

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: 10T8/4F/830/DEB

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

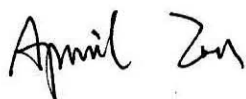
Tel: +86571 86376106

www.ledtestlab.com

Report No.: HZ20070023e

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: **10T8/4F/830/DEB**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
169.7	1724.4	10.16	0.9788
CCT (K)	CRI	Stabilization Time (Light & Power)	
3053	82.8	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

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	: 10T8/4F/830/DEB
Electrical Ratings	: 120-277V, 50/60Hz, 10W
Product Description	: 3000K
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)	0.087	0.041
Power Factor	0.9788	0.9094
Test Power (W)	10.16	10.36
THD A%	18.36	20.41
Luminous Efficacy (lm/W)	169.7	166.3
Total Luminous Flux (lm)	1724.4	1723.1
Color Rendering Index (CRI)	82.8	
R9	6.1	
Correlated Color Temperature (CCT)(K)	3053	
Chromaticity Chroma x	0.4326	
Chromaticity Chroma y	0.4017	
Chromaticity Chroma u	0.2488	
Chromaticity Chroma v	0.3465	
Duv	0.0004	
Chromaticity Chroma u'	0.2488	
Chromaticity Chroma v'	0.5198	

Special Color Rendering Indices	
R1	81.4
R2	91.7
R3	95.6
R4	80.8
R5	81.9
R6	90.2
R7	82.2
R8	58.4
R9	6.1
R10	81.4
R11	80.8
R12	71.9
R13	84
R14	98.3

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)	0.087
Power Factor	0.9791
Power (W)	10.19
Luminous Efficacy (lm/W)	166.7
Total Luminous Flux (lm)	1698.9
Beam Angle (°)	109.9 (0°-180°) / 197.3 (90°-270°)
Center Beam Candle Power (cd)	309
Maximum Beam Candle Power (cd)	309.2 (At: C=90.0, Gamma=2.0)
Spacing Criteria	1.24 (0°-180°) / 1.38 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	45.27%
Zonal Lumens in the 60 °-90 °Zone	26.41%
Zonal Lumens in the 90 °-120 °Zone	16.46%
Zonal Lumens in the 120 °-180 °Zone	11.86%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

