

## LM-79-08 TEST REPORT

for

### GREEN CREATIVE LTD

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

### LED Tube

**Model: 13T8/4F/830/GL/BYP**

### Laboratory: Leading Testing Laboratories

**NVLAP CODE: 200960-0**

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Report No.: HZ19070032h

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

Review by:



Engineer: April Zou

Jul. 25, 2019

Approved by:



Manager: Jim Zhang

Jul. 25, 2019

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: 13T8/4F/830/GL/BYP

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
142.4	1822.9	12.80	0.9807
CCT (K)	CRI	Stabilization Time (Light & Power)	
3043	82.9	60	

Table 1: Executive Data Summary

Note: The above results are recorded/ derived from measurements made using an Integrating Sphere.

### Test specifications:

<b>Date of Receipt</b>	: Jul. 22, 2019
<b>Date of Test</b>	: Jul. 22, 2019
<b>Test item</b>	: Total Luminous Flux, Luminous Distribution Intensity, Luminous Efficacy, Correlated Color Temperature, Color Rendering Index, Chromaticity Coordinate, Electrical parameters
<b>Reference Standard</b>	: IESNA LM-79-2008 Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products ANSI/IES TM-30-18 IES Method for Evaluating Light Source Color Rendition

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## SAMPLE PHOTO

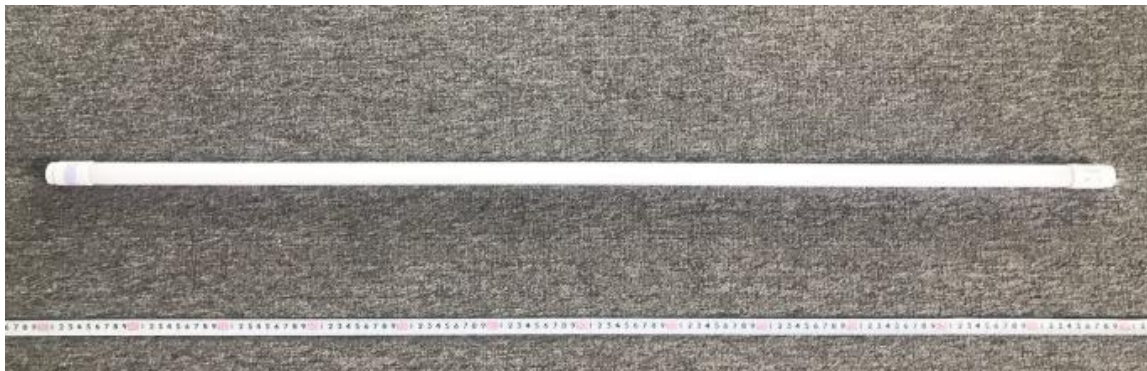


Figure 1- Overview of the sample

### Equipment Under Test(EUT)

<b>Name</b>	: LED Tube
<b>Model</b>	: 13T8/4F/830/GL/BYP
<b>Electrical Ratings</b>	: 120-277V, 50/60Hz, 13W
<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 25.0 °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 65 minutes.

### Sphere-Spectroradiometer Method

Parameter	Result	
Test Voltage (V)	120.0	277.0
Voltage frequency (Hz)	60	60
Test Current (A)	0.109	0.051
Power Factor	0.9807	0.9071
Test Power (W)	12.80	12.92
THD A%	17.21	12.97
Luminous Efficacy (lm/W)	142.4	141.8
Total Luminous Flux (lm)	1822.9	1832.8
Color Rendering Index (CRI)	82.9	
R9	10.2	
Correlated Color Temperature (CCT)(K)	3043	
Chromaticity Chroma x	0.4309	
Chromaticity Chroma y	0.3969	
Chromaticity Chroma u	0.2498	
Chromaticity Chroma v	0.3451	
Duv	-0.0021	
Chromaticity Chroma u'	0.2498	
Chromaticity Chroma v'	0.5176	

Special Color Rendering Indices	
R1	81.6
R2	91.2
R3	96.1
R4	80.8
R5	81.8
R6	88.9
R7	82.7
R8	60.2
R9	10.2
R10	79.8
R11	80.2
R12	71.7
R13	83.9
R14	98.5

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 30 m.

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)	0.109
Power Factor	0.9806
Power (W)	12.82
Luminous Efficacy (lm/W)	139.9
Total Luminous Flux (lm)	1793.7
Beam Angle ( ° )	115.7 (0°-180°) / 244.5 (90°-270°)
Center Beam Candle Power (cd)	271
Maximum Beam Candle Power (cd)	270.9 (At: C=60.0, Gamma=1.0)
Spacing Criteria	1.28 (0°-180°) / 1.46 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	40.03%
Zonal Lumens in the 60 °-90 °Zone	26.49%
Zonal Lumens in the 90 °-120 °Zone	18.61%
Zonal Lumens in the 120 °-180 °Zone	14.87%

