LM-79-08 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: 7MR16DIM/930SP15/R

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ20060049v

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

Review by: April Zou

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Oct. 16, 2020

Approved by: Jim Zhang

Manager: Jim Zhang

Oct. 16, 2020

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: **7MR16DIM/930SP15/R**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
92.3	559.6	6.06	0.9180

CCT (K)	CRI	Stabilization Time (Light & Power)
3084	96.9	60

Table 1: Executive Data Summary

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

Test specifications:

Date of Receipt : Jun. 25, 2020

Date of Test : Jun. 26, 2020

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

Reference Standard : IESNA LM-79-2008 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)	
Name	: LED Lamp
Model	: 7MR16DIM/930SP15/R
Electrical Ratings	: 12Vac, 50/60Hz, 7W
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 60 minutes, and the total operating time including stabilization was 65 minutes.

Sphere-Spectroradiometer Method

Parameter	Result
Test Voltage (V)	12.0
Voltage frequency (Hz)	60
Test Current (A)	0.547
Power Factor	0.9180
Test Power (W)	6.06
THD A%	31.24
Luminous Efficacy (lm/W)	92.3
Total Luminous Flux (lm)	559.6
Color Rendering Index (CRI)	96.9
R9	84.8
Correlated Color Temperature (CCT)(K)	3084
Chromaticity Chroma x	0.4293
Chromaticity Chroma y	0.3983
Chromaticity Chroma u	0.2481
Chromaticity Chroma v	0.3453
Duv	-0.0012
Chromaticity Chroma u ’	0.2481
Chromaticity Chroma v’	0.5179

Special Color Rendering Indices	
R1	98.3
R2	98.7
R3	96.6
R4	97.5
R5	97.3
R6	96.8
R7	96.6
R8	93.4
R9	84.8
R10	95
R11	97.3
R12	82.1
R13	98.8
R14	97.2

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 25.2 ℃.

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)	12.0
Voltage frequency (Hz)	60
Test Current (A)	0.550
Power Factor	0.9171
Power (W)	6.04
Luminous Efficacy (lm/W)	94.1
Total Luminous Flux (lm)	568.2
Beam Angle (°)	14.4 (0^o-180^o) / 14.4 (90^o-270^o)
Center Beam Candle Power (cd)	4992
Maximum Beam Candle Power (cd)	4992 (At: C=0.0, Gamma=0.0)
Spacing Criteria	0.25 (0^o-180^o) / 0.26 (90^o-270^o)
Zonal Lumens in the 0 °-60 °Zone	97.88%
Zonal Lumens in the 60 °-90 °Zone	1.73%
Zonal Lumens in the 90 °-120 °Zone	0.26%
Zonal Lumens in the 120 °-180 °Zone	0.13%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

