LM-79-08 Test Report

for

GREEN CREATIVE LTD

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

9" SQUARE DOWNLIGHT

Model: 20SMPS9DIM/930

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ17030016m

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

Review by: April Zou

Engineer: April Zou

Mar. 16, 2017

Approved by: Jim Zhang

Manager: Jim Zhang

Mar. 16, 2017

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: **20SMPS9DIM/930**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
65.7	1309.0	19.92	0.9401

CCT (K)	CRI	Stabilization Time (Light & Power)
3030	92.8	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	: Mar. 06, 2017
Date of Test	: Mar. 12, 2017
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

TABLE OF CONTENT

Sample Photos

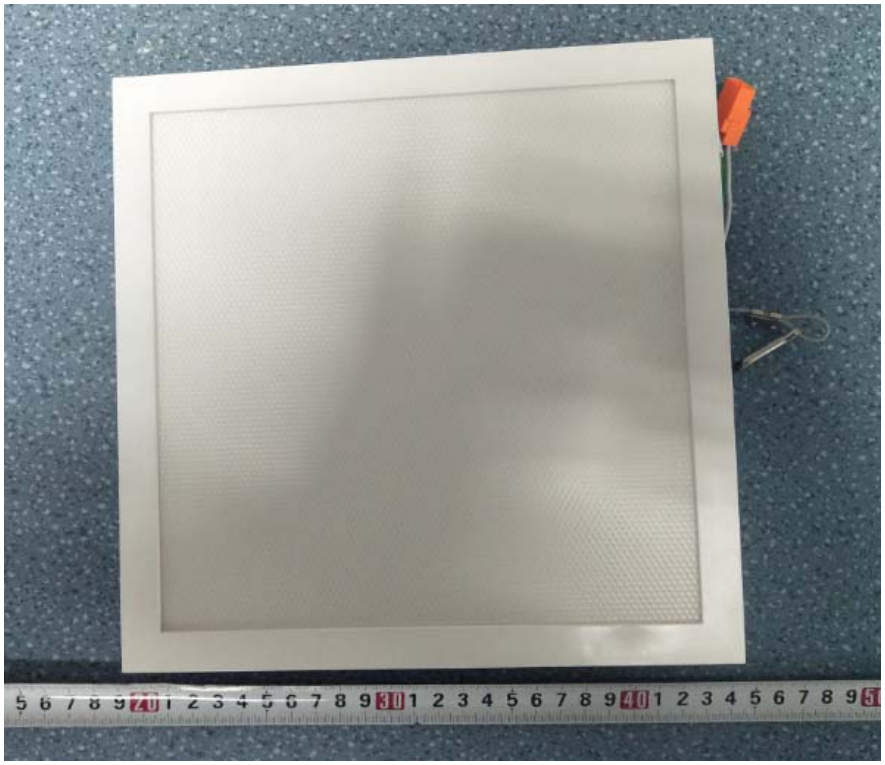


Figure 1- Overview of the sample

Equipment Under Test (EUT)	
Name	: 9” SQUARE DOWNLIGHT
Model	: 20SMPS9DIM/930
Electrical Ratings	: 120Vac, 60Hz, 20W
Product Description	: LED Adapter (E26 & GU24 optional) base, 3000K
Manufacturer	: GREEN CREATIVE LTD
Address	: 756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

TEST RESULTS

Test ambient temperature was 24.7℃.

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 70 minutes.

Sphere-Spectroradiometer Method

Parameter	Result
Test Voltage (V)	120.0
Voltage frequency (Hz)	60
Test Current (A)	0.177
Power Factor	0.9401
Test Power (W)	19.92
THD A%	33.54
Luminous Efficacy (lm/W)	65.7
Total Luminous Flux (lm)	1309.0
Color Rendering Index (CRI)	92.8
R9	62.1
Correlated Color Temperature (CCT)(K)	3030
Chromaticity Chroma x	0.4362
Chromaticity Chroma y	0.4066
Chromaticity Chroma u	0.2490
Chromaticity Chroma v	0.3482
Duv	0.0010
Chromaticity Chroma u ’	0.2490
Chromaticity Chroma v’	0.5223

Special Color Rendering Indices	
R1	93.9
R2	95.5
R3	94.9
R4	93.9
R5	92.3
R6	93.8
R7	93.9
R8	84.3
R9	62.1
R10	87
R11	94
R12	72.6
R13	94.5
R14	96
Rf	89
Rg	99

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 24.6℃.

