

LM-79-08 TEST REPORT

for

GREEN CREATIVE LTD

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

LED Lamp

Model: 11PAR30SNDIM/927NF25

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.: HZ19050046u

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

Review by:



Engineer: April Zou

Jul. 05, 2019

Approved by:



Manager: Jim Zhang

Jul. 05, 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: 11PAR30SNDIM/927NF25

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
88.8	966.8	10.89	0.9260
CCT (K)	CRI	Stabilization Time (Light & Power)	
2818	98.1	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	: May 29, 2019
Date of Test	: Jun. 05, 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	: 11PAR30SNDIM/927NF25
Electrical Ratings	: 120V, 60Hz, 11W
Product Description	: 2700K
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)	0.098
Power Factor	0.9260
Test Power (W)	10.89
THD A%	34.04
Luminous Efficacy (lm/W)	88.8
Total Luminous Flux (lm)	966.8
Color Rendering Index (CRI)	98.1
R9	87.6
Correlated Color Temperature (CCT)(K)	2818
Chromaticity Chroma x	0.4500
Chromaticity Chroma y	0.4077
Chromaticity Chroma u	0.2574
Chromaticity Chroma v	0.3498
Duv	0.0002
Chromaticity Chroma u'	0.2574
Chromaticity Chroma v'	0.5248

Special Color Rendering Indices	
R1	99.5
R2	99.7
R3	97.5
R4	99.6
R5	99
R6	97.9
R7	97.1
R8	94.6
R9	87.6
R10	97.6
R11	98
R12	88.6
R13	99.9
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 24.6 °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)	0.099
Power Factor	0.9307
Power (W)	11.05
Luminous Efficacy (lm/W)	87.9
Total Luminous Flux (lm)	971.1
Beam Angle (°)	20.1 (0°-180°) / 20.0 (90°-270°)
Center Beam Candle Power (cd)	4765
Maximum Beam Candle Power (cd)	4774(At: C=80.0, Gamma=0.5)
Spacing Criteria	0.34 (0°-180°) / 0.33 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	95.27%
Zonal Lumens in the 60 °-90 °Zone	4.57%
Zonal Lumens in the 90 °-120 °Zone	0.03%
Zonal Lumens in the 120 °-180 °Zone	0.13%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

