NVLAP LAB CODE 200960-0

LM-79-08 Test Report

for

ABBlighting, Inc.

1501 Industrial Way N. Toms River, NJ 08755

Leopard series mini flood lights and wall packs

Model: MFW15501

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

No.1805, DongLiu road, BinJiang District, Hangzhou, China

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Report No.: HZ16040046a

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

Reviewed by:

Engineer: April Zou

May 17, 2016

Approved by:

Manager: Jim Zhang

May 17, 2016

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: **MFW15501**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
114.5	1626.1	14.20	0.9870

CCT (K)	CRI	Stabilization Time (Light & Power)
5072	72.0	60

Table 1: Executive Data Summary

Test specifications:

Date of Receipt	: Apr. 21, 2016
Date of Test	: Apr. 28, 2016
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

TABLE OF CONTENT

Sample Photo

Figure 1- Overview of the sample

Equipment Under Test (EUT)	
Name	: Leopard series mini flood lights and wall packs
Model	: MFW15501
Electrical Ratings	: 100~277Vac, 50/60Hz, 15W
Product Description	: 5000K, Aluminum Enclosure, Black Coating, Silver reflector Manufacturer of light source: Samsung Model of light source: 351B Quantity of LED light source: 7 (7SIP)
Manufacturer	: ABB Lighting (shanghai) Co., Ltd.
Address	: Room 1012, North Minch Fortune 108 Plaza,# 1839 Qixin road, Shanghai

TEST RESULTS

Test ambient temperature was 24.3℃.

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 85 minutes.

The photometric distance of Goniophotometer is 2.47 m.

Luminous data was taken at 0.5° vertical intervals and 10.0°horizontal intervals.

Parameter	Result		
Test Voltage (V)	120.0	100.0	277.0
Voltage frequency (Hz)	60	60	60
Test Current (A)	0.120	0.146	0.058
Power Factor	0.9870	0.9910	0.8803
Test Power (W)	14.20	14.43	14.04
THD A%	12.05	9.72	19.97
Luminous Efficacy (lm/W)	114.5	112.6	113.0
Total Luminous Flux (lm)	1626.1	1625.4	1586.0
Color Rendering Index (CRI)	72.0		
R9	-36.5		
Correlated Color Temperature (CCT) (K)	5072		
Chromaticity (Chroma x, Chroma y)	(0.3436, 0.3557)		
Chromaticity (Chroma u, Chroma v)	(0.2088, 0.3243)		
Chromaticity (Chroma u', Chroma v')	(0.2088, 0.4864)		
Duv	0.0027		
Average Beam Angle (°)	74.4		
Center Beam Candle Power (cd)	712		
Spacing Criteria	0.94 (0°-180°)/ 1.41 (90°-270°)		
Zonal Lumens in the 0°-60°Zone	95.39%		
Zonal Lumens in the 60°-90°Zone	4.54%		
Zonal Lumens in the 90°-120°Zone	0.01%		
Zonal Lumens in the 120°-180°Zone	0.06%		

Special Color Rendering Indices	
R1	68.4
R2	77.9
R3	84.7
R4	71.7
R5	69.8
R6	69
R7	80.1
R8	54.1
R9	-36.5
R10	47.6
R11	68.2
R12	47.1
R13	69.9
R14	91.5

Table 2: Test data per Goniophotometer Method

Note: According to CIE 1976 (u',v') diagram, u' = u = 4x/(-2x+12y+3), v' = 3v/2 = 9y/(-2x+12y+3).

