

## 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: 7.5MR16DIM/927SP15/R**

### Laboratory: Leading Testing Laboratories

**NVLAP CODE: 200960-0**

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Report No.: HZ20060049p

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

Review by:



Engineer: April Zou  
Nov. 13, 2020

Approved by:



Manager: Jim Zhang  
Nov. 13, 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: 7.5MR16DIM/927SP15/R

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
83.5	557.6	6.68	0.9178
CCT (K)	CRI	Stabilization Time (Light & Power)	
2729	97.3	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>	: Jun. 25, 2020
<b>Date of Test</b>	: Nov. 12, 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>	: 7.5MR16DIM/927SP15/R
<b>Electrical Ratings</b>	: 12Vac, 50/60Hz, 7.5W
<b>Product Description</b>	: 2700K
<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)	12.0
Voltage frequency (Hz)	60
Test Current (A)	0.603
Power Factor	0.9178
Test Power (W)	6.68
THD A%	30.74
Luminous Efficacy (lm/W)	83.5
Total Luminous Flux (lm)	557.6
Color Rendering Index (CRI)	97.3
R9	82.4
Correlated Color Temperature (CCT)(K)	2729
Chromaticity Chroma x	0.4577
Chromaticity Chroma y	0.4107
Chromaticity Chroma u	0.2611
Chromaticity Chroma v	0.3514
Duv	0.0003
Chromaticity Chroma u'	0.2611
Chromaticity Chroma v'	0.5271

Special Color Rendering Indices	
R1	98.7
R2	99.4
R3	97.7
R4	98.5
R5	98
R6	98
R7	96
R8	92.1
R9	82.4
R10	96.6
R11	99.1
R12	86.9
R13	99.2
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 24.8 °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)	12.0
Voltage frequency (Hz)	60
Test Current (A)	0.604
Power Factor	0.9183
Power (W)	6.71
Luminous Efficacy (lm/W)	85.1
Total Luminous Flux (lm)	571.0
Beam Angle ( ° )	11.9 (0°-180°) / 11.8 (90°-270°)
Center Beam Candle Power (cd)	6272
Maximum Beam Candle Power (cd)	6272 (At: C=0.0, Gamma=0.0)
Spacing Criteria	0.21 (0°-180°) / 0.21 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	97.65%
Zonal Lumens in the 60 °-90 °Zone	1.92%
Zonal Lumens in the 90 °-120 °Zone	0.29%
Zonal Lumens in the 120 °-180 °Zone	0.14%

