LM-79-08 Test Report

for

GREEN CREATIVE LTD

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

Downlight

Model: 10DL4DIM/927

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ17080054a

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

Review by: April Zou

Engineer: April Zou
Sep. 01, 2017

Approved by: Zhang

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/927**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
88.5	858.0	9.69	0.9698

CCT (K)	CRI	Stabilization Time (Light & Power)
2728	93.0	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	: Aug. 29, 2017
Date of Test	: Aug. 30, 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

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Sample Photos

Figure 1- Overview of the sample

Equipment Under Test (EUT)	
Name	: Downlight
Model	: 10DL4DIM/927
Electrical Ratings	: 120V, 60Hz, 10W
Product Description	: 2700K
Manufacturer	: GREEN CREATIVE LTD
Address	: 756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

TEST RESULTS

Test ambient temperature was 25.0℃.

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)	0.083
Power Factor	0.9698
Test Power (W)	9.69
THD A%	18.56
Luminous Efficacy (lm/W)	88.5
Total Luminous Flux (lm)	858.0
Color Rendering Index (CRI)	93
R9	57.6
Correlated Color Temperature (CCT)(K)	2728
Chromaticity Chroma x	0.4572
Chromaticity Chroma y	0.4096
Chromaticity Chroma u	0.2612
Chromaticity Chroma v	0.3511
Duv	0.0004
Chromaticity Chroma u ’	0.2612
Chromaticity Chroma v’	0.5266

Special Color Rendering Indices	
R1	93.5
R2	97.8
R3	98.3
R4	93.1
R5	93.7
R6	97.4
R7	90.5
R8	80
R9	57.6
R10	94.3
R11	94.8
R12	86.8
R13	94.8
R14	99.8
Rf	91
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℃.

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	0.9697
Test Power (W)	9.86
Luminous Efficacy (lm/W)	88.3
Total Luminous Flux (lm)	870.3
Beam Angle (°)	94.4
Center Beam Candle Power (cd)	392
Spacing Criteria	1.17 (0°-180°)/ 1.17 (90°-270°)
Zonal Lumens in the 0°-60°Zone	87.08%
Zonal Lumens in the 60°-90°Zone	12.82%
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

