

LM-79-08 TEST REPORT

for

GREEN CREATIVE LTD

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

LED Tube

Model: 12T8/3F/835/GL/BYP

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ19070032f

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

Review by:



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Jul. 25, 2019

Approved by:



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/835/GL/BYP

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
140.1	1610.0	11.49	0.9832
CCT (K)	CRI	Stabilization Time (Light & Power)	
3530	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, 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

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SAMPLE PHOTO



Figure 1- Overview of the sample

Equipment Under Test(EUT)

Name	: LED Tube
Model	: 12T8/3F/835/GL/BYP
Electrical Ratings	: 120-277V, 50/60Hz, 12W
Product Description	: 3500K
Manufacturer	: GREEN CREATIVE LTD
Address	: 756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

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)	0.098	0.046
Power Factor	0.9832	0.9152
Test Power (W)	11.49	11.71
THD A%	15.85	14.17
Luminous Efficacy (lm/W)	140.1	138.1
Total Luminous Flux (lm)	1610.0	1617.7
Color Rendering Index (CRI)	82.9	
R9	9	
Correlated Color Temperature (CCT)(K)	3530	
Chromaticity Chroma x	0.4025	
Chromaticity Chroma y	0.3872	
Chromaticity Chroma u	0.2354	
Chromaticity Chroma v	0.3396	
Duv	-0.0010	
Chromaticity Chroma u'	0.2354	
Chromaticity Chroma v'	0.5094	

Special Color Rendering Indices	
R1	81.4
R2	89.3
R3	95.4
R4	82.1
R5	81.6
R6	85.9
R7	84.9
R8	62.9
R9	9
R10	75.1
R11	81.5
R12	67.1
R13	83.2
R14	97.6

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 25.1 °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)	0.098
0.098Power Factor	0.9833
Power (W)	11.53
Luminous Efficacy (lm/W)	137.5
Total Luminous Flux (lm)	1585.9
Beam Angle (°)	114.1 (0°-180°) / 254.5 (90°-270°)
Center Beam Candle Power (cd)	233
Maximum Beam Candle Power (cd)	233.3 (At: C=70.0, Gamma=2.0)
Spacing Criteria	1.28 (0°-180°) / 1.49(90°-270°)
Zonal Lumens in the 0 °-60 °Zone	39.17%
Zonal Lumens in the 60 °-90 °Zone	26.47%
Zonal Lumens in the 90 °-120 °Zone	18.97%
Zonal Lumens in the 120 °-180 °Zone	15.39%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

