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: 9290018455

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ17110001b

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

Review by: April Zou

Engineer: April Zou
Nov. 08, 2017

Approved by: Jim Zhang

Manager: Jim Zhang
Nov. 08, 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: **9290018455**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
140.0	1881.0	13.43	0.9731

CCT (K)	CRI	Stabilization Time (Light & Power)
3604	83.4	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. 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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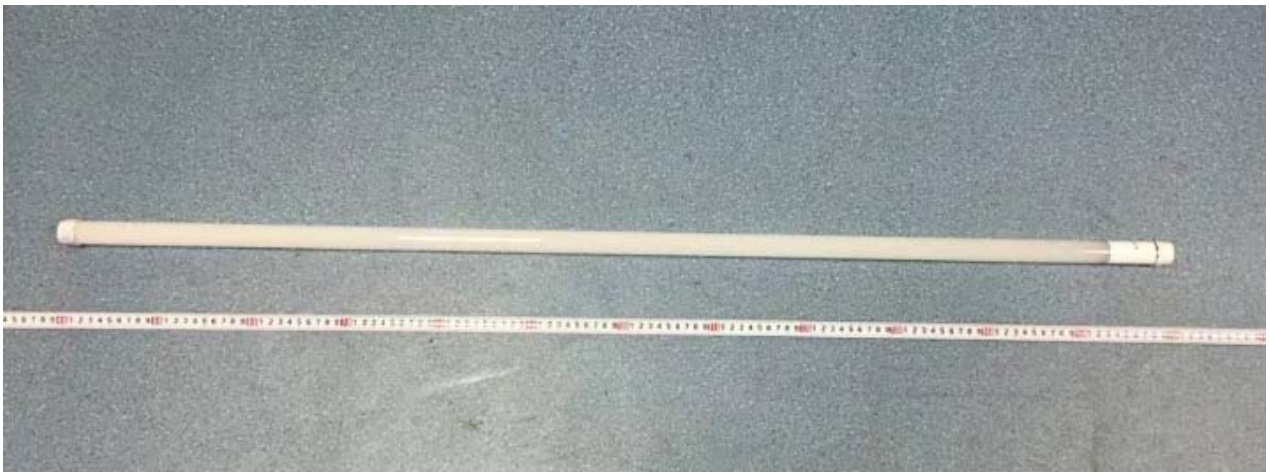
Sample Photo



Sample view

Equipment Under Test (EUT)	
Name	: LED Tube
Model	: 9290018455
Electrical Ratings	: 120-277V, 60HZ
Product Description	: 14T8PRO/48-835/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℃.

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)	0.115	0.051
Power Factor	0.9731	0.9677
Test Power (W)	13.43	13.73
THD A%	21.56	17.26
Luminous Efficacy (lm/W)	140.0	136.8
Total Luminous Flux (lm)	1881.0	1878.0
Color Rendering Index (CRI)	83.4	
R9	6.7	
Correlated Color Temperature (CCT)(K)	3604	
Chromaticity Chroma x	0.4005	
Chromaticity Chroma y	0.3905	
Chromaticity Chroma u	0.2327	
Chromaticity Chroma v	0.3403	
Duv	0.0010	
Chromaticity Chroma u ’	0.2327	
Chromaticity Chroma v’	0.5105	

Special Color Rendering Indices	
R1	82
R2	92.5
R3	95.2
R4	80.7
R5	82.5
R6	90.1
R7	83.4
R8	60.9
R9	6.7
R10	82.6
R11	80.1
R12	69.2
R13	84.9
R14	97.8
Rf	83
Rg	93

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℃.

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	0.9751
Power (W)	13.45
Luminous Efficacy (lm/W)	140.2
Total Luminous Flux (lm)	1885.4
Beam Angle (°)	112.7（0^o-180^o）/ 202.4 (90^o-270^o)
Center Beam Candle Power (cd)	331
Maximum Beam Candle Power (cd)	331.3 (At: C=340.0, Gamma=1.0)
Spacing Criteria	1.25（0^o-180^o）/1.42 (90^o-270^o)
Zonal Lumens in the 0°-60°Zone	44.88%
Zonal Lumens in the 60°-90°Zone	26.77%
Zonal Lumens in the 90°-120°Zone	16.52%
Zonal Lumens in the 120°-180°Zone	11.84%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

