

LM-79-08 TEST REPORT

for

GREEN CREATIVE LTD

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

LED Lamp

Model: 10PAR30DIM/840NF25/N

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

3rd Floor, Bld. 2, NO. 96 Longchuanwu Rd Qianjiang Economy Dev. Zone, YuhangDist,
Hangzhou, Zhejiang Province, China 311100

Tel: +86571 86376106

www.ledtestlab.com

Report No.: HZ19070039b

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: 10PAR30DIM/840NF25/N

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
112.2	1100.8	9.81	0.7364
CCT (K)	CRI	Stabilization Time (Light & Power)	
3840	81.8	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. 30, 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	: 10PAR30DIM/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 25.0 °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)	0.111
Power Factor	0.7364
Test Power (W)	9.81
THD A%	67.06
Luminous Efficacy (lm/W)	112.2
Total Luminous Flux (lm)	1100.8
Color Rendering Index (CRI)	81.8
R9	2.8
Correlated Color Temperature (CCT)(K)	3840
Chromaticity Chroma x	0.3891
Chromaticity Chroma y	0.3858
Chromaticity Chroma u	0.2271
Chromaticity Chroma v	0.3379
Duv	0.0018
Chromaticity Chroma u'	0.2271
Chromaticity Chroma v'	0.5068

Special Color Rendering Indices	
R1	79.5
R2	88.5
R3	95.2
R4	80
R5	79.6
R6	84.2
R7	85.3
R8	61.9
R9	2.8
R10	72.8
R11	78.4
R12	61.9
R13	81.6
R14	97.5

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 25.1 °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)	0.110
Power Factor	0.7416
Power (W)	9.77
Luminous Efficacy (lm/W)	113.5
Total Luminous Flux (lm)	1109.1
Beam Angle (°)	21.5 (0°-180°) / 22.1 (90°-270°)
Center Beam Candle Power (cd)	4489
Maximum Beam Candle Power (cd)	4581 (At: C=130.0, Gamma=2.5)
Spacing Criteria	0.39 (0°-180°) / 0.37 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	96.01%
Zonal Lumens in the 60 °-90 °Zone	3.76%
Zonal Lumens in the 90 °-120 °Zone	0.09%
Zonal Lumens in the 120 °-180 °Zone	0.13%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

