



LM-79-08 Test and ISTMT Report

for

A.L.P. Lighting Components, Inc.

6333 Gross Point Road, Niles, IL 60714

2x4 LED Recessed Interior Luminaires

Model: ELL24-4835LCO-1

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ15070025r

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

Review by:

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Sep. 01, 2015

Approved



1 Manager: Jim Zhang
Sep. 01, 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: **ELL24-4835LCO-1**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
92.7	4405.8	47.55	0.9955
CCT (K)	CRI	Stabilization Time (Light & Power)	
3573	83.7	60	

Table 1: Executive Data Summary

Test specifications:

Date of Receipt	: Jul. 15, 2015
Date of Test	: Aug. 21, 2015 to Aug. 31, 2015
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/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)

Name	: 2x4 LED Recessed Interior Luminaires
Model	: ELL24-4835LCO-1
Brand Name	: A.L.P Lighting
Electrical Ratings	: AC120~277V, 50/60 Hz, 48W
Product Description	: 3500K, Dimmable Driver: PIFN-X048A Manufacturer of light source: LG Model of light source: LGITLED1-28-50K Quantity of light source: 112pcs
Manufacturer	: A.L.P. Lighting Components, Inc.
Address	: 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)	0.398	0.178
Power Factor	0.9955	0.9442
Test Power (W)	47.55	46.54
Off-State Power (W)	0	0
THD A%	6.71	12.07
Luminous Efficacy (lm/W)	92.7	94.6
Total Luminous Flux (lm)	4405.8	4402.2
Color Rendering Index (CRI)	83.7	
R9	11	
Correlated Color Temperature (CCT) (K)	3573	
Chromaticity (Chroma x, Chroma y)	(0.3999, 0.3848)	
Chromaticity (Chroma u, Chroma v)	(0.2346, 0.3387)	
Chromaticity (Chroma u', Chroma v')	(0.2346, 0.5080)	
Duv	0.0014	
Average Beam Angle (°)	109.4	
Center Beam Candle Power (cd)	1608	
Spacing Criteria	1.25 (0°-180°)/ 1.24(90°-270°)	
Zonal Lumens in the 0°-60°Zone	80.48%	
Zonal Lumens in the 60°-90°Zone	19.42%	
Zonal Lumens in the 90°-120°Zone	0.04%	
Zonal Lumens in the 120°-180°Zone	0.06%	

Special Rendering Indices	Color
R1	82
R2	92
R3	96
R4	81
R5	83
R6	89
R7	84
R8	63
R9	11
R10	81
R11	80
R12	70
R13	85
R14	98

