



## LM-79-08 Test Report

for

### GREEN CREATIVE LTD

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

**A21**

**Model: 17A21G4DIM/827/R**

### Laboratory: Leading Testing Laboratories

**NVLAP CODE: 200960-0**

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Report No.: HZ18010012d

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

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Jan. 08, 2018

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Jan. 08, 2018

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: 17A21G4DIM/827/R

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
108.6	1746.0	16.08	0.9221
CCT (K)	CRI	Stabilization Time (Light & Power)	
2734	81.9	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** : Oct. 30, 2016

**Date of Test** : Nov. 17, 2016

**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

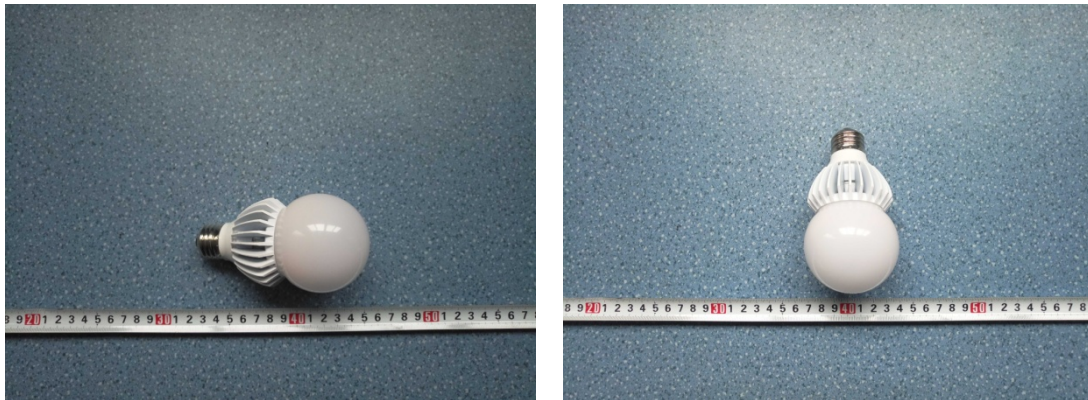


Figure 1- Overview of the sample

### Equipment Under Test (EUT)

<b>Name</b>	: A21
<b>Model</b>	: 17A21G4DIM/827/R
<b>Electrical Ratings</b>	: 120V, 60Hz, 17W
<b>Product Description</b>	: 2700K
<b>Manufacturer</b>	: GREEN CREATIVE LTD
<b>Address</b>	: 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
Voltage frequency (Hz)	60
Test Current (A)	0.145
Power Factor	0.9221
Test Power (W)	16.08
THD A%	37.61
Luminous Efficacy (lm/W)	108.6
Total Luminous Flux (lm)	1746.0
Color Rendering Index (CRI)	81.9
R9	7.8
Correlated Color Temperature (CCT)(K)	2734
Chromaticity Chroma x	0.4550
Chromaticity Chroma y	0.4064
Chromaticity Chroma u	0.2613
Chromaticity Chroma v	0.3500
Duv	0.0014
Chromaticity Chroma u'	0.2613
Chromaticity Chroma v'	0.5250

Special Color Rendering Indices	
R1	80.7
R2	93
R3	93
R4	77.8
R5	81.1
R6	92.1
R7	80
R8	56.4
R9	7.8
R10	84.3
R11	76.4
R12	76.4
R13	83.8
R14	96.9
Rf	82
Rg	94

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 24.6°C.

The photometric distance is 2.47m.

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)	0.144
Power Factor	0.9230
Test Power (W)	15.96
Luminous Efficacy (lm/W)	109.2
Total Luminous Flux (lm)	1742.1
Beam Angle (°)	317.5
Center Beam Candle Power (cd)	128
Spacing Criteria	1.64(0°-180°)/ 1.76(90°-370°)
Zonal Lumens in the 0°-60°Zone	26.44%
Zonal Lumens in the 60°-90°Zone	29.16%
Zonal Lumens in the 90°-120°Zone	26.81%
Zonal Lumens in the 120°-180°Zone	17.59%

