

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: 16A21/840/277V

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ20050007c

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: 16A21/840/277V

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
145.7	2325.5	15.96	0.9902
CCT (K)	CRI	Stabilization Time (Light & Power)	
4031	84.7	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	: 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	: 16A21/840/277V
Electrical Ratings	: 120-277Vac, 50/60Hz, 16W
Product Description	: 4000K
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)	0.134	0.064
Power Factor	0.9902	0.9065
Test Power (W)	15.96	15.93
THD A%	9.19	15.86
Luminous Efficacy (lm/W)	145.7	139.7
Total Luminous Flux (lm)	2325.5	2226.1
Color Rendering Index (CRI)	84.7	
R9	14.2	
Correlated Color Temperature (CCT)(K)	4031	
Chromaticity Chroma x	0.3785	
Chromaticity Chroma y	0.3741	
Chromaticity Chroma u	0.2249	
Chromaticity Chroma v	0.3334	
Duv	-0.0007	
Chromaticity Chroma u'	0.2249	
Chromaticity Chroma v'	0.5001	

Special Color Rendering Indices	
R1	84.1
R2	93.9
R3	94.9
R4	81.2
R5	83.9
R6	90.3
R7	84.2
R8	64.7
R9	14.2
R10	84.8
R11	80.7
R12	66.3
R13	87.2
R14	98

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)	0.134
Power Factor	0.9908
Power (W)	15.98
Luminous Efficacy (lm/W)	145.1
Total Luminous Flux (lm)	2317.9
Beam Angle (°)	304.9 (0°-180°) / 304.0 (90°-270°)
Center Beam Candle Power (cd)	174
Maximum Beam Candle Power (cd)	232.2 (At: C=225.0, Gamma=69.0)
Spacing Criteria	1.81 (0°-180°) / 1.76 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	27.46%
Zonal Lumens in the 60 °-90 °Zone	29.92%
Zonal Lumens in the 90 °-120 °Zone	26.60%
Zonal Lumens in the 120 °-180 °Zone	16.02%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