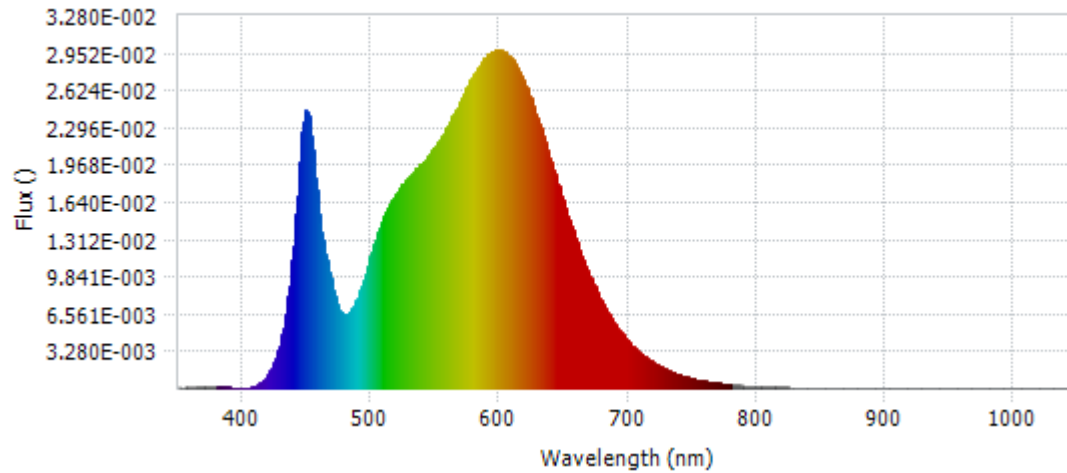
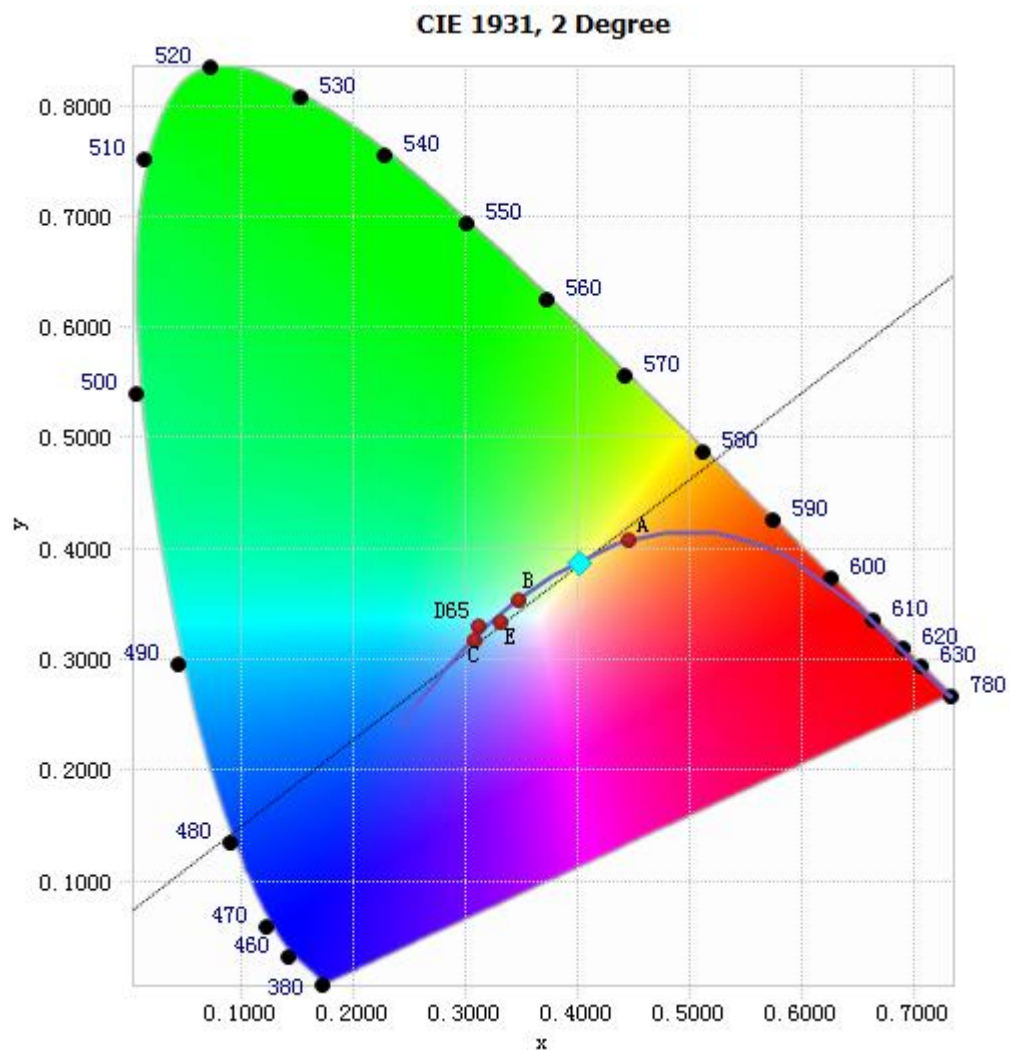


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.11E-04	485	7.08E-03	590	2.93E-02	695	4.87E-03
385	9.85E-05	490	8.28E-03	595	2.97E-02	700	4.17E-03
390	7.79E-05	495	9.99E-03	600	2.98E-02	705	3.58E-03
395	5.61E-05	500	1.20E-02	605	2.95E-02	710	3.04E-03
400	4.96E-05	505	1.37E-02	610	2.88E-02	715	2.62E-03
405	7.96E-05	510	1.52E-02	615	2.79E-02	720	2.25E-03
410	2.56E-04	515	1.64E-02	620	2.66E-02	725	1.92E-03
415	6.38E-04	520	1.73E-02	625	2.52E-02	730	1.64E-03
420	1.34E-03	525	1.80E-02	630	2.36E-02	735	1.40E-03
425	2.62E-03	530	1.87E-02	635	2.17E-02	740	1.20E-03
430	4.72E-03	535	1.93E-02	640	2.00E-02	745	1.02E-03
435	8.19E-03	540	1.99E-02	645	1.81E-02	750	8.66E-04
440	1.39E-02	545	2.07E-02	650	1.63E-02	755	7.40E-04
445	2.13E-02	550	2.14E-02	655	1.45E-02	760	6.32E-04
450	2.43E-02	555	2.23E-02	660	1.29E-02	765	5.44E-04
455	1.98E-02	560	2.32E-02	665	1.13E-02	770	4.63E-04
460	1.45E-02	565	2.43E-02	670	9.95E-03	775	4.00E-04
465	1.13E-02	570	2.55E-02	675	8.65E-03	780	3.36E-04
470	8.58E-03	575	2.66E-02	680	7.54E-03		
475	6.89E-03	580	2.77E-02	685	6.53E-03		
480	6.54E-03	585	2.86E-02	690	5.64E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4025, 0.3872)

