

LM-79-08 Test Report

for

GREEN CREATIVE LTD

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

LED Tube

Model: 11.5T8/4F/850/DEB/RC

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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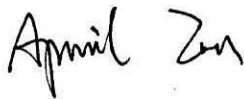
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Report No.: HZ18120037d

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

Review by:



Engineer: April Zou
Jan. 09, 2019

Approved by:



Manager: Jim Zhang
Jan. 09, 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/850/DEB/RC

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
150.9	1799.0	11.92	0.9819
CCT (K)	CRI	Stabilization Time (Light & Power)	
5047	83.0	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 : Dec. 29, 2018

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/850/DEB/RC
Electrical Ratings	: 120-277V, 50/60Hz, 11.5W
Product Description	: G13 base, 5000K
Manufacturer	: GREEN CREATIVE LTD
Address	: 756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

TEST RESULTS

Test ambient temperature was 24.9°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 70 minutes.

Sphere-Spectroradiometer Method

Parameter	Result	
Test Voltage (V)	120.0	277.0
Voltage frequency (Hz)	60	60
Test Current (A)	0.101	0.047
Power Factor	0.9819	0.9408
Test Power (W)	11.92	12.19
THD A%	18.25	17.64
Luminous Efficacy (lm/W)	150.9	148.9
Total Luminous Flux (lm)	1799.0	1815.0
Color Rendering Index (CRI)	83.0	
R9	7.9	
Correlated Color Temperature (CCT)(K)	5047	
Chromaticity Chroma x	0.3441	
Chromaticity Chroma y	0.3556	
Chromaticity Chroma u	0.2092	
Chromaticity Chroma v	0.3243	
Duv	0.0016	
Chromaticity Chroma u'	0.2092	
Chromaticity Chroma v'	0.4864	

Special Color Rendering Indices	
R1	81.3
R2	87.1
R3	91.8
R4	83.9
R5	82.7
R6	82.9
R7	86.5
R8	67.9
R9	7.9
R10	70.0
R11	84.1
R12	67.1
R13	82.5
R14	95.6
Rf	82
Rg	97

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 24.9°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	0.9777
Test Power (W)	12.01
Luminous Efficacy (lm/W)	147.7
Total Luminous Flux (lm)	1773.3
Beam Angle (°)	155.8
Center Beam Candle Power (cd)	315
Spacing Criteria	1.26(0 °-180 °)/ 1.40 (90 °-270 °)
Zonal Lumens in the 0 °-60 °Zone	44.71%
Zonal Lumens in the 60 °-90 °Zone	26.60%
Zonal Lumens in the 90 °-120 °Zone	16.76%
Zonal Lumens in the 120 °-180 °Zone	11.92%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

