



LM-79-08 Test Report

for

GREEN CREATIVE LTD

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

LED Tube

Model: 11.5T5HO/2F/835/BYP

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ19020002w

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

Review by:

April Zou

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Feb. 22, 2019

Approved by:



Jim Zhang

Manager: Jim Zhang
Feb. 22, 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: 11.5T5HO/2F/835/BYP

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
139.4	1526.0	10.95	0.9784
CCT (K)	CRI	Stabilization Time (Light & Power)	
3334	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	: Feb. 01, 2019
Date of Test	: Feb. 20, 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

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Sample Photo



Figure 1- Overview of the sample

Equipment Under Test(EUT)

Name	: LED Tube
Model	: 11.5T5HO/2F/835/BYP
Electrical Ratings	: 120-277V, 50/60Hz, 11.5W
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 70 minutes.

Sphere-Spectroradiometer Method

Parameter	Result	
Test Voltage (V)	120.0	277.0
Voltage frequency (Hz)	60	60
Test Current (A)	0.093	0.043
Power Factor	0.9784	0.9427
Test Power (W)	10.95	11.32
THD A%	19.07	19.65
Luminous Efficacy (lm/W)	139.4	134.7
Total Luminous Flux (lm)	1526.0	1525.0
Color Rendering Index (CRI)	81.6	
R9	0.4	
Correlated Color Temperature (CCT)(K)	3334	
Chromaticity Chroma x	0.4143	
Chromaticity Chroma y	0.3940	
Chromaticity Chroma u	0.2402	
Chromaticity Chroma v	0.3426	
Duv	0.0011	
Chromaticity Chroma u'	0.2402	
Chromaticity Chroma v'	0.5140	

Special Color Rendering Indices	
R1	79.7
R2	89
R3	96
R4	80.5
R5	80.1
R6	86
R7	83.1
R8	58.5
R9	0.4
R10	74.7
R11	80
R12	68.1
R13	81.9
R14	98.1
Rf	84
Rg	97

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 25.1 °C.

The photometric distance is 2.47m.

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)	0.093
Power Factor	0.9789
Test Power (W)	10.97
Luminous Efficacy (lm/W)	137.0
Total Luminous Flux (lm)	1502.7
Beam Angle (°)	116.3
Center Beam Candle Power (cd)	425
Spacing Criteria	1.20 (0 °-180 °)/ 1.30 (90 °-270 °)
Zonal Lumens in the 0 °-60 °Zone	63.98%
Zonal Lumens in the 60 °-90 °Zone	25.72%
Zonal Lumens in the 90 °-120 °Zone	7.93%
Zonal Lumens in the 120 °-180 °Zone	2.36%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

