



## LM-79-08 Test Report

for

### GREEN CREATIVE LTD

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

### Vertically-Mounted Lamps

**Model: 17PLV/830/DIR**

### Laboratory: Leading Testing Laboratories

**NVLAP CODE: 200960-0**

3rd Floor, Bld. 2, NO. 96 Longchuanwu Rd Qianjiang Economy Dev. Zone, Yuhang Dist,  
Hangzhou, Zhejiang Province, China 311100

Tel: +86 571 86376106

[www.ledtestlab.com](http://www.ledtestlab.com)

Report No.: HZ18050048a

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/830/DIR

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
102.0	2099.0	20.58	0.9947
CCT (K)	CRI	Stabilization Time (Light & Power)	
3056	83.1	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

## TABLE OF CONTENT

LM-79-08 Test Report.....	1
Test Summary.....	2
Sample Photos.....	4
TEST RESULTS .....	5
Goniophotometer Method .....	6
Spectral Power Distribution - Sphere Spectroradiometer Method .....	7
Chromaticity Diagram - Sphere Spectroradiometer Method.....	8
Nominal CCT Quadrangles – Sphere Spectroradiometer Method .....	9
Zonal Lumen Tabulation- Goniophotometer Method .....	10
Luminous Intensity Distribution Plots- Goniophotometer Method.....	12
Luminous Intensity Data- Goniophotometer Method.....	13
EQUIPMENT LIST .....	15
TEST METHODS .....	15
Seasoning of SSL Product.....	15
Sphere-Spectroradiometer Method- Photometric and Electrical Measurements.....	15
Goniophotometer Method .....	16
Photometric and Electrical Measurements.....	16
Color Characteristics Measurements.....	16
Color Spatial Uniformity .....	16

## Sample Photos



Figure 1- Overview of the sample

### Equipment Under Test (EUT)

<b>Name</b>	: Vertically-Mounted Lamps
<b>Model</b>	: 17PLV/830/DIR
<b>Electrical Ratings</b>	: 120-277V, 50/60Hz, 17W
<b>Product Description</b>	: 3000K 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)	0.172	0.077
Power Factor	0.9947	0.9724
Test Power (W)	20.58	20.76
THD A%	8.32	7.89
Luminous Efficacy (lm/W)	102.0	101.1
Total Luminous Flux (lm)	2099.0	2098.0
Color Rendering Index (CRI)	83.1	
R9	9	
Correlated Color Temperature (CCT)(K)	3056	
Chromaticity Chroma x	0.4294	
Chromaticity Chroma y	0.3953	
Chromaticity Chroma u	0.2495	
Chromaticity Chroma v	0.3445	
Duv	0.0025	
Chromaticity Chroma u'	0.2495	
Chromaticity Chroma v'	0.5168	

Special Color Rendering Indices	
R1	82.4
R2	93.4
R3	93.9
R4	80.2
R5	83
R6	91.8
R7	81.1
R8	58.7
R9	9
R10	84.7
R11	79.6
R12	75.1
R13	85.4
R14	97.4
Rf	83
Rg	95

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)	0.174
Power Factor	0.9949
Test Power (W)	20.73
Luminous Efficacy (lm/W)	103.6
Total Luminous Flux (lm)	2146.8
Beam Angle (°)	97.4
Center Beam Candle Power (cd)	883
Spacing Criteria	1.18 (0°-180°)/ 1.20 (90°-270°)
Zonal Lumens in the 0°-60°Zone	82.84%
Zonal Lumens in the 60°-90°Zone	16.81%
Zonal Lumens in the 90°-120°Zone	0.26%
Zonal Lumens in the 120°-180°Zone	0.09%

