

LM-79-08 TEST REPORT

for

GREEN CREATIVE LTD

756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

LED Lamp

Model: 9.5PLO/840/DIR

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ19120026h

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

Review by:



Engineer: April Zou
Dec. 27, 2019

Approved by:



Manager: Jim Zhang
Dec. 27, 2019

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: **9.5PLO/840/DIR**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)/2	Power Factor
114.8	1378.8	12.01	0.9947
CCT (K)	CRI	Stabilization Time (Light & Power)	
4018	81.5	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. 19, 2019
Date of Test	: Dec. 25, 2019
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

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SAMPLE PHOTO

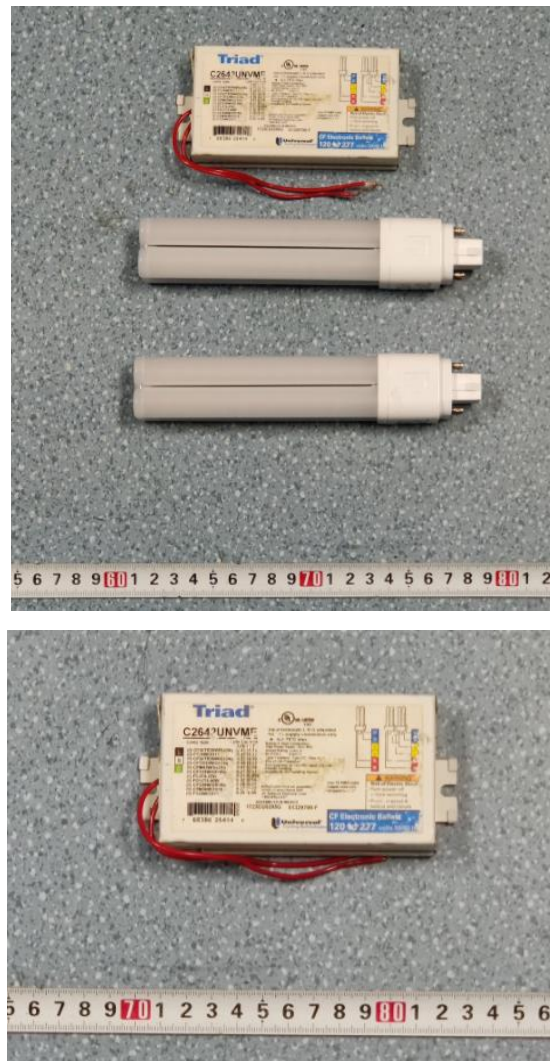


Figure 1- Overview of the sample

Equipment Under Test(EUT)

Name	: LED Lamp
Model	: 9.5PLO/840/DIR
Electrical Ratings	: 120-277V, 50/60Hz, 9.5W
Product Description	: 4000K LED lamps supplied by a high frequency fluorescent lamp ballast: C2642UNVME
Manufacturer	: GREEN CREATIVE LTD
Address	: 756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

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

Sphere-Spectroradiometer Method

Parameter	Result	
Test Voltage (V)	120.0	277.0
Voltage frequency (Hz)	60	60
Test Current (A)	0.201	0.089
Power Factor	0.9947	0.9781
Test Power (W)/2	12.01	12.08
THD A%	8.28	8.52
Luminous Efficacy (lm/W)	114.8	114.2
Total Luminous Flux (lm)	1378.8	1378.4
Color Rendering Index (CRI)	81.5	
R9	5.3	
Correlated Color Temperature (CCT)(K)	4018	
Chromaticity Chroma x	0.3807	
Chromaticity Chroma y	0.3807	
Chromaticity Chroma u	0.2237	
Chromaticity Chroma v	0.3356	
Duv	0.0018	
Chromaticity Chroma u'	0.2237	
Chromaticity Chroma v'	0.5034	

Special Color Rendering Indices	
R1	79.6
R2	86.5
R3	92.3
R4	81.5
R5	79.6
R6	81.6
R7	86.3
R8	64.5
R9	5.3
R10	68.2
R11	80.4
R12	59.6
R13	80.9
R14	95.7

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 2.47m.

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)	0.200
Power Factor	0.9954
Power (W)/2	11.92
Luminous Efficacy (lm/W)	114.6
Total Luminous Flux (lm)	1365.5
Beam Angle (°)	336.7 (0°-180°) / 329.0 (90°-270°)
Center Beam Candle Power (cd)	10.9
Maximum Beam Candle Power (cd)	153.1 (At: C=340.0, Gamma=86.0)
Spacing Criteria	5.06 (0°-180°) / 5.10 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	19.46%
Zonal Lumens in the 60 °-90 °Zone	32.72%
Zonal Lumens in the 90 °-120 °Zone	31.54%
Zonal Lumens in the 120 °-180 °Zone	16.29%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