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

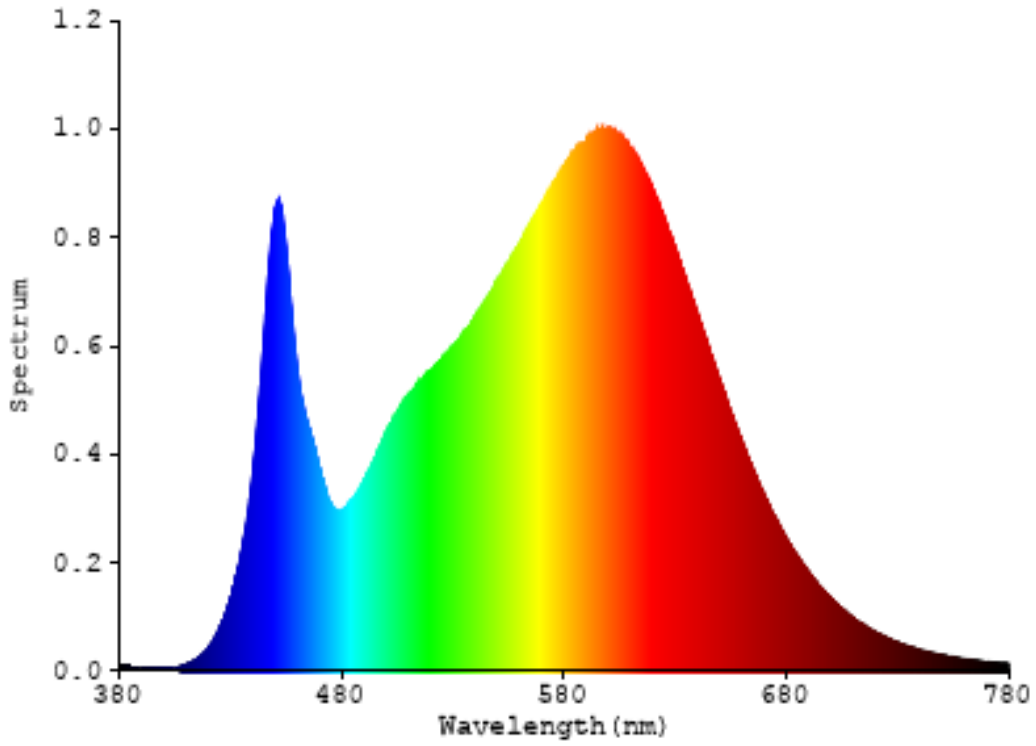


Chart 1: Spectral Power Distribution

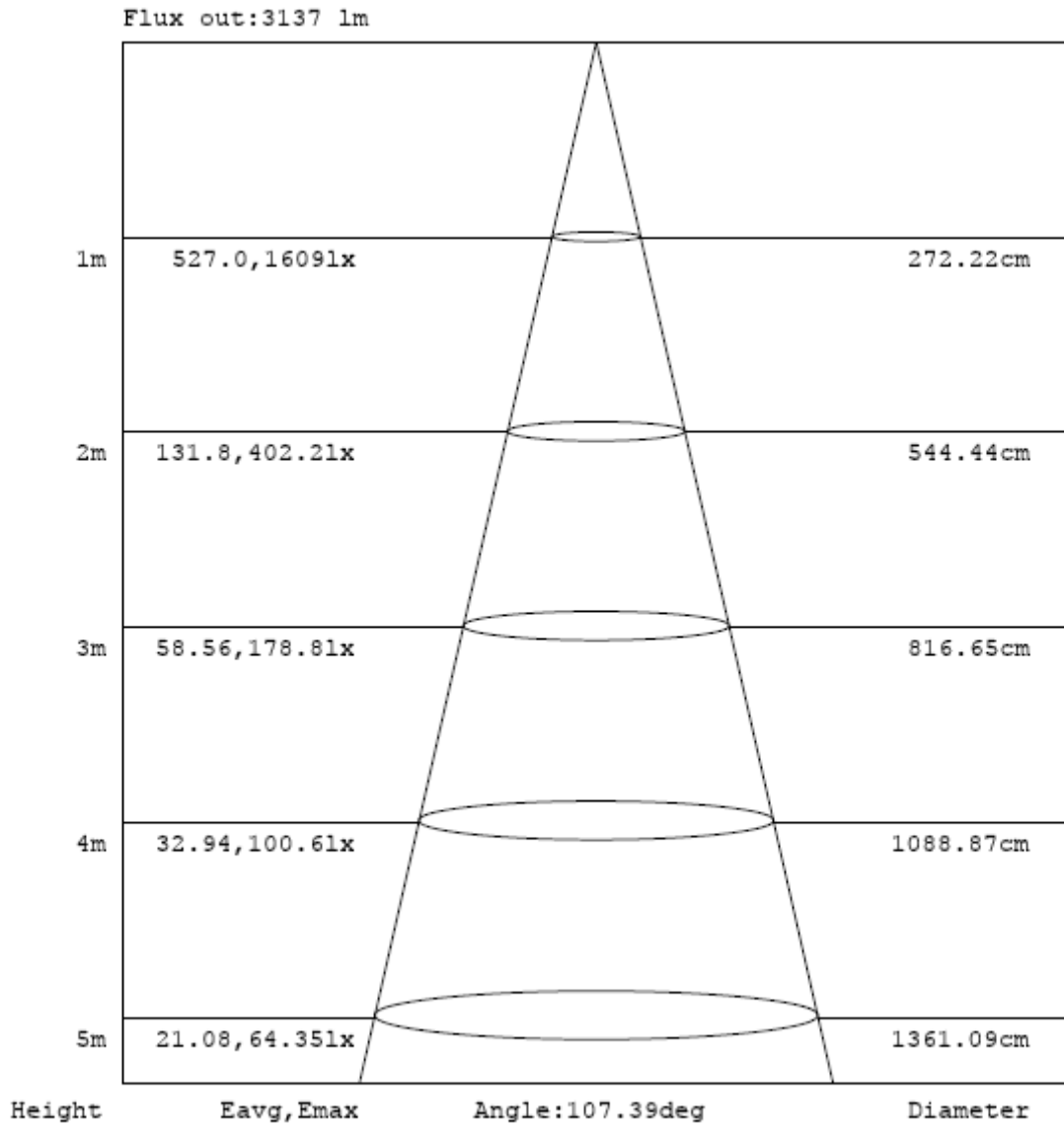
Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	152.138	3.45%
10- 20	435.175	9.88%
20- 30	657.171	14.92%
30- 40	785.975	17.84%
40- 50	804.603	18.26%
50- 60	710.737	16.13%
60- 70	522.495	11.86%
70- 80	281.138	6.38%
80- 90	51.91	1.18%
90-100	0.599	0.01%
100-110	0.571	0.01%
110-120	0.596	0.01%
120-130	0.612	0.01%
130-140	0.656	0.01%
140-150	0.585	0.01%
150-160	0.461	0.01%
160-170	0.276	0.01%
170-180	0.107	0.00%
Total	4405.8	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	3545.799	80.48%
60- 90	855.543	19.42%
0-90	4401.342	99.90%
90- 180	4.463	0.10%
0- 180	4405.8	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

