

## 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: 7MR16DIM/927SP15/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.: HZ20060049t

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: 7MR16DIM/927SP15/R

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
87.6	528.9	6.04	0.9178
CCT (K)	CRI	Stabilization Time (Light & Power)	
2758	97.7	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>	: 7MR16DIM/927SP15/R
<b>Electrical Ratings</b>	: 12Vac, 50/60Hz, 7W
<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)	0.545
Power Factor	0.9178
Test Power (W)	6.04
THD A%	31.32
Luminous Efficacy (lm/W)	87.6
Total Luminous Flux (lm)	528.9
Color Rendering Index (CRI)	97.7
R9	85.2
Correlated Color Temperature (CCT)(K)	2758
Chromaticity Chroma x	0.4543
Chromaticity Chroma y	0.4082
Chromaticity Chroma u	0.2600
Chromaticity Chroma v	0.3504
Duv	-0.0004
Chromaticity Chroma u'	0.2600
Chromaticity Chroma v'	0.5256

Special Color Rendering Indices	
R1	99.3
R2	99.8
R3	98
R4	99
R5	98.6
R6	97.5
R7	96.2
R8	93.2
R9	85.2
R10	97.9
R11	98.6
R12	86.7
R13	99.9
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 24.8 °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)	0.550
Power Factor	0.9199
Power (W)	6.05
Luminous Efficacy (lm/W)	88.9
Total Luminous Flux (lm)	537.9
Beam Angle ( ° )	11.8 (0°-180°) / 11.7 (90°-270°)
Center Beam Candle Power (cd)	6008
Maximum Beam Candle Power (cd)	6008 (At: C=0.0, Gamma=0.0)
Spacing Criteria	0.21 (0°-180°) / 0.20 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	97.73%
Zonal Lumens in the 60 °-90 °Zone	1.87%
Zonal Lumens in the 90 °-120 °Zone	0.27%
Zonal Lumens in the 120 °-180 °Zone	0.12%

