

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/850/DEB

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ20070023h

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/850/DEB

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
178.6	1832.9	10.26	0.9790
CCT (K)	CRI	Stabilization Time (Light & Power)	
5081	82.7	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. 23, 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

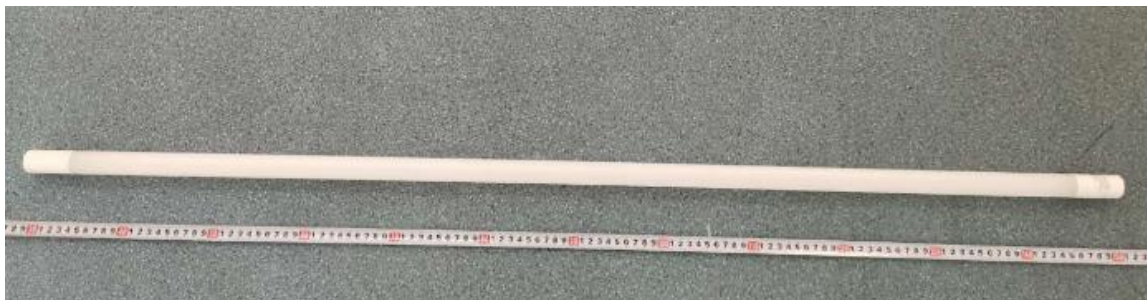


Figure 1- Overview of the sample

Equipment Under Test(EUT)

Name	: LED Tube
Model	: 10T8/4F/850/DEB
Electrical Ratings	: 120-277V, 50/60Hz, 10W
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)	0.087	0.041
Power Factor	0.9790	0.9092
Test Power (W)	10.26	10.39
THD A%	18.35	20.45
Luminous Efficacy (lm/W)	178.6	176.1
Total Luminous Flux (lm)	1832.9	1829.4
Color Rendering Index (CRI)	82.7	
R9	5.7	
Correlated Color Temperature (CCT)(K)	5081	
Chromaticity Chroma x	0.3431	
Chromaticity Chroma y	0.3534	
Chromaticity Chroma u	0.2093	
Chromaticity Chroma v	0.3235	
Duv	0.0017	
Chromaticity Chroma u'	0.2093	
Chromaticity Chroma v'	0.4852	

Special Color Rendering Indices	
R1	81
R2	87.8
R3	92.2
R4	82.6
R5	81.8
R6	82.7
R7	86.5
R8	66.7
R9	5.7
R10	70.9
R11	82.1
R12	60.3
R13	82.8
R14	95.9

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	0.9793
Power (W)	10.27
Luminous Efficacy (lm/W)	177.2
Total Luminous Flux (lm)	1819.9
Beam Angle (°)	109.9 (0°-180°) / 199.7 (90°-270°)
Center Beam Candle Power (cd)	326
Maximum Beam Candle Power (cd)	326.6 (At: C=50.0, Gamma=1.5)
Spacing Criteria	1.25 (0°-180°) / 1.39 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	44.80%
Zonal Lumens in the 60 °-90 °Zone	26.33%
Zonal Lumens in the 90 °-120 °Zone	16.61%
Zonal Lumens in the 120 °-180 °Zone	12.26%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

