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: 5GU10DIM/927FL35

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ20060049x

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

Review by: April Zou

Engineer: April Zou

Oct. 21, 2020

Approved by:

Manager: Jim Zhang

Oct. 21, 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: **5GU10DIM/927FL35**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
80.9	386.6	4.78	0.9254

CCT (K)	CRI	Stabilization Time (Light & Power)
2712	97.2	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	: 5GU10DIM/927FL35
Electrical Ratings	: 120Vac, 60Hz, 5W
Product Description	: 2700K
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 25.1 ℃.

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)	0.043
Power Factor	0.9254
Test Power (W)	4.78
THD A%	22.01
Luminous Efficacy (lm/W)	80.9
Total Luminous Flux (lm)	386.6
Color Rendering Index (CRI)	97.2
R9	88.4
Correlated Color Temperature (CCT)(K)	2712
Chromaticity Chroma x	0.4569
Chromaticity Chroma y	0.4070
Chromaticity Chroma u	0.2622
Chromaticity Chroma v	0.3503
Duv	-0.0011
Chromaticity Chroma u ’	0.2622
Chromaticity Chroma v’	0.5255

Special Color Rendering Indices	
R1	98.7
R2	98.3
R3	99.5
R4	98.7
R5	98.2
R6	95.4
R7	95.2
R8	93.8
R9	88.4
R10	98.4
R11	98.3
R12	85.9
R13	98.3
R14	98.6

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)	120.0
Voltage frequency (Hz)	60
Test Current (A)	0.043
Power Factor	0.9211
Power (W)	4.76
Luminous Efficacy (lm/W)	83.0
Total Luminous Flux (lm)	395.1
Beam Angle (°)	31.5 (0^o-180^o) / 32.5 (90^o-270^o)
Center Beam Candle Power (cd)	1200
Maximum Beam Candle Power (cd)	1200 (At: C=0.0, Gamma=0.0)
Spacing Criteria	0.52 (0^o-180^o) / 0.54 (90^o-270^o)
Zonal Lumens in the 0 °-60 °Zone	97.64%
Zonal Lumens in the 60 °-90 °Zone	1.73%
Zonal Lumens in the 90 °-120 °Zone	0.35%
Zonal Lumens in the 120 °-180 °Zone	0.28%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

