



LM-79-08 Test Report

for

GREEN CREATIVE LTD

756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

LED Tube System

Model: 14.5T8/U6/830/EXT/A2

(LED tube model: 14.5T8/U6/830/EXT 2pcs and LED driver model: 15T8T5HEDRIVER/2CH 1pcs)

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ18070047ae/R1

This report is replaced the old report No. HZ18070047ae dated Aug. 09, 2018

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

Review by:

Engineer: April Zou
Aug. 28, 2018

Approved by:



Manager: Jim Zhang
Aug. 28, 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: 14.5T8/U6/830/EXT/A2

Luminous Efficacy (Lumens /Watt)	Luminous Flux per lamp (Lumens)	Power (Watts)/2	Power Factor
134.0	2186.0	16.32	0.9982
CCT (K)	CRI	Stabilization Time (Light & Power)	
2947	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 : Jul. 30, 2018

Date of Test : Aug. 06, 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 Photos

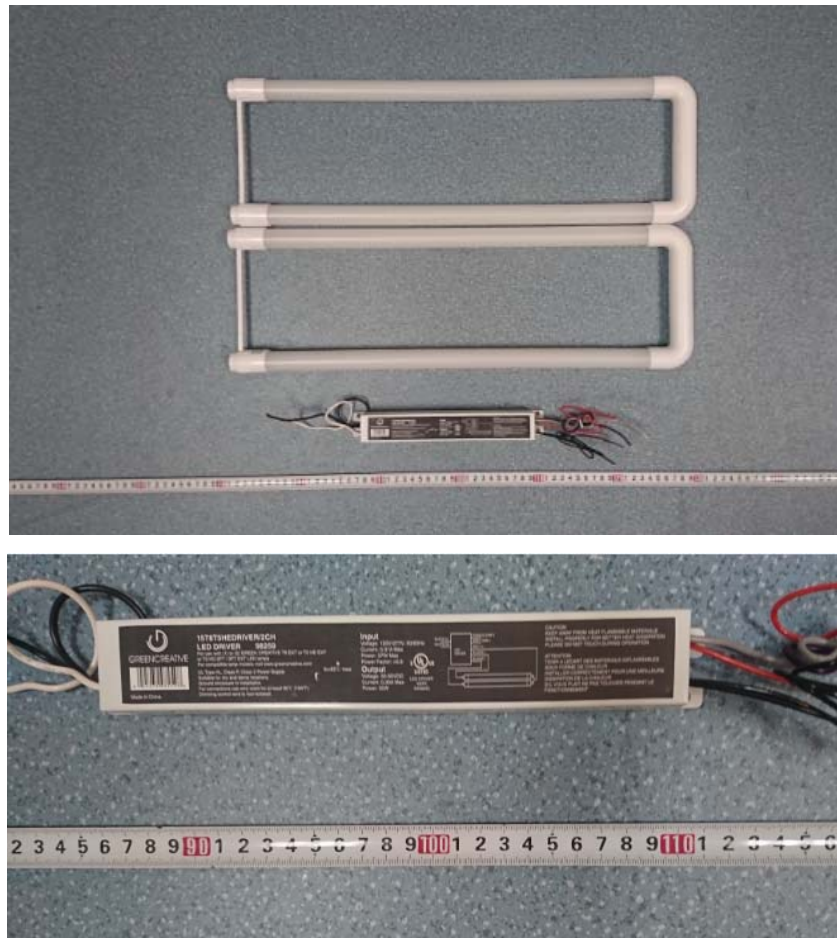


Figure 1- Overview of the sample

Equipment Under Test (EUT)

Name	: LED Tube System
Model	: 14.5T8/U6/830/EXT/A2
Electrical Ratings	: 120-277V, 50/60Hz
Product Description	: 3000K LED tube model: 14.5T8/U6/830/EXT 2 LED tubes supplied by a LED driver: 15T8T5HEDRIVER/2CH
Manufacturer	: GREEN CREATIVE LTD
Address	: 756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

TEST RESULTS

Test ambient temperature was 25.0°C.

Base orientation was light down. 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 70 minutes.

