LM-79-19 TEST REPORT

for

GREEN CREATIVE LTD

Room 3603, Level 36, Tower 1, Enterprise Square Five, 38 Wang Chiu Road, Kowloon Bay, KL, Hong Kong

LED Lamp

Model: 13PAR38DIM/930FL40

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

3rd Floor, Bld. 2, NO. 96 Longchuanwu Rd Qianjiang Economy Dev. Zone, YuhangDist, Hangzhou, Zhejiang Province, China 311100

Tel: +86571 86376106

www.ledtestlab.com

Report No.: HZ22090009g

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

Review by: April Zou

Engineer: April Zou

Sep. 21, 2022

Approved by:

Manager: Jim Zhang

Sep. 21, 2022

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: **13PAR38DIM/930FL40**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
117.4	1494.2	12.73	0.8065

CCT (K)	CRI	Stabilization Time (Light & Power)
3158	95.5	50

Table 1: Executive Data Summary

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

Test specifications:

Date of Receipt : Sep. 08, 2022

Date of Test : Sep. 16, 2022

Test item : Total Luminous Flux, Luminous Distribution Intensity, Luminous Efficacy, Correlated Color Temperature, Color Rendering Index, Chromaticity Coordinate, Electrical parameters

Reference Standard : IESNA LM-79-2019 Approved Method: 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)	
Name	: LED Lamp
Model	: 13PAR38DIM/930FL40
Electrical Ratings	: 120V, 60Hz, 13W
Product Description	: 3000K
Manufacturer	: GREEN CREATIVE LTD
Address	: Room 3603, Level 36, Tower 1, Enterprise Square Five, 38 Wang Chiu Road, Kowloon Bay, KL, Hong Kong

TEST RESULTS

Test ambient temperature was 26.0 ℃.

Base orientation was base up. Test was conducted without a dimmer in the circuit.

The stabilization time of the sample was 50 minutes, and the total operating time including stabilization was 55 minutes.

Sphere-Spectroradiometer Method

Parameter	Result
Test Voltage (V)	120.0
Voltage frequency (Hz)	60
Test Current (A)	0.132
Power Factor	0.8065
Test Power (W)	12.73
THD A%	58.99
Luminous Efficacy (lm/W)	117.4
Total Luminous Flux (lm)	1494.2
Color Rendering Index (CRI)	95.5
R9	70.7
Correlated Color Temperature (CCT)(K)	3158
Chromaticity Chroma x	0.4279
Chromaticity Chroma y	0.4044
Chromaticity Chroma u	0.2446
Chromaticity Chroma v	0.3468
Duv	0.0015
Chromaticity Chroma u ’	0.2446
Chromaticity Chroma v’	0.5202

Special Color Rendering Indices	
R1	97.6
R2	96.8
R3	94.3
R4	97.6
R5	96.4
R6	96.7
R7	95.5
R8	89
R9	70.7
R10	90
R11	96.8
R12	81.3
R13	97.2
R14	95.4

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 ℃.

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)	0.131
Power Factor	0.8100
Power (W)	12.74
Luminous Efficacy (lm/W)	118.3
Total Luminous Flux (lm)	1506.7
Beam Angle (°)	35.9 (0^o-180^o) / 36.9 (90^o-270^o)
Center Beam Candle Power (cd)	2786
Maximum Beam Candle Power (cd)	2806 (At: C=330.0, Gamma=1.5)
Spacing Criteria	0.57 (0^o-180^o) / 0.63 (90^o-270^o)
Zonal Lumens in the 0 °-60 °Zone	97.06%
Zonal Lumens in the 60 °-90 °Zone	2.84%
Zonal Lumens in the 90 °-120 °Zone	0.00%
Zonal Lumens in the 120 °-180 °Zone	0.09%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

