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: 9290019342

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ18060001e

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: **9290019342**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
123.3	1385.0	11.23	0.9889

CCT (K)	CRI	Stabilization Time (Light & Power)
3087	82.6	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. 04, 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	: 9290019342
Electrical Ratings	: 120-277V, 50/60Hz, 11.5W
Product Description	: 11.5T8PRO/36-830/BB13/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 24.9℃.

Base orientation was horizontal. 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)	0.095	0.044
Power Factor	0.9889	0.9262
Test Power (W)	11.23	11.26
THD A%	13.60	20.36
Luminous Efficacy (lm/W)	123.3	121.9
Total Luminous Flux (lm)	1385.0	1373.0
Color Rendering Index (CRI)	82.6	
R9	6.9	
Correlated Color Temperature (CCT) (K)	3087	
Chromaticity Chroma x	0.4308	
Chromaticity Chroma y	0.4021	
Chromaticity Chroma u	0.2475	
Chromaticity Chroma v	0.3465	
Duv	0.0005	
Chromaticity Chroma u ’	0.2475	
Chromaticity Chroma v’	0.5197	

Special Color Rendering Indices	
R1	81.6
R2	93.4
R3	93.4
R4	78.9
R5	82.1
R6	92.1
R7	81.1
R8	58
R9	6.9
R10	84.9
R11	78
R12	73.7
R13	84.8
R14	96.9
Rf	83
Rg	93

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)	0.096
Power Factor	0.9860
Test Power (W)	11.27
Luminous Efficacy (lm/W)	119.2
Total Luminous Flux (lm)	1343.4
Beam Angle (°)	109.2 (0°-180°)/ 209.6 (90°-270°)
Center Beam Candle Power (cd)	237
Maximum Beam Candle Power (cd)	237.0 (At: C=60.0, Gamma=1.5)
Spacing Criteria	1.24 (0°-180°)/ 1.40 (90°-270°)
Zonal Lumens in the 0°-60°Zone	44.28%
Zonal Lumens in the 60°-90°Zone	26.60%
Zonal Lumens in the 90°-120°Zone	16.93%
Zonal Lumens in the 120°-180°Zone	12.19%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

