

## 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/935NF25/277V/R**

### 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](http://www.ledtestlab.com)

Report No.: HZ20040025a

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

Review by:



Engineer: April Zou

Apr. 28, 2020

Approved by:



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/935NF25/277V/R

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
117.1	2214.7	18.91	0.9943
CCT (K)	CRI	Stabilization Time (Light & Power)	
3450	92.9	60	

Table 1: Executive Data Summary

Note: The above results are recorded/ derived from measurements made using an Integrating Sphere.

### Test specifications:

<b>Date of Receipt</b>	: Apr. 20, 2020
<b>Date of Test</b>	: Apr. 23, 2020
<b>Test item</b>	: Total Luminous Flux, Luminous Distribution Intensity, Luminous Efficacy, Correlated Color Temperature, Color Rendering Index, Chromaticity Coordinate, Electrical parameters
<b>Reference Standard</b>	: 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

LM-79-08 TEST REPORT .....	1
TEST SUMMARY .....	2
SAMPLE PHOTO .....	4
TEST RESULTS .....	5
Sphere-Spectroradiometer Method.....	5
Goniophotometer Method .....	6
Spectral Power Distribution - Sphere Spectroradiometer Method .....	7
Chromaticity Diagram - Sphere Spectroradiometer Method.....	8
Nominal CCT Quadrangles – Sphere Spectroradiometer Method .....	9
Color Rendition Report – Sphere Spectroradiometer Method .....	10
Zonal Lumen Tabulation- Goniophotometer Method .....	11
Illuminance Plots- Goniophotometer Method .....	12
Luminous Intensity Distribution Plots- Goniophotometer Method.....	13
Luminous Intensity Data- Goniophotometer Method .....	14
EQUIPMENT LIST .....	16
TEST METHODS .....	16
Seasoning of SSL Product.....	16
Sphere-Spectroradiometer Method- Photometric and Electrical Measurements.....	16
Goniophotometer Method .....	17
Photometric and Electrical Measurements .....	17
Color Characteristics Measurements.....	17
Color Spatial Uniformity .....	17

## SAMPLE PHOTO



Figure 1- Overview of the sample

### Equipment Under Test(EUT)

<b>Name</b>	: LED Lamp
<b>Model</b>	: 19.5PAR30HO/935NF25/277V/R
<b>Electrical Ratings</b>	: 120-277V, 50/60Hz, 19.5W
<b>Product Description</b>	: 3500K, Beam 25 °
<b>Manufacturer</b>	: GREEN CREATIVE LTD
<b>Address</b>	: 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 °C.

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	0.075
Power Factor	0.9943	0.9148
Test Power (W)	18.91	19.10
THD A%	5.55	18.54
Luminous Efficacy (lm/W)	117.1	118.2
Total Luminous Flux (lm)	2214.7	2257.4
Color Rendering Index (CRI)	92.9	
R9	65.4	
Correlated Color Temperature (CCT)(K)	3450	
Chromaticity Chroma x	0.4082	
Chromaticity Chroma y	0.3925	
Chromaticity Chroma u	0.2369	
Chromaticity Chroma v	0.3416	
Duv	0.0002	
Chromaticity Chroma u'	0.2369	
Chromaticity Chroma v'	0.5124	

Special Color Rendering Indices	
R1	93.2
R2	95.3
R3	95.9
R4	93.4
R5	92.5
R6	93.1
R7	94.3
R8	85.9
R9	65.4
R10	87.9
R11	93.5
R12	77.5
R13	93.7
R14	97.2

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 °C.

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)	0.159
Power Factor	0.9945
Power (W)	18.98
Luminous Efficacy (lm/W)	118.7
Total Luminous Flux (lm)	2252.1
Beam Angle ( ° )	20.1 (0°-180°) / 20.2 (90°-270°)
Center Beam Candle Power (cd)	10300
Maximum Beam Candle Power (cd)	10301 (At: C=0.0, Gamma=0.0)
Spacing Criteria	0.35 (0°-180°) / 0.34 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	97.29%
Zonal Lumens in the 60 °-90 °Zone	2.58%
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

