



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: 9290018454

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ17110001a

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

Review by:

April Zou

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Nov. 07, 2017

Jim Zhang

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: **9290018454**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
128.3	1772.0	13.81	0.9780
CCT (K)	CRI	Stabilization Time (Light & Power)	
3152	81.4	60	

Table 1: Executive Data Summary

Note: The above results are recorded/ derived from measurements made using an Integrating Sphere.

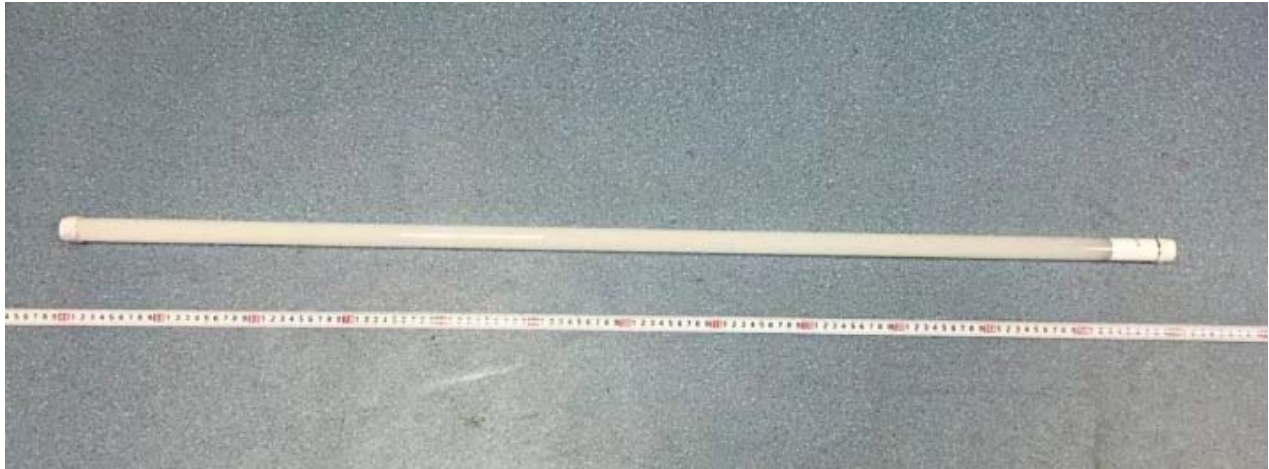
Test specifications:

Date of Receipt	: Nov. 01, 2017
Date of Test	: Nov. 02, 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	: 9290018454
Electrical Ratings	: 120-277V, 60HZ
Product Description	: 14T8PRO/48-830/BB17/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 24.9°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)	0.118	0.052
Power Factor	0.9780	0.9725
Test Power (W)	13.81	14.12
THD A%	19.77	13.92
Luminous Efficacy (lm/W)	128.3	125.5
Total Luminous Flux (lm)	1772.0	1772.0
Color Rendering Index (CRI)	81.4	
R9	2.4	
Correlated Color Temperature (CCT)(K)	3152	
Chromaticity Chroma x	0.4269	
Chromaticity Chroma y	0.4014	
Chromaticity Chroma u	0.2452	
Chromaticity Chroma v	0.3459	
Duv	0.0001	
Chromaticity Chroma u'	0.2452	
Chromaticity Chroma v'	0.5188	

Special Color Rendering Indices	
R1	79.4
R2	88.8
R3	96.3
R4	79.9
R5	79.4
R6	85.7
R7	83.3
R8	58.5
R9	2.4
R10	74.3
R11	78.8
R12	66.3
R13	81.5
R14	98.1
Rf	82
Rg	97

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 24.9°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)	0.119
Power Factor	0.9733
Power (W)	13.86
Luminous Efficacy (lm/W)	128.2
Total Luminous Flux (lm)	1776.3
Beam Angle (°)	113.0 (0°-180°) / 201.4 (90°-270°)
Center Beam Candle Power (cd)	313
Maximum Beam Candle Power (cd)	313.6 (At: C=320.0, Gamma=2.0)
Spacing Criteria	1.26 (0°-180°) / 1.41 (90°-270°)
Zonal Lumens in the 0°-60°Zone	44.90%
Zonal Lumens in the 60°-90°Zone	26.66%
Zonal Lumens in the 90°-120°Zone	16.49%
Zonal Lumens in the 120°-180°Zone	11.95%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