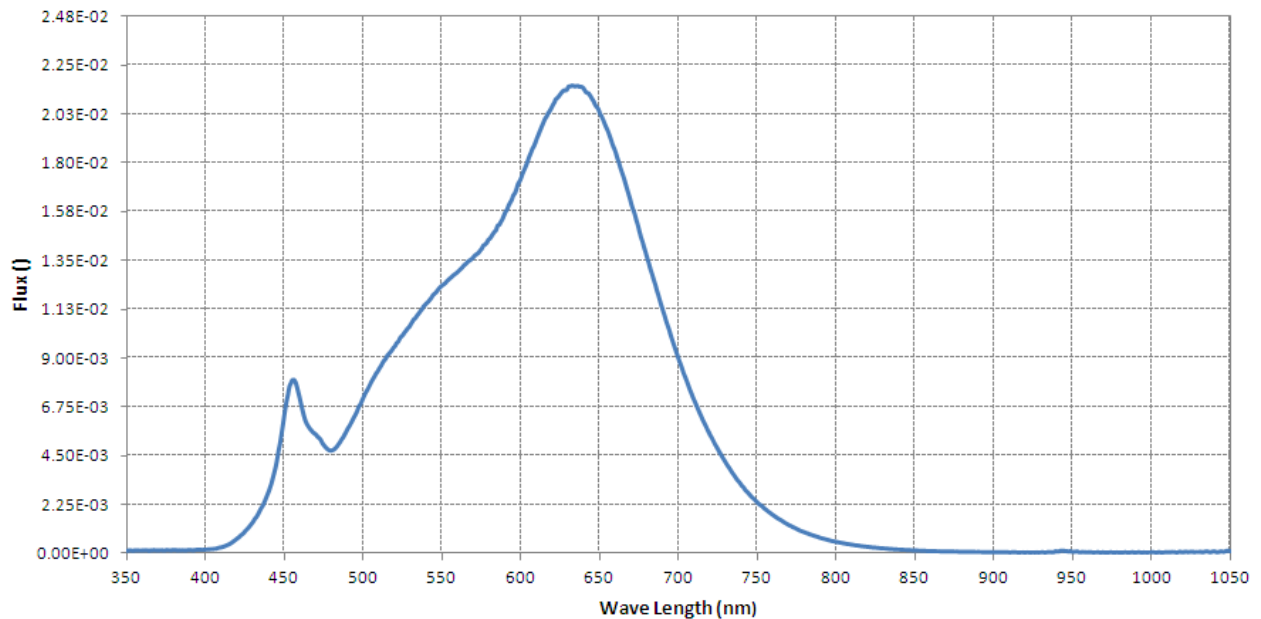
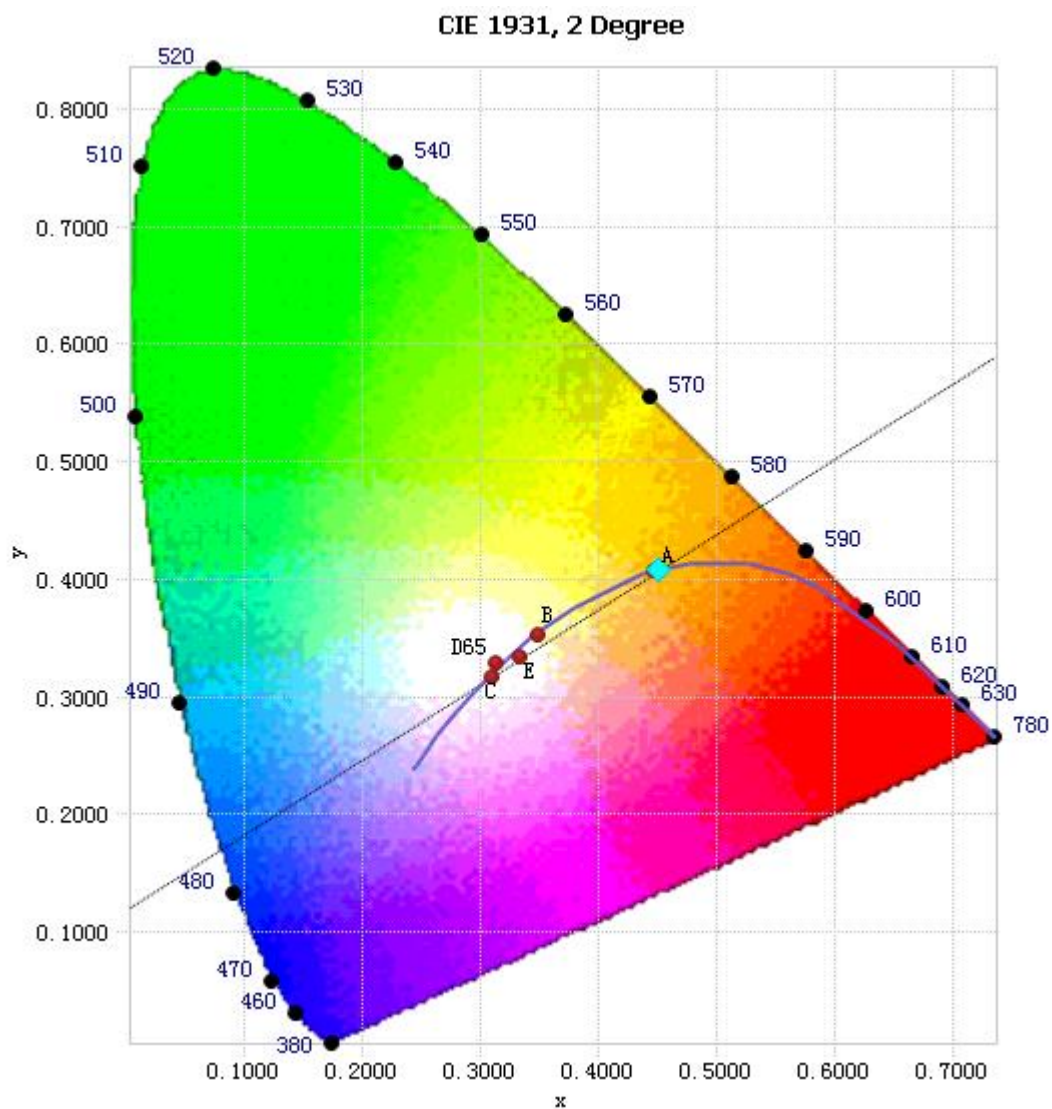


