

## LM-79-08 Test Report

for

### GREEN CREATIVE LTD

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

### LED Tube System

### Model: 10.5T8/3F/850/EXT/A4

(LED tube model: 10.5T8/3F/850/EXT 4pcs and LED driver model: 15T8T5HEDRIVER/4CH 1pcs)

### Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ18080024o

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: 10.5T8/3F/850/EXT/A4

Luminous Efficacy (Lumens /Watt)	Luminous Flux per lamp (Lumens)	Power (Watts)/4	Power Factor
138.4	1652.0	11.94	0.9963
CCT (K)	CRI	Stabilization Time (Light & Power)	
4861	83.3	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

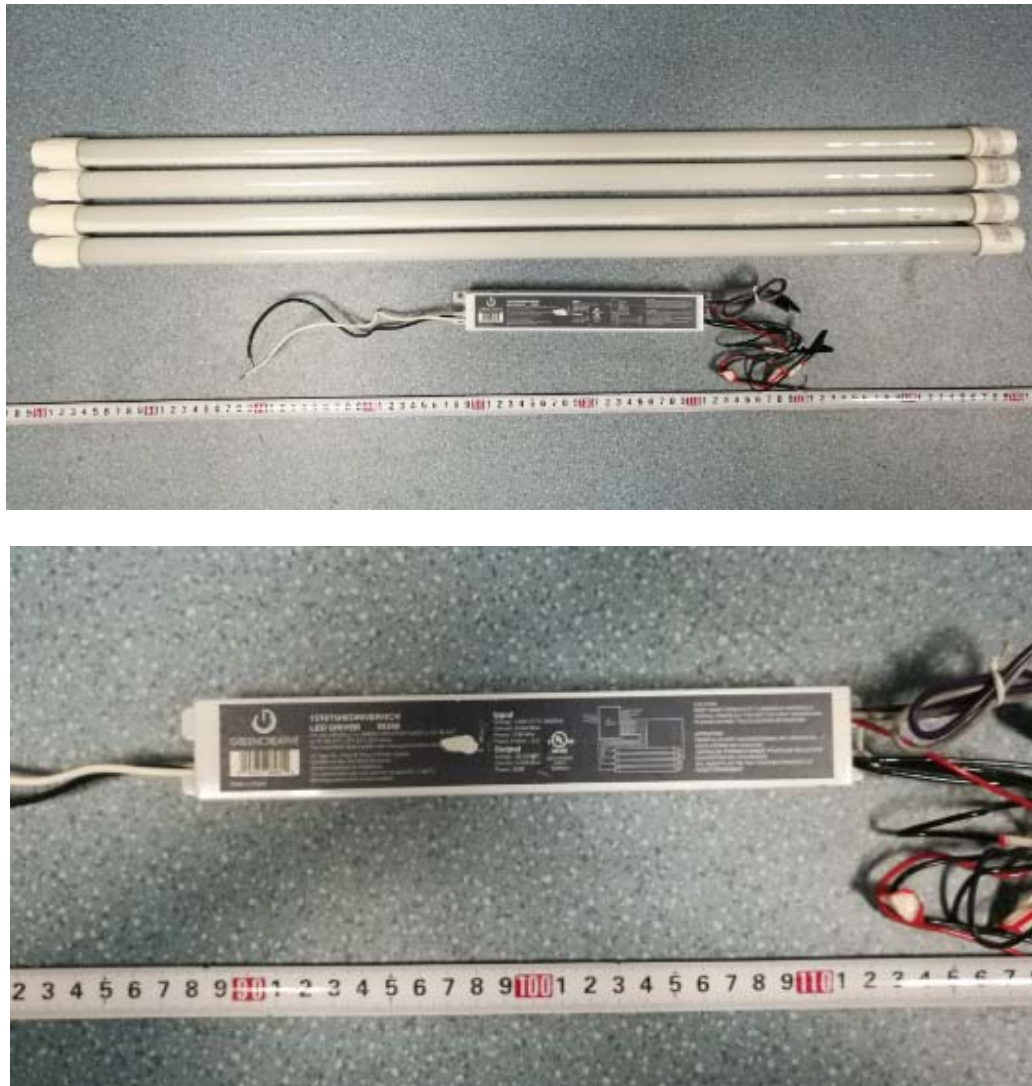


Figure 1- Overview of the sample

### Equipment Under Test (EUT)

<b>Name</b>	: LED Tube System
<b>Model</b>	: 10.5T8/3F/850/EXT/A4
<b>Electrical Ratings</b>	: 120-277V, 50/60Hz
<b>Product Description</b>	: 5000K LED tube model: 10.5T8/3F/850/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 25.1 °C.