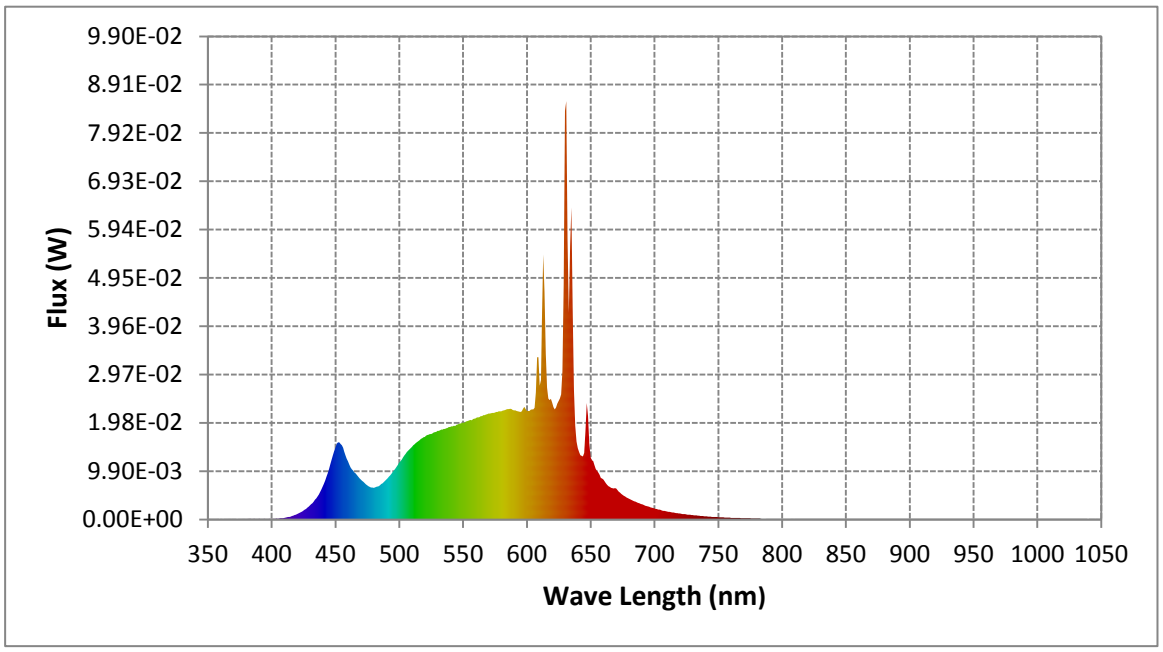
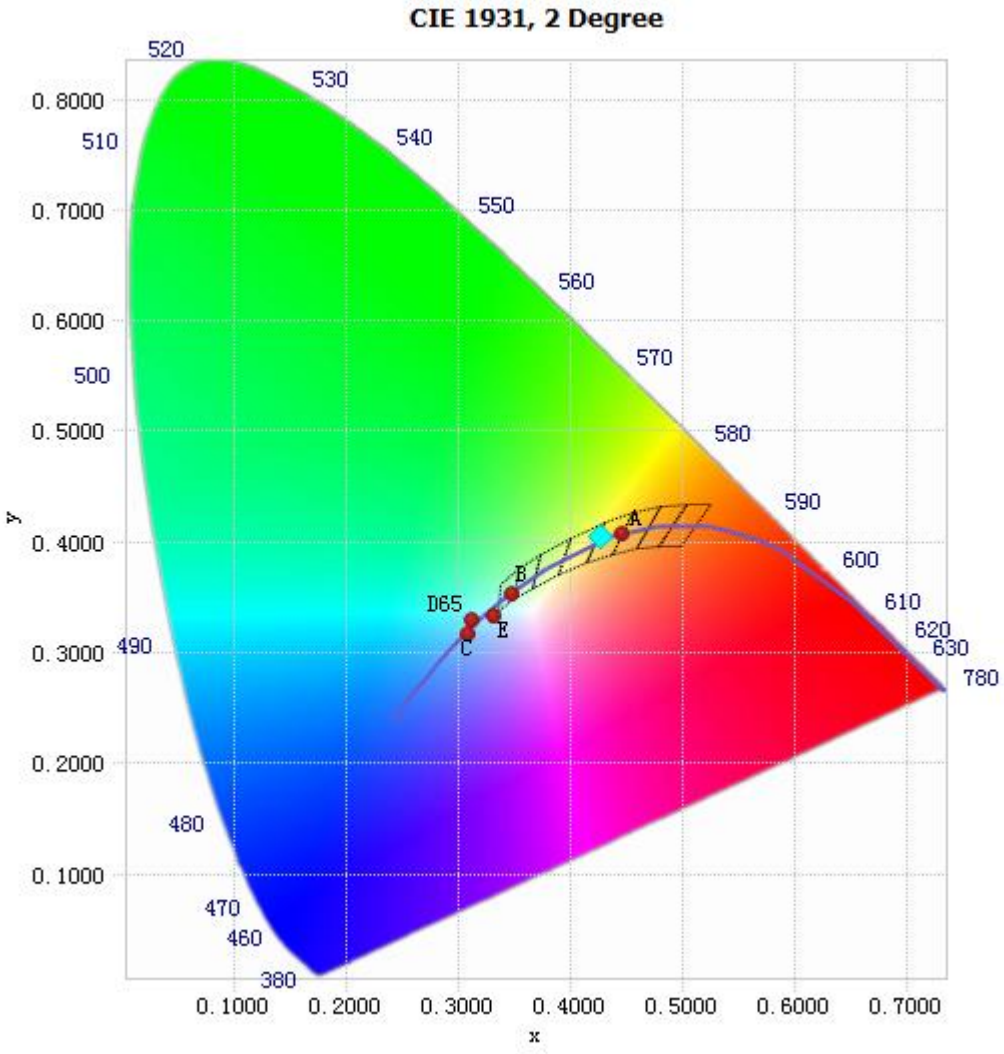


