

## LM-79-08 Test Report

for

### Philips Lighting (China) Investment Co., Ltd

Building 9, Lane 888, Tianlin Road, Minhang District, Shanghai China

### TYPEB LED TUBE

**Model: 9290019338**

### Laboratory: Leading Testing Laboratories

**NVLAP CODE: 200960-0**

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Report No.: HZ18060001a

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

Review by:



Engineer: April Zou

Jun. 06, 2018

Approved by:



Manager: Jim Zhang

Jun. 06, 2018

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: **9290019338**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
135.9	1139.0	8.38	0.9822
CCT (K)	CRI	Stabilization Time (Light & Power)	
3057	82.0	60	

Table 1: Executive Data Summary

Note: The above results are recorded/ derived from measurements made using an Integrating Sphere.

### Test specifications:

<b>Date of Receipt</b>	: Jun. 01, 2018
<b>Date of Test</b>	: Jun. 01, 2018
<b>Test item</b>	: Total Luminous Flux, Luminous Distribution Intensity, Luminous Efficacy, Correlated Color Temperature, Color Rendering Index, Chromaticity Coordinate, Electrical parameters
<b>Reference Standard</b>	: 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)

<b>Name</b>	: TYPEB LED TUBE
<b>Model</b>	: 9290019338
<b>Electrical Ratings</b>	: 120-277V, 50/60Hz, 8.5W
<b>Product Description</b>	: 8.5T8PRO/24-830/BB11/G FB
<b>Manufacturer</b>	: Philips Lighting (China) Investment Co., Ltd
<b>Address</b>	: Building 9, Lane 888, Tianlin Road, Minhang District, Shanghai China

## TEST RESULTS

Test ambient temperature was 25.0°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 65 minutes.

### Sphere-Spectroradiometer Method

Parameter	Result	
Test Voltage (V)	120.0	277.0
Voltage frequency (Hz)	60	60
Test Current (A)	0.071	0.034
Power Factor	0.9822	0.9255
Test Power (W)	8.38	8.66
THD A%	17.93	20.61
Luminous Efficacy (lm/W)	135.9	131.9
Total Luminous Flux (lm)	1139.0	1142.0
Color Rendering Index (CRI)	82.0	
R9	4.4	
Correlated Color Temperature (CCT) (K)	3057	
Chromaticity Chroma x	0.4323	
Chromaticity Chroma y	0.4015	
Chromaticity Chroma u	0.2487	
Chromaticity Chroma v	0.3464	
Duv	0.0004	
Chromaticity Chroma u'	0.2487	
Chromaticity Chroma v'	0.5197	

Special Color Rendering Indices	
R1	80.7
R2	92.5
R3	94
R4	78.7
R5	81.3
R6	91
R7	81
R8	57
R9	4.4
R10	82.9
R11	77.6
R12	73.7
R13	83.7
R14	97.3
Rf	83
Rg	94

Table 2: Test data per Sphere-Spectroradiometer Method

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

## Goniophotometer Method

Test ambient temperature was 24.8°C.

The photometric distance is 30m.

Luminous data was taken at 0.5°vertical intervals and 10°horizontal intervals.

Parameter	Result
Test Voltage (V)	120.0
Voltage frequency (Hz)	60
Test Current (A)	0.072
Power Factor	0.9792
Test Power (W)	8.44
Luminous Efficacy (lm/W)	131.0
Total Luminous Flux (lm)	1105.4
Beam Angle (°)	106.9 (0°-180°)/ 204.0 (90°-270°)
Center Beam Candle Power (cd)	203
Maximum Beam Candle Power (cd)	203.0 (At: C=100.0, Gamma=1.0)
Spacing Criteria	1.23 (0°-180°)/ 1.40 (90°-270°)
Zonal Lumens in the 0°-60°Zone	45.42%
Zonal Lumens in the 60°-90°Zone	26.76%
Zonal Lumens in the 90°-120°Zone	16.52%
Zonal Lumens in the 120°-180°Zone	11.30%