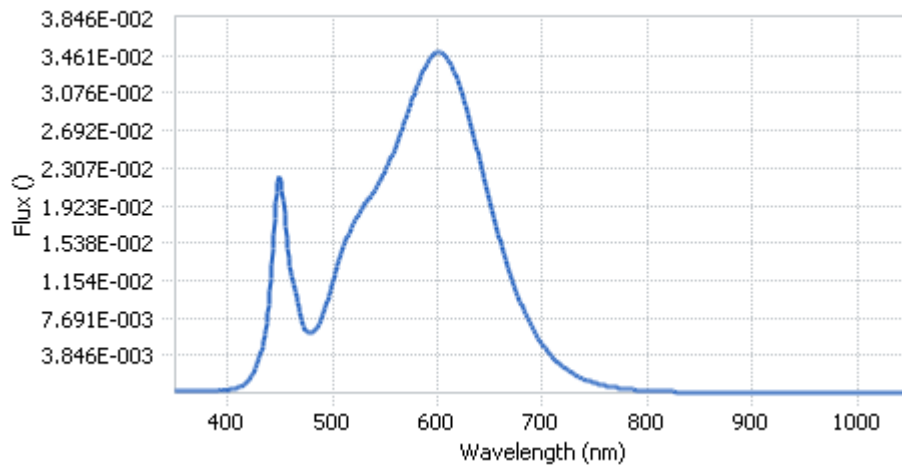
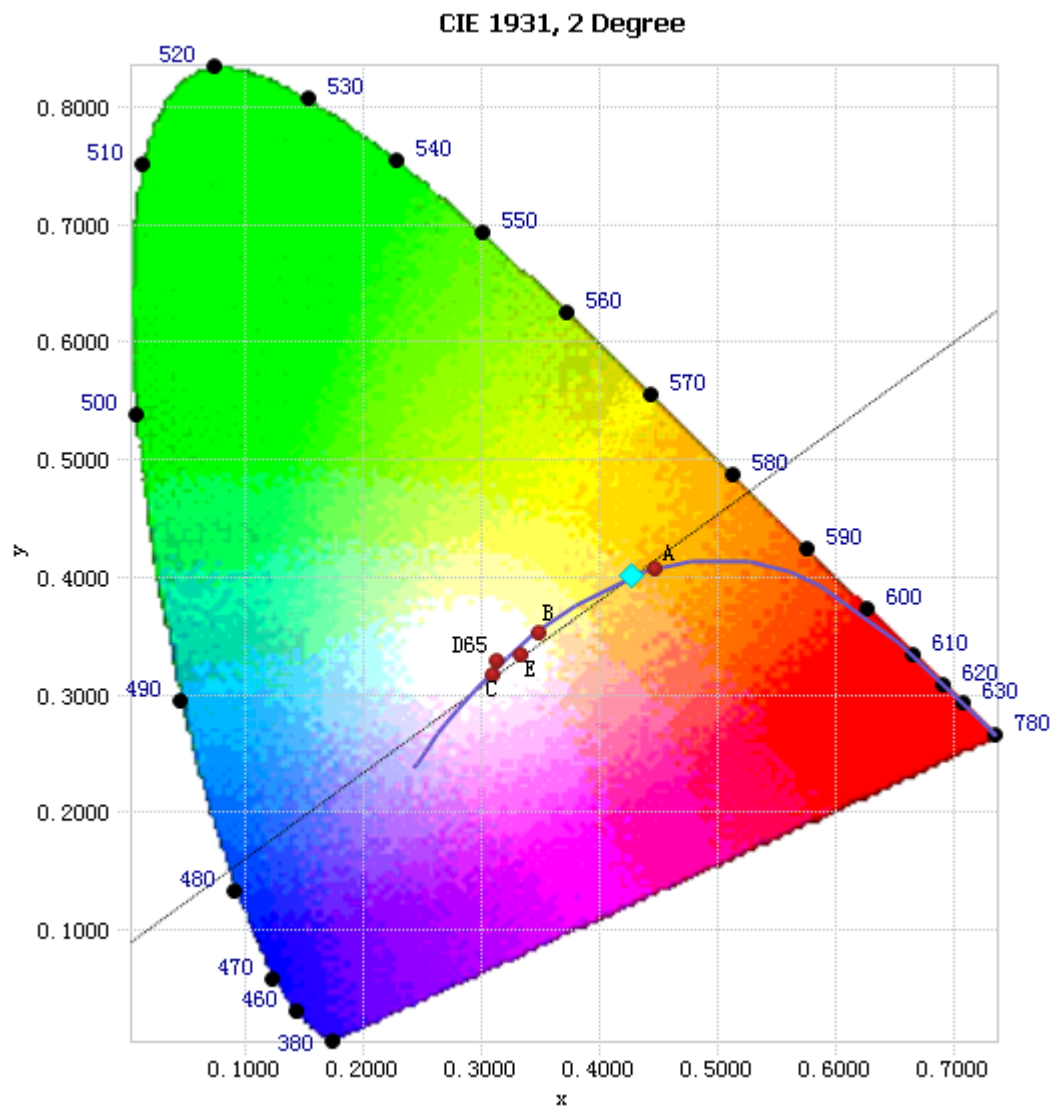


