



ENERGY STAR® Luminaire Test Report

ENERGY STAR® Program Requirements Product Specification for Luminaires - Version 2.0 - Issued 2015-05-29

Prepared For

L-TECH CORPORATION

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Catalog Number

ULD113W-##90, ULD113BZ-##90, ULD113BK-##90

(##=00-11 intends CCT 2700K, 3000K and 3500K, ##=20-30 intends CCT 2700K, 3000K and 4000K.)

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The results contained in this report pertain only to the tested sample.

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1.0 Test Summary

ENERGY STAR® Program Requirements Product Specification for Luminaires - Version 2.0 - Issued 2015-05-29

(Under Cabinet Mount)				
Requirement Category	Test Method	Requirement	Test Value	Results (Pass/Fail)
Efficacy (lm/W)	IES LM-79-08	Non-directional: 65 lm/W; Directional: 50 lm/W; Inseparable SSL Luminaire: 70 lm/W.	72.6	Pass
Light Output (lm)	IES LM-79-08	Luminous Flux (lm)	1111.48	Pass
		Under Cabinet: 125 lm/ft	416.28	
Zonal Lumen Density	IES LM-79-08	For directional luminaires only. (0°~60°C) >60%	78.80%	Pass
CCT (K)	ANSI C78.377-2011	fall within the corresponding 7-step chromaticity quadrangles	2784	Pass
CRI	IES LM-79-08, CIE 13.3-1995	Ra ≥ 80	93.1	Pass
R9	IES LM-79-08, CIE 13.3-1995	R9 > 0	58	Pass
Color Angular Uniformity	IES LM-79-08, CIE 15: 2004	≤ 0.006 on the CIE 1976 (u',v') diagram	0.00146	Pass
Lumen Maintenance & Light Source Life (hours)	IES LM-80-08*, IES TM-21-11*	L70 ≥ 25,000 hours for indoor; L70 ≥ 35,000 hours for outdoor; L70 ≥ 50,000 h for inseparable luminaires	60000	Pass
Color Maintenance	IES LM-80-08*, IES LM-84-14	≤ 0.007 on the CIE 1976 (u',v') diagram	0.0031	Pass
Source Start Time (ms)	ENERGY STAR Start Time Test Method	1 s for connected luminaires; 750 ms for other luminaires.	120	Pass
Source Run-Up Time (s)	ENERGY STAR Run Up Time Test Method	≤ 45 seconds	N/A	N/A
Power Factor	C82.77-10:2014	power ≤ 5 watts: PF ≥ 0.5; power > 5 watts: PF ≥ 0.7	0.983	Pass
Transient Protection	IEEE C62.41.2-2002	Survival	Validated	Pass
Standby Power Consumption (W)	IEC 62301 ED.2.0 B	Shall not draw power in the off state.	0.01	Pass
Operating Frequency (Hz)	N/A	Frequency ≥ 120 Hz	120.1	Pass

* The standards are NOT covered by the NVLAP scope of test laboratory UL Verification Services (Guangzhou) Co., Ltd.



1.0 Test Summary (Cont'd)

Requirement Category	Test Method	Requirement	Test Value	Results (Pass/Fail)
Light Source Replaceability	N/A	Fluorescent & Directional LED luminaire	Validated	Pass
LED Tc Temperature (°C)	ANSI/UL 153:2002 ANSI/UL 1598:2008	Within the highest test temperature in LM-80 report	40.5	Pass
Driver Case Temperature (°C)	ANSI/UL 153:2002 ANSI/UL 1598:2008	≤ TMPC marked on the the driver	55.9	Pass
Recessed Downlight Thermal Performance	ANSI/UL 1598-2008 ASTM E283-04*	Insulation contact & Airtight construction	N/A	N/A
SAFETY REQUIREMENTS for luminaire and driver	UL Safety standards	Safety documentation	Validated	Pass
Dimming: Range (Minimum)	N/A	≤20%	9.48%	Pass
Dimming: Noise	N/A	24dBA at 1 meter	18	Pass
Labeling & Packaging	N/A	Relevant document	Validated	Pass
WARRANTY REQUIREMENTS	N/A	no less than 3 years	Validated	Pass
Lighting Toxics Reduction Requirements	RoHS Directive, 2003*	Relevant Documentations	Validated	Pass

* The standards are NOT covered by the NVLAP scope of test laboratory UL Verification Services (Guangzhou) Co., Ltd.



