LM-79-08 Test Report

for

GREEN CREATIVE LTD

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

Downlight

Model: 18DL6DIM/927

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ17080054g

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: Jim 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: **18DL6DIM/927**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
85.7	1511.0	17.64	0.9194

CCT (K)	CRI	Stabilization Time (Light & Power)
2702	92.6	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	: 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	: 18DL6DIM/927
Electrical Ratings	: 120V, 60Hz, 18W
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)	0.160
Power Factor	0.9194
Test Power (W)	17.64
THD A%	35.8
Luminous Efficacy (lm/W)	85.7
Total Luminous Flux (lm)	1511.0
Color Rendering Index (CRI)	92.6
R9	55.7
Correlated Color Temperature (CCT)(K)	2702
Chromaticity Chroma x	0.4595
Chromaticity Chroma y	0.4104
Chromaticity Chroma u	0.2623
Chromaticity Chroma v	0.3515
Duv	0.0004
Chromaticity Chroma u ’	0.2623
Chromaticity Chroma v’	0.5272

Special Color Rendering Indices	
R1	93
R2	97.7
R3	98
R4	92.3
R5	93.2
R6	97.4
R7	90
R8	79
R9	55.7
R10	94.1
R11	94
R12	86.5
R13	94.4
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)	0.161
Power Factor	0.9159
Test Power (W)	17.69
Luminous Efficacy (lm/W)	86.9
Total Luminous Flux (lm)	1536.8
Beam Angle (°)	99.1
Center Beam Candle Power (cd)	651
Spacing Criteria	1.23 (0°-180°)/ 1.20 (90°-270°)
Zonal Lumens in the 0°-60°Zone	85.78%
Zonal Lumens in the 60°-90°Zone	14.12%
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

