



LM-79-08 Test Report

for

GREEN CREATIVE LTD

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

A21

Model: 17A21G4DIM/830/R

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ18010012e

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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Jim Zhang

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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/830/R

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
119.4	1936.0	16.22	0.9190
CCT (K)	CRI	Stabilization Time (Light & Power)	
3046	82.7	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

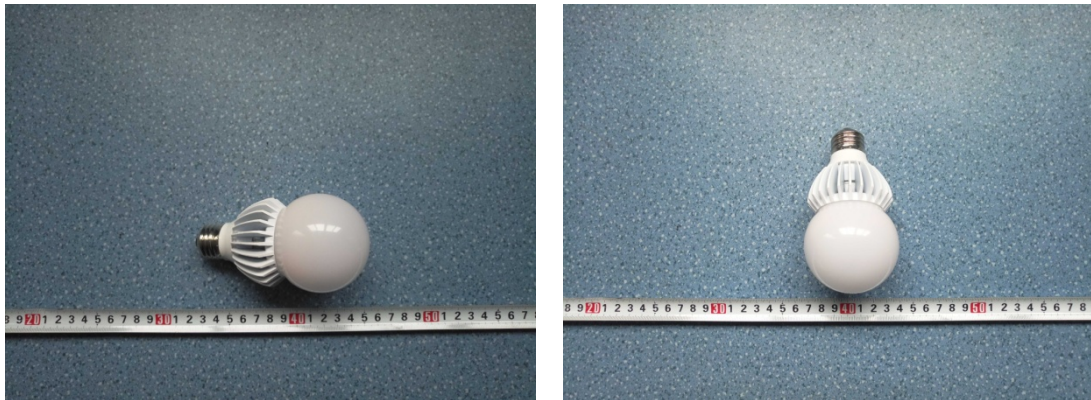


Figure 1- Overview of the sample

Equipment Under Test (EUT)

Name	: A21
Model	: 17A21G4DIM/830/R
Electrical Ratings	: 120V, 60Hz, 17W
Product Description	: 3000K
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 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)	0.147
Power Factor	0.9190
Test Power (W)	16.22
THD A%	38.20
Luminous Efficacy (lm/W)	119.4
Total Luminous Flux (lm)	1936.0
Color Rendering Index (CRI)	82.7
R9	9.1
Correlated Color Temperature (CCT)(K)	3046
Chromaticity Chroma x	0.4317
Chromaticity Chroma y	0.3989
Chromaticity Chroma u	0.2494
Chromaticity Chroma v	0.3457
Duv	0.0014
Chromaticity Chroma u'	0.2494
Chromaticity Chroma v'	0.5185

Special Color Rendering Indices	
R1	81.4
R2	92.5
R3	94.6
R4	79.5
R5	81.9
R6	90.7
R7	81.8
R8	58.9
R9	9.1
R10	82.8
R11	78.4
R12	74.1
R13	84.2
R14	97.7
Rf	83
Rg	95

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 24.2°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)	0.147
Power Factor	0.9151
Test Power (W)	16.17
Luminous Efficacy (lm/W)	119.6
Total Luminous Flux (lm)	1933.4
Beam Angle (°)	316.4
Center Beam Candle Power (cd)	139
Spacing Criteria	1.75(0°-180°)/ 1.76(90°-370°)
Zonal Lumens in the 0°-60°Zone	26.07%
Zonal Lumens in the 60°-90°Zone	29.16%
Zonal Lumens in the 90°-120°Zone	27.07%
Zonal Lumens in the 120°-180°Zone	17.69%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

