



LM-79-08 Test Report

for

Revolution Lighting Technologies, Inc.

2280 Ward Ave. Simi Valley, CA 93065

LED Tube

Model: 204100-112

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

3rd Floor, Bld. 2, NO. 96 Longchuanwu Rd Qianjiang Economy Dev. Zone, Yuhang Dist,
Hangzhou, Zhejiang Province, China 311100

Tel: +86 571 86376106

www.ledtestlab.com

Report No.: HZ18110016a

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

Review by:

Engineer: April Zou
Nov. 19, 2018

Approved by:



Manager: Jim Zhang
Nov. 19, 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: 204100-112

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
128.4	1957.0	15.24	0.9815
CCT (K)	CRI	Stabilization Time (Light & Power)	
3446	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 : Nov. 12, 2018

Date of Test : Nov. 12, 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

TABLE OF CONTENT

LM-79-08 Test Report.....	1
Test Summary.....	2
Sample Photo.....	4
TEST RESULTS	5
Goniophotometer Method	6
Spectral Power Distribution - Sphere Spectroradiometer Method	7
Chromaticity Diagram - Sphere Spectroradiometer Method.....	8
Nominal CCT Quadrangles – Sphere Spectroradiometer Method	9
Note: The location on the diagram of the tristimulus coordinates are indicated by the blue diamond.Zonal	
Lumen Tabulation- Goniophotometer Method.....	9
Zonal Lumen Tabulation- Goniophotometer Method	10
Luminous Intensity Data- Goniophotometer Method.....	13
EQUIPMENT LIST	15
TEST METHODS	15
Seasoning of SSL Product.....	15
Sphere-Spectroradiometer Method- Photometric and Electrical Measurements.....	15
Goniophotometer Method	16
Photometric and Electrical Measurements.....	16
Color Characteristics Measurements.....	16
Color Spatial Uniformity	16

Sample Photo



Figure 1- Overview of the sample

Equipment Under Test (EUT)

Name	: LED Tube
Model	: 204100-112
Electrical Ratings	: 120-277V, 60HZ
Product Description	: 3500K
Manufacturer	: Revolution Lighting Technologies, Inc.
Address	: 2280 Ward Ave. Simi Valley, CA 93065

TEST RESULTS

Test ambient temperature was 25.2°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)	0.130	0.059
Power Factor	0.9815	0.9595
Test Power (W)	15.24	15.57
THD A%	17.84	20.23
Luminous Efficacy (lm/W)	128.4	125.4
Total Luminous Flux (lm)	1957.0	1952
Color Rendering Index (CRI)	81.6	
R9	0.1	
Correlated Color Temperature (CCT)(K)	3446	
Chromaticity Chroma x	0.4089	
Chromaticity Chroma y	0.3940	
Chromaticity Chroma u	0.2367	
Chromaticity Chroma v	0.3421	
Duv	0.0003	
Chromaticity Chroma u'	0.2367	
Chromaticity Chroma v'	0.5132	

Special Color Rendering Indices	
R1	79.6
R2	89.8
R3	96.1
R4	79.3
R5	79.9
R6	86.7
R7	83.1
R8	58.4
R9	0.1
R10	76.5
R11	78.2
R12	65.5
R13	82.1
R14	98.4

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 25.0°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)	0.1282
Power Factor	0.9823
Power (W)	15.12
Luminous Efficacy (lm/W)	127.5
Total Luminous Flux (lm)	1928.4
Beam Angle (°)	107.1 (0°-180°) / 127.5 (90°-270°)
Center Beam Candle Power (cd)	540
Maximum Beam Candle Power (cd)	541.0 (At: C=20.0, Gamma=1.5)
Spacing Criteria	1.22 (0°-180°) / 1.29 (90°-270°)
Zonal Lumens in the 0°-60°Zone	64.41%
Zonal Lumens in the 60°-90°Zone	25.52%
Zonal Lumens in the 90°-120°Zone	7.55%
Zonal Lumens in the 120°-180°Zone	2.53%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

