

## LM-79-08 TEST REPORT

for

### GREEN CREATIVE LTD

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

### LED Tube

**Model: 13T8/4F/840/IS/DIR**

### Laboratory: Leading Testing Laboratories

**NVLAP CODE: 200960-0**

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Report No.: HZ19040014a

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

Review by:



Engineer: April Zou  
Apr. 18, 2019

Approved by:



Manager: Jim Zhang  
Apr. 18, 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/IS/DIR

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
136.8	2241.0	16.38	0.9924
CCT (K)	CRI	Stabilization Time (Light & Power)	
4021	81.8	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>	: Apr. 09, 2019
<b>Date of Test</b>	: Apr. 10, 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

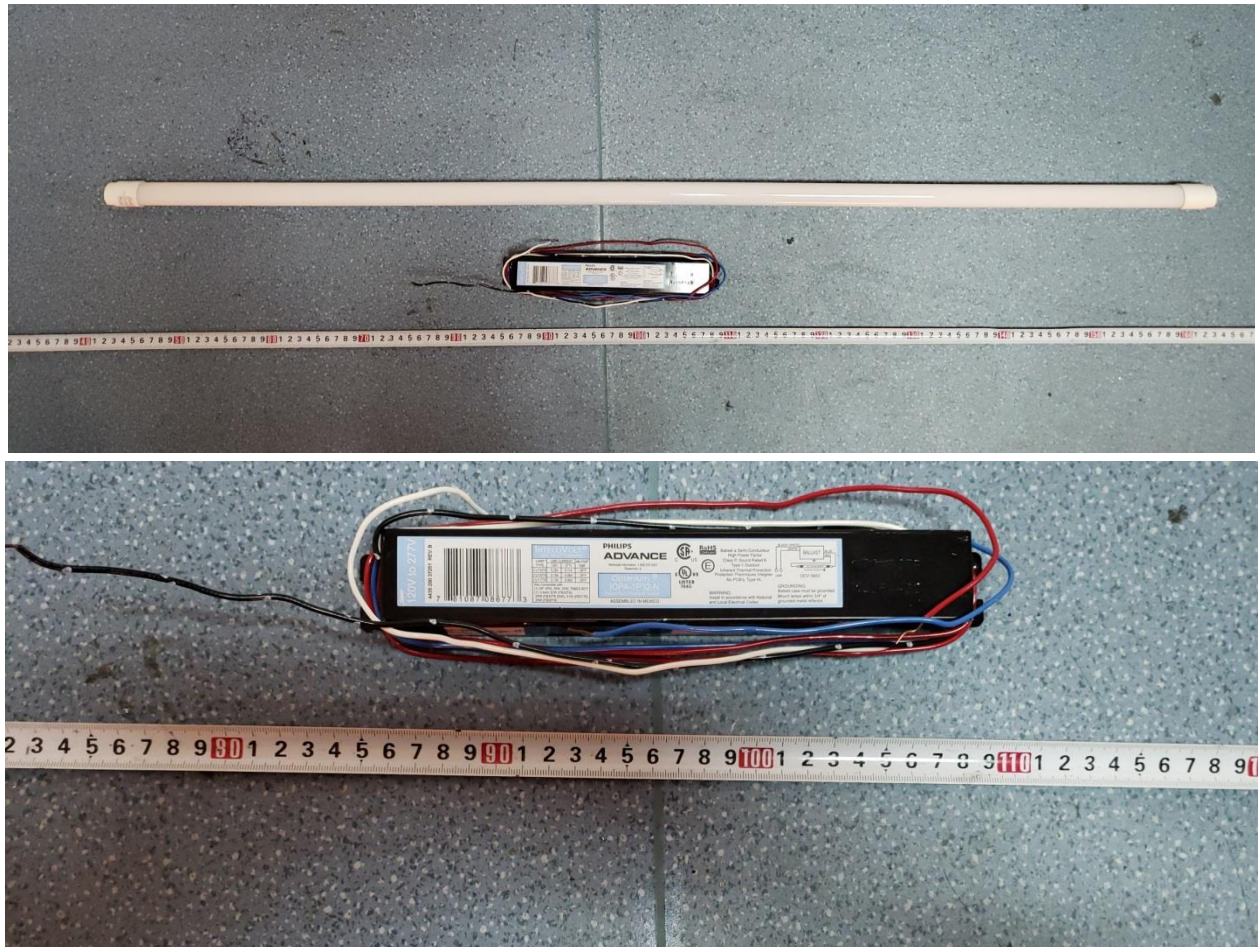


Figure 1- Overview of the sample

### Equipment Under Test(EUT)

<b>Name</b>	: LED Tube
<b>Model</b>	: 13T8/4F/840/IS/DIR
<b>Electrical Ratings</b>	: 120-277V, 60Hz
<b>Product Description</b>	: 4000K LED Tube supplied by a high frequency fluorescent lamp ballast: IOPA-1P32-N
<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)	0.137	0.063
Power Factor	0.9924	0.9467
Test Power (W)	16.38	16.43
THD A%	8.36	12.20
Luminous Efficacy (lm/W)	136.8	136.5
Total Luminous Flux (lm)	2241.0	2242.0
Color Rendering Index (CRI)	81.8	
R9	2.7	
Correlated Color Temperature (CCT)(K)	4021	
Chromaticity Chroma x	0.3807	
Chromaticity Chroma y	0.3809	
Chromaticity Chroma u	0.2236	
Chromaticity Chroma v	0.3356	
Duv	0.0011	
Chromaticity Chroma u'	0.2236	
Chromaticity Chroma v'	0.5034	

