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|----------------------------------|--|
| Report Number | TRN-15131 |
| Customer | ASD Lighting plc |
| Contact | Paul Gledhill |
| Product Type | Street Light |
| Test Purpose | UMS Energy Performance Test |
| Sales Order Ref | Q-LUX2014-2520 |
| Works Order Number | WO-5475 |
| Test Item Reference | TI-4540 |
| LAB Test Method Reference | TES-2012 |
| Test Standards | LM-79-08 and UMS charge code process v4.0 |
| Lab Location Reference | UMS |
| Tested by | Steve Hunt |
| Date of Test | 26/06/2015 |
| Analysed by | Steve Hunt |
| Number of products tested | 5 |

Address: LUX-TSI Ltd.,
Pencoed Technology Park,
Pencoed, Bridgend,
CF35 5HZ, UK

Telephone: +44 (0) 1656 864618

Authorised by: David Chan

Email: dchan@lux-tsi.com

Signed: 



28 LED - 500mA - 100% Output

Date: 26/06/2015

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Nomenclature

Lamp Orientation described below relates to the position in which a lamp is designed to operate for maximum performance and safety, these include:

BD - Base Down (bulb is vertically positioned with the metal base at the bottom, glass up)

BU - Base Up (bulb is vertically positioned with the metal base at the top, glass hanging down)

HBD - Horizontal $+15^{\circ}$ to Base Down

H45 - Horizontal to -45° only

VBV - Vertical Base Up $\pm 15^{\circ}$

VBD - Vertical Base Down $\pm 15^{\circ}$

HBU - Base Up $\pm 90^{\circ}$ (bulb can be operated in a base up or horizontal position)

HOR - Horizontal Burn (bulb is positioned with the metal base parallel to the ground)

H75 - Horizontal $\pm 75^{\circ}$ (bulb should not be operated within 15° of vertical)

U - Universal Burn (burn can be operated in any position)

Test Conditions

Measurements were made with an ambient temperature of $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$. Measurements were taken only after sufficient time for thermal stabilisation has been allowed.

Test Equipment

Yokogawa WT210 Power Analyzer. Kikusui PCR2000M Stable AC Power Supply

with PC control and data recording



Full data control and recording
using Labview software and full
integration of the AC Stable Power
Supply and Power Analyser

| | |
|------------------------------|--------------------------------------|
| Product Name | 28 LED - 500mA - 100% Output |
| Part/Serial Number | See (Identifier) below |
| Type of Product | Street Light |
| Base Type | N/A |
| Driver Type | Mains |
| Driver Model | OPTOTRONIC OT90/220-240/700 3DIMLT+E |
| Light Engine Model | PCB058 CREE XPG LED |
| Operating Orientation | Base Up |
| Test Orientation | Base Up |
| Ambient Temperature | 22.2°C |
| Manufacturer | ASD Lighting plc |
| Date of Manufacturer | 2015 |
| Thermal Management | Passive |
| Dimmable | Yes |
| Humidity | <65% RH |

| Dimension | Sample | Luminous Opening |
|----------------|--------|------------------|
| Diameter/Width | 594 mm | 275 mm |
| Length | 232 mm | 220 mm |
| Height/Depth | 120 mm | 0 mm |

| Test Item | Identifier |
|-----------|------------|
| TI-4540A | 1 |
| TI-4540B | 2 |
| TI-4540C | 3 |
| TI-4540D | 4 |
| TI-4540E | 5 |