2.0 Test List

Test Item	Test	Test Date	Test Model	Tests Conducted By
1	Integrating Sphere Test	2107-12-13	ULD113W-0190	Lily Chen
		2107-12-24	ULD113W-2090	Lily Chen
2	Goniophotometer Test	2107-12-12	ULD113W-0190	Lily Chen
3	Color Angular Uniformity	2107-12-18	ULD113W-0190	Lily Chen
4	Source Start Time & Run-Up time	2107-12-13	ULD113W-0190	Lily Chen
5	Operating Frequency Test	2107-12-13	ULD113W-0190	Lily Chen
6	Transient Protection Test	2107-12-18	ULD113W-0190	Lily Chen
7	Standby Power Consumption	2107-12-18	ULD113W-0190	Lily Chen
8	Dimming Test	2107-12-18	ULD113W-0190	Lily Chen
9	In-Situ Temperature Measurement Test	2107-12-18	ULD113W-0190	Lily Chen

Remark (if any)

1, UL test equipment information is recorded on Meter Use in UL's Aurora database.
2, The product belong to Color Tunable, where ##=00-11 intends CCT 2700K, 3000K and 3500K, ##=20-30 intends CCT 2700K, 3000K and 4000K. The default settings and maximum power are at 2700K color temperature states.



3.0 Production Description

Luminaire Description: Indoor Directional Luminaires, LED Under cabinet for Color Tunable
120Vac, 60Hz, 15W, CRI 90, CCT 2700K - 4000K, Length 32 inch

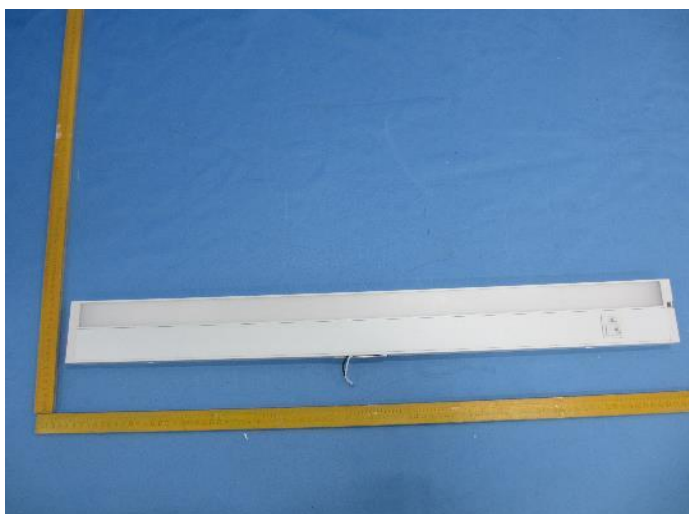
Lighting Source: 2T03X2WWxx000xxx made by Edison Opto Corporation

Mounting: Under Cabinet Mount

LED Driver:ULD11

Family Model and Variation: ULD113W-##90, ULD113BZ-##90, ULD113BK-##90, W, BZ and BK intends the color of product appearance, W=White, BZ=Brown, BK=Black, ##=00-11 intends CCT 2700K, 3000K and 3500K; ##=20-30 intends CCT 2700K, 3000K and 4000K. All of the CCT corresponding LED is 0.2 W series model 2T03X2WWxx000xxx except the model name with ##=20-30 of CCT 2700K products use LED is 0.5W series model 2T03X5WWxx000xxx.

Photos of Luminaire Characteristics





4.0 Photometric Measurements

4.1 Integrating Sphere Test

Model No.	ULD113W-0190	Sample ID.	1298526-S001	Temperature (°C)	25.1
Operate time (Min.)	50	Stabilization time (Min.)	45		

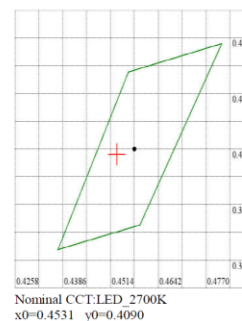
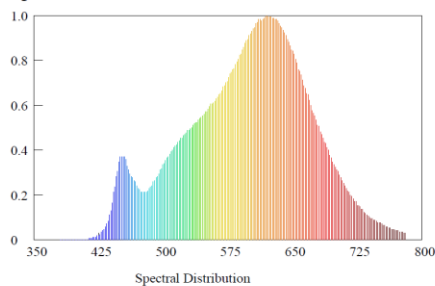
Test Method

1. The sample was tested according to the IES LM-79-2008.
2. Photometric parameters were measured using an integrating sphere, a spectroradiometer and software. The ambient temperature inside the sphere was maintained at $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$.
3. The sample measurements were made using a spectroradiometer connected by a fiber optic cable and detector through the detector port of the integrating sphere. The sample was operated at 120 Volts AC, 60Hz. It was stabilized before measurement was made. Chromaticity coordinates, correlated color temperature and color rendering index were calculated from the spectral radiant flux measurements taken at 5 nm intervals over the range of 380 to 780 nm.

