



IES LM-80-08 Test Report

For

MLS CO., LTD

No. 1 MULINSEN Avenue XIAOLAN TOWNSHIP ZHONGSHAN GUANGDONG

LED Chip

Model: BXVN-XXE-11L-3AV

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

3rd Floor, Bld. 2, NO. 96 Longchuanwu Rd Qianjiang Economy Dev. Zone, Yuhang Dist,
Hangzhou, Zhejiang Province, China 311100

Tel: +86571 86376106

www.ledtestlab.com

Report No.: HZ20050023a

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

Test specifications:

Date of Receipt : Aug. 06, 2014

Date of Test : Aug. 13, 2014 to Apr. 23, 2015, Mar. 22, 2015 to Dec. 23, 2015

Test item : 6000 hours Lumen Maintenance, 6000 hours Chromaticity Shift

Reference Standard : IES LM-80-2008 Approved Method for Measuring Lumen Maintenance of
LED Light Source

Review by:

April Zou

Engineer: April Zou
May 22, 2020



Jim Zhang

Manager: Jim Zhang
May 22, 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: 16A21/830/277V

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
144.7	2313.5	15.99	0.9897
CCT (K)	CRI	Stabilization Time (Light & Power)	
3073	82.4	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 11, 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	: 16A21/830/277V
Electrical Ratings	: 120-277Vac, 50/60Hz, 16W
Product Description	: 3000K
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 26.0 °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	277.0
Voltage frequency (Hz)	60	60
Test Current (A)	0.135	0.063
Power Factor	0.9897	0.9023
Test Power (W)	15.99	15.86
THD A%	9.29	15.81
Luminous Efficacy (lm/W)	144.7	139.4
Total Luminous Flux (lm)	2313.5	2210.3
Color Rendering Index (CRI)	82.4	
R9	5.4	
Correlated Color Temperature (CCT)(K)	3073	
Chromaticity Chroma x	0.4286	
Chromaticity Chroma y	0.3957	
Chromaticity Chroma u	0.2488	
Chromaticity Chroma v	0.3445	
Duv	-0.0022	
Chromaticity Chroma u'	0.2488	
Chromaticity Chroma v'	0.5168	

Special Color Rendering Indices	
R1	81.2
R2	91.7
R3	95.2
R4	80.2
R5	81.7
R6	89.8
R7	81.5
R8	58
R9	5.4
R10	81.1
R11	79.9
R12	72.7
R13	83.9
R14	98.1

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)	0.135
Power Factor	0.9904
Power (W)	16.00
Luminous Efficacy (lm/W)	144.9
Total Luminous Flux (lm)	2317.6
Beam Angle (°)	304.6 (0°-180°) / 304.3 (90°-270°)
Center Beam Candle Power (cd)	173
Maximum Beam Candle Power (cd)	231.1 (At: C=67.5, Gamma=71.0)
Spacing Criteria	1.75 (0°-180°) / 1.74 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	27.44%
Zonal Lumens in the 60 °-90 °Zone	30.00%
Zonal Lumens in the 90 °-120 °Zone	26.60%
Zonal Lumens in the 120 °-180 °Zone	15.96%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

