

LM-79-08 TEST REPORT

for

GREEN CREATIVE LTD

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

LED Tube

Model: 15T8/4F/850/HYB

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ19090007f

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

Review by:



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Sep. 10, 2019

Approved by:



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Sep. 10, 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: 15T8/4F/850/HYB

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)/2	Power Factor
130.3	2260.1	17.34	0.9977
CCT (K)	CRI	Stabilization Time (Light & Power)	
5103	83.0	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	: Sep. 05, 2019
Date of Test	: Sep. 09, 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

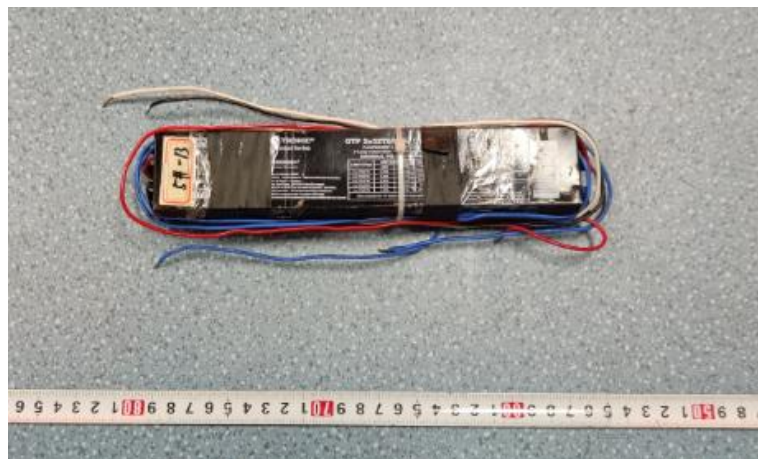


Figure 1- Overview of the sample

Equipment Under Test(EUT)

Name	: LED Tube
Model	: 15T8/4F/850/HYB
Electrical Ratings	: 120-277V, 60Hz, 15W
Product Description	: 5000K LED tubes supplied by a high frequency fluorescent lamp ballast: QTP 2x32T8/UNV ISN-SC
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)	0.290	0.130
Power Factor	0.9977	0.9687
Test Power (W)/2	17.34	17.38
THD A%	4.76	10.53
Luminous Efficacy (lm/W)	130.3	130.1
Total Luminous Flux (lm)	2260.1	2260.7
Color Rendering Index (CRI)	83.0	
R9	6.3	
Correlated Color Temperature (CCT)(K)	5103	
Chromaticity Chroma x	0.3426	
Chromaticity Chroma y	0.3547	
Chromaticity Chroma u	0.2085	
Chromaticity Chroma v	0.3239	
Duv	0.0026	
Chromaticity Chroma u'	0.2085	
Chromaticity Chroma v'	0.4858	

Special Color Rendering Indices	
R1	81.2
R2	88.4
R3	93
R4	82.6
R5	81.8
R6	83.4
R7	86.8
R8	66.8
R9	6.3
R10	72.2
R11	81.9
R12	60.1
R13	83.2
R14	96.4

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 25.2 °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)	0.294
Power Factor	0.9878
Power (W)/2	17.41
Luminous Efficacy (lm/W)	127.7
Total Luminous Flux (lm)	2223.1
Beam Angle (°)	111.0 (0°-180°) / 204.9 (90°-270°)
Center Beam Candle Power (cd)	392
Maximum Beam Candle Power (cd)	391.8 (At: C=190.0, Gamma=1.5)
Spacing Criteria	1.27 (0°-180°) / 1.41 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	44.67%
Zonal Lumens in the 60 °-90 °Zone	26.73%
Zonal Lumens in the 90 °-120 °Zone	16.78%
Zonal Lumens in the 120 °-180 °Zone	11.82%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

