



## LM-79-08 Test Report

for

### GREEN CREATIVE LTD

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

### LED Tube System

**Model: 22T5HO/4F/830/EXT/A4**

(LED tube model: 22T5HO/4F/830/EXT 4pcs and LED driver model: 24T5HODRIVER/4CH 1pcs)

### 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.: HZ18070047b/R1

This report is replaced the old report No. HZ18070047b dated Aug. 09, 2018

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

Review by:

Engineer: April Zou  
Aug. 28, 2018

Approved by:



Manager: Jim Zhang  
Aug. 28, 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: 22T5HO/4F/830/EXT/A4

Luminous Efficacy (Lumens /Watt)	Luminous Flux per lamp (Lumens)	Power (Watts)/4	Power Factor
116.4	3122.0	26.83	0.9973
CCT (K)	CRI	Stabilization Time (Light & Power)	
2927	82.0	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** : Jul. 30, 2018

**Date of Test** : Aug. 01, 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

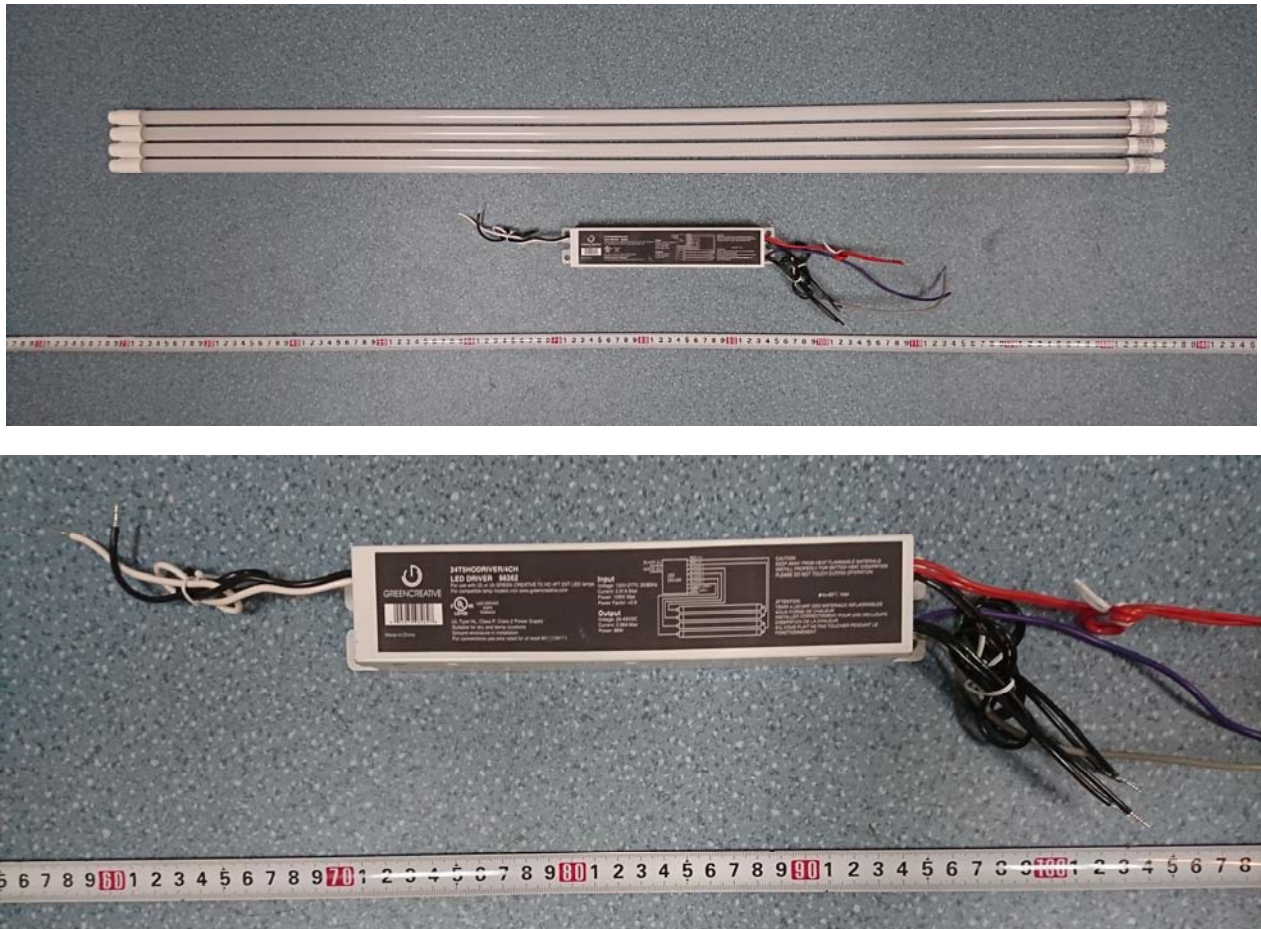


Figure 1- Overview of the sample

### Equipment Under Test (EUT)

<b>Name</b>	: LED Tube System
<b>Model</b>	: 22T5HO/4F/830/EXT/A4
<b>Electrical Ratings</b>	: 120-277V, 50/60Hz
<b>Product Description</b>	: 3000K LED tube model: 22T5HO/4F/830/EXT 4 LED tubes supplied by a LED driver: 24T5HO DRIVER/4CH
