LM-79-08 TEST REPORT

for

GREEN CREATIVE LTD

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

LED Lamp

Model: 11PAR30SNDIM/930FL40

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ19050046y

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

Review by: April Zou

Engineer: April Zou
Jul. 10, 2019

Approved by: Jim Zhang

Manager: Jim Zhang
Jul. 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: **11PAR30SNDIM/930FL40**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
96.1	1051.1	10.94	0.9160

CCT (K)	CRI	Stabilization Time (Light & Power)
3025	98.0	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 : May 29, 2019

Date of Test : Jul. 01, 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	: 11PAR30SNDIM/930FL40
Electrical Ratings	: 120V, 60Hz, 11W
Product Description	: 3000K
Manufacturer	: GREEN CREATIVE LTD
Address	: 756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

TEST RESULTS

Test ambient temperature was 25.0 ℃.

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)	120.0
Voltage frequency (Hz)	60
Test Current (A)	0.010
Power Factor	0.9160
Test Power (W)	10.94
THD A%	36.67
Luminous Efficacy (lm/W)	96.1
Total Luminous Flux (lm)	1051.1
Color Rendering Index (CRI)	98.0
R9	90.1
Correlated Color Temperature (CCT)(K)	3025
Chromaticity Chroma x	0.4356
Chromaticity Chroma y	0.4047
Chromaticity Chroma u	0.2495
Chromaticity Chroma v	0.3476
Duv	0.0005
Chromaticity Chroma u ’	0.2495
Chromaticity Chroma v’	0.5214

Special Color Rendering Indices	
R1	99.3
R2	99.9
R3	98
R4	98.6
R5	98.3
R6	97.8
R7	97
R8	95.4
R9	90.1
R10	98.2
R11	99.3
R12	84.3
R13	99.5
R14	97.9

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 ℃.

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)	0.099
Power Factor	0.9199
Power (W)	10.97
Luminous Efficacy (lm/W)	96.7
Total Luminous Flux (lm)	1061.2
Beam Angle (°)	35.3 (0^o-180^o) / 35.1 (90^o-270^o)
Center Beam Candle Power (cd)	2103
Maximum Beam Candle Power (cd)	2111 (At: C=350.0, Gamma=1.5)
Spacing Criteria	0.58 (0^o-180^o) / 0.57 (90^o-270^o)
Zonal Lumens in the 0 °-60 °Zone	95.03%
Zonal Lumens in the 60 °-90 °Zone	4.81%
Zonal Lumens in the 90 °-120 °Zone	0.03%
Zonal Lumens in the 120 °-180 °Zone	0.12%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