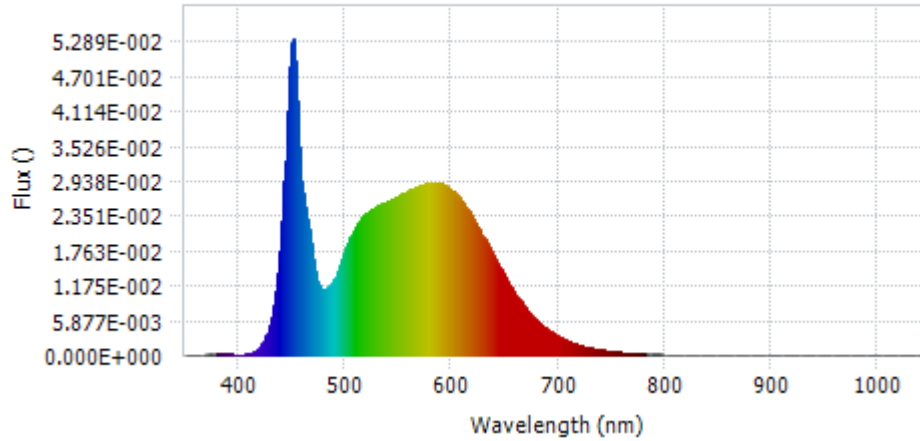
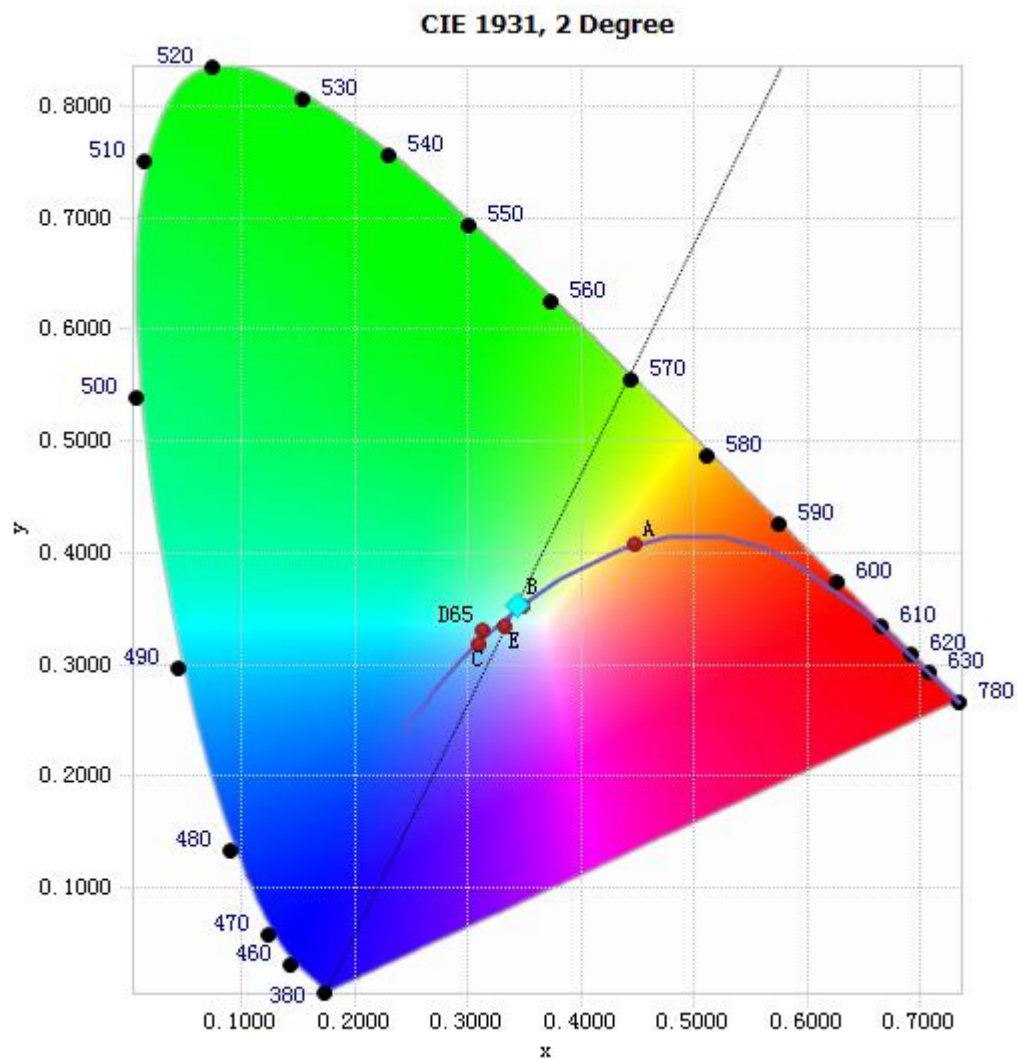