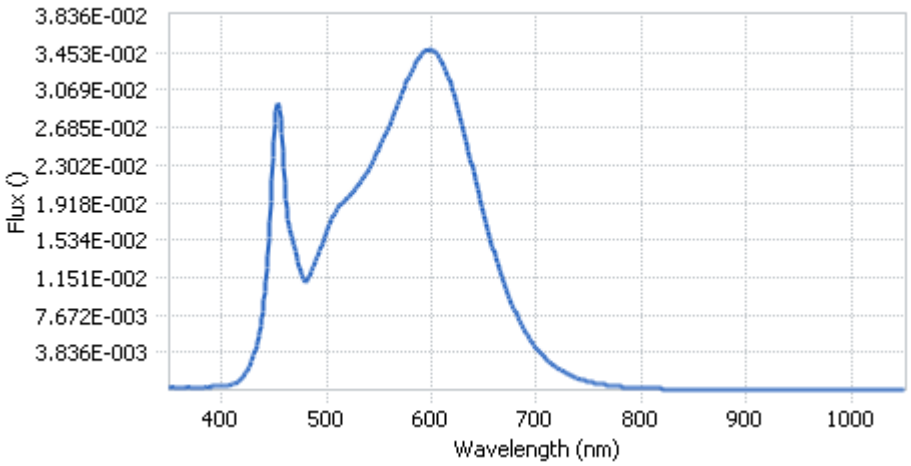
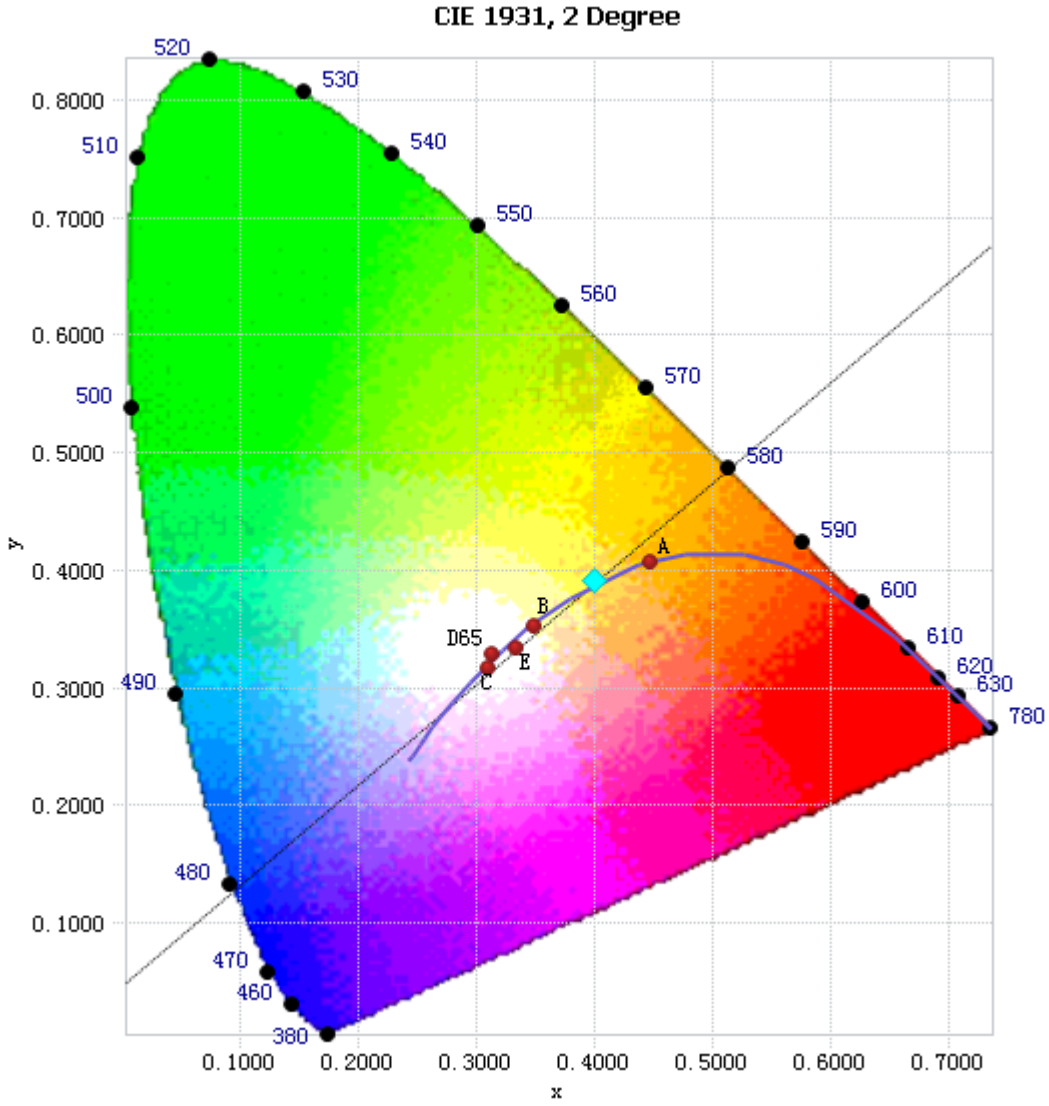


