

## 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/930SP10/R**

### Laboratory: Leading Testing Laboratories

**NVLAP CODE: 200960-0**

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Report No.: HZ20060050d

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

Review by:



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Nov. 20, 2020

Approved by:



Manager: Jim Zhang

Nov. 20, 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/930SP10/R

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
84.7	573.6	6.77	0.9142
CCT (K)	CRI	Stabilization Time (Light & Power)	
3111	96.9	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** : Jun. 25, 2020

**Date of Test** : Jul. 02, 2020

**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)

<b>Name</b>	: LED Lamp
<b>Model</b>	: 7.5MR16DIM/930SP10/R
<b>Electrical Ratings</b>	: 12Vac 50/60Hz, 7.5W
<b>Product Description</b>	: 3000K
<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 25.0 °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)	0.617
Power Factor	0.9142
Test Power (W)	6.77
THD A%	31.83
Luminous Efficacy (lm/W)	84.7
Total Luminous Flux (lm)	573.6
Color Rendering Index (CRI)	96.9
R9	84.9
Correlated Color Temperature (CCT)(K)	3111
Chromaticity Chroma x	0.4314
Chromaticity Chroma y	0.4061
Chromaticity Chroma u	0.2461
Chromaticity Chroma v	0.3476
Duv	0.0016
Chromaticity Chroma u'	0.2461
Chromaticity Chroma v'	0.5214

Special Color Rendering Indices	
R1	98.3
R2	99.3
R3	98.4
R4	96.1
R5	96.5
R6	98
R7	95.6
R8	92.9
R9	84.9
R10	96.5
R11	97.7
R12	81
R13	98.8
R14	98.1

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 25.2 °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)	0.627
Power Factor	0.9153
Power (W)	6.84
Luminous Efficacy (lm/W)	86.0
Total Luminous Flux (lm)	588.4
Beam Angle ( ° )	10.4 (0°-180°) / 10.1 (90°-270°)
Center Beam Candle Power (cd)	8310
Maximum Beam Candle Power (cd)	8310 (At: C=40.0, Gamma=0.5)
Spacing Criteria	0.17 (0°-180°) / 0.17 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	97.55%
Zonal Lumens in the 60 °-90 °Zone	1.95%
Zonal Lumens in the 90 °-120 °Zone	0.32%
Zonal Lumens in the 120 °-180 °Zone	0.17%