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.95E-04	485	1.16E-02	590	2.89E-02	695	3.72E-03
385	1.75E-04	490	1.28E-02	595	2.85E-02	700	3.18E-03
390	1.78E-04	495	1.51E-02	600	2.78E-02	705	2.72E-03
395	1.49E-04	500	1.76E-02	605	2.70E-02	710	2.31E-03
400	1.20E-04	505	1.98E-02	610	2.58E-02	715	1.98E-03
405	1.34E-04	510	2.15E-02	615	2.45E-02	720	1.70E-03
410	2.76E-04	515	2.30E-02	620	2.30E-02	725	1.45E-03
415	6.19E-04	520	2.39E-02	625	2.15E-02	730	1.23E-03
420	1.36E-03	525	2.45E-02	630	1.98E-02	735	1.06E-03
425	2.87E-03	530	2.50E-02	635	1.81E-02	740	8.98E-04
430	5.75E-03	535	2.55E-02	640	1.64E-02	745	7.68E-04
435	1.08E-02	540	2.59E-02	645	1.47E-02	750	6.57E-04
440	2.00E-02	545	2.64E-02	650	1.31E-02	755	5.60E-04
445	3.70E-02	550	2.68E-02	655	1.16E-02	760	4.76E-04
450	5.28E-02	555	2.74E-02	660	1.02E-02	765	4.13E-04
455	4.28E-02	560	2.78E-02	665	8.94E-03	770	3.52E-04
460	2.75E-02	565	2.82E-02	670	7.78E-03	775	3.02E-04
465	2.21E-02	570	2.86E-02	675	6.75E-03	780	2.62E-04
470	1.63E-02	575	2.89E-02	680	5.84E-03		
475	1.19E-02	580	2.91E-02	685	5.04E-03		
480	1.10E-02	585	2.91E-02	690	4.33E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3431, 0.3534)

