



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

ULD163W-##90, ULD163BZ-##90, ULD163BK-##90

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

Project Number

4788249285

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N/A

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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. | 75.30 | Pass |
| Light Output (lm) | IES LM-79-08 | Luminous Flux (lm) | 1462.45 | Pass |
| | | Under Cabinet: 125 lm/ft | 365.61 | |
| Zonal Lumen Density | IES LM-79-08 | For directional luminaires only. (0°~60°C) >60% | 77.20% | Pass |
| CCT (K) | ANSI C78.377-2011 | fall within the corresponding 7-step chromaticity quadrangles | 2764 | Pass |
| CRI | IES LM-79-08, CIE 13.3-1995 | Ra ≥ 80 | 93.2 | 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 | 0.00107 | 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. | 69.6 | 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 | 120.8 | 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 | 38.2 | Pass |
| Driver Case Temperature (°C) | ANSI/UL 153:2002 ANSI/UL 1598:2008 | ≤ TMPC marked on the the driver | 57.7 | 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% | 4.77% | Pass |
| Dimming: Noise | N/A | 24dBA at 1 meter | 17.9 | 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 | 2107-12-12 | ULD163W-0190 | Lily Chen |
| | | 2107-12-23 | ULD163W-2090 | Lily Chen |
| 2 | Goniophotometer Test | 2107-12-12 | ULD163W-0190 | Lily Chen |
| 3 | Color Angular Uniformity | 2107-12-18 | ULD163W-0190 | Lily Chen |
| 4 | Source Start Time & Run-Up time | 2107-12-13 | ULD163W-0190 | Lily Chen |
| 5 | Operating Frequency Test | 2107-12-13 | ULD163W-0190 | Lily Chen |
| 6 | Transient Protection Test | 2107-12-19 | ULD163W-0190 | Lily Chen |
| 7 | Standby Power Consumption | 2107-12-19 | ULD163W-0190 | Lily Chen |
| 8 | Dimming Test | 2107-12-19 | ULD163W-0190 | Lily Chen |
| 9 | In-Situ Temperature Measurement Test | 2107-12-19 | ULD163W-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, 20W, CRI 90, CCT 2700K - 4000K, Length 48 inch

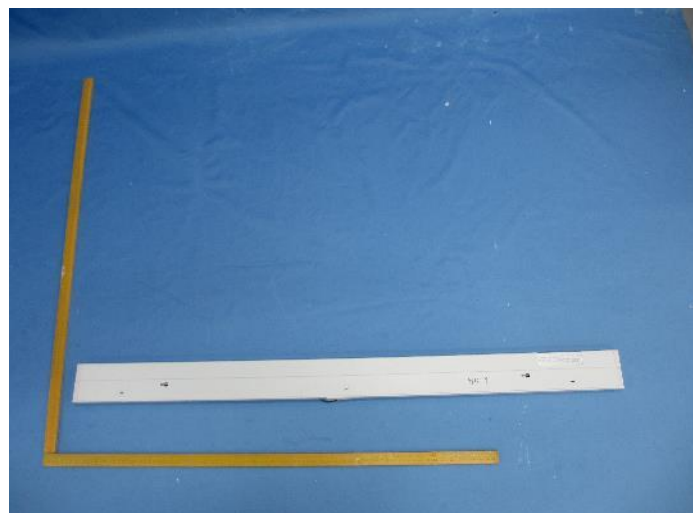
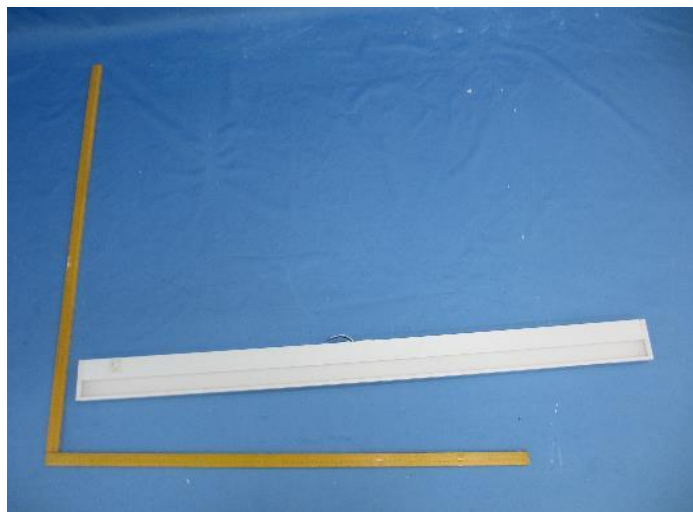
Lighting Source: 2T03X2WWxx000xxx made by Edison Opto Corporation

