



## LM-79-08 Test and ISTMT Report

for

**A.L.P. Lighting Components, Inc.**

6333 Gross Point Road, Niles, IL 60714

**4FT LED Linear Ambient Luminaire Direct**

**Model: 31424-4850LW-1**

**Laboratory: Leading Testing Laboratories**

**NVLAP CODE: 200960-0**

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Report No.: HZ15060015g

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

Review by:

Engineer: April Zou  
Jun. 26, 2015

Approved by:



Manager: Jim Zhang  
Jun. 26, 2015

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: 31424-4850LW-1

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
105.4	5057.2	47.97	0.9956
CCT (K)	CRI	Stabilization Time (Light & Power)	
5243	84.3	60	

Table 1: Executive Data Summary

### Test specifications:

<b>Date of Receipt</b>	: Jun. 04, 2015
<b>Date of Test</b>	: Jun. 15, 2015 to Jun. 24, 2015
<b>Test item</b>	: Total Luminous Flux, Luminous Distribution Intensity, Luminous Efficacy, Correlated Color Temperature, Color Rendering Index, Chromaticity Coordinate, Electrical parameters
<b>Reference Standard</b>	: IESNA LM-79-2008 Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products ANSI/UL 8750-2011 Light Emitting Diode (LED) Equipment for Use in Lighting Products ANSI/UL 1598-2010 Standard for Safety of Luminaire

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## Sample Photo



Figure 1- Overview of the sample

### Equipment Under Test (EUT)

<b>Name</b>	: 4FT LED Linear Ambient Luminaire Direct
<b>Model</b>	: 31424-4850LW-1
<b>Brand Name</b>	: A.L.P Lighting
<b>Electrical Ratings</b>	: AC120~277V, 50/60 Hz, 48W
<b>Product Description</b>	: Wrap 314 base, 5000K, Dimmable Driver: PIFN-X048A Manufacturer of light source: LG INNOTEK Model of light source: LGIT 5630 G2 Quantity of light source: 112 pcs
<b>Manufacturer</b>	: A.L.P. Lighting Components, Inc.
<b>Address</b>	: 6333 Gross Point Road, Niles, IL 60714

## TEST RESULTS

Test ambient temperature was 25.1°C.

Sample orientation was light down. 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 95 minutes.

The photometric distance of Goniophotometer is 30m.

Luminous data was taken at 0.5°vertical intervals and 10°horizontal intervals.

Parameter	Result	
Test Voltage (V)	120.0	277.0
Voltage frequency (Hz)	60	60
Test Current (A)	0.402	0.179
Power Factor	0.9956	0.9478
Test Power (W)	47.97	46.99
Off-State Power (W)	0	0
THD A%	6.91	11.85
Luminous Efficacy (lm/W)	105.4	107.7
Total Luminous Flux (lm)	5057.2	5058.6
Color Rendering Index (CRI)	84.3	
R9	12	
Correlated Color Temperature (CCT) (K)	5243	
Chromaticity (Chroma x, Chroma y)	(0.3387, 0.3483)	
Chromaticity (Chroma u, Chroma v)	(0.2084, 0.3214)	
Chromaticity (Chroma u', Chroma v')	(0.2084, 0.4821)	
Duv	0.0010	
Average Beam Angle (°)	109.7	
Center Beam Candle Power (cd)	1684	
Spacing Criteria	1.24 (0°-180°)/ 1.20 (90°-270°)	
Zonal Lumens in the 0°-60°Zone	72.67%	
Zonal Lumens in the 60°-90°Zone	22.48%	
Zonal Lumens in the 90°-120°Zone	3.06%	
Zonal Lumens in the 120°-180°Zone	1.79%	

Special Rendering Indices	Color
R1	83
R2	89
R3	93
R4	85
R5	84
R6	85
R7	87
R8	69
R9	12
R10	74
R11	84
R12	68
R13	84
R14	96

Table 2 Test data per Goniophotometer Method

Note: According to CIE 1976 (u', v') diagram,  $u' = u = 4x/(-2x+12y+3)$ ,  $v' = 3v/2 = 9y/(-2x+12y+3)$ .

