LM-79-08 TEST REPORT

for

GREEN CREATIVE LTD

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

LED Lamp

Model: 19.5PAR38HO/930NF25/277V

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ19060039f

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. 19, 2019

Approved by: Jim Zhang

Manager: Jim Zhang
Sep. 19, 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/930NF25/277V**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
107.3	2046.4	19.07	0.9944

CCT (K)	CRI	Stabilization Time (Light & Power)
2982	92.3	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. 11, 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	: 19.5PAR38HO/930NF25/277V
Electrical Ratings	: 120-277V, 60Hz, 19.5W
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)	0.160	0.080
Power Factor	0.9944	0.9128
Test Power (W)	19.07	20.32
THD A%	9.64	26.21
Luminous Efficacy (lm/W)	107.3	105.7
Total Luminous Flux (lm)	2046.4	2148.2
Color Rendering Index (CRI)	92.3	
R9	59.4	
Correlated Color Temperature (CCT)(K)	2982	
Chromaticity Chroma x	0.4413	
Chromaticity Chroma y	0.4111	
Chromaticity Chroma u	0.2504	
Chromaticity Chroma v	0.3498	
Duv	0.0022	
Chromaticity Chroma u ’	0.2504	
Chromaticity Chroma v’	0.5248	

Special Color Rendering Indices	
R1	92.1
R2	94.6
R3	96.3
R4	93.4
R5	91.6
R6	93.6
R7	93.7
R8	83
R9	59.4
R10	86.9
R11	94.2
R12	80.9
R13	92.6
R14	97.3

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 25.0 ℃.

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)	0.160
Power Factor	0.9942
Power (W)	19.07
Luminous Efficacy (lm/W)	112.5
Total Luminous Flux (lm)	2144.7
Beam Angle (°)	21.6 (0^o-180^o) / 21.3 (90^o-270^o)
Center Beam Candle Power (cd)	9579
Maximum Beam Candle Power (cd)	9579 (At: C=0.0, Gamma=0.0)
Spacing Criteria	0.37 (0^o-180^o) / 0.35 (90^o-270^o)
Zonal Lumens in the 0 °-60 °Zone	96.15%
Zonal Lumens in the 60 °-90 °Zone	3.70%
Zonal Lumens in the 90 °-120 °Zone	0.02%
Zonal Lumens in the 120 °-180 °Zone	0.14%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

