



## LM-79-08 Test Report

for

### GREEN CREATIVE LTD

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

### Downlight

**Model: 10DL4DIM/930**

### Laboratory: Leading Testing Laboratories

**NVLAP CODE: 200960-0**

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Report No.: HZ17080054b

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

Review by:

Engineer: April Zou  
Sep. 01, 2017

Approved by:



Manager: Jim Zhang  
Sep. 01, 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: 10DL4DIM/930

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
91.2	886.5	9.72	0.9709
CCT (K)	CRI	Stabilization Time (Light & Power)	
2968	93.1	60	

Table 1: Executive Data Summary

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

### Test specifications:

<b>Date of Receipt</b>	: Aug. 29, 2017
<b>Date of Test</b>	: Aug. 30, 2017
<b>Test item</b>	: Total Luminous Flux, Luminous Distribution Intensity, Luminous Efficacy, Correlated Color Temperature, Color Rendering Index, Chromaticity Coordinate, Electrical parameters
<b>Reference Standard</b>	: IESNA LM-79-2008 Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products

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## Sample Photos



Figure 1- Overview of the sample

### Equipment Under Test (EUT)

<b>Name</b>	: Downlight
<b>Model</b>	: 10DL4DIM/930
<b>Electrical Ratings</b>	: 120V, 60Hz, 10W
<b>Product Description</b>	: 3000K
<b>Manufacturer</b>	: GREEN CREATIVE LTD
<b>Address</b>	: 756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

## TEST RESULTS

Test ambient temperature was 24.9°C.

Base orientation was light down. 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)	0.084
Power Factor	0.9709
Test Power (W)	9.72
THD A%	18.35
Luminous Efficacy (lm/W)	91.2
Total Luminous Flux (lm)	886.5
Color Rendering Index (CRI)	93.1
R9	59.4
Correlated Color Temperature (CCT)(K)	2968
Chromaticity Chroma x	0.4386
Chromaticity Chroma y	0.4037
Chromaticity Chroma u	0.2518
Chromaticity Chroma v	0.3477
Duv	0.0005
Chromaticity Chroma u'	0.2518
Chromaticity Chroma v'	0.5215

Special Color Rendering Indices	
R1	93.7
R2	98
R3	98.2
R4	92.6
R5	93.6
R6	96.9
R7	90.9
R8	81.2
R9	59.4
R10	94.4
R11	93.9
R12	82.9
R13	95.1
R14	99.9
Rf	90
Rg	98

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°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)	0.085
Power Factor	0.9693
Test Power (W)	9.87
Luminous Efficacy (lm/W)	91.3
Total Luminous Flux (lm)	901.2
Beam Angle (°)	93.9
Center Beam Candle Power (cd)	409
Spacing Criteria	1.18 (0°-180°)/ 1.18 (90°-270°)
Zonal Lumens in the 0°-60°Zone	87.22%
Zonal Lumens in the 60°-90°Zone	12.68%
Zonal Lumens in the 90°-120°Zone	0.01%
Zonal Lumens in the 120°-180°Zone	0.08%