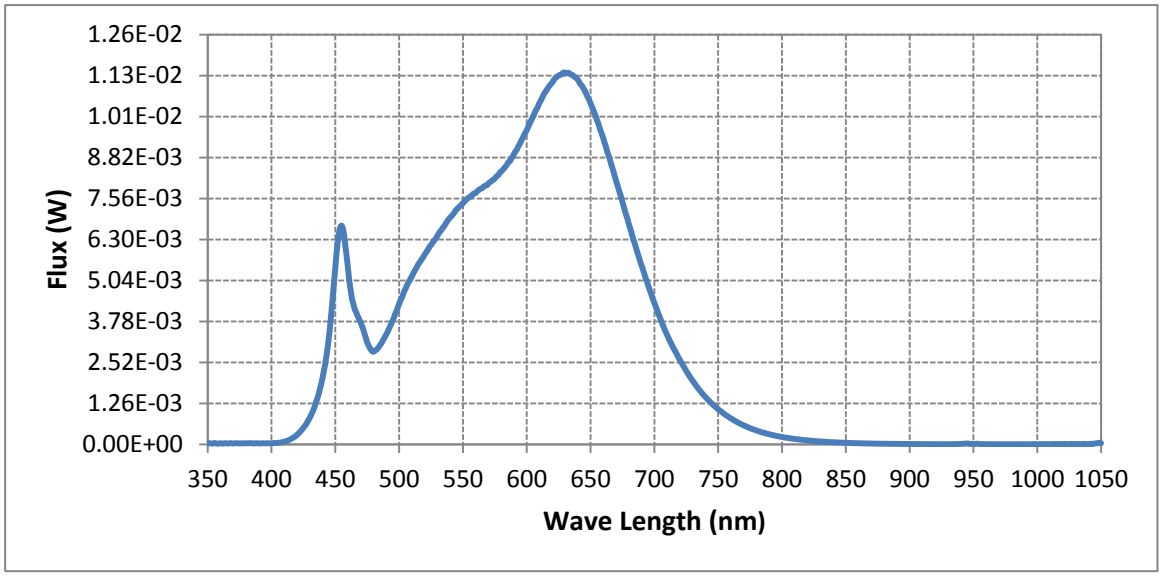
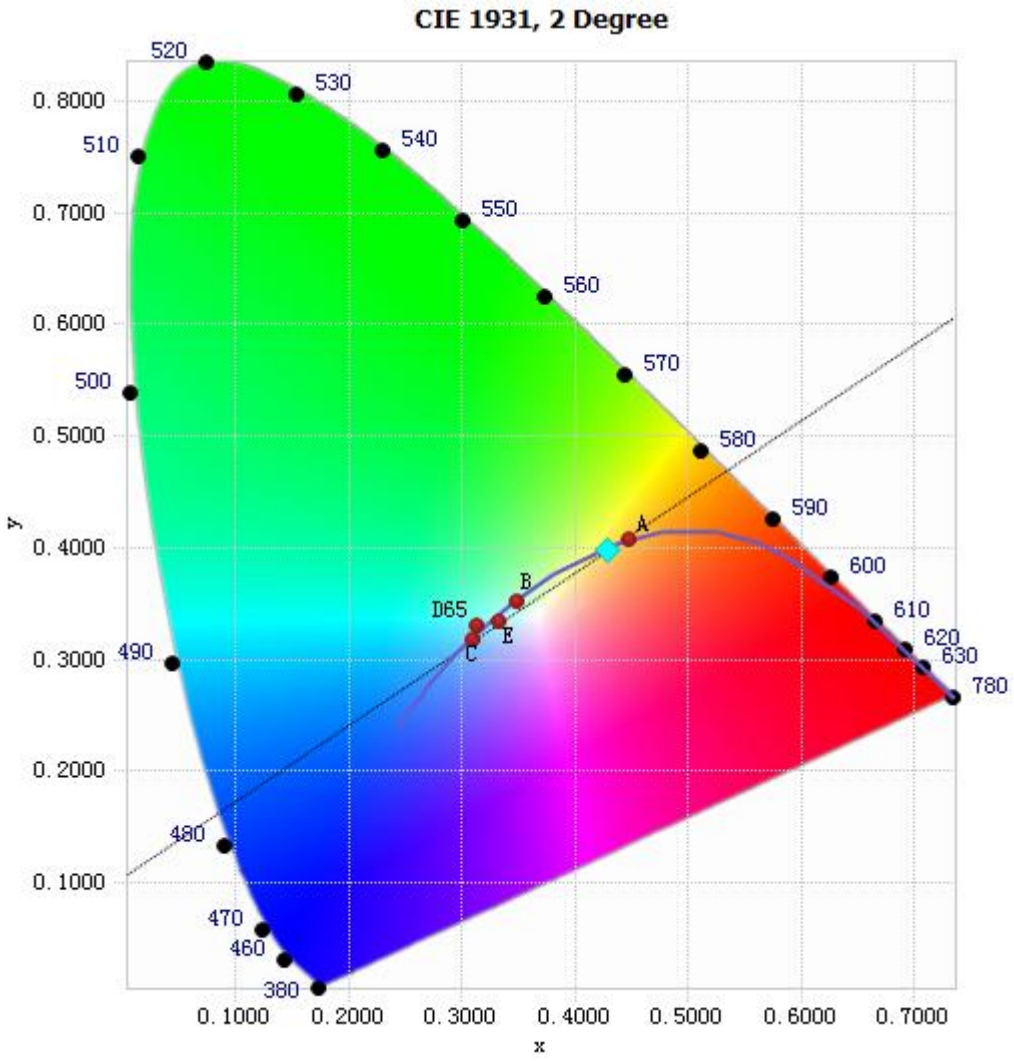


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	3.78E-05	485	3.05E-03	590	8.93E-03	695	4.91E-03
385	3.28E-05	490	3.39E-03	595	9.28E-03	700	4.35E-03
390	3.38E-05	495	3.82E-03	600	9.67E-03	705	3.84E-03
395	3.37E-05	500	4.32E-03	605	1.01E-02	710	3.36E-03
400	3.92E-05	505	4.79E-03	610	1.05E-02	715	2.96E-03
405	5.16E-05	510	5.17E-03	615	1.09E-02	720	2.60E-03
410	8.45E-05	515	5.54E-03	620	1.11E-02	725	2.26E-03
415	1.61E-04	520	5.84E-03	625	1.13E-02	730	1.96E-03
420	3.00E-04	525	6.13E-03	630	1.14E-02	735	1.69E-03
425	5.14E-04	530	6.42E-03	635	1.14E-02	740	1.46E-03
430	8.22E-04	535	6.69E-03	640	1.12E-02	745	1.26E-03
435	1.31E-03	540	6.98E-03	645	1.09E-02	750	1.08E-03
440	2.05E-03	545	7.23E-03	650	1.05E-02	755	9.31E-04
445	3.31E-03	550	7.41E-03	655	9.97E-03	760	8.00E-04
450	5.44E-03	555	7.60E-03	660	9.41E-03	765	6.87E-04
455	6.73E-03	560	7.73E-03	665	8.78E-03	770	5.88E-04
460	5.38E-03	565	7.88E-03	670	8.10E-03	775	5.00E-04
465	4.18E-03	570	8.03E-03	675	7.45E-03	780	4.31E-04
470	3.73E-03	575	8.18E-03	680	6.77E-03		
475	3.14E-03	580	8.39E-03	685	6.13E-03		
480	2.85E-03	585	8.64E-03	690	5.50E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4293, 0.3983)

