

LM-79-08 Test Report

for

GREEN CREATIVE LTD

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

LED Tube

Model: 11.5T8/4F/830/DEB/RC

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ18120037c

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

Review by:



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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/830/DEB/RC

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
143.1	1714.0	11.98	0.9824
CCT (K)	CRI	Stabilization Time (Light & Power)	
3103	82.8	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	: Dec. 26, 2018
Date of Test	: Dec. 28, 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/830/DEB/RC
Electrical Ratings	: 120-277V, 50/60Hz, 11.5W
Product Description	: G13 base, 3000K
Manufacturer	: GREEN CREATIVE LTD
Address	: 756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

TEST RESULTS

Test ambient temperature was 25.2°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)	0.102	0.047
Power Factor	0.9824	0.9433
Test Power (W)	11.98	12.26
THD A%	18.02	17.25
Luminous Efficacy (lm/W)	143.1	140.8
Total Luminous Flux (lm)	1714.0	1726.0
Color Rendering Index (CRI)	82.8	
R9	8.2	
Correlated Color Temperature (CCT)(K)	3103	
Chromaticity Chroma x	0.4292	
Chromaticity Chroma y	0.4004	
Chromaticity Chroma u	0.2471	
Chromaticity Chroma v	0.3459	
Duv	0.0008	
Chromaticity Chroma u'	0.2471	
Chromaticity Chroma v'	0.5188	

Special Color Rendering Indices	
R1	82
R2	93.7
R3	93.3
R4	79.2
R5	82.4
R6	92.3
R7	81.2
R8	58.5
R9	8.2
R10	85.4
R11	78.4
R12	73.3
R13	85.2
R14	96.9
Rf	83
Rg	93

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	0.9828
Test Power (W)	12.06
Luminous Efficacy (lm/W)	139.8
Total Luminous Flux (lm)	1686.5
Beam Angle (°)	154.1
Center Beam Candle Power (cd)	302
Spacing Criteria	1.24(0 °-180 °)/ 1.39 (90 °-270 °)
Zonal Lumens in the 0 °-60 °Zone	44.81%
Zonal Lumens in the 60 °-90 °Zone	26.41%
Zonal Lumens in the 90 °-120 °Zone	16.66%
Zonal Lumens in the 120 °-180 °Zone	12.12%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

