LM-79-08 Test Report

for

GREEN CREATIVE LTD

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

9" ROUND DOWNLIGHT

Model: 20SMPR9DIM/940

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ17050071e

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

Review by: April Zou

Engineer: April Zou
Jun. 07, 2017

Approved by:

Manager: Jim Zhang
Jun. 07, 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: **20SMPR9DIM/940**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
77.4	1520.0	19.64	0.9394

CCT (K)	CRI	Stabilization Time (Light & Power)
3884	91.6	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	: May 31, 2017
Date of Test	: Jun. 01, 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	: 9” ROUND DOWNLIGHT
Model	: 20SMPR9DIM/940
Electrical Ratings	: 120V, 60Hz, 20W
Product Description	: LED Adapter (E26 & GU24 optional) base, 4000K, CRI90
Manufacturer	: GREEN CREATIVE LTD
Address	: 756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

TEST RESULTS

Test ambient temperature was 24.8℃.

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)	0.174
Power Factor	0.9394
Test Power (W)	19.64
THD A%	33.62
Luminous Efficacy (lm/W)	77.4
Total Luminous Flux (lm)	1520.0
Color Rendering Index (CRI)	91.6
R9	62
Correlated Color Temperature (CCT)(K)	3884
Chromaticity Chroma x	0.3873
Chromaticity Chroma y	0.3859
Chromaticity Chroma u	0.2260
Chromaticity Chroma v	0.3377
Duv	0.0021
Chromaticity Chroma u ’	0.2260
Chromaticity Chroma v’	0.5066

Special Color Rendering Indices	
R1	92.6
R2	93.7
R3	92.3
R4	92.5
R5	90.3
R6	89.9
R7	95.4
R8	86
R9	62
R10	82.3
R11	91.6
R12	62.5
R13	93.1
R14	94.9

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℃.

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)	0.175
Power Factor	0.9408
Test Power (W)	19.75
Luminous Efficacy (lm/W)	78.2
Total Luminous Flux (lm)	1544.1
Beam Angle (°)	86.4
Center Beam Candle Power (cd)	764
Spacing Criteria	1.22 (0°-180°)/ 1.21 (90°-270°)
Zonal Lumens in the 0°-60°Zone	87.64%
Zonal Lumens in the 60°-90°Zone	12.25%
Zonal Lumens in the 90°-120°Zone	0.02%
Zonal Lumens in the 120°-180°Zone	0.09%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

