LM-79-08 Test Report

for

GREEN CREATIVE LTD

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

Vertically-Mounted Lamps

Model: 16.5PLV/827/BYP

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ18050048c

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. 04, 2018

Approved by:

Manager: Jim Zhang

Jun. 04, 2018

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: **16.5PLV/827/BYP**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
115.9	1851.0	15.97	0.9653

CCT (K)	CRI	Stabilization Time (Light & Power)
2702	82.1	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 25, 2018
Date of Test	: May 30, 2018
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	: Vertically-Mounted Lamps
Model	: 16.5PLV/827/BYP
Electrical Ratings	: 120-277V, 50/60Hz, 16.5W
Product Description	: 2700K
Manufacturer	: GREEN CREATIVE LTD
Address	: 756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

TEST RESULTS

Test ambient temperature was 24.9℃.

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	277.0
Voltage frequency (Hz)	60	60
Test Current (A)	0.138	0.061
Power Factor	0.9653	0.9598
Test Power (W)	15.97	16.20
THD A%	15.98	18.20
Luminous Efficacy (lm/W)	115.9	115.2
Total Luminous Flux (lm)	1851.0	1867.0
Color Rendering Index (CRI)	82.1	
R9	4.7	
Correlated Color Temperature (CCT)(K)	2702	
Chromaticity Chroma x	0.4585	
Chromaticity Chroma y	0.4086	
Chromaticity Chroma u	0.2625	
Chromaticity Chroma v	0.3509	
Duv	0.0010	
Chromaticity Chroma u ’	0.2625	
Chromaticity Chroma v’	0.5264	

Special Color Rendering Indices	
R1	80.9
R2	92.2
R3	94.2
R4	79.9
R5	81.5
R6	91.9
R7	80.4
R8	55.6
R9	4.7
R10	83.1
R11	80.1
R12	78.6
R13	83.6
R14	97.5
Rf	83
Rg	96

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 24.7℃.

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)	0.139
Power Factor	0.9663
Test Power (W)	16.08
Luminous Efficacy (lm/W)	116.7
Total Luminous Flux (lm)	1876.7
Beam Angle (°)	97.2
Center Beam Candle Power (cd)	779
Spacing Criteria	1.19 (0°-180°)/ 1.22 (90°-270°)
Zonal Lumens in the 0°-60°Zone	83.22%
Zonal Lumens in the 60°-90°Zone	16.53%
Zonal Lumens in the 90°-120°Zone	0.16%
Zonal Lumens in the 120°-180°Zone	0.09%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