<b>Manufacturer</b>	: GREEN CREATIVE LTD
<b>Address</b>	: 756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

## TEST RESULTS

Test ambient temperature was 25.0°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)	0.897	0.398
Power Factor	0.9973	0.9635
Test Power (W)/4	26.83	26.55
THD A%	2.83	5.44
Luminous Efficacy (lm/W)	116.4	117.6
Luminous Flux per lamp (lm)	3122.0	3122.0
Color Rendering Index (CRI)	82.0	
R9	4.9	
Correlated Color Temperature (CCT)(K)	2927	
Chromaticity Chroma x	0.4407	
Chromaticity Chroma y	0.4031	
Chromaticity Chroma u	0.2534	
Chromaticity Chroma v	0.3477	
Duv	0.0012	
Chromaticity Chroma u'	0.2534	
Chromaticity Chroma v'	0.5216	

Special Color Rendering Indices	
R1	80.8
R2	92.2
R3	94.3
R4	79
R5	81.2
R6	90.9
R7	80.8
R8	56.7
R9	4.9
R10	82.4
R11	78.2
R12	73.5
R13	83.7
R14	97.6
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 25.1°C.

The photometric distance is 30m.

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)	0.899
Power Factor	0.9964
Test Power (W)/4	26.85
Luminous Efficacy (lm/W)	114.5
Luminous Flux per lamp (lm)	3075.5
Beam Angle (°)	127.8
Center Beam Candle Power (cd)	772
Spacing Criteria	1.26 (0°-180°)/ 1.32 (90°-270°)
Zonal Lumens in the 0°-60°Zone	60.02%
Zonal Lumens in the 60°-90°Zone	27.51%
Zonal Lumens in the 90°-120°Zone	9.60%
Zonal Lumens in the 120°-180°Zone	2.86%