### Spectral Power Distribution

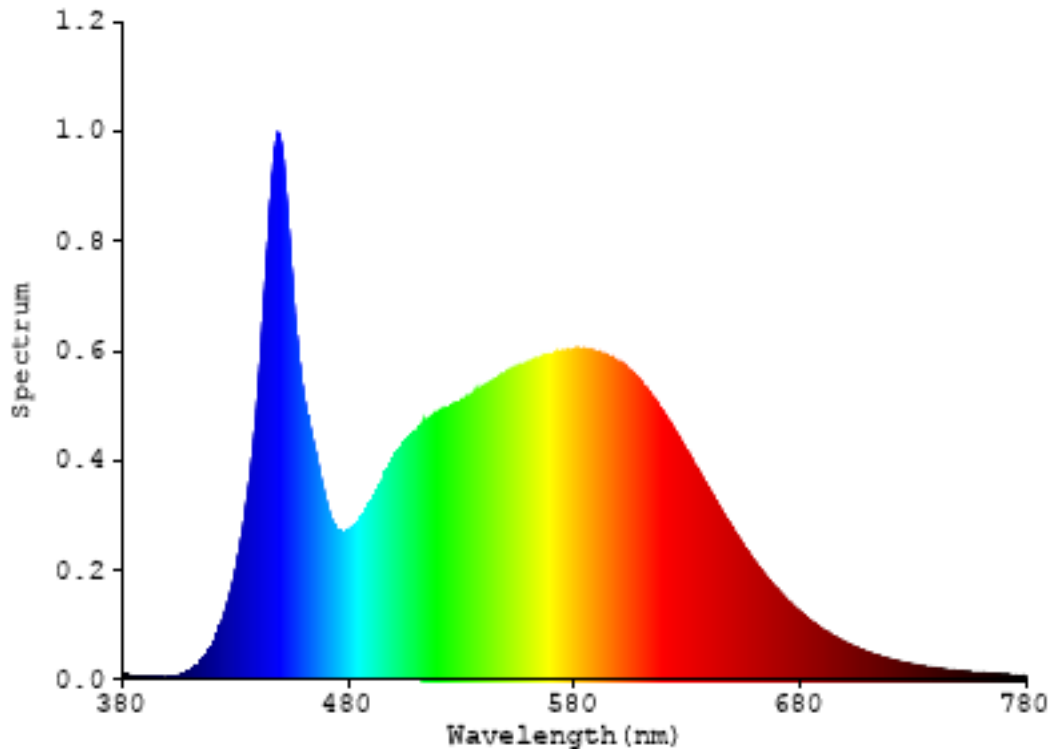


Chart 1: Spectral Power Distribution

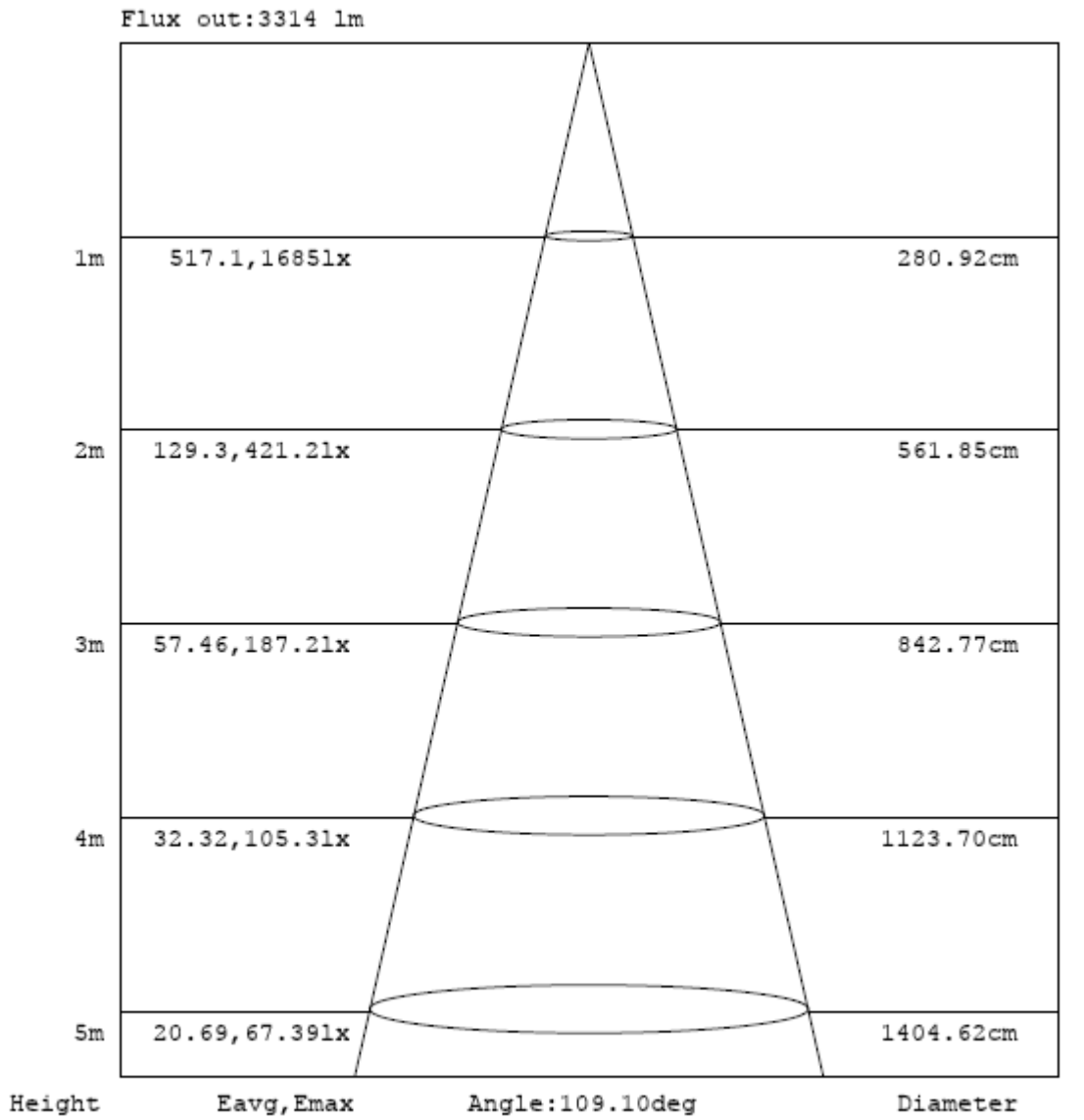
### Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	159.081	3.15%
10- 20	453.125	8.96%
20- 30	679.346	13.43%
30- 40	806.438	15.95%
40- 50	825.731	16.33%
50- 60	751.542	14.86%
60- 70	607.862	12.02%
70- 80	405.375	8.02%
80- 90	123.597	2.44%
90-100	46.666	0.92%
100-110	58.742	1.16%
110-120	49.034	0.97%
120-130	37.797	0.75%
130-140	26.268	0.52%
140-150	15.879	0.31%
150-160	7.763	0.15%
160-170	2.565	0.05%
170-180	0.407	0.01%
Total	5057.2	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	3675.263	72.67%
60- 90	1136.834	22.48%
0-90	4812.097	95.15%
90- 180	245.121	4.85%
0- 180	5057.2	100%