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.42E-04	485	5.11E-03	590	1.57E-02	695	1.00E-02
385	1.36E-04	490	5.76E-03	595	1.65E-02	700	8.93E-03
390	1.40E-04	495	6.41E-03	600	1.73E-02	705	7.95E-03
395	1.51E-04	500	7.19E-03	605	1.83E-02	710	7.01E-03
400	1.64E-04	505	7.91E-03	610	1.92E-02	715	6.17E-03
405	1.96E-04	510	8.52E-03	615	2.00E-02	720	5.43E-03
410	2.71E-04	515	9.11E-03	620	2.07E-02	725	4.76E-03
415	4.16E-04	520	9.56E-03	625	2.12E-02	730	4.15E-03
420	6.83E-04	525	1.01E-02	630	2.15E-02	735	3.60E-03
425	1.02E-03	530	1.06E-02	635	2.16E-02	740	3.10E-03
430	1.45E-03	535	1.11E-02	640	2.14E-02	745	2.69E-03
435	2.07E-03	540	1.15E-02	645	2.10E-02	750	2.33E-03
440	2.87E-03	545	1.20E-02	650	2.03E-02	755	2.02E-03
445	4.26E-03	550	1.24E-02	655	1.95E-02	760	1.74E-03
450	6.49E-03	555	1.27E-02	660	1.85E-02	765	1.51E-03
455	8.00E-03	560	1.30E-02	665	1.73E-02	770	1.28E-03
460	6.99E-03	565	1.34E-02	670	1.61E-02	775	1.11E-03
465	5.85E-03	570	1.37E-02	675	1.49E-02	780	9.54E-04
470	5.45E-03	575	1.40E-02	680	1.36E-02		
475	4.97E-03	580	1.45E-02	685	1.24E-02		
480	4.74E-03	585	1.51E-02	690	1.12E-02		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4500, 0.4077)

