

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: 5GU10DIM/930NF25

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

Report No.: HZ20060049n

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

Review by:



Engineer: April Zou

Oct. 21, 2020

Approved by:



Manager: Jim Zhang

Oct. 21, 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: **5GU10DIM/930NF25**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
86.7	421.6	4.86	0.9239
CCT (K)	CRI	Stabilization Time (Light & Power)	
3045	97.3	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	: Jun. 25, 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

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)

Name	: LED Lamp
Model	: 5GU10DIM/930NF25
Electrical Ratings	: 120Vac, 60Hz, 5W
Product Description	: 3000K
Manufacturer	: GREEN CREATIVE LTD
Address	: 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)	120.0
Voltage frequency (Hz)	60
Test Current (A)	0.044
Power Factor	0.9239
Test Power (W)	4.86
THD A%	22.33
Luminous Efficacy (lm/W)	86.7
Total Luminous Flux (lm)	421.6
Color Rendering Index (CRI)	97.3
R9	86.2
Correlated Color Temperature (CCT)(K)	3045
Chromaticity Chroma x	0.4351
Chromaticity Chroma y	0.4061
Chromaticity Chroma u	0.2485
Chromaticity Chroma v	0.3479
Duv	0.0011
Chromaticity Chroma u'	0.2485
Chromaticity Chroma v'	0.5219

Special Color Rendering Indices	
R1	98.4
R2	98.4
R3	96.2
R4	98.3
R5	97.2
R6	97.4
R7	97.7
R8	94.4
R9	86.2
R10	94.4
R11	98.6
R12	82.8
R13	98.5
R14	96.9

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)	0.044
Power Factor	0.9197
Power (W)	4.85
Luminous Efficacy (lm/W)	89.5
Total Luminous Flux (lm)	433.9
Beam Angle (°)	21.4 (0°-180°) / 20.5 (90°-270°)
Center Beam Candle Power (cd)	2552
Maximum Beam Candle Power (cd)	2552 (At: C=100.0, Gamma=0.5)
Spacing Criteria	0.35 (0°-180°) / 0.35 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	98.04%
Zonal Lumens in the 60 °-90 °Zone	1.57%
Zonal Lumens in the 90 °-120 °Zone	0.22%
Zonal Lumens in the 120 °-180 °Zone	0.17%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

