

## 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 Track Light

**Model: ORB/M/927/NR/DIM120V/xx/yy**

Where xx mean different type of Adaptor, could be J, H, L, CM, GES, TEK.

Where yy mean different color of product, could be WH, SV, BL.

### Laboratory: Leading Testing Laboratories

**NVLAP CODE: 200960-0**

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Report No.: HZ20120037t

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

Review by:



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Feb. 03, 2021

Approved by:



Manager: Jim Zhang

Feb. 03, 2021

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: **ORB/M/927/NR/DIM120V/H/BL**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
90.5	1863.1	20.59	0.9821
CCT (K)	CRI	Stabilization Time (Light & Power)	
2713	92.8	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>	: Dec. 23, 2020
<b>Date of Test</b>	: Jan. 08, 2021
<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

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## SAMPLE PHOTO



Figure 1- Overview of the sample

### Equipment Under Test(EUT)

<b>Name</b>	: LED Track Light
<b>Model</b>	: ORB/M/927/NR/DIM120V/H/BL
<b>Electrical Ratings</b>	: 120V, 60Hz, 20W
<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 light down. 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)	0.175
Power Factor	0.9821
Test Power (W)	20.59
THD A%	11.38
Luminous Efficacy (lm/W)	90.5
Total Luminous Flux (lm)	1863.1
Color Rendering Index (CRI)	92.8
R9	61.9
Correlated Color Temperature (CCT)(K)	2713
Chromaticity Chroma x	0.4614
Chromaticity Chroma y	0.4153
Chromaticity Chroma u	0.2614
Chromaticity Chroma v	0.3529
Duv	0.0016
Chromaticity Chroma u'	0.2614
Chromaticity Chroma v'	0.5294

Special Color Rendering Indices	
R1	92.8
R2	95.4
R3	97
R4	93.5
R5	92.2
R6	94.8
R7	93.4
R8	83.2
R9	61.9
R10	88.6
R11	94.4
R12	80.9
R13	93.3
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 25.1 °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)	0.176
Power Factor	0.9830
Power (W)	20.79
Luminous Efficacy (lm/W)	95.2
Total Luminous Flux (lm)	1979.1
Beam Angle ( ° )	22.2 (0°-180°) / 22.1 (90°-270°)
Center Beam Candle Power (cd)	11460
Maximum Beam Candle Power (cd)	11458 (At: C=0.0, Gamma=0.0)
Spacing Criteria	0.36 (0°-180°) / 0.37 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	98.93%
Zonal Lumens in the 60 °-90 °Zone	1.01%
Zonal Lumens in the 90 °-120 °Zone	0.00%
Zonal Lumens in the 120 °-180 °Zone	0.07%