Table 3: Test data per Goniophotometer Method

## Spectral Power Distribution - Sphere Spectroradiometer Method

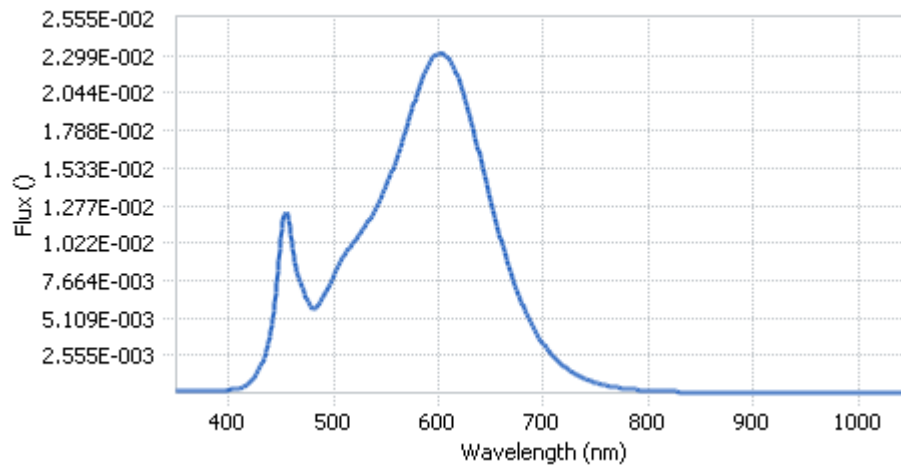


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.84E-04	485	5.97E-03	590	2.23E-02	695	3.85E-03
385	1.69E-04	490	6.53E-03	595	2.29E-02	700	3.31E-03
390	1.99E-04	495	7.18E-03	600	2.31E-02	705	2.83E-03
395	1.92E-04	500	8.02E-03	605	2.31E-02	710	2.42E-03
400	2.15E-04	505	8.77E-03	610	2.28E-02	715	2.07E-03
405	2.37E-04	510	9.36E-03	615	2.21E-02	720	1.77E-03
410	3.10E-04	515	9.89E-03	620	2.12E-02	725	1.51E-03
415	4.63E-04	520	1.04E-02	625	2.00E-02	730	1.30E-03
420	6.98E-04	525	1.08E-02	630	1.88E-02	735	1.10E-03
425	1.12E-03	530	1.14E-02	635	1.74E-02	740	9.39E-04
430	1.77E-03	535	1.19E-02	640	1.59E-02	745	7.98E-04
435	2.73E-03	540	1.26E-02	645	1.44E-02	750	6.85E-04
440	4.22E-03	545	1.33E-02	650	1.30E-02	755	5.90E-04
445	6.82E-03	550	1.41E-02	655	1.16E-02	760	5.07E-04
450	1.06E-02	555	1.50E-02	660	1.03E-02	765	4.34E-04
455	1.23E-02	560	1.60E-02	665	9.06E-03	770	3.72E-04
460	1.03E-02	565	1.71E-02	670	7.92E-03	775	3.19E-04
465	8.24E-03	570	1.82E-02	675	6.91E-03	780	2.75E-04
470	7.30E-03	575	1.94E-02	680	6.01E-03		
475	6.32E-03	580	2.05E-02	685	5.20E-03		
480	5.76E-03	585	2.15E-02	690	4.48E-03		

Table 4: Spectral Power Distribution Numerical Data per Sphere - Spectroradiometer Method

The diagram is a CIE 1931 color space plot, titled "CIE 1931, 2 Degree". The horizontal axis is labeled 'x' and ranges from 0.1000 to 0.7000. The vertical axis is labeled 'y' and ranges from 0.1000 to 0.8000. The plot shows the visible spectrum as a curved boundary, with colors transitioning from violet at the bottom left, through blue, green, yellow, orange, and red to magenta at the bottom right. A straight line, the line of purpuration, connects the ends of the visible spectrum. Several points are marked along the spectrum with numerical labels: 480, 490, 500, 510, 520, 530, 540, 550, 560, 570, 580, 590, 600, 610, 620, 630, and 780. In the interior of the plot, a series of points are marked: D65 (a white point), and a sequence of points labeled A, B, C, D, E, and F, which follow a path from the white point towards the red end of the spectrum. A blue curve is also shown, passing through point A and extending towards the red end of the spectrum.

