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: 19.5PAR30HO/935FL40/277V/R

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ20040025b

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

Review by: April Zou

Engineer: April Zou

Apr. 28, 2020

Approved by: Jim Zhang

Manager: Jim Zhang

Apr. 28, 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: **19.5PAR30HO/935FL40/277V/R**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
109.2	2072.0	18.98	0.9936

CCT (K)	CRI	Stabilization Time (Light & Power)
3478	94.2	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. 20, 2020

Date of Test : Apr. 23, 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

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SAMPLE PHOTO

Figure 1- Overview of the sample

Equipment Under Test(EUT)	
Name	: LED Lamp
Model	: 19.5PAR30HO/935FL40/277V/R
Electrical Ratings	: 120-277V, 50/60Hz, 19.5W
Product Description	: 3500K, Beam 40 °
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)	120.0	277.0
Voltage frequency (Hz)	60	60
Test Current (A)	0.159	0.076
Power Factor	0.9936	0.9150
Test Power (W)	18.98	19.21
THD A%	5.34	18.63
Luminous Efficacy (lm/W)	109.2	110.3
Total Luminous Flux (lm)	2072.0	2118.2
Color Rendering Index (CRI)	94.2	
R9	71.6	
Correlated Color Temperature (CCT)(K)	3478	
Chromaticity Chroma x	0.4057	
Chromaticity Chroma y	0.3893	
Chromaticity Chroma u	0.2365	
Chromaticity Chroma v	0.3405	
Duv	-0.0007	
Chromaticity Chroma u ’	0.2365	
Chromaticity Chroma v’	0.5107	

Special Color Rendering Indices	
R1	94.8
R2	96.3
R3	96.1
R4	94.7
R5	94.2
R6	94.2
R7	95
R8	88.4
R9	71.6
R10	90.2
R11	94.9
R12	79.4
R13	95.2
R14	97.3

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 25.0 ℃.

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)	0.160
Power Factor	0.9939
Power (W)	19.03
Luminous Efficacy (lm/W)	110.7
Total Luminous Flux (lm)	2106.4
Beam Angle (°)	34.4 (0^o-180^o) / 34.4 (90^o-270^o)
Center Beam Candle Power (cd)	4409
Maximum Beam Candle Power (cd)	4409 (At: C=0.0, Gamma=0.0)
Spacing Criteria	0.58 (0^o-180^o) / 0.57 (90^o-270^o)
Zonal Lumens in the 0 °-60 °Zone	96.11%
Zonal Lumens in the 60 °-90 °Zone	3.77%
Zonal Lumens in the 90 °-120 °Zone	0.00%
Zonal Lumens in the 120 °-180 °Zone	0.12%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

