

## **LM-79-08 Test Report**

for

### **GREEN CREATIVE LTD**

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

### **Vertically-Mounted Lamps**

**Model: 17PLV/835/DIR**

### **Laboratory: Leading Testing Laboratories**

**NVLAP CODE: 200960-0**

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Report No.: HZ18050048b

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

Review by:



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: 17PLV/835/DIR

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
100.4	2077.0	20.68	0.9947
CCT (K)	CRI	Stabilization Time (Light & Power)	
3406	84.4	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)

<b>Name</b>	: Vertically-Mounted Lamps
<b>Model</b>	: 17PLV/835/DIR
<b>Electrical Ratings</b>	: 120-277V, 50/60Hz, 17W
<b>Product Description</b>	: 3500K LED Tubes supplied by a high frequency fluorescent lamp ballast: C2642UNVBE
<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	277.0
Voltage frequency (Hz)	60	60
Test Current (A)	0.173	0.078
Power Factor	0.9947	0.9723
Test Power (W)	20.68	20.87
THD A%	8.33	7.99
Luminous Efficacy (lm/W)	100.4	99.3
Total Luminous Flux (lm)	2077.0	2073.0
Color Rendering Index (CRI)	84.4	
R9	13.4	
Correlated Color Temperature (CCT)(K)	3406	
Chromaticity Chroma x	0.4107	
Chromaticity Chroma y	0.3936	
Chromaticity Chroma u	0.2380	
Chromaticity Chroma v	0.3422	
Duv	0.0003	
Chromaticity Chroma u'	0.2380	
Chromaticity Chroma v'	0.5133	

Special Color Rendering Indices	
R1	82.9
R2	91.3
R3	96.8
R4	83.2
R5	83.3
R6	89
R7	85.1
R8	63.7
R9	13.4
R10	79.9
R11	82.9
R12	71.2
R13	85
R14	98.7
Rf	84
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 25.0°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)	0.175
Power Factor	0.9949
Test Power (W)	20.86
Luminous Efficacy (lm/W)	102.0
Total Luminous Flux (lm)	2128.3
Beam Angle (°)	97.0
Center Beam Candle Power (cd)	880
Spacing Criteria	1.20 (0°-180°)/ 1.21 (90°-270°)
Zonal Lumens in the 0°-60°Zone	82.90%
Zonal Lumens in the 60°-90°Zone	16.80%
Zonal Lumens in the 90°-120°Zone	0.21%
Zonal Lumens in the 120°-180°Zone	0.09%

