



LM-79-08 Test Report

for

Philips Lighting (China) Investment Co., Ltd.

Building 9 #, Lane 888, Tianlin Road, Minhang District, Shanghai City.

LED Tube

Model: 9290018457

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ17110001d

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

Review by:

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Nov. 07, 2017

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Approved by:

Manager: Jim Zhang
Nov. 07, 2017

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: **9290018457**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
140.7	1881.0	13.37	0.9738
CCT (K)	CRI	Stabilization Time (Light & Power)	
5190	84.0	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 : Nov. 01, 2017

Date of Test : Nov. 01, 2017

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



Sample view

Equipment Under Test (EUT)

Name	: LED Tube
Model	: 9290018457
Electrical Ratings	: 120-277V, 60HZ
Product Description	: 14T8PRO/48-850/BB18/G 10/1 FB
Manufacturer	: Philips Lighting (China) Investment Co., Ltd.
Address	: Building 9 #, Lane 888, Tianlin Road, Minhang District, Shanghai City

TEST RESULTS

Test ambient temperature was 24.8°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)	0.114	0.051
Power Factor	0.9738	0.9707
Test Power (W)	13.37	13.73
THD A%	21.41	14.24
Luminous Efficacy (lm/W)	140.7	137.4
Total Luminous Flux (lm)	1881.0	1887.0
Color Rendering Index (CRI)	84.0	
R9	7.5	
Correlated Color Temperature (CCT)(K)	5190	
Chromaticity Chroma x	0.3400	
Chromaticity Chroma y	0.3492	
Chromaticity Chroma u	0.2089	
Chromaticity Chroma v	0.3218	
Duv	0.0004	
Chromaticity Chroma u'	0.2089	
Chromaticity Chroma v'	0.4828	

Special Color Rendering Indices	
R1	82.5
R2	91.6
R3	94.7
R4	81.7
R5	83.1
R6	86.6
R7	85.5
R8	65.9
R9	7.5
R10	79.1
R11	80.8
R12	64.4
R13	85.4
R14	97.7
Rf	82
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 24.8°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)	0.115
Power Factor	0.9737
Power (W)	13.39
Luminous Efficacy (lm/W)	141.7
Total Luminous Flux (lm)	1896.8
Beam Angle (°)	111.7 (0°-180°) / 186.3 (90°-270°)
Center Beam Candle Power (cd)	353
Maximum Beam Candle Power (cd)	353.6 (At: C=290.0, Gamma=3.5)
Spacing Criteria	1.25 (0°-180°) / 1.40 (90°-270°)
Zonal Lumens in the 0°-60°Zone	46.66%
Zonal Lumens in the 60°-90°Zone	26.50%
Zonal Lumens in the 90°-120°Zone	15.69%
Zonal Lumens in the 120°-180°Zone	11.15%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

