

LM-79-08 TEST REPORT

for

GREEN CREATIVE LTD

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

LED Lamp

Model: 6GU10DIM/830FL35/R

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ19040047h

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

Review by:



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May 10, 2019

Approved by:



Manager: Jim Zhang
May 10, 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: **6GU10DIM/830FL35/R**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
102.0	596.6	5.85	0.8475
CCT (K)	CRI	Stabilization Time (Light & Power)	
3112	82.3	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	: Apr. 26, 2019
Date of Test	: Apr. 29, 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	: 6GU10DIM/830FL35/R
Electrical Ratings	: 120V, 60Hz, 6W
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°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)	0.058
Power Factor	0.8475
Test Power (W)	5.85
THD A%	43.92
Luminous Efficacy (lm/W)	102.0
Total Luminous Flux (lm)	596.6
Color Rendering Index (CRI)	82.3
R9	5.4
Correlated Color Temperature (CCT)(K)	3112
Chromaticity Chroma x	0.4293
Chromaticity Chroma y	0.4018
Chromaticity Chroma u	0.2466
Chromaticity Chroma v	0.3462
Duv	0.0003
Chromaticity Chroma u'	0.2466
Chromaticity Chroma v'	0.5193

Special Color Rendering Indices	
R1	80.3
R2	90.4
R3	96.5
R4	80.3
R5	80.7
R6	88.2
R7	83
R8	59
R9	5.4
R10	78.2
R11	79.4
R12	71.9
R13	82.6
R14	98.6

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 24.7°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)	0.058
Power Factor	0.8497
Power (W)	5.91
Luminous Efficacy (lm/W)	102.4
Total Luminous Flux (lm)	605.0
Beam Angle (°)	32.6 (0°-180°) / 32.9 (90°-270°)
Center Beam Candle Power (cd)	1231
Maximum Beam Candle Power (cd)	1239 (At: C=350.0, Gamma=1.5)
Spacing Criteria	0.52 (0°-180°) / 0.53 (90°-270°)
Zonal Lumens in the 0°-60° Zone	95.13%
Zonal Lumens in the 60°-90° Zone	4.43%
Zonal Lumens in the 90°-120° Zone	0.42%
Zonal Lumens in the 120°-180° Zone	0.03%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