Table 3: Test data per Goniophotometer Method

## Spectral Power Distribution - Sphere Spectroradiometer Method

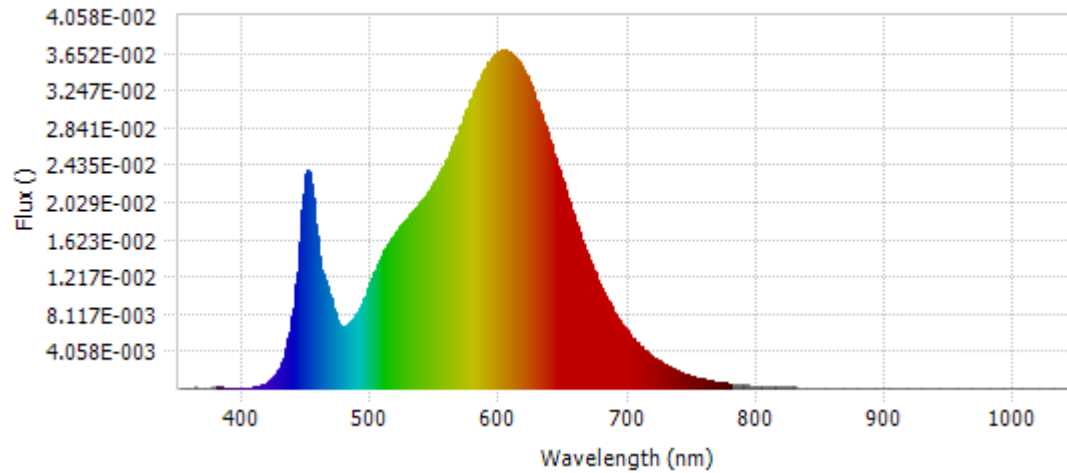
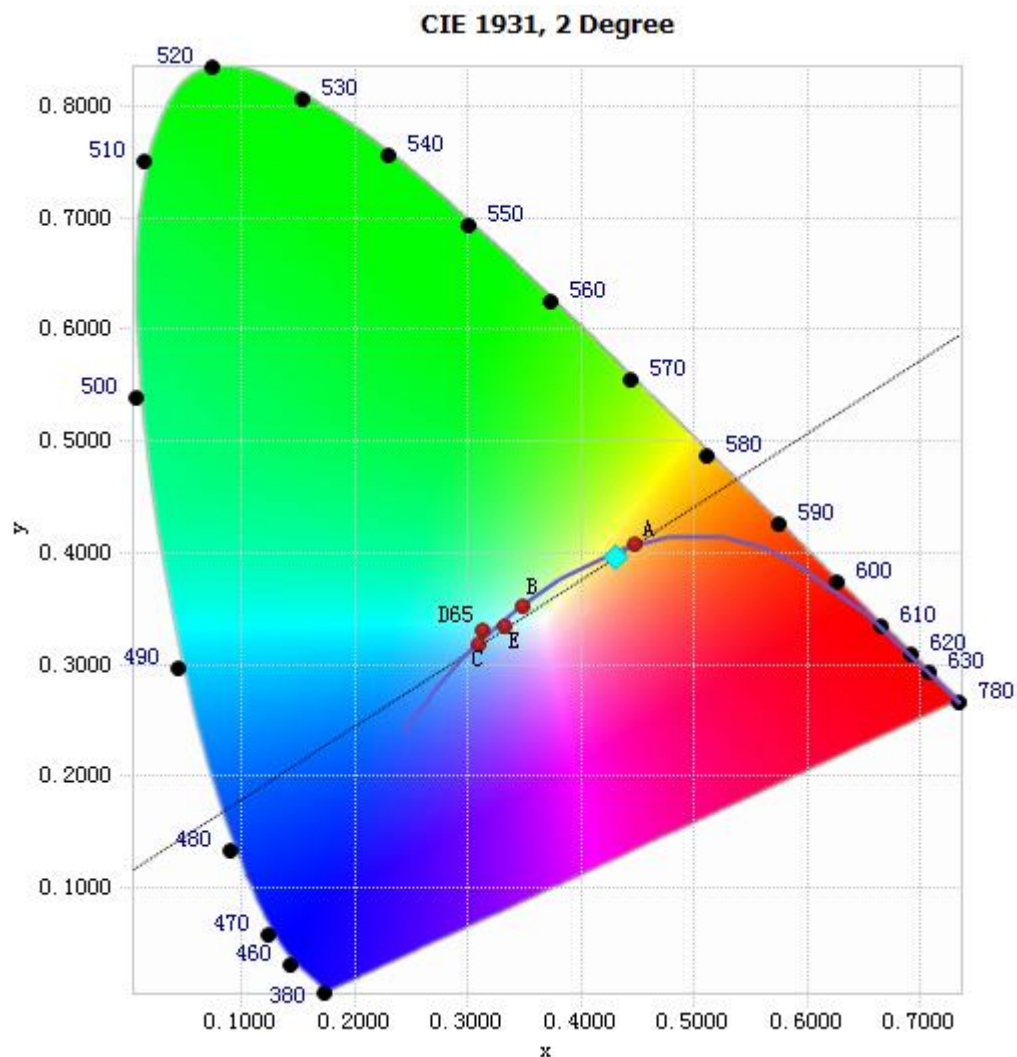