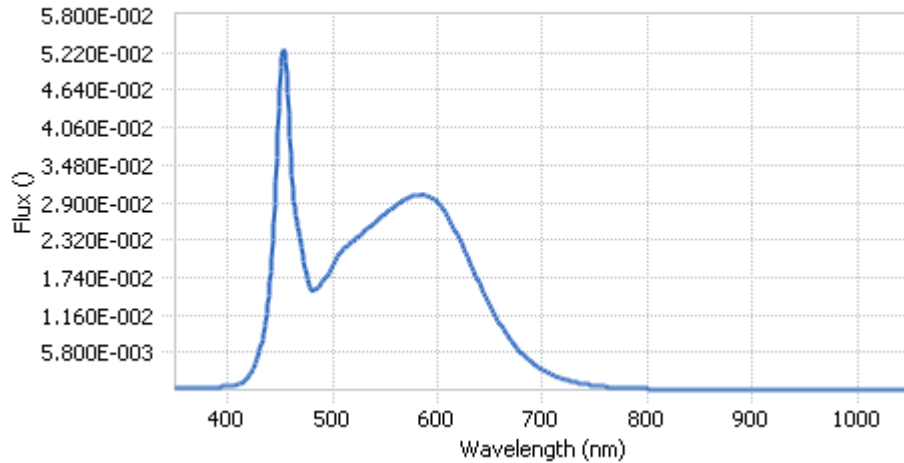
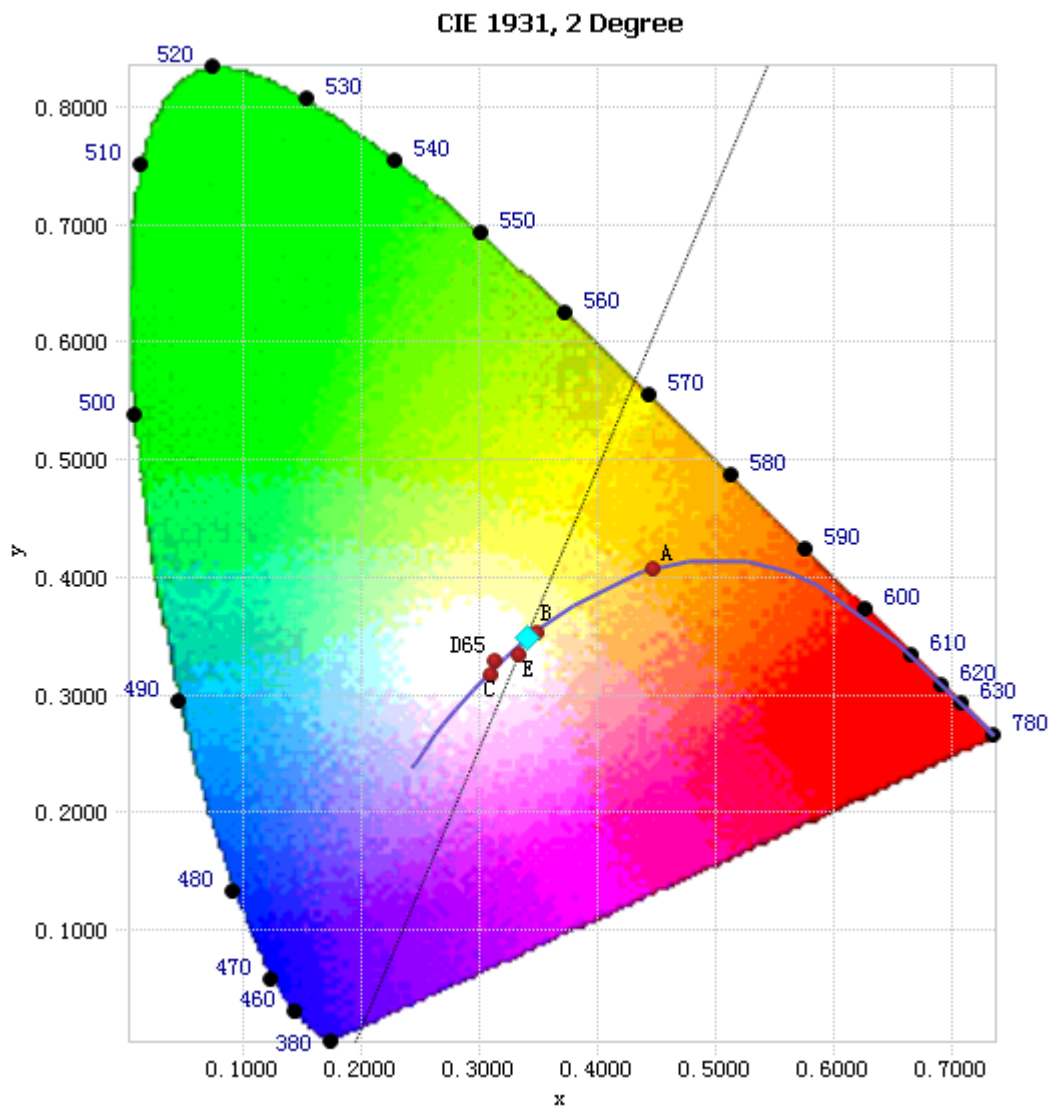


