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: 9290019343

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ18060001f

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:

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: **9290019343**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
127.2	1445.0	11.36	0.9890

CCT (K)	CRI	Stabilization Time (Light & Power)
3528	83.2	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	: 9290019343
Electrical Ratings	: 120-277V, 50/60Hz, 11.5W
Product Description	: 11.5T8PRO/36-835/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)	0.096	0.044
Power Factor	0.9890	0.9275
Test Power (W)	11.36	11.40
THD A%	13.61	20.34
Luminous Efficacy (lm/W)	127.2	125.8
Total Luminous Flux (lm)	1445.0	1434.0
Color Rendering Index (CRI)	83.2	
R9	7.5	
Correlated Color Temperature (CCT) (K)	3528	
Chromaticity Chroma x	0.4037	
Chromaticity Chroma y	0.3902	
Chromaticity Chroma u	0.2349	
Chromaticity Chroma v	0.3405	
Duv	0	
Chromaticity Chroma u ’	0.2349	
Chromaticity Chroma v’	0.5108	

Special Color Rendering Indices	
R1	81.4
R2	90.9
R3	96.3
R4	81.3
R5	81.9
R6	88.1
R7	84.2
R8	61.6
R9	7.5
R10	78.9
R11	80.5
R12	69.7
R13	83.8
R14	98.5
Rf	83
Rg	95

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	0.9861
Test Power (W)	11.39
Luminous Efficacy (lm/W)	122.9
Total Luminous Flux (lm)	1399.3
Beam Angle (°)	109.2 (0°-180°)/ 210.6 (90°-270°)
Center Beam Candle Power (cd)	246
Maximum Beam Candle Power (cd)	245.9 (At: C=90.0, Gamma=2.0)
Spacing Criteria	1.24 (0°-180°)/ 1.41 (90°-270°)
Zonal Lumens in the 0°-60°Zone	44.22%
Zonal Lumens in the 60°-90°Zone	26.67%
Zonal Lumens in the 90°-120°Zone	16.99%
Zonal Lumens in the 120°-180°Zone	12.12%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