Table 3: Test data per Goniophotometer Method

### Spectral Power Distribution - Sphere Spectroradiometer Method

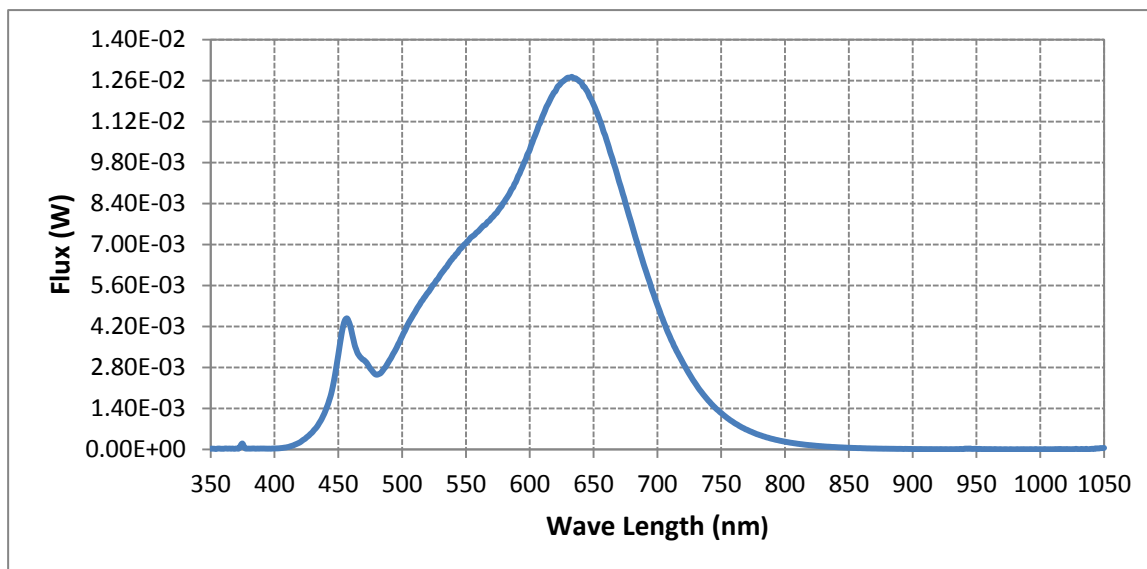
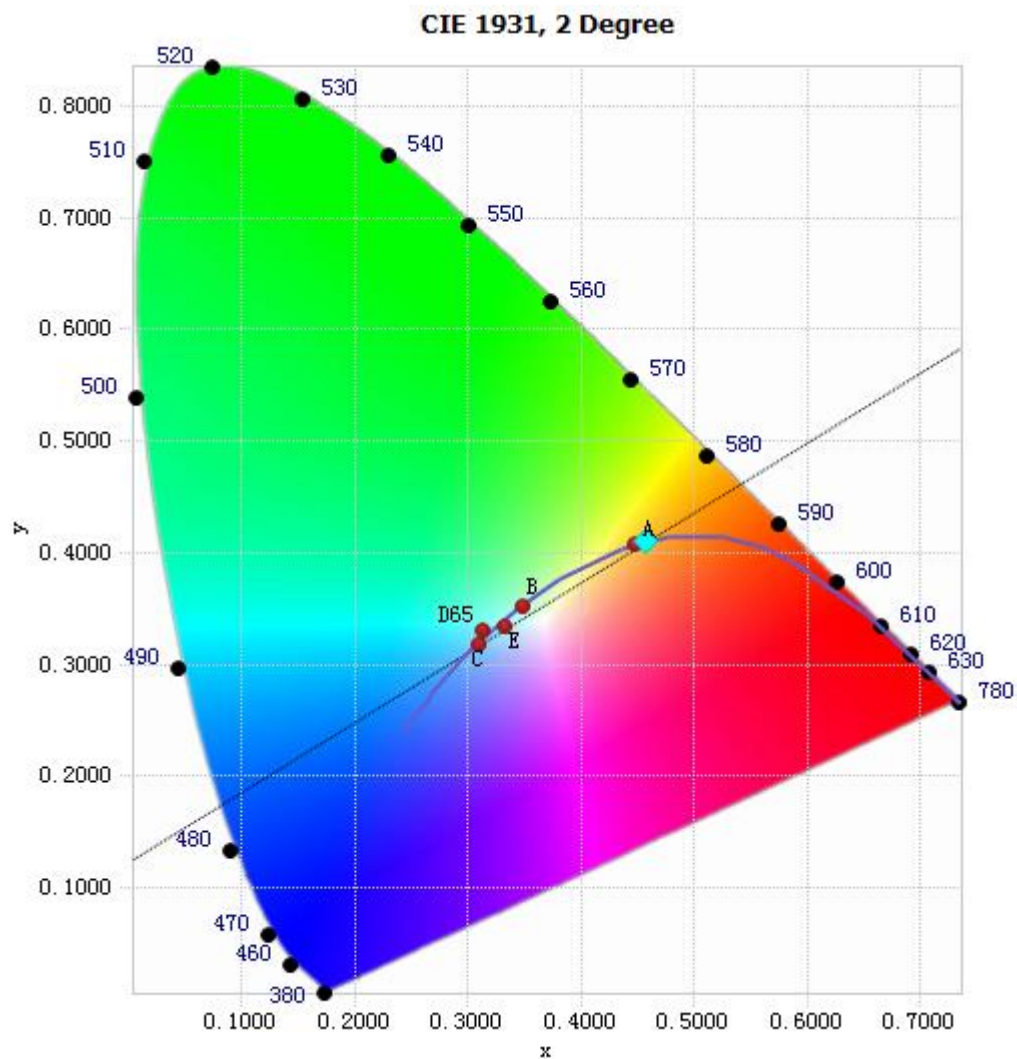


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.95E-05	485	2.71E-03	590	9.24E-03	695	5.56E-03
385	2.70E-05	490	3.04E-03	595	9.74E-03	700	4.94E-03
390	3.19E-05	495	3.42E-03	600	1.02E-02	705	4.35E-03
395	2.72E-05	500	3.86E-03	605	1.08E-02	710	3.83E-03
400	3.52E-05	505	4.32E-03	610	1.14E-02	715	3.37E-03
405	4.72E-05	510	4.68E-03	615	1.19E-02	720	2.96E-03
410	7.92E-05	515	5.05E-03	620	1.22E-02	725	2.58E-03
415	1.45E-04	520	5.35E-03	625	1.25E-02	730	2.24E-03
420	2.46E-04	525	5.65E-03	630	1.27E-02	735	1.94E-03
425	4.09E-04	530	5.97E-03	635	1.27E-02	740	1.67E-03
430	6.06E-04	535	6.25E-03	640	1.25E-02	745	1.44E-03
435	8.98E-04	540	6.56E-03	645	1.22E-02	750	1.25E-03
440	1.33E-03	545	6.83E-03	650	1.18E-02	755	1.07E-03
445	2.01E-03	550	7.05E-03	655	1.12E-02	760	9.17E-04
450	3.24E-03	555	7.28E-03	660	1.06E-02	765	7.86E-04
455	4.39E-03	560	7.47E-03	665	9.90E-03	770	6.76E-04
460	4.11E-03	565	7.67E-03	670	9.15E-03	775	5.78E-04
465	3.30E-03	570	7.91E-03	675	8.42E-03	780	4.94E-04
470	3.06E-03	575	8.15E-03	680	7.68E-03		
475	2.77E-03	580	8.46E-03	685	6.94E-03		
480	2.56E-03	585	8.82E-03	690	6.23E-03		

