

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: 2.5MR11/840FL35

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.: HZ21050012b

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

Review by:



Engineer: April Zou
May 19, 2021

Approved by:



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: 2.5MR11/840FL35

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
100.4	238.0	2.37	0.7438
CCT (K)	CRI	Stabilization Time (Light & Power)	
4091	84.5	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 12, 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

TABLE OF CONTENT

LM-79-08 TEST REPORT	1
TEST SUMMARY	2
SAMPLE PHOTO	4
TEST RESULTS	5
Sphere-Spectroradiometer Method.....	5
Goniophotometer Method	6
Spectral Power Distribution - Sphere Spectroradiometer Method	7
Chromaticity Diagram - Sphere Spectroradiometer Method.....	8
Nominal CCT Quadrangles – Sphere Spectroradiometer Method	9
Color Rendition Report – Sphere Spectroradiometer Method	10
Zonal Lumen Tabulation- Goniophotometer Method	11
Illuminance Plots- Goniophotometer Method	12
Luminous Intensity Distribution Plots- Goniophotometer Method.....	13
Luminous Intensity Data- Goniophotometer Method	14
EQUIPMENT LIST	16
TEST METHODS	16
Seasoning of SSL Product.....	16
Sphere-Spectroradiometer Method- Photometric and Electrical Measurements.....	16
Goniophotometer Method	17
Photometric and Electrical Measurements	17
Color Characteristics Measurements.....	17
Color Spatial Uniformity	17

SAMPLE PHOTO



Figure 1- Overview of the sample

Equipment Under Test(EUT)

Name	: LED Lamp
Model	: 2.5MR11/840FL35
Electrical Ratings	: 12V, 60Hz, 2.5W
Product Description	: 4000K
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 °C.

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)	0.065
Power Factor	0.7438
Test Power (W)	2.37
THD A%	52.09
Luminous Efficacy (lm/W)	100.4
Total Luminous Flux (lm)	238.0
Color Rendering Index (CRI)	84.5
R9	13.9
Correlated Color Temperature (CCT)(K)	4091
Chromaticity Chroma x	0.3770
Chromaticity Chroma y	0.3766
Chromaticity Chroma u	0.2229
Chromaticity Chroma v	0.3340
Duv	0.0010
Chromaticity Chroma u'	0.2229
Chromaticity Chroma v'	0.5010

Special Color Rendering Indices	
R1	82.7
R2	90.2
R3	95.6
R4	83.5
R5	83
R6	86.6
R7	87
R8	66.8
R9	13.9
R10	76.8
R11	82.8
R12	66.6
R13	84.7
R14	97.8

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 24.5 °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)	12.0
Voltage frequency (Hz)	60
Test Current (A)	0.293
Power Factor	0.7391
Power (W)	2.58
Luminous Efficacy (lm/W)	98.6
Total Luminous Flux (lm)	254.6
Beam Angle (°)	31.4 (0°-180°) / 31.1 (90°-270°)
Center Beam Candle Power (cd)	484
Maximum Beam Candle Power (cd)	485.0 (At: C=300.0, Gamma=1.0)
Spacing Criteria	0.51 (0°-180°) / 0.49 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	96.22%
Zonal Lumens in the 60 °-90 °Zone	2.37%
Zonal Lumens in the 90 °-120 °Zone	0.87%
Zonal Lumens in the 120 °-180 °Zone	0.54%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

