LM-79-08 TEST REPORT

for

GREEN CREATIVE LTD

756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

LED Tube

Model: 12T8/3F/840/GL/BYP

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ19070032g

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

Review by: April Zou

Engineer: April Zou
Jul. 25, 2019

Approved by: Jim Zhang

Manager: Jim Zhang
Jul. 25, 2019

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: **12T8/3F/840/GL/BYP**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
137.4	1584.1	11.53	0.9829

CCT (K)	CRI	Stabilization Time (Light & Power)
3980	84.8	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, 2019
Date of Test	: Jul. 24, 2019
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

SAMPLE PHOTO

Figure 1- Overview of the sample

Equipment Under Test(EUT)	
Name	: LED Tube
Model	: 12T8/3F/840/GL/BYP
Electrical Ratings	: 120-277V, 50/60Hz, 12W
Product Description	: 4000K
Manufacturer	: GREEN CREATIVE LTD
Address	: 756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

TEST RESULTS

Test ambient temperature was 26.0 ℃.

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)	0.098	0.046
Power Factor	0.9829	0.9189
Test Power (W)	11.53	11.73
THD A%	16.31	13.57
Luminous Efficacy (lm/W)	137.4	135.8
Total Luminous Flux (lm)	1584.1	1593.2
Color Rendering Index (CRI)	84.8	
R9	16.1	
Correlated Color Temperature (CCT)(K)	3980	
Chromaticity Chroma x	0.3803	
Chromaticity Chroma y	0.3741	
Chromaticity Chroma u	0.2261	
Chromaticity Chroma v	0.3336	
Duv	-0.0012	
Chromaticity Chroma u ’	0.2261	
Chromaticity Chroma v’	0.5004	

Special Color Rendering Indices	
R1	83.7
R2	91.4
R3	95.8
R4	83.5
R5	83.8
R6	87.6
R7	86.2
R8	66.7
R9	16.1
R10	79.2
R11	82.9
R12	65.9
R13	85.9
R14	98.1

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 25.0 ℃.

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)	0.098
Power Factor	0.9827
Power (W)	11.60
Luminous Efficacy (lm/W)	134.5
Total Luminous Flux (lm)	1560.1
Beam Angle (°)	113.9 (0^o-180^o) / 253.3 (90^o-270^o)
Center Beam Candle Power (cd)	230
Maximum Beam Candle Power (cd)	230.5 (At: C=80.0, Gamma=3.0)
Spacing Criteria	1.27 (0^o-180^o) / 1.47 (90^o-270^o)
Zonal Lumens in the 0 °-60 °Zone	39.32%
Zonal Lumens in the 60 °-90 °Zone	26.53%
Zonal Lumens in the 90 °-120 °Zone	18.92%
Zonal Lumens in the 120 °-180 °Zone	15.22%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

