

LM-79-08 TEST REPORT

for

GREEN CREATIVE LTD

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

LED Lamp

Model: 19.5PAR38HO/940NF25/277V

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ19060039k

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

Review by:



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Sep. 18, 2019

Approved by:



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/940NF25/277V

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
108.6	2062.3	18.99	0.9947
CCT (K)	CRI	Stabilization Time (Light & Power)	
3938	92.5	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. 16, 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	: 19.5PAR38HO/940NF25/277V
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 °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	277.0
Voltage frequency (Hz)	60	60
Test Current (A)	0.159	0.080
Power Factor	0.9947	0.9226
Test Power (W)	18.99	20.43
THD A%	9.49	20.76
Luminous Efficacy (lm/W)	108.6	105.8
Total Luminous Flux (lm)	2062.3	2161.4
Color Rendering Index (CRI)	92.5	
R9	64.4	
Correlated Color Temperature (CCT)(K)	3938	
Chromaticity Chroma x	0.3847	
Chromaticity Chroma y	0.3839	
Chromaticity Chroma u	0.2250	
Chromaticity Chroma v	0.3369	
Duv	0.0021	
Chromaticity Chroma u'	0.2250	
Chromaticity Chroma v'	0.5053	

Special Color Rendering Indices	
R1	92.3
R2	95.5
R3	97
R4	91.5
R5	91.1
R6	92.6
R7	94.4
R8	85.7
R9	64.4
R10	88.2
R11	91.3
R12	70.8
R13	93.2
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 25.2 °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)	0.159
Power Factor	0.9944
Power (W)	18.98
Luminous Efficacy (lm/W)	113.3
Total Luminous Flux (lm)	2150.4
Beam Angle (°)	21.8 (0°-180°) / 21.9 (90°-270°)
Center Beam Candle Power (cd)	9439
Maximum Beam Candle Power (cd)	9482 (At: C=50.0, Gamma=1.0)
Spacing Criteria	0.35 (0°-180°) / 0.36 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	96.15%
Zonal Lumens in the 60 °-90 °Zone	3.69%
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