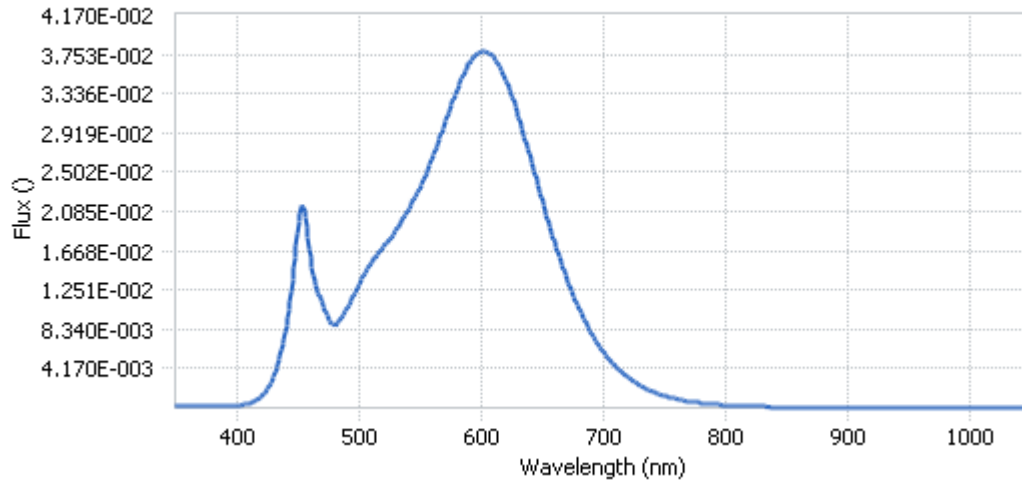
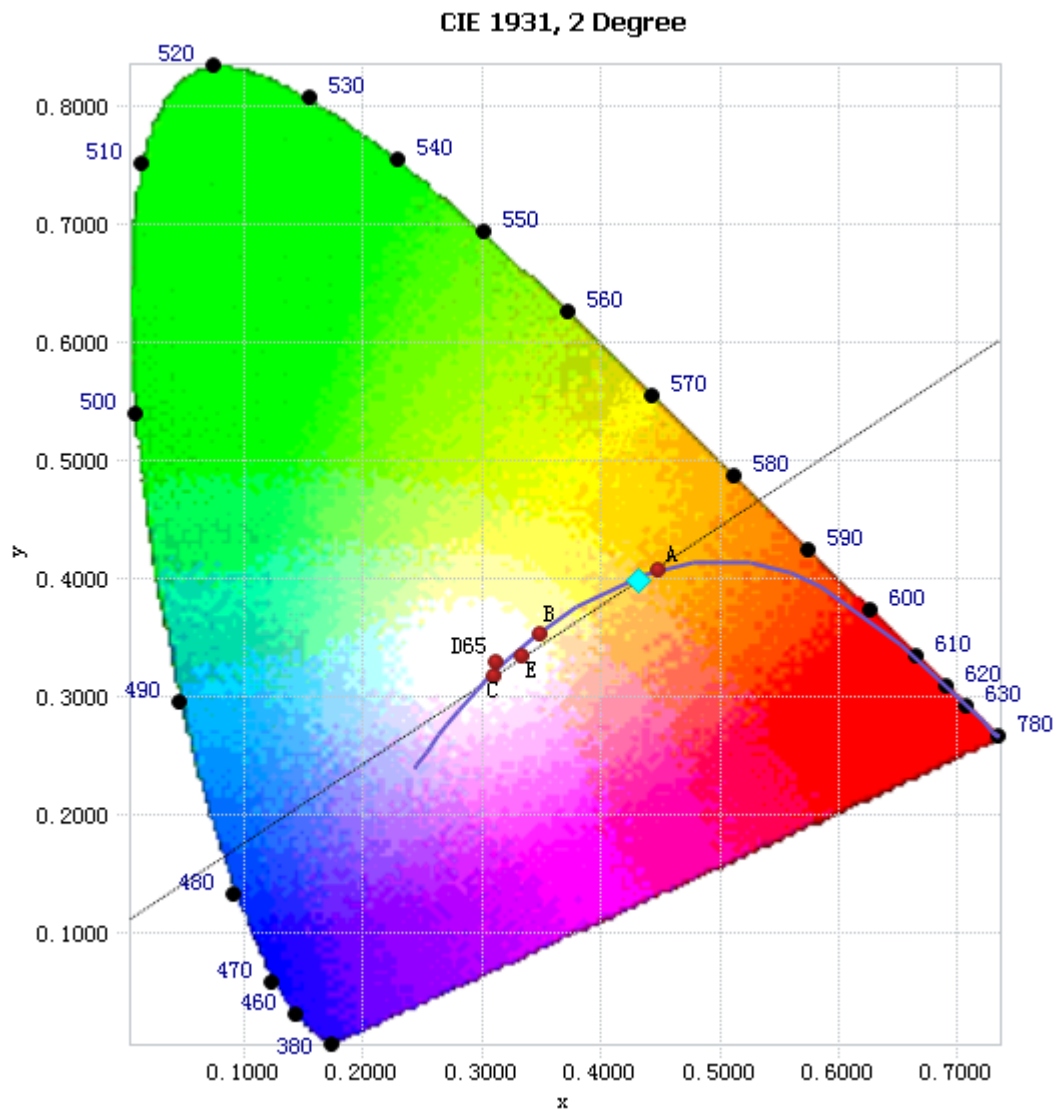