Table 3: Zonal Lumen Data

### Illuminance Plots



Note: The Curves indicate the illuminated area and the average illumination when the luminaire is at different distance.

Chart 2: Beam angle



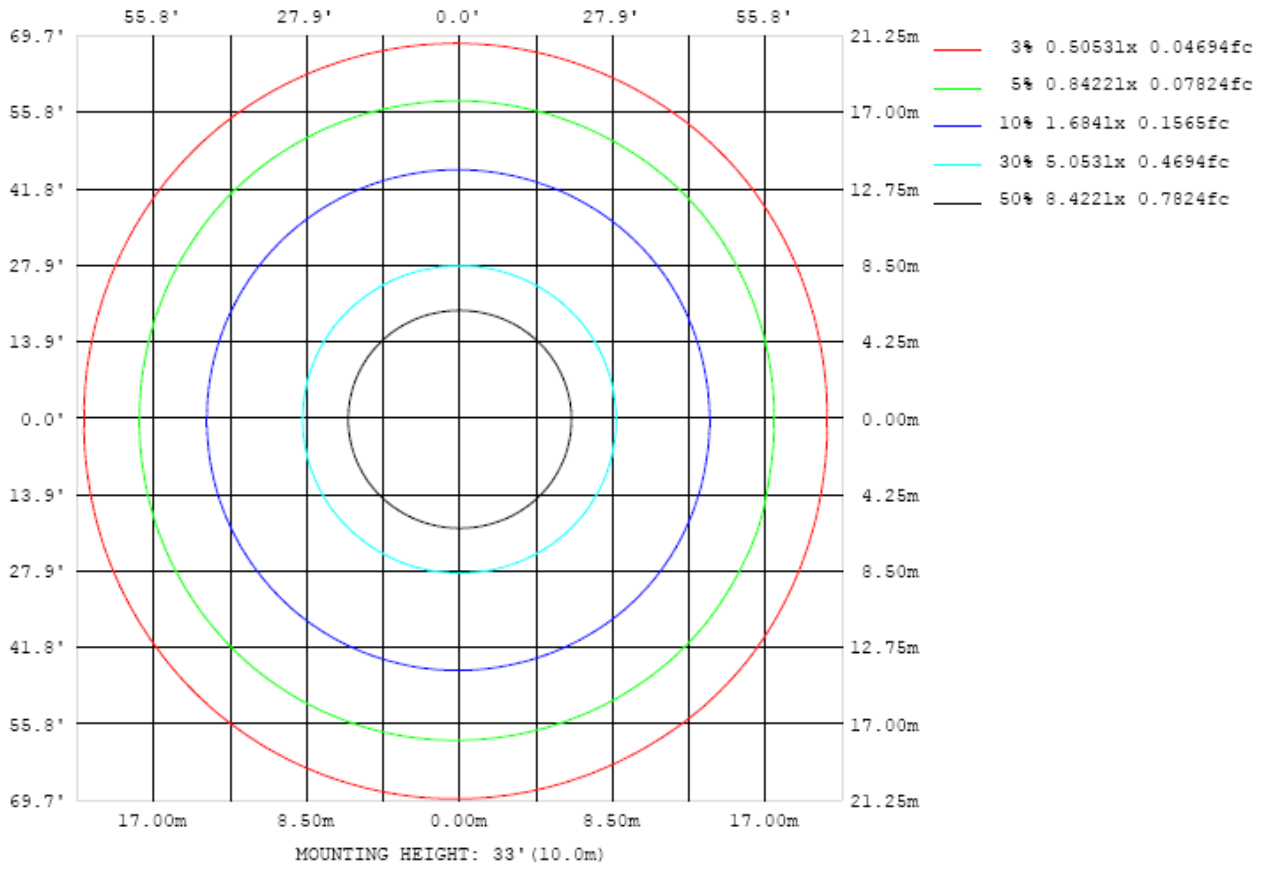


Chart 3: Illuminance Plot (Footcandles)

