

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

for

### **GREEN CREATIVE LTD**

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

### **LED Tube System**

#### **Model: 11.5T8/4F/830/EXT/A4**

(LED tube model: 11.5T8/4F/830/EXT 4pcs and LED driver model: 15T8T5HEDRIVER/4CH 1pcs)

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

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Report No.: HZ180700471

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

Review by:



Engineer: April Zou  
Aug. 09, 2018

Approved by:



Manager: Jim Zhang  
Aug. 09, 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: 11.5T8/4F/830/EXT/A4

Luminous Efficacy (Lumens /Watt)	Luminous Flux per lamp (Lumens)	Power (Watts)/4	Power Factor
128.3	1667.0	13.00	0.9976
CCT (K)	CRI	Stabilization Time (Light & Power)	
2954	82.2	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. 02, 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

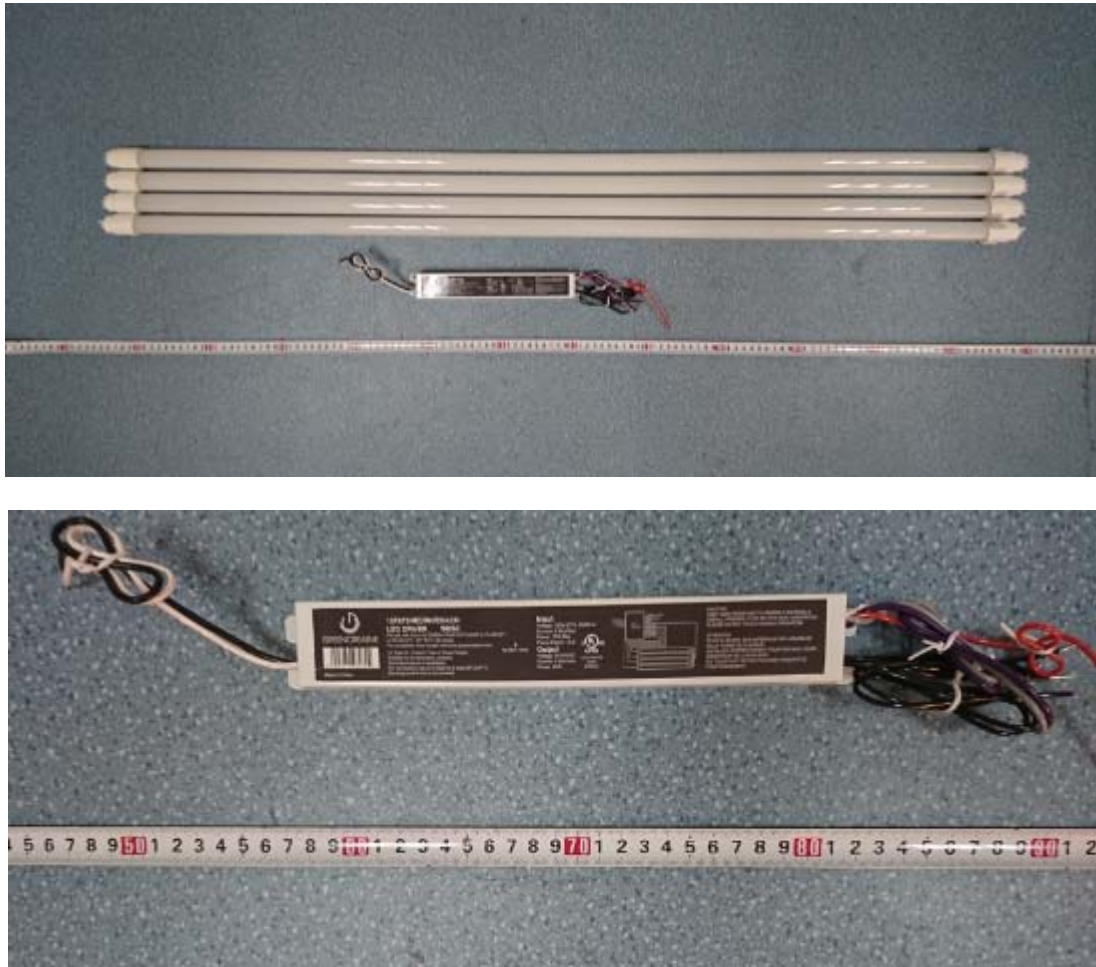


Figure 1- Overview of the sample

### Equipment Under Test (EUT)

<b>Name</b>	: LED Tube System
<b>Model</b>	: 11.5T8/4F/830/EXT/A4
<b>Electrical Ratings</b>	: 120-277V, 50/60Hz
<b>Product Description</b>	: 3000K LED tube model: 11.5T8/4F/830/EXT 4 LED tubes supplied by a LED driver: 15T8T5HEDRIVER/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)	0.434	0.193