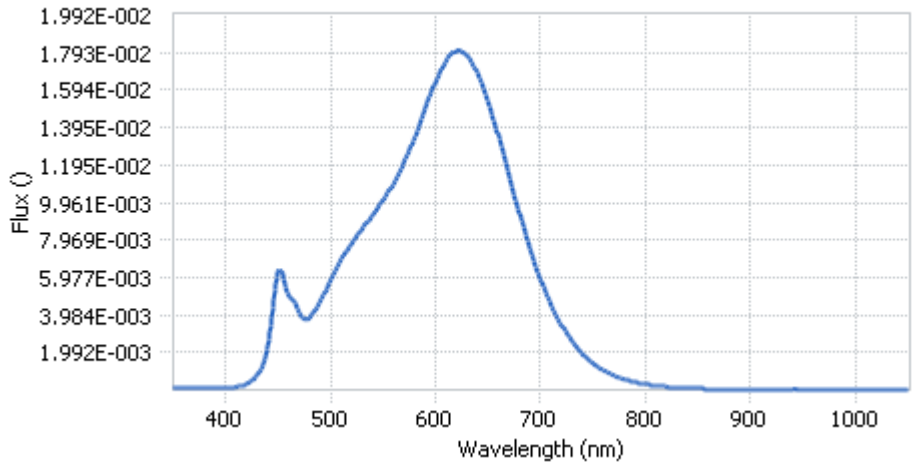
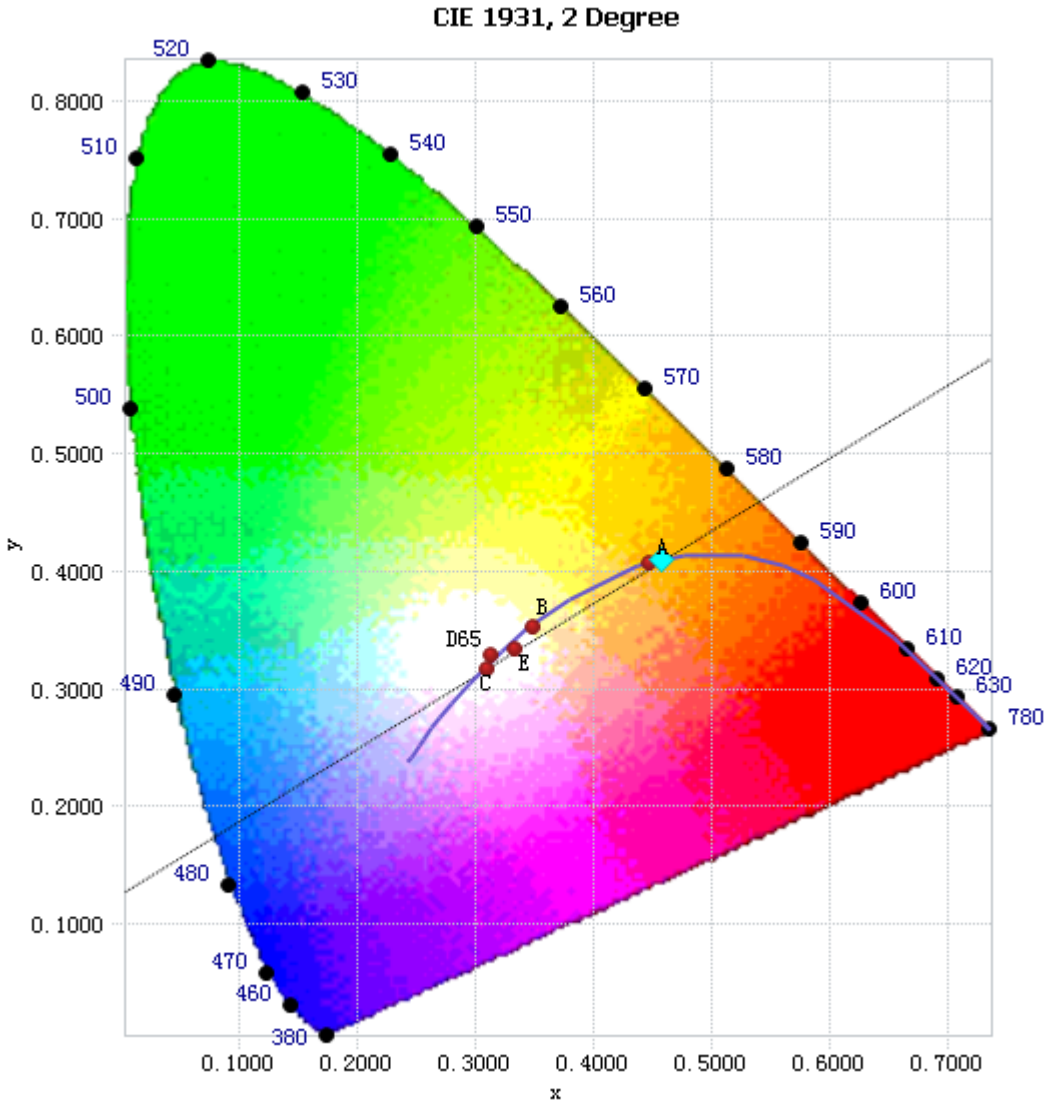


