



LM-79-08 Test Report

for

ABB Lighting, Inc.

3 Adams St Belvidere, NJ 07823.

Troffer

Model: ABBRT22D3535

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ15070041a

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

Reviewed by:

April Zou

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Aug. 10, 2015



Approved by

Jim Zhang

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: **ABBRT22D3535**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
96.1	3325.1	34.59	0.9939
CCT (K)	CRI	Stabilization Time (Light & Power)	
3422	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

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Sample Photo

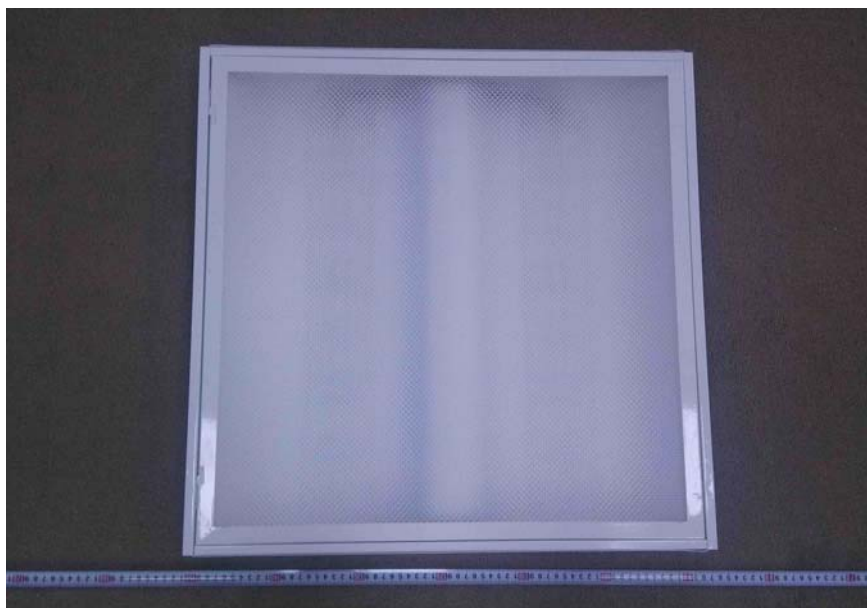


Figure 1- Overview of the sample

Equipment Under Test (EUT)

Name	: Troffer
Model	: ABBRT22D3535
Electrical Ratings	: 100~277VAC, 50/60Hz, 35W
Product Description	: 3500K, 2x2 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: 216pcs
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°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 85 minutes.

Parameter	Result			Special Color Rendering Indices	
Test Voltage (V)	120.0	100.0	277.0	R1	80
Voltage frequency (Hz)	60	60	60	R2	88
Test Current (A)	0.290	0.352	0.133	R3	95
Power Factor	0.9939	0.9897	0.9543	R4	79
Test Power (W)	34.59	34.84	35.13	R5	79
THD A%	6.03	6.45	9.61	R6	84
Luminous Efficacy (lm/W)	96.1	95.3	94.5	R7	86
Total Luminous Flux (lm)	3325.1	3320.9	3320.2	R8	64
Color Rendering Index (CRI)	81.9			R9	12
R9	12			R10	72
Correlated Color Temperature (CCT) (K)	3422			R11	76
Chromaticity (Chroma x, Chroma y)	(0.4123, 0.3993)			R12	60
Chromaticity (Chroma u, Chroma v)	(0.2367, 0.3439)			R13	81
Chromaticity (Chroma u', Chroma v')	(0.2367, 0.5158)			R14	97
Duv	0.0022				
Average Beam Angle (°)	92.5				
Center Beam Candle Power (cd)	1512				
Spacing Criteria	1.21 (0°-180°)/ 1.25 (90°-270°)				
Zonal Lumens in the 0°-60°Zone	87.07%				
Zonal Lumens in the 60°-90°Zone	12.81%				
Zonal Lumens in the 90°-120°Zone	0.06%				
Zonal Lumens in the 120°-180°Zone	0.06%				