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)	0.177
Power Factor	0.9396
Test Power (W)	19.94
Luminous Efficacy (lm/W)	66.4
Total Luminous Flux (lm)	1323.4
Beam Angle (°)	87.0
Center Beam Candle Power (cd)	645
Spacing Criteria	1.22 (0°-180°)/ 1.21 (90°-270°)
Zonal Lumens in the 0°-60°Zone	87.40%
Zonal Lumens in the 60°-90°Zone	12.50%
Zonal Lumens in the 90°-120°Zone	0.02%
Zonal Lumens in the 120°-180°Zone	0.08%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

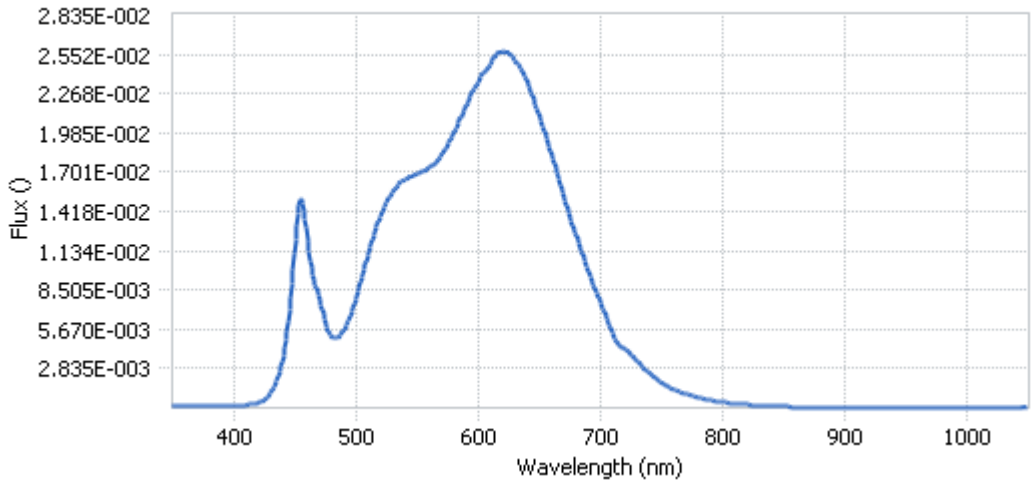
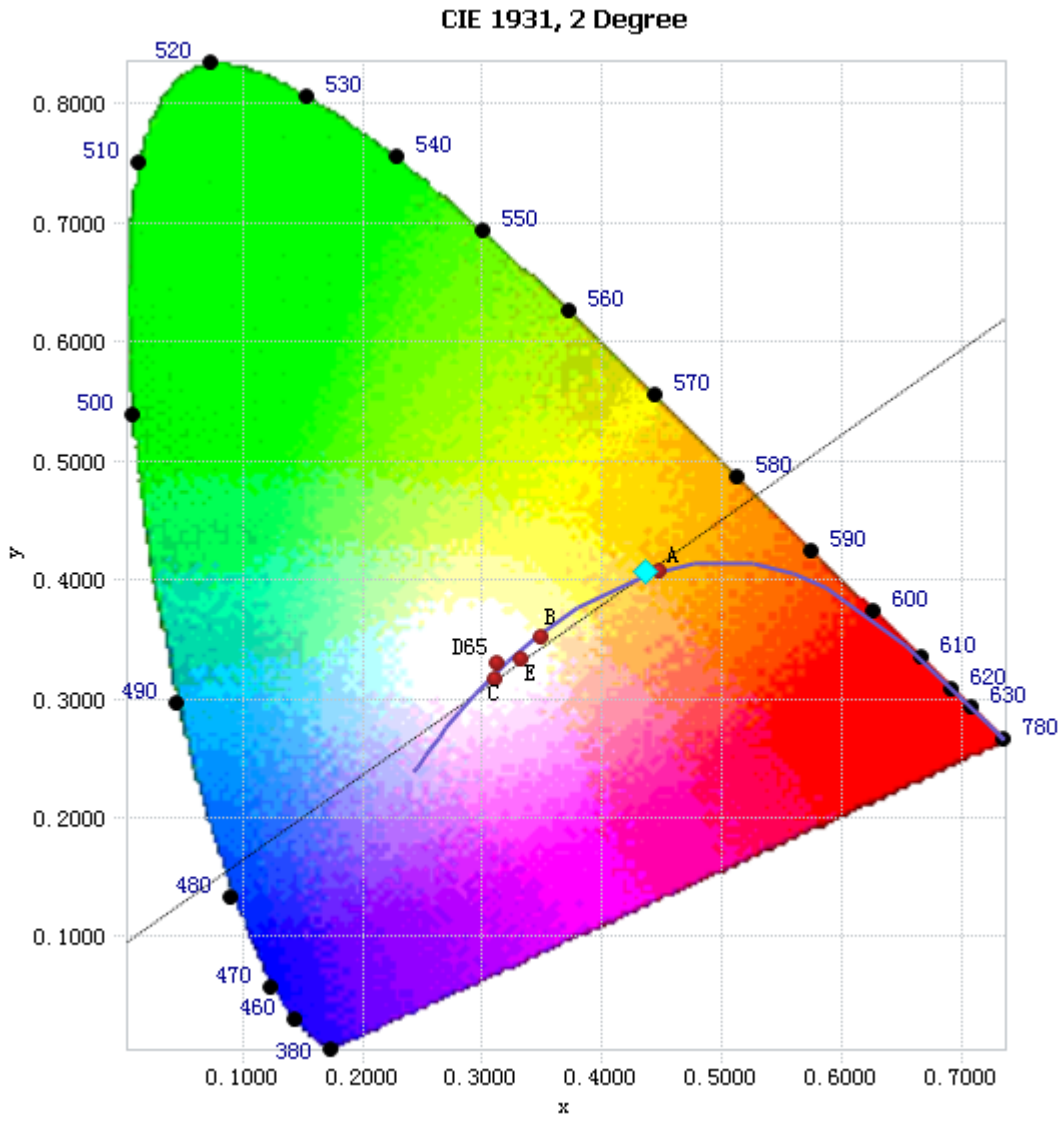