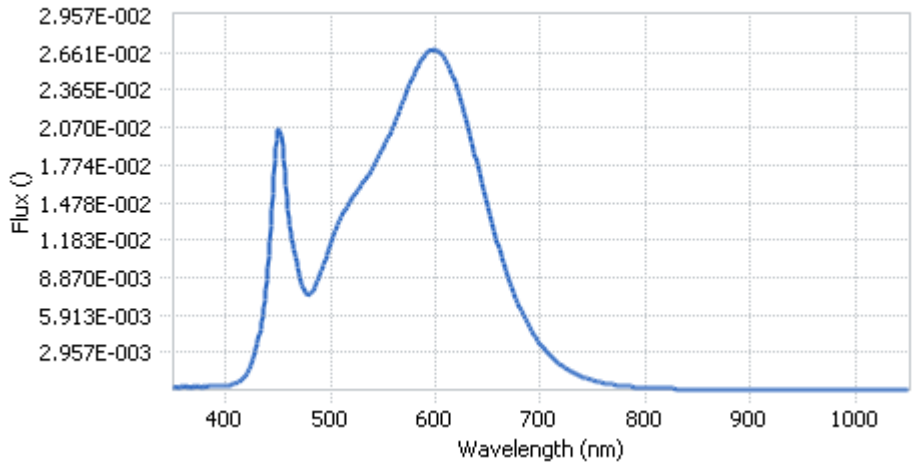
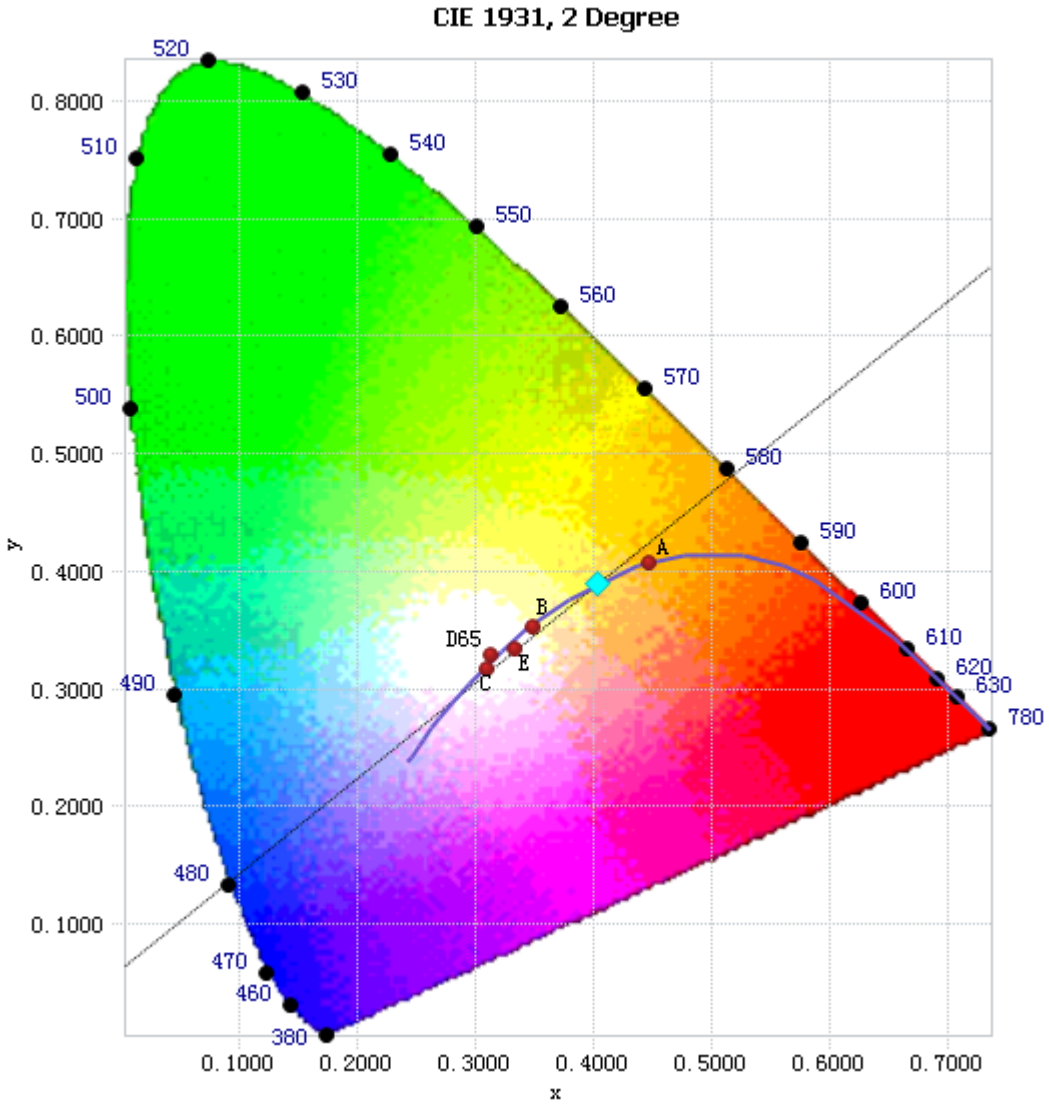


