

LM-79-08 Test Report

for

GREEN CREATIVE LTD

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

LED Tube

Model: 11.5T8/4F/835/DEB/RC

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

3rd Floor, Bld. 2, NO. 96 Longchuanwu Rd Qianjiang Economy Dev. Zone, Yuhang Dist,
Hangzhou, Zhejiang Province, China 311100

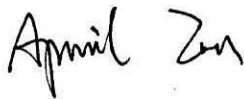
Tel: +86 571 86376106

www.ledtestlab.com

Report No.: HZ181200371

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

Review by:



Engineer: April Zou
Feb. 20, 2019

Approved by:



Manager: Jim Zhang
Feb. 20, 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: 11.5T8/4F/835/DEB/RC

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
153.3	1812.0	11.82	0.9822
CCT (K)	CRI	Stabilization Time (Light & Power)	
3512	82.6	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 : Dec. 26, 2018

Date of Test : Jan. 25, 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

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Sample Photos



Figure 1- Overview of the sample

Equipment Under Test (EUT)

Name	: LED Tube
Model	: 11.5T8/4F/835/DEB/RC
Electrical Ratings	: 120-277V, 50/60Hz, 11.5W
Product Description	: G13 base, 3500K
Manufacturer	: GREEN CREATIVE LTD
Address	: 756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

TEST RESULTS

Test ambient temperature was 25.0°C.

Base orientation was light down. 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 70 minutes.

Sphere-Spectroradiometer Method

Parameter	Result	
Test Voltage (V)	120.0	277.0
Voltage frequency (Hz)	60	60
Test Current (A)	0.100	0.047
Power Factor	0.9822	0.9494
Test Power (W)	11.82	12.42
THD A%	17.73	16.24
Luminous Efficacy (lm/W)	153.3	149.5
Total Luminous Flux (lm)	1812.0	1857.0
Color Rendering Index (CRI)	82.6	
R9	7.2	
Correlated Color Temperature (CCT)(K)	3512	
Chromaticity Chroma x	0.4046	
Chromaticity Chroma y	0.3906	
Chromaticity Chroma u	0.2353	
Chromaticity Chroma v	0.3407	
Duv	0.0001	
Chromaticity Chroma u'	0.2353	
Chromaticity Chroma v'	0.5111	

Special Color Rendering Indices	
R1	80.8
R2	89.9
R3	96
R4	80.7
R5	80.8
R6	86.3
R7	84.5
R8	61.8
R9	7.2
R10	76.1
R11	79.5
R12	64.7
R13	83
R14	98.1
Rf	82
Rg	95

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 30m.

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)	0.102
Power Factor	0.9779
Test Power (W)	11.97
Luminous Efficacy (lm/W)	149.6
Total Luminous Flux (lm)	1790.2
Beam Angle (°)	156.0
Center Beam Candle Power (cd)	319
Spacing Criteria	1.25(0 °-180 °)/ 1.40 (90 °-270 °)
Zonal Lumens in the 0 °-60 °Zone	44.74%
Zonal Lumens in the 60 °-90 °Zone	26.57%
Zonal Lumens in the 90 °-120 °Zone	16.69%
Zonal Lumens in the 120 °-180 °Zone	12.01%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