Table 3: Test data per Goniophotometer Method

### Spectral Power Distribution - Sphere Spectroradiometer Method

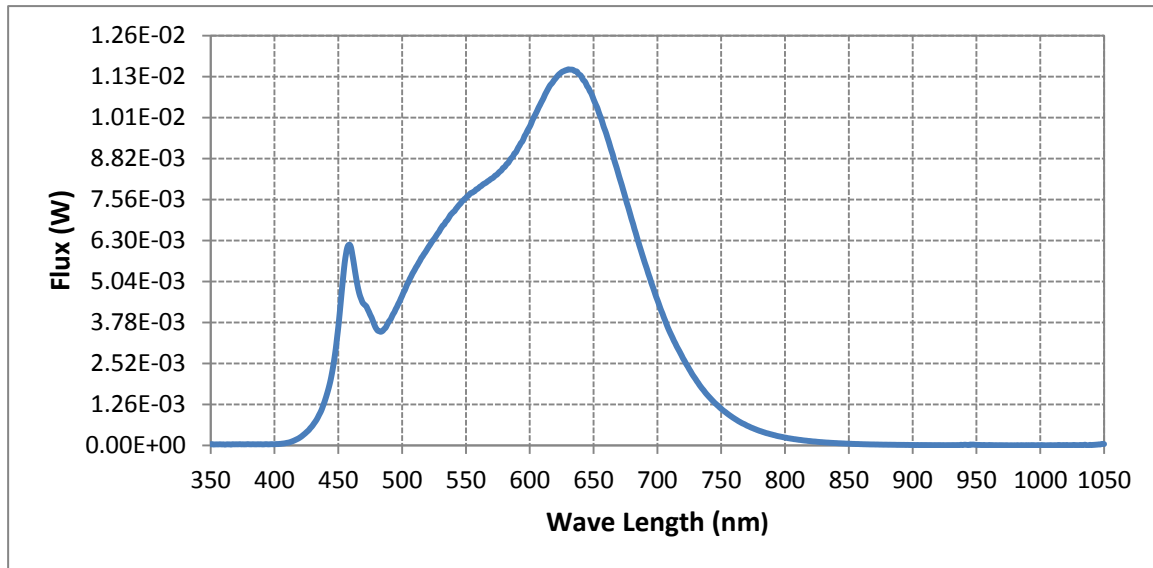
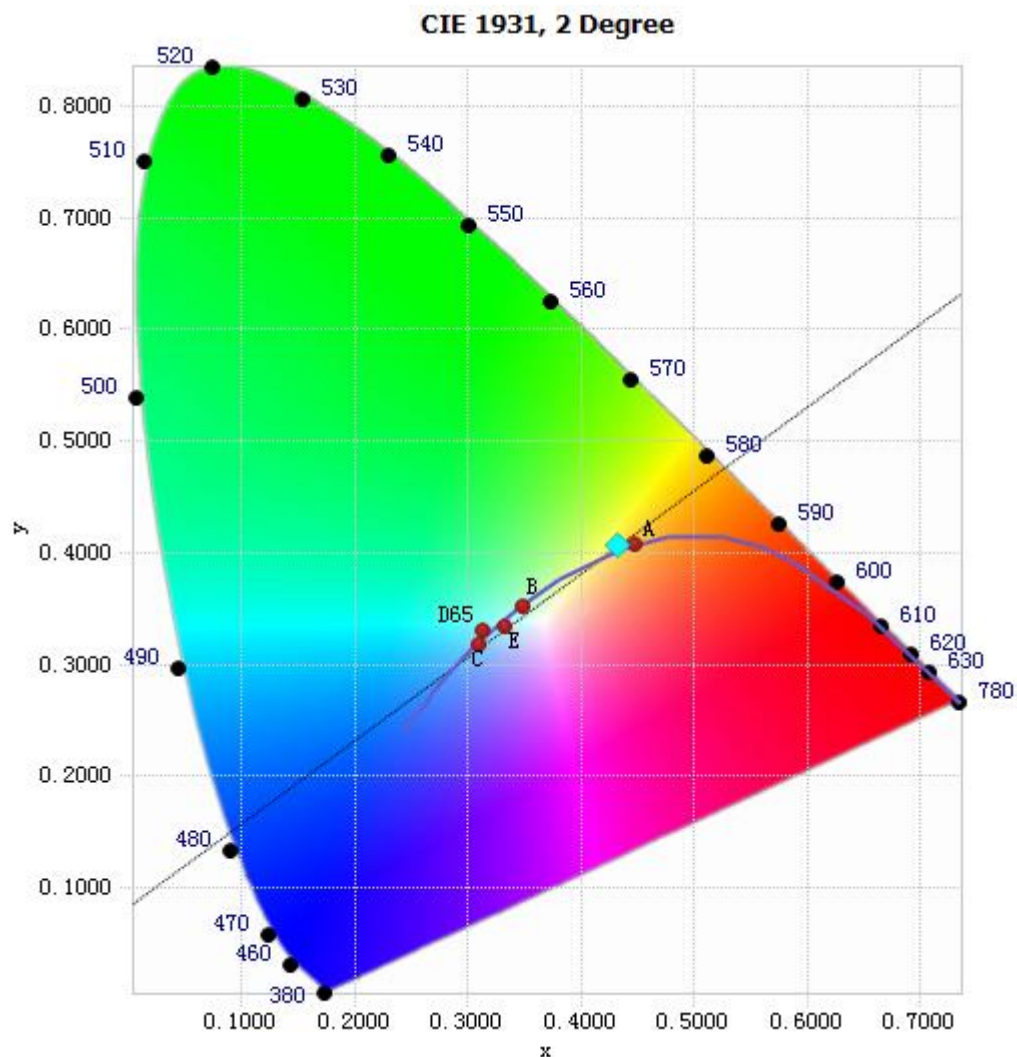


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	3.78E-05	485	3.53E-03	590	9.08E-03	695	5.03E-03
385	3.51E-05	490	3.83E-03	595	9.42E-03	700	4.48E-03
390	3.50E-05	495	4.19E-03	600	9.81E-03	705	3.94E-03
395	3.51E-05	500	4.60E-03	605	1.02E-02	710	3.47E-03
400	3.77E-05	505	5.03E-03	610	1.06E-02	715	3.06E-03
405	5.09E-05	510	5.41E-03	615	1.10E-02	720	2.69E-03
410	8.29E-05	515	5.76E-03	620	1.13E-02	725	2.35E-03
415	1.45E-04	520	6.06E-03	625	1.15E-02	730	2.04E-03
420	2.47E-04	525	6.35E-03	630	1.16E-02	735	1.75E-03
425	4.07E-04	530	6.65E-03	635	1.15E-02	740	1.52E-03
430	6.21E-04	535	6.91E-03	640	1.14E-02	745	1.31E-03
435	9.44E-04	540	7.18E-03	645	1.10E-02	750	1.13E-03
440	1.44E-03	545	7.41E-03	650	1.06E-02	755	9.74E-04
445	2.22E-03	550	7.61E-03	655	1.01E-02	760	8.37E-04
450	3.65E-03	555	7.77E-03	660	9.58E-03	765	7.16E-04
455	5.62E-03	560	7.92E-03	665	8.95E-03	770	6.15E-04
460	6.08E-03	565	8.06E-03	670	8.27E-03	775	5.28E-04
465	4.92E-03	570	8.20E-03	675	7.61E-03	780	4.50E-04
470	4.35E-03	575	8.36E-03	680	6.93E-03		
475	4.02E-03	580	8.55E-03	685	6.27E-03		
480	3.58E-03	585	8.81E-03	690	5.63E-03		