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

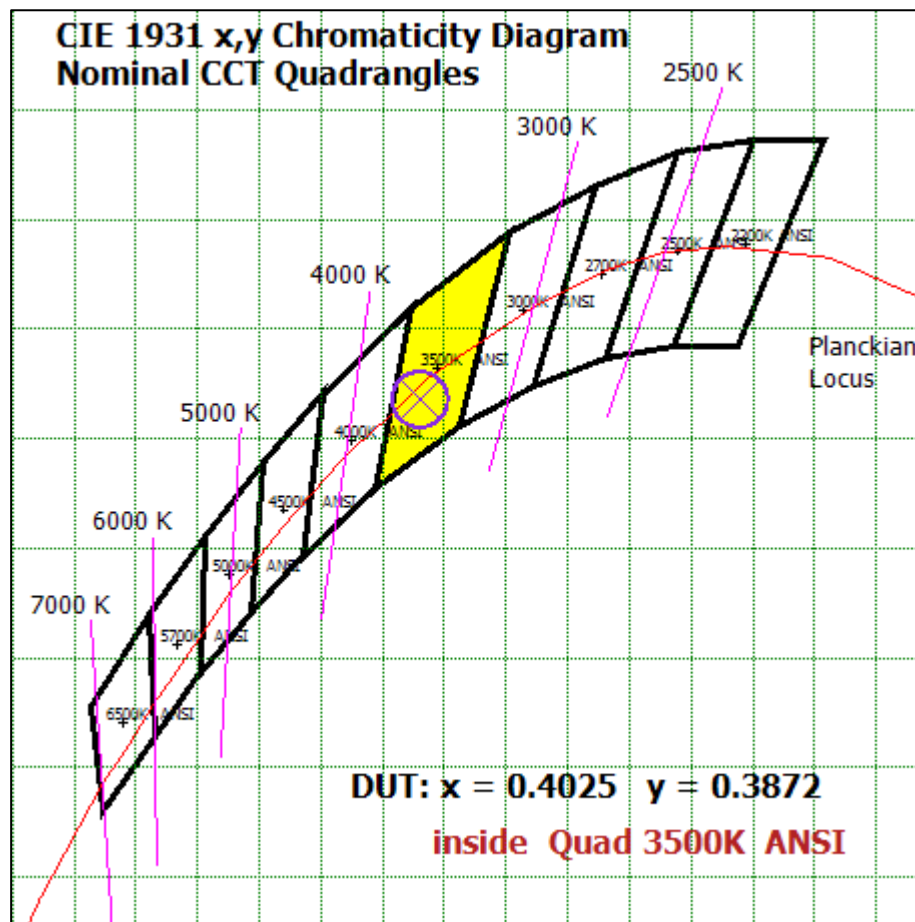


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method

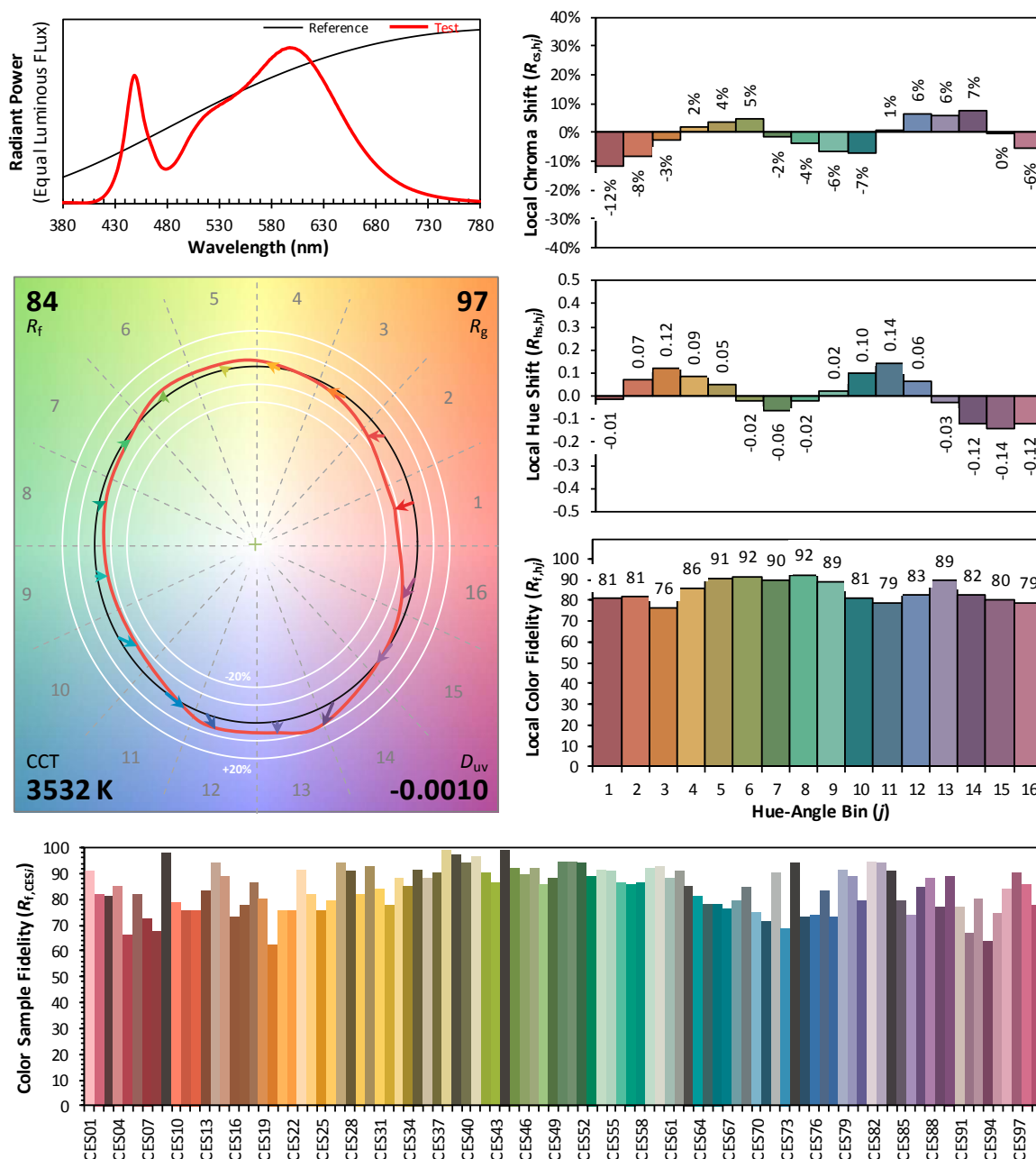


Chart 4: Full Report Created with the IES TM-30 Calculator

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	22.15	1.40%
10- 20	64.557	4.07%
20- 30	101.48	6.40%
30- 40	129.943	8.19%
40- 50	148.015	9.33%
50- 60	155.043	9.78%
60- 70	151.828	9.57%
70- 80	141.035	8.89%
80- 90	126.979	8.01%
90-100	113.699	7.17%
100-110	100.262	6.32%
110-120	86.812	5.47%
120-130	73.914	4.66%
130-140	61.578	3.88%
140-150	48.71	3.07%
150-160	34.949	2.20%
160-170	19.579	1.23%
170-180	5.324	0.34%
Total	1585.9	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	621.188	39.17%
60- 90	419.842	26.47%
0-90	1041.03	65.64%
90- 180	544.827	34.36%
0- 180	1585.9	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