### Luminous Intensity Distribution Plots

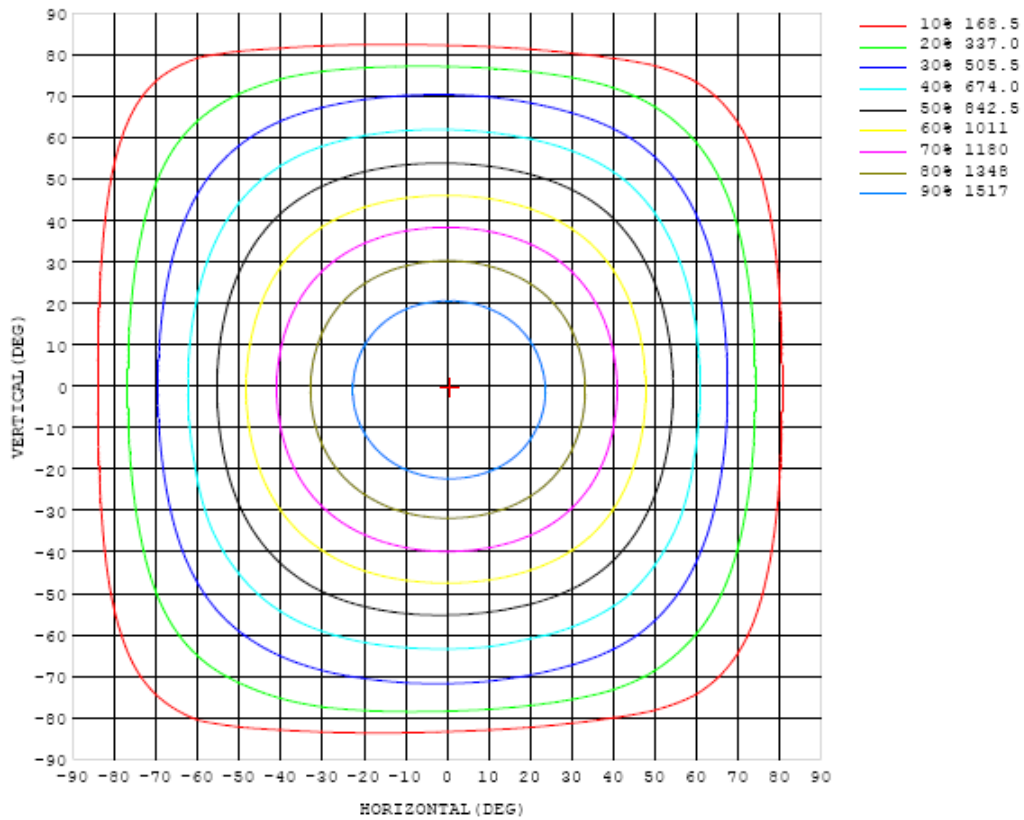


Chart 4: Isocandla Plot

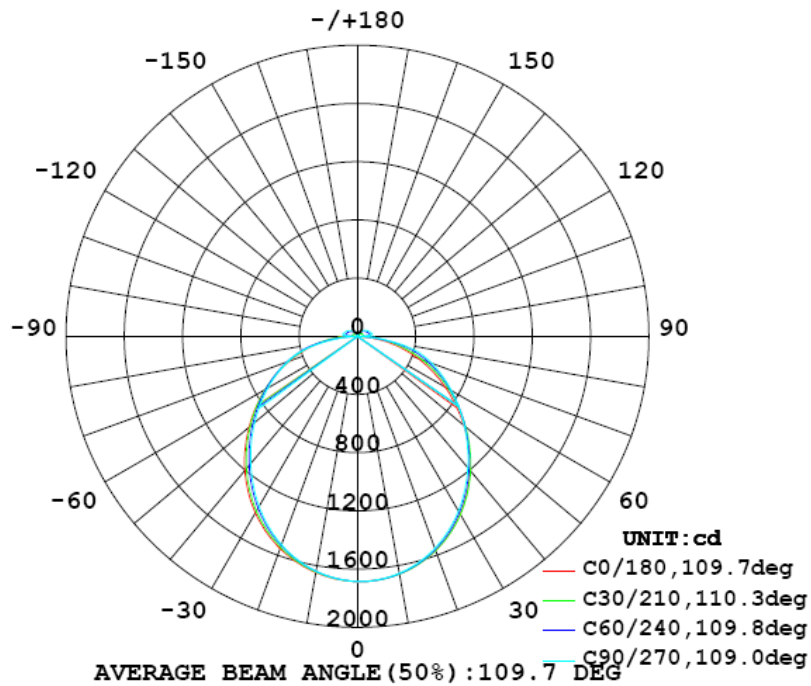


Chart 5: Polar Candela Distribution

### Luminous Intensity Data

Table--1 UNIT: cd

C (DEG) γ (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	1684	1684	1684	1684	1684	1684	1684	1684	1684	1684	1684	1684	1684	1684	1684	1684	1684	1684	1684
5	1679	1680	1680	1680	1680	1680	1679	1679	1679	1678	1678	1677	1677	1677	1676	1676	1676	1675	1674
10	1657	1658	1659	1658	1658	1657	1656	1655	1654	1653	1653	1652	1652	1651	1651	1651	1651	1650	1648
15	1620	1621	1621	1621	1619	1618	1616	1614	1612	1611	1610	1610	1609	1610	1610	1610	1610	1610	1607
20	1565	1568	1568	1567	1565	1562	1559	1556	1553	1551	1550	1550	1551	1553	1554	1555	1555	1554	1552
25	1495	1498	1498	1497	1494	1490	1485	1481	1477	1475	1475	1475	1478	1481	1483	1485	1486	1485	1483
30	1411	1413	1414	1413	1409	1404	1397	1392	1387	1385	1386	1388	1391	1395	1399	1402	1403	1403	1401
35	1311	1314	1316	1315	1311	1305	1298	1291	1287	1285	1286	1289	1293	1298	1303	1307	1309	1309	1307
40	1200	1203	1206	1207	1204	1198	1190	1184	1179	1178	1180	1183	1188	1193	1199	1203	1206	1204	1203
45	1080	1084	1087	1090	1090	1085	1079	1073	1069	1068	1069	1074	1079	1083	1088	1092	1093	1092	1090
50	953	958	964	969	971	969	964	960	957	958	960	964	969	973	975	977	977	974	972
55	824	829	837	845	851	852	849	847	847	849	853	857	860	863	862	861	859	854	852
60	694	696	711	723	735	738	738	738	740	744	748	752	754	755	751	747	741	735	731
65	567	573	586	601	617	624	628	632	637	642	645	647	648	646	640	633	625	617	613
70	440	447	461	478	497	510	519	528	537	542	544	544	542	537	528	519	510	500	496
75	314	321	336	354	377	394	408	421	432	439	442	440	434	426	415	405	395	383	380
80	184	193	210	230	250	253	257	267	276	286	296	306	313	312	301	291	280	268	264
85	53.4	62.1	73.5	79.0	82.2	80.0	87.9	98.5	108	119	130	140	148	157	170	177	164	150	147