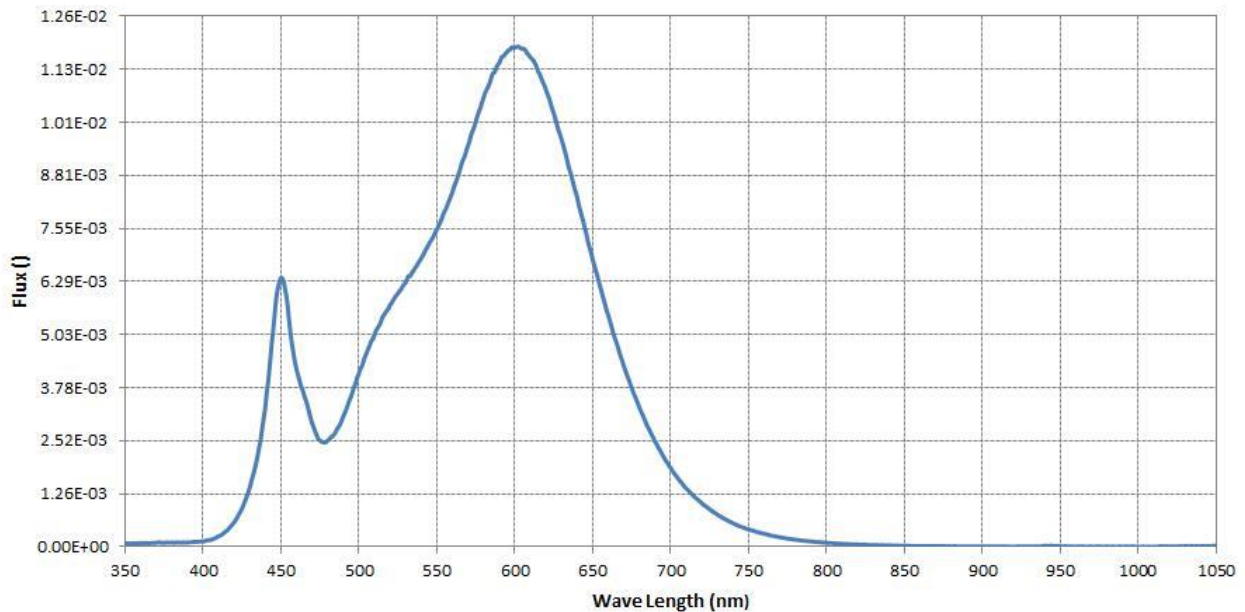
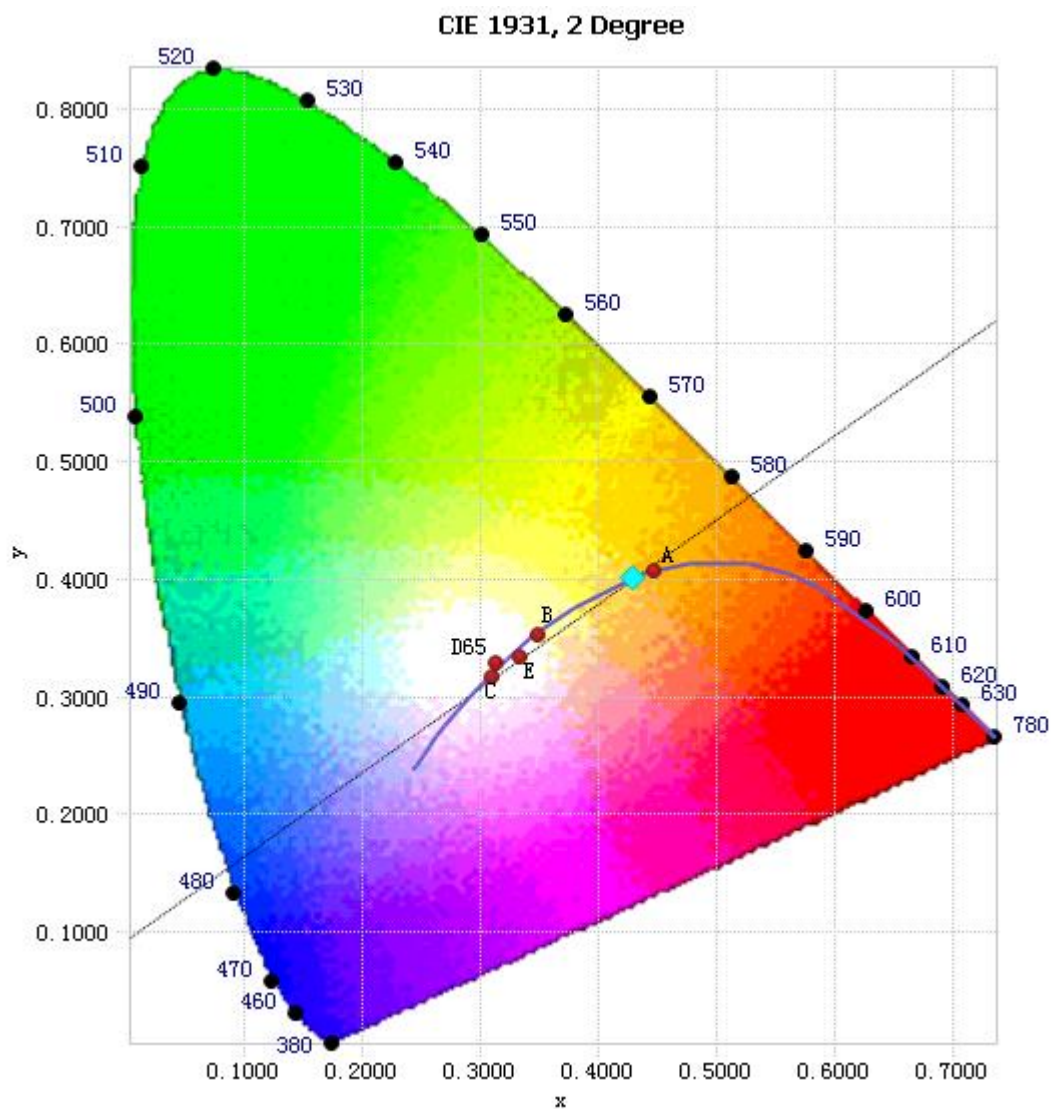