### Chart 2: Chromaticity Diagram per Sphere - Spectroradiometer Method

Note: The location on the diagram of the tristimulus coordinates are indicated by the blue diamond.



### Nominal CCT Quadrangles – Sphere Spectroradiometer Method

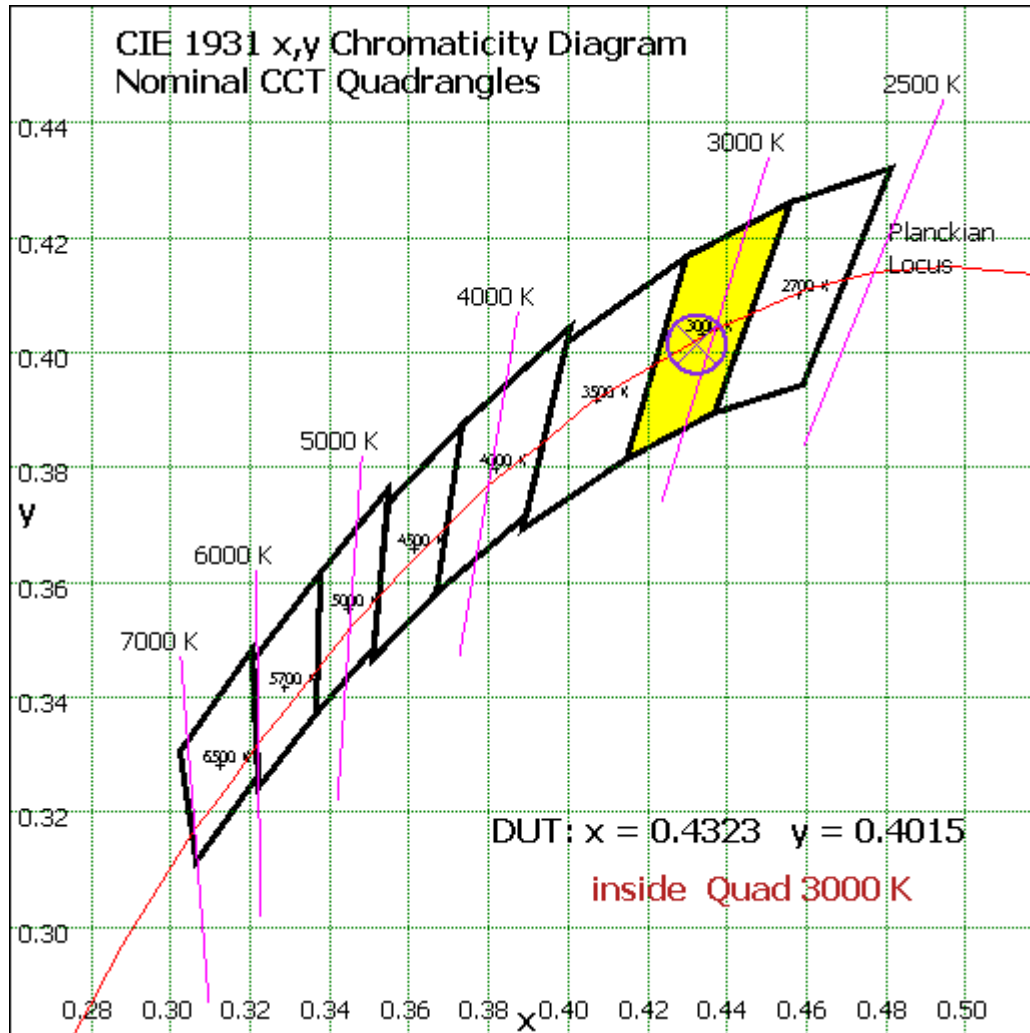


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

### Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	19.223	1.74%
10- 20	55.446	5.02%
20- 30	85.438	7.73%
30- 40	106.427	9.63%
40- 50	117.242	10.61%
50- 60	118.267	10.70%
