

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

for

### **GREEN CREATIVE LTD**

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

**LED tube**

**Model: 12T8/3F/830/BYP/R**

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

**NVLAP CODE: 200960-0**

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Report No.: HZ18040014c

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

Review by:



Engineer: April Zou  
Apr. 27, 2018

Approved by:



Manager: Jim Zhang  
Apr. 27, 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: **12T8/3F/830/BYP/R**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
127.6	1568.0	12.29	0.9884
CCT (K)	CRI	Stabilization Time (Light & Power)	
3144	81.7	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** : Apr. 09, 2018

**Date of Test** : Apr. 12, 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

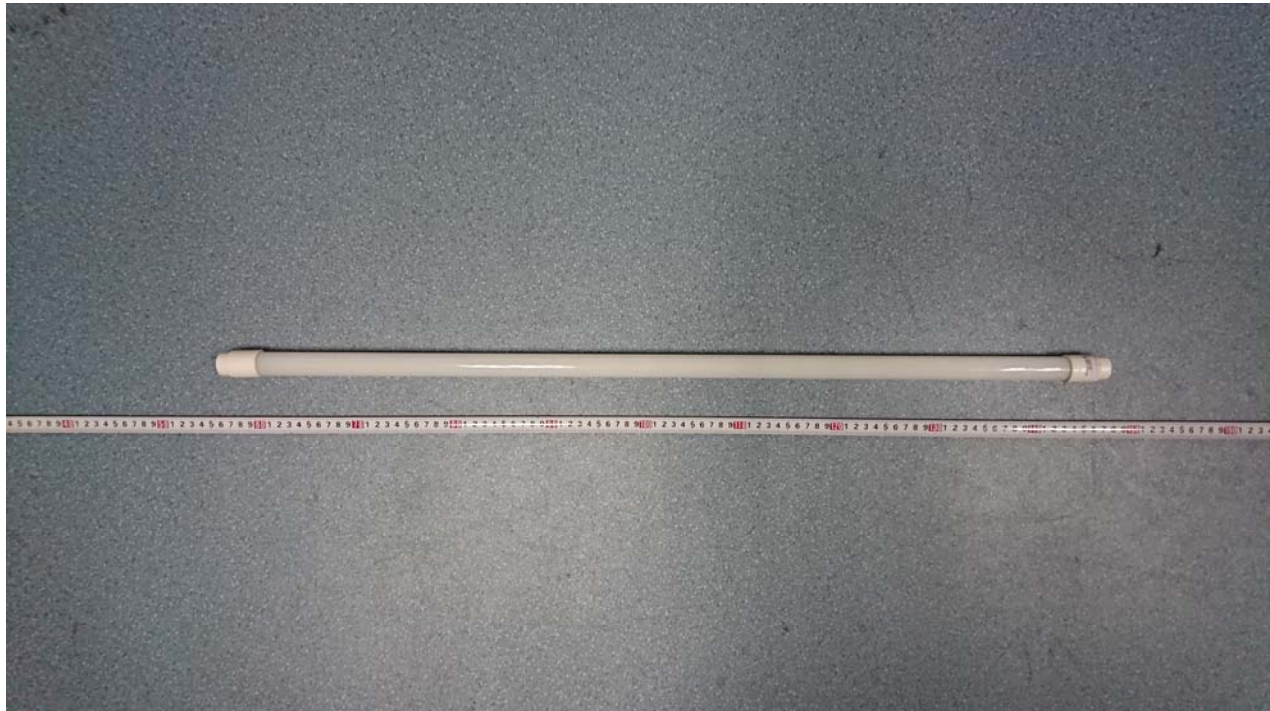


Figure 1- Overview of the sample

### Equipment Under Test (EUT)

<b>Name</b>	: LED tube
<b>Model</b>	: 12T8/3F/830/BYP/R
<b>Electrical Ratings</b>	: 120-277V, 50/60Hz, 12W
<b>Product Description</b>	: 3000K
<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)	0.104	0.048
Power Factor	0.9884	0.9185
Test Power (W)	12.29	12.32
THD A%	13.56	17.59
Luminous Efficacy (lm/W)	127.6	128.2
Total Luminous Flux (lm)	1568.0	1579.0
Color Rendering Index (CRI)	81.7	
R9	4.7	
Correlated Color Temperature (CCT)(K)	3144	
Chromaticity Chroma x	0.4295	
Chromaticity Chroma y	0.4063	
Chromaticity Chroma u	0.2449	
Chromaticity Chroma v	0.3474	
Duv	0.0016	
Chromaticity Chroma u'	0.2449	
Chromaticity Chroma v'	0.5212	