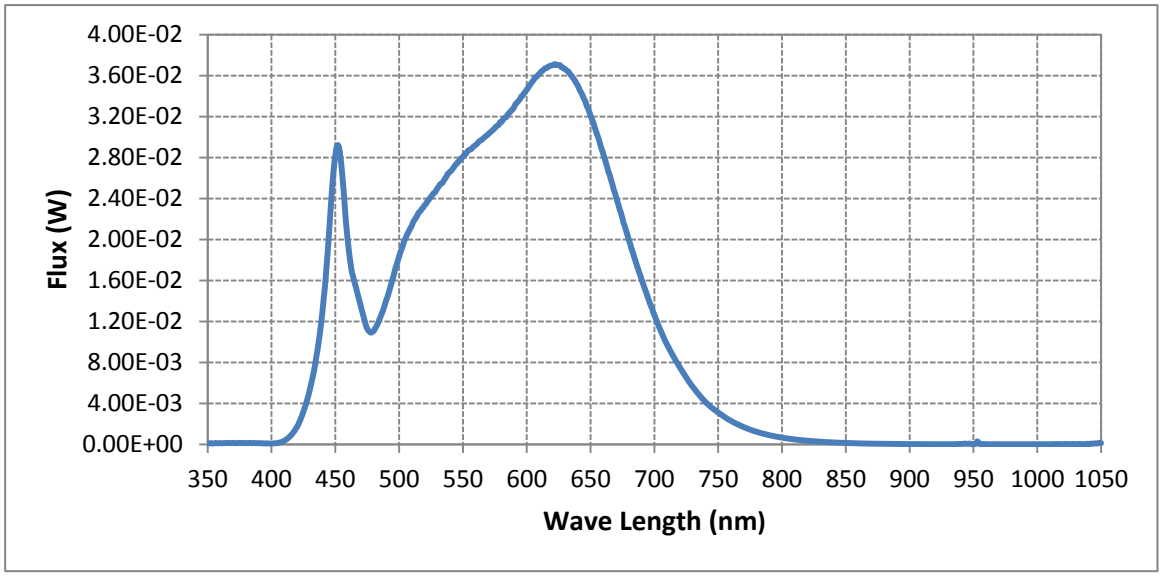
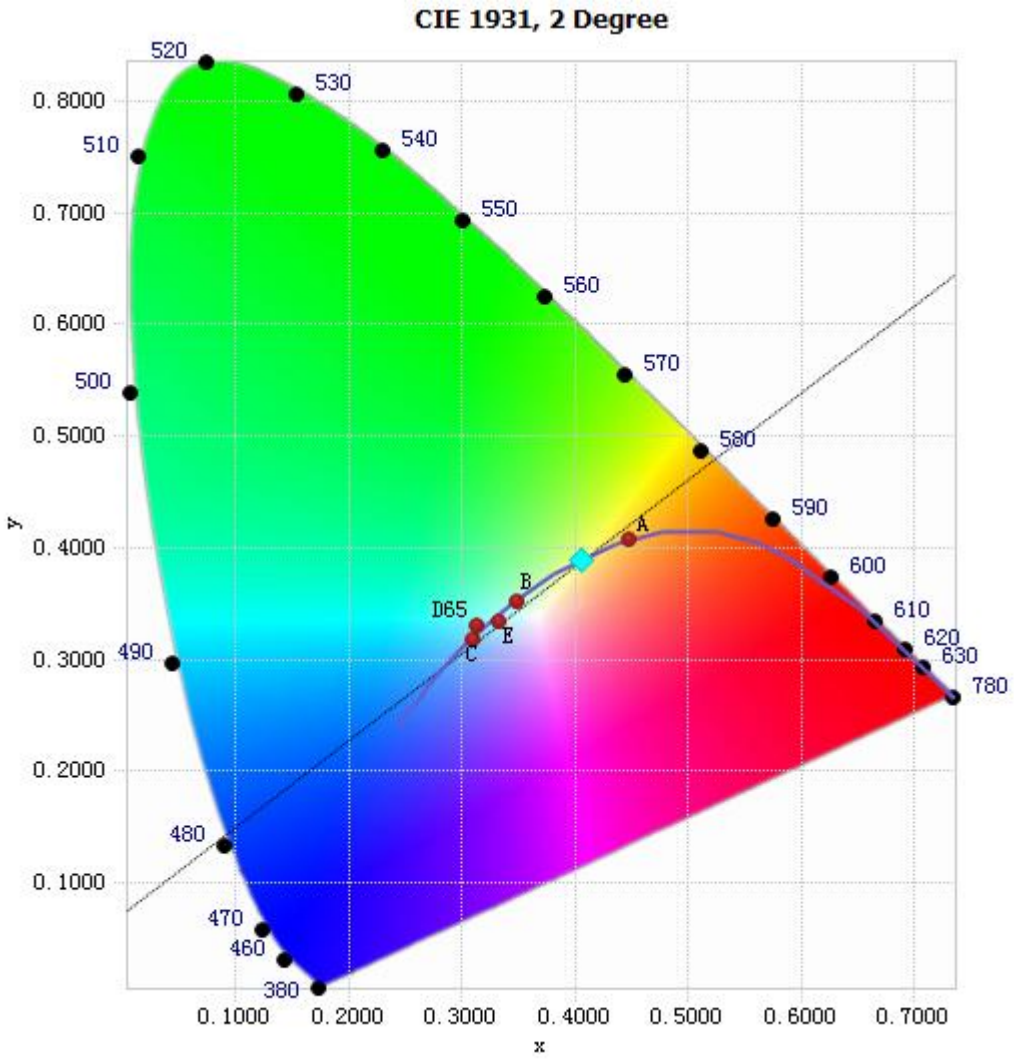