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.13E-04	485	7.41E-03	590	3.53E-02	695	7.05E-03
385	8.75E-05	490	8.47E-03	595	3.62E-02	700	6.09E-03
390	8.90E-05	495	1.01E-02	600	3.67E-02	705	5.24E-03
395	7.19E-05	500	1.20E-02	605	3.68E-02	710	4.50E-03
400	5.86E-05	505	1.36E-02	610	3.63E-02	715	3.88E-03
405	7.57E-05	510	1.50E-02	615	3.55E-02	720	3.34E-03
410	1.83E-04	515	1.63E-02	620	3.42E-02	725	2.87E-03
415	3.79E-04	520	1.73E-02	625	3.27E-02	730	2.46E-03
420	7.78E-04	525	1.81E-02	630	3.08E-02	735	2.11E-03
425	1.54E-03	530	1.89E-02	635	2.87E-02	740	1.78E-03
430	2.94E-03	535	1.97E-02	640	2.65E-02	745	1.52E-03
435	5.47E-03	540	2.06E-02	645	2.42E-02	750	1.31E-03
440	9.98E-03	545	2.16E-02	650	2.20E-02	755	1.12E-03
445	1.77E-02	550	2.27E-02	655	1.98E-02	760	9.55E-04
450	2.37E-02	555	2.40E-02	660	1.77E-02	765	8.16E-04
455	1.94E-02	560	2.54E-02	665	1.57E-02	770	6.98E-04
460	1.36E-02	565	2.71E-02	670	1.39E-02	775	5.91E-04
465	1.12E-02	570	2.89E-02	675	1.22E-02	780	5.08E-04
470	8.75E-03	575	3.06E-02	680	1.07E-02		
475	6.94E-03	580	3.23E-02	685	9.35E-03		
480	6.78E-03	585	3.40E-02	690	8.12E-03		

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

# Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4309, 0.3969)