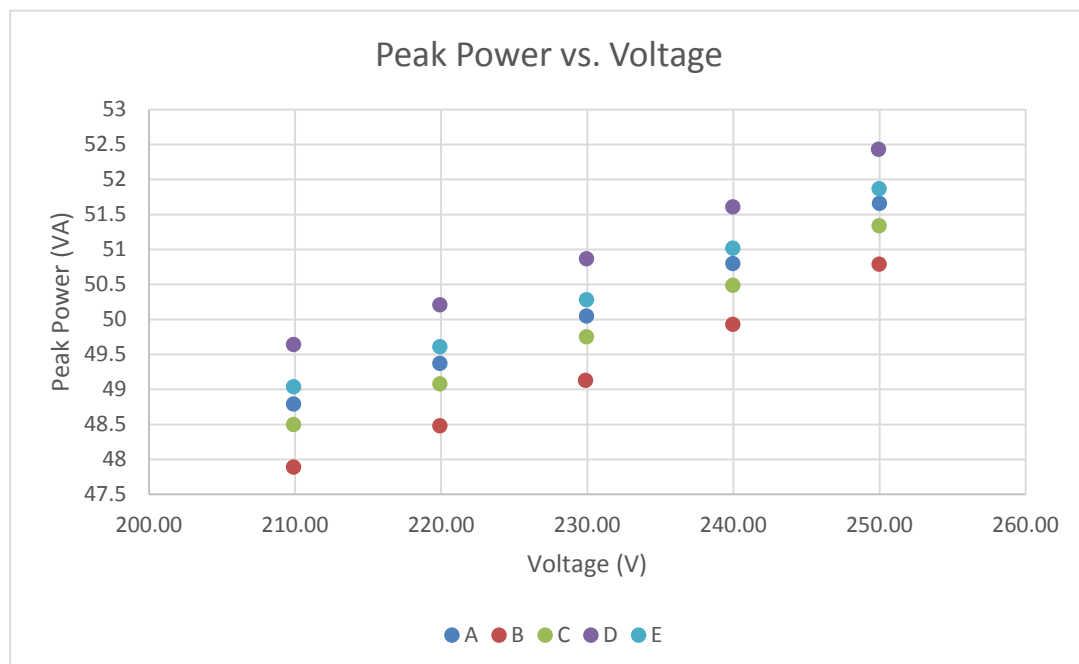
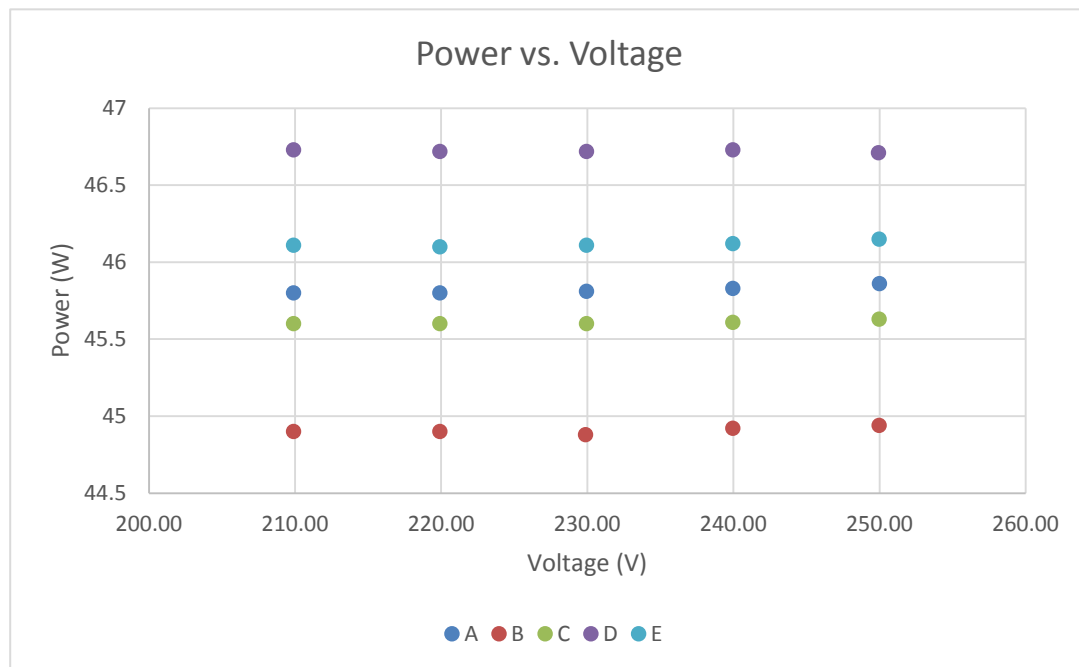
Test Conditions