90	0.31	2.31	7.89	13.4	15.7	15.4	15.8	12.4	8.42	4.80	5.17	9.25	2.01	9.72	21.8	29.7	35.1	31.5	31.8
95	0.90	5.40	21.6	40.3	58.9	76.2	84.3	82.4	78.2	72.6	66.4	59.4	51.8	43.7	35.8	27.8	12.7	3.34	0.85
100	1.33	5.64	22.1	40.9	58.9	74.5	86.8	95.6	101	102	99.7	93.7	83.6	70.1	54.0	36.8	19.4	4.25	1.27
105	1.92	5.80	21.5	39.6	56.6	71.1	82.5	90.5	94.9	96.1	94.0	88.6	79.7	67.6	52.9	36.5	19.4	4.34	1.68
110	2.37	6.09	20.4	37.5	53.6	67.4	78.2	85.4	89.4	90.4	88.4	83.5	75.4	64.4	50.5	34.8	18.6	4.77	2.17
115	2.84	6.17	19.2	35.1	50.2	63.1	73.1	80.1	83.9	84.9	83.0	78.4	70.8	60.4	47.5	32.8	17.6	5.01	2.47
120	3.31	6.05	18.0	32.4	46.4	58.3	67.7	74.3	78.0	79.0	77.3	72.8	65.7	55.9	44.0	30.3	16.6	5.10	2.78
125	3.73	6.18	16.6	29.5	42.1	53.2	62.1	68.2	71.8	72.8	71.1	66.9	60.3	51.2	40.0	27.9	15.3	5.10	3.24
130	4.01	6.07	14.9	26.4	37.7	47.8	55.6	61.7	65.1	66.0	64.5	60.7	54.4	46.0	36.3	25.2	14.1	5.33	3.59
135	4.21	5.22	12.8	23.5	33.1	42.2	49.6	54.7	57.7	58.6	57.3	53.8	48.5	41.0	32.3	22.5	12.2	5.05	3.79
140	4.50	3.53	11.3	19.9	28.8	36.5	43.1	47.7	50.5	51.4	50.3	47.1	42.2	35.8	27.9	19.6	10.5	3.30	4.09
145	4.74	3.20	9.89	16.1	24.5	31.1	36.5	40.6	43.1	43.9	43.0	40.3	36.0	30.6	23.9	15.8	9.67	2.58	4.22
150	4.93	3.39	8.64	13.6	19.1	25.6	30.2	33.6	35.6	36.3	35.5	33.4	30.1	25.2	18.8	13.1	8.47	2.87	4.48
155	5.11	3.79	6.42	11.2	15.1	18.8	22.9	26.6	28.3	28.9	28.4	26.6	23.4	18.9	14.9	11.2	7.05	3.24	4.73
160	4.73	3.99	3.58	8.83	11.6	14.4	16.6	18.5	19.9	20.4	20.0	18.6	16.9	14.7	11.8	8.28	4.19	3.54	4.78
165	4.68	4.78	2.82	4.21	8.31	10.3	12.0	13.2	14.0	14.3	14.0	13.2	12.0	10.3	8.28	5.35	2.97	4.23	4.66
170	4.83	4.89	4.12	2.95	2.78	4.79	7.07	8.30	8.67	8.73	8.75	8.49	7.35	4.79	3.35	2.86	3.58	4.49	4.23
175	5.04	5.11	5.06	5.02	4.24	3.42	2.69	2.59	3.21	3.16	3.25	3.26	3.21	3.32	3.67	4.36	4.60	4.61	4.62
180	4.95	4.95	4.95	4.95	4.95	4.95	4.95	4.95	4.95	4.95	4.95	4.95	4.95	4.95	4.95	4.95	4.95	4.95	4.95