Table 3: Test data per Goniophotometer Method

## Spectral Power Distribution - Sphere Spectroradiometer Method

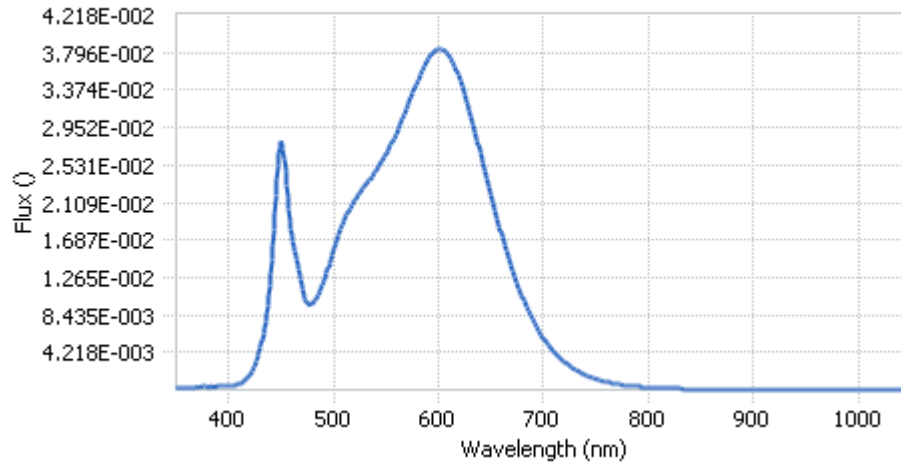


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	3.41E-04	485	1.06E-02	590	3.72E-02	695	6.73E-03
385	3.55E-04	490	1.20E-02	595	3.80E-02	700	5.79E-03
390	3.71E-04	495	1.39E-02	600	3.82E-02	705	4.94E-03
395	4.00E-04	500	1.58E-02	605	3.82E-02	710	4.27E-03
400	4.46E-04	505	1.76E-02	610	3.76E-02	715	3.65E-03
405	5.19E-04	510	1.91E-02	615	3.65E-02	720	3.14E-03
410	6.80E-04	515	2.04E-02	620	3.49E-02	725	2.69E-03
415	1.03E-03	520	2.14E-02	625	3.32E-02	730	2.29E-03
420	1.67E-03	525	2.22E-02	630	3.10E-02	735	1.96E-03
425	2.80E-03	530	2.29E-02	635	2.89E-02	740	1.67E-03
430	4.70E-03	535	2.38E-02	640	2.65E-02	745	1.43E-03
435	7.73E-03	540	2.47E-02	645	2.42E-02	750	1.23E-03
440	1.30E-02	545	2.56E-02	650	2.20E-02	755	1.05E-03
445	2.18E-02	550	2.65E-02	655	1.97E-02	760	9.05E-04
450	2.80E-02	555	2.77E-02	660	1.75E-02	765	7.77E-04
455	2.31E-02	560	2.90E-02	665	1.55E-02	770	6.62E-04
460	1.74E-02	565	3.04E-02	670	1.36E-02	775	5.68E-04
465	1.46E-02	570	3.18E-02	675	1.19E-02	780	4.90E-04
470	1.17E-02	575	3.33E-02	680	1.04E-02		
475	9.79E-03	580	3.48E-02	685	9.03E-03		
480	9.80E-03	585	3.61E-02	690	7.80E-03		