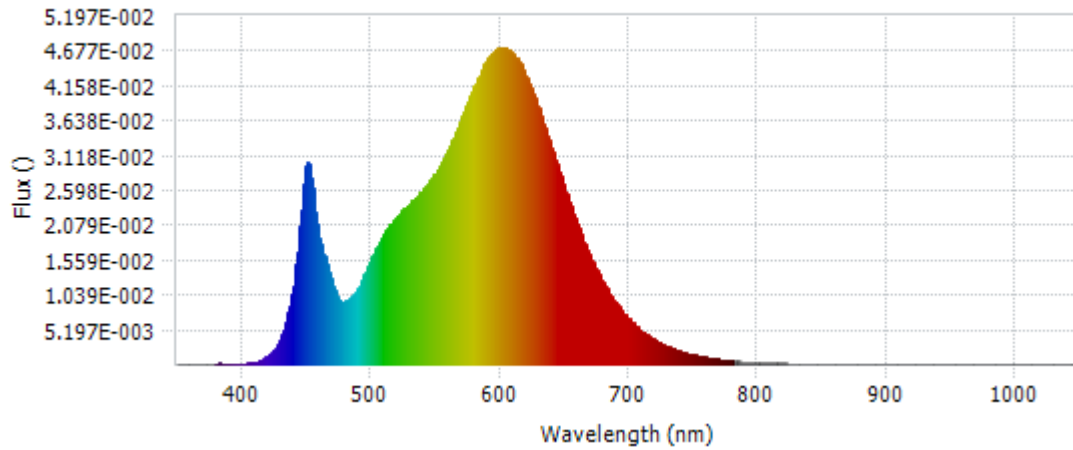
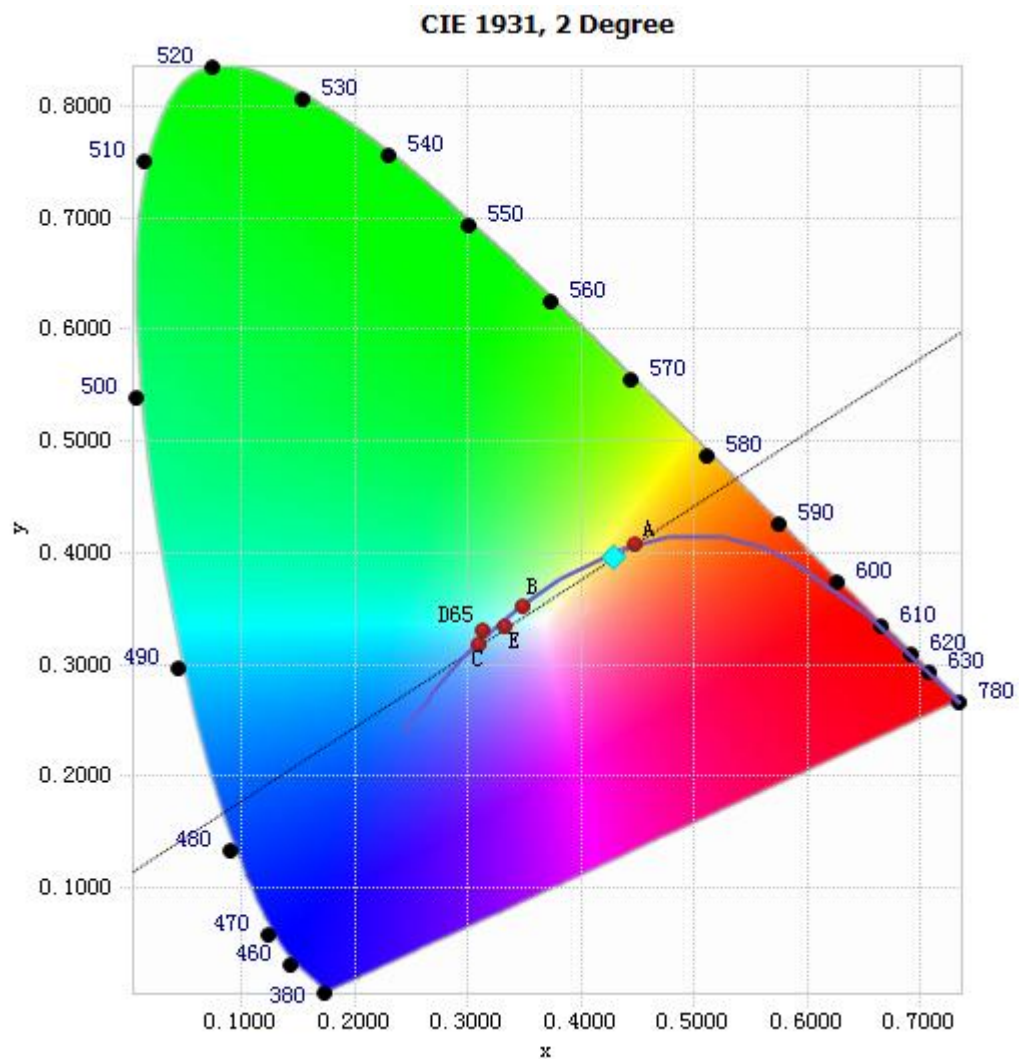


