



Ref. No: LCZP18050035

Version: 1.0

Date of issue: May. 15, 2018

Total pages: 11



Test report of

IES LM-79-08

Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products

Rendered to:

Revolution Lighting Technologies, Inc.
2280 Ward Ave Simi Valley, CA 93065, USA

For products:

2x4 Luminaires for Ambient Lighting of Interior Commercial Spaces

Models No.:

154036-113

Test Date: May. 11, 2018

Test Item: Total luminous flux, Luminous Efficacy, Electrical values, Luminous Intensity Distribution, Chromaticity coordinates, CCT and CRI, Spectral Power Distribution.

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Template No.: LC-RT-PL-001 Rev.1.1

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1. General

1.1 Product Information

Brand Name	Revolution Lighting Technologies
Category	Indoor
General Application	Troffer
Primary Use	2x4 Luminaires for Ambient Lighting of Interior Commercial Spaces
Model Number	154036-113
Rated Inputs	100-277V, 50/60Hz
Rated Power	50W
Rated Light output	6250lm
Declared CCT	4000K
Power Supply	N/A
LED Package, Array or Module	Model: 67-21S Series, manufactured by EVERLIGHT ELECTRONICS CO., LTD
Receipt Samples	1 unit
Sample Code of lab.	180202102006
Date of Receipt Samples	Feb. 2, 2018
Note	-

1.2 Standards or methods

The following standards are partly or totally used or referenced for test:

No.	Name
ANSI/NEMA/ ANSLG C78.377-2015	Specifications for the Chromaticity of Solid State Lighting Products
ANSI C82.77-2002	Harmonic Emission Limits—Related Power Quality Requirements for Lighting Equipment
CIE Pub. No. 13.3-1995	Method of Measuring and Specifying Color Rendering of Light Sources
CIE Pub. No. 15:2004	Colorimetry
IES LM-79-08	Electrical and Photometric Measurements of Solid-State Lighting Products

1.3 Equipment list

Instrument	ID	Model name	Cal. date	Next cal. Date
AC Power supply	LC-I-923	CHP-500	2018-01-10	2019-01-09
AC Power supply	LC-I-987	APW-110N	2018-01-10	2019-01-09
Power analyzer	LC-I-928	WT210	2018-01-05	2019-01-05
Power analyzer	LC-I-954	WT210	2018-01-10	2019-01-09
Multimeter	LC-I-972	Fluke 17B	2017-08-08	2018-08-07
Photometric colorimetric electric system ¹ (2 meter sphere)	LC-I-900	SPR3000	Before use	Before use
Standard lamp ²	LC-PL-I-011	D204C	2017-09-07	2018-09-06
Luminous Flux Standard Lamp ³	LC-PL-I-003	24V100W	2017-09-22	2018-09-21
Goniophotometer(with mirror)	LC-I-902	GMS2000	2018-05-07	2019-05-06
Wireless temperature transmitter	LC-I-978	DWRF-B	2018-02-11	2019-02-10
Wireless temperature transmitter	LC-I-979	DWRF-B	2018-02-11	2019-02-10

Note:

- 1, Bandwidth of spectroradiometer is 1 nm.
- 2, halogen lamp, 100W, omni-directional type, and its traceability to NIM.
- 3, halogen lamp, 100W, omni-directional type, and its traceability to NIM.

2. Test conducted and method

The luminaire was operated at least 2 hours to reach stabilization and temperature equilibrium before test.

2.1 Ambient Condition

The ambient temperature in which measurements are being taken was maintained at $25\text{ }^{\circ}\text{C} \pm 1\text{ }^{\circ}\text{C}$; the air flow around the sample(s) being tested did not affect the performance.

2.2 Power Supply Characteristics

The AC power supply had a sinusoidal voltage wave shape at the prescribed frequency (60 Hz) such that the RMS summation of the harmonic components does not exceed 3 percent of the fundamental during operation of the test item.

The voltage of AC power supply (RMS voltage) applied to the device under test was regulated to within ± 0.2 percent under load.

2.3 Seasoning and Stabilization

No seasoning was performed in accordance with IESNA LM-79-08. And before the measurement, the sample was stabilized until the light output and power variations were less than 0.5% in 30 minutes intervals (3 readings, 15 minutes apart).

2.4 Electrical Instrumentation

The calibration uncertainties of the instruments for AC voltage and current were less than 0.2 percent, and the calibration uncertainty of the AC power meter was less than 0.5 percent (95 % confidence interval, $k=2$).