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



## Chromaticity Diagram - Sphere Spectroradiometer Method

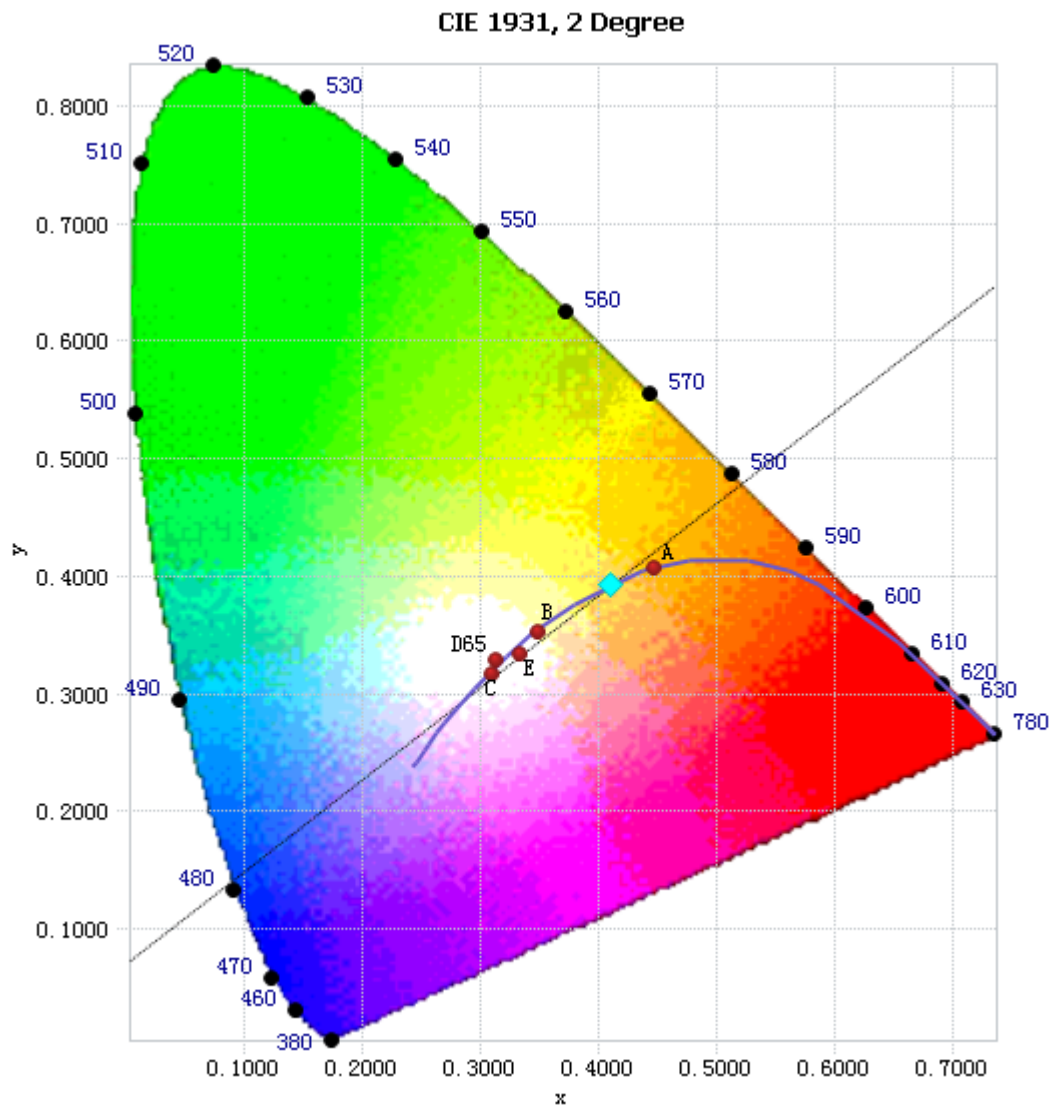


Chart 2: Chromaticity Diagram per Sphere - Spectroradiometer Method

Note: The location on the diagram of the tristimulus coordinates are indicated by the blue diamond.