Mounting: Under Cabinet Mount

LED Driver: ULD14-16

Family Model and Variation: ULD163W-##90, ULD163BZ-##90, ULD163BK-##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. | ULD163W-0190 | Sample ID. | 1298530-S001 | Temperature (°C) | 25.1 |
| Operate time (Min.) | 50 | Stabilization time (Min.) | 45 | | |

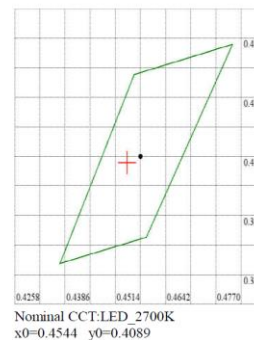
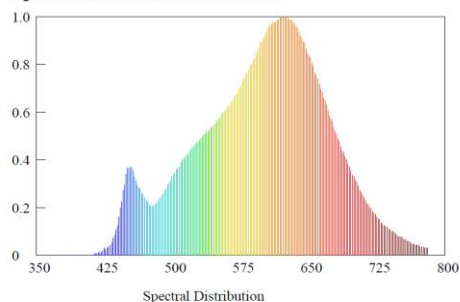
Test Method

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) |
|--------------|-------------|---------------|----------------|-------------|-----------|--------------|---------|----------|----|--------------------|--------------------------|
| ULD163W-0190 | Horizontal | 120.07 | 60 | 0.164 | 19.41 | 0.983 | 2764 | 93.2 | 58 | 1462.45 | 75.3 |

Spectroradiometric Parameters





4.0 Photometric Measurements

4.2 Integrating Sphere Test

| | | | | | |
|---------------------|--------------|---------------------------|--------------|------------------|------|
| Model No. | ULD163W-2090 | Sample ID. | 1291154-S001 | Temperature (°C) | 25.1 |
| Operate time (Min.) | 50 | Stabilization time (Min.) | 45 | | |

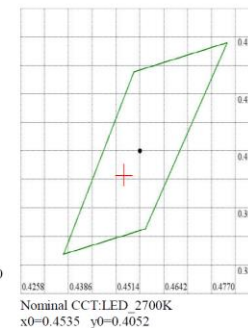
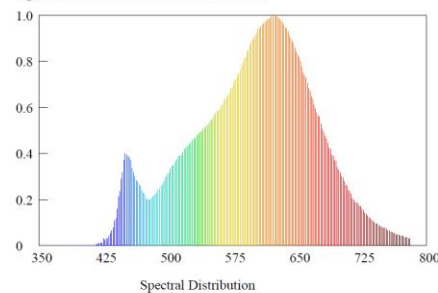
Test Method

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) |
|--------------|-------------|---------------|----------------|-------------|-----------|--------------|---------|----------|----|--------------------|--------------------------|
| ULD163W-2090 | Horizontal | 120 | 60 | 0.166 | 19.47 | 0.98 | 2719 | 92.8 | 57 | 1581.12 | 81.2 |

Spectroradiometric Parameters





5.0 Photometric Measurements

5.1 Goniophotometer Test

| | | | |
|---------------------|--------------|---------------------------|--------------|
| Model No. | ULD163W-0190 | Sample ID. | 1298530-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 | 120.12 | 60 | 0.1659 | 19.569 | 0.9818 | Horizontal |

