



LM-79-08 Test Report

for

GREEN CREATIVE LTD

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

LED Lamp

Model: 5.5PLS/827/HYB/GX23,

5.5PLS/827/BYP/2GX7

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ16010019b/R1

This report is replaced the old report No. HZ16010019b dated Jan. 22, 2016

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

Review by:

Engineer: April Zou
Feb. 26, 2016

Approved by:



Manager: Jim Zhang
Feb. 26, 2016

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: **5.5PLS/827/HYB/GX23**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
87.4	473.1	5.41	0.9684
CCT (K)	CRI	Stabilization Time (Light & Power)	
2787	81.7	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	: Jan. 15, 2016
Date of Test	: Jan. 20, 2016 to Jan. 21, 2016
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

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Sample Photos



GX23 base



2GX7 base

Figure 1- Overview of the sample

Equipment Under Test (EUT)

Name	: LED Lamp
Model	: 5.5PLS/827/HYB/GX23, 5.5PLS/827/BYP/2GX7
Electrical Ratings	: 120Vac, 60Hz, 5.5W
Product Description	: GX23 base, 2700K, Frosted lens
Manufacturer	: GREEN CREATIVE LTD
Address	: 756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

Note: Model 5.5PLS/827/BYP/2GX7 and model 5.5PLS/827/HYB/GX23 are identical except their different screw base. Model 5.5PLS/827/BYP/2GX7 is 2GX7 base. 5.5PLS/827/HYB/GX23 is GX23 base. Model 5.5PLS/827/HYB/GX23 was chosen to be representative model in this report.

TEST RESULTS

Test ambient temperature was 24.6°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)	120.0
Voltage frequency (Hz)	60
Test Current (A)	0.047
Power Factor	0.9684
Test Power (W)	5.41
THD A%	18.83
Luminous Efficacy (lm/W)	87.4
Total Luminous Flux (lm)	473.1
Color Rendering Index (CRI)	81.7
R9	7.2
Correlated Color Temperature (CCT) (K)	2787
Chromaticity Chroma x	0.4541
Chromaticity Chroma y	0.4114
Chromaticity Chroma u	0.2584
Chromaticity Chroma v	0.3512
Duv	0.0007
Chromaticity Chroma u'	0.2584
Chromaticity Chroma v'	0.5268

Special Color Rendering Indices	
R1	79.9
R2	90.8
R3	96.2
R4	78.6
R5	79.7
R6	88.8
R7	82.2
R8	57.8
R9	7.2
R10	78.9
R11	76.9
R12	70.7
R13	82.3
R14	98.6

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 24.2°C.

The photometric distance is 30m.

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)	0.047
Power Factor	0.9682
Test Power (W)	5.47
Luminous Efficacy (lm/W)	86.1
Total Luminous Flux (lm)	471.1
Beam Angle (°)	116.0
Center Beam Candle Power (cd)	139
Spacing Criteria	1.21 (0°-180°)/ 1.28 (90°-270°)
Zonal Lumens in the 0°-60°Zone	66.80%
Zonal Lumens in the 60°-90°Zone	25.66%
Zonal Lumens in the 90°-120°Zone	5.46%
Zonal Lumens in the 120°-180°Zone	2.08%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