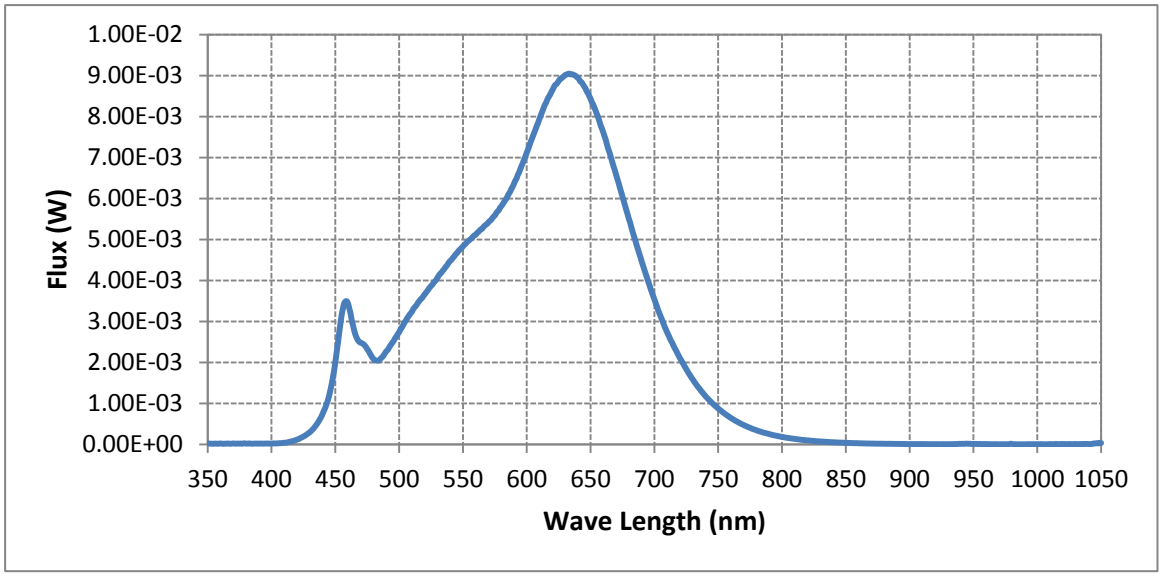
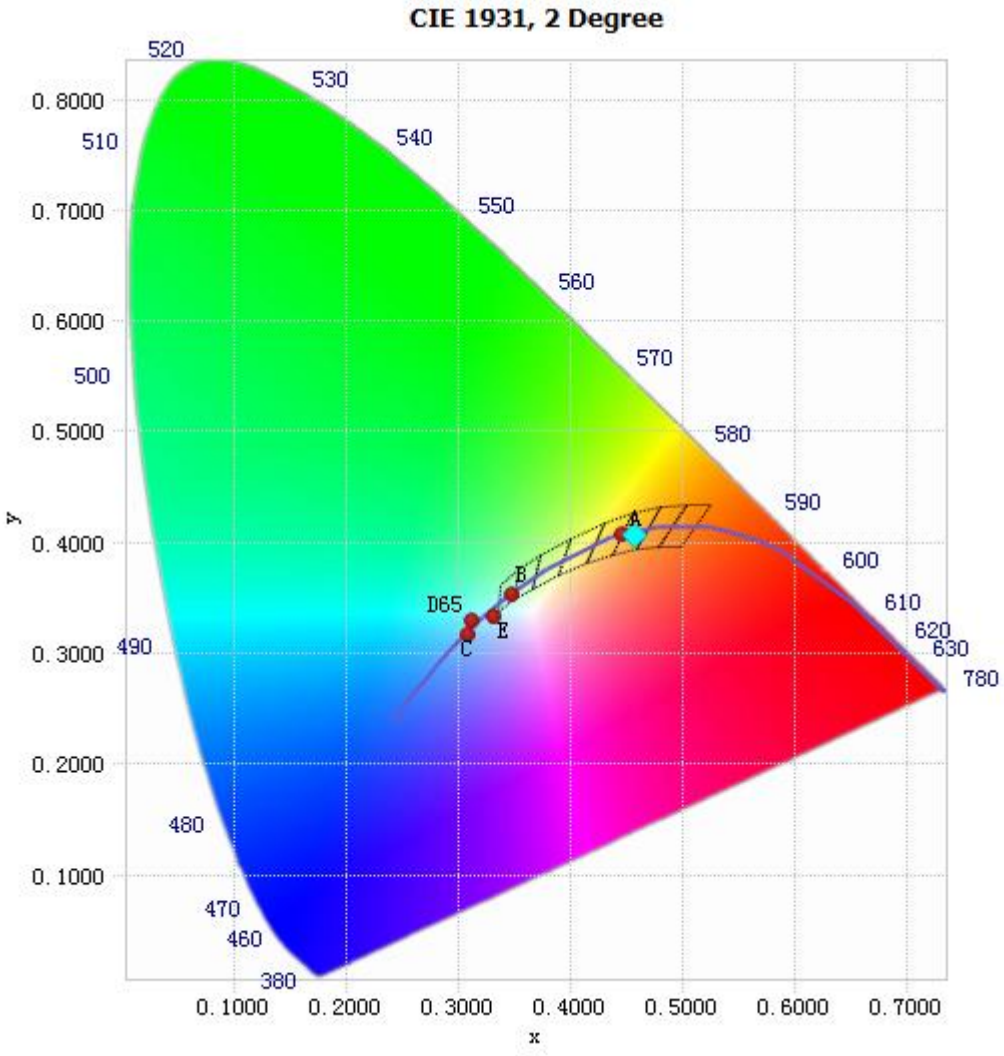


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.09E-05	485	2.07E-03	590	6.36E-03	695	3.99E-03
385	1.75E-05	490	2.27E-03	595	6.73E-03	700	3.54E-03
390	2.12E-05	495	2.50E-03	600	7.12E-03	705	3.12E-03
395	2.26E-05	500	2.74E-03	605	7.54E-03	710	2.74E-03
400	2.35E-05	505	3.01E-03	610	7.95E-03	715	2.41E-03
405	2.79E-05	510	3.24E-03	615	8.33E-03	720	2.11E-03
410	4.22E-05	515	3.47E-03	620	8.64E-03	725	1.84E-03
415	7.11E-05	520	3.66E-03	625	8.87E-03	730	1.59E-03
420	1.21E-04	525	3.87E-03	630	9.01E-03	735	1.37E-03
425	1.92E-04	530	4.07E-03	635	9.03E-03	740	1.18E-03
430	3.00E-04	535	4.27E-03	640	8.95E-03	745	1.02E-03
435	4.74E-04	540	4.48E-03	645	8.74E-03	750	8.78E-04
440	7.45E-04	545	4.66E-03	650	8.43E-03	755	7.55E-04
445	1.18E-03	550	4.83E-03	655	8.06E-03	760	6.45E-04
450	2.00E-03	555	4.99E-03	660	7.61E-03	765	5.55E-04
455	3.17E-03	560	5.12E-03	665	7.11E-03	770	4.74E-04
460	3.43E-03	565	5.26E-03	670	6.58E-03	775	4.07E-04
465	2.76E-03	570	5.42E-03	675	6.05E-03	780	3.45E-04
470	2.48E-03	575	5.59E-03	680	5.51E-03		
475	2.33E-03	580	5.81E-03	685	4.98E-03		
480	2.08E-03	585	6.06E-03	690	4.47E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4569, 0.4070)