Table 4: 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	1684	1684	1684	1684	1684	1684	1684	1684	1684	1684	1684	1684	1684	1684	1684	1684	1684		
5	1673	1673	1672	1672	1671	1670	1670	1670	1670	1670	1671	1672	1673	1674	1675	1676	1677		
10	1647	1645	1644	1642	1640	1640	1639	1638	1639	1639	1641	1642	1645	1647	1649	1652	1654		
15	1605	1603	1600	1597	1595	1592	1591	1589	1590	1591	1593	1596	1600	1604	1607	1611	1615		
20	1550	1546	1542	1538	1534	1530	1526	1524	1524	1525	1528	1533	1539	1545	1550	1555	1560		
25	1481	1477	1472	1466	1459	1454	1449	1445	1443	1443	1447	1455	1463	1471	1478	1485	1490		
30	1398	1394	1388	1380	1372	1364	1357	1352	1351	1352	1356	1363	1372	1382	1391	1399	1405		
35	1303	1299	1292	1283	1273	1263	1256	1250	1248	1249	1254	1262	1271	1282	1292	1299	1305		
40	1199	1194	1187	1177	1167	1157	1149	1143	1141	1142	1146	1154	1164	1174	1183	1190	1194		
45	1087	1082	1076	1067	1058	1048	1040	1034	1031	1032	1036	1042	1051	1059	1067	1072	1075		
50	969	966	961	955	947	939	931	925	922	921	923	929	936	942	946	949	950		
55	850	849	846	844	839	831	824	819	814	813	813	817	822	825	825	823	823		
60	730	732	732	733	731	726	720	715	711	708	706	707	710	710	705	699	695		
65	612	616	619	621	623	620	616	613	610	607	602	599	597	593	584	575	569		
70	496	501	505	510	513	513	513	513	511	506	498	490	483	475	462	451	444		
75	380	386	391	396	402	406	407	405	400	394	387	378	368	355	339	327	317		
80	265	272	277	282	279	267	258	248	239	232	226	221	222	228	217	201	190		
85	148	156	156	138	118	109	99.4	83.6	69.1	60.1	55.1	52.3	55.6	62.0	64.6	65.2	59.0		
90	32.1	29.2	17.8	1.78	1.74	13.5	7.64	10.9	14.6	18.1	20.5	21.9	21.2	18.9	15.1	9.22	1.98		
95	4.58	17.6	34.2	47.0	57.3	66.4	74.5	81.4	86.9	91.3	93.4	89.1	74.7	57.5	38.9	20.3	4.28		
100	5.86	20.6	37.9	55.0	70.5	83.3	92.9	98.6	101	99.6	94.7	85.9	73.4	57.6	39.7	20.9	4.32		
105	5.98	20.3	37.1	53.3	67.7	79.4	88.0	93.2	95.3	94.2	89.7	81.7	70.2	55.4	38.2	20.3	4.63		
110	6.09	19.5	35.4	50.7	64.3	75.3	83.3	88.0	89.8	88.8	84.7	77.2	66.2	52.3	36.2	19.2	4.83		
115	6.14	18.4	33.3	47.6	60.3	70.5	77.9	82.4	84.2	83.1	79.1	72.0	61.7	48.7	33.5	18.0	4.94		
120	6.16	17.2	30.7	44.1	55.8	65.3	72.2	76.5	78.1	77.0	73.2	66.4	56.8	44.6	30.8	16.6	4.90		
125	5.92	16.1	28.3	40.1	51.1	59.9	66.3	70.3	71.8	70.7	67.0	60.6	51.4	40.6	28.0	15.2	4.68		
130	6.11	14.6	25.5	36.4	46.0	54.0	60.1	63.7	65.0	63.9	60.2	54.3	46.3	36.3	25.0	13.5	3.28		
135	6.06	13.1	22.8	32.3	40.9	48.2	53.4	56.6	57.7	56.7	53.7	48.2	40.9	31.8	22.1	11.7	2.92		
140	5.58	11.1	19.8	28.0	35.7	41.9	46.7	49.6	50.5	49.5	46.5	41.9	35.3	27.6	18.6	10.4	3.26		
145	4.15	9.78	16.7	24.0	30.3	35.8	39.9	42.4	43.2	42.3	39.7	35.5	30.0	23.4	14.9	9.04	3.56		
150	2.68	8.28	13.1	19.5	25.1	29.6	32.9	34.9	35.5	34.8	32.8	29.4	24.7	18.2	13.0	8.08	3.97		
155	2.92	6.86	10.8	14.5	19.1	23.0	25.9	27.7	28.2	27.7	26.0	22.8	18.5	14.8	11.0	5.37	4.49		
160	3.39	4.22	7.64	10.9	13.6	15.9	17.8	19.3	19.8	19.5	18.3	16.7	14.6	11.9	9.36	3.94	4.08		
165	4.48	2.86	4.19	6.81	9.04	10.6	12.0	13.1	13.7	13.7	13.2	12.1	10.7	9.27	5.61	3.11	4.57		
170	4.25	3.80	3.06	2.62	3.54	5.86	7.42	7.92	8.06	7.97	8.15	7.60	5.71	3.23	3.13	3.78	4.91		
175	4.61	4.64	4.59	4.31	3.78	3.31	3.15	3.22	3.20	3.19	3.36	2.89	3.00	3.97	4.73	5.00	5.01		
180	4.95	4.95	4.95	4.95	4.95	4.95	4.95	4.95	4.95	4.95	4.95	4.95	4.95	4.95	4.95	4.95	4.95		

