

LM-79-08 Test Report

for

GREEN CREATIVE LTD

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

LED Tube System

Model: 10.5T8/3F/830/EXT/A4

(LED tube model: 10.5T8/3F/830/EXT 4pcs and LED driver model: 15T8T5HEDRIVER/4CH 1pcs)

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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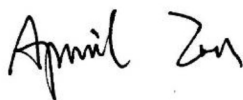
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Report No.: HZ180800241

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: 10.5T8/3F/830/EXT/A4

Luminous Efficacy (Lumens /Watt)	Luminous Flux per lamp (Lumens)	Power (Watts)/4	Power Factor
118.6	1418.0	11.96	0.9962
CCT (K)	CRI	Stabilization Time (Light & Power)	
2982	82.1	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. 02, 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

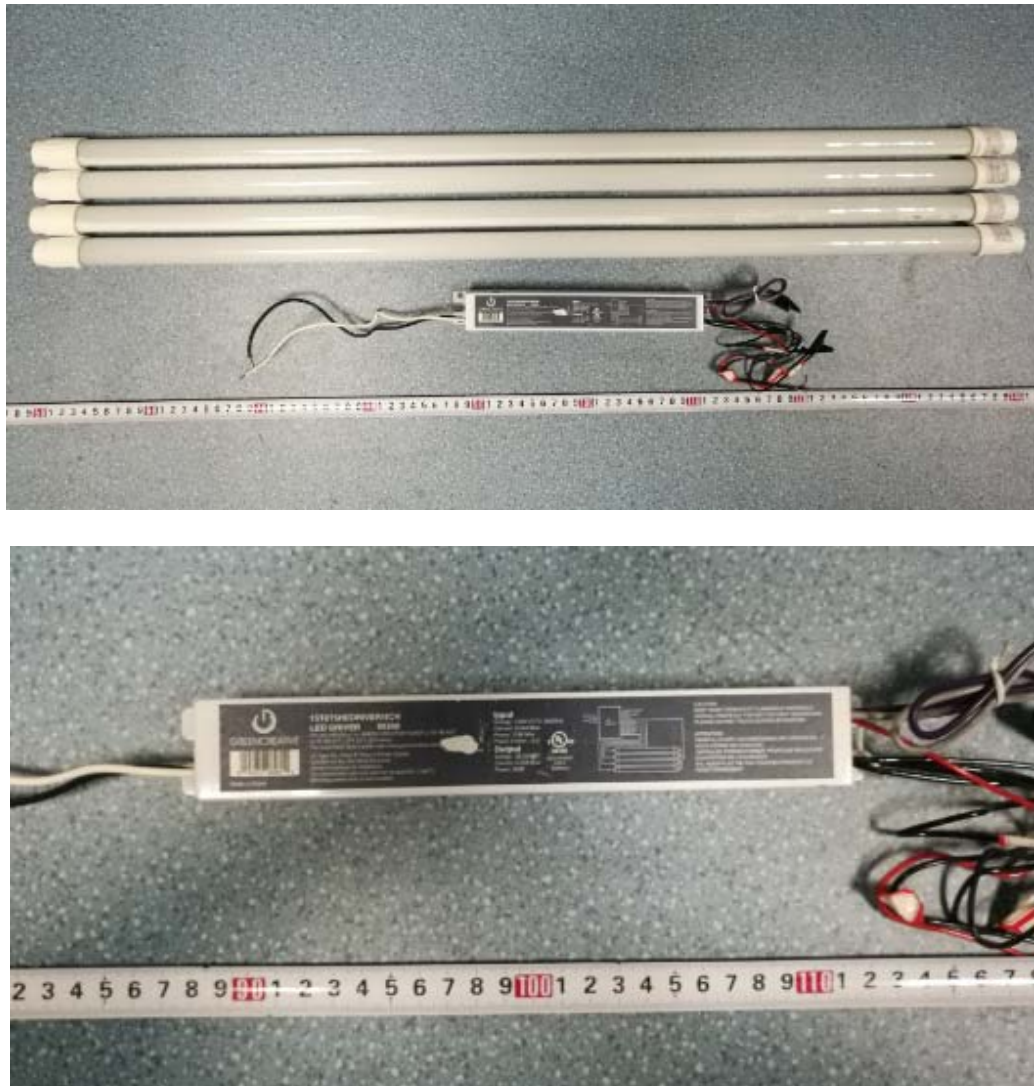


Figure 1- Overview of the sample

Equipment Under Test (EUT)

Name	: LED Tube System
Model	: 10.5T8/3F/830/EXT/A4
Electrical Ratings	: 120-277V, 50/60Hz
Product Description	: 3000K LED tube model: 10.5T8/3F/830/EXT 4 LED tubes supplied by a LED driver: 15T8T5HEDRIVER/4CH
Manufacturer	: GREEN CREATIVE LTD
Address	: 756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

TEST RESULTS

Test ambient temperature was 25.1 °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 70 minutes.

