LM-79-08 TEST REPORT

for

GREEN CREATIVE LTD

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

LED Lamp

Model: 5.5PAR20DIM/840NF25/N

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

3rd Floor, Bld. 2, NO. 96 Longchuanwu Rd Qianjiang Economy Dev. Zone, YuhangDist,
Hangzhou, Zhejiang Province, China 311100
Tel: +86571 86376106
www.ledtestlab.com

Report No.: HZ190700391

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

Review by: April Zou

Engineer: April Zou
Aug. 01, 2019

Approved by: Jim Zhang

Manager: Jim Zhang
Aug. 01, 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: **5.5PAR20DIM/840NF25/N**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
108.2	585.3	5.41	0.7165

CCT (K)	CRI	Stabilization Time (Light & Power)
3971	82.1	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 : Jul. 25, 2019

Date of Test : Jul. 31, 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

TABLE OF CONTENT

SAMPLE PHOTO

Figure 1- Overview of the sample

Equipment Under Test(EUT)	
Name	: LED Lamp
Model	: 5.5PAR20DIM/840NF25/N
Electrical Ratings	: 120V, 60Hz, 5.5W
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 ℃.

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)	0.063
Power Factor	0.7165
Test Power (W)	5.41
THD A%	69.02
Luminous Efficacy (lm/W)	108.2
Total Luminous Flux (lm)	585.3
Color Rendering Index (CRI)	82.1
R9	3.9
Correlated Color Temperature (CCT)(K)	3971
Chromaticity Chroma x	0.3828
Chromaticity Chroma y	0.3819
Chromaticity Chroma u	0.2246
Chromaticity Chroma v	0.3361
Duv	0.0017
Chromaticity Chroma u ’	0.2246
Chromaticity Chroma v’	0.5042

Special Color Rendering Indices	
R1	79.9
R2	88.8
R3	95.2
R4	80.2
R5	80
R6	84.5
R7	85.6
R8	62.7
R9	3.9
R10	73.4
R11	78.5
R12	61.9
R13	82.1
R14	97.5

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 25.2 ℃.

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)	0.062
Power Factor	0.7229
Power (W)	5.37
Luminous Efficacy (lm/W)	110.8
Total Luminous Flux (lm)	595.1
Beam Angle (°)	28.4 (0^o-180^o) / 28.3 (90^o-270^o)
Center Beam Candle Power (cd)	1665
Maximum Beam Candle Power (cd)	1674(At: C=160.0, Gamma=1.5)
Spacing Criteria	0.45 (0^o-180^o) / 0.49 (90^o-270^o)
Zonal Lumens in the 0 °-60 °Zone	97.38%
Zonal Lumens in the 60 °-90 °Zone	2.47%
Zonal Lumens in the 90 °-120 °Zone	0.02%
Zonal Lumens in the 120 °-180 °Zone	0.13%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

