

LM-79-08 TEST REPORT

for

GREEN CREATIVE LTD

756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

LED Lamp

Model: 6MR16DIM/840FL35/R

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ19040047m

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

Review by:



Engineer: April Zou
May 10, 2019

Approved by:



Manager: Jim Zhang
May 10, 2019

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: 6MR16DIM/840FL35/R

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
113.8	662.3	5.82	0.9208
CCT (K)	CRI	Stabilization Time (Light & Power)	
3990	84.0	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	: Apr. 26, 2019
Date of Test	: Apr. 30, 2019
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	: 6MR16DIM/840FL35/R
Electrical Ratings	: 12V, 60Hz, 6W
Product Description	: 4000K
Manufacturer	: GREEN CREATIVE LTD
Address	: 756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

TEST RESULTS

Test ambient temperature was 26.0°C.

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)	0.526
Power Factor	0.9208
Test Power (W)	5.82
THD A%	22.68
Luminous Efficacy (lm/W)	113.8
Total Luminous Flux (lm)	662.3
Color Rendering Index (CRI)	84
R9	10.2
Correlated Color Temperature (CCT)(K)	3990
Chromaticity Chroma x	0.3820
Chromaticity Chroma y	0.3816
Chromaticity Chroma u	0.2242
Chromaticity Chroma v	0.3359
Duv	0.0018
Chromaticity Chroma u'	0.2242
Chromaticity Chroma v'	0.5039

Special Color Rendering Indices	
R1	82.1
R2	90.9
R3	96.4
R4	82
R5	82.4
R6	87.7
R7	86
R8	64.6
R9	10.2
R10	78.6
R11	81.1
R12	67.4
R13	84.4
R14	98.4

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 24.7°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)	0.530
Power Factor	0.9246
Power (W)	5.87
Luminous Efficacy (lm/W)	115.0
Total Luminous Flux (lm)	675.2
Beam Angle (°)	32.7 (0°-180°) / 32.1 (90°-270°)
Center Beam Candle Power (cd)	1895
Maximum Beam Candle Power (cd)	1895 (At: C=0.0, Gamma=0.0)
Spacing Criteria	0.52 (0°-180°) / 0.50 (90°-270°)
Zonal Lumens in the 0°-60° Zone	96.51%
Zonal Lumens in the 60°-90° Zone	3.28%
Zonal Lumens in the 90°-120° Zone	0.19%
Zonal Lumens in the 120°-180° Zone	0.03%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

