



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/850/EXT/A4

(LED tube model: 13.5T5HE/4F/850/EXT 4pcs and LED driver model: 15T8T5HEDRIVER/4CH 1pcs)

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ18070047j/R1

This report is replaced the old report No. HZ18070047j 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/850/EXT/A4**

Luminous Efficacy (Lumens /Watt)	Luminous Flux per lamp (Lumens)	Power (Watts)/4	Power Factor
143.7	2219.0	15.44	0.9976
CCT (K)	CRI	Stabilization Time (Light & Power)	
4926	81.6	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

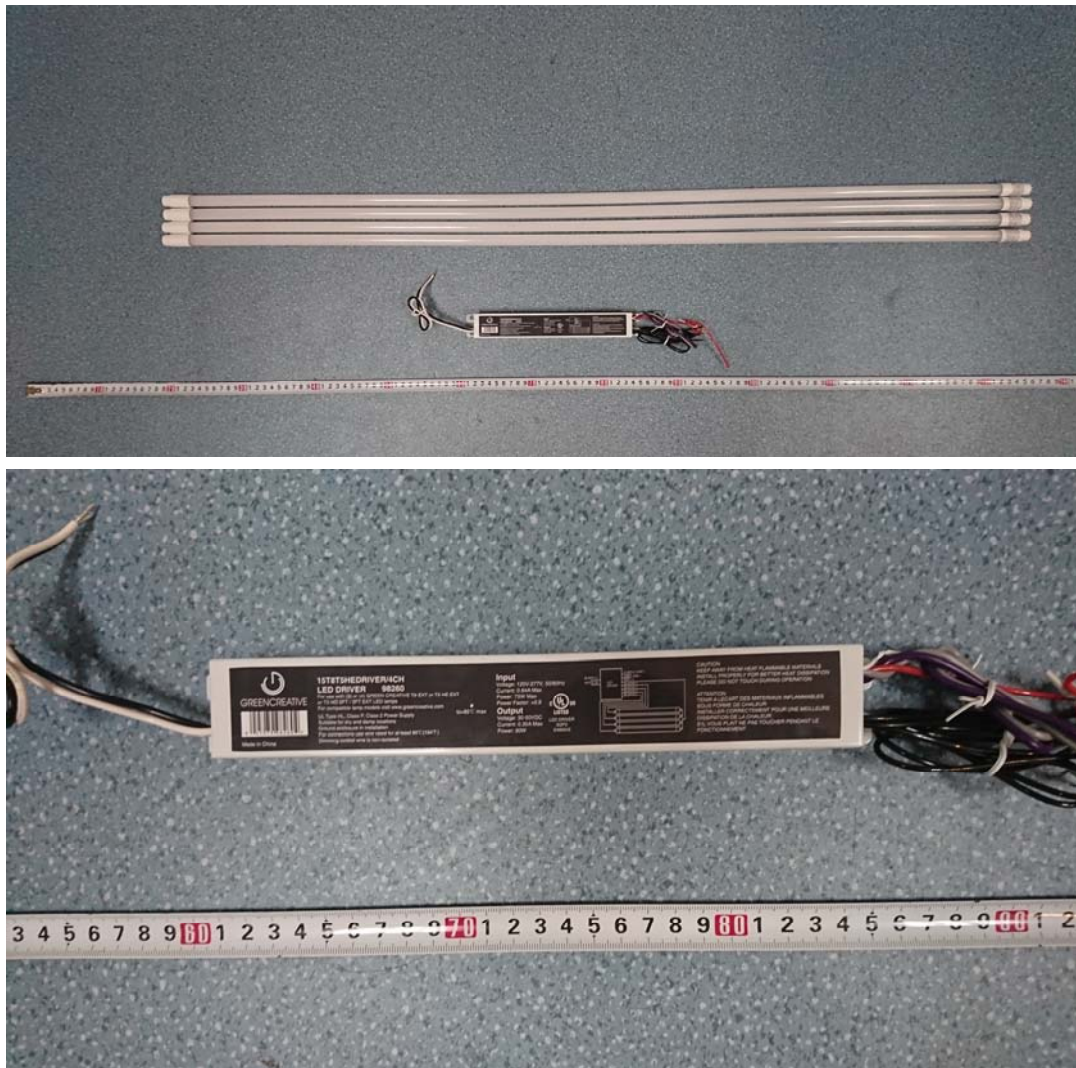


Figure 1- Overview of the sample

Equipment Under Test (EUT)