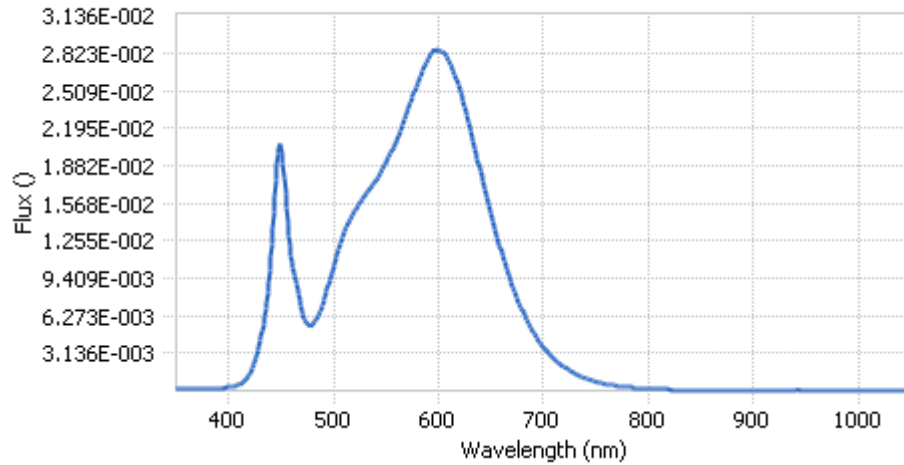
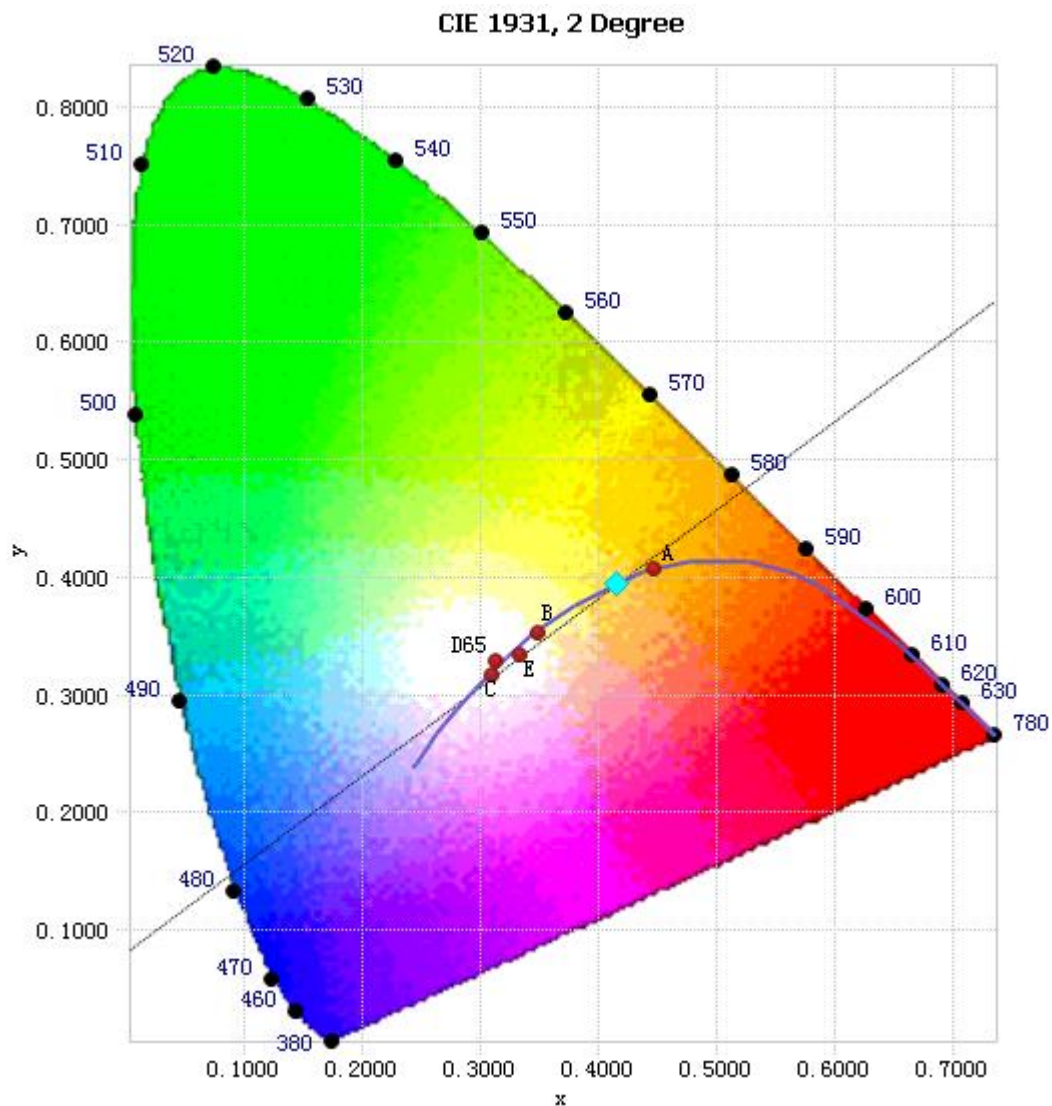