Table 3: Test data per Goniophotometer Method

## Spectral Power Distribution - Sphere Spectroradiometer Method

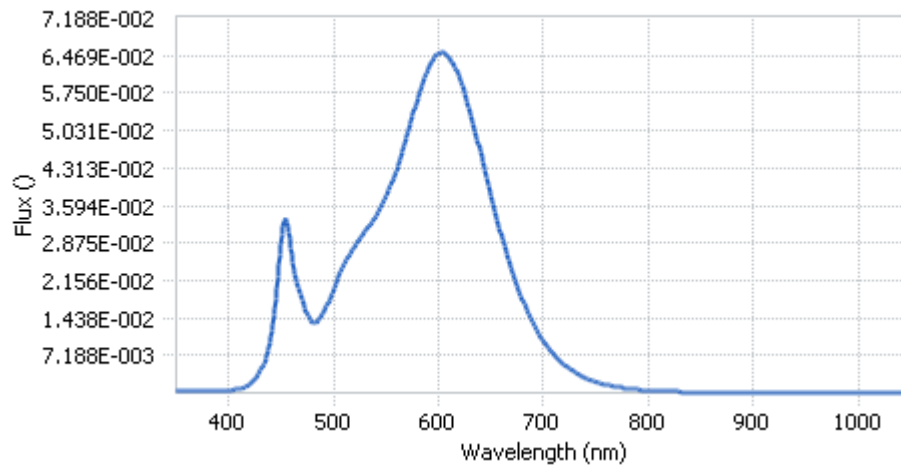


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	5.21E-04	485	1.39E-02	590	6.20E-02	695	1.15E-02
385	4.66E-04	490	1.53E-02	595	6.39E-02	700	9.96E-03
390	5.15E-04	495	1.73E-02	600	6.50E-02	705	8.51E-03
395	5.17E-04	500	1.99E-02	605	6.54E-02	710	7.31E-03
400	5.58E-04	505	2.25E-02	610	6.42E-02	715	6.28E-03
405	6.12E-04	510	2.47E-02	615	6.28E-02	720	5.39E-03
410	7.90E-04	515	2.67E-02	620	6.02E-02	725	4.63E-03
415	1.10E-03	520	2.82E-02	625	5.73E-02	730	3.96E-03
420	1.67E-03	525	2.97E-02	630	5.40E-02	735	3.34E-03
425	2.61E-03	530	3.11E-02	635	5.00E-02	740	2.88E-03
430	4.12E-03	535	3.23E-02	640	4.60E-02	745	2.47E-03
435	6.60E-03	540	3.39E-02	645	4.17E-02	750	2.12E-03
440	1.06E-02	545	3.57E-02	650	3.78E-02	755	1.81E-03
445	1.80E-02	550	3.77E-02	655	3.38E-02	760	1.54E-03
450	2.86E-02	555	4.01E-02	660	3.02E-02	765	1.33E-03
455	3.29E-02	560	4.29E-02	665	2.66E-02	770	1.15E-03
460	2.65E-02	565	4.61E-02	670	2.33E-02	775	9.89E-04
465	2.10E-02	570	4.96E-02	675	2.05E-02	780	8.49E-04
470	1.82E-02	575	5.29E-02	680	1.78E-02		
475	1.50E-02	580	5.65E-02	685	1.55E-02		
480	1.34E-02	585	5.97E-02	690	1.34E-02		

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

The diagram is a CIE 1931, 2 Degree color space plot. The x-axis is labeled 'x' and ranges from 0.1000 to 0.7000. The y-axis is labeled 'y' and ranges from 0.1000 to 0.8000. The plot shows the visible spectrum as a curved boundary with wavelength labels in nanometers: 380, 460, 470, 480, 490, 500, 510, 520, 530, 540, 550, 560, 570, 580, 590, 600, 610, 620, 630, and 780. Inside the plot, a black line represents the white point locus, and a blue curve represents the standard observer color matching functions. Points A, B, C, D65, and E are marked on the color matching functions curve.

