

LM-79-08 TEST REPORT

for

GREEN CREATIVE LTD

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

LED Lamp

Model: 10PAR30SNDIM/840NF25/N

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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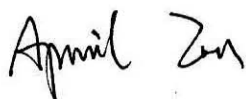
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Report No.: HZ19070039h

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/840NF25/N

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
110.1	1088.7	9.89	0.7349
CCT (K)	CRI	Stabilization Time (Light & Power)	
3859	82.0	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

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SAMPLE PHOTO



Figure 1- Overview of the sample

Equipment Under Test(EUT)

Name	: LED Lamp
Model	: 10PAR30SNDIM/840NF25/N
Electrical Ratings	: 120V, 60Hz, 10W
Product Description	: 4000K
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)	0.112
Power Factor	0.7349
Test Power (W)	9.89
THD A%	67.20
Luminous Efficacy (lm/W)	110.1
Total Luminous Flux (lm)	1088.7
Color Rendering Index (CRI)	82.0
R9	3.6
Correlated Color Temperature (CCT)(K)	3859
Chromaticity Chroma x	0.3884
Chromaticity Chroma y	0.3863
Chromaticity Chroma u	0.2265
Chromaticity Chroma v	0.3379
Duv	0.0021
Chromaticity Chroma u'	0.2265
Chromaticity Chroma v'	0.5069

Special Color Rendering Indices	
R1	79.9
R2	89.9
R3	95.9
R4	78.6
R5	79.5
R6	85.7
R7	84.7
R8	61.5
R9	3.6
R10	75.5
R11	76.5
R12	60.5
R13	82.5
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 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)	0.111
Power Factor	0.7412
Power (W)	9.85
Luminous Efficacy (lm/W)	112.1
Total Luminous Flux (lm)	1104.4
Beam Angle (°)	22.4 (0°-180°) / 22.2 (90°-270°)
Center Beam Candle Power (cd)	4281
Maximum Beam Candle Power (cd)	4365 (At: C=80.0, Gamma=1.5)
Spacing Criteria	0.41 (0°-180°) / 0.39 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	96.06%
Zonal Lumens in the 60 °-90 °Zone	3.73%
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