Table 3: Test data per Goniophotometer Method

## Spectral Power Distribution - Sphere Spectroradiometer Method

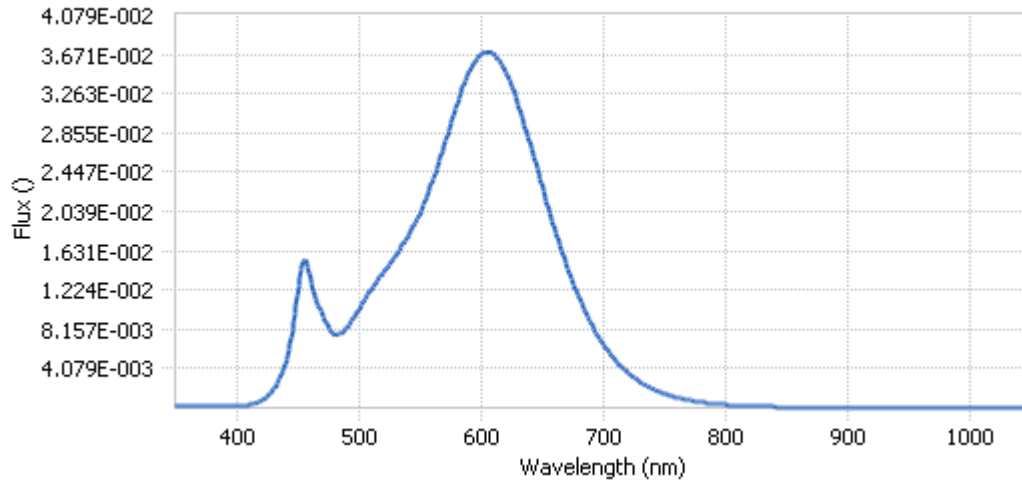
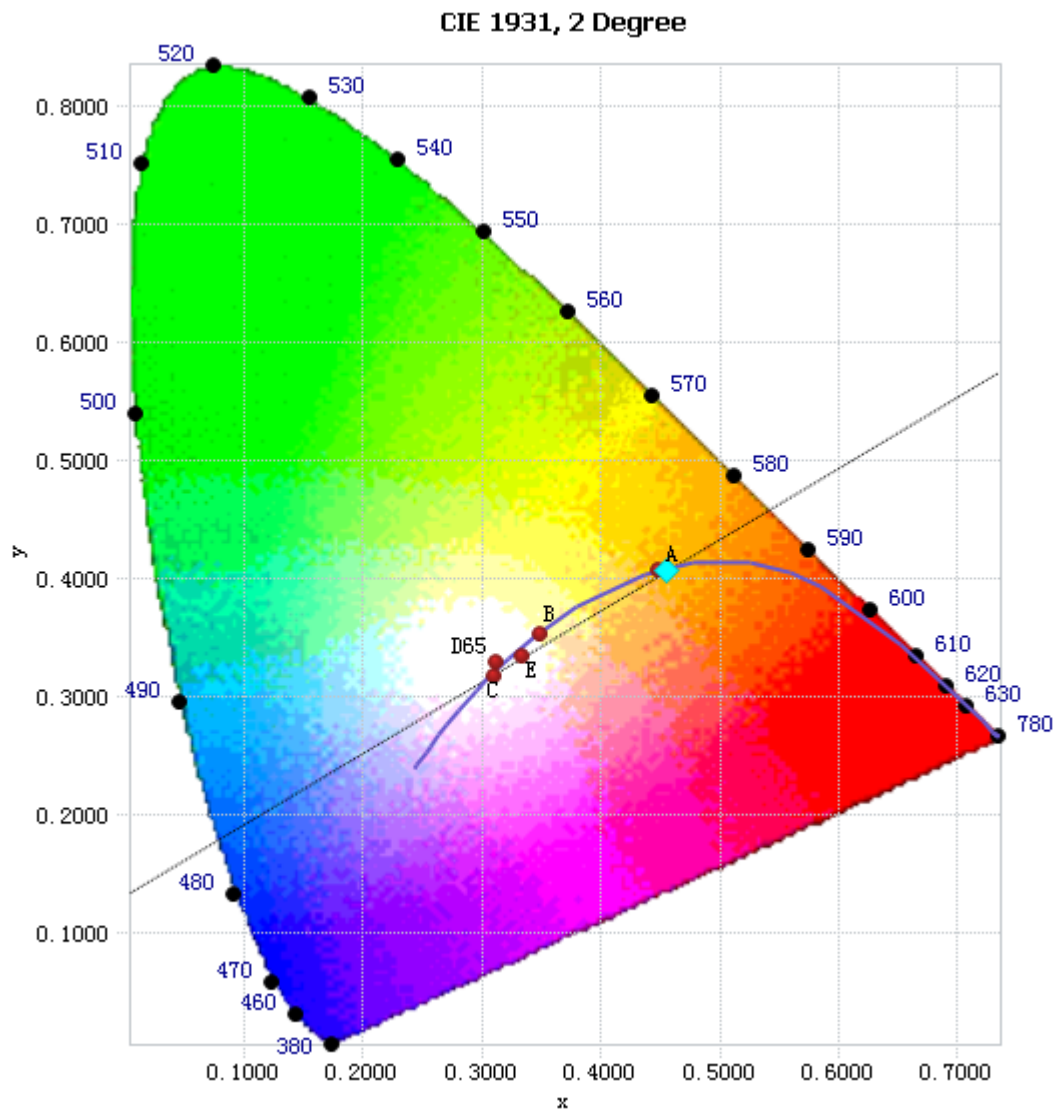


