



LM-79-08 Test Report

for

GREEN CREATIVE LTD

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

LED tube

Model: 16T8/4F/850/BYP/R

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ18040014h

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

Review by:

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Apr. 27, 2018

Approved by:



Manager: Jim Zhang
Apr. 27, 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: 16T8/4F/850/BYP/R

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
132.2	2145.0	16.22	0.9805
CCT (K)	CRI	Stabilization Time (Light & Power)	
5044	81.6	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 : Apr. 09, 2018

Date of Test : Apr. 26, 2018

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	: LED tube
Model	: 16T8/4F/850/BYP/R
Electrical Ratings	: 120-277V, 50/60Hz, 16W
Product Description	: 5000K
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	277.0
Voltage frequency (Hz)	60	60
Test Current (A)	0.138	0.063
Power Factor	0.9805	0.9325
Test Power (W)	16.22	16.15
THD A%	18.97	15.64
Luminous Efficacy (lm/W)	132.2	134.1
Total Luminous Flux (lm)	2145.0	2166.0
Color Rendering Index (CRI)	81.6	
R9	0.5	
Correlated Color Temperature (CCT)(K)	5044	
Chromaticity Chroma x	0.3444	
Chromaticity Chroma y	0.3581	
Chromaticity Chroma u	0.2084	
Chromaticity Chroma v	0.3251	
Duv	0.0028	
Chromaticity Chroma u'	0.2084	
Chromaticity Chroma v'	0.4877	

Special Color Rendering Indices	
R1	79.5
R2	86
R3	91.2
R4	82.3
R5	80.7
R6	81.4
R7	86.1
R8	65.5
R9	0.5
R10	67.3
R11	81.9
R12	62.5
R13	80.9
R14	95.3
Rf	81
Rg	96

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 24.9°C.

The photometric distance is 30m.

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)	0.139
Power Factor	0.9772
Test Power (W)	16.32
Luminous Efficacy (lm/W)	130.9
Total Luminous Flux (lm)	2136.0
Beam Angle (°)	179.7
Center Beam Candle Power (cd)	323
Spacing Criteria	1.27 (0°-180°)/ 1.46 (90°-270°)
Zonal Lumens in the 0°-60°Zone	40.29%
Zonal Lumens in the 60°-90°Zone	26.63%
Zonal Lumens in the 90°-120°Zone	18.48%
Zonal Lumens in the 120°-180°Zone	14.60%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

