

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: 9290019349

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ18050046d

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

Review by:



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Jun. 05, 2018

Approved by:



Manager: Jim Zhang
Jun. 05, 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: **9290019349**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
145.5	2173.0	14.93	0.9820
CCT (K)	CRI	Stabilization Time (Light & Power)	
5015	84.3	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 : May 25, 2018

Date of Test : May 25, 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	: 9290019349
Electrical Ratings	: 120-277V, 50/60Hz, 15.5W
Product Description	: 15.5T8-6U PRO/24-850/BB21/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°C.

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)	0.127	0.058
Power Factor	0.9820	0.9158
Test Power (W)	14.93	14.76
THD A%	17.77	21.90
Luminous Efficacy (lm/W)	145.5	146.3
Total Luminous Flux (lm)	2173.0	2159.0
Color Rendering Index (CRI)	84.3	
R9	11.6	
Correlated Color Temperature (CCT) (K)	5015	
Chromaticity Chroma x	0.3447	
Chromaticity Chroma y	0.3527	
Chromaticity Chroma u	0.2107	
Chromaticity Chroma v	0.3234	
Duv	0.0001	
Chromaticity Chroma u'	0.2107	
Chromaticity Chroma v'	0.4851	

Special Color Rendering Indices	
R1	82.8
R2	89.4
R3	93.7
R4	84.5
R5	84
R6	85.2
R7	86.7
R8	68.3
R9	11.6
R10	74.9
R11	84.4
R12	68.4
R13	84.5
R14	96.8
Rf	83
Rg	96

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 24.7°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)	0.128
Power Factor	0.9790
Test Power (W)	15.02
Luminous Efficacy (lm/W)	142.8
Total Luminous Flux (lm)	2144.7
Beam Angle (°)	106.2 (0°-180°)/ 167.1 (90°-270°)
Center Beam Candle Power (cd)	409
Maximum Beam Candle Power (cd)	409.3 (At: C=280.0, Gamma=3.0)
Spacing Criteria	1.22 (0°-180°)/ 1.42 (90°-270°)
Zonal Lumens in the 0°-60°Zone	46.75%
Zonal Lumens in the 60°-90°Zone	25.04%
Zonal Lumens in the 90°-120°Zone	14.98%
Zonal Lumens in the 120°-180°Zone	13.23%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