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.30E-04	485	1.24E-02	590	3.29E-02	695	1.43E-02
385	1.32E-04	490	1.41E-02	595	3.38E-02	700	1.27E-02
390	1.26E-04	495	1.62E-02	600	3.46E-02	705	1.11E-02
395	9.58E-05	500	1.84E-02	605	3.55E-02	710	9.73E-03
400	1.01E-04	505	2.01E-02	610	3.62E-02	715	8.57E-03
405	1.52E-04	510	2.14E-02	615	3.67E-02	720	7.51E-03
410	3.65E-04	515	2.26E-02	620	3.70E-02	725	6.53E-03
415	8.51E-04	520	2.34E-02	625	3.70E-02	730	5.63E-03
420	1.73E-03	525	2.42E-02	630	3.67E-02	735	4.85E-03
425	3.20E-03	530	2.50E-02	635	3.60E-02	740	4.17E-03
430	5.35E-03	535	2.58E-02	640	3.50E-02	745	3.59E-03
435	8.46E-03	540	2.66E-02	645	3.37E-02	750	3.12E-03
440	1.31E-02	545	2.74E-02	650	3.21E-02	755	2.69E-03
445	2.05E-02	550	2.81E-02	655	3.03E-02	760	2.31E-03
450	2.82E-02	555	2.88E-02	660	2.83E-02	765	1.98E-03
455	2.70E-02	560	2.92E-02	665	2.63E-02	770	1.70E-03
460	1.96E-02	565	2.98E-02	670	2.41E-02	775	1.45E-03
465	1.58E-02	570	3.03E-02	675	2.20E-02	780	1.24E-03
470	1.35E-02	575	3.09E-02	680	1.99E-02		
475	1.13E-02	580	3.15E-02	685	1.80E-02		
480	1.11E-02	585	3.22E-02	690	1.61E-02		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4057, 0.3893)