Integrating Sphere Conditions and Results

Model Number	Orientation	Voltage (Vac)	Frequency (Hz)	Current (A)	Power (W)	Power Factor	CCT (K)	CRI (Ra)	R9	Luminous Flux (lm)	Luminous Efficacy (lm/W)
ULD113W-0190	Horizontal	120.04	60	0.13	15.31	0.983	2784	93.1	58	1111.48	72.6

Spectroradiometric Parameters





4.0 Photometric Measurements

4.2 Integrating Sphere Test

Model No.	ULD113W-2090	Sample ID.	1291151-S001	Temperature (°C)	25.1
Operate time (Min.)	50	Stabilization time (Min.)	45		

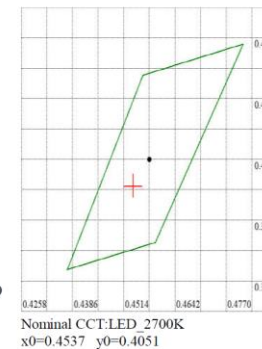
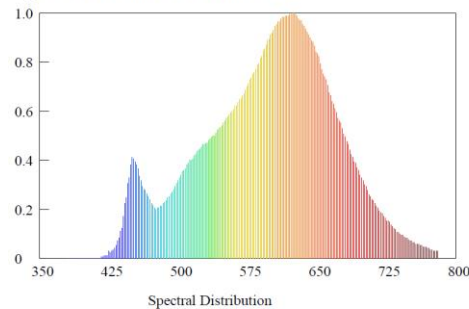
Test Method

1. The sample was tested according to the IES LM-79-2008.
2. Photometric parameters were measured using an integrating sphere, a spectroradiometer and software. The ambient temperature inside the sphere was maintained at $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$.
3. The sample measurements were made using a spectroradiometer connected by a fiber optic cable and detector through the detector port of the integrating sphere. The sample was operated at 120 Volts AC, 60Hz. It was stabilized before measurement was made. Chromaticity coordinates, correlated color temperature and color rendering index were calculated from the spectral radiant flux measurements taken at 5 nm intervals over the range of 380 to 780 nm.

Integrating Sphere Conditions and Results

Model Number	Orientation	Voltage (Vac)	Frequency (Hz)	Current (A)	Power (W)	Power Factor	CCT (K)	CRI (Ra)	R9	Luminous Flux (lm)	Luminous Efficacy (lm/W)
ULD113W-2090	Horizontal	120.08	60	0.12	14.13	0.98	2745	92.7	57	1189.86	84.2

Spectroradiometric Parameters





5.0 Photometric Measurements

5.1 Goniophotometer Test

Model No.	ULD113W-0190	Sample ID.	1298526-S001
Operate time (Min.)	90	Stabilization time (Min.)	45

Test Method

1. The sample was tested according to the IES LM-79-2008.
2. Photometric parameters were measured using a type C goniophotometer and software.
3. The ambient temperature shall be maintained at $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$, measured at a point not more than 1 m from the sample and at the same height as the sample.
4. The samples were operated at rated voltage and was stabilized before measurement. Luminous flux, luminaire efficacy, zonal lumen were calculated from the software taken at 1° vertical intervals and 22.5° horizontal intervals.

Goniophotometer Test Conditions

Temperature ($^{\circ}\text{C}$)	Voltage (Vac)	Frequency	Current (A)	Power (W)	Power Factor	Orientation
25	120.08	60	0.1303	15.376	0.9824	Horizontal

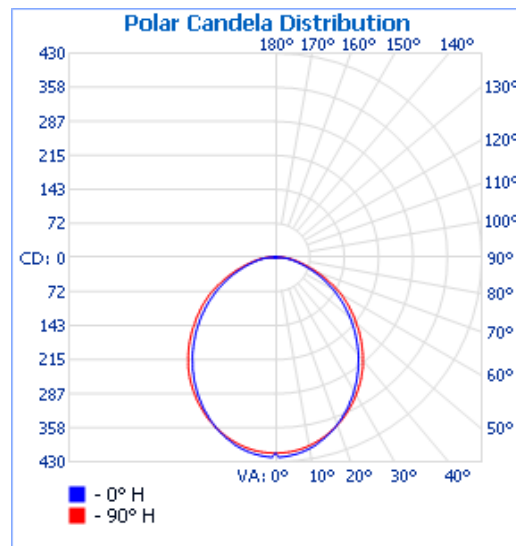
Test Results

Flux (lm)	Zonal Lumen Requirement (0-60 $^{\circ}$)	Field Angle (10%)		Beam Angle (50%)		Luminous Efficacy (lm/W)
		Horizontal Spread	Vertical Spread	Horizontal Spread	Vertical Spread	
1,087.00	78.80%	162.5	158.9	102.3	97.9	70.7