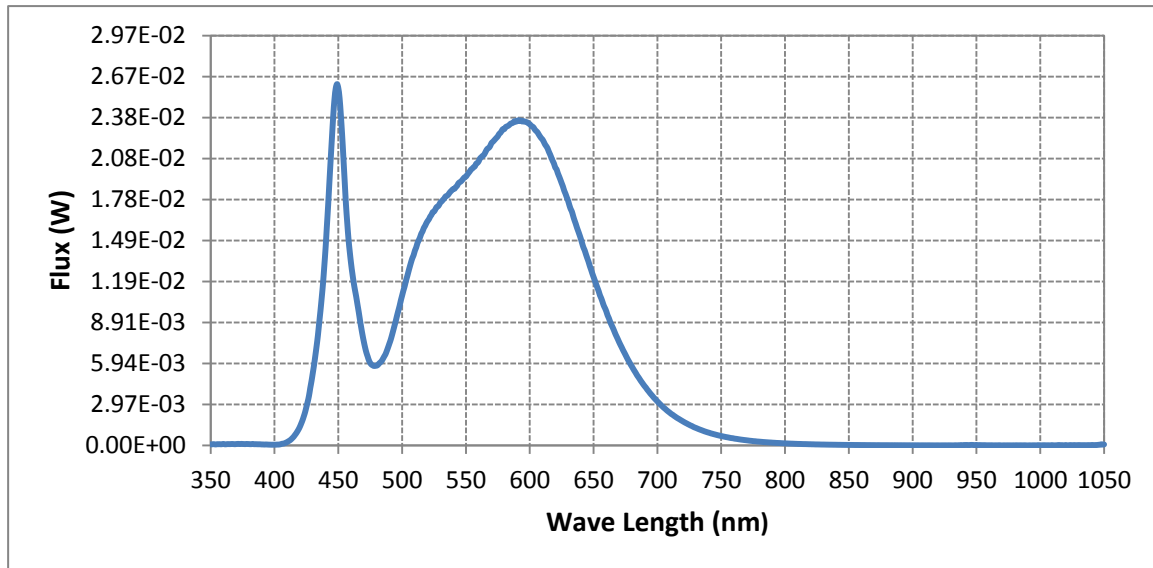
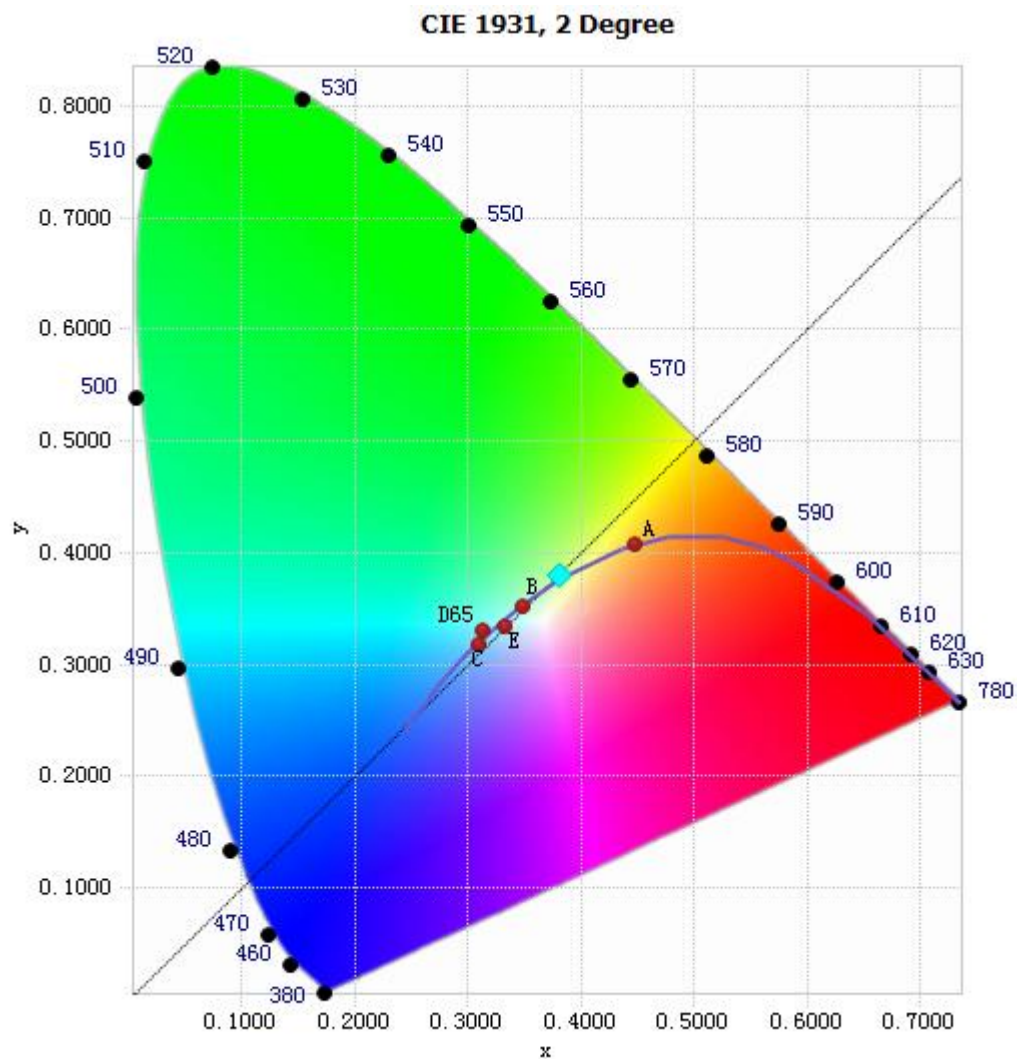


