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/835/DEB

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ20070023f

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

Review by: April Zou

Engineer: April Zou

Aug. 03, 2020

Approved by: Jim Zhang

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/835/DEB**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
165.7	1746.8	10.54	0.9786

CCT (K)	CRI	Stabilization Time (Light & Power)
3466	83.4	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)	
Name	: LED Tube
Model	: 10T8/4F/835/DEB
Electrical Ratings	: 120-277V, 50/60Hz, 10W
Product Description	: 3500K
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 25.3 ℃.

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)	0.090	0.042
Power Factor	0.9786	0.9092
Test Power (W)	10.54	10.63
THD A%	18.64	20.53
Luminous Efficacy (lm/W)	165.7	163.3
Total Luminous Flux (lm)	1746.8	1735.8
Color Rendering Index (CRI)	83.4	
R9	8.5	
Correlated Color Temperature (CCT)(K)	3466	
Chromaticity Chroma x	0.4072	
Chromaticity Chroma y	0.3920	
Chromaticity Chroma u	0.2364	
Chromaticity Chroma v	0.3414	
Duv	0.0002	
Chromaticity Chroma u ’	0.2364	
Chromaticity Chroma v’	0.5121	

Special Color Rendering Indices	
R1	81.8
R2	91
R3	96.4
R4	81.7
R5	82.1
R6	88.2
R7	84.3
R8	61.8
R9	8.5
R10	79.1
R11	81.2
R12	67.2
R13	84.2
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 ℃.

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)	0.090
Power Factor	0.9787
Power (W)	10.54
Luminous Efficacy (lm/W)	163.0
Total Luminous Flux (lm)	1718.3
Beam Angle (°)	110.0 (0^o-180^o) / 196.4 (90^o-270^o)
Center Beam Candle Power (cd)	312
Maximum Beam Candle Power (cd)	312.4 (At: C=340.0, Gamma=1.5)
Spacing Criteria	1.24 (0^o-180^o) / 1.40 (90^o-270^o)
Zonal Lumens in the 0 °-60 °Zone	45.30%
Zonal Lumens in the 60 °-90 °Zone	26.37%
Zonal Lumens in the 90 °-120 °Zone	16.42%
Zonal Lumens in the 120 °-180 °Zone	11.91%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

