LM-79-08 Test Report

for

GREEN CREATIVE LTD

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

MR11

Model: 3MR11/840NF30

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ17050071g

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

Review by: April Zou

Engineer: April Zou
Jun. 07, 2017

Approved by:

Manager: Jim Zhang
Jun. 07, 2017

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: **3MR11/840NF30**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
92.3	253.7	2.75	0.7894

CCT (K)	CRI	Stabilization Time (Light & Power)
4047	83.9	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	: May 31, 2017
Date of Test	: Jun. 01, 2017
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

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Sample Photos

Figure 1- Overview of the sample

Equipment Under Test (EUT)	
Name	: MR11
Model	: 3MR11/840NF30
Electrical Ratings	: 12V, 60Hz, 3W
Product Description	: GU4 base, 4000K, CRI80
Manufacturer	: GREEN CREATIVE LTD
Address	: 756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

TEST RESULTS

Test ambient temperature was 24.8℃.

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 70 minutes.

Sphere-Spectroradiometer Method

Parameter	Result
Test Voltage (V)	12.0
Voltage frequency (Hz)	60
Test Current (A)	0.289
Power Factor	0.7894
Test Power (W)	2.75
THD A%	42.60
Luminous Efficacy (lm/W)	92.3
Total Luminous Flux (lm)	253.7
Color Rendering Index (CRI)	83.9
R9	11.5
Correlated Color Temperature (CCT)(K)	4047
Chromaticity Chroma x	0.3796
Chromaticity Chroma y	0.3805
Chromaticity Chroma u	0.2231
Chromaticity Chroma v	0.3354
Duv	0.0014
Chromaticity Chroma u ’	0.2231
Chromaticity Chroma v’	0.5031

Special Color Rendering Indices	
R1	81.9
R2	90.5
R3	96.2
R4	81.9
R5	82.1
R6	86.8
R7	86.5
R8	65.5
R9	11.5
R10	77.4
R11	80.7
R12	65.6
R13	84.1
R14	98.2

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℃.

The photometric distance is 2.47m.

Luminous data was taken at 0.5°vertical intervals and 10°horizontal intervals.

Parameter	Result
Test Voltage (V)	12.0
Voltage frequency (Hz)	60
Test Current (A)	0.292
Power Factor	0.7865
Test Power (W)	2.76
Luminous Efficacy (lm/W)	93.3
Total Luminous Flux (lm)	257.5
Beam Angle (°)	31.2
Center Beam Candle Power (cd)	671
Spacing Criteria	0.52 (0°-180°)/ 0.49 (90°-270°)
Zonal Lumens in the 0°-60°Zone	97.10%
Zonal Lumens in the 60°-90°Zone	2.80%
Zonal Lumens in the 90°-120°Zone	0.00%
Zonal Lumens in the 120°-180°Zone	0.10%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