Base orientation was horizontal. 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)	0.400	0.180
Power Factor	0.9963	0.9528
Test Power (W)/4	11.94	11.87
THD A%	3.66	7.22
Luminous Efficacy (lm/W)	138.4	139.2
Luminous Flux per lamp (lm)	1652.0	1652.0
Color Rendering Index (CRI)	83.3	
R9	6	
Correlated Color Temperature (CCT)(K)	4861	
Chromaticity Chroma x	0.3495	
Chromaticity Chroma y	0.3590	
Chromaticity Chroma u	0.2115	
Chromaticity Chroma v	0.3259	
Duv	0.0018	
Chromaticity Chroma u'	0.2115	
Chromaticity Chroma v'	0.4889	

Special Color Rendering Indices	
R1	81.6
R2	89
R3	93.9
R4	82.6
R5	81.8
R6	84.2
R7	87.2
R8	66.4
R9	6
R10	73.4
R11	81.9
R12	58.9
R13	83.7
R14	96.9
Rf	82
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 24.8°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)	0.400
Power Factor	0.9963
Test Power (W)/4	11.95
Luminous Efficacy (lm/W)	136.5
Luminous Flux per lamp (lm)	1631.3
Beam Angle (°)	172.1
Center Beam Candle Power (cd)	261
Spacing Criteria	1.27 (0°-180°)/ 1.46 (90°-270°)
Zonal Lumens in the 0°-60°Zone	41.91%
Zonal Lumens in the 60°-90°Zone	26.93%
Zonal Lumens in the 90°-120°Zone	17.99%
Zonal Lumens in the 120°-180°Zone	13.16%