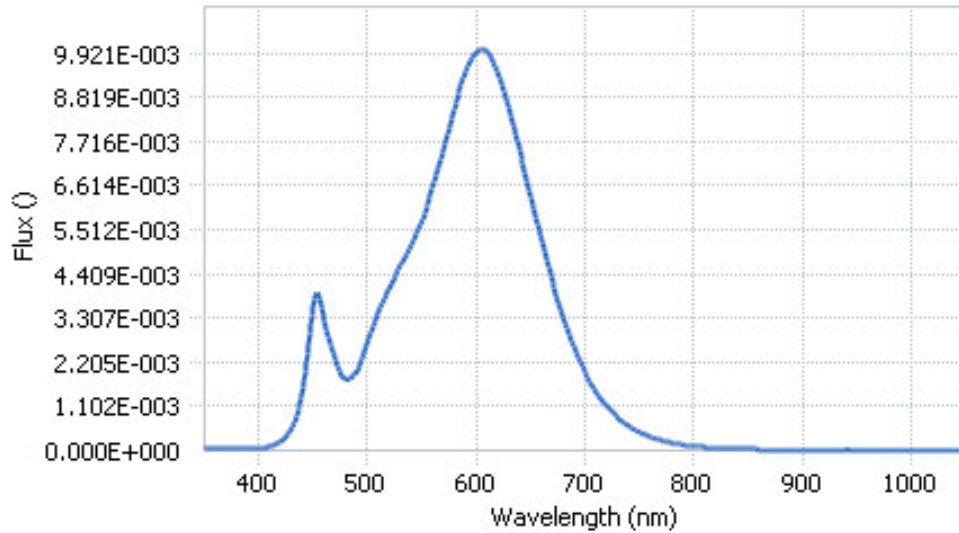
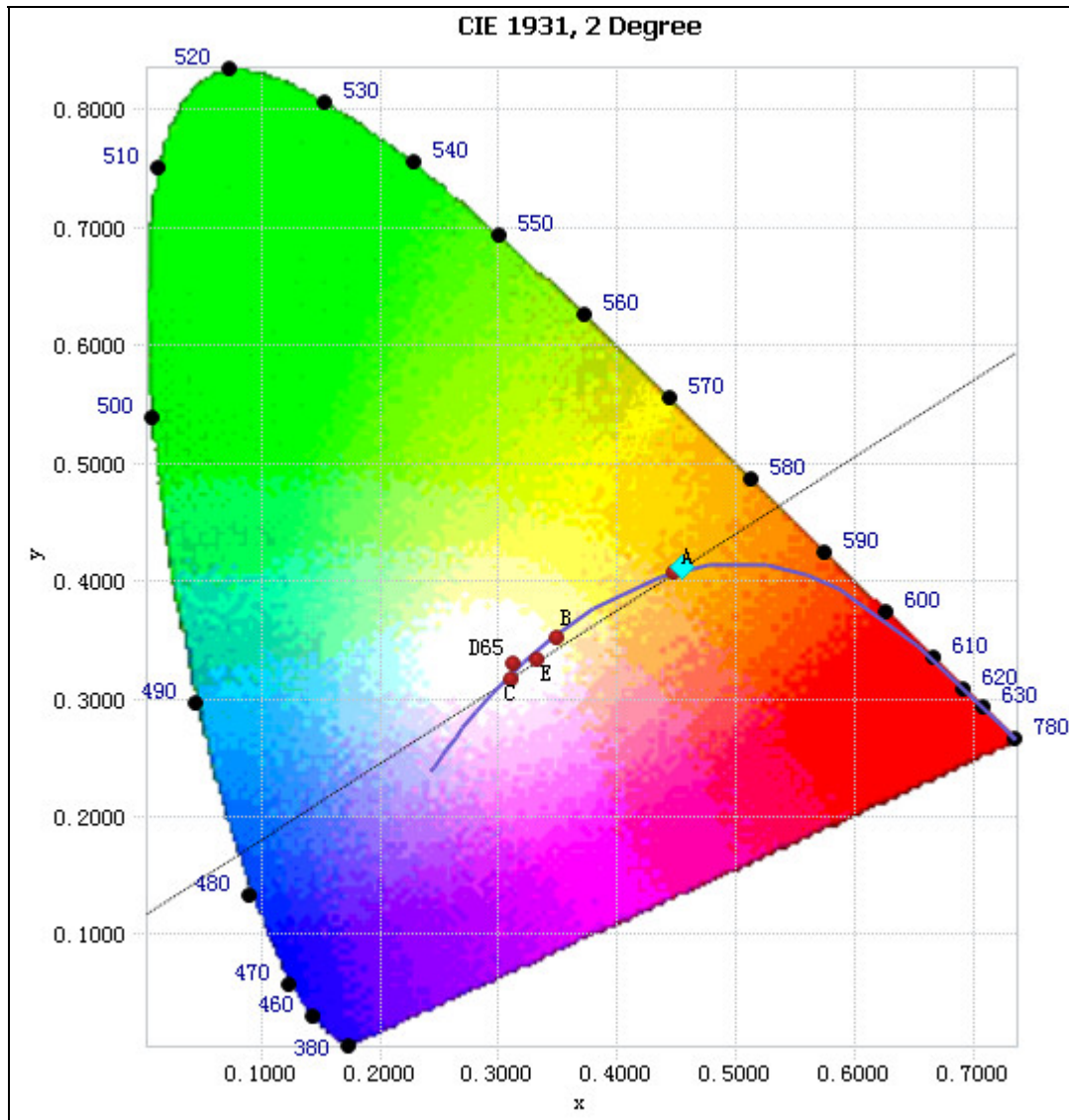


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	5.36E-05	485	1.82E-03	590	9.42E-03	695	2.25E-03
385	4.62E-05	490	2.00E-03	595	9.74E-03	700	1.95E-03
390	4.60E-05	495	2.29E-03	600	9.94E-03	705	1.69E-03
395	5.25E-05	500	2.67E-03	605	9.99E-03	710	1.47E-03
400	5.45E-05	505	3.08E-03	610	9.96E-03	715	1.28E-03
405	6.73E-05	510	3.46E-03	615	9.76E-03	720	1.11E-03
410	9.17E-05	515	3.78E-03	620	9.42E-03	725	9.55E-04
415	1.41E-04	520	4.07E-03	625	9.02E-03	730	8.24E-04
420	2.20E-04	525	4.35E-03	630	8.53E-03	735	7.07E-04
425	3.56E-04	530	4.60E-03	635	8.01E-03	740	6.10E-04
430	5.62E-04	535	4.83E-03	640	7.49E-03	745	5.23E-04
435	8.89E-04	540	5.13E-03	645	6.93E-03	750	4.52E-04
440	1.43E-03	545	5.43E-03	650	6.37E-03	755	3.91E-04
445	2.42E-03	550	5.74E-03	655	5.81E-03	760	3.37E-04
450	3.60E-03	555	6.14E-03	660	5.27E-03	765	2.90E-04
455	3.86E-03	560	6.56E-03	665	4.73E-03	770	2.50E-04
460	3.22E-03	565	7.05E-03	670	4.23E-03	775	2.15E-04
465	2.71E-03	570	7.53E-03	675	3.75E-03	780	1.88E-04
470	2.33E-03	575	8.06E-03	680	3.32E-03		
475	1.94E-03	580	8.56E-03	685	2.92E-03		
480	1.78E-03	585	9.04E-03	690	2.57E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4541, 0.4114)