Sphere-Spectroradiometer Method

Parameter	Result	
Test Voltage (V)	120.0	277.0
Voltage frequency (Hz)	60	60
Test Current (A)	0.400	0.180
Power Factor	0.9962	0.9527
Test Power (W)/4	11.96	11.87
THD A%	3.84	7.21
Luminous Efficacy (lm/W)	118.6	119.5
Luminous Flux per lamp (lm)	1418.0	1418.0
Color Rendering Index (CRI)	82.1	
R9	3.9	
Correlated Color Temperature (CCT)(K)	2982	
Chromaticity Chroma x	0.4385	
Chromaticity Chroma y	0.4054	
Chromaticity Chroma u	0.2510	
Chromaticity Chroma v	0.3481	
Duv	0.0001	
Chromaticity Chroma u'	0.2510	
Chromaticity Chroma v'	0.5221	

Special Color Rendering Indices	
R1	80.9
R2	92.5
R3	93.9
R4	79
R5	81.3
R6	91.4
R7	80.8
R8	56.5
R9	3.9
R10	83.2
R11	78.4
R12	72.4
R13	83.9
R14	97.3
Rf	82
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°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)	0.400
Power Factor	0.9963
Test Power (W)/4	11.97
Luminous Efficacy (lm/W)	116.9
Luminous Flux per lamp (lm)	1399.0
Beam Angle (°)	170.1
Center Beam Candle Power (cd)	228
Spacing Criteria	1.26 (0°-180°)/ 1.45 (90°-270°)
Zonal Lumens in the 0°-60°Zone	42.43%
Zonal Lumens in the 60°-90°Zone	26.95%
Zonal Lumens in the 90°-120°Zone	17.72%
Zonal Lumens in the 120°-180°Zone	12.89%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