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.36E-04	485	6.16E-03	590	2.77E-02	695	4.26E-03
385	2.32E-04	490	7.27E-03	595	2.83E-02	700	3.65E-03
390	2.45E-04	495	8.85E-03	600	2.84E-02	705	3.11E-03
395	2.71E-04	500	1.05E-02	605	2.82E-02	710	2.67E-03
400	3.02E-04	505	1.19E-02	610	2.76E-02	715	2.29E-03
405	3.84E-04	510	1.32E-02	615	2.65E-02	720	1.96E-03
410	5.49E-04	515	1.43E-02	620	2.51E-02	725	1.68E-03
415	8.63E-04	520	1.50E-02	625	2.36E-02	730	1.43E-03
420	1.44E-03	525	1.57E-02	630	2.19E-02	735	1.23E-03
425	2.47E-03	530	1.64E-02	635	2.01E-02	740	1.04E-03
430	4.17E-03	535	1.69E-02	640	1.83E-02	745	8.97E-04
435	6.82E-03	540	1.75E-02	645	1.65E-02	750	7.66E-04
440	1.12E-02	545	1.83E-02	650	1.48E-02	755	6.58E-04
445	1.77E-02	550	1.90E-02	655	1.31E-02	760	5.70E-04
450	2.04E-02	555	2.00E-02	660	1.16E-02	765	4.86E-04
455	1.52E-02	560	2.10E-02	665	1.01E-02	770	4.20E-04
460	1.08E-02	565	2.21E-02	670	8.82E-03	775	3.62E-04
465	8.88E-03	570	2.33E-02	675	7.67E-03	780	3.16E-04
470	6.73E-03	575	2.44E-02	680	6.68E-03		
475	5.52E-03	580	2.58E-02	685	5.76E-03		
480	5.61E-03	585	2.69E-02	690	4.96E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4143, 0.3940)