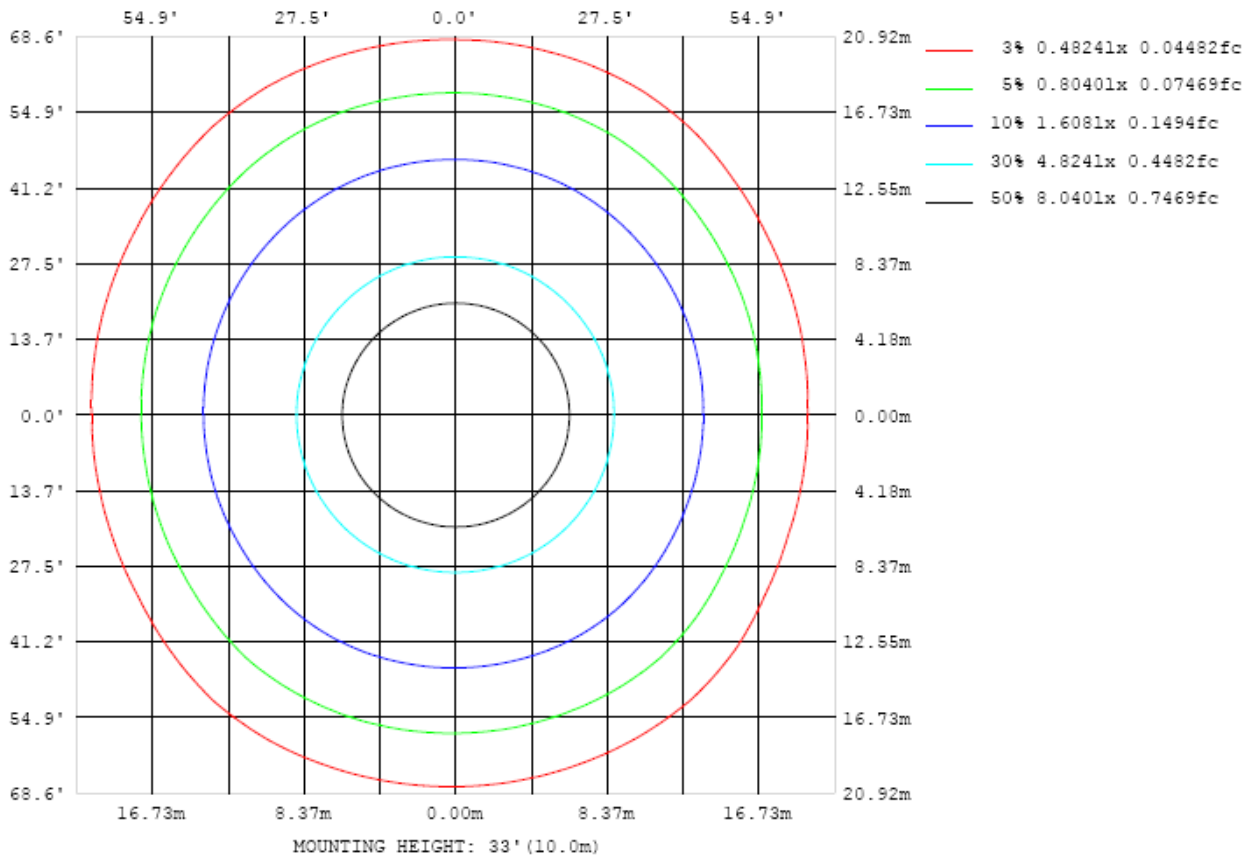


Chart 3: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots

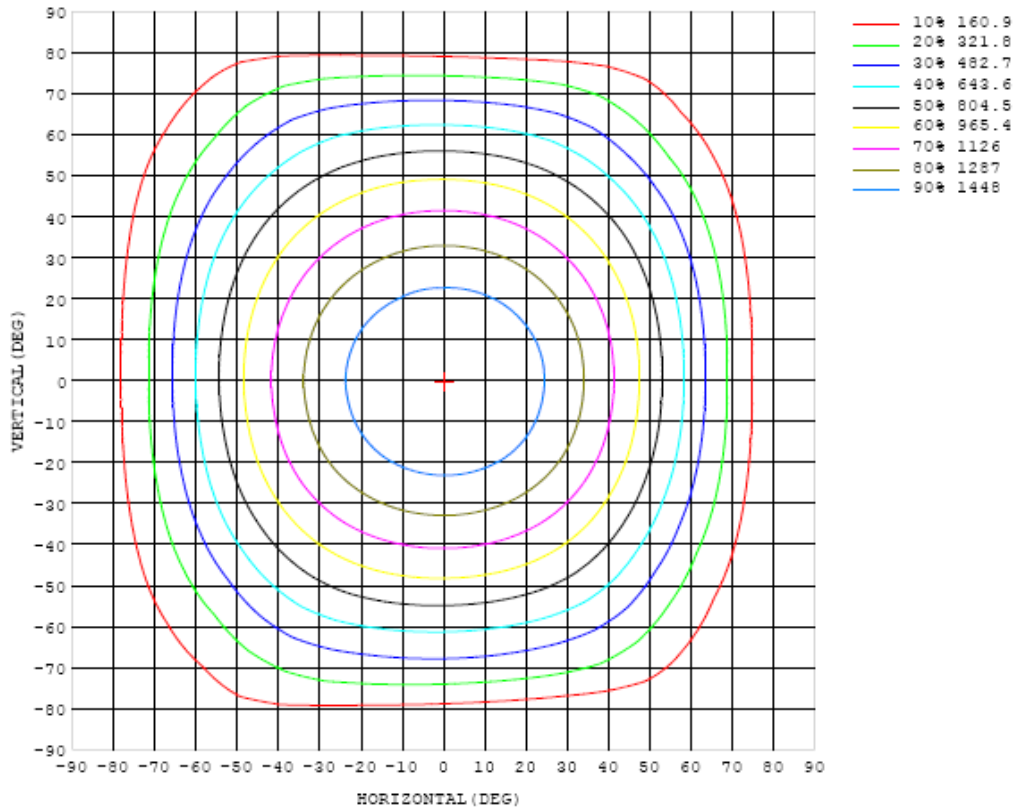


Chart 4: Isocandla Plot

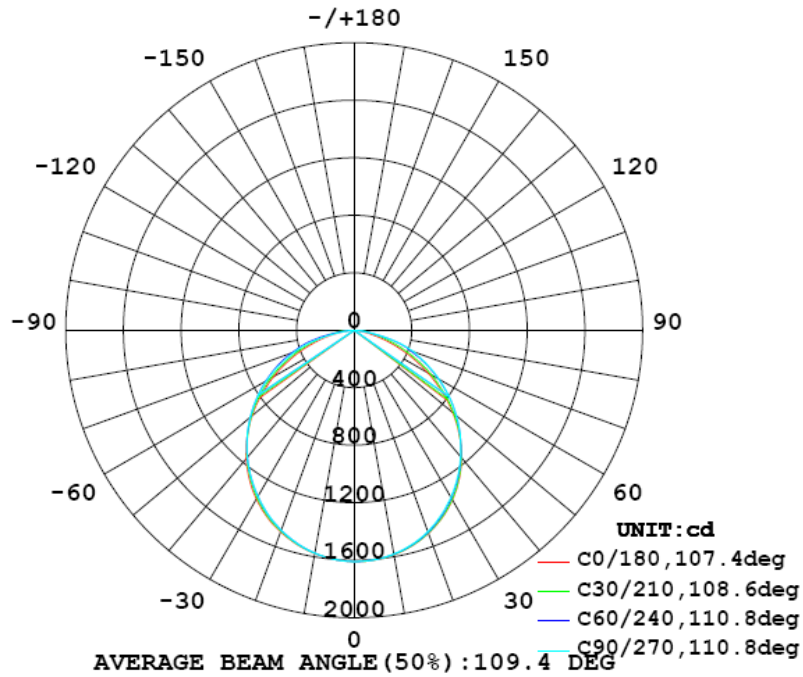


Chart 5: Polar Candela Distribution

Luminous Intensity Data

Table--1 UNIT: cd

C (DEG) \ y (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	1608	1608	1608	1608	1608	1608	1608	1608	1608	1608	1608	1608	1608	1608	1608	1608	1608	1608	1608
5	1604	1603	1603	1604	1604	1603	1603	1602	1602	1602	1602	1601	1601	1601	1601	1600	1600	1600	1600
10	1585	1585	1584	1584	1583	1583	1582	1581	1580	1580	1579	1579	1579	1579	1578	1578	1578	1578	1577
15	1551	1551	1550	1550	1549	1547	1546	1545	1544	1543	1542	1542	1542	1542	1542	1542	1543	1542	1541
20	1503	1503	1502	1501	1499	1498	1495	1493	1491	1490	1490	1490	1491	1492	1492	1493	1493	1493	1492
25	1440	1439	1439	1437	1435	1432	1428	1424	1423	1421	1422	1423	1424	1427	1429	1430	1430	1430	1432
30	1361	1360	1359	1358	1354	1351	1346	1343	1341	1340	1340	1342	1344	1348	1352	1353	1354	1355	1356
35	1267	1266	1266	1264	1260	1257	1254	1251	1249	1248	1250	1251	1253	1257	1261	1264	1265	1265	1267
40	1157	1156	1157	1155	1154	1153	1150	1149	1147	1148	1149	1150	1153	1156	1158	1162	1164	1164	1166