60- 70	111.33	10.07%
70- 80	99.152	8.97%
80- 90	85.364	7.72%
90-100	72.85	6.59%
100-110	60.501	5.47%
110-120	49.245	4.46%
120-130	39.764	3.60%
130-140	31.892	2.89%
140-150	24.449	2.21%
150-160	16.96	1.53%
160-170	9.473	0.86%
170-180	2.35	0.21%
Total	1105.4	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	502.043	45.42%
60- 90	295.846	26.76%
0-90	797.889	72.18%
90- 180	307.484	27.82%
0- 180	1105.4	100%

Table 5: Zonal Lumen Data

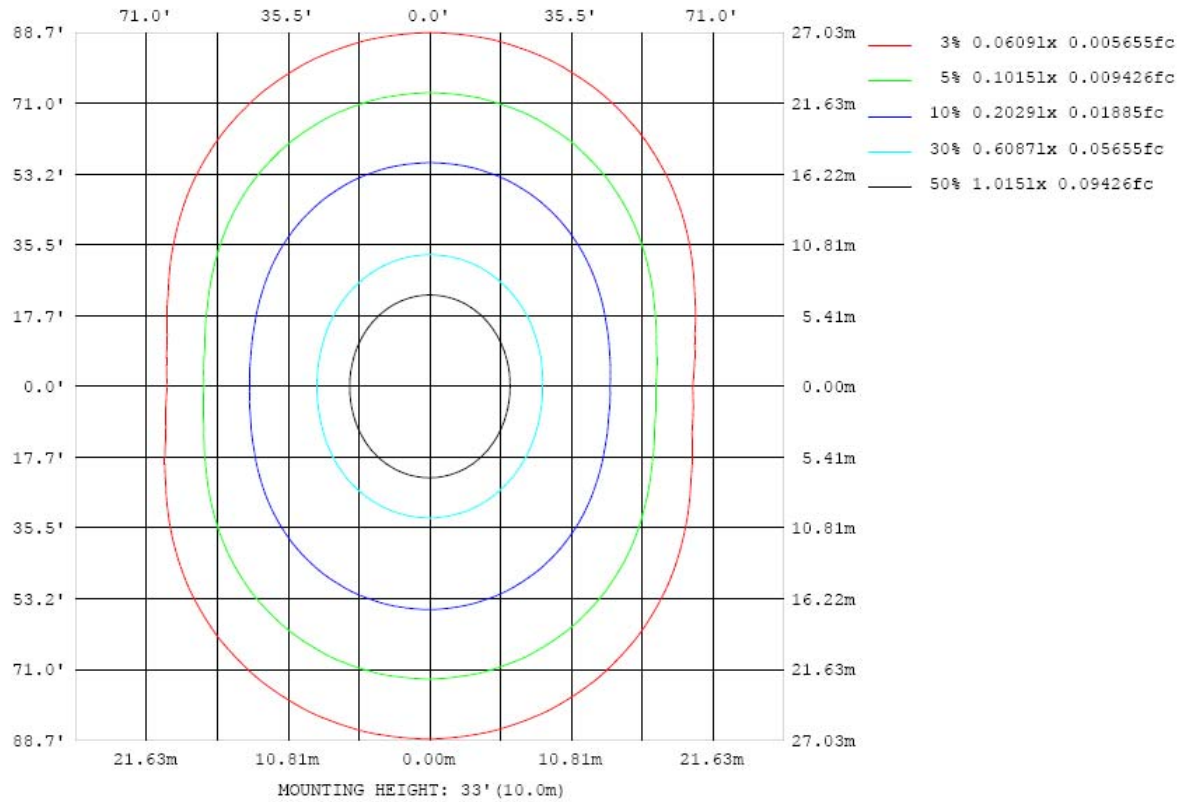


Chart 4: Illuminance Plot (Footcandles)