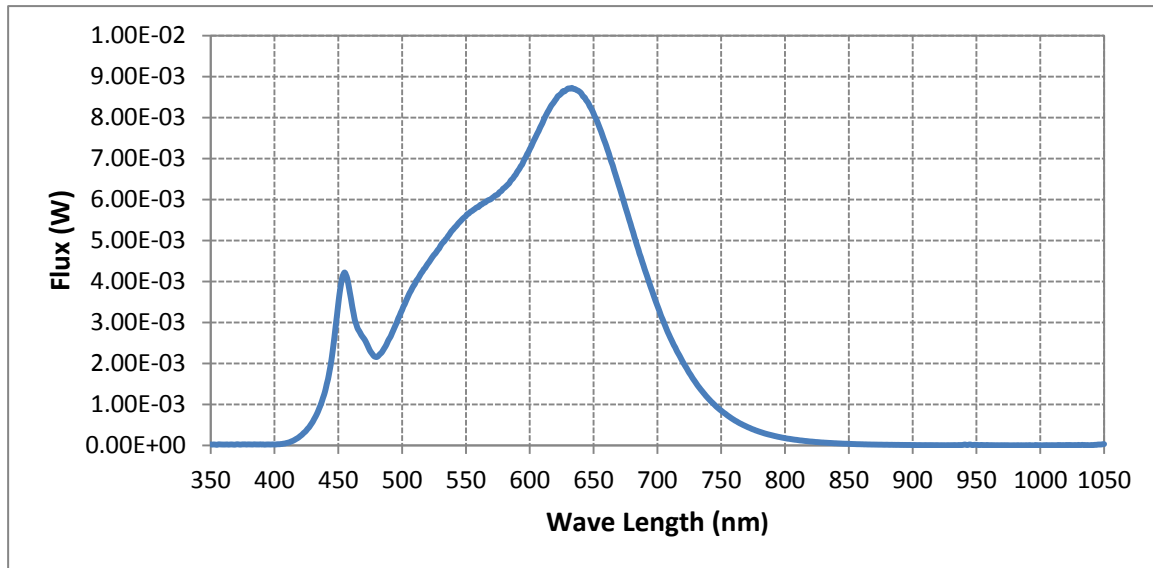
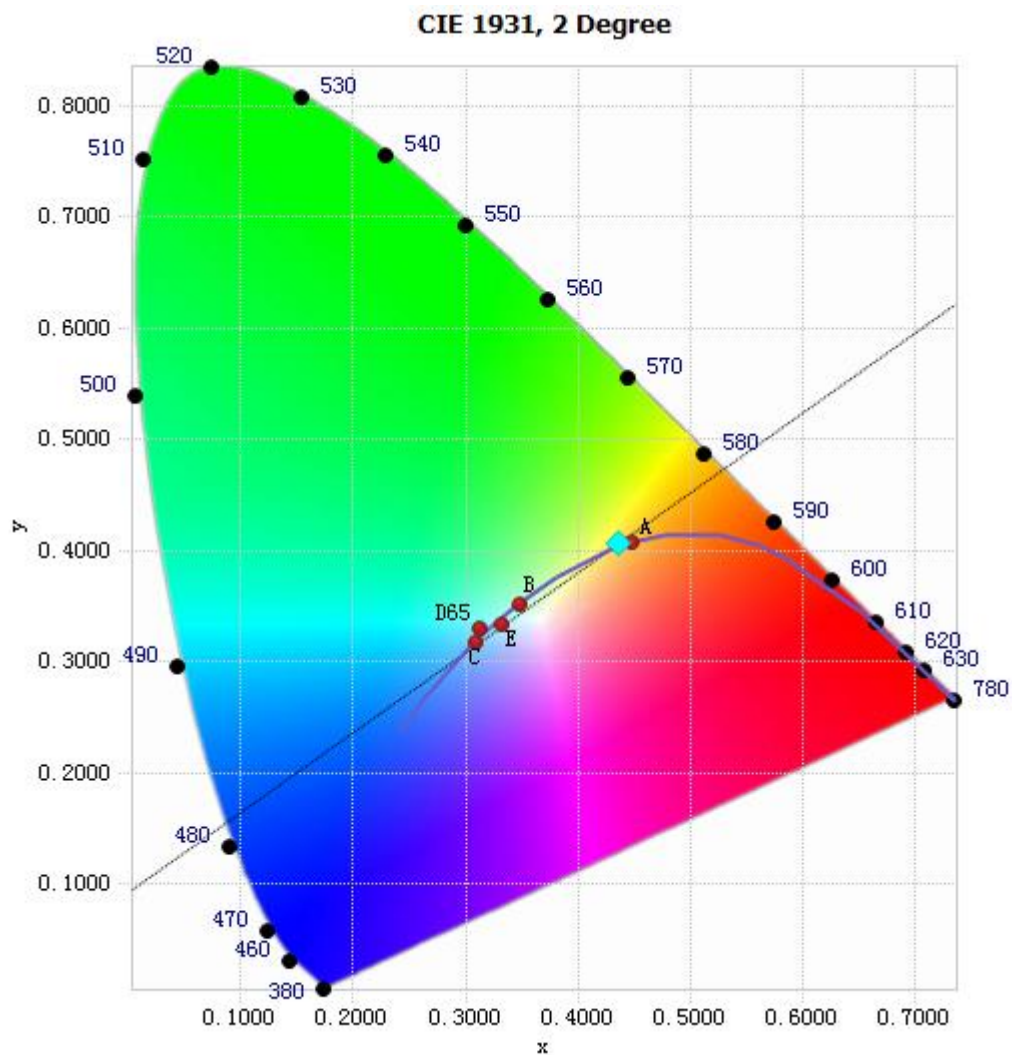


