



LM-79-08 Test and ISTMT Report

for

A.L.P. Lighting Components, Inc.

6333 Gross Point Road, Niles, IL 60714

2x2 LED Recessed Interior Luminaires

Model: ELL22-3750LCO-1

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ150700251/R1

This report is replaced the old report No. HZ150700251 dated Sep. 08, 2015

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

Review by:

Engineer: April Zou
Nov. 12, 2015

Approved by:



Manager: Jim Zhang
Nov. 12, 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: **ELL22-3750LCO-1**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
99.6	2852.4	28.65	0.9944
CCT (K)	CRI	Stabilization Time (Light & Power)	
5272	84.5	60	

Table 1: Executive Data Summary

Test specifications:

Date of Receipt	: Jul. 15, 2015
Date of Test	: Jul. 24, 2015 to Sep. 08, 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	: 2x2 LED Recessed Interior Luminaires
Model	: ELL22-3750LCO-1
Brand Name	: A.L.P Lighting
Electrical Ratings	: AC120~277V, 50/60 Hz, 37W
Product Description	: 2x2 Panel Light, 5000K, Dimmable Driver: PIFC-C201R (Consist of PIFC-C201B with Resistor 511 Ohm) Manufacturer of light source: LG Model of light source: LGITLED1-28-50K Quantity of light source: 56pcs
Manufacturer	: A.L.P. Lighting Components, Inc.
Address	: 6333 Gross Point Road, Niles, IL 60714

TEST RESULTS

Test ambient temperature was 25.2°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
Voltage frequency (Hz)	60	60
Test Current (A)	0.240	0.113
Power Factor	0.9944	0.9260
Test Power (W)	28.65	29.05
Off-State Power (W)	0	0
THD A%	6.22	18.48
Luminous Efficacy (lm/W)	99.6	98.2
Total Luminous Flux (lm)	2852.4	2851.8
Color Rendering Index (CRI)	84.5	
R9	13	
Correlated Color Temperature (CCT) (K)	5272	
Chromaticity (Chroma x, Chroma y)	(0.3380, 0.3473)	
Chromaticity (Chroma u, Chroma v)	(0.2082, 0.3210)	
Chromaticity (Chroma u', Chroma v')	(0.2082, 0.4815)	
Duv	0.0008	
Average Beam Angle (°)	106.0	
Center Beam Candle Power (cd)	1079	
Spacing Criteria	1.25 (0°-180°)/ 1.21 (90°-270°)	
Zonal Lumens in the 0°-60°Zone	81.12%	
Zonal Lumens in the 60°-90°Zone	18.77%	
Zonal Lumens in the 90°-120°Zone	0.04%	
Zonal Lumens in the 120°-180°Zone	0.07%	

Special Rendering Indices	Color
R1	83
R2	89
R3	93
R4	85
R5	85
R6	85
R7	87
R8	69
R9	13
R10	74
R11	85
R12	69
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

