

LM-79-08 TEST REPORT

for

GREEN CREATIVE LTD

Room 3603, Level 36, Tower 1, Enterprise Square Five, 38 Wang Chiu Road, Kowloon Bay, KL,
Hong Kong

TRACK LIGHTING

Model: ATM10/930/FL/DIM120V/XX/YY

Where XX mean different type of Adaptor, could be H, J, L or CM.

Where YY mean different color of product, could be BL, WH, SV.

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.: HZ20030024a

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

Review by:



Engineer: April Zou

Apr. 24, 2020

Approved by:



Manager: Jim Zhang

Apr. 24, 2020

TEST SUMMARY

Sample Tested: ATM10/930/FL/DIM120V/H/BL

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
97.0	1089.1	11.23	0.9732
CCT (K)	CRI	Stabilization Time (Light & Power)	
3020	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 : Mar. 17, 2020

Date of Test : Mar. 19, 2020

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	: TRACK LIGHTING
Model	: ATM10/930/FL/DIM120V/H/BL
Electrical Ratings	: 120Vac, 60Hz, 11.5W
Product Description	: 3000K
Manufacturer	: GREEN CREATIVE LTD
Address	: Room 3603, Level 36, Tower 1, Enterprise Square Five, 38 Wang Chiu Road, Kowloon Bay, KL, Hong Kong

TEST RESULTS

Test ambient temperature was 25.0 °C.

Base orientation was light down. 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)	0.096
Power Factor	0.9732
Test Power (W)	11.23
THD A%	17.94
Luminous Efficacy (lm/W)	97.0
Total Luminous Flux (lm)	1089.1
Color Rendering Index (CRI)	92.5
R9	58.3
Correlated Color Temperature (CCT)(K)	3020
Chromaticity Chroma x	0.4355
Chromaticity Chroma y	0.4037
Chromaticity Chroma u	0.2498
Chromaticity Chroma v	0.3474
Duv	0.0002
Chromaticity Chroma u'	0.2498
Chromaticity Chroma v'	0.5210

Special Color Rendering Indices	
R1	92.5
R2	96.8
R3	98.7
R4	91.4
R5	92
R6	95.7
R7	91.4
R8	81.1
R9	58.3
R10	91.4
R11	91.9
R12	79.4
R13	93.8
R14	99.1

Table 2: Test data per Sphere-Spectroradiometer Method

Note: According to CIE 1976 (u',v') diagram, $u' = u / (-2x + 12y + 3)$, $v' = 3v / 2 = 9y / (-2x + 12y + 3)$.

Goniophotometer Method

Test ambient temperature was 24.9 °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)	0.097
Power Factor	0.9736
Power (W)	11.31
Luminous Efficacy (lm/W)	97.7
Total Luminous Flux (lm)	1105.5
Beam Angle (°)	32.1 (0°-180°) / 31.6 (90°-270°)
Center Beam Candle Power (cd)	3118
Maximum Beam Candle Power (cd)	3134 (At: C=40.0, Gamma=1.5)
Spacing Criteria	0.48 (0°-180°) / 0.50 (90°-270°)
Zonal Lumens in the 0°-60° Zone	99.28%
Zonal Lumens in the 60°-90° Zone	0.59%
Zonal Lumens in the 90°-120° Zone	0.00%
Zonal Lumens in the 120°-180° Zone	0.12%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