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.89E-04	485	6.69E-03	590	3.38E-02	695	5.74E-03
385	2.63E-04	490	7.80E-03	595	3.46E-02	700	4.95E-03
390	2.91E-04	495	9.46E-03	600	3.49E-02	705	4.22E-03
395	3.07E-04	500	1.14E-02	605	3.48E-02	710	3.60E-03
400	3.08E-04	505	1.33E-02	610	3.42E-02	715	3.09E-03
405	3.89E-04	510	1.49E-02	615	3.32E-02	720	2.64E-03
410	5.45E-04	515	1.64E-02	620	3.17E-02	725	2.25E-03
415	7.94E-04	520	1.74E-02	625	3.01E-02	730	1.92E-03
420	1.31E-03	525	1.83E-02	630	2.82E-02	735	1.64E-03
425	2.17E-03	530	1.92E-02	635	2.61E-02	740	1.39E-03
430	3.55E-03	535	2.00E-02	640	2.39E-02	745	1.18E-03
435	5.95E-03	540	2.08E-02	645	2.17E-02	750	1.02E-03
440	1.05E-02	545	2.17E-02	650	1.95E-02	755	8.66E-04
445	1.80E-02	550	2.28E-02	655	1.74E-02	760	7.49E-04
450	2.20E-02	555	2.40E-02	660	1.54E-02	765	6.41E-04
455	1.70E-02	560	2.53E-02	665	1.36E-02	770	5.50E-04
460	1.24E-02	565	2.68E-02	670	1.19E-02	775	4.70E-04
465	1.03E-02	570	2.82E-02	675	1.04E-02	780	4.03E-04
470	7.79E-03	575	2.99E-02	680	9.01E-03		
475	6.29E-03	580	3.14E-02	685	7.81E-03		
480	6.17E-03	585	3.28E-02	690	6.70E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4269, 0.4014)

