LM-79-08 TEST REPORT

for

GREEN CREATIVE LTD

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

LED Lamp

Model: 19.5PAR38HO/940FL40/277V

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ19060039j

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

Review by: April Zou

Engineer: April Zou
Sep. 18, 2019

Approved by: Jim Zhang

Manager: Jim Zhang
Sep. 18, 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: **19.5PAR38HO/940FL40/277V**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
107.0	2048.7	19.15	0.9940

CCT (K)	CRI	Stabilization Time (Light & Power)
3864	93.2	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 : Jun. 20, 2019

Date of Test : Jul. 12, 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

SAMPLE PHOTO

Figure 1- Overview of the sample

Equipment Under Test(EUT)	
Name	: LED Lamp
Model	: 19.5PAR38HO/940FL40/277V
Electrical Ratings	: 120-277V, 60Hz, 19.5W
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 ℃.

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)	0.161	0.080
Power Factor	0.9940	0.9205
Test Power (W)	19.15	20.50
THD A%	10.37	21.06
Luminous Efficacy (lm/W)	107.0	104.6
Total Luminous Flux (lm)	2048.7	2143.5
Color Rendering Index (CRI)	93.2	
R9	65.4	
Correlated Color Temperature (CCT)(K)	3864	
Chromaticity Chroma x	0.3864	
Chromaticity Chroma y	0.3799	
Chromaticity Chroma u	0.2277	
Chromaticity Chroma v	0.3359	
Duv	0.0002	
Chromaticity Chroma u ’	0.2277	
Chromaticity Chroma v’	0.5039	

Special Color Rendering Indices	
R1	93.4
R2	96.9
R3	97.9
R4	91.9
R5	92.4
R6	94.2
R7	93.4
R8	85.4
R9	65.4
R10	91.3
R11	92
R12	74.8
R13	94.7
R14	98.8

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 25.2 ℃.

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)	0.161
Power Factor	0.9939
Power (W)	19.22
Luminous Efficacy (lm/W)	111.6
Total Luminous Flux (lm)	2144.5
Beam Angle (°)	36.1 (0^o-180^o) / 35.8 (90^o-270^o)
Center Beam Candle Power (cd)	4108
Maximum Beam Candle Power (cd)	4126 (At: C=160.0, Gamma=1.0)
Spacing Criteria	0.62 (0^o-180^o) / 0.57 (90^o-270^o)
Zonal Lumens in the 0 °-60 °Zone	96.55%
Zonal Lumens in the 60 °-90 °Zone	3.31%
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