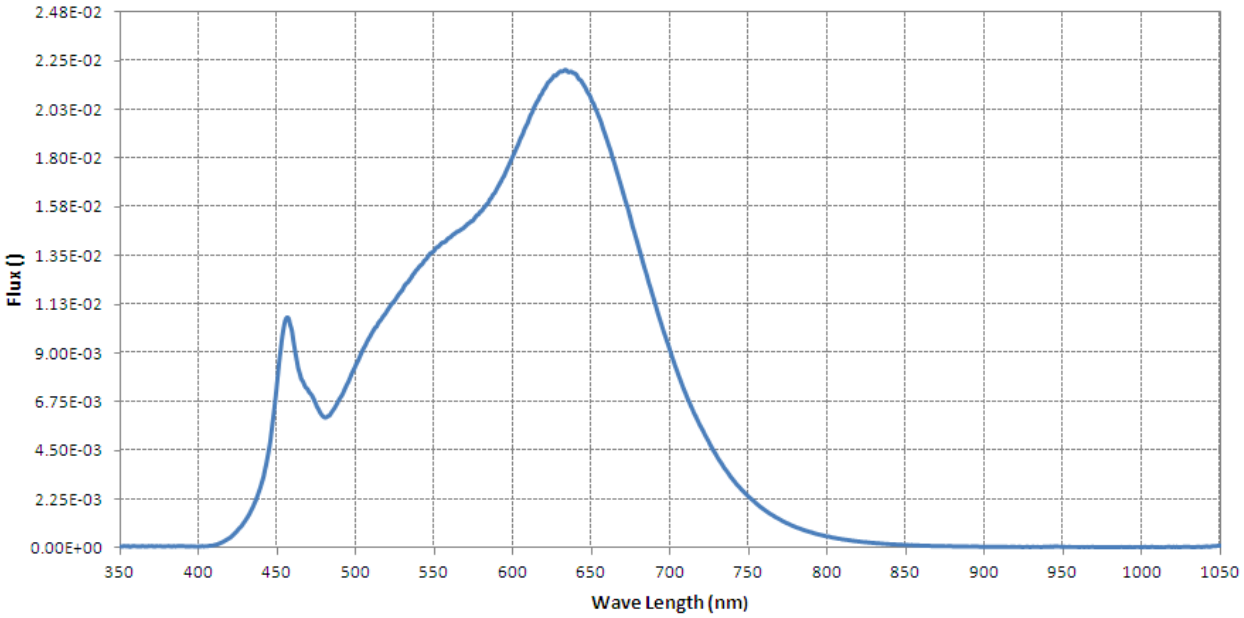
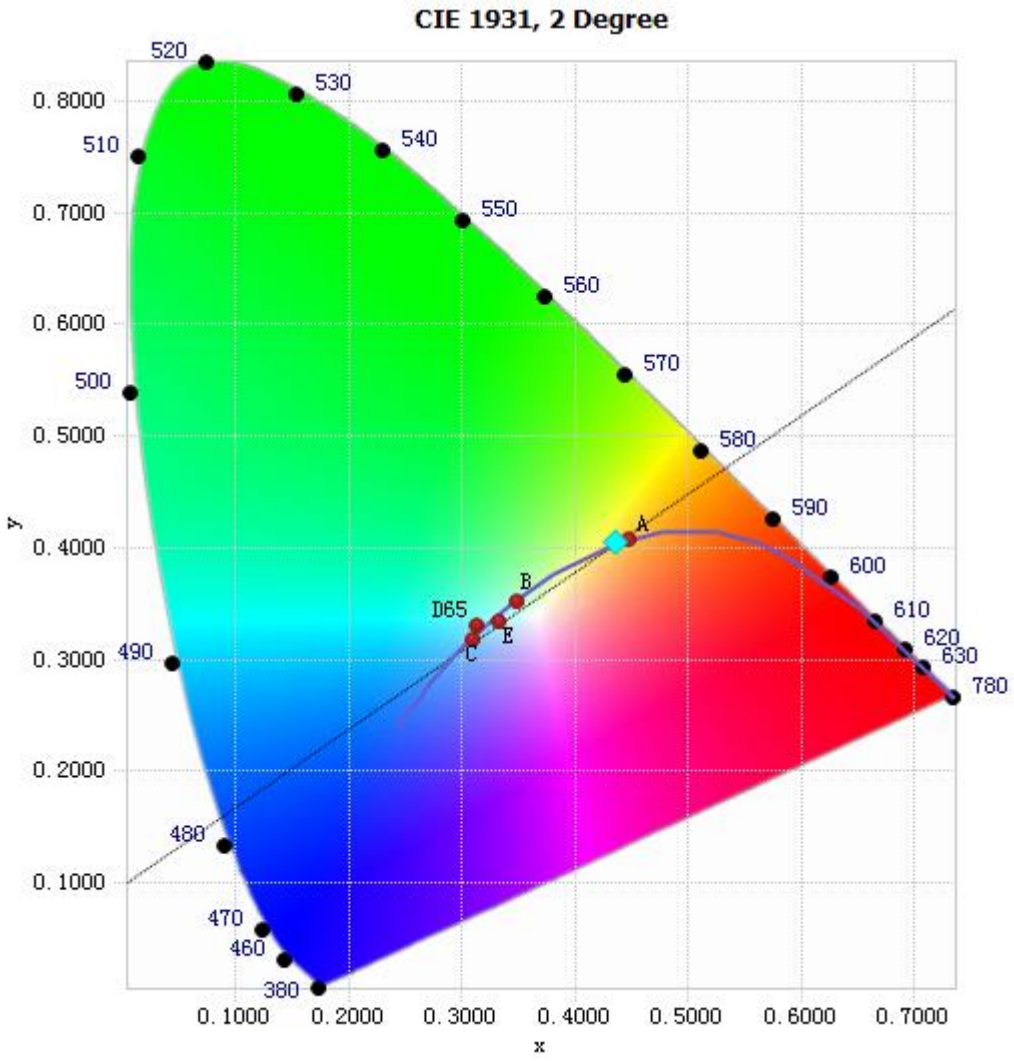