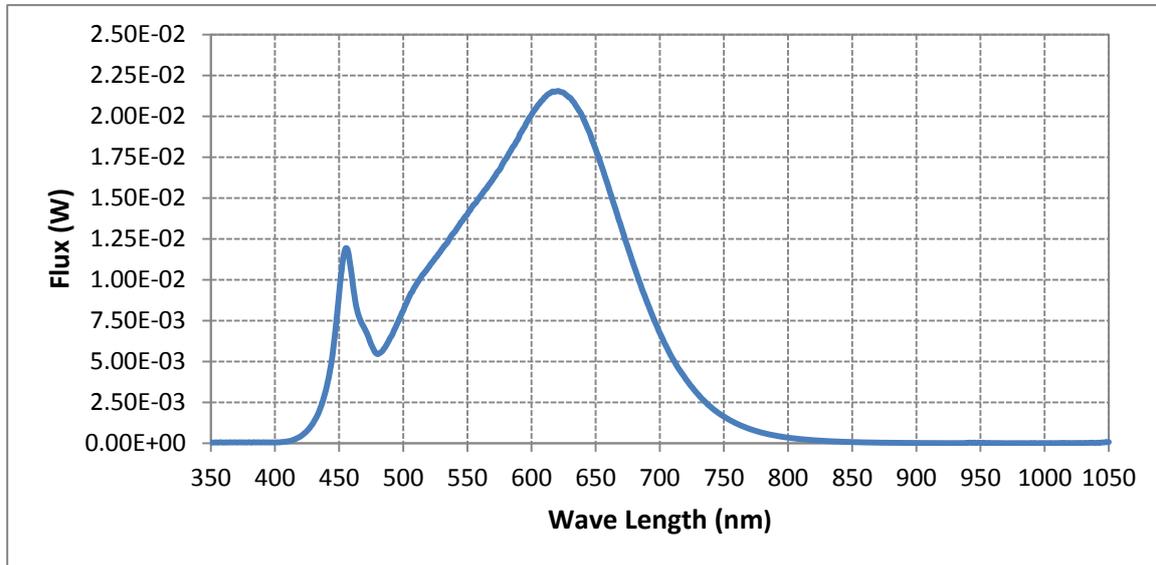
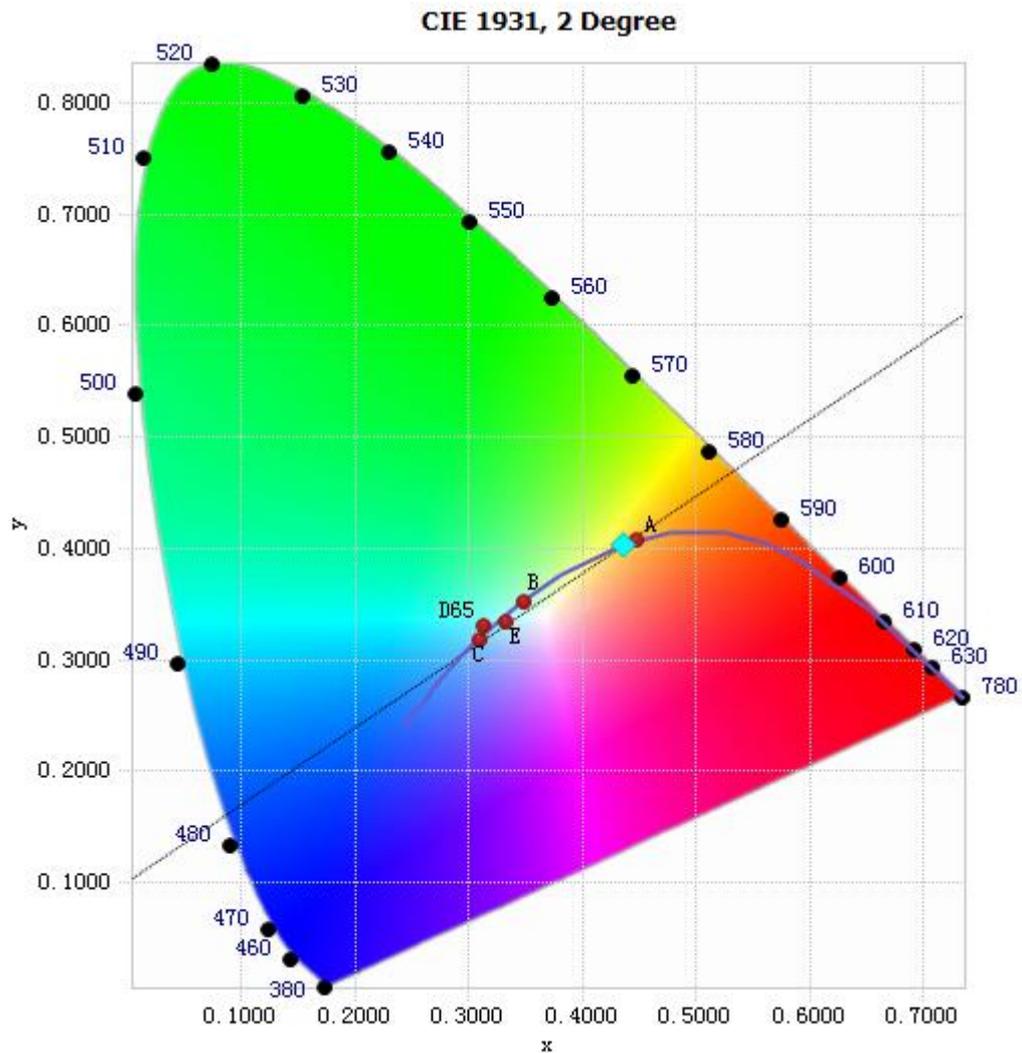