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.22E-04	485	7.65E-03	590	3.48E-02	695	7.76E-03
385	2.12E-04	490	8.27E-03	595	3.59E-02	700	6.73E-03
390	2.20E-04	495	9.08E-03	600	3.67E-02	705	5.81E-03
395	2.15E-04	500	1.01E-02	605	3.69E-02	710	5.02E-03
400	2.24E-04	505	1.12E-02	610	3.69E-02	715	4.34E-03
405	2.64E-04	510	1.22E-02	615	3.62E-02	720	3.77E-03
410	3.21E-04	515	1.32E-02	620	3.50E-02	725	3.23E-03
415	4.75E-04	520	1.39E-02	625	3.36E-02	730	2.78E-03
420	7.30E-04	525	1.48E-02	630	3.18E-02	735	2.37E-03
425	1.15E-03	530	1.57E-02	635	2.99E-02	740	2.04E-03
430	1.83E-03	535	1.66E-02	640	2.78E-02	745	1.75E-03
435	2.91E-03	540	1.78E-02	645	2.55E-02	750	1.50E-03
440	4.55E-03	545	1.89E-02	650	2.33E-02	755	1.30E-03
445	7.25E-03	550	2.01E-02	655	2.11E-02	760	1.11E-03
450	1.16E-02	555	2.16E-02	660	1.89E-02	765	9.63E-04
455	1.52E-02	560	2.33E-02	665	1.69E-02	770	8.23E-04
460	1.39E-02	565	2.52E-02	670	1.50E-02	775	7.06E-04
465	1.12E-02	570	2.72E-02	675	1.33E-02	780	6.12E-04
470	9.94E-03	575	2.92E-02	680	1.16E-02		
475	8.67E-03	580	3.12E-02	685	1.02E-02		
480	7.70E-03	585	3.32E-02	690	8.94E-03		

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

## Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4550, 0.4064)