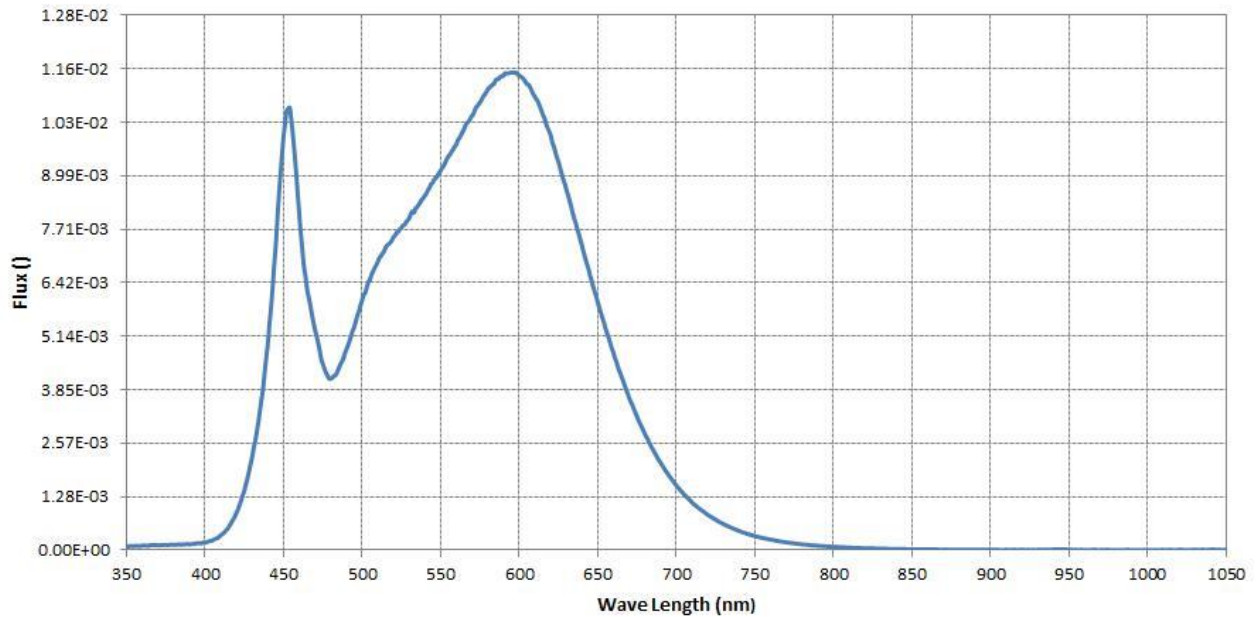
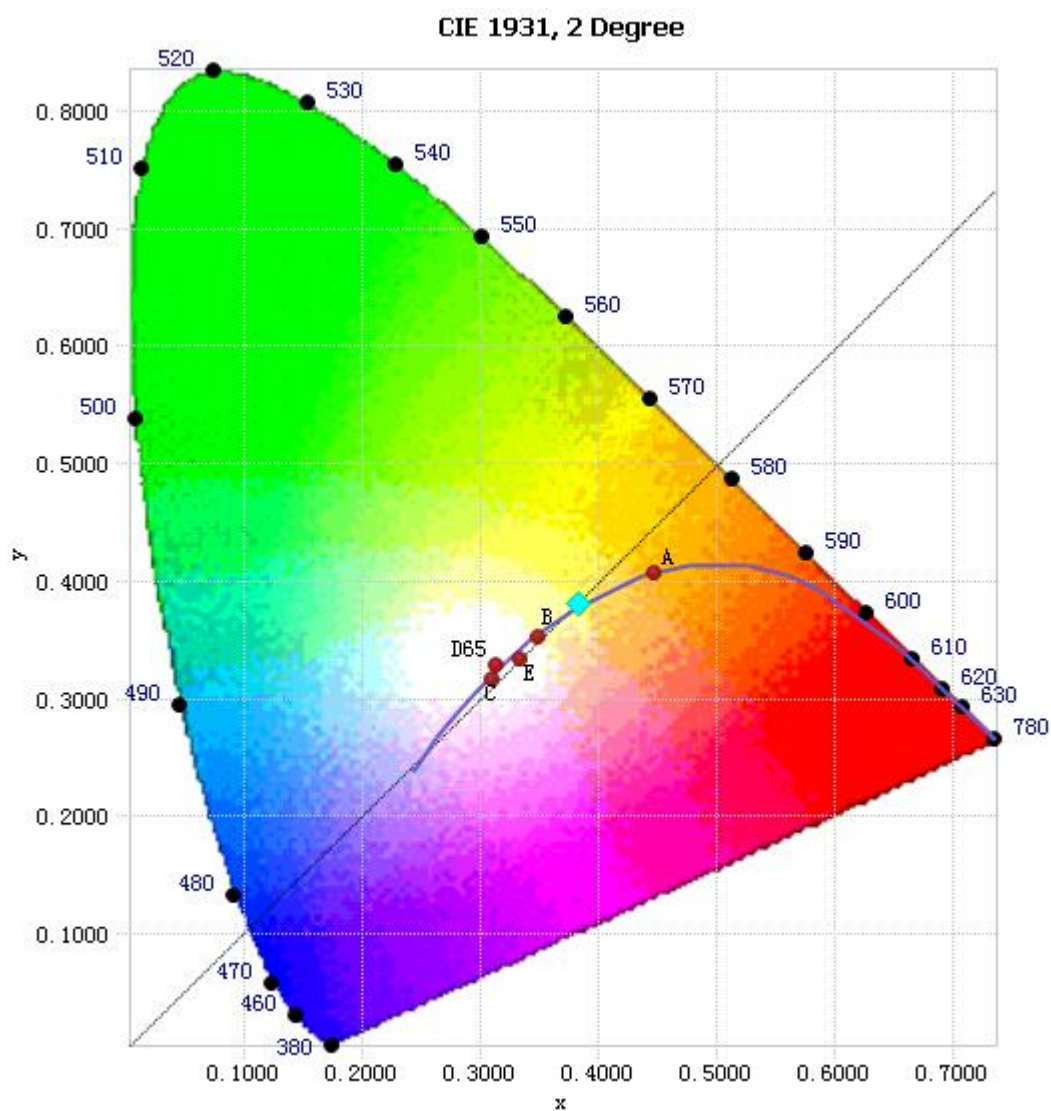


