

## LM-79-08 TEST REPORT

for

### GREEN CREATIVE LTD

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

### LED Lamp

**Model: 11PAR30SNDIM/940FL40**

### Laboratory: Leading Testing Laboratories

**NVLAP CODE: 200960-0**

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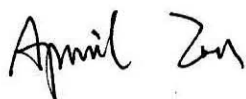
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Report No.: HZ19050046z

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

Review by:



Engineer: April Zou  
Jul. 05, 2019

Approved by:



Manager: Jim Zhang  
Jul. 05, 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: **11PAR30SNDIM/940FL40**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
99.0	1076.3	10.87	0.9189
CCT (K)	CRI	Stabilization Time (Light & Power)	
4093	95.2	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 29, 2019
<b>Date of Test</b>	: Jul. 01, 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>	: 11PAR30SNDIM/940FL40
<b>Electrical Ratings</b>	: 120V, 60Hz, 11W
<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 25.0 °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)	0.099
Power Factor	0.9189
Test Power (W)	10.87
THD A%	35.27
Luminous Efficacy (lm/W)	99.0
Total Luminous Flux (lm)	1076.3
Color Rendering Index (CRI)	95.2
R9	94.4
Correlated Color Temperature (CCT)(K)	4093
Chromaticity Chroma x	0.3757
Chromaticity Chroma y	0.3719
Chromaticity Chroma u	0.2239
Chromaticity Chroma v	0.3325
Duv	-0.0009
Chromaticity Chroma u'	0.2239
Chromaticity Chroma v'	0.4987

Special Color Rendering Indices	
R1	96.3
R2	96.1
R3	98.4
R4	93.8
R5	95.1
R6	94.7
R7	93.1
R8	94.3
R9	94.4
R10	94
R11	97.6
R12	74
R13	95.8
R14	99.2

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 24.9 °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)	0.099
Power Factor	0.9225
Power (W)	10.96
Luminous Efficacy (lm/W)	99.9
Total Luminous Flux (lm)	1095.3
Beam Angle ( ° )	36.9 (0°-180°) / 37.0 (90°-270°)
Center Beam Candle Power (cd)	1998
Maximum Beam Candle Power (cd)	1998 (At: C=220.0, Gamma=0.5)
Spacing Criteria	0.59 (0°-180°) / 0.60 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	95.03%
Zonal Lumens in the 60 °-90 °Zone	4.82%
Zonal Lumens in the 90 °-120 °Zone	0.03%
Zonal Lumens in the 120 °-180 °Zone	0.12%

