

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: 16A21/850/277V

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ20050007d

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: 16A21/850/277V

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
152.3	2394.9	15.72	0.9900
CCT (K)	CRI	Stabilization Time (Light & Power)	
5120	84.2	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	: 16A21/850/277V
Electrical Ratings	: 120-277Vac, 50/60Hz, 16W
Product Description	: 5000K
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 25.0 °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)	0.132	0.062
Power Factor	0.9900	0.9047
Test Power (W)	15.72	15.54
THD A%	9.15	15.92
Luminous Efficacy (lm/W)	152.3	148.2
Total Luminous Flux (lm)	2394.9	2303.9
Color Rendering Index (CRI)	84.2	
R9	9	
Correlated Color Temperature (CCT)(K)	5120	
Chromaticity Chroma x	0.3419	
Chromaticity Chroma y	0.3515	
Chromaticity Chroma u	0.2093	
Chromaticity Chroma v	0.3228	
Duv	0.0013	
Chromaticity Chroma u'	0.2093	
Chromaticity Chroma v'	0.4842	

Special Color Rendering Indices	
R1	82.9
R2	91.8
R3	94.9
R4	81.8
R5	83.2
R6	86.9
R7	85.7
R8	66.2
R9	9
R10	79.6
R11	81.3
R12	63.6
R13	85.8
R14	97.8

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)	0.133
Power Factor	0.9908
Power (W)	15.78
Luminous Efficacy (lm/W)	151.4
Total Luminous Flux (lm)	2389.0
Beam Angle (°)	305.7 (0°-180°) / 305.4 (90°-270°)
Center Beam Candle Power (cd)	177
Maximum Beam Candle Power (cd)	235.7 (At: C=60.0, Gamma=72.0)
Spacing Criteria	1.76 (0°-180°) / 1.75 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	27.27%
Zonal Lumens in the 60 °-90 °Zone	29.94%
Zonal Lumens in the 90 °-120 °Zone	26.69%
Zonal Lumens in the 120 °-180 °Zone	16.10%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