Table 3: Test data per Goniophotometer Method

### Spectral Power Distribution - Sphere Spectroradiometer Method

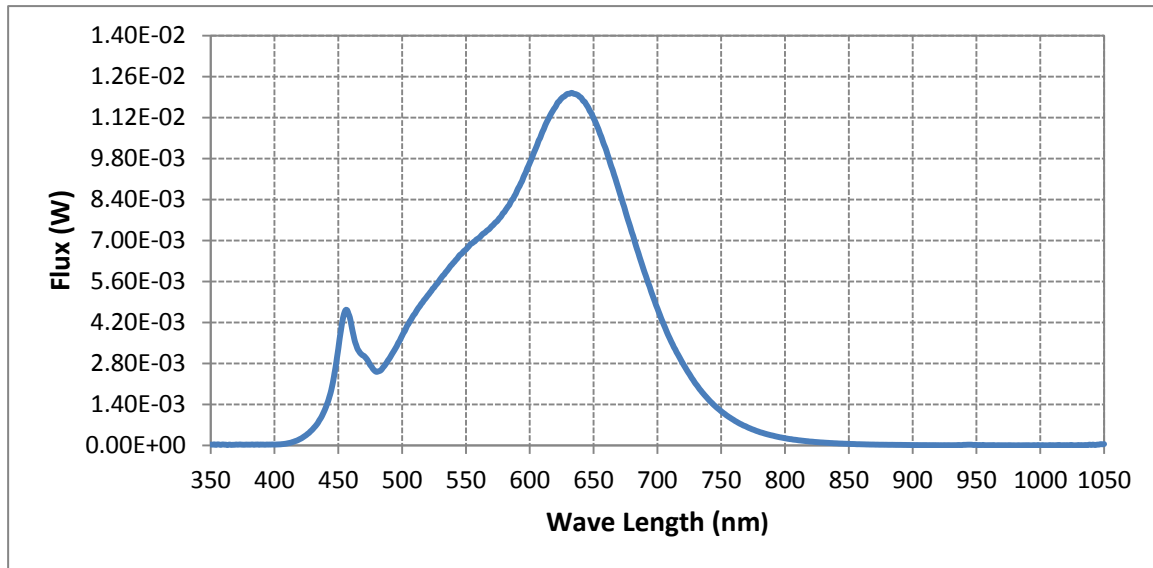
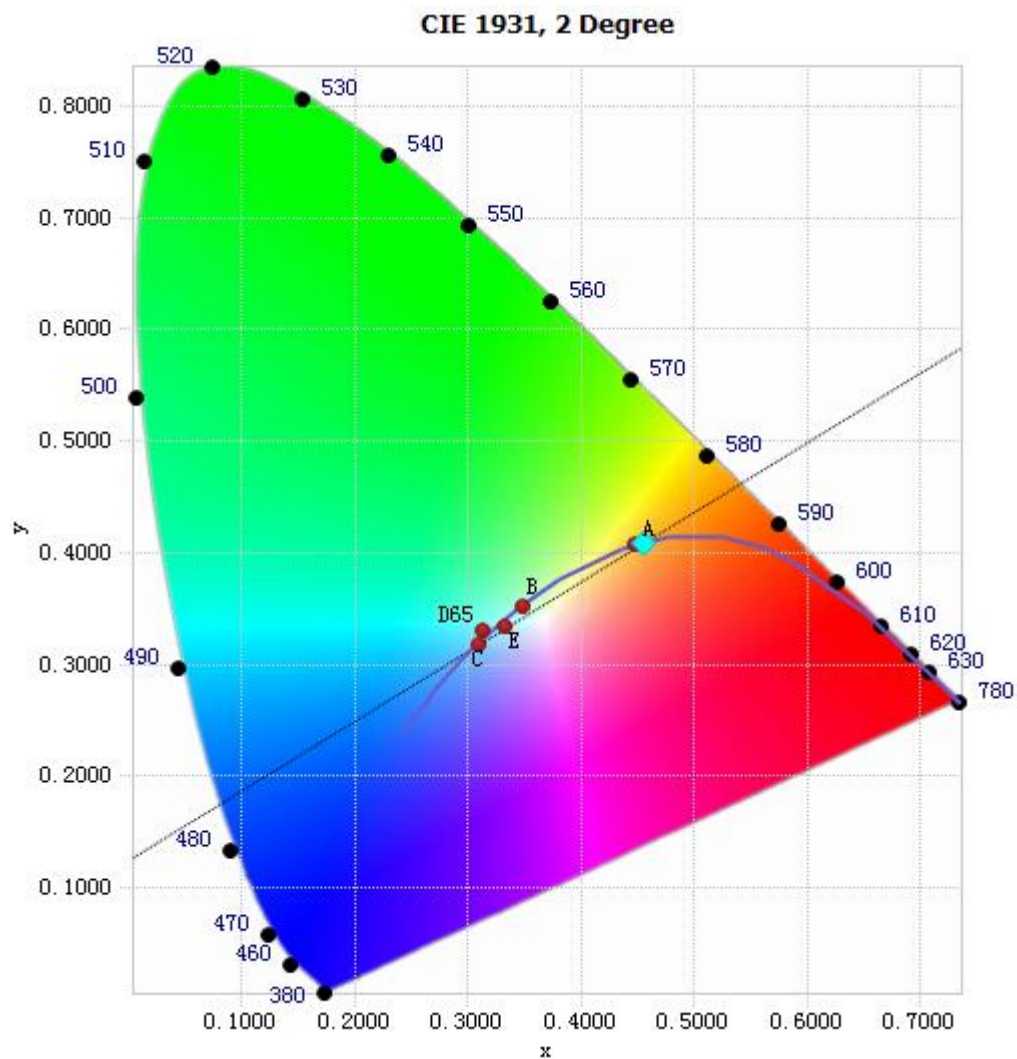


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.91E-05	485	2.66E-03	590	8.70E-03	695	5.28E-03
385	3.12E-05	490	2.97E-03	595	9.16E-03	700	4.69E-03
390	2.98E-05	495	3.33E-03	600	9.66E-03	705	4.13E-03
395	3.00E-05	500	3.75E-03	605	1.02E-02	710	3.63E-03
400	3.05E-05	505	4.16E-03	610	1.07E-02	715	3.19E-03
405	4.08E-05	510	4.50E-03	615	1.12E-02	720	2.80E-03
410	7.09E-05	515	4.84E-03	620	1.16E-02	725	2.44E-03
415	1.28E-04	520	5.12E-03	625	1.19E-02	730	2.11E-03
420	2.21E-04	525	5.39E-03	630	1.20E-02	735	1.82E-03
425	3.60E-04	530	5.69E-03	635	1.20E-02	740	1.57E-03
430	5.58E-04	535	5.96E-03	640	1.19E-02	745	1.36E-03
435	8.50E-04	540	6.23E-03	645	1.16E-02	750	1.17E-03
440	1.28E-03	545	6.50E-03	650	1.12E-02	755	1.01E-03
445	2.00E-03	550	6.69E-03	655	1.07E-02	760	8.64E-04
450	3.31E-03	555	6.91E-03	660	1.01E-02	765	7.37E-04
455	4.56E-03	560	7.08E-03	665	9.40E-03	770	6.36E-04
460	4.17E-03	565	7.28E-03	670	8.70E-03	775	5.42E-04
465	3.30E-03	570	7.48E-03	675	7.99E-03	780	4.61E-04
470	3.06E-03	575	7.69E-03	680	7.28E-03		
475	2.75E-03	580	7.97E-03	685	6.59E-03		
480	2.52E-03	585	8.31E-03	690	5.91E-03		

