LM-79-08 Test Report

for

GREEN CREATIVE LTD

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

LED Tube System

Model: 9.5T5HE/2F/830/EXT/A2

(LED tube model: 9.5T5HE/2F/830/EXT 2pcs and LED driver model: 15T8T5HEDRIVER/2CH 1pcs)

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ18080024ar

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

Review by: April Zou

Engineer: April Zou

Aug. 29, 2018

Approved by: Jim Zhang

Manager: Jim Zhang

Aug. 29, 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: **9.5T5HE/2F/830/EXT/A2**

Luminous Efficacy (Lumens /Watt)	Luminous Flux per lamp (Lumens)	Power (Watts)/2	Power Factor
120.0	1370.0	11.42	0.9946

CCT (K)	CRI	Stabilization Time (Light & Power)
2923	82.2	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. 03, 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

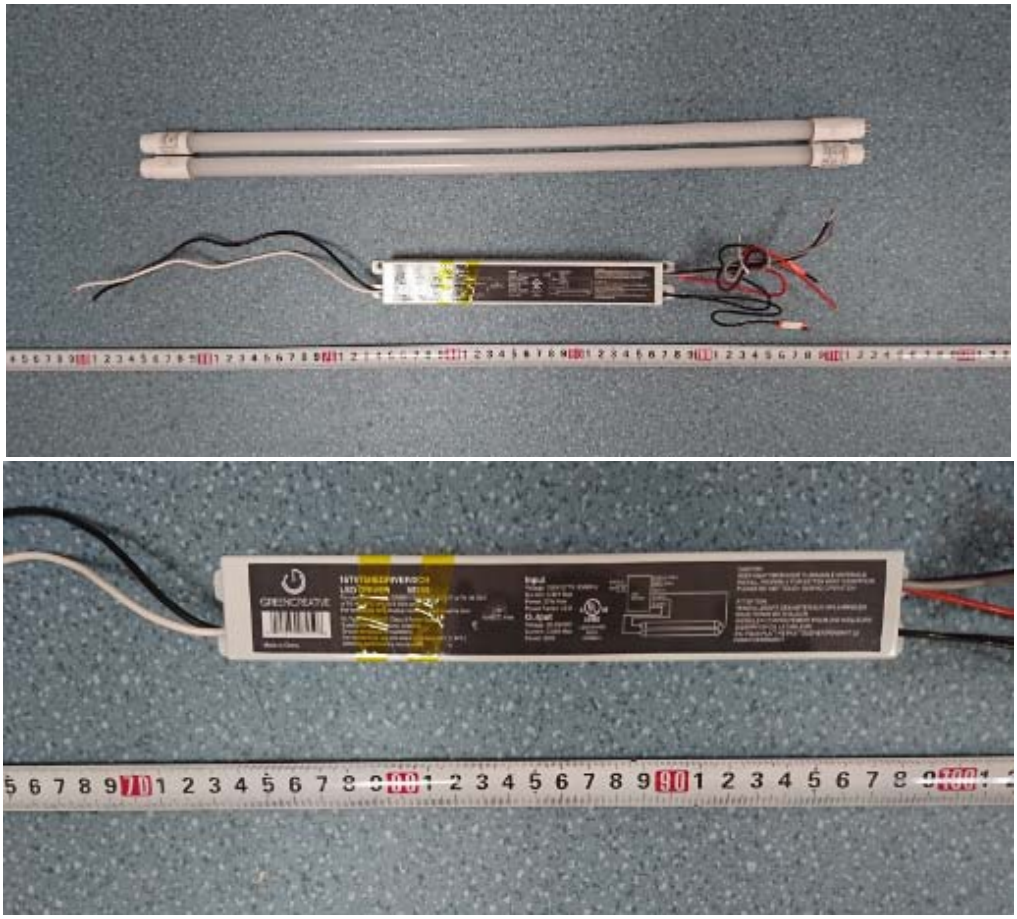


Figure 1- Overview of the sample

Equipment Under Test (EUT)	
Name	: LED Tube System
Model	: 9.5T5HE/2F/830/EXT/A2
Electrical Ratings	: 120-277V, 50/60Hz
Product Description	: 3000K LED tube model: 9.5T5HE/2F/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℃.