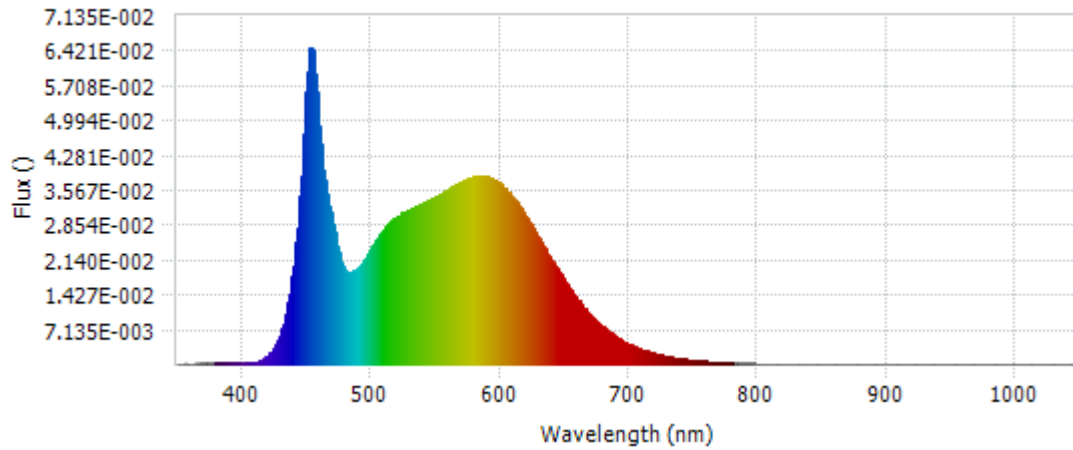
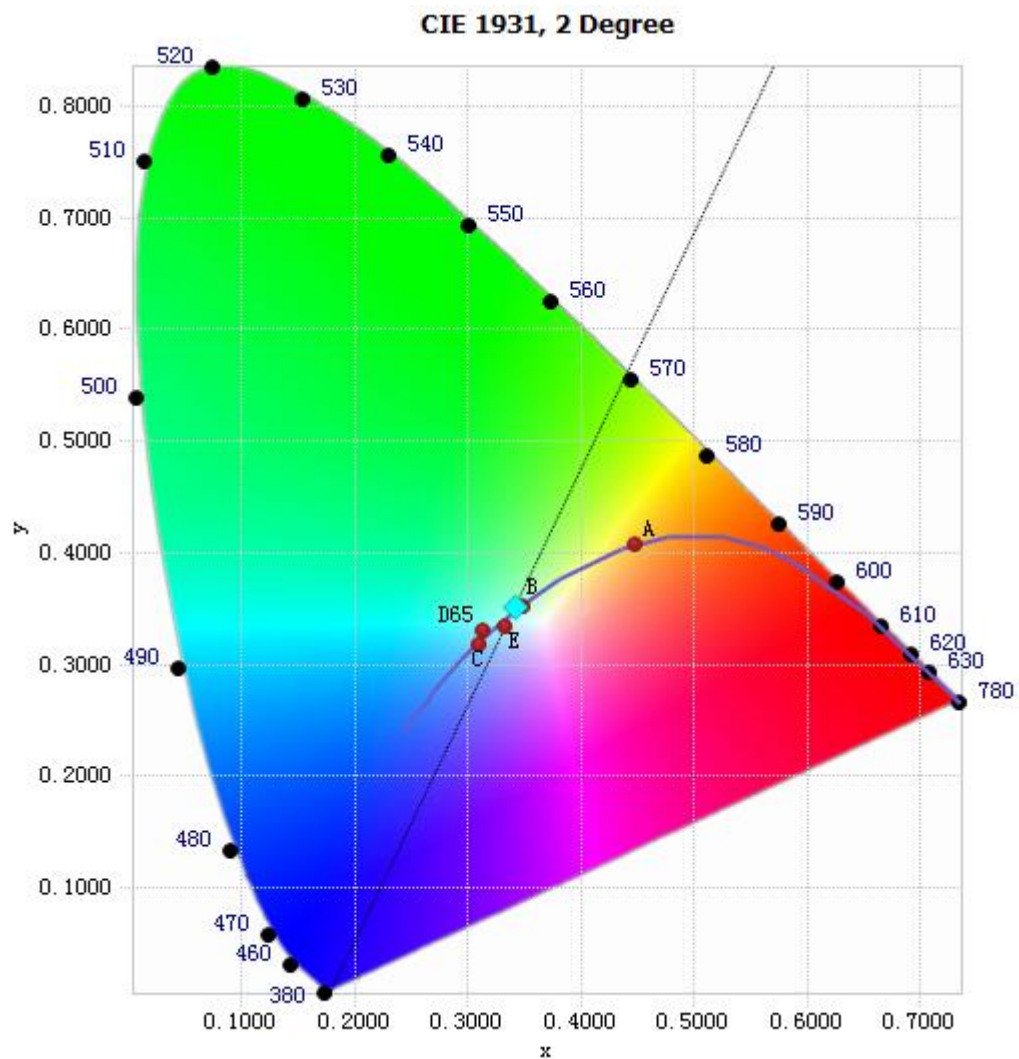