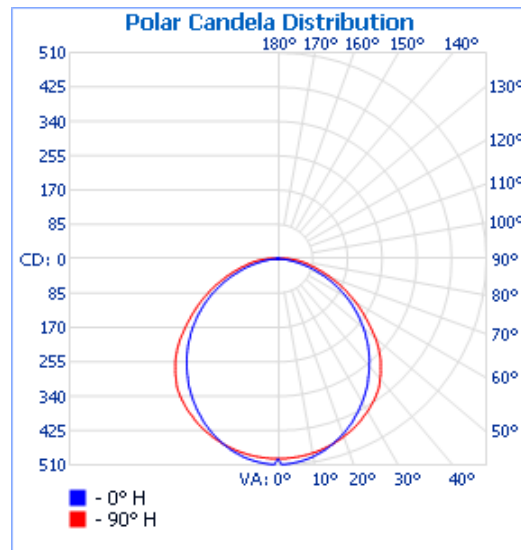
Test Results

| 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 | |
| 1,459.90 | 77.20% | 169.6 | 157.8 | 113.1 | 105.6 | 74.6 |

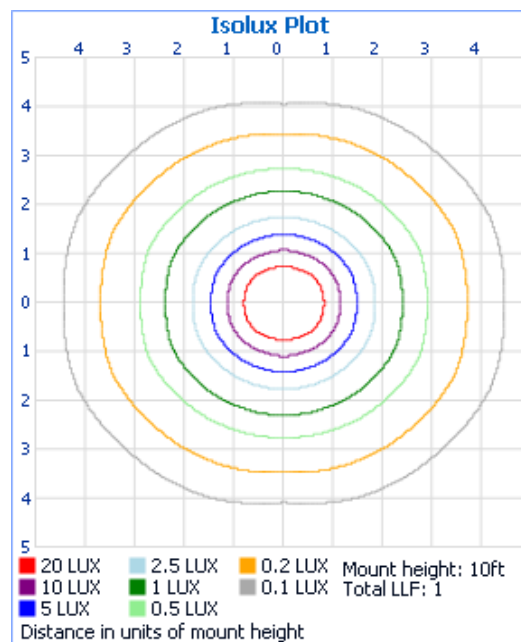


5.1 Goniophotometer Test (Cont'd)

Light Distribution Curve



Isolux Plot





5.1 Goniophotometer Test (Cont'd)

Zonal Lumen Summary

Zonal Lumen Summary

| Zone | Lumens | % Luminaire |
|--------|---------|-------------|
| 0-30 | 387.2 | 26.5% |
| 0-40 | 637.7 | 43.7% |
| 0-60 | 1,126.4 | 77.2% |
| 60-90 | 320.2 | 21.9% |
| 70-100 | 160.3 | 11% |
| 90-120 | 12.1 | 0.8% |
| 0-90 | 1,446.5 | 99.1% |
| 90-180 | 13.4 | 0.9% |
| 0-180 | 1,459.9 | 100% |