Special Color Rendering Indices	
R1	79.4
R2	88.7
R3	96.7
R4	80.3
R5	79.4
R6	85.7
R7	84.3
R8	59.7
R9	4.7
R10	74.2
R11	79.1
R12	66.9
R13	81.3
R14	98.3
Rf	83
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 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)	0.104
Power Factor	0.9851
Test Power (W)	12.32
Luminous Efficacy (lm/W)	125.0
Total Luminous Flux (lm)	1539.9
Beam Angle (°)	171.0
Center Beam Candle Power (cd)	247
Spacing Criteria	1.26 (0°-180°)/ 1.44 (90°-270°)
Zonal Lumens in the 0°-60°Zone	41.75%
Zonal Lumens in the 60°-90°Zone	26.67%
Zonal Lumens in the 90°-120°Zone	17.91%
Zonal Lumens in the 120°-180°Zone	13.67%

Table 3: Test data per Goniophotometer Method

## Spectral Power Distribution - Sphere Spectroradiometer Method

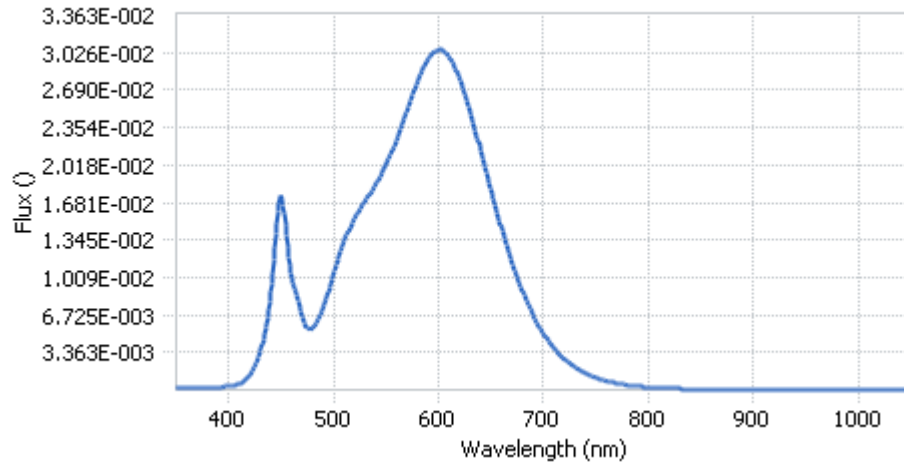
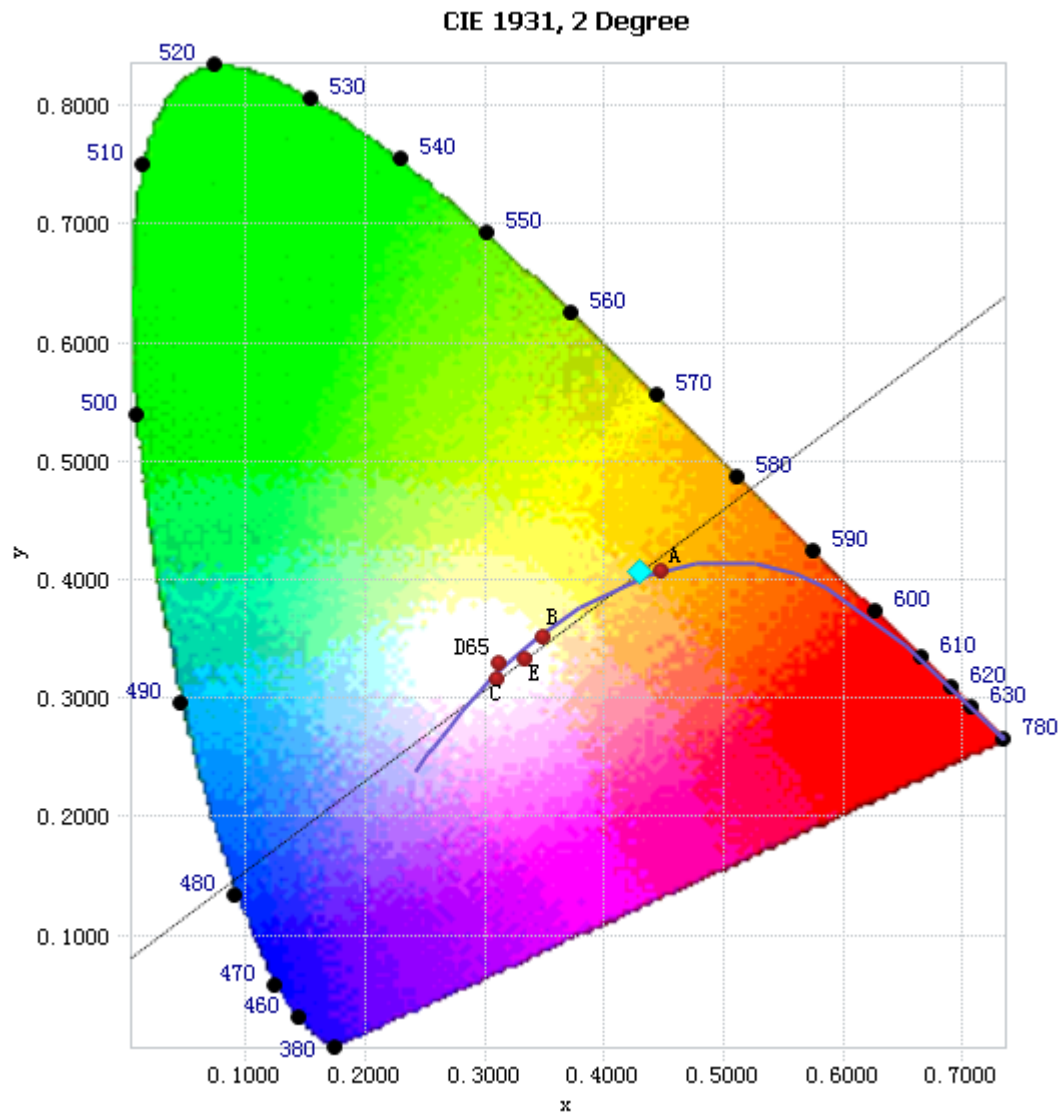