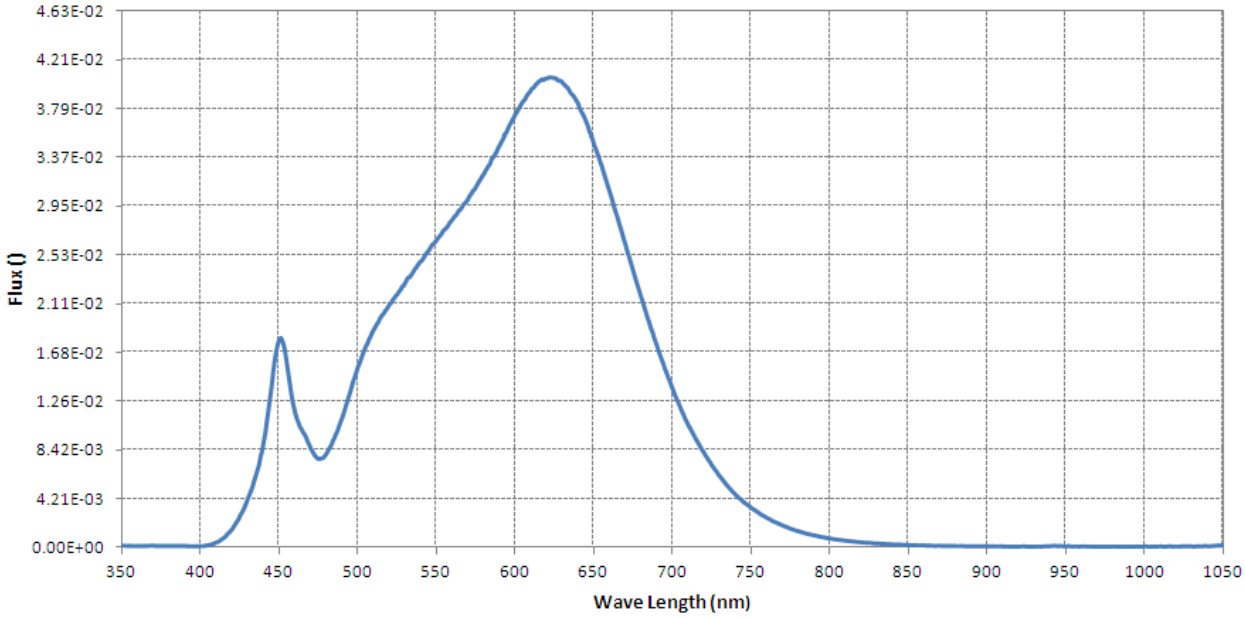
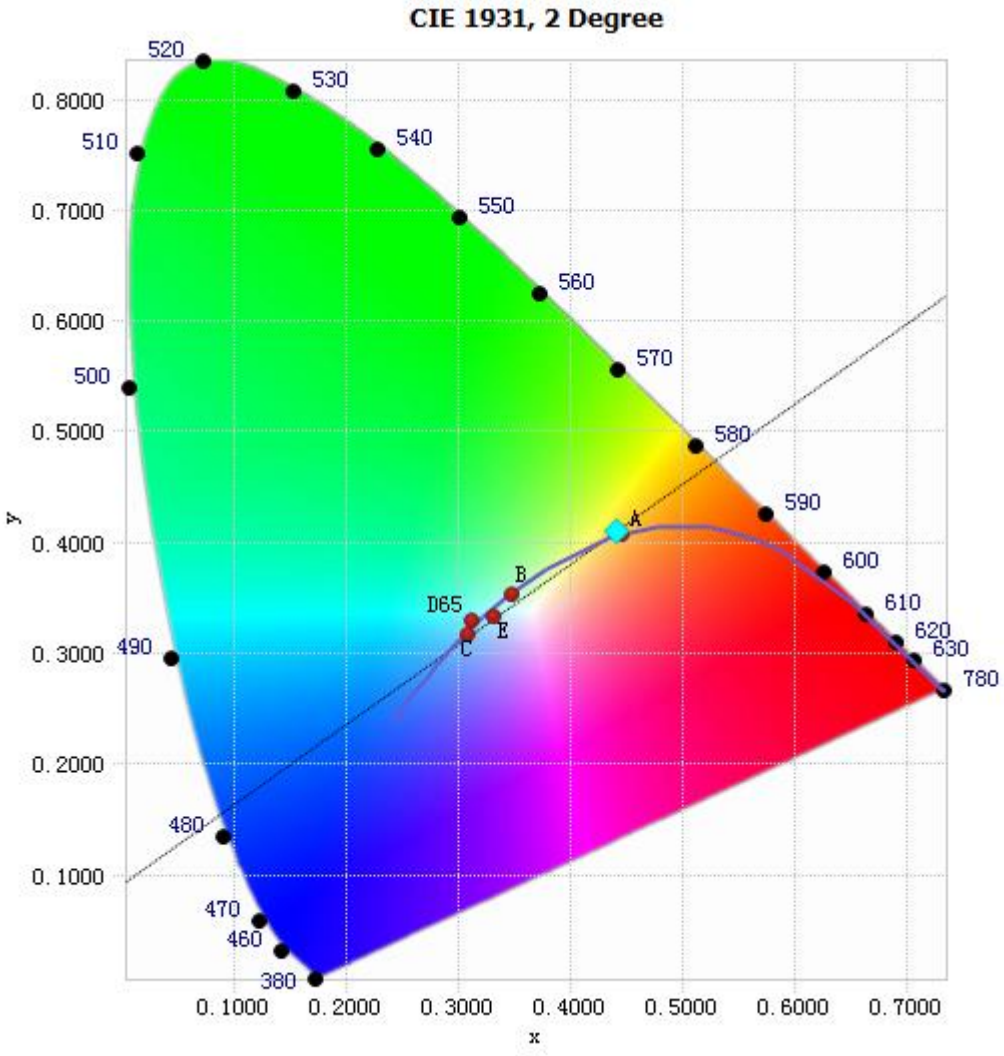