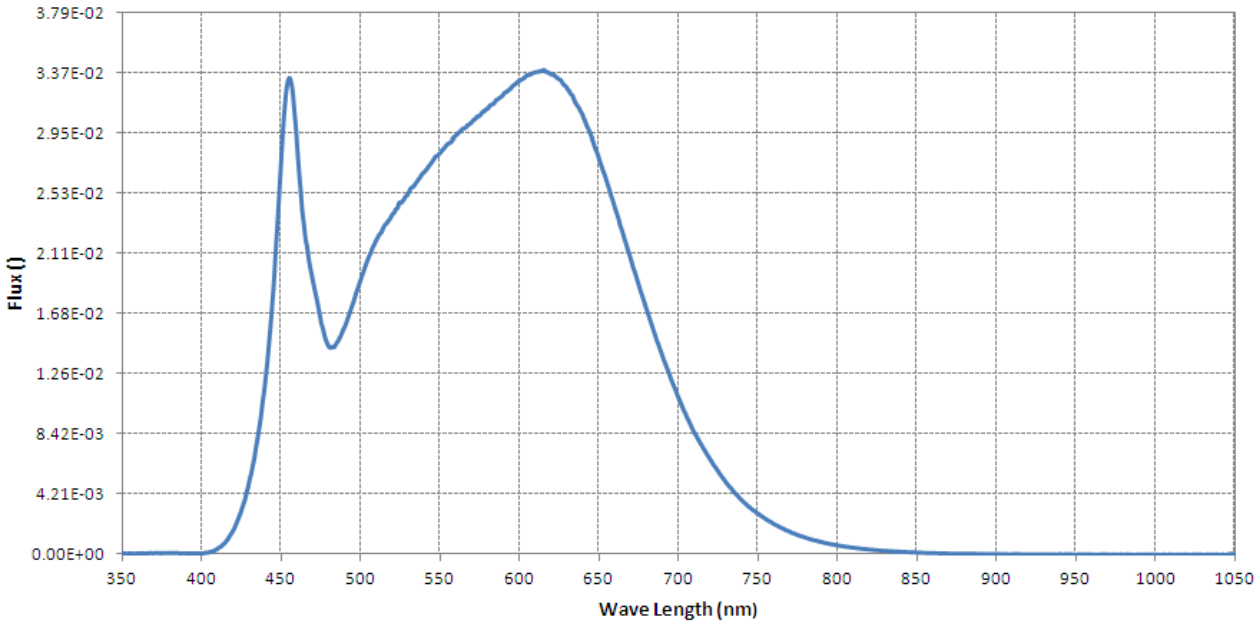
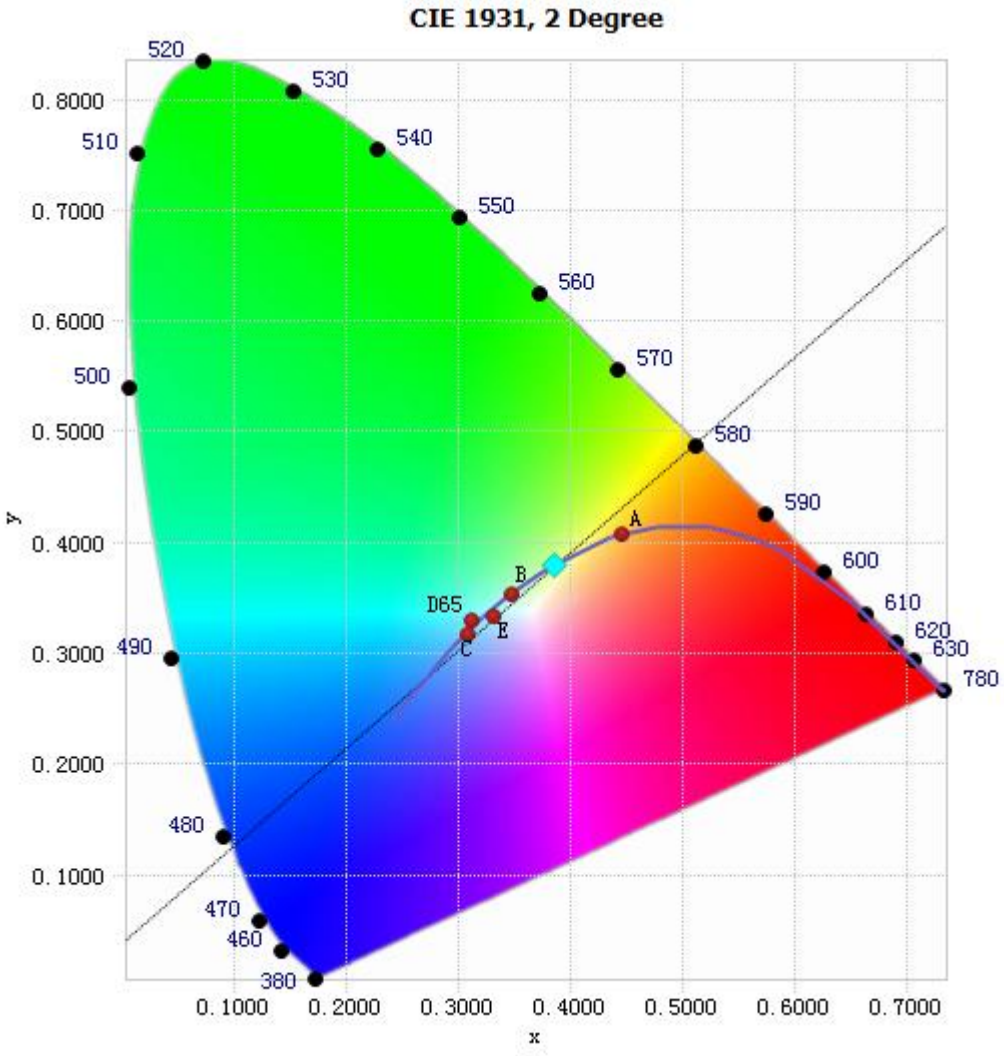


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.17E-04	485	1.49E-02	590	3.22E-02	695	1.23E-02
385	1.10E-04	490	1.60E-02	595	3.27E-02	700	1.09E-02
390	9.91E-05	495	1.76E-02	600	3.31E-02	705	9.65E-03
395	8.29E-05	500	1.93E-02	605	3.35E-02	710	8.50E-03
400	9.25E-05	505	2.09E-02	610	3.37E-02	715	7.53E-03
405	1.89E-04	510	2.21E-02	615	3.39E-02	720	6.63E-03
410	4.39E-04	515	2.31E-02	620	3.35E-02	725	5.79E-03
415	9.21E-04	520	2.39E-02	625	3.32E-02	730	5.03E-03
420	1.78E-03	525	2.46E-02	630	3.25E-02	735	4.35E-03
425	3.19E-03	530	2.54E-02	635	3.16E-02	740	3.78E-03
430	5.28E-03	535	2.61E-02	640	3.06E-02	745	3.28E-03
435	8.20E-03	540	2.68E-02	645	2.92E-02	750	2.87E-03
440	1.24E-02	545	2.76E-02	650	2.77E-02	755	2.48E-03
445	1.88E-02	550	2.82E-02	655	2.60E-02	760	2.13E-03
450	2.80E-02	555	2.88E-02	660	2.42E-02	765	1.85E-03
455	3.33E-02	560	2.93E-02	665	2.24E-02	770	1.60E-03
460	2.84E-02	565	2.98E-02	670	2.06E-02	775	1.36E-03
465	2.22E-02	570	3.03E-02	675	1.88E-02	780	1.18E-03
470	1.90E-02	575	3.07E-02	680	1.71E-02		
475	1.62E-02	580	3.12E-02	685	1.54E-02		
480	1.45E-02	585	3.18E-02	690	1.38E-02		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3864, 0.3799)