Table 3: Test data per Goniophotometer Method

## Spectral Power Distribution - Sphere Spectroradiometer Method

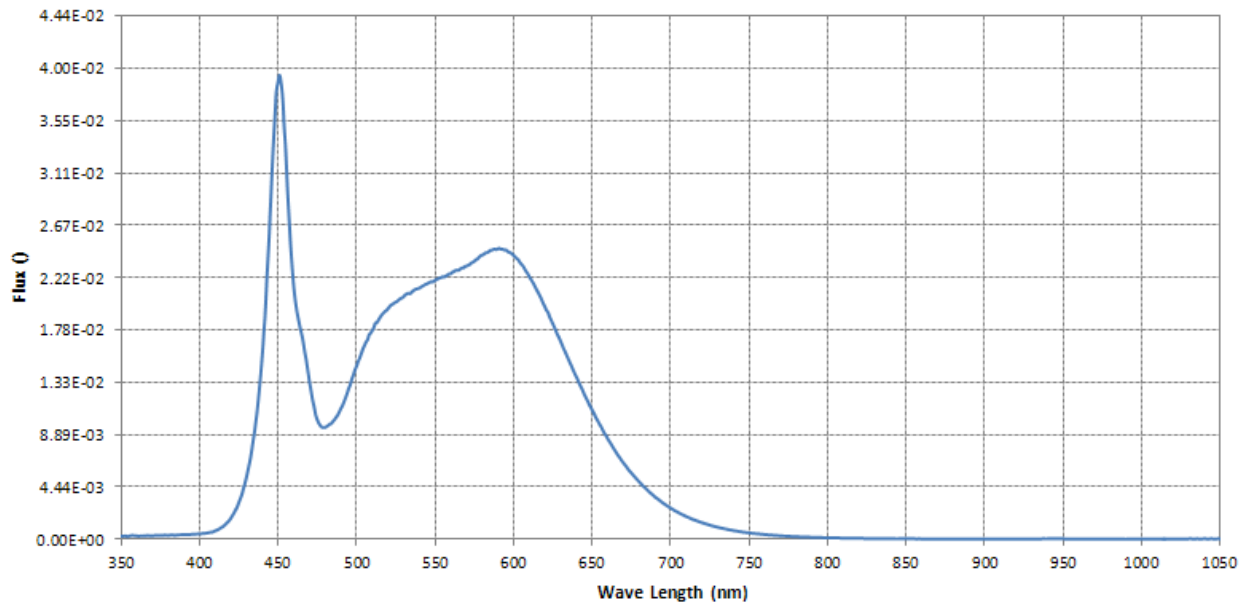


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	3.38E-04	485	1.00E-02	590	2.47E-02	695	3.10E-03
385	3.43E-04	490	1.11E-02	595	2.46E-02	700	2.66E-03
390	3.77E-04	495	1.28E-02	600	2.41E-02	705	2.26E-03
395	4.17E-04	500	1.47E-02	605	2.33E-02	710	1.94E-03
400	4.42E-04	505	1.64E-02	610	2.23E-02	715	1.66E-03
405	5.36E-04	510	1.77E-02	615	2.11E-02	720	1.42E-03
410	7.21E-04	515	1.88E-02	620	1.97E-02	725	1.21E-03
415	1.08E-03	520	1.96E-02	625	1.83E-02	730	1.03E-03
420	1.79E-03	525	2.01E-02	630	1.68E-02	735	8.82E-04
425	3.08E-03	530	2.06E-02	635	1.53E-02	740	7.46E-04
430	5.31E-03	535	2.10E-02	640	1.38E-02	745	6.42E-04
435	9.06E-03	540	2.13E-02	645	1.23E-02	750	5.46E-04
440	1.57E-02	545	2.17E-02	650	1.10E-02	755	4.70E-04
445	2.75E-02	550	2.20E-02	655	9.72E-03	760	4.03E-04
450	3.88E-02	555	2.23E-02	660	8.55E-03	765	3.48E-04
455	3.28E-02	560	2.25E-02	665	7.47E-03	770	2.98E-04
460	2.15E-02	565	2.28E-02	670	6.49E-03	775	2.58E-04
465	1.74E-02	570	2.32E-02	675	5.65E-03	780	2.23E-04
470	1.34E-02	575	2.36E-02	680	4.89E-03		
475	1.02E-02	580	2.41E-02	685	4.22E-03		
480	9.50E-03	585	2.45E-02	690	3.61E-03		