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

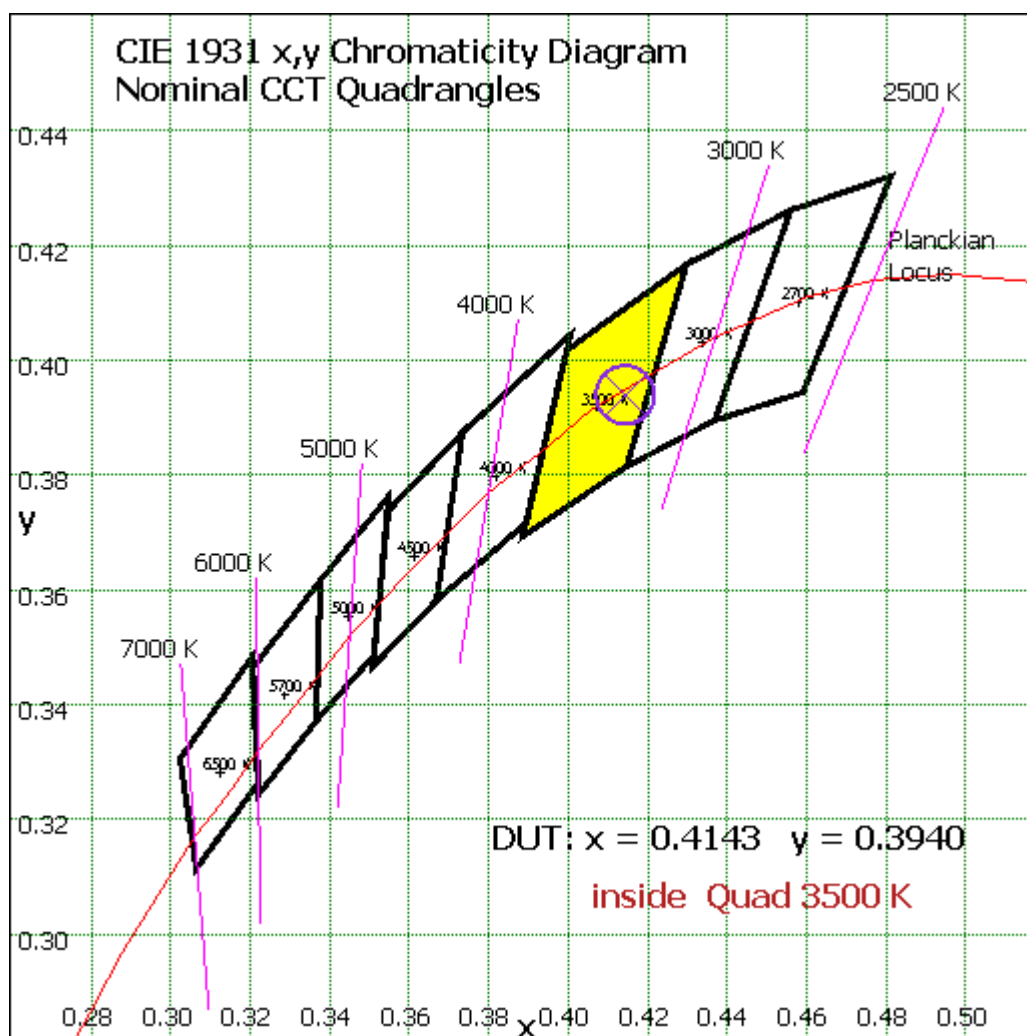


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Vector – Sphere Spectroradiometer Method

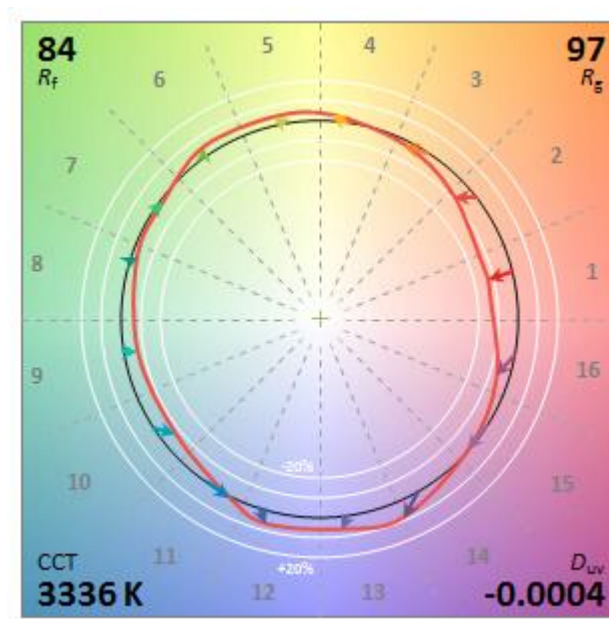


Chart 4: Color Vector Diagram of TM-30-18

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	40.124	2.67%
10- 20	114.775	7.64%
20- 30	173.672	11.56%
30- 40	209.532	13.94%
40- 50	219.149	14.58%
50- 60	204.213	13.59%
60- 70	170.847	11.37%
70- 80	128.218	8.53%
80- 90	87.443	5.82%
90-100	57.874	3.85%
100-110	37.805	2.52%
110-120	23.517	1.56%
120-130	14.739	0.98%
130-140	9.38	0.62%
140-150	5.85	0.39%
150-160	3.428	0.23%
160-170	1.698	0.11%
170-180	0.431	0.03%
Total	1502.7	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	961.465	63.98%
60- 90	386.508	25.72%
0-90	1347.973	89.70%
90- 180	154.722	10.30%
0- 180	1502.7	100%