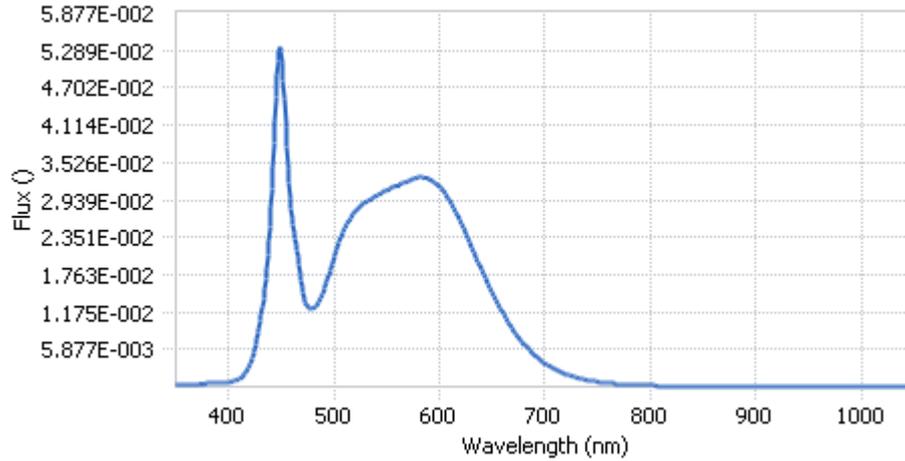
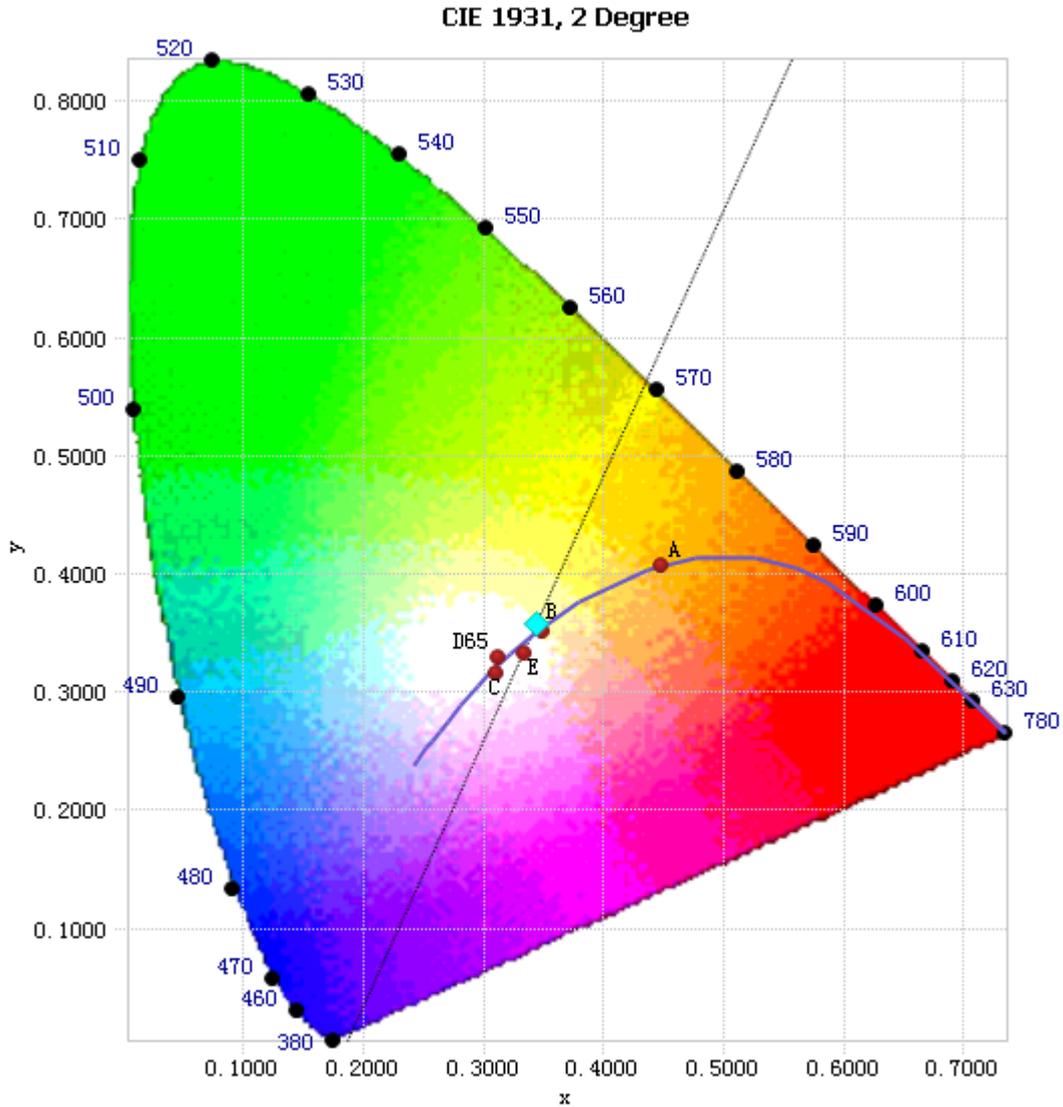


