

## LM-79-08 TEST REPORT

for

### GREEN CREATIVE LTD

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

### LED Tube

**Model: 13T8/4F/840/GL/BYP**

### Laboratory: Leading Testing Laboratories

**NVLAP CODE: 200960-0**

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Report No.: HZ19070032j

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

Review by:



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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/840/GL/BYP

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
143.3	1840.0	12.84	0.9809
CCT (K)	CRI	Stabilization Time (Light & Power)	
4040	83.1	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. 23, 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

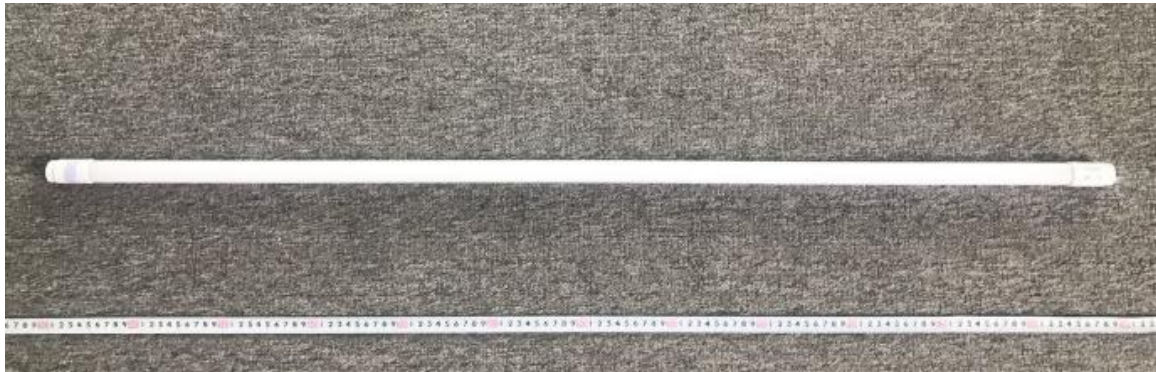


Figure 1- Overview of the sample

### Equipment Under Test(EUT)

<b>Name</b>	: LED Tube
<b>Model</b>	: 13T8/4F/840/GL/BYP
<b>Electrical Ratings</b>	: 120-277V, 50/60Hz, 13W
<b>Product Description</b>	: 4000K
<b>Manufacturer</b>	: GREEN CREATIVE LTD
<b>Address</b>	: 756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

## TEST RESULTS

Test ambient temperature was 26.0 °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	0.052
Power Factor	0.9809	0.9071
Test Power (W)	12.84	13.04
THD A%	16.86	13.52
Luminous Efficacy (lm/W)	143.3	142.0
Total Luminous Flux (lm)	1840.0	1851.1
Color Rendering Index (CRI)	83.1	
R9	9.6	
Correlated Color Temperature (CCT)(K)	4040	
Chromaticity Chroma x	0.3791	
Chromaticity Chroma y	0.3776	
Chromaticity Chroma u	0.2239	
Chromaticity Chroma v	0.3345	
Duv	0.0008	
Chromaticity Chroma u'	0.2239	
Chromaticity Chroma v'	0.5018	

Special Color Rendering Indices	
R1	81.8
R2	91.7
R3	95.7
R4	79
R5	81
R6	87.2
R7	84.6
R8	63.6
R9	9.6
R10	79
R11	77.3
R12	59.3
R13	84.8
R14	98.2

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)	0.110
Power Factor	0.9812
Power (W)	12.91
Luminous Efficacy (lm/W)	140.4
Total Luminous Flux (lm)	1813.1
Beam Angle ( ° )	117.0 (0°-180°) / 256.1 (90°-270°)
Center Beam Candle Power (cd)	263
Maximum Beam Candle Power (cd)	262.8 (At: C=170.0, Gamma=0.5)
Spacing Criteria	1.29 (0°-180°) / 1.48 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	38.96%
Zonal Lumens in the 60 °-90 °Zone	26.50%
Zonal Lumens in the 90 °-120 °Zone	19.06%
Zonal Lumens in the 120 °-180 °Zone	15.48%

