LM-79-08 Test Report

for

GREEN CREATIVE LTD

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

LED Tube System

Model: 13.5T5HE/4F/830/EXT/A4

(LED tube model: 13.5T5HE/4F/830/EXT 4pcs and LED driver model: 15T8T5HEDRIVER/4CH 1pcs)

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ18070047h/R1

This report is replaced the old report No. HZ18070047h 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: **13.5T5HE/4F/830/EXT/A4**

Luminous Efficacy (Lumens /Watt)	Luminous Flux per lamp (Lumens)	Power (Watts)/4	Power Factor
129.6	2001.0	15.44	0.9976

CCT (K)	CRI	Stabilization Time (Light & Power)
2923	82.7	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

TABLE OF CONTENT

Sample Photos

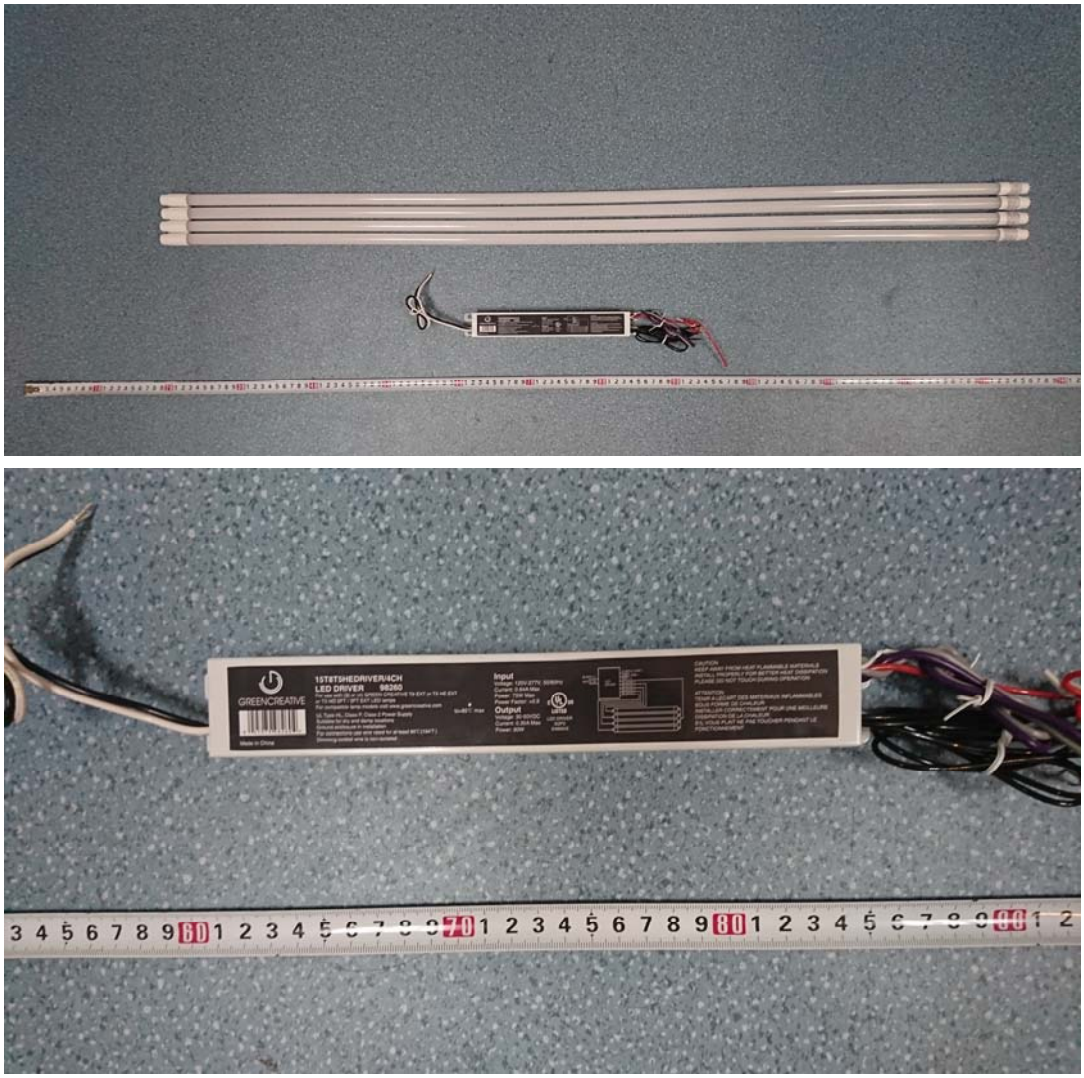


Figure 1- Overview of the sample

Equipment Under Test (EUT)	
Name	: LED Tube System
Model	: 13.5T5HE/4F/830/EXT/A4
Electrical Ratings	: 120-277V, 50/60Hz
Product Description	: 3000K LED tube model: 13.5T5HE/4F/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 25.0℃.