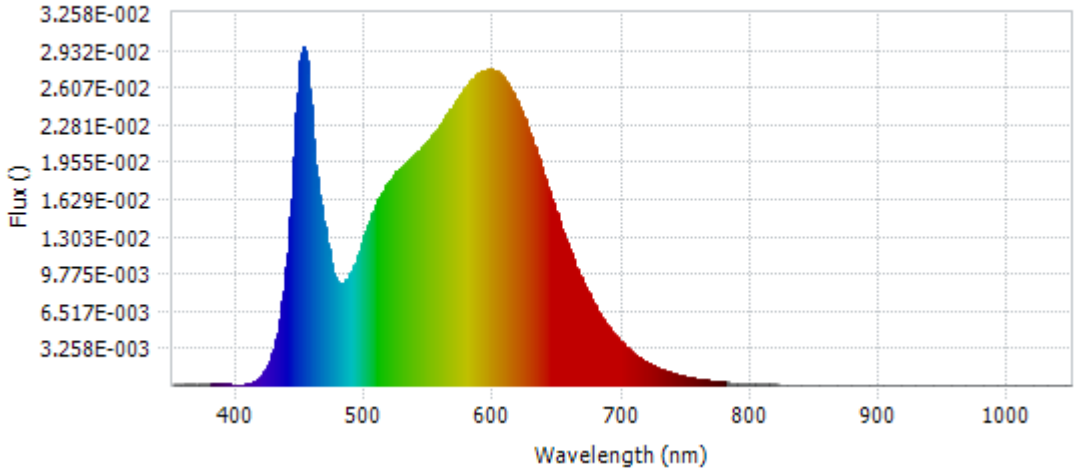
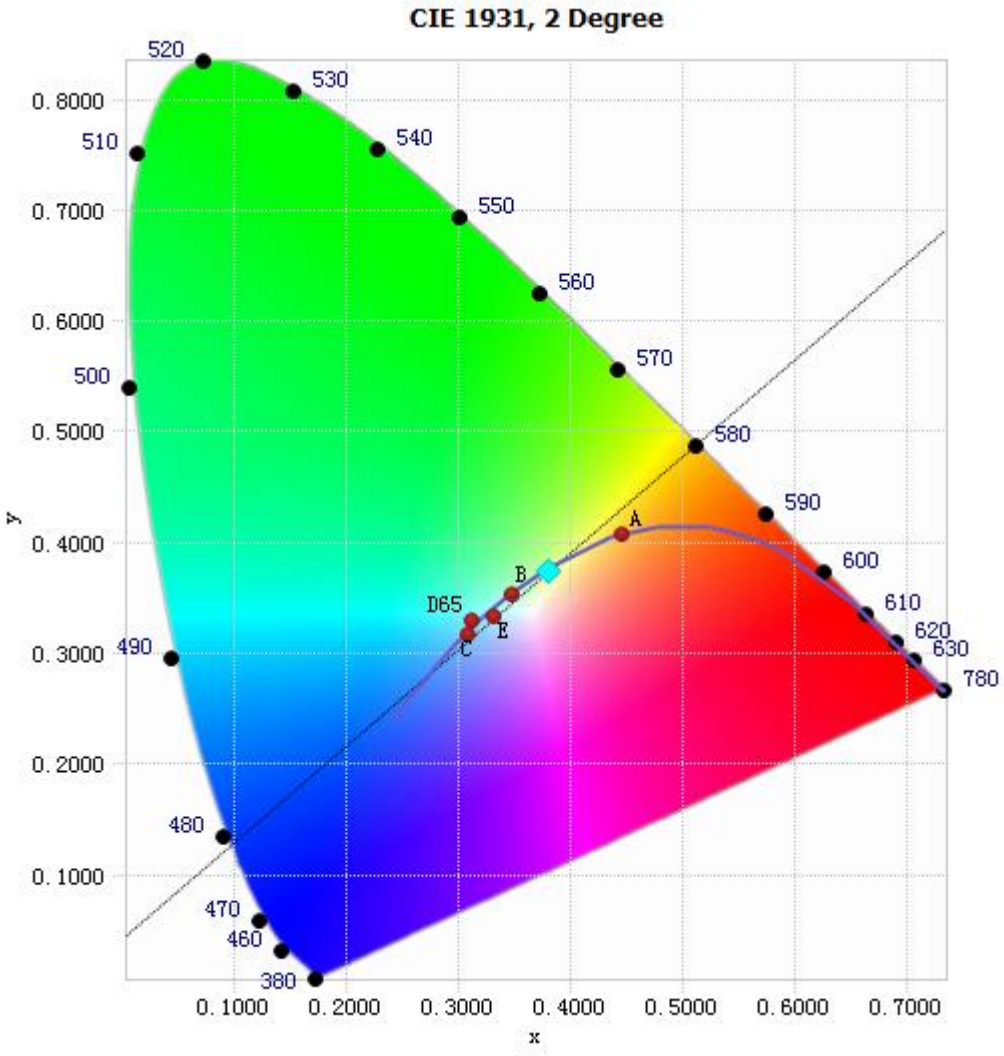


Chart 1: Spectral Power Distribution

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	9.23E-03	590	2.75E-02	695	4.31E-03
385	1.12E-04	490	1.02E-02	595	2.76E-02	700	3.70E-03
390	1.06E-04	495	1.17E-02	600	2.76E-02	705	3.18E-03
395	8.75E-05	500	1.34E-02	605	2.72E-02	710	2.71E-03
400	6.38E-05	505	1.50E-02	610	2.65E-02	715	2.32E-03
405	7.60E-05	510	1.63E-02	615	2.56E-02	720	1.98E-03
410	1.92E-04	515	1.73E-02	620	2.43E-02	725	1.70E-03
415	4.73E-04	520	1.81E-02	625	2.30E-02	730	1.44E-03
420	1.02E-03	525	1.87E-02	630	2.14E-02	735	1.23E-03
425	2.11E-03	530	1.93E-02	635	1.97E-02	740	1.05E-03
430	4.01E-03	535	1.98E-02	640	1.81E-02	745	8.92E-04
435	7.31E-03	540	2.03E-02	645	1.63E-02	750	7.65E-04
440	1.31E-02	545	2.10E-02	650	1.47E-02	755	6.51E-04
445	2.19E-02	550	2.16E-02	655	1.31E-02	760	5.65E-04
450	2.91E-02	555	2.23E-02	660	1.16E-02	765	4.76E-04
455	2.72E-02	560	2.31E-02	665	1.02E-02	770	4.08E-04
460	2.04E-02	565	2.39E-02	670	8.89E-03	775	3.52E-04
465	1.58E-02	570	2.48E-02	675	7.75E-03	780	2.98E-04
470	1.24E-02	575	2.56E-02	680	6.73E-03		
475	9.86E-03	580	2.63E-02	685	5.82E-03		
480	8.90E-03	585	2.70E-02	690	5.01E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3803, 0.3741)