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.97E-04	485	5.08E-03	590	2.17E-02	695	8.87E-03
385	1.59E-04	490	5.57E-03	595	2.27E-02	700	7.76E-03
390	1.67E-04	495	6.44E-03	600	2.35E-02	705	6.65E-03
395	1.73E-04	500	7.81E-03	605	2.42E-02	710	5.54E-03
400	1.72E-04	505	9.39E-03	610	2.48E-02	715	4.65E-03
405	1.89E-04	510	1.10E-02	615	2.55E-02	720	4.30E-03
410	2.06E-04	515	1.25E-02	620	2.58E-02	725	3.94E-03
415	2.54E-04	520	1.37E-02	625	2.56E-02	730	3.45E-03
420	3.64E-04	525	1.47E-02	630	2.52E-02	735	2.98E-03
425	5.85E-04	530	1.55E-02	635	2.46E-02	740	2.56E-03
430	9.92E-04	535	1.61E-02	640	2.37E-02	745	2.20E-03
435	1.83E-03	540	1.65E-02	645	2.25E-02	750	1.88E-03
440	3.40E-03	545	1.67E-02	650	2.13E-02	755	1.60E-03
445	6.26E-03	550	1.69E-02	655	2.00E-02	760	1.37E-03
450	1.12E-02	555	1.70E-02	660	1.86E-02	765	1.19E-03
455	1.50E-02	560	1.73E-02	665	1.70E-02	770	1.04E-03
460	1.30E-02	565	1.76E-02	670	1.55E-02	775	8.93E-04
465	9.52E-03	570	1.82E-02	675	1.41E-02	780	7.83E-04
470	8.05E-03	575	1.88E-02	680	1.27E-02		
475	6.41E-03	580	1.98E-02	685	1.13E-02		
480	5.22E-03	585	2.08E-02	690	1.01E-02		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4362, 0.4066)