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

# Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4543, 0.4082)

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

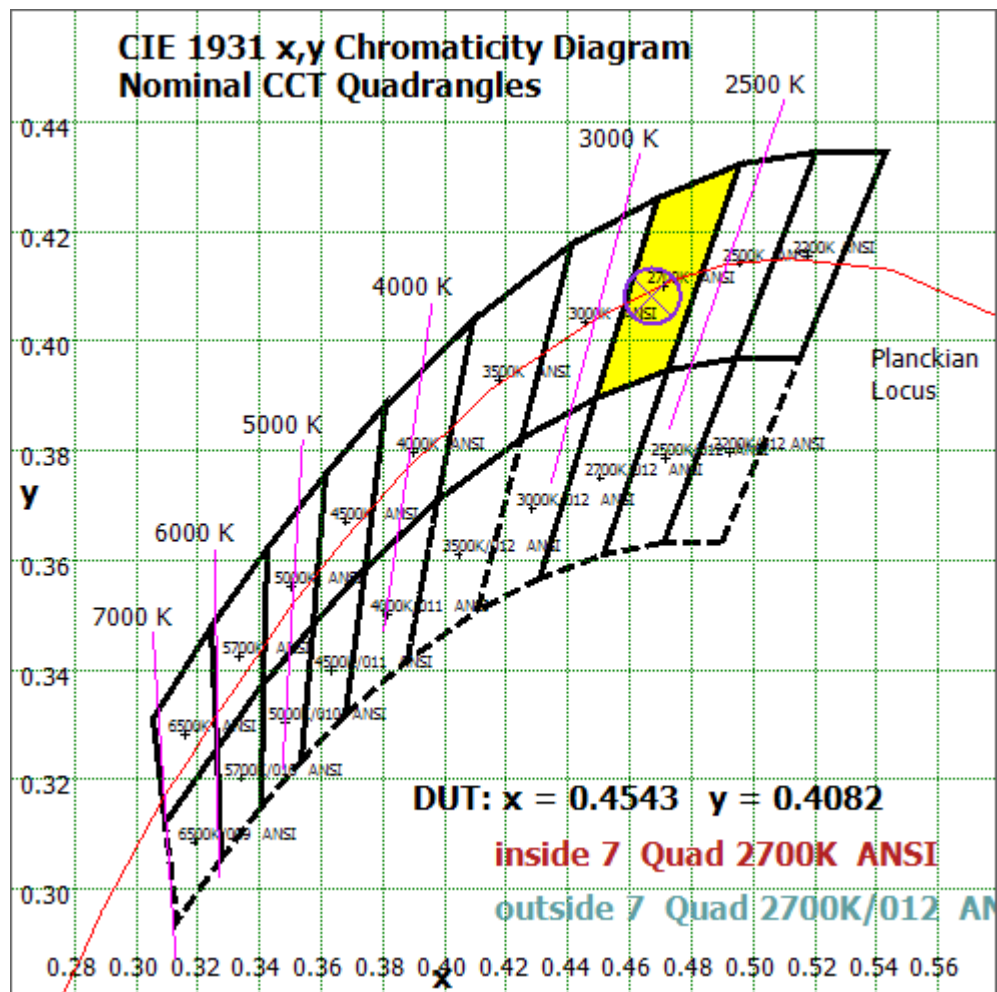


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

# Color Rendition Report – Sphere Spectroradiometer Method

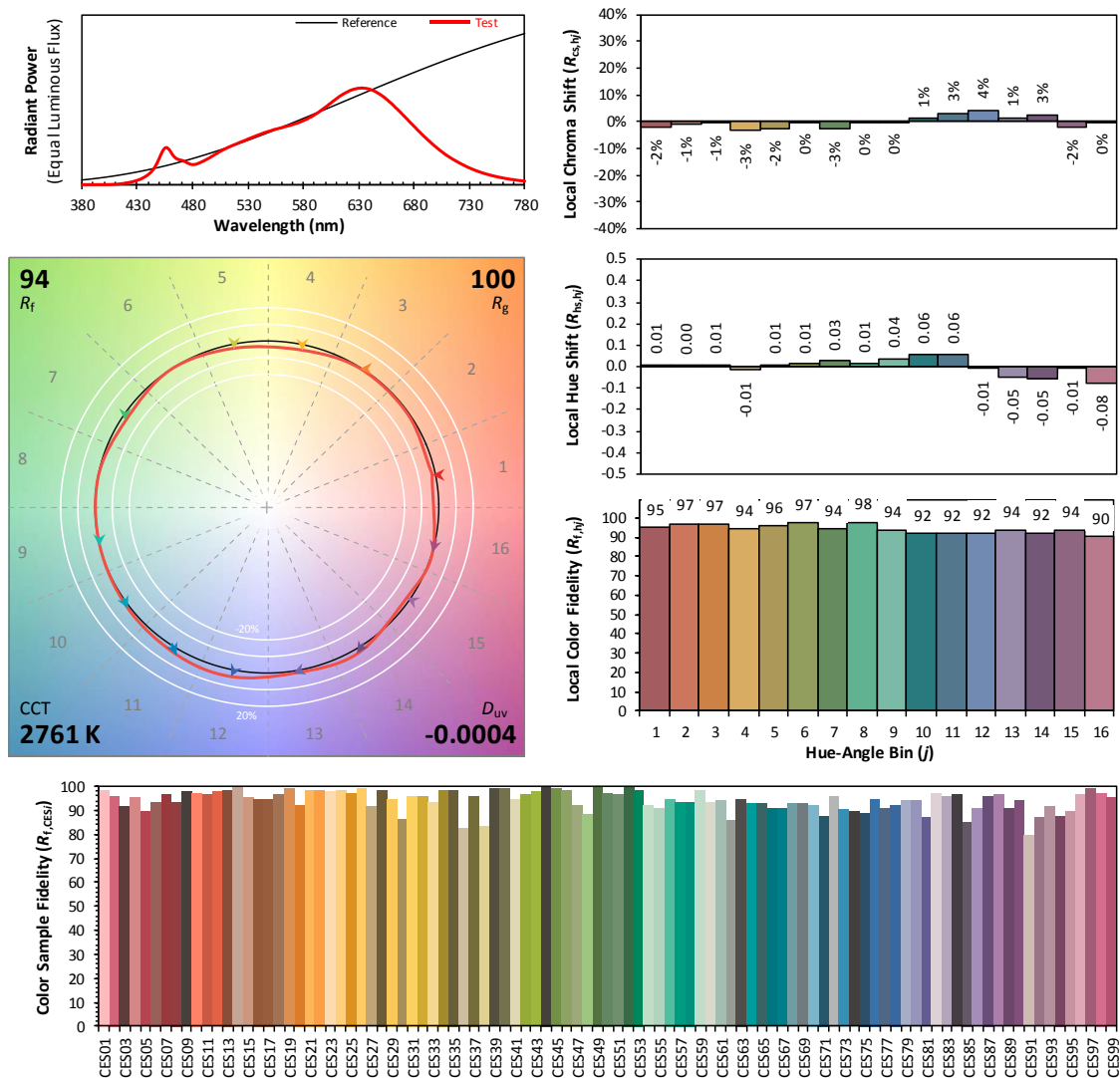
## ANSI/IES TM-30-18 Color Rendition Report

Source: LED

Manufacturer: GREEN CREATIVE LTD

Date: 2020/11/12

Model: 7MR16DIM/927SP15/R



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

$x$  0.4543  
 $y$  0.4082  
 $u'$  0.2600  
 $v'$  0.5256

CIE 13.3-1995  
(CRI)

$R_a$  98

$R_g$  86

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.