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)	0.191	0.091
Power Factor	0.9946	0.9353
Test Power (W)/2	11.42	11.82
THD A%	3.77	11.49
Luminous Efficacy (lm/W)	120.0	115.9
Luminous Flux per lamp (lm)	1370.0	1370.0
Color Rendering Index (CRI)	82.2	
R9	5.1	
Correlated Color Temperature (CCT)(K)	2923	
Chromaticity Chroma x	0.4421	
Chromaticity Chroma y	0.4053	
Chromaticity Chroma u	0.2534	
Chromaticity Chroma v	0.3484	
Duv	0.0005	
Chromaticity Chroma u ’	0.2534	
Chromaticity Chroma v’	0.5226	

Special Color Rendering Indices	
R1	81
R2	92.2
R3	94.5
R4	79.4
R5	81.4
R6	91.1
R7	81.1
R8	56.9
R9	5.1
R10	82.5
R11	78.9
R12	73.3
R13	83.8
R14	97.7
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 25.0℃.

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)	0.192
Power Factor	0.9948
Test Power (W)/2	11.44
Luminous Efficacy (lm/W)	118.3
Luminous Flux per lamp (lm)	1352.5
Beam Angle (°)	116.6
Center Beam Candle Power (cd)	380
Spacing Criteria	1.19 (0°-180°)/ 1.30 (90°-270°)
Zonal Lumens in the 0°-60°Zone	63.75%
Zonal Lumens in the 60°-90°Zone	25.78%
Zonal Lumens in the 90°-120°Zone	7.88%
Zonal Lumens in the 120°-180°Zone	2.59%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

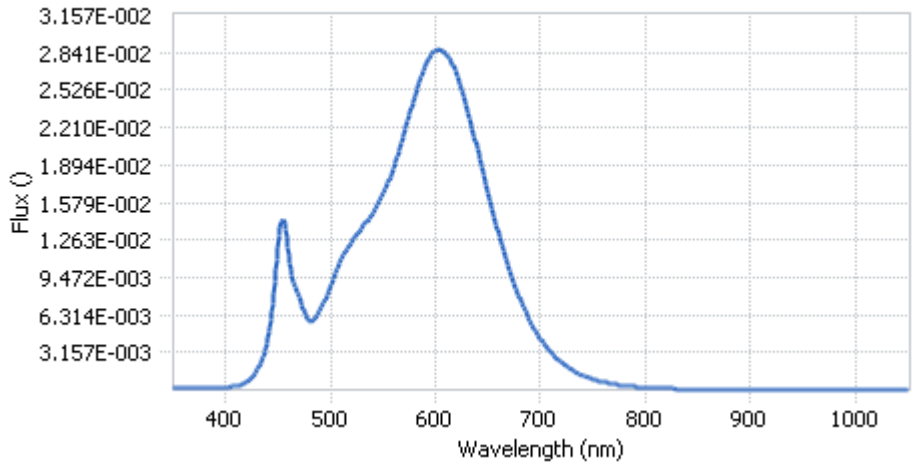
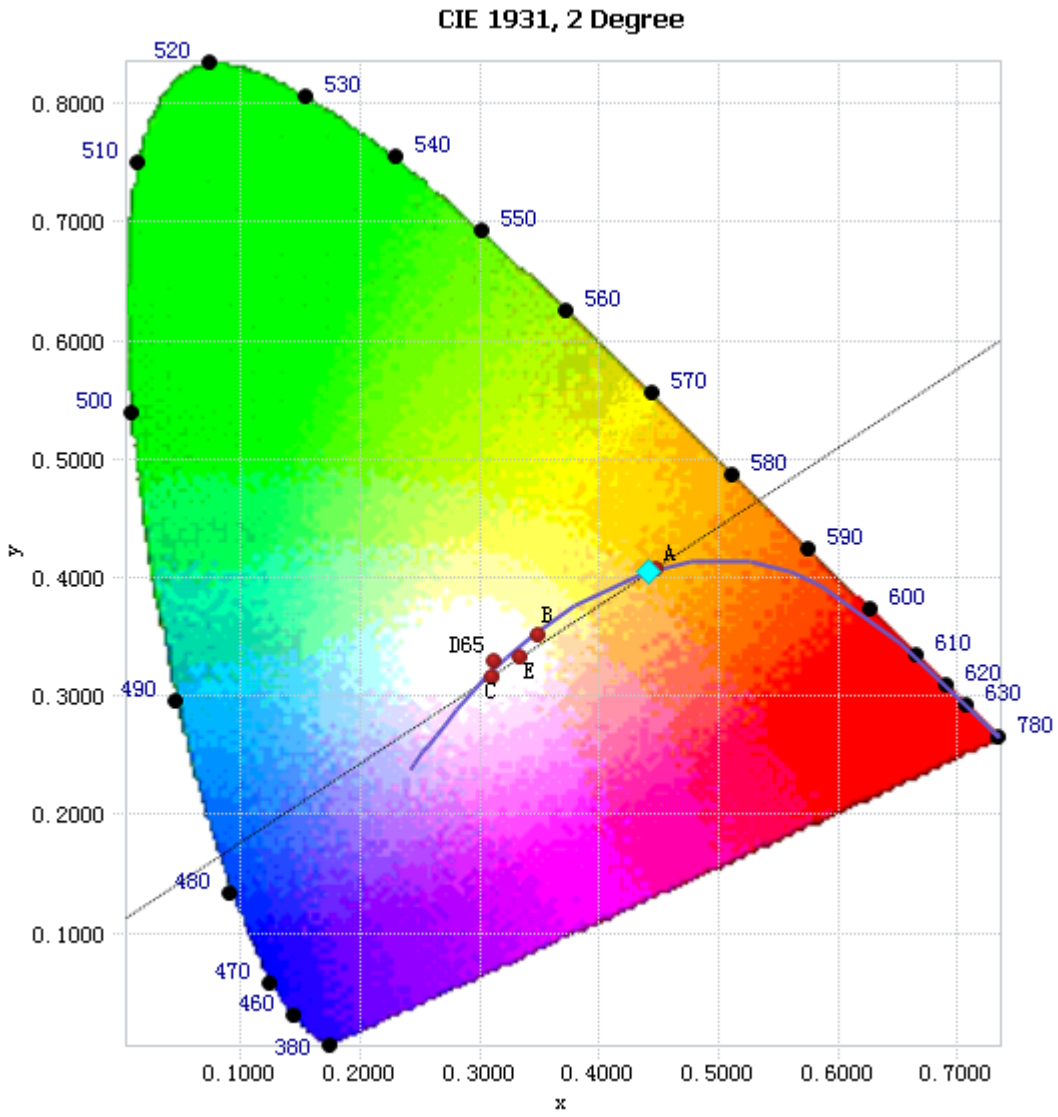