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	4.77E-04	485	1.32E-02	590	3.27E-02	695	4.32E-03
385	4.77E-04	490	1.49E-02	595	3.22E-02	700	3.70E-03
390	5.41E-04	495	1.77E-02	600	3.15E-02	705	3.16E-03
395	6.05E-04	500	2.05E-02	605	3.04E-02	710	2.69E-03
400	6.77E-04	505	2.28E-02	610	2.91E-02	715	2.31E-03
405	8.86E-04	510	2.49E-02	615	2.75E-02	720	1.98E-03
410	1.27E-03	515	2.65E-02	620	2.58E-02	725	1.69E-03
415	2.06E-03	520	2.76E-02	625	2.39E-02	730	1.45E-03
420	3.43E-03	525	2.83E-02	630	2.22E-02	735	1.23E-03
425	6.02E-03	530	2.90E-02	635	2.02E-02	740	1.05E-03
430	1.04E-02	535	2.96E-02	640	1.83E-02	745	8.95E-04
435	1.71E-02	540	3.01E-02	645	1.65E-02	750	7.63E-04
440	2.83E-02	545	3.05E-02	650	1.47E-02	755	6.61E-04
445	4.57E-02	550	3.08E-02	655	1.31E-02	760	5.68E-04
450	5.29E-02	555	3.13E-02	660	1.16E-02	765	4.93E-04
455	3.78E-02	560	3.16E-02	665	1.02E-02	770	4.20E-04
460	2.65E-02	565	3.20E-02	670	8.84E-03	775	3.60E-04
465	2.12E-02	570	3.23E-02	675	7.72E-03	780	3.10E-04
470	1.57E-02	575	3.26E-02	680	6.70E-03		
475	1.25E-02	580	3.29E-02	685	5.82E-03		
480	1.22E-02	585	3.30E-02	690	5.03E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3444, 0.3581)