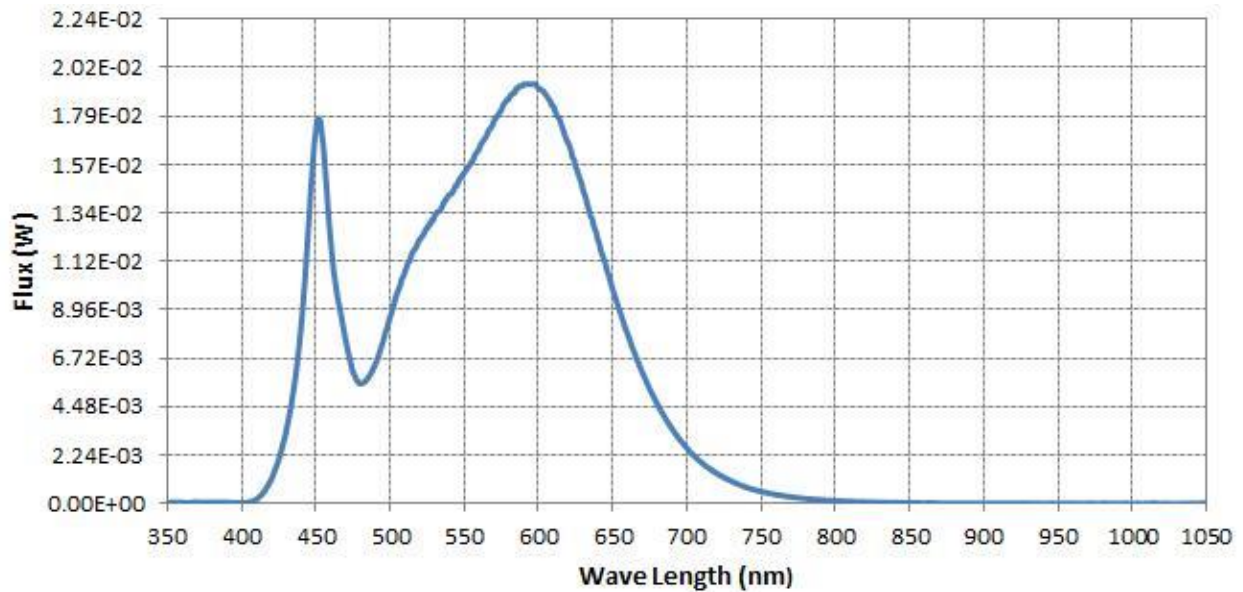
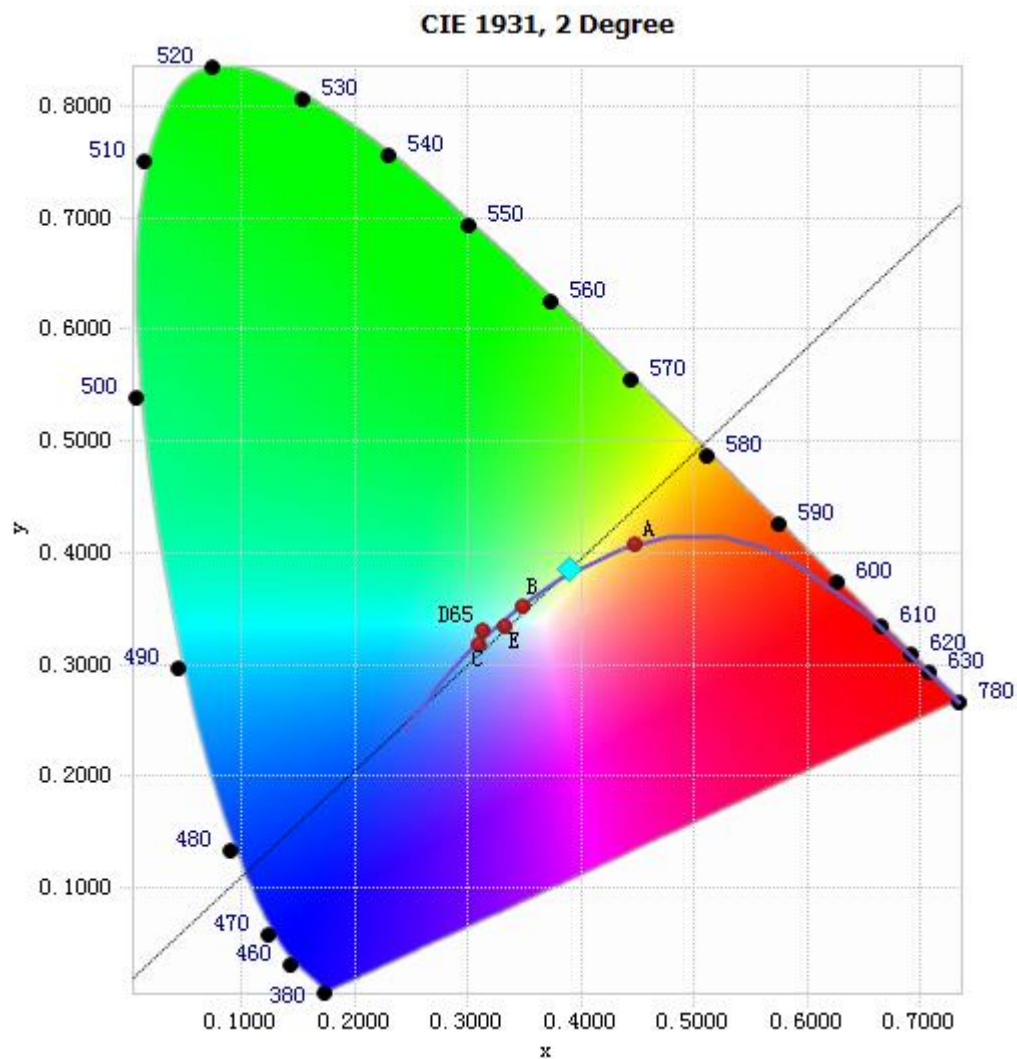