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

## Chromaticity Diagram - Sphere Spectroradiometer Method

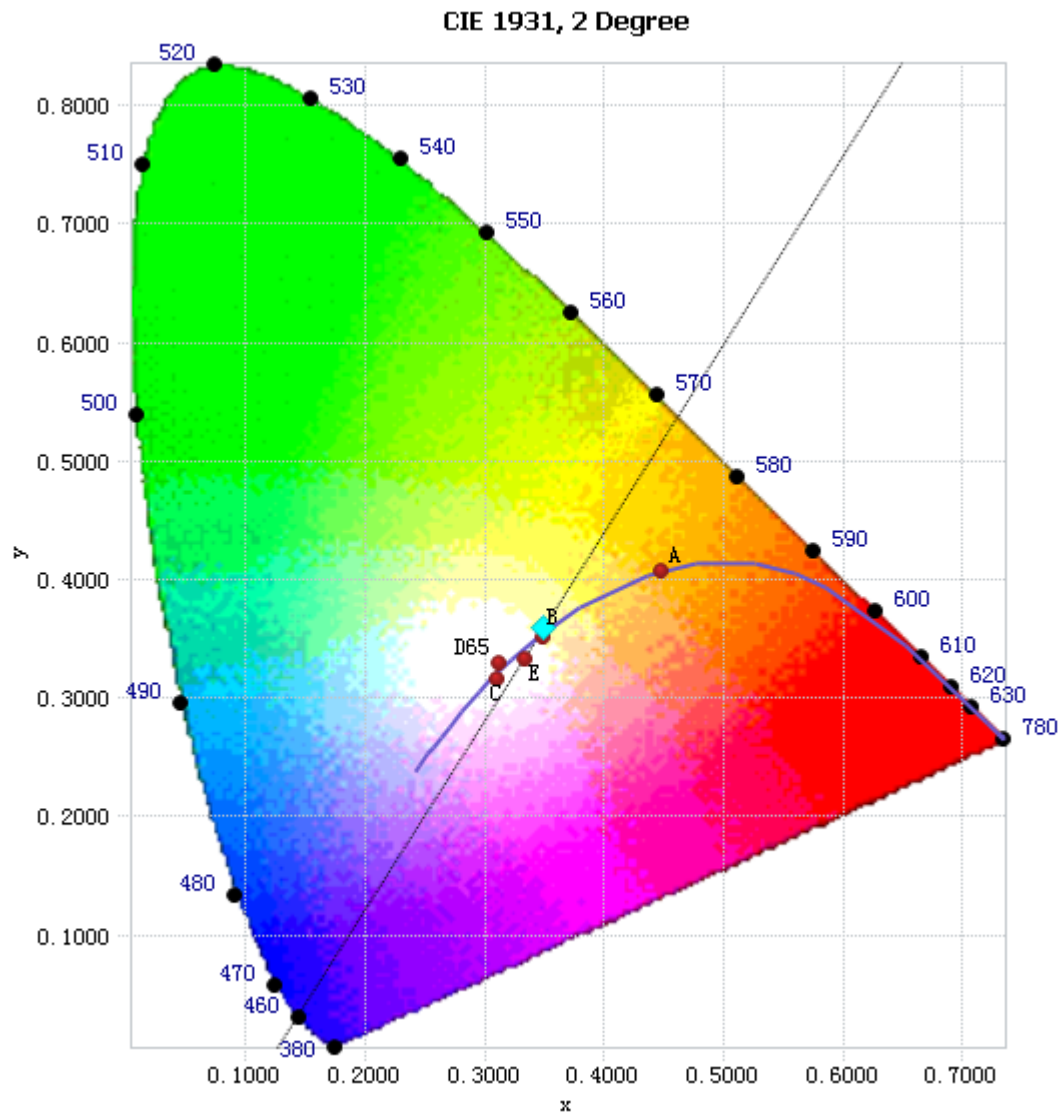


Chart 2: Chromaticity Diagram per Sphere - Spectroradiometer Method

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



### Nominal CCT Quadrangles – Sphere Spectroradiometer Method

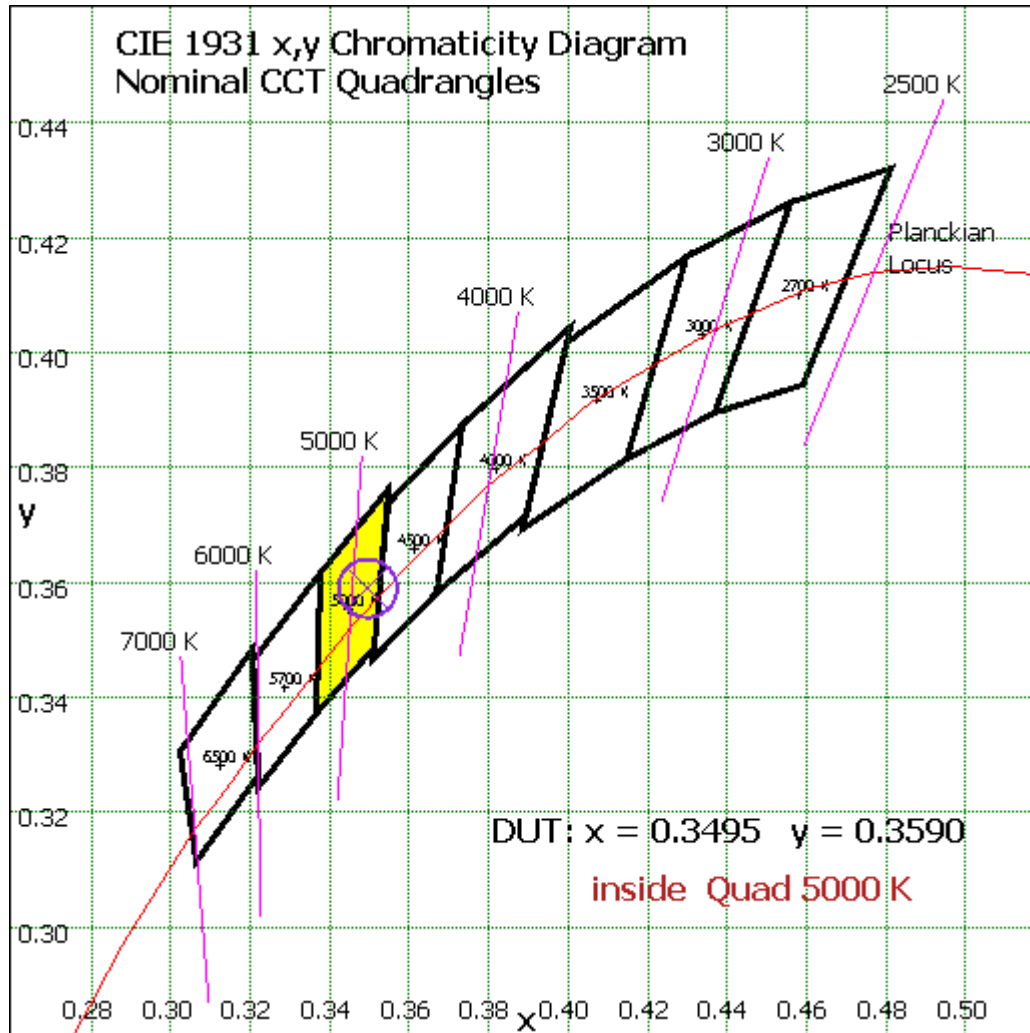


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

### Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	24.822	1.52%
10- 20	72.194	4.43%
20- 30	112.973	6.93%
30- 40	143.683	8.81%