Table 3: Test data per Goniophotometer Method

## Spectral Power Distribution - Sphere Spectroradiometer Method

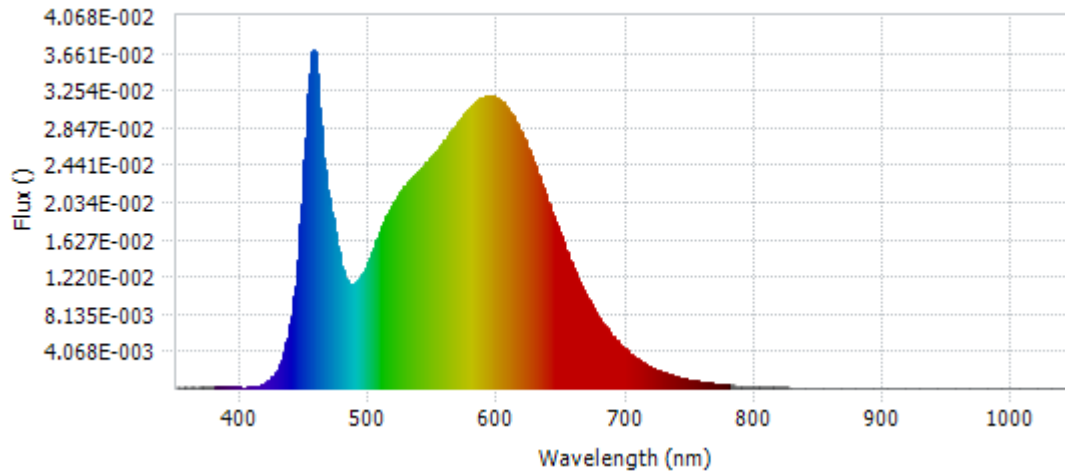
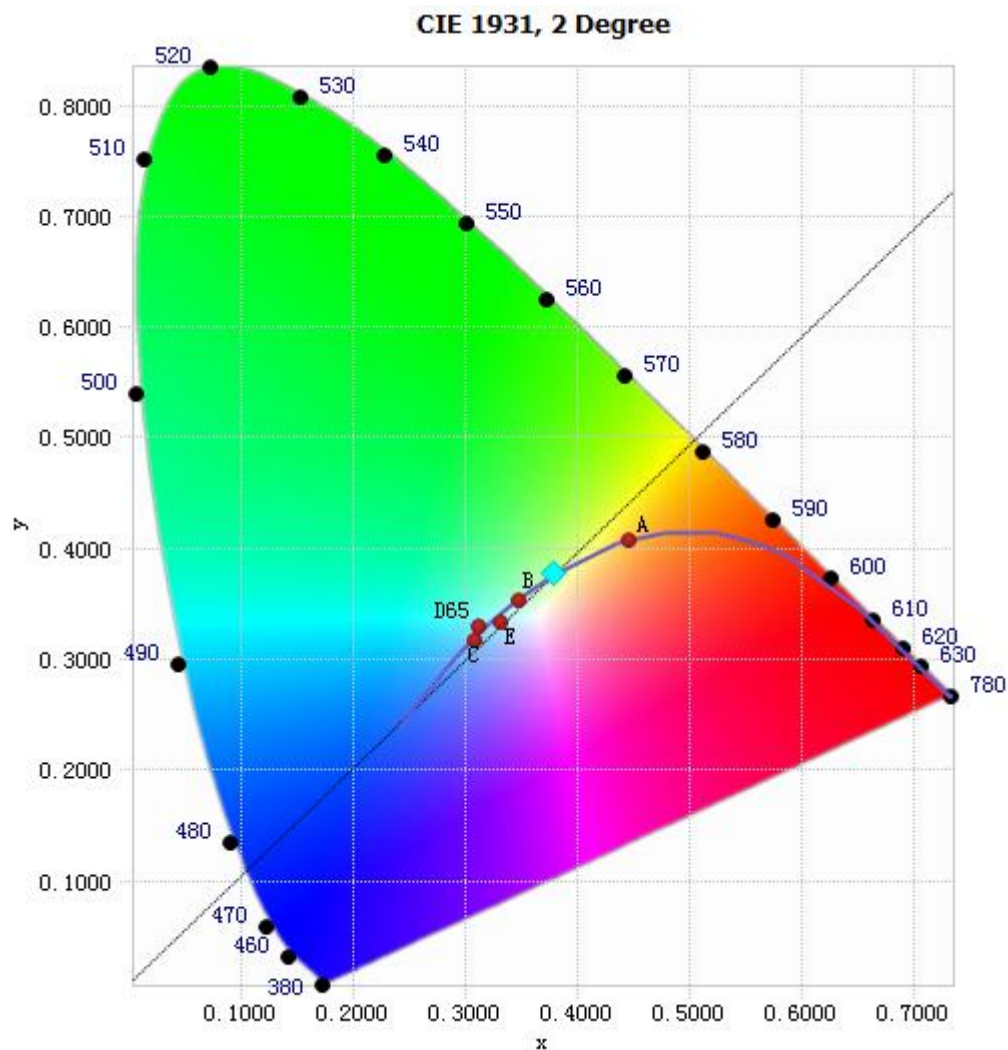