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.63E-04	485	1.90E-02	590	3.84E-02	695	4.86E-03
385	2.33E-04	490	1.98E-02	595	3.79E-02	700	4.15E-03
390	2.45E-04	495	2.14E-02	600	3.69E-02	705	3.55E-03
395	2.28E-04	500	2.37E-02	605	3.57E-02	710	3.03E-03
400	2.07E-04	505	2.59E-02	610	3.42E-02	715	2.60E-03
405	2.41E-04	510	2.77E-02	615	3.24E-02	720	2.23E-03
410	4.06E-04	515	2.92E-02	620	3.03E-02	725	1.91E-03
415	8.58E-04	520	3.02E-02	625	2.81E-02	730	1.64E-03
420	1.75E-03	525	3.10E-02	630	2.59E-02	735	1.39E-03
425	3.43E-03	530	3.17E-02	635	2.36E-02	740	1.19E-03
430	6.40E-03	535	3.23E-02	640	2.14E-02	745	1.02E-03
435	1.16E-02	540	3.30E-02	645	1.92E-02	750	8.67E-04
440	2.00E-02	545	3.37E-02	650	1.70E-02	755	7.46E-04
445	3.45E-02	550	3.43E-02	655	1.51E-02	760	6.34E-04
450	5.59E-02	555	3.50E-02	660	1.33E-02	765	5.49E-04
455	6.43E-02	560	3.58E-02	665	1.16E-02	770	4.68E-04
460	4.86E-02	565	3.66E-02	670	1.01E-02	775	4.04E-04
465	3.61E-02	570	3.74E-02	675	8.81E-03	780	3.46E-04
470	2.98E-02	575	3.80E-02	680	7.60E-03		
475	2.30E-02	580	3.84E-02	685	6.58E-03		
480	1.93E-02	585	3.86E-02	690	5.65E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3419, 0.3515)