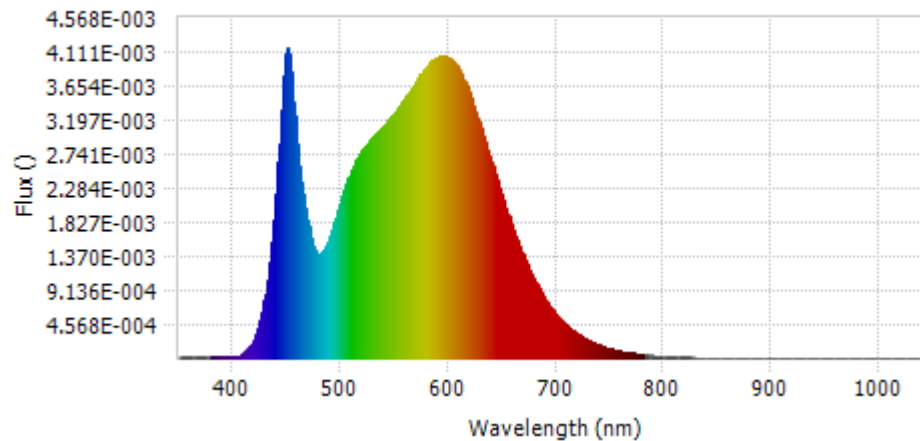
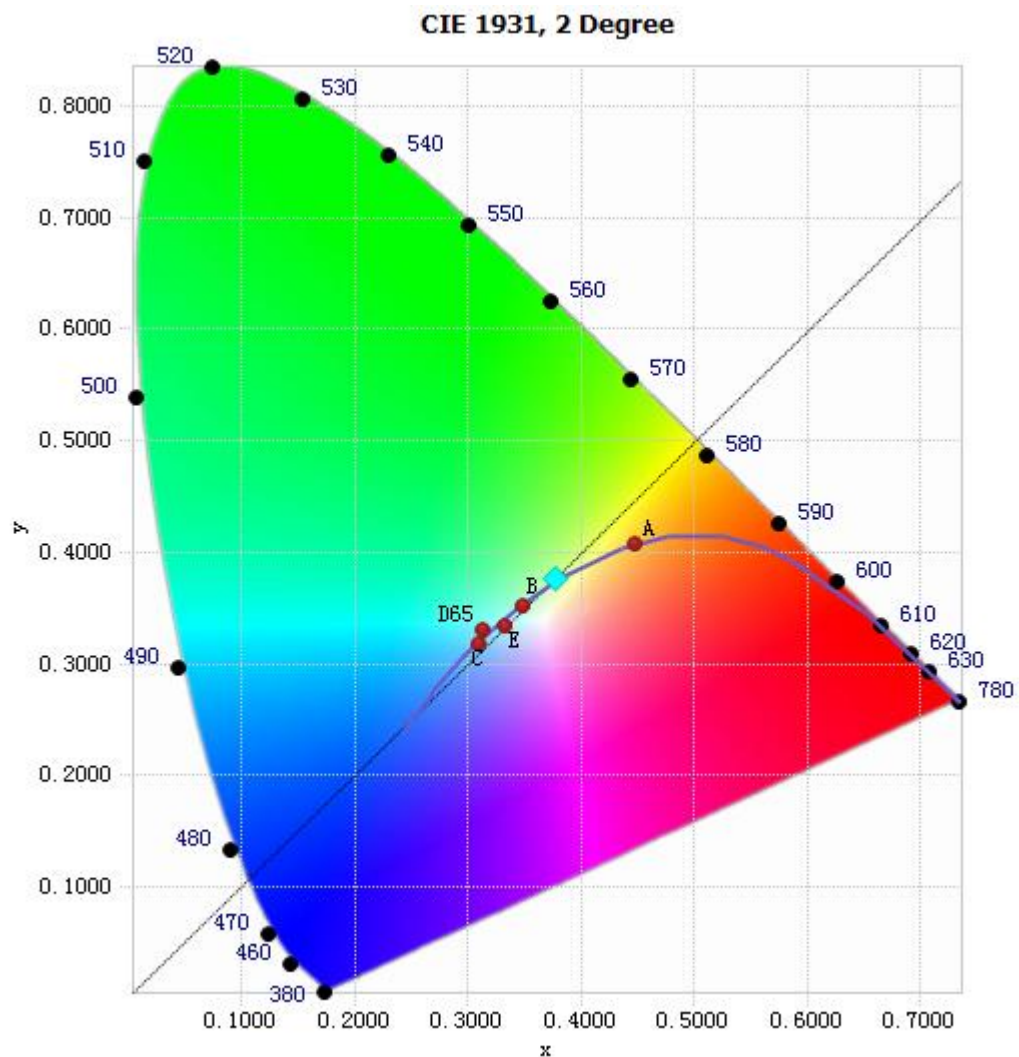


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.24E-05	485	1.49E-03	590	4.04E-03	695	6.79E-04
385	1.87E-05	490	1.64E-03	595	4.05E-03	700	5.87E-04
390	1.78E-05	495	1.87E-03	600	4.03E-03	705	5.05E-04
395	1.53E-05	500	2.12E-03	605	3.97E-03	710	4.34E-04
400	1.90E-05	505	2.34E-03	610	3.86E-03	715	3.75E-04
405	3.34E-05	510	2.52E-03	615	3.71E-03	720	3.23E-04
410	7.60E-05	515	2.68E-03	620	3.52E-03	725	2.77E-04
415	1.50E-04	520	2.80E-03	625	3.31E-03	730	2.38E-04
420	2.82E-04	525	2.89E-03	630	3.08E-03	735	2.05E-04
425	5.08E-04	530	2.97E-03	635	2.85E-03	740	1.76E-04
430	8.66E-04	535	3.05E-03	640	2.62E-03	745	1.51E-04
435	1.42E-03	540	3.12E-03	645	2.38E-03	750	1.31E-04
440	2.22E-03	545	3.21E-03	650	2.16E-03	755	1.12E-04
445	3.33E-03	550	3.30E-03	655	1.94E-03	760	9.66E-05
450	4.14E-03	555	3.39E-03	660	1.73E-03	765	8.36E-05
455	3.64E-03	560	3.50E-03	665	1.54E-03	770	7.23E-05
460	2.73E-03	565	3.61E-03	670	1.35E-03	775	6.22E-05
465	2.19E-03	570	3.71E-03	675	1.19E-03	780	5.34E-05
470	1.76E-03	575	3.82E-03	680	1.04E-03		
475	1.46E-03	580	3.92E-03	685	9.05E-04		
480	1.40E-03	585	4.00E-03	690	7.87E-04		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3770, 0.3766)