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.40E-04	485	1.13E-02	590	3.19E-02	695	4.87E-03
385	1.33E-04	490	1.17E-02	595	3.19E-02	700	4.17E-03
390	1.26E-04	495	1.26E-02	600	3.16E-02	705	3.60E-03
395	1.11E-04	500	1.42E-02	605	3.10E-02	710	3.07E-03
400	1.01E-04	505	1.61E-02	610	3.00E-02	715	2.64E-03
405	1.15E-04	510	1.78E-02	615	2.89E-02	720	2.29E-03
410	1.72E-04	515	1.93E-02	620	2.73E-02	725	1.96E-03
415	3.40E-04	520	2.06E-02	625	2.57E-02	730	1.68E-03
420	7.00E-04	525	2.16E-02	630	2.39E-02	735	1.44E-03
425	1.42E-03	530	2.25E-02	635	2.19E-02	740	1.24E-03
430	2.65E-03	535	2.32E-02	640	2.00E-02	745	1.07E-03
435	4.98E-03	540	2.40E-02	645	1.81E-02	750	9.09E-04
440	8.91E-03	545	2.48E-02	650	1.62E-02	755	7.82E-04
445	1.58E-02	550	2.56E-02	655	1.44E-02	760	6.72E-04
450	2.74E-02	555	2.64E-02	660	1.28E-02	765	5.80E-04
455	3.67E-02	560	2.73E-02	665	1.12E-02	770	5.03E-04
460	3.25E-02	565	2.83E-02	670	9.85E-03	775	4.31E-04
465	2.37E-02	570	2.93E-02	675	8.61E-03	780	3.71E-04
470	1.91E-02	575	3.01E-02	680	7.48E-03		
475	1.56E-02	580	3.09E-02	685	6.48E-03		
480	1.24E-02	585	3.15E-02	690	5.62E-03		

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

## Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3791, 0.3776)

