

LM-79-08 TEST REPORT

for

GREEN CREATIVE LTD

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

LED Lamp

Model: 10PAR30SNDIM/830NF25/N

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

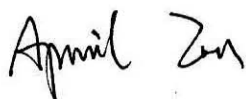
Tel: +86571 86376106

www.ledtestlab.com

Report No.: HZ19070039g

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

Review by:



Engineer: April Zou

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: 10PAR30SNDIM/830NF25/N

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
103.8	1011.7	9.75	0.7309
CCT (K)	CRI	Stabilization Time (Light & Power)	
2995	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	: 10PAR30SNDIM/830NF25/N
Electrical Ratings	: 120V, 60Hz, 10W
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)	0.111
Power Factor	0.7309
Test Power (W)	9.75
THD A%	67.68
Luminous Efficacy (lm/W)	103.8
Total Luminous Flux (lm)	1011.7
Color Rendering Index (CRI)	83.0
R9	7.1
Correlated Color Temperature (CCT)(K)	2995
Chromaticity Chroma x	0.4370
Chromaticity Chroma y	0.4039
Chromaticity Chroma u	0.2507
Chromaticity Chroma v	0.3475
Duv	0.0002
Chromaticity Chroma u'	0.2507
Chromaticity Chroma v'	0.5213

Special Color Rendering Indices	
R1	82
R2	93.2
R3	93.7
R4	80.6
R5	82.8
R6	92.5
R7	81.4
R8	57.9
R9	7.1
R10	85
R11	80.7
R12	77
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 24.9 °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)	0.110
Power Factor	0.7371
Power (W)	9.71
Luminous Efficacy (lm/W)	105.8
Total Luminous Flux (lm)	1026.9
Beam Angle (°)	21.6 (0°-180°) / 22.4 (90°-270°)
Center Beam Candle Power (cd)	3985
Maximum Beam Candle Power (cd)	4089 (At: C=170.0, Gamma=2.0)
Spacing Criteria	0.40 (0°-180°) / 0.39 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	95.98%
Zonal Lumens in the 60 °-90 °Zone	3.80%
Zonal Lumens in the 90 °-120 °Zone	0.08%
Zonal Lumens in the 120 °-180 °Zone	0.13%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

