

LM-79-08 TEST REPORT

for

GREEN CREATIVE LTD

Room 3603, Level 36, Tower 1, Enterprise Square Five, 38 Wang Chiu Road, Kowloon Bay, KL,
Hong Kong

LED Lamp

Model: 16A21/835/277V

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ20050007b

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

Review by:



Engineer: April Zou
May 19, 2020

Approved by:



Manager: Jim Zhang
May 19, 2020

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: 16A21/835/277V

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
150.1	2361.4	15.73	0.9899
CCT (K)	CRI	Stabilization Time (Light & Power)	
3472	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	: May 08, 2020
Date of Test	: May 12, 2020
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	: 16A21/835/277V
Electrical Ratings	: 120-277Vac, 50/60Hz, 16W
Product Description	: 3500K
Manufacturer	: GREEN CREATIVE LTD
Address	: Room 3603, Level 36, Tower 1, Enterprise Square Five, 38 Wang Chiu Road, Kowloon Bay, KL, Hong Kong

TEST RESULTS

Test ambient temperature was 24.9 °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	277.0
Voltage frequency (Hz)	60	60
Test Current (A)	0.132	0.062
Power Factor	0.9899	0.9038
Test Power (W)	15.73	15.52
THD A%	9.33	16.01
Luminous Efficacy (lm/W)	150.1	145.3
Total Luminous Flux (lm)	2361.4	2254.3
Color Rendering Index (CRI)	81.9	
R9	4.1	
Correlated Color Temperature (CCT)(K)	3472	
Chromaticity Chroma x	0.4059	
Chromaticity Chroma y	0.3893	
Chromaticity Chroma u	0.2367	
Chromaticity Chroma v	0.3405	
Duv	-0.0008	
Chromaticity Chroma u'	0.2367	
Chromaticity Chroma v'	0.5107	

Special Color Rendering Indices	
R1	80.1
R2	88.9
R3	95.5
R4	80.6
R5	80.3
R6	85.2
R7	84
R8	60.6
R9	4.1
R10	74.2
R11	79.6
R12	65
R13	82.1
R14	97.7

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 2.47 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)	0.132
Power Factor	0.9905
Power (W)	15.74
Luminous Efficacy (lm/W)	149.9
Total Luminous Flux (lm)	2359.8
Beam Angle (°)	303.7 (0°-180°) / 303.3 (90°-270°)
Center Beam Candle Power (cd)	180
Maximum Beam Candle Power (cd)	240.5 (At: C=45.0, Gamma=70.0)
Spacing Criteria	1.70 (0°-180°) / 1.71 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	27.63%
Zonal Lumens in the 60 °-90 °Zone	29.83%
Zonal Lumens in the 90 °-120 °Zone	26.53%
Zonal Lumens in the 120 °-180 °Zone	16.01%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