Table 3: Test data per Goniophotometer Method

## Spectral Power Distribution - Sphere Spectroradiometer Method

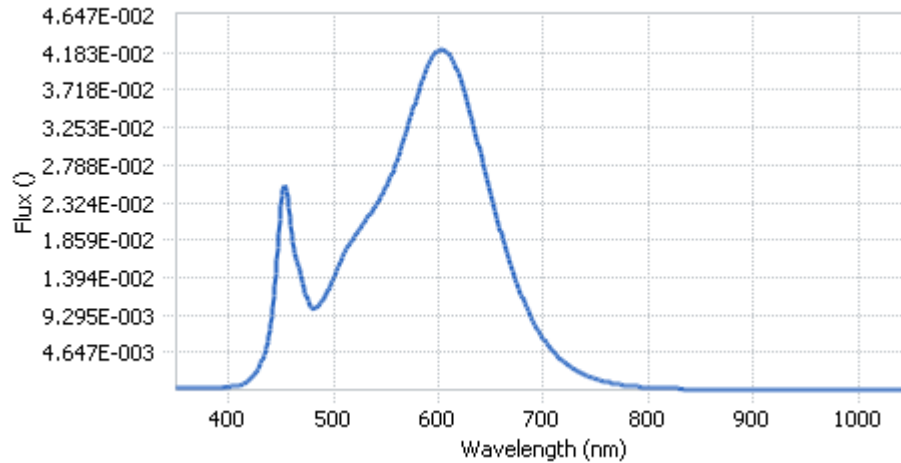


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	3.32E-04	485	1.04E-02	590	4.03E-02	695	7.34E-03
385	3.42E-04	490	1.12E-02	595	4.14E-02	700	6.33E-03
390	3.41E-04	495	1.24E-02	600	4.20E-02	705	5.42E-03
395	3.60E-04	500	1.39E-02	605	4.21E-02	710	4.63E-03
400	3.70E-04	505	1.55E-02	610	4.16E-02	715	3.99E-03
405	4.61E-04	510	1.68E-02	615	4.05E-02	720	3.43E-03
410	5.84E-04	515	1.82E-02	620	3.87E-02	725	2.91E-03
415	8.29E-04	520	1.92E-02	625	3.68E-02	730	2.51E-03
420	1.25E-03	525	2.00E-02	630	3.43E-02	735	2.13E-03
425	1.99E-03	530	2.09E-02	635	3.19E-02	740	1.82E-03
430	3.14E-03	535	2.18E-02	640	2.93E-02	745	1.56E-03
435	5.01E-03	540	2.29E-02	645	2.67E-02	750	1.34E-03
440	8.27E-03	545	2.40E-02	650	2.42E-02	755	1.15E-03
445	1.44E-02	550	2.52E-02	655	2.16E-02	760	9.86E-04
450	2.28E-02	555	2.67E-02	660	1.93E-02	765	8.46E-04
455	2.47E-02	560	2.84E-02	665	1.70E-02	770	7.21E-04
460	1.93E-02	565	3.03E-02	670	1.49E-02	775	6.25E-04
465	1.60E-02	570	3.24E-02	675	1.31E-02	780	5.34E-04
470	1.38E-02	575	3.45E-02	680	1.14E-02		
475	1.11E-02	580	3.67E-02	685	9.87E-03		
480	1.01E-02	585	3.86E-02	690	8.51E-03		

