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: 2.5MR11/827FL35

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ21050012a

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

Review by: April Zou

Engineer: April Zou

May 19, 2021

Approved by: Jim Zhang

Manager: Jim Zhang

May 19, 2021

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: **2.5MR11/827FL35**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
82.3	208.1	2.53	0.6618

CCT (K)	CRI	Stabilization Time (Light & Power)
2814	83.7	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 : May 11, 2021

Date of Test : May 13, 2021

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	: 2.5MR11/827FL35
Electrical Ratings	: 12V, 60Hz, 2.5W
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 26.0 ℃.

Base orientation was horizontal. 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)	0.318
Power Factor	0.6618
Test Power (W)	2.53
THD A%	71.81
Luminous Efficacy (lm/W)	82.3
Total Luminous Flux (lm)	208.1
Color Rendering Index (CRI)	83.7
R9	12
Correlated Color Temperature (CCT)(K)	2814
Chromaticity Chroma x	0.4500
Chromaticity Chroma y	0.4071
Chromaticity Chroma u	0.2577
Chromaticity Chroma v	0.3497
Duv	-0.0004
Chromaticity Chroma u ’	0.2577
Chromaticity Chroma v’	0.5245

Special Color Rendering Indices	
R1	82.5
R2	92.7
R3	95.1
R4	81.8
R5	83.2
R6	92.3
R7	82.3
R8	59.6
R9	12
R10	84
R11	82
R12	79.1
R13	85.1
R14	98

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 ℃.

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)	0.307
Power Factor	0.7405
Power (W)	2.71
Luminous Efficacy (lm/W)	81.1
Total Luminous Flux (lm)	219.7
Beam Angle (°)	31.3 (0^o-180^o) / 31.8 (90^o-270^o)
Center Beam Candle Power (cd)	426
Maximum Beam Candle Power (cd)	426.4 (At: C=30.0, Gamma=0.5)
Spacing Criteria	0.48 (0^o-180^o) / 0.52 (90^o-270^o)
Zonal Lumens in the 0 °-60 °Zone	96.05%
Zonal Lumens in the 60 °-90 °Zone	2.15%
Zonal Lumens in the 90 °-120 °Zone	0.92%
Zonal Lumens in the 120 °-180 °Zone	0.88%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

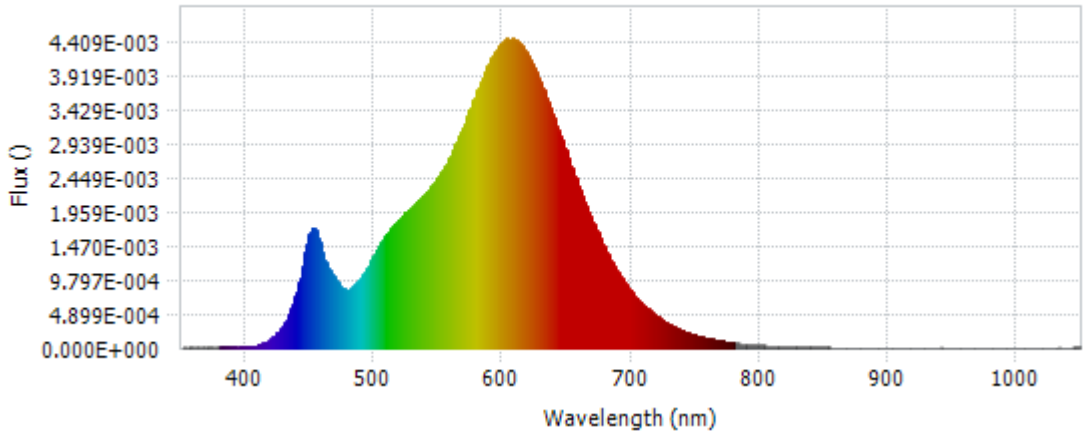
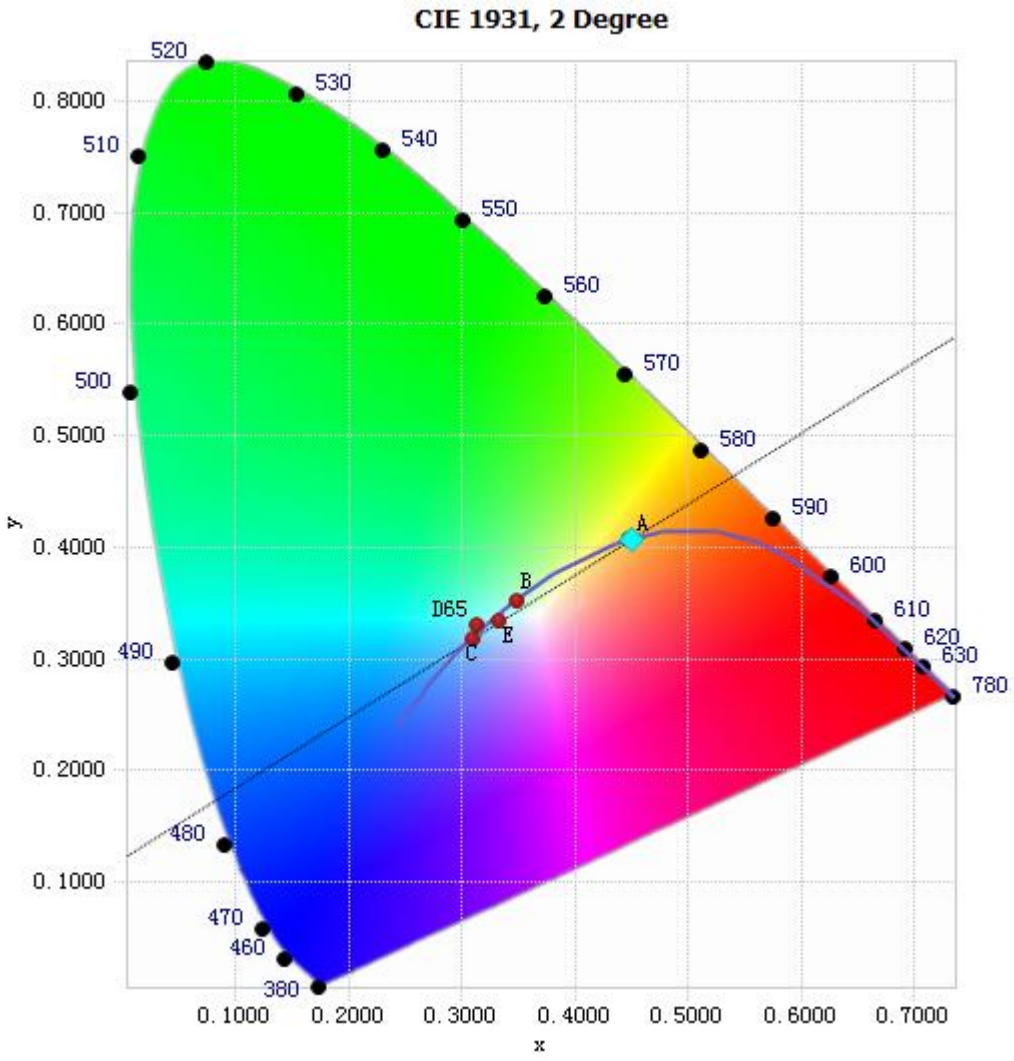