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

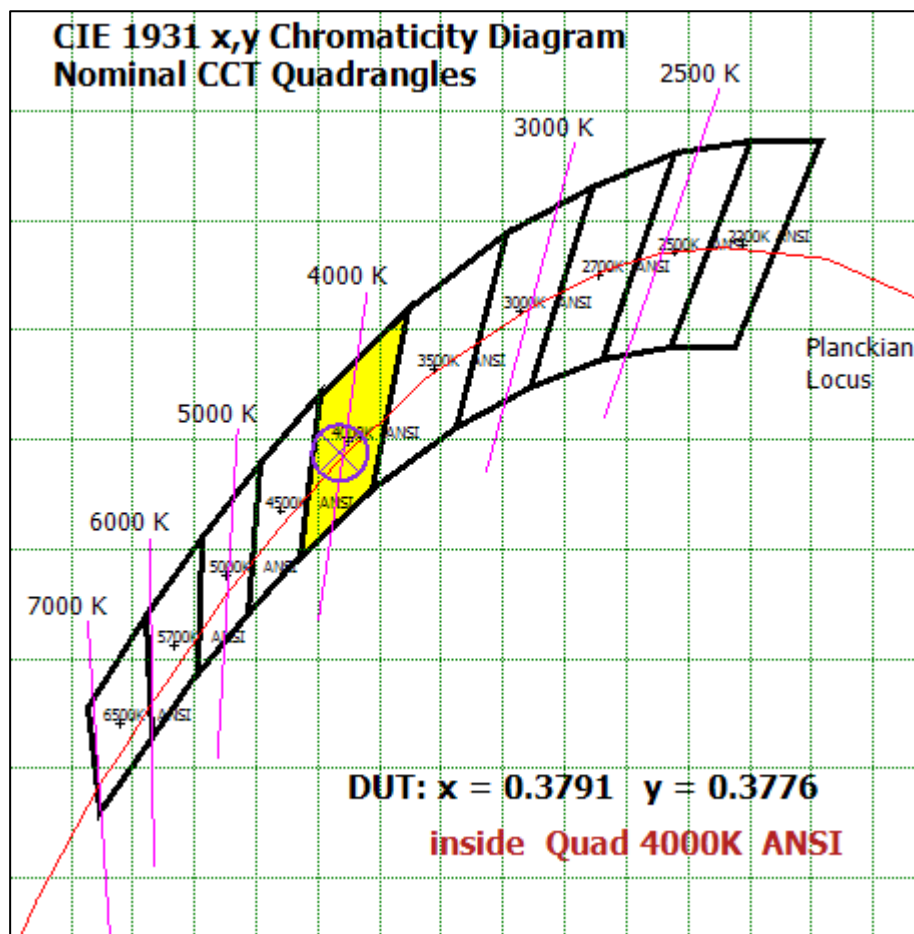


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

## Color Rendition Report – Sphere Spectroradiometer Method

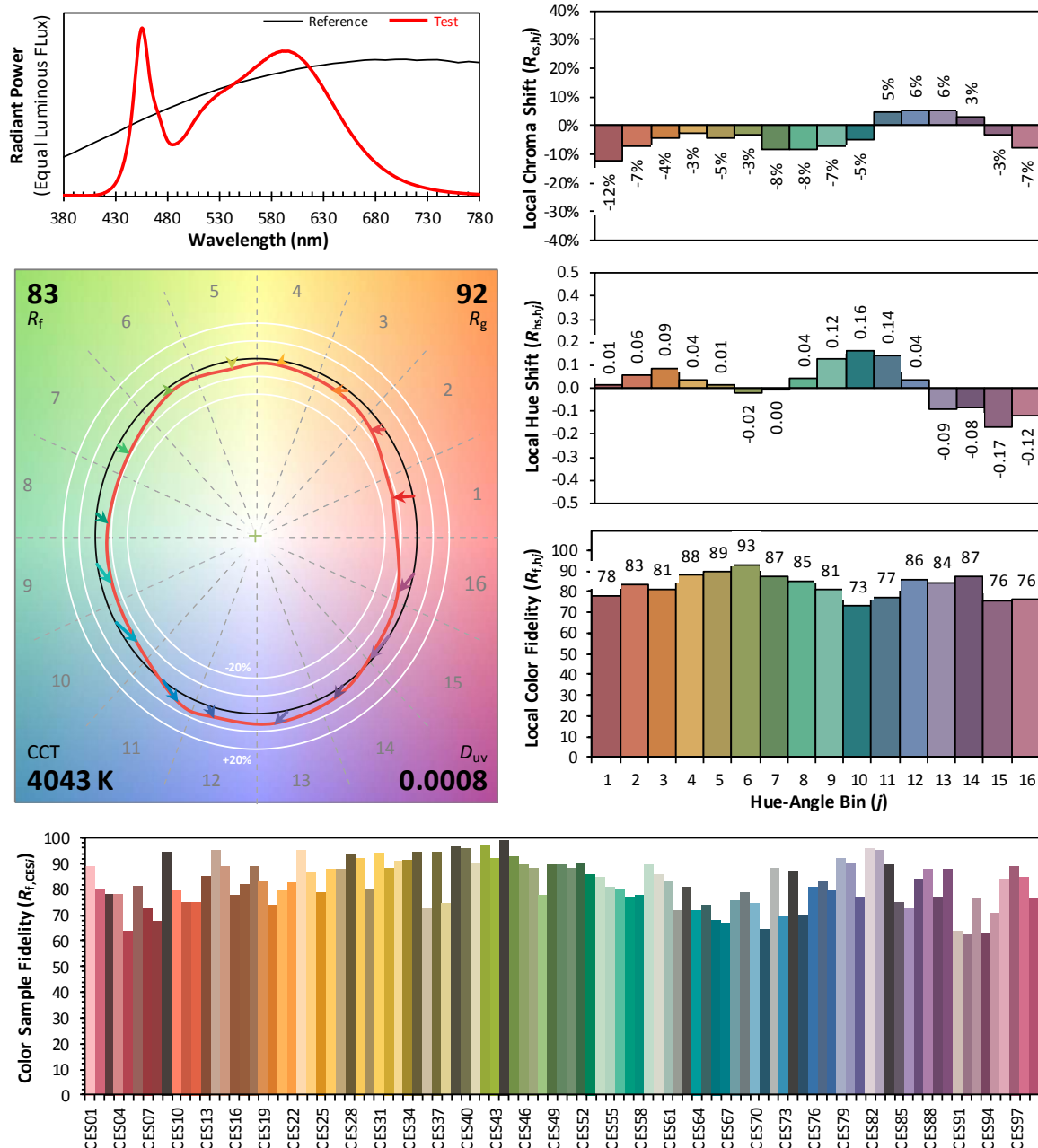


Chart 4: Full Report Created with the IES TM-30 Calculator

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	24.964	1.38%
10- 20	72.877	4.02%
20- 30	114.874	6.34%
30- 40	147.626	8.14%
40- 50	168.758	9.31%
50- 60	177.335	9.78%
60- 70	173.956	9.59%
70- 80	161.451	8.90%
80- 90	144.995	8.00%
90-100	129.874	7.16%
100-110	115.172	6.35%
110-120	100.488	5.54%
120-130	85.788	4.73%
130-140	71.192	3.93%
140-150	56.003	3.09%
150-160	39.535	2.18%
160-170	21.728	1.20%
170-180	6.476	0.36%
Total	1813.1	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	706.434	38.96%
60- 90	480.402	26.50%
0-90	1186.836	65.46%
90- 180	626.256	34.54%
0- 180	1813.1	100%

