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/940FL35/R

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ200600491

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. 15, 2020

Approved by: Jim Zhang

Manager: Jim Zhang

Oct. 15, 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/940FL35/R**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
93.5	563.9	6.03	0.9132

CCT (K)	CRI	Stabilization Time (Light & Power)
3951	96.5	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	: Jun. 25, 2020
Date of Test	: Jun. 25, 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

TABLE OF CONTENT

SAMPLE PHOTO

Figure 1- Overview of the sample

Equipment Under Test(EUT)	
Name	: LED Lamp
Model	: 7MR16DIM/940FL35/R
Electrical Ratings	: 12Vac, 50/60Hz, 7W
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 ℃.

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)	0.550
Power Factor	0.9132
Test Power (W)	6.03
THD A%	24.98
Luminous Efficacy (lm/W)	93.5
Total Luminous Flux (lm)	563.9
Color Rendering Index (CRI)	96.5
R9	90.2
Correlated Color Temperature (CCT)(K)	3951
Chromaticity Chroma x	0.3850
Chromaticity Chroma y	0.3869
Chromaticity Chroma u	0.2241
Chromaticity Chroma v	0.3378
Duv	0.0034
Chromaticity Chroma u ’	0.2241
Chromaticity Chroma v’	0.5066

Special Color Rendering Indices	
R1	98.2
R2	98.9
R3	98.2
R4	94.4
R5	95.4
R6	97.1
R7	95.1
R8	94.2
R9	90.2
R10	96.2
R11	96.6
R12	72.9
R13	98.3
R14	98.3

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 25.1 ℃.

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)	0.554
Power Factor	0.9137
Power (W)	6.07
Luminous Efficacy (lm/W)	95.4
Total Luminous Flux (lm)	578.9
Beam Angle (°)	32.5 (0^o-180^o) / 32.0 (90^o-270^o)
Center Beam Candle Power (cd)	1733
Maximum Beam Candle Power (cd)	1733 (At: C=0.0, Gamma=0.0)
Spacing Criteria	0.52 (0^o-180^o) / 0.53 (90^o-270^o)
Zonal Lumens in the 0 °-60 °Zone	97.62%
Zonal Lumens in the 60 °-90 °Zone	1.74%
Zonal Lumens in the 90 °-120 °Zone	0.35%
Zonal Lumens in the 120 °-180 °Zone	0.30%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