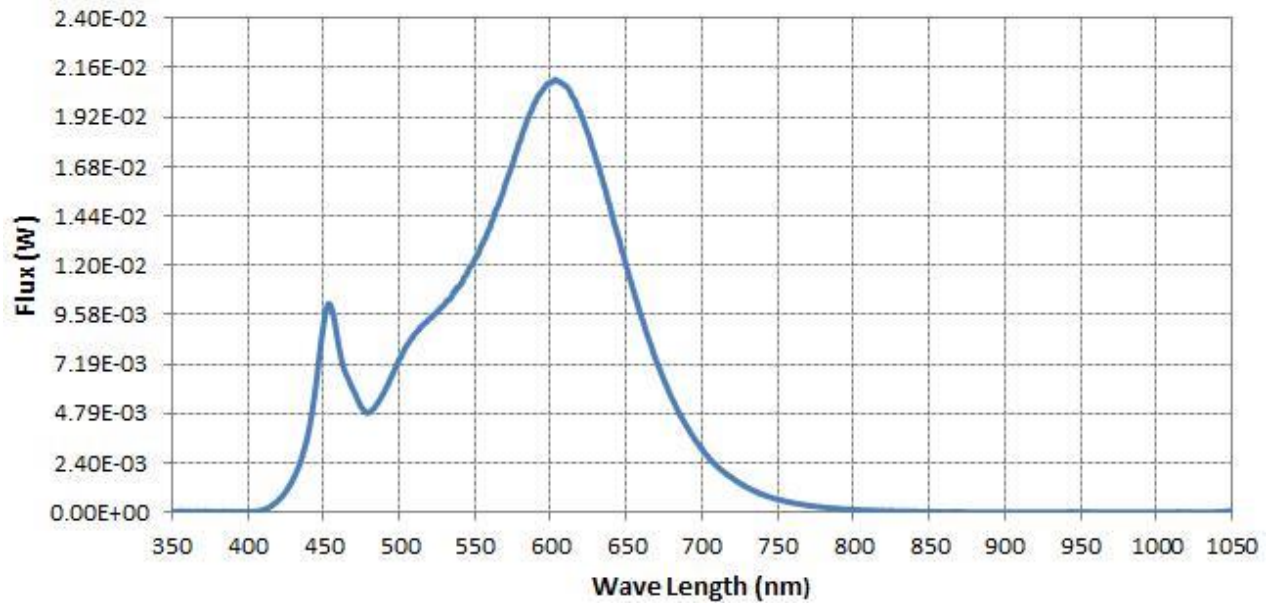
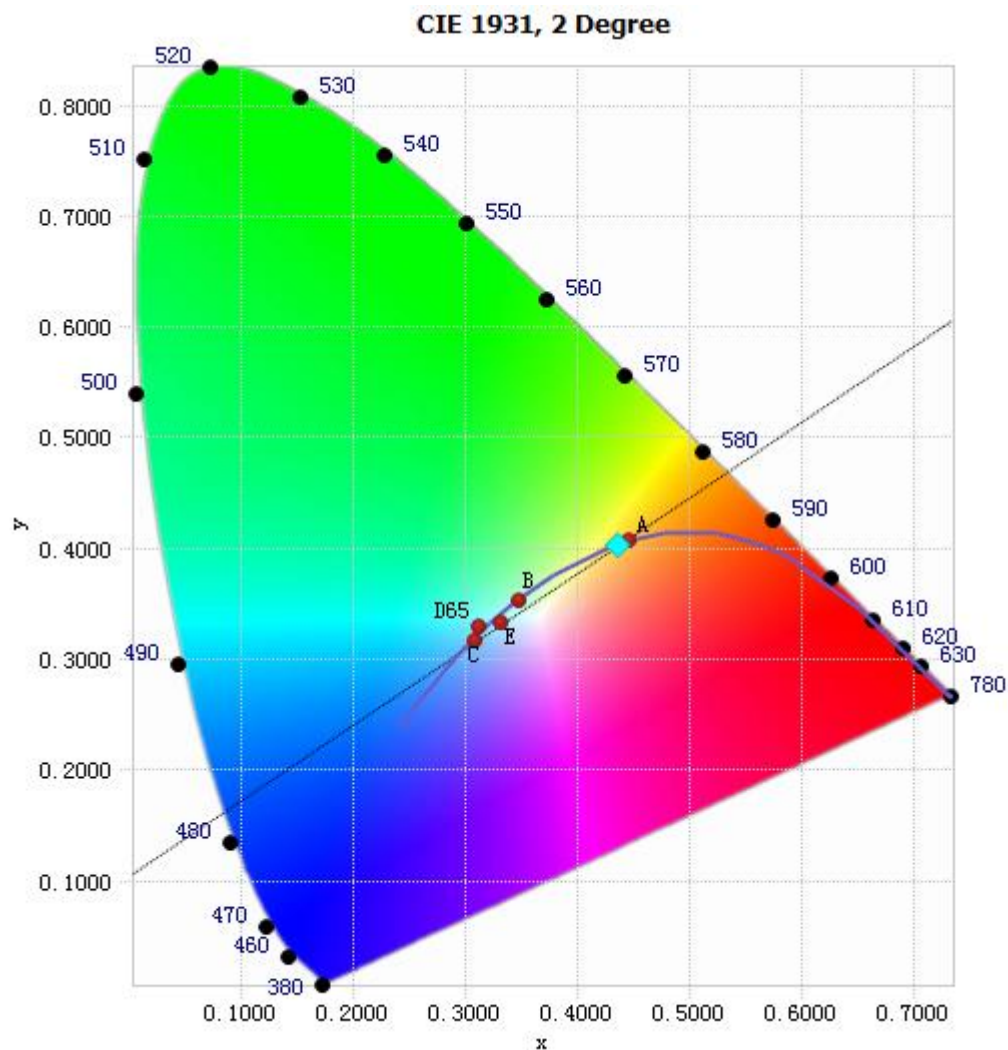