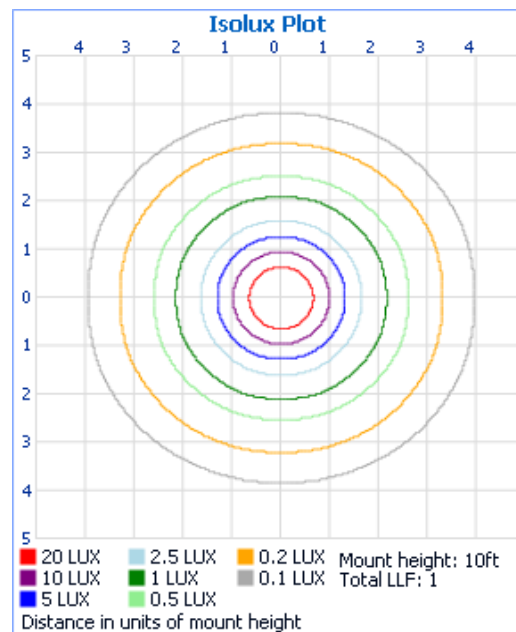


5.1 Goniophotometer Test (Cont'd)

Light Distribution Curve



Isolux Plot





5.1 Goniophotometer Test (Cont'd)

Zonal Lumen Summary

Zonal Lumen Summary

Zone	Lumens	% Luminaire
0-30	311.3	28.6%
0-40	501.1	46.1%
0-60	856.9	78.8%
60-90	222.5	20.5%
70-100	107.9	9.9%
90-120	6.6	0.6%
0-90	1,079.4	99.3%
90-180	7.6	0.7%
0-180	1,087.0	100%

Lumens Per Zone

Lumens Per Zone

Zone	Lumens	% Total	Zone	Lumens	% Total
0-5	9.8	0.9%	90-95	5.2	0.5%
5-10	29.1	2.7%	95-100	1.0	0.1%
10-15	47.0	4.3%	100-105	0.1	0%
15-20	62.9	5.8%	105-110	0.1	0%
20-25	76.2	7.0%	110-115	0.1	0%
25-30	86.3	7.9%	115-120	0.1	0%
30-35	93.2	8.6%	120-125	0.1	0%
35-40	96.7	8.9%	125-130	0.1	0%
40-45	96.8	8.9%	130-135	0.1	0%
45-50	93.6	8.6%	135-140	0.1	0%
50-55	87.2	8.0%	140-145	0.1	0%
55-60	78.1	7.2%	145-150	0.1	0%
60-65	66.8	6.1%	150-155	0.1	0%
65-70	54.0	5.0%	155-160	0.1	0%
70-75	40.8	3.7%	160-165	0.1	0%
75-80	29.0	2.7%	165-170	0.0	0%
80-85	20.0	1.8%	170-175	0.0	0%
85-90	12.0	1.1%	175-180	0.0	0%



5.1 Goniophotometer Test (Cont'd)

Candela Table - Type C

	0	22.5	45	67.5	90	112.5	135	157.5	180	202.5	225	247.5	270	292.5	315	337.5	360
0	412	412	412	412	412	412	412	412	412	412	412	412	412	412	412	412	412
1	421	411	412	412	411	412	412	411	421	411	412	412	411	412	412	411	421
2	420	411	411	411	411	411	411	411	420	411	411	411	411	411	411	411	420
3	419	411	411	411	411	411	411	411	419	411	411	411	411	411	411	411	419
4	418	410	410	410	410	410	410	410	418	410	410	410	410	410	410	410	418
5	417	409	409	410	409	410	409	409	417	409	409	410	409	410	409	409	417
6	416	408	408	408	408	408	408	408	416	408	408	408	408	408	408	408	416
7	414	406	406	407	407	407	406	406	414	406	406	407	407	407	406	406	414
8	413	405	405	406	406	406	405	405	413	405	405	406	406	406	405	405	413
9	410	403	404	405	404	421	425	427	410	403	404	405	404	386	382	380	403
10	408	401	402	402	402	402	402	401	408	401	402	402	402	402	402	401	408
11	406	399	399	400	400	400	399	399	406	399	399	400	400	400	399	399	406
12	404	396	397	398	398	398	397	396	404	396	397	398	398	398	397	396	404
13	400	394	395	396	396	396	395	394	400	394	395	396	396	396	395	394	400
14	397	391	392	394	393	394	392	391	397	391	392	394	393	394	392	391	397
15	394	388	389	391	391	391	389	388	394	388	389	391	391	391	389	388	394
16	390	385	386	388	388	388	386	385	390	385	386	388	388	388	386	385	390
17	386	382	383	385	385	385	383	382	386	382	383	385	385	385	383	382	386
18	383	378	380	381	382	381	380	378	383	378	380	381	382	381	380	378	383
19	379	375	376	378	379	378	376	375	379	375	376	378	379	378	376	375	379
20	375	371	373	375	376	375	373	371	375	371	373	375	376	375	373	371	375
25	352	349	353	355	357	355	353	349	352	349	353	355	357	355	353	349	352
30	327	325	329	332	335	332	329	325	327	325	329	332	335	332	329	325	327
35	298	298	304	308	311	308	304	298	298	298	304	308	311	308	304	298	298
40	269	270	277	282	283	282	277	270	269	270	277	282	283	282	277	270	269
45	237	242	248	254	254	254	248	242	237	242	248	254	254	254	248	242	237
50	206	211	217	224	221	224	217	211	206	211	217	224	221	224	217	211	206
55	174	181	184	192	191	192	184	181	174	181	184	192	191	192	184	181	174
60	143	150	152	160	161	160	152	150	143	150	152	160	161	160	152	150	143
65	112	118	121	128	126	128	121	118	112	118	121	128	126	128	121	118	112
70	84	89	92	97	95	97	92	89	84	89	92	97	95	97	92	89	84
75	59	62	66	69	68	69	66	62	59	62	66	69	68	69	66	62	59
80	41	41	45	49	46	49	45	41	41	41	45	49	46	49	45	41	41
85	27	26	29	32	31	32	29	26	27	26	29	32	31	32	29	26	27
90	14	14	15	16	17	16	15	14	14	14	15	16	17	16	15	14	14
95	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
120	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
130	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
135	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
140	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
150	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
160	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
165	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
170	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
175	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
180	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