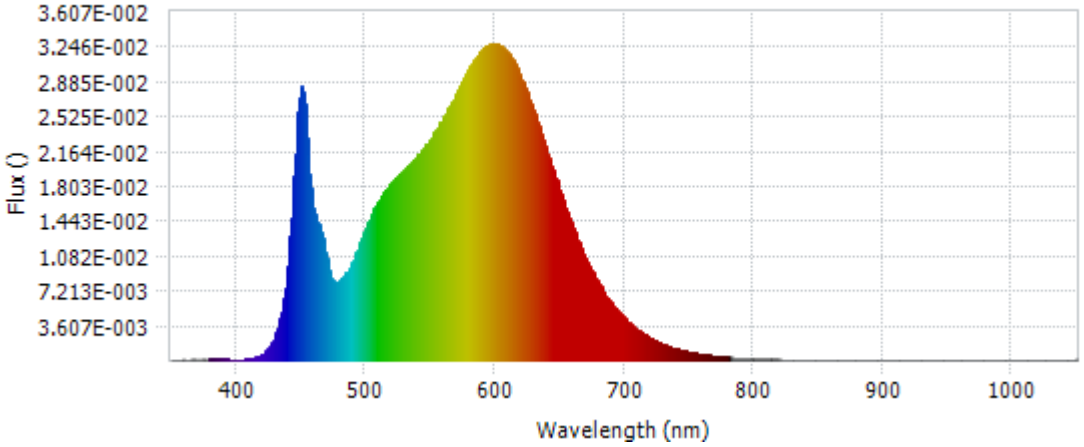
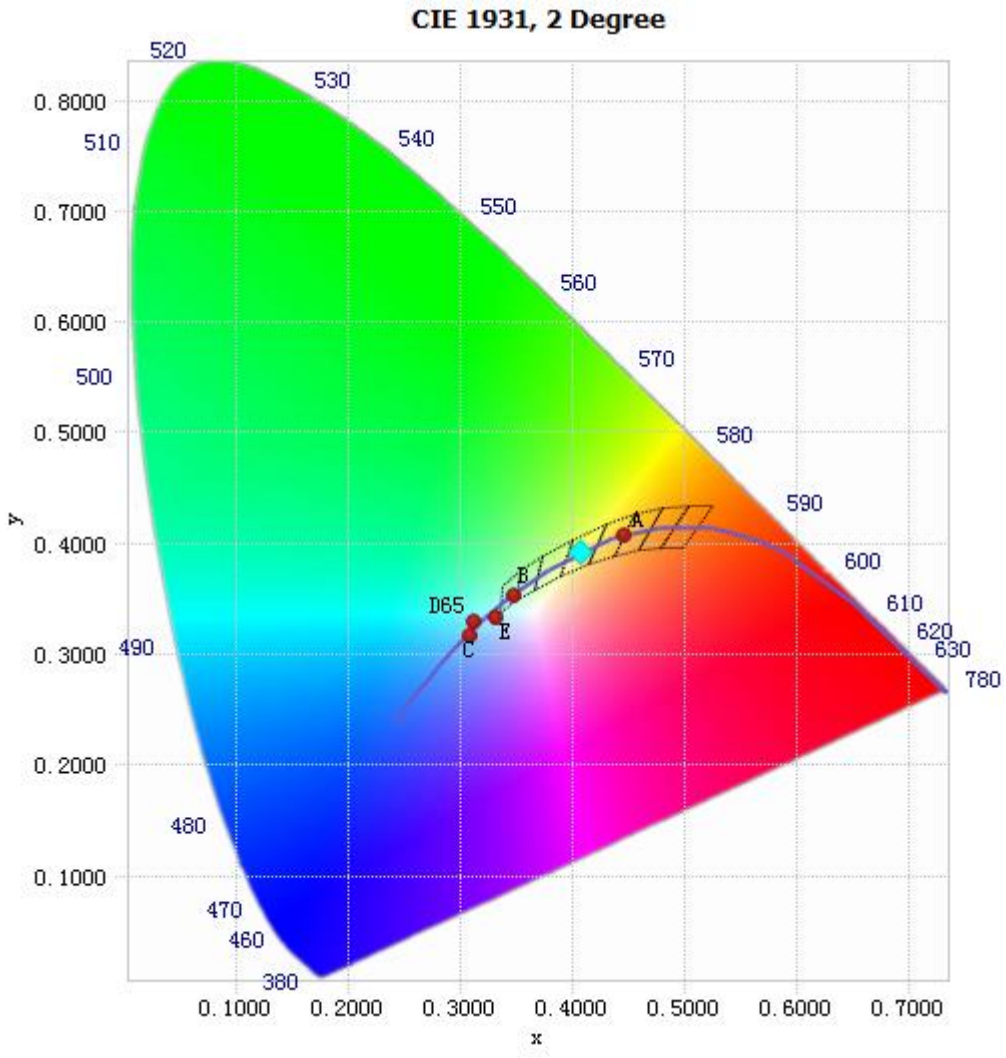


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.26E-04	485	9.03E-03	590	3.21E-02	695	5.15E-03
385	1.23E-04	490	1.02E-02	595	3.27E-02	700	4.40E-03
390	1.18E-04	495	1.18E-02	600	3.28E-02	705	3.76E-03
395	1.09E-04	500	1.36E-02	605	3.26E-02	710	3.20E-03
400	9.04E-05	505	1.52E-02	610	3.19E-02	715	2.74E-03
405	1.05E-04	510	1.64E-02	615	3.08E-02	720	2.35E-03
410	1.77E-04	515	1.76E-02	620	2.94E-02	725	2.00E-03
415	3.28E-04	520	1.84E-02	625	2.78E-02	730	1.70E-03
420	6.41E-04	525	1.90E-02	630	2.59E-02	735	1.45E-03
425	1.26E-03	530	1.97E-02	635	2.39E-02	740	1.24E-03
430	2.54E-03	535	2.04E-02	640	2.19E-02	745	1.06E-03
435	4.96E-03	540	2.11E-02	645	1.98E-02	750	9.02E-04
440	9.68E-03	545	2.20E-02	650	1.77E-02	755	7.66E-04
445	1.90E-02	550	2.29E-02	655	1.58E-02	760	6.52E-04
450	2.81E-02	555	2.39E-02	660	1.39E-02	765	5.65E-04
455	2.31E-02	560	2.50E-02	665	1.23E-02	770	4.81E-04
460	1.58E-02	565	2.62E-02	670	1.07E-02	775	4.12E-04
465	1.36E-02	570	2.76E-02	675	9.30E-03	780	3.51E-04
470	1.05E-02	575	2.89E-02	680	8.05E-03		
475	8.31E-03	580	3.01E-02	685	6.96E-03		
480	8.28E-03	585	3.13E-02	690	5.98E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4072, 0.3920)