Table 3: Test data per Goniophotometer Method

## Spectral Power Distribution - Sphere Spectroradiometer Method

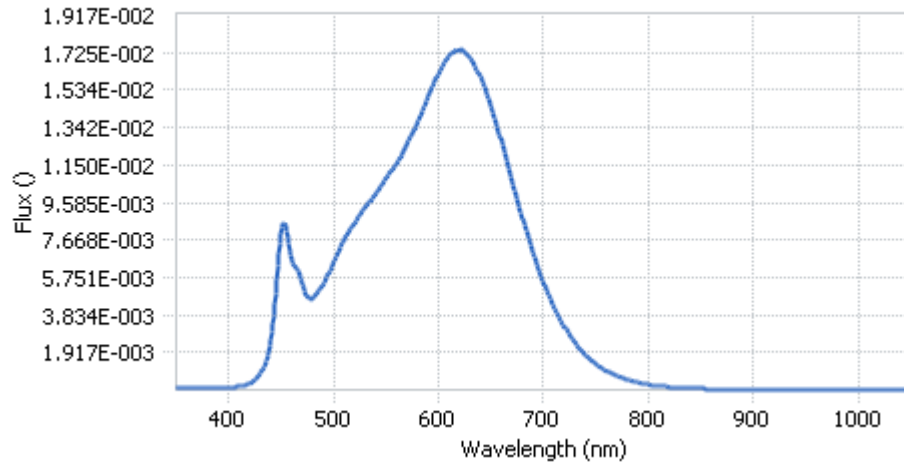


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.22E-04	485	5.00E-03	590	1.50E-02	695	6.23E-03
385	1.19E-04	490	5.39E-03	595	1.56E-02	700	5.49E-03
390	1.22E-04	495	5.94E-03	600	1.62E-02	705	4.82E-03
395	1.32E-04	500	6.56E-03	605	1.67E-02	710	4.22E-03
400	1.42E-04	505	7.13E-03	610	1.71E-02	715	3.69E-03
405	1.46E-04	510	7.64E-03	615	1.73E-02	720	3.22E-03
410	1.78E-04	515	8.17E-03	620	1.74E-02	725	2.80E-03
415	2.38E-04	520	8.55E-03	625	1.73E-02	730	2.43E-03
420	3.33E-04	525	8.95E-03	630	1.70E-02	735	2.08E-03
425	5.16E-04	530	9.30E-03	635	1.66E-02	740	1.79E-03
430	8.24E-04	535	9.69E-03	640	1.60E-02	745	1.54E-03
435	1.41E-03	540	1.01E-02	645	1.53E-02	750	1.33E-03
440	2.59E-03	545	1.04E-02	650	1.45E-02	755	1.14E-03
445	4.96E-03	550	1.08E-02	655	1.36E-02	760	9.78E-04
450	8.04E-03	555	1.12E-02	660	1.27E-02	765	8.43E-04
455	8.12E-03	560	1.16E-02	665	1.17E-02	770	7.19E-04
460	6.68E-03	565	1.20E-02	670	1.07E-02	775	6.14E-04
465	6.19E-03	570	1.26E-02	675	9.72E-03	780	5.26E-04
470	5.50E-03	575	1.31E-02	680	8.77E-03		
475	4.76E-03	580	1.37E-02	685	7.91E-03		
480	4.71E-03	585	1.44E-02	690	7.03E-03		

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

The diagram is a CIE 1931, 2 Degree color space diagram. The x-axis is labeled 'x' and ranges from 0.1000 to 0.7000. The y-axis is labeled 'y' and ranges from 0.1000 to 0.8000. The diagram shows the visible spectrum as a curved boundary, with wavelengths labeled in nanometers (nm) at various points: 380, 460, 470, 480, 490, 500, 510, 520, 530, 540, 550, 560, 570, 580, 590, 600, 610, 620, 630, and 780. The interior of the diagram is filled with a color gradient, representing the range of colors visible to the human eye. A straight line, representing the line of equal energy, extends from the bottom left towards the top right. A curved line, representing the locus of equal saturation, is also shown. Several points are marked on the diagram: D65 (a white point), and a series of points labeled A, B, C, D, E, and F, which are arranged along a curve from the bottom left towards the top right.