Table 3: Test data per Goniophotometer Method

### Spectral Power Distribution - Sphere Spectroradiometer Method

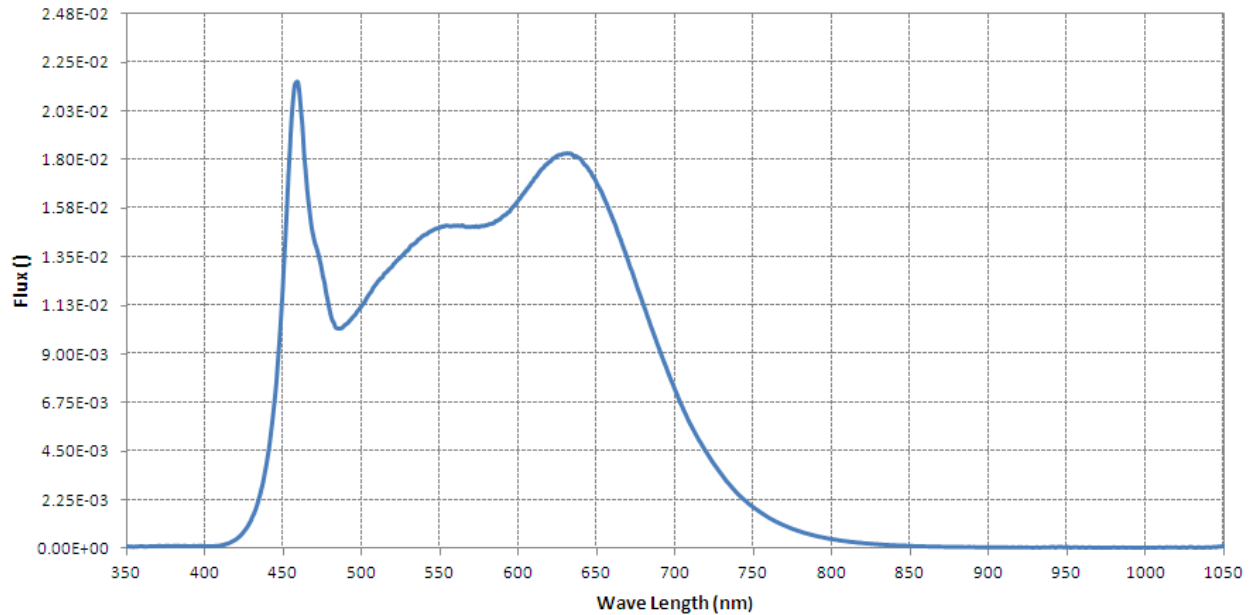
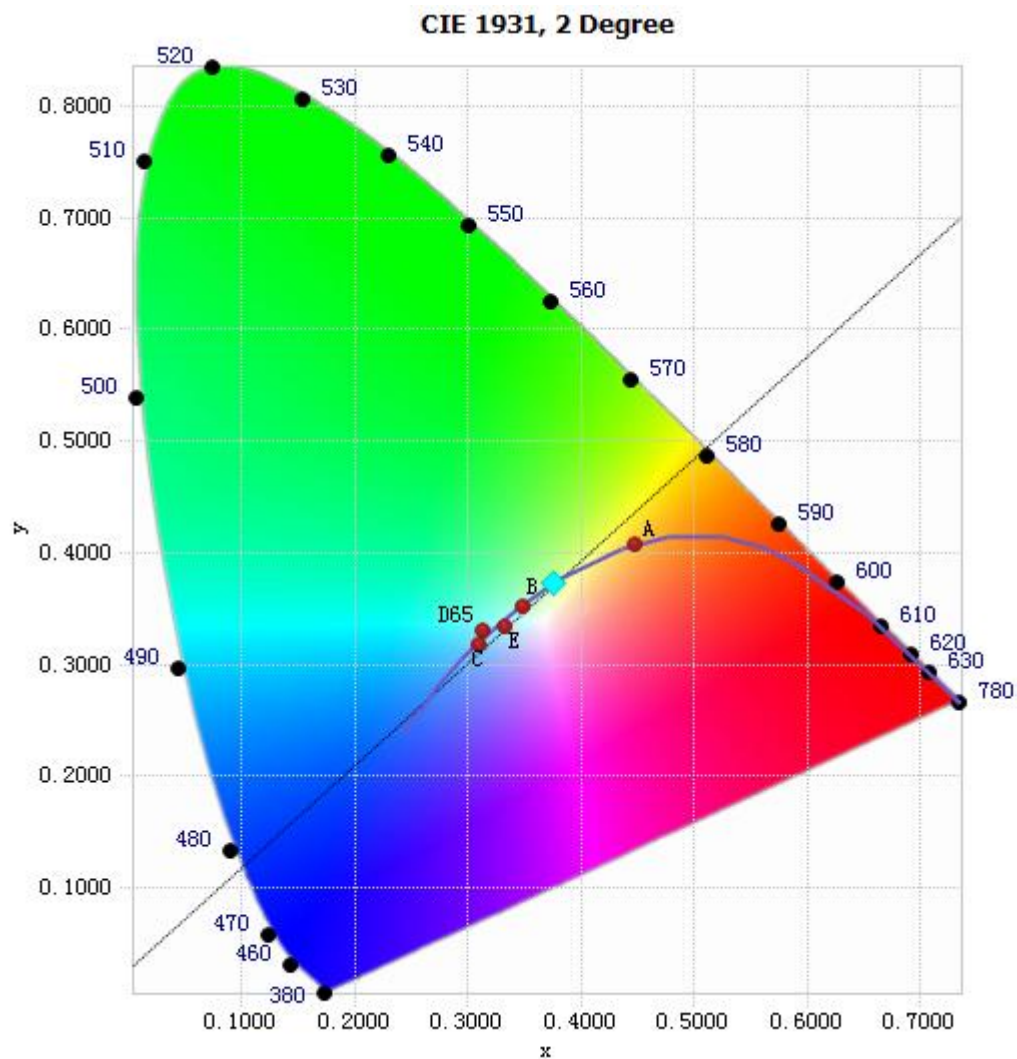