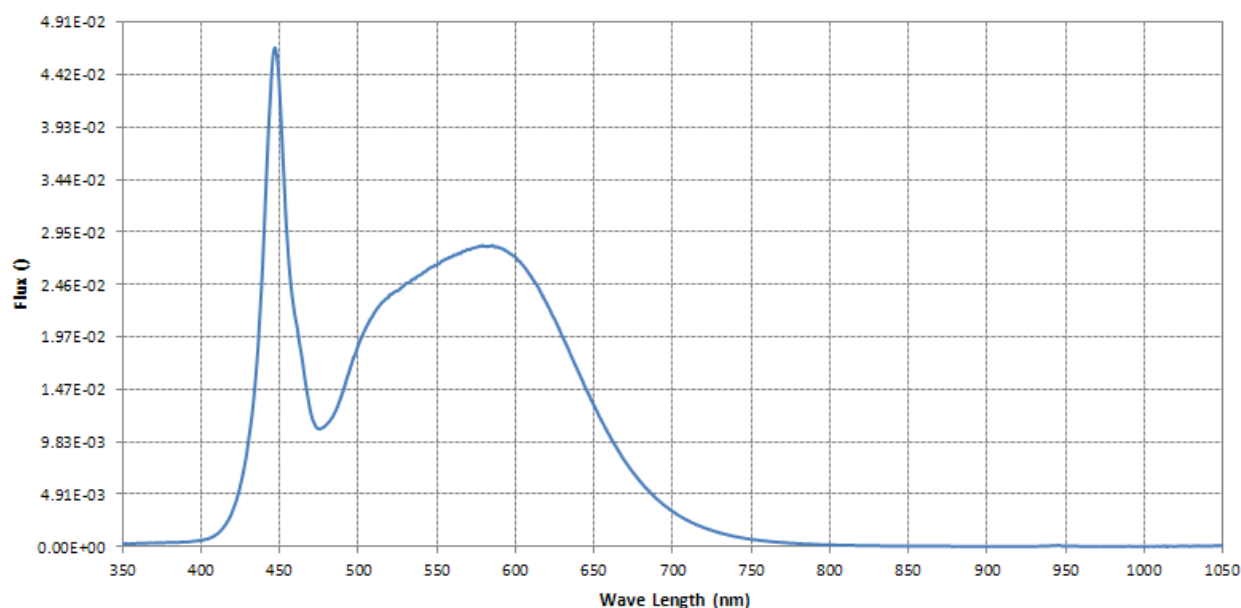
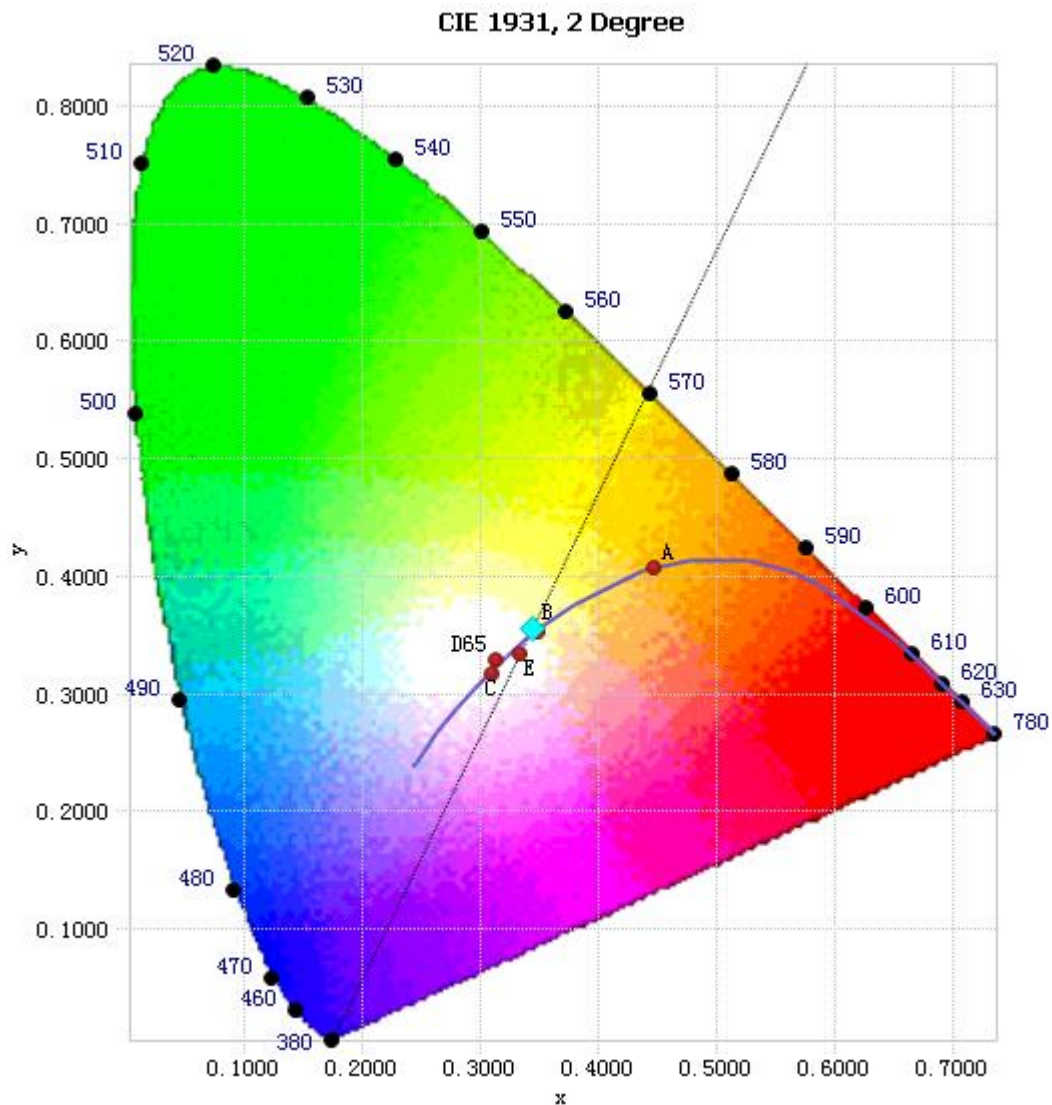