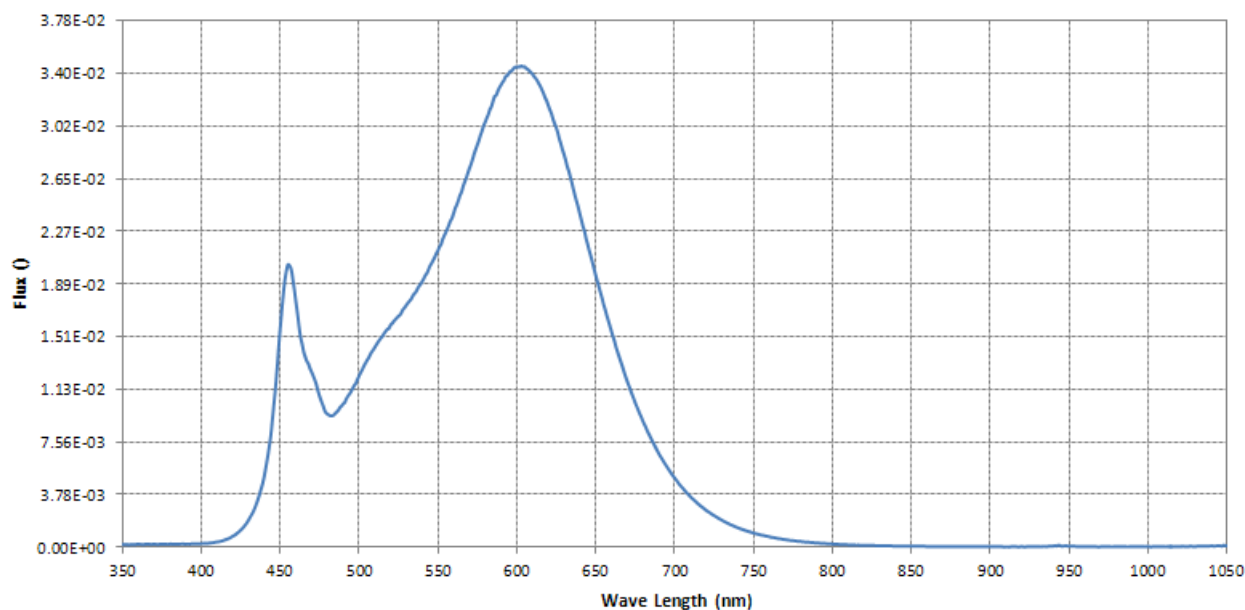
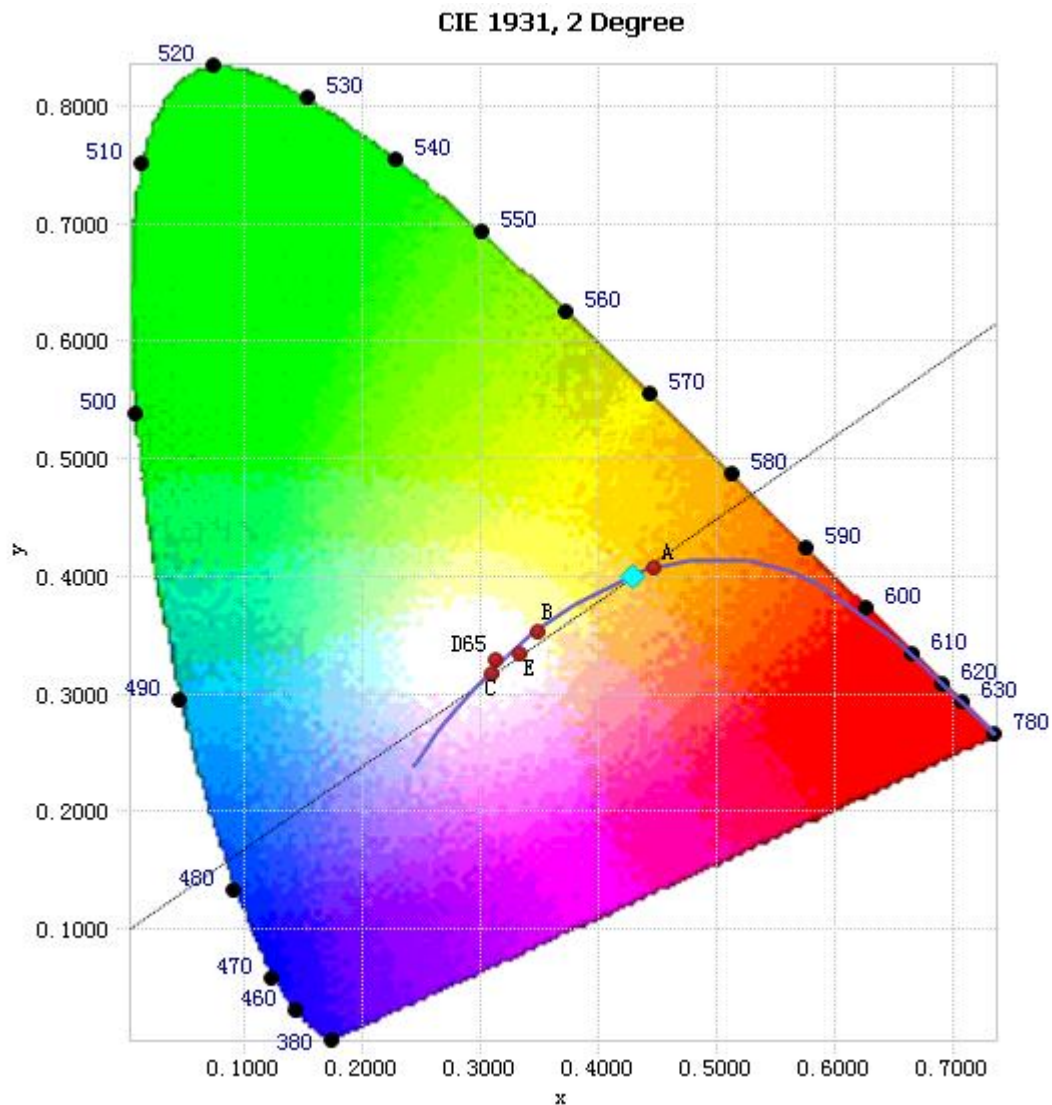