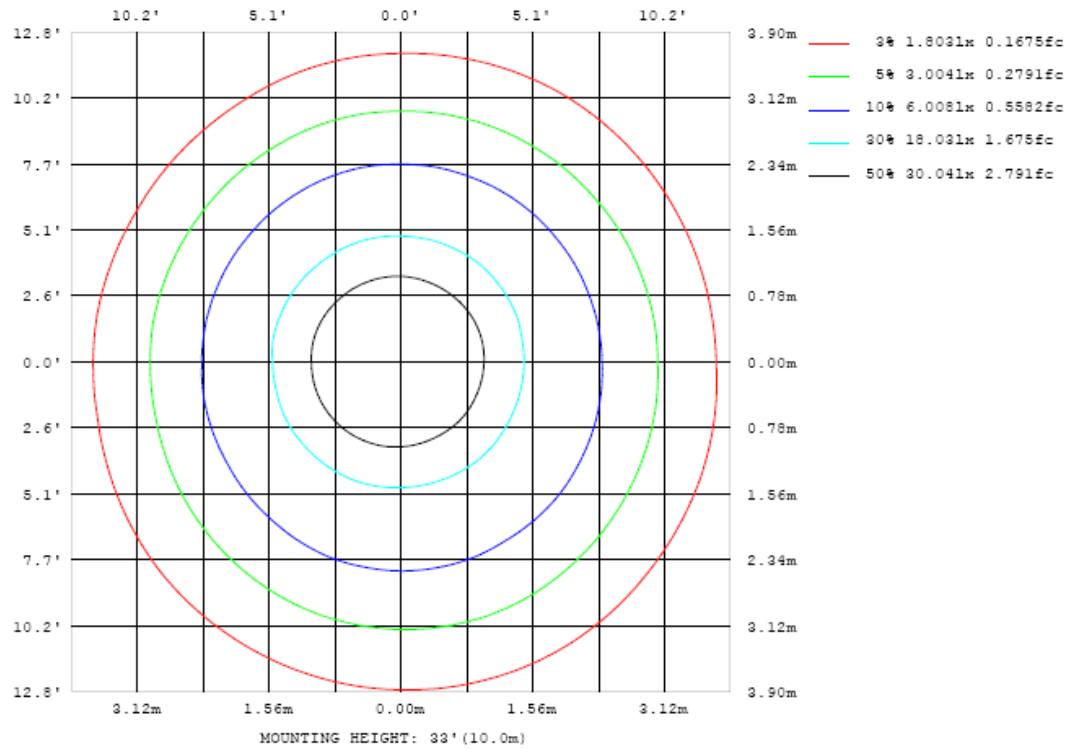
### Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	264.185	49.11%
10- 20	147.698	27.46%
20- 30	65.883	12.25%
30- 40	28.897	5.37%
40- 50	11.786	2.19%
50- 60	7.266	1.35%
60- 70	5.492	1.02%
70- 80	3.309	0.62%
80- 90	1.274	0.24%
90-100	0.405	0.08%
100-110	0.528	0.10%
110-120	0.525	0.10%
120-130	0.272	0.05%
130-140	0.072	0.01%
140-150	0.091	0.02%
150-160	0.111	0.02%
160-170	0.091	0.02%
170-180	0.033	0.01%
Total	537.9	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	525.715	97.73%
60- 90	10.075	1.87%
0-90	535.79	99.60%
90- 180	2.128	0.40%
0- 180	537.9	100%