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.50E-04	485	6.31E-03	590	2.97E-02	695	5.86E-03
385	2.56E-04	490	7.32E-03	595	3.02E-02	700	5.05E-03
390	2.62E-04	495	8.89E-03	600	3.05E-02	705	4.35E-03
395	2.87E-04	500	1.05E-02	605	3.04E-02	710	3.74E-03
400	3.04E-04	505	1.20E-02	610	2.99E-02	715	3.21E-03
405	4.07E-04	510	1.34E-02	615	2.91E-02	720	2.77E-03
410	5.49E-04	515	1.45E-02	620	2.79E-02	725	2.38E-03
415	8.49E-04	520	1.55E-02	625	2.65E-02	730	2.04E-03
420	1.33E-03	525	1.62E-02	630	2.50E-02	735	1.75E-03
425	2.18E-03	530	1.69E-02	635	2.33E-02	740	1.50E-03
430	3.52E-03	535	1.77E-02	640	2.15E-02	745	1.28E-03
435	5.51E-03	540	1.85E-02	645	1.97E-02	750	1.10E-03
440	8.78E-03	545	1.93E-02	650	1.79E-02	755	9.41E-04
445	1.40E-02	550	2.02E-02	655	1.62E-02	760	8.11E-04
450	1.74E-02	555	2.13E-02	660	1.45E-02	765	6.90E-04
455	1.39E-02	560	2.24E-02	665	1.29E-02	770	5.94E-04
460	1.00E-02	565	2.38E-02	670	1.14E-02	775	5.15E-04
465	8.46E-03	570	2.51E-02	675	1.01E-02	780	4.36E-04
470	6.75E-03	575	2.64E-02	680	8.88E-03		
475	5.57E-03	580	2.77E-02	685	7.72E-03		
480	5.62E-03	585	2.89E-02	690	6.73E-03		

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

## Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4295, 0.4063)