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.38E-04	485	1.01E-02	590	4.53E-02	695	7.85E-03
385	1.20E-04	490	1.14E-02	595	4.66E-02	700	6.74E-03
390	1.23E-04	495	1.34E-02	600	4.71E-02	705	5.78E-03
395	1.32E-04	500	1.56E-02	605	4.71E-02	710	4.93E-03
400	1.20E-04	505	1.76E-02	610	4.64E-02	715	4.23E-03
405	1.68E-04	510	1.93E-02	615	4.50E-02	720	3.64E-03
410	3.19E-04	515	2.09E-02	620	4.31E-02	725	3.10E-03
415	6.38E-04	520	2.20E-02	625	4.07E-02	730	2.65E-03
420	1.22E-03	525	2.30E-02	630	3.81E-02	735	2.25E-03
425	2.21E-03	530	2.39E-02	635	3.52E-02	740	1.91E-03
430	3.95E-03	535	2.49E-02	640	3.23E-02	745	1.65E-03
435	6.88E-03	540	2.60E-02	645	2.93E-02	750	1.39E-03
440	1.18E-02	545	2.71E-02	650	2.64E-02	755	1.19E-03
445	2.07E-02	550	2.85E-02	655	2.35E-02	760	1.02E-03
450	2.96E-02	555	3.01E-02	660	2.09E-02	765	8.73E-04
455	2.62E-02	560	3.20E-02	665	1.84E-02	770	7.52E-04
460	1.87E-02	565	3.41E-02	670	1.61E-02	775	6.49E-04
465	1.55E-02	570	3.66E-02	675	1.41E-02	780	5.47E-04
470	1.22E-02	575	3.90E-02	680	1.22E-02		
475	9.67E-03	580	4.14E-02	685	1.06E-02		
480	9.31E-03	585	4.37E-02	690	9.13E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4286, 0.3957)

