

LM-79-08 TEST REPORT

for

GREEN CREATIVE LTD

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

LED Lamp

Model: 15A21DIM/927/N

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ19050037g

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

Review by:



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May 31, 2019

Approved by:



Manager: Jim Zhang
May 31, 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: 15A21DIM/927/N

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
109.7	1719.0	15.67	0.9815
CCT (K)	CRI	Stabilization Time (Light & Power)	
2753	93.3	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	: May 23, 2019
Date of Test	: May 28, 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 Lamp
Model	: 15A21DIM/927/N
Electrical Ratings	: 120V, 60Hz, 15W
Product Description	: 2700K
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 base up. 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
Voltage frequency (Hz)	60
Test Current (A)	0.133
Power Factor	0.9815
Test Power (W)	15.67
THD A%	10.83
Luminous Efficacy (lm/W)	109.7
Total Luminous Flux (lm)	1719.0
Color Rendering Index (CRI)	93.3
R9	53.9
Correlated Color Temperature (CCT)(K)	2753
Chromaticity Chroma x	0.4523
Chromaticity Chroma y	0.4038
Chromaticity Chroma u	0.2607
Chromaticity Chroma v	0.3491
Duv	0.0021
Chromaticity Chroma u'	0.2607
Chromaticity Chroma v'	0.5236

Special Color Rendering Indices	
R1	96.3
R2	97.2
R3	95.5
R4	95.5
R5	95.3
R6	96.3
R7	90.8
R8	79.8
R9	53.9
R10	90.4
R11	95.3
R12	82.3
R13	97.2
R14	95.9

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 25.0 °C.

The photometric distance is 2.47 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)	0.134
Power Factor	0.9820
Power (W)	15.81
Luminous Efficacy (lm/W)	109.1
Total Luminous Flux (lm)	1725.2
Beam Angle (°)	226.9 (0°-180°) / 227.1 (90°-270°)
Center Beam Candle Power (cd)	210
Maximum Beam Candle Power (cd)	211.2 (At: C=160.0, Gamma=9.0)
Spacing Criteria	1.51 (0°-180°) / 1.48 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	36.41%
Zonal Lumens in the 60 °-90 °Zone	30.42%
Zonal Lumens in the 90 °-120 °Zone	22.00%
Zonal Lumens in the 120 °-180 °Zone	11.16%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