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

# Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4577, 0.4107)

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

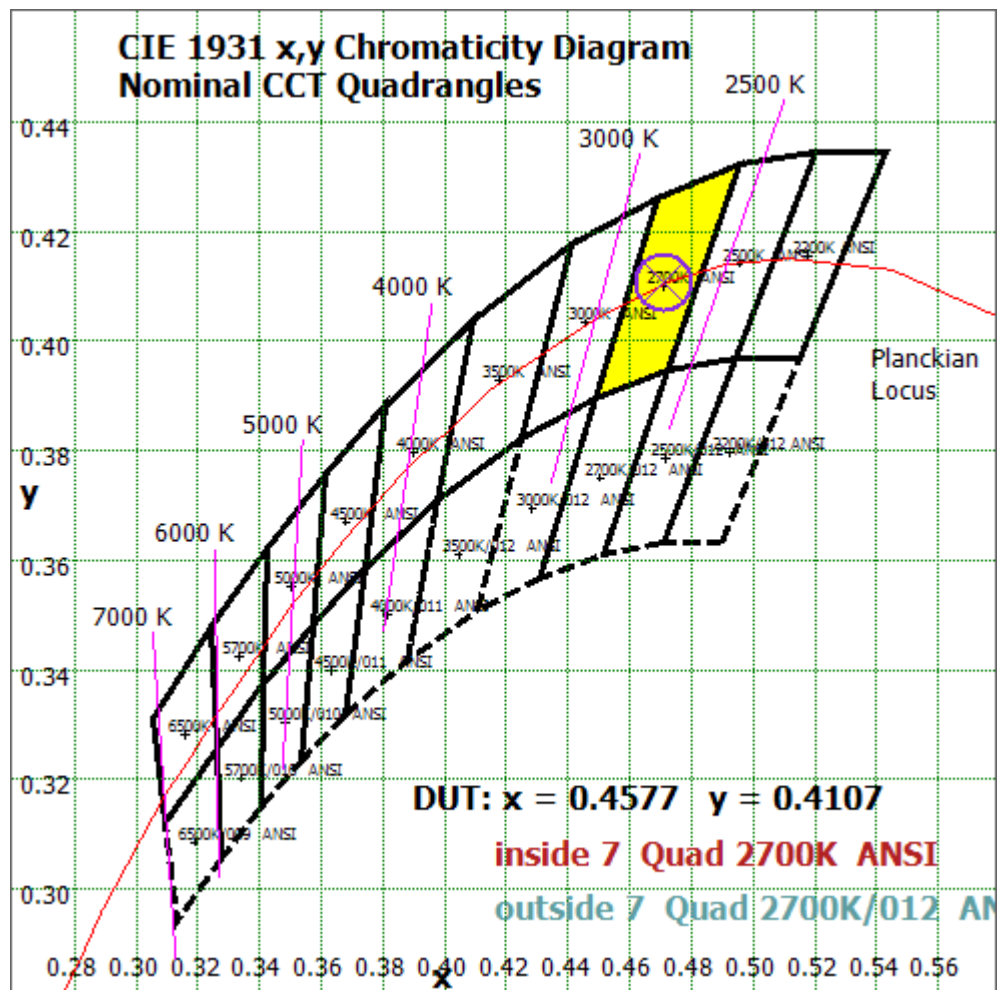


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

# Color Rendition Report – Sphere Spectroradiometer Method

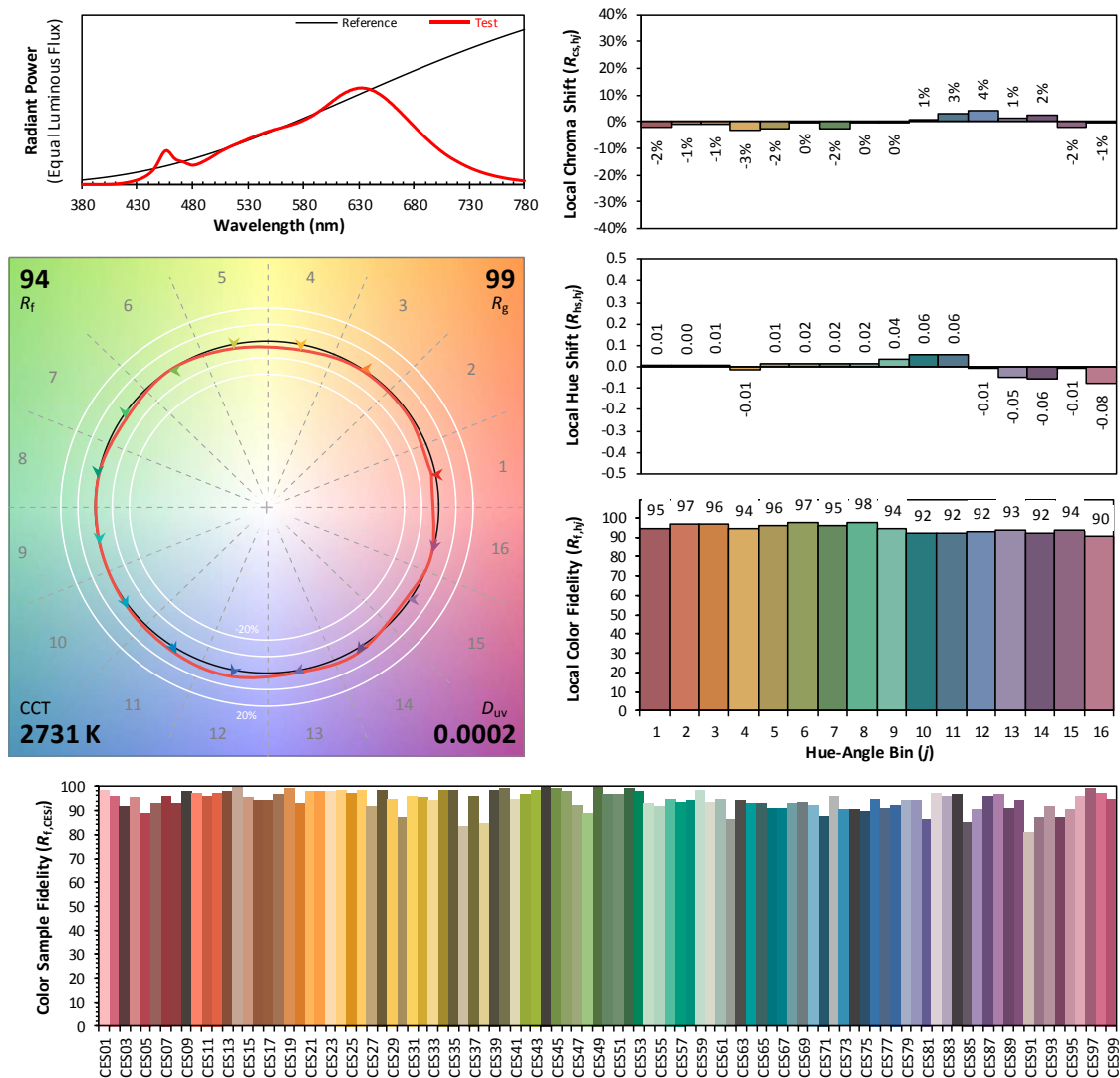
## ANSI/IES TM-30-18 Color Rendition Report

Source: LED

Manufacturer: GREEN CREATIVE LTD

Date: 2020/11/12

Model: 7.5MR16DIM/927SP15/R



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

$x$  0.4577  
 $y$  0.4107  
 $u'$  0.2611  
 $v'$  0.5271

CIE 13.3-1995  
(CRI)

$R_a$  97

$R_g$  83

Colors are for visual orientation purposes only. Created with the ANSI/IES TM-30-18 Calculator Version 2.00.

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	278.07	48.70%
10- 20	157.997	27.67%
20- 30	70.344	12.32%
30- 40	30.907	5.41%
40- 50	12.54	2.20%
50- 60	7.739	1.36%
60- 70	5.957	1.04%
70- 80	3.594	0.63%
80- 90	1.417	0.25%
90-100	0.442	0.08%
100-110	0.618	0.11%
110-120	0.586	0.10%
120-130	0.344	0.06%
130-140	0.079	0.01%
140-150	0.108	0.02%
150-160	0.138	0.02%
160-170	0.111	0.02%
170-180	0.042	0.01%
Total	571.0	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	557.597	97.65%
60- 90	10.968	1.92%
0-90	568.565	99.57%
90- 180	2.468	0.43%
0- 180	571.0	100%