Special Color Rendering Indices	
R1	79.7
R2	88
R3	94.4
R4	80.6
R5	79.7
R6	83.4
R7	85.8
R8	62.8
R9	2.7
R10	71.6
R11	79.2
R12	59.2
R13	81.7
R14	97
Rf	83
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 24.9°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)	0.138
Power Factor	0.9927
Power (W)	16.48
Luminous Efficacy (lm/W)	134.0
Total Luminous Flux (lm)	2208.9
Beam Angle (°)	117.0 (0°-180°) / 242.5 (90°-270°)
Center Beam Candle Power (cd)	334
Maximum Beam Candle Power (cd)	334.4 (At: C=20.0, Gamma=1.0)
Spacing Criteria	1.29 (0°-180°) / 1.47 (90°-270°)
Zonal Lumens in the 0°-60° Zone	40.53%
Zonal Lumens in the 60°-90° Zone	26.98%
Zonal Lumens in the 90°-120° Zone	18.55%
Zonal Lumens in the 120°-180° Zone	13.94%

Table 3: Test data per Goniophotometer Method



### Spectral Power Distribution - Sphere Spectroradiometer Method

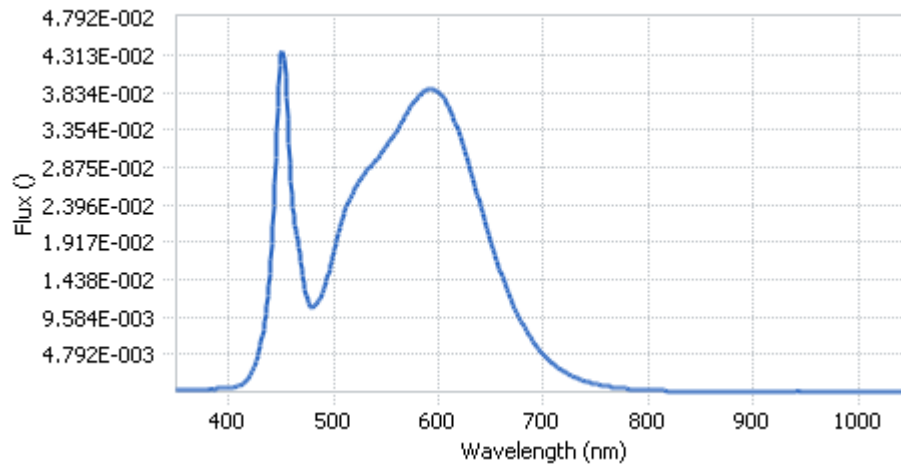
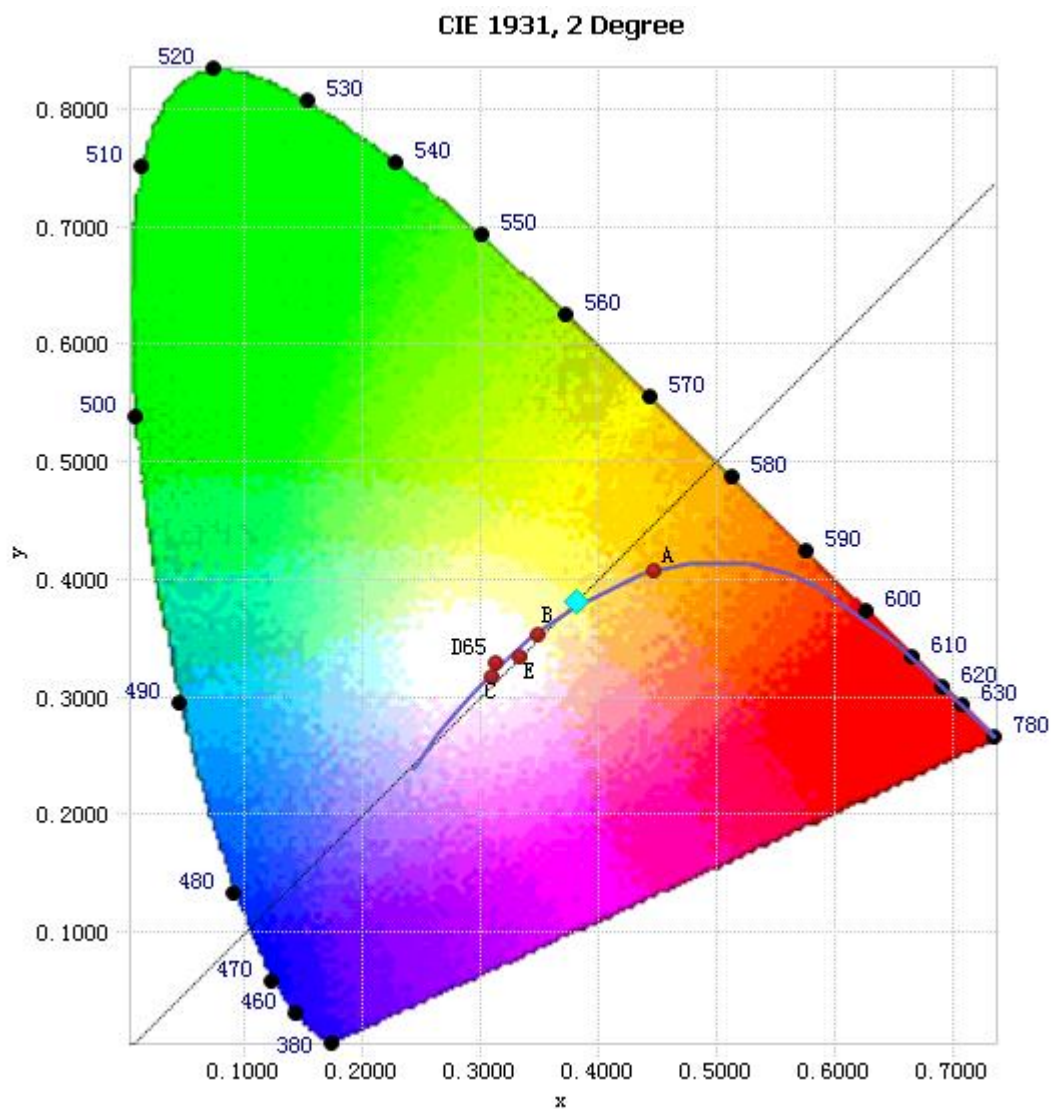


