

Lamp measurement report – 11 June 2010

High Bay Led Lamp 180W CW

by

Ledverlichting Soest



Photo courtesy by www.OliNo.org

Lamp measurement report – 11 June 2010

Summary measurement data


parameter	meas. result	remark
<u>Color temperature</u>	6808 K	cold white
Luminous intensity I_v	4102 Cd	Measured straight underneath the lamp.
Illuminance modulation index	1 %	Measured straight underneath the lamp. Is a measure for the amount of flickering.
Beam angle	113 deg	113° for all C-planes as the lamp shows symmetry along the 1st axis.
Power P	178 W	
Power Factor	0.94	For every 1 kWh net power consumed, there has been 0.4 kVAh for reactive power.
THD	10 %	Total Harmonic Distortion
Luminous flux	11398 Lm	
Luminous efficacy	64 Lm/W	
CRI_Ra	69	Color Rendering Index.
Coordinates chromaticity diagram	x=0.3080 and y=0.3237	
Fitting	E40	This lamp is connected to the 230 V grid voltage.
PAR-value	36.5 $\mu\text{Mol/s/m}^2$	The number of photons seen by an average plant when it is lit by the light of this light bulb. Value valid at 1 m distance from light bulb.
PAR-photon efficacy	0.6 $\mu\text{Mol/s/W}_e$	The total emitted number of photons by this light, divided by its consumption in W. It indicates a kind of efficacy in generating photons.

Lamp measurement report – 11 June 2010

S/P ratio	2.1	This factor indicates the amount of times more efficient the light of this light bulb is perceived under scotopic circumstances (low environmental light level).
D x H external dimensions	300 x 360 mm	External dimensions of the lamp.
D luminous area	210 mm	Dimensions of the luminous area (used in Eulumdat file). This is the surface of the reflector at the front of the lamp.
General remarks		<p>The ambient temperature during the whole set of measurements was 23.5-25 deg C. The temperature of the lamp between the fins of the heatsink gets about 42 degrees hotter.</p> <p>Warm up effect: during the warm up time the illuminance decreases with 11 %.</p> <p>Voltage dependency: the power consumption and illuminance do not vary considerably when the power voltage varies between 200-250 V.</p> <p>Additional photos at the end of the article.</p>

Lamp measurement report – 11 June 2010

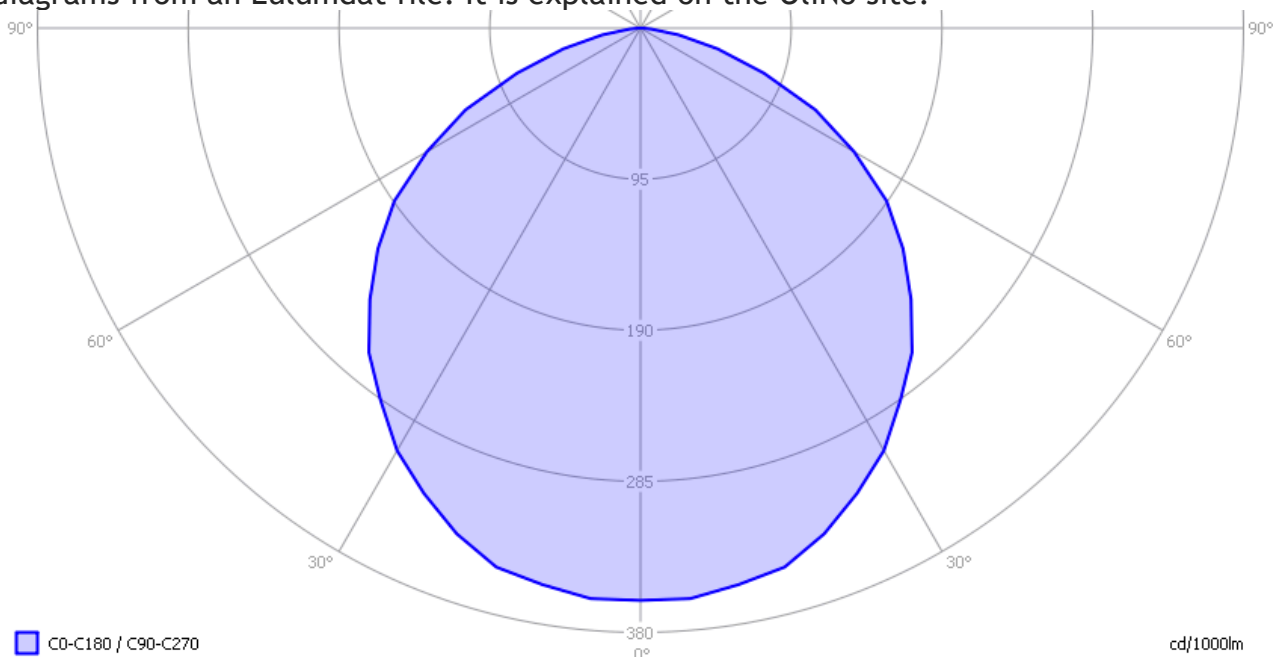
Overview table

m.	Ø 50%		C0-180: 113° C90-270: 113°	E (lux)	Luminaire Efficacy
	C0-180	C90-270			64 (lumens per Watt)
0.25	0.75	0.75		65632	Half-peak diam C0-180
0.5	1.5	1.5		16408	3.01 x diameter(m)
1	3.01	3.01		4102	Half-peak diam C90-270
1.5	4.51	4.51		1823	3.01 x diameter(m)
3	9.02	9.02		456	Illuminance
4	12.03	12.03		256	4102 / distance² (lux)
5	15.04	15.04		164	Total Output
					11398 (lumens)

The overview table is explained on the OLiNo website. Please note that this overview table makes use of calculations, use this data with care as explained on the OLiNo site. E (lux) values are not accurate, when within 5 x 210 mm (diameter) ≈ 1100 mm. Within this distance from the lamp, the measured lux values will be less than the computed values in this overview as the measurements are then within the near field of the lamp.

Eulumdat light diagram

This light diagram below comes from the program Qlumedit, that extracts these diagrams from an Eulumdat file. It is explained on the OLiNo site.



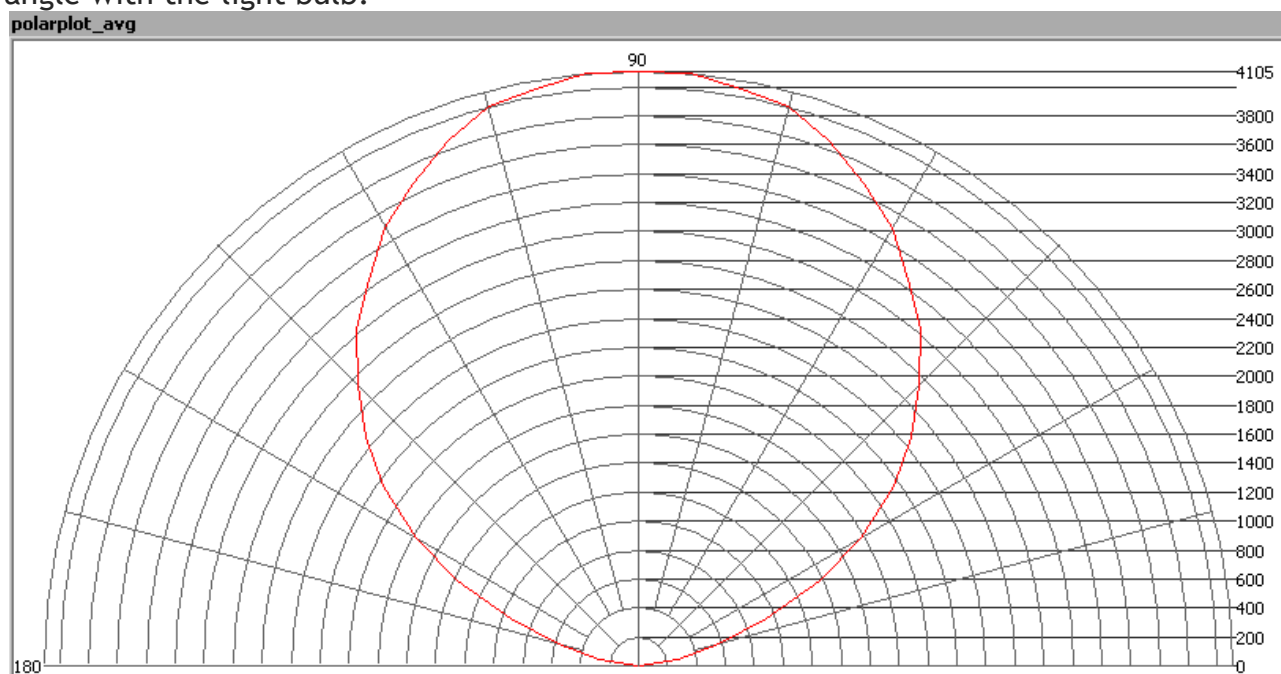
Lamp measurement report – 11 June 2010

The light diagram giving the radiation pattern.