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	6.19E-05	485	5.79E-03	590	1.94E-02	695	2.97E-03
385	4.96E-05	490	6.41E-03	595	1.94E-02	700	2.56E-03
390	5.80E-05	495	7.41E-03	600	1.92E-02	705	2.18E-03
395	3.81E-05	500	8.62E-03	605	1.89E-02	710	1.88E-03
400	2.51E-05	505	9.75E-03	610	1.84E-02	715	1.62E-03
405	6.47E-05	510	1.07E-02	615	1.76E-02	720	1.40E-03
410	1.94E-04	515	1.16E-02	620	1.67E-02	725	1.20E-03
415	5.33E-04	520	1.22E-02	625	1.56E-02	730	1.03E-03
420	1.11E-03	525	1.27E-02	630	1.45E-02	735	8.79E-04
425	2.01E-03	530	1.33E-02	635	1.33E-02	740	7.48E-04
430	3.32E-03	535	1.37E-02	640	1.22E-02	745	6.46E-04
435	5.23E-03	540	1.43E-02	645	1.11E-02	750	5.58E-04
440	8.09E-03	545	1.47E-02	650	9.91E-03	755	4.82E-04
445	1.27E-02	550	1.53E-02	655	8.84E-03	760	4.14E-04
450	1.72E-02	555	1.58E-02	660	7.83E-03	765	3.55E-04
455	1.66E-02	560	1.64E-02	665	6.91E-03	770	3.08E-04
460	1.22E-02	565	1.70E-02	670	6.04E-03	775	2.63E-04
465	9.43E-03	570	1.77E-02	675	5.28E-03	780	2.27E-04
470	7.61E-03	575	1.82E-02	680	4.60E-03		
475	6.10E-03	580	1.87E-02	685	3.99E-03		
480	5.55E-03	585	1.92E-02	690	3.45E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3891, 0.3858)