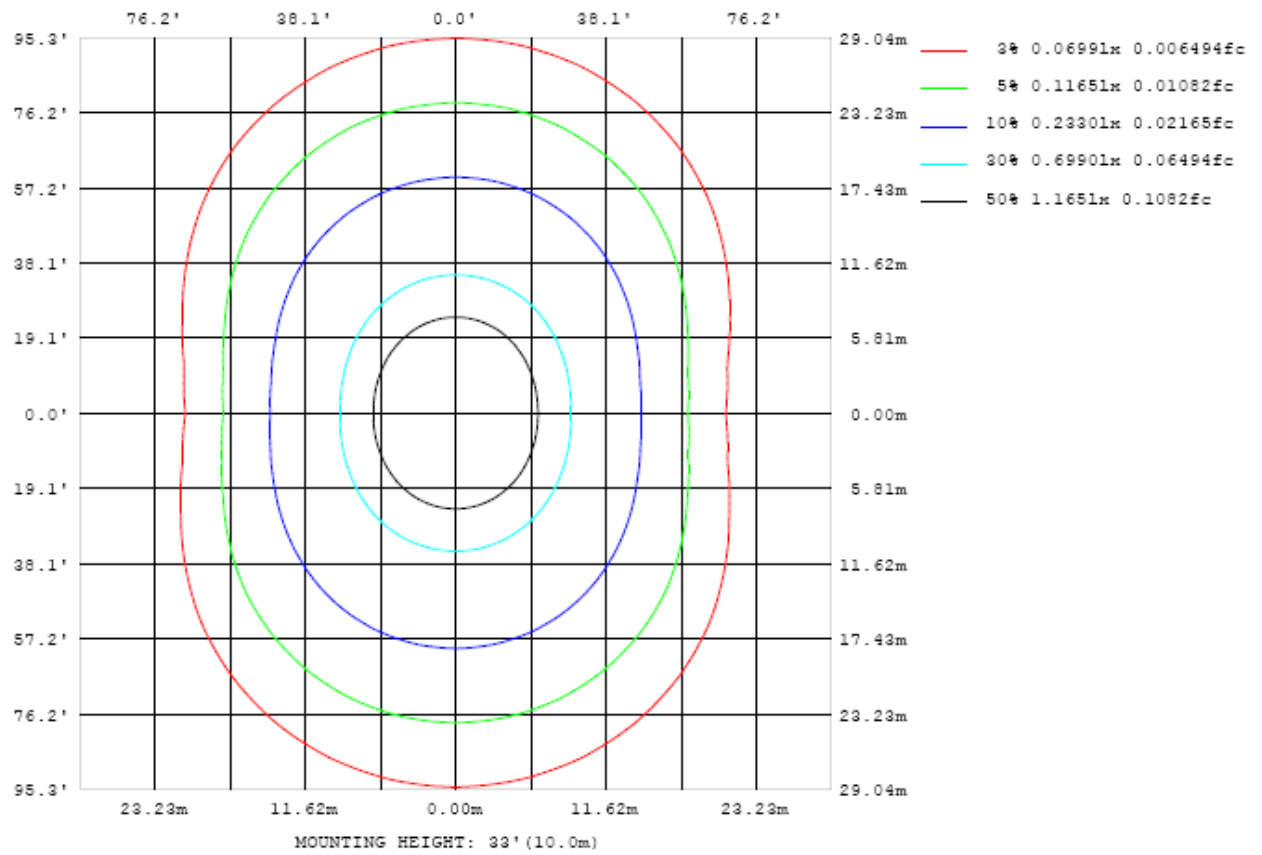


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

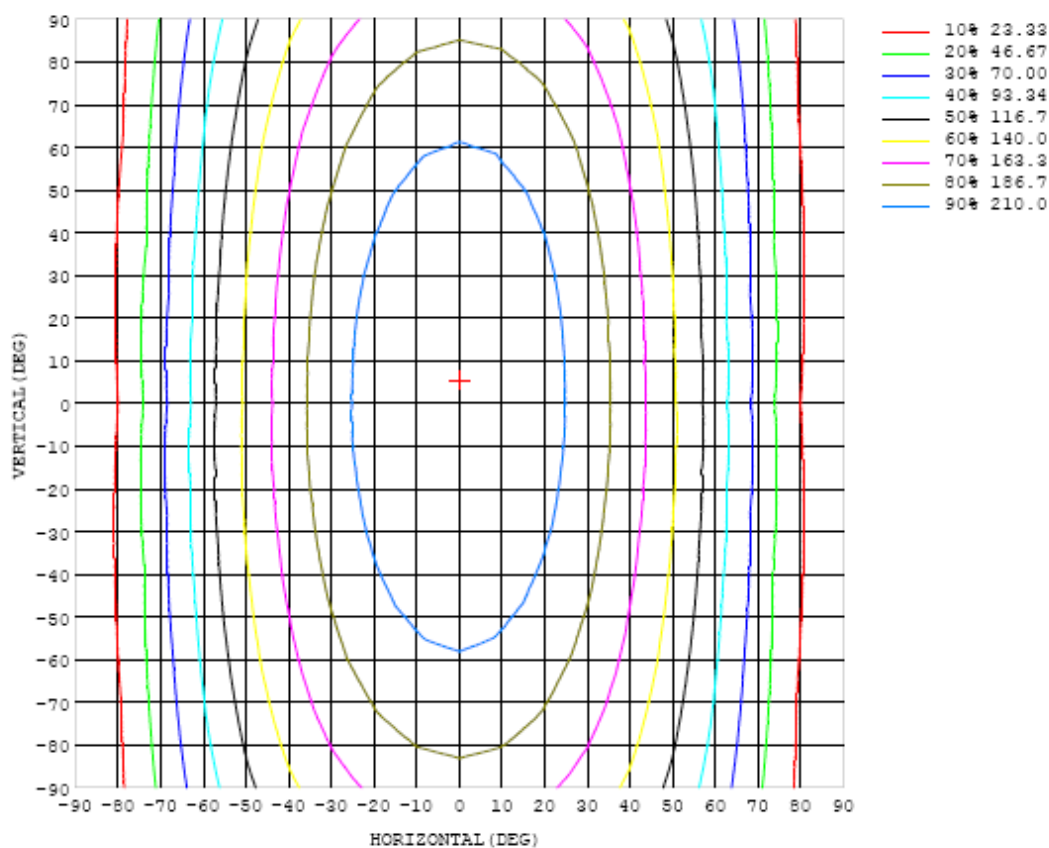


Chart 6: Isocandela Plot

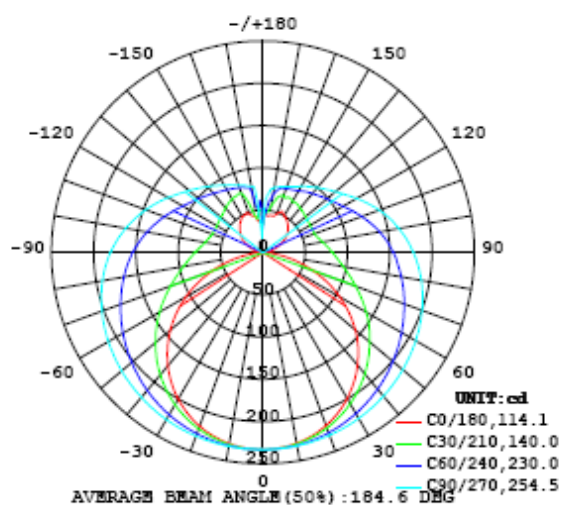


Chart 7: Polar Candela Distribution

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	233	233	233	233	233	233	233	233	233	233	233	233	233	233	233	233	233	233	233
5	232	232	232	232	233	233	233	233	233	233	233	233	233	233	233	232	232	232	232
10	229	229	230	230	230	231	232	232	232	232	232	232	232	231	231	230	230	230	229
15	224	225	225	226	227	229	229	230	231	231	231	231	230	229	228	227	226	225	225
20	218	218	219	221	223	225	227	228	230	230	230	229	228	226	223	222	220	219	218
25	210	210	212	214	218	221	224	226	228	228	228	227	224	222	218	215	213	211	210
30	199	200	203	206	211	216	220	223	226	227	226	224	221	217	212	208	204	201	200
35	187	189	192	198	204	210	216	220	223	224	223	221	217	211	205	198	194	190	188
40	174	176	180	187	196	204	211	217	220	222	220	217	212	205	197	189	182	177	175
45	159	161	167	176	187	197	206	213	217	219	218	213	207	198	188	178	169	163	160
50	143	146	154	165	178	190	201	209	214	216	214	209	201	191	179	166	156	147	143