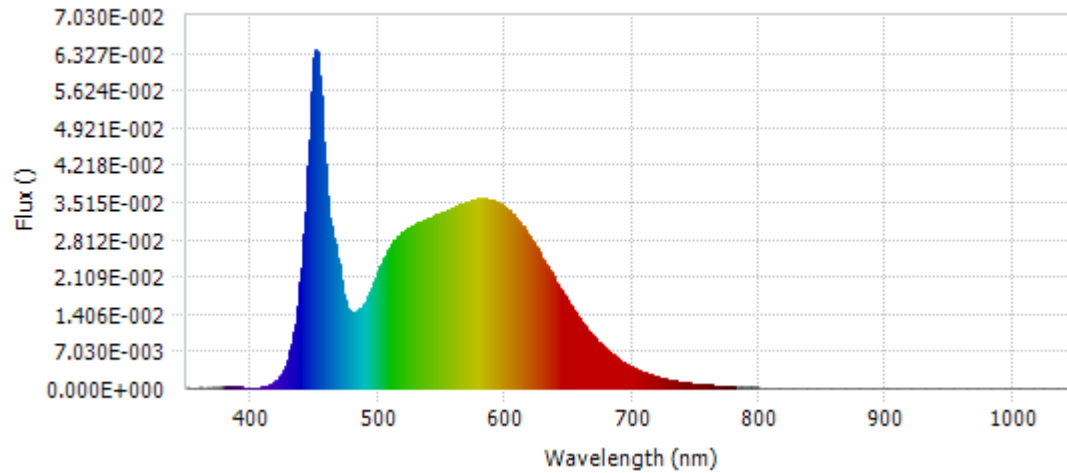
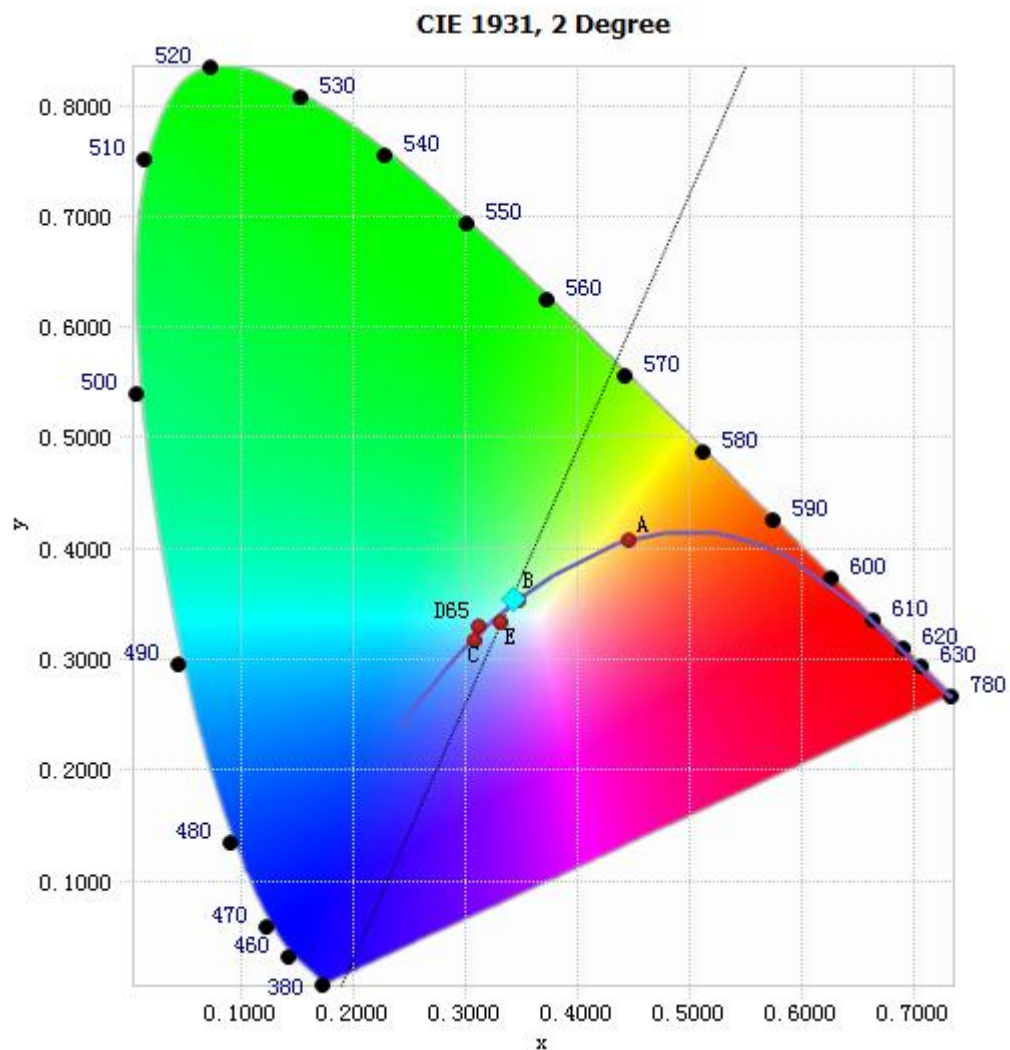