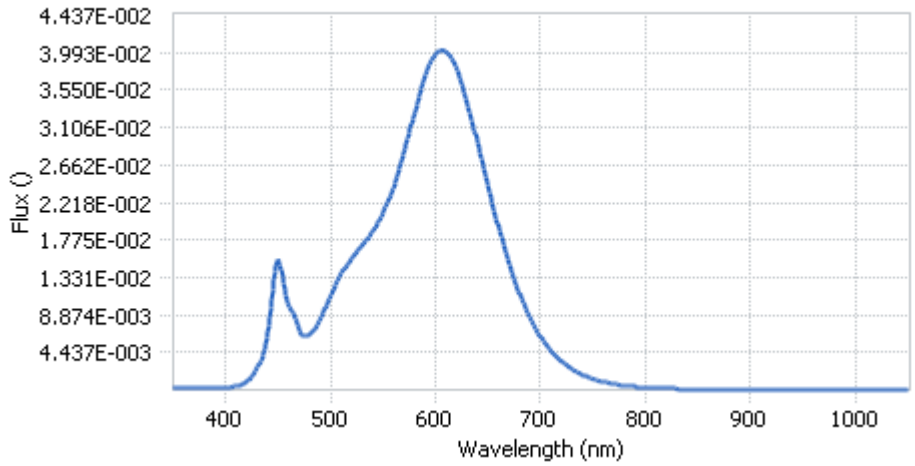
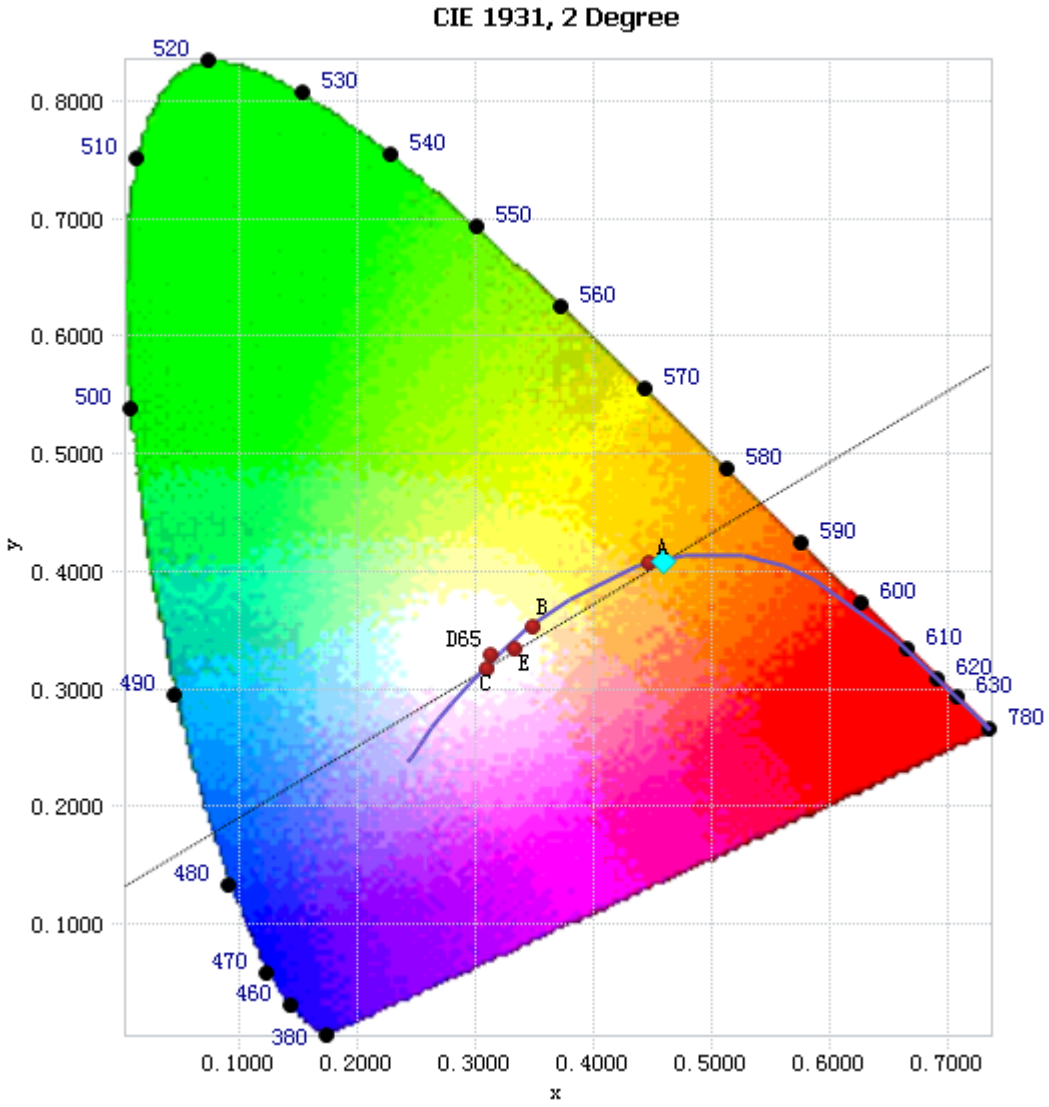