55	124	128	139	154	168	183	195	204	210	212	210	205	196	184	169	155	141	130	125
60	105	110	123	141	159	176	189	200	206	209	206	200	190	176	160	142	125	112	105
65	84.1	90.8	107	129	150	168	184	195	202	205	202	195	184	169	151	130	109	92.7	84.7
70	63.0	71.5	92.0	117	141	161	178	190	198	200	198	190	178	162	142	118	93.8	73.4	63.9
75	42.1	53.0	77.8	106	133	155	172	185	193	195	193	185	172	156	133	107	79.5	54.9	43.1
80	23.0	36.7	65.6	96.6	125	149	166	179	187	190	187	179	166	149	125	97.4	67.0	38.3	23.4
85	7.92	24.5	56.3	88.7	118	142	160	174	182	184	181	173	160	142	118	89.3	57.3	25.7	8.39
90	0.93	18.3	49.9	82.2	111	136	154	167	175	178	175	167	154	135	111	82.5	50.5	18.7	0.51
95	3.04	16.0	45.5	76.7	105	129	148	160	168	171	168	160	148	129	105	76.9	45.7	15.8	2.17
100	6.81	17.5	42.5	71.6	98.9	122	140	154	161	163	161	153	140	122	98.5	71.3	42.0	16.5	5.41
105	11.6	20.3	42.1	67.6	92.8	115	132	145	153	155	153	145	132	114	92.3	66.8	40.9	19.5	9.94
110	17.1	25.0	43.4	65.2	87.6	108	124	137	144	146	144	136	124	107	86.7	63.7	41.6	22.5	15.0
115	22.8	30.5	45.8	64.4	83.6	102	117	128	135	137	135	128	116	101	82.2	62.4	43.4	28.0	20.4
120	28.5	36.3	48.3	64.5	81.0	96.5	109	120	126	128	126	119	109	95.1	79.2	62.3	45.8	33.6	25.8