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.29E-04	485	9.61E-03	590	3.32E-02	695	5.81E-03
385	2.14E-04	490	1.03E-02	595	3.40E-02	700	5.00E-03
390	2.28E-04	495	1.12E-02	600	3.45E-02	705	4.27E-03
395	2.57E-04	500	1.23E-02	605	3.45E-02	710	3.64E-03
400	2.65E-04	505	1.34E-02	610	3.40E-02	715	3.11E-03
405	2.91E-04	510	1.43E-02	615	3.31E-02	720	2.65E-03
410	3.76E-04	515	1.52E-02	620	3.17E-02	725	2.28E-03
415	5.22E-04	520	1.59E-02	625	3.01E-02	730	1.94E-03
420	7.88E-04	525	1.66E-02	630	2.82E-02	735	1.65E-03
425	1.23E-03	530	1.74E-02	635	2.61E-02	740	1.40E-03
430	1.94E-03	535	1.82E-02	640	2.39E-02	745	1.20E-03
435	3.10E-03	540	1.91E-02	645	2.18E-02	750	1.03E-03
440	5.09E-03	545	2.02E-02	650	1.96E-02	755	8.78E-04
445	8.92E-03	550	2.13E-02	655	1.75E-02	760	7.59E-04
450	1.55E-02	555	2.26E-02	660	1.55E-02	765	6.48E-04
455	2.03E-02	560	2.40E-02	665	1.37E-02	770	5.54E-04
460	1.77E-02	565	2.55E-02	670	1.19E-02	775	4.78E-04
465	1.40E-02	570	2.72E-02	675	1.04E-02	780	4.12E-04
470	1.26E-02	575	2.89E-02	680	9.04E-03		
475	1.09E-02	580	3.05E-02	685	7.84E-03		
480	9.57E-03	585	3.20E-02	690	6.75E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y) : (0.4292, 0.4004)