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.35E-04	485	4.35E-03	590	1.14E-02	695	1.81E-03
385	1.29E-04	490	4.82E-03	595	1.15E-02	700	1.56E-03
390	1.36E-04	495	5.35E-03	600	1.14E-02	705	1.34E-03
395	1.67E-04	500	6.00E-03	605	1.12E-02	710	1.14E-03
400	1.81E-04	505	6.49E-03	610	1.09E-02	715	9.88E-04
405	2.36E-04	510	6.93E-03	615	1.05E-02	720	8.48E-04
410	3.54E-04	515	7.27E-03	620	9.97E-03	725	7.34E-04
415	5.41E-04	520	7.52E-03	625	9.33E-03	730	6.30E-04
420	8.93E-04	525	7.74E-03	630	8.66E-03	735	5.39E-04
425	1.42E-03	530	7.97E-03	635	7.97E-03	740	4.63E-04
430	2.22E-03	535	8.24E-03	640	7.31E-03	745	3.94E-04
435	3.34E-03	540	8.52E-03	645	6.61E-03	750	3.39E-04
440	4.93E-03	545	8.83E-03	650	5.95E-03	755	2.94E-04
445	7.26E-03	550	9.11E-03	655	5.33E-03	760	2.53E-04
450	9.92E-03	555	9.46E-03	660	4.74E-03	765	2.19E-04
455	1.03E-02	560	9.74E-03	665	4.18E-03	770	1.91E-04
460	8.08E-03	565	1.01E-02	670	3.65E-03	775	1.63E-04
465	6.28E-03	570	1.04E-02	675	3.20E-03	780	1.40E-04
470	5.30E-03	575	1.08E-02	680	2.79E-03		
475	4.48E-03	580	1.11E-02	685	2.43E-03		
480	4.12E-03	585	1.13E-02	690	2.10E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3820, 0.3816)