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	8.97E-05	485	1.02E-02	590	1.54E-02	695	8.19E-03
385	7.35E-05	490	1.04E-02	595	1.57E-02	700	7.29E-03
390	8.59E-05	495	1.08E-02	600	1.62E-02	705	6.43E-03
395	7.87E-05	500	1.13E-02	605	1.67E-02	710	5.67E-03
400	7.28E-05	505	1.18E-02	610	1.72E-02	715	4.99E-03
405	8.24E-05	510	1.24E-02	615	1.76E-02	720	4.41E-03
410	1.18E-04	515	1.28E-02	620	1.79E-02	725	3.85E-03
415	2.16E-04	520	1.32E-02	625	1.82E-02	730	3.35E-03
420	4.19E-04	525	1.35E-02	630	1.83E-02	735	2.89E-03
425	7.91E-04	530	1.39E-02	635	1.82E-02	740	2.49E-03
430	1.44E-03	535	1.42E-02	640	1.80E-02	745	2.16E-03
435	2.49E-03	540	1.45E-02	645	1.75E-02	750	1.87E-03
440	4.33E-03	545	1.47E-02	650	1.69E-02	755	1.61E-03
445	7.41E-03	550	1.49E-02	655	1.62E-02	760	1.38E-03
450	1.29E-02	555	1.50E-02	660	1.53E-02	765	1.19E-03
455	1.98E-02	560	1.50E-02	665	1.43E-02	770	1.02E-03
460	2.11E-02	565	1.49E-02	670	1.33E-02	775	8.70E-04
465	1.66E-02	570	1.49E-02	675	1.22E-02	780	7.49E-04
470	1.41E-02	575	1.49E-02	680	1.12E-02		
475	1.26E-02	580	1.50E-02	685	1.02E-02		
480	1.08E-02	585	1.52E-02	690	9.16E-03		

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

## Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3757, 0.3719)

