LM-79-08 TEST REPORT

for

GREEN CREATIVE LTD

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

LED Lamp

Model: 15.5PAR38/930FL40/277V

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ19050046ap

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

Review by: April Zou

Engineer: April Zou
Jul. 05, 2019

Approved by: Jim Zhang

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: **15.5PAR38/930FL40/277V**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
92.0	1400.0	15.22	0.9920

CCT (K)	CRI	Stabilization Time (Light & Power)
3097	97.9	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 : Jul. 01, 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	: 15.5PAR38/930FL40/277V
Electrical Ratings	: 120-277V, 60Hz, 15.5W
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 ℃.

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	277.0
Voltage frequency (Hz)	60	60
Test Current (A)	0.128	0.062
Power Factor	0.9920	0.9371
Test Power (W)	15.22	16.06
THD A%	10.77	17.92
Luminous Efficacy (lm/W)	92.0	87.2
Total Luminous Flux (lm)	1400.0	1400.3
Color Rendering Index (CRI)	97.9	
R9	89.9	
Correlated Color Temperature (CCT)(K)	3097	
Chromaticity Chroma x	0.4282	
Chromaticity Chroma y	0.3976	
Chromaticity Chroma u	0.2477	
Chromaticity Chroma v	0.3450	
Duv	-0.0014	
Chromaticity Chroma u ’	0.2477	
Chromaticity Chroma v’	0.5175	

Special Color Rendering Indices	
R1	99.2
R2	99.5
R3	98.1
R4	98.8
R5	98.5
R6	97.1
R7	96.7
R8	95.1
R9	89.9
R10	98.6
R11	98.5
R12	84.6
R13	99.5
R14	98

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 25.5 ℃.

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)	0.129
Power Factor	0.9924
Power (W)	15.34
Luminous Efficacy (lm/W)	92.9
Total Luminous Flux (lm)	1424.5
Beam Angle (°)	38.4 (0^o-180^o) / 37.9 (90^o-270^o)
Center Beam Candle Power (cd)	2747
Maximum Beam Candle Power (cd)	2792 (At: C=270.0, Gamma=2.5)
Spacing Criteria	0.64 (0^o-180^o) / 0.61 (90^o-270^o)
Zonal Lumens in the 0 °-60 °Zone	96.94%
Zonal Lumens in the 60 °-90 °Zone	2.92%
Zonal Lumens in the 90 °-120 °Zone	0.01%
Zonal Lumens in the 120 °-180 °Zone	0.13%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

