LM-79-08 Test Report

for

GREEN CREATIVE LTD

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

LED Tube

Model: 12T8/3F/835/DEB/R

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ18120037i

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

Review by: April Zou

Engineer: April Zou

Jan. 18, 2019

Approved by: Jim Zhang

Manager: Jim Zhang

Jan. 18, 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/DEB/R**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
129.2	1523.0	11.79	0.9792

CCT (K)	CRI	Stabilization Time (Light & Power)
3524	82.2	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	: 12T8/3F/835/DEB/R
Electrical Ratings	: 120-277V, 50/60Hz, 12W
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 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 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	0.9792	0.9308
Test Power (W)	11.79	12.10
THD A%	18.48	17.76
Luminous Efficacy (lm/W)	129.2	127.0
Total Luminous Flux (lm)	1523.0	1537.0
Color Rendering Index (CRI)	82.2	
R9	5.8	
Correlated Color Temperature (CCT)(K)	3524	
Chromaticity Chroma x	0.4038	
Chromaticity Chroma y	0.3898	
Chromaticity Chroma u	0.2351	
Chromaticity Chroma v	0.3404	
Duv	0.0002	
Chromaticity Chroma u ’	0.2351	
Chromaticity Chroma v’	0.5107	

Special Color Rendering Indices	
R1	80.2
R2	89.3
R3	95.7
R4	80.4
R5	80.3
R6	85.5
R7	84.5
R8	61.4
R9	5.8
R10	74.8
R11	79.1
R12	64.5
R13	82.4
R14	97.9
Rf	82
Rg	96

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℃.

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)	0.100
Power Factor	0.9791
Test Power (W)	11.75
Luminous Efficacy (lm/W)	127.2
Total Luminous Flux (lm)	1494.9
Beam Angle (°)	154.0
Center Beam Candle Power (cd)	270
Spacing Criteria	1.24(0 °-180 °)/ 1.38 (90 °-270 °)
Zonal Lumens in the 0 °-60 °Zone	44.79%
Zonal Lumens in the 60 °-90 °Zone	26.37%
Zonal Lumens in the 90 °-120 °Zone	16.64%
Zonal Lumens in the 120 °-180 °Zone	12.20%

Table 3: Test data per Goniophotometer Method

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Spectral Power Distribution - Sphere Spectroradiometer Method