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

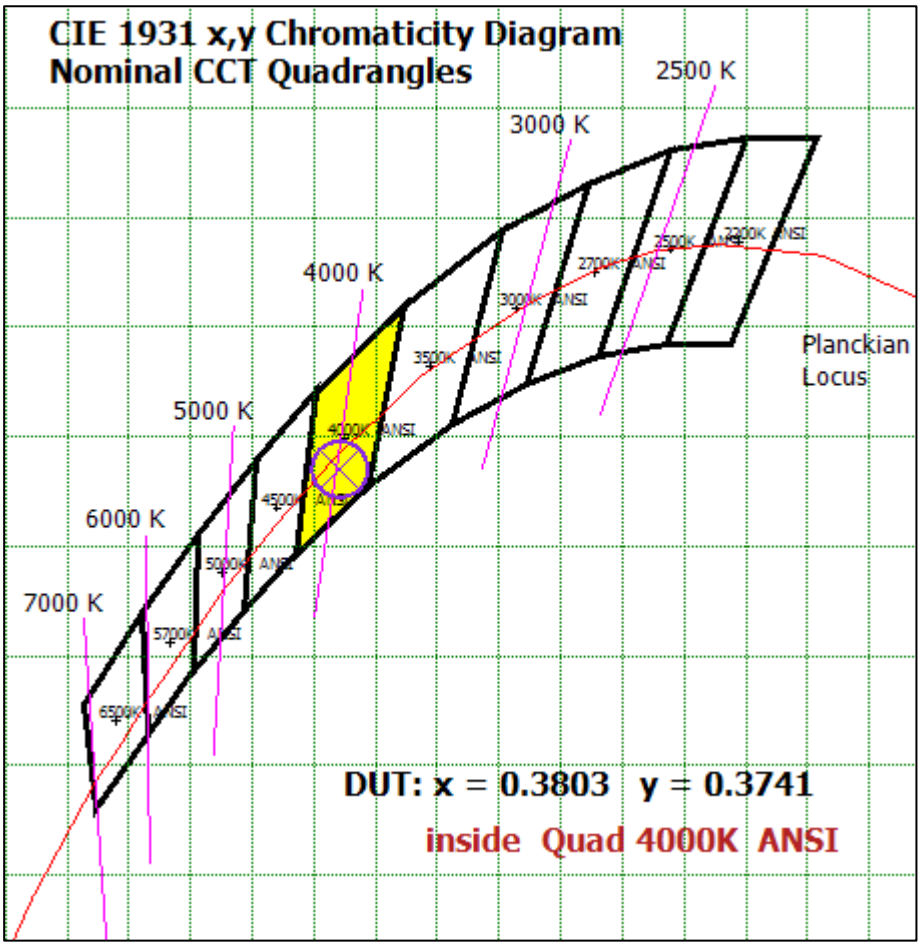
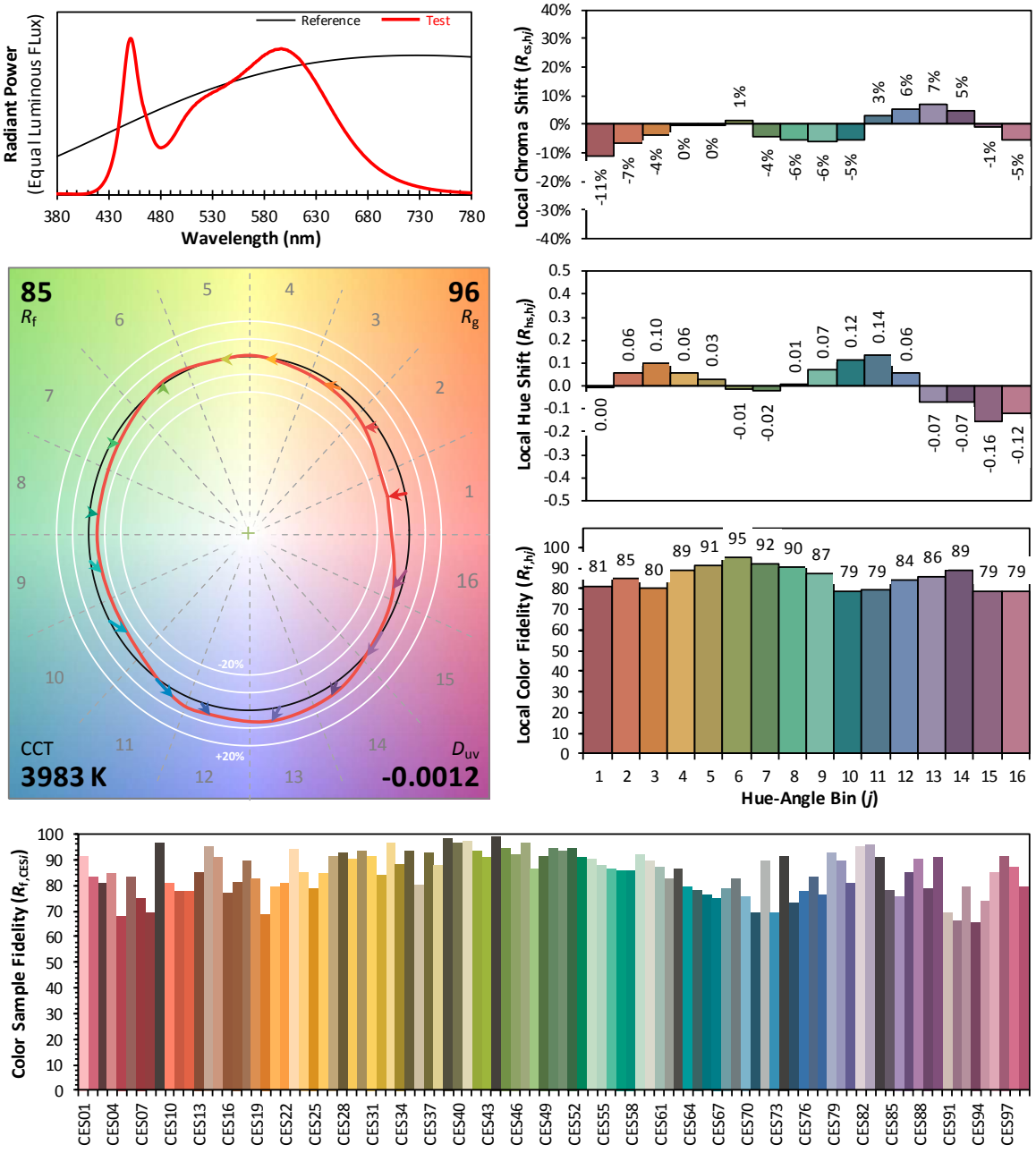