## Nominal CCT Quadrangles – Sphere Spectroradiometer Method

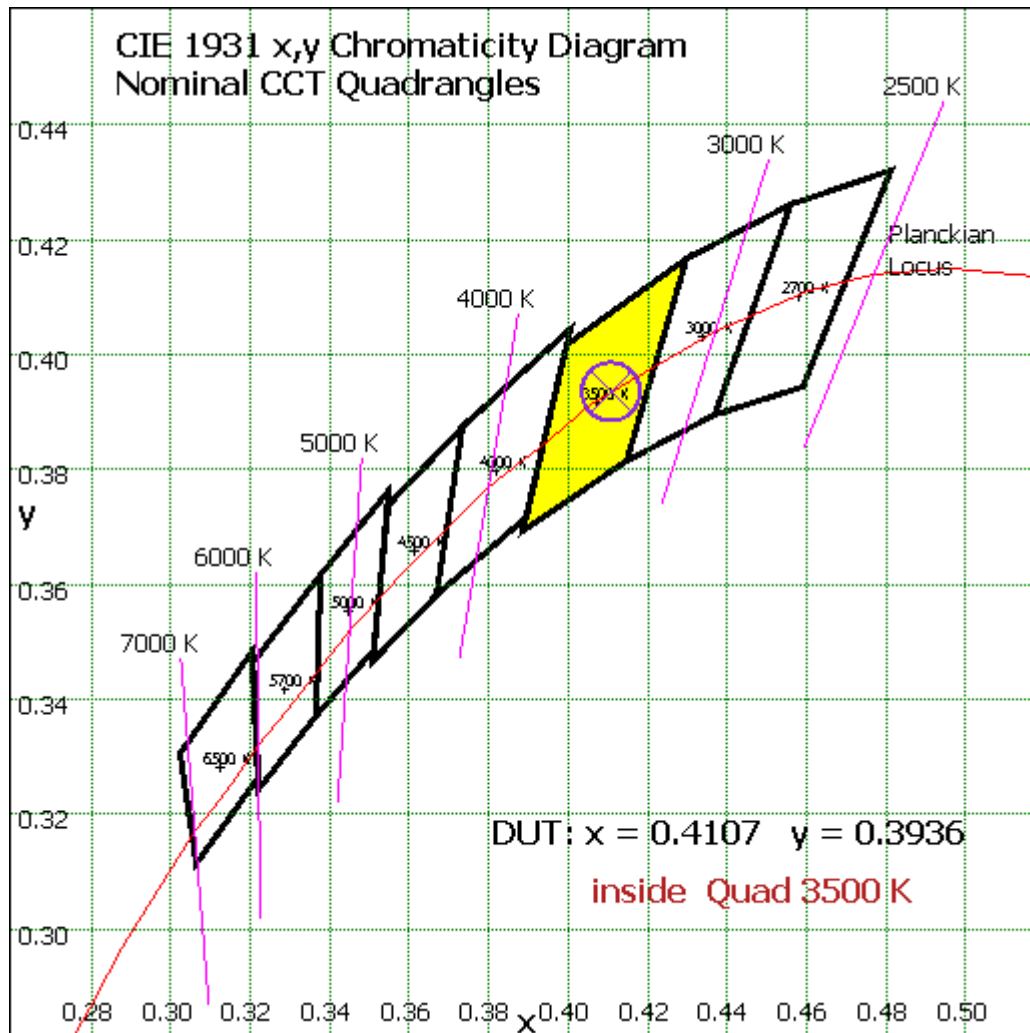


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

### Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	83.219	3.91%
10- 20	237.121	11.14%
20- 30	352.297	16.55%
30- 40	403.643	18.97%
40- 50	382.256	17.96%
50- 60	305.931	14.37%
60- 70	207.495	9.75%
70- 80	111.979	5.26%
80- 90	37.976	1.78%
90-100	4.147	0.19%
100-110	0.169	0.01%
110-120	0.218	0.01%
120-130	0.298	0.01%
130-140	0.391	0.02%
140-150	0.434	0.02%
150-160	0.385	0.02%
160-170	0.26	0.01%
170-180	0.09	0.00%
Total	2128.3	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	1764.467	82.90%
60- 90	357.45	16.80%
0-90	2121.917	99.70%
90- 180	6.392	0.30%
0- 180	2128.3	100%

Table 5: Zonal Lumen Data

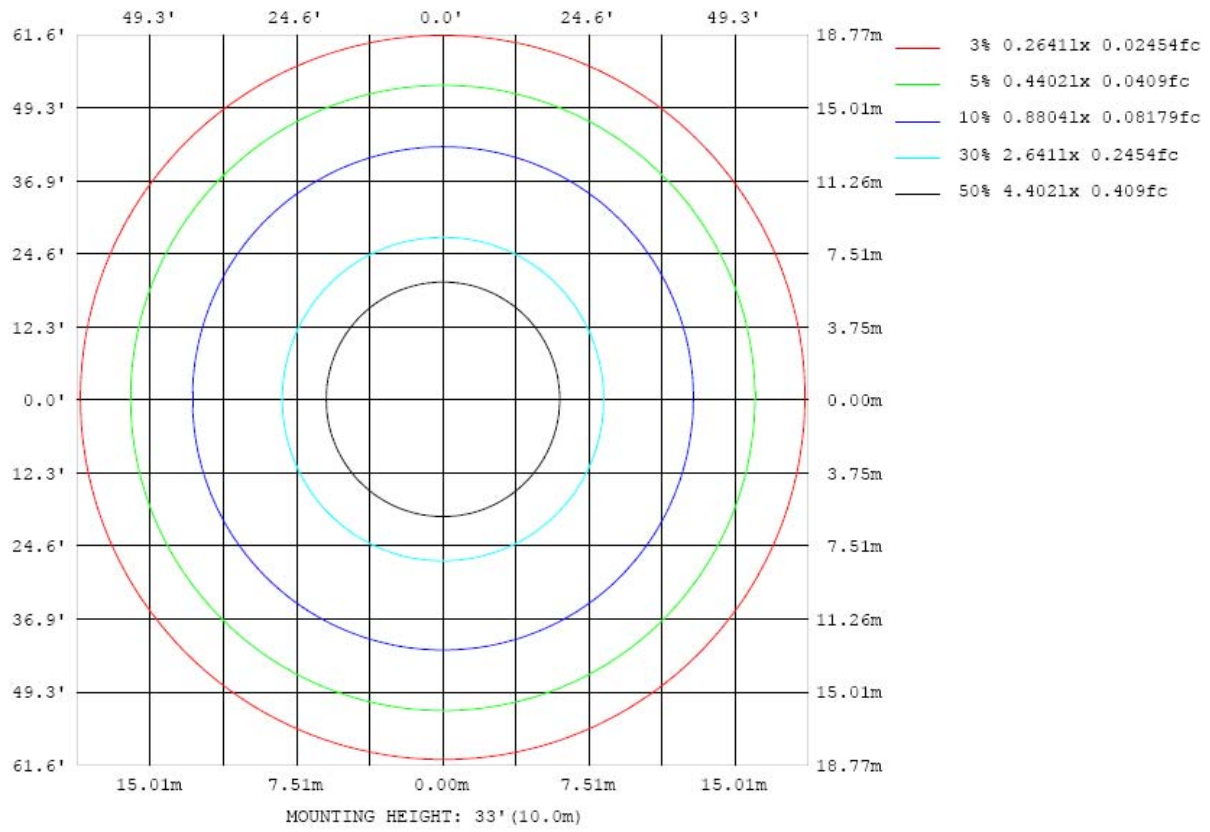


Chart 4: Illuminance Plot (Footcandles)