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.04E-04	485	2.71E-03	590	1.15E-02	695	2.17E-03
385	9.75E-05	490	3.09E-03	595	1.17E-02	700	1.87E-03
390	1.04E-04	495	3.57E-03	600	1.18E-02	705	1.61E-03
395	1.16E-04	500	4.10E-03	605	1.18E-02	710	1.38E-03
400	1.28E-04	505	4.59E-03	610	1.16E-02	715	1.20E-03
405	1.66E-04	510	5.02E-03	615	1.13E-02	720	1.03E-03
410	2.52E-04	515	5.43E-03	620	1.08E-02	725	8.93E-04
415	3.73E-04	520	5.74E-03	625	1.03E-02	730	7.66E-04
420	5.80E-04	525	6.00E-03	630	9.67E-03	735	6.58E-04
425	9.02E-04	530	6.27E-03	635	8.96E-03	740	5.63E-04
430	1.40E-03	535	6.55E-03	640	8.30E-03	745	4.81E-04
435	2.14E-03	540	6.85E-03	645	7.55E-03	750	4.17E-04
440	3.30E-03	545	7.18E-03	650	6.81E-03	755	3.60E-04
445	5.11E-03	550	7.52E-03	655	6.14E-03	760	3.11E-04
450	6.38E-03	555	7.96E-03	660	5.49E-03	765	2.67E-04
455	5.45E-03	560	8.41E-03	665	4.87E-03	770	2.29E-04
460	4.21E-03	565	8.96E-03	670	4.28E-03	775	1.99E-04
465	3.58E-03	570	9.51E-03	675	3.77E-03	780	1.73E-04
470	2.94E-03	575	1.01E-02	680	3.30E-03		
475	2.53E-03	580	1.06E-02	685	2.87E-03		
480	2.52E-03	585	1.11E-02	690	2.49E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4293, 0.4018)