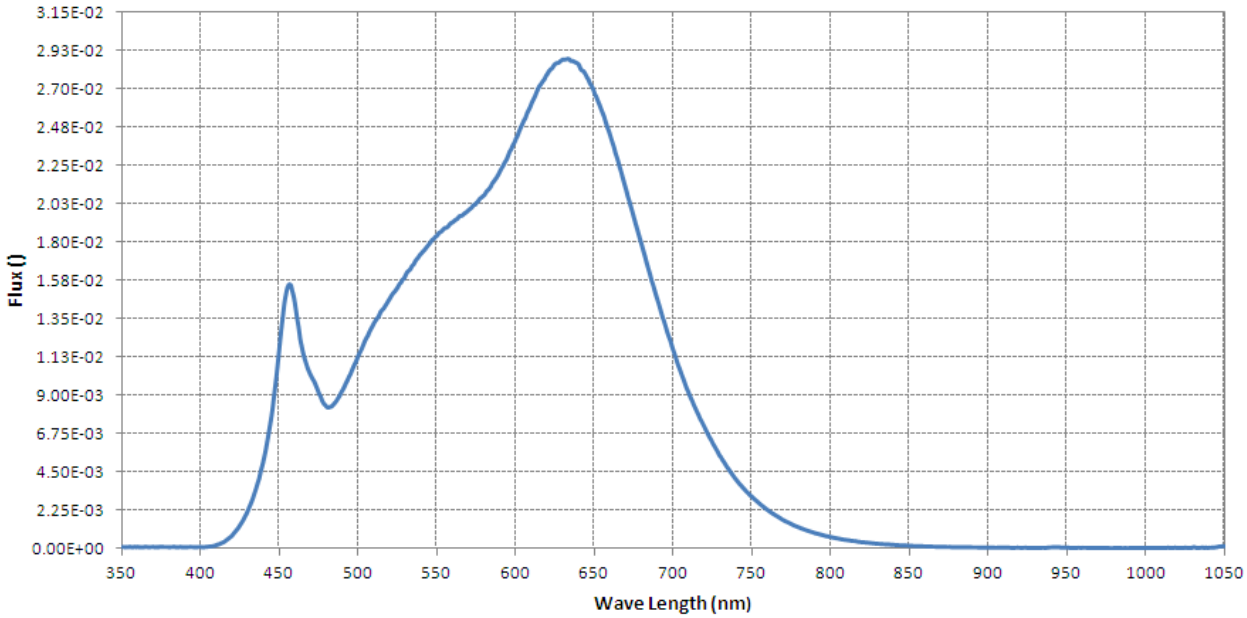
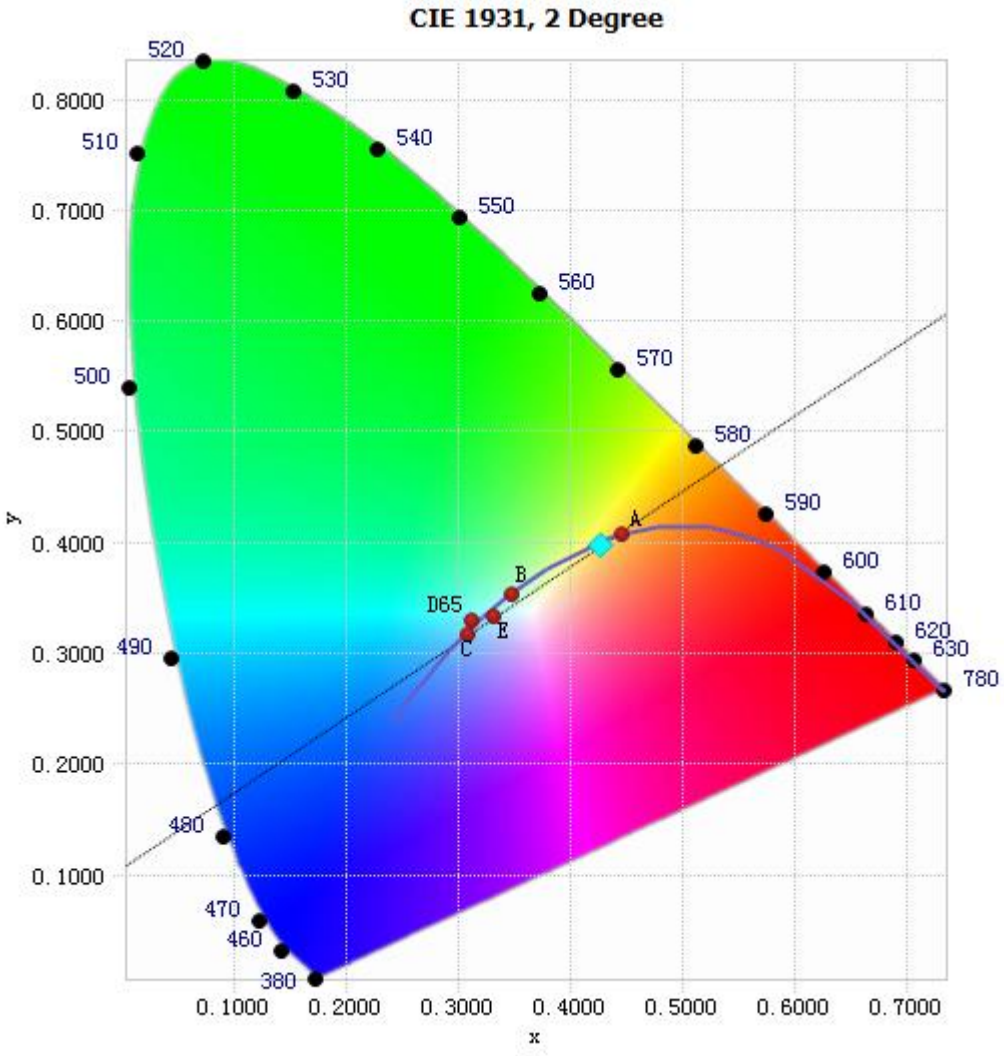