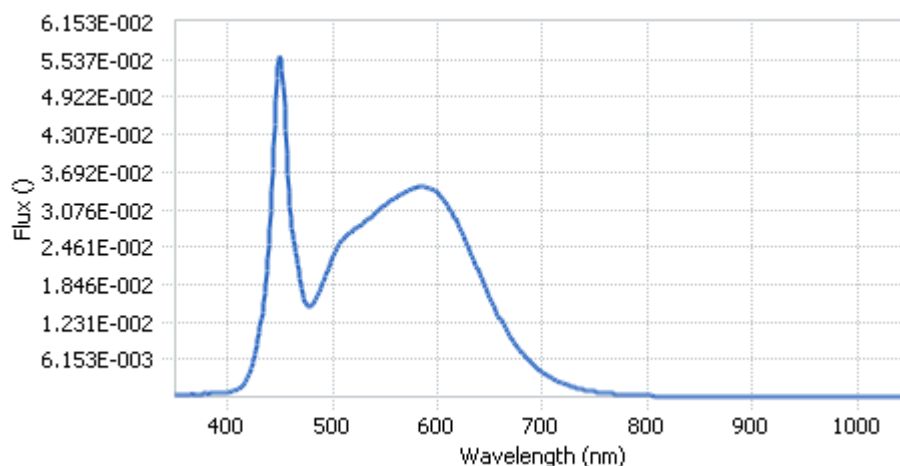
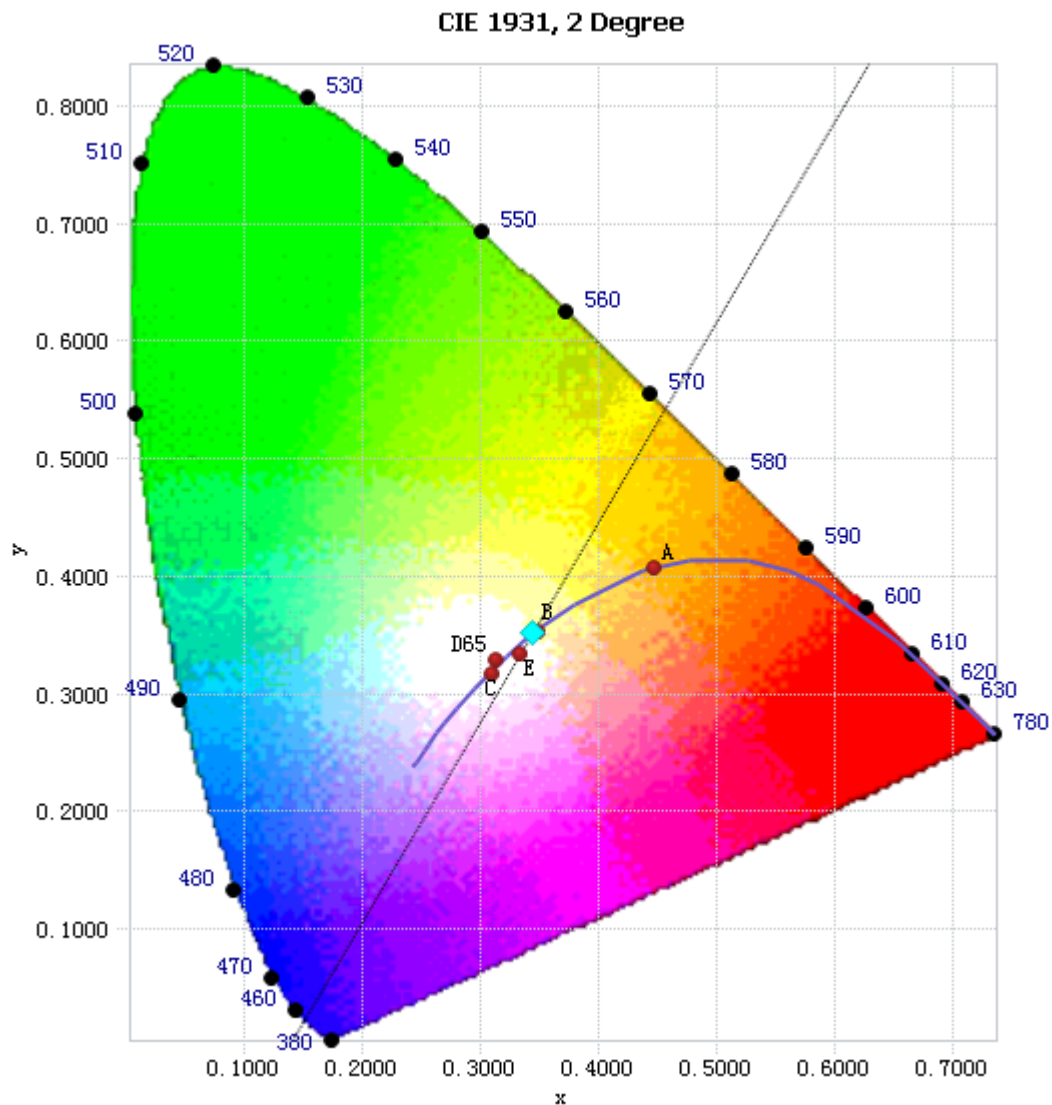


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	5.43E-04	485	1.64E-02	590	3.43E-02	695	4.70E-03
385	5.31E-04	490	1.83E-02	595	3.41E-02	700	4.03E-03
390	6.00E-04	495	2.07E-02	600	3.34E-02	705	3.45E-03
395	6.57E-04	500	2.30E-02	605	3.25E-02	710	2.94E-03
400	7.32E-04	505	2.47E-02	610	3.13E-02	715	2.52E-03
405	9.22E-04	510	2.58E-02	615	2.98E-02	720	2.18E-03
410	1.31E-03	515	2.69E-02	620	2.81E-02	725	1.86E-03
415	2.08E-03	520	2.75E-02	625	2.62E-02	730	1.59E-03
420	3.54E-03	525	2.80E-02	630	2.43E-02	735	1.37E-03
425	6.23E-03	530	2.87E-02	635	2.22E-02	740	1.17E-03
430	1.04E-02	535	2.92E-02	640	2.02E-02	745	9.97E-04
435	1.71E-02	540	3.02E-02	645	1.81E-02	750	8.61E-04
440	2.76E-02	545	3.09E-02	650	1.62E-02	755	7.44E-04
445	4.49E-02	550	3.14E-02	655	1.44E-02	760	6.36E-04
450	5.60E-02	555	3.22E-02	660	1.27E-02	765	5.51E-04
455	4.37E-02	560	3.26E-02	665	1.11E-02	770	4.78E-04
460	2.93E-02	565	3.32E-02	670	9.67E-03	775	4.16E-04
465	2.36E-02	570	3.37E-02	675	8.43E-03	780	3.58E-04
470	1.85E-02	575	3.41E-02	680	7.31E-03		
475	1.51E-02	580	3.43E-02	685	6.34E-03		
480	1.50E-02	585	3.46E-02	690	5.46E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3447, 0.3527)