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

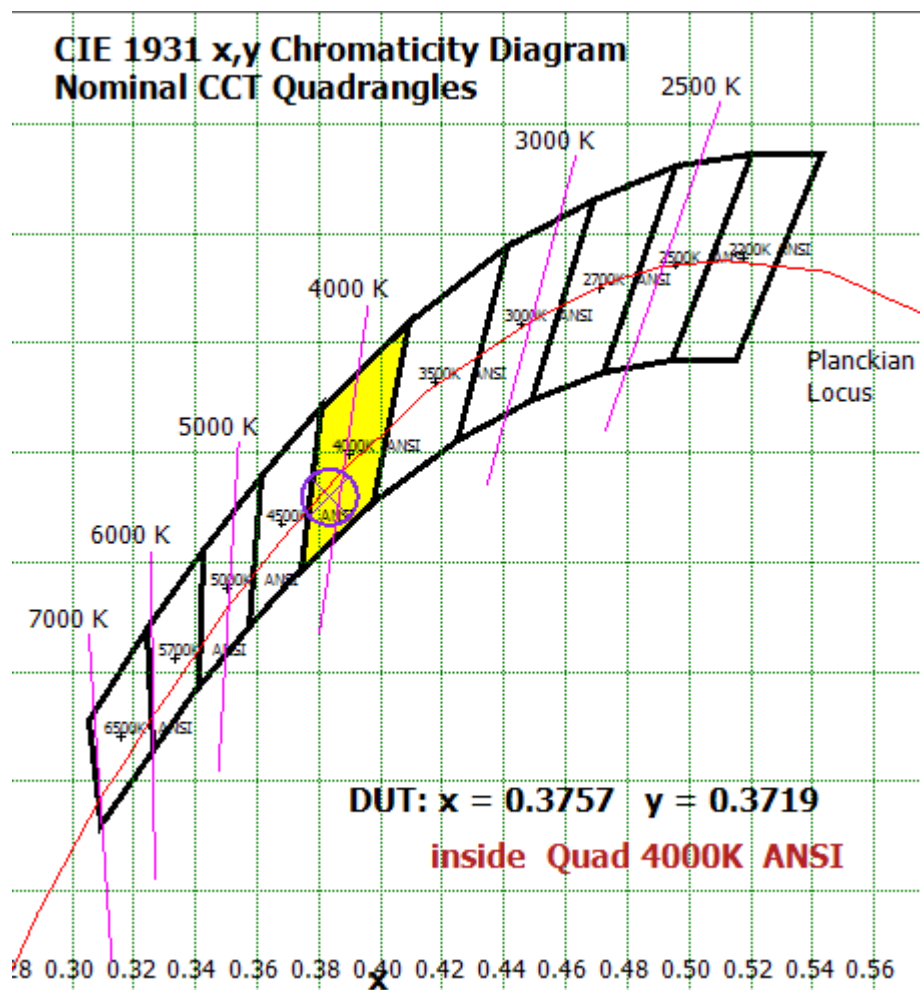


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Figure 1 consists of five subplots (a-e) illustrating colorimetric and colorimetric quality metrics of the proposed color space.

(a) Radiant power spectrum of the test light source. The x-axis is Wavelength (nm) from 380 to 780. The y-axis is Radiant Power (Equal Luminous F Lux). The plot shows a black line for the Reference and a red line for the Test. The Test spectrum has a prominent peak around 450 nm and a broader peak around 650 nm.

(b) Local chroma shift ( $R_{cs,hy}$ ). The x-axis is Hue-Angle Bin ( $j$ ) from 1 to 16. The y-axis is Local Chroma Shift ( $R_{cs,hy}$ ) from -40% to 40%. The plot shows a bar chart with values ranging from -10% to 6%.

(c) Local hue shift ( $R_{hs,hy}$ ). The x-axis is Hue-Angle Bin ( $j$ ) from 1 to 16. The y-axis is Local Hue Shift ( $R_{hs,hy}$ ) from -0.5 to 0.5. The plot shows a bar chart with values ranging from -0.05 to 0.12.

(d) Local color fidelity ( $R_{l,hy}$ ). The x-axis is Hue-Angle Bin ( $j$ ) from 1 to 16. The y-axis is Local Color Fidelity ( $R_{l,hy}$ ) from 0 to 100. The plot shows a bar chart with values ranging from 84 to 95.

(e) Color sample fidelity ( $R_{l,CES}$ ). The x-axis is Color Sample Fidelity ( $R_{l,CES}$ ) from 0 to 100. The y-axis is Color Sample Fidelity ( $R_{l,CES}$ ) from 0 to 100. The plot shows a bar chart with values ranging from 84 to 95.

$x$	0.3757
$y$	0.3719
$u'$	0.2239
$v'$	0.4987

#### 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	169.962	15.52%
10- 20	341.079	31.14%
20- 30	271.419	24.78%
30- 40	141.13	12.89%
40- 50	71.162	6.50%
50- 60	46.027	4.20%
60- 70	30.375	2.77%
70- 80	16.873	1.54%
80- 90	5.567	0.51%
90-100	0.29	0.03%
100-110	0.019	0.00%
110-120	0.035	0.00%
120-130	0.077	0.01%
130-140	0.188	0.02%
140-150	0.321	0.03%
150-160	0.366	0.03%
160-170	0.28	0.03%
170-180	0.095	0.01%
Total	1095.3	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	1040.779	95.03%
60- 90	52.815	4.82%
0-90	1093.594	99.85%
90- 180	1.671	0.15%
0- 180	1095.3	100%