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	4.05E-04	485	1.15E-02	590	3.88E-02	695	5.57E-03
385	3.86E-04	490	1.29E-02	595	3.87E-02	700	4.78E-03
390	4.32E-04	495	1.51E-02	600	3.83E-02	705	4.09E-03
395	4.62E-04	500	1.79E-02	605	3.76E-02	710	3.50E-03
400	5.02E-04	505	2.06E-02	610	3.63E-02	715	3.00E-03
405	6.24E-04	510	2.28E-02	615	3.47E-02	720	2.55E-03
410	8.48E-04	515	2.46E-02	620	3.28E-02	725	2.20E-03
415	1.26E-03	520	2.60E-02	625	3.07E-02	730	1.89E-03
420	2.01E-03	525	2.71E-02	630	2.86E-02	735	1.62E-03
425	3.42E-03	530	2.81E-02	635	2.61E-02	740	1.38E-03
430	5.88E-03	535	2.88E-02	640	2.37E-02	745	1.18E-03
435	9.99E-03	540	2.97E-02	645	2.14E-02	750	1.01E-03
440	1.70E-02	545	3.05E-02	650	1.91E-02	755	8.75E-04
445	3.00E-02	550	3.13E-02	655	1.70E-02	760	7.48E-04
450	4.32E-02	555	3.23E-02	660	1.50E-02	765	6.49E-04
455	3.76E-02	560	3.34E-02	665	1.32E-02	770	5.60E-04
460	2.52E-02	565	3.45E-02	670	1.15E-02	775	4.86E-04
465	2.01E-02	570	3.57E-02	675	9.99E-03	780	4.17E-04
470	1.56E-02	575	3.68E-02	680	8.68E-03		
475	1.18E-02	580	3.76E-02	685	7.50E-03		
480	1.08E-02	585	3.84E-02	690	6.49E-03		

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

## Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3807, 0.3809)