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

## Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4314, 0.4061)

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

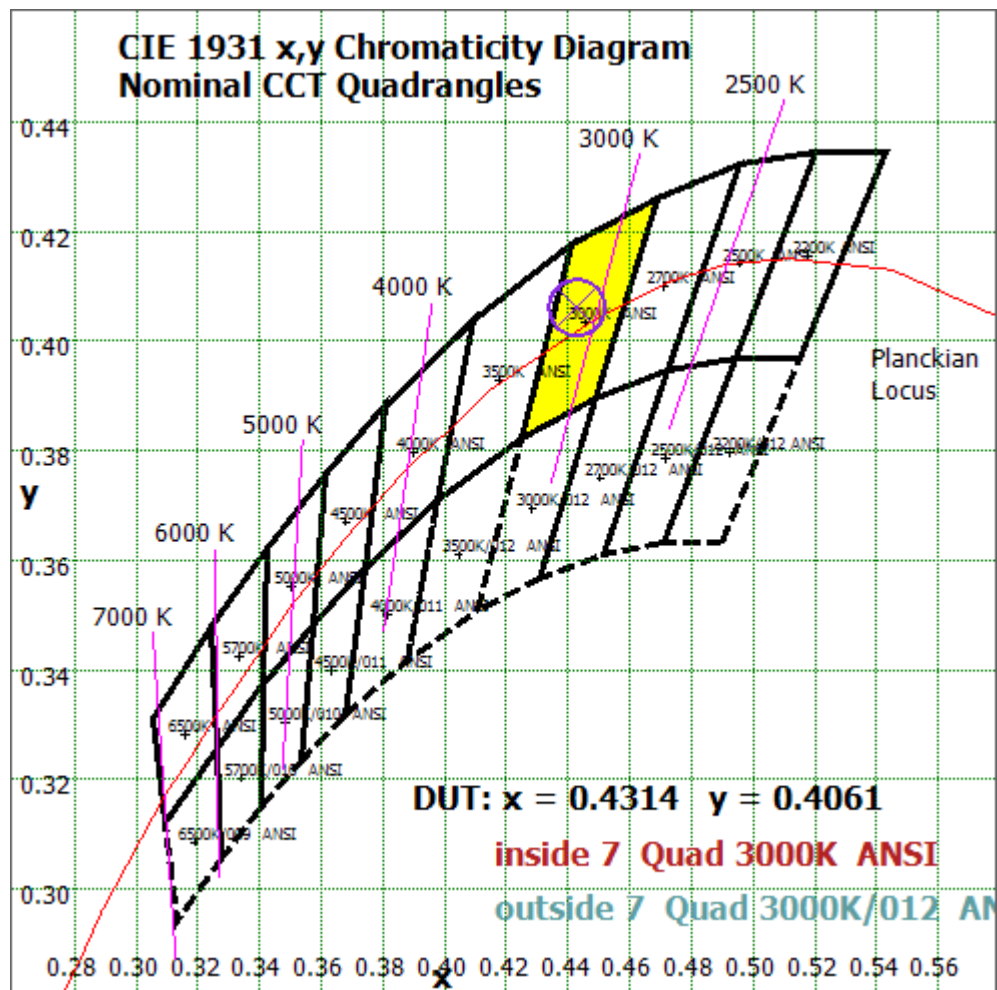


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

# Color Rendition Report – Sphere Spectroradiometer Method

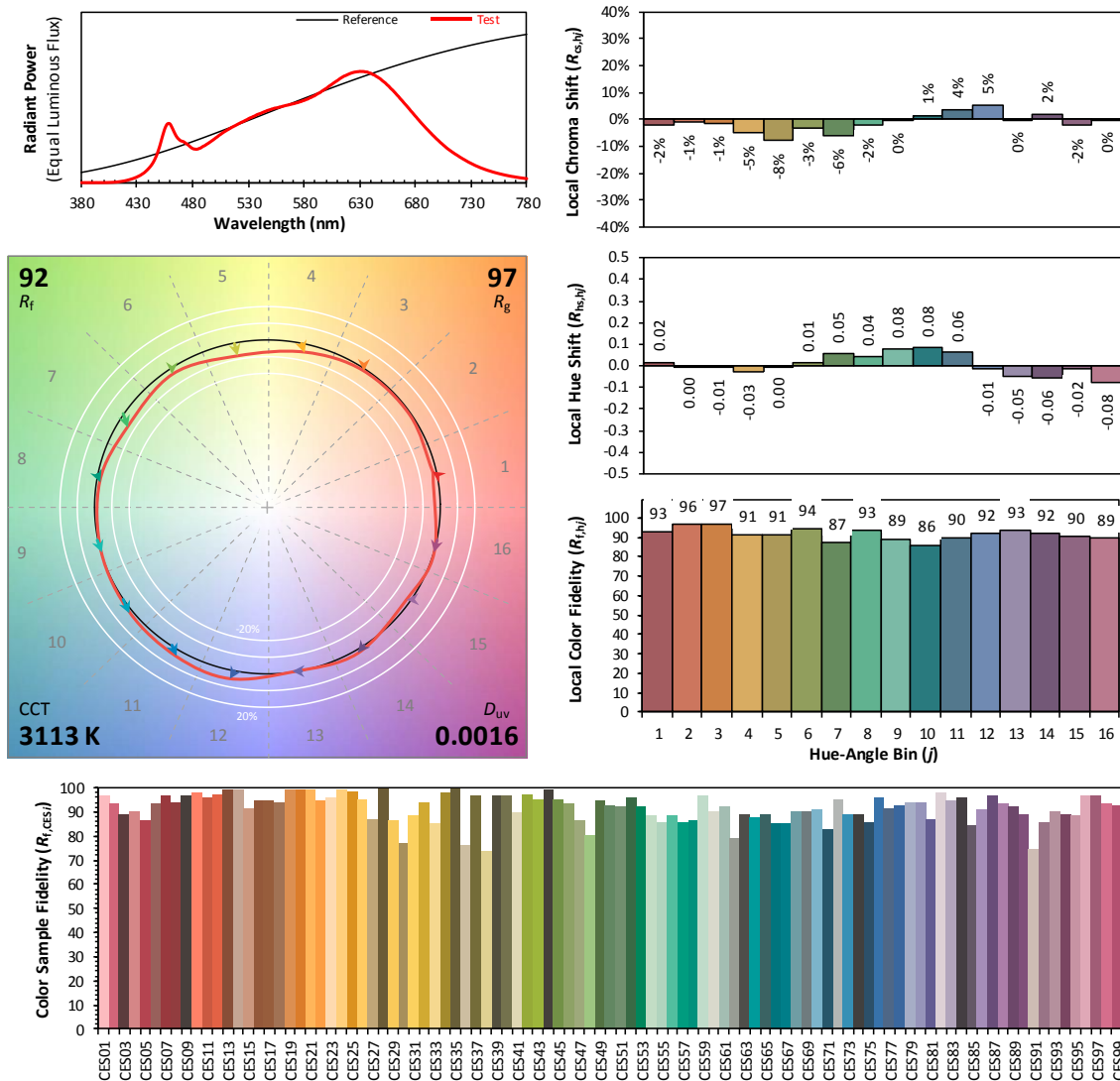
## ANSI/IES TM-30-18 Color Rendition Report

Source: LED

Manufacturer: GREEN CREATIVE LTD

Date: 2020/07/02

Model: 7.5MR16DIM/930SP10/R



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

$x$  0.4314  
 $y$  0.4061  
 $u'$  0.2461  
 $v'$  0.5214

CIE 13.3-1995  
(CRI)  
 $R_a$  97  
 $R_g$  85

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	314.721	53.49%
10- 20	147.03	24.99%
20- 30	67.55	11.48%
30- 40	25.678	4.36%
40- 50	10.937	1.86%
50- 60	8.06	1.37%
60- 70	6.701	1.14%
70- 80	3.416	0.58%
80- 90	1.336	0.23%
90-100	0.552	0.09%
100-110	0.7	0.12%
110-120	0.657	0.11%
120-130	0.444	0.08%
130-140	0.174	0.03%
140-150	0.115	0.02%
150-160	0.141	0.02%
160-170	0.113	0.02%
170-180	0.04	0.01%
Total	588.4	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	573.976	97.55%
60- 90	11.453	1.95%
0-90	585.429	99.50%
90- 180	2.936	0.50%
0- 180	588.4	100%

