

**Lamp measurement report – 2 June 2009 for Line Lite  
International BV**

**Line Lite International BV Dimmable 3×2W Cree  
WW MR16**



## Lamp measurement report – 2 June 2009 for Line Lite International BV

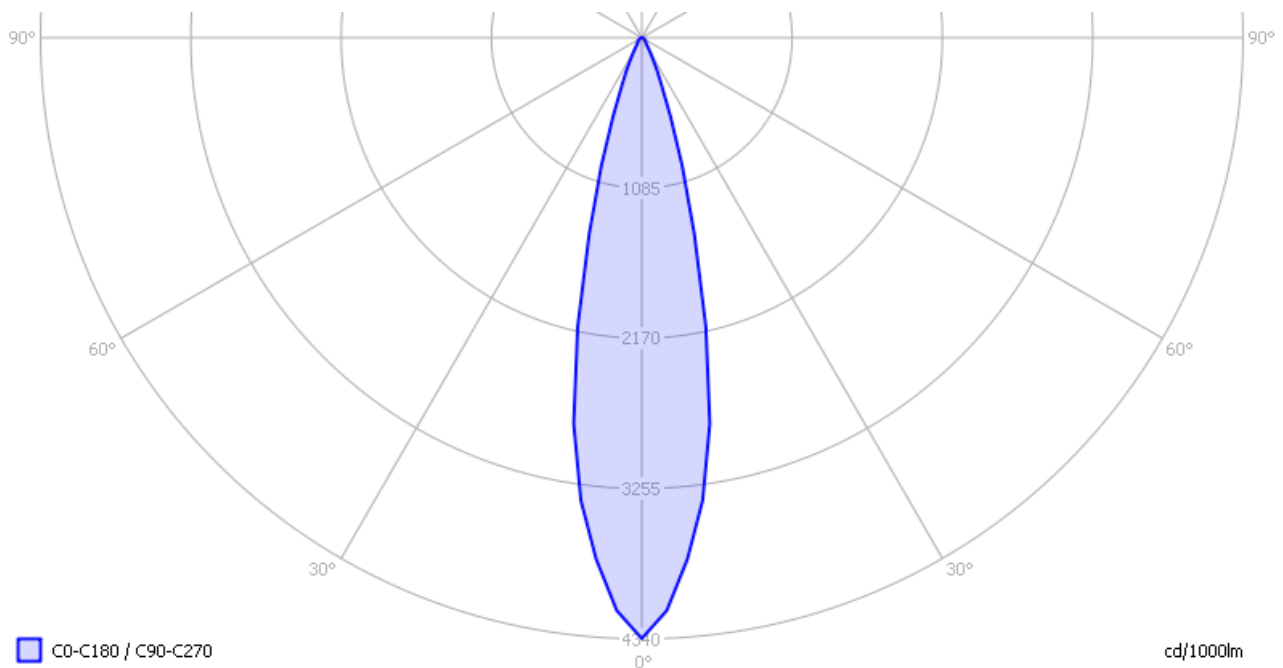
### Summary measurement data

parameter	meas. result	remark
Color temperature	2963 K	Warm white
Luminous intensity $I_v$	950 Cd	
Beam angle	25 deg	
Power P	7.0 W	This is including the constant current driver.
Power Factor	0.61	For every 1 kWh net power consumed, there has been 1.3 kVAhr for reactive power..
Luminous flux	219 lm	
Luminous efficacy	31 lm/W	
CRI_Ra	81	Color Rendering Index.
Coordinates chromaticity diagram	x=0.4361 and y=0.3980	
Fitting	GU5.3/MR16	Pay attention not to put 12 V voltage! As it needs a constant current LED driver.
D x H external dimensions	50 x 45 mm	External dimensions of the light bulb. Excluding the pins.
D luminous area	47 mm	Dimensions of the luminous area (used in Eulumdat file). This is equal to the diameter of the front side in which the leds are mounted.
General remarks		<p>The ambient temperature during the whole set of measurements was 29.5-30 deg C</p> <p>Warm up effect: during the warm up time the illuminance decreased with 20 % and the consumed power with 12 %.</p> <p>Voltage dependency: the power consumption and illuminance are dependent on the voltage, this behavior is linear.</p> <p>This article contains additional photos of the lightbulb and powersupply used.</p> <p>This lightbulb is tested on dim-performance.</p>

## Lamp measurement report – 2 June 2009 for Line Lite International BV

### Eulumdat light diagram

An interesting graph is the light diagram, indicating the intensity in the C0-C180 and the C90-C270 plane. This light diagram below comes from the program Qlumedit, that extracts these diagrams from an Eulumdat file.



*The light diagram giving the radiation pattern.*

It indicates the luminous intensity around the light bulb. This light bulb has the same light diagram for the C0-C180 as for the C90-C270 plane.