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.28E-05	485	9.17E-04	590	4.12E-03	695	9.44E-04
385	1.08E-05	490	1.04E-03	595	4.28E-03	700	8.20E-04
390	1.13E-05	495	1.19E-03	600	4.40E-03	705	7.08E-04
395	1.16E-05	500	1.36E-03	605	4.44E-03	710	6.12E-04
400	1.32E-05	505	1.52E-03	610	4.42E-03	715	5.30E-04
405	2.21E-05	510	1.65E-03	615	4.34E-03	720	4.59E-04
410	4.59E-05	515	1.78E-03	620	4.19E-03	725	3.96E-04
415	8.41E-05	520	1.87E-03	625	4.00E-03	730	3.41E-04
420	1.41E-04	525	1.96E-03	630	3.79E-03	735	2.93E-04
425	2.31E-04	530	2.05E-03	635	3.55E-03	740	2.52E-04
430	3.70E-04	535	2.14E-03	640	3.31E-03	745	2.18E-04
435	5.73E-04	540	2.23E-03	645	3.05E-03	750	1.87E-04
440	8.60E-04	545	2.34E-03	650	2.79E-03	755	1.61E-04
445	1.28E-03	550	2.47E-03	655	2.53E-03	760	1.39E-04
450	1.68E-03	555	2.63E-03	660	2.28E-03	765	1.19E-04
455	1.64E-03	560	2.80E-03	665	2.04E-03	770	1.03E-04
460	1.32E-03	565	3.00E-03	670	1.82E-03	775	8.89E-05
465	1.12E-03	570	3.23E-03	675	1.61E-03	780	7.69E-05
470	9.73E-04	575	3.46E-03	680	1.42E-03		
475	8.54E-04	580	3.71E-03	685	1.24E-03		
480	8.40E-04	585	3.93E-03	690	1.09E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4500, 0.4071)