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

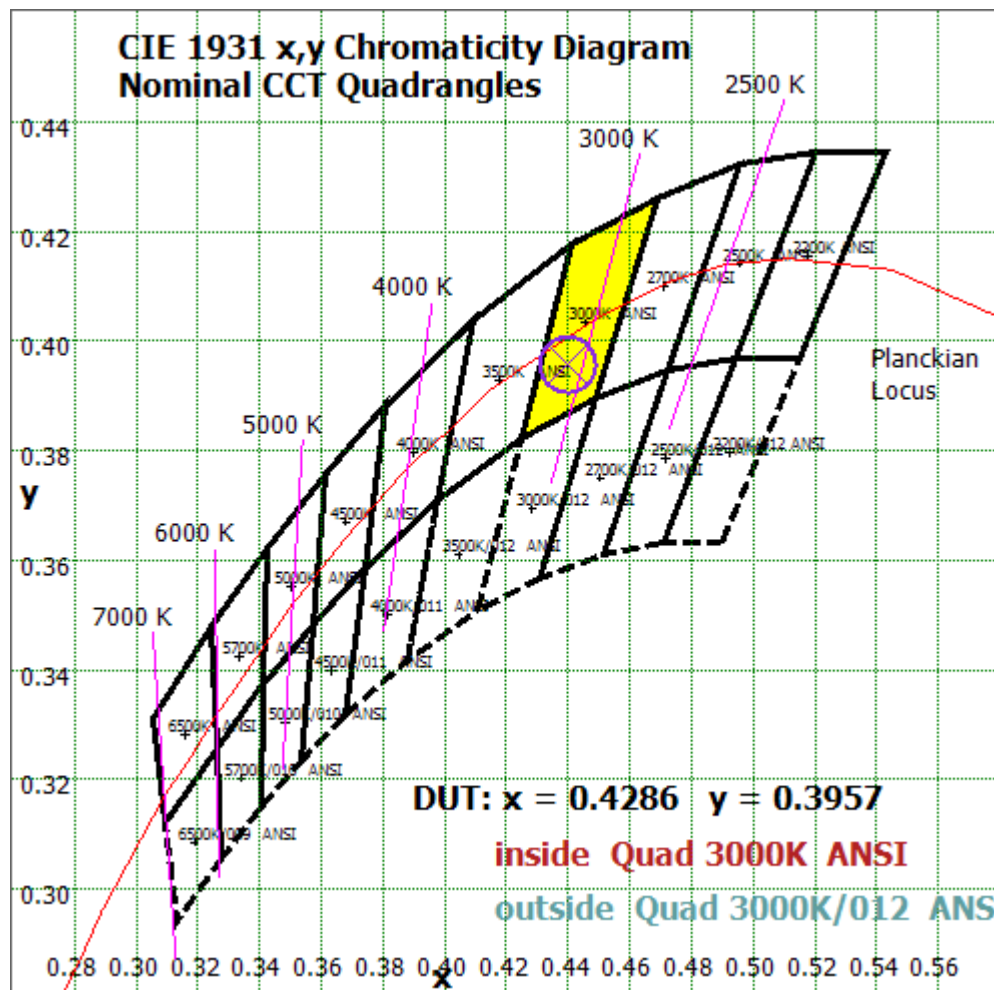
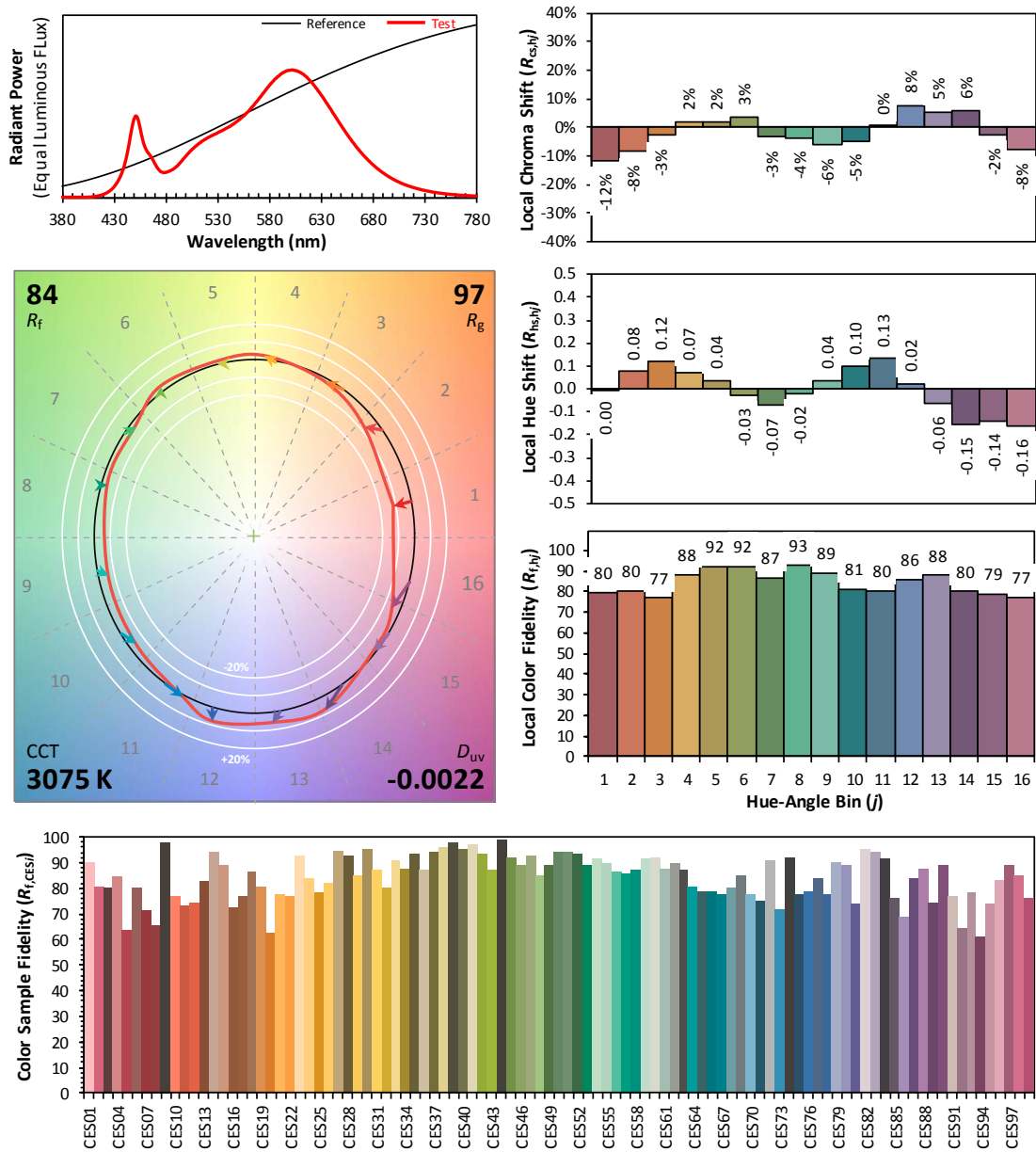