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.33E-04	485	1.48E-02	590	3.54E-02	695	4.62E-03
385	2.10E-04	490	1.63E-02	595	3.49E-02	700	3.96E-03
390	2.13E-04	495	1.89E-02	600	3.42E-02	705	3.39E-03
395	1.72E-04	500	2.19E-02	605	3.30E-02	710	2.88E-03
400	1.37E-04	505	2.46E-02	610	3.17E-02	715	2.48E-03
405	1.29E-04	510	2.67E-02	615	3.01E-02	720	2.11E-03
410	2.89E-04	515	2.85E-02	620	2.83E-02	725	1.81E-03
415	6.46E-04	520	2.96E-02	625	2.63E-02	730	1.54E-03
420	1.42E-03	525	3.04E-02	630	2.43E-02	735	1.32E-03
425	3.05E-03	530	3.10E-02	635	2.22E-02	740	1.12E-03
430	6.24E-03	535	3.15E-02	640	2.02E-02	745	9.61E-04
435	1.22E-02	540	3.21E-02	645	1.81E-02	750	8.17E-04
440	2.28E-02	545	3.26E-02	650	1.62E-02	755	7.03E-04
445	4.19E-02	550	3.31E-02	655	1.43E-02	760	5.96E-04
450	6.23E-02	555	3.36E-02	660	1.26E-02	765	5.11E-04
455	5.52E-02	560	3.42E-02	665	1.11E-02	770	4.41E-04
460	3.64E-02	565	3.47E-02	670	9.65E-03	775	3.77E-04
465	2.84E-02	570	3.52E-02	675	8.38E-03	780	3.27E-04
470	2.18E-02	575	3.55E-02	680	7.27E-03		
475	1.59E-02	580	3.56E-02	685	6.27E-03		
480	1.42E-02	585	3.57E-02	690	5.39E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3426, 0.3547)