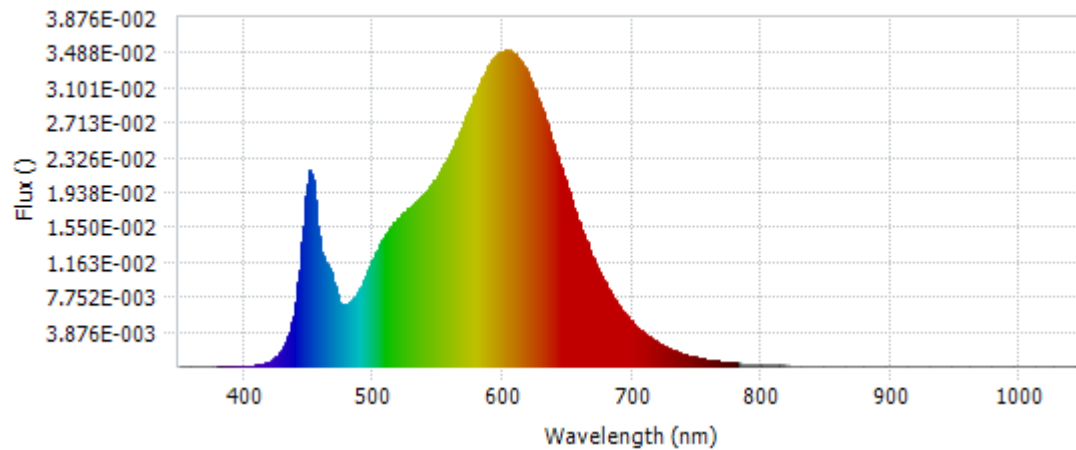
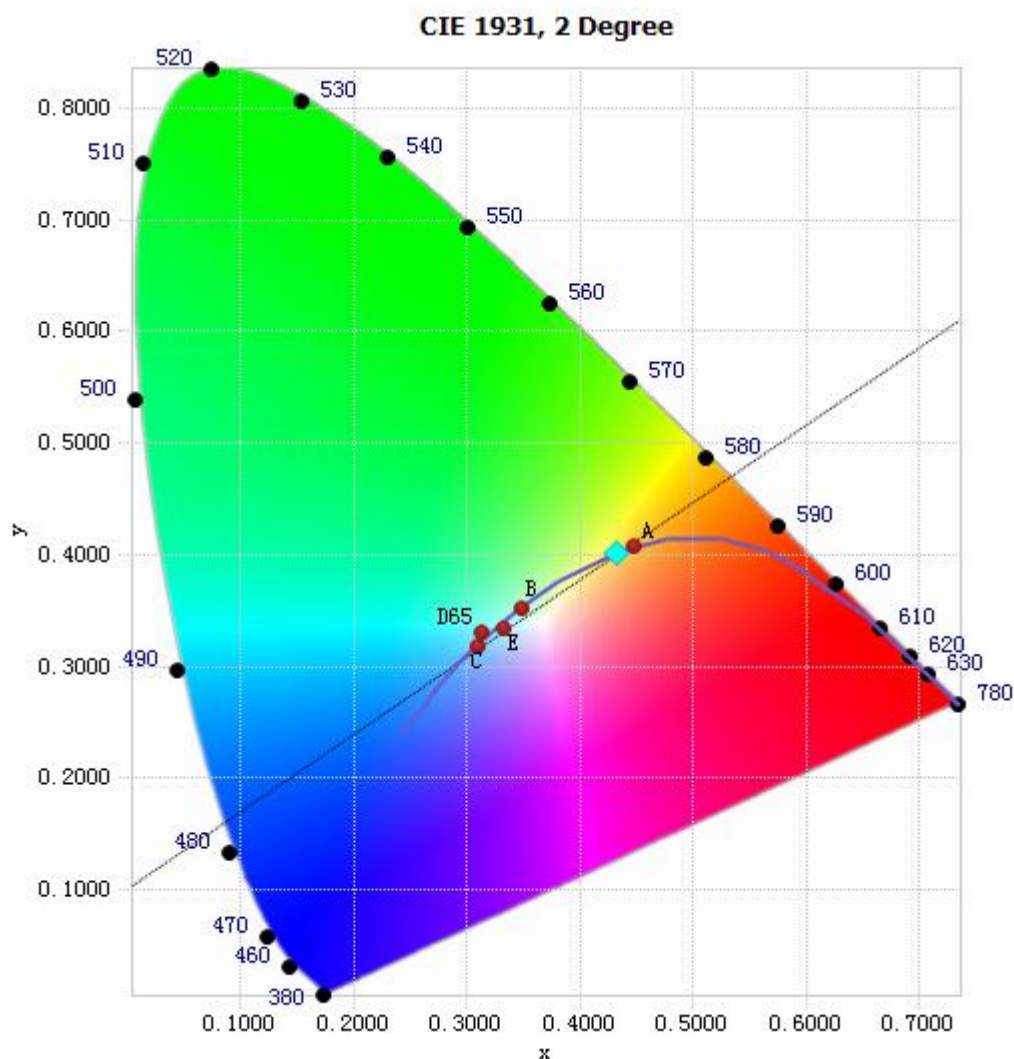


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	9.35E-05	485	7.67E-03	590	3.36E-02	695	5.75E-03
385	9.99E-05	490	8.72E-03	595	3.46E-02	700	4.91E-03
390	9.61E-05	495	1.03E-02	600	3.51E-02	705	4.19E-03
395	8.86E-05	500	1.20E-02	605	3.51E-02	710	3.57E-03
400	8.66E-05	505	1.35E-02	610	3.47E-02	715	3.04E-03
405	9.65E-05	510	1.47E-02	615	3.37E-02	720	2.60E-03
410	1.47E-04	515	1.58E-02	620	3.22E-02	725	2.21E-03
415	2.85E-04	520	1.66E-02	625	3.07E-02	730	1.88E-03
420	5.47E-04	525	1.72E-02	630	2.87E-02	735	1.59E-03
425	1.05E-03	530	1.78E-02	635	2.65E-02	740	1.35E-03
430	2.04E-03	535	1.85E-02	640	2.44E-02	745	1.16E-03
435	3.81E-03	540	1.93E-02	645	2.21E-02	750	9.84E-04
440	7.17E-03	545	2.03E-02	650	1.98E-02	755	8.39E-04
445	1.39E-02	550	2.12E-02	655	1.77E-02	760	7.08E-04
450	2.12E-02	555	2.25E-02	660	1.56E-02	765	6.08E-04
455	1.85E-02	560	2.38E-02	665	1.37E-02	770	5.20E-04
460	1.28E-02	565	2.53E-02	670	1.20E-02	775	4.46E-04
465	1.12E-02	570	2.71E-02	675	1.04E-02	780	3.83E-04
470	8.89E-03	575	2.88E-02	680	9.01E-03		
475	7.00E-03	580	3.06E-02	685	7.79E-03		
480	6.96E-03	585	3.23E-02	690	6.71E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4326, 0.4017)

