LM-79-08 Test Report

for

ABBlighting,Inc.

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

25W TROFFER

Model: ABBRT22D2535

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.: HZ14100011a

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

Reviewed by:

Engineer: April Zou

Oct. 17, 2014

Approved by:

Manager: Jim Zhang

Oct. 17, 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: **ABBRT22D2535**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
99.0	2202.5	22.24	0.9846

CCT (K)	CRI	Stabilization Time (Light & Power)
3409	81.8	60

Table 1: Executive Data Summary

Test specifications:

Date of Receipt	: Oct. 16, 2014
Date of Test	: Oct. 16, 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

TABLE OF CONTENT

LM-79-08 Test Report 1
Test Summary 2
Photos 4
TEST RESULTS 5
Spectral Power Distribution 6
Zonal Lumen Tabulation 7
Illuminance Plots 8
Luminous Intensity Distribution Plots 10
Luminous Intensity Data 11
EQUIPMENT LIST 13
TEST METHODS 13
Seasoning of SSL Product 13
Sphere-Spectroradiometer Method- Photometric and Electrical Measurements 13
Goniophotometer Method 14
Photometric and Electrical Measurements 14
Color Characteristics Measurements 14
Color Spatial Uniformity 14

Photos

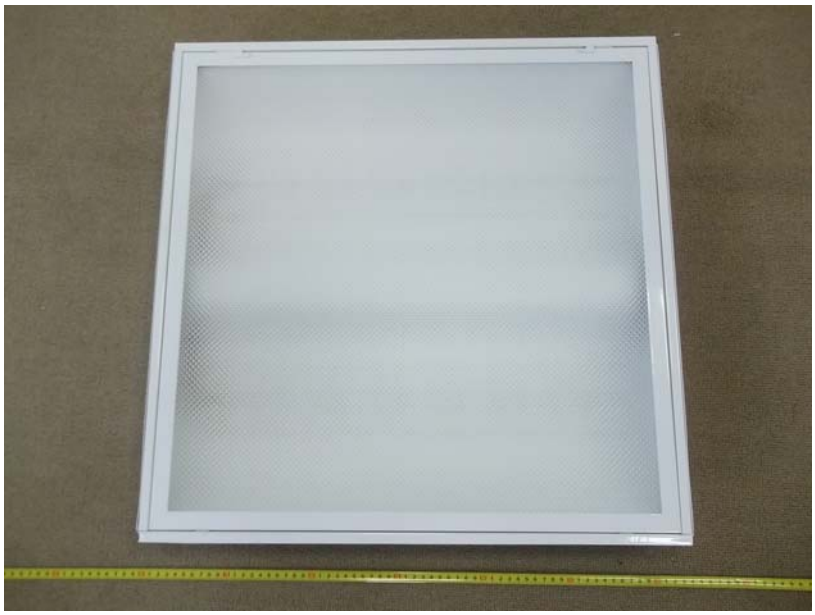


Figure 1- Overview of the sample

Equipment Under Test (EUT)	
Name	: 25W TROFFER
Model	: ABBRT22D2535
Electrical Ratings	: 100~277V AC, 50/60Hz, 25W
Product Description	: 3500K, 2x2 Luminaires for Ambient Lighting of Interior Commercial Spaces Manufacturer of light source: EVERLIGHT Model of light source: EVERLIGHT (67-21 S/KK2C-HXXXXXXXX2934Z6/2T) Quantity of LED light source: 144pcs
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.

Parameter	Result		
Test Voltage (V)	120.0	100.0	277.0
Voltage frequency (Hz)	60	60	60
Test Current (A)	0.188	0.230	0.089
Power Factor	0.9846	0.9786	0.9236
Test Power (W)	22.24	22.48	22.81
THD A%	9.69	9.00	15.55
Luminous Efficacy (lm/W)	99.0	99.3	99.5
Total Luminous Flux (lm)	2202.5	2232.3	2269.6
Color Rendering Index (CRI)	81.8		
R9	12		
Correlated Color Temperature (CCT) (K)	3409		
Chromaticity (Chroma x, Chroma y)	(0.4134, 0.4007)		
Chromaticity (Chroma u, Chroma v)	(0.2369, 0.3443)		
Chromaticity (Chroma u', Chroma v')	(0.2369, 0.5165)		
Duv	0.0025		
Average Beam Angle (°)	92.1		
Center Beam Candle Power (cd)	1002		
Spacing Criteria	1.19 (0°-180°)/ 1.21 (90°-270°)		
Zonal Lumens in the 0°-60°Zone	86.85%		
Zonal Lumens in the 60°-90°Zone	13.02%		
Zonal Lumens in the 90°-120°Zone	0.06%		
Zonal Lumens in the 120°-180°Zone	0.07%		

