LM-79-08 TEST REPORT

for

GREEN CREATIVE LTD

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

LED Lamp

Model: 11PAR30SNDIM/927FL40

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ19050046v

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. 16, 2019

Approved by: Jim Zhang

Manager: Jim Zhang
Jul. 16, 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/927FL40**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
98.9	1047.8	10.93	0.9315

CCT (K)	CRI	Stabilization Time (Light & Power)
2831	98.2	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 : 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/927FL40
Electrical Ratings	: 120V, 60Hz, 11W
Product Description	: 2700K
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)	0.0978
Power Factor	0.9315
Test Power (W)	10.93
THD A%	32.54
Luminous Efficacy (lm/W)	95.9
Total Luminous Flux (lm)	1047.8
Color Rendering Index (CRI)	98.2
R9	89.5
Correlated Color Temperature (CCT)(K)	2831
Chromaticity Chroma x	0.4485
Chromaticity Chroma y	0.4064
Chromaticity Chroma u	0.2570
Chromaticity Chroma v	0.3493
Duv	0.0005
Chromaticity Chroma u ’	0.2570
Chromaticity Chroma v’	0.5240

Special Color Rendering Indices	
R1	99.3
R2	99.6
R3	97.9
R4	99.9
R5	99.1
R6	97.3
R7	97
R8	95.2
R9	89.5
R10	98.9
R11	97.8
R12	87.5
R13	99.2
R14	97.7

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)	0.998
Power Factor	0.9350
Power (W)	10.97
Luminous Efficacy (lm/W)	96.4
Total Luminous Flux (lm)	1057.0
Beam Angle (°)	36.3 (0^o-180^o) / 36.5 (90^o-270^o)
Center Beam Candle Power (cd)	1944
Maximum Beam Candle Power (cd)	1961 (At: C=170.0, Gamma=3.0)
Spacing Criteria	0.62 (0^o-180^o) / 0.60 (90^o-270^o)
Zonal Lumens in the 0 °-60 °Zone	94.93%
Zonal Lumens in the 60 °-90 °Zone	4.92%
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