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.19E-04	485	7.03E-03	590	2.23E-02	695	2.65E-03
385	6.93E-05	490	8.19E-03	595	2.20E-02	700	2.27E-03
390	1.20E-04	495	9.74E-03	600	2.22E-02	705	1.94E-03
395	1.02E-04	500	1.16E-02	605	2.25E-02	710	1.63E-03
400	7.93E-05	505	1.34E-02	610	2.74E-02	715	1.40E-03
405	1.34E-04	510	1.49E-02	615	3.40E-02	720	1.24E-03
410	2.96E-04	515	1.61E-02	620	2.39E-02	725	1.05E-03
415	6.07E-04	520	1.69E-02	625	2.43E-02	730	8.80E-04
420	1.13E-03	525	1.75E-02	630	8.37E-02	735	7.48E-04
425	1.85E-03	530	1.81E-02	635	6.39E-02	740	6.29E-04
430	2.89E-03	535	1.85E-02	640	1.46E-02	745	5.44E-04
435	4.35E-03	540	1.90E-02	645	1.36E-02	750	4.74E-04
440	6.74E-03	545	1.94E-02	650	1.28E-02	755	4.11E-04
445	1.03E-02	550	1.98E-02	655	9.95E-03	760	3.35E-04
450	1.48E-02	555	2.03E-02	660	8.20E-03	765	2.97E-04
455	1.52E-02	560	2.07E-02	665	6.67E-03	770	2.62E-04
460	1.19E-02	565	2.12E-02	670	6.36E-03	775	2.24E-04
465	9.62E-03	570	2.17E-02	675	5.02E-03	780	1.90E-04
470	8.19E-03	575	2.19E-02	680	4.27E-03		
475	7.00E-03	580	2.22E-02	685	3.64E-03		
480	6.47E-03	585	2.26E-02	690	3.12E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4279, 0.4044)