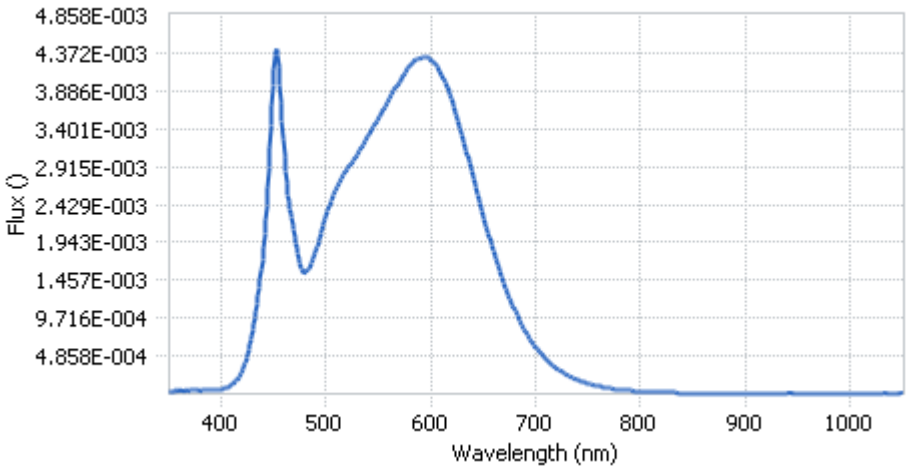
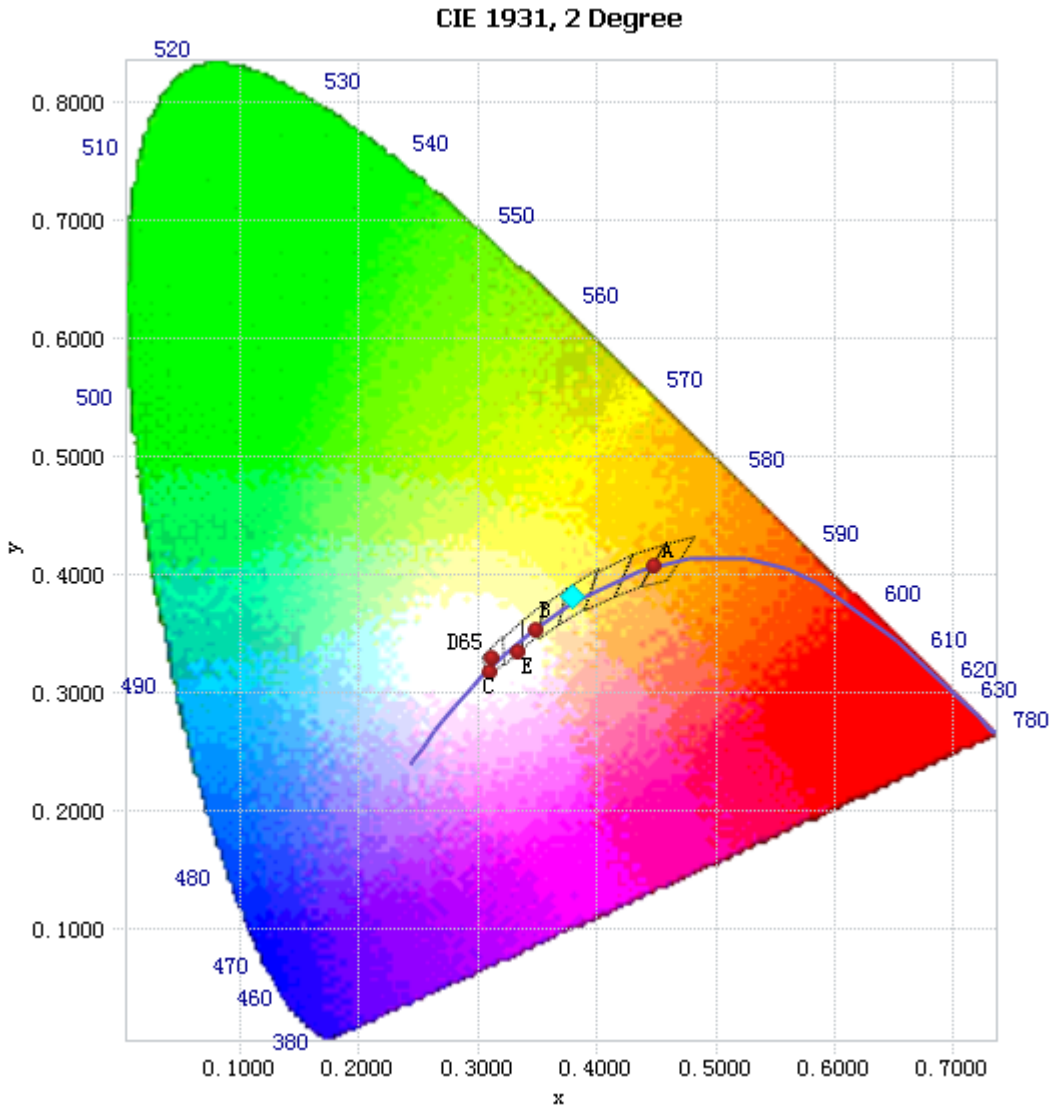