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

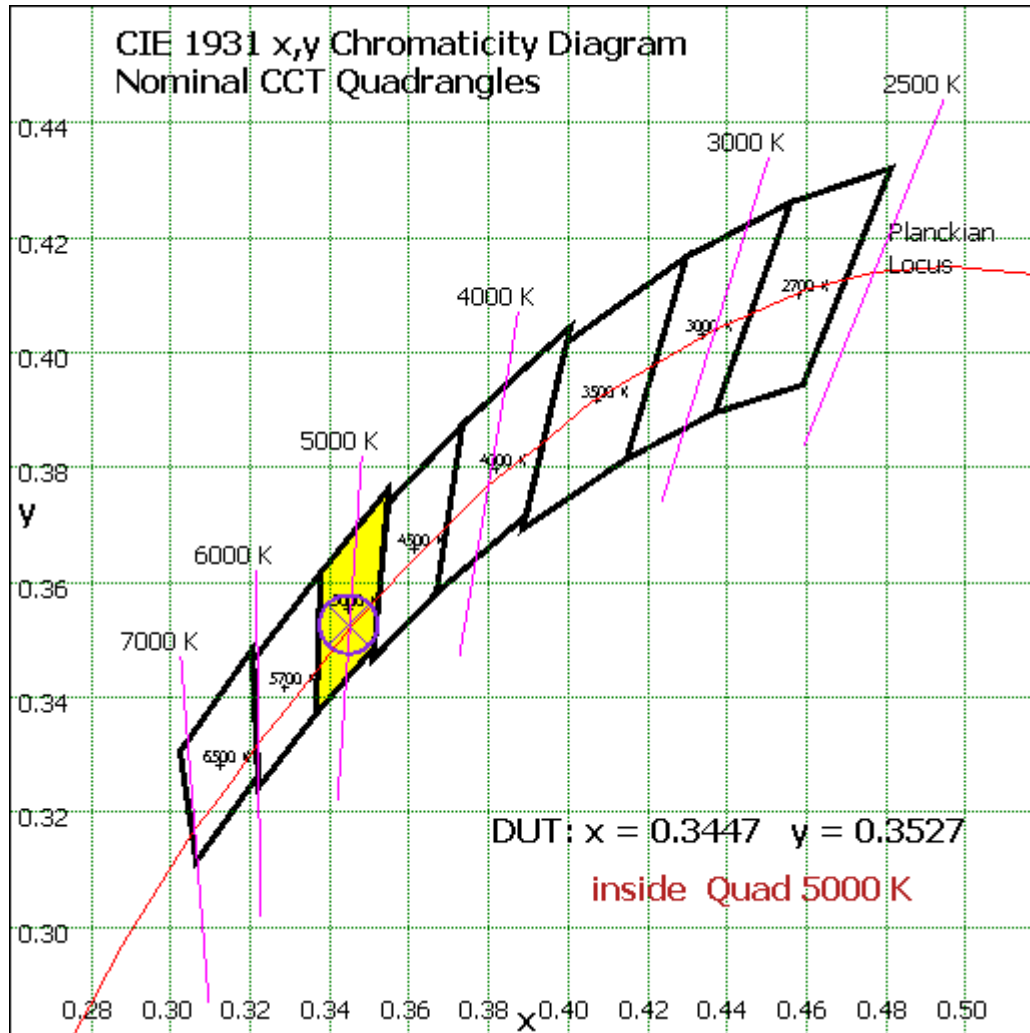


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	38.719	1.81%
10- 20	111.552	5.20%
20- 30	171.517	8.00%
30- 40	212.931	9.93%
40- 50	233.537	10.89%
50- 60	234.34	10.93%
60- 70	218.275	10.18%
70- 80	188.548	8.79%
80- 90	130.246	6.07%
90-100	101.006	4.71%
100-110	116.656	5.44%
110-120	103.689	4.83%
120-130	87.913	4.10%
130-140	72.087	3.36%
140-150	55.954	2.61%
150-160	39.491	1.84%
160-170	22.652	1.06%
170-180	5.621	0.26%
Total	2144.7	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	1002.596	46.75%
60- 90	537.069	25.04%
0-90	1539.665	71.79%
90- 180	605.069	28.21%
0- 180	2144.7	100%