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	4.13E-04	485	1.58E-02	590	3.00E-02	695	3.63E-03
385	4.01E-04	490	1.66E-02	595	2.96E-02	700	3.13E-03
390	4.56E-04	495	1.78E-02	600	2.89E-02	705	2.67E-03
395	4.94E-04	500	1.93E-02	605	2.80E-02	710	2.27E-03
400	5.17E-04	505	2.08E-02	610	2.67E-02	715	1.95E-03
405	6.41E-04	510	2.17E-02	615	2.52E-02	720	1.68E-03
410	8.48E-04	515	2.25E-02	620	2.35E-02	725	1.44E-03
415	1.29E-03	520	2.31E-02	625	2.18E-02	730	1.23E-03
420	2.12E-03	525	2.38E-02	630	2.01E-02	735	1.05E-03
425	3.55E-03	530	2.45E-02	635	1.82E-02	740	9.04E-04
430	5.82E-03	535	2.52E-02	640	1.64E-02	745	7.75E-04
435	9.78E-03	540	2.59E-02	645	1.47E-02	750	6.71E-04
440	1.66E-02	545	2.65E-02	650	1.30E-02	755	5.74E-04
445	2.89E-02	550	2.72E-02	655	1.15E-02	760	5.02E-04
450	4.67E-02	555	2.79E-02	660	1.01E-02	765	4.32E-04
455	5.09E-02	560	2.85E-02	665	8.80E-03	770	3.73E-04
460	3.61E-02	565	2.91E-02	670	7.63E-03	775	3.21E-04
465	2.70E-02	570	2.95E-02	675	6.64E-03	780	2.83E-04
470	2.27E-02	575	2.99E-02	680	5.74E-03		
475	1.78E-02	580	3.02E-02	685	4.93E-03		
480	1.54E-02	585	3.03E-02	690	4.23E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3400, 0.3492)