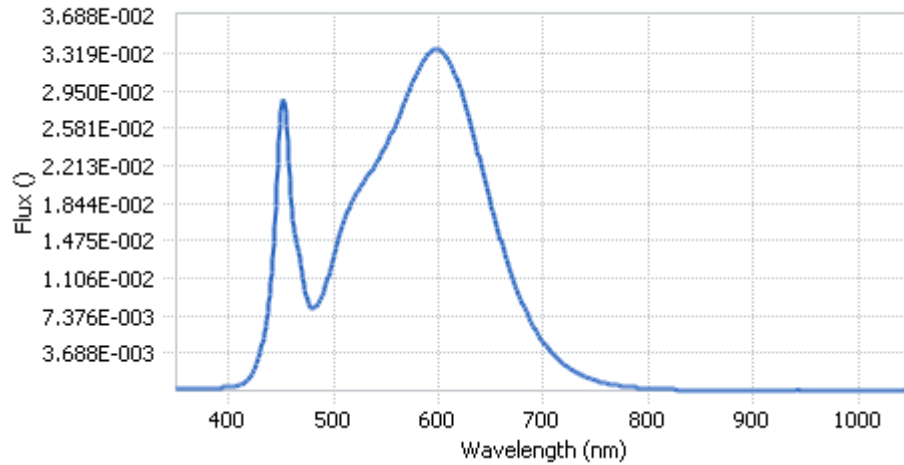
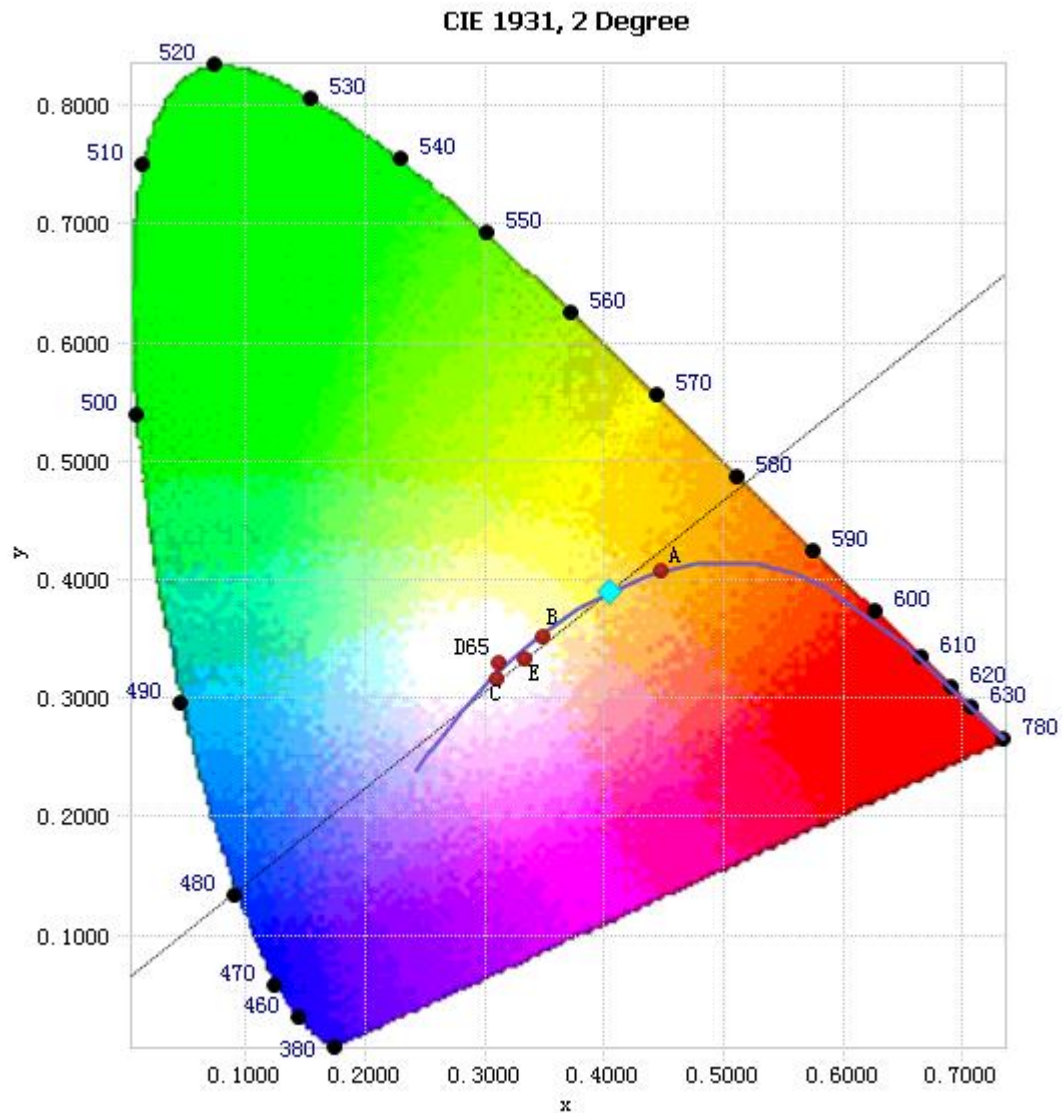


