

LM-79-08 TEST REPORT

for

GREEN CREATIVE LTD

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

LED Tube

Model: 13T8/4F/835/GL/BYP

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ19070032i

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

Review by:



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Jul. 25, 2019

Approved by:



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Jul. 25, 2019

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: 13T8/4F/835/GL/BYP

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
149.9	1889.2	12.60	0.9797
CCT (K)	CRI	Stabilization Time (Light & Power)	
3580	82.9	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	: Jul. 22, 2019
Date of Test	: Jul. 23, 2019
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

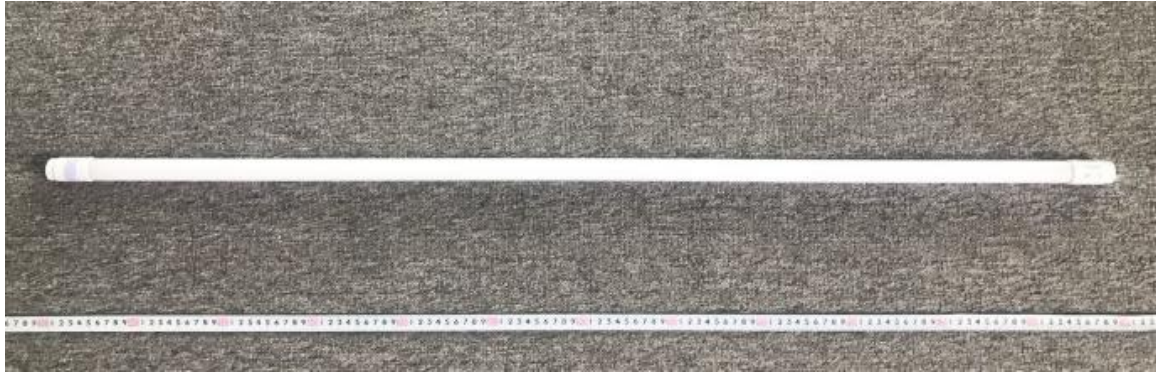


Figure 1- Overview of the sample

Equipment Under Test(EUT)

Name	: LED Tube
Model	: 13T8/4F/835/GL/BYP
Electrical Ratings	: 120-277V, 50/60Hz, 13W
Product Description	: 3500K
Manufacturer	: GREEN CREATIVE LTD
Address	: 756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

TEST RESULTS

Test ambient temperature was 26.0 °C.

Base orientation was horizontal. 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)	0.107	0.051
Power Factor	0.9797	0.9031
Test Power (W)	12.60	12.74
THD A%	17.64	12.99
Luminous Efficacy (lm/W)	149.9	149.2
Total Luminous Flux (lm)	1889.2	1901.4
Color Rendering Index (CRI)	82.9	
R9	8.5	
Correlated Color Temperature (CCT)(K)	3580	
Chromaticity Chroma x	0.3996	
Chromaticity Chroma y	0.3852	
Chromaticity Chroma u	0.2343	
Chromaticity Chroma v	0.3387	
Duv	-0.0012	
Chromaticity Chroma u'	0.2343	
Chromaticity Chroma v'	0.5081	

Special Color Rendering Indices	
R1	81.3
R2	89.9
R3	95.7
R4	81.4
R5	81.5
R6	86.2
R7	84.6
R8	62.6
R9	8.5
R10	76.2
R11	80.5
R12	65.9
R13	83.3
R14	97.9

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 25.0 °C.

The photometric distance is 30 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)	0.108
Power Factor	0.9797
Power (W)	12.67
Luminous Efficacy (lm/W)	146.8
Total Luminous Flux (lm)	1860.5
Beam Angle (°)	115.7 (0°-180°) / 242.9 (90°-270°)
Center Beam Candle Power (cd)	283
Maximum Beam Candle Power (cd)	282.9 (At: C=30.0, Gamma=1.5)
Spacing Criteria	1.27 (0°-180°) / 1.46 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	40.21%
Zonal Lumens in the 60 °-90 °Zone	26.49%
Zonal Lumens in the 90 °-120 °Zone	18.52%
Zonal Lumens in the 120 °-180 °Zone	14.78%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

