

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: 9290019346

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ18050046a

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

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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: **9290019346**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
137.5	2089.0	15.19	0.9819
CCT (K)	CRI	Stabilization Time (Light & Power)	
3061	82.0	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	: 9290019346
Electrical Ratings	: 120-277V, 50/60Hz, 15.5W
Product Description	: 15.5T8-6U PRO/24-830/BB20/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°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)	0.129	0.059
Power Factor	0.9819	0.9167
Test Power (W)	15.19	15.04
THD A%	17.96	21.82
Luminous Efficacy (lm/W)	137.5	138.2
Total Luminous Flux (lm)	2089.0	2078.0
Color Rendering Index (CRI)	82.0	
R9	4	
Correlated Color Temperature (CCT) (K)	3061	
Chromaticity Chroma x	0.4313	
Chromaticity Chroma y	0.4000	
Chromaticity Chroma u	0.2487	
Chromaticity Chroma v	0.3460	
Duv	0.0009	
Chromaticity Chroma u'	0.2487	
Chromaticity Chroma v'	0.5189	

Special Color Rendering Indices	
R1	80.5
R2	91.7
R3	94.9
R4	79.3
R5	81.1
R6	90
R7	81.5
R8	57.3
R9	4
R10	81.3
R11	78.4
R12	74
R13	83.3
R14	97.8
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 24.7°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)	0.130
Power Factor	0.9789
Test Power (W)	15.30
Luminous Efficacy (lm/W)	133.7
Total Luminous Flux (lm)	2045.6
Beam Angle (°)	105.6 (0°-180°)/ 163.6 (90°-270°)
Center Beam Candle Power (cd)	401
Maximum Beam Candle Power (cd)	401.7 (At: C=340.0, Gamma=2.0)
Spacing Criteria	1.19 (0°-180°)/ 1.39 (90°-270°)
Zonal Lumens in the 0°-60°Zone	47.68%
Zonal Lumens in the 60°-90°Zone	24.37%
Zonal Lumens in the 90°-120°Zone	14.84%
Zonal Lumens in the 120°-180°Zone	13.11%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