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.06E-04	485	6.06E-03	590	2.72E-02	695	5.02E-03
385	1.98E-04	490	6.72E-03	595	2.81E-02	700	4.30E-03
390	2.06E-04	495	7.64E-03	600	2.86E-02	705	3.68E-03
395	2.23E-04	500	8.81E-03	605	2.86E-02	710	3.16E-03
400	2.35E-04	505	9.95E-03	610	2.82E-02	715	2.70E-03
405	2.68E-04	510	1.09E-02	615	2.76E-02	720	2.31E-03
410	3.25E-04	515	1.19E-02	620	2.66E-02	725	1.98E-03
415	4.52E-04	520	1.25E-02	625	2.52E-02	730	1.70E-03
420	6.85E-04	525	1.31E-02	630	2.37E-02	735	1.44E-03
425	1.07E-03	530	1.37E-02	635	2.20E-02	740	1.23E-03
430	1.70E-03	535	1.43E-02	640	2.02E-02	745	1.05E-03
435	2.75E-03	540	1.49E-02	645	1.84E-02	750	8.94E-04
440	4.40E-03	545	1.57E-02	650	1.66E-02	755	7.71E-04
445	7.32E-03	550	1.65E-02	655	1.48E-02	760	6.60E-04
450	1.20E-02	555	1.75E-02	660	1.32E-02	765	5.67E-04
455	1.43E-02	560	1.88E-02	665	1.16E-02	770	4.84E-04
460	1.13E-02	565	2.01E-02	670	1.02E-02	775	4.13E-04
465	8.93E-03	570	2.16E-02	675	8.94E-03	780	3.60E-04
470	7.93E-03	575	2.31E-02	680	7.77E-03		
475	6.53E-03	580	2.47E-02	685	6.75E-03		
480	5.78E-03	585	2.62E-02	690	5.81E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4421, 0.4053)