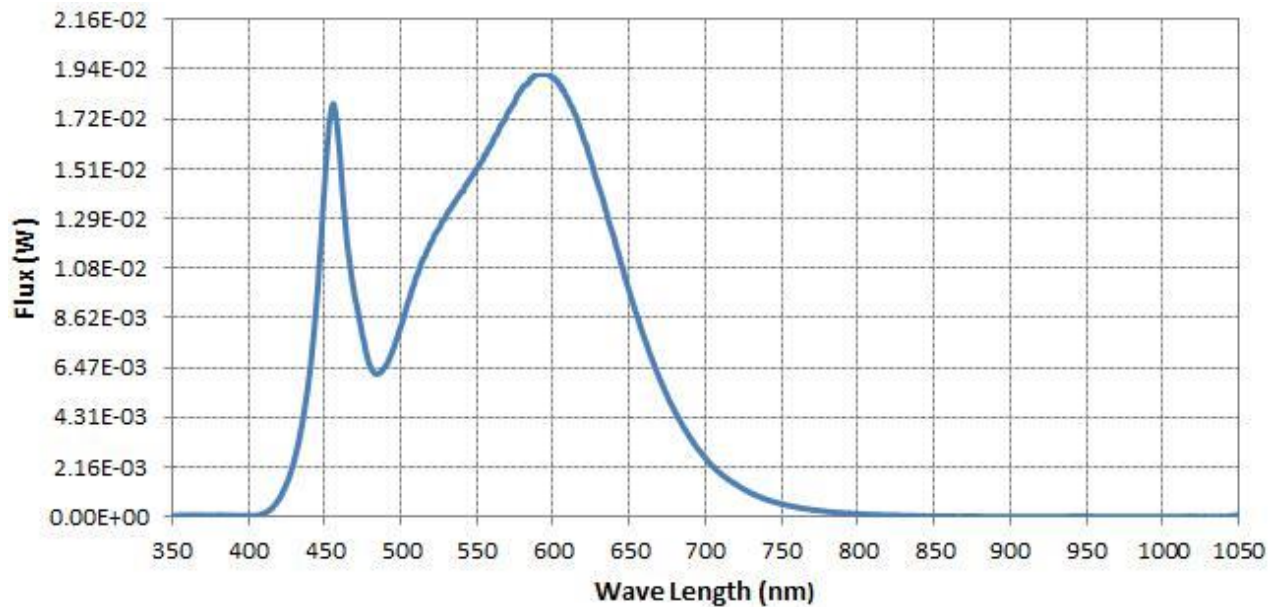
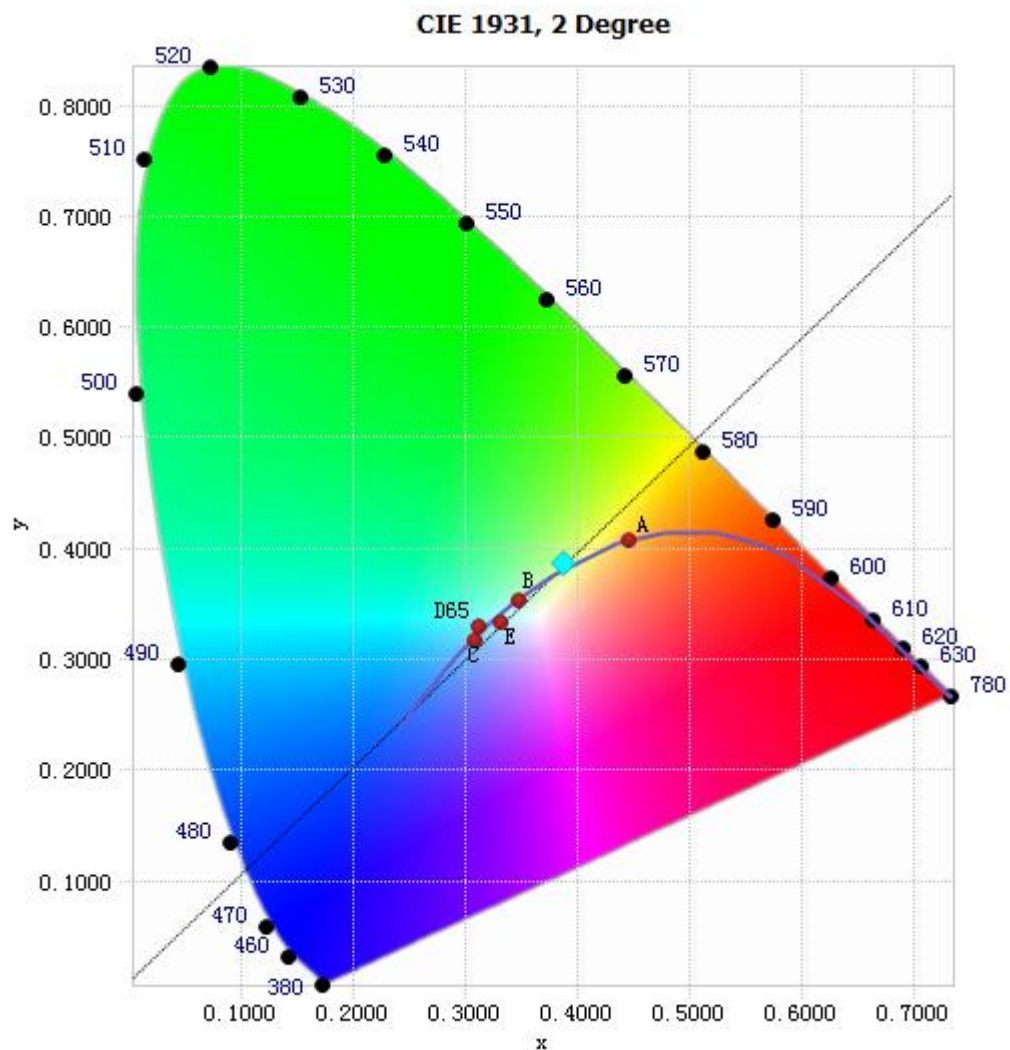