Lumens Per Zone

Lumens Per Zone

| Zone | Lumens | % Total | Zone | Lumens | % Total |
|-------|--------|---------|---------|--------|---------|
| 0-5 | 11.8 | 0.8% | 90-95 | 8.4 | 0.6% |
| 5-10 | 35.1 | 2.4% | 95-100 | 2.7 | 0.2% |
| 10-15 | 57.2 | 3.9% | 100-105 | 0.5 | 0% |
| 15-20 | 77.5 | 5.3% | 105-110 | 0.2 | 0% |
| 20-25 | 95.3 | 6.5% | 110-115 | 0.2 | 0% |
| 25-30 | 110.2 | 7.5% | 115-120 | 0.2 | 0% |
| 30-35 | 121.6 | 8.3% | 120-125 | 0.1 | 0% |
| 35-40 | 128.9 | 8.8% | 125-130 | 0.2 | 0% |
| 40-45 | 131.2 | 9.0% | 130-135 | 0.1 | 0% |
| 45-50 | 128.4 | 8.8% | 135-140 | 0.1 | 0% |
| 50-55 | 120.4 | 8.2% | 140-145 | 0.1 | 0% |
| 55-60 | 108.6 | 7.4% | 145-150 | 0.1 | 0% |
| 60-65 | 93.9 | 6.4% | 150-155 | 0.1 | 0% |
| 65-70 | 77.1 | 5.3% | 155-160 | 0.1 | 0% |
| 70-75 | 59.3 | 4.1% | 160-165 | 0.1 | 0% |
| 75-80 | 42.9 | 2.9% | 165-170 | 0.1 | 0% |
| 80-85 | 29.2 | 2.0% | 170-175 | 0.0 | 0% |
| 85-90 | 17.7 | 1.2% | 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 | 494 | 494 | 494 | 494 | 494 | 494 | 494 | 494 | 494 | 494 | 494 | 494 | 494 | 494 | 494 | 494 | 494 |
| 1 | 509 | 494 | 494 | 494 | 494 | 494 | 494 | 494 | 509 | 494 | 494 | 494 | 494 | 494 | 494 | 494 | 509 |
| 2 | 508 | 494 | 494 | 494 | 494 | 494 | 494 | 494 | 508 | 494 | 494 | 494 | 494 | 494 | 494 | 494 | 508 |
| 3 | 507 | 493 | 494 | 494 | 493 | 494 | 494 | 493 | 507 | 493 | 494 | 494 | 493 | 494 | 494 | 493 | 507 |
| 4 | 506 | 492 | 493 | 493 | 493 | 493 | 493 | 492 | 506 | 492 | 493 | 493 | 493 | 493 | 493 | 492 | 506 |
| 5 | 505 | 492 | 492 | 493 | 493 | 493 | 492 | 492 | 505 | 492 | 492 | 493 | 493 | 493 | 492 | 492 | 505 |
| 6 | 504 | 490 | 491 | 492 | 492 | 492 | 491 | 490 | 504 | 490 | 491 | 492 | 492 | 492 | 491 | 490 | 504 |
| 7 | 502 | 489 | 491 | 491 | 491 | 491 | 491 | 489 | 502 | 489 | 491 | 491 | 491 | 491 | 491 | 489 | 502 |
| 8 | 501 | 487 | 490 | 490 | 490 | 490 | 490 | 487 | 501 | 487 | 490 | 490 | 490 | 490 | 490 | 487 | 501 |
| 9 | 499 | 487 | 488 | 490 | 489 | 506 | 504 | 504 | 499 | 487 | 488 | 490 | 489 | 473 | 471 | 466 | 504 |
| 10 | 497 | 483 | 487 | 488 | 487 | 488 | 487 | 483 | 497 | 483 | 487 | 488 | 487 | 488 | 487 | 483 | 497 |
| 11 | 494 | 481 | 485 | 487 | 486 | 487 | 485 | 481 | 494 | 481 | 485 | 487 | 486 | 487 | 485 | 481 | 494 |
| 12 | 491 | 479 | 483 | 485 | 485 | 485 | 483 | 479 | 491 | 479 | 483 | 485 | 485 | 485 | 483 | 479 | 491 |
| 13 | 488 | 476 | 481 | 484 | 483 | 484 | 481 | 476 | 488 | 476 | 481 | 484 | 483 | 484 | 481 | 476 | 488 |
| 14 | 486 | 473 | 480 | 483 | 481 | 483 | 480 | 473 | 486 | 473 | 480 | 483 | 481 | 483 | 480 | 473 | 486 |
| 15 | 481 | 470 | 478 | 481 | 480 | 481 | 478 | 470 | 481 | 470 | 478 | 481 | 480 | 481 | 478 | 470 | 481 |