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

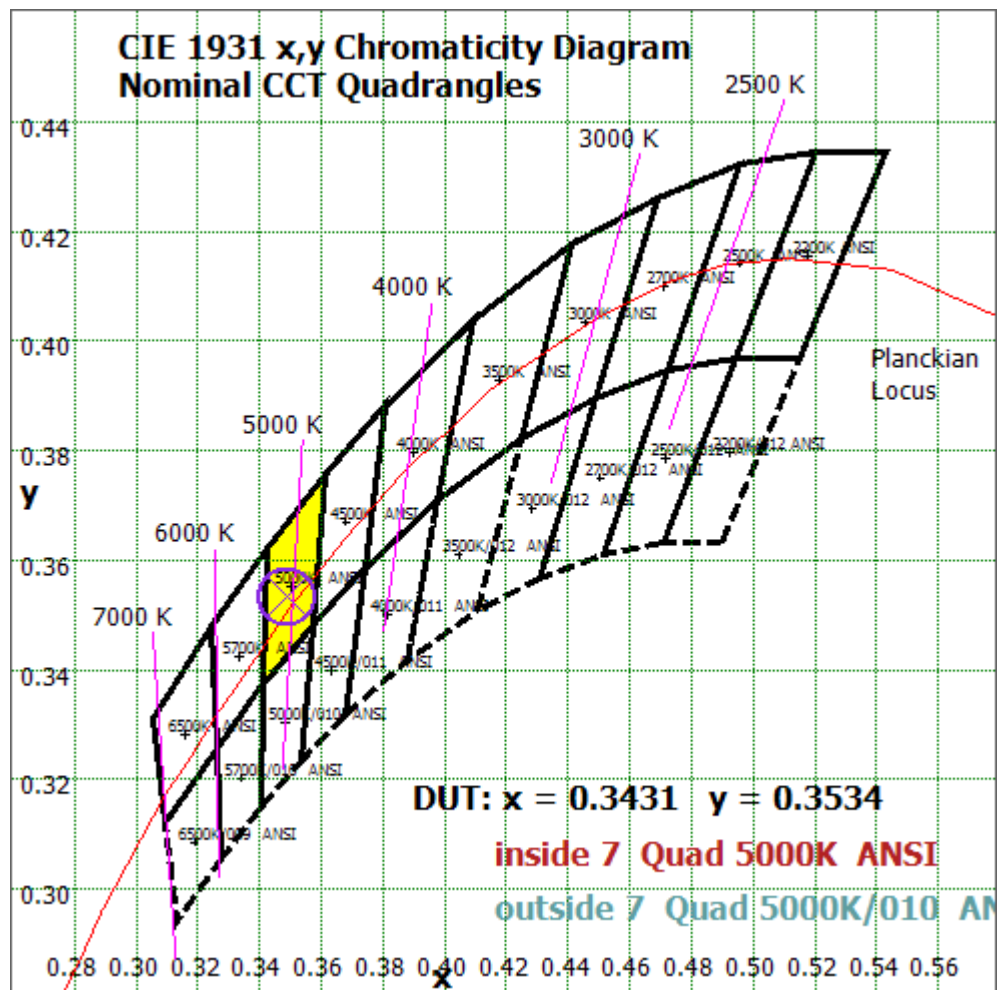
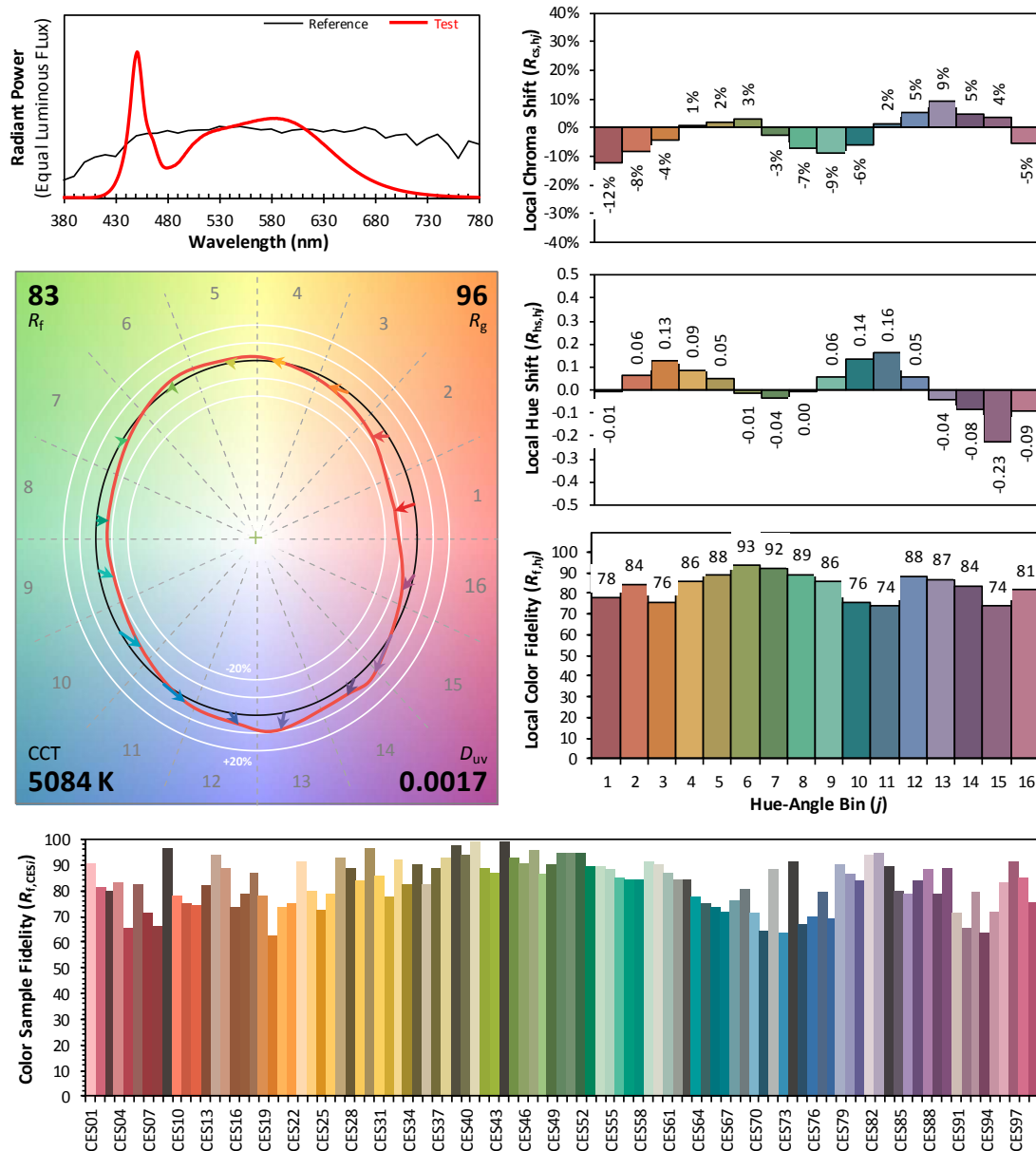