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	3.90E-05	485	5.20E-03	590	1.99E-02	695	3.56E-03
385	4.02E-05	490	5.81E-03	595	2.05E-02	700	3.07E-03
390	4.53E-05	495	6.58E-03	600	2.08E-02	705	2.59E-03
395	3.23E-05	500	7.41E-03	605	2.09E-02	710	2.22E-03
400	3.41E-05	505	8.09E-03	610	2.07E-02	715	1.92E-03
405	5.26E-05	510	8.63E-03	615	2.01E-02	720	1.66E-03
410	1.24E-04	515	9.04E-03	620	1.93E-02	725	1.41E-03
415	2.82E-04	520	9.39E-03	625	1.83E-02	730	1.20E-03
420	5.65E-04	525	9.74E-03	630	1.71E-02	735	1.02E-03
425	9.92E-04	530	1.01E-02	635	1.59E-02	740	8.65E-04
430	1.61E-03	535	1.05E-02	640	1.46E-02	745	7.42E-04
435	2.49E-03	540	1.10E-02	645	1.33E-02	750	6.36E-04
440	3.83E-03	545	1.16E-02	650	1.19E-02	755	5.42E-04
445	6.11E-03	550	1.23E-02	655	1.07E-02	760	4.65E-04
450	9.03E-03	555	1.30E-02	660	9.47E-03	765	3.97E-04
455	1.00E-02	560	1.38E-02	665	8.35E-03	770	3.44E-04
460	8.15E-03	565	1.48E-02	670	7.30E-03	775	2.92E-04
465	6.69E-03	570	1.59E-02	675	6.40E-03	780	2.47E-04
470	5.90E-03	575	1.69E-02	680	5.55E-03		
475	5.10E-03	580	1.80E-02	685	4.81E-03		
480	4.84E-03	585	1.91E-02	690	4.16E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4370, 0.4039)