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	4.60E-05	485	1.66E-03	590	4.31E-03	695	7.00E-04
385	3.98E-05	490	1.85E-03	595	4.32E-03	700	6.03E-04
390	4.53E-05	495	2.06E-03	600	4.27E-03	705	5.21E-04
395	5.18E-05	500	2.30E-03	605	4.22E-03	710	4.47E-04
400	5.94E-05	505	2.50E-03	610	4.09E-03	715	3.82E-04
405	7.83E-05	510	2.65E-03	615	3.94E-03	720	3.32E-04
410	1.17E-04	515	2.77E-03	620	3.77E-03	725	2.83E-04
415	1.83E-04	520	2.88E-03	625	3.55E-03	730	2.44E-04
420	3.07E-04	525	2.98E-03	630	3.31E-03	735	2.09E-04
425	5.17E-04	530	3.09E-03	635	3.05E-03	740	1.79E-04
430	8.24E-04	535	3.19E-03	640	2.79E-03	745	1.54E-04
435	1.26E-03	540	3.31E-03	645	2.53E-03	750	1.32E-04
440	1.88E-03	545	3.43E-03	650	2.29E-03	755	1.14E-04
445	2.90E-03	550	3.54E-03	655	2.05E-03	760	9.87E-05
450	4.15E-03	555	3.66E-03	660	1.82E-03	765	8.48E-05
455	4.19E-03	560	3.77E-03	665	1.61E-03	770	7.26E-05
460	3.04E-03	565	3.91E-03	670	1.41E-03	775	6.31E-05
465	2.38E-03	570	4.02E-03	675	1.23E-03	780	5.51E-05
470	2.01E-03	575	4.11E-03	680	1.08E-03		
475	1.66E-03	580	4.21E-03	685	9.38E-04		
480	1.56E-03	585	4.29E-03	690	8.10E-04		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3796, 0.3805)