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	6.85E-05	485	6.20E-03	590	1.92E-02	695	2.94E-03
385	6.07E-05	490	6.53E-03	595	1.92E-02	700	2.54E-03
390	6.47E-05	495	7.24E-03	600	1.90E-02	705	2.18E-03
395	5.58E-05	500	8.23E-03	605	1.87E-02	710	1.87E-03
400	4.44E-05	505	9.33E-03	610	1.81E-02	715	1.62E-03
405	5.67E-05	510	1.04E-02	615	1.74E-02	720	1.41E-03
410	1.41E-04	515	1.12E-02	620	1.64E-02	725	1.20E-03
415	3.49E-04	520	1.19E-02	625	1.54E-02	730	1.03E-03
420	7.44E-04	525	1.25E-02	630	1.43E-02	735	8.77E-04
425	1.42E-03	530	1.31E-02	635	1.32E-02	740	7.52E-04
430	2.41E-03	535	1.36E-02	640	1.21E-02	745	6.46E-04
435	3.90E-03	540	1.41E-02	645	1.09E-02	750	5.58E-04
440	6.09E-03	545	1.46E-02	650	9.78E-03	755	4.80E-04
445	9.42E-03	550	1.51E-02	655	8.71E-03	760	4.18E-04
450	1.43E-02	555	1.57E-02	660	7.72E-03	765	3.57E-04
455	1.78E-02	560	1.62E-02	665	6.81E-03	770	3.11E-04
460	1.58E-02	565	1.69E-02	670	5.97E-03	775	2.69E-04
465	1.18E-02	570	1.75E-02	675	5.23E-03	780	2.30E-04
470	9.51E-03	575	1.80E-02	680	4.55E-03		
475	7.83E-03	580	1.86E-02	685	3.95E-03		
480	6.53E-03	585	1.90E-02	690	3.42E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3884, 0.3863)

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

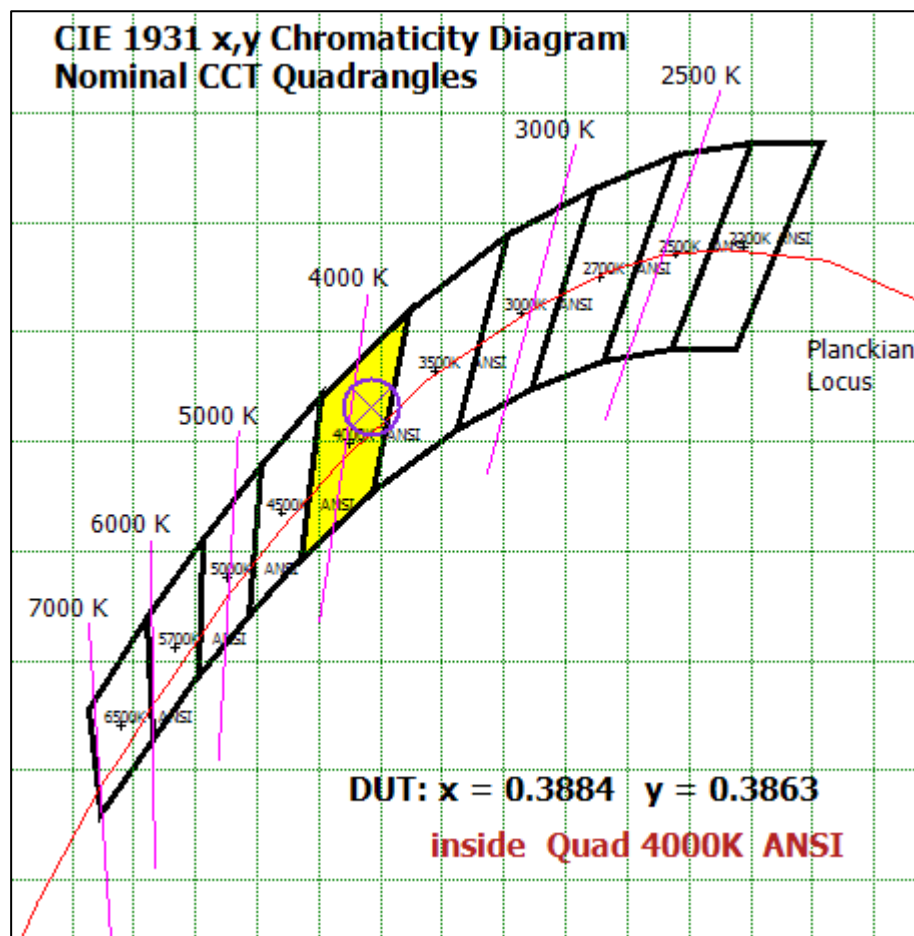
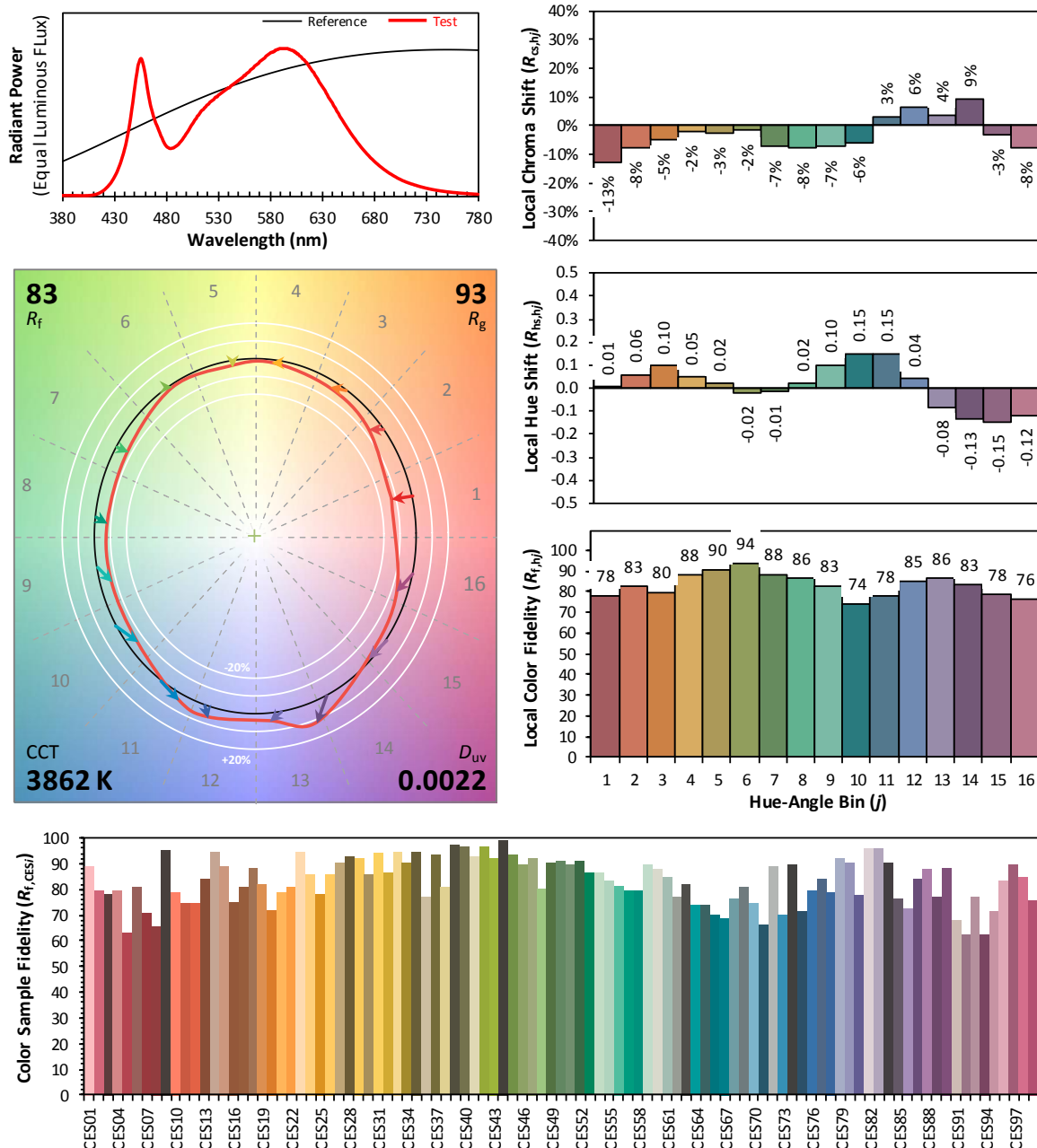