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

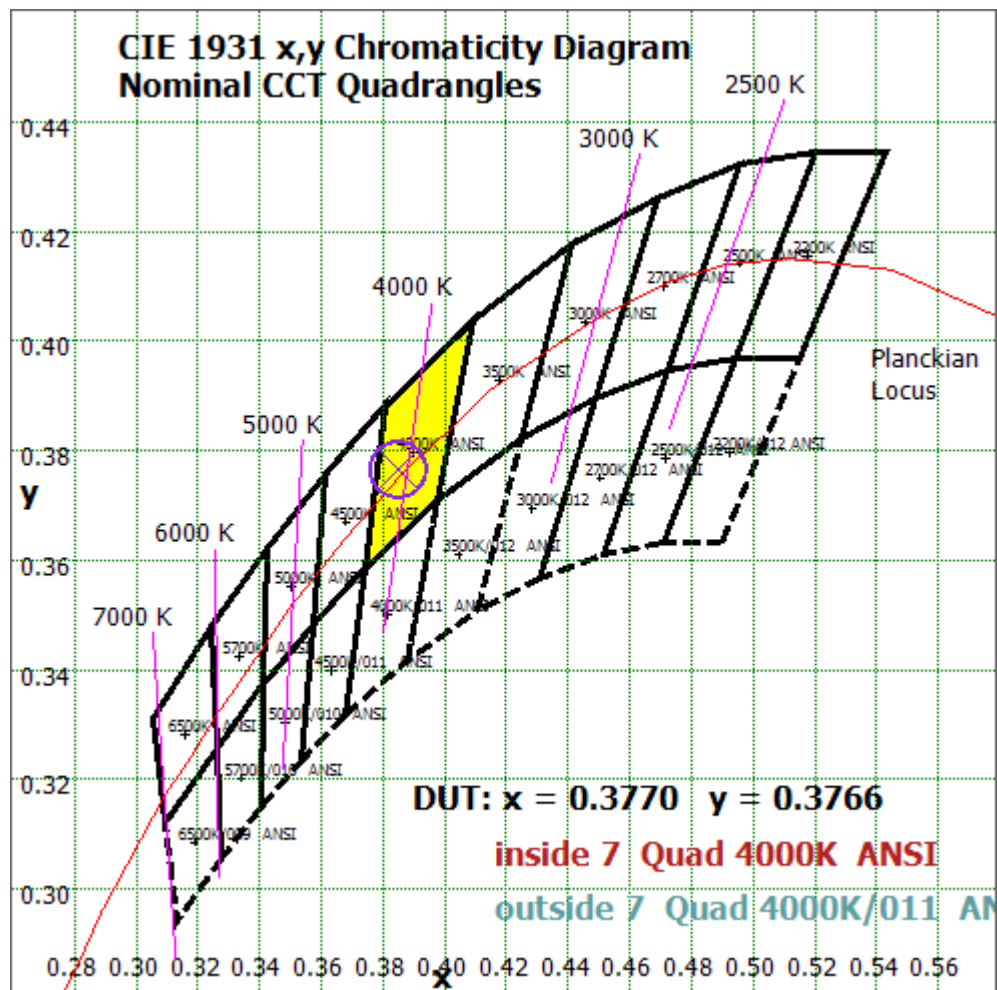


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method

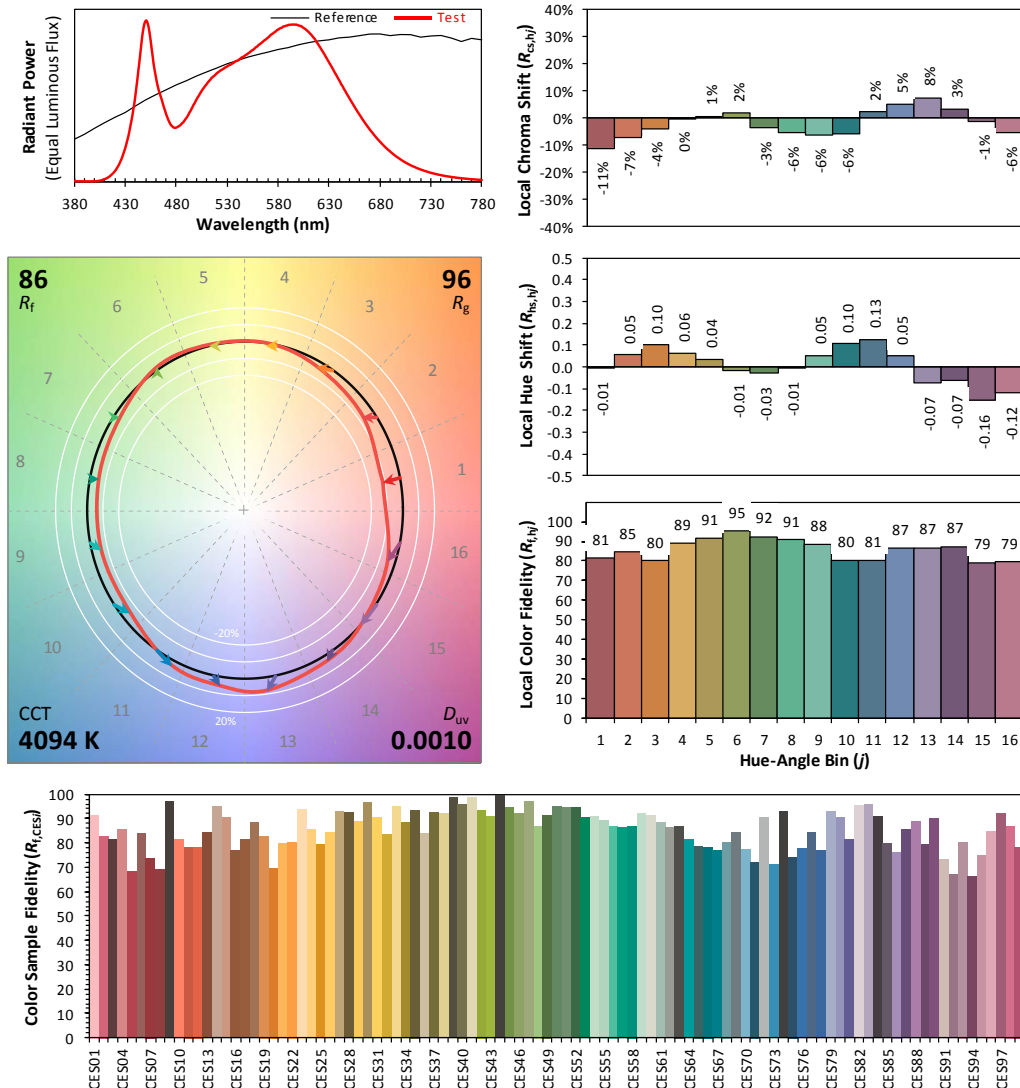
ANSI/IES TM-30-18 Color Rendition Report

Source: LED

Manufacturer: GREEN CREATIVE LTD

Date: 2021/05/12

Model: 2.5MR11/840FL35



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

x 0.3770
 y 0.3766
 u' 0.2229
 v' 0.5010

CIE 13.3-1995
(CRI)
 R_a 84
 R_g 14

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

$\gamma(^{\circ})$	Lumens	% Total
0- 10	38.664	15.19%
10- 20	69.759	27.40%
20- 30	58.1	22.82%
30- 40	41.771	16.41%
40- 50	25.945	10.19%
50- 60	10.756	4.22%
60- 70	3.551	1.39%
70- 80	1.658	0.65%
80- 90	0.828	0.33%
90-100	0.7	0.27%
100-110	0.79	0.31%
110-120	0.73	0.29%
120-130	0.499	0.20%
130-140	0.34	0.13%
140-150	0.251	0.10%
150-160	0.171	0.07%
160-170	0.084	0.03%
170-180	0.02	0.01%
Total	254.6	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	244.995	96.22%
60- 90	6.037	2.37%
0-90	251.032	98.59%
90- 180	3.585	1.41%
0- 180	254.6	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