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	6.69E-05	485	5.79E-03	590	1.87E-02	695	7.67E-03
385	5.08E-05	490	6.47E-03	595	1.94E-02	700	6.75E-03
390	5.63E-05	495	7.27E-03	600	2.01E-02	705	5.93E-03
395	5.81E-05	500	8.12E-03	605	2.07E-02	710	5.18E-03
400	5.24E-05	505	9.02E-03	610	2.12E-02	715	4.53E-03
405	7.59E-05	510	9.69E-03	615	2.14E-02	720	3.96E-03
410	1.19E-04	515	1.03E-02	620	2.15E-02	725	3.45E-03
415	2.37E-04	520	1.08E-02	625	2.14E-02	730	2.98E-03
420	4.25E-04	525	1.13E-02	630	2.11E-02	735	2.57E-03
425	7.65E-04	530	1.19E-02	635	2.06E-02	740	2.20E-03
430	1.28E-03	535	1.24E-02	640	1.99E-02	745	1.90E-03
435	2.08E-03	540	1.29E-02	645	1.91E-02	750	1.64E-03
440	3.36E-03	545	1.35E-02	650	1.80E-02	755	1.40E-03
445	5.51E-03	550	1.40E-02	655	1.69E-02	760	1.21E-03
450	9.15E-03	555	1.46E-02	660	1.57E-02	765	1.03E-03
455	1.19E-02	560	1.51E-02	665	1.44E-02	770	8.81E-04
460	1.02E-02	565	1.56E-02	670	1.32E-02	775	7.56E-04
465	7.86E-03	570	1.62E-02	675	1.20E-02	780	6.45E-04
470	7.00E-03	575	1.67E-02	680	1.08E-02		
475	6.05E-03	580	1.74E-02	685	9.71E-03		
480	5.45E-03	585	1.81E-02	690	8.65E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4355, 0.4037)