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

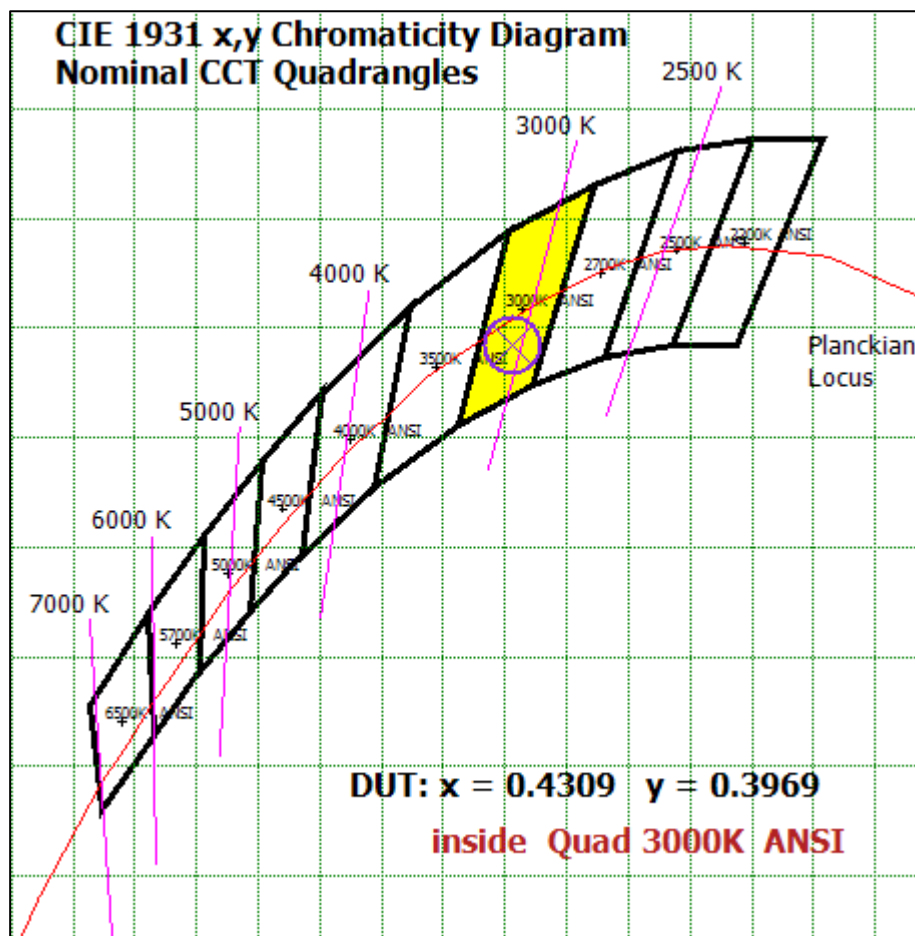
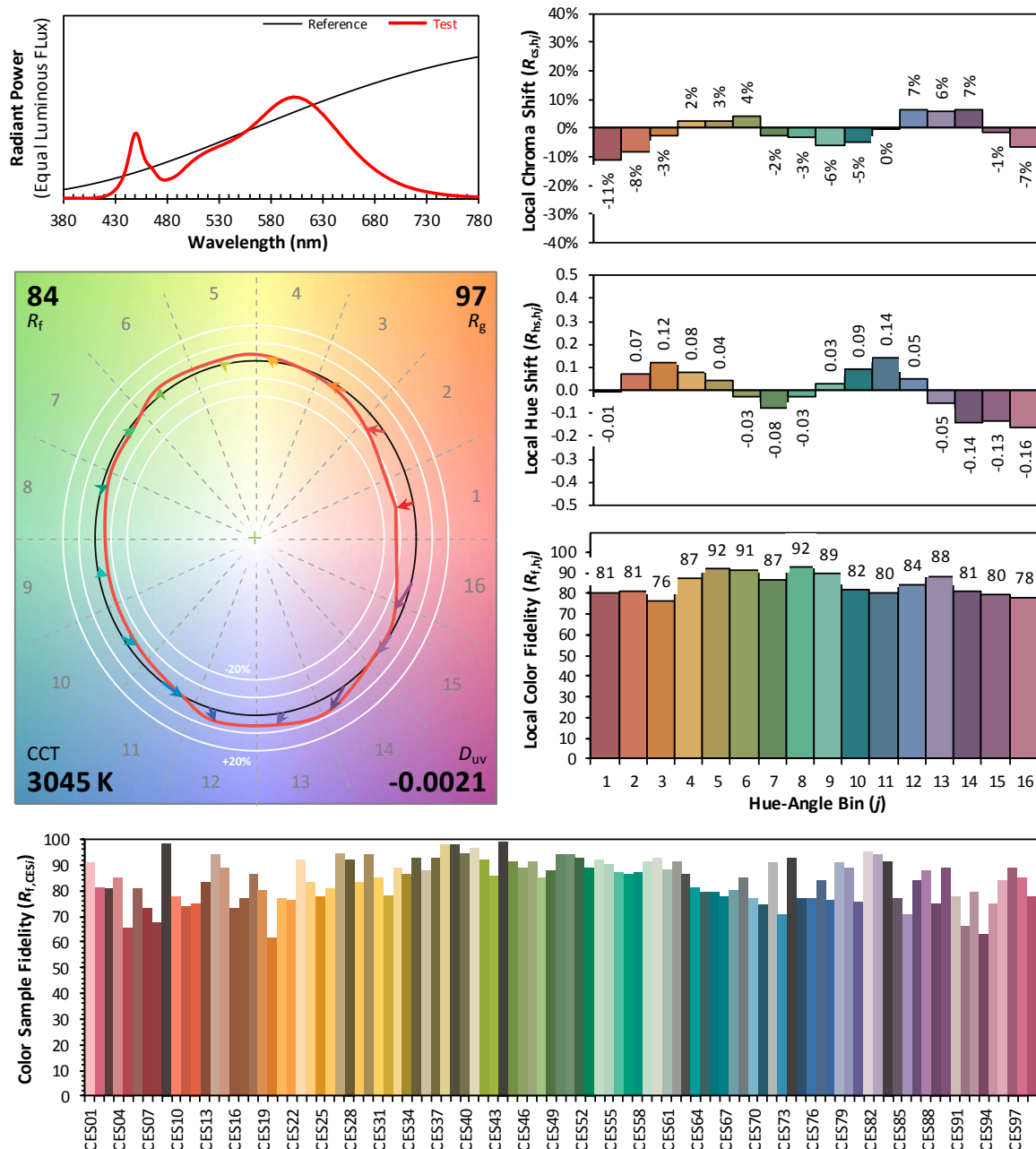


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

## Color Rendition Report – Sphere Spectroradiometer Method



Notes: This is a recommended method for displaying ANSI/IES TM-30-18 information.

$x$  0.4309  
 $y$  0.3969  
 $u'$  0.2498  
 $v'$  0.5176

Chart 4: Full Report Created with the IES TM-30 Calculator

Note: The values in this diagram might be a little different from the values in Table 2 due to rounding.

### Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	25.724	1.43%
10- 20	74.942	4.18%
20- 30	117.693	6.56%
30- 40	150.456	8.39%
40- 50	170.903	9.53%
50- 60	178.278	9.94%
60- 70	173.499	9.67%
70- 80	159.636	8.90%
80- 90	142.075	7.92%
90-100	126.284	7.04%
100-110	111.144	6.20%
110-120	96.344	5.37%
120-130	81.856	4.56%
130-140	67.667	3.77%
140-150	53.039	2.96%
150-160	37.444	2.09%
160-170	20.655	1.15%
170-180	6.064	0.34%
Total	1793.7	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	717.996	40.03%
60- 90	475.21	26.49%
0-90	1193.206	66.52%
90- 180	600.497	33.48%
0- 180	1793.7	100%

Table 5: Zonal Lumen

### Illuminance Plots- Goniophotometer Method

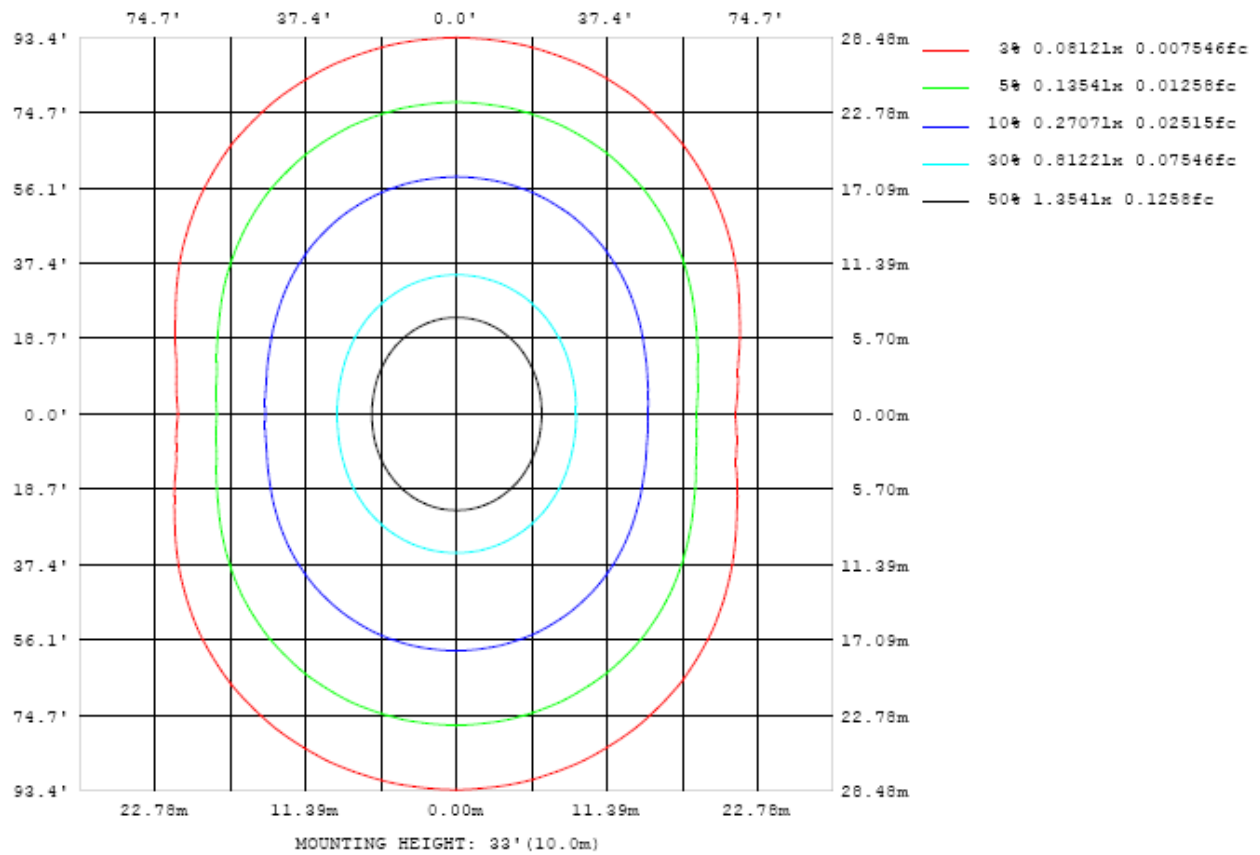


Chart 5: Illuminance Plot (Footcandles)