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

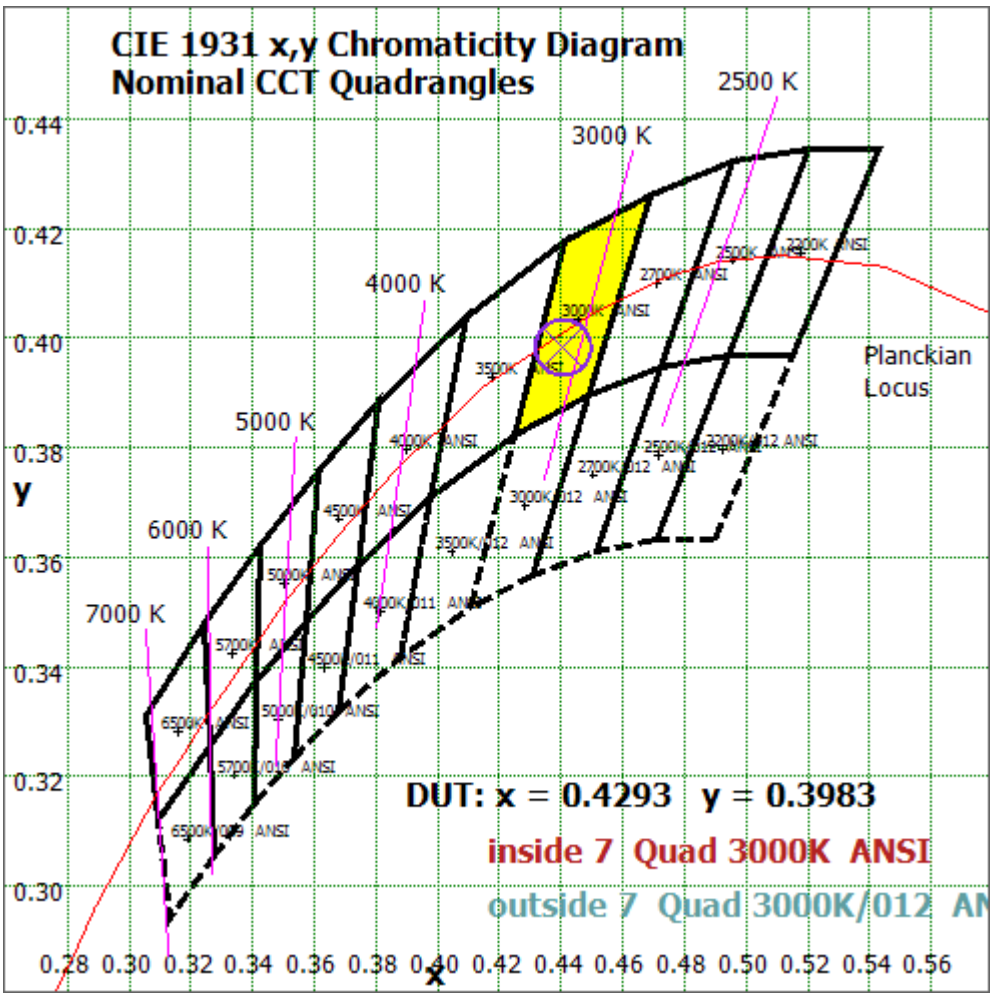


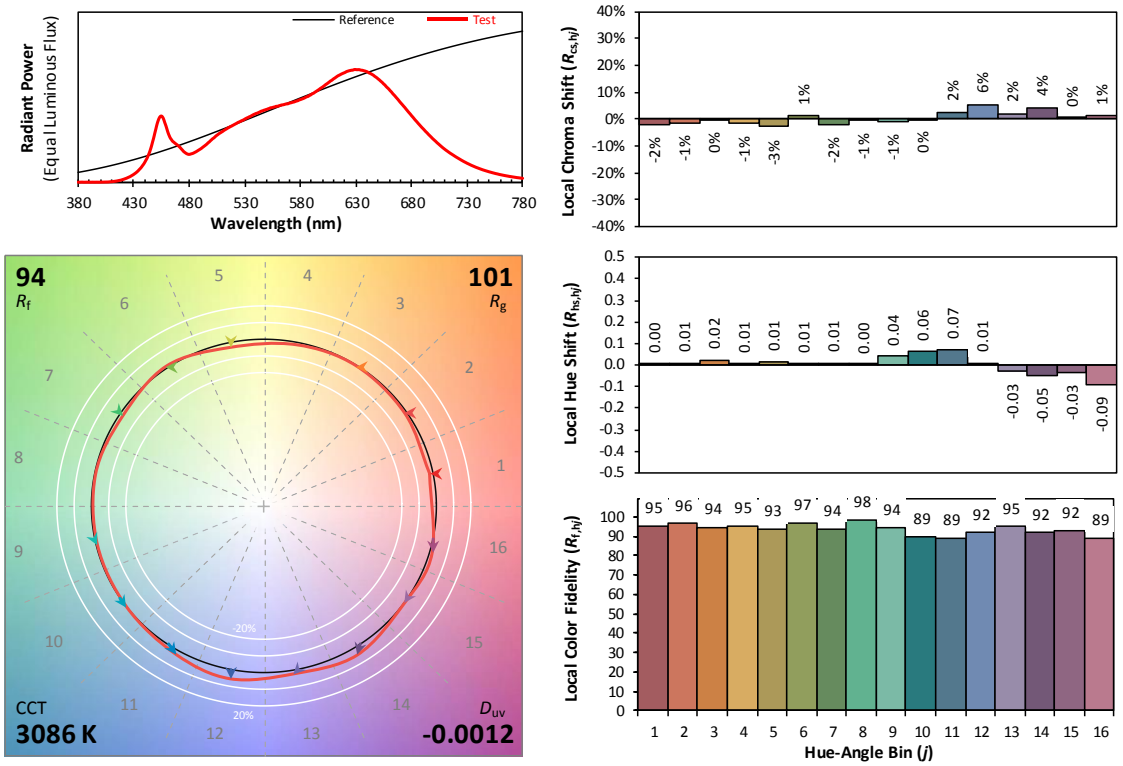
Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method

ANSI/IES TM-30-18 Color Rendition Report

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

Date: 2020/06/26 **Model:** 7MR16DIM/930SP15/R



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

x	0.4293
y	0.3983
u'	0.2481
v'	0.5179

CIE 13.3-1995 (CRI)

R_a	97
R_9	85

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	266.431	46.89%
10- 20	162.626	28.62%
20- 30	72.934	12.84%
30- 40	34.036	5.99%
40- 50	12.74	2.24%
50- 60	7.357	1.29%
60- 70	5.36	0.94%
70- 80	3.227	0.57%
80- 90	1.262	0.22%
90-100	0.414	0.07%
100-110	0.598	0.11%
110-120	0.484	0.09%
120-130	0.309	0.05%
130-140	0.068	0.01%
140-150	0.094	0.02%
150-160	0.12	0.02%
160-170	0.098	0.02%
170-180	0.033	0.01%
Total	568.2	100%

γ(°)	Lumens	% Total
0- 60	556.124	97.88%
60- 90	9.849	1.73%
0-90	565.973	99.61%
90- 180	2.218	0.39%
0- 180	568.2	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