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

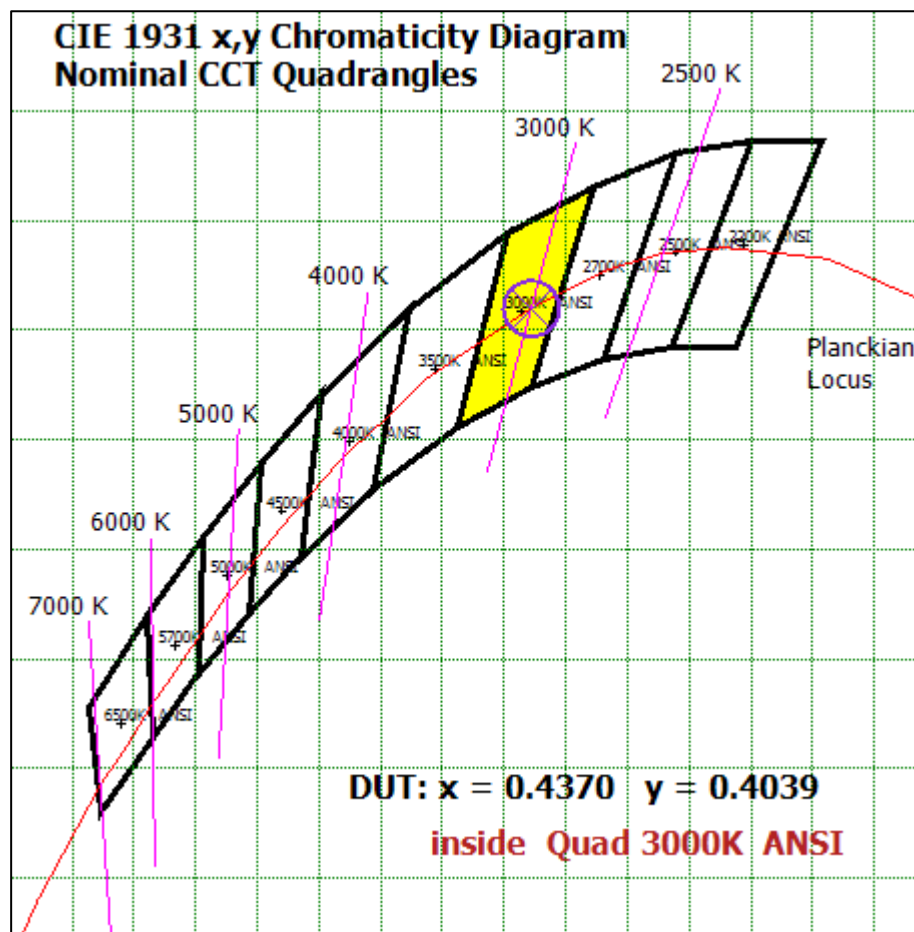
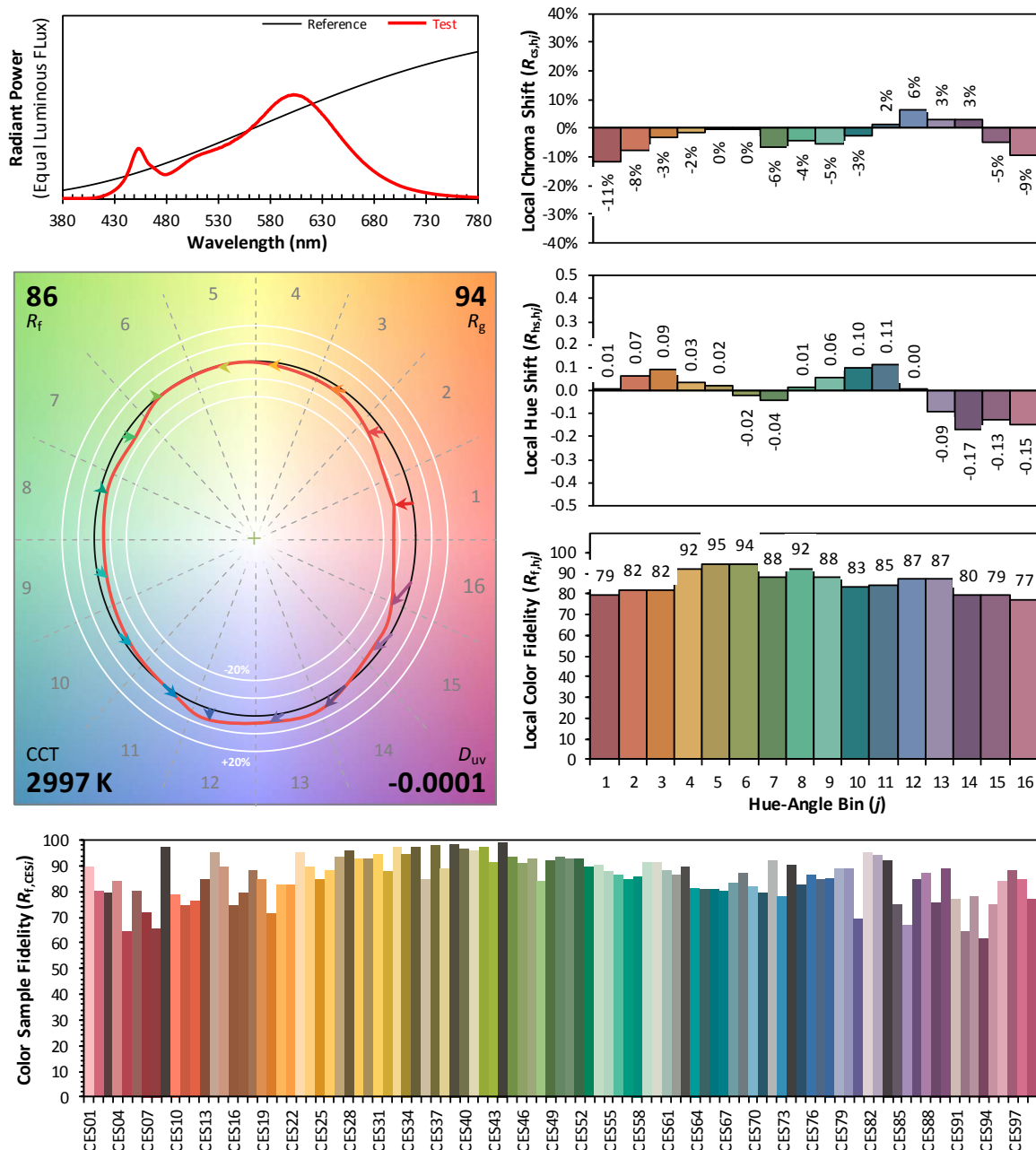


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method



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

x 0.4370
 y 0.4038
 u' 0.2507
 v' 0.5213

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	300.318	29.24%
10- 20	331.865	32.32%
20- 30	181.946	17.72%
30- 40	95.91	9.34%
40- 50	45.807	4.46%
50- 60	29.835	2.91%
60- 70	21.736	2.12%
70- 80	12.551	1.22%
80- 90	4.776	0.47%
90-100	0.79	0.08%
100-110	0.018	0.00%
110-120	0.02	0.00%
120-130	0.048	0.00%
130-140	0.139	0.01%
140-150	0.317	0.03%
150-160	0.421	0.04%
160-170	0.319	0.03%
170-180	0.101	0.01%
Total	1026.9	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	985.681	95.98%
60- 90	39.063	3.80%
0-90	1024.744	99.79%
90- 180	2.173	0.21%
0- 180	1026.9	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