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

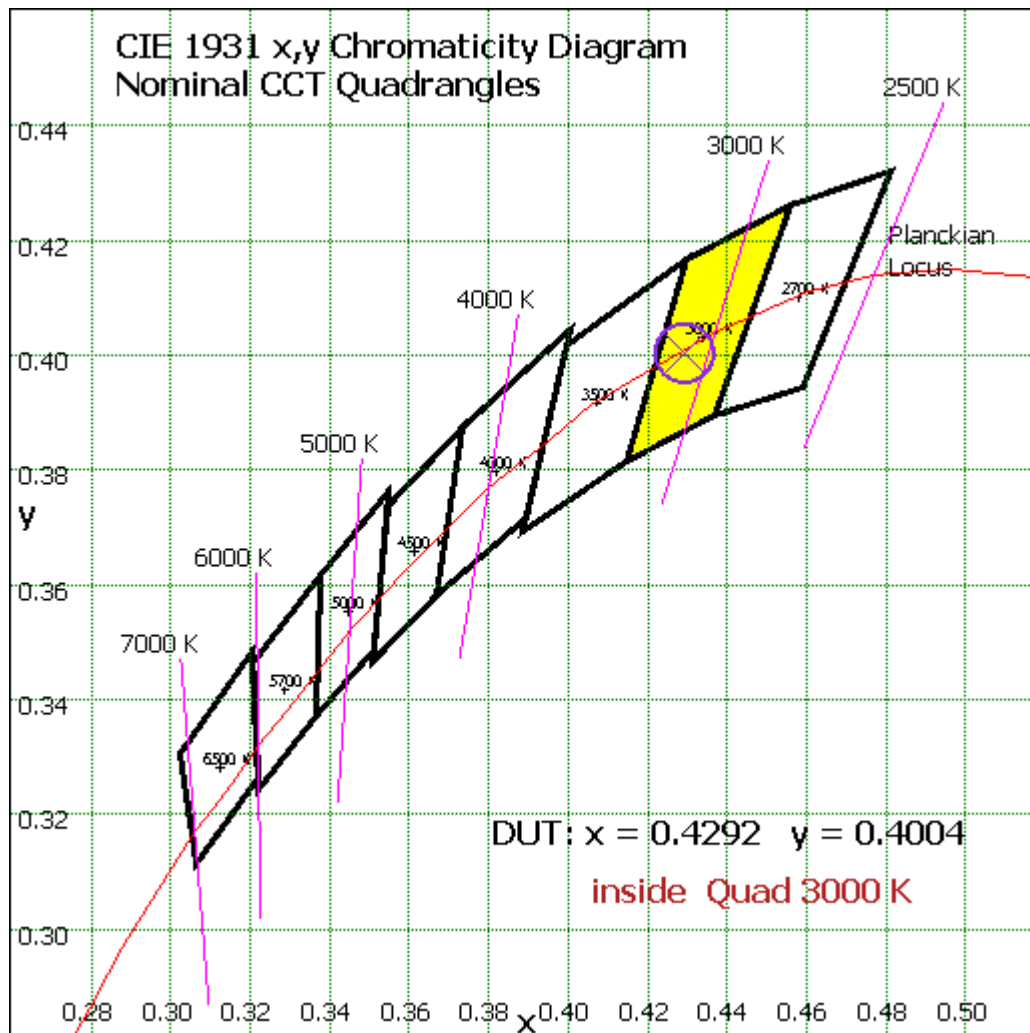


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	28.65	1.70%
10- 20	82.808	4.91%
20- 30	128.065	7.59%
30- 40	160.168	9.50%
40- 50	177.055	10.50%
50- 60	179.004	10.61%
60- 70	168.369	9.98%
70- 80	149.255	8.85%
80- 90	127.725	7.57%
90-100	109.454	6.49%
100-110	93.219	5.53%
110-120	78.275	4.64%
120-130	64.662	3.83%
130-140	52.322	3.10%
140-150	40.209	2.38%
150-160	27.954	1.66%
160-170	15.034	0.89%
170-180	4.29	0.25%
Total	1686.5	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	755.75	44.81%
60- 90	445.349	26.41%
0-90	1201.099	71.22%
90- 180	485.419	28.78%
0- 180	1686.5	100%