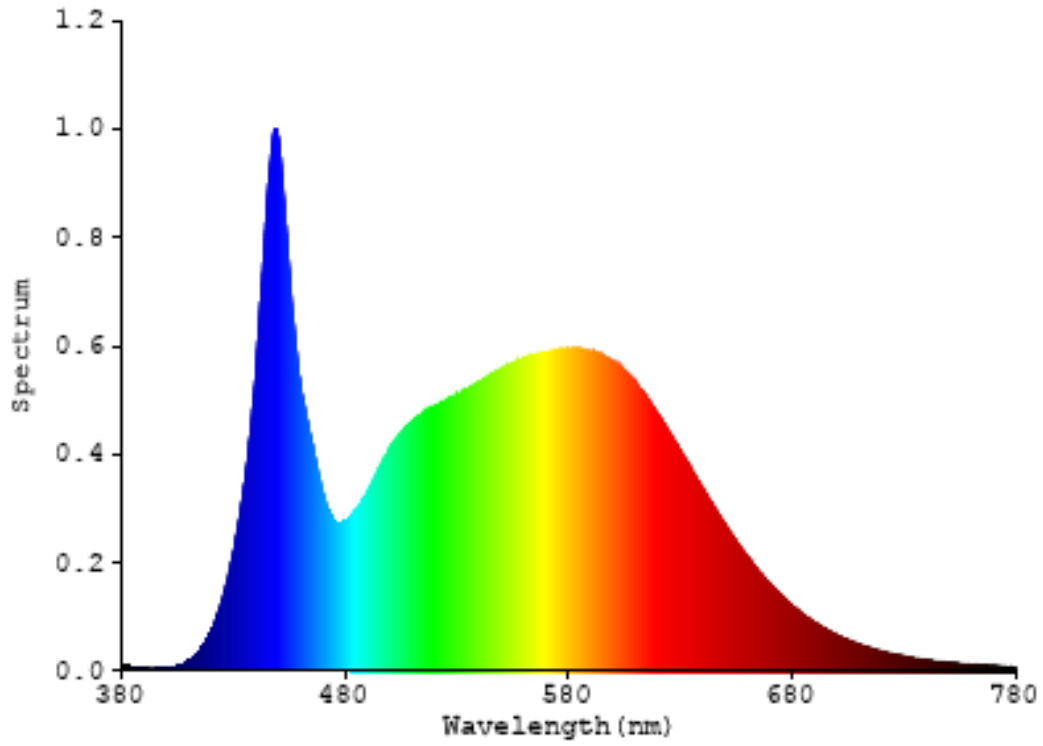


Chart 1: Spectral Power Distribution

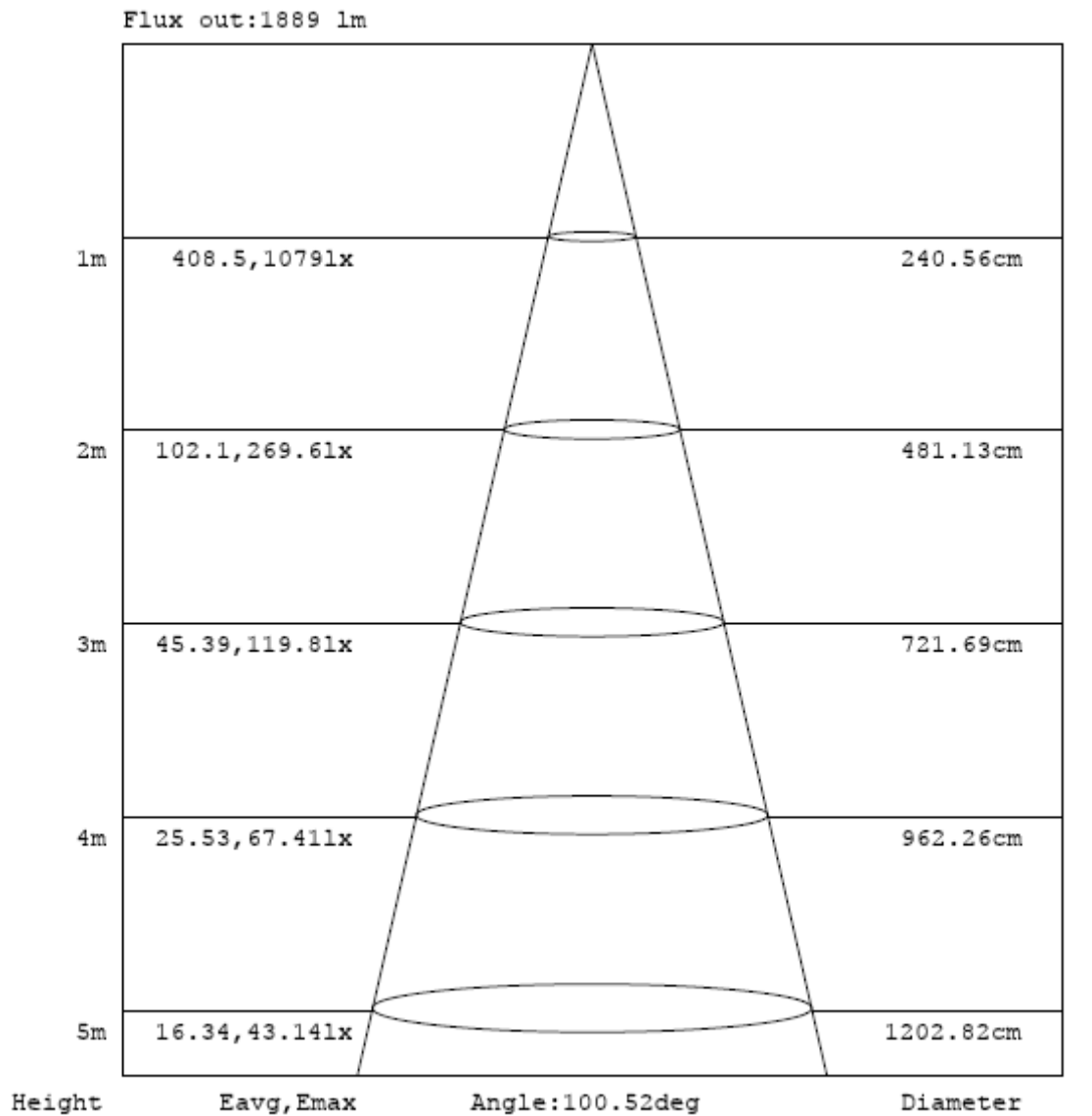
Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	101.922	3.57%
10- 20	291.093	10.21%
20- 30	436.718	15.31%
30- 40	515.546	18.07%
40- 50	518.812	18.19%
50- 60	449.746	15.77%
60- 70	326.565	11.45%
70- 80	176.254	6.18%
80- 90	32.7	1.15%
90-100	0.242	0.01%
100-110	0.347	0.01%
110-120	0.42	0.01%
120-130	0.474	0.02%
130-140	0.491	0.02%
140-150	0.445	0.02%
150-160	0.338	0.01%
160-170	0.224	0.01%
170-180	0.079	0.00%
Total	2852.4	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	2313.837	81.12%
60- 90	535.519	18.77%
0-90	2849.356	99.89%
90- 180	3.06	0.11%
0- 180	2852.4	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