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

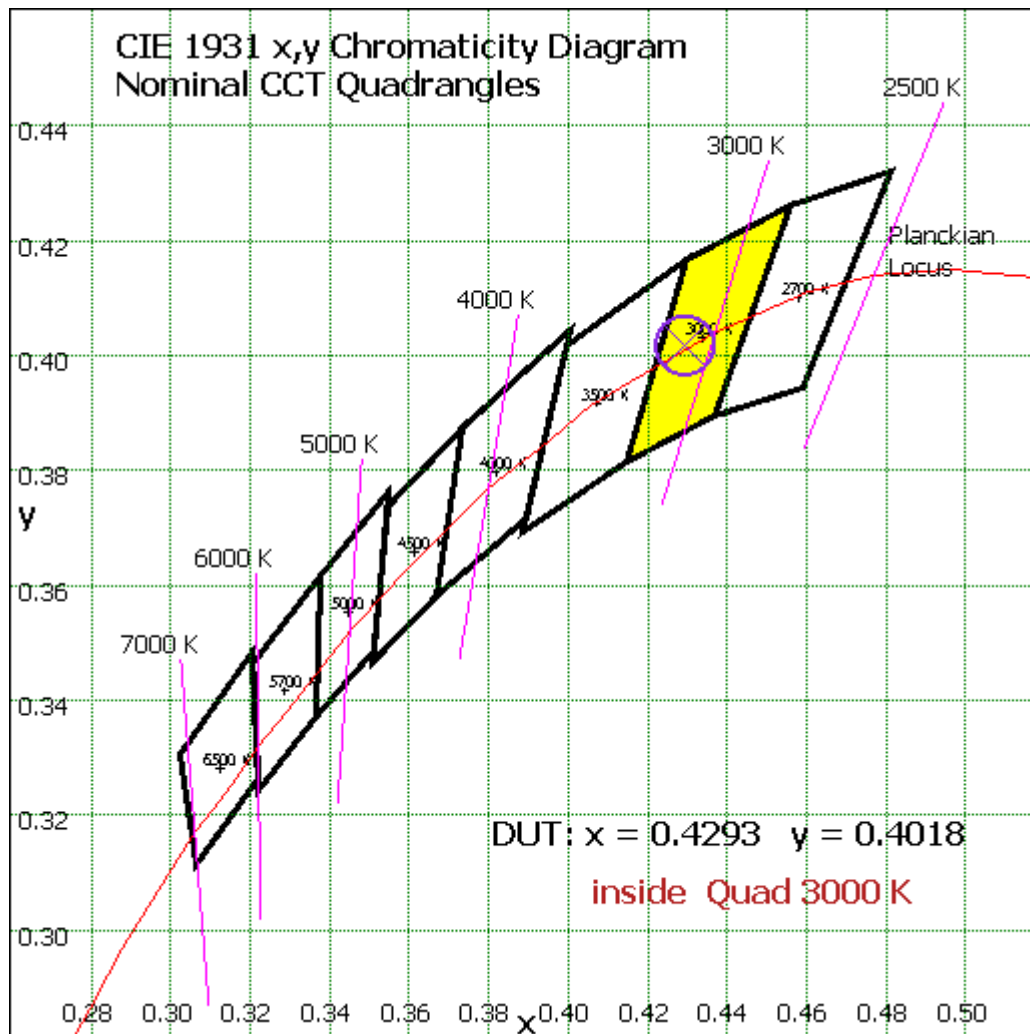
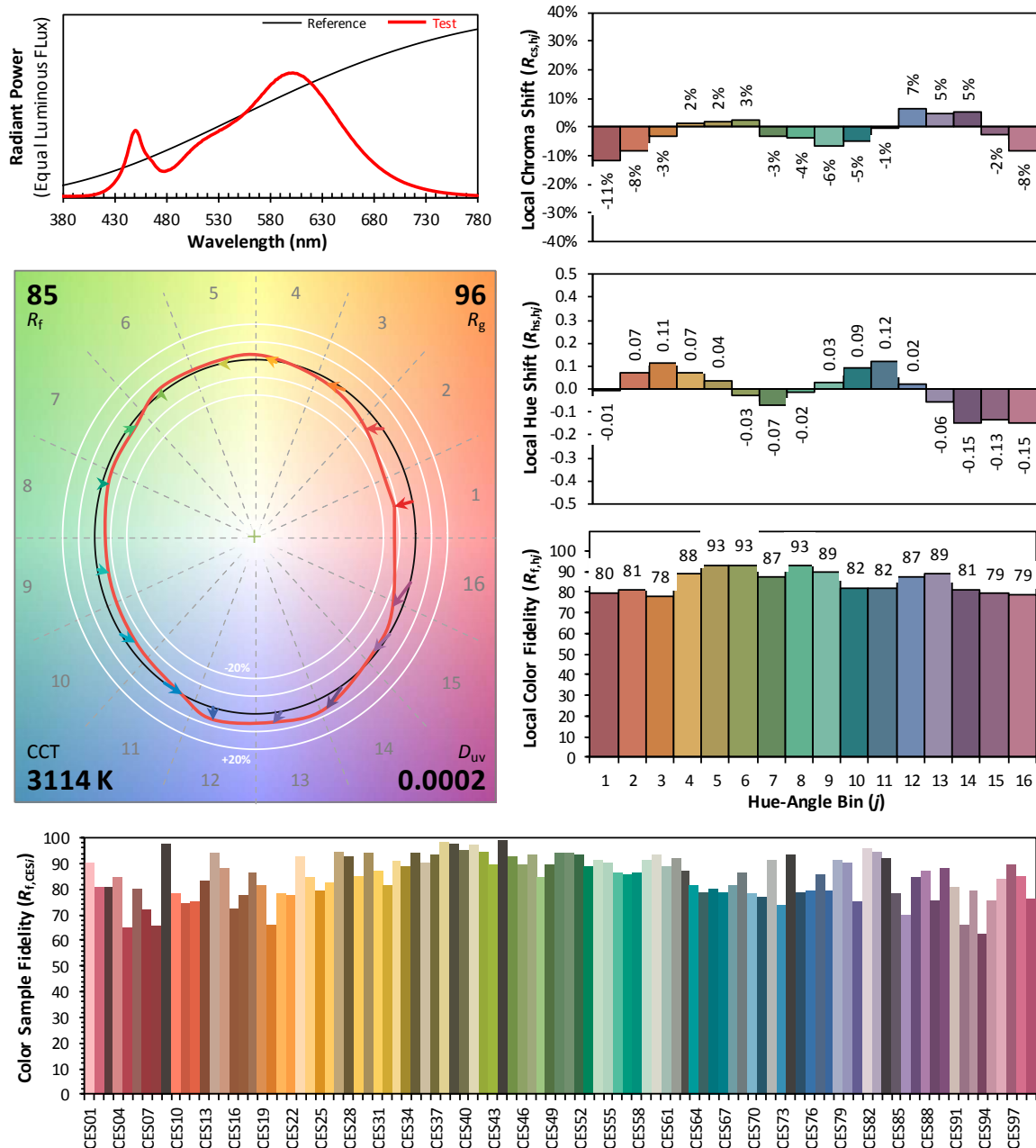