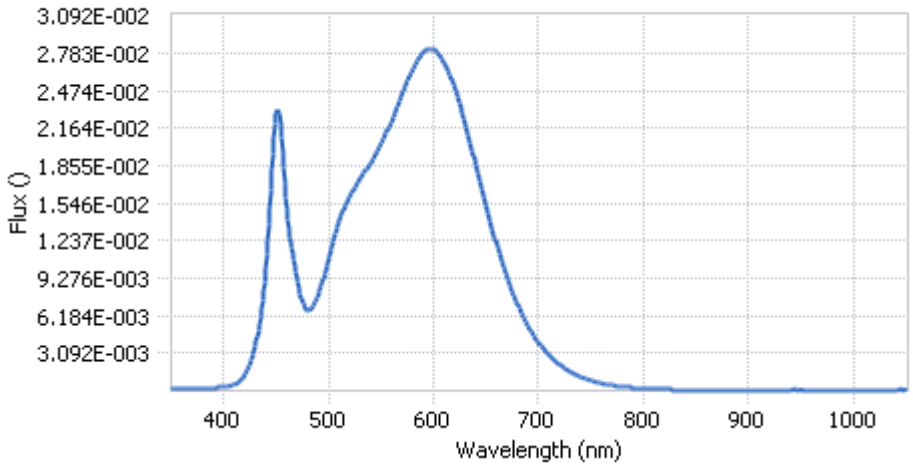
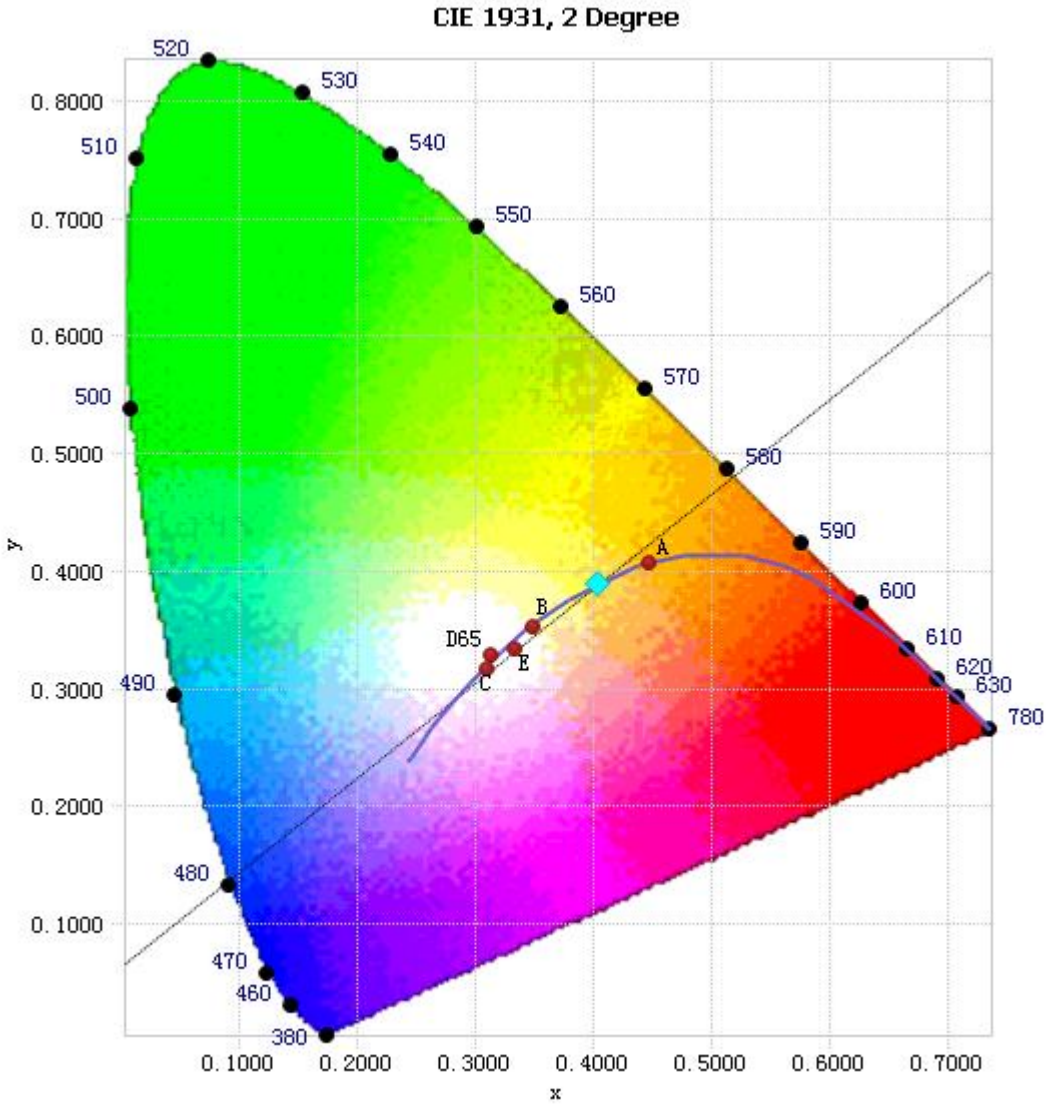