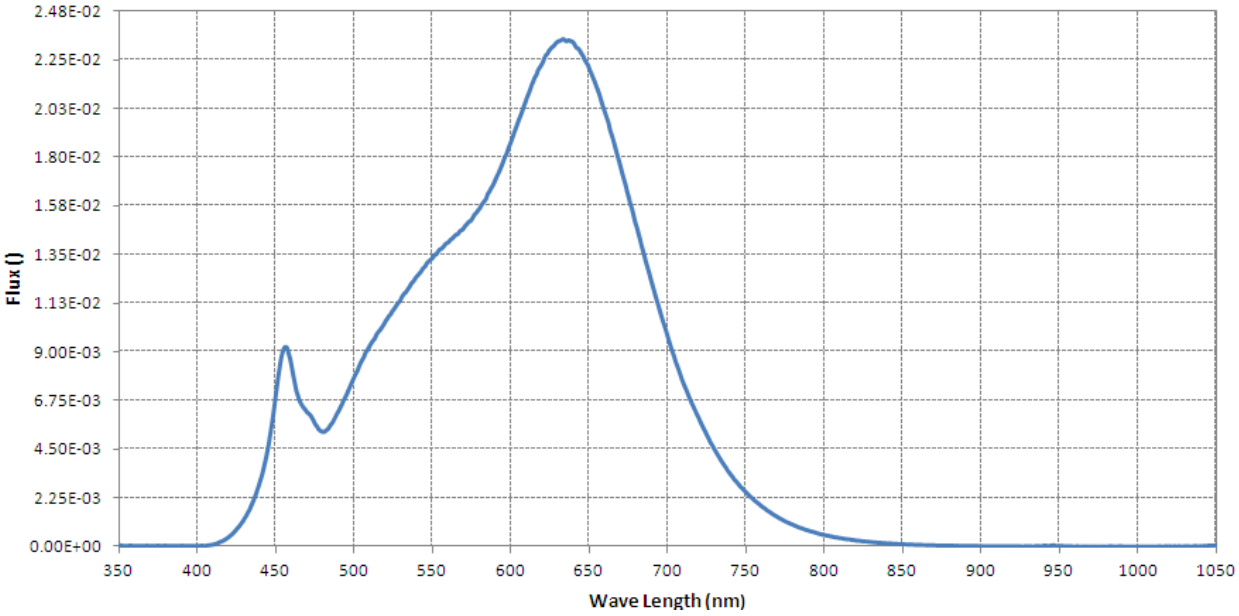
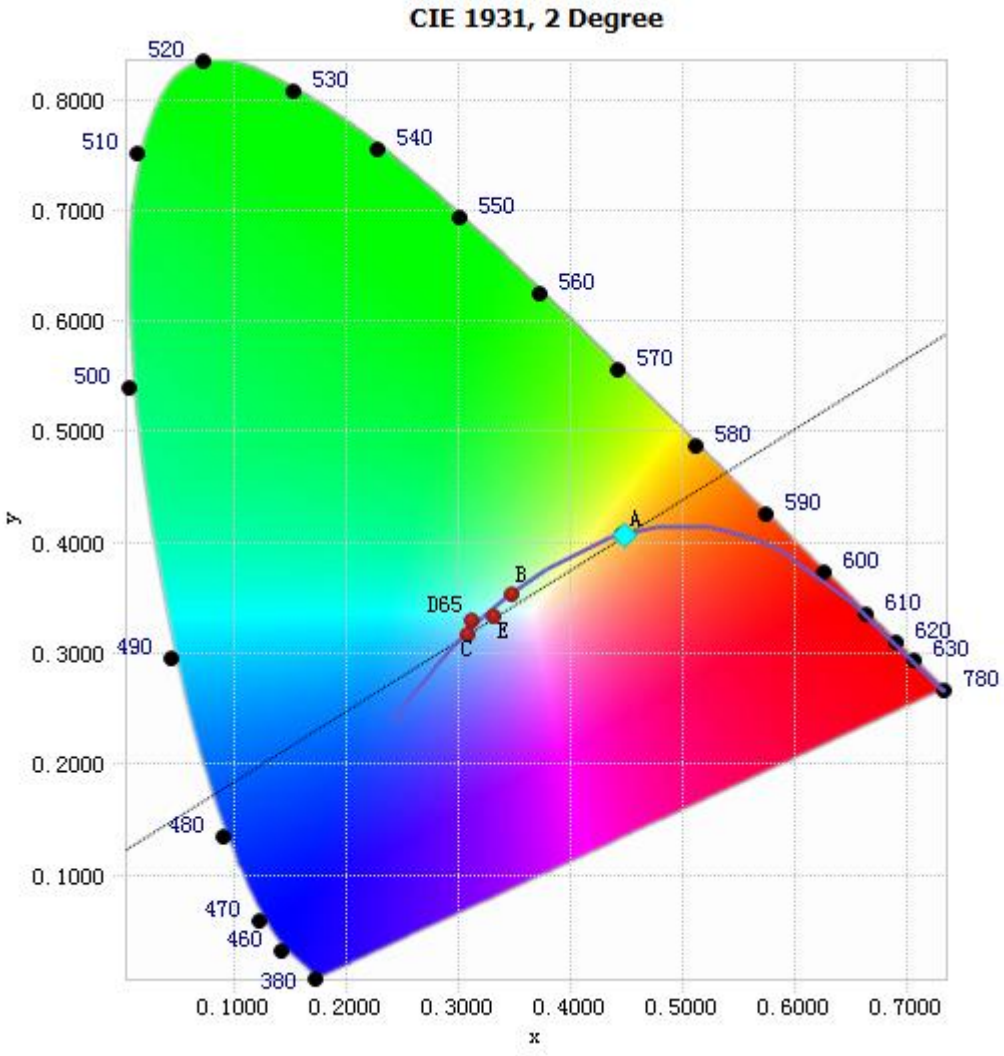