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.66E-04	485	8.11E-03	590	2.64E-02	695	4.20E-03
385	2.50E-04	490	9.11E-03	595	2.67E-02	700	3.61E-03
390	2.67E-04	495	1.03E-02	600	2.68E-02	705	3.08E-03
395	2.80E-04	500	1.16E-02	605	2.65E-02	710	2.63E-03
400	3.23E-04	505	1.27E-02	610	2.60E-02	715	2.25E-03
405	3.98E-04	510	1.36E-02	615	2.50E-02	720	1.92E-03
410	5.52E-04	515	1.45E-02	620	2.38E-02	725	1.64E-03
415	8.26E-04	520	1.51E-02	625	2.25E-02	730	1.41E-03
420	1.31E-03	525	1.56E-02	630	2.10E-02	735	1.20E-03
425	2.21E-03	530	1.63E-02	635	1.94E-02	740	1.03E-03
430	3.62E-03	535	1.69E-02	640	1.77E-02	745	8.77E-04
435	5.84E-03	540	1.76E-02	645	1.60E-02	750	7.52E-04
440	9.59E-03	545	1.83E-02	650	1.44E-02	755	6.43E-04
445	1.55E-02	550	1.91E-02	655	1.28E-02	760	5.52E-04
450	2.05E-02	555	1.99E-02	660	1.13E-02	765	4.72E-04
455	1.82E-02	560	2.09E-02	665	9.94E-03	770	4.06E-04
460	1.35E-02	565	2.20E-02	670	8.68E-03	775	3.50E-04
465	1.11E-02	570	2.29E-02	675	7.56E-03	780	3.03E-04
470	9.25E-03	575	2.40E-02	680	6.56E-03		
475	7.81E-03	580	2.50E-02	685	5.67E-03		
480	7.58E-03	585	2.59E-02	690	4.87E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4037, 0.3902)