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

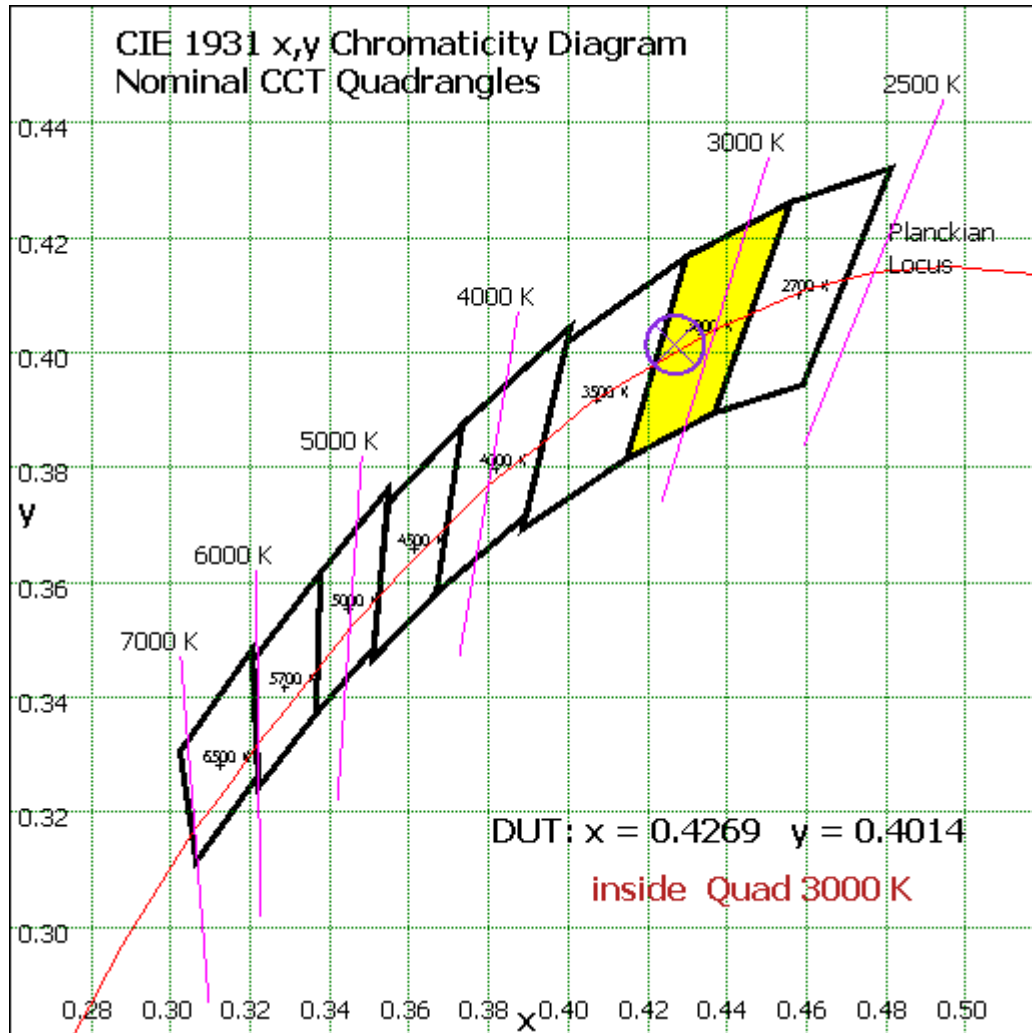


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	29.748	1.67%
10- 20	86.235	4.85%
20- 30	134.074	7.55%
30- 40	168.819	9.50%
40- 50	187.878	10.58%
50- 60	190.858	10.74%
60- 70	179.742	10.12%
70- 80	158.827	8.94%
80- 90	134.927	7.60%
90-100	114.578	6.45%
100-110	97.071	5.46%
110-120	81.347	4.58%
120-130	67.289	3.79%
130-140	54.256	3.05%
140-150	41.633	2.34%
150-160	28.87	1.63%
160-170	15.535	0.87%
170-180	4.622	0.26%
Total	1776.3	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	797.612	44.90%
60- 90	473.496	26.66%
0-90	1271.108	71.56%
90- 180	505.201	28.44%
0- 180	1776.3	100%