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

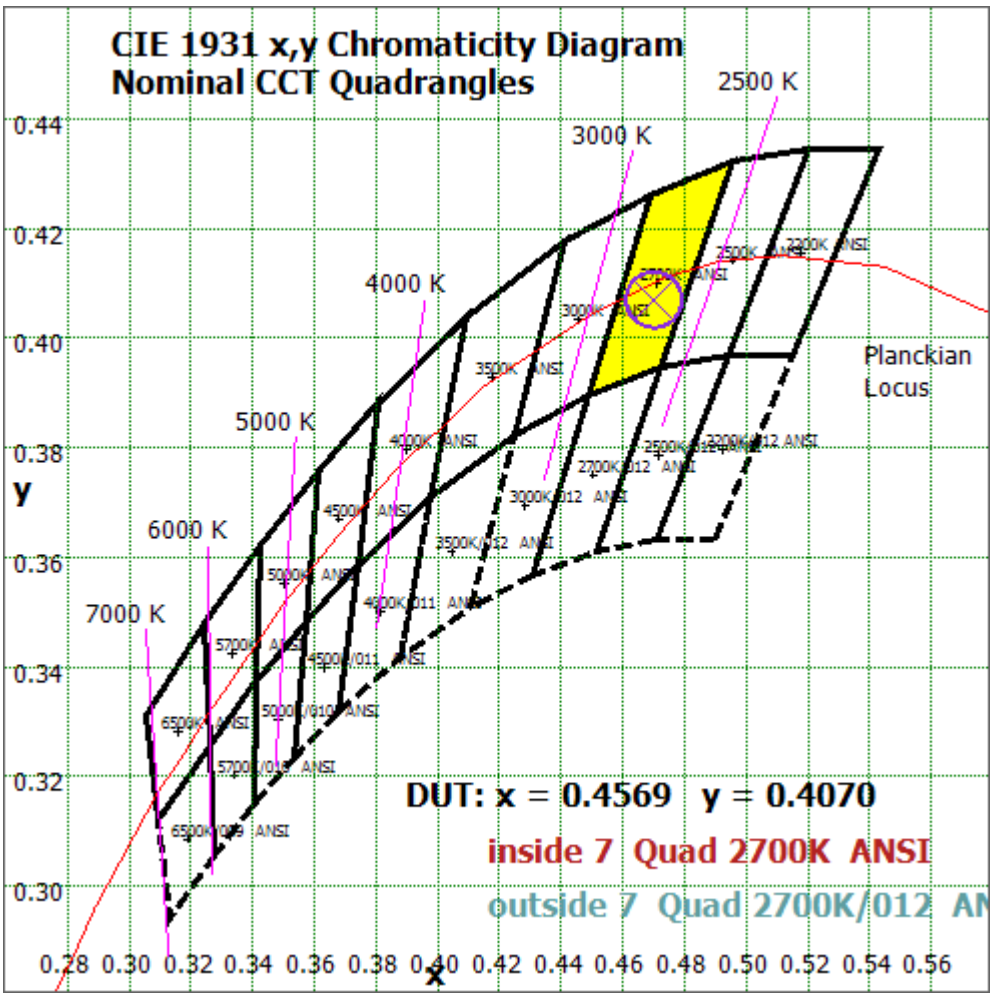


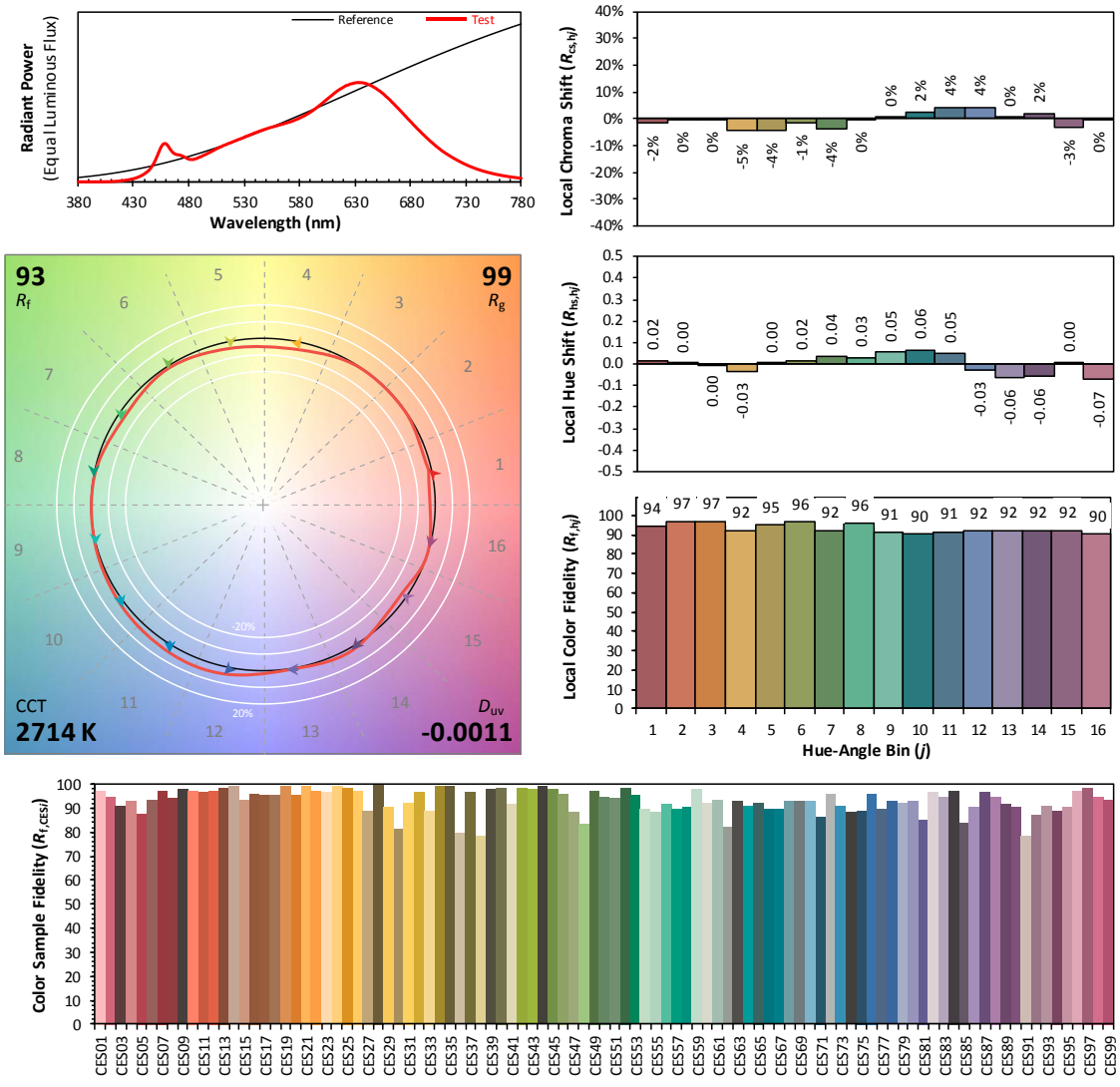
Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

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:** 5GU10DIM/927FL35



x	0.4569
y	0.4070
u'	0.2622
v'	0.5255

CIE 13.3-1995 (CRI)

R_a	97
R_9	89

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

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	97.881	24.77%
10- 20	174.208	44.09%
20- 30	79.42	20.10%
30- 40	21.829	5.52%
40- 50	7.61	1.93%
50- 60	4.886	1.24%
60- 70	3.681	0.93%
70- 80	2.186	0.55%
80- 90	0.974	0.25%
90-100	0.389	0.10%
100-110	0.418	0.11%
110-120	0.563	0.14%
120-130	0.824	0.21%
130-140	0.06	0.02%
140-150	0.066	0.02%
150-160	0.071	0.02%
160-170	0.058	0.01%
170-180	0.022	0.01%
Total	395.1	100%

γ(°)	Lumens	% Total
0- 60	385.834	97.64%
60- 90	6.841	1.73%
0-90	392.675	99.37%
90- 180	2.471	0.63%
0- 180	395.1	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