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.67E-04	485	7.24E-03	590	3.72E-02	695	7.37E-03
385	2.36E-04	490	8.29E-03	595	3.87E-02	700	6.32E-03
390	2.70E-04	495	9.71E-03	600	3.98E-02	705	5.39E-03
395	2.59E-04	500	1.12E-02	605	4.02E-02	710	4.63E-03
400	2.87E-04	505	1.25E-02	610	4.01E-02	715	3.95E-03
405	3.48E-04	510	1.37E-02	615	3.93E-02	720	3.39E-03
410	4.53E-04	515	1.47E-02	620	3.79E-02	725	2.89E-03
415	6.77E-04	520	1.56E-02	625	3.61E-02	730	2.47E-03
420	1.02E-03	525	1.63E-02	630	3.40E-02	735	2.11E-03
425	1.57E-03	530	1.71E-02	635	3.17E-02	740	1.79E-03
430	2.51E-03	535	1.79E-02	640	2.92E-02	745	1.53E-03
435	4.00E-03	540	1.88E-02	645	2.66E-02	750	1.31E-03
440	6.85E-03	545	1.99E-02	650	2.42E-02	755	1.11E-03
445	1.19E-02	550	2.10E-02	655	2.17E-02	760	9.59E-04
450	1.54E-02	555	2.24E-02	660	1.93E-02	765	8.24E-04
455	1.26E-02	560	2.41E-02	665	1.71E-02	770	7.05E-04
460	1.00E-02	565	2.61E-02	670	1.50E-02	775	6.04E-04
465	8.93E-03	570	2.82E-02	675	1.31E-02	780	5.18E-04
470	7.28E-03	575	3.05E-02	680	1.14E-02		
475	6.36E-03	580	3.28E-02	685	9.91E-03		
480	6.61E-03	585	3.51E-02	690	8.53E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4585, 0.4086)