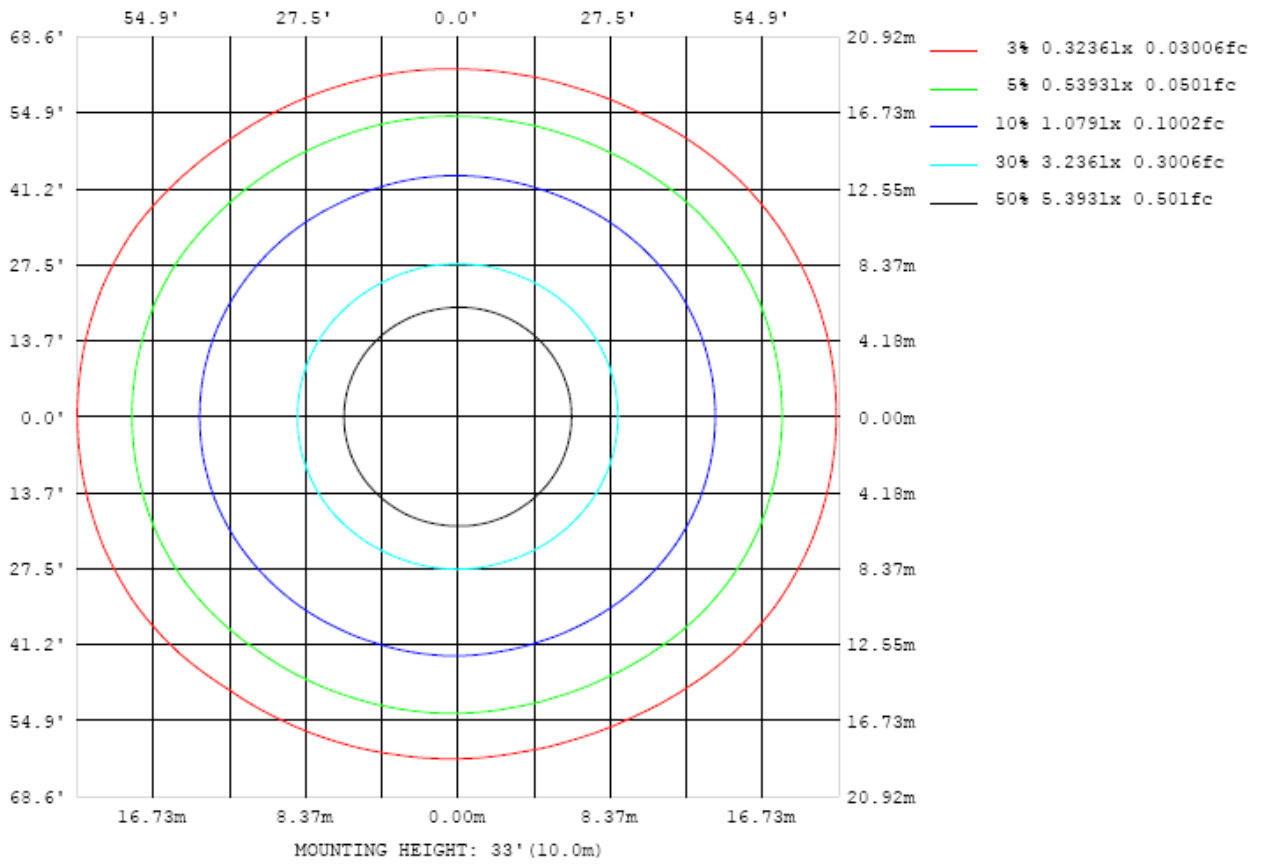


Chart 3: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots

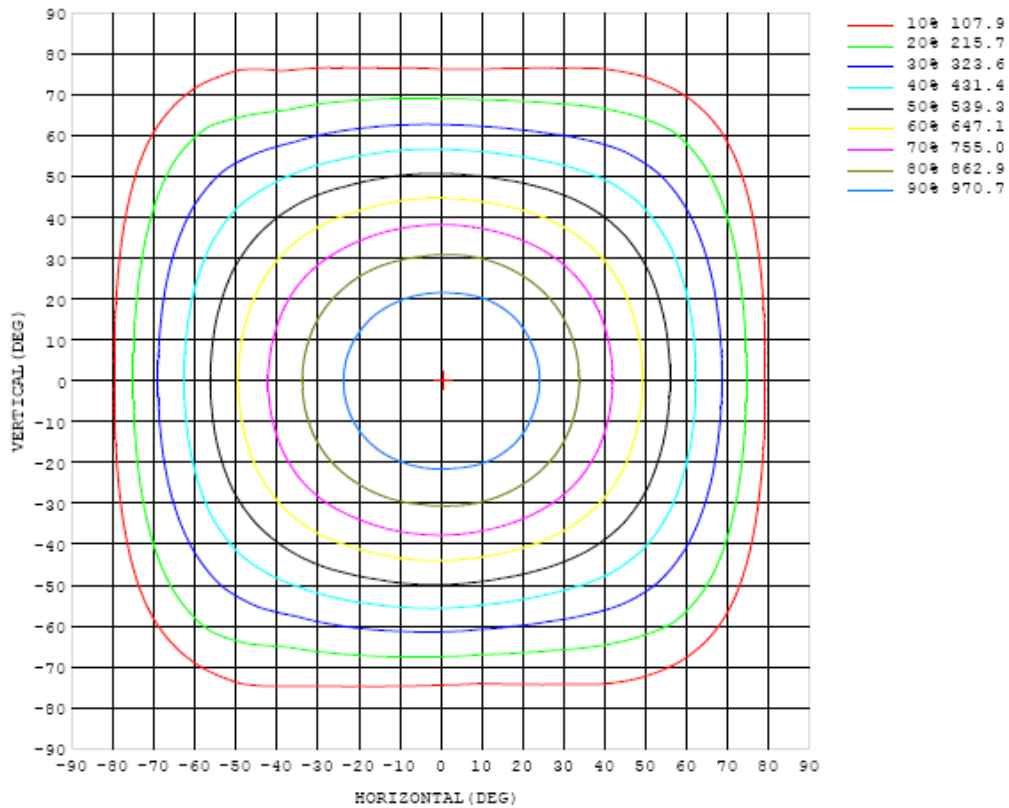


Chart 4: Isocandla Plot

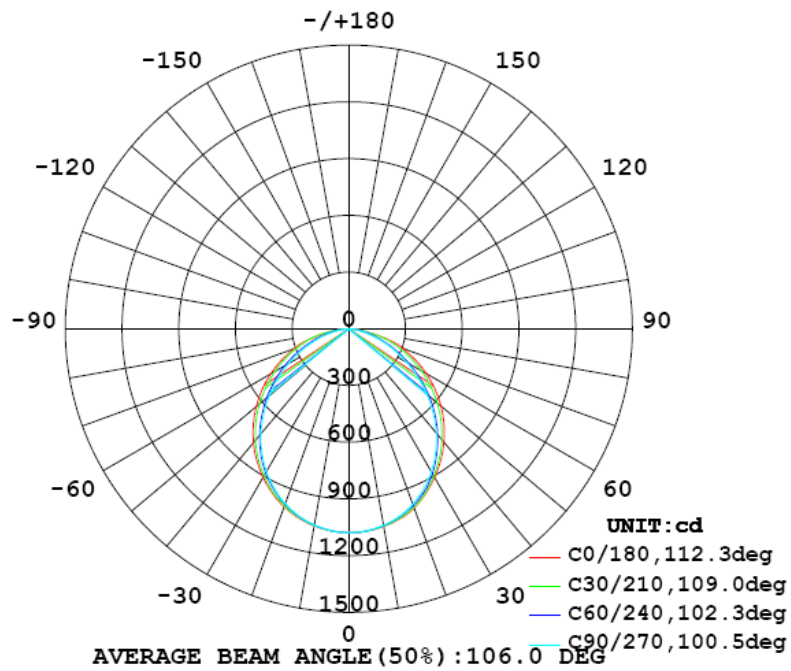


Chart 5: Polar Candela Distribution

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	1079	1079	1079	1079	1079	1079	1079	1079	1079	1079	1079	1079	1079	1079	1079	1079	1079	1079	1079
5	1074	1074	1074	1074	1074	1073	1073	1073	1073	1073	1072	1073	1073	1073	1073	1073	1073	1073	1073
10	1062	1061	1061	1059	1059	1058	1057	1057	1056	1056	1056	1056	1056	1057	1057	1058	1058	1059	1059
15	1041	1040	1039	1038	1036	1033	1031	1029	1028	1028	1029	1029	1029	1031	1032	1033	1034	1035	1035
20	1009	1008	1007	1005	1003	1000	995	991	988	987	988	989	991	994	997	999	1000	1001	1002
25	961	960	959	957	955	951	947	942	936	935	935	938	942	947	951	956	957	959	959
30	907	906	903	900	894	889	884	880	875	872	872	877	883	889	894	900	904	907	908
35	848	846	842	836	828	818	810	805	802	800	801	805	811	820	830	840	845	849	850
40	782	780	775	766	755	742	730	722	719	720	721	725	733	746	760	772	780	784	786
45	712	708	702	690	675	659	645	633	630	631	634	638	649	666	683	697	708	713	715
50	636	632	624	610	591	571	554	541	537	539	542	548	561	582	600	617	630	637	640