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

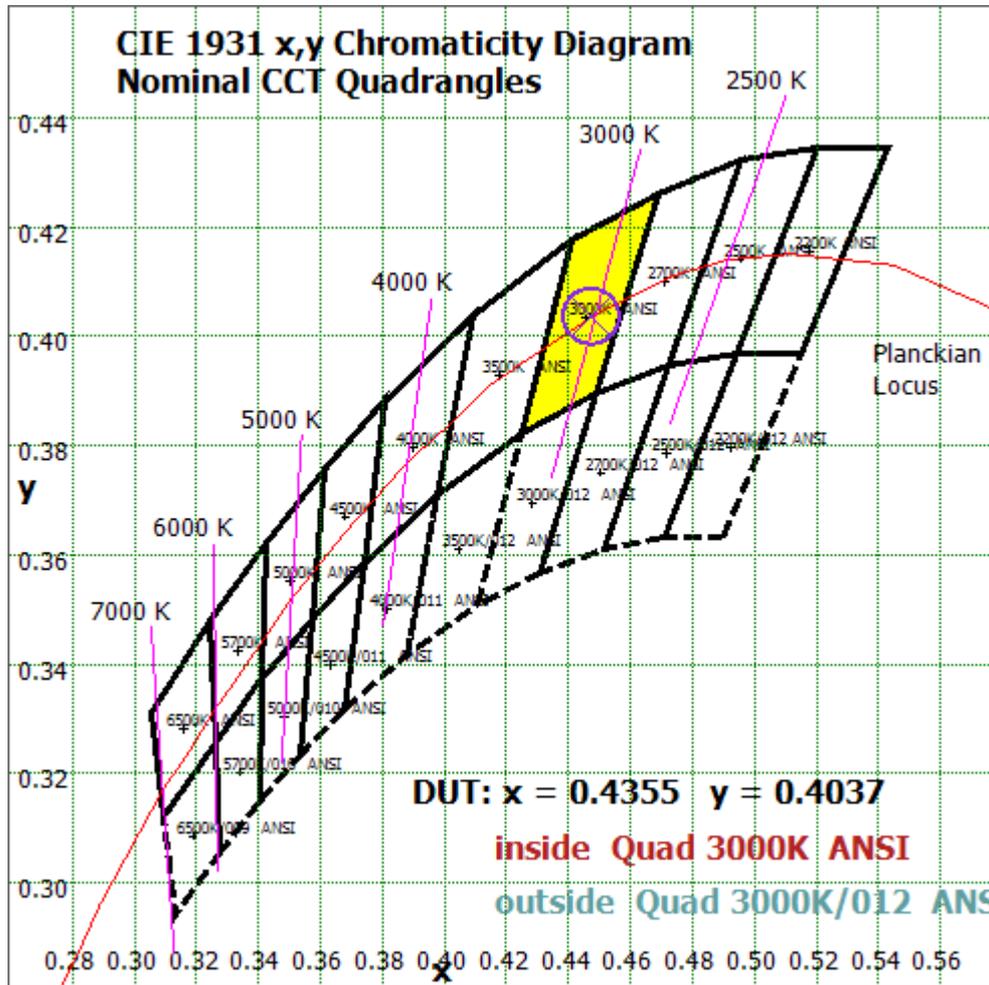
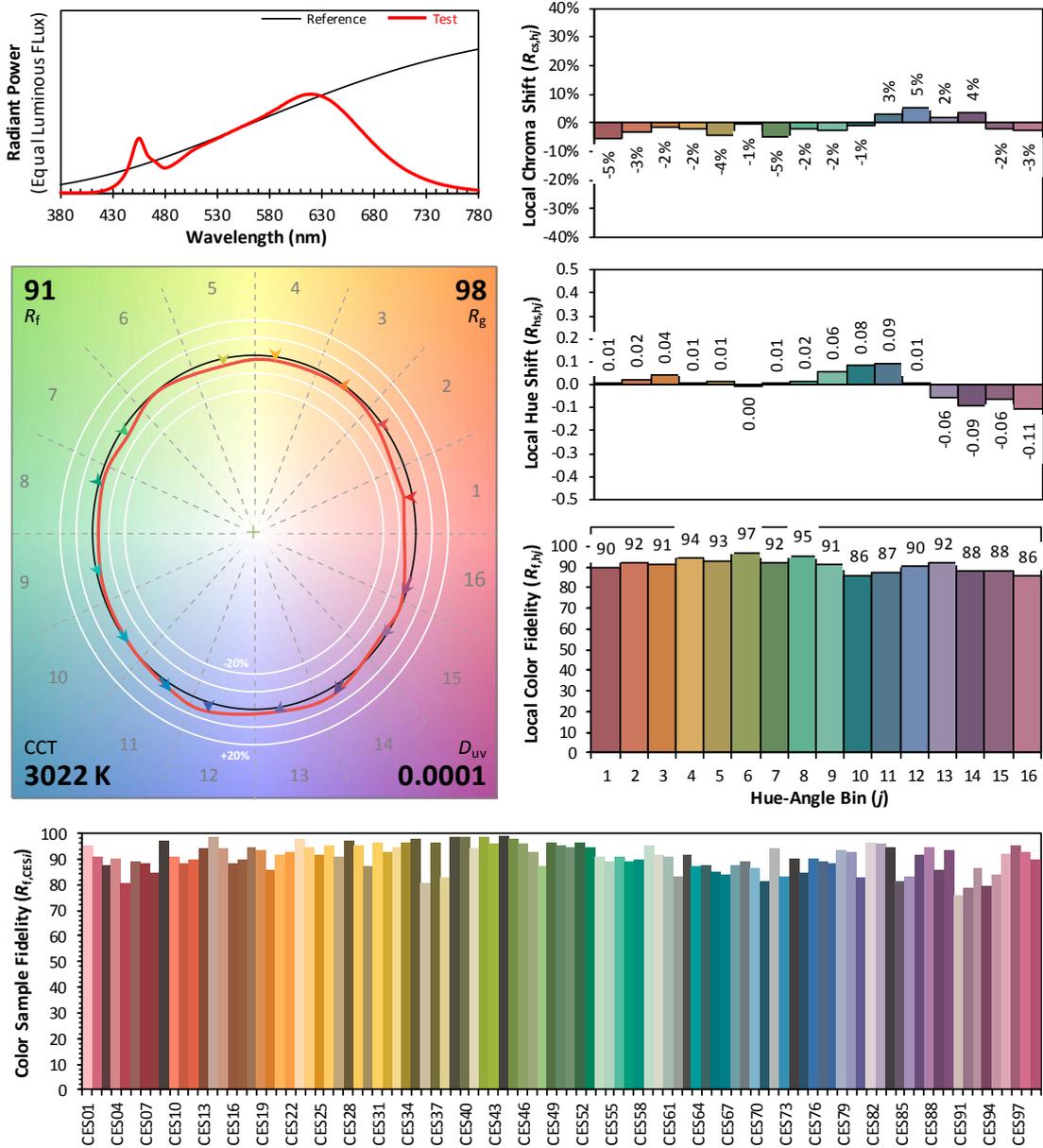


