

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: 9PLO/840/HYB/PF

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Hangzhou, Zhejiang Province, China 311100

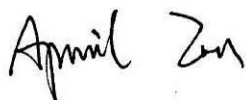
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Report No.: HZ22080002h

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

Review by:



Engineer: April Zou
Aug. 09, 2022

Approved by:



Manager: Jim Zhang
Aug. 09, 2022

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: **9PLO/840/HYB/PF**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
128.7	1191.8	9.26	0.9740
CCT (K)	CRI	Stabilization Time (Light & Power)	
4033	82.7	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	: Aug. 01, 2022
Date of Test	: Aug. 04, 2022
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	: 9PLO/840/HYB/PF
Electrical Ratings	: 120-277V, 50/60Hz, 9W
Product Description	: 4000K
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	277.0
Voltage frequency (Hz)	60	60
Test Current (A)	0.079	0.037
Power Factor	0.9740	0.9128
Test Power (W)	9.26	9.32
THD A%	10.76	18.61
Luminous Efficacy (lm/W)	128.7	129.9
Total Luminous Flux (lm)	1191.8	1210.8
Color Rendering Index (CRI)	82.7	
R9	10.1	
Correlated Color Temperature (CCT)(K)	4033	
Chromaticity Chroma x	0.3788	
Chromaticity Chroma y	0.3757	
Chromaticity Chroma u	0.2245	
Chromaticity Chroma v	0.3339	
Duv	0	
Chromaticity Chroma u'	0.2245	
Chromaticity Chroma v'	0.5009	

Special Color Rendering Indices	
R1	81.1
R2	88.2
R3	93.4
R4	82.2
R5	81.1
R6	83.5
R7	86.5
R8	65.7
R9	10.1
R10	71.7
R11	80.9
R12	61.8
R13	82.7
R14	96.3

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 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)	0.079
Power Factor	0.9760
Power (W)	9.26
Luminous Efficacy (lm/W)	128.3
Total Luminous Flux (lm)	1188.3
Beam Angle (°)	335.9 (0°-180°) / 335.1 (90°-270°)
Center Beam Candle Power (cd)	10.7
Maximum Beam Candle Power (cd)	132.9 (At: C=330.0, Gamma=89.5)
Spacing Criteria	4.84 (0°-180°) / 4.80 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	19.80%
Zonal Lumens in the 60 °-90 °Zone	32.51%
Zonal Lumens in the 90 °-120 °Zone	31.23%
Zonal Lumens in the 120 °-180 °Zone	16.46%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

