

LM-79-08 TEST REPORT

for

GREEN CREATIVE LTD

756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

LED Lamp

Model: 12PAR38DIM/830FL40/N

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ19070039n

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

Review by:



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Aug. 01, 2019

Approved by:



Manager: Jim Zhang

Aug. 01, 2019

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: 12PAR38DIM/830FL40/N

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
107.8	1267.8	11.76	0.7475
CCT (K)	CRI	Stabilization Time (Light & Power)	
3017	83.0	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	: Jul. 25, 2019
Date of Test	: Jul. 31, 2019
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	: 12PAR38DIM/830FL40/N
Electrical Ratings	: 120V, 60Hz, 12W
Product Description	: 3000K
Manufacturer	: GREEN CREATIVE LTD
Address	: 756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

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)	120.0
Voltage frequency (Hz)	60
Test Current (A)	0.131
Power Factor	0.7475
Test Power (W)	11.76
THD A%	65.89
Luminous Efficacy (lm/W)	107.8
Total Luminous Flux (lm)	1267.8
Color Rendering Index (CRI)	83.0
R9	7.0
Correlated Color Temperature (CCT)(K)	3017
Chromaticity Chroma x	0.4345
Chromaticity Chroma y	0.4014
Chromaticity Chroma u	0.2502
Chromaticity Chroma v	0.3466
Duv	-0.0008
Chromaticity Chroma u'	0.2502
Chromaticity Chroma v'	0.5200

Special Color Rendering Indices	
R1	82
R2	93.2
R3	93.7
R4	80.6
R5	82.9
R6	92.4
R7	81.3
R8	58
R9	7
R10	84.9
R11	80.7
R12	77.7
R13	84.9
R14	97.1

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 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)	120.0
Voltage frequency (Hz)	60
Test Current (A)	0.130
Power Factor	0.7513
Power (W)	11.69
Luminous Efficacy (lm/W)	109.5
Total Luminous Flux (lm)	1280.4
Beam Angle (°)	36.9 (0°-180°) / 36.5 (90°-270°)
Center Beam Candle Power (cd)	2459
Maximum Beam Candle Power (cd)	2548(At: C=240.0, Gamma=4.0)
Spacing Criteria	0.60 (0°-180°) / 0.59 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	95.50%
Zonal Lumens in the 60 °-90 °Zone	4.24%
Zonal Lumens in the 90 °-120 °Zone	0.14%
Zonal Lumens in the 120 °-180 °Zone	0.13%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