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method



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

x 0.4286
 y 0.3957
 u' 0.2488
 v' 0.5168

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	16.632	0.72%
10- 20	50.74	2.19%
20- 30	86.765	3.74%
30- 40	124.482	5.37%
40- 50	161.918	6.99%
50- 60	195.446	8.43%
60- 70	221.104	9.54%
70- 80	235.864	10.18%
80- 90	238.318	10.28%
90-100	228.646	9.87%
100-110	208.306	8.99%
110-120	179.503	7.75%
120-130	144.485	6.23%
130-140	105.903	4.57%
140-150	68.303	2.95%
150-160	36.359	1.57%
160-170	13.71	0.59%
170-180	1.14	0.05%
Total	2317.6	100%

$\gamma(^{\circ})$	Lumens	% Total
0-130	2092.209	90.27%
130-180	225.415	9.73%
0-180	2317.6	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

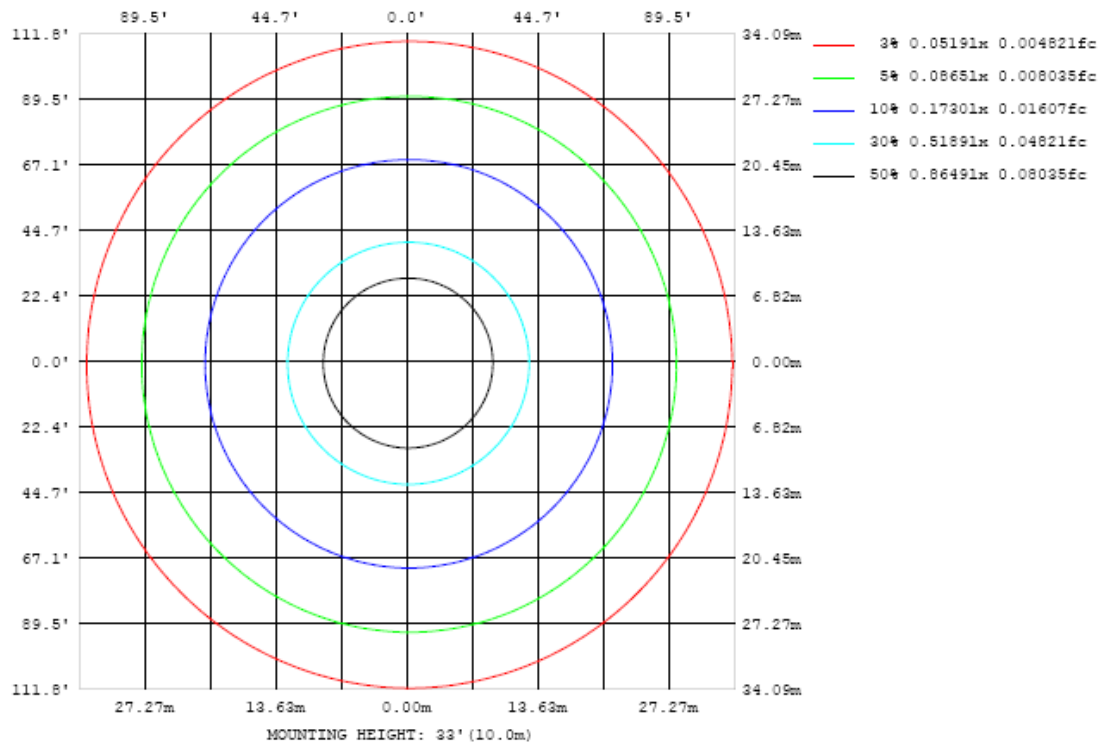


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

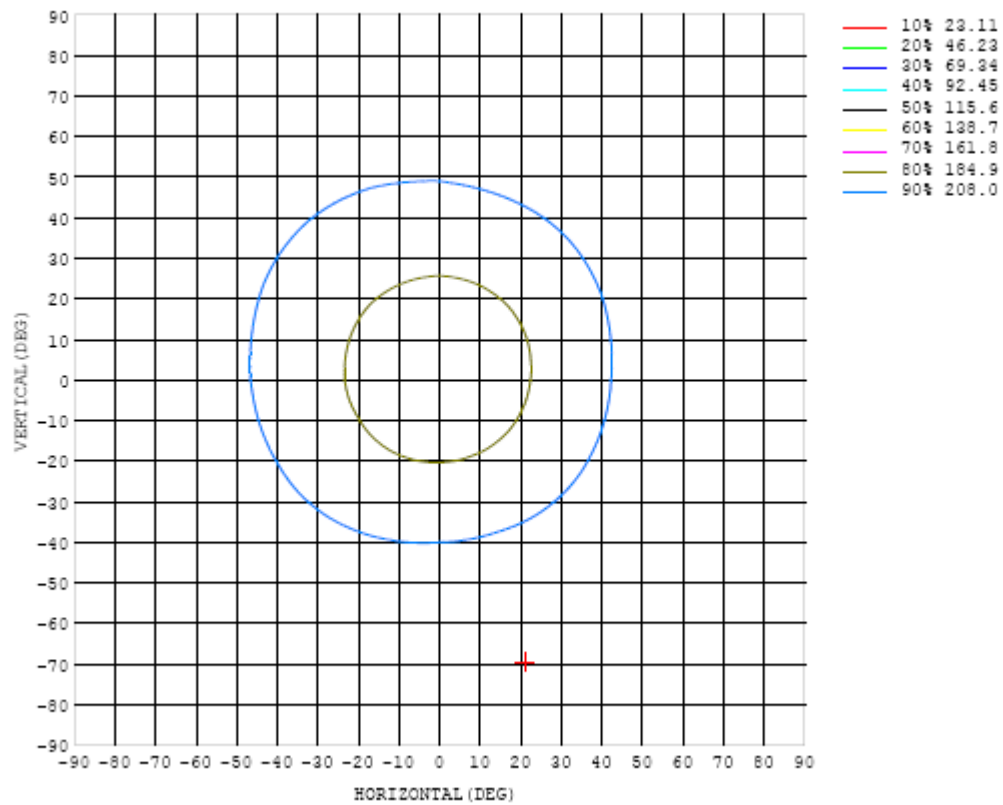


Chart 6: Isocandela Plot

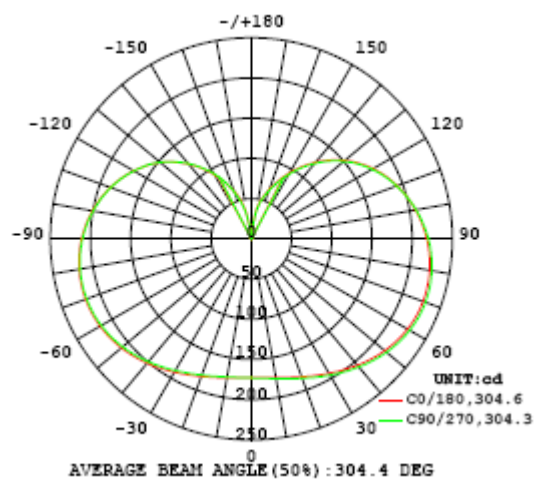


Chart 7: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1 UNIT: cd

C (DEG) γ (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	173	173	173	173	173	173	173	173	173	173	173	173	173	173	173	173			
5	174	174	174	174	174	174	174	174	174	173	173	173	173	173	173	173			
10	176	176	176	177	176	176	176	176	175	175	175	175	174	175	175	175			
