



## LM-79-08 Test Report

for

**ABB Lighting, Inc.**

1501 Industrial Way N. Toms River, NJ 08755 RD, Shanghai

**35W TROFFER**

**Model: ABBRT24D3550**

**Laboratory: Leading Testing Laboratories**

**NVLAP CODE: 200960-0**

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

Tel: +86-571-56680806

www.ledtestlab.com

Report No.: HZ14100014b

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

Reviewed by:

*April Zou*

Engineer: April Zou  
Oct. 22, 2014



*Jim Zhang*

Manager: Jim Zhang  
Oct. 22, 2014

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: ABBRT24D3550

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
100.4	3375.3	33.62	0.9929
CCT (K)	CRI	Stabilization Time (Light & Power)	
4881	83.3	60	

Table 1: Executive Data Summary

## Test specifications:

**Date of Receipt** : Oct. 20, 2014

**Date of Test** : Oct. 21, 2014

**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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## Photos

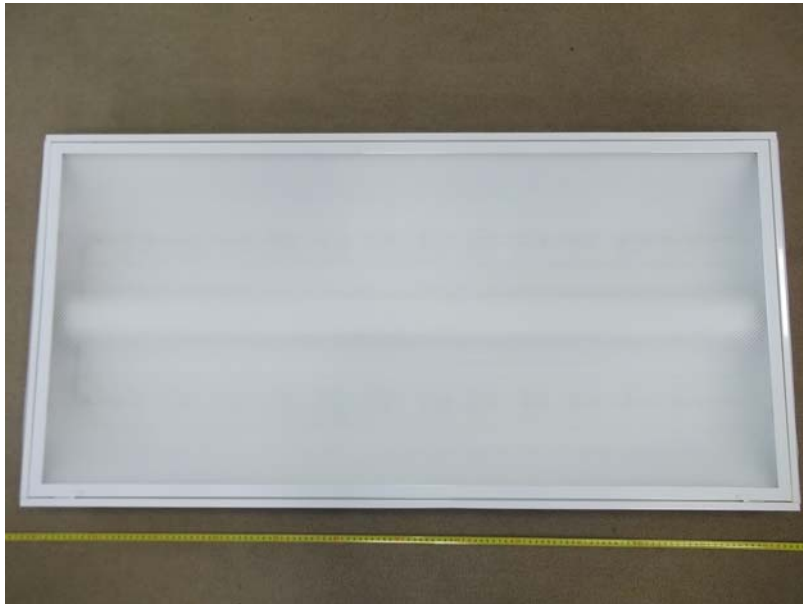


Figure 1- Overview of the sample

### Equipment Under Test (EUT)

<b>Name</b>	: 35W TROFFER
<b>Model</b>	: ABBRT24D3550
<b>Electrical Ratings</b>	: 100~277V AC, 50/60Hz, 35W
<b>Product Description</b>	: 5000K, 2x4 Luminaires for Ambient Lighting of Interior Commercial Spaces Manufacturer of light source: EVERLIGHT Model of light source: EVERLIGHT (67-21 S/KK2C-HXXXXXXXXX2934Z6/2T) Quantity of LED light source: 216pcs
<b>Manufacturer</b>	: ABB Lighting (Shanghai) Co., Ltd.
<b>Address</b>	: Room 1012, North Minch Fortune 108 Plaza,# 1839 Qixin road, Shanghai

## TEST RESULTS

Test ambient temperature was 24.4°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	81
Voltage frequency (Hz)	60	60	60	R2	89
Test Current (A)	0.282	0.343	0.131	R3	93
Power Factor	0.9929	0.9889	0.9475	R4	81
Test Power (W)	33.62	33.87	34.28	R5	81
THD A%	7.18	8.73	4.73	R6	83
Luminous Efficacy (lm/W)	100.4			R7	89
Total Luminous Flux (lm)	3375.3			R8	70
Color Rendering Index (CRI)	83.3			R9	17
R9	17			R10	72
Correlated Color Temperature (CCT) (K)	4881			R11	79
Chromaticity (Chroma x, Chroma y)	(0.3491, 0.3592)			R12	54
Chromaticity (Chroma u, Chroma v)	(0.2112, 0.3259)			R13	83
Chromaticity (Chroma u', Chroma v')	(0.2112, 0.4889)			R14	96
Duv	0.0022				
Average Beam Angle (°)	95.3				
Center Beam Candle Power (cd)	1459				
Spacing Criteria	1.25 (0°-180°)/ 1.22 (90°-270°)				
Zonal Lumens in the 0°-60°Zone	86.30%				
Zonal Lumens in the 60°-90°Zone	13.60%				
Zonal Lumens in the 90°-120°Zone	0.04%				
Zonal Lumens in the 120°-180°Zone	0.06%				

