Quality Assured

NVLAP LAB CODE 200960-0

LM-79-08 Test Report

for

ABBlighting, Inc.

3 Adams St Belvidere, NJ 07823.

Troffer

Model: ABBRT24D4535

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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

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Report No.: HZ15070041c

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

Reviewed by: April Zou

Engineer: April Zou

Aug. 10, 2015

Approved by: Jim Zhang

LEADING TESTING LABORATORIES

Manager: Jim Zhang

Aug. 10, 2015

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: **ABBRT24D4535**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
99.1	4121.4	41.58	0.9888

CCT (K)	CRI	Stabilization Time (Light & Power)
3429	81.9	60

Table 1: Executive Data Summary

Test specifications:

Date of Receipt : Jul. 23, 2015

Date of Test : Jul. 24, 2015

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

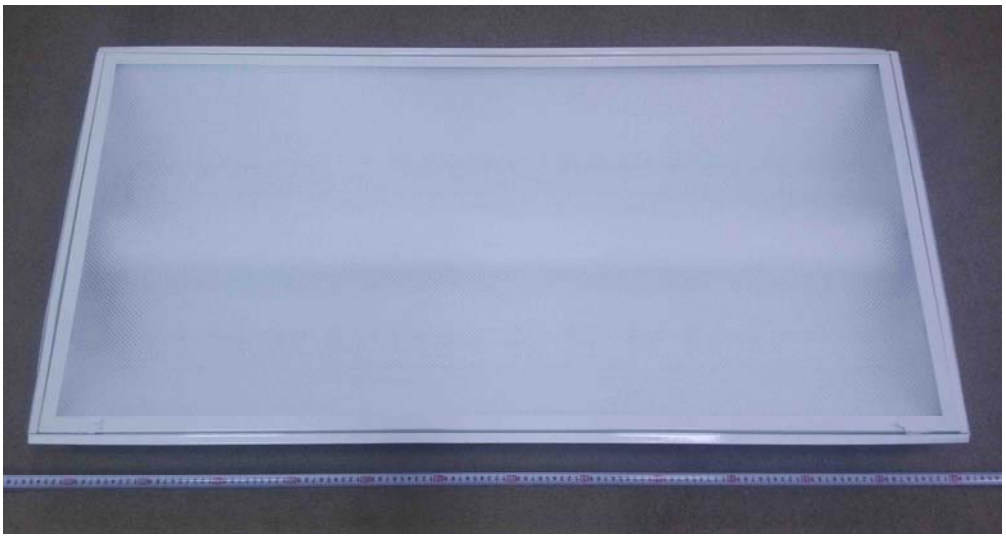


Figure 1- Overview of the sample

Equipment Under Test (EUT)	
Name	: Troffer
Model	: ABBRT24D4535
Electrical Ratings	: 100~277V AC, 50/60Hz, 45W
Product Description	: 3500K, 2x4 Luminaires for Ambient Lighting of Interior Commercial Spaces Manufacturer of light source: EVERLIGHT Model of light source: 67-21S Series 2835 Quantity of LED light source: 264 pcs
Manufacturer	: ABB Lighting (shanghai) Co., Ltd.
Address	: Room 1012, North Minch Fortune 108 Plaza,# 1839 Qixin road, Shanghai

TEST RESULTS

Test ambient temperature was 25.2℃.

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.

Parameter	Result		
Test Voltage (V)	120.0	100.0	277.0
Voltage frequency (Hz)	60	60	60
Test Current (A)	0.350	0.427	0.156
Power Factor	0.9888	0.9840	0.9697
Test Power (W)	41.58	42.03	41.86
THD A%	8.68	9.69	6.39
Luminous Efficacy (lm/W)	99.1	98.0	98.3
Total Luminous Flux (lm)	4121.4	4117.2	4116.3
Color Rendering Index (CRI)	81.9		
R9	12		
Correlated Color Temperature (CCT) (K)	3429		
Chromaticity (Chroma x, Chroma y)	(0.4118, 0.3990)		
Chromaticity (Chroma u, Chroma v)	(0.2365, 0.3437)		
Chromaticity (Chroma u', Chroma v')	(0.2365, 0.5156)		
Duv	0.0022		
Average Beam Angle (°)	95.6		
Center Beam Candle Power (cd)	1785		
Spacing Criteria	1.25 (0°-180°)/ 1.22 (90°-270°)		
Zonal Lumens in the 0°-60°Zone	86.45%		
Zonal Lumens in the 60°-90°Zone	13.47%		
Zonal Lumens in the 90°-120°Zone	0.03%		
Zonal Lumens in the 120°-180°Zone	0.05%		