Name	: LED Tube System
Model	: 13.5T5HE/4F/850/EXT/A4
Electrical Ratings	: 120-277V, 50/60Hz
Product Description	: 5000K LED tube model: 13.5T5HE/4F/850/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°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)	0.516	0.226
Power Factor	0.9976	0.9696
Test Power (W)/4	15.44	15.20
THD A%	2.97	3.94
Luminous Efficacy (lm/W)	143.7	146.0
Luminous Flux per lamp (lm)	2219.0	2219.0
Color Rendering Index (CRI)	81.6	
R9	1.1	
Correlated Color Temperature (CCT)(K)	4926	
Chromaticity Chroma x	0.3481	
Chromaticity Chroma y	0.3618	
Chromaticity Chroma u	0.2095	
Chromaticity Chroma v	0.3267	
Duv	0.0038	
Chromaticity Chroma u'	0.2095	
Chromaticity Chroma v'	0.4901	

Special Color Rendering Indices	
R1	78.7
R2	86.8
R3	93.3
R4	81.1
R5	80.5
R6	83.4
R7	85.8
R8	63.9
R9	1.1
R10	69.4
R11	82.5
R12	50.8
R13	80.1
R14	96.4
Rf	81
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°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)	0.517
Power Factor	0.9964
Test Power (W)/4	15.46
Luminous Efficacy (lm/W)	141.5
Luminous Flux per lamp (lm)	2186.3
Beam Angle (°)	128.5
Center Beam Candle Power (cd)	543
Spacing Criteria	1.27 (0°-180°)/ 1.33 (90°-270°)
Zonal Lumens in the 0°-60°Zone	59.69%
Zonal Lumens in the 60°-90°Zone	27.65%
Zonal Lumens in the 90°-120°Zone	9.75%
Zonal Lumens in the 120°-180°Zone	2.91%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

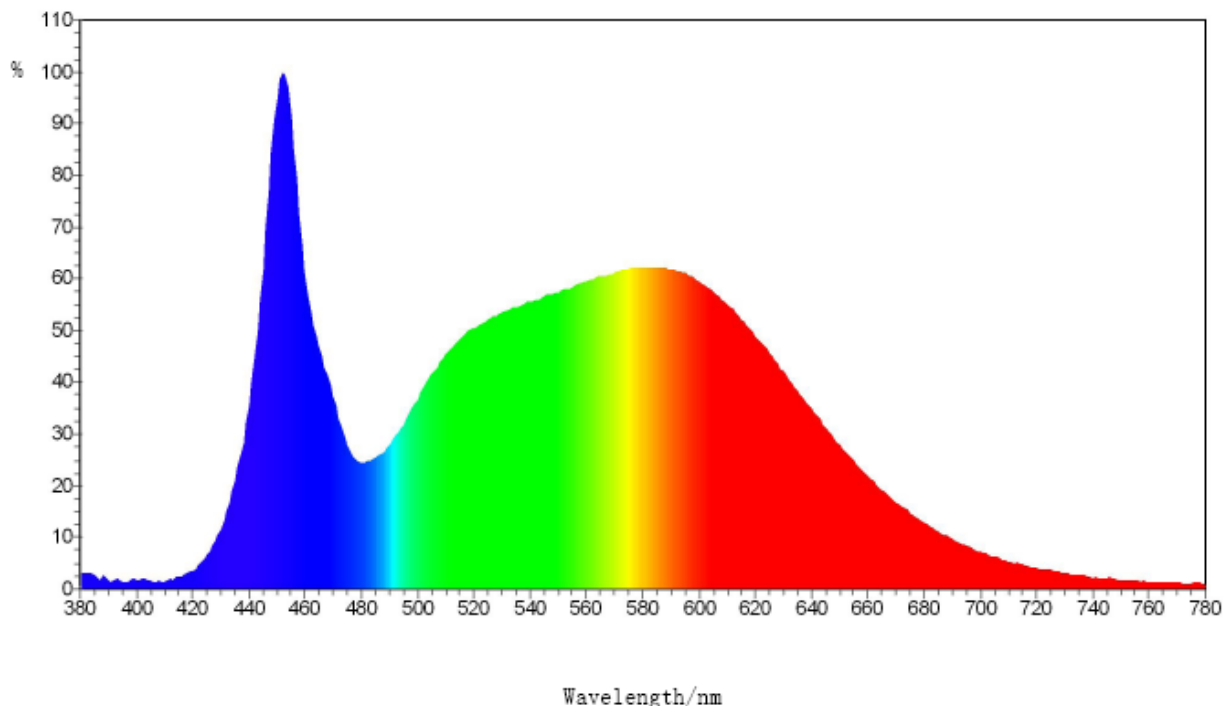
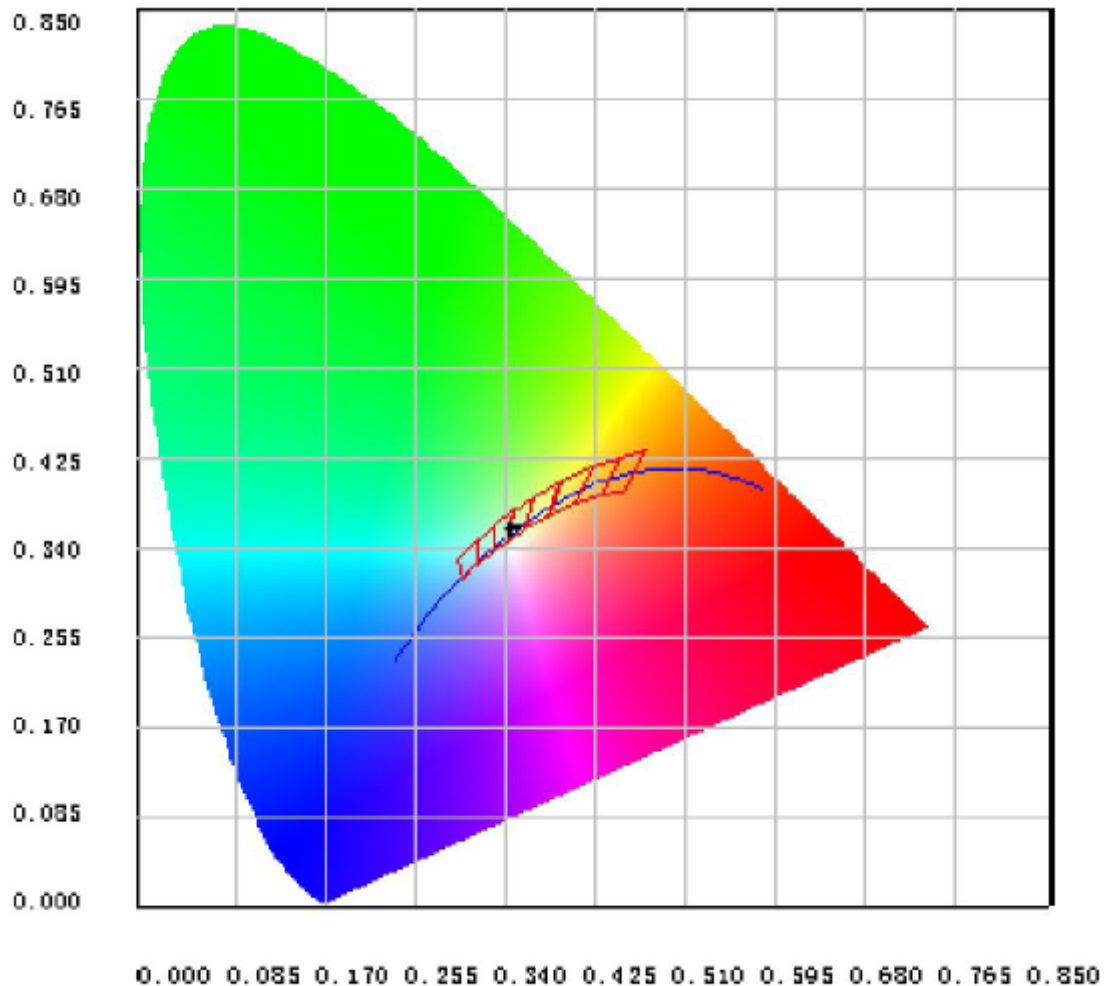