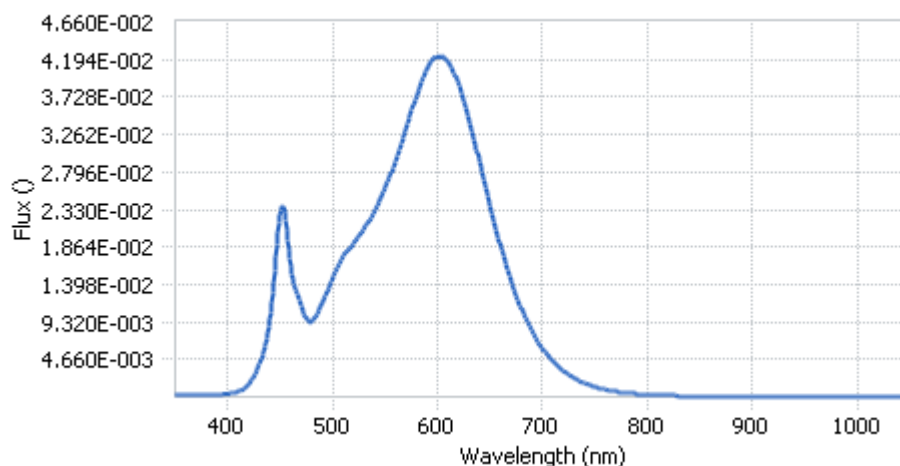
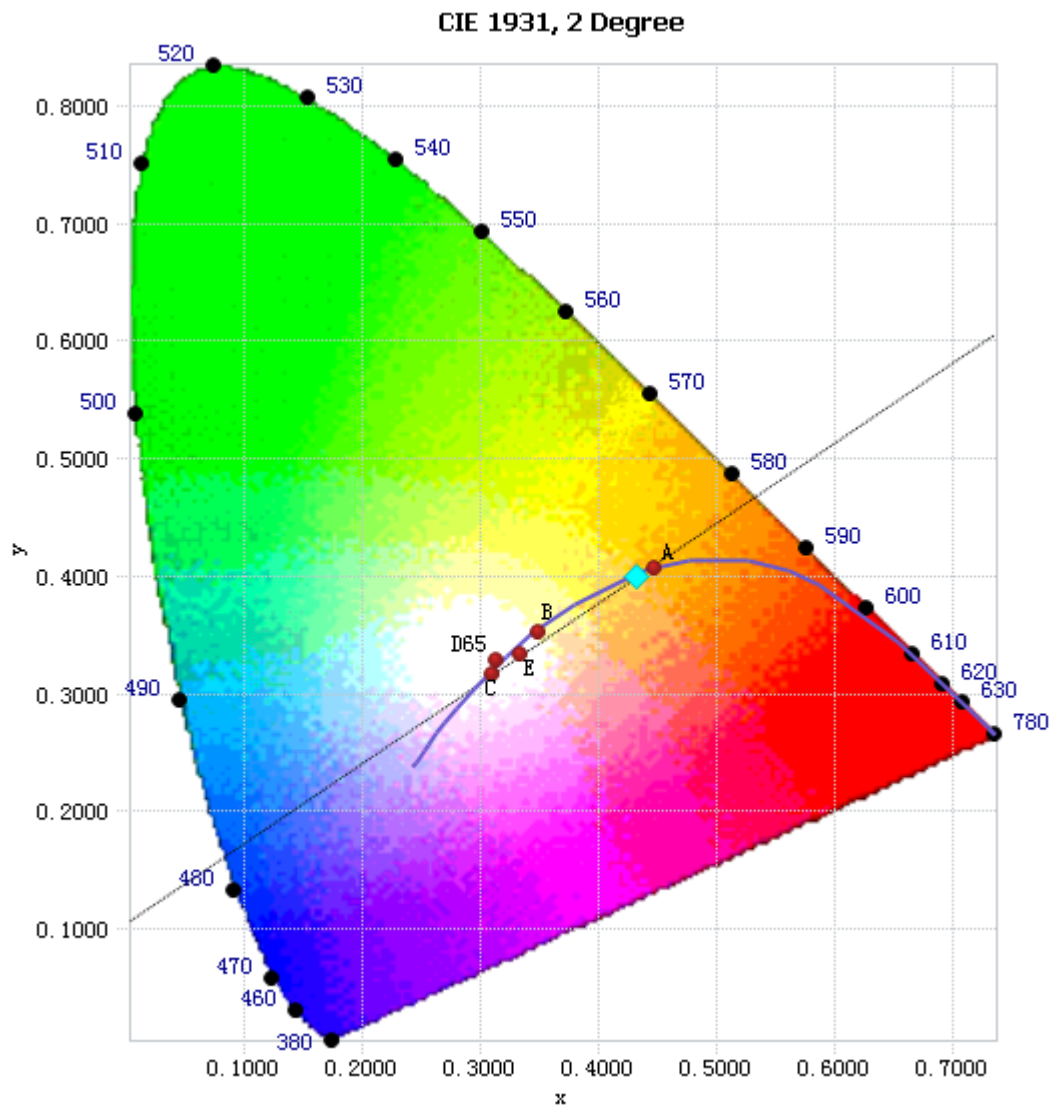


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	3.46E-04	485	1.03E-02	590	4.07E-02	695	7.00E-03
385	2.92E-04	490	1.16E-02	595	4.19E-02	700	6.04E-03
390	3.37E-04	495	1.32E-02	600	4.24E-02	705	5.15E-03
395	3.56E-04	500	1.49E-02	605	4.23E-02	710	4.40E-03
400	3.79E-04	505	1.63E-02	610	4.17E-02	715	3.76E-03
405	4.82E-04	510	1.73E-02	615	4.05E-02	720	3.22E-03
410	6.53E-04	515	1.84E-02	620	3.88E-02	725	2.74E-03
415	9.97E-04	520	1.92E-02	625	3.67E-02	730	2.35E-03
420	1.60E-03	525	2.00E-02	630	3.44E-02	735	2.00E-03
425	2.56E-03	530	2.09E-02	635	3.19E-02	740	1.71E-03
430	3.98E-03	535	2.19E-02	640	2.92E-02	745	1.46E-03
435	6.16E-03	540	2.32E-02	645	2.64E-02	750	1.24E-03
440	9.63E-03	545	2.46E-02	650	2.38E-02	755	1.07E-03
445	1.58E-02	550	2.60E-02	655	2.12E-02	760	9.16E-04
450	2.27E-02	555	2.77E-02	660	1.88E-02	765	7.92E-04
455	2.20E-02	560	2.93E-02	665	1.65E-02	770	6.76E-04
460	1.62E-02	565	3.13E-02	670	1.44E-02	775	5.80E-04
465	1.33E-02	570	3.34E-02	675	1.26E-02	780	4.94E-04
470	1.15E-02	575	3.55E-02	680	1.09E-02		
475	9.67E-03	580	3.74E-02	685	9.48E-03		
480	9.42E-03	585	3.95E-02	690	8.15E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4313, 0.4000)