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

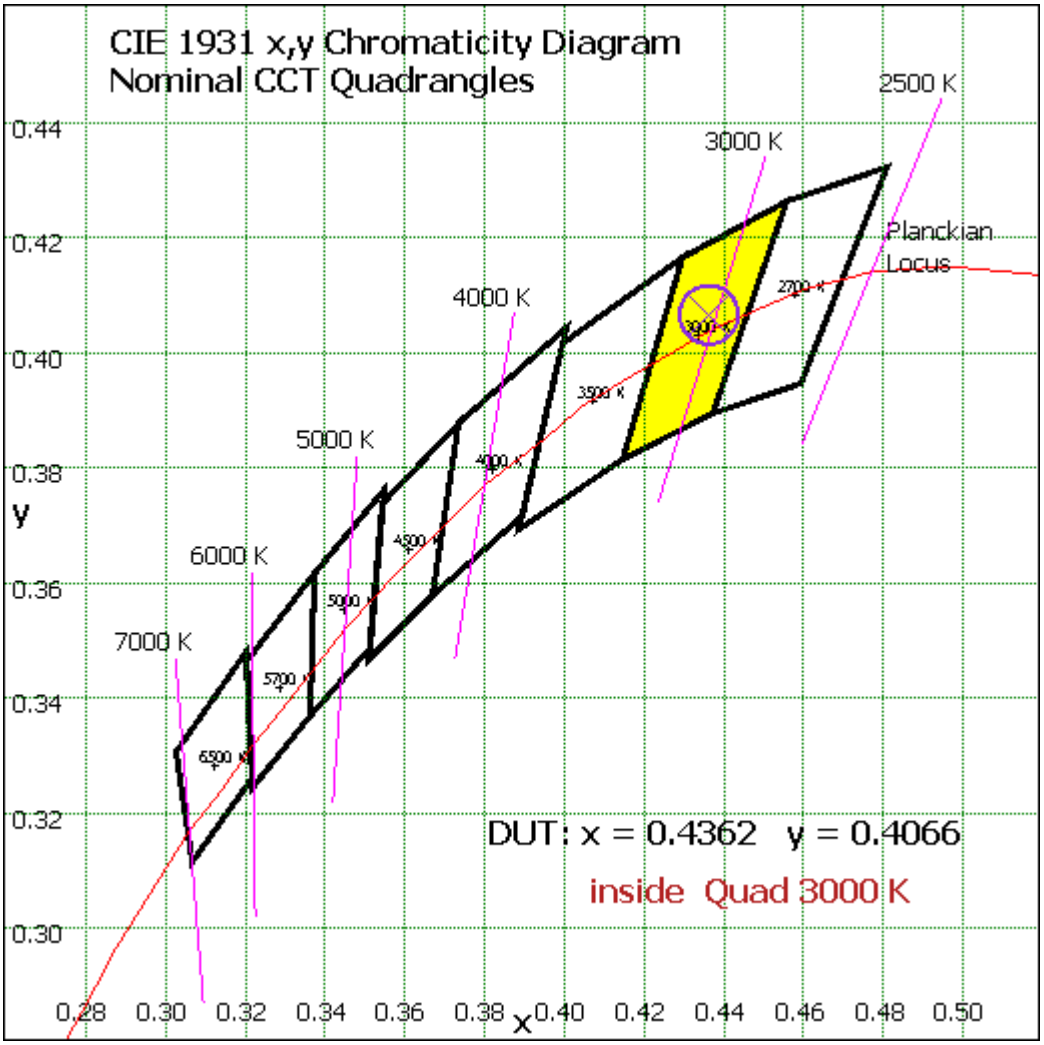


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

γ(°)	Lumens	% Total
0- 10	60.937	4.60%
10- 20	173.653	13.12%
20- 30	259.568	19.61%
30- 40	294.248	22.23%
40- 50	227.741	17.21%
50- 60	140.556	10.62%
60- 70	91.402	6.91%
70- 80	56.22	4.25%
80- 90	17.836	1.35%
90-100	0.033	0.00%
100-110	0.064	0.00%
110-120	0.112	0.01%
120-130	0.157	0.01%
130-140	0.216	0.02%
140-150	0.242	0.02%
150-160	0.211	0.02%
160-170	0.141	0.01%
170-180	0.049	0.00%
Total	1323.4	100%

γ(°)	Lumens	% Total
0- 60	1156.703	87.40%
60- 90	165.458	12.50%
0-90	1322.161	99.91%
90- 180	1.225	0.09%
0- 180	1323.4	100%