Table 5: Zonal Lumen

## Illuminance Plots- Goniophotometer Method

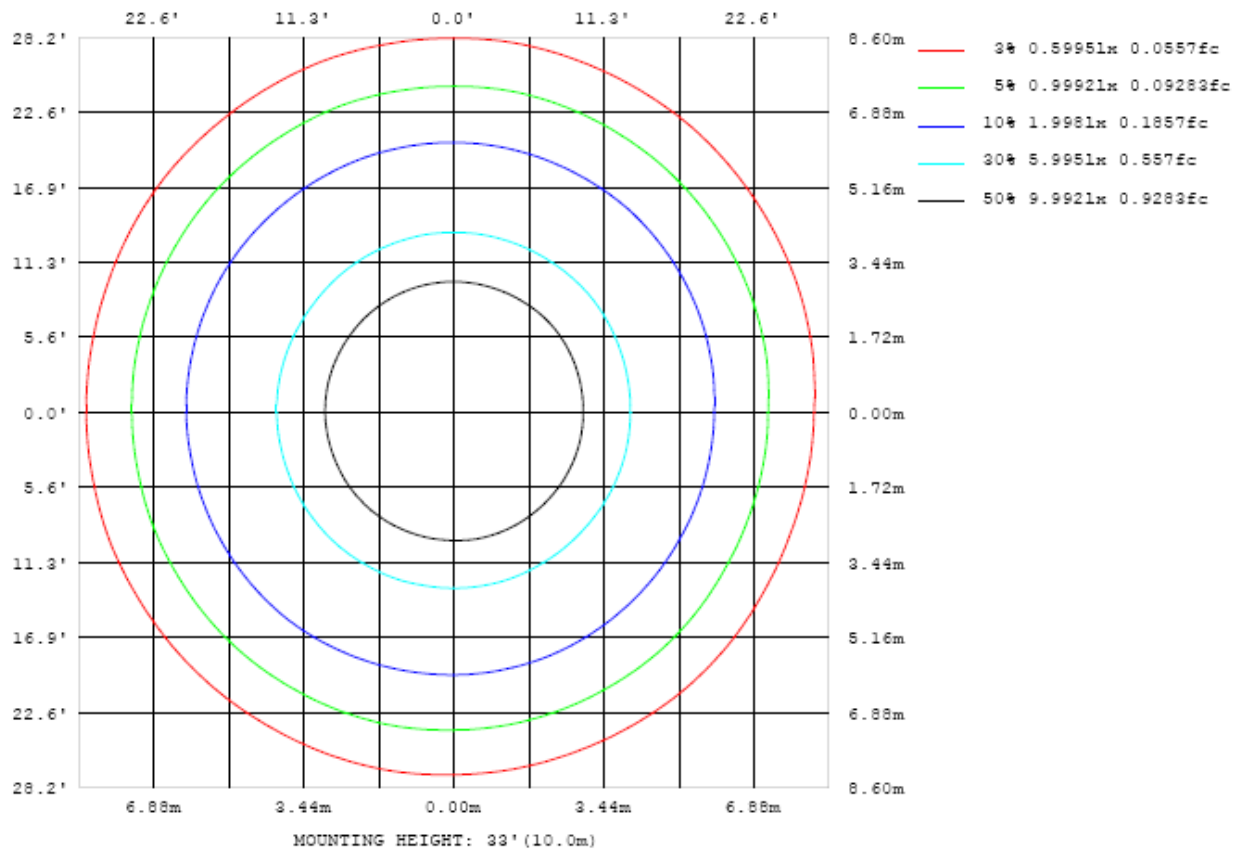


Chart 5: Illuminance Plot (Footcandles)