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.01E-04	485	6.29E-03	590	2.35E-02	695	3.71E-03
385	9.53E-05	490	7.38E-03	595	2.35E-02	700	3.19E-03
390	7.59E-05	495	9.02E-03	600	2.33E-02	705	2.74E-03
395	6.37E-05	500	1.09E-02	605	2.28E-02	710	2.35E-03
400	5.78E-05	505	1.26E-02	610	2.22E-02	715	2.03E-03
405	9.57E-05	510	1.41E-02	615	2.13E-02	720	1.75E-03
410	2.54E-04	515	1.53E-02	620	2.01E-02	725	1.50E-03
415	6.31E-04	520	1.63E-02	625	1.90E-02	730	1.28E-03
420	1.38E-03	525	1.70E-02	630	1.77E-02	735	1.09E-03
425	2.80E-03	530	1.76E-02	635	1.63E-02	740	9.35E-04
430	5.25E-03	535	1.81E-02	640	1.50E-02	745	8.01E-04
435	8.87E-03	540	1.86E-02	645	1.36E-02	750	6.86E-04
440	1.43E-02	545	1.91E-02	650	1.22E-02	755	5.92E-04
445	2.23E-02	550	1.95E-02	655	1.09E-02	760	5.07E-04
450	2.59E-02	555	2.01E-02	660	9.71E-03	765	4.34E-04
455	1.91E-02	560	2.06E-02	665	8.55E-03	770	3.74E-04
460	1.32E-02	565	2.12E-02	670	7.50E-03	775	3.17E-04
465	1.02E-02	570	2.19E-02	675	6.57E-03	780	2.76E-04
470	7.52E-03	575	2.24E-02	680	5.73E-03		
475	5.98E-03	580	2.29E-02	685	4.97E-03		
480	5.78E-03	585	2.33E-02	690	4.30E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3807, 0.3807)