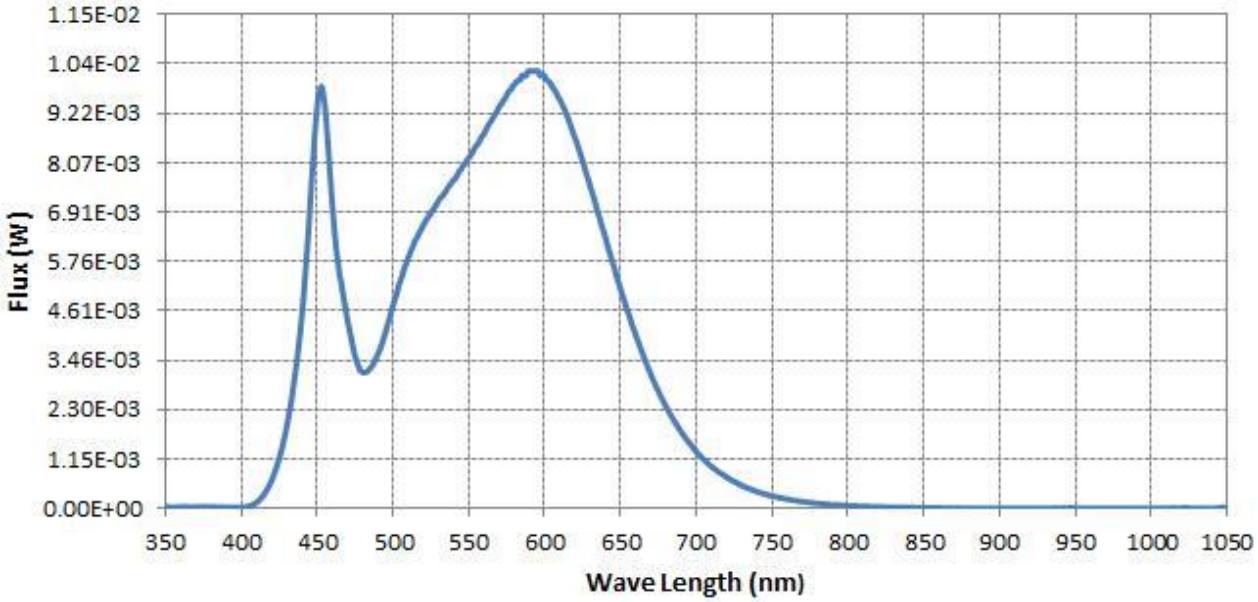
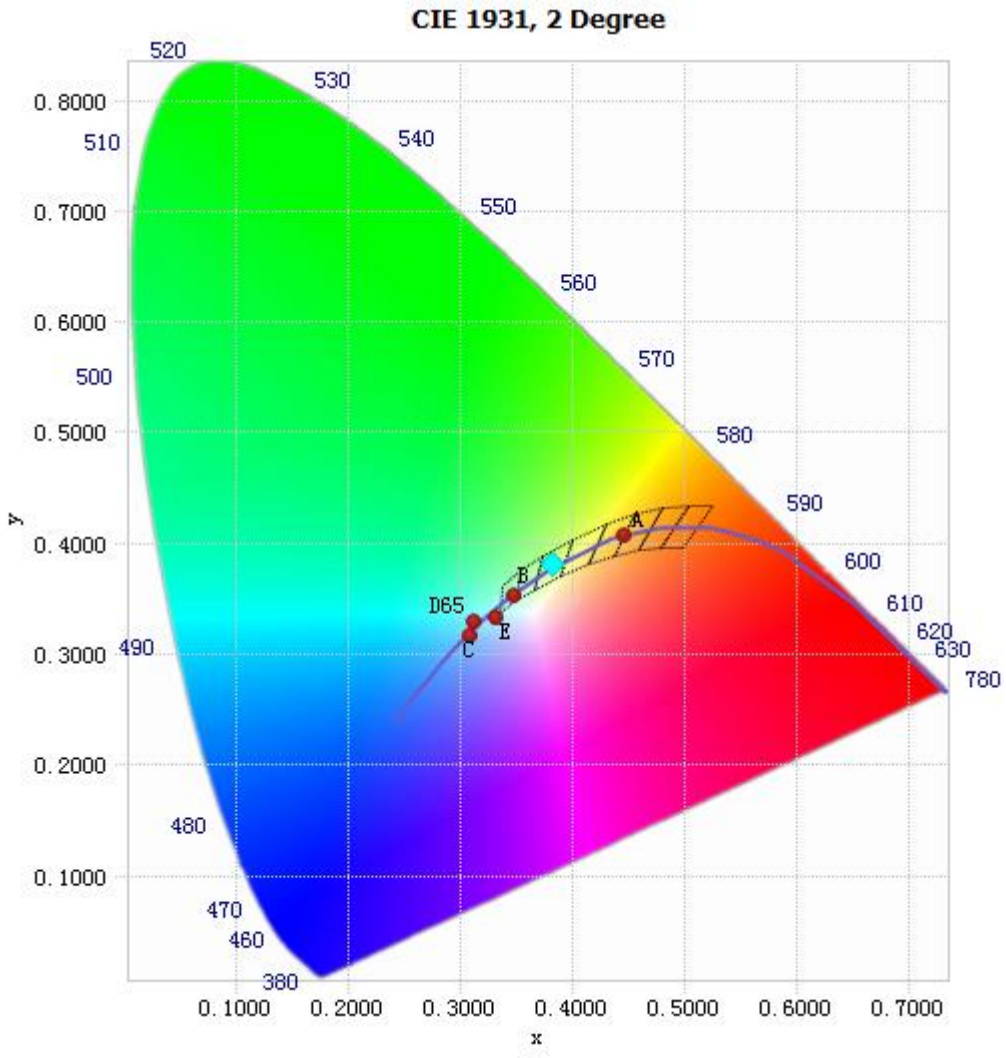