Table 5: Zonal Lumen

## Illuminance Plots- Goniophotometer Method

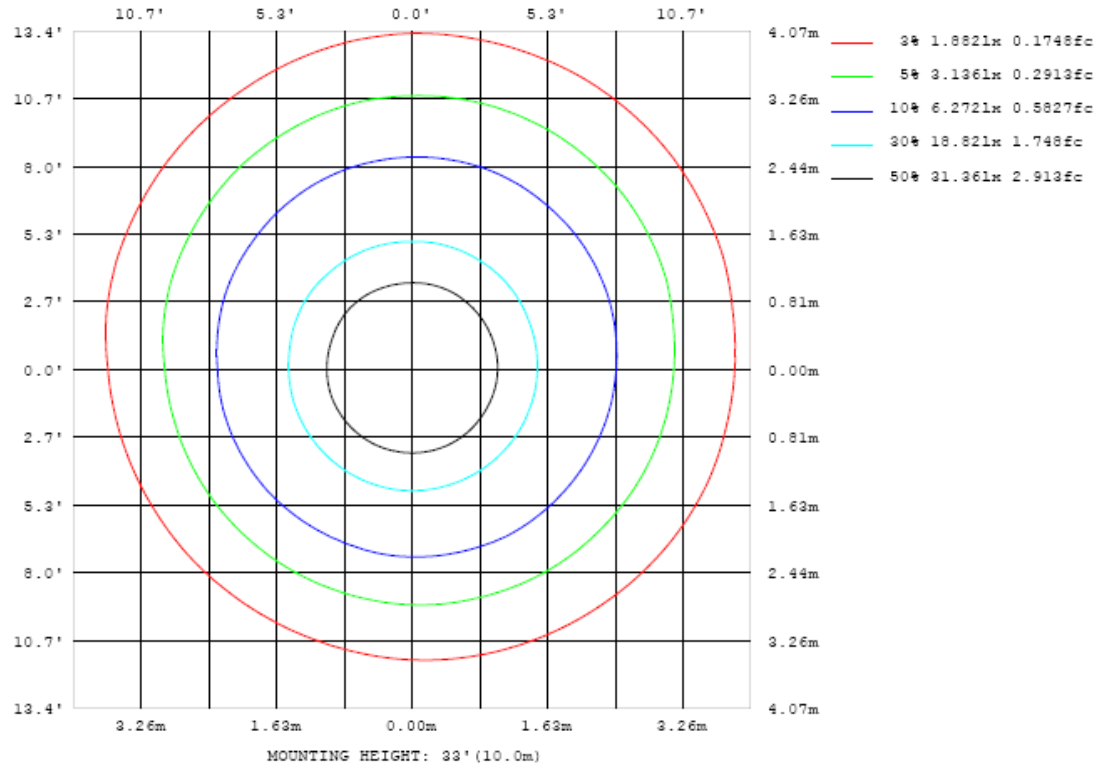


Chart 5: Illuminance Plot (Footcandles)