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

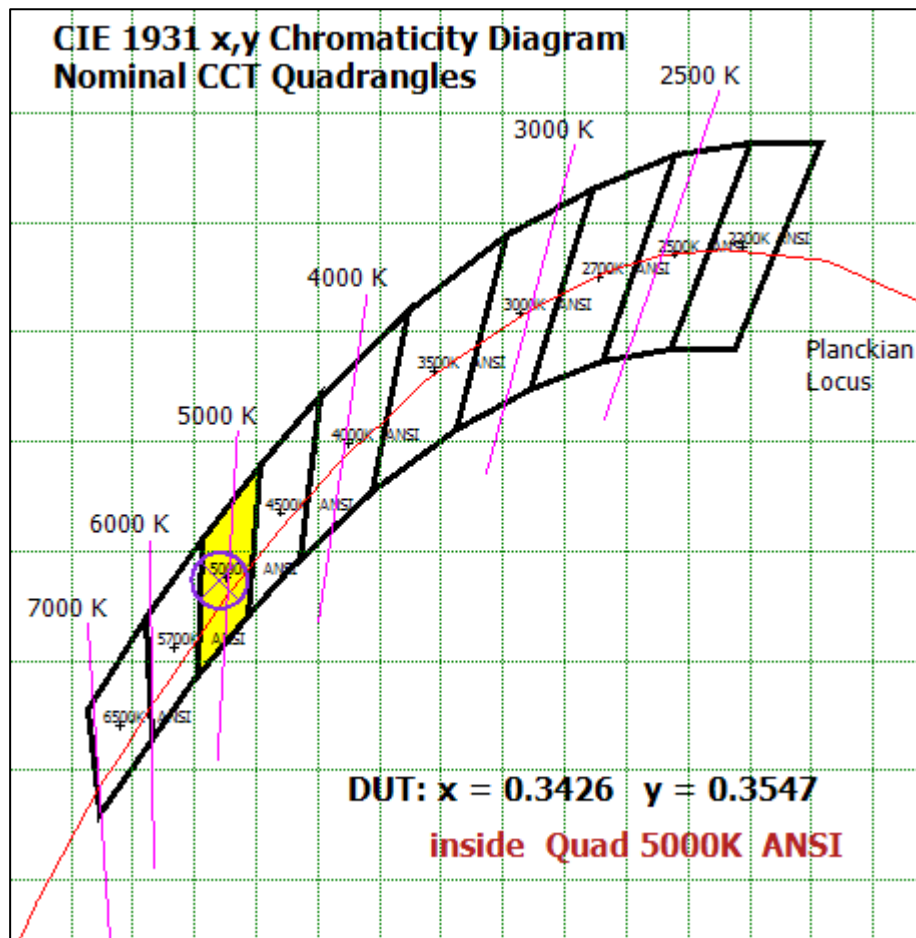
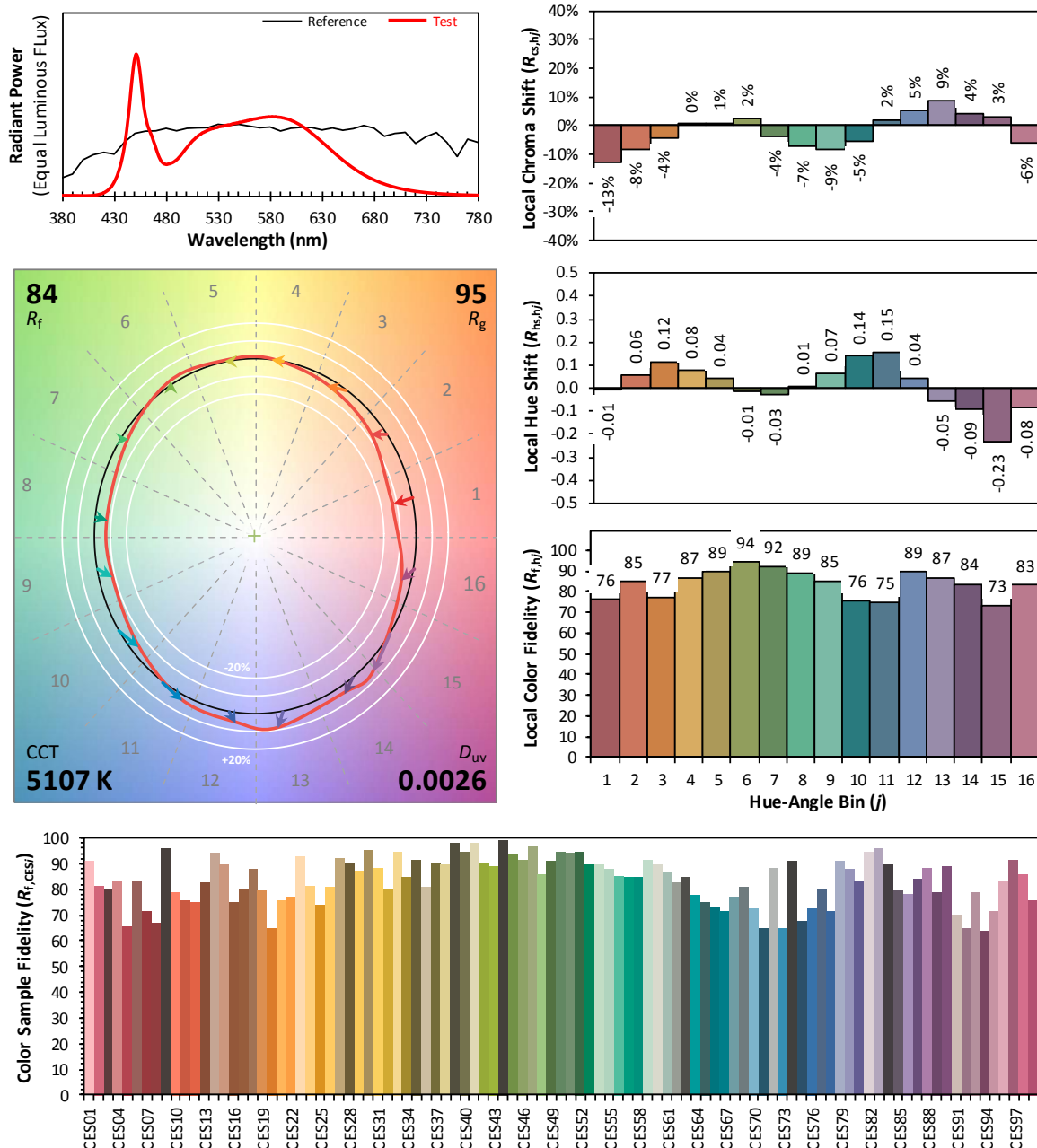