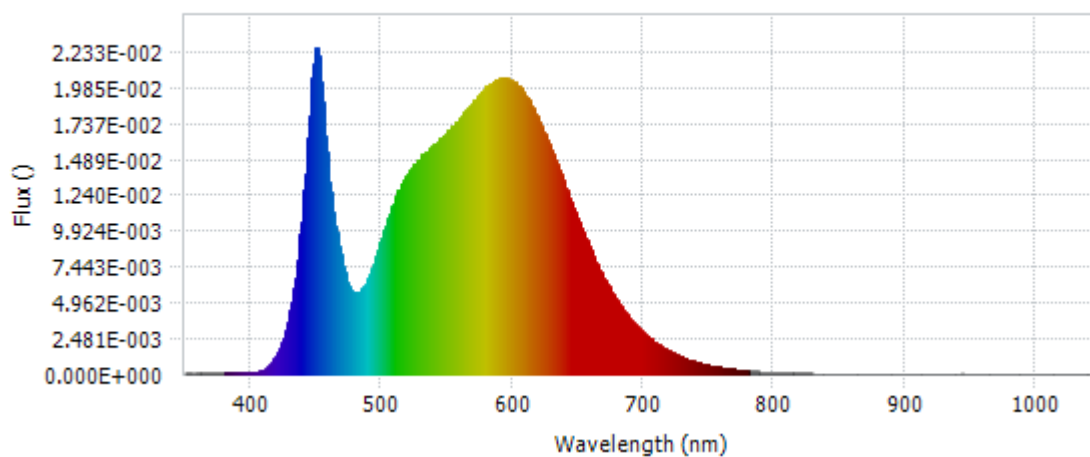
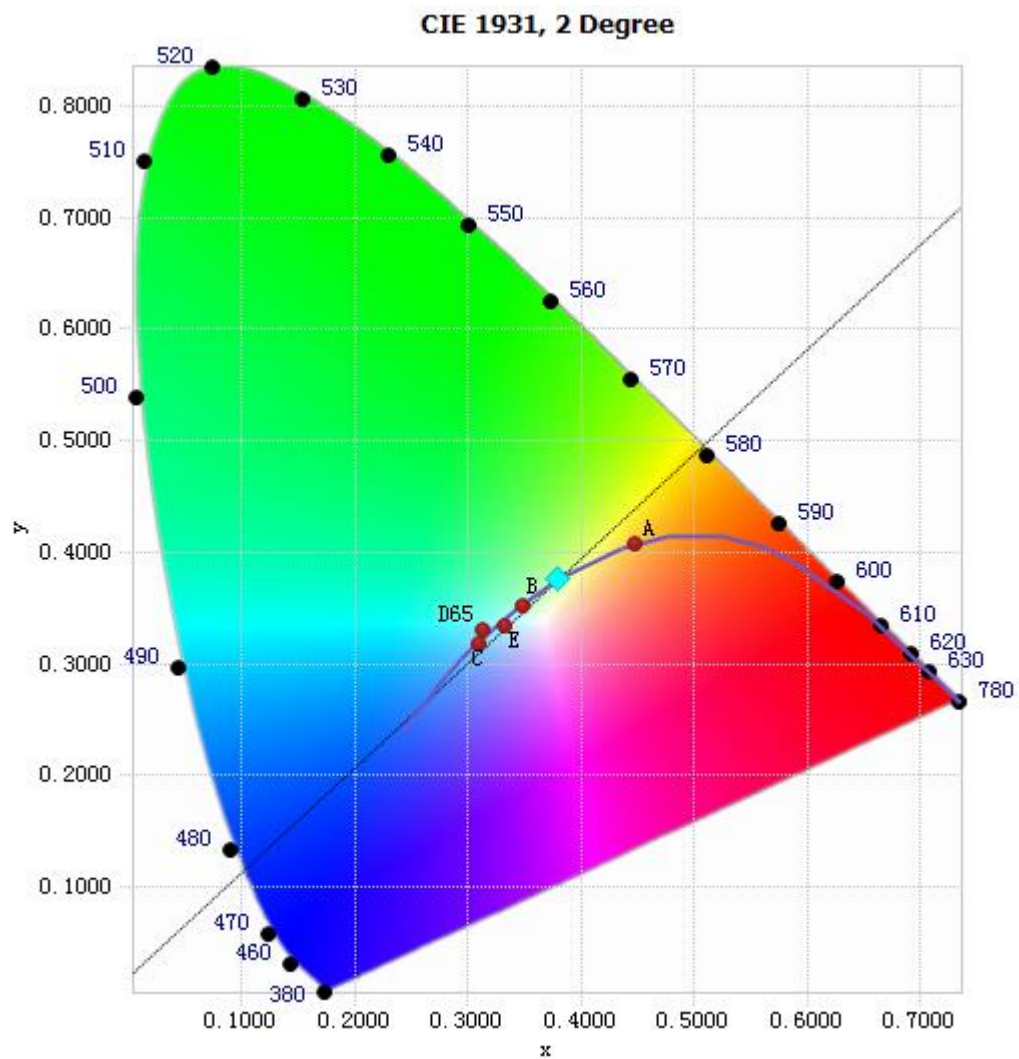


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.20E-04	485	5.92E-03	590	2.04E-02	695	3.38E-03
385	9.45E-05	490	6.67E-03	595	2.05E-02	700	2.89E-03
390	9.87E-05	495	7.92E-03	600	2.03E-02	705	2.50E-03
395	1.01E-04	500	9.40E-03	605	1.99E-02	710	2.13E-03
400	9.20E-05	505	1.08E-02	610	1.93E-02	715	1.84E-03
405	1.42E-04	510	1.21E-02	615	1.86E-02	720	1.59E-03
410	3.15E-04	515	1.31E-02	620	1.76E-02	725	1.38E-03
415	6.82E-04	520	1.39E-02	625	1.66E-02	730	1.17E-03
420	1.35E-03	525	1.45E-02	630	1.55E-02	735	1.00E-03
425	2.55E-03	530	1.50E-02	635	1.44E-02	740	8.57E-04
430	4.42E-03	535	1.54E-02	640	1.31E-02	745	7.33E-04
435	7.29E-03	540	1.59E-02	645	1.20E-02	750	6.35E-04
440	1.15E-02	545	1.63E-02	650	1.08E-02	755	5.43E-04
445	1.79E-02	550	1.68E-02	655	9.68E-03	760	4.69E-04
450	2.25E-02	555	1.72E-02	660	8.60E-03	765	4.03E-04
455	1.89E-02	560	1.77E-02	665	7.63E-03	770	3.43E-04
460	1.33E-02	565	1.83E-02	670	6.71E-03	775	2.96E-04
465	1.03E-02	570	1.88E-02	675	5.88E-03	780	2.55E-04
470	7.89E-03	575	1.94E-02	680	5.12E-03		
475	6.14E-03	580	1.99E-02	685	4.46E-03		
480	5.62E-03	585	2.02E-02	690	3.88E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3788, 0.3757)