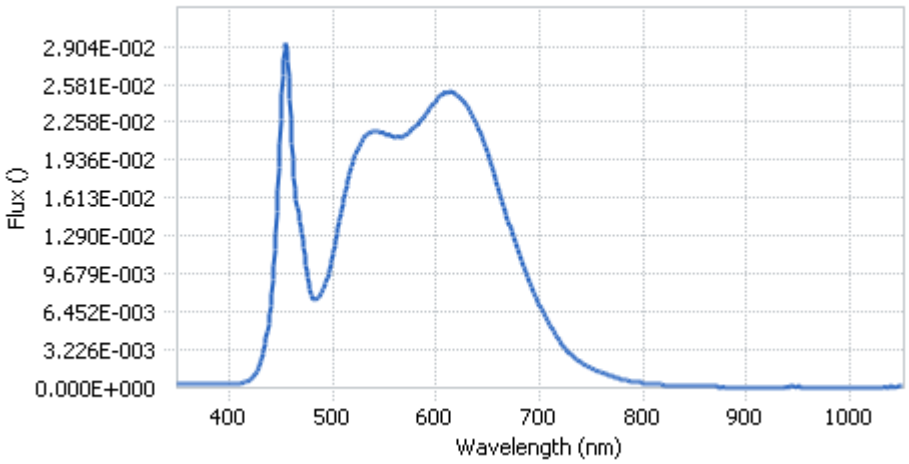
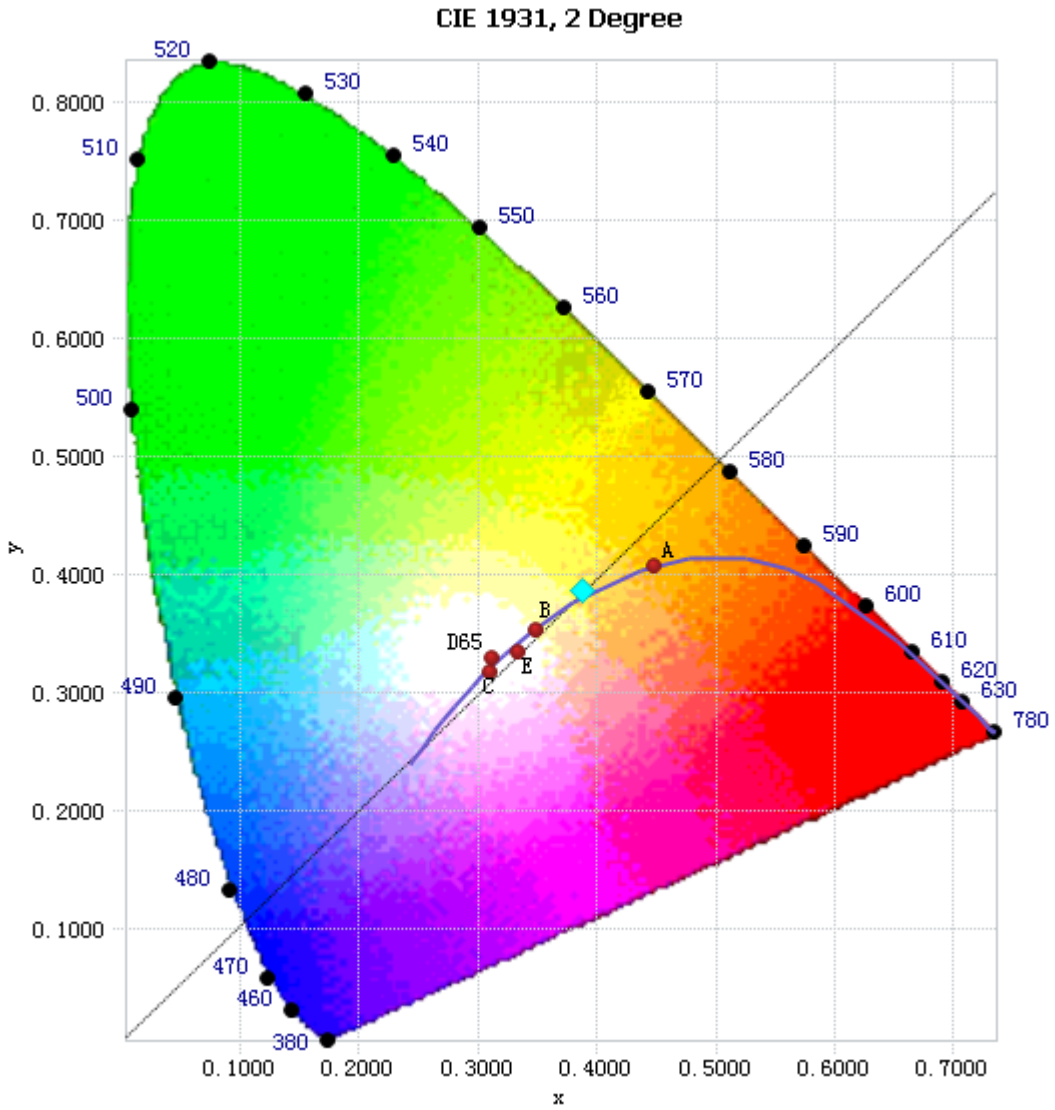


