

## LM-79-19 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: 14.5T5HE/4F/830/BYP/R**

### Laboratory: Leading Testing Laboratories

**NVLAP CODE: 200960-0**

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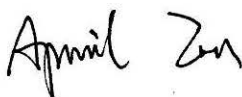
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Report No.: HZ22060037e

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

Review by:



Engineer: April Zou

Jun. 28, 2022

Approved by:



Manager: Jim Zhang

Jun. 28, 2022

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: 14.5T5HE/4F/830/BYP/R

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
133.1	1923.6	14.45	0.9736
CCT (K)	CRI	Stabilization Time (Light & Power)	
2965	82.0	50	

Table 1: Executive Data Summary

Note: The above results are recorded/ derived from measurements made using an Integrating Sphere.

### Test specifications:

**Date of Receipt** : Jun. 15, 2022

**Date of Test** : Jun. 17, 2022

**Test item** : Total Luminous Flux, Luminous Distribution Intensity, Luminous Efficacy, Correlated Color Temperature, Color Rendering Index, Chromaticity Coordinate, Electrical parameters

**Reference Standard** : IESNA LM-79-2019 Approved Method: 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>	: 14.5T5HE/4F/830/BYP/R
<b>Electrical Ratings</b>	: 120-277V, 60Hz, 14.5W
<b>Product Description</b>	: 3000K

## TEST RESULTS

Test ambient temperature was 26.0°C.

Base orientation was base up. Test was conducted without a dimmer in the circuit.

The stabilization time of the sample was 50 minutes, and the total operating time including stabilization was 55 minutes.

### Sphere-Spectroradiometer Method

Parameter	Result	
Test Voltage (V)	120.0	277.0
Voltage frequency (Hz)	60	60
Test Current (A)	0.124	0.056
Power Factor	0.9736	0.9291
Test Power (W)	14.45	14.40
THD A%	20.33	22.84
Luminous Efficacy (lm/W)	133.1	133.8
Total Luminous Flux (lm)	1923.6	1927.0
Color Rendering Index (CRI)	82.0	
R9	3.8	
Correlated Color Temperature (CCT)(K)	2965	
Chromaticity Chroma x	0.4396	
Chromaticity Chroma y	0.4056	
Chromaticity Chroma u	0.2517	
Chromaticity Chroma v	0.3482	
Duv	0.0002	
Chromaticity Chroma u'	0.2517	
Chromaticity Chroma v'	0.5224	

Special Color Rendering Indices	
R1	80.2
R2	90.4
R3	96.4
R4	80.3
R5	80.6
R6	88.6
R7	82.3
R8	57.5
R9	3.8
R10	78.6
R11	80
R12	71.9
R13	82.5
R14	98.6

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)	0.126
Power Factor	0.9743
Power (W)	14.71
Luminous Efficacy (lm/W)	129.7
Total Luminous Flux (lm)	1907.1
Beam Angle (°)	113.7 (0°-180°) / 216.1 (90°-270°)
Center Beam Candle Power (cd)	319
Maximum Beam Candle Power (cd)	320.7 (At: C=180.0, Gamma=4.5)
Spacing Criteria	1.33 (0°-180°) / 1.44 (90°-270°)
Zonal Lumens in the 0°-60°Zone	43.35%
Zonal Lumens in the 60°-90°Zone	26.89%
Zonal Lumens in the 90°-120°Zone	17.17%
Zonal Lumens in the 120°-180°Zone	12.59%