2.5 Color Measurement Method

Spectral radiant flux was measured by a sphere (2 meter)-spectroradiometer system, and the color characteristics (Color rendering index, correlated color temperature, chromaticity coordinate) were calculated from these by software automatically.

2.6 Total Luminous Flux Measurement Method

Total luminous flux was measured by type C goniophotometer system.

Light intensity distribution was measured by a type C goniophotometer (with mirror) which can keep the sample in burn position when the tests conduct, and the total luminous flux was calculated from the intensity data by software automatically.

2.7 Luminous Intensity Distribution Measurement Method

Luminous intensity distribution was measured by a mirror-type goniophotometer (Type C) which can keep the sample in burn position when the tests conduct, and the kinds of graph were generated by software automatically.

2.8 Spatial Non-uniformity of Chromaticity

The customer did not require this measurement.

3. Test Result Summary

3.1 Electrical data

Criteria Item	Result(Sphere)	Result(Goniophotometer)
Input Voltage & Frequency	119.99 V~60Hz	119.99 V~60Hz
Input Current(A)	0.449	0.450
Total Power(W)	53.63	53.72
Power Factor	0.995	0.995
I-THD	4.08 %	-
Off-state Power(W)	-	-

3.2 Photometric data

Criteria Item	Result(Sphere)	Result(Goniophotometer)
Total Lumens(lm)	- ⁴	6933.67
Luminaire Efficacy(Lm/W)	-	129.07
Correlated Color Temperature (CCT)(K)	4110	-
Color Rendering Index (CRI)	82.4	-
R9	6	-
Chromaticity Coordinate (x,y)	x=0.3767 y=0.3778	-
Chromaticity Coordinate (u,v)	u=0.2223 v=0.3343	-
Chromaticity Coordinate (u',v')	u'=0.2223 v'=0.5015	-
Duv	0.0016	-
Spacing Criteria(0-180°)	-	1.24
Spacing Criteria(90-270°)	-	1.32
Zone Lumens between 0-60 °	-	73.45%

3.3 Color Rendering Details

R1	R2	R3	R4	R5	R6	R7	R8
81	88	94	82	81	83	86	64
R9	R10	R11	R12	R13	R14	R15	-
6	72	81	60	83	96	74	-

3.4 Additional test at 277V

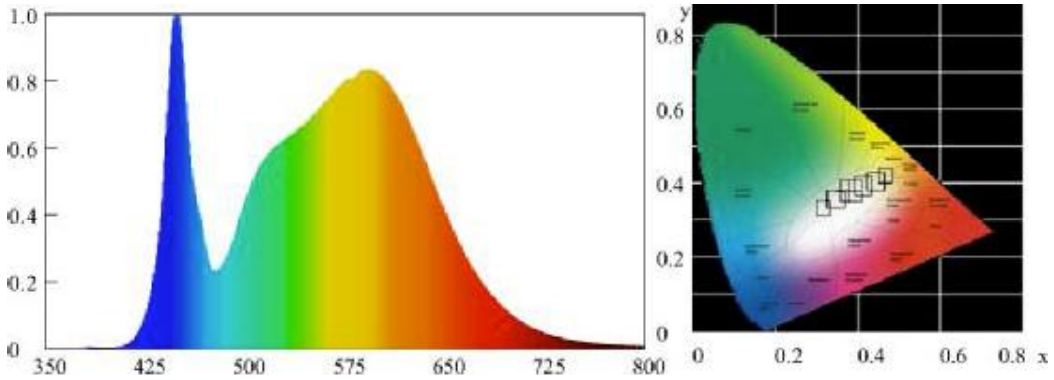
Criteria Item	Result(Sphere)	Result(Goniophotometer)
Input Voltage & Frequency	277.02V~60Hz	-
Power Factor	0.915	-
I-THD	7.86%	-

Note:

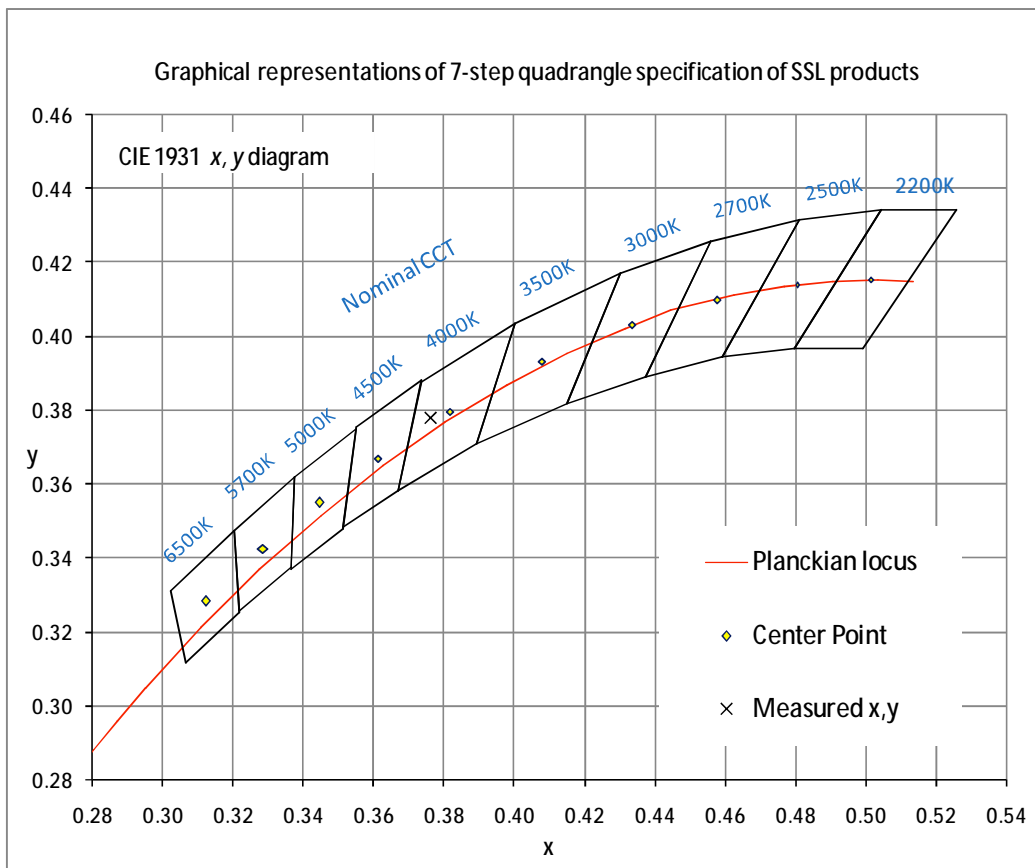
4, Self-absorption is 1.

4. Test Data

4.1 Spectral Distribution



4.2 ANSI Chromaticity Quadrangles Diagram





4.3 Goniometry Test Data

CIE Type	Direct	Basic Luminous Shape	Rectangular
Spacing Criteria (0-180)	1.24	Luminous Length	1.15 m
Spacing Criteria (90-270)	1.32	Luminous Width	0.55 m
Spacing Criteria (Diagonal)	1.40	Luminous Height	0.00 m
Test Distance	29.79 m		

4.4 Zonal Lumen Summary

Zone	Lumens	%Lamp	%Fixt
0-20	805.03	11.60	11.60
0-30	1712.08	24.70	24.70
0-40	2816.1	40.60	40.60
0-60	5092.89	73.50	73.50
0-80	6681.85	96.40	96.40
0-90	6909.59	99.70	99.70
10-90	6701.36	96.60	96.60
20-40	2011.07	29.00	29.00
20-50	3181.97	45.90	45.90
40-70	3205.32	46.20	46.20
60-80	1588.96	22.90	22.90
70-80	660.43	9.50	9.50
80-90	227.74	3.30	3.30
90-110	8.42	0.10	0.10
90-120	11.49	0.20	0.20
90-130	14.26	0.20	0.20
90-150	19.07	0.30	0.30
90-180	24.07	0.30	0.30
110-180	15.65	0.20	0.20
0-180	6933.66	100.00	100.00