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

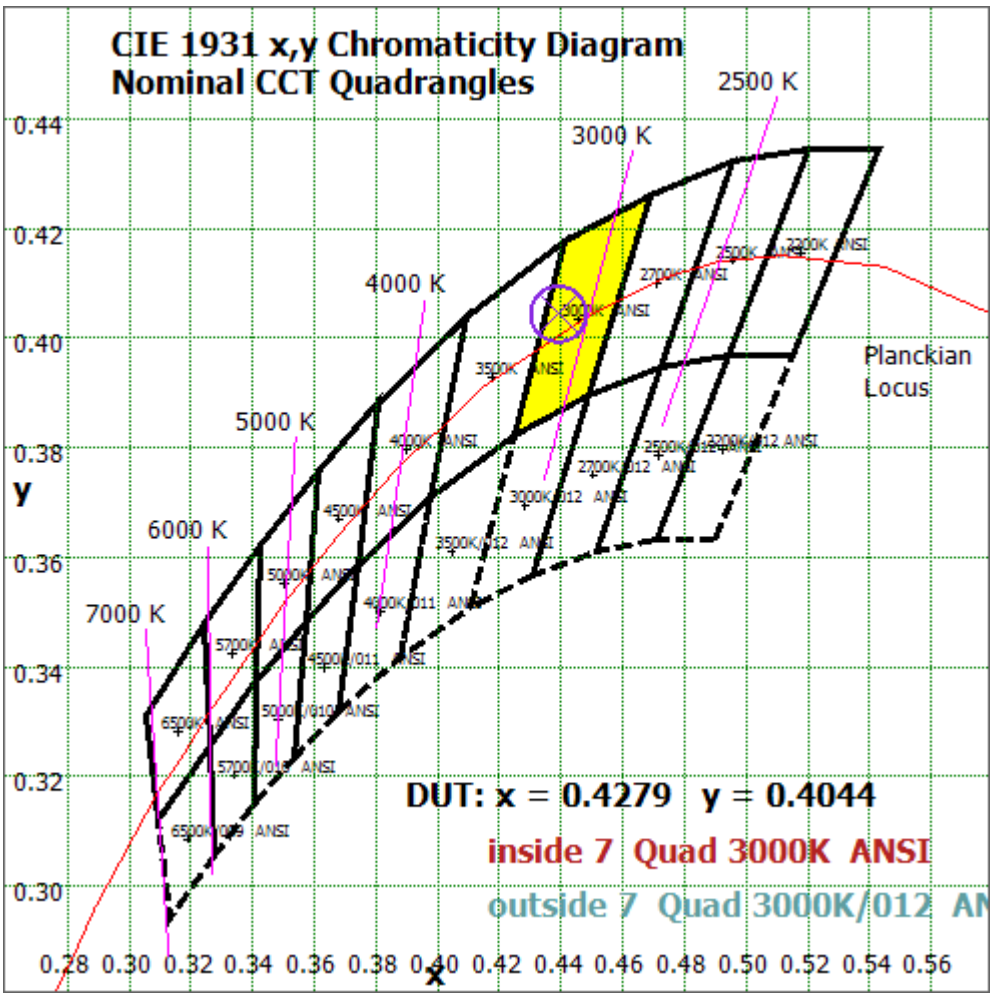


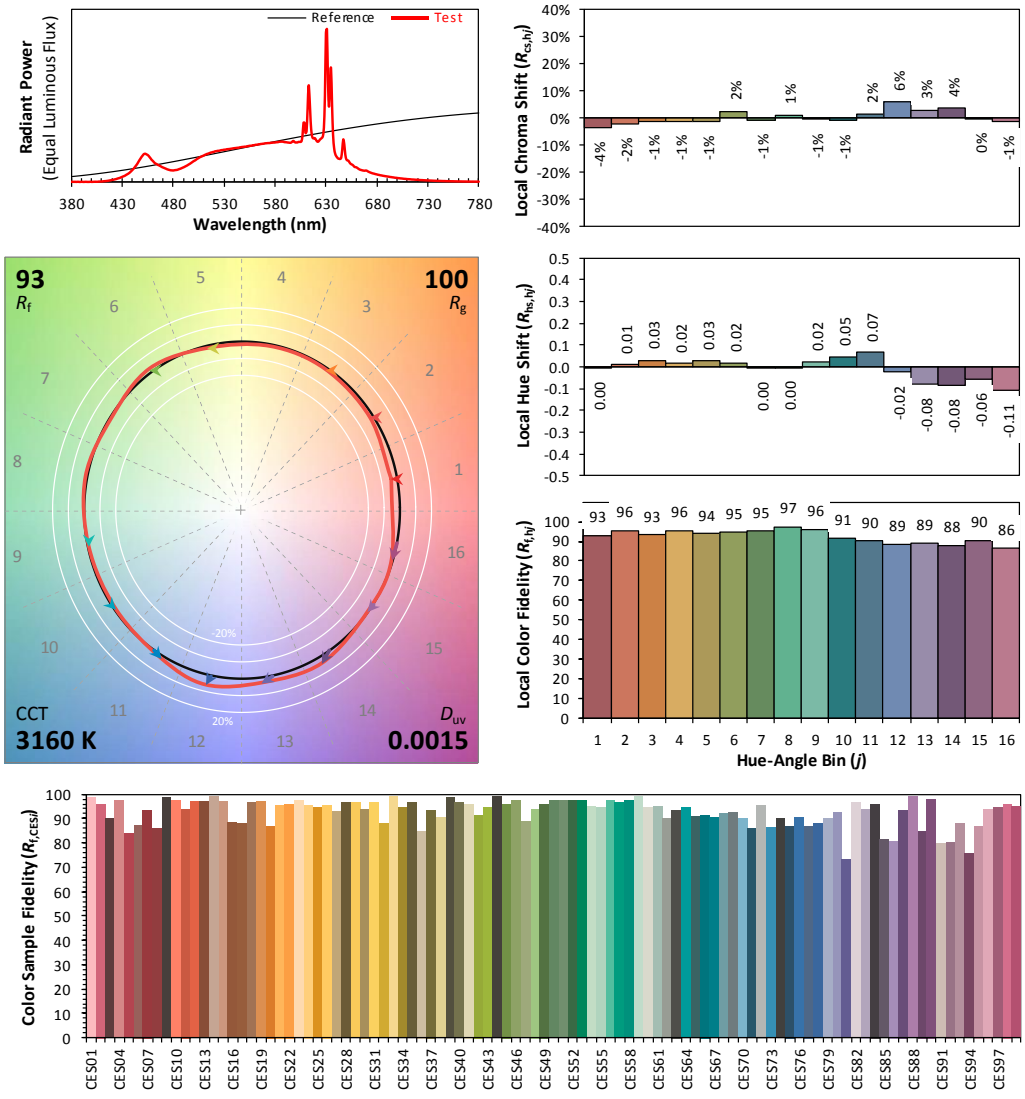
Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method

ANSI/IES TM-30-18 Color Rendition Report

Source: LED **Manufacturer:** GREEN CREATIVE LTD

Date: 2022/09/16 **Model:** 13PAR38DIM/930FL40



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

x	0.4279
y	0.4044
u'	0.2446
v'	0.5202

CIE 13.3-1995 (CRI)

R_a	96
R_9	71

Colors are for visual orientation purposes only. Created with the ANSI/IES TM-30-18 Calculator Version 2.00.