Sphere-Spectroradiometer Method

Parameter	Result	
Test Voltage (V)	120.0	277.0
Voltage frequency (Hz)	60	60
Test Current (A)	0.272	0.124
Power Factor	0.9982	0.9692
Test Power (W)/2	16.32	16.59
THD A%	2.49	4.56
Luminous Efficacy (lm/W)	134.0	131.8
Luminous Flux per lamp (lm)	2186.0	2186.0
Color Rendering Index (CRI)	82.0	
R9	3.7	
Correlated Color Temperature (CCT)(K)	2947	
Chromaticity Chroma x	0.4410	
Chromaticity Chroma y	0.4061	
Chromaticity Chroma u	0.2523	
Chromaticity Chroma v	0.3485	
Duv	0	
Chromaticity Chroma u'	0.2523	
Chromaticity Chroma v'	0.5228	

Special Color Rendering Indices	
R1	80.8
R2	92.2
R3	94.2
R4	79.1
R5	81.2
R6	91.2
R7	80.9
R8	56.4
R9	3.7
R10	82.6
R11	78.6
R12	72.3
R13	83.7
R14	97.5
Rf	83
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 24.9°C.

The photometric distance is 2.47m.

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)	0.273
Power Factor	0.9971
Test Power (W)/2	16.36
Luminous Efficacy (lm/W)	131.7
Luminous Flux per lamp (lm)	2153.9
Beam Angle (°)	140.3
Center Beam Candle Power (cd)	404
Spacing Criteria	1.23 (0°-180°)/ 1.43(90°-270°)
Zonal Lumens in the 0°-60°Zone	46.45%
Zonal Lumens in the 60°-90°Zone	25.97%
Zonal Lumens in the 90°-120°Zone	14.88%
Zonal Lumens in the 120°-180°Zone	12.70%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

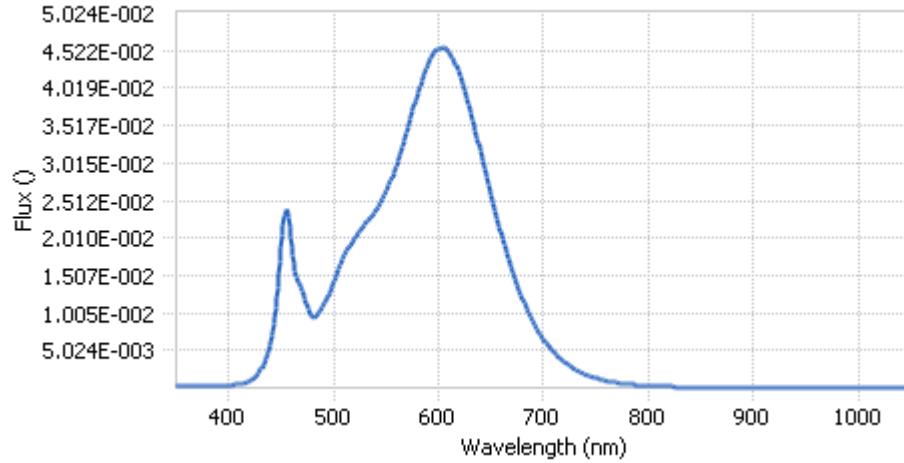


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	3.55E-04	485	9.89E-03	590	4.34E-02	695	7.59E-03
385	3.12E-04	490	1.10E-02	595	4.48E-02	700	6.49E-03
390	3.47E-04	495	1.23E-02	600	4.55E-02	705	5.56E-03
395	3.59E-04	500	1.42E-02	605	4.57E-02	710	4.75E-03
400	3.58E-04	505	1.61E-02	610	4.49E-02	715	4.04E-03
405	4.19E-04	510	1.76E-02	615	4.37E-02	720	3.44E-03
410	5.16E-04	515	1.90E-02	620	4.20E-02	725	2.94E-03
415	6.58E-04	520	2.01E-02	625	3.98E-02	730	2.50E-03
420	9.42E-04	525	2.11E-02	630	3.73E-02	735	2.11E-03
425	1.48E-03	530	2.19E-02	635	3.44E-02	740	1.80E-03
430	2.33E-03	535	2.27E-02	640	3.17E-02	745	1.53E-03
435	3.76E-03	540	2.38E-02	645	2.87E-02	750	1.31E-03
440	6.22E-03	545	2.51E-02	650	2.58E-02	755	1.12E-03
445	1.07E-02	550	2.64E-02	655	2.31E-02	760	9.54E-04
450	1.88E-02	555	2.81E-02	660	2.05E-02	765	8.18E-04
455	2.39E-02	560	3.00E-02	665	1.80E-02	770	6.97E-04
460	1.90E-02	565	3.22E-02	670	1.58E-02	775	5.92E-04
465	1.47E-02	570	3.45E-02	675	1.38E-02	780	5.07E-04
470	1.33E-02	575	3.70E-02	680	1.19E-02		
475	1.09E-02	580	3.94E-02	685	1.03E-02		
480	9.45E-03	585	4.16E-02	690	8.85E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method

