

## LM-79-08 TEST REPORT

for

### GREEN CREATIVE LTD

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

### LED lamp

**Model: 15A21DIM/940/N**

### Laboratory: Leading Testing Laboratories

**NVLAP CODE: 200960-0**

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Report No.: HZ19050042f

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

Review by:



Engineer: April Zou  
May 31, 2019

Approved by:



Manager: Jim Zhang  
May 31, 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: 15A21DIM/940/N

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
124.4	1997.0	16.05	0.9836
CCT (K)	CRI	Stabilization Time (Light & Power)	
4025	83.6	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>	: May 28, 2019
<b>Date of Test</b>	: May 30, 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 lamp
<b>Model</b>	: 15A21DIM/940/N
<b>Electrical Ratings</b>	: 120V, 60Hz, 15W
<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 24.9 °C.

Base orientation was base up. 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
Voltage frequency (Hz)	60
Test Current (A)	0.136
Power Factor	0.9836
Test Power (W)	16.05
THD A%	8.78
Luminous Efficacy (lm/W)	124.4
Total Luminous Flux (lm)	1997.0
Color Rendering Index (CRI)	83.6
R9	11.3
Correlated Color Temperature (CCT)(K)	4025
Chromaticity Chroma x	0.3797
Chromaticity Chroma y	0.3777
Chromaticity Chroma u	0.2242
Chromaticity Chroma v	0.3346
Duv	0
Chromaticity Chroma u'	0.2242
Chromaticity Chroma v'	0.5019

Special Color Rendering Indices	
R1	82.1
R2	91.3
R3	95.9
R4	80.5
R5	81.7
R6	87.3
R7	85.5
R8	64.7
R9	11.3
R10	78.3
R11	78.8
R12	63.7
R13	84.7
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 24.8 °C.

The photometric distance is 2.47 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)	0.137
Power Factor	0.9842
Power (W)	16.15
Luminous Efficacy (lm/W)	125.5
Total Luminous Flux (lm)	2026.2
Beam Angle ( ° )	234.1 (0°-180°) / 234.3 (90°-270°)
Center Beam Candle Power (cd)	239
Maximum Beam Candle Power (cd)	239.5 (At: C=330.0, Gamma=8.0)
Spacing Criteria	1.49 (0°-180°) / 1.51 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	35.61%
Zonal Lumens in the 60 °-90 °Zone	30.33%
Zonal Lumens in the 90 °-120 °Zone	22.40%
Zonal Lumens in the 120 °-180 °Zone	11.66%