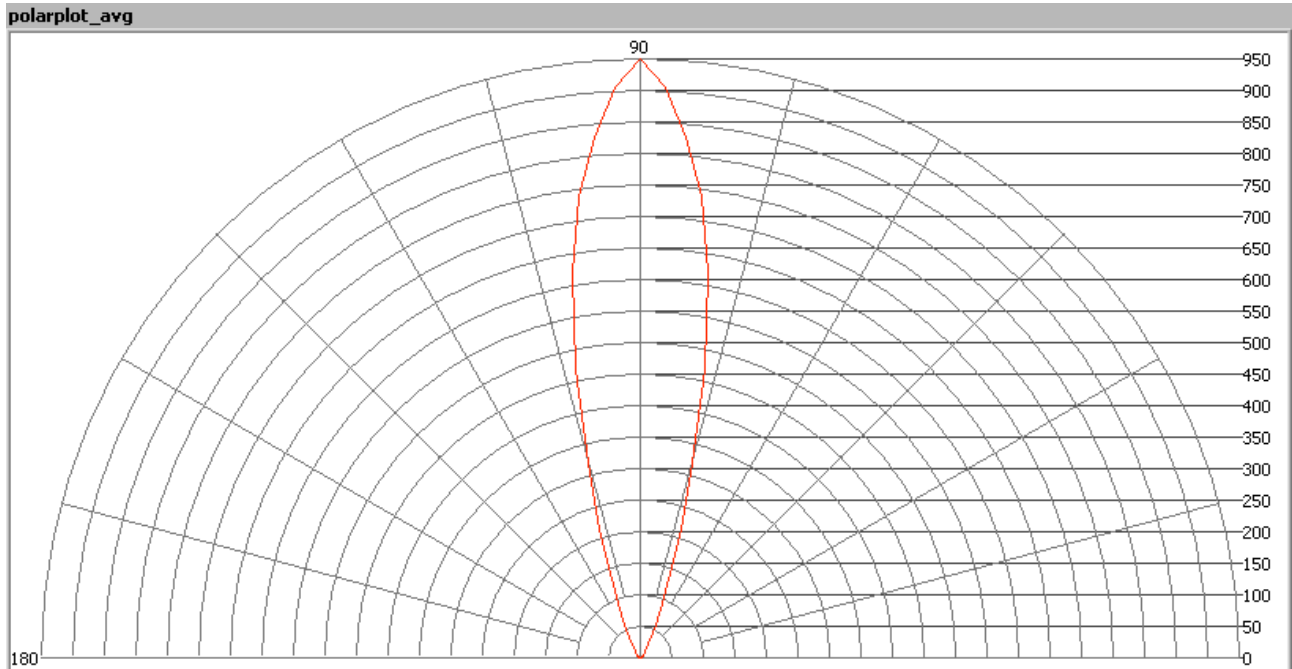
The bundle is some smaller than an average 40 degree bundle coming from an halogen light bulb.

The unit is Cd/1000lm, meaning the intensity in Cd assuming there would be 1000 lumen in the measured light bulb. This enables comparing different types of light bulbs.

### Illuminance $E_v$ at 1 m distance, or luminous intensity $I_v$

Herewith the plot of the *averaged* luminous intensity  $I_v$  as a function of the inclination angle with the light bulb.

## Lamp measurement report – 2 June 2009 for Line Lite International BV

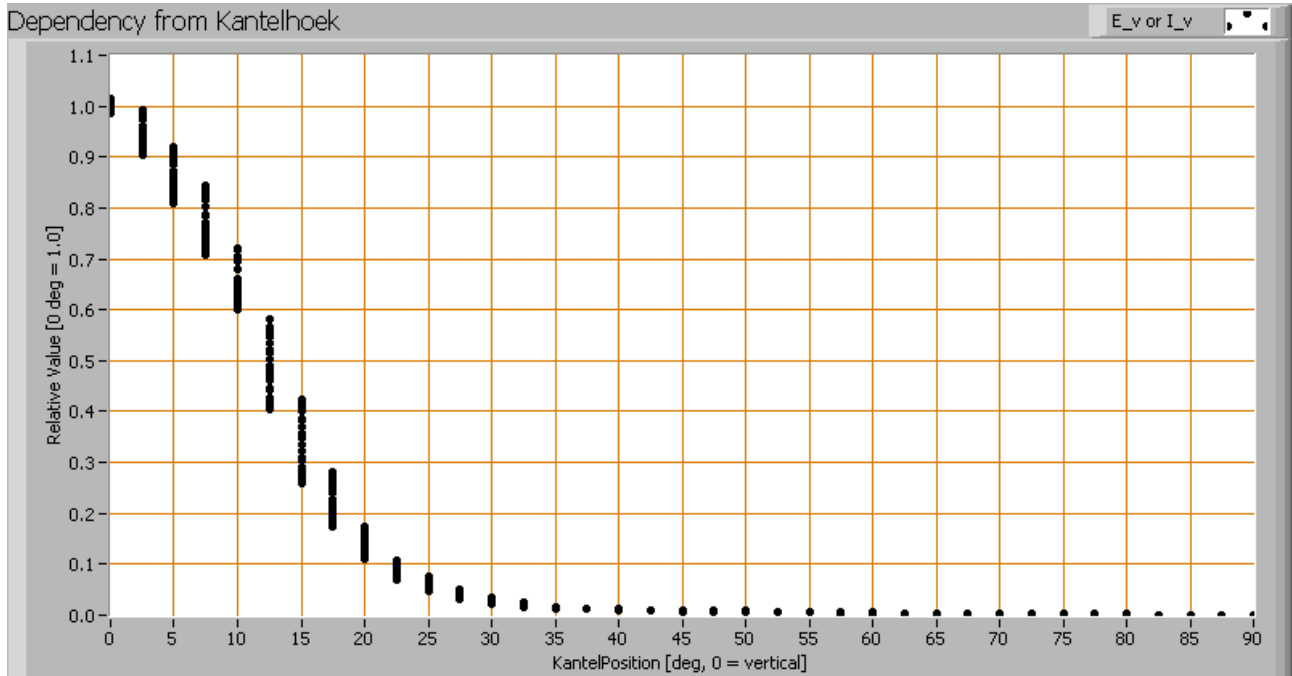


*The radiation pattern of the light bulb.*

This radiation pattern is the average of the light output of the light diagram given earlier. Also, in this graph the luminous intensity is given in Cd.

These averaged values are used (later) to compute the lumen output.

## Lamp measurement report – 2 June 2009 for Line Lite International BV



*Intensity data of every measured turn angle at each inclination angle.*

This plot shows per inclination angle the intensity measurement results for each turn angle at that inclination angle. There are differences in illuminance values for different turn angles. However for further calculations the averaged values will be used.