Special Color Rendering Indices	
R1	80
R2	88
R3	95
R4	79
R5	79
R6	84
R7	86
R8	64
R9	12
R10	72
R11	76
R12	59
R13	81
R14	97

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

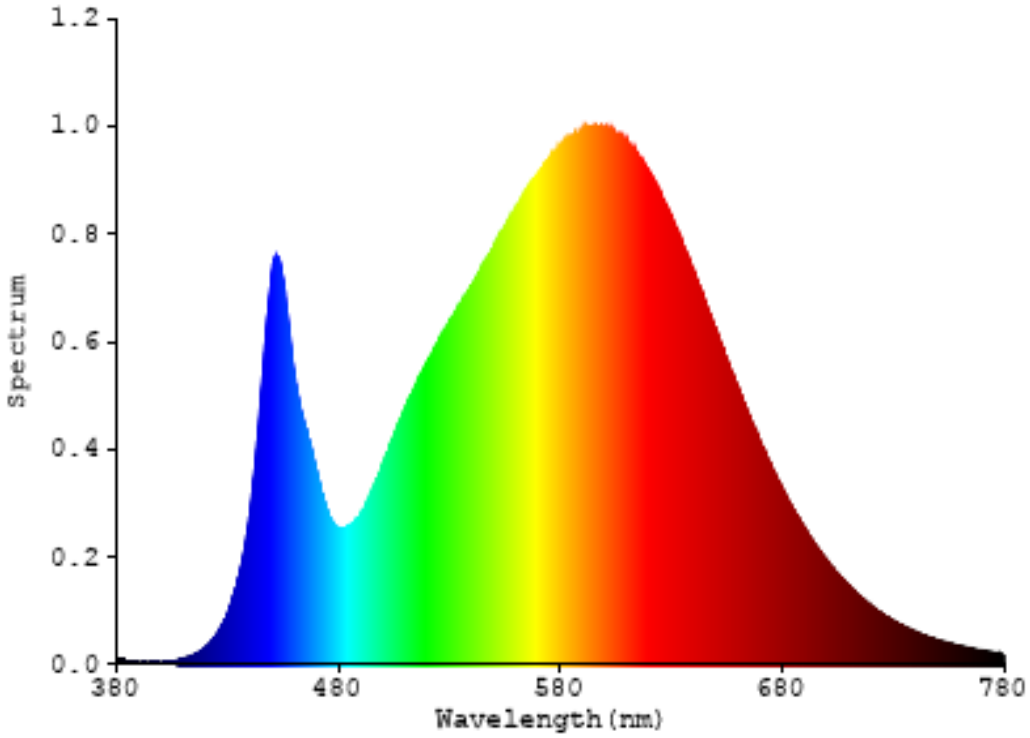


Chart 1: Spectral Power Distribution

Zonal Lumen Tabulation

γ(°)	Lumens	% Total
0- 10	169.322	4.11%
10- 20	486.694	11.81%
20- 30	734.261	17.82%
30- 40	845.647	20.52%
40- 50	773.716	18.77%
50- 60	553.118	13.42%
60- 70	306.285	7.43%
70- 80	179.051	4.34%
80- 90	69.788	1.69%
90-100	0.575	0.01%
100-110	0.519	0.01%
110-120	0.49	0.01%
120-130	0.46	0.01%
130-140	0.445	0.01%
140-150	0.397	0.01%
150-160	0.313	0.01%
160-170	0.208	0.01%
170-180	0.078	0.00%
Total	4121.4	100%

γ(°)	Lumens	% Total
0- 60	3562.758	86.45%
60- 90	555.124	13.47%
0-90	4117.882	99.92%
90- 180	3.485	0.08%
0- 180	4121.4	100%