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	7.94E-05	485	9.44E-03	590	3.48E-02	695	1.54E-02
385	8.63E-05	490	1.12E-02	595	3.60E-02	700	1.37E-02
390	7.46E-05	495	1.34E-02	600	3.73E-02	705	1.20E-02
395	5.65E-05	500	1.56E-02	605	3.85E-02	710	1.05E-02
400	8.18E-05	505	1.73E-02	610	3.95E-02	715	9.27E-03
405	1.57E-04	510	1.88E-02	615	4.02E-02	720	8.12E-03
410	3.88E-04	515	2.00E-02	620	4.04E-02	725	7.06E-03
415	8.19E-04	520	2.10E-02	625	4.05E-02	730	6.11E-03
420	1.53E-03	525	2.19E-02	630	4.01E-02	735	5.25E-03
425	2.68E-03	530	2.29E-02	635	3.92E-02	740	4.52E-03
430	4.19E-03	535	2.38E-02	640	3.82E-02	745	3.88E-03
435	6.15E-03	540	2.47E-02	645	3.67E-02	750	3.39E-03
440	9.05E-03	545	2.57E-02	650	3.49E-02	755	2.91E-03
445	1.38E-02	550	2.66E-02	655	3.30E-02	760	2.51E-03
450	1.80E-02	555	2.75E-02	660	3.08E-02	765	2.14E-03
455	1.57E-02	560	2.84E-02	665	2.85E-02	770	1.84E-03
460	1.17E-02	565	2.92E-02	670	2.62E-02	775	1.57E-03
465	9.93E-03	570	3.01E-02	675	2.39E-02	780	1.35E-03
470	8.53E-03	575	3.12E-02	680	2.16E-02		
475	7.60E-03	580	3.23E-02	685	1.95E-02		
480	8.09E-03	585	3.36E-02	690	1.74E-02		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4413, 0.4111)