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

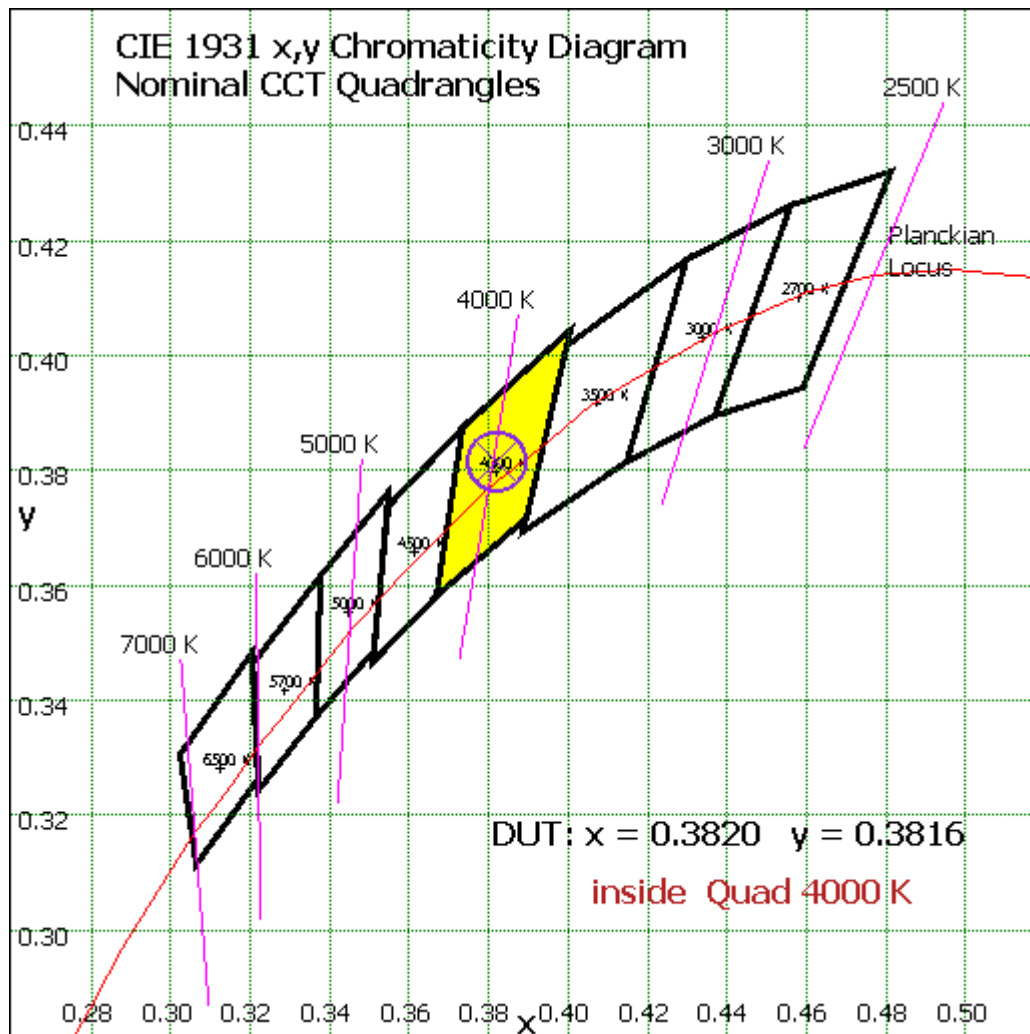
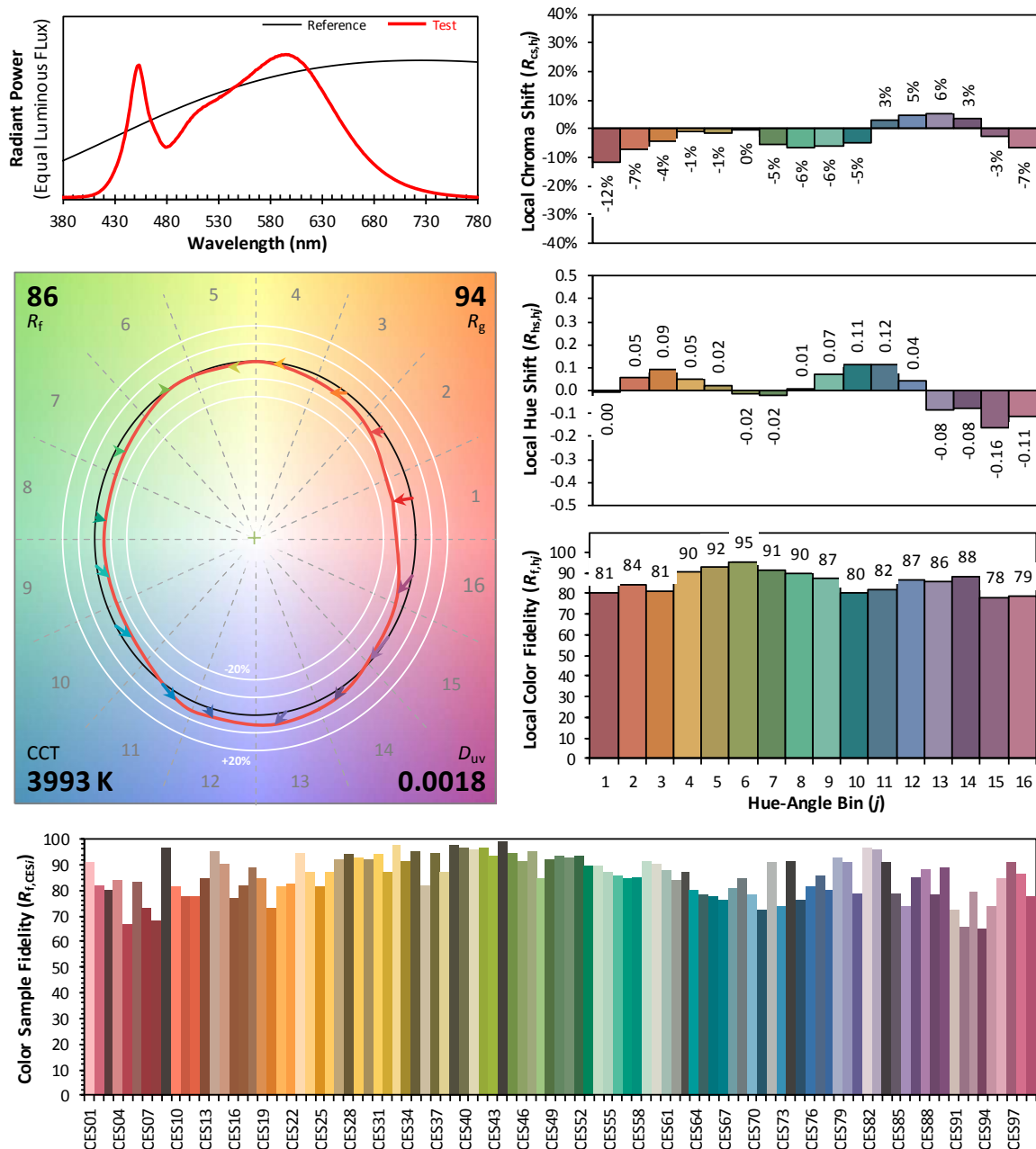