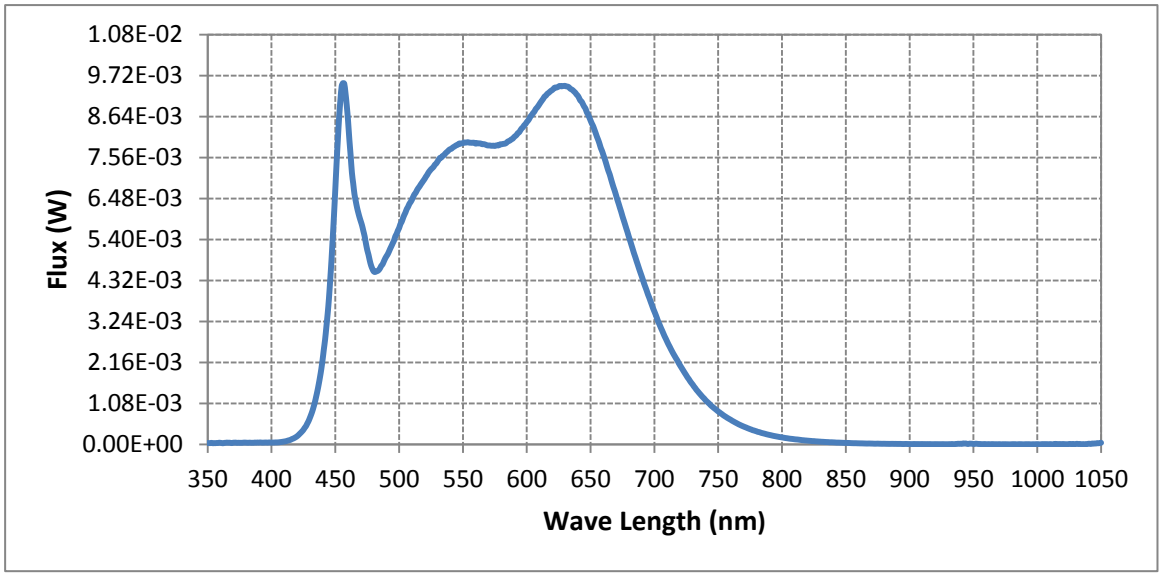
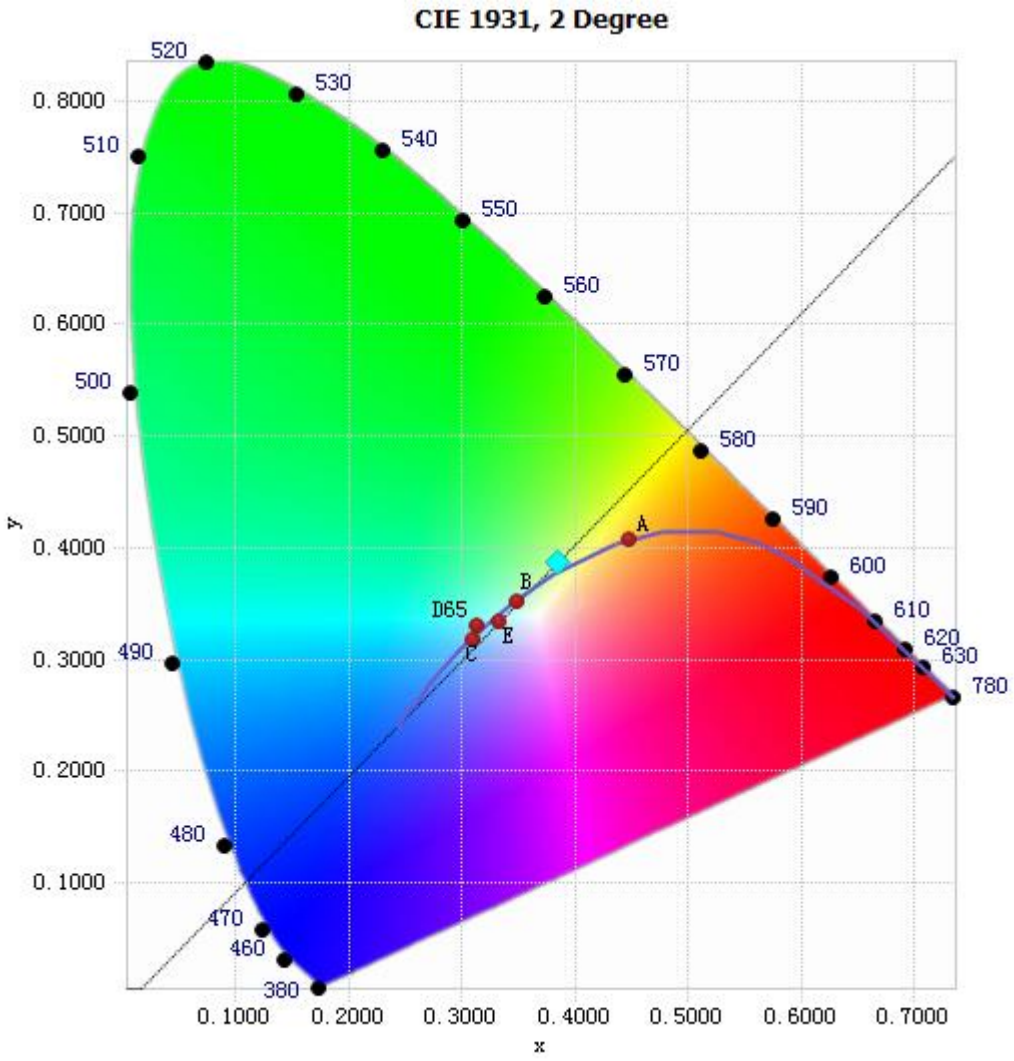


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	4.83E-05	485	4.64E-03	590	8.10E-03	695	3.95E-03
385	4.50E-05	490	4.96E-03	595	8.28E-03	700	3.51E-03
390	4.81E-05	495	5.30E-03	600	8.50E-03	705	3.08E-03
395	5.14E-05	500	5.71E-03	605	8.74E-03	710	2.71E-03
400	4.75E-05	505	6.12E-03	610	8.97E-03	715	2.38E-03
405	5.53E-05	510	6.45E-03	615	9.19E-03	720	2.09E-03
410	7.85E-05	515	6.76E-03	620	9.34E-03	725	1.82E-03
415	1.25E-04	520	7.00E-03	625	9.43E-03	730	1.58E-03
420	2.15E-04	525	7.25E-03	630	9.45E-03	735	1.36E-03
425	3.87E-04	530	7.45E-03	635	9.36E-03	740	1.17E-03
430	6.96E-04	535	7.62E-03	640	9.19E-03	745	1.01E-03
435	1.26E-03	540	7.78E-03	645	8.90E-03	750	8.70E-04
440	2.23E-03	545	7.89E-03	650	8.54E-03	755	7.49E-04
445	3.85E-03	550	7.94E-03	655	8.11E-03	760	6.46E-04
450	6.73E-03	555	7.95E-03	660	7.63E-03	765	5.51E-04
455	9.44E-03	560	7.93E-03	665	7.12E-03	770	4.72E-04
460	8.52E-03	565	7.91E-03	670	6.56E-03	775	4.04E-04
465	6.60E-03	570	7.88E-03	675	6.01E-03	780	3.47E-04
470	5.88E-03	575	7.87E-03	680	5.47E-03		
475	5.13E-03	580	7.91E-03	685	4.94E-03		
480	4.57E-03	585	7.98E-03	690	4.44E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3850, 0.3869)