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

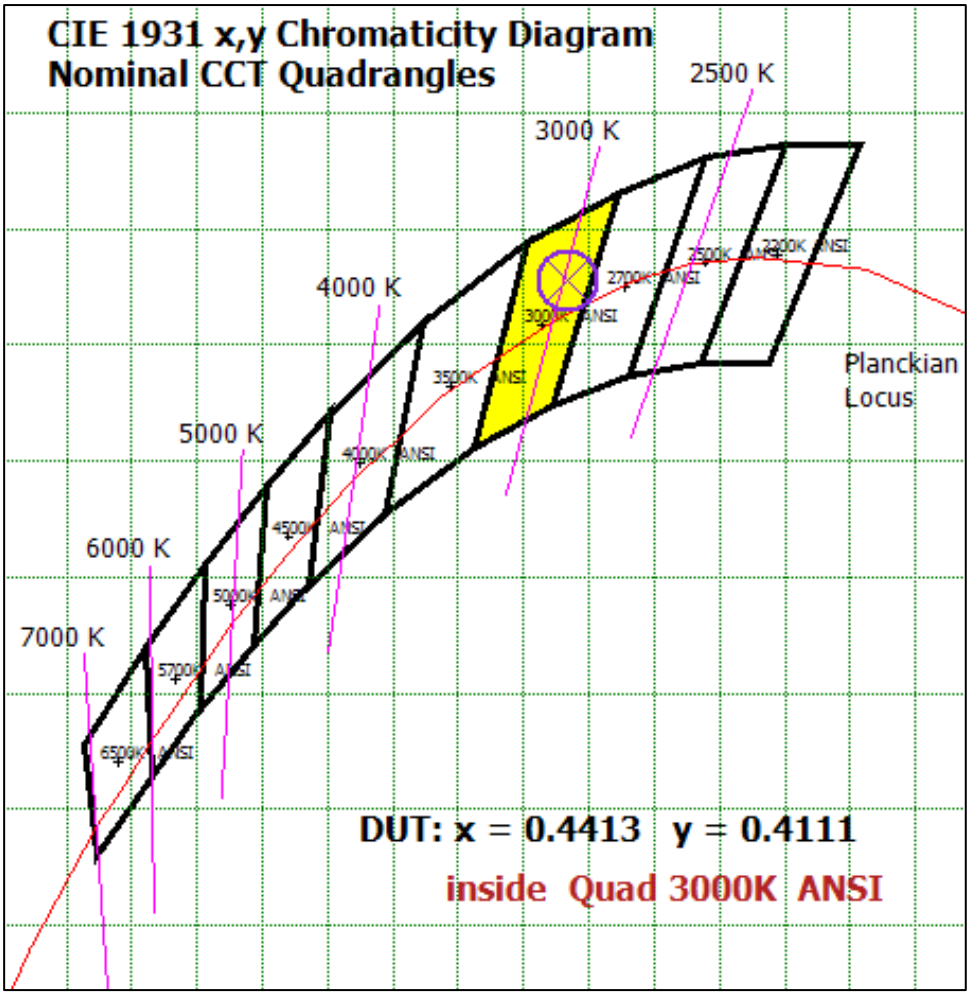
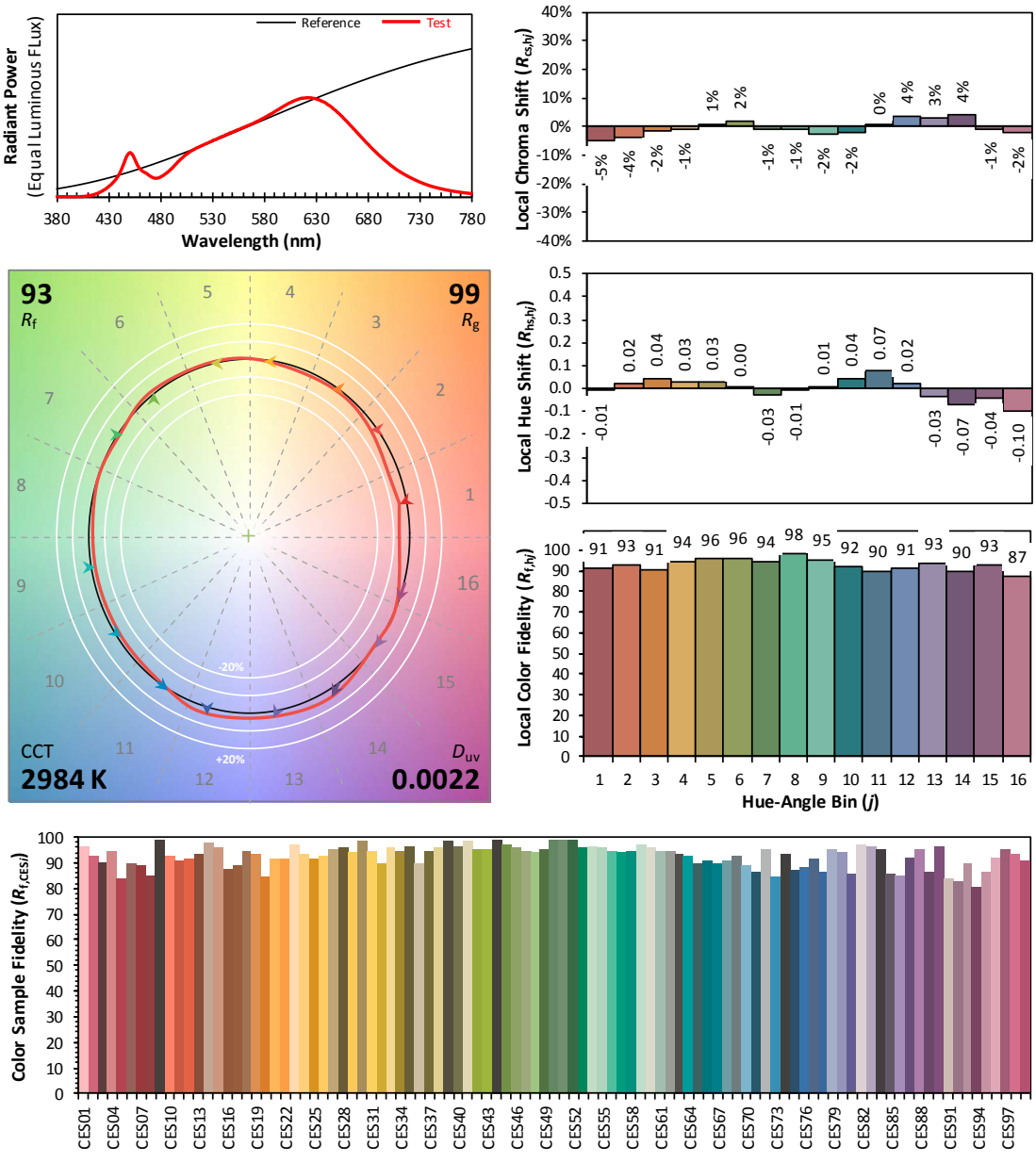


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method



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

x	0.4413
y	0.4111
u'	0.2504
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

γ(°)	Lumens	% Total
0- 10	687.248	32.04%
10- 20	765.524	35.69%
20- 30	324.855	15.15%
30- 40	136.728	6.38%
40- 50	88.553	4.13%
50- 60	59.191	2.76%
60- 70	42.857	2.00%
70- 80	27.01	1.26%
80- 90	9.397	0.44%
90-100	0.258	0.01%
100-110	0.03	0.00%
110-120	0.048	0.00%
120-130	0.095	0.00%
130-140	0.288	0.01%
140-150	0.701	0.03%
150-160	0.948	0.04%
160-170	0.713	0.03%
170-180	0.228	0.01%
Total	2144.7	100%