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.92E-04	485	8.55E-03	590	3.31E-02	695	5.51E-03
385	2.83E-04	490	9.58E-03	595	3.35E-02	700	4.75E-03
390	3.03E-04	495	1.12E-02	600	3.35E-02	705	4.08E-03
395	3.23E-04	500	1.32E-02	605	3.31E-02	710	3.50E-03
400	3.31E-04	505	1.51E-02	610	3.23E-02	715	2.99E-03
405	4.23E-04	510	1.67E-02	615	3.13E-02	720	2.57E-03
410	5.75E-04	515	1.81E-02	620	2.99E-02	725	2.19E-03
415	8.57E-04	520	1.91E-02	625	2.82E-02	730	1.88E-03
420	1.35E-03	525	2.00E-02	630	2.64E-02	735	1.60E-03
425	2.27E-03	530	2.08E-02	635	2.44E-02	740	1.37E-03
430	3.82E-03	535	2.15E-02	640	2.24E-02	745	1.17E-03
435	6.35E-03	540	2.23E-02	645	2.03E-02	750	1.00E-03
440	1.06E-02	545	2.32E-02	650	1.83E-02	755	8.61E-04
445	1.82E-02	550	2.41E-02	655	1.64E-02	760	7.44E-04
450	2.75E-02	555	2.52E-02	660	1.46E-02	765	6.33E-04
455	2.61E-02	560	2.64E-02	665	1.28E-02	770	5.47E-04
460	1.78E-02	565	2.76E-02	670	1.12E-02	775	4.66E-04
465	1.45E-02	570	2.90E-02	675	9.81E-03	780	4.07E-04
470	1.17E-02	575	3.02E-02	680	8.53E-03		
475	8.92E-03	580	3.14E-02	685	7.42E-03		
480	8.13E-03	585	3.24E-02	690	6.40E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y) : (0.4046,0.3906)