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method



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

x 0.3885
 y 0.3863
 u' 0.2265
 v' 0.5069

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	323.088	29.25%
10- 20	357.234	32.35%
20- 30	198.556	17.98%
30- 40	102.386	9.27%
40- 50	48.265	4.37%
50- 60	31.431	2.85%
60- 70	22.941	2.08%
70- 80	13.301	1.20%
80- 90	4.922	0.45%
90-100	0.806	0.07%
100-110	0.025	0.00%
110-120	0.021	0.00%
120-130	0.052	0.00%
130-140	0.15	0.01%
140-150	0.341	0.03%
150-160	0.454	0.04%
160-170	0.344	0.03%
170-180	0.11	0.01%
Total	1104.4	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	1060.96	96.06%
60- 90	41.164	3.73%
0-90	1102.124	99.79%
90- 180	2.303	0.21%
0- 180	1104.4	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

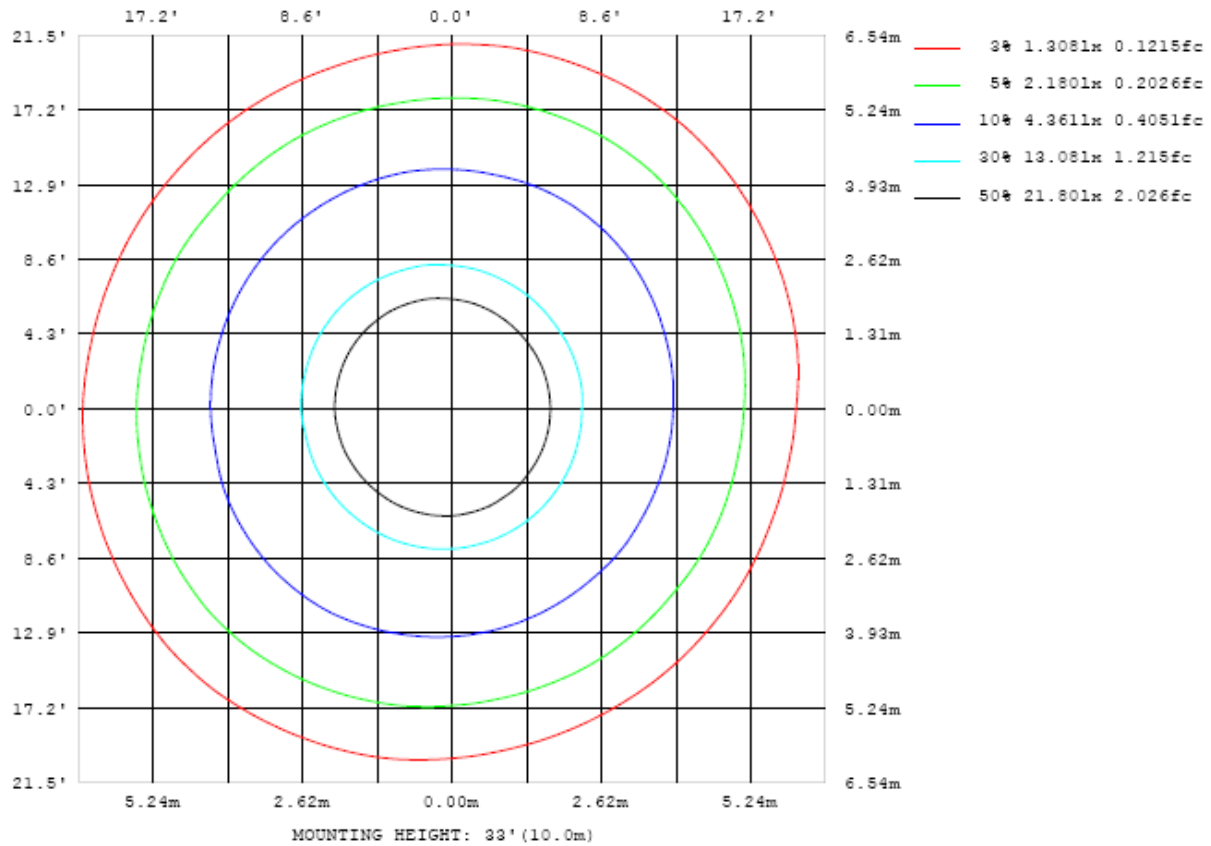


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

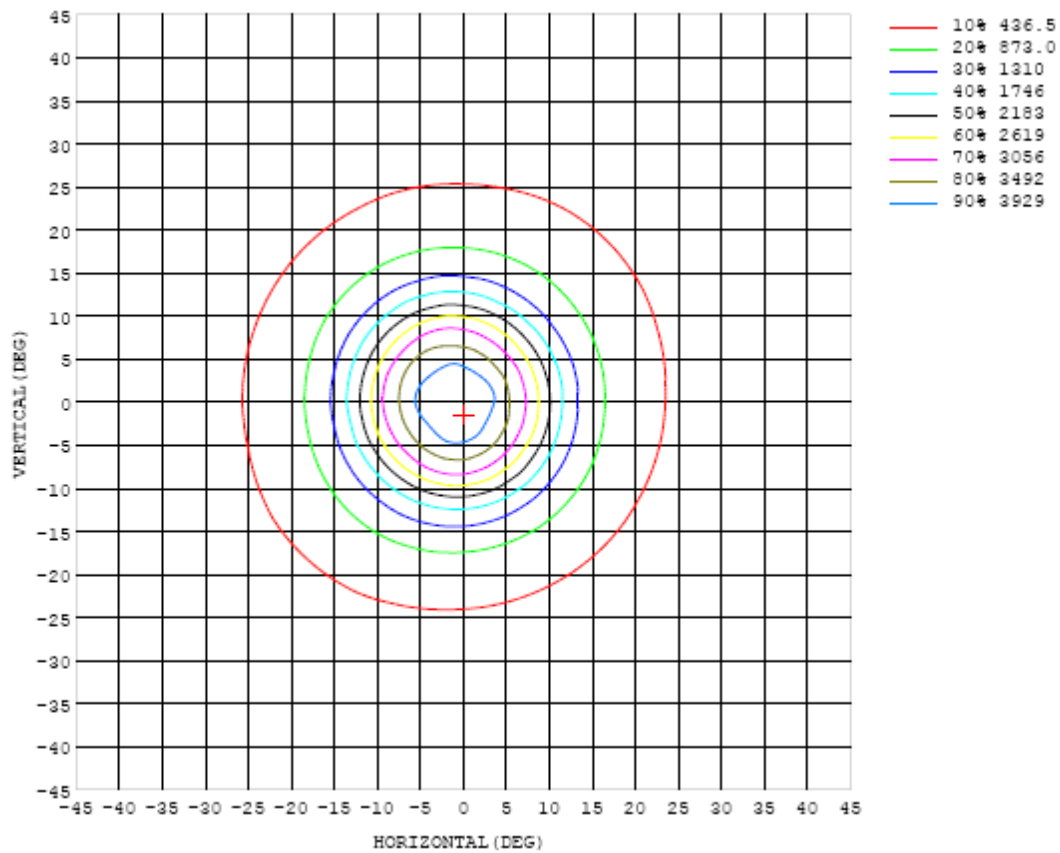


Chart 6: Isocandela Plot

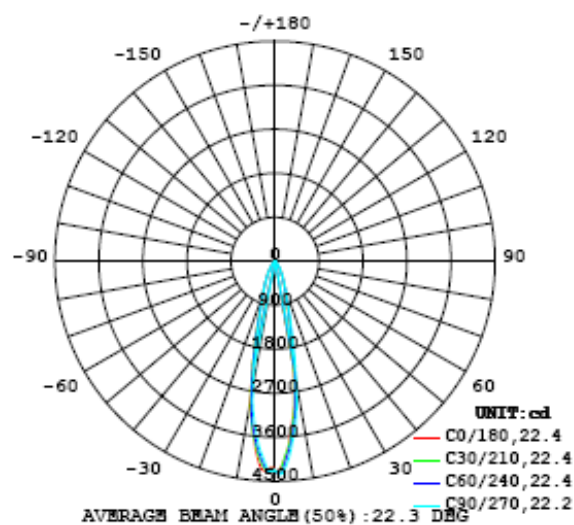


Chart 7: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1

UNIT: cd

C (DEG) γ (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	4281	4281	4281	4281	4281	4281	4281	4281	4281	4281	4281	4281	4281	4281	4281	4281	4281	4281	4281
5	3579	3589	3614	3645	3652	3694	3734	3779	3806	3838	3890	3921	3909	3893	3895	3903	3947	4013	4059
10	2210	2211	2224	2239	2264	2327	2343	2409	2440	2505	2544	2587	2632	2675	2727	2767	2806	2848	2876