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	6.35E-05	485	8.55E-03	590	2.22E-02	695	1.30E-02
385	5.59E-05	490	9.30E-03	595	2.31E-02	700	1.16E-02
390	6.05E-05	495	1.03E-02	600	2.41E-02	705	1.03E-02
395	6.59E-05	500	1.13E-02	605	2.52E-02	710	9.06E-03
400	7.44E-05	505	1.24E-02	610	2.62E-02	715	8.01E-03
405	9.37E-05	510	1.33E-02	615	2.72E-02	720	7.06E-03
410	1.95E-04	515	1.40E-02	620	2.79E-02	725	6.16E-03
415	3.86E-04	520	1.47E-02	625	2.85E-02	730	5.38E-03
420	7.65E-04	525	1.54E-02	630	2.88E-02	735	4.65E-03
425	1.38E-03	530	1.61E-02	635	2.87E-02	740	4.01E-03
430	2.25E-03	535	1.67E-02	640	2.84E-02	745	3.48E-03
435	3.50E-03	540	1.73E-02	645	2.77E-02	750	3.01E-03
440	5.27E-03	545	1.79E-02	650	2.67E-02	755	2.59E-03
445	7.89E-03	550	1.84E-02	655	2.56E-02	760	2.23E-03
450	1.19E-02	555	1.88E-02	660	2.42E-02	765	1.92E-03
455	1.53E-02	560	1.92E-02	665	2.27E-02	770	1.64E-03
460	1.42E-02	565	1.96E-02	670	2.11E-02	775	1.41E-03
465	1.14E-02	570	1.99E-02	675	1.94E-02	780	1.21E-03
470	1.01E-02	575	2.03E-02	680	1.78E-02		
475	9.10E-03	580	2.08E-02	685	1.61E-02		
480	8.30E-03	585	2.15E-02	690	1.46E-02		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4282, 0.3976)