Table 5: Zonal Lumen Data

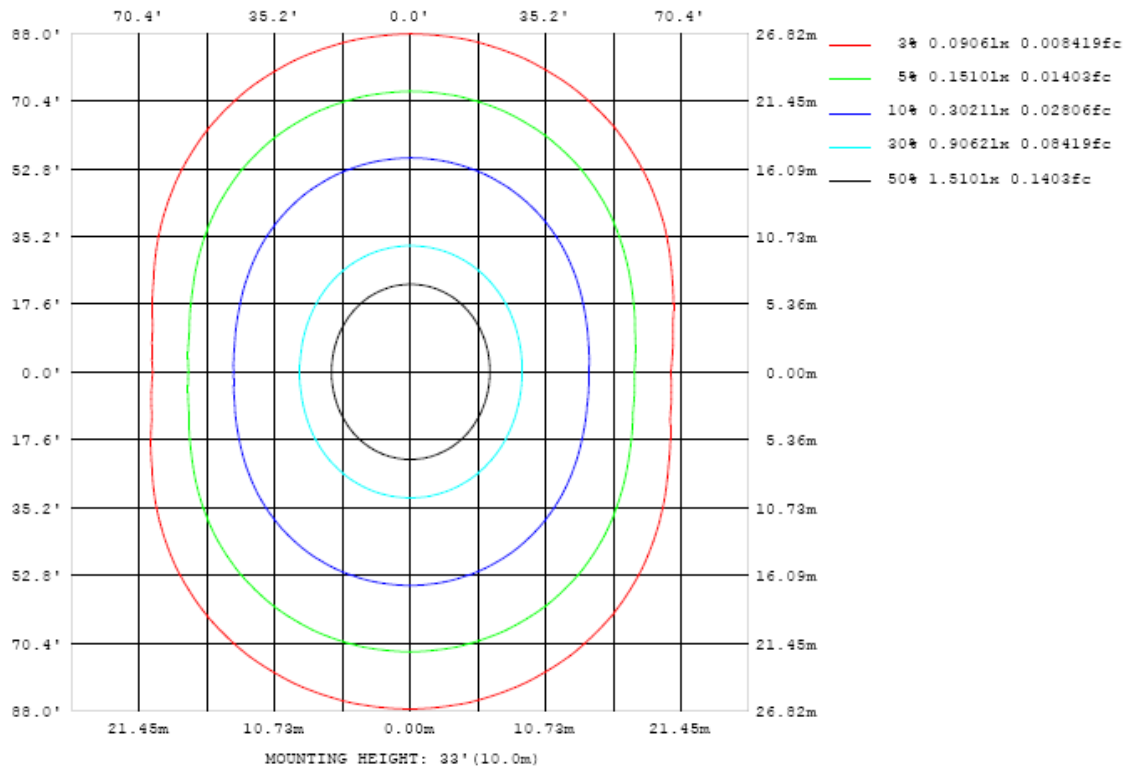


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

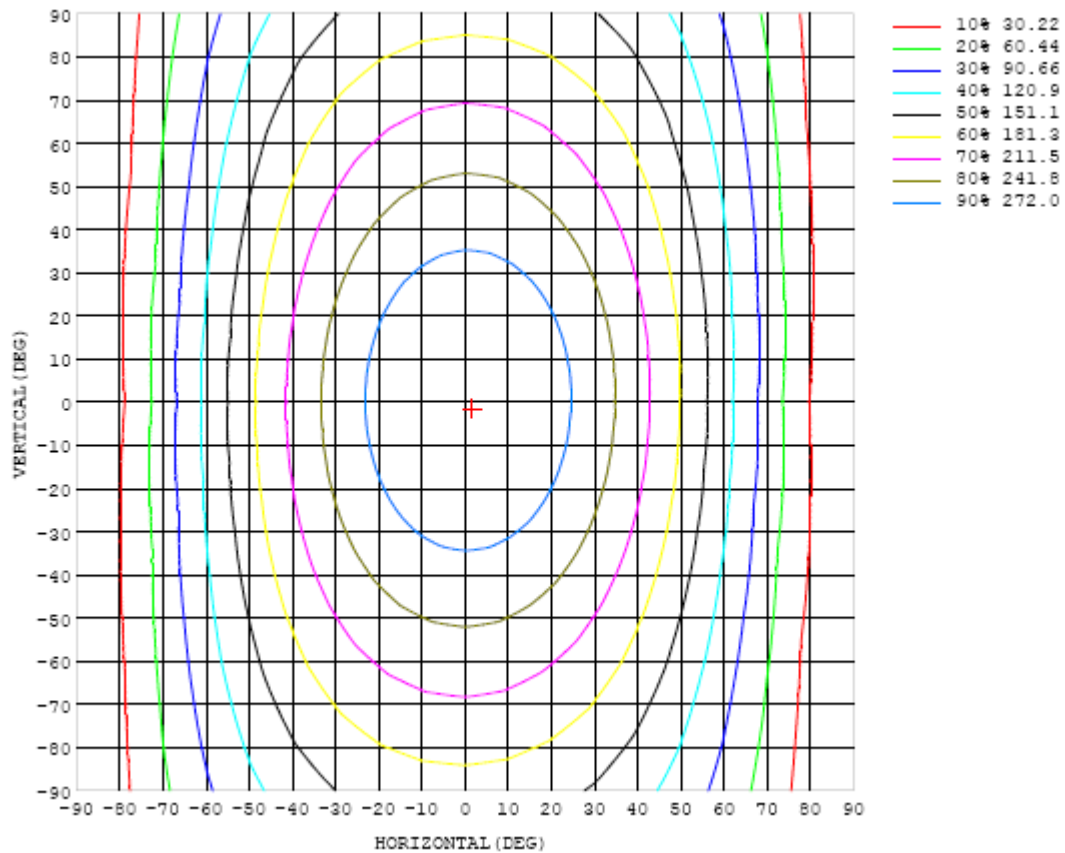


Chart 5: Isocandela Plot

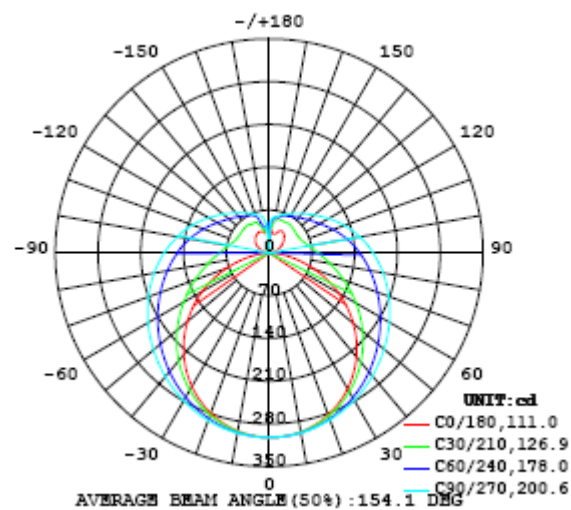


Chart 6: Polar Candela Distribution

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	302	302	302	302	302	302	302	302	302	302	302	302	302	302	302	302	302	302	302
5	301	301	301	301	301	301	301	302	301	301	301	301	301	301	301	301	301	300	300
10	298	297	298	298	298	299	299	299	299	299	299	299	298	298	297	297	296	296	296
15	291	291	292	292	293	294	295	295	296	296	295	295	294	293	292	290	290	289	289
20	282	282	283	284	286	288	289	290	291	291	290	290	288	286	284	282	281	280	279
25	271	271	272	274	277	280	282	284	285	285	285	283	281	278	275	272	269	268	267
30	257	257	259	262	266	270	274	276	278	278	278	276	272	268	264	260	256	254	253
35	241	241	244	249	254	259	264	268	270	271	270	267	263	258	252	246	241	237	236
40	222	223	227	233	241	248	254	259	262	263	262	259	253	247	239	231	224	219	217
45	202	203	209	217	226	236	244	249	253	254	253	249	243	235	225	215	205	199	197
50	180	182	189	200	212	223	233	239	244	246	244	240	232	222	211	198	186	178	174