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



## Chromaticity Diagram - Sphere Spectroradiometer Method

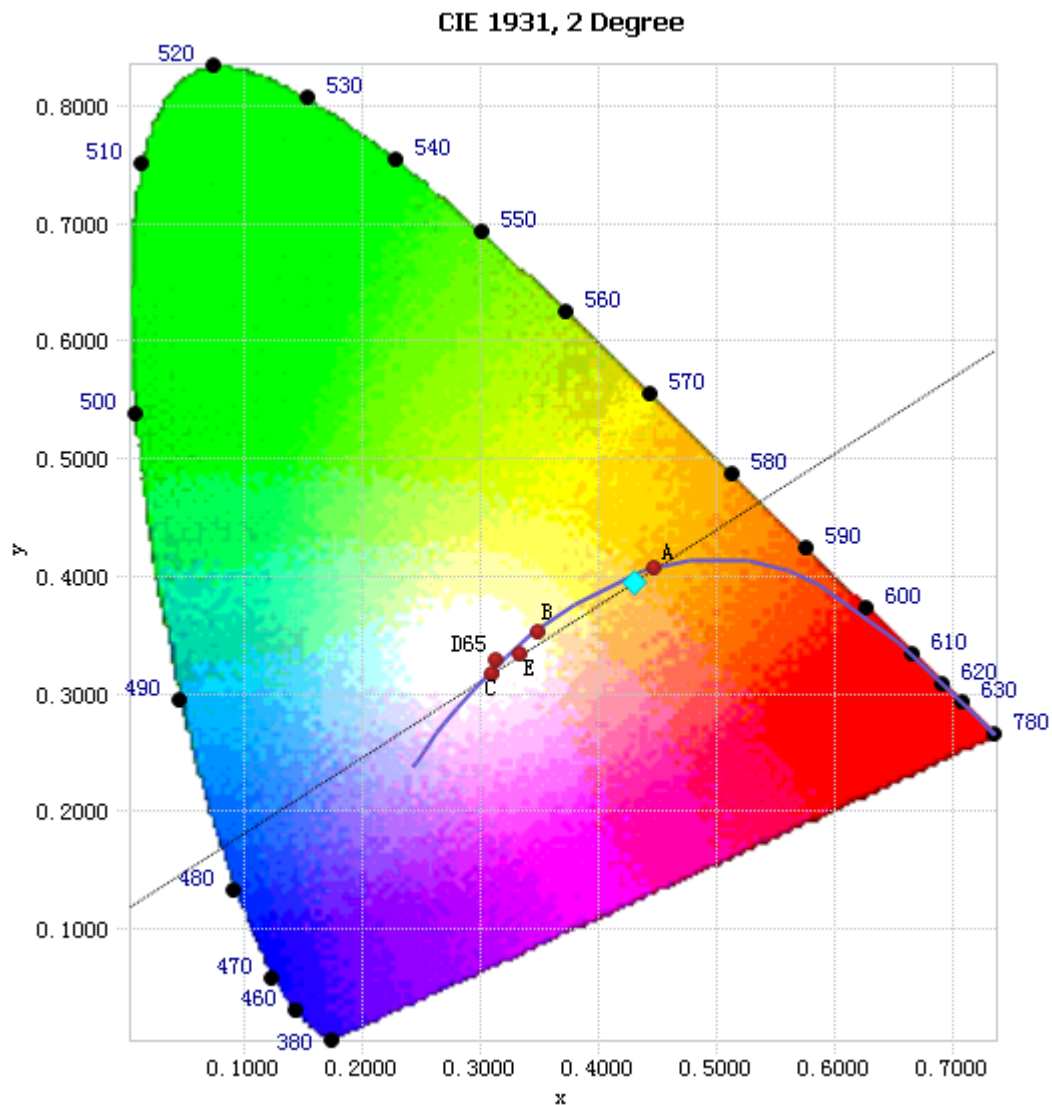


Chart 2: Chromaticity Diagram per Sphere - Spectroradiometer Method

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



### Nominal CCT Quadrangles – Sphere Spectroradiometer Method

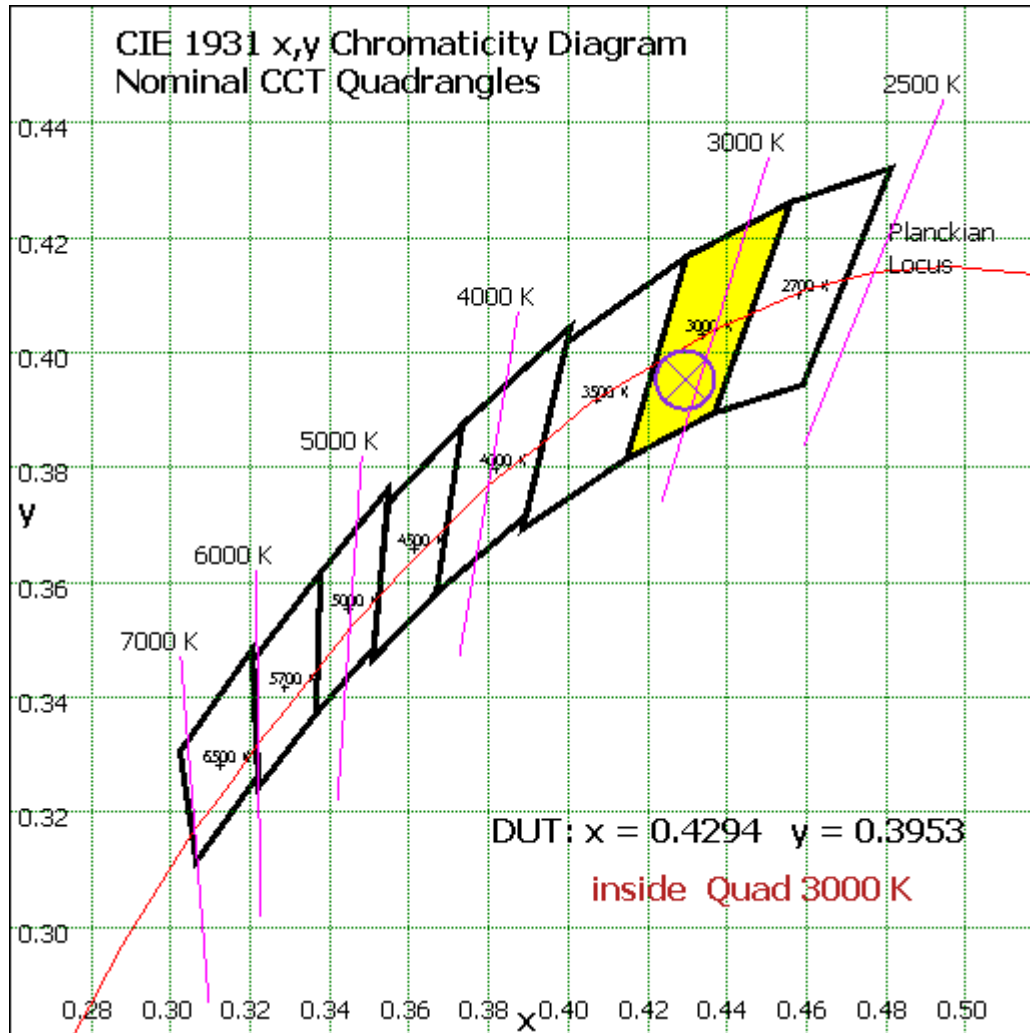


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

### Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	83.53	3.89%
10- 20	238.238	11.10%
20- 30	354.511	16.51%
30- 40	407.073	18.96%
40- 50	386.252	17.99%
50- 60	308.903	14.39%
60- 70	208.848	9.73%
70- 80	112.87	5.26%
80- 90	39.144	1.82%
90-100	5.058	0.24%
100-110	0.289	0.01%
110-120	0.22	0.01%
120-130	0.304	0.01%
130-140	0.4	0.02%
140-150	0.44	0.02%
150-160	0.384	0.02%
160-170	0.257	0.01%
170-180	0.088	0.00%
Total	2146.8	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	1778.507	82.84%
60- 90	360.862	16.81%
0-90	2139.369	99.65%
90- 180	7.44	0.35%
0- 180	2146.8	100%