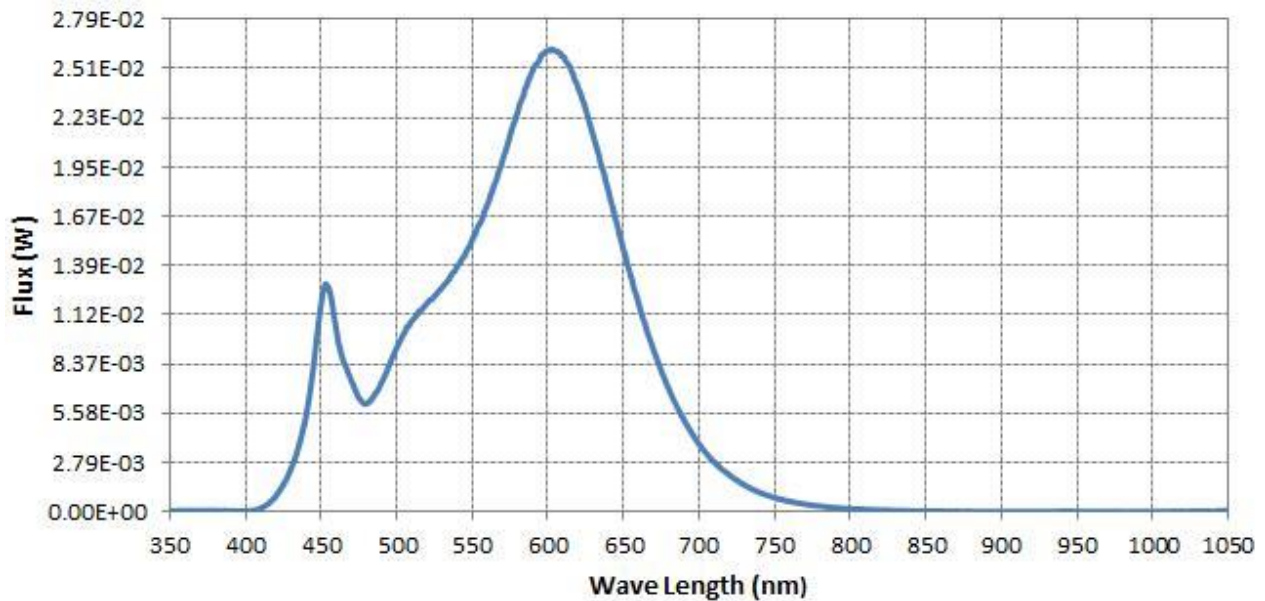


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	5.60E-05	485	6.56E-03	590	2.50E-02	695	4.47E-03
385	6.22E-05	490	7.32E-03	595	2.57E-02	700	3.83E-03
390	4.53E-05	495	8.28E-03	600	2.61E-02	705	3.29E-03
395	4.51E-05	500	9.26E-03	605	2.61E-02	710	2.81E-03
400	3.88E-05	505	1.01E-02	610	2.58E-02	715	2.41E-03
405	7.58E-05	510	1.08E-02	615	2.51E-02	720	2.08E-03
410	1.96E-04	515	1.14E-02	620	2.40E-02	725	1.78E-03
415	4.42E-04	520	1.18E-02	625	2.28E-02	730	1.51E-03
420	8.64E-04	525	1.22E-02	630	2.13E-02	735	1.29E-03
425	1.53E-03	530	1.27E-02	635	1.97E-02	740	1.09E-03
430	2.41E-03	535	1.32E-02	640	1.82E-02	745	9.43E-04
435	3.62E-03	540	1.39E-02	645	1.65E-02	750	8.04E-04
440	5.38E-03	545	1.45E-02	650	1.48E-02	755	6.90E-04
445	8.16E-03	550	1.54E-02	655	1.33E-02	760	5.85E-04
450	1.17E-02	555	1.63E-02	660	1.18E-02	765	5.10E-04
455	1.27E-02	560	1.74E-02	665	1.04E-02	770	4.32E-04
460	1.04E-02	565	1.86E-02	670	9.13E-03	775	3.68E-04
465	8.49E-03	570	1.99E-02	675	7.97E-03	780	3.19E-04
470	7.44E-03	575	2.13E-02	680	6.96E-03		
475	6.44E-03	580	2.26E-02	685	6.02E-03		
480	6.11E-03	585	2.40E-02	690	5.19E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method