Table 5: Zonal Lumen Data

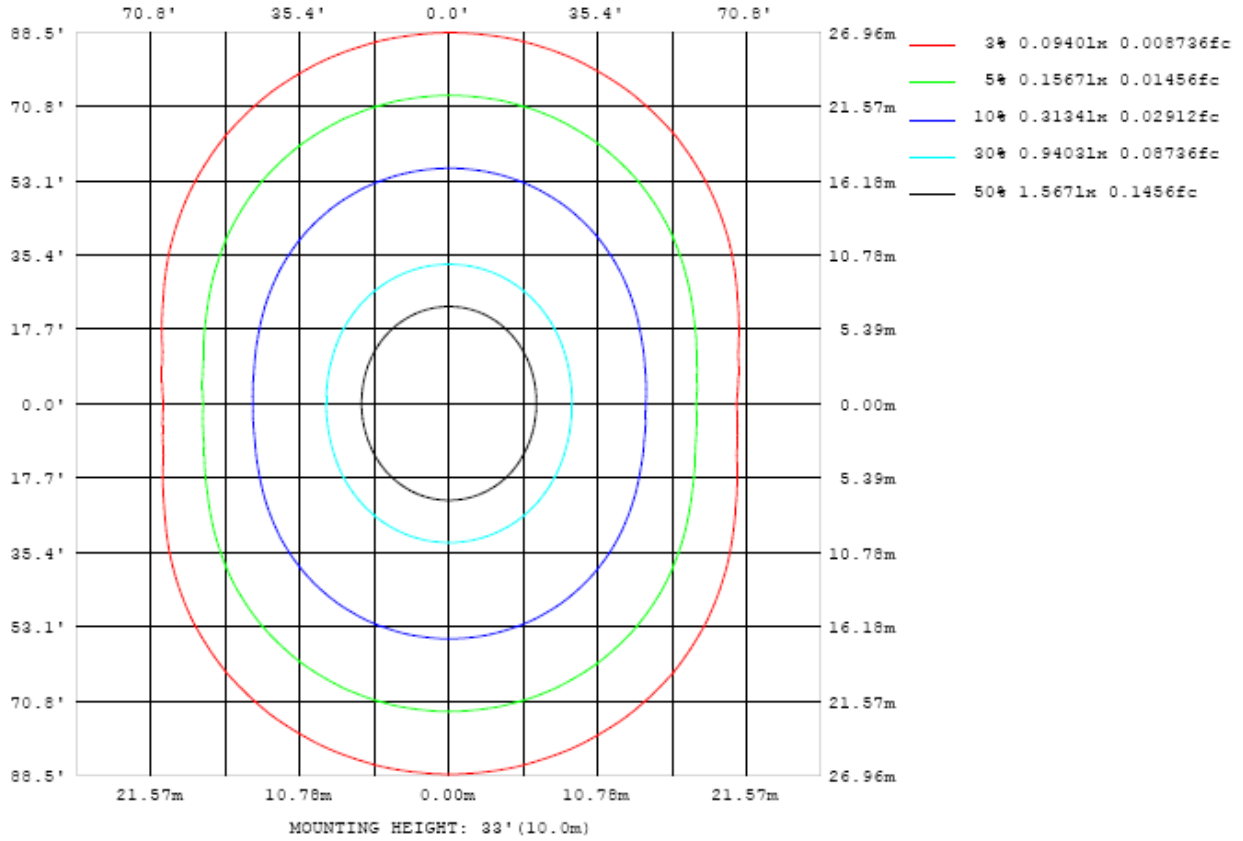


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

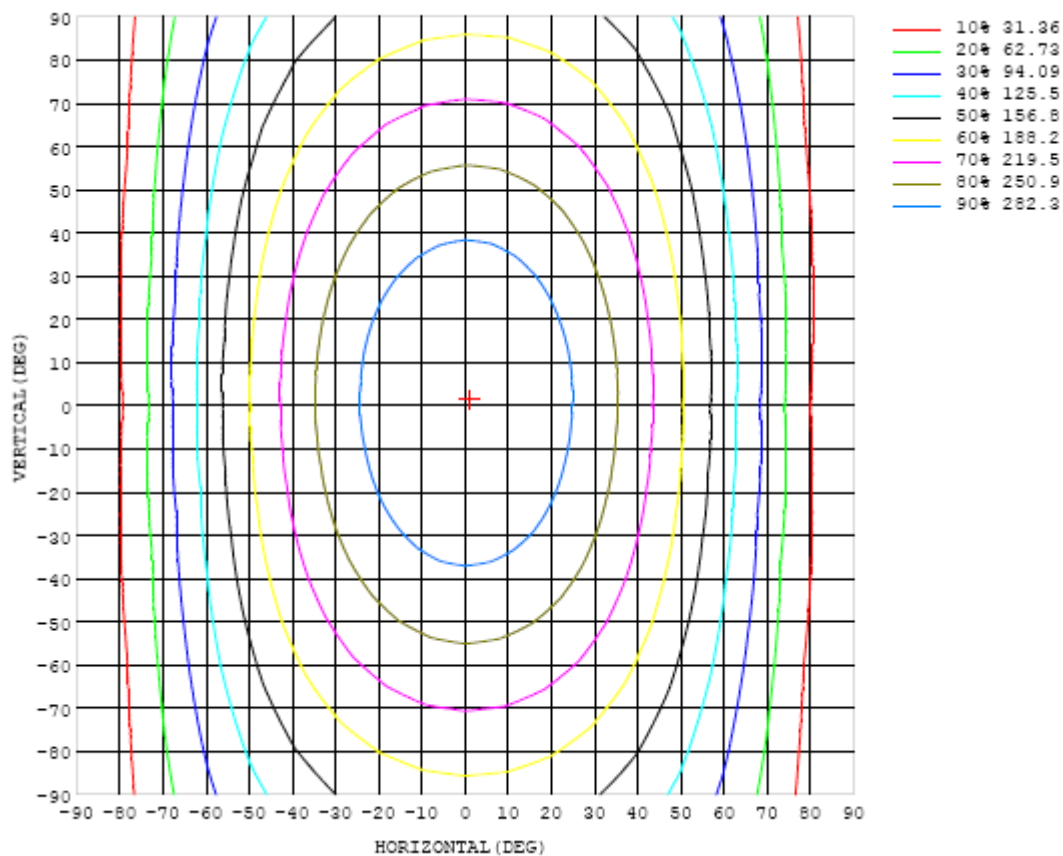


Chart 5: Isocandela Plot

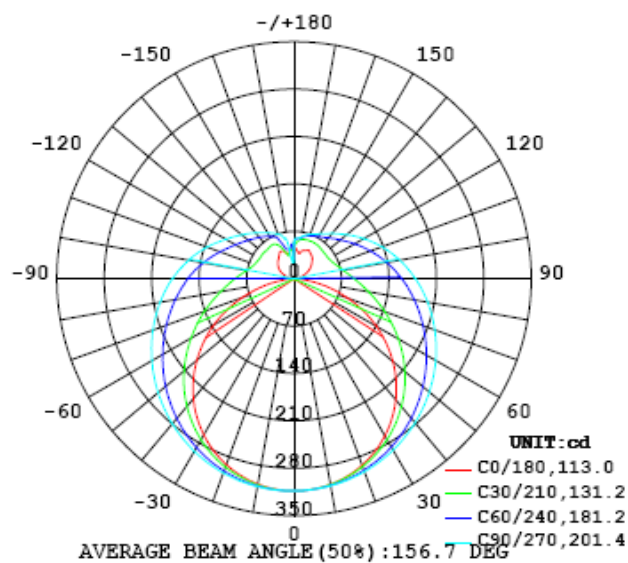


Chart 6: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1

UNIT: cd

C (DEG) γ (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	313	313	313	313	313	313	313	313	313	313	313	313	313	313	313	313	313	313	313
5	312	312	312	312	312	312	313	312	313	313	312	313	312	312	312	312	312	312	312
10	309	309	309	309	309	310	310	310	310	311	311	310	310	309	309	309	308	308	308
15	302	302	303	303	304	305	306	307	307	308	307	307	306	305	304	303	302	302	302
20	293	293	294	295	297	299	301	302	303	303	303	302	300	298	297	295	293	293	292
25	282	282	283	286	289	292	295	297	298	298	298	296	294	291	288	285	282	281	281
30	268	268	271	274	279	283	287	290	292	292	291	289	286	282	277	273	269	267	267
35	252	253	256	261	267	273	278	282	285	285	284	281	277	272	265	259	254	251	250
40	233	235	239	246	254	262	269	274	277	278	276	273	267	260	252	244	237	232	231
45	213	215	221	230	241	251	259	265	268	269	268	264	257	248	238	228	218	212	210