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

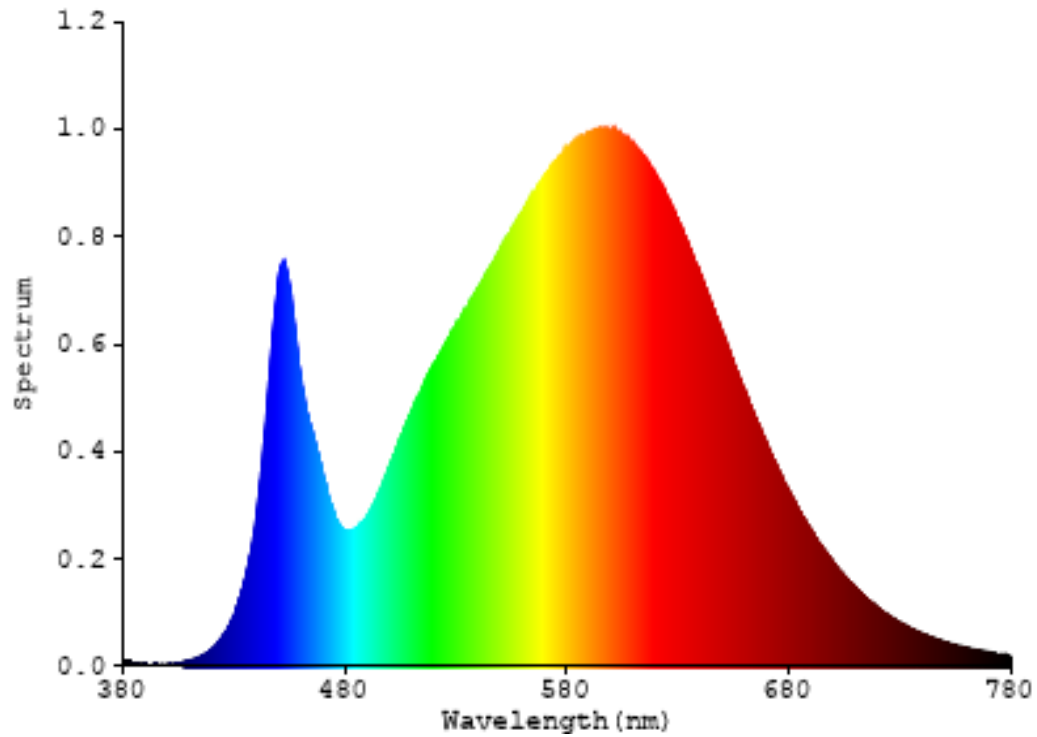


Chart 1: Spectral Power Distribution

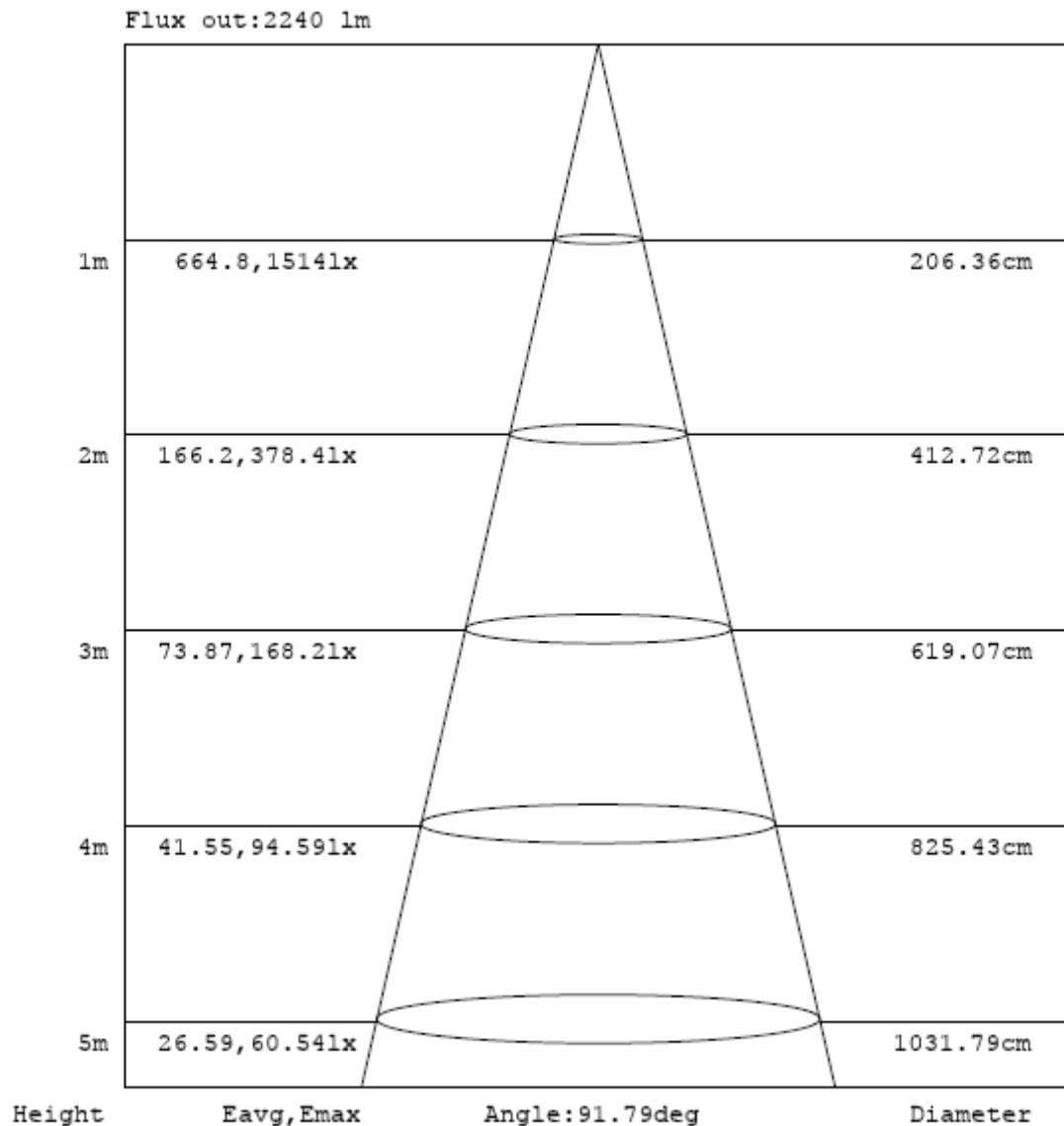
Zonal Lumen Tabulation

$\gamma(^{\circ})$	Lumens	% Total
0- 10	142.396	4.28%
10- 20	408.014	12.27%
20- 30	609.965	18.34%
30- 40	691.86	20.81%
40- 50	616.394	18.54%
50- 60	426.399	12.82%
60- 70	233.994	7.04%
70- 80	141.862	4.27%
80- 90	50.235	1.51%
90-100	0.635	0.02%
100-110	0.654	0.02%
110-120	0.637	0.02%
120-130	0.553	0.02%
130-140	0.491	0.01%
140-150	0.424	0.01%
150-160	0.321	0.01%
160-170	0.205	0.01%
170-180	0.074	0.00%
Total	3325.1	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	2895.028	87.07%
60- 90	426.091	12.81%
0-90	3321.119	99.88%
90- 180	3.994	0.12%
0- 180	3325.1	100%

Table 3: Zonal Lumen Data

Illuminance Plots



Note: The Curves indicate the illuminated area and the average illumination when the luminaire is at different distance.