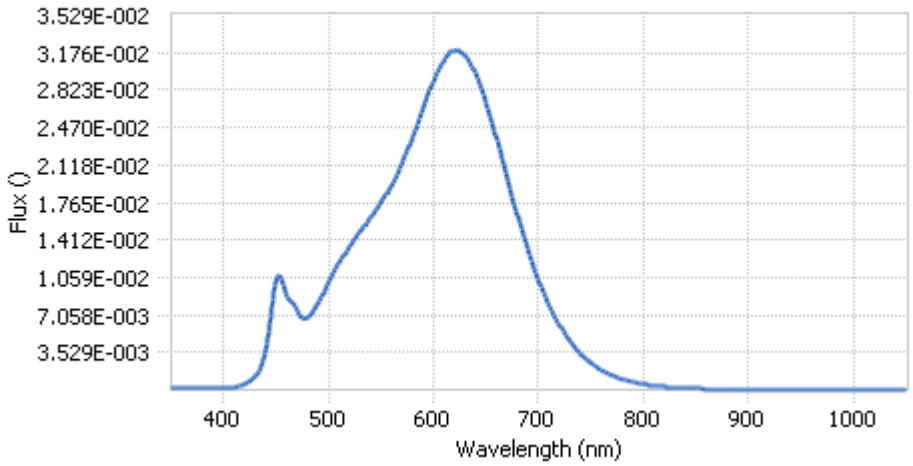
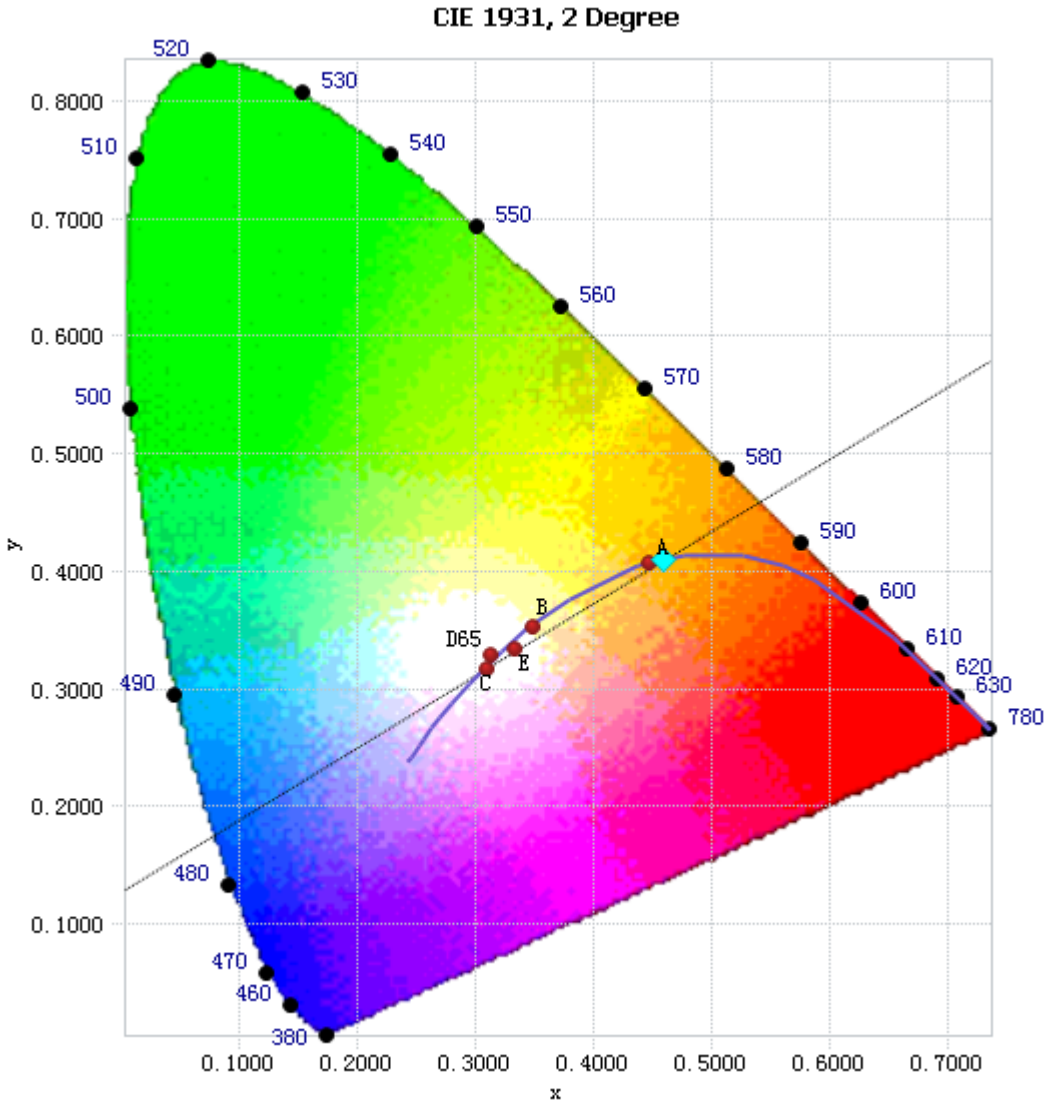


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.93E-04	485	7.36E-03	590	2.65E-02	695	1.17E-02
385	1.94E-04	490	8.13E-03	595	2.79E-02	700	1.04E-02
390	1.91E-04	495	9.09E-03	600	2.91E-02	705	9.08E-03
395	1.84E-04	500	1.01E-02	605	3.02E-02	710	7.93E-03
400	1.97E-04	505	1.11E-02	610	3.10E-02	715	6.97E-03
405	2.29E-04	510	1.20E-02	615	3.17E-02	720	6.11E-03
410	2.73E-04	515	1.28E-02	620	3.19E-02	725	5.31E-03
415	3.67E-04	520	1.35E-02	625	3.19E-02	730	4.59E-03
420	5.44E-04	525	1.42E-02	630	3.15E-02	735	3.97E-03
425	8.31E-04	530	1.49E-02	635	3.08E-02	740	3.40E-03
430	1.29E-03	535	1.56E-02	640	2.98E-02	745	2.93E-03
435	2.14E-03	540	1.63E-02	645	2.85E-02	750	2.54E-03
440	3.83E-03	545	1.70E-02	650	2.71E-02	755	2.19E-03
445	6.93E-03	550	1.77E-02	655	2.54E-02	760	1.88E-03
450	1.03E-02	555	1.85E-02	660	2.37E-02	765	1.60E-03
455	1.04E-02	560	1.93E-02	665	2.18E-02	770	1.38E-03
460	8.94E-03	565	2.03E-02	670	2.00E-02	775	1.18E-03
465	8.23E-03	570	2.14E-02	675	1.82E-02	780	1.01E-03
470	7.51E-03	575	2.25E-02	680	1.64E-02		
475	6.74E-03	580	2.38E-02	685	1.48E-02		
480	6.84E-03	585	2.52E-02	690	1.32E-02		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4595, 0.4104)