40- 50	162.152	9.94%
50- 60	167.883	10.29%
60- 70	161.961	9.93%
70- 80	147.589	9.05%
80- 90	129.79	7.96%
90-100	113.566	6.96%
100-110	97.669	5.99%
110-120	82.248	5.04%
120-130	68.101	4.17%
130-140	55.072	3.38%
140-150	42.178	2.59%
150-160	29.312	1.80%
160-170	15.935	0.98%
170-180	4.129	0.25%
Total	1631.3	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	683.707	41.91%
60- 90	439.34	26.93%
0-90	1123.047	68.85%
90- 180	508.21	31.15%
0- 180	1631.3	100%

Table 5: Zonal Lumen Data

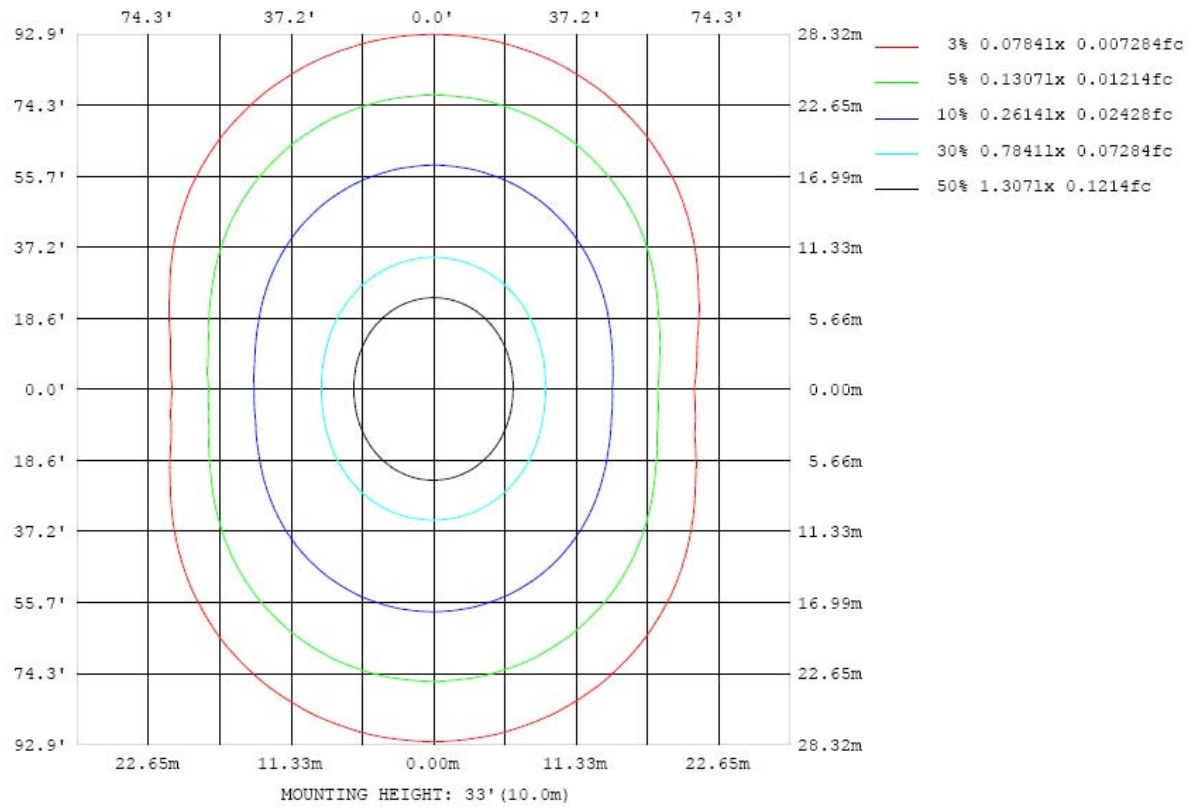


Chart 4: Illuminance Plot (Footcandles)