45	1031	1031	1033	1034	1037	1039	1039	1039	1040	1040	1041	1044	1045	1046	1047	1048	1049	1049	1052
50	892	893	897	902	911	919	924	924	924	924	928	932	933	931	927	924	923	923	925
55	742	744	749	761	779	796	801	801	801	803	807	812	816	811	801	792	789	786	789
60	588	592	597	615	647	672	673	671	675	676	682	688	690	694	671	654	649	645	647
65	434	438	443	469	512	536	542	545	549	553	557	562	570	567	543	514	505	502	503
70	286	292	298	333	382	407	416	425	432	437	439	440	445	443	417	378	366	363	364
75	156	165	174	213	263	288	285	281	283	291	303	319	333	326	298	255	238	234	234
80	61.8	68.2	81.9	114	137	131	120	116	119	127	140	157	183	209	195	154	132	126	124
85	11.2	14.0	17.7	18.0	18.9	19.0	19.8	20.7	23.0	26.5	30.9	39.9	50.2	68.2	81.3	73.4	57.9	49.8	46.3
90	0.40	0.60	0.43	0.24	0.29	0.27	0.27	0.18	0.27	0.30	0.70	0.38	2.27	2.69	4.57	5.71	7.33	7.54	9.67
95	0.81	0.57	0.43	0.25	0.29	0.22	0.22	0.21	0.23	0.24	0.25	0.22	0.23	0.22	0.28	0.27	0.45	0.45	0.75
100	0.85	0.71	0.43	0.28	0.30	0.24	0.25	0.24	0.25	0.25	0.25	0.24	0.24	0.24	0.28	0.25	0.44	0.59	0.96
105	0.84	0.77	0.55	0.34	0.41	0.30	0.29	0.26	0.26	0.25	0.27	0.26	0.27	0.28	0.33	0.29	0.49	0.65	1.04
110	0.84	0.80	0.65	0.43	0.41	0.41	0.35	0.33	0.33	0.35	0.33	0.35	0.33	0.32	0.40	0.36	0.58	0.67	0.95
115	0.87	0.89	0.68	0.57	0.45	0.41	0.40	0.39	0.38	0.38	0.39	0.41	0.41	0.41	0.46	0.50	0.64	1.11	0.90