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method



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

x 0.3426

y 0.3547

u' 0.2085

v' 0.4858

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	37.145	1.67%
10- 20	107.59	4.84%
20- 30	167.076	7.52%
30- 40	210.106	9.45%
40- 50	233.641	10.51%
50- 60	237.458	10.68%
60- 70	224.251	10.09%
70- 80	199.294	8.96%
80- 90	170.571	7.67%
90-100	145.639	6.55%
100-110	123.877	5.57%
110-120	103.605	4.66%
120-130	84.824	3.82%
130-140	67.47	3.04%
140-150	51.164	2.30%
150-160	34.89	1.57%
160-170	18.567	0.84%
170-180	5.892	0.27%
Total	2223.1	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	993.016	44.67%
60- 90	594.116	26.73%
0-90	1587.132	71.39%
90- 180	635.928	28.61%
0- 180	2223.1	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

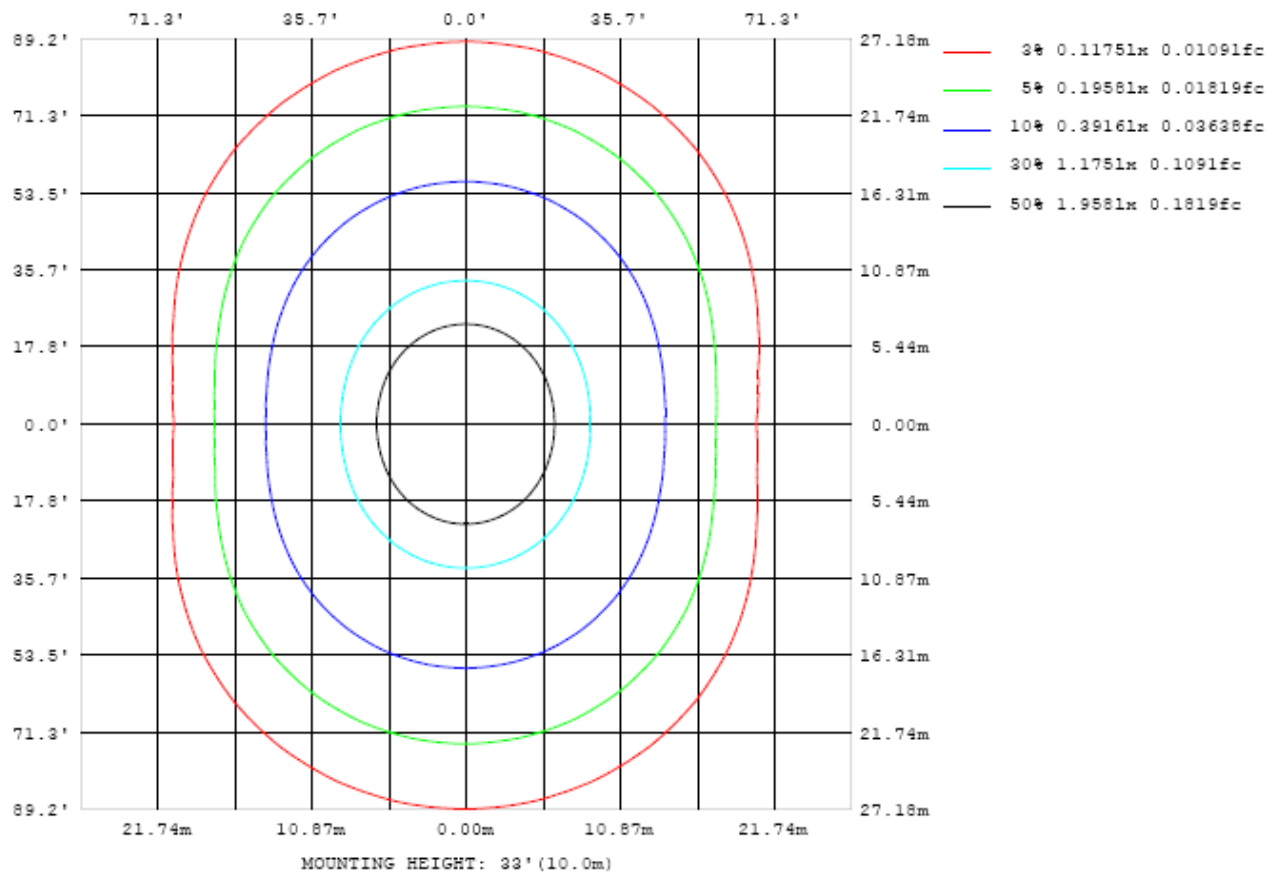


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

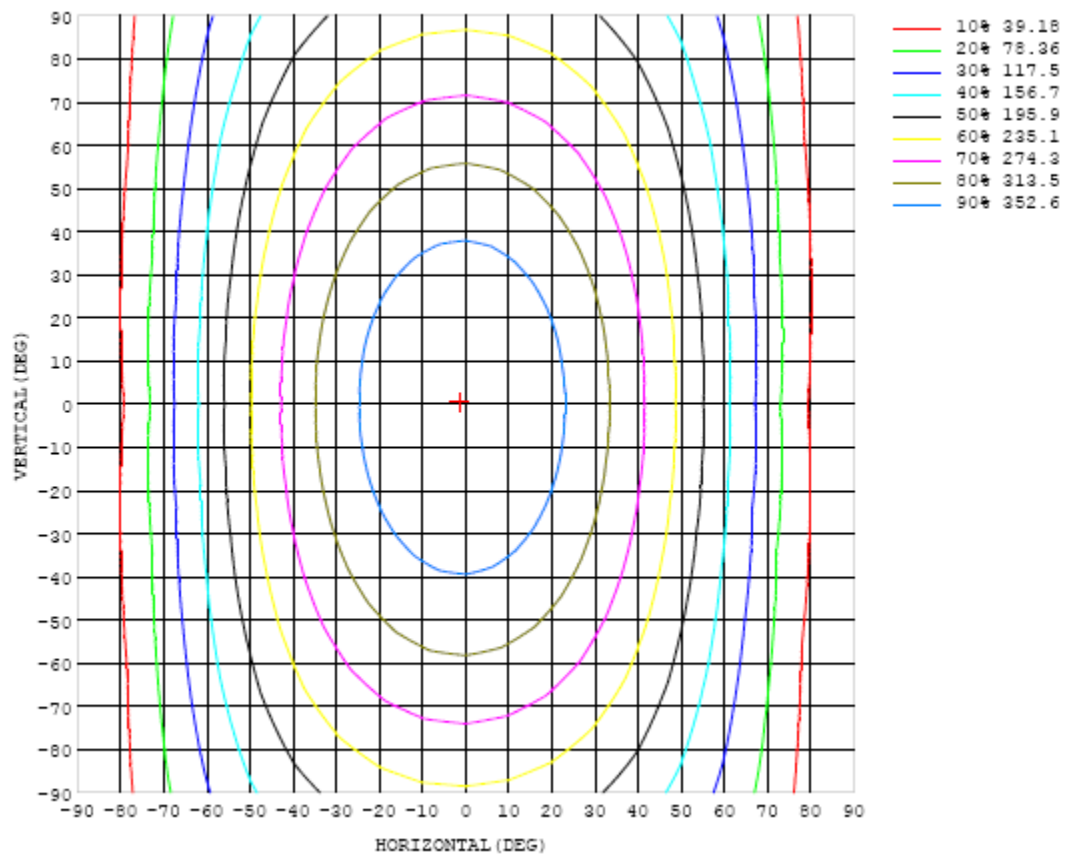


Chart 6: Isocandela Plot

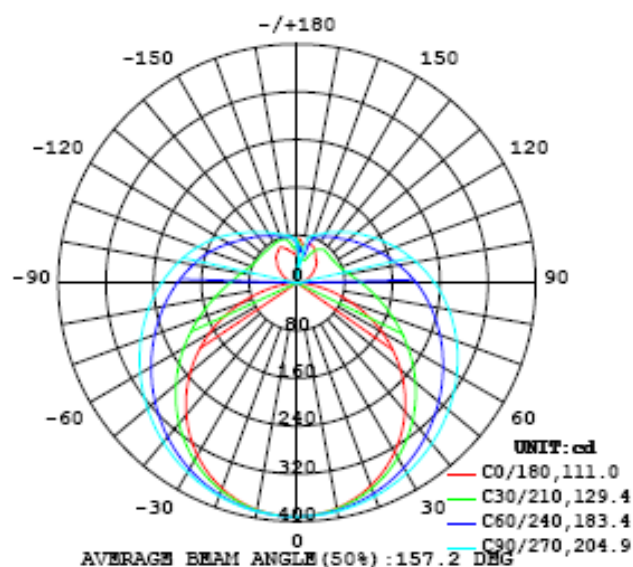


Chart 7: Polar Candela Distribution

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	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392
5	389	389	389	390	390	390	390	390	391	391	391	391	391	391	391	391	391	391	391
10	383	384	384	385	385	386	387	388	388	389	389	389	388	388	387	387	386	386	386
15	374	375	376	377	379	380	382	384	385	385	386	385	384	383	381	380	379	378	378