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.68E-04	485	7.57E-03	590	2.33E-02	695	8.01E-03
385	2.34E-04	490	8.18E-03	595	2.39E-02	700	7.01E-03
390	2.47E-04	495	9.38E-03	600	2.43E-02	705	6.11E-03
395	2.64E-04	500	1.13E-02	605	2.49E-02	710	5.31E-03
400	2.85E-04	505	1.35E-02	610	2.51E-02	715	4.56E-03
405	3.02E-04	510	1.57E-02	615	2.50E-02	720	3.90E-03
410	3.53E-04	515	1.77E-02	620	2.49E-02	725	3.29E-03
415	4.43E-04	520	1.93E-02	625	2.45E-02	730	2.83E-03
420	6.38E-04	525	2.04E-02	630	2.40E-02	735	2.43E-03
425	1.08E-03	530	2.13E-02	635	2.32E-02	740	2.12E-03
430	1.96E-03	535	2.16E-02	640	2.23E-02	745	1.87E-03
435	3.68E-03	540	2.18E-02	645	2.11E-02	750	1.64E-03
440	6.96E-03	545	2.18E-02	650	1.99E-02	755	1.44E-03
445	1.32E-02	550	2.17E-02	655	1.85E-02	760	1.25E-03
450	2.29E-02	555	2.15E-02	660	1.70E-02	765	1.08E-03
455	2.93E-02	560	2.13E-02	665	1.56E-02	770	9.22E-04
460	2.28E-02	565	2.14E-02	670	1.41E-02	775	7.94E-04
465	1.61E-02	570	2.15E-02	675	1.27E-02	780	6.82E-04
470	1.31E-02	575	2.18E-02	680	1.14E-02		
475	9.87E-03	580	2.22E-02	685	1.02E-02		
480	7.76E-03	585	2.27E-02	690	9.04E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3873, 0.3859)