Table 3: Test data per Goniophotometer Method

### Spectral Power Distribution - Sphere Spectroradiometer Method

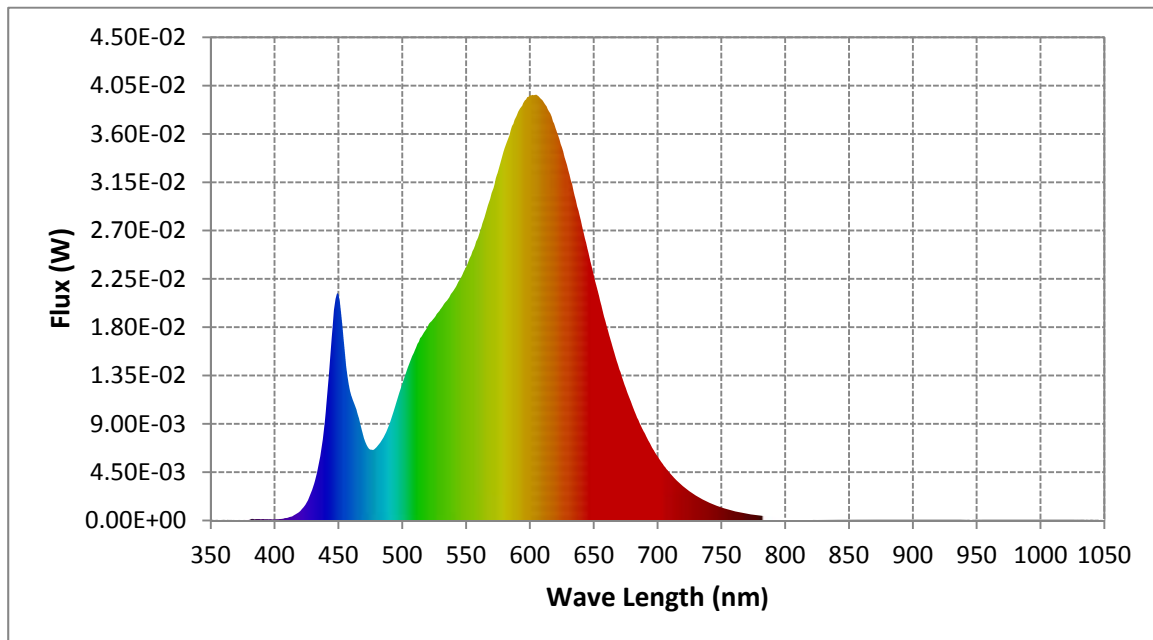
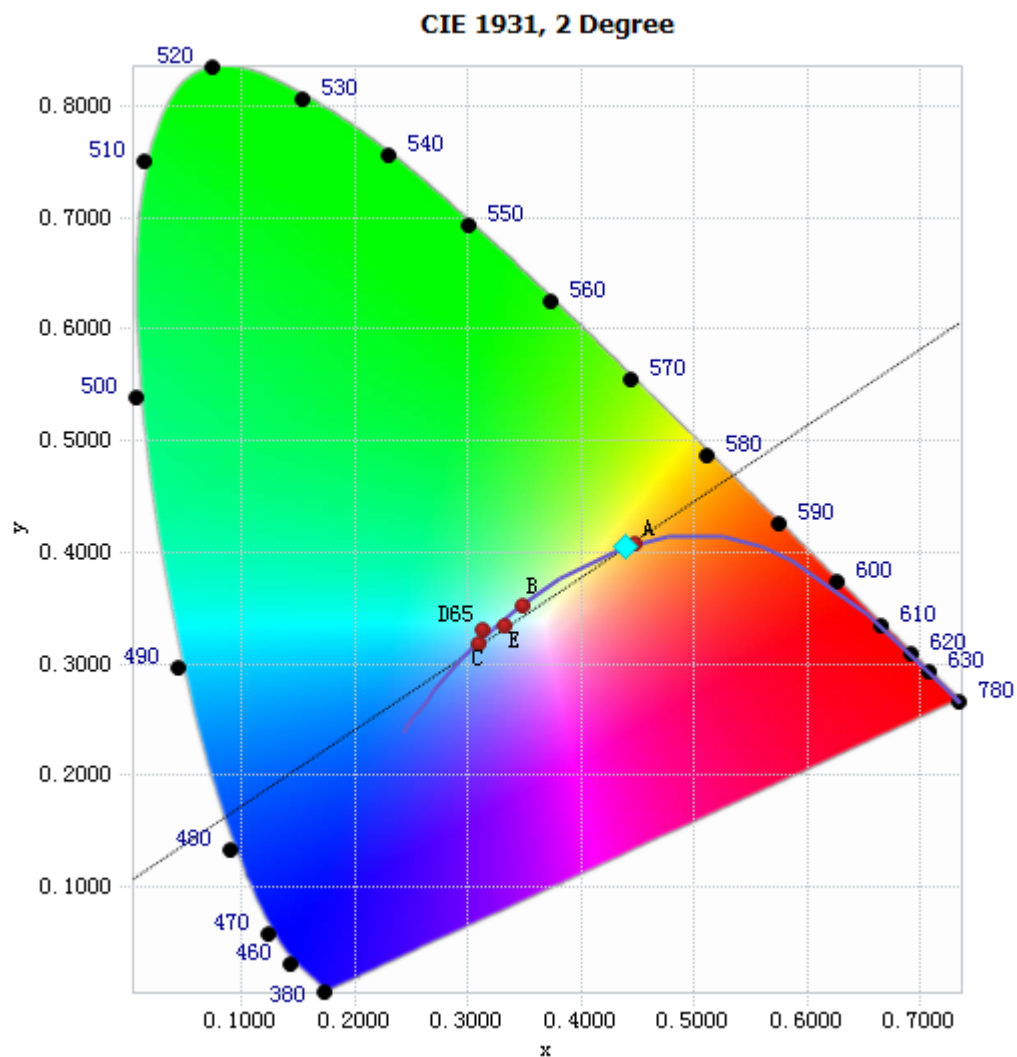