Table 2: Test data per Sphere-Spectroradiometer Method

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

### Spectral Power Distribution

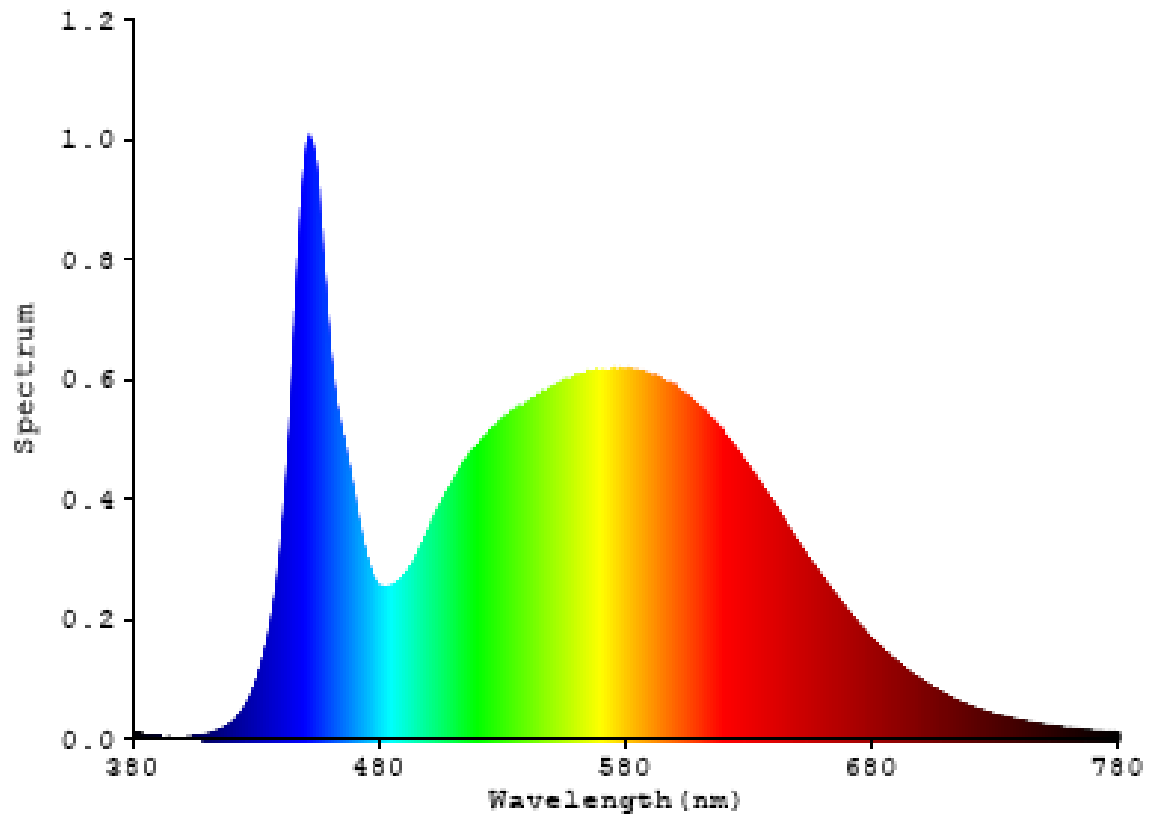


Chart 1: Spectral Power Distribution

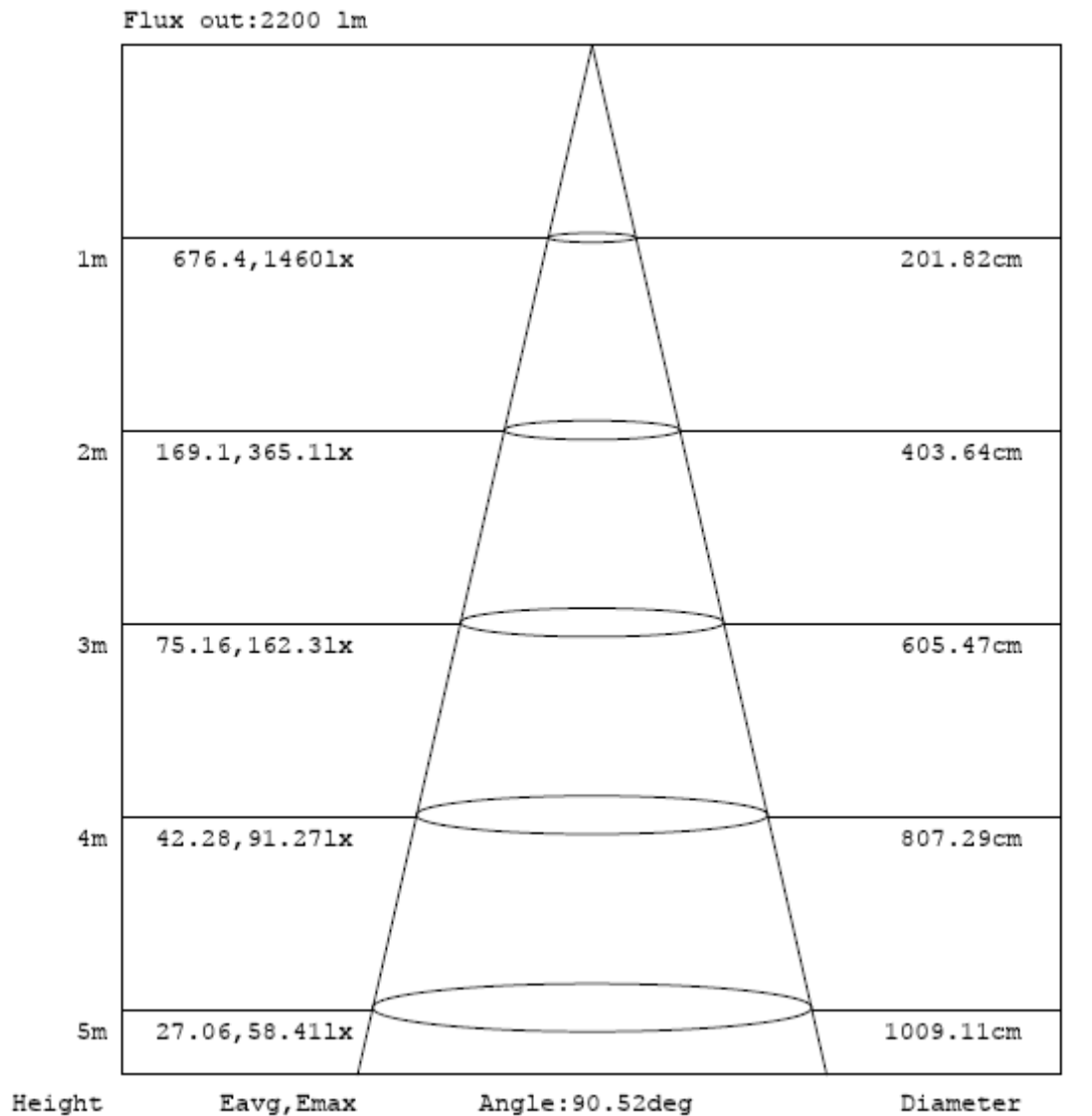
## Zonal Lumen Tabulation

$\gamma(^{\circ})$	Lumens	% Total
0- 10	138.331	4.10%
10- 20	398.571	11.81%
20- 30	603.481	17.88%
30- 40	695.665	20.61%
40- 50	630.867	18.69%
50- 60	445.947	13.21%
60- 70	252.418	7.48%
70- 80	149.76	4.44%
80- 90	56.906	1.69%
90-100	0.51	0.02%
100-110	0.48	0.01%
110-120	0.46	0.01%
120-130	0.444	0.01%
130-140	0.446	0.01%
140-150	0.39	0.01%
150-160	0.306	0.01%
160-170	0.199	0.01%
170-180	0.075	0.00%
Total	3375.3	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	2912.862	86.30%
60- 90	459.084	13.60%
0-90	3371.946	99.90%
90- 180	3.31	0.10%
0- 180	3375.3	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