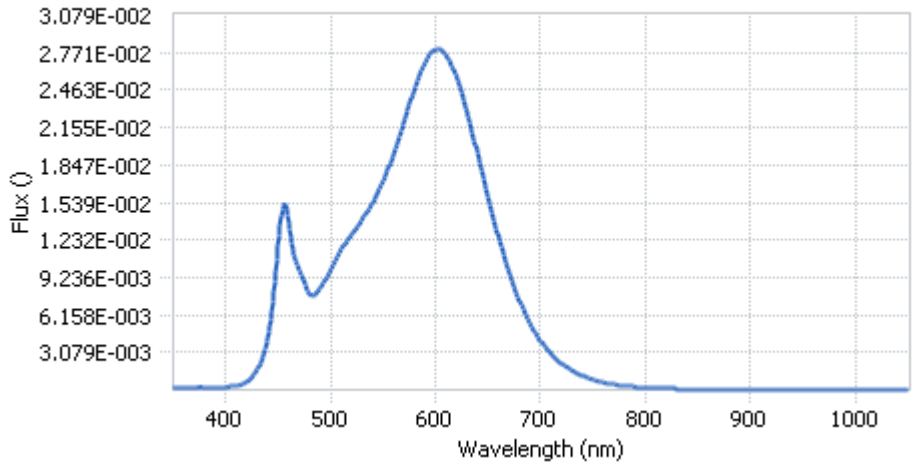
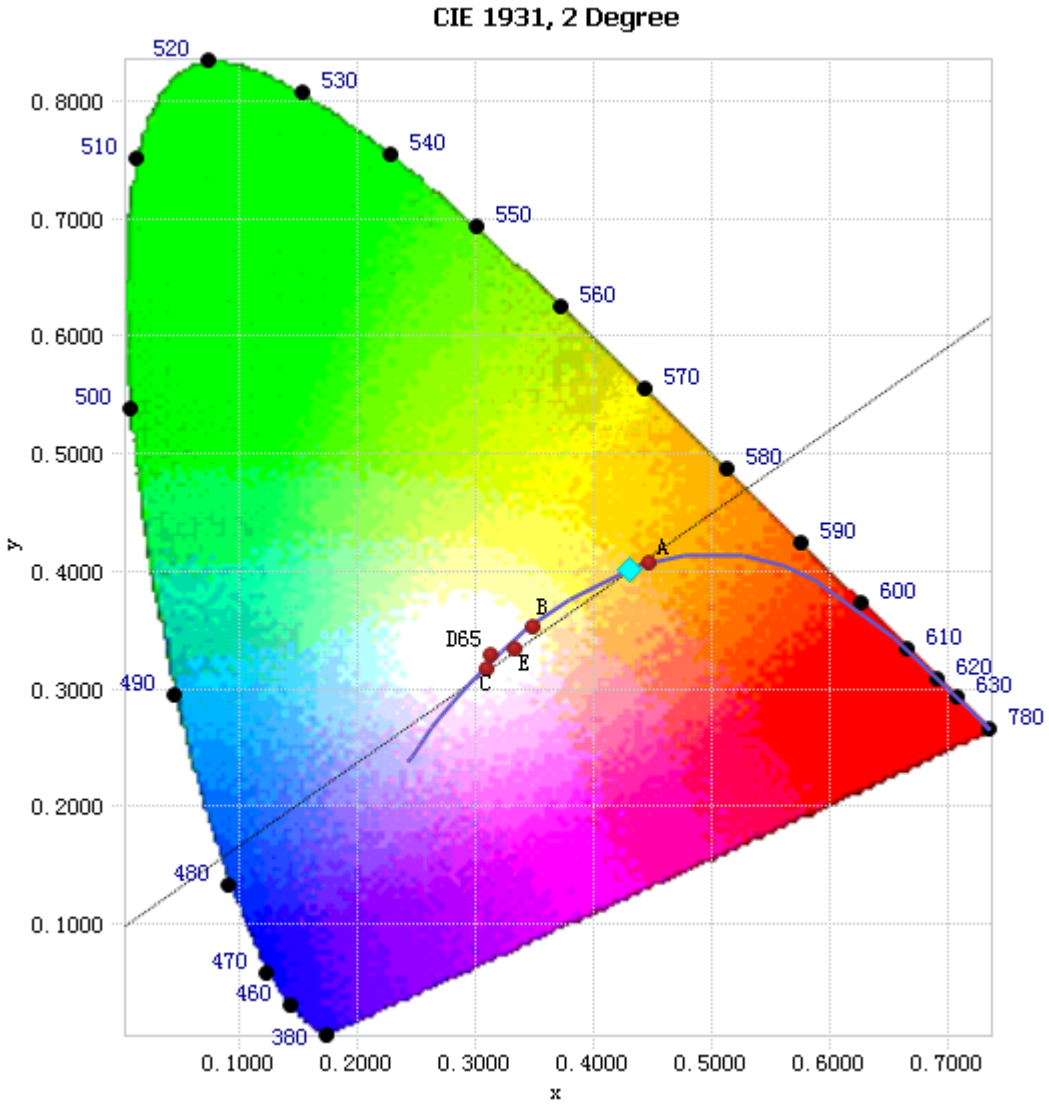