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

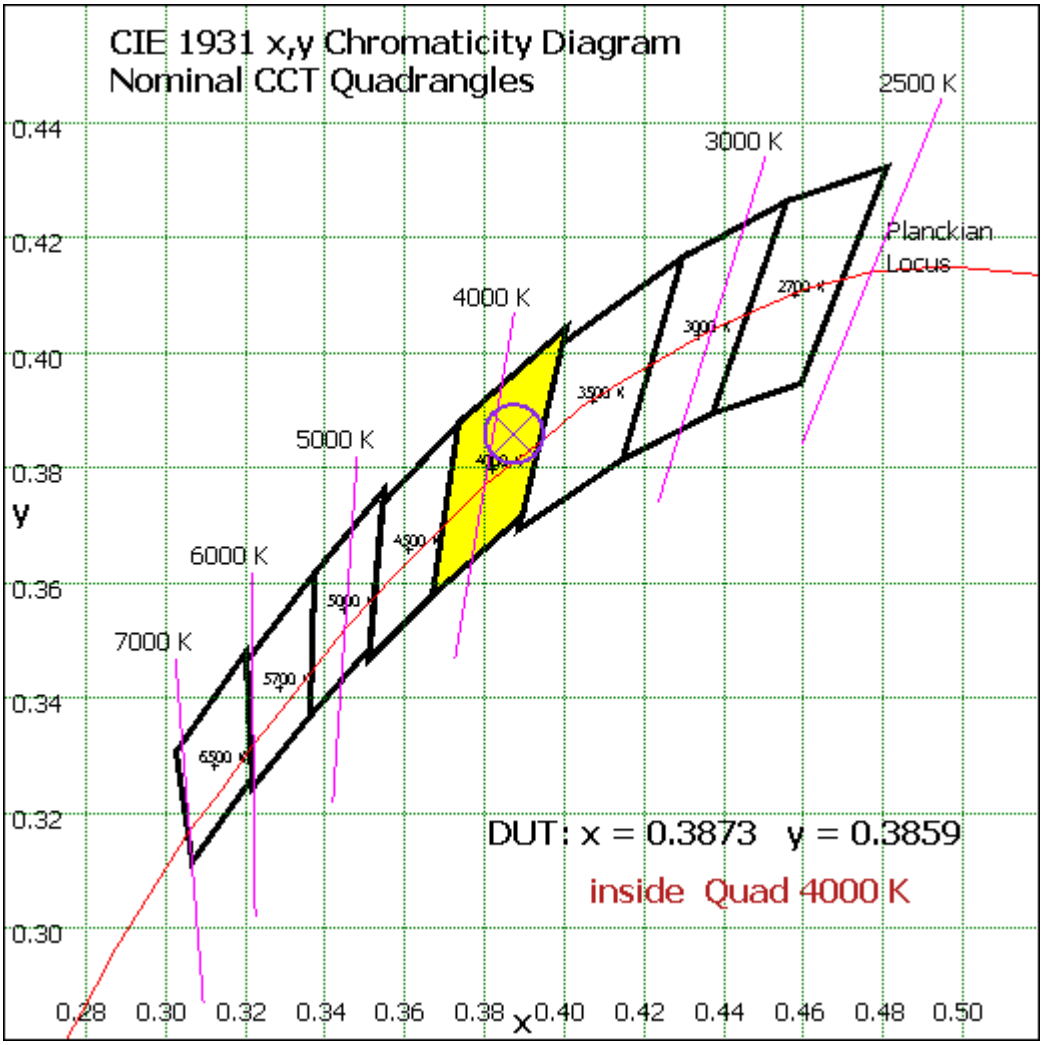


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

γ(°)	Lumens	% Total
0- 10	72.133	4.67%
10- 20	205.246	13.29%
20- 30	305.88	19.81%
30- 40	346.002	22.41%
40- 50	263.729	17.08%
50- 60	160.324	10.38%
60- 70	104.373	6.76%
70- 80	63.632	4.12%
80- 90	21.092	1.37%
90-100	0.076	0.00%
100-110	0.087	0.01%
110-120	0.141	0.01%
120-130	0.213	0.01%
130-140	0.299	0.02%
140-150	0.337	0.02%
150-160	0.294	0.02%
160-170	0.19	0.01%
170-180	0.066	0.00%
Total	1544.1	100%

γ(°)	Lumens	% Total
0- 60	1353.314	87.64%
60- 90	189.097	12.25%
0-90	1542.411	99.89%
90- 180	1.703	0.11%
0- 180	1544.1	100%