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.82E-03	485	1.44E-02	590	3.50E-02	695	4.78E-03
385	1.64E-03	490	1.60E-02	595	3.47E-02	700	4.15E-03
390	1.01E-03	495	1.81E-02	600	3.36E-02	705	3.56E-03
395	8.50E-04	500	2.09E-02	605	3.27E-02	710	3.05E-03
400	9.94E-04	505	2.36E-02	610	3.12E-02	715	2.73E-03
405	9.82E-04	510	2.57E-02	615	2.96E-02	720	2.41E-03
410	7.63E-04	515	2.74E-02	620	2.78E-02	725	2.10E-03
415	1.32E-03	520	2.85E-02	625	2.60E-02	730	1.80E-03
420	2.05E-03	525	2.96E-02	630	2.39E-02	735	1.54E-03
425	3.77E-03	530	3.03E-02	635	2.18E-02	740	1.27E-03
430	6.60E-03	535	3.09E-02	640	1.98E-02	745	1.24E-03
435	1.19E-02	540	3.15E-02	645	1.77E-02	750	1.04E-03
440	2.02E-02	545	3.21E-02	650	1.59E-02	755	9.59E-04
445	3.52E-02	550	3.26E-02	655	1.41E-02	760	8.49E-04
450	5.39E-02	555	3.32E-02	660	1.25E-02	765	7.96E-04
455	5.18E-02	560	3.37E-02	665	1.09E-02	770	8.42E-04
460	3.49E-02	565	3.43E-02	670	9.57E-03	775	6.49E-04
465	2.68E-02	570	3.48E-02	675	8.42E-03	780	6.27E-04
470	2.12E-02	575	3.52E-02	680	7.35E-03		
475	1.58E-02	580	3.53E-02	685	6.27E-03		
480	1.39E-02	585	3.54E-02	690	5.51E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3481, 0.3618)

