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: 12T8/4F/835/DEB

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ20070023m

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: **12T8/4F/835/DEB**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
149.7	1860.3	12.43	0.9794

CCT (K)	CRI	Stabilization Time (Light & Power)
3491	82.9	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	: 12T8/4F/835/DEB
Electrical Ratings	: 120-277V, 50/60Hz, 12W
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)	0.106	0.049
Power Factor	0.9794	0.9181
Test Power (W)	12.43	12.50
THD A%	18.58	18.59
Luminous Efficacy (lm/W)	149.7	147.9
Total Luminous Flux (lm)	1860.3	1848.9
Color Rendering Index (CRI)	82.9	
R9	8.6	
Correlated Color Temperature (CCT)(K)	3491	
Chromaticity Chroma x	0.4056	
Chromaticity Chroma y	0.3908	
Chromaticity Chroma u	0.2359	
Chromaticity Chroma v	0.3409	
Duv	0.0002	
Chromaticity Chroma u ’	0.2359	
Chromaticity Chroma v’	0.5113	

Special Color Rendering Indices	
R1	81.2
R2	90.4
R3	96.2
R4	80.7
R5	81.1
R6	86.9
R7	84.5
R8	62.1
R9	8.6
R10	77.2
R11	79.6
R12	64.5
R13	83.5
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 25.2 ℃.

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)	0.106
Power Factor	0.9794
Power (W)	12.43
Luminous Efficacy (lm/W)	147.8
Total Luminous Flux (lm)	1837.4
Beam Angle (°)	110.5 (0^o-180^o) / 202.1 (90^o-270^o)
Center Beam Candle Power (cd)	328
Maximum Beam Candle Power (cd)	327.9 (At: C=140.0, Gamma=1.0)
Spacing Criteria	1.25 (0^o-180^o) / 1.40 (90^o-270^o)
Zonal Lumens in the 0 °-60 °Zone	44.82%
Zonal Lumens in the 60 °-90 °Zone	26.57%
Zonal Lumens in the 90 °-120 °Zone	16.68%
Zonal Lumens in the 120 °-180 °Zone	11.93%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