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

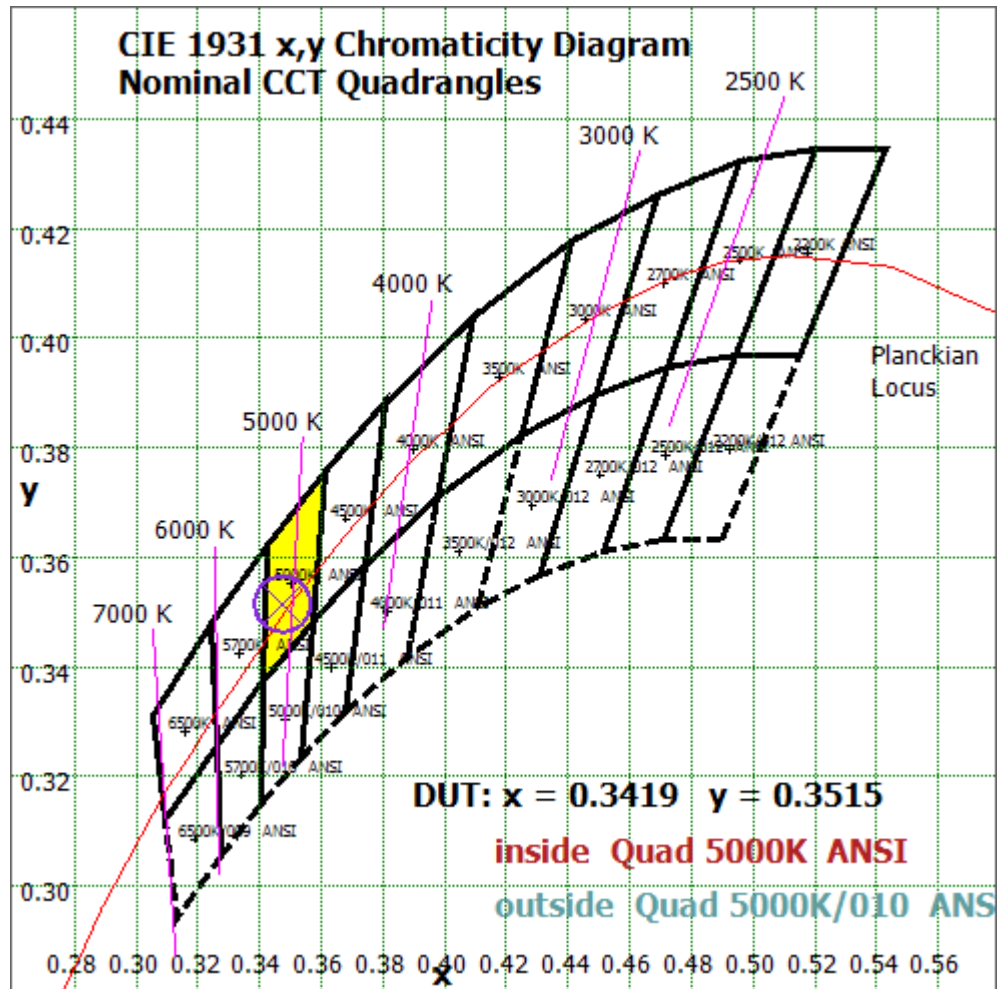
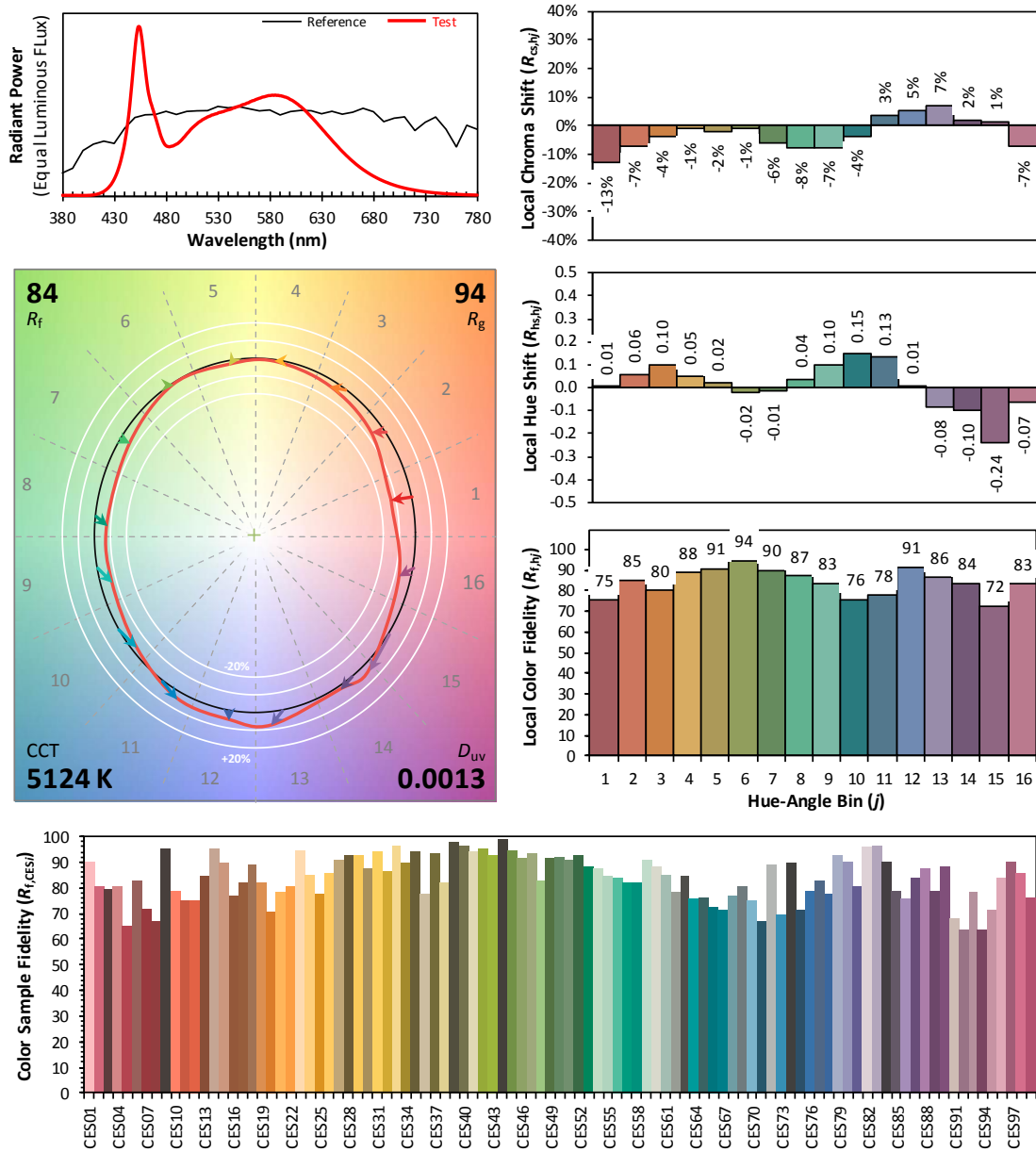