## Luminous Intensity Distribution Plots- Goniophotometer Method

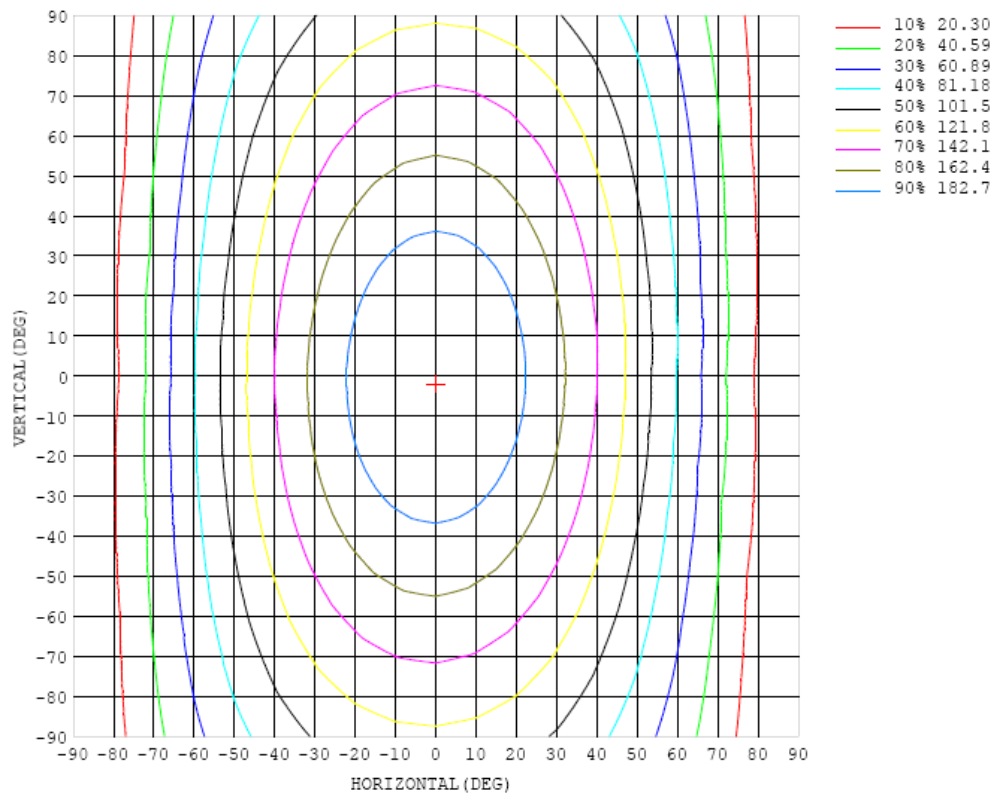


Chart 5: Isocandela Plot

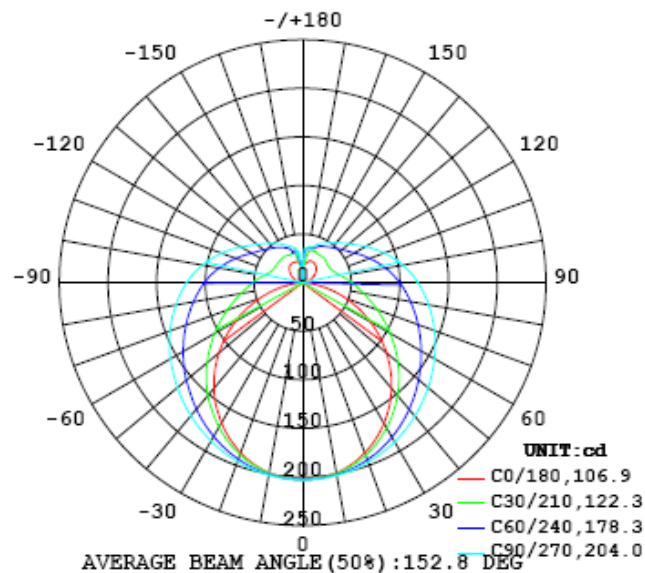


Chart 6: Polar Candela Distribution

## Luminous Intensity Data- Goniophotometer Method

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	203	203	203	203	203	203	203	203	203	203	203	203	203	203	203	203	203	203	203
5	202	202	202	202	202	202	202	202	203	203	202	202	202	202	202	202	202	202	202
10	199	199	199	199	200	200	201	201	201	201	201	201	201	200	200	199	199	199	199
15	194	194	194	195	196	197	198	199	199	199	199	199	198	197	196	195	194	194	193
20	187	187	188	189	191	192	194	196	196	197	196	196	194	193	191	189	188	187	186
25	178	178	179	181	184	187	189	191	193	193	193	192	190	187	184	182	179	178	177
30	167	168	170	173	176	180	184	187	188	189	189	187	184	181	177	173	170	168	167
35	155	156	159	162	167	172	177	181	183	184	184	182	178	174	168	163	159	156	155
40	142	143	146	152	158	164	170	175	178	179	178	176	171	166	159	153	147	143	142
45	128	129	133	140	148	156	163	169	172	174	173	170	165	158	150	141	134	129	128
50	112	114	120	128	137	147	155	162	166	168	167	164	157	149	140	130	121	114	112
55	96.5	98.5	106	116	127	138	148	156	160	162	161	157	150	141	130	118	107	99.2	96.4
60	80.0	82.7	91.6	104	117	130	141	149	154	156	155	151	143	133	120	107	93.9	83.8	79.9
65	63.8	67.0	77.7	92.3	107	121	133	142	148	150	149	144	136	125	111	95.9	80.8	68.6	63.3
70	47.2	51.7	65.1	81.6	98.4	113	126	136	142	144	143	138	129	117	103	85.8	68.3	53.9	46.7
75	31.4	37.1	53.3	71.8	90.0	106	119	129	135	138	137	131	123	110	94.7	76.6	57.7	40.0	30.9
80	17.6	24.3	43.0	63.8	82.6	99.1	113	123	129	131	130	125	116	103	87.4	69.2	48.1	28.1	16.6
85	6.13	14.7	35.1	56.7	75.8	92.5	106	116	122	125	124	119	109	96.8	80.7	62.0	40.5	19.1	5.56