It indicates the luminous intensity around the light bulb. All the planes give the same results as the lamp is symmetrical along its 1st axis.

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.

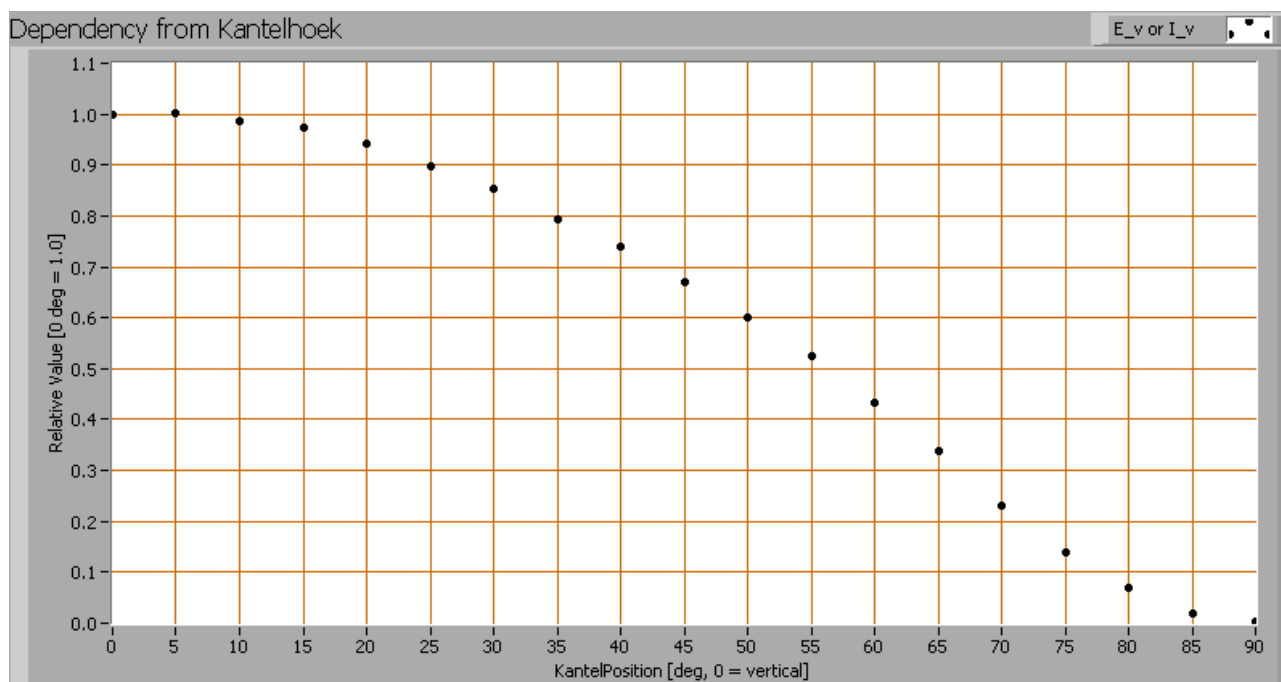


The radiation pattern of the light bulb.

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 – 11 June 2010



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 normally 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 113° for all C-planes 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 11398 Lm.

Luminous efficacy

The luminous flux being 11398 Lm, and the power of the light bulb being 178 W, yields a luminous efficacy of 64 Lm/W.

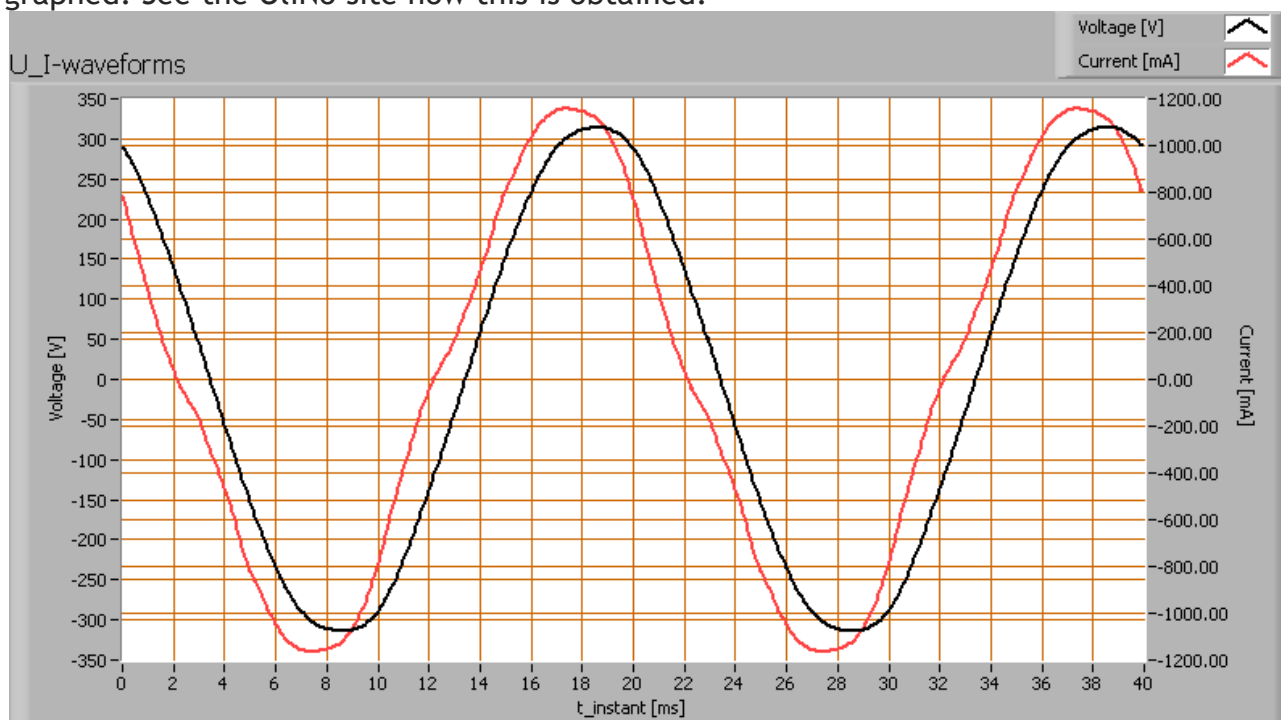
Lamp measurement report – 11 June 2010

Electrical properties

A power factor of 0.94 means that for every 1 kWh net power consumed, a reactive component of 0.4 kVAr was needed.