55	156	159	169	182	197	210	221	229	235	236	235	230	222	210	196	181	166	155	151
60	131	135	147	164	182	197	210	219	225	227	225	220	211	198	182	164	146	132	127
65	105	110	126	147	167	185	199	209	216	218	216	210	201	187	169	148	126	108	101
70	78.5	85.4	105	130	153	173	188	199	206	208	207	201	190	175	156	133	107	84.6	74.3
75	53.0	62.6	86.5	115	140	162	178	189	196	199	197	191	180	164	144	119	90.0	62.7	48.7
80	29.1	40.9	69.9	101	129	151	168	179	187	189	187	181	170	154	133	106	75.3	44.3	25.5
85	9.80	24.6	57.4	89.7	118	141	158	170	177	180	178	172	161	144	123	95.6	64.0	30.3	7.63
90	0.77	15.6	48.2	80.3	108	131	148	160	167	170	168	162	151	135	114	86.7	55.6	22.6	0.49
95	1.77	12.4	42.0	72.7	100.0	122	139	151	158	161	159	153	142	126	105	79.2	49.5	19.2	1.89
100	4.92	13.5	37.9	66.9	91.9	113	130	141	148	151	149	143	133	117	97.3	72.6	45.1	19.5	4.95
105	9.21	16.8	36.5	61.2	84.7	105	121	132	138	141	139	134	124	109	90.0	67.3	43.1	21.6	9.32
110	13.9	21.1	36.7	57.7	78.2	96.9	112	122	129	131	130	124	115	101	83.4	63.5	42.8	25.3	14.0
115	18.8	25.7	38.0	55.7	73.3	89.7	103	113	119	122	120	115	106	93.6	78.0	61.1	43.6	29.4	18.7
120	23.4	29.8	40.4	54.7	69.7	83.8	95.5	104	110	112	111	106	98.3	87.5	74.1	59.7	45.1	33.4	23.3