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

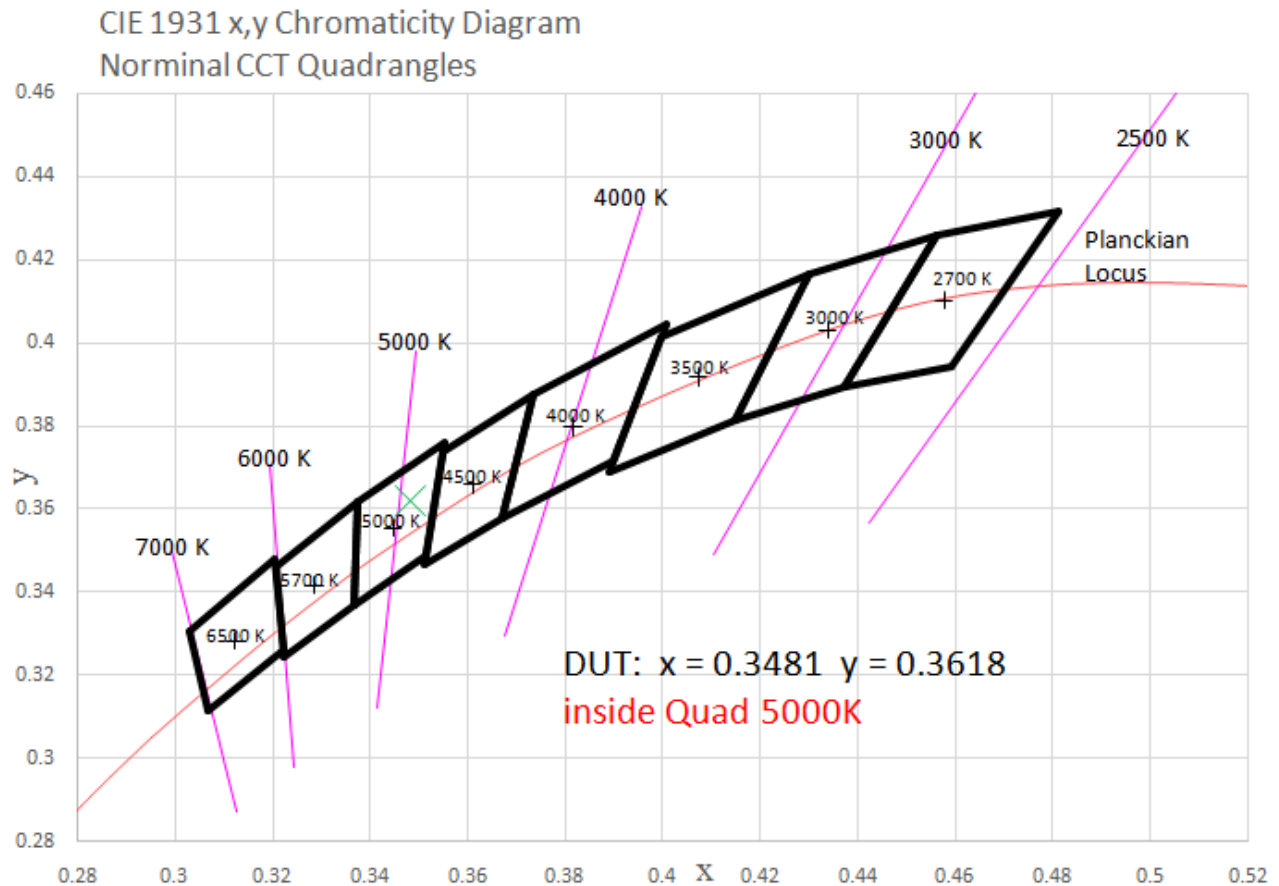


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	51.456	2.35%
10- 20	148.279	6.78%
20- 30	227.726	10.42%
30- 40	280.991	12.85%
40- 50	303.067	13.86%
50- 60	293.494	13.42%
60- 70	256.753	11.74%
70- 80	202.433	9.26%
80- 90	145.294	6.65%
90-100	100.897	4.62%
100-110	68.168	3.12%
110-120	43.997	2.01%
120-130	27.946	1.28%
130-140	17.131	0.78%
140-150	10.051	0.46%
150-160	5.478	0.25%
160-170	2.476	0.11%
170-180	0.631	0.03%
Total	2186.3	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	1305.013	59.69%
60- 90	604.48	27.65%
0-90	1909.493	87.34%
90- 180	276.775	12.66%
0- 180	2186.3	100%