## Luminous Intensity Distribution Plots- Goniophotometer Method

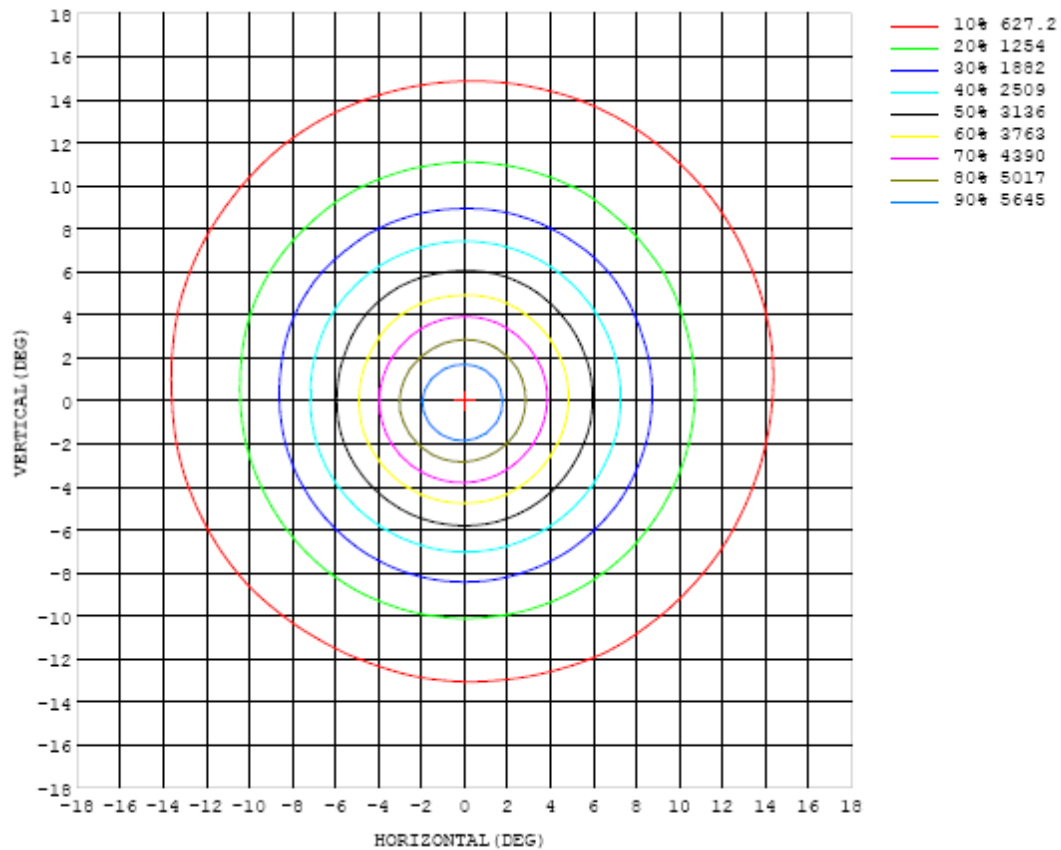


Chart 6: Isocandela Plot

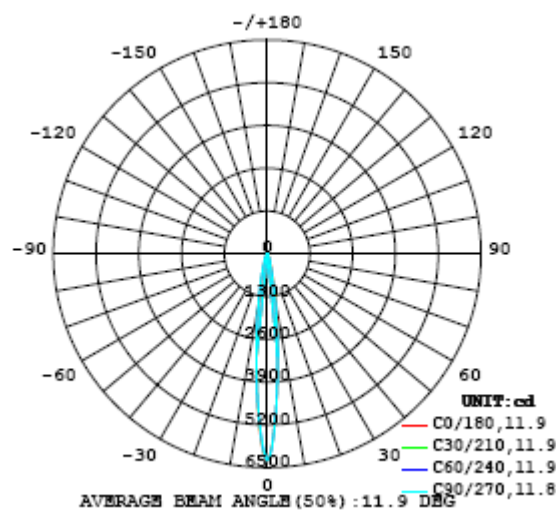


Chart 7: Polar Candela Distribution

## Luminous Intensity Data- Goniophotometer Method

Table--1

UNIT: cd

C (DEG) y (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	6272	6272	6272	6272	6272	6272	6272	6272	6272	6272	6272	6272	6272	6272	6272	6272	6272	6272	6272
5	3663	3647	3622	3608	3609	3610	3618	3612	3609	3614	3615	3625	3638	3649	3665	3682	3701	3706	3708
10	1449	1424	1397	1377	1354	1338	1314	1301	1293	1291	1285	1287	1296	1304	1311	1320	1337	1361	1382
15	555	530	502	484	465	449	446	420	416	405	398	396	398	405	413	426	439	449	465
20	263	256	251	243	234	226	220	214	210	207	204	201	201	203	207	211	216	222	229
25	162	157	154	151	147	142	137	133	129	126	123	120	120	120	123	126	129	133	139
30	96.1	93.1	91.2	90.3	88.1	84.0	80.3	75.8	72.6	69.9	68.3	67.9	67.7	67.4	69.4	72.4	74.1	76.3	80.6
35	51.7	50.3	49.2	48.3	46.7	44.0	41.8	39.0	36.6	35.1	34.2	34.2	34.5	34.9	35.4	37.1	38.6	39.9	41.6
40	26.4	25.8	25.3	24.6	23.9	22.9	21.8	20.6	19.8	19.2	19.1	19.4	19.6	19.9	20.2	20.7	21.2	21.6	22.3
45	16.6	16.1	15.8	15.5	15.2	14.9	14.7	14.4	14.1	13.6	13.4	13.5	13.5	13.6	13.8	14.0	14.5	14.6	14.5
50	12.1	11.8	11.6	11.5	11.3	11.1	10.7	10.4	10.1	9.87	9.74	9.73	9.75	9.70	9.76	10.0	10.4	10.5	10.4
55	8.85	8.86	8.84	8.76	8.54	8.27	8.08	7.88	7.77	7.77	7.78	7.76	7.75	7.65	7.73	7.71	7.94	7.88	7.79
60	7.23	7.21	7.17	7.16	7.09	7.15	7.25	7.36	7.44	7.49	7.61	7.52	7.40	7.12	7.03	6.78	6.77	6.61	6.52
65	6.01	5.94	5.88	5.83	5.76	5.70	5.65	5.70	5.65	5.67	5.72	5.67	5.70	5.58	5.61	5.49	5.55	5.46	5.46
70	4.70	4.80	4.51	4.50	4.65	4.35	4.36	4.62	4.23	4.24	4.42	4.22	4.28	4.37	4.26	4.25	4.56	4.27	4.29
75	3.46	3.54	3.32	3.34	3.38	3.20	3.19	3.31	3.11	3.14	3.30	3.11	3.12	3.24	3.12	3.11	3.26	3.14	3.15
80	2.27	2.23	2.18	2.18	2.15	2.11	2.08	2.10	2.08	2.09	2.12	2.09	2.08	2.07	2.05	2.08	2.07	2.06	2.13