γ(°)	Lumens	% Total
0- 60	2062.099	96.15%
60- 90	79.264	3.70%
0-90	2141.363	99.85%
90- 180	3.309	0.15%
0- 180	2144.7	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

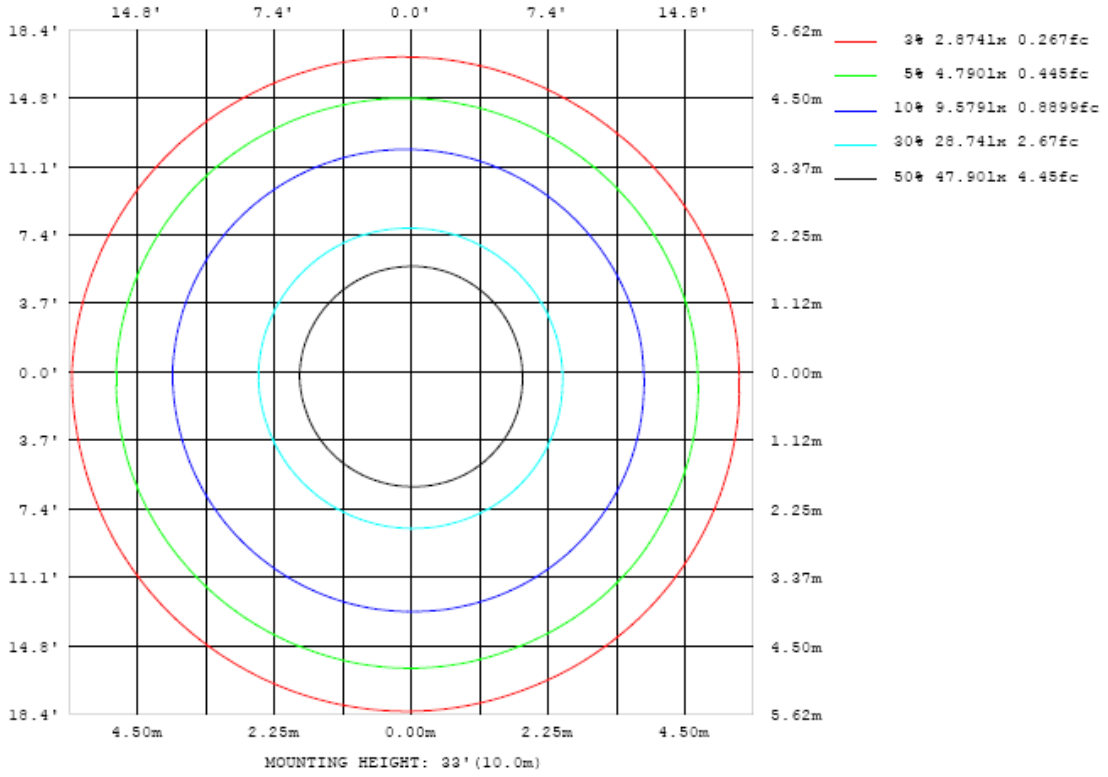


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

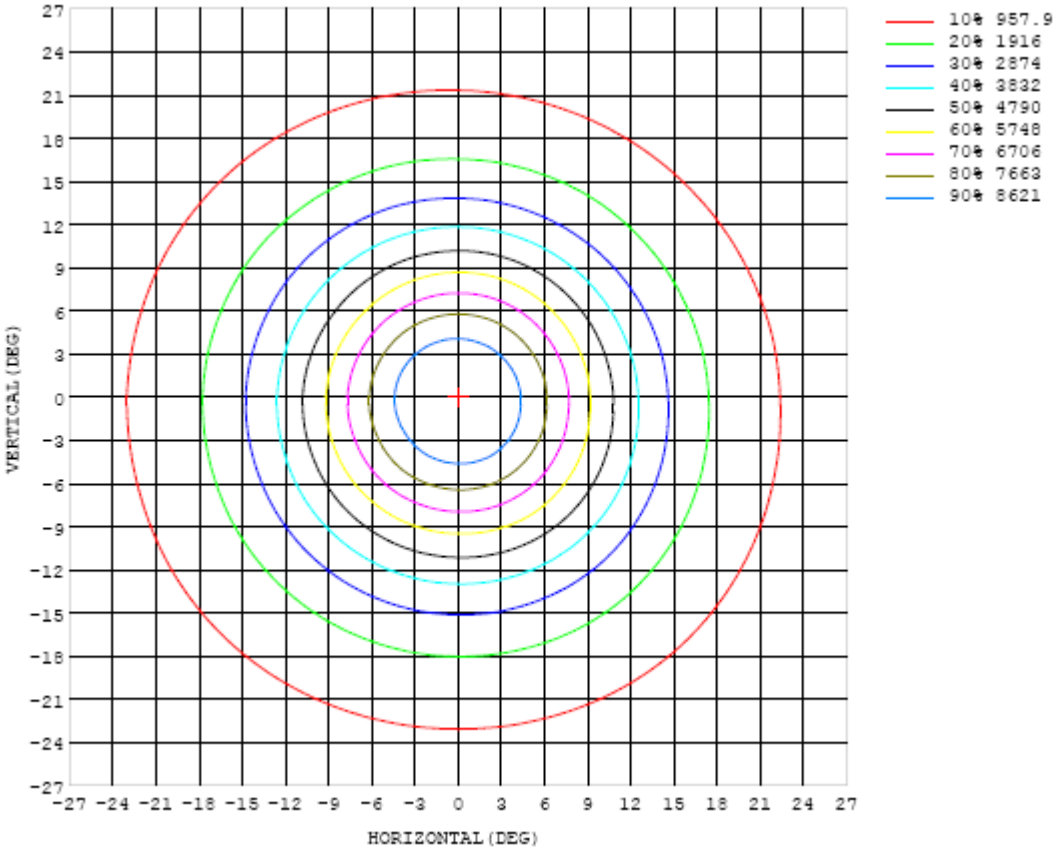


Chart 6: Isocandela Plot

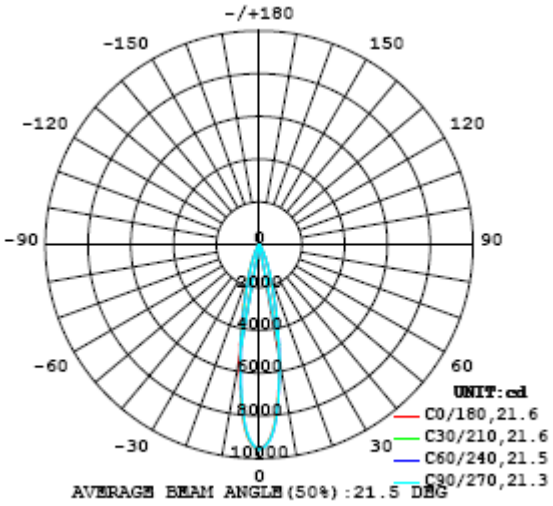


Chart 7: Polar Candela Distribution

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	9579	9579	9579	9579	9579	9579	9579	9579	9579	9579	9579	9579	9579	9579	9579	9579	9579	9579	9579
5	8329	8341	8381	8412	8437	8456	8481	8469	8466	8448	8441	8432	8423	8409	8391	8372	8362	8368	8350
10	5248	5308	5369	5430	5466	5498	5504	5493	5468	5442	5426	5412	5399	5382	5370	5349	5314	5297	5268
15	2705	2767	2826	2879	2919	2941	2946	2935	2936	2923	2910	2899	2891	2877	2862	2846	2823	2809	2791
20	1333	1367	1398	1425	1445	1459	1466	1466	1465	1461	1454	1450	1449	1448	1449	1447	1441	1438	1438
25	667	689	705	710	726	733	734	731	738	739	741	743	744	749	751	752	748	744	739
30	340	349	357	362	365	370	373	377	381	387	390	393	395	396	398	397	393	390	387
35	204	206	208	208	208	208	211	214	219	224	227	229	229	227	226	224	221	219	217
40	149	151	152	152	151	150	150	151	153	155	157	158	158	157	156	154	153	152	153
45	114	115	116	116	116	116	116	117	118	119	121	122	120	119	116	115	114	114	115
50	83.2	83.9	84.2	84.6	84.9	85.1	85.4	85.7	86.3	87.8	89.8	90.5	89.3	87.2	84.8	83.9	84.0	84.3	85.7
55	64.7	64.8	64.7	64.7	64.7	64.9	65.0	64.8	64.8	65.8	68.0	69.5	69.1	67.5	65.5	65.0	65.4	66.1	66.5
60	51.9	51.9	52.1	52.2	52.1	52.2	52.3	52.2	51.9	52.4	53.7	54.9	55.1	54.2	52.7	52.4	52.7	53.1	53.6
65	43.3	43.4	43.5	43.5	43.5	43.5	43.7	43.5	43.3	43.6	44.3	44.9	45.1	44.7	43.8	43.9	44.2	44.9	45.6
70	33.8	33.7	33.8	33.9	33.9	33.9	33.9	33.7	33.6	33.7	33.8	34.0	34.2	34.0	33.7	33.9	34.0	34.4	34.9
75	25.6	25.4	25.5	25.5	25.4	25.4	25.3	25.1	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.2	25.3	25.6	26.1