Table 3: Test data per Goniophotometer Method

## Spectral Power Distribution - Sphere Spectroradiometer Method

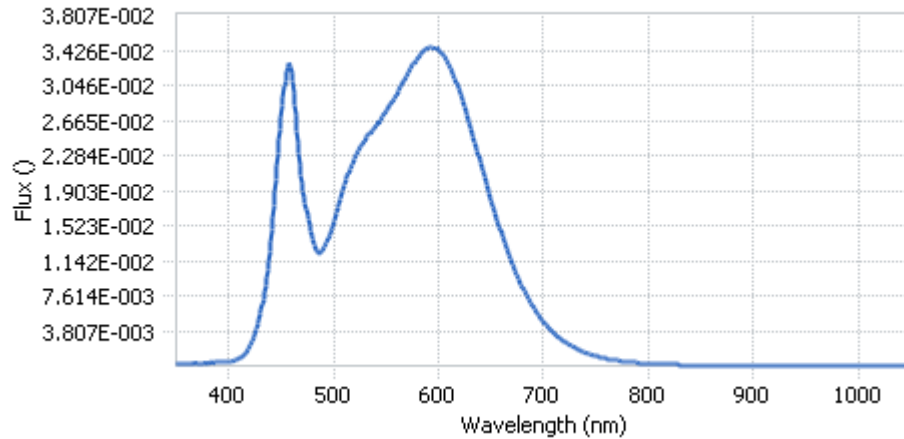


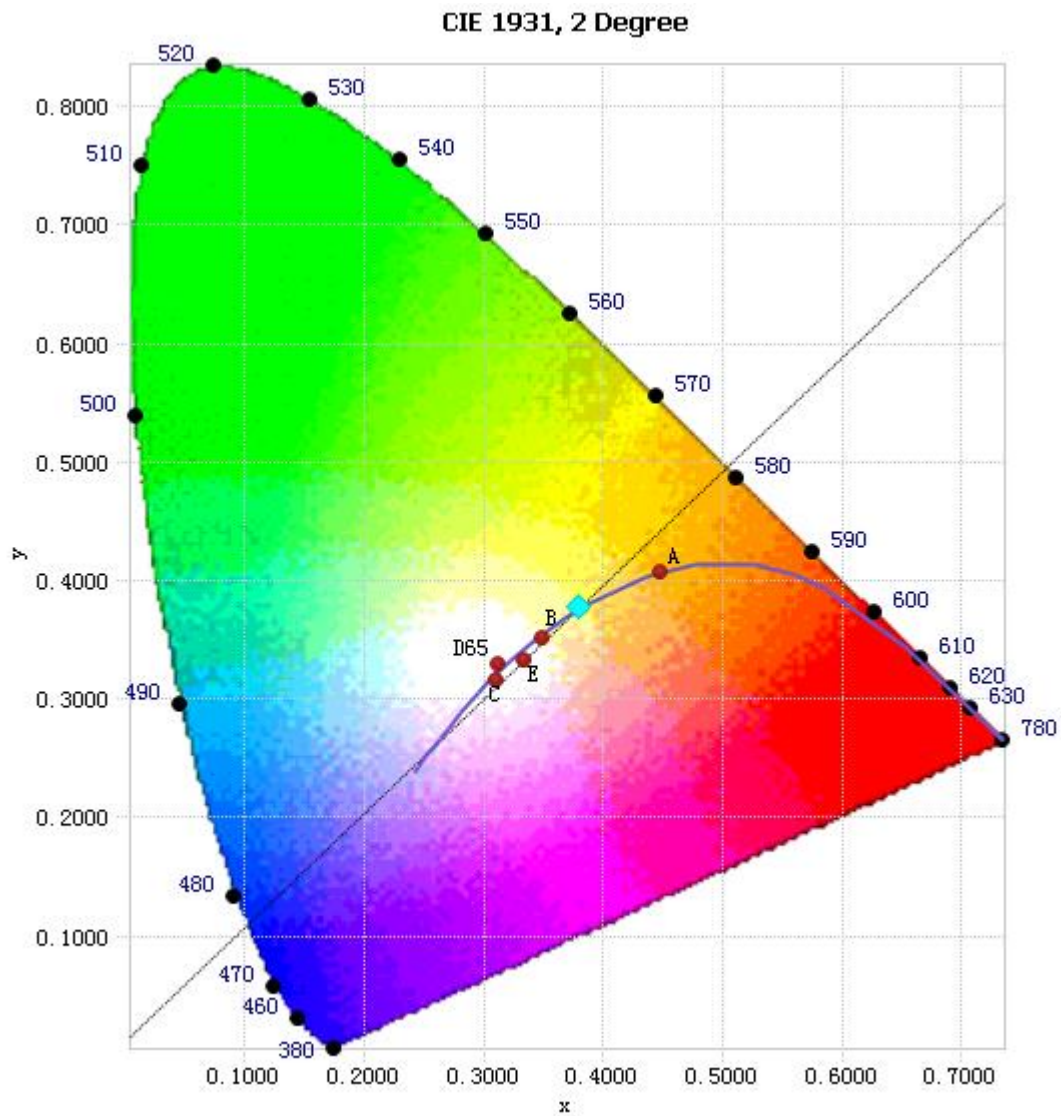
Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	3.36E-04	485	1.23E-02	590	3.46E-02	695	5.58E-03
385	3.33E-04	490	1.26E-02	595	3.46E-02	700	4.81E-03
390	3.67E-04	495	1.39E-02	600	3.43E-02	705	4.14E-03
395	4.31E-04	500	1.56E-02	605	3.37E-02	710	3.56E-03
400	4.55E-04	505	1.76E-02	610	3.27E-02	715	3.06E-03
405	5.69E-04	510	1.95E-02	615	3.14E-02	720	2.64E-03
410	7.99E-04	515	2.14E-02	620	2.97E-02	725	2.27E-03
415	1.26E-03	520	2.26E-02	625	2.81E-02	730	1.95E-03
420	2.09E-03	525	2.36E-02	630	2.60E-02	735	1.68E-03
425	3.49E-03	530	2.45E-02	635	2.41E-02	740	1.44E-03
430	5.59E-03	535	2.53E-02	640	2.20E-02	745	1.24E-03
435	8.77E-03	540	2.61E-02	645	2.00E-02	750	1.06E-03
440	1.36E-02	545	2.68E-02	650	1.80E-02	755	9.27E-04
445	2.03E-02	550	2.76E-02	655	1.61E-02	760	8.01E-04
450	2.69E-02	555	2.86E-02	660	1.44E-02	765	6.92E-04
455	3.20E-02	560	2.95E-02	665	1.27E-02	770	5.94E-04
460	3.19E-02	565	3.06E-02	670	1.11E-02	775	5.07E-04
465	2.55E-02	570	3.16E-02	675	9.80E-03	780	4.41E-04
470	1.98E-02	575	3.27E-02	680	8.54E-03		
475	1.64E-02	580	3.35E-02	685	7.45E-03		
480	1.36E-02	585	3.42E-02	690	6.44E-03		