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

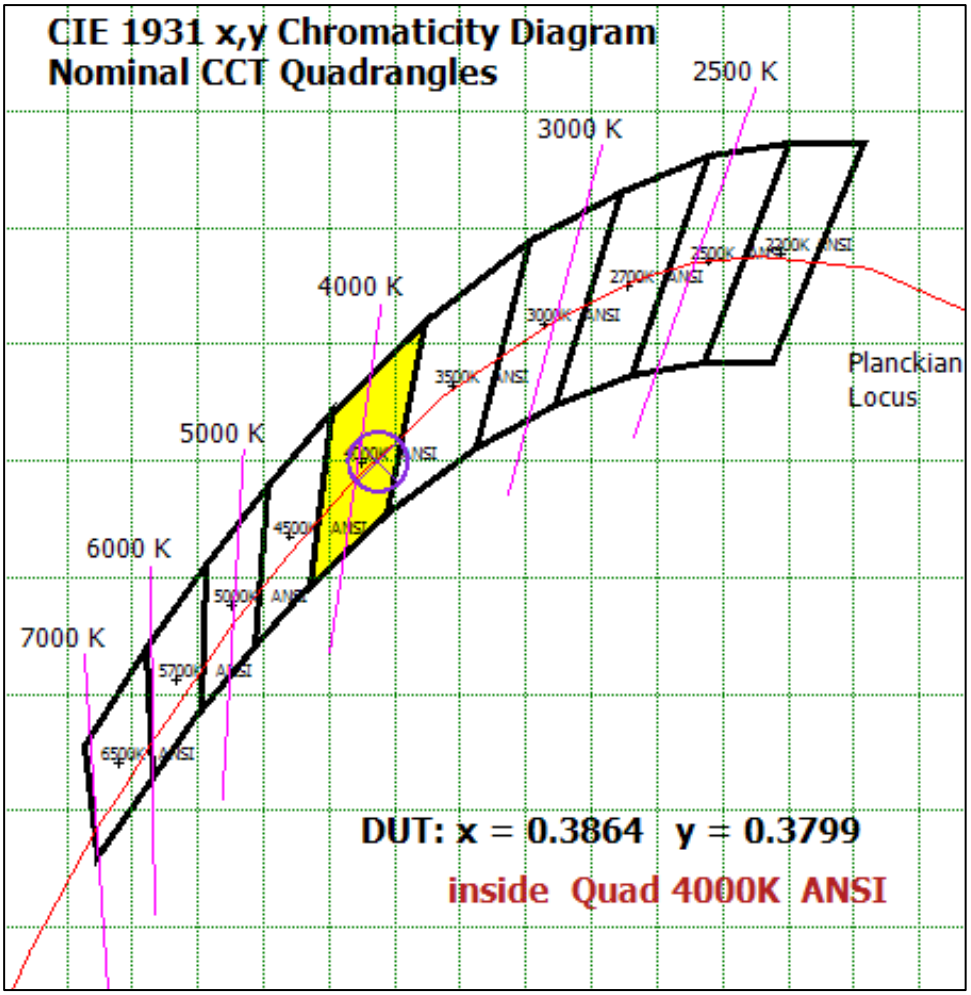
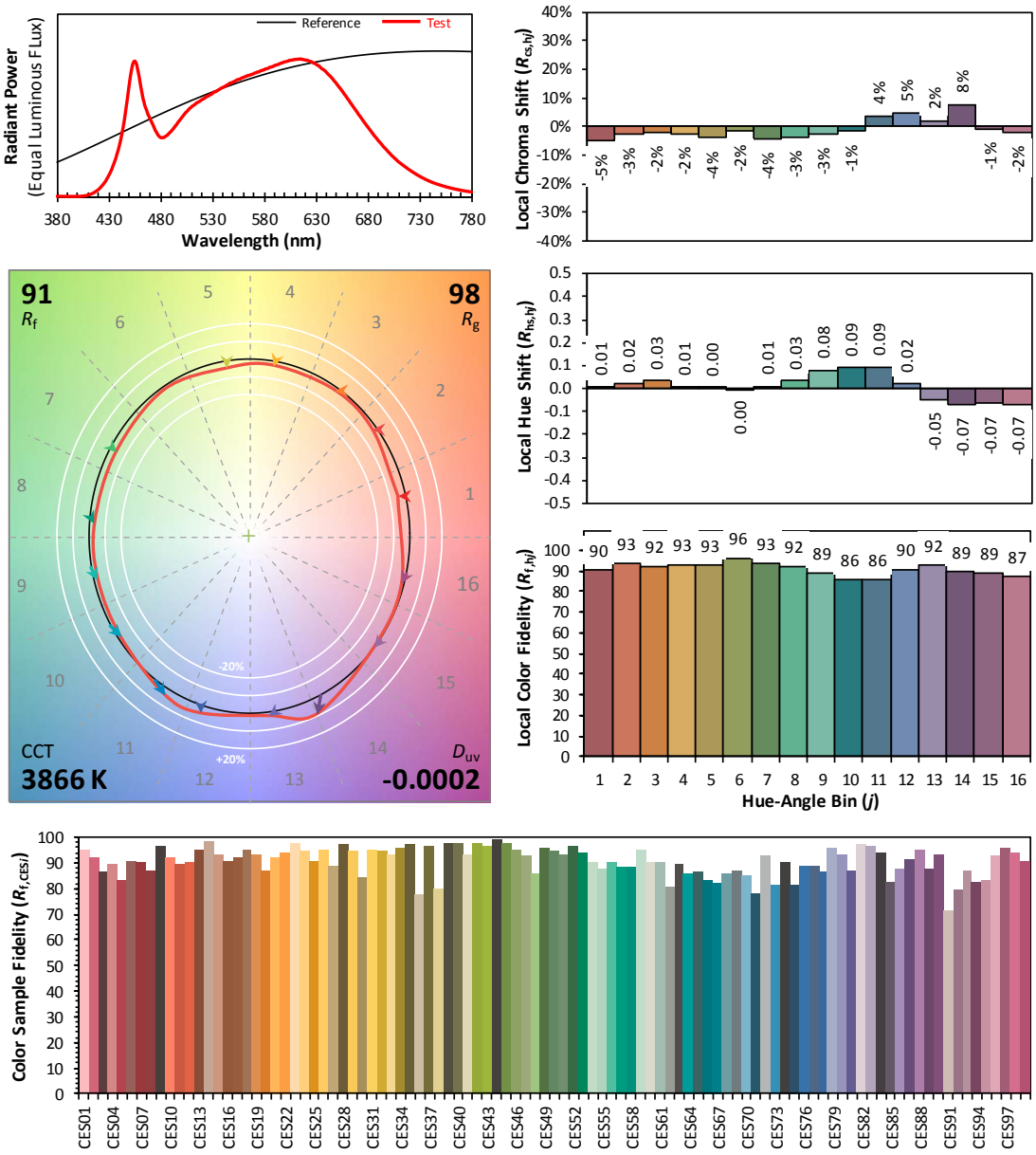