When using the average values per inclination angle, the beam angle can be computed, being 25 degrees. This is the average value but as the light bulb has a symmetry over its z-axis, this angle is valid for all turn-angles the light bulb is looked at.

### Luminous flux

With the averaged illuminance data at 1 m distance, taken from the graph showing the averaged radiation pattern, it is possible to compute the luminous flux.

The result of this computation for this light spot is a luminous flux of 219 lm.

### Luminous efficacy

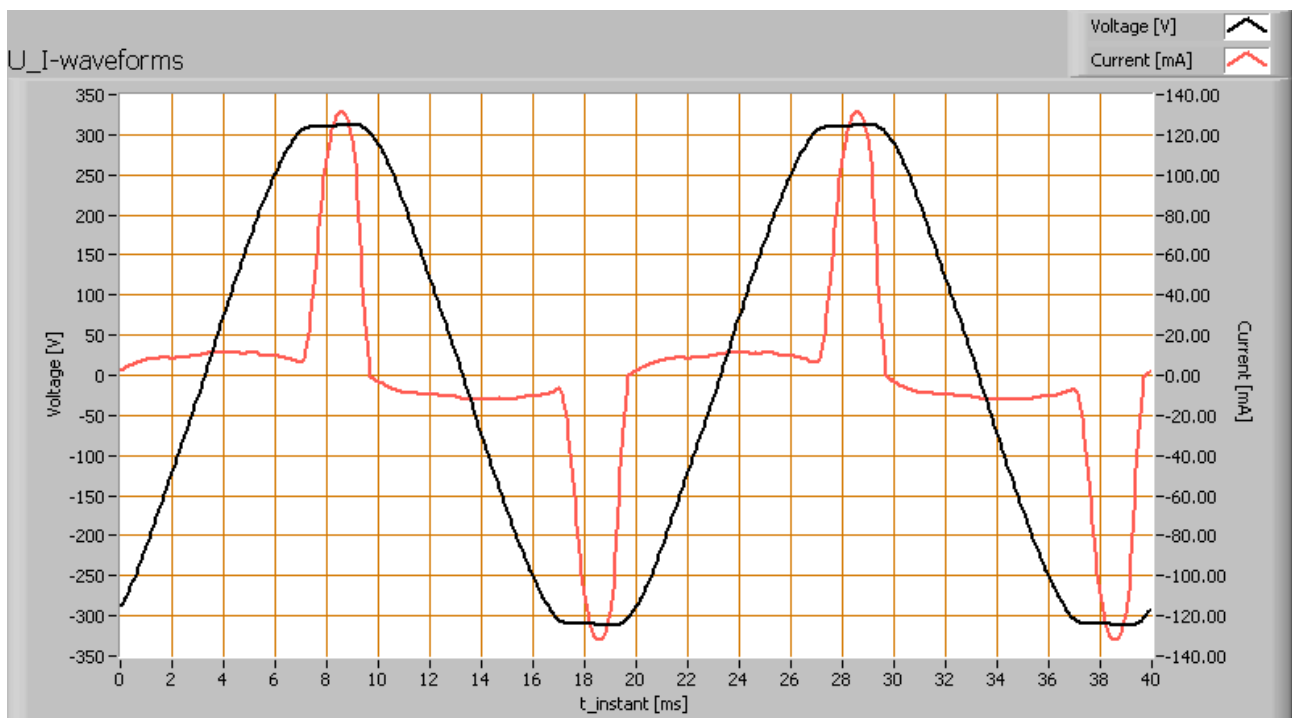
The luminous flux being 219, and the power of the lightbulb being 7.0 W, yields a luminous efficacy of 31 lm/W.

## Lamp measurement report – 2 June 2009 for Line Lite International BV

A power factor of 0.61 means that for every 1 kWh net power consumed, a reactive component of 1.3 kVAR was needed.

Light bulb voltage (used on power supply!)	230 VAC
Light bulb current	50 mA
Power P	7.0 W
Apparent power S	11.5 VA
Power factor	0.61

Of this light bulb the voltage across and the resulting current through it+its power supply are measured and graphed.