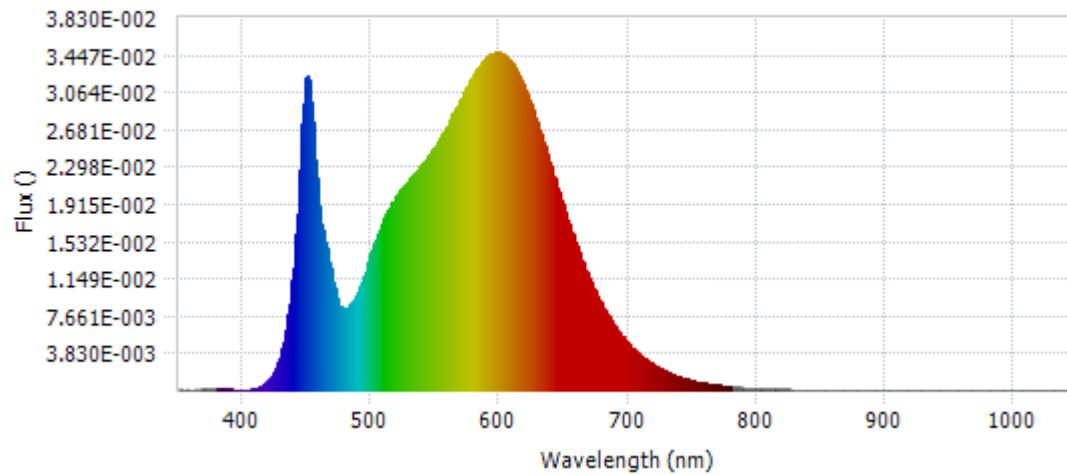
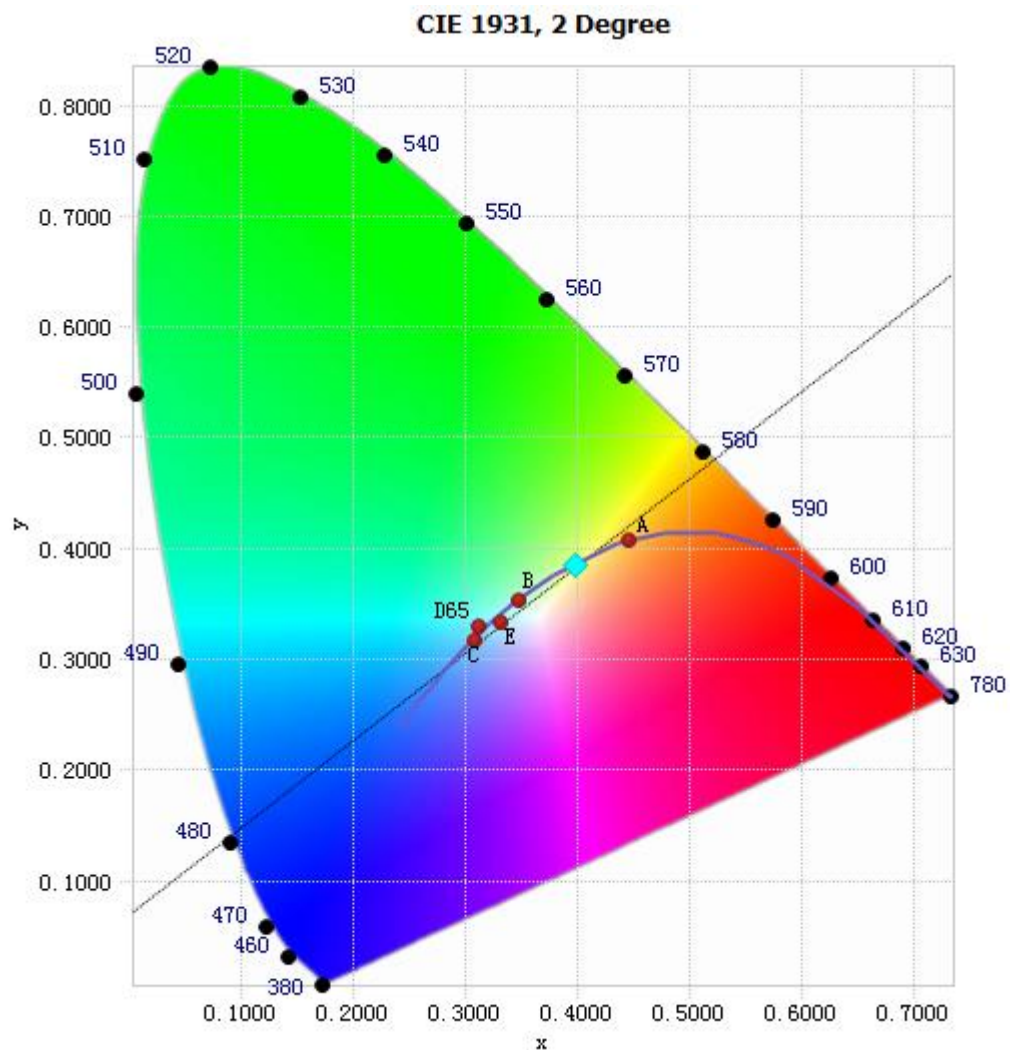