Table 5: Zonal Lumen Data

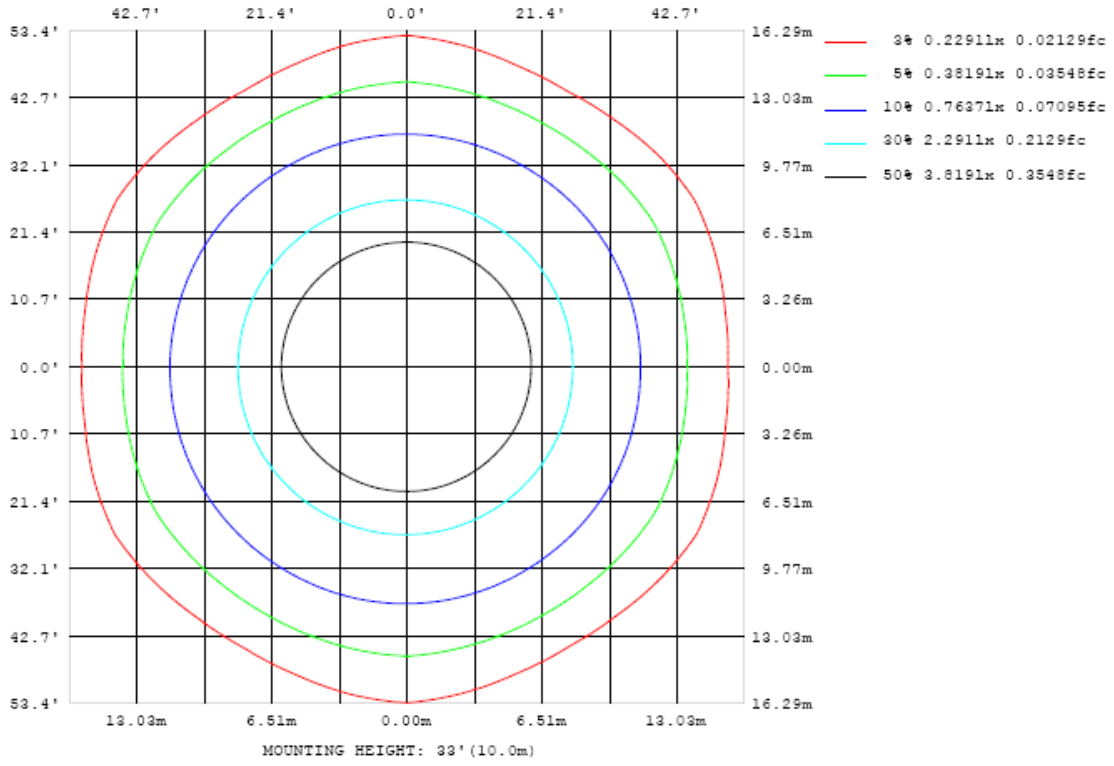


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

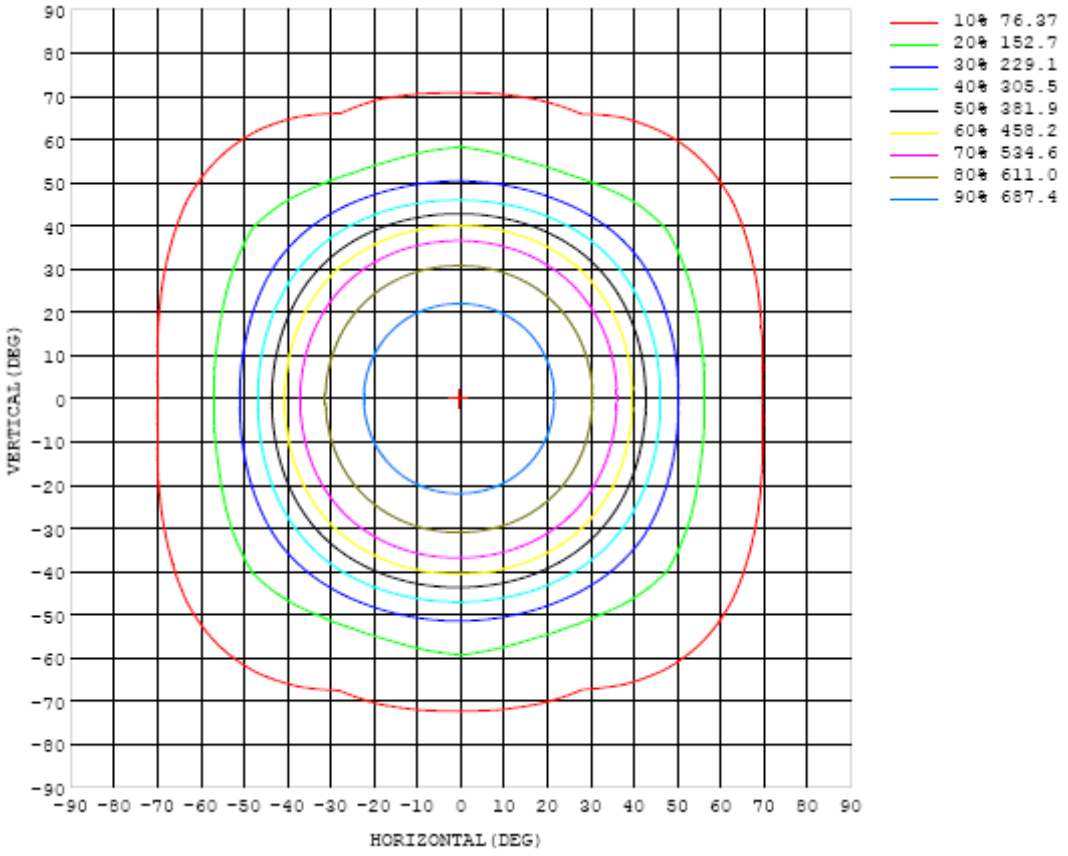


Chart 5: Isocandela Plot

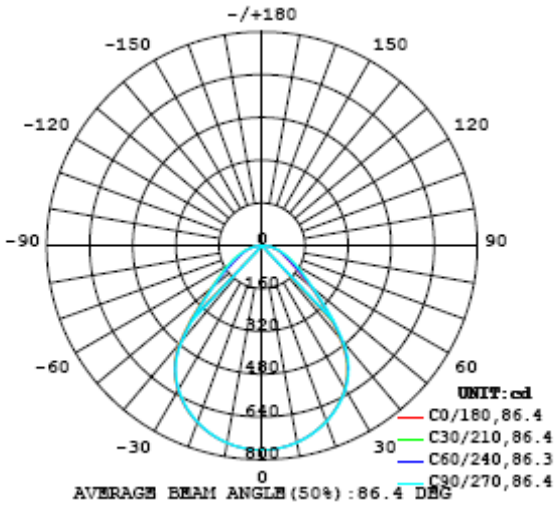


Chart 6: Polar Candela Distribution

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	764	764	764	764	764	764	764	764	764	764	764	764	764	764	764	764	764	764	764
5	759	759	759	759	759	759	759	759	759	759	760	760	760	760	760	760	760	760	760
10	747	746	746	746	747	747	747	747	747	747	748	748	748	748	748	749	749	749	749
15	726	726	726	726	726	726	727	727	727	727	728	728	728	729	729	729	729	730	730
20	698	698	698	698	698	698	699	699	700	700	700	701	701	702	702	703	703	703	704
25	662	661	662	662	662	662	663	664	664	665	665	666	666	667	667	668	668	668	669
30	615	615	615	616	617	617	618	619	620	621	621	622	623	623	623	624	624	624	625
35	551	551	553	554	555	557	559	560	562	563	564	565	565	566	567	567	567	567	567
40	448	450	453	455	458	460	463	466	469	471	473	475	475	477	477	478	477	476	476
45	327	329	332	335	337	340	342	345	348	350	352	352	352	353	353	353	352	350	350
50	233	236	239	243	243	243	243	246	249	251	251	251	250	251	252	253	252	249	248
55	165	169	177	184	179	173	172	175	182	190	184	179	176	179	184	190	185	177	174
60	121	127	137	144	138	129	125	130	140	148	142	132	127	132	141	148	142	131	126
65	93.9	101	109	112	109	102	96.6	103	111	115	112	104	97.5	104	112	116	112	103	96.3
70	74.6	80.0	83.7	85.2	84.7	81.6	76.7	82.4	86.4	87.9	87.1	83.5	77.4	83.1	87.1	88.0	86.7	82.3	76.2
75	56.9	59.8	61.5	62.0	62.6	61.5	59.6	62.5	64.2	64.5	64.8	63.8	60.3	62.9	65.0	63.9	63.8	61.8	58.5
80	38.2	39.6	40.9	41.5	42.0	41.6	41.2	42.6	43.7	43.9	44.2	43.4	42.2	43.0	43.7	43.4	43.3	41.9	40.5
85	17.3	18.5	19.6	20.3	20.8	21.0	21.2	21.9	22.7	23.1	23.4	23.1	22.8	23.1	23.4	23.4	23.1	22.2	21.6