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	4.02E-04	485	1.25E-02	590	2.80E-02	695	3.86E-03
385	3.89E-04	490	1.44E-02	595	2.76E-02	700	3.32E-03
390	4.50E-04	495	1.67E-02	600	2.71E-02	705	2.85E-03
395	5.11E-04	500	1.88E-02	605	2.63E-02	710	2.44E-03
400	5.87E-04	505	2.05E-02	610	2.53E-02	715	2.08E-03
405	7.64E-04	510	2.19E-02	615	2.42E-02	720	1.78E-03
410	1.16E-03	515	2.28E-02	620	2.28E-02	725	1.54E-03
415	1.94E-03	520	2.36E-02	625	2.13E-02	730	1.31E-03
420	3.29E-03	525	2.40E-02	630	1.97E-02	735	1.12E-03
425	5.68E-03	530	2.46E-02	635	1.80E-02	740	9.55E-04
430	9.65E-03	535	2.51E-02	640	1.64E-02	745	8.16E-04
435	1.61E-02	540	2.55E-02	645	1.48E-02	750	7.00E-04
440	2.88E-02	545	2.61E-02	650	1.32E-02	755	6.06E-04
445	4.42E-02	550	2.64E-02	655	1.18E-02	760	5.25E-04
450	4.29E-02	555	2.69E-02	660	1.04E-02	765	4.49E-04
455	2.86E-02	560	2.72E-02	665	9.14E-03	770	3.94E-04
460	2.15E-02	565	2.74E-02	670	7.97E-03	775	3.34E-04
465	1.69E-02	570	2.79E-02	675	6.93E-03	780	2.90E-04
470	1.25E-02	575	2.80E-02	680	6.02E-03		
475	1.11E-02	580	2.81E-02	685	5.23E-03		
480	1.15E-02	585	2.82E-02	690	4.49E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y) : (0.3441, 0.3556)