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method



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

x 0.3431
 y 0.3534
 u' 0.2093
 v' 0.4852

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	30.954	1.70%
10- 20	89.435	4.91%
20- 30	138.258	7.60%
30- 40	172.844	9.50%
40- 50	190.959	10.49%
50- 60	192.882	10.60%
60- 70	181.235	9.96%
70- 80	160.545	8.82%
80- 90	137.352	7.55%
90-100	117.509	6.46%
100-110	100.301	5.51%
110-120	84.481	4.64%
120-130	70.113	3.85%
130-140	56.809	3.12%
140-150	43.882	2.41%
150-160	30.633	1.68%
160-170	16.576	0.91%
170-180	5.166	0.28%
Total	1819.9	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	815.332	44.80%
60- 90	479.132	26.33%
0-90	1294.464	71.13%
90- 180	525.47	28.87%
0- 180	1819.9	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

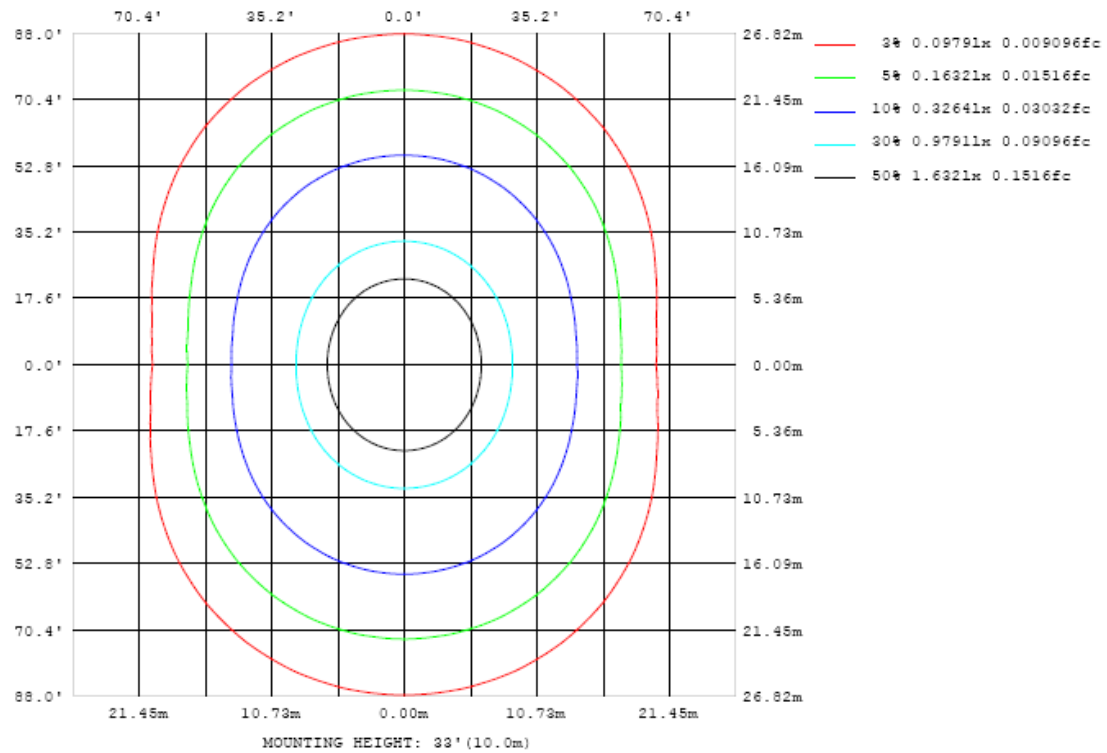


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

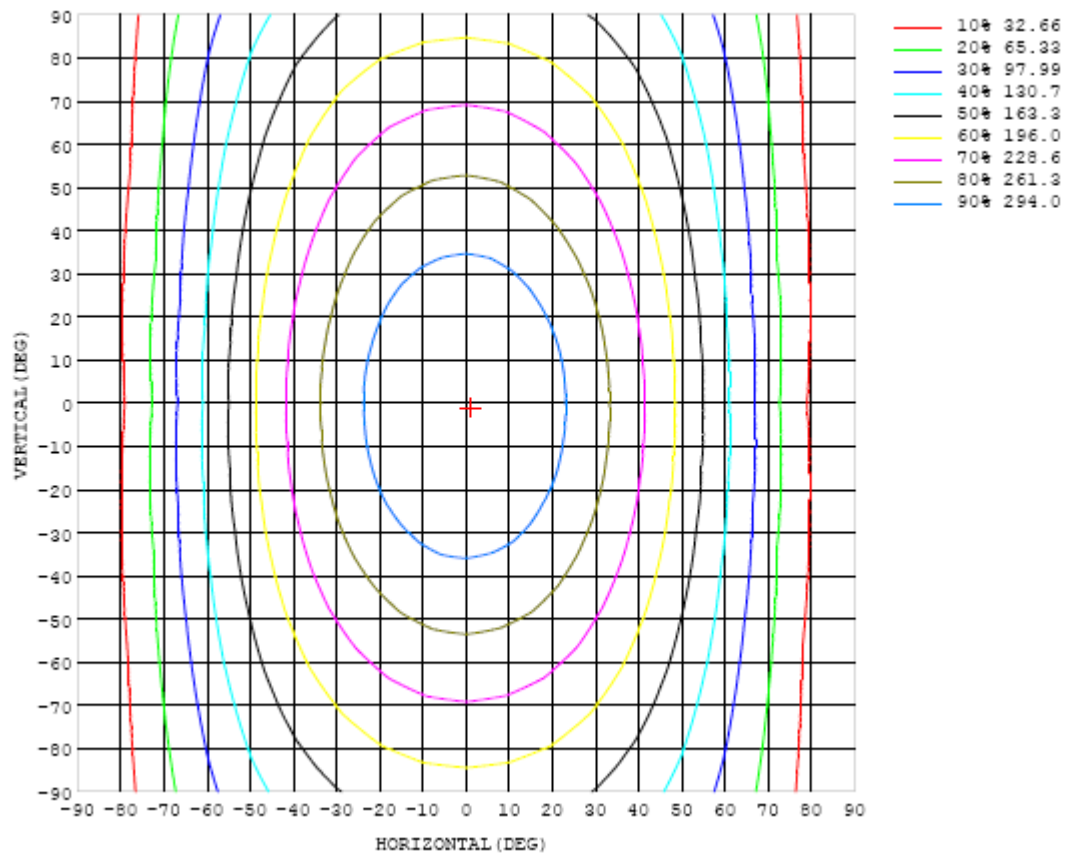


Chart 6: Isocandela Plot

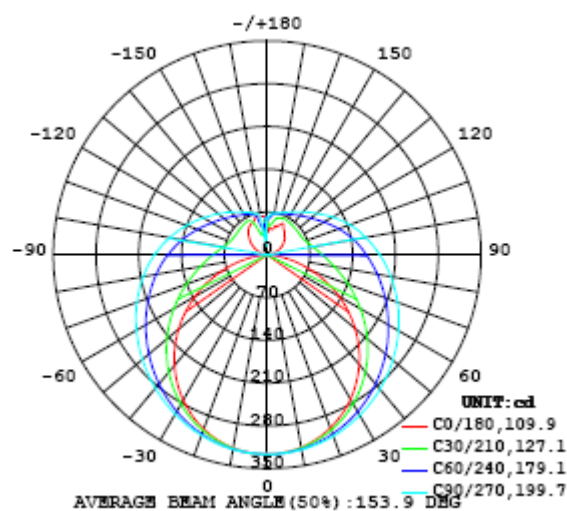


Chart 7: Polar Candela Distribution

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	326	326	326	326	326	326	326	326	326	326	326	326	326	326	326	326	326	326	326
5	325	325	325	325	325	326	326	326	326	326	326	326	326	326	325	325	325	325	325
10	320	320	320	321	321	322	323	323	324	324	324	324	323	323	322	322	321	321	321
15	312	312	313	314	316	317	318	320	320	320	321	320	319	318	317	315	314	314	314