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



## Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3797, 0.3777)

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

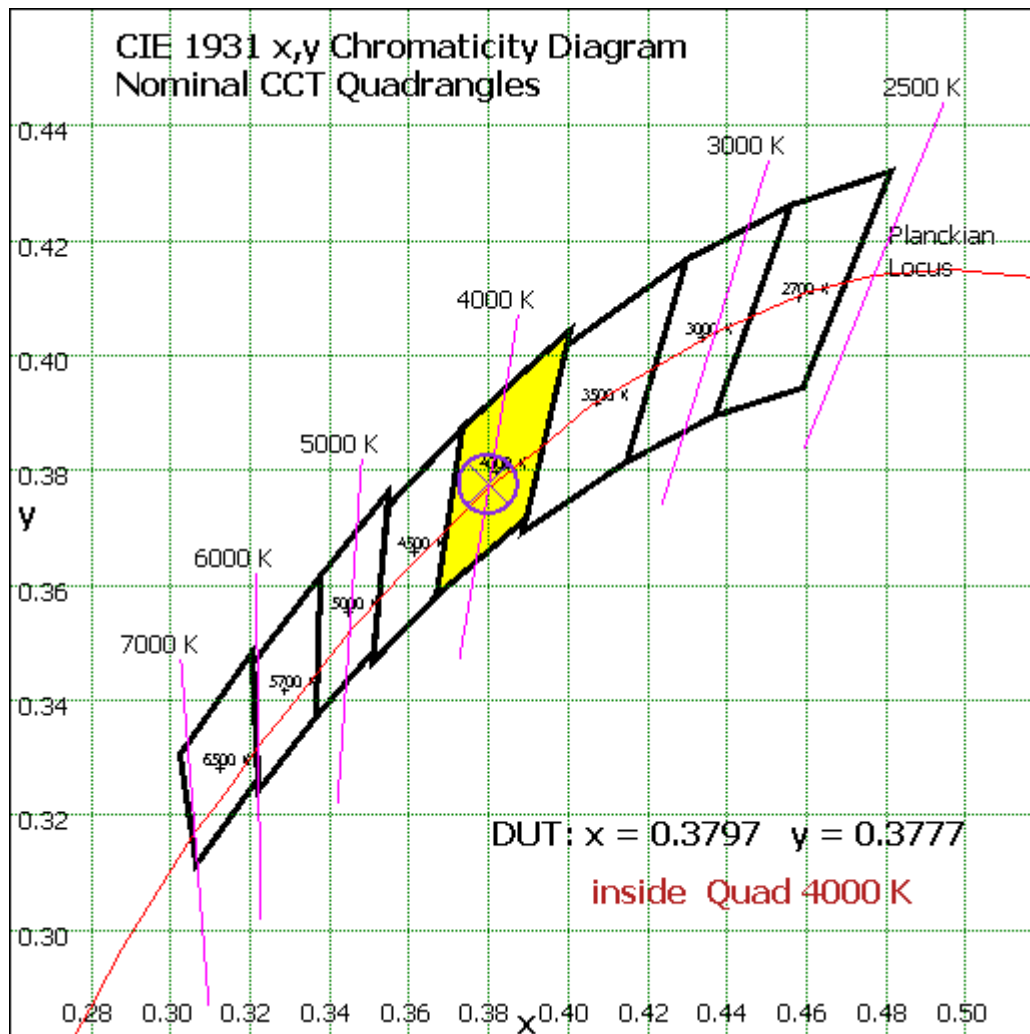
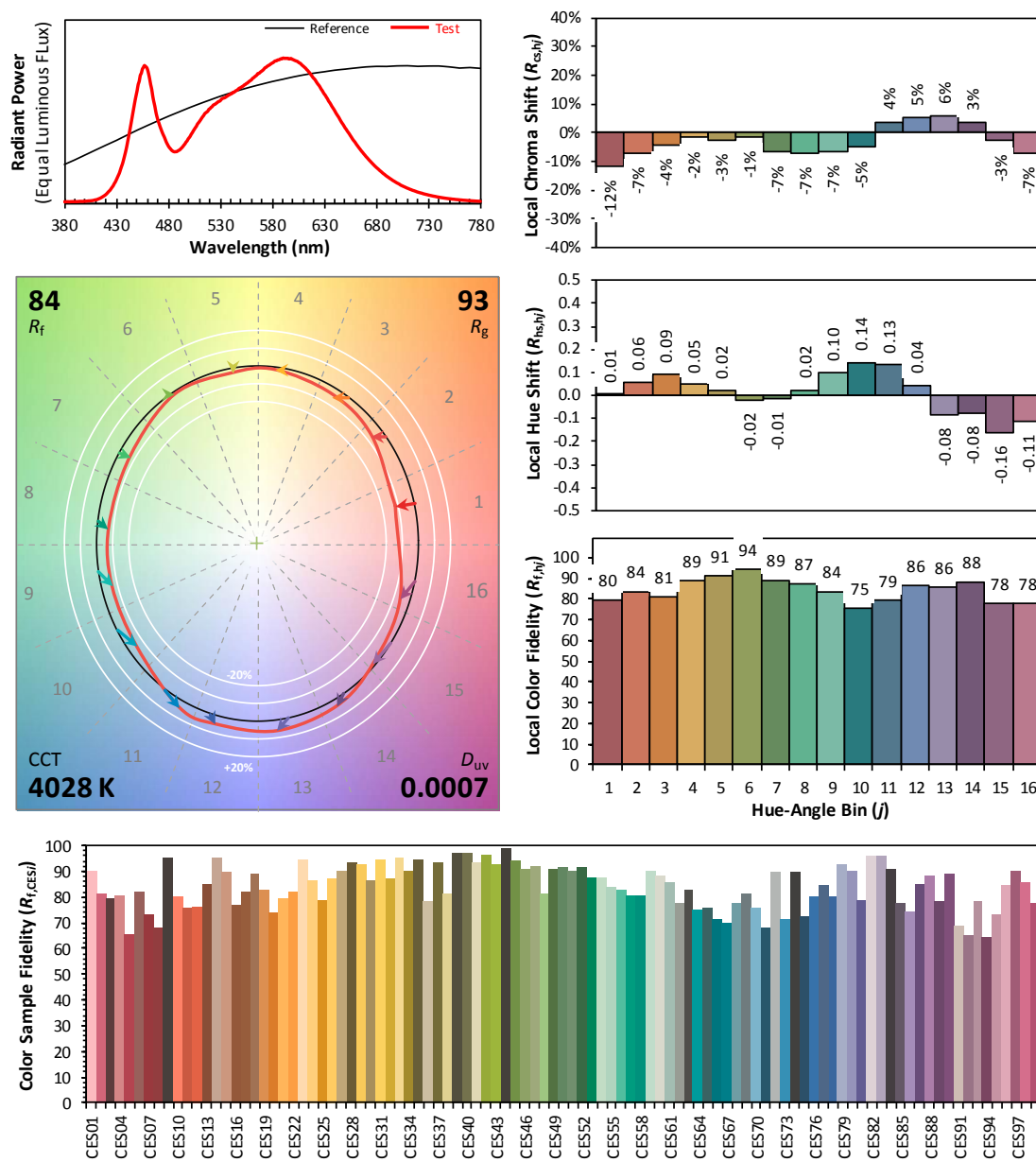