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

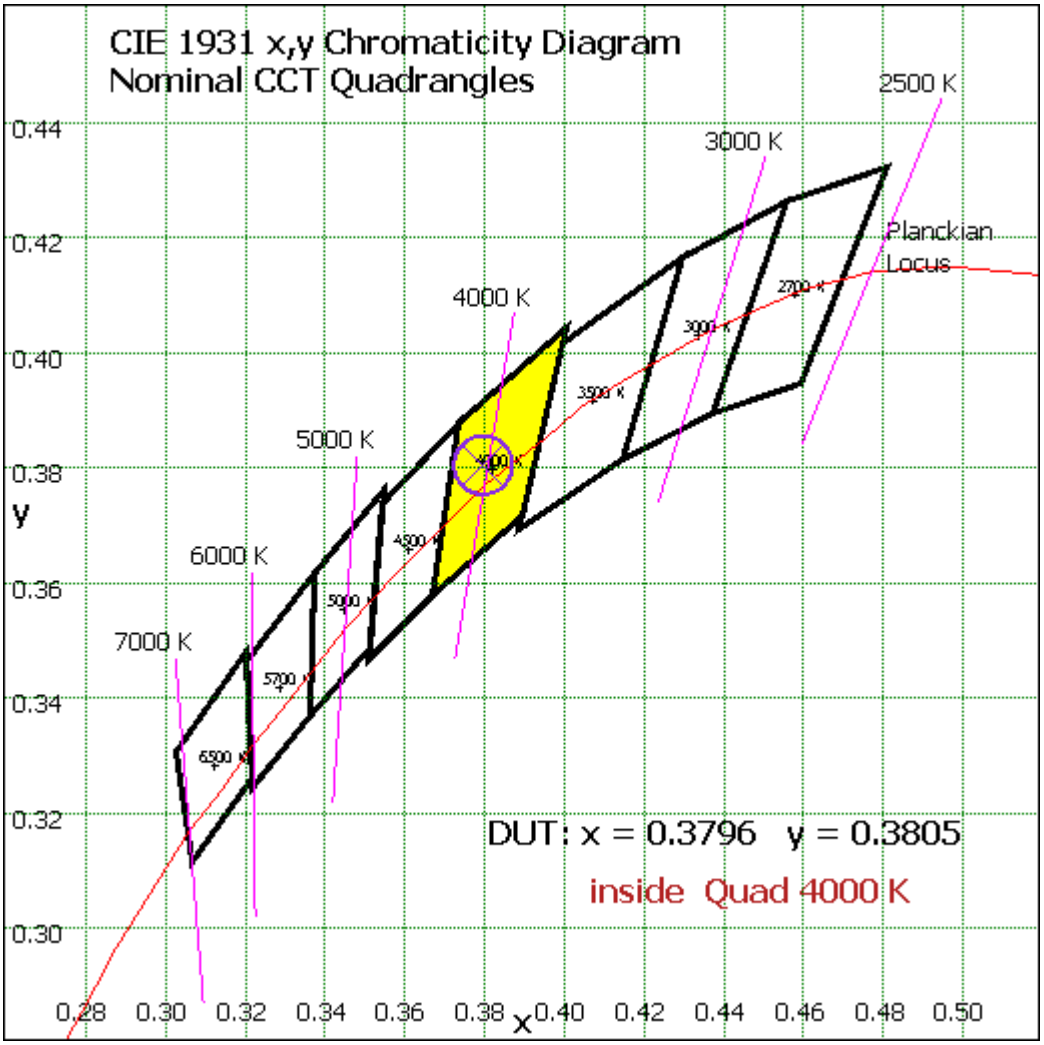


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

γ(°)	Lumens	% Total
0- 10	56.045	21.77%
10- 20	96.435	37.46%
20- 30	54.548	21.19%
30- 40	23.612	9.17%
40- 50	12.21	4.74%
50- 60	7.14	2.77%
60- 70	4.308	1.67%
70- 80	2.259	0.88%
80- 90	0.631	0.25%
90-100	0.003	0.00%
100-110	0	0.00%
110-120	0.001	0.00%
120-130	0.008	0.00%
130-140	0.031	0.01%
140-150	0.065	0.03%
150-160	0.081	0.03%
160-170	0.063	0.02%
170-180	0.021	0.01%
Total	257.5	100%

γ(°)	Lumens	% Total
0- 60	249.99	97.10%
60- 90	7.198	2.80%
0-90	257.188	99.89%
90- 180	0.273	0.11%
0- 180	257.5	100%