Table 5: Zonal Lumen Data

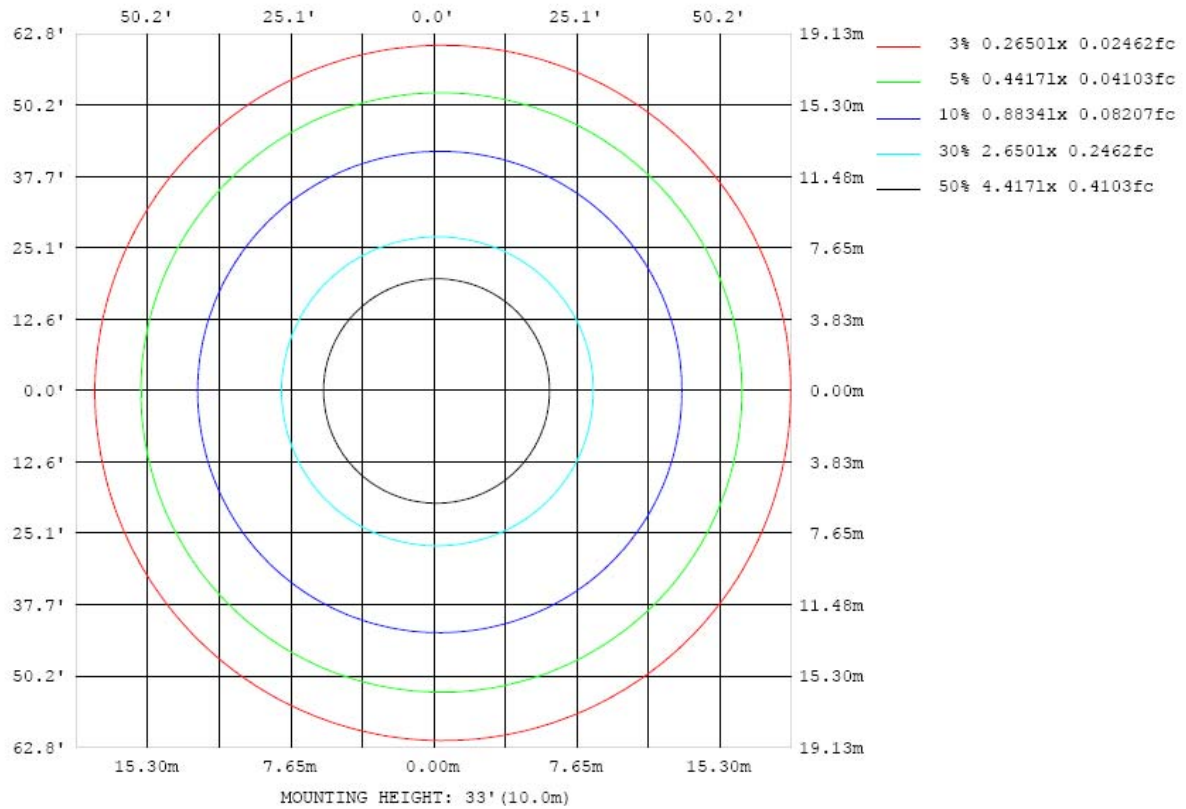


Chart 4: Illuminance Plot (Footcandles)