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)	0.516	0.226
Power Factor	0.9976	0.9696
Test Power (W)/4	15.44	15.20
THD A%	2.95	4.00
Luminous Efficacy (lm/W)	129.6	131.7
Luminous Flux per lamp (lm)	2001.0	2001.0
Color Rendering Index (CRI)	82.7	
R9	7.7	
Correlated Color Temperature (CCT)(K)	2923	
Chromaticity Chroma x	0.4409	
Chromaticity Chroma y	0.4030	
Chromaticity Chroma u	0.2536	
Chromaticity Chroma v	0.3477	
Duv	0.0013	
Chromaticity Chroma u ’	0.2536	
Chromaticity Chroma v’	0.5216	

Special Color Rendering Indices	
R1	82.1
R2	93.6
R3	93.1
R4	79.7
R5	82.6
R6	92.7
R7	80.6
R8	57.5
R9	7.7
R10	85.6
R11	79.5
R12	75
R13	85.2
R14	96.9
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 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)	0.517
Power Factor	0.9963
Test Power (W)/4	15.47
Luminous Efficacy (lm/W)	127.5
Luminous Flux per lamp (lm)	1972.4
Beam Angle (°)	128.0
Center Beam Candle Power (cd)	494
Spacing Criteria	1.26 (0°-180°)/ 1.32 (90°-270°)
Zonal Lumens in the 0°-60°Zone	59.93%
Zonal Lumens in the 60°-90°Zone	27.56%
Zonal Lumens in the 90°-120°Zone	9.66%
Zonal Lumens in the 120°-180°Zone	2.85%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

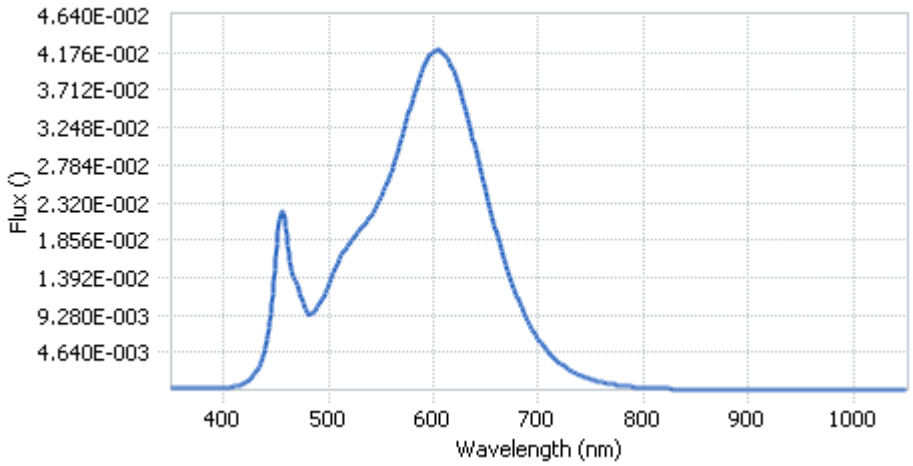
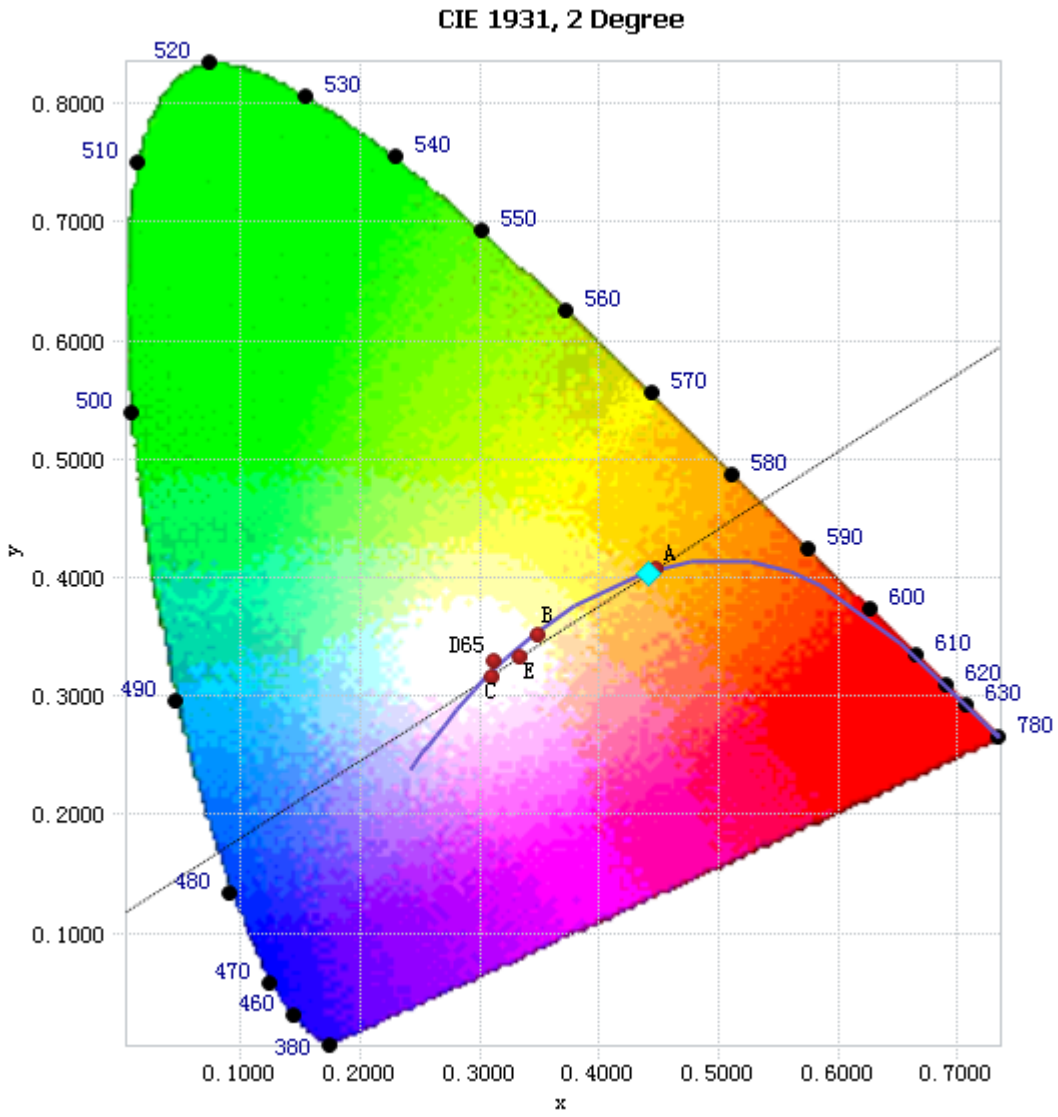