### 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

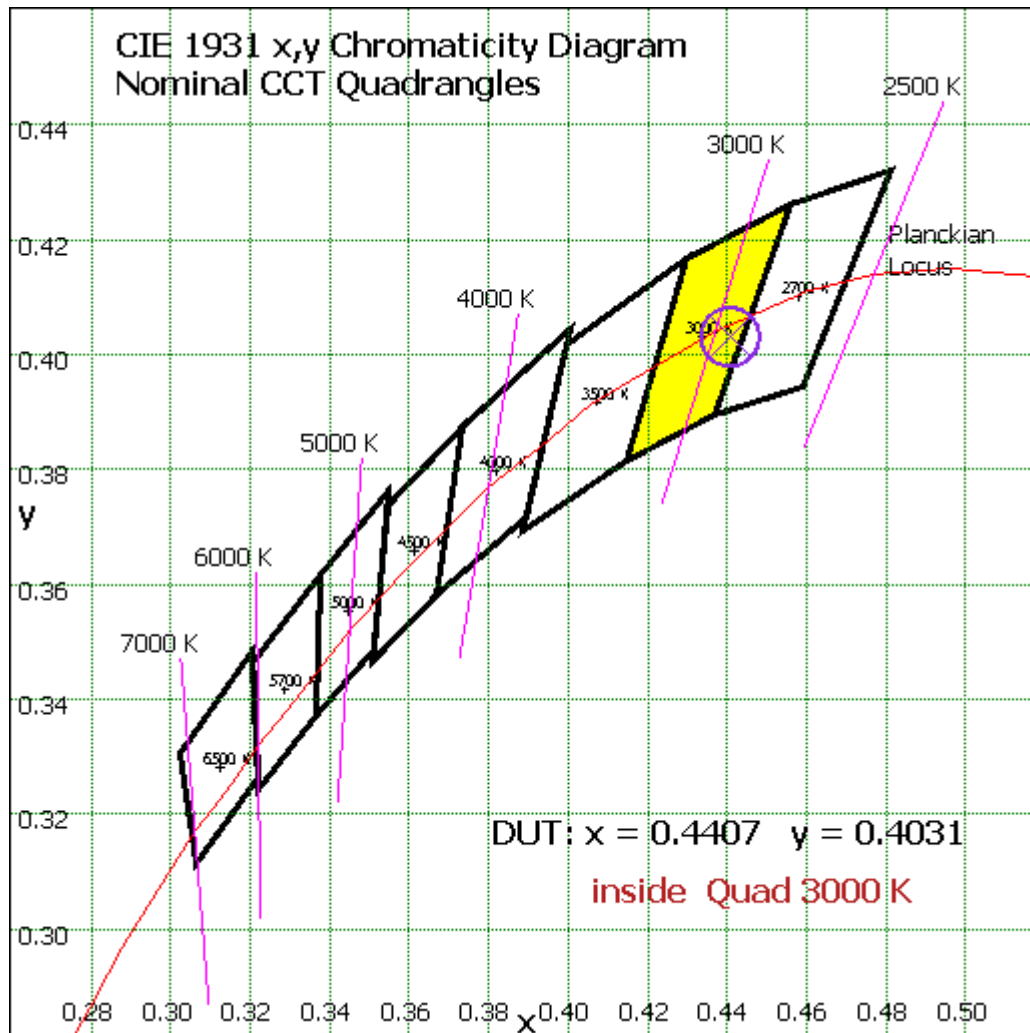


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

### Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	73.158	2.38%
10- 20	210.669	6.85%
20- 30	323.116	10.51%
30- 40	397.859	12.94%
40- 50	428.023	13.92%
50- 60	413.246	13.44%
60- 70	360.396	11.72%
70- 80	283.161	9.21%
80- 90	202.652	6.59%
90-100	140.034	4.55%
100-110	94.341	3.07%
110-120	60.919	1.98%
120-130	38.621	1.26%
130-140	23.675	0.77%
140-150	13.835	0.45%
150-160	7.569	0.25%
160-170	3.403	0.11%
170-180	0.854	0.03%
Total	3075.5	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	1846.071	60.02%
60- 90	846.209	27.51%
0-90	2692.28	87.54%
90- 180	383.251	12.46%
0- 180	3075.5	100%