Special Color Rendering Indices	
R1	79
R2	88
R3	95
R4	79
R5	79
R6	83
R7	87
R8	64
R9	12
R10	72
R11	76
R12	59
R13	81
R14	97

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

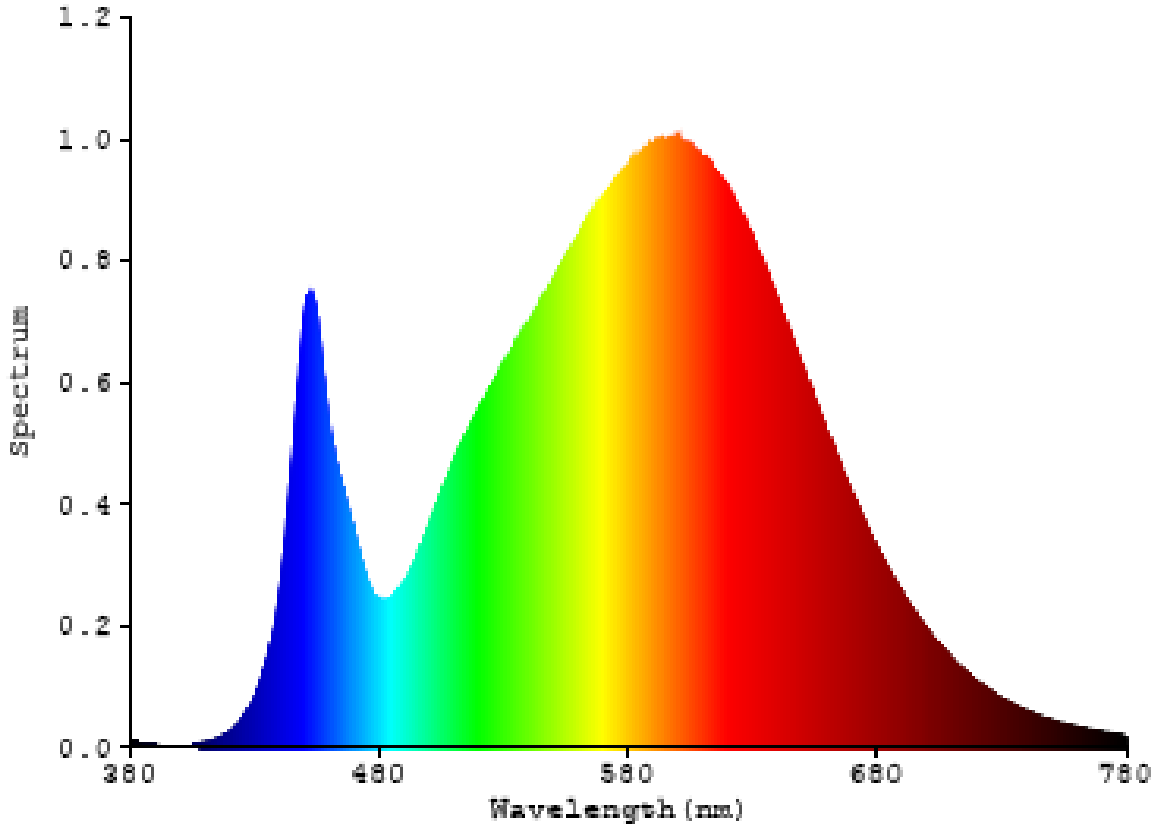


Chart 1: Spectral Power Distribution

Zonal Lumen Tabulation

γ(°)	Lumens	% Total
0- 10	95.035	4.31%
10- 20	271.426	12.32%
20- 30	404.737	18.38%
30- 40	456.388	20.72%
40- 50	406.086	18.44%
50- 60	279.236	12.68%
60- 70	156.132	7.09%
70- 80	95.923	4.36%
80- 90	34.759	1.58%
90-100	0.465	0.02%
100-110	0.442	0.02%
110-120	0.416	0.02%
120-130	0.364	0.02%
130-140	0.344	0.02%
140-150	0.312	0.01%
150-160	0.242	0.01%
160-170	0.158	0.01%
170-180	0.058	0.00%
Total	2202.5	100%