Total Luminaire Efficiency = 100.00%

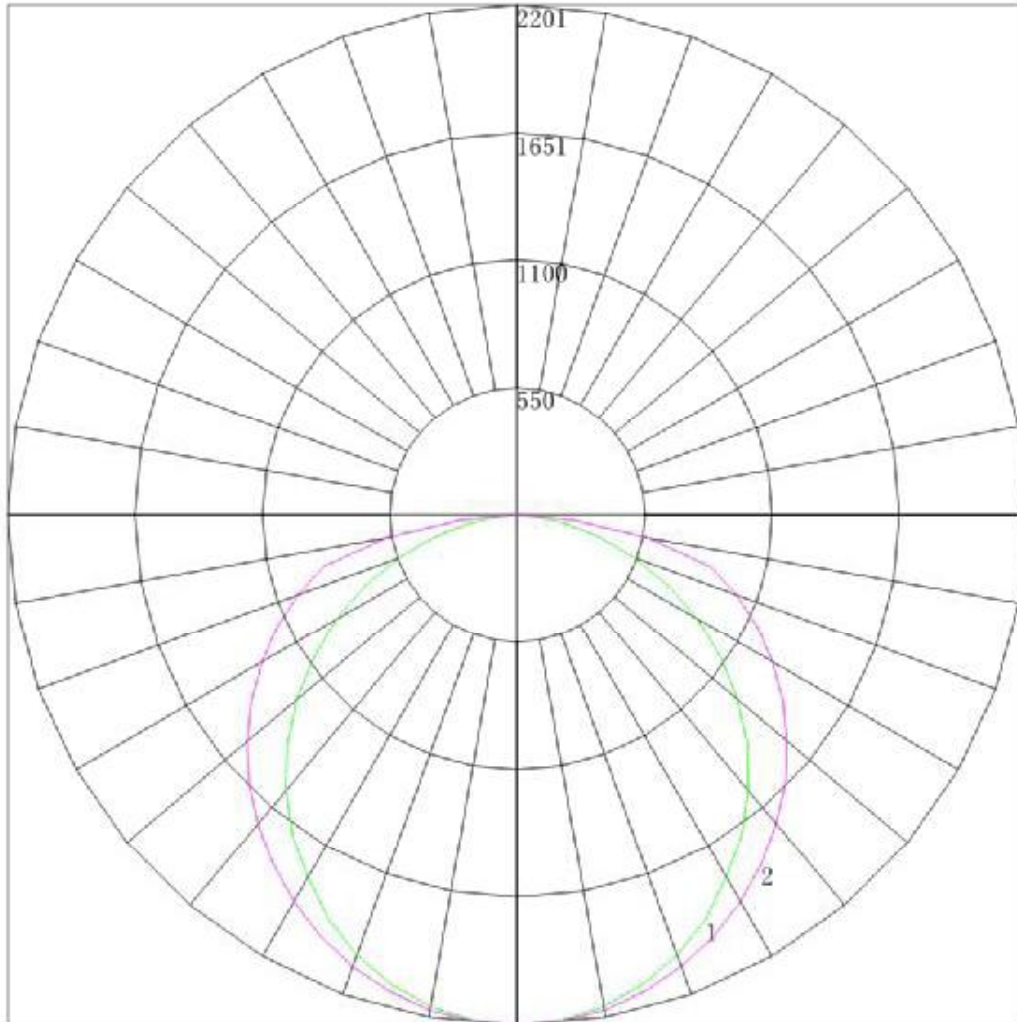
ZONAL LUMEN SUMMARY

Zone	Lumens
0-10	208.23
10-20	596.80
20-30	907.05
30-40	1104.01
40-50	1170.9
50-60	1105.89
60-70	928.53
70-80	660.43
80-90	227.74
90-100	4.85
100-110	3.57
110-120	3.07
120-130	2.77
130-140	2.31
140-150	2.50
150-160	2.49
160-170	1.82
170-180	0.70



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4.5 Polar Curves



Maximum Candela = 2200.714 Located At Horizontal Angle = 0, Vertical Angle = 0

1 - Vertical Plane Through Horizontal Angles (0 - 180)