15	179	179	180	180	180	180	179	179	178	178	177	177	177	177	177	178			
20	183	184	184	185	185	184	184	183	182	181	181	180	180	181	181	182			
25	188	189	189	190	190	189	188	188	186	186	185	184	184	185	185	186			
30	193	194	195	196	196	195	194	193	191	190	190	189	189	190	190	192			
35	199	201	201	202	202	201	200	198	196	195	195	194	194	195	196	197			
40	205	207	208	208	208	207	205	204	202	200	200	199	199	201	202	203			
45	211	213	214	214	214	212	210	209	207	205	204	204	204	206	207	209			
50	217	218	219	220	219	217	215	213	211	209	209	208	209	211	212	214			
55	221	223	224	225	224	222	219	217	215	213	212	212	213	215	216	218			
60	224	226	227	228	227	225	222	220	217	216	215	215	215	218	219	222			
65	227	228	229	230	230	227	224	222	219	217	217	216	217	220	221	224			
70	227	229	230	231	230	227	225	222	219	218	217	217	218	220	222	224			
75	227	229	230	230	230	227	224	222	219	217	217	216	218	220	222	224			
80	225	227	228	229	228	225	222	220	217	216	215	215	216	218	220	222			
85	222	224	225	225	225	222	219	217	215	213	212	212	214	216	217	219			
90	218	220	221	221	220	218	215	213	211	210	209	209	210	212	213	216			
95	213	215	216	216	214	213	210	208	206	205	204	205	205	207	208	211			
100	207	209	210	209	208	206	204	202	201	200	198	199	200	201	202	205			
105	201	202	203	202	201	199	197	195	194	193	192	193	193	194	195	198			