Table 5: Zonal Lumen Data

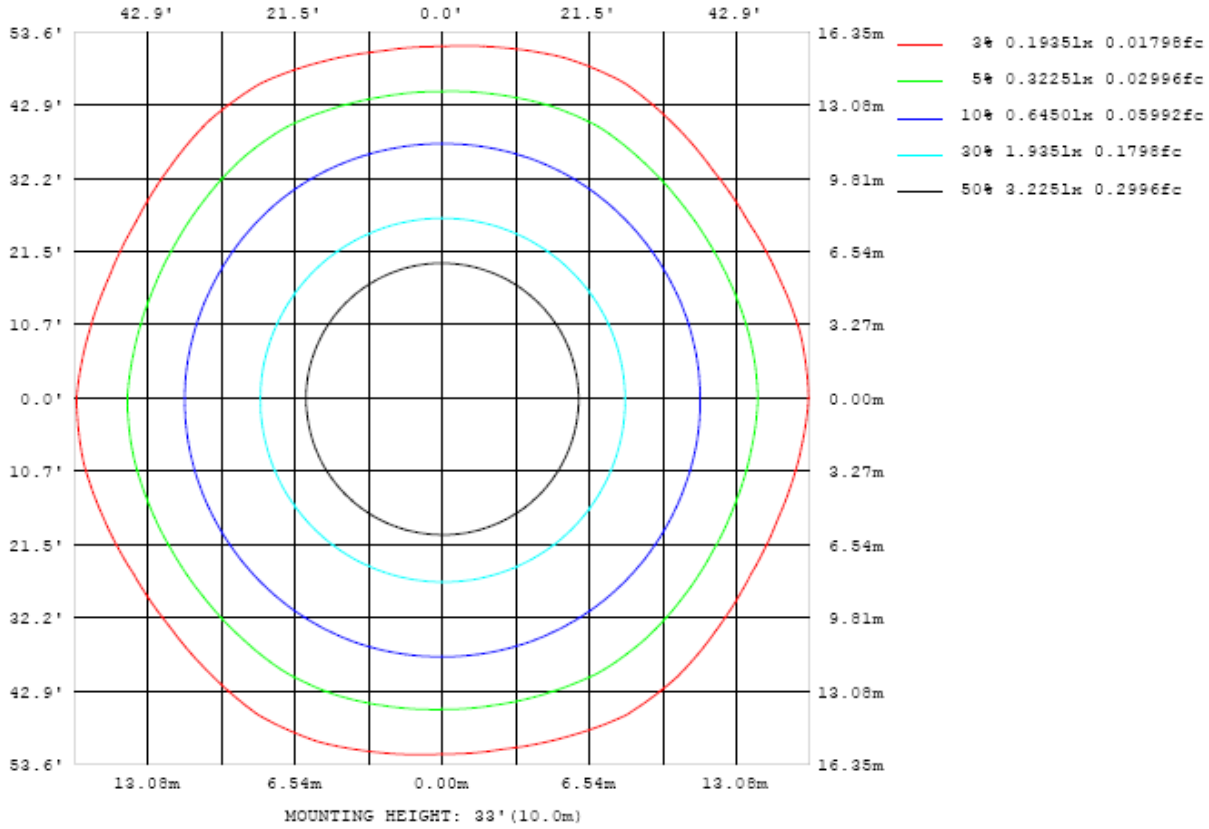


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

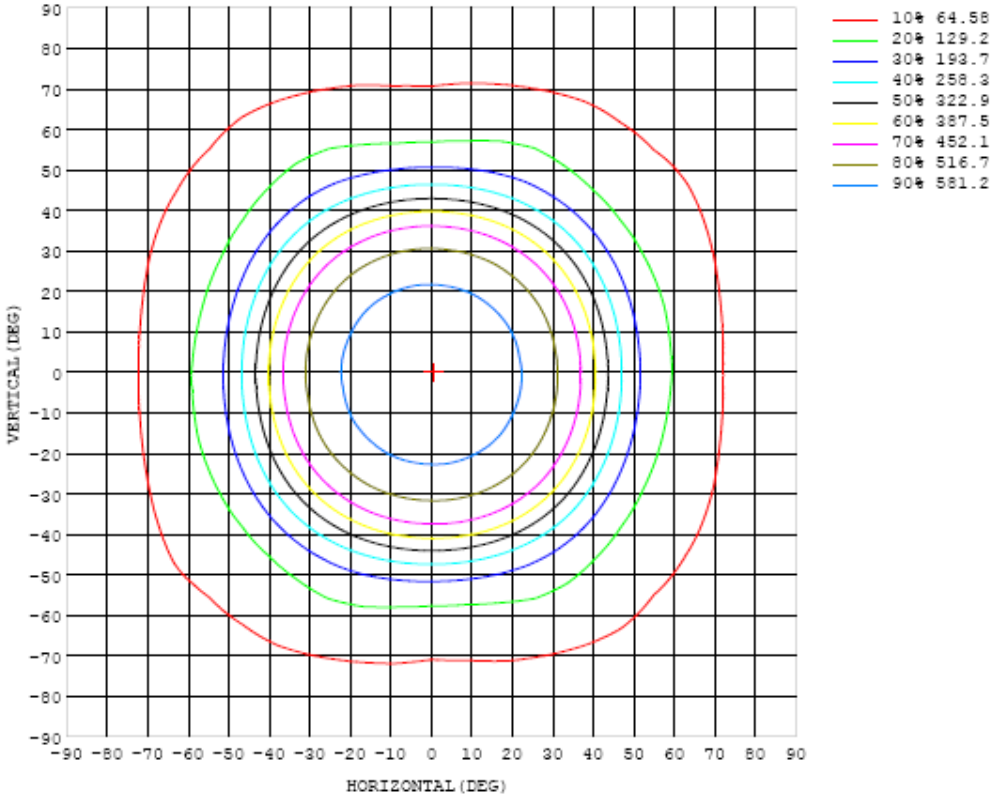


Chart 5: Isocandela Plot

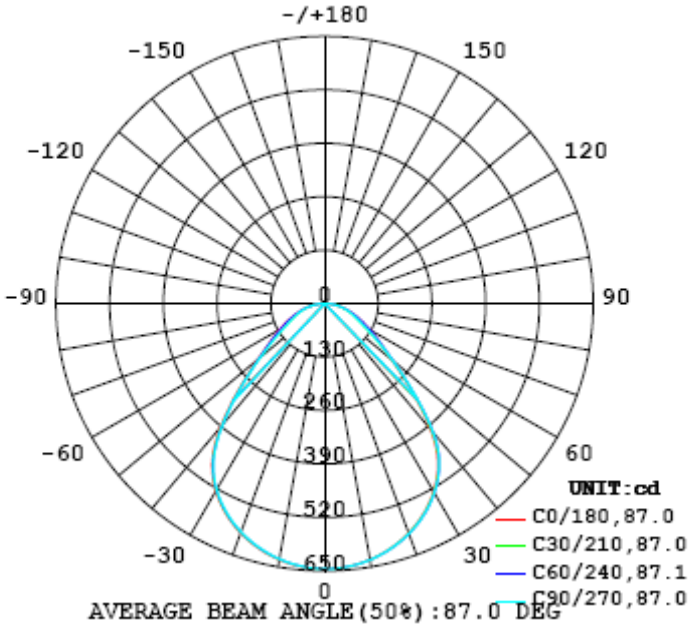


Chart 6: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1 UNIT: cd

γ (DEG) \ C (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	645	645	645	645	645	645	645	645	645	645	645	645	645	645	645	645	645	645	645
5	642	643	642	642	643	642	642	642	643	642	642	642	642	642	642	642	642	641	642
10	632	633	632	632	633	633	633	633	633	633	633	633	633	632	632	633	632	631	633
15	616	616	616	617	617	618	617	618	618	617	617	617	617	616	617	617	616	615	616
20	594	594	594	595	596	596	596	596	597	596	595	595	596	595	595	595	594	593	594
25	564	565	565	566	567	568	568	568	568	567	567	567	567	566	566	566	565	564	564
30	527	528	528	529	531	531	532	532	532	531	531	530	530	530	529	529	528	526	527
35	477	479	480	481	483	484	484	484	484	483	483	482	482	480	480	479	477	475	475
40	398	400	402	404	407	408	409	409	409	408	407	406	404	402	400	398	395	393	393
45	294	295	297	298	300	302	303	303	304	303	303	303	302	300	298	296	294	292	292
50	213	213	213	213	215	217	217	217	217	217	217	218	217	216	213	212	212	212	212
55	161	156	152	152	155	161	164	158	154	154	157	162	163	157	152	151	154	159	160
60	125	119	112	110	116	124	126	119	113	112	118	125	127	119	112	110	116	123	125
65	97.4	94.0	87.1	84.6	91.3	96.7	98.0	93.9	87.2	85.7	92.6	97.9	98.6	93.8	86.8	85.3	91.9	96.5	97.6
70	73.8	73.0	69.0	66.9	72.2	74.2	74.6	73.5	69.3	67.5	72.8	74.8	75.3	73.7	69.2	67.8	72.4	73.9	74.5
75	53.9	54.2	52.0	50.9	53.9	54.5	54.3	54.7	52.3	51.5	54.6	55.2	55.4	55.2	52.7	52.0	54.5	54.6	54.5
80	36.0	36.1	35.0	34.5	35.9	36.3	36.2	36.5	35.4	35.3	36.8	37.1	37.0	36.9	35.8	35.6	36.3	36.2	36.1
85	17.4	17.4	17.0	16.8	17.3	17.6	17.9	17.9	17.7	17.8	18.5	18.4	18.0	17.5	16.8	16.4	16.4	16.2	16.1