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method



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

x 0.3820
 y 0.3816
 u' 0.2242
 v' 0.5039

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	164.525	24.37%
10- 20	287.541	42.59%
20- 30	134.308	19.89%
30- 40	36.612	5.42%
40- 50	16.091	2.38%
50- 60	12.487	1.85%
60- 70	10.829	1.60%
70- 80	7.588	1.12%
80- 90	3.701	0.55%
90-100	1.118	0.17%
100-110	0.132	0.02%
110-120	0.001	0.00%
120-130	0.006	0.00%
130-140	0.014	0.00%
140-150	0.031	0.00%
150-160	0.062	0.01%
160-170	0.073	0.01%
170-180	0.028	0.00%
Total	675.1	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	651.564	96.51%
60- 90	22.118	3.28%
0-90	673.682	99.78%
90- 180	1.465	0.22%
0- 180	675.1	100%

Table 5: Zonal Lumen

Note: The Flux in this table might be a little different from the total flux in Table 2 due to rounding.

Illuminance Plots- Goniophotometer Method

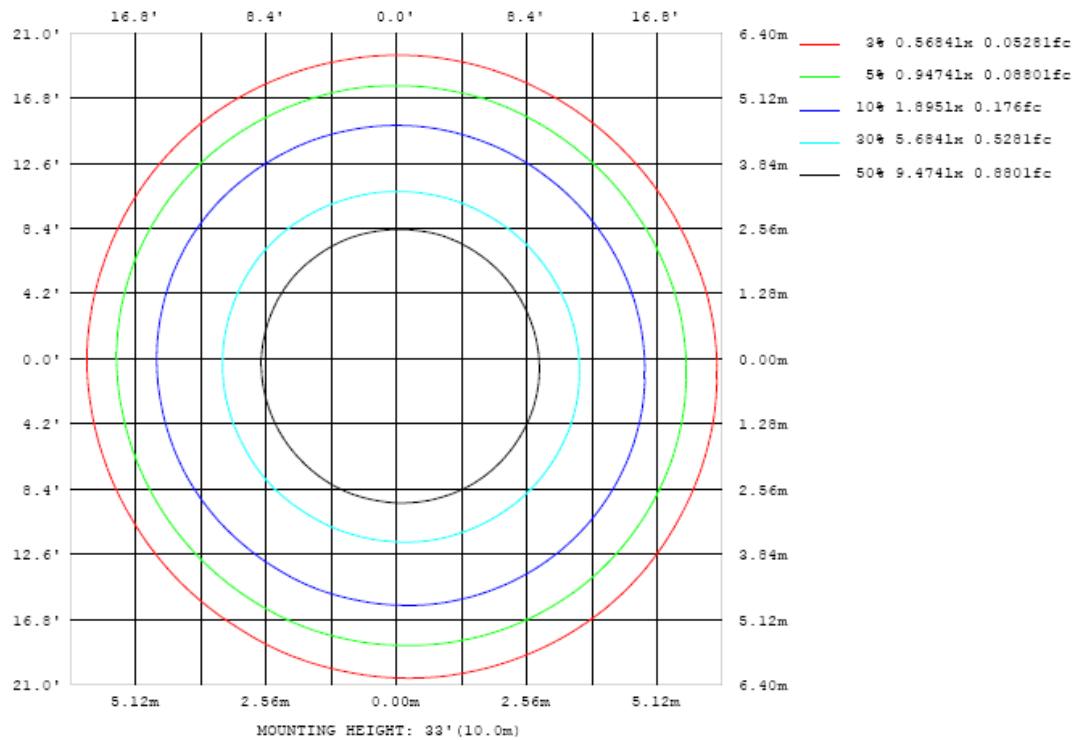


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

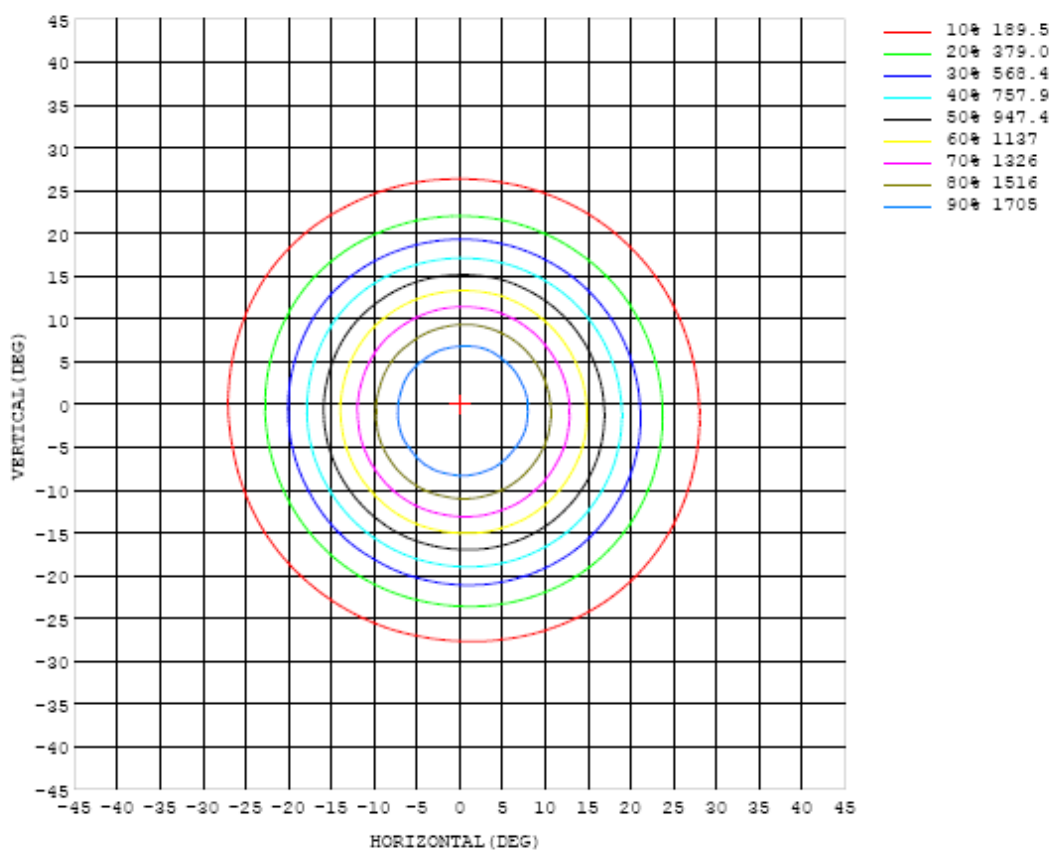


Chart 6: Isocandela Plot

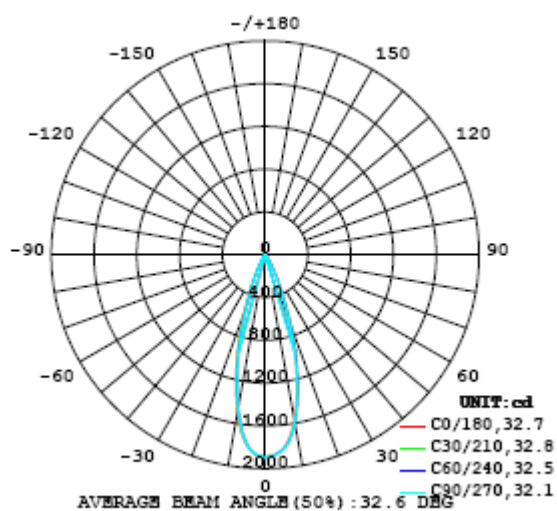


Chart 7: Polar Candela Distribution

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	1895	1895	1895	1895	1895	1895	1895	1895	1895	1895	1895	1895	1895	1895	1895	1895	1895	1895	1895
5	1827	1831	1829	1836	1832	1828	1835	1836	1831	1836	1838	1836	1836	1834	1831	1830	1822	1819	1808
10	1565	1575	1587	1590	1594	1598	1601	1599	1601	1595	1587	1582	1576	1568	1553	1543	1530	1509	1497