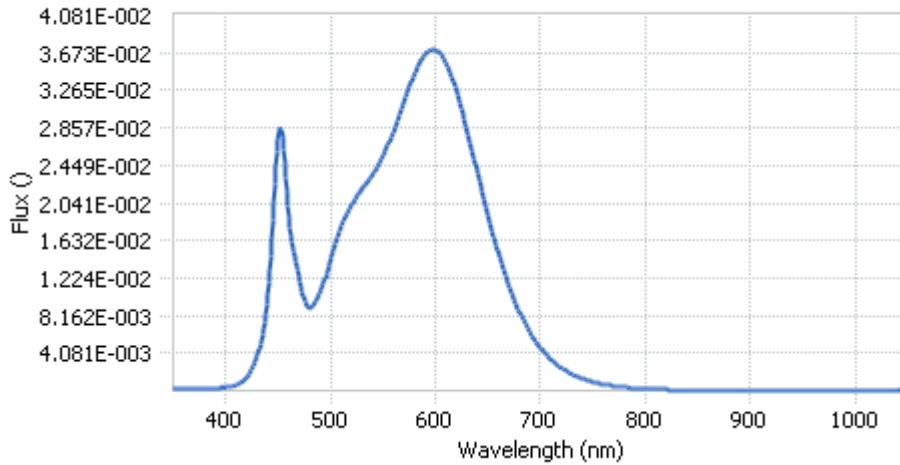
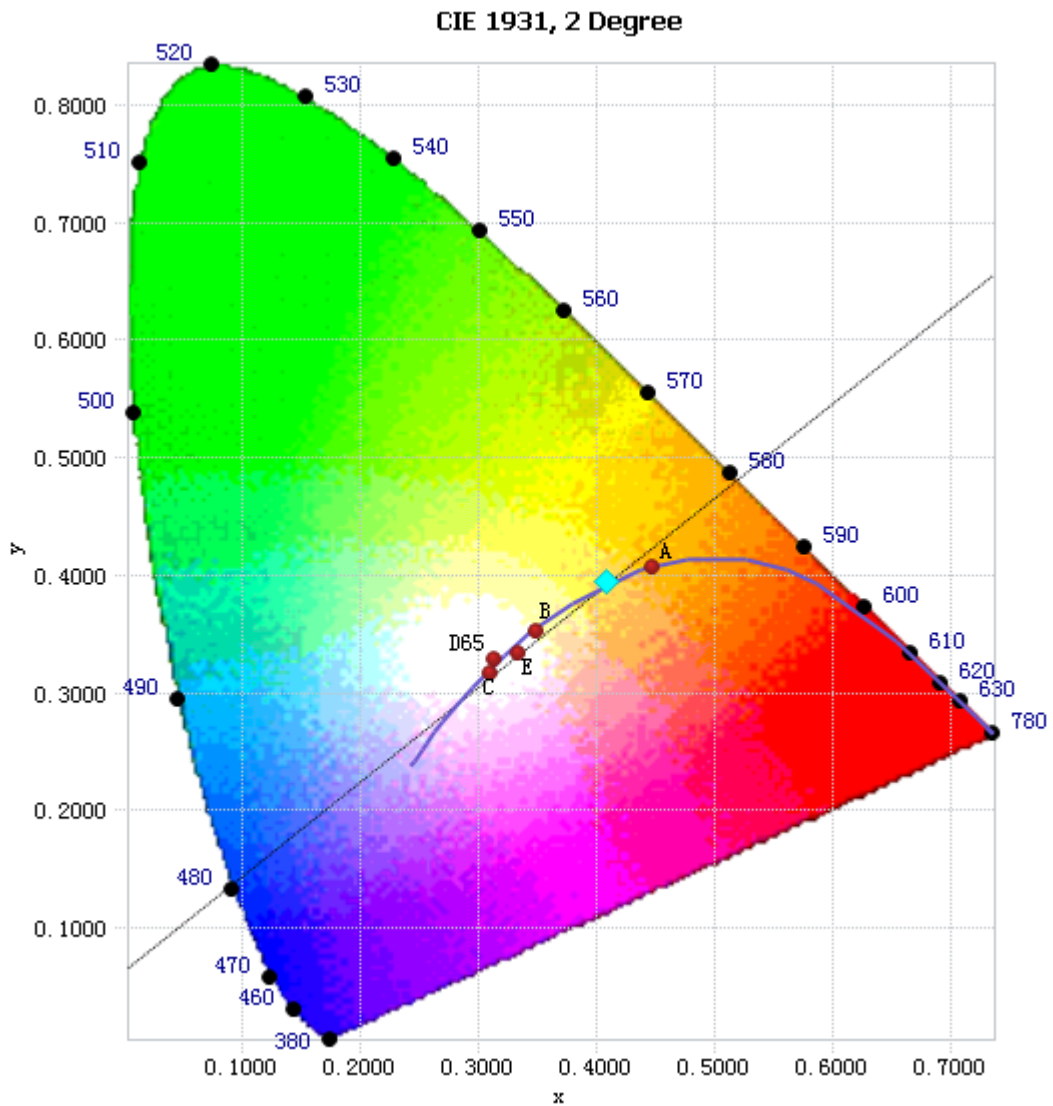