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

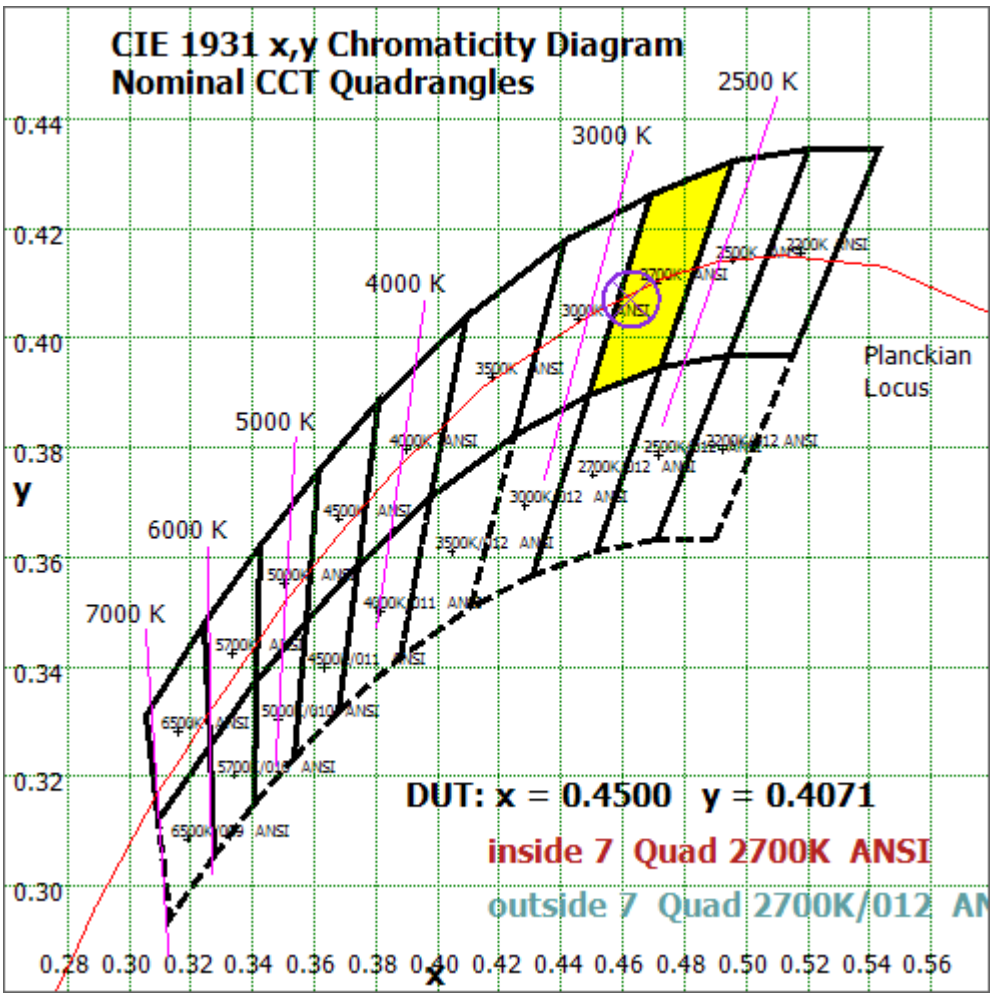


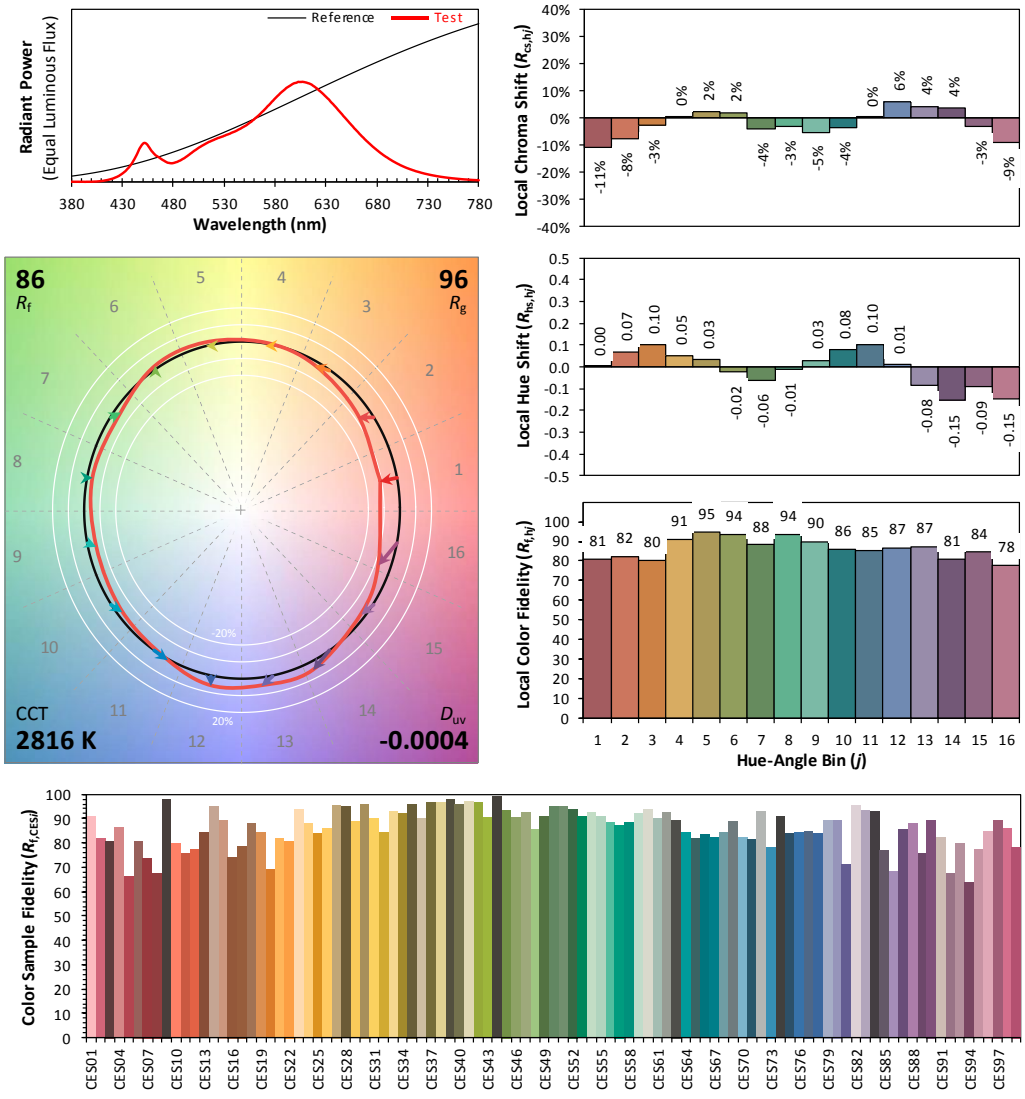
Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method