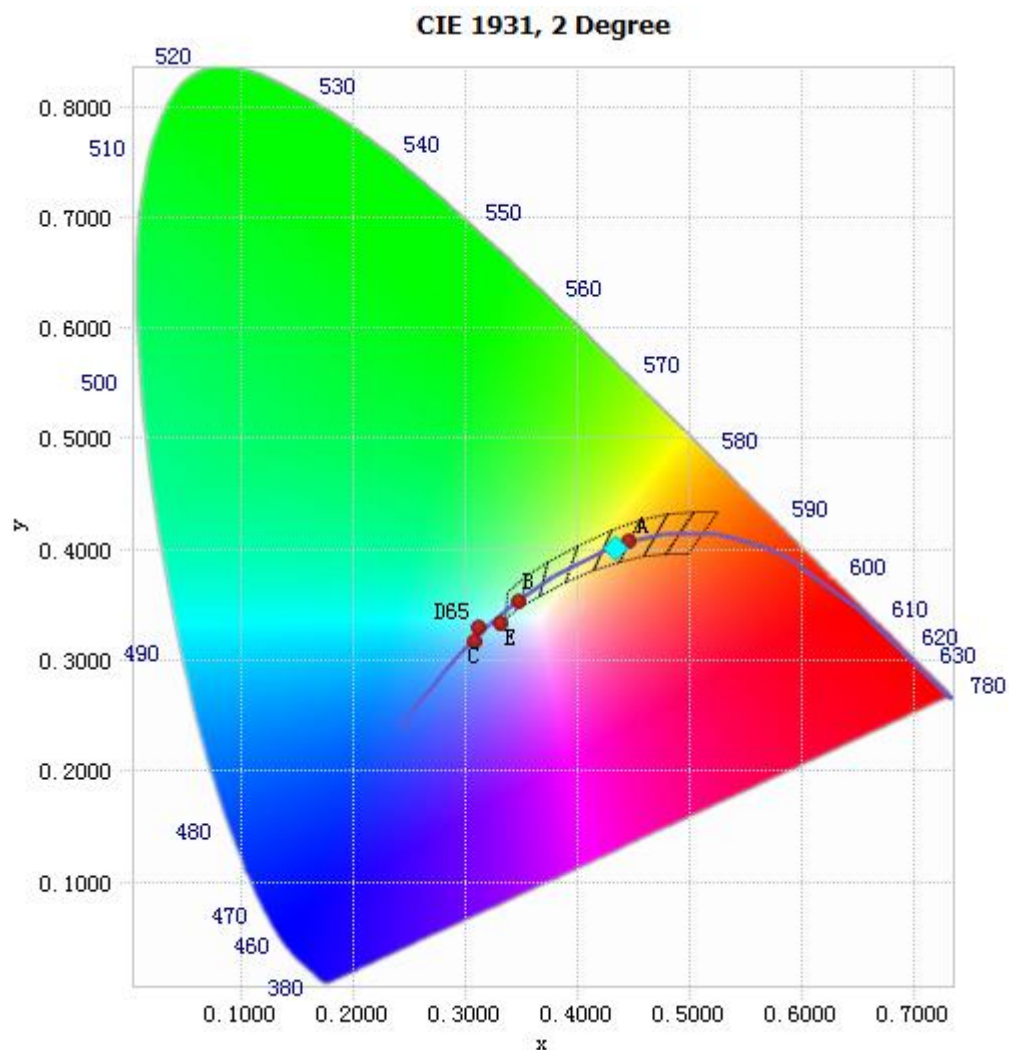


Chart 2: Chromaticity Diagram per Sphere - Spectroradiometer Method

Note: The location on the diagram of the tristimulus coordinates are indicated by the blue diamond.