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

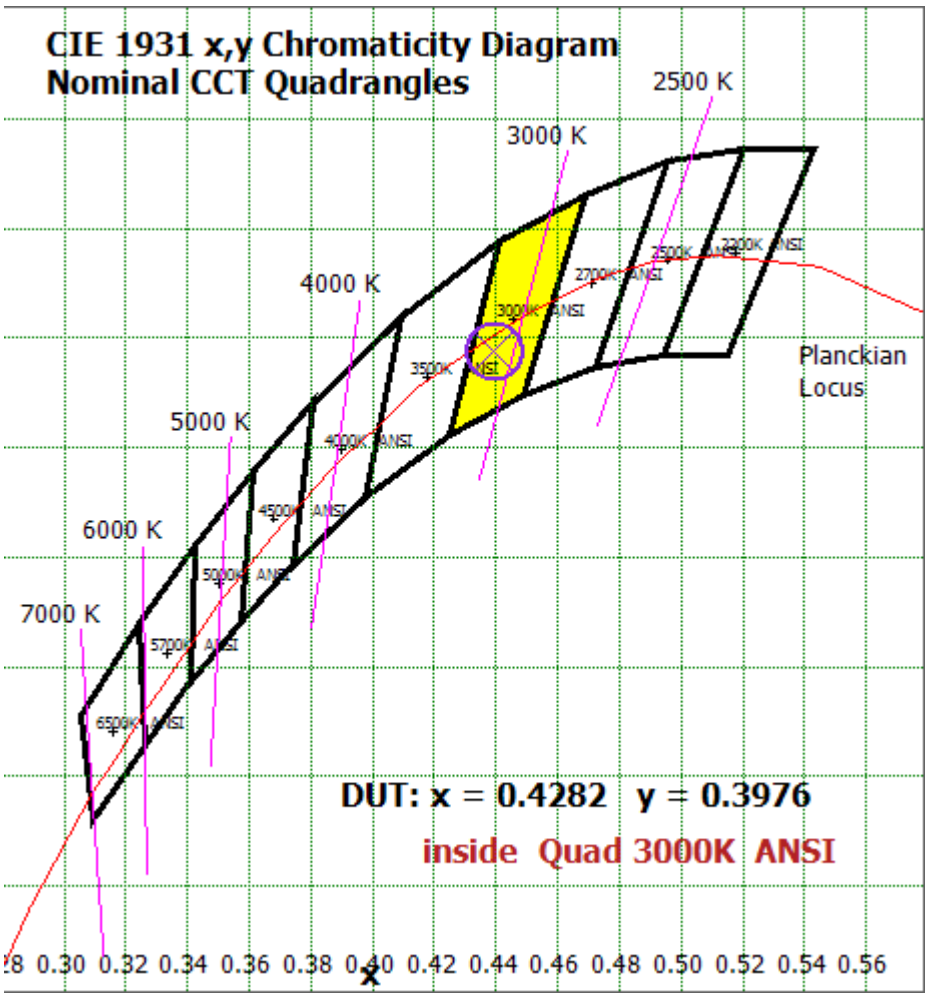
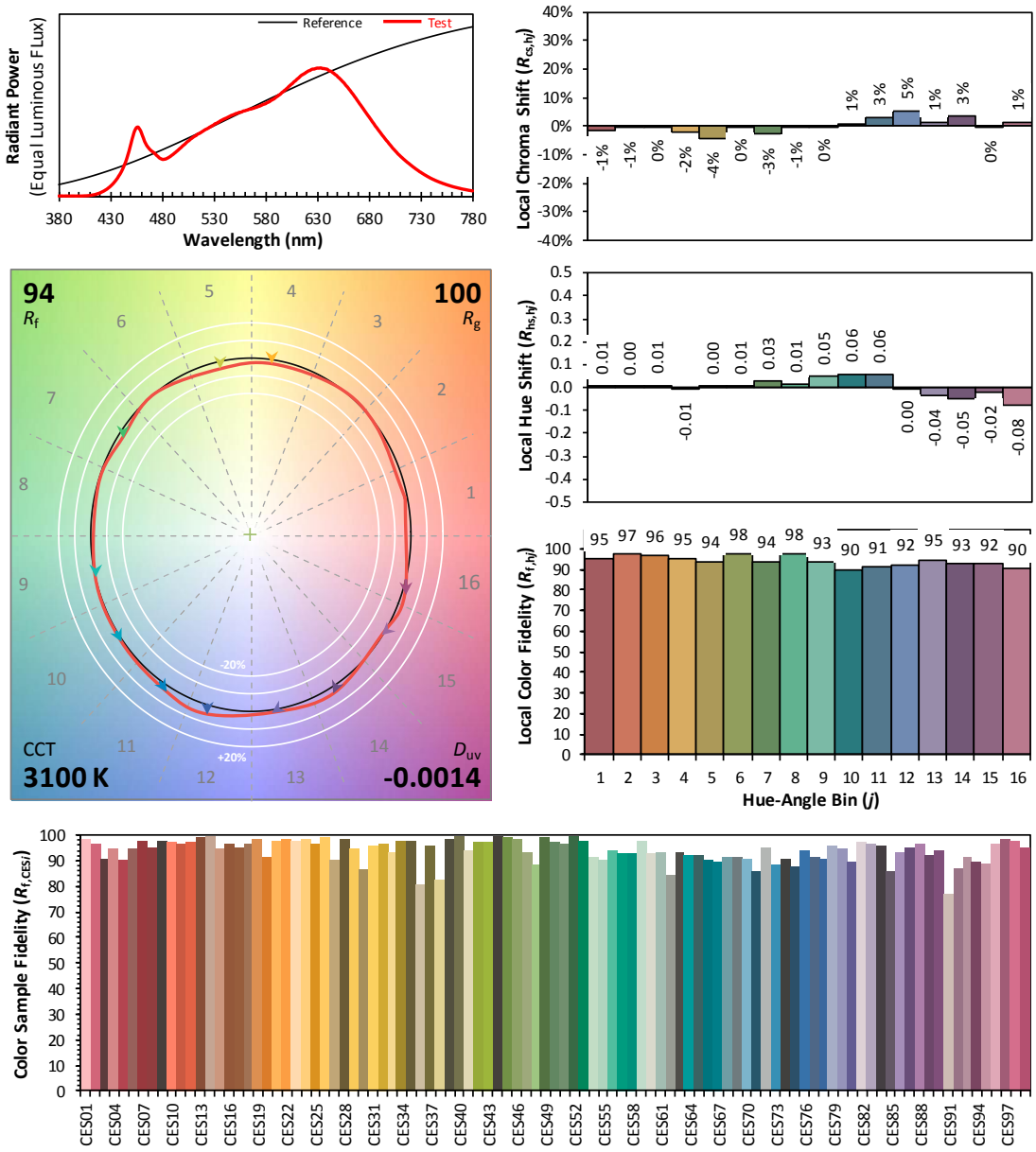


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method



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

x	0.4282
y	0.3976
u'	0.2477
v'	0.5175

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

γ(°)	Lumens	% Total
0- 10	244.159	17.14%
10- 20	508.452	35.69%
20- 30	360.805	25.33%
30- 40	160.404	11.26%
40- 50	68.616	4.82%
50- 60	38.572	2.71%
60- 70	25.132	1.76%
70- 80	13.145	0.92%
80- 90	3.343	0.23%
90-100	0.044	0.00%
100-110	0.017	0.00%
110-120	0.032	0.00%
120-130	0.085	0.01%
130-140	0.244	0.02%
140-150	0.444	0.03%
150-160	0.519	0.04%
160-170	0.402	0.03%
170-180	0.135	0.01%
Total	1424.6	100%

γ(°)	Lumens	% Total
0- 60	1381.008	96.94%
60- 90	41.62	2.92%
0-90	1422.628	99.87%
90- 180	1.922	0.13%
0- 180	1424.6	100%

Table 5: Zonal Lumen

Note: The Flux in this table might be a little different from the total flux in Table 2 due to rounding.