5.0 Photometric Measurements

5.2 Color Angular Uniformity

Model No.	ULD113W-0190	Sample ID.	1298526-S001
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Test Method

1. The sample was tested according to the IES LM-79-2008.
2. Photometric parameters were measured using a type C goniophotometer and software.
3. The ambient temperature shall be maintained at $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$, measured at a point not more than 1 m from the sample and at the same height as the sample.
4. The sample was operated at 120 Volts AC, 60Hz. It was stabilized before measurement was made. Color spatial uniformity was calculated from the software taken at 1° vertical intervals and 90° horizontal intervals.

Test Results

Temperature (°C)	Voltage (Vac)	Frequency	Current (A)	Power (W)	Maximum $\Delta u'v'$
25.1	120.02	60	0.128	15.13	0.00146



6.0 Electrical Test

6.1 Source Start Time & Run-Up time

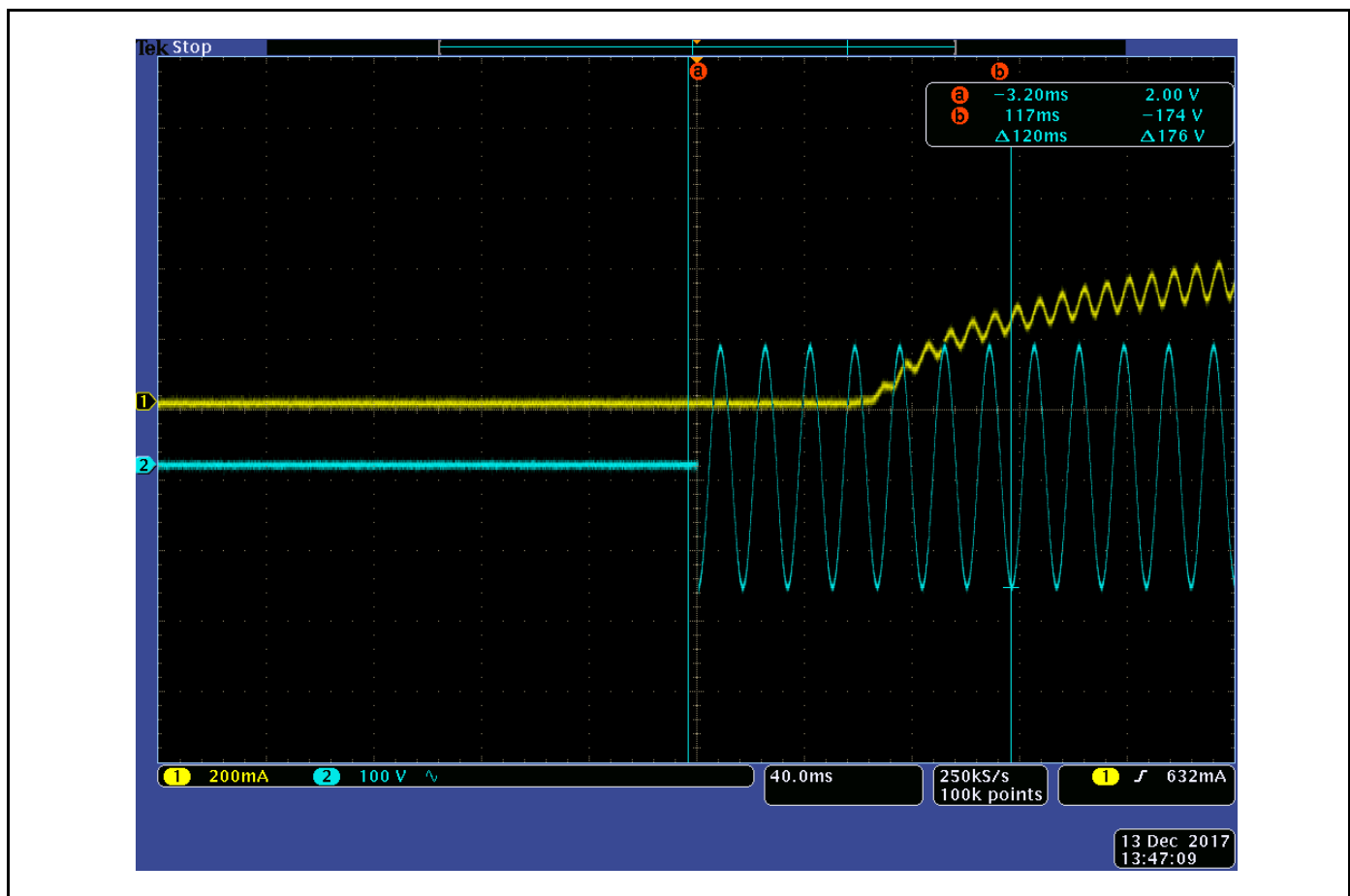
Model No.	ULD113W-0190	Sample ID.	1298526-S001
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Test Method