Spectral Power Distribution

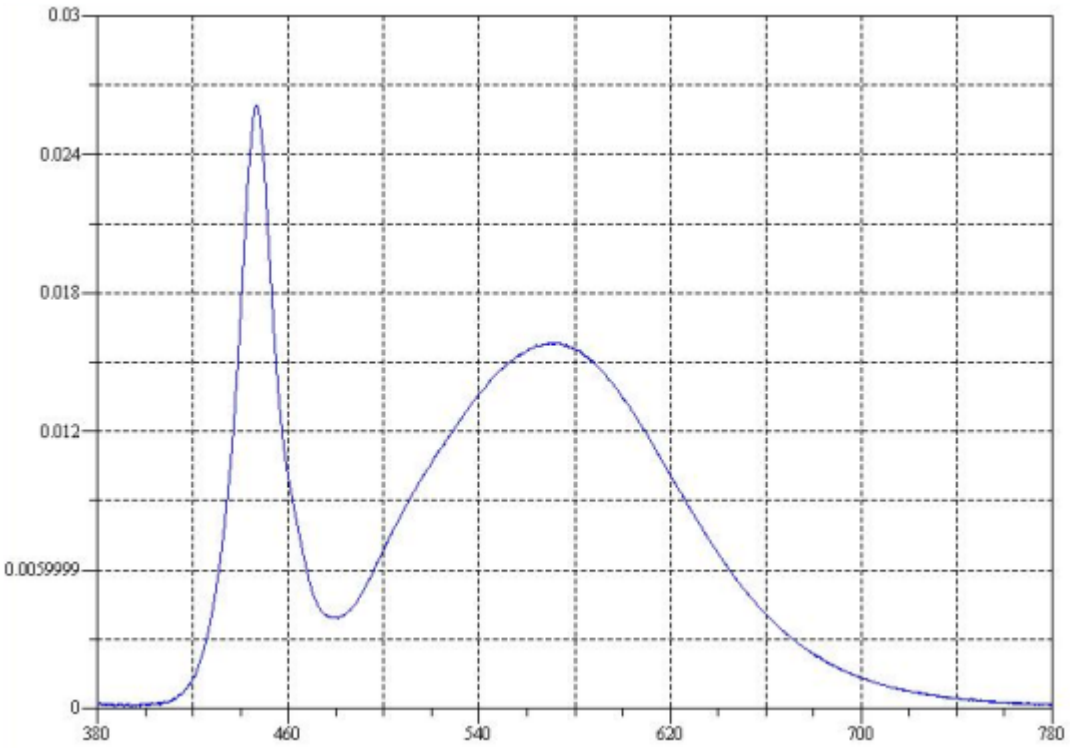


Chart 1: Spectral Power Distribution

Zonal Lumen Tabulation

γ(°)	Lumens	% Total
0- 10	70.087	4.31%
10- 20	217.329	13.37%
20- 30	359.605	22.12%
30- 40	406.078	24.97%
40- 50	316.88	19.49%
50- 60	181.09	11.14%
60- 70	64.984	4.00%
70- 80	8.223	0.51%
80- 90	0.691	0.04%
90-100	0.036	0.00%
100-110	0.048	0.00%
110-120	0.081	0.00%
120-130	0.134	0.01%
130-140	0.201	0.01%
140-150	0.223	0.01%
150-160	0.187	0.01%
160-170	0.127	0.01%
170-180	0.047	0.00%
Total	1626.1	100%

γ(°)	Lumens	% Total
0- 60	1551.069	95.39%
60- 90	73.898	4.54%
0-90	1624.967	99.93%
90- 180	1.084	0.07%
0- 180	1626.1	100%