Lamp voltage	230 VAC
Lamp current	823 mA
Power P	178 W
Apparent power S	189 VA
Power factor	0.94

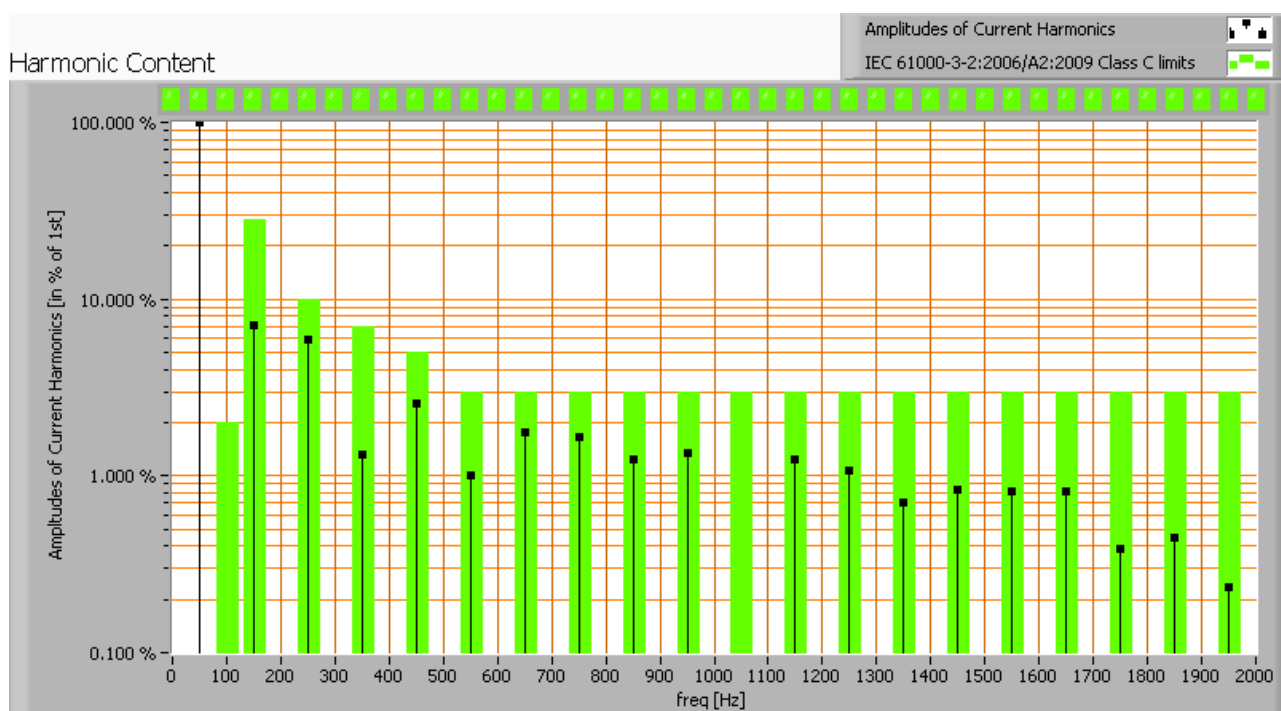
Of this light bulb the voltage across and the resulting current through it are measured and graphed. See the OliNo site how this is obtained.



Voltage across and current through the lightbulb

This waveforms have been checked on requirements posed by the norm IEC 61000-3-2:2006 (including up to A2:2009). See also the explanation on the OliNo website.

Lamp measurement report – 11 June 2010

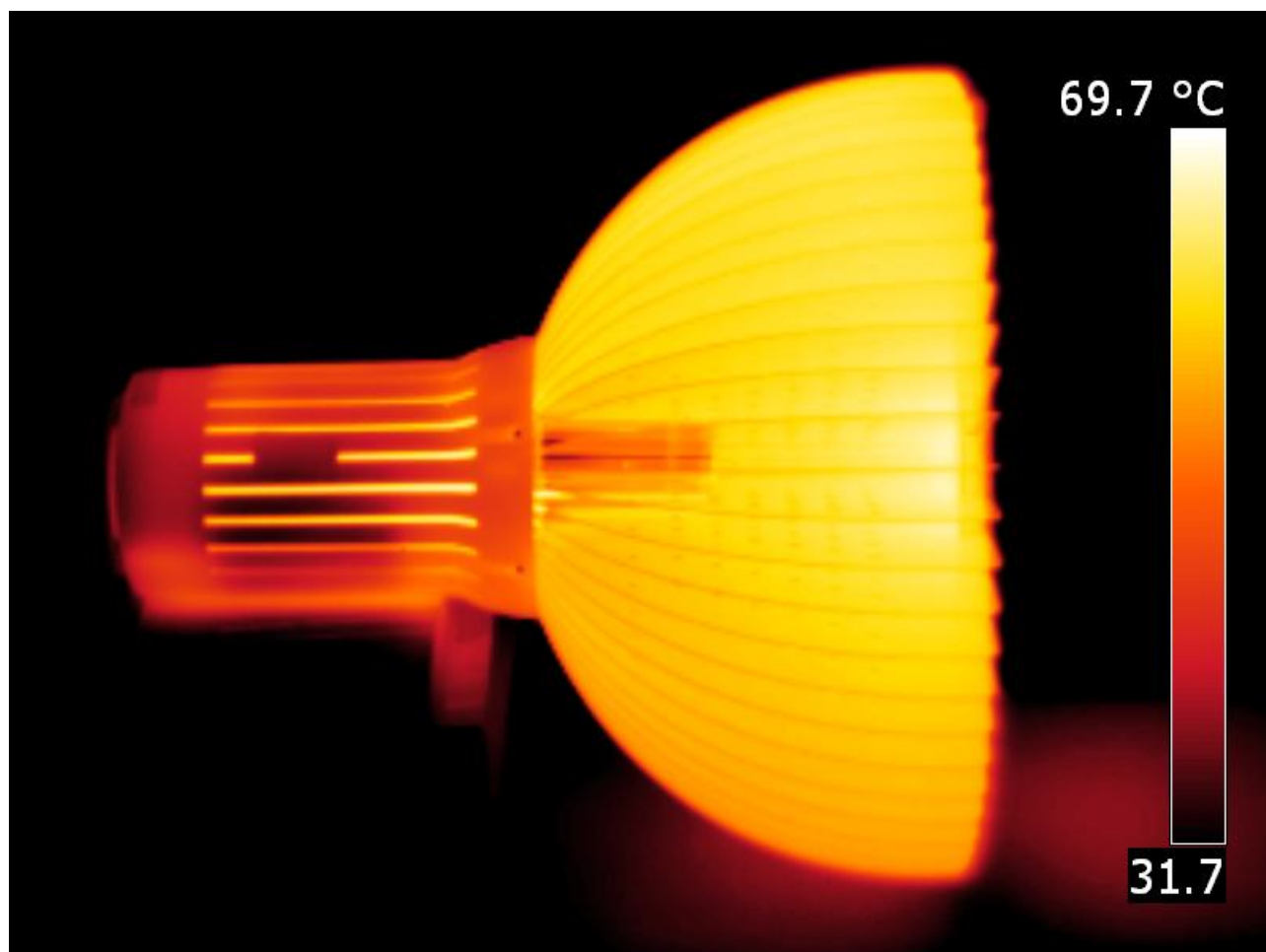


Harmonics in the current waveform and checked against IEC61000-3-2:2006

There are limits for the harmonics for lighting equipment > 25 W which are fulfilled.
The Total Harmonic Distortion of the current is computed as 10 %.