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

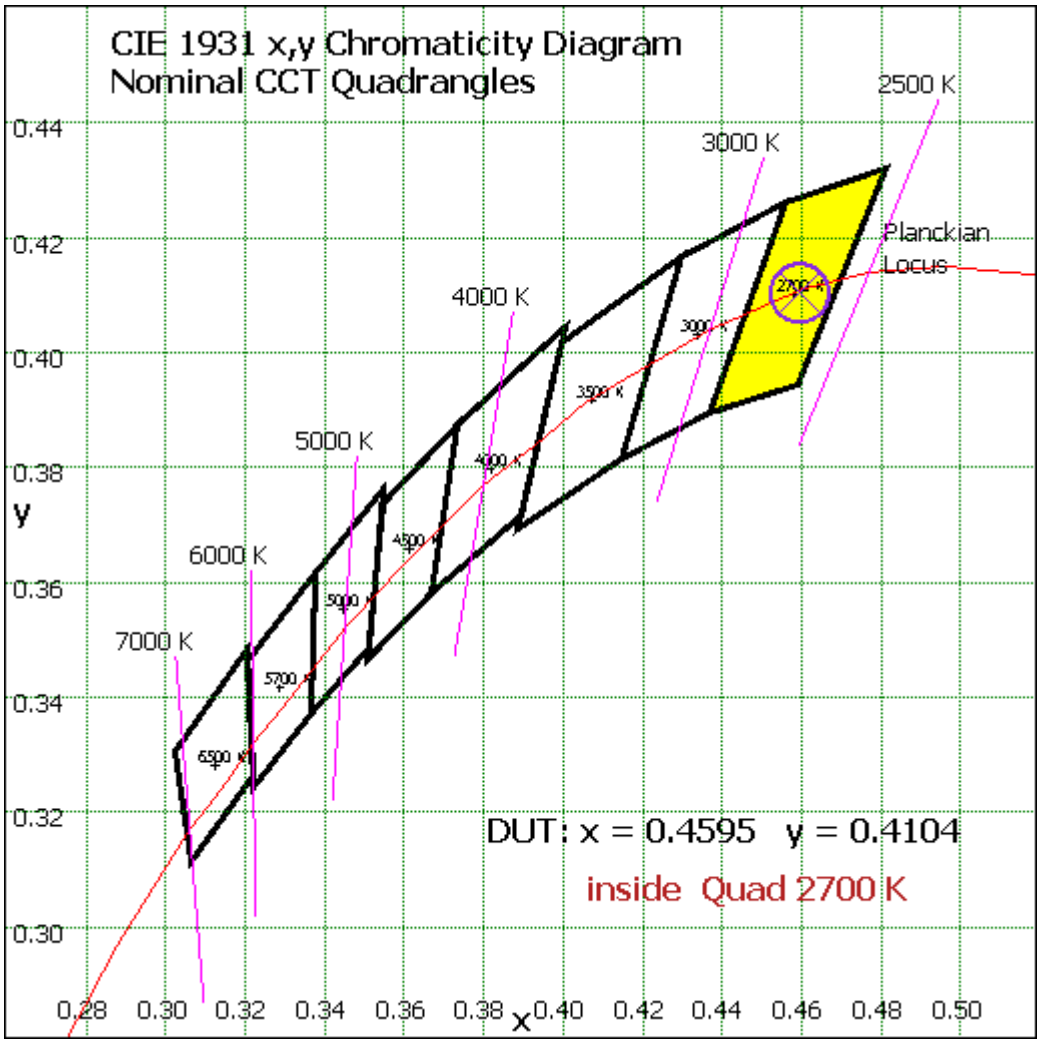


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

γ(°)	Lumens	% Total
0- 10	61.483	4.00%
10- 20	174.057	11.33%
20- 30	257.686	16.77%
30- 40	299.7	19.50%
40- 50	291.526	18.97%
50- 60	233.853	15.22%
60- 70	147.403	9.59%
70- 80	58.811	3.83%
80- 90	10.734	0.70%
90-100	0.059	0.00%
100-110	0.087	0.01%
110-120	0.145	0.01%
120-130	0.207	0.01%
130-140	0.279	0.02%
140-150	0.306	0.02%
150-160	0.26	0.02%
160-170	0.172	0.01%
170-180	0.06	0.00%
Total	1536.8	100%