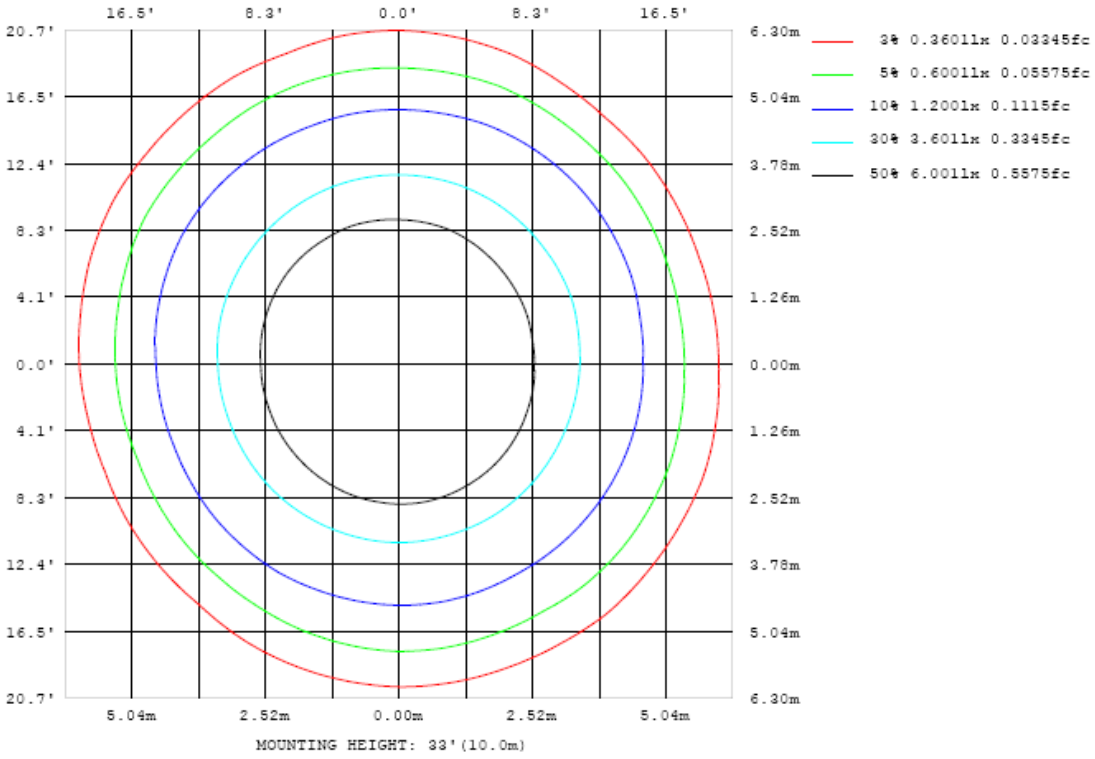


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

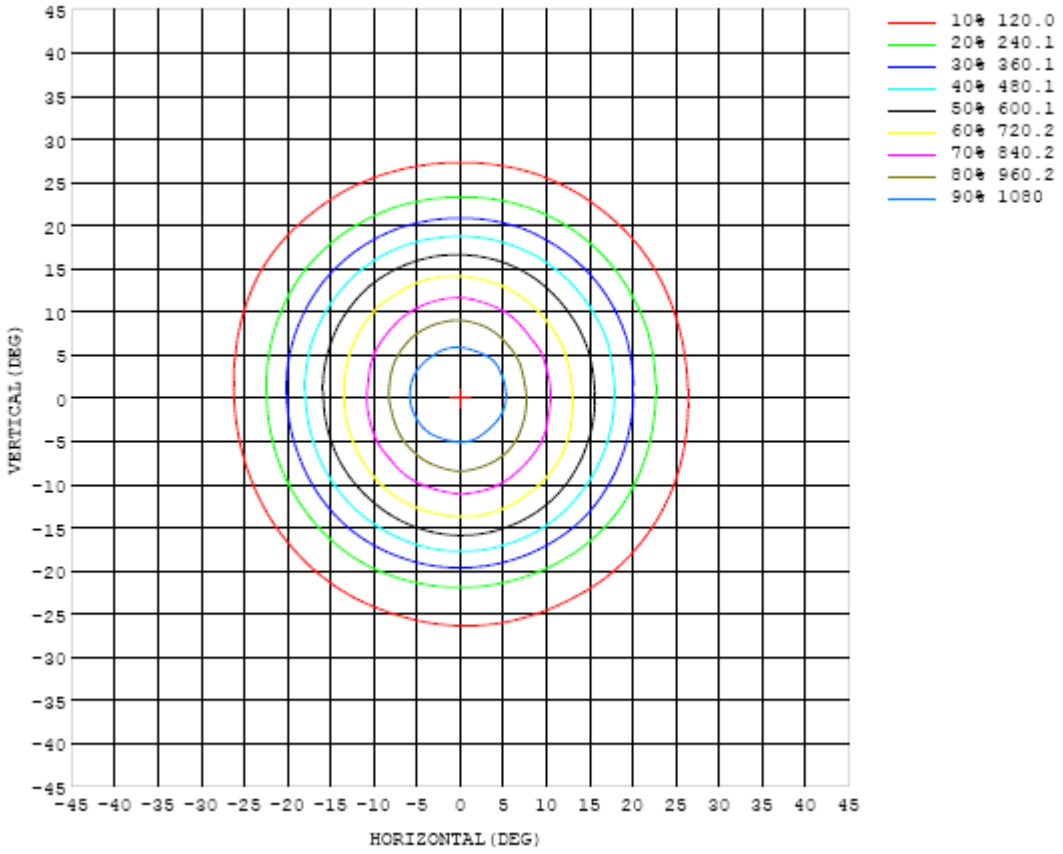


Chart 6: Isocandela Plot

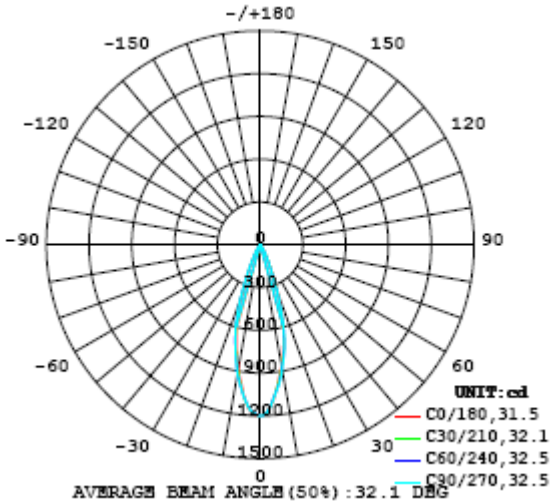


Chart 7: Polar Candela Distribution

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	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200
5	1092	1090	1086	1081	1076	1075	1077	1081	1084	1084	1082	1084	1090	1097	1103	1108	1114	1119	1121
10	861	858	865	870	872	875	880	882	884	888	883	880	882	876	873	880	880	879	881
15	632	632	634	638	644	649	648	652	655	653	650	648	643	641	639	640	640	642	644
20	362	356	351	351	351	348	342	341	340	339	340	341	343	346	346	347	350	357	366
25	154	154	154	153	150	148	146	147	147	146	144	143	144	143	141	140	140	143	149
30	67.2	70.1	72.8	72.1	72.3	72.6	70.0	69.9	70.2	70.6	69.0	66.5	64.0	61.5	62.1	62.2	62.2	64.3	67.3
35	30.5	31.2	32.2	32.3	33.2	34.2	32.9	32.7	32.2	31.9	31.1	30.8	29.7	28.2	28.1	28.4	28.4	29.2	30.5
40	14.8	15.1	15.3	15.3	15.5	15.5	15.4	15.2	14.6	14.5	14.4	14.4	14.6	14.7	14.8	14.9	15.0	15.5	15.9
45	9.00	9.08	9.18	9.41	9.35	9.30	9.11	9.08	9.07	9.14	9.22	9.20	9.26	9.41	9.36	9.25	9.14	9.09	9.24
50	6.35	6.48	6.66	6.63	6.62	6.72	6.73	6.67	6.63	6.66	6.73	6.84	7.00	7.09	7.03	6.97	6.89	6.72	6.70
