

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: 8.5T8/2F/850/DEB/RC

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

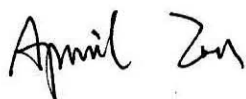
Tel: +86571 86376106

www.ledtestlab.com

Report No.: HZ20100014d

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

Review by:



Engineer: April Zou

Oct. 23, 2020

Approved by:



Manager: Jim Zhang

Oct. 23, 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: **8.5T8/2F/850/DEB/RC**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
139.9	1151.6	8.23	0.9765
CCT (K)	CRI	Stabilization Time (Light & Power)	
5060	84.2	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	: Oct. 20, 2020
Date of Test	: Oct. 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

TABLE OF CONTENT

LM-79-08 TEST REPORT	1
TEST SUMMARY	2
SAMPLE PHOTO	4
TEST RESULTS	5
Sphere-Spectroradiometer Method.....	5
Goniophotometer Method	6
Spectral Power Distribution - Sphere Spectroradiometer Method	7
Chromaticity Diagram - Sphere Spectroradiometer Method.....	8
Nominal CCT Quadrangles – Sphere Spectroradiometer Method	9
Color Rendition Report – Sphere Spectroradiometer Method	10
Zonal Lumen Tabulation- Goniophotometer Method	11
Illuminance Plots- Goniophotometer Method	12
Luminous Intensity Distribution Plots- Goniophotometer Method.....	13
Luminous Intensity Data- Goniophotometer Method	14
EQUIPMENT LIST	16
TEST METHODS	16
Seasoning of SSL Product.....	16
Sphere-Spectroradiometer Method- Photometric and Electrical Measurements.....	16
Goniophotometer Method	17
Photometric and Electrical Measurements	17
Color Characteristics Measurements.....	17
Color Spatial Uniformity	17

SAMPLE PHOTO

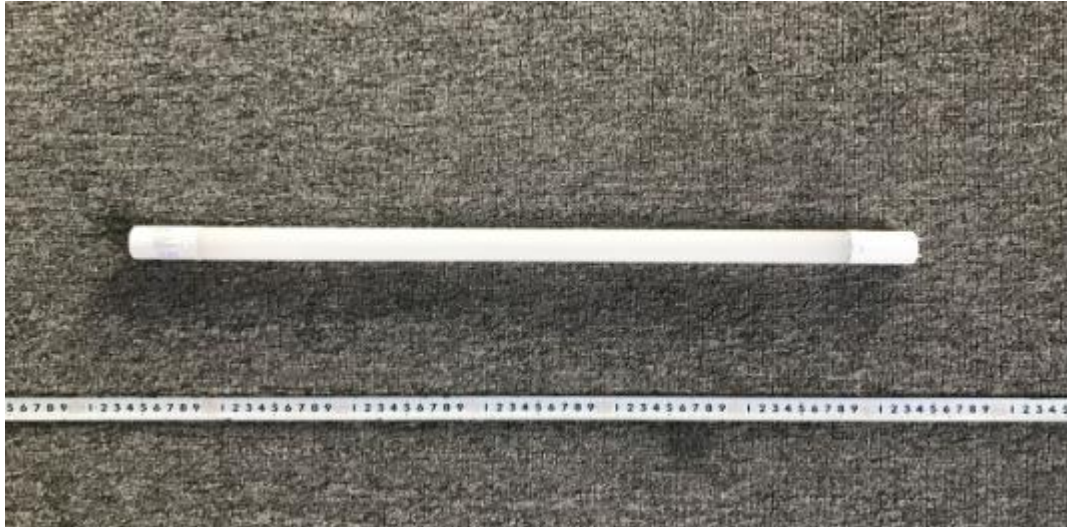


Figure 1- Overview of the sample

Equipment Under Test(EUT)

Name	: LED Tube
Model	: 8.5T8/2F/850/DEB/RC
Electrical Ratings	: 120-277V, 50/60Hz, 8.5W
Product Description	: 5000K
Manufacturer	: GREEN CREATIVE LTD
Address	: Room 3603, Level 36, Tower 1, Enterprise Square Five, 38 Wang Chiu Road, Kowloon Bay, KL, Hong Kong

TEST RESULTS

Test ambient temperature was 26.0 °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)	0.070	0.034
Power Factor	0.9765	0.9021
Test Power (W)	8.23	8.36
THD A%	16.57	18.24
Luminous Efficacy (lm/W)	139.9	137.3
Total Luminous Flux (lm)	1151.6	1147.6
Color Rendering Index (CRI)	84.2	
R9	13.2	
Correlated Color Temperature (CCT)(K)	5060	
Chromaticity Chroma x	0.3435	
Chromaticity Chroma y	0.3516	
Chromaticity Chroma u	0.2103	
Chromaticity Chroma v	0.3229	
Duv	0.0007	
Chromaticity Chroma u'	0.2103	
Chromaticity Chroma v'	0.4844	

Special Color Rendering Indices	
R1	83
R2	89.5
R3	93.1
R4	84
R5	83.5
R6	84.6
R7	87.1
R8	68.9
R9	13.2
R10	74.4
R11	83.5
R12	63.3
R13	84.8
R14	96.4