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

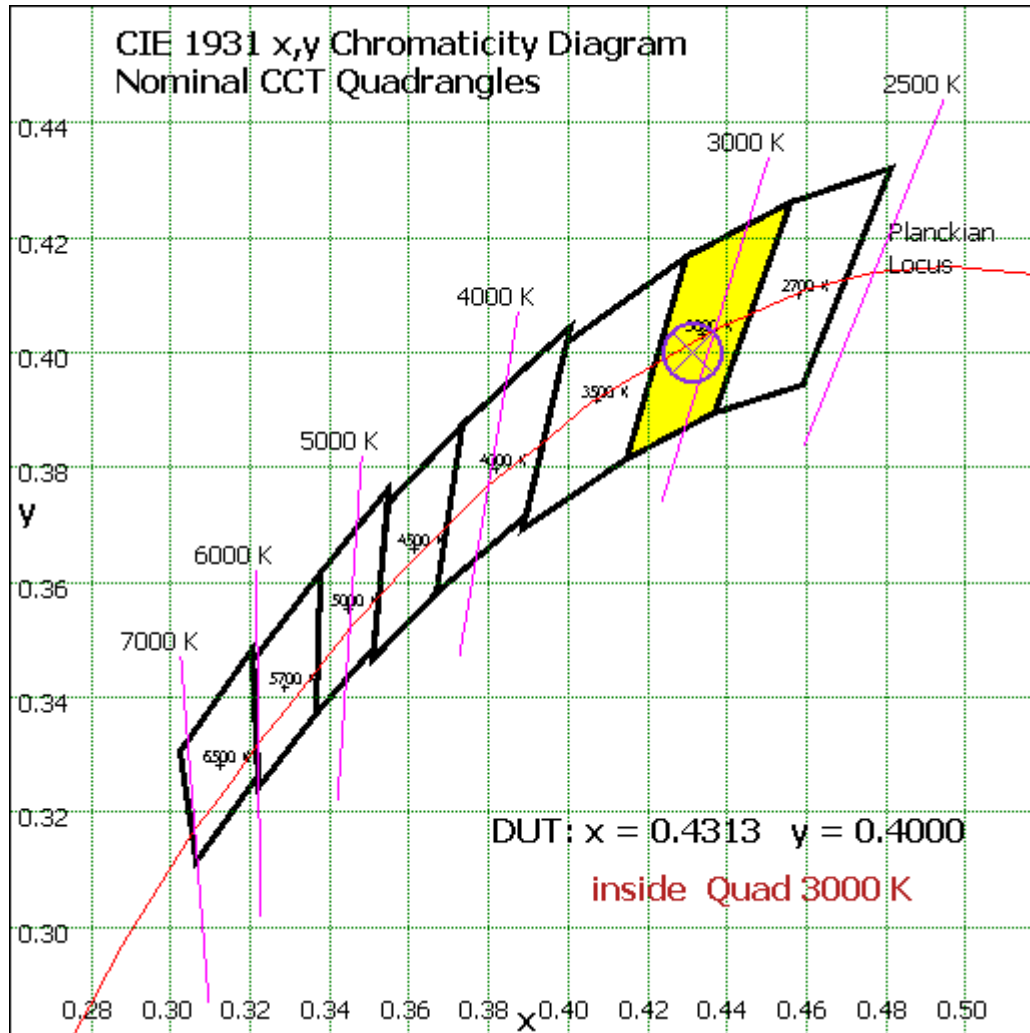


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	37.994	1.86%
10- 20	109.328	5.34%
20- 30	167.704	8.20%
30- 40	207.54	10.15%
40- 50	226.728	11.08%
50- 60	226.05	11.05%
60- 70	208.125	10.17%
70- 80	176.014	8.60%
80- 90	114.33	5.59%
90-100	94.709	4.63%
100-110	111.084	5.43%
110-120	97.782	4.78%
120-130	82.761	4.05%
130-140	67.898	3.32%
140-150	52.901	2.59%
150-160	37.695	1.84%
160-170	21.628	1.06%
170-180	5.36	0.26%
Total	2045.6	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	975.344	47.68%
60- 90	498.469	24.37%
0-90	1473.813	72.05%
90- 180	571.818	27.95%
0- 180	2045.6	100%