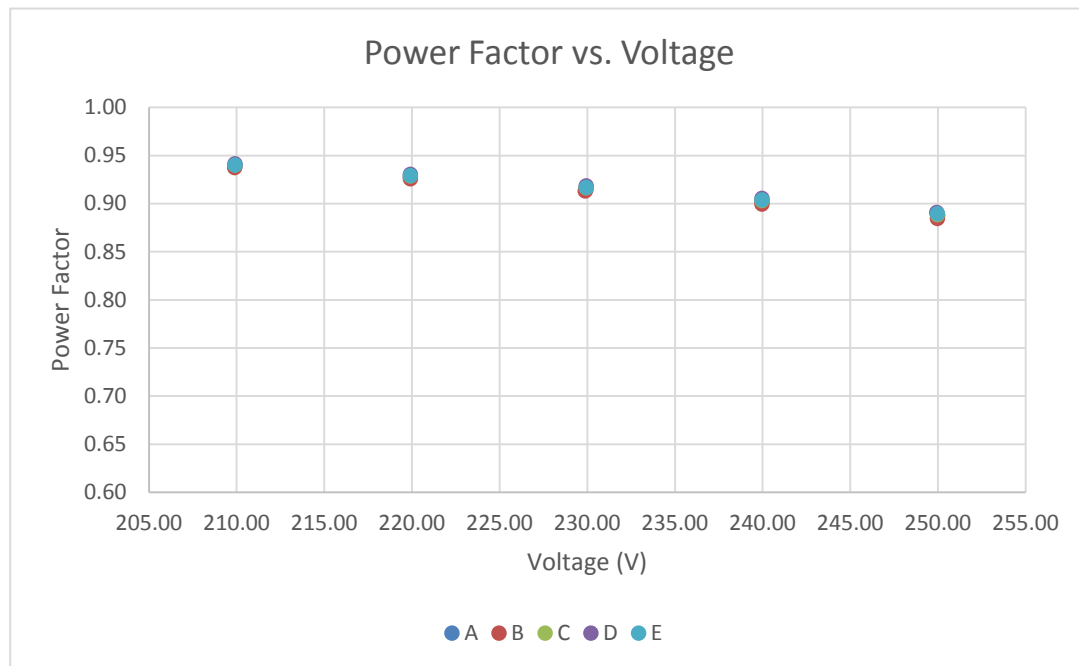
| | Before Test | After Test |
|--|-------------|------------|
| AC Supply Voltage (V) | 249.92V | 249.98V |
| AC Supply Frequency (Hz) | 50Hz | 49.99Hz |
| Voltage RMS Summation of the Harmonic Components (THD) | 0.079% | 0.09% |

The test items were stabilised according to the electrical power stability of LM79-08. Stabilization is achieved when the difference in electrical power measurement is less than 0.5%. Each test item was stabilised at 250V.

Test Results Summary

These are the summary graphs of the test results for all products tested. The raw results are on page 6 of this test report.





Power factors measured have a Leading phase angle and therefore the driver has capacitive properties.

Measurement Uncertainty

| Parameter | Uncertainty |
|---------------------------------|--------------------------------------|
| Voltage (300 V, 50/60 Hz) | $\pm 0.061 \text{ V}_{\text{rms}}$ |
| Current (200 mA, 50/60Hz) | $\pm 0.07 \text{ mA}_{\text{rms}}$ |
| Current (0.5 A, 50/60Hz) | $\pm 0.16 \text{ mA}_{\text{rms}}$ |
| Current (5 A, 50/60Hz) | $\pm 0.0016 \text{ A}_{\text{rms}}$ |
| Power (300 V, 200 mA, 50/60 Hz) | $\pm 0.032 \text{ W}_{\text{rms}}$ |
| Power (300 V, 0.5 A, 50/60 Hz) | $\pm 0.09 \text{ W}_{\text{rms}}$ |
| Power (300 V, 5 A, 50/60 Hz) | $\pm 0.0009 \text{ kW}_{\text{rms}}$ |
| Frequency (50/60 Hz) | $\pm 0.001 \text{ Hz}$ |
| Power Factor | $\pm 0.0006 \text{ PF}$ |

Measurements of power of 0.50W or greater are made with an uncertainty of less than or equal to 2% at the 95% confidence level. Measurements of power less than 0.50W are made with an uncertainty of less than or equal to 0.01W at the 95% confidence level.