### 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

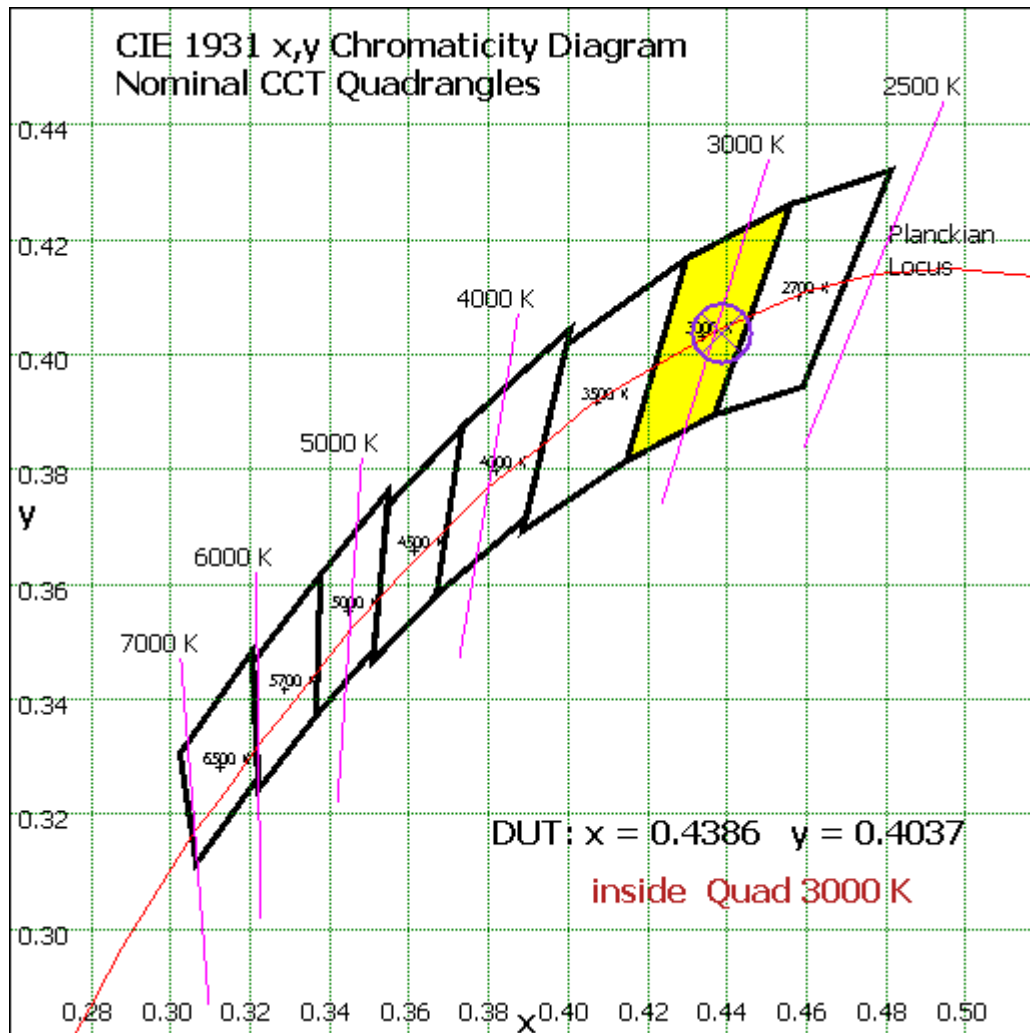


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

### Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	38.546	4.28%
10- 20	108.668	12.06%
20- 30	159.275	17.67%
30- 40	180.978	20.08%
40- 50	168.727	18.72%
50- 60	129.76	14.40%
60- 70	77.657	8.62%
70- 80	30.033	3.33%
80- 90	6.614	0.73%
90-100	0.016	0.00%
100-110	0.043	0.00%
110-120	0.076	0.01%
120-130	0.115	0.01%
130-140	0.162	0.02%
140-150	0.182	0.02%
150-160	0.158	0.02%
160-170	0.105	0.01%
170-180	0.037	0.00%
Total	901.2	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	785.954	87.22%
60- 90	114.304	12.68%
0-90	900.258	99.90%
90- 180	0.894	0.10%
0- 180	901.2	100%