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

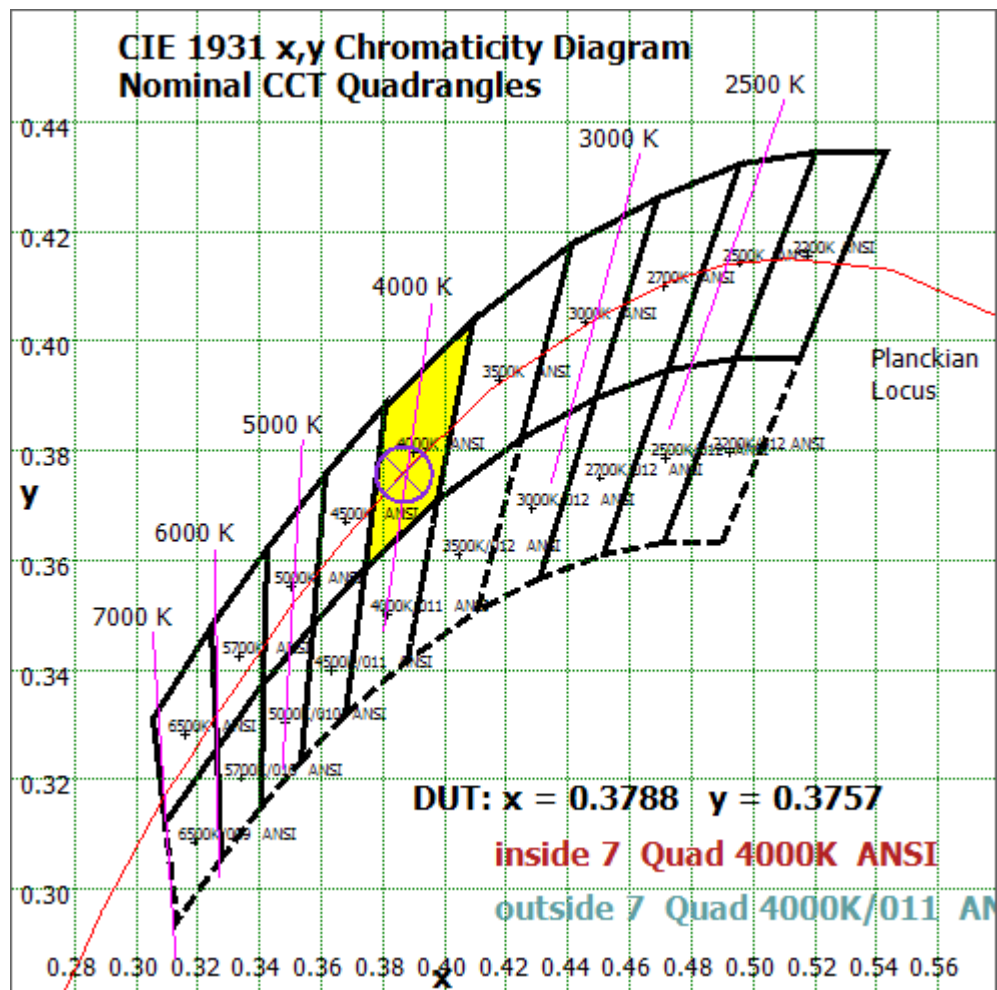


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method

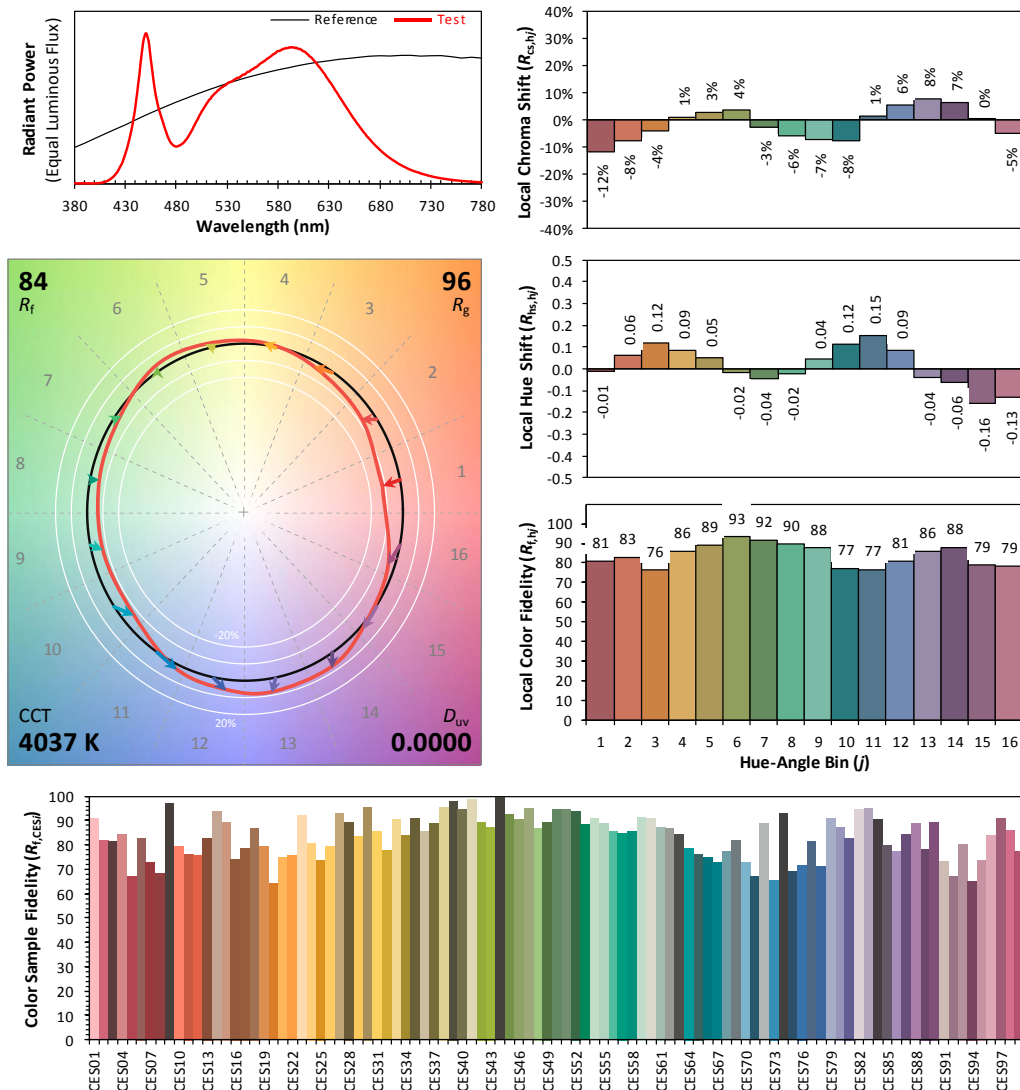
ANSI/IES TM-30-18 Color Rendition Report

Source: LED

Manufacturer: GREEN CREATIVE LTD

Date: 2022/08/04

Model: 9PLO/840/HYB/PF



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

x 0.3788
 y 0.3757
 u' 0.2245
 v' 0.5009

CIE 13.3-1995
(CRI)
 R_a 83
 R_9 10

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	1.531	0.13%
10- 20	8.621	0.73%
20- 30	22.86	1.92%
30- 40	42.975	3.62%
40- 50	67.037	5.64%
50- 60	92.23	7.76%
60- 70	114.945	9.67%
70- 80	131.668	11.08%
80- 90	139.729	11.76%
90-100	137.872	11.60%
100-110	126.278	10.63%
110-120	106.948	9.00%
120-130	83.051	6.99%
130-140	58.017	4.88%
140-150	34.916	2.94%
150-160	16.099	1.35%
160-170	3.5	0.29%
170-180	0.048	0.00%
Total	1188.3	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	235.254	19.80%
60- 90	386.342	32.51%
0-90	621.596	52.31%
90- 180	566.729	47.69%
0- 180	1188.3	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