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

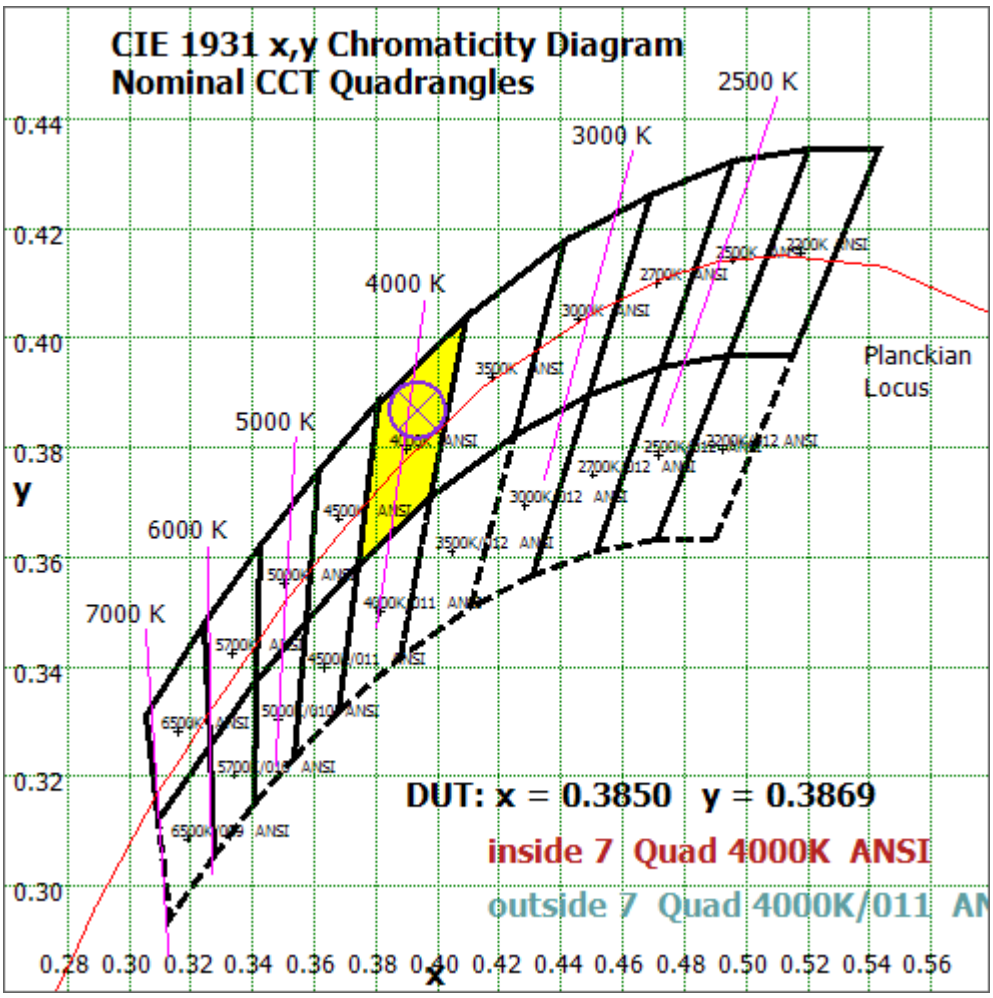


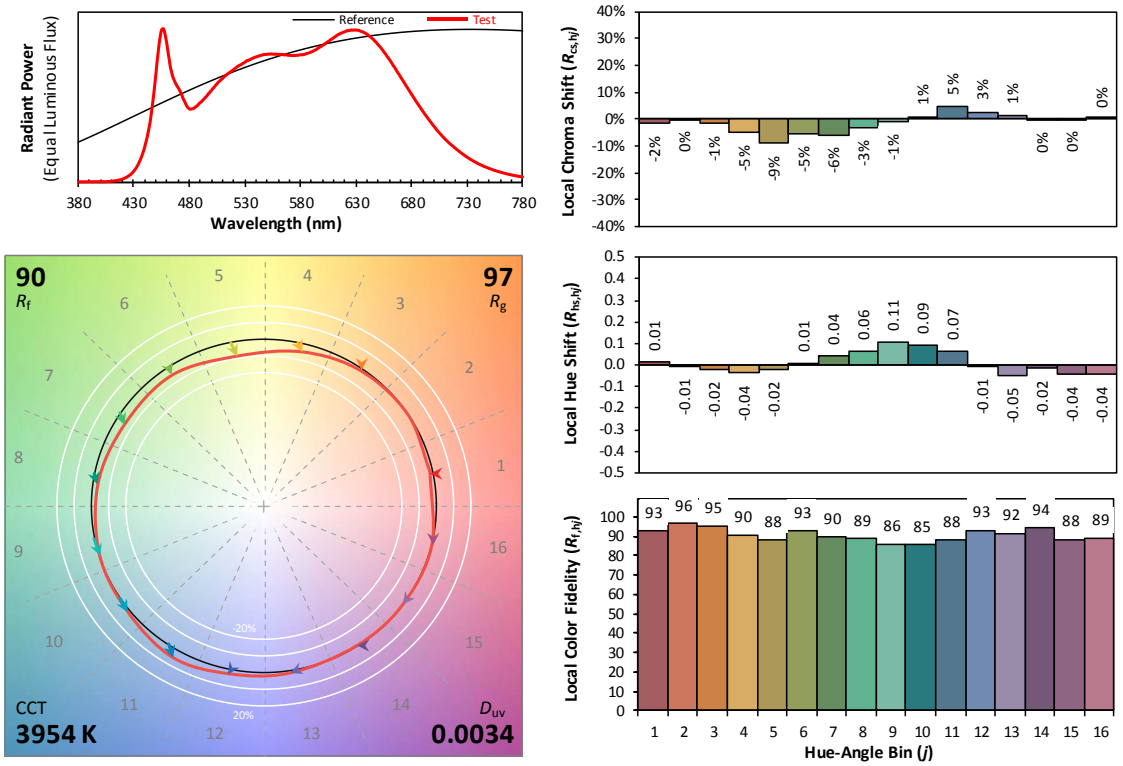
Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

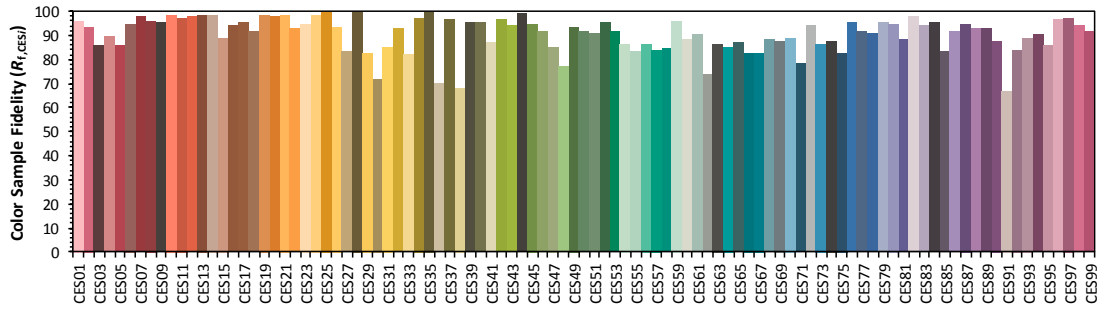
Color Rendition Report – Sphere Spectroradiometer Method

ANSI/IES TM-30-18 Color Rendition Report

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

Date: 2020/06/25 **Model:** 7MR16DIM/940FL35/R





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

x	0.3850
y	0.3869
u'	0.2241
v'	0.5066

CIE 13.3-1995 (CRI)

R_a	96
R_9	91

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	140.892	24.34%
10- 20	256.036	44.23%
20- 30	118.142	20.41%
30- 40	32.026	5.53%
40- 50	10.933	1.89%
50- 60	7.103	1.23%
60- 70	5.386	0.93%
70- 80	3.209	0.55%
80- 90	1.483	0.26%
90-100	0.573	0.10%
100-110	0.679	0.12%
110-120	0.749	0.13%
120-130	1.255	0.22%
130-140	0.097	0.02%
140-150	0.108	0.02%
150-160	0.118	0.02%
160-170	0.097	0.02%
170-180	0.033	0.01%
Total	578.9	100%

γ(°)	Lumens	% Total
0- 60	565.132	97.62%
60- 90	10.078	1.74%
0-90	575.21	99.36%
90- 180	3.709	0.64%
0- 180	578.9	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