Chart 2: Beam Angle

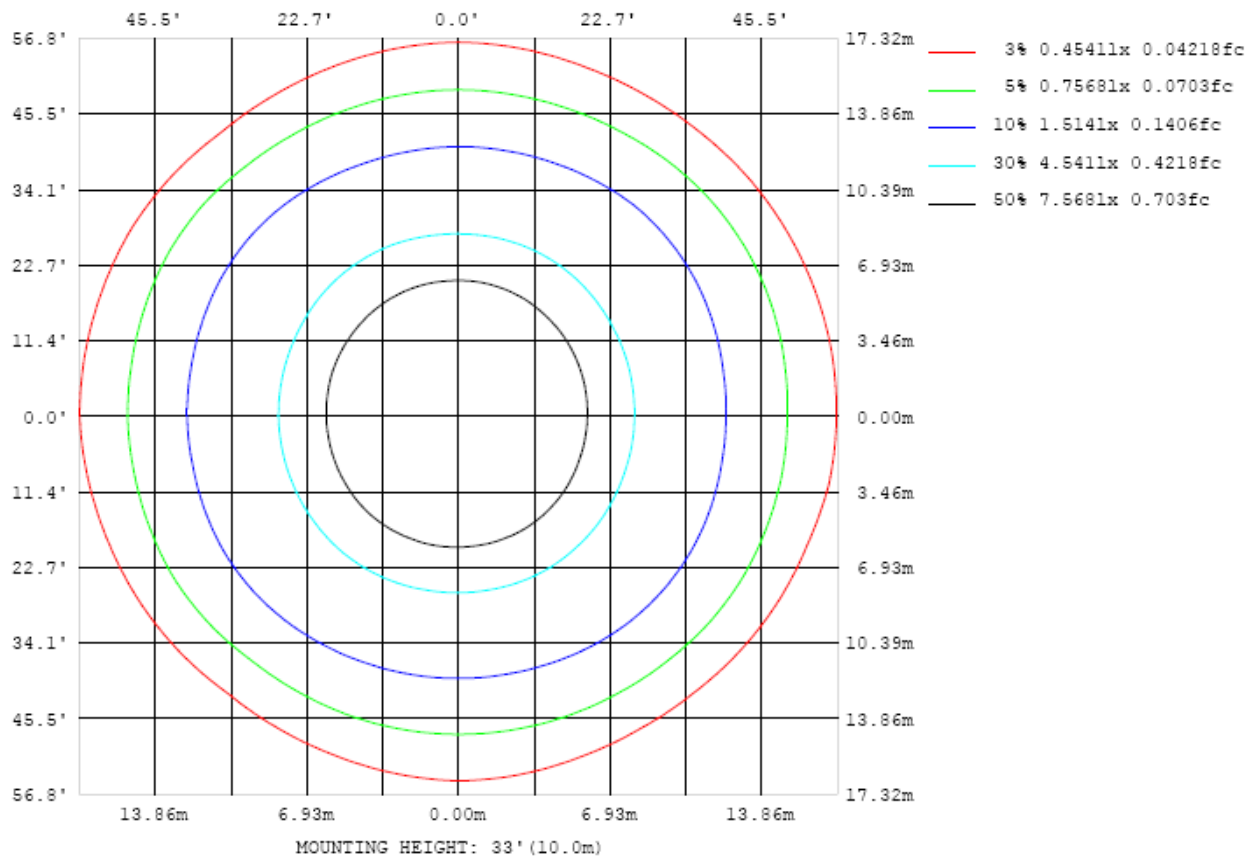


Chart 3: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots

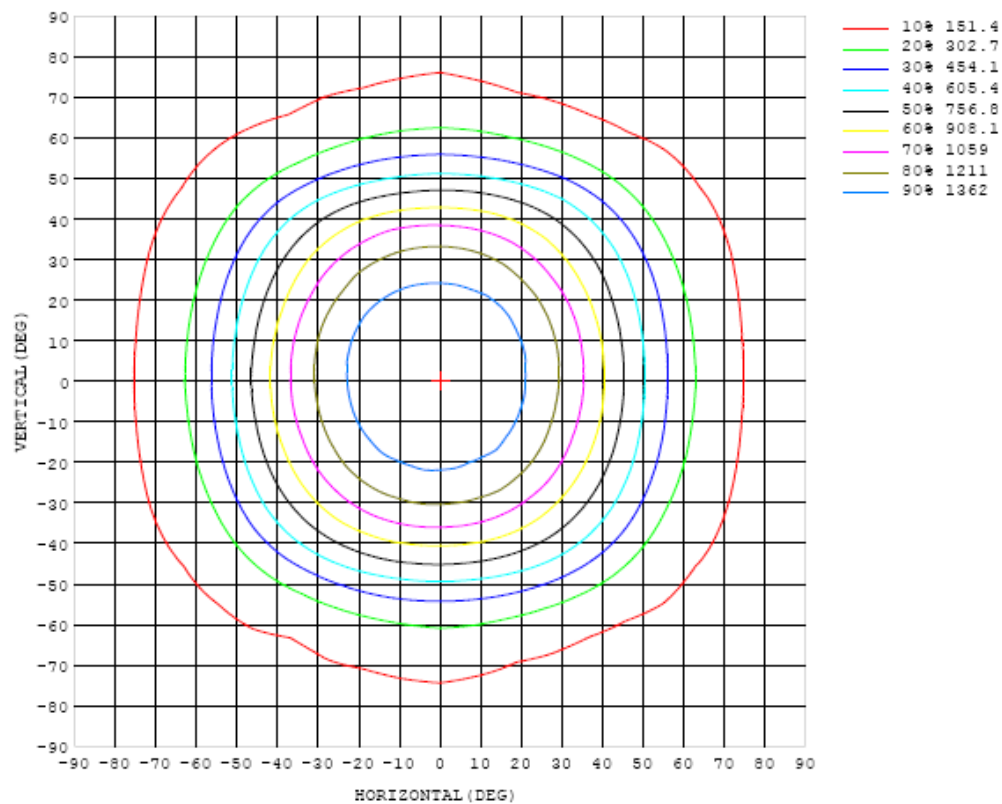


Chart 4: Isocandela Plot

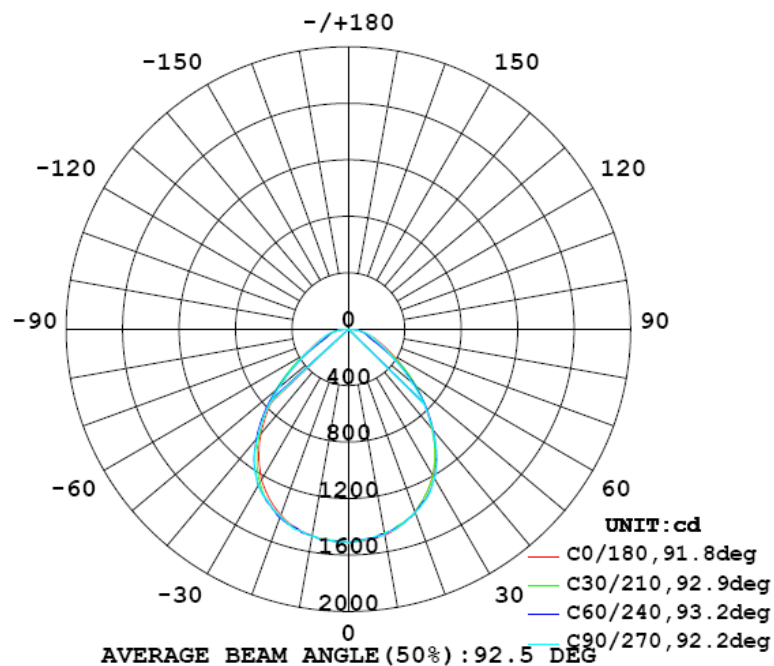


Chart 5: Polar Candela Distribution

Luminous Intensity Data

Table--1 UNIT: cd

C (DEG) γ (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	1512	1512	1512	1512	1512	1512	1512	1512	1512	1512	1512	1512	1512	1512	1512	1512	1512	1512	1512
5	1499	1498	1491	1494	1495	1492	1489	1487	1489	1492	1490	1489	1494	1500	1501	1496	1495	1502	1503
10	1479	1465	1472	1465	1476	1462	1471	1475	1477	1475	1475	1480	1474	1470	1481	1477	1484	1480	1487
15	1437	1434	1433	1427	1434	1436	1436	1436	1436	1437	1441	1443	1438	1446	1442	1440	1452	1452	1453
20	1377	1375	1371	1376	1379	1378	1383	1378	1380	1383	1382	1386	1388	1392	1394	1391	1391	1400	1402
25	1293	1295	1293	1296	1308	1302	1315	1314	1319	1321	1320	1321	1324	1323	1328	1322	1323	1325	1327
30	1195	1191	1189	1197	1206	1210	1220	1216	1217	1219	1223	1226	1231	1230	1230	1226	1228	1227	1232
35	1069	1063	1062	1069	1079	1080	1087	1091	1092	1094	1098	1103	1106	1105	1108	1104	1101	1107	1110
40	921	920	918	921	926	932	935	933	930	929	935	944	951	957	957	957	957	962	967
45	764	763	768	772	777	779	777	770	764	763	767	778	787	795	802	802	797	799	806