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	5.34E-05	485	6.31E-03	590	1.67E-02	695	1.01E-02
385	4.62E-05	490	6.94E-03	595	1.74E-02	700	9.05E-03
390	5.65E-05	495	7.67E-03	600	1.81E-02	705	7.98E-03
395	5.40E-05	500	8.47E-03	605	1.90E-02	710	7.04E-03
400	4.51E-05	505	9.24E-03	610	1.98E-02	715	6.20E-03
405	5.20E-05	510	9.92E-03	615	2.06E-02	720	5.48E-03
410	1.13E-04	515	1.05E-02	620	2.12E-02	725	4.79E-03
415	2.42E-04	520	1.10E-02	625	2.17E-02	730	4.15E-03
420	4.62E-04	525	1.15E-02	630	2.20E-02	735	3.60E-03
425	8.30E-04	530	1.20E-02	635	2.20E-02	740	3.10E-03
430	1.30E-03	535	1.25E-02	640	2.19E-02	745	2.68E-03
435	1.99E-03	540	1.30E-02	645	2.14E-02	750	2.33E-03
440	3.01E-03	545	1.34E-02	650	2.06E-02	755	2.01E-03
445	4.76E-03	550	1.38E-02	655	1.98E-02	760	1.73E-03
450	7.84E-03	555	1.41E-02	660	1.88E-02	765	1.48E-03
455	1.05E-02	560	1.43E-02	665	1.76E-02	770	1.28E-03
460	9.57E-03	565	1.46E-02	670	1.64E-02	775	1.10E-03
465	7.80E-03	570	1.49E-02	675	1.51E-02	780	9.26E-04
470	7.19E-03	575	1.52E-02	680	1.38E-02		
475	6.51E-03	580	1.56E-02	685	1.26E-02		
480	6.01E-03	585	1.61E-02	690	1.13E-02		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4356, 0.4047)