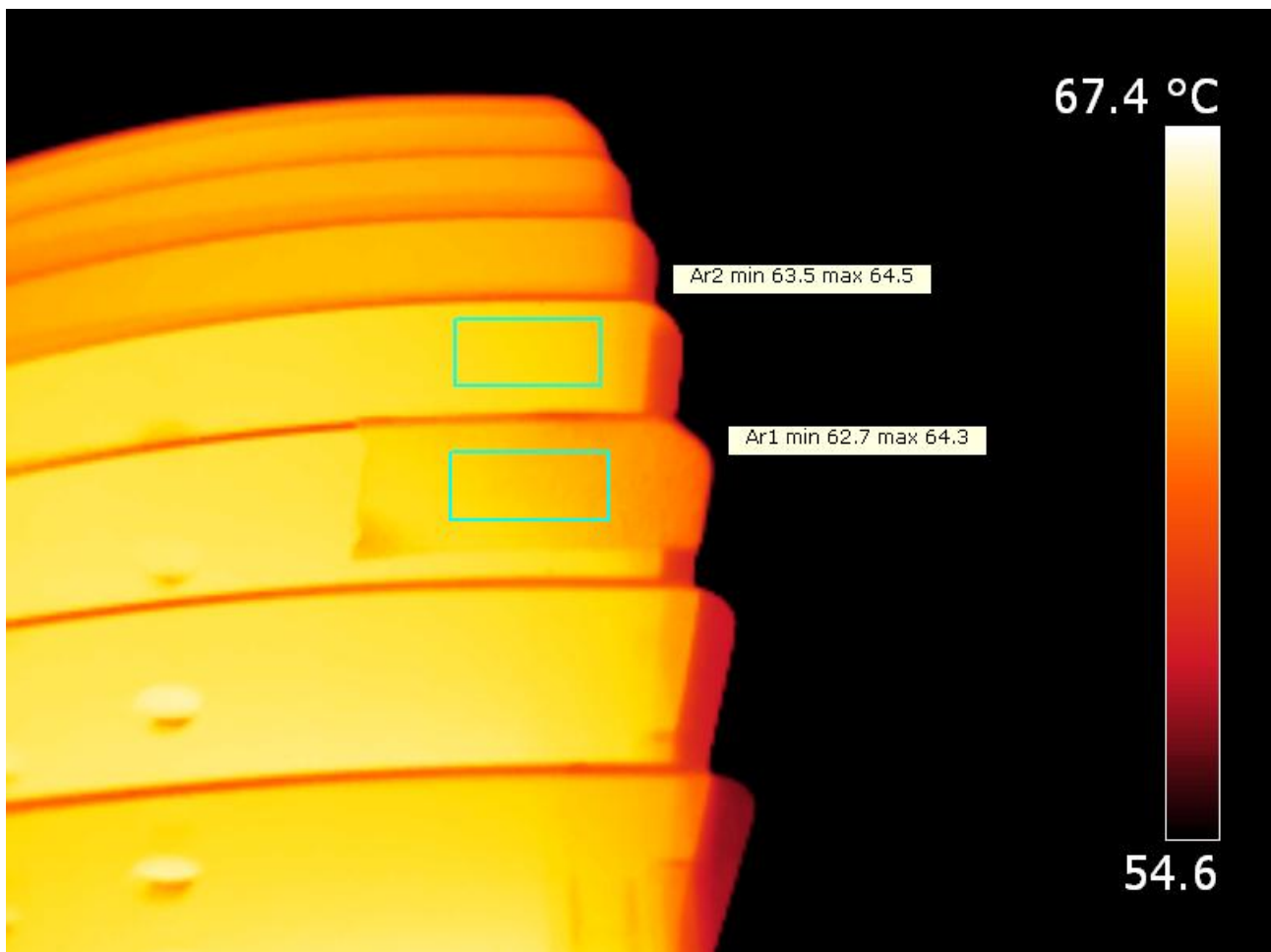
Lamp measurement report – 11 June 2010

Temperature measurements lamp



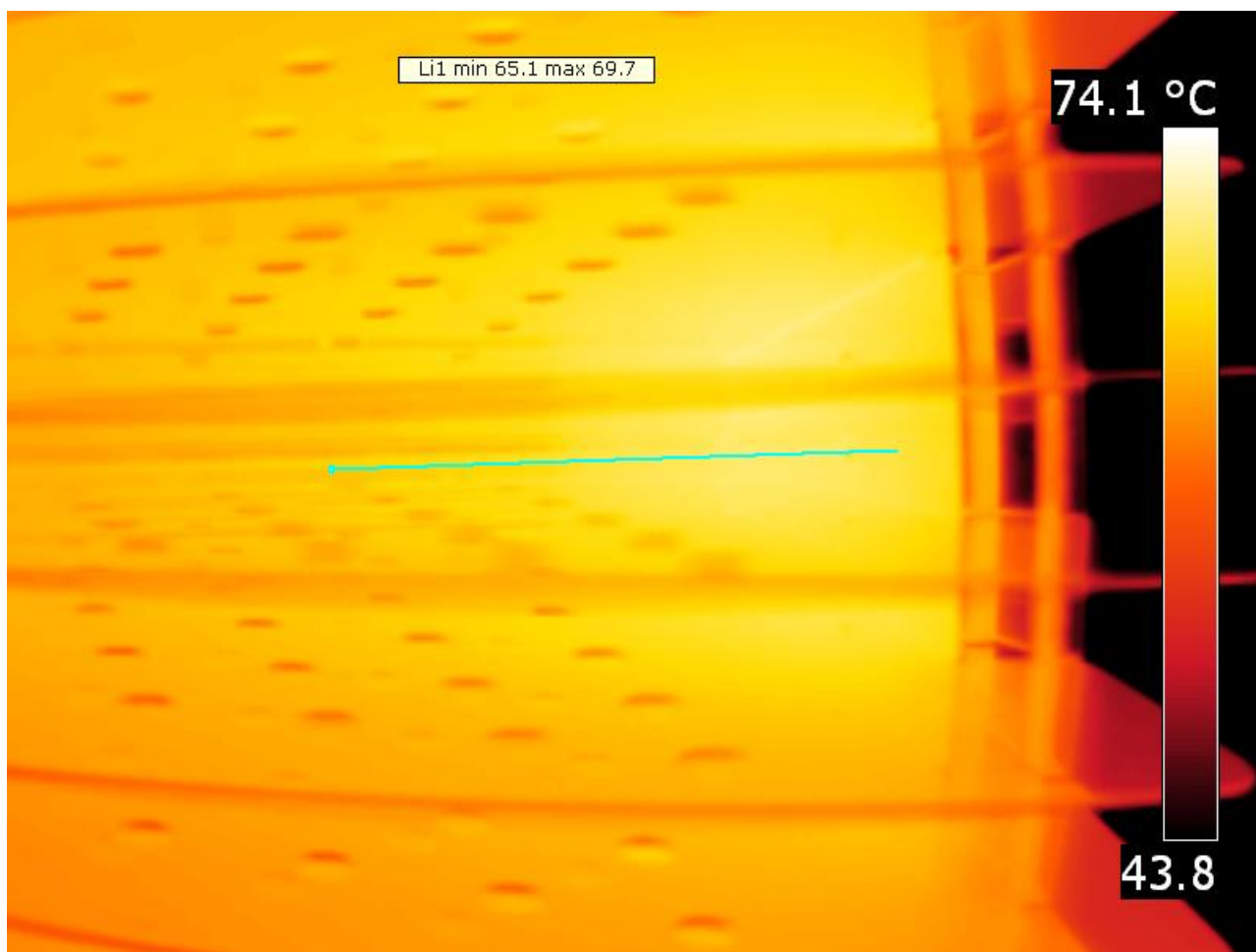
Overview image

Lamp measurement report – 11 June 2010



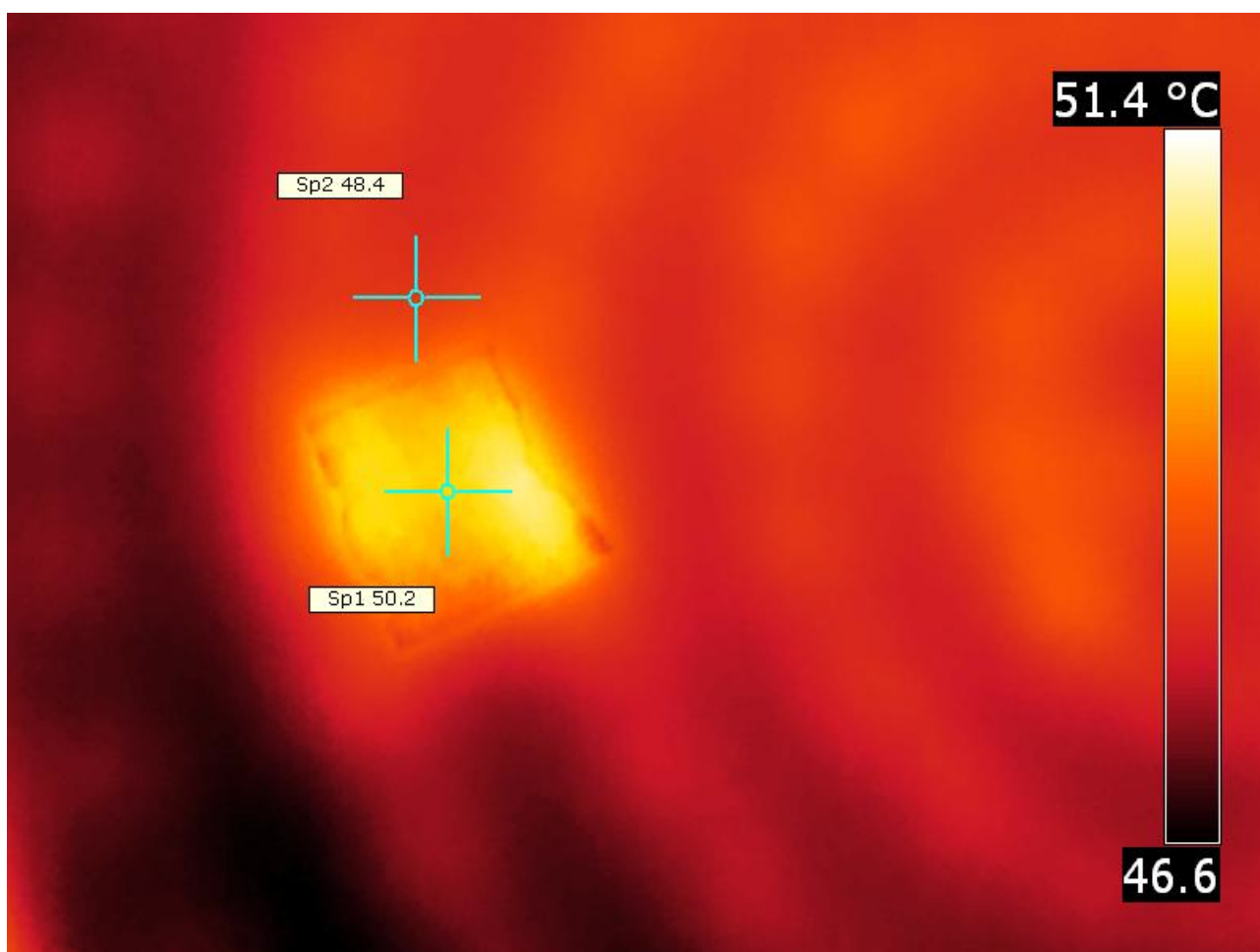
The fins emit their heat efficiently, as the emissivity is about the same as that of the painter's tape being about 0.95.