Table 5: Zonal Lumen

## Illuminance Plots- Goniophotometer Method



## Luminous Intensity Distribution Plots- Goniophotometer Method

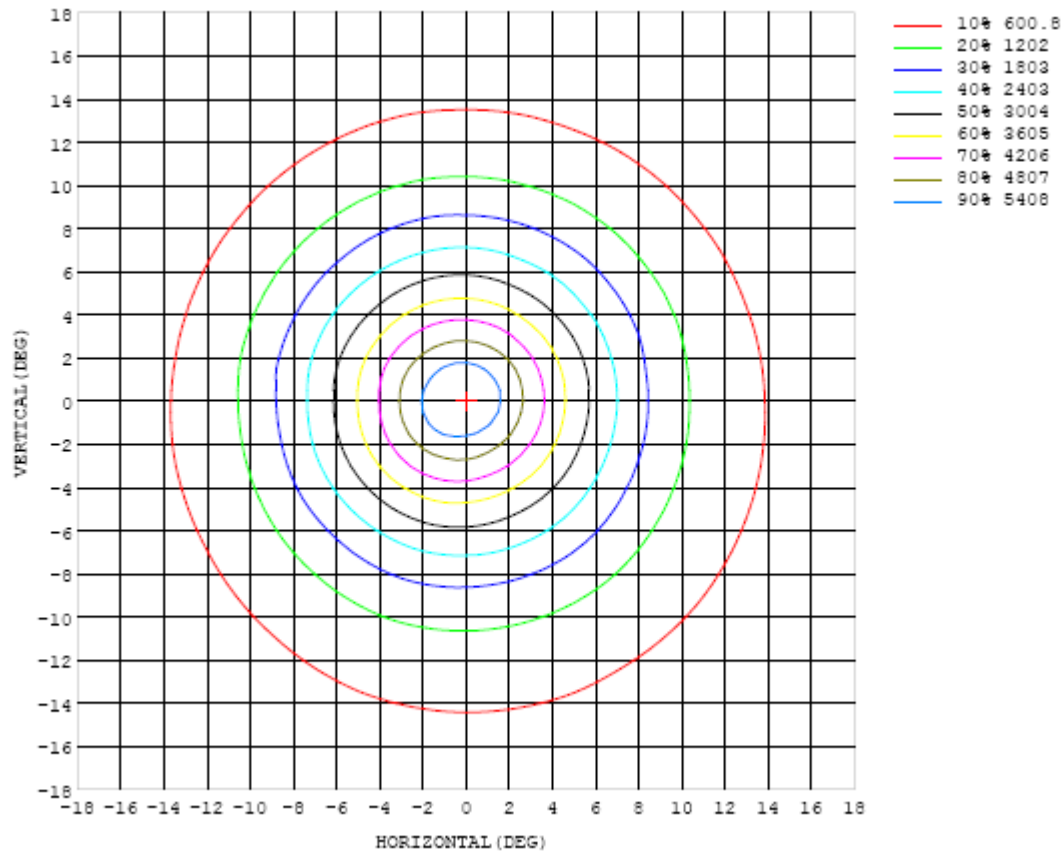


Chart 6: Isocandela Plot

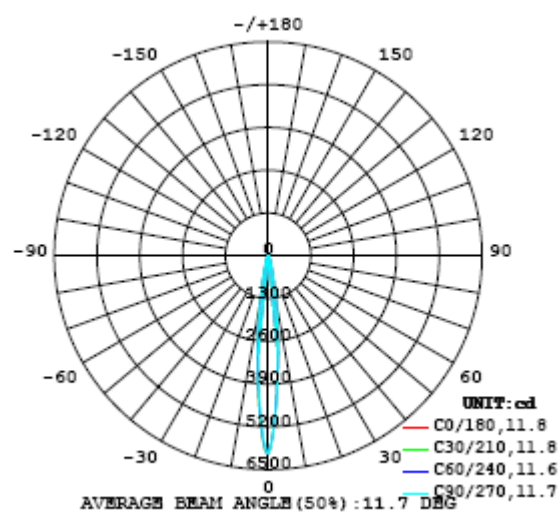


Chart 7: Polar Candela Distribution

## 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	6008	6008	6008	6008	6008	6008	6008	6008	6008	6008	6008	6008	6008	6008	6008	6008	6008	6008	6008
5	3372	3355	3348	3352	3359	3365	3357	3376	3397	3439	3481	3517	3545	3581	3611	3630	3634	3634	3639
10	1292	1299	1305	1316	1332	1344	1351	1354	1358	1370	1376	1389	1386	1379	1380	1386	1375	1367	1381
15	468	479	489	499	509	516	522	538	539	540	536	527	509	492	477	466	455	449	451
20	230	235	239	242	245	249	253	255	254	252	250	247	244	240	236	230	224	219	218
25	139	143	146	149	152	155	157	157	156	155	154	152	150	147	145	142	136	133	133
30	80.1	82.3	85.8	88.9	91.5	93.9	95.3	96.2	96.1	95.2	94.0	92.4	90.1	87.2	85.1	83.6	79.8	77.2	76.7
35	42.4	43.2	45.2	47.3	48.5	50.2	51.4	52.3	52.9	52.4	51.6	50.4	49.2	47.2	45.8	44.8	43.1	41.2	39.7
40	22.3	22.4	22.9	24.6	26.5	24.7	25.6	26.2	26.5	26.4	26.1	25.7	25.0	24.3	23.8	23.8	23.2	22.6	21.6
45	14.3	14.5	14.7	15.8	17.0	15.5	15.5	15.3	15.4	15.5	15.8	15.7	15.7	15.3	15.3	15.7	15.6	15.1	14.9
50	10.7	11.0	11.4	11.8	11.5	11.5	11.4	11.3	11.3	11.4	11.7	11.7	11.5	11.1	11.1	11.2	11.2	10.9	10.6
55	7.46	7.51	7.73	8.10	8.26	8.26	8.18	8.20	8.30	8.40	8.52	8.37	8.45	8.47	8.50	8.56	8.46	7.97	7.82
60	6.08	6.12	6.26	6.50	6.67	6.71	6.77	6.76	6.83	6.88	6.92	6.82	6.90	6.77	6.82	6.73	6.62	6.50	6.47
65	5.09	5.15	5.24	5.39	5.47	5.53	5.66	5.66	5.69	5.70	5.73	5.70	5.73	5.61	5.58	5.51	5.49	5.37	5.39
70	4.00	4.25	4.14	4.24	4.45	4.28	4.42	4.74	4.41	4.40	4.57	4.38	4.39	4.43	4.26	4.23	4.51	4.12	4.07
75	2.93	3.10	3.04	3.12	3.26	3.15	3.22	3.36	3.23	3.24	3.40	3.21	3.22	3.29	3.13	3.11	3.23	3.01	3.00
80	1.92	1.94	1.97	2.02	2.04	2.07	2.09	2.12	2.12	2.11	2.11	2.09	2.09	2.05	2.05	2.02	2.03	1.99	1.99