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

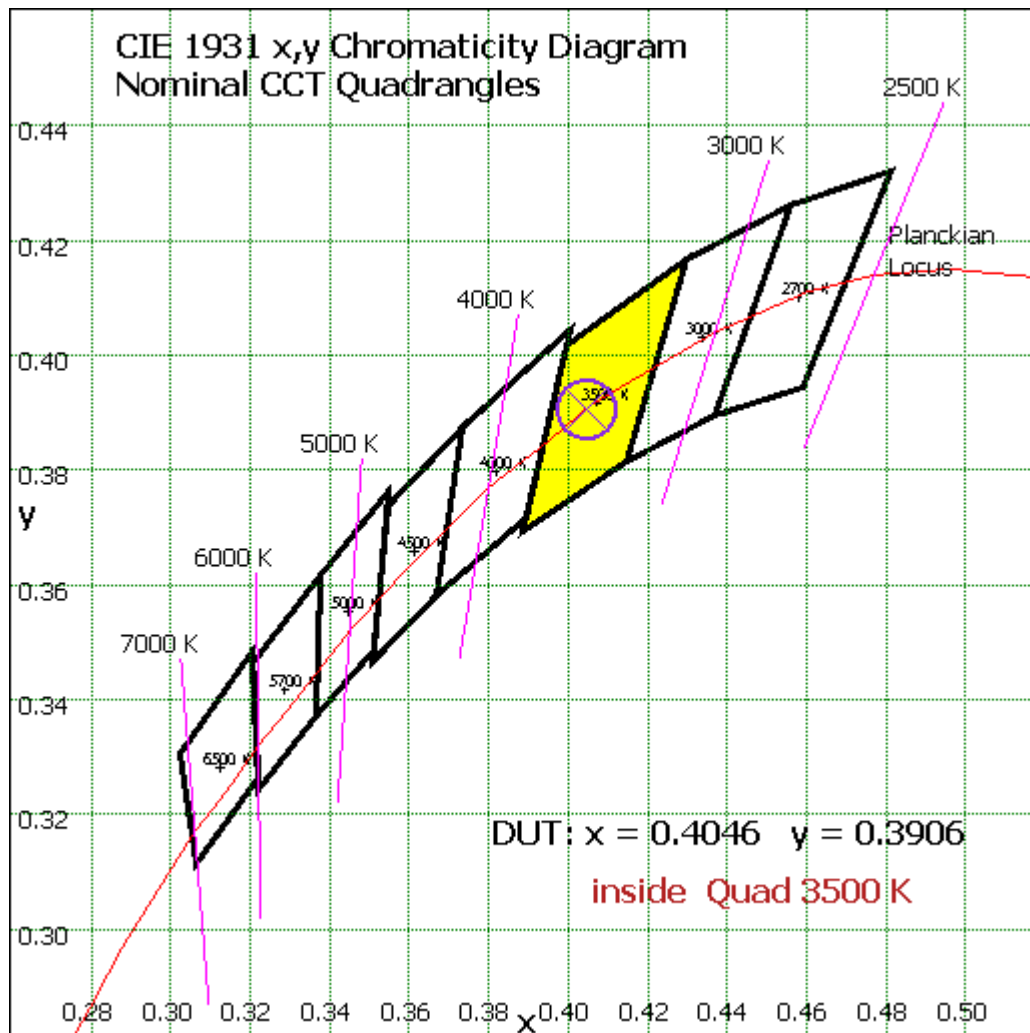


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	30.212	1.69%
10- 20	87.378	4.88%
20- 30	135.317	7.56%
30- 40	169.576	9.47%
40- 50	187.92	10.50%
50- 60	190.493	10.64%
60- 70	179.595	10.03%
70- 80	159.45	8.91%
80- 90	136.547	7.63%
90-100	116.812	6.53%
100-110	99.085	5.53%
110-120	82.837	4.63%
120-130	68.164	3.81%
130-140	54.68	3.05%
140-150	42.08	2.35%
150-160	29.45	1.65%
160-170	15.956	0.89%
170-180	4.645	0.26%
Total	1790.2	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	800.896	44.74%
60- 90	475.592	26.57%
0-90	1276.488	71.30%
90- 180	513.709	28.70%
0- 180	1790.2	100%