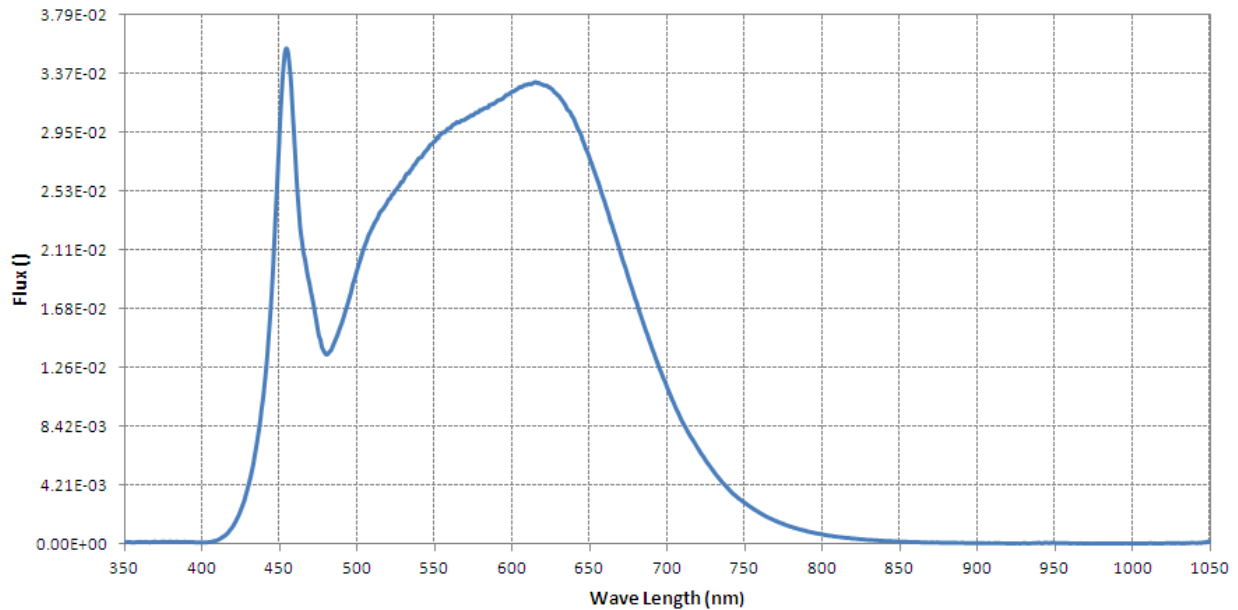
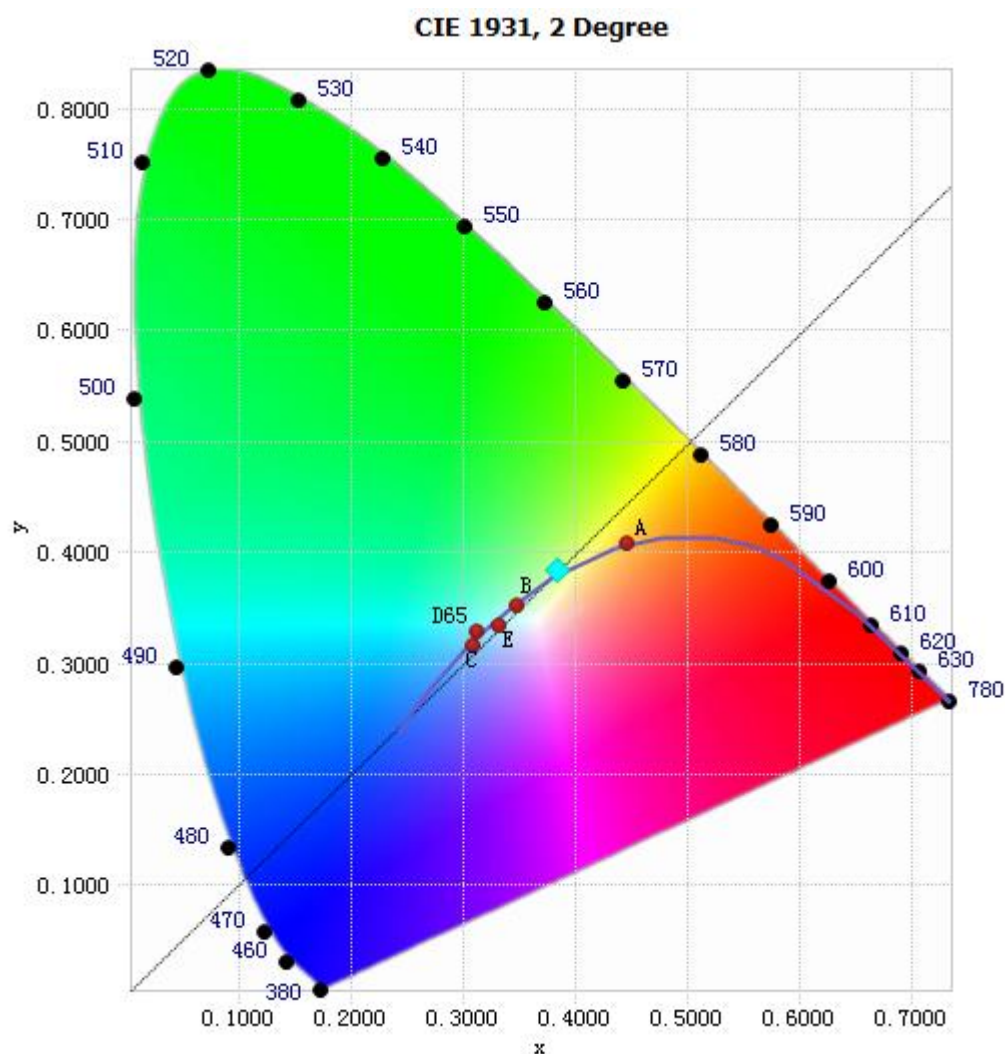