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.41E-04	485	6.97E-03	590	2.78E-02	695	4.63E-03
385	2.31E-04	490	7.86E-03	595	2.81E-02	700	4.00E-03
390	2.60E-04	495	9.27E-03	600	2.81E-02	705	3.42E-03
395	2.84E-04	500	1.10E-02	605	2.77E-02	710	2.94E-03
400	3.18E-04	505	1.26E-02	610	2.70E-02	715	2.51E-03
405	3.85E-04	510	1.39E-02	615	2.62E-02	720	2.17E-03
410	5.43E-04	515	1.52E-02	620	2.50E-02	725	1.86E-03
415	8.36E-04	520	1.61E-02	625	2.36E-02	730	1.59E-03
420	1.32E-03	525	1.68E-02	630	2.20E-02	735	1.36E-03
425	2.19E-03	530	1.75E-02	635	2.03E-02	740	1.15E-03
430	3.69E-03	535	1.81E-02	640	1.86E-02	745	9.94E-04
435	6.12E-03	540	1.88E-02	645	1.69E-02	750	8.46E-04
440	1.01E-02	545	1.96E-02	650	1.52E-02	755	7.32E-04
445	1.66E-02	550	2.04E-02	655	1.36E-02	760	6.33E-04
450	2.28E-02	555	2.13E-02	660	1.21E-02	765	5.41E-04
455	2.08E-02	560	2.22E-02	665	1.07E-02	770	4.68E-04
460	1.48E-02	565	2.33E-02	670	9.39E-03	775	4.07E-04
465	1.17E-02	570	2.45E-02	675	8.20E-03	780	3.42E-04
470	9.34E-03	575	2.54E-02	680	7.16E-03		
475	7.30E-03	580	2.64E-02	685	6.20E-03		
480	6.63E-03	585	2.73E-02	690	5.37E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y) : (0.4038,0.3898)