Table 5: Zonal Lumen Data

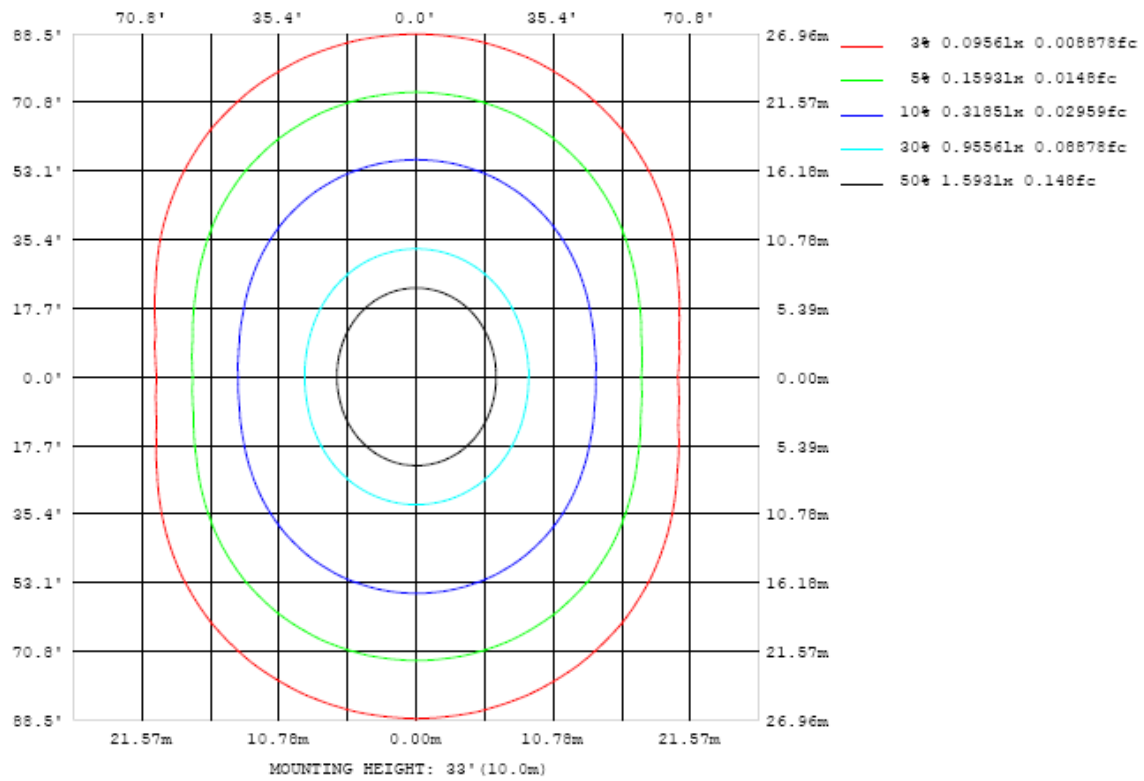


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

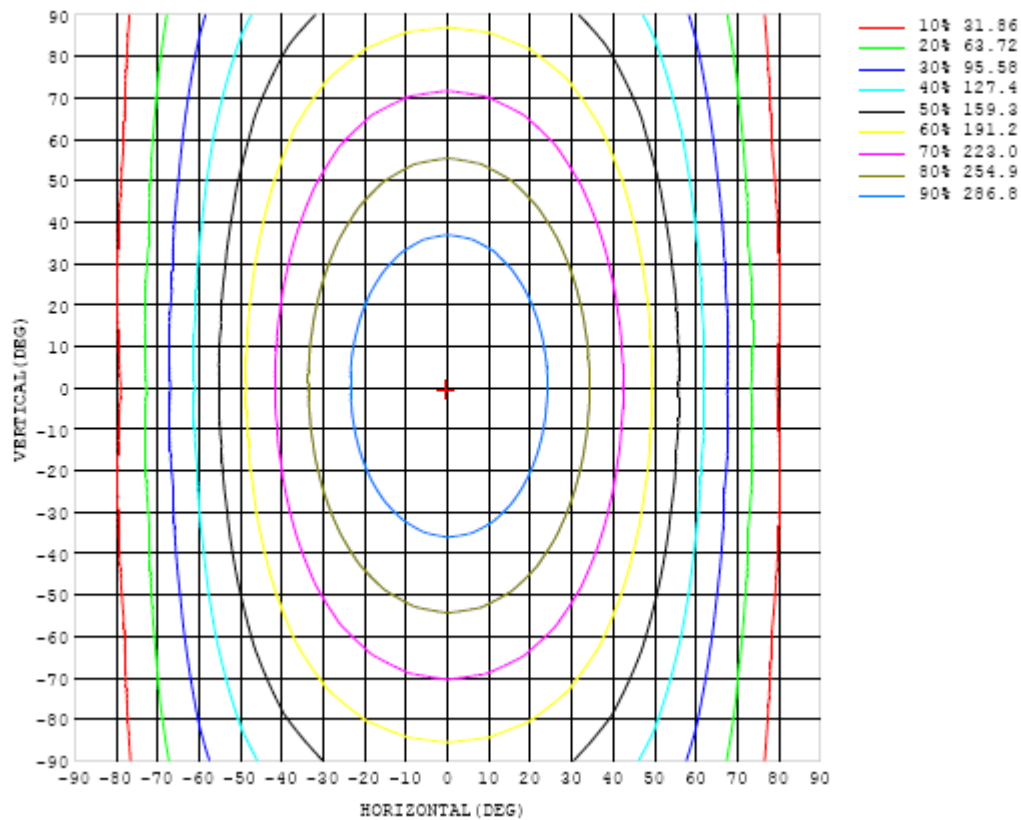


Chart 5: Isocandela Plot

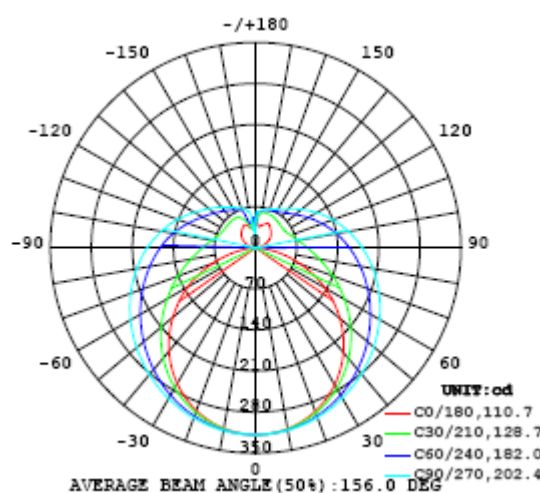


Chart 6: Polar Candela Distribution

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	319	319	319	319	319	319	319	319	319	319	319	319	319	319	319	319	319	319	319
5	317	317	317	317	318	318	318	318	318	318	318	318	318	317	317	317	317	317	317
10	313	313	313	314	314	315	315	315	316	316	315	315	315	314	314	313	313	313	313
15	306	306	307	308	309	310	311	312	312	312	312	311	310	309	308	307	306	305	305
20	297	297	298	299	301	303	305	307	308	308	307	306	305	302	300	298	296	295	295
25	284	285	286	289	292	295	298	300	302	302	301	300	297	294	291	287	285	283	283
30	269	270	273	276	281	286	290	293	295	296	295	292	289	284	279	275	271	268	267
35	252	253	257	262	269	275	281	285	288	288	287	284	279	273	267	260	254	251	250
40	233	234	239	246	255	263	271	276	279	280	279	275	269	262	253	244	236	231	230
45	211	213	220	229	240	251	260	267	271	272	270	266	259	249	238	227	217	210	208
50	188	191	199	212	225	238	249	257	262	263	261	256	247	236	223	209	196	187	184
