

## LM-79-08 TEST REPORT

for

### GREEN CREATIVE LTD

Room 3603, Level 36, Tower 1, Enterprise Square Five, 38 Wang Chiu Road, Kowloon Bay, KL,  
Hong Kong

### LED Tube

**Model: 14T8/4F/840/DEB/R**

### Laboratory: Leading Testing Laboratories

**NVLAP CODE: 200960-0**

3rd Floor, Bld. 2, NO. 96 Longchuanwu Rd Qianjiang Economy Dev. Zone, YuhangDist,  
Hangzhou, Zhejiang Province, China 311100

Tel: +86571 86376106

[www.ledtestlab.com](http://www.ledtestlab.com)

Report No.: HZ20070023j

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

Review by:



Engineer: April Zou

Aug. 03, 2020

Approved by:



Manager: Jim Zhang

Aug. 03, 2020

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: 14T8/4F/840/DEB/R

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
169.3	2449.7	14.47	0.9803
CCT (K)	CRI	Stabilization Time (Light & Power)	
4009	82.5	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. 22, 2020

**Date of Test** : Jul. 22, 2020

**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  
ANSI/IES TM-30-18 IES Method for Evaluating Light Source Color Rendition

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## SAMPLE PHOTO



Figure 1- Overview of the sample

### Equipment Under Test(EUT)

<b>Name</b>	: LED Tube
<b>Model</b>	: 14T8/4F/840/DEB/R
<b>Electrical Ratings</b>	: 120-277V, 50/60Hz, 14W
<b>Product Description</b>	: 4000K
<b>Manufacturer</b>	: GREEN CREATIVE LTD
<b>Address</b>	: Room 3603, Level 36, Tower 1, Enterprise Square Five, 38 Wang Chiu Road, Kowloon Bay, KL, Hong Kong

## TEST RESULTS

Test ambient temperature was 24.8 °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 65 minutes.

### Sphere-Spectroradiometer Method

Parameter	Result	
Test Voltage (V)	120.0	277.0
Voltage frequency (Hz)	60	60
Test Current (A)	0.123	0.057
Power Factor	0.9803	0.9146
Test Power (W)	14.47	14.45
THD A%	18.50	21.31
Luminous Efficacy (lm/W)	169.3	168.3
Total Luminous Flux (lm)	2449.7	2431.4
Color Rendering Index (CRI)	82.5	
R9	6	
Correlated Color Temperature (CCT)(K)	4009	
Chromaticity Chroma x	0.3804	
Chromaticity Chroma y	0.3781	
Chromaticity Chroma u	0.2245	
Chromaticity Chroma v	0.3348	
Duv	0.0007	
Chromaticity Chroma u'	0.2245	
Chromaticity Chroma v'	0.5022	

Special Color Rendering Indices	
R1	80.7
R2	88.8
R3	94.7
R4	81.4
R5	80.8
R6	84.4
R7	85.8
R8	63.7
R9	6
R10	73.5
R11	80.4
R12	60.6
R13	82.7
R14	97.3

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 30 m.

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)	0.123
Power Factor	0.9803
Power (W)	14.47
Luminous Efficacy (lm/W)	166.7
Total Luminous Flux (lm)	2412.7
Beam Angle ( ° )	110.5 (0°-180°) / 202.4 (90°-270°)
Center Beam Candle Power (cd)	428
Maximum Beam Candle Power (cd)	428.4 (At: C=60.0, Gamma=2.5)
Spacing Criteria	1.24 (0°-180°) / 1.41 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	44.75%
Zonal Lumens in the 60 °-90 °Zone	26.54%
Zonal Lumens in the 90 °-120 °Zone	16.63%
Zonal Lumens in the 120 °-180 °Zone	12.08%