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.44E-04	485	1.45E-02	590	3.17E-02	695	1.25E-02
385	1.28E-04	490	1.59E-02	595	3.21E-02	700	1.11E-02
390	1.23E-04	495	1.78E-02	600	3.24E-02	705	9.79E-03
395	1.05E-04	500	1.98E-02	605	3.27E-02	710	8.65E-03
400	1.05E-04	505	2.15E-02	610	3.29E-02	715	7.66E-03
405	1.31E-04	510	2.28E-02	615	3.31E-02	720	6.77E-03
410	2.82E-04	515	2.39E-02	620	3.28E-02	725	5.90E-03
415	6.38E-04	520	2.47E-02	625	3.26E-02	730	5.13E-03
420	1.31E-03	525	2.55E-02	630	3.21E-02	735	4.44E-03
425	2.51E-03	530	2.62E-02	635	3.12E-02	740	3.83E-03
430	4.38E-03	535	2.70E-02	640	3.03E-02	745	3.34E-03
435	7.19E-03	540	2.77E-02	645	2.90E-02	750	2.91E-03
440	1.14E-02	545	2.83E-02	650	2.76E-02	755	2.52E-03
445	1.88E-02	550	2.89E-02	655	2.60E-02	760	2.18E-03
450	3.01E-02	555	2.95E-02	660	2.43E-02	765	1.88E-03
455	3.52E-02	560	2.98E-02	665	2.26E-02	770	1.63E-03
460	2.75E-02	565	3.02E-02	670	2.07E-02	775	1.40E-03
465	2.10E-02	570	3.05E-02	675	1.90E-02	780	1.20E-03
470	1.81E-02	575	3.08E-02	680	1.73E-02		
475	1.50E-02	580	3.11E-02	685	1.56E-02		
480	1.36E-02	585	3.15E-02	690	1.40E-02		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3847, 0.3839)