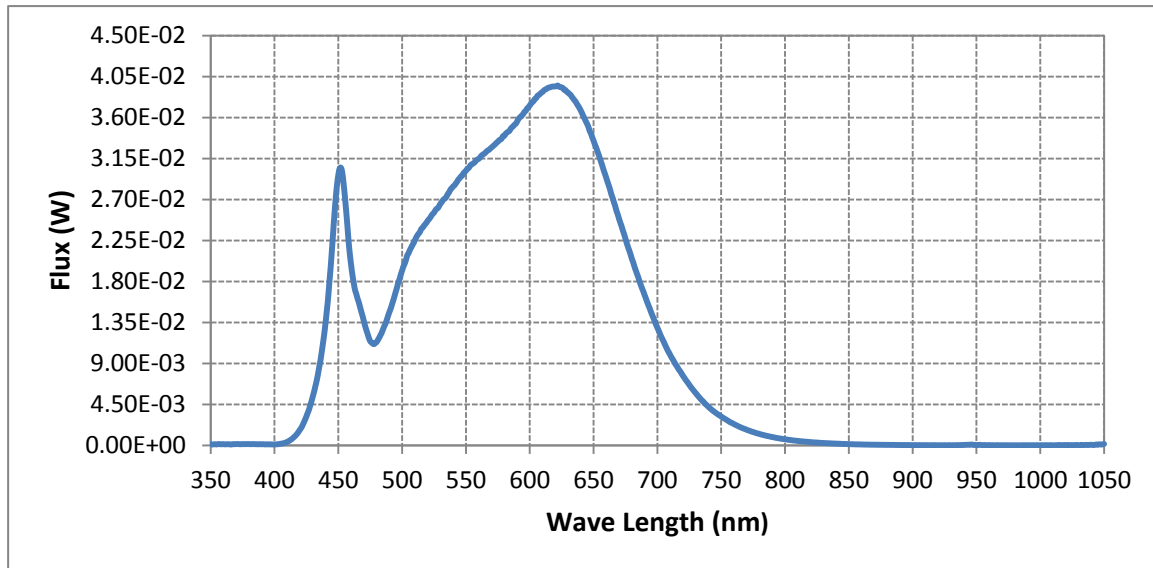
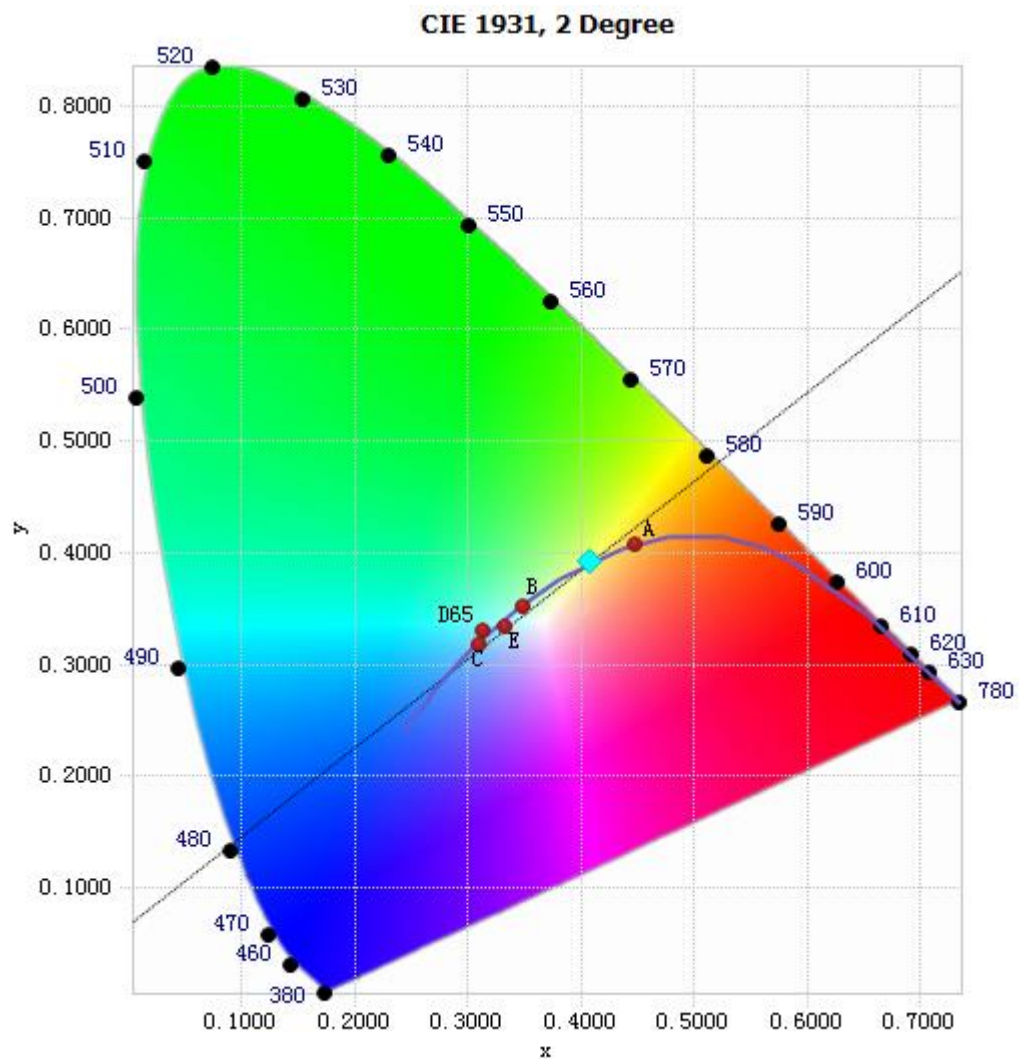