85	1.25	1.34	1.22	1.19	1.29	1.15	1.14	1.22	1.13	1.13	1.23	1.13	1.12	1.19	1.11	1.15	1.23	1.13	1.21
90	0.55	0.66	0.51	0.52	0.78	0.50	0.49	0.73	0.51	0.57	0.62	0.50	0.51	0.84	0.50	0.51	0.70	0.53	0.63
95	0.34	0.35	0.32	0.32	0.34	0.30	0.30	0.32	0.31	0.32	0.35	0.31	0.31	0.34	0.31	0.33	0.35	0.33	0.37
100	0.47	0.43	0.27	0.85	0.68	0.31	0.52	0.54	0.32	0.78	0.67	0.29	0.68	0.82	0.28	0.49	0.70	0.33	0.47
105	0.51	0.75	0.36	0.87	0.86	0.40	0.65	0.94	0.39	0.64	0.77	0.36	0.48	1.07	0.34	0.53	0.93	0.37	0.53
110	0.60	0.51	0.34	0.56	0.56	0.36	0.56	0.53	0.32	0.58	0.50	0.30	0.54	0.48	0.32	0.46	0.43	0.42	0.49
115	0.26	0.26	0.22	0.26	0.30	0.21	0.24	0.28	0.22	0.24	0.28	0.23	0.27	0.27	0.41	0.28	0.27	0.36	0.24
120	1.05	1.74	0.39	1.80	3.33	1.01	2.14	3.35	0.97	2.08	3.11	0.55	1.93	2.07	0.64	1.38	1.53	1.20	1.23
125	0.20	0.28	0.19	0.23	0.27	0.17	0.22	0.29	0.19	0.20	0.27	0.17	0.21	0.27	0.19	0.22	0.24	0.20	0.24
130	0.10	0.13	0.12	0.11	0.12	0.10	0.11	0.12	0.11	0.11	0.12	0.10	0.11	0.12	0.12	0.11	0.12	0.12	0.12
135	0.09	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.11	0.10	0.10	0.10	0.10
140	0.11	0.12	0.12	0.12	0.13	0.13	0.13	0.13	0.13	0.12	0.13	0.13	0.13	0.13	0.12	0.13	0.12	0.13	0.13
145	0.17	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	0.17	0.17	0.17	0.17	0.18
150	0.24	0.25	0.25	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.25	0.25	0.25	0.24	0.24	0.23	0.22	0.25	0.26
155	0.30	0.31	0.31	0.32	0.32	0.32	0.32	0.33	0.33	0.32	0.32	0.31	0.30	0.29	0.29	0.28	0.27	0.32	0.32
160	0.35	0.36	0.37	0.38	0.38	0.39	0.39	0.39	0.39	0.39	0.38	0.38	0.37	0.35	0.34	0.33	0.32	0.38	0.37
165	0.40	0.42	0.42	0.43	0.43	0.44	0.44	0.44	0.44	0.44	0.43	0.42	0.41	0.40	0.38	0.38	0.38	0.41	0.40
170	0.44	0.47	0.46	0.46	0.46	0.45	0.45	0.45	0.45	0.45	0.44	0.44	0.44	0.43	0.42	0.41	0.40	0.38	0.45
175	0.47	0.48	0.51	0.52	0.49	0.42	0.41	0.40	0.39	0.37	0.35	0.32	0.30	0.32	0.47	0.45	0.47	0.47	0.46
180	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44