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

## Color Rendition Report – Sphere Spectroradiometer Method



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

$x$	0.3797
$y$	0.3777
$u'$	0.2242
$v'$	0.5019

#### 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	22.801	1.13%
10- 20	67.409	3.33%
20- 30	109.248	5.39%
30- 40	146.628	7.24%
40- 50	177.071	8.74%
50- 60	198.29	9.79%
60- 70	208.841	10.31%
70- 80	208.306	10.28%
80- 90	197.426	9.74%
90-100	178.168	8.79%
100-110	152.586	7.53%
110-120	123.207	6.08%
120-130	93.353	4.61%
130-140	65.707	3.24%
140-150	42.287	2.09%
150-160	23.485	1.16%
160-170	9.691	0.48%
170-180	1.689	0.08%
Total	2026.2	100%

$\gamma(^{\circ})$	Lumens	% Total
0-130	1883.334	92.95%
130-180	142.859	7.05%
0-180	2026.2	100%

Table 5: Zonal Lumen

## Illuminance Plots- Goniophotometer Method

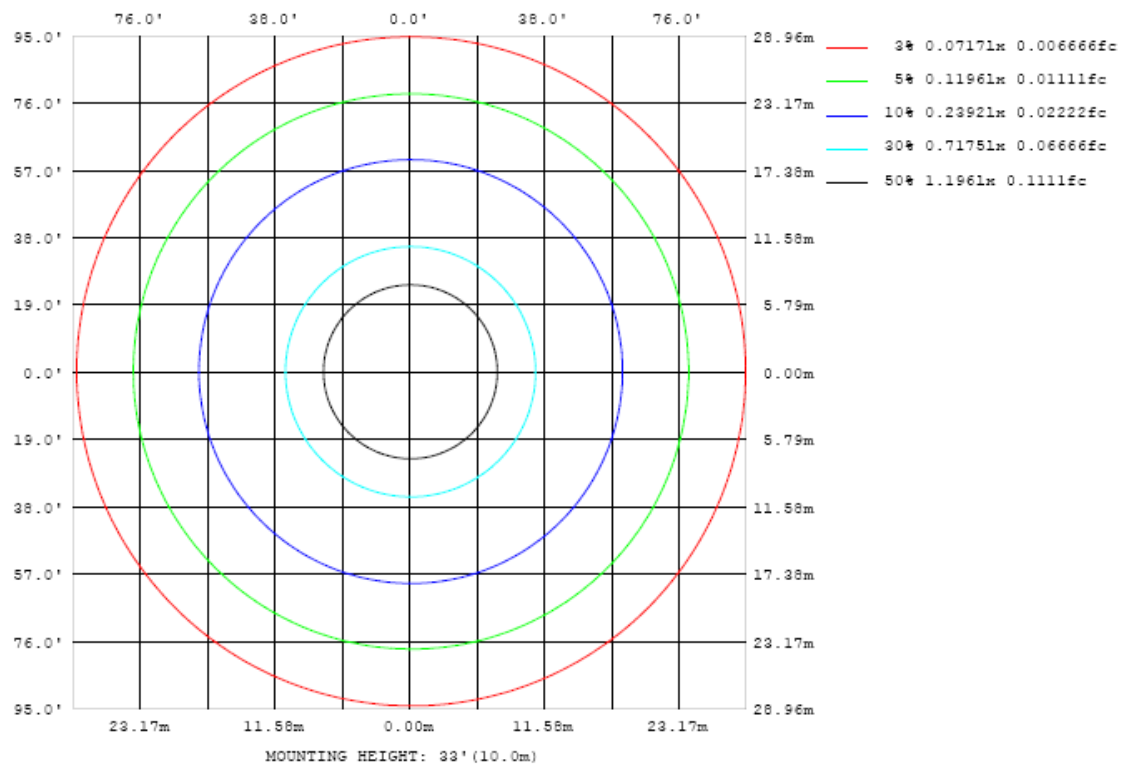


Chart 5: Illuminance Plot (Footcandles)