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 25.1 °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)	0.070
Power Factor	0.9772
Power (W)	8.23
Luminous Efficacy (lm/W)	137.5
Total Luminous Flux (lm)	1131.9
Beam Angle (°)	105.6 (0°-180°) / 195.4 (90°-270°)
Center Beam Candle Power (cd)	216
Maximum Beam Candle Power (cd)	216.1 (At: C=170.0, Gamma=0.5)
Spacing Criteria	1.23 (0°-180°) / 1.38 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	46.71%
Zonal Lumens in the 60 °-90 °Zone	26.82%
Zonal Lumens in the 90 °-120 °Zone	16.00%
Zonal Lumens in the 120 °-180 °Zone	10.47%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

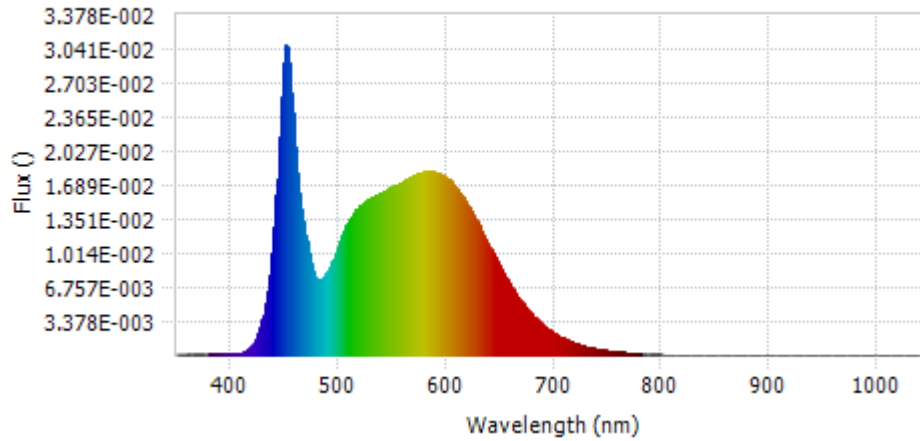
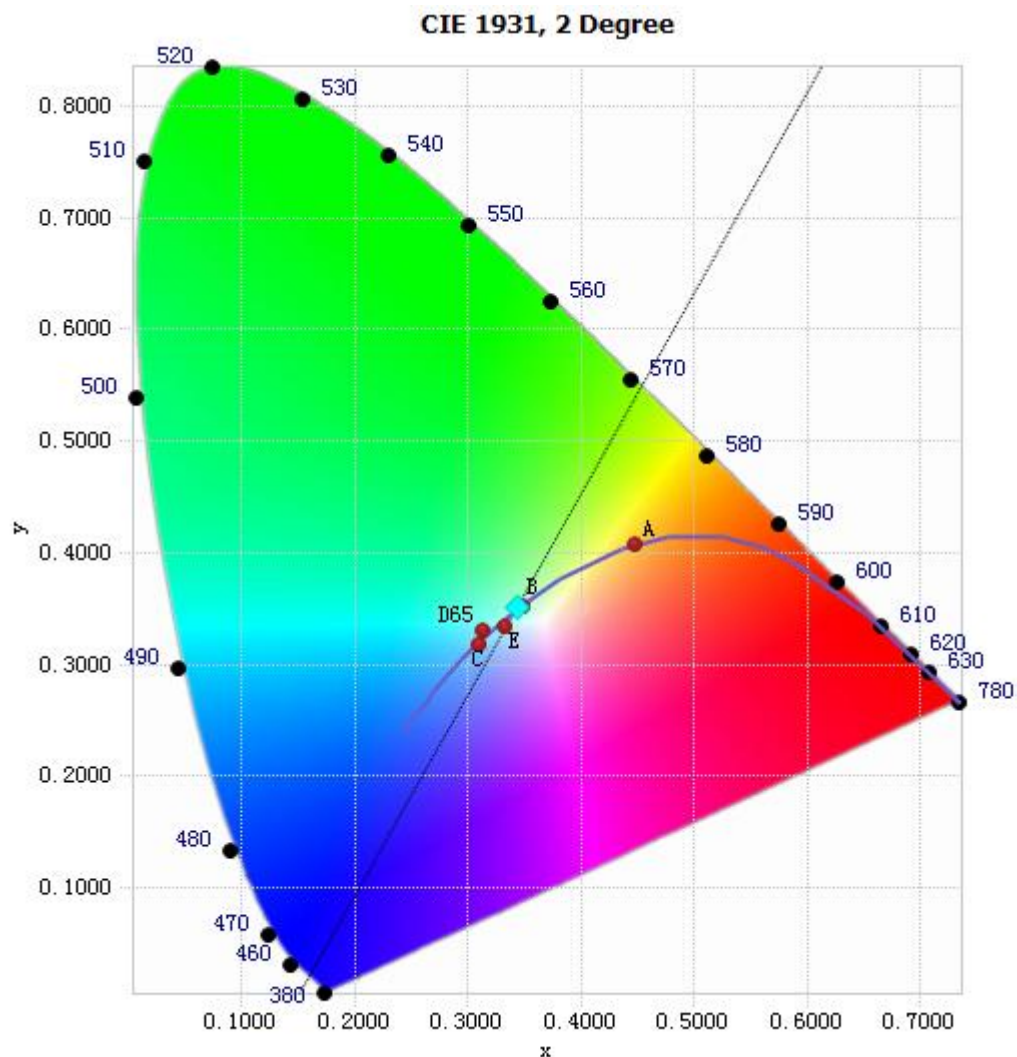