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	3.18E-04	485	9.55E-03	590	3.98E-02	695	7.30E-03
385	2.83E-04	490	1.04E-02	595	4.11E-02	700	6.30E-03
390	2.87E-04	495	1.15E-02	600	4.19E-02	705	5.36E-03
395	3.18E-04	500	1.31E-02	605	4.22E-02	710	4.58E-03
400	3.34E-04	505	1.48E-02	610	4.15E-02	715	3.93E-03
405	3.65E-04	510	1.60E-02	615	4.07E-02	720	3.36E-03
410	4.37E-04	515	1.73E-02	620	3.91E-02	725	2.88E-03
415	5.72E-04	520	1.82E-02	625	3.72E-02	730	2.44E-03
420	8.48E-04	525	1.91E-02	630	3.50E-02	735	2.09E-03
425	1.32E-03	530	1.99E-02	635	3.24E-02	740	1.78E-03
430	2.09E-03	535	2.06E-02	640	2.98E-02	745	1.52E-03
435	3.36E-03	540	2.15E-02	645	2.70E-02	750	1.30E-03
440	5.48E-03	545	2.26E-02	650	2.45E-02	755	1.11E-03
445	9.45E-03	550	2.39E-02	655	2.19E-02	760	9.45E-04
450	1.64E-02	555	2.54E-02	660	1.94E-02	765	8.03E-04
455	2.22E-02	560	2.71E-02	665	1.71E-02	770	6.95E-04
460	1.91E-02	565	2.91E-02	670	1.50E-02	775	5.91E-04
465	1.47E-02	570	3.14E-02	675	1.31E-02	780	5.16E-04
470	1.31E-02	575	3.37E-02	680	1.14E-02		
475	1.10E-02	580	3.60E-02	685	9.87E-03		
480	9.41E-03	585	3.81E-02	690	8.51E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4409, 0.4030)