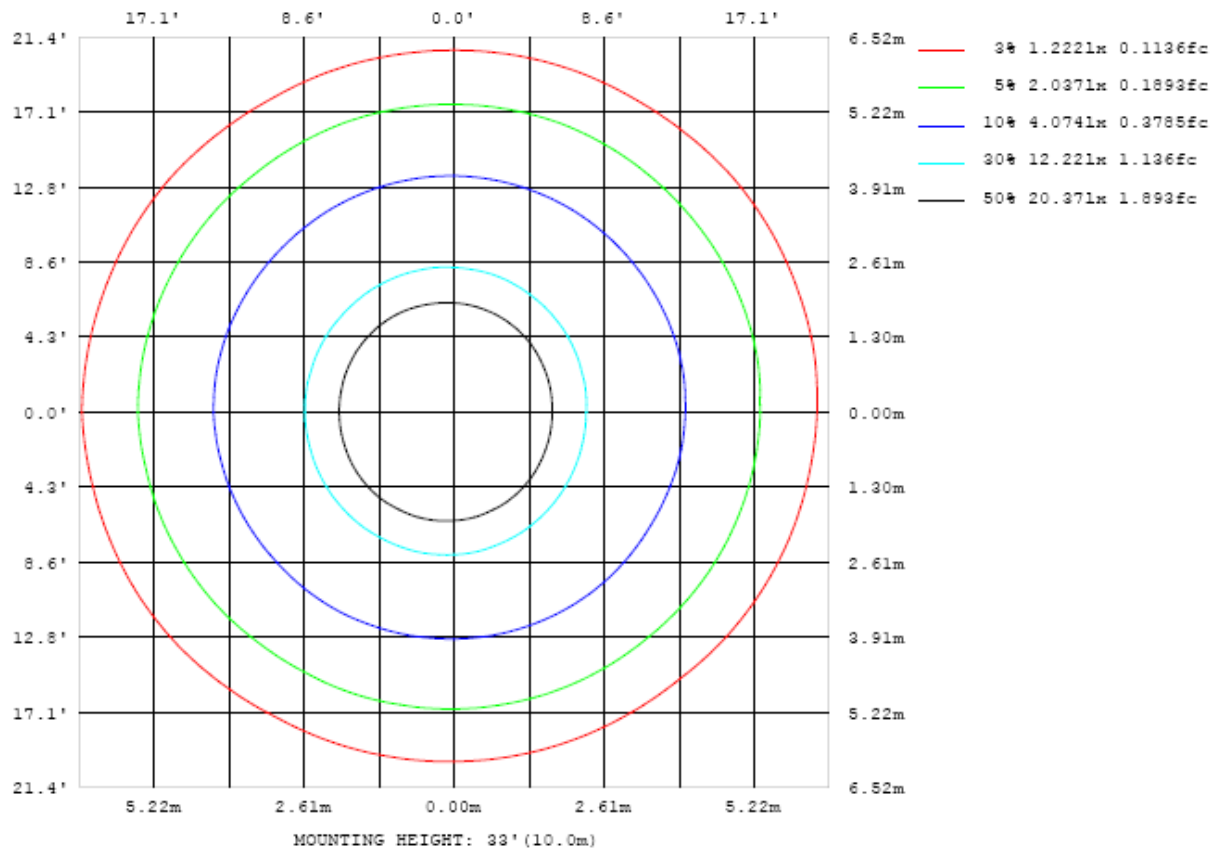


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

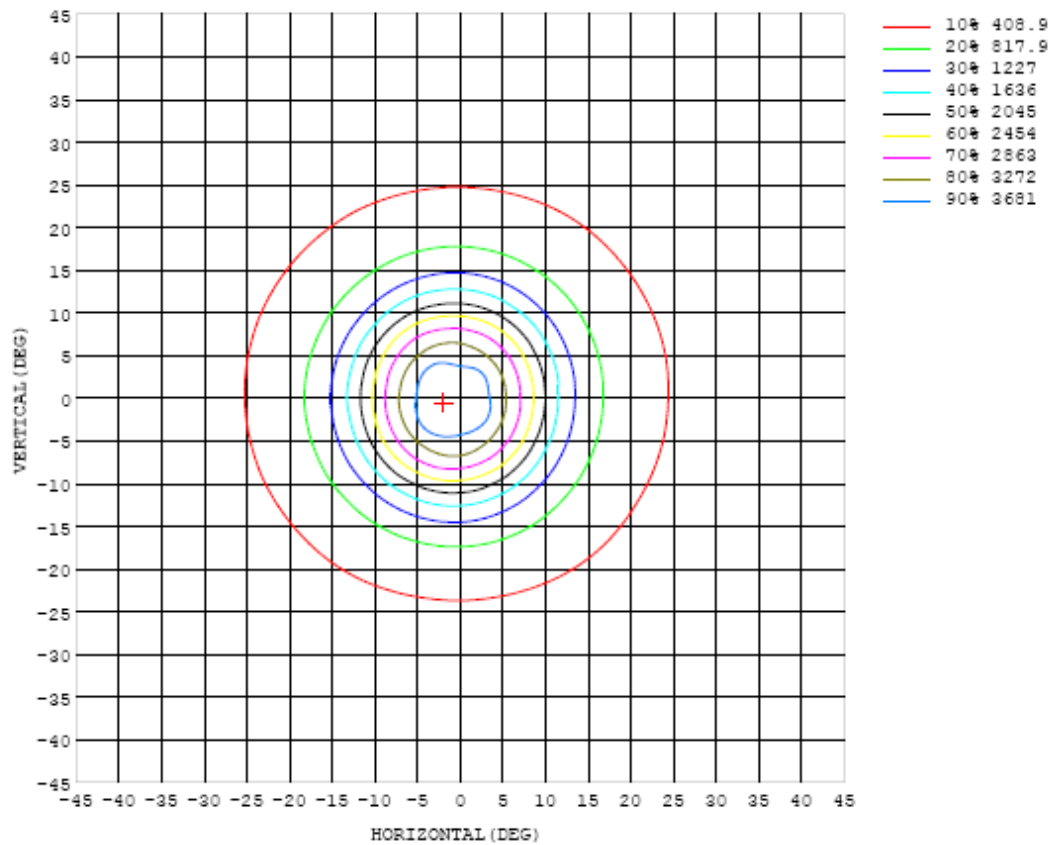


Chart 6: Isocandela Plot

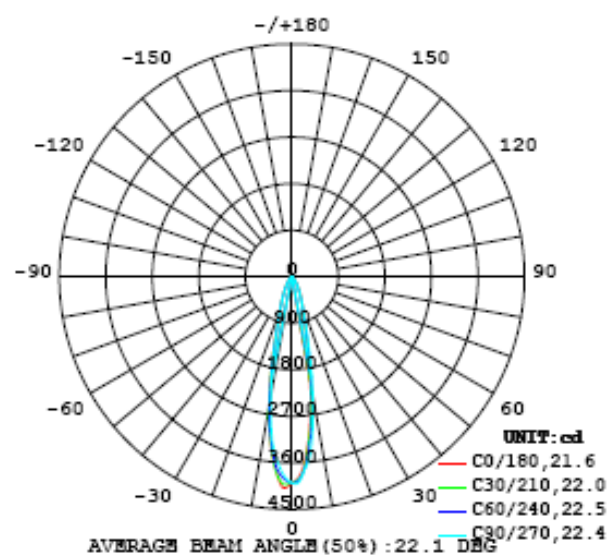


Chart 7: Polar Candela Distribution

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	3985	3985	3985	3985	3985	3985	3985	3985	3985	3985	3985	3985	3985	3985	3985	3985	3985	3985	3985
5	3355	3362	3387	3409	3439	3472	3510	3537	3570	3592	3614	3650	3688	3738	3787	3797	3767	3736	3714
10	2026	2033	2041	2071	2122	2158	2216	2248	2302	2335	2387	2431	2465	2511	2535	2543	2541	2538	2546
15	996	995	1001	1011	1021	1040	1068	1091	1118	1139	1159	1176	1191	1212	1224	1241	1248	1254	1264
20	601	595	587	583	586	582	591	592	596	601	608	615	623	636	636	655	671	670	681
25	386	382	376	371	367	365	362	359	357	359	362	367	375	381	388	396	406	413	420
30	249	243	239	234	228	222	221	221	221	223	225	228	230	237	247	254	260	266	274
35	154	151	148	143	139	134	131	128	130	132	132	134	139	145	150	158	160	163	167
40	93.0	92.0	90.1	86.7	83.9	80.9	78.0	76.2	75.7	75.8	77.6	79.9	83.1	86.6	90.1	93.7	96.2	96.5	97.4
45	60.2	59.0	57.6	56.5	55.2	53.6	51.9	50.3	49.1	48.6	49.8	51.8	54.2	55.9	57.2	58.2	58.8	59.8	60.9