ANSI/IES TM-30-18 Color Rendition Report

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

Date: 2021/05/13 **Model:** 2.5MR11/827FL35



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

x	0.4500
y	0.4071
u'	0.2577
v'	0.5245

CIE 13.3-1995 (CRI)

R_a	84
R_9	12

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	34.276	15.60%
10- 20	62.191	28.30%
20- 30	51.448	23.41%
30- 40	35.32	16.07%
40- 50	20.317	9.25%
50- 60	7.519	3.42%
60- 70	2.581	1.17%
70- 80	1.44	0.66%
80- 90	0.705	0.32%
90-100	0.575	0.26%
100-110	0.679	0.31%
110-120	0.766	0.35%
120-130	0.618	0.28%
130-140	0.481	0.22%
140-150	0.358	0.16%
150-160	0.272	0.12%
160-170	0.158	0.07%
170-180	0.043	0.02%
Total	219.7	100%

γ(°)	Lumens	% Total
0- 60	211.071	96.05%
60- 90	4.726	2.15%
0-90	215.797	98.20%
90- 180	3.95	1.80%
0- 180	219.7	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

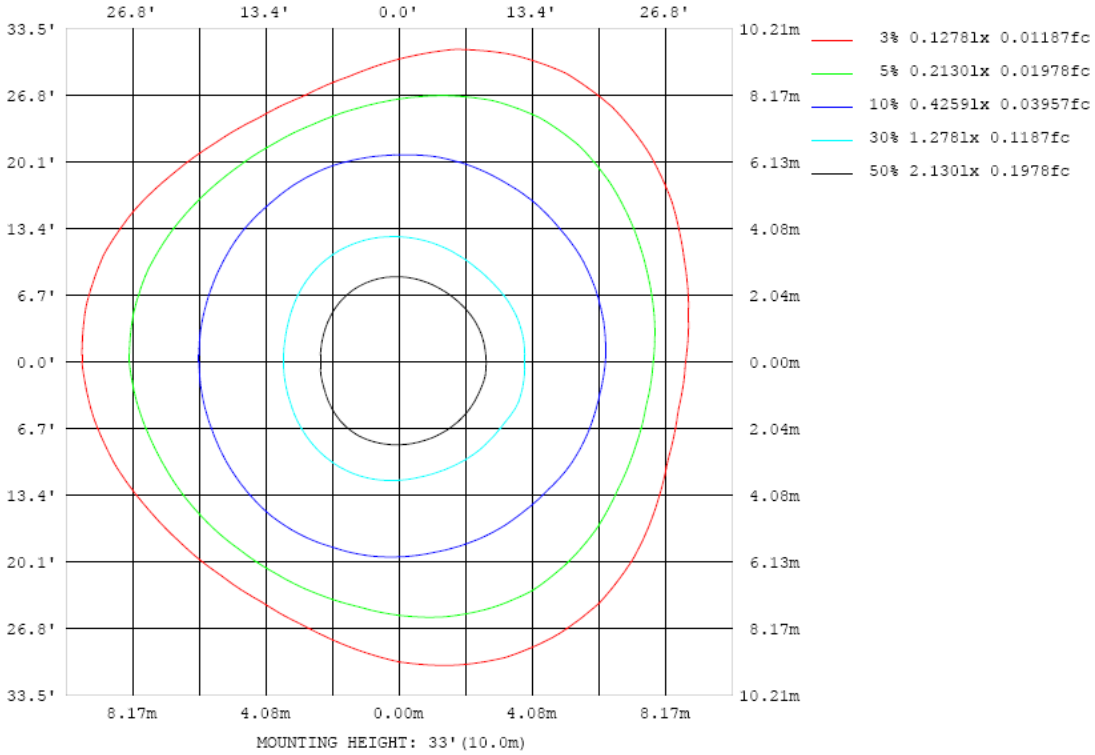


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

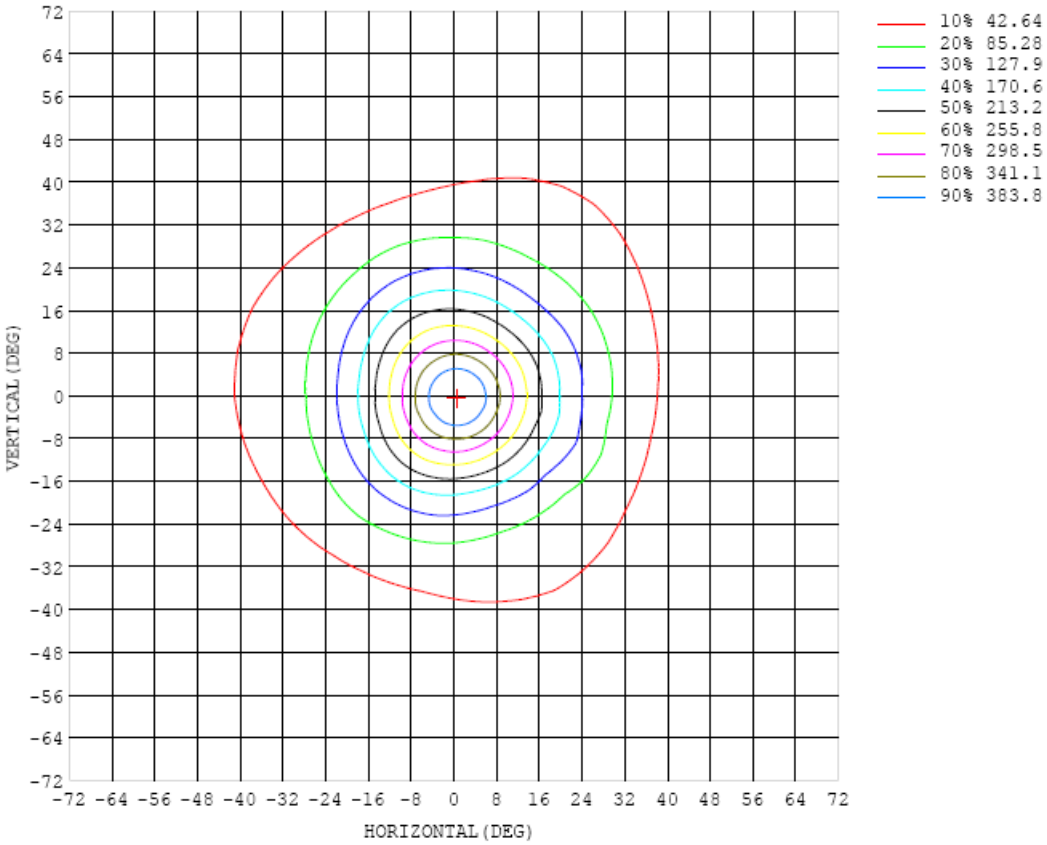


Chart 6: Isocandela Plot

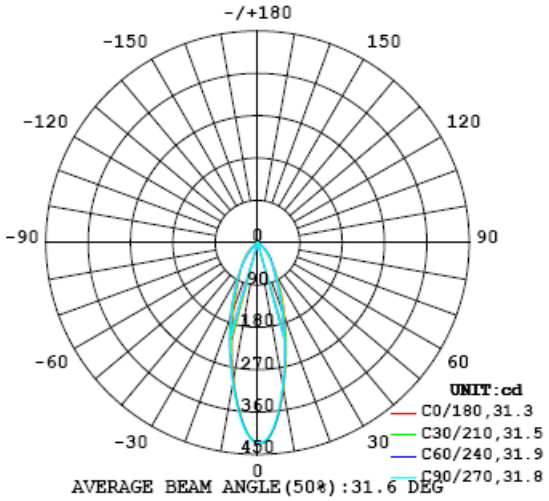


Chart 7: Polar Candela Distribution

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	426	426	426	426	426	426	426	426	426	426	426	426	426	426	426	426	426	426	426
5	397	398	399	397	397	396	395	394	393	392	390	388	386	384	382	383	381	380	379
10	317	316	314	313	312	311	310	309	308	308	306	306	305	304	301	297	295	294	293
15	235	236	231	229	226	224	222	220	220	222	223	225	227	225	222	217	212	211	210
20	169	170	167	160	156	154	151	149	150	153	156	158	159	157	154	151	148	147	147