90	0.95	9.49	29.4	50.6	69.8	86.2	99.6	110	116	118	117	112	103	90.5	74.6	56.1	34.9	14.0	0.70
95	1.43	6.87	25.1	45.5	64.4	80.2	93.4	103	109	112	110	106	96.8	84.5	69.3	51.0	30.6	11.0	1.24
100	3.14	7.03	21.9	40.6	58.7	73.9	86.7	96.1	102	105	103	98.5	90.0	78.2	63.7	46.1	27.1	10.7	2.83
105	5.32	8.60	20.6	36.7	53.3	68.2	79.9	88.9	94.7	97.0	95.8	91.3	83.1	71.8	58.1	41.8	25.0	11.7	5.17
110	7.72	11.1	20.4	34.0	48.7	62.2	73.2	81.7	87.1	89.3	88.2	84.0	76.3	66.1	53.1	38.4	24.8	13.7	7.86
115	10.2	13.0	21.0	32.5	44.8	56.9	67.3	74.7	79.7	81.9	80.8	76.8	70.5	60.4	48.7	36.8	25.4	16.4	10.3
120	12.9	16.0	22.4	31.8	42.3	52.3	61.4	68.3	72.6	74.6	73.7	71.1	64.0	55.3	46.0	35.8	26.3	18.9	12.7
125	15.4	19.0	24.4	31.6	40.6	49.1	56.6	62.4	66.3	68.1	67.2	64.0	58.7	51.9	43.9	35.4	27.4	21.4	15.0
130	17.7	21.7	25.7	32.0	39.4	46.6	52.9	57.9	61.1	62.5	61.7	59.2	54.8	49.0	42.3	35.3	28.8	23.9	17.3
135	19.8	24.1	26.9	32.9	38.6	44.6	49.8	54.0	56.6	57.8	57.2	55.1	51.5	46.7	41.1	35.4	30.0	26.0	19.4
140	21.5	26.4	28.9	33.7	38.3	43.0	47.3	50.6	52.8	53.7	53.3	51.5	48.6	44.7	40.2	35.7	30.7	27.3	21.3
145	22.6	27.8	30.4	33.4	38.2	41.8	45.1	47.7	49.4	50.2	49.9	48.4	46.1	43.0	39.5	35.5	31.8	27.3	22.2
150	23.4	28.5	31.9	33.5	37.1	40.9	43.3	45.3	46.6	47.2	46.9	45.8	44.0	41.7	38.9	34.9	32.7	28.8	22.7
155	23.9	28.6	33.2	34.0	35.3	38.9	41.8	43.2	44.1	44.6	44.3	43.5	42.3	40.3	37.7	35.7	33.9	29.3	22.7
160	23.8	28.6	34.2	34.5	35.3	36.5	38.2	40.2	41.1	41.7	41.5	40.9	39.9	38.7	37.3	36.4	34.2	29.8	22.9
165	22.3	27.8	33.6	34.8	35.4	36.3	36.8	37.6	37.9	38.1	38.5	38.5	38.1	37.5	37.1	35.9	34.0	29.0	22.3
170	20.0	20.5	24.3	31.2	34.8	35.1	36.0	37.0	37.5	37.8	37.8	37.5	37.2	35.9	32.8	29.4	26.8	23.6	20.9
175	18.4	18.5	18.3	18.6	21.7	27.9	33.0	35.4	35.8	35.8	36.2	32.8	26.4	21.1	19.2	19.0	19.4	19.7	19.6
180	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09