Table 3: Zonal Lumen Data

Illuminance Plots

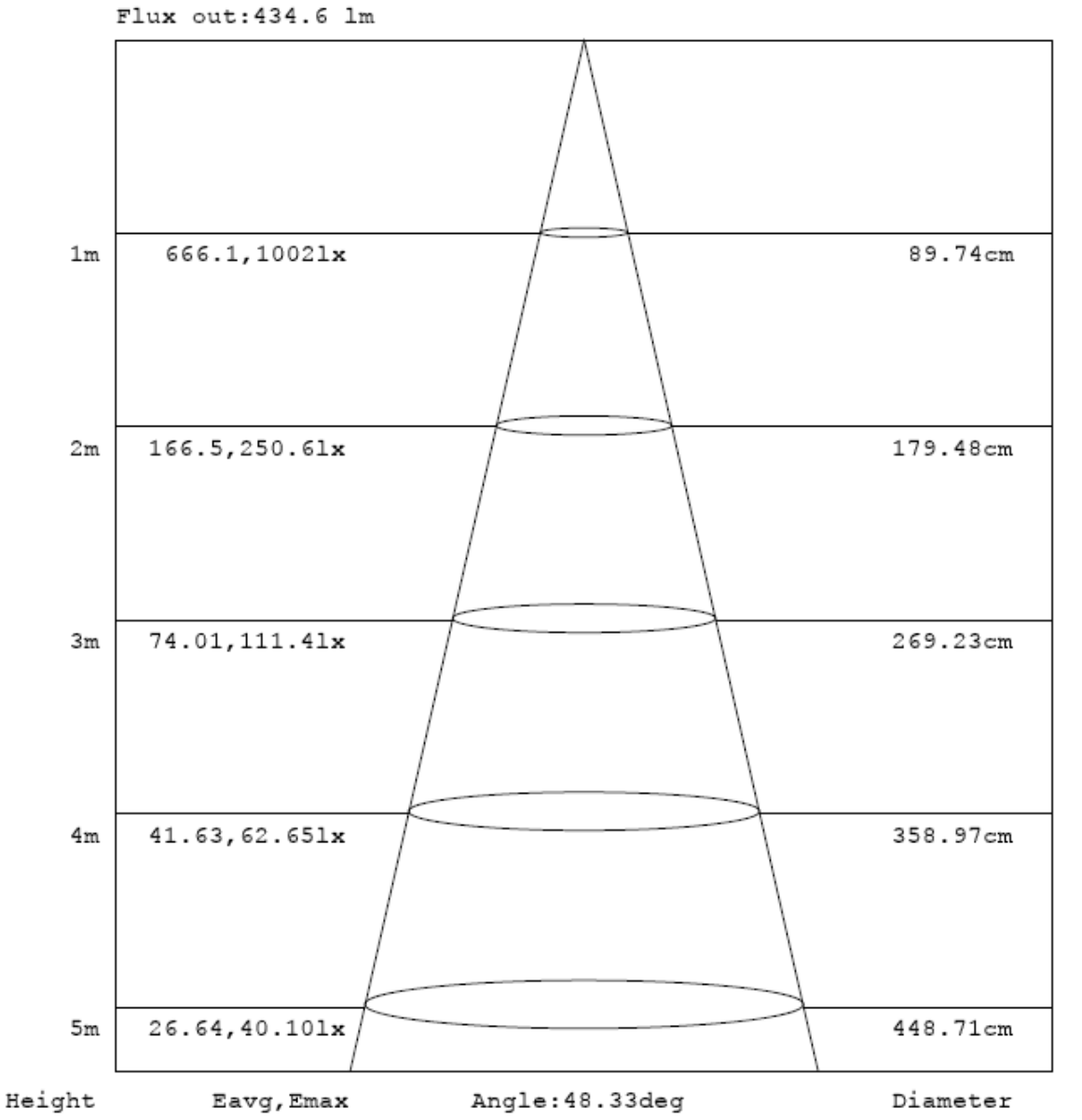


Chart 2: Beam Angle

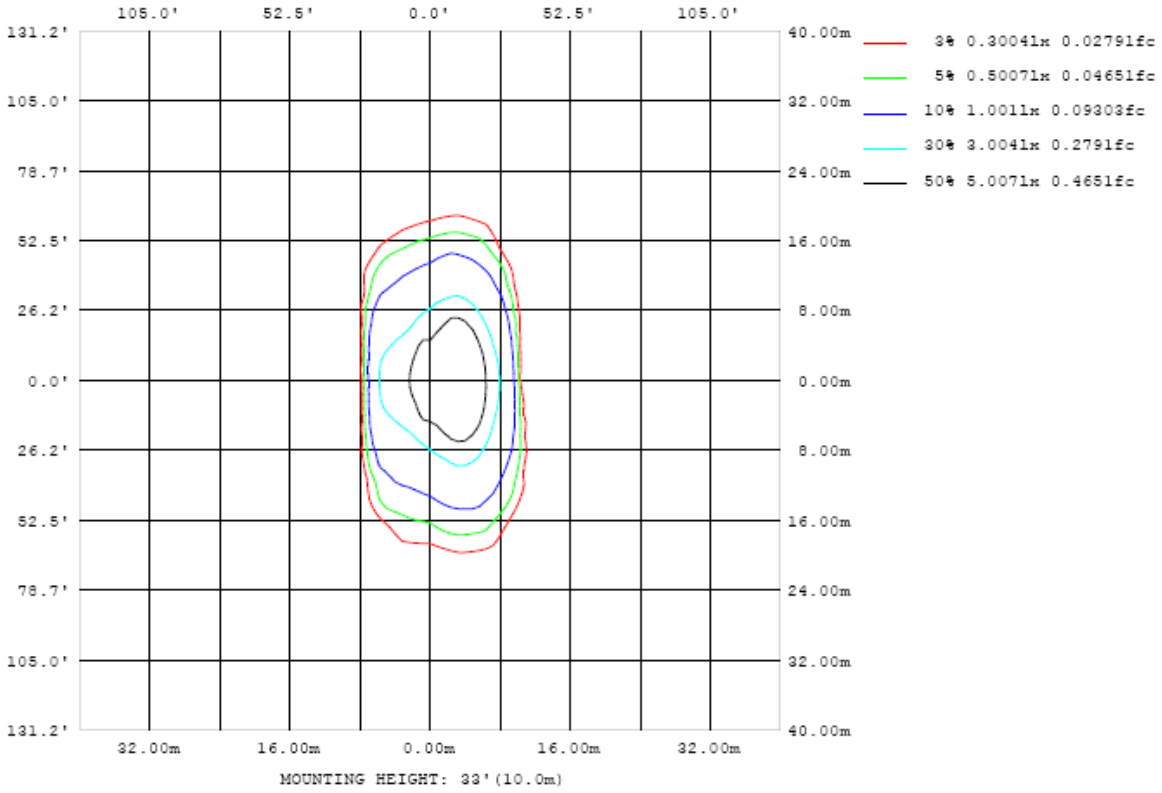


Chart 3: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots

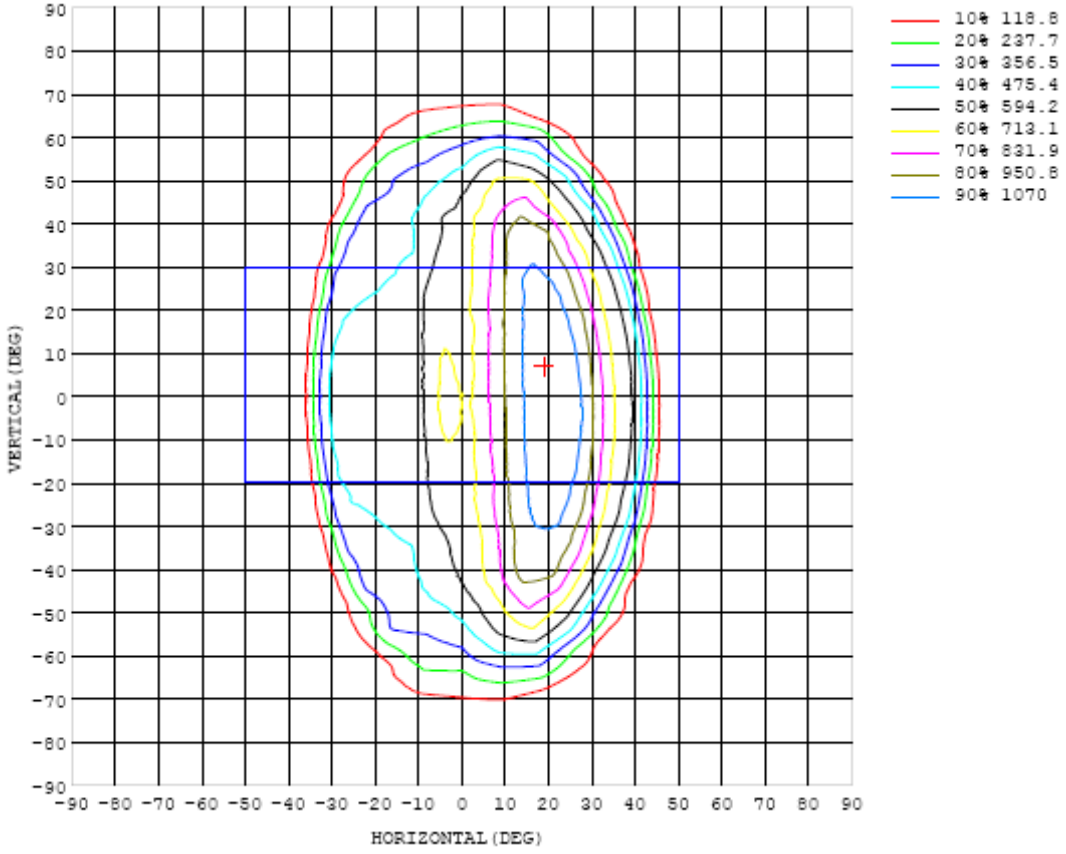


Chart 4: Isocandela Plot

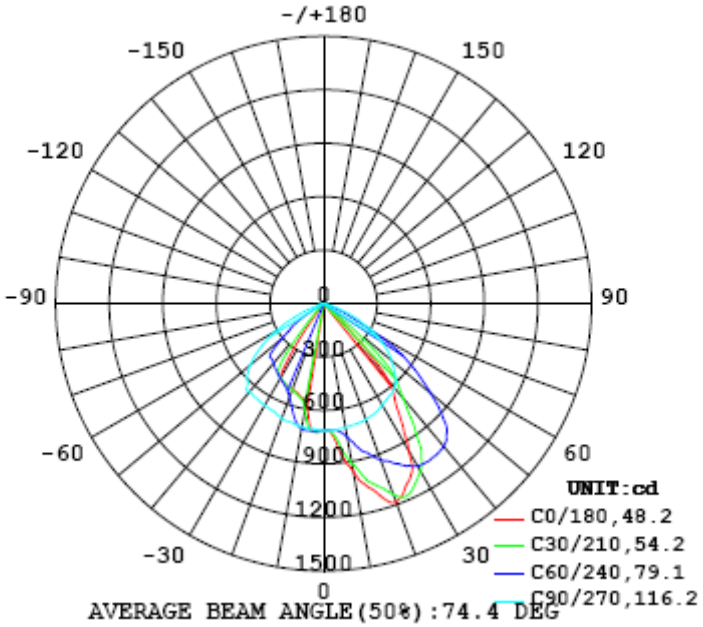


Chart 5: Polar Candela Distribution

Luminous Intensity Data

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	712	712	712	712	712	712	712	712	712	712	712	712	712	712	712	712	712	712	712
5	772	769	759	748	736	723	713	710	711	713	717	719	719	718	721	721	719	718	717
10	954	946	930	912	879	826	762	715	703	705	713	716	708	677	633	600	580	569	566
15	1083	1078	1066	1041	998	935	859	763	707	699	710	690	618	558	542	540	536	533	531
20	1187	1188	1175	1139	1086	1025	934	807	713	693	705	626	550	531	524	521	518	513	511
25	1111	1120	1140	1164	1161	1089	991	866	724	679	665	571	518	507	502	505	504	501	501