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	4.26E-05	485	3.27E-03	590	1.02E-02	695	1.55E-03
385	3.10E-05	490	3.58E-03	595	1.02E-02	700	1.33E-03
390	3.04E-05	495	4.08E-03	600	1.01E-02	705	1.14E-03
395	2.47E-05	500	4.72E-03	605	9.85E-03	710	9.79E-04
400	2.34E-05	505	5.31E-03	610	9.55E-03	715	8.48E-04
405	5.48E-05	510	5.84E-03	615	9.15E-03	720	7.33E-04
410	1.37E-04	515	6.27E-03	620	8.65E-03	725	6.29E-04
415	3.22E-04	520	6.61E-03	625	8.11E-03	730	5.39E-04
420	6.41E-04	525	6.88E-03	630	7.53E-03	735	4.61E-04
425	1.15E-03	530	7.17E-03	635	6.92E-03	740	3.95E-04
430	1.90E-03	535	7.40E-03	640	6.34E-03	745	3.39E-04
435	2.98E-03	540	7.66E-03	645	5.72E-03	750	2.93E-04
440	4.49E-03	545	7.91E-03	650	5.13E-03	755	2.51E-04
445	6.80E-03	550	8.17E-03	655	4.58E-03	760	2.19E-04
450	9.32E-03	555	8.47E-03	660	4.06E-03	765	1.89E-04
455	9.46E-03	560	8.73E-03	665	3.57E-03	770	1.61E-04
460	7.15E-03	565	9.05E-03	670	3.13E-03	775	1.40E-04
465	5.44E-03	570	9.36E-03	675	2.74E-03	780	1.21E-04
470	4.42E-03	575	9.63E-03	680	2.38E-03		
475	3.57E-03	580	9.88E-03	685	2.07E-03		
480	3.18E-03	585	1.01E-02	690	1.79E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3828, 0.3819)