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

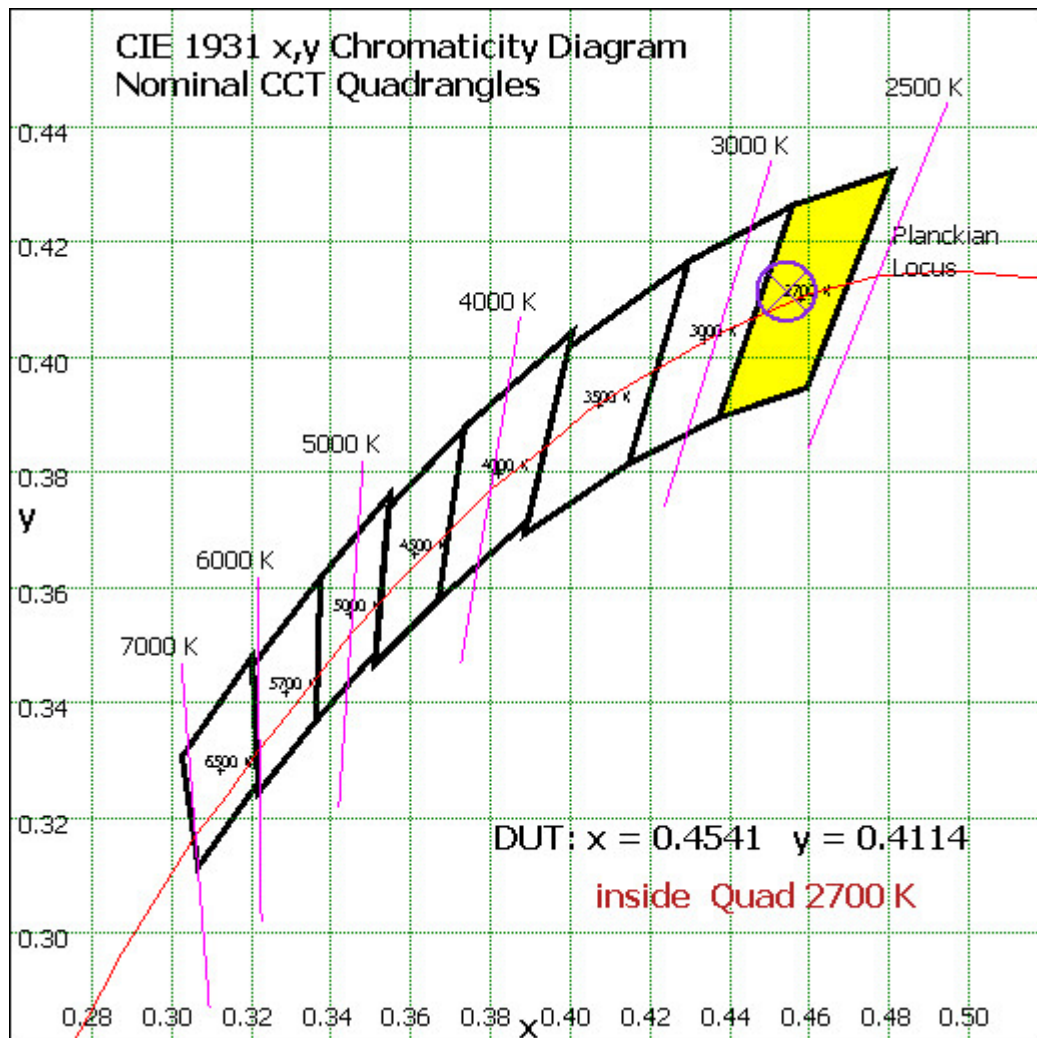


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

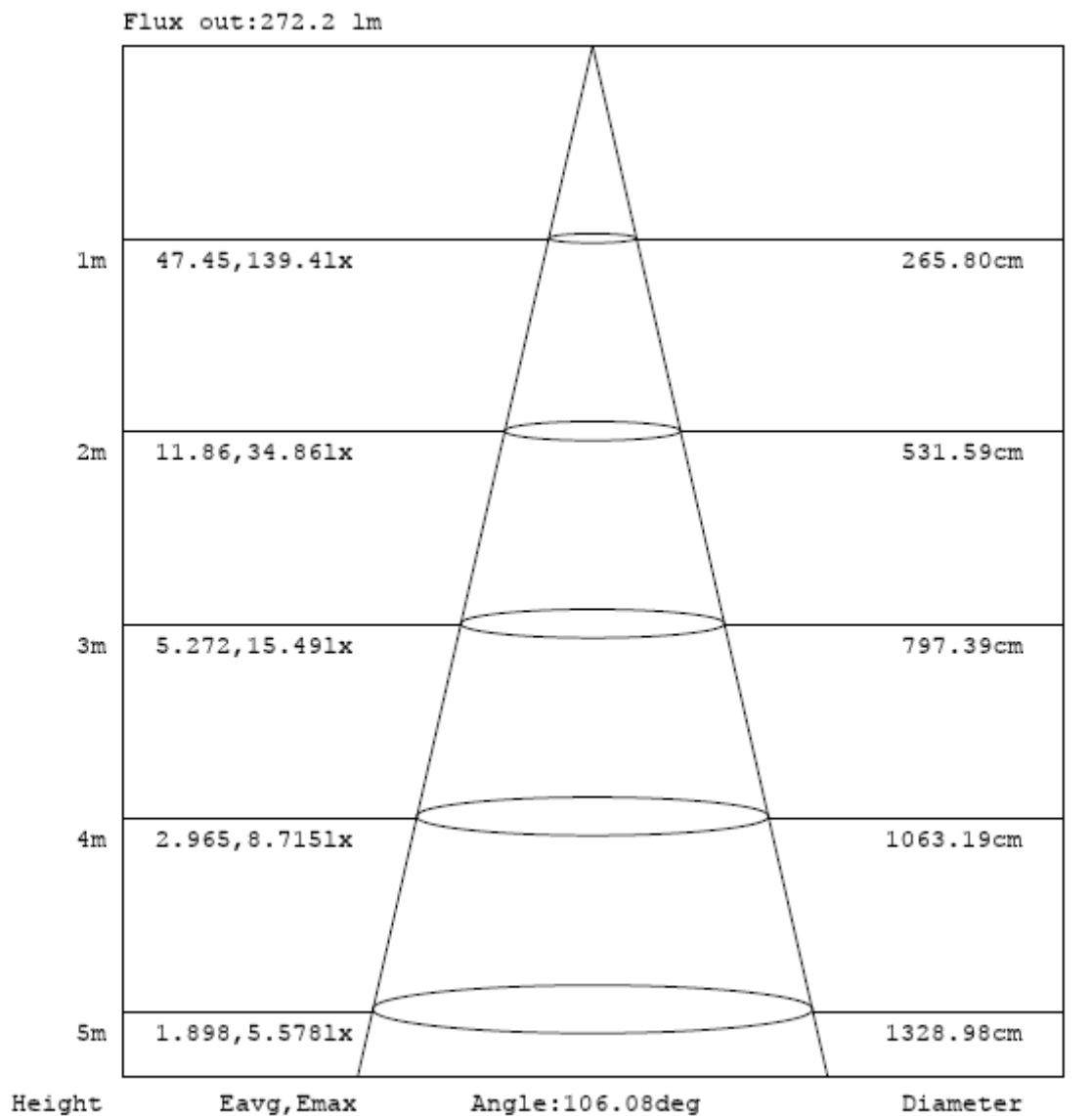
Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	13.177	2.80%
10- 20	37.727	8.01%
20- 30	56.928	12.09%
30- 40	68.5	14.54%
40- 50	71.613	15.20%
50- 60	66.739	14.17%
60- 70	55.53	11.79%
70- 80	40.274	8.55%
80- 90	25.062	5.32%
90-100	14.752	3.13%
100-110	7.336	1.56%
110-120	3.629	0.77%
120-130	2.749	0.58%
130-140	2.357	0.50%
140-150	1.987	0.42%
150-160	1.531	0.33%
160-170	0.933	0.20%
170-180	0.238	0.05%
Total	471.1	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	314.684	66.80%
60- 90	120.866	25.66%
0-90	435.55	92.46%
90- 180	35.512	7.54%
0- 180	471.1	100%

Table 5: Zonal Lumen Data

Illuminance Plots- Goniophotometer Method



Note: The Curves indicate the illuminated area and the average illumination when the luminaire is at different distance.