20	362	362	364	366	369	373	375	378	380	381	381	380	378	376	373	371	368	367	367
25	346	347	349	353	358	363	367	371	374	375	375	373	370	366	362	358	355	353	352
30	327	329	332	338	345	352	358	363	366	368	368	365	361	356	350	344	338	335	334
35	306	308	313	321	330	339	347	354	358	360	360	356	351	343	335	327	320	314	313
40	282	284	291	301	313	325	336	344	349	351	351	346	339	330	319	308	298	291	289
45	255	259	268	281	296	310	323	333	339	342	341	336	327	315	302	288	275	266	262
50	227	231	243	259	277	295	310	321	329	332	330	324	314	300	284	266	250	238	233
55	196	202	216	237	259	279	297	309	317	321	319	312	301	285	265	244	223	208	202
60	164	171	190	214	240	264	283	297	306	309	307	300	287	269	247	221	196	177	170
65	131	140	163	193	222	248	269	284	293	297	295	287	273	254	229	199	169	145	135
70	98.0	109	137	172	205	233	255	271	281	285	282	274	259	238	211	179	144	113	101
75	65.6	79.2	114	153	188	218	241	258	268	272	269	261	246	224	195	159	120	82.8	66.6
80	35.4	53.0	93.2	135	173	204	227	244	254	258	256	247	232	209	179	142	99.4	57.0	35.4
85	11.4	33.1	77.1	121	159	190	214	231	241	245	243	234	218	196	165	127	83.3	37.6	10.7
90	0.53	22.4	65.4	108	146	176	200	217	227	231	229	220	204	182	152	115	71.7	26.9	0.44
95	2.43	18.7	56.8	97.1	133	163	186	203	213	217	214	206	191	169	140	104	63.0	22.8	2.48
100	6.58	19.8	51.8	88.4	122	151	173	189	199	203	200	192	178	156	129	94.9	57.8	23.6	6.87
105	12.1	22.5	49.7	81.8	113	140	161	176	185	189	187	179	165	145	119	88.0	55.4	25.8	12.4