Table 3: Test data per Goniophotometer Method

### Spectral Power Distribution - Sphere Spectroradiometer Method

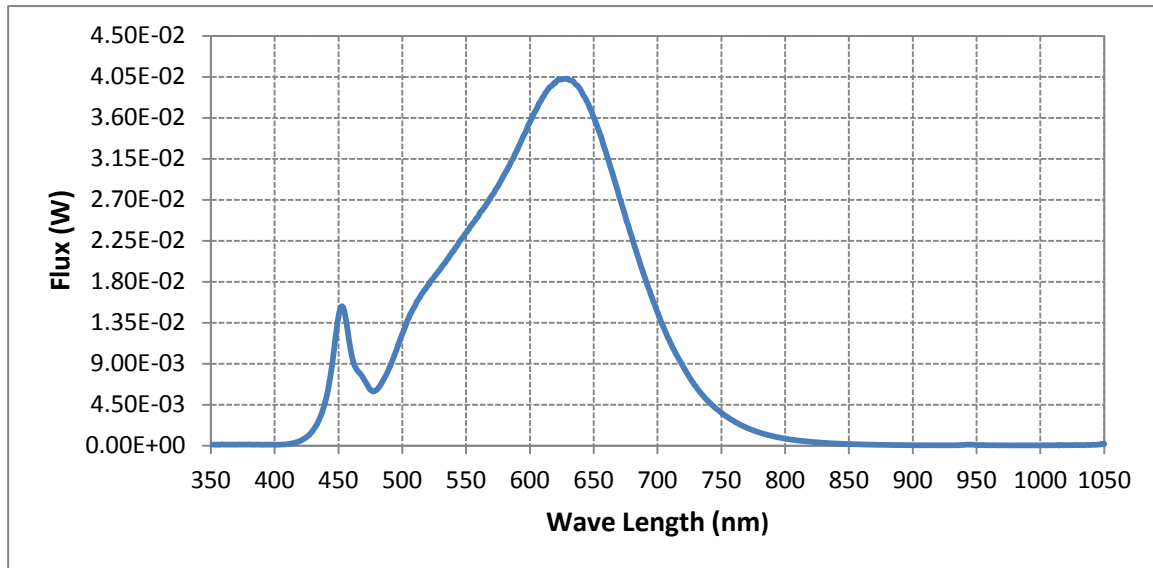
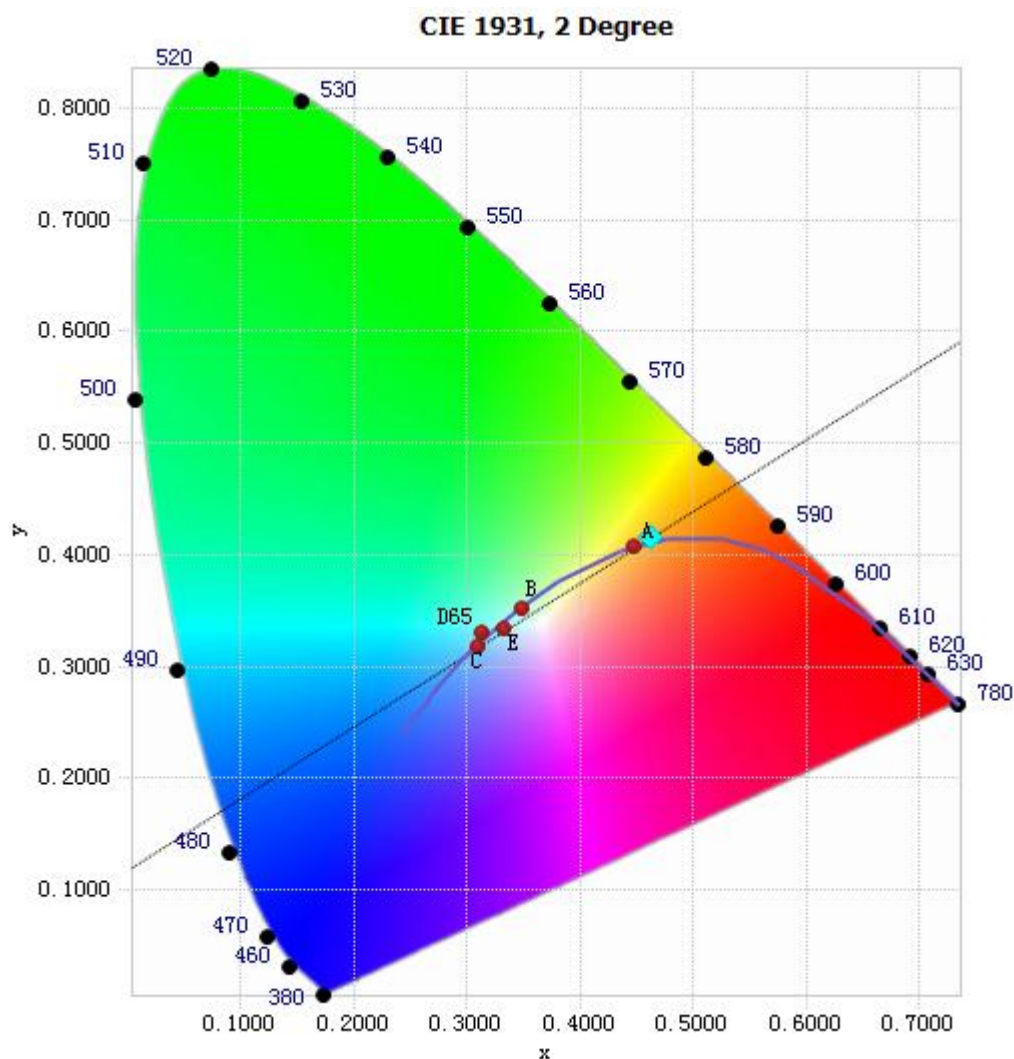