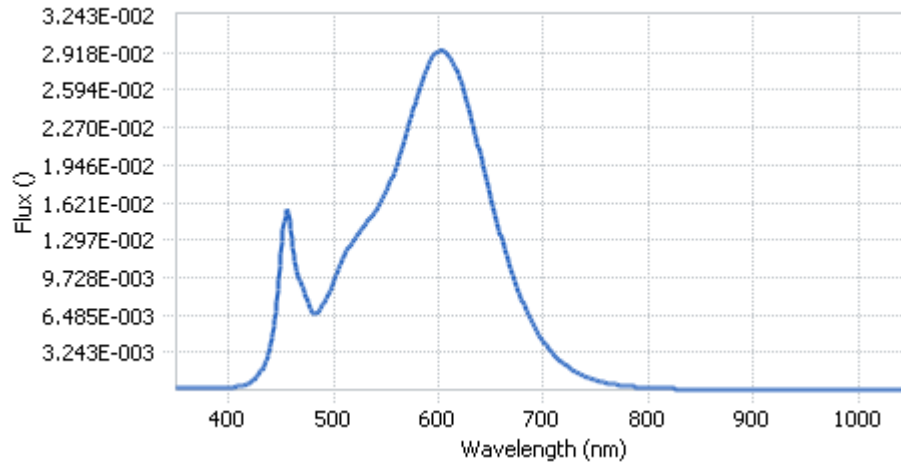
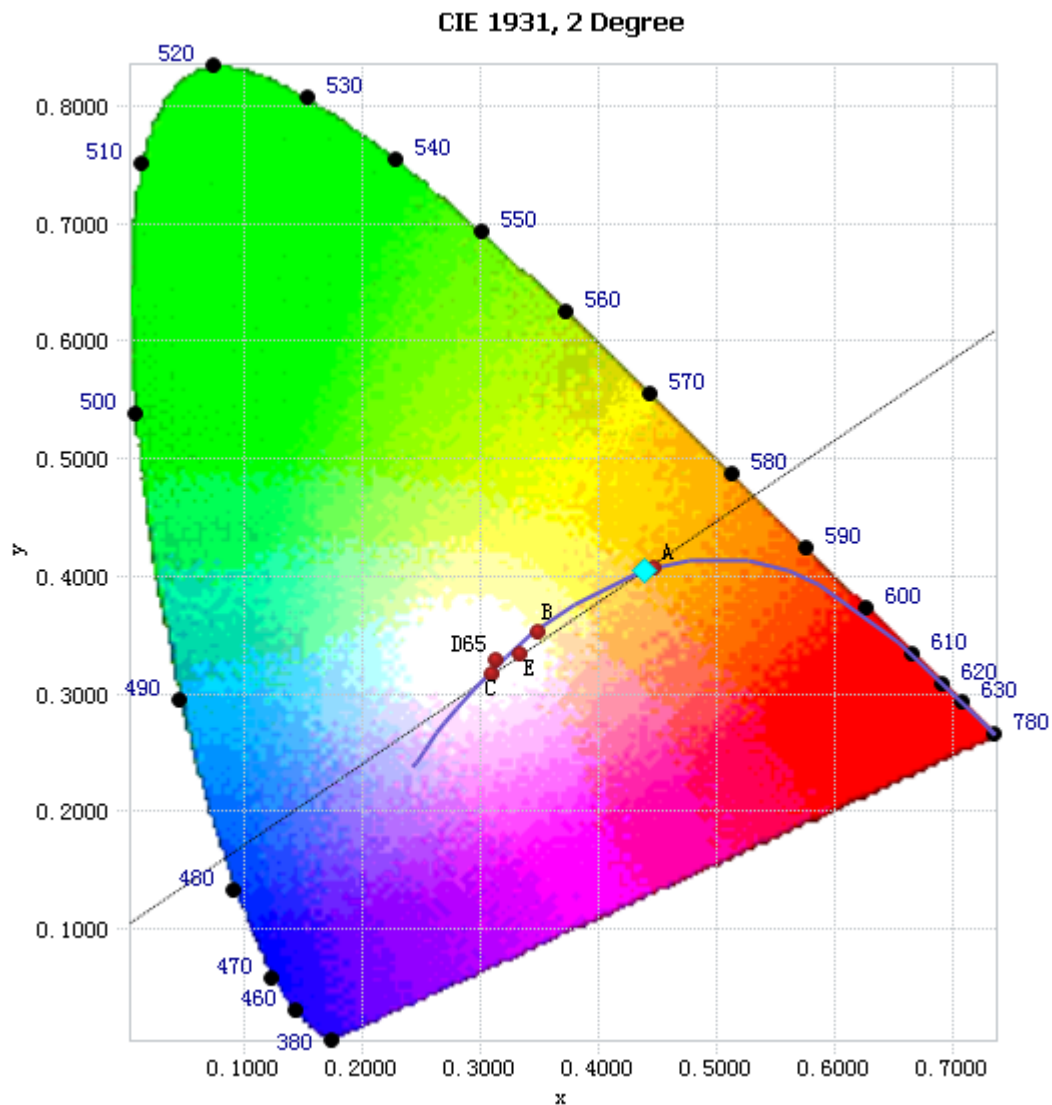


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.23E-04	485	6.75E-03	590	2.81E-02	695	4.86E-03
385	1.97E-04	490	7.41E-03	595	2.90E-02	700	4.16E-03
390	2.14E-04	495	8.26E-03	600	2.94E-02	705	3.55E-03
395	2.17E-04	500	9.37E-03	605	2.93E-02	710	3.04E-03
400	2.29E-04	505	1.06E-02	610	2.89E-02	715	2.58E-03
405	2.56E-04	510	1.15E-02	615	2.81E-02	720	2.21E-03
410	2.98E-04	515	1.24E-02	620	2.70E-02	725	1.88E-03
415	4.08E-04	520	1.31E-02	625	2.55E-02	730	1.59E-03
420	6.08E-04	525	1.37E-02	630	2.39E-02	735	1.36E-03
425	9.41E-04	530	1.43E-02	635	2.21E-02	740	1.15E-03
430	1.50E-03	535	1.49E-02	640	2.03E-02	745	9.75E-04
435	2.44E-03	540	1.55E-02	645	1.84E-02	750	8.29E-04
440	4.00E-03	545	1.63E-02	650	1.66E-02	755	7.09E-04
445	6.83E-03	550	1.72E-02	655	1.48E-02	760	6.05E-04
450	1.17E-02	555	1.83E-02	660	1.31E-02	765	5.20E-04
455	1.55E-02	560	1.95E-02	665	1.16E-02	770	4.43E-04
460	1.31E-02	565	2.09E-02	670	1.01E-02	775	3.76E-04
465	1.02E-02	570	2.24E-02	675	8.82E-03	780	3.26E-04
470	9.07E-03	575	2.40E-02	680	7.65E-03		
475	7.68E-03	580	2.56E-02	685	6.60E-03		
480	6.62E-03	585	2.69E-02	690	5.68E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4385, 0.4054)