Table 3: Zonal Lumen Data

Illuminance Plots

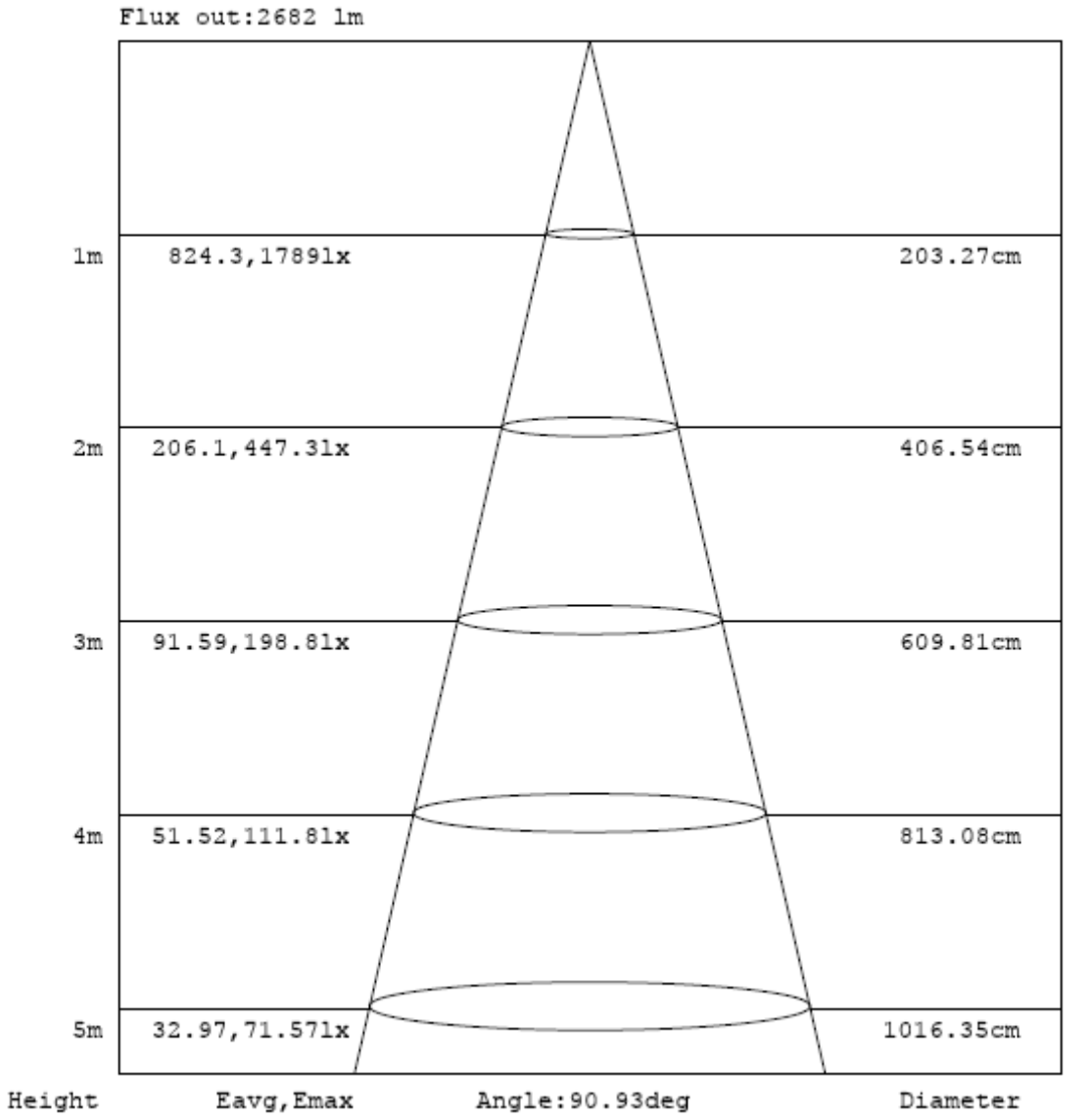


Chart 2: Beam Angle

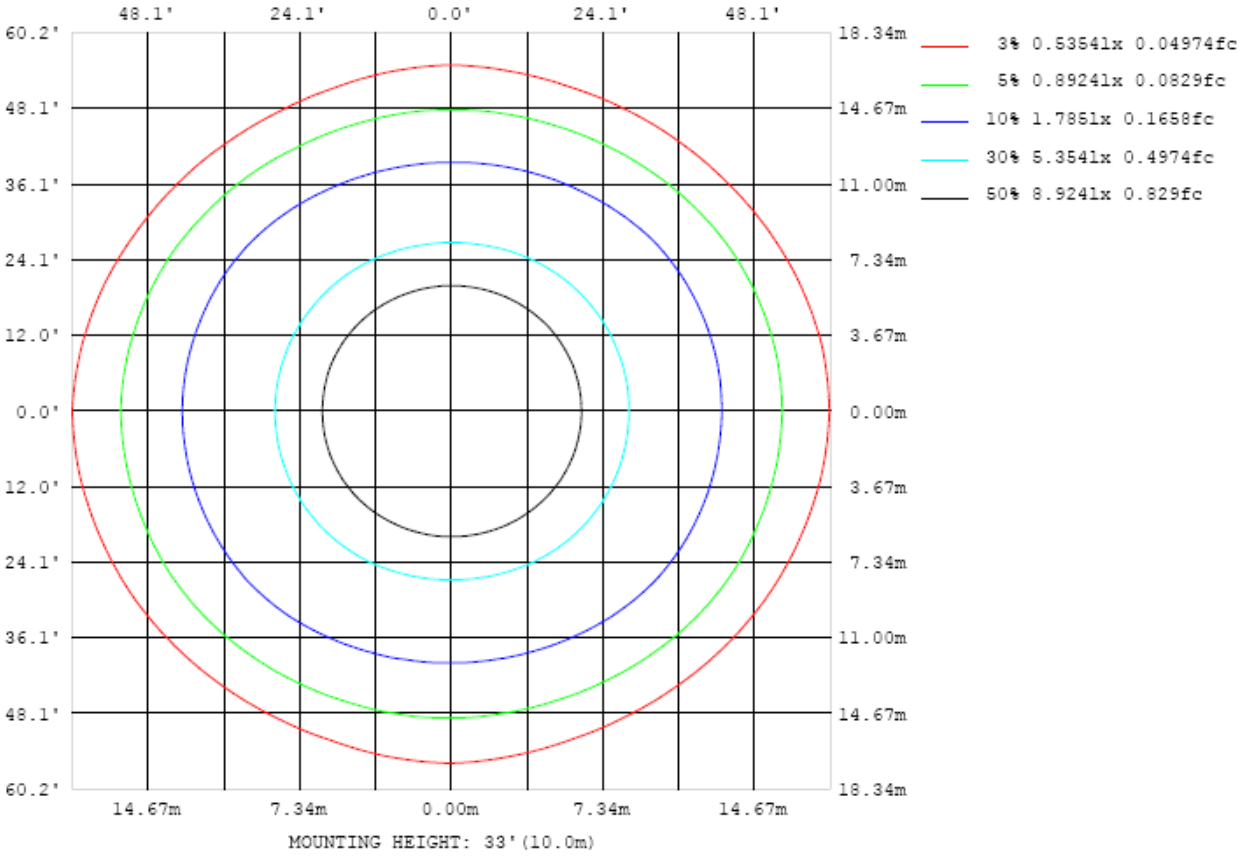


Chart 3: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots

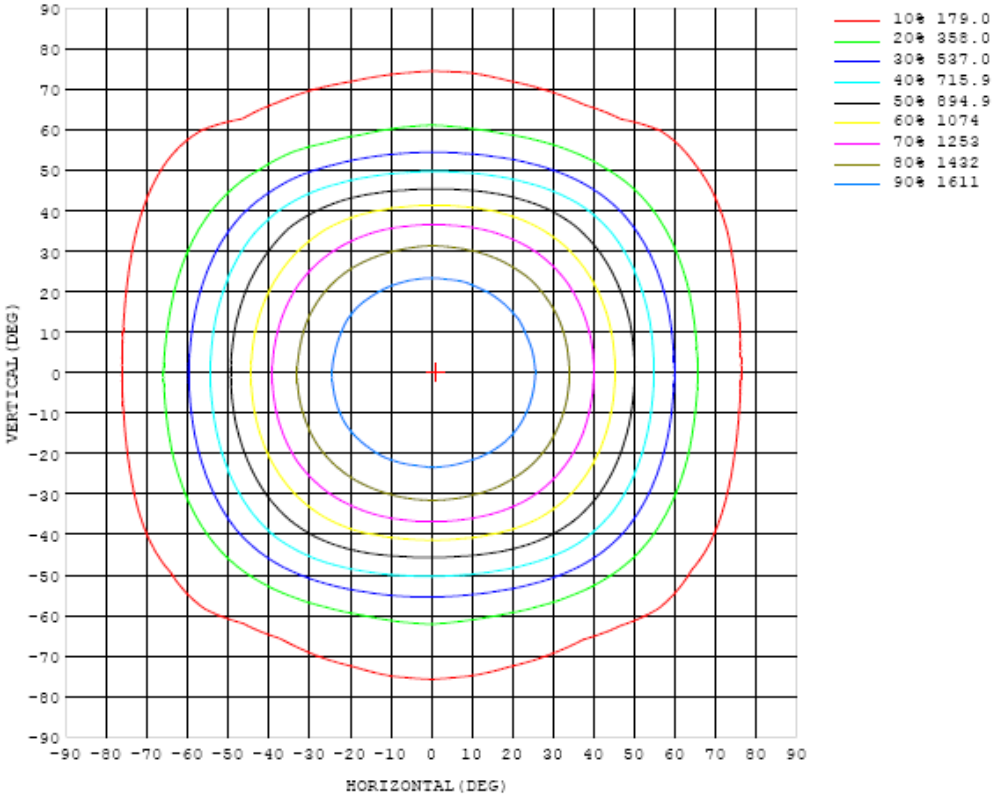


Chart 4: Isocandela Plot

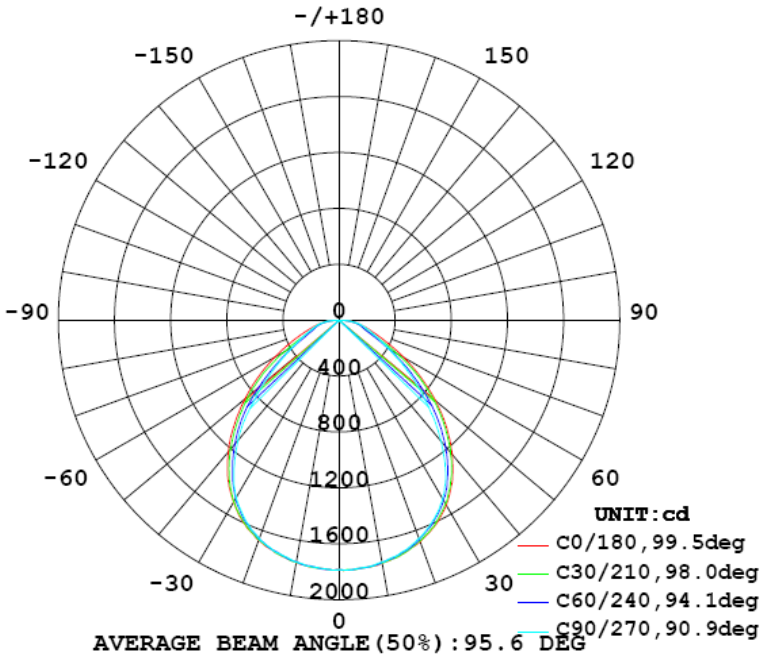


Chart 5: Polar Candela Distribution

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	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
5	1779	1780	1781	1781	1780	1782	1781	1782	1780	1778	1778	1779	1777	1776	1780	1783	1779	1777	1778
10	1763	1766	1765	1765	1763	1761	1760	1761	1758	1758	1758	1753	1760	1763	1761	1763	1763	1758	1761
15	1732	1733	1734	1734	1732	1727	1724	1724	1722	1718	1718	1725	1723	1725	1726	1728	1728	1724	1725
20	1687	1688	1685	1681	1677	1674	1670	1663	1661	1663	1659	1667	1665	1669	1672	1672	1675	1677	1675
25	1620	1618	1616	1614	1608	1601	1591	1587	1579	1581	1581	1586	1590	1594	1599	1602	1605	1604	1603
