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: 9290019339

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ18060001b

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

Review by: April Zou

Engineer: April Zou

Jun. 06, 2018

Approved by: Jim Zhang

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: **9290019339**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
135.1	1124.0	8.32	0.9818

CCT (K)	CRI	Stabilization Time (Light & Power)
3488	82.5	60

Table 1: Executive Data Summary

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

Test specifications:

Date of Receipt	: Jun. 01, 2018
Date of Test	: Jun. 01, 2018
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	: TYPEB LED TUBE
Model	: 9290019339
Electrical Ratings	: 120-277V, 50/60Hz, 8.5W
Product Description	: 8.5T8PRO/24-835/BB11/G FB
Manufacturer	: Philips Lighting (China) Investment Co., Ltd
Address	: Building 9, Lane 888, Tianlin Road, Minhang District, Shanghai China

TEST RESULTS

Test ambient temperature was 25.0℃.

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	0.9818	0.9230
Test Power (W)	8.32	8.64
THD A%	18.19	21.39
Luminous Efficacy (lm/W)	135.1	131.0
Total Luminous Flux (lm)	1124.0	1132.0
Color Rendering Index (CRI)	82.5	
R9	4.3	
Correlated Color Temperature (CCT) (K)	3488	
Chromaticity Chroma x	0.4058	
Chromaticity Chroma y	0.3909	
Chromaticity Chroma u	0.2359	
Chromaticity Chroma v	0.3410	
Duv	0.0002	
Chromaticity Chroma u ’	0.2359	
Chromaticity Chroma v’	0.5114	

Special Color Rendering Indices	
R1	80.7
R2	91.2
R3	95.7
R4	79.8
R5	81.2
R6	88.4
R7	83.1
R8	59.8
R9	4.3
R10	79.6
R11	78.6
R12	69.3
R13	83.4
R14	98.2
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 24.6℃.

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)	0.071
Power Factor	0.9786
Test Power (W)	8.37
Luminous Efficacy (lm/W)	129.5
Total Luminous Flux (lm)	1084.3
Beam Angle (°)	107.9 (0°-180°)/ 211.2 (90°-270°)
Center Beam Candle Power (cd)	192
Maximum Beam Candle Power (cd)	192.1 (At: C=80.0, Gamma=4.0)
Spacing Criteria	1.23 (0°-180°)/ 1.41 (90°-270°)
Zonal Lumens in the 0°-60°Zone	44.64%
Zonal Lumens in the 60°-90°Zone	27.02%
Zonal Lumens in the 90°-120°Zone	16.82%
Zonal Lumens in the 120°-180°Zone	11.52%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