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

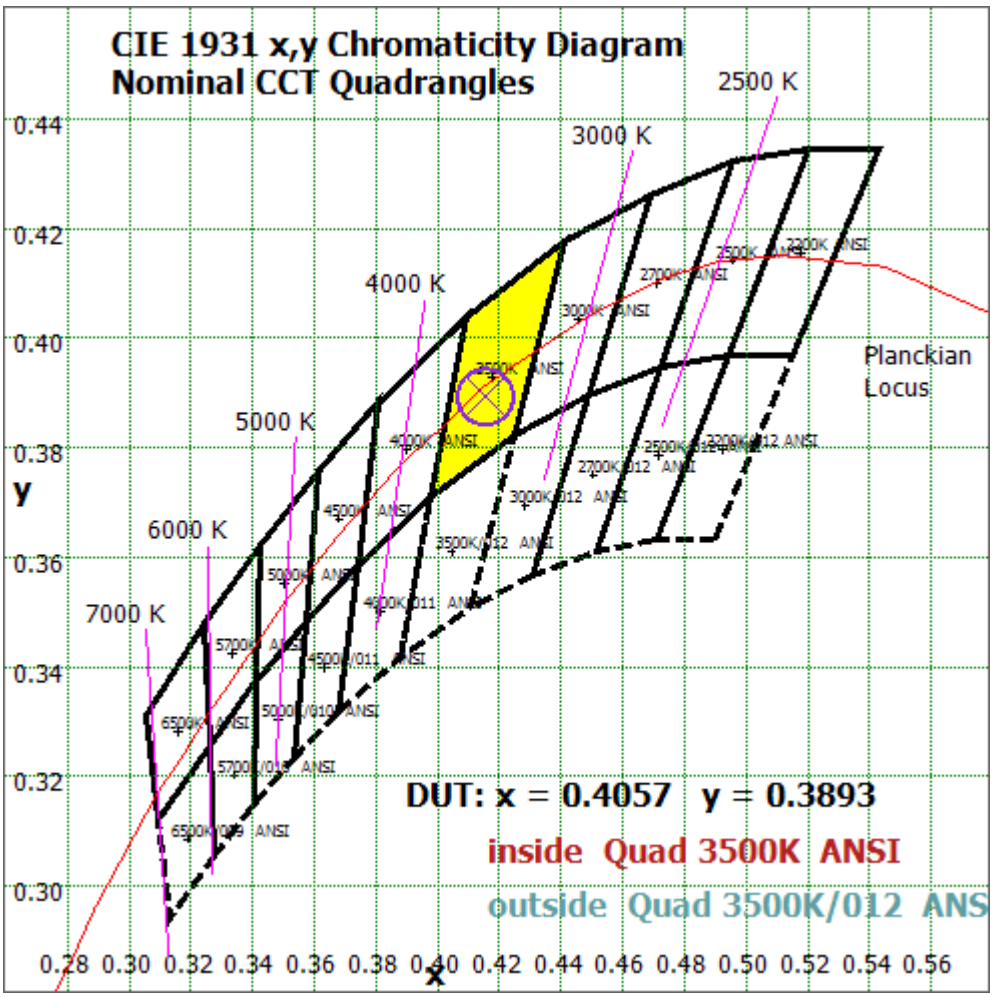
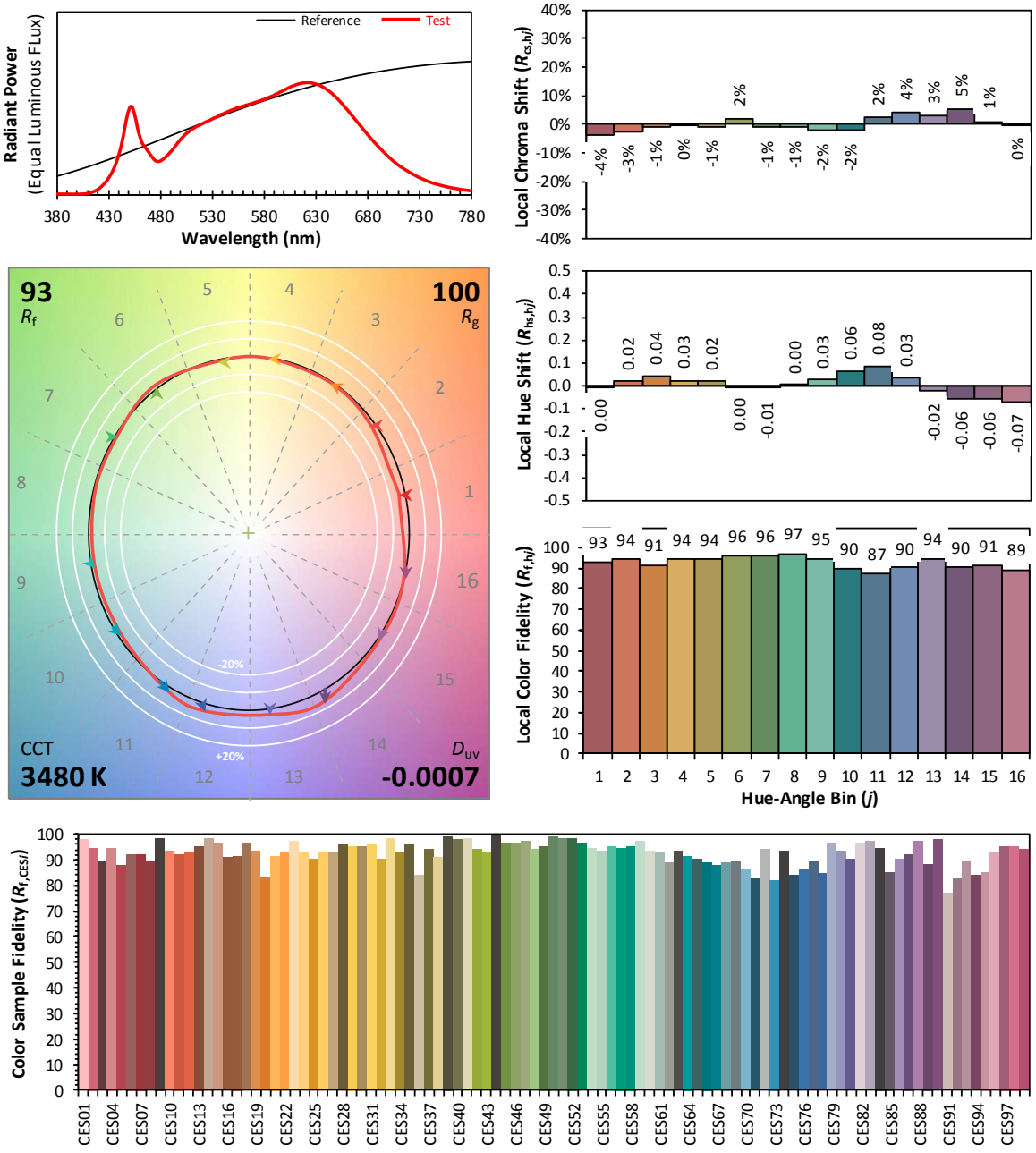


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method



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

x	0.4057
y	0.3893
u'	0.2365
v'	0.5107

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	369.655	17.55%
10- 20	705.696	33.50%
20- 30	510.444	24.23%
30- 40	250.128	11.87%
40- 50	116.224	5.52%
50- 60	72.445	3.44%
60- 70	47.952	2.28%
70- 80	25.516	1.21%
80- 90	5.84	0.28%
90-100	0.02	0.00%
100-110	0.029	0.00%
110-120	0.05	0.00%
120-130	0.122	0.01%
130-140	0.339	0.02%
140-150	0.61	0.03%
150-160	0.694	0.03%
160-170	0.512	0.02%
170-180	0.171	0.01%
Total	2106.4	100%

