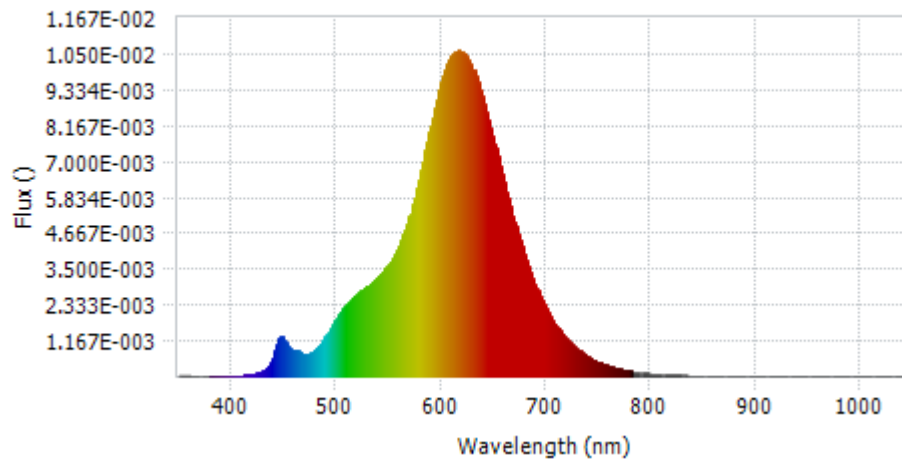
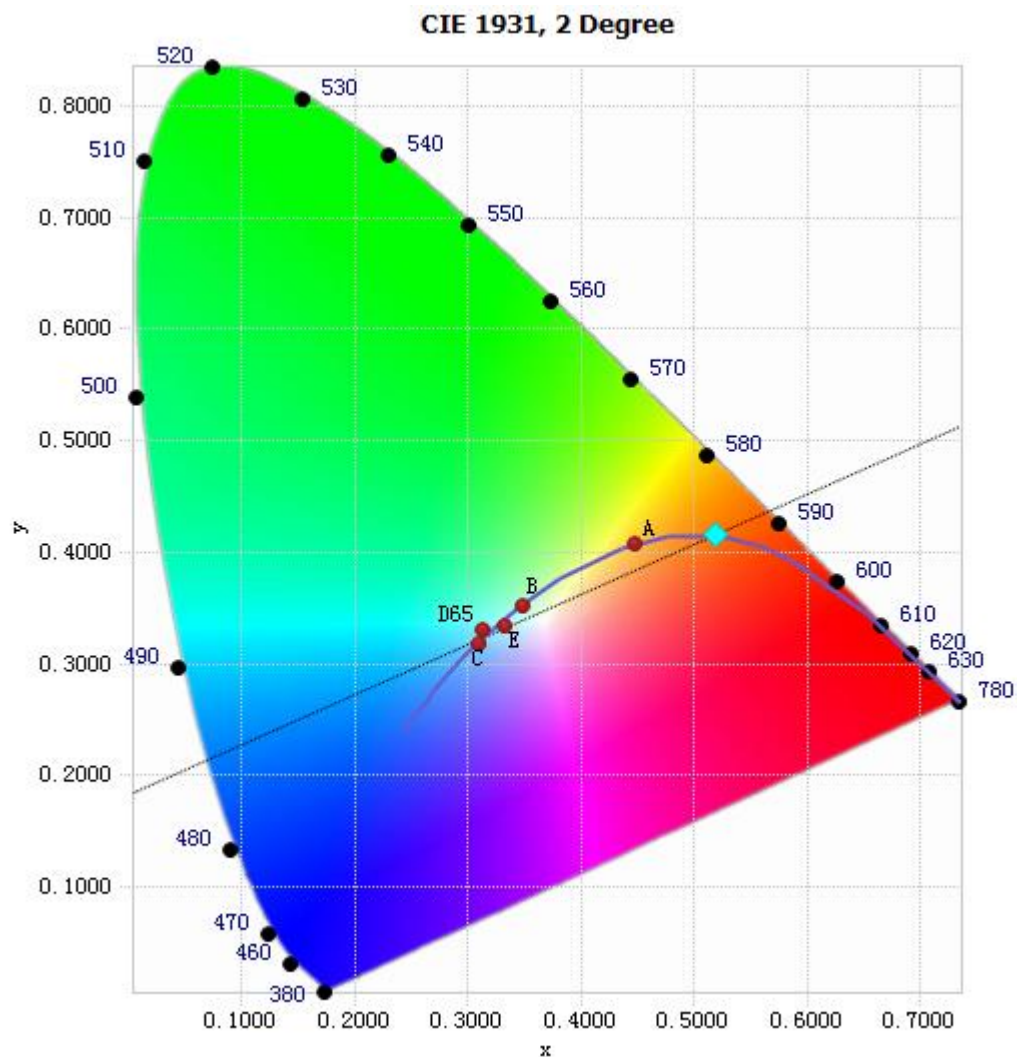