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

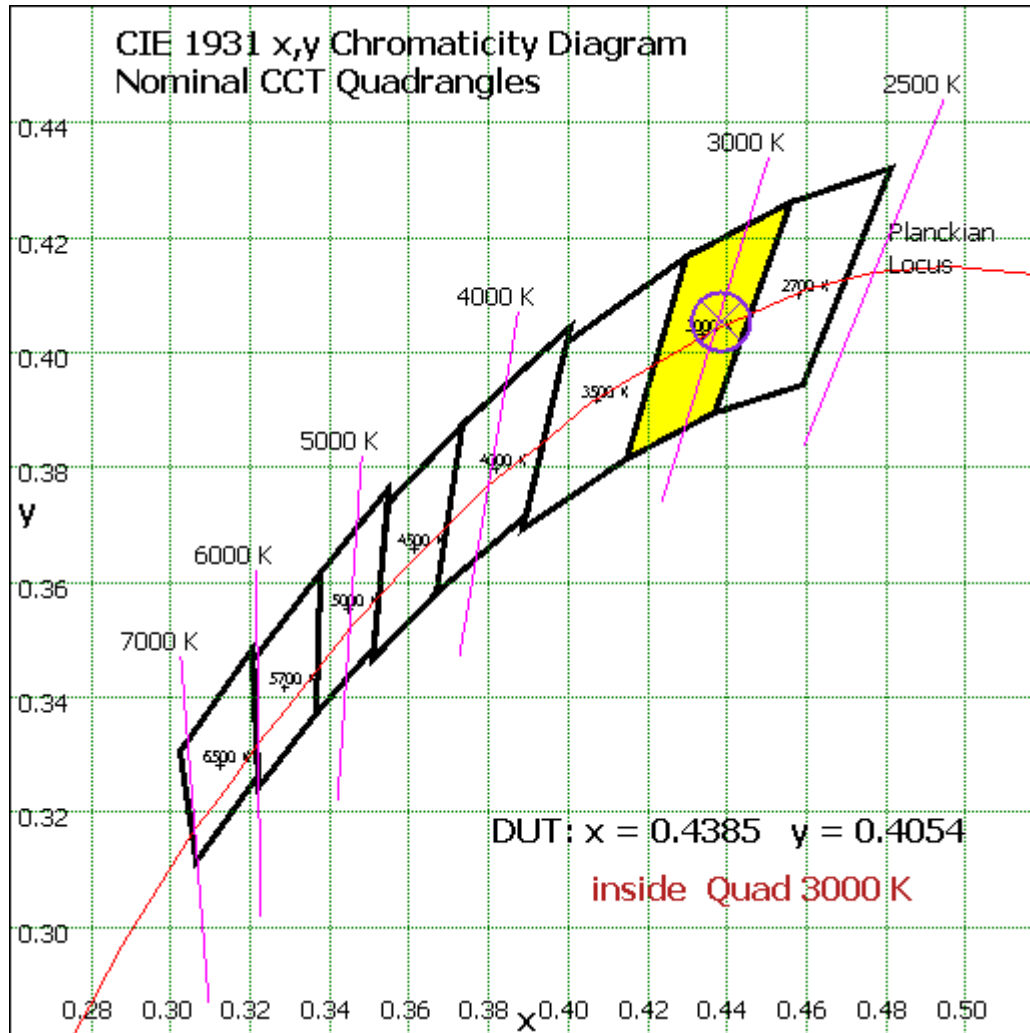


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	21.656	1.55%
10- 20	62.926	4.50%
20- 30	98.335	7.03%
30- 40	124.851	8.92%
40- 50	140.648	10.05%
50- 60	145.197	10.38%
60- 70	139.584	9.98%
70- 80	126.658	9.05%
80- 90	110.837	7.92%
90-100	96.336	6.89%
100-110	82.472	5.90%
110-120	69.122	4.94%
120-130	57.029	4.08%
130-140	46.219	3.30%
140-150	35.383	2.53%
150-160	24.626	1.76%
160-170	13.391	0.96%
170-180	3.731	0.27%
Total	1399.0	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	593.613	42.43%
60- 90	377.079	26.95%
0-90	970.692	69.38%
90- 180	428.309	30.62%
0- 180	1399.0	100%