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

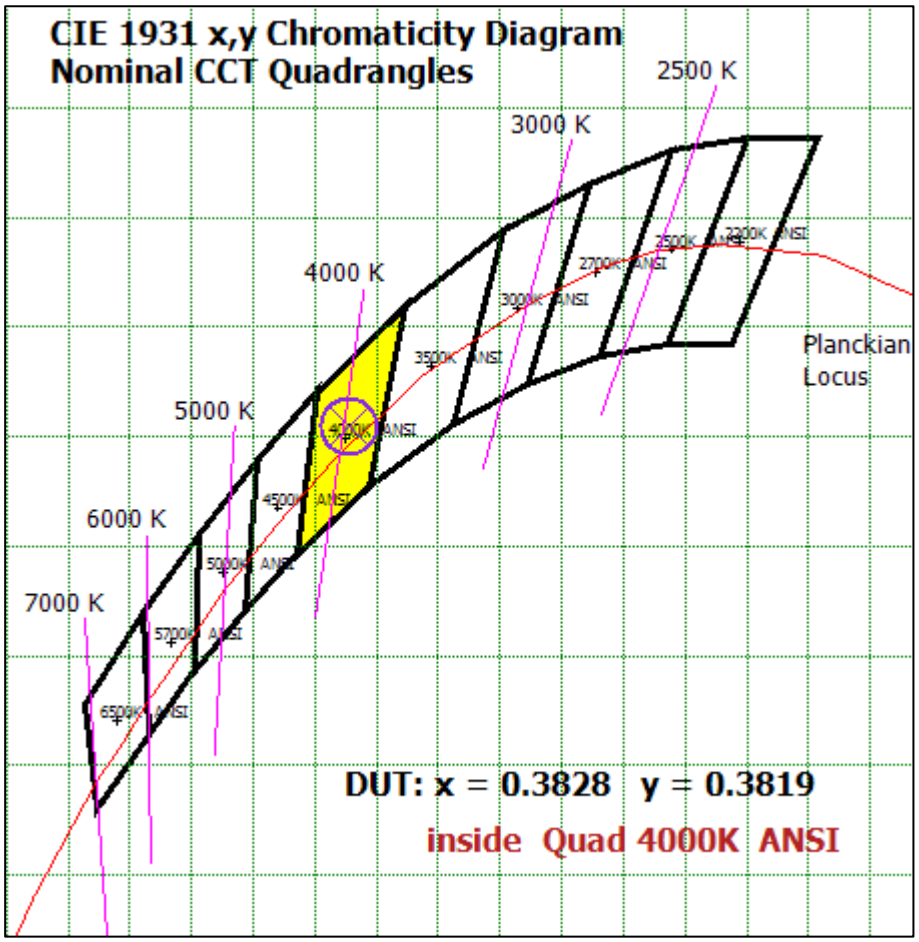
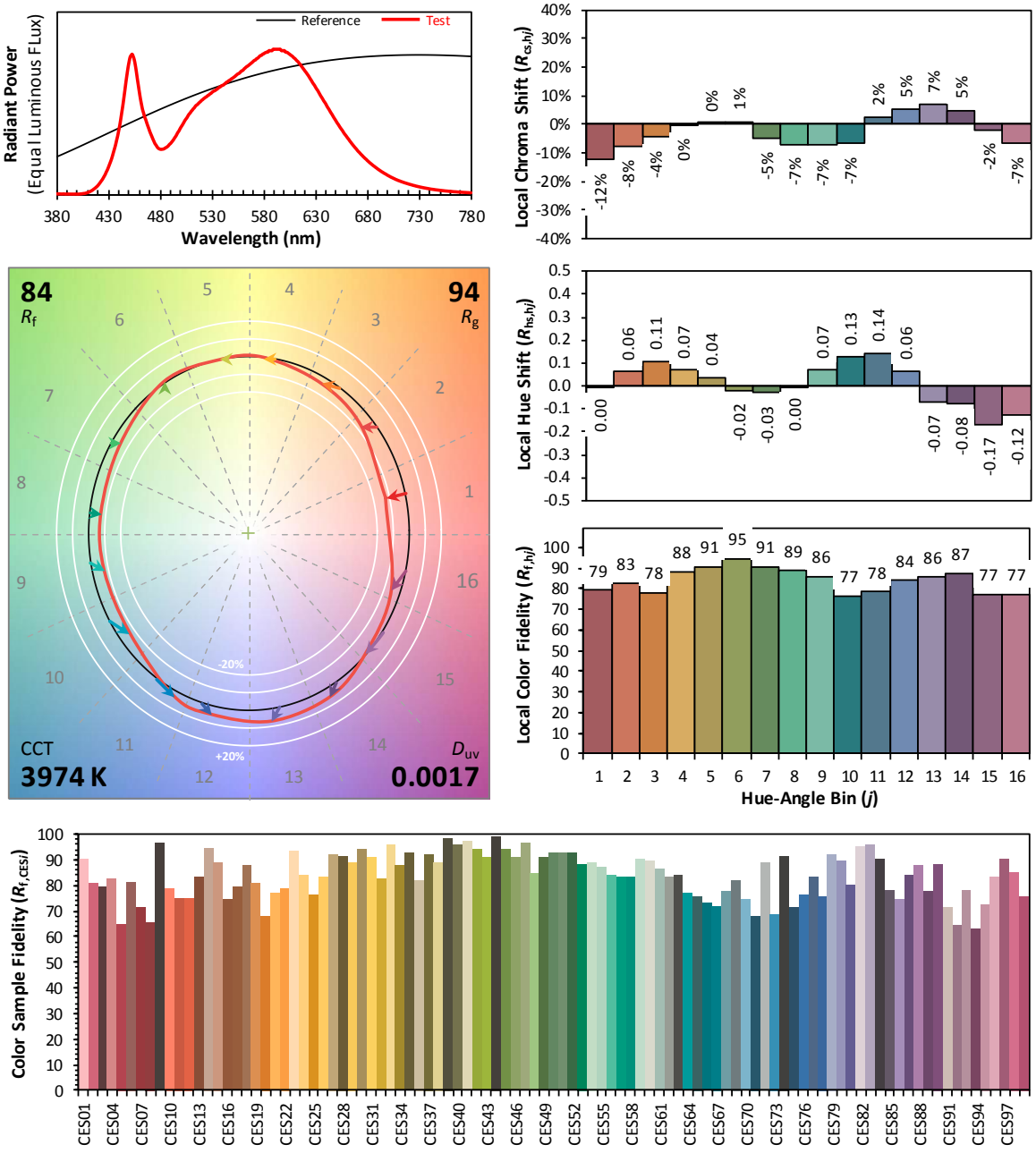


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method



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

x	0.3828
y	0.3818
u'	0.2246
v'	0.5042

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	136.203	22.89%
10- 20	207.044	34.79%
20- 30	124.304	20.89%
30- 40	71.773	12.06%
40- 50	28.645	4.81%
50- 60	11.483	1.93%
60- 70	8.642	1.45%
70- 80	4.716	0.79%
80- 90	1.349	0.23%
90-100	0.115	0.02%
100-110	0.012	0.00%
110-120	0.01	0.00%
120-130	0.031	0.01%
130-140	0.091	0.02%
140-150	0.184	0.03%
150-160	0.229	0.04%
160-170	0.175	0.03%
170-180	0.057	0.01%
Total	595.1	100%