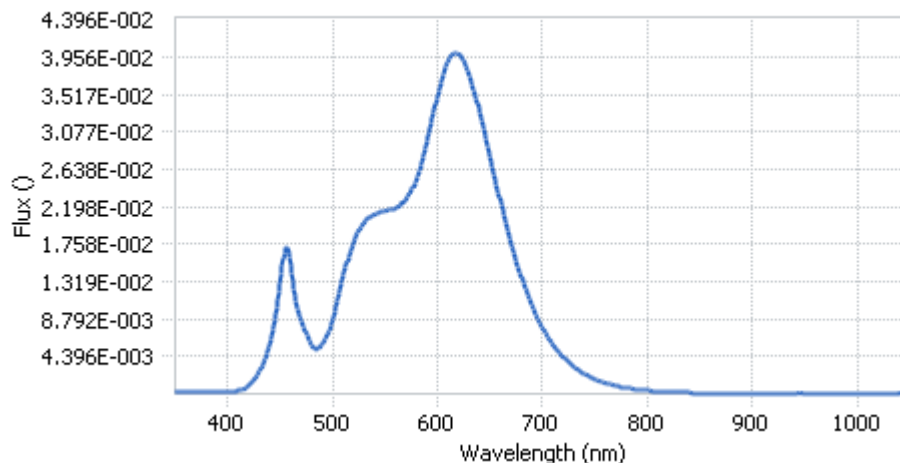
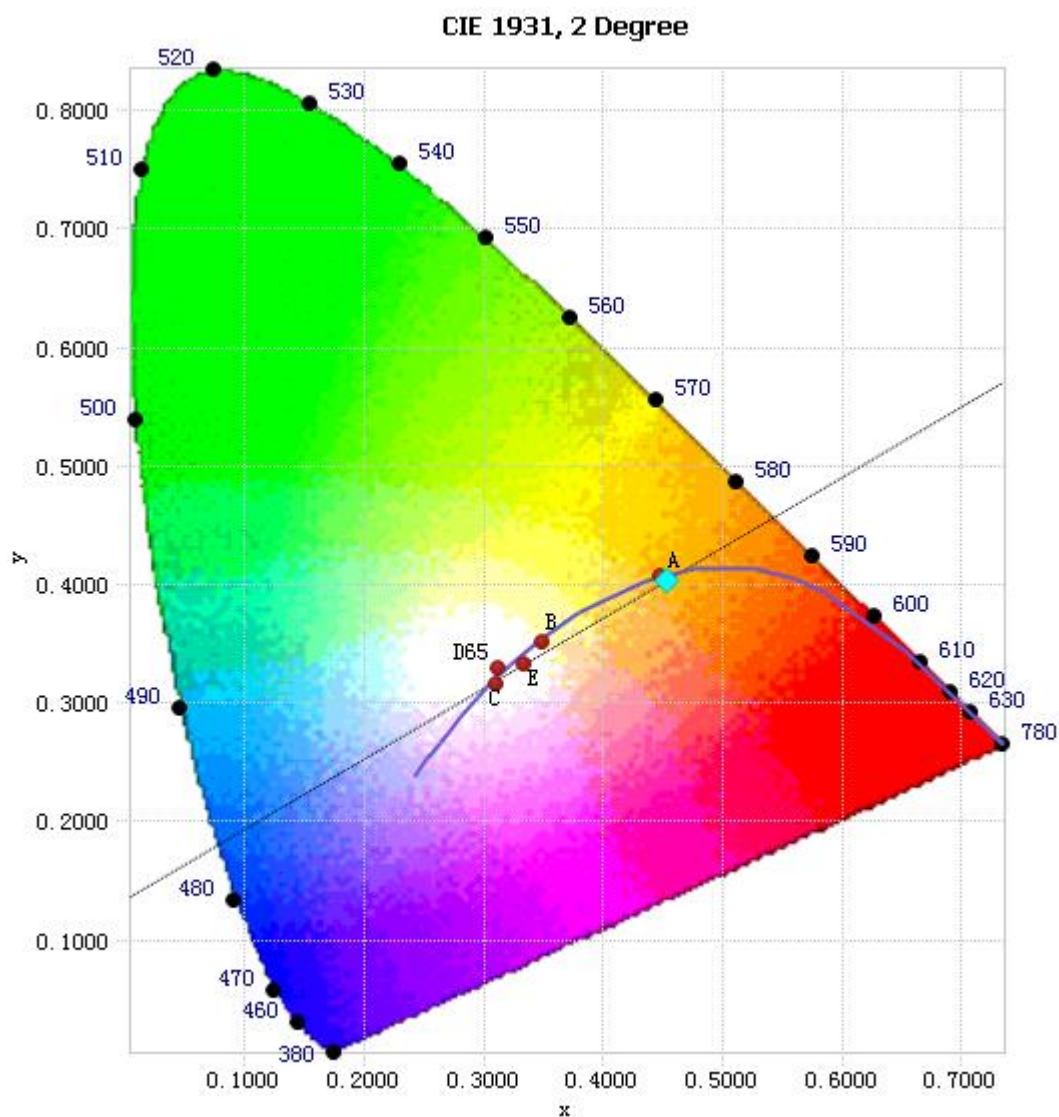


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.31E-04	485	5.30E-03	590	2.97E-02	695	8.97E-03
385	2.17E-04	490	5.82E-03	595	3.24E-02	700	7.74E-03
390	2.21E-04	495	6.98E-03	600	3.51E-02	705	6.68E-03
395	2.37E-04	500	8.83E-03	605	3.74E-02	710	5.77E-03
400	2.57E-04	505	1.13E-02	610	3.91E-02	715	4.98E-03
405	2.86E-04	510	1.38E-02	615	3.99E-02	720	4.29E-03
410	3.89E-04	515	1.61E-02	620	3.98E-02	725	3.69E-03
415	6.09E-04	520	1.78E-02	625	3.91E-02	730	3.18E-03
420	1.03E-03	525	1.92E-02	630	3.74E-02	735	2.74E-03
425	1.68E-03	530	2.01E-02	635	3.54E-02	740	2.35E-03
430	2.64E-03	535	2.07E-02	640	3.30E-02	745	2.01E-03
435	4.03E-03	540	2.11E-02	645	3.04E-02	750	1.74E-03
440	5.97E-03	545	2.14E-02	650	2.78E-02	755	1.50E-03
445	8.70E-03	550	2.15E-02	655	2.51E-02	760	1.29E-03
450	1.30E-02	555	2.16E-02	660	2.26E-02	765	1.13E-03
455	1.71E-02	560	2.18E-02	665	2.00E-02	770	9.61E-04
460	1.52E-02	565	2.22E-02	670	1.77E-02	775	8.29E-04
465	1.08E-02	570	2.29E-02	675	1.56E-02	780	7.14E-04
470	8.65E-03	575	2.39E-02	680	1.37E-02		
475	7.05E-03	580	2.53E-02	685	1.20E-02		
480	5.63E-03	585	2.73E-02	690	1.04E-02		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4523, 0.4038)