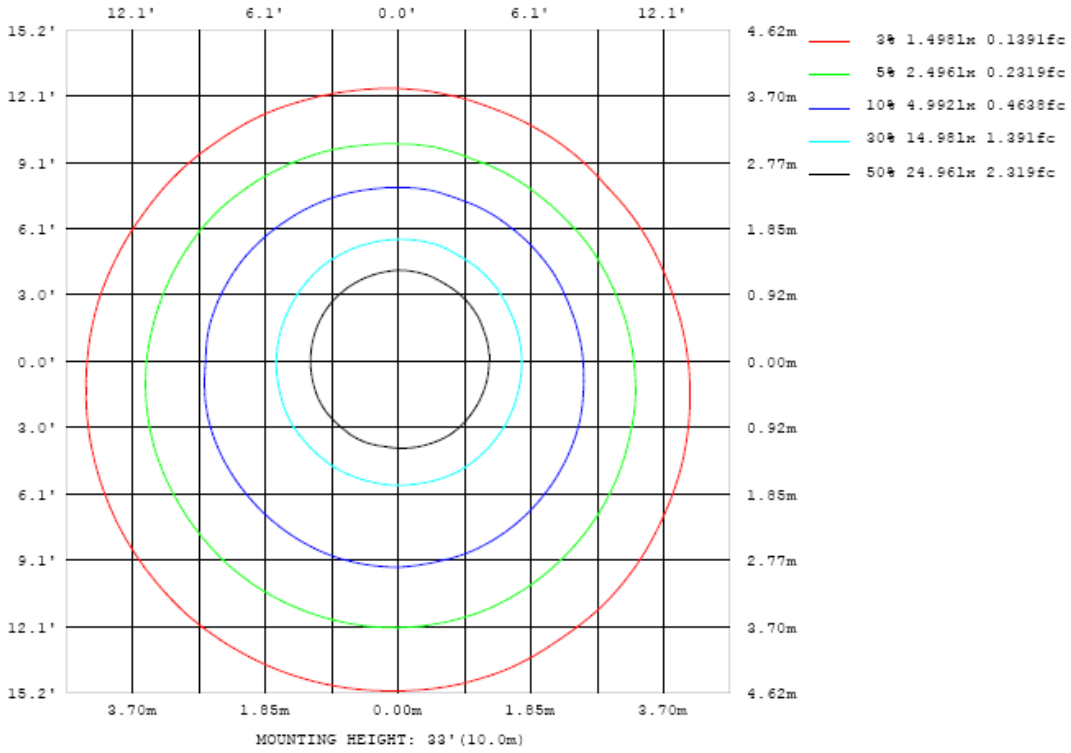


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

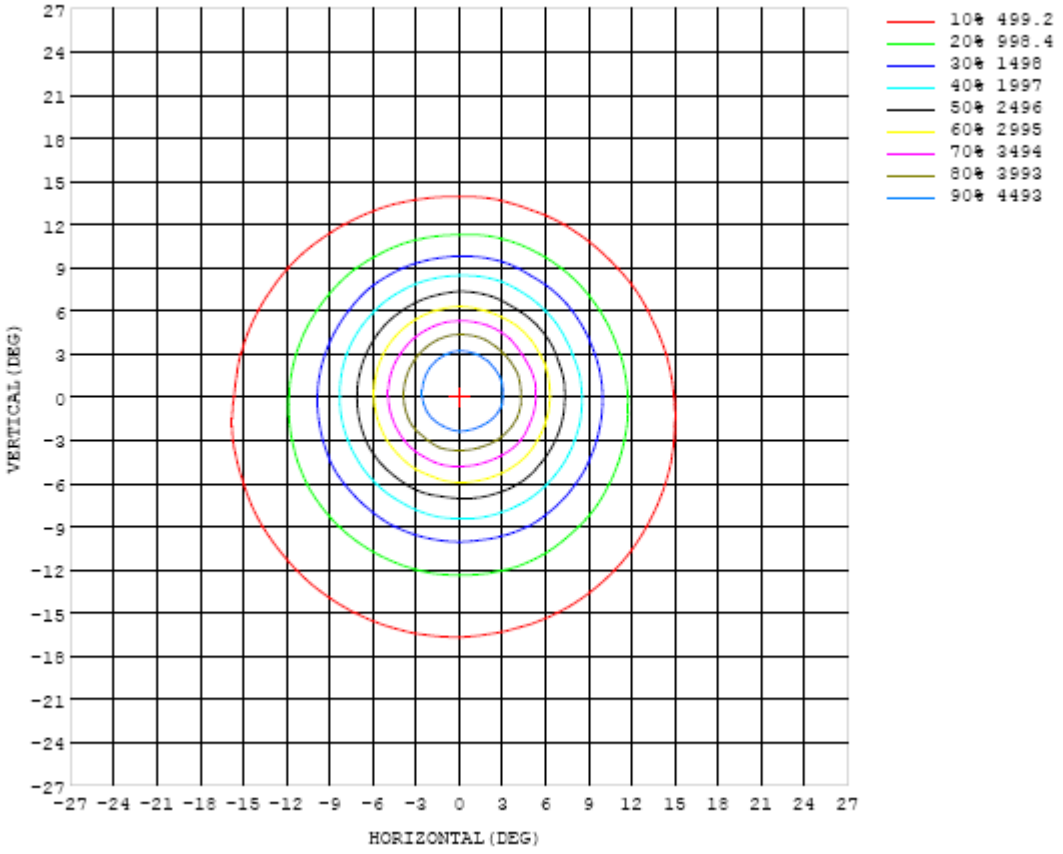


Chart 6: Isocandela Plot

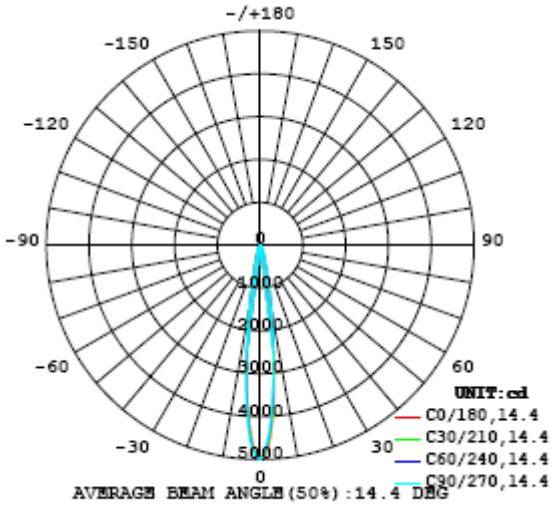


Chart 7: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1 UNIT: cd

γ (DEG) \ C (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	4992	4992	4992	4992	4992	4992	4992	4992	4992	4992	4992	4992	4992	4992	4992	4992	4992	4992	4992
5	3666	3644	3608	3619	3578	3519	3458	3427	3416	3407	3425	3411	3395	3423	3423	3412	3430	3453	3467
10	1488	1489	1500	1514	1523	1532	1547	1528	1502	1512	1504	1505	1508	1494	1494	1509	1485	1469	1460
15	492	516	548	573	595	618	635	648	652	663	663	659	643	632	626	618	611	581	556
20	232	243	252	265	275	287	298	306	311	316	317	317	316	313	306	299	294	284	274
25	140	148	155	163	172	179	183	189	193	194	196	196	196	195	191	188	182	176	169
30	82.0	88.2	93.8	98.9	107	112	117	121	124	124	124	123	122	121	120	116	112	109	105
35	43.1	46.0	50.6	55.4	60.2	64.4	66.1	68.8	70.2	70.7	71.5	71.4	69.6	69.0	68.6	67.0	63.7	60.4	57.2
40	21.3	22.5	24.5	26.6	29.0	31.1	32.5	34.4	35.2	34.9	34.7	34.6	34.7	34.5	34.6	33.8	32.3	30.2	28.5
45	13.2	13.6	14.3	15.2	15.9	16.6	17.3	18.2	18.7	18.6	18.6	18.3	18.3	18.5	18.7	18.7	17.7	16.7	16.4