γ(°)	Lumens	% Total
0- 60	2024.592	96.11%
60- 90	79.308	3.77%
0-90	2103.9	99.88%
90- 180	2.547	0.12%
0- 180	2106.4	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

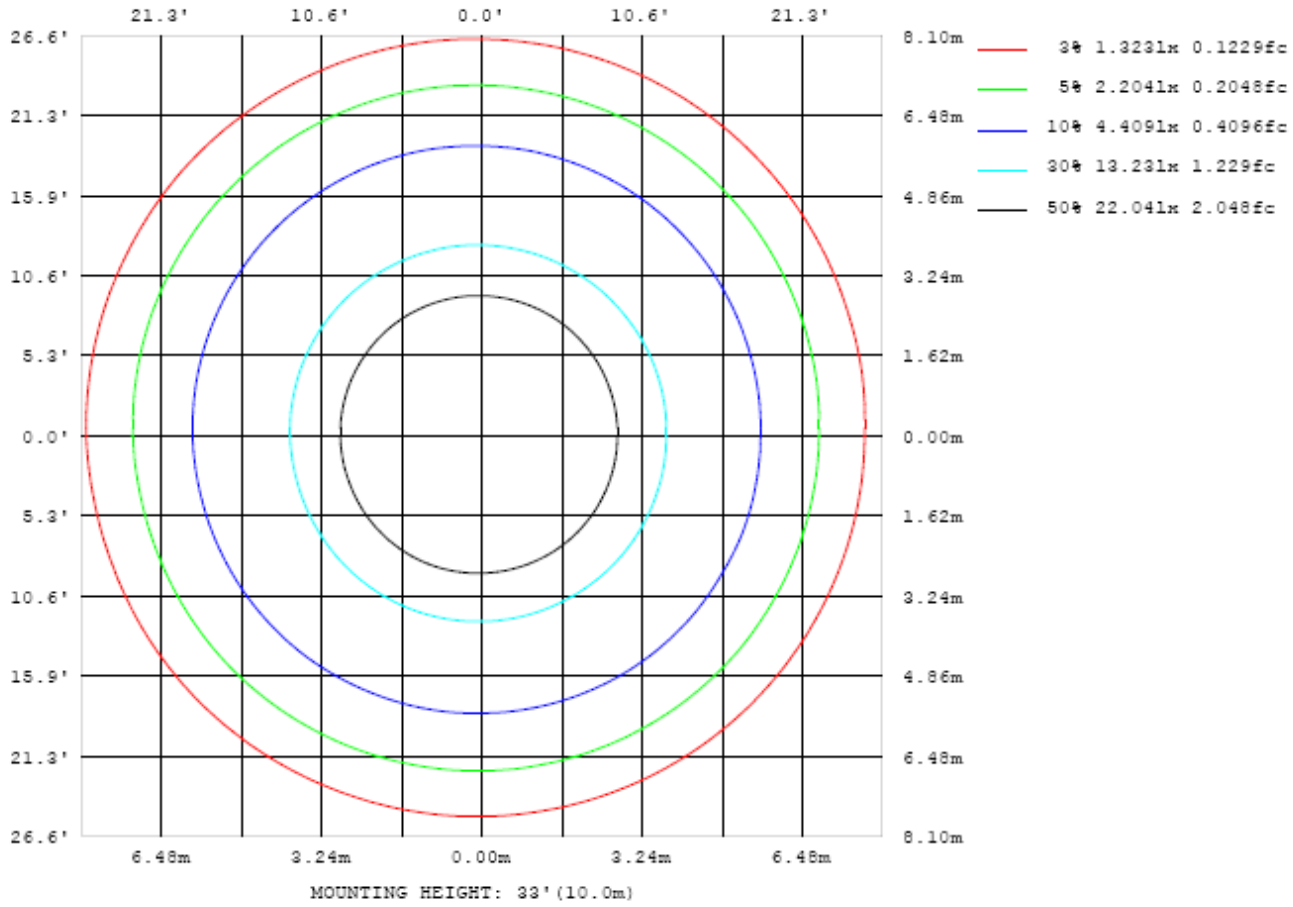


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

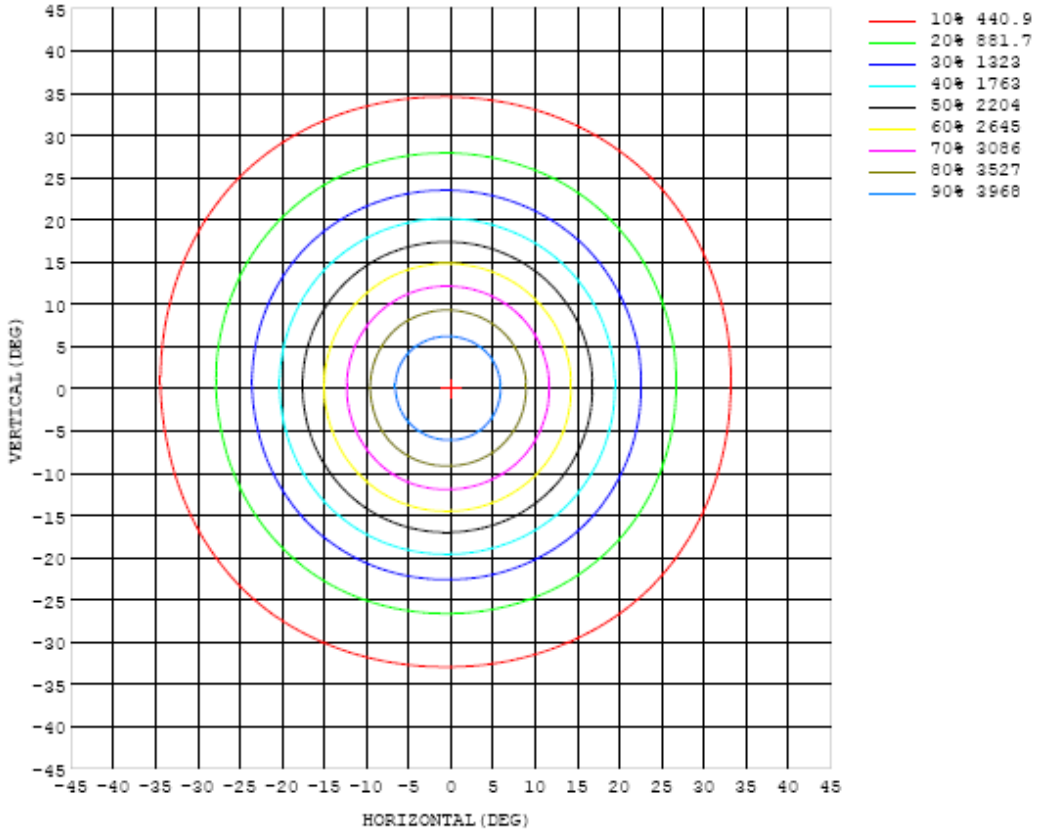


Chart 6: Isocandela Plot

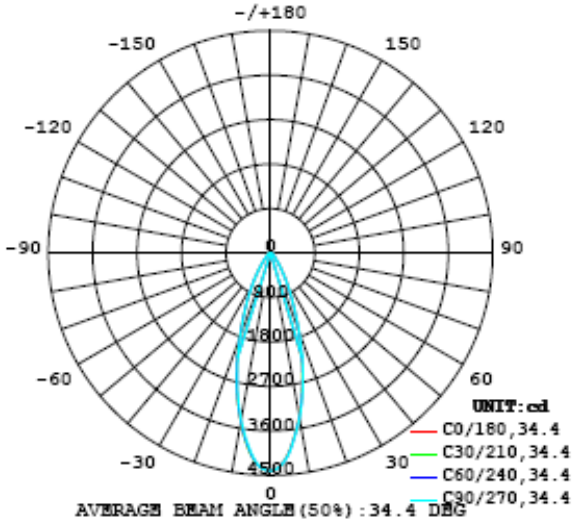


Chart 7: Polar Candela Distribution

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	4409	4409	4409	4409	4409	4409	4409	4409	4409	4409	4409	4409	4409	4409	4409	4409	4409	4409	4409
5	4082	4086	4085	4089	4091	4095	4102	4104	4107	4109	4113	4119	4125	4130	4136	4142	4148	4155	4159
10	3354	3354	3358	3364	3367	3373	3378	3383	3391	3397	3411	3429	3444	3455	3459	3458	3459	3456	3462
15	2510	2510	2511	2514	2516	2522	2528	2535	2543	2557	2572	2589	2603	2611	2619	2624	2631	2641	2653
20	1672	1670	1666	1667	1667	1668	1671	1677	1687	1699	1713	1729	1742	1752	1764	1774	1784	1798	1812
25	1043	1038	1033	1030	1026	1025	1027	1031	1035	1040	1049	1061	1075	1088	1098	1111	1125	1140	1161
30	625	621	618	611	611	609	610	608	611	615	623	630	642	655	665	676	686	698	712
35	361	357	355	352	350	349	348	348	349	352	356	362	368	376	384	390	396	404	415
40	212	210	208	206	205	205	205	205	206	206	209	212	216	220	224	228	231	234	241