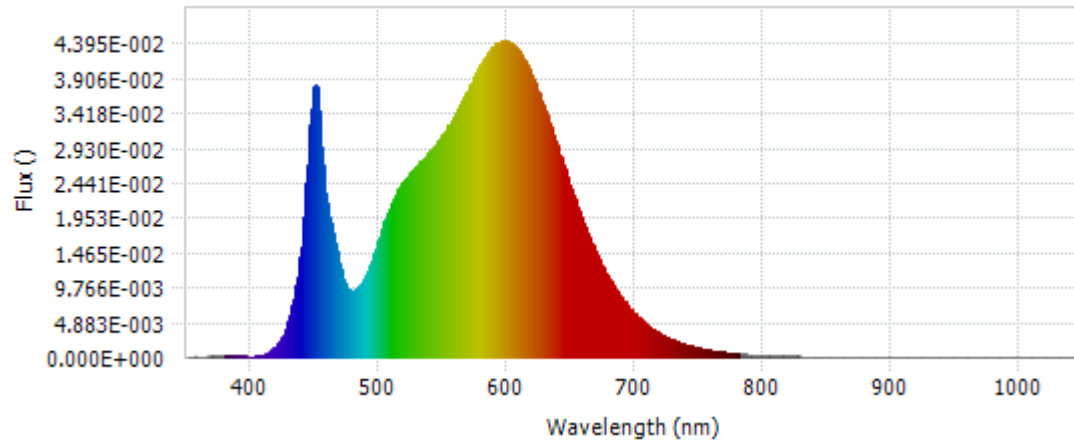
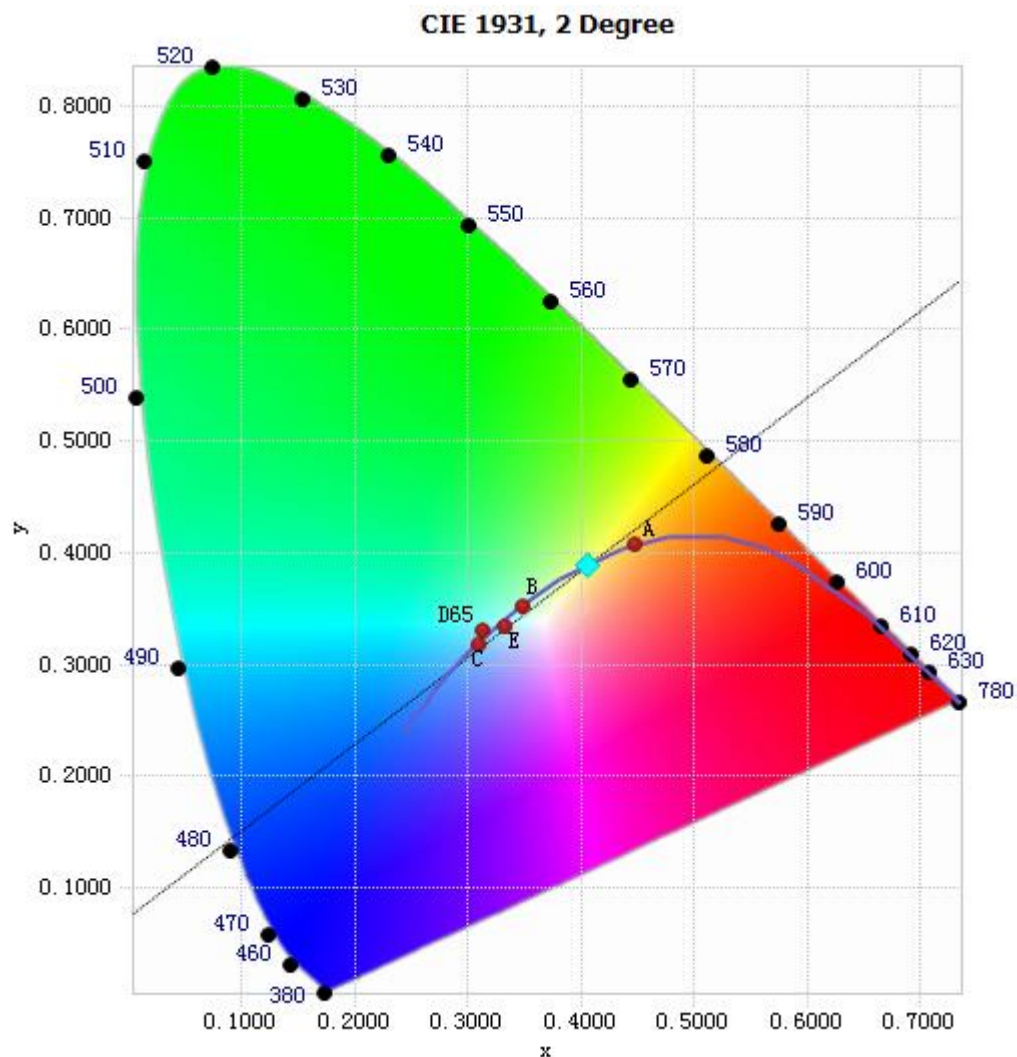