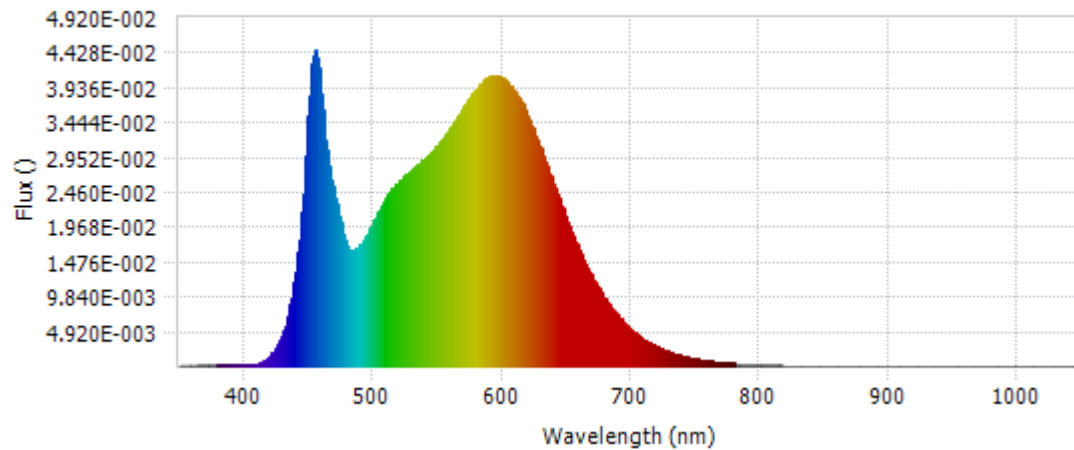
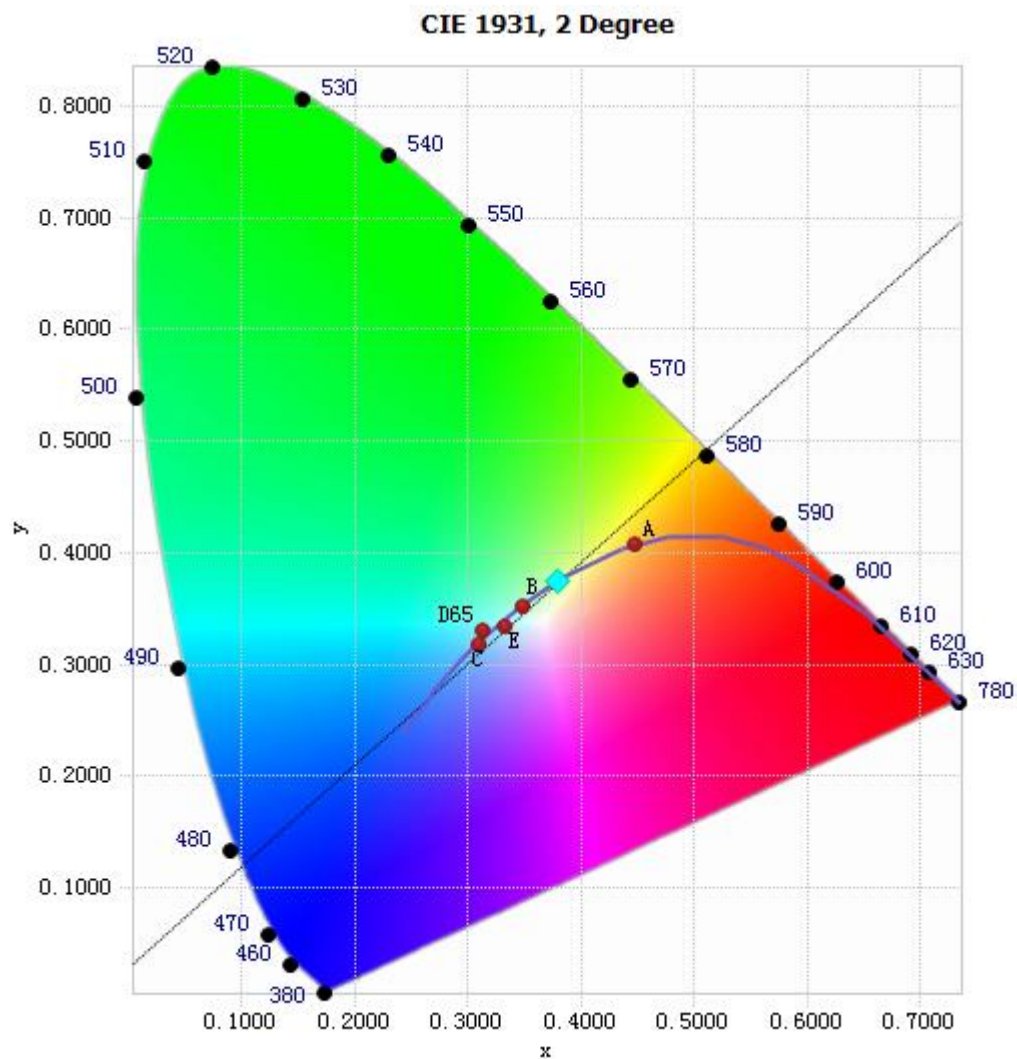