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	4.91E-05	485	5.65E-03	590	1.70E-02	695	1.09E-02
385	4.84E-05	490	6.28E-03	595	1.78E-02	700	9.69E-03
390	5.30E-05	495	7.03E-03	600	1.87E-02	705	8.55E-03
395	3.57E-05	500	7.86E-03	605	1.98E-02	710	7.54E-03
400	3.21E-05	505	8.64E-03	610	2.07E-02	715	6.67E-03
405	4.59E-05	510	9.32E-03	615	2.17E-02	720	5.89E-03
410	1.06E-04	515	9.91E-03	620	2.24E-02	725	5.14E-03
415	2.43E-04	520	1.05E-02	625	2.30E-02	730	4.47E-03
420	4.61E-04	525	1.10E-02	630	2.34E-02	735	3.86E-03
425	8.25E-04	530	1.15E-02	635	2.34E-02	740	3.34E-03
430	1.32E-03	535	1.20E-02	640	2.33E-02	745	2.89E-03
435	2.04E-03	540	1.25E-02	645	2.28E-02	750	2.51E-03
440	3.08E-03	545	1.29E-02	650	2.21E-02	755	2.16E-03
445	4.62E-03	550	1.34E-02	655	2.12E-02	760	1.86E-03
450	7.09E-03	555	1.38E-02	660	2.00E-02	765	1.60E-03
455	9.16E-03	560	1.41E-02	665	1.88E-02	770	1.37E-03
460	8.31E-03	565	1.44E-02	670	1.75E-02	775	1.17E-03
465	6.74E-03	570	1.48E-02	675	1.62E-02	780	1.01E-03
470	6.19E-03	575	1.51E-02	680	1.48E-02		
475	5.66E-03	580	1.56E-02	685	1.34E-02		
480	5.31E-03	585	1.63E-02	690	1.21E-02		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4485, 0.4064)