Lamp measurement report – 11 June 2010



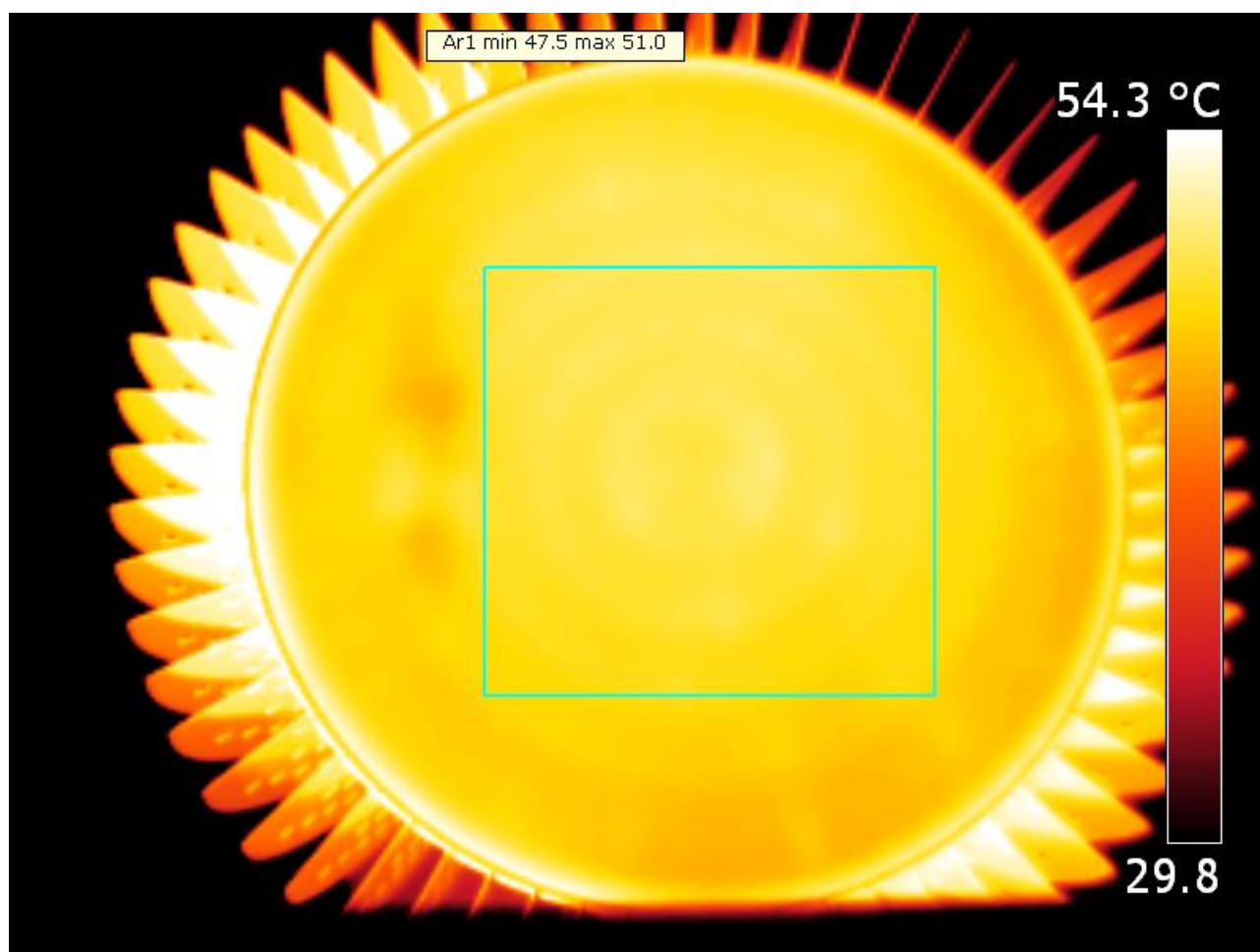
Between the fins the highest temperature is measured.

Lamp measurement report – 11 June 2010



Glassplate at the front. The emissivity needs to be put at 0.88 to have the temperature reading on the glass plate the same as that of the painter's tape.