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

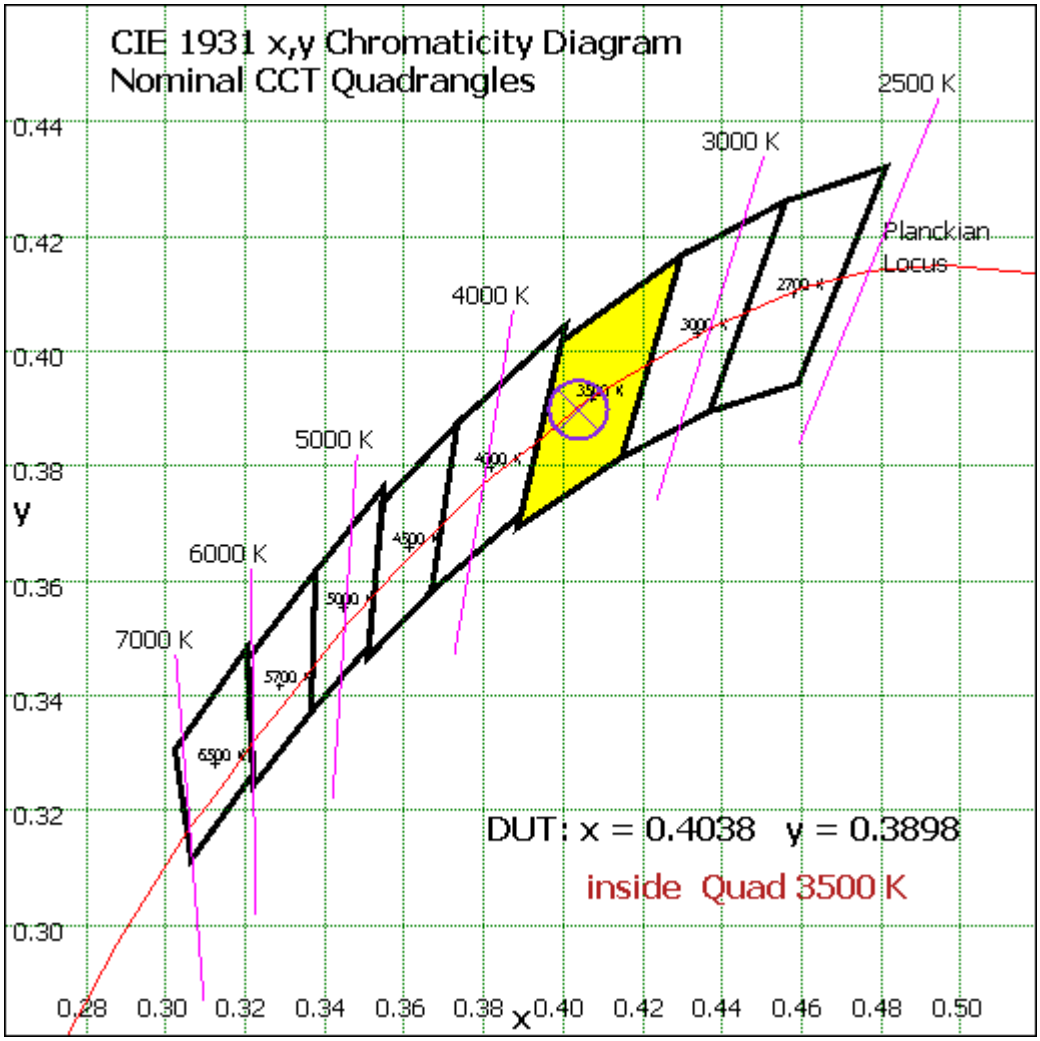


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

γ(°)	Lumens	% Total
0- 10	25.561	1.71%
10- 20	73.771	4.93%
20- 30	113.809	7.61%
30- 40	141.932	9.49%
40- 50	156.489	10.47%
50- 60	158.01	10.57%
60- 70	148.615	9.94%
70- 80	132.107	8.84%
80- 90	113.521	7.59%
90-100	97.101	6.50%
100-110	82.494	5.52%
110-120	69.18	4.63%
120-130	57.305	3.83%
130-140	46.325	3.10%
140-150	35.807	2.40%
150-160	25.112	1.68%
160-170	13.617	0.91%
170-180	4.189	0.28%
Total	1494.9	100%

γ(°)	Lumens	% Total
0- 60	669.572	44.79%
60- 90	394.243	26.37%
0-90	1063.815	71.16%
90- 180	431.13	28.84%
0- 180	1494.9	100%