Table 5: Zonal Lumen Data

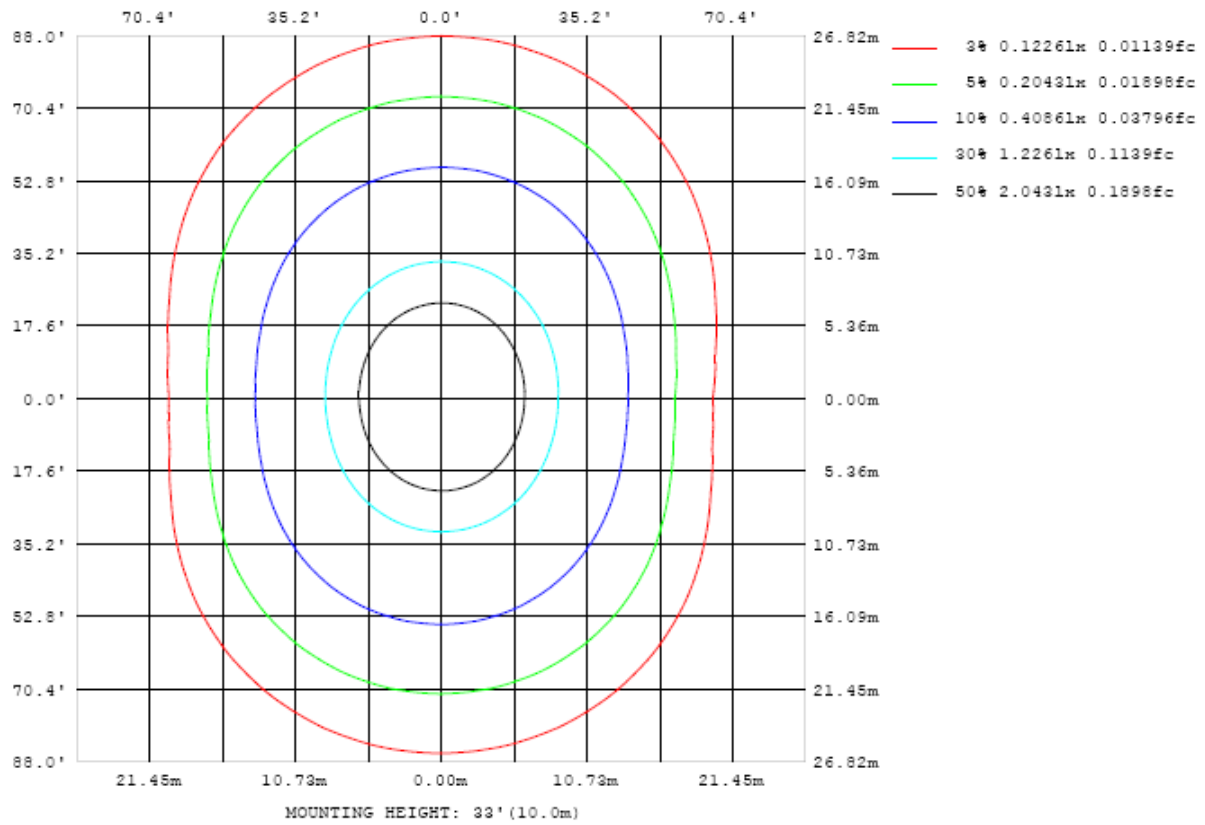


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

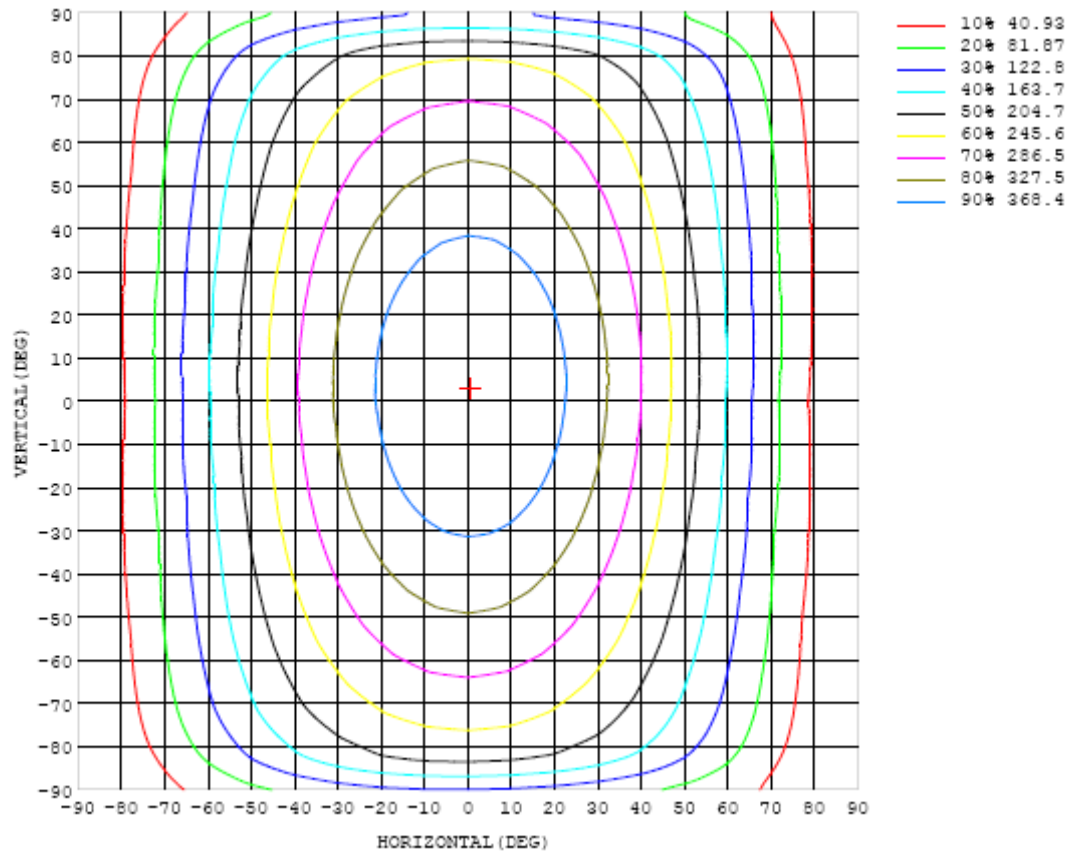


Chart 5: Isocandela Plot

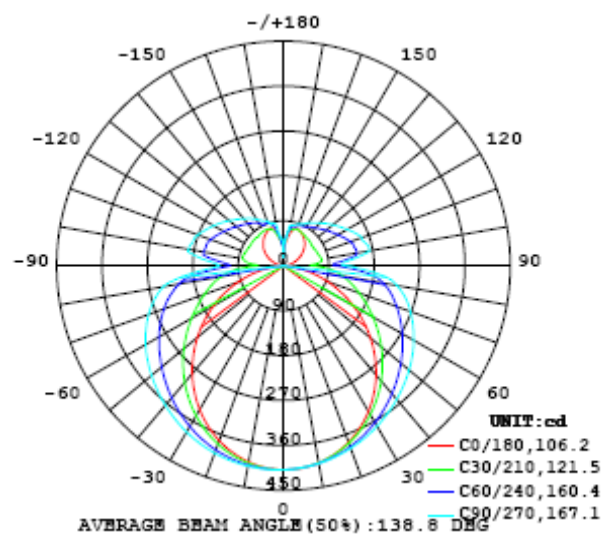


Chart 6: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1

UNIT: cd

C (DEG) y (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	409	409	409	409	409	409	409	409	409	409	409	409	409	409	409	409	409	409	409
5	407	407	407	407	407	407	407	407	407	406	406	406	406	406	406	406	406	406	406
10	401	401	400	401	401	402	402	402	402	402	402	401	401	400	399	399	398	398	399
15	391	390	391	391	393	394	395	396	397	397	396	395	394	392	390	389	388	387	388
20	376	376	377	379	381	384	386	388	389	389	389	387	384	381	378	375	373	372	373
25	358	358	360	363	367	371	375	379	380	381	380	377	373	369	364	359	356	354	354
30	337	337	340	344	351	357	363	368	370	371	370	366	361	354	347	341	335	332	333
35	312	313	317	324	332	341	349	356	359	361	359	354	348	339	329	320	313	308	308
40	285	286	292	301	313	324	335	343	348	349	347	342	333	322	310	298	288	282	282
45	256	258	266	278	292	307	319	330	335	337	335	329	319	305	290	276	263	254	253