Power Factor	0.9976	0.9617
Test Power (W)/4	13.00	12.88
THD A%	2.33	4.59
Luminous Efficacy (lm/W)	128.3	129.5
Luminous Flux per lamp (lm)	1667.0	1667.0
Color Rendering Index (CRI)	82.2	
R9	3.4	
Correlated Color Temperature (CCT)(K)	2954	
Chromaticity Chroma x	0.4384	
Chromaticity Chroma y	0.4010	
Chromaticity Chroma u	0.2529	
Chromaticity Chroma v	0.3469	
Duv	-0.0014	
Chromaticity Chroma u'	0.2529	
Chromaticity Chroma v'	0.5204	

Special Color Rendering Indices	
R1	79.4
R2	89.3
R3	96.7
R4	82
R5	82.8
R6	91
R7	80.3
R8	56
R9	3.4
R10	77.1
R11	74.2
R12	73.3
R13	81
R14	98.6
Rf	82
Rg	97

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 24.9°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)	0.435
Power Factor	0.9967
Test Power (W)/4	12.99
Luminous Efficacy (lm/W)	126.2
Luminous Flux per lamp (lm)	1639.2
Beam Angle (°)	173.8
Center Beam Candle Power (cd)	260
Spacing Criteria	1.29 (0°-180°)/ 1.45 (90°-270°)
Zonal Lumens in the 0°-60°Zone	41.84%
Zonal Lumens in the 60°-90°Zone	26.94%
Zonal Lumens in the 90°-120°Zone	18.01%
Zonal Lumens in the 120°-180°Zone	13.21%

Table 3: Test data per Goniophotometer Method

## Spectral Power Distribution - Sphere Spectroradiometer Method

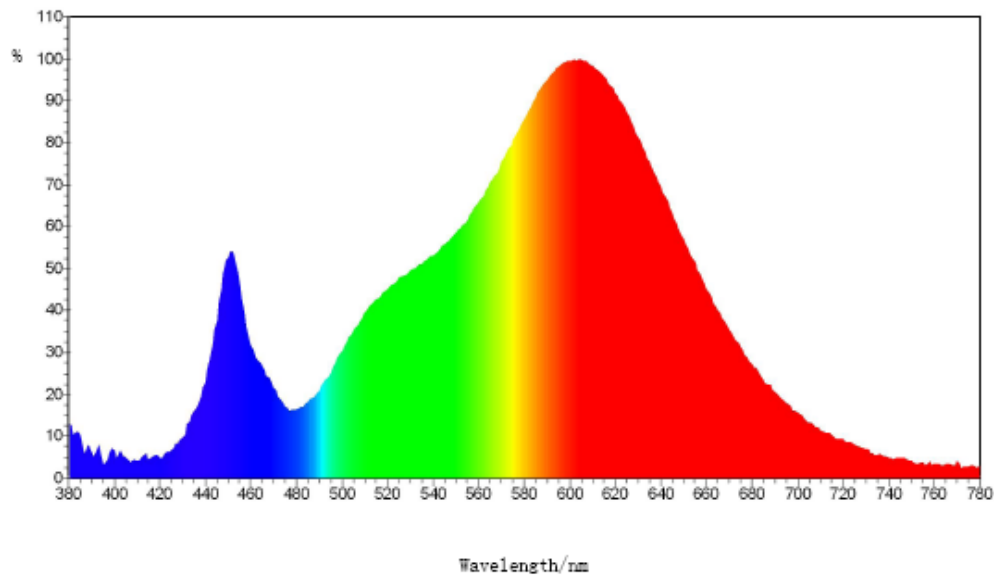
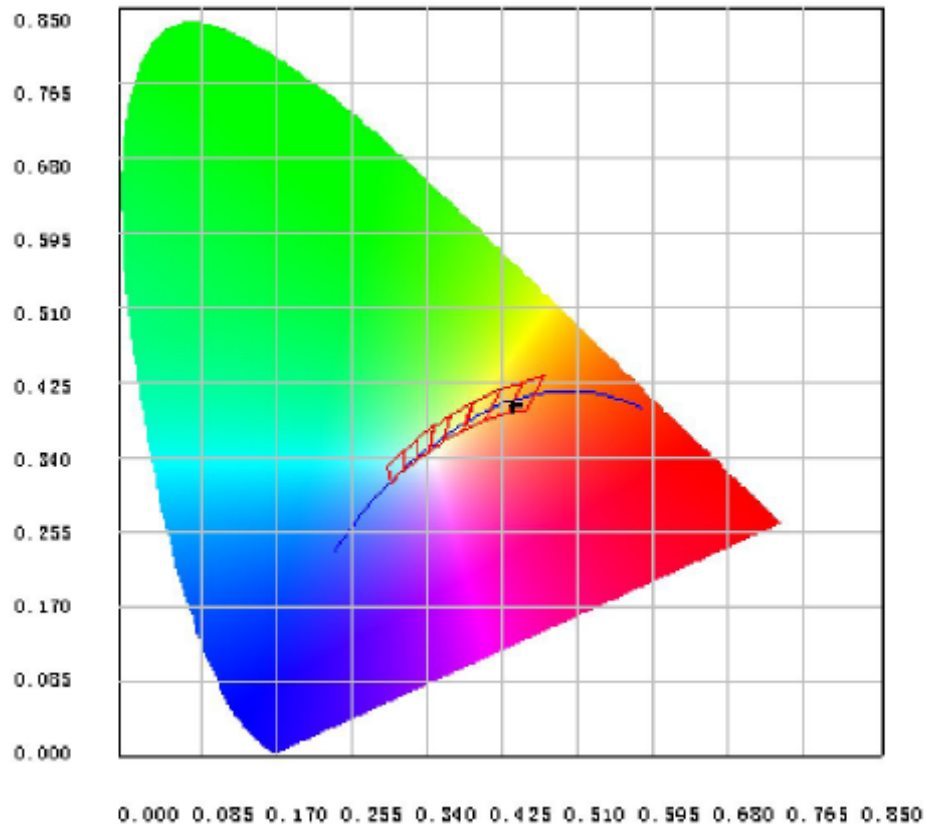