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.66E-05	485	2.32E-03	590	6.67E-03	695	3.85E-03
385	2.60E-05	490	2.61E-03	595	6.93E-03	700	3.41E-03
390	2.36E-05	495	2.94E-03	600	7.23E-03	705	3.01E-03
395	2.51E-05	500	3.31E-03	605	7.55E-03	710	2.64E-03
400	2.35E-05	505	3.66E-03	610	7.87E-03	715	2.32E-03
405	3.50E-05	510	3.94E-03	615	8.19E-03	720	2.03E-03
410	6.36E-05	515	4.21E-03	620	8.43E-03	725	1.77E-03
415	1.24E-04	520	4.43E-03	625	8.60E-03	730	1.54E-03
420	2.25E-04	525	4.65E-03	630	8.71E-03	735	1.33E-03
425	3.69E-04	530	4.87E-03	635	8.70E-03	740	1.14E-03
430	5.79E-04	535	5.06E-03	640	8.61E-03	745	9.86E-04
435	9.01E-04	540	5.27E-03	645	8.40E-03	750	8.50E-04
440	1.37E-03	545	5.45E-03	650	8.10E-03	755	7.30E-04
445	2.17E-03	550	5.60E-03	655	7.73E-03	760	6.25E-04
450	3.46E-03	555	5.73E-03	660	7.31E-03	765	5.35E-04
455	4.22E-03	560	5.82E-03	665	6.84E-03	770	4.60E-04
460	3.56E-03	565	5.93E-03	670	6.33E-03	775	3.93E-04
465	2.87E-03	570	6.02E-03	675	5.81E-03	780	3.35E-04
470	2.61E-03	575	6.13E-03	680	5.30E-03		
475	2.30E-03	580	6.28E-03	685	4.79E-03		
480	2.16E-03	585	6.46E-03	690	4.30E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4351, 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