Nominal CCT Quadrangles – Sphere Spectroradiometer Method

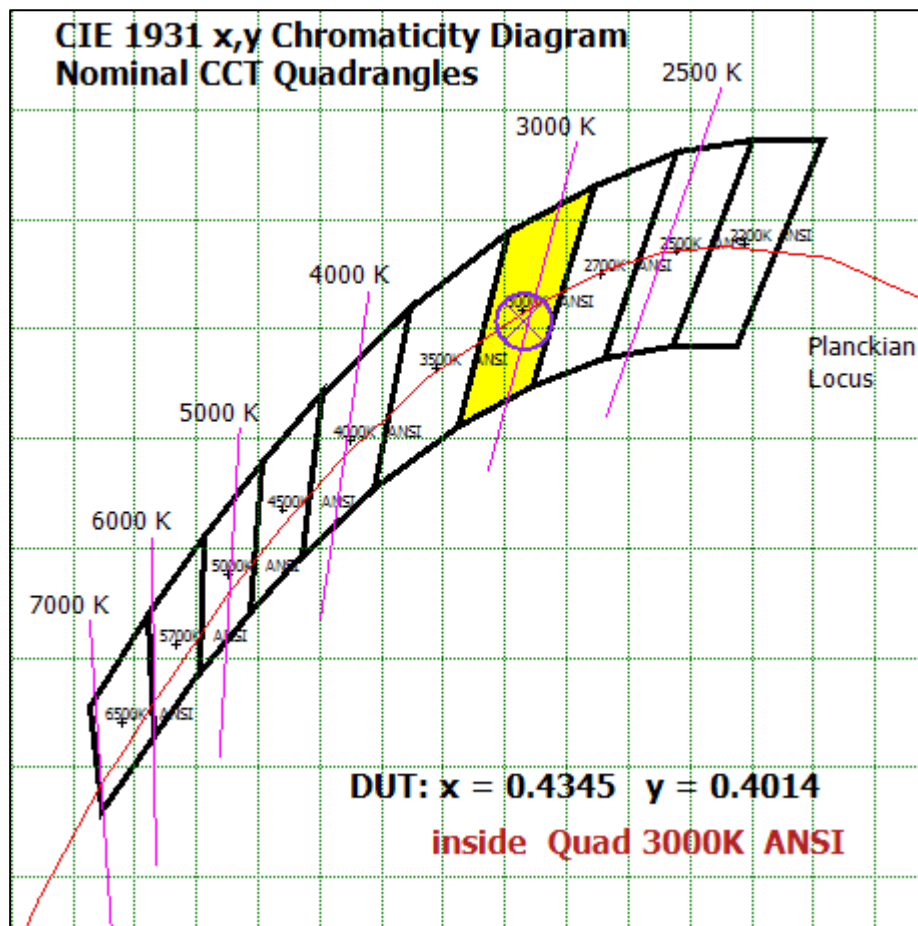
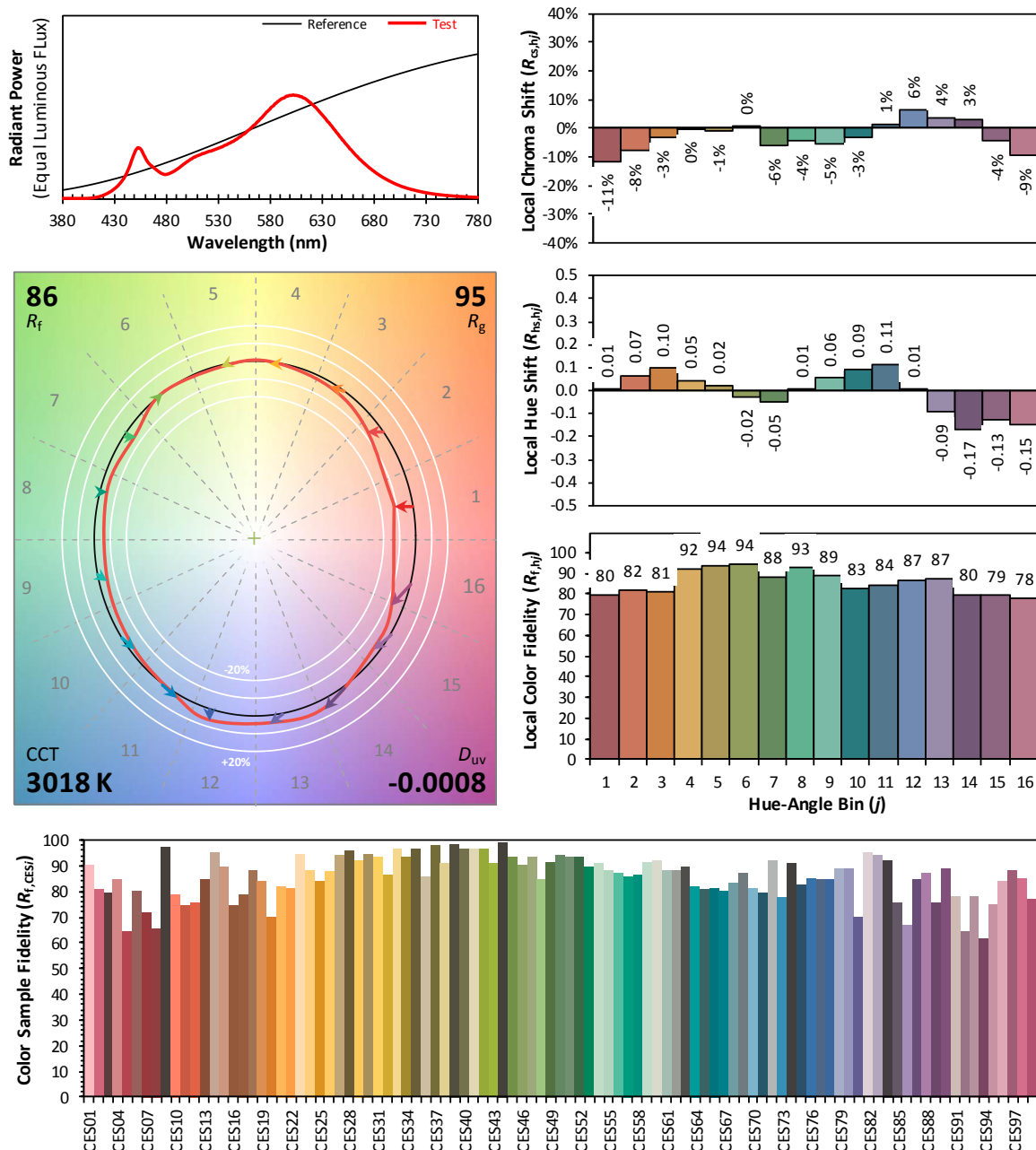


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method



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

x 0.4345
 y 0.4014
 u' 0.2502
 v' 0.5199

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	224.668	17.55%
10- 20	455.075	35.54%
20- 30	301.889	23.58%
30- 40	147.61	11.53%
40- 50	54.092	4.22%
50- 60	39.432	3.08%
60- 70	29.505	2.30%
70- 80	17.495	1.37%
80- 90	7.238	0.57%
90-100	1.608	0.13%
100-110	0.116	0.01%
110-120	0.033	0.00%
120-130	0.077	0.01%
130-140	0.216	0.02%
140-150	0.399	0.03%
150-160	0.471	0.04%
160-170	0.363	0.03%
170-180	0.121	0.01%
Total	1280.4	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	1222.766	95.50%
60- 90	54.238	4.24%
0-90	1277.004	99.73%
90- 180	3.404	0.27%
0- 180	1280.4	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