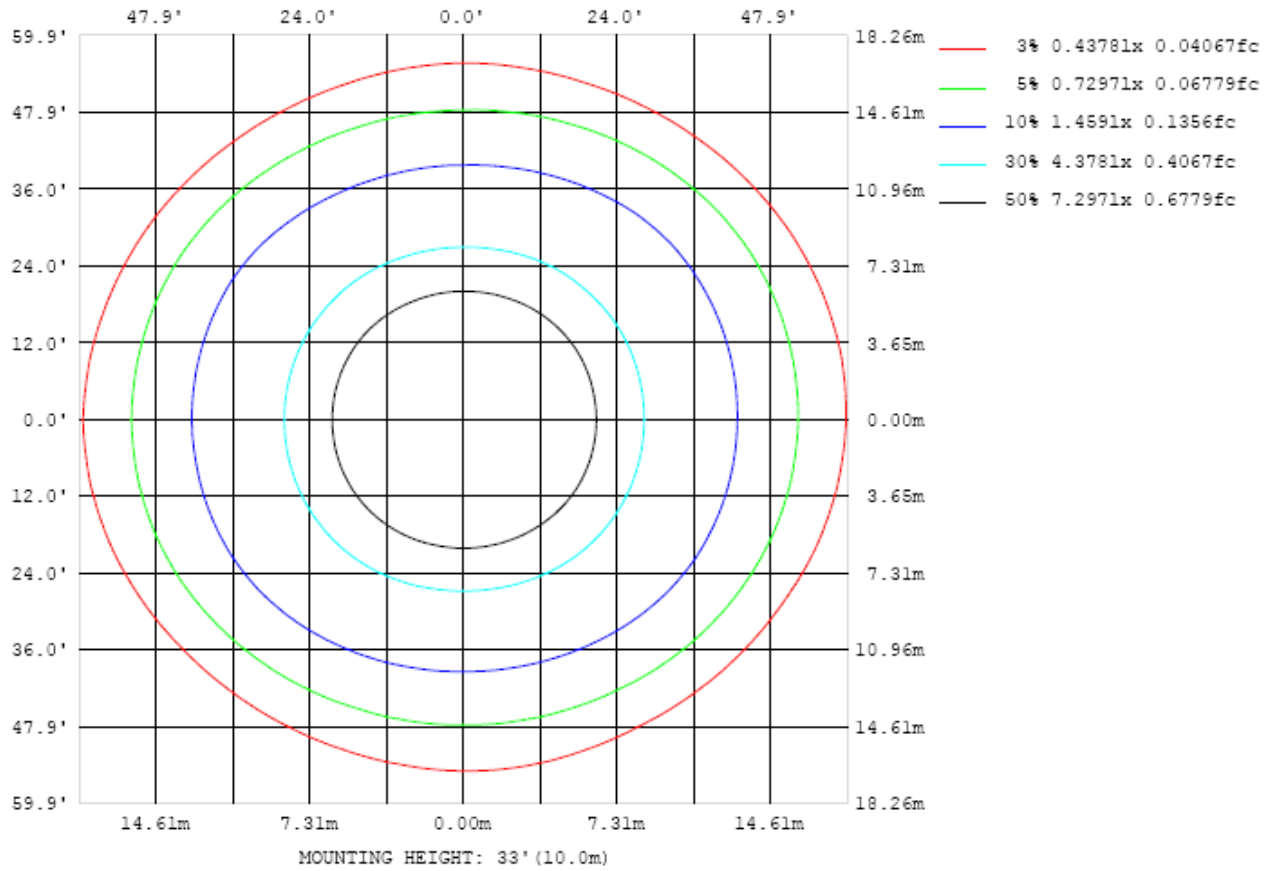


Chart 3: Illuminance Plot (Footcandles)