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

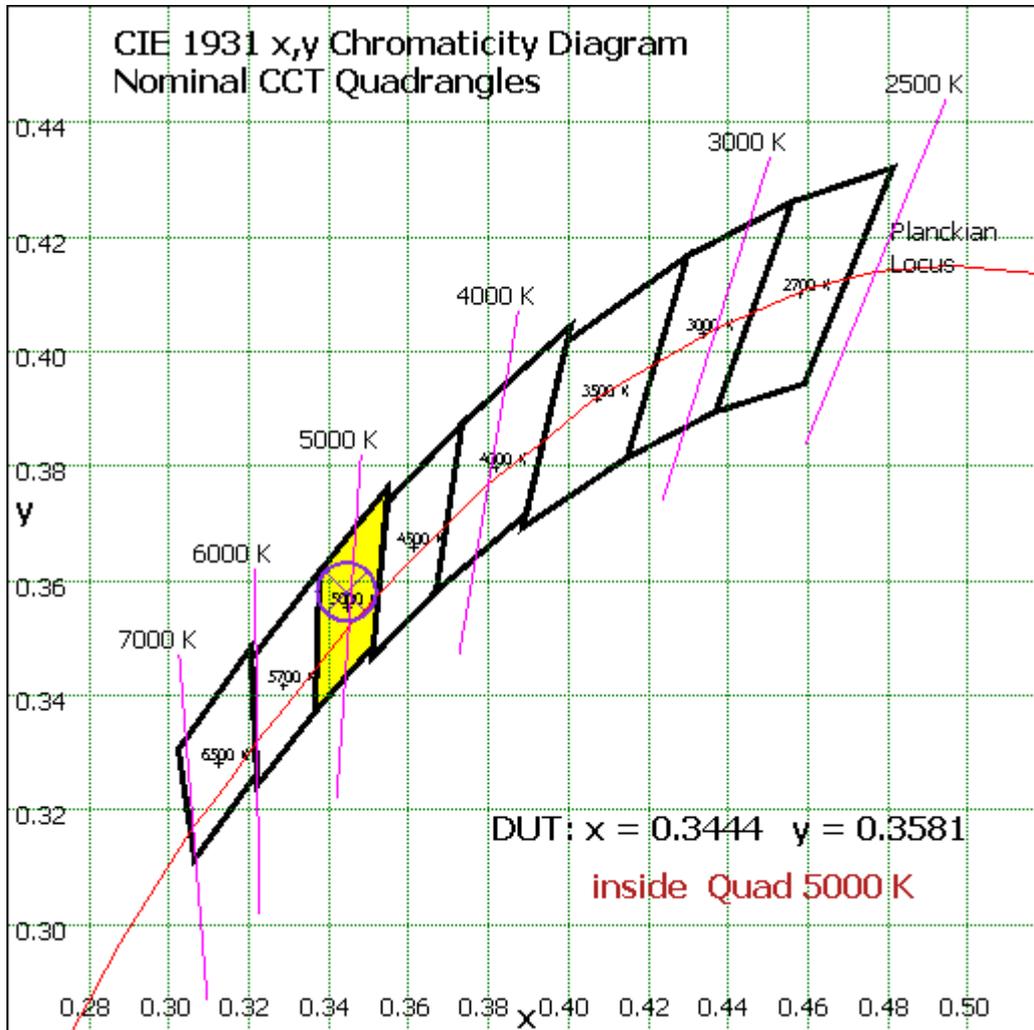


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	30.703	1.44%
10- 20	89.513	4.19%
20- 30	140.774	6.59%
30- 40	180.278	8.44%
40- 50	205.123	9.60%
50- 60	214.107	10.02%
60- 70	208.279	9.75%
70- 80	191.19	8.95%
80- 90	169.445	7.93%
90-100	149.852	7.02%
100-110	131.403	6.15%
110-120	113.466	5.31%
120-130	96.168	4.50%
130-140	79.218	3.71%
140-150	61.91	2.90%
150-160	43.625	2.04%
160-170	23.911	1.12%
170-180	7.053	0.33%
Total	2136.0	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	860.498	40.29%
60- 90	568.914	26.63%
0-90	1429.412	66.92%
90- 180	706.606	33.08%
0- 180	2136.0	100%