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.18E-04	485	7.18E-03	590	3.25E-02	695	1.65E-02
385	1.09E-04	490	8.59E-03	595	3.40E-02	700	1.46E-02
390	1.02E-04	495	1.04E-02	600	3.55E-02	705	1.29E-02
395	1.06E-04	500	1.23E-02	605	3.69E-02	710	1.13E-02
400	1.04E-04	505	1.40E-02	610	3.83E-02	715	9.92E-03
405	1.10E-04	510	1.54E-02	615	3.93E-02	720	8.70E-03
410	1.70E-04	515	1.66E-02	620	3.99E-02	725	7.51E-03
415	2.82E-04	520	1.76E-02	625	4.02E-02	730	6.49E-03
420	5.15E-04	525	1.85E-02	630	4.02E-02	735	5.59E-03
425	9.44E-04	530	1.95E-02	635	3.98E-02	740	4.82E-03
430	1.67E-03	535	2.04E-02	640	3.90E-02	745	4.16E-03
435	2.92E-03	540	2.13E-02	645	3.77E-02	750	3.61E-03
440	5.01E-03	545	2.24E-02	650	3.60E-02	755	3.11E-03
445	8.87E-03	550	2.34E-02	655	3.42E-02	760	2.67E-03
450	1.42E-02	555	2.44E-02	660	3.20E-02	765	2.28E-03
455	1.44E-02	560	2.53E-02	665	2.98E-02	770	1.95E-03
460	1.02E-02	565	2.63E-02	670	2.73E-02	775	1.67E-03
465	8.21E-03	570	2.74E-02	675	2.50E-02	780	1.43E-03
470	7.26E-03	575	2.85E-02	680	2.28E-02		
475	6.13E-03	580	2.98E-02	685	2.06E-02		
480	6.14E-03	585	3.11E-02	690	1.85E-02		

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

## Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4614, 0.4153)