γ(°)	Lumens	% Total
0- 60	1912.908	86.85%
60- 90	286.814	13.02%
0-90	2199.722	99.87%
90- 180	2.801	0.13%
0- 180	2202.5	100%

Table 3: Zonal Lumen Data

Illuminance Plots

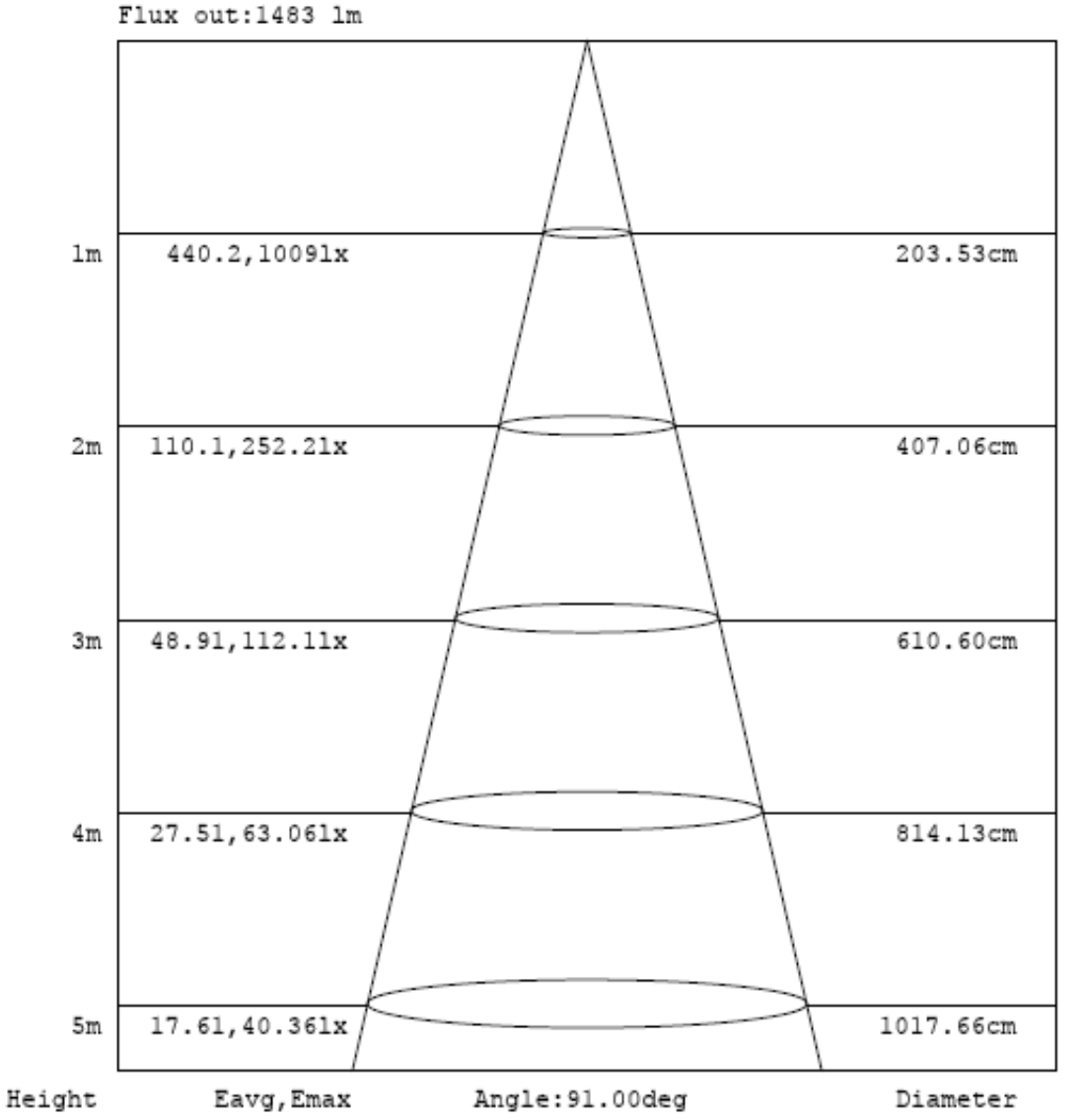


Chart 2: Beam Angle

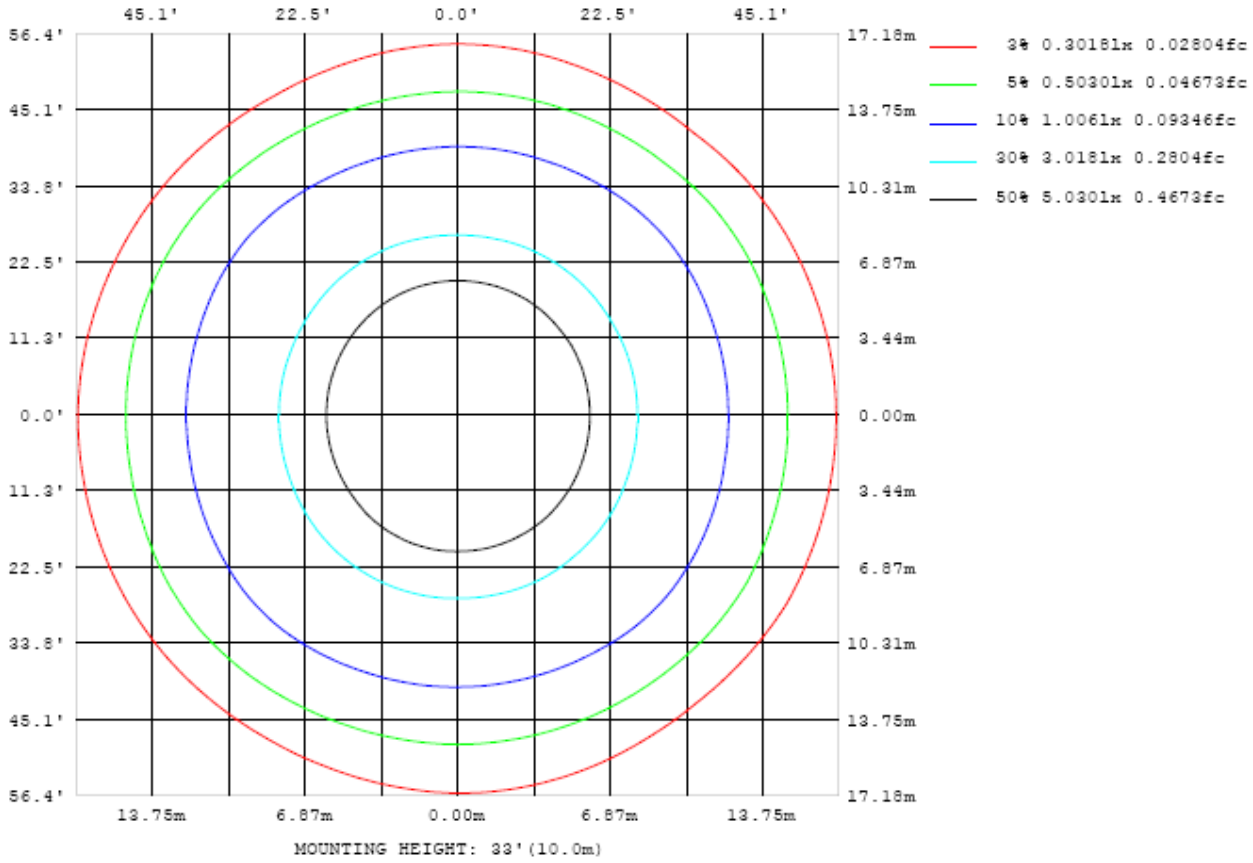


Chart 3: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots

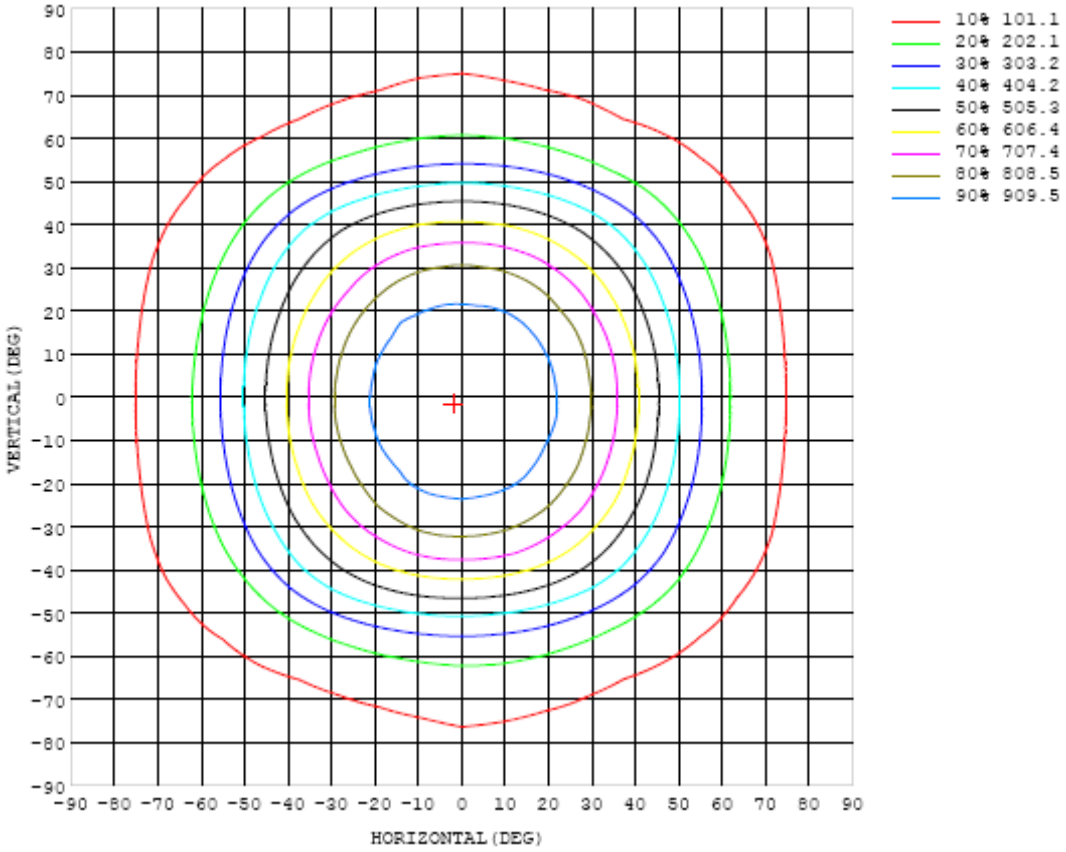


Chart 4: Isocandela Plot

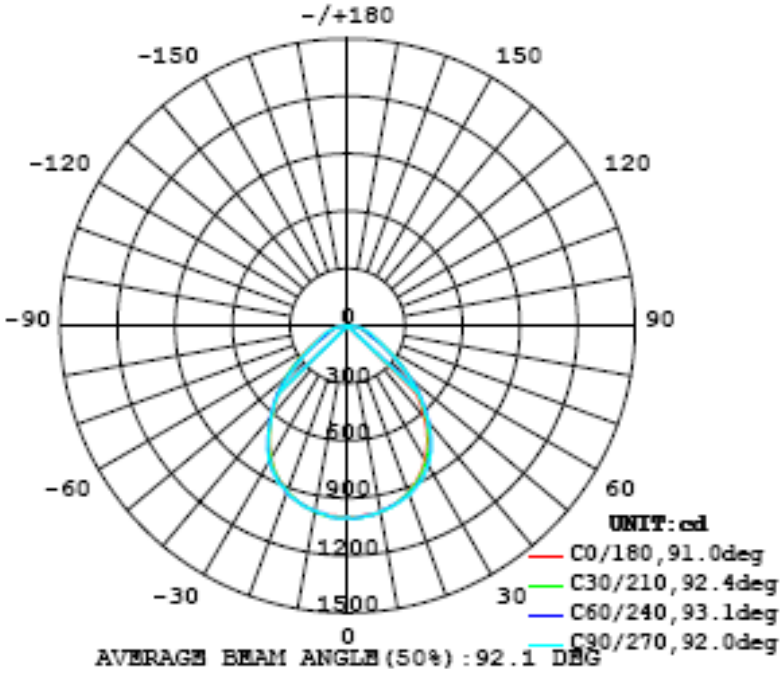


Chart 5: Polar Candela Distribution

Luminous Intensity Data

Table--1 UNIT: cd

C(DEG) / γ (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	1002	1002	1002	1002	1002	1002	1002	1002	1002	1002	1002	1002	1002	1002	1002	1002	1002	1002	1002
5	994	1001	1003	998	1001	1003	1000	1001	1004	1004	1003	1004	1004	1001	1000	1003	1004	1000	995
10	987	988	990	987	990	987	986	984	987	986	987	985	987	989	988	989	992	990	983
15	962	965	964	964	962	963	964	968	967	966	966	969	966	965	964	962	964	963	961
20	928	931	928	928	930	934	937	941	942	940	940	937	932	935	927	927	925	922	921