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method



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

x 0.4355
 y 0.4037
 u' 0.2498
 v' 0.5210

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	281.151	25.43%
10- 20	472.446	42.74%
20- 30	202.743	18.34%
30- 40	89.441	8.09%
40- 50	36.245	3.28%
50- 60	15.523	1.40%
60- 70	5.981	0.54%
70- 80	0.539	0.05%
80- 90	0.024	0.00%
90-100	0	0.00%
100-110	0.001	0.00%
110-120	0.006	0.00%
120-130	0.034	0.00%
130-140	0.15	0.01%
140-150	0.344	0.03%
150-160	0.426	0.04%
160-170	0.308	0.03%
170-180	0.094	0.01%
Total	1105.5	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	1097.549	99.28%
60- 90	6.544	0.59%
0-90	1104.093	99.88%
90- 180	1.363	0.12%
0- 180	1105.5	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

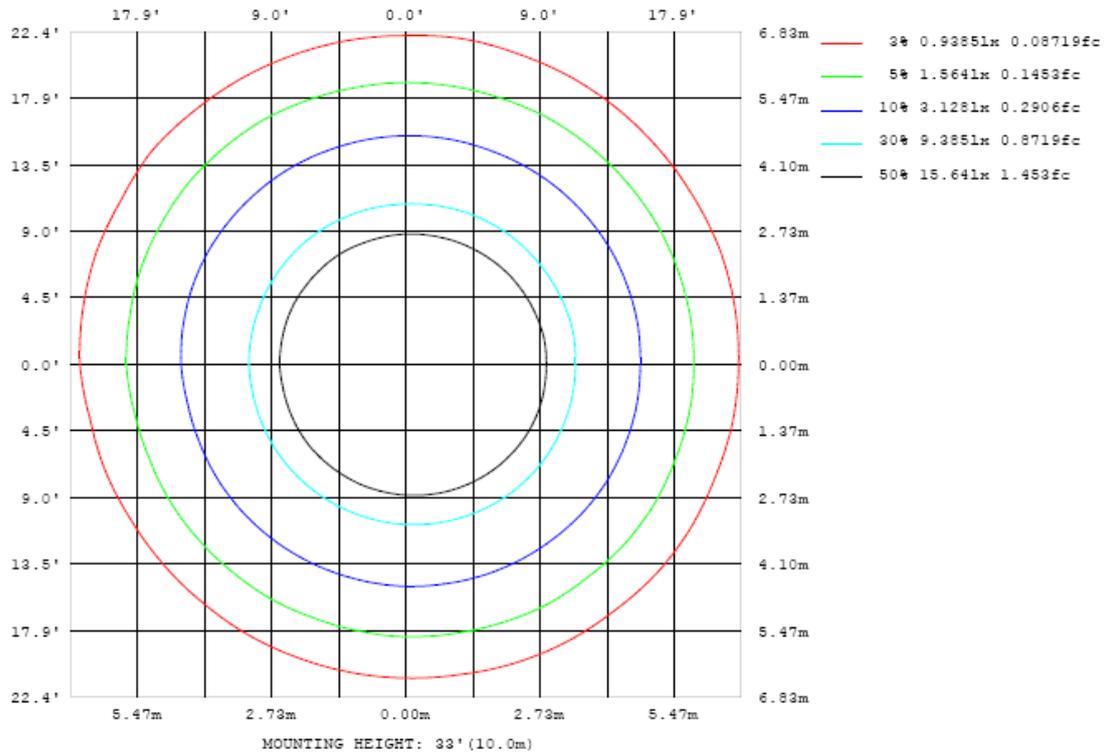


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

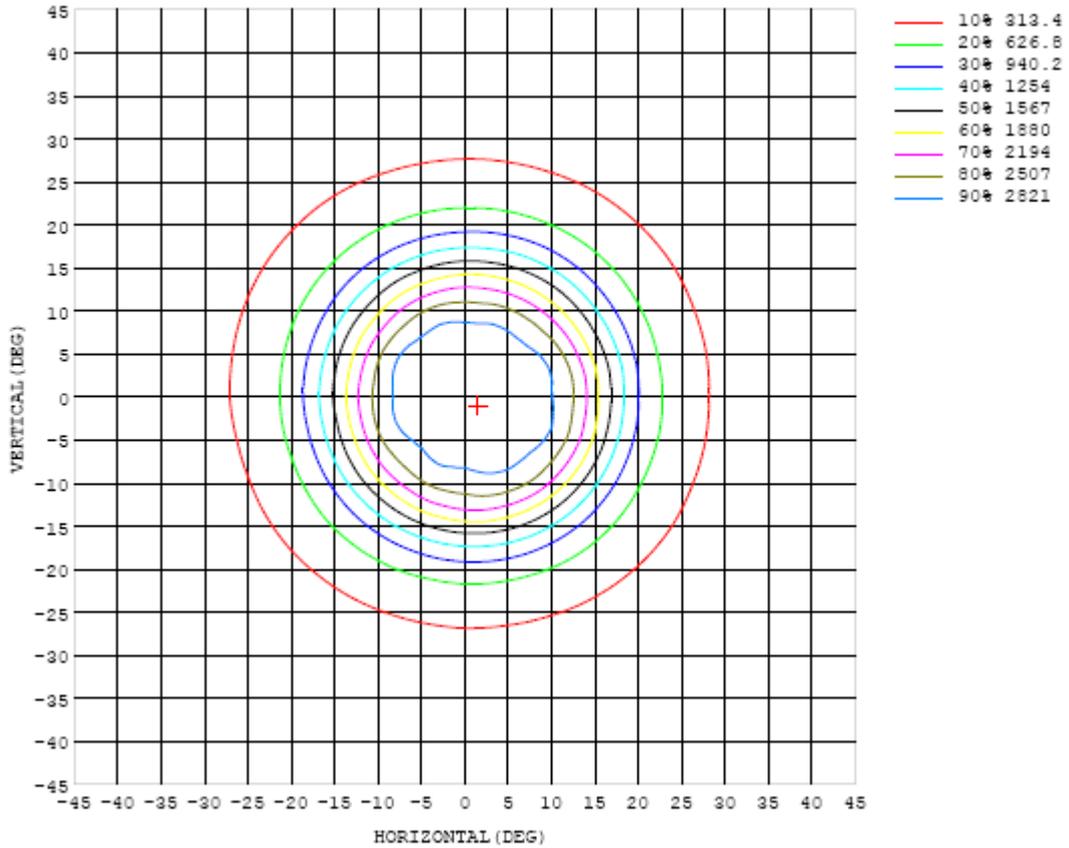


Chart 6: Isocandela Plot

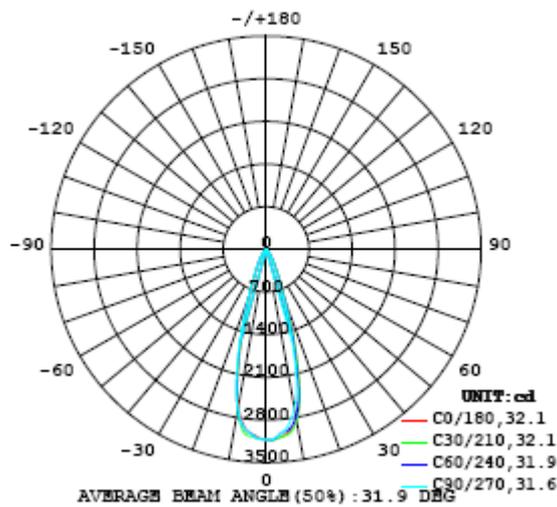


Chart 7: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1 UNIT: cd

C (DEG) y (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	3118	3118	3118	3118	3118	3118	3118	3118	3118	3118	3118	3118	3118	3118	3118	3118	3118	3118	3118
5	3078	3097	3099	3083	3062	3035	3016	3016	3016	3018	3024	3025	3013	2999	2990	2996	3005	3014	3026
10	2827	2859	2884	2856	2811	2800	2800	2764	2712	2652	2649	2660	2629	2594	2593	2618	2629	2628	2611
15	1979	1983	1995	1979	1947	1919	1872	1830	1788	1749	1706	1676	1642	1619	1610	1594	1582	1574	1613
20	949	947	938	928	913	896	873	852	825	805	787	774	759	750	746	737	730	738	762
25	454	454	451	446	436	424	414	405	394	391	382	377	376	374	376	376	376	382	399
30	255	253	249	247	242	234	232	224	218	216	211	209	210	209	211	214	216	221	231
35	151	150	146	144	141	136	133	129	125	123	123	120	121	122	124	124	130	132	140
40	82.5	81.3	79.8	77.4	75.8	74.2	70.7	69.1	68.3	66.1	66.1	65.4	66.1	66.5	68.0	68.4	70.9	72.7	78.8
45	47.5	46.9	46.0	45.0	44.2	43.0	41.2	40.3	39.8	39.0	38.6	38.1	38.7	39.0	39.7	40.3	41.7	43.7	46.8