Table 5: Zonal Lumen

## Illuminance Plots- Goniophotometer Method

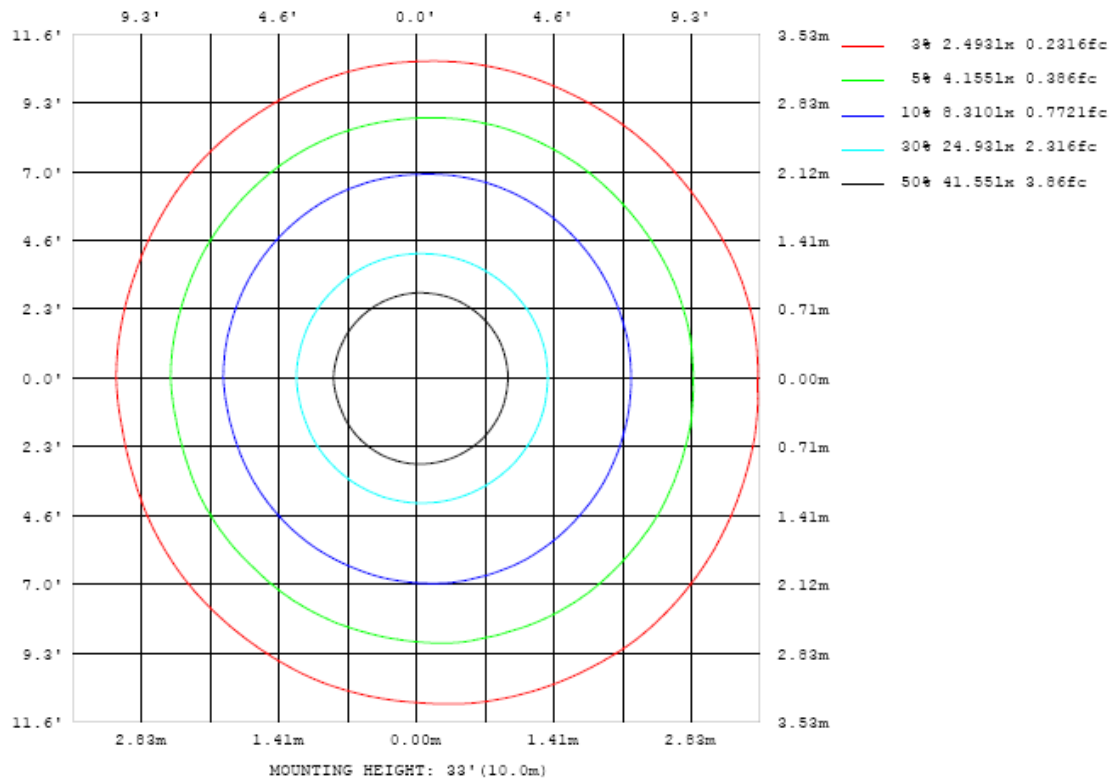


Chart 5: Illuminance Plot (Footcandles)