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

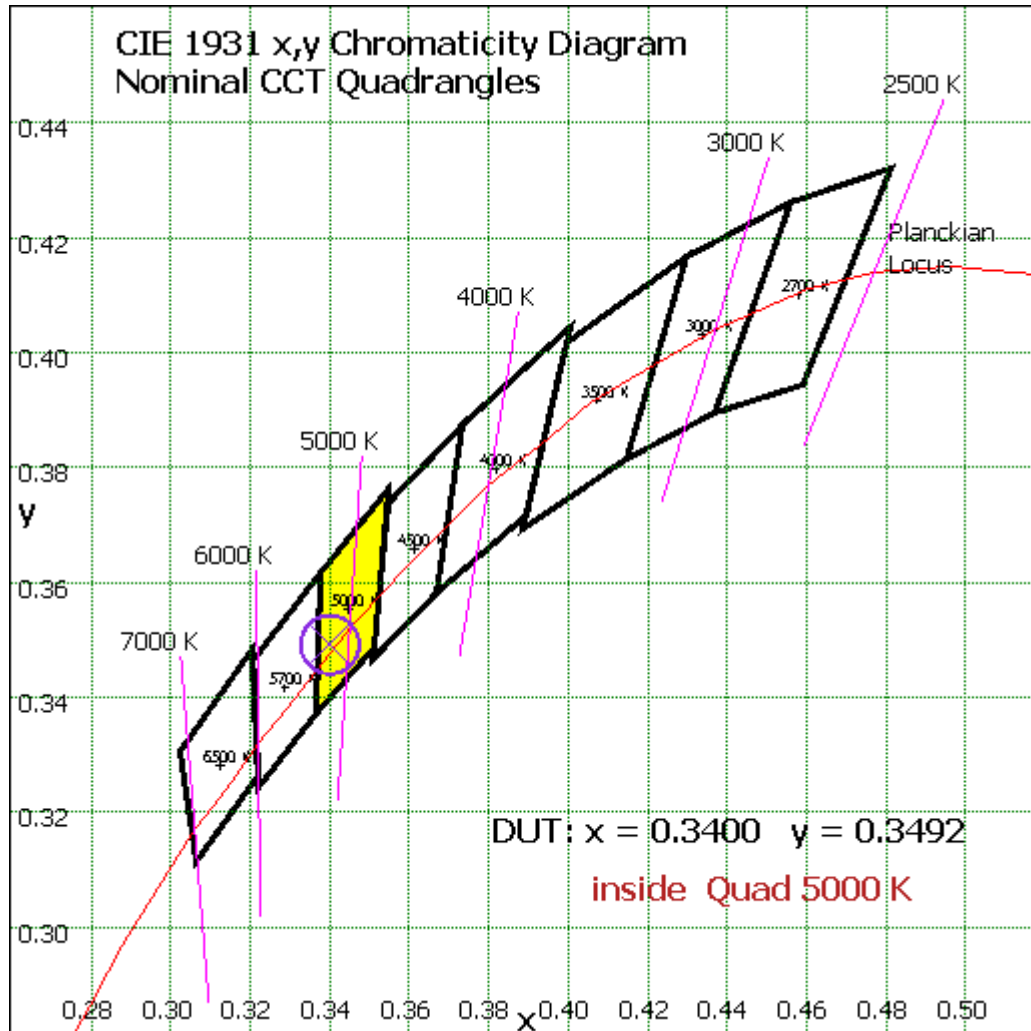


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	33.519	1.77%
10- 20	96.993	5.11%
20- 30	150.25	7.92%
30- 40	188.111	9.92%
40- 50	207.633	10.95%
50- 60	208.593	11.00%
60- 70	193.724	10.21%
70- 80	168.395	8.88%
80- 90	140.576	7.41%
90-100	117.591	6.20%
100-110	98.373	5.19%
110-120	81.597	4.30%
120-130	67.041	3.53%
130-140	53.964	2.84%
140-150	41.441	2.18%
150-160	28.798	1.52%
160-170	15.637	0.82%
170-180	4.604	0.24%
Total	1896.8	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	885.099	46.66%
60- 90	502.695	26.50%
0-90	1387.794	73.16%
90- 180	509.046	26.84%
0- 180	1896.8	100%