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	8.22E-03	485	1.12E-02	590	5.84E-02	695	1.11E-02
385	6.54E-03	490	1.30E-02	595	6.04E-02	700	9.76E-03
390	3.90E-03	495	1.55E-02	600	6.14E-02	705	8.28E-03
395	2.18E-03	500	1.87E-02	605	6.16E-02	710	7.10E-03
400	4.18E-03	505	2.15E-02	610	6.06E-02	715	6.46E-03
405	3.29E-03	510	2.42E-02	615	5.91E-02	720	5.78E-03
410	2.48E-03	515	2.63E-02	620	5.66E-02	725	4.95E-03
415	2.88E-03	520	2.76E-02	625	5.37E-02	730	4.35E-03
420	3.07E-03	525	2.94E-02	630	5.02E-02	735	3.51E-03
425	4.04E-03	530	3.05E-02	635	4.64E-02	740	2.96E-03
430	6.07E-03	535	3.15E-02	640	4.28E-02	745	3.07E-03
435	9.83E-03	540	3.27E-02	645	3.88E-02	750	2.49E-03
440	1.43E-02	545	3.43E-02	650	3.50E-02	755	2.46E-03
445	2.33E-02	550	3.60E-02	655	3.15E-02	760	2.09E-03
450	3.26E-02	555	3.80E-02	660	2.80E-02	765	2.05E-03
455	2.82E-02	560	4.05E-02	665	2.46E-02	770	2.49E-03
460	1.97E-02	565	4.34E-02	670	2.19E-02	775	1.66E-03
465	1.66E-02	570	4.64E-02	675	1.93E-02	780	2.03E-03
470	1.33E-02	575	4.96E-02	680	1.67E-02		
475	1.05E-02	580	5.27E-02	685	1.45E-02		
480	1.02E-02	585	5.60E-02	690	1.26E-02		

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

## Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4384, 0.4010)