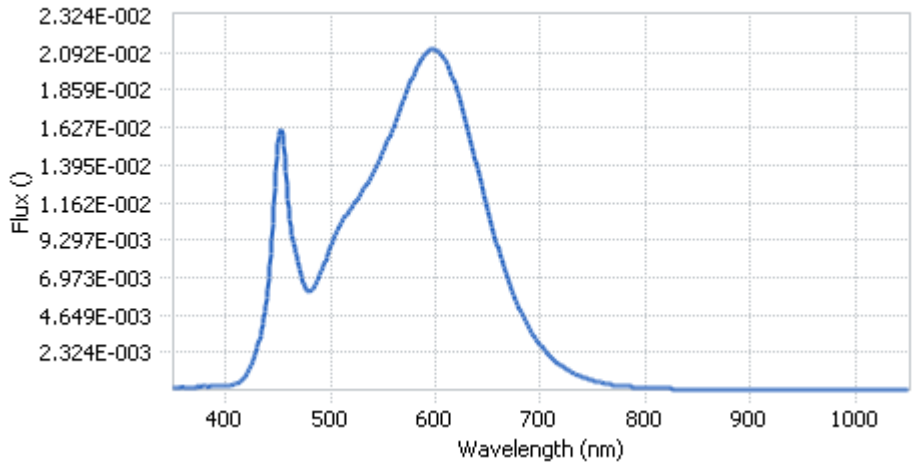
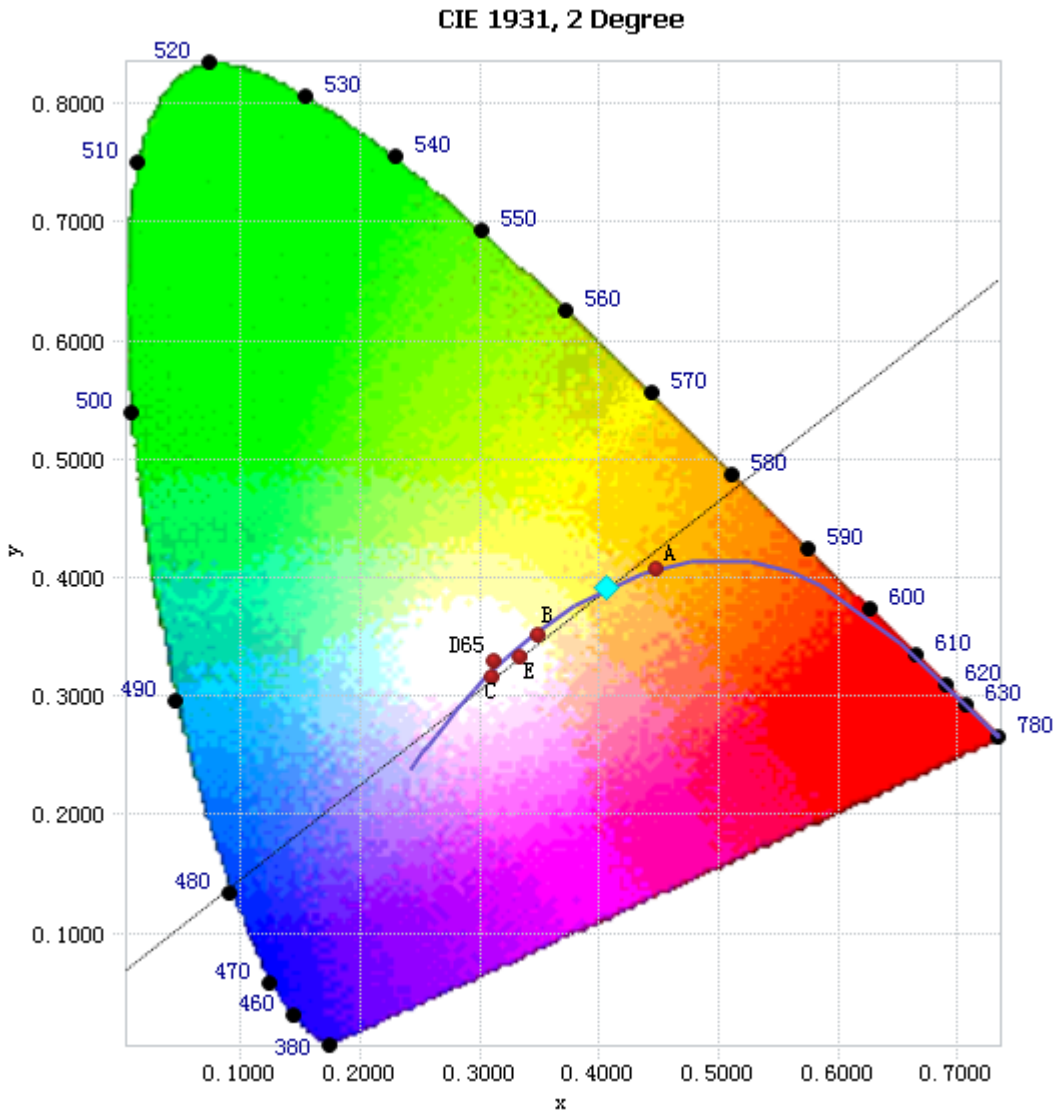