55	163	167	178	193	210	225	237	247	252	254	252	246	236	223	208	191	175	163	160
60	137	142	156	175	194	212	226	236	242	244	242	235	225	210	192	172	153	138	134
65	109	116	134	157	179	199	214	226	232	234	232	225	214	198	178	155	131	113	106
70	81.4	90.6	113	140	165	187	203	215	222	224	221	214	202	185	164	138	111	87.4	78.4
75	54.6	66.3	93.9	124	152	175	192	204	211	213	211	204	191	174	151	123	91.9	63.7	51.4
80	29.4	45.3	77.1	110	140	163	181	193	201	203	200	193	180	162	139	109	75.8	43.4	26.7
85	9.73	28.9	64.3	98.5	128	152	170	183	190	192	190	182	170	152	128	97.8	63.7	28.0	7.79
90	0.37	19.7	54.7	88.6	118	142	160	172	180	182	179	172	159	142	118	88.2	54.6	19.9	0.38
95	1.95	16.2	48.2	80.5	109	132	150	162	169	172	169	162	150	132	109	80.3	48.4	17.0	1.97
100	5.32	16.0	43.6	73.4	101	123	140	152	159	161	159	152	140	123	100	73.6	44.3	17.7	5.18
105	10.0	18.5	41.0	68.1	92.7	114	130	142	148	150	148	141	130	114	92.9	68.7	42.2	20.1	9.50
110	15.4	22.5	39.9	63.6	85.8	105	121	132	138	140	138	131	121	105	86.2	64.4	42.1	24.1	14.2
115	20.8	27.2	40.3	60.1	79.8	97.6	112	122	128	130	128	122	112	97.8	80.4	61.8	43.1	28.9	19.1
120	26.1	32.1	42.2	57.7	74.5	90.4	103	113	118	120	118	113	103	90.8	75.8	60.1	45.0	33.8	24.0