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

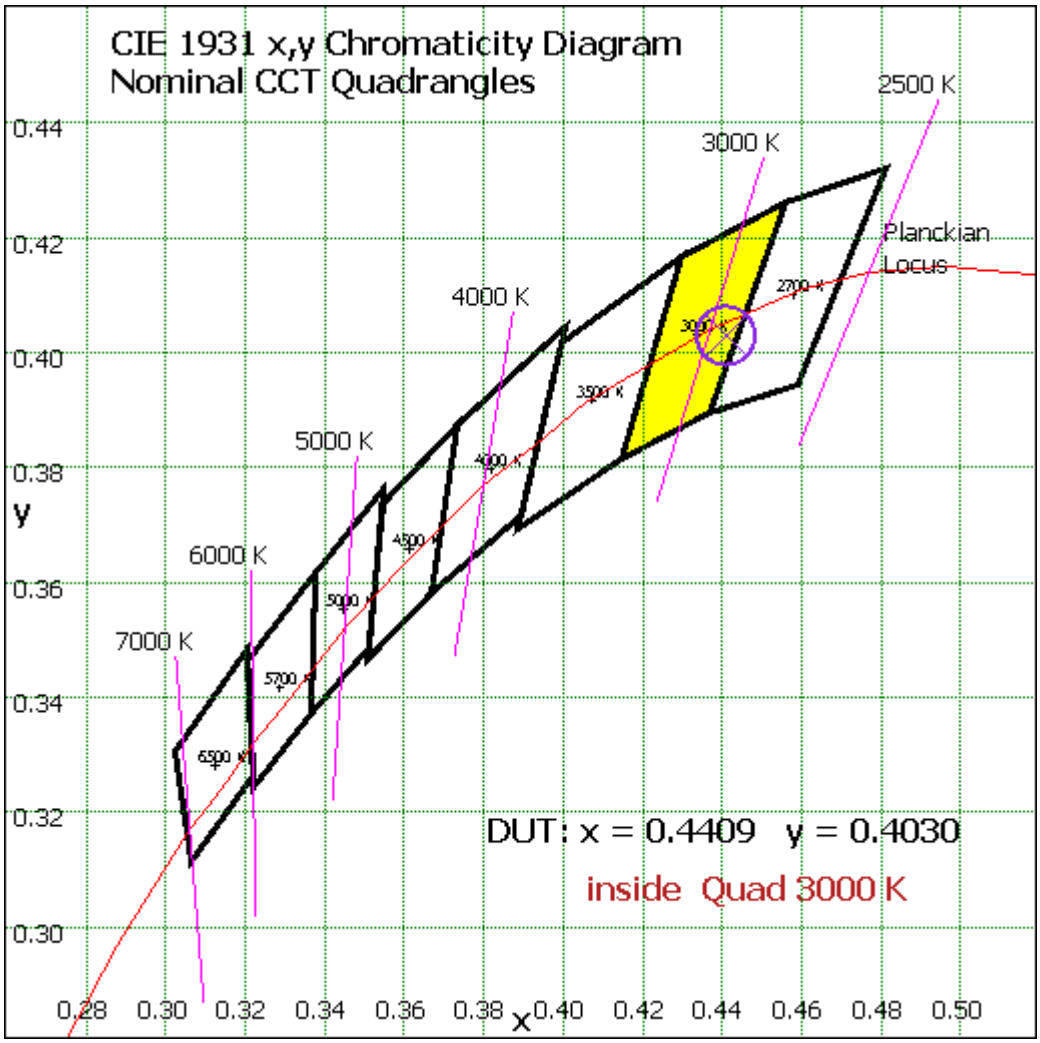


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

γ(°)	Lumens	% Total
0- 10	46.796	2.37%
10- 20	134.771	6.83%
20- 30	206.739	10.48%
30- 40	254.688	12.91%
40- 50	274.156	13.90%
50- 60	264.924	13.43%
60- 70	231.253	11.72%
70- 80	181.921	9.22%
80- 90	130.34	6.61%
90-100	90.303	4.58%
100-110	60.912	3.09%
110-120	39.319	1.99%
120-130	24.907	1.26%
130-140	15.164	0.77%
140-150	8.706	0.44%
150-160	4.731	0.24%
160-170	2.176	0.11%
170-180	0.585	0.03%
Total	1972.4	100%

γ(°)	Lumens	% Total
0- 60	1182.074	59.93%
60- 90	543.514	27.56%
0-90	1725.588	87.49%
90- 180	246.803	12.51%
0- 180	1972.4	100%