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

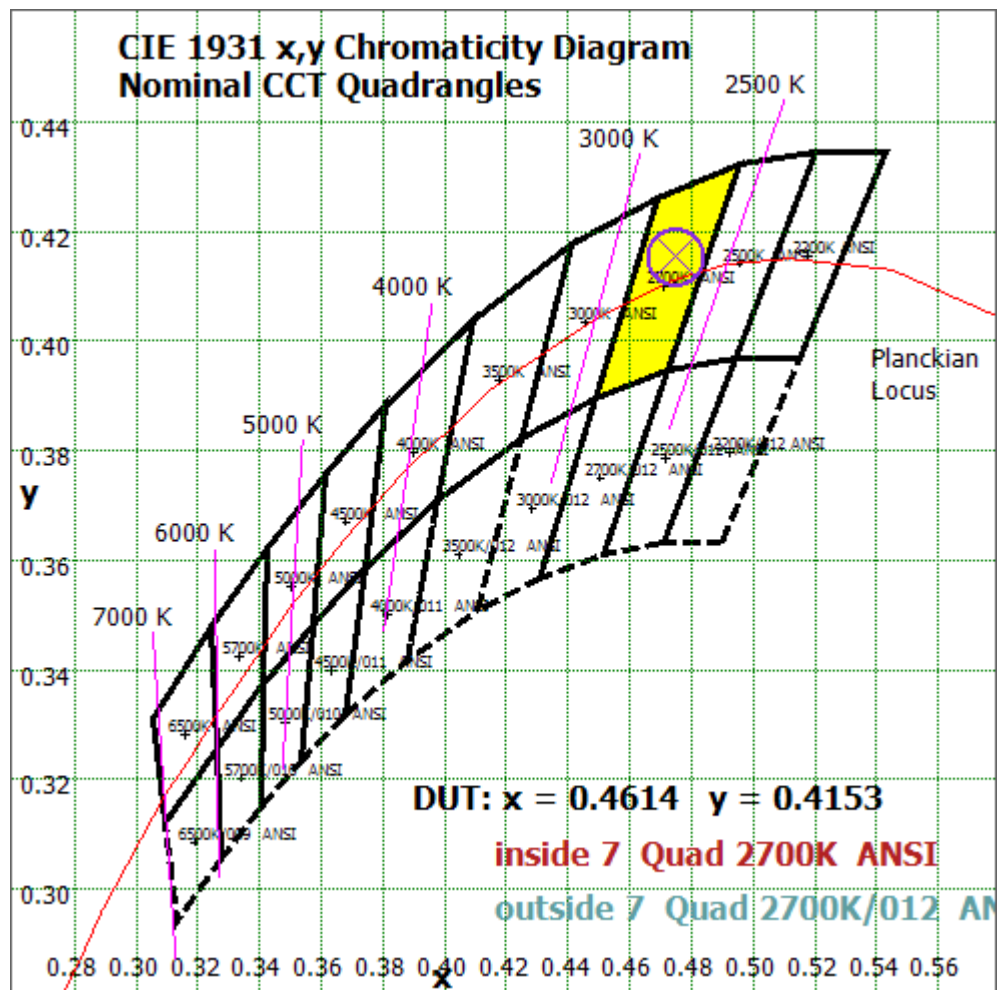


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

# Color Rendition Report – Sphere Spectroradiometer Method

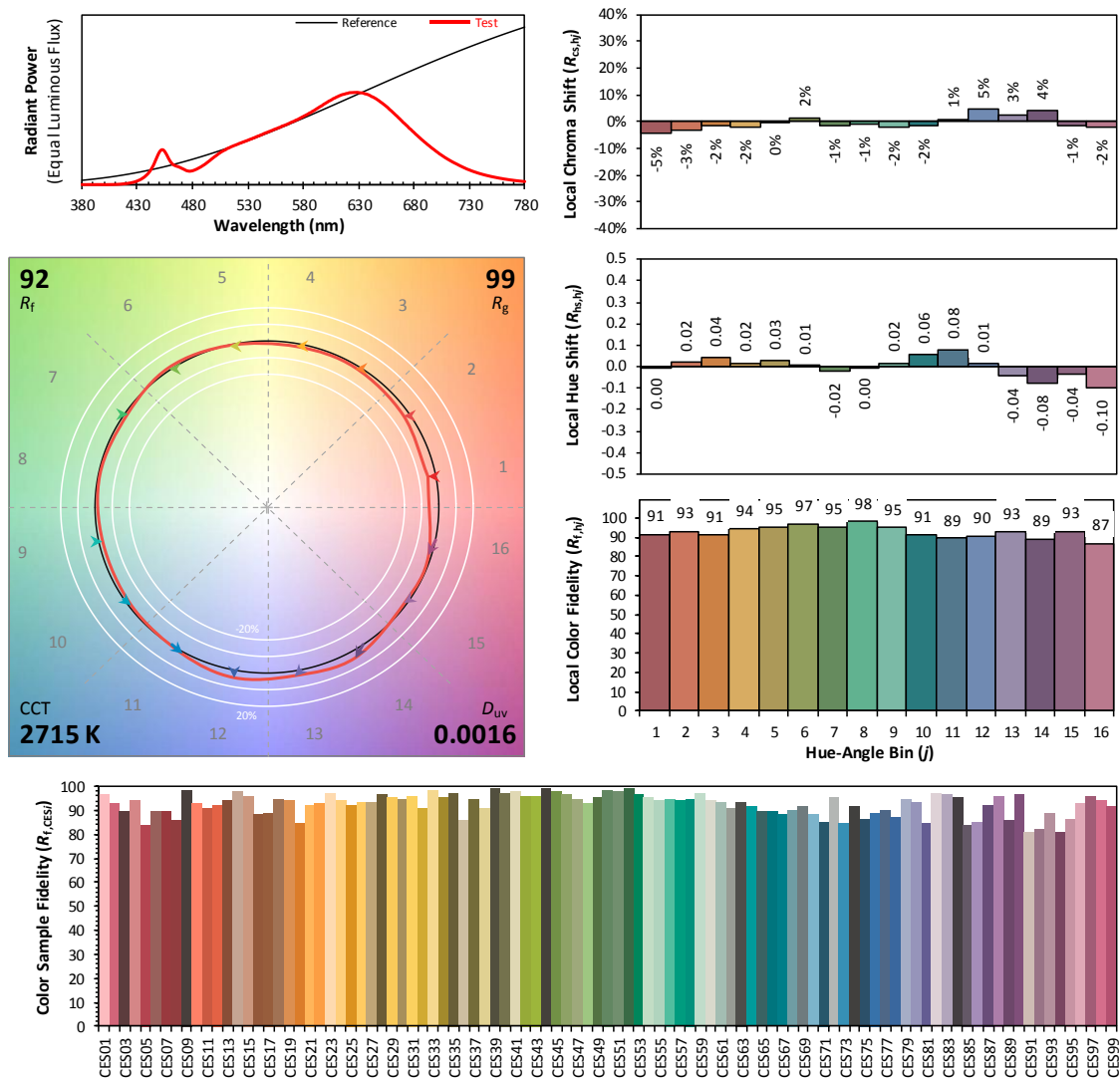
## ANSI/IES TM-30-18 Color Rendition Report