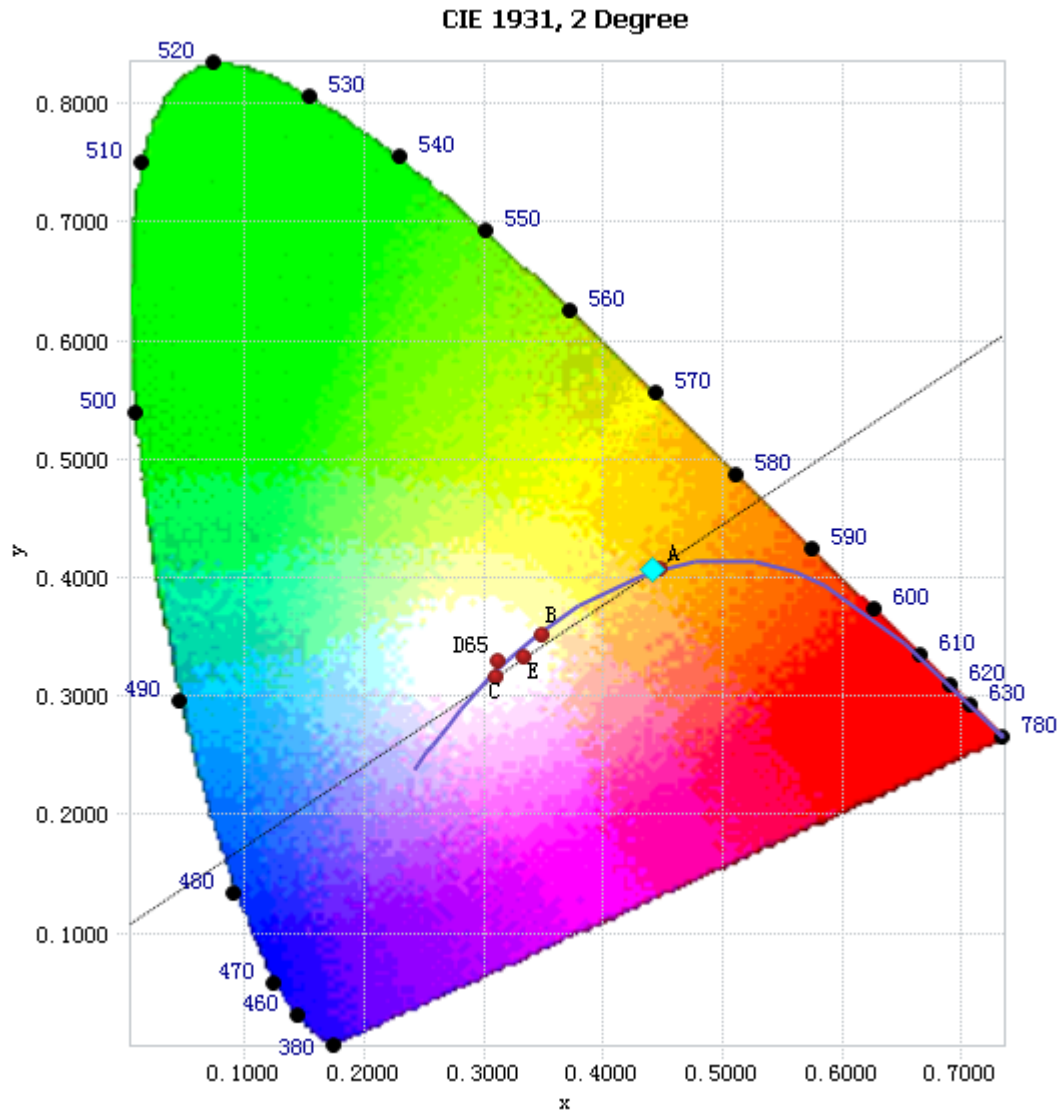


Chart 2: Chromaticity Diagram per Sphere - Spectroradiometer Method

Note: The location on the diagram of the tristimulus coordinates are indicated by the blue diamond.