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

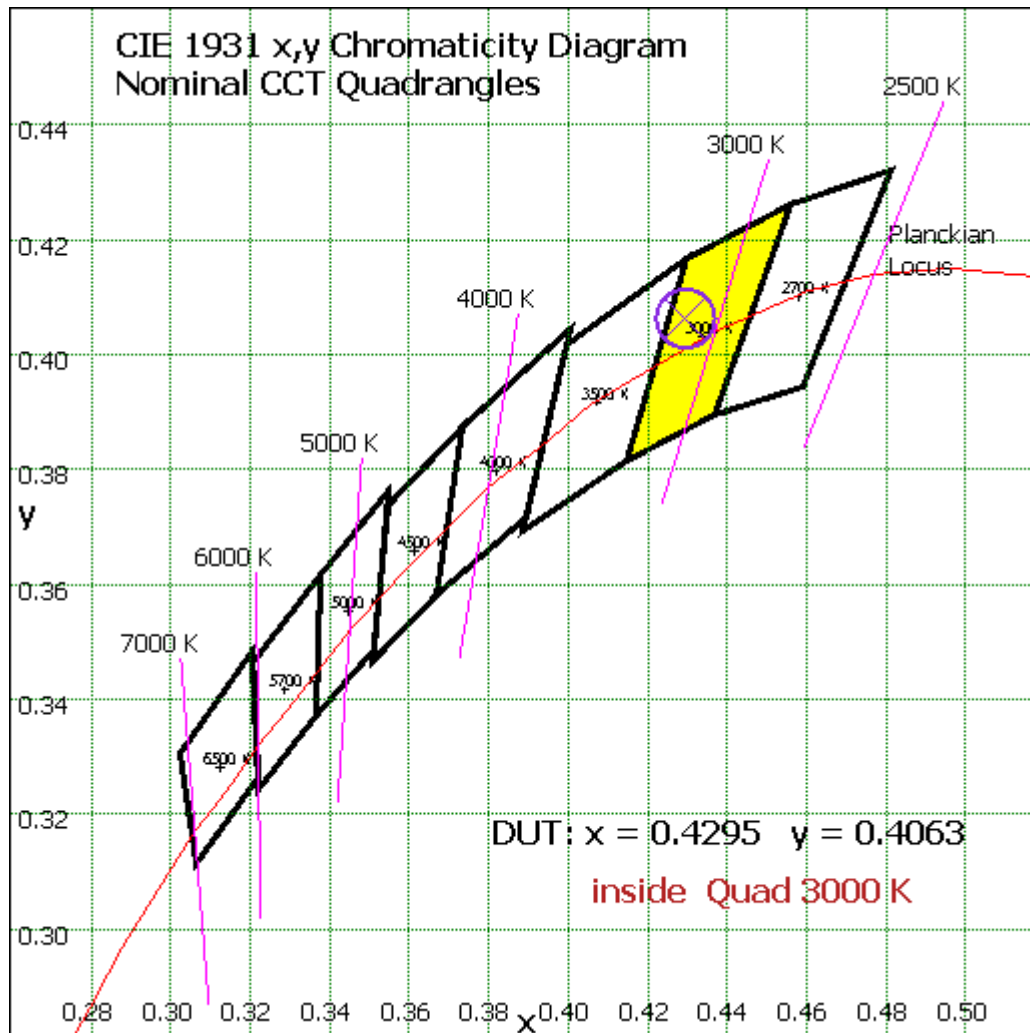


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

### Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	23.437	1.52%
10- 20	68.109	4.42%
20- 30	106.449	6.91%
30- 40	135.183	8.78%
40- 50	152.317	9.89%
50- 60	157.443	10.22%
60- 70	151.618	9.85%
70- 80	137.91	8.96%
80- 90	121.145	7.87%
90-100	106.029	6.89%
100-110	91.712	5.96%
110-120	78.015	5.07%
120-130	65.315	4.24%
130-140	53.541	3.48%
140-150	41.621	2.70%
150-160	29.44	1.91%
160-170	16.202	1.05%
170-180	4.407	0.29%
Total	1539.9	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	642.938	41.75%
60- 90	410.673	26.67%
0-90	1053.611	68.42%
90- 180	486.282	31.58%
0- 180	1539.9	100%