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.81E-04	485	1.65E-02	590	4.08E-02	695	6.08E-03
385	1.70E-04	490	1.72E-02	595	4.10E-02	700	5.20E-03
390	1.92E-04	495	1.84E-02	600	4.07E-02	705	4.45E-03
395	1.97E-04	500	2.02E-02	605	4.00E-02	710	3.80E-03
400	1.79E-04	505	2.21E-02	610	3.88E-02	715	3.26E-03
405	2.07E-04	510	2.37E-02	615	3.72E-02	720	2.80E-03
410	3.82E-04	515	2.51E-02	620	3.52E-02	725	2.40E-03
415	7.47E-04	520	2.61E-02	625	3.31E-02	730	2.04E-03
420	1.45E-03	525	2.70E-02	630	3.07E-02	735	1.73E-03
425	2.68E-03	530	2.77E-02	635	2.82E-02	740	1.48E-03
430	4.67E-03	535	2.85E-02	640	2.57E-02	745	1.26E-03
435	7.96E-03	540	2.93E-02	645	2.32E-02	750	1.08E-03
440	1.32E-02	545	3.03E-02	650	2.08E-02	755	9.26E-04
445	2.18E-02	550	3.12E-02	655	1.85E-02	760	7.87E-04
450	3.54E-02	555	3.24E-02	660	1.63E-02	765	6.74E-04
455	4.47E-02	560	3.36E-02	665	1.44E-02	770	5.79E-04
460	3.83E-02	565	3.50E-02	670	1.26E-02	775	4.93E-04
465	2.91E-02	570	3.65E-02	675	1.09E-02	780	4.27E-04
470	2.46E-02	575	3.79E-02	680	9.49E-03		
475	2.02E-02	580	3.92E-02	685	8.20E-03		
480	1.70E-02	585	4.02E-02	690	7.07E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3785, 0.3741)