50	190	193	201	213	226	238	248	255	259	260	259	254	246	236	224	210	198	190	187
55	166	170	181	196	211	226	237	245	250	251	249	244	235	223	209	193	177	166	163
60	140	145	159	178	196	213	225	234	240	241	239	233	223	210	193	175	155	141	137
65	113	119	137	160	181	200	214	224	229	231	229	222	212	197	179	157	134	115	109
70	84.7	93.5	116	142	167	187	203	213	219	221	218	212	200	185	164	140	113	89.8	81.2
75	57.1	68.7	96.0	126	153	175	191	202	209	211	208	201	189	172	150	124	93.6	65.7	53.5
80	31.2	46.5	78.4	112	140	163	180	192	198	200	197	190	178	161	138	110	76.8	44.5	28.1
85	10.1	29.0	64.7	99.2	129	152	169	181	188	190	187	179	167	150	127	97.6	63.9	28.5	8.31
90	0.29	19.1	54.6	88.7	118	142	159	171	177	179	176	169	157	139	116	87.6	54.4	20.0	0.29
95	1.81	15.8	47.9	80.4	109	132	149	160	167	169	166	159	147	130	107	79.5	48.1	17.2	1.95
100	5.34	16.3	43.6	73.5	100	122	139	150	157	158	156	149	137	120	98.8	72.9	44.1	17.9	5.28
105	9.70	19.1	41.4	68.3	92.8	113	129	140	146	148	146	139	127	112	91.4	67.9	42.1	20.7	9.87
110	14.7	23.3	41.2	64.1	86.1	105	120	130	136	138	136	129	118	104	85.0	63.9	42.0	24.7	14.7
115	20.1	28.2	42.1	61.2	80.3	97.7	111	121	127	128	126	120	110	96.3	79.6	61.1	43.1	29.2	19.7