55	5.21	5.26	5.29	5.32	5.34	5.31	5.31	5.36	5.41	5.55	5.54	5.52	5.64	5.79	5.83	5.75	5.57	5.40	5.32
60	4.47	4.50	4.51	4.51	4.50	4.48	4.47	4.43	4.48	4.54	4.54	4.53	4.63	4.66	4.68	4.66	4.53	4.43	4.39
65	3.79	3.82	3.79	3.78	3.80	3.74	3.71	3.74	3.67	3.66	3.70	3.64	3.64	3.73	3.66	3.64	3.72	3.66	3.67
70	2.86	2.94	2.79	2.77	3.01	2.73	2.70	2.95	2.69	2.68	2.95	2.73	2.71	3.00	2.74	2.66	2.92	2.73	2.69
75	2.07	2.04	1.99	1.97	2.02	1.94	1.92	1.91	1.88	1.89	1.91	1.91	1.93	1.95	1.91	1.91	1.98	1.95	1.96
80	1.37	1.33	1.30	1.29	1.25	1.25	1.25	1.21	1.23	1.24	1.23	1.25	1.25	1.22	1.24	1.24	1.26	1.27	1.30
85	0.89	0.92	0.87	0.81	0.84	0.80	0.77	0.83	0.82	0.79	0.85	0.82	0.77	0.84	0.82	0.76	0.83	0.85	0.85
90	0.56	0.63	0.54	0.49	0.57	0.47	0.44	0.54	0.47	0.44	0.53	0.47	0.43	0.53	0.46	0.41	0.52	0.47	0.47
95	0.32	0.33	0.30	0.28	0.30	0.28	0.26	0.29	0.28	0.27	0.29	0.29	0.28	0.33	0.30	0.26	0.30	0.28	0.28
100	0.33	0.35	0.34	0.31	0.33	0.33	0.30	0.33	0.32	0.30	0.35	0.33	0.33	0.37	0.33	0.30	0.32	0.32	0.29
105	0.39	0.34	0.61	0.32	0.63	0.39	0.31	0.64	0.44	0.29	0.59	0.45	0.29	0.43	0.40	0.31	0.43	0.58	0.35
110	0.27	0.29	0.25	0.34	0.28	0.26	0.37	0.28	0.29	0.33	0.27	0.29	0.36	0.30	0.28	0.33	0.26	0.26	0.29