15	1040	1043	1052	1066	1083	1104	1123	1147	1173	1203	1233	1264	1290	1305	1329	1344	1360	1366	1417
20	606	601	598	599	610	604	618	628	637	658	670	692	707	728	736	736	734	731	739
25	378	372	369	367	364	368	373	377	386	397	409	424	443	451	460	466	463	460	465
30	232	225	222	221	220	222	224	227	233	244	256	267	278	290	298	299	298	297	295
35	140	134	128	125	127	128	127	132	140	147	155	164	170	175	180	182	182	181	180
40	83.9	79.9	76.4	74.0	72.9	73.9	76.1	79.7	84.2	89.4	93.7	99.4	103	104	107	110	110	107	107
45	55.1	53.4	51.0	49.3	48.4	49.0	50.8	53.3	55.9	58.6	60.8	63.1	64.8	66.5	67.0	67.9	67.6	66.9	66.4
50	40.8	40.1	38.9	38.2	37.9	38.1	38.9	40.1	41.9	43.0	43.5	44.4	45.6	46.0	46.4	46.9	46.5	46.2	46.4
55	33.1	32.8	32.0	31.8	31.8	32.1	32.3	33.2	34.4	35.1	35.4	36.1	37.0	37.1	37.3	37.4	37.1	37.0	37.2
60	26.9	26.9	26.5	26.4	26.4	26.5	26.7	27.1	27.9	28.4	28.7	29.2	29.8	29.9	30.1	30.3	30.1	30.0	30.2
65	21.6	21.5	21.4	21.4	21.6	21.8	21.9	22.2	22.7	23.2	23.6	24.0	24.4	24.5	24.7	24.8	24.7	24.7	24.7
70	16.4	16.3	16.4	16.5	16.7	16.9	17.0	17.3	17.7	18.0	18.3	18.6	18.9	18.9	19.0	19.1	19.1	19.0	19.0
75	11.3	11.3	11.4	11.6	11.8	12.0	12.2	12.5	12.7	13.0	13.2	13.4	13.5	13.5	13.5	13.6	13.6	13.6	13.5
80	6.81	6.81	6.89	7.01	7.23	7.44	7.58	7.78	7.96	8.14	8.24	8.35	8.40	8.33	8.32	8.36	8.36	8.35	8.30
85	3.71	3.72	3.74	3.86	3.99	4.14	4.25	4.38	4.51	4.68	4.79	4.93	4.99	4.93	4.93	4.97	4.97	4.97	4.98