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	6272	6272	6272	6272	6272	6272	6272	6272	6272	6272	6272	6272	6272	6272	6272	6272	6272		
5	3706	3711	3712	3740	3755	3746	3727	3712	3708	3720	3729	3728	3708	3705	3698	3681	3677		
10	1414	1474	1501	1524	1527	1542	1543	1545	1557	1562	1561	1573	1562	1564	1540	1483	1464		
15	497	518	535	549	569	584	596	604	612	617	621	618	612	608	597	585	576		
20	241	249	254	261	268	274	282	287	290	293	294	295	295	293	286	281	270		
25	147	153	155	160	164	167	172	175	179	180	180	180	179	177	173	171	165		
30	85.1	88.6	92.1	96.1	99.7	102	104	106	110	111	110	109	107	106	103	101	98.3		
35	43.9	46.4	48.4	51.2	53.8	55.5	56.4	57.4	59.9	60.4	60.5	59.6	57.8	56.9	55.6	54.1	52.8		
40	23.1	23.9	24.9	26.0	27.1	28.0	28.8	29.3	29.8	29.8	29.8	29.4	28.9	28.6	28.5	28.1	27.5		
45	14.8	15.4	15.8	16.4	16.8	17.0	17.3	17.6	17.9	17.9	18.0	17.6	17.4	17.3	17.5	17.4	17.2		
50	10.4	10.7	11.1	11.6	11.9	12.1	12.3	12.8	13.1	13.0	12.7	12.3	12.2	12.1	12.3	12.2	12.2		
55	7.75	7.94	8.28	8.63	8.78	8.80	8.94	9.04	9.20	9.33	9.22	8.96	8.90	8.76	8.93	8.93	8.81		
60	6.57	6.68	6.95	7.15	7.28	7.29	7.28	7.34	7.39	7.45	7.39	7.26	7.31	7.22	7.30	7.32	7.25		
65	5.55	5.68	5.86	5.99	6.09	6.19	6.18	6.24	6.21	6.21	6.18	6.14	6.18	6.12	6.13	6.16	6.07		
70	4.45	4.43	4.60	4.74	4.73	4.92	5.06	4.95	4.94	5.06	4.90	4.86	5.05	4.81	4.83	5.15	4.70		
75	3.31	3.27	3.37	3.51	3.49	3.57	3.67	3.64	3.64	3.78	3.63	3.59	3.77	3.55	3.54	3.71	3.49		
80	2.16	2.17	2.23	2.27	2.28	2.34	2.35	2.36	2.40	2.39	2.37	2.36	2.39	2.36	2.36	2.36	2.33		
85	1.29	1.21	1.28	1.35	1.26	1.33	1.38	1.28	1.33	1.43	1.30	1.33	1.43	1.31	1.33	1.44	1.29		
90	0.72	0.53	0.58	0.78	0.53	0.60	0.68	0.52	0.62	0.70	0.52	0.61	0.73	0.54	0.58	0.83	0.52		
95	0.38	0.36	0.38	0.38	0.35	0.38	0.37	0.34	0.37	0.37	0.34	0.35	0.38	0.35	0.35	0.37	0.34		
100	0.44	0.38	0.44	0.41	0.33	0.53	0.36	0.33	0.47	0.38	0.35	0.67	0.40	0.27	0.52	0.47	0.28		
105	0.91	0.48	0.50	0.79	0.40	0.63	0.62	0.41	0.53	0.79	0.50	0.59	0.85	0.38	0.73	0.96	0.44		
110	0.41	0.39	0.48	0.43	0.48	0.44	0.41	0.49	0.46	0.42	0.41	0.54	0.47	0.38	0.58	0.51	0.35		
115	0.35	0.31	0.24	0.34	0.29	0.24	0.30	0.27	0.26	0.29	0.27	0.26	0.26	0.24	0.27	0.26	0.23		
120	1.82	1.33	0.56	1.05	0.72	0.37	0.69	0.74	0.49	0.57	0.30	0.64	0.71	0.21	1.10	1.47	0.32		
125	0.26	0.21	0.23	0.27	0.20	0.20	0.24	0.19	0.22	0.25	0.19	0.20	0.23	0.15	0.20	0.23	0.17		
130	0.13	0.12	0.13	0.13	0.11	0.12	0.12	0.11	0.12	0.13	0.11	0.11	0.11	0.09	0.10	0.11	0.10		
135	0.10	0.10	0.10	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.08	0.08	0.08	0.08	0.08	0.08		
140	0.12	0.13	0.12	0.12	0.11	0.11	0.11	0.11	0.10	0.10	0.11	0.11	0.10	0.11	0.11	0.11	0.11		
145	0.18	0.17	0.18	0.17	0.16	0.16	0.16	0.16	0.16	0.16	0.15	0.15	0.16	0.16	0.16	0.16	0.16		
150	0.25	0.25	0.25	0.24	0.24	0.24	0.24	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.24	0.24		
155	0.31	0.31	0.31	0.30	0.30	0.30	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.30		
160	0.36	0.36	0.36	0.36	0.35	0.34	0.34	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.34	0.34	0.34		
165	0.40	0.42	0.42	0.40	0.38	0.37	0.37	0.36	0.36	0.37	0.37	0.37	0.36	0.36	0.38	0.38	0.38		
170	0.49	0.49	0.44	0.41	0.41	0.40	0.39	0.38	0.41	0.42	0.41	0.40	0.39	0.39	0.41	0.43	0.42		
175	0.46	0.45	0.43	0.42	0.41	0.43	0.45	0.46	0.46	0.45	0.44	0.43	0.42	0.41	0.44	0.47	0.48		
180	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44		