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.96E-04	485	9.57E-03	590	3.65E-02	695	5.42E-03
385	2.94E-04	490	1.06E-02	595	3.70E-02	700	4.66E-03
390	3.02E-04	495	1.23E-02	600	3.70E-02	705	3.98E-03
395	3.37E-04	500	1.43E-02	605	3.66E-02	710	3.39E-03
400	3.69E-04	505	1.62E-02	610	3.56E-02	715	2.90E-03
405	4.38E-04	510	1.78E-02	615	3.42E-02	720	2.48E-03
410	6.04E-04	515	1.92E-02	620	3.25E-02	725	2.11E-03
415	9.21E-04	520	2.02E-02	625	3.05E-02	730	1.80E-03
420	1.47E-03	525	2.11E-02	630	2.82E-02	735	1.53E-03
425	2.37E-03	530	2.20E-02	635	2.59E-02	740	1.31E-03
430	3.77E-03	535	2.27E-02	640	2.36E-02	745	1.12E-03
435	6.16E-03	540	2.35E-02	645	2.13E-02	750	9.51E-04
440	1.05E-02	545	2.45E-02	650	1.90E-02	755	8.22E-04
445	1.86E-02	550	2.56E-02	655	1.69E-02	760	7.04E-04
450	2.74E-02	555	2.68E-02	660	1.49E-02	765	6.00E-04
455	2.63E-02	560	2.82E-02	665	1.31E-02	770	5.18E-04
460	1.88E-02	565	2.99E-02	670	1.14E-02	775	4.47E-04
465	1.51E-02	570	3.14E-02	675	9.88E-03	780	3.89E-04
470	1.24E-02	575	3.30E-02	680	8.54E-03		
475	9.82E-03	580	3.45E-02	685	7.39E-03		
480	9.04E-03	585	3.58E-02	690	6.32E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4089, 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