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

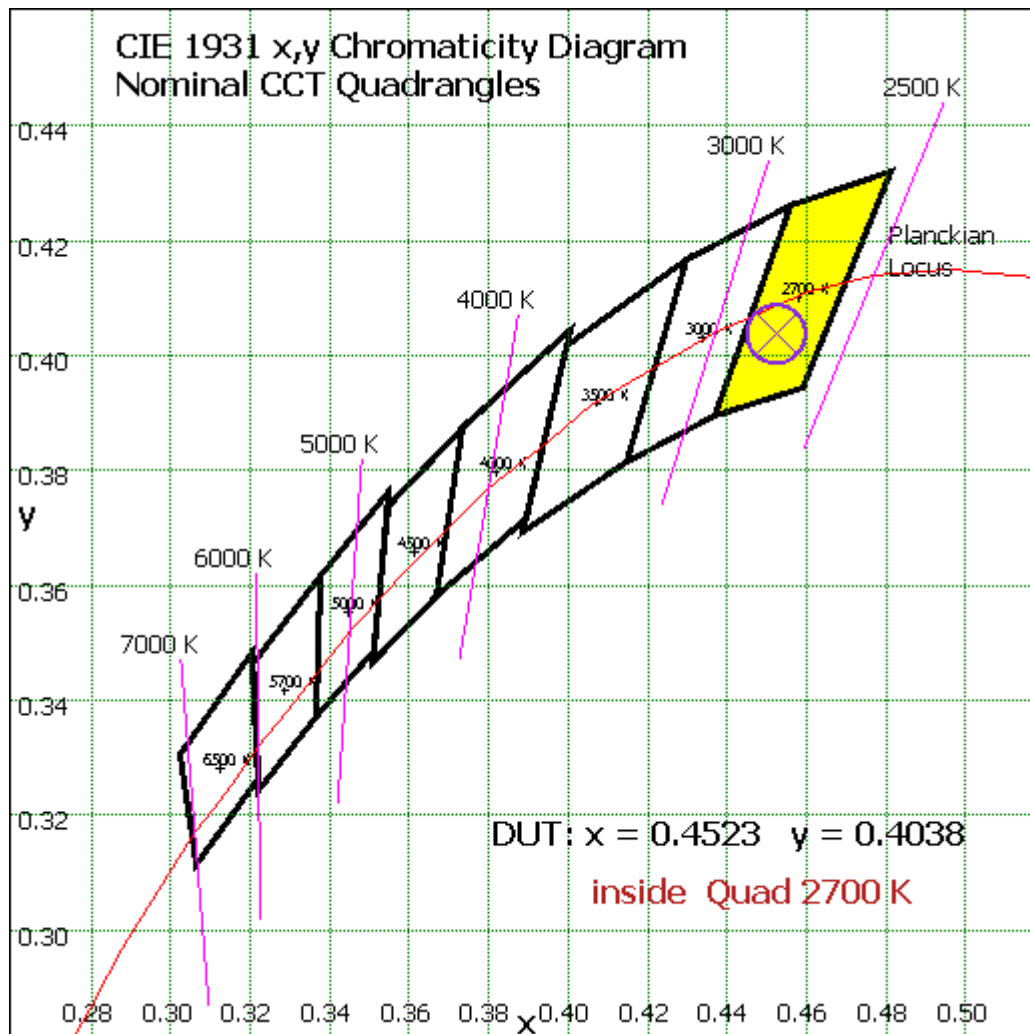
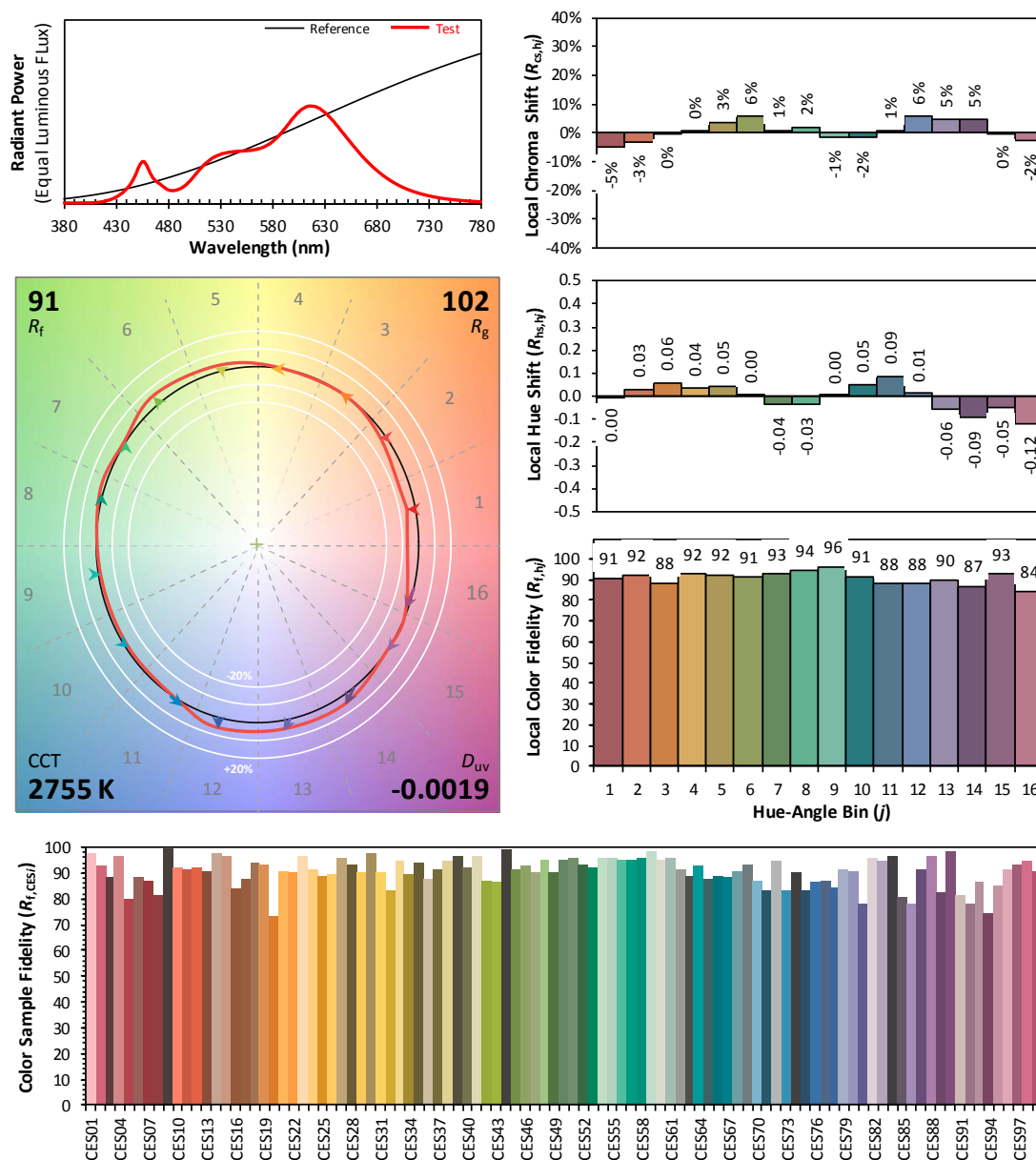


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method



Notes: This is a recommended method for displaying ANSI/IES TM-30-18 information.