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.17E-05	485	1.03E-03	590	8.12E-03	695	2.56E-03
385	1.89E-05	490	1.29E-03	595	8.88E-03	700	2.21E-03
390	2.31E-05	495	1.59E-03	600	9.58E-03	705	1.90E-03
395	2.11E-05	500	1.86E-03	605	1.01E-02	710	1.63E-03
400	2.01E-05	505	2.11E-03	610	1.04E-02	715	1.40E-03
405	2.89E-05	510	2.33E-03	615	1.06E-02	720	1.20E-03
410	3.40E-05	515	2.52E-03	620	1.05E-02	725	1.02E-03
415	5.32E-05	520	2.66E-03	625	1.04E-02	730	8.72E-04
420	7.21E-05	525	2.81E-03	630	1.00E-02	735	7.46E-04
425	1.13E-04	530	2.94E-03	635	9.57E-03	740	6.35E-04
430	1.87E-04	535	3.07E-03	640	9.02E-03	745	5.40E-04
435	3.10E-04	540	3.23E-03	645	8.37E-03	750	4.62E-04
440	6.25E-04	545	3.42E-03	650	7.68E-03	755	3.92E-04
445	1.15E-03	550	3.63E-03	655	7.00E-03	760	3.37E-04
450	1.24E-03	555	3.90E-03	660	6.31E-03	765	2.86E-04
455	9.23E-04	560	4.26E-03	665	5.66E-03	770	2.43E-04
460	8.70E-04	565	4.68E-03	670	5.02E-03	775	2.09E-04
465	8.13E-04	570	5.21E-03	675	4.43E-03	780	1.78E-04
470	6.99E-04	575	5.84E-03	680	3.89E-03		
475	7.27E-04	580	6.54E-03	685	3.40E-03		
480	8.66E-04	585	7.35E-03	690	2.96E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.5193, 0.4161)