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.32E-04	485	9.08E-03	590	3.43E-02	695	5.66E-03
385	1.10E-04	490	1.04E-02	595	3.47E-02	700	4.85E-03
390	9.58E-05	495	1.22E-02	600	3.47E-02	705	4.18E-03
395	9.82E-05	500	1.43E-02	605	3.43E-02	710	3.56E-03
400	5.66E-05	505	1.62E-02	610	3.35E-02	715	3.05E-03
405	9.50E-05	510	1.77E-02	615	3.24E-02	720	2.62E-03
410	2.22E-04	515	1.91E-02	620	3.09E-02	725	2.24E-03
415	5.44E-04	520	2.02E-02	625	2.92E-02	730	1.92E-03
420	1.13E-03	525	2.10E-02	630	2.72E-02	735	1.63E-03
425	2.25E-03	530	2.18E-02	635	2.51E-02	740	1.39E-03
430	4.29E-03	535	2.25E-02	640	2.30E-02	745	1.20E-03
435	7.80E-03	540	2.33E-02	645	2.08E-02	750	1.02E-03
440	1.43E-02	545	2.43E-02	650	1.88E-02	755	8.70E-04
445	2.51E-02	550	2.52E-02	655	1.67E-02	760	7.57E-04
450	3.22E-02	555	2.63E-02	660	1.48E-02	765	6.45E-04
455	2.56E-02	560	2.75E-02	665	1.31E-02	770	5.47E-04
460	1.79E-02	565	2.88E-02	670	1.15E-02	775	4.68E-04
465	1.45E-02	570	3.01E-02	675	1.00E-02	780	4.03E-04
470	1.11E-02	575	3.13E-02	680	8.74E-03		
475	8.75E-03	580	3.25E-02	685	7.56E-03		
480	8.47E-03	585	3.36E-02	690	6.54E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3996, 0.3852)