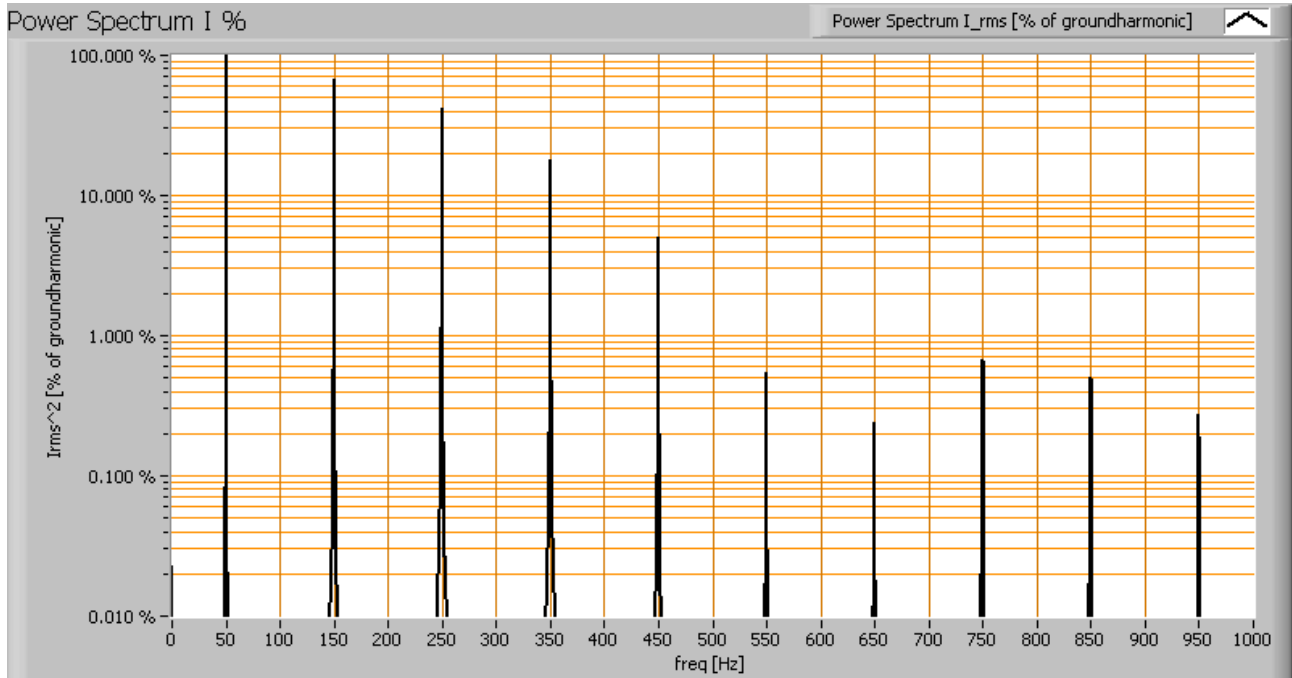


*Voltage across and current through the lightbulb*

There are peaks in current near the tops of the voltage. This results in a waveform for the current that is different from the sineform of the voltage, resulting in a power factor less than 1. Also the power spectrum of the current is determined.



## Lamp measurement report – 2 June 2009 for Line Lite International BV

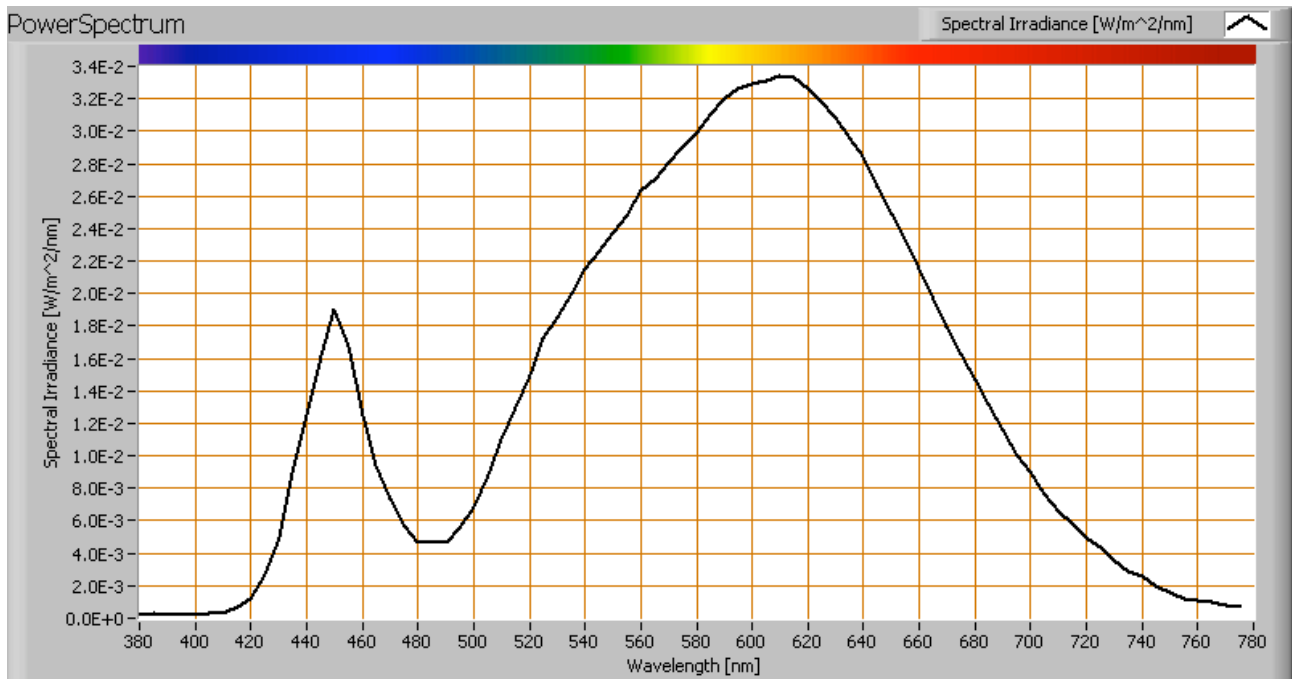


*Current power spectrum in % of the first harmonic (50 Hz).*

The current peaks result in a current power spectrum with a considerable amount of higher harmonics.