Table 3: Test data per Goniophotometer Method

## Spectral Power Distribution - Sphere Spectroradiometer Method

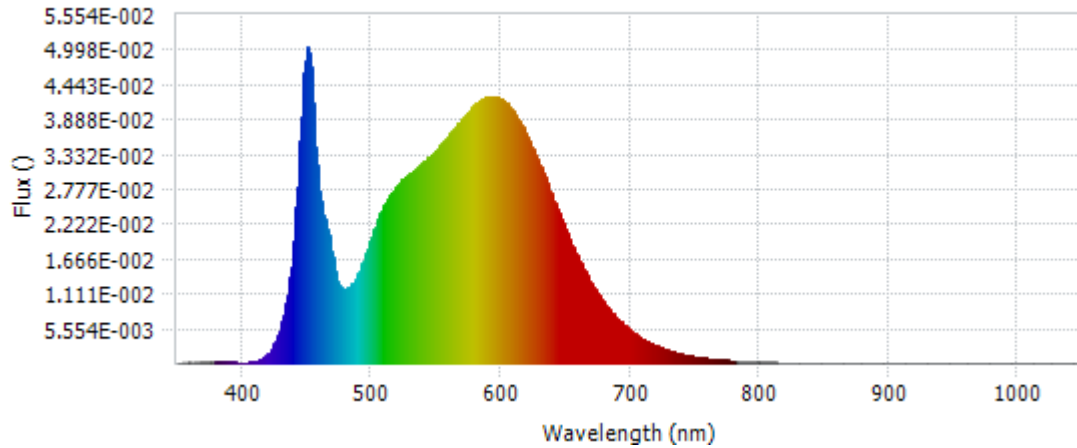
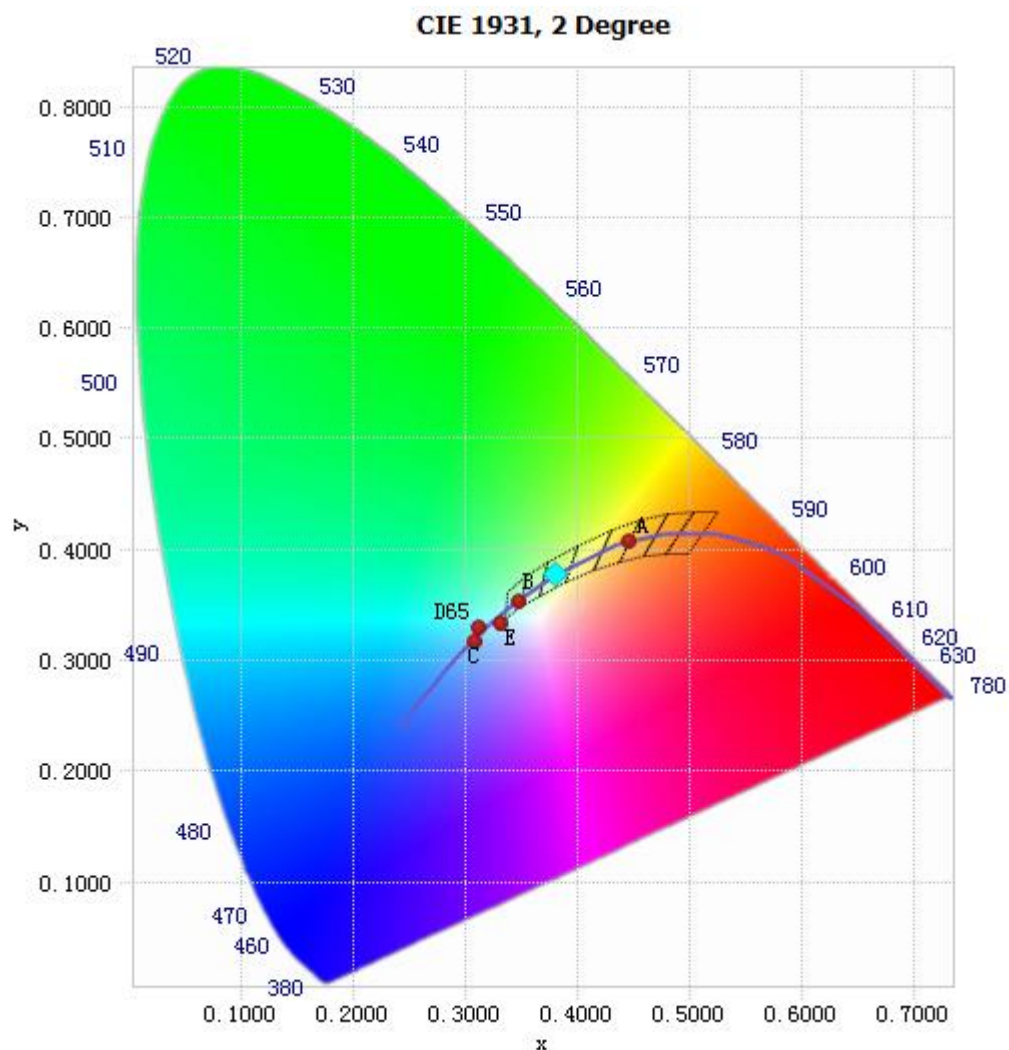