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method



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

x	0.3864
y	0.3799
u'	0.2277
v'	0.5039

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	349.959	16.32%
10- 20	697.379	32.52%
20- 30	531.272	24.77%
30- 40	283.03	13.20%
40- 50	137.841	6.43%
50- 60	71.11	3.32%
60- 70	42.884	2.00%
70- 80	22.177	1.03%
80- 90	5.875	0.27%
90-100	0.092	0.00%
100-110	0.034	0.00%
110-120	0.063	0.00%
120-130	0.149	0.01%
130-140	0.383	0.02%
140-150	0.672	0.03%
150-160	0.776	0.04%
160-170	0.593	0.03%
170-180	0.199	0.01%
Total	2144.5	100%

γ(°)	Lumens	% Total
0- 60	2070.591	96.55%
60- 90	70.936	3.31%
0-90	2141.527	99.86%
90- 180	2.961	0.14%
0- 180	2144.5	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

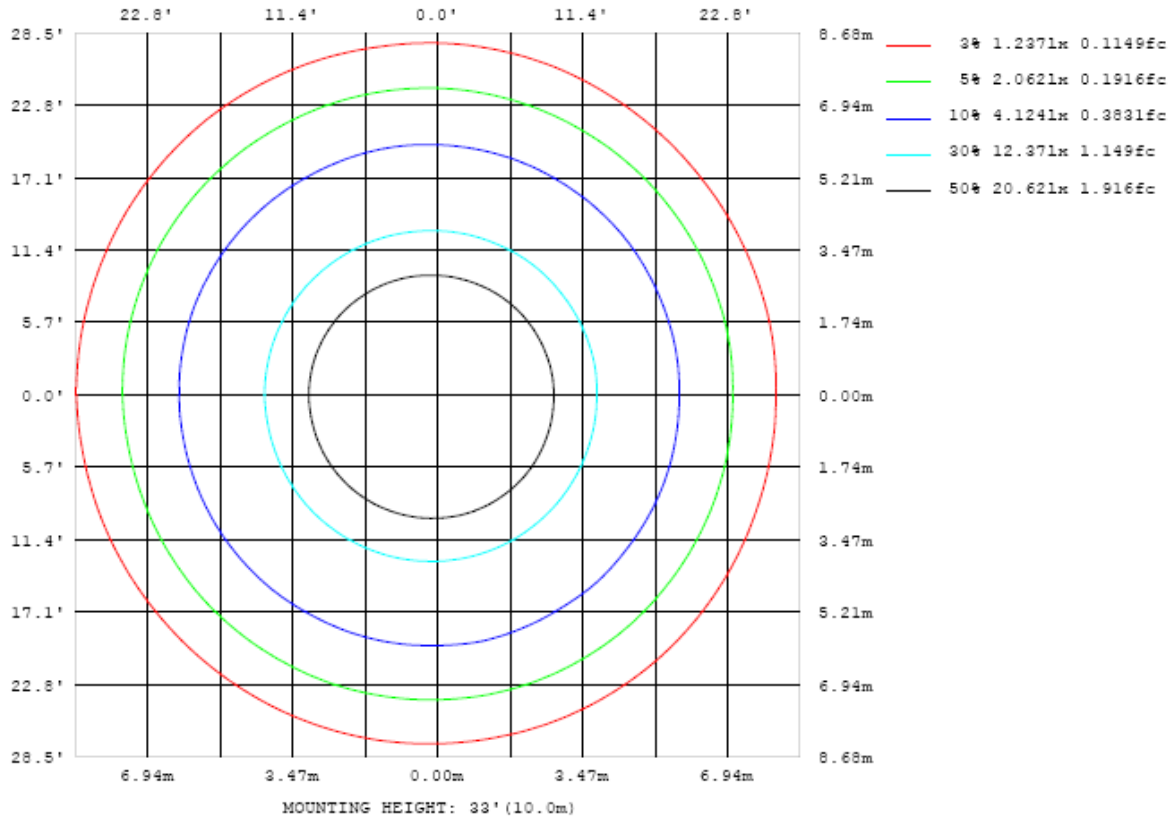


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

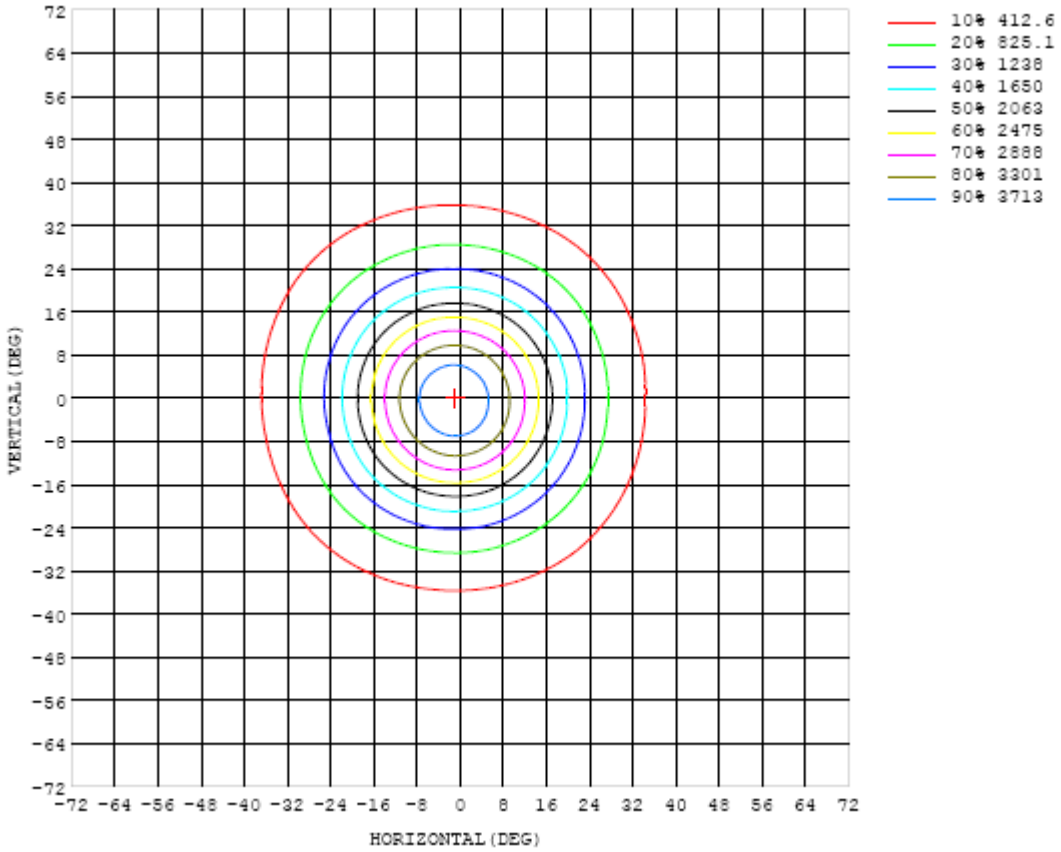


Chart 6: Isocandela Plot

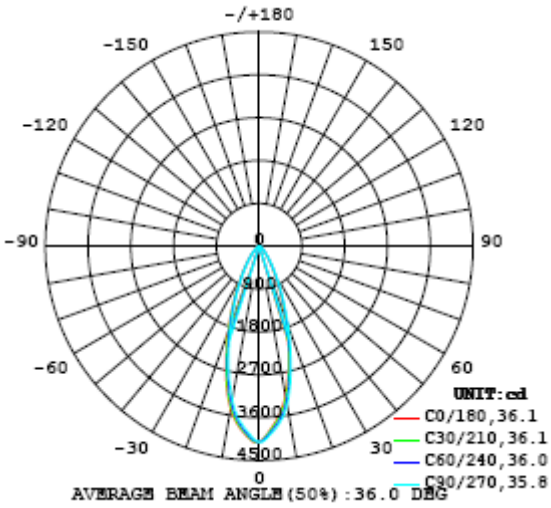


Chart 7: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1 UNIT: cd

γ (DEG) \ C (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	4108	4108	4108	4108	4108	4108	4108	4108	4108	4108	4108	4108	4108	4108	4108	4108	4108	4108	4108
5	3734	3737	3749	3762	3779	3796	3811	3829	3844	3855	3872	3882	3894	3903	3912	3916	3917	3916	3914
10	3185	3195	3216	3238	3263	3288	3317	3342	3365	3386	3407	3422	3436	3446	3453	3454	3458	3462	3466
15	2394	2401	2416	2435	2461	2484	2510	2539	2566	2588	2614	2638	2663	2680	2696	2702	2712	2717	2724