30	1527	1525	1522	1517	1509	1496	1485	1479	1478	1476	1474	1476	1482	1490	1496	1503	1507	1509	1503
35	1406	1402	1397	1389	1381	1366	1349	1339	1327	1322	1325	1334	1340	1354	1366	1374	1379	1381	1382
40	1252	1249	1246	1234	1221	1204	1179	1155	1138	1132	1137	1153	1175	1191	1207	1219	1226	1230	1229
45	1082	1079	1072	1059	1046	1021	988	957	933	921	934	958	988	1016	1029	1041	1052	1054	1055
50	897	892	884	873	855	823	783	751	733	729	736	756	790	826	848	861	868	874	876
55	708	702	692	678	650	617	584	562	553	553	558	568	592	622	656	675	687	690	700
60	530	520	499	477	449	422	402	393	398	407	402	397	407	430	457	485	505	523	532
65	375	359	331	307	284	270	270	278	293	307	297	276	269	273	290	316	343	371	385
70	265	248	220	207	193	188	198	211	229	238	229	209	197	187	191	210	227	256	273
75	194	179	163	165	156	155	162	168	181	187	181	169	162	153	150	163	165	183	195
80	135	131	120	125	118	119	122	128	132	137	135	131	123	117	112	121	121	132	137
85	72.1	77.9	64.7	62.8	66.7	61.3	59.8	69.1	73.5	74.5	75.2	70.9	60.9	61.7	65.5	61.5	63.9	75.5	75.2
90	1.84	6.70	5.61	3.04	2.34	2.71	3.10	3.31	3.31	3.39	3.60	2.76	4.83	4.40	3.62	3.98	3.64	1.95	0.76
95	0.46	0.49	0.70	0.52	0.43	0.31	0.19	0.13	0.11	0.11	0.11	0.14	0.18	0.30	0.42	0.51	0.59	0.43	0.62
100	0.61	0.66	0.65	0.59	0.46	0.33	0.22	0.15	0.13	0.13	0.13	0.15	0.20	0.31	0.43	0.55	0.54	0.49	0.69
105	0.70	0.70	0.65	0.51	0.43	0.33	0.25	0.18	0.16	0.15	0.16	0.19	0.23	0.32	0.41	0.51	0.55	0.53	0.77
110	0.72	0.69	0.70	0.52	0.41	0.34	0.29	0.22	0.20	0.19	0.20	0.24	0.27	0.33	0.39	0.52	0.58	0.54	0.72
115	0.70	0.64	0.74	0.57	0.44	0.37	0.32	0.26	0.24	0.23	0.25	0.28	0.31	0.36	0.42	0.55	0.59	0.52	0.64
120	0.74	0.67	0.70	0.59	0.49	0.42	0.37	0.31	0.30	0.29	0.31	0.32	0.37	0.42	0.49	0.59	0.60	0.52	0.58
125	0.69	0.62	0.70	0.63	0.53	0.47	0.42	0.37	0.36	0.35	0.37	0.39	0.43	0.49	0.53	0.63	0.63	0.55	0.61
130	0.73	0.67	0.68	0.61	0.58	0.50	0.48	0.44	0.42	0.42	0.43	0.44	0.48	0.53	0.57	0.58	0.58	0.57	0.62