120	0.91	0.85	0.70	0.71	0.61	0.51	0.55	0.46	0.45	0.45	0.48	0.50	0.52	0.52	0.59	0.62	0.67	0.74	0.91
125	0.97	1.08	0.79	0.76	0.75	0.65	0.57	0.57	0.57	0.58	0.62	0.57	0.58	0.64	0.71	0.70	0.73	0.81	0.86
130	1.03	0.95	1.28	0.85	0.82	0.81	0.74	0.66	0.64	0.62	0.65	0.68	0.72	0.77	0.81	0.77	1.14	0.82	0.91
135	1.02	0.95	0.87	0.92	0.80	0.85	0.87	0.81	0.77	0.79	0.79	0.81	0.84	0.83	0.80	0.87	0.84	0.87	0.96
140	1.05	0.96	0.88	0.96	0.92	0.83	0.83	0.87	0.85	0.86	0.86	0.84	0.81	0.80	0.90	0.98	0.80	0.93	1.00
145	0.96	0.94	0.80	1.03	1.21	0.96	0.91	0.82	0.81	0.81	0.80	0.81	0.86	0.94	0.98	0.90	0.74	0.93	0.98
150	1.12	1.12	0.93	0.94	1.05	1.03	0.96	0.92	0.91	0.90	0.90	0.91	0.94	1.00	1.01	0.82	0.87	1.03	1.03
155	1.10	1.13	1.02	0.90	0.90	0.92	1.01	1.05	0.96	0.93	1.02	1.07	0.99	0.95	0.82	0.79	0.91	1.00	1.00
160	1.09	1.14	1.10	0.94	0.84	0.80	0.79	0.83	0.90	0.91	0.93	0.89	0.86	0.82	0.84	0.94	1.02	1.04	1.04
165	1.14	1.16	1.14	1.09	0.96	0.85	0.77	0.70	0.75	0.78	0.79	0.79	0.87	0.92	0.97	1.04	1.06	1.03	1.01
170	1.14	1.15	1.15	1.14	1.11	1.01	0.94	0.90	0.85	0.84	0.91	0.98	1.03	1.10	1.10	1.10	1.11	1.10	1.07
175	1.17	1.24	1.22	1.21	1.14	1.12	1.07	1.00	1.02	1.03	1.10	1.10	1.10	1.11	1.11	1.11	1.12	1.15	1.17
180	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16