20	1631	1634	1642	1656	1674	1693	1715	1740	1762	1784	1809	1831	1853	1873	1891	1899	1906	1911	1919
25	1037	1043	1051	1058	1067	1083	1102	1121	1142	1159	1175	1192	1211	1228	1243	1249	1252	1255	1267
30	639	643	650	654	661	681	680	698	722	720	733	743	754	767	779	782	784	788	797
35	387	390	393	397	402	411	418	425	432	438	445	453	458	465	472	475	479	485	493
40	240	241	241	246	252	257	261	265	267	271	276	280	284	287	292	296	301	304	310
45	153	154	154	158	161	165	166	168	169	171	173	175	177	180	182	186	189	193	196
50	99.5	101	101	103	104	106	108	110	110	111	111	112	113	116	118	121	122	123	127
55	71.0	71.4	71.9	72.9	72.9	74.4	75.2	76.2	76.3	77.1	76.9	77.2	77.7	79.2	80.9	82.3	83.4	84.6	86.4
60	52.9	53.2	53.8	54.5	55.0	55.6	56.2	56.8	57.0	57.4	57.4	57.3	57.6	58.1	58.7	59.8	60.8	61.5	62.1
65	40.2	40.3	40.8	41.3	41.8	42.2	42.6	43.0	43.3	43.6	43.9	44.3	44.2	44.2	44.5	45.0	45.8	46.1	46.4
70	28.9	29.1	29.3	29.6	29.9	30.2	30.5	31.1	31.5	31.9	32.4	32.6	32.6	32.6	32.8	33.0	33.4	33.6	33.8
75	18.9	19.2	19.4	19.6	19.9	20.2	20.5	21.0	21.4	21.7	22.0	22.2	22.3	22.3	22.4	22.5	22.6	22.7	22.8
80	10.5	10.8	11.0	11.2	11.4	11.7	12.0	12.3	12.6	12.9	13.1	13.3	13.4	13.5	13.6	13.6	13.6	13.6	13.5
85	3.82	3.98	4.15	4.31	4.48	4.69	4.92	5.17	5.38	5.63	5.80	5.93	6.09	6.17	6.22	6.21	6.15	6.10	6.11
90	0.30	0.33	0.37	0.42	0.48	0.55	0.63	0.71	0.80	0.88	0.96	1.01	1.06	1.10	1.11	1.10	1.08	1.04	1.08
95	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
100	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