## Luminous Intensity Distribution Plots- Goniophotometer Method

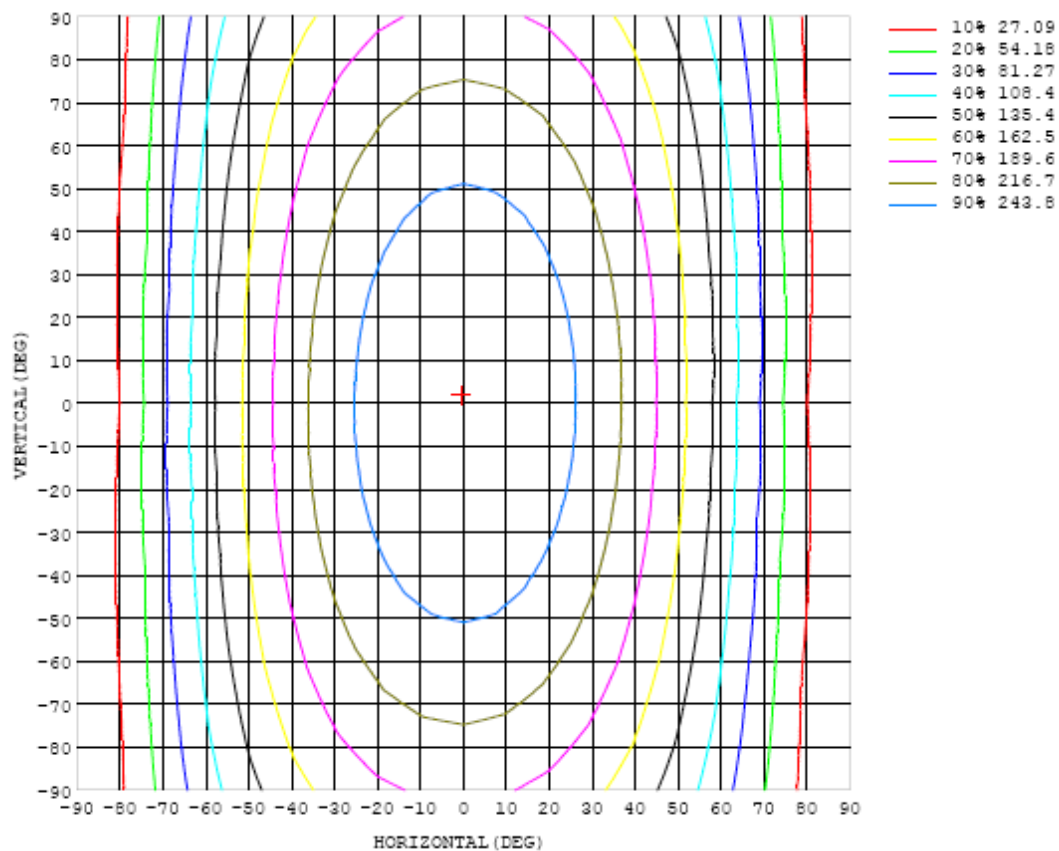


Chart 6: Isocandela Plot

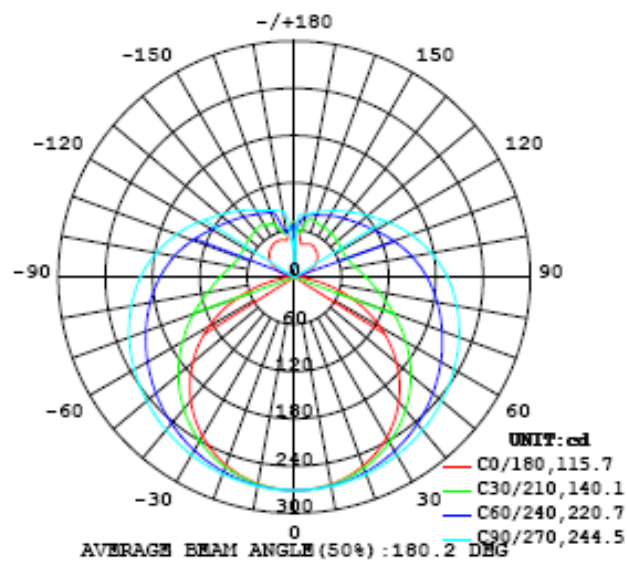


Chart 7: Polar Candela Distribution

## 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	271	271	271	271	271	271	271	271	271	271	271	271	271	271	271	271	271	271	271
5	270	270	270	270	270	270	270	270	271	271	270	270	270	270	270	270	270	270	270
10	267	267	267	268	268	269	269	269	270	270	269	269	269	268	268	267	267	267	266
15	262	262	263	264	265	266	267	268	269	268	268	268	267	265	264	263	262	261	261
20	255	256	257	258	260	262	264	265	266	266	266	265	263	261	259	258	256	254	254
25	246	247	248	251	254	257	260	262	264	264	263	262	259	257	253	250	247	245	245
30	235	236	238	242	246	251	255	258	261	261	260	258	255	251	246	241	237	234	233
35	222	223	226	232	238	244	249	254	257	258	257	254	250	244	238	231	225	222	220
40	207	208	213	220	228	236	243	249	253	254	252	249	244	236	228	220	212	207	205
45	189	191	198	207	218	228	237	244	248	249	248	244	237	229	218	207	197	190	187
50	170	173	181	193	207	219	230	238	243	245	243	239	231	220	208	194	181	172	168
55	149	152	163	179	195	210	223	232	238	240	238	233	224	211	197	180	164	152	148
60	126	131	145	164	183	201	215	226	232	234	233	227	217	203	186	166	146	131	125
65	101	108	126	149	172	192	207	219	226	229	227	221	210	194	175	152	128	109	101
70	76.1	84.6	107	135	161	183	200	212	220	223	221	214	202	185	164	138	110	86.1	75.8
75	51.3	62.4	90.0	121	150	174	192	206	214	216	214	207	195	177	154	125	93.9	64.6	51.7
80	27.5	42.2	74.7	109	140	165	184	198	207	210	208	200	187	169	144	114	79.6	45.8	28.1
85	9.11	26.7	63.3	99.4	131	157	177	191	199	202	200	193	180	161	136	105	68.7	31.3	8.94