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

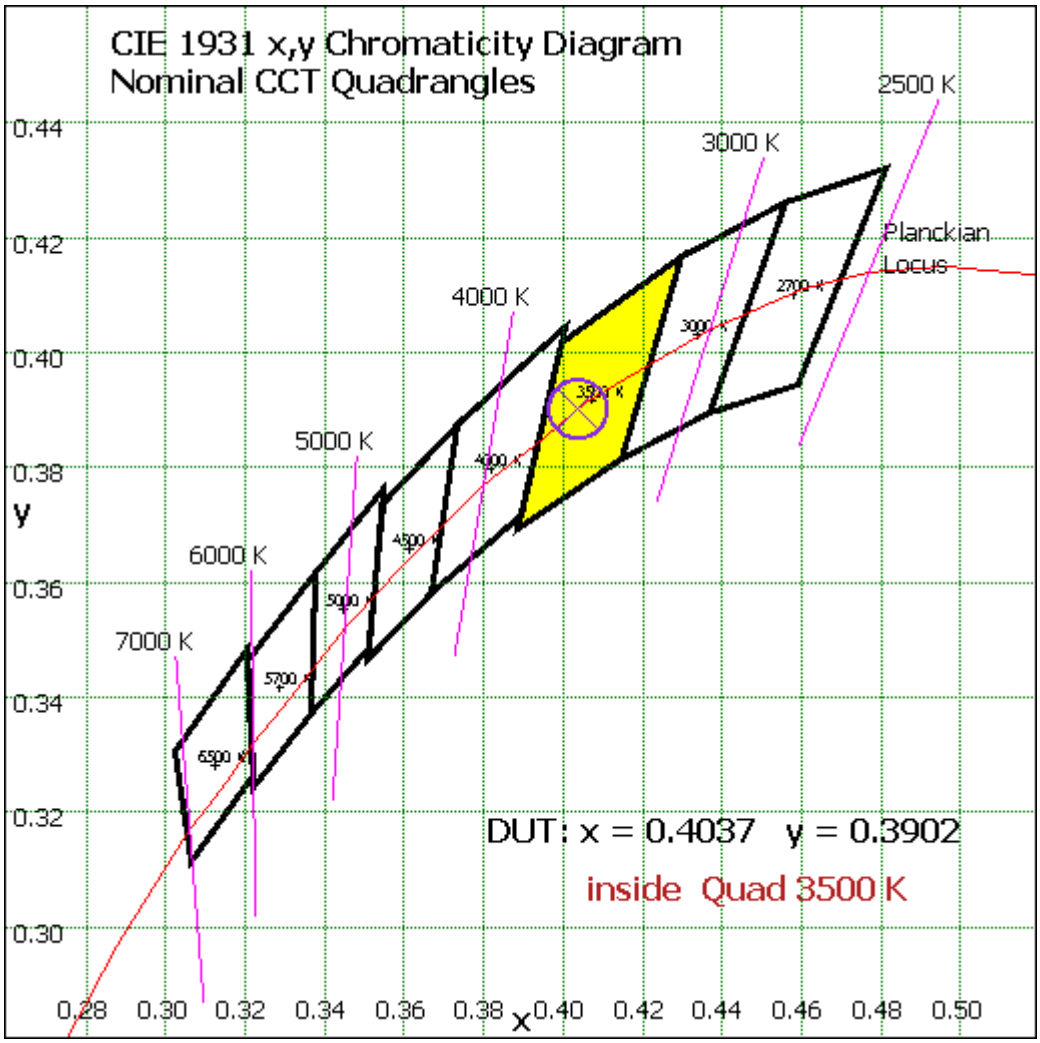


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

γ(°)	Lumens	% Total
0- 10	23.304	1.67%
10- 20	67.392	4.82%
20- 30	104.362	7.46%
30- 40	130.852	9.35%
40- 50	145.231	10.38%
50- 60	147.671	10.55%
60- 70	139.865	10.00%
70- 80	125.144	8.94%
80- 90	108.176	7.73%
90-100	93.066	6.65%
100-110	78.913	5.64%
110-120	65.707	4.70%
120-130	53.835	3.85%
130-140	43.208	3.09%
140-150	33.052	2.36%
150-160	23.185	1.66%
160-170	12.886	0.92%
170-180	3.456	0.25%
Total	1399.3	100%

γ(°)	Lumens	% Total
0- 60	618.812	44.22%
60- 90	373.185	26.67%
0-90	991.997	70.89%
90- 180	407.308	29.11%
0- 180	1399.3	100%