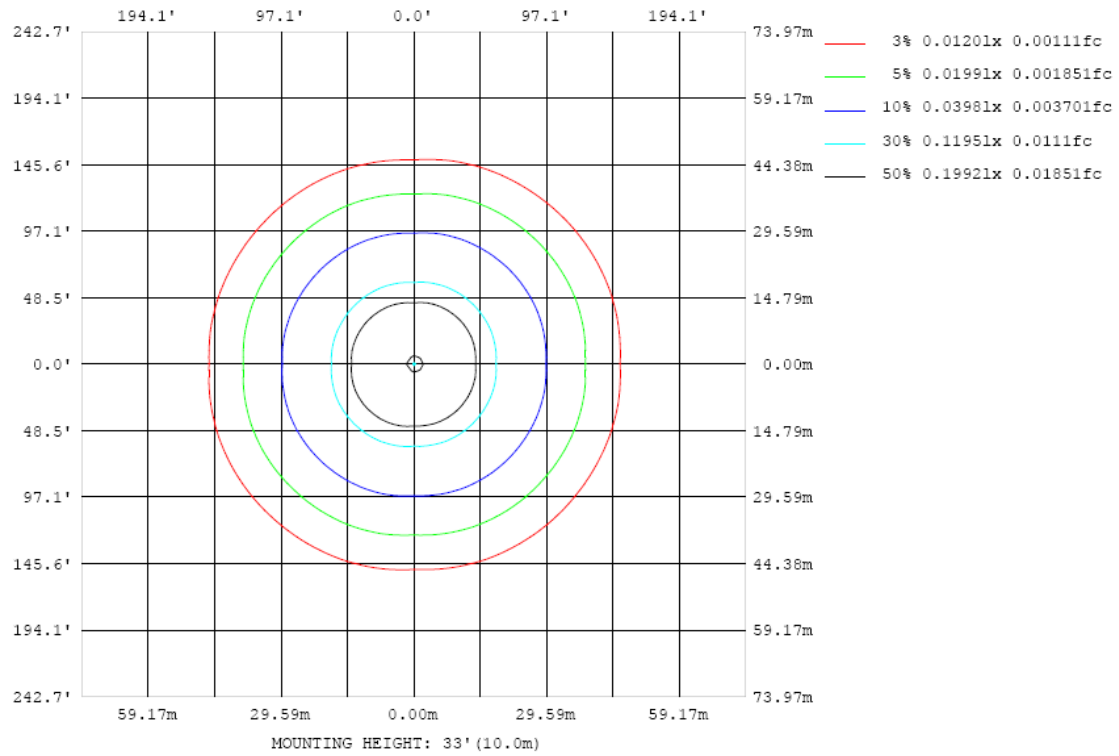


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

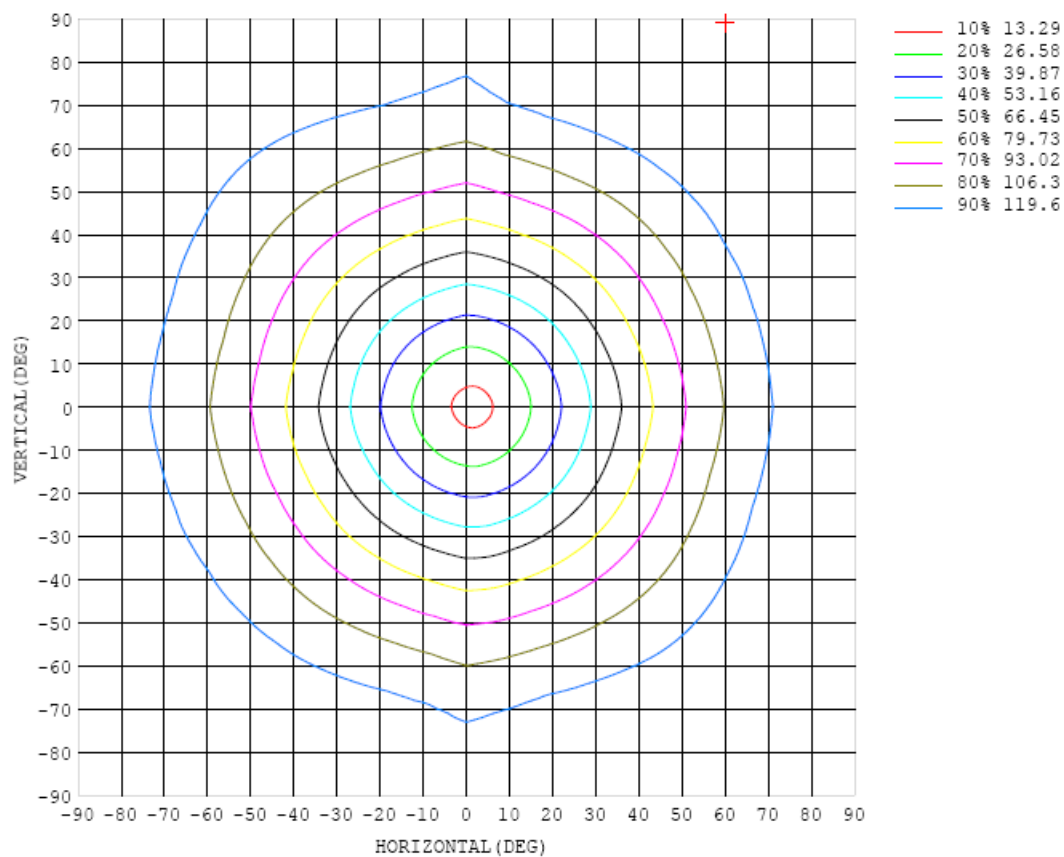


Chart 6: Isocandela Plot

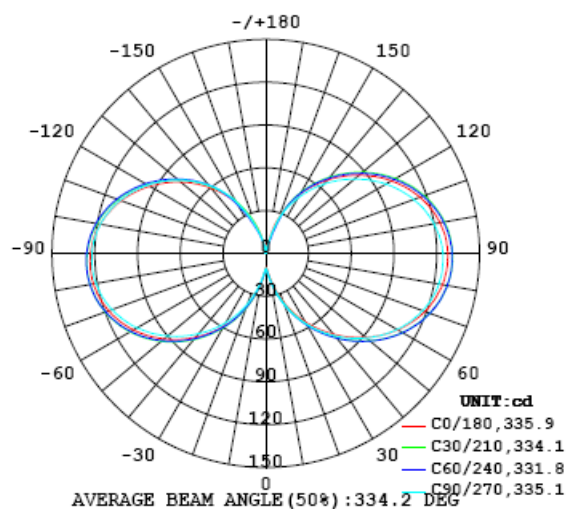


Chart 7: Polar Candela Distribution

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	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7
5	12.2	12.2	12.4	12.5	12.7	12.8	13.0	13.1	13.4	13.8	14.1	14.4	14.6	14.8	15.0	15.1	15.1	15.1	15.0
10	18.2	18.5	18.7	18.9	19.2	19.4	19.7	19.8	19.9	20.4	21.0	21.5	21.9	22.2	22.4	22.6	22.6	22.4	22.2
15	26.6	27.1	27.4	27.7	28.0	28.3	28.4	28.5	28.5	29.0	29.7	30.4	30.9	31.4	31.6	31.7	31.6	31.3	30.9
20	35.9	36.5	37.0	37.3	37.7	38.0	38.1	38.0	37.8	38.3	39.3	40.1	40.7	41.2	41.5	41.6	41.3	40.7	40.2
25	45.8	46.7	47.2	47.6	48.0	48.2	48.2	48.0	47.5	47.9	49.2	50.1	50.8	51.4	51.7	51.8	51.3	50.4	49.7
30	55.4	56.6	57.3	57.7	57.9	58.2	58.3	57.8	57.1	57.2	58.8	59.8	60.4	61.1	61.4	61.5	60.9	59.8	58.8
35	64.6	66.2	67.0	67.5	67.8	68.0	68.0	67.4	66.5	66.4	68.1	69.5	70.2	70.9	71.1	71.2	70.5	69.0	67.9
40	73.9	75.7	76.8	77.0	77.4	77.5	77.5	77.0	75.9	75.3	77.6	78.9	79.7	80.4	80.6	80.6	79.8	78.1	76.7
45	82.8	84.9	86.1	86.4	86.8	86.7	86.8	85.9	84.5	83.9	86.3	87.8	88.7	89.3	89.7	89.6	88.6	86.9	85.2