90	1.43	1.44	1.46	1.50	1.57	1.64	1.70	1.76	1.82	1.89	1.94	2.02	2.08	2.08	2.12	2.15	2.17	2.17	2.20
95	0.46	0.46	0.46	0.48	0.50	0.52	0.55	0.59	0.62	0.66	0.70	0.75	0.78	0.79	0.81	0.82	0.83	0.83	0.83
100	0.04	0.04	0.04	0.05	0.05	0.06	0.06	0.07	0.08	0.09	0.10	0.12	0.13	0.14	0.15	0.16	0.17	0.17	0.17
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	0.05	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	0.04	0.06
130	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.07	0.11
135	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.14	0.14	0.14	0.14	0.14	0.13	0.13	0.13	0.21
140	0.27	0.27	0.27	0.27	0.27	0.27	0.26	0.26	0.26	0.26	0.25	0.25	0.25	0.24	0.24	0.23	0.23	0.23	0.38
145	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.40	0.40	0.39	0.39	0.39	0.38	0.37	0.37	0.36	0.36	0.64
150	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.56	0.56	0.56	0.55	0.55	0.54	0.53	0.53	0.52	0.52	0.95
155	0.72	0.72	0.72	0.72	0.72	0.73	0.72	0.72	0.72	0.72	0.72	0.71	0.71	0.70	0.70	0.69	0.69	0.68	1.24
160	0.84	0.84	0.84	0.85	0.85	0.85	0.85	0.85	0.85	0.84	0.84	0.84	0.84	0.83	0.83	0.82	0.82	0.81	1.45
165	0.93	0.93	0.93	0.94	0.94	0.94	0.94	0.93	0.93	0.93	0.93	0.92	0.92	0.92	0.92	0.91	0.91	0.91	1.52
170	0.98	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.98	0.99	0.98	0.98	0.98	0.98	0.97	1.45
175	0.99	0.99	0.99	0.99	0.99	1.00	1.00	1.00	1.01	1.01	1.01	1.01	1.01	1.01	1.00	1.01	1.00	1.00	1.24
180	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98