Table 5: Zonal Lumen Data

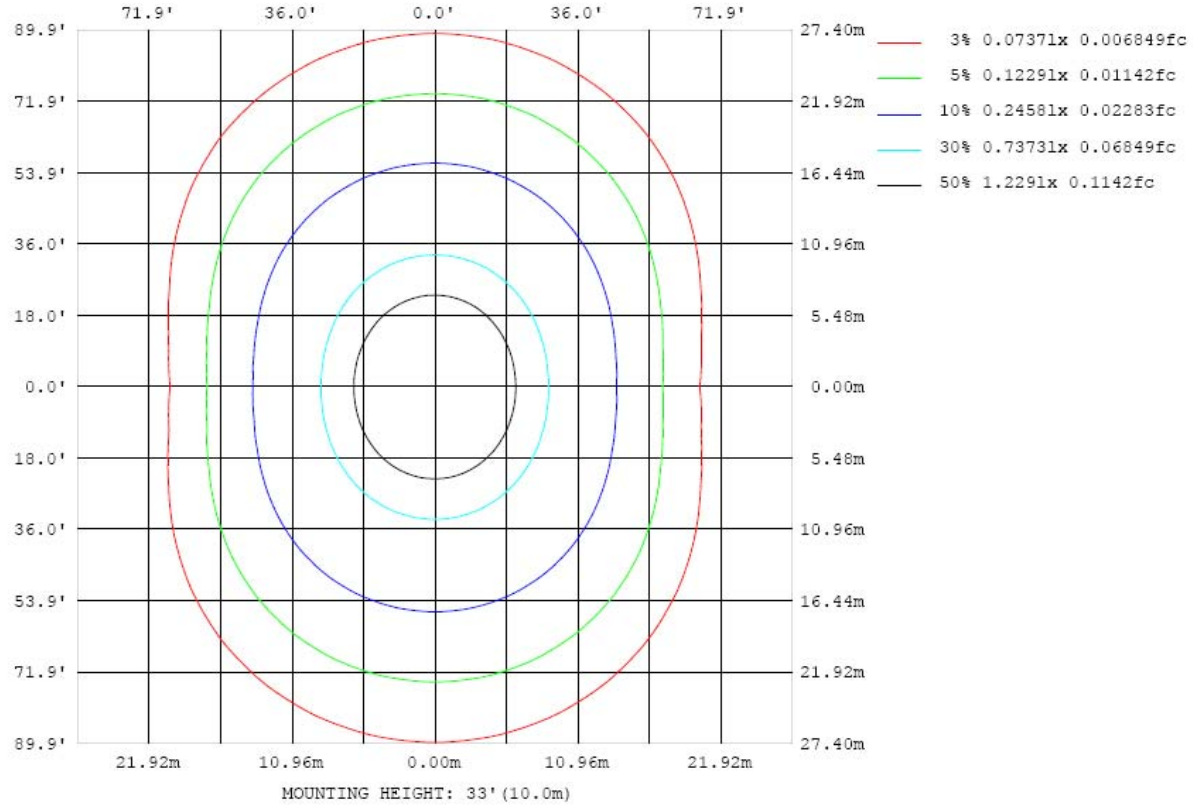


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

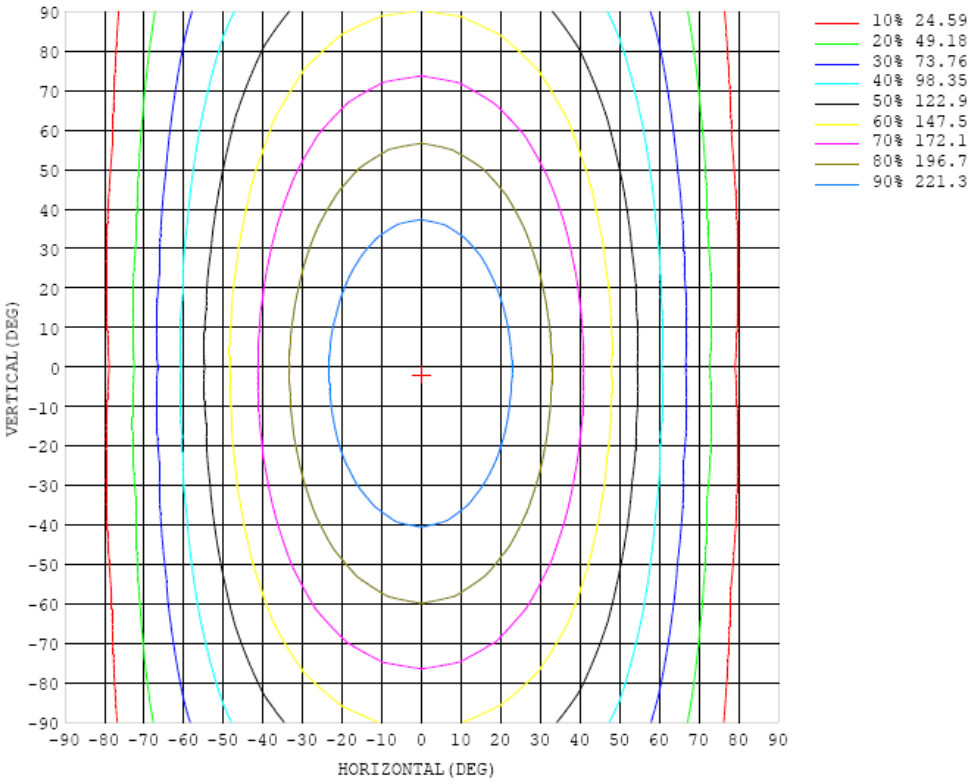


Chart 5: Isocandela Plot

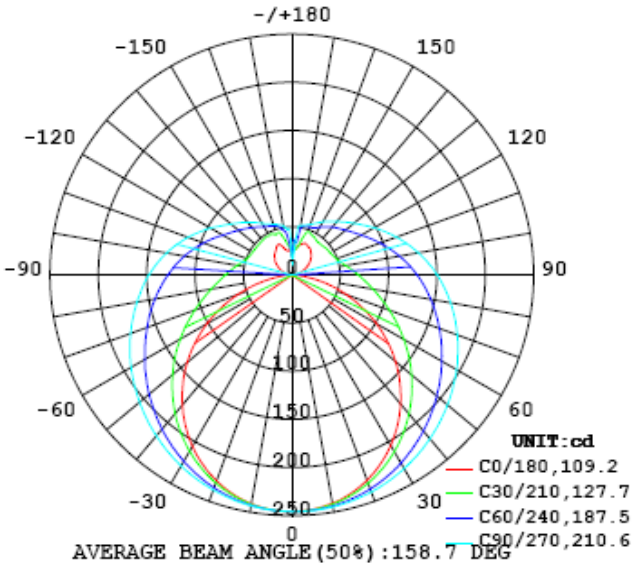


Chart 6: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1 UNIT: cd

γ (DEG) \ C(DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	246	246	246	246	246	246	246	246	246	246	246	246	246	246	246	246	246	246	246
5	244	245	245	245	245	245	245	245	246	246	246	245	245	245	245	245	245	245	245
10	241	241	241	242	242	243	244	244	244	245	244	244	244	243	243	242	242	241	241
15	235	235	236	237	238	239	241	242	242	243	242	242	241	240	239	238	237	236	236
20	227	227	228	230	232	235	237	238	239	240	240	239	237	235	233	231	229	228	228
25	217	217	219	222	225	228	231	234	236	236	236	234	232	229	226	223	220	218	218
30	205	205	208	212	216	221	225	229	231	232	232	229	226	222	218	213	209	207	206
35	190	192	195	201	207	213	219	223	226	227	227	224	220	214	208	202	197	193	192
40	175	177	181	188	196	204	211	217	221	222	221	218	212	205	198	190	183	178	176
45	158	160	166	175	185	195	204	210	215	216	215	211	205	196	186	177	168	162	159
50	140	143	150	161	174	186	196	203	208	210	208	204	196	187	175	163	152	144	141