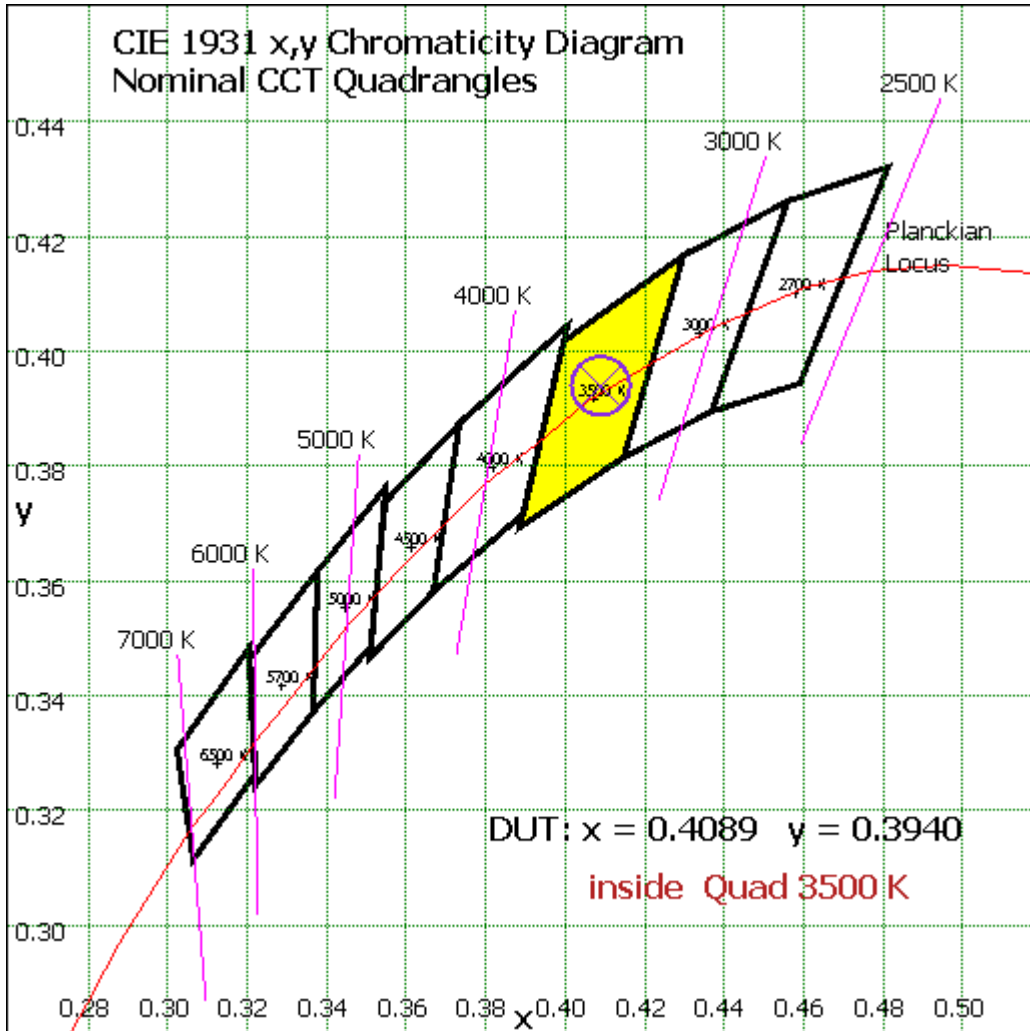


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Note: The location on the diagram of the tristimulus coordinates are indicated by the blue diamond.

Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	51.132	2.65%
10- 20	146.698	7.61%
20- 30	223.124	11.57%
30- 40	270.823	14.04%
40- 50	284.694	14.76%
50- 60	265.564	13.77%
60- 70	220.805	11.45%
70- 80	163.024	8.45%
80- 90	108.211	5.61%
90-100	69.998	3.63%
100-110	45.807	2.38%
110-120	29.803	1.55%
120-130	19.578	1.02%
130-140	12.874	0.67%
140-150	8.26	0.43%
150-160	4.931	0.26%
160-170	2.405	0.12%
170-180	0.679	0.04%
Total	1928.4	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	1242.035	64.41%
60- 90	492.04	25.52%
0-90	1734.075	89.92%
90- 180	194.335	10.08%
0- 180	1928.4	100%