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

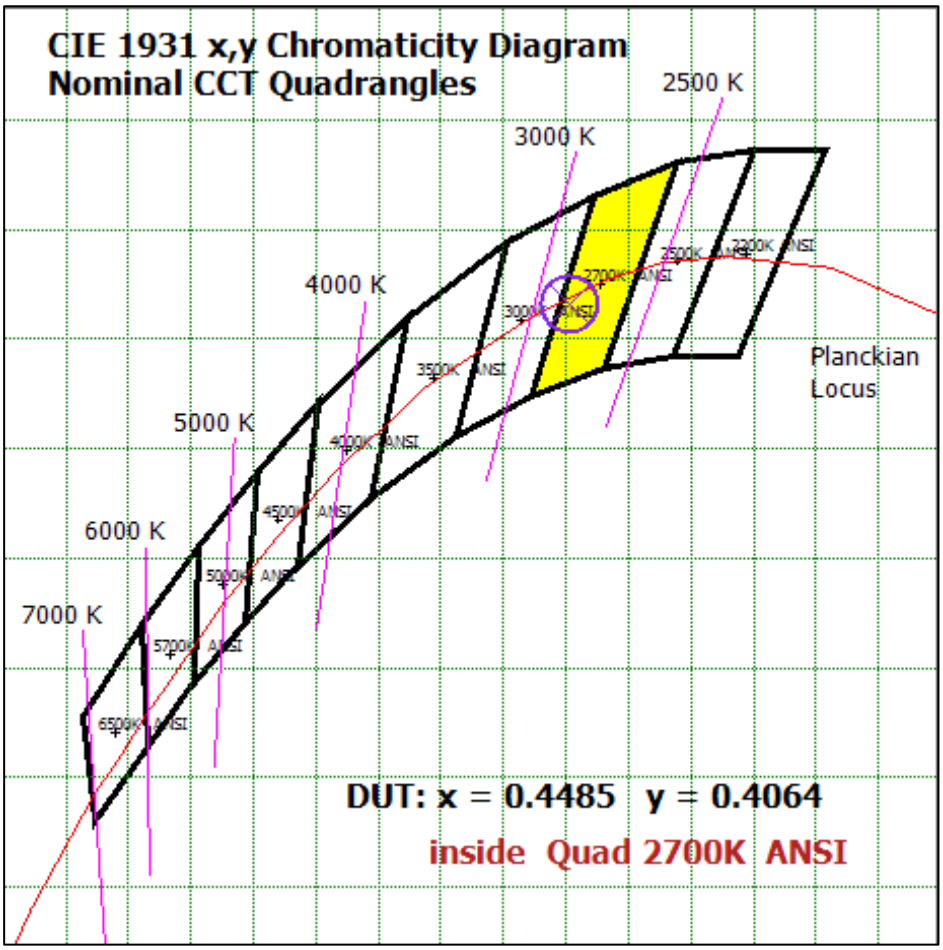
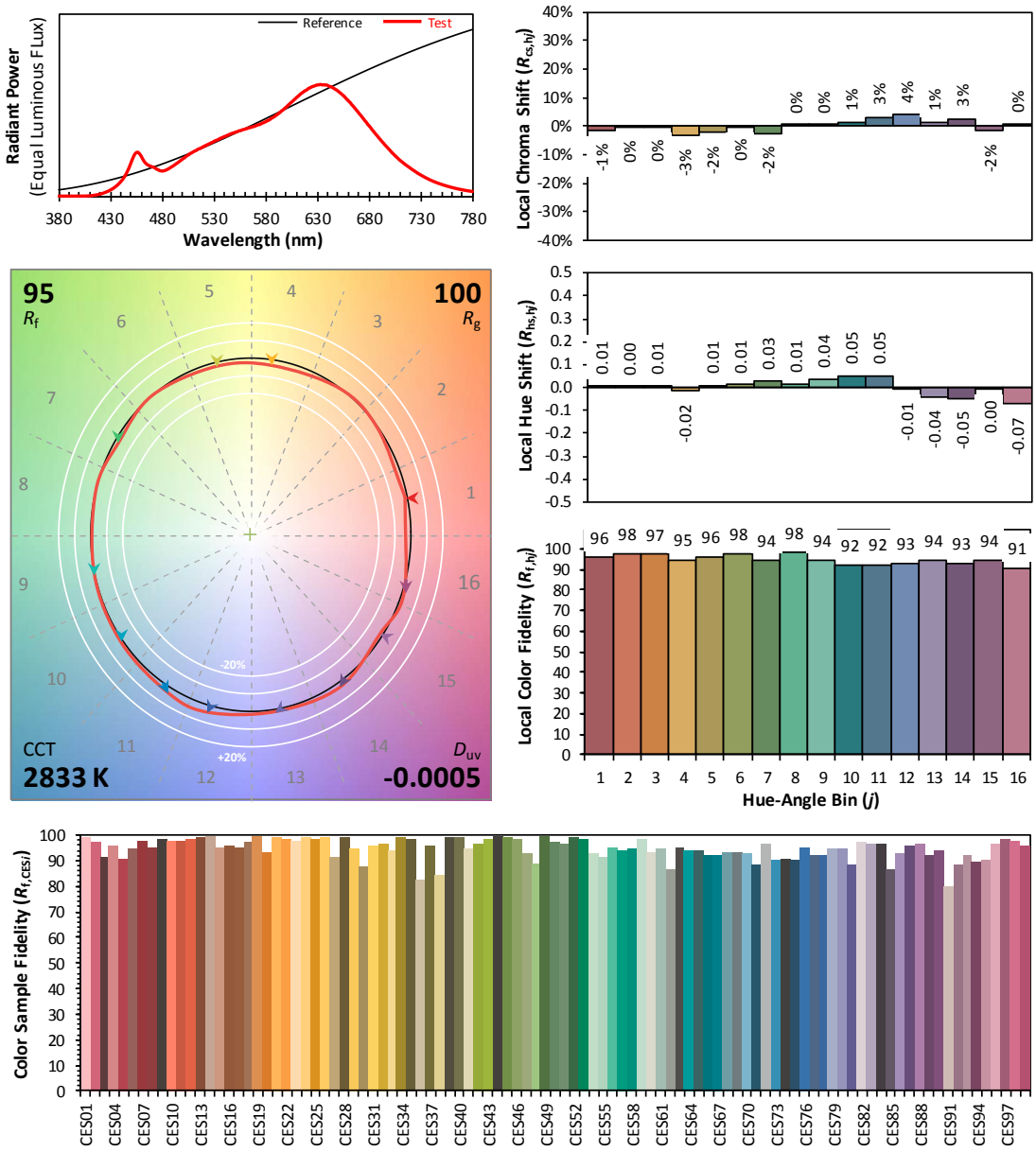


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method



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

x	0.4485
y	0.4064
u'	0.2570
v'	0.5240

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	169.34	16.02%
10- 20	331.769	31.39%
20- 30	257.721	24.38%
30- 40	132.66	12.55%
40- 50	67.445	6.38%
50- 60	44.472	4.21%
60- 70	29.657	2.81%
70- 80	16.721	1.58%
80- 90	5.599	0.53%
90-100	0.318	0.03%
100-110	0.017	0.00%
110-120	0.031	0.00%
120-130	0.071	0.01%
130-140	0.179	0.02%
140-150	0.312	0.03%
150-160	0.362	0.03%
160-170	0.277	0.03%
170-180	0.094	0.01%
Total	1057.0	100%