50	225	228	238	253	271	289	304	316	323	325	323	315	304	288	270	252	236	225	223
55	193	196	210	229	250	271	288	302	310	312	310	302	288	271	250	229	209	195	192
60	160	165	182	205	230	253	272	287	295	298	296	287	273	254	231	206	182	165	160
65	126	133	154	182	210	235	256	271	280	283	281	272	257	237	212	184	156	134	128
70	93.1	102	128	160	191	217	239	255	265	268	265	256	241	220	194	164	132	105	95.8
75	61.5	73.1	104	139	172	200	222	238	247	251	248	239	224	203	175	144	109	77.4	64.7
80	33.5	48.6	83.3	120	153	180	201	216	225	228	226	217	202	181	155	124	88.0	53.7	36.3
85	12.0	29.0	62.8	96.1	125	148	165	177	185	188	187	180	168	150	127	96.8	65.2	33.2	14.2
90	1.67	11.1	34.7	58.8	73.9	89.3	102	112	119	122	121	116	106	91.4	73.5	53.5	31.0	10.1	1.03
95	5.35	16.9	43.9	70.7	92.2	108	119	127	132	133	131	125	115	102	85.9	65.3	38.9	17.0	3.83
100	10.2	20.3	45.5	77.0	105	128	147	161	170	174	172	164	150	129	104	75.4	47.7	22.1	8.63
105	16.8	23.2	46.2	74.3	102	127	145	159	167	170	167	159	144	126	106	77.8	49.0	26.2	14.9
110	24.0	28.9	46.9	72.3	97.2	121	141	155	163	165	162	155	142	124	102	75.9	50.5	31.0	22.1
115	31.5	35.0	48.3	71.1	93.0	114	133	146	153	156	154	146	134	117	97.0	74.7	52.4	36.7	29.6