Nominal CCT Quadrangles – Sphere Spectroradiometer Method

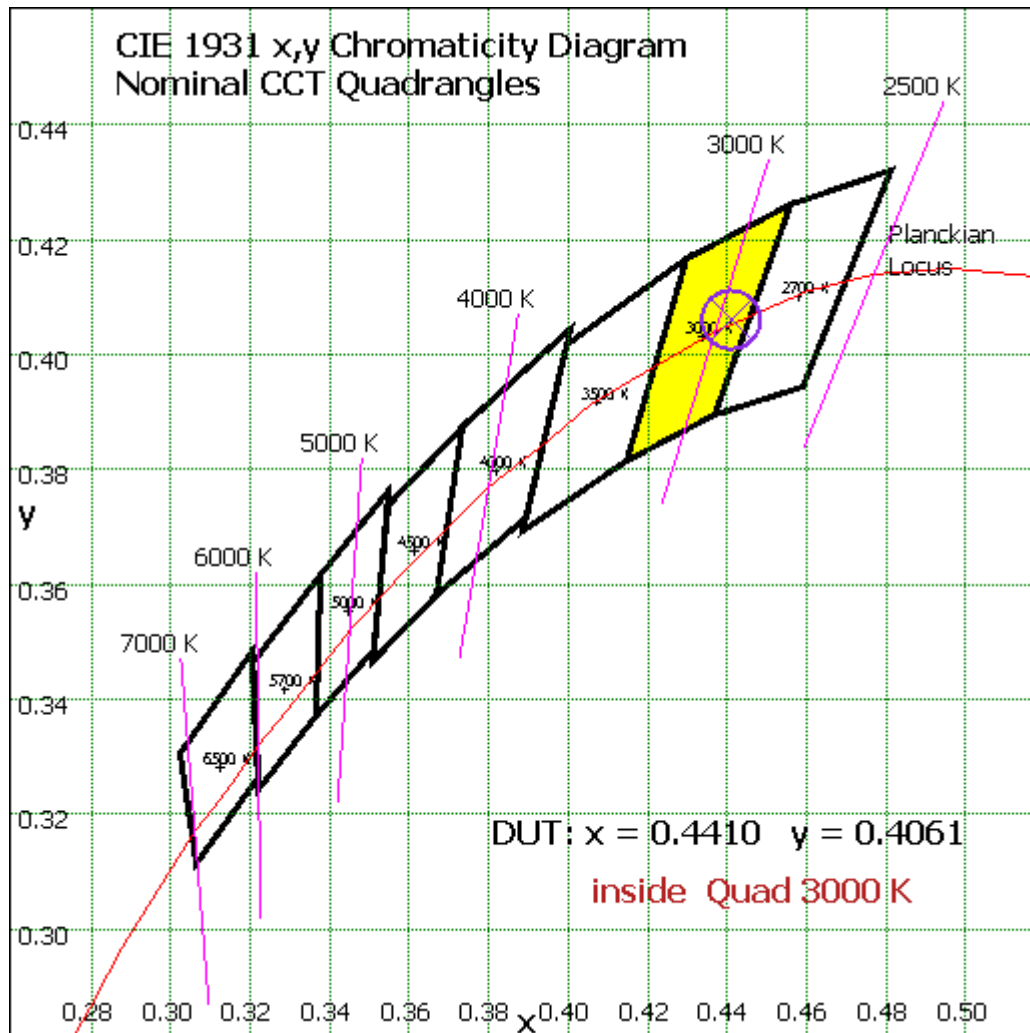


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	38.238	1.78%
10- 20	110.25	5.12%
20- 30	169.877	7.89%
30- 40	211.794	9.83%
40- 50	233.765	10.85%
50- 60	236.513	10.98%
60- 70	223.254	10.37%
70- 80	197.44	9.17%
80- 90	138.721	6.44%
90-100	100.755	4.68%
100-110	116.648	5.42%
110-120	103.092	4.79%
120-130	86.343	4.01%
130-140	69.647	3.23%
140-150	53.342	2.48%
150-160	37.486	1.74%
160-170	21.301	0.99%
170-180	5.41	0.25%
Total	2153.9	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	1000.437	46.45%
60- 90	559.415	25.97%
0-90	1559.852	72.42%
90- 180	594.024	27.58%
0- 180	2153.9	100%