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

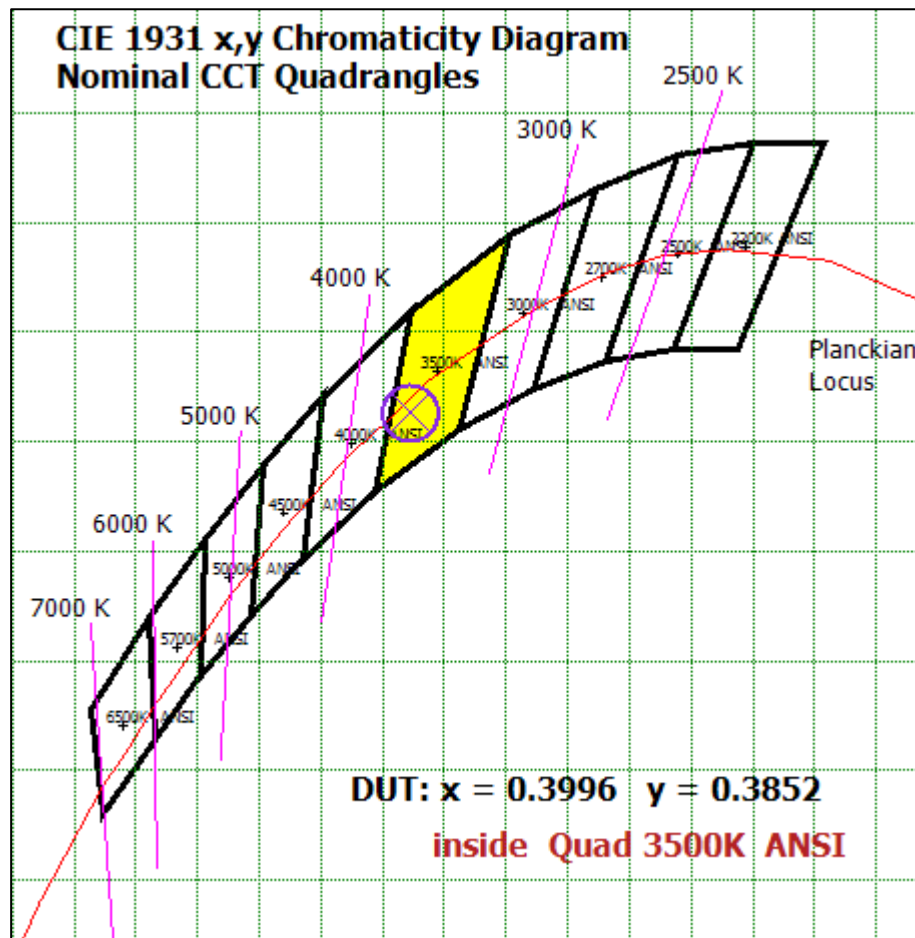


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method

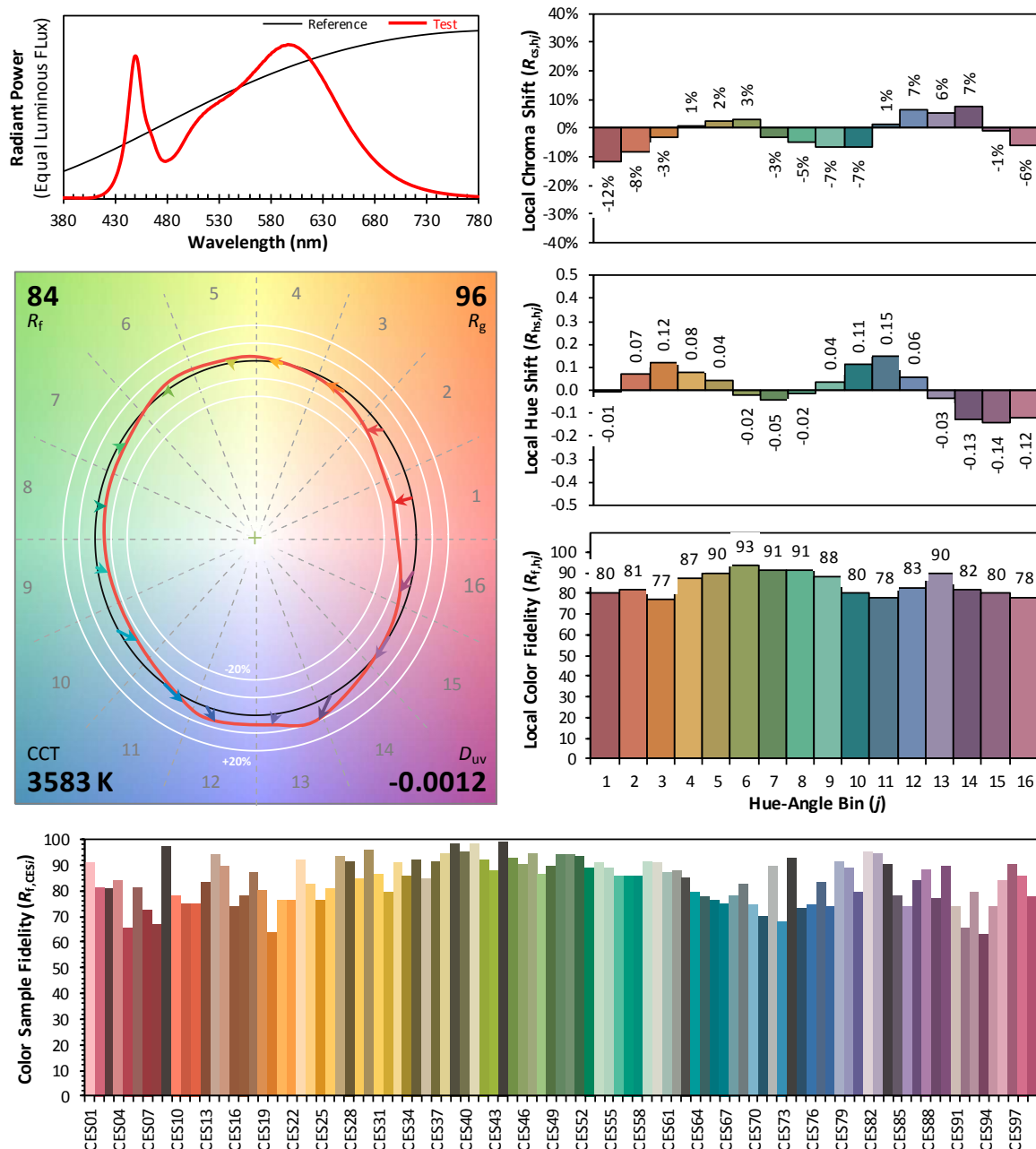


Chart 4: Full Report Created with the IES TM-30 Calculator

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	26.856	1.44%
10- 20	78.226	4.20%
20- 30	122.781	6.60%
30- 40	156.821	8.43%
40- 50	177.952	9.56%
50- 60	185.396	9.96%
60- 70	180.213	9.69%
70- 80	165.58	8.90%
80- 90	147.087	7.91%
90-100	130.433	7.01%
100-110	114.704	6.17%
110-120	99.478	5.35%
120-130	84.637	4.55%
130-140	69.788	3.75%
140-150	54.659	2.94%
150-160	38.529	2.07%
160-170	21.145	1.14%
170-180	6.223	0.33%
Total	1860.5	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	748.032	40.21%
60- 90	492.88	26.49%
0-90	1240.912	66.70%
90- 180	619.596	33.30%
0- 180	1860.5	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