| 16 | 478 | 467 | 476 | 479 | 478 | 479 | 476 | 467 | 478 | 467 | 476 | 479 | 478 | 479 | 476 | 467 | 478 |
| 17 | 474 | 463 | 473 | 477 | 475 | 477 | 473 | 463 | 474 | 463 | 473 | 477 | 475 | 477 | 473 | 463 | 474 |
| 18 | 470 | 459 | 470 | 475 | 473 | 475 | 470 | 459 | 470 | 459 | 470 | 475 | 473 | 475 | 470 | 459 | 470 |
| 19 | 466 | 455 | 468 | 473 | 471 | 473 | 468 | 455 | 466 | 455 | 468 | 473 | 471 | 473 | 468 | 455 | 466 |
| 20 | 462 | 452 | 465 | 471 | 469 | 471 | 465 | 452 | 462 | 452 | 465 | 471 | 469 | 471 | 465 | 452 | 462 |
| 25 | 438 | 429 | 450 | 458 | 454 | 458 | 450 | 429 | 438 | 429 | 450 | 458 | 454 | 458 | 450 | 429 | 438 |
| 30 | 411 | 405 | 431 | 441 | 437 | 441 | 431 | 405 | 411 | 405 | 431 | 441 | 437 | 441 | 431 | 405 | 411 |
| 35 | 381 | 378 | 406 | 421 | 416 | 421 | 406 | 378 | 381 | 378 | 406 | 421 | 416 | 421 | 406 | 378 | 381 |
| 40 | 348 | 347 | 377 | 394 | 388 | 394 | 377 | 347 | 348 | 347 | 377 | 394 | 388 | 394 | 377 | 347 | 348 |
| 45 | 313 | 313 | 341 | 360 | 355 | 360 | 341 | 313 | 313 | 313 | 341 | 360 | 355 | 360 | 341 | 313 | 313 |
| 50 | 276 | 276 | 300 | 321 | 314 | 321 | 300 | 276 | 276 | 276 | 300 | 321 | 314 | 321 | 300 | 276 | 276 |
| 55 | 237 | 237 | 256 | 278 | 267 | 278 | 256 | 237 | 237 | 237 | 256 | 278 | 267 | 278 | 256 | 237 | 237 |
| 60 | 197 | 198 | 213 | 236 | 223 | 236 | 213 | 198 | 197 | 198 | 213 | 236 | 223 | 236 | 213 | 198 | 197 |
| 65 | 156 | 158 | 172 | 192 | 182 | 192 | 172 | 158 | 156 | 158 | 172 | 192 | 182 | 192 | 172 | 158 | 156 |
| 70 | 116 | 121 | 131 | 149 | 139 | 149 | 131 | 121 | 116 | 121 | 131 | 149 | 139 | 149 | 131 | 121 | 116 |
| 75 | 77 | 88 | 96 | 109 | 104 | 109 | 96 | 88 | 77 | 88 | 96 | 109 | 104 | 109 | 96 | 88 | 77 |
| 80 | 44 | 61 | 66 | 77 | 75 | 77 | 66 | 61 | 44 | 61 | 66 | 77 | 75 | 77 | 66 | 61 | 44 |
| 85 | 21 | 39 | 43 | 53 | 49 | 53 | 43 | 39 | 21 | 39 | 43 | 53 | 49 | 53 | 43 | 39 | 21 |
| 90 | 7 | 22 | 24 | 30 | 26 | 30 | 24 | 22 | 7 | 22 | 24 | 30 | 26 | 30 | 24 | 22 | 7 |
| 95 | 1 | 10 | 9 | 11 | 11 | 11 | 9 | 10 | 1 | 10 | 9 | 11 | 11 | 11 | 9 | 10 | 1 |
| 100 | 0 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 0 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 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 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 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 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 160 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 |
| 165 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| 170 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 |
| 175 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 |
| 180 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |



5.0 Photometric Measurements

5.2 Color Angular Uniformity

| | | | |
|------------------|--------------|-------------------|--------------|
| Model No. | ULD163W-0190 | Sample ID. | 1298530-S001 |
|------------------|--------------|-------------------|--------------|

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 | 119.94 | 60 | 0.166 | 19.64 | 0.00107 |



6.0 Electrical Test

6.1 Source Start Time & Run-Up time

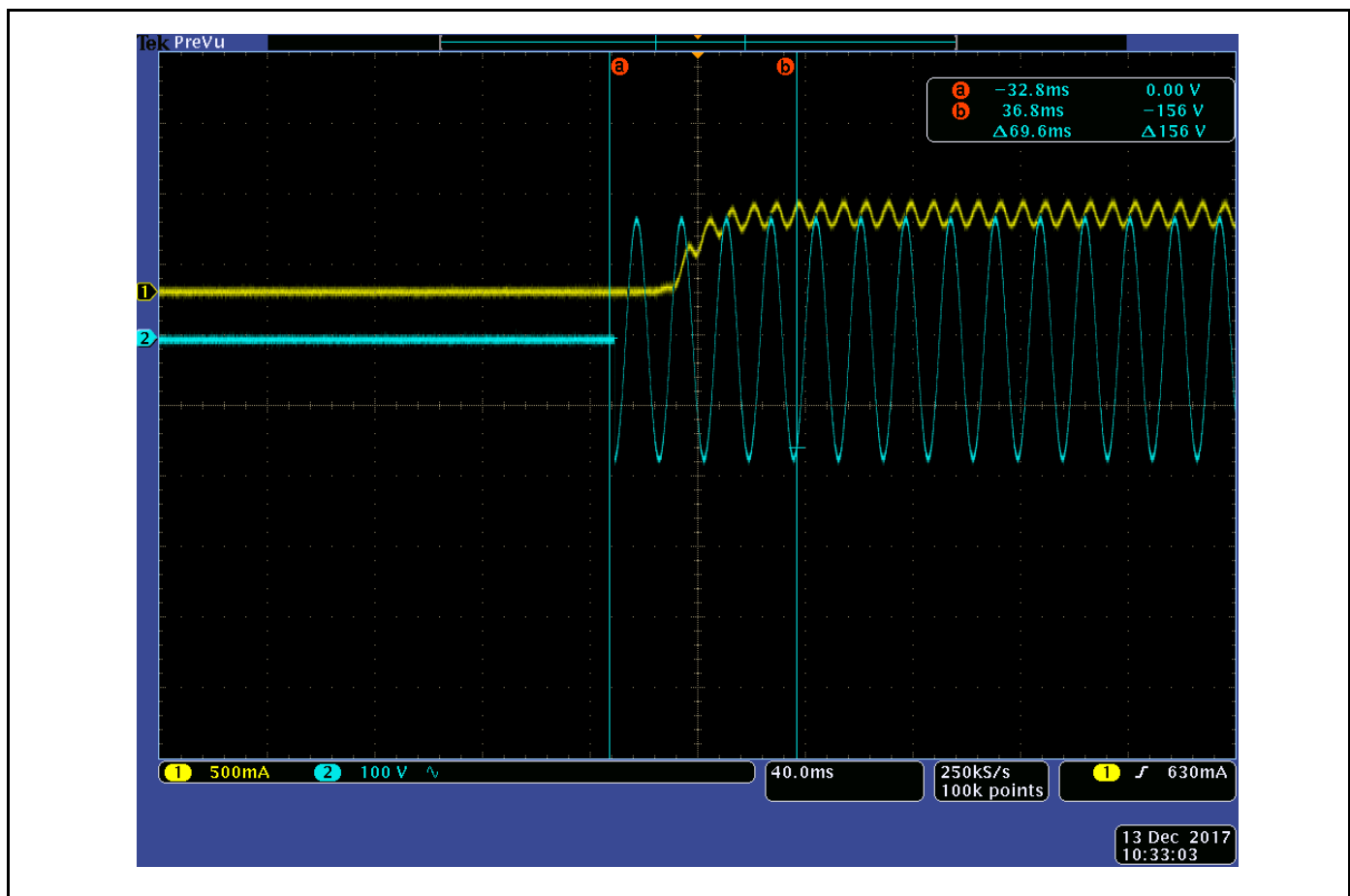
| Model No. | ULD163W-0190 | Sample ID. | 1298530-S001 |
|-----------|--------------|------------|--------------|
|-----------|--------------|------------|--------------|