Table 5: Luminous Intensity Data

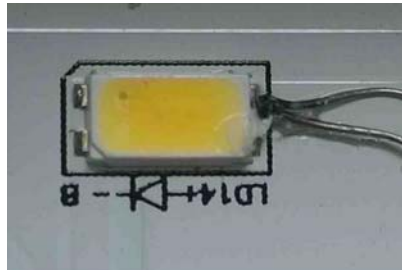
**ISTMT TEST DATA:**

Sample Tested: **31424-4850LW-1**

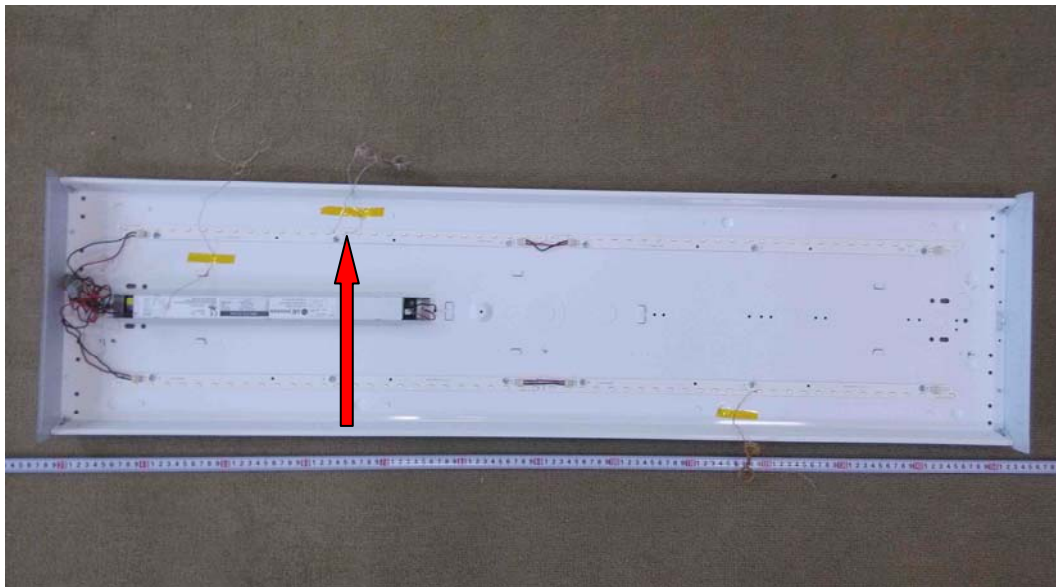
Test ambient temperature was 27.8°C.