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.80E-04	485	9.34E-03	590	3.65E-02	695	7.02E-03
385	2.55E-04	490	1.04E-02	595	3.73E-02	700	6.06E-03
390	2.66E-04	495	1.16E-02	600	3.78E-02	705	5.21E-03
395	2.72E-04	500	1.30E-02	605	3.77E-02	710	4.48E-03
400	2.98E-04	505	1.43E-02	610	3.74E-02	715	3.87E-03
405	3.44E-04	510	1.53E-02	615	3.65E-02	720	3.33E-03
410	4.61E-04	515	1.62E-02	620	3.50E-02	725	2.85E-03
415	7.07E-04	520	1.69E-02	625	3.34E-02	730	2.45E-03
420	1.17E-03	525	1.78E-02	630	3.14E-02	735	2.09E-03
425	1.93E-03	530	1.87E-02	635	2.92E-02	740	1.79E-03
430	3.16E-03	535	1.96E-02	640	2.70E-02	745	1.53E-03
435	5.08E-03	540	2.08E-02	645	2.47E-02	750	1.32E-03
440	8.00E-03	545	2.21E-02	650	2.24E-02	755	1.14E-03
445	1.24E-02	550	2.32E-02	655	2.00E-02	760	9.76E-04
450	1.85E-02	555	2.48E-02	660	1.79E-02	765	8.35E-04
455	2.14E-02	560	2.64E-02	665	1.59E-02	770	7.23E-04
460	1.68E-02	565	2.81E-02	670	1.40E-02	775	6.18E-04
465	1.29E-02	570	2.99E-02	675	1.23E-02	780	5.38E-04
470	1.14E-02	575	3.17E-02	680	1.08E-02		
475	9.70E-03	580	3.35E-02	685	9.37E-03		
480	8.85E-03	585	3.52E-02	690	8.14E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4317, 0.3989)