Table 7: Luminous Intensity Data

## EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Aug. 05, 2020	Aug. 04, 2021
Digital Power Meter	PF2010A	HZTE028-01	Aug. 05, 2020	Aug. 04, 2021
AC Power Supply	DPS1060	HZTE001-06	Aug. 05, 2020	Aug. 04, 2021
DC Power Supply	WY12010	HZTE004-03	Aug. 05, 2020	Aug. 04, 2021
Temperature recorder	JM624U	HZTE018-08	Aug. 05, 2020	Aug. 04, 2021
Temperature and humidity recorder	JR900	HZTE018-01	Aug. 05, 2020	Aug. 04, 2021
Standard source	D908	HZTE012-01	Aug. 05, 2020	Aug. 04, 2021
Integrate Sphere system	3M	HZTE015-04	Aug. 05, 2020	Aug. 04, 2021
Digital Power Meter	WT210	HZTE008-01	Aug. 05, 2020	Aug. 04, 2021
AC Power Supply	PCR 500L	HZTE001-07	Aug. 05, 2020	Aug. 04, 2021
DC Power Supply	IT6154	HZTE004-04	Aug. 05, 2020	Aug. 04, 2021
Standard source	SCL-1400	HZTE012-02	Aug. 05, 2020	Aug. 04, 2021
Temperature and humidity recorder	JR900	HZTE018-02	Aug. 05, 2020	Aug. 04, 2021
Temperature Meter	TES1310	HZTE017-01	Aug. 05, 2020	Aug. 04, 2021

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**

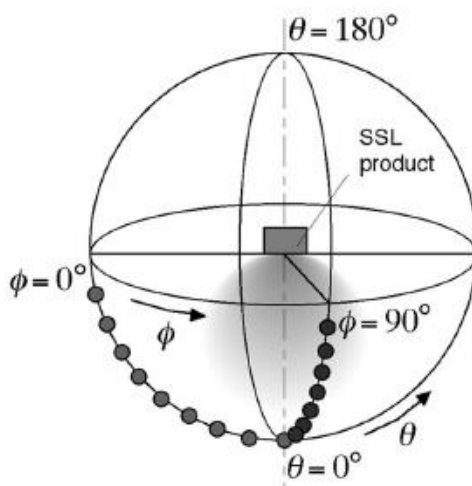
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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

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