Table 5: Zonal Lumen Data

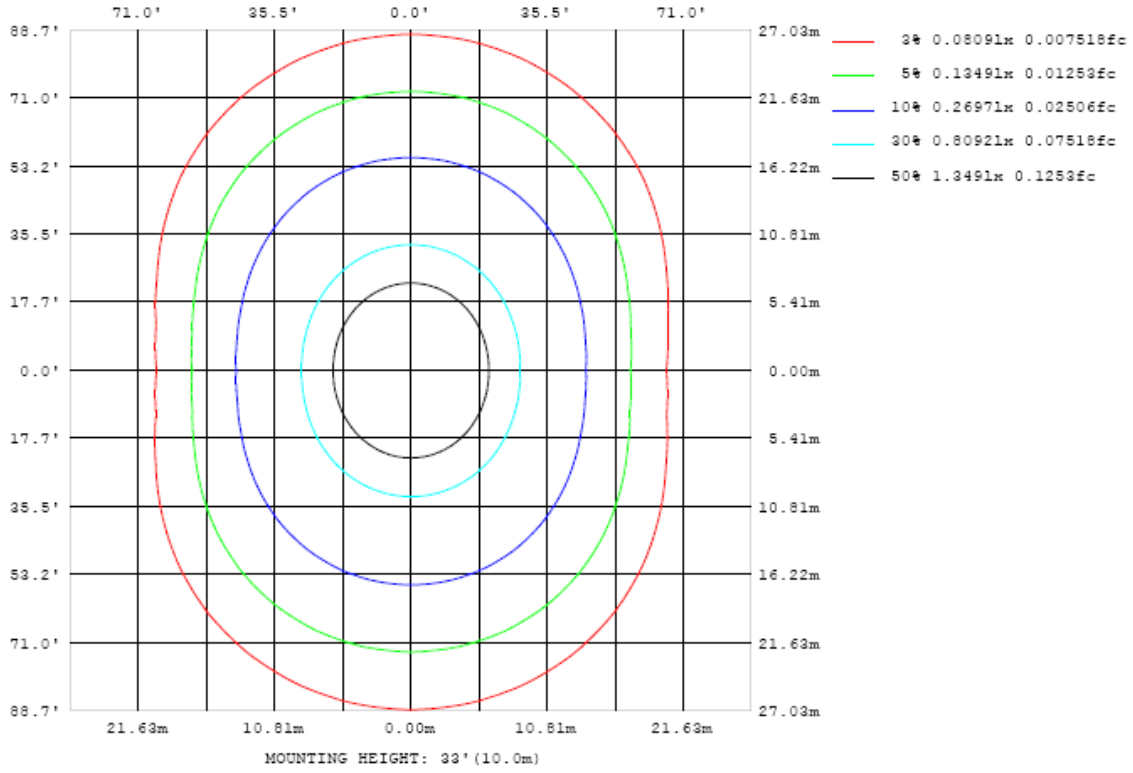


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

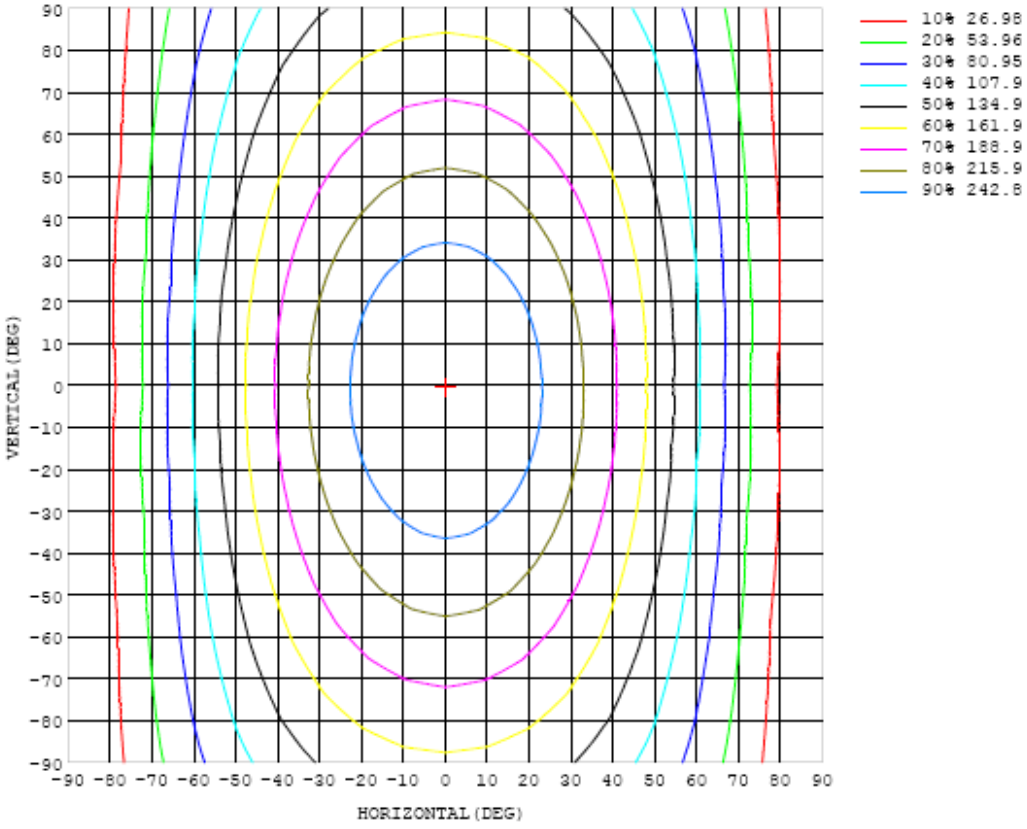


Chart 5: Isocandela Plot

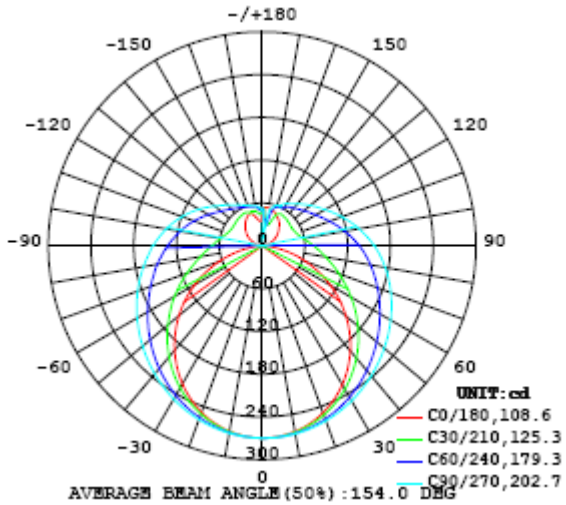


Chart 6: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1 UNIT: cd

γ (DEG) \ C (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	270	270	270	270	270	270	270	270	270	270	270	270	270	270	270	270	270	270	270
5	268	269	269	269	269	269	269	269	269	269	269	269	269	269	269	269	268	268	268
10	265	265	265	266	266	267	267	267	268	268	268	267	267	266	266	265	265	264	264
15	258	259	259	260	261	263	264	264	265	265	265	264	263	262	261	260	259	258	258
20	249	250	251	253	255	257	259	260	261	261	261	260	258	256	254	252	250	249	249
25	238	239	241	243	246	250	252	255	256	256	256	254	252	249	245	242	240	238	237
30	225	226	229	232	237	241	245	248	250	251	250	248	244	240	235	231	227	225	224
35	209	211	215	219	225	232	237	241	244	245	244	241	236	230	224	218	213	210	208
40	192	194	199	206	213	221	228	234	237	238	237	233	227	220	212	204	198	193	191
45	174	176	182	191	201	211	219	226	230	231	229	225	218	209	200	190	181	175	172
50	154	157	164	175	188	200	210	217	222	224	222	217	209	199	187	174	163	155	153