15	1120	1138	1155	1161	1166	1169	1169	1161	1154	1140	1129	1122	1110	1091	1077	1066	1055	1045	1036
20	657	680	695	701	704	703	696	687	678	661	647	635	619	616	607	593	588	582	574
25	305	316	324	329	330	329	325	316	308	298	288	282	274	270	269	268	266	264	264
30	135	140	144	145	145	144	141	137	133	129	125	122	117	115	114	112	112	112	114
35	59.9	62.1	62.3	63.6	64.5	65.6	65.6	64.4	62.2	61.0	59.0	56.9	54.3	53.1	51.3	50.2	49.6	49.3	48.9
40	30.8	31.6	31.9	32.2	32.8	33.6	34.1	34.2	33.9	32.9	31.7	30.5	29.5	28.7	28.3	27.7	27.7	27.4	26.9
45	21.0	21.5	21.7	21.9	22.2	22.4	22.7	22.8	22.7	22.2	21.6	20.9	20.3	20.1	19.8	19.4	19.2	19.1	18.9
50	16.3	16.7	16.9	16.9	17.0	17.1	17.3	17.4	17.4	17.1	16.8	16.5	16.3	16.2	16.0	15.8	15.7	15.6	15.5
55	13.8	14.0	14.2	14.2	14.3	14.4	14.5	14.5	14.4	14.4	14.3	14.1	14.0	14.0	14.0	13.8	13.7	13.5	13.5
60	12.3	12.6	12.7	12.7	12.7	12.8	12.9	12.9	12.7	12.8	12.9	12.6	12.5	12.5	12.9	12.7	12.4	12.3	12.2
65	10.8	11.1	11.2	11.3	11.3	11.4	11.5	11.4	11.6	11.4	11.2	11.2	11.2	11.0	11.0	10.9	10.7	10.8	10.8
70	9.44	9.82	9.79	9.88	9.97	10.0	10.0	10.0	10.1	9.87	9.71	9.79	9.60	9.45	9.26	9.16	9.06	9.20	9.03
75	7.39	7.62	7.50	7.58	7.66	7.57	7.66	7.61	7.63	7.54	7.57	7.60	7.42	7.31	7.14	7.11	6.95	7.08	7.14
80	5.44	5.54	5.47	5.57	5.61	5.56	5.69	5.62	5.65	5.57	5.61	5.59	5.54	5.42	5.36	5.36	5.11	5.01	4.90
85	3.71	3.75	3.75	3.82	3.79	3.74	3.71	3.70	3.83	3.74	3.72	3.67	3.74	3.67	3.62	3.57	3.44	3.19	3.10