105	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
110	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	0.04	0.04	0.04
115	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	0.05	0.06
120	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.07	0.07	0.09
125	0.14	0.15	0.14	0.14	0.14	0.14	0.14	0.13	0.13	0.13	0.13	0.13	0.12	0.12	0.12	0.12	0.12	0.12	0.16
130	0.24	0.24	0.24	0.23	0.23	0.23	0.23	0.22	0.22	0.21	0.21	0.21	0.20	0.20	0.20	0.20	0.20	0.20	0.30
135	0.40	0.40	0.39	0.39	0.39	0.38	0.38	0.37	0.37	0.36	0.36	0.35	0.35	0.34	0.34	0.34	0.34	0.33	0.55
140	0.60	0.60	0.59	0.59	0.59	0.58	0.57	0.57	0.56	0.55	0.55	0.54	0.53	0.53	0.53	0.52	0.52	0.51	0.88
145	0.82	0.82	0.81	0.81	0.80	0.80	0.79	0.79	0.78	0.77	0.76	0.75	0.75	0.74	0.73	0.73	0.73	0.72	1.27
150	1.06	1.06	1.05	1.05	1.04	1.04	1.03	1.02	1.01	1.01	1.00	0.99	0.98	0.97	0.97	0.97	0.96	0.94	1.65
155	1.32	1.32	1.31	1.31	1.30	1.30	1.29	1.29	1.28	1.27	1.26	1.25	1.25	1.24	1.24	1.23	1.23	1.20	1.98
160	1.56	1.57	1.56	1.56	1.56	1.55	1.55	1.55	1.54	1.53	1.53	1.52	1.51	1.51	1.50	1.50	1.49	1.46	2.23
165	1.74	1.75	1.74	1.74	1.74	1.74	1.74	1.73	1.73	1.72	1.72	1.71	1.71	1.70	1.70	1.70	1.70	1.66	2.37
170	1.81	1.82	1.82	1.82	1.82	1.82	1.83	1.83	1.82	1.82	1.82	1.81	1.81	1.81	1.80	1.80	1.80	1.75	2.32
175	1.88	1.88	1.88	1.88	1.87	1.88	1.88	1.87	1.87	1.87	1.87	1.87	1.86	1.86	1.86	1.86	1.86	1.83	2.03
180	2.07	2.07	2.07	2.07	2.07	2.07	2.07	2.07	2.07	2.07	2.07	2.07	2.07	2.07	2.07	2.07	2.07	2.07	2.07