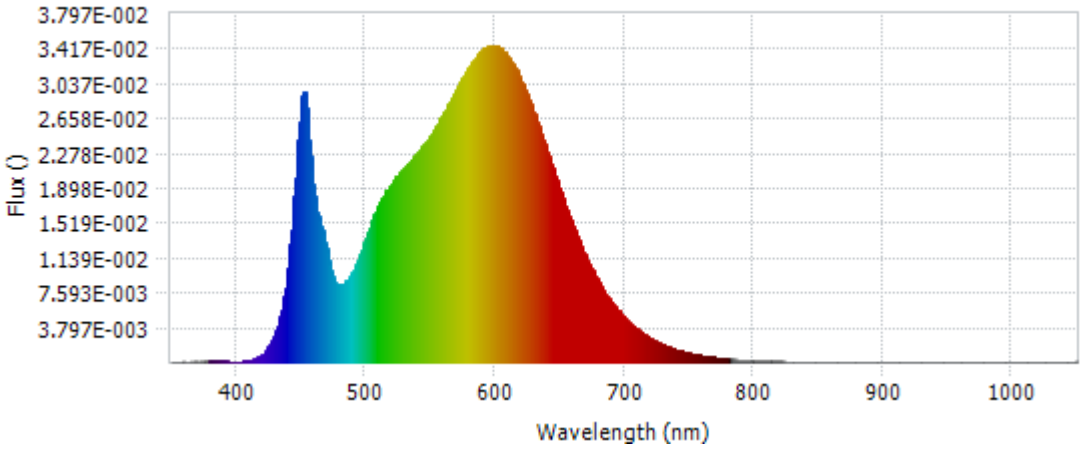
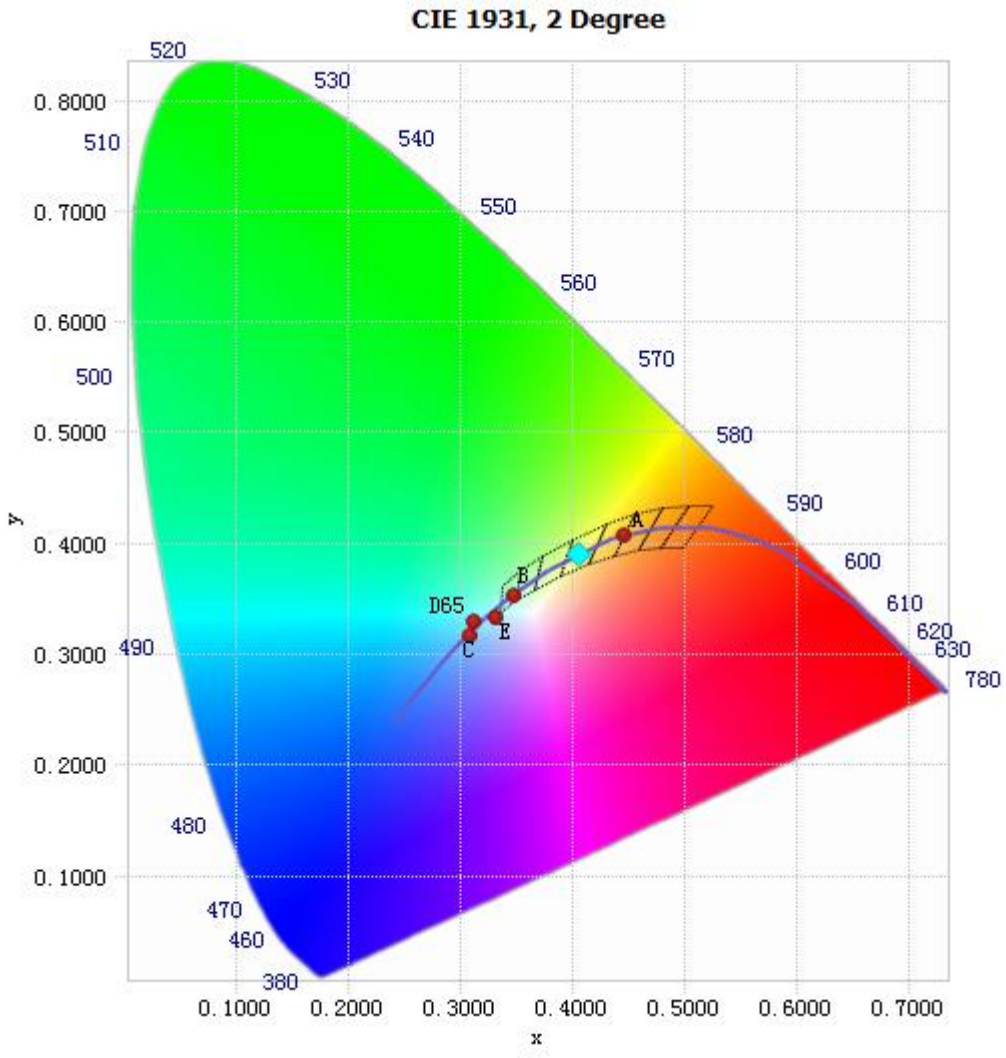


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.23E-04	485	8.86E-03	590	3.40E-02	695	5.75E-03
385	1.27E-04	490	9.86E-03	595	3.45E-02	700	4.94E-03
390	1.32E-04	495	1.15E-02	600	3.45E-02	705	4.23E-03
395	1.04E-04	500	1.35E-02	605	3.42E-02	710	3.62E-03
400	9.73E-05	505	1.54E-02	610	3.35E-02	715	3.10E-03
405	1.23E-04	510	1.70E-02	615	3.24E-02	720	2.68E-03
410	2.14E-04	515	1.85E-02	620	3.09E-02	725	2.28E-03
415	4.12E-04	520	1.95E-02	625	2.93E-02	730	1.95E-03
420	8.32E-04	525	2.04E-02	630	2.74E-02	735	1.66E-03
425	1.66E-03	530	2.11E-02	635	2.53E-02	740	1.41E-03
430	3.17E-03	535	2.20E-02	640	2.33E-02	745	1.21E-03
435	5.75E-03	540	2.28E-02	645	2.12E-02	750	1.03E-03
440	1.02E-02	545	2.37E-02	650	1.90E-02	755	8.83E-04
445	1.80E-02	550	2.47E-02	655	1.70E-02	760	7.50E-04
450	2.77E-02	555	2.58E-02	660	1.51E-02	765	6.44E-04
455	2.77E-02	560	2.70E-02	665	1.33E-02	770	5.58E-04
460	1.93E-02	565	2.83E-02	670	1.17E-02	775	4.73E-04
465	1.53E-02	570	2.97E-02	675	1.02E-02	780	4.08E-04
470	1.25E-02	575	3.10E-02	680	8.90E-03		
475	9.48E-03	580	3.22E-02	685	7.72E-03		
480	8.44E-03	585	3.33E-02	690	6.66E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4056, 0.3908)