80	17.1	16.9	16.9	16.9	16.9	16.8	16.7	16.6	16.5	16.5	16.4	16.3	16.2	16.2	16.2	16.3	16.5	16.6	17.0
85	8.67	8.47	8.45	8.49	8.47	8.42	8.34	8.23	8.13	8.13	8.05	7.92	7.82	7.84	7.82	7.86	7.86	7.91	8.11
90	1.88	1.82	1.82	1.83	1.84	1.82	1.80	1.78	1.74	1.73	1.69	1.63	1.59	1.56	1.54	1.52	1.49	1.45	1.55
95	0.01	0.02	0.02	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.01
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	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03
110	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	0.04
115	0.04	0.05	0.05	0.04	0.05	0.04	0.05	0.04	0.04	0.04	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.05
120	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	0.06	0.06	0.07
125	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	0.08	0.11
130	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	0.13	0.13	0.14	0.14	0.14	0.22
135	0.25	0.25	0.25	0.24	0.24	0.24	0.24	0.23	0.23	0.23	0.23	0.24	0.24	0.24	0.25	0.25	0.26	0.25	0.44
140	0.45	0.46	0.45	0.45	0.45	0.45	0.44	0.44	0.44	0.44	0.44	0.45	0.45	0.45	0.46	0.46	0.47	0.45	0.82
145	0.75	0.77	0.76	0.76	0.76	0.76	0.75	0.75	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.75	0.75	0.72	1.36
150	1.04	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.09	1.09	1.09	1.10	1.10	1.11	1.11	1.05	1.97
155	1.32	1.38	1.39	1.39	1.40	1.40	1.41	1.42	1.42	1.43	1.44	1.44	1.44	1.45	1.45	1.45	1.45	1.36	2.48
160	1.57	1.64	1.65	1.65	1.66	1.67	1.68	1.69	1.70	1.71	1.71	1.71	1.71	1.71	1.71	1.70	1.69	1.57	2.75
165	1.77	1.84	1.84	1.85	1.86	1.87	1.88	1.89	1.89	1.90	1.91	1.92	1.92	1.92	1.91	1.90	1.89	1.79	2.73
170	1.94	1.97	1.98	1.99	2.00	2.01	2.02	2.03	2.03	2.04	2.04	2.04	2.03	2.02	2.01	2.00	1.97	1.93	2.30
175	1.94	1.95	1.96	1.97	1.98	1.98	1.99	2.00	2.00	2.00	2.00	2.00	2.00	2.00	1.99	1.98	1.97	1.95	1.91
180	1.99	1.99	1.99	1.99	1.99	1.99	1.99	1.99	1.99	1.99	1.99	1.99	1.99	1.99	1.99	1.99	1.99	1.99	1.99