20	302	302	303	305	308	310	312	314	315	316	316	315	313	311	309	307	305	304	304
25	288	289	291	294	298	301	305	308	309	310	310	308	306	303	299	296	293	291	291
30	273	274	277	281	286	291	296	300	302	303	303	300	297	293	288	283	279	276	275
35	255	256	260	266	273	280	286	292	294	295	295	292	287	281	275	268	262	258	257
40	234	237	242	250	259	268	276	282	286	287	286	282	276	269	261	252	244	238	236
45	212	215	222	232	244	255	265	272	276	278	277	272	265	256	245	234	224	217	214
50	188	192	201	214	228	241	253	262	266	268	267	262	253	242	230	216	203	193	189
55	162	167	179	195	212	228	241	251	256	258	257	251	241	229	213	197	181	169	163
60	136	142	157	176	196	214	229	240	246	248	246	240	229	215	198	178	159	144	137
65	108	116	135	158	181	201	217	229	235	238	235	229	217	202	182	160	137	118	109
70	79.9	89.9	114	141	166	188	205	218	224	227	225	218	206	189	168	143	116	92.2	80.5
75	52.6	65.4	93.9	125	154	176	194	207	214	216	214	207	194	177	154	127	95.8	67.9	53.8
80	28.2	44.0	77.1	112	142	165	183	196	203	206	203	196	183	165	142	113	78.9	46.4	28.6
85	8.38	28.1	64.2	99.9	130	155	172	185	192	195	193	185	172	155	131	101	65.5	30.1	8.96
90	0.30	19.8	55.2	90.3	120	145	162	175	182	184	182	175	162	145	121	90.7	56.0	20.8	0.44
95	2.21	17.1	49.5	82.7	112	135	153	165	172	174	172	164	153	135	112	82.7	49.8	17.3	1.80
100	6.05	18.1	45.6	76.3	104	126	144	156	162	164	162	155	143	126	103	75.9	45.3	17.5	5.00
105	10.9	21.2	43.7	70.9	96.3	118	134	146	152	154	152	145	134	117	95.6	70.2	42.9	20.4	9.23