135	0.75	0.70	0.74	0.67	0.57	0.54	0.52	0.49	0.46	0.47	0.48	0.48	0.51	0.55	0.55	0.63	0.62	0.58	0.56
140	0.76	0.71	0.78	0.66	0.61	0.56	0.56	0.53	0.51	0.52	0.52	0.51	0.54	0.53	0.62	0.65	0.67	0.61	0.63
145	0.71	0.70	0.74	0.67	0.64	0.61	0.57	0.55	0.55	0.56	0.53	0.52	0.54	0.60	0.64	0.66	0.70	0.66	0.67
150	0.75	0.74	0.75	0.71	0.65	0.65	0.65	0.61	0.58	0.58	0.57	0.57	0.59	0.63	0.65	0.69	0.71	0.68	0.68
155	0.79	0.79	0.76	0.75	0.67	0.63	0.64	0.64	0.64	0.61	0.62	0.61	0.61	0.62	0.65	0.69	0.68	0.72	0.69
160	0.84	0.82	0.76	0.76	0.71	0.65	0.62	0.61	0.60	0.57	0.60	0.61	0.63	0.68	0.68	0.69	0.70	0.73	0.69
165	0.86	0.86	0.83	0.76	0.72	0.67	0.67	0.67	0.62	0.59	0.62	0.65	0.70	0.73	0.74	0.74	0.76	0.78	0.73
170	0.89	0.88	0.87	0.83	0.76	0.70	0.67	0.66	0.69	0.67	0.66	0.68	0.73	0.77	0.79	0.81	0.82	0.83	0.81
175	0.92	0.92	0.91	0.89	0.86	0.81	0.78	0.78	0.78	0.75	0.75	0.75	0.78	0.82	0.83	0.83	0.84	0.84	0.86
180	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80