25	120	119	123	114	104	102	100	99.5	101	104	107	108	108	108	108	106	103	103	103
30	83.1	79.6	81.6	78.0	72.1	70.6	70.3	69.9	69.8	71.4	72.7	73.5	75.5	76.6	75.6	74.3	74.0	74.8	74.5
35	56.9	53.6	52.7	52.3	53.1	53.6	54.1	53.7	52.5	50.6	49.7	49.5	49.8	50.8	52.7	54.1	55.0	56.7	58.2
40	34.9	33.0	34.1	37.0	40.4	42.2	43.5	42.4	40.5	38.0	34.4	31.2	29.7	30.4	33.0	36.2	39.8	43.0	45.6
45	19.0	18.3	20.8	24.8	28.5	31.4	32.2	31.8	29.8	26.6	22.0	18.3	15.8	15.6	18.2	22.5	26.8	30.4	32.7
50	9.39	9.74	11.9	14.8	17.7	20.3	21.2	21.0	18.9	15.5	12.6	9.69	8.11	7.78	9.09	12.4	15.9	18.8	20.9
55	4.71	5.01	6.20	7.95	9.44	10.7	11.1	10.6	9.13	7.42	5.86	5.04	4.48	4.41	4.87	6.07	8.12	9.88	10.9
60	3.10	3.09	3.23	3.77	4.39	4.71	4.81	4.57	4.00	3.60	3.29	3.09	3.04	3.08	3.10	3.27	3.82	4.51	4.98
65	2.45	2.40	2.40	2.49	2.60	2.70	2.70	2.58	2.49	2.42	2.46	2.44	2.38	2.38	2.38	2.27	2.32	2.54	2.74
70	1.93	1.86	1.93	2.05	1.92	1.98	2.04	1.95	1.97	1.87	1.95	1.92	1.83	1.83	1.86	1.77	1.75	1.89	2.00
75	1.44	1.44	1.44	1.57	1.46	1.63	1.60	1.49	1.58	1.41	1.46	1.38	1.35	1.31	1.32	1.27	1.24	1.37	1.44
80	1.02	1.08	1.04	1.10	1.11	1.23	1.18	1.14	1.14	1.07	1.09	1.03	1.03	0.95	0.93	0.88	0.86	0.91	0.95
85	0.70	0.71	0.71	0.71	0.74	0.77	0.74	0.70	0.68	0.66	0.66	0.65	0.63	0.61	0.60	0.59	0.60	0.60	0.61
90	0.57	0.59	0.61	0.60	0.61	0.61	0.59	0.57	0.55	0.57	0.59	0.59	0.56	0.54	0.53	0.49	0.45	0.42	0.39
95	0.65	0.68	0.70	0.70	0.75	0.78	0.77	0.73	0.66	0.65	0.65	0.63	0.60	0.58	0.57	0.53	0.49	0.47	0.43
100	0.68	0.69	0.70	0.72	0.76	0.79	0.78	0.75	0.67	0.66	0.68	0.67	0.66	0.64	0.62	0.58	0.55	0.54	0.53