Table 5: Zonal Lumen Data

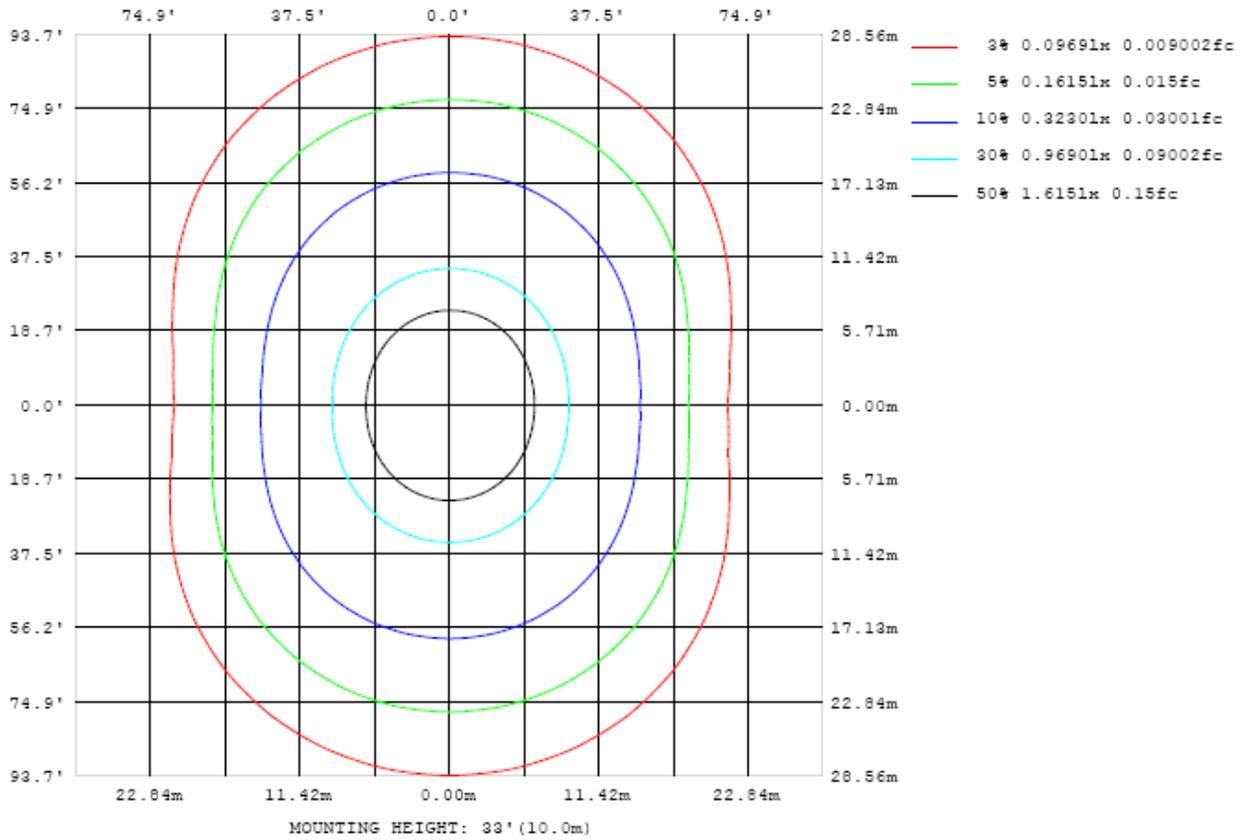


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

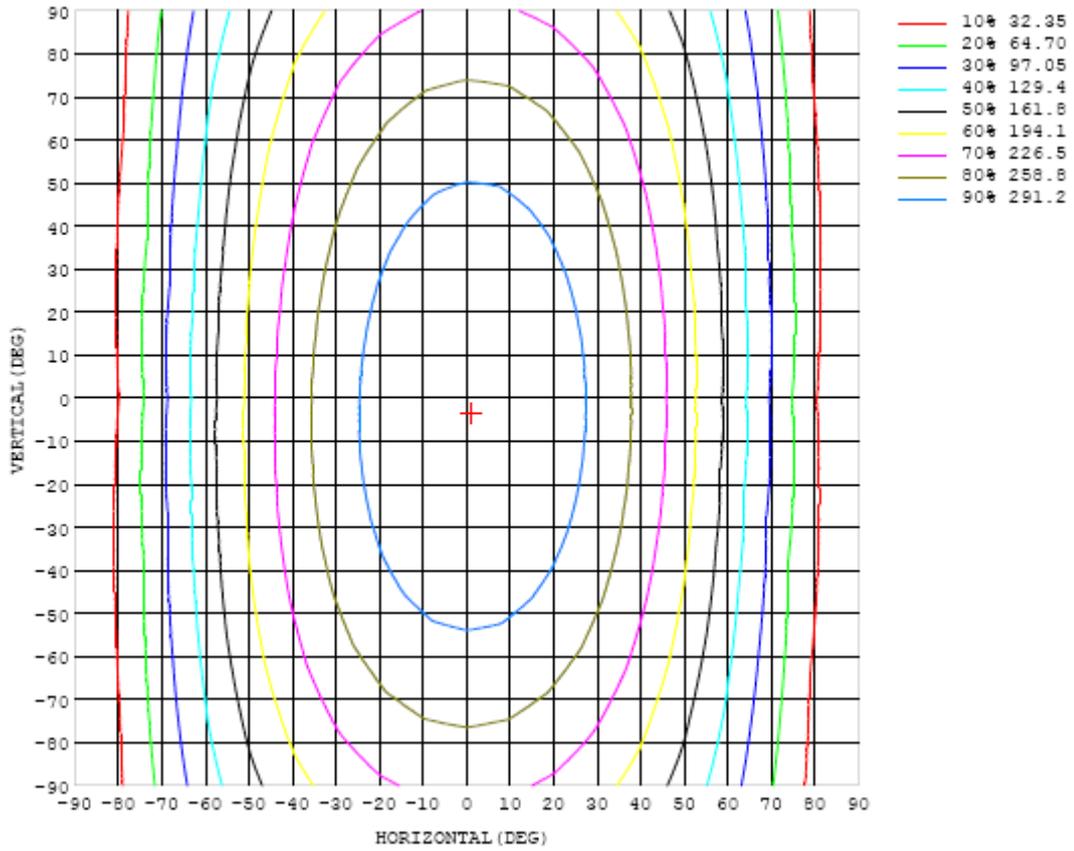


Chart 5: Isocandela Plot

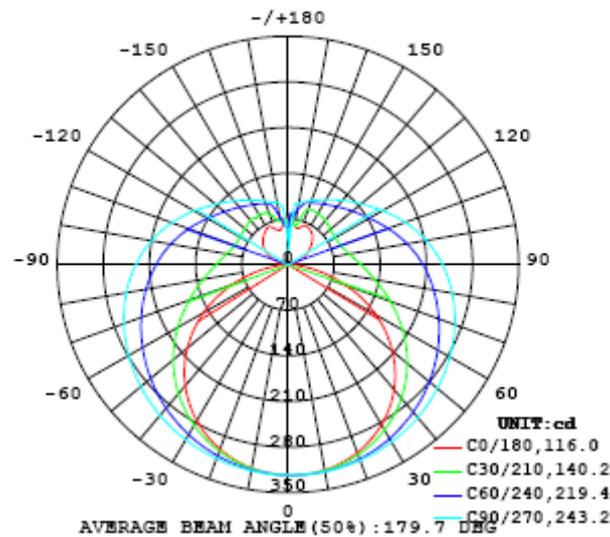


Chart 6: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1 UNIT: cd

C (DEG) y (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	323	323	323	323	323	323	323	323	323	323	323	323	323	323	323	323	323	323	323
5	323	323	323	323	323	323	323	323	323	323	323	323	323	322	322	322	322	321	321
10	320	320	320	321	321	322	322	323	323	323	322	322	322	321	320	319	319	318	317
15	315	315	316	317	318	319	320	321	322	323	321	321	320	319	317	315	313	312	311
20	307	307	309	311	313	315	318	319	320	320	319	317	315	312	309	306	304	302	301
25	296	298	300	303	306	310	313	316	317	317	316	314	311	307	302	298	294	291	290
30	284	285	288	293	298	304	308	312	314	314	313	310	306	300	294	288	282	278	277
35	268	270	274	281	288	296	302	307	310	311	309	305	299	292	284	276	268	263	261
40	250	253	259	268	277	287	296	302	306	306	305	300	293	283	273	262	253	246	243
45	230	233	241	253	265	277	288	296	300	301	299	294	286	274	261	248	235	226	222
50	207	211	221	236	252	267	280	289	294	296	294	288	278	264	249	232	216	204	199
55	182	186	200	219	238	257	271	282	288	290	288	281	269	254	236	216	196	181	174
60	154	160	178	201	224	245	262	274	281	283	281	273	261	244	223	199	175	156	148
65	124	133	155	183	210	234	253	266	274	276	274	266	252	233	209	182	153	130	119
70	93.8	104	132	165	196	223	244	258	267	269	266	258	243	223	197	166	132	103	89.6
75	63.2	76.7	111	149	183	212	234	249	259	261	258	249	234	212	184	150	113	77.3	59.8
80	34.5	52.1	91.7	134	171	201	224	241	250	253	250	241	225	202	173	137	95.4	54.9	31.9