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.46E-04	485	1.00E-02	590	4.36E-02	695	7.04E-03
385	1.40E-04	490	1.16E-02	595	4.42E-02	700	6.05E-03
390	1.40E-04	495	1.41E-02	600	4.41E-02	705	5.18E-03
395	1.17E-04	500	1.69E-02	605	4.37E-02	710	4.43E-03
400	1.12E-04	505	1.94E-02	610	4.27E-02	715	3.80E-03
405	1.59E-04	510	2.16E-02	615	4.12E-02	720	3.28E-03
410	3.79E-04	515	2.35E-02	620	3.91E-02	725	2.80E-03
415	8.47E-04	520	2.49E-02	625	3.69E-02	730	2.39E-03
420	1.69E-03	525	2.60E-02	630	3.44E-02	735	2.04E-03
425	3.20E-03	530	2.70E-02	635	3.17E-02	740	1.73E-03
430	5.82E-03	535	2.79E-02	640	2.90E-02	745	1.50E-03
435	1.01E-02	540	2.90E-02	645	2.63E-02	750	1.27E-03
440	1.74E-02	545	3.00E-02	650	2.36E-02	755	1.09E-03
445	2.98E-02	550	3.13E-02	655	2.10E-02	760	9.33E-04
450	3.81E-02	555	3.26E-02	660	1.87E-02	765	8.02E-04
455	2.94E-02	560	3.41E-02	665	1.64E-02	770	6.89E-04
460	2.05E-02	565	3.59E-02	670	1.44E-02	775	5.89E-04
465	1.66E-02	570	3.78E-02	675	1.26E-02	780	5.08E-04
470	1.23E-02	575	3.96E-02	680	1.09E-02		
475	9.58E-03	580	4.12E-02	685	9.48E-03		
480	9.31E-03	585	4.27E-02	690	8.18E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4059, 0.3893)