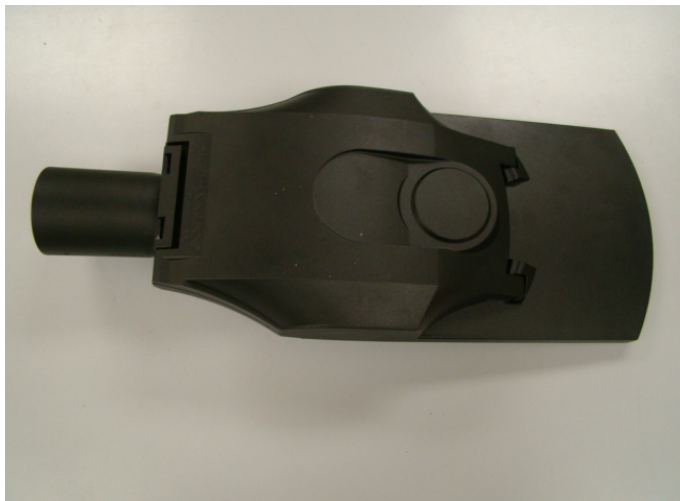
Full Test Results

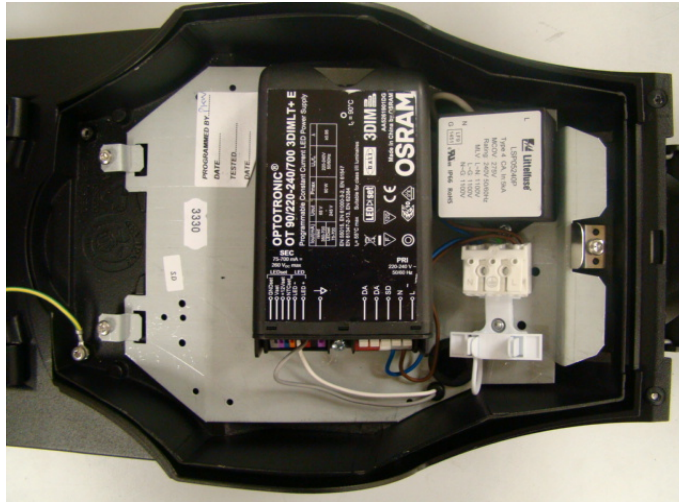
| Test Item | Voltage (V) | Current (mA) | Electrical Power (W) | Ambient Temp (°C) | Peak Power (VA) | Power Factor | Leading / Lagging |
|-----------|-------------|--------------|----------------------|-------------------|-----------------|--------------|-------------------|
| A | 249.98 | 206.68 | 45.86 | 22.20 | 51.66 | 0.888 | Leading |
| B | 249.97 | 203.20 | 44.94 | 22.21 | 50.79 | 0.885 | Leading |
| C | 249.97 | 205.39 | 45.63 | 22.31 | 51.34 | 0.889 | Leading |
| D | 249.92 | 209.78 | 46.71 | 22.26 | 52.43 | 0.891 | Leading |
| E | 249.97 | 207.49 | 46.15 | 22.23 | 51.87 | 0.890 | Leading |
| A | 239.95 | 211.70 | 45.83 | 22.28 | 50.80 | 0.902 | Leading |
| B | 239.95 | 208.07 | 44.92 | 22.25 | 49.93 | 0.900 | Leading |
| C | 239.96 | 210.41 | 45.61 | 22.14 | 50.49 | 0.903 | Leading |
| D | 239.95 | 215.07 | 46.73 | 22.03 | 51.61 | 0.906 | Leading |
| E | 239.95 | 212.62 | 46.12 | 22.14 | 51.02 | 0.904 | Leading |
| A | 229.93 | 217.69 | 45.81 | 22.30 | 50.05 | 0.915 | Leading |
| B | 229.88 | 213.73 | 44.88 | 22.20 | 49.13 | 0.913 | Leading |
| C | 229.93 | 216.36 | 45.60 | 22.13 | 49.75 | 0.917 | Leading |
| D | 229.93 | 221.22 | 46.72 | 22.14 | 50.87 | 0.919 | Leading |
| E | 229.93 | 218.66 | 46.11 | 22.21 | 50.28 | 0.917 | Leading |
| A | 219.91 | 224.50 | 45.80 | 22.28 | 49.37 | 0.928 | Leading |
| B | 219.90 | 220.47 | 44.90 | 22.26 | 48.48 | 0.926 | Leading |
| C | 219.91 | 223.19 | 45.60 | 22.31 | 49.08 | 0.929 | Leading |
| D | 219.91 | 228.33 | 46.72 | 22.36 | 50.21 | 0.930 | Leading |
| E | 219.91 | 225.59 | 46.10 | 22.31 | 49.61 | 0.929 | Leading |
| A | 209.90 | 232.44 | 45.80 | 22.19 | 48.79 | 0.939 | Leading |
| B | 209.89 | 228.16 | 44.90 | 22.18 | 47.89 | 0.938 | Leading |
| C | 209.90 | 231.07 | 45.60 | 22.10 | 48.50 | 0.940 | Leading |
| D | 209.90 | 236.48 | 46.73 | 22.27 | 49.64 | 0.942 | Leading |
| E | 209.90 | 233.63 | 46.11 | 22.15 | 49.04 | 0.940 | Leading |