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

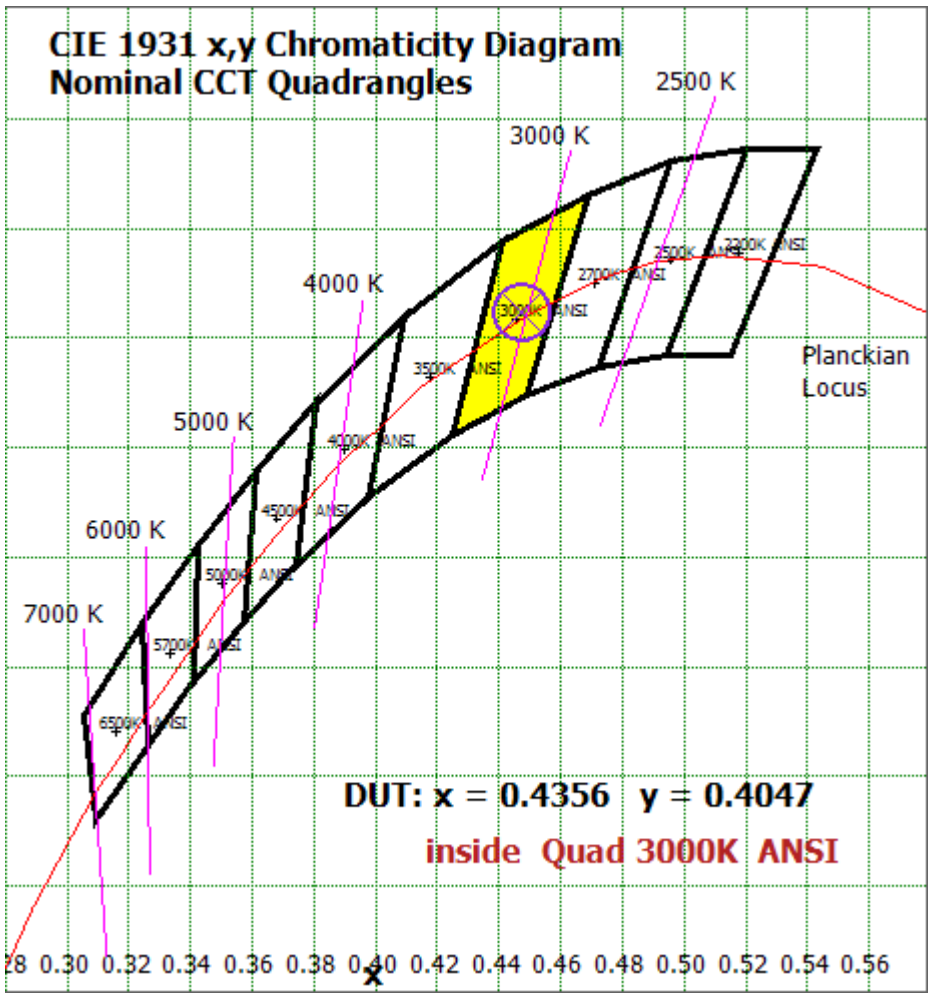
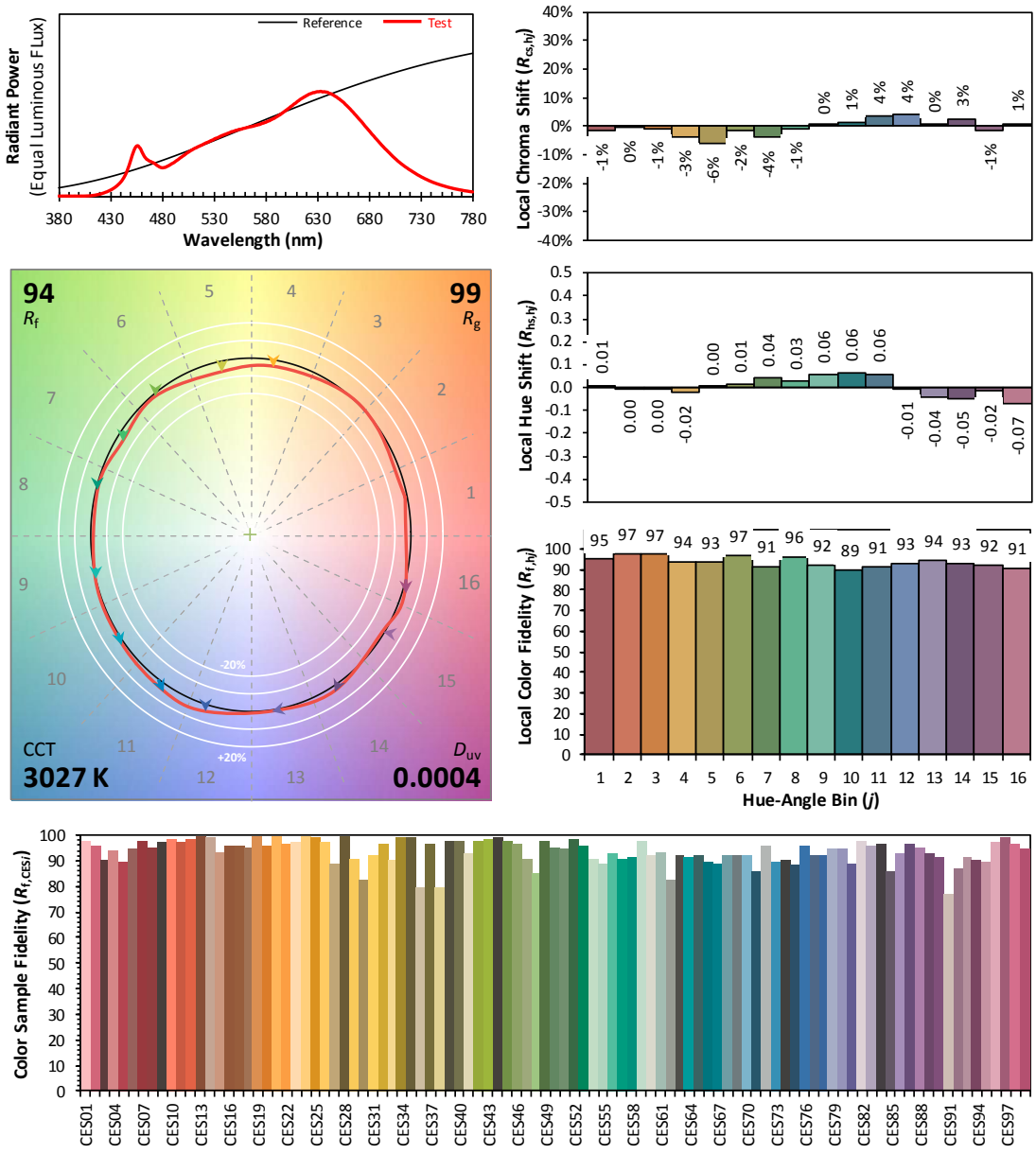