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	4108	4108	4108	4108	4108	4108	4108	4108	4108	4108	4108	4108	4108	4108	4108	4108	4108		
5	3909	3901	3891	3877	3862	3851	3835	3818	3799	3783	3765	3754	3746	3739	3732	3727	3729		
10	3459	3445	3428	3405	3377	3350	3324	3293	3268	3241	3221	3205	3191	3179	3173	3171	3178		
15	2718	2701	2675	2648	2613	2577	2546	2506	2475	2448	2426	2414	2404	2393	2386	2387	2392		
20	1912	1899	1881	1858	1829	1797	1771	1742	1716	1698	1681	1670	1658	1645	1638	1639	1641		
25	1268	1260	1246	1228	1207	1186	1171	1151	1133	1114	1098	1088	1078	1068	1057	1048	1046		
30	800	800	789	778	763	748	739	731	713	700	689	676	668	662	652	645	645		
35	495	496	492	485	477	468	461	453	444	435	426	417	411	405	399	394	393		
40	311	311	310	307	304	297	291	284	280	274	268	260	254	248	246	244	244		
45	196	195	195	194	192	188	184	179	176	171	168	164	162	158	157	156	156		
50	127	125	125	123	122	120	118	114	112	109	106	105	105	103	102	101	101		
55	86.3	84.8	84.6	83.8	82.7	81.6	80.6	78.4	77.2	75.8	74.1	73.0	72.7	71.8	71.6	71.2	71.5		
60	61.5	60.9	60.5	60.1	59.9	59.1	58.1	57.2	56.5	55.7	54.8	54.4	54.0	53.6	53.3	53.2	53.2		
65	46.0	45.5	45.1	44.9	44.7	44.1	43.4	42.8	42.3	42.0	41.4	41.0	40.7	40.5	40.4	40.4	40.6		
70	33.5	33.1	32.7	32.5	32.3	31.7	31.2	30.7	30.3	30.1	29.6	29.3	29.1	28.9	28.8	28.8	29.1		
75	22.6	22.2	21.9	21.7	21.5	21.0	20.6	20.3	19.9	19.7	19.4	19.2	19.0	18.9	18.8	18.8	19.0		
80	13.3	13.1	12.8	12.6	12.3	12.0	11.7	11.5	11.2	11.0	10.7	10.5	10.4	10.3	10.2	10.3	10.4		
85	5.96	5.76	5.55	5.35	5.14	4.91	4.71	4.53	4.35	4.16	3.99	3.88	3.80	3.74	3.71	3.74	3.84		
90	1.00	0.92	0.83	0.74	0.65	0.58	0.51	0.46	0.40	0.36	0.32	0.30	0.28	0.28	0.28	0.29	0.31		
95	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		
100	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02		
105	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04		
110	0.04	0.04	0.04	0.04	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		
115	0.06	0.06	0.06	0.06	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		
120	0.10	0.10	0.10	0.10	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		
125	0.17	0.17	0.17	0.17	0.18	0.18	0.18	0.18	0.19	0.19	0.19	0.20	0.20	0.20	0.20	0.20	0.20		
130	0.31	0.31	0.32	0.32	0.33	0.33	0.34	0.34	0.35	0.35	0.36	0.36	0.37	0.37	0.37	0.37	0.37		
135	0.57	0.57	0.58	0.58	0.59	0.60	0.61	0.62	0.63	0.64	0.64	0.65	0.66	0.66	0.66	0.67	0.66		
140	0.91	0.92	0.92	0.93	0.94	0.96	0.97	0.98	0.99	1.00	1.01	1.02	1.03	1.04	1.04	1.05	1.03		
145	1.32	1.32	1.33	1.34	1.35	1.36	1.38	1.39	1.40	1.42	1.43	1.44	1.45	1.46	1.46	1.47	1.44		
150	1.72	1.72	1.73	1.74	1.75	1.77	1.78	1.80	1.81	1.83	1.84	1.85	1.86	1.87	1.87	1.88	1.84		
155	2.08	2.07	2.07	2.08	2.09	2.11	2.12	2.13	2.14	2.16	2.16	2.18	2.19	2.19	2.20	2.21	2.15		
160	2.37	2.35	2.36	2.36	2.37	2.38	2.39	2.40	2.41	2.41	2.42	2.43	2.43	2.44	2.44	2.46	2.37		
165	2.54	2.52	2.52	2.53	2.53	2.54	2.54	2.54	2.55	2.55	2.55	2.56	2.56	2.56	2.56	2.58	2.47		
170	2.55	2.52	2.52	2.51	2.51	2.51	2.51	2.51	2.51	2.50	2.50	2.50	2.50	2.50	2.50	2.53	2.38		
175	2.29	2.27	2.26	2.25	2.25	2.24	2.23	2.23	2.22	2.22	2.21	2.21	2.21	2.20	2.20	2.22	2.06		
180	2.07	2.07	2.07	2.07	2.07	2.07	2.07	2.07	2.07	2.07	2.07	2.07	2.07	2.07	2.07	2.07	2.07		