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

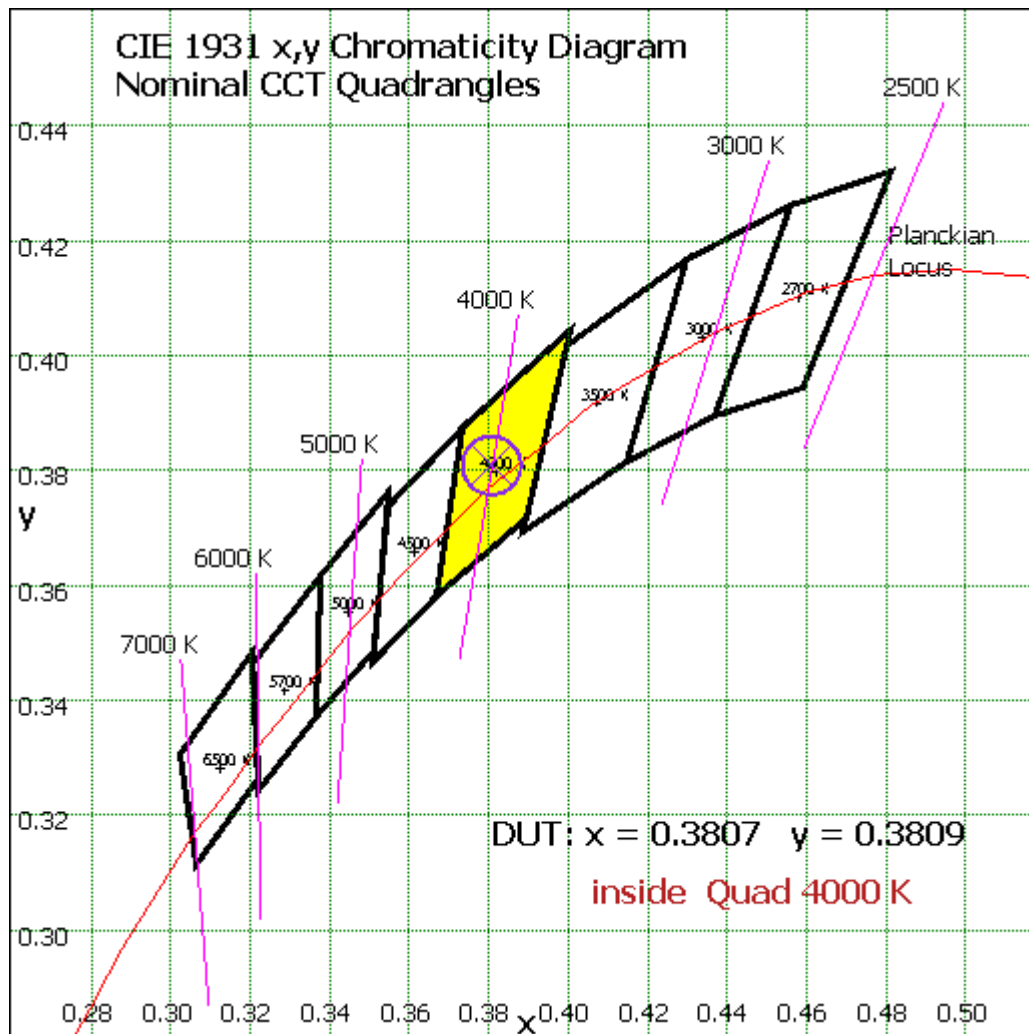
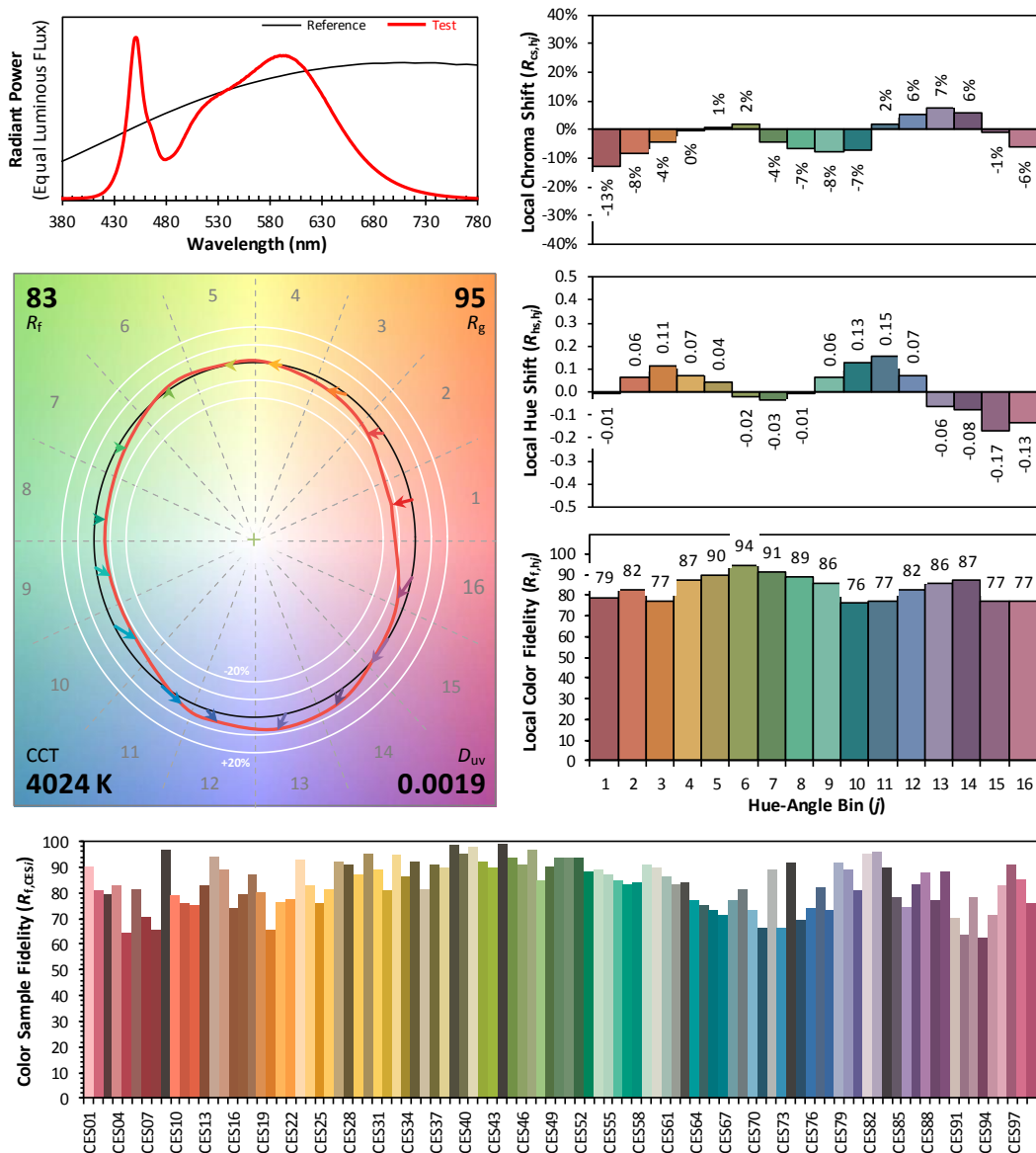