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

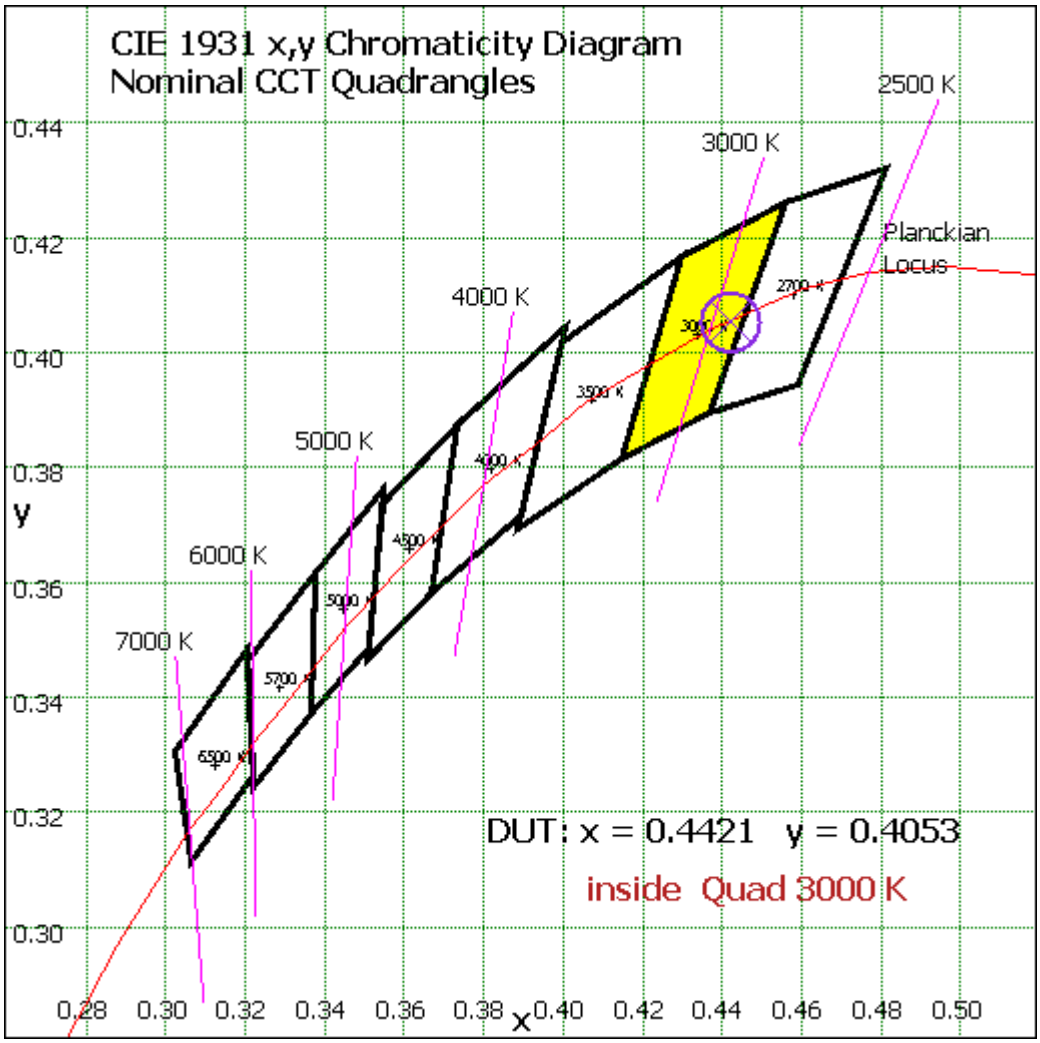


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

γ(°)	Lumens	% Total
0- 10	35.956	2.66%
10- 20	102.854	7.60%
20- 30	155.613	11.51%
30- 40	187.725	13.88%
40- 50	196.502	14.53%
50- 60	183.542	13.57%
60- 70	154.054	11.39%
70- 80	115.835	8.56%
80- 90	78.82	5.83%
90-100	51.979	3.84%
100-110	33.619	2.49%
110-120	20.997	1.55%
120-130	13.867	1.03%
130-140	9.243	0.68%
140-150	5.972	0.44%
150-160	3.59	0.27%
160-170	1.87	0.14%
170-180	0.48	0.04%
Total	1352.5	100%

γ(°)	Lumens	% Total
0- 60	862.192	63.75%
60- 90	348.709	25.78%
0-90	1210.901	89.53%
90- 180	141.617	10.47%
0- 180	1352.5	100%