55	121	125	134	148	162	176	187	196	201	203	202	197	188	177	163	149	135	125	122
60	101	105	118	134	151	166	179	189	194	197	195	189	180	167	152	135	119	106	101
65	80.4	86.3	101	120	139	157	171	181	187	189	187	181	171	157	140	121	102	86.5	80.5
70	60.2	67.5	85.4	107	129	147	162	173	180	182	180	174	163	148	130	108	86.2	67.5	59.4
75	40.0	49.4	71.0	95.6	119	138	154	165	172	174	172	166	155	139	120	96.7	71.4	49.6	39.0
80	21.6	33.4	58.7	85.2	109	130	146	157	164	167	164	158	146	131	110	86.3	59.8	33.8	20.5
85	7.14	21.2	48.7	76.2	101	121	138	149	156	159	156	149	138	122	102	77.5	50.1	22.2	6.38
90	0.50	14.4	41.4	68.7	93.1	114	130	141	148	150	148	141	130	115	94.3	69.7	43.0	15.9	0.36
95	1.51	11.6	36.0	62.3	85.7	106	121	133	139	142	140	133	122	107	87.0	63.9	37.8	13.1	1.53
100	3.98	12.1	32.4	56.6	78.8	97.9	113	124	131	133	131	124	114	98.9	80.2	58.4	34.4	13.7	3.68
105	7.44	14.1	31.0	52.1	72.5	90.6	105	115	122	124	122	116	106	91.6	74.0	53.9	32.9	15.6	6.55
110	11.1	16.2	30.9	49.0	67.4	83.7	97.1	107	113	115	113	107	98.0	84.8	68.3	50.7	33.1	17.9	9.79
115	14.8	19.1	31.6	47.1	63.1	77.5	89.7	98.7	104	106	105	99.4	90.7	78.6	64.5	49.1	34.0	21.1	13.0