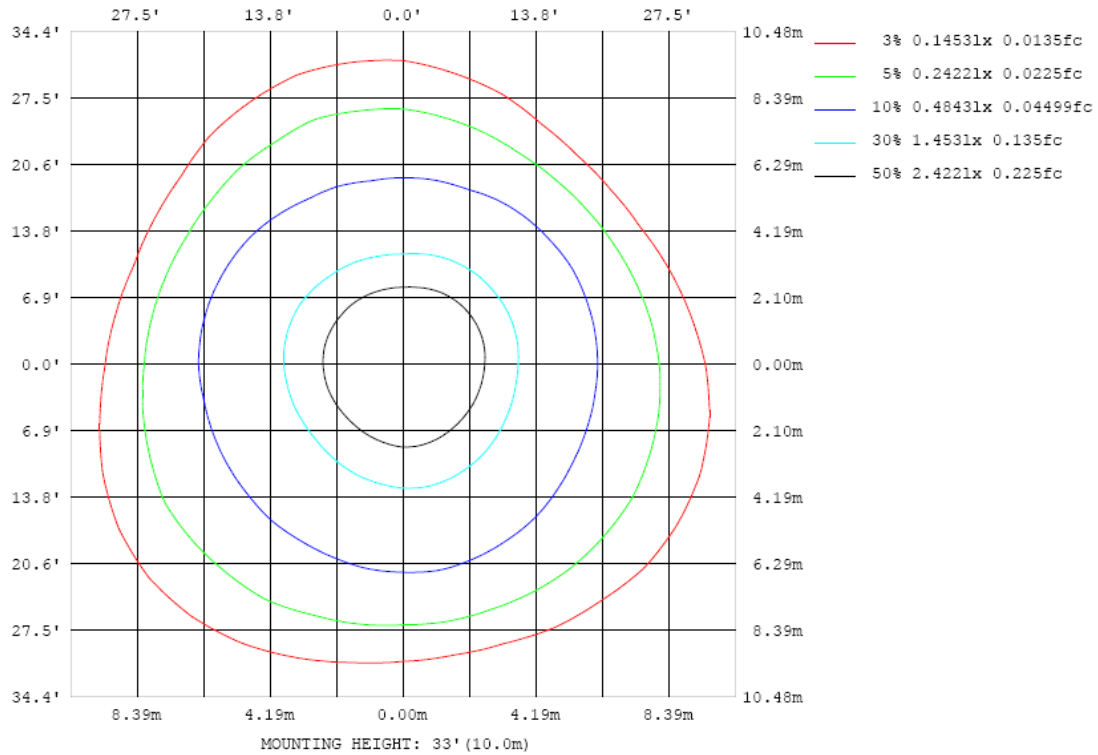


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

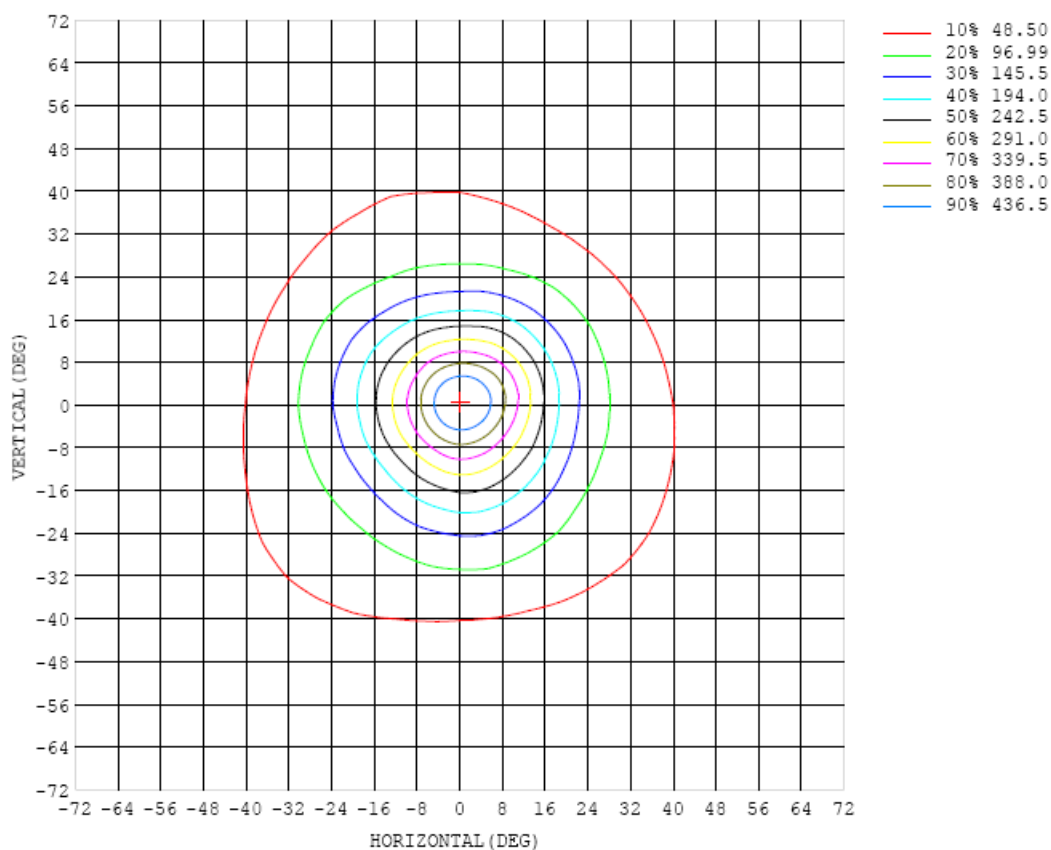


Chart 6: Isocandela Plot

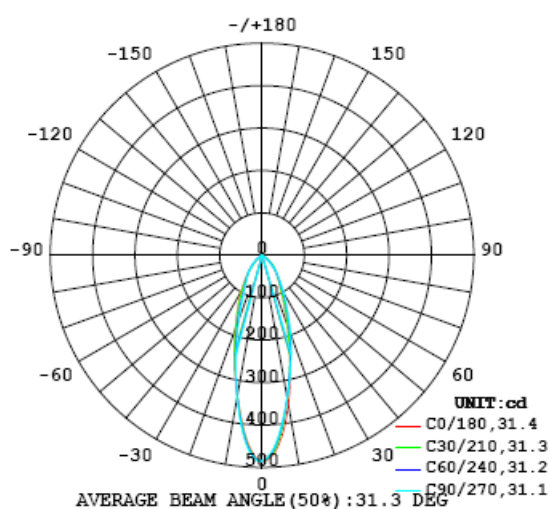


Chart 7: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1

UNIT: cd

C (DEG) γ (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	484	484	484	484	484	484	484	484	484	484	484	484	484	484	484	484	484	484	484
5	448	447	444	442	439	436	434	433	432	431	430	429	430	429	430	430	431	431	433
10	357	352	347	343	341	341	342	342	342	342	341	336	332	330	330	332	333	335	337
15	256	253	252	254	254	256	259	262	263	262	257	252	249	245	244	246	249	250	253
20	174	173	175	178	183	188	192	196	198	196	190	187	182	178	175	175	179	181	185
25	120	120	120	123	128	133	137	141	143	140	137	135	130	126	126	127	130	131	135
30	85.6	85.6	85.2	86.9	89.9	95.1	97.6	100	103	102	101	97.3	94.5	93.1	92.8	94.0	94.8	96.0	98.6
35	64.2	65.0	66.8	67.2	68.6	69.9	71.3	72.9	74.3	73.4	73.4	71.8	73.0	73.4	72.0	70.9	70.6	70.4	70.0
40	48.5	50.7	52.0	53.4	53.0	52.5	51.3	49.7	49.7	49.8	52.1	54.0	57.4	57.7	58.0	58.7	55.8	52.8	49.2
45	34.6	38.7	40.9	41.3	40.5	37.3	34.6	30.6	29.2	30.2	34.1	38.9	43.1	45.9	47.2	45.9	42.2	36.9	31.3