Table 5: Zonal Lumen

### Illuminance Plots- Goniophotometer Method

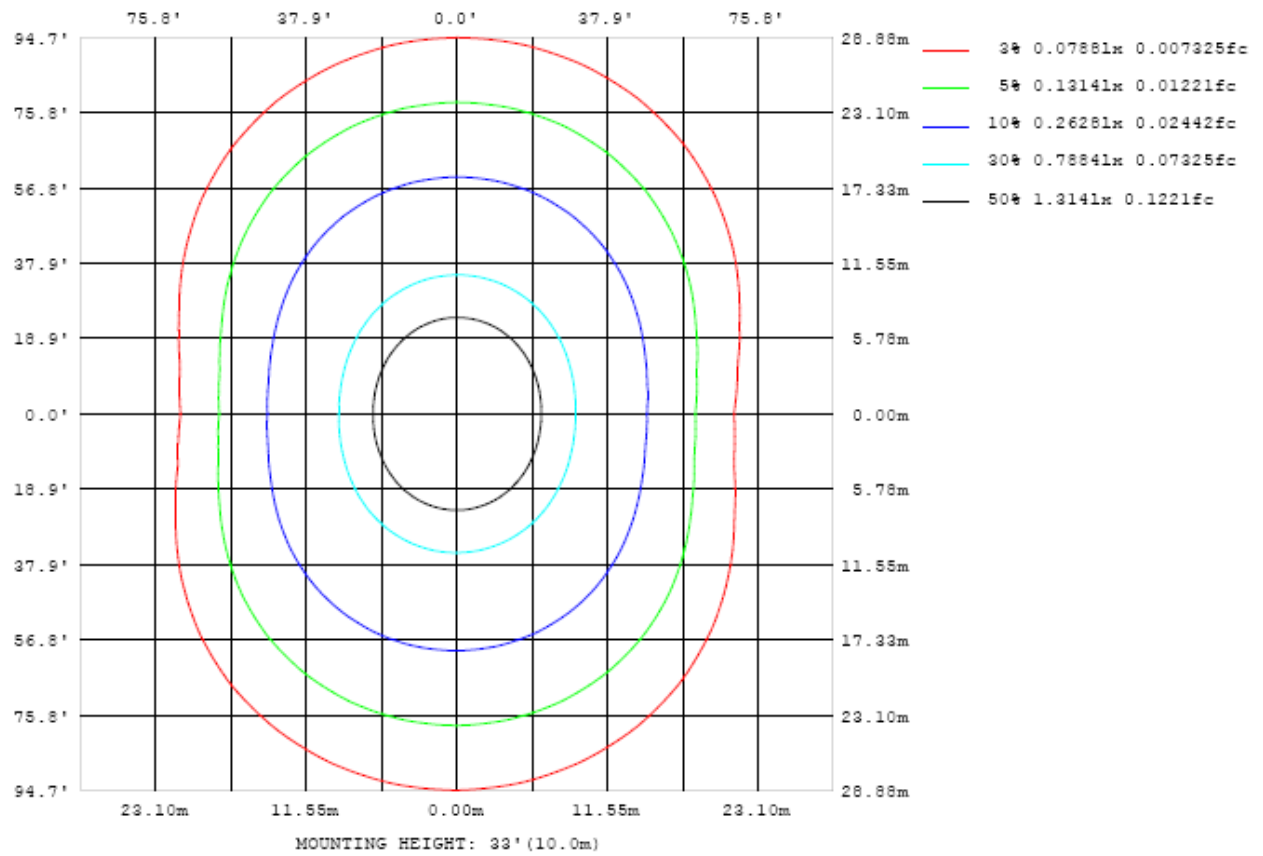


Chart 5: Illuminance Plot (Footcandles)