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

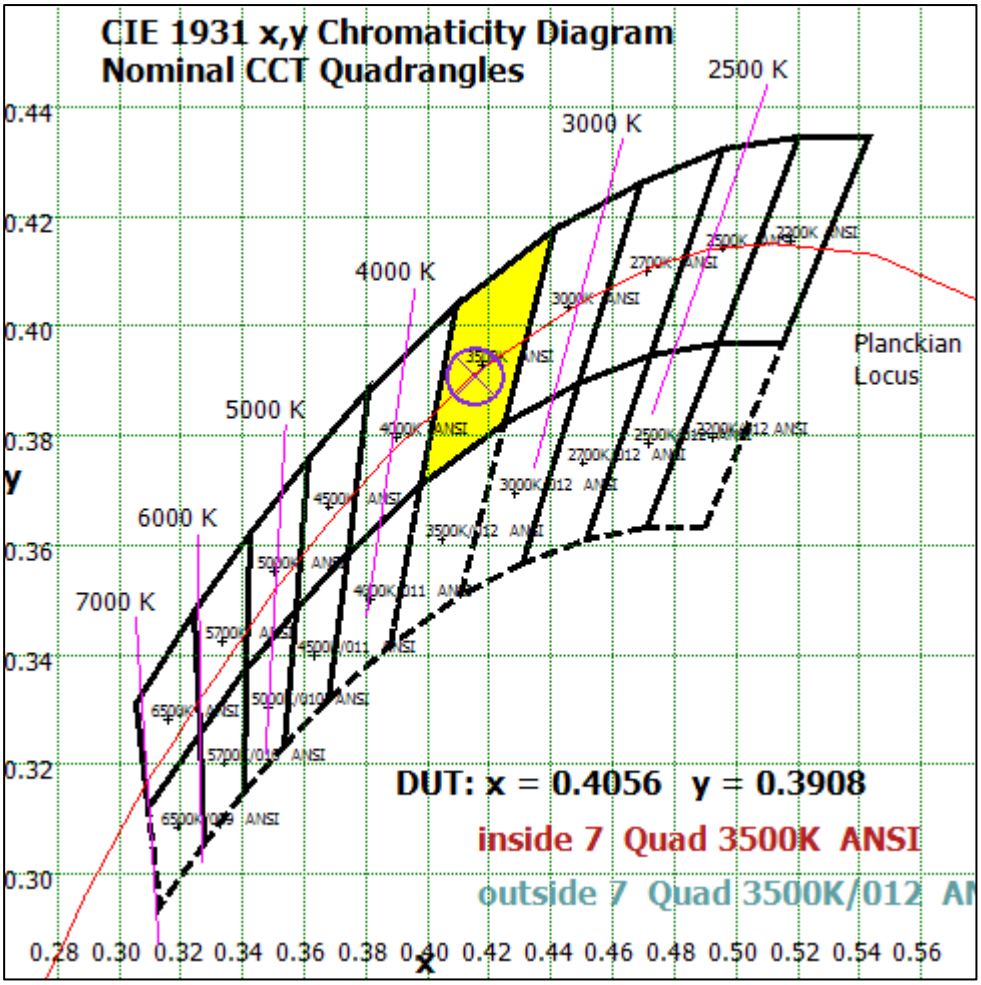
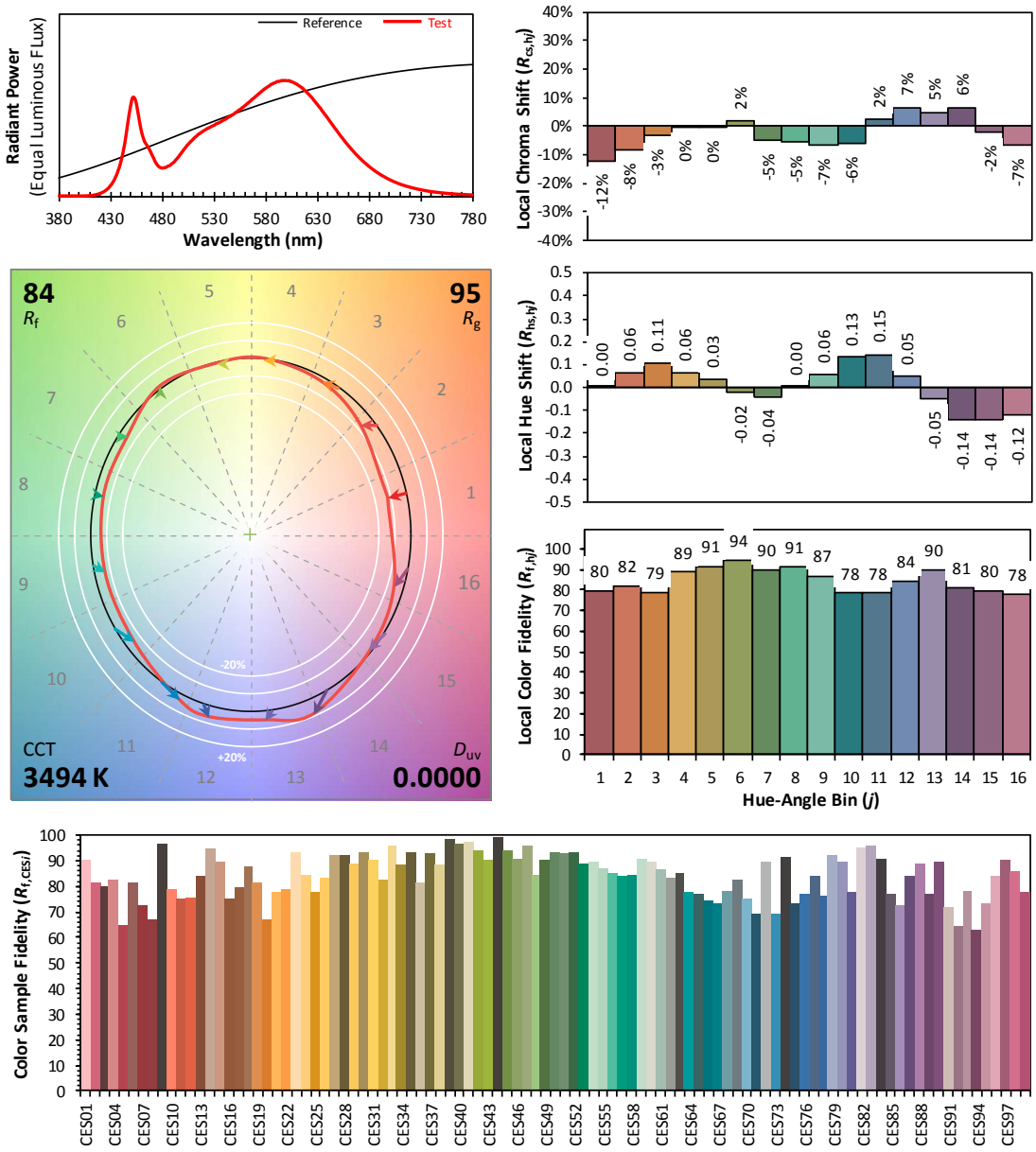