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.55E-04	485	1.28E-02	590	3.55E-02	695	1.47E-02
385	1.42E-04	490	1.47E-02	595	3.64E-02	700	1.29E-02
390	1.32E-04	495	1.69E-02	600	3.73E-02	705	1.14E-02
395	1.23E-04	500	1.92E-02	605	3.81E-02	710	9.95E-03
400	1.19E-04	505	2.11E-02	610	3.88E-02	715	8.76E-03
405	1.97E-04	510	2.25E-02	615	3.93E-02	720	7.66E-03
410	3.95E-04	515	2.38E-02	620	3.94E-02	725	6.67E-03
415	8.89E-04	520	2.47E-02	625	3.93E-02	730	5.76E-03
420	1.75E-03	525	2.56E-02	630	3.88E-02	735	4.94E-03
425	3.19E-03	530	2.66E-02	635	3.79E-02	740	4.24E-03
430	5.38E-03	535	2.74E-02	640	3.68E-02	745	3.66E-03
435	8.57E-03	540	2.85E-02	645	3.53E-02	750	3.18E-03
440	1.35E-02	545	2.93E-02	650	3.35E-02	755	2.74E-03
445	2.15E-02	550	3.02E-02	655	3.15E-02	760	2.35E-03
450	2.97E-02	555	3.09E-02	660	2.94E-02	765	2.01E-03
455	2.76E-02	560	3.15E-02	665	2.72E-02	770	1.72E-03
460	1.98E-02	565	3.21E-02	670	2.49E-02	775	1.48E-03
465	1.62E-02	570	3.27E-02	675	2.27E-02	780	1.27E-03
470	1.37E-02	575	3.33E-02	680	2.05E-02		
475	1.15E-02	580	3.40E-02	685	1.85E-02		
480	1.14E-02	585	3.48E-02	690	1.65E-02		

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

## Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4082, 0.3925)