50	9.65	9.92	10.3	11.0	11.3	11.6	11.8	12.1	12.5	12.4	12.2	12.0	12.0	12.5	12.5	12.3	11.5	10.8	10.5
55	6.91	7.16	7.35	8.00	8.12	8.23	8.26	8.42	8.85	9.08	9.00	8.98	9.05	9.38	9.36	9.25	8.67	8.24	7.95
60	5.80	5.94	6.04	6.38	6.48	6.61	6.68	6.69	6.94	6.96	6.89	6.86	6.61	6.69	6.64	6.81	6.68	6.48	6.45
65	4.89	4.99	5.05	5.30	5.39	5.47	5.60	5.66	5.71	5.66	5.58	5.57	5.46	5.57	5.61	5.71	5.76	5.58	5.53
70	3.79	4.09	3.98	4.22	4.47	4.28	4.44	4.79	4.45	4.46	4.63	4.31	4.25	4.57	4.29	4.36	4.63	4.16	4.13
75	2.86	3.02	3.00	3.12	3.18	3.14	3.20	3.28	3.25	3.23	3.22	3.15	3.09	3.17	3.08	3.11	3.16	3.00	3.02
80	1.93	1.97	1.98	2.04	2.02	2.00	2.05	2.05	2.04	2.04	2.00	1.97	1.96	1.99	1.98	2.01	2.01	1.97	1.96
85	1.11	1.16	1.08	1.12	1.18	1.07	1.12	1.16	1.05	1.07	1.10	0.99	1.00	1.09	0.99	1.03	1.15	1.00	1.02
90	0.68	0.76	0.55	0.60	0.67	0.50	0.53	0.59	0.48	0.50	0.68	0.43	0.52	0.63	0.44	0.48	0.89	0.44	0.46
95	0.34	0.32	0.30	0.31	0.29	0.28	0.30	0.31	0.28	0.31	0.32	0.27	0.28	0.29	0.27	0.29	0.31	0.29	0.29
100	0.47	0.65	0.26	0.27	0.28	0.23	0.50	0.30	0.23	0.50	0.31	0.24	0.53	0.46	0.21	0.91	0.36	0.23	0.82
105	0.63	1.30	0.36	0.59	0.92	0.37	0.70	0.82	0.40	0.43	0.80	0.34	0.43	0.80	0.32	0.56	1.09	0.29	0.37
110	0.53	0.44	0.29	0.53	0.48	0.29	0.50	0.54	0.29	0.43	0.52	0.28	0.41	0.45	0.25	0.36	0.49	0.28	0.32
115	0.25	0.22	0.27	0.20	0.19	0.19	0.21	0.21	0.19	0.19	0.19	0.18	0.21	0.19	0.18	0.31	0.19	0.22	0.50