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method



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

x	0.4356
y	0.4047
u'	0.2495
v'	0.5214

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	183.883	17.33%
10- 20	350.898	33.07%
20- 30	247.719	23.34%
30- 40	120.407	11.35%
40- 50	62.337	5.87%
50- 60	43.268	4.08%
60- 70	28.784	2.71%
70- 80	16.586	1.56%
80- 90	5.675	0.53%
90-100	0.303	0.03%
100-110	0.017	0.00%
110-120	0.03	0.00%
120-130	0.069	0.01%
130-140	0.177	0.02%
140-150	0.316	0.03%
150-160	0.367	0.03%
160-170	0.281	0.03%
170-180	0.093	0.01%
Total	1061.2	100%

γ(°)	Lumens	% Total
0- 60	1008.512	95.03%
60- 90	51.045	4.81%
0-90	1059.557	99.84%
90- 180	1.653	0.16%
0- 180	1061.2	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

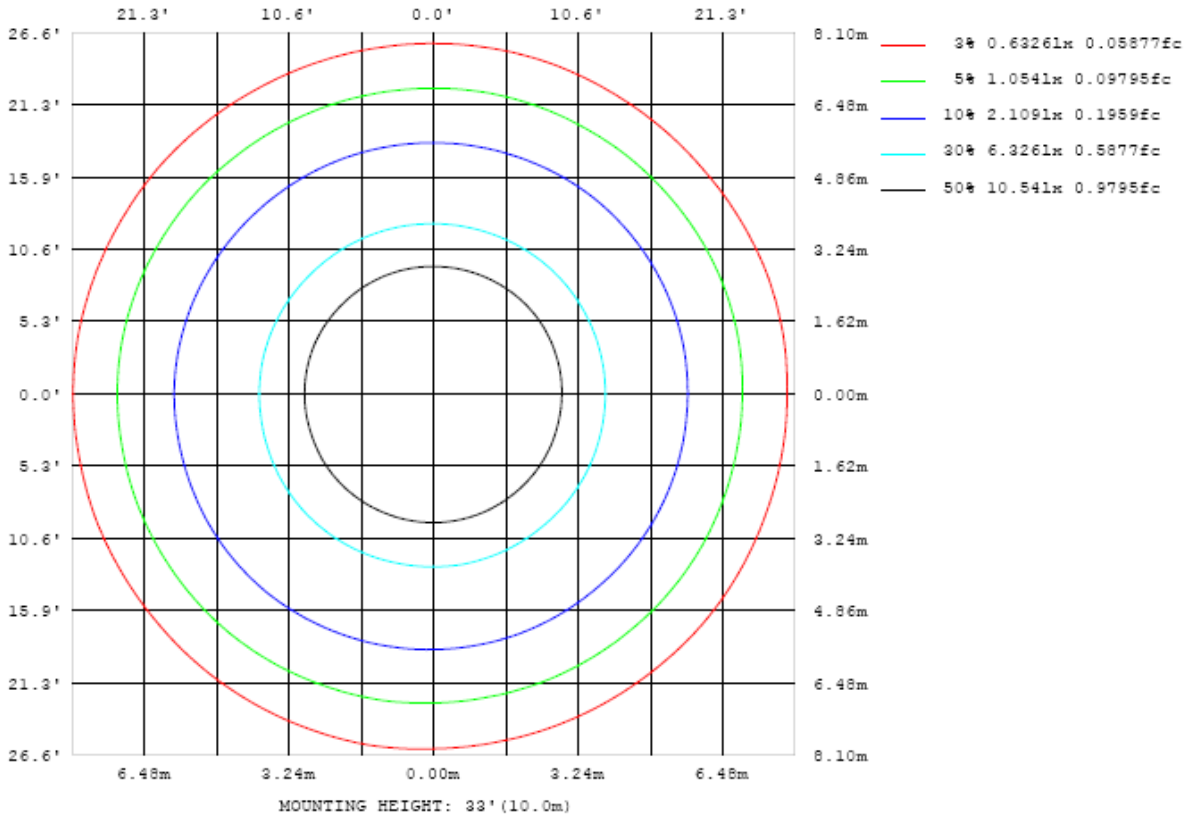


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

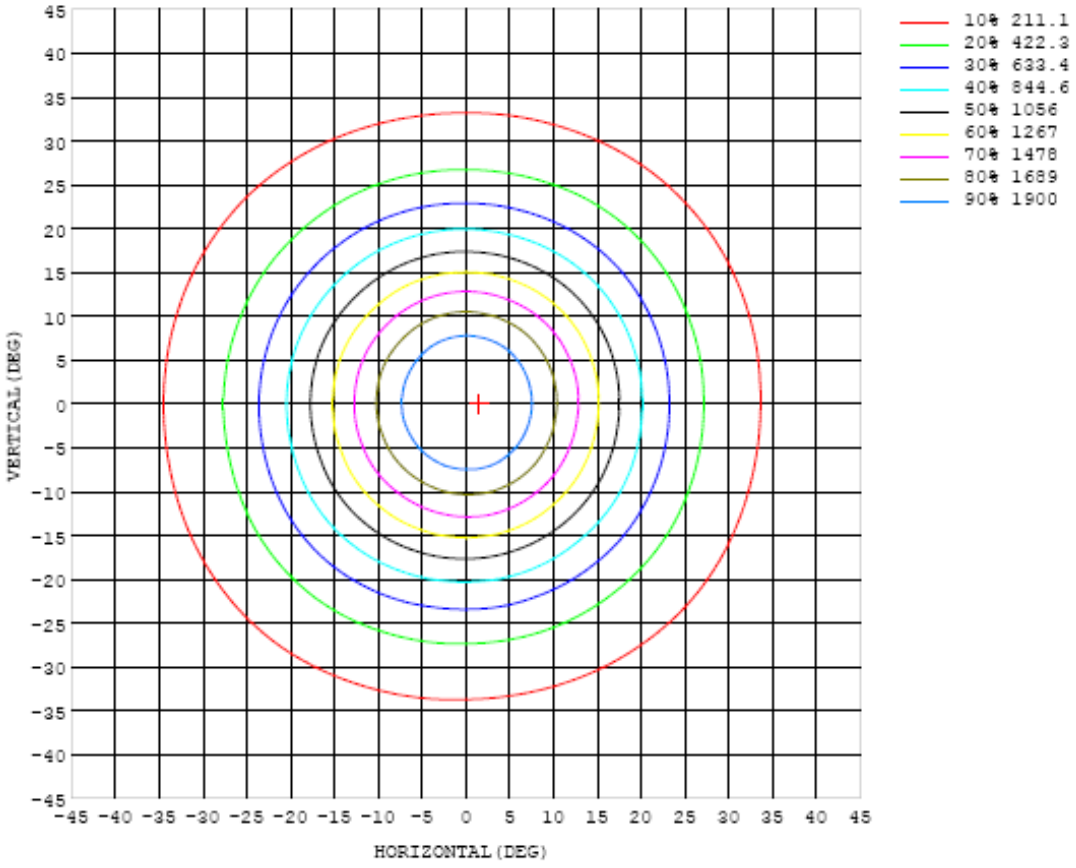


Chart 6: Isocandela Plot

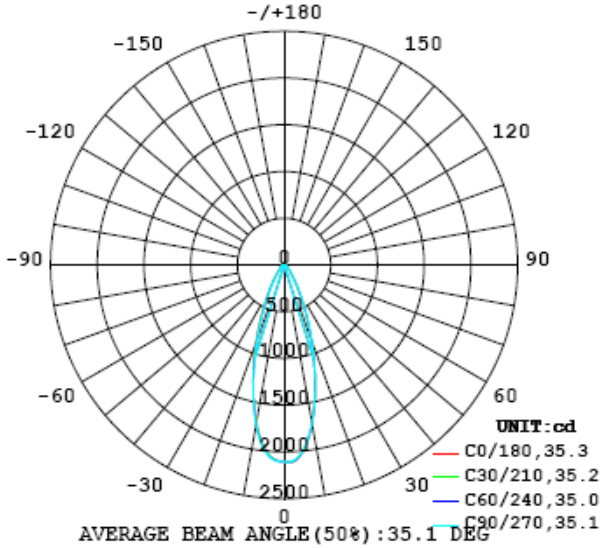


Chart 7: Polar Candela Distribution

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	2103	2103	2103	2103	2103	2103	2103	2103	2103	2103	2103	2103	2103	2103	2103	2103	2103	2103	2103
5	2040	2039	2038	2037	2036	2038	2036	2036	2036	2031	2028	2027	2024	2024	2022	2023	2023	2023	2024
10	1720	1715	1717	1718	1723	1723	1721	1721	1720	1716	1713	1708	1705	1705	1705	1705	1702	1707	1709
15	1281	1275	1278	1281	1281	1281	1284	1288	1289	1289	1288	1286	1288	1288	1291	1290	1285	1287	1288