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	3.00E-04	485	1.21E-02	590	3.43E-02	695	4.98E-03
385	2.84E-04	490	1.34E-02	595	3.48E-02	700	4.26E-03
390	2.95E-04	495	1.47E-02	600	3.47E-02	705	3.63E-03
395	3.55E-04	500	1.63E-02	605	3.44E-02	710	3.07E-03
400	3.57E-04	505	1.76E-02	610	3.36E-02	715	2.62E-03
405	4.27E-04	510	1.85E-02	615	3.23E-02	720	2.23E-03
410	5.59E-04	515	1.92E-02	620	3.06E-02	725	1.90E-03
415	8.22E-04	520	1.96E-02	625	2.88E-02	730	1.62E-03
420	1.31E-03	525	2.02E-02	630	2.67E-02	735	1.37E-03
425	2.15E-03	530	2.10E-02	635	2.45E-02	740	1.16E-03
430	3.40E-03	535	2.17E-02	640	2.23E-02	745	9.92E-04
435	5.54E-03	540	2.27E-02	645	2.00E-02	750	8.44E-04
440	9.16E-03	545	2.36E-02	650	1.79E-02	755	7.23E-04
445	1.56E-02	550	2.47E-02	655	1.58E-02	760	6.19E-04
450	2.54E-02	555	2.59E-02	660	1.39E-02	765	5.29E-04
455	2.87E-02	560	2.72E-02	665	1.22E-02	770	4.52E-04
460	2.11E-02	565	2.84E-02	670	1.06E-02	775	3.84E-04
465	1.63E-02	570	2.98E-02	675	9.20E-03	780	3.29E-04
470	1.45E-02	575	3.12E-02	680	7.94E-03		
475	1.21E-02	580	3.24E-02	685	6.81E-03		
480	1.12E-02	585	3.36E-02	690	5.84E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4005, 0.3905)