Table 5: Zonal Lumen Data

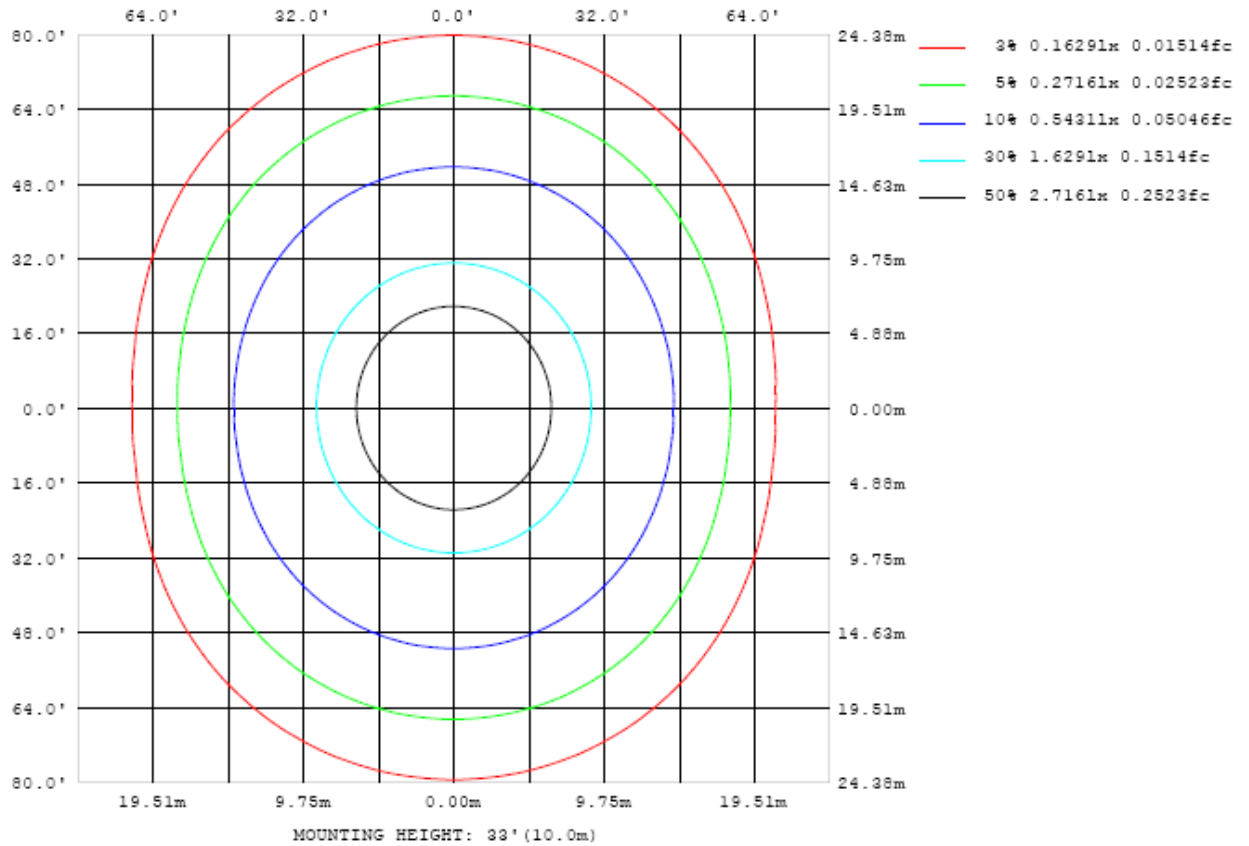


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

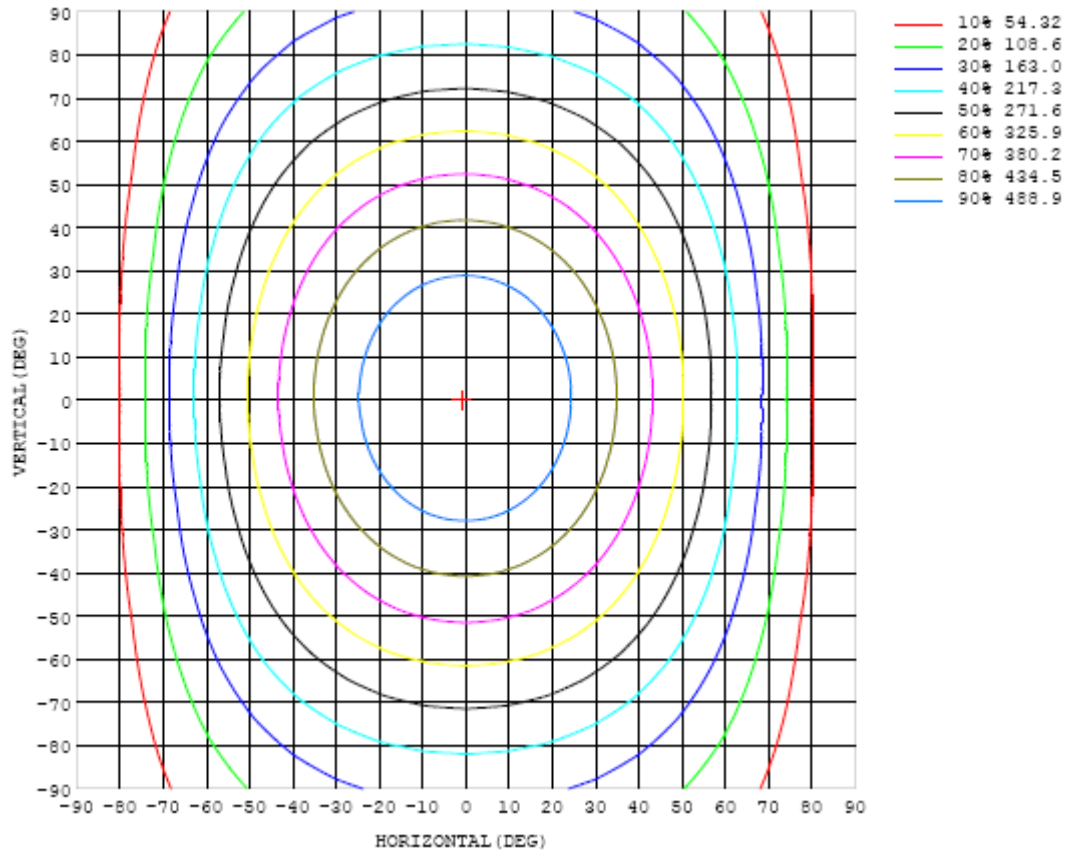


Chart 5: Isocandela Plot

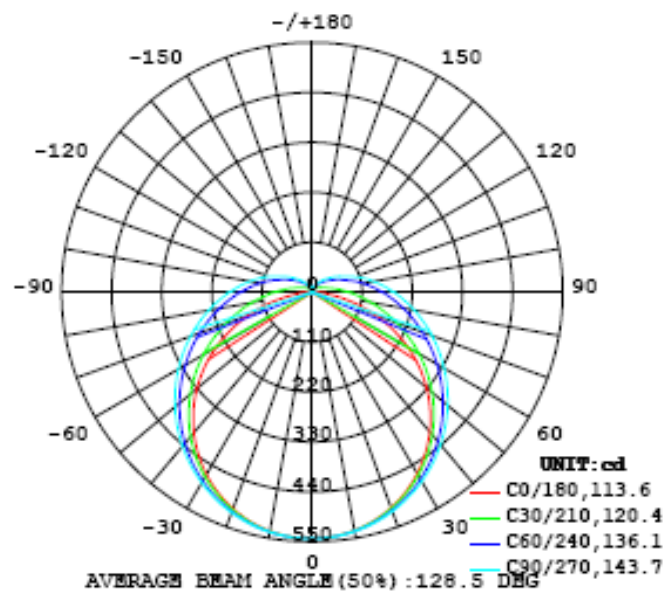


Chart 6: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1

UNIT: cd

C (DEG) y (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	543	543	543	543	543	543	543	543	543	543	543	543	543	543	543	543	543	543	543
5	541	541	540	541	541	541	541	541	541	541	541	541	541	541	541	541	541	541	541
10	533	533	533	534	534	534	535	535	535	535	535	535	535	535	535	535	534	534	535
15	522	522	522	523	523	524	525	526	526	527	526	526	526	525	524	524	523	523	523
20	506	506	506	507	509	511	512	513	514	514	514	514	513	511	510	509	508	507	508
25	486	486	487	488	491	493	495	497	499	499	499	498	496	494	492	490	488	488	488
30	461	462	463	466	469	473	476	479	481	481	481	479	477	474	470	467	465	463	464
35	433	434	436	439	444	449	454	457	460	461	460	458	455	450	446	441	438	436	436
40	401	402	405	410	416	423	429	434	437	438	437	435	430	424	418	412	407	404	404
45	366	367	371	378	386	395	403	409	413	414	413	409	403	396	388	379	373	369	369
50	328	329	335	344	354	365	375	382	387	388	387	383	375	366	355	345	336	330	330