20	855	854	856	858	855	853	858	862	867	867	870	874	880	883	886	886	881	880	882
25	528	528	529	529	528	526	530	534	536	539	543	548	555	559	561	560	556	554	556
30	309	309	309	309	308	307	309	312	314	316	320	324	329	333	335	334	333	332	334
35	184	183	182	183	182	181	182	182	182	184	188	190	194	197	199	200	201	201	201
40	113	113	113	113	114	113	113	114	114	116	118	118	119	120	120	120	122	122	123
45	76.4	76.8	76.0	76.5	77.0	76.6	76.8	77.1	77.7	78.0	79.6	80.1	80.5	81.2	81.5	82.0	82.1	81.8	82.2
50	58.6	58.7	58.8	58.9	59.0	58.9	59.0	59.2	59.7	59.9	60.2	60.3	60.4	60.4	60.5	60.7	60.7	60.7	60.9
55	48.0	48.0	48.1	48.5	48.5	48.2	48.1	48.2	48.7	49.0	49.0	48.8	48.4	48.2	48.6	48.6	48.5	48.9	49.1
60	38.1	38.6	38.3	37.8	37.8	38.2	38.4	38.4	38.3	38.0	38.0	38.0	38.0	37.9	37.9	37.9	37.9	38.1	38.3
65	28.9	28.8	28.9	28.8	28.7	28.7	28.6	28.8	29.0	28.9	28.9	29.0	29.0	29.0	28.9	28.9	28.7	28.7	28.8
70	21.5	21.6	21.6	21.6	21.5	21.6	22.2	21.9	21.7	21.5	21.5	21.6	21.7	21.6	21.5	21.4	21.3	21.5	21.9
75	16.0	16.0	15.6	15.6	15.5	15.6	15.7	16.1	16.4	16.0	15.6	15.6	15.8	15.4	15.2	15.1	15.1	15.2	15.4
80	10.7	10.6	10.5	10.2	10.3	10.5	10.4	10.6	10.8	10.8	10.7	10.6	10.4	10.1	10.0	9.93	9.87	10.0	10.0
85	5.04	4.93	4.86	4.86	4.80	4.75	4.78	4.81	4.78	4.82	4.91	4.92	4.84	4.81	4.84	4.76	4.70	4.71	4.72
90	1.54	1.56	1.55	1.54	1.49	1.44	1.40	1.40	1.39	1.38	1.40	1.39	1.40	1.41	1.39	1.39	1.36	1.33	1.42
95	0.03	0.03	0.03	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.02
100	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
105	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02
110	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	0.02
115	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	0.03	0.03
120	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
125	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.08
130	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	0.09	0.09	0.09	0.10	0.10	0.14
135	0.17	0.17	0.17	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.26
140	0.26	0.26	0.26	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	0.26	0.25	0.40
145	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	0.36	0.36	0.35	0.57
150	0.48	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.48	0.48	0.46	0.72
155	0.60	0.60	0.60	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.60	0.60	0.60	0.61	0.61	0.58	0.84
160	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.73	0.73	0.73	0.73	0.71	0.91
165	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.82	0.82	0.82	0.83	0.83	0.81	0.92
170	0.86	0.86	0.86	0.86	0.87	0.87	0.87	0.87	0.88	0.88	0.88	0.88	0.88	0.88	0.89	0.89	0.89	0.89	0.88
175	0.89	0.89	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.89	0.89	0.89	0.90	0.90	0.91	0.91	0.92
180	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