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

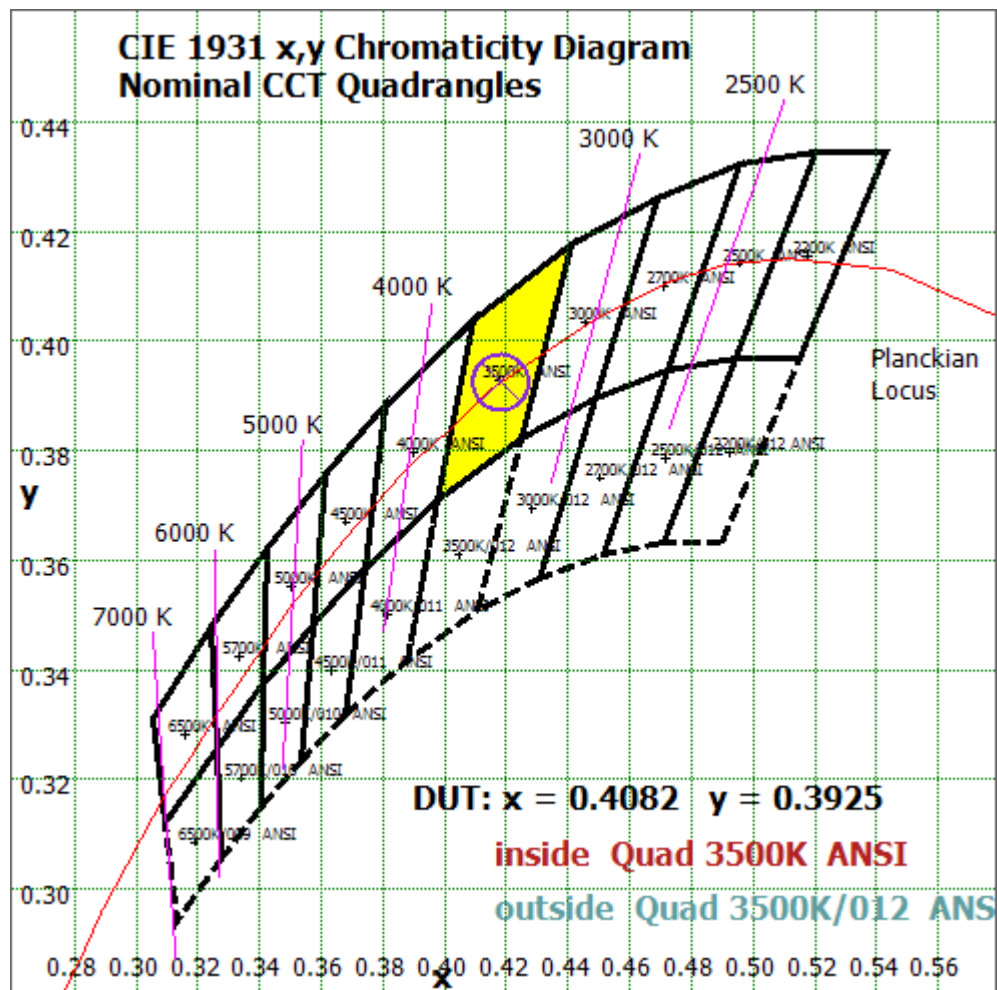
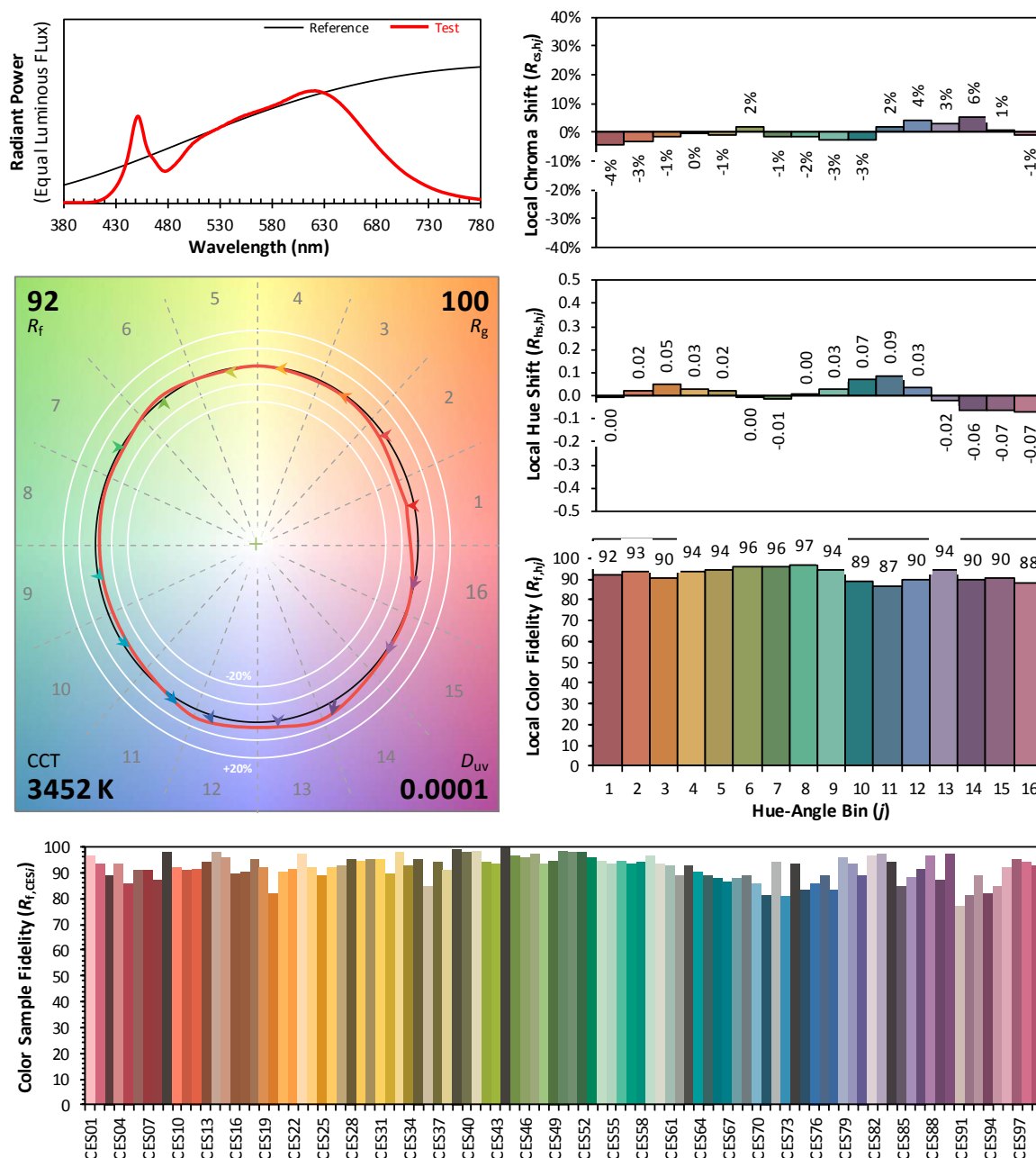