55	286	289	296	308	321	334	346	354	360	362	360	355	346	335	322	308	297	289	288
60	242	245	256	271	287	303	316	326	332	334	332	326	317	303	288	271	256	246	244
65	196	201	214	234	254	272	287	298	304	307	305	298	287	272	254	234	214	200	197
70	148	155	174	197	221	241	258	270	277	280	277	270	258	241	221	197	173	154	149
75	99.9	110	135	163	189	212	230	243	250	253	250	243	230	212	189	163	134	109	100
80	55.2	69.4	99.4	131	160	184	203	216	224	227	225	217	203	184	160	131	99.2	68.7	54.1
85	18.5	36.7	70.4	103	133	158	178	192	200	202	200	192	178	158	134	104	69.7	36.8	17.7
90	1.43	16.8	48.0	80.3	110	135	154	168	176	179	177	168	155	135	110	81.0	48.7	17.3	0.75
95	0.21	8.00	32.5	62.4	90.0	114	133	147	155	158	155	147	133	114	90.6	63.1	33.3	8.73	0.26
100	0.50	5.32	22.3	47.1	72.9	95.4	114	127	135	137	135	127	114	95.9	73.3	47.9	23.3	5.84	0.51
105	0.96	4.64	16.5	36.2	57.7	77.9	95.3	108	116	118	116	108	95.6	78.6	58.8	37.4	17.8	5.02	0.87
110	1.47	4.63	13.4	28.9	46.8	63.9	78.3	89.4	96.3	98.8	96.5	89.7	79.0	65.1	47.9	30.1	14.6	5.02	1.26
115	2.01	4.86	11.8	23.6	38.4	53.2	65.7	74.7	80.8	82.9	81.1	75.4	66.5	54.0	39.6	24.8	12.8	5.20	1.66
120	2.54	5.12	10.8	19.9	31.8	43.8	54.9	63.2	68.4	70.1	68.6	63.6	55.6	45.0	32.8	21.0	11.6	5.32	2.12