Chart 4: Beam Angle

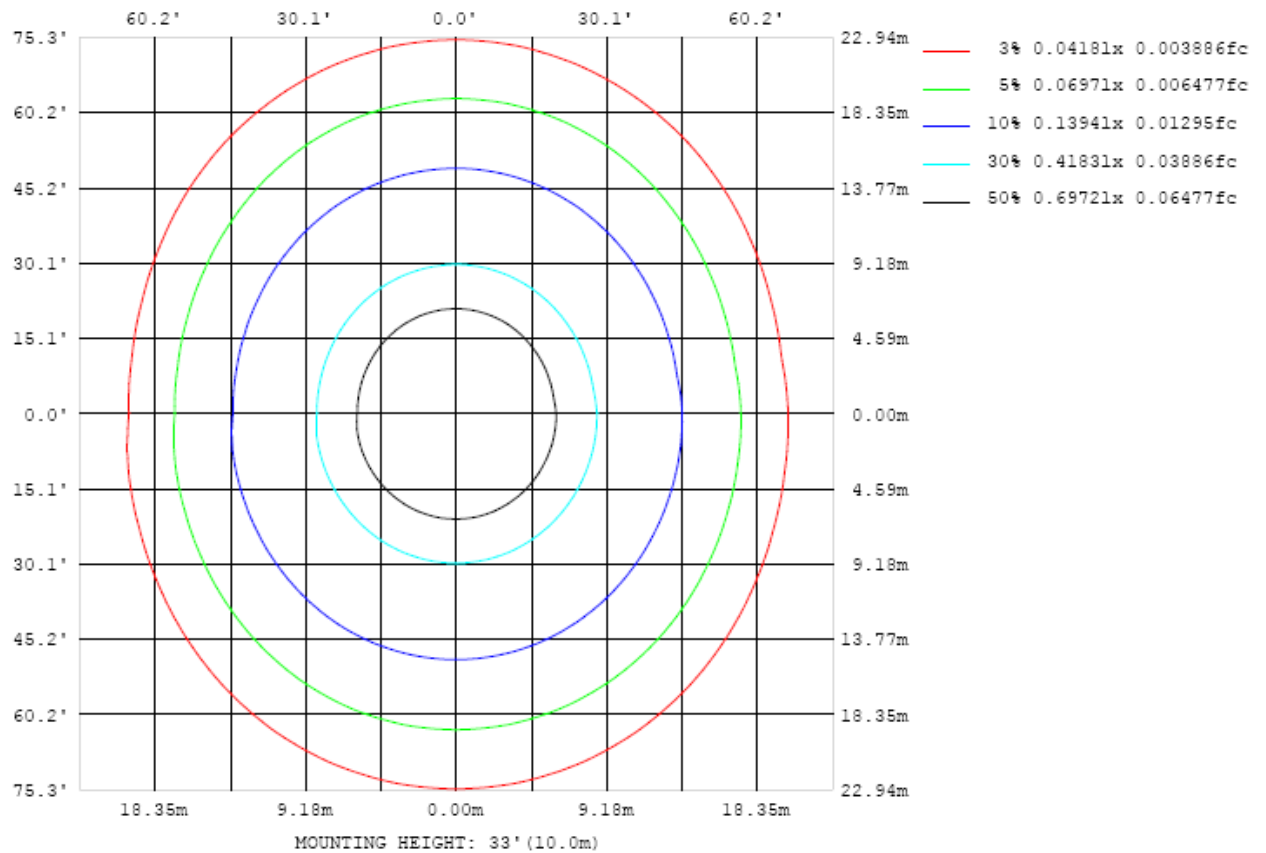


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

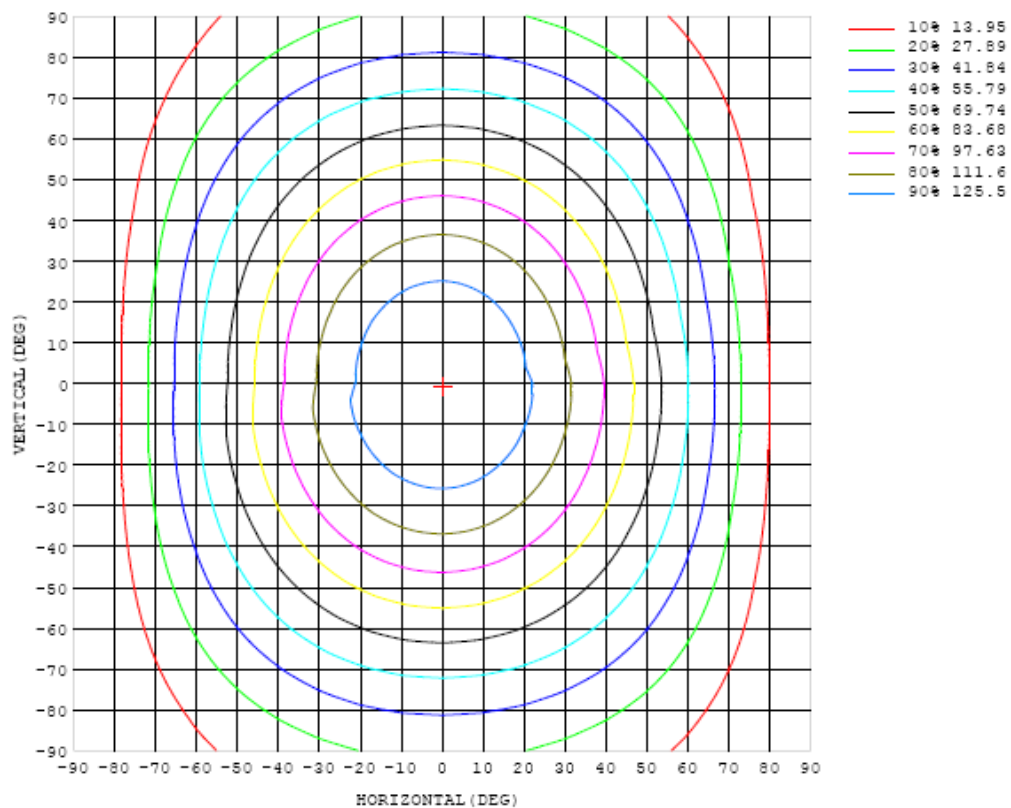


Chart 6: Isocandela Plot

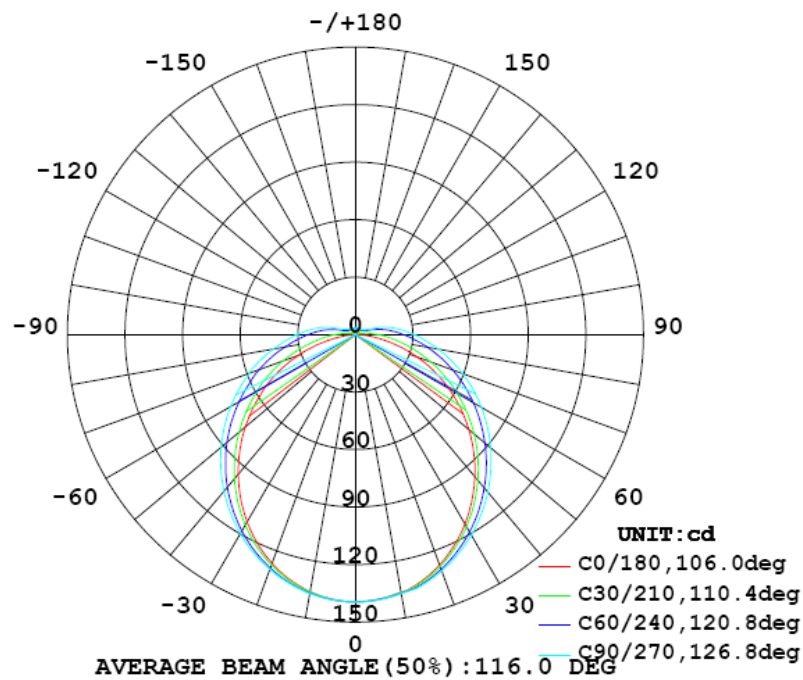


Chart 7: Polar Candela Distribution

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	139	139	139	139	139	139	139	139	139	139	139	139	139	139	139	139	139	139	139
5	138	139	139	139	139	139	139	139	139	139	139	139	139	139	139	139	139	139	139
10	136	137	137	137	137	137	137	137	137	137	137	137	137	137	137	137	137	137	136
15	133	133	134	134	134	134	135	135	135	135	135	135	135	135	134	134	134	134	132
20	128	128	128	129	129	130	130	131	131	131	131	131	131	130	130	129	129	129	127
25	121	122	122	123	124	124	125	126	126	126	126	126	126	125	124	123	123	123	120
30	114	114	115	116	117	118	119	120	120	121	121	120	119	118	117	116	116	115	113
35	106	106	107	108	109	111	112	113	114	114	114	113	112	111	110	109	107	107	104
40	96.7	97.1	97.9	99.1	101	103	104	106	107	107	107	106	105	103	101	99.8	98.6	97.7	95.0
45	87.1	87.6	88.5	90.1	92.1	94.2	96.3	98.1	99.3	99.7	99.4	98.4	96.8	94.8	92.7	90.7	89.1	88.0	85.2
50	77.0	77.6	78.8	80.6	83.0	85.5	87.9	90.0	91.4	91.9	91.5	90.3	88.4	86.0	83.4	81.0	79.1	77.8	75.0