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

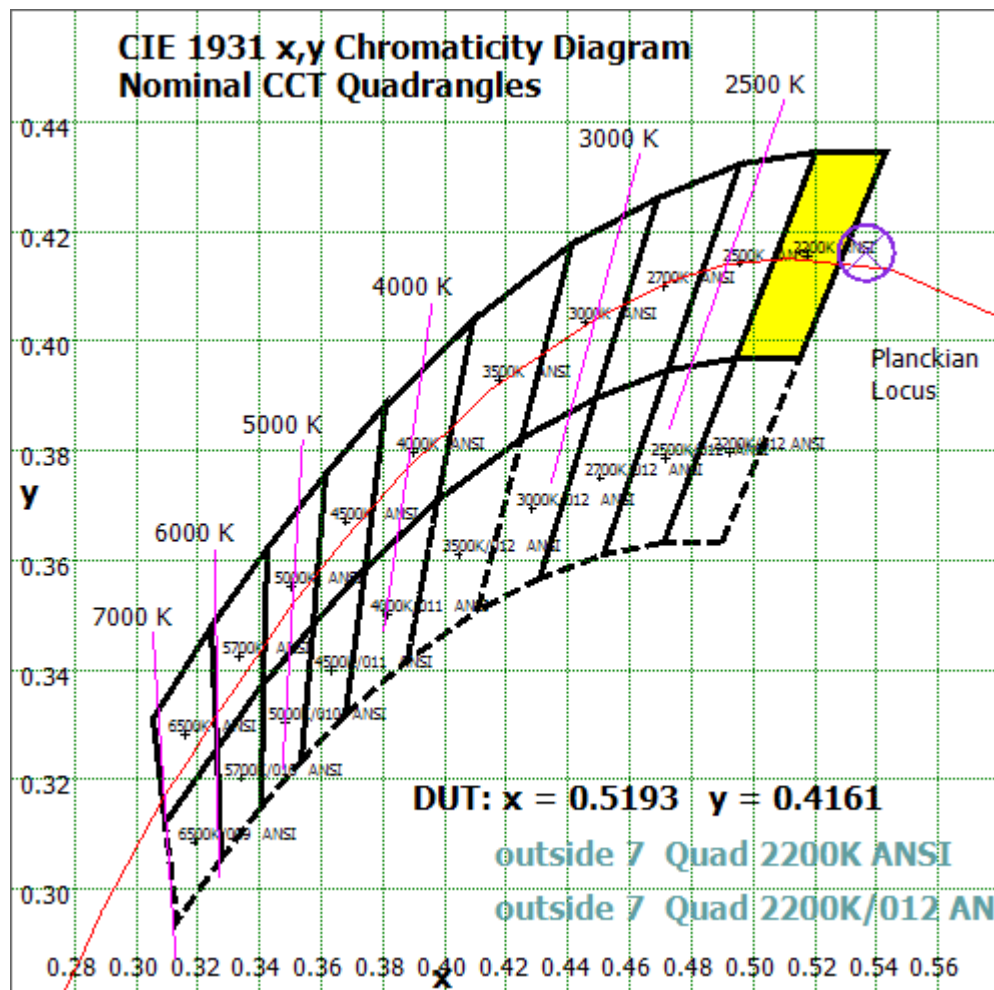


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method

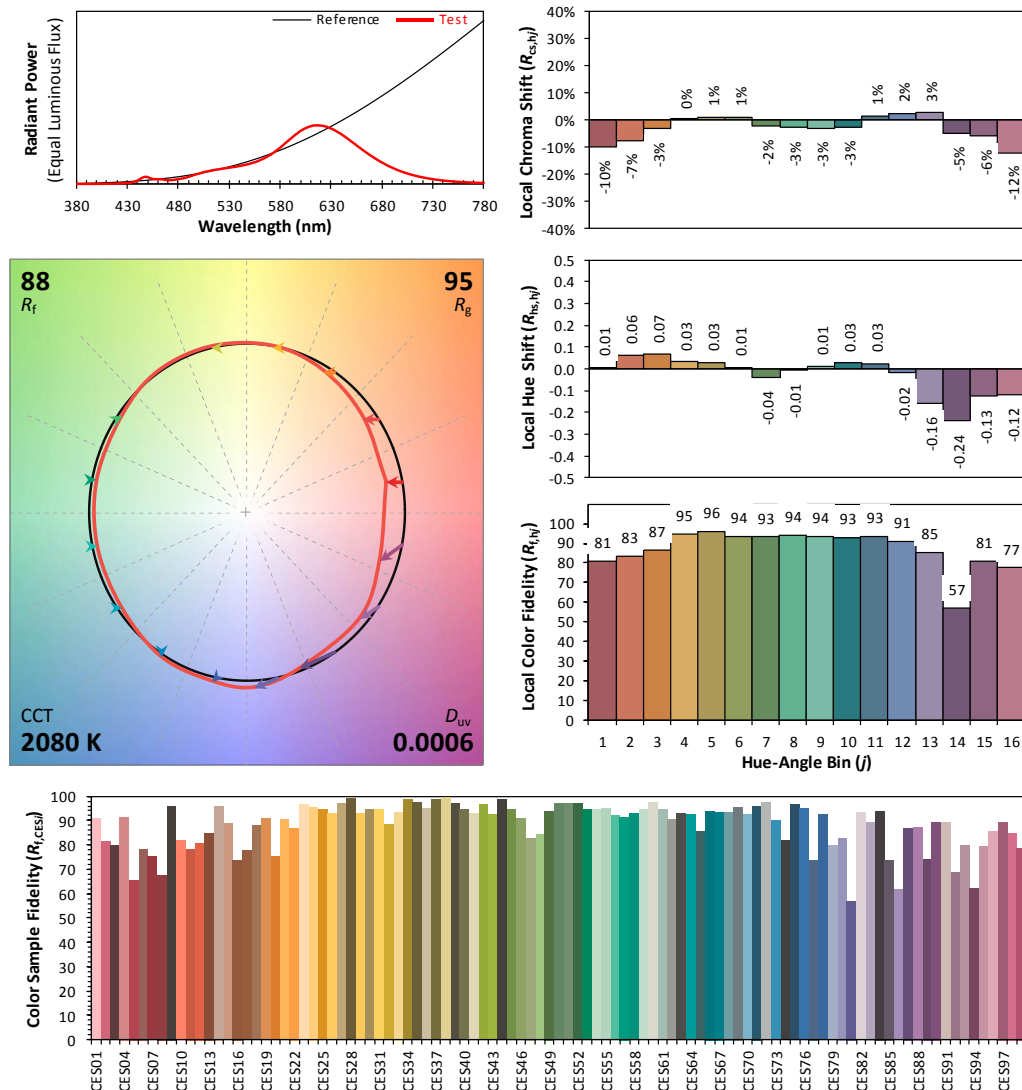
ANSI/IES TM-30-18 Color Rendition Report