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.16E-04	485	7.67E-03	590	3.78E-02	695	6.94E-03
385	1.12E-04	490	8.99E-03	595	3.89E-02	700	5.97E-03
390	1.13E-04	495	1.09E-02	600	3.96E-02	705	5.08E-03
395	1.08E-04	500	1.27E-02	605	3.97E-02	710	4.36E-03
400	9.39E-05	505	1.45E-02	610	3.91E-02	715	3.72E-03
405	1.35E-04	510	1.59E-02	615	3.81E-02	720	3.19E-03
410	2.33E-04	515	1.71E-02	620	3.66E-02	725	2.72E-03
415	4.70E-04	520	1.81E-02	625	3.48E-02	730	2.32E-03
420	8.74E-04	525	1.89E-02	630	3.26E-02	735	1.95E-03
425	1.63E-03	530	1.97E-02	635	3.02E-02	740	1.67E-03
430	3.05E-03	535	2.05E-02	640	2.79E-02	745	1.42E-03
435	5.50E-03	540	2.14E-02	645	2.53E-02	750	1.20E-03
440	1.00E-02	545	2.24E-02	650	2.28E-02	755	1.03E-03
445	1.75E-02	550	2.36E-02	655	2.04E-02	760	8.65E-04
450	2.11E-02	555	2.51E-02	660	1.81E-02	765	7.40E-04
455	1.56E-02	560	2.66E-02	665	1.61E-02	770	6.31E-04
460	1.16E-02	565	2.85E-02	670	1.41E-02	775	5.36E-04
465	9.90E-03	570	3.05E-02	675	1.24E-02	780	4.55E-04
470	7.64E-03	575	3.24E-02	680	1.08E-02		
475	6.58E-03	580	3.46E-02	685	9.34E-03		
480	6.86E-03	585	3.64E-02	690	8.11E-03		

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

# Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4396, 0.4056)