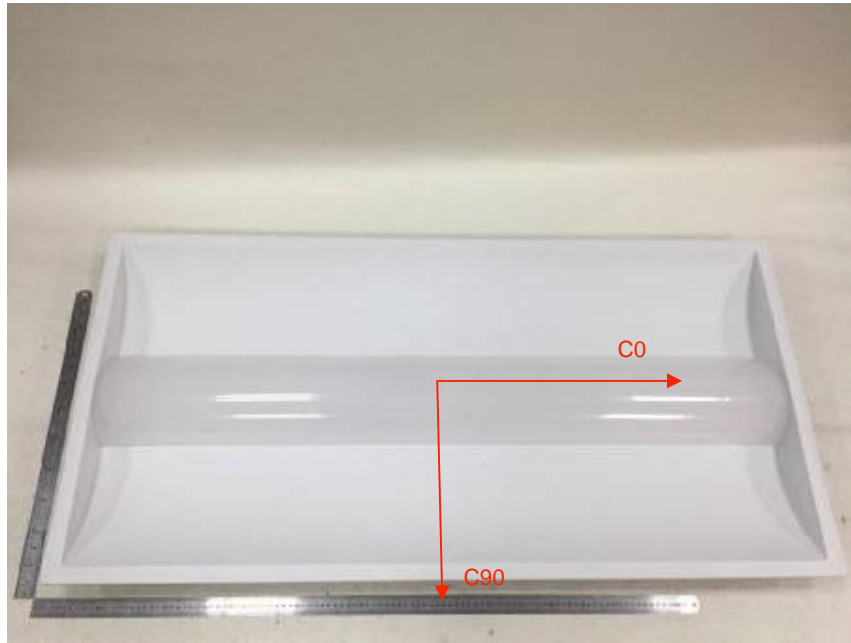
2 - Vertical Plane Through Horizontal Angles (90 - 270)



4.6 Candela Tabulation

	<u>0</u>	<u>15</u>	<u>30</u>	<u>45</u>	<u>60</u>	<u>75</u>	<u>90</u>
0	2200.714	2200.714	2200.714	2200.714	2200.714	2200.714	2200.714
5	2189.117	2189.358	2189.410	2191.398	2191.856	2192.961	2194.537
10	2155.219	2155.296	2158.607	2162.125	2165.500	2169.037	2169.381
15	2098.573	2100.965	2107.411	2114.447	2121.649	2127.608	2128.334
20	2022.302	2025.260	2035.604	2050.584	2062.285	2072.229	2075.812
25	1927.297	1933.532	1946.526	1968.757	1987.655	2003.110	2008.282
30	1806.200	1819.163	1842.369	1871.846	1899.727	1921.368	1929.275
35	1692.328	1699.856	1725.217	1763.665	1800.131	1830.092	1838.793
40	1553.390	1564.994	1592.380	1644.986	1691.430	1730.091	1741.384
45	1405.308	1416.752	1452.501	1516.244	1574.444	1623.336	1636.689
50	1241.882	1257.382	1305.328	1376.780	1451.118	1504.261	1520.474
55	1072.480	1093.245	1151.221	1237.230	1318.444	1380.622	1400.989
60	899.822	924.506	991.582	1091.330	1181.255	1251.023	1273.032
65	719.938	749.165	831.810	944.748	1045.535	1118.701	1143.091
70	536.307	579.798	680.243	797.485	904.651	982.684	1010.546
75	363.381	426.336	530.791	654.988	763.020	838.878	863.746
80	202.899	269.386	384.468	493.821	538.186	561.118	570.277
85	76.360	134.995	193.293	219.711	233.308	234.953	238.490
90	4.594	4.587	5.945	6.659	8.496	6.960	7.153
95	3.256	3.318	3.568	3.970	4.186	4.342	4.371
100	3.167	3.206	3.435	3.637	3.854	3.965	4.018
105	2.988	3.050	3.169	3.437	3.566	3.678	3.753
110	2.810	2.783	2.903	3.171	3.300	3.456	3.488
115	2.676	2.739	2.837	3.038	3.212	3.367	3.399
120	2.899	2.895	3.036	3.194	3.279	3.456	3.399
125	2.855	2.894	3.058	3.215	3.323	3.390	3.399
130	2.632	2.605	2.726	2.794	2.946	2.969	3.134
135	2.810	2.828	2.881	2.927	2.835	2.880	2.913
140	3.301	3.318	3.347	3.437	3.455	3.500	3.531
145	3.791	3.807	3.834	3.969	4.031	4.098	4.104
150	4.550	4.609	4.632	4.701	4.696	4.763	4.810
155	5.397	5.410	5.430	5.411	5.471	5.494	5.561
160	5.888	5.923	5.962	6.077	6.047	6.136	6.223
165	6.334	6.323	6.338	6.431	6.379	6.535	6.620
170	6.958	6.902	6.870	6.896	6.866	7.111	7.062
175	7.360	7.392	7.402	7.517	7.686	7.754	7.636
180	7.783	7.783	7.783	7.783	7.783	7.783	7.783

Appendix A Product Photo



Picture 1



Picture 2

****End of test report****