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	2103	2103	2103	2103	2103	2103	2103	2103	2103	2103	2103	2103	2103	2103	2103	2103	2103		
5	2024	2023	2022	2024	2029	2033	2038	2040	2038	2042	2043	2042	2043	2043	2042	2041	2041		
10	1710	1716	1718	1719	1723	1728	1731	1734	1733	1733	1731	1732	1731	1729	1726	1724	1720		
15	1288	1288	1285	1278	1276	1276	1274	1272	1270	1271	1272	1276	1281	1285	1286	1284	1283		
20	880	876	867	858	853	850	846	843	840	838	839	844	848	852	854	854	855		
25	552	545	538	529	522	519	514	512	509	508	511	517	521	525	527	529	530		
30	330	325	319	313	307	304	301	298	297	297	298	301	304	306	308	310	310		
35	200	197	193	189	185	182	180	178	177	177	177	177	179	181	184	185	186		
40	122	120	118	118	116	114	112	111	111	112	112	111	111	111	112	114	114		
45	81.4	80.5	79.2	78.4	77.5	76.8	77.2	77.2	77.1	77.6	77.5	77.3	77.0	77.0	77.3	78.0	77.5		
50	60.4	60.0	59.5	59.0	58.7	58.4	58.2	58.4	58.2	58.7	59.0	59.1	59.1	59.0	58.9	58.9	58.9		
55	48.8	48.8	48.8	48.7	48.7	48.4	48.1	48.2	48.0	48.3	48.5	48.4	48.6	48.5	48.3	48.5	48.5		
60	38.2	38.3	38.2	38.1	38.0	37.8	37.7	37.6	37.4	37.6	37.6	37.6	37.7	37.8	37.9	38.1	38.2		
65	28.8	28.8	29.1	28.8	28.8	28.8	28.6	28.5	28.4	28.5	28.6	28.6	28.6	28.7	28.8	29.0	29.1		
70	21.8	21.6	21.4	21.4	21.5	21.4	21.4	21.4	21.3	21.4	21.7	21.8	21.8	21.8	21.6	21.6	21.6		
75	15.6	15.9	16.1	15.8	15.4	15.4	15.3	15.1	15.0	15.2	15.3	15.3	15.6	15.7	15.7	15.8	15.8		
80	10.0	10.2	10.2	10.3	10.5	10.3	10.1	9.93	9.77	9.88	10.0	10.0	10.2	10.4	10.3	10.7	10.8		
85	4.80	4.79	4.79	4.83	4.91	4.91	4.73	4.62	4.62	4.64	4.69	4.74	4.80	4.80	4.89	5.00	5.08		
90	1.41	1.43	1.48	1.49	1.57	1.64	1.57	1.53	1.52	1.52	1.52	1.50	1.48	1.47	1.49	1.53	1.56		
95	0.02	0.02	0.03	0.03	0.03	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03		
100	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		
105	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		
110	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		
115	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		
120	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05		
125	0.08	0.08	0.08	0.08	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.08		
130	0.15	0.15	0.16	0.16	0.16	0.16	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.16		
135	0.28	0.28	0.28	0.29	0.29	0.29	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.28		
140	0.46	0.45	0.46	0.46	0.46	0.47	0.47	0.47	0.47	0.48	0.47	0.47	0.48	0.48	0.47	0.48	0.44		
145	0.66	0.65	0.65	0.66	0.66	0.66	0.66	0.67	0.67	0.67	0.67	0.67	0.67	0.68	0.67	0.69	0.61		
150	0.86	0.85	0.85	0.85	0.85	0.86	0.86	0.86	0.86	0.87	0.87	0.87	0.87	0.87	0.87	0.89	0.78		
155	1.03	1.01	1.01	1.01	1.02	1.02	1.02	1.03	1.03	1.03	1.03	1.04	1.04	1.04	1.04	1.07	0.91		
160	1.16	1.14	1.15	1.15	1.15	1.16	1.16	1.16	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.20	0.98		
165	1.22	1.21	1.22	1.22	1.22	1.23	1.23	1.24	1.24	1.24	1.24	1.24	1.24	1.25	1.25	1.27	0.96		
170	1.14	1.19	1.18	1.18	1.18	1.18	1.18	1.19	1.19	1.19	1.20	1.20	1.21	1.21	1.22	1.19	0.85		
175	0.92	1.00	1.03	1.03	1.03	1.03	1.04	1.05	1.05	1.06	1.06	1.07	1.07	1.07	1.04	0.90	0.90		
180	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		

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.

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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

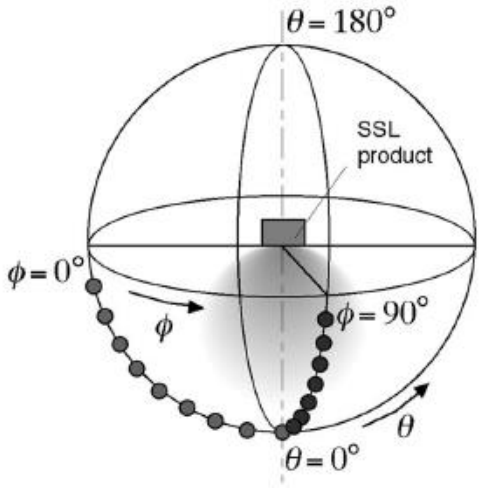
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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