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

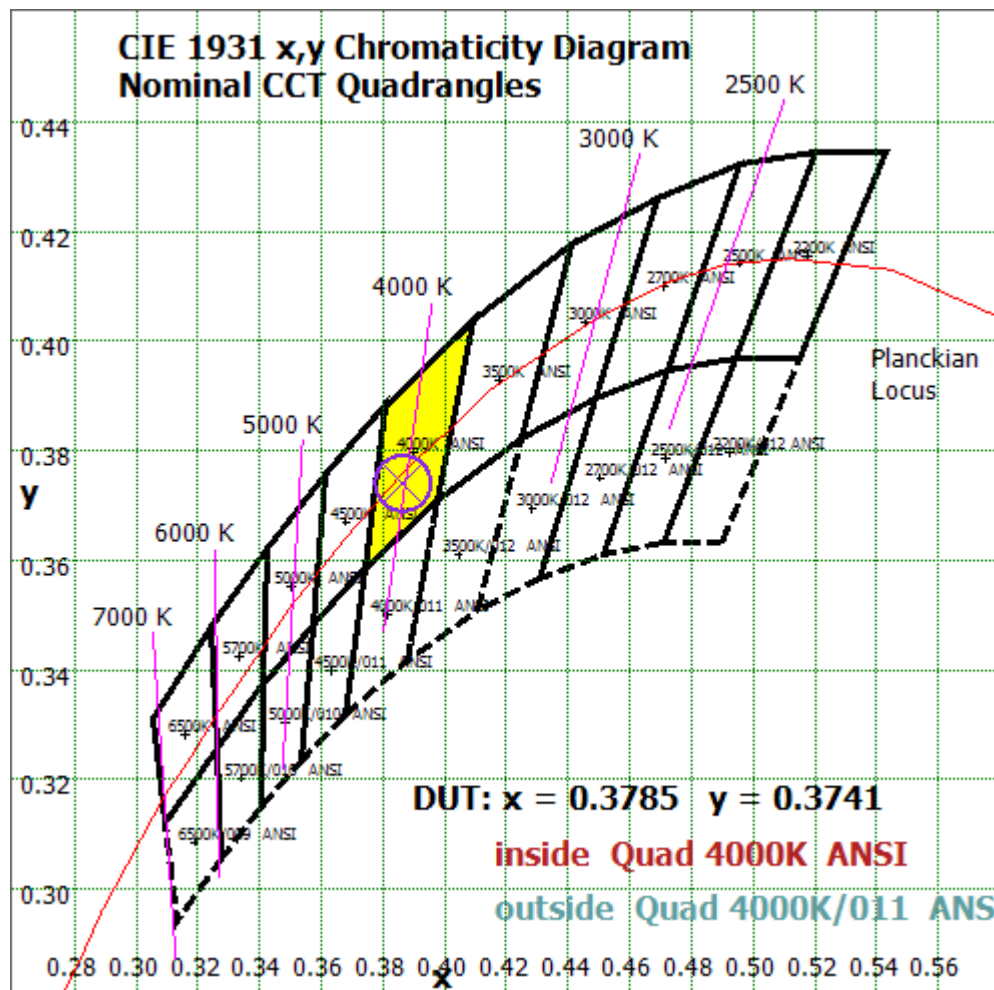
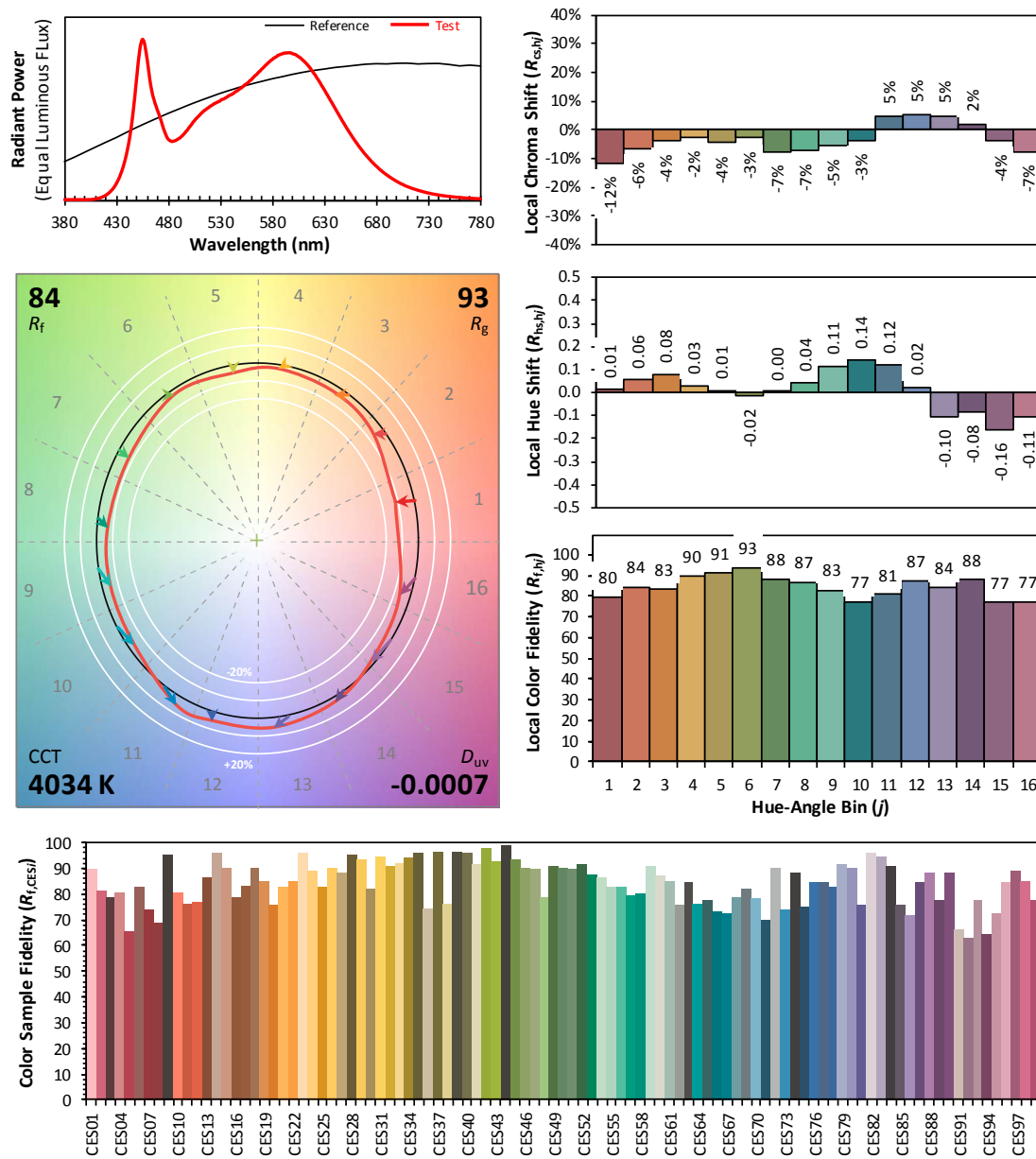