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

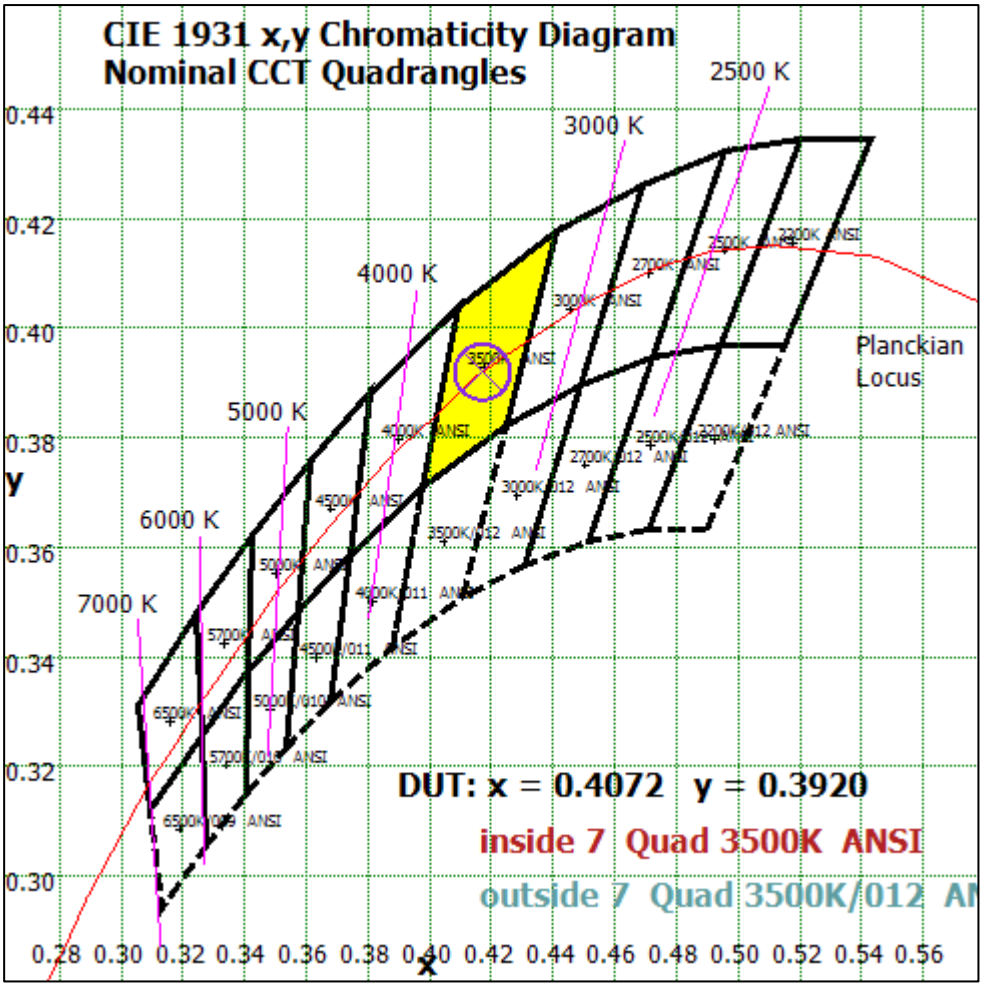
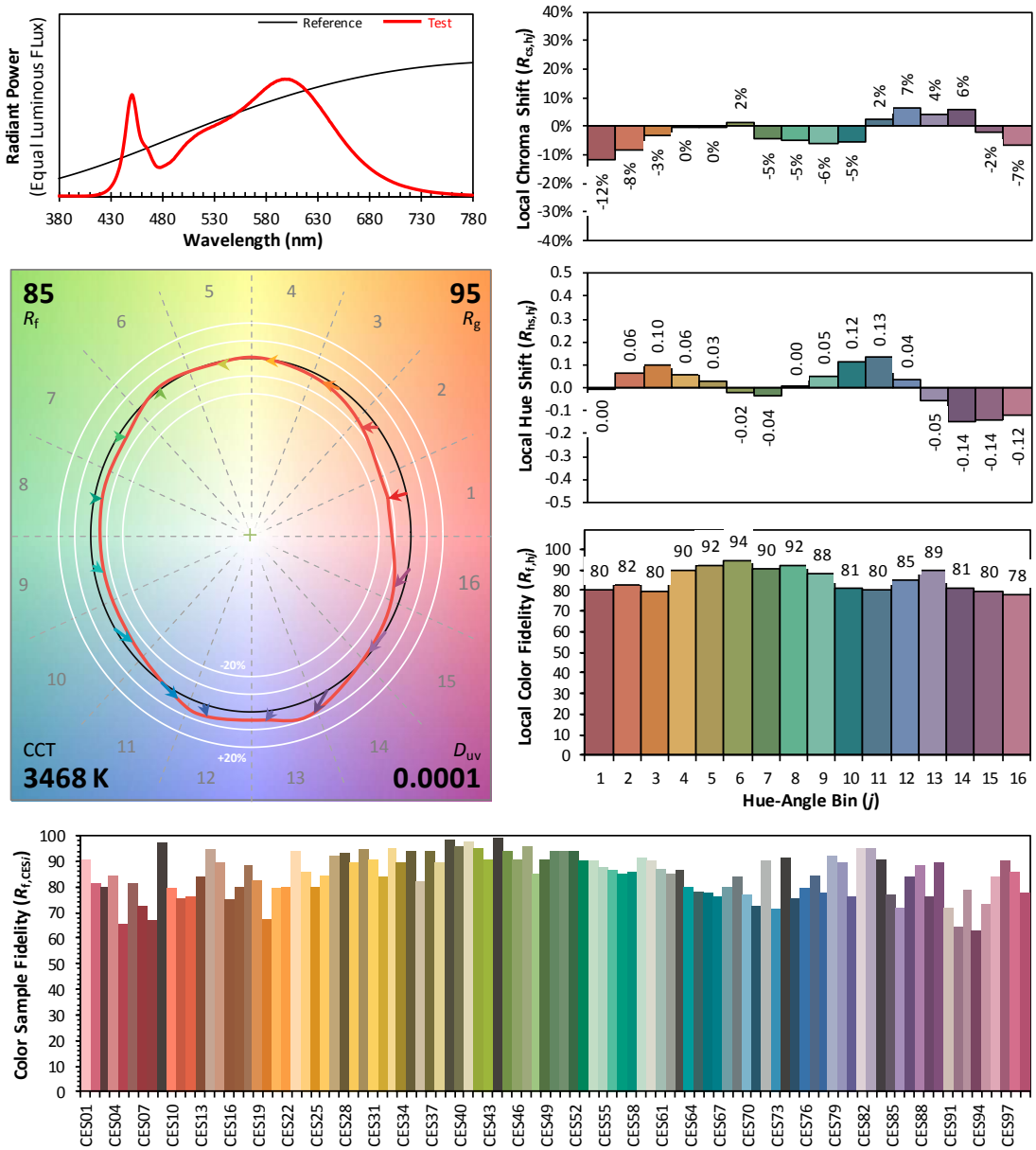