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.05E-04	485	6.52E-03	590	2.08E-02	695	3.22E-03
385	1.98E-04	490	7.20E-03	595	2.11E-02	700	2.77E-03
390	2.10E-04	495	8.02E-03	600	2.11E-02	705	2.38E-03
395	2.24E-04	500	8.95E-03	605	2.08E-02	710	2.02E-03
400	2.35E-04	505	9.76E-03	610	2.04E-02	715	1.74E-03
405	2.99E-04	510	1.04E-02	615	1.96E-02	720	1.48E-03
410	4.02E-04	515	1.09E-02	620	1.86E-02	725	1.28E-03
415	6.16E-04	520	1.14E-02	625	1.75E-02	730	1.09E-03
420	9.96E-04	525	1.18E-02	630	1.63E-02	735	9.34E-04
425	1.62E-03	530	1.23E-02	635	1.50E-02	740	7.95E-04
430	2.62E-03	535	1.28E-02	640	1.37E-02	745	6.81E-04
435	4.07E-03	540	1.34E-02	645	1.23E-02	750	5.82E-04
440	6.27E-03	545	1.41E-02	650	1.11E-02	755	5.02E-04
445	1.04E-02	550	1.48E-02	655	9.84E-03	760	4.31E-04
450	1.53E-02	555	1.55E-02	660	8.71E-03	765	3.71E-04
455	1.52E-02	560	1.63E-02	665	7.65E-03	770	3.19E-04
460	1.12E-02	565	1.72E-02	670	6.66E-03	775	2.77E-04
465	9.03E-03	570	1.81E-02	675	5.82E-03	780	2.38E-04
470	7.74E-03	575	1.89E-02	680	5.04E-03		
475	6.44E-03	580	1.97E-02	685	4.35E-03		
480	6.10E-03	585	2.04E-02	690	3.76E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4058, 0.3909)