Table 5: Zonal Lumen Data

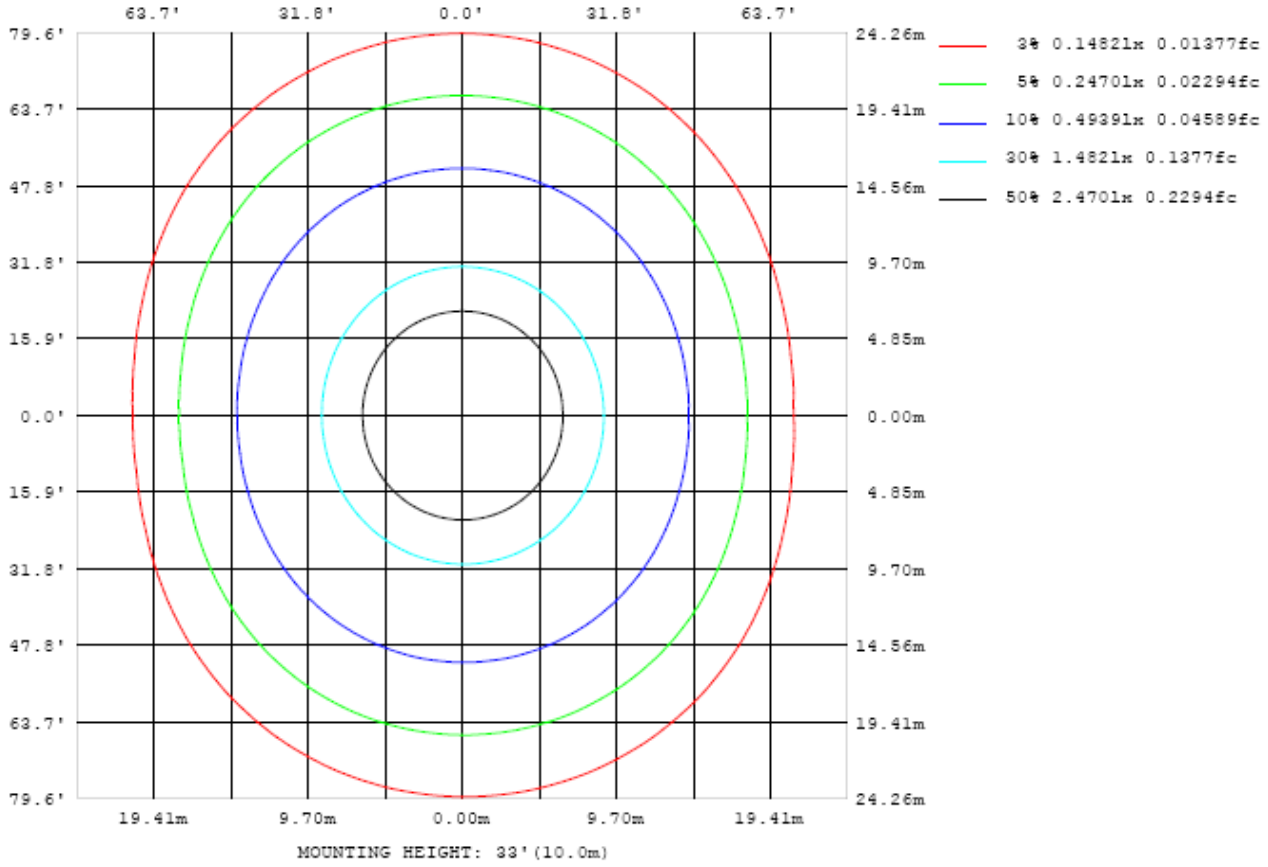


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

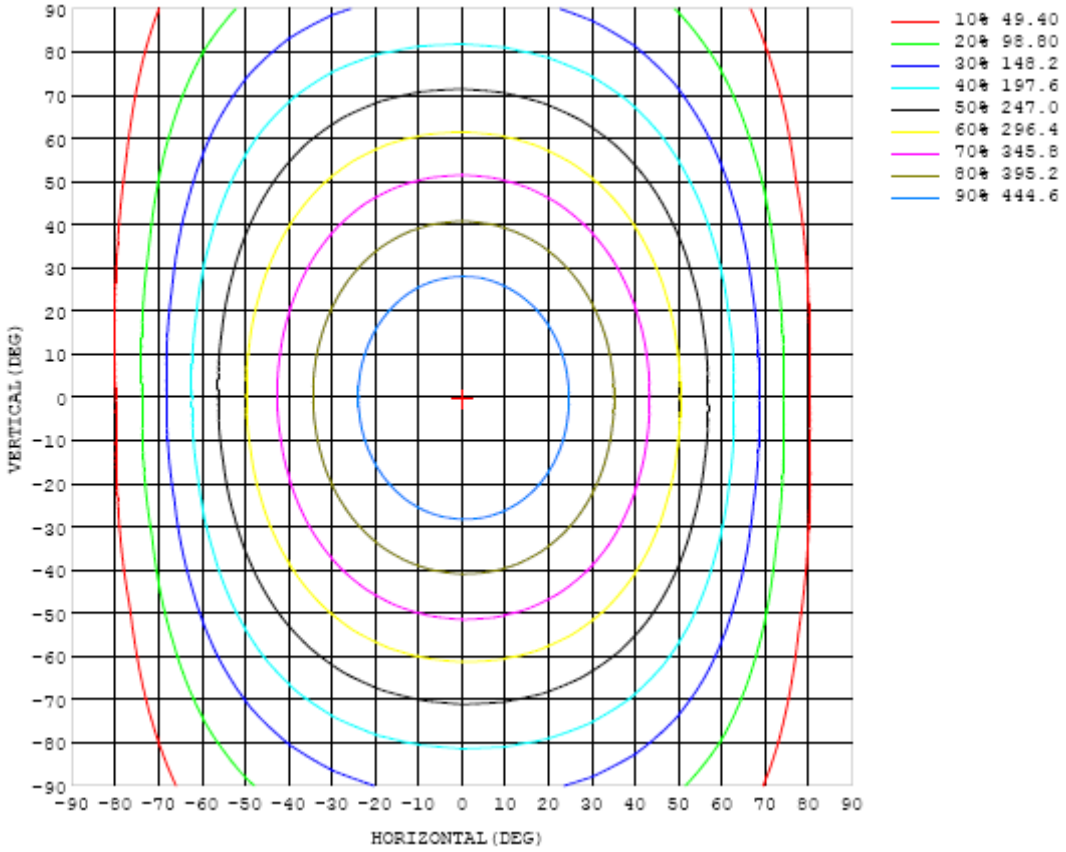


Chart 5: Isocandela Plot

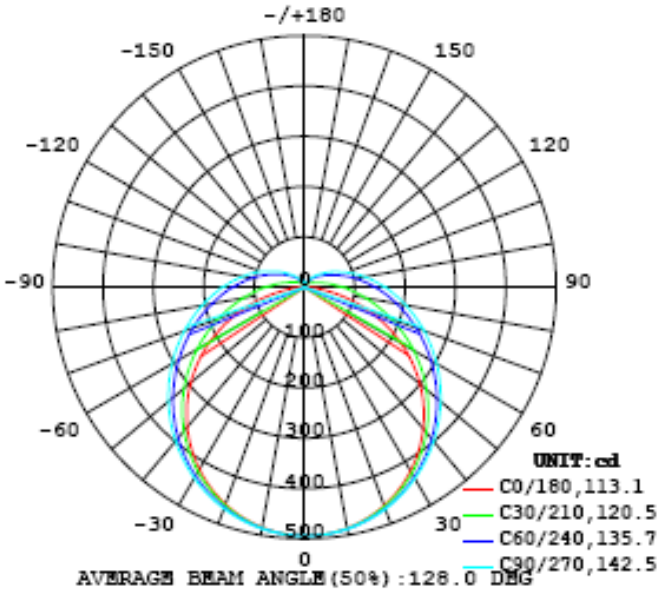


Chart 6: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1 UNIT: cd

C (DEG) / γ (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	494	494	494	494	494	494	494	494	494	494	494	494	494	494	494	494	494	494	494
5	492	492	492	492	493	493	493	493	493	493	493	492	492	492	492	492	491	491	492
10	486	486	486	487	487	487	488	488	488	488	488	487	487	486	486	485	485	485	485
15	476	476	477	477	478	479	479	480	480	480	479	479	478	477	476	475	475	474	474
20	462	462	463	464	465	467	468	469	469	469	468	467	466	464	463	461	460	459	459
25	443	444	445	447	449	451	453	455	455	455	454	453	451	448	446	444	442	441	440
30	421	422	424	427	430	433	435	438	439	439	438	436	433	429	426	423	420	418	418
35	396	397	399	403	407	411	415	418	420	420	419	416	412	408	403	398	395	392	392
40	367	368	371	376	382	388	393	397	399	399	398	394	389	383	377	371	366	363	362
45	334	336	341	347	355	362	369	374	376	377	375	371	365	357	349	341	335	331	330
50	299	302	308	316	326	335	343	349	353	353	351	346	339	330	319	310	301	296	295