## Luminous Intensity Distribution Plots- Goniophotometer Method

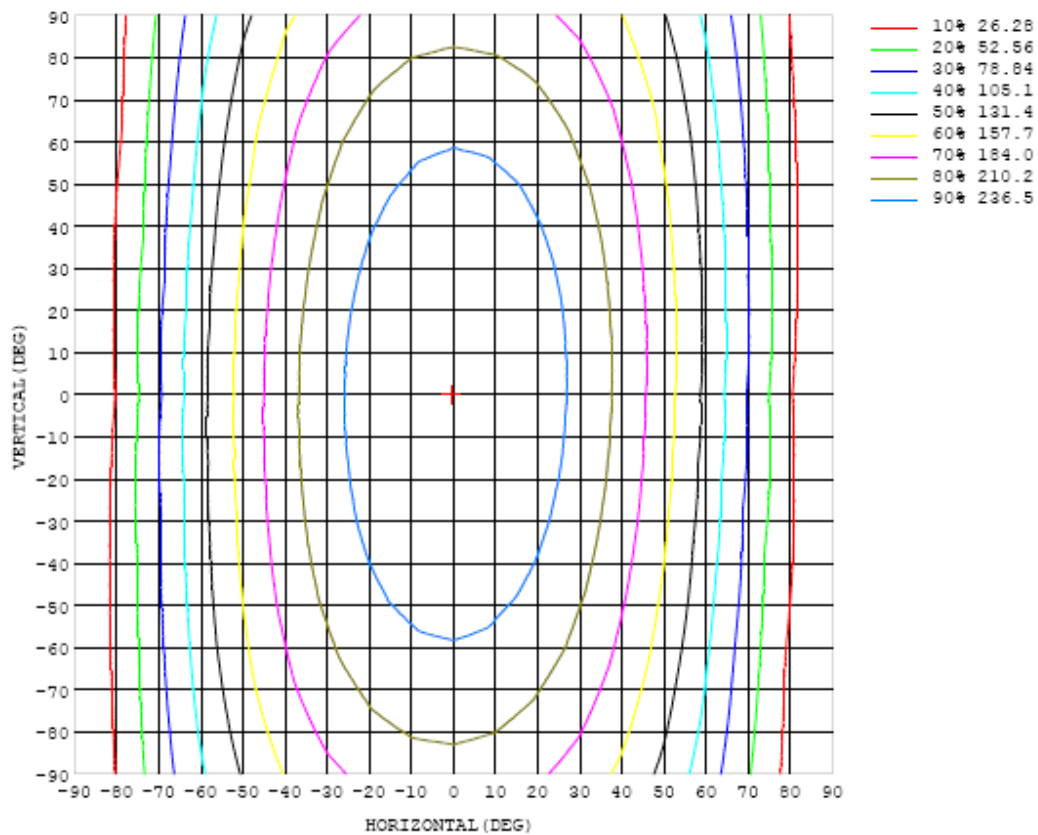


Chart 6: Isocandela Plot

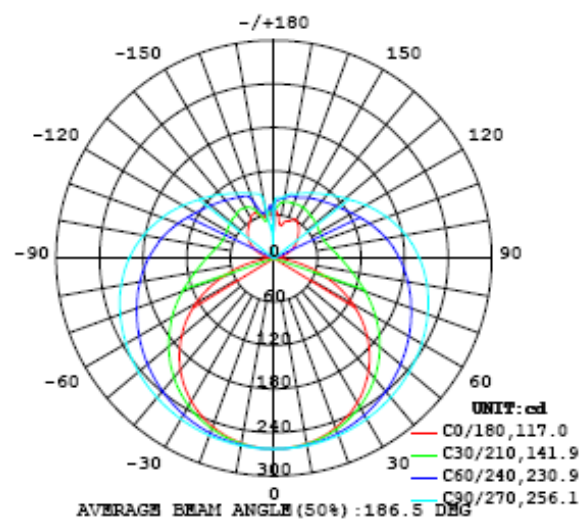


Chart 7: Polar Candela Distribution

## Luminous Intensity Data- Goniophotometer Method

Table--1

UNIT: cd

C (DEG) y (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	263	263	263	263	263	263	263	263	263	263	263	263	263	263	263	263	263	263	263
5	262	262	262	262	262	262	262	262	262	262	262	262	262	262	262	262	262	262	262
10	259	259	259	260	260	261	261	262	262	262	262	261	261	260	260	259	259	259	258
15	255	255	255	256	257	258	259	260	261	261	261	260	259	258	256	255	254	254	254
20	249	249	250	251	253	255	257	258	259	260	259	258	256	254	252	250	249	247	247
25	240	240	242	244	247	250	253	256	257	258	257	256	253	250	247	243	241	239	238
30	230	230	232	236	241	245	249	253	255	256	255	253	250	245	240	235	231	229	228
35	217	218	221	227	233	239	245	249	252	253	252	250	245	240	233	226	220	217	215
40	203	204	209	216	224	232	239	245	249	250	249	246	240	233	225	216	208	203	201
45	186	188	194	203	214	225	234	241	245	247	246	242	235	226	216	204	194	187	184
50	168	170	178	190	204	217	228	236	241	243	242	237	229	219	206	192	179	170	166
55	148	150	161	176	193	209	221	231	237	239	238	233	224	212	196	179	163	151	146
60	125	129	143	162	182	200	215	226	232	235	233	227	217	204	186	166	146	130	124
65	101	107	124	148	171	191	208	220	228	231	229	222	211	196	176	153	129	109	100
70	76.6	83.9	106	134	160	183	201	214	222	225	224	217	205	188	166	140	112	87.4	75.6
75	52.0	61.8	88.9	121	150	175	194	208	217	220	218	211	199	181	157	129	96.5	66.5	51.1
80	28.4	41.5	73.7	109	141	167	187	202	211	214	212	205	192	173	149	118	83.1	48.5	28.3
85	9.80	25.7	62.5	99.7	133	160	180	195	204	208	206	198	185	166	141	109	72.5	34.7	9.41