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

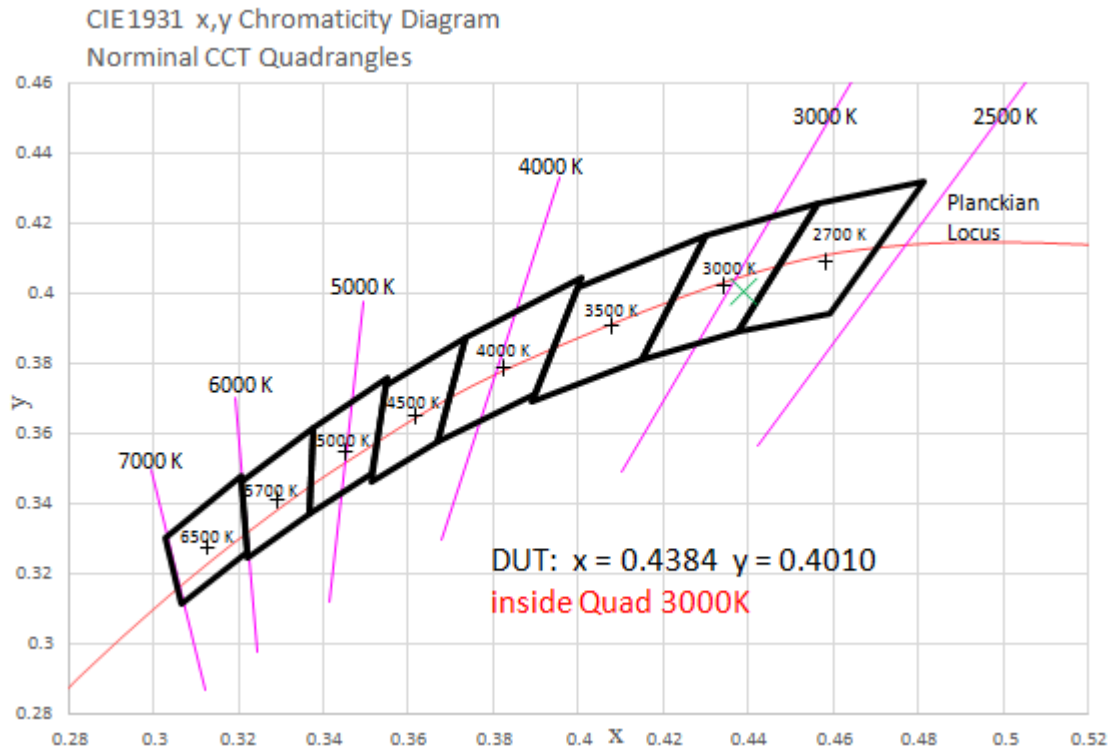


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

### Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	24.735	1.51%
10- 20	72.015	4.39%
20- 30	112.921	6.89%
30- 40	144.014	8.79%
40- 50	162.994	9.94%
50- 60	169.118	10.32%
60- 70	163.199	9.96%
70- 80	148.387	9.05%
80- 90	130.027	7.93%
90-100	113.659	6.93%
100-110	98.272	5.99%
110-120	83.321	5.08%
120-130	69.116	4.22%
130-140	55.725	3.40%
140-150	42.538	2.59%
150-160	29.228	1.78%
160-170	15.522	0.95%
170-180	4.452	0.27%
Total	1639.2	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	685.797	41.84%
60- 90	441.613	26.94%
0-90	1127.41	68.78%
90- 180	511.833	31.22%
0- 180	1639.2	100%