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method



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

x	0.4072
y	0.3920
u'	0.2364
v'	0.5121

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

γ(°)	Lumens	% Total
0- 10	29.598	1.72%
10- 20	85.522	4.98%
20- 30	132.18	7.69%
30- 40	165.132	9.61%
40- 50	182.228	10.61%
50- 60	183.703	10.69%
60- 70	172.043	10.01%
70- 80	151.757	8.83%
80- 90	129.224	7.52%
90-100	110.185	6.41%
100-110	93.589	5.45%
110-120	78.419	4.56%
120-130	64.732	3.77%
130-140	52.199	3.04%
140-150	40.084	2.33%
150-160	27.923	1.63%
160-170	15.103	0.88%
170-180	4.64	0.27%
Total	1718.3	100%

γ(°)	Lumens	% Total
0- 60	778.363	45.30%
60- 90	453.024	26.37%
0-90	1231.387	71.66%
90- 180	486.874	28.34%
0- 180	1718.3	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

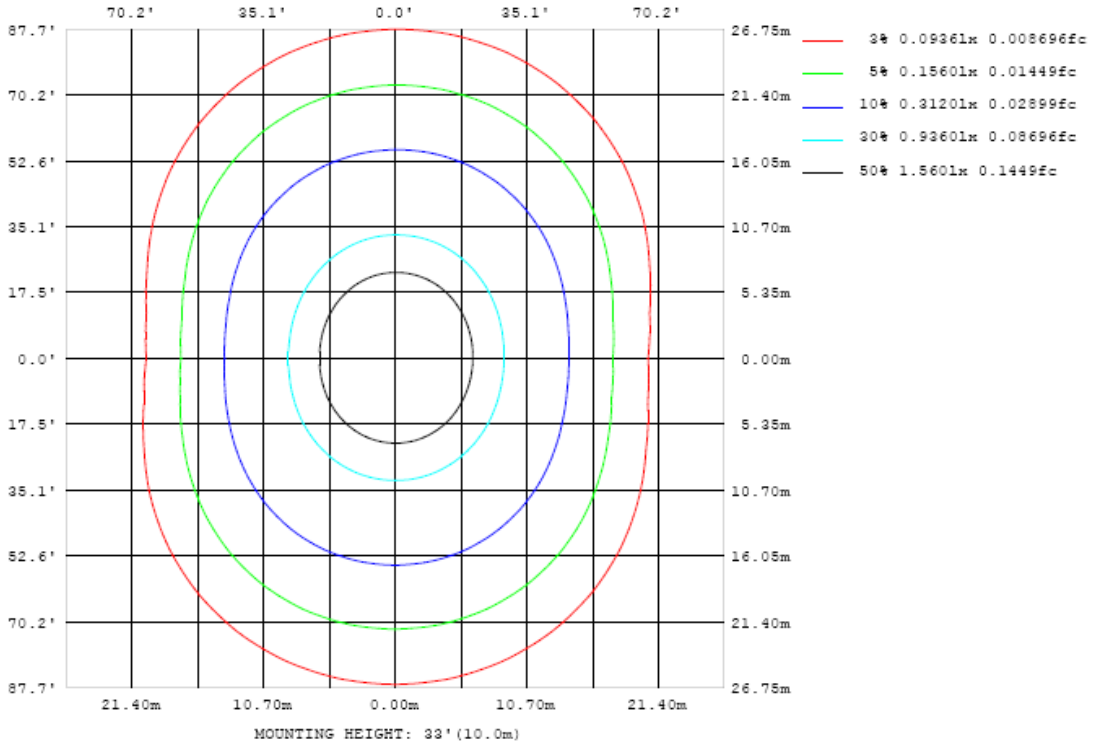


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

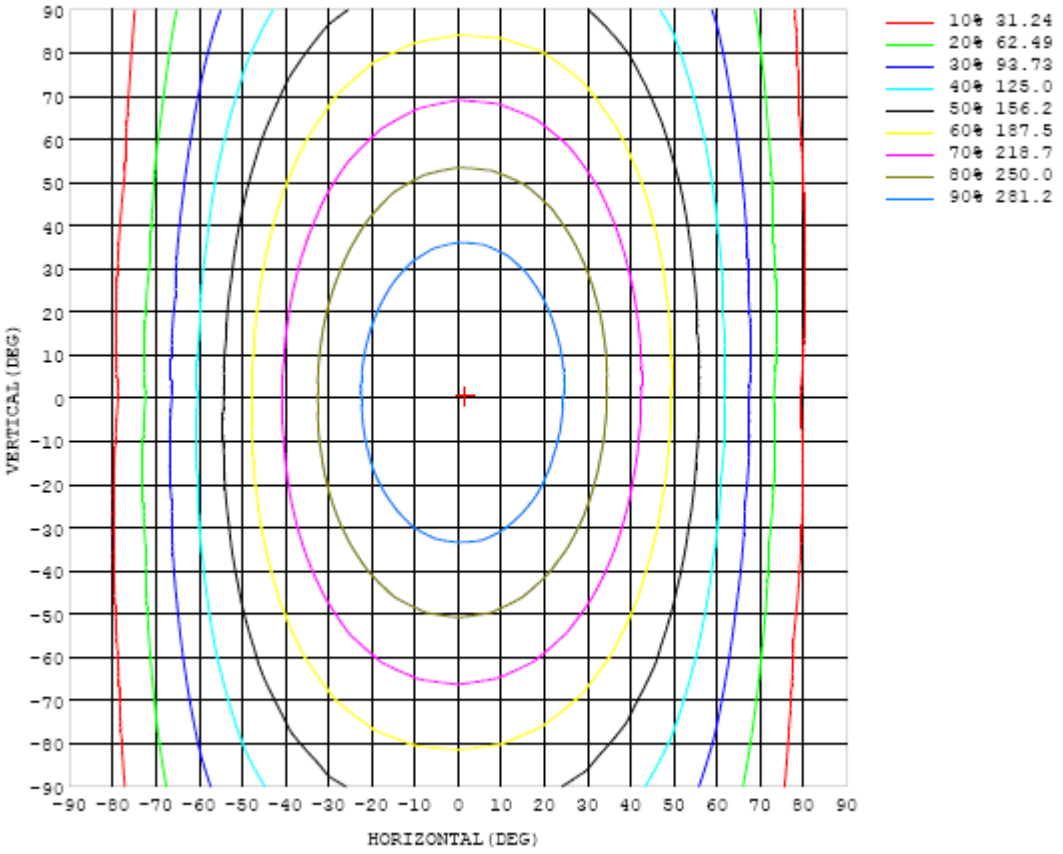


Chart 6: Isocandela Plot

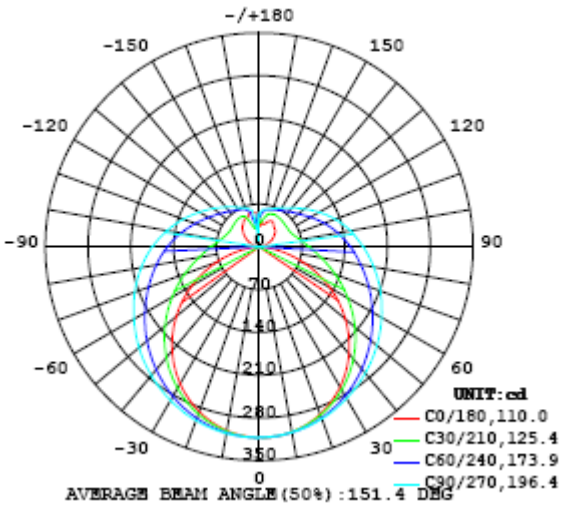


Chart 7: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1 UNIT: cd

γ (DEG) \ C (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312
5	311	311	311	311	311	311	311	311	311	311	311	311	311	311	310	310	310	310	310
10	308	308	307	307	308	308	308	309	309	308	309	308	308	307	306	306	305	305	305
15	301	301	301	302	302	303	304	305	305	305	305	304	303	302	300	299	298	297	298
20	292	291	292	293	295	297	298	299	300	300	299	298	296	295	293	290	289	287	287