Source: LED

Manufacturer: GREEN CREATIVE LTD

Date: 2023/02/14

Model: 4.5FSG40DIM/821



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

x 0.5193
 y 0.4161
 u' 0.2987
 v' 0.5385

CIE 13.3-1995
(CRI)
 R_a 85
 R_g 17

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	2.492	0.65%
10- 20	9.017	2.34%
20- 30	15.283	3.96%
30- 40	21.36	5.53%
40- 50	26.264	6.80%
50- 60	30.094	7.80%
60- 70	30.934	8.01%
70- 80	30.421	7.88%
80- 90	31.902	8.26%
90-100	31.809	8.24%
100-110	30.217	7.83%
110-120	30.607	7.93%
120-130	29.479	7.64%
130-140	25.412	6.58%
140-150	20.843	5.40%
150-160	14.44	3.74%
160-170	5.363	1.39%
170-180	0.091	0.02%
Total	386.0	100%

$\gamma(^{\circ})$	Lumens	% Total
0-110	259.793	67.30%
110-180	126.235	32.70%
0-180	386.0	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

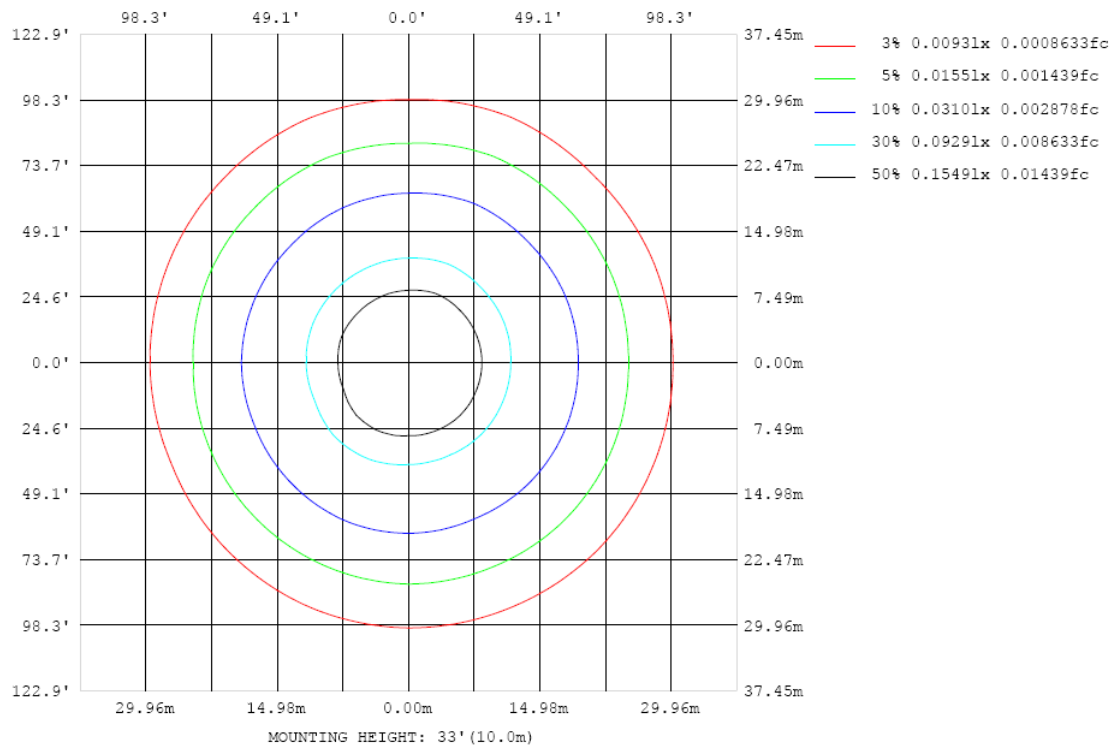


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

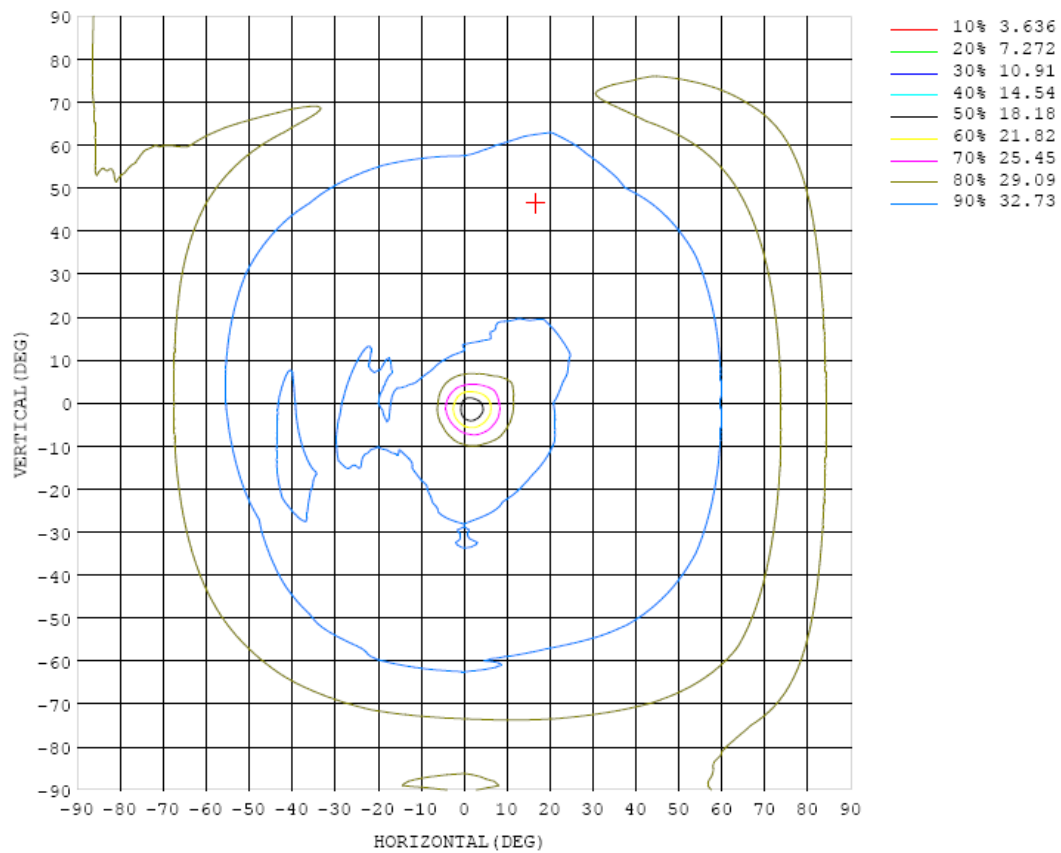


Chart 6: Isocandela Plot

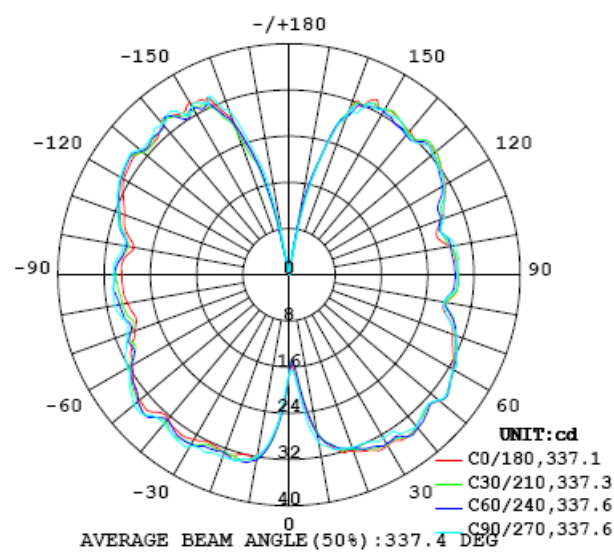


Chart 7: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1

UNIT: cd

C (DEG) γ (DEG)	0	22.5	45	67.5	90	112.5	135	157.5	180	202.5	225	247.5	270	292.5	315	337.5			
0	17.3	17.3	17.3	17.3	17.3	17.3	17.3	17.3	17.3	17.3	17.3	17.3	17.3	17.3	17.3	17.3			
5	19.8	18.6	18.6	19.2	21.0	23.5	25.3	26.4	27.3	27.5	27.4	27.1	26.8	26.0	24.3	21.9			
10	27.6	27.5	27.9	28.5	29.4	30.2	30.6	31.1	31.8	32.2	32.6	32.4	31.8	31.1	29.7	27.8			