Table 5: Zonal Lumen Data

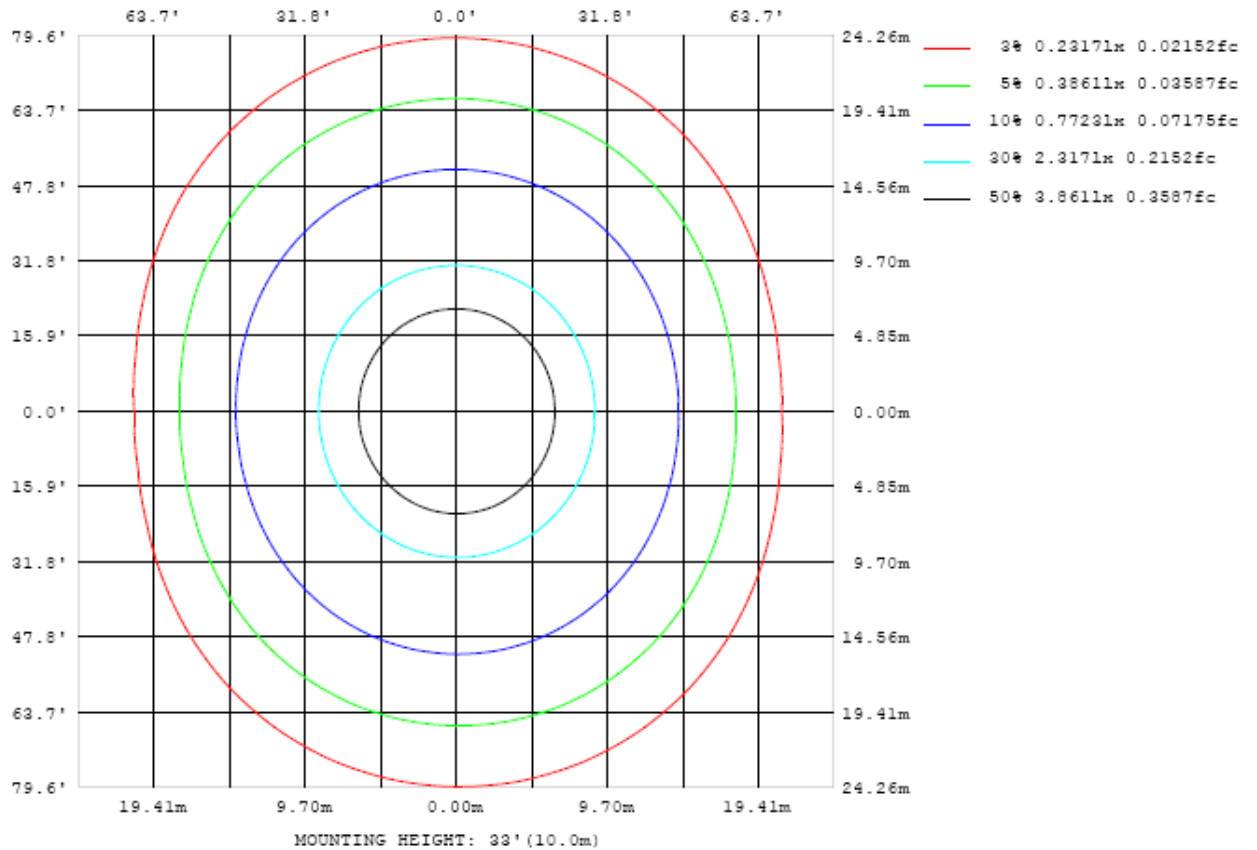


Chart 4: Illuminance Plot (Footcandles)