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method



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

x	0.4056
y	0.3908
u'	0.2359
v'	0.5113

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	31.075	1.69%
10- 20	89.884	4.89%
20- 30	139.203	7.58%
30- 40	174.434	9.49%
40- 50	193.231	10.52%
50- 60	195.745	10.65%
60- 70	184.429	10.04%
70- 80	163.69	8.91%
80- 90	140.105	7.63%
90-100	119.846	6.52%
100-110	101.708	5.54%
110-120	84.955	4.62%
120-130	69.776	3.80%
130-140	55.973	3.05%
140-150	42.805	2.33%
150-160	29.733	1.62%
160-170	16.175	0.88%
170-180	4.662	0.25%
Total	1837.4	100%

γ(°)	Lumens	% Total
0- 60	823.572	44.82%
60- 90	488.224	26.57%
0-90	1311.796	71.39%
90- 180	525.633	28.61%
0- 180	1837.4	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

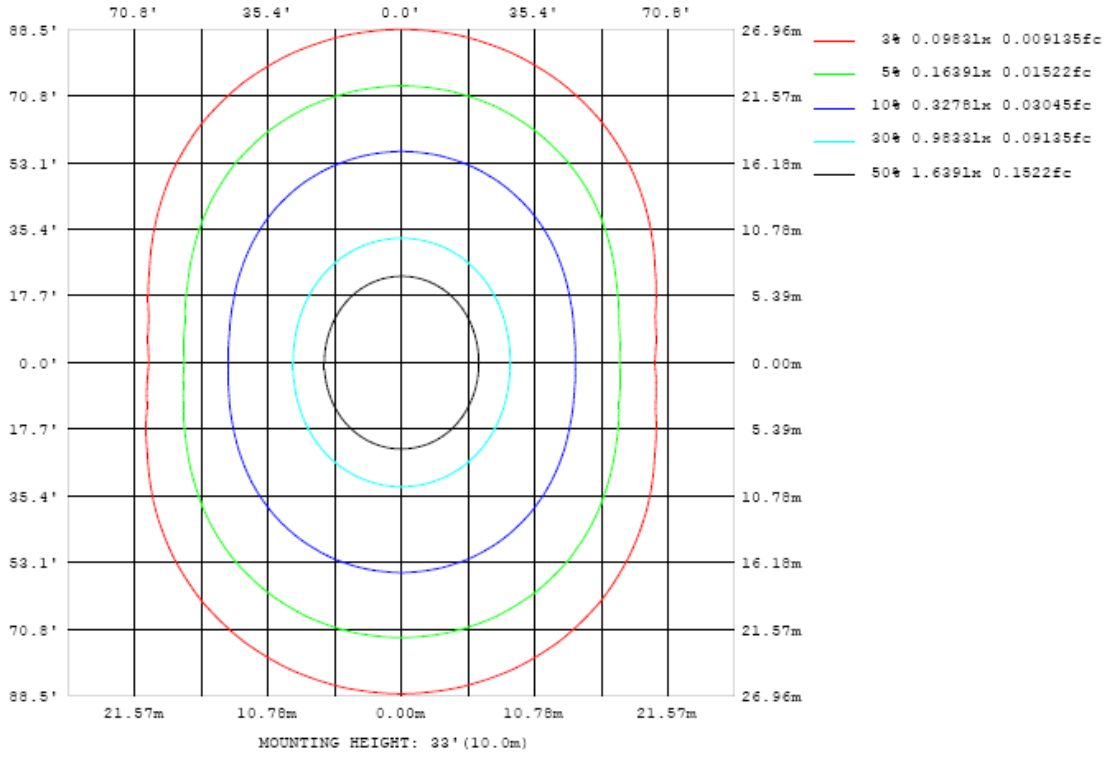


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

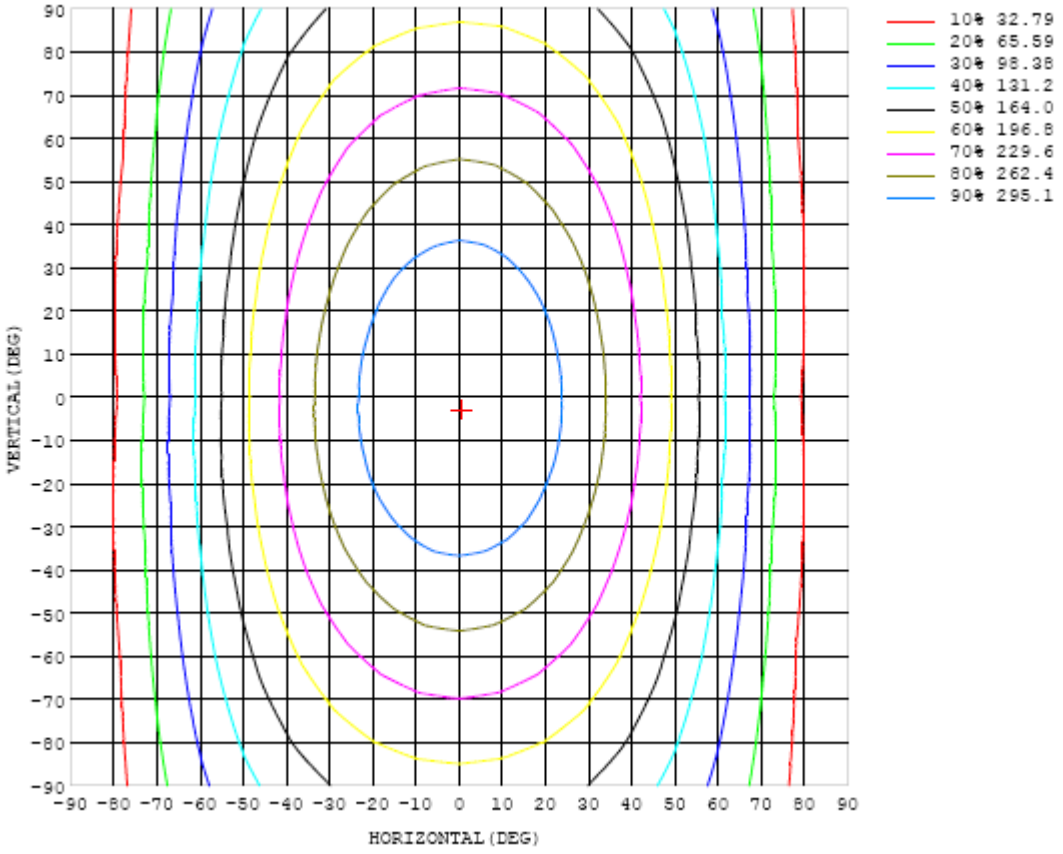


Chart 6: Isocandela Plot

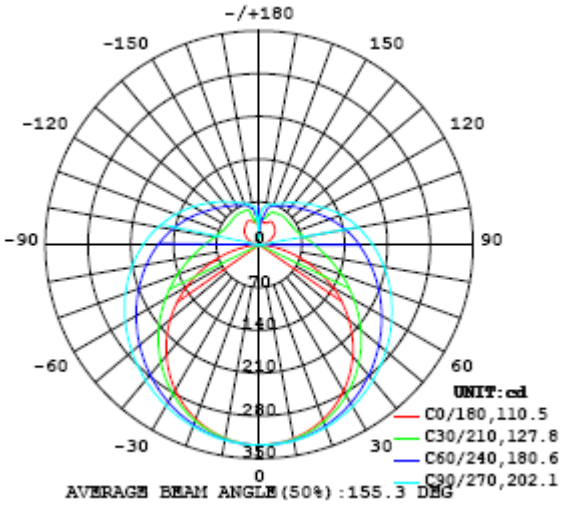


Chart 7: Polar Candela Distribution

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	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328
5	326	326	326	326	327	327	327	328	327	327	327	327	327	327	326	326	326	326	326
10	322	322	322	323	324	324	325	326	326	326	326	325	325	324	323	322	322	321	321
15	315	315	316	317	318	319	321	322	322	322	322	321	320	319	318	316	315	314	314
20	305	305	307	309	310	313	315	317	318	318	318	316	315	313	310	308	306	304	303