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

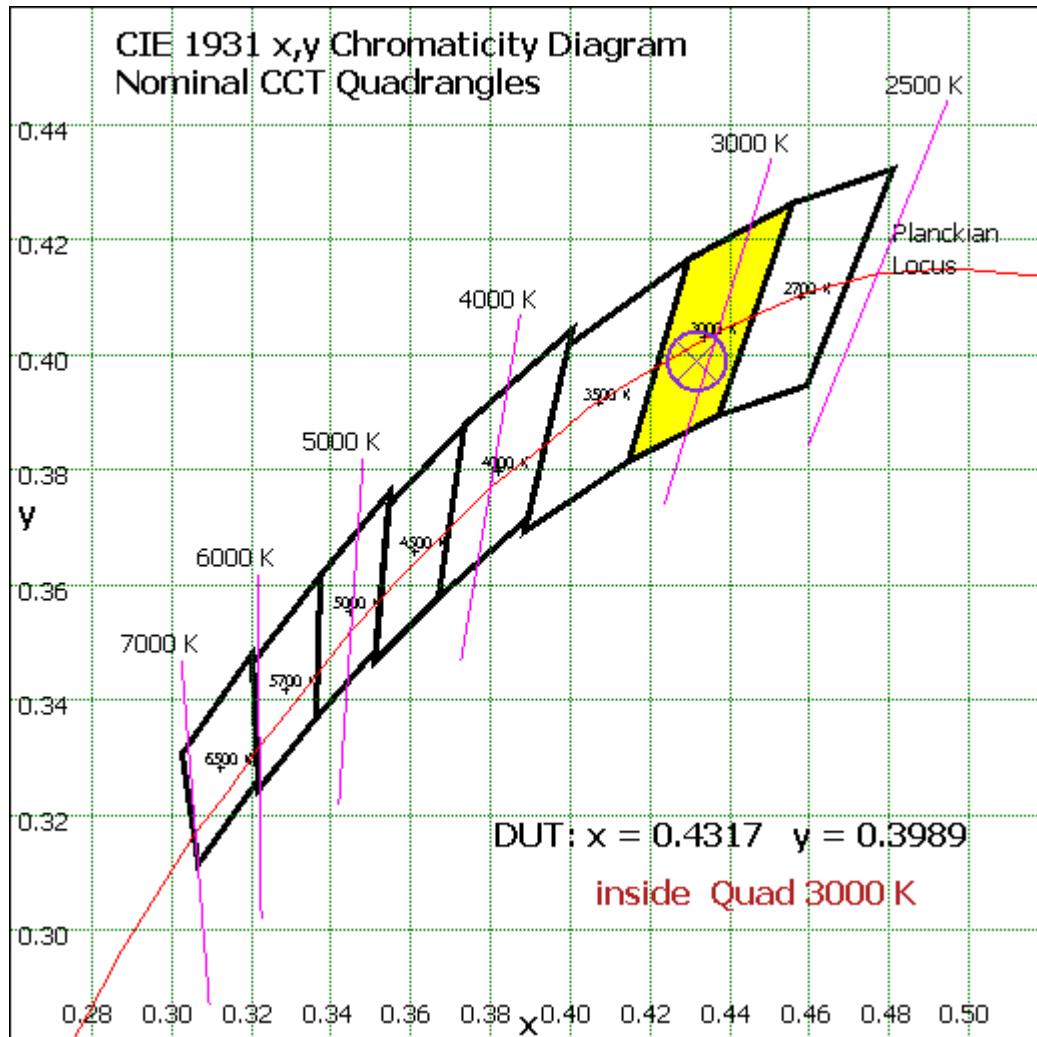


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	13.327	0.69%
10- 20	40.443	2.09%
20- 30	68.666	3.55%
30- 40	98.165	5.08%
40- 50	128.012	6.62%
50- 60	155.451	8.04%
60- 70	177.28	9.17%
70- 80	191.048	9.88%
80- 90	195.538	10.11%
90-100	190.562	9.86%
100-110	176.894	9.15%
110-120	155.926	8.06%
120-130	128.396	6.64%
130-140	96.368	4.98%
140-150	63.961	3.31%
150-160	36.064	1.87%
160-170	15.325	0.79%
170-180	1.975	0.10%
Total	1933.4	100%

$\gamma(^{\circ})$	Lumens	% Total
0-130	1719.708	88.95%
130-180	213.693	11.05%
0-180	1933.4	100%