120	2.27	2.60	0.45	1.01	1.43	0.36	0.52	0.77	0.23	0.36	0.42	0.19	0.29	0.25	0.17	0.35	0.54	0.14	0.44
125	0.19	0.24	0.15	0.14	0.20	0.13	0.15	0.18	0.13	0.13	0.15	0.11	0.12	0.15	0.12	0.14	0.17	0.11	0.13
130	0.10	0.10	0.08	0.09	0.10	0.09	0.09	0.09	0.08	0.08	0.08	0.07	0.07	0.08	0.07	0.08	0.07	0.08	0.07
135	0.09	0.09	0.08	0.08	0.08	0.08	0.08	0.08	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.08	0.07
140	0.11	0.11	0.11	0.10	0.10	0.10	0.10	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.10	0.10
145	0.16	0.16	0.15	0.15	0.15	0.15	0.14	0.14	0.14	0.14	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.14	0.14
150	0.22	0.21	0.21	0.21	0.21	0.20	0.20	0.20	0.19	0.19	0.19	0.19	0.19	0.18	0.18	0.18	0.18	0.19	0.19
155	0.27	0.27	0.27	0.27	0.27	0.27	0.26	0.26	0.26	0.26	0.25	0.25	0.25	0.24	0.24	0.24	0.24	0.24	0.24
160	0.31	0.31	0.31	0.31	0.33	0.33	0.33	0.33	0.32	0.32	0.32	0.31	0.31	0.31	0.30	0.30	0.30	0.30	0.30
165	0.34	0.34	0.34	0.34	0.37	0.39	0.39	0.39	0.39	0.39	0.38	0.38	0.37	0.37	0.36	0.36	0.36	0.36	0.36
170	0.36	0.36	0.36	0.36	0.37	0.42	0.42	0.42	0.42	0.41	0.41	0.41	0.40	0.40	0.40	0.40	0.40	0.40	0.40
175	0.35	0.35	0.35	0.35	0.35	0.34	0.34	0.38	0.39	0.38	0.37	0.36	0.34	0.33	0.31	0.30	0.31	0.29	0.29
180	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25