## Luminous Intensity Distribution Plots- Goniophotometer Method

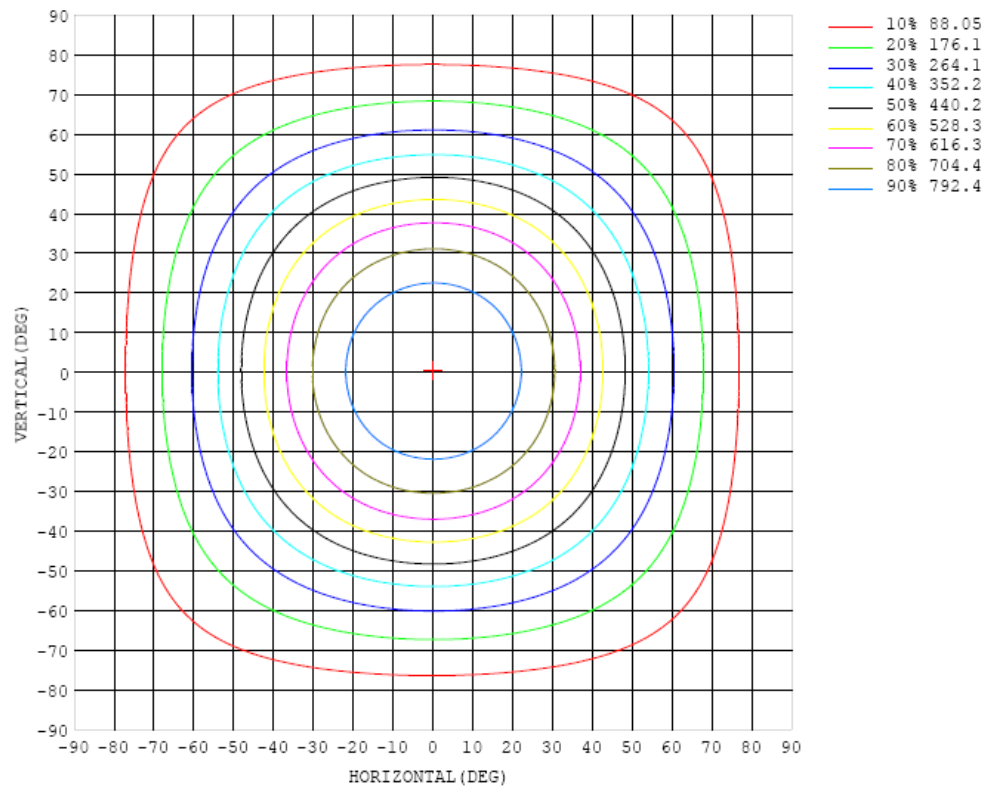


Chart 5: Isocandela Plot

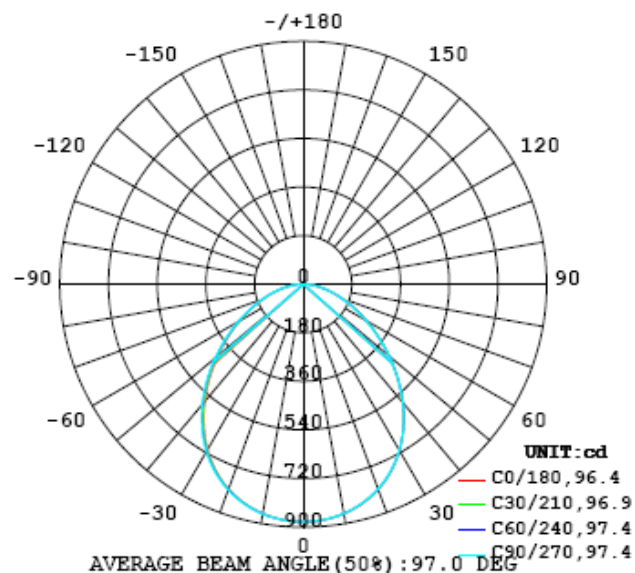


Chart 6: Polar Candela Distribution

## Luminous Intensity Data- Goniophotometer Method

Table--1

UNIT: cd

C (DEG) γ (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	880	880	880	880	880	880	880	880	880	880	880	880	880	880	880	880	880	880	880
5	877	876	876	876	876	876	876	876	876	876	876	876	876	876	876	876	875	876	876
10	864	864	863	863	863	863	862	862	862	862	862	862	862	862	862	862	862	862	862
15	842	841	841	841	840	840	840	840	840	840	840	839	840	840	840	839	840	840	840
20	810	809	809	808	808	808	808	808	808	808	807	807	807	807	807	807	807	807	807
25	767	766	765	765	765	765	765	765	765	764	764	764	764	764	763	763	763	763	763
30	712	711	710	710	711	710	710	710	711	710	710	710	710	709	708	708	707	707	707
35	645	644	645	645	646	646	646	646	645	645	645	645	645	644	643	642	640	640	640
40	570	570	570	572	573	574	573	573	572	572	572	572	572	571	569	568	566	566	566
45	492	491	492	493	495	496	495	495	494	493	493	493	493	493	491	490	488	488	488
50	413	413	413	414	415	416	415	415	414	414	413	414	414	414	413	412	411	411	411
55	339	338	338	338	338	339	338	338	337	337	337	337	337	337	337	337	338	338	338
60	270	270	268	268	267	267	267	267	267	266	266	266	266	266	267	268	269	270	270
65	209	207	206	205	204	204	204	203	203	203	203	203	203	204	205	206	207	208	209
70	153	152	151	150	149	148	148	148	148	148	147	148	148	149	150	151	152	153	155
75	104	103	102	101	101	100	100	99.9	99.9	100	100	100	101	102	102	103	104	105	106
80	63.2	62.4	61.7	61.4	60.9	60.8	60.8	60.7	60.8	60.9	61.1	61.4	61.7	62.3	62.6	63.6	64.3	65.4	65.4
85	31.5	31.0	30.7	30.4	30.2	30.2	30.2	30.2	30.4	30.6	30.8	31.0	31.3	31.6	32.0	32.5	32.9	33.3	33.6