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

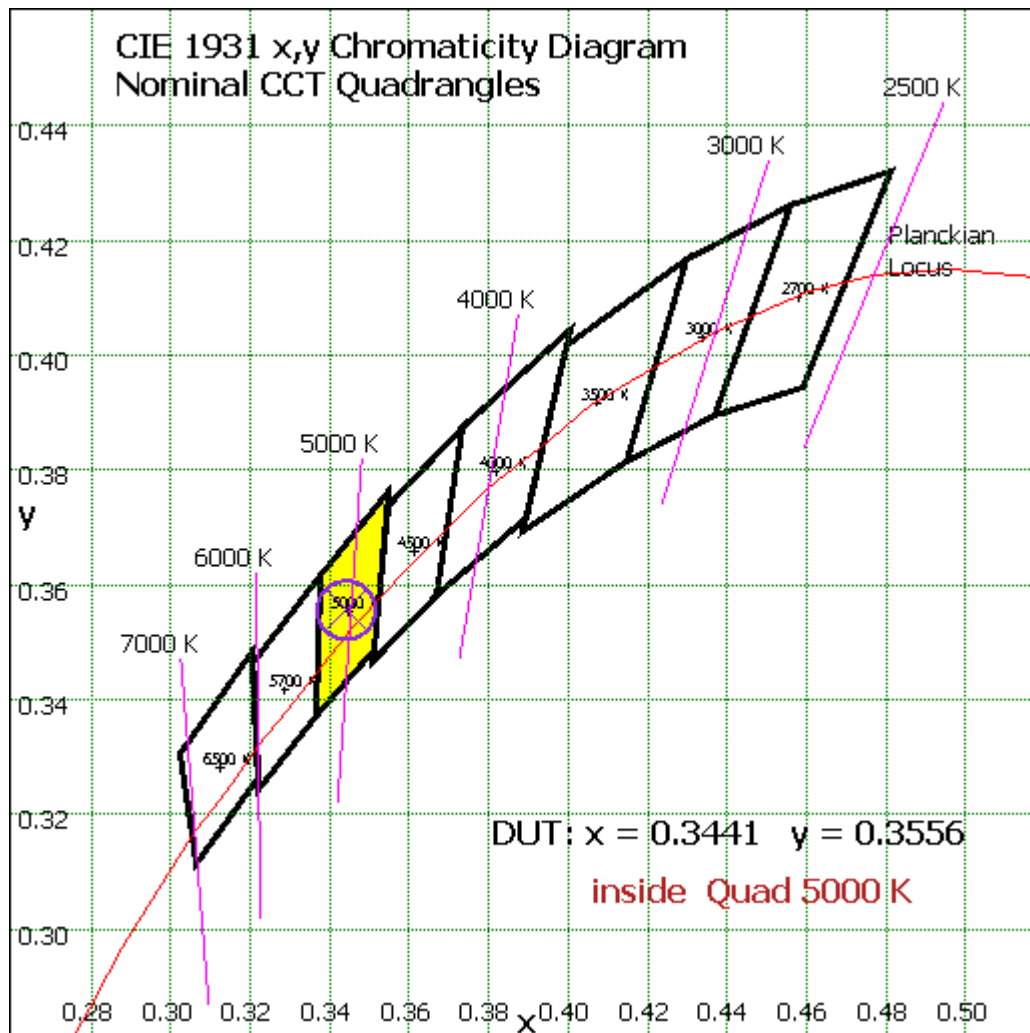


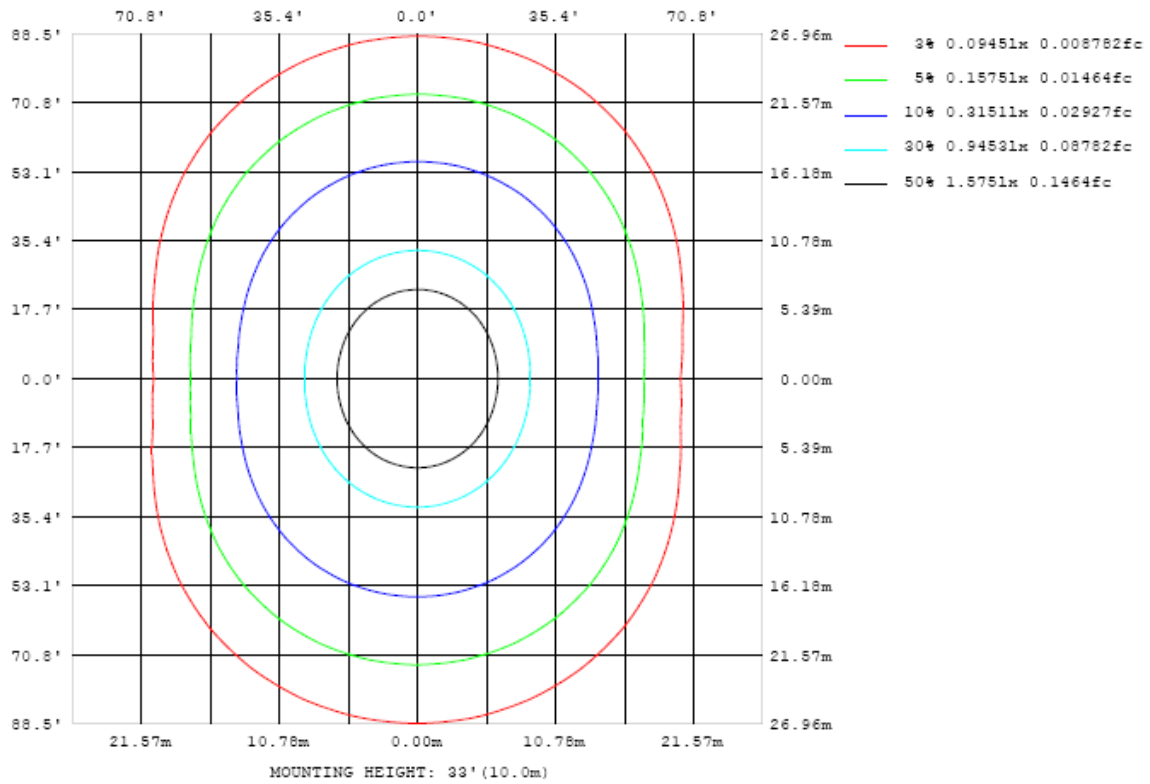
Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	29.879	1.68%
10- 20	86.431	4.87%
20- 30	133.882	7.55%
30- 40	167.87	9.47%
40- 50	186.12	10.50%
50- 60	188.709	10.64%
60- 70	177.993	10.04%
70- 80	158.168	8.92%
80- 90	135.577	7.65%
90-100	116.056	6.54%
100-110	98.737	5.57%
110-120	82.479	4.65%
120-130	67.574	3.81%
130-140	54.021	3.05%
140-150	41.086	2.32%
150-160	28.373	1.60%
160-170	15.553	0.88%
170-180	4.782	0.27%
Total	1773.3	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	792.891	44.71%
60- 90	471.738	26.60%
0-90	1264.629	71.32%
90- 180	508.661	28.68%
0- 180	1773.3	100%