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

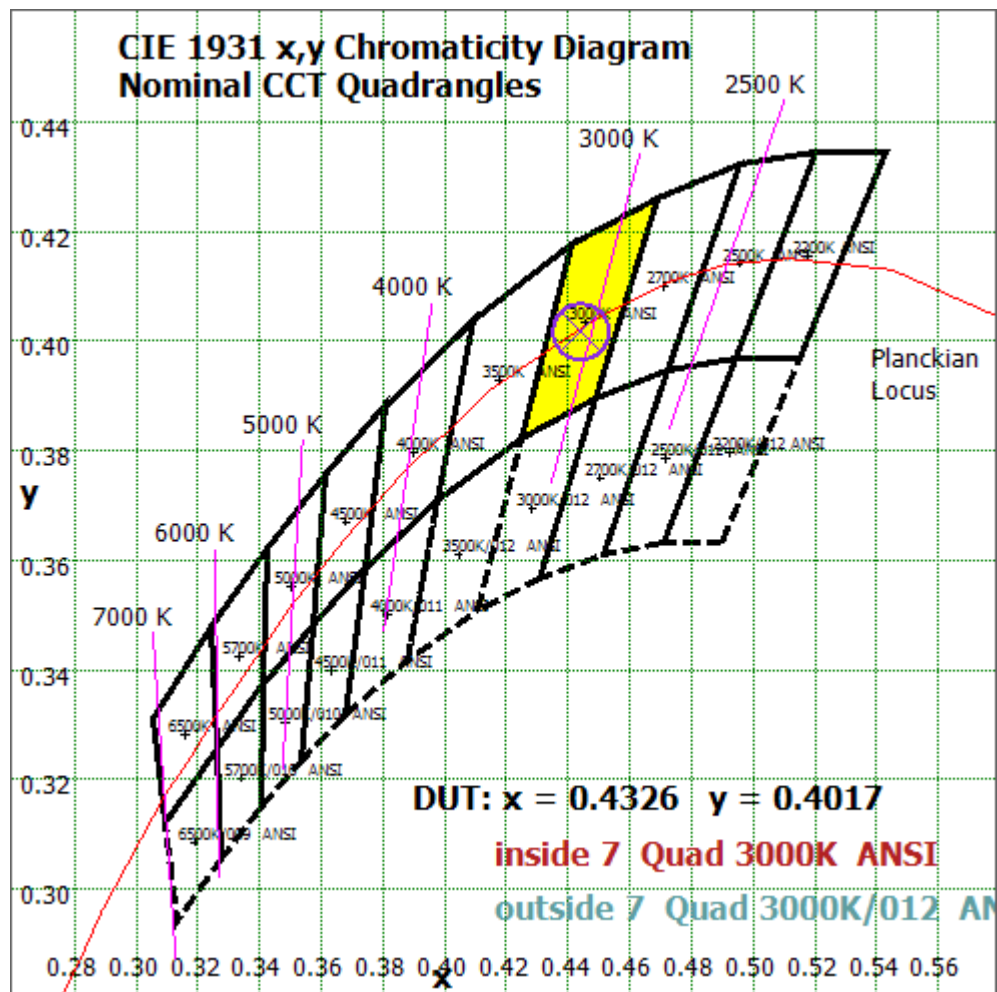
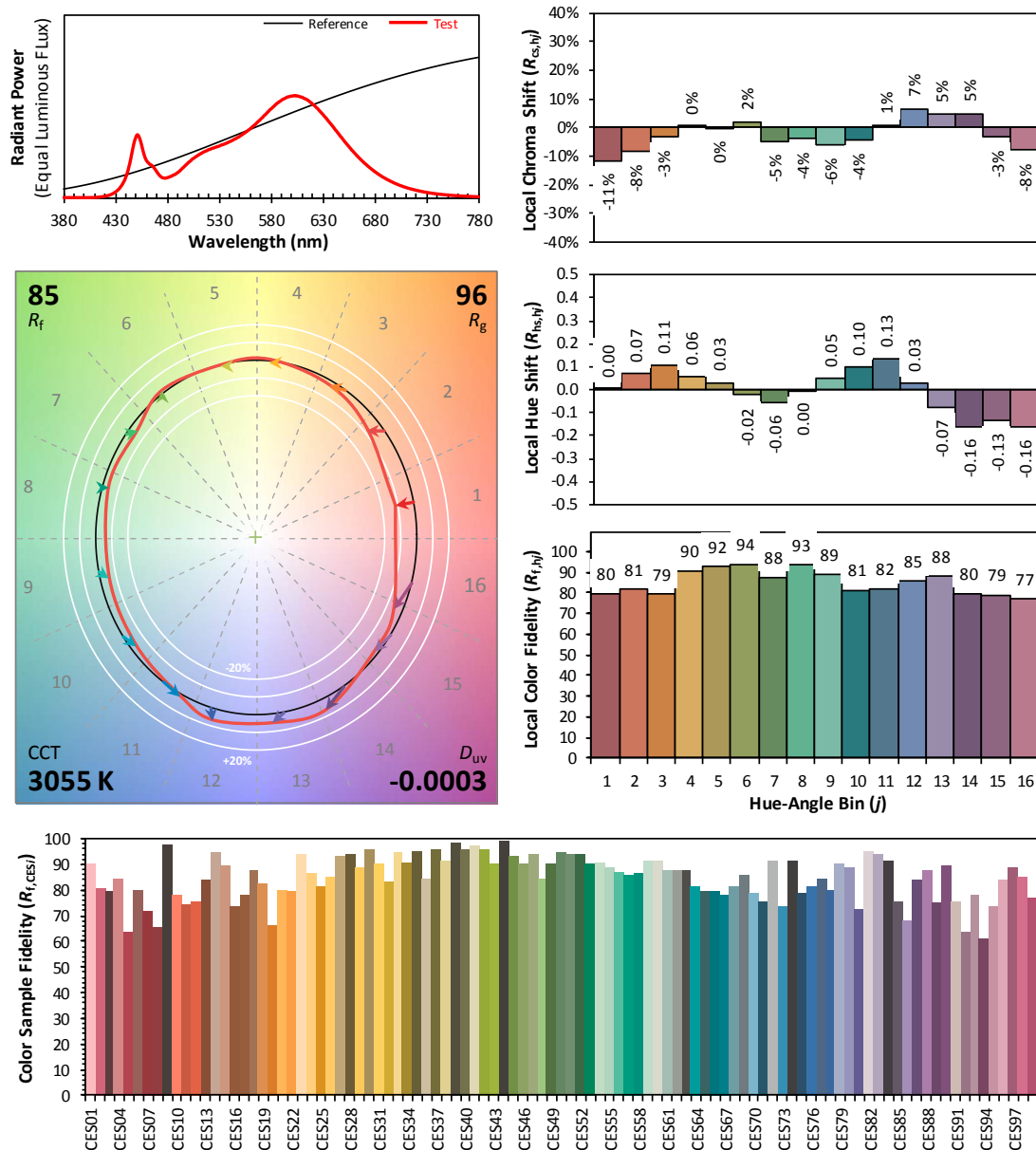