45	139	138	137	137	136	136	136	135	135	135	135	137	139	141	142	144	146	148	152
50	102	101	101	100	99.9	99.8	99.9	99.4	98.6	98.6	99.2	100	102	103	103	104	105	106	109
55	77.7	77.2	76.9	76.6	76.5	76.5	76.5	76.2	75.9	75.9	76.6	77.6	78.5	79.0	79.4	79.8	80.4	81.2	82.9
60	60.8	60.6	60.5	60.3	60.1	60.0	60.0	59.8	59.8	59.8	60.3	61.0	61.6	62.1	62.3	62.6	63.0	63.6	64.3
65	47.1	46.9	46.8	46.6	46.6	46.7	46.7	46.6	46.5	46.5	46.8	47.3	47.7	48.0	48.1	48.3	48.6	49.1	49.6
70	34.6	34.5	34.4	34.4	34.4	34.5	34.5	34.5	34.5	34.6	34.8	35.2	35.5	35.7	35.7	35.9	36.1	36.4	36.8
75	23.1	23.1	23.1	23.1	23.1	23.2	23.2	23.2	23.2	23.4	23.6	23.8	24.0	24.2	24.2	24.4	24.5	24.7	25.0
80	12.6	12.7	12.7	12.8	12.9	12.9	13.0	13.0	13.1	13.2	13.3	13.5	13.7	13.8	13.8	13.9	13.9	14.0	14.2
85	3.88	3.93	3.98	4.04	4.10	4.16	4.22	4.32	4.41	4.52	4.65	4.75	4.86	4.92	4.96	4.99	5.01	4.99	5.16
90	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.05	0.08	0.08	0.13	0.15	0.19	0.20	0.20	0.20	0.18	0.25
95	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	0.02
100	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
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	0.02	0.03
110	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	0.04