Lamp measurement report – 11 June 2010



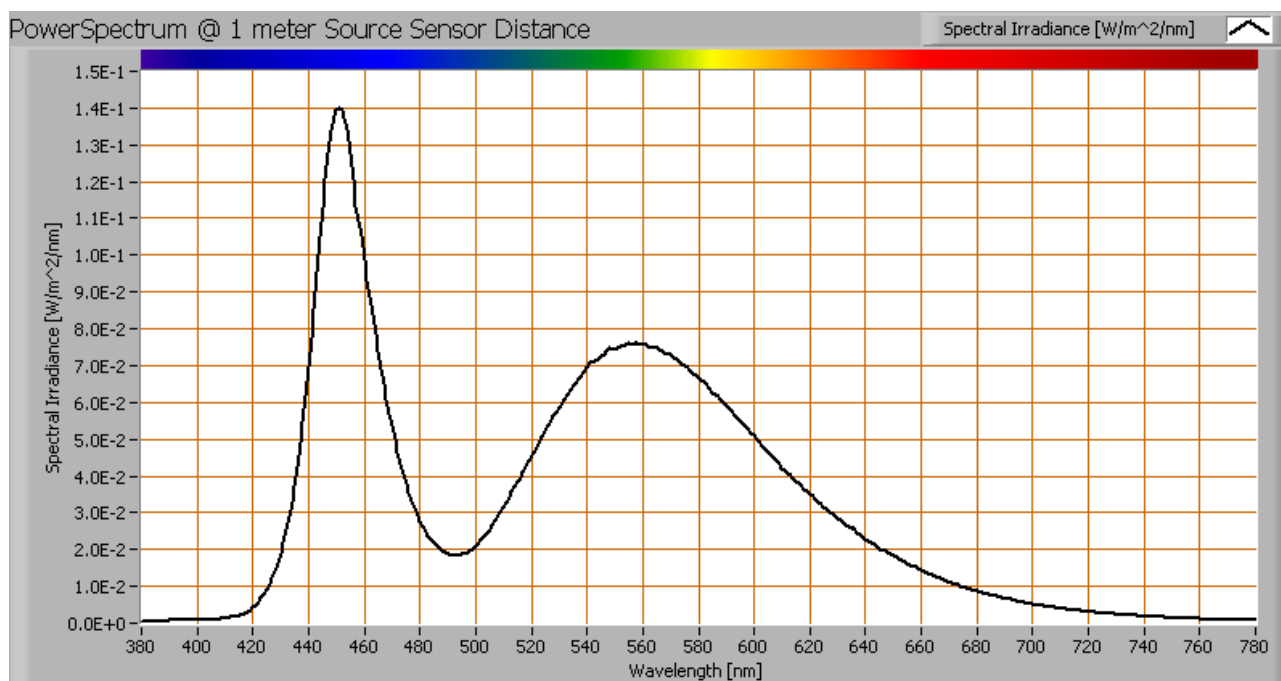
Temperature of the front, with the emissivity set at 0.88.

status lamp	> 2 hours on
ambient temperature	24 deg C
reflected background temperature	24 deg C
camera	Flir T335
emissivity	0.88, 0.95 ⁽¹⁾
measurement distance	zoom is at 0.2 m
IFOV _{geometric}	0.3 mm
NETD (thermal sensitivity)	50 mK

⁽¹⁾ See the text for expansion.

Lamp measurement report – 11 June 2010

Color temperature and Spectral power distribution

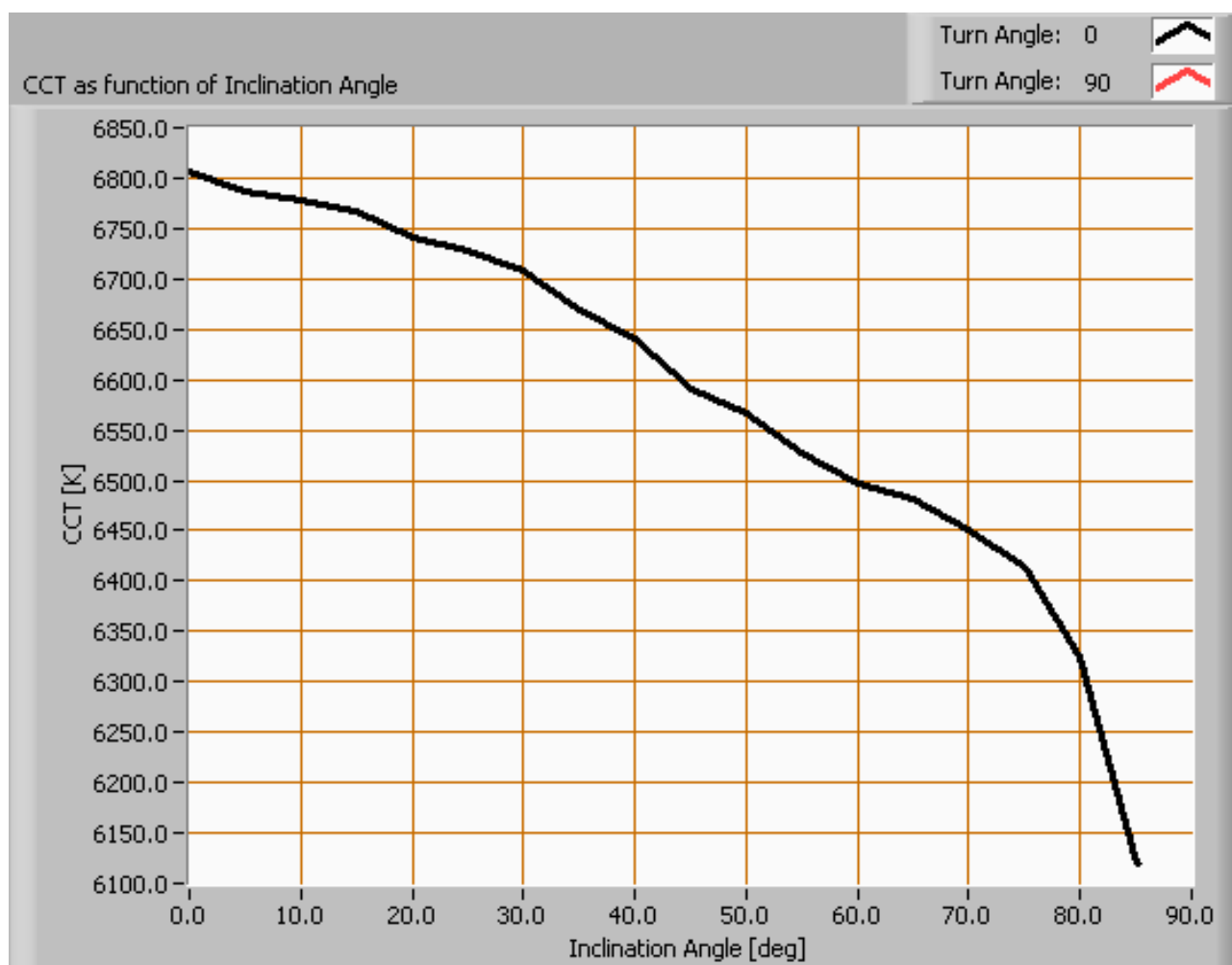


The spectral power distribution of this light bulb, energies on y-axis valid at 1 m distance.

The measured color temperature is about 6800 K which is cold 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 – 11 June 2010



Color temperature as a function of inclination angle.

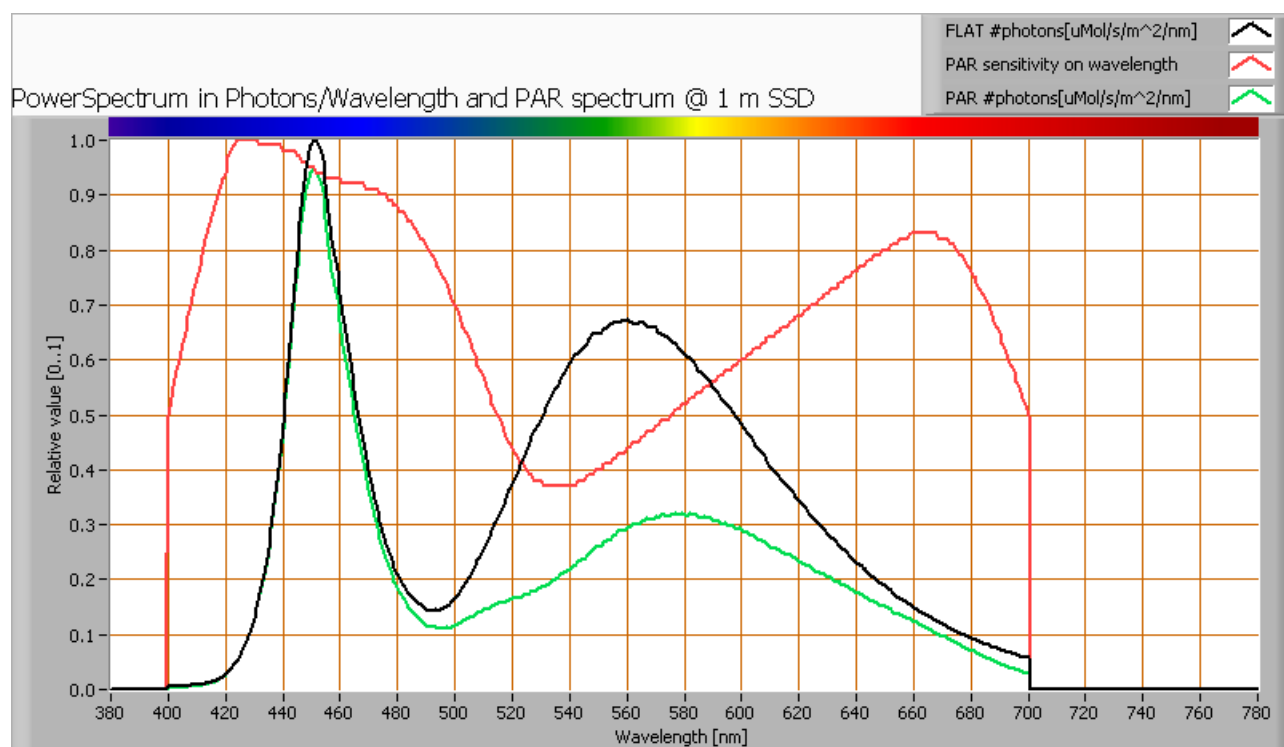
The measurement of CCT is measured for inclination angles up to 85°.