120	18.7	22.6	32.3	46.0	59.9	72.2	82.9	91.1	96.2	98.1	96.6	91.7	83.7	73.3	61.5	48.1	34.7	23.6	16.3
125	22.3	26.0	33.3	45.3	57.5	68.3	77.2	84.2	88.7	90.3	88.9	84.7	78.1	69.2	59.0	47.3	35.9	26.8	19.6
130	25.6	29.4	34.5	44.5	55.4	65.0	72.4	78.4	82.3	83.7	82.5	78.9	73.3	66.0	56.9	46.2	37.3	29.8	22.9
135	28.2	32.2	36.4	43.7	53.5	61.9	68.5	73.3	76.5	77.7	76.7	73.8	69.2	62.9	54.9	45.2	37.6	32.1	25.1
140	30.8	34.1	39.1	43.6	51.1	58.9	64.9	69.0	71.5	72.4	71.6	69.3	65.7	59.9	52.4	45.6	41.3	33.3	27.8
145	33.1	35.8	41.5	44.1	49.0	55.4	61.1	65.0	67.3	68.1	67.5	65.5	62.1	57.2	50.4	45.4	44.2	33.7	29.8
150	33.9	36.3	43.5	45.7	48.0	52.0	57.1	60.9	62.9	63.7	63.2	61.5	58.2	53.2	49.5	48.3	45.8	33.0	32.4
155	35.1	34.7	44.9	46.9	49.1	51.1	54.0	57.0	58.8	59.4	58.9	56.5	53.5	52.0	50.3	49.0	47.6	31.7	34.5
160	34.7	30.3	40.8	47.7	50.0	51.4	53.1	54.3	55.5	55.9	55.6	54.9	53.8	51.5	49.4	46.9	42.8	27.4	32.4
165	32.5	28.1	32.0	36.9	49.4	51.3	52.2	52.9	53.3	53.8	53.6	52.7	48.8	42.5	39.6	37.9	33.8	23.8	27.9
170	28.6	25.7	27.3	28.3	28.9	35.6	45.2	51.3	52.1	52.1	49.0	36.7	32.4	31.3	30.4	29.1	24.2	22.5	25.6
175	31.6	29.9	28.3	29.7	33.3	34.2	33.7	35.1	32.9	20.9	27.1	35.5	36.3	34.9	32.2	29.8	28.6	27.4	27.1
180	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3