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.02E-04	485	1.26E-02	590	4.25E-02	695	6.16E-03
385	2.03E-04	490	1.43E-02	595	4.25E-02	700	5.26E-03
390	1.86E-04	495	1.70E-02	600	4.21E-02	705	4.50E-03
395	1.71E-04	500	2.01E-02	605	4.14E-02	710	3.83E-03
400	1.41E-04	505	2.29E-02	610	4.01E-02	715	3.28E-03
405	1.78E-04	510	2.51E-02	615	3.84E-02	720	2.82E-03
410	3.41E-04	515	2.70E-02	620	3.63E-02	725	2.40E-03
415	7.23E-04	520	2.84E-02	625	3.42E-02	730	2.04E-03
420	1.51E-03	525	2.93E-02	630	3.17E-02	735	1.73E-03
425	3.06E-03	530	3.02E-02	635	2.91E-02	740	1.48E-03
430	5.91E-03	535	3.11E-02	640	2.65E-02	745	1.27E-03
435	1.08E-02	540	3.20E-02	645	2.39E-02	750	1.08E-03
440	1.95E-02	545	3.30E-02	650	2.13E-02	755	9.18E-04
445	3.54E-02	550	3.40E-02	655	1.90E-02	760	7.92E-04
450	4.99E-02	555	3.51E-02	660	1.67E-02	765	6.81E-04
455	4.14E-02	560	3.63E-02	665	1.47E-02	770	5.83E-04
460	2.74E-02	565	3.76E-02	670	1.28E-02	775	4.99E-04
465	2.23E-02	570	3.89E-02	675	1.11E-02	780	4.31E-04
470	1.68E-02	575	4.01E-02	680	9.64E-03		
475	1.26E-02	580	4.11E-02	685	8.34E-03		
480	1.18E-02	585	4.20E-02	690	7.16E-03		

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

# Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3804, 0.3781)