Table 5: Zonal Lumen

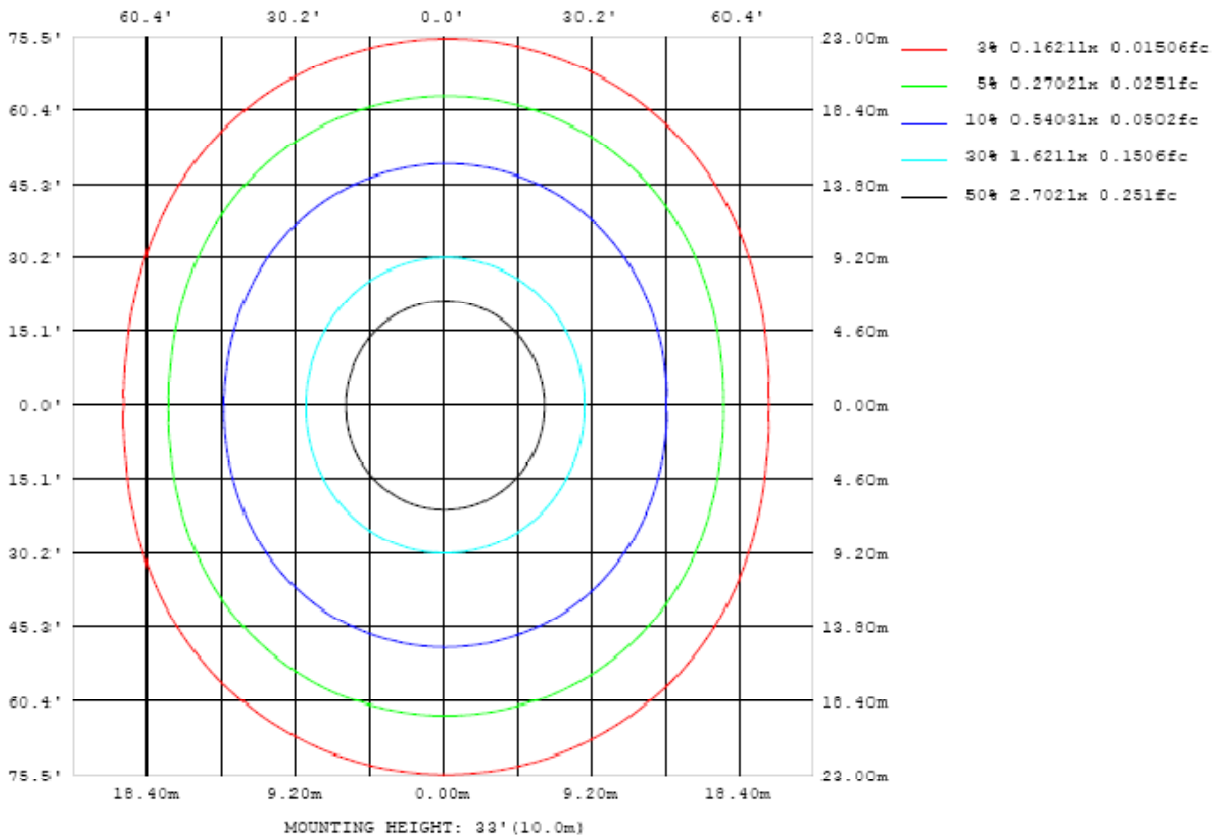


Chart 4: Beam Angle

Luminous Intensity Distribution Plots- Goniophotometer Method

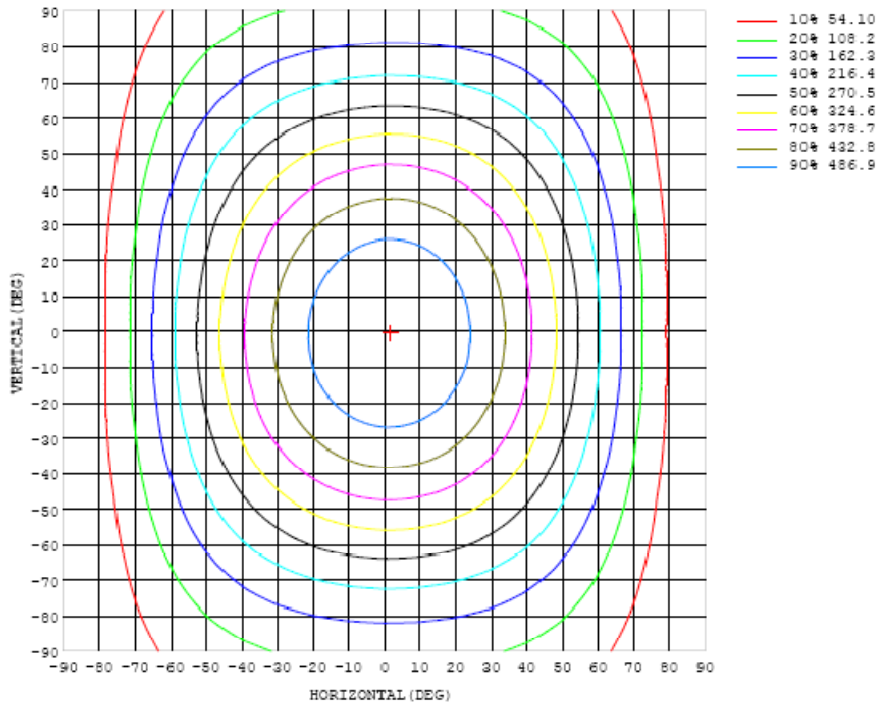


Chart 5: Illuminance Plot (Footcandles)