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method



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

x 0.4326

y 0.4017

u' 0.2488

v' 0.5198

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	29.278	1.72%
10- 20	84.567	4.98%
20- 30	130.628	7.69%
30- 40	163.124	9.60%
40- 50	179.958	10.59%
50- 60	181.492	10.68%
60- 70	170.194	10.02%
70- 80	150.356	8.85%
80- 90	128.178	7.54%
90-100	109.413	6.44%
100-110	92.698	5.46%
110-120	77.451	4.56%
120-130	63.82	3.76%
130-140	51.44	3.03%
140-150	39.479	2.32%
150-160	27.568	1.62%
160-170	15.042	0.89%
170-180	4.214	0.25%
Total	1698.9	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	769.047	45.27%
60- 90	448.728	26.41%
0-90	1217.775	71.68%
90- 180	481.125	28.32%
0- 180	1698.9	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

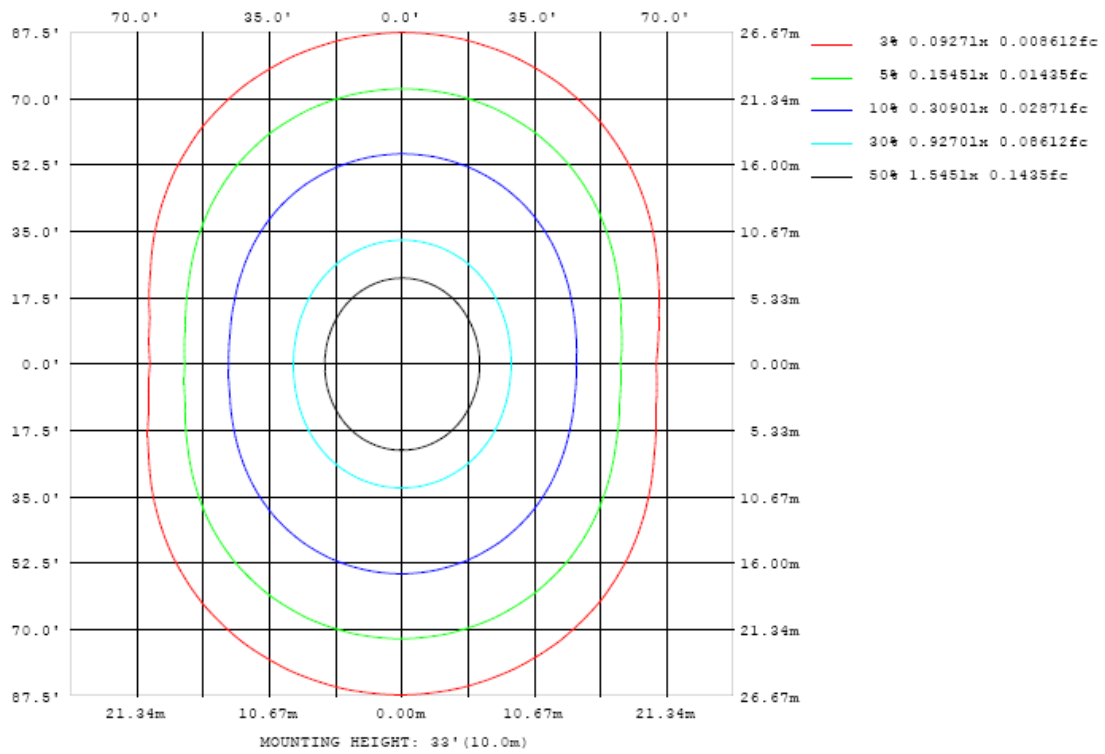


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

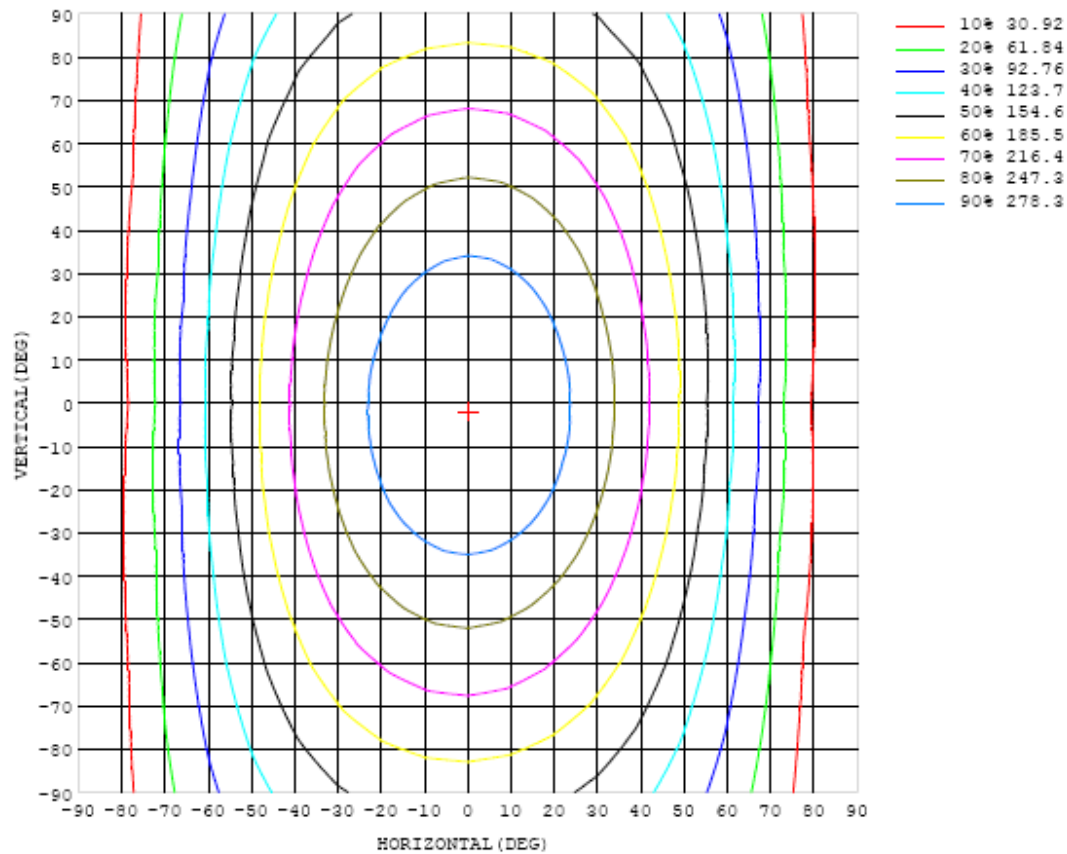


Chart 6: Isocandela Plot

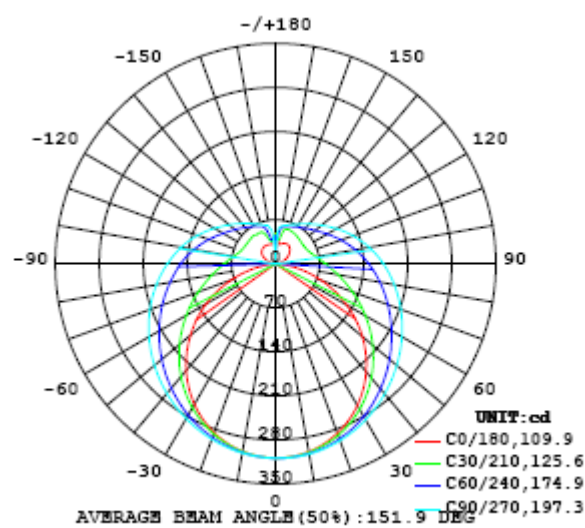


Chart 7: Polar Candela Distribution

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	309	309	309	309	309	309	309	309	309	309	309	309	309	309	309	309	309	309	309
5	307	308	308	308	308	308	309	308	309	309	308	308	308	308	308	308	307	307	307
10	303	304	304	304	305	306	306	306	307	307	307	306	306	306	305	304	303	303	303
15	296	297	298	298	300	301	302	303	304	304	303	303	302	301	299	298	297	296	296
20	287	288	289	290	292	294	296	298	299	299	299	297	296	294	292	289	288	287	286