55	66.7	67.3	68.7	70.9	73.7	76.6	79.4	81.8	83.2	83.9	83.4	82.0	79.8	76.9	74.0	71.1	68.9	67.3	64.3
60	56.0	56.7	58.5	61.1	64.4	67.7	70.8	73.4	75.0	75.7	75.2	73.6	71.1	67.9	64.5	61.1	58.4	56.5	54.0
65	45.2	46.0	48.1	51.3	55.1	58.9	62.3	65.1	66.9	67.5	66.9	65.2	62.5	58.9	55.1	51.2	47.9	45.6	42.9
70	34.2	35.3	38.0	41.8	46.0	50.2	53.9	56.8	58.7	59.4	58.8	56.9	54.0	50.2	45.9	41.5	37.5	34.7	31.7
75	23.5	24.9	28.3	32.7	37.4	41.9	45.8	48.8	50.8	51.5	50.8	48.9	45.8	41.7	37.1	32.2	27.6	24.1	20.7
80	13.6	15.4	19.5	24.4	29.4	34.1	38.1	41.2	43.1	43.8	43.2	41.3	38.1	33.9	29.0	23.8	18.7	14.4	10.7
85	5.62	7.73	12.2	17.3	22.4	27.1	31.1	34.1	36.0	36.7	36.1	34.1	31.1	26.9	22.1	16.7	11.2	6.59	3.22
90	0.75	3.17	7.24	12.0	16.9	21.3	25.1	28.1	29.9	30.5	29.9	28.1	25.1	21.2	16.6	11.5	6.52	2.40	0.06
95	0.17	1.23	4.07	8.00	12.4	16.6	20.2	22.9	24.6	25.2	24.7	23.0	20.2	16.5	12.2	7.74	3.72	0.97	0.10
100	0.29	0.58	1.74	4.40	8.36	12.2	15.5	18.1	19.7	20.2	19.7	18.1	15.5	12.1	8.22	4.22	1.70	0.47	0.20
105	0.48	0.66	1.15	2.35	4.54	7.58	10.7	13.2	14.8	15.3	14.8	13.2	10.7	7.50	4.29	2.23	1.07	0.52	0.36
110	0.67	0.77	1.21	1.96	3.31	4.86	6.49	8.02	9.17	9.64	9.16	7.94	6.38	4.66	3.07	1.79	1.01	0.66	0.60
115	0.91	0.97	1.40	2.00	2.86	3.91	4.94	5.86	6.45	6.66	6.44	5.75	4.82	3.72	2.57	1.72	1.12	0.81	0.90