γ(°)	Lumens	% Total
0- 60	1003.407	94.93%
60- 90	51.977	4.92%
0-90	1055.384	99.84%
90- 180	1.661	0.16%
0- 180	1057.0	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

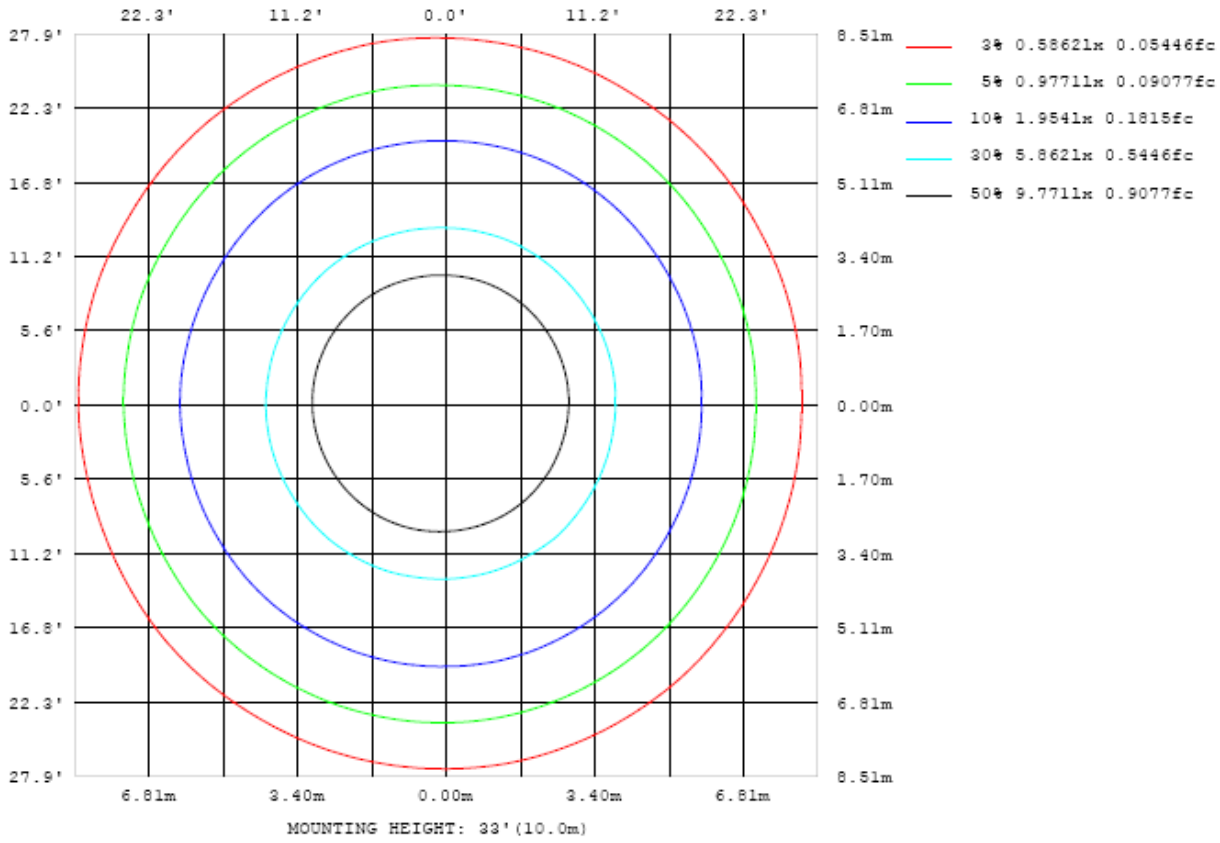


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

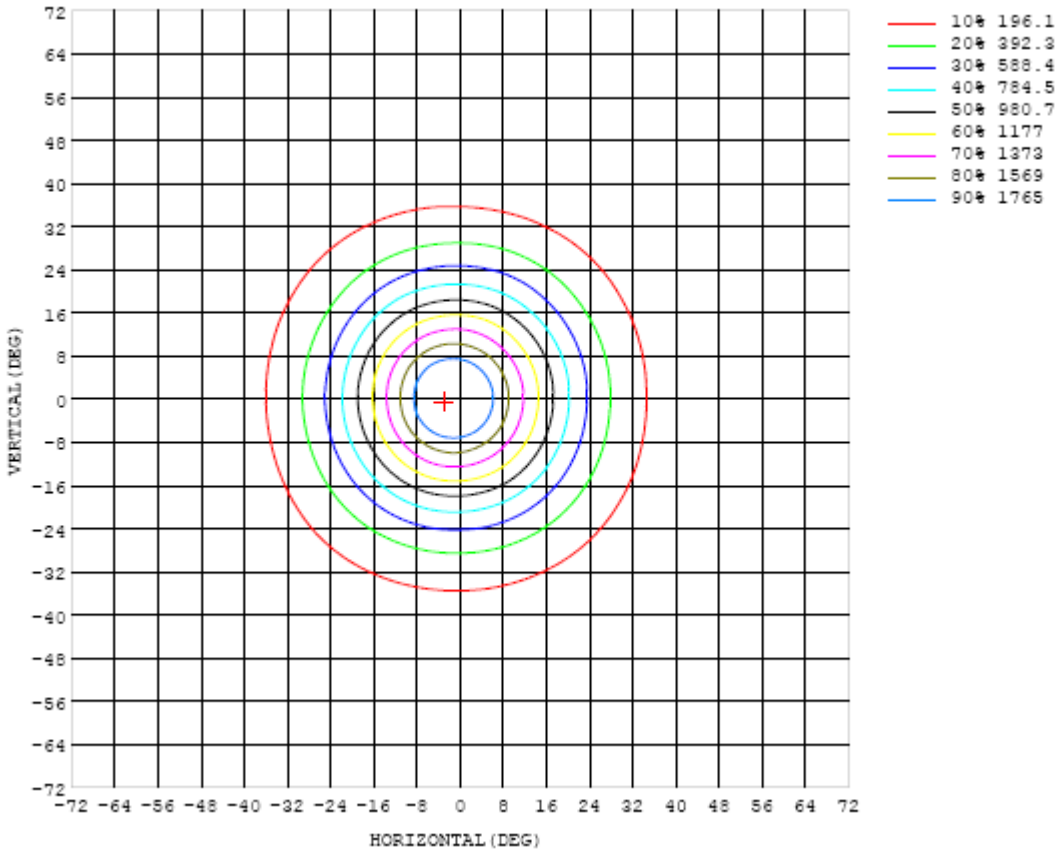


Chart 6: Isocandela Plot

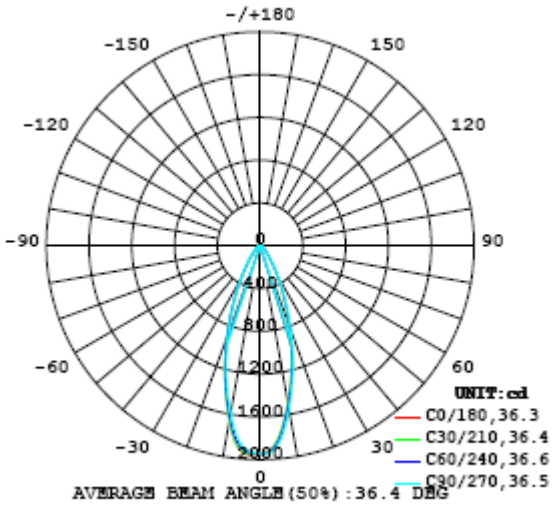


Chart 7: Polar Candela Distribution

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	1944	1944	1944	1944	1944	1944	1944	1944	1944	1944	1944	1944	1944	1944	1944	1944	1944	1944	1944
5	1830	1828	1829	1833	1837	1844	1853	1860	1866	1876	1886	1896	1905	1915	1923	1928	1933	1934	1937
10	1495	1493	1495	1500	1505	1511	1520	1529	1542	1558	1575	1588	1600	1613	1626	1637	1647	1652	1661
15	1141	1136	1136	1141	1144	1153	1160	1168	1175	1187	1201	1212	1224	1235	1243	1249	1256	1262	1271
20	796	792	793	798	806	811	819	824	830	840	852	864	873	880	885	890	899	905	912
25	513	512	514	518	524	530	535	540	544	549	555	563	570	574	578	580	584	588	595
30	314	314	315	318	323	327	331	335	338	339	343	347	350	353	355	354	356	358	364
35	186	187	189	190	192	195	197	201	204	206	208	210	211	212	214	213	214	215	218