30	952	997	1049	1084	1125	1128	1049	907	726	656	601	522	493	489	492	493	490	485	484
35	717	745	804	916	1028	1093	1058	929	731	638	550	482	473	470	476	425	309	217	188
40	559	587	628	695	836	976	1044	970	744	615	526	454	449	463	328	122	36.8	30.6	31.7
45	160	217	365	536	638	805	973	945	715	572	497	428	435	285	76.7	22.3	26.7	23.9	23.3
50	47.4	58.1	58.5	175	431	608	783	847	661	498	423	400	309	100	15.9	21.0	16.4	14.6	13.4
55	26.7	27.5	38.4	50.8	135	369	593	724	596	419	362	366	153	9.53	18.9	14.0	13.4	12.6	11.2
60	15.8	18.1	22.1	27.2	30.4	150	349	517	462	327	311	192	50.1	11.5	14.3	11.9	9.64	8.52	7.66
65	5.21	7.10	9.46	14.6	20.5	17.7	151	300	289	217	221	86.7	2.18	12.5	10.3	8.07	7.08	6.18	5.86
70	0.18	0.31	0.87	3.49	8.12	8.70	11.9	87.4	130	109	82.3	28.5	6.18	8.34	5.96	5.64	5.24	4.62	4.33
75	0.03	0.03	0.06	0.00	1.03	2.65	4.99	18.7	29.3	30.9	15.4	6.49	5.45	4.27	3.40	2.99	2.76	2.45	2.36
80	0.01	0.01	0.01	0.02	0.04	0.31	1.48	4.63	8.35	10.2	6.58	3.38	2.94	2.17	1.50	1.34	0.68	0.24	0.21