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.20E-04	485	4.22E-03	590	1.49E-02	695	6.66E-03
385	1.11E-04	490	4.67E-03	595	1.57E-02	700	5.88E-03
390	1.18E-04	495	5.24E-03	600	1.64E-02	705	5.17E-03
395	1.11E-04	500	5.85E-03	605	1.70E-02	710	4.52E-03
400	1.25E-04	505	6.42E-03	610	1.75E-02	715	3.96E-03
405	1.40E-04	510	6.92E-03	615	1.79E-02	720	3.46E-03
410	1.57E-04	515	7.40E-03	620	1.80E-02	725	3.01E-03
415	2.18E-04	520	7.82E-03	625	1.80E-02	730	2.59E-03
420	3.16E-04	525	8.18E-03	630	1.78E-02	735	2.23E-03
425	4.97E-04	530	8.55E-03	635	1.74E-02	740	1.92E-03
430	7.78E-04	535	8.94E-03	640	1.69E-02	745	1.65E-03
435	1.31E-03	540	9.32E-03	645	1.61E-02	750	1.43E-03
440	2.37E-03	545	9.68E-03	650	1.54E-02	755	1.22E-03
445	4.35E-03	550	1.01E-02	655	1.44E-02	760	1.05E-03
450	6.26E-03	555	1.05E-02	660	1.35E-02	765	9.08E-04
455	5.89E-03	560	1.10E-02	665	1.25E-02	770	7.70E-04
460	5.03E-03	565	1.15E-02	670	1.14E-02	775	6.56E-04
465	4.69E-03	570	1.21E-02	675	1.04E-02	780	5.64E-04
470	4.11E-03	575	1.27E-02	680	9.39E-03		
475	3.76E-03	580	1.34E-02	685	8.44E-03		
480	3.89E-03	585	1.42E-02	690	7.50E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4572, 0.4096)