25	279	280	281	283	285	288	291	293	294	294	293	292	289	286	283	279	277	275	274
30	265	265	267	270	274	278	282	285	286	287	286	284	280	276	271	267	263	260	259
35	248	248	251	256	262	267	272	276	278	279	278	275	270	265	259	252	247	243	241
40	229	229	233	240	247	255	261	266	269	270	269	266	260	253	245	237	229	224	222
45	207	209	214	223	232	242	250	256	260	261	260	256	249	240	230	220	210	203	200
50	184	186	194	205	217	228	238	246	250	251	250	246	238	227	215	202	190	181	177
55	160	162	172	186	201	215	226	235	240	241	240	235	226	215	200	185	170	158	153
60	134	138	151	168	185	201	214	224	230	231	230	224	215	202	186	167	150	135	127
65	107	112	129	150	170	188	202	213	219	221	220	214	204	189	171	151	129	111	101
70	79.2	86.8	108	133	156	175	191	202	209	211	209	203	193	177	158	135	110	87.1	74.7
75	52.6	62.6	88.2	117	143	163	180	191	198	201	199	193	182	166	146	120	91.8	65.0	49.6
80	28.1	41.4	71.5	103	131	153	169	181	188	190	189	183	171	156	134	107	76.3	45.6	26.1
85	8.97	25.5	58.5	91.4	120	142	159	171	178	180	179	172	161	145	123	96.0	64.0	30.8	8.03
90	0.34	17.0	49.4	81.8	110	132	149	161	168	170	169	162	152	136	114	86.6	55.1	22.4	0.46
95	1.93	14.2	43.6	74.3	101	123	140	152	159	160	159	154	143	126	105	79.0	49.0	19.0	1.98
100	5.20	15.1	39.8	68.1	93.6	115	131	142	149	152	150	144	133	118	97.5	72.6	44.7	18.7	5.05
105	9.71	17.9	38.0	62.9	86.5	106	122	133	140	142	140	135	124	110	90.2	67.1	42.1	20.7	9.16