120	1.19	1.29	1.57	2.13	2.74	3.46	4.19	4.83	5.24	5.37	5.21	4.76	4.08	3.27	2.40	1.80	1.23	0.96	1.20
125	1.49	1.52	1.79	2.22	2.76	3.27	3.79	4.27	4.55	4.65	4.53	4.20	3.68	3.06	2.43	2.01	1.32	1.12	1.50
130	1.76	1.75	1.99	2.31	2.83	3.24	3.62	3.96	4.16	4.23	4.14	3.89	3.50	3.05	2.62	2.21	1.57	1.39	1.79
135	2.05	1.96	2.17	2.49	2.88	3.28	3.57	3.81	3.96	4.00	3.93	3.74	3.44	3.10	2.78	2.44	1.88	1.73	1.93
140	2.32	2.17	2.42	2.66	2.99	3.31	3.56	3.75	3.86	3.89	3.84	3.69	3.46	3.19	2.93	2.68	2.20	2.02	1.95
145	2.57	2.34	2.67	2.85	3.09	3.36	3.57	3.72	3.80	3.83	3.79	3.67	3.49	3.28	3.08	2.88	2.42	2.23	2.14
150	2.78	2.50	2.88	3.07	3.23	3.42	3.59	3.71	3.78	3.79	3.76	3.68	3.54	3.38	3.23	3.07	2.59	2.40	2.58
155	2.98	2.63	3.01	3.30	3.38	3.51	3.63	3.72	3.76	3.78	3.76	3.70	3.60	3.49	3.39	3.25	2.76	2.55	3.01
160	3.14	2.71	3.03	3.49	3.54	3.61	3.67	3.73	3.77	3.78	3.77	3.73	3.67	3.59	3.53	3.42	2.99	2.70	3.17
165	3.28	2.88	3.00	3.60	3.63	3.68	3.72	3.76	3.78	3.79	3.79	3.77	3.74	3.61	3.64	3.57	3.27	2.82	3.24
170	2.82	2.76	2.55	3.05	3.76	3.71	3.43	3.03	3.20	3.81	3.68	3.80	3.80	3.69	3.71	3.50	3.13	2.82	2.54
175	2.02	2.02	2.01	2.05	2.29	2.62	2.76	2.70	3.04	3.51	2.47	2.93	3.12	2.66	2.30	1.97	1.53	1.47	1.41
180	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15