40	117	118	118	119	120	123	124	125	127	128	128	129	129	130	131	130	130	131	133
45	78.6	78.7	79.4	79.5	80.4	81.3	82.5	83.5	84.4	84.6	85.4	86.2	86.7	86.7	87.4	86.9	86.9	87.1	88.6
50	58.0	58.1	58.6	58.9	59.0	59.7	60.5	61.2	62.2	62.6	62.6	62.9	63.1	63.3	63.9	63.7	63.7	63.9	64.3
55	47.4	47.3	47.4	47.5	47.7	48.1	48.3	48.7	49.1	49.5	49.6	50.0	50.3	50.7	50.9	51.1	51.2	51.4	51.8
60	36.9	36.7	36.9	36.9	36.9	37.1	37.4	37.6	38.1	38.4	38.6	39.0	39.3	39.6	39.9	40.2	40.4	40.5	40.8
65	27.8	27.8	27.9	28.0	28.1	28.2	28.5	28.7	29.0	29.4	29.6	29.9	30.3	30.4	30.7	30.8	31.0	31.1	31.4
70	20.6	20.5	20.6	20.7	20.8	21.0	21.2	21.4	21.8	22.2	22.3	22.5	22.8	22.9	23.1	23.2	23.3	23.5	23.8
75	14.3	14.2	14.3	14.4	14.5	14.6	14.8	15.0	15.3	15.6	15.8	16.0	16.3	16.3	16.4	16.5	16.7	16.8	17.0
80	8.84	8.78	8.82	8.81	8.90	8.96	9.09	9.21	9.38	9.59	9.83	10.1	10.3	10.4	10.4	10.6	10.6	10.9	11.0
85	3.72	3.71	3.82	3.92	3.99	4.09	4.20	4.30	4.42	4.55	4.72	4.92	5.09	5.20	5.31	5.28	5.37	5.54	5.73
90	0.88	0.89	0.91	0.96	1.01	1.05	1.13	1.20	1.28	1.35	1.43	1.52	1.60	1.66	1.70	1.72	1.78	1.80	1.89
95	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.04	0.05	0.06	0.08	0.09	0.10	0.11	0.12	0.13