Source: LED

Manufacturer: GREEN CREATIVE LTD

Date: 2021/01/08

Model: ORB/M/927/NR/DIM120V/H/BL



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

$x$  0.4614  
 $y$  0.4153  
 $u'$  0.2614  
 $v'$  0.5294

CIE 13.3-1995  
(CRI)

$R_a$  93

$R_g$  62

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	835.504	42.22%
10- 20	824.383	41.65%
20- 30	183.408	9.27%
30- 40	57.277	2.89%
40- 50	32.332	1.63%
50- 60	24.963	1.26%
60- 70	15.099	0.76%
70- 80	4.634	0.23%
80- 90	0.168	0.01%
90-100	0	0.00%
100-110	0	0.00%
110-120	0	0.00%
120-130	0.008	0.00%
130-140	0.087	0.00%
140-150	0.292	0.01%
150-160	0.456	0.02%
160-170	0.387	0.02%
170-180	0.14	0.01%
Total	1979.1	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	1957.867	98.93%
60- 90	19.901	1.01%
0-90	1977.768	99.93%
90- 180	1.37	0.07%
0- 180	1979.1	100%

Table 5: Zonal Lumen

## Illuminance Plots- Goniophotometer Method

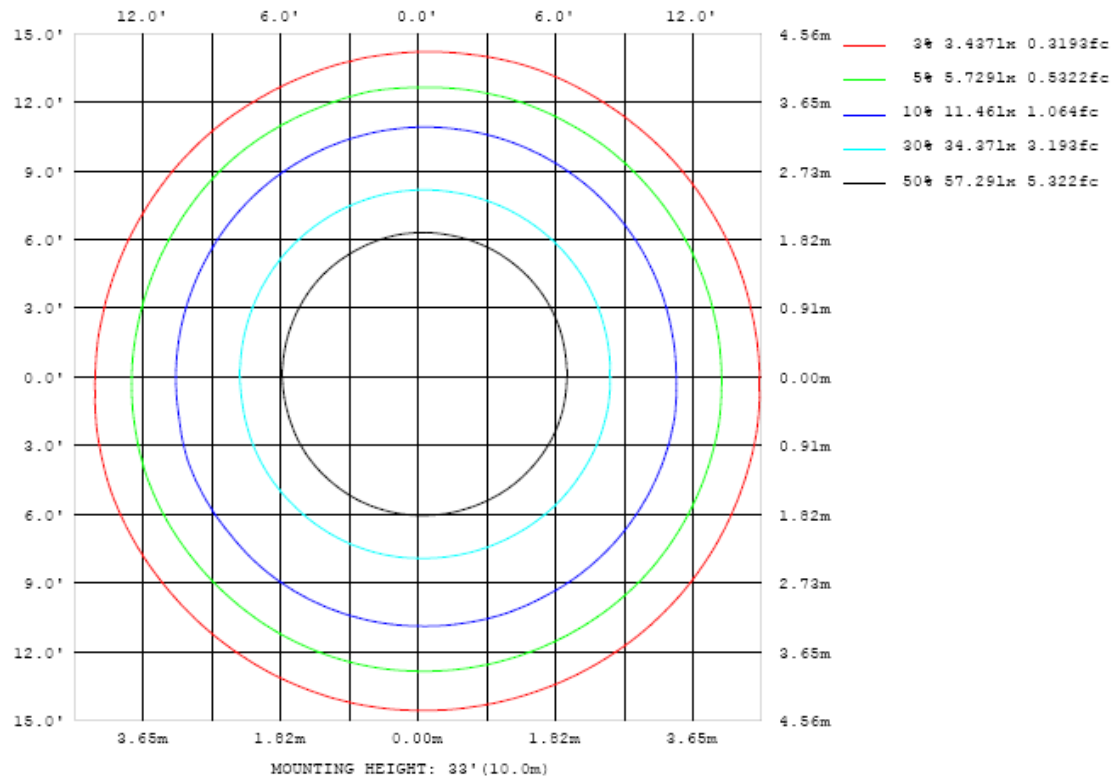


Chart 5: Illuminance Plot (Footcandles)