90	2.14	2.06	2.19	2.31	2.17	2.14	1.97	1.99	2.04	2.09	2.06	2.13	2.04	2.02	1.88	1.91	1.72	1.83	1.77
95	1.01	1.01	1.08	1.09	1.06	1.10	1.13	1.03	1.13	1.11	1.10	1.15	1.06	1.03	1.04	1.01	0.91	0.94	0.91
100	0.42	0.40	0.42	0.44	0.42	0.43	0.46	0.46	0.44	0.45	0.44	0.45	0.43	0.43	0.39	0.35	0.34	0.32	0.33
105	0.12	0.13	0.13	0.13	0.14	0.15	0.15	0.15	0.14	0.15	0.14	0.14	0.13	0.13	0.12	0.11	0.10	0.09	0.08
110	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	0.00	0.00
115	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	0.00	0.00
120	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	0.00	0.00
125	0.01	0.01	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	0.01	0.01
130	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
135	0.01	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	0.02
140	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	0.03	0.03	0.03	0.03	0.03
145	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.05
150	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.09
155	0.12	0.12	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.12	0.12	0.12	0.15
160	0.18	0.18	0.18	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.18	0.18	0.18	0.18	0.19	0.19	0.21
165	0.25	0.25	0.25	0.24	0.25	0.25	0.24	0.24	0.24	0.24	0.25	0.25	0.25	0.25	0.25	0.26	0.26	0.26	0.27
170	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31
175	0.27	0.27	0.28	0.29	0.29	0.30	0.30	0.30	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.30
180	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26