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	0.02	0.01	0.01	0.02	0.02	0.02	0.01	0.02	0.02	0.02	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	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.08
130	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.15
135	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.17	0.17	0.17	0.17	0.17	0.16	0.16	0.16	0.27
140	0.27	0.27	0.27	0.27	0.28	0.27	0.27	0.27	0.27	0.27	0.26	0.26	0.26	0.26	0.25	0.25	0.25	0.25	0.43
145	0.38	0.38	0.38	0.38	0.38	0.38	0.37	0.37	0.37	0.37	0.36	0.36	0.36	0.36	0.35	0.35	0.35	0.35	0.61
150	0.49	0.49	0.49	0.49	0.49	0.49	0.48	0.48	0.48	0.48	0.48	0.47	0.47	0.47	0.46	0.46	0.46	0.46	0.80
155	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.60	0.60	0.60	0.60	0.59	0.59	0.59	0.58	0.58	0.58	0.96
160	0.72	0.72	0.72	0.73	0.73	0.73	0.72	0.72	0.72	0.72	0.72	0.72	0.71	0.71	0.71	0.70	0.70	0.70	1.09
165	0.81	0.81	0.81	0.82	0.82	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.80	0.80	0.80	0.80	1.17
170	0.85	0.85	0.85	0.86	0.86	0.86	0.85	0.86	0.86	0.86	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	1.17
175	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.90	0.90	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	1.05
180	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96