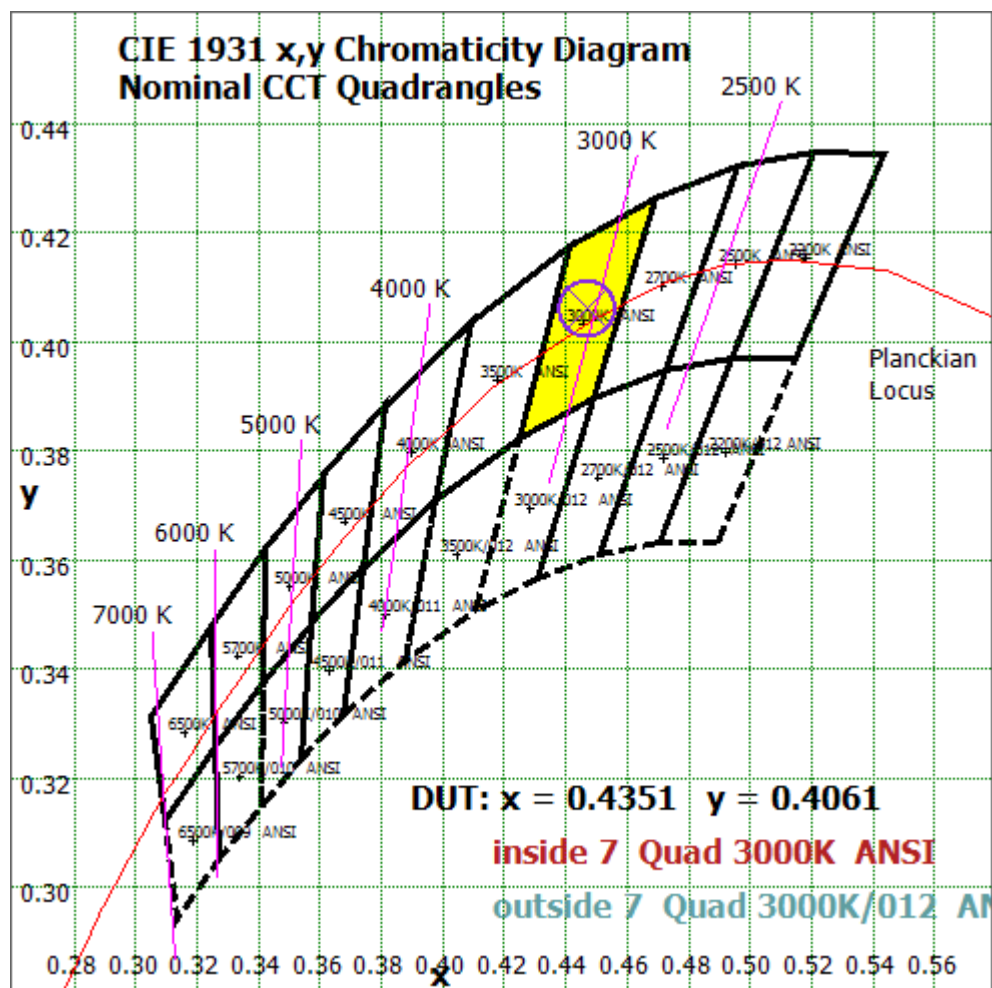


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method

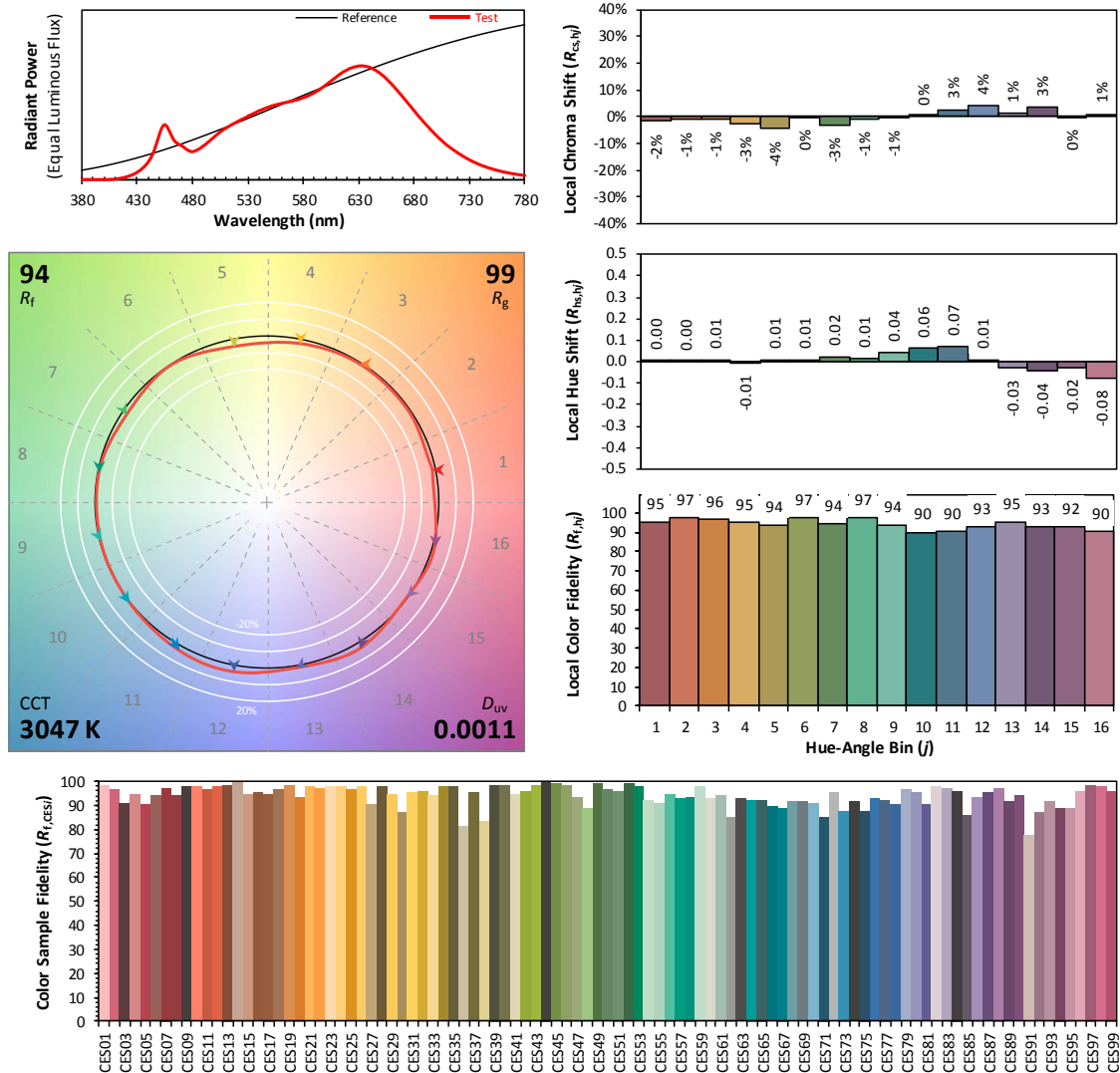
ANSI/IES TM-30-18 Color Rendition Report

Source: LED

Manufacturer: GREEN CREATIVE LTD

Date: 2020/06/25

Model: 5GU10DIM/930NF25



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

x 0.4351
 y 0.4061
 u' 0.2485
 v' 0.5219

CIE 13.3-1995
(CRI)