Table 5: Zonal Lumen Data

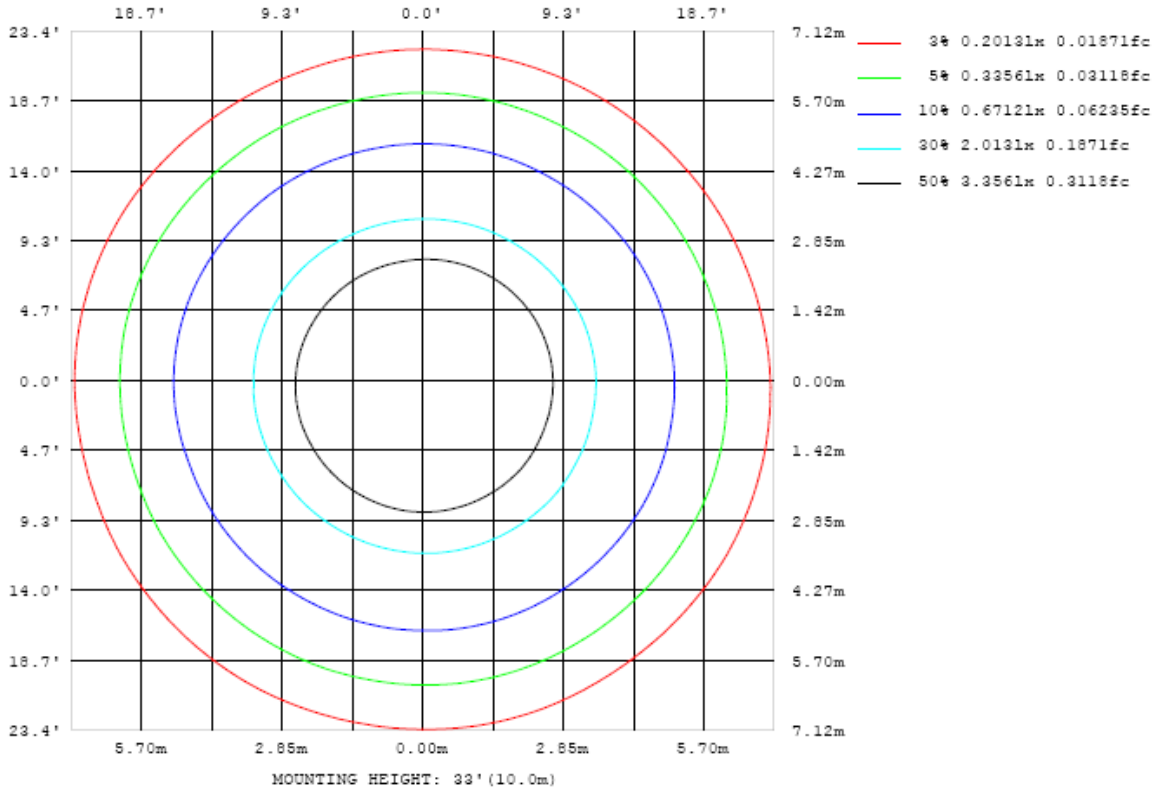


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

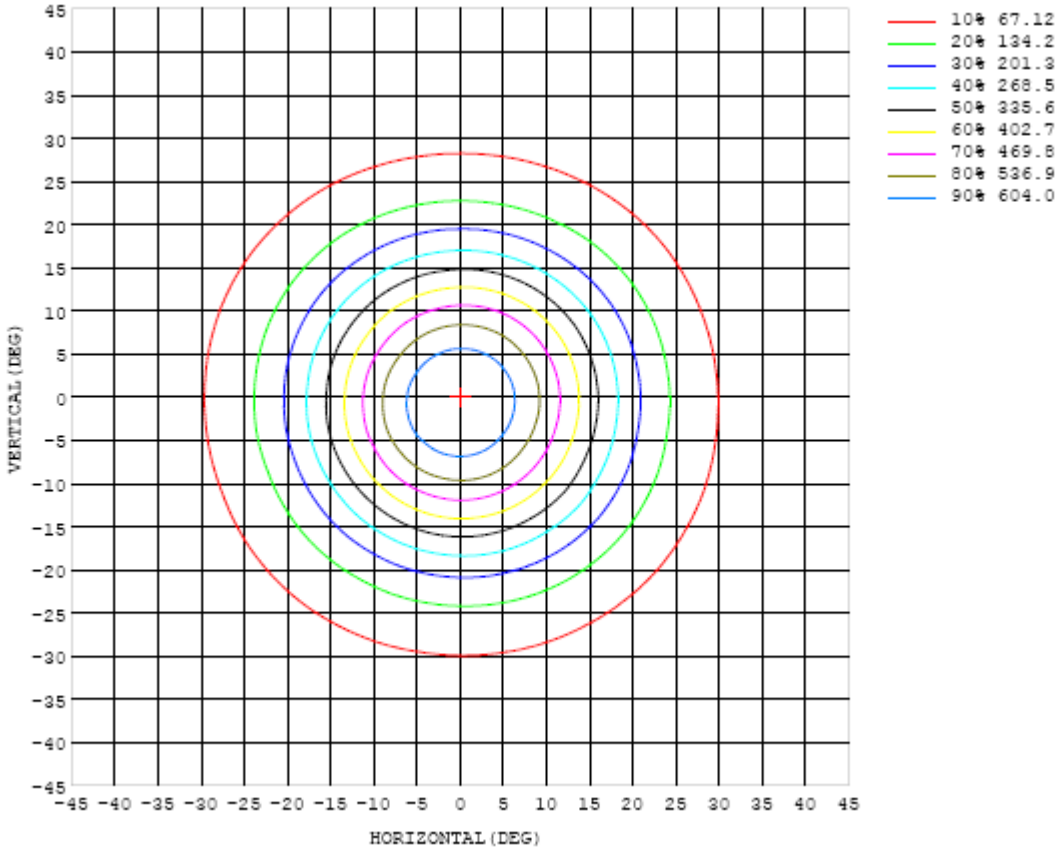


Chart 5: Isocandela Plot

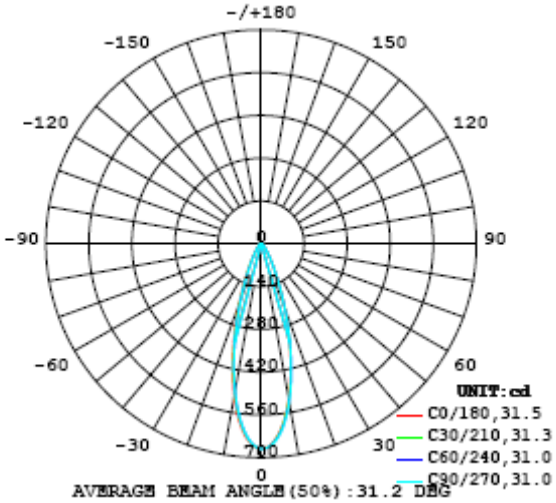


Chart 6: Polar Candela Distribution

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	671	671	671	671	671	671	671	671	671	671	671	671	671	671	671	671	671	671	671
5	628	629	630	631	632	634	635	636	636	636	636	635	635	635	634	633	630	629	627
10	514	516	516	518	520	523	525	526	527	526	526	525	524	523	520	517	515	511	508
15	366	367	367	369	374	375	373	373	373	373	371	369	367	365	362	360	359	356	352
20	223	223	226	227	229	228	227	226	225	223	221	220	217	217	215	214	213	213	212
25	122	123	125	125	125	124	124	123	122	121	120	119	118	118	117	117	116	117	117
30	66.1	67.0	67.5	67.0	67.0	66.4	66.2	66.8	66.6	66.5	66.0	66.0	65.3	65.6	65.0	64.7	64.1	64.4	64.5
35	37.5	38.1	38.5	38.8	38.5	38.2	38.3	38.8	38.9	38.7	38.4	38.5	38.7	38.5	38.2	38.0	37.5	37.5	37.7
40	23.2	23.8	24.1	24.3	24.3	24.0	24.1	24.1	24.3	24.3	24.3	24.4	24.5	24.6	24.6	24.3	23.8	23.6	23.6
45	15.6	16.1	16.4	16.5	16.4	16.3	16.3	16.5	16.6	16.7	16.5	16.6	16.7	16.8	16.8	16.6	16.1	15.8	15.8
50	10.9	11.2	11.5	11.7	11.6	11.4	11.5	11.7	11.8	11.8	11.8	11.7	11.7	11.7	11.8	11.7	11.3	10.9	10.8
55	7.84	8.09	8.30	8.45	8.36	8.25	8.31	8.45	8.55	8.63	8.60	8.52	8.46	8.46	8.46	8.30	8.01	7.76	7.69
60	5.79	5.92	6.10	6.19	6.13	6.05	6.10	6.22	6.26	6.29	6.28	6.24	6.20	6.18	6.14	6.00	5.78	5.59	5.57
65	4.35	4.43	4.56	4.66	4.59	4.51	4.54	4.62	4.63	4.65	4.67	4.67	4.62	4.56	4.51	4.42	4.24	4.09	4.07
70	3.15	3.22	3.34	3.43	3.37	3.29	3.28	3.34	3.36	3.41	3.44	3.40	3.35	3.30	3.26	3.19	3.06	2.90	2.85
75	2.12	2.18	2.29	2.38	2.33	2.24	2.19	2.22	2.28	2.33	2.36	2.31	2.26	2.21	2.20	2.17	2.06	1.91	1.85
80	1.27	1.31	1.40	1.48	1.44	1.36	1.30	1.31	1.38	1.42	1.43	1.38	1.32	1.29	1.30	1.30	1.23	1.11	1.04
85	0.58	0.61	0.67	0.72	0.70	0.64	0.60	0.60	0.64	0.67	0.67	0.62	0.57	0.56	0.57	0.56	0.52	0.46	0.42