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

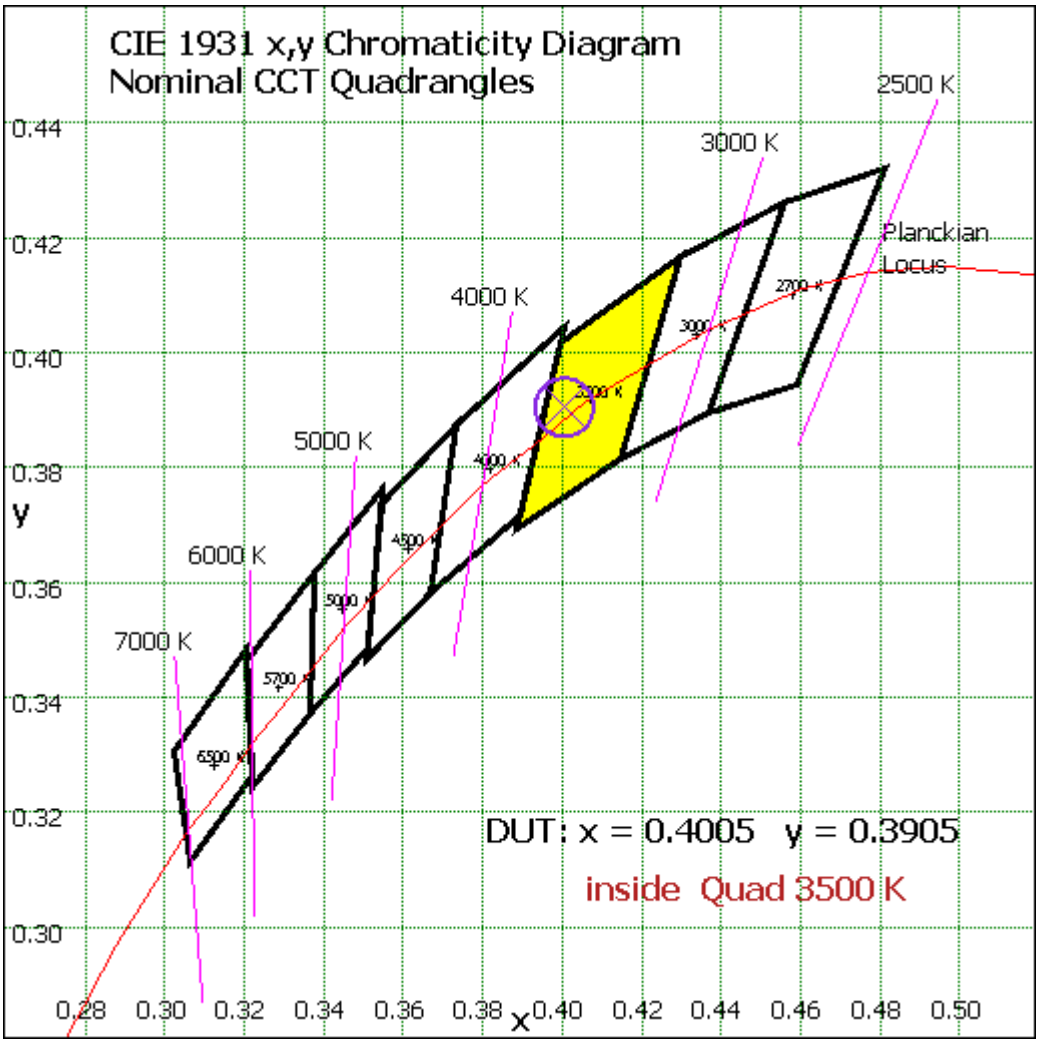


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

γ(°)	Lumens	% Total
0- 10	31.421	1.67%
10- 20	91.148	4.83%
20- 30	141.902	7.53%
30- 40	178.991	9.49%
40- 50	199.573	10.58%
50- 60	203.077	10.77%
60- 70	191.497	10.16%
70- 80	169.356	8.98%
80- 90	143.899	7.63%
90-100	122.159	6.48%
100-110	103.213	5.47%
110-120	86.056	4.56%
120-130	70.894	3.76%
130-140	57.013	3.02%
140-150	43.719	2.32%
150-160	30.325	1.61%
160-170	16.467	0.87%
170-180	4.737	0.25%
Total	1885.4	100%

γ(°)	Lumens	% Total
0- 60	846.112	44.88%
60- 90	504.752	26.77%
0-90	1350.864	71.65%
90- 180	534.583	28.35%
0- 180	1885.4	100%