Table 5: Zonal Lumen Data



Luminous Intensity Distribution Plots- Goniophotometer Method

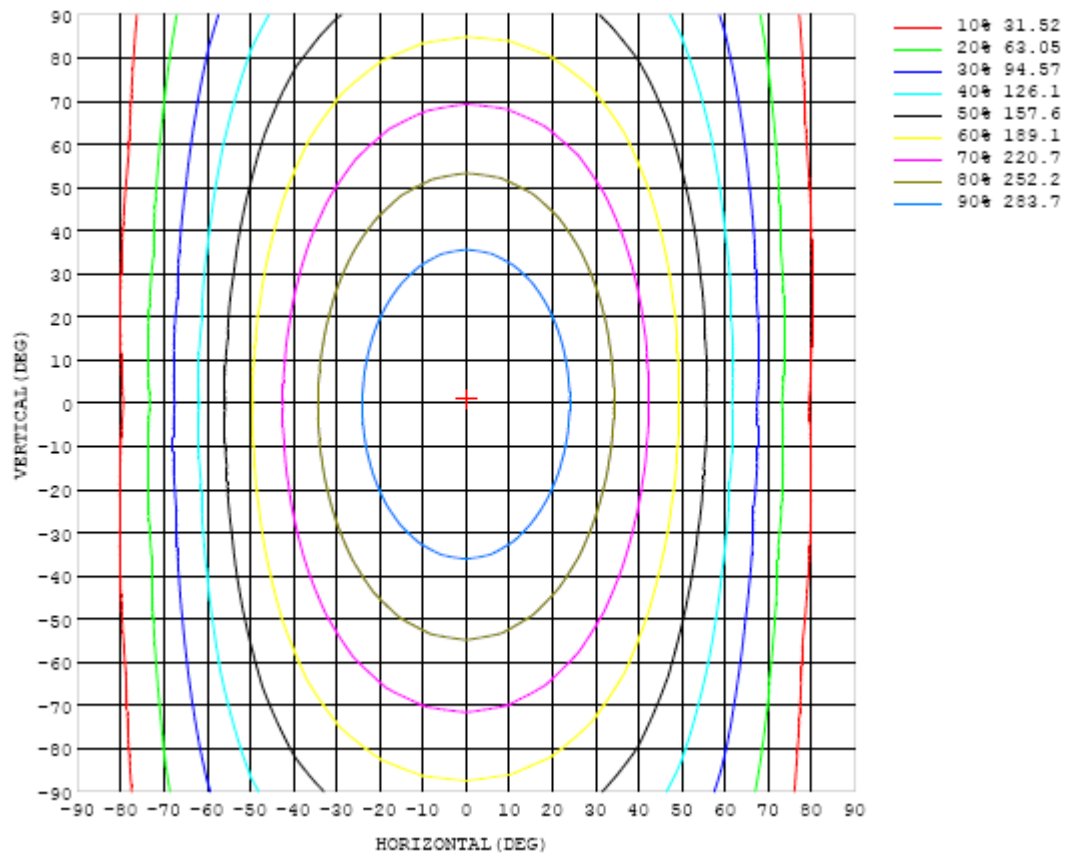


Chart 5: Isocandela Plot

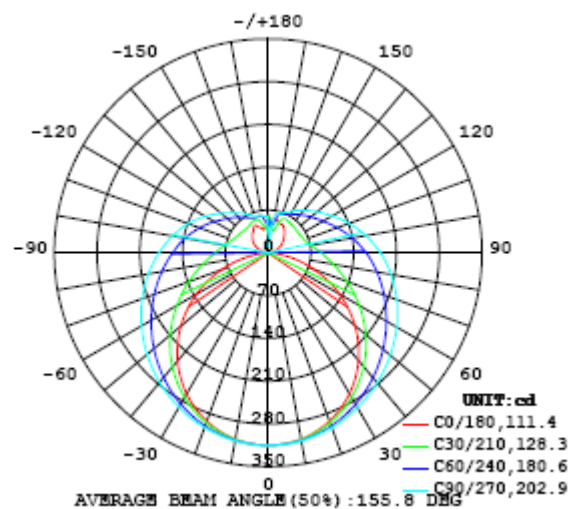


Chart 6: Polar Candela Distribution

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	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
5	314	314	314	314	314	314	314	314	314	314	314	314	314	314	314	314	314	314	314
10	310	310	310	310	311	311	312	312	312	312	312	312	312	311	311	310	310	310	310
15	303	303	303	304	305	306	307	308	309	309	309	309	308	307	306	305	304	303	303
20	293	293	294	296	298	300	302	303	304	304	304	303	302	300	298	296	295	294	293
25	281	281	283	285	288	292	294	297	298	299	298	297	295	292	289	286	284	282	281
30	266	267	269	273	277	282	286	289	292	292	292	290	287	283	278	274	270	268	267
35	249	250	254	259	265	271	277	281	284	285	284	282	278	272	266	260	255	251	250
40	230	231	236	243	251	260	267	273	276	278	277	273	268	261	253	245	238	233	231
45	209	211	217	226	237	247	256	263	268	270	268	264	258	249	239	228	219	212	210
50	185	188	197	208	222	235	246	254	259	261	259	255	247	237	224	211	199	190	186
55	161	164	175	190	207	222	235	244	250	252	250	245	236	224	210	193	178	166	162
60	134	139	153	172	192	209	224	234	241	243	241	235	226	212	195	176	157	142	136
65	108	114	132	155	177	197	213	224	231	233	231	225	215	200	181	159	136	116	109
70	80.0	88.3	111	138	163	185	202	214	221	224	222	215	204	188	167	142	115	91.4	81.4
75	53.7	64.1	91.4	122	150	173	191	204	212	214	212	205	194	177	154	127	96.5	67.6	54.2
80	28.8	42.7	74.7	108	138	162	181	194	201	204	202	195	183	166	143	114	80.3	47.4	29.2
85	9.26	26.4	62.1	96.7	127	152	171	184	192	194	192	185	173	155	132	102	67.6	31.6	9.61