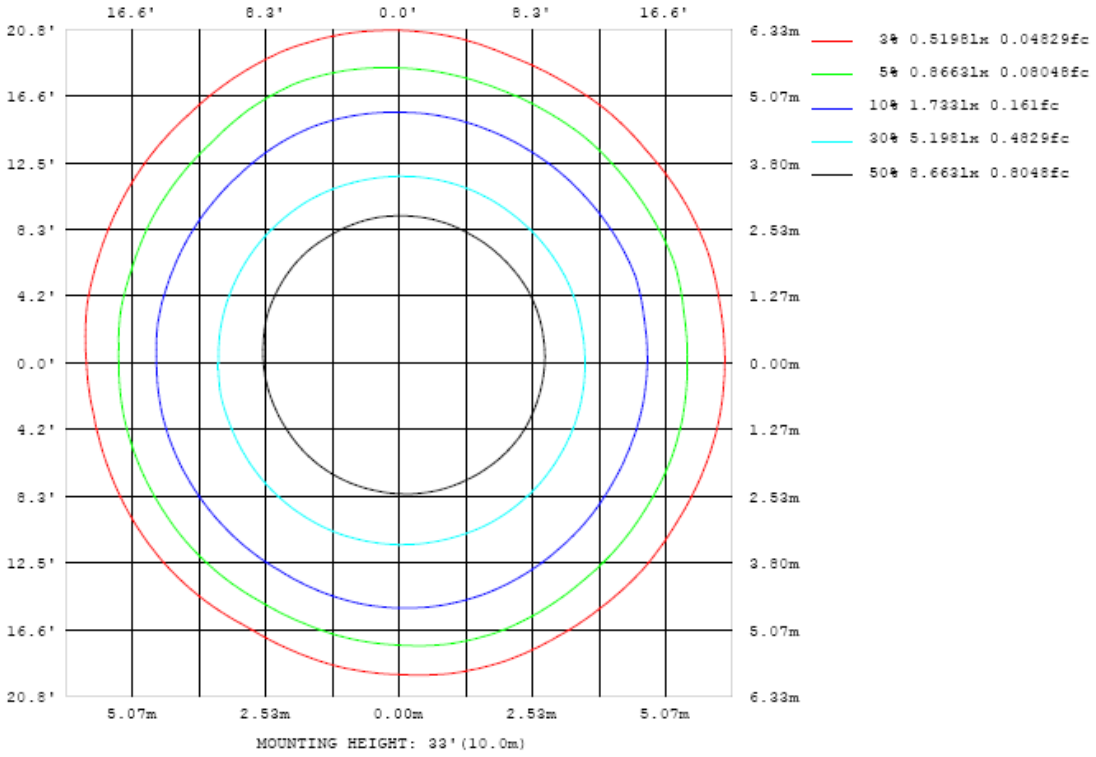


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

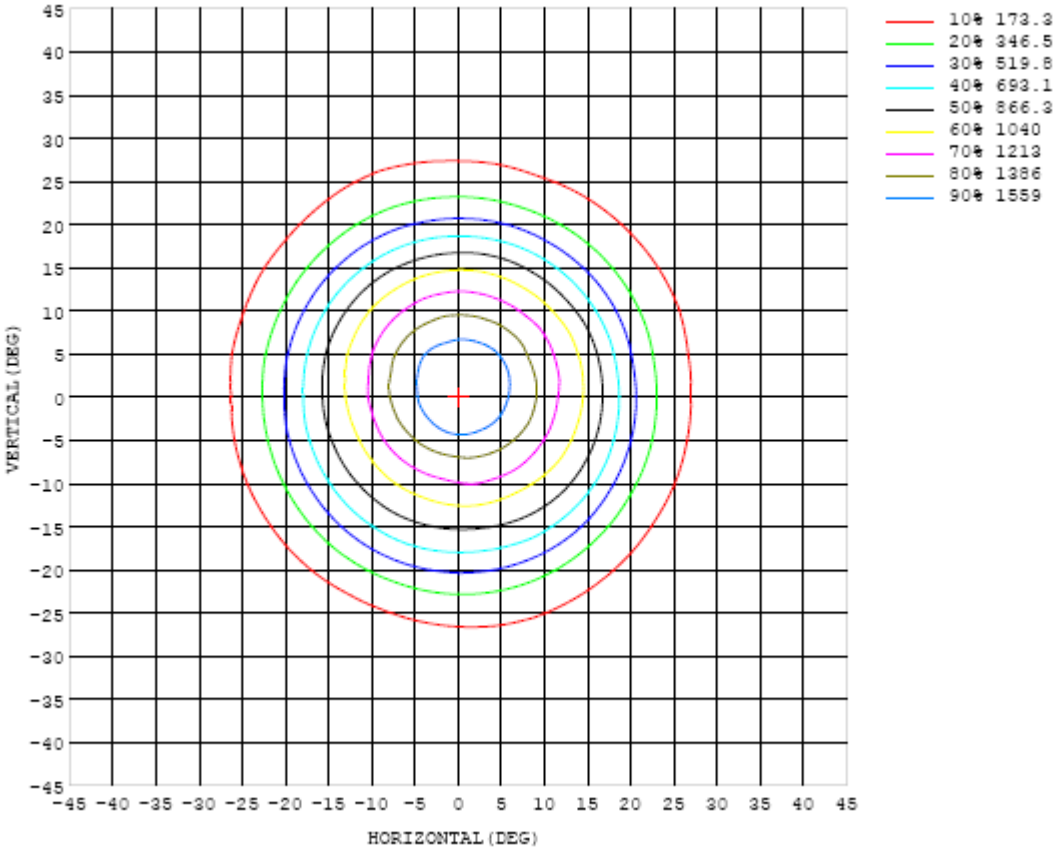


Chart 6: Isocandela Plot

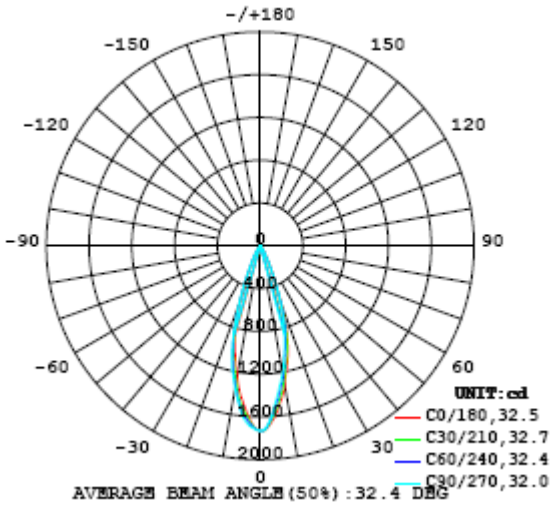


Chart 7: Polar Candela Distribution

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	1733	1733	1733	1733	1733	1733	1733	1733	1733	1733	1733	1733	1733	1733	1733	1733	1733	1733	1733
5	1599	1587	1576	1569	1557	1544	1532	1523	1515	1509	1507	1508	1505	1503	1508	1516	1525	1537	1543
10	1323	1309	1300	1282	1268	1257	1239	1229	1225	1205	1190	1187	1190	1194	1200	1208	1214	1224	1243
15	1004	988	977	969	950	933	920	905	892	885	883	882	884	884	886	889	893	907	921
20	573	572	571	564	568	564	561	553	551	546	539	536	531	528	525	526	530	537	535
25	245	241	234	231	232	231	234	235	235	231	225	215	207	209	211	214	219	221	221
30	107	107	105	101	99.5	98.0	97.4	96.8	93.7	89.6	87.4	83.4	80.6	84.1	86.8	87.4	86.9	87.8	90.8
35	52.9	52.2	50.3	49.3	48.6	46.4	44.2	44.3	43.2	41.4	40.8	39.3	38.2	38.6	38.0	38.1	38.9	39.6	42.1
40	24.3	24.1	23.9	23.0	23.0	22.8	22.7	22.8	22.4	22.2	21.6	21.3	20.8	20.1	19.5	19.3	19.7	20.0	20.8
45	14.1	14.1	13.8	13.5	13.5	13.9	14.1	14.2	14.5	14.6	14.4	14.1	13.8	13.3	13.0	12.7	12.6	12.6	12.7
50	10.1	10.1	9.99	9.86	9.82	9.85	9.87	9.87	9.93	9.86	9.79	9.72	9.69	9.44	9.11	8.95	9.09	9.18	9.30