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

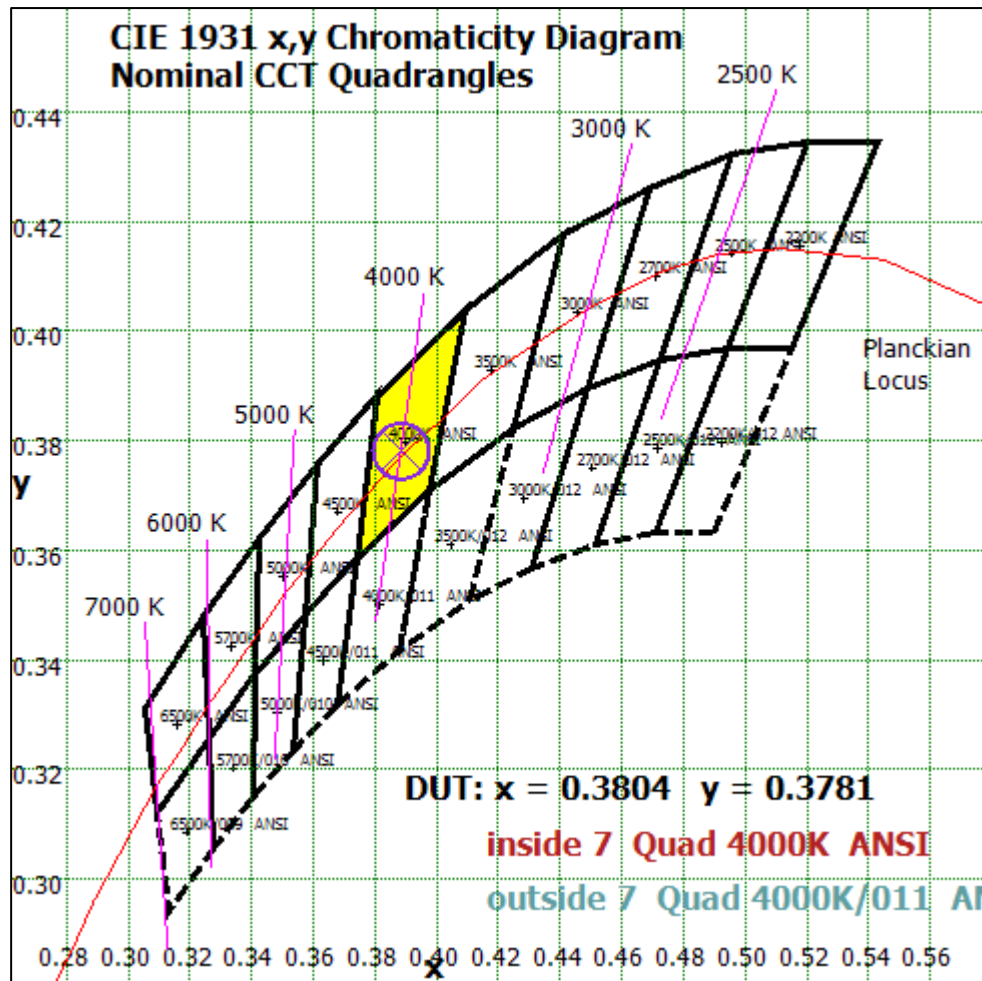
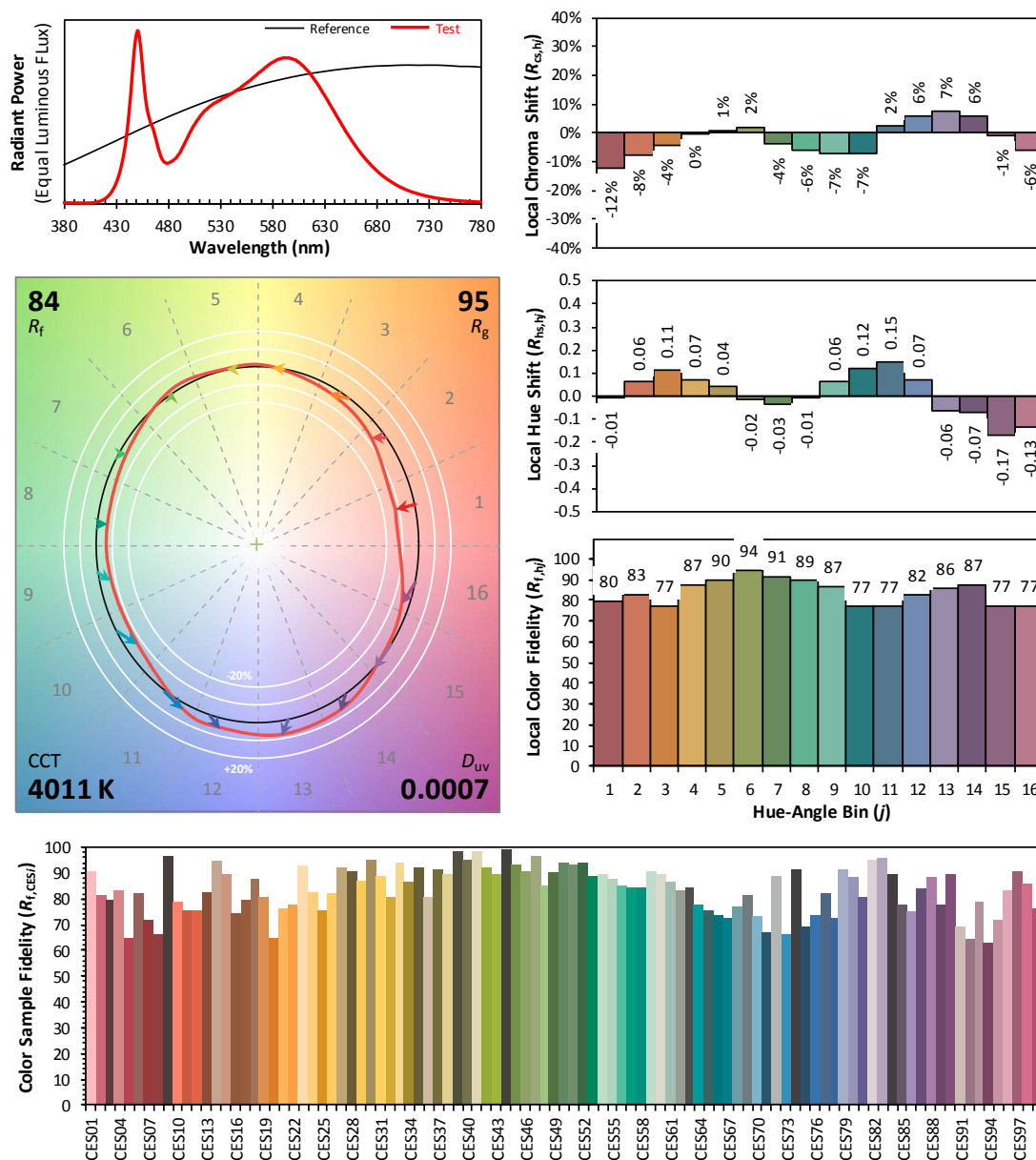


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

## Color Rendition Report – Sphere Spectroradiometer Method



**Notes:** This is a recommended method for displaying ANSI/IES TM-30-18 information.

$x$  0.3804

$y$  0.3781

$u'$  0.2245

$v'$  0.5022

Chart 4: Full Report Created with the IES TM-30 Calculator

Note: The values in this diagram might be a little different from the values in Table 2 due to rounding.

### Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	40.621	1.68%
10- 20	117.565	4.87%
20- 30	182.246	7.55%
30- 40	228.638	9.48%
40- 50	253.542	10.51%
50- 60	256.97	10.65%
60- 70	242.073	10.03%
70- 80	214.725	8.90%
80- 90	183.63	7.61%
90-100	156.91	6.50%
100-110	133.019	5.51%
110-120	111.38	4.62%
120-130	92.053	3.82%
130-140	74.393	3.08%
140-150	57.184	2.37%
150-160	39.878	1.65%
160-170	21.706	0.90%
170-180	6.179	0.26%
Total	2412.7	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	1079.582	44.75%
60- 90	640.428	26.54%
0-90	1720.01	71.29%
90- 180	692.702	28.71%
0- 180	2412.7	100%

Table 5: Zonal Lumen

## Illuminance Plots- Goniophotometer Method

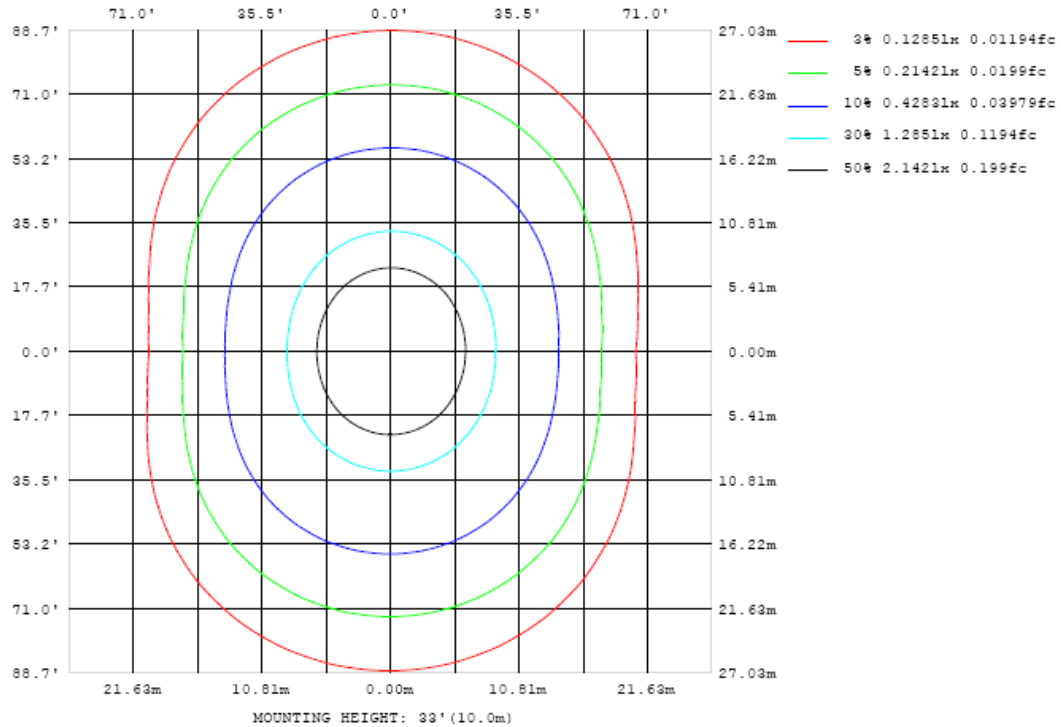


Chart 5: Illuminance Plot (Footcandles)