γ(°)	Lumens	% Total
0- 60	1318.305	85.78%
60- 90	216.948	14.12%
0-90	1535.253	99.90%
90- 180	1.575	0.10%
0- 180	1536.8	100%

Table 5: Zonal Lumen Data

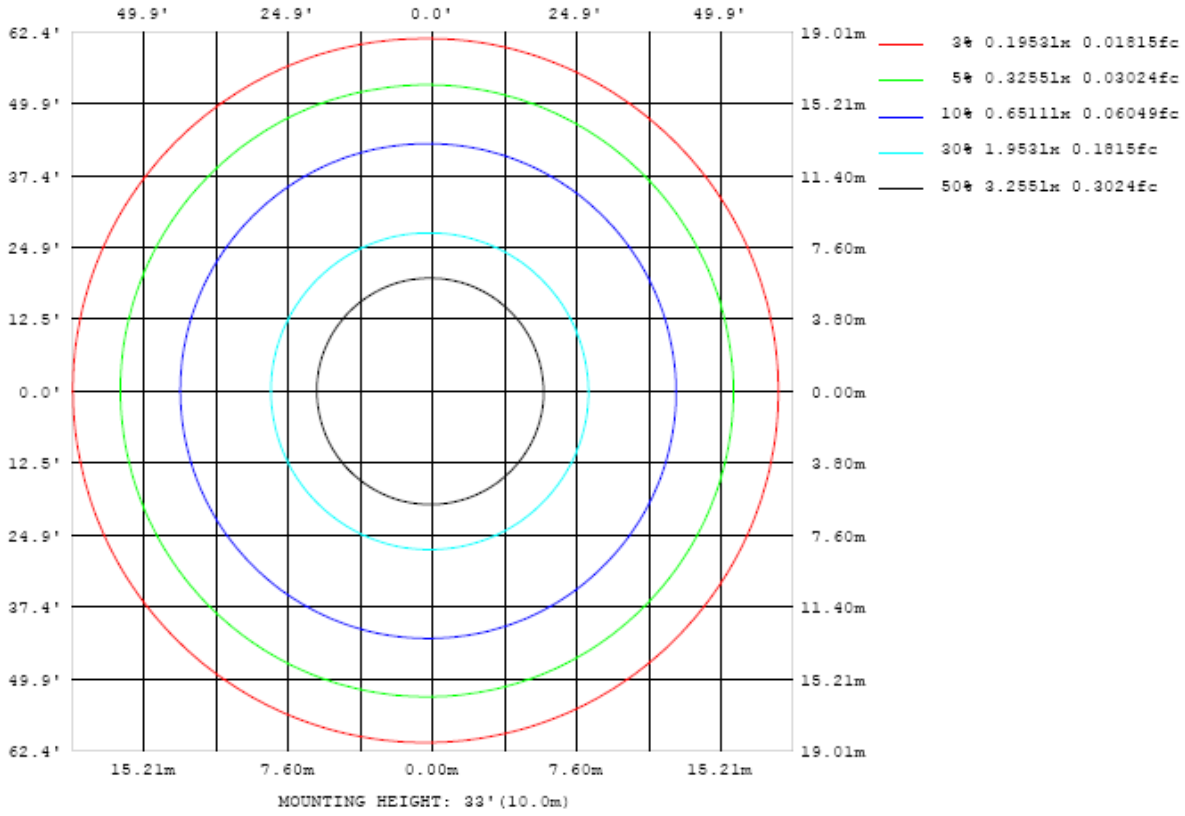


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

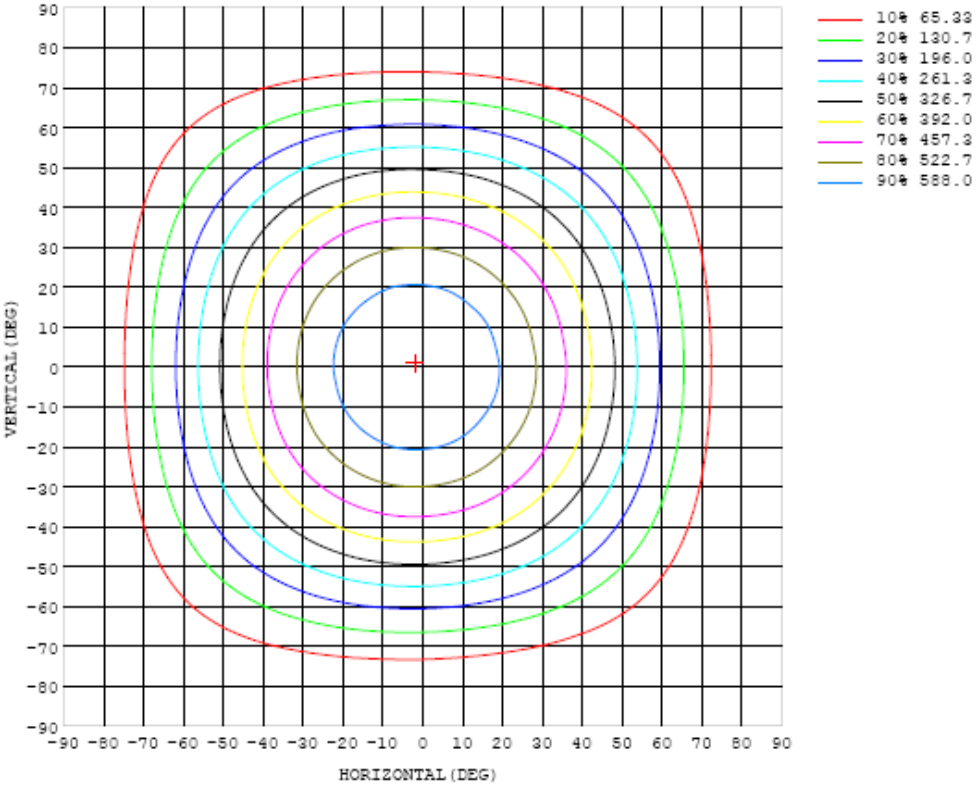


Chart 5: Isocandela Plot

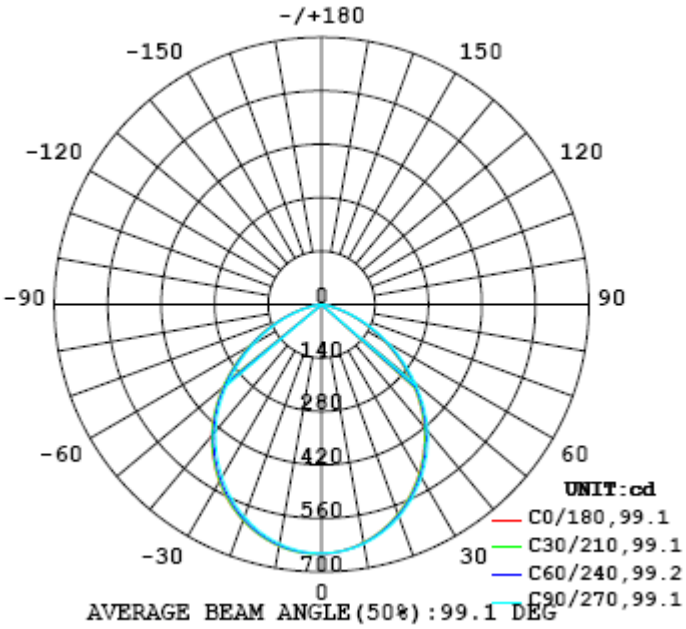


Chart 6: Polar Candela Distribution

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	651	651	651	651	651	651	651	651	651	651	651	651	651	651	651	651	651	651	651
5	647	647	647	647	646	647	647	647	647	648	648	649	648	649	649	650	650	650	650
10	633	633	633	633	633	634	635	635	635	636	637	638	639	639	639	640	641	640	642
15	612	612	612	612	612	613	615	616	616	617	619	620	621	622	623	624	624	623	625
20	584	584	585	585	585	586	588	590	590	592	594	595	596	597	599	600	600	600	602
25	550	550	551	551	552	553	555	557	558	560	562	564	565	567	568	570	570	570	572
30	510	511	512	512	513	515	517	519	520	522	525	527	528	530	532	533	534	534	536
35	467	467	468	469	470	472	474	476	478	480	483	485	487	488	490	492	492	492	494
40	418	418	419	420	421	423	426	428	430	432	435	438	440	442	444	446	446	446	448
45	363	364	365	366	367	369	371	374	376	378	381	384	386	388	391	392	393	394	395