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

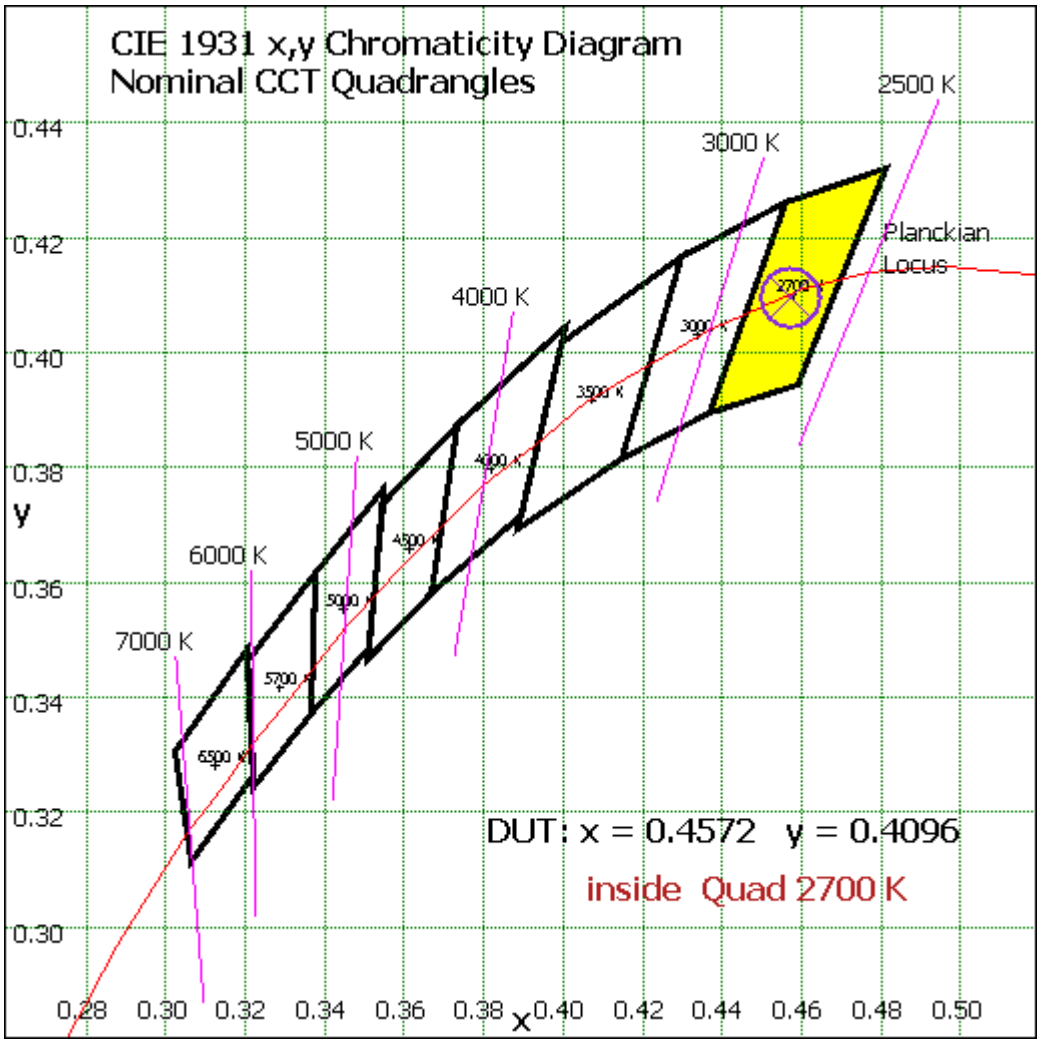


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

γ(°)	Lumens	% Total
0- 10	36.983	4.25%
10- 20	104.348	11.99%
20- 30	153.12	17.59%
30- 40	174.285	20.03%
40- 50	163.06	18.74%
50- 60	126.005	14.48%
60- 70	75.745	8.70%
70- 80	29.379	3.38%
80- 90	6.465	0.74%
90-100	0.016	0.00%
100-110	0.042	0.00%
110-120	0.075	0.01%
120-130	0.111	0.01%
130-140	0.156	0.02%
140-150	0.176	0.02%
150-160	0.153	0.02%
160-170	0.102	0.01%
170-180	0.036	0.00%
Total	870.3	100%

γ(°)	Lumens	% Total
0- 60	757.801	87.08%
60- 90	111.589	12.82%
0-90	869.39	99.90%
90- 180	0.867	0.10%
0- 180	870.3	100%