## Luminous Intensity Distribution Plots- Goniophotometer Method

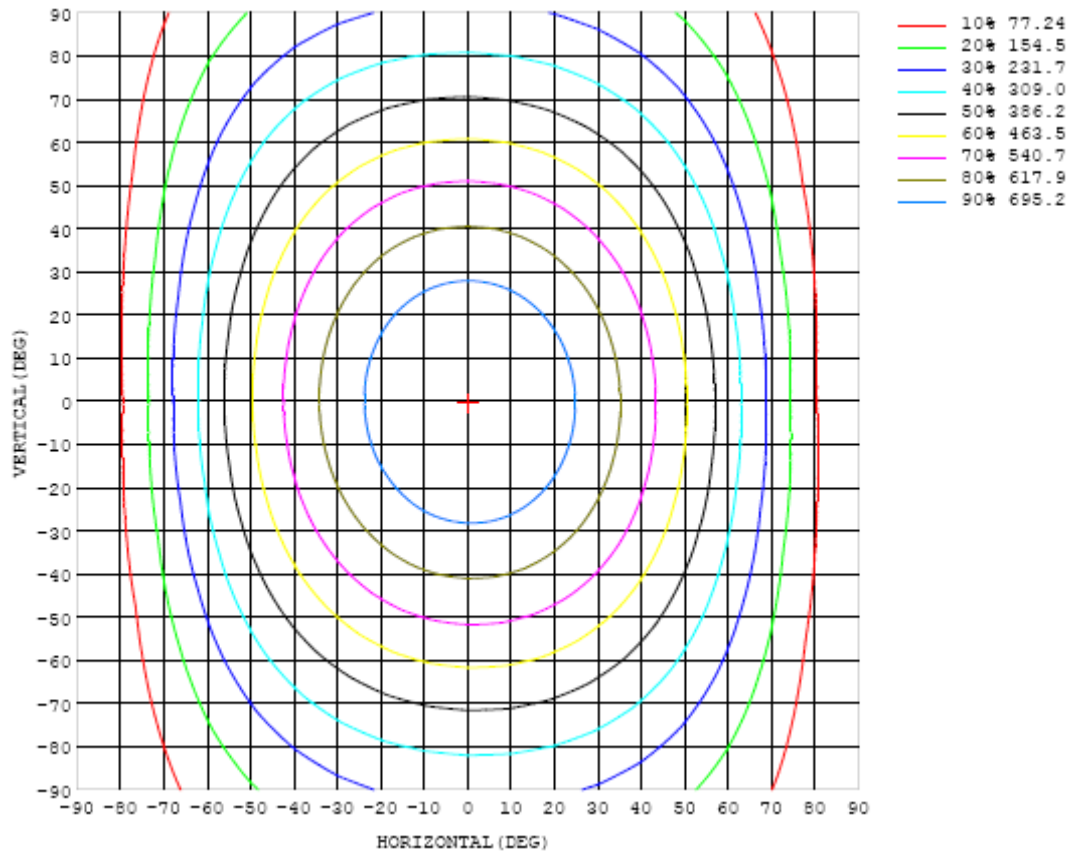


Chart 5: Isocandela Plot

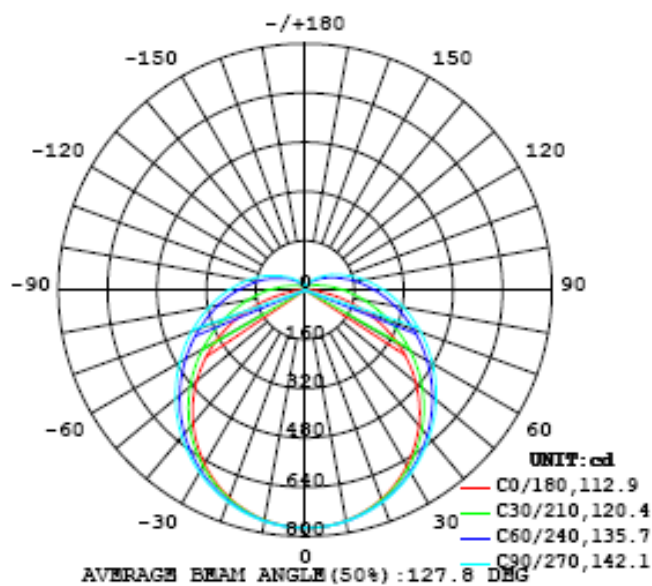


Chart 6: Polar Candela Distribution



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	772	772	772	772	772	772	772	772	772	772	772	772	772	772	772	772	772		
5	768	769	769	769	769	769	769	769	770	770	770	770	769	769	770	770	770		
10	758	758	759	759	760	761	761	762	762	762	762	762	761	761	761	760	760		
15	741	742	743	744	746	747	748	749	749	749	749	748	747	746	746	745	744		
20	718	719	721	724	726	728	730	731	732	732	731	730	728	726	724	723	722		
25	689	691	694	697	701	705	707	709	710	710	708	706	703	700	697	695	694		
30	654	657	661	666	672	677	681	683	684	683	681	678	673	668	664	661	659		
35	613	617	623	630	638	645	650	653	654	654	650	645	639	632	627	622	619		
40	567	573	581	591	601	609	616	620	622	620	616	609	601	592	584	578	574		
45	517	525	536	548	561	571	580	585	586	584	579	570	560	549	538	530	525		
50	463	473	486	503	518	531	541	547	549	546	540	529	516	502	488	477	470		
55	405	418	436	455	474	489	501	508	510	507	499	487	471	454	436	421	412		
60	344	361	383	407	429	447	460	468	470	466	458	444	426	404	382	363	351		
65	282	303	331	360	385	405	419	428	430	426	416	401	380	355	329	304	287		
70	217	247	281	313	341	363	379	388	390	386	376	358	335	307	276	245	221		
75	155	193	233	270	300	323	340	350	352	348	336	318	293	262	226	188	157		
80	98.8	144	189	228	261	286	303	312	315	310	298	280	253	219	180	136	96.7		
85	55.0	103	150	191	225	250	268	278	281	276	264	244	216	181	139	92.3	48.8		
90	27.7	72.3	118	158	191	217	235	245	247	243	230	210	182	147	106	60.2	20.1		
95	14.6	50.3	91.4	130	162	187	204	214	216	211	199	179	152	119	79.5	38.8	7.58		