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.22E-04	485	7.80E-03	590	2.68E-02	695	4.71E-03
385	1.97E-04	490	8.36E-03	595	2.76E-02	700	4.04E-03
390	2.01E-04	495	9.04E-03	600	2.79E-02	705	3.48E-03
395	2.27E-04	500	9.87E-03	605	2.79E-02	710	2.96E-03
400	2.33E-04	505	1.08E-02	610	2.75E-02	715	2.53E-03
405	2.68E-04	510	1.15E-02	615	2.67E-02	720	2.15E-03
410	3.38E-04	515	1.22E-02	620	2.56E-02	725	1.85E-03
415	4.66E-04	520	1.28E-02	625	2.43E-02	730	1.58E-03
420	6.83E-04	525	1.33E-02	630	2.28E-02	735	1.35E-03
425	1.07E-03	530	1.40E-02	635	2.12E-02	740	1.15E-03
430	1.68E-03	535	1.46E-02	640	1.94E-02	745	9.80E-04
435	2.67E-03	540	1.54E-02	645	1.75E-02	750	8.34E-04
440	4.32E-03	545	1.63E-02	650	1.58E-02	755	7.20E-04
445	7.19E-03	550	1.72E-02	655	1.41E-02	760	6.14E-04
450	1.18E-02	555	1.82E-02	660	1.25E-02	765	5.26E-04
455	1.51E-02	560	1.94E-02	665	1.10E-02	770	4.53E-04
460	1.38E-02	565	2.07E-02	670	9.65E-03	775	3.87E-04
465	1.11E-02	570	2.20E-02	675	8.44E-03	780	3.36E-04
470	9.92E-03	575	2.34E-02	680	7.33E-03		
475	8.81E-03	580	2.48E-02	685	6.34E-03		
480	7.84E-03	585	2.60E-02	690	5.47E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4308, 0.4021)