## Luminous Intensity Distribution Plots- Goniophotometer Method

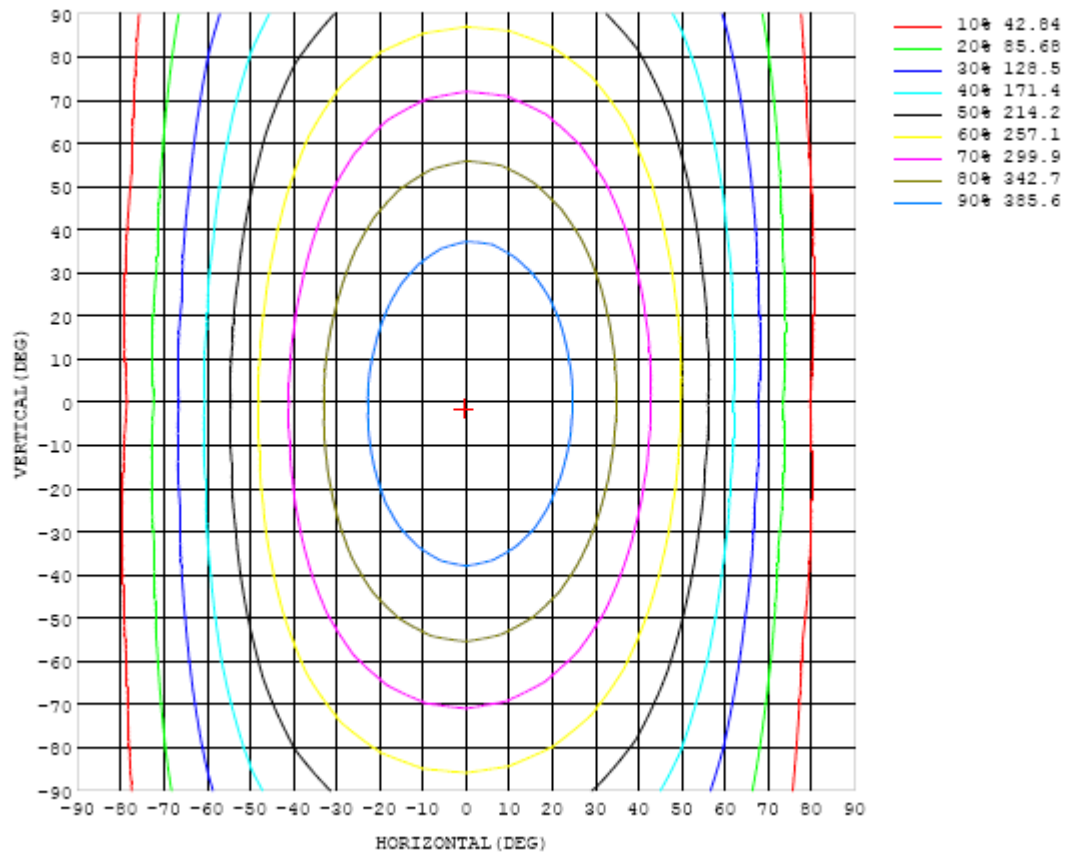


Chart 6: Isocandela Plot

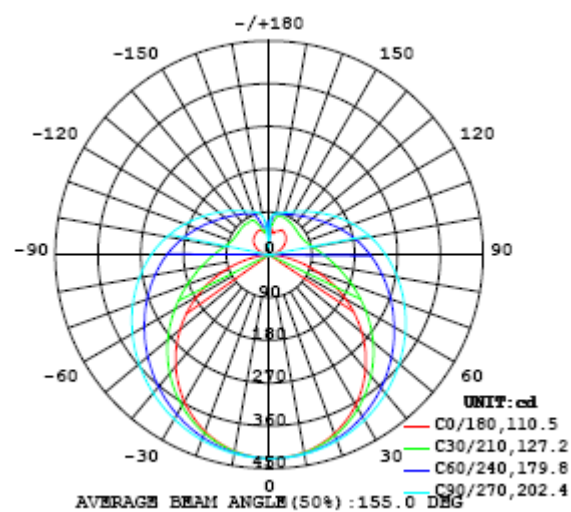


Chart 7: Polar Candela Distribution

## 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	428	428	428	428	428	428	428	428	428	428	428	428	428	428	428	428	428	428	428
5	427	427	427	428	428	427	428	428	428	428	427	427	427	426	426	426	426	426	426
10	422	422	423	423	424	424	425	425	426	426	425	425	424	423	421	421	420	420	420
15	413	413	414	415	417	418	420	421	422	422	421	420	418	416	414	412	411	409	409
20	400	401	402	405	407	410	413	415	416	416	416	414	411	408	404	401	398	396	395
25	384	385	387	390	395	399	404	407	409	410	408	406	402	397	392	386	382	379	378
30	364	365	369	374	380	387	393	397	400	401	400	396	391	385	377	369	363	359	357
35	341	343	347	354	363	372	380	386	390	392	390	386	379	371	360	350	342	335	333
40	315	317	324	333	344	356	366	374	379	381	379	374	366	355	342	329	318	309	306
45	286	289	297	310	324	339	351	361	367	369	367	361	351	339	323	307	292	281	277
50	255	258	269	285	303	321	336	347	354	357	355	348	337	321	303	283	264	250	245
55	221	225	240	260	282	303	320	333	341	344	342	334	321	304	282	259	236	218	211
60	185	191	210	234	261	284	304	318	327	330	328	320	306	287	262	235	207	185	176
65	148	156	179	210	240	267	288	303	313	317	314	305	291	270	243	211	179	151	140
70	111	121	150	186	220	249	272	288	299	302	300	291	276	253	224	189	152	118	103
75	74.0	87.6	123	164	201	232	256	273	284	288	286	276	261	237	207	169	127	87.4	67.2
80	41.0	58.4	100	145	184	217	241	259	270	274	271	262	246	222	190	151	106	61.8	34.6
85	13.7	35.6	81.6	128	169	202	227	244	255	260	257	248	232	208	176	136	89.9	41.8	9.70