125	33.9	42.1	51.3	65.2	79.3	92.6	104	112	117	119	117	111	103	91.0	77.4	62.9	48.7	38.8	30.7
130	38.5	47.7	54.9	66.1	78.2	89.4	98.7	106	110	112	110	105	97.7	88.0	76.4	63.7	52.7	43.8	34.7
135	42.2	53.0	58.7	67.2	77.7	86.9	94.5	101	104	106	104	99.9	93.6	85.5	75.8	64.6	56.5	48.6	38.5
140	45.5	57.6	62.3	68.6	76.7	84.8	91.0	95.9	99.0	100	98.6	95.3	90.1	83.5	74.5	66.5	60.3	53.2	42.4
145	48.1	60.6	64.9	70.2	76.2	82.4	87.9	91.8	94.2	95.0	94.0	91.2	86.9	80.7	74.3	68.8	63.4	56.8	45.7
150	50.6	63.1	66.3	70.0	76.4	80.5	84.4	87.6	89.7	90.3	89.3	86.9	83.2	79.1	75.1	71.0	65.9	59.3	48.8
155	53.5	65.5	69.4	71.3	75.3	79.4	82.0	84.1	85.4	85.6	85.0	83.6	81.4	78.8	75.8	72.6	68.6	61.3	49.2
160	48.8	63.3	70.7	71.1	74.3	78.6	80.2	81.8	82.7	83.0	82.6	81.6	80.1	78.3	76.2	73.3	70.0	65.0	48.3
165	44.9	57.0	62.9	67.5	70.1	74.4	78.7	79.5	80.1	80.4	80.0	79.5	78.7	77.7	76.0	73.4	71.0	67.8	44.8
170	44.3	48.1	53.0	55.6	59.4	65.4	69.6	74.3	77.7	77.7	77.6	77.2	76.5	75.6	74.5	73.1	72.5	60.7	39.7
175	45.6	46.4	46.8	47.6	46.6	48.0	52.2	59.3	65.7	70.1	71.3	71.9	73.0	73.2	72.6	68.6	59.0	48.6	44.0
180	34.2	34.2	34.2	34.2	34.2	34.2	34.2	34.2	34.2	34.2	34.2	34.2	34.2	34.2	34.2	34.2	34.2	34.2	34.2