Table 5: Zonal Lumen Data

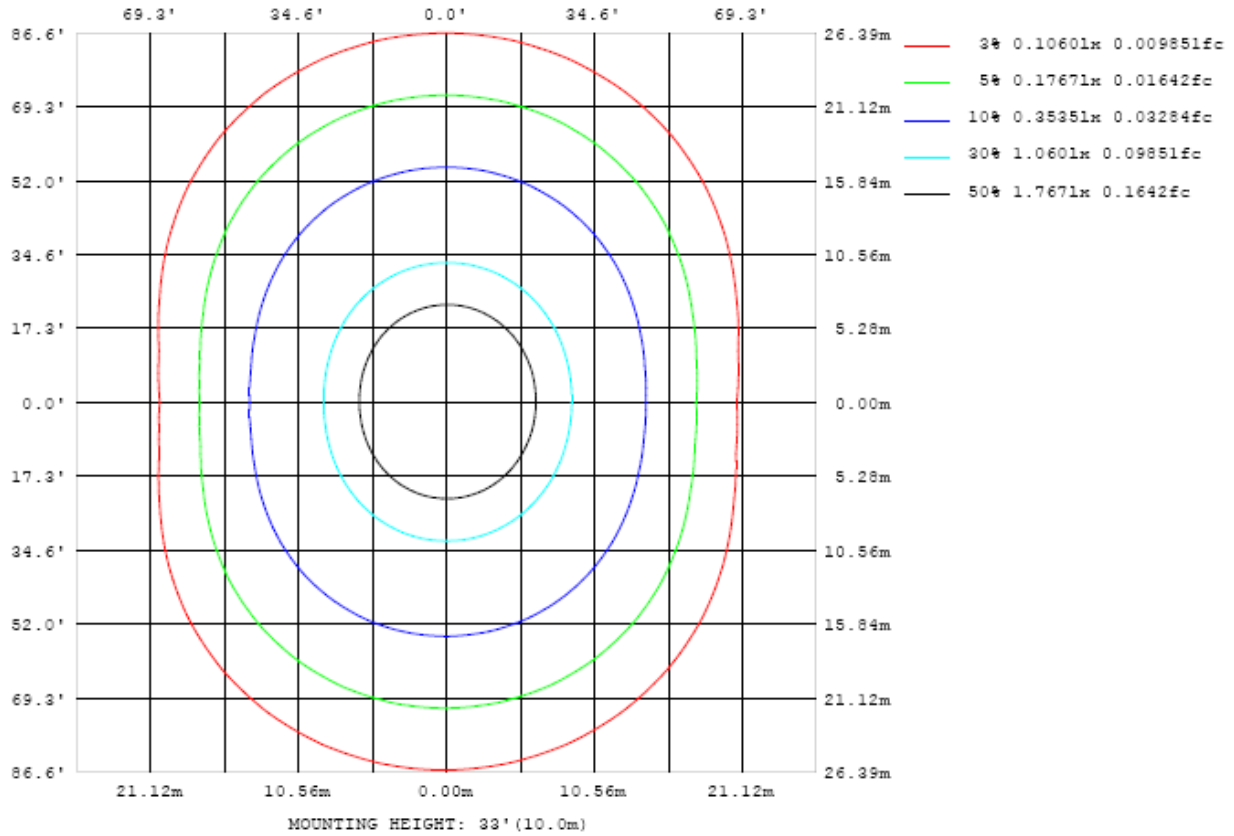


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

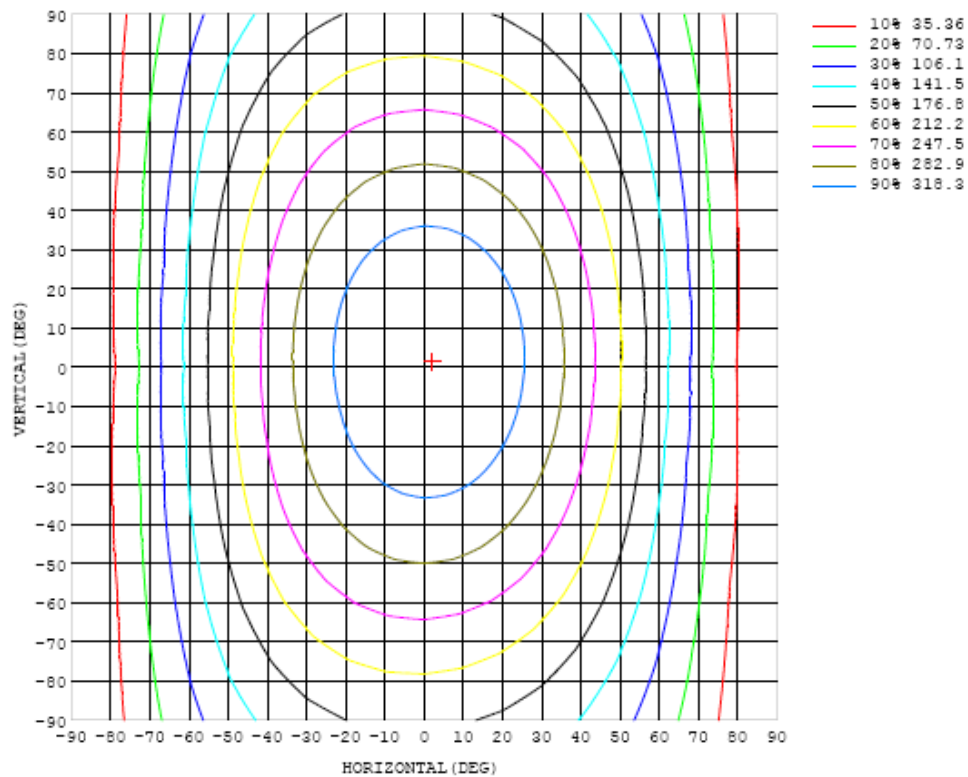


Chart 5: Isocandela Plot

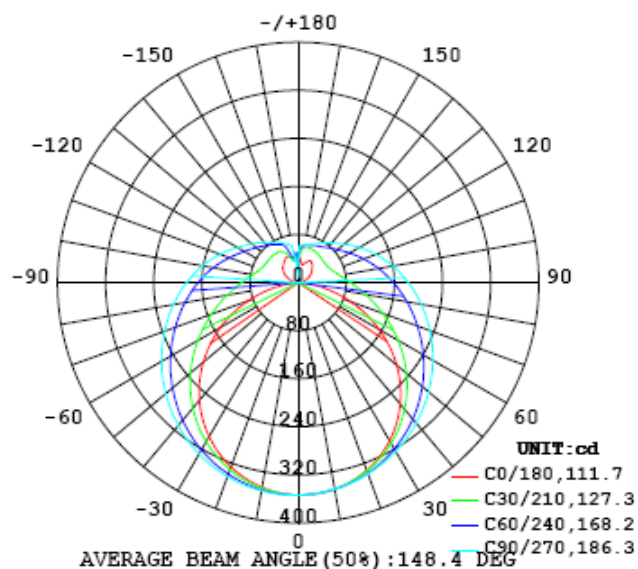


Chart 6: Polar Candela Distribution

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	353	353	353	353	353	353	353	353	353	353	353	353	353	353	353	353	353	353	353
5	353	353	352	352	352	352	352	352	352	352	352	352	352	351	351	351	351	351	351
10	349	349	349	349	349	349	349	349	349	349	349	348	348	347	346	346	346	346	346
15	342	342	342	343	343	344	344	345	345	345	344	343	342	341	340	339	338	338	337
20	333	332	333	334	335	336	338	339	339	339	338	337	335	333	331	329	327	326	326
25	320	320	320	322	325	327	329	331	332	332	331	329	327	324	320	317	314	313	313
30	304	304	306	309	312	316	320	322	324	324	323	321	317	313	308	303	299	296	296
35	285	285	288	293	298	304	309	312	314	315	314	311	306	301	294	287	282	278	277
40	264	265	269	275	282	290	296	301	304	305	304	301	295	287	279	270	262	257	255
45	240	241	247	256	265	275	283	289	293	294	293	289	282	273	263	252	241	234	232
50	214	216	223	235	247	259	269	277	281	283	282	277	269	259	246	232	219	209	206