Table 5: Zonal Lumen Data

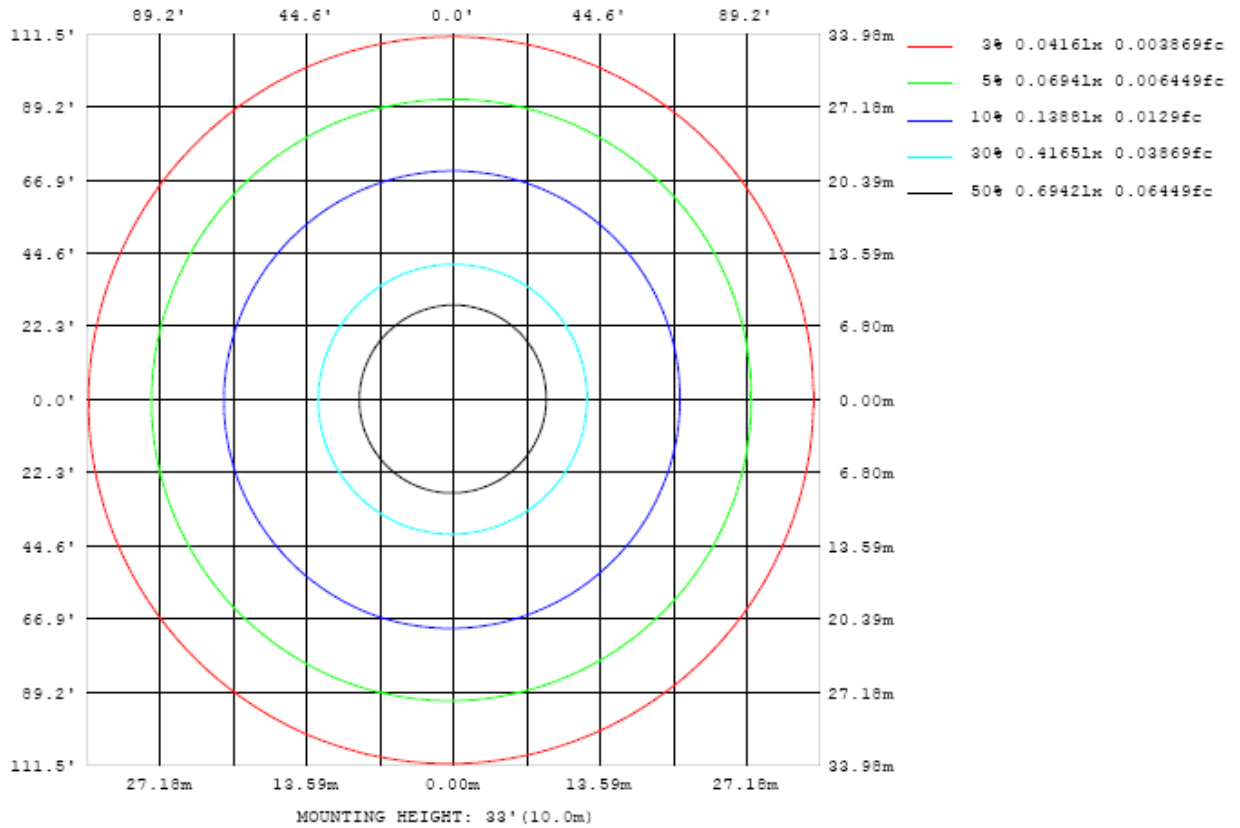


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

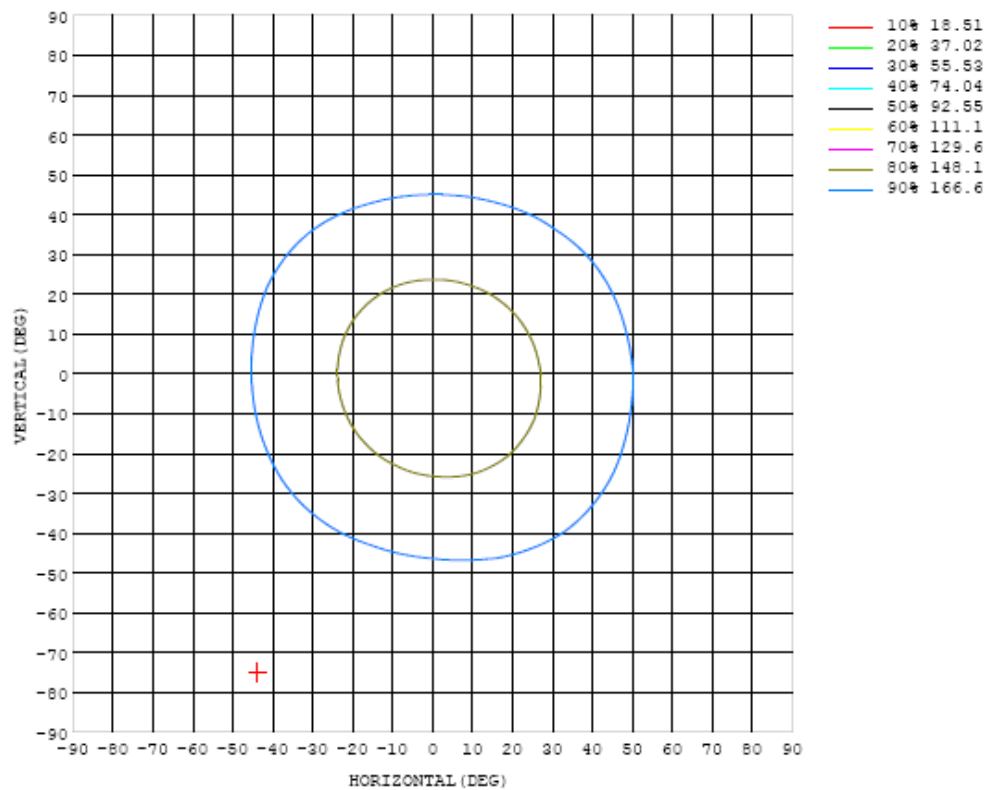


Chart 5: Isocandela Plot

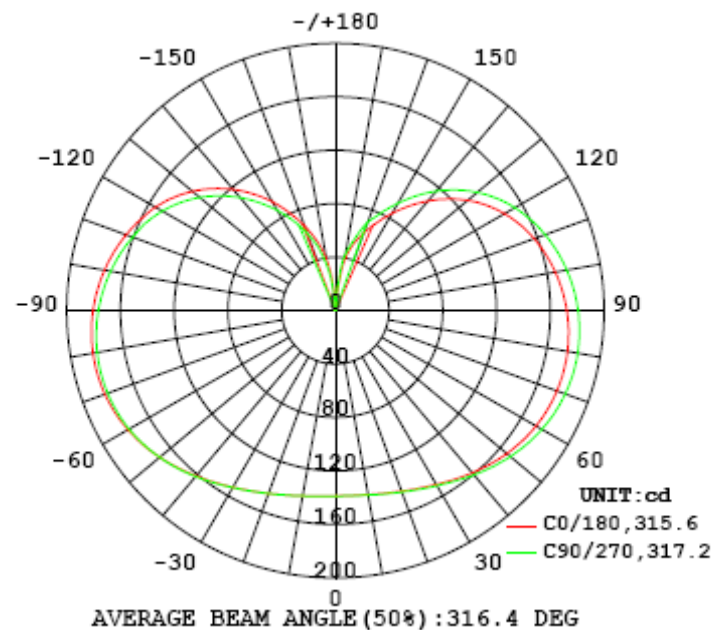


Chart 6: Polar Candela Distribution

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	139	139	139	139	139	139	139	139	139	139	139	139	139	139	139	139			
5	139	139	139	139	139	139	139	139	139	139	139	139	139	139	139	139			
10	140	140	140	140	140	140	141	141	141	141	141	141	141	141	140	140			
15	142	141	141	141	142	142	143	143	143	143	143	143	143	143	142	142			
20	144	144	144	144	144	145	145	146	146	146	146	146	146	145	145	144			
25	147	146	146	147	148	148	149	149	149	149	149	149	149	149	148	148			
30	150	150	150	150	151	152	153	153	153	153	153	153	153	153	152	151			
35	154	154	154	155	156	157	157	157	157	157	157	157	157	157	156	155			
40	158	158	158	159	160	161	162	162	162	161	161	162	162	162	161	160			
45	163	162	163	164	165	166	167	167	166	166	166	167	167	166	166	164			
50	166	166	167	168	170	171	171	171	171	170	170	171	171	171	170	168			