100	9.72	35.0	70.2	105	136	159	176	185	188	183	171	152	126	94.7	59.0	24.9	4.59		
105	7.80	25.9	54.0	83.7	112	134	150	159	161	157	145	127	103	73.8	43.1	18.3	3.92		
110	7.19	20.8	42.8	67.5	90.3	110	125	134	136	131	121	104	81.9	57.8	34.0	14.5	4.22		
115	7.09	17.1	34.4	54.5	74.1	90.4	103	110	112	108	98.4	84.3	66.7	46.9	27.6	12.4	4.72		
120	7.38	15.0	28.1	44.6	60.8	74.3	85.4	91.1	92.4	89.3	81.3	69.5	54.6	38.2	22.7	11.4	5.28		
125	7.71	13.6	23.6	37.1	49.8	61.7	70.5	75.6	76.7	73.7	67.2	57.1	44.9	31.7	19.5	10.8	5.99		
130	8.32	13.0	20.5	30.5	41.3	50.3	57.5	62.3	63.2	60.8	55.1	47.1	37.2	26.7	17.3	10.5	6.64		
135	8.91	12.5	18.1	25.4	33.7	41.5	47.3	51.0	51.7	49.8	45.4	38.9	30.9	22.7	15.8	10.6	7.31		
140	9.46	12.2	16.6	21.8	27.6	33.0	38.1	40.8	42.0	40.5	36.9	31.6	26.0	20.0	14.5	10.7	8.14		
145	9.91	11.9	15.4	19.2	23.2	27.3	30.2	32.4	33.2	32.2	29.9	26.4	22.1	17.7	13.8	10.9	8.87		
150	10.3	11.8	14.2	17.1	20.0	22.6	24.6	25.5	27.0	26.4	24.6	22.1	19.0	16.0	13.2	10.9	9.43		
155	9.76	11.0	12.3	15.1	17.3	19.1	20.6	21.1	20.7	21.3	20.3	18.6	16.6	14.6	12.7	11.0	9.08		
160	8.40	9.99	10.7	11.5	14.4	16.1	17.0	17.7	17.7	17.1	16.7	15.9	14.8	13.3	12.0	10.4	8.32		
165	7.37	8.45	9.22	9.79	10.4	12.3	13.8	14.8	15.0	14.8	14.5	13.7	12.5	11.2	10.9	10.1	7.46		
170	7.14	7.38	8.38	8.81	8.63	8.34	8.82	10.9	13.1	13.0	12.2	10.2	10.5	10.5	10.3	8.74	7.26		
175	8.94	8.86	8.81	9.01	8.73	8.66	7.46	6.05	4.57	2.67	9.60	9.69	9.59	9.32	9.30	8.95	8.83		
180	4.12	4.13	4.13	4.14	4.14	4.15	4.16	4.17	4.18	4.20	4.21	4.23	4.25	4.26	4.27	4.28	4.28		

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**

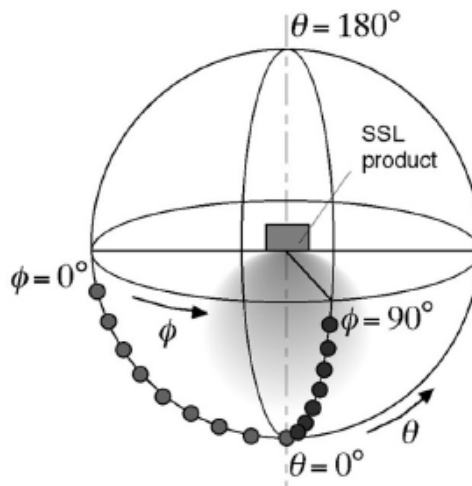
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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