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

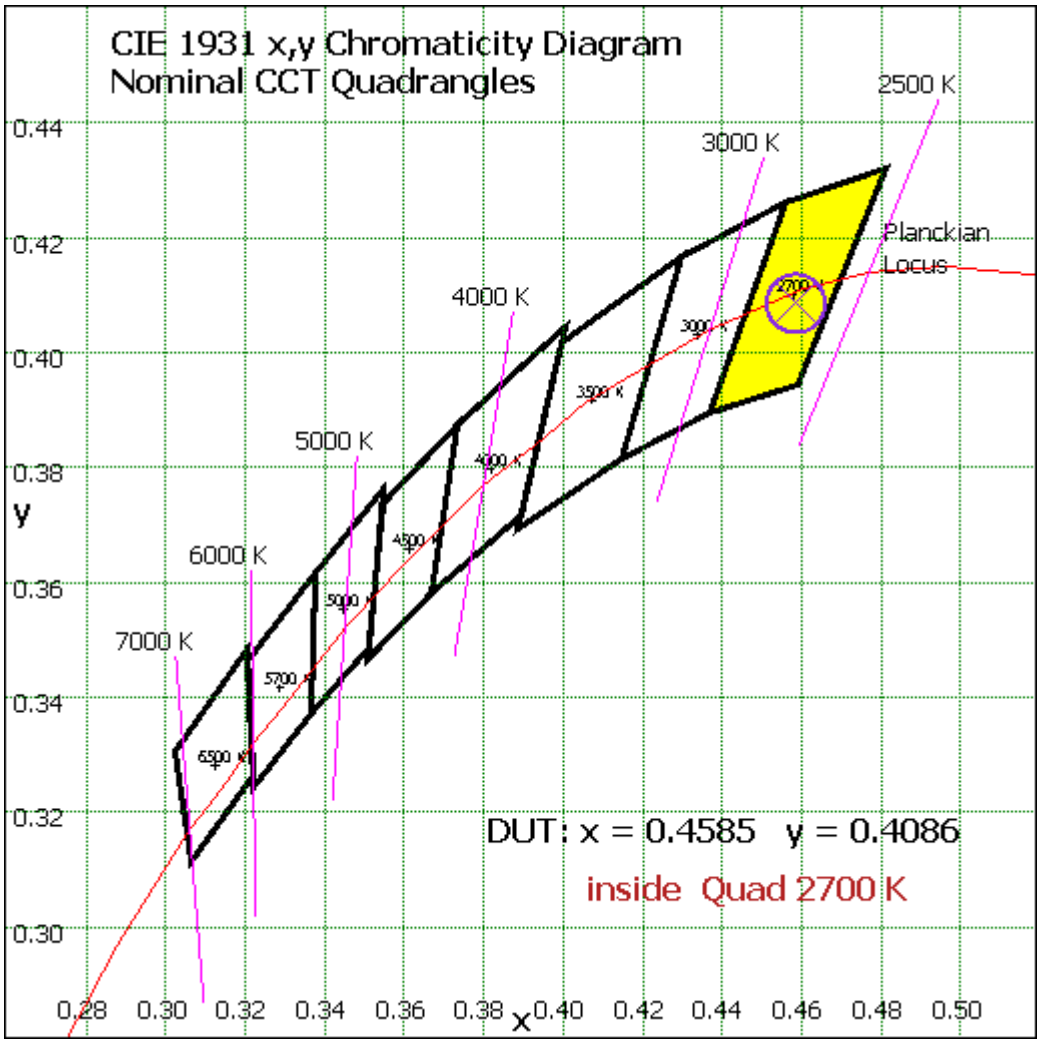


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

γ(°)	Lumens	% Total
0- 10	73.675	3.93%
10- 20	210.011	11.19%
20- 30	312.137	16.63%
30- 40	357.744	19.06%
40- 50	338.394	18.03%
50- 60	269.767	14.37%
60- 70	181.695	9.68%
70- 80	96.893	5.16%
80- 90	31.681	1.69%
90-100	2.744	0.15%
100-110	0.122	0.01%
110-120	0.19	0.01%
120-130	0.264	0.01%
130-140	0.351	0.02%
140-150	0.387	0.02%
150-160	0.337	0.02%
160-170	0.226	0.01%
170-180	0.077	0.00%
Total	1876.7	100%

γ(°)	Lumens	% Total
0- 60	1561.728	83.22%
60- 90	310.269	16.53%
0-90	1871.997	99.75%
90- 180	4.698	0.25%
0- 180	1876.7	100%