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method



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

x	0.3785
y	0.3741
u'	0.2249
v'	0.5001

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	16.731	0.72%
10- 20	50.991	2.20%
20- 30	87.055	3.76%
30- 40	124.67	5.38%
40- 50	161.905	6.99%
50- 60	195.17	8.42%
60- 70	220.561	9.52%
70- 80	235.174	10.15%
80- 90	237.693	10.25%
90-100	228.324	9.85%
100-110	208.375	8.99%
110-120	179.856	7.76%
120-130	144.859	6.25%
130-140	106.202	4.58%
140-150	68.447	2.95%
150-160	36.444	1.57%
160-170	13.942	0.60%
170-180	1.478	0.06%
Total	2317.9	100%

$\gamma(^{\circ})$	Lumens	% Total
0-130	2091.364	90.23%
130-180	226.513	9.77%
0-180	2317.9	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

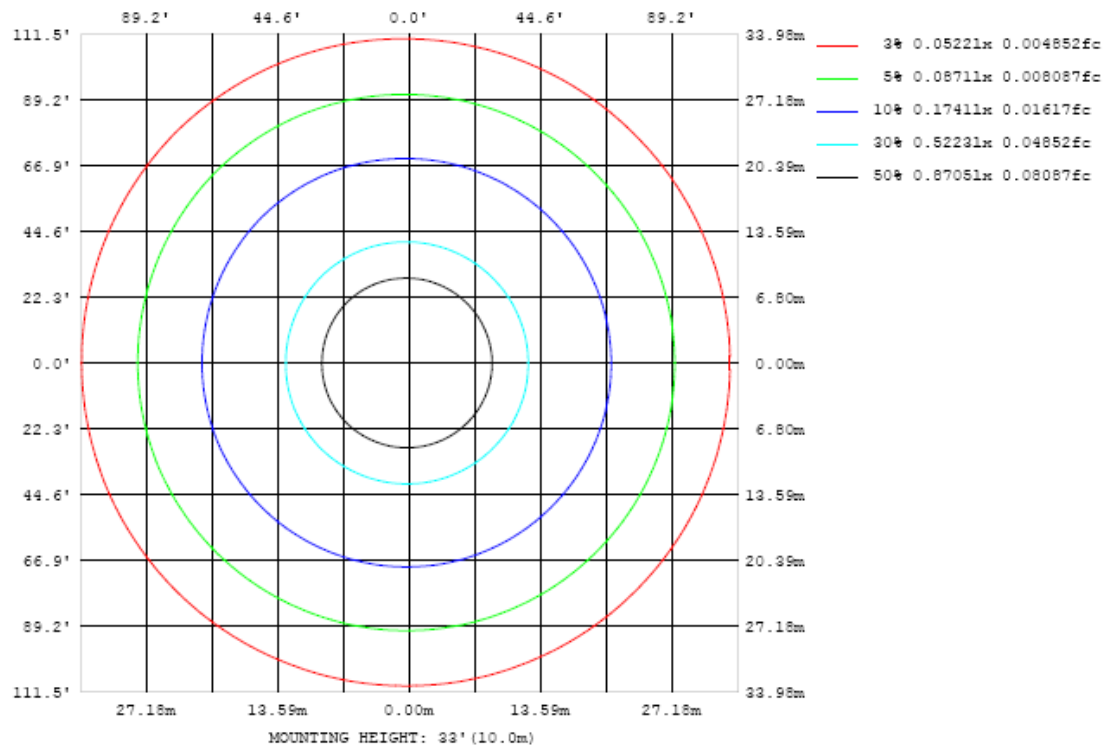


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

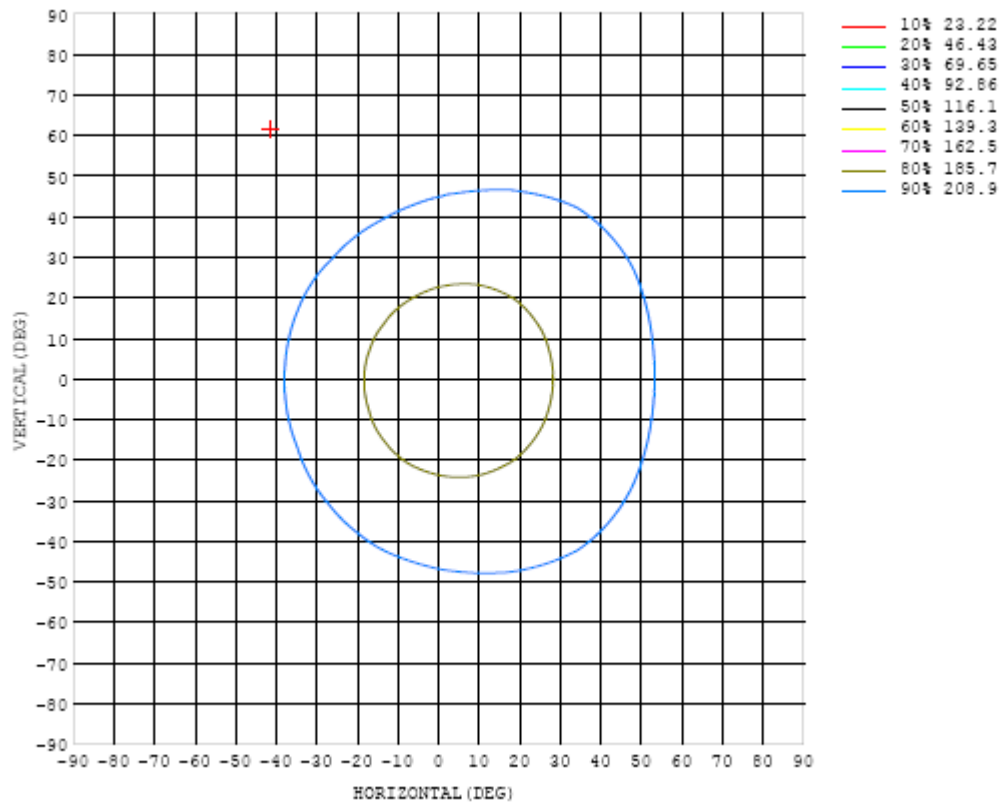


Chart 6: Isocandela Plot

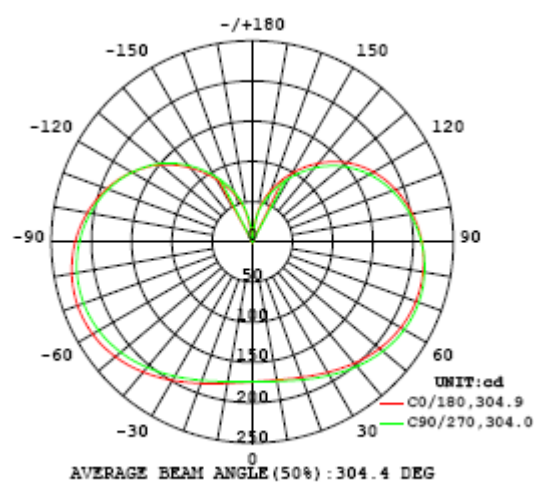


Chart 7: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1																	UNIT: cd			
C(°)\ Y (°)	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	174	174	174	174	174	174	174	174	174	174	174	174	174	174	174	174				
5	174	174	174	174	174	175	175	176	176	176	176	175	175	174	174	174				
10	174	175	175	176	176	177	178	178	179	179	178	178	177	176	175	175				