Table 6: Luminous Intensity Data

Table--2 UNIT: cd

γ (DEG) \ C (DEG)	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350		
0	4992	4992	4992	4992	4992	4992	4992	4992	4992	4992	4992	4992	4992	4992	4992	4992	4992		
5	3492	3518	3530	3543	3576	3599	3620	3651	3658	3672	3696	3691	3702	3626	3639	3673	3681		
10	1447	1430	1418	1414	1436	1419	1423	1415	1429	1442	1454	1419	1447	1457	1454	1457	1476		
15	554	529	499	478	453	435	418	405	397	390	395	400	413	419	431	449	473		
20	263	250	239	229	218	212	207	199	198	195	192	194	196	198	204	210	219		
25	162	154	147	142	136	132	128	125	123	121	121	120	120	122	124	128	134		
30	99.4	94.6	90.7	86.6	82.1	78.0	76.2	74.3	72.9	71.6	69.9	69.3	69.0	70.5	72.0	74.4	77.9		
35	55.1	52.8	50.6	48.1	44.7	42.1	40.1	39.7	38.3	36.9	35.9	36.2	36.3	36.4	38.2	39.4	41.0		
40	27.4	26.5	25.9	25.0	23.9	22.9	22.0	21.7	21.0	20.4	19.9	19.6	19.5	19.6	19.8	20.2	20.4		
45	16.2	16.0	16.2	16.1	15.6	15.0	14.4	14.2	13.8	13.5	13.3	13.0	13.0	12.9	12.8	13.0	13.0		
50	10.5	10.8	11.2	11.4	11.3	10.9	10.7	10.6	10.3	9.91	9.58	9.43	9.40	9.43	9.55	9.62	9.56		
55	7.87	8.10	8.24	8.21	8.20	8.10	7.93	7.87	7.75	7.60	7.33	7.02	6.95	6.88	6.94	6.98	6.90		
60	6.47	6.47	6.57	6.46	6.42	6.36	6.55	6.56	6.48	6.38	6.33	6.22	6.18	6.15	6.21	6.15	5.94		
65	5.46	5.39	5.50	5.52	5.66	5.75	5.92	5.87	5.87	5.61	5.47	5.35	5.25	5.17	5.15	5.13	5.02		
70	4.36	4.04	4.05	4.14	3.97	3.93	4.22	4.01	4.00	4.01	3.90	3.89	3.97	3.80	3.84	4.01	3.80		
75	3.07	2.96	2.98	2.99	2.92	2.85	2.98	2.93	2.95	3.02	2.93	2.92	3.01	2.88	2.86	2.97	2.87		
80	1.95	1.93	1.93	1.90	1.90	1.88	1.92	1.92	1.94	1.93	1.94	1.95	1.95	1.92	1.92	1.91	1.92		
85	1.13	1.04	1.07	1.17	1.06	1.06	1.15	1.05	1.09	1.16	1.07	1.12	1.16	1.06	1.13	1.17	1.06		
90	0.84	0.48	0.59	0.85	0.53	0.66	0.79	0.54	0.77	0.83	0.56	0.80	0.83	0.59	0.69	0.79	0.58		
95	0.31	0.31	0.32	0.33	0.32	0.33	0.33	0.31	0.33	0.34	0.32	0.35	0.35	0.32	0.34	0.35	0.31		
100	0.41	0.27	0.65	0.29	0.30	0.96	0.32	0.25	0.65	0.42	0.25	0.49	0.34	0.25	0.69	0.55	0.23		
105	0.85	0.27	0.54	0.65	0.29	0.67	0.94	0.26	0.86	1.31	0.27	0.57	1.10	0.33	0.72	1.23	0.33		
110	0.42	0.30	0.48	0.38	0.35	0.50	0.38	0.42	0.44	0.36	0.32	0.55	0.38	0.36	0.53	0.40	0.30		
115	0.19	0.28	0.34	0.19	0.29	0.31	0.22	0.26	0.25	0.24	0.25	0.25	0.26	0.26	0.23	0.23	0.42		
120	1.28	0.12	1.30	2.24	0.16	2.01	2.51	0.40	2.87	2.49	0.71	2.61	1.65	0.47	2.54	2.39	0.34		
125	0.17	0.12	0.17	0.21	0.16	0.20	0.27	0.15	0.26	0.42	0.14	0.25	0.37	0.19	0.22	0.37	0.16		
130	0.08	0.08	0.09	0.10	0.10	0.10	0.11	0.10	0.10	0.11	0.09	0.10	0.11	0.10	0.09	0.10	0.09		
135	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	0.08	0.08		
140	0.10	0.11	0.11	0.11	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.11	0.11		
145	0.15	0.15	0.15	0.16	0.16	0.16	0.16	0.16	0.16	0.17	0.16	0.16	0.17	0.16	0.16	0.16	0.16		
150	0.19	0.21	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.23	0.23	0.23	0.23	0.22	0.22	0.22	0.22		
155	0.25	0.26	0.27	0.27	0.27	0.27	0.27	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.27		
160	0.30	0.32	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31		
165	0.36	0.35	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34		
170	0.36	0.34	0.34	0.34	0.34	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.36	0.36	0.35		
175	0.29	0.30	0.31	0.31	0.32	0.32	0.33	0.33	0.34	0.34	0.34	0.34	0.35	0.35	0.35	0.35	0.35		
180	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25		