Table 6: Luminous Intensity Data

Table--2

UNIT: cd

C (DEG) y (DEG)	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350		
0	139	139	139	139	139	139	139	139	139	139	139	139	139	139	139	139	139		
5	139	139	139	139	139	139	139	139	139	139	139	139	139	139	138	138	138		
10	136	136	136	137	137	137	137	137	137	137	137	137	137	136	136	136	136		
15	132	133	133	133	134	134	134	134	134	134	134	134	133	133	132	132	132		
20	127	127	128	129	129	130	130	130	130	130	130	129	129	128	127	127	126		
25	121	121	122	123	124	124	125	125	126	125	125	124	123	122	121	120	120		
30	113	114	115	116	117	118	119	120	120	120	119	118	117	115	114	113	112		
35	105	106	107	108	110	111	113	113	114	113	112	111	109	108	106	105	104		
40	95.5	96.5	98.0	100	102	104	105	106	107	106	105	103	101	99.3	97.4	95.9	94.8		
45	85.7	87.0	88.8	91.1	93.5	95.8	97.6	98.7	99.1	98.6	97.2	95.3	93.0	90.5	88.4	86.5	85.2		
50	75.5	77.0	79.1	81.9	84.7	87.4	89.6	90.8	91.3	90.8	89.2	87.0	84.3	81.4	78.8	76.7	75.2		
55	64.9	66.7	69.2	72.4	75.7	78.7	81.2	82.7	83.3	82.6	80.9	78.5	75.4	72.1	69.1	66.6	64.9		
60	54.8	56.6	59.3	62.9	66.5	70.0	72.8	74.4	75.0	74.4	72.6	69.8	66.4	62.8	59.2	56.8	55.0		
65	43.8	46.3	49.9	54.1	57.9	61.3	64.3	66.1	66.8	66.1	64.2	61.3	57.9	54.1	50.1	46.7	44.2		
70	32.8	35.9	40.1	44.8	49.4	53.4	56.6	58.5	58.6	58.1	56.5	53.5	49.5	45.0	40.5	36.5	33.5		
75	22.3	26.0	30.9	36.0	40.9	45.2	48.5	50.5	51.2	50.5	48.4	45.3	41.1	36.4	31.5	26.8	23.2		
80	12.7	17.2	22.5	28.0	33.0	37.4	40.7	42.8	43.5	42.8	40.8	37.6	33.3	28.5	23.3	18.1	13.8		
85	5.49	10.2	15.7	21.2	26.2	30.5	33.7	35.7	36.4	35.8	33.8	30.7	26.5	21.7	16.5	11.3	6.71		
90	1.98	5.97	10.9	16.1	20.8	24.9	28.0	29.9	30.6	30.0	28.1	25.1	21.1	16.5	11.6	6.75	2.66		
95	0.79	3.24	7.14	11.7	16.1	19.9	22.8	24.6	25.2	24.6	22.8	20.0	16.3	12.0	7.51	3.57	0.97		
100	0.38	1.53	3.71	7.60	11.6	15.1	17.8	19.5	20.0	19.5	17.8	15.2	11.7	7.75	3.79	1.56	0.62		
105	0.43	1.09	2.22	4.21	6.88	10.1	12.6	14.2	14.7	14.2	12.6	10.1	6.88	4.31	2.45	1.34	0.68		
110	0.69	1.07	1.79	3.09	4.74	6.37	7.83	8.86	9.22	8.83	7.79	6.39	4.79	3.49	2.27	1.36	0.80		
115	0.85	1.10	1.80	2.63	3.87	5.02	5.96	6.61	6.82	6.60	5.98	5.14	4.20	3.16	2.24	1.54	1.01		
120	0.99	1.16	1.97	2.51	3.48	4.37	5.06	5.51	5.67	5.56	5.18	4.58	3.77	2.90	2.26	1.68	1.30		
125	1.11	1.43	2.12	2.70	3.32	4.00	4.53	4.87	5.00	4.92	4.63	4.19	3.58	2.98	2.45	1.91	1.56		
130	1.35	1.79	2.22	2.84	3.27	3.81	4.21	4.46	4.56	4.52	4.33	3.99	3.54	3.12	2.62	2.11	1.76		
135	1.67	1.97	2.29	2.94	3.26	3.70	4.03	4.23	4.30	4.26	4.13	3.89	3.53	3.18	2.74	2.27	1.94		
140	1.95	1.90	2.34	2.99	3.35	3.63	3.93	4.08	4.15	4.11	3.99	3.81	3.55	3.24	2.87	2.48	2.14		
145	2.19	1.99	2.54	3.01	3.43	3.59	3.86	3.99	4.04	4.01	3.91	3.76	3.56	3.28	2.97	2.68	2.30		
150	2.38	1.95	3.03	3.12	3.44	3.60	3.57	3.92	3.97	3.95	3.88	3.75	3.58	3.33	3.09	2.86	2.44		
155	2.58	2.52	3.26	3.41	3.34	3.62	3.41	3.30	3.66	3.87	3.85	3.75	3.60	3.42	3.26	3.02	2.60		
160	2.55	2.71	3.16	3.48	3.23	2.90	3.20	3.25	3.19	3.35	3.59	3.73	3.63	3.54	3.45	3.17	2.74		
165	2.86	2.78	3.08	3.20	3.47	3.18	2.85	2.78	2.92	3.15	3.23	3.38	3.48	3.56	3.48	3.20	2.87		
170	2.08	2.62	3.03	3.26	3.19	3.11	3.05	2.92	2.97	3.09	3.29	3.35	3.30	3.29	3.19	2.68	2.60		
175	1.04	1.19	1.33	1.34	1.30	1.17	1.06	1.16	1.65	1.60	1.82	2.00	1.99	1.99	2.00	2.00	2.01		
180	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15		

Table 7: Luminous Intensity Data

EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Jul. 17, 2015	Jul. 16, 2016
Digital Power Meter	PF2010A	HZTE028-01	Jul. 17, 2015	Jul. 16, 2016
AC Power Supply	PCR 500L	HZTE001-08	Jul. 17, 2015	Jul. 16, 2016
DC Power Supply	WY12010	HZTE004-03	Jul. 17, 2015	Jul. 16, 2016
Temperature Meter	TES1310	HZTE017-01	Jul. 17, 2015	Jul. 16, 2016
Standard source	D908	HZTE012-01	Jul. 23, 2015	Jul. 22, 2016
Integrate Sphere system	2M	HZTE015-01	Jul. 16, 2015	Jul. 15, 2016
Digital Power Meter	WT210	HZTE008-01	Jul. 17, 2015	Jul. 16, 2016
AC Power Supply	PCR 500L	HZTE001-07	Jul. 17, 2015	Jul. 16, 2016
DC Power Supply	6154	HZTE004-04	Jul. 17, 2015	Jul. 16, 2016
Temperature and humidity recorder	JR900	HZTE018-01	Jul. 21, 2015	Jul. 20, 2016
Standard source	SCL-1400	HZTE012-02	Oct. 21, 2015	Oct. 20, 2016

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 1.06% 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 1.94% with a coverage factor $k=2$.

Color Characteristics Measurements

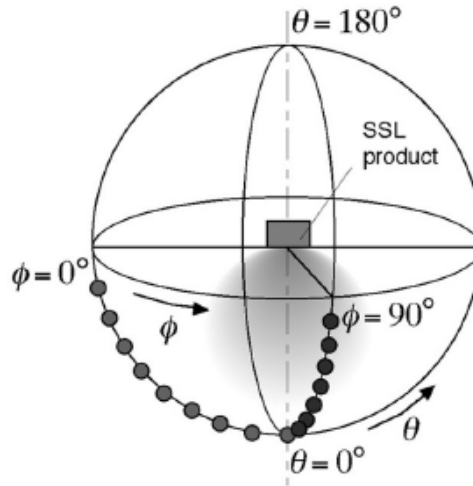
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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