## Luminous Intensity Distribution Plots- Goniophotometer Method

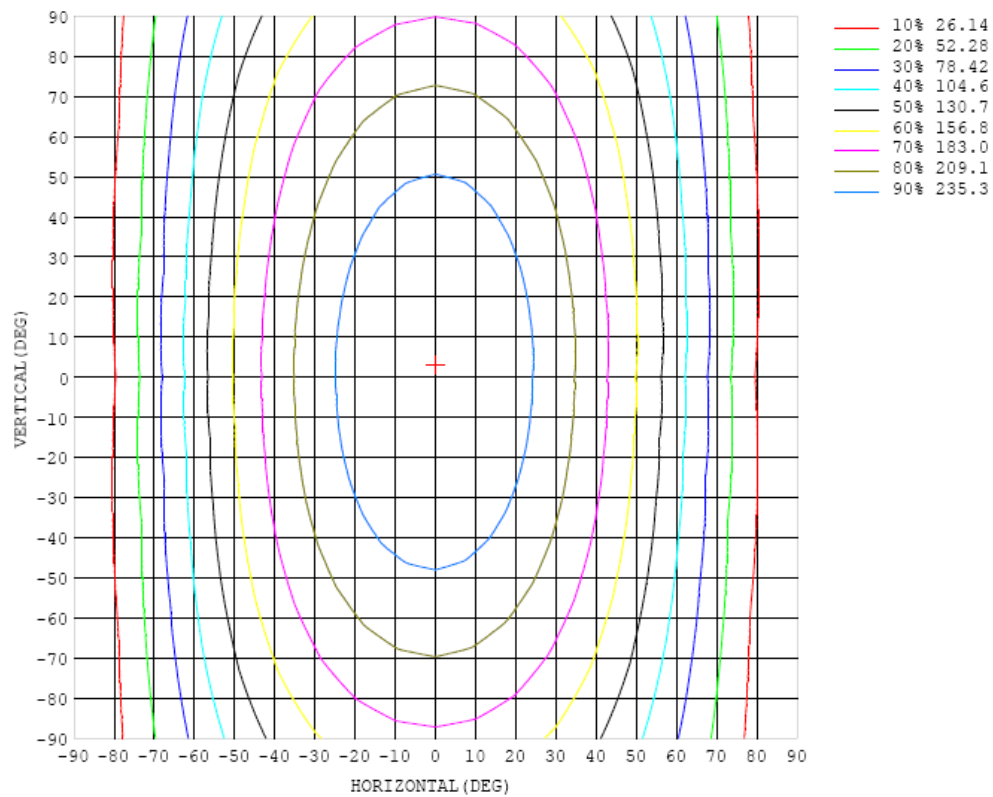


Chart 5: Isocandela Plot

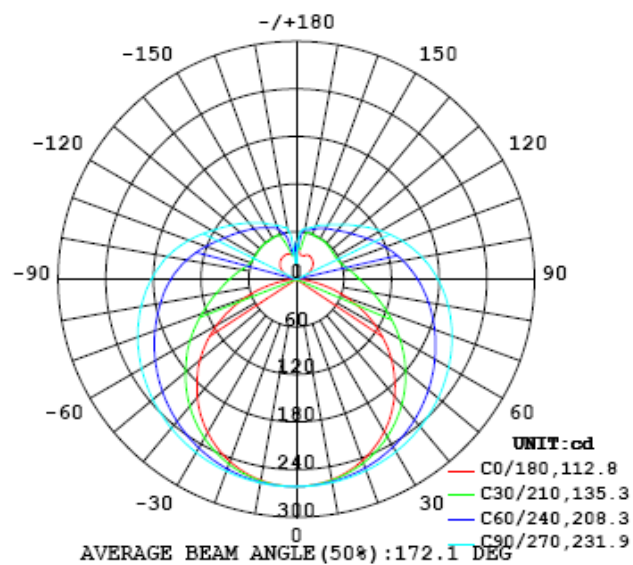


Chart 6: Polar Candela Distribution

## 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	261	261	261	261	261	261	261	261	261	261	261	261	261	261	261	261	261	261	261
5	260	260	260	260	260	261	261	261	261	261	261	261	261	261	261	261	261	260	260
10	257	257	257	257	258	258	259	260	260	260	260	260	260	259	258	258	258	257	257
15	251	251	252	253	254	255	257	258	258	259	259	258	257	256	255	254	253	252	252
20	243	244	245	247	249	251	253	255	256	257	256	256	254	252	250	248	246	245	244
25	234	234	236	239	242	246	249	252	253	254	254	252	250	247	243	240	237	235	235
30	222	222	225	229	234	239	244	248	250	251	250	248	245	241	236	231	227	224	223
35	208	209	213	218	225	232	238	243	246	247	247	244	239	233	227	220	215	211	210
40	192	194	199	206	215	224	232	238	242	243	242	239	233	226	217	208	201	195	194
45	175	177	184	193	204	215	225	232	237	238	237	233	226	217	207	196	186	179	177
50	156	159	167	180	193	206	217	226	231	233	232	227	219	208	195	182	169	160	158
55	136	139	150	165	181	197	209	219	225	228	226	221	211	199	184	168	152	141	138
60	114	119	132	151	170	187	202	212	219	222	220	214	203	189	172	153	135	120	116
65	91.3	97.4	114	136	158	177	194	205	213	215	213	207	195	180	161	139	117	98.9	92.7
70	68.6	76.2	96.9	122	147	168	185	198	206	209	207	199	187	170	149	125	99.5	77.2	69.1
75	45.6	56.0	80.6	109	136	159	177	191	199	202	199	192	179	161	139	112	83.5	57.8	46.1
80	24.3	37.7	66.9	97.7	126	150	169	183	191	194	192	184	171	153	129	101	70.1	39.9	24.5
85	7.75	23.7	55.7	87.9	117	142	161	175	184	187	184	176	163	144	120	91.2	59.1	26.5	7.75