90	0.05	0.06	0.08	0.10	0.09	0.08	0.07	0.06	0.06	0.05	0.05	0.04	0.03	0.02	0.02	0.02	0.02	0.01	0.01
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	0.00
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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	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	0.02
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	0.03	0.03	0.03	0.03	0.04
140	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.07
145	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.08	0.08	0.08	0.08	0.08	0.10
150	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.11	0.11	0.11	0.11	0.12
155	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	0.14	0.14	0.14	0.15	0.15
160	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.17	0.17	0.17	0.17	0.17	0.17	0.18	0.18	0.18	0.17
165	0.18	0.18	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.20	0.20	0.20	0.20	0.20	0.20	0.20
170	0.20	0.20	0.20	0.20	0.20	0.20	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.22	0.21	0.21	0.21	0.21
175	0.20	0.20	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.22	0.22
180	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21

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	671	671	671	671	671	671	671	671	671	671	671	671	671	671	671	671	671		
5	624	621	620	619	618	618	617	617	617	617	618	619	621	623	624	626	627		
10	504	499	495	493	491	490	489	489	490	492	496	498	500	503	506	510	513		
15	349	345	341	337	335	331	329	329	330	333	336	340	345	350	355	359	363		
20	210	207	203	200	196	193	191	190	190	191	194	197	201	206	212	217	220		
25	116	114	112	108	106	104	102	101	100	101	102	104	107	111	114	118	120		
30	64.1	62.9	61.0	59.0	57.4	56.1	55.1	54.5	54.5	54.6	55.1	55.8	57.3	59.0	60.9	62.7	64.6		
35	37.5	36.9	36.0	34.8	33.6	32.6	32.0	31.9	31.9	31.9	32.2	32.6	33.0	33.7	34.7	35.4	36.5		
40	23.5	23.4	23.1	22.2	21.3	20.6	20.3	20.2	20.3	20.3	20.4	20.6	20.9	21.4	21.9	22.3	22.7		
45	15.8	15.9	15.7	15.1	14.3	13.7	13.7	13.7	13.8	13.8	13.8	13.9	14.2	14.6	14.9	15.0	15.2		