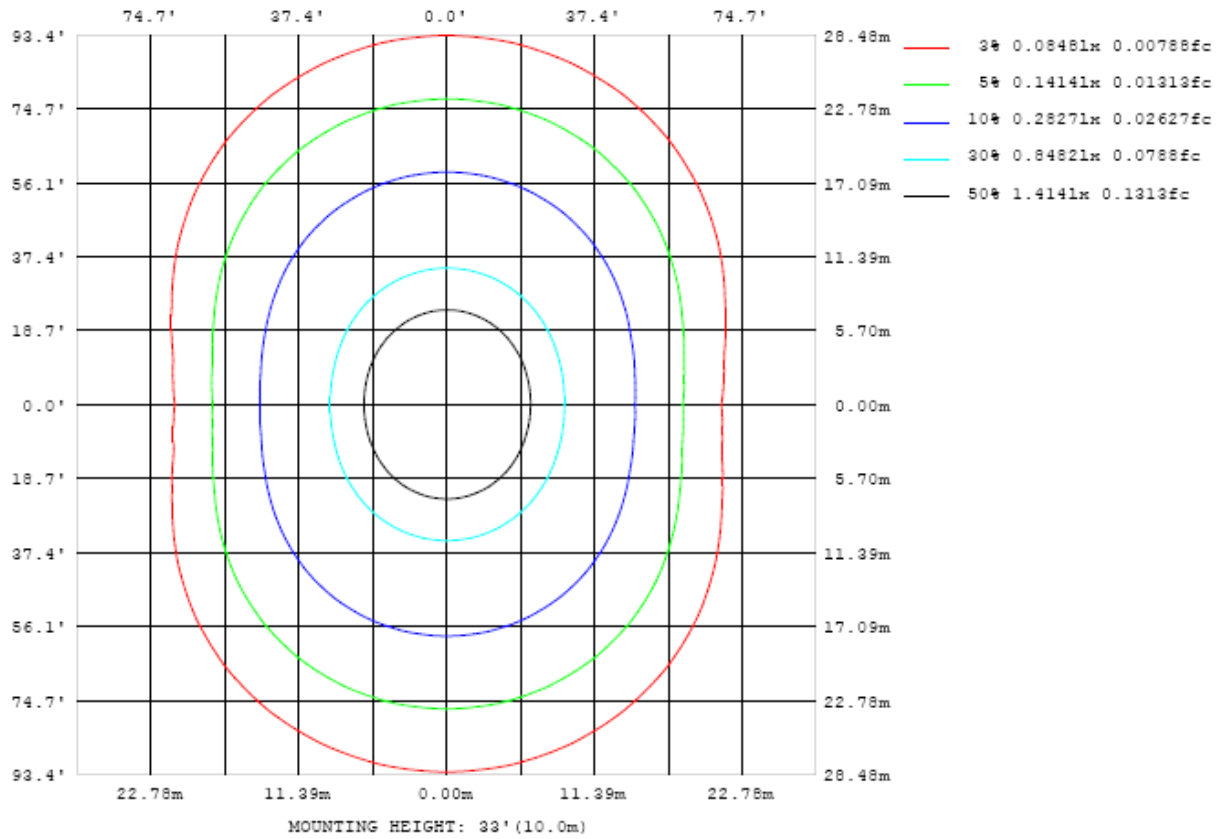


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

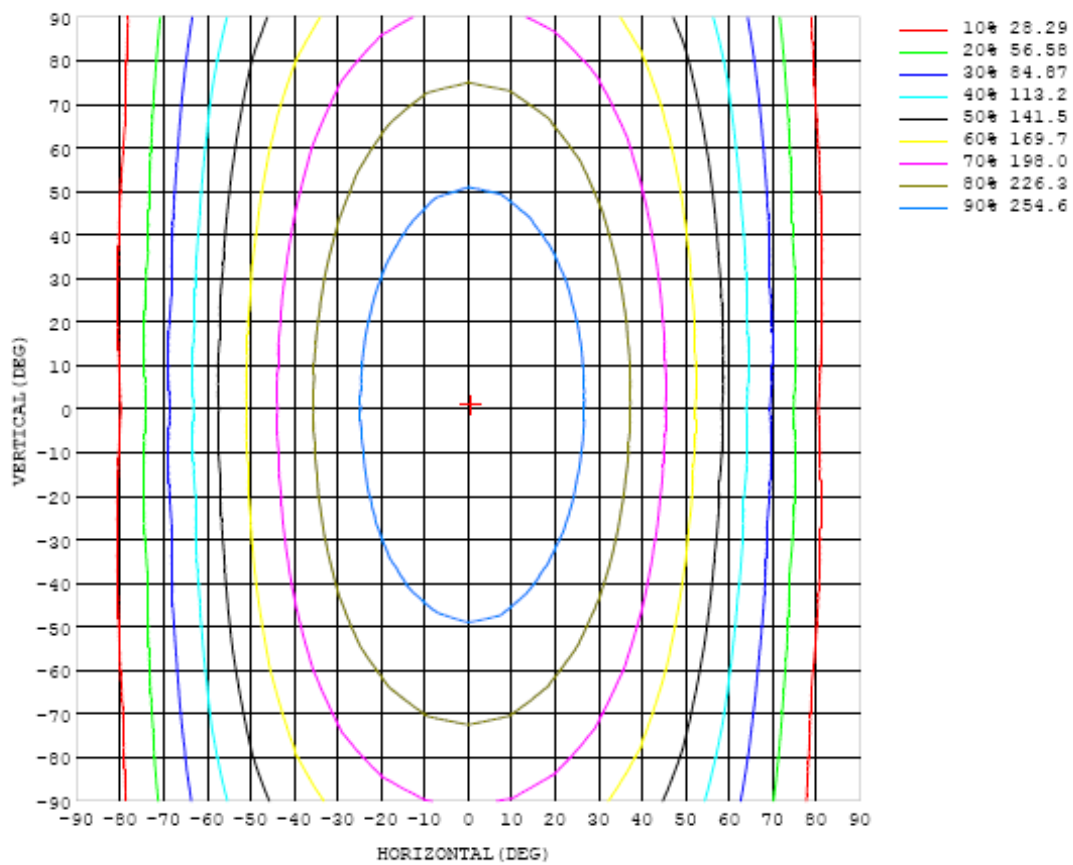


Chart 6: Isocandela Plot

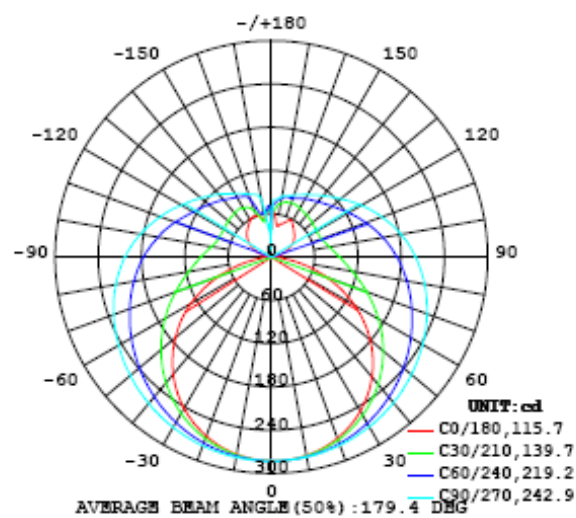


Chart 7: Polar Candela Distribution

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	283	283	283	283	283	283	283	283	283	283	283	283	283	283	283	283	283	283	283
5	282	282	282	282	283	282	283	282	282	282	282	282	282	282	282	282	281	281	281
10	279	280	280	280	280	281	281	281	281	281	281	281	280	280	279	278	278	278	278
15	274	275	275	276	277	278	279	279	280	280	279	278	278	276	275	273	273	272	272
20	267	267	269	270	272	274	275	276	278	278	277	276	274	272	269	267	265	264	264
25	258	259	260	262	266	269	271	273	275	275	274	272	270	266	263	259	256	255	254
30	247	247	249	253	258	262	266	269	271	271	270	268	265	260	255	250	245	243	242
35	233	234	237	242	249	255	260	264	267	268	266	263	259	253	246	239	233	229	228
40	217	219	223	230	239	247	253	259	263	263	262	258	252	244	236	227	219	214	212
45	199	201	207	217	228	238	247	253	258	259	257	252	246	236	225	214	203	196	194
50	179	181	190	202	216	228	239	247	252	253	252	247	238	227	214	200	186	177	174