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.30E-04	485	7.72E-03	590	1.82E-02	695	2.56E-03
385	1.34E-04	490	8.41E-03	595	1.80E-02	700	2.20E-03
390	1.34E-04	495	9.64E-03	600	1.76E-02	705	1.88E-03
395	1.20E-04	500	1.11E-02	605	1.71E-02	710	1.61E-03
400	1.08E-04	505	1.24E-02	610	1.64E-02	715	1.38E-03
405	1.35E-04	510	1.35E-02	615	1.57E-02	720	1.19E-03
410	2.59E-04	515	1.43E-02	620	1.48E-02	725	1.01E-03
415	5.54E-04	520	1.48E-02	625	1.38E-02	730	8.68E-04
420	1.08E-03	525	1.53E-02	630	1.28E-02	735	7.43E-04
425	2.13E-03	530	1.56E-02	635	1.18E-02	740	6.34E-04
430	3.98E-03	535	1.59E-02	640	1.08E-02	745	5.43E-04
435	7.23E-03	540	1.62E-02	645	9.68E-03	750	4.64E-04
440	1.27E-02	545	1.64E-02	650	8.68E-03	755	4.00E-04
445	2.16E-02	550	1.67E-02	655	7.69E-03	760	3.41E-04
450	3.00E-02	555	1.70E-02	660	6.81E-03	765	2.96E-04
455	2.77E-02	560	1.72E-02	665	5.99E-03	770	2.53E-04
460	1.93E-02	565	1.76E-02	670	5.24E-03	775	2.18E-04
465	1.46E-02	570	1.78E-02	675	4.58E-03	780	1.88E-04
470	1.14E-02	575	1.81E-02	680	3.97E-03		
475	8.59E-03	580	1.82E-02	685	3.44E-03		
480	7.55E-03	585	1.83E-02	690	2.97E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3435, 0.3516)