25	874	877	877	880	887	893	892	897	900	900	899	897	891	886	881	874	870	867	867
30	806	807	812	820	824	837	839	839	840	840	840	839	837	828	815	806	803	801	799
35	723	726	730	738	748	753	759	761	764	764	763	759	756	748	737	726	717	716	714
40	622	626	631	643	651	652	659	659	657	657	657	657	655	650	642	634	622	618	615
45	513	518	527	537	544	551	550	549	545	544	547	549	549	547	541	532	520	513	511
50	407	411	421	431	441	443	432	424	420	421	423	427	438	446	441	429	419	412	411
55	310	313	318	327	328	321	314	312	310	311	310	313	320	330	336	330	321	316	315
60	228	228	228	229	222	217	219	225	229	230	226	222	221	224	228	230	231	231	231
65	171	166	156	150	147	144	149	161	172	175	168	158	149	145	148	150	159	170	172
70	132	124	113	106	105	104	110	121	133	140	131	117	108	104	107	108	118	130	134
75	99.3	97.3	85.3	83.8	85.5	86.7	91.0	94.3	103	110	97.7	89.4	88.9	86.2	87.8	85.8	90.9	99.6	103
80	68.0	72.2	63.7	61.9	63.3	66.3	69.6	69.1	76.1	76.2	70.7	64.1	66.9	61.9	65.8	64.3	68.6	72.4	69.9