15	176	176	177	178	179	180	181	182	183	183	182	181	180	178	177	177				
20	179	179	180	181	183	184	186	187	187	187	187	185	183	182	180	180				
25	183	183	184	185	187	189	191	192	193	193	192	190	188	186	184	183				
30	187	188	188	190	192	194	196	198	199	199	198	196	193	190	189	187				
35	192	192	193	195	197	199	203	205	205	205	204	202	198	195	193	192				
40	197	197	198	200	202	205	209	211	211	211	211	208	204	200	198	197				
45	202	202	203	205	207	210	214	217	217	217	216	213	209	205	203	202				
50	206	207	207	209	212	215	219	222	222	222	222	218	214	210	207	206				
55	210	210	211	213	215	219	224	226	226	226	226	223	218	214	211	210				
60	213	213	214	215	218	221	226	229	229	230	230	226	221	216	214	213				
65	215	215	216	217	220	223	228	231	231	232	232	228	223	218	216	215				
70	216	216	217	218	220	223	228	231	231	232	232	228	223	219	217	216				
75	216	217	217	218	219	222	226	229	230	231	231	228	223	219	217	216				
80	216	216	215	216	217	220	223	227	228	230	229	226	221	218	216	215				
85	214	214	213	213	214	216	219	223	225	226	226	223	219	216	214	214				
90	211	211	210	210	210	212	214	217	220	222	222	218	215	212	211	211				
95	207	207	206	205	205	206	208	211	215	217	216	213	210	208	207	207				
100	202	202	201	200	199	200	201	204	209	211	210	207	205	203	203	203				
105	196	196	196	194	193	193	194	197	201	203	202	200	198	197	197	197				