15	31.2	30.7	30.8	31.2	31.3	31.5	32.1	32.0	32.2	33.1	33.3	33.6	33.3	32.5	31.0	30.1			
20	32.5	32.2	32.0	32.0	31.8	32.6	32.9	32.5	32.7	32.7	32.8	33.4	33.5	32.8	31.2	31.3			
25	33.5	33.2	33.0	32.8	32.0	33.1	33.4	32.6	32.2	32.6	33.1	33.4	34.0	33.5	32.6	32.4			
30	34.1	34.0	33.8	33.7	32.6	33.4	33.8	32.4	33.0	33.8	33.9	33.8	34.4	33.6	32.8	33.0			
35	34.7	34.4	34.2	33.9	33.5	35.2	35.1	32.9	33.3	34.3	33.9	33.8	34.5	34.9	34.1	34.5			
40	34.3	34.3	34.7	34.5	34.3	35.4	34.9	32.4	32.5	33.2	32.8	32.9	33.7	34.9	34.3	34.3			
45	33.2	33.4	33.8	33.4	33.1	33.8	33.8	32.0	33.6	34.6	34.8	34.4	34.5	35.0	33.7	33.6			
50	34.0	33.9	33.9	33.6	33.8	35.0	35.1	33.1	33.8	34.2	34.1	34.3	35.0	36.1	34.8	34.5			
55	33.8	33.9	33.9	33.6	34.0	34.3	33.7	32.2	32.8	33.2	32.9	33.3	33.7	35.0	33.7	34.2			
60	32.7	33.0	32.9	32.6	32.8	33.0	32.1	31.0	31.4	31.8	31.4	32.2	32.2	33.7	32.6	32.9			
65	31.3	31.8	31.9	31.5	32.0	31.4	30.6	29.9	30.0	29.3	29.9	30.9	31.1	32.7	31.6	31.8			
70	30.2	30.6	30.7	30.5	30.8	30.1	29.3	28.5	28.4	29.0	29.2	30.1	29.8	31.1	30.5	30.7			
75	28.5	29.5	29.3	28.9	28.3	27.8	26.5	25.9	27.6	28.6	29.4	30.0	29.6	29.8	28.1	28.2			
80	27.5	27.6	27.4	27.1	27.3	27.4	27.0	28.2	28.4	29.3	29.9	30.8	30.5	31.0	29.1	28.4			
85	29.2	29.2	28.6	28.2	28.9	28.7	28.0	28.7	28.8	29.7	30.5	31.1	30.5	31.0	29.7	29.6			
90	29.2	29.3	28.8	28.9	29.1	29.0	27.9	28.6	28.9	30.0	30.3	30.8	30.4	31.0	29.7	29.5			
95	29.0	29.1	28.6	29.0	29.4	28.8	28.2	28.7	28.8	29.5	29.4	30.1	30.0	30.6	29.7	29.4			