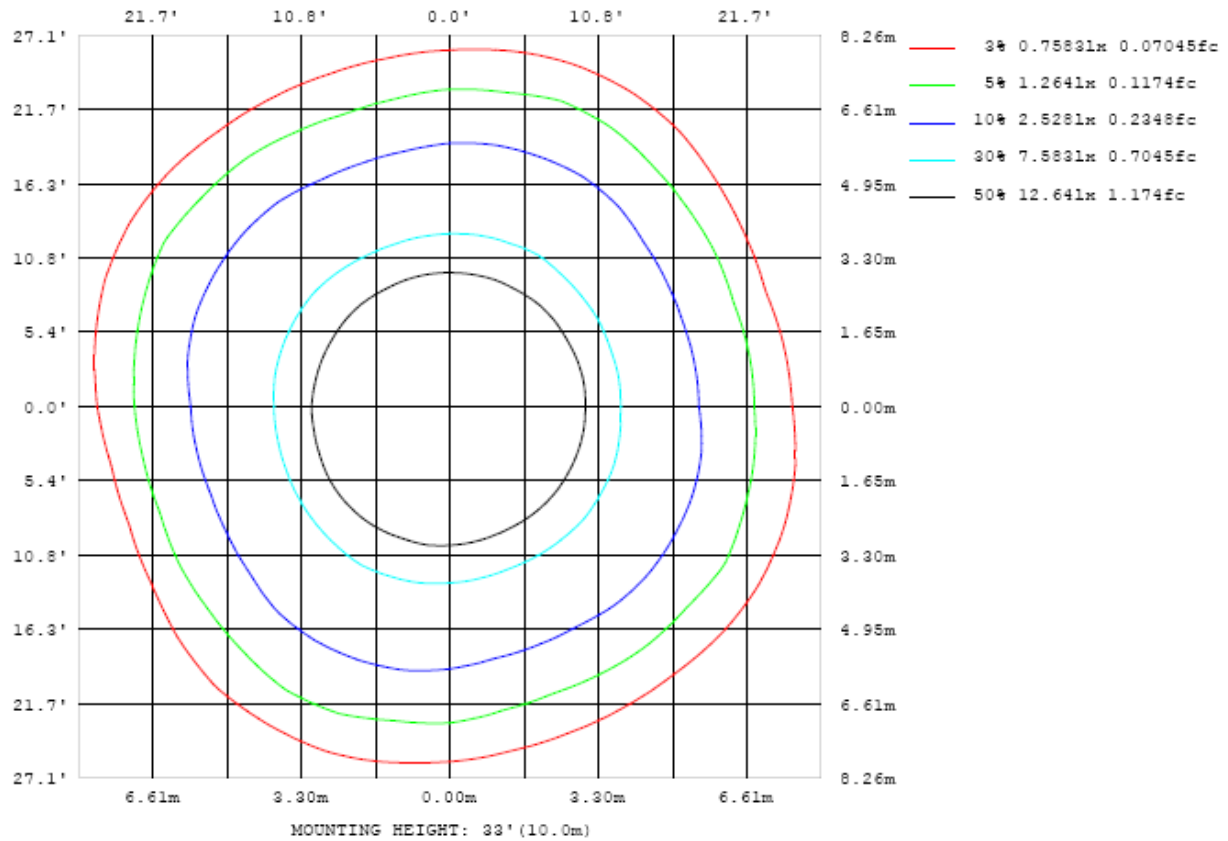


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

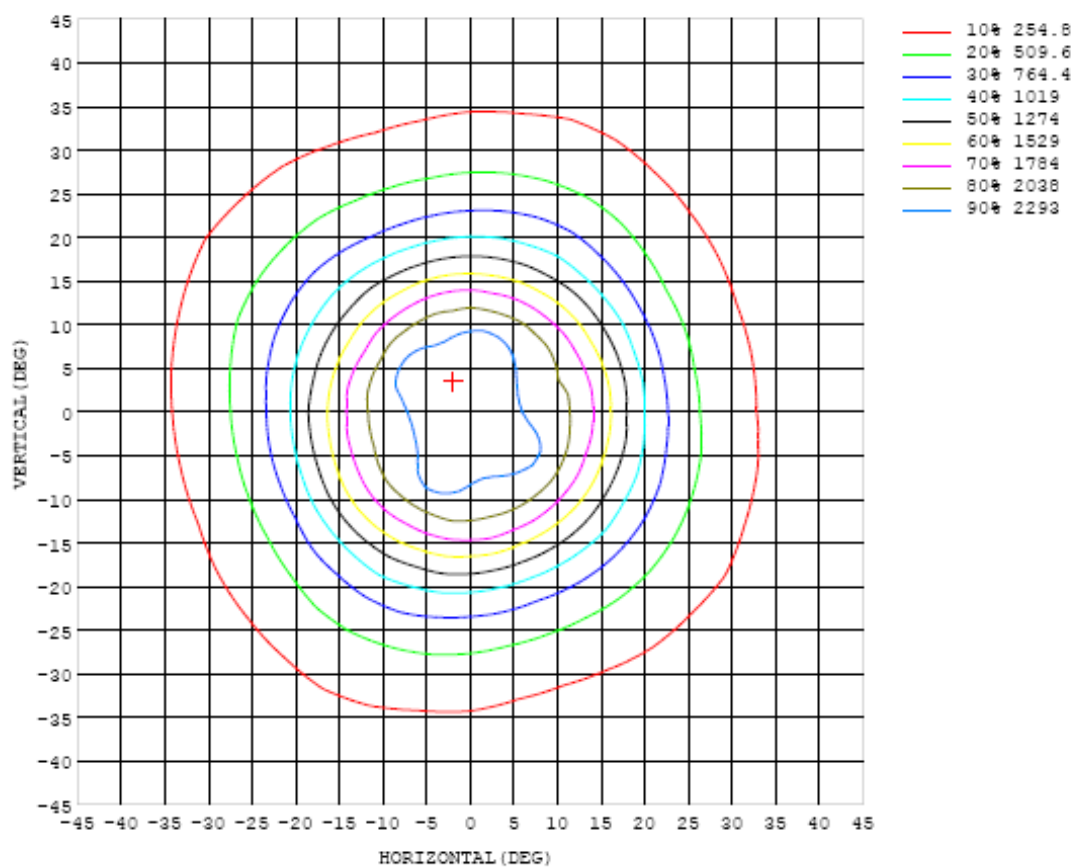


Chart 6: Isocandela Plot

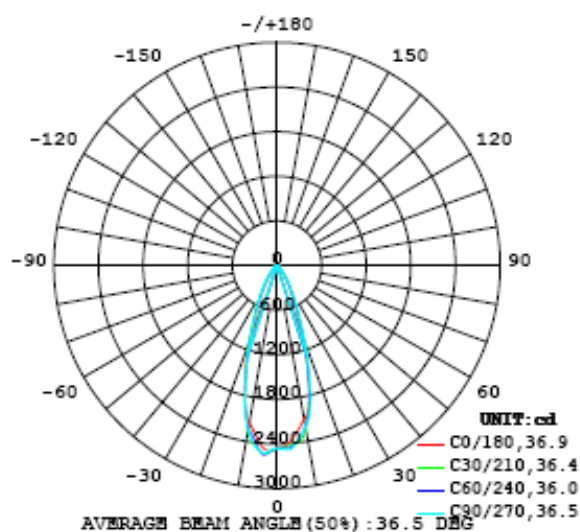


Chart 7: Polar Candela Distribution

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	2459	2459	2459	2459	2459	2459	2459	2459	2459	2459	2459	2459	2459	2459	2459	2459	2459	2459	2459
5	2342	2357	2382	2408	2423	2426	2440	2444	2452	2457	2457	2460	2451	2436	2421	2406	2405	2415	2431
10	2103	2144	2193	2227	2252	2217	2199	2183	2171	2209	2249	2285	2301	2253	2199	2155	2121	2125	2138
15	1674	1671	1665	1683	1687	1687	1689	1693	1733	1738	1755	1754	1752	1766	1759	1737	1709	1704	1685
20	1017	1036	1055	1048	1066	1048	1039	1041	1060	1094	1125	1129	1154	1143	1131	1119	1090	1086	1096
25	594	608	634	646	640	633	619	618	638	659	687	712	712	694	679	643	641	647	657
30	339	371	383	386	390	382	360	359	368	402	429	437	442	433	395	376	365	378	389
35	201	213	222	236	217	215	209	203	212	234	243	264	270	247	233	227	212	219	233
40	105	120	128	129	128	115	106	112	114	120	139	145	146	147	127	99.9	89.0	91.8	117
45	52.0	64.9	73.3	73.2	63.0	52.1	52.1	51.9	53.3	54.8	64.4	75.6	81.8	73.6	59.8	49.5	48.0	49.0	53.4
50	45.7	48.9	53.5	53.5	47.1	45.5	46.7	46.5	47.5	48.5	48.5	53.7	58.4	54.4	47.7	45.7	44.7	44.7	45.7
55	41.1	42.3	48.0	47.5	40.7	40.9	42.4	41.4	42.7	44.7	43.2	46.3	53.3	47.2	42.4	42.1	40.6	40.7	41.9
60	35.9	35.6	39.3	38.4	34.8	35.7	36.9	35.8	37.0	39.0	37.1	37.8	41.9	38.0	36.4	36.6	35.1	35.4	36.6
65	29.5	29.2	29.8	29.7	28.8	29.3	29.8	29.5	30.3	31.2	30.3	30.4	30.9	30.0	29.7	29.7	28.9	28.9	29.4
70	22.9	22.8	22.7	23.0	22.9	23.0	23.1	23.3	23.6	23.9	23.7	23.5	23.1	22.9	22.8	22.8	22.7	22.5	22.3
75	16.5	16.5	16.5	16.6	16.8	16.8	16.9	17.1	17.2	17.3	17.2	17.0	16.6	16.5	16.3	16.3	16.3	16.2	16.0
80	10.9	10.9	10.9	10.9	11.0	11.1	11.1	11.2	11.3	11.3	11.2	11.0	10.7	10.5	10.4	10.5	10.4	10.3	10.1