55	157	160	172	187	204	219	231	240	246	248	246	240	231	218	202	185	168	156	153
60	133	138	152	172	191	209	223	234	240	242	240	234	223	209	190	170	150	134	129
65	108	114	132	156	179	199	215	227	234	236	234	227	216	199	179	155	131	111	104
70	81.3	89.7	113	141	167	190	207	220	227	230	227	220	208	190	168	141	112	87.5	77.6
75	55.3	66.3	94.4	127	156	180	199	212	220	223	220	213	200	181	157	128	95.3	66.1	51.5
80	30.4	45.2	78.4	114	146	171	191	204	213	216	213	205	192	173	148	116	80.5	45.8	27.7
85	10.3	28.6	66.1	103	136	162	183	197	205	208	206	198	184	165	139	106	68.7	31.2	8.63
90	0.62	19.6	57.3	94.6	127	154	174	188	197	200	198	190	176	156	130	98.6	61.6	23.6	0.52
95	2.42	17.1	51.8	87.6	120	146	166	180	189	192	189	181	168	149	123	91.8	56.6	21.6	3.19
100	6.66	18.9	48.6	81.6	112	137	157	171	180	183	180	172	159	141	116	86.3	53.6	23.4	8.15
105	12.5	23.3	47.8	77.3	106	129	148	162	170	173	171	163	151	133	109	81.9	52.7	27.6	14.2
110	18.9	28.8	48.9	74.2	99.9	122	140	152	161	163	161	154	142	125	104	78.9	54.0	33.2	21.0
115	25.3	34.5	51.4	72.6	95.0	115	131	143	151	153	152	145	134	118	98.8	77.2	56.5	38.9	27.8
120	31.9	41.3	54.8	72.6	91.1	109	123	134	142	144	142	136	126	112	95.0	76.8	59.6	45.3	34.4