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

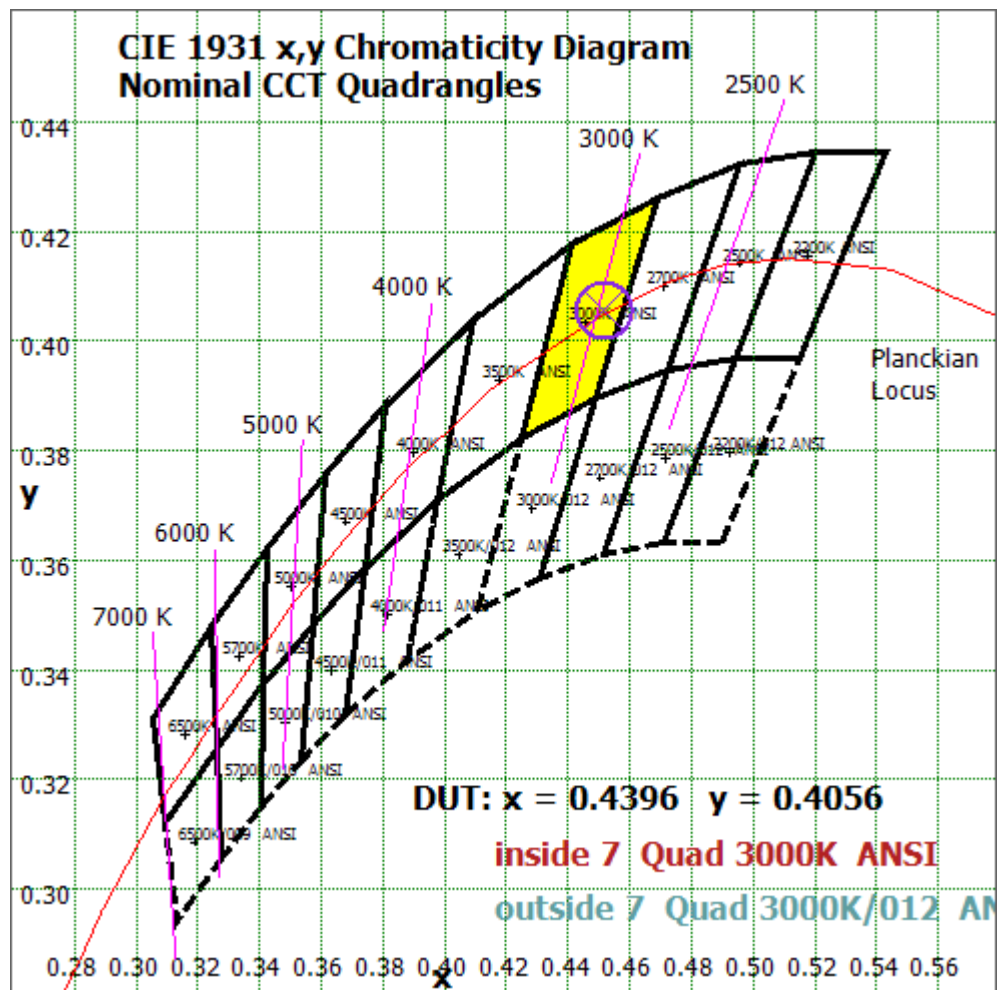


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

# Color Rendition Report – Sphere Spectroradiometer Method

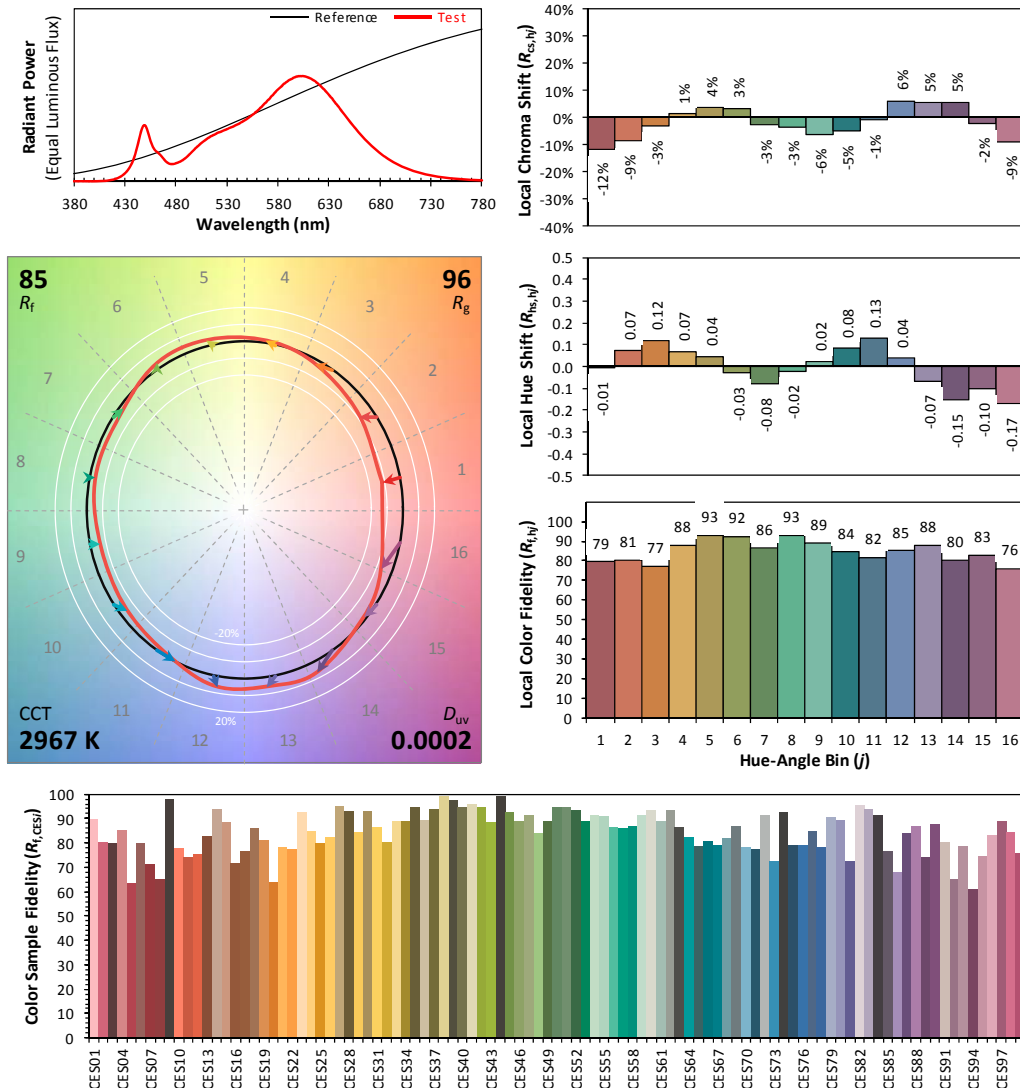
## ANSI/IES TM-30-18 Color Rendition Report

Source: LED

Manufacturer: GREEN CREATIVE LTD

Date: 2022/06/17

Model: 14.5T5HE/4F/830/BYP/R



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

$x$  0.4396  
 $y$  0.4056  
 $u'$  0.2517  
 $v'$  0.5224

CIE 13.3-1995  
(CRI)  
 $R_a$  82  
 $R_9$  4

Colors are for visual orientation purposes only. Created with the ANSI/IES TM-30-18 Calculator Version 2.00.