85	0.01	0.01	0.01	0.01	0.02	0.02	0.18	0.55	3.04	4.28	2.61	1.03	0.40	0.22	0.11	0.10	0.09	0.09	0.09
90	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.05	0.06	0.06	0.05	0.06	0.06	0.07	0.07	0.07	0.08	0.08
95	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
100	0.01	0.01	0.01	0.01	0.01	0.02	0.04	0.05	0.07	0.06	0.04	0.04	0.04	0.04	0.03	0.02	0.02	0.01	0.01
105	0.01	0.01	0.01	0.01	0.02	0.04	0.06	0.08	0.11	0.08	0.05	0.06	0.05	0.05	0.03	0.02	0.02	0.02	0.02
110	0.01	0.01	0.01	0.02	0.03	0.05	0.08	0.11	0.15	0.11	0.07	0.07	0.07	0.06	0.05	0.03	0.02	0.02	0.02
115	0.02	0.02	0.02	0.03	0.05	0.08	0.10	0.14	0.18	0.14	0.09	0.09	0.09	0.09	0.07	0.05	0.03	0.03	0.03
120	0.03	0.03	0.04	0.05	0.08	0.11	0.13	0.17	0.21	0.17	0.12	0.12	0.12	0.12	0.10	0.07	0.06	0.05	0.06
125	0.07	0.07	0.08	0.09	0.12	0.14	0.17	0.20	0.25	0.21	0.16	0.16	0.16	0.15	0.14	0.11	0.10	0.09	0.10
130	0.11	0.11	0.12	0.14	0.16	0.19	0.21	0.25	0.30	0.27	0.21	0.21	0.21	0.20	0.18	0.16	0.15	0.15	0.16