Table 5: Zonal Lumen Data

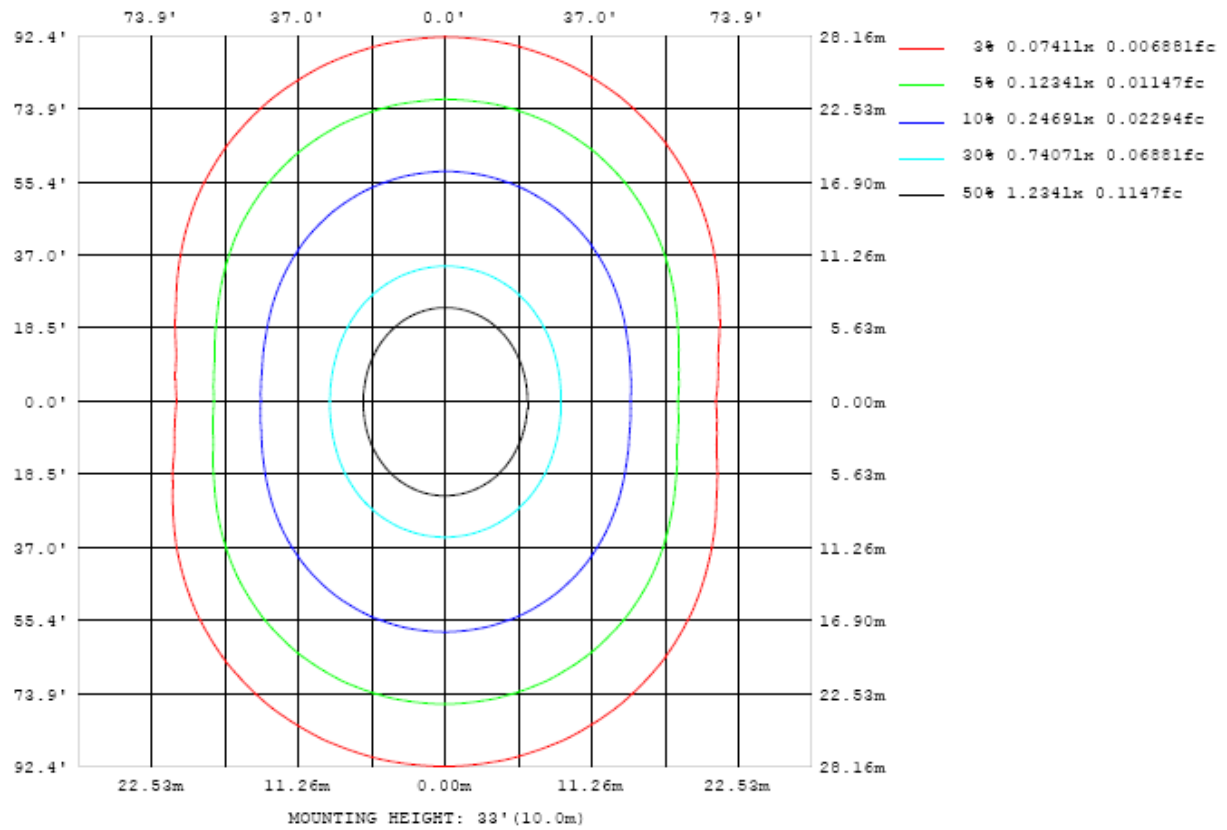


Chart 4: Illuminance Plot (Footcandles)