Table 4: 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	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785		
5	1778	1779	1780	1779	1779	1779	1779	1778	1776	1777	1778	1779	1780	1781	1781	1781	1781		
10	1760	1759	1759	1759	1758	1755	1755	1756	1758	1758	1758	1760	1761	1762	1763	1764	1763		
15	1724	1723	1725	1724	1721	1717	1719	1721	1720	1718	1722	1723	1724	1726	1728	1730	1733		
20	1674	1675	1672	1668	1669	1666	1660	1658	1662	1661	1662	1668	1675	1675	1678	1682	1682		
25	1602	1600	1599	1596	1590	1586	1579	1577	1579	1580	1586	1591	1596	1602	1610	1611	1616		
30	1503	1505	1500	1491	1482	1474	1465	1463	1467	1468	1472	1483	1493	1505	1515	1519	1521		
35	1380	1373	1366	1355	1341	1326	1315	1308	1306	1313	1325	1341	1356	1374	1385	1397	1403		
40	1225	1218	1205	1188	1174	1156	1136	1122	1122	1129	1147	1170	1194	1214	1231	1243	1252		
45	1050	1039	1024	1009	994	968	937	912	905	918	946	981	1010	1035	1055	1070	1081		
50	871	858	841	827	789	748	718	701	697	706	728	761	806	847	870	884	897		
55	692	673	655	617	576	542	524	516	515	518	531	556	591	634	670	690	707		
60	514	487	450	417	391	369	364	373	380	373	371	384	403	429	465	497	523		
65	360	327	294	268	258	255	260	278	288	280	266	262	266	278	305	333	362		
70	249	229	210	192	191	196	202	215	222	219	206	196	190	193	212	231	252		
75	187	180	171	156	158	161	164	169	174	172	163	157	153	155	170	176	189		
80	141	131	126	114	114	118	124	128	130	128	122	113	113	117	127	130	141		
85	80.6	64.9	62.2	60.9	54.4	54.6	64.9	69.5	69.2	69.5	64.4	53.7	58.1	64.0	63.3	69.3	81.2		
90	5.08	0.63	0.64	0.43	0.32	0.26	0.23	0.22	0.23	0.22	0.19	0.20	0.32	0.42	0.65	0.63	0.37		
95	0.64	0.86	0.67	0.56	0.45	0.36	0.31	0.28	0.28	0.28	0.29	0.33	0.46	0.58	0.69	0.76	0.65		
100	0.83	0.79	0.74	0.61	0.50	0.41	0.36	0.33	0.33	0.33	0.35	0.39	0.52	0.65	0.79	0.80	0.74		
105	0.86	0.83	0.72	0.61	0.53	0.46	0.41	0.37	0.37	0.38	0.41	0.45	0.56	0.65	0.80	0.84	0.81		
110	0.81	0.81	0.70	0.58	0.51	0.47	0.42	0.39	0.39	0.40	0.43	0.47	0.55	0.64	0.75	0.82	0.76		
115	0.69	0.71	0.63	0.53	0.49	0.45	0.40	0.38	0.38	0.39	0.42	0.46	0.52	0.60	0.71	0.74	0.66		
120	0.61	0.66	0.60	0.52	0.46	0.41	0.36	0.36	0.35	0.36	0.39	0.45	0.50	0.57	0.68	0.70	0.67		
125	0.62	0.65	0.60	0.54	0.48	0.43	0.38	0.37	0.36	0.37	0.40	0.45	0.50	0.58	0.66	0.67	0.63		
130	0.59	0.61	0.60	0.57	0.51	0.47	0.44	0.45	0.44	0.44	0.46	0.49	0.55	0.60	0.64	0.62	0.64		
135	0.57	0.61	0.64	0.59	0.56	0.53	0.52	0.53	0.52	0.52	0.53	0.56	0.58	0.62	0.67	0.68	0.68		
140	0.61	0.66	0.66	0.64	0.59	0.59	0.57	0.60	0.59	0.57	0.59	0.59	0.60	0.62	0.63	0.71	0.68		
145	0.66	0.69	0.63	0.67	0.65	0.61	0.60	0.64	0.63	0.61	0.61	0.63	0.64	0.62	0.61	0.65	0.63		
150	0.65	0.67	0.68	0.65	0.68	0.66	0.65	0.69	0.65	0.66	0.66	0.69	0.64	0.63	0.68	0.65	0.70		
155	0.67	0.68	0.68	0.68	0.66	0.63	0.66	0.71	0.69	0.71	0.67	0.67	0.68	0.71	0.70	0.69	0.72		
160	0.67	0.68	0.67	0.69	0.72	0.72	0.68	0.69	0.66	0.70	0.70	0.75	0.76	0.78	0.74	0.73	0.76		
165	0.70	0.72	0.73	0.75	0.76	0.78	0.76	0.75	0.74	0.75	0.78	0.78	0.77	0.77	0.78	0.78	0.79		
170	0.78	0.80	0.84	0.88	0.86	0.86	0.83	0.78	0.78	0.82	0.80	0.78	0.80	0.84	0.85	0.83	0.85		
175	0.86	0.86	0.88	0.88	0.89	0.88	0.86	0.83	0.84	0.86	0.87	0.85	0.86	0.87	0.85	0.85	0.91		
180	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80		