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

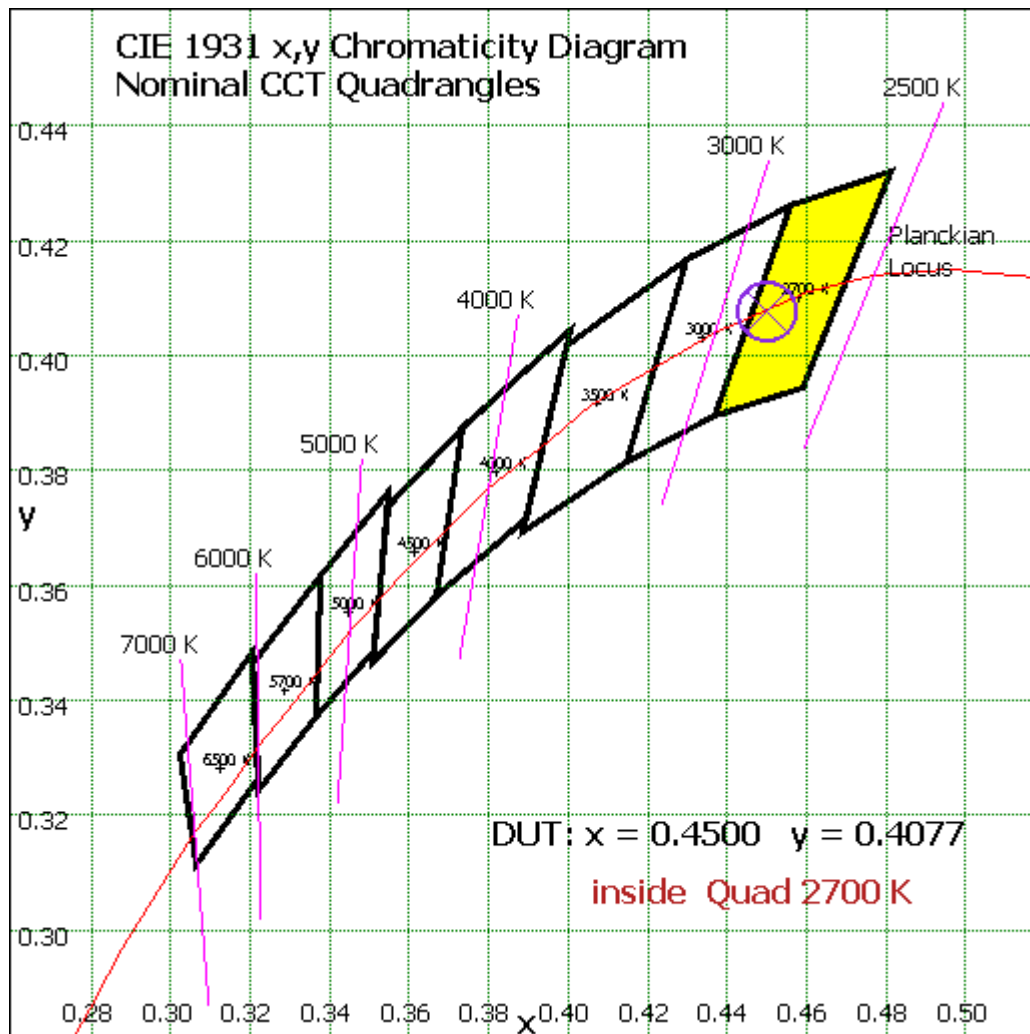
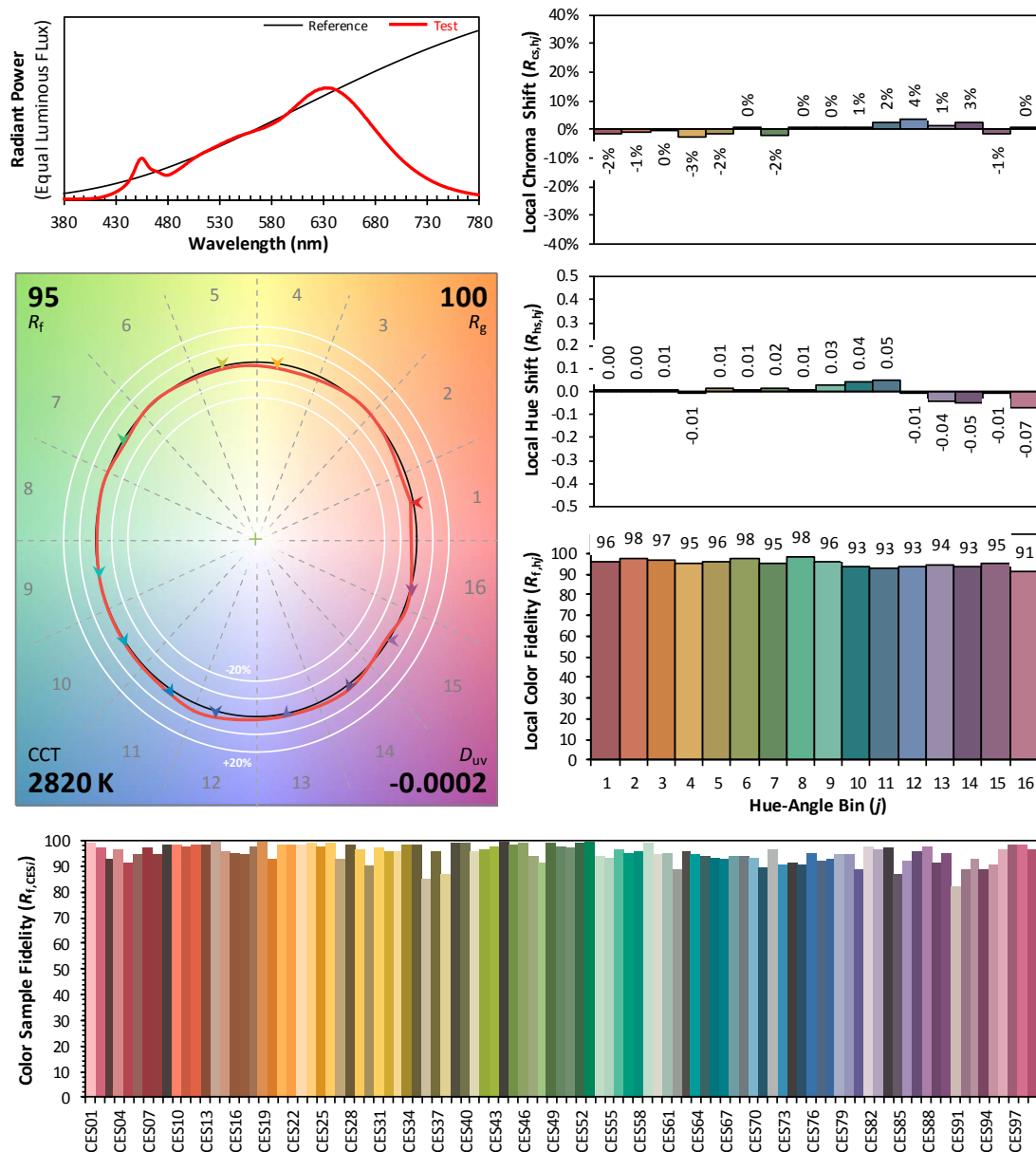