55	8.05	8.05	8.06	8.05	8.24	8.39	8.41	8.38	8.41	8.50	8.59	8.56	8.35	8.00	7.54	7.16	7.13	7.21	7.36
60	6.75	6.74	6.74	6.80	7.06	7.42	7.53	7.57	7.56	7.62	7.62	7.52	7.14	6.63	6.26	6.08	6.01	6.04	6.20
65	5.68	5.78	5.69	5.70	5.82	5.78	5.79	5.79	5.80	5.78	5.70	5.56	5.49	5.41	5.28	5.19	5.15	5.11	5.23
70	4.21	4.49	4.19	4.28	4.60	4.30	4.33	4.47	4.36	4.37	4.41	4.17	4.15	4.15	3.97	3.90	3.91	3.83	3.94
75	3.07	3.19	3.08	3.16	3.36	3.23	3.25	3.37	3.27	3.28	3.38	3.15	3.14	3.16	3.04	2.99	3.00	2.94	2.97
80	1.98	1.97	2.02	2.03	2.08	2.15	2.13	2.13	2.16	2.13	2.06	2.02	1.98	1.97	1.95	1.92	1.91	1.91	1.91
85	1.34	1.35	1.32	1.37	1.43	1.50	1.50	1.48	1.43	1.42	1.36	1.31	1.36	1.34	1.34	1.44	1.46	1.41	1.40
90	0.84	0.91	0.80	0.86	0.94	0.93	0.95	1.00	0.90	0.89	0.89	0.79	0.83	0.90	0.90	0.96	1.02	0.96	0.97
95	0.49	0.50	0.43	0.50	0.50	0.47	0.55	0.54	0.48	0.54	0.50	0.44	0.45	0.46	0.43	0.45	0.46	0.45	0.46
100	0.44	0.43	0.40	0.41	0.41	0.41	0.43	0.43	0.41	0.43	0.41	0.38	0.39	0.38	0.38	0.40	0.41	0.39	0.42
105	1.24	0.75	0.50	1.98	1.10	0.56	1.85	0.91	0.47	2.23	0.65	0.48	2.22	0.62	0.68	2.31	0.51	0.74	2.28
110	0.45	0.43	0.56	0.48	0.47	0.51	0.54	0.51	0.44	0.54	0.56	0.41	0.45	0.53	0.37	0.42	0.48	0.34	0.41
115	0.37	0.36	0.35	0.38	0.38	0.35	0.35	0.36	0.37	0.37	0.36	0.45	0.38	0.37	0.47	0.36	0.37	0.39	0.32