## Luminous Intensity Distribution Plots- Goniophotometer Method

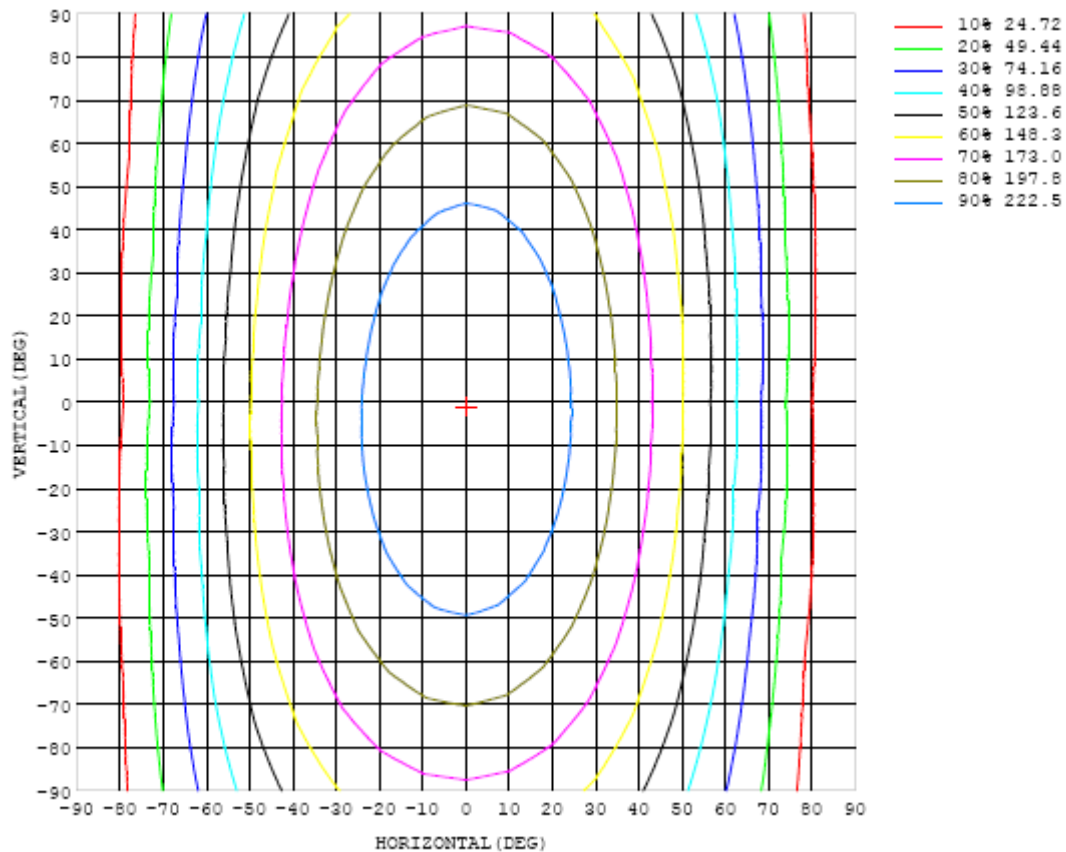


Chart 5: Isocandela Plot

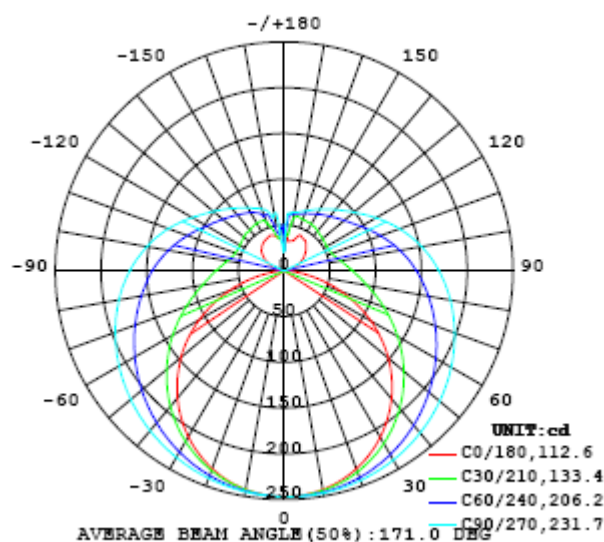


Chart 6: Polar Candela Distribution

## 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	247	247	247	247	247	247	247	247	247	247	247	247	247	247	247	247	247	247	247
5	246	246	246	246	246	247	247	247	247	247	247	247	247	247	246	246	246	246	246
10	243	243	243	244	244	245	246	246	246	247	246	246	246	245	244	244	243	243	243
15	237	238	239	240	241	242	244	245	245	246	245	245	244	242	241	240	239	238	237
20	230	231	232	234	236	238	241	242	243	244	243	242	241	239	236	234	232	231	230
25	221	222	224	227	230	233	237	239	241	242	241	239	237	234	230	227	224	222	221
30	210	211	214	218	223	227	232	235	238	239	238	236	232	228	223	218	214	211	209
35	197	199	202	208	214	220	226	231	234	235	234	232	227	221	215	208	202	198	196
40	183	184	189	196	204	213	220	226	230	231	230	227	221	214	205	197	189	184	181
45	166	169	175	184	194	205	214	220	225	227	225	221	215	206	195	185	175	168	165
50	149	151	159	171	183	196	206	215	220	222	220	216	208	197	185	172	160	151	147
55	130	133	143	157	172	187	199	208	214	216	215	210	201	189	174	158	144	132	128
60	109	114	126	143	161	178	191	202	208	211	209	203	193	180	163	145	127	113	107
65	88.1	93.5	109	129	150	168	184	195	202	205	203	196	186	171	152	132	111	93.0	85.4
70	66.3	73.2	92.4	116	139	159	176	188	195	198	196	189	178	162	142	119	94.6	73.3	63.3
75	45.1	54.0	76.7	103	129	150	168	181	188	191	189	182	170	154	132	107	79.8	55.0	42.4
80	25.0	36.1	63.0	92.2	119	142	160	173	181	184	182	175	163	145	123	96.6	67.0	38.6	22.1
85	8.72	22.2	52.1	82.7	110	134	152	166	174	177	175	167	155	137	115	87.6	57.4	26.3	6.66
90	0.86	14.5	44.2	74.7	103	126	144	158	166	169	167	160	147	129	107	80.1	50.0	19.6	0.53