50	10.9	11.0	11.0	10.5	9.89	9.62	9.60	9.73	9.77	9.70	9.64	9.70	9.88	10.1	10.4	10.5	10.6		
55	7.74	7.88	7.91	7.56	7.14	6.99	7.06	7.18	7.16	7.08	7.04	7.09	7.22	7.41	7.58	7.61	7.64		
60	5.63	5.74	5.79	5.54	5.29	5.22	5.30	5.38	5.40	5.32	5.26	5.30	5.40	5.53	5.63	5.66	5.69		
65	4.12	4.21	4.26	4.13	3.95	3.89	3.95	4.07	4.10	4.04	3.97	3.99	4.07	4.17	4.27	4.28	4.29		
70	2.91	2.99	3.05	3.00	2.86	2.81	2.86	2.99	3.05	3.00	2.92	2.91	2.96	3.06	3.14	3.15	3.13		
75	1.88	1.97	2.03	2.01	1.90	1.85	1.91	2.04	2.12	2.08	1.99	1.95	1.98	2.08	2.17	2.18	2.13		
80	1.06	1.13	1.18	1.17	1.10	1.06	1.10	1.21	1.29	1.26	1.17	1.13	1.15	1.25	1.33	1.33	1.29		
85	0.42	0.45	0.48	0.47	0.43	0.42	0.44	0.50	0.56	0.55	0.50	0.47	0.49	0.56	0.61	0.62	0.60		
90	0.01	0.01	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.03	0.04	0.05		
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	0.00	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		
120	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.01	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	0.03	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	0.02	0.02	0.02		
135	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.05	0.05	0.05	0.05	0.04		
140	0.10	0.09	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.09	0.09	0.09	0.09	0.09	0.07		
145	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.10		
150	0.19	0.18	0.18	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.13		
155	0.22	0.22	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.24	0.14		
160	0.24	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.27	0.25	0.16		
165	0.22	0.27	0.27	0.27	0.27	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.29	0.23	0.18		
170	0.21	0.23	0.25	0.25	0.25	0.25	0.26	0.26	0.26	0.26	0.27	0.27	0.27	0.28	0.25	0.20	0.20		
175	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.23	0.23	0.21	0.20	0.20	0.20	0.20	0.20		
180	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21		