x 0.4523

y 0.4038

u' 0.2607

v' 0.5236

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	20.045	1.16%
10- 20	59.185	3.43%
20- 30	95.715	5.55%
30- 40	128.011	7.42%
40- 50	153.866	8.92%
50- 60	171.363	9.93%
60- 70	179.376	10.40%
70- 80	177.807	10.31%
80- 90	167.683	9.72%
90-100	150.075	8.70%
100-110	127.389	7.38%
110-120	102.132	5.92%
120-130	76.862	4.46%
130-140	53.886	3.12%
140-150	34.269	1.99%
150-160	18.45	1.07%
160-170	7.703	0.45%
170-180	1.351	0.08%
Total	1725.2	100%

$\gamma(^{\circ})$	Lumens	% Total
0-130	1609.509	93.30%
130-180	115.659	6.70%
0-180	1725.2	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

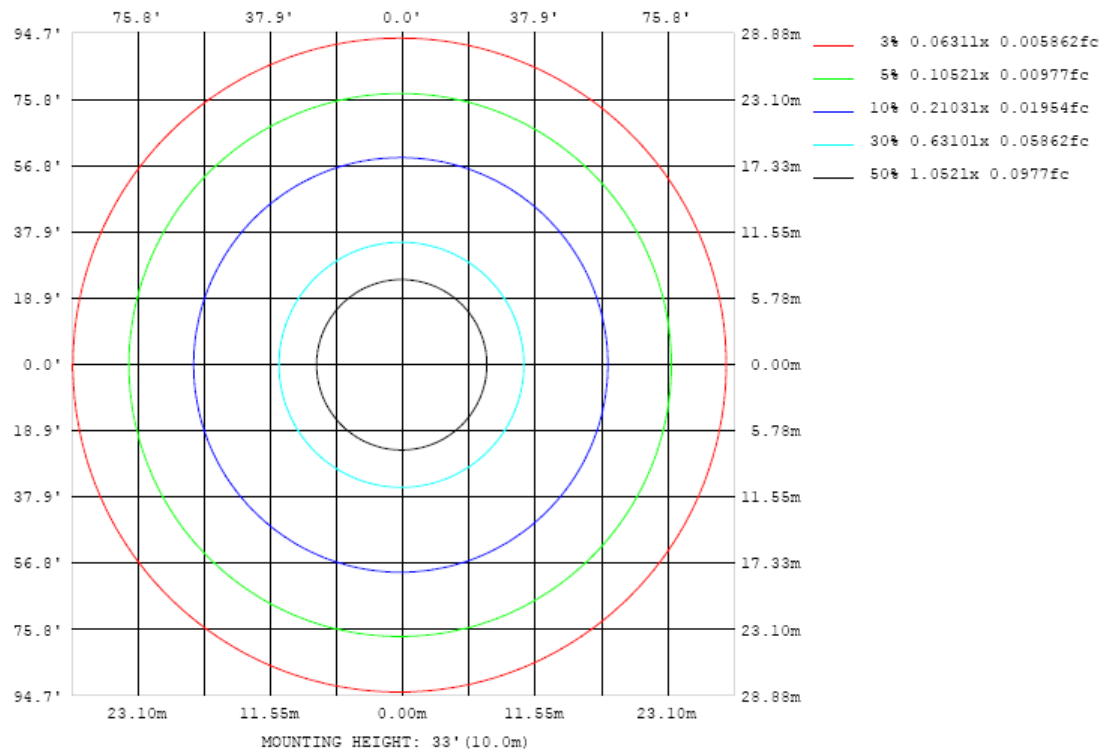


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

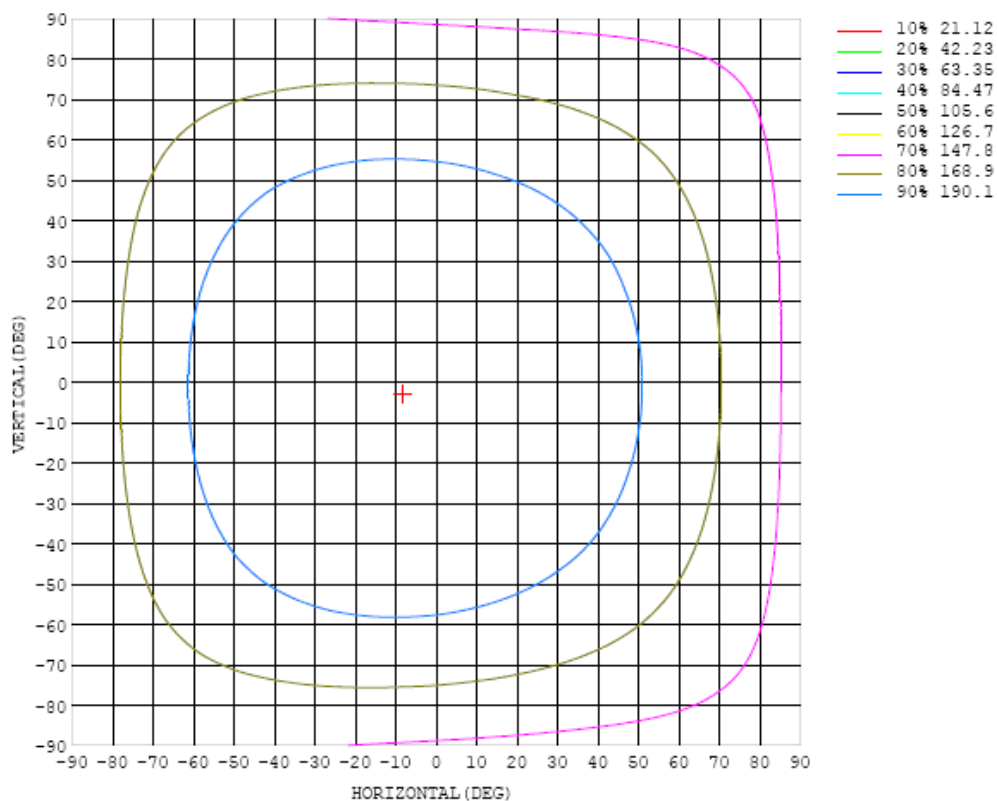


Chart 6: Isocandela Plot

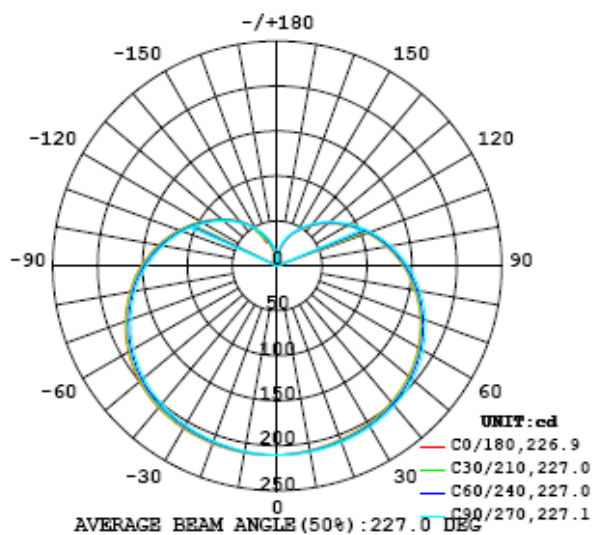


Chart 7: Polar Candela Distribution

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	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
5	209	209	210	210	210	210	210	210	210	211	211	211	211	211	211	211	211	211	211
10	208	208	209	209	209	209	209	210	210	210	211	211	211	211	211	211	211	211	211
15	207	207	207	208	208	208	209	209	209	210	210	210	211	211	211	211	211	211	211
20	206	206	206	206	207	207	208	208	209	209	209	210	210	210	210	211	211	210	210
25	204	204	205	205	205	206	206	207	208	208	208	209	209	210	210	210	210	210	210