110	14.7	22.2	38.1	59.0	80.3	98.6	113	124	130	132	131	125	116	102	83.7	62.7	41.3	24.2	13.4
115	19.6	26.9	39.5	56.8	74.9	91.4	105	115	121	123	121	116	107	94.2	77.9	59.7	41.7	28.3	18.3
120	24.6	31.5	41.6	55.7	70.9	85.0	97.0	106	111	113	112	107	99.1	87.3	73.2	57.9	43.0	32.5	23.5
125	29.2	36.0	43.9	55.4	68.0	79.8	90.0	97.8	103	105	103	99.1	91.7	81.6	69.7	56.9	44.9	36.8	28.5
130	33.5	40.1	46.4	55.7	65.9	75.7	84.2	90.8	94.9	96.5	95.3	91.7	85.5	77.1	67.2	56.6	47.2	40.9	33.4
135	37.3	43.9	48.9	56.2	64.4	72.4	79.4	84.9	88.3	89.6	88.6	85.6	80.4	73.5	65.3	56.8	49.5	44.7	38.3
140	39.0	46.2	51.1	56.8	63.2	69.6	75.3	79.7	82.6	83.6	82.8	80.3	76.1	70.4	63.9	57.3	51.8	48.1	42.8
145	41.6	49.5	53.4	57.6	62.5	67.4	71.8	75.3	77.6	78.4	77.7	75.7	72.3	67.9	62.9	58.0	53.9	50.8	46.0
150	45.9	52.8	52.6	58.0	61.9	65.5	68.9	71.5	73.2	73.8	73.3	71.7	69.2	66.0	62.2	58.7	55.7	53.6	50.0
155	46.8	54.7	54.9	58.6	61.5	64.0	66.4	68.3	69.6	69.9	69.6	68.5	66.7	64.4	61.8	59.4	57.4	56.4	51.0
160	43.7	51.0	55.4	57.9	61.2	62.8	64.3	65.6	66.5	66.7	66.5	65.8	64.7	63.3	61.6	60.2	59.0	58.3	53.4
165	38.9	46.1	51.0	56.1	59.4	62.0	62.8	63.6	64.1	64.2	64.2	63.8	63.2	62.5	61.5	60.8	60.2	59.7	58.7
170	36.9	40.7	44.2	49.0	54.9	58.9	61.1	62.2	62.4	62.5	62.5	62.4	62.2	61.9	61.5	61.2	60.6	59.2	57.1
175	40.5	38.7	37.7	40.7	46.5	51.5	55.7	58.8	60.4	61.0	61.3	61.4	61.4	61.3	61.1	60.6	59.4	57.3	55.9
180	51.9	51.9	51.9	51.9	51.9	51.9	51.9	51.9	51.9	51.9	51.9	51.9	51.9	51.9	51.9	51.9	51.9	51.9	51.9