## Luminous Intensity Distribution Plots- Goniophotometer Method

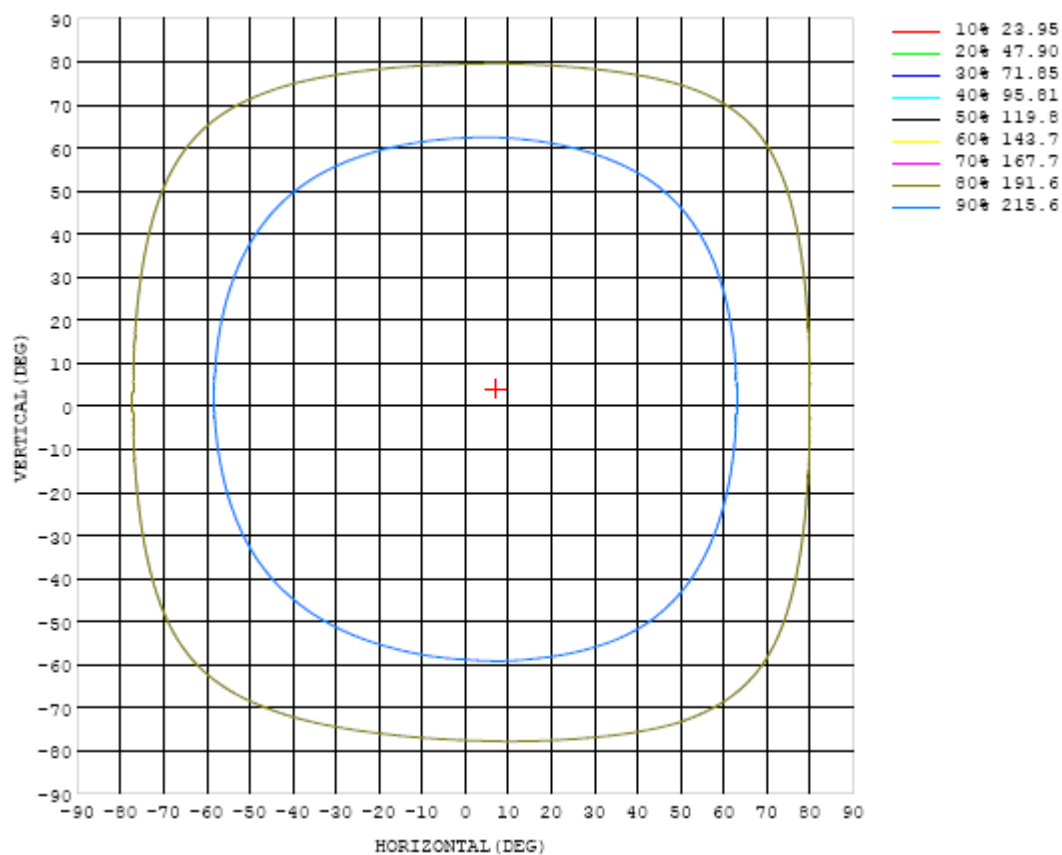


Chart 6: Isocandela Plot

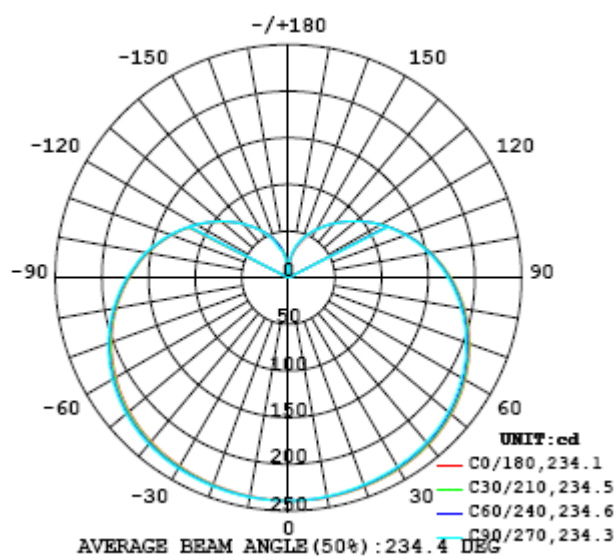


Chart 7: Polar Candela Distribution

## 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	239	239	239	239	239	239	239	239	239	239	239	239	239	239	239	239	239	239	239
5	239	239	239	239	239	239	239	239	239	239	239	239	239	239	239	239	239	239	239
10	239	239	239	239	239	239	238	238	238	238	238	238	238	238	238	238	238	238	238
15	239	239	239	238	238	238	238	238	237	237	237	237	237	237	237	237	237	237	237
20	238	238	238	238	237	237	237	237	236	236	236	236	235	235	235	235	236	236	236
25	238	237	237	237	237	236	236	236	235	235	235	234	234	234	234	234	234	234	234
30	237	237	236	236	236	235	235	234	234	234	233	233	232	232	232	233	233	233	233
35	236	235	235	235	234	234	233	233	233	232	232	231	231	231	231	231	231	231	231
40	234	233	233	233	232	232	231	231	230	230	229	229	229	228	228	228	229	229	229
45	231	231	231	230	230	229	229	228	228	227	226	226	226	226	225	226	226	226	226
50	228	227	227	227	226	226	225	225	224	224	223	222	222	222	222	222	222	223	223
55	224	223	223	223	222	222	221	221	220	219	219	218	218	218	218	218	218	218	219
60	219	218	218	218	218	217	216	216	215	214	214	213	213	213	213	213	213	213	214
65	213	213	212	212	212	211	211	210	209	209	208	208	207	207	207	207	207	208	208
70	207	206	206	206	205	205	204	204	203	202	202	201	201	201	201	201	201	201	202
75	200	199	199	199	198	198	197	197	196	195	195	194	194	194	194	194	194	194	195
80	192	191	191	191	190	190	189	189	188	188	187	187	186	186	186	186	187	187	187
85	183	183	183	182	182	182	181	181	180	180	179	179	178	178	178	178	179	179	179