## Lamp measurement report – 2 June 2009 for Line Lite International BV

### Color temperature and Spectral power distribution



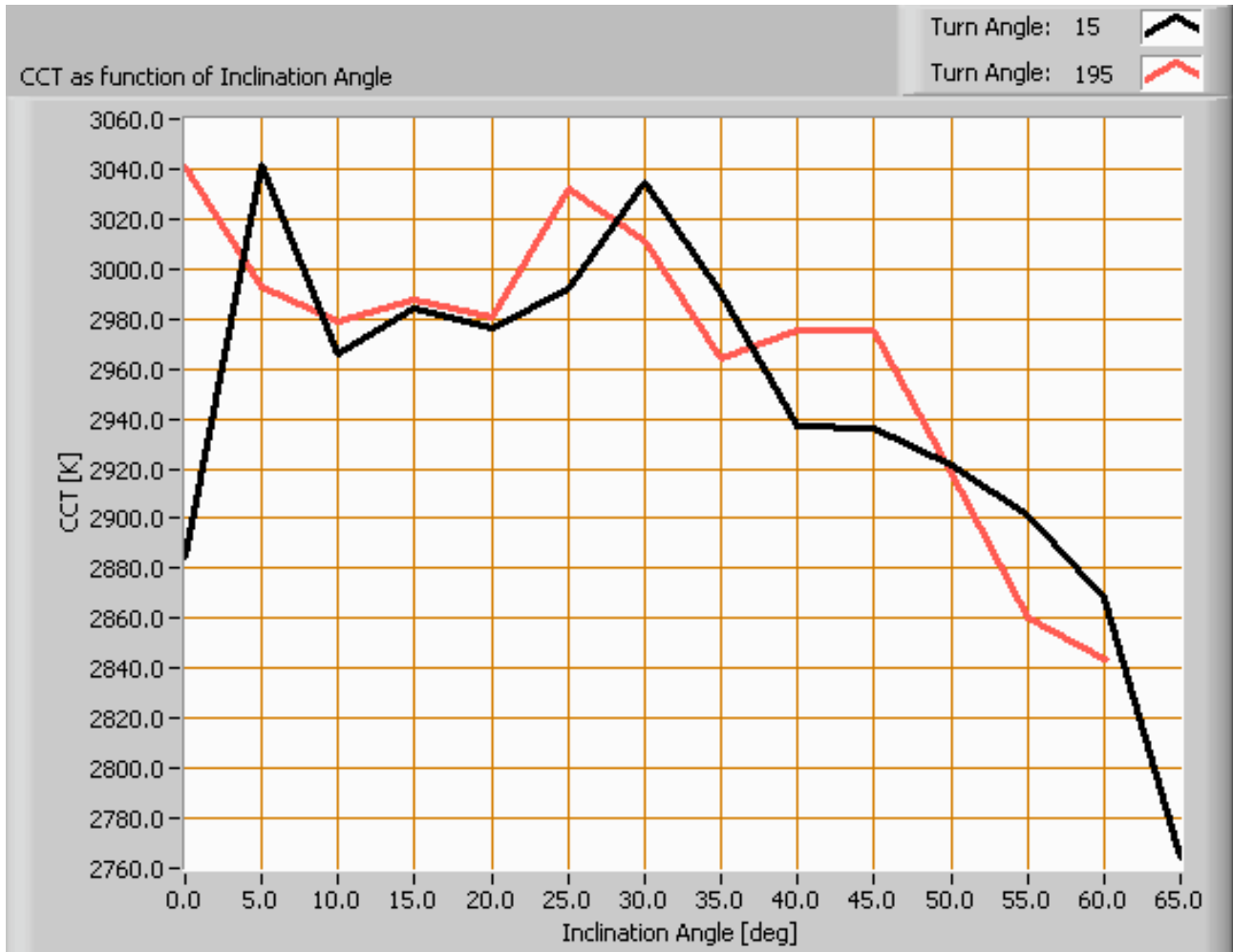
*The spectral power distribution of this light bulb.*

The measured color temperature is about 2950 K which is warm white.

This color temperature is measured straight underneath the light bulb. Below a graph showing the color temperature for different inclination angles.



## Lamp measurement report – 2 June 2009 for Line Lite International BV



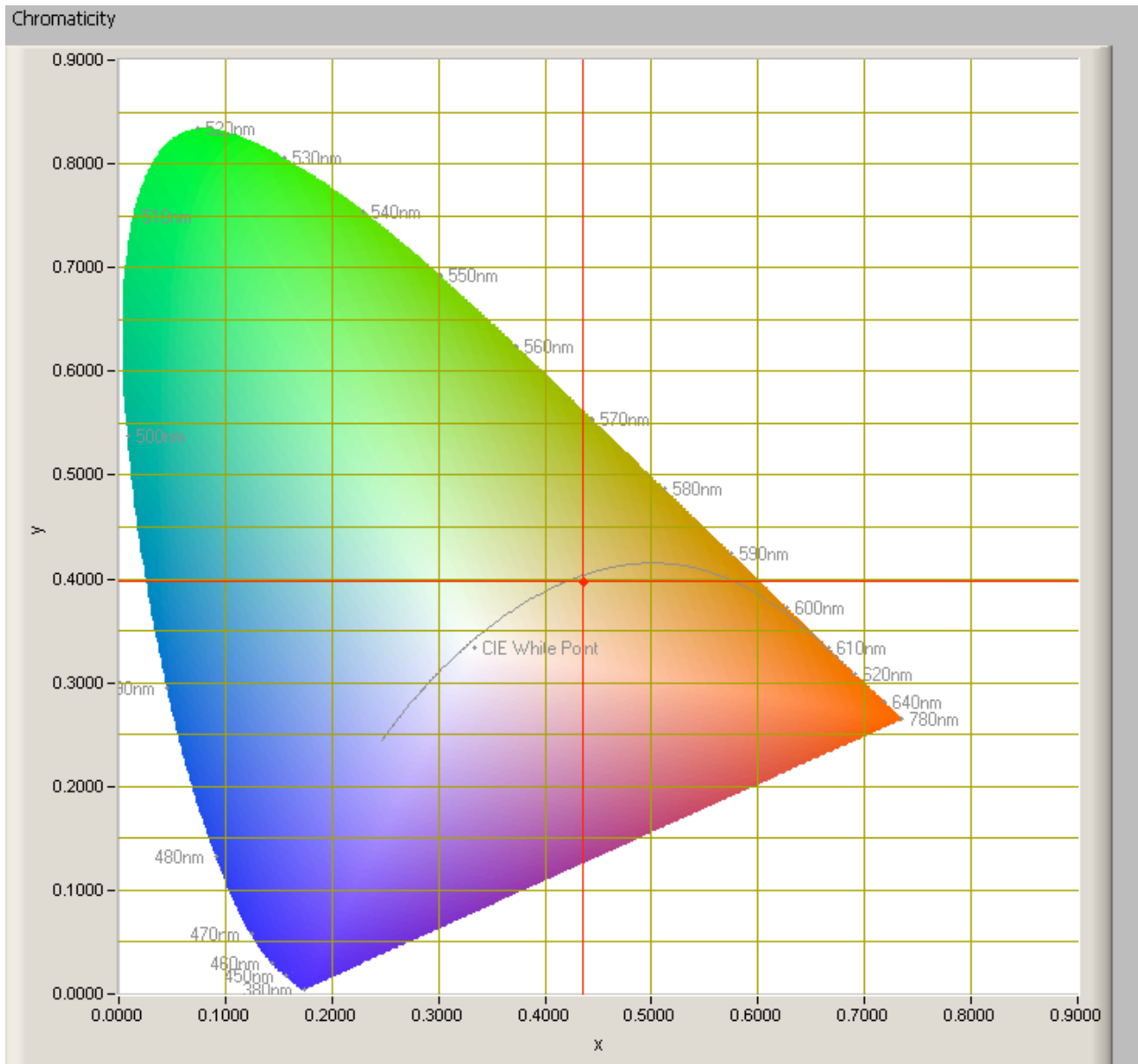
*Color temperature as a function of inclination angle.*