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method



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

x	0.3803
y	0.3741
u'	0.2261
v'	0.5004

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	21.881	1.40%
10- 20	63.781	4.09%
20- 30	100.254	6.43%
30- 40	128.352	8.23%
40- 50	146.172	9.37%
50- 60	153.063	9.81%
60- 70	149.806	9.60%
70- 80	139.061	8.91%
80- 90	125.099	8.02%
90-100	111.807	7.17%
100-110	98.367	6.30%
110-120	85.038	5.45%
120-130	72.36	4.64%
130-140	60.038	3.85%
140-150	47.282	3.03%
150-160	33.763	2.16%
160-170	18.982	1.22%
170-180	5.043	0.32%
Total	1560.1	100%

γ(°)	Lumens	% Total
0- 60	613.503	39.32%
60- 90	413.966	26.53%
0-90	1027.469	65.86%
90- 180	532.68	34.14%
0- 180	1560.1	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

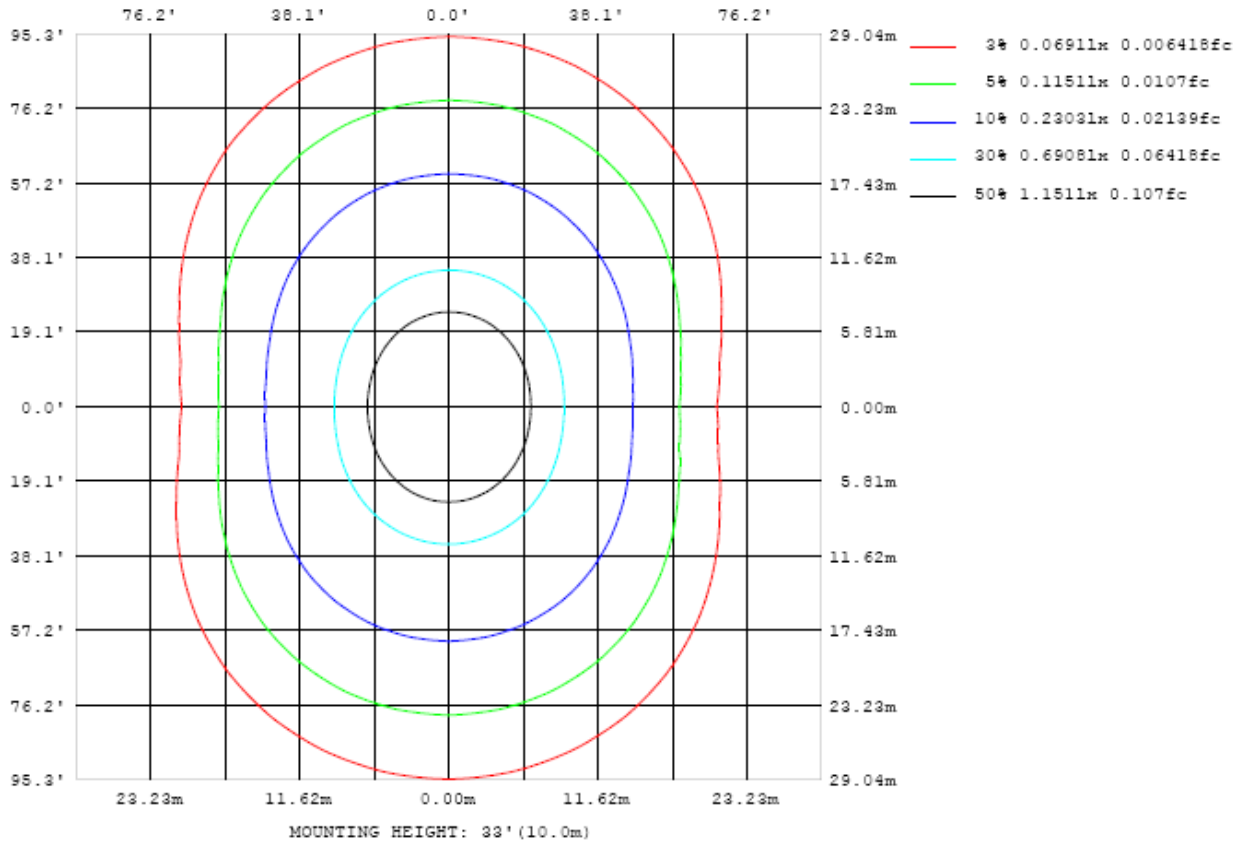


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

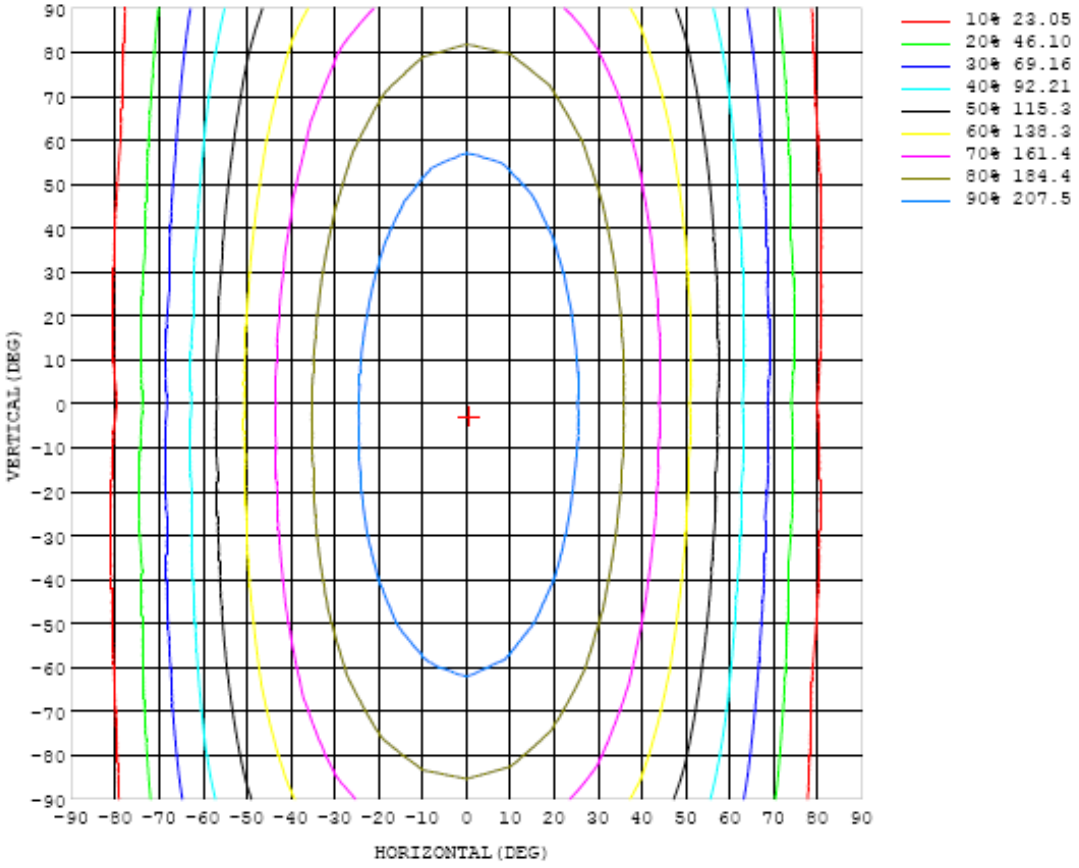


Chart 6: Isocandela Plot

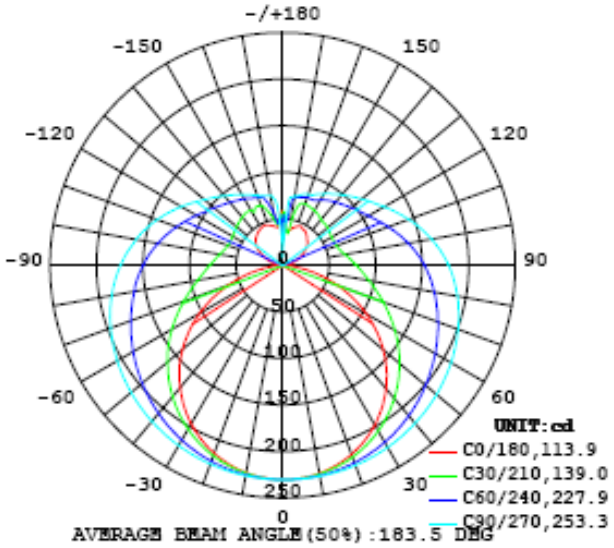


Chart 7: Polar Candela Distribution

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	230	230	230	230	230	230	230	230	230	230	230	230	230	230	230	230	230	230	230
5	230	230	230	230	230	230	230	230	230	230	230	230	230	230	230	229	229	229	229
10	227	227	227	228	228	229	229	230	230	230	230	230	229	229	228	227	227	226	226
15	222	223	223	224	225	227	228	229	230	230	229	229	228	226	225	224	223	222	222
20	216	217	218	219	221	224	226	227	228	229	228	227	225	223	221	219	217	215	215