25	274	276	277	280	283	286	289	291	293	293	293	291	289	286	282	279	276	274	273
30	260	261	264	267	272	276	280	283	285	286	285	283	280	276	271	266	262	259	258
35	243	245	248	253	259	265	270	274	277	278	277	275	271	265	259	252	247	242	240
40	224	226	230	237	245	253	259	265	268	270	269	265	260	253	245	236	229	223	221
45	203	205	211	220	230	240	248	255	259	261	259	255	249	241	230	220	210	203	200
50	180	183	190	202	214	226	236	244	249	251	250	245	238	228	215	202	190	180	177
55	156	159	169	183	198	213	225	233	239	242	240	235	227	215	200	184	169	157	153
60	130	135	148	165	183	199	213	223	229	232	230	225	215	202	186	167	148	133	127
65	104	110	126	147	168	186	201	212	219	222	220	214	204	190	171	150	127	108	101
70	77.4	84.7	105	130	154	174	190	201	209	212	210	204	193	178	158	134	108	84.5	74.0
75	51.9	61.5	86.1	114	140	162	179	191	199	202	200	194	183	166	145	119	90.1	62.8	48.0
80	27.9	40.4	69.6	101	128	151	168	181	188	191	190	183	172	156	133	106	75.0	43.6	24.6
85	9.24	24.4	57.0	89.0	117	140	158	170	178	181	180	173	162	145	123	95.4	63.6	29.5	6.75
90	0.58	15.7	47.7	79.4	108	130	148	160	168	171	170	163	152	136	114	86.3	55.0	21.9	0.36
95	1.63	12.7	41.5	71.6	98.9	121	138	151	158	161	160	153	142	126	105	78.6	48.9	19.0	2.01
100	4.89	13.6	37.6	65.6	90.8	112	129	141	148	151	149	143	133	117	96.8	72.0	44.9	19.5	5.24
105	8.95	16.3	36.0	60.5	83.6	104	119	131	138	141	139	133	123	109	89.5	67.3	43.0	21.6	9.29