Table 5: Zonal Lumen Data

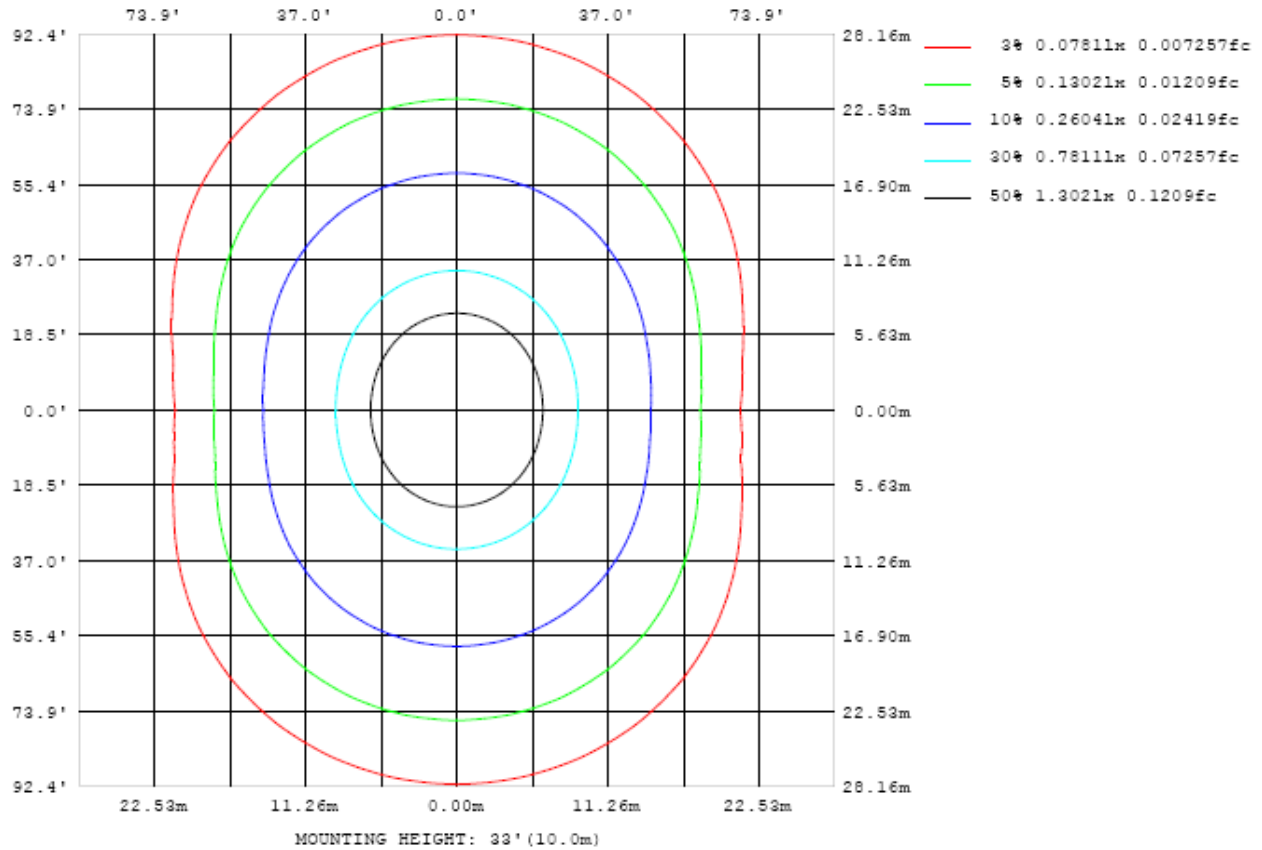


Chart 4: Illuminance Plot (Footcandles)