25	208	209	211	213	216	220	223	225	227	227	227	225	223	219	216	212	209	207	207
30	198	199	202	205	210	215	219	223	225	226	225	223	219	215	210	205	200	198	197
35	186	188	191	197	203	209	215	220	223	224	223	220	215	209	203	196	190	186	185
40	173	175	180	187	195	203	211	216	220	221	220	217	211	204	195	186	179	173	171
45	158	160	167	176	186	197	206	213	217	219	218	213	206	197	187	176	166	159	157
50	141	144	152	164	177	190	201	209	214	216	215	209	201	191	178	165	152	143	141
55	123	127	137	152	167	182	195	204	210	212	211	205	196	184	169	153	138	126	122
60	104	108	122	139	158	175	189	200	206	209	207	201	191	177	160	141	123	108	103
65	83.3	89.4	106	127	148	168	183	195	202	205	203	196	185	170	151	129	108	89.8	82.7
70	62.9	70.2	90.3	115	139	160	178	190	198	201	198	191	179	163	142	118	92.8	71.3	61.8
75	42.0	51.8	75.9	104	130	153	172	185	193	196	194	186	174	156	134	108	79.3	54.0	41.1
80	22.8	35.1	63.9	94.3	122	146	165	179	187	191	188	181	168	149	126	98.5	67.6	38.3	22.2
85	8.44	22.4	54.1	86.2	115	140	159	173	182	185	182	175	162	143	119	90.9	58.9	26.7	7.64
90	1.61	15.8	47.3	79.3	108	133	152	166	175	178	176	168	155	137	113	84.4	52.6	20.6	1.16
95	2.39	13.3	42.1	73.5	101	126	145	159	168	171	169	161	148	130	106	78.3	47.6	18.0	2.67
100	6.11	15.0	39.1	67.9	94.6	118	137	151	159	163	160	153	140	122	99.7	73.0	44.5	19.3	6.46
105	10.9	19.4	38.7	63.8	88.5	111	129	142	150	154	152	144	132	115	93.5	68.8	44.1	22.5	11.5