105	0.73	0.76	0.74	0.76	0.77	0.78	0.77	0.76	0.73	0.72	0.74	0.72	0.70	0.68	0.67	0.64	0.60	0.60	0.59
110	0.85	0.86	0.86	0.87	0.89	0.91	0.88	0.83	0.83	0.82	0.85	0.85	0.81	0.80	0.78	0.74	0.69	0.69	0.66
115	1.03	1.04	1.04	1.05	1.03	1.08	1.00	0.97	0.98	0.92	0.91	0.94	0.95	0.94	0.93	0.86	0.75	0.68	0.60
120	0.98	1.00	1.00	1.02	1.02	1.09	1.02	0.99	0.95	0.89	0.86	0.85	0.84	0.80	0.74	0.68	0.62	0.57	0.51
125	0.82	0.82	0.78	0.78	0.81	0.84	0.84	0.82	0.78	0.77	0.77	0.77	0.75	0.73	0.68	0.63	0.57	0.50	0.43
130	0.69	0.70	0.70	0.72	0.74	0.76	0.76	0.74	0.72	0.72	0.72	0.72	0.70	0.67	0.61	0.55	0.47	0.41	0.35
135	0.56	0.58	0.60	0.63	0.66	0.66	0.66	0.65	0.65	0.65	0.66	0.64	0.62	0.59	0.53	0.46	0.40	0.35	0.31
140	0.46	0.49	0.51	0.54	0.56	0.57	0.57	0.57	0.56	0.51	0.30	0.45	0.53	0.50	0.46	0.42	0.38	0.34	0.31
145	0.41	0.43	0.44	0.46	0.48	0.48	0.49	0.50	0.49	0.41	0.20	0.28	0.32	0.37	0.40	0.37	0.35	0.34	0.32
150	0.40	0.40	0.41	0.42	0.43	0.44	0.45	0.45	0.42	0.36	0.23	0.27	0.15	0.11	0.10	0.16	0.22	0.20	0.29
155	0.39	0.39	0.40	0.40	0.41	0.42	0.42	0.41	0.38	0.34	0.28	0.14	0.30	0.28	0.24	0.30	0.40	0.39	0.38
160	0.37	0.37	0.36	0.37	0.38	0.39	0.39	0.37	0.34	0.33	0.35	0.25	0.17	0.17	0.23	0.27	0.34	0.40	0.37
165	0.20	0.22	0.26	0.28	0.29	0.29	0.29	0.29	0.26	0.27	0.27	0.24	0.21	0.15	0.12	0.17	0.24	0.25	0.22
170	0.12	0.12	0.12	0.12	0.12	0.12	0.11	0.12	0.12	0.12	0.12	0.11	0.12	0.12	0.12	0.12	0.11	0.11	0.11
175	0.12	0.12	0.12	0.12	0.12	0.11	0.11	0.12	0.12	0.12	0.12	0.11	0.11	0.12	0.12	0.12	0.12	0.12	0.12
180	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12