120	25.4	32.7	43.8	59.4	75.7	90.8	103	112	117	119	117	111	102	89.8	75.1	59.8	45.1	32.7	24.2
125	29.9	37.0	46.1	58.7	72.5	85.0	95.7	104	108	110	108	103	94.8	84.1	72.3	59.2	47.3	36.7	28.1
130	34.0	41.4	48.9	58.6	69.6	80.2	89.2	95.8	100	101	99.8	95.3	88.5	79.7	69.7	59.1	49.7	39.4	30.9
135	37.9	45.3	51.1	59.0	67.7	76.0	83.7	89.3	92.8	93.9	92.6	89.0	83.3	75.9	67.8	59.5	51.6	42.7	33.7
140	41.7	48.5	52.7	59.8	66.5	73.1	78.8	83.4	86.3	87.3	86.3	83.2	78.6	73.0	66.7	60.1	53.1	45.5	36.5
145	43.7	50.6	55.1	60.4	65.8	70.7	74.9	78.4	80.7	81.5	80.7	78.4	74.9	70.7	65.8	60.7	54.0	47.3	39.3
150	46.2	52.8	56.2	60.7	65.3	69.0	72.2	74.4	76.1	76.7	76.1	74.4	72.0	68.8	65.1	61.2	55.3	50.2	43.4
155	46.6	54.8	57.7	61.0	64.6	67.5	69.8	71.5	72.3	72.7	72.4	71.3	69.6	67.3	64.6	61.0	55.5	51.3	44.9
160	44.8	56.7	58.1	60.8	63.4	65.8	67.6	68.9	69.7	69.9	69.7	68.9	67.5	65.9	64.3	60.3	51.1	46.9	42.3
165	42.3	54.2	59.3	59.9	61.7	63.7	65.0	66.1	66.8	67.0	66.8	66.2	65.4	64.2	60.2	51.8	46.6	43.1	38.3
170	39.5	50.7	56.9	58.9	59.9	60.7	61.3	62.0	62.6	62.9	62.9	62.7	61.4	56.6	50.9	45.7	44.4	45.4	42.1
175	42.9	46.5	52.3	55.1	57.0	59.1	60.0	60.1	60.1	60.1	60.7	59.3	53.9	47.1	41.4	39.6	41.9	43.8	43.8
180	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8