125	3.03	5.31	10.2	17.3	26.7	36.7	45.4	52.8	57.2	58.8	57.5	53.2	46.4	37.5	27.5	18.3	10.8	5.72	2.51
130	3.50	5.44	9.62	15.5	22.8	30.8	38.0	43.8	47.7	49.0	47.9	44.4	38.7	31.2	23.5	16.2	10.2	5.75	2.91
135	3.92	5.56	9.38	14.1	19.7	25.9	31.7	36.4	39.4	40.5	39.6	36.8	32.2	26.4	20.3	14.6	9.54	5.73	3.35
140	4.28	5.72	9.17	12.7	17.3	22.0	26.4	30.1	32.5	33.4	32.7	30.4	26.8	22.4	17.7	13.3	9.26	5.99	3.74
145	4.56	5.78	8.49	11.8	15.2	18.8	22.1	24.8	26.6	27.3	26.8	25.1	22.4	19.1	15.6	11.9	9.08	6.14	4.08
150	4.70	5.86	8.51	10.9	13.3	16.0	18.5	20.5	21.9	22.3	22.0	20.7	18.8	16.4	13.5	11.0	8.51	6.25	4.33
155	4.76	5.56	8.13	9.83	12.0	13.8	15.4	17.0	17.9	18.3	18.0	17.1	15.6	13.9	12.1	9.73	8.09	5.82	4.49
160	4.75	5.21	7.70	9.32	10.4	12.1	13.2	14.2	14.8	15.0	14.9	14.3	13.3	12.2	9.85	8.47	6.67	5.17	4.54
165	4.73	4.62	5.99	8.54	9.49	10.1	10.9	11.9	12.3	12.5	12.4	12.0	11.1	8.68	7.86	6.52	5.60	4.59	4.58
170	4.84	4.54	4.92	6.27	7.94	8.74	9.40	10.0	10.2	10.3	10.2	9.34	7.22	6.36	6.45	5.73	5.25	5.06	4.80
175	5.93	5.70	5.51	5.59	6.12	6.12	6.43	6.85	7.61	7.84	5.82	4.49	5.49	5.82	5.78	6.23	6.00	5.95	6.06
180	0.16	0.16	0.16	0.14	0.13	0.11	0.10	0.08	0.06	0.04	0.05	0.06	0.07	0.08	0.09	0.09	0.10	0.10	0.10