50	615	615	624	628	628	622	610	594	586	583	586	594	610	626	639	644	641	638	646
55	479	479	478	477	467	453	441	436	433	433	433	435	435	444	467	482	483	485	493
60	359	355	335	325	314	302	298	302	313	319	310	301	294	294	309	323	335	350	362
65	269	249	223	212	199	196	197	208	233	245	228	211	199	193	204	209	224	248	268
70	203	184	161	156	144	143	150	155	178	193	178	164	156	145	154	155	164	186	204
75	149	142	128	126	117	116	125	120	134	146	140	132	134	123	129	126	128	145	155
80	97.5	105	92.9	86.6	84.8	82.0	85.8	81.3	94.3	93.0	98.5	90.1	93.3	85.1	88.8	87.5	94.9	111	106
85	49.7	52.9	46.9	36.1	38.4	36.6	29.8	29.9	37.2	34.7	38.7	33.2	33.6	41.3	38.9	38.0	50.3	56.5	56.0
90	1.89	2.27	1.59	0.62	0.52	0.35	0.24	0.14	0.08	0.07	0.13	0.20	0.33	0.61	0.78	0.69	2.18	2.56	0.63
95	0.55	0.92	0.67	0.62	0.57	0.42	0.28	0.18	0.14	0.11	0.21	0.30	0.42	0.56	0.75	0.86	0.85	1.09	0.67
100	0.54	0.86	0.74	0.53	0.60	0.50	0.32	0.21	0.16	0.12	0.20	0.35	0.47	0.64	0.79	0.77	0.85	1.01	0.67
105	0.56	0.84	0.78	0.55	0.48	0.41	0.32	0.25	0.17	0.14	0.20	0.40	0.47	0.55	0.64	0.79	0.93	0.97	0.69
110	0.61	0.88	0.83	0.60	0.53	0.40	0.34	0.29	0.19	0.17	0.22	0.40	0.49	0.55	0.66	0.82	1.02	1.01	0.71
115	0.68	0.89	0.87	0.61	0.57	0.45	0.38	0.34	0.22	0.22	0.25	0.42	0.54	0.62	0.72	0.86	1.10	1.03	0.69