95	1.72	11.6	38.9	68.2	95.4	118	137	150	158	161	159	152	140	122	99.9	73.8	45.0	16.8	1.95
100	4.79	12.6	35.4	63.0	88.5	111	129	142	149	152	150	143	131	115	93.2	68.2	41.4	17.4	5.12
105	8.86	15.7	34.3	58.5	82.2	103	120	133	141	143	141	135	123	107	86.9	64.0	39.8	20.0	9.48
110	13.3	19.5	35.1	55.4	76.6	96.2	112	124	131	134	132	126	115	99.9	81.1	60.6	40.3	23.8	14.3
115	18.0	24.4	36.8	54.1	72.1	89.6	104	115	122	125	123	117	107	93.1	76.3	59.0	41.9	28.4	19.2
120	22.5	29.1	39.2	53.8	69.0	83.9	97.0	107	113	116	114	109	99.5	87.2	73.1	58.4	44.1	33.0	23.8
125	26.6	33.1	41.7	54.1	66.9	79.7	90.7	99.3	105	107	106	101	93.1	82.8	70.7	58.3	46.5	37.0	28.2
130	30.4	36.2	45.1	54.9	66.0	76.3	85.7	93.0	97.6	99.5	98.4	94.5	87.9	79.1	69.0	58.8	49.1	40.4	32.2
135	34.0	40.2	48.1	55.6	65.1	73.6	81.4	87.4	91.4	92.9	92.1	88.8	83.3	76.1	67.8	59.5	51.5	43.4	34.9
140	36.9	42.5	50.5	56.9	64.4	71.4	77.7	82.7	86.0	87.2	86.5	83.8	79.4	73.5	66.8	60.1	53.5	46.6	37.1
145	40.3	47.1	52.4	58.4	63.6	69.5	74.6	78.5	81.1	82.1	81.5	79.5	76.0	71.3	66.2	60.8	55.1	48.7	38.6
150	40.8	47.8	54.5	59.2	63.5	67.3	71.6	74.9	76.8	77.7	77.2	75.6	72.9	69.2	65.4	61.3	55.5	51.6	39.8
155	42.9	50.5	55.8	59.4	63.2	66.1	68.8	71.1	72.7	73.4	73.2	71.9	69.9	67.4	64.9	60.6	56.4	53.9	40.8
160	38.0	47.4	57.7	59.7	62.4	64.9	66.8	68.4	69.4	69.7	69.6	68.9	67.7	66.1	64.5	59.6	56.3	52.9	41.4
165	33.7	39.7	53.3	61.0	62.3	63.3	64.5	65.6	66.2	66.8	67.1	66.7	66.2	64.5	58.8	52.6	49.1	45.8	39.6
170	32.9	32.3	42.1	57.0	61.6	62.4	63.4	63.8	64.2	65.0	65.8	65.6	62.1	54.0	45.9	42.3	41.0	39.3	36.6
175	37.8	35.3	36.4	38.9	42.9	51.2	59.8	63.3	63.4	63.6	64.0	54.4	41.6	36.3	37.4	38.5	39.8	40.3	39.7
180	21.3	21.3	21.3	21.3	21.3	21.3	21.3	21.3	21.3	21.3	21.3	21.3	21.3	21.3	21.3	21.3	21.3	21.3	21.3