Table 5: Zonal Lumen Data

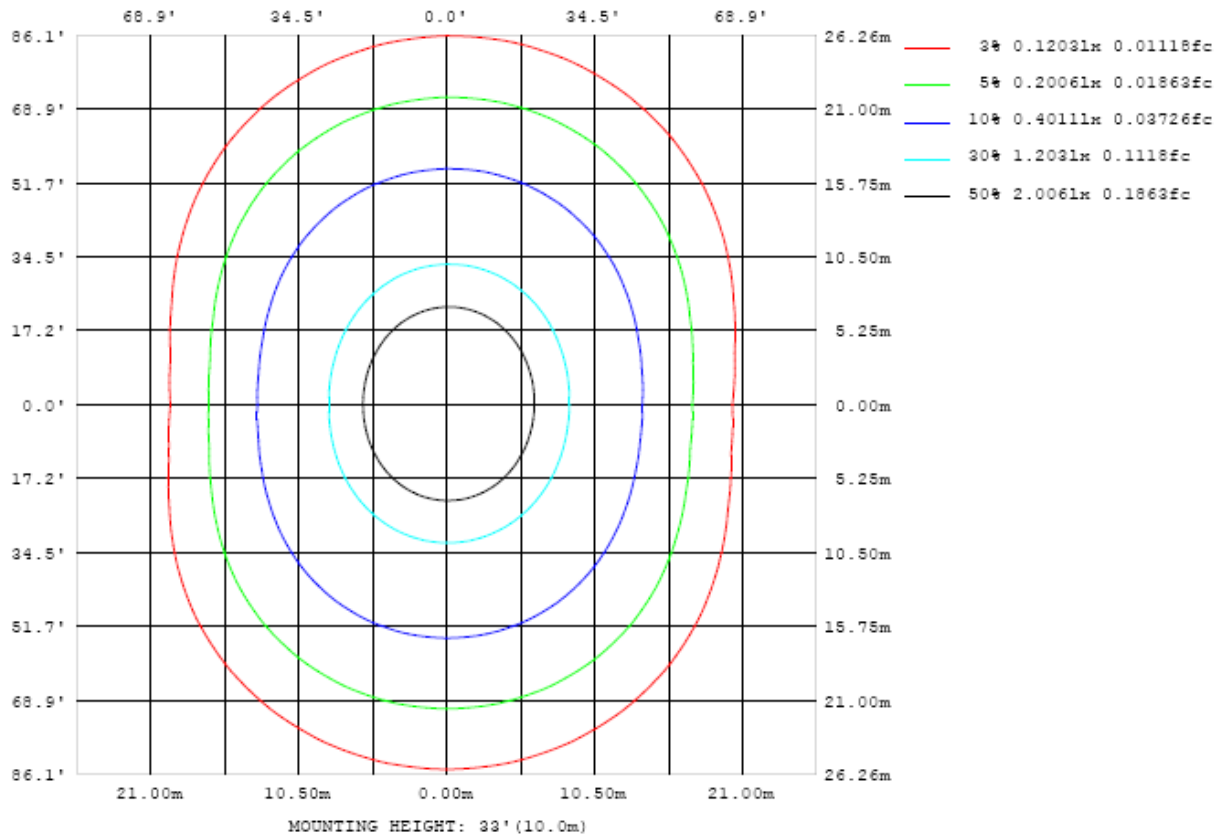


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

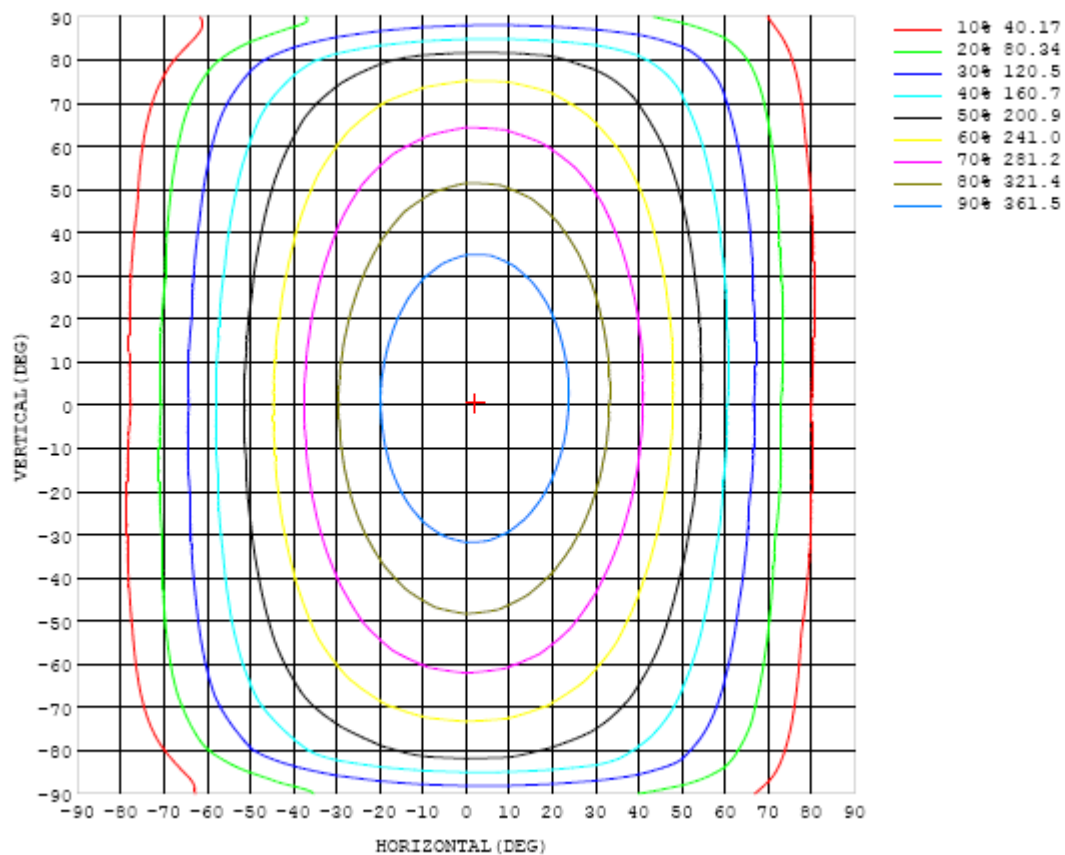


Chart 5: Isocandela Plot

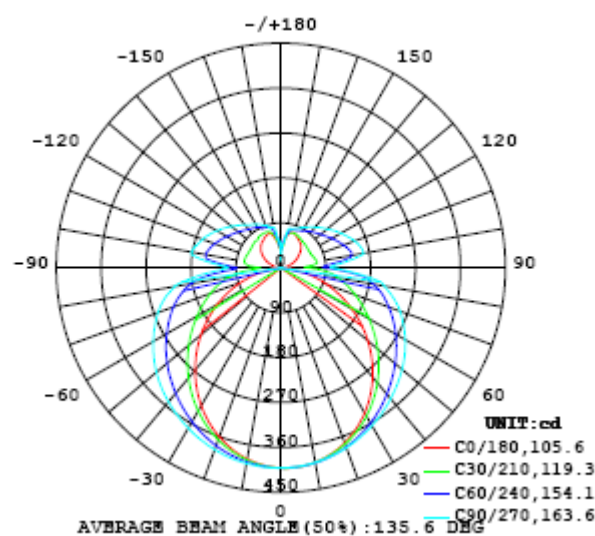


Chart 6: Polar Candela Distribution

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	401	401	401	401	401	401	401	401	401	401	401	401	401	401	401	401	401	401	401
5	401	401	401	401	401	400	400	400	400	400	399	399	399	398	398	398	397	397	397
10	396	396	396	396	396	397	397	397	397	396	396	395	394	392	391	390	389	389	389
15	387	387	387	388	389	390	391	391	391	391	390	388	386	384	382	380	378	377	377
20	374	374	374	376	378	380	382	384	384	384	382	380	377	373	369	366	363	361	361
25	357	357	358	361	365	368	372	374	375	375	373	370	366	360	355	349	345	342	341
30	336	336	339	343	349	354	359	363	365	365	363	359	353	346	338	331	325	320	319
35	312	313	317	323	331	339	346	351	354	354	352	347	339	330	320	310	302	296	294
40	286	287	292	301	311	321	331	338	342	342	340	334	324	313	301	288	277	270	267
45	258	259	266	277	290	303	315	324	329	330	327	320	309	296	281	265	252	242	239
50	228	230	239	253	269	285	299	309	315	317	314	306	294	279	261	243	226	213	209