1. The sample was tested according to ENERGY STAR Start Time Test and ENERGY STAR Run-Up Time Test for fluorescent luminaires only.
2. Each test sample was operated in its designated orientation at rated input voltage in a $25 \pm 5^\circ\text{C}$ ambient. A photodetector is used to monitor the luminaire light output. Time was recorded when the sample was fully illuminated and reached 90% of stabilized lumen output.

Test Results

Temperature (°C)	Voltage (Vac)	Frequency	Start Time (ms)	Run-Up time (s)
25.2	120	60	120	N/A





6.0 Electrical Test

6.2 Operating Frequency Test

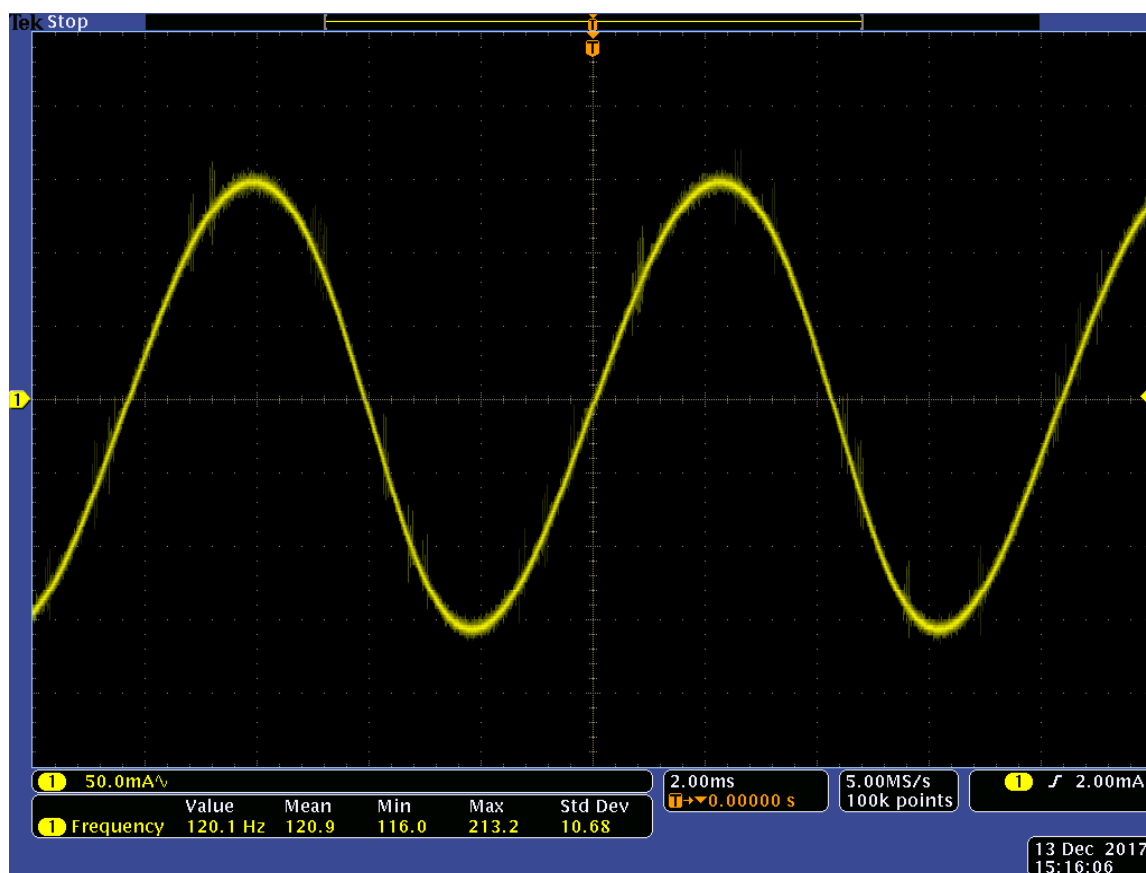
Model No.	ULD113W-0190	Sample ID.	1298526-S001
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Test Method