90	0.91	17.6	54.6	91.9	125	152	173	188	197	200	198	191	178	159	134	102	65.7	27.4	1.43
95	3.03	15.4	49.5	85.5	118	145	165	180	189	193	191	184	171	152	127	95.8	60.6	24.7	3.37
100	7.75	17.9	46.5	79.8	111	137	157	172	181	185	183	175	163	144	120	90.1	57.2	26.2	8.45
105	13.7	23.3	46.5	75.6	104	129	149	163	172	175	174	167	154	136	113	85.6	56.0	30.0	14.8
110	20.0	28.8	48.3	73.4	98.8	122	140	154	162	166	164	157	146	129	107	82.1	57.2	35.7	21.8
115	26.7	35.5	51.4	72.6	94.3	115	132	145	153	156	154	148	137	122	102	80.6	59.7	41.2	29.0
120	32.6	40.9	55.5	72.8	91.2	109	124	136	143	146	145	139	129	115	98.6	80.2	62.8	47.7	36.0
125	38.0	45.6	59.3	73.8	89.2	105	117	127	134	137	135	130	122	110	95.9	80.5	65.9	54.0	41.8
130	42.6	51.0	63.2	75.3	87.9	101	112	120	126	128	127	123	116	106	94.0	81.2	68.5	59.0	46.7
135	47.8	56.8	67.5	76.8	87.3	97.9	107	114	119	121	120	117	110	102	92.5	81.9	71.6	64.2	51.1
140	53.2	61.7	69.9	77.7	86.8	95.5	103	109	113	115	114	111	106	99.2	91.4	82.4	74.7	68.9	55.0
145	57.6	65.3	72.1	79.5	86.0	93.4	99.5	104	107	109	108	106	102	96.6	90.6	83.5	77.4	72.8	59.1
150	61.2	68.5	74.7	80.6	85.1	91.1	96.0	99.8	102	104	103	101	98.3	94.4	90.0	84.8	79.6	75.9	64.0
155	58.0	70.5	75.9	81.1	85.3	88.5	92.3	95.5	97.7	98.7	98.6	97.5	95.4	92.7	89.6	85.5	78.8	74.9	67.5
160	54.1	73.7	77.8	80.1	84.9	88.2	89.8	91.5	93.1	93.9	94.4	94.1	92.9	91.2	88.9	84.6	77.8	71.2	65.9
165	50.1	65.9	80.3	80.3	82.6	85.9	88.8	90.6	91.5	92.0	92.1	91.6	90.6	89.0	84.7	76.1	68.6	64.9	59.5
170	46.9	61.3	74.7	79.0	80.7	82.8	83.9	84.9	85.8	86.4	86.6	86.5	85.0	80.1	72.8	65.7	62.8	63.3	59.4
175	59.9	62.2	68.1	73.3	77.0	78.9	80.9	82.8	83.5	83.6	84.3	82.5	75.9	66.3	57.4	56.3	59.6	61.3	61.5
180	67.1	67.1	67.1	67.1	67.1	67.1	67.1	67.1	67.1	67.1	67.1	67.1	67.1	67.1	67.1	67.1	67.1	67.1	67.1