120	39.0	41.9	51.6	70.0	89.9	108	125	137	143	146	144	137	126	111	93.4	73.8	55.0	42.8	37.1
125	46.3	48.3	55.3	69.5	86.8	103	117	128	134	136	135	128	119	106	90.5	73.6	57.9	48.9	44.4
130	53.1	54.6	58.7	70.6	84.1	98.4	111	120	126	128	126	121	112	101	88.1	74.0	60.9	54.7	51.4
135	59.5	60.5	62.7	71.9	82.3	94.1	105	113	118	120	118	114	106	96.9	86.3	74.4	64.2	60.2	57.5
140	64.7	65.7	66.0	72.2	81.5	90.7	99.1	106	110	112	111	107	101	93.4	85.1	75.2	67.5	65.3	62.7
145	69.6	70.3	69.4	73.7	79.8	87.9	94.9	99.9	103	105	104	101	96.7	90.6	83.6	76.2	69.9	69.7	68.0
150	73.8	74.1	73.0	75.2	79.4	84.7	90.3	95.0	98.0	99.1	98.6	96.3	92.2	87.3	82.0	76.9	72.7	73.3	72.3
155	77.0	77.5	75.5	76.8	79.5	83.5	87.1	90.4	92.0	93.0	92.2	90.8	88.6	85.1	81.4	76.1	74.6	75.0	76.4
160	79.4	79.7	77.5	78.2	78.6	81.9	85.3	87.1	87.8	88.3	88.3	87.7	86.5	82.5	78.4	76.7	76.1	76.3	79.4
165	76.2	77.8	77.5	75.0	78.2	80.3	81.3	82.8	84.3	85.0	84.8	83.8	80.0	79.5	77.8	74.5	71.9	72.6	76.7
170	63.0	65.9	73.9	73.1	71.6	71.3	75.6	80.7	82.9	83.0	82.6	74.9	70.1	67.9	67.3	64.8	62.7	61.1	62.5
175	46.5	46.8	48.3	54.7	60.9	59.6	57.7	56.2	54.6	53.6	55.8	57.1	57.5	52.7	50.0	48.7	47.7	47.0	47.0
180	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0