Table 6: Luminous Intensity Data

Table--2 UNIT: cd

γ (DEG) \ C (DEG)	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350		
0	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312		
5	310	310	311	311	311	312	312	312	312	312	312	312	312	312	312	312	311		
10	306	306	306	307	308	309	310	310	310	310	310	310	310	309	309	308	308		
15	298	299	300	301	303	305	306	307	307	307	307	307	305	304	303	302	302		
20	288	289	291	293	296	299	301	302	303	303	302	301	299	297	295	294	293		
25	275	277	280	284	288	291	294	296	297	297	296	294	292	288	285	283	281		
30	260	263	267	272	278	282	286	289	290	290	289	286	282	278	273	270	267		
35	243	247	253	259	266	273	278	281	283	283	281	277	272	265	260	254	250		
40	223	229	236	245	254	262	269	273	275	275	272	267	260	252	244	237	231		
45	202	209	219	230	241	251	259	264	266	266	262	256	248	238	228	218	211		
50	180	189	201	215	228	240	249	254	257	256	252	245	235	223	210	198	188		
55	156	167	183	199	215	228	238	244	247	246	242	234	222	208	192	177	165		
60	132	146	164	184	201	216	227	234	237	236	231	222	209	193	174	156	140		
65	107	124	147	169	188	204	216	224	227	226	221	211	196	178	157	135	115		
70	82.2	104	130	154	175	193	206	214	217	216	210	199	183	164	140	114	90.8		
75	59.3	84.8	114	141	163	182	195	203	207	205	200	188	172	151	125	95.7	68.1		
80	38.6	68.8	99.9	128	152	171	184	193	196	195	189	177	161	139	111	79.5	48.0		
85	23.2	55.6	88.6	118	142	161	174	182	186	185	179	167	150	128	99.8	67.3	32.6		
90	15.1	47.1	79.5	108	132	150	163	172	175	174	168	157	140	118	90.4	58.5	24.3		
95	12.8	41.0	71.5	99.2	122	140	153	161	164	163	157	146	130	109	82.0	51.7	20.8		
100	14.0	37.5	65.5	91.1	113	130	142	150	153	152	146	136	120	100	75.0	47.4	20.8		
105	16.9	36.4	60.7	83.9	104	121	132	140	143	142	136	126	111	92.4	69.6	45.3	22.6		
110	20.8	36.9	57.5	78.0	96.5	112	123	130	132	131	126	117	103	85.8	65.7	45.0	25.6		
115	24.9	38.4	55.5	73.3	89.7	103	114	120	123	122	117	108	95.7	80.5	63.5	45.7	28.9		
120	28.7	40.8	54.6	69.8	84.0	96.1	105	111	113	112	108	100	89.5	76.4	61.8	47.0	32.1		
125	31.6	43.5	54.6	67.2	79.3	89.9	97.9	103	105	104	100	93.7	84.3	73.2	60.8	48.7	34.7		
130	33.6	46.0	55.2	65.5	75.7	84.5	91.4	95.8	97.6	97.0	93.7	87.8	79.8	70.5	60.3	50.5	36.4		
135	34.1	47.7	56.0	64.3	72.5	79.8	85.7	89.4	91.0	90.5	87.7	82.7	75.9	68.4	60.1	52.3	37.1		
140	34.0	48.6	56.9	63.5	70.0	75.7	80.6	83.7	85.0	84.6	82.2	78.1	72.7	66.6	60.1	53.9	36.9		
145	33.2	48.5	57.5	62.9	67.9	72.3	76.0	78.6	79.6	79.3	77.5	74.2	70.3	65.5	60.1	54.2	35.5		
150	34.5	49.1	57.2	62.2	66.2	69.7	72.2	74.1	74.9	74.7	73.2	71.1	68.1	63.7	59.8	51.1	35.4		
155	38.0	41.5	54.2	61.4	64.7	67.3	69.3	70.5	70.8	70.7	70.0	68.5	64.3	60.2	54.0	43.7	35.9		
160	40.0	31.9	41.9	54.4	63.0	64.7	66.4	67.4	67.8	67.9	66.7	57.8	52.9	48.7	46.2	35.7	37.0		
165	46.1	32.8	32.8	36.3	47.2	58.4	60.6	64.0	64.1	59.7	46.0	44.5	43.6	39.6	35.8	33.1	35.5		
170	51.6	41.3	35.4	36.6	39.2	39.8	44.0	45.5	50.8	40.5	43.5	44.2	40.9	37.1	34.9	33.5	34.3		
175	54.2	50.5	46.6	42.5	38.7	35.9	33.6	40.0	17.8	46.5	46.0	43.1	43.2	42.9	40.8	39.2	39.8		
180	51.9	51.9	51.9	51.9	51.9	51.9	51.9	51.9	51.9	51.9	51.9	51.9	51.9	51.9	51.9	51.9	51.9		

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.

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The uncertainty of integrating sphere system reported in this document is expended 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 expended uncertainty is 2.3% with a coverage factor k=2.

Color Characteristics Measurements

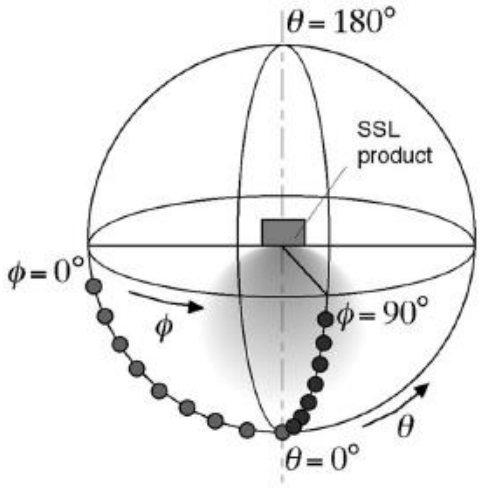
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as 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°/180° and C=90°/270°) 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, Δu'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 ***