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

γ(°)	Lumens	% Total
0- 10	237.026	15.73%
10- 20	469.487	31.16%
20- 30	394.919	26.21%
30- 40	226.043	15.00%
40- 50	94.603	6.28%
50- 60	40.315	2.68%
60- 70	25.688	1.70%
70- 80	13.918	0.92%
80- 90	3.213	0.21%
90-100	0.007	0.00%
100-110	0.013	0.00%
110-120	0.029	0.00%
120-130	0.08	0.01%
130-140	0.207	0.01%
140-150	0.336	0.02%
150-160	0.378	0.03%
160-170	0.304	0.02%
170-180	0.109	0.01%
Total	1506.7	100%

γ(°)	Lumens	% Total
0- 60	1462.39	97.06%
60- 90	42.819	2.84%
0-90	1505.21	99.90%
90- 180	1.463	0.10%
0- 180	1506.7	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

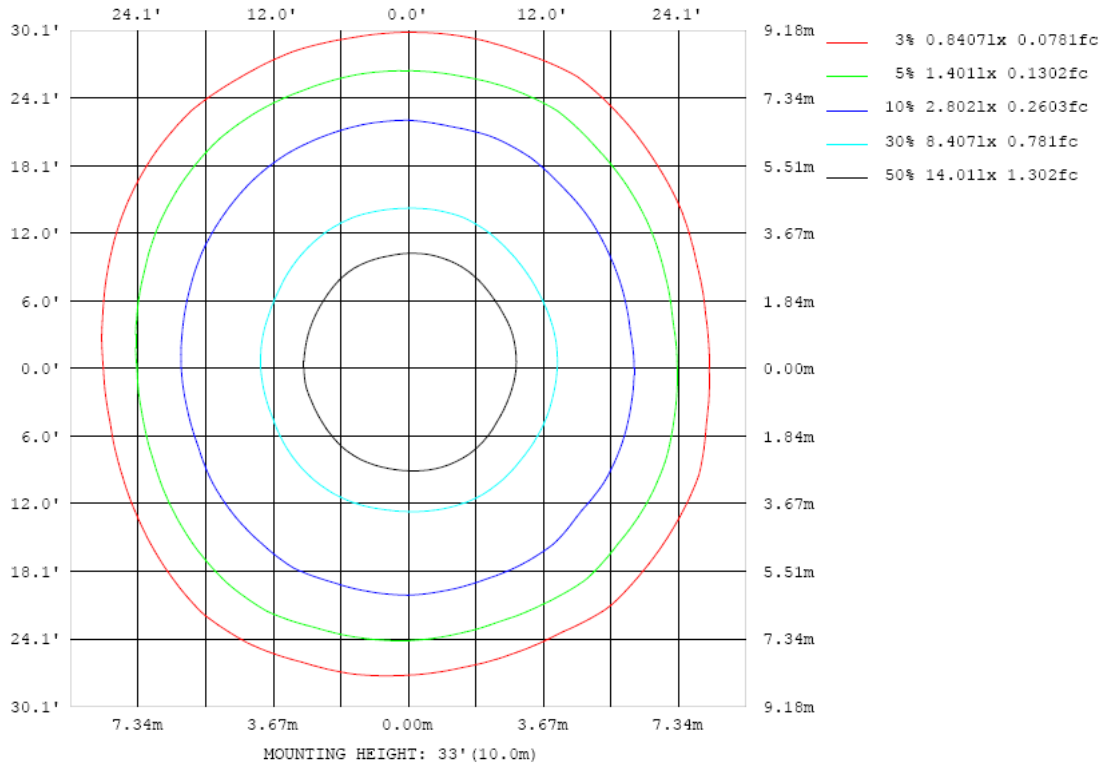


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

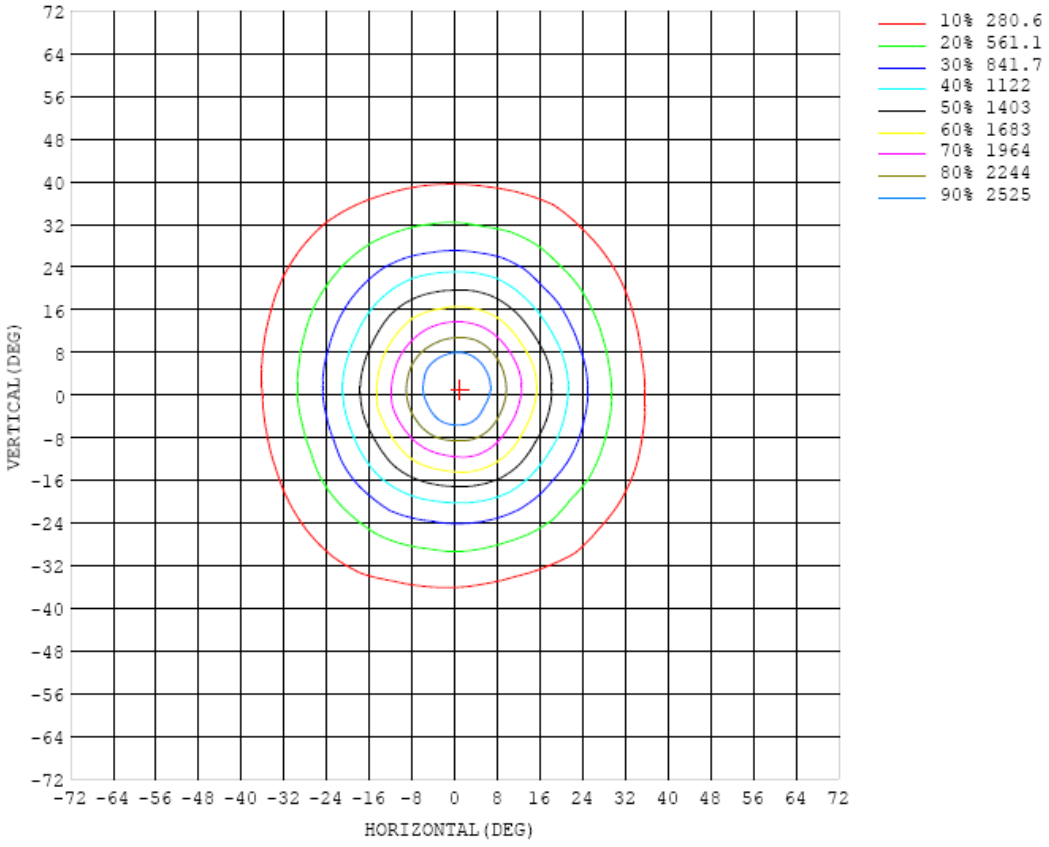


Chart 6: Isocandela Plot

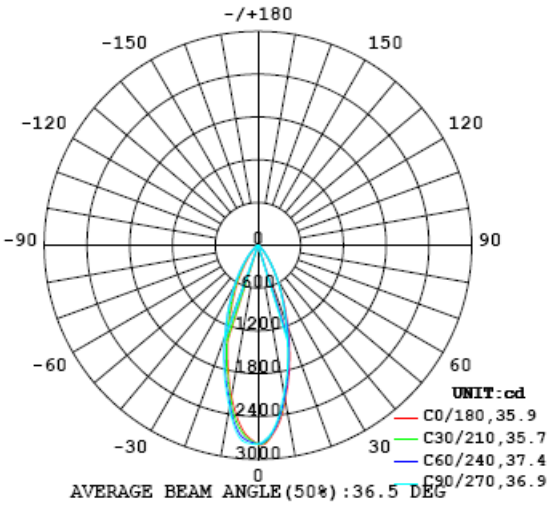


Chart 7: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1 UNIT: cd

γ (DEG) \ C (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	2786	2786	2786	2786	2786	2786	2786	2786	2786	2786	2786	2786	2786	2786	2786	2786	2786	2786	2786
5	2629	2612	2599	2592	2599	2598	2598	2591	2585	2575	2571	2566	2565	2560	2554	2552	2553	2567	2582
10	2207	2183	2165	2157	2154	2160	2156	2144	2121	2103	2100	2103	2106	2107	2107	2112	2129	2143	2154
15	1718	1678	1652	1640	1655	1666	1662	1660	1647	1622	1614	1621	1629	1626	1610	1606	1613	1648	1654
20	1229	1208	1192	1174	1177	1190	1196	1177	1158	1139	1140	1157	1169	1180	1171	1160	1158	1180	1199