50	42.4	41.8	41.2	40.7	40.0	39.5	38.7	37.8	37.4	37.4	37.8	38.5	39.7	40.5	40.9	40.9	41.4	41.9	42.4
55	33.8	33.3	33.1	32.8	32.6	32.3	32.0	31.6	31.6	31.5	31.8	32.0	32.8	33.4	33.5	33.5	33.9	34.1	34.3
60	27.0	26.6	26.3	26.4	26.1	25.9	26.0	25.7	25.7	25.7	25.9	26.1	26.7	27.2	27.2	27.3	27.6	27.8	27.7
65	21.6	21.3	21.1	21.2	21.1	20.9	21.0	21.0	21.0	21.1	21.3	21.5	22.1	22.6	22.7	22.9	23.0	23.1	23.1
70	16.0	16.0	15.9	16.0	16.0	16.0	16.1	16.2	16.2	16.4	16.6	16.8	17.2	17.6	17.8	18.0	18.1	18.2	18.2
75	10.9	10.9	10.9	11.0	11.1	11.1	11.3	11.5	11.6	11.7	11.9	12.1	12.4	12.7	12.8	12.9	13.0	13.0	12.9
80	6.56	6.59	6.63	6.69	6.83	6.91	7.05	7.20	7.31	7.42	7.55	7.71	7.88	8.05	8.14	8.20	8.20	8.16	8.11
85	3.71	3.72	3.76	3.81	3.89	3.97	4.05	4.14	4.23	4.34	4.46	4.61	4.75	4.85	4.93	4.96	4.95	4.91	4.94
90	1.45	1.46	1.47	1.50	1.55	1.59	1.63	1.67	1.72	1.78	1.84	1.91	2.00	2.08	2.14	2.18	2.19	2.17	2.22
95	0.44	0.45	0.45	0.46	0.48	0.50	0.53	0.55	0.58	0.61	0.64	0.68	0.72	0.75	0.77	0.79	0.80	0.80	0.82
100	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.05	0.06	0.06	0.07	0.08	0.09	0.09	0.10	0.11	0.11	0.12	0.12
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	0.01	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
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	0.05	0.04	0.04	0.04	0.06
130	0.08	0.07	0.08	0.08	0.08	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	0.11
135	0.14	0.14	0.14	0.14	0.14	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	0.21
140	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.23	0.23	0.23	0.23	0.23	0.23	0.22	0.22	0.22	0.37
145	0.38	0.38	0.38	0.38	0.38	0.37	0.37	0.37	0.37	0.36	0.36	0.36	0.36	0.35	0.35	0.35	0.35	0.35	0.62
150	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.51	0.51	0.51	0.51	0.50	0.50	0.50	0.50	0.49	0.91
155	0.66	0.66	0.66	0.66	0.67	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.65	0.65	0.65	0.65	0.64	1.17
160	0.77	0.77	0.77	0.77	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.77	0.77	0.77	0.77	0.76	0.76	1.36
165	0.85	0.85	0.85	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.85	0.85	0.85	0.84	0.84	1.42
170	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.92	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.90	0.90	1.35
175	0.91	0.91	0.91	0.92	0.92	0.92	0.92	0.92	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	1.14
180	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90