90	0.03	0.03	0.04	0.17	0.53	1.43	1.20	1.69	2.08	2.31	2.44	2.90	2.45	2.15	2.22	1.54	1.40	1.48	0.52
95	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.04	0.04	0.04	0.04	0.04
100	0.06	0.06	0.06	0.06	0.05	0.06	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.06
105	0.08	0.08	0.08	0.08	0.07	0.08	0.08	0.07	0.07	0.07	0.07	0.06	0.06	0.06	0.06	0.06	0.07	0.07	0.08
110	0.10	0.10	0.11	0.10	0.09	0.11	0.10	0.10	0.09	0.08	0.09	0.09	0.08	0.08	0.08	0.09	0.09	0.09	0.11
115	0.14	0.13	0.16	0.13	0.14	0.14	0.13	0.13	0.12	0.11	0.11	0.11	0.11	0.11	0.11	0.12	0.12	0.12	0.15
120	0.17	0.16	0.16	0.16	0.17	0.18	0.17	0.16	0.16	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.16	0.20
125	0.21	0.21	0.21	0.22	0.23	0.22	0.21	0.21	0.20	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.20	0.20	0.26
130	0.26	0.26	0.28	0.29	0.28	0.27	0.26	0.26	0.25	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.26	0.33
135	0.33	0.33	0.34	0.35	0.34	0.33	0.33	0.32	0.31	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.31	0.32	0.42
140	0.39	0.39	0.41	0.41	0.40	0.40	0.39	0.38	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.49
145	0.47	0.47	0.47	0.47	0.46	0.46	0.45	0.45	0.44	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.42	0.55
150	0.51	0.51	0.51	0.51	0.50	0.50	0.49	0.49	0.48	0.48	0.48	0.48	0.47	0.47	0.47	0.47	0.47	0.46	0.58
155	0.55	0.55	0.55	0.55	0.54	0.54	0.53	0.53	0.52	0.52	0.52	0.52	0.52	0.51	0.51	0.51	0.52	0.50	0.61
160	0.59	0.59	0.59	0.58	0.58	0.58	0.57	0.57	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.55	0.61
165	0.62	0.62	0.61	0.61	0.61	0.60	0.60	0.60	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.61
170	0.66	0.66	0.66	0.66	0.65	0.65	0.65	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.63
175	0.70	0.69	0.69	0.68	0.68	0.67	0.67	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.67	0.67	0.68	0.69	0.69
180	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72