25	841	821	815	807	789	802	808	800	794	792	780	801	824	811	814	804	783	793	824
30	532	526	526	529	508	533	528	516	523	532	525	534	546	535	531	527	508	514	537
35	305	312	322	322	315	332	317	302	305	316	321	328	352	346	339	327	311	309	316
40	165	171	189	189	190	195	177	173	172	180	191	196	211	217	203	189	178	171	176
45	79.2	85.2	99.9	104	109	109	98.6	87.4	77.7	80.7	100.0	116	125	127	117	106	92.1	85.0	89.1
50	47.2	48.2	55.5	59.4	66.2	63.7	54.6	47.5	45.0	45.5	51.5	65.0	74.0	76.7	68.6	59.0	52.2	50.4	52.2
55	35.6	35.5	37.6	39.0	42.7	41.7	37.6	35.5	35.1	35.4	37.1	40.9	47.7	49.7	43.4	39.6	38.2	38.0	38.8
60	28.7	28.7	29.5	30.8	33.0	32.4	30.2	29.0	28.6	28.9	29.8	31.6	35.6	36.3	32.2	30.8	30.2	30.2	30.7
65	22.9	22.9	23.0	24.0	25.8	25.6	23.9	23.3	23.0	23.1	23.6	24.5	27.2	27.3	24.4	23.7	23.5	23.4	23.7
70	17.9	17.8	17.7	18.2	19.5	19.3	18.2	17.8	17.6	17.6	17.9	18.4	20.1	20.1	18.3	18.1	18.1	18.0	18.3
75	12.5	12.4	12.2	12.3	12.8	12.7	12.0	11.8	11.7	11.6	11.7	11.9	12.7	12.7	12.0	12.1	12.3	12.3	12.5
80	7.33	7.19	6.94	6.77	6.68	6.54	6.37	6.35	6.27	6.26	6.18	6.13	6.21	6.33	6.35	6.58	6.83	6.96	7.08
85	3.04	2.87	2.68	2.52	2.38	2.25	2.15	2.08	2.02	1.98	1.95	1.94	1.94	1.99	2.07	2.18	2.32	2.50	2.63
90	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
95	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
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	0.01	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