125	27.5	33.1	43.1	54.4	67.4	79.2	89.3	96.9	102	104	103	98.7	91.9	82.4	71.0	58.9	47.0	36.0	26.9
130	31.4	37.2	46.1	54.8	65.4	75.2	83.9	90.5	94.8	96.4	95.5	92.1	86.2	78.2	68.5	58.6	49.1	38.6	29.6
135	34.8	40.4	48.5	55.7	64.0	71.9	79.3	84.8	88.5	89.9	89.1	86.1	81.2	74.5	67.1	58.8	51.1	43.8	32.3
140	38.2	43.6	49.6	56.8	63.1	69.3	75.2	79.8	82.9	84.0	83.4	81.0	76.9	71.4	65.5	59.1	51.8	45.8	34.4
145	40.4	46.2	50.9	57.5	62.5	67.1	71.8	75.4	77.9	78.8	78.3	76.4	73.2	68.8	64.3	59.6	51.7	46.5	36.1
150	41.3	46.8	52.7	57.0	62.4	65.9	68.8	71.6	73.5	74.2	73.8	72.4	69.9	66.9	63.6	58.8	53.0	46.6	36.9
155	39.5	45.8	53.8	56.6	61.1	64.6	66.8	68.4	69.8	70.3	70.1	69.0	67.2	65.4	62.7	55.6	53.2	48.5	38.1
160	33.9	42.6	55.3	56.8	58.3	61.7	64.4	66.0	66.7	67.1	66.9	66.4	65.5	63.9	58.4	53.4	48.6	43.2	37.4
165	32.2	37.0	50.5	57.4	58.6	58.9	59.5	61.2	62.8	63.7	63.8	63.5	62.6	58.3	51.8	45.7	41.5	38.3	34.8
170	31.9	32.0	42.1	52.2	55.1	57.1	59.0	59.7	60.1	60.2	60.2	60.3	54.7	46.8	41.0	39.0	40.9	37.3	32.8
175	40.0	38.0	39.5	42.1	45.4	49.4	52.3	55.1	56.6	56.0	55.3	45.2	34.2	33.0	36.7	39.1	40.4	41.6	41.4
180	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7