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method



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

x 0.4293
 y 0.4018
 u' 0.2466
 v' 0.5193

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	106.836	17.66%
10- 20	192.35	31.79%
20- 30	135.754	22.44%
30- 40	80.028	13.23%
40- 50	40.243	6.65%
50- 60	20.337	3.36%
60- 70	13.496	2.23%
70- 80	9.123	1.51%
80- 90	4.159	0.69%
90-100	1.598	0.26%
100-110	0.779	0.13%
110-120	0.136	0.02%
120-130	0.006	0.00%
130-140	0.016	0.00%
140-150	0.031	0.01%
150-160	0.049	0.01%
160-170	0.051	0.01%
170-180	0.019	0.00%
Total	605.0	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	575.548	95.13%
60- 90	26.778	4.43%
0-90	602.326	99.56%
90- 180	2.685	0.44%
0- 180	605.0	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

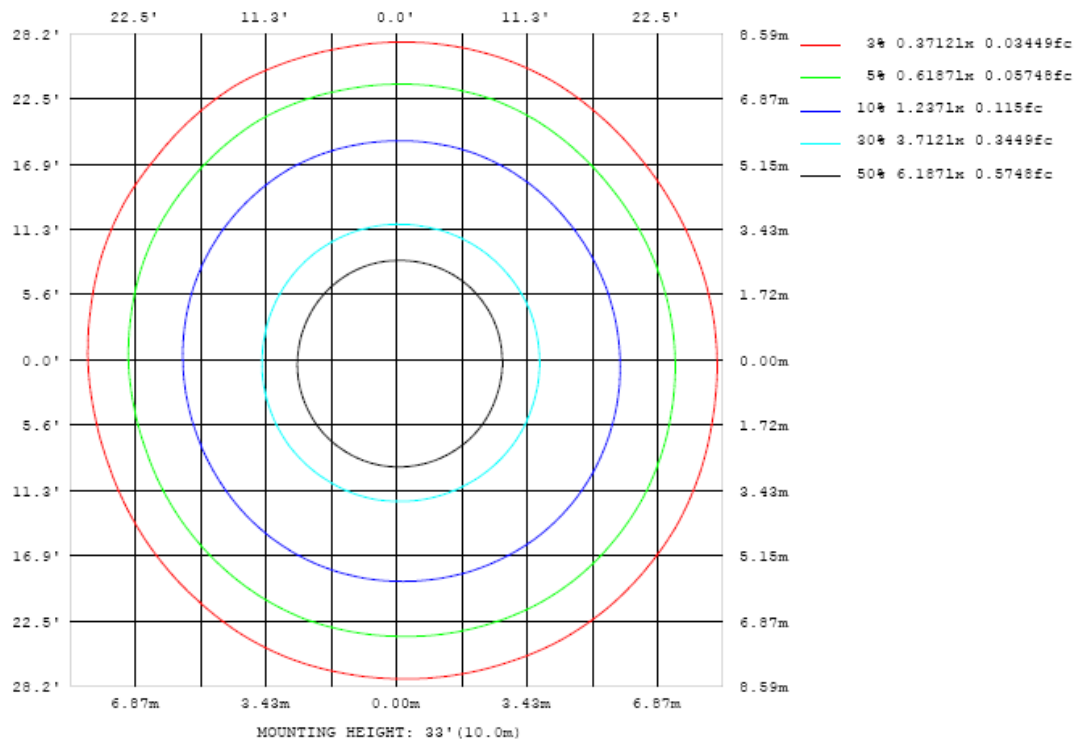


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

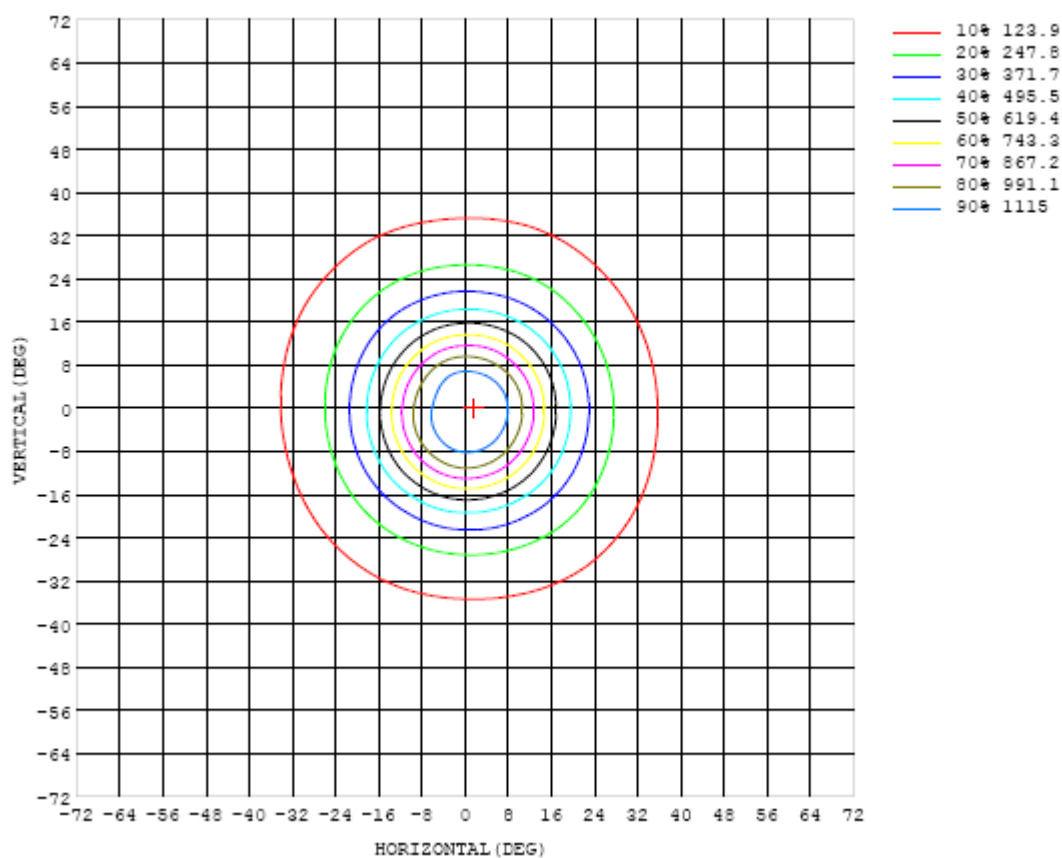


Chart 6: Isocandela Plot

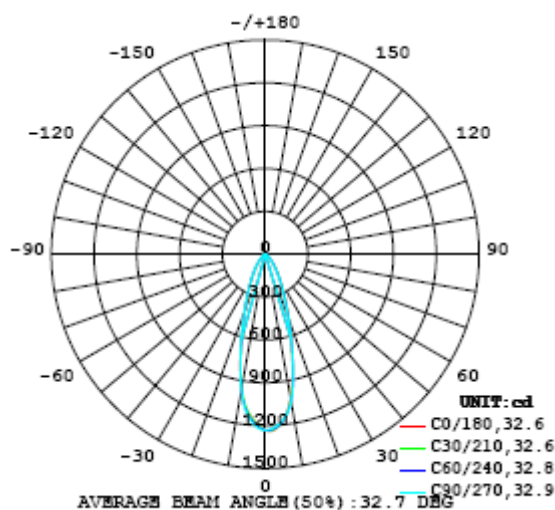


Chart 7: Polar Candela Distribution

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	1231	1231	1231	1231	1231	1231	1231	1231	1231	1231	1231	1231	1231	1231	1231	1231	1231	1231	1231
5	1198	1198	1197	1196	1195	1194	1194	1192	1190	1187	1184	1180	1174	1169	1163	1157	1152	1147	1141
10	1022	1025	1027	1030	1036	1041	1044	1047	1049	1048	1044	1037	1029	1020	1010	1001	991	981	970
15	724	728	732	737	744	746	745	742	741	739	734	727	718	710	699	687	678	670	662