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

## Color Rendition Report – Sphere Spectroradiometer Method



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

$x$  0.3807  
 $y$  0.3809  
 $u'$  0.2236  
 $v'$  0.5034

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	31.78	1.44%
10- 20	92.718	4.20%
20- 30	146.034	6.61%
30- 40	187.407	8.48%
40- 50	213.742	9.68%
50- 60	223.654	10.12%
60- 70	218.056	9.87%
70- 80	200.403	9.07%
80- 90	177.487	8.03%
90-100	156.59	7.09%
100-110	136.481	6.18%
110-120	116.633	5.28%
120-130	97.425	4.41%
130-140	78.966	3.57%
140-150	60.725	2.75%
150-160	41.821	1.89%
160-170	22.36	1.01%
170-180	6.666	0.30%
Total	2208.9	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	895.335	40.53%
60- 90	595.946	26.98%
0-90	1491.281	67.51%
90- 180	717.667	32.49%
0- 180	2208.9	100%

Table 5: Zonal Lumen

### Illuminance Plots- Goniophotometer Method

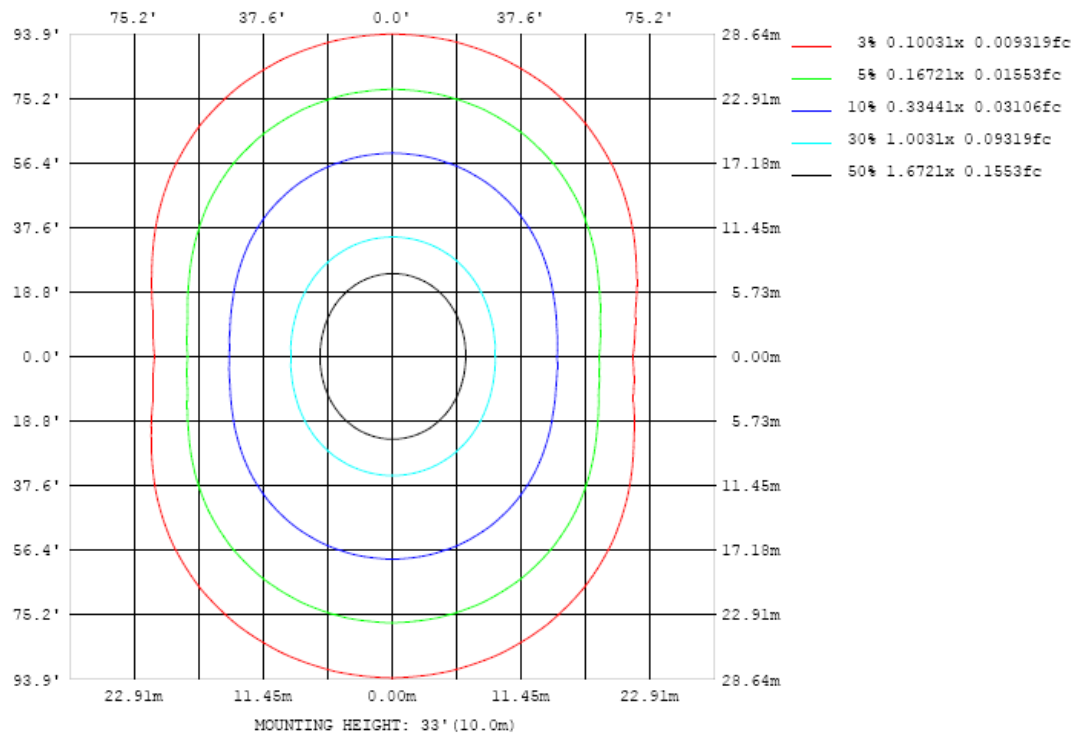


Chart 5: Illuminance Plot (Footcandles)