Table 5: Zonal Lumen

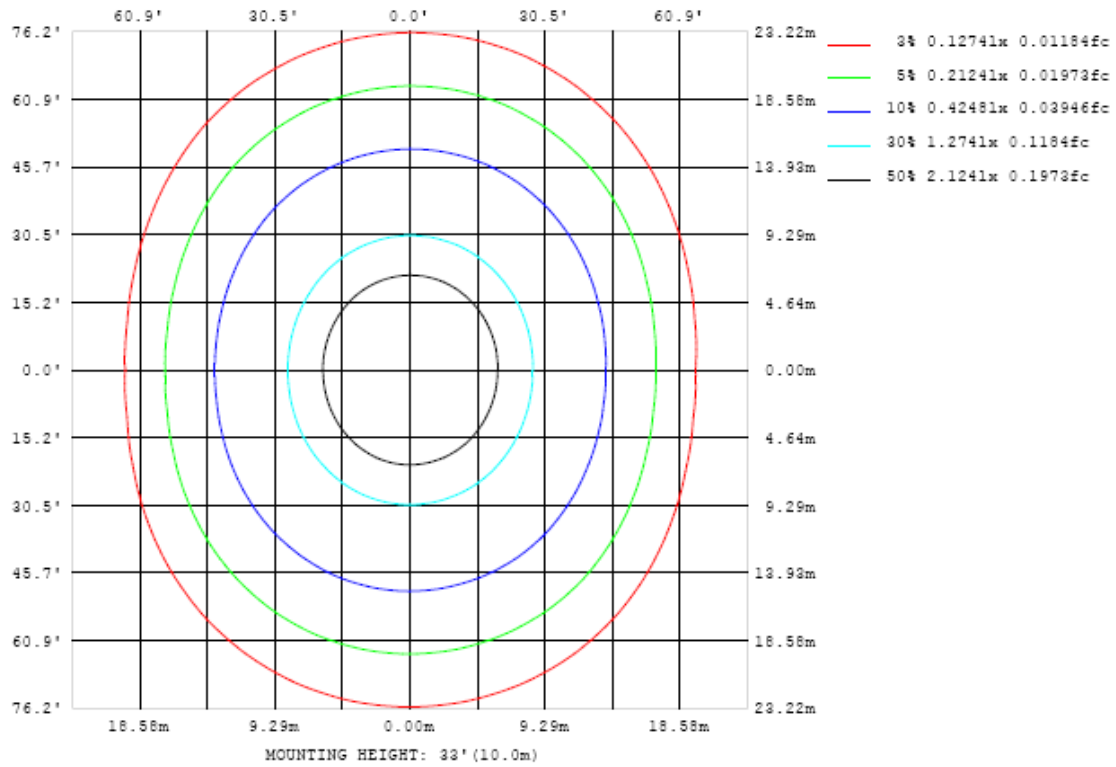


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

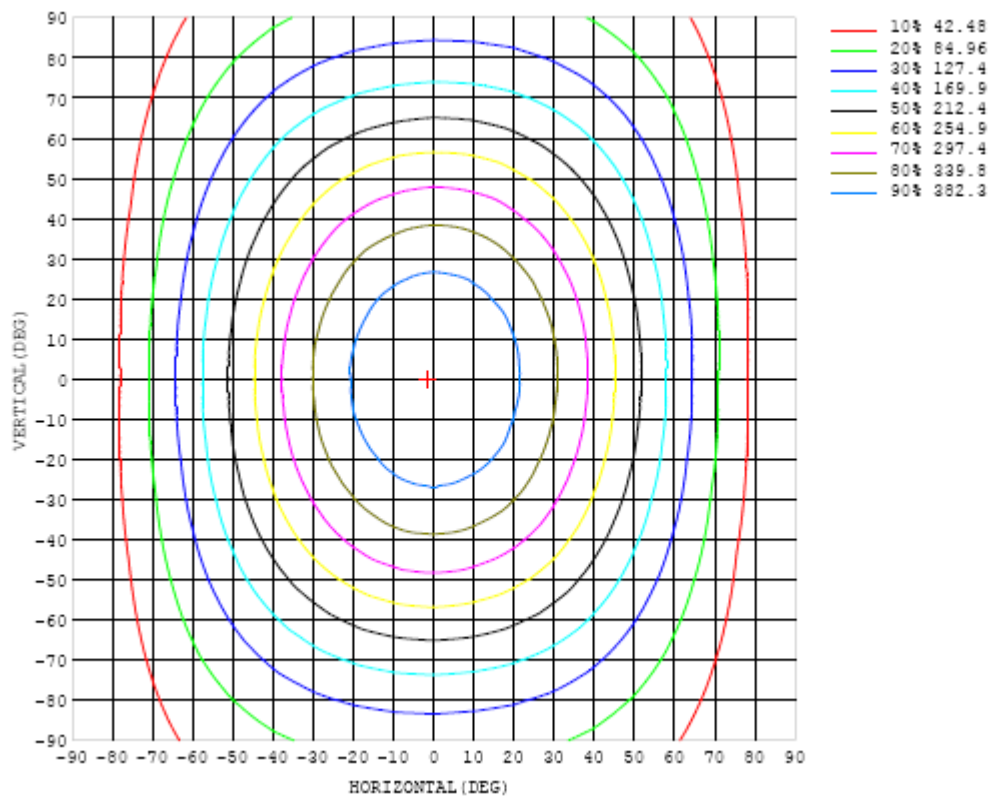


Chart 6: Isocandela Plot

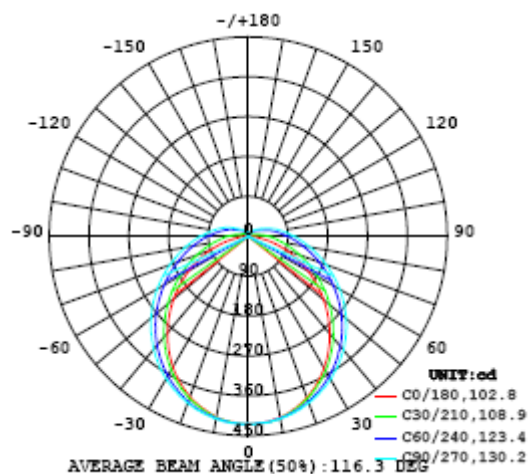


Chart 7: Polar Candela Distribution

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	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425
5	422	424	423	422	423	423	422	422	422	423	423	423	423	423	423	422	422	422	421
10	414	415	415	417	418	417	417	417	418	418	418	418	417	416	415	415	413	414	414
15	403	404	404	406	408	408	409	410	411	411	410	410	409	406	405	404	403	402	401
20	387	388	388	390	394	395	397	398	399	401	400	399	397	394	391	389	388	386	385
25	367	367	370	372	376	380	383	385	387	387	386	386	382	378	374	370	368	366	365
30	343	345	346	350	356	362	365	368	371	372	371	369	365	360	354	349	345	341	341
35	316	318	321	325	333	340	346	350	354	355	353	351	345	338	330	324	319	314	314
40	287	288	293	299	308	317	324	330	333	335	333	330	323	314	306	298	290	285	284
45	255	257	262	270	280	292	300	307	312	313	312	307	299	290	280	270	261	254	253
50	223	225	231	241	253	265	275	282	287	289	287	283	274	264	252	241	230	222	220
55	189	192	200	211	224	238	249	257	262	265	263	258	249	237	224	211	199	190	187