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

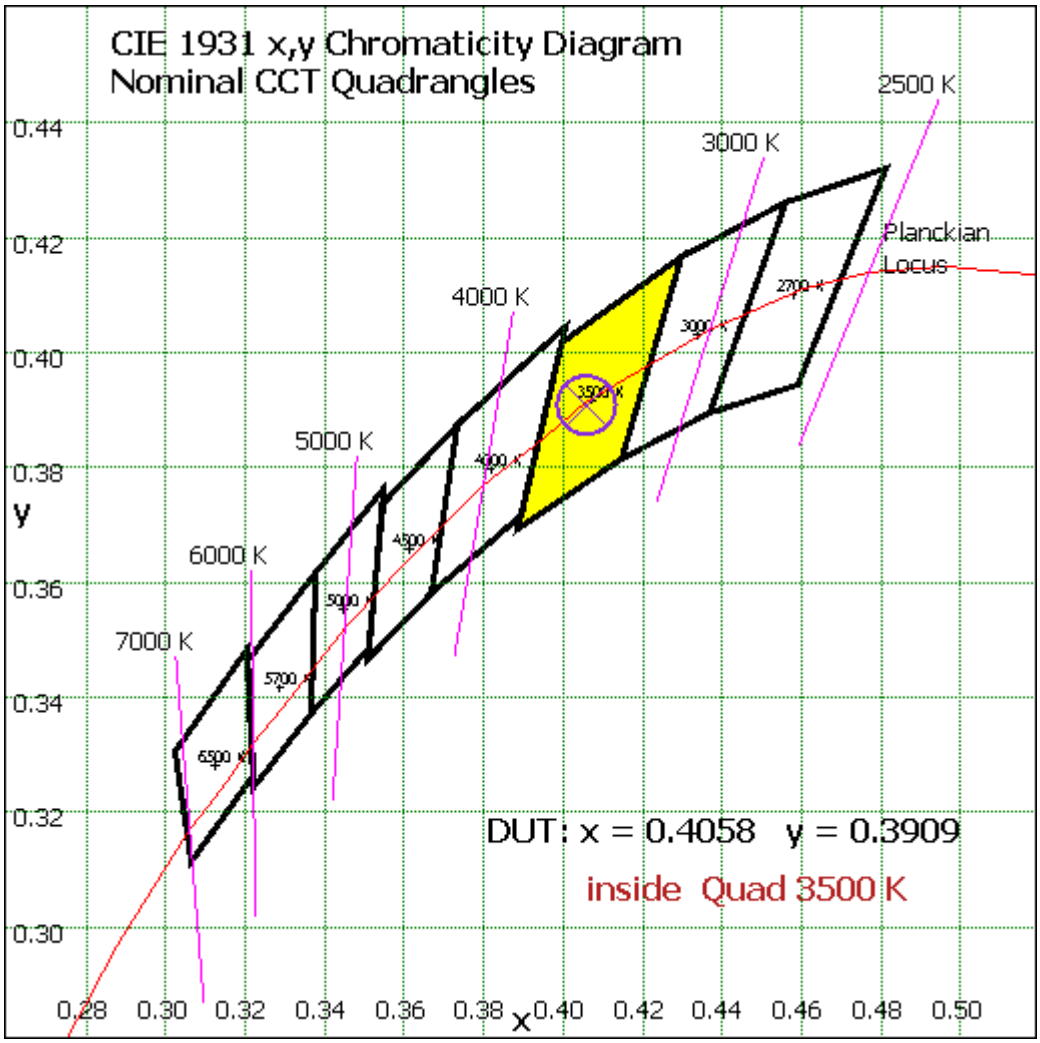


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

γ(°)	Lumens	% Total
0- 10	18.192	1.68%
10- 20	52.621	4.85%
20- 30	81.53	7.52%
30- 40	102.326	9.44%
40- 50	113.682	10.48%
50- 60	115.696	10.67%
60- 70	109.742	10.12%
70- 80	98.331	9.07%
80- 90	84.925	7.83%
90-100	72.424	6.68%
100-110	60.519	5.58%
110-120	49.385	4.55%
120-130	39.825	3.67%
130-140	31.954	2.95%
140-150	24.486	2.26%
150-160	16.992	1.57%
160-170	9.146	0.84%
170-180	2.5	0.23%
Total	1084.3	100%

γ(°)	Lumens	% Total
0- 60	484.047	44.64%
60- 90	292.998	27.02%
0-90	777.045	71.66%
90- 180	307.231	28.34%
0- 180	1084.3	100%