55	261	265	273	284	296	307	317	324	328	328	326	320	312	301	289	276	265	258	257
60	221	226	236	250	265	279	290	298	302	303	300	294	285	272	257	242	228	219	217
65	179	185	199	217	234	250	263	272	277	278	275	268	257	243	226	207	190	178	175
70	135	144	162	184	204	222	236	246	251	253	249	242	230	215	195	174	152	136	132
75	91.7	104	127	152	176	195	210	221	227	228	225	217	204	187	166	142	116	94.6	89.1
80	51.5	67.4	95.2	124	149	169	186	197	203	204	201	193	180	162	139	113	83.6	57.5	48.6
85	18.4	37.9	68.8	98.2	124	146	162	174	180	182	178	170	157	138	115	87.7	57.4	28.0	16.6
90	1.95	19.1	48.0	77.1	103	124	141	152	159	160	157	149	135	117	94.1	67.2	37.8	11.1	1.36
95	0.34	9.73	33.0	59.8	84.2	105	121	132	139	140	137	129	116	98.2	76.2	51.0	24.6	5.04	0.57
100	0.41	6.36	22.8	45.4	68.3	87.6	103	114	120	122	119	111	98.4	81.6	61.1	38.0	17.0	3.42	0.61
105	0.71	4.96	17.1	34.8	54.1	71.8	86.2	96.7	103	104	101	93.8	82.0	66.4	48.0	29.5	12.8	2.77	1.04
110	1.25	4.54	13.7	27.8	43.7	58.7	71.2	80.1	85.8	87.2	84.4	77.6	67.5	54.3	39.2	23.5	10.5	2.84	1.50
115	1.82	4.48	11.4	22.6	35.7	48.5	59.3	67.3	72.1	73.8	70.8	65.3	56.4	44.9	32.0	19.3	9.01	3.19	2.03