85	11.2	32.8	76.7	121	160	191	215	231	241	244	241	232	216	193	162	125	81.7	37.5	9.73
90	0.71	22.3	66.4	111	149	181	205	221	231	235	232	222	206	183	153	115	72.0	28.1	0.44
95	2.49	18.9	59.3	102	139	170	194	211	221	224	221	212	196	173	143	107	65.2	24.7	2.84
100	6.90	21.2	55.2	94.2	130	160	183	200	210	213	210	201	185	163	134	99.5	61.4	26.4	8.29
105	12.5	26.1	54.5	88.6	122	150	173	189	198	201	199	190	175	153	126	93.9	60.3	30.7	15.4
110	19.4	32.7	55.9	85.1	115	141	162	177	186	190	187	178	164	144	119	90.2	61.5	36.7	23.2
115	26.1	39.9	58.7	83.4	109	132	152	166	174	177	175	167	154	136	113	88.5	64.1	43.6	31.1
120	32.8	47.1	62.6	82.8	105	125	142	155	163	166	164	156	144	128	109	87.6	67.4	50.3	38.7
125	39.4	53.9	67.1	83.2	102	120	134	145	152	155	153	147	137	123	106	87.7	71.0	56.5	44.7
130	46.1	59.1	71.5	84.4	99.6	115	127	137	143	145	144	138	130	117	103	88.3	74.9	62.0	49.5
135	52.4	63.0	75.5	86.1	98.2	111	121	129	135	136	135	131	123	113	101	89.1	78.4	65.1	53.8
140	57.8	65.0	78.9	87.9	97.2	107	116	123	127	128	128	124	118	109	99.8	90.3	80.9	65.6	57.6
145	61.6	69.9	82.9	89.5	96.7	104	111	117	120	121	121	118	113	106	98.7	91.3	82.5	66.5	61.0
150	64.0	73.3	85.2	90.5	96.4	102	107	111	114	115	114	112	108	103	97.7	90.9	83.8	69.1	64.1
155	65.2	67.2	82.5	91.3	96.2	100	104	107	109	109	109	107	105	101	95.4	86.4	80.3	66.8	63.9
160	62.0	57.9	75.7	90.5	95.1	98.5	101	103	104	105	104	103	101	94.2	82.6	75.7	71.0	61.6	58.2
165	57.5	52.3	60.4	72.5	90.9	93.1	97.2	99.7	100	101	101	97.8	86.3	74.2	69.0	65.0	61.5	55.5	54.8
170	60.7	54.4	57.8	58.9	67.5	81.5	88.0	90.3	95.0	96.0	91.6	68.6	65.4	69.5	65.3	63.9	57.5	57.3	56.4
175	70.2	69.6	70.5	72.3	73.9	72.6	74.9	76.5	70.2	65.3	52.3	71.1	72.1	73.3	72.6	73.0	72.1	70.5	68.2
180	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1