90	0.37	16.3	47.8	79.9	109	133	153	167	175	178	176	168	155	136	112	83.3	51.3	19.2	0.30
95	1.96	13.7	42.5	73.7	102	126	145	159	167	170	168	160	147	128	105	76.8	46.0	16.5	1.70
100	4.79	14.6	39.0	67.9	94.5	118	136	150	158	161	159	151	138	120	97.3	71.3	42.5	17.0	4.62
105	8.45	17.4	37.4	63.3	88.0	110	128	141	149	151	149	142	129	112	90.9	66.6	40.7	19.7	8.57
110	12.1	21.2	38.0	59.8	82.2	103	119	132	139	142	140	133	121	105	84.9	62.9	41.0	23.6	12.3
115	15.9	25.5	39.4	57.8	77.4	95.6	111	123	130	132	130	124	113	97.8	79.7	60.6	42.3	27.4	16.2
120	19.8	29.4	41.6	57.0	73.7	89.2	103	114	120	122	121	115	105	91.2	76.0	59.7	44.3	30.7	20.1
125	23.6	33.8	44.1	57.0	71.0	83.9	95.8	105	111	113	112	106	97.3	85.7	73.3	59.3	46.7	34.0	23.9
130	27.1	37.7	46.6	57.4	69.1	79.9	89.8	97.6	102	104	103	98.5	91.1	81.5	71.0	59.6	48.7	38.0	26.9
135	29.7	41.3	48.8	58.2	67.7	77.1	84.8	91.3	95.4	96.9	95.7	92.1	85.9	78.1	69.3	60.1	50.1	41.4	29.2
140	31.6	44.7	50.5	58.8	66.7	74.2	80.3	85.6	89.0	90.2	89.3	86.4	81.3	75.3	68.1	60.4	51.4	44.4	31.0
145	32.9	46.9	52.5	59.1	65.7	71.9	77.1	80.7	83.3	84.3	83.7	81.3	77.7	72.8	67.1	60.2	51.7	46.6	32.4
150	33.9	47.0	54.0	59.0	64.8	69.6	73.9	76.9	78.6	79.2	78.8	77.4	74.6	70.6	65.7	58.1	54.4	48.6	33.0
155	33.9	45.7	56.5	59.2	63.3	67.4	70.9	73.3	74.9	75.5	75.1	73.9	71.5	68.0	63.3	58.2	56.6	49.7	33.8
160	32.1	40.1	58.4	60.1	62.2	65.0	67.6	69.4	70.6	71.1	71.0	69.9	68.1	65.7	59.9	59.5	56.1	45.6	34.1
165	30.9	34.1	48.4	61.6	62.4	63.6	64.6	65.9	66.8	67.3	67.5	67.0	66.2	59.6	57.5	51.9	45.9	37.6	33.3
170	31.1	31.1	35.3	48.9	59.9	62.5	63.6	64.3	64.7	65.0	65.1	65.2	56.4	48.7	42.3	39.0	36.0	32.6	32.3
175	39.1	37.8	37.0	39.4	41.0	43.0	49.6	57.6	60.1	60.3	57.4	39.7	31.8	34.1	36.1	36.8	37.3	36.6	37.7
180	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1