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	246	246	246	246	246	246	246	246	246	246	246	246	246	246	246	246	246		
5	245	245	245	245	245	245	245	245	245	245	245	245	245	245	245	244	244		
10	241	241	242	242	242	243	243	243	243	243	243	243	242	242	241	241	241		
15	236	236	237	238	239	240	240	241	241	241	240	239	238	237	236	235	235		
20	228	229	230	232	234	235	237	237	238	237	236	235	233	231	229	228	227		
25	218	220	221	224	227	230	232	233	234	233	232	229	226	223	221	218	217		
30	206	208	211	216	220	224	227	228	229	228	226	223	219	215	211	207	205		
35	193	196	200	206	211	217	221	223	224	223	220	216	211	205	199	194	191		
40	178	182	188	195	202	209	214	217	218	217	214	208	202	194	187	181	176		
45	161	167	175	184	193	201	207	211	212	211	207	200	192	183	174	166	160		
50	144	151	161	172	183	193	200	204	206	204	199	192	183	172	160	150	143		
55	125	135	147	161	173	184	192	197	199	197	192	184	173	160	147	134	125		
60	106	118	133	150	164	176	185	190	192	190	184	175	163	149	133	117	106		
65	86.4	101	120	138	154	167	177	183	185	183	177	167	154	138	119	101	86.7		
70	67.0	85.1	107	128	146	159	169	176	177	175	169	159	145	127	107	85.6	67.8		
75	48.8	70.6	95.0	118	137	152	162	168	170	168	161	151	136	117	94.8	71.1	49.9		
80	33.0	58.2	84.8	108	128	144	154	161	163	160	154	143	128	108	84.6	58.6	34.2		
85	21.3	48.6	76.0	100	120	136	147	154	155	153	146	135	120	99.5	75.7	48.7	22.1		
90	15.1	41.7	68.8	92.8	113	128	139	146	148	145	139	128	112	92.1	68.4	41.6	15.2		
95	12.4	37.0	62.8	86.1	106	121	132	138	140	138	131	120	105	85.4	62.3	36.7	12.3		
100	12.9	33.5	57.4	79.6	98.2	113	123	130	132	129	123	112	97.6	78.8	56.8	33.0	12.1		
105	15.2	32.1	52.9	73.4	91.0	105	115	121	123	121	115	105	90.4	72.6	52.1	31.0	14.4		
110	18.5	32.2	49.6	67.9	84.2	97.3	107	112	114	112	106	96.8	83.4	66.9	48.5	30.6	17.4		
115	21.7	33.3	47.9	63.2	77.7	89.9	98.7	104	106	104	98.2	89.3	76.9	62.1	46.4	31.4	20.3		
120	25.1	34.8	47.1	60.2	72.3	82.7	90.8	95.7	97.2	95.4	90.3	82.1	71.3	58.7	45.3	33.1	23.8		
125	28.1	36.4	46.8	57.8	68.2	77.0	83.6	87.7	89.1	87.5	83.1	76.2	67.1	56.3	45.0	34.7	27.0		
130	31.0	37.9	46.7	56.1	64.8	72.3	77.9	81.3	82.4	81.1	77.3	71.5	63.7	54.5	45.1	36.1	30.2		
135	33.3	39.8	46.9	54.5	61.8	68.1	72.8	75.7	76.6	75.5	72.3	67.4	60.7	52.8	45.1	38.0	33.5		
140	37.1	41.3	47.2	53.1	59.1	64.3	68.2	70.7	71.5	70.5	67.8	63.5	57.8	51.4	45.3	39.4	36.2		
145	38.9	42.0	47.6	52.3	56.6	60.7	64.0	66.0	66.6	65.7	63.4	59.8	55.5	50.9	45.9	41.0	38.7		
150	40.8	42.1	46.8	51.8	55.1	57.8	60.0	61.5	61.8	61.1	59.5	57.1	54.4	50.7	46.8	42.6	39.1		
155	42.7	44.0	46.8	50.8	54.0	55.9	57.4	58.3	58.6	58.2	57.2	55.5	53.1	50.6	47.5	44.6	41.5		
160	43.2	45.0	45.8	49.0	52.7	54.1	55.3	56.0	56.3	56.1	55.3	54.1	52.4	50.4	47.8	45.9	43.9		
165	36.6	40.6	44.6	46.1	48.7	51.9	53.4	53.8	54.1	53.9	53.2	52.3	51.2	50.0	48.6	47.5	43.7		
170	29.5	32.9	35.1	38.7	44.4	46.2	48.2	50.7	52.0	51.6	50.9	50.4	49.9	49.7	49.6	48.7	40.9		
175	28.7	29.2	29.9	29.2	30.4	34.0	41.1	46.1	47.8	47.5	47.3	47.8	48.1	48.2	46.3	40.5	34.2		
180	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3		

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

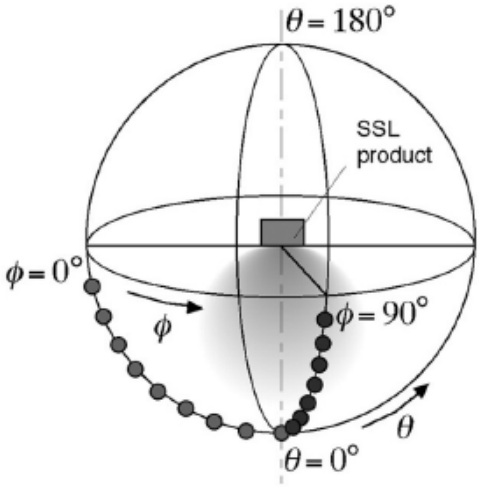
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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