Table 5: Zonal Lumen Data

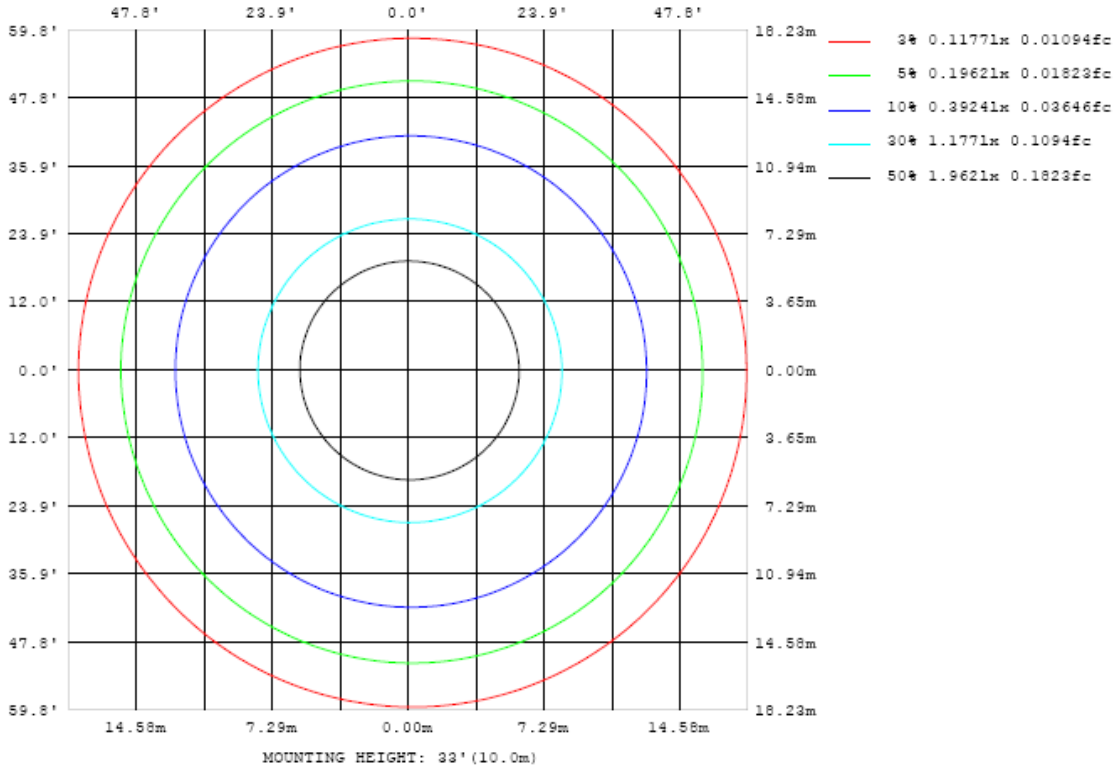


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

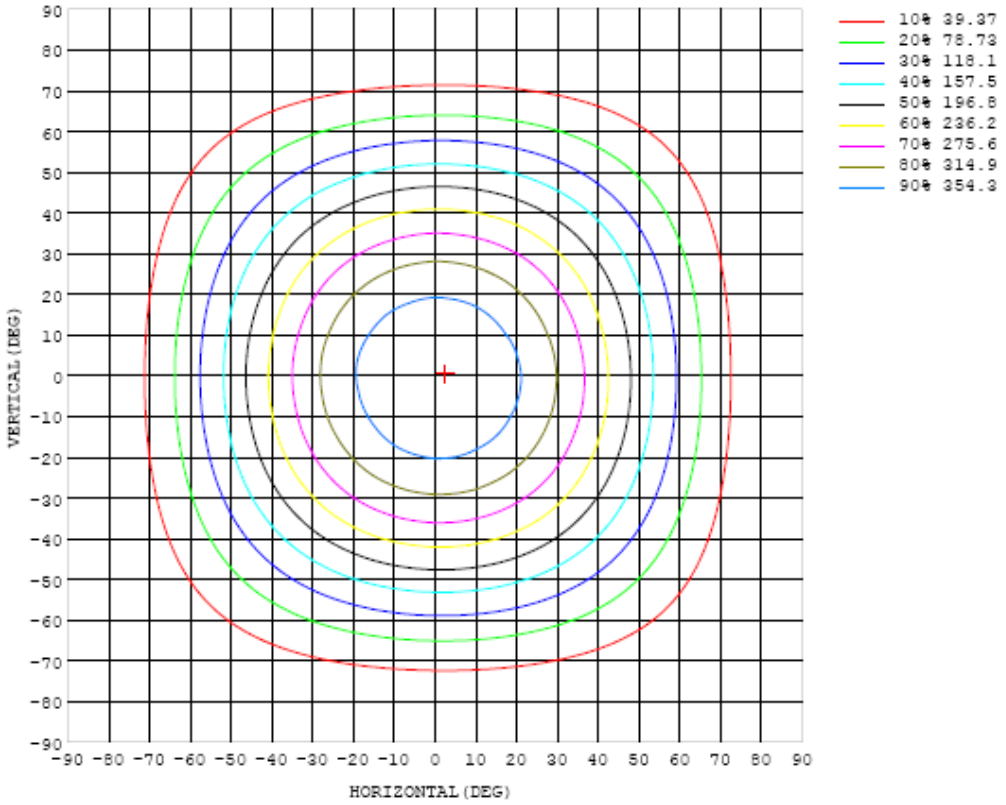


Chart 5: Isocandela Plot

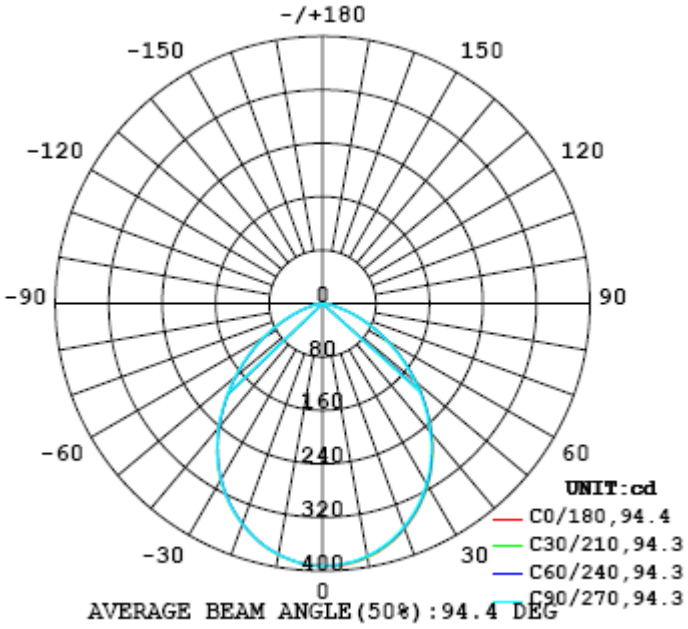


Chart 6: Polar Candela Distribution

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	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392
5	392	391	391	391	391	391	390	390	390	390	389	389	389	389	389	388	389	389	389
10	386	386	386	385	385	384	383	384	384	383	382	382	382	382	381	381	381	381	382
15	375	374	374	374	374	373	373	373	372	372	371	370	370	369	369	368	368	368	369
20	358	358	358	358	358	357	357	356	356	355	354	354	353	352	352	351	351	351	352
25	338	339	338	338	338	337	336	336	336	335	334	333	332	332	331	330	330	330	331
30	314	314	314	314	314	313	312	312	311	310	309	309	308	307	306	305	305	305	305
35	286	286	286	286	286	285	285	284	283	282	281	280	279	278	277	276	276	275	276
40	254	254	254	254	254	253	253	252	251	250	249	247	246	245	244	243	243	242	242
45	219	219	219	219	219	219	218	217	216	215	214	213	212	211	209	208	207	207	207
50	183	183	184	184	184	183	182	182	181	180	178	177	176	175	173	172	172	171	171
55	147	148	148	148	148	148	147	147	146	145	143	142	141	140	138	137	137	136	136
60	113	113	113	114	114	113	113	112	112	111	110	109	107	106	105	104	103	102	103
65	80.7	81.2	81.4	81.5	81.6	81.5	81.0	80.5	79.9	79.2	78.2	77.3	76.3	75.3	74.2	73.3	72.6	71.9	71.8
70	52.2	52.5	52.8	52.9	52.9	52.7	52.5	52.2	51.7	51.2	50.5	49.7	48.9	48.1	47.3	46.5	45.9	45.3	45.0
75	28.7	28.9	29.0	29.1	29.1	29.0	28.8	28.6	28.4	28.0	27.6	27.1	26.6	26.1	25.6	25.1	24.7	24.4	24.2
80	14.1	14.2	14.2	14.2	14.2	14.1	14.0	13.9	13.8	13.6	13.4	13.2	13.0	12.8	12.5	12.3	12.2	12.1	11.9
85	6.62	6.72	6.77	6.74	6.76	6.73	6.67	6.56	6.50	6.39	6.22	6.06	5.91	5.74	5.57	5.43	5.29	5.18	5.11
90	0.03	0.03	0.04	0.05	0.04	0.05	0.05	0.03	0.03	0.02	0.02	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	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.05
110	0.05	0.05	0.05	0.05	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.07
115	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.07	0.06	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	0.09	0.08	0.08	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.11
125	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.13
130	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.18
135	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	0.19	0.19	0.19	0.23
140	0.22	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.22	0.22	0.22	0.22	0.22	0.22	0.23	0.28
145	0.25	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.25	0.33
150	0.27	0.25	0.25	0.26	0.26	0.25	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.28	0.37
155	0.30	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.30	0.39
160	0.33	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.32	0.40
165	0.35	0.32	0.32	0.32	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.32	0.35	0.40
170	0.38	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.35	0.34	0.34	0.35	0.35	0.34	0.37	0.39
175	0.38	0.38	0.37	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38
180	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38