Table 6: Luminous Intensity Data

Table--2 UNIT: cd

C (DEG) y (DEG)	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350		
0	323	323	323	323	323	323	323	323	323	323	323	323	323	323	323	323	323		
5	321	321	321	321	322	322	322	322	322	323	323	323	323	323	323	323	323		
10	317	317	318	318	319	320	320	321	321	321	321	321	321	320	320	320	320		
15	310	311	312	313	315	316	318	319	319	320	319	319	318	317	316	315	315		
20	302	303	305	307	310	312	314	316	317	317	316	315	313	311	310	308	307		
25	291	292	295	299	303	307	310	313	314	314	313	311	308	305	301	299	297		
30	277	280	285	290	296	302	306	309	310	311	309	306	301	297	292	288	285		
35	262	266	272	280	288	295	300	305	306	306	304	300	294	287	280	274	270		
40	244	250	258	268	279	288	295	300	302	302	298	293	285	276	267	258	253		
45	224	232	243	256	269	280	289	294	297	296	292	285	276	264	252	241	233		
50	203	213	227	243	259	272	282	289	291	291	286	278	266	251	236	222	211		
55	179	192	210	230	248	263	275	282	285	285	279	269	255	238	219	201	187		
60	154	170	193	216	238	255	267	276	279	278	271	260	244	224	202	179	162		
65	127	149	176	203	227	246	260	269	272	270	263	251	233	211	184	157	135		
70	100	127	159	190	216	237	252	261	265	263	256	242	223	197	167	136	107		
75	73.7	107	144	177	206	228	244	253	257	255	247	233	212	185	151	115	80.7		
80	49.9	89.1	130	166	196	219	235	245	249	247	238	223	201	173	137	96.5	56.3		
85	32.1	75.3	119	155	186	209	226	236	240	238	229	214	191	162	125	81.7	37.5		
90	22.8	65.9	109	146	177	200	217	227	231	228	219	204	181	151	114	71.3	26.9		
95	20.2	59.7	101	137	168	191	207	217	221	219	209	194	172	142	106	64.2	23.1		
100	22.5	56.2	94.6	129	158	181	197	207	210	208	199	184	162	133	98.2	59.7	24.0		
105	27.4	55.5	89.5	121	149	171	186	196	199	197	188	173	152	125	92.2	57.8	28.4		
110	34.4	57.1	85.8	115	140	161	175	184	188	185	177	163	143	117	87.9	58.3	34.7		
115	41.9	60.2	84.3	109	132	151	164	173	176	174	166	153	135	111	85.4	60.5	41.9		
120	49.2	64.1	84.0	105	125	141	154	162	165	163	155	144	127	106	84.3	63.6	49.3		
125	56.4	68.2	84.6	102	119	133	145	151	154	152	146	135	120	103	84.3	67.3	56.4		
130	62.8	72.4	85.6	99.8	114	126	136	142	144	142	137	127	115	100	84.9	71.6	63.1		
135	68.7	75.1	87.1	98.3	110	120	128	133	135	134	129	121	111	98.5	86.2	75.8	69.4		
140	74.0	79.0	88.6	97.3	107	115	122	126	127	126	122	116	107	97.4	87.8	79.8	75.1		
145	79.0	81.3	87.1	96.7	104	110	116	119	120	119	116	111	104	96.7	89.4	83.4	80.3		
150	83.0	84.3	88.3	96.2	101	106	110	113	114	113	111	107	102	96.4	91.0	87.0	82.0		
155	81.0	84.9	86.0	90.9	99.6	103	106	108	109	108	106	104	100	96.3	92.6	90.3	83.3		
160	71.1	80.2	83.3	87.7	95.0	99.3	102	103	104	104	103	101	99.2	96.5	94.1	93.4	83.3		
165	63.3	69.7	73.3	77.3	83.8	93.9	98.1	98.7	99.0	98.9	99.8	99.4	98.3	96.7	95.1	94.7	85.0		
170	56.3	65.3	69.5	67.7	69.8	76.0	85.3	95.3	96.7	96.7	95.8	96.6	96.9	94.4	91.9	90.3	75.9		
175	66.5	66.8	66.2	66.6	64.5	59.8	63.0	73.5	86.0	90.3	93.0	93.6	88.4	86.1	82.6	76.2	72.3		
180	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1		