Illuminance Plots- Goniophotometer Method

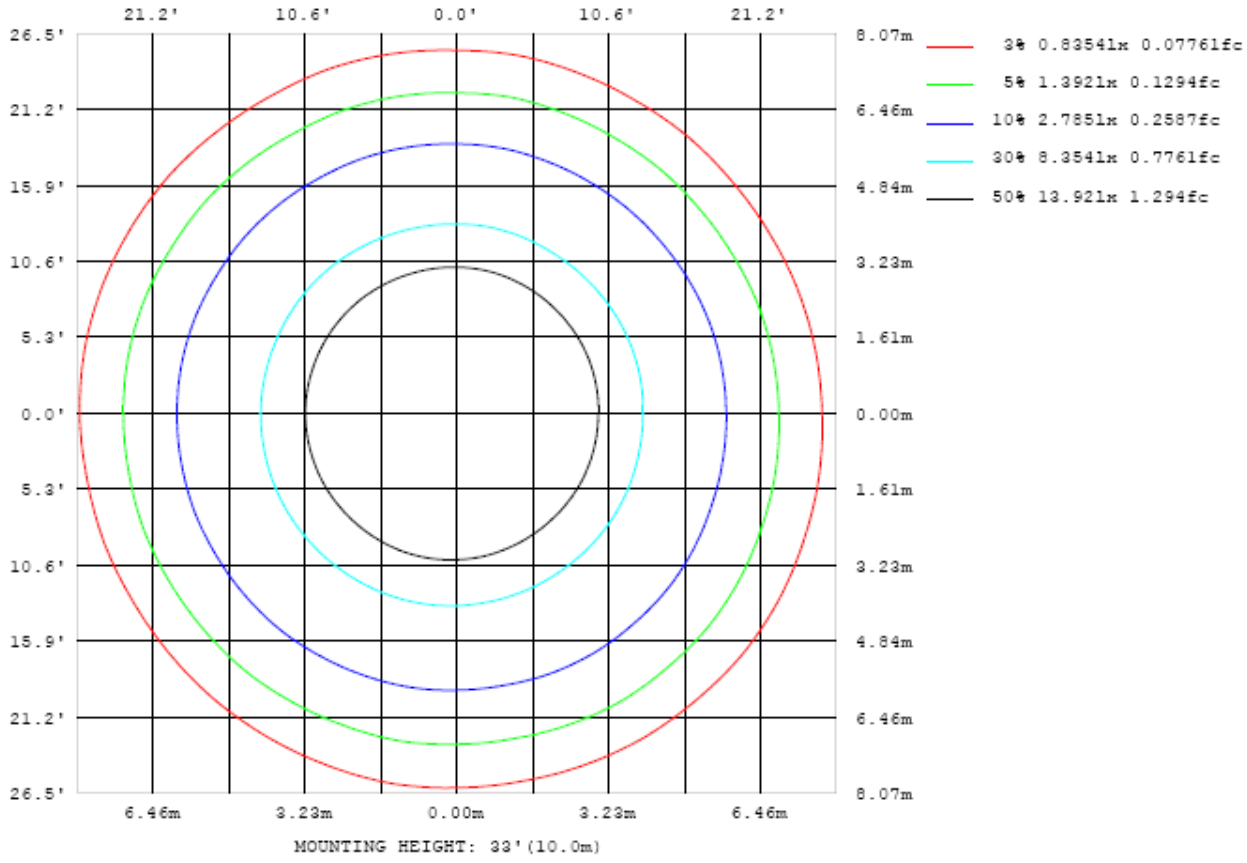


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

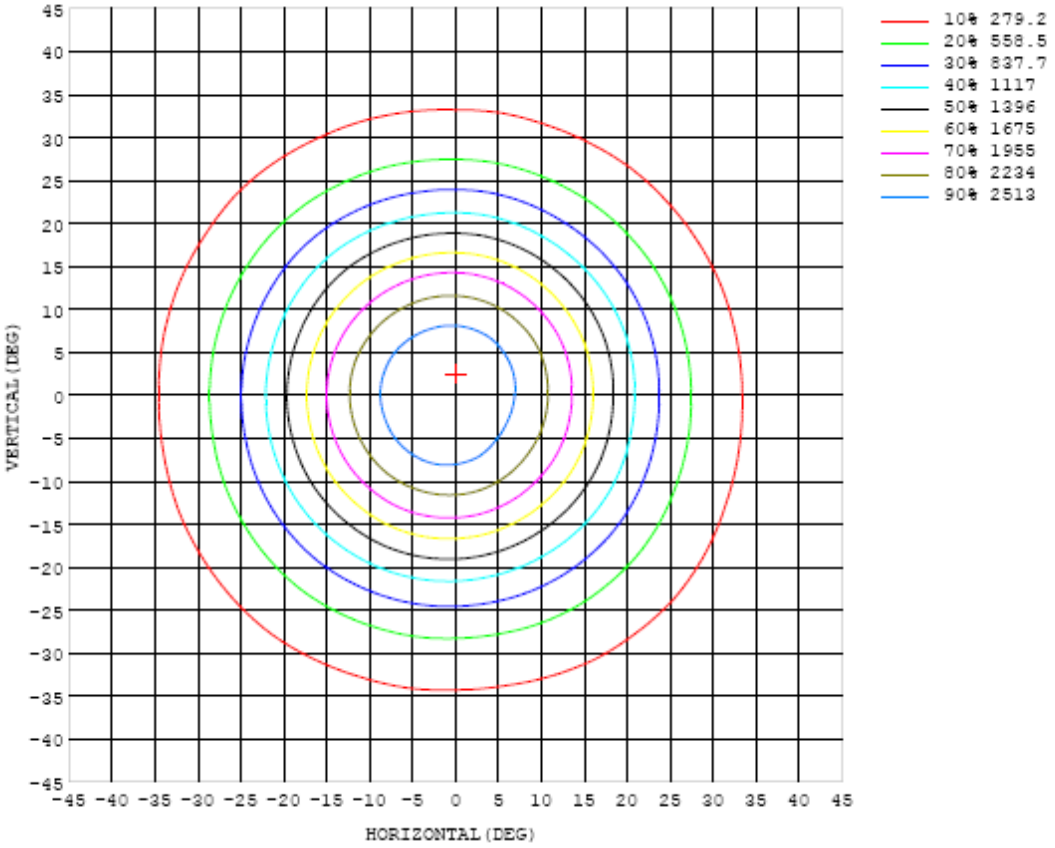


Chart 6: Isocandela Plot

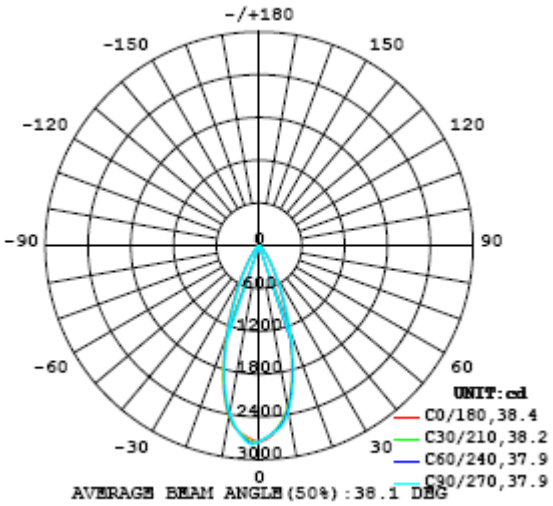


Chart 7: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1 UNIT: cd

γ (DEG) \ C (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	2747	2747	2747	2747	2747	2747	2747	2747	2747	2747	2747	2747	2747	2747	2747	2747	2747	2747	2747
5	2618	2605	2600	2599	2597	2598	2605	2611	2615	2618	2625	2627	2628	2633	2636	2638	2642	2647	2655
10	2298	2296	2297	2300	2306	2317	2332	2349	2363	2375	2388	2399	2408	2416	2423	2427	2426	2429	2435
15	1791	1790	1794	1798	1800	1807	1821	1837	1854	1871	1884	1900	1910	1918	1930	1940	1947	1955	1958
20	1208	1208	1217	1224	1227	1232	1241	1255	1270	1289	1304	1314	1321	1327	1337	1347	1352	1355	1357
25	730	734	740	753	759	765	775	783	788	799	809	814	820	828	831	835	837	835	835
30	416	421	425	436	444	446	454	457	454	459	466	467	470	475	475	476	480	479	479
35	232	238	241	249	255	255	259	258	255	258	263	261	262	266	265	266	269	267	267
40	134	138	141	145	147	147	148	147	146	147	150	148	148	147	147	147	150	150	151
45	81.6	83.8	86.2	88.1	89.0	89.3	89.5	88.7	88.6	87.7	88.2	87.8	88.2	87.3	88.0	87.3	87.9	88.7	91.3
50	55.5	56.1	57.3	57.8	58.1	58.4	59.0	58.4	58.4	57.7	57.6	57.9	58.1	57.9	58.5	58.2	58.1	58.4	59.6
55	41.1	41.2	41.7	41.9	42.1	42.5	42.7	42.8	42.8	42.9	42.9	42.8	42.9	43.0	43.3	43.3	43.4	43.7	44.1
60	31.6	31.6	31.9	32.0	32.1	32.2	32.3	32.4	32.6	32.9	33.0	33.1	33.1	33.2	33.4	33.6	33.6	33.5	33.6
65	24.4	24.4	24.5	24.8	25.0	25.1	25.0	25.1	25.2	25.3	25.6	25.8	25.9	25.9	26.1	26.3	26.3	26.2	26.1
70	17.9	17.9	17.9	18.1	18.2	18.3	18.3	18.4	18.4	18.6	18.9	19.0	19.1	19.2	19.3	19.4	19.5	19.4	19.3
75	11.7	11.7	11.7	11.8	11.9	12.0	12.1	12.2	12.2	12.4	12.6	12.7	12.8	12.8	12.9	12.8	12.9	12.9	12.8