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

## Color Rendition Report – Sphere Spectroradiometer Method



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

$x$  0.4082  
 $y$  0.3925  
 $u'$  0.2369  
 $v'$  0.5124

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

$\gamma(^{\circ})$	Lumens	% Total
0- 10	696.379	30.92%
10- 20	809.416	35.94%
20- 30	381.936	16.96%
30- 40	176.356	7.83%
40- 50	77.562	3.44%
50- 60	49.377	2.19%
60- 70	33.453	1.49%
70- 80	19.249	0.85%
80- 90	5.451	0.24%
90-100	0.016	0.00%
100-110	0.023	0.00%
110-120	0.037	0.00%
120-130	0.09	0.00%
130-140	0.299	0.01%
140-150	0.703	0.03%
150-160	0.901	0.04%
160-170	0.633	0.03%
170-180	0.186	0.01%
Total	2252.1	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	2191.026	97.29%
60- 90	58.153	2.58%
0-90	2249.179	99.87%
90- 180	2.888	0.13%
0- 180	2252.1	100%

Table 5: Zonal Lumen

## Illuminance Plots- Goniophotometer Method

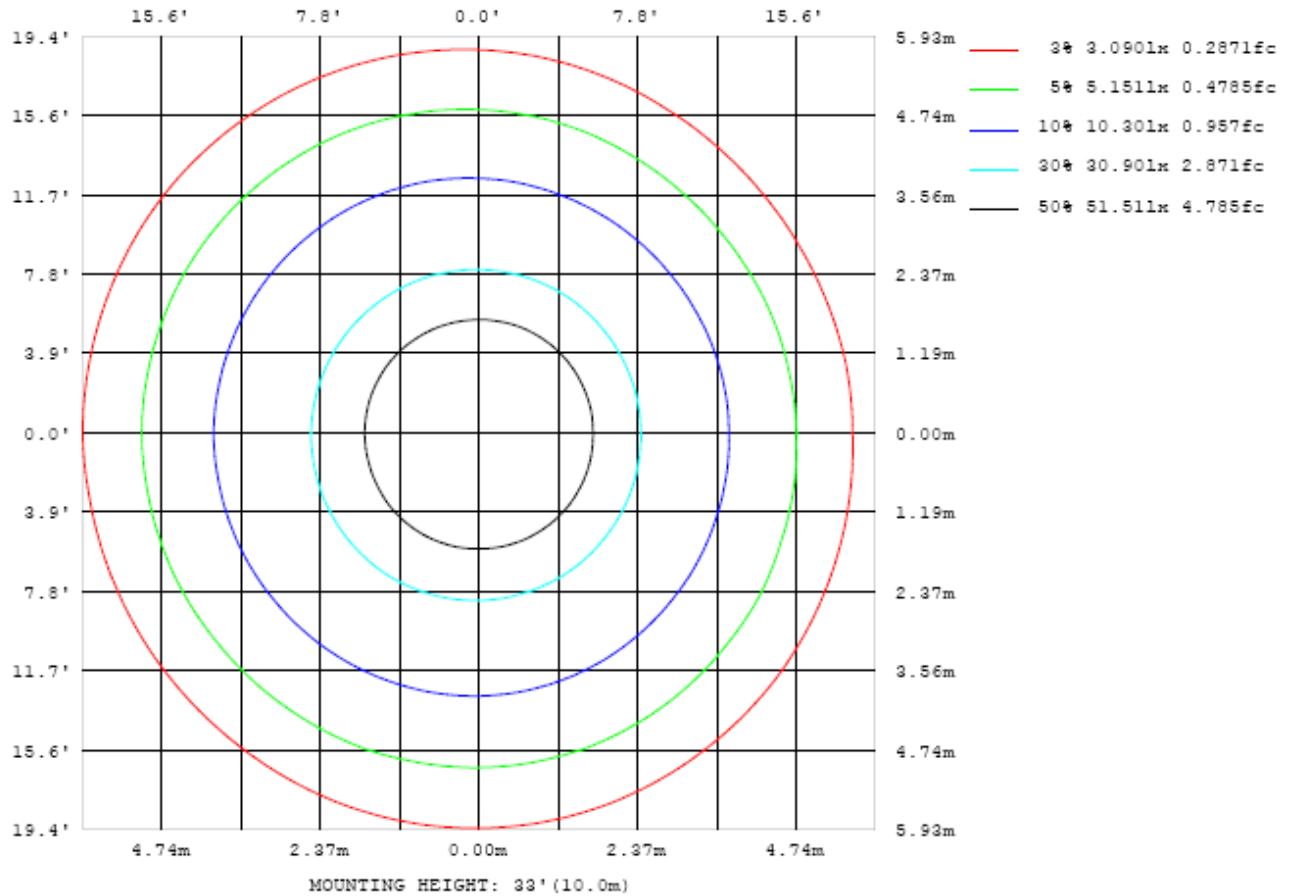


Chart 5: Illuminance Plot (Footcandles)