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

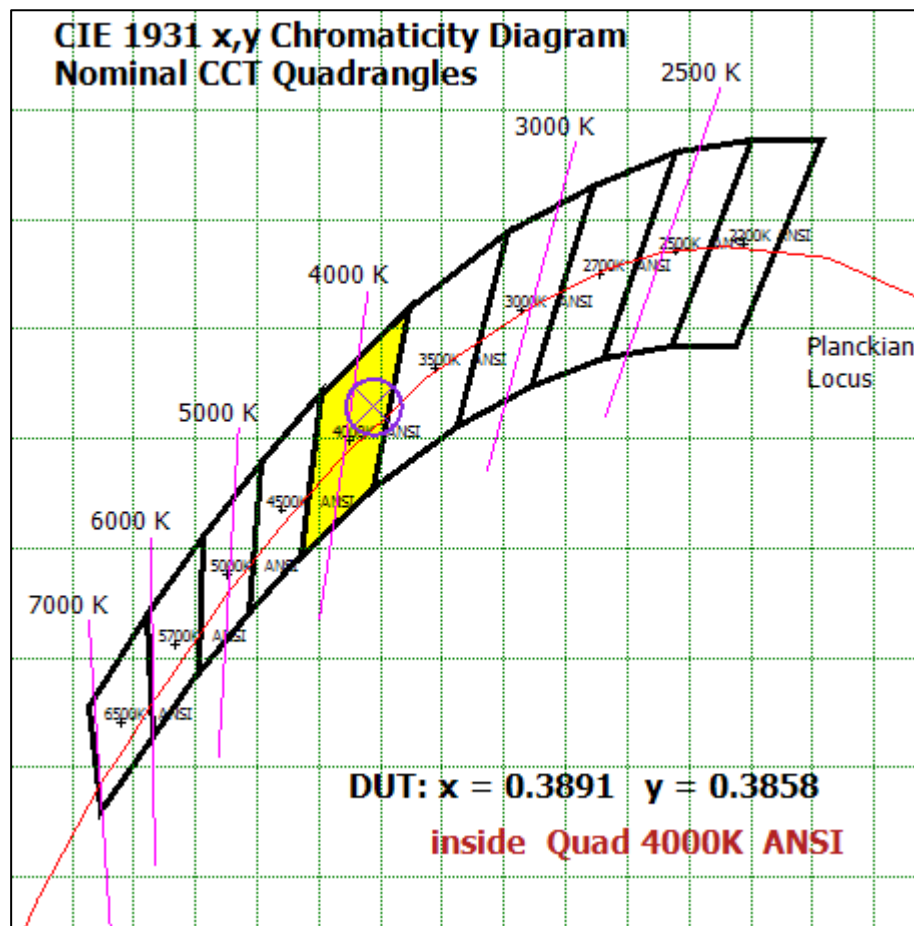
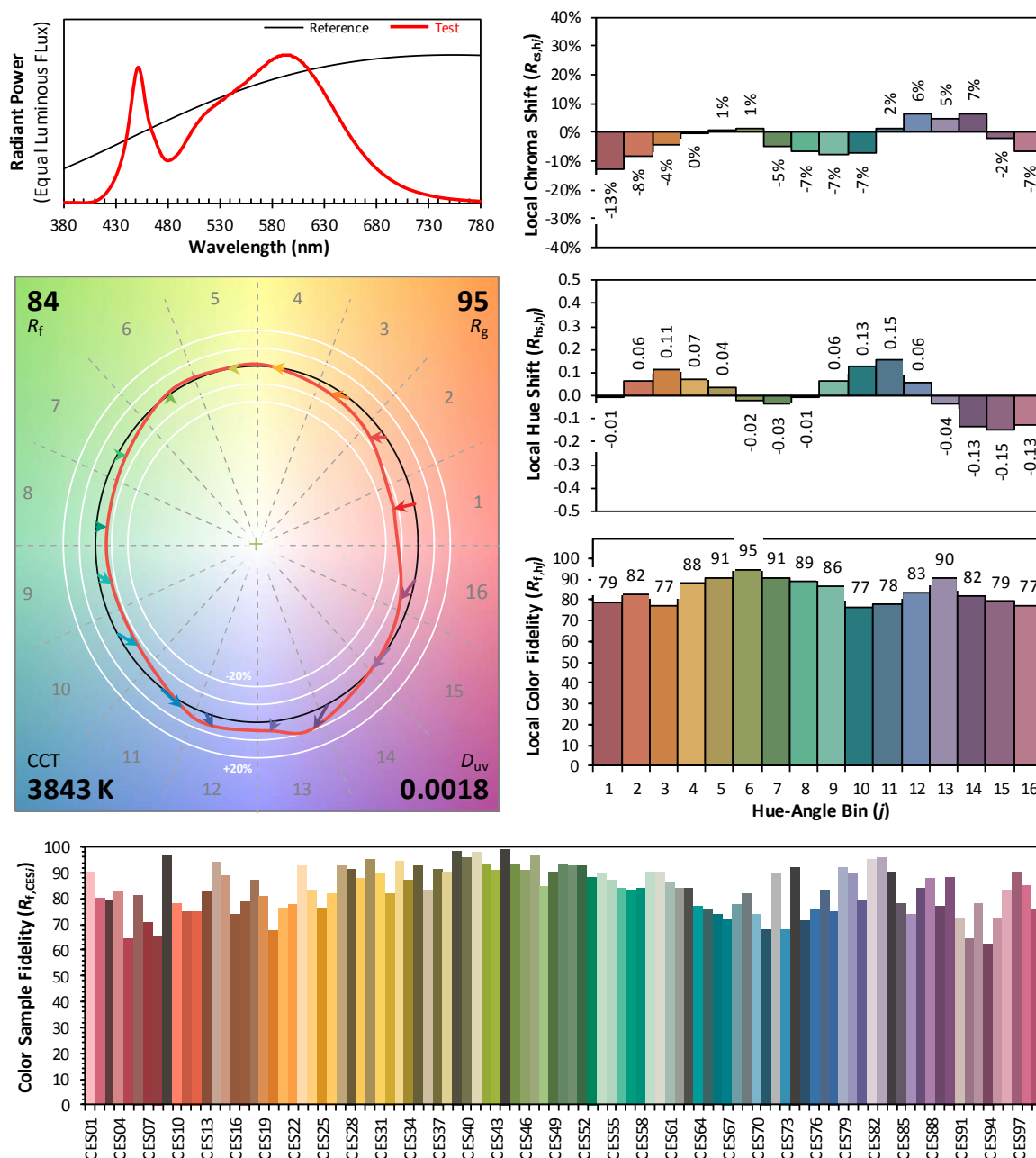


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method



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

x 0.3891

y 0.3858

u' 0.2271

v' 0.5068

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	337.569	30.44%
10- 20	358.861	32.36%
20- 30	190.775	17.20%
30- 40	98.76	8.90%
40- 50	47.188	4.25%
50- 60	31.699	2.86%
60- 70	23.325	2.10%
70- 80	13.384	1.21%
80- 90	5.039	0.45%
90-100	0.942	0.08%
100-110	0.046	0.00%
110-120	0.023	0.00%
120-130	0.053	0.00%
130-140	0.15	0.01%
140-150	0.344	0.03%
150-160	0.457	0.04%
160-170	0.344	0.03%
170-180	0.108	0.01%
Total	1109.1	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	1064.852	96.01%
60- 90	41.748	3.76%
0-90	1106.6	99.78%
90- 180	2.467	0.22%
0- 180	1109.1	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