85	36.6	39.9	35.0	29.3	33.1	36.0	33.6	36.7	42.6	38.8	40.9	32.4	33.0	35.0	33.9	31.2	38.1	40.0	37.8
90	1.73	3.94	2.61	2.12	1.90	1.69	1.93	2.24	4.19	3.37	4.03	1.96	1.88	1.89	2.21	2.46	2.34	2.17	0.44
95	0.50	0.67	0.54	0.40	0.39	0.29	0.20	0.13	0.09	0.08	0.09	0.14	0.22	0.32	0.41	0.54	0.54	0.65	0.49
100	0.46	0.71	0.52	0.36	0.44	0.32	0.22	0.14	0.09	0.09	0.10	0.15	0.23	0.36	0.47	0.44	0.55	0.59	0.49
105	0.49	0.68	0.60	0.37	0.38	0.31	0.23	0.16	0.11	0.11	0.11	0.17	0.23	0.32	0.37	0.46	0.59	0.65	0.53
110	0.50	0.65	0.59	0.42	0.39	0.30	0.24	0.18	0.14	0.14	0.14	0.18	0.23	0.29	0.38	0.49	0.63	0.67	0.52
115	0.51	0.63	0.61	0.44	0.39	0.32	0.26	0.22	0.17	0.17	0.17	0.21	0.26	0.31	0.39	0.48	0.62	0.65	0.50
120	0.56	0.64	0.58	0.44	0.41	0.35	0.30	0.24	0.21	0.20	0.21	0.24	0.28	0.34	0.41	0.50	0.58	0.61	0.52
125	0.56	0.63	0.48	0.50	0.41	0.38	0.35	0.27	0.25	0.24	0.25	0.27	0.32	0.37	0.41	0.45	0.54	0.59	0.50
130	0.57	0.63	0.50	0.52	0.42	0.40	0.38	0.33	0.29	0.29	0.29	0.31	0.36	0.39	0.42	0.51	0.49	0.55	0.39