120	2.38	4.55	9.88	18.8	29.4	40.0	49.2	56.1	60.3	61.3	59.4	54.5	46.8	37.1	26.5	16.0	7.63	3.55	2.55
125	2.79	4.62	9.03	15.8	24.4	33.0	40.6	46.5	50.0	50.9	49.3	45.1	38.8	30.8	22.1	13.7	7.32	3.72	3.02
130	3.29	4.92	8.48	13.5	20.3	27.3	33.5	38.4	41.3	42.1	40.7	37.3	32.0	25.5	18.2	11.5	7.08	3.82	3.46
135	3.79	5.10	8.08	12.0	16.9	22.5	27.6	31.5	33.9	34.5	33.4	30.6	26.4	20.8	15.1	10.6	6.81	4.09	3.94
140	4.16	5.18	7.76	10.8	14.5	18.3	22.4	25.6	27.5	28.0	27.1	24.8	21.2	16.9	13.2	9.75	6.58	4.35	4.41
145	4.30	5.24	7.49	9.75	12.6	15.5	17.9	20.1	21.7	22.1	21.2	19.4	17.1	14.6	11.8	9.04	6.62	4.56	4.75
150	4.56	5.08	7.34	8.88	10.9	13.1	15.1	16.6	17.5	17.7	17.2	16.2	14.6	12.6	10.2	8.18	6.56	4.68	4.98
155	4.54	4.63	6.77	8.33	9.55	11.0	12.5	13.7	14.3	14.5	14.2	13.4	12.1	10.6	8.93	7.24	6.03	4.46	4.98
160	4.50	4.17	5.69	7.75	8.72	9.52	10.4	11.2	11.8	11.9	11.7	11.3	10.1	8.33	6.80	6.15	5.39	4.37	4.85
165	4.94	4.02	4.47	5.36	7.05	8.15	8.85	9.38	9.64	9.86	9.58	8.19	6.89	6.02	5.77	5.17	4.73	4.39	4.55
170	5.31	4.37	4.46	4.87	5.22	5.99	6.63	7.30	7.84	7.77	5.65	5.29	5.89	5.64	5.53	4.98	4.74	4.55	4.46
175	5.79	5.46	5.40	5.38	5.75	6.14	6.34	6.43	5.30	3.07	6.62	6.55	6.42	6.16	5.97	5.73	5.46	5.35	5.33
180	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92