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	30.288	1.59%
10- 20	87.976	4.61%
20- 30	137.411	7.21%
30- 40	174.232	9.14%
40- 50	195.719	10.26%
50- 60	201.123	10.55%
60- 70	191.958	10.07%
70- 80	172.165	9.03%
80- 90	148.716	7.80%
90-100	127.555	6.69%
100-110	108.571	5.69%
110-120	91.365	4.79%
120-130	75.71	3.97%
130-140	61.321	3.22%
140-150	47.122	2.47%
150-160	32.727	1.72%
160-170	17.666	0.93%
170-180	5.496	0.29%
Total	1907.1	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	826.749	43.35%
60- 90	512.839	26.89%
0-90	1339.59	70.24%
90- 180	567.533	29.76%
0- 180	1907.1	100%

Table 5: Zonal Lumen

## Illuminance Plots- Goniophotometer Method

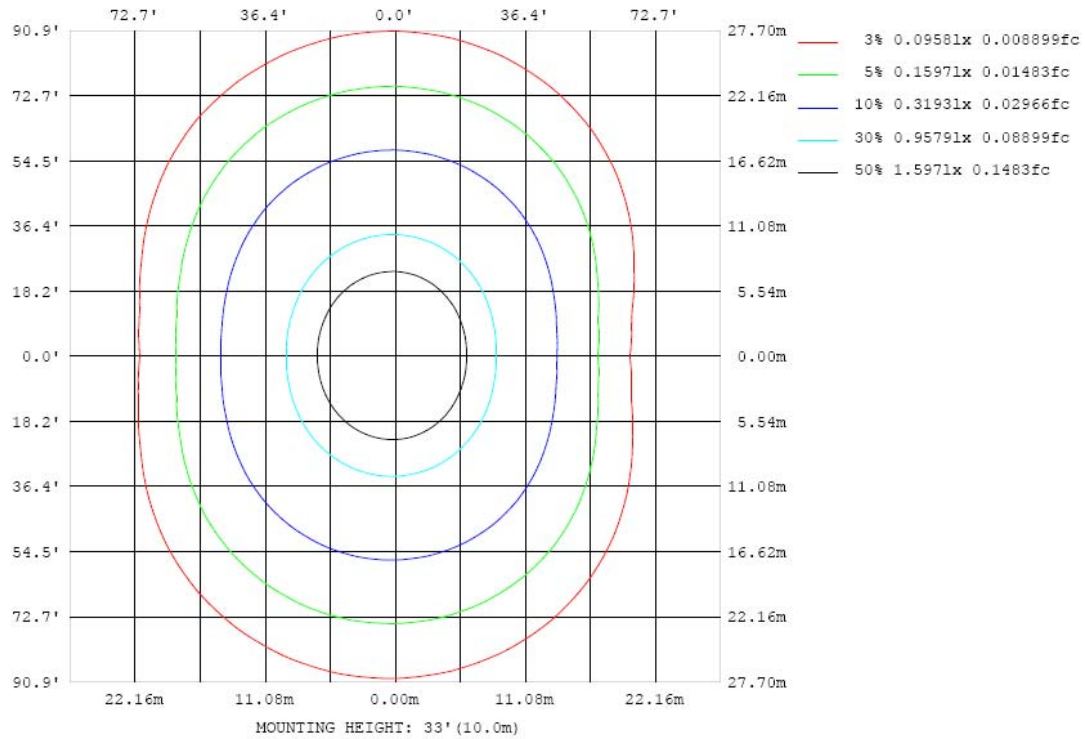


Chart 5: Illuminance Plot (Footcandles)