Table 5: Zonal Lumen Data

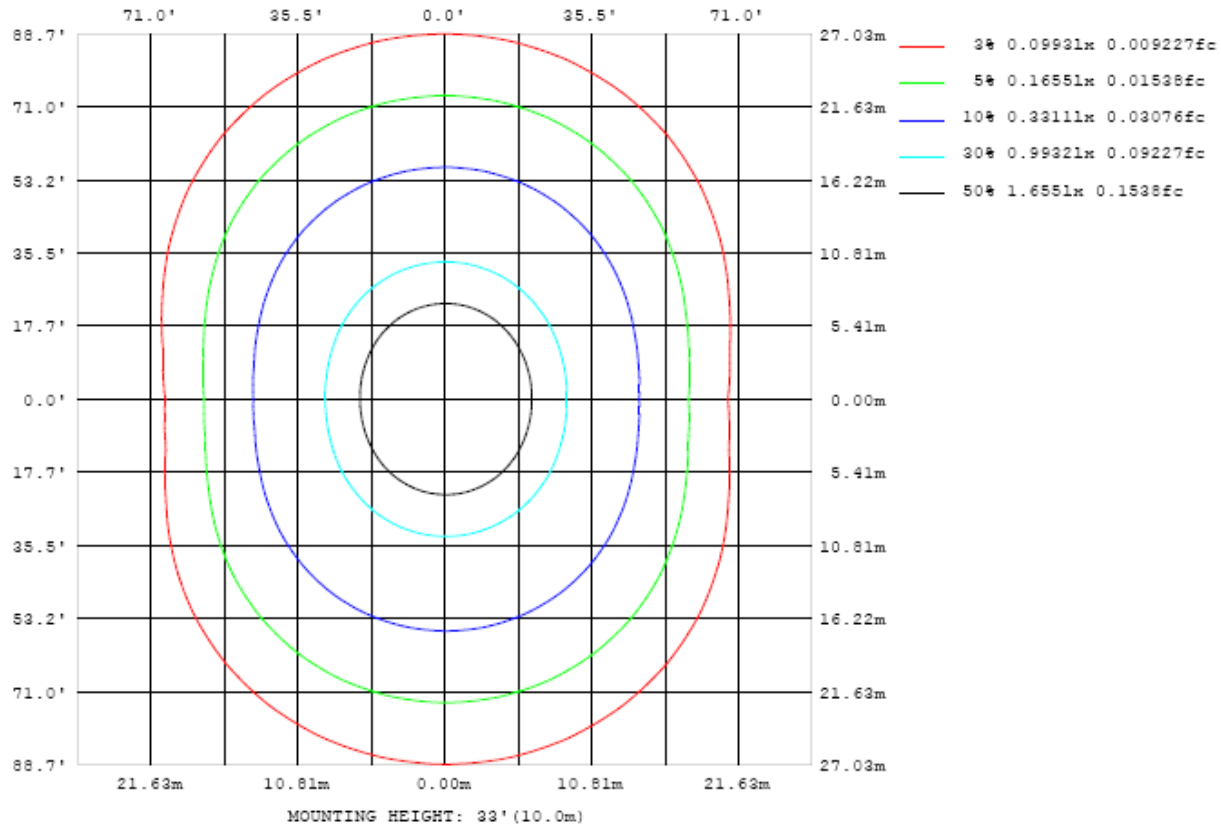


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

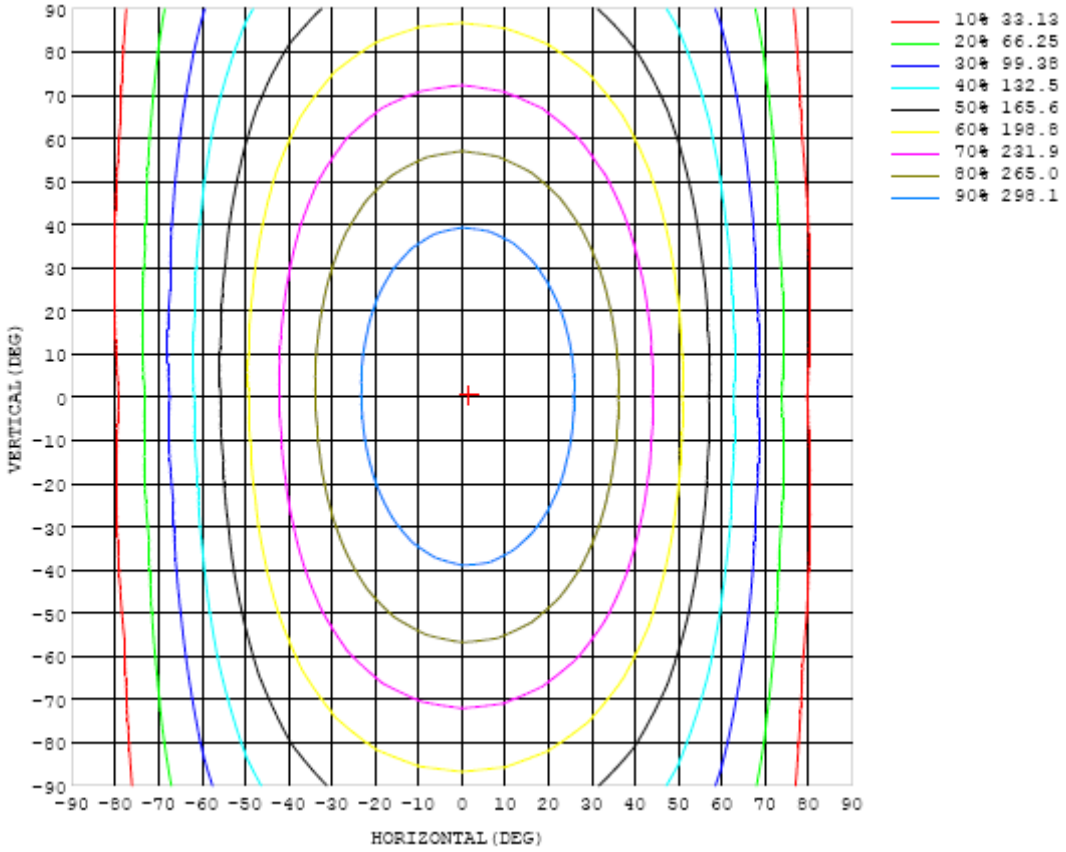


Chart 5: Isocandela Plot

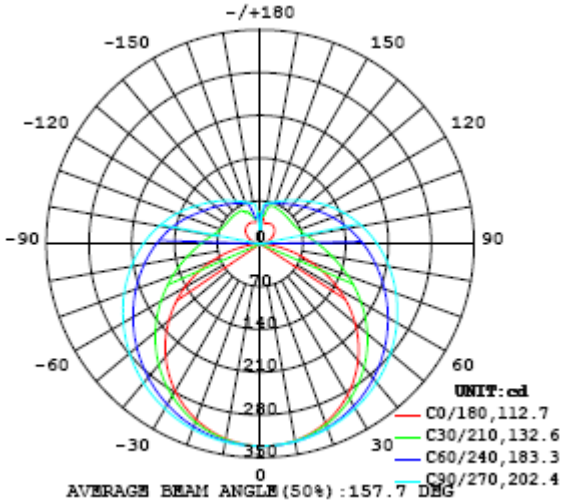


Chart 6: Polar Candela Distribution

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	331	331	331	331	331	331	331	331	331	331	331	331	331	331	331	331	331	331	331
5	330	330	330	330	331	331	330	331	330	330	330	330	330	330	329	329	329	329	329
10	327	327	327	328	328	328	329	329	329	329	328	328	327	326	326	325	324	324	324
15	321	321	322	322	323	324	325	326	326	326	325	324	323	321	320	318	317	316	316
20	312	312	313	315	317	319	320	321	322	322	321	319	317	315	312	310	308	306	306
25	300	301	303	305	308	311	314	316	317	317	316	313	310	307	303	299	296	294	294
30	286	287	290	293	298	303	306	309	311	311	309	306	302	297	291	286	282	279	278
35	269	270	274	280	286	292	298	302	304	304	302	299	293	287	279	272	266	261	261
40	249	251	257	264	273	281	288	293	296	296	294	290	283	275	266	256	248	242	241
45	227	230	237	247	258	269	277	283	287	288	285	281	273	263	251	239	228	221	219
50	203	207	216	229	243	256	266	273	278	279	276	270	261	250	236	221	207	197	195