## Luminous Intensity Distribution Plots- Goniophotometer Method

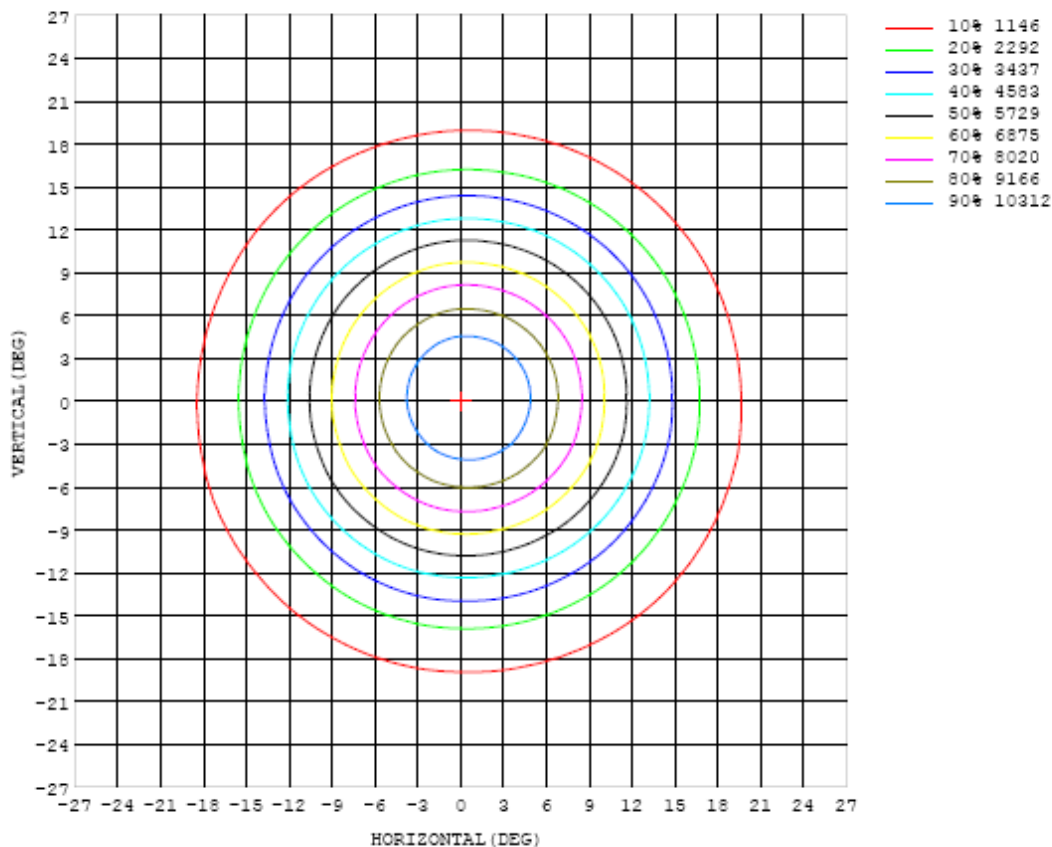


Chart 6: Isocandela Plot

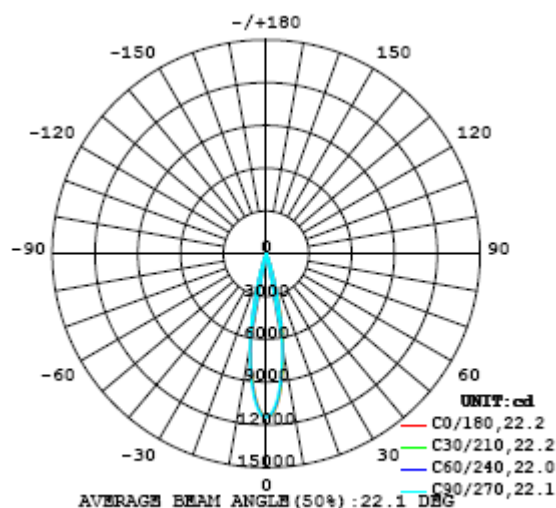


Chart 7: Polar Candela Distribution

## Luminous Intensity Data- Goniophotometer Method

Table--1

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

C (DEG) y (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	1146	1146	1146	1146	1146	1146	1146	1146	1146	1146	1146	1146	1146	1146	1146	1146	1146	1146	1146
5	1026	1022	1019	1016	1013	1005	998	991	986	980	976	971	967	965	961	960	959	960	962
10	692	690	688	680	671	663	654	644	637	632	628	626	623	620	619	617	614	614	617
15	332	331	326	319	312	304	296	289	283	280	277	274	271	267	266	265	264	260	261
20	106	108	106	105	103	100	97.5	95.0	93.0	91.5	90.4	89.1	88.0	86.5	85.8	85.6	85.2	82.8	81.9
25	40.8	41.7	41.3	40.9	40.6	39.8	38.9	38.1	37.7	37.2	37.0	36.4	35.9	35.4	35.1	35.0	34.8	33.8	32.9
30	18.4	18.7	18.5	18.5	18.3	18.0	17.5	17.5	17.5	17.3	17.2	17.2	16.9	16.7	16.4	16.3	16.3	15.7	14.9
35	9.57	9.66	9.53	9.38	9.24	9.08	8.97	8.94	8.94	8.91	8.84	8.74	8.65	8.60	8.57	8.53	8.48	8.33	8.10
40	5.97	5.99	5.90	5.80	5.72	5.65	5.61	5.66	5.71	5.72	5.68	5.62	5.60	5.60	5.57	5.53	5.52	5.49	5.40
45	4.43	4.41	4.29	4.19	4.14	4.09	4.07	4.12	4.18	4.21	4.17	4.11	4.10	4.10	4.10	4.08	4.09	4.09	4.05
50	3.55	3.54	3.43	3.38	3.35	3.32	3.31	3.33	3.38	3.41	3.42	3.38	3.39	3.41	3.40	3.40	3.40	3.39	3.40
55	2.95	2.97	2.91	2.87	2.85	2.81	2.78	2.78	2.79	2.82	2.83	2.79	2.78	2.79	2.79	2.79	2.79	2.78	2.78