110	15.9	24.4	39.9	61.6	83.4	104	121	133	141	144	142	136	124	108	88.2	66.8	45.4	27.2	16.8
115	20.6	28.5	42.5	60.7	79.7	97.8	113	125	132	135	133	127	116	101	84.4	66.2	47.7	31.7	22.6
120	25.5	33.4	45.8	60.8	77.2	93.1	107	116	123	126	124	118	109	96.9	81.9	66.2	50.6	36.5	28.2
125	30.4	38.3	47.9	61.9	75.5	89.3	101	110	116	118	117	112	104	92.9	80.0	66.7	53.4	41.8	33.5
130	34.5	42.6	51.5	63.1	74.5	86.2	96.3	104	109	111	110	106	98.8	89.6	78.7	67.5	55.5	46.6	37.7
135	37.4	46.5	55.5	63.7	74.1	83.8	92.2	98.6	103	105	104	100	94.3	86.7	77.7	68.2	58.0	50.9	40.8
140	40.3	49.7	58.3	64.3	73.2	81.7	88.7	93.8	97.5	98.9	98.1	95.2	90.5	84.2	76.8	68.5	61.6	54.6	43.0
145	43.3	51.6	61.1	66.6	71.2	79.2	85.2	89.6	92.5	93.8	93.2	90.9	87.1	82.2	76.3	69.7	64.7	57.7	44.9
150	44.5	50.1	63.4	68.1	71.5	75.6	81.3	85.2	87.8	88.9	88.6	86.9	84.1	80.4	76.1	71.3	67.2	58.5	46.3
155	46.4	50.1	64.8	69.3	72.3	75.2	77.5	80.1	82.7	84.0	84.3	83.6	81.6	79.0	76.1	72.6	67.6	59.9	47.3
160	44.4	43.3	62.3	70.4	72.5	75.3	77.8	79.1	80.3	81.0	81.4	80.8	79.5	77.7	75.0	72.5	66.1	55.8	45.9
165	41.6	36.5	44.4	66.6	72.4	74.1	75.6	76.9	77.9	78.5	78.6	78.1	77.0	73.5	67.8	59.7	55.3	47.5	44.0
170	37.8	35.0	32.7	37.7	57.1	70.7	73.7	74.4	74.9	75.5	76.0	73.9	61.6	53.4	50.2	47.6	44.5	42.7	42.0
175	44.0	46.0	44.1	40.5	42.7	45.5	46.5	51.3	58.8	62.4	47.4	37.2	42.5	46.0	47.3	47.2	46.9	48.1	48.1
180	27.4	27.4	27.4	27.4	27.4	27.4	27.4	27.4	27.4	27.4	27.4	27.4	27.4	27.4	27.4	27.4	27.4	27.4	27.4