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method



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

x 0.4500

y 0.4077

u' 0.2574

v' 0.5248

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	322.945	33.26%
10- 20	338.838	34.89%
20- 30	118.208	12.17%
30- 40	61.223	6.30%
40- 50	47.39	4.88%
50- 60	36.624	3.77%
60- 70	25.323	2.61%
70- 80	14.169	1.46%
80- 90	4.848	0.50%
90-100	0.257	0.03%
100-110	0.012	0.00%
110-120	0.022	0.00%
120-130	0.041	0.00%
130-140	0.119	0.01%
140-150	0.297	0.03%
150-160	0.406	0.04%
160-170	0.304	0.03%
170-180	0.091	0.01%
Total	971.1	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	925.228	95.27%
60- 90	44.34	4.57%
0-90	969.568	99.84%
90- 180	1.549	0.16%
0- 180	971.1	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

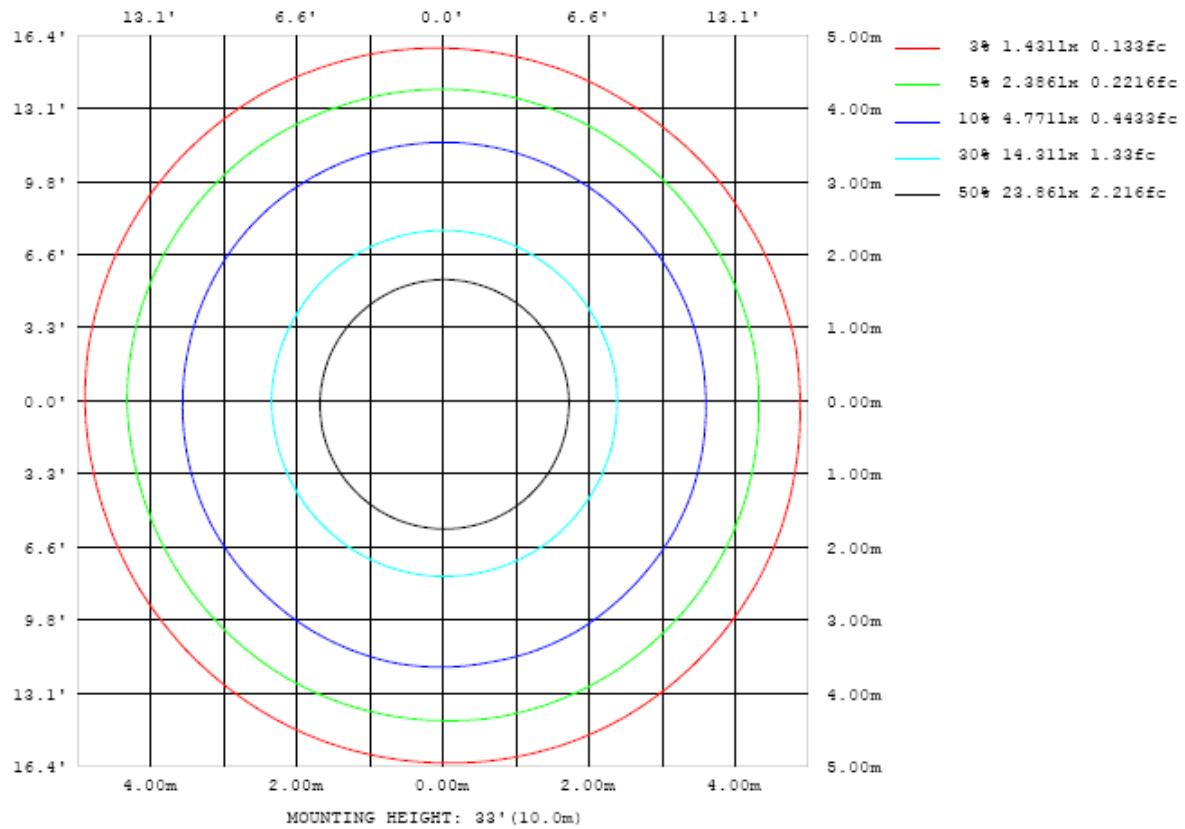


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

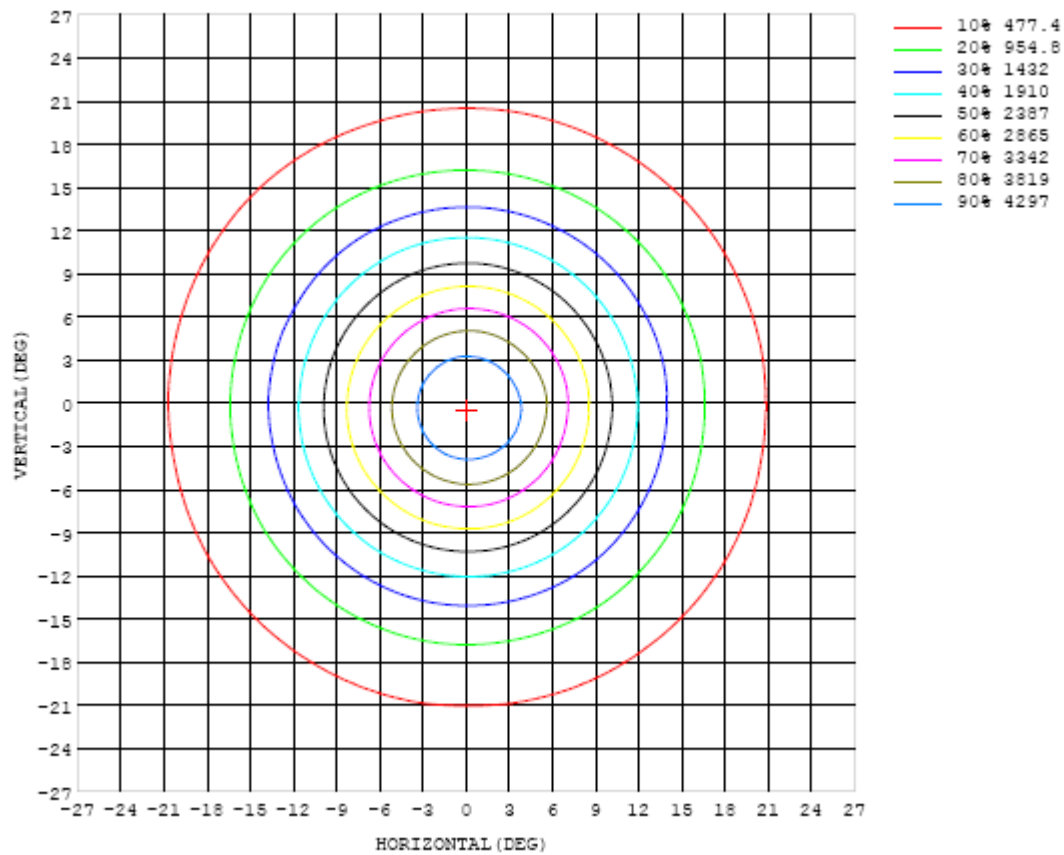


Chart 6: Isocandela Plot

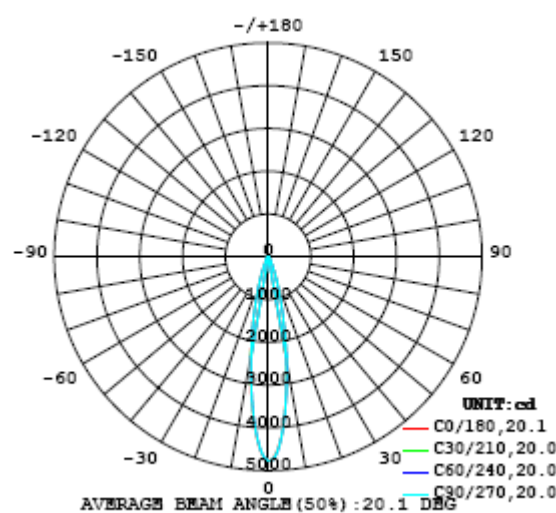


Chart 7: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1 UNIT: 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	4765	4765	4765	4765	4765	4765	4765	4765	4765	4765	4765	4765	4765	4765	4765	4765	4765	4765	4765
5	3996	4003	4007	4013	4018	4020	4019	4016	4012	4004	3993	3982	3968	3950	3936	3915	3899	3884	3866
10	2427	2435	2450	2465	2473	2480	2486	2488	2484	2478	2473	2462	2453	2438	2426	2410	2393	2377	2360
15	1223	1225	1235	1241	1245	1252	1254	1251	1249	1248	1243	1234	1224	1215	1207	1200	1194	1186	1183