135	0.54	0.56	0.47	0.50	0.48	0.45	0.39	0.37	0.34	0.35	0.34	0.35	0.37	0.43	0.47	0.50	0.50	0.56	0.50
140	0.57	0.59	0.58	0.46	0.51	0.44	0.44	0.40	0.38	0.39	0.38	0.38	0.39	0.45	0.48	0.47	0.54	0.55	0.52
145	0.61	0.61	0.62	0.54	0.45	0.47	0.46	0.43	0.42	0.42	0.41	0.41	0.42	0.44	0.47	0.51	0.58	0.58	0.57
150	0.65	0.59	0.57	0.55	0.50	0.46	0.47	0.46	0.44	0.45	0.44	0.44	0.44	0.44	0.47	0.55	0.58	0.58	0.61
155	0.55	0.55	0.60	0.59	0.55	0.51	0.44	0.43	0.43	0.43	0.44	0.44	0.44	0.49	0.54	0.53	0.54	0.55	0.58
160	0.58	0.58	0.60	0.58	0.55	0.51	0.46	0.44	0.45	0.44	0.48	0.49	0.50	0.53	0.56	0.57	0.58	0.57	0.61
165	0.57	0.56	0.55	0.55	0.54	0.49	0.47	0.47	0.48	0.49	0.52	0.53	0.54	0.56	0.58	0.58	0.59	0.58	0.61
170	0.58	0.57	0.56	0.56	0.56	0.52	0.51	0.49	0.52	0.53	0.52	0.55	0.57	0.59	0.60	0.60	0.60	0.61	0.63
175	0.64	0.64	0.63	0.63	0.62	0.61	0.61	0.60	0.61	0.59	0.61	0.62	0.64	0.65	0.67	0.67	0.67	0.67	0.67
180	0.67	0.68	0.66	0.65	0.63	0.61	0.60	0.58	0.58	0.56	0.56	0.60	0.61	0.64	0.64	0.64	0.66	0.65	0.66