## Luminous Intensity Distribution Plots- Goniophotometer Method

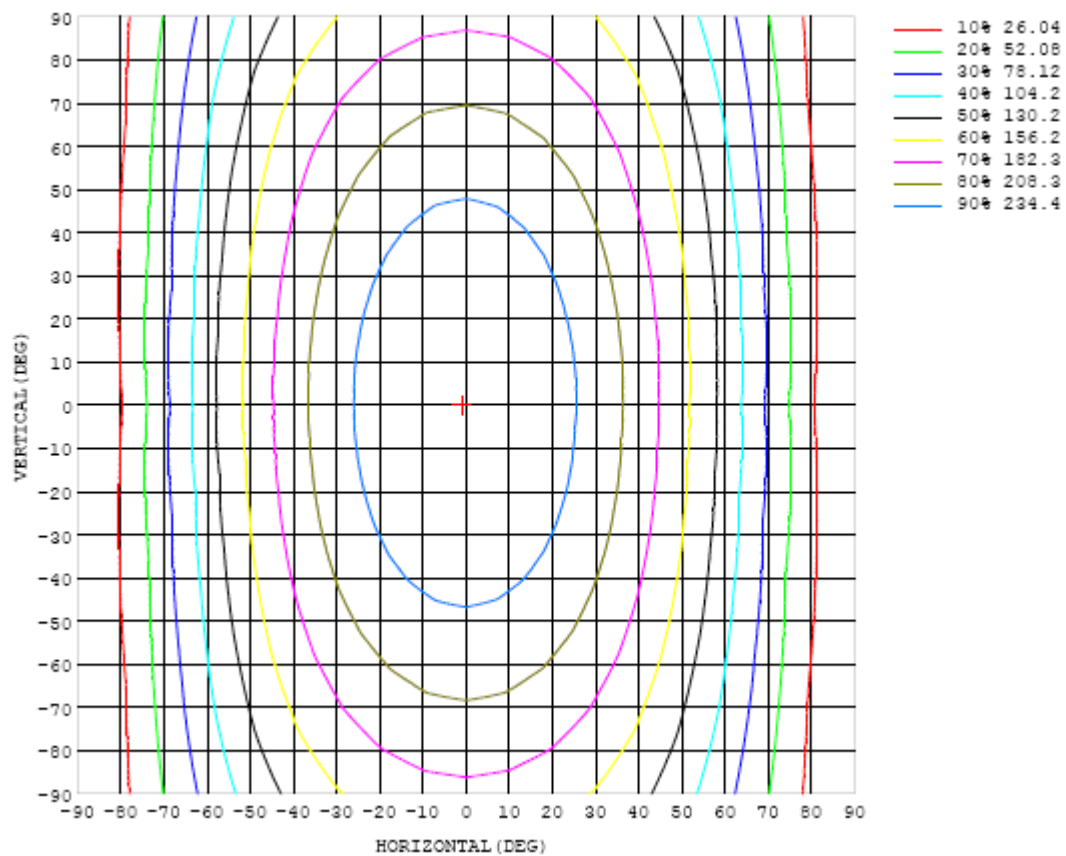


Chart 5: Isocandela Plot

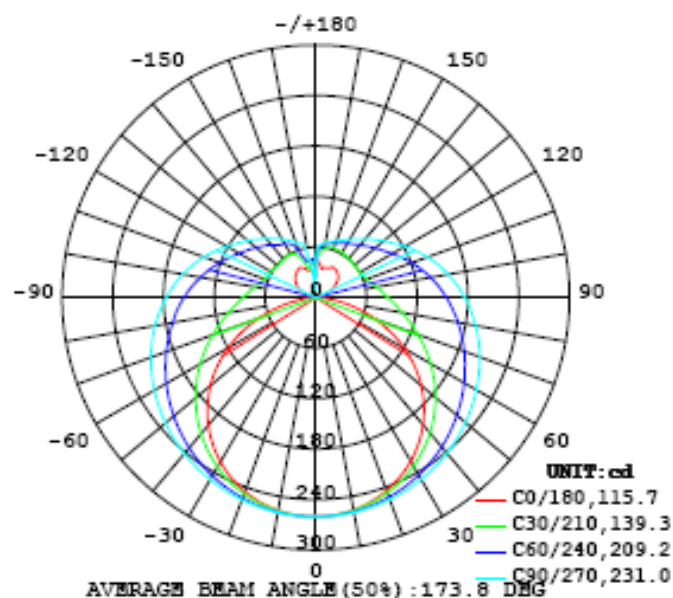


Chart 6: Polar Candela Distribution

## Luminous Intensity Data- Goniophotometer Method

Table--1

UNIT: cd

C (DEG) y (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	260	260	260	260	260	260	260	260	260	260	260	260	260	260	260	260	260	260	260
5	259	259	259	260	260	260	260	260	260	260	260	260	260	260	260	260	260	260	260
10	256	256	256	257	257	258	258	259	259	259	259	259	259	258	258	257	257	257	257
15	251	251	252	253	254	255	256	257	257	258	258	257	256	255	255	254	253	252	252
20	244	244	245	247	249	251	253	254	255	255	255	254	253	251	250	248	247	246	245
25	235	236	237	240	243	246	248	251	252	253	252	251	249	246	244	241	238	237	236
30	224	225	227	231	235	240	243	247	249	249	249	247	244	240	236	232	228	226	226
35	212	213	216	221	227	233	238	242	244	246	245	242	239	234	228	222	217	214	213
40	197	199	203	210	218	225	232	237	240	241	240	237	232	226	218	210	204	199	198
45	181	183	189	198	208	217	225	231	235	236	235	231	225	217	208	198	189	183	181
50	163	165	173	185	197	208	218	225	229	231	230	225	218	209	197	185	173	165	163
55	143	146	157	171	186	199	210	218	223	225	224	219	210	199	186	170	156	145	142
60	121	126	139	157	174	190	203	212	217	219	217	212	203	190	174	156	138	124	120
65	98.1	104	121	143	163	181	195	205	211	213	211	205	195	181	162	141	120	102	96.3
70	74.2	82.7	104	129	152	171	187	198	204	206	204	198	187	171	151	128	102	80.1	71.7
75	51.1	62.1	87.3	116	141	162	179	190	197	199	197	190	179	162	141	115	85.6	59.3	47.3
80	28.6	42.8	73.1	104	131	154	171	183	189	192	190	182	171	154	131	103	71.2	40.5	24.8
85	10.5	27.8	61.3	93.9	122	145	163	175	182	184	182	175	162	145	122	93.6	60.7	26.5	7.44