30	203	203	203	203	204	204	205	206	206	207	207	208	208	209	209	209	209	209	209
35	200	201	201	201	202	202	203	204	205	205	206	206	207	207	208	208	208	208	208
40	198	198	198	199	199	200	201	201	202	203	204	205	205	206	206	206	206	206	206
45	195	195	195	196	196	197	198	199	199	200	201	202	203	203	203	204	204	203	203
50	191	191	191	192	192	193	194	195	196	197	198	199	199	200	200	200	200	200	200
55	186	187	187	187	188	189	190	191	192	193	194	194	195	196	196	196	196	196	196
60	181	181	182	182	183	184	185	186	187	188	189	190	190	191	192	192	192	192	192
65	176	176	176	177	177	178	179	180	181	182	183	184	185	186	186	187	186	186	186
70	170	170	170	171	171	172	173	174	175	176	177	178	179	180	180	180	180	180	180
75	163	163	163	164	164	165	166	167	168	169	170	171	172	173	173	174	174	173	173
80	156	156	156	157	157	158	159	160	161	162	163	164	165	165	166	166	166	166	166
85	148	148	148	149	150	150	151	152	153	154	155	156	157	158	158	159	159	159	159
90	140	140	141	141	142	142	143	144	145	146	147	148	149	149	150	150	151	150	151
95	132	132	133	133	133	134	135	136	137	137	138	139	140	141	141	142	142	142	143
100	124	124	124	125	125	125	126	127	128	129	130	131	132	133	133	133	133	133	134
105	116	115	116	116	116	117	118	118	119	120	121	122	122	123	124	124	124	125	125
110	107	107	107	107	108	108	109	110	110	111	112	113	113	114	115	115	115	116	116