55	185	188	199	213	229	243	255	263	269	271	269	265	256	244	229	212	195	183	178
60	155	160	173	192	210	227	240	250	256	258	257	252	243	229	212	192	171	155	150
65	124	130	148	170	192	211	225	236	243	246	245	239	229	214	195	172	148	127	119
70	92.4	101	123	150	174	195	211	223	230	233	232	226	216	200	179	153	124	98.8	88.0
75	61.6	72.7	100	131	157	180	197	209	217	220	219	213	203	186	164	136	103	72.3	57.4
80	33.3	48.3	80.3	114	142	166	183	196	204	208	207	201	190	173	150	120	84.9	49.5	29.5
85	10.9	29.2	64.7	99.1	129	152	171	184	192	195	194	189	177	160	137	107	70.2	32.2	8.14
90	0.67	18.4	53.3	87.2	116	140	158	171	179	183	182	177	166	149	125	95.4	60.1	22.8	0.26
95	1.80	14.6	45.7	77.7	106	129	147	160	168	171	171	165	154	138	115	86.2	52.9	19.5	2.14
100	4.77	14.9	40.9	70.3	96.5	119	136	148	156	160	159	154	143	127	106	78.7	48.3	20.1	5.85
105	8.72	17.4	38.5	64.4	88.4	109	125	137	145	149	148	143	133	118	97.4	72.6	45.9	22.9	10.6
110	13.1	21.3	38.2	60.0	81.4	100	116	127	134	138	137	132	123	109	90.1	68.4	45.6	26.9	15.2
115	17.8	25.9	39.0	57.2	75.7	92.8	107	117	124	127	127	122	113	100	83.9	65.3	46.5	31.4	20.0
120	22.4	30.6	40.6	55.8	71.5	86.1	98.7	108	114	117	117	113	105	93.2	78.9	63.5	48.2	35.8	24.8