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	4281	4281	4281	4281	4281	4281	4281	4281	4281	4281	4281	4281	4281	4281	4281	4281	4281		
5	4059	4017	3963	3916	3902	3881	3883	3843	3790	3748	3704	3668	3622	3603	3609	3584	3571		
10	2878	2869	2848	2824	2803	2771	2729	2674	2584	2533	2449	2381	2317	2270	2243	2216	2208		
15	1411	1418	1421	1408	1390	1349	1309	1285	1239	1207	1172	1136	1107	1085	1067	1059	1047		
20	744	748	756	753	750	744	734	726	714	701	693	684	673	657	640	625	614		
25	467	465	464	462	461	457	459	457	451	446	447	443	435	425	415	401	391		
30	289	289	288	282	282	282	277	276	280	282	282	282	281	273	263	256	246		
35	176	171	169	168	166	164	165	168	172	175	176	175	173	169	164	158	149		
40	103	98.8	95.9	94.7	93.9	93.9	96.4	100	103	104	107	105	103	101	99.0	94.3	89.7		
45	64.5	61.8	59.3	57.3	57.4	59.2	61.1	63.4	64.6	65.1	65.5	65.5	64.7	63.2	60.7	58.5	56.8		
50	45.8	44.1	42.9	42.1	42.1	42.7	43.8	45.0	45.1	45.0	45.4	45.5	45.0	44.3	43.2	41.9	41.2		
55	36.7	35.6	35.2	34.9	35.0	35.2	35.7	36.5	36.4	36.2	36.4	36.3	35.9	35.3	34.5	33.8	33.5		
60	29.7	29.0	28.7	28.5	28.5	28.4	28.7	28.9	29.0	29.1	29.1	29.0	28.8	28.4	27.8	27.5	27.4		
65	24.3	23.8	23.7	23.5	23.5	23.4	23.4	23.4	23.6	23.6	23.5	23.4	23.1	22.8	22.4	22.2	22.0		
70	18.8	18.4	18.3	18.2	18.2	18.1	18.1	18.0	18.0	18.0	17.9	17.7	17.4	17.2	16.9	16.8	16.7		
75	13.4	13.1	13.0	13.0	12.9	12.8	12.7	12.6	12.6	12.4	12.3	12.1	11.9	11.7	11.6	11.5	11.4		
80	8.18	8.00	7.94	7.92	7.91	7.83	7.75	7.68	7.57	7.46	7.36	7.25	7.13	7.01	6.94	6.89	6.86		
85	4.90	4.79	4.71	4.67	4.64	4.58	4.52	4.43	4.32	4.22	4.15	4.08	4.01	3.92	3.85	3.80	3.77		
90	2.16	2.10	2.05	2.00	1.96	1.88	1.81	1.74	1.66	1.61	1.58	1.55	1.52	1.50	1.48	1.46	1.46		
95	0.81	0.78	0.76	0.74	0.72	0.69	0.67	0.64	0.61	0.59	0.56	0.54	0.53	0.51	0.50	0.49	0.49		
100	0.17	0.17	0.15	0.14	0.13	0.11	0.10	0.09	0.08	0.08	0.07	0.07	0.07	0.06	0.06	0.05	0.05		
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	0.01	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	0.03	0.02	0.03	0.03		
120	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04		
125	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.07	0.07	0.07		
130	0.11	0.11	0.10	0.10	0.11	0.11	0.11	0.11	0.12	0.12	0.12	0.13	0.13	0.13	0.13	0.14	0.13		
135	0.21	0.21	0.21	0.21	0.21	0.21	0.22	0.22	0.23	0.24	0.24	0.25	0.25	0.25	0.26	0.26	0.26		
140	0.38	0.38	0.38	0.39	0.39	0.40	0.40	0.41	0.42	0.43	0.44	0.45	0.46	0.46	0.47	0.47	0.48		
145	0.64	0.64	0.65	0.65	0.66	0.67	0.68	0.69	0.70	0.71	0.73	0.74	0.75	0.76	0.76	0.77	0.77		
150	0.95	0.95	0.96	0.96	0.97	0.98	0.99	1.01	1.02	1.03	1.04	1.05	1.06	1.07	1.08	1.09	1.09		
155	1.24	1.24	1.25	1.25	1.26	1.26	1.27	1.29	1.30	1.31	1.32	1.33	1.33	1.34	1.35	1.35	1.35		
160	1.45	1.45	1.46	1.46	1.47	1.47	1.47	1.48	1.49	1.49	1.50	1.50	1.50	1.51	1.51	1.51	1.51		
165	1.53	1.53	1.53	1.53	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.53	1.53	1.53	1.53		
170	1.47	1.47	1.47	1.47	1.47	1.47	1.47	1.47	1.47	1.46	1.46	1.45	1.44	1.44	1.44	1.43	1.43		
175	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.24	1.23	1.23	1.22	1.21	1.20	1.19	1.19	1.18	1.17		
180	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98		

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

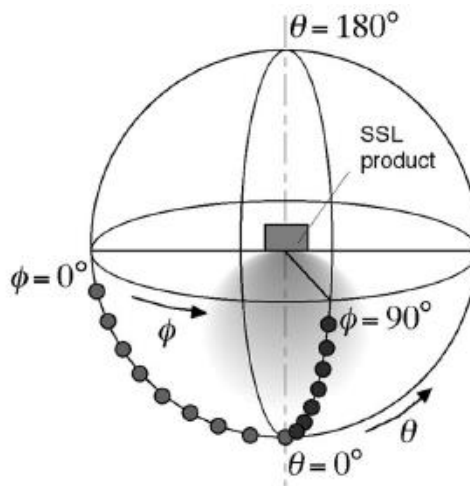
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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