125	30.5	36.5	44.5	56.9	71.0	84.0	95.4	104	109	111	109	104	95.8	85.0	72.4	59.3	47.2	38.2	28.3
130	34.0	40.2	47.4	57.0	67.8	78.8	88.5	95.6	100	102	100	96.0	89.3	80.2	70.0	59.4	49.7	41.2	31.4
135	37.1	43.7	50.3	57.6	66.3	74.4	82.5	88.6	92.4	93.8	92.8	89.2	83.5	76.0	68.1	59.8	52.2	44.6	34.4
140	40.0	47.1	53.1	58.5	65.3	71.7	77.4	82.4	85.6	86.9	86.0	83.2	78.6	73.0	66.9	60.3	54.6	47.8	37.2
145	43.0	50.2	55.3	59.7	64.7	69.9	74.1	77.7	79.9	80.8	80.2	78.3	75.0	71.0	66.0	60.9	56.4	50.7	39.5
150	46.1	53.2	56.9	60.8	64.4	68.3	71.7	74.0	75.7	76.5	76.0	74.4	71.9	68.9	65.3	61.8	55.9	51.4	42.3
155	46.0	54.6	58.6	61.5	64.3	66.9	69.2	70.7	72.0	72.5	72.2	71.0	69.7	67.5	64.9	61.6	57.8	53.8	43.2
160	42.7	55.4	60.0	61.6	64.0	65.9	67.4	68.6	69.4	69.7	69.6	68.9	67.7	66.4	64.0	58.6	53.3	47.9	39.9
165	40.2	50.9	60.7	62.1	63.3	64.9	65.9	66.6	67.0	67.3	67.2	66.8	66.2	64.6	59.6	52.2	46.3	43.3	35.0
170	36.5	43.8	55.7	60.9	61.9	63.2	64.0	64.5	64.9	65.1	65.1	65.2	62.5	55.5	48.2	43.2	43.4	40.6	34.4
175	42.1	42.9	46.2	52.8	57.2	59.6	61.4	62.6	63.0	62.9	63.5	58.9	48.4	40.6	39.0	42.5	43.3	41.5	41.4
180	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0