55	133	136	146	160	175	189	200	209	214	216	214	208	199	188	174	159	145	135	131
60	111	115	128	144	162	178	191	201	206	208	206	200	190	177	161	144	127	114	109
65	88.1	93.8	109	129	149	167	181	192	198	200	198	191	181	167	149	129	109	92.6	86.4
70	65.6	72.5	91.7	115	137	157	172	183	190	192	190	183	172	157	138	115	92.1	72.2	63.7
75	44.2	53.1	75.6	102	126	147	163	175	182	184	181	174	163	147	127	103	76.8	53.2	41.9
80	24.0	35.4	62.4	90.5	116	137	154	166	173	175	173	166	154	138	117	92.1	64.4	36.6	22.0
85	8.15	22.0	51.5	80.7	107	129	145	157	164	167	164	157	146	129	108	82.8	54.1	24.5	6.77
90	0.64	14.6	43.3	72.2	98.2	120	136	148	155	157	155	148	137	120	99.7	74.5	46.3	17.6	0.36
95	1.52	11.5	37.0	65.1	89.8	111	127	139	145	148	146	139	127	112	91.5	67.5	40.3	14.5	1.70
100	4.17	12.2	33.4	58.9	82.1	102	118	129	136	138	136	129	118	103	84.0	61.5	36.7	15.0	4.27
105	7.59	14.6	32.3	54.3	75.4	94.1	109	120	126	128	126	120	110	95.4	77.3	56.9	35.5	16.9	8.00
110	12.0	18.3	32.5	51.4	69.9	86.9	101	111	117	119	117	111	102	88.3	71.8	54.2	36.0	20.0	12.1
115	16.5	22.2	33.9	49.5	65.9	80.8	93.2	102	108	110	108	103	94.1	82.0	68.1	52.6	37.2	23.4	16.5
120	20.9	25.9	36.1	48.8	63.2	76.0	86.8	94.9	99.8	102	100	95.4	87.8	77.5	65.3	51.9	38.9	26.6	21.2