55	556	552	543	527	505	481	460	446	442	445	449	456	471	491	512	534	550	558	561
60	472	467	458	442	419	391	367	354	348	351	356	366	380	398	426	451	467	475	478
65	385	381	372	356	333	304	280	265	257	260	265	276	290	309	342	367	382	389	392
70	305	300	287	271	249	223	198	183	173	175	181	192	206	224	260	284	298	307	311
75	206	203	199	191	171	146	126	110	99.3	101	107	117	131	148	187	208	213	216	219
80	91.8	90.6	90.9	90.5	84.7	77.5	64.9	53.8	45.0	44.4	48.8	57.0	69.0	83.3	101	103	101	102	104
85	16.6	15.5	15.2	15.7	16.0	14.7	15.7	14.2	12.1	12.9	14.0	17.1	19.5	20.6	23.4	22.6	23.1	23.7	25.3
90	0.13	0.09	0.09	0.09	0.08	0.08	0.08	0.07	0.07	0.18	0.18	0.19	0.21	0.22	0.23	0.24	0.27	0.29	0.36
95	0.15	0.12	0.11	0.11	0.12	0.11	0.11	0.10	0.12	0.27	0.26	0.26	0.27	0.29	0.30	0.30	0.31	0.32	0.38
100	0.18	0.14	0.14	0.14	0.14	0.13	0.13	0.12	0.15	0.32	0.31	0.31	0.32	0.33	0.35	0.36	0.37	0.37	0.40
105	0.21	0.19	0.19	0.19	0.18	0.17	0.17	0.19	0.20	0.39	0.37	0.38	0.37	0.38	0.40	0.42	0.42	0.42	0.44
110	0.26	0.25	0.25	0.25	0.24	0.24	0.26	0.26	0.27	0.42	0.40	0.41	0.40	0.41	0.43	0.44	0.45	0.45	0.46
115	0.32	0.32	0.32	0.32	0.30	0.32	0.33	0.31	0.32	0.43	0.41	0.43	0.43	0.42	0.44	0.48	0.45	0.45	0.46