# Luminous Intensity Distribution Plots- Goniophotometer Method

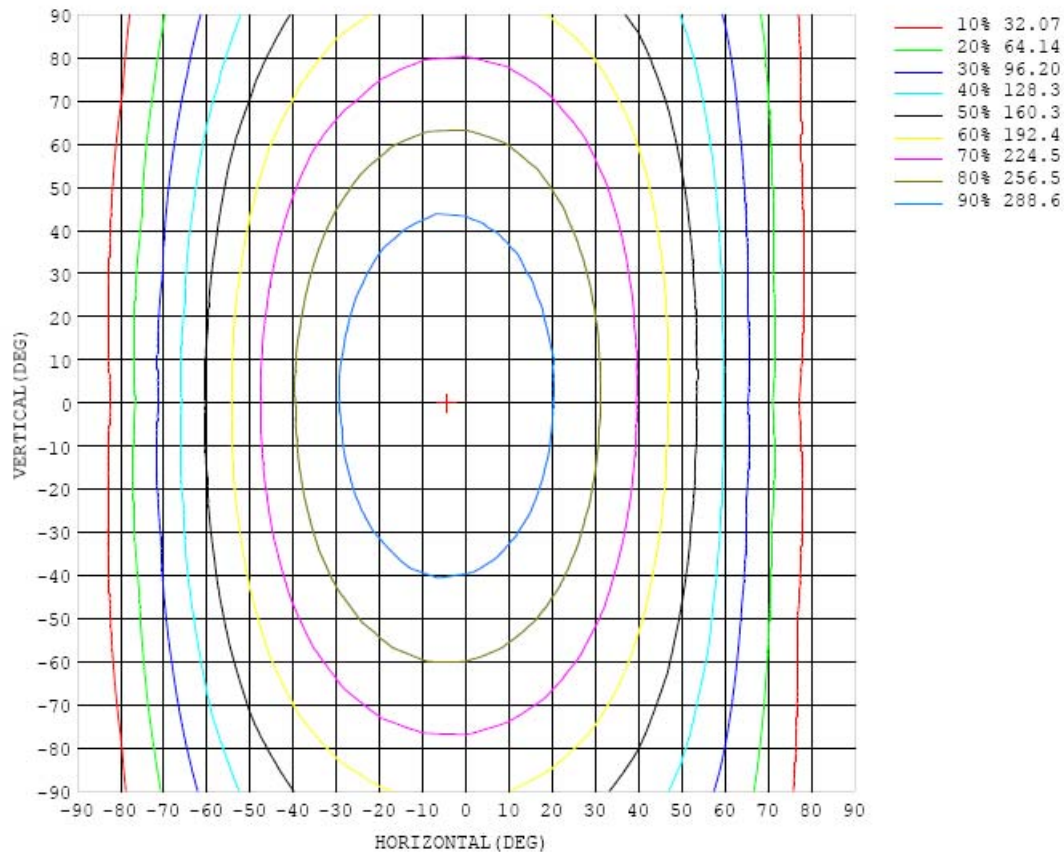


Chart 6: Isocandela Plot

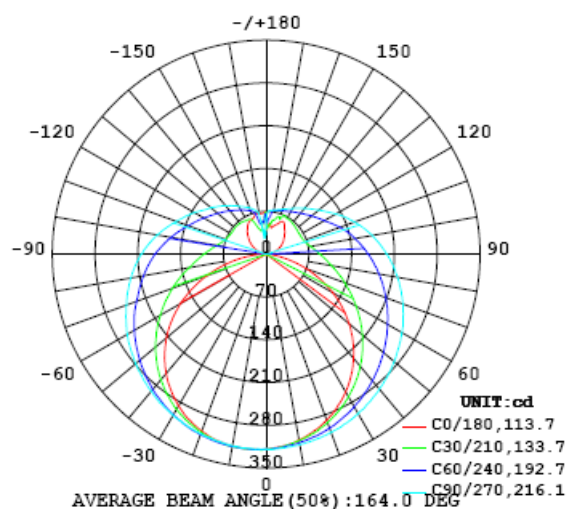


Chart 7: Polar Candela Distribution

## Luminous Intensity Data- Goniophotometer Method

Table--1 UNIT: cd

C (DEG) γ (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	319	319	319	319	319	319	319	319	319	319	319	319	319	319	319	319	319	319	319
5	315	315	316	316	316	317	317	318	318	319	319	319	319	320	319	320	320	320	321
10	309	309	309	310	311	313	313	314	316	317	317	317	318	318	318	318	319	319	318
15	300	300	301	303	305	306	309	311	312	314	315	315	316	316	315	315	314	314	315
20	289	289	291	293	297	300	303	306	308	310	312	312	312	312	310	310	308	308	308
25	276	276	278	282	286	292	296	300	304	306	307	308	307	306	304	302	300	298	299
30	260	261	264	269	275	282	288	294	298	301	302	303	300	299	295	292	289	286	287
35	242	244	249	255	263	272	279	286	292	295	296	296	293	290	285	280	276	273	272
40	222	224	231	239	250	261	270	279	285	288	290	289	285	280	274	267	260	256	255
45	201	203	211	223	236	249	260	270	276	281	282	281	276	270	261	252	243	237	235
50	177	181	191	206	221	237	251	261	269	274	275	272	266	258	248	236	224	216	213
55	152	156	170	188	207	225	240	252	260	265	266	263	256	246	233	218	204	193	188
60	125	132	149	170	192	213	230	243	251	256	257	253	245	234	218	200	182	168	162
65	97.9	106	128	153	178	201	219	233	242	247	248	243	234	221	203	182	160	142	133
70	69.7	80.6	107	137	164	189	209	223	233	238	239	233	223	208	188	164	138	115	104
75	42.7	56.8	88.1	122	151	177	198	213	223	228	228	223	212	196	174	147	116	88.0	73.6
80	19.2	36.8	72.5	109	141	167	188	203	213	218	218	212	201	183	160	131	96.4	62.8	44.9
85	3.55	23.5	60.5	97.5	130	156	177	192	203	208	207	201	189	171	147	117	79.7	41.6	19.3