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

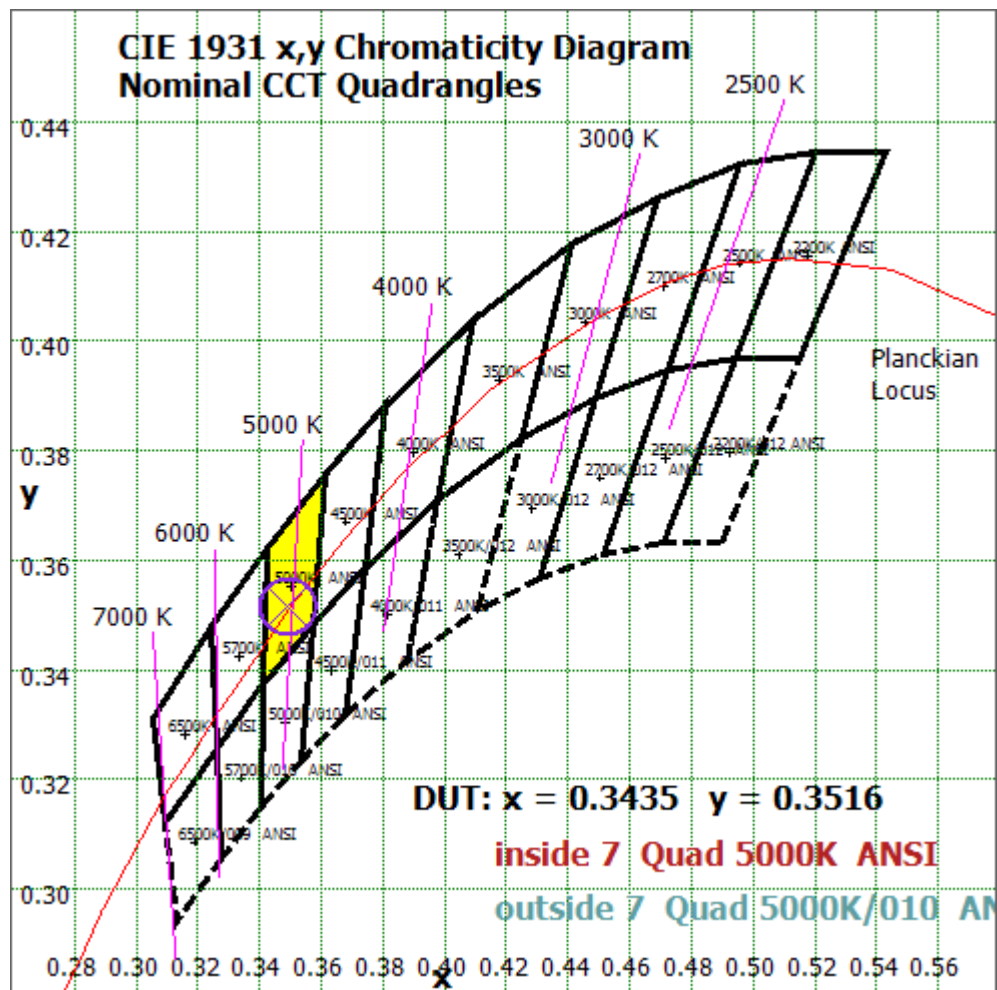


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method

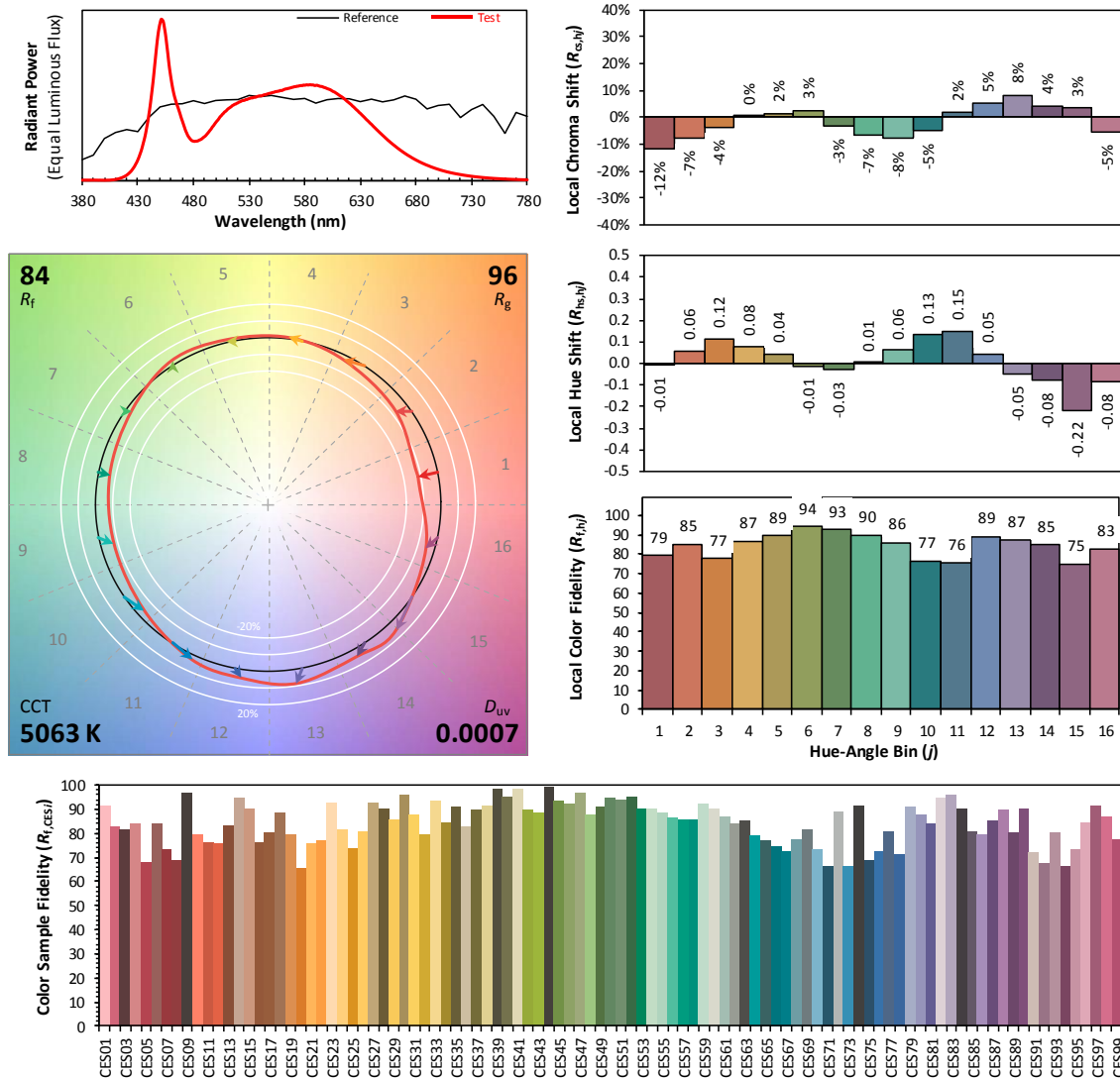
ANSI/IES TM-30-18 Color Rendition Report

Source: LED

Manufacturer: GREEN CREATIVE LTD

Date: 2020/10/22

Model: 8.5T8/2F/850/DEB/RC



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

x 0.3435
 y 0.3516
 u' 0.2103
 v' 0.4844

CIE 13.3-1995
(CRI)

R_a 84
 R_g 13

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	20.459	1.81%
10- 20	58.931	5.21%
20- 30	90.547	8.00%
30- 40	112.299	9.92%
40- 50	123.082	10.87%
50- 60	123.359	10.90%
60- 70	115.259	10.18%
70- 80	101.712	8.99%
80- 90	86.632	7.65%
90-100	73.155	6.46%
100-110	59.927	5.29%
110-120	48.056	4.25%
120-130	38.21	3.38%
130-140	30.217	2.67%
140-150	22.935	2.03%
150-160	15.935	1.41%
160-170	9.014	0.80%
170-180	2.164	0.19%
Total	1131.9	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	528.677	46.71%
60- 90	303.603	26.82%
0-90	832.28	73.53%
90- 180	299.613	26.47%
0- 180	1131.9	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