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

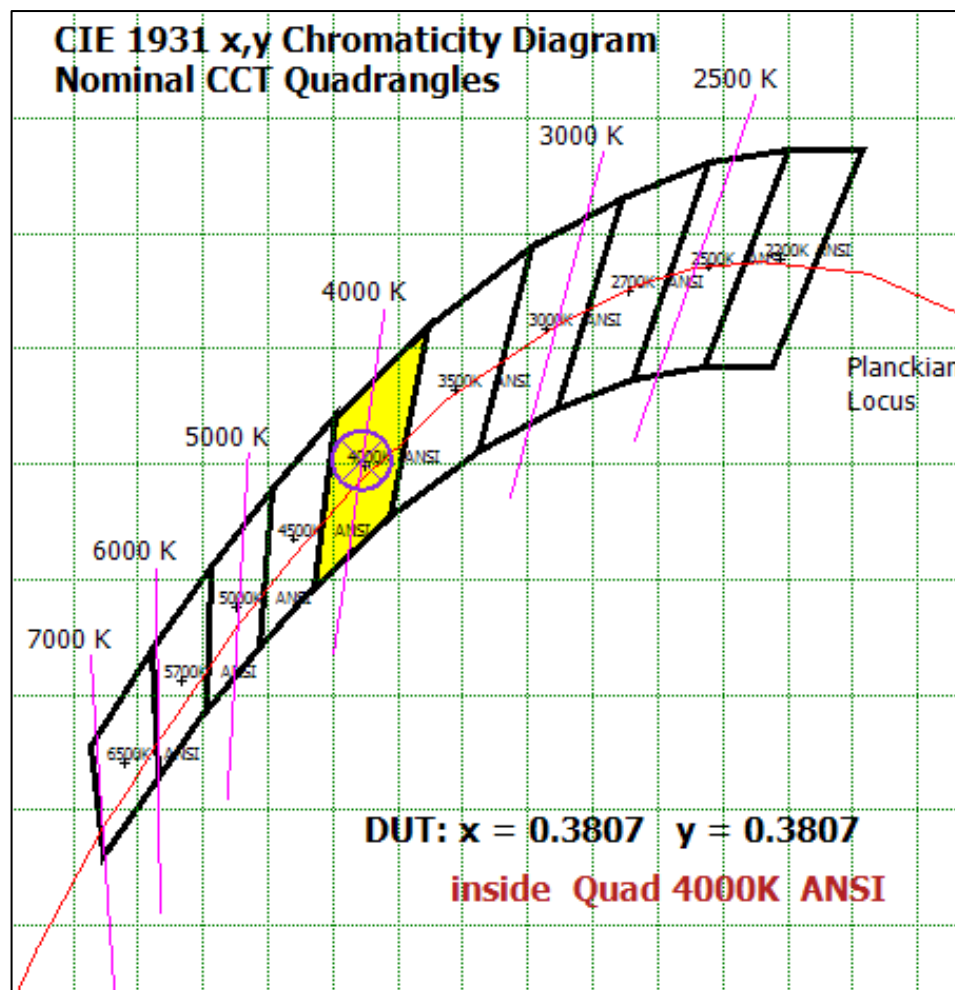
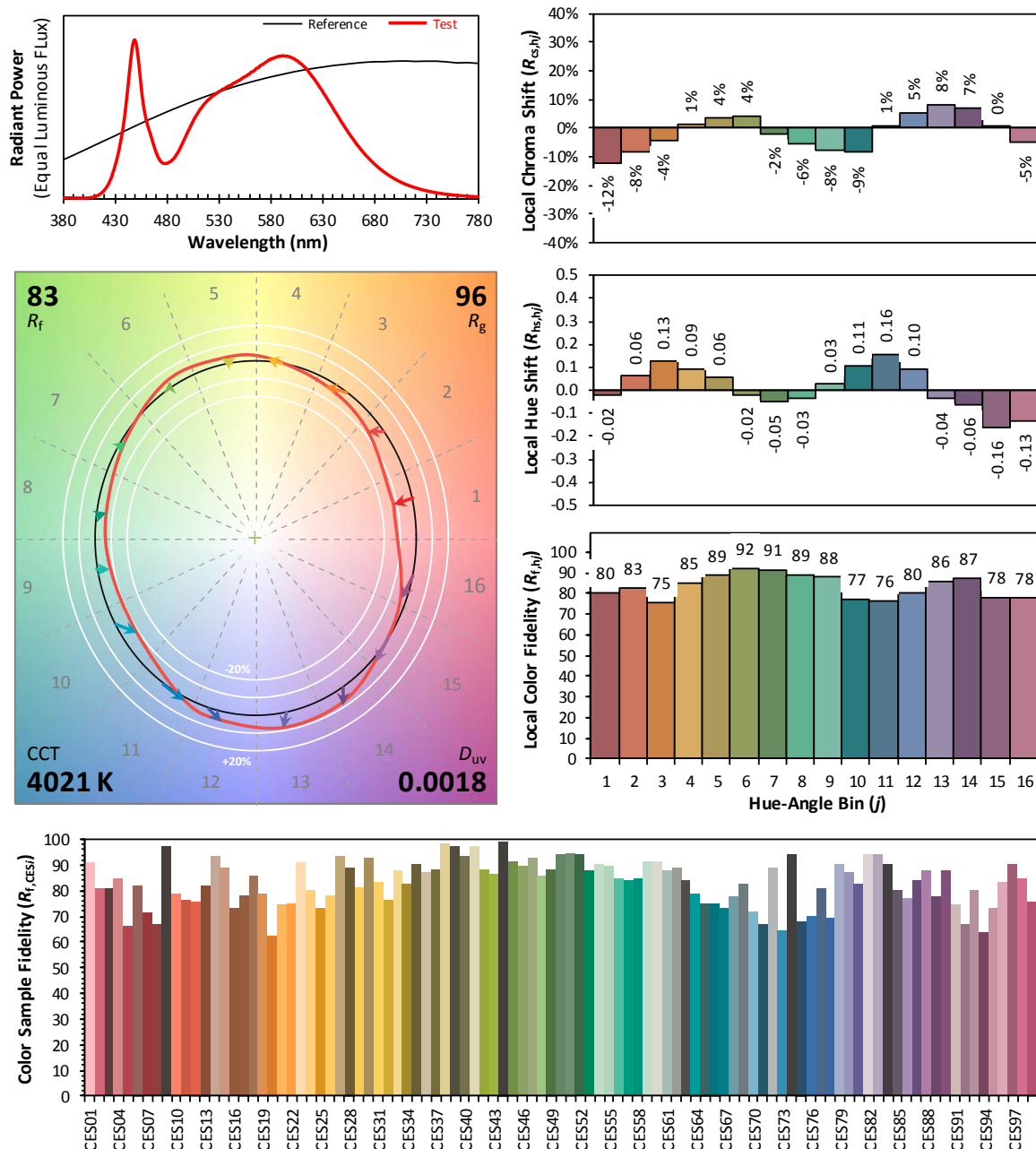