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

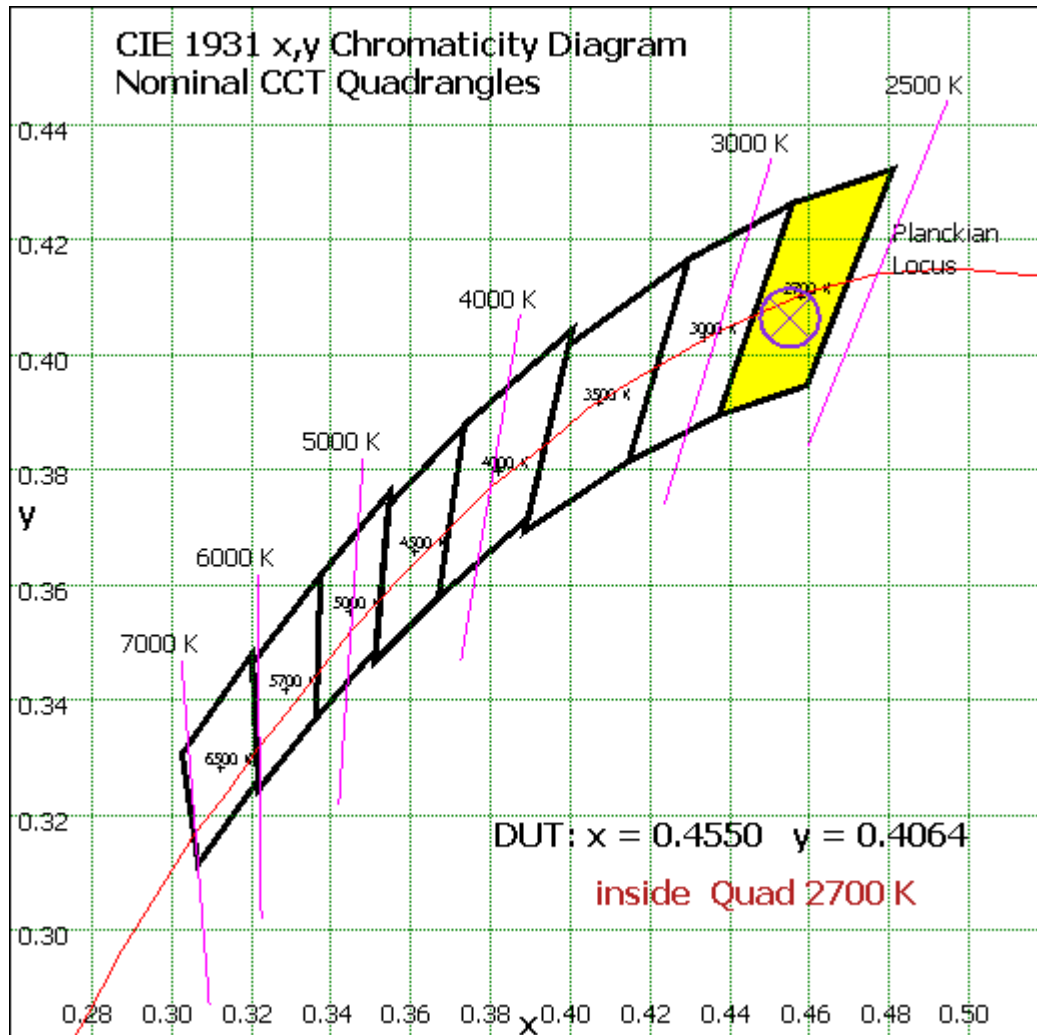


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

### Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	12.246	0.70%
10- 20	37.157	2.13%
20- 30	63.052	3.62%
30- 40	89.974	5.16%
40- 50	116.885	6.71%
50- 60	141.307	8.11%
60- 70	160.405	9.21%
70- 80	172.098	9.88%
80- 90	175.434	10.07%
90-100	170.508	9.79%
100-110	157.925	9.07%
110-120	138.695	7.96%
120-130	113.977	6.54%
130-140	85.657	4.92%
140-150	57.24	3.29%
150-160	32.991	1.89%
160-170	14.676	0.84%
170-180	1.886	0.11%
Total	1742.1	100%

$\gamma(^{\circ})$	Lumens	% Total
0-130	1549.663	88.95%
130-180	192.45	11.05%
0-180	1742.1	100%