Table 5: Zonal Lumen Data

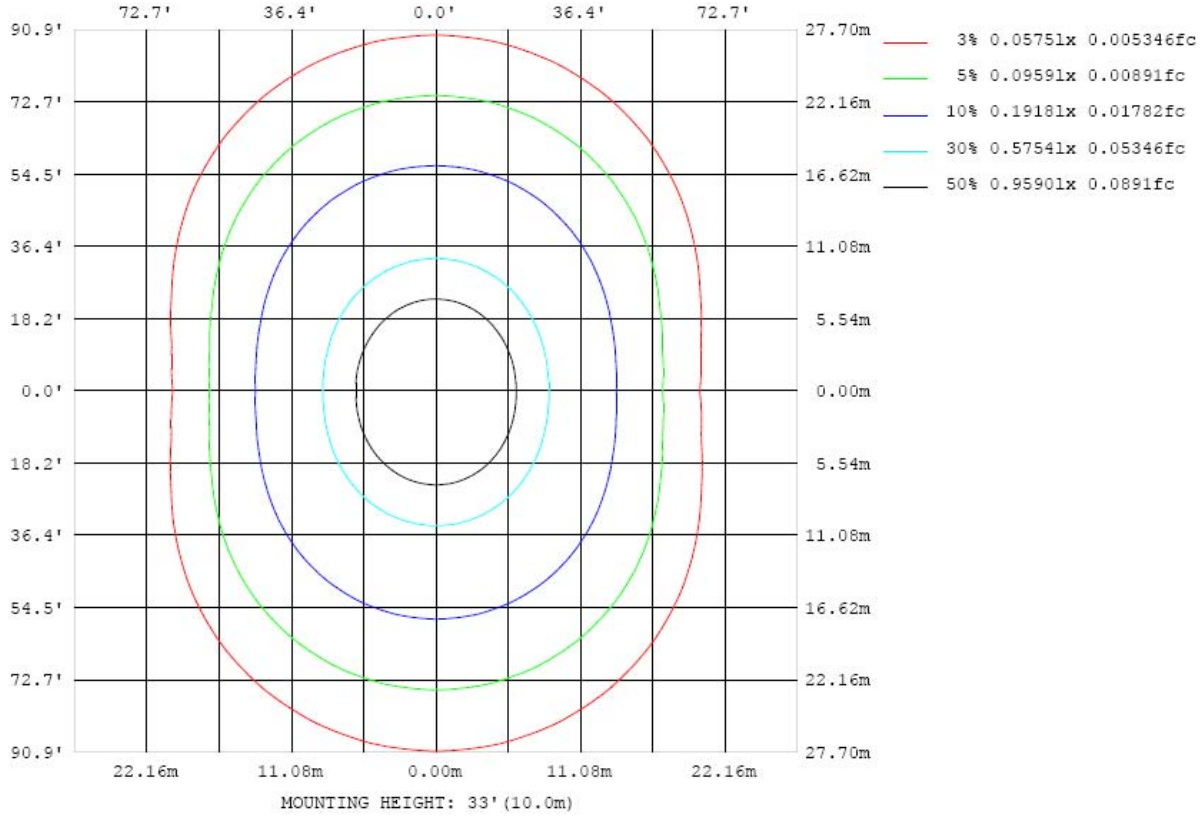


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

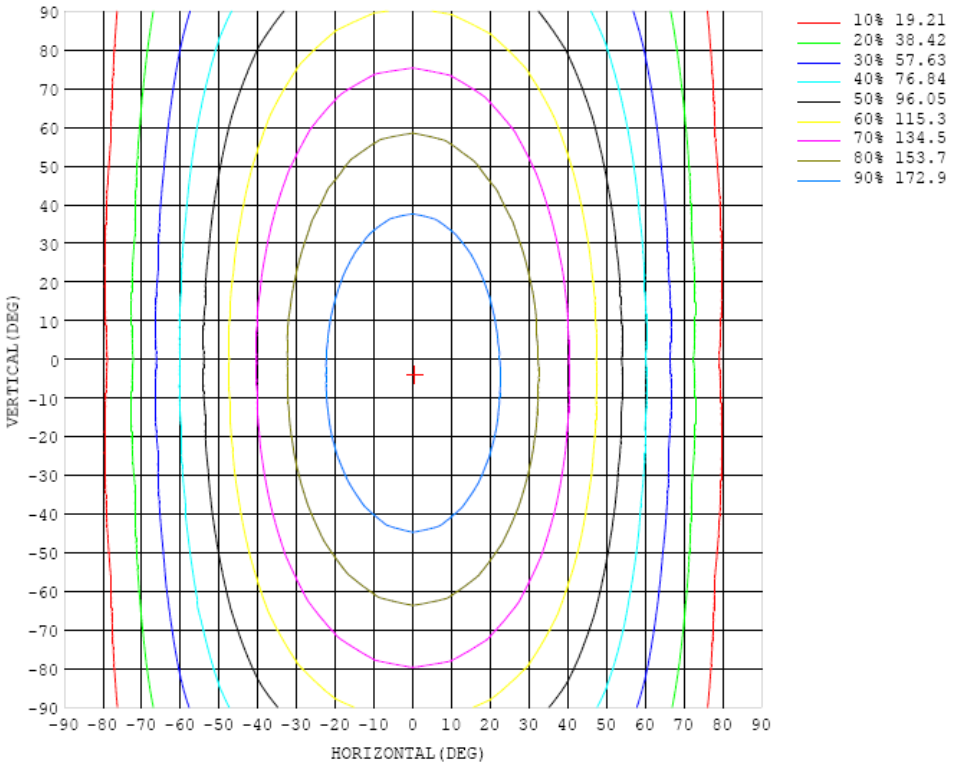


Chart 5: Isocandela Plot

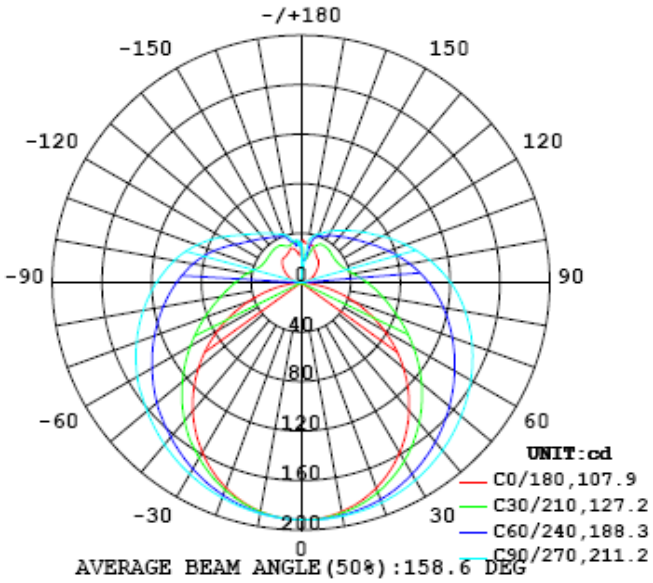


Chart 6: Polar Candela Distribution

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	192	192	192	192	192	192	192	192	192	192	192	192	192	192	192	192	192	192	192
5	191	191	191	191	192	192	192	192	192	192	192	192	192	192	191	191	191	191	191
10	188	188	189	189	190	190	191	191	192	192	192	191	191	190	190	189	189	188	188
15	183	184	185	186	187	188	189	190	191	191	191	190	189	188	187	185	184	183	183
20	177	177	179	180	182	185	187	188	189	189	189	188	186	184	182	180	178	177	177
25	168	169	171	174	177	180	183	185	187	187	187	185	183	180	177	174	171	169	168
30	159	160	162	166	171	175	179	182	184	184	184	181	178	174	170	166	162	160	159
35	148	149	153	158	163	169	174	178	180	181	180	177	173	168	163	157	152	149	148
40	135	137	142	148	155	162	168	173	176	177	176	173	168	161	154	147	141	137	135
45	122	124	130	137	146	155	162	168	172	173	171	167	161	154	145	137	129	124	122
50	108	110	117	127	137	147	156	163	167	168	166	162	155	146	136	126	117	110	108