120	0.72	0.86	0.81	0.66	0.58	0.49	0.44	0.36	0.27	0.27	0.30	0.43	0.57	0.65	0.77	0.89	1.02	1.00	0.72
125	0.78	0.88	0.75	0.71	0.55	0.54	0.50	0.39	0.32	0.32	0.35	0.47	0.60	0.69	0.71	0.78	0.83	0.99	0.68
130	0.66	0.85	0.74	0.71	0.61	0.56	0.53	0.44	0.37	0.38	0.40	0.49	0.58	0.64	0.67	0.90	0.81	0.86	0.57
135	0.81	0.82	0.70	0.69	0.66	0.62	0.52	0.47	0.42	0.44	0.46	0.48	0.50	0.66	0.81	0.80	0.73	0.86	0.71
140	0.79	0.80	0.77	0.73	0.69	0.64	0.57	0.50	0.48	0.49	0.49	0.52	0.61	0.59	0.77	0.75	0.85	0.78	0.72
145	0.84	0.84	0.83	0.73	0.70	0.61	0.60	0.54	0.54	0.55	0.55	0.56	0.63	0.60	0.67	0.77	0.89	0.78	0.74
150	0.87	0.81	0.85	0.78	0.65	0.65	0.61	0.59	0.58	0.59	0.59	0.60	0.64	0.70	0.66	0.68	0.82	0.78	0.77
155	0.72	0.73	0.73	0.74	0.72	0.64	0.60	0.60	0.61	0.60	0.61	0.62	0.61	0.67	0.78	0.80	0.72	0.67	0.69
160	0.79	0.76	0.78	0.75	0.70	0.64	0.61	0.60	0.61	0.57	0.61	0.64	0.67	0.70	0.74	0.78	0.79	0.77	0.81
165	0.76	0.75	0.75	0.74	0.71	0.66	0.65	0.65	0.64	0.63	0.64	0.67	0.70	0.73	0.74	0.75	0.75	0.75	0.76
170	0.76	0.75	0.75	0.75	0.73	0.68	0.66	0.66	0.70	0.68	0.65	0.69	0.71	0.73	0.75	0.75	0.76	0.77	0.81
175	0.85	0.86	0.85	0.85	0.83	0.80	0.77	0.77	0.77	0.74	0.75	0.76	0.77	0.78	0.81	0.82	0.83	0.83	0.85
180	0.85	0.85	0.85	0.86	0.83	0.82	0.83	0.77	0.77	0.72	0.75	0.75	0.75	0.78	0.78	0.78	0.80	0.80	0.84