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	261	261	261	261	261	261	261	261	261	261	261	261	261	261	261	261	261		
5	260	261	261	261	261	261	261	261	261	261	261	261	261	261	260	260	260		
10	257	258	258	259	259	260	260	261	261	260	260	260	259	258	258	257	257		
15	252	253	254	255	257	258	259	259	259	259	258	257	256	255	253	252	252		
20	245	246	248	250	252	254	256	257	258	257	256	254	252	250	247	246	244		
25	236	238	241	244	247	250	253	255	255	254	253	250	247	243	240	237	235		
30	224	227	231	236	241	246	249	251	252	251	249	245	241	236	231	226	223		
35	211	215	221	227	234	240	245	248	249	248	245	240	234	227	220	214	210		
40	196	201	209	218	226	234	240	244	245	244	240	234	226	217	209	201	195		
45	179	186	196	207	218	227	234	239	241	239	235	227	218	207	196	186	179		
50	162	170	182	196	209	220	229	234	236	234	229	221	210	196	183	170	162		
55	142	154	168	185	200	213	222	229	231	229	223	213	201	185	169	154	142		
60	121	136	155	173	191	205	216	223	225	223	216	206	191	174	155	136	122		
65	99.9	118	140	163	181	197	209	216	219	217	210	198	182	164	141	119	101		
70	78.5	100	126	151	172	190	202	210	213	210	203	190	173	153	128	102	79.3		
75	57.9	84.2	114	141	164	182	195	203	206	203	196	183	166	142	115	85.7	59.0		
80	39.7	70.2	102	131	156	174	187	196	199	196	188	175	157	133	104	71.8	40.9		
85	26.0	59.1	92.5	122	147	166	179	188	191	188	180	167	148	124	94.1	60.6	27.2		
90	18.4	51.1	84.2	114	139	158	171	179	183	180	172	159	140	115	85.7	52.5	19.5		
95	14.9	45.0	77.0	106	130	149	163	171	174	171	164	151	132	107	78.4	46.3	15.7		
100	15.6	40.7	70.3	97.9	122	140	154	162	165	163	155	141	123	99.2	71.5	41.6	16.1		
105	18.8	39.5	64.8	90.4	113	131	144	152	155	152	145	132	114	91.5	65.8	39.8	19.2		
110	23.1	40.1	61.8	83.9	105	121	134	141	144	142	134	122	105	84.7	62.1	39.8	22.8		
115	27.3	42.0	60.3	79.4	97.1	112	124	131	133	131	124	113	97.7	79.7	60.0	41.3	26.9		
120	31.1	44.3	59.7	76.0	91.5	105	114	120	123	121	115	105	91.8	76.0	59.0	43.9	31.1		
125	34.5	46.4	59.7	73.6	86.9	98.3	107	112	114	112	107	98.4	87.0	73.3	59.0	45.8	35.0		
130	38.7	48.9	60.0	71.7	82.9	92.7	99.9	105	106	105	100	92.7	83.0	71.4	59.7	48.4	39.3		
135	42.2	51.3	60.1	70.2	79.5	87.7	93.8	97.7	99.3	97.9	94.0	87.7	79.6	70.1	59.6	51.0	42.7		
140	44.0	52.0	60.6	68.7	76.6	83.3	88.4	91.6	92.8	91.7	88.5	83.3	76.6	68.5	60.2	53.4	44.5		
145	44.4	53.6	59.6	67.1	73.6	79.3	83.4	86.0	87.0	86.2	83.5	79.3	73.5	66.9	61.4	55.6	45.2		
150	44.4	55.5	60.0	65.1	70.8	75.0	78.5	80.8	81.7	81.0	78.6	74.9	70.8	66.5	62.4	57.5	45.2		
155	42.3	55.5	60.3	62.5	68.2	71.6	74.0	75.4	76.0	75.7	74.3	72.1	69.4	66.3	63.3	58.4	46.1		
160	35.2	48.1	57.0	60.3	62.9	68.2	70.4	71.6	72.2	72.3	71.3	69.9	68.2	66.2	63.7	56.7	41.5		
165	33.8	36.6	42.2	48.1	55.7	60.7	64.5	67.8	68.5	68.8	68.6	67.7	67.0	65.5	61.8	52.0	35.5		
170	32.6	31.7	30.7	32.4	35.7	39.8	48.2	59.7	65.2	65.6	65.3	64.0	62.4	58.4	48.3	36.7	32.0		
175	37.0	37.0	35.7	36.0	36.0	35.5	32.6	27.9	28.7	49.8	50.7	43.8	42.1	42.2	39.2	37.1	38.4		
180	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1		

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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