85	1.06	1.15	1.10	1.08	1.23	1.10	1.12	1.26	1.14	1.14	1.25	1.15	1.12	1.23	1.11	1.09	1.20	1.10	1.09
90	0.46	0.56	0.46	0.47	0.59	0.48	0.48	0.70	0.49	0.48	0.71	0.50	0.48	0.61	0.51	0.49	0.71	0.47	0.48
95	0.31	0.32	0.30	0.31	0.33	0.32	0.33	0.35	0.32	0.31	0.34	0.32	0.31	0.33	0.32	0.29	0.31	0.31	0.30
100	0.30	0.41	0.50	0.38	0.35	0.36	0.35	0.37	0.41	0.27	0.37	0.37	0.41	0.38	0.34	0.32	0.47	0.41	0.27
105	0.36	0.57	0.44	0.42	0.63	0.45	0.43	0.65	0.55	0.37	0.77	0.43	0.45	0.68	0.45	0.39	0.83	0.52	0.39
110	0.42	0.36	0.34	0.41	0.36	0.36	0.43	0.42	0.35	0.45	0.43	0.44	0.39	0.42	0.46	0.35	0.43	0.46	0.44
115	0.30	0.23	0.26	0.28	0.25	0.24	0.28	0.27	0.24	0.28	0.26	0.24	0.31	0.25	0.26	0.34	0.24	0.26	0.28
120	0.41	0.54	0.30	0.41	0.83	0.36	0.61	0.91	0.33	0.48	0.90	0.55	0.52	0.89	0.94	0.70	1.29	1.91	0.72
125	0.16	0.19	0.16	0.17	0.20	0.17	0.17	0.21	0.19	0.16	0.22	0.18	0.18	0.26	0.19	0.18	0.28	0.20	0.22
130	0.10	0.10	0.10	0.11	0.10	0.10	0.10	0.11	0.10	0.10	0.11	0.11	0.11	0.13	0.11	0.10	0.11	0.11	0.12
135	0.09	0.08	0.09	0.09	0.08	0.08	0.09	0.08	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.10
140	0.10	0.10	0.11	0.11	0.11	0.11	0.11	0.11	0.10	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.12
145	0.13	0.16	0.15	0.15	0.16	0.15	0.15	0.15	0.15	0.15	0.16	0.15	0.15	0.16	0.15	0.15	0.16	0.16	0.16
150	0.17	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.21	0.21	0.21	0.21	0.22	0.24
155	0.19	0.27	0.27	0.28	0.27	0.27	0.28	0.28	0.27	0.27	0.27	0.27	0.27	0.26	0.26	0.26	0.26	0.26	0.30
160	0.19	0.32	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.32	0.32	0.32	0.31	0.31	0.31	0.30	0.31	0.35
165	0.15	0.38	0.38	0.38	0.38	0.38	0.39	0.39	0.39	0.38	0.38	0.38	0.37	0.37	0.37	0.36	0.36	0.37	0.37
170	0.09	0.43	0.42	0.42	0.42	0.42	0.41	0.42	0.42	0.41	0.41	0.41	0.40	0.40	0.40	0.40	0.39	0.39	0.37
175	0.00	0.17	0.42	0.40	0.40	0.40	0.39	0.39	0.38	0.38	0.37	0.37	0.37	0.36	0.36	0.36	0.35	0.35	0.39
180	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