The maximum beam angle is 113°, meaning a 56.5° inclination angle. In this area most of the light is present. The variation in correlated color temperature in this area is about 4 %.

PAR value and PAR spectrum

To make a statement how well the light of this light bulb is for growing plants, the PAR-area needs to be determined. See the OLiNo website how this all is determined and the explanation of the graph.

Lamp measurement report – 11 June 2010



The photon spectrum, then the sensitivity curve and as result the final PAR spectrum of the light of this light bulb

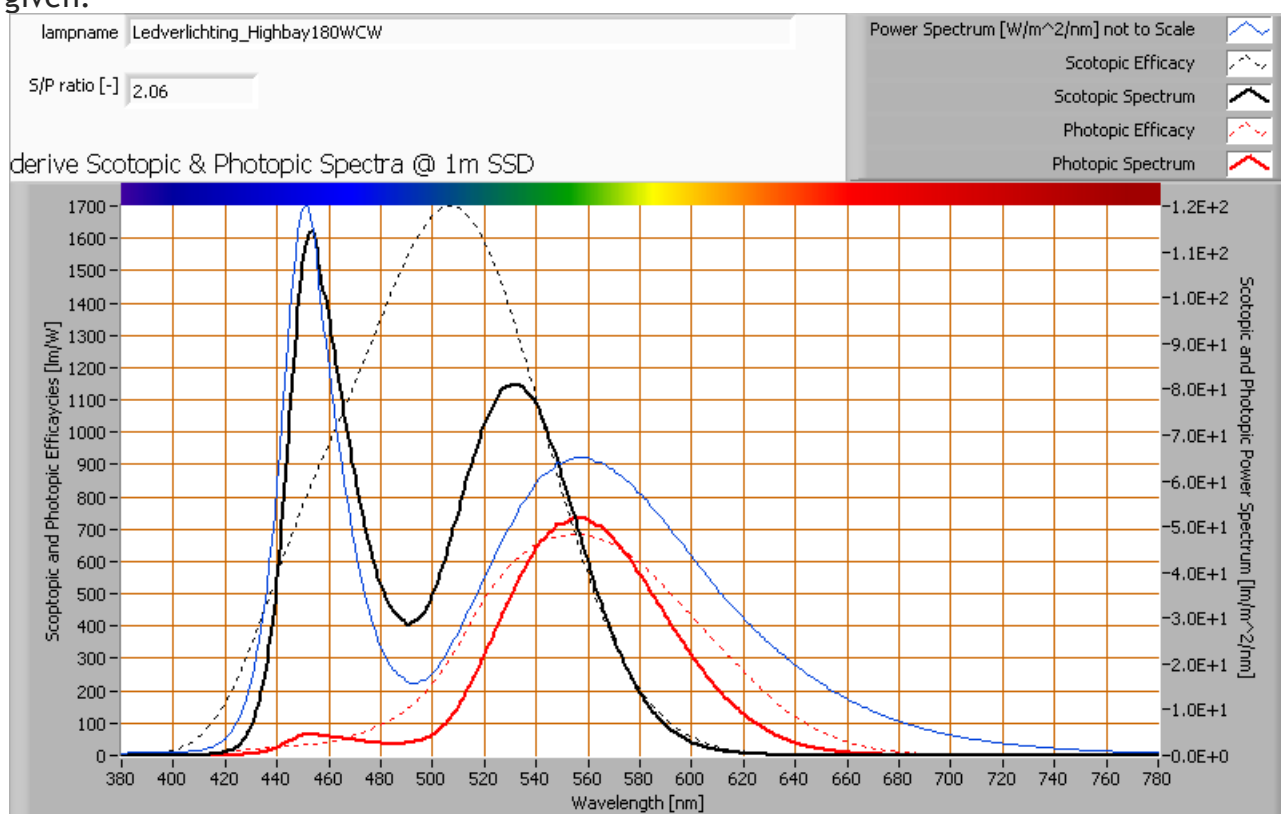
parameter	value	unit
PAR-number	36.5	μMol/s/m ²
PAR-photon current	101	μMol/s
PAR-photon efficacy	0.6	μMol/s/W

The PAR efficiency is 66 % (valid for the PAR wave length range of 400 - 700 nm). So maximally 66 % of the total of photons in the light is effectively used by the average plant (since the plant might not take 100 % of the photons at the frequency where its relative sensitivity is 100 %).

Lamp measurement report – 11 June 2010

S/P ratio

The S/P ratio and measurement is explained on the OliNo website. Here the results are given.



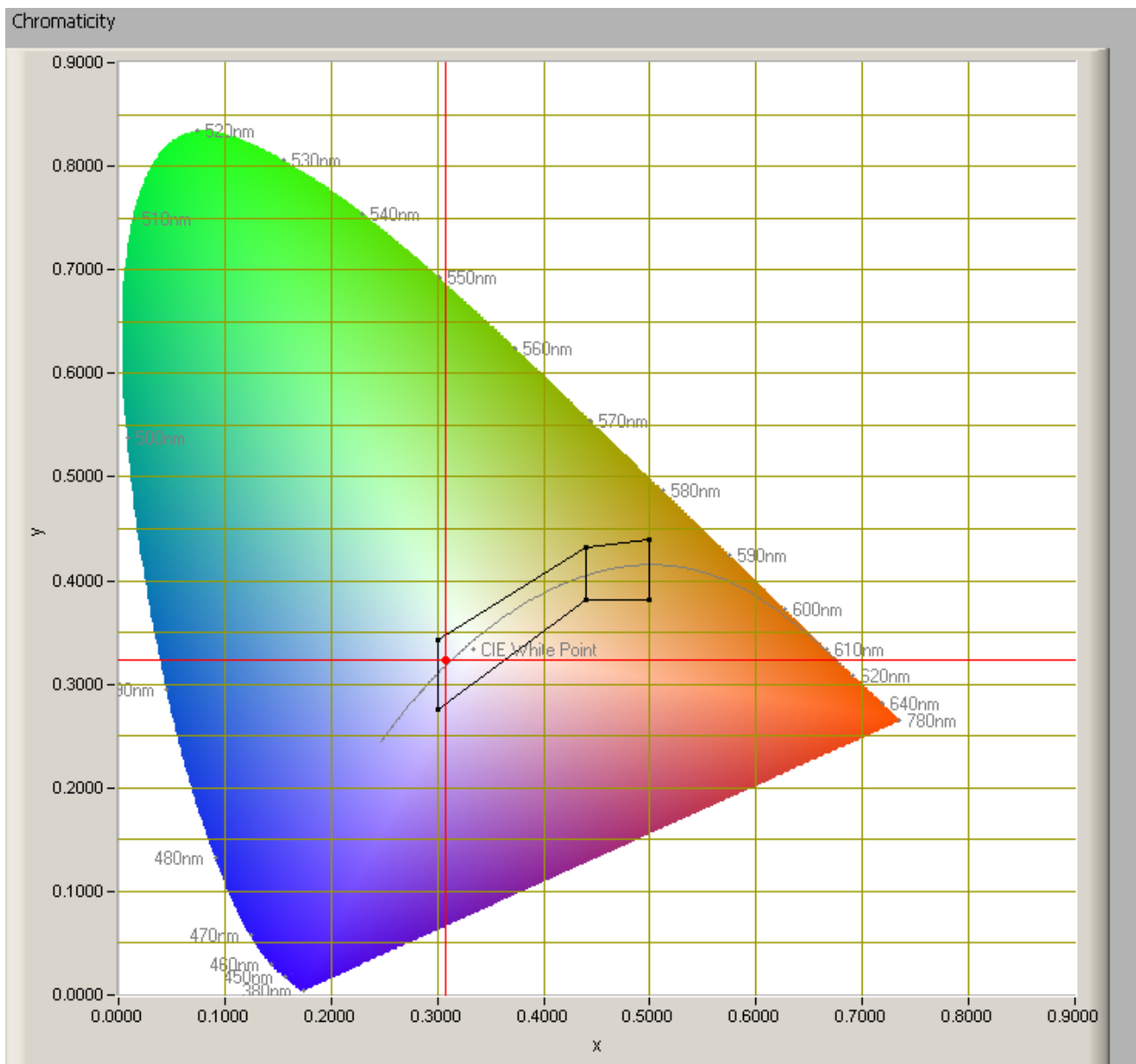
The power spectrum, sensitivity curves and resulting scotopic and photopic spectra (spectra energy content defined at 1 m distance).