## Luminous Intensity Distribution Plots- Goniophotometer Method

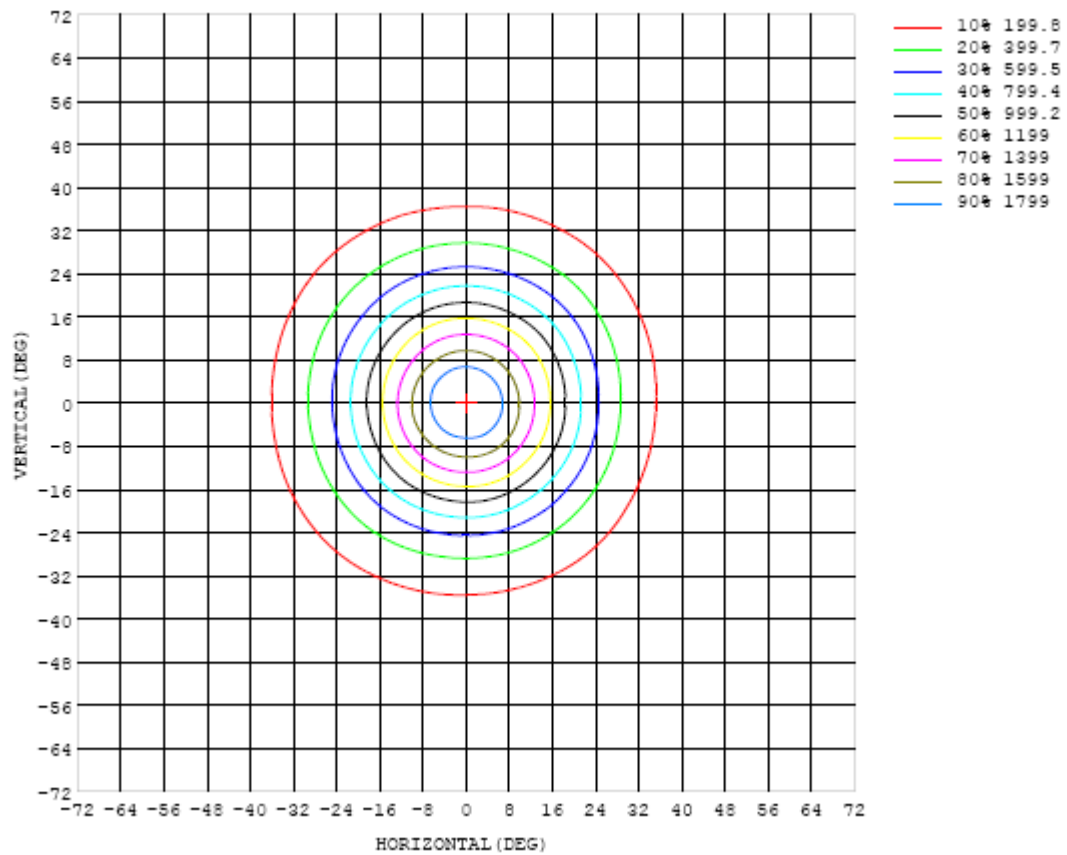


Chart 6: Isocandela Plot

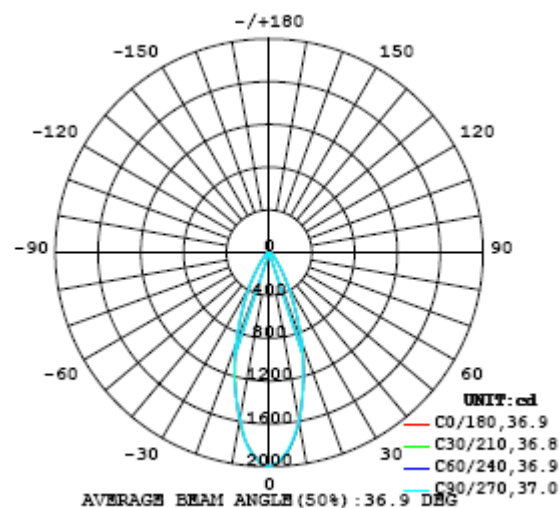


Chart 7: Polar Candela Distribution

## 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	1998	1998	1998	1998	1998	1998	1998	1998	1998	1998	1998	1998	1998	1998	1998	1998	1998	1998	1998
5	1877	1878	1882	1883	1884	1881	1878	1871	1866	1867	1870	1870	1868	1872	1878	1881	1879	1878	1875
10	1587	1592	1597	1603	1606	1607	1608	1605	1601	1595	1596	1595	1596	1597	1597	1600	1603	1606	1605
15	1238	1238	1237	1235	1233	1233	1234	1233	1233	1229	1228	1229	1231	1231	1232	1231	1231	1233	1236
20	888	888	883	879	875	873	875	880	882	882	878	879	883	885	886	884	886	890	895
25	575	571	570	567	564	566	566	570	572	573	575	578	581	583	583	582	584	587	594
30	345	342	340	338	339	341	345	349	350	352	353	357	362	366	366	367	369	371	377
35	203	201	199	199	203	205	206	207	210	211	214	216	217	220	221	221	223	223	226
40	127	125	123	124	125	126	126	126	127	128	131	131	131	133	134	134	136	135	136
45	86.1	84.9	84.2	84.4	85.6	86.3	85.8	85.8	86.7	86.5	86.7	87.4	87.4	87.9	88.4	88.4	89.3	89.3	90.7
50	62.9	62.2	61.8	61.8	61.9	62.1	62.1	62.2	62.7	63.5	63.9	64.0	64.3	64.5	64.5	64.6	64.7	64.6	65.2
55	50.2	49.9	49.7	49.7	49.5	49.6	49.3	49.4	50.0	50.2	50.6	50.9	51.1	51.3	51.4	51.7	51.7	51.7	52.0
60	39.4	39.1	39.1	38.8	38.4	38.3	38.0	38.0	38.2	38.4	38.8	39.2	39.5	39.6	39.8	40.0	40.3	40.4	40.7
65	29.9	29.8	29.7	29.6	29.5	29.4	29.3	29.2	29.2	29.3	29.5	29.7	29.8	30.0	30.3	30.4	30.6	30.7	30.8
70	22.4	22.3	22.2	22.2	22.1	22.0	22.0	21.9	21.9	22.0	22.1	22.2	22.4	22.5	22.6	22.6	22.8	22.9	23.0