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	230	230	230	230	230	230	230	230	230	230	230	230	230	230	230	230	230		
5	229	229	229	229	229	230	230	230	230	230	230	230	230	230	230	230	230		
10	226	226	227	227	228	228	229	229	229	229	229	229	229	228	228	227	227		
15	222	222	223	224	225	227	227	228	228	228	228	227	226	225	224	223	223		
20	215	216	218	220	222	224	225	227	227	227	226	225	223	221	219	218	217		
25	207	209	211	214	218	221	223	225	226	225	224	222	219	216	213	211	209		
30	197	200	203	208	212	217	220	222	223	223	221	218	214	210	205	202	199		
35	186	189	194	200	207	213	217	220	221	221	218	214	209	203	197	192	188		
40	173	177	184	192	200	208	213	217	219	218	215	210	203	195	187	180	175		
45	159	164	173	183	193	202	209	214	216	215	211	204	196	186	176	167	161		
50	143	151	162	174	186	197	205	211	213	211	207	199	189	177	165	154	146		
55	126	136	150	164	179	191	201	207	209	208	202	194	182	168	153	139	128		
60	107	120	137	156	172	186	196	203	205	203	198	188	174	158	141	124	110		
65	88.5	104	125	146	164	180	191	198	201	199	193	182	167	149	129	108	91.3		
70	69.3	89.0	113	137	158	174	186	194	197	194	188	176	160	140	117	92.7	72.4		
75	50.9	74.8	102	128	151	168	181	189	192	190	182	170	154	132	106	78.5	54.1		
80	34.6	62.6	92.8	120	144	162	175	183	186	184	177	164	147	124	96.5	66.2	37.9		
85	22.4	53.2	84.8	113	137	157	169	178	181	178	171	158	140	116	88.3	56.6	25.6		
90	16.3	46.9	78.4	107	131	150	163	171	174	172	164	152	133	110	81.6	49.8	18.9		
95	14.5	42.8	73.1	101	125	143	157	165	168	165	158	145	127	104	75.8	45.2	16.5		
100	16.3	40.3	68.5	95.0	118	136	149	157	160	158	151	138	120	97.2	70.7	42.2	17.1		
105	19.9	39.9	65.0	89.6	111	129	142	149	152	150	142	130	113	91.4	66.6	41.0	20.2		
110	25.4	41.5	62.6	84.8	105	121	133	141	144	141	134	123	106	86.2	63.8	41.8	24.2		
115	31.2	44.3	62.0	80.8	98.9	114	125	132	135	133	126	115	100.0	81.9	62.2	43.7	29.0		
120	36.6	47.6	62.3	78.3	93.5	107	117	124	126	124	118	108	94.3	78.6	62.0	46.4	34.5		
125	41.6	51.2	63.3	76.7	89.7	101	110	116	118	116	110	101	89.8	76.5	62.5	49.2	39.5		
130	46.5	54.7	64.7	75.6	86.5	96.1	103	108	110	108	104	96.2	86.5	75.2	63.4	52.3	44.9		
135	51.7	58.0	66.2	75.0	84.0	92.0	98.1	102	103	102	98.0	91.8	83.7	74.3	64.5	55.7	48.8		
140	55.7	60.8	67.6	74.8	81.9	88.3	93.2	96.4	97.5	96.4	93.1	88.1	81.5	73.8	65.6	58.9	53.3		
145	59.1	62.8	68.9	74.4	80.2	85.2	89.0	91.6	92.4	91.5	88.9	84.9	79.6	73.2	67.2	62.5	57.4		
150	62.2	64.5	68.1	74.1	78.4	82.4	85.4	87.3	87.9	87.2	85.3	82.1	77.6	72.9	68.6	64.9	60.9		
155	64.3	66.8	68.9	73.8	76.8	79.6	81.8	83.3	83.7	83.2	81.7	79.2	76.3	73.4	70.7	67.5	63.8		
160	57.2	66.4	68.6	69.1	75.9	77.4	78.7	79.6	80.0	79.7	78.8	77.6	75.9	74.0	72.1	70.2	61.8		
165	47.9	55.7	59.5	63.0	66.9	73.2	77.0	77.4	77.6	77.6	77.2	76.6	75.8	74.5	73.2	71.8	53.8		
170	42.8	45.4	48.9	50.8	53.7	57.8	64.0	73.6	75.9	75.9	75.8	75.5	75.1	74.6	72.3	57.9	41.6		
175	47.6	46.3	47.5	47.0	46.2	45.0	41.7	47.5	61.8	70.9	72.4	71.4	61.4	51.7	46.9	44.2	42.1		
180	27.4	27.4	27.4	27.4	27.4	27.4	27.4	27.4	27.4	27.4	27.4	27.4	27.4	27.4	27.4	27.4	27.4		