60	156	159	168	181	196	211	222	231	237	239	237	232	222	210	196	182	168	158	155
65	123	127	137	152	168	184	196	206	210	213	211	206	197	184	169	153	138	126	122
70	90.7	94.9	108	125	142	158	171	180	186	188	186	181	172	159	144	127	110	96.0	90.4
75	60.2	65.2	81.2	100	118	135	148	156	162	164	162	157	148	136	120	103	84.2	67.7	59.8
80	32.6	39.9	58.4	78.0	96.8	113	126	134	139	142	140	135	126	114	99.2	81.4	62.2	43.3	32.5
85	11.0	19.9	39.5	60.0	78.0	94.0	106	114	119	121	120	115	107	95.6	80.8	63.7	43.8	23.9	10.8
90	0.78	8.15	25.7	45.1	62.7	77.6	89.0	97.2	102	103	102	98.1	90.2	79.5	65.6	48.9	30.0	11.8	0.52
95	0.40	3.22	16.4	33.5	50.0	63.9	74.6	81.9	86.5	88.2	87.0	83.0	75.8	66.0	53.0	37.3	20.2	5.44	0.36
100	0.52	1.99	10.3	24.0	39.0	52.2	62.4	69.1	73.3	74.9	73.5	70.1	64.4	54.4	42.0	27.6	13.1	3.59	0.43
105	0.68	1.60	7.53	17.5	29.2	41.1	50.9	57.8	61.8	63.4	62.5	58.9	52.5	43.5	32.1	20.2	9.83	2.81	0.75
110	1.02	1.50	5.89	13.5	22.7	31.9	40.1	46.4	50.4	52.1	51.3	47.9	41.9	33.9	25.3	16.1	7.93	2.74	1.13
115	1.39	1.86	4.93	11.0	18.4	25.8	32.3	37.2	40.4	41.8	41.1	38.4	33.8	27.8	20.5	13.1	6.88	2.93	1.52
120	1.77	2.36	4.61	9.22	15.1	21.3	26.7	30.8	33.5	34.6	34.1	31.8	28.0	22.9	17.0	11.1	6.25	3.09	1.94