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

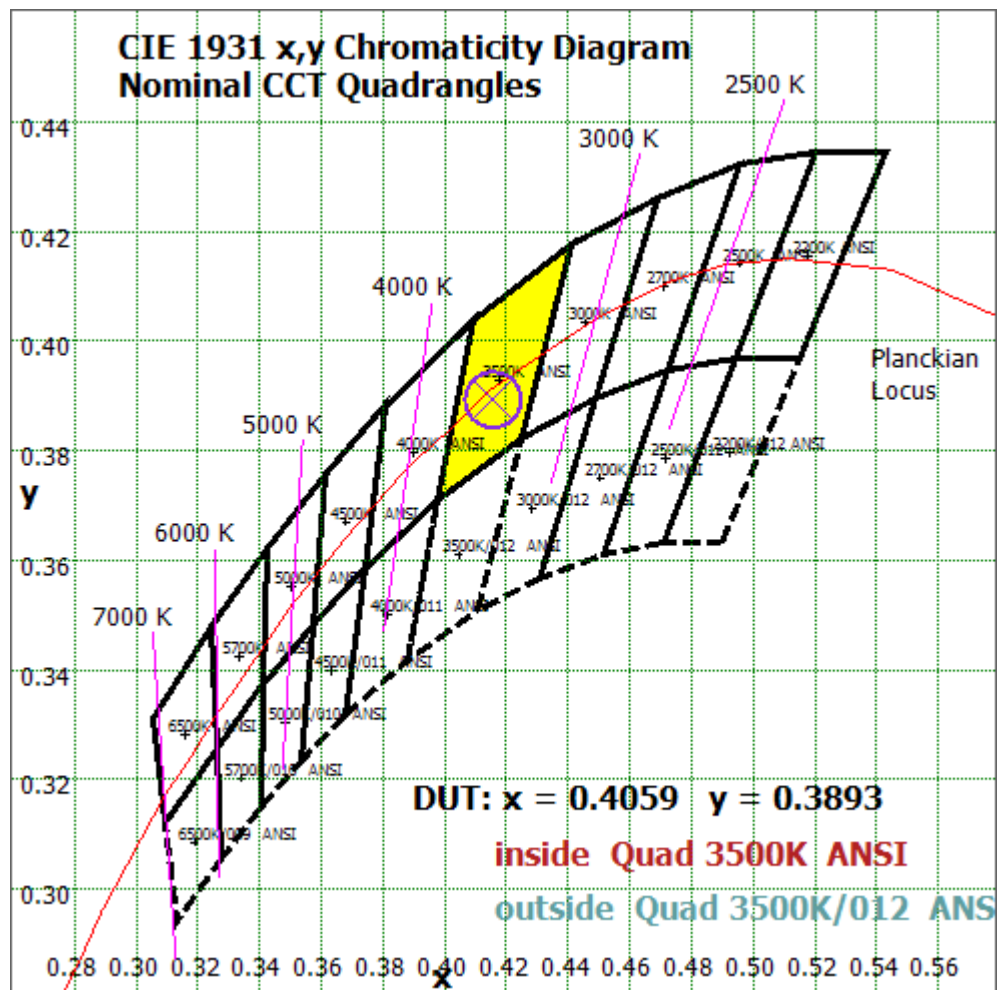
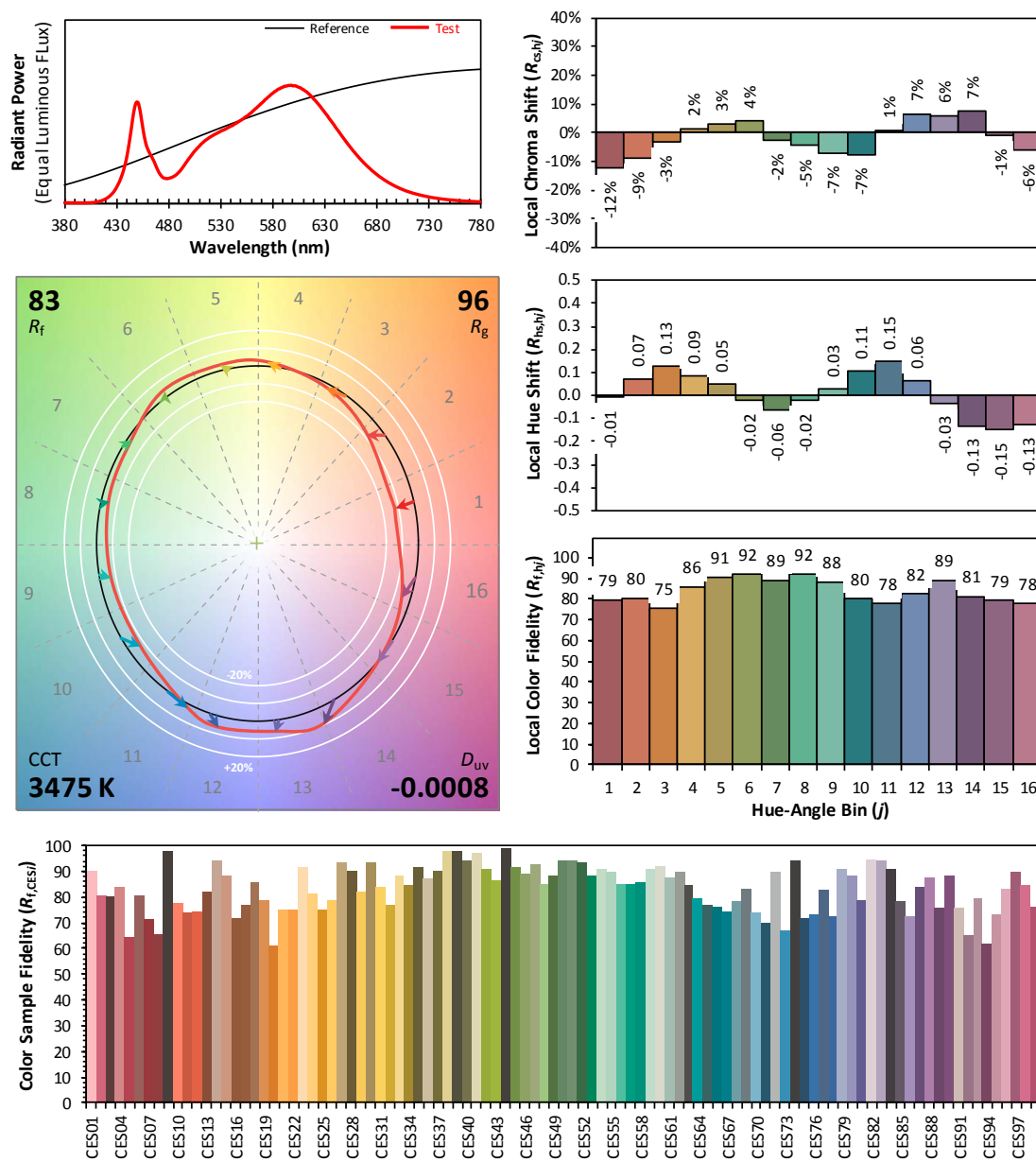