50	22.6	26.3	29.2	30.0	28.1	24.7	20.3	16.2	14.7	15.9	20.0	25.2	30.1	34.0	34.5	32.5	28.5	23.4	18.0
55	12.3	15.8	17.8	17.5	16.1	13.3	10.2	8.07	7.31	8.02	10.3	13.9	17.3	20.4	21.2	20.0	17.8	13.8	9.57
60	6.38	8.15	9.48	9.18	7.91	6.52	5.14	4.36	4.12	4.34	5.19	6.68	8.52	10.5	11.7	11.1	9.16	6.92	4.78
65	3.27	3.91	4.49	4.47	3.95	3.31	2.91	2.85	2.83	2.82	2.86	3.30	4.15	5.01	5.65	5.18	4.13	3.43	2.96
70	2.06	2.27	2.57	2.50	2.40	2.18	2.03	2.03	2.01	2.02	1.99	2.12	2.43	2.68	2.96	2.67	2.32	2.23	2.13
75	1.45	1.54	1.72	1.66	1.61	1.51	1.44	1.43	1.39	1.40	1.39	1.46	1.60	1.67	1.83	1.69	1.56	1.50	1.49
80	1.00	1.06	1.15	1.15	1.10	1.05	1.00	0.97	0.96	0.97	0.98	1.00	1.04	1.09	1.15	1.10	1.05	1.01	1.04
85	0.67	0.69	0.74	0.73	0.71	0.69	0.66	0.64	0.65	0.65	0.65	0.65	0.67	0.71	0.73	0.71	0.70	0.70	0.75
90	0.51	0.51	0.51	0.49	0.49	0.50	0.49	0.49	0.50	0.51	0.51	0.51	0.53	0.56	0.57	0.56	0.56	0.58	0.64
95	0.59	0.59	0.60	0.57	0.57	0.57	0.56	0.55	0.55	0.56	0.54	0.55	0.58	0.64	0.68	0.66	0.63	0.65	0.69
100	0.63	0.64	0.66	0.62	0.62	0.61	0.61	0.61	0.60	0.63	0.62	0.63	0.66	0.72	0.78	0.73	0.69	0.70	0.73
105	0.67	0.67	0.68	0.63	0.65	0.67	0.69	0.71	0.73	0.74	0.71	0.73	0.76	0.76	0.83	0.78	0.70	0.67	0.73
110	0.66	0.69	0.71	0.69	0.74	0.76	0.77	0.82	0.82	0.84	0.83	0.86	0.88	0.85	0.91	0.85	0.75	0.68	0.73