Table 6: Luminous Intensity Data

Table--2

UNIT: cd

C (DEG) y (DEG)	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350		
0	6008	6008	6008	6008	6008	6008	6008	6008	6008	6008	6008	6008	6008	6008	6008	6008	6008		
5	3651	3652	3633	3604	3580	3554	3522	3495	3474	3450	3426	3408	3408	3404	3406	3396	3390		
10	1421	1404	1391	1385	1373	1363	1354	1346	1332	1321	1314	1329	1321	1327	1338	1333	1297		
15	448	444	439	439	438	441	443	444	444	443	445	449	453	456	458	463	469		
20	217	214	212	212	212	213	216	217	218	220	222	224	225	226	227	227	228		
25	133	131	130	130	130	132	134	136	137	138	139	140	139	139	138	138	139		
30	75.9	74.5	74.1	74.9	75.9	76.9	78.5	80.6	81.7	82.2	82.5	82.3	81.6	81.9	81.5	81.5	81.2		
35	38.5	37.8	37.4	38.0	38.7	39.5	40.4	41.5	42.1	42.2	42.4	42.6	42.4	42.2	42.6	42.9	42.8		
40	20.5	20.0	19.9	20.0	20.3	20.7	20.9	21.1	21.5	21.8	21.9	22.0	21.9	22.1	22.3	22.6	22.6		
45	14.2	13.9	13.6	13.4	13.4	13.4	13.6	13.6	13.8	13.9	14.0	14.1	14.0	14.3	14.2	14.4	14.3		
50	10.1	9.83	9.69	9.54	9.54	9.49	9.65	9.88	10.3	10.4	10.4	10.2	10.0	10.2	10.3	10.4	10.6		
55	7.66	7.57	7.63	7.51	7.44	7.32	7.41	7.42	7.61	7.66	7.60	7.63	7.50	7.58	7.65	7.71	7.61		
60	6.40	6.55	6.69	6.72	6.68	6.51	6.54	6.42	6.47	6.49	6.43	6.51	6.37	6.43	6.45	6.36	6.30		
65	5.38	5.53	5.65	5.59	5.54	5.44	5.54	5.41	5.38	5.35	5.31	5.43	5.32	5.33	5.34	5.30	5.28		
70	4.20	4.13	4.14	4.28	4.14	4.13	4.51	4.20	4.13	4.29	4.12	4.21	4.32	4.12	4.11	4.42	4.10		
75	3.16	3.03	3.03	3.19	3.03	3.02	3.23	3.05	2.99	3.12	3.00	3.05	3.15	3.00	2.99	3.12	2.99		
80	1.99	2.01	2.01	2.03	2.02	2.01	2.01	1.99	1.97	1.96	1.96	2.00	1.98	1.97	1.98	1.98	1.97		
85	1.19	1.11	1.10	1.21	1.09	1.06	1.18	1.07	1.04	1.15	1.05	1.09	1.17	1.07	1.08	1.19	1.09		
90	0.64	0.49	0.50	0.64	0.49	0.48	0.76	0.47	0.45	0.61	0.46	0.46	0.61	0.47	0.46	0.67	0.47		
95	0.31	0.31	0.31	0.35	0.32	0.30	0.32	0.30	0.31	0.32	0.30	0.32	0.34	0.33	0.32	0.33	0.31		
100	0.31	0.50	0.26	0.39	0.40	0.30	0.47	0.41	0.27	0.43	0.40	0.33	0.46	0.33	0.34	0.58	0.44		
105	0.74	0.46	0.35	0.81	0.44	0.40	1.06	0.42	0.34	0.72	0.33	0.33	0.65	0.37	0.39	0.92	0.46		
110	0.40	0.50	0.38	0.40	0.56	0.33	0.42	0.42	0.34	0.36	0.38	0.33	0.37	0.41	0.37	0.41	0.34		
115	0.24	0.28	0.27	0.23	0.27	0.26	0.24	0.28	0.26	0.23	0.28	0.28	0.23	0.29	0.29	0.23	0.25		
120	1.32	1.44	0.55	2.03	1.70	0.51	2.33	2.47	0.38	1.42	1.41	0.30	0.92	1.07	0.58	0.71	0.55		
125	0.28	0.19	0.20	0.26	0.18	0.17	0.22	0.17	0.15	0.22	0.18	0.15	0.22	0.18	0.17	0.21	0.19		
130	0.13	0.10	0.11	0.11	0.09	0.10	0.10	0.09	0.09	0.10	0.09	0.09	0.09	0.09	0.09	0.10	0.10		
135	0.09	0.09	0.10	0.09	0.09	0.09	0.09	0.09	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.07	0.08		
140	0.11	0.12	0.12	0.11	0.12	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.08	0.09	0.07	0.05	0.06		
145	0.16	0.16	0.16	0.17	0.16	0.16	0.17	0.16	0.16	0.16	0.16	0.14	0.09	0.09	0.07	0.03	0.04		
150	0.23	0.24	0.24	0.23	0.24	0.24	0.23	0.23	0.23	0.23	0.22	0.18	0.09	0.09	0.06	0.01	0.03		
155	0.29	0.29	0.29	0.29	0.29	0.30	0.30	0.29	0.29	0.29	0.28	0.22	0.09	0.10	0.06	0.00	0.01		
160	0.34	0.34	0.34	0.33	0.35	0.37	0.36	0.34	0.33	0.34	0.35	0.24	0.09	0.10	0.05	0.00	0.00		
165	0.37	0.37	0.37	0.38	0.41	0.45	0.42	0.39	0.38	0.40	0.40	0.25	0.09	0.10	0.05	0.00	0.00		
170	0.37	0.39	0.43	0.45	0.51	0.51	0.46	0.43	0.44	0.47	0.45	0.21	0.10	0.10	0.04	0.01	0.00		
175	0.47	0.51	0.58	0.59	0.53	0.48	0.47	0.51	0.53	0.51	0.31	0.10	0.11	0.09	0.04	0.01	0.00		
180	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		

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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