Table 7: Luminous Intensity Data

EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Jul. 26, 2016	Jul. 25, 2017
Digital Power Meter	PF2010A	HZTE028-01	Jul. 26, 2016	Jul. 25, 2017
AC Power Supply	DPS1060	HZTE001-06	Dec. 25, 2016	Dec. 24, 2017
DC Power Supply	WY12010	HZTE004-03	Dec. 25, 2016	Dec. 24, 2017
Temperature Meter	TES1310	HZTE017-01	Aug. 08, 2016	Aug. 07, 2017
Standard source	D908	HZTE012-01	Jul. 28, 2016	Jul. 27, 2017
Integrate Sphere system	2M	HZTE015-01	Jul. 26, 2016	Jul. 25, 2017
Digital Power Meter	WT210	HZTE008-01	Jul. 26, 2016	Jul. 25, 2017
AC Power Supply	PCR 500L	HZTE001-07	Dec. 25, 2016	Dec. 24, 2017
DC Power Supply	IT6154	HZTE004-04	Jul. 27, 2016	Jul. 26, 2017
Temperature and humidity recorder	JR900	HZTE018-01	Dec. 25, 2016	Dec. 24, 2017
Standard source	SCL-1400	HZTE012-02	Jul. 28, 2016	Jul. 27, 2017

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 FA19 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 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 FA19 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

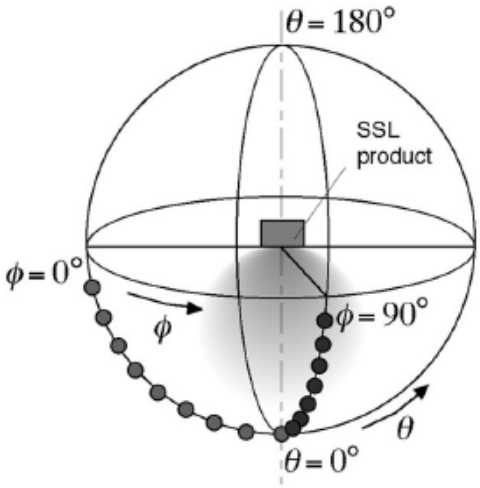
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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