25	292	293	295	298	301	304	308	310	312	312	312	310	307	304	301	297	294	292	291
30	276	277	281	285	289	295	299	303	305	306	305	303	299	294	289	284	280	276	275
35	258	260	264	270	276	283	290	294	297	298	297	294	289	283	276	269	263	259	257
40	238	240	246	253	262	271	279	285	288	289	288	284	278	271	262	253	245	239	236
45	216	219	226	236	247	258	268	275	279	280	279	274	267	258	247	235	225	218	214
50	192	195	204	217	231	244	256	264	269	271	269	264	255	244	231	217	204	195	190
55	166	171	182	198	215	231	244	253	259	261	259	253	243	231	215	198	182	170	164
60	140	145	160	179	199	217	232	242	248	250	248	242	231	217	199	180	161	145	137
65	111	119	138	161	183	203	219	231	237	240	238	231	219	204	184	162	139	120	110
70	82.5	92.2	116	144	169	191	208	220	227	229	227	220	208	191	170	145	117	93.8	81.6
75	54.3	67.1	95.8	127	156	178	196	209	216	218	216	209	196	179	157	129	97.8	69.4	54.8
80	29.2	45.1	78.7	113	143	167	185	198	205	207	205	198	185	167	144	115	80.9	47.9	29.5
85	8.94	28.8	65.2	101	132	156	174	187	194	197	194	187	174	157	133	102	67.3	31.4	9.49
90	0.34	20.0	55.6	90.9	121	146	164	176	183	186	184	176	164	146	122	92.2	57.4	21.9	0.51
95	2.12	16.7	49.1	82.6	112	136	154	166	173	175	173	166	154	136	113	83.7	50.5	17.8	1.88
100	5.74	17.5	44.6	75.3	103	126	144	156	162	164	163	156	144	126	104	76.0	45.3	17.7	5.24
105	10.5	20.4	42.8	69.4	94.9	116	133	145	152	154	152	145	133	117	95.2	69.6	42.6	20.2	9.70