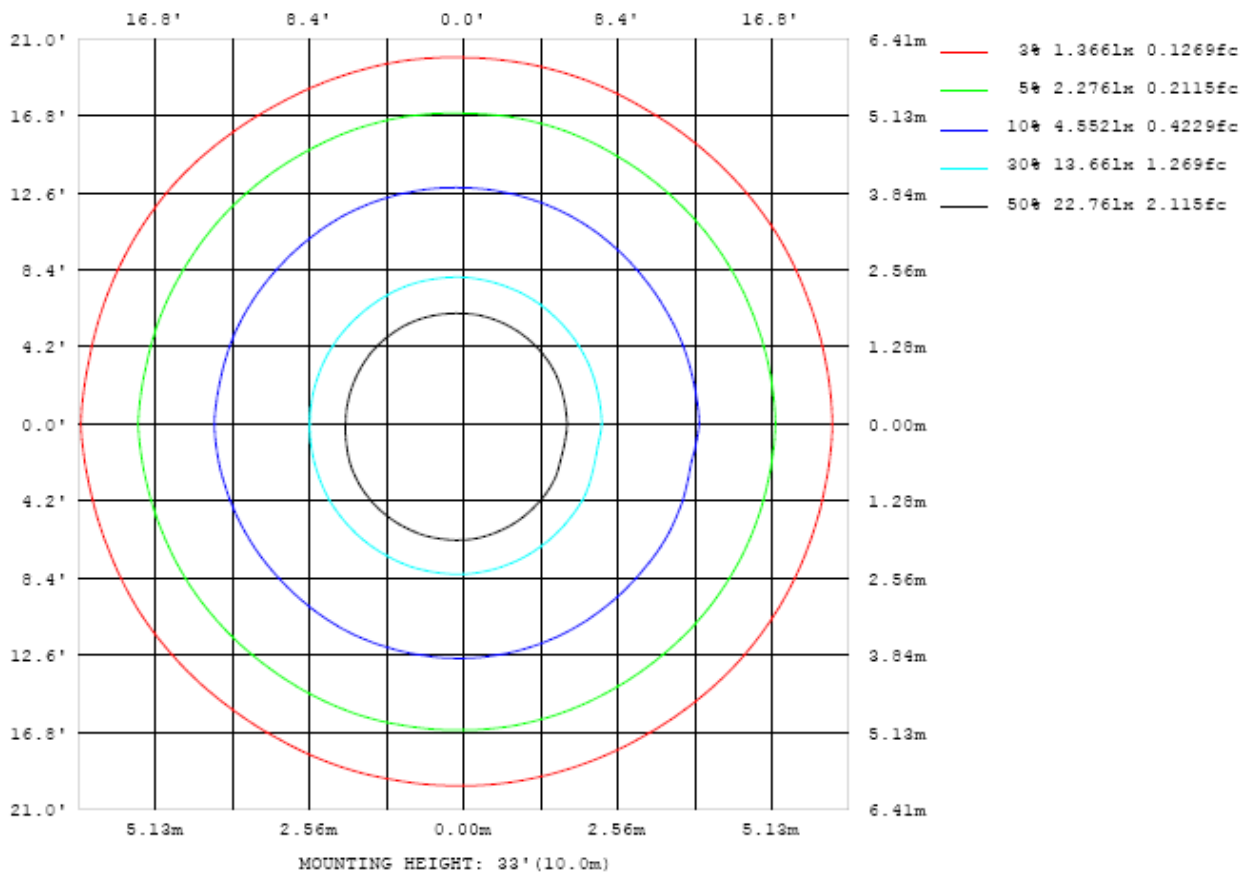


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

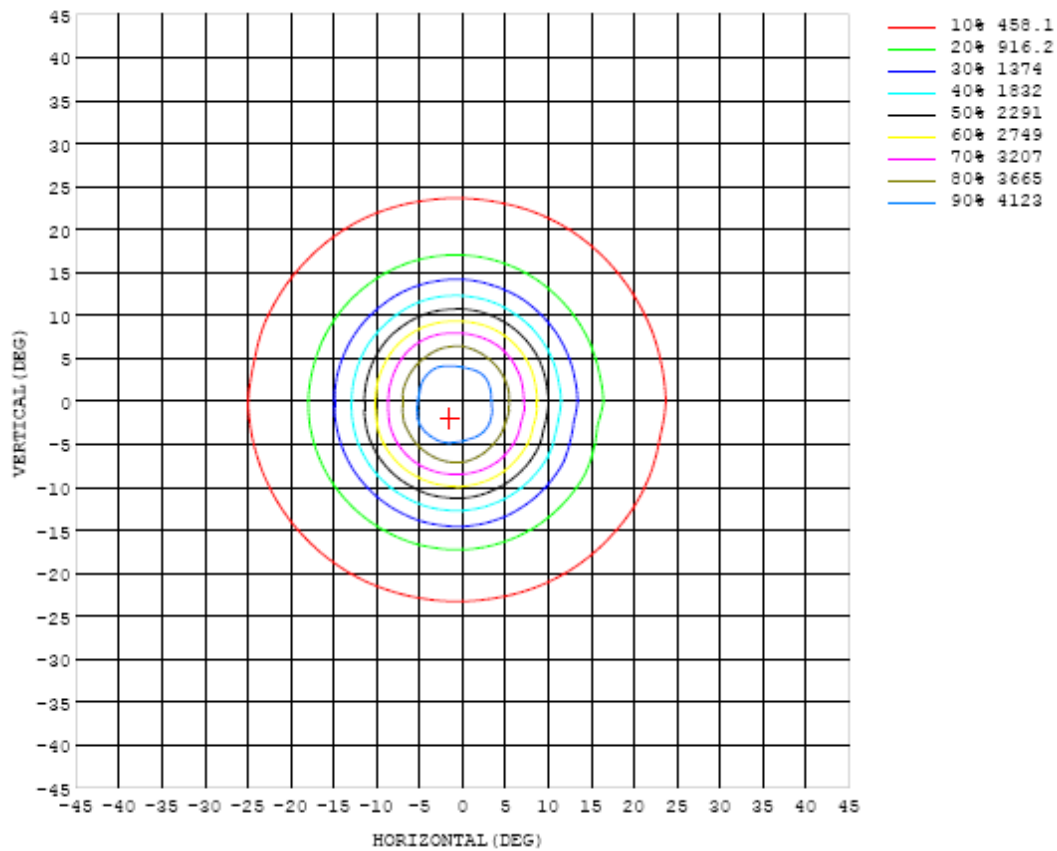


Chart 6: Isocandela Plot

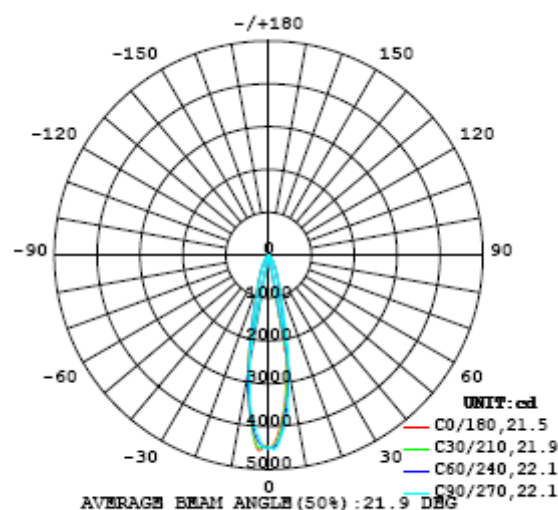


Chart 7: Polar Candela Distribution

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	4489	4489	4489	4489	4489	4489	4489	4489	4489	4489	4489	4489	4489	4489	4489	4489	4489	4489	4489
5	3760	3784	3793	3820	3879	3924	3973	4018	4033	4071	4099	4138	4193	4232	4275	4295	4271	4210	4178
10	2292	2263	2284	2394	2442	2486	2549	2612	2669	2716	2745	2791	2829	2873	2890	2892	2879	2827	2807
15	1090	1039	1076	1128	1145	1167	1195	1228	1254	1286	1298	1321	1331	1348	1359	1373	1373	1369	1356
20	644	609	627	632	624	627	631	638	647	656	660	669	676	684	692	709	718	729	739
25	405	395	393	390	385	384	384	384	385	389	392	398	406	413	421	431	441	451	458
30	256	252	249	246	243	239	236	238	239	241	243	247	249	254	262	270	275	281	291
35	153	152	152	151	149	147	144	142	141	143	144	144	149	154	159	164	168	172	177
40	92.5	92.0	92.4	91.5	90.4	88.4	86.4	84.6	83.0	83.0	83.3	84.9	88.1	91.5	95.0	97.8	101	103	105
45	60.2	59.5	59.3	59.0	58.7	58.1	56.9	54.9	53.4	52.5	53.0	54.8	57.2	59.5	61.2	62.4	63.3	64.6	66.1
50	44.0	43.4	43.2	42.8	42.7	42.6	42.0	40.9	40.1	39.8	40.0	40.8	42.3	43.7	44.2	44.4	44.8	45.7	46.7