## Luminous Intensity Distribution Plots- Goniophotometer Method

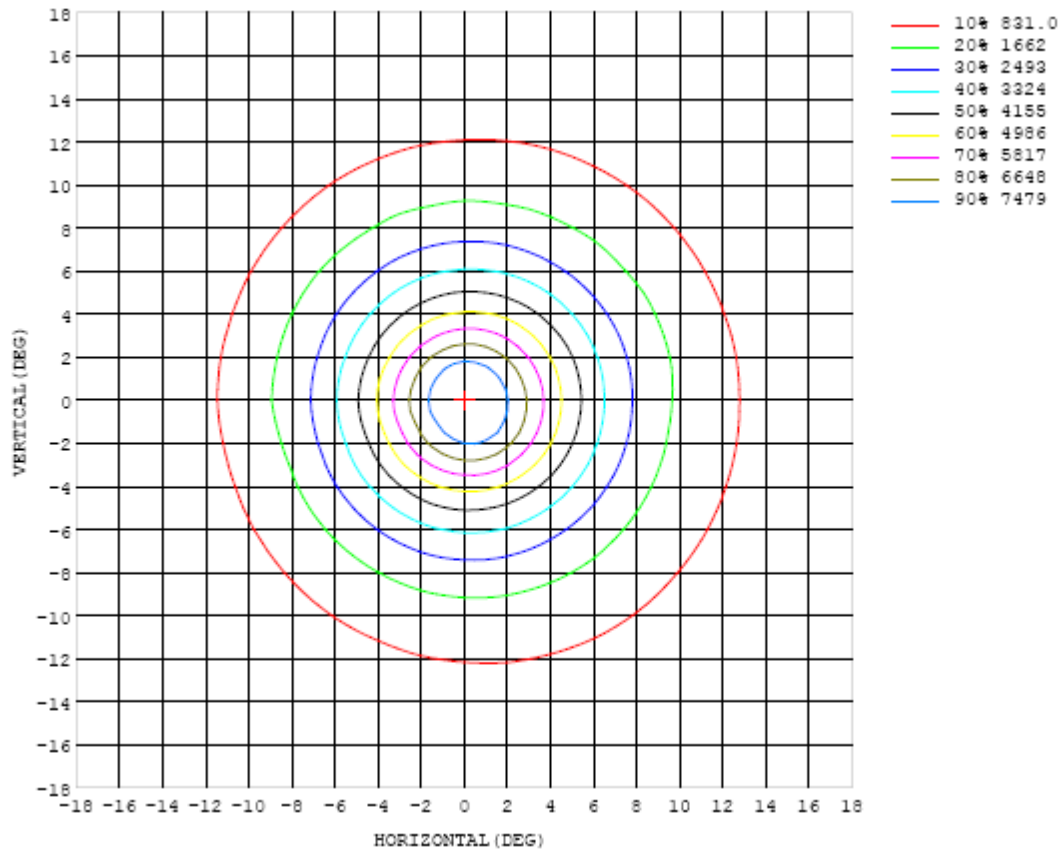


Chart 6: Isocandela Plot

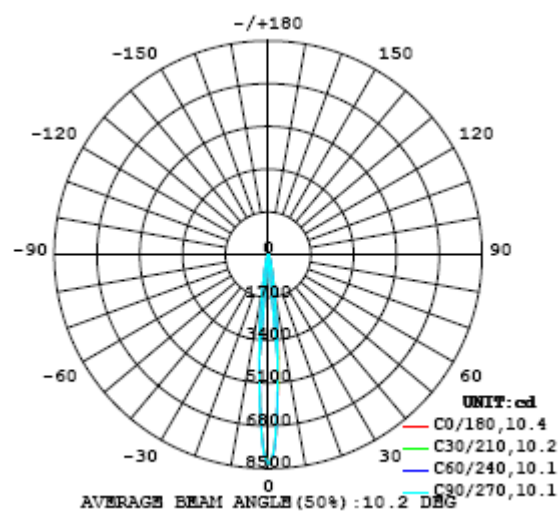


Chart 7: Polar Candela Distribution

## 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	8310	8310	8310	8310	8310	8310	8310	8310	8310	8310	8310	8310	8310	8310	8310	8310	8310	8310	8310
5	4538	4522	4515	4482	4457	4396	4347	4310	4265	4241	4212	4186	4138	4113	4090	4056	4011	4053	4093
10	1534	1511	1510	1497	1483	1473	1450	1418	1393	1359	1326	1291	1267	1238	1216	1193	1173	1182	1208
15	556	563	551	561	547	542	535	510	502	476	452	437	423	412	402	393	384	384	394
20	278	282	280	281	281	279	272	264	257	248	242	239	232	225	219	212	209	207	210
25	170	171	174	176	176	173	167	161	157	152	147	144	140	135	129	125	122	122	125
30	95.5	97.2	98.8	97.3	98.9	97.2	94.7	90.3	87.0	83.0	78.3	76.0	75.5	72.0	68.4	66.6	64.2	63.5	65.1
35	46.7	48.0	48.4	48.0	47.3	47.2	45.9	43.8	41.0	38.9	36.7	35.4	34.7	33.6	32.4	31.4	30.2	30.3	30.9
40	23.0	22.4	22.5	21.9	21.5	21.1	20.8	20.1	19.7	19.0	18.4	17.8	17.6	17.7	17.7	17.9	17.7	17.6	17.9
45	14.5	14.1	14.6	14.7	14.7	14.6	14.4	14.6	14.4	14.0	13.7	13.3	13.2	13.0	13.1	13.3	13.1	13.2	13.2
50	11.0	10.6	10.8	11.0	11.0	11.2	11.0	11.2	10.9	10.7	10.5	10.3	10.3	10.2	10.4	10.6	10.8	10.8	10.6
55	8.39	8.32	8.50	8.77	8.93	8.93	8.72	8.75	8.57	8.58	8.73	8.82	8.83	8.61	8.52	8.56	8.67	8.66	8.45
60	7.67	7.50	7.36	7.34	7.44	7.83	7.91	7.93	7.83	7.98	7.94	7.99	8.04	7.92	7.75	7.83	8.13	8.38	8.38
65	6.67	6.58	6.52	6.49	6.55	6.54	6.55	6.73	6.61	6.70	6.85	6.84	6.81	6.83	6.85	6.91	7.20	7.10	7.22
70	4.62	4.97	4.60	4.66	5.05	4.69	4.72	5.13	4.72	4.74	5.00	4.69	4.66	4.86	4.54	4.50	4.84	4.40	4.44
75	3.22	3.28	3.24	3.27	3.30	3.26	3.28	3.33	3.25	3.25	3.29	3.18	3.15	3.17	3.08	3.05	3.08	2.98	3.00
80	2.12	2.15	2.14	2.14	2.16	2.13	2.14	2.18	2.13	2.12	2.13	2.07	2.04	2.04	2.01	2.00	2.03	1.95	1.97
85	1.19	1.29	1.21	1.20	1.31	1.21	1.21	1.33	1.21	1.18	1.27	1.16	1.13	1.23	1.13	1.11	1.18	1.10	1.11