## Luminous Intensity Distribution Plots- Goniophotometer Method

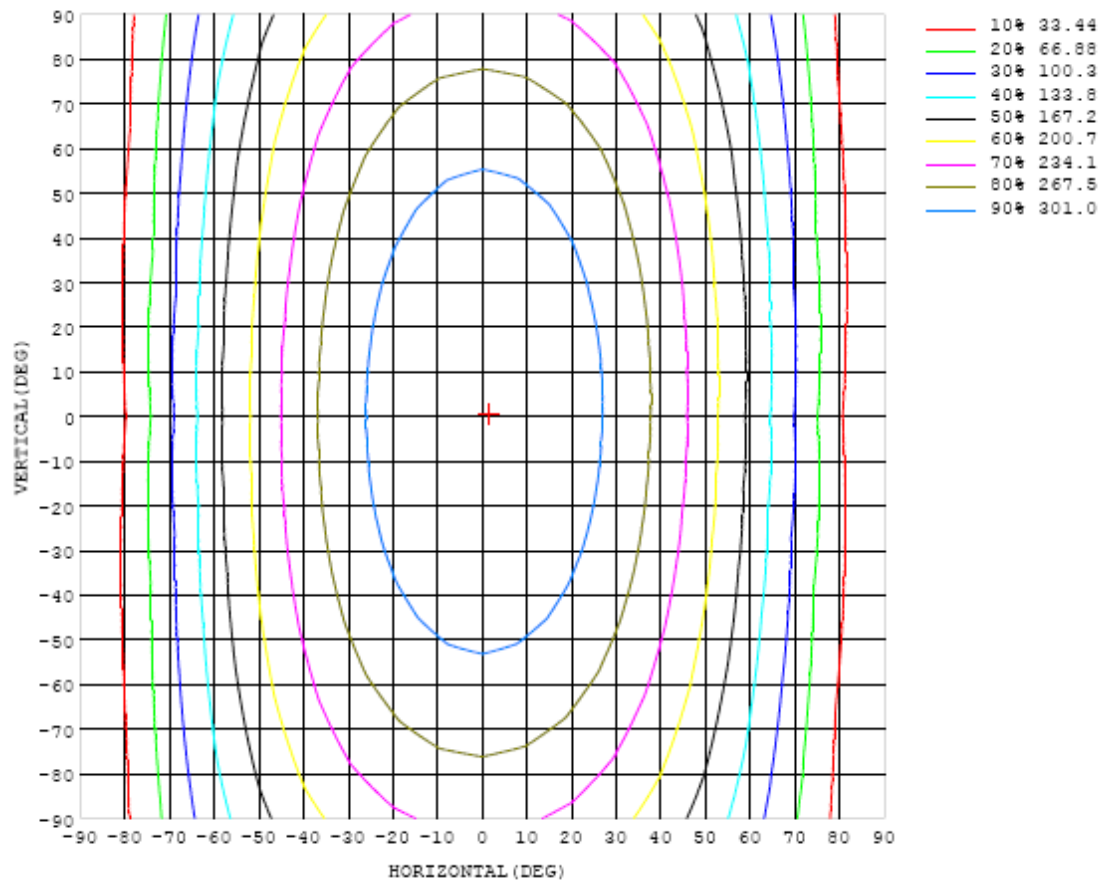


Chart 6: Isocandela Plot

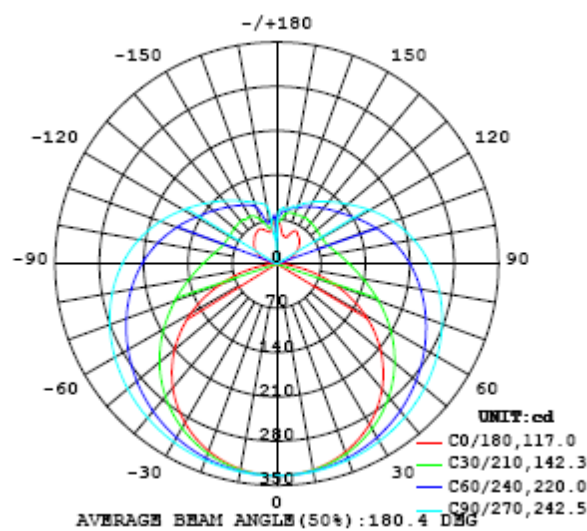


Chart 7: Polar Candela Distribution

## 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	334	334	334	334	334	334	334	334	334	334	334	334	334	334	334	334	334	334	334
5	333	333	334	334	334	334	334	334	334	334	334	334	334	334	333	333	333	333	333
10	330	330	330	331	331	332	332	333	333	333	333	332	332	331	331	330	330	329	329
15	324	324	325	326	327	329	330	331	331	332	331	330	329	328	326	325	324	323	323
20	316	316	318	319	322	324	326	328	329	329	329	328	326	323	321	318	316	315	314
25	306	306	308	311	315	318	322	325	326	327	326	324	321	317	313	310	306	304	303
30	293	293	296	301	306	311	316	320	323	323	322	320	316	311	305	299	294	291	290
35	277	278	282	289	296	303	310	315	319	320	318	315	310	303	295	287	280	275	274
40	259	260	266	275	285	294	303	310	314	315	314	309	303	294	284	273	264	258	255
45	238	240	248	260	272	285	295	304	308	310	308	303	295	284	272	258	246	237	234
50	214	218	228	243	259	274	287	297	303	305	303	297	287	274	259	242	226	215	211
55	189	193	207	225	245	263	278	290	296	299	297	290	279	264	245	225	205	190	184
60	161	166	184	207	231	252	269	282	289	292	290	282	270	253	232	207	183	164	157
65	130	138	160	189	216	241	260	274	282	285	283	275	261	242	218	190	160	136	126
70	98.8	109	137	171	202	229	250	265	274	278	275	266	252	231	205	173	138	107	94.3
75	67.2	80.9	115	154	189	218	241	257	266	270	267	258	243	221	192	157	117	80.1	62.4
80	37.1	55.4	95.6	139	176	207	231	247	257	261	258	249	233	210	180	143	99.3	56.5	32.7
85	12.5	35.1	80.0	125	164	196	220	238	248	251	249	239	223	200	169	130	85.0	38.5	9.43