Table 5: Zonal Lumen Data

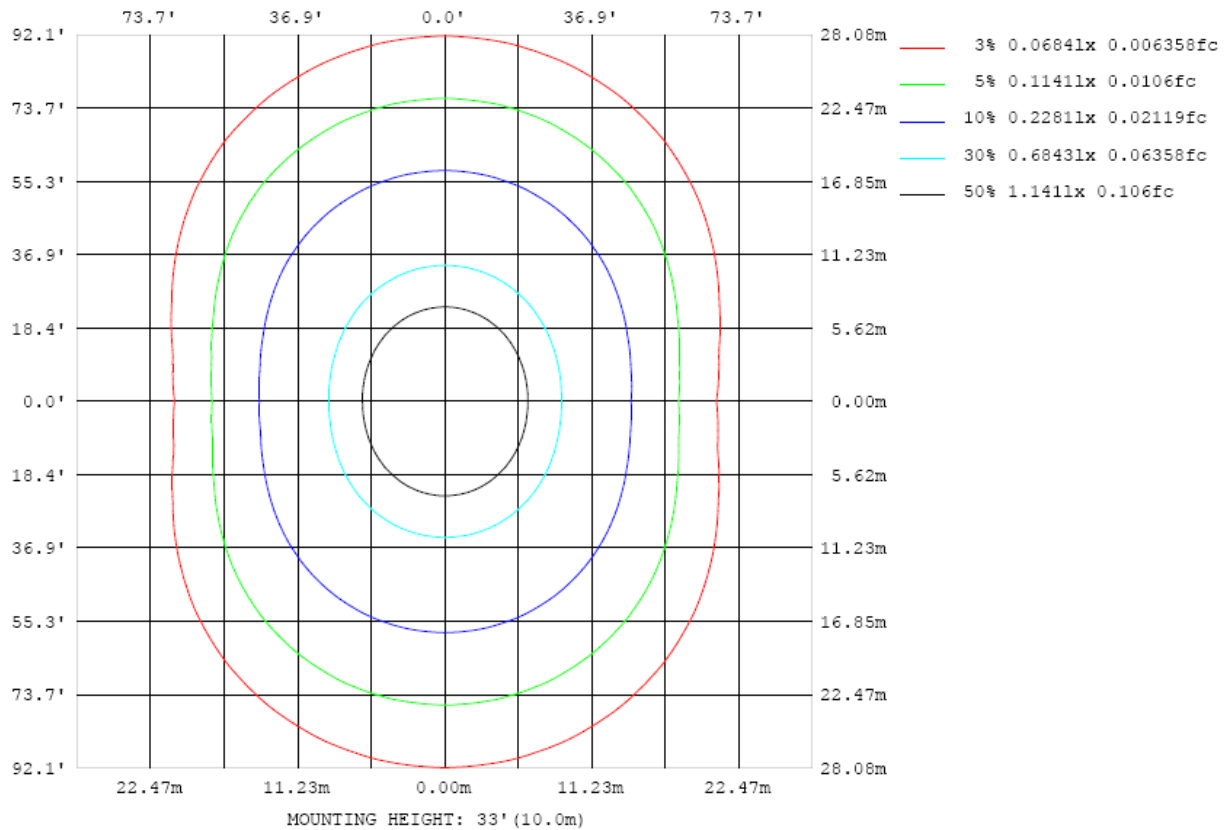


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

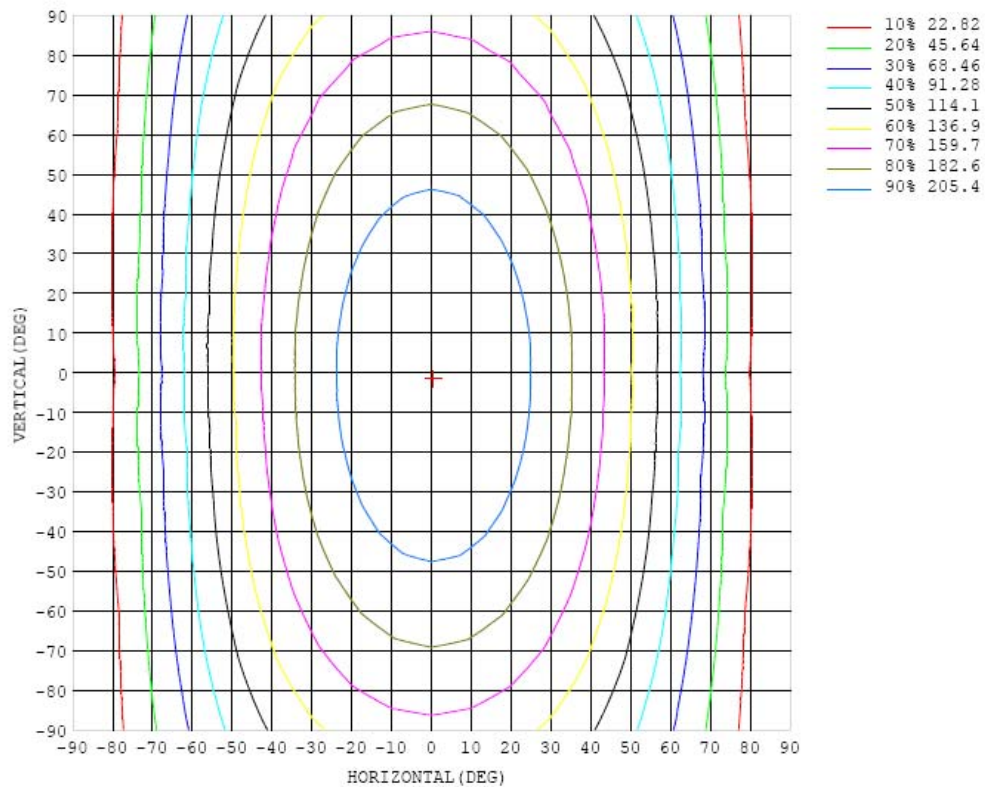


Chart 5: Isocandela Plot

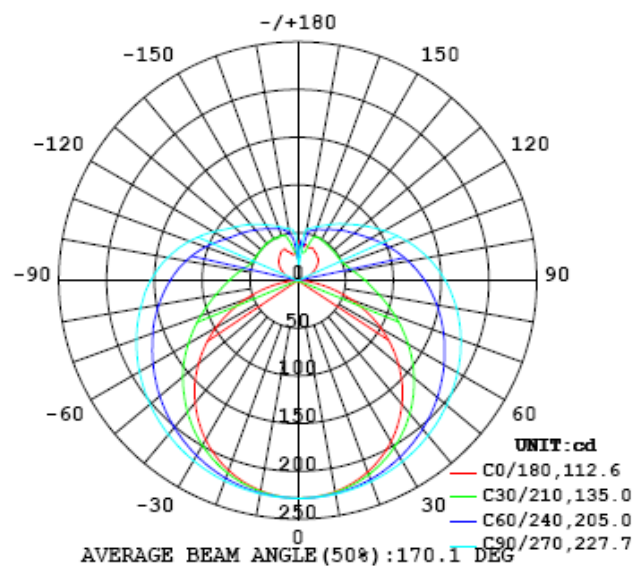


Chart 6: Polar Candela Distribution

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	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228
5	227	227	227	227	228	228	228	228	228	228	228	228	228	227	227	227	227	227	227
10	225	225	225	225	226	226	227	227	227	227	227	227	226	226	225	225	224	224	224
15	220	220	221	222	223	224	225	225	226	226	226	225	224	223	222	220	220	219	219
20	214	214	215	217	218	220	222	223	224	224	224	223	221	219	217	215	213	212	212
25	205	206	207	210	213	216	218	220	222	222	221	220	217	214	211	208	205	204	203
30	195	196	198	202	206	210	214	217	218	219	218	216	213	208	204	200	196	193	193
35	183	184	188	193	198	204	209	213	215	216	215	212	208	202	196	190	185	182	181
40	170	171	176	182	190	197	203	208	211	212	211	207	202	195	188	180	173	168	167
45	154	157	162	171	180	189	197	203	207	208	206	202	196	188	178	169	160	154	152
50	138	140	148	159	170	181	191	198	202	203	201	197	189	180	168	157	146	138	136