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	1002	1002	1002	1002	1002	1002	1002	1002	1002	1002	1002	1002	1002	1002	1002	1002	1002		
5	1000	1002	1002	1000	1003	1003	999	999	1003	1002	1001	999	1001	1004	1003	1003	998		
10	989	989	985	981	984	983	979	980	979	978	982	983	983	981	986	988	988		
15	963	958	958	957	959	959	961	961	961	960	961	963	959	961	956	961	965		
20	920	923	922	922	924	928	928	923	922	923	927	927	928	928	925	924	927		
25	865	867	869	874	875	877	880	881	880	882	883	879	880	879	877	873	872		
30	799	799	801	807	810	815	817	817	818	817	818	818	816	808	810	808	804		
35	713	713	714	715	722	726	728	726	725	727	730	730	729	726	721	723	724		
40	615	614	617	622	626	627	626	624	620	621	625	626	627	625	622	622	623		
45	512	515	521	526	531	528	521	516	515	517	519	523	526	523	519	514	516		
50	412	415	423	429	422	408	398	395	396	397	398	406	416	420	415	409	408		
55	315	317	318	314	302	292	287	285	286	287	288	292	298	309	312	309	309		
60	227	220	215	209	204	201	204	209	211	209	203	200	199	209	215	220	226		
65	162	149	141	137	135	137	147	159	164	156	145	137	134	138	143	153	166		
70	124	111	104	101	101	106	113	126	132	121	112	106	101	103	106	113	126		
75	97.3	86.5	85.0	82.0	82.8	84.6	86.4	96.5	101	94.5	89.3	89.5	84.1	84.6	83.6	89.4	97.5		
80	73.9	63.8	61.1	57.1	55.9	58.2	59.7	66.8	67.1	68.6	62.7	64.0	57.7	60.1	59.3	66.4	73.1		
85	39.6	31.6	24.9	27.6	25.2	21.6	24.4	28.2	28.1	29.5	24.1	25.2	26.5	25.1	27.0	35.6	38.7		
90	0.60	0.91	0.56	0.46	0.35	0.26	0.19	0.15	0.14	0.18	0.23	0.30	0.40	0.48	0.63	0.55	0.69		
95	0.77	0.60	0.55	0.50	0.39	0.29	0.22	0.18	0.17	0.23	0.27	0.35	0.46	0.56	0.63	0.69	0.78		
100	0.86	0.62	0.49	0.52	0.42	0.32	0.24	0.20	0.19	0.24	0.29	0.39	0.51	0.60	0.58	0.73	0.76		
105	0.77	0.69	0.50	0.48	0.41	0.33	0.26	0.23	0.22	0.26	0.32	0.40	0.47	0.55	0.65	0.80	0.87		