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

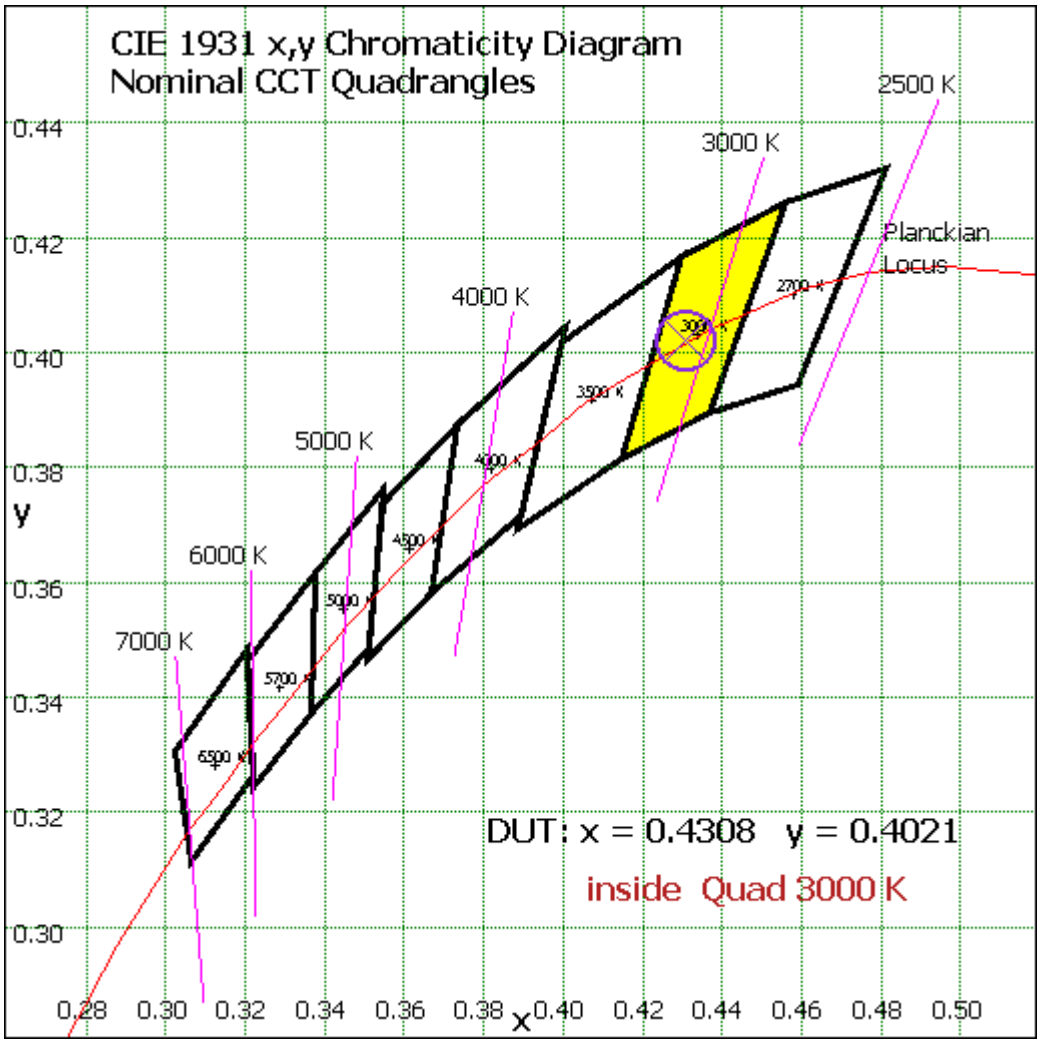


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

γ(°)	Lumens	% Total
0- 10	22.46	1.67%
10- 20	64.917	4.83%
20- 30	100.437	7.48%
30- 40	125.794	9.36%
40- 50	139.488	10.38%
50- 60	141.725	10.55%
60- 70	134.123	9.98%
70- 80	119.875	8.92%
80- 90	103.423	7.70%
90-100	88.866	6.61%
100-110	75.548	5.62%
110-120	63.055	4.69%
120-130	51.751	3.85%
130-140	41.684	3.10%
140-150	32.094	2.39%
150-160	22.433	1.67%
160-170	12.294	0.92%
170-180	3.471	0.26%
Total	1343.4	100%

γ(°)	Lumens	% Total
0- 60	594.821	44.28%
60- 90	357.421	26.60%
0-90	952.242	70.88%
90- 180	391.196	29.12%
0- 180	1343.4	100%