80	6.46	6.49	6.50	6.56	6.62	6.70	6.79	6.88	6.96	7.08	7.21	7.31	7.39	7.43	7.46	7.48	7.50	7.46	7.45
85	2.38	2.39	2.42	2.46	2.50	2.56	2.63	2.70	2.77	2.85	2.93	3.00	3.06	3.11	3.13	3.14	3.14	3.13	3.19
90	0.19	0.20	0.21	0.22	0.24	0.26	0.29	0.31	0.34	0.36	0.39	0.42	0.45	0.47	0.48	0.48	0.48	0.48	0.51
95	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
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	0.02	0.02	0.02	0.01	0.01	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02
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	0.02	0.03	0.03
120	0.05	0.05	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	0.04	0.04	0.05
125	0.08	0.08	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.06	0.06	0.07	0.07	0.07	0.07	0.10
130	0.13	0.13	0.13	0.13	0.13	0.13	0.12	0.12	0.12	0.12	0.12	0.12	0.11	0.11	0.12	0.12	0.12	0.12	0.19
135	0.24	0.24	0.24	0.23	0.23	0.23	0.23	0.22	0.22	0.22	0.22	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.36
140	0.37	0.37	0.37	0.36	0.36	0.36	0.35	0.35	0.35	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.33	0.59
145	0.52	0.52	0.52	0.51	0.51	0.51	0.51	0.50	0.50	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.47	0.84
150	0.68	0.68	0.68	0.68	0.67	0.67	0.67	0.66	0.66	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.63	1.08
155	0.86	0.86	0.86	0.86	0.85	0.85	0.85	0.84	0.84	0.84	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.81	1.28
160	1.04	1.04	1.04	1.04	1.03	1.03	1.03	1.03	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	0.99	1.44
165	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.17	1.17	1.13	1.51
170	1.22	1.23	1.23	1.23	1.23	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.21	1.44
175	1.26	1.26	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.26	1.26	1.26	1.27	1.27	1.27
180	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42