Table 5: Zonal Lumen Data

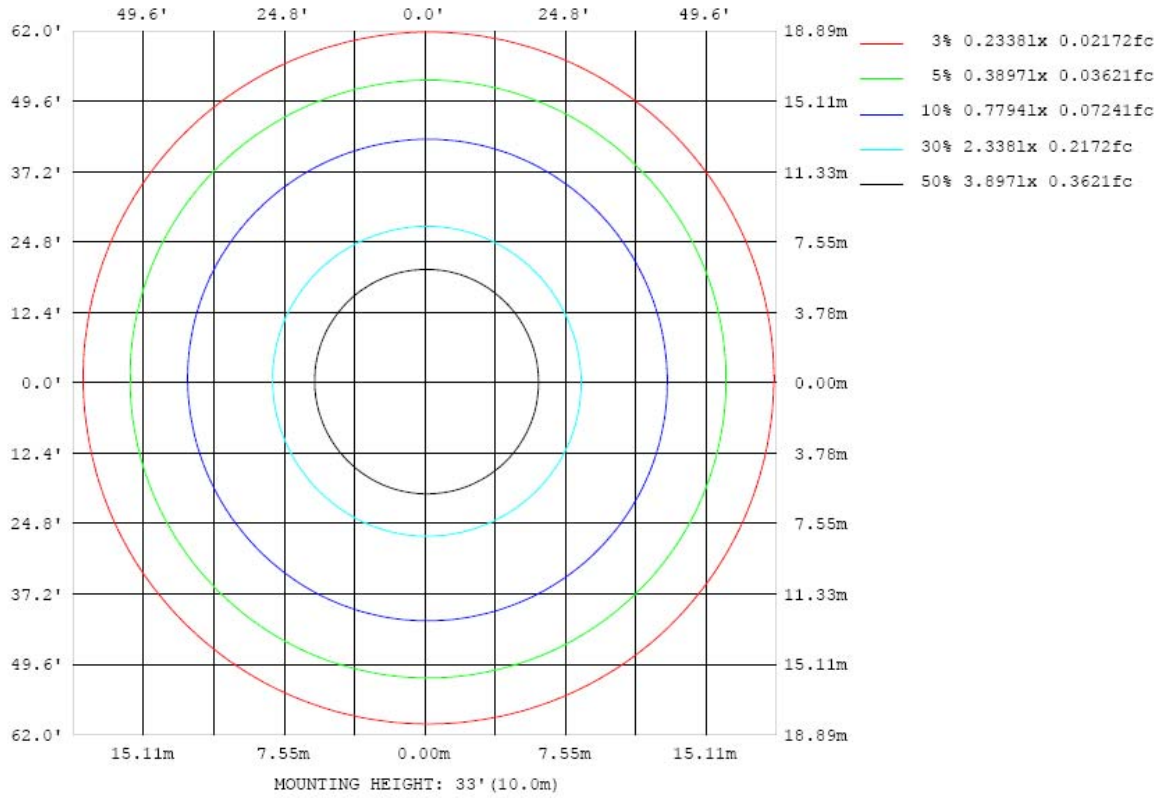


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

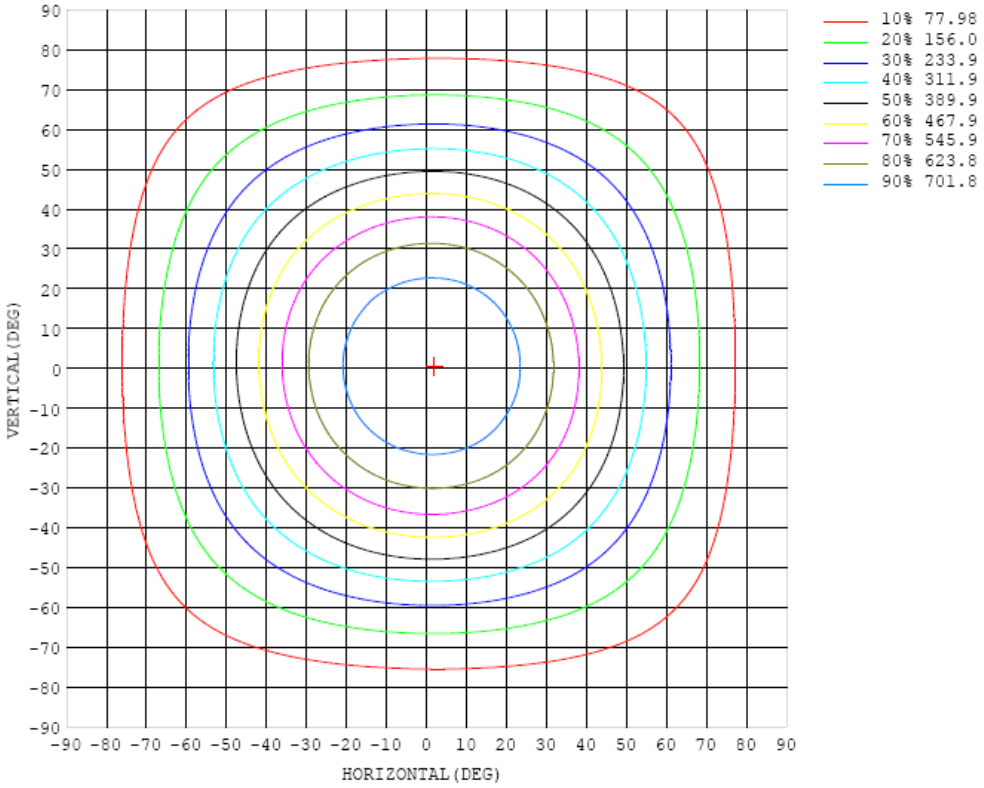


Chart 5: Isocandela Plot

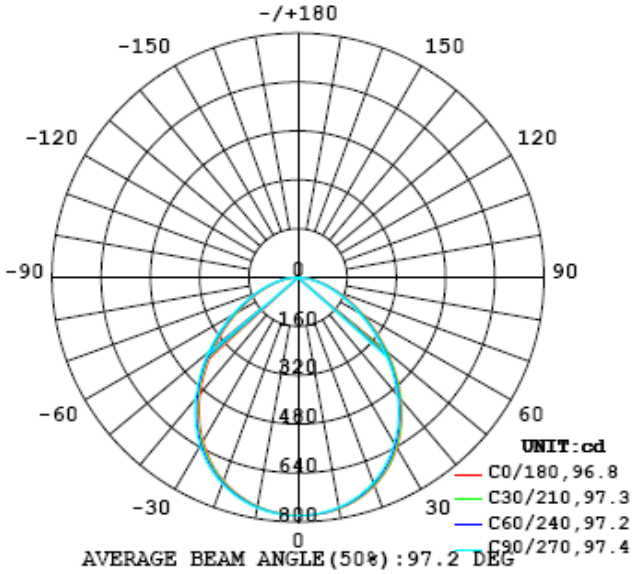


Chart 6: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1 UNIT: cd

C(DEG) / γ (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	779	779	779	779	779	779	779	779	779	779	779	779	779	779	779	779	779	779	779
5	778	777	777	777	777	777	776	776	775	775	775	774	774	774	774	774	774	774	773
10	769	768	767	767	767	766	765	765	763	763	762	762	761	761	760	760	760	760	760
15	751	751	750	749	749	748	746	745	743	743	741	741	740	739	738	738	738	738	739
20	725	725	724	723	721	720	718	717	715	713	712	710	709	708	708	708	707	707	708
25	690	689	688	686	685	683	681	679	676	674	672	670	669	667	667	666	666	667	668
30	643	642	641	639	638	635	633	630	627	625	623	620	618	616	615	615	615	616	618
35	586	586	585	583	581	578	575	572	569	567	564	561	559	556	555	555	555	557	559
40	521	521	520	519	516	513	509	507	504	502	499	496	493	489	488	488	489	490	494
45	451	451	451	449	446	443	439	436	434	432	429	426	423	420	418	418	419	421	425
50	380	380	378	376	374	371	368	365	362	360	358	356	354	351	350	350	351	353	356
55	310	310	308	306	304	301	298	296	294	291	290	288	287	285	284	285	286	287	290
60	247	245	243	241	239	237	234	232	230	228	227	226	225	225	225	225	226	227	229
65	190	188	186	184	182	180	177	175	173	172	171	171	171	171	171	172	173	174	175
70	139	137	135	133	131	129	127	126	124	123	123	122	122	123	123	124	125	126	128
75	95.3	93.6	91.7	89.9	88.2	86.7	85.1	83.8	82.5	81.6	81.0	80.8	80.9	81.2	81.7	82.4	83.4	84.3	86.2
80	58.5	57.4	56.0	54.5	53.1	51.7	50.6	49.4	48.5	47.7	47.2	47.0	47.0	47.2	47.6	48.3	49.1	50.0	51.3
85	29.6	28.6	27.6	26.6	25.6	24.7	23.9	23.1	22.5	22.0	21.7	21.5	21.5	21.6	21.9	22.4	23.0	23.9	24.9