## Luminous Intensity Distribution Plots

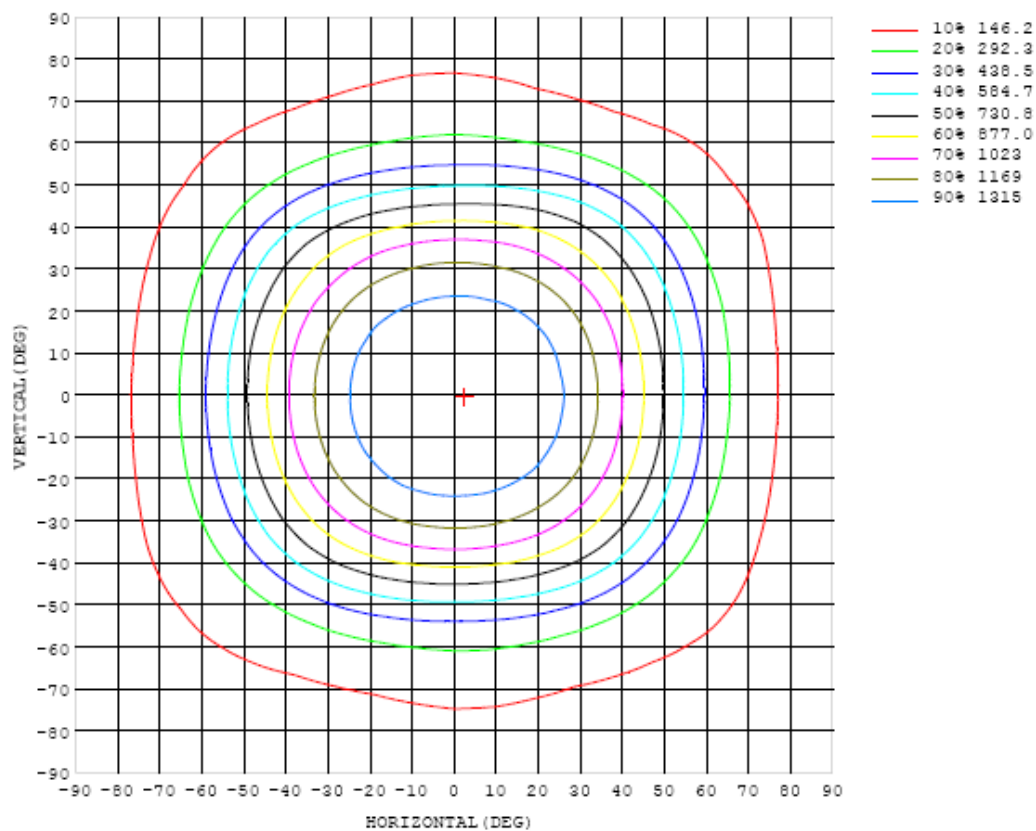


Chart 4: Isocandela Plot

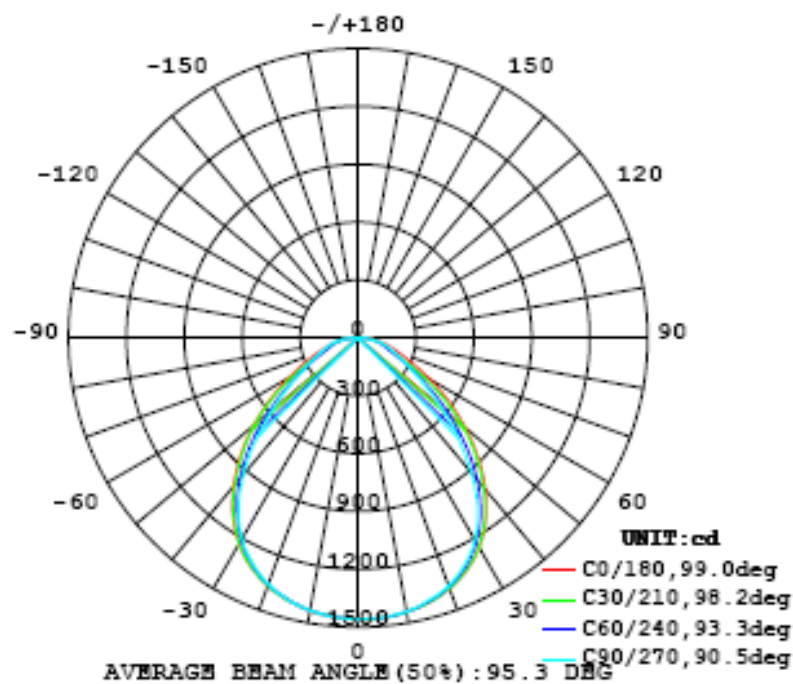


Chart 5: Polar Candela Distribution

## Luminous Intensity Data

Table--1

UNIT: cd

C (DNG) γ (DNG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	1459	1459	1459	1459	1459	1459	1459	1459	1459	1459	1459	1459	1459	1459	1459	1459	1459	1459	1459
5	1456	1456	1456	1455	1457	1459	1457	1455	1455	1455	1454	1456	1455	1455	1454	1453	1453	1455	1455
10	1442	1444	1445	1446	1445	1442	1443	1443	1441	1439	1439	1439	1439	1437	1442	1440	1440	1438	1438
15	1422	1422	1421	1419	1419	1418	1415	1413	1412	1409	1412	1411	1412	1409	1413	1411	1411	1410	1411
20	1385	1387	1384	1383	1380	1377	1374	1371	1369	1369	1368	1371	1370	1369	1371	1374	1373	1374	1369
25	1330	1331	1329	1327	1326	1319	1314	1308	1304	1301	1304	1306	1311	1314	1314	1316	1315	1315	1312
30	1254	1256	1254	1252	1244	1235	1225	1215	1212	1210	1213	1216	1223	1230	1234	1234	1236	1236	1232
35	1151	1154	1150	1147	1136	1122	1108	1093	1083	1078	1081	1092	1103	1116	1126	1131	1133	1133	1131
40	1025	1024	1022	1013	1000	983	959	937	920	914	920	936	957	975	989	998	1004	1005	1005
45	880	878	873	863	849	821	789	758	739	733	741	759	786	818	839	850	857	860	861
50	724	723	717	705	683	647	611	585	567	561	568	587	611	644	675	693	699	703	707
55	573	565	555	534	506	476	447	427	416	412	416	426	447	473	501	526	542	550	554
60	426	415	396	368	345	325	311	308	310	309	304	304	311	324	343	369	393	408	414
65	305	290	266	241	225	218	217	227	237	238	228	218	216	215	226	246	271	292	301
70	224	204	185	169	161	160	162	174	187	188	177	165	160	157	163	174	190	211	220
75	167	153	145	138	133	130	127	133	142	144	136	128	127	129	133	138	143	158	164
80	118	115	107	103	96.7	91.5	89.9	93.8	96.6	97.6	94.2	89.8	87.4	93.0	98.8	102	107	114	115
85	63.3	63.1	51.5	49.0	45.5	37.6	37.3	42.5	43.0	43.5	43.7	40.6	36.1	42.8	48.2	47.8	59.2	64.8	65.1