50	91.5	93.8	95.0	95.3	95.6	95.6	95.5	94.7	93.1	92.1	94.8	96.3	97.2	97.8	98.2	98.1	97.1	95.1	93.3
55	99.6	102	103	104	104	104	104	103	101	99.6	102	104	105	106	106	106	105	103	101
60	107	110	111	111	111	111	111	110	108	106	110	111	112	113	113	113	112	110	107
65	113	116	117	117	117	117	117	116	114	112	115	117	118	118	119	119	118	115	113
70	119	122	122	123	122	122	123	122	119	117	120	122	123	123	123	124	122	120	117
75	123	126	127	127	126	127	127	126	124	121	124	126	126	127	127	127	126	123	121
80	126	129	130	129	129	129	129	128	126	123	126	128	128	129	129	130	128	126	123
85	127	131	131	131	131	131	131	130	127	124	128	129	129	130	130	130	129	127	124
90	128	131	131	131	131	131	131	130	128	124	128	129	129	129	130	130	129	126	123
95	127	130	130	130	130	129	129	128	126	123	126	127	127	128	128	128	127	124	121
100	124	127	128	127	127	127	127	125	123	120	123	124	124	124	125	125	123	121	118
105	120	123	124	123	123	123	123	121	119	116	118	120	120	120	120	120	119	116	114
110	115	118	119	118	118	118	118	116	114	111	113	114	115	114	115	114	113	111	108
115	109	112	112	112	112	112	111	110	108	104	107	108	108	108	108	108	106	104	102