115	98.4	98.3	98.4	98.8	99.1	99.5	100	101	102	102	103	104	104	105	106	106	106	107	107
120	89.9	89.8	89.9	90.2	90.5	90.9	91.4	92.1	92.8	93.4	94.2	94.9	95.5	96.2	96.7	97.2	97.4	97.7	98.4
125	81.6	81.5	81.6	81.8	82.1	82.5	83.0	83.6	84.2	84.9	85.5	86.2	86.8	87.4	87.9	88.4	88.7	88.9	89.7
130	73.5	74.6	73.7	73.8	73.9	74.2	74.8	75.3	75.9	76.4	77.1	77.7	78.3	78.9	79.4	79.9	80.1	80.4	81.1
135	66.1	66.0	66.1	66.3	66.6	66.9	67.3	67.8	68.3	68.9	69.5	70.1	70.7	71.1	71.6	71.9	72.2	72.4	72.9
140	58.7	58.6	58.7	58.9	59.1	59.4	59.8	60.2	60.7	61.2	61.8	62.3	62.9	63.4	63.8	64.2	64.5	64.7	64.9
145	51.6	51.5	51.6	51.8	52.0	52.3	52.6	53.1	53.5	54.0	54.5	55.0	55.5	56.0	56.4	56.7	57.0	56.9	56.0
150	45.1	45.0	45.1	45.2	45.4	45.7	46.0	46.4	46.8	47.2	47.7	48.2	48.6	49.0	49.4	49.7	49.8	47.9	43.6
155	38.9	38.8	38.9	39.1	39.3	39.5	39.8	40.2	40.5	41.0	41.4	41.8	42.3	42.6	43.1	42.8	41.6	39.0	28.4
160	32.8	32.7	32.8	33.0	33.3	33.4	33.8	34.1	34.6	35.0	35.4	35.9	36.3	36.6	37.1	35.6	31.2	30.1	30.7
165	26.3	26.2	26.4	26.6	26.9	27.0	27.2	27.8	28.3	28.7	29.2	29.6	30.0	30.3	30.8	30.0	26.5	20.3	17.2
170	19.0	19.0	19.2	19.5	19.8	19.9	20.0	20.9	21.4	21.8	22.3	22.7	23.1	23.5	23.8	22.3	21.3	20.4	20.4
175	7.06	7.16	7.16	7.54	8.35	9.59	10.5	11.3	12.1	12.9	13.6	14.2	14.7	15.0	14.8	14.5	12.9	13.0	13.0
180	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28