90	0.03	0.05	0.11	0.57	0.27	0.28	0.25	0.19	0.09	0.05	0.05	0.07	0.12	0.16	0.21	0.23	0.21	0.12	0.12
95	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.02	0.04
100	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.05
105	0.05	0.05	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.05	0.05	0.04	0.13
110	0.06	0.06	0.05	0.05	0.06	0.06	0.07	0.07	0.07	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.07	0.06	0.11
115	0.08	0.08	0.07	0.07	0.09	0.09	0.09	0.09	0.09	0.09	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.13
120	0.11	0.11	0.09	0.10	0.11	0.12	0.12	0.12	0.12	0.11	0.11	0.11	0.11	0.11	0.11	0.10	0.11	0.10	0.16
125	0.14	0.14	0.13	0.14	0.15	0.15	0.15	0.15	0.15	0.15	0.14	0.14	0.14	0.14	0.14	0.13	0.14	0.13	0.21
130	0.18	0.18	0.18	0.16	0.19	0.19	0.19	0.19	0.19	0.19	0.18	0.18	0.18	0.18	0.18	0.17	0.18	0.17	0.27
135	0.22	0.21	0.22	0.23	0.23	0.24	0.24	0.24	0.23	0.23	0.23	0.22	0.22	0.22	0.22	0.22	0.22	0.21	0.34
140	0.26	0.24	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.27	0.27	0.27	0.27	0.27	0.26	0.27	0.26	0.42
145	0.28	0.31	0.32	0.31	0.32	0.32	0.32	0.32	0.32	0.32	0.31	0.31	0.31	0.31	0.31	0.30	0.31	0.30	0.48
150	0.33	0.34	0.35	0.34	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.34	0.34	0.34	0.34	0.33	0.34	0.33	0.52
155	0.37	0.38	0.38	0.37	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.37	0.37	0.37	0.37	0.38	0.37	0.55
160	0.41	0.41	0.41	0.35	0.41	0.41	0.41	0.42	0.41	0.41	0.41	0.41	0.41	0.41	0.40	0.39	0.37	0.40	0.57
165	0.44	0.44	0.42	0.38	0.44	0.44	0.45	0.45	0.45	0.45	0.44	0.44	0.44	0.44	0.44	0.41	0.39	0.43	0.57
170	0.47	0.47	0.42	0.41	0.47	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.42	0.42	0.44	0.58
175	0.48	0.48	0.48	0.47	0.52	0.53	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.53	0.53	0.48	0.47	0.47	0.54
180	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.46	0.46	0.46	0.46	0.46	0.46	0.46