55	176	181	194	210	227	242	254	262	268	269	266	260	250	236	220	202	185	173	169
60	148	155	171	191	211	228	241	251	257	258	255	249	238	223	204	183	163	147	143
65	119	127	147	171	194	214	229	240	246	247	245	238	226	209	189	164	140	120	114
70	88.7	99.6	124	153	179	200	216	228	235	236	234	226	214	196	173	147	118	92.9	84.7
75	59.3	73.1	103	135	163	186	204	216	223	225	222	215	202	183	159	130	97.2	67.4	55.9
80	31.6	50.0	84.6	119	150	174	192	204	212	214	211	204	190	171	146	115	79.4	45.0	29.4
85	9.84	32.1	69.7	106	137	162	180	193	200	203	200	192	179	160	134	102	65.9	28.1	8.70
90	0.23	21.9	59.1	94.8	126	150	169	182	189	191	189	181	168	149	123	92.0	55.9	19.3	0.52
95	1.84	18.3	51.8	85.5	115	139	157	170	178	180	178	170	157	138	114	83.5	49.5	16.6	1.93
100	5.07	18.5	47.2	78.0	106	129	147	159	166	169	166	159	147	129	105	76.6	45.7	17.8	5.62
105	9.27	21.2	44.7	72.0	97.9	120	136	148	155	158	155	148	136	119	97.3	71.3	43.9	21.2	10.3
110	14.0	24.9	44.2	68.0	90.8	111	126	138	145	147	145	138	127	111	90.6	67.7	44.2	25.7	15.3
115	18.9	29.2	45.0	64.8	84.8	103	117	128	134	136	134	128	118	103	84.9	65.0	45.7	30.6	19.9
120	23.3	33.9	46.6	63.1	79.8	95.6	109	118	124	126	124	119	109	96.1	80.2	63.8	47.8	35.0	24.0