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method



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

x	0.4059
y	0.3893
u'	0.2367
v'	0.5107

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	17.305	0.73%
10- 20	52.668	2.23%
20- 30	89.679	3.80%
30- 40	127.98	5.42%
40- 50	165.563	7.02%
50- 60	198.921	8.43%
60- 70	224.23	9.50%
70- 80	238.688	10.11%
80- 90	241.075	10.22%
90-100	231.588	9.81%
100-110	211.52	8.96%
110-120	182.826	7.75%
120-130	147.448	6.25%
130-140	108.277	4.59%
140-150	69.759	2.96%
150-160	37.048	1.57%
160-170	14.077	0.60%
170-180	1.114	0.05%
Total	2359.8	100%

$\gamma(^{\circ})$	Lumens	% Total
0-130	2129.491	90.24%
130-180	230.275	9.76%
0-180	2359.8	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

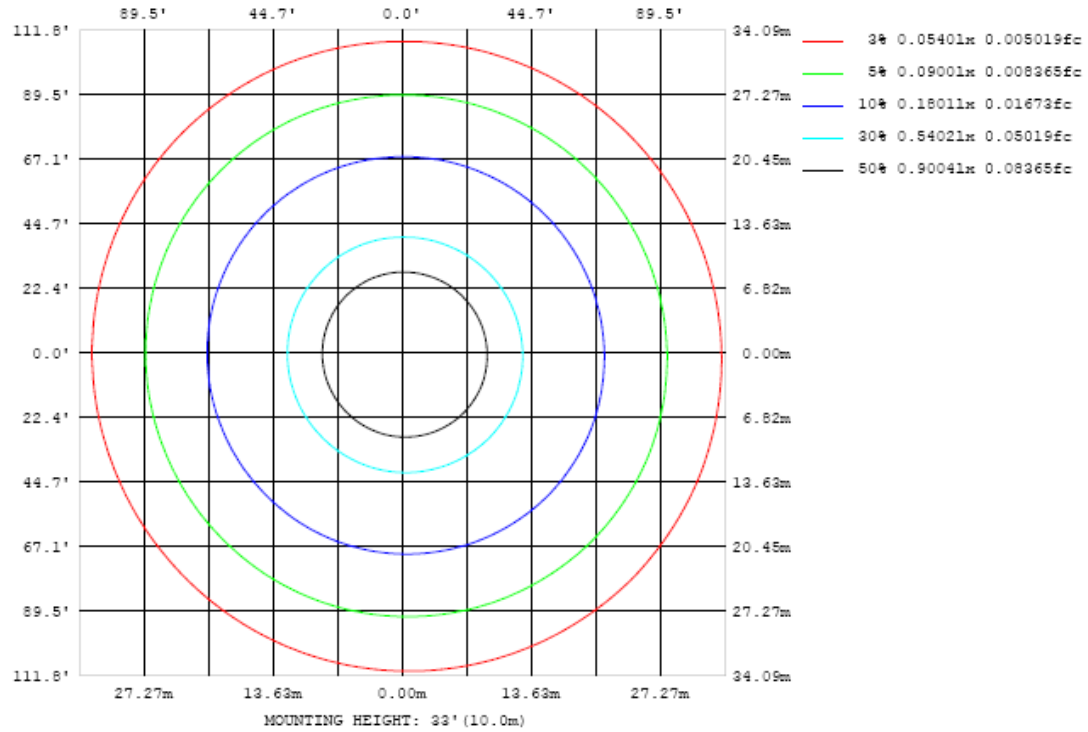


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

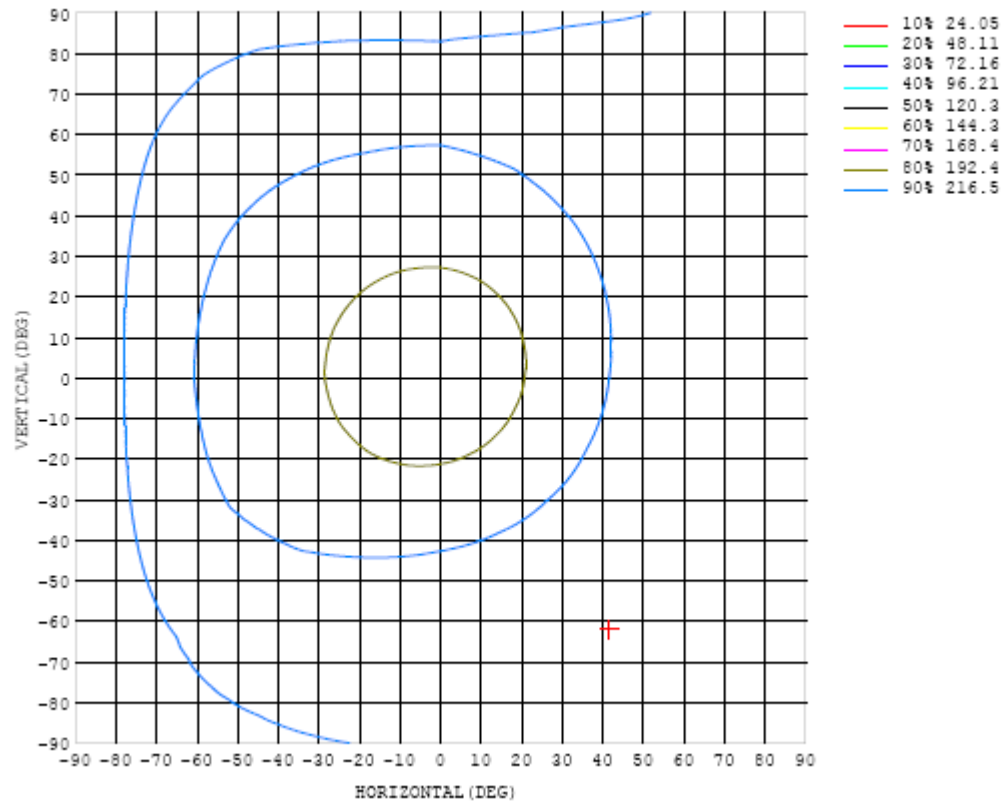


Chart 6: Isocandela Plot

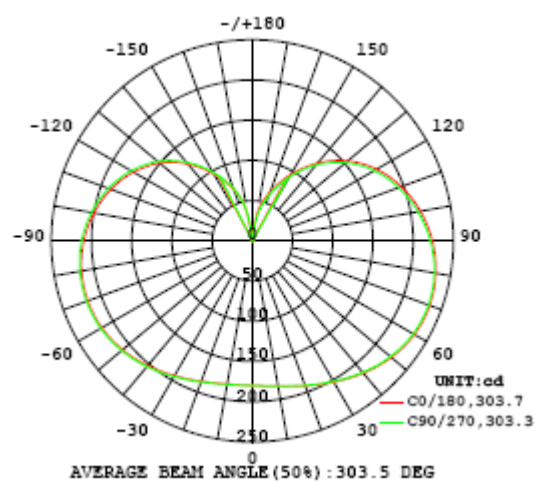


Chart 7: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table---1 UNIT: cd

C (DEG) Y (DEG)	0	22.5	45	67.5	90	112.5	135	157.5	180	202.5	225	247.5	270	292.5	315	337.5			
0	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180			
5	181	182	182	182	181	181	181	180	180	180	180	180	180	180	180	181	181		
10	184	184	184	184	184	183	182	182	181	181	181	181	181	182	183	183			
15	187	188	188	188	187	186	185	184	183	183	183	183	184	184	185	186			
20	192	193	193	192	191	190	188	187	186	186	186	186	187	188	189	190			
25	197	198	198	198	196	194	192	191	190	189	189	190	191	192	193	195			
30	203	204	205	204	202	199	197	195	194	193	194	194	195	196	198	200			
35	209	211	211	210	208	205	202	199	198	198	198	199	199	201	203	206			