γ(°)	Lumens	% Total
0- 60	579.452	97.38%
60- 90	14.707	2.47%
0-90	594.159	99.85%
90- 180	0.904	0.15%
0- 180	595.1	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

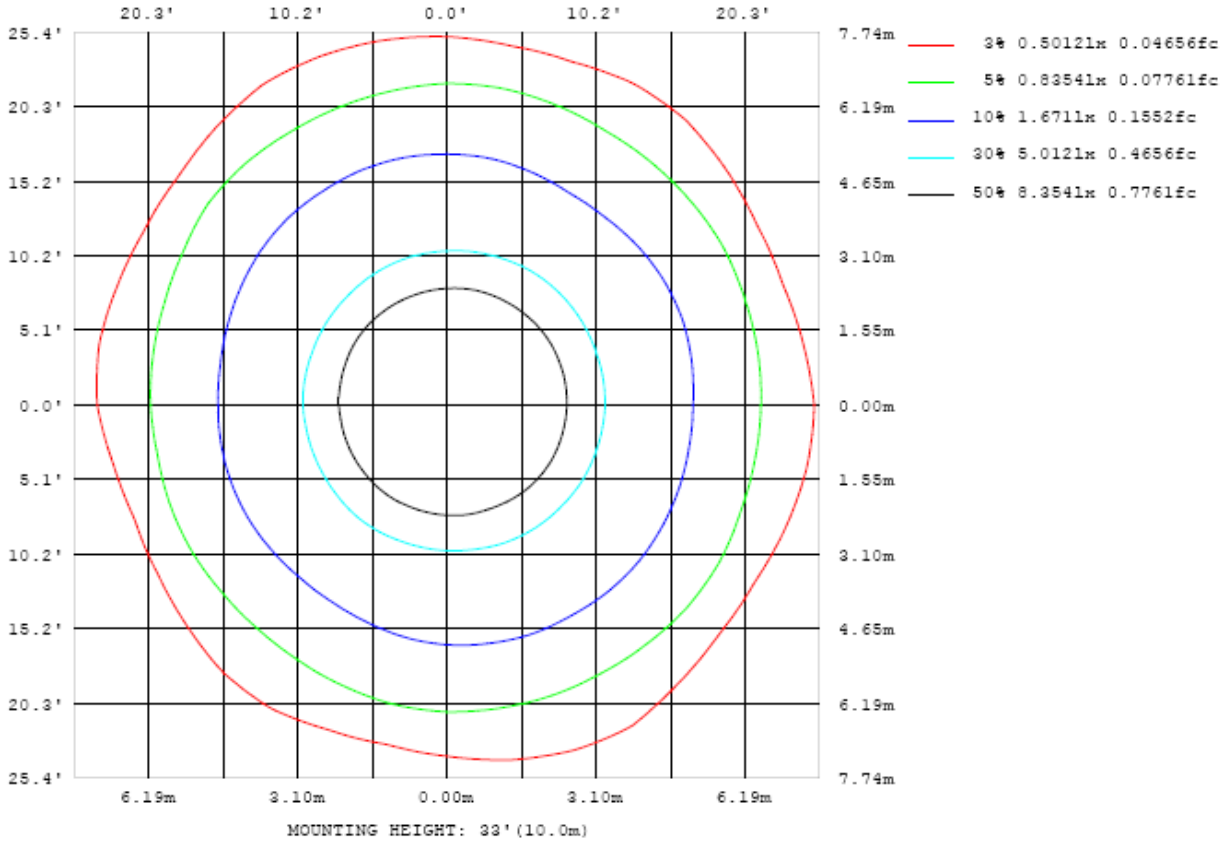


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

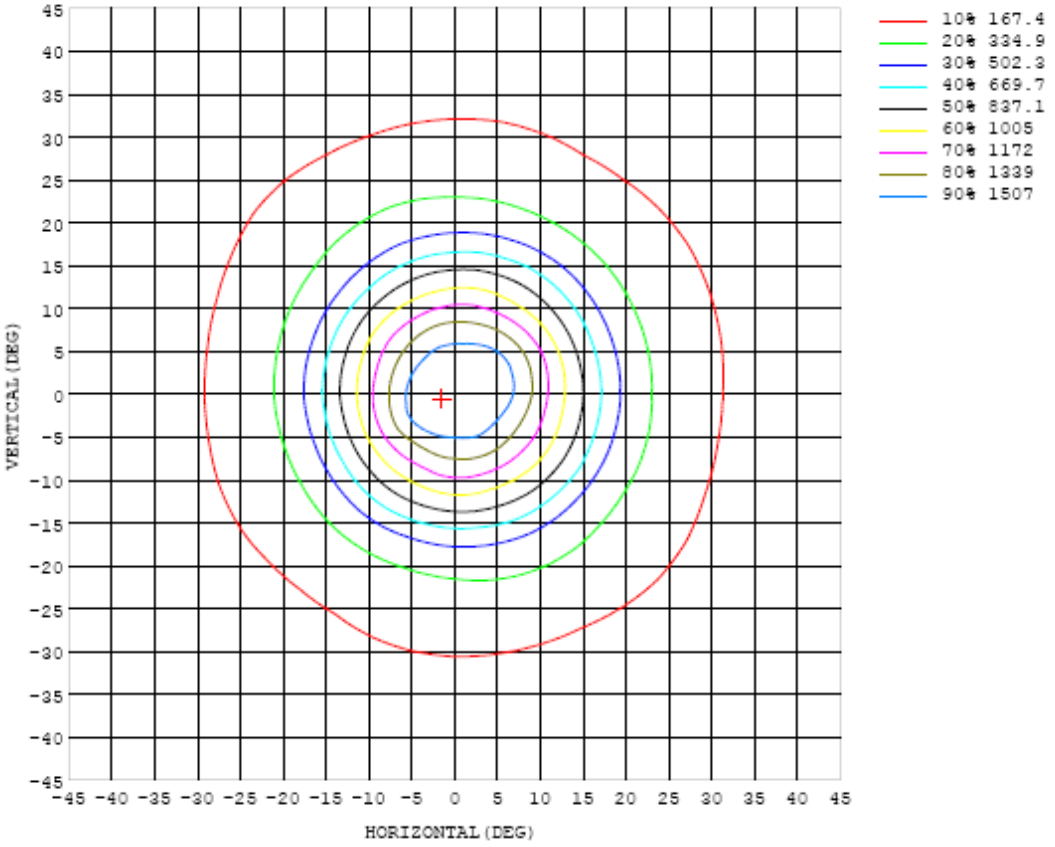


Chart 6: Isocandela Plot

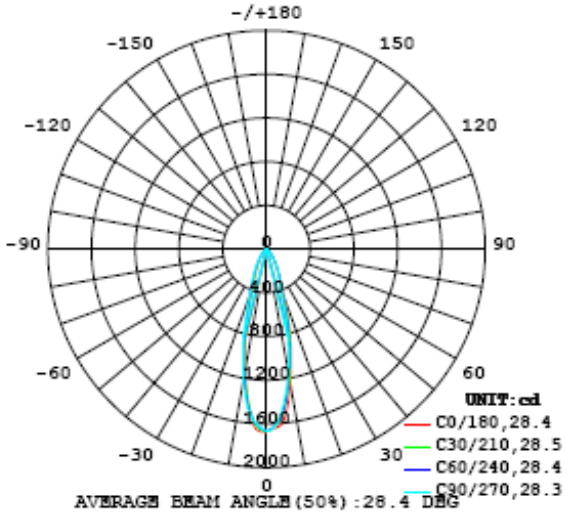


Chart 7: Polar Candela Distribution

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	1665	1665	1665	1665	1665	1665	1665	1665	1665	1665	1665	1665	1665	1665	1665	1665	1665	1665	1665
5	1608	1585	1563	1546	1538	1535	1533	1526	1516	1509	1510	1515	1527	1540	1555	1574	1574	1562	1558
10	1249	1230	1219	1207	1192	1180	1168	1157	1155	1149	1138	1115	1109	1119	1122	1131	1135	1134	1135
15	838	830	825	815	801	790	773	755	732	722	711	707	707	705	699	687	689	693	705
20	462	456	447	436	428	423	418	408	396	386	376	369	370	368	362	358	361	368	376
25	280	281	281	279	280	279	276	274	268	259	249	240	233	230	232	234	235	235	235
30	186	184	189	193	193	187	179	178	178	176	172	164	153	151	151	155	157	155	156
35	121	118	116	115	114	116	119	117	114	108	100	100	104	102	95.2	88.9	86.2	93.3	103
40	75.4	76.7	70.7	65.7	66.1	74.4	83.2	81.4	72.1	63.2	58.0	59.4	62.3	59.4	51.7	45.5	45.8	51.7	60.0