Table 6: Luminous Intensity Data

Table--2

UNIT: cd

C (DEG) y (DEG)	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350		
0	409	409	409	409	409	409	409	409	409	409	409	409	409	409	409	409	409		
5	406	407	407	408	408	408	409	409	409	409	409	409	409	408	408	408	408		
10	400	401	402	403	404	405	407	407	408	408	407	407	406	405	404	403	402		
15	389	391	393	395	398	400	402	404	404	404	404	402	400	398	396	394	392		
20	374	377	380	385	389	393	396	398	399	399	398	395	392	388	384	381	379		
25	356	360	365	371	378	383	388	391	393	392	390	386	381	375	370	365	361		
30	335	340	347	356	364	372	379	383	385	384	381	375	368	360	352	345	341		
35	311	318	327	338	349	359	368	373	375	374	370	363	353	343	332	323	317		
40	285	293	305	319	333	345	356	362	365	364	358	349	337	324	311	299	291		
45	257	267	282	299	316	331	343	351	354	352	345	334	320	304	288	273	262		
50	228	241	258	278	298	316	330	338	342	340	332	320	303	284	264	246	233		
55	198	213	234	258	281	300	316	326	329	327	318	304	285	263	240	218	202		
60	167	186	211	238	264	285	302	312	316	313	304	289	268	243	216	190	170		
65	137	159	188	219	247	269	287	297	301	298	289	273	251	223	193	163	139		
70	107	134	167	200	229	252	270	281	285	282	272	256	233	204	172	138	108		
75	78.2	110	147	181	210	234	251	262	266	263	254	237	215	185	152	114	79.8		
80	52.8	88.6	126	159	187	211	228	239	242	239	230	215	193	165	132	93.1	55.0		
85	31.7	64.1	97.2	126	148	164	176	183	185	182	176	165	151	132	105	71.2	34.9		
90	8.86	29.6	52.2	73.5	92.3	107	119	126	128	126	120	110	97.9	82.2	63.1	40.9	15.3		
95	16.9	41.4	71.9	98.9	121	138	151	158	162	161	155	145	131	112	84.6	54.1	23.0		
100	22.0	49.8	82.6	111	139	161	178	187	191	188	179	165	146	121	89.9	55.5	26.0		
105	26.4	51.1	82.7	113	140	159	173	182	186	185	177	165	144	117	86.9	55.1	29.6		
110	31.6	52.4	80.6	109	134	154	168	177	181	178	170	157	137	112	83.8	55.8	34.1		
115	37.5	54.7	79.0	104	127	146	159	167	171	168	160	148	129	106	81.6	57.1	37.5		
120	43.8	57.6	78.1	100	120	137	150	157	160	158	151	139	122	102	80.4	59.6	44.2		
125	50.0	60.7	78.0	96.7	115	130	141	148	151	148	142	131	116	98.6	79.8	60.7	50.5		
130	55.9	64.0	78.4	94.3	109	122	132	138	141	139	133	123	111	95.7	79.0	62.4	56.6		
135	61.4	67.9	78.6	92.5	105	116	124	130	132	130	125	117	106	93.2	77.5	66.7	62.3		
140	66.5	70.8	77.5	90.6	101	110	117	122	123	122	118	111	102	89.5	78.1	69.8	67.7		
145	71.3	73.5	79.5	87.7	97.2	105	111	114	116	115	111	105	96.3	85.3	79.7	72.7	71.6		
150	72.3	75.0	80.0	86.4	90.8	98.9	104	107	108	107	104	98.2	90.8	86.9	80.7	74.7	74.0		
155	74.0	76.2	80.0	85.6	90.1	91.8	96.1	98.8	99.5	98.5	96.5	93.9	91.4	86.6	80.7	76.4	76.4		
160	75.1	75.4	77.9	83.5	88.1	90.3	91.7	90.4	95.4	96.0	94.7	92.5	89.6	84.3	81.3	76.9	79.5		
165	73.9	71.1	73.1	76.6	81.0	86.3	88.2	89.0	89.3	84.8	86.9	86.2	82.4	81.5	77.1	75.3	77.7		
170	61.8	60.9	59.0	61.1	67.6	67.8	71.4	73.9	82.4	84.9	82.9	78.6	73.5	70.8	71.0	71.7	68.9		
175	47.1	46.0	45.1	44.8	44.2	45.5	48.1	57.3	56.5	54.0	53.7	53.8	57.2	59.2	56.1	48.2	46.1		
180	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0		

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 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° 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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