Table 6: Luminous Intensity Data

Table--2 UNIT: cd

γ (DEG) \ C (DEG)	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350		
0	2747	2747	2747	2747	2747	2747	2747	2747	2747	2747	2747	2747	2747	2747	2747	2747	2747		
5	2660	2664	2667	2674	2680	2685	2691	2695	2700	2704	2704	2696	2681	2663	2649	2639	2627		
10	2436	2432	2427	2418	2408	2400	2392	2384	2375	2367	2358	2348	2339	2331	2323	2314	2304		
15	1956	1949	1937	1924	1911	1897	1888	1879	1870	1865	1852	1839	1829	1821	1813	1806	1798		
20	1350	1342	1335	1327	1314	1295	1279	1268	1260	1253	1243	1230	1222	1220	1222	1223	1219		
25	831	823	811	802	789	774	761	749	742	739	727	718	715	717	725	731	732		
30	477	471	459	453	443	432	428	420	414	411	403	400	399	399	404	411	414		
35	267	263	255	251	243	235	234	230	224	226	220	216	217	216	219	225	228		
40	153	151	148	145	141	137	136	133	129	129	127	126	126	125	126	128	131		
45	91.6	91.4	89.6	87.9	86.4	84.7	82.8	81.2	79.9	79.2	78.4	78.7	78.7	78.0	78.2	78.6	80.4		
50	60.1	60.5	59.6	58.8	58.0	57.5	56.4	55.9	55.2	54.7	54.3	54.5	54.1	54.2	54.3	54.7	55.3		
55	44.1	44.0	43.8	43.5	42.9	42.9	42.5	42.3	41.9	41.6	41.3	41.2	41.0	41.0	41.2	41.2	41.3		
60	33.5	33.4	33.2	33.1	32.8	32.7	32.5	32.4	32.3	32.2	31.9	31.7	31.7	31.7	31.8	31.8	31.8		
65	26.0	25.9	25.8	25.8	25.6	25.5	25.3	25.3	25.3	25.1	24.9	24.8	24.7	24.7	24.8	24.8	24.6		
70	19.3	19.1	19.1	19.1	18.9	18.9	18.8	18.7	18.7	18.6	18.4	18.4	18.3	18.3	18.3	18.3	18.1		
75	12.7	12.6	12.6	12.5	12.4	12.4	12.3	12.2	12.2	12.2	12.0	12.0	11.9	11.9	11.8	11.8	11.7		
80	7.40	7.33	7.27	7.22	7.12	7.09	7.02	6.96	6.89	6.86	6.76	6.70	6.67	6.61	6.57	6.56	6.52		
85	3.16	3.12	3.08	3.01	2.96	2.91	2.85	2.80	2.73	2.67	2.62	2.57	2.54	2.51	2.47	2.46	2.45		
90	0.49	0.48	0.45	0.43	0.41	0.38	0.36	0.35	0.33	0.31	0.29	0.27	0.26	0.24	0.23	0.22	0.21		
95	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		
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	0.02	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		
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	0.03	0.03	0.03	0.04	0.03	0.04	0.04	0.03	0.03	0.04	0.04	0.04	0.03	0.04	0.04	0.03	0.03		
120	0.05	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06		
125	0.10	0.10	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11		
130	0.20	0.21	0.21	0.21	0.21	0.22	0.22	0.22	0.22	0.22	0.23	0.23	0.23	0.23	0.23	0.22	0.22		
135	0.38	0.39	0.39	0.39	0.40	0.40	0.41	0.41	0.41	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.41		
140	0.62	0.63	0.63	0.63	0.64	0.65	0.65	0.66	0.66	0.67	0.67	0.67	0.68	0.68	0.68	0.68	0.65		
145	0.90	0.90	0.90	0.91	0.92	0.92	0.93	0.94	0.94	0.95	0.95	0.96	0.96	0.96	0.96	0.97	0.92		
150	1.18	1.17	1.18	1.18	1.19	1.20	1.20	1.21	1.22	1.22	1.23	1.23	1.23	1.24	1.24	1.26	1.18		
155	1.42	1.41	1.41	1.41	1.42	1.43	1.43	1.44	1.44	1.45	1.45	1.46	1.46	1.46	1.47	1.49	1.39		
160	1.62	1.60	1.60	1.61	1.61	1.62	1.63	1.63	1.64	1.64	1.64	1.64	1.65	1.65	1.65	1.67	1.54		
165	1.74	1.72	1.73	1.73	1.73	1.74	1.74	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.77	1.60		
170	1.74	1.72	1.72	1.71	1.71	1.71	1.71	1.71	1.72	1.72	1.72	1.72	1.72	1.72	1.72	1.75	1.50		
175	1.49	1.53	1.52	1.52	1.52	1.52	1.52	1.52	1.52	1.52	1.51	1.51	1.51	1.51	1.52	1.49	1.26		
180	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42		

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.

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The uncertainty of integrating sphere system reported in this document is expended 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 expended uncertainty is 2.3% with a coverage factor k=2.

Color Characteristics Measurements

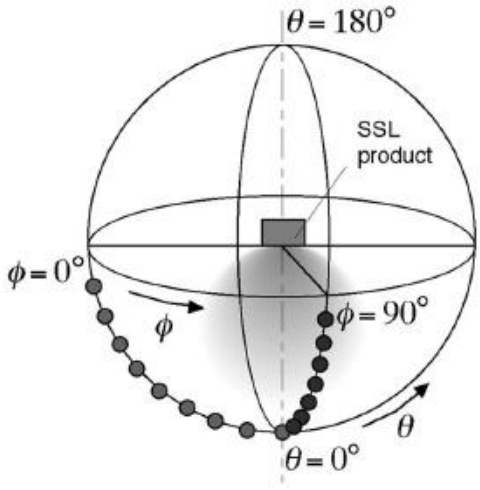
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as 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 °/180 ° and C=90 °/270 °) 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, Δu'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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