The color temperature is given for inclination angles up to 60 degrees, since at higher angles there is almost no light output anymore.

The value remains constant within 6 %.

## Lamp measurement report – 2 June 2009 for Line Lite International BV

### Chromaticity diagram



*The chromaticity space and the position of the lamp's color coordinates in it.*

The light coming from this lamp is close to the Planckian Locus (the black path in the graph).

Its coordinates are  $x=0.4361$  and  $y=0.3980$ .

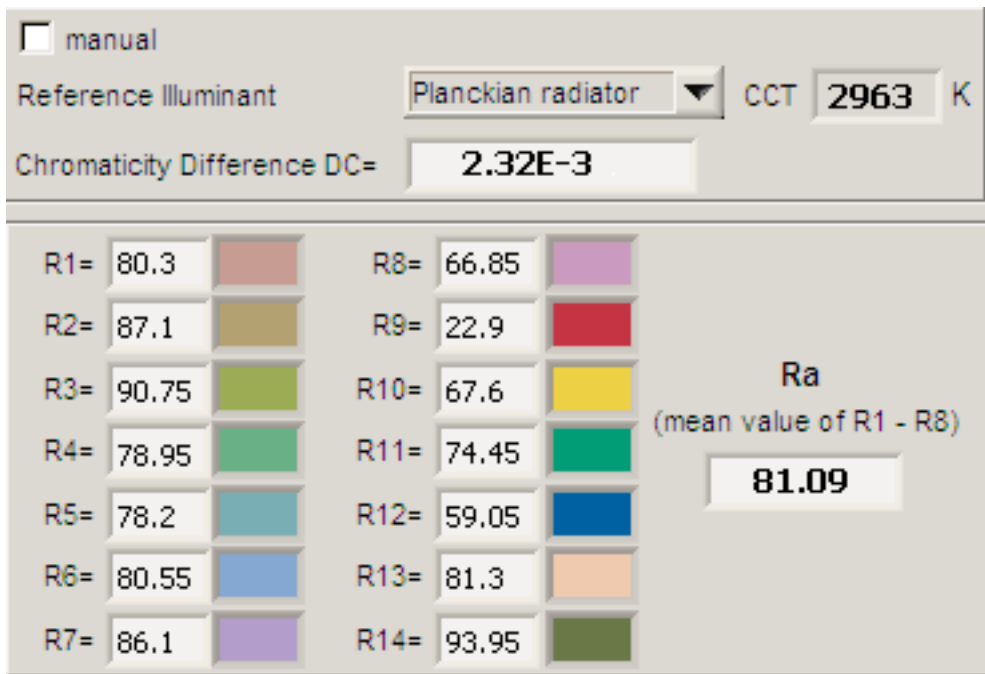


## Lamp measurement report – 2 June 2009 for Line Lite International BV

### Color Rendering Index (CRI) or also Ra

Herewith the image showing the CRI as well as how well different colors are represented (rendered). The higher the number, the better the resemblance with the color when a black body radiator would have been used (the sun, or an incandescent lamp).

Each color has an index Rx, and the first 8 indexes (R1 .. R8) are averaged to compute the Ra which is equivalent to the CRI.



CRI of the light of this lightbulb.

The value of 81 is higher than 80 which is considered a minimum value for indoor usage.