50	305	306	307	307	309	311	313	315	318	320	323	326	328	330	332	334	335	336	337
55	247	247	248	249	250	252	254	256	258	261	263	266	268	271	273	274	275	276	277
60	190	190	190	191	192	194	196	198	200	202	205	207	209	212	214	215	216	217	218
65	136	135	136	136	137	138	140	142	144	146	149	151	153	155	157	159	160	161	162
70	85.8	85.2	85.3	85.6	86.3	87.4	88.9	90.6	92.5	94.6	96.7	99.0	101	103	105	107	108	108	110
75	44.3	43.7	43.5	43.6	44.0	44.8	45.8	47.1	48.7	50.3	52.3	54.2	56.1	58.0	59.8	61.2	62.1	62.9	63.9
80	18.1	17.8	17.7	17.7	17.8	18.0	18.4	18.8	19.5	20.2	21.2	22.1	23.2	24.3	25.4	26.5	27.4	28.2	28.6
85	6.27	5.97	5.81	5.81	5.87	6.07	6.24	6.71	7.16	7.66	8.24	8.81	9.49	10.2	10.8	11.3	11.8	12.2	12.4
90	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	0.06	0.19	0.43	0.76	1.08	1.32
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	0.02	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	0.05	0.05	0.04	0.04	0.04	0.04	0.04	0.06
105	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.06	0.06	0.08
110	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	0.09	0.09	0.09	0.09	0.11
115	0.14	0.14	0.14	0.14	0.14	0.15	0.15	0.14	0.14	0.14	0.13	0.13	0.13	0.13	0.13	0.13	0.12	0.13	0.15