90	10.3	9.80	9.23	8.64	8.12	7.66	7.24	6.87	6.79	6.53	6.39	6.34	6.35	6.44	6.66	6.73	7.11	7.59	8.11
95	1.39	1.19	1.01	0.84	0.71	0.59	0.50	0.44	0.42	0.41	0.42	0.45	0.48	0.51	0.56	0.63	0.71	0.82	0.98
100	0.07	0.07	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	0.09
105	0.10	0.10	0.10	0.10	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.13
110	0.13	0.13	0.13	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	0.14	0.14	0.17
115	0.17	0.17	0.18	0.18	0.18	0.18	0.18	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.21
120	0.22	0.22	0.22	0.22	0.22	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.24	0.23	0.23	0.23	0.23	0.23	0.25
125	0.27	0.27	0.27	0.27	0.28	0.28	0.28	0.28	0.28	0.28	0.29	0.29	0.29	0.29	0.29	0.29	0.28	0.28	0.32
130	0.33	0.33	0.33	0.33	0.34	0.34	0.34	0.34	0.34	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.40
135	0.40	0.40	0.40	0.40	0.41	0.41	0.41	0.41	0.41	0.41	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.41	0.51
140	0.46	0.47	0.47	0.47	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.49	0.49	0.49	0.49	0.49	0.49	0.48	0.62
145	0.52	0.53	0.53	0.53	0.53	0.54	0.54	0.54	0.54	0.54	0.54	0.55	0.55	0.54	0.54	0.54	0.54	0.54	0.71
150	0.57	0.57	0.57	0.58	0.58	0.58	0.58	0.58	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.79
155	0.62	0.62	0.62	0.62	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.64	0.64	0.63	0.63	0.63	0.63	0.63	0.84
160	0.67	0.67	0.67	0.67	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.87
165	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.72	0.72	0.72	0.72	0.72	0.72	0.71	0.88
170	0.74	0.74	0.74	0.74	0.74	0.74	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.74	0.87
175	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.84
180	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81