Table 7: Luminous Intensity Data

EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Aug. 02, 2019	Aug. 01, 2020
Digital Power Meter	PF2010A	HZTE028-01	Aug. 02, 2019	Aug. 01, 2020
AC Power Supply	DPS1060	HZTE001-06	Aug. 02, 2019	Aug. 01, 2020
DC Power Supply	WY12010	HZTE004-03	Aug. 02, 2019	Aug. 01, 2020
Temperature recorder	JM624U	HZTE018-08	Aug. 02, 2019	Aug. 01, 2020
Temperature and humidity recorder	JR900	HZTE018-01	Aug. 02, 2019	Aug. 01, 2020
Standard source	D908	HZTE012-01	Aug. 02, 2019	Aug. 01, 2020
Integrate Sphere system	3M	HZTE015-04	Aug. 02, 2019	Aug. 01, 2020
Digital Power Meter	WT210	HZTE008-01	Aug. 02, 2019	Aug. 01, 2020
AC Power Supply	PCR 500L	HZTE001-07	Aug. 02, 2019	Aug. 01, 2020
DC Power Supply	IT6154	HZTE004-04	Aug. 02, 2019	Aug. 01, 2020
Standard source	SCL-1400	HZTE012-02	Aug. 02, 2019	Aug. 01, 2020
Temperature and humidity recorder	JR900	HZTE018-02	Aug. 02, 2019	Aug. 01, 2020
Temperature Meter	TES1310	HZTE017-01	Aug. 02, 2019	Aug. 01, 2020

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 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 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.

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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 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 expended uncertainty is 2.3% with a coverage factor k=2.

Color Characteristics Measurements

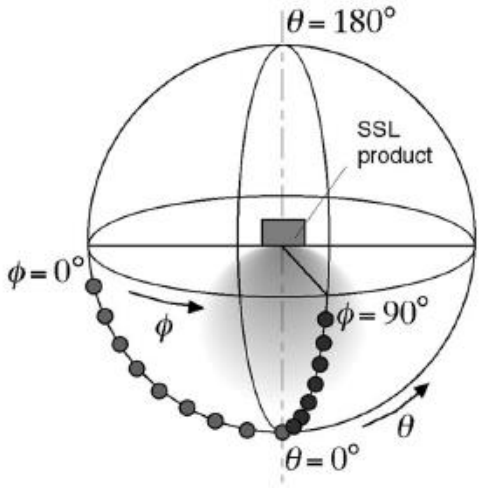
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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

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°/180° and C=90°/270°) and at 10° 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, Δu'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 ***