90	0.56	0.66	0.56	0.57	0.67	0.56	0.58	0.70	0.56	0.56	0.69	0.55	0.56	0.65	0.55	0.56	0.62	0.55	0.56
95	0.47	0.50	0.47	0.48	0.52	0.48	0.48	0.52	0.48	0.48	0.51	0.47	0.46	0.51	0.48	0.47	0.51	0.48	0.48
100	0.57	0.50	0.56	0.63	0.51	0.54	0.62	0.55	0.60	0.67	0.58	0.71	0.63	0.56	0.83	0.61	0.68	0.75	0.70
105	0.49	0.67	0.51	0.53	0.79	0.51	0.55	0.82	0.53	0.56	0.87	0.58	0.52	0.86	0.60	0.54	0.86	0.59	0.56
110	0.72	0.53	0.75	0.79	0.55	0.76	0.81	0.58	0.77	0.74	0.57	0.75	0.69	0.57	0.72	0.74	0.62	0.74	0.70
115	0.41	0.43	0.41	0.41	0.42	0.40	0.42	0.44	0.41	0.41	0.42	0.40	0.39	0.41	0.41	0.43	0.44	0.41	0.41
120	0.80	0.96	0.87	1.10	1.26	0.70	1.25	1.66	0.82	1.28	1.66	0.86	1.21	1.77	0.96	1.03	1.63	0.96	1.20
125	0.36	0.39	0.35	0.36	0.38	0.35	0.39	0.42	0.39	0.38	0.42	0.38	0.37	0.41	0.37	0.41	0.45	0.40	0.38
130	0.31	0.30	0.28	0.29	0.32	0.29	0.30	0.33	0.31	0.30	0.31	0.31	0.30	0.30	0.29	0.32	0.34	0.32	0.29
135	0.22	0.22	0.22	0.22	0.22	0.23	0.23	0.24	0.24	0.23	0.23	0.23	0.22	0.23	0.22	0.24	0.25	0.24	0.22
140	0.16	0.16	0.16	0.16	0.16	0.17	0.17	0.18	0.18	0.18	0.18	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
145	0.16	0.15	0.16	0.16	0.16	0.17	0.17	0.17	0.18	0.18	0.17	0.17	0.18	0.18	0.19	0.19	0.19	0.19	0.20
150	0.22	0.23	0.23	0.23	0.23	0.24	0.24	0.24	0.24	0.24	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.27
155	0.28	0.28	0.28	0.29	0.29	0.29	0.30	0.30	0.30	0.30	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.34
160	0.33	0.33	0.34	0.34	0.35	0.35	0.35	0.35	0.36	0.36	0.36	0.36	0.37	0.37	0.37	0.37	0.36	0.36	0.39
165	0.39	0.39	0.40	0.41	0.41	0.41	0.42	0.42	0.42	0.42	0.42	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43
170	0.45	0.45	0.46	0.46	0.46	0.46	0.46	0.47	0.47	0.47	0.47	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.43
175	0.46	0.46	0.46	0.46	0.46	0.45	0.45	0.45	0.45	0.45	0.44	0.44	0.44	0.44	0.43	0.43	0.43	0.43	0.41
180	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	0.29	0.29	0.29	0.29	0.29	0.29