90	5.87	3.62	2.12	2.29	0.48	0.28	0.24	0.21	0.19	0.21	0.22	0.18	0.21	0.29	2.35	1.80	2.99	6.00	0.94
95	0.66	0.40	0.62	0.53	0.41	0.30	0.23	0.18	0.15	0.15	0.14	0.17	0.23	0.35	0.44	0.54	0.68	0.44	0.70
100	0.74	0.52	0.60	0.54	0.42	0.32	0.24	0.19	0.17	0.16	0.16	0.19	0.24	0.34	0.45	0.59	0.61	0.52	0.77
105	0.71	0.52	0.59	0.48	0.40	0.34	0.26	0.22	0.20	0.19	0.20	0.23	0.28	0.39	0.48	0.53	0.63	0.52	0.76
110	0.70	0.53	0.63	0.47	0.39	0.35	0.31	0.26	0.25	0.26	0.27	0.31	0.34	0.42	0.46	0.54	0.68	0.51	0.72
115	0.69	0.52	0.65	0.55	0.42	0.37	0.34	0.30	0.28	0.29	0.32	0.37	0.40	0.43	0.48	0.63	0.70	0.53	0.65
120	0.70	0.55	0.69	0.57	0.49	0.40	0.38	0.34	0.34	0.34	0.37	0.41	0.43	0.47	0.58	0.66	0.71	0.55	0.61
125	0.70	0.56	0.66	0.60	0.55	0.49	0.44	0.40	0.40	0.40	0.42	0.45	0.49	0.57	0.64	0.69	0.73	0.59	0.62
130	0.72	0.60	0.65	0.62	0.61	0.55	0.52	0.48	0.47	0.48	0.50	0.51	0.56	0.65	0.68	0.71	0.72	0.61	0.62
135	0.72	0.64	0.68	0.66	0.62	0.61	0.59	0.57	0.55	0.57	0.59	0.59	0.62	0.67	0.69	0.71	0.72	0.63	0.63
140	0.74	0.69	0.72	0.65	0.61	0.63	0.63	0.61	0.59	0.63	0.63	0.63	0.64	0.64	0.69	0.70	0.72	0.67	0.63
145	0.68	0.68	0.68	0.64	0.63	0.64	0.63	0.62	0.62	0.66	0.63	0.62	0.65	0.68	0.68	0.70	0.71	0.70	0.66
150	0.71	0.73	0.71	0.70	0.65	0.65	0.65	0.64	0.62	0.65	0.65	0.64	0.67	0.69	0.70	0.70	0.71	0.71	0.65
155	0.74	0.76	0.74	0.70	0.68	0.65	0.63	0.65	0.63	0.64	0.66	0.64	0.67	0.70	0.73	0.71	0.73	0.73	0.67
160	0.75	0.77	0.76	0.73	0.70	0.65	0.67	0.64	0.62	0.61	0.65	0.65	0.69	0.72	0.72	0.75	0.75	0.75	0.70
165	0.81	0.80	0.81	0.77	0.73	0.68	0.67	0.67	0.64	0.64	0.65	0.69	0.72	0.76	0.78	0.78	0.78	0.77	0.70
170	0.82	0.82	0.83	0.80	0.79	0.74	0.70	0.68	0.70	0.70	0.69	0.73	0.79	0.82	0.83	0.83	0.82	0.80	0.75
175	0.87	0.87	0.87	0.86	0.86	0.82	0.79	0.80	0.81	0.78	0.76	0.77	0.82	0.82	0.83	0.83	0.84	0.85	0.81
180	0.80	0.81	0.80	0.79	0.80	0.80	0.78	0.77	0.79	0.81	0.77	0.77	0.77	0.79	0.78	0.77	0.78	0.79	0.80