Table 5: Zonal Lumen Data

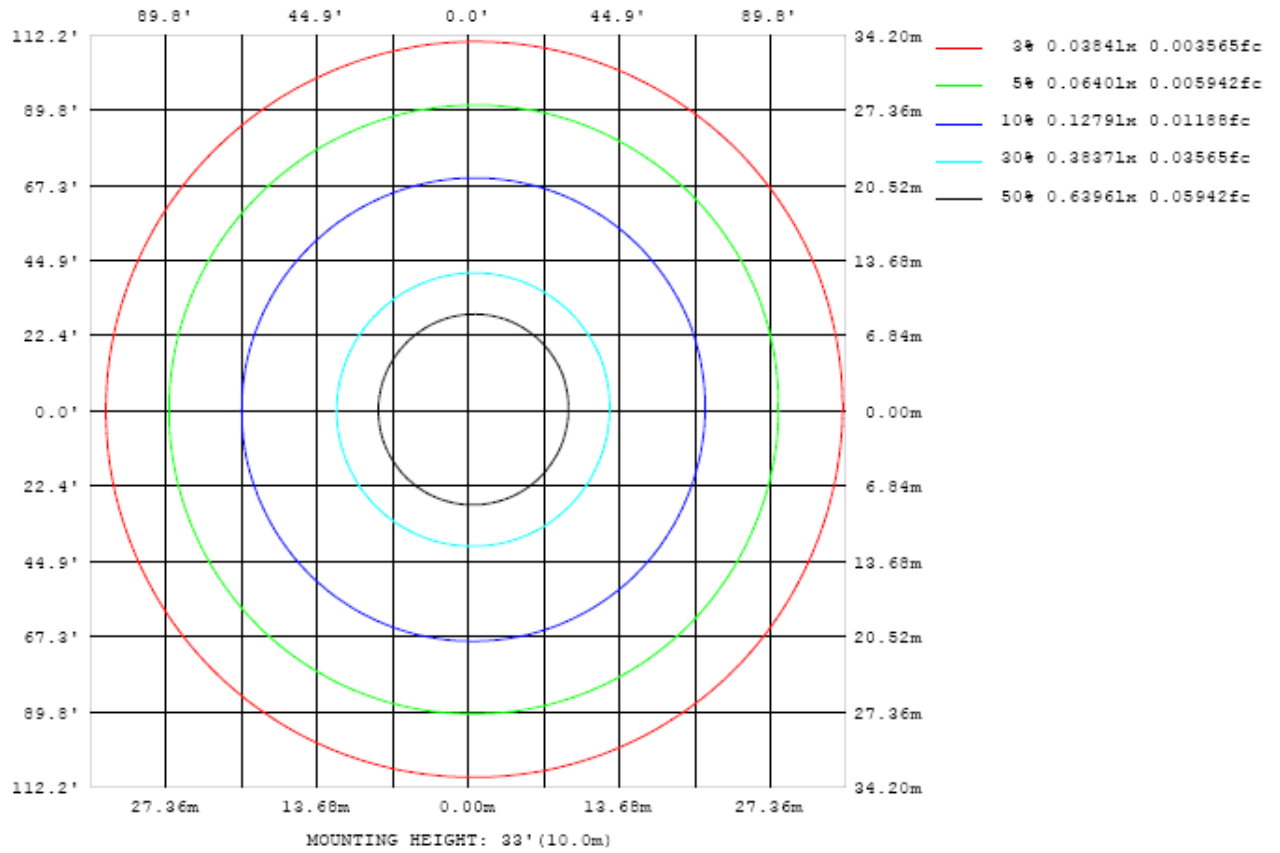


Chart 4: Illuminance Plot (Footcandles)