55	170	170	170	172	174	176	176	175	175	174	174	175	174	174	173	171			
60	172	173	173	175	177	179	179	179	178	177	177	178	177	177	176	174			
65	174	175	176	177	180	182	182	182	181	180	179	180	179	179	178	176			
70	175	176	177	179	182	184	184	183	183	181	181	181	180	180	179	177			
75	176	176	178	180	183	185	185	184	183	182	181	181	181	180	179	177			
80	175	176	178	180	183	185	185	184	183	182	181	181	180	179	178	177			
85	174	175	177	179	182	184	184	184	182	181	180	179	179	178	177	175			
90	172	173	175	178	181	182	183	182	180	179	178	177	177	176	174	173			
95	170	170	172	176	178	180	180	179	178	177	175	174	174	173	171	170			
100	166	167	169	173	175	177	177	176	175	173	172	170	170	169	167	166			
105	162	162	165	169	171	173	173	172	171	169	167	166	166	165	163	162			
110	157	158	160	164	166	168	169	168	166	165	163	161	161	160	158	157			
115	152	152	155	159	161	162	163	162	161	159	158	156	156	155	153	152			
120	145	146	148	152	154	156	157	156	155	154	152	149	149	148	146	146			
125	138	138	141	145	147	148	150	149	148	146	144	142	141	140	138	138			
130	128	129	132	136	138	140	141	140	139	138	135	133	132	131	129	129			