75	15.7	15.6	15.7	15.6	15.6	15.6	15.6	15.6	15.6	15.5	15.6	15.6	15.6	15.8	15.8	15.9	15.9	15.9	16.0
80	9.66	9.70	9.69	9.65	9.63	9.62	9.63	9.66	9.66	9.61	9.56	9.57	9.60	9.63	9.62	9.65	9.67	9.66	9.69
85	4.87	4.83	4.78	4.83	4.85	4.84	4.85	4.85	4.83	4.81	4.77	4.71	4.73	4.79	4.81	4.81	4.81	4.75	4.89
90	1.44	1.43	1.42	1.41	1.39	1.40	1.41	1.42	1.40	1.37	1.35	1.33	1.33	1.32	1.33	1.34	1.35	1.35	1.43
95	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.02	0.02	0.02
100	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
105	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
110	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03
115	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
120	0.04	0.04	0.05	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.04	0.04	0.04	0.04	0.05
125	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.09
130	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.16
135	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.28
140	0.27	0.27	0.27	0.27	0.28	0.27	0.27	0.27	0.28	0.27	0.28	0.28	0.27	0.27	0.27	0.27	0.27	0.26	0.44
145	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.36	0.62
150	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.47	0.78
155	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.59	0.92
160	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.71	1.01
165	0.82	0.81	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.83	0.80	1.05
170	0.86	0.86	0.87	0.87	0.87	0.87	0.87	0.87	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.86	1.00
175	0.91	0.91	0.91	0.91	0.91	0.90	0.90	0.90	0.90	0.90	0.91	0.91	0.91	0.91	0.92	0.92	0.92	0.92	0.92
180	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