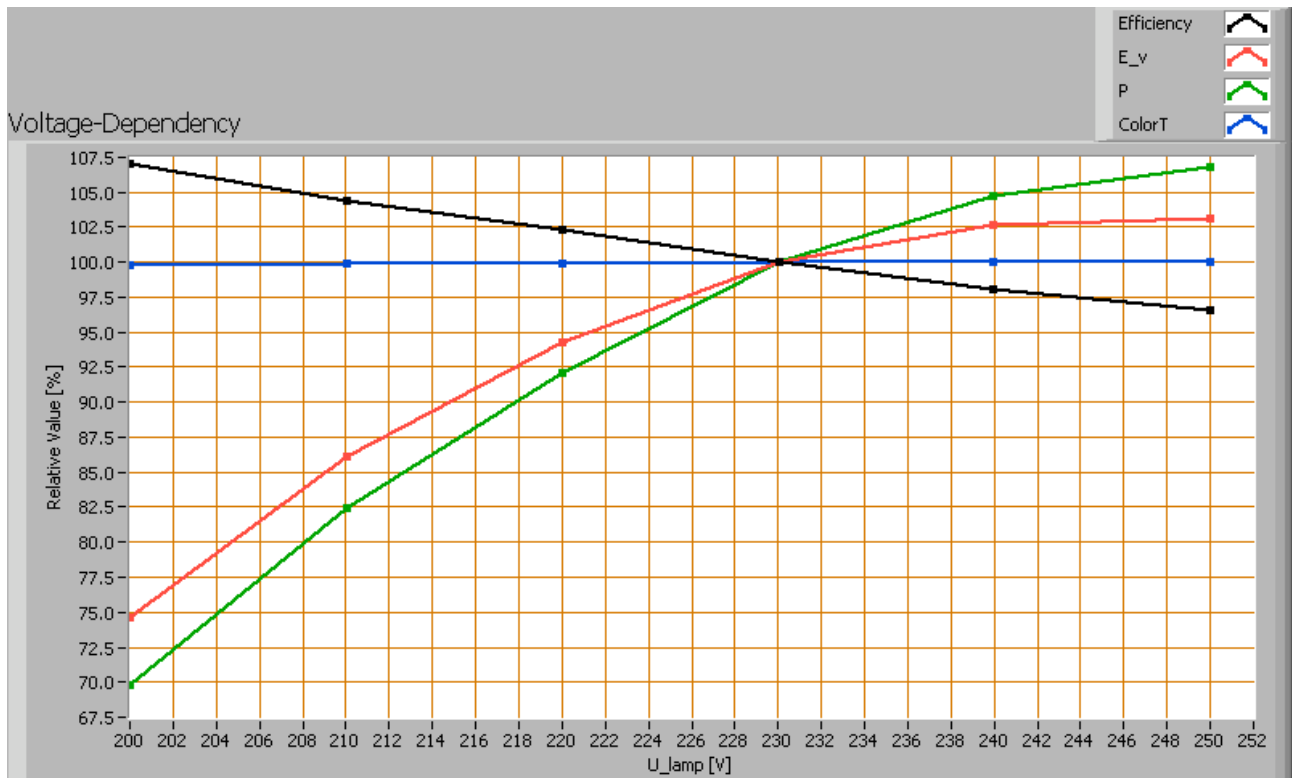
Note: the chromaticity difference is 0.0023 indicates the distance to the Planckian Locus. Its value is lower than 0.0054, which means that the calculated CRI result is meaningful.

### Voltage dependency

The dependency of a number of lamp parameters on the lamp voltage is determined. For this, the lamp voltage has been varied and its effect on the following light bulb parameters measured: illuminance E\_v [lx], the lamp power P [W], the (Correlated) Color

## Lamp measurement report – 2 June 2009 for Line Lite International BV

Temperature [K] and the luminous efficacy [lm/W].



Lamp voltage dependencies of certain light bulb parameters, where the value at 230 V is taken as 100 %.

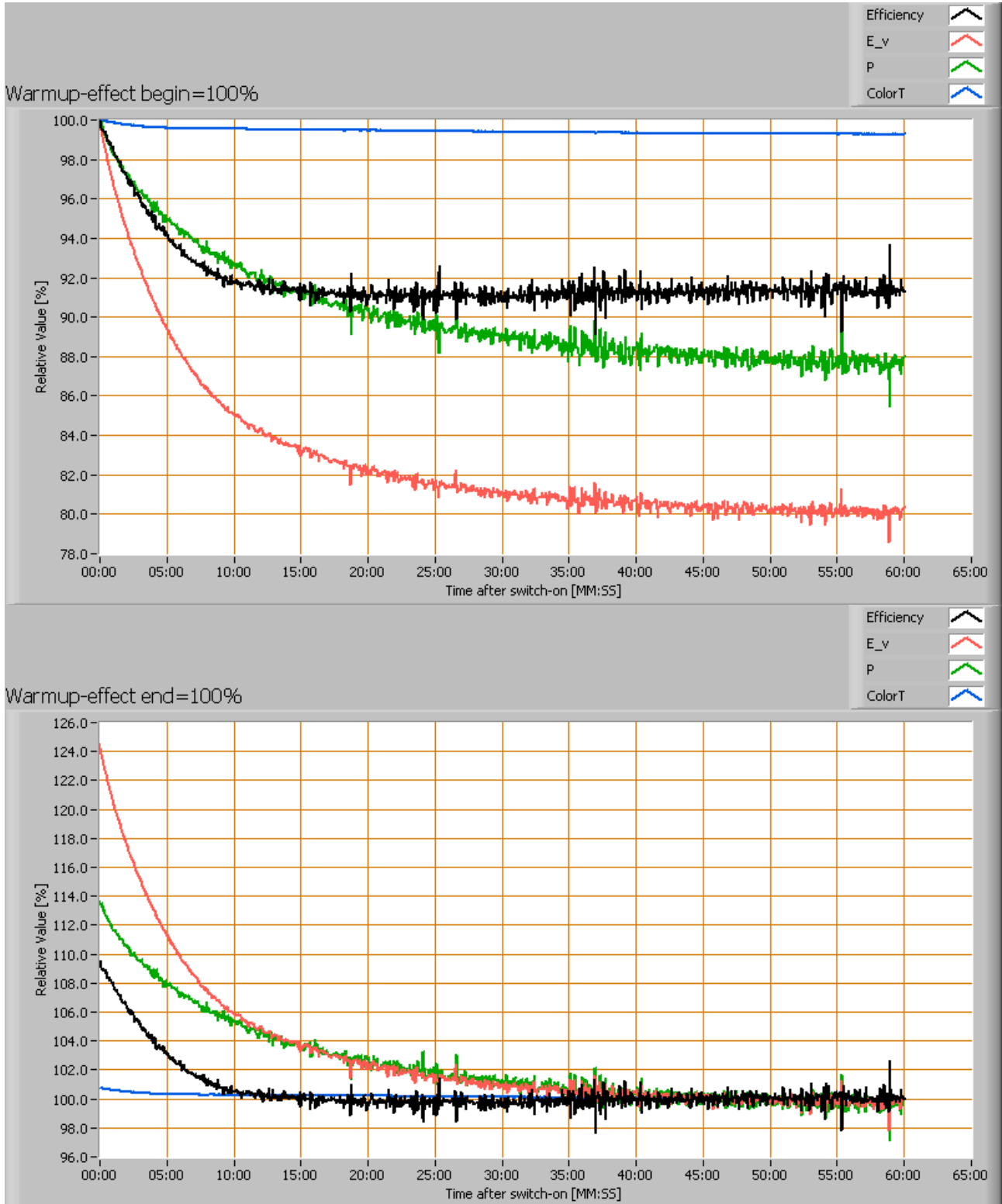
The consumed power and illuminance vary, in a linear way, when the voltage varies between 200-250 V. The variation is more towards the lower voltages.