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	1608	1608	1608	1608	1608	1608	1608	1608	1608	1608	1608	1608	1608	1608	1608	1608	1608		
5	1599	1599	1599	1599	1599	1599	1599	1599	1600	1600	1601	1601	1601	1602	1603	1603	1603		
10	1577	1576	1576	1575	1575	1574	1574	1574	1574	1575	1577	1578	1579	1580	1582	1583	1584		
15	1540	1539	1539	1537	1536	1534	1534	1534	1534	1535	1537	1539	1542	1544	1546	1548	1550		
20	1491	1489	1488	1485	1483	1481	1480	1479	1480	1481	1484	1487	1490	1493	1497	1499	1502		
25	1430	1428	1425	1421	1418	1415	1414	1414	1414	1415	1418	1421	1425	1429	1434	1438	1440		
30	1354	1352	1348	1343	1339	1336	1335	1335	1335	1336	1338	1341	1345	1349	1354	1359	1361		
35	1266	1263	1257	1253	1250	1248	1248	1248	1248	1249	1250	1251	1253	1256	1261	1266	1268		
40	1165	1161	1158	1154	1154	1153	1154	1154	1154	1154	1154	1153	1152	1152	1155	1158	1158		
45	1052	1050	1048	1048	1049	1050	1052	1053	1052	1051	1049	1046	1043	1039	1036	1036	1035		
50	928	929	931	934	938	941	943	943	941	940	938	933	924	916	909	903	898		
55	795	800	806	812	820	826	829	828	826	824	820	813	799	785	773	761	751		
60	655	664	673	685	700	708	710	708	703	701	699	689	670	645	626	612	598		
65	514	524	535	557	581	587	584	575	568	567	568	563	542	505	475	460	446		
70	376	385	400	433	461	461	451	447	443	439	434	430	414	372	330	312	300		
75	246	255	274	316	340	340	321	306	297	293	297	303	294	253	203	182	171		
80	135	145	171	210	210	183	155	136	125	121	125	138	150	141	107	82.7	71.4		
85	53.9	65.9	78.3	76.5	60.3	43.2	33.1	27.9	24.6	22.0	20.9	21.9	24.9	25.5	24.0	21.3	15.9		
90	8.36	6.22	3.36	1.46	0.82	0.60	0.48	0.43	0.37	0.36	0.34	0.37	0.40	0.45	0.42	0.71	0.74		
95	0.69	0.61	0.47	0.49	0.46	0.47	0.46	0.46	0.45	0.45	0.44	0.46	0.48	0.53	0.48	0.68	0.82		
100	0.76	0.65	0.51	0.54	0.51	0.52	0.52	0.51	0.51	0.51	0.51	0.52	0.53	0.57	0.56	0.78	1.01		
105	0.89	0.67	0.57	0.60	0.56	0.57	0.57	0.57	0.56	0.57	0.57	0.58	0.59	0.76	0.62	0.89	1.05		
110	0.92	0.74	0.60	0.62	0.57	0.59	0.58	0.57	0.56	0.57	0.57	0.59	0.59	0.64	0.66	0.88	1.13		
115	0.85	0.73	0.61	0.57	0.55	0.56	0.55	0.54	0.54	0.54	0.55	0.60	0.55	0.61	0.66	0.83	0.94		
120	1.19	0.68	0.63	0.54	0.51	0.50	0.49	0.49	0.50	0.49	0.50	0.53	0.52	0.66	0.70	0.82	0.92		
125	0.81	0.68	0.71	0.61	0.56	0.52	0.49	0.49	0.52	0.50	0.51	0.57	0.61	0.75	0.73	0.90	0.90		
130	0.83	0.80	0.76	0.73	0.69	0.64	0.59	0.57	0.58	0.60	0.65	0.71	0.74	0.77	0.82	0.98	0.94		
135	0.90	0.88	0.88	0.76	0.81	0.81	0.77	0.76	0.77	0.79	0.83	0.87	0.81	0.89	0.96	0.92	0.98		
140	0.86	0.83	0.91	0.91	0.83	0.86	0.88	0.91	0.91	0.91	0.90	0.87	0.94	0.95	0.95	0.92	0.99		
145	0.84	0.83	1.13	1.01	0.99	0.90	0.88	0.91	0.93	0.93	0.92	1.00	1.05	1.16	1.10	0.84	0.87		
150	1.00	0.87	0.93	1.06	1.07	1.03	1.00	1.02	1.04	1.00	1.02	1.05	1.13	1.05	0.92	0.97	1.05		
155	1.00	0.86	0.88	0.96	1.12	1.09	1.07	1.06	1.05	1.06	1.17	1.18	1.04	0.97	0.96	1.08	1.11		
160	1.02	1.02	0.91	0.89	0.95	0.95	1.02	1.08	1.10	1.10	1.03	0.98	0.97	0.96	1.04	1.11	1.12		
165	1.02	1.01	1.01	0.96	0.95	0.94	0.92	0.94	0.96	0.95	0.93	0.95	0.95	1.00	1.09	1.14	1.11		
170	1.07	1.07	1.09	1.09	1.13	1.13	1.06	1.01	1.00	1.00	1.03	1.07	1.11	1.12	1.15	1.16	1.14		
175	1.17	1.18	1.19	1.19	1.20	1.20	1.21	1.18	1.12	1.08	1.09	1.08	1.14	1.14	1.08	1.15	1.17		
180	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16		