90	0.88	23.0	68.7	115	155	188	213	230	241	245	243	234	218	194	163	124	78.0	31.4	0.54
95	2.47	18.6	60.3	104	143	174	199	216	227	231	229	220	204	181	151	113	69.8	27.2	2.96
100	7.27	19.7	54.6	94.4	131	162	185	202	213	217	214	206	191	169	139	104	64.5	28.0	7.51
105	13.3	23.8	52.2	86.9	121	150	172	188	198	202	200	192	177	156	129	96.2	61.7	31.2	13.4
110	20.0	29.8	52.3	81.7	112	139	160	175	184	188	186	178	165	145	120	90.3	61.3	36.4	20.1
115	27.1	36.4	53.8	78.5	105	128	148	162	171	174	172	165	152	134	112	86.9	62.4	42.3	26.5
120	33.9	43.0	56.7	76.9	99.0	119	137	149	158	161	159	153	141	125	106	84.7	64.5	48.0	32.9
125	40.2	49.4	60.5	76.3	95.0	113	127	138	146	149	147	141	131	118	101	83.5	67.0	53.3	38.4
130	45.7	55.5	64.5	76.7	92.0	107	119	129	135	138	136	131	123	112	97.7	83.0	69.7	58.8	43.1
135	50.2	59.6	68.5	77.7	89.9	102	112	120	126	128	127	123	116	106	94.9	83.0	72.5	64.3	46.6
140	53.6	62.6	72.3	79.1	88.5	98.1	107	113	118	119	119	115	109	102	92.6	83.2	75.1	68.5	49.0
145	56.1	65.2	75.8	80.7	87.7	95.1	102	107	110	112	111	108	104	97.9	90.8	83.6	77.3	71.8	51.4
150	58.0	69.1	78.8	82.0	87.2	92.5	97.4	101	104	105	105	103	99.3	94.7	89.5	84.2	79.7	74.0	53.5
155	56.9	69.9	80.5	83.4	86.9	90.6	94.0	96.8	98.8	99.7	99.3	97.8	95.3	92.1	88.5	83.7	80.2	74.5	55.4
160	52.4	66.3	80.5	84.6	86.8	89.1	91.2	93.0	94.4	95.0	94.7	93.7	92.2	90.2	86.4	81.3	74.0	67.3	55.1
165	50.8	58.2	75.8	85.0	86.6	87.9	89.1	90.1	90.9	91.2	91.1	90.5	89.8	86.0	78.5	70.9	63.8	59.0	51.4
170	45.5	48.1	64.0	78.2	83.8	86.1	87.4	87.8	88.2	88.3	88.2	88.4	81.6	71.0	63.6	59.4	59.2	55.7	47.9
175	55.0	56.2	56.6	61.3	68.0	74.1	78.7	82.8	84.8	84.3	83.9	72.4	56.1	50.8	54.8	58.5	58.5	60.2	58.6
180	38.6	38.6	38.6	38.6	38.6	38.6	38.6	38.6	38.6	38.6	38.6	38.6	38.6	38.6	38.6	38.6	38.6	38.6	38.6