115	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	0.06
120	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	0.09
125	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.17
130	0.16	0.16	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.32
135	0.29	0.29	0.29	0.29	0.29	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.29	0.29	0.29	0.29	0.28	0.59
140	0.45	0.44	0.45	0.45	0.45	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.45	0.45	0.45	0.44	0.44	0.95
145	0.64	0.61	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.61	0.61	0.60	0.60	0.60	0.59	0.58	1.35
150	0.80	0.76	0.77	0.77	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.77	0.77	0.76	0.76	0.75	1.75
155	0.98	0.93	0.93	0.94	0.95	0.95	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.95	0.94	0.94	0.93	2.08
160	1.17	1.09	1.10	1.11	1.12	1.12	1.13	1.13	1.13	1.13	1.13	1.13	1.12	1.12	1.11	1.10	1.09	1.08	2.34
165	1.31	1.21	1.22	1.23	1.24	1.24	1.25	1.25	1.26	1.27	1.27	1.26	1.26	1.26	1.25	1.24	1.23	1.22	2.46
170	1.42	1.28	1.29	1.30	1.30	1.31	1.31	1.31	1.31	1.32	1.31	1.31	1.30	1.29	1.28	1.27	1.26	1.25	2.39
175	1.53	1.34	1.35	1.37	1.38	1.39	1.41	1.43	1.44	1.46	1.47	1.48	1.48	1.49	1.48	1.48	1.47	1.45	2.13
180	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78