Table 6: Luminous Intensity Data

Table--2

UNIT: cd

$\gamma$ (DEG) \ C (DEG)	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350		
0	203	203	203	203	203	203	203	203	203	203	203	203	203	203	203	203	203		
5	202	202	202	202	202	202	202	202	202	202	202	202	202	202	202	202	202		
10	199	199	199	199	200	200	201	201	201	201	201	200	200	200	199	199	199		
15	194	194	195	195	196	197	198	198	199	199	198	198	197	196	195	194	194		
20	187	187	188	190	192	193	195	195	196	196	195	194	192	190	189	188	187		
25	178	179	181	183	186	188	191	192	192	192	191	189	187	184	181	179	178		
30	167	169	172	176	179	183	186	188	188	188	186	183	180	176	173	170	168		
35	156	158	162	167	172	177	180	183	184	183	181	177	173	168	163	159	157		
40	143	146	152	158	164	170	175	178	179	178	175	171	165	159	153	148	144		
45	129	133	140	148	156	163	169	172	174	173	169	164	157	150	142	135	130		
50	114	120	128	138	148	156	162	166	168	167	163	157	150	140	130	122	116		
55	98.6	106	116	128	139	149	156	161	162	161	157	151	141	130	119	108	100		
60	82.8	91.8	104	118	131	142	150	155	157	156	151	143	133	121	107	94.5	84.7		
65	67.0	78.3	93.1	109	123	135	144	149	151	150	145	136	125	111	96.2	81.2	69.2		
70	51.6	65.4	82.5	99.6	115	128	137	143	145	144	138	130	117	103	85.9	68.7	54.2		
75	37.2	53.6	72.8	91.4	108	121	131	137	139	137	132	123	110	94.5	76.5	57.4	40.1		
80	24.6	43.6	64.5	84.0	101	114	124	130	132	131	125	116	103	87.1	68.3	47.6	27.9		
85	15.2	35.8	57.4	77.1	93.9	107	117	124	126	124	119	109	96.5	80.3	61.2	39.9	18.7		
90	9.95	30.2	51.5	71.0	87.6	101	111	117	119	118	112	103	90.2	74.2	55.2	34.1	13.4		
95	7.32	25.8	46.2	65.1	81.3	94.4	104	110	112	111	105	96.3	83.8	68.2	49.7	29.5	10.3		
100	7.48	22.5	41.2	59.2	74.7	87.3	96.7	102	104	103	97.9	89.2	77.1	62.0	44.4	25.6	9.47		
105	8.81	21.2	37.0	53.6	68.2	80.2	89.1	94.6	96.7	95.1	90.3	82.0	70.6	56.3	39.9	23.4	10.3		
110	11.2	21.3	34.5	48.7	62.1	73.3	81.7	86.9	88.8	87.4	82.9	75.0	64.3	51.1	36.5	22.7	12.5		
115	13.5	22.3	33.1	45.1	56.5	66.8	74.5	79.4	81.2	79.8	75.6	68.3	58.4	46.8	34.5	22.8	14.9		
120	15.7	23.5	32.6	42.6	52.3	60.7	67.6	72.1	73.7	72.5	68.6	62.1	53.7	43.9	33.4	23.9	17.6		
125	17.7	24.5	32.6	40.9	49.1	56.3	62.0	65.6	66.9	65.8	62.6	57.3	50.2	41.9	33.0	25.3	20.1		
130	19.7	25.6	32.7	39.8	46.6	52.7	57.4	60.5	61.5	60.7	57.9	53.5	47.5	40.5	33.1	26.9	22.3		
135	21.6	26.7	32.7	38.9	44.6	49.6	53.6	56.1	57.0	56.3	54.0	50.3	45.4	39.5	33.4	28.5	24.3		
140	23.6	27.8	32.6	37.8	42.7	46.9	50.2	52.3	53.1	52.5	50.6	47.5	43.5	38.7	33.8	30.1	26.1		
145	25.0	29.0	32.7	36.9	40.9	44.4	47.2	48.9	49.6	49.1	47.6	45.1	41.7	37.8	34.3	31.3	27.4		
150	24.7	29.3	32.4	35.9	39.2	41.9	44.2	45.7	46.2	45.9	44.7	42.7	40.1	37.3	34.8	32.2	27.7		
155	24.3	29.3	31.8	33.6	37.2	39.7	41.3	42.5	42.9	42.8	42.0	40.6	38.9	36.9	35.2	32.7	27.4		
160	23.3	29.2	32.3	33.2	33.8	36.1	38.8	39.8	40.2	40.2	39.8	39.0	37.8	36.5	35.4	32.5	27.0		
165	20.5	24.6	30.3	33.4	33.8	33.8	31.2	36.7	37.7	37.8	37.7	37.3	36.7	36.0	35.0	29.7	23.3		
170	19.3	19.6	20.2	23.4	25.7	27.9	32.5	32.5	33.3	36.1	36.1	36.1	35.8	31.1	24.1	20.6	19.6		
175	18.9	18.1	18.1	18.0	18.0	17.9	17.7	16.2	18.3	19.1	22.2	20.3	17.5	17.6	17.9	18.0	18.2		
180	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09		