Table 5: Zonal Lumen Data

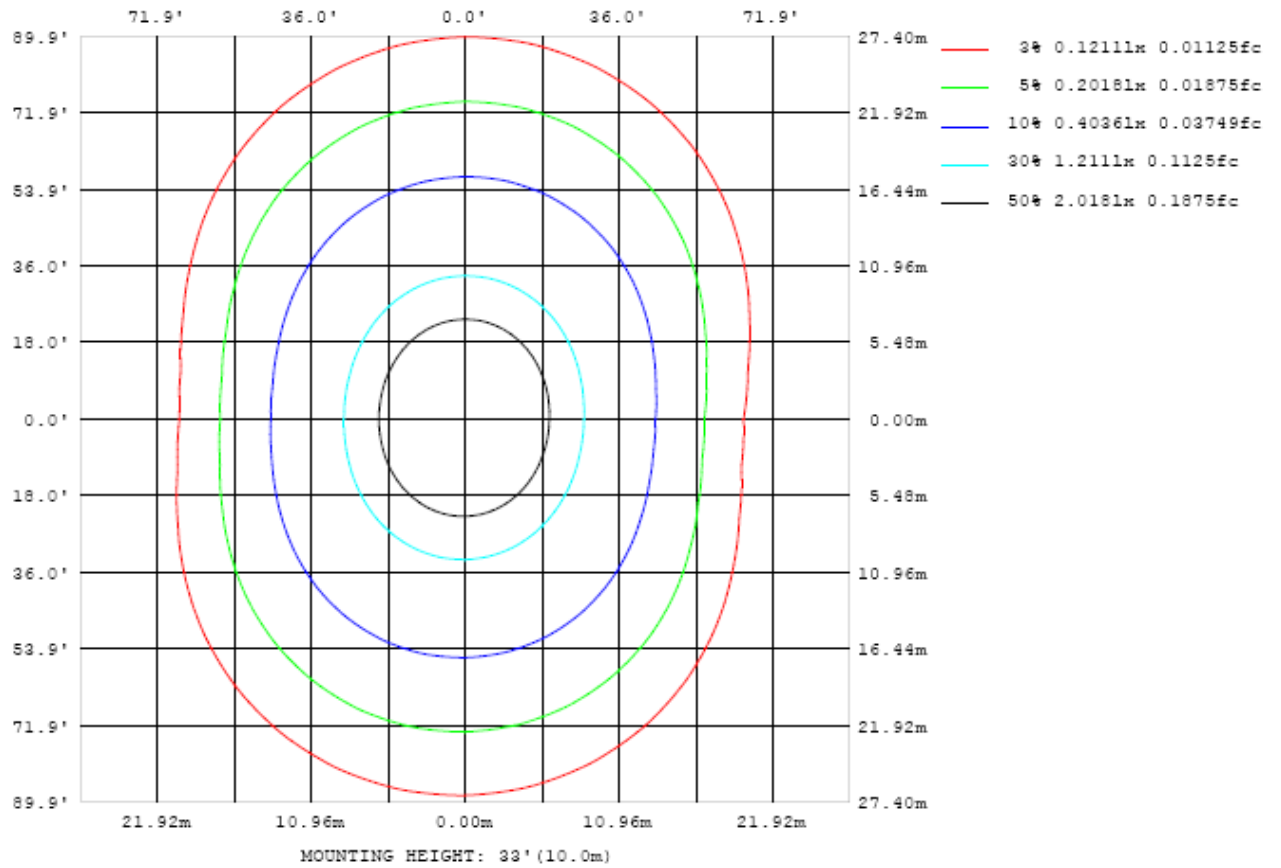


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

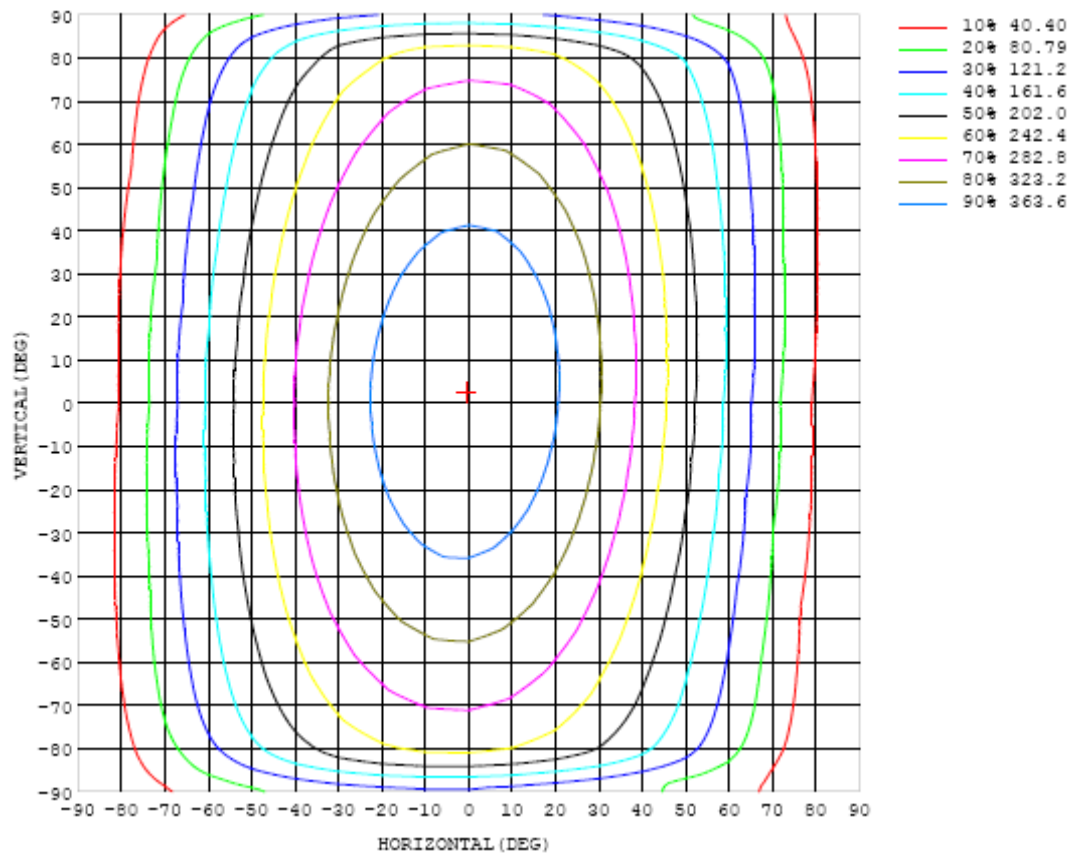


Chart 5: Isocandela Plot

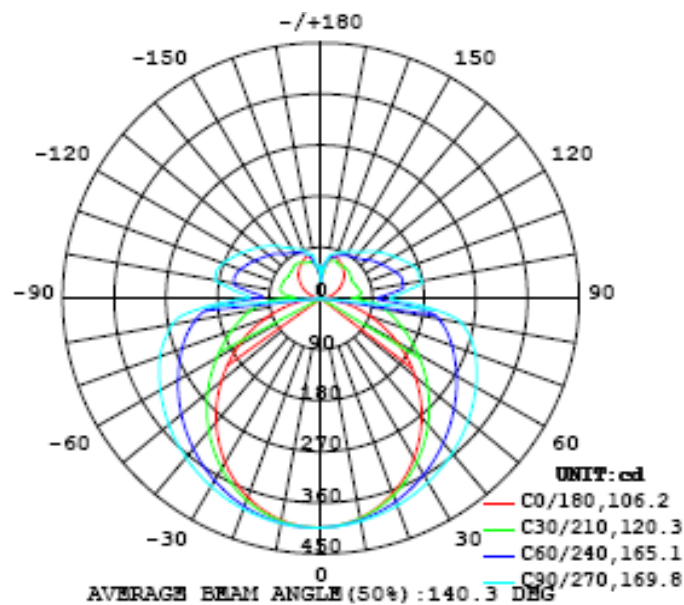


Chart 6: Polar Candela Distribution

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	404	404	404	404	404	404	404	404	404	404	404	404	404	404	404	404	404	404	404
5	400	400	400	400	401	401	401	401	402	402	402	402	402	402	402	402	402	402	402
10	393	393	393	393	394	396	397	397	398	399	399	399	399	398	398	397	397	396	396
15	381	381	382	383	385	387	389	391	393	394	395	394	393	392	390	388	387	386	387
20	366	366	367	369	373	377	381	384	387	388	389	388	386	383	380	377	374	373	372
25	347	347	349	353	358	364	370	375	379	381	382	380	377	373	367	362	358	355	355
30	325	325	328	334	342	350	358	366	371	374	374	372	367	360	353	345	339	335	334
35	300	300	305	313	323	335	346	355	362	365	365	362	355	347	337	327	318	312	310
40	273	274	280	291	304	318	332	343	352	356	356	352	343	332	319	306	295	287	284
45	245	246	254	267	283	301	317	331	341	346	346	340	330	317	301	285	271	260	256
50	215	216	226	243	263	284	303	318	330	335	335	328	317	301	282	263	245	232	227