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	302	302	302	302	302	302	302	302	302	302	302	302	302	302	302	302	302		
5	300	301	301	301	301	301	301	302	302	302	302	302	301	301	301	301	301		
10	296	296	297	297	298	299	299	300	300	300	300	299	299	298	298	298	298		
15	289	290	291	292	293	295	295	296	296	296	296	296	295	294	293	292	291		
20	280	281	283	285	287	289	290	291	292	292	291	290	289	287	285	284	283		
25	268	270	272	275	278	281	284	286	286	286	285	283	281	278	275	273	272		
30	254	256	260	264	269	273	276	279	280	279	278	275	272	268	264	260	258		
35	237	241	246	252	258	264	268	271	272	272	270	266	261	256	250	246	242		
40	219	224	231	238	246	254	259	263	264	264	261	256	250	243	235	229	224		
45	199	205	214	224	234	243	250	254	256	255	252	246	238	229	220	211	205		
50	177	185	197	209	222	232	240	245	247	246	242	235	226	215	203	192	184		
55	154	165	179	195	209	222	230	236	238	237	232	224	213	200	186	172	161		
60	131	144	161	180	197	211	221	227	229	228	222	214	201	186	168	152	138		
65	106	123	145	166	185	200	211	217	220	218	212	203	189	172	152	132	114		
70	82.0	103	129	153	173	189	201	208	210	209	203	192	178	159	137	112	90.2		
75	58.8	84.8	114	141	162	179	191	198	201	199	193	182	166	147	122	93.7	67.2		
80	38.5	69.0	101	130	152	169	181	189	191	189	183	172	156	135	109	77.9	47.0		
85	23.4	56.8	90.3	119	143	159	172	179	182	180	173	162	147	125	97.3	65.1	31.4		
90	15.7	48.2	81.3	110	133	150	162	169	172	170	163	152	137	115	87.7	55.6	22.2		
95	13.4	42.5	73.8	102	124	142	153	160	162	160	154	144	128	106	79.6	48.9	18.2		
100	14.7	39.2	67.7	93.8	115	132	144	150	152	151	145	134	119	98.0	72.6	44.2	17.8		
105	17.6	38.0	62.8	86.9	107	123	134	141	143	141	135	125	110	90.6	67.0	41.6	19.7		
110	21.9	38.6	59.5	80.9	99.5	114	125	131	133	132	126	116	102	83.9	62.7	41.0	23.2		
115	26.6	40.3	57.8	75.8	92.5	106	116	122	124	122	117	108	94.6	78.3	59.9	41.5	26.9		
120	30.6	42.2	56.9	72.4	86.4	98.5	107	113	115	113	108	99.7	88.1	74.0	58.2	42.9	31.2		
125	33.6	44.5	56.8	69.7	81.7	92.0	99.5	104	106	105	100	92.8	82.8	70.7	57.3	45.2	35.7		
130	37.2	47.1	56.8	67.5	77.6	86.4	93.0	97.0	98.4	97.3	93.3	87.0	78.5	68.2	57.2	47.0	38.8		
135	40.5	48.7	57.1	65.9	74.3	81.6	87.1	90.5	91.7	90.7	87.3	82.0	74.9	66.3	57.4	49.4	42.3		
140	42.8	49.8	57.5	64.7	71.3	77.4	81.9	84.7	85.7	84.9	82.1	77.6	71.8	64.9	57.4	51.2	45.4		
145	44.5	51.8	56.8	63.4	68.8	73.5	77.2	79.5	80.3	79.6	77.5	73.9	69.1	63.5	58.1	52.8	48.1		
150	45.8	53.7	54.9	61.8	66.8	70.2	73.0	74.9	75.5	75.0	73.2	70.4	66.9	62.9	58.2	54.7	49.3		
155	44.0	52.3	55.1	56.4	63.3	67.5	69.4	70.6	71.1	70.8	69.7	67.9	65.2	61.7	58.7	55.7	48.0		
160	38.0	44.8	49.6	52.9	56.0	63.2	66.5	67.1	67.5	67.4	66.7	65.1	62.9	60.9	60.0	53.7	42.4		
165	34.5	37.3	41.3	43.6	46.8	49.1	57.2	62.9	63.5	63.6	63.1	62.5	61.7	60.5	59.1	47.3	36.6		
170	33.8	34.5	35.8	41.0	42.2	42.5	41.5	47.2	58.9	61.0	61.5	59.5	57.5	54.6	44.4	37.3	35.2		
175	43.0	43.5	44.1	44.5	45.1	45.4	43.7	39.2	28.3	47.7	44.6	45.8	46.7	44.0	43.3	43.5	41.4		
180	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7		

able 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

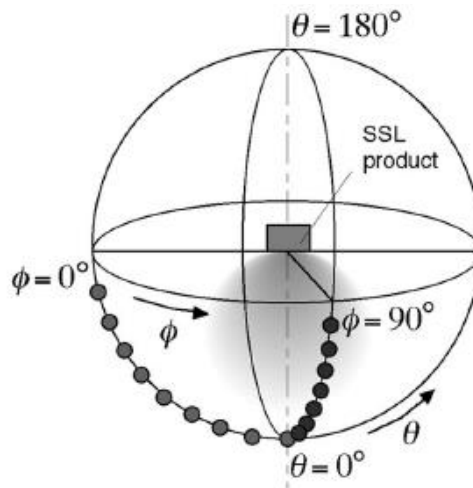
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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