55	196	199	211	228	248	267	283	294	301	303	300	292	279	262	241	220	199	184	178
60	164	168	183	204	227	249	266	278	286	288	285	276	263	245	222	197	173	154	148
65	131	136	155	181	207	230	248	261	269	271	268	260	246	227	204	176	148	125	116
70	98.4	106	129	159	187	211	230	244	252	254	251	242	228	209	185	156	125	97.2	84.7
75	67.2	76.5	105	138	167	192	212	224	231	233	230	221	208	189	165	136	103	71.6	55.2
80	39.9	51.5	83.7	117	147	171	188	201	208	211	208	199	184	164	140	112	81.7	49.5	29.1
85	16.8	31.0	63.1	92.9	120	140	151	158	161	161	158	150	138	122	103	80.0	53.0	27.7	9.26
90	3.22	12.4	33.8	53.9	69.2	80.3	89.4	96.1	101	102	99.6	94.6	86.5	75.2	62.4	45.2	27.4	10.0	1.14
95	5.27	15.8	41.2	64.6	82.6	96.2	108	117	123	127	127	125	119	109	93.9	71.4	44.7	21.4	5.92
100	10.0	19.0	43.5	73.5	102	125	143	157	165	168	166	159	146	127	104	78.5	49.9	25.3	11.0
105	16.3	22.4	43.6	70.7	97.7	122	142	155	163	165	162	155	142	125	103	77.5	50.8	29.0	17.3
110	23.1	27.4	44.6	68.3	93.1	115	134	147	155	158	156	148	136	119	99.1	75.4	51.6	33.5	24.3
115	30.3	33.1	46.7	66.4	88.6	109	126	138	145	148	146	140	129	113	94.8	73.3	53.3	38.8	31.6