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	1512	1512	1512	1512	1512	1512	1512	1512	1512	1512	1512	1512	1512	1512	1512	1512	1512		
5	1496	1497	1501	1504	1503	1503	1499	1501	1502	1501	1500	1500	1501	1499	1496	1491	1493		
10	1480	1487	1487	1487	1489	1487	1486	1487	1489	1482	1483	1484	1483	1479	1482	1477	1472		
15	1453	1456	1460	1457	1461	1455	1463	1462	1470	1463	1459	1450	1451	1445	1449	1446	1441		
20	1401	1413	1416	1415	1423	1422	1418	1414	1410	1409	1413	1412	1412	1403	1393	1391	1380		
25	1334	1341	1347	1354	1354	1357	1353	1353	1349	1350	1341	1346	1335	1329	1321	1312	1300		
30	1239	1246	1256	1260	1267	1277	1280	1280	1277	1273	1269	1260	1244	1238	1226	1213	1204		
35	1117	1126	1134	1144	1157	1164	1167	1170	1166	1159	1154	1142	1129	1113	1101	1090	1077		
40	971	978	988	1003	1013	1017	1016	1007	1002	1002	1002	997	983	968	950	939	929		
45	807	815	831	846	852	850	840	833	829	832	838	841	833	824	804	784	771		
50	648	660	672	681	680	664	647	642	643	646	653	666	678	672	661	642	624		
55	496	502	511	509	493	480	476	476	477	476	479	487	503	511	510	501	489		
60	361	358	356	344	329	332	338	345	349	345	338	337	341	350	356	360	362		
65	261	243	233	224	214	223	238	253	261	251	233	223	220	222	231	241	259		
70	194	174	166	162	158	165	176	193	204	190	169	161	157	156	165	172	191		
75	147	133	133	132	129	139	138	150	160	144	130	133	127	129	133	136	148		
80	112	100	97.2	99.2	98.2	106	101	109	111	104	93.8	101	95.4	94.8	97.7	99.4	107		
85	62.1	56.7	47.0	52.4	52.5	49.5	49.7	56.2	51.1	54.7	45.2	47.5	51.2	52.4	46.8	53.6	56.6		
90	0.98	0.91	0.87	0.95	1.31	0.74	0.83	1.24	0.78	1.48	0.98	0.80	0.90	0.67	1.26	0.78	0.82		
95	1.15	0.88	0.71	0.70	0.54	0.41	0.33	0.27	0.24	0.33	0.39	0.52	0.66	0.78	0.96	0.95	1.20		
100	1.25	0.95	0.65	0.76	0.61	0.48	0.42	0.30	0.26	0.36	0.44	0.57	0.76	0.90	0.87	1.00	1.11		