90	0.88	23.8	69.4	114	154	186	210	227	238	242	239	229	213	190	159	120	75.4	29.1	0.45
95	2.71	19.9	62.1	105	144	175	200	217	227	231	228	219	203	180	149	111	68.7	25.8	2.82
100	7.45	21.5	56.9	97.2	134	165	189	206	216	220	217	208	192	170	140	104	64.2	27.4	8.24
105	13.6	25.6	54.9	90.7	125	155	178	194	204	208	205	196	181	159	131	97.6	62.3	31.5	15.3
110	20.8	32.2	55.8	85.9	117	144	166	182	192	195	193	184	170	149	123	92.8	63.0	37.2	22.9
115	28.0	39.2	57.8	83.2	110	135	155	170	179	183	180	172	159	140	116	90.3	65.1	42.9	30.5
120	35.0	45.9	61.0	82.3	105	126	144	158	166	170	168	160	148	131	111	88.8	67.5	47.6	37.6
125	41.1	51.0	65.1	82.1	101	119	135	147	154	158	156	149	138	124	107	88.2	70.6	51.5	42.8
130	46.0	54.8	68.0	82.5	98.7	114	127	137	144	147	145	140	130	118	104	87.9	72.0	55.8	47.2
135	51.1	61.1	72.6	83.6	96.5	109	121	129	134	137	136	131	123	113	101	88.1	71.1	58.8	50.7
140	54.4	64.7	74.4	84.5	94.9	105	114	121	126	128	127	123	117	109	97.9	86.7	75.1	65.3	54.4
145	57.2	68.0	77.2	85.1	93.7	102	109	115	119	120	119	116	111	104	96.4	82.0	72.7	70.5	57.9
150	60.3	70.4	77.7	84.7	91.6	98.9	104	108	111	113	111	109	105	100	92.3	83.3	76.2	73.5	60.4
155	53.9	67.1	81.0	85.3	90.2	94.3	100.0	104	105	105	105	104	101	95.6	89.5	80.3	74.6	72.3	60.8
160	44.5	64.2	82.0	83.6	88.0	91.8	94.5	95.1	96.0	97.1	98.1	96.9	94.6	90.8	82.8	75.3	71.3	65.4	56.7
165	45.3	57.8	78.6	83.6	85.1	88.7	90.7	90.9	91.8	93.4	92.6	89.7	85.7	79.8	72.0	66.8	64.0	58.0	52.6
170	48.9	50.0	68.8	80.0	81.9	83.0	84.5	86.9	88.4	88.2	86.8	83.1	76.8	69.3	63.4	62.1	61.9	57.7	53.6
175	62.2	61.3	63.3	69.0	75.5	78.9	79.1	85.1	89.1	87.1	84.2	73.7	60.3	56.1	59.6	63.2	63.2	64.2	63.6
180	45.4	45.4	45.4	45.4	45.4	45.4	45.4	45.4	45.4	45.4	45.4	45.4	45.4	45.4	45.4	45.4	45.4	45.4	45.4