55	92.8	96.1	104	115	128	139	149	157	162	163	161	156	149	139	127	115	104	95.6	92.8
60	77.3	81.3	91.4	105	119	132	143	151	156	158	156	150	142	131	118	104	90.8	80.7	77.1
65	62.0	66.7	78.5	93.9	110	124	136	145	150	152	150	144	135	123	109	93.4	77.9	66.1	61.3
70	46.2	52.1	66.6	83.8	101	117	129	139	145	146	144	138	129	116	101	83.3	66.1	51.5	45.3
75	30.8	38.1	55.3	74.6	93.4	110	123	133	138	140	138	132	122	109	92.7	74.3	55.0	37.6	29.9
80	16.8	25.8	45.6	66.8	86.1	103	116	126	132	134	132	126	116	102	85.5	66.5	45.4	25.6	16.1
85	6.02	16.5	37.8	59.7	79.2	96.2	110	120	126	128	125	119	109	95.7	78.8	59.5	37.8	16.6	5.26
90	0.63	11.2	31.8	53.4	72.8	89.5	103	113	119	121	118	112	103	89.2	72.5	53.4	32.0	11.5	0.47
95	1.16	8.52	27.1	47.6	66.8	82.8	95.8	105	111	113	111	105	95.4	82.5	66.6	47.8	27.5	8.95	1.31
100	2.55	8.53	24.0	42.7	60.9	76.1	88.6	97.8	103	105	103	97.6	88.3	75.9	60.7	43.0	24.5	9.25	2.91
105	4.80	9.67	22.5	38.9	55.5	69.7	81.6	90.3	95.7	97.4	95.6	90.3	81.5	69.6	55.4	39.2	23.2	10.6	5.30
110	7.53	11.6	22.2	36.1	50.9	64.3	75.0	83.1	88.1	89.8	88.1	83.0	74.8	64.2	50.8	36.6	23.5	12.8	8.01
115	10.2	14.3	22.8	34.4	47.1	59.0	68.9	76.2	80.8	82.4	80.9	76.2	68.8	58.9	47.2	35.5	24.4	15.3	10.6
120	12.4	16.9	24.0	33.5	44.5	54.6	63.3	69.8	73.8	75.2	73.9	69.7	63.2	54.7	44.9	34.9	25.6	17.5	13.1