55	35.9	35.5	35.1	35.0	35.0	35.1	35.0	34.2	33.9	33.7	33.9	34.3	35.3	36.2	36.5	36.5	36.9	37.4	38.0
60	29.2	28.5	28.2	28.3	28.3	28.1	28.1	27.8	27.7	27.5	27.6	27.8	28.5	29.2	29.3	29.5	29.7	30.0	30.4
65	23.9	23.3	23.0	23.0	23.1	22.8	22.8	22.7	22.6	22.6	22.8	22.9	23.5	24.0	24.2	24.4	24.5	24.7	25.0
70	17.5	17.4	17.3	17.3	17.5	17.3	17.3	17.4	17.4	17.4	17.6	17.8	18.2	18.6	18.8	18.9	19.0	19.1	19.4
75	12.0	12.0	11.9	11.9	12.1	12.1	12.1	12.2	12.3	12.4	12.6	12.7	12.9	13.1	13.3	13.4	13.5	13.6	13.5
80	7.20	7.24	7.14	7.18	7.27	7.34	7.41	7.54	7.64	7.78	7.85	7.95	8.07	8.18	8.32	8.41	8.46	8.48	8.38
85	4.04	4.17	4.02	4.04	4.10	4.17	4.23	4.32	4.42	4.53	4.62	4.69	4.79	4.87	4.95	5.00	5.03	5.04	5.07
90	1.78	1.85	1.69	1.70	1.73	1.76	1.78	1.83	1.88	1.94	2.01	2.06	2.12	2.17	2.23	2.26	2.27	2.28	2.35
95	0.70	0.72	0.66	0.67	0.69	0.70	0.72	0.74	0.75	0.78	0.79	0.81	0.83	0.84	0.86	0.87	0.89	0.90	0.91
100	0.14	0.15	0.14	0.15	0.16	0.16	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.18	0.19	0.19	0.20
105	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	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	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.02	0.02	0.02	0.01	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	0.02	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	0.04