45	31.9	35.9	39.2	40.6	41.9	42.7	40.8	39.1	37.2	37.1	36.4	33.4	27.0	22.5	21.6	21.9	21.8	21.3	22.3
50	14.9	16.2	19.0	22.1	22.2	19.5	16.2	15.3	17.0	18.8	18.4	16.3	14.0	12.7	12.5	12.7	12.5	12.4	12.4
55	12.2	12.3	13.1	14.2	13.9	13.0	12.2	12.1	12.5	13.1	13.1	12.2	11.3	10.9	10.9	11.0	10.9	10.8	10.7
60	10.5	10.6	11.2	12.0	11.9	11.2	10.6	10.4	10.9	11.5	11.4	10.5	9.78	9.49	9.49	9.57	9.45	9.32	9.31
65	8.73	8.74	9.21	9.85	9.78	9.19	8.79	8.75	9.09	9.53	9.33	8.59	8.11	7.79	7.80	7.87	7.79	7.63	7.73
70	6.62	6.60	6.85	7.25	7.18	6.86	6.62	6.58	6.72	6.94	6.75	6.27	5.95	5.80	5.81	5.89	5.82	5.70	5.87
75	4.68	4.61	4.66	4.79	4.75	4.65	4.56	4.52	4.50	4.49	4.35	4.15	4.00	3.92	3.92	3.96	3.91	3.83	3.97
80	2.61	2.55	2.55	2.57	2.58	2.57	2.55	2.52	2.45	2.38	2.30	2.22	2.18	2.17	2.16	2.18	2.15	2.11	2.21
85	1.35	1.32	1.30	1.31	1.27	1.25	1.23	1.19	1.14	1.10	1.05	1.01	0.97	0.96	0.96	0.96	0.96	0.96	1.01
90	0.31	0.30	0.29	0.31	0.27	0.26	0.25	0.24	0.23	0.21	0.20	0.19	0.18	0.17	0.17	0.17	0.18	0.19	0.20
95	0.10	0.09	0.09	0.09	0.08	0.08	0.08	0.08	0.08	0.07	0.07	0.06	0.06	0.06	0.06	0.06	0.07	0.07	0.08
100	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03
105	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
110	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.00
115	0.00	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
120	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.02
125	0.02	0.02	0.02	0.02	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
130	0.04	0.04	0.04	0.04	0.04	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	0.08
135	0.07	0.08	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	0.15
140	0.13	0.13	0.13	0.13	0.14	0.14	0.14	0.14	0.14	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.16	0.15	0.25
145	0.19	0.20	0.20	0.20	0.20	0.21	0.21	0.21	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.23	0.23	0.22	0.38
150	0.27	0.27	0.27	0.27	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	0.29	0.50
155	0.35	0.35	0.35	0.35	0.36	0.36	0.36	0.36	0.37	0.37	0.38	0.38	0.38	0.38	0.39	0.39	0.39	0.37	0.60
160	0.42	0.42	0.43	0.43	0.43	0.43	0.43	0.44	0.44	0.45	0.45	0.45	0.46	0.46	0.46	0.46	0.47	0.45	0.65
165	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.49	0.49	0.49	0.50	0.50	0.50	0.51	0.51	0.51	0.51	0.50	0.65
170	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.52	0.52	0.52	0.53	0.53	0.53	0.53	0.54	0.54	0.54	0.53	0.60
175	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.53	0.53	0.53	0.53	0.54	0.54	0.54	0.55	0.55	0.55
180	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56