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method



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

x 0.3419
 y 0.3515
 u' 0.2093
 v' 0.4842

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	17.019	0.71%
10- 20	51.916	2.17%
20- 30	88.766	3.72%
30- 40	127.407	5.33%
40- 50	165.865	6.94%
50- 60	200.468	8.39%
60- 70	227.104	9.51%
70- 80	242.621	10.16%
80- 90	245.552	10.28%
90-100	236.043	9.88%
100-110	215.529	9.02%
110-120	186.162	7.79%
120-130	150.023	6.28%
130-140	110.146	4.61%
140-150	71.009	2.97%
150-160	37.732	1.58%
160-170	14.428	0.60%
170-180	1.199	0.05%
Total	2389.0	100%

$\gamma(^{\circ})$	Lumens	% Total
0-130	2154.475	90.18%
130-180	234.514	9.82%
0-180	2389.0	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

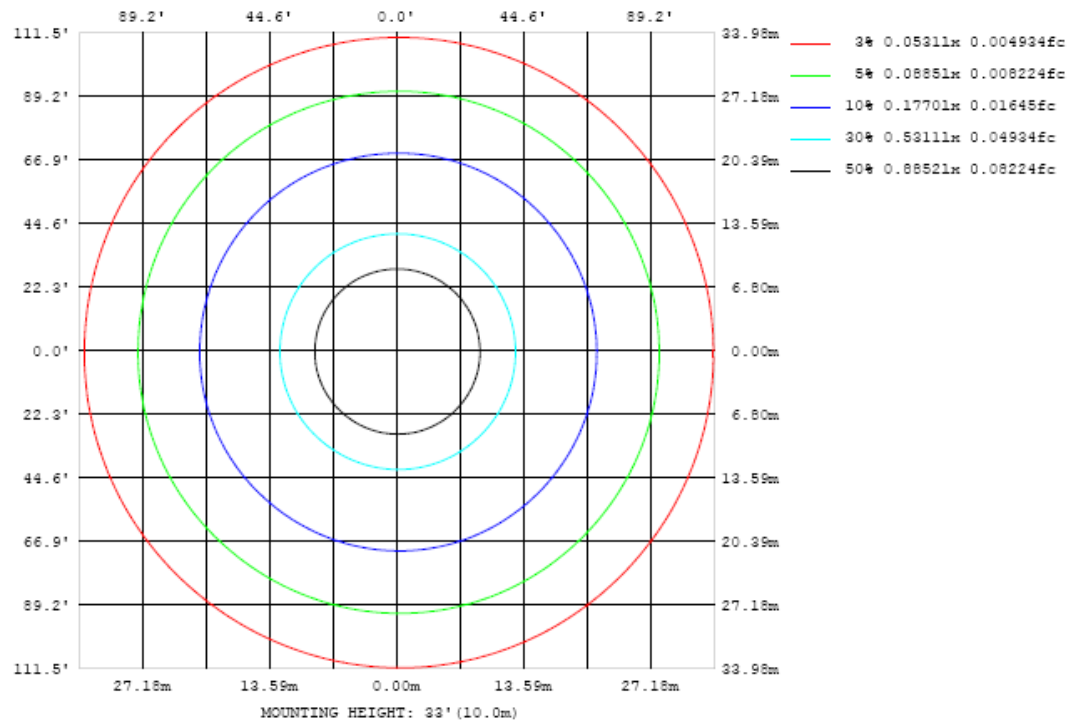


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

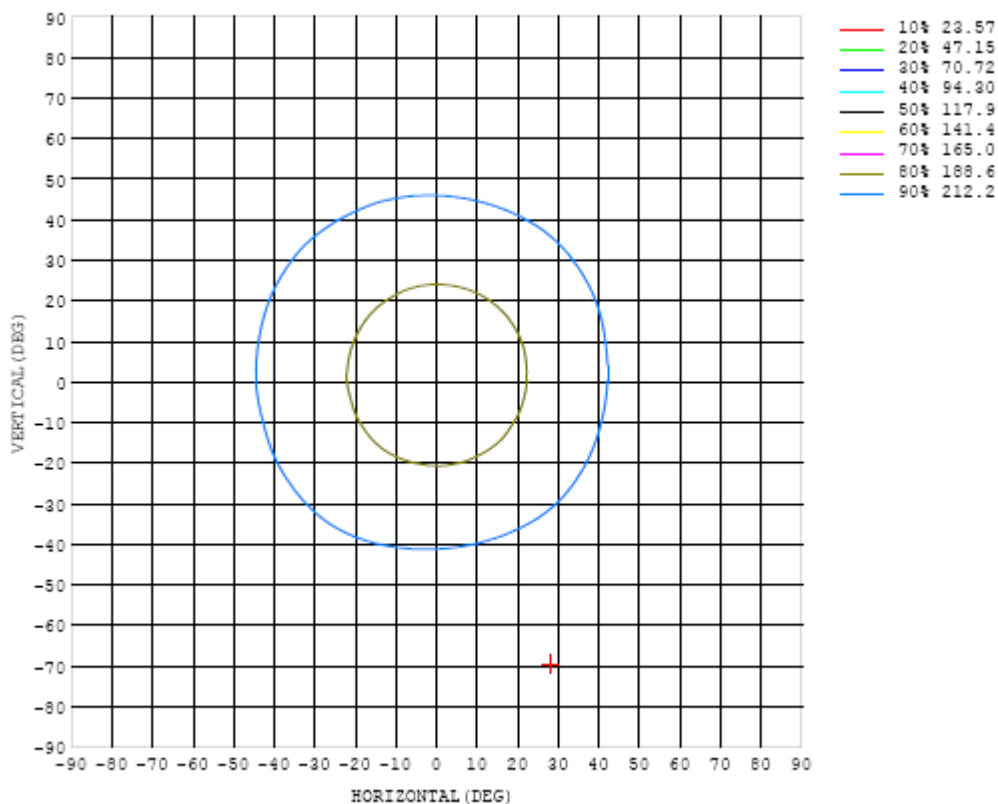


Chart 6: Isocandela Plot

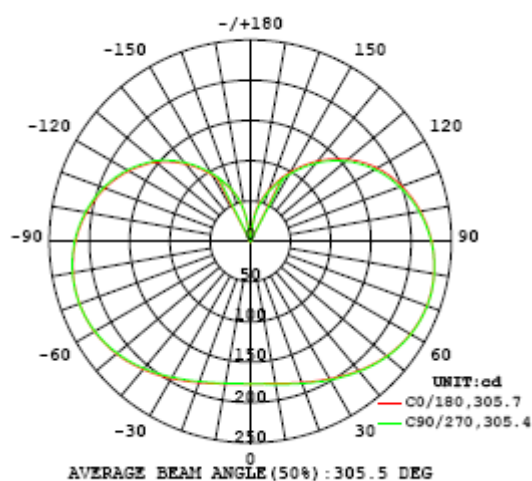


Chart 7: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1

UNIT: cd

C (DEG) Y (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177
5	178	178	178	178	178	178	178	178	178	178	178	178	178	178	178	178	178	178	178
10	179	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180
15	182	183	183	183	183	183	184	184	184	184	184	184	184	183	183	183	183	183	183