R_a 97
 R_g 87

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	178.872	41.23%
10- 20	157.719	36.35%
20- 30	53.086	12.24%
30- 40	20.189	4.65%
40- 50	9.972	2.30%
50- 60	5.557	1.28%
60- 70	3.709	0.85%
70- 80	2.247	0.52%
80- 90	0.854	0.20%
90-100	0.292	0.07%
100-110	0.292	0.07%
110-120	0.355	0.08%
120-130	0.411	0.09%
130-140	0.056	0.01%
140-150	0.075	0.02%
150-160	0.093	0.02%
160-170	0.078	0.02%
170-180	0.027	0.01%
Total	433.9	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	425.395	98.04%
60- 90	6.81	1.57%
0-90	432.205	99.61%
90- 180	1.679	0.39%
0- 180	433.9	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

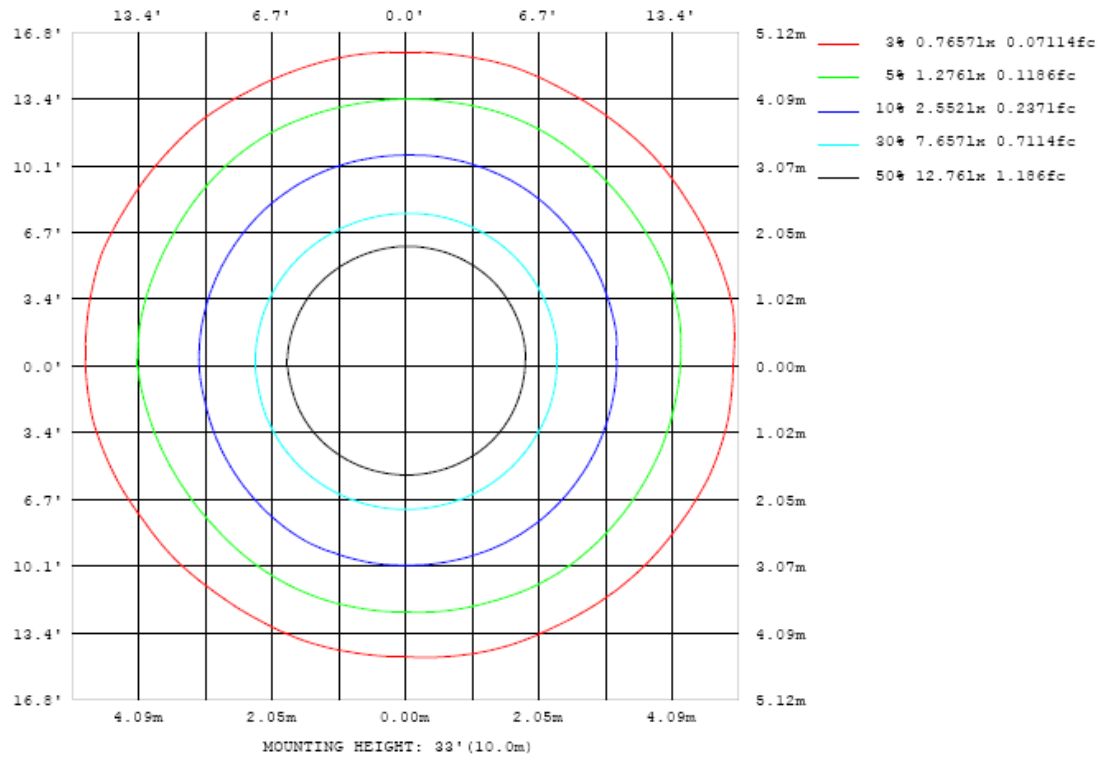


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

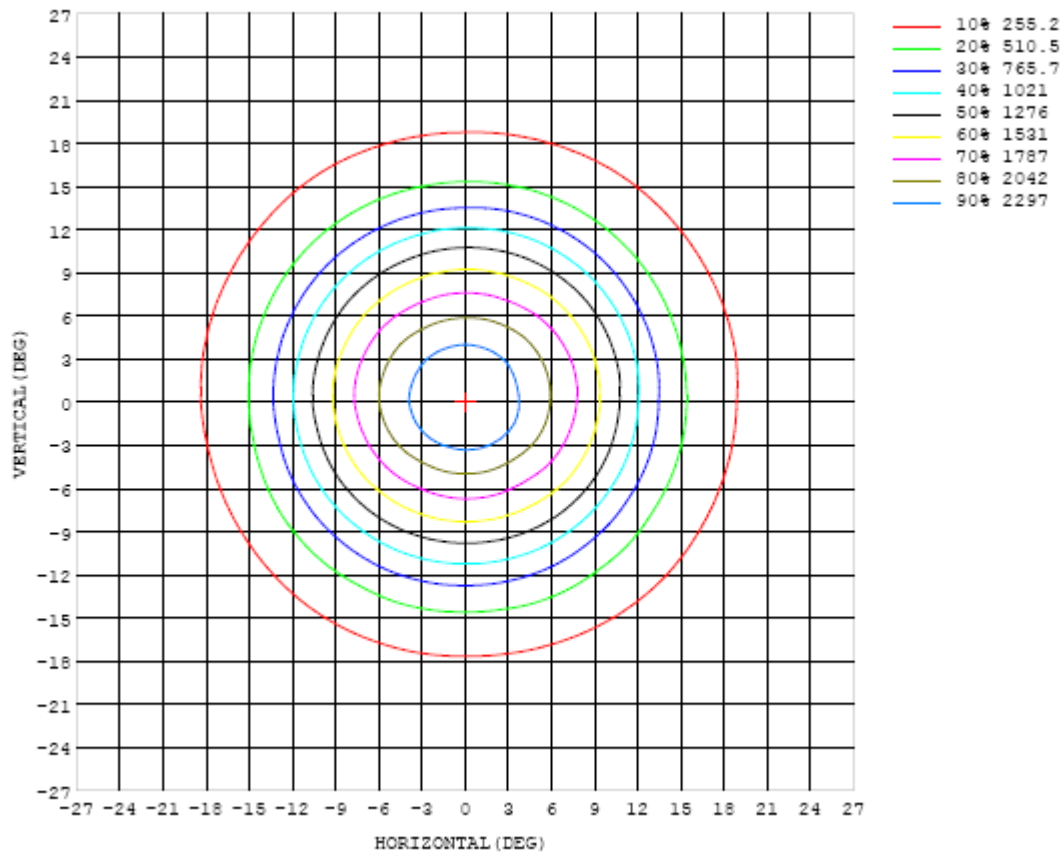


Chart 6: Isocandela Plot

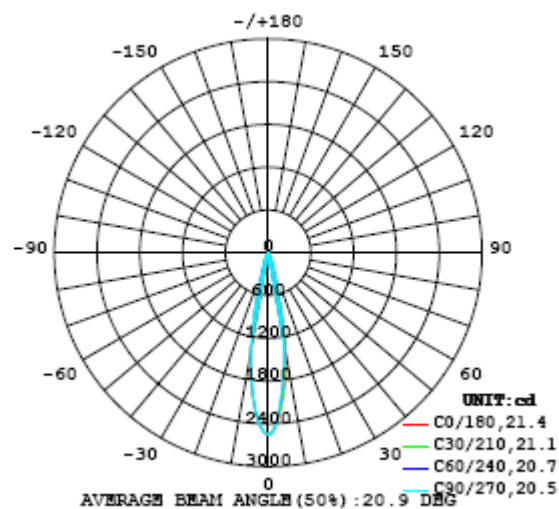


Chart 7: Polar Candela Distribution

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	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552
5	2152	2146	2135	2119	2093	2071	2057	2048	2041	2037	2039	2045	2052	2072	2098	2119	2136	2151	2167
10	1419	1396	1376	1355	1329	1303	1279	1258	1245	1239	1240	1249	1264	1283	1304	1326	1346	1364	1398
15	562	552	538	516	510	492	487	478	459	456	461	469	473	487	494	505	505	505	518
20	220	215	209	204	200	195	187	179	175	171	172	174	175	176	178	183	190	196	204
25	130	128	123	117	111	105	98.7	96.1	92.6	88.4	88.8	90.6	90.9	94.1	99.9	104	111	117	121