115	0.26	0.23	0.26	0.49	0.25	0.28	0.77	0.24	0.34	0.57	0.23	0.26	0.24	0.24	0.52	0.80	0.20	0.29	0.29
120	3.09	0.63	3.27	2.16	0.77	3.31	1.18	0.97	2.61	0.52	1.25	1.43	0.61	1.27	1.44	0.92	1.52	2.86	2.93
125	0.35	0.84	0.62	0.19	0.57	0.48	0.16	0.45	0.46	0.12	0.28	0.19	0.16	0.45	0.44	0.16	0.46	0.63	0.25
130	0.08	0.09	0.08	0.09	0.09	0.08	0.09	0.09	0.09	0.08	0.08	0.08	0.08	0.08	0.09	0.08	0.08	0.08	0.08
135	0.06	0.08	0.08	0.09	0.09	0.09	0.09	0.08	0.08	0.09	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
140	0.05	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
145	0.05	0.12	0.12	0.11	0.12	0.12	0.12	0.12	0.12	0.11	0.12	0.12	0.11	0.12	0.11	0.11	0.12	0.11	0.11
150	0.04	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.13
155	0.03	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	0.17	0.16
160	0.00	0.23	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.20	0.19
165	0.00	0.20	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.26	0.26	0.26	0.26	0.25	0.25	0.25	0.23	0.23
170	0.00	0.00	0.25	0.24	0.24	0.24	0.24	0.24	0.24	0.25	0.25	0.25	0.26	0.26	0.26	0.27	0.25	0.25	0.25
175	0.21	0.23	0.05	0.00	0.23	0.22	0.23	0.24	0.25	0.25	0.25	0.25	0.25	0.24	0.23	0.23	0.23	0.24	0.25
180	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	0.31	0.31	0.31	0.31