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	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210		
5	211	211	211	210	210	210	210	210	210	210	210	210	210	209	209	209	209		
10	211	211	210	210	210	210	210	209	209	209	209	209	208	208	208	208	208		
15	211	210	210	210	209	209	209	209	208	208	207	207	207	207	207	207	207		
20	210	210	209	209	209	208	208	207	207	207	206	206	206	206	206	205	206		
25	209	209	209	208	208	207	207	206	206	205	205	204	204	204	204	204	204		
30	209	208	208	207	207	206	206	205	204	204	203	203	203	202	202	202	202		
35	207	207	206	206	205	205	204	203	203	202	201	201	201	200	200	200	200		
40	205	205	205	204	203	203	202	201	200	200	199	198	198	198	198	198	198		
45	203	203	202	201	201	200	199	198	197	197	196	195	195	195	195	194	195		
50	200	199	199	198	197	196	196	195	194	193	192	192	191	191	191	191	191		
55	196	195	195	194	193	192	192	191	190	189	188	188	187	187	187	186	186		
60	191	191	190	189	189	188	187	186	185	184	183	183	182	182	182	181	181		
65	186	185	185	184	183	182	181	180	179	179	178	177	177	176	176	176	176		
70	180	179	179	178	177	176	175	174	173	173	172	171	171	170	170	170	170		
75	173	173	172	171	171	170	169	168	167	166	165	165	164	164	164	163	163		
80	166	166	165	164	164	163	162	162	161	160	159	159	158	158	157	157	157		
85	159	159	158	158	157	156	155	154	153	153	152	151	151	150	150	149	149		
90	151	151	150	150	149	148	147	146	145	145	144	143	143	143	142	142	141		
95	143	142	142	141	141	140	139	138	137	137	136	135	135	134	134	134	133		
100	134	134	133	133	132	131	131	130	129	128	128	127	127	126	126	125	125		
105	125	125	124	124	123	123	122	121	120	120	119	119	118	118	117	117	116		
110	116	116	116	115	114	114	113	112	112	111	110	110	109	109	109	108	108		
115	107	107	107	106	106	105	104	104	103	102	102	101	101	100	99.8	99.4	99.3		
120	98.4	98.1	97.7	97.3	96.8	96.3	95.6	95.0	94.4	93.8	93.2	92.6	92.1	91.7	91.3	90.9	90.7		
125	89.6	89.4	89.0	88.6	88.1	87.6	87.0	86.4	85.9	85.3	84.7	84.2	83.7	83.2	82.8	82.5	82.3		
130	81.1	80.8	80.5	80.1	79.7	79.2	78.7	78.1	77.6	77.1	76.5	76.0	75.5	75.0	74.7	74.4	74.2		
135	72.8	72.6	72.3	71.9	71.5	71.1	70.6	70.1	69.6	69.1	68.6	68.1	67.6	67.2	66.9	66.5	66.4		
140	64.9	64.7	64.3	64.1	63.8	63.4	62.8	62.4	62.0	61.5	61.1	60.6	60.1	59.7	59.4	59.1	58.9		
145	56.8	57.0	56.0	55.8	56.2	55.9	55.3	55.2	54.8	54.3	53.9	53.4	53.0	52.6	52.3	52.0	51.9		
150	45.4	43.0	44.7	46.6	47.5	47.7	47.9	48.0	47.6	47.2	46.7	46.3	46.0	45.7	45.5	45.3			
155	22.6	27.0	33.8	38.1	39.0	40.0	39.4	40.9	41.6	41.3	40.8	40.5	40.1	39.7	39.5	39.3	39.2		
160	31.6	30.5	28.3	30.5	31.9	31.7	31.6	33.8	35.2	35.1	34.6	34.2	33.8	33.4	33.3	33.1	33.0		
165	16.2	16.9	20.5	22.9	23.3	24.1	25.7	27.6	28.0	28.4	28.3	27.8	27.1	26.9	26.8	26.5	26.4		
170	19.4	18.5	18.1	19.3	20.4	20.8	21.1	21.0	20.7	20.8	21.1	20.8	19.9	19.4	19.4	19.2	19.0		
175	12.8	12.4	12.5	13.5	13.4	13.1	12.6	12.1	11.8	11.6	11.2	10.4	9.57	8.93	8.01	7.35	7.04		
180	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28		

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

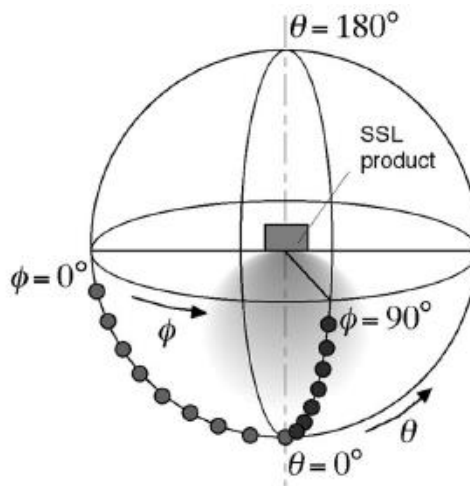
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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