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	428	428	428	428	428	428	428	428	428	428	428	428	428	428	428	428	428		
5	426	426	426	426	426	427	427	427	427	427	427	427	427	427	427	427	427		
10	419	419	420	421	422	423	423	424	425	425	425	424	424	423	423	422	422		
15	409	410	411	413	415	417	418	420	420	420	420	419	418	417	415	414	413		
20	396	397	399	402	406	409	411	414	415	415	414	412	410	407	404	402	401		
25	379	381	384	389	395	399	403	406	408	407	406	403	399	395	391	387	385		
30	358	361	367	374	381	388	393	397	399	399	396	392	387	381	375	369	366		
35	335	340	347	357	367	376	383	388	390	389	386	381	373	365	356	349	344		
40	308	315	326	338	351	362	371	377	380	379	375	368	358	347	335	325	319		
45	280	289	303	319	335	348	359	366	369	368	362	353	342	328	313	300	291		
50	249	261	278	298	317	334	346	354	357	356	349	339	325	308	290	273	261		
55	216	232	254	278	300	318	332	341	345	343	336	324	308	288	265	244	229		
60	183	203	229	257	283	303	318	328	332	330	322	309	291	267	241	215	195		
65	149	174	206	237	266	288	305	315	319	317	308	294	273	247	217	186	162		
70	115	147	183	219	249	273	290	301	305	303	294	279	257	228	194	159	128		
75	82.8	121	163	201	234	258	276	287	291	289	280	264	241	210	173	133	95.1		
80	54.6	99.1	145	185	218	244	262	273	277	275	265	249	225	194	156	111	66.3		
85	34.0	82.0	130	170	204	230	248	259	263	260	251	234	210	178	139	92.7	44.2		
90	23.5	70.0	117	157	190	216	233	244	248	246	236	220	196	164	126	79.3	31.4		
95	19.9	61.5	106	145	177	202	219	230	234	231	222	206	183	152	114	69.5	25.8		
100	21.6	56.3	96.6	134	164	188	204	215	219	216	207	191	169	140	103	62.7	25.5		
105	25.9	54.7	89.3	123	152	174	190	200	204	201	192	178	157	129	95.0	59.1	28.3		
110	31.9	55.4	84.7	114	141	161	176	185	189	187	178	164	145	119	88.8	58.2	33.3		
115	38.2	57.7	82.1	107	131	150	163	172	175	173	165	153	134	111	84.8	59.0	39.2		
120	44.3	60.6	80.8	102	122	139	151	159	161	159	153	141	125	105	82.4	61.1	45.3		
125	50.0	63.9	80.4	98.5	116	130	141	147	150	148	142	131	117	100	81.2	64.2	51.0		
130	55.1	67.4	80.7	95.5	110	122	131	137	139	138	132	123	111	96.5	81.0	67.7	56.3		
135	58.9	70.2	81.1	93.3	105	115	123	128	130	128	124	116	106	93.8	81.5	71.1	61.1		
140	60.4	72.9	81.9	91.5	101	109	116	120	121	120	116	110	102	91.9	82.4	74.1	64.6		
145	60.4	75.3	81.1	89.4	97.5	104	109	112	113	113	109	104	98.0	90.6	83.3	76.7	66.6		
150	58.5	76.3	81.4	87.9	94.4	99.4	103	106	107	106	104	99.9	95.1	89.7	84.5	79.0	67.7		
155	53.0	70.9	79.8	83.7	90.8	95.6	98.3	100	101	101	98.9	96.3	92.9	89.2	86.1	77.9	62.7		
160	49.4	59.5	68.8	74.6	81.8	89.6	94.0	95.4	96.1	96.0	95.1	93.5	91.4	89.0	87.0	73.2	55.8		
165	46.8	49.6	53.5	60.1	65.4	70.0	79.6	89.4	92.1	92.1	91.7	90.9	89.6	87.1	83.4	62.6	49.5		
170	46.4	47.2	49.0	55.3	56.8	59.4	55.9	66.2	81.1	85.8	87.2	84.0	80.9	74.3	60.3	50.4	48.4		
175	60.4	60.4	60.2	63.2	63.0	64.2	61.7	57.7	34.9	71.9	75.7	69.2	48.9	52.5	54.7	61.0	56.7		
180	38.6	38.6	38.6	38.6	38.6	38.6	38.6	38.6	38.6	38.6	38.6	38.6	38.6	38.6	38.6	38.6	38.6		

Table 7: Luminous Intensity Data



## EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Aug. 02, 2019	Aug. 01, 2020
Digital Power Meter	PF2010A	HZTE028-01	Aug. 02, 2019	Aug. 01, 2020
AC Power Supply	DPS1060	HZTE001-06	Aug. 02, 2019	Aug. 01, 2020
DC Power Supply	WY12010	HZTE004-03	Aug. 02, 2019	Aug. 01, 2020
Temperature recorder	JM624U	HZTE018-08	Aug. 02, 2019	Aug. 01, 2020
Temperature and humidity recorder	JR900	HZTE018-01	Aug. 02, 2019	Aug. 01, 2020
Standard source	D908	HZTE012-01	Aug. 02, 2019	Aug. 01, 2020
Integrate Sphere system	3M	HZTE015-04	Aug. 02, 2019	Aug. 01, 2020
Digital Power Meter	WT210	HZTE008-01	Aug. 02, 2019	Aug. 01, 2020
AC Power Supply	PCR 500L	HZTE001-07	Aug. 02, 2019	Aug. 01, 2020
DC Power Supply	IT6154	HZTE004-04	Aug. 02, 2019	Aug. 01, 2020
Standard source	SCL-1400	HZTE012-02	Aug. 02, 2019	Aug. 01, 2020
Temperature and humidity recorder	JR900	HZTE018-02	Aug. 02, 2019	Aug. 01, 2020
Temperature Meter	TES1310	HZTE017-01	Aug. 02, 2019	Aug. 01, 2020

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  $4\pi$ . 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  $10^\circ$  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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