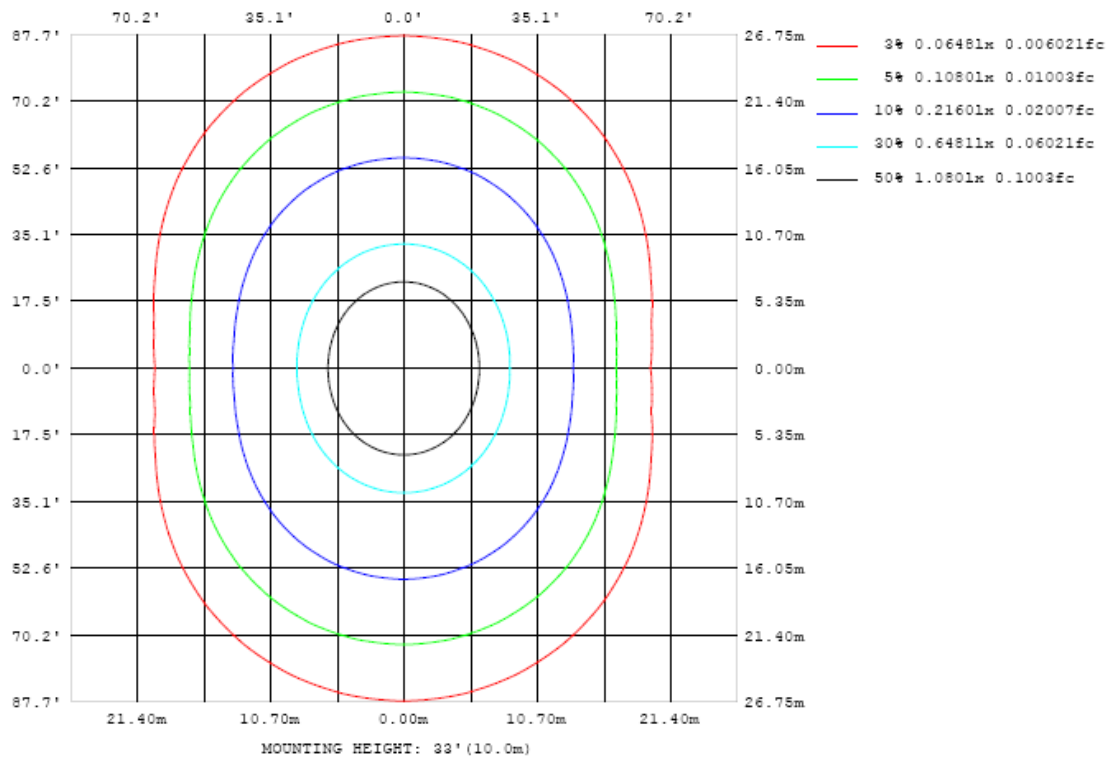


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

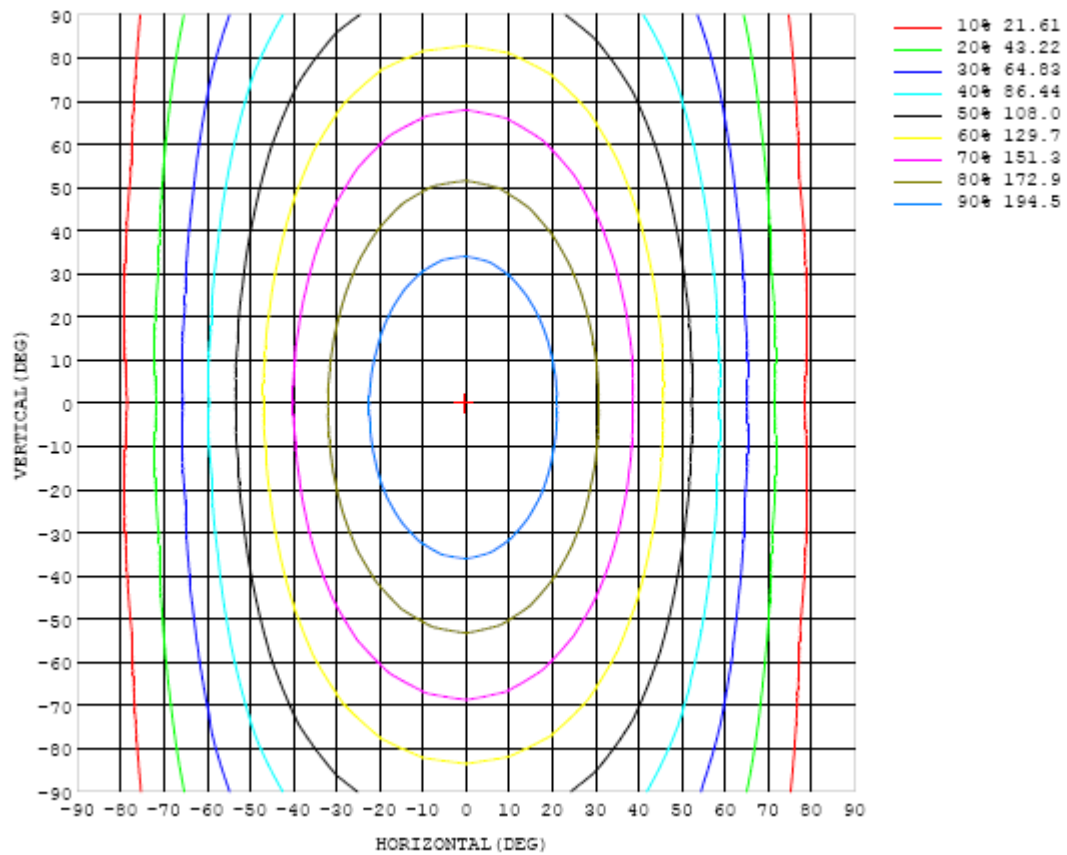


Chart 6: Isocandela Plot

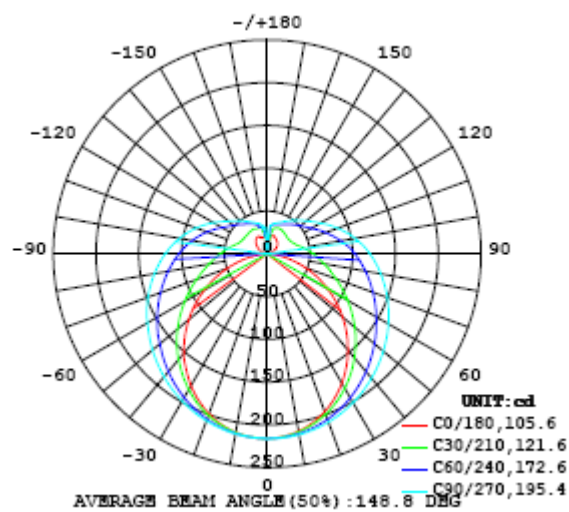


Chart 7: Polar Candela Distribution

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	216	216	216	216	216	216	216	216	216	216	216	216	216	216	216	216	216	216	216
5	214	215	215	215	215	215	215	216	216	216	216	216	216	216	216	215	215	215	215
10	211	211	211	212	212	213	213	214	214	215	215	214	214	214	213	213	212	212	212
15	205	205	206	206	208	209	210	211	212	213	212	212	211	210	209	208	207	207	207
20	196	197	198	200	202	204	206	208	209	209	209	208	207	206	204	202	200	199	199
25	186	187	189	191	194	198	201	203	205	206	205	204	202	200	197	194	192	190	189
30	175	176	178	181	186	190	194	198	200	201	200	199	196	192	188	184	181	179	178
35	161	163	166	171	176	182	187	192	194	196	195	193	189	184	179	174	169	166	165
40	147	149	153	159	166	173	180	185	188	190	189	186	182	176	169	162	156	152	152
45	131	133	139	146	155	164	172	178	182	184	183	179	174	166	158	149	142	137	136
50	115	118	124	134	144	155	164	171	175	177	176	172	165	157	147	137	128	121	120
55	98.5	102	110	121	134	145	156	163	169	170	169	165	157	147	136	124	113	105	103
60	81.4	85.3	95.3	109	123	136	147	156	161	164	162	157	149	138	125	111	97.8	88.0	84.9
65	64.8	69.5	81.3	96.9	113	127	139	149	154	157	155	150	141	129	115	98.9	83.4	71.3	67.1
70	47.8	53.9	68.6	85.8	103	119	132	141	147	149	148	142	133	121	105	87.6	69.8	55.5	49.4
75	31.5	39.2	56.7	76.3	94.6	111	124	134	140	142	140	135	125	112	96.2	77.5	58.0	40.3	32.6
80	17.2	26.4	46.4	67.6	86.7	103	117	126	133	135	133	127	118	105	88.1	68.5	47.4	27.2	17.6
85	6.41	16.8	38.4	60.2	79.4	96.2	109	119	125	128	126	120	111	97.5	80.8	61.4	39.0	17.3	5.97