110	190	189	189	187	185	185	185	188	193	195	194	192	191	190	190	191				
115	182	182	181	179	177	177	176	179	184	186	184	183	182	182	183	184				
120	174	173	173	170	168	167	167	168	173	175	174	173	173	173	174	175				
125	164	164	163	160	158	156	156	157	161	163	162	162	163	163	165	166				
130	153	153	152	149	146	145	144	145	149	150	150	150	151	152	154	156				
135	141	140	139	136	133	132	131	131	135	136	136	137	138	140	142	143				
140	127	127	126	123	120	118	117	117	120	121	121	122	124	126	128	130				
145	113	112	111	108	106	104	103	103	105	106	106	107	110	112	114	115				
150	98.5	97.2	95.7	93.3	91.1	89.7	88.7	88.2	90.0	90.3	90.1	91.9	94.8	96.9	99.4	101				
155	83.5	81.9	80.3	78.1	76.4	75.4	74.6	74.3	75.5	74.9	64.1	69.0	80.3	82.2	84.5	85.6				
160	68.4	66.9	65.3	63.5	62.4	62.0	61.8	61.8	62.3	58.3	44.6	49.0	65.9	68.1	69.8	70.7				
165	53.1	51.5	49.9	49.0	48.6	49.0	49.5	50.0	47.8	40.9	30.1	32.3	50.9	54.6	54.8	55.7				
170	35.2	32.6	30.6	31.9	32.1	32.6	32.7	30.2	22.6	14.0	9.85	15.0	32.3	41.0	39.8	40.7				
175	4.94	5.68	6.82	5.78	4.56	3.67	2.12	0.31	0.27	0.27	0.29	0.00	13.3	27.4	24.8	25.7				
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

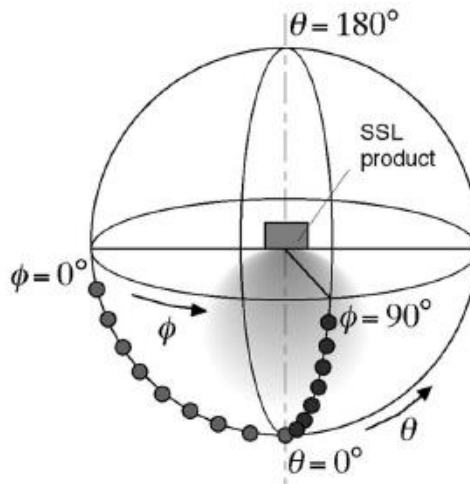
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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