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	543	543	543	543	543	543	543	543	543	543	543	543	543	543	543	543	543		
5	541	541	541	542	542	542	542	542	542	541	541	541	541	541	541	541	541		
10	535	535	535	536	536	536	537	537	536	536	536	536	535	535	534	534	534		
15	524	524	525	526	527	528	528	528	528	528	527	527	526	525	524	523	522		
20	508	509	510	512	514	515	516	517	517	516	515	514	512	510	509	508	507		
25	489	490	492	495	497	499	501	502	502	501	500	498	496	493	490	488	487		
30	465	467	470	474	477	480	483	485	485	484	482	479	475	471	468	465	463		
35	437	440	444	449	454	459	462	465	465	464	461	457	452	447	442	438	435		
40	406	410	415	422	429	435	439	442	443	441	438	433	426	420	413	407	404		
45	371	376	383	392	401	408	414	418	419	417	413	407	399	390	381	374	369		
50	333	340	349	360	371	380	388	392	393	391	386	379	369	358	347	338	331		
55	292	300	313	327	340	351	360	365	367	364	358	350	338	324	311	299	291		
60	249	260	276	293	309	322	332	338	339	337	330	320	306	291	274	259	248		
65	203	218	238	259	277	292	303	310	312	309	302	290	275	256	236	218	203		
70	157	177	201	225	246	263	275	282	284	281	273	261	244	223	200	177	158		
75	112	138	167	193	216	234	247	255	257	254	246	232	214	191	165	138	113		
80	70.5	102	135	164	188	207	220	228	230	227	219	205	186	162	134	102	71.7		
85	37.4	72.1	106	137	162	181	195	203	205	202	193	179	160	135	105	71.6	38.4		
90	17.7	49.4	82.9	113	138	158	171	179	181	178	170	156	137	112	81.7	48.7	17.7		
95	8.40	33.7	64.0	92.4	117	136	149	157	160	157	148	135	115	91.1	62.8	32.9	8.04		
100	5.32	23.1	48.6	74.9	97.7	116	129	136	139	136	128	115	96.5	73.7	47.6	22.3	4.85		
105	4.38	17.1	37.1	59.0	80.3	97.4	110	117	120	117	109	96.5	79.2	58.1	36.0	16.2	3.78		
110	4.15	13.4	29.2	47.5	64.9	79.6	91.3	98.4	101	98.0	90.7	78.9	63.8	46.2	28.1	12.5	3.71		
115	4.33	11.3	23.5	38.4	53.2	65.8	75.4	81.2	83.0	80.8	74.7	64.9	52.1	37.3	22.5	10.4	3.91		
120	4.62	9.93	19.4	31.4	43.5	54.2	62.4	67.4	69.0	67.0	61.7	53.4	42.6	30.3	18.4	9.19	4.26		
125	4.96	9.07	16.4	25.8	35.7	44.4	51.3	55.7	57.0	55.3	50.8	43.8	34.8	24.9	15.5	8.53	4.70		
130	5.36	8.48	14.0	21.4	29.2	36.3	42.0	45.5	46.7	45.3	41.5	35.7	28.5	20.6	13.4	8.20	5.19		
135	5.79	8.22	12.4	18.0	24.0	29.6	34.1	37.0	37.9	36.7	33.7	29.1	23.4	17.4	11.9	8.03	5.68		
140	6.25	8.05	11.2	15.4	19.9	24.1	27.6	29.8	30.5	29.6	27.2	23.7	19.4	14.9	10.9	7.96	6.15		
145	6.65	7.98	9.95	13.2	16.6	19.7	22.2	23.9	24.4	23.7	22.0	19.4	16.2	12.9	10.1	7.99	6.59		
150	6.92	7.97	9.40	11.6	13.8	16.2	18.0	19.1	19.5	19.0	17.8	16.0	13.7	11.5	9.49	8.07	6.98		
155	6.65	7.64	8.64	9.88	11.9	13.2	14.4	15.3	15.6	15.3	14.3	13.2	11.9	10.4	9.13	8.11	6.83		
160	5.71	6.80	7.58	8.49	10.0	11.1	11.9	12.4	12.6	12.4	12.0	11.4	10.6	9.68	8.92	8.14	6.18		
165	5.06	5.81	6.32	6.82	7.67	8.78	10.1	10.4	10.5	10.5	10.3	10.0	9.58	9.13	8.65	7.96	5.48		
170	4.89	5.24	5.81	6.17	6.28	6.13	6.83	8.75	9.23	9.21	9.16	9.03	8.64	8.32	7.83	6.28	4.95		
175	6.07	6.20	6.23	6.44	6.21	6.32	5.62	4.91	6.31	8.54	8.29	7.27	6.87	6.49	6.38	6.02	5.90		
180	0.10	0.10	0.09	0.08	0.08	0.07	0.06	0.05	0.04	0.06	0.08	0.10	0.12	0.13	0.15	0.16	0.16		

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

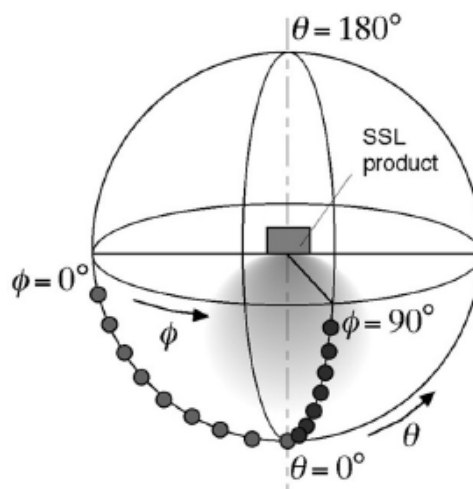
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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