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 | 69.6 | N/A |





6.0 Electrical Test

6.2 Operating Frequency Test

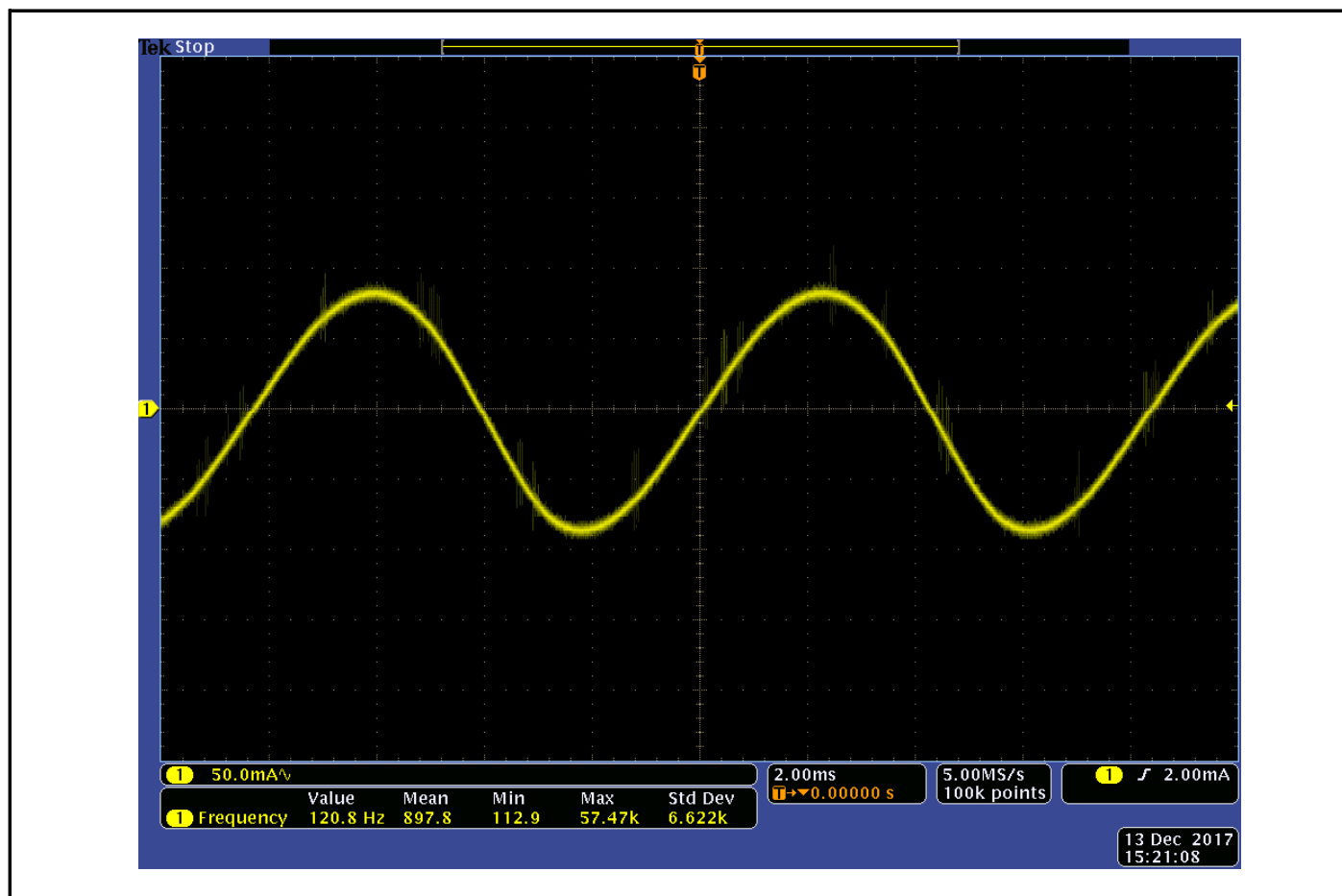
| | | | |
|-----------|--------------|------------|--------------|
| Model No. | ULD163W-0190 | Sample ID. | 1298530-S001 |
|-----------|--------------|------------|--------------|