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	426	426	426	426	426	426	426	426	426	426	426	426	426	426	426	426	426		
5	379	378	378	379	380	380	382	383	384	386	387	388	390	392	394	395	396		
10	293	295	297	299	300	301	302	303	304	305	306	306	308	310	312	315	316		
15	211	215	220	225	229	231	232	231	230	228	226	225	226	228	232	234	235		
20	148	152	157	163	168	170	170	170	167	165	163	161	160	162	167	170	170		
25	105	108	111	114	116	119	120	120	118	116	114	113	113	115	119	121	121		
30	75.5	76.9	78.4	79.8	80.8	83.1	84.2	83.9	82.9	83.1	82.1	81.4	81.9	83.1	84.9	85.2	84.8		
35	58.3	57.9	57.2	56.4	55.5	55.8	56.9	57.7	59.0	61.0	62.3	63.1	63.7	62.8	62.1	60.7	59.2		
40	45.7	44.3	41.4	37.6	34.3	32.4	32.7	36.1	41.0	45.4	49.1	51.0	50.7	48.6	45.5	41.7	38.2		
45	33.0	31.4	27.4	22.2	18.1	15.9	16.9	20.8	26.5	32.5	36.3	38.6	38.3	35.9	32.0	26.6	22.2		
50	20.7	18.5	14.6	10.9	8.27	7.31	7.86	10.3	14.8	20.0	24.0	26.4	26.2	23.8	20.0	15.5	11.5		
55	10.4	8.66	6.59	5.06	4.32	4.11	4.27	4.97	6.54	9.07	12.2	14.4	14.8	13.4	10.5	7.56	5.54		
60	4.68	3.92	3.27	2.97	2.86	2.88	2.91	2.96	3.25	4.10	5.21	6.30	6.88	6.24	4.82	3.75	3.27		
65	2.64	2.35	2.18	2.17	2.15	2.14	2.18	2.22	2.26	2.41	2.76	3.11	3.18	2.87	2.53	2.41	2.44		
70	2.01	1.82	1.65	1.63	1.59	1.55	1.56	1.61	1.69	1.71	1.91	2.02	1.98	1.97	1.85	1.83	1.92		
75	1.43	1.28	1.15	1.13	1.08	1.07	1.05	1.08	1.14	1.18	1.34	1.47	1.41	1.47	1.34	1.36	1.45		
80	0.91	0.83	0.78	0.77	0.75	0.74	0.73	0.73	0.74	0.79	0.89	0.96	1.00	1.01	0.94	0.98	1.01		
85	0.58	0.53	0.50	0.48	0.47	0.47	0.47	0.47	0.48	0.53	0.58	0.63	0.65	0.62	0.63	0.66	0.70		
90	0.35	0.33	0.32	0.32	0.33	0.33	0.34	0.36	0.37	0.40	0.42	0.44	0.45	0.45	0.48	0.50	0.55		
95	0.40	0.37	0.35	0.35	0.36	0.36	0.36	0.37	0.37	0.39	0.42	0.45	0.47	0.47	0.52	0.56	0.62		
100	0.51	0.47	0.44	0.43	0.42	0.41	0.42	0.42	0.42	0.45	0.49	0.52	0.53	0.52	0.55	0.60	0.64		
105	0.58	0.55	0.51	0.52	0.51	0.49	0.48	0.48	0.49	0.50	0.54	0.55	0.57	0.56	0.58	0.63	0.70		
110	0.63	0.60	0.55	0.56	0.58	0.56	0.55	0.56	0.57	0.57	0.61	0.63	0.63	0.65	0.68	0.76	0.83		
115	0.52	0.46	0.43	0.44	0.45	0.47	0.47	0.48	0.50	0.54	0.66	0.76	0.84	0.89	0.80	0.86	1.03		
120	0.44	0.39	0.38	0.38	0.41	0.44	0.46	0.38	0.27	0.33	0.57	0.89	1.08	1.12	0.91	0.97	1.21		
125	0.37	0.33	0.31	0.32	0.33	0.38	0.44	0.29	0.05	0.13	0.48	1.03	1.31	1.35	1.01	1.08	1.38		
130	0.31	0.28	0.27	0.27	0.26	0.33	0.42	0.19	0.00	0.01	0.40	1.17	1.56	1.57	1.11	1.21	1.53		
135	0.28	0.27	0.26	0.24	0.20	0.28	0.40	0.09	0.00	0.00	0.32	1.32	1.80	1.79	1.20	1.36	1.67		
140	0.29	0.29	0.29	0.22	0.13	0.22	0.38	0.02	0.00	0.00	0.25	1.48	2.05	1.98	1.29	1.52	1.78		
145	0.32	0.32	0.32	0.20	0.07	0.16	0.35	0.02	0.00	0.00	0.19	1.65	2.31	2.17	1.37	1.71	1.86		
150	0.34	0.35	0.35	0.19	0.01	0.10	0.33	0.03	0.00	0.00	0.21	1.84	2.58	2.32	1.44	1.93	1.89		
155	0.37	0.39	0.38	0.20	0.00	0.06	0.29	0.03	0.00	0.00	0.29	2.06	2.85	2.42	1.50	2.20	1.82		
160	0.32	0.33	0.42	0.23	0.00	0.02	0.25	0.04	0.00	0.00	0.41	2.32	3.14	2.44	1.55	2.55	1.50		
165	0.15	0.19	0.44	0.32	0.00	0.00	0.19	0.06	0.00	0.00	0.65	2.68	3.43	2.29	1.63	2.96	0.48		
170	0.12	0.02	0.28	0.47	0.04	0.00	0.10	0.09	0.00	0.00	1.24	3.25	3.49	1.88	2.43	2.42	0.11		
175	0.12	0.12	0.11	0.02	0.50	0.16	0.00	0.23	0.00	0.00	3.35	3.33	1.79	3.38	0.16	0.12	0.12		
180	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12		