Table 4: Luminous Intensity Data

Table--2

UNIT: cd

C (DGG) γ (DGG)	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350		
0	1459	1459	1459	1459	1459	1459	1459	1459	1459	1459	1459	1459	1459	1459	1459	1459	1459		
5	1453	1454	1454	1448	1450	1451	1452	1451	1452	1452	1456	1456	1454	1454	1455	1458	1458		
10	1436	1436	1436	1435	1434	1435	1433	1435	1437	1437	1436	1437	1439	1439	1441	1443	1444		
15	1409	1409	1408	1406	1407	1403	1404	1405	1406	1405	1409	1409	1414	1412	1417	1417	1418		
20	1370	1370	1368	1366	1364	1361	1362	1357	1358	1362	1363	1368	1372	1376	1381	1381	1383		
25	1311	1312	1310	1308	1301	1294	1293	1292	1292	1296	1301	1308	1315	1322	1326	1327	1329		
30	1234	1232	1230	1226	1219	1211	1204	1200	1201	1206	1214	1224	1234	1244	1253	1254	1252		
35	1129	1128	1124	1116	1104	1095	1085	1081	1079	1089	1097	1110	1126	1140	1148	1153	1152		
40	1003	1000	992	980	970	953	933	924	922	933	952	975	990	1006	1019	1026	1027		
45	860	856	848	838	816	791	766	748	747	763	791	822	845	861	873	878	881		
50	709	704	699	682	649	612	589	577	576	589	614	649	690	714	723	729	729		
55	551	546	536	510	480	456	440	431	430	442	459	485	517	549	565	571	575		
60	407	393	376	355	337	325	319	321	324	324	327	339	357	381	404	419	428		
65	288	268	251	236	228	230	236	245	250	243	232	227	232	247	268	288	305		
70	203	184	174	168	165	171	182	195	199	190	173	165	163	169	181	198	222		
75	148	137	137	134	135	138	145	157	159	151	140	136	133	134	140	145	165		
80	108	101	103	103	103	105	109	115	117	113	108	104	103	102	103	105	115		
85	64.6	54.3	56.9	58.7	54.3	56.1	61.2	64.1	64.9	64.0	59.4	54.4	58.0	58.7	54.2	62.5	65.9		
90	1.44	1.35	1.38	1.44	1.55	1.82	1.87	1.72	1.57	1.59	1.55	1.45	1.48	1.65	1.52	1.86	1.37		
95	0.50	0.68	0.59	0.51	0.42	0.36	0.32	0.31	0.31	0.31	0.33	0.36	0.46	0.55	0.64	0.78	0.64		
100	0.56	0.68	0.62	0.49	0.39	0.34	0.30	0.30	0.30	0.30	0.32	0.36	0.47	0.60	0.69	0.78	0.70		
105	0.58	0.66	0.57	0.48	0.41	0.36	0.33	0.32	0.32	0.33	0.35	0.39	0.48	0.57	0.68	0.81	0.72		
110	0.60	0.65	0.54	0.45	0.41	0.36	0.33	0.32	0.33	0.34	0.37	0.40	0.46	0.53	0.63	0.81	0.67		
115	0.54	0.60	0.48	0.42	0.37	0.34	0.31	0.31	0.31	0.33	0.36	0.38	0.43	0.48	0.62	0.75	0.61		