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method



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

x 0.3807
 y 0.3807
 u' 0.2237
 v' 0.5034

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	1.601	0.12%
10- 20	9.335	0.68%
20- 30	25.189	1.84%
30- 40	48.174	3.53%
40- 50	76.002	5.57%
50- 60	105.387	7.72%
60- 70	132.231	9.68%
70- 80	152.317	11.15%
80- 90	162.197	11.88%
90-100	160.192	11.73%
100-110	146.535	10.73%
110-120	123.921	9.08%
120-130	95.938	7.03%
130-140	66.652	4.88%
140-150	39.805	2.92%
150-160	16.962	1.24%
160-170	2.938	0.22%
170-180	0.121	0.01%
Total	1365.5	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	265.688	19.46%
60- 90	446.745	32.72%
0-90	712.433	52.17%
90- 180	653.064	47.83%
0- 180	1365.5	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

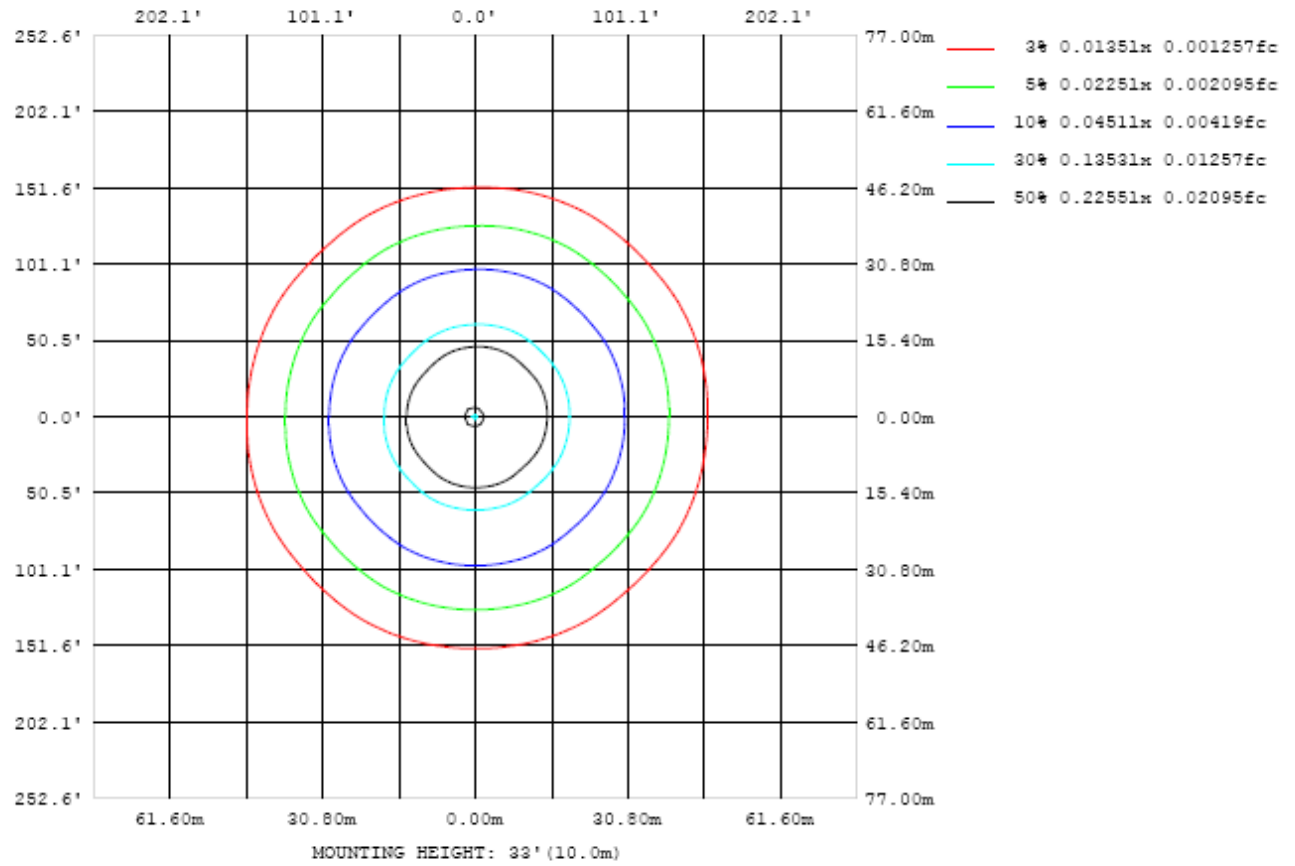


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

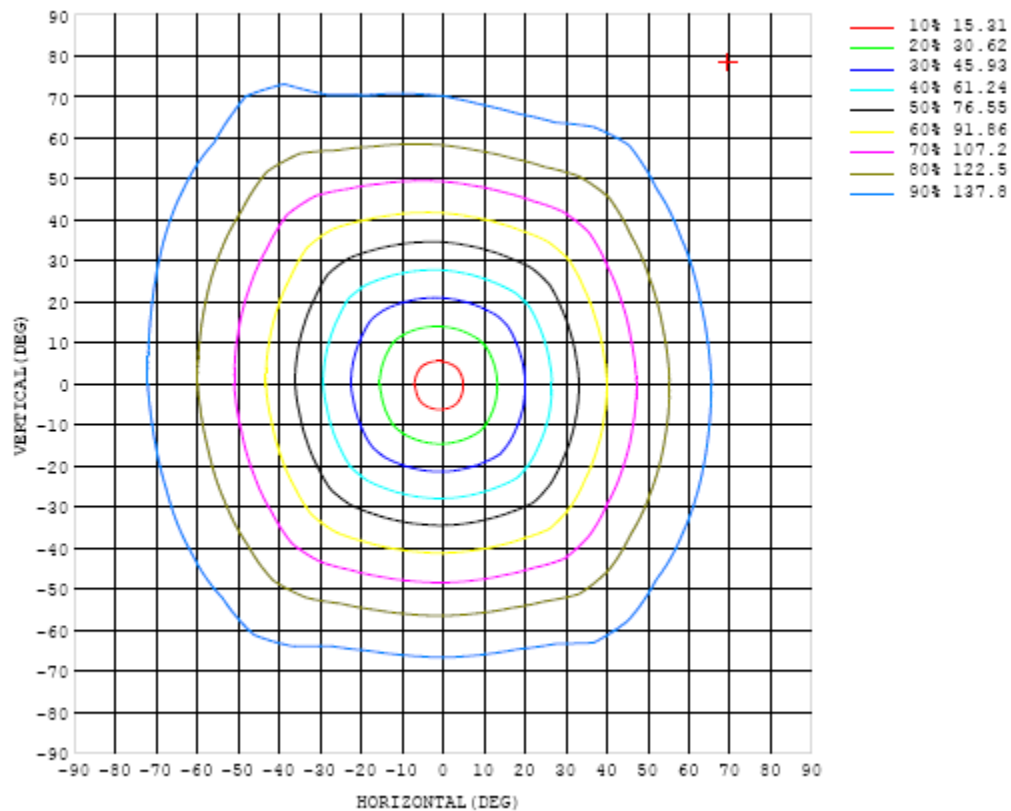


Chart 6: Isocandela Plot

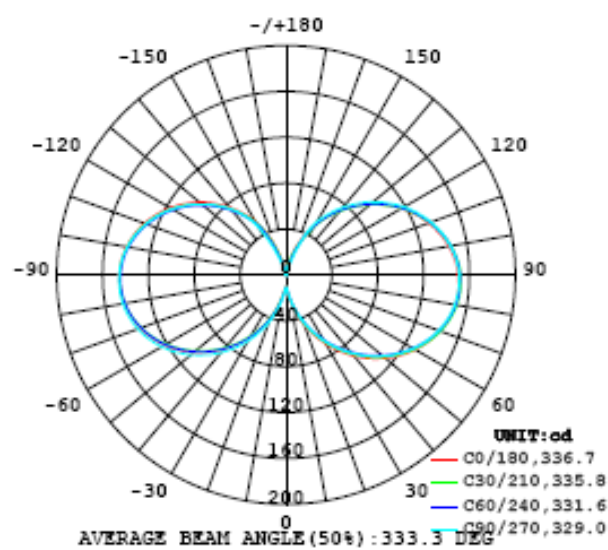


Chart 7: Polar Candela Distribution

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	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9
5	15.5	15.4	15.2	15.0	14.7	14.4	14.2	14.0	13.9	13.7	13.6	13.4	13.3	13.1	13.0	13.0	13.0	13.1	12.9
10	24.0	23.8	23.5	23.1	22.5	21.9	21.8	21.7	21.6	21.4	21.1	20.8	20.5	20.1	19.8	19.9	20.1	20.2	19.9
15	34.5	34.3	33.8	33.2	32.3	31.4	31.6	31.7	31.7	31.4	31.1	30.7	30.2	29.4	29.0	29.5	29.8	29.9	29.5