90	1.45	11.5	32.5	53.9	73.3	89.4	102	112	118	120	118	113	104	90.6	74.2	55.0	33.0	11.8	0.88
95	1.16	8.48	27.4	48.1	67.0	82.6	95.4	105	111	113	111	106	96.5	83.8	67.9	49.2	28.2	9.04	0.97
100	2.50	7.96	23.2	42.3	60.3	75.3	87.7	96.8	102	104	103	97.6	88.8	76.8	61.8	43.6	24.4	8.77	2.41
105	4.35	9.27	21.4	37.4	54.2	68.7	79.9	88.7	94.1	96.0	94.4	89.5	81.2	69.8	55.6	38.9	22.5	9.68	4.51
110	6.29	11.2	20.6	34.3	48.6	62.1	72.8	80.8	85.9	87.7	86.2	81.7	73.9	63.6	50.1	35.6	22.4	11.7	7.04
115	8.64	13.4	20.6	32.3	44.4	55.9	66.0	73.1	77.9	79.7	78.3	74.1	67.4	57.4	45.9	34.1	23.1	14.2	9.67
120	11.1	15.6	21.7	31.0	41.6	51.3	59.6	66.3	70.4	71.6	70.8	67.3	60.8	52.7	43.2	33.2	24.1	16.4	11.7
125	13.6	17.9	23.2	30.3	39.4	47.9	55.0	60.5	64.1	65.4	64.4	61.3	56.1	49.2	41.1	32.7	25.2	18.8	14.2
130	15.7	20.0	24.9	30.4	37.7	44.9	51.0	55.8	58.8	59.9	59.1	56.4	52.1	46.2	39.5	32.6	26.5	21.0	16.4
135	17.3	20.7	26.6	30.9	36.5	42.5	47.6	51.6	54.2	55.1	54.4	52.2	48.6	43.8	38.3	32.7	27.8	23.0	18.6
140	18.2	20.3	28.1	31.5	35.9	40.6	44.7	48.0	50.1	50.9	50.3	48.5	45.6	41.7	37.3	32.8	29.0	24.7	20.6
145	19.3	20.3	29.4	32.1	35.5	39.0	42.2	44.8	46.5	47.2	46.7	45.3	43.0	39.9	36.5	33.1	30.0	25.4	22.1
150	20.5	20.0	28.8	32.7	35.2	37.8	40.1	42.1	43.5	44.0	43.6	42.5	40.8	38.5	35.9	33.5	30.5	24.8	22.6
155	21.5	19.8	28.2	33.2	34.9	36.7	38.4	39.8	40.8	41.1	40.9	40.2	38.9	37.3	35.6	33.6	30.2	24.6	22.6
160	22.7	22.1	26.9	32.1	34.7	35.9	37.0	37.9	38.6	38.9	38.7	38.2	37.4	36.4	35.1	32.9	29.8	24.5	20.7
165	21.2	19.8	25.9	30.9	33.8	35.2	35.9	36.4	36.8	37.0	36.9	36.7	36.3	35.2	33.3	30.9	27.1	23.1	19.4
170	17.9	15.7	17.4	20.3	27.8	33.3	34.2	35.0	35.3	35.3	35.0	34.8	33.3	29.0	24.9	23.3	21.4	19.2	20.0
175	15.2	15.1	15.0	14.8	14.8	15.1	18.0	22.7	28.4	29.5	23.3	18.8	19.3	19.3	19.1	18.3	17.7	18.3	18.6
180	5.36	5.36	5.36	5.36	5.36	5.36	5.36	5.36	5.36	5.36	5.36	5.36	5.36	5.36	5.36	5.36	5.36	5.36	5.36