120	102	104	105	105	105	104	104	103	100	97.4	99.3	100	101	101	100	99.9	98.5	96.3	94.3
125	94.1	96.3	97.1	97.1	96.9	96.6	96.1	94.5	92.5	89.5	91.4	92.4	92.4	92.6	92.0	91.6	90.3	88.2	86.3
130	85.6	87.5	88.4	88.5	88.3	87.8	87.5	86.0	83.8	81.3	82.7	83.5	83.7	83.6	83.2	82.8	81.5	79.4	77.9
135	76.6	78.4	79.2	79.3	79.2	78.8	78.3	76.8	74.9	72.6	73.6	74.3	74.6	74.5	73.9	73.5	72.1	70.4	69.0
140	67.2	68.8	69.5	69.8	69.7	69.3	68.7	67.4	65.6	63.4	64.2	64.9	64.9	64.9	64.4	63.8	62.6	61.0	59.8
145	57.6	58.9	59.6	59.8	59.8	59.5	59.0	57.6	56.0	54.2	54.5	55.0	55.0	54.9	54.5	53.8	52.7	51.3	50.5
150	48.0	48.9	49.5	49.7	49.5	49.2	48.7	47.5	46.2	44.7	44.7	44.9	44.9	44.7	44.2	43.6	42.7	41.6	40.9
155	37.4	38.0	38.0	37.7	37.8	37.3	37.6	37.1	36.3	35.1	34.8	34.7	34.6	34.3	33.8	33.3	32.6	31.7	31.3
160	26.4	26.2	24.7	22.7	20.3	18.0	18.8	21.7	24.6	24.3	23.9	23.5	23.1	22.8	23.0	22.9	22.5	22.1	21.8
165	13.4	12.1	9.80	8.14	6.06	3.15	2.11	4.71	8.61	9.73	9.68	9.11	9.18	9.44	9.86	10.3	10.7	10.9	11.3
170	2.47	2.01	1.28	0.78	0.59	0.50	0.45	0.45	0.28	0.24	0.26	0.25	0.29	0.40	0.49	0.53	0.59	0.63	1.06
175	0.37	0.33	0.31	0.30	0.29	0.27	0.25	0.23	0.22	0.21	0.21	0.20	0.18	0.17	0.17	0.16	0.17	0.17	0.18
180	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07