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	9579	9579	9579	9579	9579	9579	9579	9579	9579	9579	9579	9579	9579	9579	9579	9579	9579
5	8319	8286	8258	8232	8208	8181	8162	8155	8146	8143	8160	8168	8185	8212	8236	8271	8303
10	5207	5139	5076	5021	4975	4942	4922	4907	4904	4916	4937	4964	4997	5042	5089	5134	5193
15	2744	2697	2650	2600	2553	2512	2474	2440	2414	2409	2411	2426	2450	2485	2537	2594	2656
20	1421	1381	1345	1307	1271	1237	1208	1184	1167	1155	1152	1161	1174	1199	1229	1265	1304
25	720	698	673	650	626	604	586	571	560	555	554	557	566	582	602	625	648
30	374	360	346	335	324	315	307	302	297	294	293	293	296	304	313	324	335
35	212	208	204	202	199	196	193	190	189	188	187	187	188	190	193	197	201
40	151	151	151	150	148	146	145	144	144	143	142	141	142	142	144	146	149
45	116	117	118	117	115	114	114	112	111	110	109	109	109	110	111	112	114
50	85.6	86.5	87.2	86.2	84.8	83.9	83.1	82.3	81.9	81.6	81.4	81.5	81.6	81.8	82.2	82.8	83.5
55	65.9	66.0	66.4	65.8	65.2	64.8	64.2	63.7	63.4	63.1	63.2	63.4	63.5	63.8	64.2	64.5	64.6
60	53.1	53.0	53.3	53.2	52.9	52.7	52.3	51.7	51.3	51.1	51.1	51.1	51.3	51.5	51.7	51.7	51.9
65	45.5	45.3	45.5	45.4	45.1	44.7	44.1	43.3	42.8	42.3	42.3	42.7	43.1	43.2	43.3	43.3	43.4
70	34.8	34.8	34.9	34.9	34.8	34.7	34.4	34.1	33.8	33.6	33.9	34.2	34.4	34.5	34.5	34.3	34.1
75	26.1	26.0	26.1	26.1	26.0	26.0	25.9	25.7	25.5	25.5	25.8	26.2	26.5	26.6	26.5	26.3	26.0
80	17.0	17.0	16.9	16.9	16.9	16.9	17.0	16.8	16.8	16.8	17.2	17.6	18.0	18.1	18.2	17.9	17.6
85	8.09	8.04	8.01	8.00	8.01	8.06	8.05	8.03	8.06	8.17	8.48	8.85	9.15	9.34	9.40	9.29	9.05
90	1.51	1.46	1.45	1.43	1.44	1.44	1.44	1.45	1.49	1.57	1.70	1.84	1.96	2.05	2.13	2.14	2.09
95	0.01	0.02	0.01	0.02	0.02	0.02	0.02	0.02	0.01	0.02	0.02	0.01	0.02	0.02	0.02	0.01	0.01
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
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
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
115	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
120	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.08	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
125	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.11	0.11	0.11	0.11	0.11	0.11
130	0.23	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.23	0.23	0.22	0.22	0.22	0.21	0.21	0.20
135	0.47	0.47	0.48	0.49	0.49	0.49	0.49	0.49	0.49	0.48	0.47	0.47	0.46	0.45	0.45	0.44	0.42
140	0.87	0.88	0.90	0.91	0.91	0.92	0.92	0.92	0.92	0.92	0.91	0.90	0.89	0.88	0.87	0.87	0.81
145	1.46	1.48	1.49	1.51	1.52	1.53	1.54	1.55	1.55	1.55	1.54	1.54	1.53	1.51	1.50	1.51	1.40
150	2.14	2.15	2.17	2.19	2.20	2.22	2.23	2.24	2.25	2.25	2.25	2.25	2.24	2.23	2.22	2.24	2.05
155	2.74	2.74	2.76	2.78	2.79	2.81	2.82	2.83	2.84	2.85	2.85	2.85	2.84	2.84	2.83	2.87	2.58
160	3.15	3.13	3.15	3.16	3.17	3.19	3.20	3.21	3.22	3.22	3.22	3.22	3.21	3.20	3.19	3.25	2.85
165	3.27	3.25	3.26	3.27	3.28	3.29	3.29	3.30	3.30	3.30	3.30	3.30	3.29	3.29	3.27	3.35	2.85
170	3.02	2.99	3.00	3.01	3.02	3.03	3.04	3.08	3.10	3.09	3.15	3.21	3.18	3.17	3.15	3.20	2.57
175	2.36	2.37	2.39	2.40	2.43	2.39	2.80	2.79	2.76	3.08	3.11	3.06	3.04	3.01	3.06	2.78	1.94
180	1.99	1.99	1.99	1.99	1.99	1.99	1.99	1.99	1.99	1.99	1.99	1.99	1.99	1.99	1.99	1.99	1.99

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

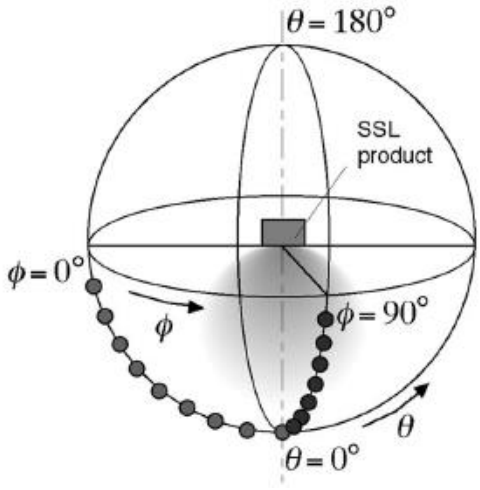
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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