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	247	247	247	247	247	247	247	247	247	247	247	247	247	247	247	247	247		
5	246	246	246	246	246	246	246	246	246	246	246	246	246	246	246	246	246		
10	243	243	243	243	244	244	245	245	245	245	245	244	244	243	243	243	243		
15	237	238	238	239	240	242	242	243	243	243	243	242	241	240	239	238	237		
20	230	231	232	234	236	238	240	241	241	241	240	239	237	235	233	231	230		
25	221	222	225	228	231	234	236	238	239	238	237	234	232	228	225	223	222		
30	210	212	215	220	225	229	232	234	236	235	233	230	226	221	217	213	211		
35	197	200	205	211	217	223	228	231	232	231	228	224	219	213	207	202	198		
40	182	187	193	201	210	217	222	226	228	227	224	218	212	204	196	189	184		
45	166	172	181	191	201	210	217	222	224	222	218	212	204	194	184	175	169		
50	149	156	168	180	192	203	211	217	219	217	213	205	195	183	171	160	152		
55	131	141	154	169	183	196	205	211	214	212	207	198	187	173	158	145	135		
60	111	124	141	158	174	188	199	205	208	206	201	191	178	162	146	129	115		
65	90.7	107	127	148	166	181	192	199	202	200	194	184	170	152	132	112	95.7		
70	70.4	90.0	114	137	157	173	186	193	196	194	188	177	161	142	120	96.1	76.0		
75	51.0	74.6	102	127	149	166	179	187	190	188	181	169	153	132	108	81.1	57.0		
80	33.9	61.4	90.8	118	141	158	172	180	183	181	174	162	145	123	97.2	68.0	40.1		
85	21.1	51.0	81.9	110	133	151	165	173	176	174	167	155	138	115	88.0	57.3	26.9		
90	14.6	43.9	74.6	103	126	144	157	165	169	167	159	148	130	108	80.4	49.7	19.2		
95	12.2	39.0	68.3	95.2	118	136	149	157	161	159	151	140	122	100	73.7	44.1	15.8		
100	13.7	36.2	63.1	88.7	111	129	142	149	152	150	144	132	115	93.2	67.8	40.2	15.8		
105	17.2	35.8	59.1	82.7	104	120	133	141	144	142	135	123	107	86.7	63.0	38.4	18.4		
110	21.8	37.0	56.9	77.6	96.8	113	124	132	135	133	126	115	99.9	80.8	59.5	38.7	22.6		
115	26.6	39.4	56.0	73.7	90.5	105	116	123	125	123	117	107	93.1	76.0	57.7	40.0	27.2		
120	30.9	42.1	56.0	71.1	85.8	97.9	107	114	116	115	109	99.7	87.5	72.7	56.9	42.4	31.9		
125	35.0	44.9	56.6	69.4	81.8	92.4	101	106	108	106	102	93.7	83.1	70.4	57.1	45.4	36.1		
130	38.2	47.8	57.5	68.1	78.6	87.6	94.6	99.2	101	99.5	95.4	88.6	79.6	68.8	57.9	48.4	39.7		
135	42.4	49.9	58.5	67.3	75.9	83.4	89.3	93.2	94.6	93.4	89.9	84.1	76.7	67.8	59.0	51.4	43.4		
140	44.5	52.1	58.1	66.4	73.6	79.7	84.6	87.7	89.0	87.9	85.0	80.2	74.2	67.1	60.1	53.5	46.5		
145	45.6	52.9	59.3	64.8	71.4	76.5	80.3	82.8	83.9	83.0	80.7	76.9	72.1	66.7	60.9	53.6	47.5		
150	47.3	53.9	60.0	63.0	69.4	73.7	76.6	78.5	79.3	78.7	76.9	74.1	70.5	66.4	61.2	54.9	49.2		
155	47.9	57.3	59.7	63.2	62.6	70.0	73.3	74.7	75.4	75.0	73.8	71.8	69.2	65.6	60.9	57.5	51.1		
160	41.4	51.6	56.1	60.6	64.4	63.5	68.2	71.1	71.8	71.6	70.8	69.5	66.9	64.0	61.1	57.2	47.6		
165	37.2	41.8	45.9	49.0	54.3	59.8	63.6	61.8	65.8	67.4	67.0	65.9	64.4	63.6	61.3	51.5	39.3		
170	34.8	35.1	36.1	37.7	39.5	42.3	47.0	60.5	63.0	60.8	63.3	64.0	62.5	58.3	44.5	37.6	33.9		
175	41.2	42.2	42.7	42.6	43.9	43.9	42.2	35.7	29.9	50.5	44.8	43.1	44.4	42.2	40.2	40.8	40.1		
180	21.3	21.3	21.3	21.3	21.3	21.3	21.3	21.3	21.3	21.3	21.3	21.3	21.3	21.3	21.3	21.3	21.3		

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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