Table 6: Luminous Intensity Data

Table--2

UNIT: cd

C (DEG) γ (DEG)	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350		
0	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7		
5	15.0	15.0	15.0	14.9	14.7	14.6	14.3	14.0	13.7	13.4	13.1	12.9	12.8	12.7	12.5	12.3	12.2		
10	22.3	22.4	22.3	22.1	21.9	21.6	21.2	20.7	20.2	19.7	19.6	19.4	19.3	19.1	18.9	18.6	18.3		
15	31.2	31.3	31.2	30.9	30.7	30.4	29.9	29.2	28.5	28.2	28.3	28.2	28.1	27.9	27.7	27.3	26.8		
20	40.7	40.9	40.8	40.7	40.4	40.0	39.3	38.5	37.5	37.5	37.8	37.8	37.8	37.6	37.4	36.9	36.2		
25	50.5	50.8	50.7	50.6	50.3	49.8	49.1	48.0	46.8	47.3	47.8	47.9	48.1	47.9	47.7	47.0	46.2		
30	59.9	60.3	60.2	60.0	59.7	59.5	58.6	57.5	55.9	56.9	57.6	57.9	58.0	58.0	57.8	57.2	56.2		
35	69.2	69.6	69.7	69.6	69.2	68.8	67.8	66.5	64.8	66.1	67.2	67.6	67.9	67.8	67.6	66.9	65.6		
40	78.2	78.8	78.8	78.7	78.3	78.0	76.9	75.4	73.5	75.4	76.6	77.2	77.6	77.6	77.4	76.6	75.1		
45	86.9	87.5	87.6	87.4	87.1	86.7	85.6	84.0	82.1	84.3	85.7	86.3	86.8	87.0	86.9	86.0	84.2		
50	95.0	95.9	95.7	95.7	95.3	95.0	93.8	92.2	90.2	92.8	94.4	95.1	95.6	95.8	95.7	94.9	93.2		
55	103	103	103	103	103	103	101	99.7	97.6	101	102	103	104	104	104	103	101		
60	110	110	110	110	110	110	108	107	104	107	110	110	111	112	112	111	109		
65	115	116	115	115	115	115	114	112	110	114	116	117	118	118	118	118	115		
70	120	120	120	120	120	120	119	117	115	119	121	122	123	123	124	123	121		
75	123	124	123	123	123	123	122	121	119	122	125	125	127	128	128	127	125		
80	125	126	125	125	125	125	125	123	121	125	127	128	129	130	131	130	128		
85	126	126	126	126	126	126	126	124	122	126	129	130	131	132	132	132	130		
90	125	126	125	125	125	126	125	124	122	126	129	130	131	132	132	132	130		
95	123	124	124	124	124	124	123	122	121	125	127	128	130	131	131	131	129		
100	120	121	120	120	121	121	120	119	118	122	124	125	127	128	129	129	127		
105	116	116	116	116	116	117	116	115	114	118	120	121	123	124	125	124	123		
110	110	111	111	111	111	111	111	110	109	113	115	116	118	119	119	119	117		
115	104	104	104	104	105	105	104	103	103	106	109	110	111	113	113	113	111		
120	96.1	96.9	96.8	97.0	97.4	97.8	97.1	96.0	95.8	99.2	101	103	104	105	106	105	104		
125	88.0	88.8	89.0	89.3	89.5	89.9	89.1	87.9	88.2	91.2	93.6	94.8	96.2	97.1	97.5	97.0	95.5		
130	79.3	80.1	80.3	80.8	81.0	81.2	79.4	79.2	80.0	82.9	85.0	86.1	87.6	88.5	88.7	88.3	86.9		
135	70.3	71.1	71.4	71.7	72.0	72.3	68.8	69.6	71.4	73.8	75.8	77.1	78.3	79.3	79.4	79.0	77.7		
140	60.9	61.6	62.1	62.4	62.7	62.9	57.8	59.6	62.3	64.5	66.3	67.5	68.8	69.6	69.7	69.4	68.3		
145	51.2	51.9	52.3	52.7	53.0	51.8	45.5	46.9	52.9	54.9	56.6	57.8	58.9	59.7	59.7	59.4	58.5		
150	41.4	42.0	42.3	42.7	42.9	39.0	32.9	32.9	42.0	44.8	46.5	47.6	48.6	49.3	49.4	49.2	48.7		
155	31.5	31.9	32.2	32.5	32.8	26.5	21.5	20.2	29.9	34.1	36.3	37.2	38.1	38.8	39.0	38.9	37.8		
160	21.9	22.1	22.3	22.6	22.9	16.7	12.6	10.5	18.6	23.0	25.7	26.8	27.6	28.1	28.6	28.7	27.1		
165	11.6	11.6	11.7	12.0	12.4	9.86	7.48	7.49	10.8	12.4	14.5	14.7	15.0	15.6	16.0	16.4	14.9		
170	1.18	1.43	1.75	2.02	2.25	2.29	1.74	3.28	3.00	3.01	3.52	3.07	2.85	3.11	3.37	3.58	3.42		
175	0.18	0.19	0.20	0.20	0.21	0.22	0.23	0.25	0.27	0.30	0.33	0.35	0.36	0.37	0.38	0.38	0.38		
180	0.07	0.07	0.07	0.07	0.07	0.07	0.08	0.08	0.08	0.08	0.07	0.07	0.07	0.07	0.07	0.07	0.07		

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 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 ***

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