Test Item Photographs

TI-4540

Images of Product(s) under test. Identification of each of the products can be found on page 3 of this report





Internal Circuitry including Rating Labels

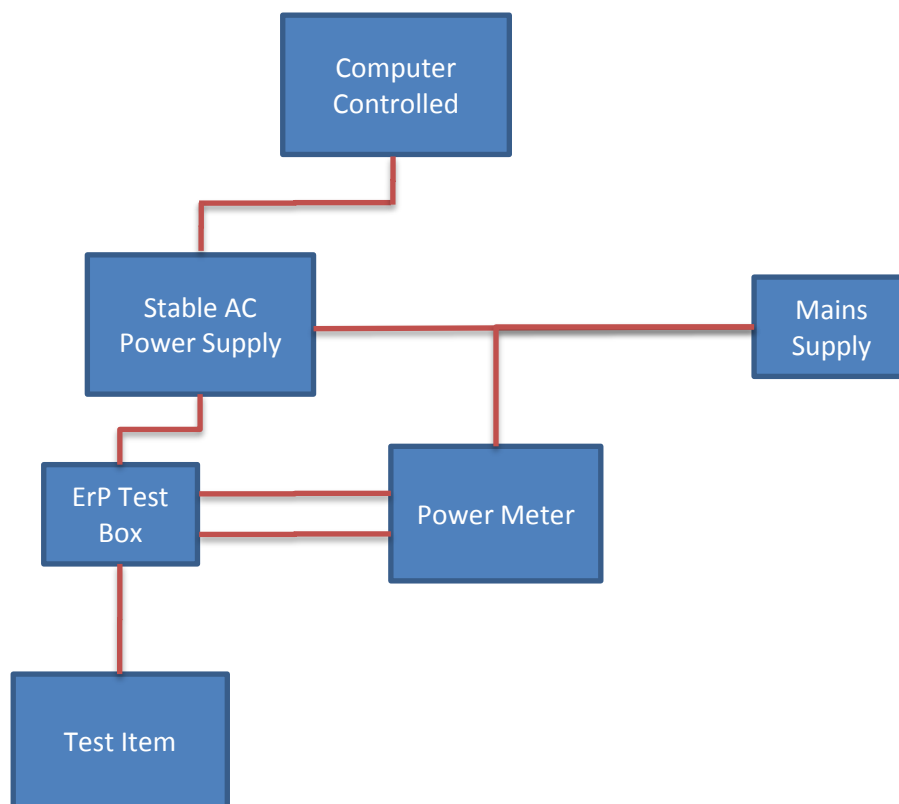


Driver in Situ



Light Engine

Appendix 1: Test item set-up



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