40	215	217	218	216	213	210	206	204	203	202	203	204	204	206	208	211			
45	220	223	224	222	219	215	211	208	207	207	207	208	208	210	213	217			
50	225	229	230	227	224	219	215	212	211	211	211	212	212	214	217	221			
55	230	233	234	232	228	223	218	215	214	214	215	215	215	217	221	225			
60	233	237	238	235	231	226	220	217	216	216	217	218	218	220	223	228			
65	234	239	240	237	233	227	222	218	218	218	219	219	219	221	225	229			
70	235	240	241	237	233	228	222	219	218	218	219	220	219	221	225	230			
75	234	239	240	236	232	227	221	218	217	218	219	219	219	221	224	229			
80	231	237	238	234	230	224	219	216	216	217	218	218	218	219	223	226			
85	228	233	234	231	226	221	217	214	213	215	216	216	215	217	219	223			
90	224	229	230	226	221	216	213	210	210	211	213	213	212	213	215	219			
95	218	223	224	221	216	211	208	206	205	207	209	208	208	209	211	214			
100	212	217	218	214	209	205	202	200	200	202	204	203	203	204	205	207			
105	205	209	210	207	202	198	196	194	194	196	198	197	197	198	198	200			
110	197	201	202	199	194	190	189	187	187	190	191	191	191	191	190	193			
115	188	192	192	190	185	182	181	180	180	182	183	183	183	183	182	184			
120	178	181	182	179	175	172	171	171	171	173	175	174	174	174	173	175			
125	167	169	170	168	164	161	161	161	161	163	164	164	164	164	163	164			
130	155	156	156	155	151	149	149	149	151	153	154	154	154	153	152	153			
135	141	142	142	141	138	136	136	137	138	140	141	141	141	141	139	140			
140	126	126	126	125	123	121	122	123	125	127	128	128	128	127	126	126			
145	111	110	110	109	107	106	107	109	111	113	113	113	113	113	111	111			
150	94.8	93.8	93.0	92.2	91.0	91.1	92.8	94.1	96.2	98.0	98.4	98.2	98.7	98.1	96.4	95.9			
155	79.2	77.4	76.1	75.5	75.1	76.1	78.1	79.7	82.0	82.5	73.9	76.9	84.2	83.7	82.1	81.0			