125	26.3	35.3	42.9	55.2	68.4	80.5	91.5	100.0	106	108	108	104	96.9	87.1	75.3	62.6	50.1	40.2	29.1
130	29.8	39.6	45.6	55.1	66.1	76.3	85.4	92.6	97.4	99.7	99.3	96.1	90.3	82.3	72.4	62.1	52.1	44.2	32.8
135	32.9	43.3	48.4	55.6	64.3	72.8	80.5	86.6	90.6	92.5	92.2	89.6	84.9	78.2	70.5	62.2	54.0	47.7	36.1
140	36.5	46.9	51.1	56.5	63.3	70.3	76.2	81.2	84.6	86.3	86.1	84.0	80.1	74.7	68.8	62.2	55.9	50.7	38.7
145	39.7	50.0	53.7	57.6	62.7	68.0	72.6	76.6	79.4	80.7	80.6	79.0	76.0	71.8	67.4	62.5	56.9	53.2	41.4
150	41.8	52.1	55.8	58.8	62.5	66.5	70.1	72.7	74.8	75.9	75.9	74.7	72.4	69.7	66.3	62.5	58.5	56.0	44.2
155	39.5	51.8	57.7	59.9	62.4	65.2	67.8	69.9	71.1	71.9	71.9	71.1	69.9	67.9	65.4	61.8	58.7	56.9	46.1
160	35.3	52.7	59.3	60.6	62.4	64.3	66.0	67.4	68.4	69.0	69.1	68.6	67.6	66.2	64.4	60.6	56.0	52.9	46.2
165	32.3	46.8	58.4	61.1	62.3	63.5	64.6	65.4	66.0	66.4	66.5	66.2	65.6	64.8	60.6	53.4	50.1	47.3	43.6
170	32.5	41.0	53.8	59.1	59.6	61.6	63.1	63.7	64.0	64.2	64.3	64.4	62.9	57.8	50.3	46.1	46.0	45.3	41.3
175	39.7	41.6	45.1	51.1	55.6	57.8	59.1	61.4	62.4	62.4	63.1	60.0	52.1	44.1	41.0	43.1	44.5	44.2	44.1
180	39.9	39.9	39.9	39.9	39.9	39.9	39.9	39.9	39.9	39.9	39.9	39.9	39.9	39.9	39.9	39.9	39.9	39.9	39.9