20	477	479	480	484	483	481	477	475	472	467	465	460	451	448	443	437	432	428	424
25	310	312	314	316	316	314	310	307	303	298	295	290	286	282	278	274	272	271	270
30	201	204	206	208	209	208	205	202	198	195	193	191	188	184	181	178	176	176	178
35	131	134	136	137	138	138	136	133	131	128	126	125	123	120	117	115	113	114	116
40	84.3	85.2	87.4	89.2	89.3	89.5	88.4	85.9	84.0	82.4	81.4	80.8	78.9	75.9	74.1	72.5	71.2	71.2	72.9
45	53.0	54.5	55.9	56.9	57.0	56.6	55.8	54.5	53.4	52.8	52.4	51.8	50.4	48.3	46.4	44.9	44.1	44.3	45.1
50	33.3	34.6	35.3	35.6	35.8	35.7	35.3	34.5	33.3	33.0	33.3	33.4	32.7	31.3	29.7	28.5	28.3	28.5	29.0
55	22.8	23.4	23.5	23.6	23.9	24.1	24.1	23.3	22.6	22.4	22.7	23.2	22.9	22.0	21.0	20.2	20.3	20.6	20.8
60	17.2	17.5	17.4	17.4	17.7	18.1	18.1	17.5	17.0	16.9	17.1	17.6	17.6	17.0	16.3	15.8	15.9	16.1	16.4
65	13.8	14.0	13.9	13.9	14.2	14.5	14.5	14.1	13.7	13.6	13.7	14.1	14.2	13.8	13.2	13.0	13.0	13.2	13.3
70	11.3	11.6	11.7	11.7	11.9	12.1	12.0	11.7	11.3	11.2	11.3	11.5	11.5	11.2	10.8	10.6	10.7	10.8	10.8
75	8.91	9.11	9.23	9.35	9.44	9.59	9.54	9.29	9.00	8.86	8.85	8.92	8.92	8.67	8.38	8.24	8.29	8.33	8.31
80	6.38	6.53	6.67	6.75	6.81	6.88	6.86	6.69	6.53	6.41	6.33	6.32	6.28	6.10	5.91	5.79	5.79	5.78	5.79
85	3.84	3.94	4.05	4.11	4.14	4.18	4.15	4.09	4.01	3.93	3.84	3.79	3.72	3.61	3.51	3.44	3.42	3.39	3.38
90	2.04	2.08	2.15	2.18	2.20	2.23	2.25	2.26	2.26	2.22	2.17	2.13	2.08	2.05	2.00	1.96	1.96	1.95	1.95