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	645	645	645	645	645	645	645	645	645	645	645	645	645	645	645	645	645		
5	642	642	641	642	641	641	641	641	641	641	641	641	641	641	641	641	641		
10	632	631	631	632	631	631	631	631	630	630	630	631	630	630	631	631	631		
15	616	615	615	615	615	614	614	614	614	613	614	614	614	614	615	615	615		
20	594	593	592	593	592	592	591	591	591	590	591	591	591	591	592	592	592		
25	564	563	563	563	563	562	561	561	561	560	560	561	561	561	563	563	563		
30	526	525	524	524	524	523	523	523	522	521	522	522	522	524	525	525	525		
35	475	473	472	472	471	470	469	469	468	468	469	470	470	472	474	475	476		
40	390	388	387	386	386	385	383	383	383	383	384	386	387	389	391	393	396		
45	290	288	287	286	286	285	284	283	283	283	284	285	286	287	289	291	293		
50	209	207	205	206	208	207	205	203	203	205	207	208	207	206	207	209	211		
55	153	149	147	151	156	158	152	147	146	149	155	158	153	148	148	152	158		
60	117	110	109	114	121	123	116	109	108	114	121	124	117	110	108	114	123		
65	93.1	86.2	84.7	90.5	95.0	95.7	91.9	85.6	84.2	90.3	95.3	96.4	92.5	85.8	83.9	90.9	96.4		
70	72.9	68.5	67.1	71.6	72.9	73.1	71.9	67.9	66.8	71.1	73.0	73.1	72.1	68.2	66.8	71.8	74.0		
75	54.2	51.7	51.1	53.4	53.7	53.6	53.3	51.3	50.4	52.7	53.2	53.3	53.4	51.3	50.8	53.4	54.0		
80	35.8	34.5	34.3	35.2	35.2	35.1	34.9	34.0	33.7	34.5	34.9	35.1	35.4	34.6	34.6	35.6	35.9		
85	15.9	15.3	15.0	15.1	14.8	14.7	14.6	14.3	14.4	15.0	15.4	15.8	16.2	16.3	16.5	17.1	17.3		
90	0.05	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03		
95	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03		
100	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.05	0.05	0.05	0.05	0.05		
105	0.07	0.07	0.07	0.07	0.07	0.07	0.06	0.07	0.07	0.07	0.08	0.08	0.08	0.07	0.06	0.06	0.07		
110	0.12	0.14	0.13	0.13	0.12	0.12	0.13	0.10	0.18	0.11	0.09	0.11	0.10	0.09	0.09	0.09	0.09		
115	0.14	0.15	0.15	0.18	0.18	0.18	0.18	0.13	0.12	0.14	0.14	0.13	0.13	0.12	0.11	0.11	0.11		
120	0.17	0.17	0.17	0.19	0.19	0.19	0.16	0.18	0.18	0.18	0.17	0.17	0.16	0.15	0.14	0.15	0.15		
125	0.21	0.22	0.21	0.22	0.22	0.20	0.22	0.22	0.20	0.19	0.21	0.21	0.20	0.19	0.18	0.19	0.19		
130	0.27	0.28	0.27	0.28	0.28	0.28	0.28	0.28	0.24	0.25	0.27	0.27	0.27	0.25	0.25	0.25	0.26		
135	0.34	0.35	0.34	0.34	0.34	0.35	0.35	0.32	0.32	0.34	0.34	0.34	0.34	0.32	0.33	0.33	0.34		
140	0.41	0.41	0.39	0.39	0.41	0.42	0.41	0.39	0.42	0.41	0.41	0.41	0.40	0.39	0.41	0.40	0.41		
145	0.48	0.48	0.48	0.49	0.49	0.47	0.46	0.48	0.48	0.48	0.48	0.47	0.46	0.45	0.46	0.45	0.45		
150	0.52	0.52	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.52	0.52	0.51	0.50	0.50	0.50	0.49	0.50		
155	0.55	0.55	0.56	0.56	0.56	0.56	0.55	0.53	0.55	0.54	0.54	0.54	0.53	0.54	0.52	0.51	0.54		
160	0.57	0.57	0.58	0.58	0.58	0.58	0.58	0.55	0.57	0.54	0.56	0.56	0.56	0.55	0.53	0.53	0.57		
165	0.58	0.58	0.58	0.59	0.58	0.59	0.57	0.57	0.58	0.54	0.58	0.57	0.55	0.54	0.53	0.54	0.58		
170	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.57	0.53	0.54	0.54	0.54	0.54	0.54	0.55	0.59		
175	0.55	0.54	0.54	0.54	0.54	0.53	0.53	0.54	0.54	0.53	0.53	0.54	0.53	0.53	0.54	0.57	0.55		
180	0.46	0.46	0.46	0.46	0.46	0.46	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47		