## Luminous Intensity Distribution Plots- Goniophotometer Method

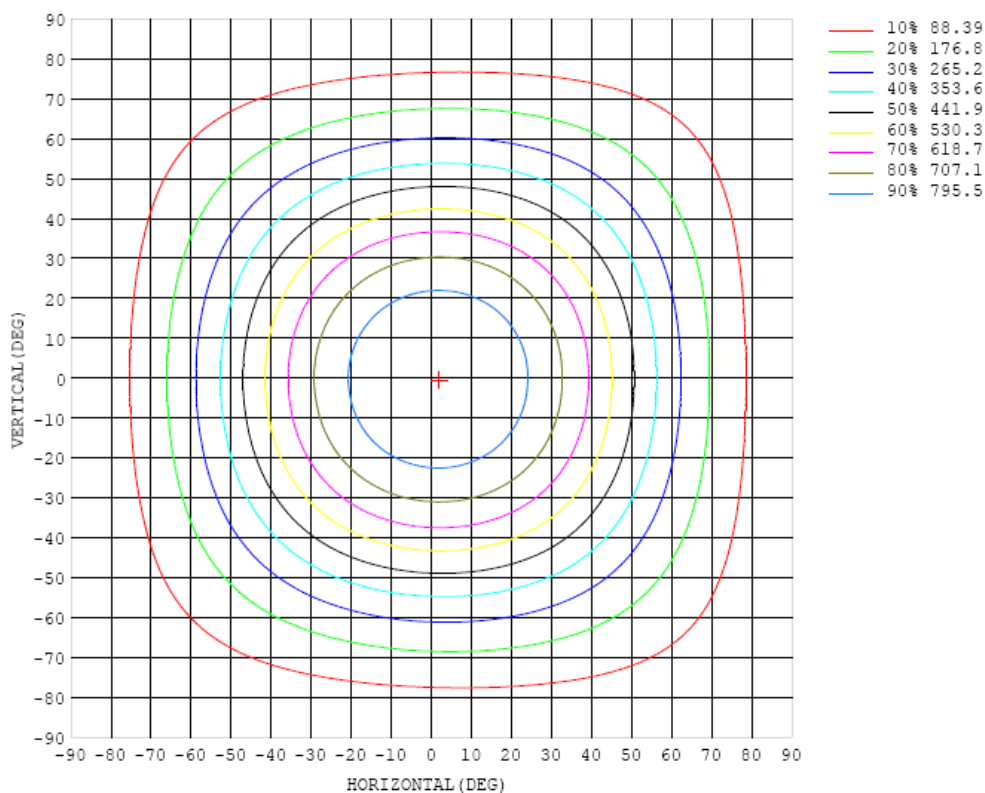


Chart 5: Isocandela Plot

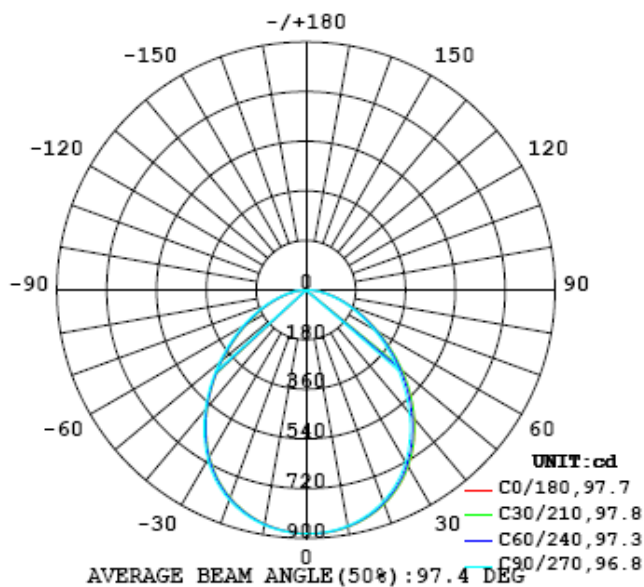


Chart 6: Polar Candela Distribution

## Luminous Intensity Data- Goniophotometer Method

Table--1

UNIT: cd

C (DEG) γ (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	883	883	883	883	883	883	883	883	883	883	883	883	883	883	883	883	883	883	883
5	882	882	882	882	882	881	881	881	880	880	879	879	878	878	877	877	877	877	876
10	872	872	872	872	871	871	870	869	868	867	867	866	865	864	863	862	862	861	861
15	854	854	854	853	852	852	850	849	848	846	845	843	842	841	839	838	838	837	837
20	826	826	826	825	824	823	821	819	817	815	813	811	809	807	806	804	803	802	802
25	788	788	788	787	785	783	781	779	776	773	770	768	765	763	761	759	757	756	756
30	738	739	738	737	736	733	730	726	723	719	716	713	710	708	705	702	700	699	698
35	678	679	678	677	675	672	667	663	658	654	651	647	645	642	639	636	633	630	631
40	608	609	609	608	606	602	596	591	586	581	577	574	571	569	566	562	559	555	555
45	532	533	533	533	530	526	520	514	508	504	499	496	493	490	487	482	479	475	475
50	452	453	454	453	451	447	441	435	430	425	421	417	414	410	406	402	399	396	395
55	373	374	374	374	372	369	364	359	354	350	345	341	337	333	329	325	322	319	319
60	298	299	299	299	298	295	292	288	284	280	276	271	267	263	259	255	252	250	250
65	230	231	232	231	231	229	226	224	221	217	213	208	204	200	196	193	191	189	189
70	171	172	172	172	172	170	168	166	164	160	157	153	149	146	142	140	137	136	136
75	120	121	121	121	120	119	118	116	113	111	108	105	101	98.7	96.1	94.0	92.1	90.7	91.0
80	76.9	77.5	77.7	77.5	77.0	76.0	74.6	72.5	71.2	68.7	66.9	64.6	62.1	60.3	58.4	56.7	55.3	54.2	54.0
85	43.1	43.5	43.5	43.2	42.6	41.8	40.6	39.3	37.8	36.2	34.7	33.2	31.9	30.6	29.3	28.2	27.3	26.5	26.3