90	174	174	174	174	173	173	173	172	172	171	171	170	170	170	170	170	170	170	171
95	165	165	165	164	164	164	163	163	163	162	162	161	161	161	161	161	161	161	162
100	155	155	155	155	155	154	154	154	153	153	152	152	152	152	151	152	152	152	153
105	145	145	145	145	145	145	144	144	144	143	143	142	142	142	142	142	142	142	143
110	135	135	135	135	135	135	134	134	134	133	133	133	133	132	132	132	132	132	133
115	124	125	125	125	125	124	124	124	124	124	123	123	123	123	122	122	122	122	123
120	114	114	114	115	115	114	114	114	114	114	113	113	113	113	112	112	112	112	113
125	104	104	104	104	104	104	104	104	104	104	104	103	103	103	103	103	103	102	103
130	94.2	94.3	94.5	94.6	94.7	94.6	94.5	94.4	94.3	94.1	93.9	93.7	93.5	93.3	93.1	93.0	93.0	92.7	93.5
135	84.6	84.8	85.0	85.1	85.1	85.1	85.0	84.9	84.9	84.7	84.5	84.3	84.2	84.1	83.8	83.7	83.6	83.4	84.0
140	75.4	75.6	75.7	75.9	75.9	75.9	75.9	75.8	75.8	75.7	75.5	75.4	75.2	75.1	74.9	74.7	74.6	74.4	75.0
145	67.1	67.3	67.5	67.6	67.7	67.7	67.7	67.7	67.7	67.6	67.5	67.3	67.2	67.0	66.8	66.7	66.5	66.4	66.6
150	58.7	59.1	59.2	59.4	59.4	59.5	59.5	59.5	59.6	59.5	59.4	59.3	59.1	59.0	58.8	58.6	58.4	58.3	58.5
155	50.4	51.5	51.6	51.7	51.8	51.8	51.9	51.9	51.9	51.9	51.8	51.7	51.6	51.4	51.3	51.1	50.9	50.8	50.9
160	41.8	43.6	44.2	44.4	44.4	44.4	44.5	44.6	44.6	44.6	44.6	44.5	44.4	44.3	44.1	43.9	43.7	43.5	43.4
165	33.6	35.3	36.0	36.6	36.7	36.6	36.5	36.8	37.1	37.0	37.0	37.0	36.9	36.8	36.6	36.4	36.1	35.9	35.5
170	25.6	26.4	27.3	28.0	28.2	28.1	27.9	28.3	28.8	28.8	28.8	28.7	28.6	28.5	28.3	28.1	27.8	27.5	27.0
175	14.6	15.6	16.4	16.8	17.1	17.5	17.9	18.2	18.6	18.8	18.8	18.7	18.6	18.3	18.1	17.7	17.2	16.6	15.8
180	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27