1. The sample was tested according to ANSI C82.2-2002 for fluorescent luminaires.
2. Each test sample was operated at rated input voltage. Light output waveform shall be measured with a photodetector, transimpedance amplifier and oscilloscope. The AC ripple on the output DC line was measured and recorded by the oscilloscope according to Energy Star directions.

Test Results

Temperature (°C)	Voltage (Vac)	Frequency	Operating Frequency (Hz)
25.1	120.1	60	120.1





6.0 Electrical Test

6.3 Transient Protection Test

Model No.	ULD113W-0190	Sample ID.	1298526-S001
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Test Method

The transient protection tests at ambient temperature were performed on one sample. Each sample was operated at rated input voltage in the specific orientation during the tests. A test system with an 100kHz Ring Wave Module and a Coupler/Decoupler Module was used to generate the 2500 volt ring wave transient strike across the luminaire contacts. Each wave consisted of a 0.5 microsecond rise time. Seven strikes were performed on each sample in accordance with ANSI/IEEE C62.41 (Category A): Recommended Practice on Surge Voltages in Low – Voltage AC Circuits.

Test Results

Temperature (°C)	Voltage (Vac)	Frequency	After Test - Seven Strikes (Survival/Dead)
25	120.1	60	Survival



6.0 Electrical Test

6.4 Standby Power Consumption

Model No.	ULD113W-0190	Sample ID.	1298526-S001
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Test Method

A sample was tested according to the IEC 62301-2011 Edition 2. The sample was operated at rated voltage and frequency, working in the active and standby mode*. For loads greater than or equal to 10 W, at least three significant figures shall be reported. After stability, the electrical parameter would be measured using proper method** and the value of U_e *** was calculated according to the Annex D. The test results shall be compliant with the relative requirements#.

Test Results

Temperature (°C)	Mode	Voltage (Vac)	Frequency	Current (mA)	Power Factor	Standby Power (W)
25.1	Standby mode	120	60	0.091	0.911	0.01

* The working mode is controlled stably by the light sensor. When environment gets dim, it works in active mode. If not, it works in standby mode. The sample was tested under different illuminance to change mode.

** The sample was tested with direct meter reading method according to IEC 62301-2011 Section 5.3.4.

*** The uncertainty of the test equipment (Power Analyzer) U_e is equal to 0.2% ($K=2$, at the 95% confidence level).

As U_e is no greater than the permitted value U_{ma} specified in IEC 62301-2011 Section 4.4.1, the measurement is acceptable.



6.0 Electrical Test

6.5 Dimming Test

Model No.	ULD113W-0190	Sample ID.	1298526-S001
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Dimmer Information

Manufacture	Lutron	Model Number	DVCL-153P
Rated for CFL / LED	LED	Technology / Features	Forward phase-cut

Test Method

1. The test was performed using a relative photometry method, according to ENERGY STAR Recommended Practice - Light Output on a Dimmer and ENERGY STAR[®] Recommended Practice - Noise.
2. The measurement was taken one test sample combined with the dimmers. The sample was tested at the rated electrical parameter, and allowed to stabilize and verify by taking light output measurements every minute, until consecutive measurements are no more than 0.5% apart.
3. The noise test shall be conducted on sample in the sound chamber with one microphone. The microphone was located in six position to get the peak noise.

Test Results

Temperature (°C)	Voltage (Vac)	Frequency	Baseline Light Output (lx)		Maximum Light Output (lx)	Minimum Light Output (lx)
25.1	120	60	833		826	79
Ambient Sound (dBA)	Peak Noise at BLO (dBA)	Peak Noise at MaxLO (dBA)	Peak Noise at MinLO (dBA)	Position (degree)	Maximum Light Output Ratio (%)	Minimum Light Output Ratio (%)
17.7	17.8	18.1	18	N/A	99.16%	9.48%



7.0 In-Situ Temperature Measurement Test

Model No.	ULD113W-0190	Sample ID.	1298526-S001
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Test Method

1. In-Situ Temperature Measurement Test is conducted according to the UL1598-2008, Section 14 or UL 153-2002, Sections 124.
2. The testing was conducted in a room with ambient temperature of $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$. The apparatus construction followed those described in UL1598-2008 for normal temperature testing. Thermocouples were placed on the LED package in the locations indicated by LM-80 report. The temperature was recorded after the lamp was operating for a minimum of 7.5 hours.