55	184	186	199	219	242	266	288	305	318	324	323	316	303	285	263	241	219	203	196
60	153	156	171	195	222	249	273	292	305	312	311	303	289	269	245	219	194	174	166
65	122	126	145	172	203	232	258	278	293	299	299	290	274	253	226	198	169	145	134
70	91.0	96.0	119	151	185	216	243	264	279	286	285	276	260	237	209	177	145	117	103
75	62.3	68.7	96.5	132	168	200	227	249	264	270	269	261	244	221	192	158	123	90.7	72.5
80	35.1	44.0	77.0	115	150	182	208	229	243	249	249	241	224	201	173	139	103	67.7	44.1
85	13.8	25.0	59.1	93.2	121	143	159	172	182	187	188	185	176	162	141	113	80.4	46.7	19.5
90	3.59	11.1	33.8	54.8	73.7	86.9	98.8	109	117	120	120	115	105	91.6	76.3	60.2	36.6	16.4	1.83
95	7.50	14.7	40.0	68.1	95.8	114	128	139	146	148	147	140	129	113	94.7	72.1	45.9	23.0	4.38
100	12.1	18.2	40.0	70.3	101	124	145	162	173	178	177	170	156	136	111	83.3	54.4	27.8	9.47
105	18.1	22.9	41.1	67.4	96.2	122	145	162	172	176	175	167	154	136	113	84.5	55.0	31.2	15.5
110	24.5	27.3	42.7	65.7	91.2	115	137	154	165	170	169	162	148	130	108	81.2	54.8	34.7	22.0
115	31.6	33.9	44.7	63.1	87.5	109	129	145	154	159	158	152	139	122	102	78.2	53.8	38.7	28.9
120	38.4	38.6	49.1	62.7	83.4	103	121	135	144	148	147	142	130	115	96.6	74.9	54.8	43.4	35.8