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

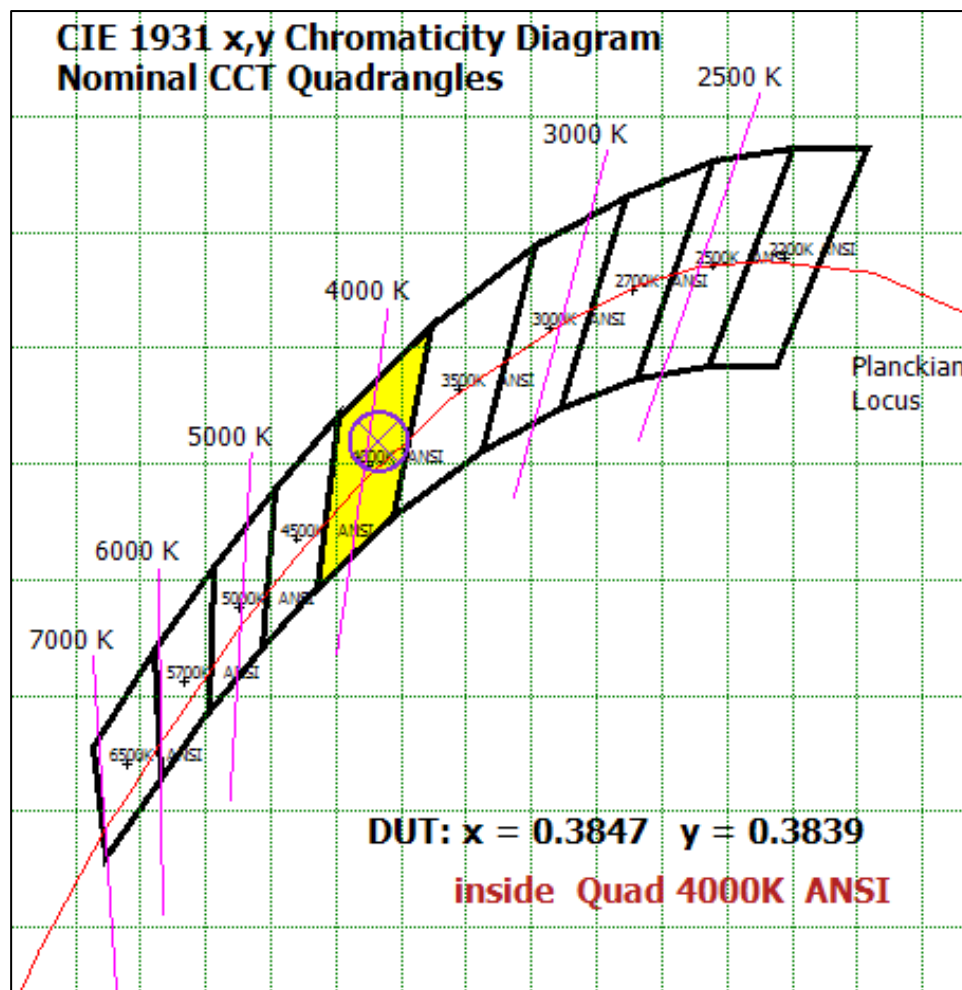
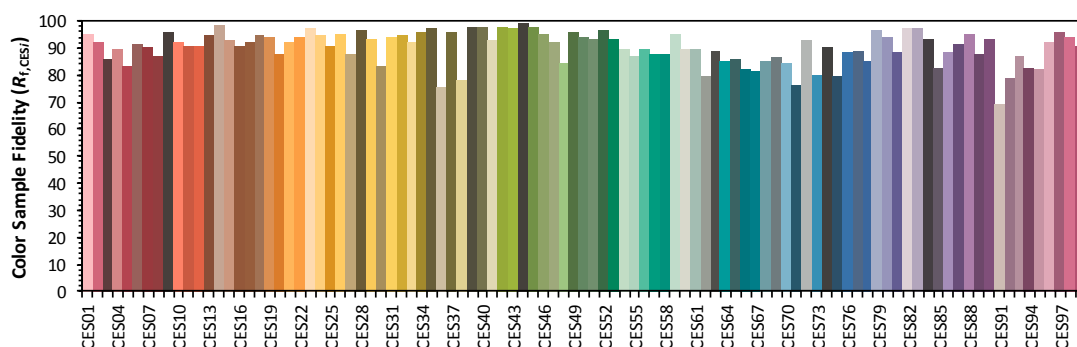
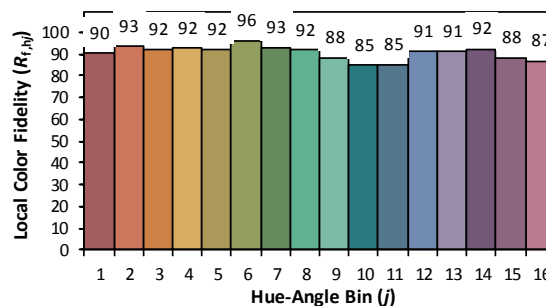
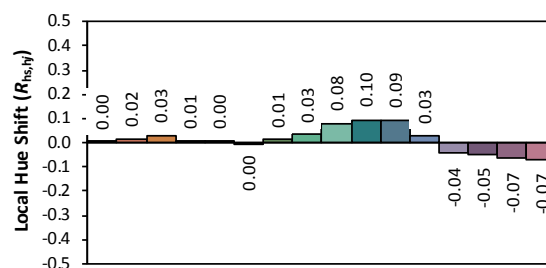
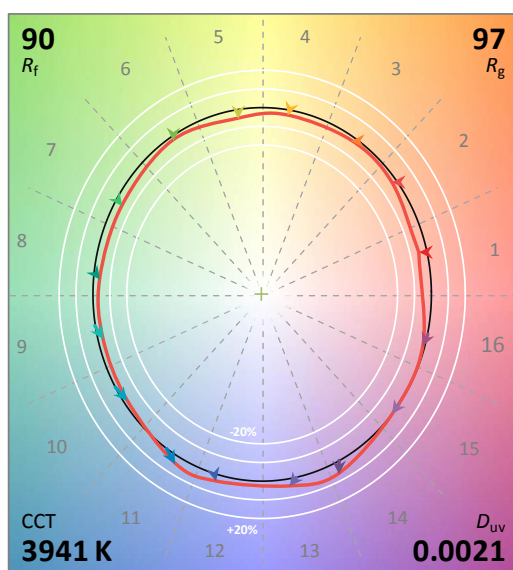
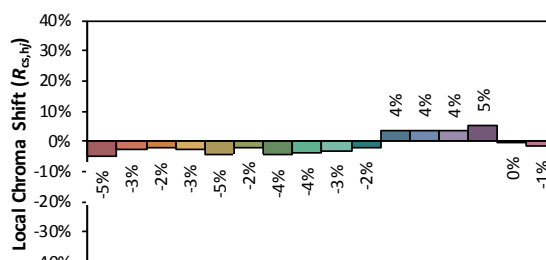


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram



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

 x 0.3847 y 0.3839
$$U' \quad 0.2250$$

V' 0.5053

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	691.786	32.17%
10- 20	760.168	35.35%
20- 30	317.574	14.77%
30- 40	142.803	6.64%
40- 50	94.242	4.38%
50- 60	61.052	2.84%
60- 70	43.17	2.01%
70- 80	26.845	1.25%
80- 90	9.365	0.44%
90-100	0.353	0.02%
100-110	0.034	0.00%
110-120	0.053	0.00%
120-130	0.098	0.00%
130-140	0.286	0.01%
140-150	0.696	0.03%
150-160	0.945	0.04%
160-170	0.709	0.03%
170-180	0.218	0.01%
Total	2150.4	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	2067.625	96.15%
60- 90	79.38	3.69%
0-90	2147.005	99.84%
90- 180	3.392	0.16%
0- 180	2150.4	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