Table 5: Zonal Lumen Data

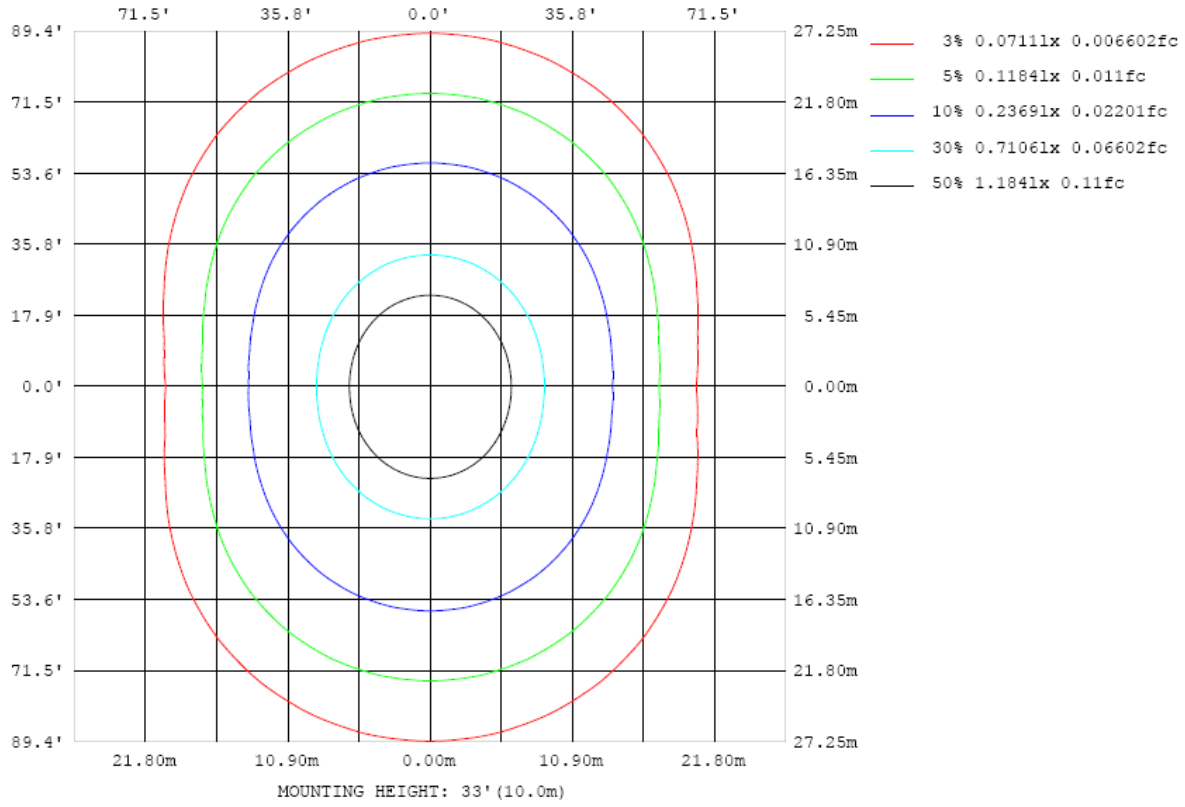


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

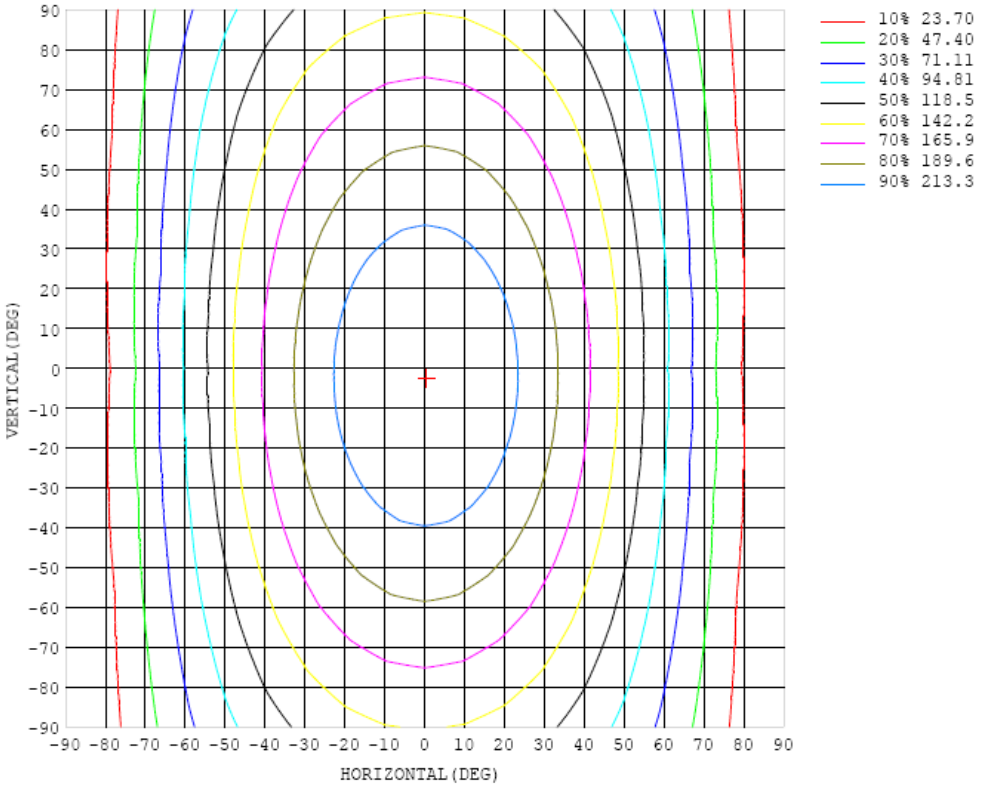


Chart 5: Isocandela Plot

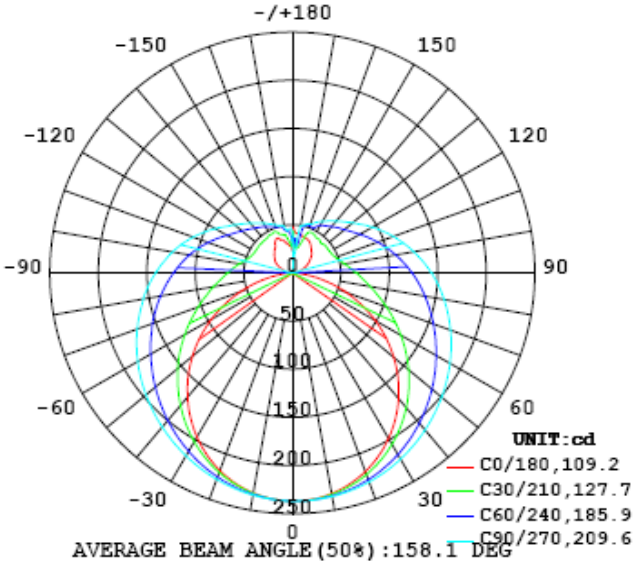


Chart 6: Polar Candela Distribution

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	237	237	237	237	237	237	237	237	237	237	237	237	237	237	237	237	237	237	237
5	236	236	236	236	236	236	237	237	237	237	237	237	237	236	236	236	236	236	236
10	233	233	233	234	234	235	235	235	236	236	236	235	235	234	234	233	233	232	232
15	227	228	228	229	230	231	232	233	234	234	234	233	232	231	230	228	227	227	226
20	220	220	221	223	225	227	228	230	231	231	231	230	228	226	224	222	220	219	218
25	210	211	212	215	218	221	224	226	227	227	227	225	223	220	217	214	211	209	209
30	198	199	202	205	210	214	218	221	223	223	222	220	217	213	209	204	200	198	197
35	185	186	190	195	200	206	211	215	217	218	217	215	210	205	199	193	188	185	183
40	170	172	176	183	190	197	204	209	212	213	212	208	203	196	189	181	175	170	168
45	154	156	162	170	179	188	196	202	206	207	206	202	195	187	178	168	160	154	152
50	137	139	146	156	168	178	188	195	199	201	199	195	187	178	166	155	144	137	135