120	1.49	2.62	1.01	2.13	2.89	1.03	2.56	2.83	0.51	2.91	2.31	2.65	3.25	2.02	4.51	3.22	1.62	4.51	2.55
125	0.96	2.91	0.65	1.40	3.25	0.79	2.45	3.36	0.44	3.44	2.52	0.79	2.50	1.22	1.15	1.83	1.14	1.48	1.61
130	0.13	0.14	0.14	0.14	0.14	0.14	0.15	0.15	0.14	0.14	0.15	0.14	0.14	0.14	0.14	0.13	0.13	0.12	0.11
135	0.12	0.13	0.14	0.13	0.13	0.14	0.14	0.13	0.15	0.14	0.13	0.13	0.13	0.13	0.14	0.13	0.13	0.13	0.13
140	0.14	0.14	0.15	0.15	0.14	0.15	0.15	0.15	0.16	0.16	0.15	0.15	0.14	0.14	0.16	0.14	0.14	0.15	0.14
145	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.18	0.18	0.18	0.17	0.17	0.17	0.17	0.17	0.18	0.17	0.17
150	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.22	0.22	0.22	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21
155	0.25	0.26	0.26	0.26	0.26	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.25	0.25
160	0.29	0.31	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.30	0.30
165	0.34	0.35	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.38	0.37	0.35	0.34
170	0.37	0.37	0.37	0.38	0.37	0.37	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.37	0.36	0.35	0.35	0.36
175	0.34	0.34	0.34	0.34	0.33	0.32	0.33	0.36	0.35	0.34	0.33	0.30	0.30	0.30	0.30	0.31	0.31	0.31	0.32
180	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29