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	779	779	779	779	779	779	779	779	779	779	779	779	779	779	779	779	779		
5	774	774	774	774	775	775	776	775	776	776	777	777	777	778	778	778	778		
10	760	760	761	762	763	763	764	765	766	766	767	768	768	768	769	769	769		
15	739	740	740	742	743	743	745	746	747	748	749	750	751	752	752	752	752		
20	709	710	711	712	714	715	717	718	720	721	723	724	725	726	726	726	726		
25	669	671	672	674	676	678	680	682	684	685	687	688	689	690	690	690	690		
30	620	621	624	626	629	631	633	635	638	639	641	642	642	643	643	643	643		
35	562	565	567	570	572	574	577	580	583	585	586	586	586	586	586	586	586		
40	498	501	504	506	508	511	513	517	520	521	522	522	521	521	520	520	520		
45	429	432	435	438	440	442	445	448	452	454	454	454	452	451	450	450	450		
50	360	363	366	368	370	373	376	379	382	384	384	384	382	381	380	380	380		
55	293	296	298	301	303	305	308	311	313	315	316	316	315	314	313	312	312		
60	231	234	236	239	241	243	245	247	250	251	252	253	252	252	251	250	249		
65	177	179	181	183	185	187	189	190	192	194	195	195	196	195	195	194	192		
70	129	131	133	135	136	138	140	141	143	144	145	146	146	146	145	144	142		
75	87.6	89.2	90.9	92.4	94.0	95.6	96.9	98.0	99.2	100	101	101	101	101	100	98.9	97.5		
80	52.6	54.0	55.6	57.0	58.3	59.7	60.7	61.6	62.4	63.0	63.3	63.5	63.3	62.9	62.2	61.2	60.1		
85	26.0	27.0	28.2	29.3	30.3	31.3	32.1	32.7	33.2	33.5	33.7	33.6	33.3	32.9	32.3	31.5	30.6		
90	8.74	9.37	10.0	10.6	11.2	11.8	12.2	12.8	13.1	13.2	13.2	13.1	12.9	12.5	11.8	11.3	10.8		
95	1.14	1.31	1.48	1.66	1.86	2.02	2.17	2.29	2.39	2.44	2.45	2.42	2.31	2.19	2.01	1.82	1.62		
100	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.08	0.08	0.08	0.09	0.08	0.08	0.08	0.09	0.09	0.09		
105	0.13	0.13	0.13	0.13	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		
110	0.17	0.17	0.17	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16		
115	0.21	0.21	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.19	0.19	0.19	0.19	0.19	0.19	0.20	0.20		
120	0.25	0.25	0.25	0.25	0.25	0.25	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24		
125	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30		
130	0.40	0.40	0.40	0.40	0.40	0.40	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39		
135	0.51	0.51	0.51	0.51	0.51	0.50	0.50	0.50	0.50	0.50	0.49	0.49	0.49	0.49	0.49	0.49	0.49		
140	0.62	0.62	0.61	0.61	0.61	0.61	0.61	0.61	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60		
145	0.72	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70		
150	0.79	0.79	0.79	0.79	0.79	0.79	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.77	0.77	0.78	0.78		
155	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83		
160	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87		
165	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89		
170	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87		
175	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.85	0.85		
180	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81		

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 recorder	JM624U	HZTE018-08	Aug. 17, 2017	Aug. 16, 2018
Temperature and humidity recorder	JR900	HZTE018-01	Aug. 16, 2017	Aug. 15, 2018
Standard source	D908	HZTE012-01	Aug. 20, 2017	Aug. 19, 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
Standard source	SCL-1400	HZTE012-02	Aug. 20, 2017	Aug. 19, 2018
Temperature and humidity recorder	JR900	HZTE018-02	Aug. 16, 2017	Aug. 15, 2018
Temperature Meter	TES1310	HZTE017-01	Aug. 17, 2017	Aug. 16, 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 LED 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 LED 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

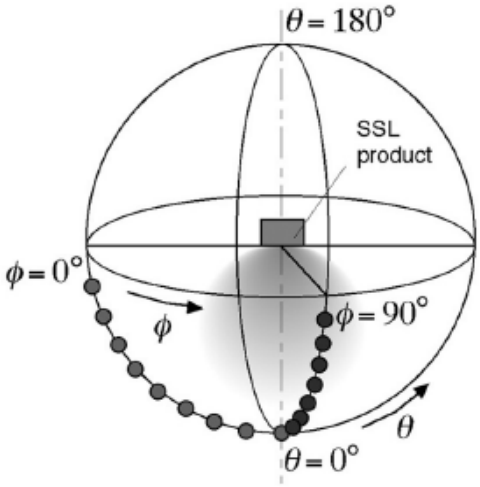
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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