125	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.04	0.04	0.05	0.05	0.04	0.04	0.05	0.05	0.05	0.06
130	0.10	0.17	0.08	0.08	0.08	0.08	0.08	0.08	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.08	0.07	0.11
135	0.15	0.16	0.14	0.15	0.14	0.14	0.14	0.14	0.14	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.21
140	0.26	0.26	0.26	0.26	0.25	0.25	0.25	0.25	0.24	0.24	0.24	0.24	0.23	0.23	0.23	0.23	0.23	0.23	0.38
145	0.40	0.39	0.40	0.40	0.40	0.40	0.39	0.39	0.39	0.39	0.38	0.38	0.38	0.38	0.37	0.37	0.37	0.36	0.63
150	0.56	0.56	0.56	0.56	0.56	0.56	0.55	0.55	0.55	0.55	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.52	0.92
155	0.70	0.70	0.70	0.71	0.71	0.71	0.70	0.71	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.67	1.16
160	0.82	0.82	0.82	0.83	0.83	0.83	0.83	0.83	0.83	0.84	0.83	0.84	0.84	0.83	0.83	0.83	0.83	0.80	1.31
165	0.91	0.91	0.91	0.92	0.92	0.92	0.92	0.93	0.92	0.93	0.92	0.93	0.93	0.93	0.92	0.92	0.92	0.88	1.31
170	0.97	0.97	0.97	0.98	0.98	0.98	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.96	1.19
175	0.97	0.97	0.97	0.98	0.98	0.98	0.99	0.99	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.00
180	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99