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	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200		
5	1122	1123	1118	1112	1109	1109	1113	1112	1110	1107	1106	1109	1112	1106	1101	1098	1094		
10	880	890	902	905	911	920	920	919	920	913	906	897	880	871	874	864	863		
15	655	664	672	680	682	682	688	684	678	675	673	664	655	648	642	639	631		
20	377	385	392	397	402	407	409	410	408	408	407	402	396	391	388	383	371		
25	160	168	176	179	180	180	180	182	181	181	183	181	179	174	170	165	155		
30	70.3	74.2	77.0	76.5	77.3	79.2	79.6	80.4	79.5	78.6	77.6	73.1	69.8	69.1	68.5	67.4	67.2		
35	32.1	34.3	35.8	35.7	36.9	37.0	36.2	37.3	36.9	34.8	33.9	32.6	31.1	30.8	30.1	30.1	30.5		
40	16.4	16.6	17.1	17.3	17.4	17.6	17.0	17.0	16.6	16.3	16.2	15.9	15.4	15.2	14.9	15.0	14.9		
45	9.60	9.74	9.76	9.82	9.70	9.71	9.75	9.81	9.86	9.73	9.50	9.42	9.25	8.93	8.77	8.71	8.81		
50	6.90	7.00	6.96	7.00	6.92	6.83	6.81	6.82	6.79	6.70	6.62	6.61	6.53	6.37	6.33	6.30	6.30		
55	5.43	5.46	5.46	5.44	5.41	5.41	5.40	5.36	5.33	5.31	5.28	5.25	5.20	5.14	5.14	5.16	5.18		
60	4.42	4.46	4.49	4.52	4.53	4.55	4.54	4.54	4.54	4.52	4.50	4.49	4.48	4.45	4.44	4.42	4.43		
65	3.73	3.72	3.75	3.85	3.86	3.87	3.89	3.88	3.88	3.89	3.86	3.83	3.84	3.85	3.84	3.89	3.83		
70	2.89	2.77	2.80	2.97	2.89	2.91	3.06	2.96	2.98	3.04	2.98	2.95	2.99	2.91	2.92	3.05	2.91		
75	2.06	2.03	2.06	2.23	2.14	2.16	2.27	2.20	2.23	2.33	2.22	2.18	2.22	2.13	2.13	2.18	2.11		
80	1.31	1.34	1.37	1.37	1.39	1.41	1.42	1.44	1.46	1.47	1.45	1.45	1.41	1.39	1.40	1.39	1.38		
85	0.89	0.92	0.91	0.93	0.94	0.90	0.92	0.96	0.95	0.98	1.00	0.94	0.92	0.90	0.87	0.90	0.91		
90	0.57	0.54	0.54	0.63	0.61	0.58	0.66	0.67	0.66	0.72	0.69	0.64	0.63	0.56	0.54	0.60	0.58		
95	0.32	0.30	0.31	0.35	0.32	0.31	0.34	0.33	0.33	0.37	0.35	0.34	0.36	0.33	0.31	0.34	0.34		
100	0.30	0.30	0.29	0.29	0.28	0.27	0.28	0.29	0.28	0.31	0.31	0.31	0.32	0.32	0.31	0.32	0.31		
105	0.45	0.62	0.40	0.38	0.91	0.45	0.35	1.02	0.58	0.36	1.13	0.56	0.37	0.77	0.61	0.35	0.59		
110	0.27	0.25	0.28	0.30	0.25	0.25	0.29	0.27	0.25	0.39	0.30	0.25	0.34	0.26	0.24	0.29	0.25		
115	0.22	0.25	0.26	0.23	0.26	0.28	0.23	0.27	0.29	0.25	0.29	0.28	0.24	0.26	0.27	0.24	0.27		
120	0.75	2.34	2.81	0.49	2.29	2.52	0.42	1.82	2.21	0.57	2.08	2.71	0.70	2.52	2.94	0.89	2.67		
125	0.90	1.03	0.58	1.00	1.57	1.09	0.53	1.64	1.13	0.71	1.26	1.21	1.12	0.80	0.52	0.53	0.44		
130	0.08	0.08	0.07	0.07	0.07	0.07	0.08	0.07	0.07	0.08	0.07	0.07	0.07	0.08	0.08	0.08	0.07		
135	0.07	0.07	0.08	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.08	0.08	0.08	0.08	0.07	0.04	0.02		
140	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	0.10	0.08	0.02	0.00		
145	0.10	0.09	0.11	0.11	0.11	0.11	0.11	0.11	0.12	0.11	0.11	0.11	0.11	0.12	0.09	0.02	0.00		
150	0.13	0.13	0.13	0.14	0.14	0.14	0.14	0.14	0.14	0.13	0.13	0.13	0.12	0.13	0.10	0.01	0.00		
155	0.16	0.16	0.17	0.17	0.17	0.17	0.17	0.16	0.16	0.15	0.14	0.14	0.14	0.14	0.13	0.00	0.00		
160	0.19	0.19	0.19	0.19	0.20	0.19	0.20	0.20	0.18	0.17	0.16	0.16	0.15	0.16	0.17	0.01	0.00		
165	0.23	0.22	0.22	0.22	0.23	0.21	0.23	0.23	0.20	0.20	0.17	0.18	0.17	0.17	0.19	0.09	0.00		
170	0.25	0.25	0.25	0.25	0.25	0.24	0.26	0.27	0.23	0.22	0.20	0.19	0.20	0.19	0.19	0.21	0.06		
175	0.27	0.28	0.27	0.28	0.28	0.27	0.26	0.30	0.31	0.27	0.25	0.24	0.22	0.20	0.21	0.21	0.20		
180	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	0.31	0.31		

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

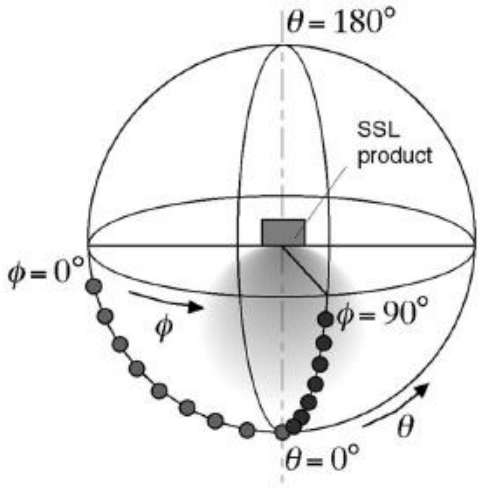
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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