125	37.3	47.1	58.2	73.1	88.4	103	116	126	132	135	133	128	119	107	92.3	77.0	62.9	51.7	39.8
130	41.4	51.2	61.5	74.1	86.7	99.2	110	118	124	126	124	120	112	102	90.3	77.8	66.0	57.1	44.4
135	45.0	55.7	65.2	75.2	85.5	95.8	105	112	116	118	117	113	107	98.6	88.9	78.7	68.7	62.0	48.3
140	48.5	60.7	69.1	76.3	84.8	93.1	100	106	110	111	111	107	102	95.6	87.9	79.7	72.0	66.4	51.6
145	52.4	65.1	71.8	77.1	84.2	91.0	96.6	101	104	105	105	102	98.4	93.1	87.3	80.6	75.1	70.6	55.1
150	57.0	68.3	73.6	78.7	83.0	88.8	93.3	97.0	99.4	100	99.7	97.8	95.0	91.1	86.7	82.0	77.5	74.0	59.0
155	55.8	68.4	75.6	80.1	82.6	86.2	90.0	92.8	94.8	95.4	95.3	94.2	92.2	89.5	86.5	82.5	76.5	72.7	61.4
160	50.1	69.1	76.6	80.2	83.3	85.0	86.9	89.0	90.7	91.2	91.3	90.9	89.9	88.2	85.9	81.6	74.3	68.1	61.1
165	47.5	62.9	76.5	79.1	82.2	84.9	86.3	87.2	88.1	88.5	88.8	88.7	88.1	86.3	80.2	71.5	65.2	62.2	57.0
170	44.5	54.8	70.3	75.8	77.6	80.7	82.9	84.3	85.3	85.6	85.7	85.6	82.3	74.4	66.9	61.9	62.1	60.8	55.6
175	56.7	58.0	61.4	68.0	72.2	74.7	76.9	79.6	80.7	80.6	81.4	77.3	67.0	57.4	54.2	57.1	59.0	59.0	60.1
180	55.4	55.4	55.4	55.4	55.4	55.4	55.4	55.4	55.4	55.4	55.4	55.4	55.4	55.4	55.4	55.4	55.4	55.4	55.4