Table 5: Zonal Lumen Data

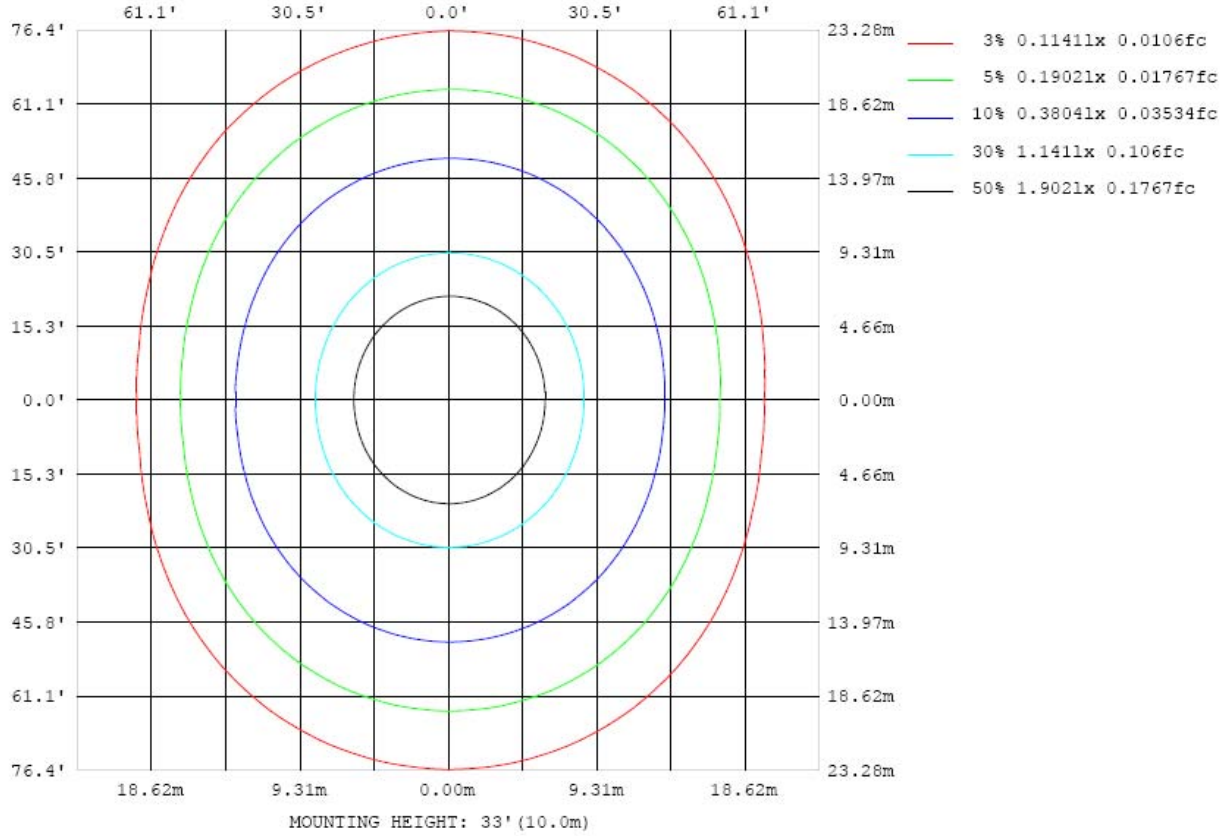


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

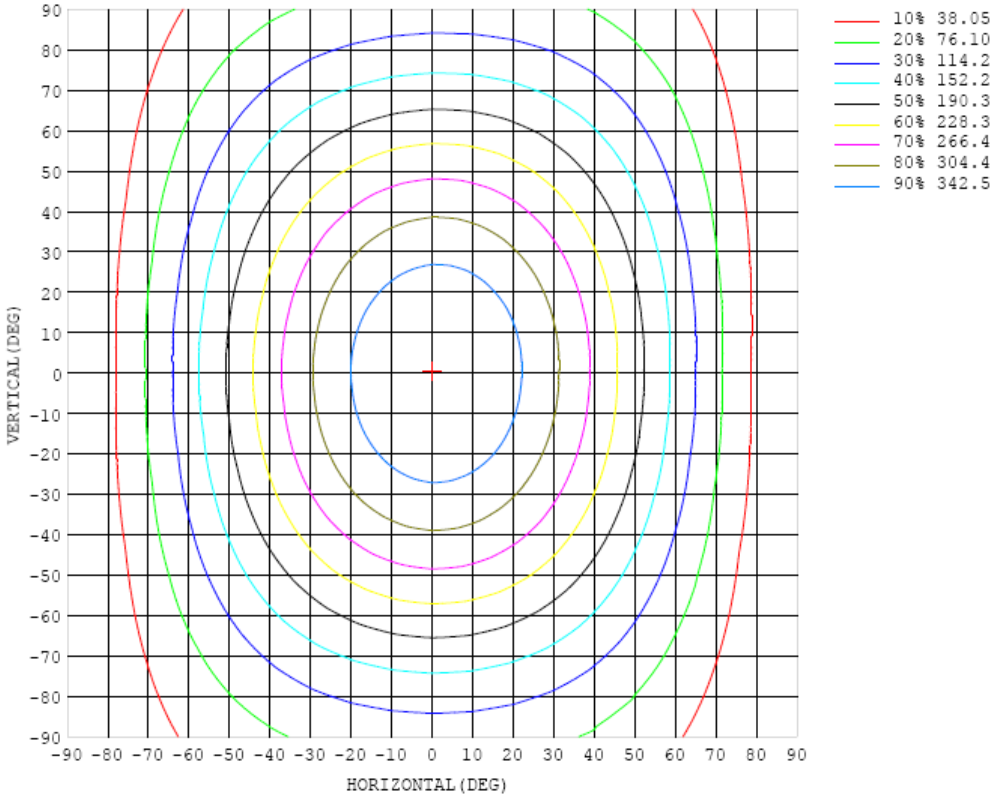


Chart 5: Isocandela Plot

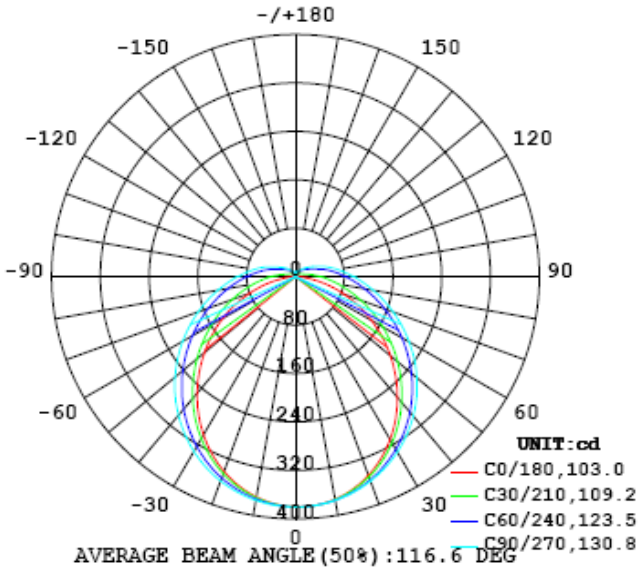


Chart 6: Polar Candela Distribution

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	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
5	379	379	379	379	379	379	379	379	379	379	379	378	378	378	377	377	377	377	377
10	373	373	374	374	374	375	375	375	375	375	375	374	373	372	371	371	370	370	369
15	363	364	364	365	366	367	367	368	368	368	368	366	365	363	362	360	359	358	358
20	349	350	351	352	354	356	357	359	359	359	358	356	354	352	349	346	344	343	342
25	332	332	334	336	339	342	345	347	348	348	347	344	341	337	333	329	326	324	324
30	310	311	313	317	321	325	329	332	334	334	333	329	325	320	314	309	305	302	302
35	286	287	290	295	300	306	312	316	318	318	316	313	307	301	294	287	282	278	277
40	260	261	265	271	278	285	292	297	300	301	298	294	288	280	271	263	256	252	251
45	232	234	238	245	254	263	271	277	280	281	279	273	266	257	247	238	230	225	223
50	203	205	210	219	229	239	248	255	259	260	257	252	244	234	223	212	203	196	195