55	118	121	130	143	156	169	180	188	193	194	193	187	179	168	155	141	128	119	116
60	98.7	103	114	129	145	159	171	180	186	188	186	180	171	158	144	127	112	100	96.6
65	78.8	84.2	98.2	116	134	150	163	173	179	181	179	173	163	149	133	114	96.0	81.7	76.7
70	59.0	65.8	82.7	103	123	141	155	165	171	173	171	165	155	140	122	102	80.7	63.6	56.9
75	39.5	48.3	69.0	91.7	113	132	147	157	164	166	164	158	147	132	113	90.4	67.2	46.1	37.4
80	21.6	32.8	56.7	81.5	104	123	139	150	157	159	157	150	139	123	104	80.5	55.2	30.9	19.7
85	7.31	21.0	47.0	72.8	96.2	116	131	142	149	151	149	143	131	116	95.9	72.2	45.9	19.7	6.07
90	0.38	14.5	40.0	66.1	88.9	108	124	134	141	143	141	135	124	108	88.8	65.7	39.4	13.8	0.43
95	1.43	11.9	35.0	59.9	81.9	101	116	127	133	135	133	127	116	101	82.1	59.9	34.9	11.8	1.49
100	3.89	12.1	31.8	54.7	75.6	93.7	108	119	125	127	125	119	109	94.2	76.1	55.2	32.3	12.6	3.89
105	7.25	14.0	30.2	50.6	69.9	87.0	101	111	117	119	117	111	101	87.7	70.7	51.5	31.2	14.7	7.30
110	11.0	16.5	30.1	47.5	65.4	80.8	93.7	103	109	111	109	104	94.4	81.7	66.3	48.7	31.6	17.7	11.0
115	14.8	19.8	31.0	45.6	61.1	75.0	86.9	95.6	101	103	101	96.2	87.6	76.0	62.2	47.1	32.7	21.0	14.8
120	18.5	23.2	32.4	44.6	57.8	69.9	80.4	88.4	93.4	95.2	93.8	89.0	81.2	70.9	59.2	46.3	34.2	24.0	18.7