50	29.7	29.4	29.0	28.7	28.5	27.7	26.6	25.6	25.3	24.4	23.9	23.5	23.1	23.4	23.5	24.1	25.1	25.9	27.1
55	17.9	17.8	17.5	17.5	17.5	17.1	16.7	16.3	16.1	15.8	15.4	15.2	15.0	15.0	15.2	15.5	15.8	16.1	16.9
60	12.0	12.0	11.9	11.7	11.6	11.4	11.1	10.9	10.7	10.4	10.3	10.2	9.99	9.97	10.0	10.2	10.4	10.5	10.7
65	6.80	6.87	6.91	6.81	6.72	6.60	6.46	6.44	6.23	6.06	5.94	5.85	5.82	5.80	5.84	5.91	5.99	5.95	6.07
70	1.93	1.99	2.00	1.98	1.97	1.95	1.87	1.82	1.76	1.68	1.65	1.57	1.52	1.46	1.41	1.40	1.38	1.36	1.40
75	0.51	0.53	0.53	0.52	0.50	0.49	0.46	0.44	0.41	0.37	0.34	0.31	0.29	0.26	0.25	0.22	0.21	0.19	0.21
80	0.08	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.08	0.07	0.07	0.07	0.07	0.06	0.05	0.05	0.05	0.05
85	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.02	0.02	0.01	0.01	0.01	0.01	0.01
90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
105	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
110	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
115	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
120	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	0.02
125	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	0.05
130	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	0.06	0.06	0.06	0.06	0.06	0.12
135	0.11	0.11	0.11	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	0.13	0.28
140	0.22	0.22	0.22	0.22	0.22	0.22	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.24	0.24	0.24	0.24	0.25	0.53
145	0.31	0.32	0.32	0.32	0.32	0.32	0.32	0.33	0.33	0.33	0.33	0.33	0.33	0.34	0.33	0.34	0.34	0.34	0.83
150	0.41	0.41	0.41	0.41	0.41	0.42	0.42	0.42	0.42	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	1.14
155	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	1.39
160	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	1.55
165	0.65	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	1.55
170	0.64	0.64	0.64	0.64	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	1.42
175	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.70	0.70	0.70	0.70	0.70	1.17
180	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96