90	0.69	17.7	52.6	86.9	117	142	160	173	181	184	182	175	163	145	122	92.5	58.6	22.8	0.44
95	2.02	14.6	45.8	78.5	108	132	150	163	171	173	171	164	152	135	112	84.0	51.6	19.2	2.00
100	5.36	15.8	41.8	71.6	99.2	122	140	152	160	162	160	154	142	126	104	76.9	47.3	19.6	5.36
105	9.72	18.7	40.4	66.2	91.5	113	130	142	149	152	150	143	132	116	95.8	71.3	45.3	22.0	9.83
110	14.4	22.5	40.6	62.7	85.0	105	121	132	139	141	139	133	123	108	89.0	67.3	45.3	25.2	14.8
115	19.6	26.2	41.6	61.0	80.0	97.4	112	122	129	131	129	124	114	100	83.6	65.1	46.0	28.6	20.1
120	24.7	30.3	43.2	59.8	76.2	91.3	104	113	119	121	120	114	106	94.1	79.6	63.5	46.6	31.6	25.5
125	28.7	34.6	45.9	59.3	73.2	86.3	97.3	105	111	112	111	107	99.2	88.9	76.4	62.2	47.6	34.8	30.0
130	32.4	38.4	48.6	59.1	70.8	81.9	91.5	98.5	103	105	104	99.8	93.3	84.4	73.5	61.2	49.3	38.1	33.6
135	36.8	41.2	51.2	59.6	68.8	78.2	86.3	92.3	96.2	97.6	96.7	93.5	88.0	80.1	70.5	59.9	51.3	40.5	36.6
140	41.4	41.9	53.5	60.1	67.5	74.7	81.5	86.7	90.0	91.2	90.5	87.6	82.8	75.9	68.1	59.2	53.8	41.8	40.1
145	45.9	41.9	55.9	60.9	66.4	71.9	77.1	81.2	84.0	85.0	84.3	81.9	77.9	72.3	65.9	57.6	55.7	41.5	42.8
150	50.1	40.0	56.7	61.7	65.5	69.4	73.5	76.5	78.5	79.2	78.6	76.9	73.7	69.1	63.3	59.6	58.2	39.5	47.2
155	51.7	40.1	51.3	61.6	64.9	67.1	69.8	72.1	73.7	74.1	73.6	72.1	69.5	64.5	59.0	57.5	52.9	38.8	49.9
160	52.3	41.7	41.5	54.8	63.9	66.4	67.1	68.3	69.1	69.3	68.9	68.4	60.4	54.3	52.1	50.4	43.1	36.9	44.1
165	56.8	41.6	36.8	40.2	44.4	59.9	63.9	65.4	67.0	66.8	65.2	50.6	46.9	47.5	44.9	41.3	36.0	37.1	42.0
170	55.4	45.5	38.3	39.3	42.3	42.5	46.7	50.1	54.8	63.3	34.4	45.8	46.3	44.8	41.2	38.7	37.1	35.6	38.9
175	55.4	52.2	47.9	48.0	48.8	48.6	50.3	52.2	52.0	34.7	54.4	54.1	52.1	49.7	46.9	45.2	44.1	43.1	43.2
180	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7