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	1944	1944	1944	1944	1944	1944	1944	1944	1944	1944	1944	1944	1944	1944	1944	1944	1944
5	1931	1931	1925	1922	1914	1905	1893	1886	1877	1868	1857	1848	1842	1840	1834	1832	1828
10	1659	1659	1659	1652	1643	1632	1616	1601	1586	1570	1556	1543	1528	1518	1508	1505	1501
15	1276	1277	1275	1273	1265	1258	1243	1232	1223	1214	1203	1191	1178	1165	1159	1153	1148
20	911	911	911	909	906	900	891	881	871	864	857	845	833	822	816	810	804
25	594	594	594	596	595	593	588	582	576	571	568	558	545	535	527	523	519
30	363	362	361	361	365	364	362	357	354	351	348	342	334	327	322	320	318
35	219	219	219	220	220	219	218	215	211	208	205	202	199	195	191	190	189
40	134	135	135	136	136	135	135	134	132	130	128	126	125	123	121	121	119
45	89.0	89.1	89.3	89.5	89.4	88.7	88.5	88.1	87.0	86.4	85.0	83.6	82.7	81.9	80.9	80.4	79.5
50	64.6	64.9	64.8	64.6	64.2	64.2	64.0	63.8	62.9	62.2	61.6	60.8	60.4	60.0	59.2	58.6	58.2
55	52.1	52.0	52.2	51.8	51.5	51.5	51.0	50.4	50.1	49.6	49.4	48.6	48.5	48.3	47.9	47.7	47.4
60	41.1	40.9	41.1	40.9	40.5	40.4	40.0	39.6	39.2	38.8	38.5	38.2	37.9	37.6	37.3	37.3	37.2
65	31.6	31.6	31.7	31.5	31.2	31.0	30.7	30.4	30.2	29.8	29.5	29.3	29.0	28.7	28.4	28.1	28.0
70	23.9	23.9	24.0	23.9	23.7	23.5	23.2	23.0	22.8	22.4	22.2	21.9	21.7	21.5	21.2	20.9	20.8
75	17.2	17.2	17.3	17.3	17.1	16.9	16.6	16.4	16.2	15.9	15.6	15.4	15.1	14.9	14.6	14.4	14.3
80	11.1	11.2	11.3	11.2	11.1	10.9	10.7	10.5	10.3	9.97	9.73	9.53	9.42	9.35	9.12	8.99	8.89
85	5.83	5.95	5.86	5.84	5.89	5.72	5.53	5.44	5.17	4.97	4.81	4.55	4.39	4.25	4.04	3.92	3.82
90	1.91	1.90	1.90	1.88	1.81	1.78	1.71	1.63	1.55	1.47	1.36	1.28	1.19	1.09	1.03	0.97	0.93
95	0.12	0.10	0.09	0.08	0.07	0.06	0.06	0.05	0.05	0.04	0.03	0.02	0.01	0.01	0.01	0.01	0.01
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	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	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	0.03	0.03	0.03	0.02	0.03	0.03
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	0.04
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	0.08	0.08	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
130	0.15	0.15	0.15	0.15	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.17	0.17	0.17	0.17	0.17
135	0.27	0.27	0.27	0.27	0.28	0.28	0.28	0.28	0.29	0.29	0.29	0.29	0.30	0.30	0.30	0.30	0.30
140	0.43	0.43	0.43	0.43	0.44	0.44	0.44	0.45	0.45	0.46	0.46	0.46	0.47	0.47	0.47	0.47	0.47
145	0.61	0.61	0.62	0.62	0.62	0.63	0.63	0.64	0.64	0.65	0.65	0.66	0.66	0.66	0.67	0.67	0.67
150	0.80	0.80	0.80	0.81	0.81	0.81	0.82	0.82	0.83	0.84	0.84	0.84	0.85	0.85	0.86	0.86	0.86
155	0.96	0.96	0.97	0.97	0.97	0.98	0.98	0.98	0.99	0.99	1.00	1.00	1.00	1.01	1.01	1.01	1.01
160	1.09	1.09	1.10	1.10	1.10	1.10	1.10	1.11	1.11	1.11	1.11	1.12	1.12	1.12	1.12	1.12	1.12
165	1.17	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18
170	1.17	1.17	1.18	1.18	1.18	1.18	1.18	1.17	1.17	1.17	1.17	1.17	1.17	1.16	1.16	1.16	1.16
175	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.05	1.05	1.05	1.05	1.04	1.04	1.03	1.03	1.03	1.02
180	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96

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

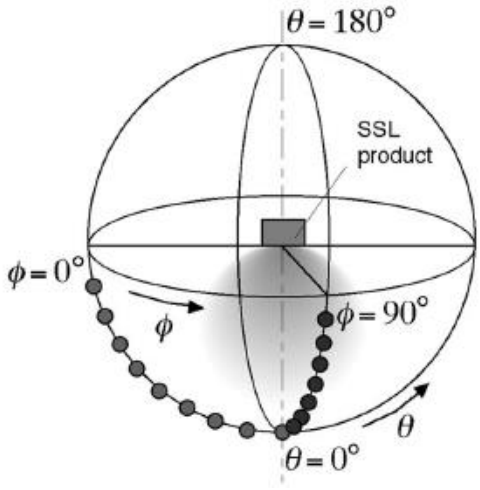
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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