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, 2020	Aug. 04, 2021
Digital Power Meter	PF2010A	HZTE028-01	Aug. 05, 2020	Aug. 04, 2021
AC Power Supply	DPS1060	HZTE001-06	Aug. 05, 2020	Aug. 04, 2021
DC Power Supply	WY12010	HZTE004-03	Aug. 05, 2020	Aug. 04, 2021
Temperature recorder	JM624U	HZTE018-08	Aug. 05, 2020	Aug. 04, 2021
Temperature and humidity recorder	JR900	HZTE018-01	Aug. 05, 2020	Aug. 04, 2021
Standard source	D908	HZTE012-01	Aug. 05, 2020	Aug. 04, 2021
Integrate Sphere system	3M	HZTE015-04	Aug. 05, 2020	Aug. 04, 2021
Digital Power Meter	WT210	HZTE008-01	Aug. 05, 2020	Aug. 04, 2021
AC Power Supply	PCR 500L	HZTE001-07	Aug. 05, 2020	Aug. 04, 2021
DC Power Supply	IT6154	HZTE004-04	Aug. 05, 2020	Aug. 04, 2021
Standard source	SCL-1400	HZTE012-02	Aug. 05, 2020	Aug. 04, 2021
Temperature and humidity recorder	JR900	HZTE018-02	Aug. 05, 2020	Aug. 04, 2021
Temperature Meter	TES1310	HZTE017-01	Aug. 05, 2020	Aug. 04, 2021

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

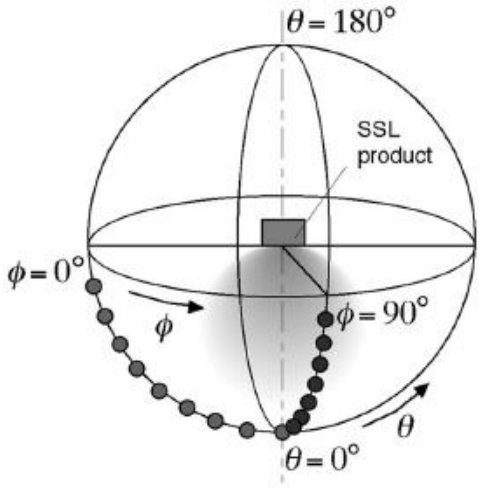
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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