110	13.2	20.4	36.0	56.9	77.4	95.9	111	121	128	131	129	124	114	101	83.1	63.3	42.6	25.2	13.8
115	17.9	24.9	37.1	54.7	72.4	88.8	102	112	119	121	120	115	106	93.4	77.6	60.8	43.4	29.2	18.2
120	22.2	29.5	39.1	53.5	68.6	82.8	94.7	104	109	112	111	106	97.9	87.0	73.5	59.2	44.8	33.3	22.5
125	26.0	33.8	41.7	53.1	66.1	77.9	88.1	95.8	101	103	102	97.9	91.1	81.8	70.1	58.3	46.5	37.1	26.4
130	29.2	37.9	44.5	53.3	64.0	73.8	82.5	89.2	93.6	95.5	94.5	91.1	85.3	77.4	68.2	58.0	48.4	40.5	29.1
135	32.1	40.4	47.2	54.0	62.5	70.5	77.7	83.4	87.1	88.7	88.0	85.0	80.2	73.5	66.1	57.9	50.3	43.7	30.7
140	34.5	42.1	49.7	55.0	61.5	68.3	73.6	78.3	81.4	82.7	82.1	79.7	75.7	70.3	64.5	58.0	52.2	46.5	31.9
145	36.0	42.9	51.9	56.0	60.9	66.1	70.1	73.8	76.3	77.4	76.9	75.0	71.9	68.2	63.2	58.3	53.8	48.6	32.7
150	36.2	45.4	53.9	56.9	60.5	64.2	67.7	69.9	71.9	72.7	72.3	70.9	68.9	65.9	62.3	58.7	55.1	49.5	33.0
155	35.5	44.1	54.6	57.8	60.3	62.9	65.2	67.2	68.5	68.7	68.5	68.0	66.4	64.1	61.5	58.4	54.1	48.7	32.8
160	34.3	38.9	51.9	58.2	60.2	61.8	63.3	64.6	65.6	66.0	65.8	65.2	64.1	62.7	57.8	53.9	48.3	44.4	32.5
165	32.7	35.6	41.4	56.5	59.7	61.0	61.9	62.6	63.1	63.4	63.3	62.9	62.0	54.8	50.2	44.6	41.8	38.5	32.0
170	32.8	31.5	33.0	41.7	53.3	57.1	59.1	60.9	61.1	61.2	61.1	57.7	47.7	41.2	41.5	40.4	39.2	33.8	31.9
175	41.6	38.5	37.7	39.3	42.0	41.4	44.1	47.2	54.8	57.2	43.5	31.4	37.2	41.8	41.7	44.0	41.7	42.0	40.4
180	8.73	8.73	8.73	8.72	8.71	8.70	8.69	8.67	8.66	8.64	8.66	8.67	8.68	8.69	8.70	8.71	8.72	8.72	8.72