125	21.7	26.2	34.1	44.3	55.5	66.1	74.8	81.6	86.1	87.7	86.5	82.3	75.7	67.2	56.9	46.0	36.0	26.8	21.9
130	25.0	28.9	35.9	44.3	53.7	62.8	70.2	75.9	79.7	81.0	80.0	76.6	71.0	63.8	55.1	45.8	37.7	29.6	23.9
135	28.3	31.3	36.5	43.0	52.6	59.9	66.5	71.0	74.2	75.3	74.4	71.6	67.2	60.9	54.0	44.8	38.5	31.5	26.4
140	30.7	32.8	38.9	44.2	51.4	57.6	62.9	66.9	69.8	70.2	69.6	67.5	63.6	58.5	52.6	44.7	40.0	32.6	28.6
145	33.3	33.1	41.3	44.2	48.5	55.8	59.8	63.0	65.1	65.9	65.4	63.5	60.4	56.5	49.9	44.6	42.3	32.7	31.3
150	36.4	31.9	42.6	45.7	48.4	51.7	57.1	59.7	61.2	61.9	61.5	60.1	57.8	53.0	47.9	45.0	43.1	31.6	35.9
155	38.1	30.8	41.0	46.4	48.6	50.4	51.5	55.2	57.4	58.1	58.1	56.8	54.2	49.3	48.3	46.8	42.7	31.1	39.0
160	38.9	31.5	33.5	42.9	48.7	50.4	52.2	53.5	54.0	54.3	54.6	53.5	48.4	47.8	45.2	43.0	36.3	30.0	36.7
165	39.9	30.3	28.3	30.4	35.0	48.4	51.0	51.6	52.1	52.1	52.4	45.5	40.3	36.7	35.6	34.1	29.5	28.8	34.9
170	41.3	28.8	25.9	26.5	25.9	25.0	29.8	34.8	46.3	49.5	28.5	28.7	29.9	29.4	28.0	27.8	27.5	28.0	31.5
175	41.6	34.7	30.1	31.0	30.7	32.1	35.3	37.2	37.1	20.4	39.3	38.9	37.0	34.7	32.0	29.8	29.2	28.5	28.8
180	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0