95	1.45	1.48	1.50	1.52	1.53	1.54	1.55	1.57	1.57	1.56	1.54	1.52	1.50	1.47	1.43	1.41	1.39	1.38	1.38
100	1.11	1.13	1.16	1.17	1.18	1.18	1.18	1.17	1.16	1.14	1.13	1.11	1.09	1.06	1.04	1.03	1.02	1.02	1.02
105	0.77	0.79	0.81	0.82	0.82	0.82	0.81	0.80	0.80	0.79	0.78	0.77	0.77	0.76	0.73	0.72	0.71	0.70	0.70
110	0.46	0.47	0.47	0.47	0.46	0.45	0.44	0.44	0.44	0.45	0.45	0.45	0.45	0.44	0.42	0.41	0.40	0.40	0.41
115	0.09	0.10	0.11	0.11	0.11	0.10	0.10	0.10	0.11	0.12	0.13	0.13	0.12	0.11	0.10	0.09	0.09	0.09	0.09
120	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
125	0.01	0.00	0.00	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
130	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	0.01
135	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
140	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
145	0.04	0.04	0.04	0.04	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
150	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	0.06	0.07	0.07	0.08
155	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	0.10	0.10	0.10	0.10	0.10	0.11
160	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	0.15
165	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.18	0.18	0.18	0.18	0.18	0.18	0.19
170	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.21
175	0.18	0.19	0.19	0.19	0.19	0.19	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.19	0.19	0.19	0.19
180	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16