Table 6: Luminous Intensity Data

Table--2		UNIT: cd																	
y (DEG)	C (DEG)	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350	
0		3985	3985	3985	3985	3985	3985	3985	3985	3985	3985	3985	3985	3985	3985	3985	3985	3985	
5		3709	3717	3731	3726	3702	3656	3605	3545	3518	3496	3483	3473	3449	3424	3399	3374	3360	
10		2539	2552	2557	2560	2540	2500	2441	2392	2357	2318	2280	2239	2198	2155	2102	2070	2046	
15		1264	1260	1250	1238	1229	1218	1204	1195	1178	1155	1136	1110	1088	1063	1040	1023	1011	
20		680	673	665	659	655	651	648	644	639	636	631	623	618	615	612	609	607	
25		422	421	417	412	409	409	404	401	398	396	396	396	393	390	391	392	392	
30		272	268	266	261	255	252	252	250	248	248	248	246	248	250	252	253	253	
35		167	166	165	161	158	154	150	150	151	150	150	152	155	158	159	159	158	
40		98.8	99.6	98.3	95.7	93.5	91.1	88.8	88.1	88.8	88.3	89.0	91.8	93.6	95.8	97.2	97.8	95.9	
45		60.8	60.7	60.6	60.4	59.3	58.1	56.8	55.4	55.0	55.8	57.4	59.1	60.7	61.7	61.9	61.8	61.3	
50		42.5	42.6	42.5	42.6	42.5	42.0	41.0	40.4	40.2	40.5	41.2	42.5	43.1	43.2	43.3	43.3	43.0	
55		34.5	34.4	34.2	34.2	34.4	34.1	33.5	33.2	33.1	33.3	33.5	34.2	34.4	34.3	34.4	34.4	34.1	
60		27.9	27.9	27.7	27.7	27.8	27.4	27.0	26.8	26.7	26.8	26.9	27.3	27.3	27.3	27.3	27.3	27.2	
65		23.1	23.0	22.8	22.7	22.7	22.4	22.1	21.9	21.8	21.8	21.8	21.9	21.8	21.8	21.9	21.8	21.8	
70		18.1	18.0	17.8	17.7	17.7	17.4	17.1	16.9	16.7	16.7	16.6	16.6	16.5	16.4	16.4	16.3	16.2	
75		12.8	12.7	12.6	12.4	12.3	12.2	11.9	11.7	11.6	11.5	11.4	11.2	11.1	11.1	11.0	10.9	10.9	
80		8.08	8.02	7.93	7.83	7.72	7.58	7.40	7.23	7.12	7.03	6.93	6.81	6.72	6.66	6.61	6.61	6.61	
85		4.92	4.87	4.78	4.71	4.62	4.54	4.41	4.27	4.15	4.05	3.95	3.84	3.78	3.74	3.71	3.72	3.73	
90		2.21	2.17	2.11	2.05	1.97	1.90	1.82	1.74	1.68	1.63	1.58	1.54	1.50	1.48	1.47	1.47	1.48	
95		0.82	0.80	0.79	0.77	0.74	0.71	0.68	0.64	0.61	0.58	0.55	0.53	0.50	0.49	0.48	0.47	0.47	
100		0.13	0.13	0.12	0.12	0.11	0.10	0.09	0.08	0.07	0.07	0.07	0.06	0.06	0.05	0.05	0.05	0.04	
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		0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01	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	0.04	0.04	
125		0.06	0.06	0.06	0.06	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.06	0.07	0.06	
130		0.11	0.11	0.11	0.11	0.10	0.10	0.10	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.12	0.12	0.12	
135		0.21	0.21	0.21	0.20	0.20	0.20	0.21	0.21	0.21	0.21	0.21	0.22	0.22	0.23	0.23	0.23	0.23	
140		0.37	0.37	0.37	0.37	0.38	0.38	0.38	0.39	0.39	0.40	0.40	0.41	0.41	0.42	0.42	0.43	0.43	
145		0.62	0.62	0.62	0.62	0.63	0.63	0.64	0.65	0.65	0.66	0.67	0.68	0.68	0.69	0.69	0.70	0.70	
150		0.91	0.91	0.91	0.91	0.92	0.92	0.93	0.94	0.95	0.95	0.96	0.97	0.98	0.98	0.99	0.99	0.99	
155		1.17	1.17	1.18	1.18	1.18	1.19	1.19	1.20	1.21	1.21	1.22	1.22	1.23	1.23	1.24	1.24	1.24	
160		1.36	1.36	1.37	1.37	1.37	1.37	1.37	1.38	1.38	1.38	1.39	1.39	1.39	1.39	1.39	1.39	1.39	
165		1.42	1.42	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.42	1.42	1.42	1.42	1.42	
170		1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.35	1.35	1.35	1.34	1.34	1.34	1.33	1.33	
175		1.15	1.15	1.15	1.15	1.14	1.15	1.14	1.14	1.13	1.13	1.13	1.12	1.11	1.11	1.10	1.09	1.09	
180		0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	

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

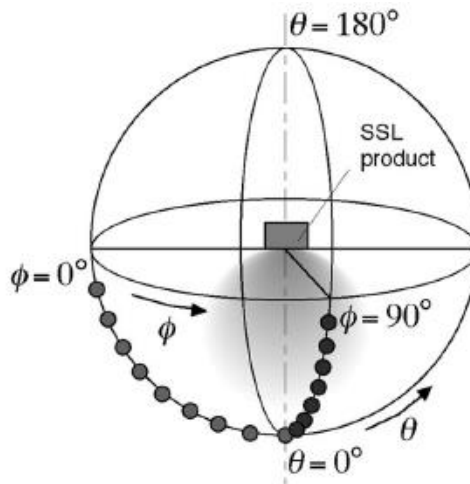
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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