115	0.59	0.61	0.64	0.64	0.66	0.67	0.68	0.70	0.70	0.72	0.71	0.74	0.79	0.79	0.87	0.81	0.70	0.63	0.66
120	0.53	0.53	0.55	0.56	0.58	0.59	0.60	0.61	0.61	0.61	0.59	0.59	0.60	0.63	0.66	0.63	0.58	0.55	0.58
125	0.47	0.47	0.48	0.48	0.49	0.50	0.50	0.52	0.52	0.52	0.52	0.52	0.52	0.54	0.56	0.53	0.50	0.48	0.51
130	0.42	0.41	0.40	0.39	0.40	0.40	0.41	0.41	0.41	0.41	0.40	0.41	0.41	0.41	0.42	0.42	0.42	0.42	0.44
135	0.37	0.36	0.34	0.34	0.34	0.36	0.37	0.37	0.37	0.35	0.36	0.34	0.36	0.36	0.36	0.36	0.36	0.36	0.39
140	0.34	0.33	0.32	0.33	0.34	0.36	0.37	0.38	0.38	0.31	0.25	0.33	0.37	0.36	0.35	0.35	0.35	0.35	0.36
145	0.34	0.33	0.34	0.35	0.36	0.38	0.40	0.41	0.39	0.32	0.15	0.28	0.37	0.36	0.37	0.36	0.36	0.36	0.36
150	0.35	0.35	0.36	0.37	0.39	0.40	0.42	0.43	0.41	0.34	0.29	0.20	0.11	0.27	0.33	0.34	0.35	0.36	0.37
155	0.37	0.37	0.38	0.39	0.40	0.42	0.43	0.44	0.41	0.37	0.19	0.26	0.20	0.15	0.13	0.18	0.27	0.27	0.30
160	0.36	0.36	0.37	0.37	0.39	0.40	0.42	0.42	0.40	0.37	0.27	0.18	0.24	0.31	0.31	0.34	0.36	0.36	0.32
165	0.20	0.22	0.25	0.28	0.28	0.28	0.28	0.28	0.27	0.22	0.20	0.19	0.13	0.12	0.15	0.20	0.20	0.21	0.18
170	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
175	0.14	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
180	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13