90	0.49	18.7	55.1	91.1	123	149	169	183	191	194	192	185	172	153	128	96.8	61.0	23.7	0.59
95	2.49	16.3	49.7	84.2	115	141	160	175	183	186	184	177	164	145	120	90.1	55.7	21.3	2.94
100	6.52	18.3	46.5	78.5	108	133	152	166	174	177	175	168	155	137	113	84.4	52.5	22.8	7.69
105	12.0	22.7	45.9	74.1	101	125	143	157	165	168	166	159	147	129	107	79.8	51.5	26.7	13.7
110	18.2	27.6	47.3	71.2	95.9	118	135	147	155	158	156	150	138	122	101	76.7	52.7	32.1	20.2
115	24.1	33.2	49.9	70.0	91.1	111	127	138	146	149	147	141	130	115	95.9	75.3	55.1	37.4	26.9
120	29.9	38.3	53.1	69.9	87.9	105	119	130	137	139	138	132	122	108	92.5	74.8	58.2	43.4	33.2
125	34.7	42.9	56.2	70.5	85.7	100	112	122	128	130	129	124	115	104	89.9	75.1	61.2	49.3	38.1
130	38.5	48.4	58.8	71.5	84.2	96.3	107	115	120	122	121	116	109	99.5	88.0	75.9	63.5	54.2	41.9
135	41.2	53.7	62.2	72.4	83.2	93.1	102	109	113	115	114	110	104	96.0	86.7	76.5	66.4	59.3	44.8
140	43.3	58.7	64.5	72.5	82.3	90.7	97.7	103	107	108	108	105	99.7	93.2	85.7	76.8	69.3	63.5	47.1
145	45.1	62.9	66.5	73.7	81.0	88.3	94.1	98.6	102	103	102	99.8	95.8	90.8	85.0	77.8	71.6	67.6	48.9
150	46.7	66.5	69.3	74.0	79.8	85.4	90.5	94.3	96.7	97.6	97.2	95.6	92.6	88.7	84.4	78.6	73.3	70.9	50.3
155	46.3	62.8	72.5	74.1	79.0	83.0	86.4	89.8	91.9	92.9	92.8	92.0	89.7	86.9	83.4	77.1	71.8	69.9	50.7
160	44.8	55.5	75.0	75.6	77.7	81.1	84.0	86.2	87.5	88.3	88.7	88.5	86.8	84.4	78.9	73.5	68.0	64.1	50.4
165	43.8	49.0	62.3	76.8	77.7	79.5	81.1	82.8	84.0	84.5	84.6	84.0	82.3	75.3	70.1	63.2	60.4	56.1	49.0
170	45.9	45.2	49.0	62.9	74.3	76.1	78.0	80.5	80.8	81.0	81.2	77.8	68.1	60.7	60.4	60.3	58.5	52.6	50.0
175	60.4	59.0	57.7	59.2	61.9	63.2	67.0	70.4	79.2	80.3	67.0	48.0	50.7	57.9	58.9	61.0	60.6	60.7	62.1
180	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0