Table 5: Luminous Intensity Data

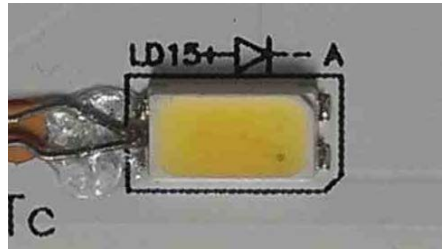
ISTMT TEST DATA:

Sample Tested: **ELL24-4835LCO-1**

Test ambient temperature was 29.1°C.

Test orientation was Light Down.

The stabilization time of the sample was 7.5 hours.



View of In-Situ Point- Ts



Point B Location

Point A Location

Location of In-Situ Point from overall view

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)	
				Point A	Point B
120.0	47.55	108.7	57.1	45.4	44.3
277.0	46.54	108.5	57.0	45.4	44.2

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 $k=2$.

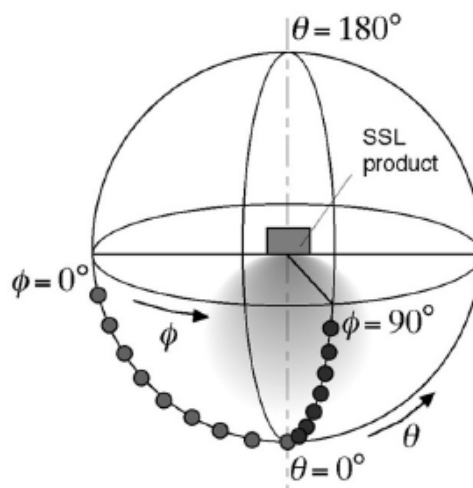
Color Characteristics Measurements

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° 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.



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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 ± 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 (0.21mm^2) and no smaller than No. 30 AWG (0.05mm^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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