## Luminous Intensity Distribution Plots- Goniophotometer Method

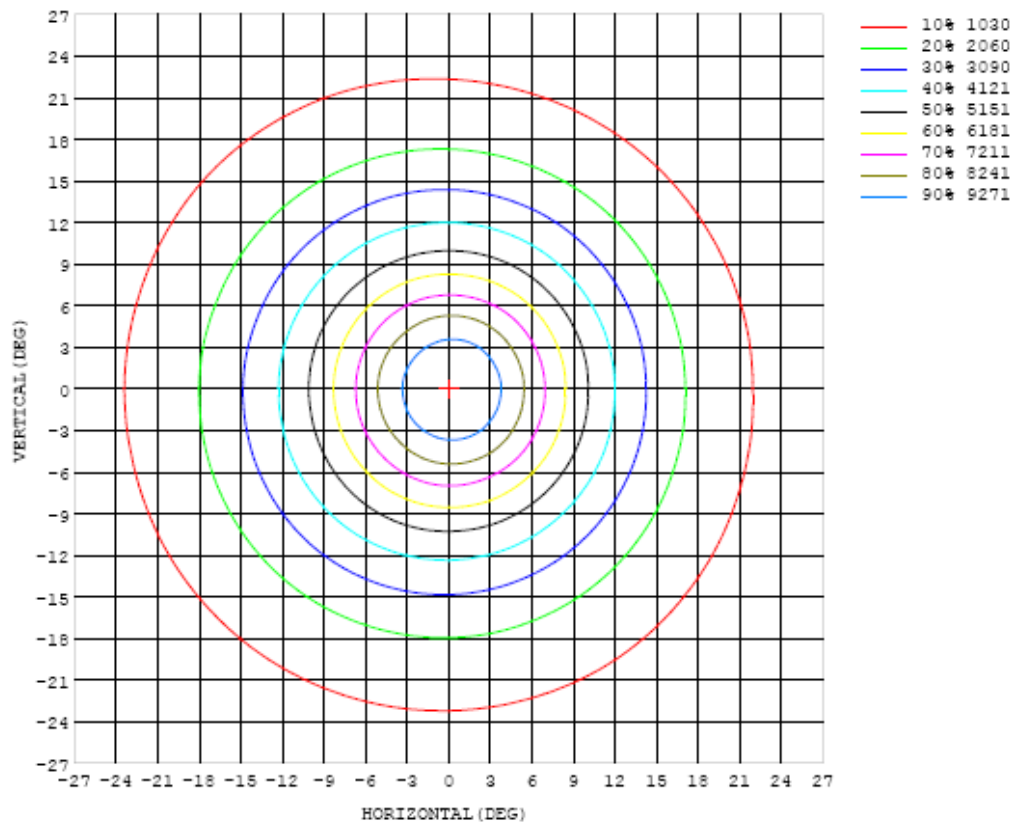


Chart 6: Isocandela Plot

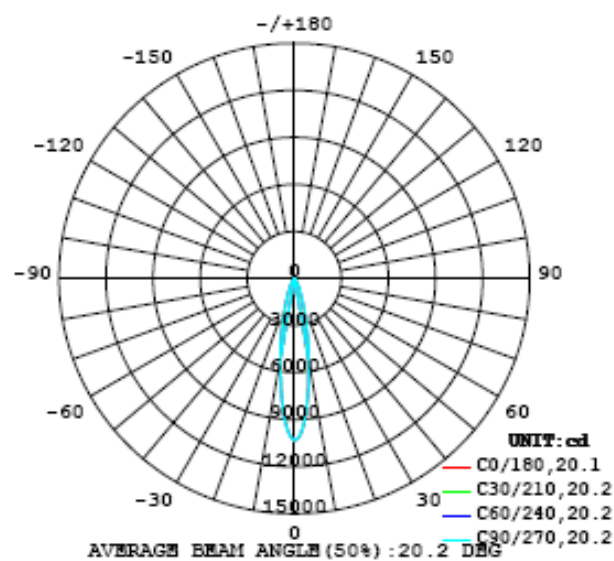


Chart 7: Polar Candela Distribution

## Luminous Intensity Data- Goniophotometer Method

Table--1

UNIT: ×10cd

C (DEG) y (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	1030	1030	1030	1030	1030	1030	1030	1030	1030	1030	1030	1030	1030	1030	1030	1030	1030	1030	1030
5	853	853	855	854	856	857	855	854	852	850	848	845	843	839	837	836	834	833	833
10	518	521	523	524	526	527	528	529	529	529	531	531	530	529	527	524	522	520	521
15	278	280	282	285	288	291	294	297	300	303	305	306	307	308	307	307	306	304	304
20	134	136	137	140	143	146	148	151	154	155	156	157	158	158	158	159	159	158	160
25	72.6	73.6	74.8	76.3	77.8	79.4	81.2	82.4	83.5	84.4	84.9	85.0	85.0	85.0	85.0	85.4	85.8	86.0	86.4
30	42.4	43.4	44.6	46.0	47.3	48.3	49.3	50.3	51.0	51.3	51.5	51.6	51.3	51.1	51.1	51.2	51.4	51.4	52.2
35	23.0	23.7	24.6	25.7	26.8	27.8	28.5	29.1	29.5	29.7	29.8	29.6	29.3	29.0	28.7	28.5	28.6	28.5	29.0
40	13.2	13.7	14.3	14.9	15.6	16.1	16.5	16.7	17.0	17.1	17.2	17.1	17.1	16.9	16.5	16.3	16.2	16.1	16.5
45	8.16	8.32	8.55	8.82	9.14	9.45	9.76	10.0	10.2	10.3	10.3	10.2	10.2	10.1	9.96	9.88	9.80	9.76	9.90
50	6.21	6.21	6.26	6.38	6.49	6.62	6.78	6.95	7.11	7.19	7.21	7.27	7.25	7.23	7.21	7.20	7.15	7.11	7.21
55	5.01	5.04	5.09	5.14	5.17	5.28	5.32	5.40	5.50	5.57	5.65	5.70	5.70	5.70	5.68	5.66	5.66	5.61	5.63
60	4.07	4.10	4.13	4.15	4.19	4.22	4.23	4.26	4.30	4.35	4.41	4.44	4.47	4.49	4.51	4.50	4.50	4.47	4.50
65	3.25	3.28	3.30	3.31	3.32	3.32	3.31	3.33	3.35	3.37	3.40	3.41	3.42	3.43	3.44	3.44	3.43	3.41	3.42
70	2.51	2.53	2.54	2.55	2.55	2.56	2.55	2.56	2.57	2.58	2.59	2.59	2.60	2.61	2.61	2.60	2.60	2.58	2.59
75	1.82	1.83	1.83	1.84	1.84	1.85	1.85	1.86	1.86	1.87	1.87	1.87	1.89	1.89	1.88	1.87	1.87	1.86	1.86
80	1.10	1.10	1.11	1.12	1.13	1.14	1.15	1.15	1.15	1.15	1.15	1.15	1.16	1.16	1.15	1.14	1.14	1.13	1.13
85	0.48	0.48	0.49	0.49	0.49	0.50	0.50	0.50	0.50	0.50	0.50	0.49	0.49	0.49	0.48	0.48	0.47	0.47	0.48
90	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	0.00	0.00	0.00	0.00	0.00	0.00
95	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
100	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
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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
115	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
120	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	0.01
125	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
130	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
135	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	0.05
140	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	0.09
145	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.15
150	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	0.09	0.22
155	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.10	0.28
160	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.11	0.32
165	0.12	0.12	0.12	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.12	0.33
170	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.12	0.12	0.11	0.29
175	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.13	0.13	0.24
180	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18