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	0.01	0.01
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	0.02	0.02
120	0.05	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.04	0.04	0.04
125	0.08	0.08	0.08	0.08	0.08	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.08	0.08	0.08	0.08	0.07	0.07
130	0.16	0.13	0.13	0.14	0.14	0.14	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.14	0.14	0.14	0.13	0.13	0.13
135	0.28	0.23	0.23	0.24	0.24	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.24	0.24	0.23	0.22
140	0.43	0.32	0.33	0.34	0.35	0.36	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.36	0.36	0.35	0.34	0.34	0.32
145	0.59	0.43	0.44	0.45	0.45	0.46	0.47	0.48	0.48	0.48	0.48	0.48	0.48	0.47	0.47	0.46	0.46	0.45	0.42
150	0.74	0.54	0.55	0.55	0.56	0.56	0.57	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.57	0.57	0.56	0.54
155	0.85	0.67	0.67	0.68	0.68	0.69	0.69	0.70	0.70	0.70	0.71	0.71	0.71	0.71	0.71	0.71	0.70	0.70	0.67
160	0.93	0.80	0.81	0.81	0.81	0.82	0.82	0.83	0.83	0.83	0.84	0.84	0.84	0.84	0.85	0.85	0.84	0.83	0.81
165	0.93	0.90	0.90	0.90	0.91	0.91	0.91	0.92	0.92	0.93	0.93	0.94	0.94	0.94	0.95	0.95	0.95	0.94	0.94
170	0.96	0.97	0.97	0.97	0.97	0.97	0.97	0.98	0.98	0.99	0.99	1.00	1.01	1.01	1.01	1.01	1.01	1.01	1.00
175	1.04	1.02	1.01	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.02	1.02	1.03	1.03	1.04	1.04	1.05	1.07	1.08
180	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28