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	309	309	309	309	309	309	309	309	309	309	309	309	309	309	309	309	309		
5	307	307	307	307	308	308	308	308	308	308	308	308	308	308	307	307	308		
10	303	303	303	303	304	305	305	305	305	305	305	305	305	304	304	304	303		
15	296	296	297	298	299	300	300	301	302	301	301	300	300	298	297	297	297		
20	286	287	288	290	292	294	295	296	297	296	295	294	293	291	289	288	287		
25	274	275	277	280	283	286	288	290	291	290	289	287	285	282	279	276	275		
30	259	261	264	269	273	278	281	283	284	284	282	279	275	271	266	263	261		
35	242	245	250	256	262	268	272	276	277	276	273	270	265	259	252	248	245		
40	222	227	234	242	250	258	263	267	269	268	265	260	253	245	237	231	226		
45	202	208	217	228	238	247	254	258	260	259	255	249	241	231	221	212	206		
50	179	188	199	213	225	236	244	249	251	250	246	239	229	217	204	193	184		
55	156	167	181	197	213	225	234	240	242	241	236	228	216	202	187	172	162		
60	132	146	164	183	200	214	224	230	232	231	225	216	204	188	169	152	138		
65	107	125	147	168	187	203	213	220	223	221	215	205	191	173	153	132	114		
70	82.4	105	131	155	175	192	203	210	213	211	205	195	179	160	137	112	89.6		
75	59.2	86.0	116	143	164	181	193	200	203	201	194	184	168	148	122	93.6	66.6		
80	39.0	70.2	103	131	154	170	182	190	192	190	184	173	157	136	109	77.7	46.5		
85	24.1	57.9	91.3	120	143	160	172	179	182	180	174	163	147	125	97.3	64.9	31.0		
90	16.5	49.3	82.1	110	134	151	162	169	172	170	164	153	137	115	87.6	55.5	22.0		
95	14.0	43.4	74.4	102	124	141	153	160	162	160	155	144	128	106	79.4	48.8	18.1		
100	15.2	39.6	67.9	93.7	115	132	143	150	153	151	145	134	118	97.6	72.3	43.9	17.7		
105	18.2	38.4	62.7	86.4	107	122	133	140	142	140	134	124	109	89.8	66.3	41.3	19.6		
110	22.5	38.7	59.3	80.0	98.5	113	123	130	132	130	125	115	101	82.8	61.9	40.6	23.2		
115	27.0	40.2	57.3	75.0	91.2	105	114	120	122	121	115	106	93.2	77.1	59.0	40.9	27.2		
120	31.4	42.1	56.3	71.3	85.2	96.7	105	111	113	111	106	97.8	86.6	72.7	57.2	42.2	31.5		
125	35.7	44.3	55.9	68.5	80.4	90.3	97.5	102	104	103	98.1	91.0	81.3	69.4	56.3	44.3	35.5		
130	39.6	46.6	56.0	66.4	76.3	84.7	90.9	94.9	96.4	95.1	91.3	85.2	76.9	66.8	56.0	46.6	39.3		
135	42.8	48.6	56.3	64.7	72.8	79.8	85.1	88.5	89.7	88.7	85.3	80.1	73.2	64.8	56.3	48.9	42.9		
140	43.5	50.4	56.8	63.4	69.9	75.6	79.9	82.7	83.7	82.9	80.1	75.8	70.1	63.4	56.8	51.0	45.6		
145	44.3	52.4	56.6	62.3	67.5	71.9	75.4	77.6	78.4	77.7	75.5	72.0	67.6	62.5	57.4	52.9	47.4		
150	45.2	54.1	55.7	61.6	65.4	68.8	71.4	73.1	73.7	73.2	71.5	68.9	65.5	61.8	58.0	54.8	49.2		
155	41.8	53.0	55.7	58.0	63.6	66.0	67.9	69.2	69.7	69.3	68.1	66.3	64.0	61.4	58.7	56.5	47.0		
160	38.5	44.7	50.7	53.3	59.1	63.7	65.0	65.9	66.3	66.1	65.4	64.3	62.9	61.2	59.5	56.7	42.4		
165	34.5	35.8	40.9	45.1	48.3	56.3	61.2	63.2	63.6	63.6	63.1	62.5	61.8	60.9	59.0	55.7	38.4		
170	32.1	33.4	36.5	40.3	40.7	39.9	46.1	55.0	59.3	61.5	61.3	60.9	58.4	56.2	53.3	43.5	34.5		
175	40.3	41.8	40.8	43.2	40.5	40.5	34.9	28.3	37.2	54.8	51.5	47.3	45.8	43.2	43.5	41.0	40.8		
180	8.72	8.72	8.71	8.70	8.69	8.68	8.67	8.66	8.64	8.66	8.67	8.69	8.70	8.71	8.72	8.73	8.73		

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 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

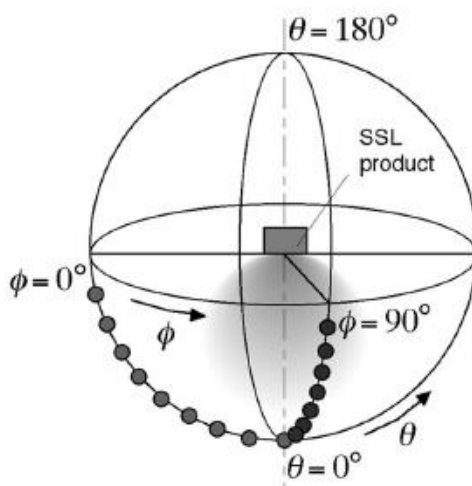
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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

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.