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	1998	1998	1998	1998	1998	1998	1998	1998	1998	1998	1998	1998	1998	1998	1998	1998	1998		
5	1874	1873	1871	1873	1876	1879	1882	1884	1884	1883	1881	1881	1880	1878	1877	1876	1875		
10	1601	1595	1591	1587	1585	1583	1583	1584	1581	1582	1581	1580	1579	1580	1581	1581	1584		
15	1236	1237	1238	1242	1248	1251	1254	1253	1252	1252	1252	1253	1257	1258	1252	1246	1241		
20	897	898	894	894	900	904	908	910	911	909	907	905	905	906	901	895	891		
25	598	598	597	599	604	608	610	614	615	613	611	610	609	607	601	591	583		
30	379	381	383	382	384	385	388	389	389	387	383	380	380	375	368	361	354		
35	226	229	230	232	231	232	234	233	232	232	229	226	225	221	217	213	209		
40	137	138	141	143	143	144	146	145	144	145	143	141	140	138	136	134	131		
45	91.4	92.4	93.1	94.0	93.5	94.3	94.8	94.8	94.4	95.4	95.1	94.2	94.2	92.8	91.1	89.8	88.7		
50	65.8	65.9	66.2	66.5	66.1	66.1	66.1	66.5	66.8	67.1	67.0	66.7	66.3	65.5	65.0	64.5	63.7		
55	52.3	52.3	52.8	53.2	53.3	53.2	53.0	53.1	53.0	52.8	52.6	52.2	51.9	51.7	51.2	50.9	50.6		
60	40.7	40.8	41.0	41.3	41.5	41.6	41.6	41.6	41.4	41.1	41.0	40.9	40.8	40.6	40.4	39.9	39.6		
65	30.9	31.1	31.2	31.4	31.6	31.8	31.5	31.6	31.4	31.1	30.9	30.9	30.8	30.8	30.7	30.4	30.2		
70	23.0	23.2	23.3	23.3	23.5	23.6	23.4	23.4	23.4	23.2	23.1	23.1	23.0	22.9	22.9	22.8	22.6		
75	16.0	16.2	16.3	16.3	16.4	16.4	16.4	16.4	16.4	16.3	16.2	16.2	16.1	16.1	16.1	16.0	15.8		
80	9.73	9.79	9.88	9.91	9.94	9.98	9.96	9.99	9.99	9.89	9.84	9.84	9.81	9.78	9.79	9.74	9.61		
85	4.87	4.89	4.94	4.92	4.92	4.92	4.93	4.96	4.97	4.99	4.98	4.99	5.00	4.94	4.98	4.98	4.95		
90	1.44	1.44	1.47	1.47	1.47	1.49	1.51	1.51	1.52	1.53	1.53	1.54	1.54	1.52	1.53	1.51	1.49		
95	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03		
100	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01		
105	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02		
110	0.03	0.02	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03		
115	0.03	0.03	0.03	0.04	0.04	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04		
120	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06		
125	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10		
130	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.18	0.18	0.17	0.17	0.17	0.17		
135	0.30	0.29	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.31	0.31	0.31	0.30	0.31	0.31	0.30		
140	0.47	0.46	0.46	0.46	0.46	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.48	0.46		
145	0.66	0.65	0.65	0.65	0.65	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.67	0.64		
150	0.85	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.85	0.85	0.85	0.85	0.85	0.86	0.82		
155	1.01	0.99	0.99	0.99	0.99	0.99	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.02	0.96		
160	1.13	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.13	1.13	1.13	1.13	1.13	1.13	1.15	1.06		
165	1.21	1.19	1.19	1.19	1.19	1.19	1.19	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.22	1.11		
170	1.19	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.18	1.18	1.18	1.18	1.18	1.18	1.21	1.04		
175	1.03	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.06	1.06	1.06	1.06	1.06	1.07	1.06	0.91		
180	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		

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**

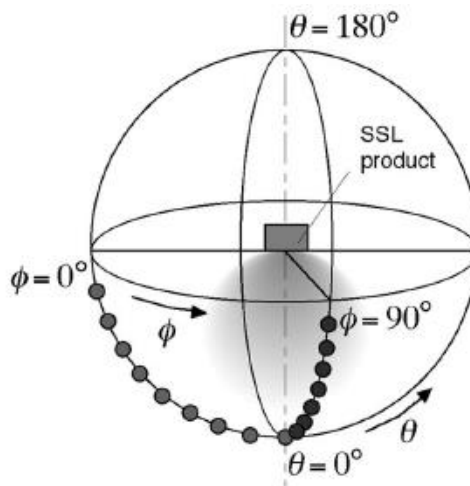
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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