90	1.14	17.6	52.3	88.0	120	146	167	182	193	197	197	191	178	160	136	104	66.7	27.2	3.15
95	3.76	16.2	46.7	80.6	112	138	157	172	182	187	186	179	167	149	125	94.0	57.4	20.6	1.24
100	7.88	18.2	43.0	73.8	103	129	148	162	172	176	175	169	156	140	115	85.4	50.9	18.5	4.13
105	12.9	22.6	42.7	68.4	95.4	119	138	152	161	165	164	158	146	129	106	77.4	46.4	20.3	8.49
110	18.2	28.0	43.8	65.5	88.5	111	129	142	150	154	153	147	136	119	97.1	71.2	45.1	24.7	13.7
115	23.5	33.4	46.1	64.1	83.7	102	119	131	140	143	142	136	125	109	89.5	67.5	45.5	29.8	19.8
120	28.7	38.5	48.8	63.7	80.3	96.4	110	121	128	132	131	125	115	101	84.0	65.4	47.3	35.2	25.5
125	33.5	43.4	51.9	63.9	77.9	91.5	103	112	118	121	120	115	106	94.5	80.2	64.3	49.9	40.8	31.2
130	37.6	48.0	55.0	64.6	76.0	87.5	97.1	105	110	112	111	107	99.4	89.4	77.2	64.3	53.1	45.9	36.9
135	42.7	52.1	58.0	65.6	74.6	83.9	91.9	98.5	103	104	104	99.8	93.6	85.1	75.1	64.8	56.4	50.6	42.4
140	47.5	54.5	59.9	66.6	73.7	81.0	87.6	92.7	96.3	97.7	96.8	93.7	88.4	81.6	73.7	65.9	59.2	54.6	48.3
145	52.4	58.4	62.6	67.7	73.0	78.6	83.6	87.8	90.5	91.5	90.9	88.2	84.0	78.8	72.9	67.2	62.0	57.9	53.6
150	58.8	61.6	62.0	67.7	72.8	76.6	80.4	83.5	85.4	86.2	85.6	83.7	80.5	76.5	72.4	68.1	64.2	61.1	58.4
155	58.9	63.4	65.0	69.5	72.3	75.0	77.7	79.9	81.4	81.8	81.3	79.9	77.6	75.0	72.1	69.4	66.2	64.6	61.5
160	52.1	61.4	65.4	64.8	72.3	74.0	75.6	76.9	77.8	78.2	77.9	77.0	75.7	73.9	72.1	69.8	68.1	67.4	62.6
165	48.0	52.9	60.9	59.3	65.6	73.0	73.8	74.7	75.3	75.5	75.4	75.0	74.2	73.1	71.8	70.7	69.7	68.9	68.3
170	45.4	48.4	51.1	55.0	53.3	64.2	72.7	73.0	73.0	73.0	73.0	72.7	72.3	72.0	71.4	70.9	70.5	69.6	68.0
175	49.8	48.0	46.1	45.7	44.9	48.7	60.0	69.7	71.9	71.6	71.6	71.5	71.4	71.5	71.4	71.2	70.9	69.3	66.6
180	57.8	57.8	57.8	57.8	57.8	57.8	57.8	57.8	57.8	57.8	57.8	57.8	57.8	57.8	57.8	57.8	57.8	57.8	57.8