125	2.19	2.73	4.50	7.88	12.7	17.7	22.2	25.5	27.8	28.8	28.2	26.5	23.3	19.1	14.4	9.70	5.72	3.08	2.34
130	2.59	3.13	4.38	7.03	10.9	14.9	18.5	21.3	23.2	24.0	23.5	22.0	19.4	16.0	12.3	8.40	5.16	3.27	2.62
135	2.99	3.32	4.57	6.43	9.27	12.6	15.6	17.9	19.3	20.0	19.6	18.4	16.2	13.6	10.6	7.45	4.83	3.42	2.97
140	3.28	3.39	4.79	5.73	7.96	10.8	13.1	14.9	16.1	16.6	16.4	15.4	13.7	11.6	9.06	6.67	5.03	3.71	3.44
145	3.56	3.47	4.68	5.74	6.87	8.71	11.0	12.5	13.5	13.9	13.6	12.9	11.7	9.95	8.09	6.46	5.21	3.97	3.86
150	3.91	3.47	4.82	5.49	6.73	7.72	8.85	9.95	11.1	11.4	11.4	10.9	9.96	8.80	7.51	6.29	5.43	4.08	4.29
155	4.30	3.39	4.87	5.36	5.97	7.04	7.86	8.50	8.88	9.08	9.29	9.15	8.56	7.77	6.72	5.99	5.37	4.01	4.55
160	4.80	3.93	4.37	5.23	5.70	6.10	6.77	7.32	7.63	7.80	7.87	7.78	7.48	6.71	6.19	5.75	4.82	3.90	4.64
165	5.06	4.69	3.28	4.16	4.81	5.36	6.06	6.22	6.34	6.49	6.56	6.49	6.05	5.81	5.44	4.88	3.80	3.99	4.87
170	5.12	3.99	3.51	3.11	3.36	3.24	3.28	3.63	4.99	5.85	3.99	3.55	3.61	3.56	3.67	3.50	3.48	3.80	4.38
175	5.08	3.89	3.18	3.07	3.03	3.07	3.12	3.39	3.58	1.30	3.79	3.69	3.38	3.36	3.36	3.38	3.38	3.48	3.73
180	4.05	4.05	4.05	4.05	4.05	4.05	4.05	4.05	4.05	4.05	4.05	4.05	4.05	4.05	4.05	4.05	4.05	4.05	4.05