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	319	319	319	319	319	319	319	319	319	319	319	319	319	319	319	319	319		
5	317	317	317	318	318	318	318	318	318	318	318	318	318	318	318	317	317		
10	313	313	314	314	315	315	316	316	316	316	316	316	315	315	314	314	313		
15	306	306	307	309	310	311	312	313	313	313	312	311	310	309	308	307	307		
20	296	297	299	301	303	305	307	308	309	308	307	306	304	302	300	298	297		
25	283	285	288	292	295	298	301	303	303	303	301	299	296	293	289	287	285		
30	268	271	276	280	286	290	294	296	297	296	294	291	286	282	277	273	270		
35	251	255	261	268	275	281	286	289	290	289	286	281	276	269	263	257	254		
40	232	237	245	254	263	271	277	280	282	281	277	271	264	255	247	240	235		
45	211	218	228	240	251	260	267	272	273	272	268	261	252	241	230	220	214		
50	188	197	210	224	238	249	258	263	265	263	258	250	239	226	212	200	191		
55	164	176	192	209	225	238	248	254	256	254	248	239	226	211	194	179	167		
60	140	155	174	194	212	227	238	244	246	244	238	227	213	195	176	157	143		
65	114	133	157	180	200	216	227	234	236	234	228	216	200	181	159	136	117		
70	88.8	113	141	166	188	205	217	224	226	224	217	205	188	166	142	115	91.6		
75	64.9	93.8	125	154	176	194	206	214	216	214	207	194	176	154	126	95.0	67.0		
80	44.1	77.7	112	142	165	183	196	204	206	203	196	183	165	142	112	78.1	45.3		
85	28.8	65.1	100	131	155	173	186	193	195	193	185	172	155	131	100	64.6	28.7		
90	20.6	56.0	90.9	121	145	163	175	183	185	182	175	162	145	120	90.1	55.0	19.7		
95	17.5	49.4	82.5	112	135	153	164	172	174	171	164	153	134	111	81.3	47.9	15.9		
100	18.2	45.2	75.4	103	125	143	155	161	163	160	154	142	124	101	73.7	43.1	16.2		
105	20.8	43.6	69.8	94.8	116	132	144	150	153	150	143	131	115	93.2	67.7	41.1	18.9		
110	24.7	43.6	66.0	88.0	107	123	133	140	142	139	133	121	106	86.0	63.6	40.8	23.3		
115	29.0	44.9	63.6	82.7	99.6	113	123	129	131	129	122	112	97.9	80.5	60.9	41.7	28.1		
120	33.2	46.7	62.3	78.5	93.3	105	114	119	121	119	113	104	91.4	76.2	59.4	43.9	32.6		
125	36.7	48.8	61.6	75.2	88.0	98.3	106	111	112	110	105	97.0	86.1	72.9	58.9	46.5	35.8		
130	38.6	50.6	61.6	72.7	83.4	92.2	98.8	103	104	102	98.0	91.0	81.6	70.5	59.3	49.3	39.6		
135	40.0	52.3	61.8	70.8	79.5	86.9	92.4	95.8	96.9	95.4	91.7	85.7	77.9	68.9	60.2	51.2	41.4		
140	41.2	53.0	61.7	69.3	76.2	82.2	86.8	89.6	90.4	89.2	86.1	81.2	74.9	68.0	60.9	53.7	44.9		
145	43.3	53.9	61.4	68.1	73.5	78.2	81.7	84.0	84.7	83.7	81.3	77.5	72.7	67.3	60.7	54.7	47.2		
150	43.3	55.8	60.8	66.5	71.1	74.7	77.5	79.2	79.8	79.1	77.4	74.5	70.8	66.7	61.2	57.3	49.0		
155	40.2	51.8	55.7	62.7	68.7	71.6	73.6	75.0	75.6	75.2	74.0	71.9	69.1	65.3	60.4	55.9	46.4		
160	35.7	43.0	49.4	51.2	57.8	67.4	70.4	71.3	71.8	71.7	71.0	69.6	66.9	63.6	62.9	52.0	41.1		
165	33.3	35.8	39.6	43.5	44.3	46.6	58.1	66.7	67.8	67.8	67.4	66.0	62.9	62.7	59.3	43.4	37.7		
170	32.3	35.0	35.9	40.0	42.6	44.6	39.2	43.0	63.6	64.6	63.1	60.8	58.7	51.2	41.9	37.9	36.9		
175	40.8	42.2	45.4	47.5	48.9	49.0	49.6	46.5	24.6	39.8	50.8	50.0	48.3	48.3	47.6	45.1	42.6		
180	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0		

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

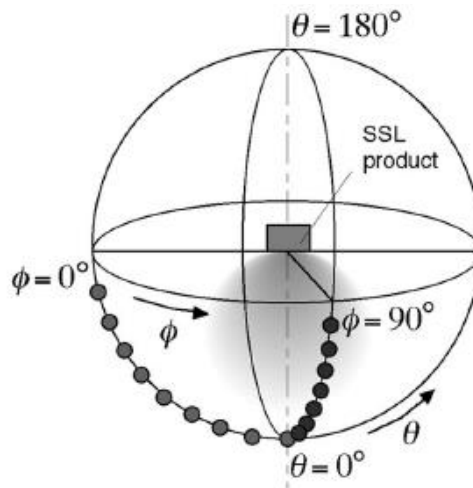
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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