60	2.36	2.38	2.35	2.30	2.27	2.24	2.24	2.23	2.21	2.22	2.23	2.20	2.18	2.16	2.16	2.17	2.17	2.14	2.14
65	1.69	1.71	1.68	1.62	1.59	1.56	1.56	1.56	1.44	1.52	1.52	1.50	1.47	1.45	1.45	1.47	1.47	1.39	1.42
70	0.96	0.97	0.94	0.90	0.87	0.85	0.87	0.87	0.82	0.83	0.81	0.79	0.75	0.74	0.73	0.76	0.77	0.76	0.77
75	0.52	0.52	0.49	0.47	0.46	0.46	0.45	0.46	0.45	0.44	0.43	0.41	0.40	0.39	0.39	0.39	0.40	0.40	0.39
80	0.15	0.14	0.14	0.14	0.16	0.14	0.12	0.12	0.11	0.11	0.10	0.09	0.09	0.09	0.08	0.08	0.08	0.08	0.07
85	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
90	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
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	0.00
125	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
130	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
135	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
140	0.02	0.02	0.02	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
145	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	0.06	0.05
150	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
155	0.11	0.10	0.10	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
160	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	0.13	0.13	0.13	0.13
165	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.15
170	0.15	0.15	0.15	0.15	0.15	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.15	0.14	0.15	0.16	0.16
175	0.14	0.14	0.14	0.14	0.14	0.15	0.15	0.15	0.14	0.14	0.15	0.15	0.15	0.15	0.15	0.15	0.16	0.17	0.17
180	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15