105	1.21	1.08	0.69	0.72	0.63	0.54	0.50	0.33	0.30	0.38	0.50	0.58	0.68	0.78	0.92	1.10	1.13		
110	1.15	1.06	0.75	0.72	0.61	0.56	0.50	0.34	0.32	0.37	0.51	0.57	0.64	0.76	0.93	1.11	1.11		
115	1.06	1.08	0.77	0.74	0.63	0.56	0.47	0.32	0.31	0.34	0.51	0.58	0.64	0.75	0.86	1.04	1.06		
120	1.05	0.97	0.77	0.76	0.62	0.52	0.42	0.31	0.30	0.32	0.46	0.56	0.63	0.73	0.85	0.94	0.97		
125	0.99	0.88	0.77	0.68	0.61	0.51	0.42	0.31	0.30	0.31	0.42	0.56	0.62	0.63	0.68	0.86	0.89		
130	0.88	0.85	0.82	0.67	0.59	0.54	0.43	0.35	0.34	0.35	0.44	0.55	0.61	0.64	0.74	0.68	0.78		
135	0.86	0.76	0.74	0.73	0.62	0.53	0.45	0.42	0.41	0.41	0.47	0.54	0.65	0.73	0.73	0.74	0.82		
140	0.83	0.77	0.76	0.74	0.62	0.59	0.51	0.49	0.47	0.46	0.49	0.54	0.66	0.74	0.67	0.77	0.72		
145	0.86	0.85	0.74	0.72	0.65	0.61	0.55	0.55	0.55	0.51	0.53	0.59	0.61	0.69	0.76	0.83	0.72		
150	0.88	0.84	0.72	0.71	0.70	0.64	0.61	0.59	0.57	0.56	0.59	0.62	0.66	0.65	0.79	0.85	0.76		
155	0.73	0.76	0.80	0.79	0.69	0.65	0.64	0.62	0.62	0.63	0.61	0.63	0.66	0.74	0.74	0.72	0.68		
160	0.80	0.84	0.82	0.78	0.74	0.71	0.69	0.67	0.64	0.67	0.64	0.66	0.68	0.74	0.78	0.80	0.79		
165	0.76	0.78	0.77	0.77	0.77	0.75	0.72	0.69	0.69	0.69	0.69	0.69	0.69	0.72	0.74	0.75	0.76		
170	0.81	0.81	0.83	0.82	0.81	0.79	0.78	0.74	0.74	0.74	0.74	0.72	0.70	0.73	0.76	0.78	0.77		
175	0.85	0.86	0.85	0.85	0.83	0.82	0.80	0.79	0.76	0.76	0.80	0.78	0.77	0.80	0.82	0.82	0.82		
180	0.84	0.85	0.84	0.85	0.83	0.82	0.80	0.79	0.76	0.78	0.76	0.76	0.78	0.80	0.80	0.81	0.82		

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.

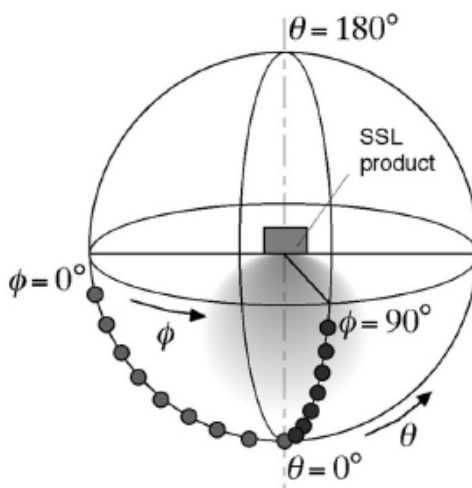
Color Characteristics Measurements

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 ($C=0^\circ/180^\circ$ 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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