125	14.5	19.4	25.5	33.2	42.5	51.3	58.8	64.4	67.9	69.0	67.9	64.4	58.8	51.6	43.2	34.7	26.9	19.5	16.0
130	17.0	21.5	27.4	33.4	41.0	48.6	55.0	59.8	62.8	63.8	62.8	59.8	55.1	48.9	41.9	34.9	28.2	21.4	18.7
135	19.8	23.0	29.2	34.0	40.0	46.3	51.7	55.7	58.3	59.2	58.3	55.8	51.9	46.8	41.0	35.0	29.2	23.0	21.3
140	22.3	24.0	30.7	34.7	39.5	44.4	48.8	52.2	54.3	55.0	54.3	52.3	49.1	45.0	40.3	34.8	30.0	24.1	23.5
145	23.5	24.1	30.8	35.2	38.6	42.9	46.4	49.0	50.8	51.4	50.8	49.2	46.7	43.5	39.0	34.9	28.4	24.5	24.5
150	24.8	23.5	30.5	35.2	38.3	40.5	44.3	46.4	47.7	48.2	47.7	46.5	44.7	41.7	38.4	34.8	26.6	24.2	24.7
155	27.1	23.7	28.6	34.2	37.4	39.8	41.3	42.7	44.5	45.1	44.9	44.1	42.8	40.2	37.9	33.7	26.4	23.5	25.7
160	29.5	24.3	24.4	30.8	35.5	37.7	39.7	40.8	41.6	42.2	42.1	41.4	40.3	37.9	35.8	30.2	23.6	22.1	27.5
165	31.1	26.9	22.2	22.6	26.9	30.5	35.4	38.3	39.0	39.2	39.3	38.0	31.6	27.7	27.5	23.4	20.4	21.8	28.9
170	32.6	25.7	20.0	18.9	19.0	19.1	19.4	20.1	24.9	30.3	16.4	16.4	17.3	19.3	19.0	18.6	18.6	20.2	27.2
175	33.2	28.6	22.9	19.0	18.2	18.0	18.2	16.5	13.2	5.58	16.2	18.4	17.9	17.7	17.7	17.9	18.5	20.5	23.2
180	31.9	31.9	31.9	31.9	31.9	31.9	31.9	31.9	31.9	31.9	31.9	31.9	31.9	31.9	31.9	31.9	31.9	31.9	31.9