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	1231	1231	1231	1231	1231	1231	1231	1231	1231	1231	1231	1231	1231	1231	1231	1231	1231		
5	1139	1139	1142	1146	1153	1158	1164	1168	1170	1174	1177	1181	1186	1190	1193	1196	1197		
10	960	954	953	955	958	962	966	968	968	972	977	983	991	999	1008	1017	1020		
15	655	651	649	650	652	654	658	661	664	669	677	686	696	702	710	716	720		
20	422	422	422	423	425	424	426	428	430	432	438	445	452	458	465	472	474		
25	272	274	276	278	280	281	282	281	282	283	287	290	293	295	298	304	307		
30	180	182	184	185	187	189	189	189	189	191	193	194	193	192	194	196	198		
35	118	120	122	123	125	127	127	126	126	128	129	129	127	126	126	128	130		
40	74.5	77.0	78.4	78.2	80.2	82.0	80.8	80.2	81.4	82.4	83.1	83.0	81.3	80.1	80.4	81.4	83.1		
45	46.4	47.8	48.0	48.2	49.8	50.9	50.0	49.3	50.2	51.2	52.0	52.3	51.4	50.2	49.8	50.5	51.5		
50	29.6	29.9	29.9	30.3	31.4	32.0	31.3	30.5	30.6	31.7	32.8	33.2	32.8	31.7	30.7	31.0	31.9		
55	21.1	21.0	20.9	21.2	21.8	22.1	21.6	21.0	20.8	21.4	22.4	22.8	22.5	21.5	21.0	21.2	21.8		
60	16.4	16.3	16.2	16.4	16.8	17.0	16.6	16.1	15.9	16.2	16.9	17.2	16.9	16.2	15.9	16.0	16.6		
65	13.2	13.1	13.0	13.1	13.4	13.5	13.2	12.9	12.7	12.9	13.4	13.7	13.4	13.0	12.8	12.9	13.3		
70	10.8	10.6	10.6	10.6	10.9	10.9	10.7	10.5	10.4	10.6	11.0	11.2	11.0	10.8	10.7	10.7	10.9		
75	8.29	8.20	8.15	8.20	8.35	8.42	8.30	8.19	8.14	8.29	8.56	8.69	8.63	8.52	8.48	8.47	8.64		
80	5.77	5.71	5.68	5.70	5.79	5.85	5.81	5.78	5.77	5.84	5.99	6.09	6.10	6.11	6.14	6.14	6.25		
85	3.36	3.31	3.27	3.26	3.29	3.33	3.35	3.38	3.38	3.40	3.45	3.50	3.57	3.64	3.72	3.75	3.78		
90	1.93	1.90	1.87	1.85	1.86	1.87	1.87	1.88	1.88	1.88	1.88	1.89	1.91	1.93	1.95	1.96	2.00		
95	1.36	1.35	1.33	1.32	1.32	1.32	1.32	1.33	1.34	1.34	1.36	1.37	1.39	1.39	1.40	1.41	1.42		
100	1.01	1.00	0.99	0.98	0.97	0.96	0.96	0.96	0.96	0.98	1.00	1.02	1.04	1.05	1.06	1.06	1.08		
105	0.70	0.70	0.69	0.69	0.68	0.66	0.65	0.64	0.63	0.64	0.65	0.67	0.69	0.71	0.72	0.74	0.76		
110	0.42	0.42	0.42	0.43	0.42	0.41	0.39	0.36	0.35	0.33	0.33	0.35	0.37	0.39	0.41	0.43	0.44		
115	0.09	0.08	0.07	0.07	0.06	0.05	0.05	0.04	0.04	0.03	0.03	0.04	0.05	0.06	0.07	0.08	0.08		
120	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		
125	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		
130	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		
135	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		
140	0.03	0.03	0.03	0.04	0.04	0.04	0.03	0.03	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03		
145	0.05	0.05	0.05	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		
150	0.08	0.08	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		
155	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.11	0.12	0.11		
160	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.15		
165	0.20	0.20	0.20	0.21	0.21	0.21	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.18		
170	0.22	0.22	0.22	0.22	0.22	0.22	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.20		
175	0.19	0.18	0.18	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.18	0.18	0.18		
180	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16		

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 ***

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