110	0.74	0.68	0.49	0.47	0.39	0.33	0.28	0.24	0.24	0.28	0.33	0.38	0.46	0.56	0.65	0.82	0.85		
115	0.68	0.64	0.47	0.44	0.38	0.31	0.26	0.23	0.23	0.27	0.32	0.37	0.44	0.52	0.62	0.74	0.78		
120	0.62	0.59	0.47	0.42	0.36	0.30	0.25	0.23	0.23	0.26	0.31	0.37	0.42	0.50	0.61	0.63	0.72		
125	0.59	0.49	0.46	0.39	0.35	0.32	0.26	0.24	0.24	0.26	0.30	0.36	0.42	0.51	0.51	0.58	0.63		
130	0.57	0.52	0.48	0.39	0.36	0.33	0.29	0.28	0.28	0.31	0.34	0.39	0.41	0.48	0.52	0.54	0.59		
135	0.55	0.49	0.46	0.47	0.43	0.36	0.34	0.34	0.34	0.36	0.37	0.39	0.49	0.51	0.50	0.52	0.56		
140	0.56	0.56	0.52	0.48	0.45	0.42	0.40	0.40	0.39	0.39	0.42	0.46	0.44	0.52	0.52	0.59	0.55		
145	0.59	0.59	0.54	0.52	0.44	0.43	0.44	0.44	0.45	0.45	0.46	0.47	0.46	0.53	0.57	0.62	0.54		
150	0.59	0.58	0.56	0.50	0.51	0.47	0.46	0.45	0.44	0.45	0.47	0.52	0.55	0.52	0.57	0.64	0.58		
155	0.53	0.55	0.55	0.57	0.52	0.50	0.51	0.51	0.49	0.50	0.50	0.51	0.54	0.60	0.62	0.58	0.53		
160	0.58	0.61	0.60	0.59	0.57	0.54	0.53	0.54	0.51	0.51	0.50	0.52	0.55	0.58	0.62	0.61	0.60		
165	0.59	0.58	0.60	0.60	0.60	0.58	0.57	0.56	0.55	0.53	0.53	0.53	0.54	0.57	0.59	0.60	0.59		
170	0.63	0.62	0.62	0.62	0.63	0.62	0.61	0.59	0.59	0.58	0.57	0.56	0.55	0.58	0.60	0.61	0.61		
175	0.67	0.66	0.64	0.65	0.63	0.63	0.61	0.60	0.59	0.58	0.61	0.59	0.59	0.62	0.64	0.64	0.64		
180	0.66	0.67	0.66	0.66	0.63	0.62	0.61	0.59	0.58	0.60	0.57	0.57	0.60	0.63	0.64	0.65	0.66		

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 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 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 expended uncertainty is 1.94% with a coverage factor k=2.

Color Characteristics Measurements

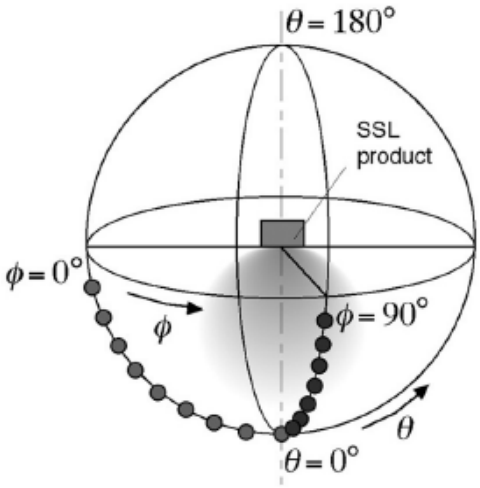
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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