125	45.1	45.5	52.8	64.3	79.5	97.3	114	127	134	137	137	132	122	108	91.3	72.6	57.6	48.5	42.6
130	51.5	51.4	54.7	66.3	78.3	91.0	106	118	125	128	127	122	113	101	86.7	71.7	60.0	53.0	49.2
135	57.2	57.1	59.2	68.0	78.2	87.8	97.8	108	115	118	117	112	104	94.5	83.9	72.1	63.3	57.6	55.3
140	61.8	62.6	60.1	67.9	77.5	86.4	93.9	100	105	107	107	104	97.9	90.8	82.2	72.5	66.0	62.0	60.7
145	66.8	66.5	65.8	69.4	77.3	83.9	90.9	96.2	99.7	101	101	98.4	93.8	87.9	80.2	74.3	67.3	65.8	65.4
150	70.5	70.7	70.1	66.4	75.2	82.3	87.5	91.7	94.4	95.5	95.3	93.0	89.5	84.6	81.1	75.2	68.6	66.9	69.7
155	74.3	74.3	71.0	68.6	72.8	79.0	83.5	87.9	89.9	90.6	90.4	89.1	86.6	82.6	78.8	74.0	70.1	67.6	73.4
160	77.8	78.5	70.5	70.9	71.7	74.3	80.7	83.4	84.6	85.1	85.7	85.4	82.6	80.0	76.9	74.1	68.4	71.3	77.0
165	74.9	76.2	72.6	69.0	70.0	75.1	76.5	77.4	78.8	80.2	79.6	77.6	77.1	76.0	74.8	67.8	65.1	74.0	76.3
170	60.9	61.4	67.2	67.6	65.3	66.4	68.7	72.9	74.8	72.9	73.9	69.3	64.8	63.5	60.1	60.8	61.6	63.8	62.5
175	44.7	44.6	44.4	45.8	54.6	58.5	56.7	53.3	51.8	51.7	53.3	53.9	54.1	48.4	47.4	46.8	47.2	47.7	46.8
180	57.7	57.7	57.7	57.7	57.7	57.7	57.7	57.7	57.7	57.7	57.6	57.6	57.6	57.6	57.6	57.6	57.6	57.5	57.5