When the voltage at 230 V varies with + and - 5 V, then the illuminance varies within 2.5 %, so when abrupt voltage changes occur this effect is not visible in the illuminance output.

### Warm up effects

After switch on of a cold lamp, the effect of heating up of the lamp is measured on illuminance E<sub>v</sub> [lx], color temperature CT or correlated color temperature CCT [K], the lamp power P [W] and the luminous efficacy [lm/W].

## Lamp measurement report – 2 June 2009 for Line Lite International BV



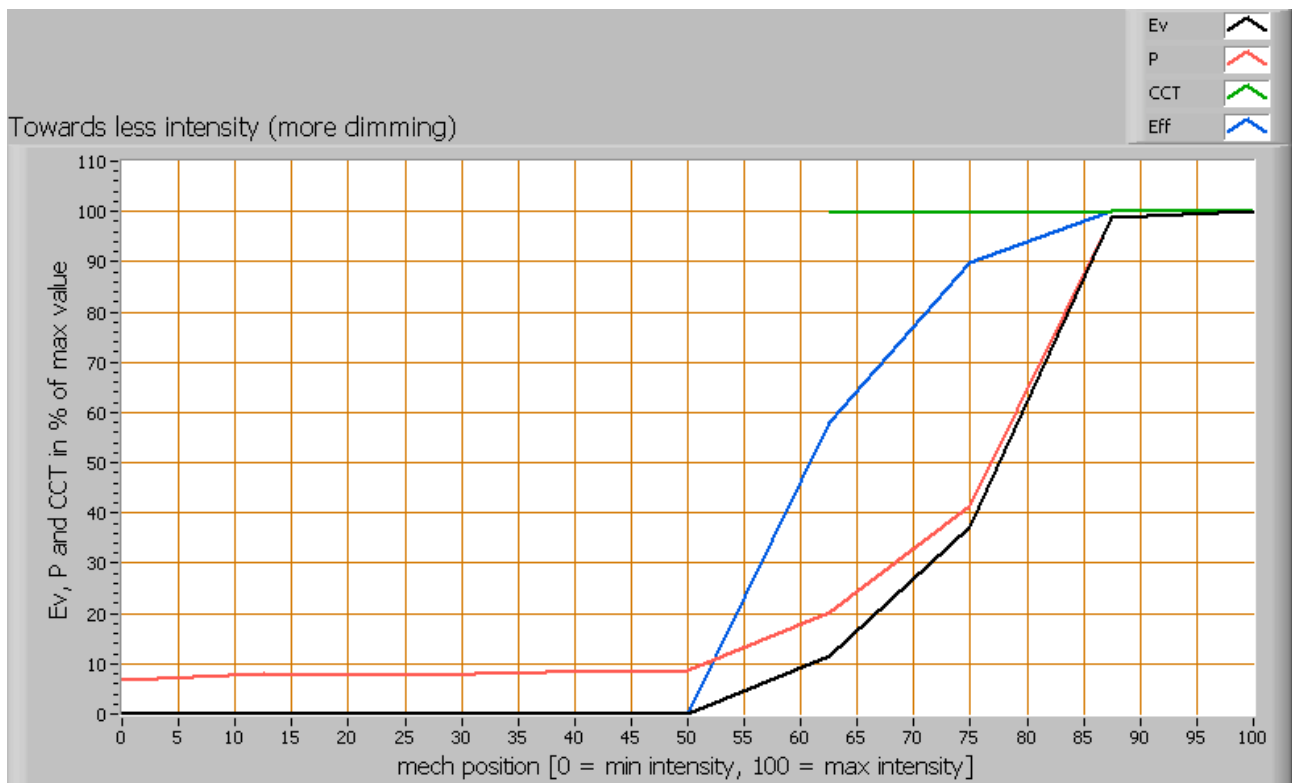
## Lamp measurement report – 2 June 2009 for Line Lite International BV

*Effect of warming up on different light bulb parameters. At top the 100 % level is put at begin, and at bottom at the end.*

The warm-up time is about 30 minutes, during which the illumination drops about 20 % and the consumed power 12 %.

### Dim performance

This lightbulb has been tested on dim-performance. It was connected using the guidelines as given on the website of Line Lite International BV.



*Light bulb parameter values depending on the mechanical position of the knob of the dimmer*

The light bulb is dimmed using a mechanical range of the knob of about 35 %. This is enough to well dim the light bulb.

In this range, the light output can be dimmed from 100 % down to 10 %. This is a wide range.

## **Lamp measurement report – 2 June 2009 for Line Lite International BV**

When dimming the light output, the luminous efficacy decreases with increasing dimming level; simply because the amount of energy taken by the dim-unit is relatively more than the amount of energy used by the LEDs themselves.

This graph outputs the parameters when starting at 100 % light output and increasing dimming levels. Going from 0 % light output towards 100 % gives the same result.

**Additional photos**



**Lamp measurement report – 2 June 2009 for Line Lite  
International BV**



*Front side of the light bulb.*

A rippled lens is used for each led.

## Lamp measurement report – 2 June 2009 for Line Lite International BV



*The power supply used to drive the leds.*

### **Disclaimer**

The information in this OliNo report is created with the utmost care. Despite of this the information can have inaccuracies. OliNo cannot be held liable for the content of the information in this report nor for the consequences of its use. The data in this report is not legally binding.