110	16.4	25.9	43.9	66.7	89.6	109	125	136	142	144	142	135	124	109	88.7	65.7	42.5	25.0	14.1
115	22.0	30.9	45.4	64.3	83.7	101	116	126	132	134	132	125	115	101	82.7	62.9	43.5	29.8	20.0
120	27.6	35.8	47.6	63.1	79.4	94.5	107	117	122	124	122	116	107	93.5	78.0	61.3	45.5	34.8	25.8
125	32.3	40.6	50.0	62.7	76.2	88.9	99.6	108	113	114	112	107	98.8	87.7	74.7	60.7	48.1	39.8	31.7
130	37.0	45.1	52.6	62.8	73.9	84.5	93.5	100	104	105	104	99.6	92.5	83.3	72.4	60.9	51.0	44.6	37.1
135	40.7	49.0	55.1	63.2	72.1	80.8	88.2	93.8	97.1	98.1	96.9	93.2	87.3	79.6	70.7	61.5	53.9	48.9	42.5
140	44.2	51.6	57.4	63.7	70.8	77.7	83.7	88.2	91.0	91.8	90.7	87.7	82.8	76.6	69.5	62.5	56.6	52.7	47.9
145	48.8	55.3	59.6	64.3	69.7	75.1	79.8	83.4	85.6	86.2	85.3	82.9	79.1	74.2	68.8	63.4	59.0	55.9	52.9
150	54.2	58.3	58.8	64.9	68.9	72.9	76.5	79.2	80.9	81.3	80.7	78.8	75.9	72.2	68.2	64.5	61.3	59.0	55.8
155	56.1	59.0	61.1	65.6	68.3	71.1	73.7	75.6	76.8	77.1	76.7	75.4	73.3	70.7	68.0	65.4	63.3	62.0	57.9
160	49.6	57.8	61.3	64.4	68.0	69.7	71.4	72.7	73.5	73.7	73.4	72.6	71.3	69.7	67.9	66.3	65.0	64.4	61.3
165	48.1	50.9	56.9	62.3	66.0	68.7	69.6	70.3	70.8	71.0	70.9	70.5	69.8	68.9	67.9	67.1	66.3	65.5	65.0
170	43.5	45.1	49.1	55.3	62.2	66.0	68.4	68.7	68.9	69.0	69.0	68.9	68.7	68.3	67.9	67.5	67.0	65.4	64.3
175	42.4	41.5	43.0	47.8	53.2	58.8	63.5	66.2	67.3	67.8	67.9	67.9	67.8	67.6	67.2	66.8	66.2	65.2	63.4
180	60.1	60.1	60.1	60.1	60.1	60.1	60.1	60.1	60.1	60.1	60.1	60.1	60.1	60.1	60.1	60.1	60.1	60.1	60.1