55	174	176	182	192	203	215	225	232	237	238	235	229	221	210	198	186	175	168	166
60	144	146	154	165	178	191	201	209	214	215	213	207	198	186	173	160	148	139	138
65	114	117	126	139	153	167	178	186	191	193	190	184	175	163	149	135	121	111	109
70	84.8	88.1	99.2	114	130	144	156	164	169	170	168	162	153	141	127	111	96.0	83.8	80.1
75	57.1	61.6	75.8	91.4	108	123	135	143	148	149	147	141	132	120	106	89.6	73.3	58.9	52.8
80	31.2	37.4	53.7	71.7	88.5	103	115	123	128	129	127	122	113	102	87.3	71.0	53.4	36.7	28.2
85	10.8	18.7	36.2	54.9	72.4	86.2	97.6	106	110	112	110	105	96.6	85.3	71.7	55.3	37.3	19.8	9.07
90	0.65	7.90	23.7	41.4	57.9	72.2	82.4	89.9	94.3	95.7	93.9	89.3	81.7	71.6	58.2	42.5	25.5	9.71	0.22
95	0.37	2.99	15.3	31.0	46.2	59.4	69.6	76.2	80.5	81.8	80.3	76.0	69.4	59.6	47.0	32.5	17.3	4.74	0.39
100	0.50	2.20	9.62	22.5	36.5	48.7	58.2	65.0	69.0	70.3	68.9	64.9	58.4	49.2	37.6	24.2	11.8	3.33	0.56
105	0.75	1.92	7.42	16.3	27.5	38.6	47.9	54.4	58.3	59.5	58.2	54.5	48.2	39.4	28.7	18.4	9.06	2.89	0.88
110	1.11	2.33	6.09	13.2	21.6	30.1	37.7	43.7	47.5	48.8	47.6	44.1	38.4	31.5	23.3	14.9	7.73	3.08	1.27
115	1.49	2.66	5.39	11.1	18.0	24.9	30.9	35.6	38.5	39.6	38.8	36.2	31.9	26.1	19.4	12.7	6.94	3.21	1.69