Table 7: Luminous Intensity Data



## EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Aug. 23, 2017	Aug. 22, 2018
Digital Power Meter	PF2010A	HZTE028-01	Aug. 10, 2017	Aug. 09, 2018
AC Power Supply	DPS1060	HZTE001-06	Aug. 10, 2017	Aug. 09, 2018
DC Power Supply	WY12010	HZTE004-03	Aug. 10, 2017	Aug. 09, 2018
Temperature recorder	JM624U	HZTE018-08	Aug. 17, 2017	Aug. 16, 2018
Temperature and humidity recorder	JR900	HZTE018-01	Aug. 16, 2017	Aug. 15, 2018
Standard source	D908	HZTE012-01	Aug. 20, 2017	Aug. 19, 2018
Integrate Sphere system	2M	HZTE015-01	Aug. 23, 2017	Aug. 22, 2018
Digital Power Meter	WT210	HZTE008-01	Aug. 10, 2017	Aug. 09, 2018
AC Power Supply	PCR 500L	HZTE001-07	Aug. 10, 2017	Aug. 09, 2018
DC Power Supply	IT6154	HZTE004-04	Aug. 10, 2017	Aug. 09, 2018
Standard source	SCL-1400	HZTE012-02	Aug. 20, 2017	Aug. 19, 2018
Temperature and humidity recorder	JR900	HZTE018-02	Aug. 16, 2017	Aug. 15, 2018
Temperature Meter	TES1310	HZTE017-01	Aug. 17, 2017	Aug. 16, 2018

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.

### 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 expanded uncertainty is 2.1% 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 2.3% 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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