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	353	353	353	353	353	353	353	353	353	353	353	353	353	353	353	353	353		
5	351	351	352	352	353	353	353	353	353	353	354	354	353	353	353	353	353		
10	346	347	348	348	349	350	351	351	352	352	352	352	351	351	350	350	349		
15	338	339	341	342	344	346	347	348	348	349	348	348	347	346	345	344	343		
20	327	329	331	334	337	339	341	343	344	344	343	342	340	338	337	335	333		
25	314	316	320	323	327	331	334	336	337	337	336	334	332	329	326	323	321		
30	298	301	306	311	317	322	325	328	329	329	328	325	321	317	312	308	305		
35	279	283	290	297	304	311	316	319	320	320	318	314	309	303	297	291	287		
40	258	264	272	282	291	299	305	309	310	309	307	302	295	287	279	272	266		
45	235	243	254	265	277	286	293	297	299	298	295	288	280	270	260	250	243		
50	210	220	234	248	262	273	281	286	288	286	282	274	264	252	239	227	218		
55	183	196	213	231	246	259	268	273	275	273	268	260	248	234	218	203	191		
60	156	172	193	213	231	245	255	260	262	260	254	245	232	215	196	178	162		
65	127	148	172	196	216	231	242	248	249	247	241	230	215	197	175	153	133		
70	98.6	125	154	180	201	217	228	235	236	234	227	215	200	179	155	128	104		
75	71.5	103	136	164	187	204	216	222	224	221	213	201	185	163	136	106	76.4		
80	47.6	83.7	120	150	173	191	203	209	211	208	200	188	170	148	119	85.7	51.9		
85	29.8	68.7	106	137	161	178	190	197	198	195	187	175	158	134	105	69.7	33.0		
90	20.4	57.9	94.6	125	150	166	178	184	186	182	175	162	145	122	92.7	58.0	22.1		
95	17.0	50.3	84.8	115	138	155	166	172	173	170	162	151	134	111	82.3	49.5	17.3		
100	18.1	45.6	76.7	105	127	143	155	160	161	158	151	139	122	100	73.6	43.8	17.0		
105	21.3	44.0	70.6	95.9	117	132	143	149	150	147	139	128	112	91.2	66.8	41.1	19.3		
110	25.5	44.2	66.6	88.5	107	122	132	137	138	135	128	117	103	83.6	62.2	40.4	23.2		
115	29.5	45.6	64.3	83.0	99.2	112	121	126	127	124	118	108	94.4	77.8	59.2	40.9	27.3		
120	33.4	47.4	62.9	78.7	92.8	104	112	116	117	114	109	99.8	87.9	73.5	57.5	42.9	31.1		
125	36.6	49.4	62.2	75.4	87.4	97.1	104	108	108	106	101	93.1	82.7	70.1	56.9	45.3	34.2		
130	39.8	51.5	62.1	72.9	82.9	91.0	96.9	100	101	98.7	94.2	87.4	78.3	67.7	57.2	47.8	37.4		
135	42.0	53.1	62.1	70.9	78.9	85.7	90.6	93.4	93.9	92.1	88.1	82.3	74.8	66.3	57.8	49.8	39.6		
140	43.3	53.7	61.8	69.3	75.7	81.0	85.1	87.2	87.7	86.1	82.8	78.1	72.1	65.3	58.5	51.4	41.3		
145	42.8	53.1	61.1	67.8	72.9	77.1	80.3	82.0	82.3	81.0	78.4	74.7	69.9	64.6	59.2	52.3	41.2		
150	41.8	54.3	60.4	65.3	70.3	73.6	76.0	77.4	77.7	76.7	74.7	71.8	68.1	64.1	59.6	52.6	40.9		
155	39.8	50.8	55.7	61.3	66.7	70.3	72.1	73.3	73.5	72.9	71.4	69.3	66.7	63.6	59.8	48.5	36.0		
160	37.8	43.7	47.2	51.7	57.2	64.3	68.7	69.3	69.7	69.3	68.4	67.1	65.3	62.6	59.2	42.2	31.7		
165	36.8	38.2	41.1	40.6	45.4	48.0	56.6	64.8	65.7	65.6	65.2	63.8	60.8	58.1	51.8	32.2	30.1		
170	37.5	37.7	38.6	42.0	42.3	42.1	38.6	41.5	60.5	62.5	59.2	56.8	52.0	44.7	36.8	33.7	32.4		
175	43.1	43.4	45.4	46.8	48.0	48.8	49.2	46.3	27.8	38.1	49.5	48.3	46.6	46.4	45.0	42.0	39.5		
180	39.9	39.9	39.9	39.9	39.9	39.9	39.9	39.9	39.9	39.9	39.9	39.9	39.9	39.9	39.9	39.9	39.9		

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 Tubes) 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 Tubes) 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

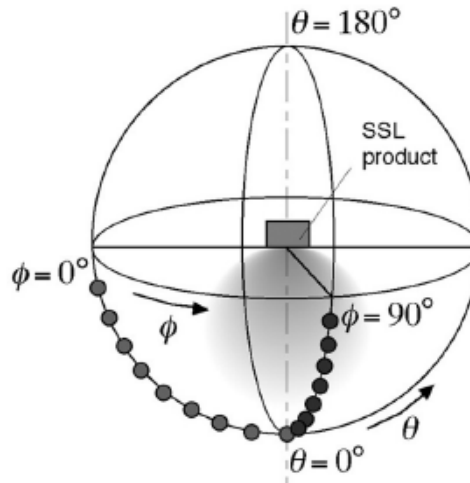
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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