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	283	283	283	283	283	283	283	283	283	283	283	283	283	283	283	283	283		
5	281	281	281	282	282	282	282	283	283	283	283	282	282	282	282	282	282		
10	278	278	279	279	280	280	281	282	282	282	282	281	281	281	280	280	280		
15	272	273	274	275	277	278	279	280	280	280	280	279	279	278	276	275	275		
20	264	266	268	270	272	274	276	278	278	278	278	276	275	273	271	269	268		
25	255	257	260	263	267	270	273	275	276	276	274	272	270	267	263	261	259		
30	243	246	250	255	260	265	268	271	273	272	270	267	264	259	255	250	248		
35	230	234	239	246	253	259	264	268	269	268	266	262	257	250	244	239	235		
40	214	219	227	236	245	253	259	263	265	264	261	256	249	241	232	225	219		
45	197	204	214	226	237	246	253	259	260	259	255	249	241	230	219	209	202		
50	177	187	200	214	228	239	248	253	255	254	250	242	232	219	205	192	183		
55	157	169	185	203	218	232	241	248	250	249	243	235	222	207	190	174	163		
60	135	151	170	191	209	224	235	242	245	243	237	227	213	195	175	156	141		
65	112	131	156	179	200	217	229	236	239	237	230	219	203	183	161	137	117		
70	87.7	112	141	168	191	209	222	230	233	231	223	212	194	172	146	118	93.4		
75	64.7	94.9	128	158	182	202	215	223	226	224	216	204	185	162	133	100	70.1		
80	44.3	79.6	116	149	174	194	208	216	219	217	209	196	177	152	120	84.2	49.1		
85	29.1	68.0	106	140	166	186	200	209	211	209	201	187	168	143	110	71.8	32.9		
90	21.4	59.8	98.1	131	158	178	192	200	203	201	192	179	160	134	101	62.8	23.9		
95	18.9	54.0	90.7	123	150	169	183	191	194	192	184	170	151	125	93.1	56.2	20.2		
100	21.2	50.8	84.6	115	141	160	173	181	184	182	174	161	142	117	86.2	51.9	21.3		
105	25.9	50.8	79.9	108	132	151	163	172	174	172	164	152	133	109	80.8	50.8	25.2		
110	31.9	52.5	77.7	102	124	142	154	162	164	162	155	142	125	103	77.4	51.5	30.6		
115	38.1	55.6	76.7	98.1	117	133	145	152	154	152	145	133	117	97.7	75.6	53.8	36.9		
120	43.9	58.9	76.6	95.0	112	126	136	142	144	142	136	126	111	94.0	74.9	56.4	42.5		
125	48.6	62.5	77.1	92.7	107	119	128	134	136	134	128	119	107	91.4	75.1	60.3	47.3		
130	53.3	66.2	78.0	90.9	103	113	121	126	128	126	121	113	102	89.3	75.6	64.3	51.7		
135	56.7	69.1	78.9	89.5	99.7	108	115	119	120	119	114	108	98.7	87.5	77.1	67.6	56.0		
140	59.3	70.4	79.5	88.5	96.5	104	109	113	114	112	109	103	95.1	86.9	78.7	70.8	58.8		
145	60.5	74.2	80.6	87.7	93.9	99.3	104	106	107	106	103	98.4	93.0	86.5	79.4	73.0	60.4		
150	60.2	76.7	77.7	83.8	92.0	95.8	99.0	101	102	101	98.7	95.5	91.2	86.0	80.9	75.4	60.5		
155	55.8	71.0	76.1	80.0	87.2	92.8	95.0	96.6	97.2	96.7	95.1	92.9	89.8	85.9	82.5	73.3	55.4		
160	51.1	59.7	67.4	70.3	74.0	83.9	91.8	92.7	93.3	92.9	92.0	90.7	88.6	86.1	83.8	64.5	47.9		
165	49.5	51.0	56.0	59.7	63.5	64.4	73.4	87.5	89.9	89.9	89.5	88.4	86.1	83.7	76.7	49.0	44.5		
170	51.5	51.7	52.6	56.8	59.4	63.5	58.4	57.4	80.6	85.9	83.7	80.5	75.4	63.5	50.6	46.8	45.8		
175	59.9	61.6	64.4	66.2	67.5	67.7	68.6	64.1	36.0	52.0	66.5	65.7	64.1	64.8	63.9	60.5	56.9		
180	55.4	55.4	55.4	55.4	55.4	55.4	55.4	55.4	55.4	55.4	55.4	55.4	55.4	55.4	55.4	55.4	55.4		

Table 7: Luminous Intensity Data

EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Aug. 14, 2018	Aug. 13, 2019
Digital Power Meter	PF2010A	HZTE028-01	Sep. 12, 2018	Sep. 11, 2019
AC Power Supply	DPS1060	HZTE001-06	Aug. 09, 2018	Aug. 08, 2019
DC Power Supply	WY12010	HZTE004-03	Aug. 09, 2018	Aug. 08, 2019
Temperature recorder	JM624U	HZTE018-08	Aug. 09, 2018	Aug. 08, 2019
Temperature and humidity recorder	JR900	HZTE018-01	Aug. 09, 2018	Aug. 08, 2019
Standard source	D908	HZTE012-01	Aug. 14, 2018	Aug. 13, 2019
Integrate Sphere system	3M	HZTE015-04	Aug. 16, 2018	Aug. 15, 2019
Digital Power Meter	WT210	HZTE008-01	Aug. 02, 2018	Aug. 01, 2019
AC Power Supply	PCR 500L	HZTE001-07	Aug. 09, 2018	Aug. 08, 2019
DC Power Supply	IT6154	HZTE004-04	Aug. 09, 2018	Aug. 08, 2019
Standard source	SCL-1400	HZTE012-02	Aug. 16, 2018	Aug. 15, 2019
Temperature and humidity recorder	JR900	HZTE018-02	Aug. 09, 2018	Aug. 08, 2019
Temperature Meter	TES1310	HZTE017-01	Aug. 09, 2018	Aug. 08, 2019

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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