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	263	263	263	263	263	263	263	263	263	263	263	263	263	263	263	263	263		
5	262	262	262	262	262	262	262	263	263	263	263	262	262	262	262	262	262		
10	259	259	259	260	261	261	262	262	262	262	262	262	261	261	260	260	259		
15	254	255	255	257	258	259	260	261	261	261	261	260	259	258	257	256	255		
20	247	248	250	252	254	256	258	259	260	260	259	258	256	254	252	250	249		
25	239	240	243	246	250	253	256	257	258	258	257	255	252	249	245	242	241		
30	228	231	235	240	244	249	252	255	256	255	254	251	247	242	238	233	231		
35	216	220	225	232	238	244	249	252	253	253	251	246	241	235	229	223	219		
40	202	207	214	223	231	239	245	249	250	250	247	242	235	227	218	211	205		
45	186	193	202	213	224	233	240	246	247	246	243	236	228	217	207	197	190		
50	169	177	189	203	216	227	236	241	244	242	238	231	220	208	194	182	172		
55	150	161	176	192	208	221	231	237	240	238	233	224	213	198	181	165	154		
60	129	143	162	181	200	215	225	233	235	233	228	218	204	187	168	149	133		
65	106	125	148	171	191	208	220	228	230	229	222	212	196	177	155	131	112		
70	83.6	106	134	161	183	201	214	222	225	223	217	205	188	167	142	114	89.4		
75	61.2	89.3	122	151	175	194	208	217	220	218	211	198	180	158	129	97.5	67.8		
80	41.2	74.4	110	142	167	188	202	210	214	212	204	191	173	149	118	83.1	48.5		
85	26.1	62.9	101	134	160	180	195	204	207	205	197	184	165	140	109	71.8	33.7		
90	18.5	55.3	93.1	126	153	173	187	196	200	197	190	176	158	133	101	63.7	25.6		
95	16.7	50.2	86.4	119	145	165	179	188	191	189	182	168	150	125	93.5	57.8	22.5		
100	19.3	47.7	81.0	112	137	157	170	179	182	180	173	160	142	117	87.4	54.2	23.5		
105	24.2	48.1	77.2	106	130	149	162	170	173	171	164	152	134	110	82.6	52.9	27.1		
110	30.7	50.5	75.1	100	122	140	153	161	164	162	155	143	126	104	79.4	53.7	31.9		
115	37.4	54.0	74.7	96.2	116	132	144	152	155	153	146	135	119	99.4	77.6	56.0	38.3		
120	43.6	58.0	75.2	93.5	111	125	136	143	145	143	137	127	113	95.9	76.8	58.4	44.4		
125	48.8	62.1	76.3	91.7	106	119	128	134	136	134	129	120	108	93.2	76.9	62.2	49.8		
130	53.3	66.3	77.6	90.3	103	113	121	127	128	127	122	114	104	91.0	77.4	66.3	54.1		
135	56.9	69.8	79.1	89.5	99.6	109	115	120	121	120	116	109	100	89.3	79.0	70.0	57.8		
140	59.5	71.9	80.0	89.0	96.8	104	110	114	115	114	110	104	96.8	88.6	80.6	73.4	61.4		
145	60.1	75.9	81.5	88.6	94.8	100	104	108	108	107	105	100	94.7	88.5	81.9	76.5	63.2		
150	59.5	78.6	79.4	84.0	93.3	97.1	100	103	103	102	101	97.4	93.2	88.4	82.8	78.8	63.3		
155	55.8	72.1	77.2	80.4	87.5	94.4	96.6	98.3	98.8	98.5	97.2	94.9	91.8	88.0	85.0	76.0	57.3		
160	53.0	59.6	68.4	71.1	73.7	82.0	93.2	94.7	95.0	94.9	94.3	92.8	90.8	88.2	86.1	66.9	49.7		
165	53.0	51.7	56.3	59.7	64.8	63.9	70.2	86.9	91.8	91.9	91.7	89.9	87.8	85.6	74.8	51.2	46.8		
170	53.8	53.7	55.0	57.0	62.1	64.4	63.2	56.6	76.5	89.2	84.2	81.6	74.4	61.7	50.4	50.9	48.5		
175	63.3	63.5	65.8	68.7	70.6	72.0	72.0	69.1	37.7	63.0	66.9	67.0	68.1	67.9	65.7	61.8	58.7		
180	67.1	67.1	67.1	67.1	67.1	67.1	67.1	67.1	67.1	67.1	67.1	67.1	67.1	67.1	67.1	67.1	67.1		

Table 7: Luminous Intensity Data



## EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Aug. 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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