120	37.5	39.2	49.3	66.0	85.3	102	118	130	136	139	138	131	121	107	90.7	72.4	55.7	44.3	38.7
125	44.4	45.7	52.6	65.9	82.3	97.4	110	121	127	130	129	123	114	102	87.7	72.2	58.6	49.8	45.5
130	50.9	51.8	56.4	66.8	80.2	93.5	105	113	119	121	120	116	108	97.3	85.6	72.1	61.4	55.2	51.9
135	56.9	57.5	60.3	67.7	78.4	89.7	99.2	107	112	114	113	109	102	93.5	83.6	73.0	64.3	60.3	57.4
140	61.9	62.6	64.2	68.2	77.1	85.8	94.5	101	105	107	106	103	97.4	89.7	81.9	73.8	66.9	64.8	61.4
145	65.1	66.7	67.5	70.0	75.7	83.1	89.6	94.6	98.6	100	99.9	97.1	92.3	87.0	80.5	74.4	69.4	68.6	64.4
150	68.1	70.0	70.8	71.5	76.4	80.5	84.7	90.0	92.8	93.7	93.6	91.8	87.8	83.2	79.1	74.7	72.1	71.5	67.5
155	71.6	73.1	73.5	73.8	76.8	80.3	83.0	85.1	86.7	87.4	87.7	86.4	84.5	81.6	77.6	75.1	74.1	73.0	70.7
160	74.7	74.9	75.7	74.2	77.0	78.5	80.6	82.3	83.4	84.0	84.2	83.5	81.4	77.5	77.0	75.4	74.4	73.2	73.1
165	72.7	70.6	72.7	73.1	72.2	75.8	79.6	81.2	81.5	81.3	81.3	80.5	77.7	74.4	71.3	69.3	69.2	69.4	69.2
170	66.0	57.6	60.4	65.9	68.2	67.2	68.0	69.5	73.2	74.7	67.8	64.2	63.9	63.8	60.8	58.1	56.7	56.8	57.5
175	46.2	43.0	42.8	42.0	42.5	45.4	51.3	51.2	45.3	48.4	50.4	47.7	44.3	42.8	43.7	43.4	42.5	42.5	43.1
180	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7