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	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425		
5	421	422	423	421	421	423	423	423	423	422	422	422	423	422	422	422	422		
10	414	415	416	416	417	417	419	418	417	419	418	418	417	417	417	416	415		
15	403	404	404	406	407	409	410	410	411	411	410	409	408	407	406	405	404		
20	386	387	389	391	392	396	398	399	400	400	399	397	396	395	391	390	389		
25	366	368	370	374	377	381	384	386	386	386	386	383	380	377	373	370	369		
30	342	345	348	353	358	363	367	370	371	371	369	366	361	357	352	349	345		
35	315	318	324	329	337	343	348	351	353	353	350	345	340	334	328	322	319		
40	285	289	296	304	313	321	326	330	333	332	329	323	316	308	301	295	290		
45	255	259	268	277	287	296	304	308	311	310	307	299	292	282	273	264	259		
50	222	229	238	249	261	271	279	284	287	286	282	275	265	254	243	233	226		
55	190	197	208	220	234	245	254	260	263	261	258	249	238	226	214	202	194		
60	158	166	178	192	207	220	229	235	238	237	232	223	211	198	184	171	161		
65	126	136	150	165	181	194	204	210	213	212	207	198	186	171	155	141	129		
70	94.6	107	123	141	157	170	180	186	189	188	183	173	161	146	129	112	98.3		
75	65.6	80.8	99.1	118	135	148	157	163	166	164	160	151	139	123	105	85.8	69.3		
80	40.0	58.1	77.8	96.8	114	127	136	143	145	143	139	130	118	102	83.3	62.9	44.0		
85	20.4	39.8	60.0	78.7	95.3	108	117	123	125	124	120	111	99.0	83.3	64.7	44.4	24.4		
90	8.81	26.5	45.7	63.7	79.4	91.5	100	105	108	107	102	94.2	82.7	67.8	50.1	30.7	12.0		
95	3.93	17.7	34.8	51.3	65.9	77.3	85.5	90.5	92.6	91.6	87.5	79.8	68.9	55.0	38.7	21.2	5.80		
100	2.48	11.3	26.4	41.4	54.7	65.3	72.8	77.4	79.3	78.5	74.5	67.5	57.4	44.6	29.7	14.2	3.47		
105	2.28	8.41	19.2	32.8	45.1	54.9	61.9	66.2	67.8	66.9	63.3	56.7	47.5	35.5	22.0	9.99	2.83		
110	2.50	6.95	14.8	24.8	35.9	45.3	52.0	56.1	57.8	56.9	53.5	47.1	38.1	27.0	16.6	7.73	2.76		
115	2.75	6.26	12.3	20.1	28.1	35.4	42.0	46.1	47.7	46.8	43.3	36.9	29.4	21.3	13.3	6.53	2.89		
120	3.06	5.90	10.6	16.8	23.2	28.8	33.5	36.4	37.6	36.7	34.1	29.6	24.0	17.6	11.1	6.03	3.16		
125	3.36	5.70	9.47	14.2	19.5	24.0	27.7	30.0	30.9	30.2	28.1	24.5	20.0	14.8	9.67	5.82	3.50		
130	3.60	5.62	8.64	12.4	16.5	20.1	23.0	25.0	25.8	25.2	23.5	20.6	17.0	12.7	8.75	5.76	3.81		
135	3.82	5.53	7.89	10.9	14.1	17.0	19.4	21.0	21.6	21.1	19.7	17.4	14.4	11.1	8.15	5.77	4.12		
140	4.24	5.58	7.43	9.76	12.2	14.5	16.4	17.7	18.1	17.7	16.6	14.8	12.4	9.99	7.68	5.81	4.43		
145	4.52	5.62	7.08	8.85	10.7	12.4	13.9	14.9	15.2	14.9	14.0	12.6	10.9	9.02	7.27	5.88	4.71		
150	4.81	5.71	6.79	8.08	9.46	10.7	11.8	12.5	12.7	12.5	11.9	10.9	9.58	8.21	6.96	5.95	5.01		
155	4.68	5.65	6.53	7.45	8.39	9.30	10.0	10.5	10.7	10.6	10.1	9.40	8.51	7.58	6.73	5.97	5.10		
160	5.06	5.51	6.22	6.92	7.54	8.11	8.58	8.91	9.05	8.96	8.68	8.23	7.67	7.10	6.56	6.08	5.13		
165	5.14	5.28	5.78	6.29	6.84	7.19	7.46	7.65	7.74	7.71	7.59	7.36	7.04	6.72	6.41	6.08	5.60		
170	4.93	5.23	5.42	5.60	5.85	6.44	6.66	6.75	6.81	6.81	6.77	6.68	6.54	6.38	6.22	6.04	5.94		
175	3.91	4.12	4.50	5.06	5.45	5.44	5.44	5.74	6.05	6.11	6.09	6.09	6.08	6.05	6.01	5.97	5.81		
180	4.05	4.05	4.05	4.05	4.05	4.05	4.05	4.05	4.05	4.05	4.05	4.05	4.05	4.05	4.05	4.05	4.05		

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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