135	0.17	0.17	0.18	0.20	0.22	0.24	0.27	0.31	0.36	0.34	0.29	0.28	0.27	0.26	0.24	0.22	0.21	0.22	0.24
140	0.23	0.23	0.23	0.25	0.26	0.29	0.32	0.36	0.42	0.39	0.34	0.33	0.32	0.30	0.29	0.27	0.27	0.28	0.30
145	0.28	0.27	0.28	0.28	0.30	0.33	0.36	0.40	0.45	0.42	0.38	0.37	0.36	0.35	0.33	0.33	0.33	0.33	0.35
150	0.33	0.31	0.31	0.32	0.33	0.36	0.39	0.42	0.47	0.43	0.37	0.37	0.38	0.38	0.38	0.37	0.38	0.38	0.39
155	0.37	0.36	0.35	0.35	0.36	0.38	0.40	0.43	0.47	0.42	0.35	0.36	0.38	0.39	0.41	0.42	0.43	0.43	0.42
160	0.42	0.41	0.40	0.40	0.40	0.40	0.41	0.43	0.47	0.41	0.36	0.37	0.38	0.40	0.42	0.44	0.45	0.45	0.43
165	0.48	0.47	0.46	0.45	0.45	0.44	0.44	0.45	0.46	0.42	0.38	0.39	0.41	0.43	0.45	0.47	0.48	0.46	0.45
170	0.54	0.52	0.51	0.50	0.50	0.48	0.47	0.47	0.47	0.44	0.43	0.44	0.45	0.47	0.49	0.50	0.49	0.48	0.45
175	0.58	0.56	0.54	0.52	0.51	0.50	0.48	0.47	0.47	0.47	0.48	0.49	0.51	0.53	0.54	0.55	0.54	0.52	0.51
180	0.54	0.53	0.51	0.50	0.49	0.48	0.47	0.46	0.45	0.47	0.50	0.51	0.52	0.53	0.54	0.55	0.55	0.55	0.53