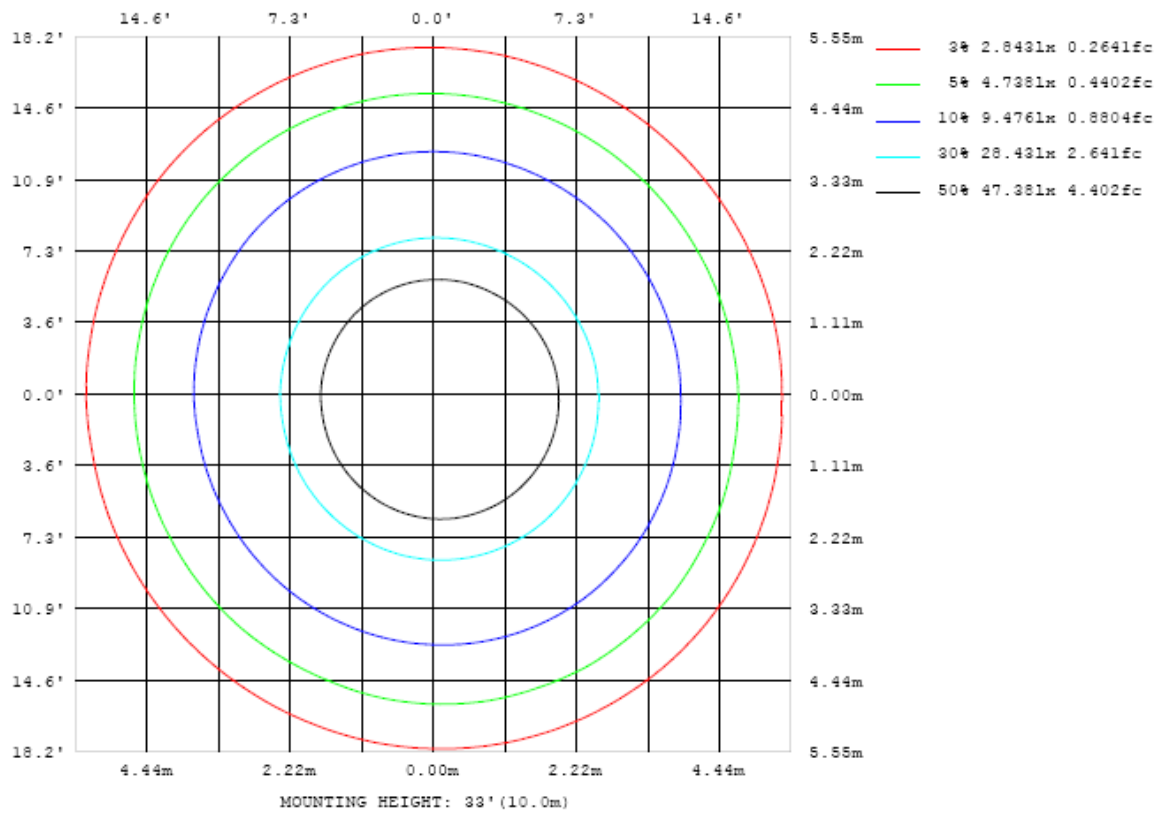


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

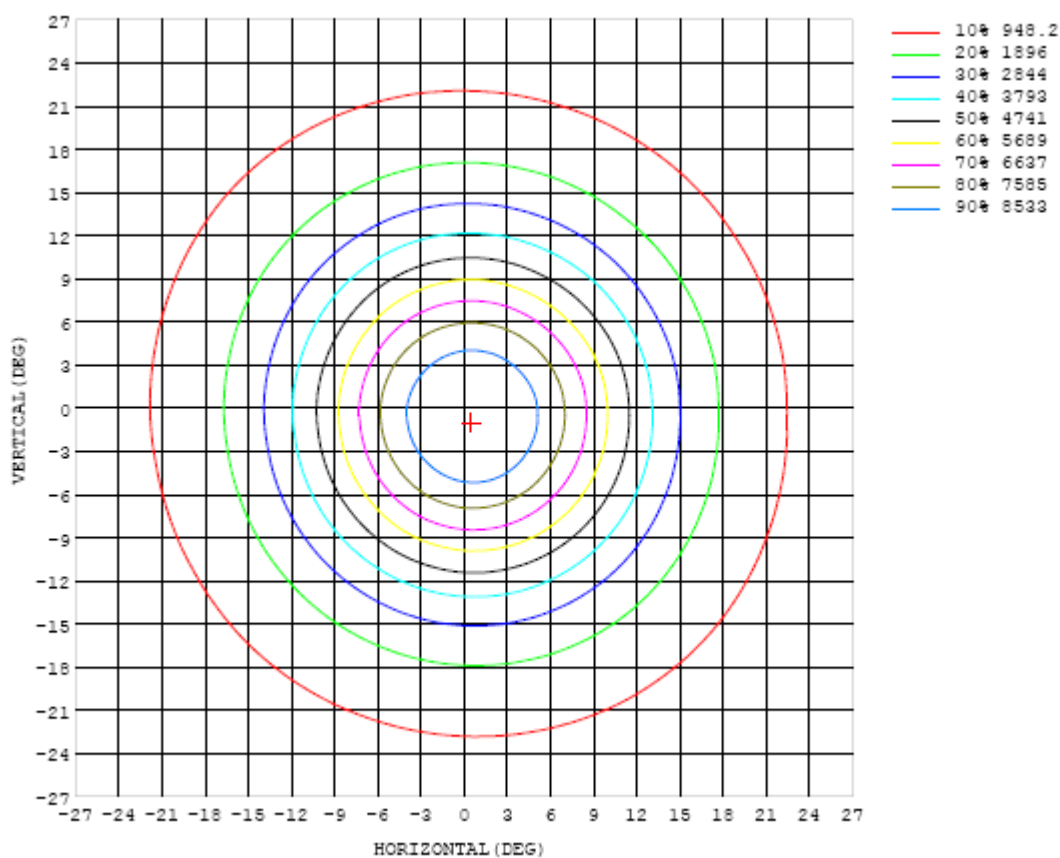


Chart 6: Isocandela Plot

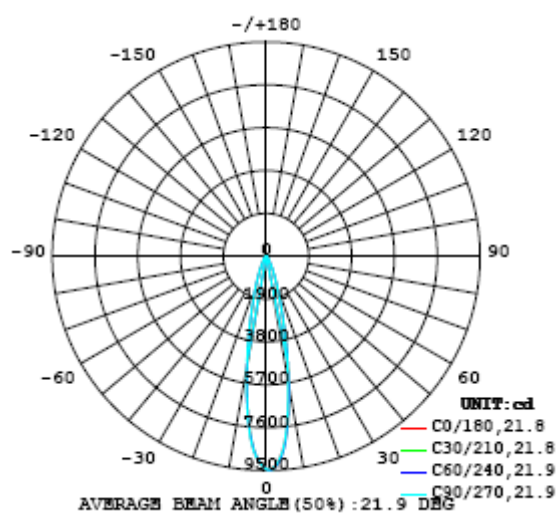


Chart 7: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1

UNIT: cd

C (DEG) y (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	9439	9439	9439	9439	9439	9439	9439	9439	9439	9439	9439	9439	9439	9439	9439	9439	9439	9439	9439
5	8569	8606	8638	8659	8686	8696	8693	8673	8639	8582	8524	8459	8382	8321	8249	8192	8138	8094	8068
10	5656	5717	5759	5789	5806	5794	5779	5747	5691	5617	5531	5436	5322	5220	5129	5047	4976	4918	4909
15	2840	2888	2930	2965	2992	3002	2996	2974	2936	2889	2825	2755	2684	2612	2550	2494	2452	2425	2428
20	1348	1377	1401	1425	1444	1456	1456	1446	1425	1400	1368	1334	1303	1272	1246	1224	1211	1202	1216
25	675	677	698	705	723	725	732	722	721	712	697	673	662	655	644	635	631	628	630
30	347	353	361	369	373	376	376	375	372	368	363	358	354	350	349	348	345	342	345
35	210	213	217	220	223	224	226	226	225	224	224	223	223	223	223	223	221	219	219
40	157	159	162	164	166	168	169	170	170	168	167	165	165	165	165	166	165	163	163
45	119	120	122	124	125	125	125	125	125	124	122	121	121	121	122	123	124	123	122
50	88.6	89.9	91.5	92.4	92.7	92.4	92.4	92.5	92.5	92.0	91.2	90.0	89.1	88.5	89.0	90.6	91.2	90.3	89.5
55	68.1	68.8	69.3	70.0	70.4	69.8	69.8	69.7	69.6	69.2	69.1	68.1	67.4	66.4	66.5	67.9	68.6	68.0	67.0
60	53.9	54.3	54.7	54.9	55.1	55.2	55.3	55.1	55.1	55.0	54.8	54.2	53.4	52.7	52.6	52.8	52.9	52.9	52.4
65	44.6	45.2	46.0	46.1	45.8	45.9	45.9	45.7	45.6	45.3	44.9	44.3	43.7	43.6	43.4	42.9	42.2	42.4	42.2
70	34.7	34.9	35.1	35.4	35.6	35.8	35.9	35.9	35.8	35.5	35.4	34.9	34.2	33.8	33.5	33.2	32.8	32.5	32.5
75	26.2	26.3	26.5	26.8	27.3	27.6	27.6	27.5	27.1	26.9	26.8	26.2	25.6	25.1	24.8	24.5	24.1	23.8	23.8