120	0.18	0.18	0.18	0.18	0.18	0.19	0.19	0.18	0.18	0.17	0.17	0.17	0.17	0.17	0.16	0.16	0.16	0.16	0.18
125	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.22	0.22	0.22	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.23
130	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.27	0.27	0.27	0.27	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.30
135	0.34	0.34	0.34	0.34	0.34	0.33	0.33	0.33	0.33	0.33	0.32	0.32	0.32	0.32	0.32	0.32	0.31	0.32	0.39
140	0.40	0.39	0.39	0.39	0.39	0.39	0.39	0.38	0.38	0.38	0.38	0.38	0.37	0.37	0.37	0.37	0.37	0.37	0.48
145	0.44	0.43	0.43	0.43	0.43	0.43	0.43	0.42	0.42	0.42	0.42	0.42	0.41	0.41	0.41	0.41	0.41	0.42	0.55
150	0.47	0.46	0.46	0.46	0.46	0.45	0.45	0.45	0.45	0.45	0.45	0.44	0.44	0.44	0.44	0.44	0.44	0.45	0.61
155	0.50	0.49	0.49	0.49	0.49	0.49	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.47	0.47	0.49	0.64
160	0.54	0.52	0.52	0.52	0.52	0.52	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.50	0.52	0.66
165	0.57	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.54	0.56	0.67
170	0.61	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.60	0.66
175	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.63	0.63	0.64	0.65
180	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64