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	233	233	233	233	233	233	233	233	233	233	233	233	233	233	233	233	233		
5	232	233	233	233	233	233	233	233	233	233	233	233	233	232	232	232	232		
10	230	230	231	231	231	232	232	232	233	233	232	232	231	231	230	230	229		
15	225	226	227	228	229	230	231	232	232	232	231	230	229	228	226	225	225		
20	219	220	222	224	226	228	230	231	231	231	230	228	226	224	221	219	218		
25	211	213	216	219	222	225	228	229	230	229	227	225	222	218	215	212	210		
30	201	204	208	213	217	222	225	227	228	227	225	222	217	212	207	203	200		
35	190	193	199	205	212	218	223	225	226	225	222	218	212	205	198	193	189		
40	177	182	189	197	206	213	219	223	224	223	219	213	206	197	189	181	176		
45	162	169	178	189	199	208	215	220	221	219	215	208	199	188	178	168	161		
50	146	154	166	179	192	202	211	216	218	216	211	203	192	179	166	154	145		
55	128	139	154	170	184	197	207	212	214	213	207	198	185	170	154	139	128		
60	110	123	141	160	177	191	202	208	211	209	202	192	178	160	142	123	109		
65	90.8	107	128	150	169	185	197	204	207	205	198	186	171	151	129	108	90.4		
70	71.4	91.6	116	141	162	179	192	200	202	200	193	181	164	142	118	92.8	71.4		
75	53.0	77.0	105	132	155	173	187	195	198	195	188	175	157	134	107	78.8	53.6		
80	36.1	64.8	95.3	124	148	167	181	190	193	190	182	169	150	126	97.9	67.1	37.4		
85	23.3	54.9	87.1	116	141	161	175	184	187	184	176	163	144	119	90.1	57.9	25.6		
90	16.7	48.2	80.4	110	135	154	168	177	180	178	170	156	137	113	83.7	51.5	19.5		
95	14.4	43.4	74.3	103	127	147	161	170	173	170	162	149	130	106	78.0	47.0	17.5		
100	16.0	40.8	69.4	96.9	120	139	153	162	165	162	155	142	123	100	73.2	44.5	19.3		
105	19.6	40.3	66.2	91.2	114	132	145	153	156	154	147	134	117	94.6	69.5	44.3	22.8		
110	24.2	41.7	63.8	86.4	107	124	137	145	148	145	138	126	110	89.7	67.3	46.0	27.1		
115	29.6	44.2	63.0	82.4	101	117	129	136	139	137	130	119	104	85.8	67.2	48.6	32.5		
120	35.1	46.8	63.0	80.0	95.9	110	120	127	130	128	122	112	98.7	83.5	67.3	51.4	37.7		
125	40.3	50.2	63.8	78.2	92.1	104	113	119	121	120	115	106	94.9	81.8	67.9	54.1	42.6		
130	45.1	54.4	64.9	77.1	89.0	99.2	107	112	114	113	108	101	91.6	80.5	68.9	57.7	46.8		
135	48.6	58.6	66.3	76.3	86.3	95.0	102	106	108	107	103	97.0	88.9	79.4	69.6	61.4	50.3		
140	52.0	62.6	68.8	75.7	84.0	91.3	96.9	100	102	101	98.0	92.9	86.2	78.4	71.2	64.7	52.6		
145	54.5	66.3	71.0	76.3	82.1	88.1	92.7	95.3	96.5	95.9	93.6	89.3	83.8	78.1	72.7	67.4	53.7		
150	54.9	69.2	72.9	77.0	81.2	85.4	88.9	91.0	92.0	91.5	89.7	86.4	82.4	78.4	73.4	69.3	53.8		
155	51.6	70.3	74.1	77.3	80.3	83.3	85.8	87.3	88.0	87.6	86.4	84.3	81.6	77.3	73.5	72.1	52.9		
160	43.7	61.4	73.9	77.3	79.3	81.6	83.2	84.2	84.6	84.5	83.7	82.5	79.4	74.0	69.7	66.1	48.3		
165	39.9	48.6	55.2	75.5	78.0	79.6	80.9	81.6	82.0	81.9	81.7	76.4	65.1	61.1	58.5	53.9	43.7		
170	35.0	40.1	41.0	43.0	55.1	67.8	77.1	79.3	79.3	74.9	56.1	50.2	49.6	48.2	46.4	44.1	43.1		
175	42.2	43.1	49.7	54.5	55.8	55.4	56.6	52.6	33.5	43.2	55.4	56.5	55.6	54.1	51.9	49.7	47.1		
180	34.2	34.2	34.2	34.2	34.2	34.2	34.2	34.2	34.2	34.2	34.2	34.2	34.2	34.2	34.2	34.2	34.2		

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.

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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