125	27.4	38.6	48.5	62.2	76.1	89.4	101	109	115	116	115	110	101	90.1	76.9	63.4	50.2	39.4	28.0
130	30.7	43.2	50.7	61.9	73.4	84.5	94.0	101	106	108	106	102	94.7	85.4	74.4	63.3	52.6	43.9	31.3
135	33.6	47.3	53.1	61.9	71.2	80.4	88.4	94.5	98.4	99.7	98.6	95.0	89.2	81.4	72.4	63.6	54.9	47.4	33.8
140	35.0	50.9	55.5	62.3	70.1	77.1	83.6	88.6	91.8	93.0	92.0	89.2	84.4	78.1	70.9	64.0	56.1	51.1	35.7
145	36.5	54.0	57.8	62.8	68.8	74.2	79.4	83.4	86.0	86.9	86.1	84.0	80.2	75.2	70.1	64.4	57.1	54.2	37.1
150	37.0	56.1	59.9	63.4	67.9	71.8	75.8	78.9	80.9	81.6	81.1	79.4	76.6	72.8	69.0	64.4	59.8	56.3	37.8
155	36.5	53.2	61.7	64.2	67.1	70.2	72.7	75.0	76.4	77.0	76.6	75.5	73.4	70.7	67.9	59.8	59.0	52.9	38.1
160	35.5	47.9	62.9	64.8	66.7	68.5	70.3	71.6	72.7	73.1	72.8	72.1	70.6	69.0	62.2	56.9	53.5	46.2	37.7
165	34.3	41.2	54.7	64.0	65.5	67.4	68.4	69.2	69.6	69.8	69.6	69.3	67.3	58.4	52.5	49.0	45.5	41.1	36.7
170	36.1	37.9	43.1	53.1	61.7	63.4	65.0	67.3	67.5	67.6	67.5	62.6	51.6	45.9	47.7	45.3	43.0	39.0	37.5
175	46.8	46.2	45.3	46.3	48.9	49.0	51.8	55.6	62.7	63.7	46.6	34.5	41.4	46.2	45.3	47.6	46.4	47.3	46.5
180	21.3	21.3	21.3	21.2	21.1	21.0	20.8	20.7	20.5	20.4	20.5	20.5	20.6	20.7	20.8	20.8	20.9	20.9	20.9