120	0.38	0.38	0.43	0.41	0.44	0.43	0.43	0.38	0.35	0.43	0.39	0.44	0.46	0.47	0.43	0.44	0.44	0.44	0.45
125	0.45	0.48	0.46	0.47	0.50	0.51	0.46	0.45	0.38	0.45	0.36	0.45	0.47	0.50	0.50	0.47	0.46	0.44	0.45
130	0.52	0.53	0.55	0.57	0.58	0.52	0.55	0.56	0.49	0.57	0.52	0.56	0.53	0.55	0.53	0.55	0.52	0.49	0.51
135	0.61	0.59	0.61	0.63	0.57	0.56	0.55	0.55	0.59	0.63	0.54	0.60	0.62	0.59	0.62	0.61	0.60	0.58	0.60
140	0.66	0.62	0.63	0.62	0.63	0.63	0.68	0.58	0.60	0.58	0.56	0.58	0.67	0.70	0.64	0.64	0.64	0.64	0.66
145	0.68	0.66	0.66	0.69	0.69	0.68	0.57	0.59	0.73	0.68	0.69	0.60	0.65	0.70	0.72	0.69	0.66	0.65	0.67
150	0.67	0.67	0.68	0.67	0.78	0.81	0.68	0.65	0.73	0.66	0.69	0.62	0.70	0.80	0.74	0.66	0.68	0.69	0.71
155	0.66	0.65	0.73	0.76	0.76	0.75	0.75	0.81	0.76	0.77	0.78	0.78	0.76	0.79	0.79	0.73	0.68	0.64	0.67
160	0.75	0.71	0.71	0.73	0.73	0.76	0.78	0.87	0.87	0.90	0.90	0.86	0.78	0.79	0.78	0.78	0.78	0.77	0.80
165	0.69	0.68	0.69	0.73	0.77	0.80	0.86	0.81	0.76	0.76	0.79	0.86	0.87	0.82	0.79	0.76	0.73	0.74	0.76
170	0.79	0.75	0.76	0.79	0.82	0.82	0.79	0.77	0.79	0.81	0.81	0.84	0.88	0.92	0.89	0.81	0.78	0.78	0.81
175	0.83	0.80	0.81	0.80	0.80	0.81	0.81	0.82	0.83	0.84	0.83	0.84	0.85	0.84	0.83	0.82	0.84	0.86	0.88
180	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87