Table 6: 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	192	192	192	192	192	192	192	192	192	192	192	192	192	192	192	192	192
5	191	191	191	191	191	191	191	191	191	191	191	191	191	191	191	191	191
10	188	188	188	188	189	189	189	190	190	189	189	189	189	188	188	188	188
15	183	183	184	185	186	186	187	187	188	187	187	186	186	185	184	183	183
20	177	177	178	180	181	183	184	185	185	185	184	183	181	180	178	177	177
25	169	170	172	174	176	179	181	182	182	182	181	179	176	174	172	170	168
30	159	161	164	167	171	174	177	178	179	178	176	174	170	167	163	161	159
35	149	152	156	160	164	169	172	174	175	174	172	168	164	159	155	151	148
40	137	140	146	152	158	163	167	170	171	170	167	163	157	151	145	140	136
45	124	129	135	143	151	157	162	165	166	165	162	157	150	143	135	128	123
50	110	116	125	134	143	151	157	160	162	160	157	151	143	133	124	116	110
55	95.7	103	114	125	136	145	152	156	157	156	151	144	135	124	113	103	95.6
60	80.8	90.2	103	116	128	138	146	151	152	150	145	138	127	115	102	90.1	80.9
65	65.8	77.5	92.3	107	121	132	140	145	146	145	139	131	120	106	91.7	77.4	66.3
70	51.2	65.4	82.5	99.0	114	125	134	139	141	139	133	125	112	98.0	81.8	65.3	51.8
75	37.5	54.4	73.4	91.3	107	119	128	133	135	133	127	118	106	90.2	72.7	54.2	38.1
80	25.6	44.9	65.5	84.2	100	113	122	127	129	127	121	112	98.8	83.0	64.7	44.6	26.1
85	16.7	37.5	58.7	77.7	93.7	106	116	121	123	121	115	105	92.4	76.4	57.7	36.9	16.8
90	11.8	32.1	53.0	71.8	87.6	100	109	115	116	114	108	99.1	86.3	70.4	51.9	31.3	11.3
95	9.33	28.4	48.3	66.5	81.9	94.1	103	108	110	108	102	93.0	80.5	65.1	47.1	27.4	8.47
100	9.07	24.9	43.8	61.3	76.3	88.2	96.9	102	104	102	96.1	87.2	75.0	59.9	42.4	23.5	7.70
105	10.3	23.0	39.5	55.9	70.2	81.7	90.1	95.1	96.6	94.7	89.3	80.7	68.9	54.4	37.9	21.2	9.11
110	12.6	22.8	36.1	50.8	64.1	74.9	82.9	87.7	89.1	87.3	82.1	73.9	62.8	49.1	34.2	20.5	11.6
115	14.9	23.5	34.4	46.3	58.3	68.2	75.6	80.1	81.4	79.7	74.9	67.2	56.8	44.5	32.2	20.8	13.8
120	16.8	24.9	33.7	43.5	53.1	61.8	68.5	72.6	73.9	72.2	67.8	60.7	51.6	41.5	31.3	22.5	15.7
125	19.5	26.3	33.5	41.6	49.6	56.5	61.8	65.4	66.5	65.0	61.1	55.3	48.0	39.7	31.0	24.5	17.8
130	22.0	27.6	33.8	40.4	46.9	52.6	57.0	59.7	60.5	59.3	56.2	51.5	45.5	38.5	31.6	26.3	20.4
135	23.4	28.4	34.2	39.5	44.8	49.4	53.0	55.2	55.9	54.9	52.3	48.5	43.5	37.9	32.6	27.6	22.2
140	24.8	29.4	34.6	38.9	43.0	46.7	49.7	51.5	52.0	51.2	49.1	46.0	42.1	37.7	33.7	28.8	23.7
145	26.8	30.2	34.8	38.4	41.7	44.6	46.9	48.3	48.7	48.0	46.4	44.0	40.9	37.7	34.3	29.7	26.1
150	29.4	30.0	34.7	38.1	40.5	42.7	44.5	45.5	45.8	45.4	44.1	42.3	40.1	37.7	34.2	29.4	28.9
155	30.2	30.2	33.0	37.2	39.6	41.2	42.5	43.3	43.5	43.1	42.3	41.0	39.4	37.0	32.8	30.7	30.6
160	31.5	31.5	31.5	34.4	37.5	39.6	40.7	41.3	41.5	41.3	40.7	39.7	37.8	34.6	32.3	32.5	32.6
165	31.9	32.6	32.0	32.0	34.1	35.5	36.8	37.8	38.3	38.0	37.2	35.9	34.4	33.4	33.3	33.9	33.8
170	31.4	33.2	33.4	32.7	31.9	32.6	34.0	34.3	34.3	34.3	34.2	34.1	34.1	34.3	34.7	34.7	34.6
175	25.9	28.9	32.2	34.1	33.1	31.0	30.9	33.1	35.0	35.2	35.1	35.3	35.4	35.4	35.3	35.1	34.6
180	31.9	31.9	31.9	31.9	31.9	31.9	31.9	31.9	31.9	31.9	31.9	31.9	31.9	31.9	31.9	31.9	31.9

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 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 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 expended uncertainty is 2.3% with a coverage factor k=2.

Color Characteristics Measurements

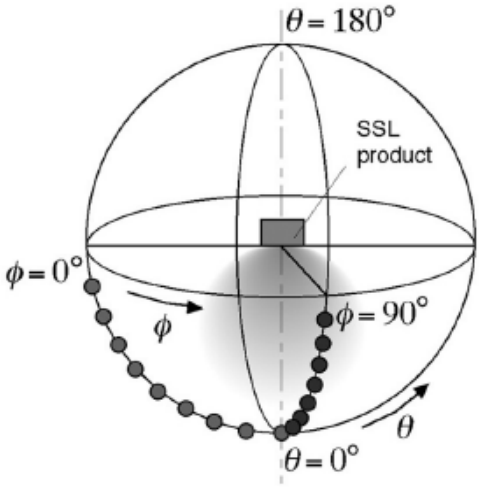
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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