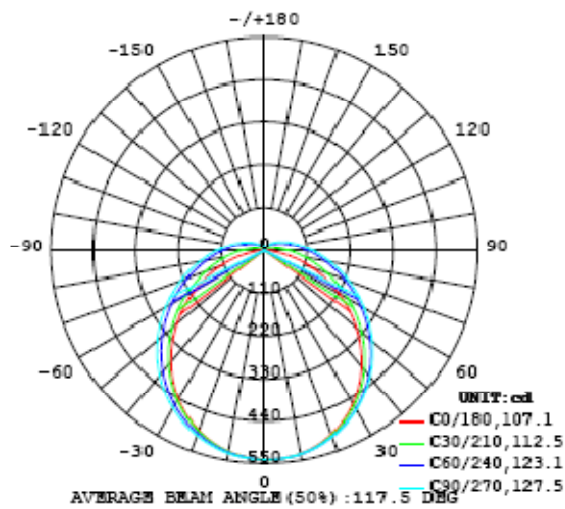


Chart 6: Polar Candela Distribution

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	540	540	540	540	540	540	540	540	540	540	540	540	540	540	540	540	540	540	540
5	539	539	539	539	539	539	540	539	539	539	539	538	538	537	537	537	536	536	536
10	533	533	533	534	534	534	534	534	534	533	533	532	531	530	529	528	528	527	527
15	521	522	522	523	523	524	524	525	524	524	523	522	520	519	517	515	514	513	513
20	504	505	506	507	508	510	511	512	511	511	510	508	506	503	501	498	496	494	493
25	482	483	485	486	489	491	493	494	494	494	492	490	487	483	479	476	473	470	469
30	456	457	459	462	465	469	471	474	474	473	472	468	465	460	455	450	446	443	441
35	424	426	429	433	438	443	446	449	450	450	448	444	439	433	427	421	415	411	409
40	389	391	395	401	407	413	419	422	424	423	421	417	411	403	396	388	380	375	373
45	351	353	358	365	374	382	388	392	394	394	391	387	380	371	362	352	343	337	334
50	309	312	318	327	338	348	355	361	363	363	360	355	347	338	327	315	304	296	293
55	265	268	277	289	302	312	321	327	330	330	327	322	314	303	290	277	263	254	250
60	220	224	235	249	264	277	287	293	297	297	294	288	280	268	254	238	223	211	207
65	175	180	193	210	227	242	253	260	263	264	261	255	246	234	219	201	183	169	163
70	130	136	153	173	192	208	220	227	231	231	229	223	214	201	185	166	145	128	121
75	86.8	95.3	116	139	160	176	188	196	200	201	198	193	184	171	154	133	110	89.4	79.8
80	47.1	59.0	83.2	109	131	148	160	167	171	172	170	165	156	143	126	105	80.2	56.0	42.1
85	15.1	30.3	57.3	83.2	105	122	134	142	146	147	145	140	131	119	102	81.1	56.3	29.8	12.9
90	0.37	13.0	38.0	63.1	84.2	101	112	120	124	125	123	118	110	98.5	82.6	62.3	38.4	14.2	0.15
95	0.23	6.08	25.3	47.6	67.0	82.5	93.9	101	105	106	104	100.0	92.5	81.3	66.2	47.8	26.4	7.32	0.37