## Luminous Intensity Distribution Plots- Goniophotometer Method

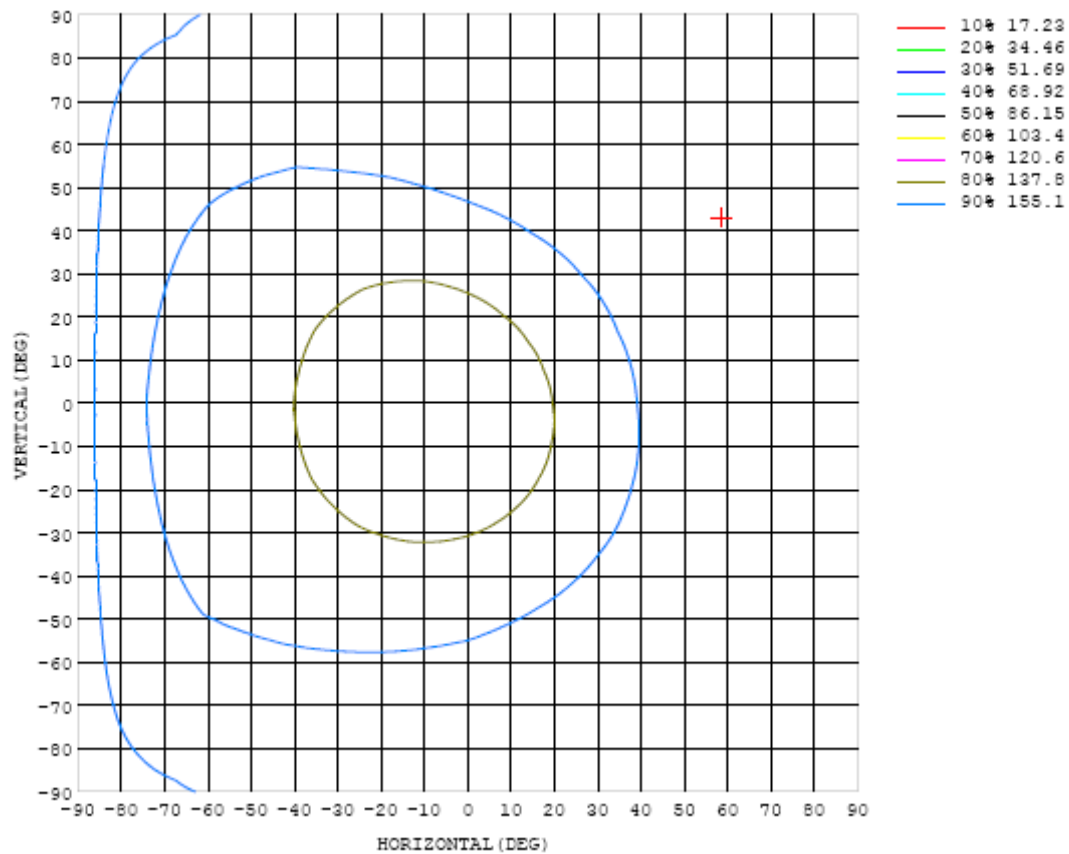


Chart 5: Isocandela Plot

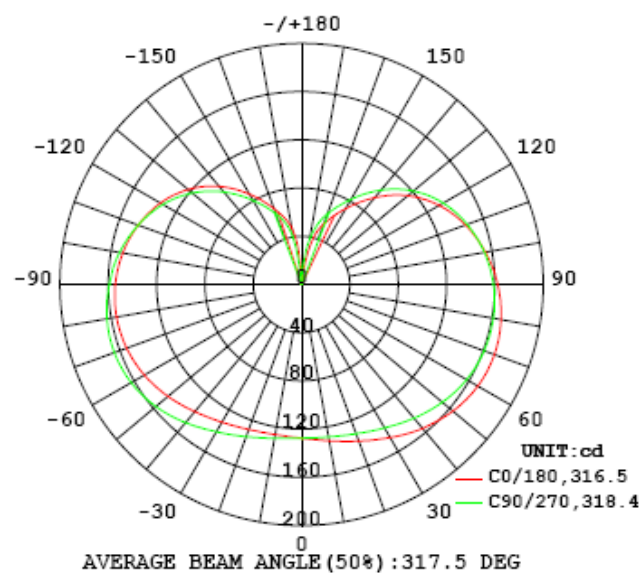


Chart 6: Polar Candela Distribution

## Luminous Intensity Data- Goniophotometer Method

Table--1

UNIT: cd

C (DEG) y (DEG)	0	22.5	45	67.5	90	112.5	135	157.5	180	202.5	225	247.5	270	292.5	315	337.5			
0	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128			
5	129	129	129	128	128	127	127	127	127	127	127	128	128	129	129	129			
10	132	131	130	129	128	128	127	126	126	127	128	129	130	131	131	132			
15	135	134	133	131	130	129	127	127	127	127	128	130	132	133	134	135			
20	138	137	135	134	132	130	129	128	128	129	130	132	134	137	138	139			
25	142	141	139	137	134	132	131	130	130	130	132	135	138	140	142	143			
30	147	145	143	140	137	135	133	132	132	133	135	138	141	144	147	147			
35	151	149	147	144	141	138	136	135	135	135	138	141	145	149	151	152			
40	156	154	151	148	145	142	140	138	138	139	141	145	150	154	156	157			
45	160	157	155	152	148	146	143	142	141	142	145	149	154	158	161	162			
50	163	161	159	156	152	149	147	145	144	146	148	152	157	162	165	166			
55	166	164	162	159	155	153	150	148	148	149	151	155	161	165	168	169			
60	168	166	164	161	158	155	153	151	150	151	154	158	163	167	170	171			
65	170	167	166	163	160	157	155	153	153	154	156	159	164	168	171	172			
70	170	167	166	164	161	159	157	155	154	155	157	160	165	169	171	172			
75	169	167	166	164	161	160	158	156	155	156	158	161	165	168	170	171			
80	168	166	165	163	161	160	158	156	156	156	158	160	164	167	169	170			
85	165	164	164	162	160	159	157	156	155	156	157	159	162	165	166	167			
90	162	162	161	160	159	157	156	155	154	155	157	157	159	162	163	164			
95	159	158	158	157	157	155	154	153	153	153	155	156	157	158	160	160			
100	154	154	154	154	154	153	152	151	150	150	152	152	153	155	156	156			
105	150	150	150	150	150	149	148	148	147	147	149	149	149	150	151	151			
110	144	145	145	145	146	145	145	145	144	144	145	145	144	145	146	146			
115	138	139	139	140	141	141	140	141	140	139	141	140	139	140	140	139			
120	131	132	133	134	135	135	135	136	135	134	135	134	133	133	133	132			
125	124	125	125	127	129	129	129	130	129	129	129	128	126	126	125	124			