Table 5: Zonal Lumen Data

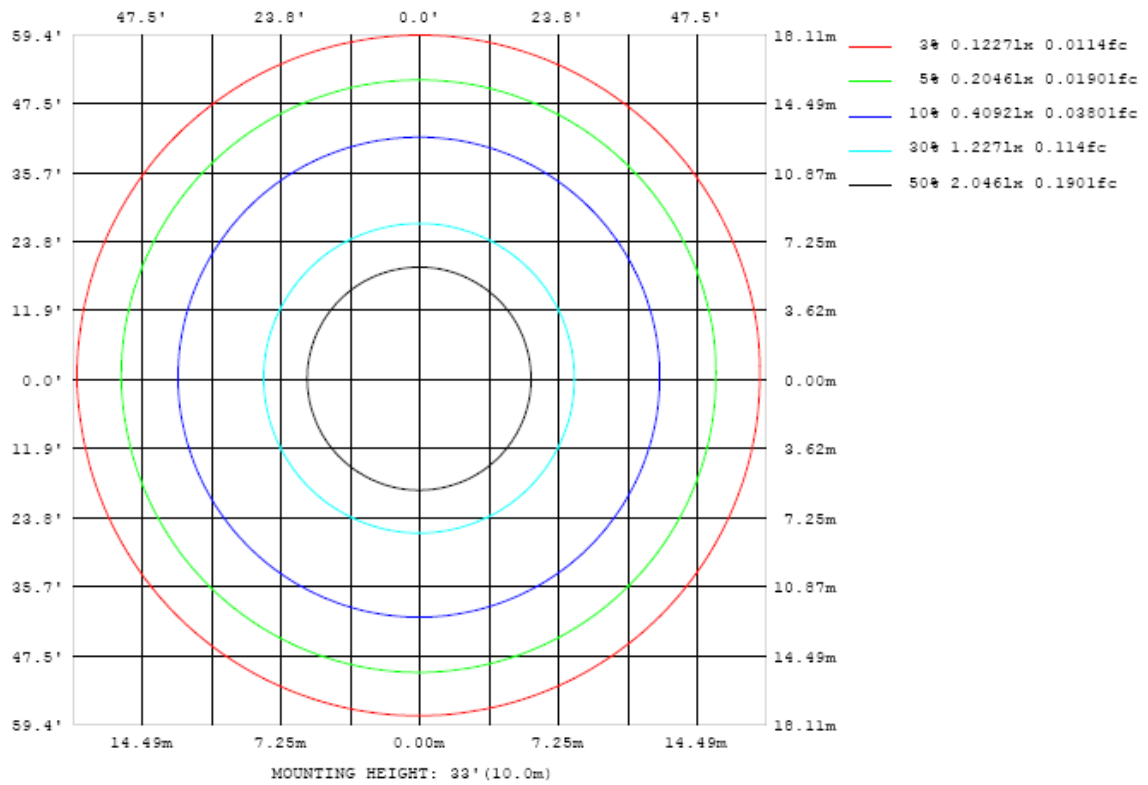


Chart 4: Illuminance Plot (Footcandles)