85	6.59	6.60	6.68	6.70	6.77	6.81	6.86	6.89	6.99	6.97	6.82	6.64	6.46	6.36	6.27	6.28	6.34	6.18	6.13
90	3.18	3.19	3.22	3.27	3.30	3.32	3.36	3.37	3.39	3.36	3.28	3.16	3.07	2.98	2.94	2.94	2.92	2.87	2.85
95	1.35	1.35	1.37	1.39	1.40	1.41	1.44	1.45	1.47	1.46	1.44	1.40	1.36	1.32	1.30	1.28	1.25	1.22	1.21
100	0.39	0.38	0.39	0.39	0.40	0.40	0.41	0.41	0.43	0.43	0.43	0.43	0.43	0.42	0.40	0.39	0.36	0.34	0.34
105	0.06	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.05	0.05	0.05	0.05	0.06	0.07	0.06	0.06	0.06	0.05
110	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
115	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
120	0.04	0.04	0.04	0.04	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.05	0.04	0.04	0.04	0.04	0.05
125	0.06	0.07	0.07	0.07	0.07	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	0.09
130	0.11	0.11	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	0.11	0.11	0.17
135	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.19	0.33
140	0.33	0.32	0.33	0.33	0.33	0.33	0.33	0.33	0.32	0.32	0.32	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.55
145	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.45	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.80
150	0.61	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.59	0.59	0.58	0.58	0.58	0.58	0.58	0.58	0.58	1.06
155	0.78	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.76	0.76	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	1.28
160	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.93	0.93	0.92	0.92	0.92	0.92	0.92	0.92	0.91	0.91	1.45
165	1.06	1.06	1.07	1.07	1.07	1.06	1.06	1.06	1.06	1.05	1.05	1.05	1.05	1.05	1.04	1.04	1.04	1.04	1.54
170	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.08	1.08	1.53
175	1.12	1.12	1.12	1.12	1.12	1.11	1.11	1.11	1.11	1.11	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.09	1.35
180	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30