Table 6: Luminous Intensity Data

Table--2		UNIT: cd																		
y (DEG)	C (DEG)	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350		
0		1895	1895	1895	1895	1895	1895	1895	1895	1895	1895	1895	1895	1895	1895	1895	1895	1895		
5		1811	1809	1806	1799	1799	1798	1798	1801	1803	1807	1813	1815	1814	1815	1818	1816	1822		
10		1483	1475	1467	1460	1449	1446	1446	1450	1456	1464	1473	1484	1496	1509	1522	1536	1551		
15		1022	1014	1002	991	978	970	965	960	963	970	983	997	1014	1035	1054	1074	1099		
20		567	559	553	545	533	523	516	514	515	516	523	532	547	565	586	609	634		
25		263	263	259	253	246	241	239	236	237	237	237	242	247	257	269	281	294		
30		113	111	110	108	106	104	102	101	102	103	103	105	107	111	116	121	128		
35		47.8	46.1	45.5	45.8	46.0	45.8	46.0	45.9	45.9	46.0	46.6	47.1	48.2	49.7	51.7	53.7	56.4		
40		26.3	26.0	25.6	25.6	25.7	25.9	26.3	26.7	26.7	26.7	26.6	26.8	27.1	28.0	28.7	29.5	30.2		
45		18.8	18.5	18.4	18.4	18.5	18.7	18.9	19.1	19.1	19.2	19.1	19.1	19.2	19.4	19.6	20.1	20.5		
50		15.6	15.6	15.6	15.8	15.7	15.6	15.8	15.8	15.6	15.6	15.5	15.4	15.5	15.5	15.5	15.7	16.0		
55		13.7	13.7	13.8	13.8	13.6	13.6	13.7	13.7	13.6	13.3	13.2	13.2	13.2	13.2	13.1	13.3	13.6		
60		12.3	12.4	12.5	12.5	12.4	12.3	12.3	12.3	12.2	11.9	11.9	12.1	12.0	12.2	12.0	12.1	12.4		
65		10.9	10.8	11.0	10.9	10.9	10.8	10.7	10.7	10.6	10.5	10.4	10.5	10.4	10.5	10.5	10.6	10.6		
70		9.27	9.04	8.99	8.99	8.88	8.77	8.63	8.82	8.73	8.83	8.80	8.82	8.84	8.88	8.96	9.02	9.11		
75		7.32	6.95	6.96	6.84	6.77	6.76	6.60	6.83	6.78	6.86	6.83	6.89	6.95	6.90	7.08	7.06	7.14		
80		5.04	4.86	4.72	4.64	4.62	4.58	4.53	4.67	4.68	4.82	4.75	4.75	4.92	5.09	5.32	5.24	5.42		
85		3.00	3.07	2.93	2.94	2.97	2.82	2.88	2.82	2.88	2.86	2.87	2.86	2.94	3.19	3.32	3.42	3.60		
90		1.66	1.64	1.63	1.59	1.59	1.64	1.57	1.55	1.59	1.57	1.59	1.63	1.61	1.77	1.86	1.95	2.05		
95		0.92	0.93	0.90	0.82	0.85	0.85	0.89	0.87	0.89	0.88	0.96	0.95	0.84	0.91	0.98	1.00	1.00		
100		0.30	0.31	0.28	0.28	0.29	0.29	0.26	0.27	0.29	0.28	0.31	0.33	0.31	0.31	0.34	0.36	0.36		
105		0.08	0.07	0.07	0.06	0.06	0.06	0.06	0.06	0.06	0.07	0.07	0.08	0.08	0.09	0.10	0.11	0.11		
110		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		
115		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		
120		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		
125		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		
130		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		
135		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		
140		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		
145		0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.05	0.06	0.05	0.05	0.05	0.05	0.05	0.05		
150		0.10	0.10	0.10	0.10	0.10	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.09	0.09	0.09	0.09		
155		0.16	0.17	0.17	0.17	0.17	0.17	0.16	0.16	0.16	0.16	0.16	0.16	0.15	0.15	0.15	0.15	0.14		
160		0.23	0.24	0.24	0.24	0.24	0.24	0.23	0.23	0.23	0.23	0.23	0.22	0.22	0.22	0.22	0.22	0.20		
165		0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.29	0.29	0.29	0.29	0.29	0.28	0.29	0.26		
170		0.34	0.34	0.34	0.34	0.33	0.33	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.29		
175		0.30	0.29	0.29	0.28	0.27	0.27	0.26	0.25	0.25	0.25	0.25	0.25	0.25	0.26	0.26	0.26	0.26		
180		0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26		

Table 7: Luminous Intensity Data

EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Aug. 14, 2018	Aug. 13, 2019
Digital Power Meter	PF2010A	HZTE028-01	Sep. 12, 2018	Sep. 11, 2019
AC Power Supply	DPS1060	HZTE001-06	Aug. 09, 2018	Aug. 08, 2019
DC Power Supply	WY12010	HZTE004-03	Aug. 09, 2018	Aug. 08, 2019
Temperature recorder	JM624U	HZTE018-08	Aug. 09, 2018	Aug. 08, 2019
Temperature and humidity recorder	JR900	HZTE018-01	Aug. 09, 2018	Aug. 08, 2019
Standard source	D908	HZTE012-01	Aug. 14, 2018	Aug. 13, 2019
Integrate Sphere system	3M	HZTE015-04	Aug. 16, 2018	Aug. 15, 2019
Digital Power Meter	WT210	HZTE008-01	Aug. 02, 2018	Aug. 01, 2019
AC Power Supply	PCR 500L	HZTE001-07	Aug. 09, 2018	Aug. 08, 2019
DC Power Supply	IT6154	HZTE004-04	Aug. 09, 2018	Aug. 08, 2019
Standard source	SCL-1400	HZTE012-02	Aug. 16, 2018	Aug. 15, 2019
Temperature and humidity recorder	JR900	HZTE018-02	Aug. 09, 2018	Aug. 08, 2019
Temperature Meter	TES1310	HZTE017-01	Aug. 09, 2018	Aug. 08, 2019

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 ***

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