20	45.9	45.6	45.0	44.2	42.9	41.8	42.5	42.8	42.8	42.6	42.3	41.8	41.0	39.9	39.4	40.2	40.6	40.8	40.3
25	57.6	57.3	56.6	55.6	53.9	52.7	53.8	54.3	54.5	54.3	54.0	53.3	52.3	50.9	50.2	51.3	51.9	52.2	51.5
30	69.3	69.0	68.2	67.1	65.1	63.7	65.2	66.0	66.2	66.1	65.7	65.0	63.8	62.0	61.2	62.6	63.4	63.6	62.8
35	80.8	80.6	79.8	78.5	76.1	74.8	76.6	77.6	77.8	77.7	77.4	76.6	75.2	73.1	72.2	73.9	74.7	74.9	74.0
40	92.0	91.8	91.1	89.7	87.1	85.7	87.8	88.9	89.2	89.0	88.7	87.9	86.5	84.1	83.2	85.0	85.9	86.0	84.9
45	103	103	102	101	97.8	96.4	98.8	99.9	100	99.9	99.7	98.9	97.5	94.8	93.8	95.8	96.6	96.6	95.3
50	113	113	112	111	108	107	109	110	110	110	110	109	108	105	104	106	107	107	105
55	122	122	122	121	118	116	119	120	120	120	120	119	118	115	114	116	116	116	114
60	130	130	130	129	126	125	128	129	129	128	128	128	127	124	123	125	125	124	123
65	137	137	138	137	134	133	136	136	136	136	136	136	135	132	130	133	133	132	130
70	143	143	144	143	140	139	142	143	142	142	142	142	142	138	137	139	139	138	136
75	147	148	148	148	145	144	147	147	147	146	147	147	147	144	142	144	144	143	140
80	150	150	151	151	148	148	150	151	150	149	150	151	151	147	146	148	148	146	143
85	151	151	152	153	150	149	152	152	151	151	152	153	152	149	148	150	150	148	145
90	150	151	152	153	149	149	152	152	151	151	152	153	153	150	149	150	150	148	145
95	148	149	150	150	147	147	150	150	149	149	150	151	151	148	147	149	148	147	144
100	144	145	145	146	143	143	146	146	146	145	147	148	147	145	144	146	145	144	141