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	237	237	237	237	237	237	237	237	237	237	237	237	237	237	237	237	237		
5	236	236	236	236	236	236	236	236	236	236	236	236	236	236	236	236	236		
10	232	232	232	233	233	233	234	234	234	234	234	234	234	233	233	233	233		
15	226	227	227	228	229	230	231	231	232	232	231	231	230	229	228	228	227		
20	219	219	220	222	224	226	227	228	228	228	227	226	225	223	222	220	220		
25	209	210	212	215	218	220	222	223	224	224	223	221	218	216	213	212	210		
30	197	199	202	206	210	214	217	219	219	219	217	214	211	207	204	201	199		
35	184	187	192	197	202	207	211	213	214	214	211	208	203	198	193	189	186		
40	170	174	180	187	194	200	205	208	209	208	205	200	194	188	181	175	172		
45	154	159	167	176	185	192	198	202	203	202	198	193	185	177	168	161	156		
50	137	145	154	165	175	184	191	196	197	196	192	185	176	166	156	146	140		
55	120	129	141	154	166	177	184	189	191	189	185	177	167	155	142	130	122		
60	101	113	128	144	157	169	177	182	184	182	177	169	158	144	129	114	103		
65	82.9	97.4	115	133	149	161	170	176	177	176	170	161	149	133	116	98.3	84.6		
70	64.8	82.6	103	123	140	154	163	168	170	168	163	154	140	123	103	83.0	66.2		
75	47.7	69.0	92.4	114	132	146	155	161	163	161	155	145	131	113	91.9	68.8	48.6		
80	32.9	57.4	82.6	105	123	138	148	154	156	154	148	138	123	104	81.8	56.6	33.0		
85	21.9	48.1	74.0	96.8	116	130	141	147	149	147	140	130	115	96.0	73.0	46.8	21.1		
90	15.7	41.3	66.9	89.4	108	123	133	139	141	139	133	122	107	88.5	65.6	39.7	14.2		
95	12.7	36.5	60.9	82.7	101	115	125	131	133	131	125	115	100	81.8	59.6	34.9	11.1		
100	12.6	32.5	55.4	76.4	94.1	108	118	124	126	124	118	107	93.4	75.4	54.1	30.8	10.9		
105	14.5	30.7	50.6	70.1	86.9	100	110	116	117	115	110	99.8	86.3	69.2	49.2	28.8	13.2		
110	17.1	30.6	47.1	64.4	80.0	92.5	102	107	109	107	101	92.1	79.4	63.4	45.6	28.5	16.3		
115	20.3	31.7	45.3	59.8	73.6	85.1	93.5	98.7	100	98.6	93.4	84.7	72.9	58.7	43.6	29.3	19.6		
120	24.1	33.2	44.5	56.7	68.3	78.1	85.8	90.5	92.1	90.4	85.6	77.6	67.4	55.5	42.6	31.3	22.8		
125	26.3	34.3	44.4	54.5	64.3	72.6	78.8	82.8	84.1	82.7	78.5	71.9	63.4	53.2	42.4	33.6	25.7		
130	27.6	36.4	44.6	52.9	61.1	68.1	73.4	76.7	77.8	76.5	73.0	67.4	60.2	51.6	42.9	36.0	29.0		
135	30.7	37.7	44.4	51.8	58.5	64.2	68.6	71.4	72.3	71.2	68.3	63.6	57.6	50.6	43.8	38.1	32.4		
140	34.7	40.3	44.6	50.8	56.3	60.9	64.5	66.8	67.5	66.6	64.2	60.4	55.5	50.1	44.7	40.0	35.0		
145	36.2	40.9	44.9	49.7	54.4	58.1	60.9	62.7	63.3	62.6	60.7	57.6	53.9	49.6	45.5	41.4	36.7		
150	36.0	42.4	45.9	48.9	52.2	55.4	57.8	59.2	59.7	59.1	57.7	55.3	52.3	49.2	46.2	43.0	38.4		
155	38.6	41.9	46.4	48.4	50.9	52.9	54.5	55.6	56.1	55.8	54.7	53.2	51.2	49.0	47.1	43.4	40.5		
160	41.2	40.0	44.8	48.6	49.5	50.8	52.3	53.1	53.4	53.3	52.6	51.4	50.1	49.2	47.0	43.6	42.8		
165	39.4	41.7	41.7	45.1	48.9	50.1	50.6	50.9	51.0	51.1	51.0	50.6	49.7	48.0	45.3	44.4	44.4		
170	34.7	36.8	39.8	41.1	42.4	45.3	46.9	48.0	48.5	48.5	48.0	47.0	45.7	44.9	45.1	45.9	46.1		
175	30.1	30.5	32.2	34.4	37.9	42.7	45.6	45.8	45.4	45.5	45.6	45.8	46.0	46.3	46.5	46.5	45.4		
180	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0		

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

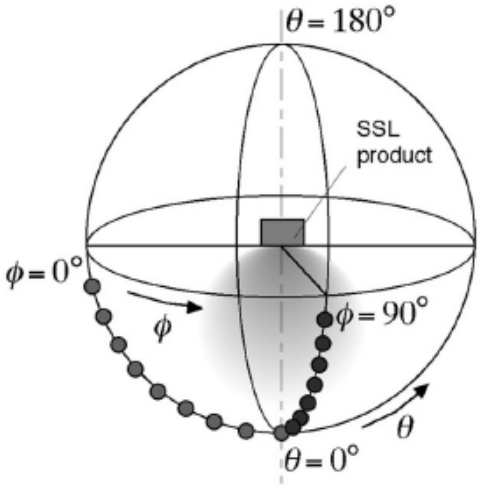
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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