100	0.52	3.96	17.1	36.0	53.9	67.8	78.4	85.2	88.9	90.1	88.7	84.5	77.5	67.1	53.8	36.8	18.4	4.99	0.67
105	0.98	3.58	12.8	27.3	42.9	56.1	65.6	72.0	75.5	76.7	75.3	71.6	65.1	55.9	43.3	28.1	14.1	4.35	1.15
110	1.58	3.72	10.4	21.5	34.0	45.6	54.7	61.0	64.2	65.2	64.0	60.8	54.7	45.9	34.5	22.6	11.7	4.46	1.73
115	2.23	4.11	9.15	17.8	27.7	37.0	45.0	50.8	54.2	55.3	54.3	51.0	45.1	37.4	28.5	18.9	10.4	4.81	2.34
120	2.87	4.61	8.55	15.2	23.2	30.9	37.3	42.1	45.0	46.0	45.1	42.3	37.7	31.4	24.0	16.3	9.62	5.24	2.97
125	3.52	5.16	8.26	13.4	19.8	26.0	31.4	35.4	37.9	38.8	38.0	35.7	31.8	26.6	20.6	14.4	9.19	5.72	3.59
130	4.12	5.63	8.13	12.1	17.1	22.2	26.6	30.0	32.1	32.8	32.2	30.3	27.0	22.8	18.0	13.1	8.95	6.20	4.15
135	4.65	6.09	8.19	11.3	15.1	19.1	22.7	25.5	27.2	27.8	27.3	25.7	23.0	19.7	15.8	12.0	8.82	6.60	4.65
140	5.29	6.62	8.26	10.6	13.6	16.7	19.5	21.7	23.1	23.6	23.3	21.9	19.8	17.1	14.2	11.2	8.76	7.00	5.15
145	5.86	7.10	8.38	10.2	12.4	14.7	16.8	18.5	19.6	20.1	19.8	18.8	17.1	15.1	12.8	10.6	8.78	7.39	5.67
150	6.10	7.33	8.45	9.79	11.4	13.1	14.6	15.9	16.7	17.1	16.9	16.1	14.9	13.4	11.8	10.2	8.73	7.58	6.24
155	6.26	7.53	8.52	9.51	10.6	11.7	12.9	13.7	14.3	14.6	14.4	13.9	13.1	12.0	10.9	9.78	8.72	7.89	6.73
160	6.06	8.05	8.61	9.28	9.98	10.7	11.4	12.0	12.4	12.6	12.5	12.1	11.6	10.9	10.2	9.31	8.19	7.36	6.54
165	5.90	7.60	8.79	9.09	9.51	9.94	10.4	10.7	10.9	11.0	10.9	10.8	10.5	10.1	9.63	8.52	7.27	6.48	5.90
170	5.35	7.16	8.43	8.85	9.14	9.38	9.57	9.72	9.82	9.87	9.85	9.78	9.62	9.17	8.12	6.93	6.12	6.11	5.80
175	6.13	6.72	7.47	8.10	8.46	8.82	9.00	9.03	9.04	9.04	9.08	8.92	8.24	7.21	6.20	5.65	5.81	6.15	6.20
180	7.49	7.49	7.49	7.49	7.49	7.49	7.49	7.49	7.49	7.49	7.49	7.49	7.49	7.49	7.49	7.49	7.49	7.49	7.49