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	1665	1665	1665	1665	1665	1665	1665	1665	1665	1665	1665	1665	1665	1665	1665	1665	1665		
5	1551	1543	1536	1532	1533	1541	1547	1546	1547	1553	1569	1589	1608	1624	1629	1624	1618		
10	1133	1138	1152	1165	1170	1172	1183	1194	1210	1223	1226	1238	1255	1271	1282	1278	1264		
15	710	714	725	737	746	764	779	790	801	817	822	832	835	836	837	837	838		
20	380	384	391	399	410	422	433	436	440	446	450	457	465	465	463	463	464		
25	238	246	255	264	274	282	288	291	288	287	281	277	278	283	287	287	283		
30	158	164	174	185	189	189	192	197	199	200	194	185	186	193	198	198	193		
35	106	104	105	112	118	122	123	125	128	126	124	124	125	124	120	117	119		
40	64.7	64.7	61.3	62.6	72.3	83.0	84.7	80.8	74.3	70.5	75.7	83.0	80.5	70.4	62.4	62.3	69.2		
45	26.4	33.0	36.7	39.6	42.0	44.9	47.0	45.6	44.5	44.5	44.5	41.3	36.7	33.4	31.4	31.2	31.2		
50	13.2	15.8	19.0	21.0	19.9	18.2	18.6	21.5	24.7	25.5	22.4	18.2	16.2	16.1	16.7	16.0	15.0		
55	11.0	11.7	12.6	13.1	12.9	12.2	12.2	13.0	14.4	14.9	13.7	12.5	11.9	12.0	12.4	12.5	12.3		
60	9.53	10.0	10.8	11.3	11.1	10.5	10.4	11.0	12.0	12.2	11.3	10.6	10.2	10.4	10.7	10.8	10.5		
65	7.93	8.34	8.92	9.34	9.19	8.82	8.75	9.27	10.0	10.1	9.37	8.78	8.53	8.63	8.97	9.03	8.72		
70	6.04	6.29	6.65	6.96	6.95	6.78	6.76	7.12	7.54	7.58	7.13	6.73	6.55	6.57	6.89	6.97	6.68		
75	4.11	4.25	4.42	4.58	4.65	4.63	4.67	4.83	5.00	5.00	4.86	4.71	4.60	4.52	4.72	4.82	4.68		
80	2.31	2.37	2.42	2.49	2.53	2.58	2.61	2.64	2.65	2.63	2.62	2.61	2.54	2.43	2.52	2.61	2.58		
85	1.04	1.07	1.11	1.16	1.21	1.26	1.29	1.32	1.34	1.35	1.35	1.35	1.34	1.30	1.34	1.38	1.37		
90	0.21	0.22	0.23	0.24	0.25	0.27	0.28	0.29	0.30	0.31	0.31	0.32	0.32	0.33	0.33	0.33	0.33		
95	0.08	0.09	0.10	0.10	0.10	0.10	0.11	0.11	0.11	0.11	0.11	0.10	0.10	0.10	0.10	0.11	0.10		
100	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.04	0.05	0.05	0.05		
105	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.00		
110	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.00		
115	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		
120	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		
125	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	0.03	0.03	0.03	0.03		
130	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07		
135	0.16	0.16	0.16	0.16	0.15	0.15	0.15	0.15	0.14	0.14	0.14	0.14	0.13	0.13	0.13	0.13	0.13		
140	0.27	0.27	0.26	0.26	0.26	0.26	0.25	0.25	0.25	0.24	0.24	0.24	0.23	0.23	0.23	0.23	0.22		
145	0.41	0.40	0.40	0.40	0.39	0.39	0.38	0.38	0.38	0.37	0.37	0.37	0.36	0.36	0.36	0.37	0.35		
150	0.55	0.54	0.54	0.53	0.53	0.52	0.52	0.52	0.51	0.51	0.51	0.50	0.50	0.50	0.50	0.51	0.48		
155	0.67	0.66	0.66	0.65	0.65	0.65	0.64	0.64	0.64	0.64	0.63	0.63	0.63	0.63	0.63	0.65	0.59		
160	0.75	0.74	0.74	0.74	0.74	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.75	0.67		
165	0.78	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.78	0.78	0.78	0.78	0.78	0.78	0.80	0.69		
170	0.74	0.72	0.72	0.73	0.73	0.73	0.73	0.73	0.74	0.74	0.75	0.75	0.76	0.76	0.76	0.78	0.62		
175	0.59	0.61	0.61	0.61	0.61	0.61	0.62	0.62	0.63	0.64	0.64	0.65	0.66	0.66	0.67	0.63	0.52		
180	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56		

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.

3rd Floor, Bld. 2, NO. 96 Longchuanwu Rd Qianjiang Economy Dev. Zone, YuhangDist,
Hangzhou, Zhejiang Province, China 311100
Tel: +86 571 86376106 www.ledtestlab.com

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

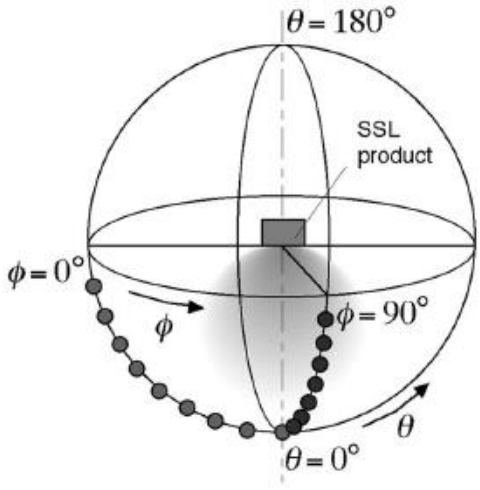
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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