90	18.8	19.0	19.0	18.7	18.3	17.7	17.0	16.2	15.3	14.5	13.7	12.9	12.2	11.5	10.8	10.1	9.56	9.08	8.91
95	5.48	5.50	5.61	5.58	5.31	5.12	4.85	4.39	4.09	3.76	3.44	3.11	2.78	2.45	2.11	1.80	1.56	1.44	1.54
100	0.51	0.67	0.83	0.96	1.04	1.09	1.09	1.06	0.99	0.87	0.72	0.54	0.36	0.20	0.11	0.10	0.11	0.12	0.14
105	0.12	0.13	0.18	0.28	0.36	0.40	0.42	0.40	0.35	0.27	0.18	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.16
110	0.15	0.14	0.14	0.15	0.15	0.15	0.15	0.15	0.15	0.16	0.16	0.16	0.16	0.17	0.17	0.17	0.17	0.18	0.21
115	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.20	0.20	0.20	0.20	0.21	0.21	0.22	0.22	0.22	0.22	0.23	0.25
120	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.25	0.25	0.25	0.25	0.26	0.26	0.27	0.27	0.27	0.27	0.28	0.30
125	0.30	0.29	0.30	0.30	0.30	0.30	0.30	0.31	0.31	0.31	0.31	0.32	0.32	0.33	0.33	0.33	0.33	0.34	0.37
130	0.37	0.36	0.36	0.37	0.37	0.37	0.37	0.37	0.38	0.38	0.38	0.39	0.39	0.40	0.40	0.40	0.40	0.41	0.47
135	0.44	0.44	0.44	0.44	0.45	0.45	0.45	0.45	0.46	0.46	0.46	0.47	0.47	0.47	0.48	0.48	0.48	0.48	0.59
140	0.52	0.52	0.52	0.52	0.52	0.53	0.53	0.53	0.53	0.54	0.54	0.54	0.55	0.55	0.55	0.56	0.56	0.56	0.71
145	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.60	0.60	0.60	0.61	0.61	0.61	0.62	0.62	0.62	0.62	0.62	0.82
150	0.64	0.64	0.64	0.64	0.64	0.65	0.65	0.65	0.65	0.66	0.66	0.66	0.67	0.67	0.67	0.67	0.67	0.67	0.90
155	0.70	0.70	0.70	0.70	0.70	0.70	0.71	0.71	0.71	0.71	0.71	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.96
160	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.77	0.77	0.77	0.77	0.77	0.77	0.78	0.78	0.78	0.78	0.78	1.00
165	0.80	0.80	0.80	0.80	0.80	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.82	0.82	0.82	0.81	0.81	0.81	1.00
170	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.99
175	0.90	0.90	0.90	0.90	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	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