125	25.4	29.2	38.7	48.8	60.8	71.9	81.4	88.5	92.9	94.6	93.2	89.1	82.4	73.6	63.2	51.6	40.6	29.1	25.5
130	29.3	31.8	41.3	49.5	59.2	68.5	76.7	82.9	86.7	88.1	87.0	83.5	77.7	70.2	61.4	51.3	42.5	31.8	29.4
135	33.1	33.2	43.0	50.0	58.2	66.1	72.7	77.8	81.0	82.3	81.4	78.3	73.5	67.2	60.3	48.0	42.0	32.7	33.4
140	37.5	33.4	44.1	50.8	57.1	63.9	69.2	73.2	76.0	77.0	76.2	73.7	70.0	65.1	58.1	50.9	43.3	32.7	37.3
145	41.6	33.6	45.6	51.4	55.7	61.5	66.4	69.5	71.4	72.3	71.7	69.9	67.1	62.4	52.8	51.7	44.7	32.4	41.0
150	44.6	35.7	44.4	51.8	55.5	58.3	62.0	66.1	67.9	68.7	68.2	66.8	63.7	57.8	56.1	50.9	42.2	34.2	44.1
155	46.8	40.0	40.4	48.5	54.8	57.7	59.8	60.3	60.0	61.5	62.6	62.7	60.3	57.4	53.6	47.4	38.2	37.8	47.1
160	50.4	43.6	33.1	37.0	47.9	55.5	58.0	59.4	59.9	60.5	60.6	60.1	54.4	48.1	43.1	38.7	32.6	37.6	47.9
165	52.2	44.9	34.5	30.2	32.2	40.3	51.0	53.9	55.0	55.6	54.1	40.1	35.6	35.3	33.2	30.9	31.3	36.7	44.2
170	54.2	48.3	35.7	30.8	29.5	30.2	28.5	34.4	36.2	34.1	29.3	33.1	31.2	29.1	28.8	29.4	30.8	34.7	38.6
175	53.8	53.4	49.2	42.3	37.3	36.3	37.6	36.9	28.2	18.0	35.3	38.7	36.8	35.5	33.3	31.7	32.5	33.8	34.7
180	51.7	51.7	51.7	51.7	51.7	51.7	51.7	51.7	51.7	51.7	51.7	51.7	51.7	51.7	51.7	51.7	51.7	51.7	51.7