160	64.7	62.4	60.5	59.8	60.2	61.9	64.1	66.3	68.5	65.4	55.0	48.1	69.5	70.0	68.5	67.0			
165	50.9	48.0	45.5	44.9	45.3	47.7	50.3	53.1	53.6	49.4	36.2	33.0	53.8	57.1	56.0	54.3			
170	34.9	30.9	27.8	26.3	25.9	29.0	32.2	32.4	24.9	15.7	8.99	21.3	30.4	37.5	39.0	38.0			
175	3.73	3.72	4.11	4.05	3.74	3.32	2.09	0.77	0.29	0.30	0.31	0.30	0.62	1.25	1.77	2.41			
180	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25			

Table 6: Luminous Intensity Data

EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Aug. 02, 2019	Aug. 01, 2020
Digital Power Meter	PF2010A	HZTE028-01	Aug. 02, 2019	Aug. 01, 2020
AC Power Supply	DPS1060	HZTE001-06	Aug. 02, 2019	Aug. 01, 2020
DC Power Supply	WY12010	HZTE004-03	Aug. 02, 2019	Aug. 01, 2020
Temperature recorder	JM624U	HZTE018-08	Aug. 02, 2019	Aug. 01, 2020
Temperature and humidity recorder	JR900	HZTE018-01	Aug. 02, 2019	Aug. 01, 2020
Standard source	D908	HZTE012-01	Aug. 02, 2019	Aug. 01, 2020
Integrate Sphere system	3M	HZTE015-04	Aug. 02, 2019	Aug. 01, 2020
Digital Power Meter	WT210	HZTE008-01	Aug. 02, 2019	Aug. 01, 2020
AC Power Supply	PCR 500L	HZTE001-07	Aug. 02, 2019	Aug. 01, 2020
DC Power Supply	IT6154	HZTE004-04	Aug. 02, 2019	Aug. 01, 2020
Standard source	SCL-1400	HZTE012-02	Aug. 02, 2019	Aug. 01, 2020
Temperature and humidity recorder	JR900	HZTE018-02	Aug. 02, 2019	Aug. 01, 2020
Temperature Meter	TES1310	HZTE017-01	Aug. 02, 2019	Aug. 01, 2020

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 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

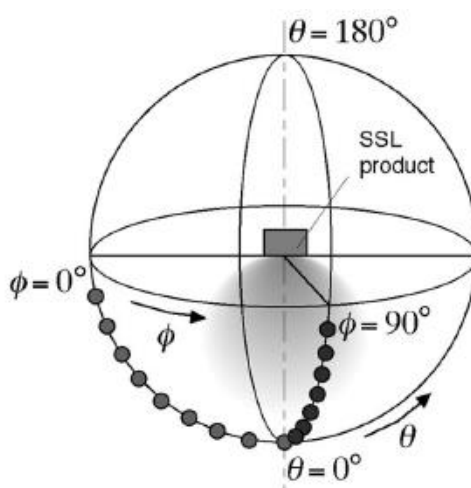
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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