In-Situ Temperature Measurement Test Conditions

Temperature	Voltage (Vac)	Frequency	Current (A)	Power (W)	Power Factor	Orientation
22.4	120.04	60	0.13	15.31	0.983	Face Down

Test Results

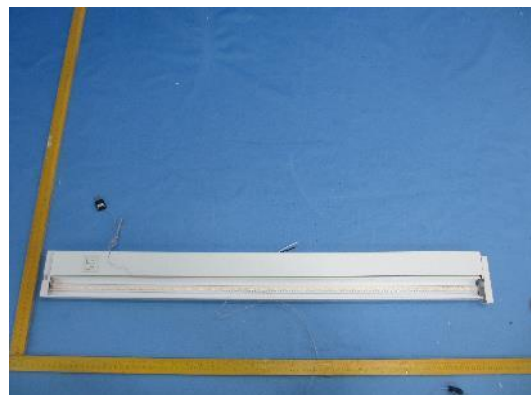
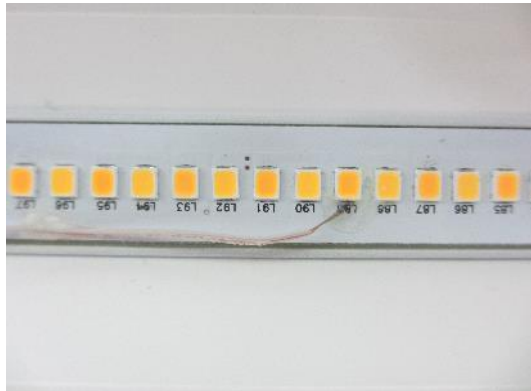
Thermocouple Location	Customer claim Current (mA)	Temperature for Lighting source ($^{\circ}\text{C}$)		LED Model Number	LM-80 Limit Current (mA)	LM-80 Limit Temp. ($^{\circ}\text{C}$)
		Test result column 1	Test result (Correct to 25°C)			
TMP of LEDs	60	37.9	40.5	2T03X2WWxx00 0xxx	60	85
Ambient temperature	N/A	22.4	25.0			

Thermocouple Location	Temperature for LED driver ($^{\circ}\text{C}$)		LED driver Model Number	LED Driver Tc Temp. ($^{\circ}\text{C}$)
	Test result column 1	Test result (Correct to 25°C)		
TMP of LED drivers	53.3	55.9	ULD11	90
Ambient temperature	22.4	25.0		

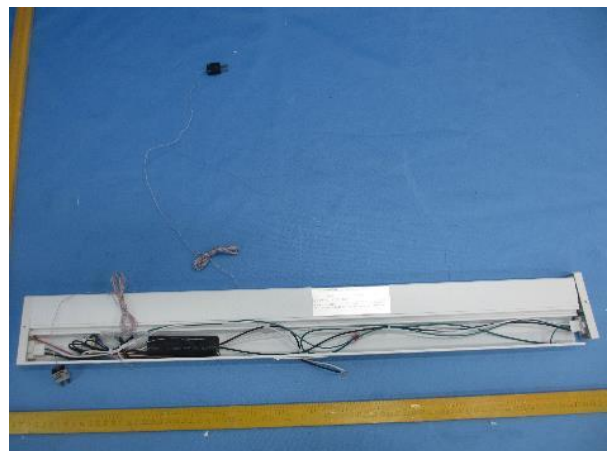
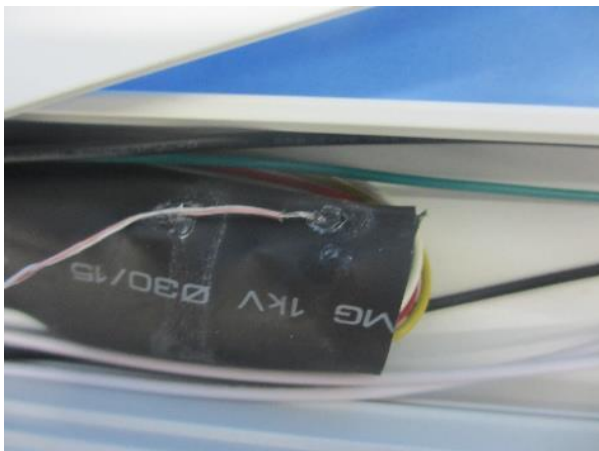


7.0 In-Situ Temperature Measurement Test (Cont'd)

Test Photos for LEDs



Test Photos for LED Drivers





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