90	1.65	19.2	52.9	85.5	114	137	154	167	174	176	174	167	154	137	114	85.5	52.9	19.4	0.74
95	2.37	16.1	47.1	78.8	106	129	146	158	165	168	166	158	146	129	106	78.7	47.7	17.2	2.34
100	5.74	16.9	43.2	72.8	98.8	121	138	150	157	159	157	150	138	121	99.4	73.4	44.4	18.4	5.69
105	10.1	19.7	41.6	67.7	92.0	113	129	141	148	150	148	141	129	113	92.7	68.8	43.1	21.3	9.75
110	15.0	24.0	41.6	63.9	85.8	105	121	132	138	141	138	132	121	106	86.7	65.2	43.6	25.3	14.5
115	20.1	28.7	42.7	61.6	80.2	98.1	112	123	129	131	129	123	113	98.8	81.6	63.3	45.0	29.9	19.7
120	24.9	33.2	44.5	60.6	76.9	91.7	104	114	120	122	120	114	105	92.5	77.9	62.3	46.8	34.6	24.6
125	29.4	37.5	46.9	59.9	73.9	86.4	97.4	106	111	113	111	106	98.0	87.5	75.4	61.8	48.9	38.8	28.5
130	34.1	42.2	49.7	59.7	71.4	82.1	91.5	98.5	103	104	103	98.9	92.1	83.3	73.0	61.6	51.2	42.5	31.7
135	37.6	45.9	52.3	60.0	69.6	78.7	86.3	92.3	95.9	97.3	96.2	92.6	86.9	79.4	70.9	61.6	52.8	45.7	34.4
140	38.9	47.3	54.6	60.8	68.0	75.5	81.5	86.6	89.8	90.8	89.9	86.9	82.2	76.4	69.2	61.7	55.1	48.3	36.6
145	41.0	49.5	56.9	61.5	66.9	72.6	77.5	81.3	84.0	85.0	84.2	81.7	77.9	73.3	67.6	61.6	56.7	50.5	38.5
150	41.4	51.4	58.7	61.8	66.4	70.3	74.3	77.4	78.8	79.6	78.9	77.1	74.5	70.7	66.6	61.7	58.1	51.9	39.9
155	38.6	52.2	60.3	62.3	65.7	68.7	71.2	73.4	74.8	75.3	74.9	73.5	71.5	68.9	65.4	60.6	57.6	51.4	38.9
160	37.3	52.8	61.0	62.9	64.6	67.1	69.2	70.5	71.3	71.7	71.4	70.6	69.0	67.2	63.9	58.8	53.7	45.0	36.5
165	36.8	46.9	59.7	63.3	64.2	65.4	67.2	68.2	68.7	69.0	68.8	68.2	67.2	64.3	58.2	51.8	44.9	39.9	33.2
170	36.4	42.5	53.3	58.4	61.5	64.2	65.2	65.3	65.6	65.9	66.1	65.7	61.9	53.9	47.5	42.2	40.2	38.9	36.3
175	41.7	44.0	48.6	52.7	55.6	57.2	58.9	61.0	61.9	62.3	63.0	58.1	46.9	38.8	35.6	36.9	39.0	40.8	41.6
180	43.6	43.6	43.6	43.6	43.6	43.6	43.6	43.6	43.6	43.6	43.6	43.6	43.6	43.6	43.6	43.6	43.6	43.6	43.6