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	401	401	401	401	401	401	401	401	401	401	401	401	401	401	401	401	401		
5	397	398	398	398	399	399	400	400	401	401	401	401	401	401	401	401	401		
10	390	390	391	392	394	395	396	397	398	399	399	399	399	398	397	397	396		
15	377	379	381	383	386	388	391	392	394	395	394	394	393	391	390	389	388		
20	362	364	367	371	375	379	383	386	388	389	388	387	385	382	379	377	375		
25	343	346	350	356	362	369	374	378	380	381	380	377	374	369	365	361	358		
30	321	325	331	339	348	356	363	368	371	372	370	366	361	355	348	343	338		
35	296	302	311	321	332	343	351	358	361	362	359	354	346	338	329	321	315		
40	270	277	288	301	315	328	339	346	350	351	347	340	331	319	308	298	290		
45	242	251	265	281	298	313	326	334	339	339	334	326	314	300	285	272	263		
50	213	224	241	261	280	298	311	321	326	326	320	311	297	280	262	246	234		
55	183	197	217	240	262	281	296	306	311	311	305	294	279	259	238	218	203		
60	153	170	194	220	244	264	280	290	296	295	289	277	260	239	215	191	173		
65	123	144	172	200	225	247	263	274	279	278	272	259	241	219	192	165	143		
70	93.5	119	150	180	207	229	246	257	262	261	254	241	223	198	170	140	113		
75	66.2	95.8	129	160	186	208	225	236	242	242	235	223	204	179	149	116	84.7		
80	42.3	73.1	105	134	161	183	200	211	216	215	209	198	181	158	128	94.0	59.9		
85	20.9	44.3	70.7	95.2	116	133	145	154	159	160	158	153	142	127	102	71.7	38.5		
90	7.32	23.5	43.5	61.3	76.9	89.6	98.4	104	107	105	100	93.7	84.2	72.9	58.0	39.9	17.4		
95	16.4	39.8	68.1	96.9	117	133	142	147	149	146	139	130	117	99.3	77.6	49.5	22.0		
100	20.9	44.6	74.7	104	130	153	168	178	182	178	169	156	137	113	83.7	52.6	24.4		
105	25.7	46.7	74.2	102	128	148	163	172	175	172	164	153	134	111	81.6	51.5	26.7		
110	31.3	48.5	73.0	98.2	122	141	156	164	167	165	158	147	128	105	78.2	51.3	31.2		
115	37.3	51.1	71.9	94.5	115	133	147	155	158	156	150	138	121	99.2	75.6	51.8	36.7		
120	43.3	54.2	71.4	91.2	110	126	138	146	149	146	140	129	113	94.5	73.5	54.2	43.1		
125	49.3	57.4	71.7	88.4	105	118	129	136	139	136	130	121	107	90.4	72.2	57.0	48.7		
130	54.9	60.8	72.8	86.3	99.9	112	121	127	129	127	122	113	101	86.9	73.1	60.4	53.9		
135	60.1	64.4	73.9	85.3	96.0	106	114	119	121	119	114	106	96.2	85.3	74.0	64.2	58.6		
140	64.6	67.2	72.9	84.8	93.3	101	107	111	113	111	107	101	93.1	84.3	75.1	67.0	63.1		
145	68.2	70.2	76.5	82.9	91.2	97.2	102	105	106	104	102	96.9	90.7	83.4	76.1	69.2	65.6		
150	72.4	71.1	77.2	82.2	87.1	93.9	97.3	99.6	100	99.3	97.1	93.4	88.3	81.2	77.2	71.2	68.2		
155	73.5	72.5	77.3	81.9	84.9	86.7	92.7	94.7	95.5	94.5	92.8	88.9	85.7	82.7	77.7	72.9	72.9		
160	73.1	74.0	77.0	81.4	84.4	86.1	85.7	88.7	90.8	90.2	89.4	87.9	85.6	81.9	74.7	71.2	74.3		
165	69.2	70.8	72.5	77.4	81.7	84.7	85.1	84.7	81.7	82.4	84.4	84.0	80.8	77.7	76.3	70.4	71.4		
170	58.3	59.7	63.1	65.6	66.3	69.5	75.0	80.4	81.8	81.2	80.1	79.8	77.2	70.8	66.3	67.2	69.0		
175	43.3	44.5	45.8	48.0	50.8	54.3	56.8	57.5	55.7	54.4	55.4	57.2	58.1	57.0	57.7	58.8	54.2		
180	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7		

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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