20	186	187	187	187	187	188	188	188	188	188	188	188	188	188	188	188	187	187	187
25	192	192	192	192	192	193	193	193	193	193	193	193	193	192	192	192	192	192	191
30	197	198	198	198	198	199	199	199	199	199	198	198	198	198	198	198	197	197	196
35	203	204	204	204	204	205	205	205	205	204	204	204	204	203	203	203	203	203	202
40	210	210	210	211	211	211	211	211	211	210	210	210	210	209	209	209	208	208	207
45	216	216	217	217	217	217	217	217	217	216	215	215	215	214	214	214	214	214	213
50	221	222	222	223	223	223	223	223	223	222	221	220	220	219	219	219	218	218	217
55	226	227	227	228	227	228	228	228	228	227	226	225	224	223	223	223	222	222	221
60	230	231	231	231	231	232	232	232	231	230	229	228	227	226	226	226	225	225	224
65	232	233	234	234	234	234	234	234	234	233	232	230	229	228	228	228	227	226	226
70	234	234	235	235	235	235	236	235	235	234	233	231	230	229	228	228	228	227	226
75	233	234	235	235	235	235	235	235	235	234	232	231	229	228	228	228	227	226	226
80	232	233	233	234	234	234	234	234	233	232	231	229	228	227	226	226	225	225	224
85	229	230	231	231	231	231	231	231	230	229	228	226	225	224	223	223	222	222	221
90	225	226	227	227	227	227	227	227	226	225	224	222	221	220	219	219	218	218	217
95	221	221	222	222	222	222	222	221	220	220	219	217	216	215	214	214	213	213	213
100	215	216	216	216	216	216	216	215	214	213	212	211	210	209	208	208	207	207	207