30	71.8	71.8	70.3	65.3	60.8	55.6	50.4	48.6	46.7	44.2	44.6	45.4	45.8	48.7	52.7	53.7	58.5	62.9	64.1
35	35.6	35.5	35.0	32.3	30.5	27.8	25.9	24.5	24.4	24.4	24.6	25.0	25.4	25.7	26.1	26.7	28.0	29.0	30.4
40	19.7	19.7	19.7	19.4	18.1	17.3	17.3	17.7	18.0	18.5	18.5	19.0	19.1	18.9	18.4	17.8	16.9	16.3	17.0
45	12.8	13.0	13.3	13.7	13.7	13.5	13.4	13.1	12.6	12.6	12.4	12.5	12.6	12.7	13.0	13.1	12.9	12.7	12.6
50	8.59	8.76	8.73	8.61	8.49	8.39	8.63	8.82	8.91	8.88	8.94	9.01	9.01	8.75	8.57	8.41	8.23	8.11	8.01
55	6.04	6.25	6.32	6.39	6.42	6.32	6.35	6.32	6.20	6.17	6.27	6.32	6.25	6.22	6.22	6.26	6.16	6.15	6.28
60	4.81	4.82	4.72	4.69	4.62	4.56	4.54	4.44	4.34	4.30	4.27	4.26	4.29	4.30	4.35	4.38	4.40	4.42	4.53
65	3.94	3.91	3.87	3.86	3.75	3.71	3.65	3.55	3.52	3.51	3.45	3.46	3.48	3.50	3.53	3.57	3.61	3.64	3.74
70	3.19	2.99	2.97	3.07	2.86	2.86	2.93	2.72	2.77	2.84	2.67	2.72	2.79	2.69	2.78	2.84	2.81	2.91	2.98
75	2.22	2.15	2.15	2.18	2.06	2.06	2.10	1.97	2.00	2.01	1.95	1.97	2.02	1.96	2.00	2.04	2.03	2.06	2.14
80	1.40	1.37	1.37	1.37	1.32	1.31	1.31	1.27	1.28	1.29	1.26	1.28	1.28	1.27	1.30	1.30	1.30	1.34	1.38
85	0.84	0.73	0.76	0.82	0.71	0.74	0.78	0.68	0.72	0.74	0.69	0.72	0.73	0.67	0.72	0.72	0.69	0.76	0.77
90	0.39	0.34	0.36	0.38	0.33	0.33	0.35	0.34	0.33	0.34	0.34	0.34	0.34	0.32	0.34	0.33	0.32	0.34	0.35
95	0.28	0.22	0.24	0.26	0.22	0.24	0.25	0.22	0.25	0.25	0.22	0.26	0.25	0.21	0.24	0.26	0.21	0.26	0.26
100	0.27	0.17	0.29	0.25	0.16	0.23	0.28	0.17	0.23	0.25	0.16	0.22	0.23	0.15	0.29	0.30	0.16	0.36	0.35