Table 7: Luminous Intensity Data

EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Jul. 27, 2016	Jul. 26, 2017
Digital Power Meter	PF2010A	HZTE028-01	Jul. 27, 2016	Jul. 26, 2017
AC Power Supply	PCR 500L	HZTE001-08	Jul. 27, 2016	Jul. 26, 2017
DC Power Supply	WY12010	HZTE004-03	Jul. 27, 2016	Jul. 26, 2017
Temperature Meter	TES1310	HZTE017-01	Jul. 27, 2016	Jul. 26, 2017
Standard source	D908	HZTE012-01	Jul. 27, 2016	Jul. 26, 2017
Integrate Sphere system	2M	HZTE015-01	Jul. 27, 2016	Jul. 26, 2017
Digital Power Meter	WT210	HZTE008-01	Jul. 27, 2016	Jul. 26, 2017
AC Power Supply	PCR 500L	HZTE001-07	Jul. 27, 2016	Jul. 26, 2017
DC Power Supply	6154	HZTE004-04	Jul. 27, 2016	Jul. 26, 2017
Temperature and humidity recorder	JR900	HZTE018-01	Jul. 27, 2016	Jul. 26, 2017
Standard source	SCL-1400	HZTE012-02	Jul. 27, 2016	Jul. 26, 2017

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 FA19 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 expended uncertainty is 1.06% 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 FA19 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 expended uncertainty is 1.94% with a coverage factor k=2.

Color Characteristics Measurements

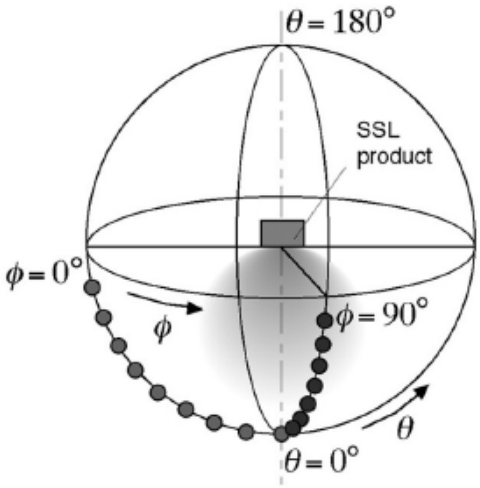
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as 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°/180° and C=90°/270°) 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, Δu'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 ***