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	326	326	326	326	326	326	326	326	326	326	326	326	326	326	326	326	326		
5	325	325	326	326	326	326	325	325	325	326	326	326	325	325	325	325	325		
10	321	321	322	322	323	323	323	323	323	323	323	323	322	321	321	320	320		
15	314	314	315	316	318	319	319	319	319	319	319	318	316	315	314	313	313		
20	304	305	306	308	311	312	314	314	314	314	313	311	309	307	305	303	302		
25	291	293	295	298	302	305	307	308	308	308	306	303	300	297	294	291	289		
30	276	278	282	287	292	296	299	301	301	300	298	294	290	285	280	276	274		
35	258	262	267	274	280	286	290	293	293	292	289	284	278	271	265	259	256		
40	238	243	251	259	268	276	281	284	285	284	280	273	265	257	248	241	236		
45	216	223	233	244	255	264	271	275	276	274	269	262	252	242	231	221	214		
50	193	202	214	228	242	253	261	265	267	265	259	250	239	226	212	200	191		
55	168	179	195	212	228	241	250	255	257	255	249	239	226	210	194	178	166		
60	142	157	176	197	215	229	240	245	247	245	238	227	212	195	175	156	141		
65	116	134	158	181	202	218	229	235	237	235	227	216	200	180	157	134	115		
70	89.4	113	141	167	189	207	218	225	227	224	217	204	187	166	140	113	89.0		
75	65.1	93.2	125	153	177	195	208	215	216	214	206	193	175	152	125	93.7	65.4		
80	43.2	76.3	111	141	166	184	197	204	206	203	195	182	164	140	111	77.5	44.5		
85	26.9	63.5	98.9	130	155	174	186	193	195	193	185	172	153	129	99.4	65.3	29.2		
90	18.4	53.9	88.8	119	144	163	175	182	184	182	174	161	143	119	89.6	56.0	20.9		
95	15.5	47.1	80.1	110	134	152	164	171	173	171	163	150	133	110	81.3	49.3	17.9		
100	16.7	43.3	73.2	101	124	141	153	160	162	159	152	140	123	101	74.5	45.4	18.8		
105	19.6	42.0	67.9	93.1	115	131	143	149	151	149	142	130	114	93.6	69.2	43.9	21.5		
110	23.6	42.4	64.4	86.6	106	122	132	138	141	138	132	121	106	87.2	65.7	44.4	25.3		
115	28.1	43.9	62.6	81.6	98.7	113	123	128	130	128	122	112	98.7	82.2	63.7	45.8	29.4		
120	32.0	46.2	61.4	77.7	92.6	105	114	119	121	119	113	105	92.8	78.7	63.0	47.9	33.2		
125	35.2	49.1	61.1	74.6	87.5	98.2	106	111	112	111	106	98.2	87.9	75.7	62.6	50.4	36.1		
130	36.7	51.9	61.4	72.4	83.1	92.4	99.1	103	105	103	99.1	92.4	83.6	73.5	62.6	53.1	38.1		
135	36.9	54.4	62.1	70.9	79.5	87.3	92.9	96.4	97.6	96.6	93.0	87.4	80.1	71.8	63.0	55.7	39.1		
140	35.8	56.5	62.9	69.9	76.5	82.8	87.5	90.4	91.4	90.5	87.6	83.0	77.0	70.5	63.5	57.7	38.6		
145	34.3	57.4	63.5	69.2	74.1	79.0	82.7	85.1	85.9	85.2	82.8	79.2	74.5	69.6	64.1	58.4	37.0		
150	38.2	54.8	64.1	68.6	72.1	75.9	78.7	80.4	81.0	80.5	78.7	75.9	72.4	68.0	64.7	54.2	39.8		
155	44.5	44.3	60.4	68.5	70.5	73.1	75.2	76.4	76.8	76.4	75.1	73.2	66.9	62.7	58.0	44.9	42.4		
160	45.6	33.5	44.5	61.8	69.6	70.2	72.0	72.9	73.2	73.2	70.4	59.1	54.9	52.1	48.4	37.1	38.9		
165	54.7	37.7	33.6	38.5	50.2	62.6	66.3	69.4	69.9	61.2	47.8	48.9	46.9	42.0	37.3	35.1	41.0		
170	59.2	48.5	40.3	39.1	44.1	47.3	49.2	51.8	49.3	48.5	50.7	48.3	44.9	40.5	37.5	35.6	41.3		
175	60.7	58.4	56.3	54.2	52.4	50.9	46.7	35.5	21.5	44.7	44.8	44.8	44.2	43.2	43.5	45.6	45.2		
180	60.1	60.1	60.1	60.1	60.1	60.1	60.1	60.1	60.1	60.1	60.1	60.1	60.1	60.1	60.1	60.1	60.1		

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 ***

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