C (DEG) γ (DEG)	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350		
0	883	883	883	883	883	883	883	883	883	883	883	883	883	883	883	883	883		
5	877	877	877	877	877	877	878	878	879	879	880	880	881	881	881	882	882		
10	862	861	862	862	862	863	864	864	866	867	868	869	870	871	871	872	872		
15	837	837	837	837	838	839	840	842	844	845	847	848	850	851	852	853	854		
20	801	802	802	802	803	805	806	808	811	813	815	817	820	822	823	825	826		
25	756	755	756	757	758	759	761	763	766	769	773	776	779	782	785	786	788		
30	698	698	698	699	700	702	704	706	710	714	718	723	727	731	734	737	738		
35	630	630	631	632	633	634	636	638	642	647	653	658	664	669	674	677	679		
40	554	555	556	557	557	558	560	562	566	572	578	585	592	599	604	607	609		
45	475	475	476	477	478	479	481	484	488	493	500	507	515	522	527	530	532		
50	395	395	396	397	399	400	403	406	409	415	421	428	435	441	446	450	453		
55	318	318	319	320	322	325	328	331	335	340	345	351	356	362	366	370	373		
60	249	249	250	251	253	256	259	263	267	270	275	279	284	288	292	295	298		
65	188	188	188	190	192	194	198	201	204	208	211	215	218	222	225	228	230		
70	135	135	136	137	139	141	144	147	150	153	156	159	162	164	167	169	171		
75	90.4	90.3	90.6	91.4	92.8	94.6	96.8	99.1	102	104	107	109	112	114	117	119	120		
80	53.5	53.2	53.4	53.8	54.7	56.0	57.5	59.4	61.4	63.5	65.8	68.0	70.1	72.2	74.1	75.8	77.2		
85	25.9	25.7	25.6	25.9	26.4	27.1	28.1	29.3	30.8	32.3	34.1	35.9	37.6	39.2	40.6	41.9	43.0		
90	8.69	8.60	8.60	8.78	9.06	9.43	9.93	10.5	11.3	12.2	13.5	14.7	15.7	16.8	17.8	18.5	19.1		
95	1.61	1.71	1.81	1.92	2.05	2.18	2.37	2.58	2.80	3.05	3.32	3.63	3.96	4.29	4.64	4.95	5.22		
100	0.17	0.28	0.41	0.55	0.66	0.77	0.85	0.90	0.92	0.89	0.82	0.73	0.62	0.51	0.42	0.39	0.45		
105	0.16	0.16	0.16	0.18	0.24	0.29	0.33	0.34	0.33	0.29	0.24	0.18	0.15	0.14	0.14	0.14	0.14		
110	0.21	0.21	0.21	0.21	0.21	0.21	0.20	0.20	0.20	0.19	0.19	0.19	0.19	0.18	0.18	0.18	0.18		
115	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.24	0.24	0.23	0.23	0.23	0.23	0.22	0.22	0.22		
120	0.31	0.31	0.31	0.31	0.30	0.30	0.30	0.30	0.30	0.29	0.29	0.28	0.28	0.28	0.27	0.27	0.27		
125	0.38	0.38	0.38	0.37	0.37	0.37	0.37	0.36	0.36	0.36	0.35	0.35	0.35	0.35	0.34	0.34	0.34		
130	0.48	0.48	0.47	0.47	0.47	0.47	0.47	0.46	0.46	0.46	0.45	0.45	0.45	0.44	0.44	0.44	0.44		
135	0.60	0.60	0.60	0.60	0.59	0.59	0.59	0.59	0.58	0.58	0.58	0.57	0.57	0.56	0.56	0.56	0.56		
140	0.72	0.72	0.72	0.71	0.71	0.71	0.71	0.71	0.70	0.70	0.69	0.69	0.69	0.68	0.68	0.68	0.68		
145	0.83	0.83	0.83	0.82	0.82	0.82	0.82	0.82	0.81	0.81	0.80	0.80	0.80	0.80	0.79	0.79	0.79		
150	0.91	0.91	0.91	0.91	0.91	0.90	0.90	0.90	0.90	0.90	0.89	0.89	0.89	0.88	0.88	0.88	0.88		
155	0.96	0.97	0.97	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.95	0.95	0.95	0.95	0.94	0.94		
160	1.00	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.99	0.99		
165	1.01	1.01	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.01	1.01	1.01	1.01		
170	0.99	0.99	0.99	0.99	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99		
175	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	0.96	0.96	0.96	0.96		
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**

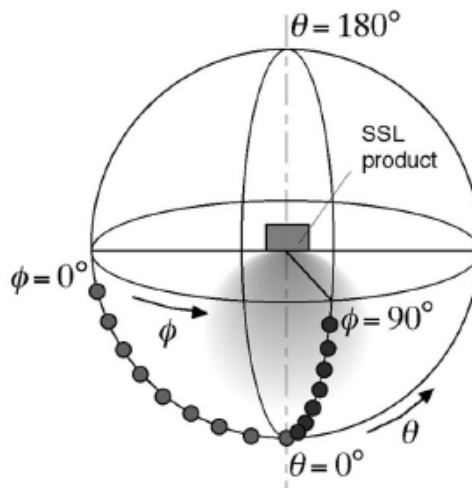
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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

This report is considered invalidated without the Special Seal for Inspection of the LTL. This report shall not be altered, increased or deleted. The results shown in this test report refer only to the sample(s) tested. Without written approval of LTL, this test report shall not be copied except in full and published as advertisement.