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	4409	4409	4409	4409	4409	4409	4409	4409	4409	4409	4409	4409	4409	4409	4409	4409	4409		
5	4162	4163	4160	4154	4150	4144	4136	4130	4122	4116	4110	4104	4100	4098	4090	4087	4087		
10	3464	3468	3470	3468	3466	3456	3444	3432	3420	3411	3400	3394	3389	3381	3373	3361	3362		
15	2659	2662	2663	2663	2658	2650	2639	2628	2615	2600	2587	2578	2565	2552	2544	2527	2525		
20	1823	1833	1835	1834	1827	1821	1811	1799	1786	1769	1752	1740	1729	1715	1706	1693	1685		
25	1174	1182	1186	1189	1188	1184	1177	1168	1155	1143	1130	1114	1103	1091	1078	1065	1056		
30	722	729	733	737	737	736	732	724	714	705	695	685	673	662	651	640	634		
35	422	428	431	434	433	432	430	427	421	415	409	403	396	390	381	375	370		
40	245	248	251	253	252	251	249	246	243	241	238	235	231	228	224	220	218		
45	154	155	157	158	157	157	155	154	152	151	150	149	147	146	144	143	142		
50	110	110	111	111	111	111	110	109	108	107	107	107	106	105	104	104	104		
55	83.3	83.7	84.0	84.4	84.2	84.0	83.3	82.7	82.1	81.9	81.8	81.5	81.0	80.3	79.8	79.1	78.9		
60	64.7	64.9	65.2	65.4	65.4	65.2	64.8	64.4	64.0	63.9	63.7	63.5	63.1	62.5	62.0	61.5	61.3		
65	49.8	50.0	50.1	50.2	50.3	50.1	49.9	49.7	49.4	49.3	49.2	48.9	48.6	48.1	47.7	47.4	47.5		
70	36.9	37.0	37.0	37.2	37.2	37.1	37.0	36.8	36.6	36.5	36.3	36.1	35.8	35.4	35.0	34.8	34.8		
75	25.1	25.1	25.1	25.1	25.1	25.0	24.9	24.7	24.5	24.4	24.3	24.2	23.9	23.7	23.5	23.3	23.3		
80	14.2	14.1	14.1	14.1	14.0	13.9	13.7	13.6	13.5	13.4	13.2	13.1	13.0	12.9	12.8	12.7	12.7		
85	5.12	5.08	5.03	4.97	4.88	4.83	4.71	4.62	4.51	4.43	4.31	4.21	4.19	4.13	4.07	4.03	4.04		
90	0.23	0.21	0.19	0.15	0.14	0.10	0.11	0.06	0.05	0.03	0.02	0.02	0.01	0.01	0.01	0.02	0.02		
95	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		
100	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.02	0.03	0.03	0.02	0.03	0.03	0.03		
105	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.03	0.03	0.04	0.04	0.03		
110	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	0.05	0.05		
115	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		
120	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09		
125	0.16	0.16	0.16	0.16	0.16	0.16	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.16	0.16	0.16	0.16		
130	0.32	0.31	0.31	0.31	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		
135	0.59	0.58	0.58	0.58	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.58	0.58		
140	0.94	0.94	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.94	0.94	0.94	0.95	0.95	0.96		
145	1.34	1.34	1.33	1.33	1.33	1.34	1.34	1.34	1.35	1.35	1.35	1.36	1.37	1.37	1.38	1.39	1.39		
150	1.73	1.73	1.73	1.74	1.74	1.74	1.75	1.75	1.76	1.76	1.77	1.77	1.78	1.79	1.79	1.80	1.81		
155	2.05	2.06	2.06	2.06	2.07	2.07	2.08	2.09	2.09	2.10	2.11	2.11	2.12	2.13	2.13	2.14	2.14		
160	2.30	2.31	2.31	2.31	2.31	2.31	2.32	2.32	2.32	2.32	2.32	2.33	2.33	2.33	2.33	2.34	2.33		
165	2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.41	2.41	2.41	2.41	2.41	2.41	2.41	2.42	2.40		
170	2.34	2.35	2.36	2.36	2.36	2.36	2.36	2.36	2.36	2.36	2.35	2.35	2.35	2.34	2.34	2.35	2.33		
175	2.10	2.11	2.12	2.12	2.12	2.13	2.13	2.12	2.12	2.12	2.11	2.11	2.10	2.10	2.09	2.11	2.08		
180	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78		

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

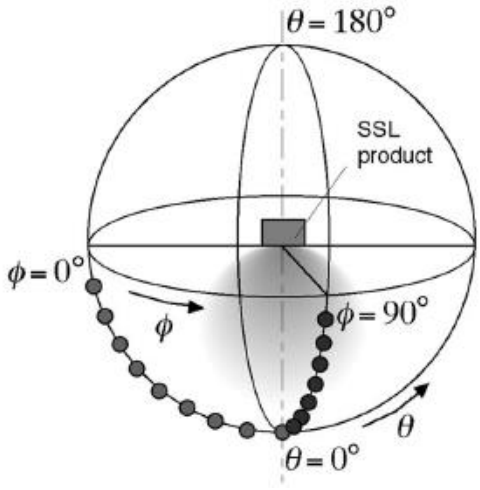
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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