55	120	123	133	146	160	173	184	192	197	198	196	191	183	172	158	144	131	121	118
60	101	105	117	133	150	164	177	186	191	193	191	185	176	163	148	131	115	103	98.9
65	80.9	86.6	102	121	139	156	170	180	186	187	185	179	169	155	138	119	99.7	84.2	79.0
70	61.0	68.3	86.4	108	129	148	162	173	179	182	179	173	162	147	128	107	84.7	66.2	58.9
75	40.9	50.2	72.3	96.9	120	140	155	166	173	175	173	166	155	139	119	95.9	71.2	48.6	39.0
80	22.2	34.1	59.8	86.6	111	132	148	159	166	169	166	159	148	131	111	86.1	59.1	33.1	20.8
85	7.82	21.9	49.7	77.6	103	124	140	152	159	162	159	152	140	124	103	77.6	49.6	21.5	6.75
90	0.69	14.9	42.3	70.6	95.3	116	133	145	152	154	152	145	133	117	95.6	71.0	42.8	15.3	0.82
95	1.59	12.3	37.1	64.2	88.2	109	125	137	144	146	144	137	125	109	88.8	64.9	38.0	13.1	1.82
100	4.30	12.9	33.9	58.8	81.7	102	117	129	136	138	136	129	118	102	82.4	59.8	35.2	14.1	4.23
105	7.87	15.0	32.5	54.6	75.7	94.5	110	121	127	130	128	121	110	95.2	76.7	55.8	34.0	16.2	7.55
110	11.4	17.8	32.7	51.6	70.7	87.9	102	113	119	121	119	113	103	88.8	72.0	52.9	34.4	18.8	10.9
115	15.4	20.4	33.6	49.8	66.7	81.9	94.9	105	111	113	111	105	95.6	82.8	67.8	51.3	35.5	21.4	14.7
120	19.5	24.1	35.1	48.9	63.4	76.6	88.1	96.9	102	104	103	97.5	88.8	77.5	64.6	50.6	36.8	24.6	18.6