110	193	195	195	193	192	191	189	187	187	186	185	186	186	186	188	191			
115	184	186	186	185	183	182	180	179	178	178	176	177	178	178	180	183			
120	175	176	176	175	173	173	171	169	169	168	167	168	169	169	171	173			
125	164	165	166	164	162	162	160	158	159	158	158	159	159	159	161	163			
130	152	153	153	151	150	150	148	147	148	147	146	148	148	148	150	152			
135	138	140	140	138	137	136	135	134	135	134	134	135	136	136	137	139			
140	124	125	125	124	122	122	122	120	121	121	120	122	122	122	124	125			
145	110	110	110	108	107	108	107	106	107	107	106	107	108	108	110	111			
150	94.5	94.4	94.1	92.8	92.3	92.8	92.7	91.6	92.2	92.1	91.6	92.7	93.7	94.1	95.2	95.9			
155	79.5	78.9	78.5	77.4	77.3	78.2	78.4	77.3	77.4	76.5	71.0	74.0	78.2	79.0	80.3	80.9			
160	65.4	64.9	64.2	63.7	63.6	64.8	65.3	64.5	63.1	59.6	44.8	46.6	61.6	63.8	65.6	66.4			
165	51.9	51.6	50.6	50.4	50.6	51.8	52.8	51.7	47.9	42.3	31.3	26.3	44.1	49.0	51.2	52.5			
170	37.0	34.5	32.8	33.9	33.8	35.0	34.6	31.9	21.8	14.3	7.54	12.7	22.7	30.1	34.1	36.5			
175	5.45	4.80	5.64	5.39	4.43	3.60	2.93	0.57	0.27	0.27	0.28	0.28	0.33	0.67	1.62	2.66			
180	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24			

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

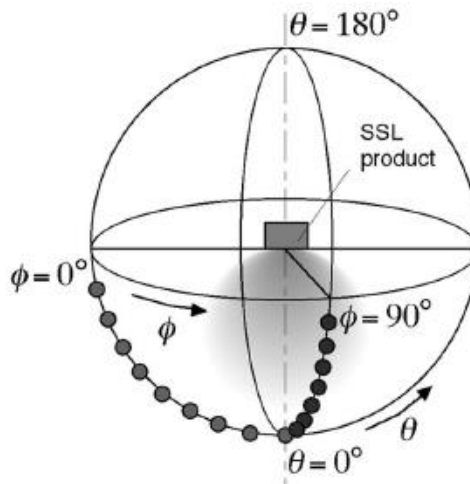
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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