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	764	764	764	764	764	764	764	764	764	764	764	764	764	764	764	764	764		
5	760	760	760	760	760	760	760	760	760	760	760	760	759	759	759	759	759		
10	749	749	749	749	749	748	748	748	748	748	748	747	747	747	747	747	747		
15	730	730	729	729	729	729	729	728	728	728	728	727	727	727	727	726	726		
20	703	703	703	702	702	702	701	701	701	700	700	700	699	699	699	698	699		
25	668	668	668	667	667	667	666	665	665	664	664	663	663	663	662	662	662		
30	624	623	623	622	622	622	621	620	619	619	618	617	617	616	616	616	615		
35	566	565	565	564	563	562	561	560	559	558	557	555	555	554	553	553	552		
40	474	473	471	469	467	465	463	461	459	457	454	452	451	451	450	450	449		
45	348	346	343	340	336	333	330	328	327	326	325	324	325	326	327	328	328		
50	247	246	245	242	238	235	234	235	235	232	230	229	231	234	236	235	234		
55	176	181	185	178	170	166	168	174	179	171	165	162	166	174	180	173	167		
60	130	139	145	137	127	120	126	135	140	132	123	118	126	136	141	135	126		
65	103	110	113	108	99.9	92.2	99.5	106	108	105	97.5	91.5	99.6	107	110	107	100.0		
70	81.7	84.7	84.6	82.9	78.9	72.5	78.4	80.5	80.6	80.1	77.0	72.1	78.2	81.0	82.3	82.4	79.3		
75	60.6	61.5	60.2	59.9	57.7	54.3	56.7	57.6	56.7	57.3	55.6	53.7	56.9	58.4	58.7	59.7	58.5		
80	40.9	41.0	40.1	39.5	38.0	36.2	36.7	37.2	36.7	36.7	35.8	35.3	36.6	37.7	38.2	38.7	38.5		
85	21.4	20.7	19.9	18.9	17.7	16.6	16.4	16.1	15.7	15.4	14.9	14.7	15.3	15.8	16.3	16.9	17.2		
90	0.23	0.10	0.00	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.03	0.03	0.03	0.03	0.02		
95	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	0.05	0.05	0.05	0.05		
100	0.06	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		
105	0.09	0.09	0.09	0.10	0.10	0.09	0.10	0.10	0.10	0.09	0.10	0.10	0.09	0.09	0.09	0.09	0.09		
110	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.13	0.13	0.13	0.12	0.12	0.12	0.12	0.12		
115	0.16	0.16	0.16	0.15	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.17	0.15	0.16	0.16	0.16	0.16		
120	0.21	0.20	0.21	0.20	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.20	0.20	0.21	0.21	0.20		
125	0.27	0.27	0.27	0.26	0.27	0.27	0.28	0.28	0.27	0.28	0.27	0.27	0.27	0.27	0.27	0.27	0.26		
130	0.36	0.35	0.35	0.35	0.35	0.36	0.37	0.37	0.36	0.36	0.36	0.37	0.37	0.36	0.36	0.36	0.33		
135	0.47	0.46	0.46	0.45	0.46	0.47	0.45	0.48	0.48	0.47	0.46	0.46	0.47	0.46	0.47	0.46	0.42		
140	0.56	0.57	0.58	0.58	0.56	0.56	0.57	0.54	0.58	0.57	0.58	0.58	0.58	0.57	0.56	0.54	0.50		
145	0.64	0.66	0.67	0.68	0.68	0.64	0.62	0.63	0.62	0.66	0.66	0.67	0.66	0.65	0.64	0.63	0.60		
150	0.69	0.71	0.74	0.75	0.75	0.75	0.73	0.68	0.68	0.70	0.73	0.72	0.72	0.73	0.70	0.69	0.64		
155	0.72	0.73	0.77	0.79	0.80	0.80	0.80	0.79	0.78	0.79	0.78	0.76	0.75	0.74	0.72	0.73	0.65		
160	0.75	0.74	0.76	0.78	0.80	0.81	0.81	0.81	0.80	0.80	0.79	0.78	0.78	0.76	0.74	0.75	0.65		
165	0.75	0.75	0.75	0.75	0.76	0.76	0.77	0.77	0.77	0.77	0.77	0.77	0.76	0.76	0.74	0.74	0.64		
170	0.69	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.73	0.74	0.73	0.70	0.66		
175	0.70	0.70	0.73	0.73	0.73	0.73	0.73	0.72	0.72	0.72	0.71	0.71	0.71	0.71	0.71	0.71	0.70		
180	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72		