130	115	116	117	119	121	121	122	123	123	122	122	121	118	117	117	116			
135	105	106	108	110	112	113	114	115	115	114	114	112	110	108	107	106			
140	94.1	95.3	97.3	99.7	102	104	105	106	106	105	105	103	100	98.1	96.6	95.3			
145	83.2	84.5	86.7	89.3	91.9	93.8	95.2	96.5	96.6	95.9	95.4	93.4	90.5	87.8	86.1	84.5			
150	72.5	73.8	76.1	78.9	81.6	83.5	85.1	86.4	86.6	85.7	85.3	83.6	80.7	77.9	75.7	74.0			
155	62.7	64.0	66.3	69.1	71.6	73.3	75.0	76.2	76.6	75.7	75.1	73.8	71.3	68.3	66.1	64.1			
160	53.1	54.2	56.3	59.8	62.3	64.2	65.8	66.9	66.9	65.9	65.5	64.5	62.4	59.5	57.1	54.9			
165	42.6	42.2	43.3	50.1	52.0	54.9	56.7	57.8	58.1	57.1	56.6	56.0	53.2	50.8	47.4	44.3			
170	22.5	22.7	21.3	23.8	38.1	43.1	45.6	47.1	47.6	46.3	44.7	42.8	37.4	35.9	31.4	25.7			
175	1.74	3.94	5.29	8.97	16.2	21.5	24.5	25.5	23.0	16.1	8.49	3.04	0.31	0.10	0.14	0.45			
180	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13			

Table 6: Luminous Intensity Data

## EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Jul. 27, 2016	Jul. 26, 2017
Digital Power Meter	PF2010A	HZTE028-01	Jul. 27, 2016	Jul. 26, 2017
AC Power Supply	PCR 500L	HZTE001-08	Jul. 27, 2016	Jul. 26, 2017
DC Power Supply	WY12010	HZTE004-03	Jul. 27, 2016	Jul. 26, 2017
Temperature Meter	TES1310	HZTE017-01	Jul. 27, 2016	Jul. 26, 2017
Standard source	D908	HZTE012-01	Jul. 27, 2016	Jul. 26, 2017
Integrate Sphere system	2M	HZTE015-01	Jul. 27, 2016	Jul. 26, 2017
Digital Power Meter	WT210	HZTE008-01	Jul. 27, 2016	Jul. 26, 2017
AC Power Supply	PCR 500L	HZTE001-07	Jul. 27, 2016	Jul. 26, 2017
DC Power Supply	6154	HZTE004-04	Jul. 27, 2016	Jul. 26, 2017
Temperature and humidity recorder	JR900	HZTE018-01	Jul. 27, 2016	Jul. 26, 2017
Standard source	SCL-1400	HZTE012-02	Jul. 27, 2016	Jul. 26, 2017

Table 7: 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  $4\pi$ . 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 FA21 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 FA21 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**

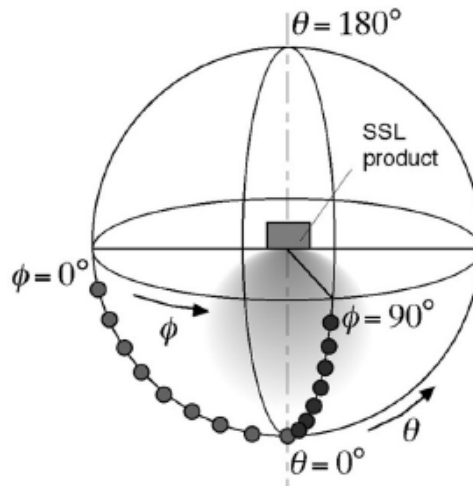
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as 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  $10^\circ$  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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