90	11.4	11.2	11.0	10.9	10.8	10.7	10.6	10.6	10.7	10.8	10.9	11.1	11.4	11.6	11.9	12.1	12.4	12.6	12.9
95	2.26	2.19	2.13	2.04	1.92	1.77	1.61	1.49	1.43	1.43	1.51	1.67	1.87	2.07	2.27	2.43	2.59	2.72	2.79
100	0.35	0.31	0.24	0.16	0.10	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.10	0.16	0.26	0.37	0.47	0.54	0.56
105	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	0.15
110	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	0.16	0.16	0.16	0.16	0.19
115	0.21	0.20	0.20	0.20	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.23
120	0.26	0.25	0.25	0.25	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.28
125	0.32	0.31	0.31	0.31	0.31	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.31	0.32	0.35
130	0.40	0.38	0.38	0.39	0.39	0.39	0.39	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.39	0.39	0.39	0.40	0.45
135	0.49	0.46	0.46	0.46	0.46	0.47	0.47	0.47	0.48	0.48	0.48	0.48	0.48	0.47	0.47	0.47	0.46	0.49	0.57
140	0.60	0.53	0.54	0.54	0.54	0.54	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.54	0.59	0.69
145	0.70	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.59	0.69	0.80
150	0.80	0.65	0.65	0.65	0.65	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.65	0.77	0.89
155	0.89	0.70	0.71	0.71	0.71	0.72	0.72	0.72	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.72	0.70	0.85	0.95
160	0.97	0.75	0.76	0.76	0.76	0.76	0.76	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.76	0.94	0.99
165	1.02	0.83	0.80	0.80	0.81	0.81	0.81	0.81	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.81	0.83	1.00	1.00
170	1.00	0.96	0.82	0.83	0.83	0.83	0.84	0.84	0.84	0.84	0.85	0.85	0.84	0.84	0.84	0.84	0.93	0.98	0.99
175	0.95	0.95	0.96	0.94	0.91	0.92	0.92	0.92	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.94	0.94	0.95	0.95
180	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93