## Luminous Intensity Distribution Plots- Goniophotometer Method

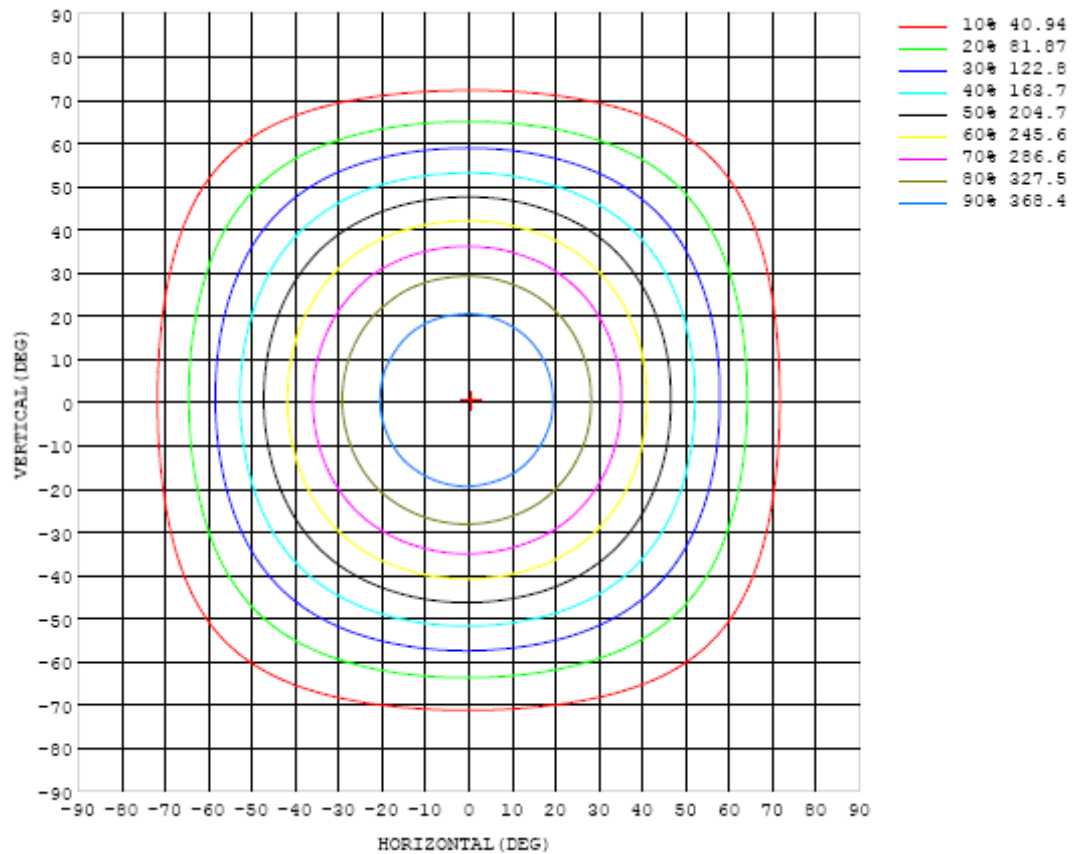


Chart 5: Isocandela Plot

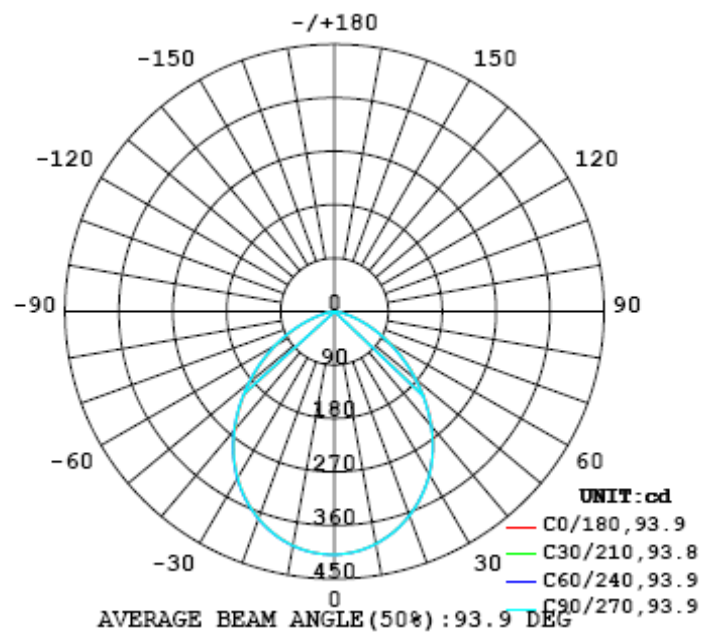


Chart 6: Polar Candela Distribution

## Luminous Intensity Data- Goniophotometer Method

Table--1

UNIT: cd

C (DEG) y (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	409	409	409	409	409	409	409	409	409	409	409	409	409	409	409	409	409	409	409
5	406	406	406	405	405	406	406	405	405	406	406	406	406	406	407	407	406	407	407
10	397	398	397	397	397	397	397	397	397	397	398	397	398	398	399	399	399	400	399
15	384	384	384	383	384	384	384	383	383	384	385	385	385	385	386	386	386	387	387
20	366	366	365	365	365	365	365	365	365	366	366	366	367	367	368	369	369	370	371
25	344	344	343	343	343	343	343	343	343	343	344	344	345	345	346	347	347	348	349
30	317	317	317	316	316	316	316	316	316	317	317	318	318	319	320	321	321	322	323
35	287	287	286	286	286	286	286	285	286	286	287	287	288	289	289	290	291	292	293
40	253	252	252	251	251	251	251	251	251	251	252	252	253	254	255	256	256	258	258
45	216	216	215	214	214	214	214	213	213	214	214	215	215	217	218	218	219	220	222
50	179	178	178	177	177	176	176	176	176	176	177	177	178	179	180	181	182	183	184
55	143	142	141	140	140	140	139	139	139	140	140	140	141	142	143	144	145	146	147
60	108	107	107	106	106	105	105	105	105	105	105	106	106	107	108	109	109	110	112
65	76.6	75.9	75.3	74.8	74.2	73.9	73.6	73.5	73.5	73.7	74.0	74.2	74.7	75.2	75.8	76.3	77.0	77.7	79.3
70	49.0	48.4	48.0	47.5	47.2	46.9	46.7	46.5	46.4	46.6	46.8	46.9	47.2	47.5	47.9	48.3	48.8	49.2	50.0
75	27.0	26.7	26.3	26.0	25.8	25.6	25.5	25.3	25.2	25.2	25.2	25.3	25.4	25.5	25.7	25.9	26.1	26.4	26.9
80	13.6	13.4	13.3	13.1	13.0	12.9	12.7	12.6	12.5	12.5	12.4	12.4	12.4	12.4	12.4	12.5	12.6	12.7	12.9
85	6.32	6.19	6.05	5.93	5.80	5.71	5.59	5.48	5.40	5.35	5.30	5.25	5.26	5.28	5.33	5.37	5.43	5.52	5.66
90	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
95	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02
100	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	0.02	0.02	0.02	0.03
105	0.03	0.03	0.03	0.03	0.04	0.03	0.03	0.04	0.04	0.04	0.03	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.05
110	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.06
115	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	0.08
120	0.09	0.09	0.09	0.09	0.10	0.10	0.10	0.10	0.10	0.10	0.09	0.10	0.10	0.09	0.09	0.09	0.09	0.09	0.10
125	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.13
130	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.18
135	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.23
140	0.22	0.22	0.22	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.29
145	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.33
150	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.37
155	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.39
160	0.31	0.31	0.31	0.31	0.31	0.32	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.40
165	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.33	0.33	0.33	0.41
170	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.40
175	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39
180	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40