Table 6: Luminous Intensity Data

Table--2

UNIT: cd

C (DEG) γ (DEG)	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350		
0	4489	4489	4489	4489	4489	4489	4489	4489	4489	4489	4489	4489	4489	4489	4489	4489	4489		
5	4146	4168	4181	4168	4130	4067	4003	3966	3936	3902	3878	3852	3831	3817	3798	3794	3781		
10	2804	2788	2782	2762	2721	2678	2619	2561	2524	2500	2460	2430	2390	2366	2343	2303	2273		
15	1357	1342	1324	1308	1286	1272	1251	1233	1208	1180	1151	1132	1108	1091	1081	1075	1072		
20	726	719	706	695	685	678	671	662	652	645	638	632	624	620	620	625	630		
25	445	446	436	429	425	421	413	407	402	399	397	396	394	393	394	397	401		
30	283	280	276	272	264	257	257	256	250	250	248	244	244	247	250	250	253		
35	173	172	171	166	162	157	152	149	149	146	145	146	148	149	152	154	154		
40	103	104	103	100.0	96.7	92.4	88.8	86.0	84.4	83.7	84.5	86.1	88.4	90.0	91.2	92.8	92.6		
45	65.0	64.6	64.3	63.4	61.7	59.5	57.0	54.3	52.6	53.1	54.7	56.5	57.8	58.6	58.8	59.3	59.5		
50	45.7	45.8	45.3	45.0	44.7	43.8	42.2	40.9	40.4	40.5	41.3	42.6	43.3	43.2	43.1	43.5	43.6		
55	37.4	37.6	37.2	37.2	37.1	36.6	35.5	34.8	34.5	34.5	34.6	35.4	35.7	35.5	35.4	35.5	35.5		
60	30.1	30.2	30.0	30.0	30.0	29.5	28.8	28.5	28.2	28.2	28.3	28.7	28.9	28.8	28.7	28.7	28.7		
65	24.7	24.8	24.7	24.7	24.6	24.3	23.7	23.6	23.4	23.3	23.3	23.5	23.5	23.4	23.4	23.4	23.4		
70	19.1	19.1	19.0	19.0	18.9	18.6	18.3	18.0	17.8	17.7	17.7	17.7	17.7	17.8	17.7	17.6	17.5		
75	13.4	13.4	13.4	13.3	13.2	13.0	12.8	12.6	12.4	12.3	12.2	12.1	12.0	12.0	12.0	11.9	11.9		
80	8.32	8.27	8.23	8.17	8.06	7.95	7.80	7.64	7.54	7.45	7.38	7.30	7.25	7.25	7.24	7.18	7.12		
85	5.00	4.97	4.95	4.90	4.84	4.75	4.65	4.51	4.42	4.33	4.28	4.21	4.17	4.15	4.15	4.09	4.04		
90	2.33	2.20	2.17	2.11	2.05	2.00	1.94	1.89	1.85	1.82	1.79	1.76	1.74	1.73	1.72	1.70	1.68		
95	0.90	0.88	0.88	0.86	0.84	0.82	0.80	0.77	0.75	0.73	0.71	0.69	0.68	0.66	0.65	0.65	0.64		
100	0.20	0.21	0.22	0.22	0.21	0.21	0.20	0.19	0.17	0.16	0.15	0.14	0.13	0.12	0.12	0.12	0.13		
105	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02	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		
115	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03		
120	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		
125	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.07	0.07		
130	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.13	0.13	0.13	0.13	0.13	0.13		
135	0.22	0.22	0.22	0.22	0.23	0.23	0.23	0.23	0.24	0.24	0.24	0.24	0.25	0.25	0.25	0.26	0.25		
140	0.39	0.40	0.41	0.41	0.42	0.42	0.42	0.43	0.44	0.44	0.45	0.45	0.46	0.46	0.47	0.47	0.45		
145	0.66	0.67	0.68	0.69	0.69	0.70	0.71	0.72	0.73	0.73	0.74	0.75	0.76	0.76	0.77	0.78	0.74		
150	0.98	0.99	1.00	1.01	1.01	1.02	1.03	1.04	1.05	1.06	1.07	1.08	1.09	1.09	1.10	1.11	1.05		
155	1.27	1.28	1.29	1.29	1.30	1.31	1.31	1.32	1.33	1.34	1.35	1.36	1.36	1.37	1.37	1.39	1.29		
160	1.48	1.48	1.49	1.50	1.50	1.51	1.51	1.52	1.52	1.53	1.53	1.54	1.54	1.54	1.54	1.57	1.42		
165	1.54	1.54	1.56	1.56	1.56	1.56	1.57	1.57	1.57	1.57	1.57	1.57	1.57	1.57	1.57	1.60	1.40		
170	1.47	1.44	1.47	1.46	1.46	1.47	1.47	1.46	1.47	1.47	1.46	1.46	1.46	1.46	1.46	1.49	1.24		
175	1.18	1.19	1.20	1.20	1.20	1.20	1.19	1.19	1.19	1.19	1.18	1.18	1.18	1.18	1.19	1.17	0.96		
180	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99		

Table 7: Luminous Intensity Data

EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Aug. 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 ***

This report is considered invalidated without the Special Seal for Inspection of the LTL. This report shall not be altered, increased or deleted. The results shown in this test report refer only to the sample(s) tested. Without written approval of LTL, this test report shall not be copied except in full and published as advertisement.