Table 6: Luminous Intensity Data

Table--2

UNIT: cd

$\gamma$ (DEG) C (DEG)	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350		
0	880	880	880	880	880	880	880	880	880	880	880	880	880	880	880	880	880		
5	876	876	876	876	876	876	876	877	877	877	877	877	877	877	877	877	877		
10	863	863	863	863	863	864	864	864	864	865	864	865	864	864	864	864	864		
15	840	841	841	841	842	842	842	843	843	843	843	843	843	843	842	842	842		
20	808	808	809	809	810	810	811	811	812	812	812	812	812	811	811	810	810		
25	764	765	766	766	767	768	769	770	770	770	770	770	769	769	768	767	767		
30	708	709	711	712	714	715	715	716	717	717	717	717	716	715	714	713	712		
35	641	643	646	648	650	651	652	653	654	654	654	654	653	651	649	647	646		
40	567	570	573	576	578	579	580	581	582	582	583	583	582	579	576	573	571		
45	490	493	496	499	501	502	504	504	505	505	506	505	504	502	499	495	493		
50	413	415	418	420	422	424	425	425	426	426	427	427	425	423	420	417	415		
55	339	341	343	345	346	347	348	349	349	350	350	349	348	347	345	343	341		
60	272	272	274	275	276	276	277	278	278	278	278	278	277	276	275	273	272		
65	210	211	211	212	212	213	213	214	214	214	214	213	213	212	211	211	210		
70	156	156	157	157	158	158	158	158	158	158	158	158	157	156	156	155	154		
75	107	108	109	109	109	109	110	110	110	109	109	109	108	107	107	106	105		
80	66.0	66.7	67.3	67.7	68.0	68.3	68.5	68.5	68.5	68.3	67.9	67.3	66.6	65.9	65.1	64.6	63.9		
85	34.1	34.7	35.3	35.7	35.9	36.2	36.3	36.4	36.3	36.1	35.8	35.3	34.7	34.0	33.4	32.8	32.2		
90	13.3	13.6	13.9	14.3	14.4	14.7	14.6	14.7	14.7	14.5	14.3	14.0	13.8	13.2	12.8	12.2	11.8		
95	2.95	3.13	3.25	3.29	3.27	3.21	3.11	3.00	2.94	2.92	2.92	2.90	2.85	2.73	2.61	2.49	2.40		
100	0.55	0.50	0.43	0.35	0.28	0.23	0.23	0.23	0.22	0.18	0.13	0.12	0.18	0.25	0.32	0.37	0.39		
105	0.15	0.15	0.14	0.14	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		
110	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		
115	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	0.23	0.23		
120	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	0.28		
125	0.35	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	0.35		
130	0.44	0.44	0.43	0.43	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.43	0.43	0.43	0.43	0.44		
135	0.56	0.55	0.55	0.54	0.54	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.54	0.54	0.55	0.55	0.57		
140	0.68	0.67	0.67	0.66	0.66	0.66	0.65	0.65	0.65	0.65	0.65	0.66	0.66	0.66	0.67	0.68	0.69		
145	0.79	0.79	0.78	0.78	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.78	0.78	0.78	0.79	0.81		
150	0.88	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	0.88	0.88	0.90		
155	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.95	0.95	0.96		
160	0.98	0.98	0.98	0.97	0.97	0.97	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.99	0.99	1.00		
165	1.00	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02		
170	0.99	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.00	1.00		
175	0.95	0.95	0.95	0.95	0.95	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.95		
180	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93		

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  $4\pi$ . 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 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 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 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 expanded uncertainty is 2.3% with a coverage factor  $k=2$ .

### **Color Characteristics Measurements**

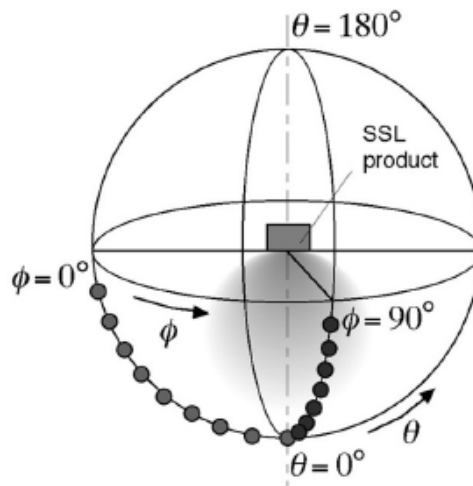
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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