Table 6: Luminous Intensity Data

C (DEG) y (DEG)	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350		
0	239	239	239	239	239	239	239	239	239	239	239	239	239	239	239	239	239		
5	239	239	239	239	239	239	239	239	239	239	239	239	239	239	239	239	239		
10	238	238	238	238	239	239	239	239	239	239	239	239	239	239	239	239	239		
15	237	237	237	238	238	238	238	239	239	239	239	239	239	239	239	239	239		
20	236	236	237	237	237	237	238	238	238	238	239	239	239	239	239	239	239		
25	235	235	235	236	236	236	237	237	237	238	238	238	238	238	238	238	238		
30	233	234	234	235	235	235	236	236	236	237	237	237	237	237	237	237	237		
35	232	232	233	233	233	234	234	235	235	236	236	236	236	236	236	236	236		
40	230	230	231	231	231	232	232	233	233	234	234	234	234	234	234	234	234		
45	227	227	228	228	229	229	230	230	231	231	231	232	232	232	232	232	232		
50	223	224	224	225	225	226	226	227	227	228	228	228	228	229	229	229	228		
55	219	220	220	221	221	222	222	223	223	224	224	224	224	224	225	224	224		
60	214	215	215	216	216	217	217	218	218	219	219	219	219	219	220	220	219		
65	209	209	210	210	211	211	212	212	212	213	213	213	213	214	214	214	214		
70	202	203	203	204	204	205	205	206	206	206	206	207	207	207	207	207	207		
75	195	196	196	196	197	197	198	198	199	199	199	199	200	200	200	200	200		
80	188	188	188	189	189	190	190	191	191	191	191	191	192	192	192	192	192		
85	179	180	180	181	181	181	182	182	182	183	183	183	183	183	184	184	184		
90	171	171	171	172	172	173	173	173	174	174	174	174	174	174	175	175	175		
95	162	162	163	163	163	164	164	164	164	165	165	165	165	165	165	165	165		
100	153	153	154	154	154	155	155	155	155	156	156	156	156	156	156	156	156		
105	143	144	144	144	144	145	145	145	145	145	145	146	146	146	146	146	146		
110	133	134	134	134	134	134	135	135	135	135	135	135	135	135	136	136	136		
115	123	124	124	124	124	124	124	125	125	125	125	125	125	125	125	125	125		
120	113	113	114	114	114	114	114	114	114	114	114	114	114	115	115	115	115		
125	103	103	104	104	104	104	104	104	104	104	104	104	104	104	105	105	105		
130	93.8	93.8	93.8	93.9	93.9	94.0	94.0	94.1	94.1	94.1	94.2	94.2	94.3	94.4	94.6	94.8	94.7		
135	84.4	84.4	84.4	84.4	84.4	84.4	84.5	84.4	84.4	84.5	84.5	84.5	84.6	84.8	84.9	85.1	85.1		
140	75.3	75.3	75.3	75.3	75.3	75.3	75.2	75.2	75.2	75.2	75.2	75.3	75.4	75.6	75.7	75.8	75.8		
145	66.8	66.7	66.7	66.6	66.6	66.5	66.5	66.4	66.4	66.4	66.3	66.5	66.6	66.8	66.7	66.7	67.2		
150	58.7	58.6	58.6	58.5	58.4	58.4	58.3	58.2	58.0	57.8	56.8	57.8	57.9	58.5	58.1	57.9	58.0		
155	51.1	50.9	50.8	50.8	50.7	50.6	50.5	49.8	48.8	48.0	44.9	47.6	47.5	47.7	48.4	49.2	48.0		
160	43.7	43.3	43.3	43.1	43.0	42.6	42.3	40.5	37.6	34.1	26.3	24.2	27.1	32.5	37.6	38.1	37.7		
165	35.6	35.3	35.1	35.0	34.8	34.3	32.9	33.5	31.8	27.4	28.2	27.2	25.7	27.1	28.0	28.7	30.0		
170	26.4	27.0	26.2	26.0	25.9	25.1	24.7	24.0	23.1	22.4	22.1	21.5	20.9	21.4	21.0	20.2	23.6		
175	15.1	14.6	13.9	14.1	12.1	9.20	4.34	2.83	2.15	2.68	2.76	3.80	5.42	6.98	9.43	11.7	13.3		
180	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27		

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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