105	139	140	140	141	138	138	140	141	141	141	142	143	143	140	139	141	141	139	137
110	132	133	134	134	131	131	134	135	135	135	136	137	136	134	133	135	134	133	131
115	125	125	126	126	123	123	126	127	127	127	128	129	128	126	125	128	127	127	125
120	116	117	117	116	114	114	117	118	119	119	120	120	120	117	117	119	119	118	117
125	107	107	107	106	104	104	107	108	109	109	110	110	110	107	107	110	110	109	108
130	96.0	96.3	96.1	95.4	93.2	93.6	96.2	97.8	98.8	99.2	100	100	99.6	97.2	97.0	99.2	99.8	99.7	98.6
135	85.0	85.0	84.9	84.1	82.2	82.6	85.1	86.8	87.8	88.3	88.8	89.1	88.2	86.2	86.4	88.4	89.0	89.0	88.2
140	73.6	73.7	73.4	72.5	70.8	71.3	73.8	75.4	76.3	76.9	77.6	77.5	76.9	75.1	75.4	77.2	77.1	77.1	76.9
145	61.8	61.9	61.6	60.8	59.3	60.0	62.1	63.5	64.7	65.4	65.9	65.9	65.3	63.7	63.9	65.6	64.0	64.3	65.6
150	49.9	49.6	48.9	48.8	48.0	47.9	50.1	51.2	51.6	53.5	54.0	54.0	53.7	51.7	52.7	54.1	50.8	50.9	53.5
155	37.8	37.6	35.9	34.8	34.7	33.7	35.7	36.9	34.7	37.0	38.8	40.7	41.4	40.2	41.7	42.6	37.6	38.3	39.9
160	25.8	25.8	23.9	24.0	24.0	21.0	21.2	18.8	12.6	11.2	22.6	28.2	26.9	27.5	29.4	30.3	25.3	24.2	24.4
165	14.4	15.3	14.2	15.8	15.4	10.7	7.63	6.46	4.79	9.43	12.4	16.6	15.4	16.1	15.0	15.3	13.0	10.5	9.20
170	5.61	6.25	5.72	6.41	6.69	5.36	3.76	2.39	0.86	2.39	4.57	5.49	6.10	6.59	5.61	5.06	2.24	1.35	0.90
175	1.41	0.90	0.74	0.74	0.82	0.83	0.30	0.19	0.17	0.17	0.16	0.16	0.16	0.16	0.16	0.16	0.15	0.16	0.25
180	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08