125	23.4	27.5	36.8	48.5	60.9	72.2	82.1	89.8	94.7	96.5	94.9	90.2	82.7	73.0	62.3	50.2	38.4	27.7	22.3
130	27.2	30.5	38.2	48.2	58.9	69.0	77.1	83.5	87.7	89.1	87.9	84.0	77.8	70.0	60.2	49.8	39.7	29.6	25.5
135	30.4	33.4	40.3	48.3	57.3	65.8	73.0	78.1	81.6	82.8	81.8	78.6	73.4	66.7	58.5	49.7	41.7	32.2	28.1
140	32.1	35.3	42.3	48.3	55.6	62.8	68.9	73.3	76.0	77.1	76.3	73.7	69.5	63.7	57.0	49.4	42.1	32.3	30.4
145	34.0	35.4	43.5	48.7	54.3	60.1	65.0	68.9	71.4	72.3	71.5	69.3	65.6	61.2	55.3	48.8	43.4	32.6	32.4
150	35.2	34.0	43.1	49.2	53.4	57.6	61.7	64.8	66.7	67.6	66.9	65.1	62.4	59.0	54.3	49.0	44.3	31.8	35.0
155	37.3	32.3	41.9	49.8	52.8	56.1	58.9	61.1	62.8	63.4	63.0	61.7	60.0	56.0	52.2	49.9	43.6	29.9	35.5
160	36.4	31.0	34.0	47.9	52.8	54.4	56.9	58.7	59.7	60.1	59.9	59.4	56.0	51.8	48.2	44.5	34.6	27.3	32.4
165	37.4	29.0	30.2	32.9	45.5	52.5	54.3	55.2	56.6	57.1	57.3	52.6	45.3	39.7	37.0	32.1	27.7	27.7	30.1
170	36.1	29.5	29.4	29.6	29.6	33.9	39.8	48.1	54.1	54.7	44.6	32.4	32.2	30.1	28.5	26.4	27.0	27.3	27.4
175	36.6	35.9	34.6	34.4	37.1	40.2	41.4	41.3	38.8	17.9	33.2	36.4	36.7	36.4	34.8	33.2	31.3	30.3	30.5
180	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7