80	17.5	17.7	17.9	18.1	18.4	18.5	18.3	18.1	17.9	17.7	17.6	17.2	16.8	16.5	16.2	15.9	15.5	15.2	15.2
85	9.36	9.49	9.63	9.75	9.88	9.81	9.63	9.42	9.22	9.03	8.86	8.60	8.37	8.20	7.93	7.62	7.34	7.09	7.03
90	2.64	2.75	2.80	2.81	2.80	2.70	2.60	2.47	2.36	2.23	2.11	1.97	1.84	1.71	1.57	1.43	1.31	1.21	1.25
95	0.09	0.09	0.09	0.08	0.06	0.05	0.04	0.03	0.03	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	0.03
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	0.05	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	0.05	0.06
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	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.12
130	0.13	0.13	0.13	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.15	0.15	0.15	0.23
135	0.24	0.24	0.24	0.25	0.25	0.25	0.25	0.25	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.27	0.27	0.47
140	0.45	0.44	0.44	0.45	0.45	0.45	0.45	0.46	0.46	0.47	0.47	0.47	0.48	0.48	0.48	0.49	0.49	0.49	0.89
145	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.75	0.75	0.75	0.76	0.76	0.76	0.77	0.77	0.78	0.77	1.50
150	1.06	1.06	1.06	1.06	1.06	1.07	1.07	1.08	1.08	1.09	1.09	1.10	1.10	1.11	1.11	1.11	1.12	1.09	2.19
155	1.38	1.38	1.39	1.39	1.39	1.40	1.40	1.41	1.42	1.42	1.43	1.43	1.43	1.43	1.43	1.43	1.44	1.39	2.77
160	1.65	1.65	1.65	1.66	1.66	1.66	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.66	1.66	1.66	1.60	3.15
165	1.83	1.83	1.84	1.84	1.84	1.84	1.85	1.85	1.85	1.86	1.86	1.86	1.86	1.86	1.85	1.85	1.85	1.79	3.22
170	1.96	1.96	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.96	1.96	1.95	1.95	1.94	1.93	1.93	1.86	2.95
175	1.94	1.94	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.94	1.93	1.93	1.92	1.91	1.90	1.88	1.84	2.33
180	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97