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 | 121 | 60 | 120.8 |





6.0 Electrical Test

6.3 Transient Protection Test

| | | | |
|-----------|--------------|------------|--------------|
| Model No. | ULD163W-0190 | Sample ID. | 1298530-S001 |
|-----------|--------------|------------|--------------|

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. | ULD163W-0190 | Sample ID. | 1298530-S001 |
|-----------|--------------|------------|--------------|

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 | 0.093 | 0.898 | 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. | ULD163W-0190 | Sample ID. | 1298530-S001 |
|-----------|--------------|------------|--------------|

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 | 1038 | | 890 | 49.5 |
| 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 | 18.2 | 18.2 | 17.9 | N/A | 85.74% | 4.77% |



7.0 In-Situ Temperature Measurement Test

| | | | |
|------------------|--------------|-------------------|--------------|
| Model No. | ULD163W-0190 | Sample ID. | 1298530-S001 |
|------------------|--------------|-------------------|--------------|

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 | 120.07 | 60 | 0.164 | 19.41 | 0.983 | Face Down |

Test Results

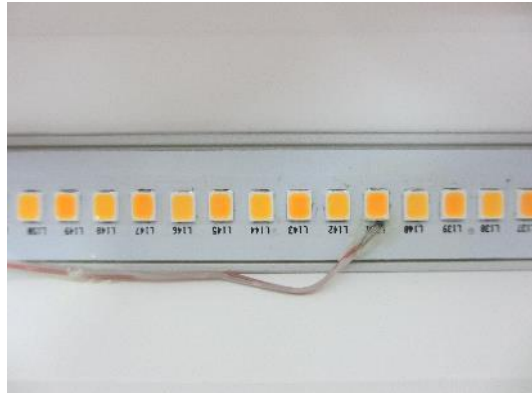
| Thermocouple Location | Customer claim Current (mA) | Temperature for Lighting source ($^{\circ}\text{C}$) | | LED Model Number | LM-80 Limit Current (mA) | LM-80 Limit Temp. ($^{\circ}\text{C}$) |
|-----------------------|-----------------------------|--|--|----------------------|--------------------------|--|
| | | Test result column 1 | Test result (Correct to 25°C) | | | |
| TMP of LEDs | 60 | 35.6 | 38.2 | 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 | 55.1 | 57.7 | ULD14-16 | 90 |
| Ambient temperature | 22.4 | 25.0 | | |

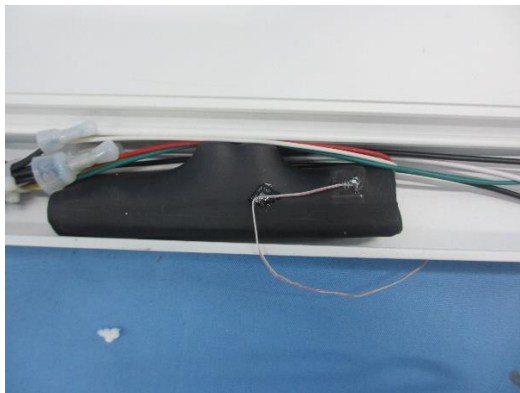


7.0 In-Situ Temperature Measurement Test (Cont'd)

Test Photos for LEDs



Test Photos for LED Drivers





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