Table 5: Luminous Intensity Data

EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Sep. 18, 2014	Sep. 17, 2015
Digital Power Meter	PF2010A	HZTE028-01	Sep. 18, 2014	Sep. 17, 2015
AC Power Supply	PCR 500L	HZTE001-08	Sep. 18, 2014	Sep. 17, 2015
DC Power Supply	WY12010	HZTE004-03	Sep. 18, 2014	Sep. 17, 2015
Temperature Meter	TES1310	HZTE017-01	Sep. 18, 2014	Sep. 17, 2015
Standard Source	D908	HZTE012-01	Sep. 18, 2014	Sep. 17, 2015
Standard source	SCL-1400	HZTE012-02	Sep. 18, 2014	Sep. 17, 2015

Table 6: 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

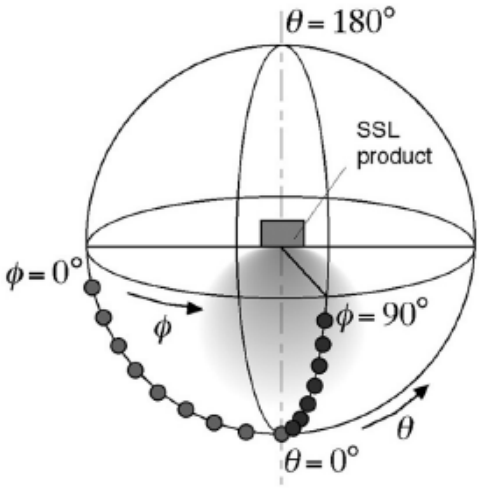
An EVERFINE Type C Model GO-R5000 Goniophotometer was used to measure the intensity at each angle of distribution for each sample. The photometric distance is 2.475m for near-field measurement or 30m for far-field measurement. Bandwidth of spectroradiometer is 380nm-780nm.
Ambient temperature was measured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