120	1.90	2.87	5.11	9.63	15.2	20.9	26.0	29.8	32.3	33.2	32.5	30.4	26.8	22.0	16.5	11.1	6.33	3.53	2.14
125	2.31	3.40	5.02	8.58	13.2	17.8	22.0	25.2	27.3	28.1	27.5	25.7	22.7	18.8	14.4	10.0	6.20	3.61	2.55
130	2.73	3.99	5.20	7.82	11.5	15.4	18.8	21.4	23.2	23.8	23.4	21.9	19.3	16.2	12.6	8.98	5.95	4.04	2.90
135	3.15	4.52	5.37	7.09	10.1	13.4	16.1	18.3	19.8	20.3	19.9	18.7	16.7	14.1	11.2	8.24	5.49	4.39	3.37
140	3.58	4.90	4.82	6.61	9.07	11.4	13.9	15.7	16.8	17.3	17.0	16.0	14.4	12.2	9.96	7.66	5.44	4.76	3.80
145	3.95	5.07	4.66	6.30	8.44	10.1	11.6	12.8	14.1	14.6	14.3	13.4	12.1	10.7	8.85	6.75	5.48	4.67	4.09
150	4.35	5.03	5.60	5.47	6.98	8.91	10.2	11.2	11.9	12.2	12.1	11.4	10.5	9.26	7.30	6.28	5.66	4.77	4.36
155	4.74	4.86	5.70	5.52	6.24	7.44	8.21	9.33	10.1	10.3	10.2	9.55	8.06	7.64	6.56	5.63	5.59	4.48	4.61
160	5.14	4.55	5.35	6.10	6.36	6.63	7.40	7.87	8.40	8.60	8.38	7.86	7.12	6.13	5.86	5.92	4.89	4.13	4.62
165	5.36	4.08	4.84	5.60	6.38	7.13	7.33	6.99	6.80	6.54	6.16	6.00	6.29	6.60	6.23	4.97	4.06	3.91	4.16
170	4.61	3.99	4.14	4.22	4.40	5.67	6.86	7.31	7.51	7.55	7.45	7.01	5.63	4.52	4.34	3.91	3.82	3.96	3.94
175	3.95	3.96	3.96	3.97	3.97	3.97	4.12	4.20	4.98	3.47	3.28	3.61	3.65	3.67	3.73	3.78	3.78	3.82	3.85
180	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78