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	484	484	484	484	484	484	484	484	484	484	484	484	484	484	484	484	484		
5	434	435	437	438	439	440	441	442	444	445	447	448	449	450	450	451	450		
10	338	337	336	337	338	338	337	337	339	342	345	351	356	361	363	363	362		
15	254	253	251	249	246	244	240	237	237	241	249	255	259	261	263	262	260		
20	186	186	184	179	173	170	165	161	160	165	170	173	176	177	178	178	178		
25	134	133	131	126	119	114	111	108	107	109	111	115	119	121	122	122	121		
30	97.6	95.3	94.1	90.4	85.1	80.8	79.5	76.8	77.3	77.4	77.2	80.4	83.3	84.3	86.5	86.0	86.0		
35	69.9	68.5	65.9	65.1	64.0	62.3	63.8	61.8	61.2	58.7	57.3	56.9	56.3	57.3	59.5	61.2	62.7		
40	46.5	44.0	43.9	44.6	47.3	48.4	50.5	48.8	47.9	44.6	41.9	37.4	35.2	35.2	36.6	40.7	44.7		
45	27.8	26.1	26.9	29.4	33.2	35.4	37.1	36.4	35.1	31.6	27.9	23.6	20.2	18.3	20.5	24.2	29.1		
50	14.2	13.1	14.7	17.7	20.5	22.7	23.9	23.3	21.6	19.2	15.6	12.8	10.4	9.41	9.88	12.6	17.6		
55	6.91	6.22	7.27	8.91	10.5	11.9	12.6	12.2	10.5	9.05	7.59	6.43	5.55	5.13	5.31	6.57	9.07		
60	3.97	3.85	3.97	4.52	5.17	5.66	5.82	5.53	5.04	4.45	4.03	3.67	3.50	3.49	3.49	3.78	4.65		
65	2.83	2.93	2.99	2.97	3.18	3.33	3.12	3.00	2.91	2.87	2.77	2.65	2.69	2.71	2.63	2.57	2.77		
70	2.15	2.27	2.31	2.28	2.33	2.41	2.21	2.22	2.10	2.12	2.10	2.01	2.08	2.07	1.99	1.88	1.95		
75	1.58	1.64	1.64	1.64	1.66	1.70	1.57	1.57	1.47	1.48	1.48	1.44	1.48	1.46	1.41	1.35	1.38		
80	1.10	1.14	1.13	1.16	1.18	1.17	1.12	1.09	1.05	1.05	1.06	1.05	1.05	1.04	1.00	0.96	0.97		
85	0.79	0.82	0.82	0.84	0.85	0.84	0.81	0.79	0.75	0.76	0.78	0.78	0.77	0.74	0.69	0.65	0.65		
90	0.70	0.73	0.73	0.73	0.73	0.70	0.68	0.67	0.63	0.64	0.66	0.66	0.64	0.60	0.54	0.49	0.48		
95	0.74	0.75	0.75	0.76	0.77	0.77	0.74	0.73	0.69	0.70	0.73	0.73	0.71	0.67	0.59	0.55	0.37		
100	0.78	0.80	0.81	0.83	0.84	0.86	0.83	0.83	0.76	0.76	0.79	0.78	0.77	0.72	0.64	0.60	0.27		
105	0.80	0.84	0.86	0.86	0.87	0.91	0.86	0.87	0.81	0.79	0.81	0.80	0.82	0.76	0.66	0.65	0.16		
110	0.87	0.94	0.98	0.97	0.95	0.97	0.92	0.93	0.87	0.87	0.89	0.88	0.90	0.82	0.69	0.71	0.05		
115	0.78	0.86	0.91	0.90	0.89	0.93	0.88	0.89	0.84	0.82	0.86	0.87	0.87	0.77	0.65	0.76	0.00		
120	0.63	0.68	0.71	0.72	0.72	0.73	0.71	0.70	0.68	0.68	0.72	0.76	0.76	0.69	0.60	0.81	0.00		
125	0.56	0.60	0.62	0.64	0.65	0.65	0.65	0.64	0.64	0.64	0.67	0.69	0.70	0.65	0.56	0.87	0.00		
130	0.48	0.52	0.54	0.56	0.57	0.57	0.58	0.58	0.58	0.59	0.61	0.63	0.64	0.62	0.51	0.92	0.00		
135	0.42	0.46	0.48	0.50	0.51	0.52	0.52	0.53	0.54	0.56	0.58	0.56	0.58	0.59	0.47	0.98	0.00		
140	0.39	0.42	0.44	0.46	0.47	0.48	0.49	0.50	0.51	0.53	0.55	0.49	0.52	0.57	0.43	1.03	0.00		
145	0.38	0.40	0.41	0.43	0.44	0.45	0.45	0.47	0.48	0.49	0.52	0.42	0.46	0.54	0.38	1.08	0.00		
150	0.38	0.39	0.40	0.41	0.42	0.42	0.43	0.44	0.44	0.46	0.49	0.36	0.40	0.52	0.34	1.14	0.00		
155	0.37	0.39	0.40	0.41	0.40	0.41	0.41	0.41	0.41	0.42	0.46	0.29	0.35	0.49	0.30	1.19	0.00		
160	0.32	0.37	0.38	0.40	0.40	0.40	0.39	0.39	0.38	0.39	0.43	0.22	0.29	0.47	0.25	1.24	0.00		
165	0.19	0.24	0.28	0.39	0.39	0.39	0.37	0.37	0.34	0.35	0.41	0.16	0.23	0.44	0.21	1.30	0.00		
170	0.13	0.14	0.17	0.39	0.39	0.38	0.35	0.34	0.31	0.31	0.38	0.09	0.17	0.41	0.17	1.35	0.00		
175	0.13	0.15	0.07	0.38	0.38	0.37	0.34	0.32	0.28	0.28	0.35	0.02	0.11	0.39	0.13	1.40	0.00		
180	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13		

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.

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

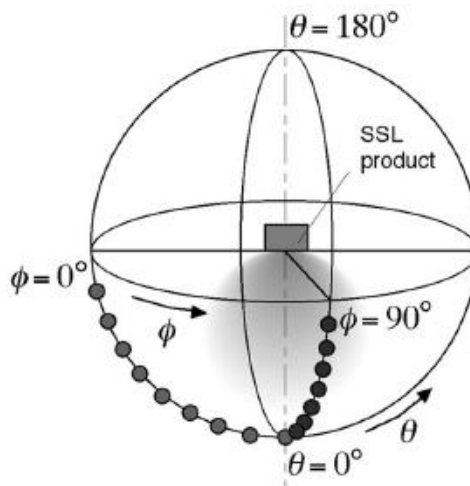
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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

This report is considered invalidated without the Special Seal for Inspection of the LTL. This report shall not be altered, increased or deleted. The results shown in this test report refer only to the sample(s) tested. Without written approval of LTL, this test report shall not be copied except in full and published as advertisement.