110	15.8	24.6	42.8	65.3	87.8	108	123	134	141	143	141	134	123	108	87.7	64.9	41.8	23.9	14.3
115	21.0	29.2	44.2	62.9	82.1	99.5	114	124	130	132	130	124	113	99.2	81.6	61.9	42.6	27.9	19.4
120	26.1	33.4	45.8	61.7	77.9	92.9	105	114	120	122	120	114	105	92.2	77.0	60.1	44.5	32.0	24.1
125	30.3	36.8	47.9	61.0	74.7	87.5	98.0	106	110	112	110	105	97.4	86.6	73.5	59.4	46.5	35.6	27.9
130	33.9	41.4	50.0	60.7	72.3	82.9	92.0	98.6	103	104	103	98.2	91.1	81.9	70.9	59.3	48.6	40.6	31.5
135	36.5	44.3	51.5	60.8	70.2	79.1	86.6	92.2	95.6	96.7	95.5	91.7	85.8	78.1	69.0	59.5	50.2	44.2	34.5
140	38.6	47.1	52.9	61.1	68.3	75.7	81.9	86.5	89.3	90.3	89.2	86.1	81.2	74.8	67.3	60.0	52.1	47.3	36.6
145	40.7	50.4	53.1	60.0	67.1	72.6	77.7	81.5	83.7	84.5	83.6	81.1	77.0	71.7	66.1	60.2	53.7	50.3	38.8
150	42.4	53.8	55.6	59.3	66.1	70.1	73.9	76.8	78.5	79.1	78.4	76.4	73.3	69.4	65.2	60.1	56.7	53.9	41.4
155	42.1	52.8	56.2	57.3	62.1	68.2	70.7	72.7	73.9	74.4	74.0	72.6	70.4	67.6	64.1	60.7	58.6	55.4	43.2
160	38.5	46.1	52.9	55.5	58.4	64.0	67.9	69.5	70.2	70.6	70.4	69.4	67.7	65.8	63.6	62.1	60.8	54.3	41.8
165	37.9	41.2	45.6	48.7	51.6	57.2	63.7	67.5	67.7	68.0	67.9	67.3	66.1	64.8	63.8	62.9	61.5	54.5	39.2
170	36.3	35.6	40.6	44.2	43.3	45.2	52.0	59.9	64.4	65.8	65.8	65.7	65.2	64.1	62.1	60.1	57.0	48.7	36.4
175	44.5	42.6	43.0	43.6	44.6	43.0	38.5	39.6	47.3	57.2	59.6	61.7	63.9	63.8	60.0	56.5	53.6	47.6	37.1
180	43.7	43.7	43.7	43.7	43.7	43.7	43.7	43.7	43.7	43.7	43.7	43.7	43.7	43.7	43.7	43.7	43.7	43.7	43.7