100	28.2	28.4	28.4	28.8	29.2	28.5	27.5	27.3	27.3	28.3	28.5	29.5	29.1	29.3	28.3	28.5			
105	26.4	27.4	27.5	27.7	27.5	26.8	26.6	28.4	29.2	29.9	30.2	30.5	30.0	29.5	28.0	26.7			
110	28.0	28.0	27.9	28.1	28.5	28.7	29.0	29.8	30.3	31.2	31.3	31.7	31.6	31.2	29.9	29.0			
115	29.6	29.2	28.4	28.9	29.6	29.7	29.8	31.1	31.6	32.6	32.5	33.1	32.8	32.4	31.2	30.4			
120	31.3	31.0	30.6	30.4	31.0	31.1	31.1	32.4	33.1	33.5	33.5	34.2	33.8	33.5	32.5	31.7			
125	32.2	32.0	31.6	31.7	31.9	31.8	32.0	33.2	33.6	34.2	34.1	34.7	34.3	34.2	33.2	32.5			
130	33.1	33.2	32.6	32.5	32.6	32.7	32.5	33.1	33.1	33.0	33.3	33.7	33.7	34.0	33.6	33.3			
135	32.2	33.0	32.6	32.5	32.1	31.7	31.8	33.0	32.8	33.1	33.5	33.9	33.7	33.1	32.1	31.9			
140	32.4	32.2	31.6	31.3	31.9	31.8	32.5	34.1	34.2	34.1	33.8	34.1	34.1	33.4	33.2	33.0			
145	33.1	33.1	31.9	31.9	32.9	32.5	33.6	33.9	33.8	33.6	33.2	34.0	34.7	34.1	33.7	33.3			
150	32.9	33.1	32.7	32.7	33.1	32.9	33.4	34.1	34.4	33.5	33.3	33.3	33.5	32.2	31.6	31.1			
155	33.3	32.7	32.1	32.4	32.8	32.9	32.3	32.3	33.8	31.9	32.7	33.1	33.1	24.9	30.2	23.5			
160	29.8	29.9	29.0	29.6	29.5	28.2	28.2	28.0	27.8	26.5	27.7	28.5	30.1	21.3	25.5	17.9			
165	20.6	20.6	21.1	22.2	20.5	18.4	18.1	16.3	17.2	17.2	18.5	20.3	20.7	18.8	15.7	13.8			
170	7.10	7.17	7.97	6.81	5.15	2.31	1.06	0.88	0.86	0.90	1.72	1.85	4.49	4.87	6.70	6.40			
175	0.21	0.19	0.18	0.19	0.18	0.15	0.15	0.14	0.14	0.14	0.14	0.16	0.16	0.16	0.17	0.20			
180	0.01	0.02	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03			