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	409	409	409	409	409	409	409	409	409	409	409	409	409	409	409	409	409		
5	407	407	407	407	408	407	407	407	407	407	407	406	407	407	407	406	406		
10	400	400	400	400	400	400	400	400	400	400	399	399	399	399	398	398	398		
15	388	388	388	388	389	389	388	388	388	388	387	387	386	386	386	385	385		
20	371	371	371	371	372	372	371	371	371	370	370	369	369	368	368	367	367		
25	349	349	350	350	351	350	350	350	349	349	348	348	347	346	346	345	344		
30	324	324	324	324	325	325	324	324	324	323	323	322	321	321	320	319	318		
35	294	294	294	295	294	295	295	294	294	294	293	292	292	291	290	289	288		
40	259	260	260	261	262	261	261	261	261	260	259	258	258	257	256	255	254		
45	223	223	224	224	224	225	225	225	225	224	223	222	221	220	219	218	218		
50	185	186	186	187	187	187	188	187	187	187	186	185	184	183	182	181	180		
55	148	149	150	150	151	151	151	151	151	151	149	149	148	148	147	145	145		
60	113	114	114	115	115	116	116	116	115	115	115	114	113	112	112	111	110		
65	79.6	80.5	80.8	81.5	81.9	82.2	82.3	82.6	82.4	82.2	82.3	81.7	81.0	80.5	79.7	78.6	78.0		
70	50.5	51.0	51.4	51.9	52.2	52.4	52.7	52.8	52.8	52.9	52.6	52.3	52.0	51.5	51.1	50.4	49.8		
75	27.2	27.4	27.7	28.1	28.4	28.6	28.8	28.9	29.0	29.0	28.9	28.9	28.7	28.5	28.3	27.9	27.5		
80	13.0	13.1	13.5	13.7	13.8	14.0	14.1	14.2	14.3	14.4	14.6	14.6	14.3	14.3	14.2	14.1	13.9		
85	5.79	5.89	6.01	6.13	6.24	6.35	6.45	6.54	6.63	6.68	6.70	6.71	6.72	6.69	6.65	6.58	6.48		
90	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.02	0.02	0.02		
95	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	0.02	0.02		
100	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		
105	0.05	0.05	0.04	0.05	0.05	0.05	0.05	0.04	0.05	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05		
110	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.07		
115	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		
120	0.11	0.11	0.11	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.11	0.11	0.11	0.11		
125	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.14	0.14	0.14	0.14		
130	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18		
135	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.24	0.24		
140	0.29	0.29	0.29	0.29	0.29	0.28	0.28	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29		
145	0.34	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34		
150	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37		
155	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.40	0.39	0.39	0.40	0.40		
160	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41		
165	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41		
170	0.41	0.41	0.40	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41		
175	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40		
180	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40		

Table 7: Luminous Intensity Data

## EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Aug. 23, 2017	Aug. 22, 2018
Digital Power Meter	PF2010A	HZTE028-01	Aug. 10, 2017	Aug. 09, 2018
AC Power Supply	DPS1060	HZTE001-06	Aug. 10, 2017	Aug. 09, 2018
DC Power Supply	WY12010	HZTE004-03	Aug. 10, 2017	Aug. 09, 2018
Temperature Meter	TES1310	HZTE017-01	Aug. 17, 2017	Aug. 16, 2018
Standard source	D908	HZTE012-01	Aug. 15, 2017	Aug. 14, 2018
Integrate Sphere system	2M	HZTE015-01	Aug. 23, 2017	Aug. 22, 2018
Digital Power Meter	WT210	HZTE008-01	Aug. 10, 2017	Aug. 09, 2018
AC Power Supply	PCR 500L	HZTE001-07	Aug. 10, 2017	Aug. 09, 2018
DC Power Supply	IT6154	HZTE004-04	Aug. 10, 2017	Aug. 09, 2018
Temperature and humidity recorder	JR900	HZTE018-01	Aug. 16, 2017	Aug. 15, 2018
Standard source	SCL-1400	HZTE012-02	Aug. 15, 2017	Aug. 14, 2018

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  $4\pi$ . 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 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 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 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  $10^\circ$  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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