20	551	560	569	572	570	572	579	575	570	576	579	570	564	555	553	552	547	541	536
25	234	239	245	247	249	251	252	251	249	246	243	241	239	236	234	233	232	232	236
30	121	124	128	132	134	135	136	137	138	138	138	136	135	134	134	133	133	133	133
35	92.1	94.5	97.2	98.9	100	102	103	104	104	103	103	102	101	100	99.7	99.3	99.4	99.5	100
40	75.4	75.9	76.3	77.2	78.5	79.5	79.8	79.7	79.3	79.3	79.0	78.9	78.9	78.8	78.2	77.5	77.3	77.1	77.9
45	60.5	60.7	61.0	61.6	62.3	62.8	63.4	63.9	64.1	64.1	63.5	62.7	62.4	62.4	62.2	62.0	62.1	61.8	61.8
50	48.8	49.4	50.1	50.3	50.2	50.0	50.1	49.8	49.6	49.6	49.6	49.5	49.2	49.1	49.0	49.1	49.0	48.7	48.6
55	41.0	41.4	41.2	41.3	41.5	41.6	41.7	41.3	41.3	41.4	41.4	41.7	41.5	41.5	41.2	41.0	40.7	40.5	40.4
60	33.5	33.5	33.5	33.5	33.4	33.4	33.5	33.4	33.2	33.0	32.8	32.9	32.9	33.0	33.0	32.9	32.8	32.6	32.5
65	26.0	26.1	26.1	26.0	25.9	25.9	25.9	25.8	25.6	25.5	25.4	25.3	25.3	25.4	25.2	25.1	25.0	24.9	25.0
70	19.4	19.4	19.4	19.4	19.4	19.4	19.4	19.4	19.3	19.1	19.0	19.0	19.0	19.0	18.9	18.7	18.7	18.6	18.7
75	13.5	13.5	13.5	13.6	13.6	13.7	13.7	13.8	13.7	13.5	13.5	13.4	13.4	13.3	13.3	13.2	13.2	13.1	13.0
80	8.49	8.55	8.54	8.61	8.73	8.76	8.89	9.00	8.93	8.92	8.86	8.81	8.88	8.79	8.59	8.51	8.51	8.43	8.43
85	4.24	4.39	4.37	4.49	4.59	4.55	4.57	4.68	4.56	4.51	4.55	4.45	4.38	4.44	4.39	4.30	4.35	4.22	4.21
90	1.19	1.22	1.24	1.29	1.32	1.32	1.34	1.34	1.33	1.33	1.31	1.28	1.26	1.24	1.22	1.20	1.17	1.15	1.16
95	0.03	0.03	0.04	0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.05	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03
100	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
105	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
110	0.02	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	0.02	0.01	0.01	0.01	0.02
115	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
120	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
125	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	0.03	0.04	0.04	0.04	0.04
130	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.08
135	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.17
140	0.21	0.20	0.20	0.20	0.20	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.34
145	0.33	0.32	0.32	0.32	0.32	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.32	0.32	0.32	0.33	0.33	0.33	0.59
150	0.48	0.47	0.47	0.46	0.46	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.46	0.46	0.47	0.46	0.47	0.88
155	0.62	0.61	0.60	0.60	0.59	0.58	0.58	0.58	0.57	0.57	0.58	0.58	0.58	0.58	0.59	0.59	0.59	0.60	1.11
160	0.71	0.70	0.70	0.69	0.69	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.69	0.69	0.70	0.70	0.70	0.70	1.23
165	0.80	0.79	0.79	0.78	0.78	0.77	0.77	0.76	0.76	0.76	0.76	0.77	0.77	0.77	0.78	0.79	0.78	0.78	1.22
170	0.83	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.83	0.83	0.84	0.84	0.84	0.85	0.85	0.86	0.86	0.84	1.11
175	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.81	0.82	0.82	0.83	0.83	0.84	0.84	0.84	0.83	0.89
180	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84