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	3118	3118	3118	3118	3118	3118	3118	3118	3118	3118	3118	3118	3118	3118	3118	3118	3118		
5	3046	3065	3076	3071	3045	3023	3016	3018	3027	3038	3048	3051	3053	3051	3046	3051	3061		
10	2606	2643	2666	2650	2633	2664	2688	2681	2650	2652	2703	2724	2722	2744	2807	2846	2843		
15	1611	1626	1639	1644	1663	1685	1686	1707	1733	1749	1777	1802	1839	1877	1911	1946	1982		
20	770	773	782	794	804	813	816	825	832	855	872	891	906	915	926	945	961		
25	405	413	417	418	419	422	422	426	429	433	435	441	448	453	459	461	461		
30	233	238	240	243	243	244	242	241	243	243	244	249	250	252	254	254	256		
35	144	148	146	152	150	149	149	149	148	152	151	152	152	152	152	155	153		
40	80.1	82.6	82.9	85.4	84.8	84.4	84.1	85.3	83.9	85.9	85.7	84.9	85.7	86.0	84.4	84.7	85.0		
45	48.1	48.6	48.7	49.0	49.4	48.2	47.8	47.7	47.8	47.8	48.2	48.6	48.6	48.4	47.2	46.9	47.7		
50	27.7	27.9	28.1	28.0	28.3	27.4	27.5	27.3	27.3	27.6	27.9	28.3	28.9	29.2	29.3	29.7	30.3		
55	16.9	17.0	17.2	17.3	17.3	17.1	16.9	17.0	17.1	17.0	16.9	16.8	17.0	17.4	17.7	17.9	18.0		
60	10.7	10.8	10.8	10.7	10.7	10.6	10.5	10.5	10.6	10.6	10.7	10.8	11.2	11.6	11.8	11.8	12.0		
65	6.07	6.08	6.13	6.10	6.07	6.03	5.95	5.90	5.88	5.86	5.87	5.91	6.09	6.40	6.64	6.67	6.76		
70	1.38	1.38	1.39	1.40	1.41	1.39	1.37	1.38	1.42	1.44	1.43	1.46	1.54	1.63	1.76	1.84	1.94		
75	0.21	0.21	0.20	0.20	0.20	0.22	0.23	0.26	0.27	0.29	0.32	0.35	0.39	0.44	0.48	0.51	0.53		
80	0.06	0.07	0.05	0.05	0.04	0.05	0.05	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.07	0.08	0.08		
85	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02		
90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
105	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
110	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
115	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		
120	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		
125	0.05	0.05	0.05	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	0.05		
130	0.12	0.12	0.12	0.11	0.11	0.11	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10		
135	0.28	0.28	0.27	0.27	0.27	0.26	0.25	0.25	0.25	0.24	0.24	0.24	0.23	0.23	0.23	0.23	0.24		
140	0.53	0.53	0.52	0.52	0.51	0.50	0.50	0.49	0.48	0.47	0.47	0.46	0.46	0.46	0.46	0.46	0.46		
145	0.83	0.83	0.82	0.82	0.81	0.80	0.79	0.78	0.77	0.76	0.76	0.75	0.75	0.74	0.74	0.74	0.74		
150	1.13	1.13	1.12	1.11	1.11	1.10	1.09	1.08	1.08	1.07	1.06	1.06	1.05	1.05	1.05	1.04	1.05		
155	1.39	1.38	1.38	1.37	1.37	1.36	1.36	1.35	1.35	1.34	1.33	1.33	1.33	1.32	1.32	1.32	1.32		
160	1.55	1.55	1.54	1.54	1.54	1.53	1.53	1.53	1.53	1.53	1.53	1.53	1.53	1.53	1.53	1.53	1.53		
165	1.55	1.55	1.54	1.54	1.54	1.54	1.55	1.55	1.56	1.56	1.57	1.57	1.58	1.58	1.58	1.59	1.59		
170	1.42	1.42	1.42	1.42	1.42	1.42	1.43	1.43	1.44	1.45	1.46	1.47	1.47	1.48	1.49	1.49	1.50		
175	1.18	1.18	1.18	1.18	1.18	1.18	1.19	1.20	1.20	1.21	1.22	1.23	1.24	1.25	1.26	1.27	1.27		
180	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96		

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

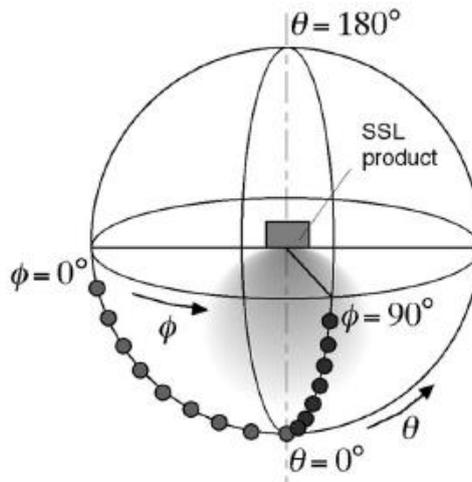
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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

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.