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	2459	2459	2459	2459	2459	2459	2459	2459	2459	2459	2459	2459	2459	2459	2459	2459	2459		
5	2459	2495	2519	2525	2525	2522	2515	2517	2516	2499	2480	2452	2429	2405	2375	2351	2339		
10	2189	2232	2250	2259	2241	2221	2209	2220	2229	2239	2218	2203	2165	2139	2106	2073	2101		
15	1702	1678	1654	1666	1655	1643	1649	1651	1642	1633	1641	1640	1647	1658	1648	1662	1680		
20	1098	1094	1090	1079	1064	1038	1019	1020	1029	1037	1041	1055	1035	1026	1030	1011	1023		
25	678	702	699	689	667	635	625	624	639	651	667	667	644	616	590	588	578		
30	421	446	441	435	423	394	384	386	405	414	414	416	398	361	346	333	337		
35	246	262	276	261	252	230	218	222	236	242	261	253	229	214	206	192	199		
40	136	150	150	145	134	126	127	124	126	140	139	140	135	115	88.3	82.8	86.4		
45	67.0	81.9	81.4	73.5	62.8	60.5	58.6	58.7	58.6	65.5	78.9	82.2	70.2	55.8	49.2	48.3	48.5		
50	49.7	56.9	57.4	51.1	49.6	50.4	49.4	50.3	49.6	49.8	56.4	58.8	53.0	47.0	45.5	44.8	45.1		
55	43.1	50.2	50.5	42.8	45.1	46.0	43.3	45.6	45.4	42.4	48.4	52.1	45.0	41.9	41.1	40.2	40.6		
60	36.2	38.8	39.5	35.4	38.0	38.7	36.3	38.3	38.6	35.9	38.4	40.7	37.2	36.4	35.9	34.8	35.5		
65	29.0	29.1	29.2	28.7	29.6	29.9	29.5	30.0	30.1	29.5	29.9	30.3	29.9	29.9	29.6	29.1	29.5		
70	22.2	22.0	22.0	22.3	22.5	22.7	22.9	22.9	23.0	23.0	23.0	22.9	23.1	23.2	23.1	23.0	23.0		
75	15.8	15.7	15.7	16.0	16.1	16.2	16.4	16.4	16.5	16.7	16.6	16.6	16.7	16.8	16.8	16.8	16.7		
80	10.0	10.0	10.1	10.3	10.4	10.5	10.6	10.6	10.7	10.8	10.8	10.9	10.9	10.9	10.9	11.0	10.9		
85	6.08	6.09	6.12	6.20	6.24	6.31	6.38	6.42	6.47	6.51	6.52	6.55	6.55	6.56	6.59	6.62	6.65		
90	2.81	2.80	2.82	2.86	2.89	2.96	3.02	3.07	3.10	3.11	3.10	3.13	3.14	3.14	3.17	3.21	3.24		
95	1.19	1.18	1.20	1.22	1.24	1.27	1.31	1.34	1.35	1.35	1.34	1.36	1.35	1.35	1.36	1.38	1.39		
100	0.33	0.32	0.33	0.33	0.34	0.35	0.38	0.39	0.40	0.40	0.40	0.41	0.41	0.41	0.42	0.42	0.42		
105	0.05	0.04	0.04	0.04	0.04	0.04	0.05	0.06	0.07	0.07	0.08	0.08	0.08	0.08	0.08	0.08	0.08		
110	0.02	0.02	0.03	0.03	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		
115	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.03	0.04	0.04	0.04	0.03	0.03	0.03	0.03		
120	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.05	0.05	0.05	0.05		
125	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.09	0.10		
130	0.17	0.17	0.18	0.18	0.18	0.18	0.18	0.18	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19		
135	0.33	0.33	0.34	0.34	0.34	0.35	0.35	0.35	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36		
140	0.55	0.55	0.56	0.56	0.56	0.57	0.58	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59		
145	0.80	0.80	0.81	0.81	0.82	0.83	0.84	0.85	0.85	0.85	0.84	0.84	0.85	0.85	0.85	0.85	0.85		
150	1.06	1.06	1.06	1.07	1.08	1.08	1.09	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.11	1.11	1.11		
155	1.28	1.28	1.28	1.29	1.30	1.30	1.31	1.31	1.32	1.31	1.31	1.31	1.31	1.32	1.32	1.32	1.32		
160	1.45	1.45	1.46	1.46	1.46	1.47	1.47	1.48	1.48	1.48	1.47	1.47	1.47	1.47	1.48	1.48	1.48		
165	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.56	1.56	1.56	1.55	1.55	1.55	1.56	1.56	1.56	1.57		
170	1.54	1.54	1.55	1.54	1.54	1.54	1.54	1.54	1.54	1.53	1.54	1.53	1.53	1.53	1.54	1.54	1.54		
175	1.37	1.36	1.36	1.36	1.36	1.35	1.35	1.35	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34		
180	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30		

Table 7: Luminous Intensity Data

EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Aug. 14, 2018	Aug. 13, 2019
Digital Power Meter	PF2010A	HZTE028-01	Sep. 12, 2018	Sep. 11, 2019
AC Power Supply	DPS1060	HZTE001-06	Aug. 09, 2018	Aug. 08, 2019
DC Power Supply	WY12010	HZTE004-03	Aug. 09, 2018	Aug. 08, 2019
Temperature recorder	JM624U	HZTE018-08	Aug. 09, 2018	Aug. 08, 2019
Temperature and humidity recorder	JR900	HZTE018-01	Aug. 09, 2018	Aug. 08, 2019
Standard source	D908	HZTE012-01	Aug. 14, 2018	Aug. 13, 2019
Integrate Sphere system	3M	HZTE015-04	Aug. 16, 2018	Aug. 15, 2019
Digital Power Meter	WT210	HZTE008-01	Aug. 02, 2018	Aug. 01, 2019
AC Power Supply	PCR 500L	HZTE001-07	Aug. 09, 2018	Aug. 08, 2019
DC Power Supply	IT6154	HZTE004-04	Aug. 09, 2018	Aug. 08, 2019
Standard source	SCL-1400	HZTE012-02	Aug. 16, 2018	Aug. 15, 2019
Temperature and humidity recorder	JR900	HZTE018-02	Aug. 09, 2018	Aug. 08, 2019
Temperature Meter	TES1310	HZTE017-01	Aug. 09, 2018	Aug. 08, 2019

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 ***

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