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	4765	4765	4765	4765	4765	4765	4765	4765	4765	4765	4765	4765	4765	4765	4765	4765	4765		
5	3849	3835	3825	3817	3814	3813	3816	3821	3830	3841	3852	3862	3876	3893	3916	3946	3975		
10	2344	2335	2321	2311	2308	2307	2311	2310	2315	2318	2321	2330	2341	2354	2371	2391	2413		
15	1175	1170	1165	1162	1162	1160	1159	1155	1156	1157	1158	1163	1171	1182	1196	1207	1221		
20	534	532	532	530	528	523	519	518	520	520	520	520	524	529	534	541	549		
25	236	235	233	232	230	227	224	221	219	218	216	215	216	219	222	226	231		
30	132	131	130	128	126	123	121	119	118	117	116	115	115	116	117	118	120		
35	98.8	97.6	96.8	96.1	95.0	93.7	92.4	91.1	90.5	90.1	89.7	89.3	88.9	89.0	89.7	90.3	91.2		
40	77.6	77.4	76.5	75.6	74.5	73.5	73.4	73.4	73.1	72.9	73.0	72.9	73.1	73.5	74.2	75.0	75.6		
45	61.4	61.1	60.8	60.5	60.0	59.5	59.4	59.1	59.1	59.1	59.0	59.0	59.1	59.4	59.8	60.5	60.7		
50	48.4	48.3	48.3	48.4	48.2	47.9	47.8	48.0	48.0	48.3	48.7	49.2	49.3	49.2	48.6	48.5	48.6		
55	40.3	40.3	40.5	40.6	40.7	40.8	41.1	41.4	41.5	41.7	41.7	41.5	41.3	41.2	41.0	40.9	40.8		
60	32.3	32.3	32.3	32.4	32.4	32.5	32.8	33.0	33.2	33.2	33.1	33.0	32.9	32.9	33.2	33.3	33.4		
65	24.8	24.8	24.8	24.8	24.9	25.0	25.1	25.2	25.3	25.3	25.4	25.4	25.5	25.6	25.7	26.0	26.0		
70	18.6	18.5	18.6	18.5	18.6	18.7	18.7	18.8	18.8	18.8	18.9	18.9	19.0	19.1	19.1	19.3	19.4		
75	12.9	12.9	12.9	12.9	12.9	13.0	13.0	13.0	13.0	12.9	12.9	12.9	13.0	13.1	13.2	13.3	13.4		
80	8.47	8.50	8.53	8.63	8.61	8.47	8.47	8.41	8.27	8.34	8.31	8.32	8.35	8.31	8.33	8.37	8.40		
85	4.15	3.99	3.93	3.89	3.82	3.79	3.79	3.78	3.75	3.80	3.82	3.86	3.96	3.99	4.07	4.21	4.25		
90	1.12	1.09	1.07	1.05	1.03	1.02	1.01	1.00	1.00	1.02	1.04	1.07	1.09	1.12	1.15	1.17	1.20		
95	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03		
100	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		
105	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		
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		
115	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		
120	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		
125	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		
130	0.08	0.08	0.08	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	0.09		
135	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	0.19	0.19	0.19	0.19		
140	0.36	0.36	0.36	0.36	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.36		
145	0.64	0.63	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.63	0.63	0.63	0.63	0.61		
150	0.97	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.94	0.94	0.94	0.94	0.95	0.91		
155	1.25	1.22	1.22	1.22	1.22	1.22	1.21	1.21	1.21	1.21	1.21	1.21	1.22	1.22	1.22	1.23	1.16		
160	1.42	1.38	1.38	1.38	1.38	1.37	1.37	1.37	1.38	1.38	1.38	1.38	1.39	1.39	1.40	1.42	1.32		
165	1.45	1.41	1.41	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.41	1.41	1.42	1.43	1.44	1.46	1.33		
170	1.35	1.32	1.31	1.30	1.29	1.28	1.27	1.27	1.26	1.27	1.27	1.28	1.28	1.30	1.31	1.33	1.15		
175	1.05	1.09	1.06	1.05	1.03	1.02	1.00	0.99	0.97	0.96	0.96	0.96	0.97	0.98	1.00	1.04	0.80		
180	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84		

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

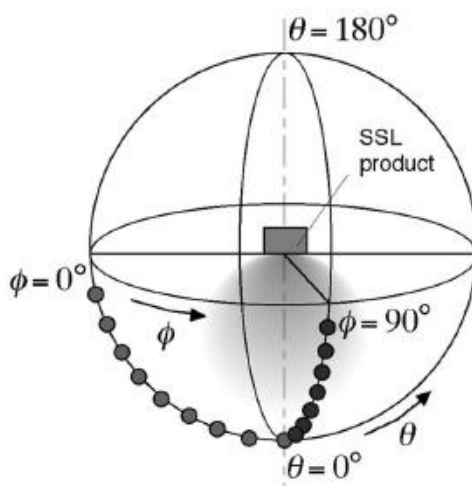
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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

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.