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	8310	8310	8310	8310	8310	8310	8310	8310	8310	8310	8310	8310	8310	8310	8310	8310	8310		
5	4068	4043	4044	4060	4068	4088	4117	4155	4202	4227	4275	4331	4377	4435	4475	4510	4517		
10	1206	1212	1230	1257	1279	1286	1333	1333	1385	1384	1435	1453	1502	1505	1555	1561	1572		
15	392	392	398	405	413	424	435	444	455	467	479	487	497	505	517	530	538		
20	209	208	208	213	217	218	222	226	230	236	241	244	250	254	261	271	278		
25	123	122	124	126	130	135	136	137	139	142	145	148	150	153	157	164	169		
30	65.3	66.2	65.7	67.7	71.2	73.3	73.7	75.5	77.2	78.3	79.2	80.5	81.6	83.9	85.3	88.3	93.5		
35	31.0	31.2	32.5	32.4	33.5	35.2	36.1	36.1	36.4	37.4	37.8	37.8	38.8	39.4	41.3	42.7	44.7		
40	17.8	18.3	18.6	18.9	18.7	19.3	19.3	19.6	19.6	19.3	19.5	19.4	19.7	20.2	20.7	21.8	22.2		
45	13.0	13.1	13.1	13.4	13.5	14.0	13.9	13.8	13.7	13.5	13.6	13.6	13.6	13.7	13.8	14.2	14.0		
50	10.5	10.4	10.4	10.5	10.7	11.1	11.1	11.1	11.1	11.1	11.3	11.4	11.3	11.0	10.5	10.7	10.8		
55	8.58	8.45	8.45	8.76	9.06	9.32	9.21	9.30	9.20	9.15	9.30	9.28	9.07	8.79	8.41	8.27	8.07		
60	8.52	8.41	8.40	8.64	8.85	9.10	9.19	9.10	8.69	8.17	8.05	8.24	8.25	8.14	7.92	7.76	7.58		
65	7.28	7.27	7.25	7.32	7.28	7.44	7.50	7.35	7.17	6.89	6.77	7.00	7.15	7.19	7.04	7.02	6.80		
70	4.75	4.47	4.50	4.77	4.47	4.54	4.86	4.57	4.59	4.83	4.56	4.60	4.94	4.66	4.60	5.06	4.61		
75	3.04	3.01	3.03	3.08	3.03	3.06	3.15	3.07	3.10	3.13	3.09	3.12	3.22	3.17	3.17	3.29	3.22		
80	1.97	1.96	1.96	2.00	1.96	1.98	2.04	1.99	2.00	2.05	2.01	2.05	2.13	2.09	2.11	2.19	2.13		
85	1.15	1.09	1.09	1.15	1.09	1.09	1.20	1.10	1.11	1.19	1.13	1.16	1.27	1.20	1.20	1.31	1.23		
90	0.64	0.55	0.54	0.63	0.54	0.54	0.62	0.54	0.53	0.60	0.54	0.55	0.66	0.56	0.56	0.69	0.57		
95	0.50	0.46	0.46	0.49	0.45	0.45	0.49	0.44	0.45	0.47	0.44	0.45	0.49	0.46	0.46	0.49	0.47		
100	0.64	0.66	0.63	0.61	0.64	0.53	0.59	0.56	0.56	0.51	0.57	0.50	0.50	0.58	0.69	0.49	0.50		
105	0.80	0.53	0.54	0.80	0.52	0.51	0.76	0.50	0.49	0.78	0.47	0.46	0.78	0.48	0.51	0.77	0.48		
110	0.60	0.65	0.66	0.61	0.70	0.66	0.66	0.76	0.57	0.58	0.67	0.59	0.57	0.74	0.74	0.55	0.73		
115	0.42	0.40	0.39	0.40	0.39	0.39	0.39	0.38	0.38	0.39	0.38	0.39	0.40	0.40	0.41	0.41	0.40		
120	1.69	1.01	1.03	1.89	1.12	0.92	1.86	1.28	0.65	1.22	1.12	0.66	1.36	1.02	0.84	1.19	0.79		
125	0.40	0.36	0.36	0.38	0.35	0.37	0.39	0.35	0.35	0.40	0.36	0.34	0.39	0.35	0.36	0.40	0.37		
130	0.30	0.28	0.29	0.29	0.27	0.29	0.30	0.28	0.28	0.29	0.27	0.27	0.29	0.28	0.28	0.30	0.29		
135	0.23	0.22	0.22	0.22	0.21	0.21	0.23	0.21	0.20	0.22	0.20	0.20	0.21	0.21	0.22	0.22	0.22		
140	0.17	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.15	0.14	0.14	0.15	0.15	0.15	0.15	0.16		
145	0.18	0.19	0.19	0.18	0.19	0.19	0.18	0.18	0.17	0.16	0.17	0.16	0.16	0.16	0.16	0.16	0.16		
150	0.27	0.27	0.27	0.26	0.26	0.26	0.26	0.25	0.25	0.25	0.25	0.24	0.24	0.24	0.24	0.24	0.24		
155	0.34	0.34	0.34	0.33	0.33	0.33	0.33	0.33	0.32	0.32	0.32	0.32	0.31	0.31	0.31	0.31	0.30		
160	0.39	0.39	0.38	0.38	0.38	0.38	0.37	0.37	0.37	0.37	0.37	0.36	0.36	0.35	0.34	0.34	0.35		
165	0.42	0.42	0.41	0.41	0.41	0.41	0.40	0.40	0.40	0.40	0.40	0.40	0.39	0.39	0.38	0.37	0.37		
170	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.39	0.40	0.40	0.40	0.39	0.40	0.42		
175	0.34	0.34	0.35	0.35	0.35	0.35	0.36	0.36	0.36	0.37	0.38	0.42	0.41	0.39	0.38	0.44	0.46		
180	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	0.29	0.29	0.29	0.29		

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 \*\*\*

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