105	208	209	209	209	209	209	208	207	207	206	205	204	203	202	201	201	200	200	200
110	200	201	202	202	201	201	200	199	198	198	197	196	195	194	194	193	193	193	193
115	192	192	193	193	193	192	191	190	189	189	188	188	187	186	185	184	184	184	184
120	182	182	183	183	183	182	181	180	179	179	178	178	177	176	175	175	174	174	175
125	171	171	172	172	172	171	170	169	168	167	167	167	166	165	164	164	163	164	164
130	158	159	159	159	159	159	158	157	156	155	155	154	154	153	152	152	151	151	153
135	145	145	145	146	145	145	144	143	142	141	141	141	140	140	139	138	138	138	139
140	130	130	130	131	131	130	129	128	127	126	126	126	126	125	125	124	124	124	125
145	114	114	115	115	115	114	113	112	111	111	111	111	111	110	110	110	109	109	110
150	98.8	98.6	98.7	98.6	98.2	97.8	97.1	96.2	95.6	95.4	95.4	95.5	95.5	95.2	95.0	94.7	94.2	94.3	95.5
155	83.2	82.9	82.7	82.4	81.9	81.4	80.8	80.2	79.8	79.7	80.0	80.2	80.2	80.3	80.2	80.2	79.8	79.8	80.9
160	67.5	67.5	67.1	66.7	66.1	65.6	65.2	64.8	64.6	65.0	65.2	65.5	66.0	66.2	66.5	66.7	66.7	66.9	67.3
165	53.1	52.4	51.7	51.2	50.4	49.9	49.8	49.7	49.4	49.9	50.7	51.3	52.0	52.7	53.3	53.9	54.2	54.0	52.4
170	36.2	35.2	33.6	32.1	30.6	30.0	30.8	31.2	31.7	32.0	32.8	33.4	34.0	34.5	34.5	33.8	32.8	31.1	25.6
175	4.53	4.78	5.14	5.59	6.01	6.20	5.98	5.70	5.35	4.79	5.51	3.96	3.42	2.49	2.12	2.00	0.41	0.28	0.28
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	0.25	0.25	0.25