110	18.0	26.4	49.6	77.3	105	129	149	163	172	175	174	166	153	134	110	83.3	55.4	29.1	18.2
115	23.5	30.6	50.4	74.1	98.4	120	138	151	159	163	161	154	142	125	104	80.0	55.9	32.1	23.8
120	29.0	34.3	52.4	72.3	93.2	113	128	140	147	150	149	142	132	117	98.5	77.8	57.3	34.8	29.5
125	34.4	36.3	54.0	70.9	88.7	106	120	130	137	139	138	132	123	110	93.4	75.8	59.3	36.7	35.3
130	40.8	36.0	53.2	71.0	85.2	99.6	112	121	127	129	128	123	115	103	89.5	74.8	60.4	37.4	41.9
135	46.4	35.2	51.2	71.0	82.6	94.7	105	113	118	120	119	115	108	98.1	86.2	74.2	59.1	37.0	47.2
140	50.3	36.4	51.7	72.0	81.6	91.1	99.5	106	110	112	111	107	101	92.9	82.9	73.6	54.3	37.2	54.2
145	55.0	40.6	50.6	68.9	79.7	87.7	94.4	99.8	103	104	103	100	94.5	88.0	80.4	70.5	50.8	41.6	59.0
150	60.9	48.3	47.9	64.0	76.2	85.0	90.0	94.0	96.3	96.3	95.4	92.9	89.2	83.8	75.9	66.7	46.7	47.5	62.6
155	65.9	53.5	39.8	53.5	71.4	80.1	86.3	88.9	89.9	89.9	89.5	87.3	81.9	70.7	60.9	56.5	40.2	55.5	66.2
160	68.2	55.2	43.1	41.8	56.7	71.3	77.7	82.9	84.7	85.2	84.5	80.7	67.3	51.4	49.5	43.6	41.3	52.4	62.0
165	65.4	60.4	49.4	39.6	39.4	43.0	48.2	67.9	73.7	79.3	82.4	87.5	98.8	106.3	99.5	87.3	62.9	51.7	57.5
170	64.3	58.9	58.2	53.1	49.0	49.2	55.0	57.2	55.4	55.6	55.8	56.1	51.1	46.5	45.0	45.7	47.3	49.8	52.3
175	72.3	62.5	55.8	54.8	57.8	60.6	60.9	52.5	32.1	16.8	40.1	52.7	56.5	54.7	53.2	51.7	49.4	47.6	48.4
180	63.9	63.9	63.9	63.9	63.9	63.9	63.9	63.9	63.9	63.9	63.9	63.9	63.9	63.9	63.9	63.9	63.9	63.9	63.9