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	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380		
5	377	377	377	378	378	378	378	379	379	379	379	379	379	379	379	379	379		
10	370	370	371	371	372	373	374	374	375	375	375	375	375	375	374	374	373		
15	358	359	360	362	363	365	366	367	368	369	369	368	367	366	365	365	364		
20	343	344	346	349	351	354	356	358	359	359	359	358	356	355	353	351	350		
25	324	326	329	333	336	340	343	346	347	348	347	345	342	340	337	335	333		
30	302	305	309	314	319	324	328	331	333	333	332	330	326	322	318	314	312		
35	278	281	287	292	299	306	311	315	317	317	316	312	307	302	296	292	288		
40	252	256	262	270	278	285	292	296	299	299	297	292	287	280	273	267	263		
45	225	230	237	246	255	264	271	276	279	279	276	271	264	256	248	240	235		
50	197	202	211	221	232	241	249	255	258	258	255	249	241	231	221	213	207		
55	168	175	185	196	208	218	227	233	236	236	232	226	217	206	195	185	178		
60	140	148	159	171	184	195	204	211	214	213	210	203	193	181	169	158	149		
65	112	121	134	148	162	173	182	188	191	191	187	180	170	158	144	130	120		
70	84.3	95.8	111	126	140	152	161	167	170	169	166	159	148	134	119	104	92.0		
75	58.5	72.4	88.9	105	119	131	140	146	149	148	145	137	127	113	97.0	80.2	65.4		
80	35.7	52.0	69.7	86.3	101	112	121	127	129	129	125	118	107	93.4	77.0	58.9	41.8		
85	18.2	35.4	53.5	70.0	84.1	95.2	103	109	111	111	107	100	89.7	76.2	59.7	41.3	23.0		
90	7.79	23.4	40.4	56.2	69.6	80.3	88.0	93.0	95.1	94.5	91.0	84.3	74.5	61.5	45.7	28.0	11.0		
95	3.25	14.9	30.3	44.8	57.4	67.4	74.6	79.2	81.2	80.5	77.1	70.9	61.5	49.3	34.6	18.7	4.83		
100	2.22	9.70	21.5	35.3	47.0	56.3	63.1	67.3	69.1	68.4	65.2	59.3	50.6	39.1	25.4	11.8	3.04		
105	2.33	7.37	16.2	26.2	37.0	46.2	52.9	56.9	58.5	57.8	54.7	48.9	40.1	29.3	18.3	8.55	2.60		
110	2.60	6.25	12.9	21.1	29.1	36.0	41.7	45.8	47.5	46.6	43.3	37.9	30.9	22.8	14.2	6.76	2.80		
115	2.92	5.85	11.0	17.4	24.0	29.7	34.1	36.9	38.0	37.4	35.0	30.8	25.3	18.6	11.7	6.03	3.05		
120	3.32	5.68	9.65	14.7	20.1	24.8	28.5	30.8	31.7	31.2	29.2	25.7	21.0	15.5	9.89	5.82	3.42		
125	3.70	5.62	8.77	12.8	17.1	20.9	24.0	26.0	26.8	26.3	24.6	21.7	17.8	13.2	8.89	5.83	3.84		
130	4.05	5.60	8.07	11.2	14.6	17.9	20.4	22.0	22.7	22.3	20.8	18.4	15.2	11.5	8.32	5.87	4.28		
135	4.51	5.76	7.70	10.2	12.8	15.4	17.4	18.8	19.3	18.9	17.8	15.8	13.2	10.4	7.98	6.01	4.73		
140	4.98	5.99	7.47	9.35	11.4	13.3	14.9	16.1	16.5	16.2	15.1	13.6	11.6	9.59	7.69	6.18	5.18		
145	5.43	6.21	7.33	8.73	10.2	11.7	12.9	13.6	14.0	13.7	13.0	11.8	10.4	8.90	7.50	6.38	5.62		
150	5.78	6.25	6.99	7.95	9.34	10.4	11.2	11.8	12.0	11.8	11.3	10.5	9.46	8.38	7.39	6.59	6.02		
155	6.04	6.34	6.98	7.52	8.24	9.30	9.87	10.3	10.4	10.3	9.97	9.42	8.74	8.01	7.34	6.81	6.33		
160	6.00	6.56	6.90	7.32	7.59	7.96	8.82	9.06	9.18	9.14	8.94	8.61	8.19	7.75	7.33	7.02	6.59		
165	5.64	6.72	6.91	7.13	7.30	7.31	7.40	8.20	8.26	8.25	8.17	8.00	7.79	7.55	7.33	7.14	6.66		
170	4.49	5.16	5.62	6.05	6.76	7.12	6.98	6.91	7.11	7.57	7.63	7.55	7.47	7.38	7.27	6.60	5.13		
175	3.95	3.93	3.93	4.09	4.30	4.60	5.41	6.41	6.91	6.54	6.58	6.92	7.16	6.37	5.12	4.21	3.92		
180	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78		

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

Color Characteristics Measurements

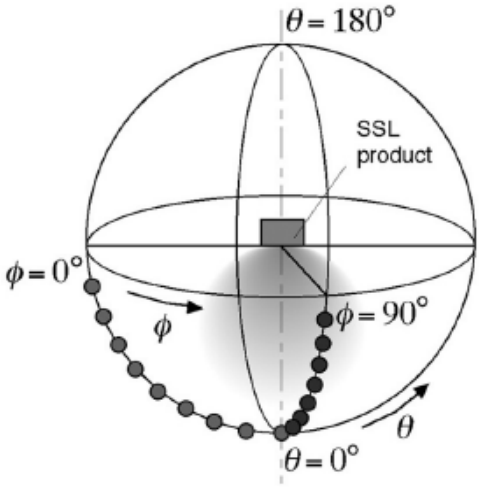
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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