Test orientation was Light Down.

The stabilization time of the sample was 7.5 hours.



View of In-Situ Point- Ts



Location of In-Situ Point from overall view

To get the maximum temperature, Ts point is middle of the LED board.

Input Voltage (V)	Input Power (W)	Tested LED source current (mA)	Measured Driver Temp Maximum Temperature (Corrected to Ta=25°C)	Measured In-Situ Maximum Temperature (Corrected to Ta=25°C)
120.0	47.97	107.7	53.7	50.5
277.0	46.99	107.7	53.8	50.7

Table 6: ISTMT test data



## EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Sep. 18, 2014	Sep. 17, 2015
Digital Power Meter	PF2010A	HZTE028-01	Sep. 18, 2014	Sep. 17, 2015
AC Power Supply	PCR 500L	HZTE001-08	Sep. 18, 2014	Sep. 17, 2015
DC Power Supply	WY12010	HZTE004-03	Sep. 18, 2014	Sep. 17, 2015
Temperature Meter	TES1310	HZTE017-01	Sep. 18, 2014	Sep. 17, 2015
Standard source	D908	HZTE012-01	Sep. 18, 2014	Sep. 17, 2015
Digital Power Meter	WT210	HZTE008-01	Sep. 18, 2014	Sep. 17, 2015
AC Power Supply	PCR 500L	HZTE001-07	Sep. 18, 2014	Sep. 17, 2015
DC Power Supply	6154	HZTE004-04	Sep. 18, 2014	Sep. 17, 2015
Temperature and humidity recorder	JR900	HZTE018-01	Sep. 18, 2014	Sep. 17, 2015
Multi-Meter	FLUKE 289	HZTE020-03	Nov. 09, 2014	Nov. 08, 2015

Table 7: 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.

### 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 1.94% with a coverage factor  $k=2$ .

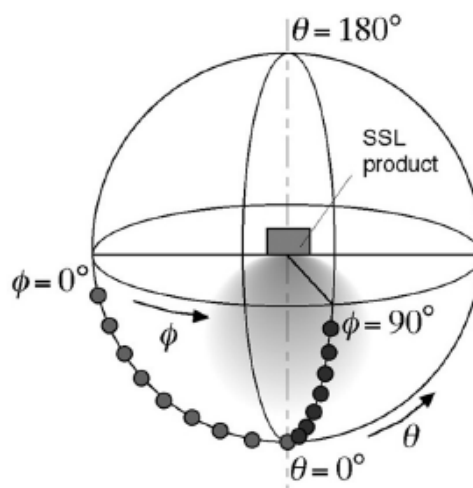
### Color Characteristics Measurements

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  $10^\circ$  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.



### ISTMT

The luminaire was installed to simulate intended usage, in accordance with the manufacturer's instructions.

Temperatures were measured after they stabilized, when the test was run for a minimum of 7.5 h.

The tests were conducted in an ambient temperature of  $25 \pm 5$  °C. Ambient temperature variations above or below 25°C were respectively subtracted from or added to temperatures recorded at points on the luminaire. Temperatures recorded at points on a luminaire were measured by means of thermocouples.

The thermocouples had conductors no larger than No. 24 AWG ( $0.21\text{mm}^2$ ) and no smaller than No. 30 AWG ( $0.05\text{mm}^2$ ). Thermocouples complied with the requirements specified in ASTM MNL 12 and thermocouples as listed in the table of the limits of error specified in NIST ITS 90, or ISA MC96.1.

The luminaire was installed in the test box in the configuration that resulted in the highest operating temperatures, considering different trim and maximum lamp wattage combinations, lampholder adjustment heights, and the like.

The test box was constructed of 12mm thick plywood as described below:

The test box was rectangular and had four sides and a bottom.

The four sides of the test box for a ceiling-mounted luminaire were a minimum distance of 8.5 in (215mm) from the nearest part of the lamp housing or heat-producing parts. The top edge of the sides of the test box were a minimum of 8.5 in (215mm) above the highest point of any permanently attached part of the lamp housing.

Thermal insulation of the loose-fill type was poured into the test box through the open top, until level with the top, without applying any compacting procedure.

The thermal insulation was conditioned to the density specified by the insulation manufacturer to obtain a required rated thermal resistance of Rsi 0.56 to 0.678 (R3.2 to R3.85).

All spaces around the luminaire and between it and the sides of the box were filled with the thermal insulation.

\*\*\* End of Report \*\*\*

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