Table 4: 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	712	712	712	712	712	712	712	712	712	712	712	712	712	712	712	712	712		
5	717	719	720	722	722	718	713	710	701	711	712	708	720	739	752	762	769		
10	570	582	604	646	692	715	715	708	702	699	724	780	840	886	915	936	950		
15	533	535	539	543	571	650	704	703	691	706	788	877	947	1008	1050	1073	1082		
20	510	511	518	522	529	562	664	706	686	737	853	960	1032	1099	1161	1189	1189		
25	502	501	501	500	506	511	604	679	665	755	913	1015	1116	1162	1145	1122	1109		
30	486	485	481	481	479	484	536	634	659	775	945	1084	1126	1087	1059	1012	962		
35	222	318	430	470	465	460	474	592	651	789	990	1069	1039	948	846	767	723		
40	31.4	37.3	136	353	445	436	445	572	647	800	1007	1010	873	734	653	608	571		
45	23.7	26.8	22.9	82.1	311	425	409	515	605	764	917	837	672	580	441	272	176		
50	14.2	16.5	22.1	15.4	112	305	368	444	541	726	786	634	518	285	91.1	57.5	50.4		
55	11.8	12.7	12.9	19.8	2.21	195	323	352	432	605	576	466	202	40.8	38.8	27.6	26.6		
60	8.20	9.20	10.8	12.1	12.6	34.3	174	252	301	389	387	164	30.4	28.2	22.9	19.2	16.0		
65	6.13	6.51	7.01	7.84	11.3	2.98	92.2	149	176	203	147	47.4	12.2	14.4	10.6	7.51	5.49		
70	4.53	4.93	4.71	5.26	7.43	5.87	18.3	47.5	67.7	69.8	31.4	4.79	5.96	4.25	1.28	0.33	0.17		
75	2.41	2.59	2.61	2.64	4.37	4.49	5.97	10.1	12.7	9.69	4.89	2.26	0.95	0.25	0.02	0.03	0.03		
80	0.20	0.27	0.85	1.18	1.19	1.25	3.05	5.65	6.18	3.69	1.31	0.43	0.09	0.02	0.02	0.02	0.01		
85	0.09	0.09	0.09	0.08	0.09	0.11	0.24	0.50	0.77	0.45	0.08	0.02	0.02	0.02	0.01	0.01	0.01		
90	0.08	0.08	0.07	0.07	0.06	0.05	0.05	0.03	0.03	0.04	0.03	0.02	0.01	0.01	0.01	0.01	0.01		
95	0.04	0.04	0.03	0.03	0.04	0.04	0.04	0.04	0.05	0.05	0.04	0.02	0.01	0.01	0.01	0.01	0.01		
100	0.01	0.02	0.03	0.04	0.04	0.05	0.05	0.05	0.08	0.08	0.06	0.04	0.02	0.01	0.01	0.01	0.01		
105	0.02	0.02	0.03	0.05	0.06	0.06	0.07	0.06	0.11	0.12	0.09	0.06	0.04	0.02	0.01	0.01	0.01		
110	0.02	0.04	0.05	0.07	0.08	0.09	0.09	0.09	0.14	0.15	0.11	0.09	0.06	0.03	0.02	0.02	0.01		
115	0.04	0.06	0.09	0.11	0.11	0.11	0.12	0.11	0.17	0.18	0.14	0.11	0.08	0.05	0.03	0.02	0.02		
120	0.07	0.10	0.13	0.14	0.15	0.15	0.15	0.15	0.19	0.20	0.17	0.14	0.11	0.08	0.06	0.04	0.03		
125	0.12	0.15	0.18	0.19	0.19	0.19	0.19	0.19	0.23	0.25	0.21	0.17	0.15	0.13	0.10	0.08	0.07		
130	0.19	0.21	0.23	0.24	0.24	0.24	0.24	0.24	0.29	0.31	0.27	0.23	0.20	0.17	0.15	0.13	0.11		
135	0.26	0.27	0.29	0.29	0.30	0.31	0.31	0.31	0.36	0.38	0.34	0.30	0.26	0.24	0.21	0.19	0.17		
140	0.31	0.32	0.33	0.34	0.35	0.36	0.36	0.35	0.42	0.45	0.41	0.36	0.32	0.29	0.27	0.25	0.23		
145	0.35	0.35	0.36	0.37	0.38	0.39	0.39	0.37	0.46	0.51	0.47	0.42	0.38	0.35	0.32	0.30	0.29		
150	0.38	0.37	0.37	0.37	0.37	0.38	0.37	0.35	0.47	0.54	0.51	0.47	0.43	0.40	0.37	0.35	0.34		
155	0.40	0.38	0.37	0.36	0.35	0.35	0.35	0.32	0.46	0.55	0.53	0.50	0.47	0.45	0.43	0.41	0.38		
160	0.41	0.39	0.38	0.37	0.35	0.34	0.34	0.31	0.45	0.55	0.54	0.53	0.51	0.49	0.48	0.47	0.44		
165	0.42	0.40	0.39	0.38	0.36	0.35	0.35	0.33	0.45	0.53	0.53	0.53	0.54	0.53	0.53	0.52	0.50		
170	0.44	0.42	0.41	0.40	0.39	0.38	0.37	0.36	0.46	0.53	0.53	0.55	0.56	0.57	0.58	0.57	0.56		
175	0.49	0.48	0.47	0.45	0.43	0.42	0.41	0.40	0.48	0.53	0.53	0.55	0.56	0.58	0.59	0.60	0.59		
180	0.52	0.51	0.50	0.48	0.47	0.46	0.45	0.45	0.47	0.49	0.49	0.51	0.52	0.53	0.54	0.55	0.55		