120	0.52	0.58	0.48	0.39	0.34	0.31	0.28	0.28	0.29	0.30	0.34	0.37	0.40	0.48	0.62	0.67	0.60		
125	0.52	0.56	0.53	0.45	0.36	0.32	0.29	0.29	0.29	0.31	0.34	0.39	0.44	0.49	0.56	0.66	0.58		
130	0.53	0.60	0.55	0.50	0.38	0.38	0.36	0.36	0.35	0.37	0.40	0.42	0.50	0.54	0.56	0.63	0.57		
135	0.56	0.59	0.57	0.49	0.48	0.47	0.43	0.45	0.43	0.45	0.49	0.51	0.54	0.54	0.61	0.64	0.62		
140	0.53	0.63	0.55	0.48	0.53	0.53	0.54	0.56	0.53	0.55	0.57	0.57	0.52	0.55	0.60	0.67	0.65		
145	0.57	0.62	0.60	0.60	0.52	0.51	0.55	0.60	0.56	0.58	0.56	0.53	0.58	0.58	0.57	0.60	0.60		
150	0.56	0.61	0.64	0.63	0.62	0.59	0.56	0.59	0.55	0.56	0.60	0.65	0.63	0.61	0.62	0.60	0.66		
155	0.65	0.59	0.63	0.64	0.63	0.60	0.62	0.62	0.59	0.64	0.65	0.67	0.66	0.63	0.64	0.65	0.66		
160	0.69	0.63	0.61	0.65	0.66	0.62	0.63	0.64	0.63	0.63	0.67	0.68	0.70	0.69	0.69	0.67	0.68		
165	0.69	0.69	0.66	0.64	0.66	0.66	0.65	0.65	0.64	0.62	0.65	0.70	0.70	0.68	0.69	0.71	0.73		
170	0.75	0.76	0.77	0.78	0.75	0.71	0.68	0.65	0.65	0.67	0.65	0.67	0.70	0.75	0.79	0.79	0.77		
175	0.82	0.83	0.83	0.83	0.82	0.82	0.78	0.72	0.78	0.81	0.81	0.77	0.80	0.84	0.83	0.82	0.82		
180	0.80	0.80	0.80	0.79	0.79	0.80	0.77	0.78	0.79	0.81	0.77	0.76	0.77	0.79	0.77	0.77	0.78		

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
Integrate Sphere system	2M	HZTE015-01	Sep. 18, 2014	Sep. 17, 2015
Digital Power Meter	WT210	HZTE008-01	Sep. 18, 2014	Sep. 17, 2015
AC Power Supply	PCR 500L	HZTE001-07	Sep. 18, 2014	Sep. 17, 2015
DC Power Supply	6154	HZTE004-04	Sep. 18, 2014	Sep. 17, 2015
Temperature and humidity recorder	JR900	HZTE018-01	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.

### 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  $4\pi$ . 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 expended uncertainty is 1.06% 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 1.94% with a coverage factor  $k=2$ .

### **Color Characteristics Measurements**

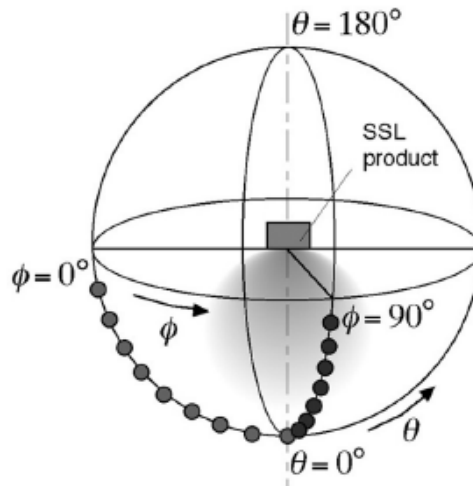
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as 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  $10^\circ$  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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