Table 7: Luminous Intensity Data

EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Aug. 02, 2019	Aug. 01, 2020
Digital Power Meter	PF2010A	HZTE028-01	Aug. 02, 2019	Aug. 01, 2020
AC Power Supply	DPS1060	HZTE001-06	Aug. 02, 2019	Aug. 01, 2020
DC Power Supply	WY12010	HZTE004-03	Aug. 02, 2019	Aug. 01, 2020
Temperature recorder	JM624U	HZTE018-08	Aug. 02, 2019	Aug. 01, 2020
Temperature and humidity recorder	JR900	HZTE018-01	Aug. 02, 2019	Aug. 01, 2020
Standard source	D908	HZTE012-01	Aug. 02, 2019	Aug. 01, 2020
Integrate Sphere system	3M	HZTE015-04	Aug. 02, 2019	Aug. 01, 2020
Digital Power Meter	WT210	HZTE008-01	Aug. 02, 2019	Aug. 01, 2020
AC Power Supply	PCR 500L	HZTE001-07	Aug. 02, 2019	Aug. 01, 2020
DC Power Supply	IT6154	HZTE004-04	Aug. 02, 2019	Aug. 01, 2020
Standard source	SCL-1400	HZTE012-02	Aug. 02, 2019	Aug. 01, 2020
Temperature and humidity recorder	JR900	HZTE018-02	Aug. 02, 2019	Aug. 01, 2020
Temperature Meter	TES1310	HZTE017-01	Aug. 02, 2019	Aug. 01, 2020

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

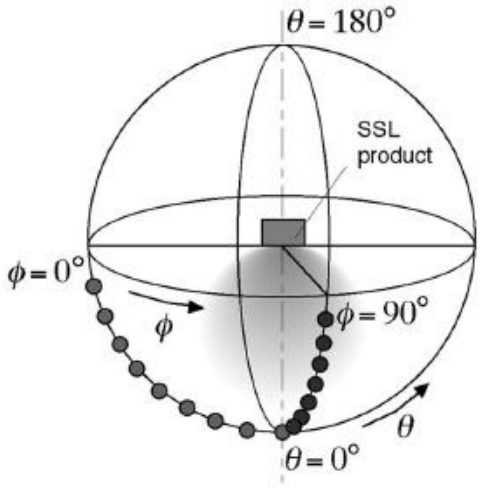
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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