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	9439	9439	9439	9439	9439	9439	9439	9439	9439	9439	9439	9439	9439	9439	9439	9439	9439		
5	8030	8008	7995	7986	7986	8000	8021	8045	8084	8129	8185	8241	8293	8352	8414	8472	8531		
10	4879	4860	4854	4868	4896	4914	4943	4975	5013	5058	5105	5163	5247	5336	5434	5524	5608		
15	2421	2421	2436	2451	2470	2490	2513	2537	2550	2561	2579	2604	2634	2672	2716	2773	2822		
20	1219	1224	1234	1247	1253	1257	1259	1261	1259	1260	1261	1265	1273	1285	1299	1317	1342		
25	631	636	642	646	646	646	644	642	639	633	628	628	628	633	637	647	657		
30	344	345	346	346	345	344	342	340	338	334	331	330	331	335	339	342	346		
35	217	216	217	217	217	217	217	217	215	212	209	207	206	209	210	210	211		
40	159	158	158	159	159	160	163	165	166	163	162	161	160	161	161	159	159		
45	119	118	117	116	116	117	118	120	121	120	120	120	121	121	121	120	121		
50	86.7	85.1	84.5	84.3	84.6	85.0	85.6	86.7	87.3	86.7	86.4	86.8	86.8	87.2	87.8	88.7	89.2		
55	65.0	64.0	63.8	63.9	64.4	64.8	65.1	65.8	66.3	66.3	66.2	66.4	66.5	66.7	66.9	67.3	67.9		
60	51.0	50.7	50.6	50.8	51.3	51.6	52.0	52.6	53.0	53.2	53.2	53.1	53.0	53.0	53.1	53.4	53.8		
65	41.5	41.2	41.1	41.5	41.8	42.3	42.9	43.6	43.4	43.2	43.4	43.4	43.4	43.6	43.3	43.6	44.2		
70	32.4	32.6	32.6	32.7	32.8	33.0	33.4	33.7	33.8	33.8	33.8	33.9	34.0	34.1	34.1	34.4	34.7		
75	23.9	24.1	24.1	24.3	24.2	24.2	24.4	24.7	24.9	25.1	25.4	25.7	25.9	26.0	26.0	26.3	26.4		
80	15.2	15.4	15.3	15.3	15.3	15.4	15.5	15.7	15.9	16.1	16.2	16.3	16.5	16.7	16.9	17.1	17.4		
85	7.01	7.03	7.02	7.01	7.07	7.22	7.25	7.44	7.66	7.81	7.84	7.99	8.15	8.35	8.57	8.83	9.20		
90	1.21	1.20	1.19	1.22	1.27	1.37	1.47	1.59	1.68	1.76	1.85	1.90	2.01	2.18	2.31	2.44	2.63		
95	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.05	0.05	0.06	0.07	0.08	0.09	0.10		
100	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		
105	0.03	0.03	0.04	0.04	0.04	0.03	0.04	0.04	0.04	0.03	0.04	0.03	0.03	0.03	0.03	0.03	0.03		
110	0.04	0.04	0.05	0.05	0.04	0.04	0.04	0.05	0.05	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	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06		
120	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	0.07	0.07		
125	0.12	0.12	0.12	0.13	0.13	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	0.23	0.23	0.23	0.22	0.22	0.21	0.21	0.21	0.20	0.20	0.20	0.19		
135	0.47	0.48	0.48	0.48	0.49	0.48	0.48	0.47	0.46	0.45	0.44	0.43	0.42	0.41	0.41	0.40	0.39		
140	0.90	0.91	0.92	0.92	0.92	0.92	0.91	0.90	0.89	0.87	0.86	0.84	0.83	0.81	0.80	0.79	0.77		
145	1.52	1.53	1.54	1.55	1.55	1.54	1.54	1.52	1.51	1.49	1.47	1.45	1.43	1.41	1.40	1.39	1.36		
150	2.20	2.21	2.22	2.23	2.23	2.23	2.23	2.22	2.20	2.19	2.17	2.15	2.14	2.12	2.10	2.09	2.05		
155	2.78	2.79	2.80	2.80	2.81	2.80	2.80	2.80	2.79	2.78	2.77	2.76	2.75	2.73	2.72	2.72	2.66		
160	3.15	3.17	3.16	3.17	3.17	3.17	3.16	3.16	3.16	3.15	3.15	3.14	3.14	3.13	3.12	3.14	3.05		
165	3.22	3.23	3.22	3.22	3.23	3.23	3.23	3.23	3.23	3.23	3.23	3.23	3.23	3.23	3.23	3.23	3.16		
170	2.96	2.97	2.97	2.97	2.97	2.98	2.99	3.00	3.01	3.01	3.02	3.03	3.04	3.05	3.06	3.10	2.98		
175	2.35	2.35	2.36	2.36	2.37	2.38	2.39	2.41	2.43	2.45	2.47	2.49	2.51	2.52	2.53	2.58	2.46		
180	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97		

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.

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

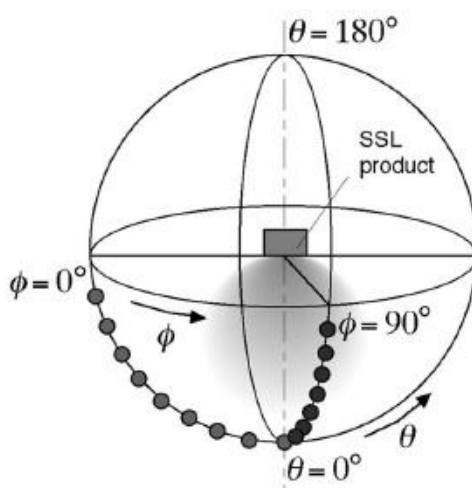
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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