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	1079	1079	1079	1079	1079	1079	1079	1079	1079	1079	1079	1079	1079	1079	1079	1079	1079		
5	1073	1073	1073	1072	1072	1072	1072	1072	1072	1072	1072	1073	1073	1074	1074	1074	1074		
10	1058	1058	1057	1056	1055	1054	1054	1054	1054	1054	1055	1056	1057	1058	1059	1060	1061		
15	1034	1033	1031	1029	1028	1027	1026	1025	1025	1026	1027	1029	1032	1034	1037	1039	1040		
20	1001	998	997	994	991	988	986	985	985	986	989	994	998	1001	1004	1007	1009		
25	958	956	953	948	944	939	935	933	933	936	941	946	950	954	956	959	961		
30	906	903	898	892	887	881	875	872	872	876	880	885	890	895	900	903	906		
35	847	844	837	828	819	812	806	802	802	805	808	814	821	830	838	843	847		
40	783	778	770	758	745	735	729	725	724	725	729	737	748	759	769	776	781		
45	712	707	697	683	667	652	645	642	639	639	643	655	668	682	695	705	710		
50	637	629	617	602	585	566	557	553	549	549	554	567	584	601	617	628	634		
55	558	550	535	516	498	479	468	463	458	458	464	477	497	517	536	548	555		
60	476	469	453	429	408	392	380	374	369	368	374	387	409	434	453	464	471		
65	392	386	372	345	319	306	294	286	281	281	288	302	325	350	368	379	384		
70	309	303	291	265	236	224	212	204	198	199	208	222	244	266	283	294	303		
75	223	226	218	191	159	151	137	130	123	125	136	150	167	189	206	209	209		
80	110	119	127	122	96.1	86.6	74.9	68.2	62.9	65.6	74.3	85.2	99.0	105	105	102	95.9		
85	27.5	30.3	36.4	40.1	36.6	36.7	29.4	24.9	22.4	23.9	28.5	31.9	29.8	29.6	25.9	21.2	18.5		
90	0.34	0.37	0.41	0.57	1.07	1.47	1.86	1.54	1.87	1.31	2.01	0.40	0.18	0.08	0.12	0.11	0.11		
95	0.37	0.37	0.35	0.32	0.29	0.27	0.25	0.24	0.10	0.10	0.12	0.13	0.13	0.14	0.16	0.16	0.15		
100	0.41	0.48	0.46	0.41	0.38	0.36	0.33	0.32	0.15	0.13	0.17	0.18	0.20	0.23	0.26	0.23	0.21		
105	0.44	0.50	0.50	0.47	0.45	0.43	0.42	0.41	0.24	0.17	0.29	0.30	0.36	0.39	0.40	0.31	0.22		
110	0.46	0.51	0.53	0.56	0.55	0.51	0.49	0.51	0.39	0.21	0.32	0.37	0.41	0.40	0.38	0.32	0.27		
115	0.46	0.48	0.51	0.57	0.59	0.59	0.54	0.40	0.27	0.35	0.38	0.49	0.47	0.43	0.38	0.35	0.32		
120	0.46	0.48	0.50	0.58	0.66	0.70	0.58	0.57	0.43	0.37	0.56	0.63	0.58	0.52	0.44	0.42	0.38		
125	0.48	0.51	0.53	0.61	0.73	0.75	0.43	0.80	0.52	0.75	0.60	0.75	0.67	0.58	0.52	0.50	0.47		
130	0.54	0.58	0.60	0.65	0.77	0.82	0.61	0.90	0.61	0.72	0.51	0.80	0.74	0.66	0.63	0.58	0.53		
135	0.62	0.67	0.69	0.71	0.78	0.82	0.86	0.64	0.58	0.70	0.96	0.75	0.71	0.71	0.70	0.67	0.61		
140	0.67	0.69	0.70	0.73	0.69	0.74	0.85	0.95	0.73	0.94	0.87	0.80	0.68	0.72	0.69	0.69	0.66		
145	0.68	0.73	0.73	0.73	0.73	0.82	0.80	0.93	0.79	0.90	0.79	0.83	0.76	0.69	0.71	0.72	0.69		
150	0.70	0.72	0.72	0.72	0.87	0.84	0.79	0.74	0.66	0.76	0.83	0.84	0.81	0.86	0.72	0.67	0.68		
155	0.70	0.74	0.70	0.69	0.65	0.64	0.64	0.66	0.66	0.66	0.64	0.57	0.61	0.70	0.73	0.93	0.78		
160	0.84	0.86	0.86	0.80	0.68	0.67	0.71	0.73	0.72	0.76	0.74	0.67	0.68	0.78	0.78	0.76	0.78		
165	0.80	0.79	0.77	0.83	0.96	0.89	0.89	0.84	0.73	0.71	0.78	0.89	0.92	0.84	0.78	0.73	0.71		
170	0.83	0.82	0.84	0.87	0.93	0.93	0.82	0.75	0.72	0.69	0.70	0.74	0.84	0.91	0.89	0.86	0.82		
175	0.92	0.91	0.89	0.86	0.86	0.81	0.76	0.75	0.73	0.72	0.73	0.74	0.76	0.77	0.78	0.82	0.86		
180	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87		