Table 5: Luminous Intensity Data

EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Jul. 17, 2015	Jul. 16, 2016
Digital Power Meter	PF2010A	HZTE028-01	Jul. 17, 2015	Jul. 16, 2016
AC Power Supply	PCR 500L	HZTE001-08	Jul. 17, 2015	Jul. 16, 2016
DC Power Supply	WY12010	HZTE004-03	Jul. 17, 2015	Jul. 16, 2016
Temperature Meter	TES1310	HZTE017-01	Jul. 17, 2015	Jul. 16, 2016
Standard Source	D908	HZTE012-01	Jul. 23, 2015	Jul. 22, 2016
Standard source	SCL-1400	HZTE012-02	Oct. 21, 2015	Oct. 20, 2016

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.

Goniophotometer Method

Photometric and Electrical Measurements

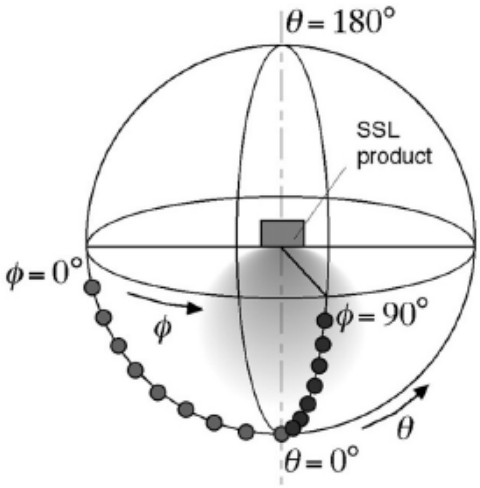
An EVERFINE Type C Model GO-R5000 Goniophotometer was used to measure the intensity at each angle of distribution for each sample. The photometric distance is 2.475m for near-field measurement or 30m for far-field measurement. Bandwidth of spectroradiometer is 380nm-780nm.
Ambient temperature was measured 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 expended uncertainty is 1.94% 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 ***