Table 6: Luminous Intensity Data

Table--2

UNIT: cd

C (DEG) y (DEG)	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350		
0	260	260	260	260	260	260	260	260	260	260	260	260	260	260	260	260	260		
5	260	260	260	260	260	260	260	260	260	260	260	260	260	260	259	259	259		
10	257	257	258	258	258	259	259	259	259	259	259	258	258	257	257	257	256		
15	252	253	254	255	256	257	257	258	258	258	257	256	255	254	253	252	251		
20	246	247	248	250	252	254	255	255	256	255	254	253	251	249	247	246	245		
25	237	239	241	244	247	249	251	253	253	252	251	249	246	243	240	238	236		
30	227	229	233	237	241	245	248	249	250	249	247	244	240	236	231	228	226		
35	214	218	223	228	234	239	243	246	246	245	242	238	233	227	222	217	213		
40	200	204	211	219	227	233	238	241	242	241	237	232	226	218	211	204	199		
45	183	190	199	209	218	226	233	236	237	236	232	226	218	208	198	190	183		
50	166	174	186	198	210	219	226	231	232	230	226	219	209	198	185	174	167		
55	147	158	172	187	201	212	220	225	227	225	220	211	200	186	172	158	148		
60	126	140	158	175	191	204	213	219	221	219	213	204	191	175	158	141	127		
65	104	122	144	165	182	196	207	212	214	212	206	196	182	165	144	123	106		
70	81.4	104	130	154	173	188	199	206	208	205	199	188	173	154	130	105	84.1		
75	59.9	87.3	117	143	165	180	192	198	201	198	191	180	165	143	117	88.5	62.8		
80	40.9	72.8	105	133	156	172	184	191	193	191	184	172	156	133	105	73.6	43.4		
85	26.8	61.4	94.9	124	147	164	176	183	185	183	176	165	147	124	95.0	61.5	28.3		
90	19.4	53.2	86.5	115	139	156	168	175	177	175	168	156	139	115	86.3	52.8	19.7		
95	16.8	47.4	79.2	107	130	147	160	167	169	167	160	148	130	107	78.8	46.7	16.4		
100	17.9	43.8	73.1	99.7	122	139	151	158	160	158	151	139	122	99.3	72.4	42.8	16.8		
105	20.3	42.5	68.2	92.8	114	130	141	148	151	148	141	130	113	92.3	67.3	41.1	19.4		
110	24.0	42.9	64.8	86.6	106	121	132	139	141	139	132	121	106	86.0	63.7	41.1	22.6		
115	28.8	44.3	62.8	81.7	98.7	113	123	129	131	129	123	113	98.3	80.8	61.5	42.4	26.9		
120	32.6	44.4	61.5	78.1	92.8	105	114	120	122	120	114	105	92.2	77.0	60.3	44.1	31.3		
125	36.2	46.9	60.5	74.8	87.8	98.4	106	111	113	111	106	98.0	87.1	74.0	59.6	45.9	35.4		
130	38.9	49.3	58.6	71.8	83.2	92.5	99.4	104	105	104	99.2	92.2	82.9	71.4	59.0	48.3	39.1		
135	41.3	51.8	59.1	68.7	79.0	86.9	93.2	96.9	98.1	96.7	93.0	87.1	78.9	68.9	58.9	50.9	42.2		
140	42.9	53.8	58.1	65.7	74.3	81.8	87.1	90.7	91.7	90.6	87.4	82.3	75.0	66.7	59.4	53.3	44.4		
145	43.4	55.6	59.9	66.1	71.6	76.0	80.5	84.6	85.8	85.0	82.2	77.5	71.4	65.7	60.3	55.2	46.3		
150	43.0	56.9	59.6	61.9	68.7	73.9	76.8	79.1	80.0	79.3	77.1	73.2	69.3	65.1	61.0	55.7	45.2		
155	38.8	50.8	56.5	60.5	64.8	69.9	72.4	73.7	75.0	74.4	72.7	70.5	67.8	64.7	61.8	52.3	40.7		
160	34.5	40.0	48.1	51.3	54.5	59.0	67.2	69.6	69.0	70.5	69.6	68.3	66.5	64.4	58.4	45.5	36.2		
165	33.5	34.5	38.0	41.4	45.2	45.4	47.9	58.0	66.6	67.3	66.9	65.5	63.2	55.3	48.9	36.4	34.3		
170	33.7	35.8	36.7	39.9	43.3	44.7	41.0	35.5	43.6	63.0	53.7	49.9	51.1	45.5	38.7	36.9	36.9		
175	41.4	41.4	42.3	44.0	44.7	45.7	45.4	39.2	19.2	30.8	45.6	45.0	45.9	47.0	45.6	44.6	42.8		
180	43.6	43.6	43.6	43.6	43.6	43.6	43.6	43.6	43.6	43.6	43.6	43.6	43.6	43.6	43.6	43.6	43.6		

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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