Table 7: Luminous Intensity Data

EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Aug. 23, 2017	Aug. 22, 2018
Digital Power Meter	PF2010A	HZTE028-01	Aug. 10, 2017	Aug. 09, 2018
AC Power Supply	DPS1060	HZTE001-06	Aug. 10, 2017	Aug. 09, 2018
DC Power Supply	WY12010	HZTE004-03	Aug. 10, 2017	Aug. 09, 2018
Temperature recorder	JM624U	HZTE018-08	Aug. 17, 2017	Aug. 16, 2018
Temperature and humidity recorder	JR900	HZTE018-01	Aug. 16, 2017	Aug. 15, 2018
Standard source	D908	HZTE012-01	Aug. 20, 2017	Aug. 19, 2018
Integrate Sphere system	2M	HZTE015-01	Aug. 23, 2017	Aug. 22, 2018
Digital Power Meter	WT210	HZTE008-01	Aug. 10, 2017	Aug. 09, 2018
AC Power Supply	PCR 500L	HZTE001-07	Aug. 10, 2017	Aug. 09, 2018
DC Power Supply	IT6154	HZTE004-04	Aug. 10, 2017	Aug. 09, 2018
Standard source	SCL-1400	HZTE012-02	Aug. 20, 2017	Aug. 19, 2018
Temperature and humidity recorder	JR900	HZTE018-02	Aug. 16, 2017	Aug. 15, 2018
Temperature Meter	TES1310	HZTE017-01	Aug. 17, 2017	Aug. 16, 2018

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

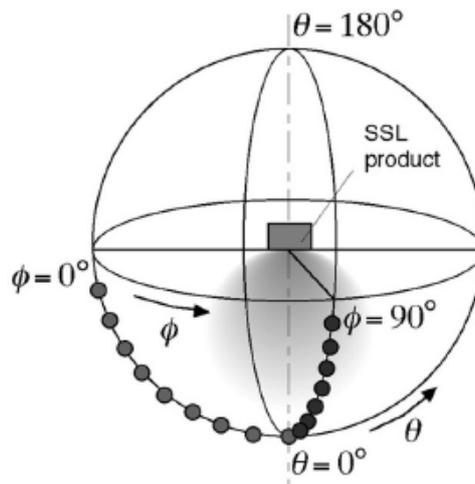
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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