Table 6: Luminous Intensity Data

Table--2

UNIT: cd

C (DEG) γ (DEG)	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350		
0	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228		
5	227	227	227	227	227	227	228	228	228	228	228	228	228	228	227	227	227		
10	224	224	224	225	225	226	226	227	227	227	227	227	226	226	225	225	225		
15	219	220	220	221	223	224	224	225	225	225	225	224	223	223	222	221	220		
20	212	213	215	217	219	220	222	223	223	223	222	221	220	218	216	215	214		
25	204	205	208	211	214	216	219	220	221	221	219	217	215	212	210	207	206		
30	194	196	200	204	208	212	215	217	218	217	216	213	209	205	202	198	196		
35	182	185	190	196	202	207	211	214	215	214	212	208	203	198	192	188	184		
40	169	173	180	187	195	201	206	210	211	210	207	202	196	189	182	176	171		
45	155	161	168	178	187	195	201	205	206	205	202	196	188	180	171	163	157		
50	139	147	157	168	179	188	196	200	202	200	196	189	180	170	159	149	142		
55	122	132	145	159	171	182	190	195	197	195	190	182	172	160	147	134	125		
60	104	116	132	149	163	175	184	190	191	189	184	175	164	150	134	118	106		
65	85.5	101	120	139	156	168	178	184	186	184	178	168	156	139	121	103	87.9		
70	67.1	85.9	108	129	147	161	171	178	180	177	171	161	147	129	109	87.4	69.2		
75	49.5	72.0	97.0	120	140	155	165	171	174	171	164	154	139	120	97.2	73.0	51.3		
80	34.1	60.0	87.2	112	132	148	159	165	167	165	158	147	131	111	86.7	60.2	35.2		
85	22.5	50.5	78.8	104	125	141	152	159	161	158	151	139	123	102	77.7	49.9	22.6		
90	16.2	43.8	71.9	96.8	118	134	145	152	154	151	144	132	116	94.8	70.1	42.3	15.2		
95	13.5	39.1	66.0	90.3	111	126	138	144	146	144	136	125	108	87.9	63.6	36.8	11.4		
100	13.9	35.5	60.6	83.8	103	119	130	136	138	136	128	117	101	81.0	57.6	32.3	12.2		
105	16.2	34.0	55.8	77.5	96.2	111	121	128	130	127	120	109	93.4	74.3	52.2	30.6	14.9		
110	19.4	34.2	52.6	71.6	88.9	103	113	119	121	118	111	100	85.9	68.0	48.4	31.4	18.4		
115	23.2	35.5	51.1	66.9	82.0	94.8	104	110	111	109	102	92.3	78.7	62.8	47.4	33.0	22.0		
120	26.4	37.2	50.4	64.0	76.5	87.2	95.5	101	102	99.7	93.7	84.5	72.9	60.5	47.2	35.5	25.8		
125	29.9	38.9	50.2	61.9	72.7	81.4	88.1	92.2	93.3	91.2	86.2	78.8	69.8	59.1	47.5	37.9	29.5		
130	33.0	40.9	50.2	60.2	69.5	77.2	82.7	86.0	86.8	85.1	81.1	75.1	67.2	57.8	48.2	40.2	33.1		
135	36.3	42.7	50.3	58.6	66.5	73.1	77.9	80.9	81.6	80.2	76.8	71.5	64.8	56.8	49.2	42.4	36.4		
140	38.9	44.3	50.7	57.3	63.8	69.2	73.4	75.9	76.6	75.4	72.5	68.1	62.4	56.0	50.1	44.8	38.7		
145	41.1	45.3	50.5	56.3	61.3	65.7	69.1	71.3	71.8	70.8	68.4	64.8	60.3	55.3	50.9	46.8	41.1		
150	43.3	46.7	51.0	55.5	59.3	62.6	65.2	67.0	67.3	66.6	64.7	62.0	58.6	54.9	51.7	48.8	43.6		
155	44.7	48.3	49.0	52.9	57.6	59.9	61.8	63.1	63.4	62.8	61.6	59.6	57.2	54.8	52.5	50.6	46.8		
160	44.5	49.0	50.1	51.9	55.0	57.5	58.9	59.9	60.1	59.7	58.9	57.6	56.1	54.6	53.2	51.8	49.0		
165	36.1	43.0	48.1	49.6	51.7	54.4	56.4	57.0	57.2	57.1	56.6	56.0	55.3	54.4	53.7	53.1	50.2		
170	29.8	33.7	37.6	42.4	46.6	50.2	53.2	54.9	55.1	54.9	54.7	54.5	54.3	54.1	53.8	53.3	49.6		
175	30.0	30.3	29.6	30.6	34.0	39.0	44.0	48.0	50.7	52.5	53.3	53.3	53.2	53.1	52.1	48.2	41.7		
180	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7		

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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