Table 5: Luminous Intensity Data

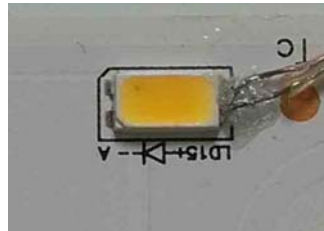
ISTMT TEST DATA:

Sample Tested: **ELL22-3750LCO-1**

Test ambient temperature was 28.1 °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	28.65	137.3	48.3	48.5
277.0	29.05	137.4	48.4	48.4

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 $k=2$.

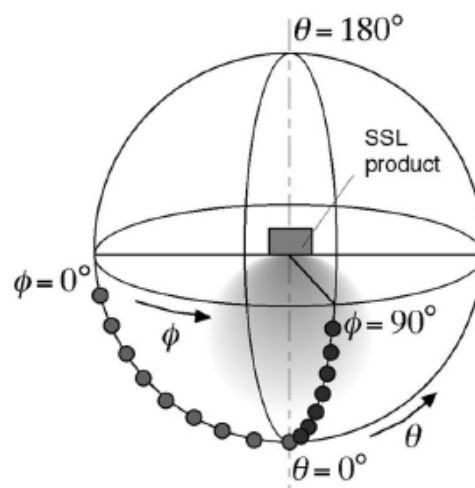
Color Characteristics Measurements

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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