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	494	494	494	494	494	494	494	494	494	494	494	494	494	494	494	494	494		
5	492	492	491	492	492	492	492	492	492	492	492	492	492	492	492	492	492		
10	485	485	485	486	486	486	487	487	487	487	487	487	487	487	486	486	486		
15	474	475	475	476	477	478	478	479	479	479	479	478	478	477	477	476	476		
20	459	460	461	463	464	466	467	467	468	468	467	466	465	464	463	462	462		
25	441	442	444	446	448	451	452	454	454	454	453	451	450	448	446	445	444		
30	419	420	423	426	430	433	435	437	438	437	436	434	431	428	425	423	422		
35	393	396	399	404	408	413	416	418	419	418	416	413	409	405	401	398	396		
40	364	368	373	379	385	391	395	398	399	398	395	391	385	380	375	370	368		
45	332	337	343	351	359	366	372	375	377	375	372	366	359	352	345	339	336		
50	298	304	312	322	332	341	348	352	353	352	347	340	332	322	314	306	301		
55	261	269	280	292	305	315	323	327	329	327	322	314	303	292	280	270	264		
60	222	233	247	262	276	288	297	302	304	302	296	286	274	260	246	233	224		
65	182	196	214	232	248	262	271	277	279	276	270	259	245	229	211	195	183		
70	142	160	181	202	221	236	246	252	254	251	244	232	217	198	177	157	141		
75	102	126	152	174	194	210	221	228	230	227	219	207	190	169	145	120	99.8		
80	66.3	95.0	124	149	170	186	198	204	206	203	195	182	164	142	116	87.0	61.5		
85	38.0	69.2	99.2	126	147	164	175	182	184	180	172	160	141	118	90.2	59.5	30.9		
90	20.4	49.3	78.6	105	126	143	155	161	163	160	152	138	120	96.6	69.1	39.3	12.8		
95	11.0	35.0	61.8	86.5	107	124	135	142	143	140	132	119	101	78.5	52.6	25.7	5.11		
100	7.26	24.8	47.9	71.1	90.7	106	117	123	125	122	114	101	84.3	63.2	39.4	17.1	3.03		
105	5.90	18.7	37.1	56.8	75.3	90.1	100	106	108	105	97.4	85.4	69.0	49.6	29.6	12.4	2.44		
110	5.35	15.0	29.8	46.0	61.2	74.0	84.0	89.8	91.3	88.3	80.9	69.5	55.4	39.4	23.3	9.87	2.78		
115	5.25	12.7	24.4	37.7	50.5	61.4	69.4	74.0	75.1	72.6	66.5	57.3	45.4	32.0	18.7	8.35	3.20		
120	5.28	11.0	20.4	31.2	41.9	51.1	57.9	61.8	62.8	60.6	55.3	47.4	37.4	26.2	15.5	7.11	3.52		
125	5.44	9.92	17.2	26.0	34.7	42.4	48.1	51.4	52.2	50.4	45.9	39.2	30.8	21.7	13.0	6.98	4.02		
130	5.67	9.11	14.6	21.7	28.7	35.0	39.7	42.5	43.2	41.6	37.8	32.3	25.5	18.0	10.9	6.95	4.58		
135	5.89	8.55	12.7	18.2	23.9	28.8	32.6	34.9	35.4	34.1	31.0	26.5	21.0	14.8	9.86	7.00	5.01		
140	6.25	8.45	11.3	15.1	19.7	23.6	26.6	28.4	28.8	27.7	25.2	21.6	17.0	12.3	9.43	7.21	5.31		
145	6.36	8.10	10.4	12.9	15.8	19.0	21.4	22.8	23.0	22.2	20.1	17.0	13.6	11.1	9.16	7.20	5.47		
150	6.48	7.85	9.69	11.6	13.2	14.9	16.6	17.6	17.8	17.0	15.5	13.6	12.1	10.6	8.88	7.32	5.95		
155	6.49	7.46	8.68	10.4	11.8	12.8	13.5	13.9	14.0	13.6	13.1	12.3	11.2	9.87	8.52	7.42	6.32		
160	6.03	6.95	7.74	9.17	10.3	11.1	11.7	12.1	12.2	12.0	11.6	10.9	10.0	9.13	8.24	7.49	6.56		
165	5.19	6.09	6.76	7.51	8.81	9.49	9.87	10.1	10.2	10.2	9.94	9.58	9.09	8.52	8.01	7.60	6.71		
170	4.79	5.32	5.65	6.10	6.72	7.63	8.29	8.57	8.64	8.66	8.58	8.42	8.22	7.99	7.67	7.17	6.41		
175	5.26	5.29	5.20	5.08	5.22	5.68	6.23	6.96	7.56	7.69	7.70	7.68	7.54	7.25	6.89	6.57	6.29		
180	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92		

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

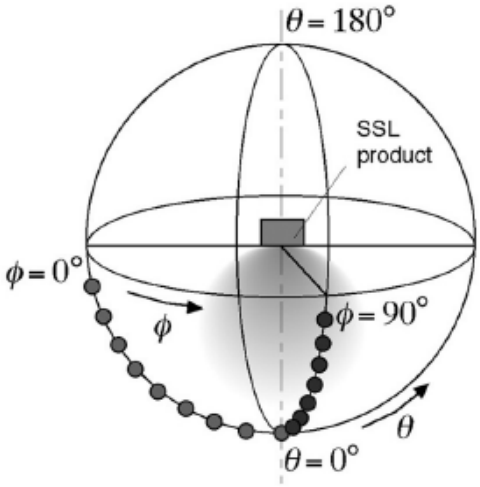
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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