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	270	270	270	270	270	270	270	270	270	270	270	270	270	270	270	270	270		
5	268	268	268	268	268	269	269	269	269	269	269	269	269	268	268	268	268		
10	264	264	265	265	266	266	266	267	267	267	266	266	266	265	265	265	265		
15	258	258	259	260	261	262	263	263	264	263	263	262	261	260	259	259	258		
20	249	250	251	253	255	257	258	259	259	259	258	257	255	253	252	250	249		
25	238	239	242	244	247	250	252	254	254	254	253	250	248	245	242	240	239		
30	225	227	230	234	238	242	245	247	248	248	246	243	239	235	231	228	225		
35	209	213	217	223	229	234	238	241	242	241	238	234	229	224	218	214	211		
40	193	197	203	211	218	225	230	233	234	233	230	225	219	212	204	198	194		
45	174	180	188	198	207	215	221	225	227	226	222	216	208	199	190	182	176		
50	156	162	173	184	195	205	213	217	219	217	213	206	197	186	174	164	157		
55	135	145	157	171	184	195	204	209	211	209	204	196	185	172	159	147	137		
60	114	126	142	158	173	185	195	201	203	201	195	186	174	160	144	128	116		
65	92.3	107	126	146	162	176	186	192	194	192	186	177	163	148	129	110	95.2		
70	71.1	89.7	112	134	153	166	177	184	186	184	178	167	154	136	115	93.1	74.5		
75	51.2	73.7	99.1	123	143	157	168	175	178	175	169	158	144	125	102	77.2	55.2		
80	34.0	60.1	87.8	113	133	149	160	167	169	167	160	150	135	114	90.5	63.5	38.0		
85	21.3	49.6	78.2	104	125	141	152	158	161	159	153	142	126	105	80.8	52.7	24.8		
90	14.7	42.4	70.7	95.7	117	133	144	151	153	151	144	133	117	97.1	72.7	44.9	17.0		
95	12.5	37.9	64.7	88.8	109	125	136	143	145	143	136	125	110	89.9	66.3	39.7	13.9		
100	13.2	34.8	59.7	82.6	102	117	128	135	137	135	128	118	103	83.5	60.9	35.9	13.4		
105	15.5	33.2	55.4	76.7	95.1	110	120	126	128	126	120	110	95.4	77.3	56.1	33.5	15.2		
110	19.3	33.4	52.0	71.3	88.3	102	112	118	120	118	112	102	88.5	71.5	52.2	32.9	18.5		
115	23.0	34.7	50.0	66.5	82.0	94.4	104	109	111	109	104	94.5	82.0	66.5	49.6	33.5	22.3		
120	27.4	36.7	49.2	62.9	76.2	87.4	95.7	101	103	101	95.7	87.3	75.9	62.4	48.2	34.9	26.2		
125	31.4	38.9	49.1	60.4	71.4	80.8	88.3	92.9	94.4	92.8	88.2	80.7	70.7	59.5	47.8	37.2	30.1		
130	34.5	41.2	49.4	58.7	67.7	75.5	81.5	85.3	86.7	85.2	81.2	75.0	67.0	57.7	48.0	39.8	33.9		
135	37.6	43.2	50.1	57.5	64.8	71.2	76.1	79.2	80.2	79.0	75.8	70.7	64.0	56.4	48.7	42.4	37.2		
140	40.1	45.1	51.0	56.7	62.5	67.6	71.5	74.0	74.8	73.8	71.2	67.0	61.7	55.6	49.8	44.5	40.0		
145	42.7	46.7	51.6	56.2	60.6	64.5	67.6	69.6	70.2	69.4	67.3	64.0	59.9	55.2	50.9	46.7	43.0		
150	45.2	46.3	52.2	55.8	59.0	62.0	64.3	65.8	66.3	65.6	64.0	61.6	58.5	55.2	51.9	47.8	45.9		
155	47.9	48.4	52.1	55.5	57.8	59.9	61.5	62.6	62.9	62.5	61.3	59.6	57.5	55.2	52.2	49.7	48.8		
160	50.5	48.1	49.1	54.4	56.5	58.2	59.3	60.0	60.2	59.9	59.2	58.2	56.7	54.6	52.5	51.3	51.0		
165	48.0	51.2	50.4	53.4	56.1	56.8	57.5	58.0	58.2	57.8	57.3	56.4	55.1	54.0	53.1	52.7	52.7		
170	41.5	46.3	48.7	50.0	54.4	56.1	56.3	56.6	56.7	56.2	55.5	54.9	54.5	54.2	53.8	53.7	53.8		
175	37.1	40.5	44.5	47.5	48.8	50.5	52.9	54.6	55.4	55.3	54.8	54.6	54.5	54.4	54.4	54.5	54.5		
180	51.7	51.7	51.7	51.7	51.7	51.7	51.7	51.7	51.7	51.7	51.7	51.7	51.7	51.7	51.7	51.7	51.7		

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.

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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

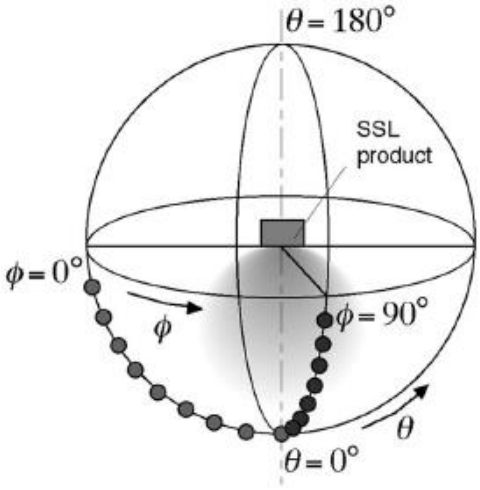
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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