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	404	404	404	404	404	404	404	404	404	404	404	404	404	404	404	404	404		
5	402	403	403	403	403	404	404	404	404	404	403	403	402	402	401	401	401		
10	397	398	398	399	401	401	402	402	402	402	401	400	399	397	396	394	394		
15	387	389	390	392	395	397	398	399	399	399	397	395	392	390	387	384	382		
20	373	376	378	382	386	390	393	394	395	394	392	388	384	379	374	371	368		
25	356	359	364	369	375	381	385	388	389	388	385	379	373	366	359	354	349		
30	335	340	346	354	363	371	377	381	383	381	377	370	361	351	342	334	328		
35	312	318	326	337	348	359	367	373	375	373	367	359	348	335	323	312	304		
40	286	293	304	318	332	346	356	363	366	364	357	346	333	318	302	288	279		
45	259	267	281	298	316	332	345	353	356	354	346	334	318	299	280	264	251		
50	230	241	258	278	299	318	332	342	346	344	335	320	302	280	258	238	223		
55	200	213	234	257	281	303	319	331	335	332	323	307	286	262	236	212	194		
60	170	185	210	237	264	288	306	318	323	321	310	293	270	243	214	187	166		
65	139	159	187	217	247	273	293	306	311	308	297	279	254	225	193	163	137		
70	109	133	165	198	230	258	279	293	298	295	284	265	239	208	174	140	109		
75	80.1	109	145	181	214	242	263	276	282	279	268	249	224	192	157	119	83.7		
80	54.0	86.7	125	162	194	222	244	258	263	260	249	231	206	175	140	100	61.6		
85	31.3	65.3	102	137	164	188	203	211	213	209	199	186	167	146	117	81.6	43.7		
90	8.08	29.5	53.6	75.7	95.3	111	122	129	130	127	119	109	97.6	83.5	66.5	47.5	23.8		
95	11.6	33.1	57.4	81.0	102	121	135	144	149	149	144	135	123	107	85.4	58.4	28.6		
100	17.8	41.7	70.8	101	128	154	172	183	189	187	178	163	144	121	90.8	58.8	31.0		
105	22.5	43.9	73.5	104	131	155	172	183	188	187	177	164	143	117	87.8	58.0	34.3		
110	28.0	46.3	72.3	101	127	149	167	177	182	179	171	157	137	112	84.6	58.9	36.7		
115	33.7	48.5	71.7	96.4	121	142	157	167	170	169	162	149	130	107	82.7	59.6	40.3		
120	39.8	50.2	70.9	93.3	114	133	147	156	160	159	152	140	123	103	81.5	60.0	43.2		
125	45.5	52.9	68.5	90.4	109	125	138	146	150	148	142	132	117	99.1	79.8	60.3	49.5		
130	51.4	57.6	70.4	84.9	104	119	129	137	140	139	133	124	111	95.5	77.8	62.5	54.4		
135	56.8	61.7	70.9	83.4	96.7	111	122	128	131	130	125	116	105	91.6	76.8	62.6	60.8		
140	61.6	65.0	73.4	82.6	92.8	102	112	118	121	120	116	108	99.0	87.2	76.6	66.6	64.7		
145	66.0	66.8	74.5	82.0	89.9	97.4	103	107	110	109	106	100	93.7	85.8	75.1	66.8	68.0		
150	68.3	66.6	72.7	81.5	86.7	93.0	97.6	101	102	102	99.0	95.5	90.5	82.2	75.7	70.0	70.1		
155	70.3	65.8	68.9	78.7	85.0	87.8	92.4	95.8	96.6	96.5	94.6	90.8	86.0	80.8	74.4	71.6	71.7		
160	74.5	68.3	66.8	73.1	80.5	85.2	87.3	86.9	90.1	90.8	89.0	86.6	82.4	77.5	75.4	72.7	72.1		
165	75.0	70.3	66.5	66.7	73.0	78.4	81.1	82.5	80.6	78.4	79.3	79.8	78.4	76.7	74.3	70.9	71.8		
170	62.3	61.7	59.9	59.6	61.7	61.8	63.0	67.5	76.5	76.7	76.5	75.2	72.8	69.2	69.0	69.2	69.6		
175	46.9	47.2	47.5	48.0	48.8	49.1	53.7	56.2	54.7	52.9	51.7	52.4	54.4	57.0	58.7	53.1	45.6		
180	57.5	57.6	57.6	57.6	57.6	57.6	57.6	57.6	57.7	57.7	57.7	57.7	57.7	57.7	57.7	57.7	57.7		

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

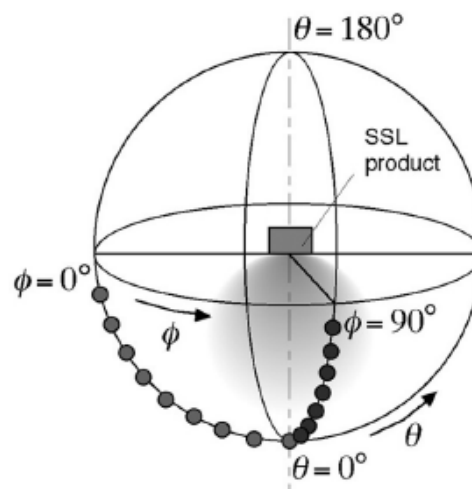
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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