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	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328		
5	326	326	326	327	327	327	327	327	327	327	327	327	326	326	327	326	326		
10	321	322	322	323	323	324	324	324	325	325	324	324	323	323	323	322	322		
15	314	315	315	317	318	319	320	321	321	321	320	319	318	318	316	315	315		
20	304	305	306	309	311	313	315	316	316	316	315	314	312	310	308	306	305		
25	291	293	295	299	303	306	308	310	311	310	309	306	303	300	297	294	292		
30	276	278	282	287	293	297	301	303	304	304	302	298	294	289	284	280	277		
35	258	262	267	274	282	288	293	296	297	296	293	289	283	276	269	263	260		
40	238	243	251	260	269	278	284	288	289	288	285	279	271	262	253	245	240		
45	216	223	233	245	257	267	274	279	281	280	275	268	258	247	236	225	218		
50	193	202	215	229	244	255	264	270	272	270	265	257	246	232	218	205	195		
55	168	180	196	214	230	244	254	260	263	261	255	245	233	217	199	183	170		
60	143	158	177	198	217	233	244	251	253	251	245	234	220	201	181	160	145		
65	116	135	159	183	204	221	233	240	243	241	234	223	207	187	163	138	118		
70	90.5	114	142	168	192	210	222	230	233	231	224	211	194	172	145	117	92.4		
75	66.1	94.1	126	155	179	198	212	220	222	220	213	200	182	159	130	97.8	68.1		
80	44.1	76.9	112	142	168	187	201	209	212	210	202	189	171	146	116	81.2	47.1		
85	27.5	64.0	99.7	131	157	176	190	198	201	199	191	178	160	135	104	68.7	31.2		
90	18.5	54.3	89.6	121	146	166	179	187	190	188	181	168	149	125	94.2	59.2	22.6		
95	15.4	47.6	81.2	111	136	155	168	176	179	177	170	157	139	115	85.7	52.5	19.3		
100	16.2	43.5	74.2	103	126	145	157	165	168	166	159	147	129	106	78.7	48.1	19.9		
105	19.0	41.6	69.2	94.7	117	134	147	154	157	155	148	137	120	98.6	72.9	45.9	22.5		
110	23.2	41.6	65.0	87.9	108	125	136	143	146	144	138	127	111	91.5	69.1	45.9	26.2		
115	28.1	42.7	62.4	82.1	100	115	126	133	135	134	128	117	103	85.6	66.3	46.7	30.4		
120	32.9	44.5	60.9	77.7	93.5	107	117	123	125	123	118	109	96.2	81.0	64.7	48.1	34.7		
125	36.3	46.8	60.3	74.4	87.9	99.3	108	113	115	114	109	101	90.5	77.4	63.6	50.0	38.4		
130	38.1	49.3	60.2	71.7	83.2	93.0	100	105	107	106	101	94.7	85.5	74.5	63.1	51.9	41.0		
135	40.7	51.8	60.6	70.2	79.3	87.4	93.6	97.6	99.1	98.2	94.6	88.9	81.2	72.1	63.0	53.7	42.9		
140	44.7	54.0	61.2	68.8	76.0	82.6	87.6	90.9	92.2	91.4	88.5	83.8	77.6	70.7	63.1	55.3	44.7		
145	48.2	55.5	61.6	67.8	73.2	78.3	82.3	84.9	86.0	85.4	83.0	79.3	74.5	69.3	62.5	55.0	46.9		
150	49.9	56.1	61.0	66.9	71.4	74.8	77.7	79.7	80.6	80.1	78.2	75.4	71.8	68.1	62.2	56.4	48.2		
155	46.7	55.8	60.3	65.2	69.4	72.1	73.9	75.3	76.0	75.6	74.3	72.2	70.1	65.7	59.5	54.7	46.0		
160	39.6	53.1	61.0	62.6	66.4	69.2	71.0	71.9	72.2	71.9	71.3	70.2	66.1	57.9	52.2	49.4	42.2		
165	34.6	42.1	52.3	61.9	62.5	64.9	66.7	67.9	68.7	68.9	67.9	61.7	52.4	48.1	45.0	42.8	38.3		
170	34.2	36.9	39.0	46.3	55.6	60.2	61.9	63.9	64.7	63.4	50.6	44.5	46.1	43.7	43.3	37.7	37.0		
175	28.2	38.0	47.6	47.7	47.1	50.1	50.4	47.4	46.8	32.6	46.8	48.6	49.2	47.7	48.5	47.2	46.3		
180	43.7	43.7	43.7	43.7	43.7	43.7	43.7	43.7	43.7	43.7	43.7	43.7	43.7	43.7	43.7	43.7	43.7		

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

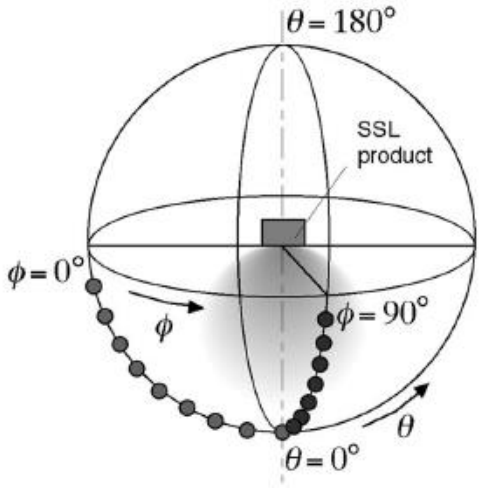
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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