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	271	271	271	271	271	271	271	271	271	271	271	271	271	271	271	271	271		
5	269	270	270	270	270	270	270	271	270	270	270	270	270	270	270	270	270		
10	266	267	267	268	268	269	269	270	270	269	269	269	269	268	268	267	267		
15	261	262	263	264	265	266	267	268	268	268	268	267	266	265	264	263	262		
20	254	255	257	259	261	263	265	266	266	266	265	264	262	260	258	257	256		
25	245	247	249	253	256	259	262	263	264	263	262	260	257	254	251	248	247		
30	234	237	241	245	250	254	258	260	261	260	258	255	251	247	242	239	236		
35	221	225	230	237	243	249	253	256	258	257	254	250	245	239	232	227	223		
40	206	211	219	227	236	243	249	252	254	252	249	244	237	229	221	214	208		
45	190	196	206	217	228	236	244	248	249	248	244	238	229	219	209	199	192		
50	171	180	193	206	219	230	238	243	245	243	239	231	221	208	195	183	173		
55	152	163	179	195	210	223	232	238	240	238	233	224	212	197	181	166	154		
60	131	145	164	184	201	215	226	233	235	233	227	217	203	186	167	148	133		
65	108	127	150	173	193	208	220	227	229	227	221	210	194	175	153	130	111		
70	85.3	109	136	162	184	201	213	221	223	221	214	202	186	164	139	112	87.6		
75	63.1	91.6	123	152	175	193	207	215	217	215	207	195	177	155	126	94.7	65.6		
80	43.2	76.9	112	143	167	186	200	208	210	208	201	187	169	145	115	79.8	45.8		
85	28.3	65.4	102	134	159	179	192	200	203	201	193	180	161	136	105	68.2	30.8		
90	20.6	57.5	94.4	126	152	171	185	193	196	193	185	172	154	128	96.7	60.1	22.7		
95	18.2	52.2	87.7	119	144	163	176	185	187	185	177	164	146	120	89.6	54.3	19.7		
100	20.3	49.1	81.8	112	136	155	168	176	178	176	168	156	137	113	83.4	50.6	20.9		
105	24.8	48.8	77.3	105	128	146	159	166	169	166	159	147	129	106	78.5	49.5	25.0		
110	30.9	50.4	74.7	99.0	121	137	150	157	159	157	150	138	121	99.8	75.3	50.3	30.0		
115	37.3	53.4	73.7	94.6	113	129	140	147	150	147	141	129	114	94.8	73.5	52.4	36.3		
120	43.3	56.7	73.8	91.6	108	121	132	138	140	138	132	121	108	91.3	73.0	55.1	42.2		
125	48.7	60.2	74.4	89.3	103	115	124	129	131	129	124	115	103	88.8	73.2	58.3	47.4		
130	54.1	63.9	75.3	87.8	99.6	110	117	122	123	122	117	109	99.1	87.0	73.6	62.4	52.2		
135	58.7	67.1	76.3	86.6	96.4	105	111	115	116	115	111	104	95.8	85.4	74.5	65.8	57.5		
140	63.0	66.9	77.5	85.5	93.5	100	106	109	110	109	105	99.9	92.6	84.0	76.2	69.2	62.0		
145	66.3	71.9	78.6	84.7	90.8	96.2	101	103	104	103	100	95.6	89.7	83.6	77.5	71.4	65.7		
150	69.1	74.5	77.1	84.2	88.8	92.6	95.8	97.9	98.5	97.6	95.3	92.0	88.0	83.7	79.0	74.3	68.7		
155	65.1	73.1	74.6	82.3	87.1	89.9	92.0	93.5	93.9	93.3	92.0	89.7	87.0	83.6	80.1	77.0	65.6		
160	55.6	65.6	70.1	71.7	82.9	87.3	89.0	90.0	90.4	90.0	89.3	88.0	86.1	83.8	81.6	78.2	58.2		
165	49.8	56.0	60.1	62.6	66.0	72.7	85.7	87.2	87.4	87.3	87.0	86.2	85.2	83.3	81.3	74.9	48.3		
170	50.0	50.4	56.7	60.1	60.7	57.3	61.1	73.8	85.1	85.0	85.0	84.0	80.6	79.5	72.9	56.0	43.6		
175	62.4	62.4	61.5	62.9	61.5	61.9	57.7	46.5	51.6	76.1	74.1	65.8	62.6	60.0	58.6	56.4	58.7		
180	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0		

Table 7: Luminous Intensity Data



## EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Aug. 14, 2018	Aug. 13, 2019
Digital Power Meter	PF2010A	HZTE028-01	Sep. 12, 2018	Sep. 11, 2019
AC Power Supply	DPS1060	HZTE001-06	Aug. 09, 2018	Aug. 08, 2019
DC Power Supply	WY12010	HZTE004-03	Aug. 09, 2018	Aug. 08, 2019
Temperature recorder	JM624U	HZTE018-08	Aug. 09, 2018	Aug. 08, 2019
Temperature and humidity recorder	JR900	HZTE018-01	Aug. 09, 2018	Aug. 08, 2019
Standard source	D908	HZTE012-01	Aug. 14, 2018	Aug. 13, 2019
Integrate Sphere system	3M	HZTE015-04	Aug. 16, 2018	Aug. 15, 2019
Digital Power Meter	WT210	HZTE008-01	Aug. 02, 2018	Aug. 01, 2019
AC Power Supply	PCR 500L	HZTE001-07	Aug. 09, 2018	Aug. 08, 2019
DC Power Supply	IT6154	HZTE004-04	Aug. 09, 2018	Aug. 08, 2019
Standard source	SCL-1400	HZTE012-02	Aug. 16, 2018	Aug. 15, 2019
Temperature and humidity recorder	JR900	HZTE018-02	Aug. 09, 2018	Aug. 08, 2019
Temperature Meter	TES1310	HZTE017-01	Aug. 09, 2018	Aug. 08, 2019

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**

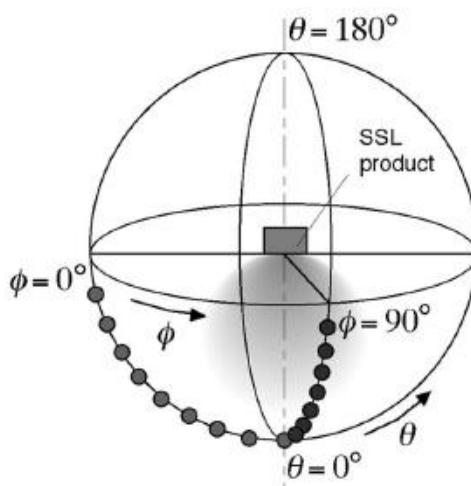
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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