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	216	216	216	216	216	216	216	216	216	216	216	216	216	216	216	216	216		
5	215	215	215	215	215	215	215	215	215	215	215	215	215	215	215	214	214		
10	212	212	212	213	213	213	213	214	214	213	213	213	212	212	211	211	211		
15	207	207	207	208	209	210	211	211	211	211	210	209	208	207	206	205	205		
20	199	200	201	203	204	206	207	208	208	207	206	205	203	201	199	198	197		
25	190	191	193	195	198	200	202	203	204	203	201	199	196	193	190	188	187		
30	178	181	183	187	191	194	197	198	199	198	196	192	189	185	180	177	175		
35	166	169	173	178	183	187	191	193	193	192	189	185	180	175	170	165	162		
40	153	157	161	167	174	180	184	187	188	186	183	178	171	165	158	153	149		
45	138	143	150	158	165	172	177	181	181	180	176	170	162	155	146	139	134		
50	122	128	137	147	156	164	170	174	175	173	169	162	154	144	133	124	118		
55	105	113	124	136	147	157	163	167	168	166	162	155	144	133	121	110	102		
60	88.6	98.4	111	125	138	149	156	160	162	160	155	146	135	122	108	95.1	85.4		
65	71.9	84.0	99.3	115	129	141	149	154	155	153	148	138	126	112	96.2	80.9	69.2		
70	55.7	70.5	88.1	105	120	133	142	147	148	146	140	131	118	102	85.1	67.6	53.4		
75	40.6	58.2	77.9	96.4	112	125	134	140	141	139	133	123	110	93.6	75.1	55.5	38.7		
80	27.6	47.7	68.9	88.3	105	118	127	132	134	131	125	115	102	85.6	66.2	45.1	26.0		
85	17.6	39.5	61.3	80.9	97.4	110	120	125	126	124	118	108	94.9	78.3	58.7	37.0	16.5		
90	12.1	33.4	54.9	74.2	90.5	103	112	118	119	117	111	101	88.1	71.7	52.3	31.0	11.1		
95	9.30	29.0	49.5	68.2	84.0	96.4	105	110	112	110	104	94.5	81.7	65.7	46.9	26.5	8.40		
100	8.97	25.2	44.3	62.1	77.2	89.2	97.7	103	104	102	96.5	87.3	75.0	59.6	41.7	22.9	7.67		
105	9.93	23.1	39.7	56.3	70.5	81.9	90.0	94.8	96.2	94.2	88.8	80.1	68.4	53.8	37.3	20.6	8.40		
110	12.1	22.6	36.1	50.9	64.1	74.8	82.4	86.9	88.3	86.4	81.3	73.0	62.0	48.6	33.7	20.1	10.0		
115	14.4	23.1	34.2	46.2	58.1	67.9	75.0	79.2	80.4	78.7	73.9	66.2	56.1	44.0	31.5	20.2	12.2		
120	16.7	24.0	33.2	43.3	52.8	61.4	67.9	71.7	72.8	71.2	66.8	59.8	50.8	40.8	30.3	20.9	15.0		
125	18.7	25.1	32.6	41.0	49.1	55.9	61.2	64.5	65.5	64.0	60.2	54.3	47.1	38.6	29.7	22.3	17.7		
130	20.6	26.3	32.5	39.3	46.0	51.8	56.2	58.7	59.5	58.2	55.1	50.3	44.1	37.0	29.6	23.8	20.1		
135	22.6	27.6	32.5	38.1	43.5	48.3	51.9	54.0	54.6	53.5	50.9	46.9	41.8	35.9	30.1	25.3	22.1		
140	24.7	28.7	32.7	37.1	41.4	45.2	48.1	49.9	50.3	49.5	47.3	44.0	39.9	35.2	30.7	27.2	23.1		
145	26.6	29.6	32.8	36.3	39.6	42.6	44.9	46.3	46.6	45.9	44.2	41.6	38.4	34.8	31.2	28.6	24.1		
150	26.8	30.4	33.1	35.6	38.1	40.4	42.1	43.1	43.4	42.9	41.6	39.6	37.1	34.2	32.2	29.8	25.4		
155	28.5	30.3	32.3	34.5	36.9	38.5	39.7	40.5	40.7	40.4	39.4	37.8	36.0	34.5	32.7	30.7	27.4		
160	26.3	31.2	31.8	33.1	33.8	36.6	37.6	38.1	38.3	38.0	37.5	36.6	35.6	34.6	33.3	31.1	27.4		
165	23.2	29.7	32.0	32.6	33.5	33.5	34.3	36.5	36.6	36.5	36.3	35.8	35.2	34.5	33.2	31.6	26.5		
170	20.7	21.9	24.7	27.5	29.7	32.0	32.7	31.7	31.0	33.0	34.4	34.4	33.9	33.3	30.3	22.2	19.1		
175	18.8	18.6	17.8	17.8	18.5	18.9	19.6	23.1	29.5	31.8	30.3	27.6	22.6	17.1	15.0	15.1	15.2		
180	5.36	5.36	5.36	5.36	5.36	5.36	5.36	5.36	5.36	5.36	5.36	5.36	5.36	5.36	5.36	5.36	5.36		