Table 6: Luminous Intensity Data

Table--2

UNIT: ×10cd

C (DEG) y (DEG)	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350		
0	1146	1146	1146	1146	1146	1146	1146	1146	1146	1146	1146	1146	1146	1146	1146	1146	1146		
5	964	968	973	978	984	990	997	1002	1008	1011	1015	1020	1022	1025	1027	1028	1027		
10	620	623	628	634	641	647	655	662	667	672	678	684	689	693	696	698	695		
15	263	265	270	274	279	284	290	297	303	308	314	319	325	330	334	334	333		
20	81.0	80.1	80.5	81.3	82.1	82.7	84.0	85.7	88.7	90.5	93.2	95.8	98.1	101	103	104	105		
25	32.2	31.7	31.3	31.2	31.2	31.3	31.6	32.2	33.0	33.7	34.6	35.2	36.0	37.0	38.2	39.2	39.9		
30	14.6	14.3	14.1	13.9	13.9	14.0	14.2	14.6	14.9	15.3	15.7	16.0	16.3	16.7	17.1	17.5	17.8		
35	7.92	7.72	7.60	7.52	7.50	7.56	7.67	7.88	8.06	8.17	8.32	8.45	8.61	8.81	9.01	9.16	9.32		
40	5.28	5.16	5.09	5.10	5.09	5.04	5.09	5.23	5.33	5.35	5.37	5.42	5.51	5.59	5.66	5.75	5.87		
45	3.98	3.88	3.84	3.82	3.79	3.76	3.78	3.89	4.00	4.04	4.06	4.10	4.17	4.23	4.25	4.32	4.36		
50	3.37	3.29	3.26	3.24	3.20	3.16	3.16	3.21	3.29	3.32	3.31	3.32	3.37	3.40	3.43	3.47	3.49		
55	2.78	2.73	2.68	2.66	2.64	2.64	2.66	2.70	2.75	2.80	2.79	2.79	2.81	2.83	2.85	2.87	2.89		
60	2.17	2.14	2.11	2.08	2.07	2.10	2.13	2.15	2.19	2.23	2.23	2.23	2.23	2.25	2.28	2.30	2.31		
65	1.50	1.49	1.46	1.45	1.46	1.49	1.53	1.47	1.56	1.60	1.61	1.59	1.59	1.61	1.64	1.68	1.59		
70	0.77	0.78	0.77	0.77	0.78	0.82	0.84	0.84	0.88	0.89	0.90	0.89	0.89	0.91	0.94	0.95	0.91		
75	0.39	0.39	0.39	0.39	0.40	0.41	0.43	0.44	0.45	0.46	0.46	0.45	0.45	0.46	0.48	0.50	0.51		
80	0.07	0.08	0.08	0.09	0.09	0.09	0.10	0.11	0.11	0.11	0.12	0.13	0.13	0.13	0.13	0.14	0.14		
85	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		
90	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		
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	0.00	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		
125	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		
130	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		
135	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		
140	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02		
145	0.05	0.05	0.05	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		
150	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	0.07		
155	0.10	0.10	0.10	0.10	0.10	0.10	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.10		
160	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.13		
165	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.13	0.13	0.13	0.13	0.13	0.13	0.15		
170	0.16	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.15	0.15		
175	0.18	0.18	0.17	0.13	0.13	0.13	0.13	0.13	0.13	0.12	0.12	0.12	0.13	0.13	0.13	0.13	0.13		
180	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15		

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**

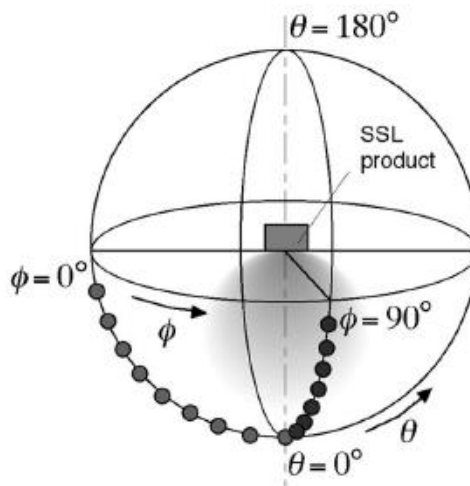
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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