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	651	651	651	651	651	651	651	651	651	651	651	651	651	651	651	651	651		
5	651	652	651	650	650	649	649	648	647	647	647	646	645	646	645	644	645		
10	642	642	642	640	640	639	638	637	636	635	634	633	633	632	632	631	631		
15	626	625	625	623	623	621	621	618	617	616	615	613	612	612	611	610	610		
20	601	602	601	599	598	597	595	593	592	590	588	586	584	584	583	582	582		
25	572	571	570	569	567	564	564	561	559	557	556	553	550	550	549	548	548		
30	535	536	534	532	530	529	527	524	521	519	517	514	512	511	510	509	508		
35	494	494	492	491	488	488	485	482	479	476	474	472	469	467	467	466	465		
40	448	447	446	444	442	441	439	435	432	430	426	424	421	419	418	417	417		
45	395	395	394	392	390	388	386	383	379	376	372	370	367	365	364	363	362		
50	337	336	336	334	332	330	328	324	321	318	315	313	310	308	307	306	304		
55	277	277	276	274	273	271	268	265	263	259	257	254	251	250	248	247	246		
60	218	218	217	215	214	212	210	207	204	202	200	197	195	193	191	191	190		
65	162	162	161	160	159	157	155	153	151	148	146	144	141	140	138	137	136		
70	110	110	109	108	107	106	104	102	100	98.1	96.1	94.0	92.1	90.2	88.9	87.6	86.2		
75	64.1	64.3	63.8	63.2	62.3	61.3	60.1	58.6	56.8	55.3	53.7	51.7	49.9	48.5	46.9	45.7	44.7		
80	28.9	29.2	29.1	28.8	28.3	27.7	27.0	26.0	25.1	24.1	23.2	22.1	21.2	20.3	19.6	19.0	18.4		
85	12.7	12.8	12.8	12.7	12.6	12.4	12.0	11.6	11.1	10.5	9.92	9.33	8.64	8.02	7.44	6.90	6.45		
90	1.53	1.65	1.70	1.64	1.50	1.31	1.10	0.77	0.43	0.17	0.03	0.02	0.02	0.02	0.02	0.02	0.02		
95	0.03	0.03	0.03	0.03	0.03	0.04	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04		
100	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	0.06	0.07	0.07		
105	0.08	0.09	0.08	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.10	0.10	0.10	0.10	0.10		
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	0.13	0.13	0.13	0.13	0.13		
115	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.17		
120	0.18	0.18	0.18	0.18	0.18	0.19	0.19	0.19	0.19	0.19	0.19	0.20	0.20	0.20	0.20	0.20	0.20		
125	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.24	0.24	0.24	0.24	0.24	0.25	0.25	0.25	0.25	0.25		
130	0.30	0.30	0.30	0.30	0.30	0.31	0.31	0.31	0.31	0.31	0.31	0.32	0.32	0.32	0.32	0.32	0.33		
135	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.40	0.40	0.40	0.40	0.41	0.41	0.41	0.41	0.41		
140	0.47	0.48	0.47	0.48	0.48	0.48	0.48	0.48	0.48	0.49	0.49	0.49	0.49	0.49	0.50	0.50	0.50		
145	0.55	0.55	0.55	0.55	0.55	0.56	0.56	0.56	0.56	0.56	0.57	0.57	0.57	0.57	0.57	0.57	0.58		
150	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.62	0.62	0.62	0.62	0.62	0.62	0.63	0.63	0.63		
155	0.64	0.64	0.64	0.64	0.64	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.66	0.66	0.66	0.66		
160	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.68		
165	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67		
170	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66		
175	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65		
180	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64		

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

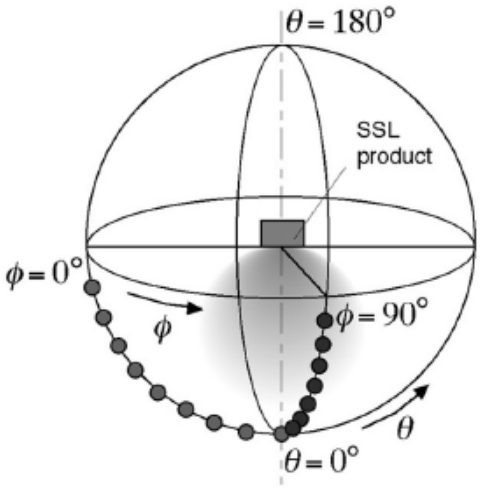
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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