135	118	119	122	126	128	130	131	130	129	128	125	123	122	120	119	118			
140	107	109	112	115	117	118	119	119	118	117	114	112	110	109	108	107			
145	95.5	97.4	100	103	105	106	107	107	107	105	102	99.6	98.7	97.2	95.8	95.4			
150	83.9	85.9	88.6	91.0	92.7	94.2	93.8	93.7	94.1	93.2	90.2	86.5	86.6	85.4	83.9	83.5			
155	72.5	74.7	77.4	79.5	80.9	82.3	80.4	79.9	80.6	80.5	78.4	73.3	74.2	73.9	72.7	71.8			
160	61.9	64.6	66.7	69.0	70.3	71.0	67.7	67.3	67.4	67.5	66.2	61.7	61.5	62.2	61.5	60.6			
165	51.5	53.7	53.3	57.7	55.7	60.1	56.2	54.7	54.2	54.1	53.3	49.9	48.7	49.8	49.8	49.2			
170	37.6	39.9	38.0	29.4	42.8	48.4	44.9	41.5	38.9	39.3	38.2	34.7	31.5	33.7	32.6	33.0			
175	5.87	7.18	8.93	8.55	12.9	19.2	19.6	17.2	10.1	10.5	6.27	4.37	2.45	1.00	0.65	0.75			
180	0.13	0.13	0.12	0.12	0.14	0.14	0.14	0.14	0.13	0.13	0.14	0.14	0.14	0.14	0.14	0.14			

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 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 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

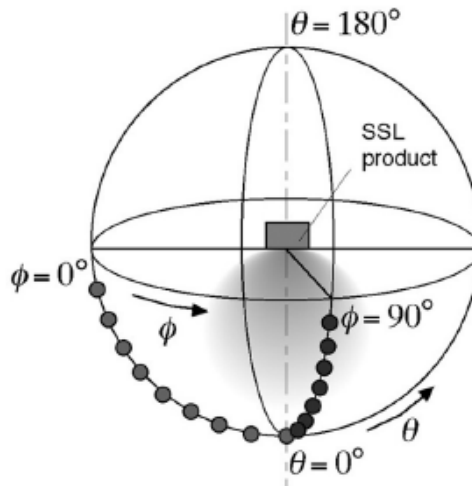
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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