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	540	540	540	540	540	540	540	540	540	540	540	540	540	540	540	540	540		
5	536	536	536	536	536	536	537	537	538	538	538	539	539	539	539	539	539		
10	526	527	527	528	528	529	530	531	531	532	532	533	532	532	533	533	533		
15	512	513	514	515	516	517	519	520	521	522	522	522	522	522	521	521	521		
20	493	494	496	497	500	502	504	506	507	508	508	508	507	506	506	505	505		
25	470	470	473	476	479	483	486	488	490	491	491	490	489	487	485	483	482		
30	442	443	446	451	455	460	464	467	469	470	470	469	466	463	460	458	456		
35	410	412	416	422	428	434	439	443	446	446	446	444	440	436	431	423	425		
40	374	377	383	391	399	406	412	416	419	420	419	415	411	405	400	391	391		
45	335	340	348	357	367	375	382	387	390	391	389	385	380	372	365	357	352		
50	295	301	310	322	333	343	350	356	359	360	358	353	346	337	327	313	311		
55	253	260	272	286	298	309	318	323	327	327	325	320	311	301	288	277	269		
60	210	220	234	249	264	275	284	290	294	294	291	285	276	264	249	235	224		
65	167	180	197	214	230	242	251	257	260	260	258	251	241	227	211	194	180		
70	127	142	161	180	197	210	219	225	228	228	225	218	207	192	174	154	138		
75	07.7	100	130	150	166	179	190	194	197	197	194	187	176	160	140	117	96.6		
80	53.4	77.1	101	122	140	152	160	166	169	168	165	158	147	131	110	84.8	60.0		
85	27.2	52.7	77.4	98.7	116	128	136	141	144	143	140	133	122	106	84.1	58.5	31.5		
90	11.9	35.0	58.4	78.9	94.9	107	115	120	122	121	118	111	100	84.3	63.5	39.0	14.4		
95	5.50	23.3	44.0	62.9	77.9	89.1	96.7	101	103	103	99.2	92.6	81.9	67.0	47.8	25.9	6.50		
100	3.83	15.8	32.9	49.9	63.8	74.3	81.5	85.6	87.6	86.9	83.5	77.0	67.0	53.0	35.7	17.5	4.17		
105	3.37	12.0	25.1	39.0	51.7	61.5	68.3	72.3	74.1	73.3	69.9	63.7	54.1	41.6	26.9	12.9	3.50		
110	3.59	9.94	20.1	31.5	41.8	50.2	56.5	59.3	61.9	61.1	57.8	51.9	43.5	33.0	21.2	10.4	3.60		
115	3.96	8.85	16.7	25.9	34.6	41.8	47.0	50.1	51.5	50.7	47.8	42.9	35.8	27.0	17.4	8.52	3.95		
120	4.37	8.29	14.4	21.7	28.9	35.1	39.6	42.3	43.4	42.7	40.2	35.9	29.8	22.4	14.8	8.24	4.35		
125	4.79	8.04	12.7	18.6	24.5	29.6	33.4	35.8	36.7	36.1	33.9	30.1	25.0	19.0	12.8	7.56	4.77		
130	5.14	7.96	11.6	16.2	20.9	25.1	28.3	30.3	31.1	30.5	28.6	25.5	21.2	16.4	11.6	7.66	5.14		
135	5.36	7.89	10.7	14.4	18.1	21.4	24.0	25.7	26.3	25.8	24.2	21.6	18.3	14.4	10.8	7.64	5.45		
140	5.56	7.91	10.1	12.8	15.8	18.4	20.5	21.8	22.3	21.9	20.6	18.5	15.9	12.9	10.2	7.74	5.55		
145	5.60	7.93	9.21	11.4	13.9	16.9	17.8	18.5	18.9	18.5	17.6	16.0	13.9	11.7	9.76	7.68	5.64		
150	5.53	7.92	9.07	10.5	12.2	13.7	15.0	15.7	16.0	15.8	15.1	13.9	12.4	10.9	9.28	7.67	5.74		
155	5.27	7.29	8.21	9.39	10.6	11.9	12.8	13.3	13.6	13.5	13.0	12.3	11.3	10.2	8.72	7.10	5.40		
160	5.22	5.55	6.94	7.54	8.54	9.40	10.7	11.5	11.7	11.7	11.4	11.0	10.3	9.43	8.37	6.18	5.09		
165	5.35	5.09	5.51	6.00	6.49	6.76	7.89	9.29	9.74	10.1	10.1	9.79	9.09	8.53	6.93	5.10	5.10		
170	5.31	5.27	5.51	5.57	6.14	6.29	6.26	5.60	8.20	8.96	8.33	7.87	6.91	6.04	5.31	5.19	5.01		
175	6.28	6.39	6.42	6.68	6.94	7.17	7.28	5.98	3.86	6.68	6.92	7.01	6.98	6.71	6.35	6.04	5.96		
180	7.49	7.49	7.49	7.49	7.49	7.49	7.49	7.49	7.49	7.49	7.49	7.49	7.49	7.49	7.49	7.49	7.49		

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	2M	HZTE015-01	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

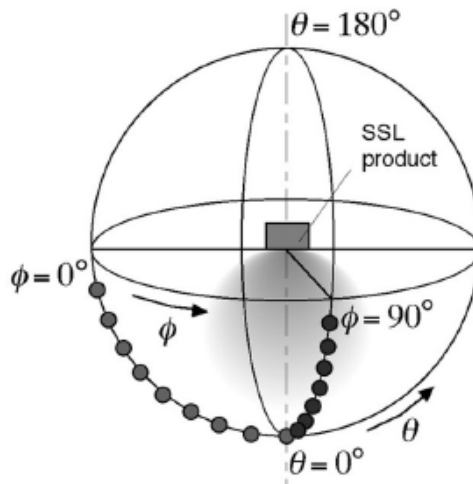
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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

This report is considered invalidated without the Special Seal for Inspection of the LTL. This report shall not be altered, increased or deleted. The results shown in this test report refer only to the sample(s) tested. Without written approval of LTL, this test report shall not be copied except in full and published as advertisement.