Table 7: Luminous Intensity Data

EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Jul. 26, 2016	Jul. 25, 2017
Digital Power Meter	PF2010A	HZTE028-01	Jul. 26, 2016	Jul. 25, 2017
AC Power Supply	DPS1060	HZTE001-06	Dec. 25, 2016	Dec. 24, 2017
DC Power Supply	WY12010	HZTE004-03	Dec. 25, 2016	Dec. 24, 2017
Temperature Meter	TES1310	HZTE017-01	Aug. 08, 2016	Aug. 07, 2017
Standard source	D908	HZTE012-01	Jul. 28, 2016	Jul. 27, 2017
Integrate Sphere system	2M	HZTE015-01	Jul. 26, 2016	Jul. 25, 2017
Digital Power Meter	WT210	HZTE008-01	Jul. 26, 2016	Jul. 25, 2017
AC Power Supply	PCR 500L	HZTE001-07	Dec. 25, 2016	Dec. 24, 2017
DC Power Supply	IT6154	HZTE004-04	Jul. 27, 2016	Jul. 26, 2017
Temperature and humidity recorder	JR900	HZTE018-01	Dec. 25, 2016	Dec. 24, 2017
Standard source	SCL-1400	HZTE012-02	Jul. 28, 2016	Jul. 27, 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 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

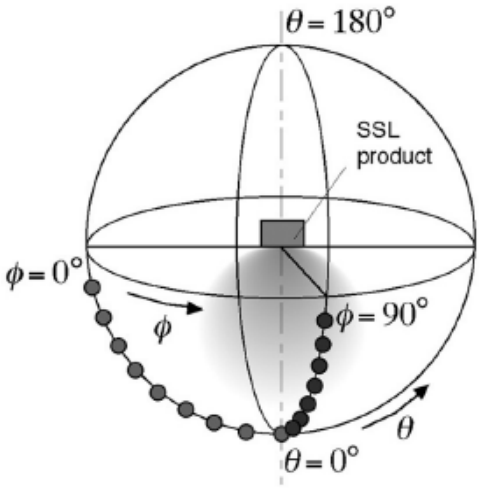
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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