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	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392		
5	390	391	390	390	390	389	389	389	389	389	389	390	389	390	390	391	392		
10	382	382	382	381	381	381	381	381	381	381	382	382	382	382	383	384	385		
15	370	369	368	368	368	368	368	368	369	368	369	370	370	370	371	372	373		
20	352	351	351	351	350	350	350	350	352	352	352	353	353	354	354	356	357		
25	331	330	329	329	329	329	329	330	330	330	331	332	333	333	334	336	337		
30	305	304	304	304	304	303	304	304	305	305	306	307	308	309	310	311	312		
35	275	274	274	274	274	274	274	275	276	276	277	278	280	281	281	283	284		
40	241	241	241	240	241	241	241	242	243	243	245	245	247	248	249	251	252		
45	206	206	205	205	205	205	206	206	207	208	209	211	212	213	215	216	218		
50	170	170	169	169	169	169	170	171	172	173	174	175	176	177	178	180	181		
55	136	135	135	135	135	135	135	136	137	138	139	140	141	143	144	145	147		
60	102	102	101	101	101	102	102	103	104	105	105	107	108	109	110	111	112		
65	71.4	71.0	70.9	70.7	70.8	70.8	71.6	72.2	72.8	73.5	74.7	75.7	76.5	77.5	78.6	79.4	80.3		
70	44.5	44.4	44.2	44.2	44.4	44.6	45.1	45.5	46.1	46.7	47.4	48.0	48.9	49.5	50.4	51.0	51.5		
75	24.0	23.8	23.9	23.7	23.9	24.0	24.3	24.6	25.0	25.3	25.8	26.3	26.7	27.2	27.7	28.0	28.4		
80	11.8	11.8	11.7	11.8	11.8	11.9	12.0	12.1	12.3	12.4	12.6	12.8	13.2	13.3	13.7	13.8	14.1		
85	5.07	5.01	5.01	5.00	5.03	5.07	5.14	5.22	5.34	5.48	5.62	5.79	5.94	6.10	6.27	6.42	6.54		
90	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.01	0.03		
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	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.04	0.04	0.04	0.05		
110	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.06	0.06	0.06	0.06	0.06	0.06	0.06		
115	0.08	0.08	0.09	0.09	0.08	0.08	0.09	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	0.11	0.11	0.11	0.11	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10		
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	0.13	0.13	0.13	0.13		
130	0.18	0.18	0.18	0.18	0.18	0.17	0.18	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17		
135	0.23	0.23	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	0.23		
140	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.27	0.28	0.28	0.28		
145	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.33		
150	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		
155	0.38	0.38	0.38	0.39	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.39		
160	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.40	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.40		
165	0.39	0.39	0.39	0.40	0.39	0.40	0.40	0.40	0.40	0.39	0.40	0.40	0.40	0.40	0.39	0.40	0.40		
170	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	0.40		
175	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38		
180	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38		

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 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 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 expended uncertainty is 2.3% with a coverage factor k=2.

Color Characteristics Measurements

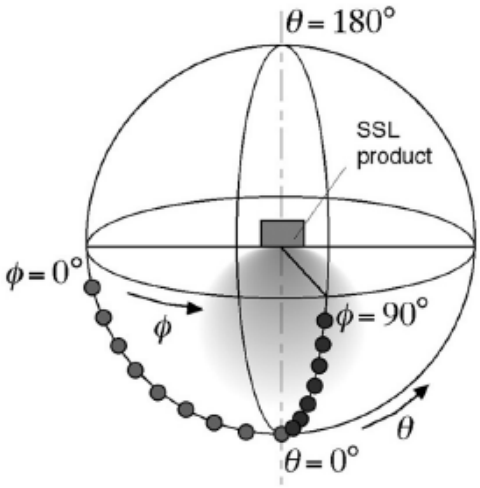
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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