Table 6: Luminous Intensity Data

Table--2

UNIT: cd

C (DEG) Y (DEG)	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350		
0	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9		
5	13.0	13.1	13.2	13.4	13.7	14.0	14.3	14.5	14.8	15.0	15.1	15.1	15.2	15.3	15.4	15.5	15.5		
10	20.0	20.1	20.1	20.1	20.7	21.3	21.9	22.4	22.8	23.1	23.2	23.3	23.2	23.3	23.7	24.0	24.0		
15	29.6	29.5	29.4	29.1	29.8	30.8	31.6	32.3	32.9	33.3	33.5	33.3	33.0	33.2	33.9	34.4	34.6		
20	40.3	40.1	39.7	39.0	39.9	41.2	42.3	43.2	43.9	44.4	44.5	44.2	43.6	43.8	45.0	45.7	46.0		
25	51.4	51.1	50.5	49.3	50.2	51.9	53.3	54.4	55.1	55.7	55.8	55.5	54.5	54.8	56.4	57.3	57.7		
30	62.7	62.2	61.3	59.8	60.7	62.8	64.4	65.6	66.5	67.1	67.3	66.8	65.6	65.9	67.8	69.0	69.5		
35	73.8	73.2	72.2	70.2	71.1	73.6	75.4	76.6	77.6	78.3	78.5	78.1	76.6	76.8	79.2	80.6	81.2		
40	84.7	84.0	82.8	80.6	81.4	84.1	86.1	87.4	88.4	89.3	89.6	89.1	87.4	87.7	90.4	91.9	92.5		
45	95.1	94.4	93.2	90.6	91.4	94.4	96.4	97.7	98.7	99.7	100	99.8	98.0	98.2	101	103	103		
50	105	104	103	100	101	104	106	107	108	110	110	110	108	108	111	113	114		
55	114	114	112	109	110	113	115	116	117	119	120	119	117	118	121	123	123		
60	122	122	121	118	118	122	123	124	125	127	128	128	126	126	130	131	131		
65	130	129	128	125	125	129	130	131	132	134	135	135	133	134	137	138	138		
70	136	135	135	131	132	135	136	137	138	139	141	142	140	140	143	144	144		
75	140	140	139	136	136	140	141	141	142	144	146	146	144	144	148	149	149		
80	143	143	143	140	140	143	144	144	145	147	148	149	147	147	151	152	151		
85	145	145	145	142	141	144	145	145	146	148	150	151	149	149	152	153	152		
90	145	146	145	142	142	144	145	145	146	148	149	150	149	149	152	153	152		
95	144	144	144	141	140	143	144	143	144	146	148	148	147	146	150	150	150		
100	141	141	141	138	137	140	141	140	141	142	144	145	143	143	146	147	146		
105	137	137	136	133	132	135	136	136	136	138	139	139	137	137	140	141	141		
110	131	131	130	127	126	129	130	130	130	131	132	133	131	130	133	134	134		
115	125	124	123	120	119	122	123	123	123	124	125	125	123	123	125	126	126		
120	117	116	115	112	111	114	115	115	115	116	116	116	114	114	116	117	118		
125	108	107	106	103	102	105	106	106	106	107	107	106	104	104	106	108	108		
130	98.2	97.3	96.0	93.2	92.3	94.6	95.8	96.1	96.3	96.5	96.4	95.7	93.7	93.1	95.6	96.9	97.2		
135	87.9	87.0	85.6	83.0	82.0	84.1	85.5	85.9	85.9	85.9	85.6	84.7	82.7	82.1	84.4	85.7	86.1		
140	77.0	76.1	74.8	72.3	71.5	73.3	74.7	75.1	75.0	74.9	74.3	73.4	71.5	70.9	72.9	74.1	74.5		
145	65.6	65.0	63.8	61.6	60.7	62.3	63.4	63.7	62.8	63.2	62.2	61.6	60.3	59.7	61.3	62.3	62.8		
150	54.1	53.5	52.6	50.9	50.0	51.0	51.3	50.7	47.8	42.9	44.7	49.2	49.1	48.5	49.7	50.5	50.9		
155	40.4	39.6	38.4	36.8	35.4	34.8	33.5	30.3	25.5	20.9	22.2	28.7	33.0	35.4	37.3	38.8	39.2		
160	24.2	23.2	22.3	21.2	19.9	17.2	14.8	11.1	6.97	2.13	2.77	7.48	12.1	16.1	21.1	24.8	26.1		
165	9.26	7.24	6.16	6.85	6.06	3.49	0.68	0.16	0.16	0.17	0.18	0.20	0.29	0.68	4.23	9.20	13.2		
170	0.88	0.60	0.43	0.34	0.27	0.27	0.25	0.25	0.27	0.32	0.38	0.47	0.62	0.87	1.07	1.34	3.69		
175	0.27	0.21	0.22	0.90	1.20	1.18	1.01	0.98	1.03	1.08	1.16	1.24	1.35	1.47	1.52	1.46	1.39		
180	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08		

Table 7: Luminous Intensity Data

EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Aug. 02, 2019	Aug. 01, 2020
Digital Power Meter	PF2010A	HZTE028-01	Aug. 02, 2019	Aug. 01, 2020
AC Power Supply	DPS1060	HZTE001-06	Aug. 02, 2019	Aug. 01, 2020
DC Power Supply	WY12010	HZTE004-03	Aug. 02, 2019	Aug. 01, 2020
Temperature recorder	JM624U	HZTE018-08	Aug. 02, 2019	Aug. 01, 2020
Temperature and humidity recorder	JR900	HZTE018-01	Aug. 02, 2019	Aug. 01, 2020
Standard source	D908	HZTE012-01	Aug. 02, 2019	Aug. 01, 2020
Integrate Sphere system	3M	HZTE015-04	Aug. 02, 2019	Aug. 01, 2020
Digital Power Meter	WT210	HZTE008-01	Aug. 02, 2019	Aug. 01, 2020
AC Power Supply	PCR 500L	HZTE001-07	Aug. 02, 2019	Aug. 01, 2020
DC Power Supply	IT6154	HZTE004-04	Aug. 02, 2019	Aug. 01, 2020
Standard source	SCL-1400	HZTE012-02	Aug. 02, 2019	Aug. 01, 2020
Temperature and humidity recorder	JR900	HZTE018-02	Aug. 02, 2019	Aug. 01, 2020
Temperature Meter	TES1310	HZTE017-01	Aug. 02, 2019	Aug. 01, 2020

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 ***

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