Table 6: Luminous Intensity Data



Table--2

UNIT: cd

C (DBG) y (DBG)	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350		
0	334	334	334	334	334	334	334	334	334	334	334	334	334	334	334	334	334		
5	333	333	333	334	334	334	334	334	334	334	334	334	334	334	334	333	333		
10	329	330	330	331	332	332	333	333	333	333	333	333	332	331	331	331	330		
15	323	324	325	327	329	330	331	332	332	332	331	330	329	328	327	326	325		
20	315	316	319	321	324	327	329	330	330	330	329	327	325	322	320	318	317		
25	304	307	310	314	318	322	325	327	328	327	326	323	319	316	312	309	307		
30	291	295	299	305	311	317	321	324	325	324	322	318	313	307	302	297	294		
35	276	280	287	295	304	311	316	320	322	321	317	312	305	298	290	284	279		
40	258	264	273	284	295	304	311	316	317	316	312	306	297	287	277	268	261		
45	237	246	258	272	285	296	305	311	313	311	306	299	288	275	262	250	241		
50	215	226	242	259	275	288	299	305	307	305	300	291	278	263	246	231	219		
55	190	205	224	245	264	280	292	299	301	299	293	282	267	249	229	210	195		
60	164	182	206	231	253	271	284	292	295	293	286	274	257	235	212	188	169		
65	136	159	188	217	242	262	276	285	288	286	278	264	245	222	194	166	142		
70	107	136	171	203	231	253	268	277	281	278	269	255	234	208	176	143	113		
75	78.2	115	155	190	220	243	259	269	272	270	261	246	223	195	161	122	85.3		
80	52.9	96.0	140	178	210	233	250	260	264	261	251	236	212	182	146	102	59.7		
85	34.1	81.1	128	167	199	223	240	251	254	251	242	225	202	171	133	86.8	39.7		
90	24.5	70.8	117	157	188	213	230	240	244	241	231	215	191	161	121	75.5	28.5		
95	21.4	63.5	108	147	178	202	219	229	233	230	220	204	180	150	112	67.4	24.1		
100	23.6	59.2	99.9	137	167	191	208	218	221	218	208	192	169	140	103	61.9	24.5		
105	28.3	58.2	93.8	128	158	179	196	205	209	206	196	181	159	130	96.0	59.3	28.3		
110	34.9	59.4	89.7	120	147	168	183	193	196	193	184	169	149	122	90.7	59.3	34.2		
115	41.5	62.2	87.7	114	138	158	171	180	183	180	172	159	139	115	87.6	61.0	40.8		
120	47.9	65.6	86.8	109	130	147	160	168	170	168	161	148	130	109	86.0	63.9	47.6		
125	53.6	69.2	86.8	106	124	139	150	157	159	156	150	138	123	105	85.4	67.7	53.7		
130	58.1	72.7	87.3	103	118	131	140	146	148	146	140	130	117	102	85.7	71.6	58.5		
135	61.9	74.7	87.9	101	113	124	132	137	139	137	132	123	112	99.5	86.7	75.4	63.3		
140	65.1	77.6	88.5	99.1	109	118	124	128	130	128	124	117	108	97.9	87.9	78.8	66.5		
145	67.1	80.2	84.9	96.2	105	112	117	121	122	120	117	112	104	96.7	89.1	81.6	69.3		
150	69.2	82.7	85.9	94.1	102	107	111	114	115	114	111	107	102	95.9	90.0	83.8	71.6		
155	65.1	77.4	82.9	87.9	96.6	102	106	108	109	108	106	103	99.6	95.4	91.1	81.8	65.7		
160	58.4	66.9	73.0	77.1	83.3	94.8	100	103	103	103	102	100	97.8	94.4	92.3	76.5	57.2		
165	55.2	58.0	62.6	64.5	67.6	72.3	86.0	96.3	99.0	98.8	98.2	97.0	93.9	91.1	89.8	63.5	49.4		
170	56.3	58.6	59.1	65.1	64.4	67.8	62.6	68.9	92.8	94.6	92.2	89.1	87.6	80.5	64.1	54.0	52.3		
175	65.7	68.8	70.3	71.4	71.3	72.6	70.6	66.2	43.2	64.6	70.9	74.5	72.3	66.8	67.3	68.6	65.8		
180	45.4	45.4	45.4	45.4	45.4	45.4	45.4	45.4	45.4	45.4	45.4	45.4	45.4	45.4	45.4	45.4	45.4		

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**

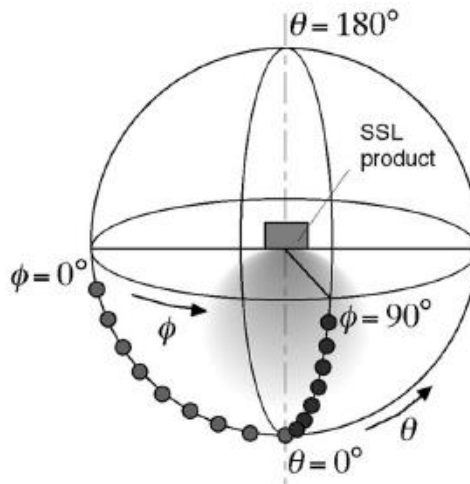
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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