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, 2020	Aug. 04, 2021
Digital Power Meter	PF2010A	HZTE028-01	Aug. 05, 2020	Aug. 04, 2021
AC Power Supply	DPS1060	HZTE001-06	Aug. 05, 2020	Aug. 04, 2021
DC Power Supply	WY12010	HZTE004-03	Aug. 05, 2020	Aug. 04, 2021
Temperature recorder	JM624U	HZTE018-08	Aug. 05, 2020	Aug. 04, 2021
Temperature and humidity recorder	JR900	HZTE018-01	Aug. 05, 2020	Aug. 04, 2021
Standard source	D908	HZTE012-01	Aug. 05, 2020	Aug. 04, 2021
Integrate Sphere system	3M	HZTE015-04	Aug. 05, 2020	Aug. 04, 2021
Digital Power Meter	WT210	HZTE008-01	Aug. 05, 2020	Aug. 04, 2021
AC Power Supply	PCR 500L	HZTE001-07	Aug. 05, 2020	Aug. 04, 2021
DC Power Supply	IT6154	HZTE004-04	Aug. 05, 2020	Aug. 04, 2021
Standard source	SCL-1400	HZTE012-02	Aug. 05, 2020	Aug. 04, 2021
Temperature and humidity recorder	JR900	HZTE018-02	Aug. 05, 2020	Aug. 04, 2021
Temperature Meter	TES1310	HZTE017-01	Aug. 05, 2020	Aug. 04, 2021

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 Tubes) 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 Tubes) 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

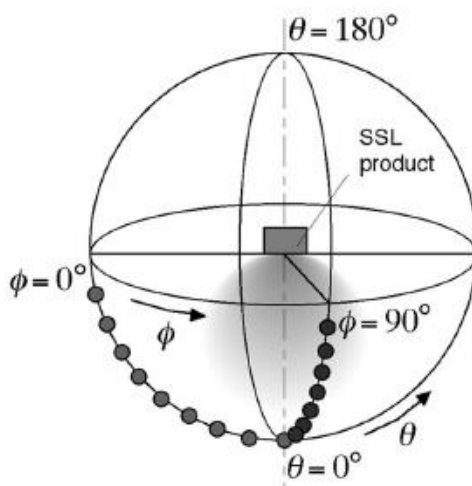
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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

This report is considered invalidated without the Special Seal for Inspection of the LTL. This report shall not be altered, increased or deleted. The results shown in this test report refer only to the sample(s) tested. Without written approval of LTL, this test report shall not be copied except in full and published as advertisement.