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	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392		
5	391	391	391	391	391	391	391	391	391	391	391	390	390	390	390	389	389		
10	386	386	387	387	388	388	389	389	389	388	388	387	386	385	385	384	384		
15	378	379	380	381	383	384	385	385	385	385	384	382	380	378	377	375	374		
20	367	368	371	373	376	378	379	380	380	380	378	375	372	369	366	364	362		
25	352	355	358	362	366	370	372	374	374	373	370	367	363	358	353	349	347		
30	335	339	344	349	355	360	364	366	367	365	362	357	351	344	338	332	328		
35	315	320	327	335	342	349	354	357	358	356	352	346	338	329	321	313	307		
40	292	298	308	318	328	337	344	348	348	347	341	334	324	313	301	291	284		
45	266	275	287	300	313	324	332	337	338	336	330	321	309	295	281	268	259		
50	238	249	265	282	297	310	320	326	327	325	318	307	293	277	259	243	231		
55	208	223	242	263	281	296	307	314	315	313	305	293	277	258	237	217	202		
60	177	195	219	244	265	282	294	301	303	300	292	279	261	240	215	191	173		
65	145	168	197	225	249	268	281	289	291	288	279	265	246	221	194	166	142		
70	113	143	176	207	233	254	268	276	278	275	266	251	230	204	173	141	112		
75	82.8	118	157	191	219	240	255	263	265	262	253	237	216	188	155	117	83.1		
80	55.9	97.2	140	175	204	226	242	250	253	249	240	224	202	173	138	96.9	57.4		
85	35.8	80.8	125	162	191	213	229	237	240	236	227	211	189	160	123	80.7	37.5		
90	25.1	69.2	113	150	178	201	216	224	227	224	214	198	176	147	111	69.0	26.0		
95	21.4	61.8	103	139	168	188	203	212	214	211	202	186	165	136	101	61.2	21.4		
100	22.2	56.6	94.7	129	156	177	191	199	202	198	190	175	154	126	93.0	55.5	21.0		
105	25.5	53.9	87.7	119	146	166	179	187	189	186	178	164	143	117	85.7	52.1	24.1		
110	30.6	53.7	82.1	111	135	154	167	174	176	174	166	152	133	108	79.9	51.1	28.7		
115	36.3	55.0	78.7	103	125	143	155	163	165	162	154	141	123	101	75.9	51.9	33.4		
120	41.6	56.9	76.9	97.3	116	132	144	150	152	150	142	130	114	94.5	73.6	54.0	38.6		
125	46.9	59.1	75.9	93.1	109	122	132	138	140	138	131	120	106	90.1	72.5	56.5	44.0		
130	52.1	61.6	75.3	89.9	103	114	123	128	129	127	121	112	101	86.9	72.4	59.6	49.5		
135	56.7	64.1	74.7	87.0	98.2	107	114	118	120	118	113	106	95.9	84.4	72.8	62.8	54.5		
140	59.8	67.0	74.7	84.2	93.7	102	107	111	112	110	106	99.9	91.8	82.6	73.8	65.9	58.5		
145	62.7	69.6	75.0	82.0	89.3	95.8	101	103	104	103	99.7	94.6	88.3	81.5	74.8	68.4	62.0		
150	66.8	71.6	75.9	80.4	85.7	90.9	94.5	96.6	97.2	96.3	93.9	90.3	85.8	80.8	75.8	70.2	66.5		
155	66.2	71.7	76.7	79.9	82.7	86.7	89.7	91.3	91.8	91.2	89.5	86.9	83.7	80.0	76.2	71.8	68.7		
160	68.4	73.8	77.0	79.3	81.3	82.9	85.0	86.4	86.8	86.5	85.5	83.9	81.7	78.9	75.8	72.5	71.3		
165	62.1	66.9	76.3	77.8	79.1	80.7	82.4	83.4	83.5	83.3	82.6	81.5	79.9	77.9	75.5	73.5	72.4		
170	55.4	59.4	68.1	74.5	76.8	77.5	78.0	79.0	80.0	79.8	79.1	78.5	77.7	76.1	75.1	75.2	72.8		
175	49.7	52.9	59.9	66.2	70.8	74.1	75.0	74.3	73.6	74.4	75.6	76.4	76.4	76.3	76.3	76.6	76.6		
180	63.9	63.9	63.9	63.9	63.9	63.9	63.9	63.9	63.9	63.9	63.9	63.9	63.9	63.9	63.9	63.9	63.9		

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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