105	0.45	0.20	0.35	0.36	0.18	0.31	0.39	0.19	0.25	0.32	0.18	0.29	0.29	0.18	0.36	0.38	0.19	0.34	0.42
110	0.31	0.18	0.26	0.27	0.18	0.23	0.30	0.17	0.24	0.26	0.17	0.26	0.28	0.17	0.31	0.26	0.18	0.34	0.38
115	0.13	0.13	0.13	0.14	0.12	0.13	0.13	0.13	0.16	0.14	0.13	0.13	0.13	0.12	0.15	0.13	0.13	0.15	0.14
120	3.57	0.10	3.29	4.39	0.31	3.57	4.09	0.33	3.41	2.50	0.12	3.66	2.91	0.14	3.36	3.34	0.13	3.89	3.25
125	0.22	0.09	0.16	0.24	0.08	0.24	0.28	0.10	0.24	0.23	0.08	0.38	0.24	0.07	0.23	0.22	0.09	0.18	0.24
130	0.08	0.07	0.08	0.09	0.07	0.08	0.09	0.07	0.08	0.09	0.07	0.10	0.09	0.06	0.08	0.09	0.07	0.08	0.08
135	0.07	0.06	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.06	0.07	0.07	0.07	0.07	0.07	0.06	0.07	0.06
140	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	0.09
145	0.12	0.12	0.12	0.12	0.13	0.13	0.12	0.13	0.13	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
150	0.16	0.16	0.16	0.16	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
155	0.20	0.20	0.20	0.20	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.20	0.21
160	0.25	0.25	0.25	0.25	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.25	0.25	0.25
165	0.29	0.29	0.29	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.28
170	0.31	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.31	0.31	0.31	0.31	0.29
175	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.29	0.29	0.29	0.29	0.29	0.28	0.28	0.28	0.27	0.27	0.24
180	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21