Table 6: Luminous Intensity Data

EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Aug. 05, 2022	Aug. 04, 2023
Digital Power Meter	PF2010A	HZTE028-01	Aug. 05, 2022	Aug. 04, 2023
AC Power Supply	DPS1060	HZTE001-06	Aug. 05, 2022	Aug. 04, 2023
DC Power Supply	WY12010	HZTE004-03	Aug. 05, 2022	Aug. 04, 2023
Temperature recorder	JM624U	HZTE018-08	Aug. 05, 2022	Aug. 04, 2023
Temperature and humidity recorder	JR900	HZTE018-01	Aug. 05, 2022	Aug. 04, 2023
Standard source	D908	HZTE012-01	Aug. 05, 2022	Aug. 04, 2023
Integrate Sphere system	3M	HZTE015-04	Aug. 05, 2022	Aug. 04, 2023
Digital Power Meter	WT210	HZTE008-01	Aug. 05, 2022	Aug. 04, 2023
AC Power Supply	PCR 500L	HZTE001-07	Aug. 05, 2022	Aug. 04, 2023
DC Power Supply	IT6154	HZTE004-04	Aug. 05, 2022	Aug. 04, 2023
Standard source	SCL-1400	HZTE012-02	Aug. 05, 2022	Aug. 04, 2023
Temperature and humidity recorder	JR900	HZTE018-02	Aug. 05, 2022	Aug. 04, 2023
Temperature Meter	TES1310	HZTE017-01	Aug. 05, 2022	Aug. 04, 2023

Table 7: 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 3 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 20 min, taken 10 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 20 min, taken 10 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.

*** 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.