Table 7: Luminous Intensity Data

EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Aug. 14, 2018	Aug. 13, 2019
Digital Power Meter	PF2010A	HZTE028-01	Sep. 12, 2018	Sep. 11, 2019
AC Power Supply	DPS1060	HZTE001-06	Aug. 09, 2018	Aug. 08, 2019
DC Power Supply	WY12010	HZTE004-03	Aug. 09, 2018	Aug. 08, 2019
Temperature recorder	JM624U	HZTE018-08	Aug. 09, 2018	Aug. 08, 2019
Temperature and humidity recorder	JR900	HZTE018-01	Aug. 09, 2018	Aug. 08, 2019
Standard source	D908	HZTE012-01	Aug. 14, 2018	Aug. 13, 2019
Integrate Sphere system	3M	HZTE015-04	Aug. 16, 2018	Aug. 15, 2019
Digital Power Meter	WT210	HZTE008-01	Aug. 02, 2018	Aug. 01, 2019
AC Power Supply	PCR 500L	HZTE001-07	Aug. 09, 2018	Aug. 08, 2019
DC Power Supply	IT6154	HZTE004-04	Aug. 09, 2018	Aug. 08, 2019
Standard source	SCL-1400	HZTE012-02	Aug. 16, 2018	Aug. 15, 2019
Temperature and humidity recorder	JR900	HZTE018-02	Aug. 09, 2018	Aug. 08, 2019
Temperature Meter	TES1310	HZTE017-01	Aug. 09, 2018	Aug. 08, 2019

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

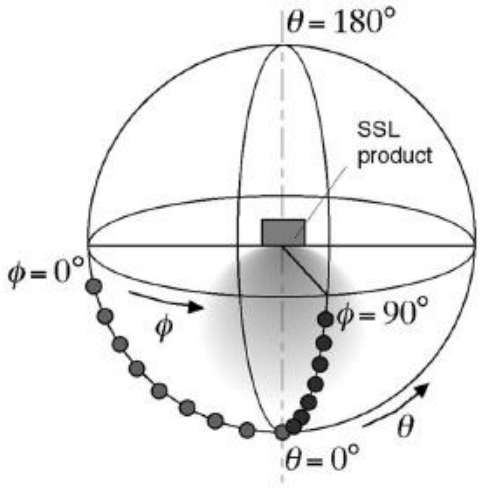
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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