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	1733	1733	1733	1733	1733	1733	1733	1733	1733	1733	1733	1733	1733	1733	1733	1733	1733		
5	1551	1564	1578	1591	1601	1612	1621	1628	1639	1646	1649	1646	1645	1641	1630	1623	1611		
10	1257	1273	1297	1311	1324	1336	1344	1353	1358	1357	1360	1363	1365	1362	1345	1335	1333		
15	936	957	968	983	994	996	1009	1016	1020	1021	1022	1017	1021	1022	1029	1021	1013		
20	543	549	553	559	563	573	575	573	578	582	584	582	579	582	585	583	570		
25	230	229	231	234	238	250	258	256	253	253	250	248	248	249	255	259	248		
30	96.1	97.6	102	107	110	117	123	121	117	115	112	111	113	111	113	114	108		
35	45.6	46.2	48.5	51.7	52.9	56.0	57.8	57.6	57.9	57.2	54.3	52.6	53.4	52.3	53.1	54.6	54.1		
40	21.3	21.1	21.6	22.1	23.0	23.7	24.5	25.2	25.6	25.4	24.2	23.5	23.2	23.4	23.8	24.5	24.7		
45	12.6	12.5	12.4	12.3	12.6	12.8	13.0	13.3	13.3	13.2	13.2	13.0	13.1	13.1	13.5	13.7	14.0		
50	9.18	9.03	8.89	8.98	9.21	9.33	9.48	9.55	9.58	9.54	9.48	9.49	9.54	9.56	9.71	9.92	10.1		
55	7.44	7.37	7.33	7.44	7.69	7.76	7.77	7.70	7.73	7.82	7.82	7.82	7.81	7.82	7.84	7.95	8.00		
60	6.33	6.32	6.29	6.32	6.40	6.45	6.47	6.48	6.50	6.53	6.56	6.59	6.60	6.64	6.59	6.62	6.68		
65	5.30	5.30	5.34	5.32	5.31	5.36	5.39	5.37	5.40	5.44	5.38	5.42	5.47	5.50	5.48	5.54	5.61		
70	3.93	3.87	4.01	3.98	3.92	4.02	4.06	3.95	4.04	4.20	3.98	4.05	4.32	4.05	4.09	4.29	4.12		
75	2.94	2.88	2.86	2.86	2.87	2.89	3.12	2.96	2.87	2.94	2.87	2.89	2.93	2.94	2.94	3.00	3.02		
80	1.87	1.85	1.84	1.85	1.88	1.92	1.95	1.94	1.89	1.88	1.90	1.90	1.91	1.96	1.95	1.96	2.01		
85	1.31	1.21	1.28	1.27	1.25	1.38	1.39	1.26	1.32	1.28	1.17	1.26	1.28	1.24	1.31	1.35	1.34		
90	0.91	0.78	0.86	0.86	0.76	0.85	0.87	0.77	0.83	0.85	0.66	0.73	0.78	0.66	0.73	0.84	0.78		
95	0.43	0.40	0.40	0.41	0.39	0.44	0.45	0.42	0.45	0.47	0.42	0.44	0.45	0.42	0.46	0.48	0.44		
100	0.39	0.38	0.42	0.40	0.41	0.48	0.48	0.44	0.49	0.47	0.42	0.47	0.45	0.41	0.45	0.45	0.43		
105	0.58	0.55	1.59	0.64	0.49	1.10	0.59	0.48	0.87	0.72	0.42	1.02	0.76	0.40	1.43	0.68	0.46		
110	0.44	0.37	0.41	0.41	0.42	0.44	0.46	0.54	0.40	0.42	0.55	0.38	0.38	0.50	0.39	0.39	0.55		
115	0.51	0.61	0.38	0.54	0.72	0.41	0.48	0.93	0.42	0.38	0.42	0.37	0.33	0.31	0.33	0.33	0.34		
120	1.87	4.38	2.18	1.63	4.65	2.90	1.09	2.77	2.93	1.46	0.44	2.97	2.56	0.44	1.98	2.80	0.93		
125	0.88	1.17	0.78	0.68	0.62	0.47	0.56	0.29	0.47	0.70	0.21	0.51	0.52	0.16	0.67	0.91	0.14		
130	0.12	0.12	0.13	0.12	0.12	0.13	0.13	0.12	0.12	0.14	0.12	0.10	0.10	0.10	0.10	0.10	0.11		
135	0.13	0.12	0.12	0.12	0.12	0.13	0.13	0.12	0.11	0.10	0.11	0.10	0.09	0.10	0.10	0.10	0.11		
140	0.14	0.14	0.14	0.14	0.15	0.15	0.14	0.14	0.14	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.14		
145	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.16	0.17	0.16	0.17	0.17	0.17		
150	0.21	0.21	0.20	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.20	0.20	0.20	0.20	0.20	0.21	0.21		
155	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		
160	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29		
165	0.34	0.34	0.34	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.34	0.34	0.34		
170	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.37	0.37		
175	0.33	0.33	0.34	0.34	0.34	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35		
180	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29		

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

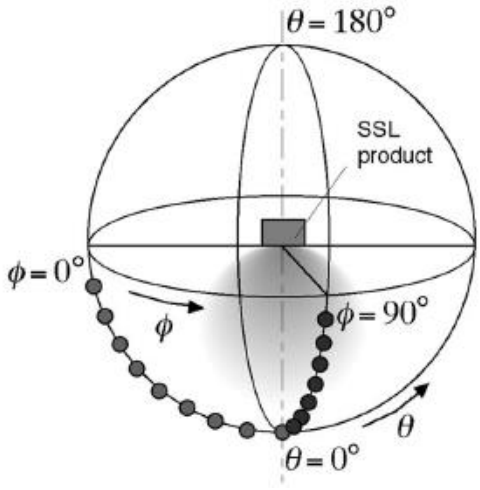
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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