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	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552	2552		
5	2172	2173	2179	2180	2175	2168	2167	2166	2167	2168	2172	2176	2178	2179	2173	2165	2159		
10	1407	1406	1406	1411	1403	1401	1401	1407	1412	1413	1420	1430	1440	1444	1443	1446	1435		
15	528	536	542	546	548	546	546	545	552	556	565	568	572	573	571	566	560		
20	206	207	206	209	213	213	211	209	210	213	217	220	223	223	223	226	225		
25	124	124	121	120	121	117	116	115	114	116	119	120	123	125	129	133	135		
30	66.7	69.7	67.4	66.4	64.8	61.2	60.5	60.7	58.9	59.8	61.8	62.2	65.3	69.1	70.5	74.6	75.1		
35	32.5	33.7	33.0	32.7	31.7	30.2	29.2	28.8	28.0	28.6	29.3	30.1	31.6	32.9	33.5	36.0	36.2		
40	17.5	18.5	19.0	19.0	18.3	17.7	17.2	17.0	16.9	17.2	17.3	17.6	17.8	18.4	18.8	19.6	19.6		
45	12.7	13.0	13.4	13.5	13.3	13.0	12.8	12.6	12.6	12.8	12.9	12.9	12.7	12.5	12.6	12.9	12.8		
50	8.06	8.22	8.28	8.26	8.21	8.06	7.90	7.83	7.87	7.86	7.85	7.92	7.94	8.00	8.33	8.61	8.58		
55	6.21	6.31	6.49	6.51	6.36	6.13	5.91	5.94	5.98	5.93	5.92	5.93	6.05	6.08	6.09	6.03	5.99		
60	4.61	4.68	4.71	4.68	4.64	4.59	4.54	4.54	4.54	4.56	4.64	4.78	4.87	4.82	4.85	4.90	4.83		
65	3.77	3.82	3.83	3.82	3.83	3.80	3.75	3.78	3.78	3.82	3.87	3.87	3.91	3.98	3.99	4.02	4.00		
70	2.94	3.05	3.04	2.99	3.05	3.01	2.94	3.10	3.06	2.97	3.08	3.08	3.02	3.14	3.16	3.06	3.13		
75	2.13	2.18	2.20	2.16	2.17	2.17	2.14	2.18	2.18	2.15	2.20	2.22	2.19	2.27	2.28	2.19	2.21		
80	1.36	1.39	1.40	1.37	1.37	1.37	1.35	1.38	1.39	1.36	1.38	1.39	1.38	1.40	1.40	1.39	1.40		
85	0.72	0.80	0.79	0.72	0.79	0.79	0.72	0.80	0.81	0.72	0.78	0.80	0.73	0.79	0.81	0.74	0.80		
90	0.34	0.36	0.36	0.33	0.35	0.35	0.33	0.35	0.35	0.33	0.34	0.35	0.34	0.35	0.36	0.34	0.38		
95	0.22	0.26	0.27	0.22	0.27	0.26	0.22	0.27	0.27	0.22	0.26	0.26	0.21	0.27	0.29	0.21	0.28		
100	0.16	0.31	0.34	0.17	0.31	0.30	0.17	0.27	0.29	0.17	0.27	0.28	0.16	0.39	0.31	0.16	0.31		
105	0.19	0.32	0.33	0.19	0.31	0.31	0.19	0.30	0.33	0.19	0.32	0.35	0.19	0.39	0.40	0.19	0.38		
110	0.19	0.29	0.29	0.19	0.26	0.26	0.19	0.26	0.28	0.18	0.26	0.27	0.19	0.40	0.35	0.19	0.32		
115	0.13	0.15	0.14	0.14	0.14	0.14	0.13	0.14	0.14	0.13	0.14	0.14	0.13	0.15	0.14	0.13	0.14		
120	0.14	2.99	3.09	0.07	1.43	1.88	0.09	1.07	2.06	0.09	1.51	2.17	0.17	2.19	2.69	0.13	2.63		
125	0.09	0.15	0.16	0.08	0.14	0.15	0.09	0.15	0.17	0.10	0.14	0.19	0.09	0.15	0.19	0.09	0.15		
130	0.06	0.08	0.08	0.07	0.08	0.07	0.08	0.08	0.08	0.08	0.08	0.08	0.07	0.09	0.10	0.07	0.08		
135	0.06	0.07	0.07	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.07	0.07	0.06	0.06		
140	0.08	0.09	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.09	0.08	0.09		
145	0.12	0.12	0.12	0.12	0.12	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.12	0.12	0.12	0.12	0.12		
150	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.15	0.15	0.15	0.15	0.16	0.16	0.16	0.16	0.16	0.16		
155	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.19	0.19	0.19	0.19	0.20	0.20	0.20	0.20	0.20		
160	0.24	0.24	0.24	0.24	0.24	0.24	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23		
165	0.27	0.27	0.27	0.27	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26		
170	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.27	0.27	0.27	0.27	0.28	0.27	0.28		
175	0.23	0.24	0.24	0.24	0.24	0.25	0.25	0.25	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.27		
180	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21		

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 4π . 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° 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.