Table 6: Luminous Intensity Data

Table--2 UNIT: cd

C(DEG) / γ (DEG)	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350		
0	2786	2786	2786	2786	2786	2786	2786	2786	2786	2786	2786	2786	2786	2786	2786	2786	2786		
5	2596	2609	2626	2647	2667	2687	2704	2720	2735	2742	2743	2737	2724	2708	2692	2673	2650		
10	2166	2177	2204	2233	2253	2268	2283	2300	2314	2329	2338	2332	2313	2291	2267	2245	2225		
15	1657	1676	1704	1731	1767	1802	1816	1817	1832	1839	1839	1823	1794	1765	1753	1757	1741		
20	1218	1222	1236	1280	1328	1357	1370	1369	1368	1386	1382	1354	1313	1270	1254	1259	1252		
25	839	850	881	915	944	979	987	981	979	982	986	957	904	887	857	840	845		
30	547	569	600	622	651	672	675	670	674	658	669	651	608	590	564	541	527		
35	335	358	385	406	426	437	438	446	445	431	437	424	390	373	347	323	303		
40	191	211	235	253	267	267	267	268	267	265	267	269	244	223	205	182	169		
45	99.6	120	136	152	162	158	158	151	154	160	158	162	146	130	113	90.0	82.9		
50	55.4	65.2	78.4	92.0	92.4	86.7	79.6	74.2	76.1	83.5	90.9	93.1	86.1	71.1	59.3	50.5	49.1		
55	40.0	43.4	49.3	57.3	57.5	51.7	48.0	45.4	46.3	48.2	52.8	56.5	52.1	43.7	40.2	37.3	36.5		
60	31.8	33.4	36.9	41.7	41.5	38.2	37.0	35.7	36.1	36.4	38.2	39.9	36.9	32.9	31.3	29.9	29.0		
65	24.5	25.4	27.8	31.5	31.2	29.0	28.6	27.8	28.1	28.3	29.2	30.6	28.0	25.3	24.3	23.6	23.0		
70	18.9	19.5	20.8	23.4	23.1	21.9	21.8	21.2	21.6	21.5	21.9	23.0	21.1	19.4	18.8	18.4	18.0		
75	12.9	13.2	13.8	15.3	15.1	14.7	14.7	14.3	14.7	14.7	14.9	15.6	14.4	13.5	13.2	13.0	12.7		
80	7.11	7.24	7.36	7.64	7.69	7.73	7.77	7.76	7.95	8.00	8.06	8.21	7.99	7.85	7.81	7.71	7.56		
85	2.75	2.85	2.94	3.04	3.12	3.18	3.21	3.29	3.36	3.36	3.37	3.38	3.39	3.39	3.38	3.33	3.22		
90	0.00	0.01	0.02	0.03	0.05	0.07	0.09	0.12	0.13	0.14	0.15	0.15	0.13	0.12	0.10	0.07	0.04		
95	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01		
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	0.01	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		
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		
115	0.02	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	0.05	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05		
125	0.08	0.08	0.08	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09		
130	0.15	0.16	0.16	0.17	0.17	0.17	0.17	0.18	0.18	0.18	0.18	0.18	0.17	0.17	0.17	0.17	0.16		
135	0.28	0.30	0.30	0.29	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.29	0.29	0.29	0.30		
140	0.42	0.46	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.46		
145	0.56	0.64	0.63	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.63	0.65		
150	0.70	0.83	0.81	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.81	0.81	0.84		
155	0.82	0.98	0.96	0.96	0.96	0.95	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.97	0.97	1.00		
160	0.91	1.15	1.14	1.14	1.14	1.15	1.15	1.15	1.16	1.16	1.16	1.15	1.15	1.15	1.14	1.14	1.16		
165	0.95	1.28	1.28	1.29	1.30	1.30	1.31	1.32	1.32	1.32	1.32	1.31	1.31	1.30	1.29	1.29	1.29		
170	0.98	1.19	1.34	1.33	1.34	1.35	1.36	1.37	1.37	1.37	1.37	1.37	1.37	1.37	1.36	1.37	1.23		
175	1.09	1.11	1.12	1.26	1.25	1.28	1.30	1.31	1.33	1.33	1.33	1.32	1.32	1.30	1.30	1.09	1.06		
180	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28		

Table 7: Luminous Intensity Data

EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Aug. 05, 2022	Aug. 04, 2023
Digital Power Meter	PF2010A	HZTE028-01	Aug. 05, 2022	Aug. 04, 2023
AC Power Supply	DPS1060	HZTE001-06	Aug. 05, 2022	Aug. 04, 2023
DC Power Supply	WY12010	HZTE004-03	Aug. 05, 2022	Aug. 04, 2023
Temperature recorder	JM624U	HZTE018-08	Aug. 05, 2022	Aug. 04, 2023
Temperature and humidity recorder	JR900	HZTE018-01	Aug. 05, 2022	Aug. 04, 2023
Standard source	D908	HZTE012-01	Aug. 05, 2022	Aug. 04, 2023
Integrate Sphere system	3M	HZTE015-04	Aug. 05, 2022	Aug. 04, 2023
Digital Power Meter	WT210	HZTE008-01	Aug. 05, 2022	Aug. 04, 2023
AC Power Supply	PCR 500L	HZTE001-07	Aug. 05, 2022	Aug. 04, 2023
DC Power Supply	IT6154	HZTE004-04	Aug. 05, 2022	Aug. 04, 2023
Standard source	SCL-1400	HZTE012-02	Aug. 05, 2022	Aug. 04, 2023
Temperature and humidity recorder	JR900	HZTE018-02	Aug. 05, 2022	Aug. 04, 2023
Temperature Meter	TES1310	HZTE017-01	Aug. 05, 2022	Aug. 04, 2023

Table 7: 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 3 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 4π. 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 20 min, taken 10 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.

3rd Floor, Bld. 2, NO. 96 Longchuanwu Rd Qianjiang Economy Dev. Zone, YuhangDist,
Hangzhou, Zhejiang Province, China 311100
Tel: +86 571 86376106 www.ledtestlab.com

The uncertainty of integrating sphere system reported in this document is expended 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 20 min, taken 10 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 expended 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.

*** End of Report ***