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	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315		
5	314	314	314	314	314	314	314	314	314	314	314	314	314	314	314	314	314		
10	310	310	310	311	311	312	312	312	312	312	312	312	311	311	310	310	310		
15	303	303	304	305	306	307	308	309	309	309	308	307	306	305	304	303	303		
20	294	295	296	298	300	302	303	304	304	304	303	302	300	298	296	294	293		
25	282	283	286	289	292	294	297	298	299	298	297	295	292	289	286	283	282		
30	267	270	273	278	282	286	289	291	292	292	290	287	282	278	274	270	267		
35	251	254	259	265	271	277	281	284	285	284	281	277	272	266	259	254	251		
40	232	237	244	252	260	266	272	275	276	276	272	267	260	252	244	237	232		
45	212	218	227	237	247	256	262	266	268	267	263	257	248	238	228	218	211		
50	189	197	209	222	234	244	252	257	258	257	253	246	235	223	210	198	189		
55	166	176	191	206	221	232	241	247	249	248	243	234	223	208	192	177	166		
60	142	155	173	191	208	221	231	237	239	238	232	223	210	193	175	156	142		
65	116	134	155	176	195	210	220	227	229	228	222	212	197	179	157	135	117		
70	90.2	112	138	162	182	198	210	217	219	218	212	201	185	165	141	115	91.6		
75	65.9	92.9	123	149	170	187	199	206	209	207	201	190	173	152	126	95.7	67.8		
80	44.3	76.0	109	137	159	177	189	196	199	197	191	179	162	141	112	79.4	46.9		
85	28.1	62.7	96.8	126	149	166	179	186	189	187	181	169	152	130	101	66.2	30.9		
90	19.0	53.2	87.1	116	140	156	169	176	179	177	170	159	143	119	90.7	56.7	21.7		
95	15.7	47.0	79.2	107	130	148	159	166	169	167	161	150	133	111	82.6	50.2	17.9		
100	15.7	42.6	72.5	99.3	121	138	150	157	159	157	151	141	124	102	75.6	45.4	17.3		
105	17.3	40.1	66.9	91.8	113	129	140	147	150	148	142	131	115	94.5	69.5	42.4	18.9		
110	20.4	39.5	62.1	84.9	104	120	131	137	140	138	132	122	107	87.3	64.5	41.3	21.2		
115	24.8	39.7	59.2	78.7	96.5	111	121	127	130	128	122	112	98.5	80.9	61.0	41.2	25.3		
120	29.2	40.2	57.3	74.0	89.2	102	112	117	119	118	113	104	90.9	75.6	58.6	41.8	29.8		
125	33.3	41.2	55.8	70.2	83.3	94.1	103	108	110	108	104	95.4	84.6	71.5	57.0	43.6	33.7		
130	37.2	43.4	54.4	67.1	78.2	87.5	94.6	99.1	101	99.5	95.3	88.5	79.3	68.1	56.0	45.8	37.4		
135	41.8	46.3	53.4	64.1	73.7	81.6	87.7	91.5	92.9	91.8	88.3	82.5	74.7	65.3	56.0	48.2	41.8		
140	46.1	49.0	53.3	61.2	69.4	76.4	81.4	84.6	85.8	84.9	81.9	77.1	70.7	63.2	56.4	50.7	46.1		
145	49.3	51.9	54.4	59.1	65.3	71.0	75.5	78.3	79.3	78.5	76.0	72.1	67.1	62.1	57.1	52.4	49.0		
150	51.3	54.3	55.8	58.4	62.2	66.3	69.8	72.0	72.9	72.4	70.6	67.8	64.8	61.6	58.2	54.9	50.8		
155	54.2	56.0	57.8	58.8	60.6	63.2	65.4	66.8	67.5	67.4	66.5	64.9	63.1	61.4	59.3	56.5	54.1		
160	51.0	53.6	58.0	60.0	60.6	61.5	62.6	63.5	64.0	64.0	63.8	63.2	62.5	61.8	60.3	57.1	57.1		
165	45.5	49.4	53.8	59.1	61.3	61.9	62.4	62.7	62.9	63.0	63.1	62.9	62.6	61.8	60.0	58.4	58.9		
170	41.7	43.2	46.2	49.6	56.1	61.1	61.8	61.8	62.0	62.1	62.0	61.8	61.2	60.4	59.6	58.6	58.7		
175	43.2	41.2	39.8	42.1	46.9	52.3	57.2	59.2	59.7	59.8	59.7	59.8	60.0	60.4	60.3	59.0	57.2		
180	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7		

Table 7: Luminous Intensity Data

EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Aug. 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

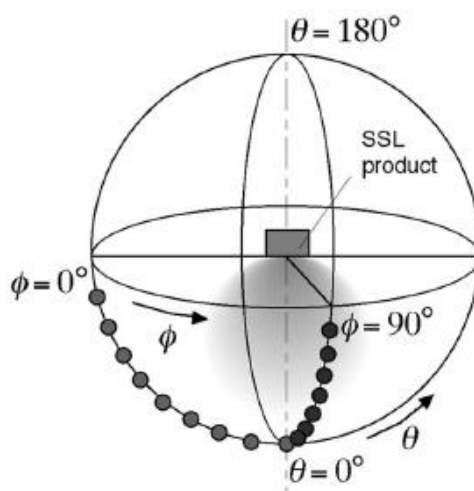
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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