Table 6: Luminous Intensity Data



Table--2

UNIT:  $\times 10\text{cd}$

C (DEG) y (DEG)	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350		
0	1030	1030	1030	1030	1030	1030	1030	1030	1030	1030	1030	1030	1030	1030	1030	1030	1030		
5	833	833	833	833	833	836	838	841	844	846	848	851	851	852	851	852	853		
10	521	520	519	518	517	515	514	513	513	513	515	515	516	517	517	518	520		
15	302	299	297	295	292	290	288	287	284	282	280	278	277	276	276	277	278		
20	159	157	156	153	152	150	147	145	143	139	136	134	133	132	132	133	134		
25	85.8	85.1	84.3	83.2	82.0	80.7	79.4	77.8	76.2	74.7	73.3	71.8	70.8	70.5	70.8	71.4	71.9		
30	52.0	51.7	51.5	50.9	50.2	49.3	48.3	47.2	46.1	45.0	43.8	42.6	41.8	41.3	41.2	41.6	42.2		
35	28.9	29.0	29.0	28.9	28.6	28.0	27.4	26.7	26.2	25.4	24.7	24.1	23.4	22.9	22.5	22.5	22.8		
40	16.7	16.8	16.7	16.7	16.5	16.2	15.9	15.8	15.5	15.1	14.8	14.6	14.2	13.8	13.4	13.2	13.2		
45	9.97	10.0	10.0	10.1	10.1	10.1	10.1	9.99	9.85	9.66	9.42	9.21	8.98	8.79	8.58	8.42	8.25		
50	7.23	7.22	7.22	7.22	7.21	7.23	7.22	7.22	7.20	7.10	7.01	6.92	6.84	6.70	6.51	6.32	6.25		
55	5.65	5.63	5.61	5.60	5.58	5.61	5.66	5.70	5.70	5.70	5.65	5.59	5.48	5.34	5.23	5.13	5.04		
60	4.47	4.47	4.45	4.43	4.43	4.44	4.48	4.48	4.47	4.44	4.40	4.37	4.32	4.25	4.18	4.12	4.08		
65	3.42	3.40	3.38	3.36	3.32	3.32	3.34	3.35	3.35	3.35	3.35	3.33	3.30	3.26	3.24	3.23	3.23		
70	2.59	2.58	2.56	2.53	2.50	2.48	2.49	2.49	2.49	2.50	2.51	2.51	2.50	2.49	2.48	2.49	2.50		
75	1.86	1.85	1.83	1.81	1.79	1.77	1.77	1.77	1.77	1.78	1.79	1.79	1.80	1.80	1.80	1.81	1.82		
80	1.12	1.11	1.10	1.08	1.07	1.06	1.05	1.05	1.05	1.06	1.06	1.07	1.08	1.08	1.08	1.09	1.10		
85	0.47	0.47	0.47	0.46	0.45	0.45	0.45	0.44	0.44	0.45	0.46	0.47	0.48	0.48	0.48	0.49	0.49		
90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01		
95	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		
100	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		
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		
110	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		
115	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		
120	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		
125	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		
130	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02		
135	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		
140	0.09	0.09	0.09	0.09	0.09	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.09		
145	0.15	0.15	0.15	0.15	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16		
150	0.22	0.22	0.22	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23		
155	0.28	0.28	0.28	0.28	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29		
160	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.33	0.32	0.32	0.32	0.32	0.33	0.32		
165	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.32	0.33	0.31		
170	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.29	0.29	0.29	0.30	0.28		
175	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.23	0.24	0.22		
180	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18		

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  $4\pi$ . 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 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 expanded uncertainty is 2.3% with a coverage factor  $k=2$ .

### **Color Characteristics Measurements**

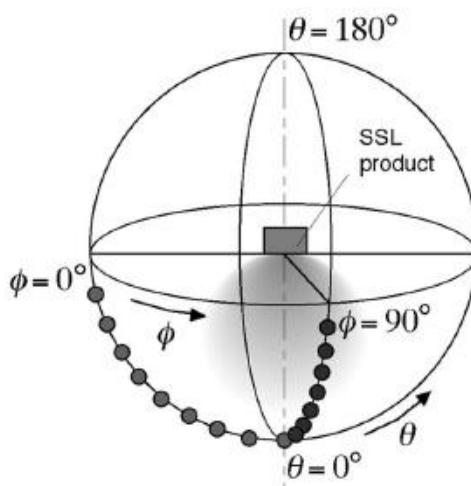
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as 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 ( $C=0^\circ/180^\circ$  and  $C=90^\circ/270^\circ$ ) and at  $10^\circ$  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 \*\*\*

This report is considered invalidated without the Special Seal for Inspection of the LTL. This report shall not be altered, increased or deleted. The results shown in this test report refer only to the sample(s) tested. Without written approval of LTL, this test report shall not be copied except in full and published as advertisement.