Table 6: Luminous Intensity Data

Table--2

UNIT: cd

C(°)	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350		
0	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177		
5	178	178	178	178	177	177	177	177	177	177	177	177	177	177	177	177	177		
10	180	180	179	179	179	179	179	179	179	179	179	179	179	179	179	179	179		
15	183	182	182	182	182	182	182	182	181	181	182	182	182	182	182	182	182		
20	187	186	186	186	186	186	185	185	185	185	185	185	185	185	186	186	186		
25	191	191	191	190	190	190	190	190	190	190	190	190	190	190	190	191	191		
30	196	196	196	195	195	195	195	195	195	195	195	195	195	195	196	196	197		
35	202	201	201	201	201	201	200	200	200	200	201	201	201	201	202	202	203		
40	207	207	207	206	206	206	206	206	206	206	207	207	207	207	208	208	209		
45	212	212	212	212	212	211	211	211	211	211	212	212	213	213	214	214	215		
50	217	217	217	216	216	216	216	216	216	217	217	218	218	219	219	220	221		
55	221	221	220	220	220	220	220	220	220	221	221	222	222	223	224	225	225		
60	224	223	223	223	223	223	223	223	223	224	225	225	226	227	227	228	229		
65	225	225	225	225	225	225	224	225	225	226	227	228	228	229	230	230	232		
70	226	226	226	225	226	225	225	226	226	227	228	228	229	230	231	232	233		
75	225	225	225	225	225	225	225	225	226	227	227	228	229	229	230	231	233		
80	224	223	224	223	223	223	223	224	225	225	226	226	227	228	229	230	231		
85	221	221	221	221	221	221	221	221	222	223	223	224	224	225	226	227	229		
90	217	217	217	217	217	217	217	218	219	219	219	220	220	221	223	224	225		
95	213	212	212	212	212	213	213	213	214	214	214	215	216	217	218	219	220		
100	207	207	207	206	207	207	207	208	208	208	208	209	210	211	212	213	214		
105	200	200	200	200	200	200	201	202	202	202	202	202	203	204	205	207	208		
110	193	193	192	192	193	193	194	194	194	194	194	195	196	197	198	199	200		
115	185	184	184	184	184	185	185	186	186	186	186	186	187	188	190	191	191		
120	175	175	175	174	175	176	176	177	177	177	177	177	178	179	180	181	182		
125	164	164	164	164	164	165	166	166	166	166	166	166	167	168	170	170	171		
130	153	153	153	152	153	154	154	155	155	155	155	156	157	158	159	159	160		
135	140	140	139	139	140	141	141	142	142	142	142	143	144	144	145	146	146		
140	125	125	125	125	126	126	127	128	128	128	128	129	129	130	131	131	131		
145	111	110	110	110	111	112	112	113	113	113	113	114	115	115	116	116	116		
150	95.7	95.5	95.2	94.1	96.0	96.6	96.2	97.0	98.2	98.3	98.5	98.8	99.4	100	101	100	100		
155	81.0	80.4	77.7	68.0	67.7	72.8	70.7	75.4	83.4	83.5	83.6	83.8	84.3	84.8	85.0	84.8	84.7		
160	67.0	64.5	58.2	50.8	47.4	51.0	51.6	60.3	68.6	69.5	69.5	69.6	69.9	70.0	69.9	69.6	69.1		
165	51.0	45.7	42.2	38.1	25.6	23.8	37.1	48.5	52.2	53.2	56.4	56.7	56.4	56.1	55.8	55.2	54.5		
170	24.2	17.9	11.7	9.96	11.8	13.8	17.8	22.7	29.2	33.5	37.0	38.5	39.1	38.6	38.7	38.8	38.1		
175	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.29	0.32	0.41	0.60	0.96	1.44	2.05	2.68	2.99	3.36		
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	0.25		

Table 7: 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 8: 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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