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	319	319	319	319	319	319	319	319	319	319	319	319	319	319	319	319	319		
5	320	320	320	320	320	320	320	320	319	319	318	317	317	317	316	316	315		
10	319	319	319	319	319	319	319	319	318	317	316	314	313	312	311	310	310		
15	315	315	316	317	317	318	318	317	316	314	313	311	308	306	304	303	301		
20	309	309	310	312	313	314	315	314	313	311	308	305	302	298	295	292	290		
25	300	301	302	306	308	310	310	310	309	307	303	299	294	289	284	280	277		
30	288	290	293	297	301	304	305	306	305	301	297	291	285	278	271	266	262		
35	274	277	282	287	293	296	300	301	299	296	291	283	275	266	258	250	245		
40	257	262	268	276	283	289	292	294	293	289	283	274	264	254	242	233	225		
45	238	244	253	263	273	280	285	288	286	282	275	266	253	240	226	214	204		
50	216	225	237	250	261	270	276	279	279	274	267	256	242	226	209	193	182		
55	193	204	219	234	249	260	267	271	271	267	258	246	230	212	192	173	158		
60	167	182	200	219	236	249	258	263	262	258	249	235	218	198	175	151	133		
65	140	159	182	204	223	238	248	253	253	249	239	225	207	184	158	130	107		
70	113	136	163	189	211	226	236	243	243	239	230	215	195	170	142	110	82.2		
75	85.0	114	145	173	197	214	227	234	235	230	220	205	184	158	127	92.2	59.4		
80	59.6	93.2	128	159	185	204	216	224	225	221	211	195	174	147	114	76.4	40.3		
85	38.2	75.2	114	147	173	193	206	214	215	211	201	185	164	137	103	65.6	27.3		
90	23.9	63.3	102	135	162	182	195	203	204	200	190	175	154	127	94.1	57.8	21.0		
95	17.7	54.3	91.1	124	151	170	184	191	193	189	179	164	143	117	85.8	51.6	19.8		
100	16.6	48.4	82.2	113	139	158	172	179	181	177	168	153	133	108	79.3	49.2	21.8		
105	20.1	45.1	75.5	104	128	147	160	167	169	165	157	142	124	101	75.1	48.0	26.0		
110	24.5	45.7	70.9	96.4	119	136	148	155	157	153	145	133	116	95.0	70.4	50.3	30.2		
115	29.1	47.0	68.4	90.8	111	127	138	144	146	143	136	124	108	88.7	70.8	52.3	33.9		
120	32.6	49.2	67.1	86.2	104	118	128	134	136	134	126	115	102	87.0	70.4	54.4	36.8		
125	35.1	51.0	66.5	82.4	97.8	110	119	124	125	123	117	109	98.1	84.6	70.5	56.5	39.3		
130	37.1	52.8	67.0	79.8	92.9	104	112	116	118	116	111	104	94.1	82.3	70.4	58.3	40.8		
135	37.9	54.4	67.0	77.6	88.9	98.0	105	109	111	109	105	98.5	90.2	80.5	70.2	59.1	41.3		
140	38.1	55.3	66.2	76.0	84.8	92.8	98.6	102	103	102	99.0	93.7	86.7	78.8	68.9	60.1	41.6		
145	37.6	56.8	65.3	74.1	81.5	87.6	92.4	95.6	96.8	96.0	93.6	89.0	84.0	74.7	67.9	62.6	41.0		
150	38.2	57.7	63.9	71.2	78.1	83.5	87.2	89.5	90.5	90.1	88.3	84.9	79.6	72.0	66.5	62.7	40.1		
155	44.4	52.1	63.1	69.2	74.2	79.4	82.8	84.6	85.3	85.2	83.6	80.1	68.9	67.7	61.6	54.4	42.6		
160	48.5	41.2	53.2	64.6	71.8	75.5	78.1	79.6	80.4	80.4	77.2	61.6	59.3	55.3	54.4	43.5	41.7		
165	51.7	39.6	42.4	43.4	57.6	67.6	71.5	74.5	75.2	70.3	54.2	50.6	50.7	47.0	41.9	38.2	40.8		
170	55.6	42.8	39.8	44.4	46.7	49.4	53.8	55.0	62.8	40.9	50.6	50.9	48.3	46.9	44.1	40.7	40.9		
175	62.5	56.6	52.5	53.0	53.5	53.0	53.4	53.0	30.2	56.5	56.9	55.5	53.9	53.0	51.6	49.6	49.2		
180	57.8	57.8	57.8	57.8	57.8	57.8	57.8	57.8	57.8	57.8	57.8	57.8	57.8	57.8	57.8	57.8	57.8		

Table 7: Luminous Intensity Data

## EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Aug. 05, 2021	Aug. 04, 2022
Digital Power Meter	PF2010A	HZTE028-01	Aug. 05, 2021	Aug. 04, 2022
AC Power Supply	DPS1060	HZTE001-06	Aug. 05, 2021	Aug. 04, 2022
DC Power Supply	WY12010	HZTE004-03	Aug. 05, 2021	Aug. 04, 2022
Temperature recorder	JM624U	HZTE018-08	Aug. 05, 2021	Aug. 04, 2022
Temperature and humidity recorder	JR900	HZTE018-01	Aug. 05, 2021	Aug. 04, 2022
Standard source	D908	HZTE012-01	Aug. 05, 2021	Aug. 04, 2022
Integrate Sphere system	3M	HZTE015-04	Aug. 05, 2021	Aug. 04, 2022
Digital Power Meter	WT210	HZTE008-01	Aug. 05, 2021	Aug. 04, 2022
AC Power Supply	PCR 500L	HZTE001-07	Aug. 05, 2021	Aug. 04, 2022
DC Power Supply	IT6154	HZTE004-04	Aug. 05, 2021	Aug. 04, 2022
Standard source	SCL-1400	HZTE012-02	Aug. 05, 2021	Aug. 04, 2022
Temperature and humidity recorder	JR900	HZTE018-02	Aug. 05, 2021	Aug. 04, 2022
Temperature Meter	TES1310	HZTE017-01	Aug. 05, 2021	Aug. 04, 2022

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 3 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 20 min, taken 10 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 20 min, taken 10 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.

\*\*\* End of Report \*\*\*

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