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	313	313	313	313	313	313	313	313	313	313	313	313	313	313	313	313	313		
5	312	312	313	313	313	313	313	313	313	313	313	313	313	313	313	312	312		
10	308	309	309	310	310	311	311	312	312	312	312	311	311	310	309	309	309		
15	302	303	304	305	306	307	308	309	309	309	309	308	307	305	304	303	303		
20	293	294	296	298	300	302	304	305	305	305	304	303	301	299	297	295	294		
25	281	283	286	290	293	296	298	300	300	300	299	297	294	290	287	285	283		
30	268	271	275	279	284	288	291	294	294	294	292	289	285	280	276	272	269		
35	251	255	261	267	274	279	283	286	287	287	284	280	275	269	263	257	254		
40	233	239	246	254	262	269	275	278	280	279	276	271	264	256	248	241	236		
45	213	220	229	240	250	259	265	269	271	270	267	261	252	242	232	223	216		
50	191	200	212	225	237	248	255	260	262	261	257	250	240	228	215	203	194		
55	167	179	194	210	224	236	245	250	252	251	247	239	227	213	198	183	171		
60	143	157	176	194	211	224	234	240	242	241	236	227	214	198	180	161	147		
65	117	135	158	179	198	212	223	230	232	231	225	215	201	183	162	140	122		
70	90.9	114	141	164	185	201	212	219	222	220	214	204	189	169	145	119	95.8		
75	66.3	94.4	124	151	172	189	201	209	211	210	204	193	177	156	129	99.1	70.8		
80	44.6	77.2	110	138	161	178	190	198	201	199	193	182	165	143	115	81.4	48.4		
85	28.4	63.6	97.7	127	150	167	180	188	190	189	182	171	155	131	102	67.2	30.9		
90	19.5	53.7	87.3	116	139	157	169	177	180	178	172	160	144	121	91.5	56.6	20.8		
95	16.1	46.6	78.5	106	129	147	159	166	169	167	161	150	133	111	82.1	48.9	16.6		
100	16.9	42.3	71.2	97.5	119	136	148	156	158	157	151	140	123	101	74.2	43.9	17.0		
105	19.8	40.8	65.6	89.5	110	126	137	145	147	146	140	129	114	92.8	68.1	41.9	20.1		
110	23.7	41.2	62.3	83.0	101	116	127	134	137	135	129	119	105	85.7	64.0	41.8	24.3		
115	27.9	42.8	60.3	78.3	94.3	107	117	124	126	125	119	110	96.9	80.3	61.5	43.1	28.6		
120	31.8	44.7	59.4	74.7	88.6	100	109	114	117	115	111	102	90.7	76.2	60.3	45.3	32.5		
125	35.3	47.0	59.1	71.9	83.9	94.1	102	107	108	107	103	95.8	85.6	73.2	60.0	47.6	35.8		
130	38.1	49.1	59.0	69.9	80.0	88.6	95.2	99.5	101	100	96.4	90.1	81.4	70.9	60.2	49.9	38.8		
135	39.7	51.2	58.3	67.5	76.7	83.9	89.5	93.1	94.4	93.6	90.4	85.1	77.8	69.4	60.6	52.0	41.4		
140	40.5	53.1	58.9	66.4	73.8	79.7	84.3	87.4	88.5	87.7	85.1	80.7	74.9	68.2	60.8	53.4	42.9		
145	40.2	54.5	59.5	64.1	70.6	76.1	79.8	82.2	83.1	82.6	80.5	77.0	72.4	67.0	60.9	53.9	42.9		
150	38.6	54.7	59.3	62.5	67.2	71.7	75.8	77.7	78.4	78.1	76.5	73.8	70.2	65.7	61.2	54.5	41.8		
155	35.7	48.5	54.4	58.3	62.5	67.6	70.8	73.6	74.1	73.9	72.9	70.9	68.0	64.6	61.7	52.4	39.0		
160	34.5	38.4	45.4	49.5	53.1	57.6	64.8	68.9	70.1	70.0	69.4	68.0	66.1	64.1	60.2	44.6	36.9		
165	33.4	33.8	37.2	40.3	45.3	45.3	48.8	58.7	64.2	66.6	66.4	64.9	63.4	59.6	47.7	36.7	35.8		
170	36.6	36.3	38.5	39.0	42.2	44.7	44.2	36.9	51.8	60.6	57.8	54.5	47.2	41.7	37.2	37.7	36.4		
175	43.4	43.8	43.4	45.8	49.1	51.2	52.0	50.4	27.5	46.6	49.6	50.8	50.2	48.2	45.7	43.4	42.9		
180	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8		

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

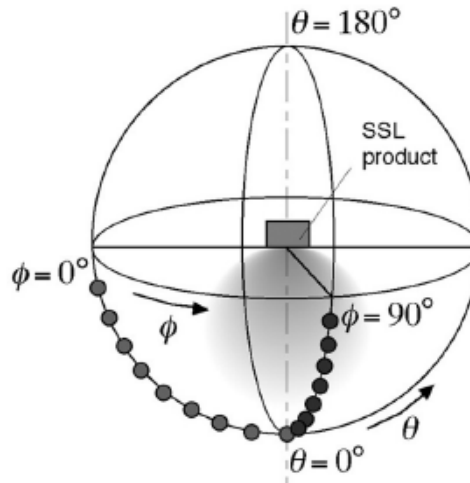
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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