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	331	331	331	331	331	331	331	331	331	331	331	331	331	331	331	331	331		
5	329	329	329	330	330	330	330	331	331	331	331	331	331	331	331	331	331		
10	324	325	325	326	327	327	328	329	329	329	329	329	329	328	328	328	327		
15	317	318	319	321	322	324	325	326	327	327	326	326	325	324	323	322	321		
20	307	308	311	313	316	318	320	322	323	323	322	321	319	317	316	314	313		
25	294	297	300	304	308	312	315	317	318	318	317	315	312	309	306	303	301		
30	280	283	288	293	299	304	308	311	312	311	310	307	303	298	294	290	287		
35	263	267	274	281	289	295	300	303	305	304	302	298	293	286	280	275	271		
40	244	250	258	268	277	285	291	295	297	296	293	288	281	273	265	257	252		
45	223	231	242	254	265	275	282	287	288	287	283	277	268	258	248	238	231		
50	200	210	224	239	253	264	272	277	279	278	273	266	255	243	229	217	207		
55	175	189	206	224	239	252	261	267	269	267	262	254	242	227	210	194	182		
60	150	167	188	208	226	240	250	256	259	257	251	241	227	211	191	171	156		
65	124	145	169	193	213	228	239	246	248	246	239	229	213	194	171	148	128		
70	97.5	124	153	178	200	216	228	235	237	234	228	216	200	179	153	125	100		
75	72.3	104	136	164	187	204	216	224	226	223	216	204	186	163	136	104	73.7		
80	50.3	86.0	121	152	175	193	205	212	214	211	204	192	173	150	120	84.7	49.5		
85	33.5	71.8	109	139	163	181	193	201	203	200	192	180	161	137	106	69.2	30.9		
90	23.9	61.4	97.4	128	153	170	182	189	191	188	181	168	150	126	94.5	58.0	20.4		
95	19.6	53.7	88.1	118	142	159	171	178	180	177	169	157	139	115	84.7	49.9	16.0		
100	20.0	48.4	79.9	108	131	148	159	166	168	165	158	146	128	105	76.2	44.4	16.6		
105	22.7	46.2	73.2	99.1	121	137	148	155	157	154	147	135	118	95.7	69.6	42.1	19.8		
110	26.7	46.0	69.0	91.3	111	126	137	143	145	143	136	124	108	88.0	65.1	41.8	23.3		
115	30.0	47.2	66.5	85.7	103	116	126	132	134	131	125	114	99.7	82.2	62.3	42.9	26.0		
120	33.7	48.8	65.0	81.3	96.1	108	117	122	123	121	115	106	93.1	77.7	60.7	45.0	32.4		
125	38.9	50.5	64.1	77.9	90.6	101	108	113	114	112	107	98.7	87.7	74.4	60.1	46.8	37.0		
130	42.4	52.0	63.7	75.2	85.9	94.8	101	105	106	104	99.7	92.6	83.1	71.9	60.3	47.8	41.1		
135	45.4	53.2	63.5	73.0	81.9	89.3	94.7	97.9	98.8	97.3	93.4	87.2	79.3	70.1	60.2	50.1	44.9		
140	48.7	55.5	63.2	71.2	78.4	84.4	88.9	91.6	92.4	91.0	87.7	82.5	76.1	68.4	59.8	54.1	47.9		
145	51.2	52.3	62.7	69.7	75.4	80.1	83.7	85.8	86.4	85.3	82.6	78.5	73.1	66.8	59.6	56.4	50.1		
150	53.4	57.6	63.2	68.4	72.8	76.5	79.1	80.8	81.2	80.4	78.2	74.8	70.4	64.7	62.1	57.6	51.1		
155	50.2	55.3	55.7	66.9	70.5	73.1	75.1	76.4	76.8	76.0	74.2	71.3	67.6	65.7	63.2	58.7	47.7		
160	41.4	50.4	54.0	57.2	68.0	70.2	71.6	72.6	72.9	72.2	70.7	69.1	67.9	66.0	63.1	60.5	42.5		
165	37.0	41.3	45.8	47.8	49.5	62.1	68.0	68.8	69.3	69.2	68.6	67.6	66.6	64.1	61.9	57.0	36.7		
170	37.1	37.1	41.7	45.6	45.1	42.6	48.9	62.3	66.5	66.5	66.3	65.3	61.6	60.9	55.6	43.0	33.6		
175	46.5	46.0	45.3	47.2	45.3	46.1	41.4	34.1	42.5	62.9	59.1	53.3	49.8	46.9	46.7	44.2	45.2		
180	20.9	20.9	20.8	20.8	20.7	20.6	20.5	20.5	20.4	20.5	20.7	20.8	21.0	21.1	21.2	21.3	21.3		

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 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 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 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 expended uncertainty is 2.3% with a coverage factor k=2.

Color Characteristics Measurements

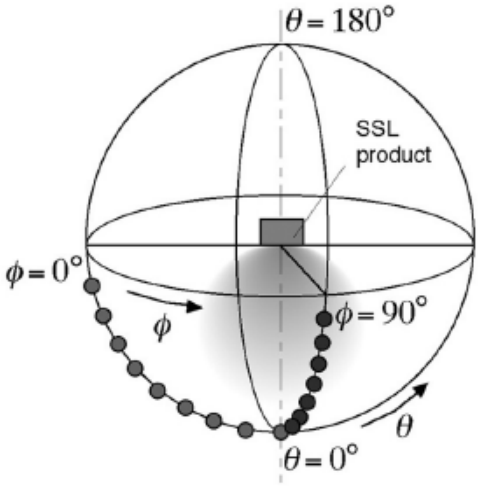
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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