The S/P ratio is 2.1.

More info on S/P ratio can be found on the OliNo website.

Lamp measurement report – 11 June 2010

Chromaticity diagram



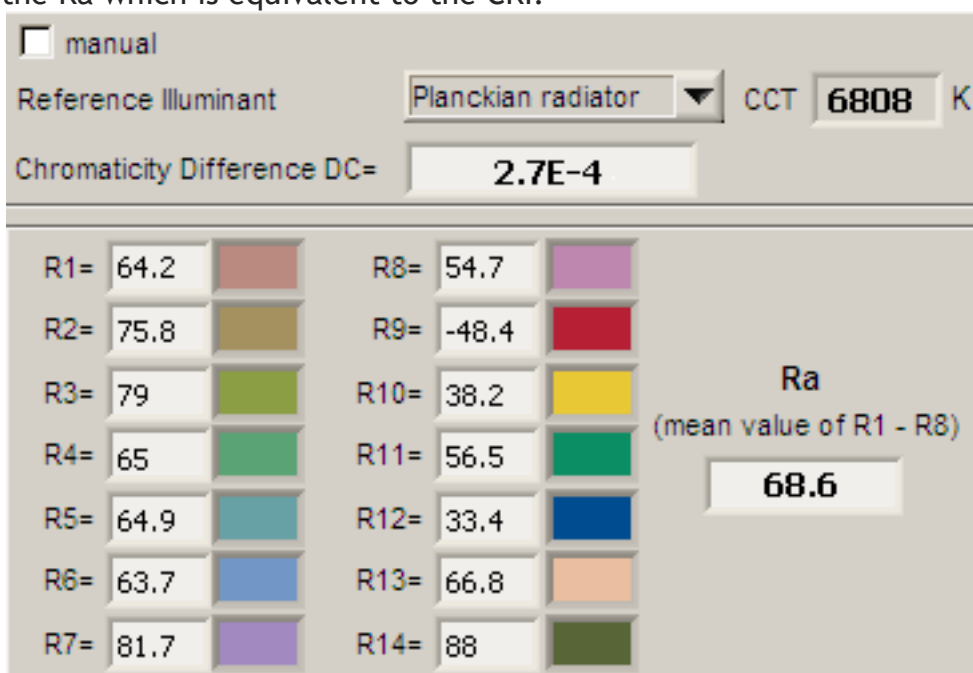
The chromaticity space and the position of the lamp's color coordinates in it.

The light coming from this lamp is inside the area designated with class A. This class A is an area that is defined for signal lamps, see also the OLiNo website.
Its coordinates are $x=0.3080$ and $y=0.3237$.

Lamp measurement report – 11 June 2010

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). Practical information and also some critics about the CRI can be found on the OliNo website. Each color has an index R_x , and the first 8 indexes ($R_1 \dots R_8$) are averaged to compute the R_a which is equivalent to the CRI.



CRI of the light of this lightbulb.

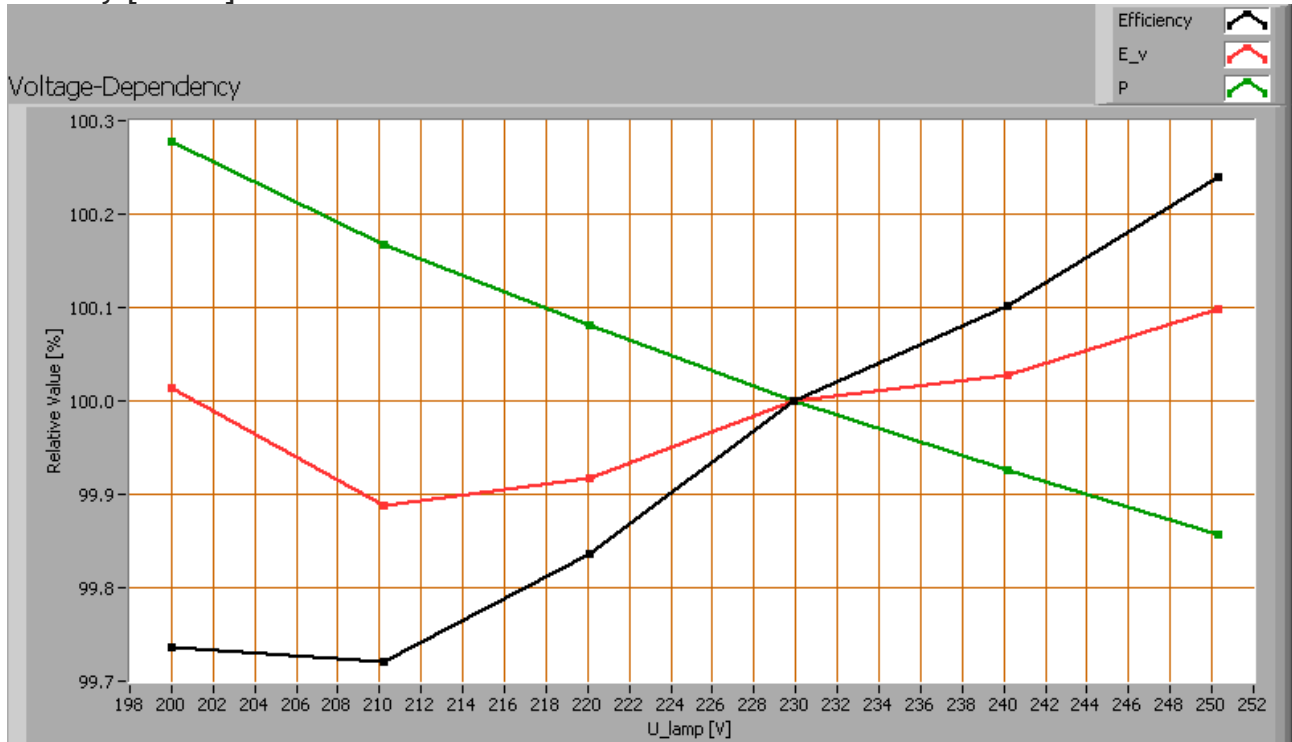
The value of 69 is lower than 80 which is considered a minimum value for indoor usage. Note: the chromaticity difference is 0.0003 indicates the distance to the Planckian Locus. There is no norm yet that states what the max deviation from white light is allowed to be. A reference with signal lights as a reference is given in the chromaticity diagram.

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] and the luminous

Lamp measurement report – 11 June 2010

efficacy [lm/W].



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

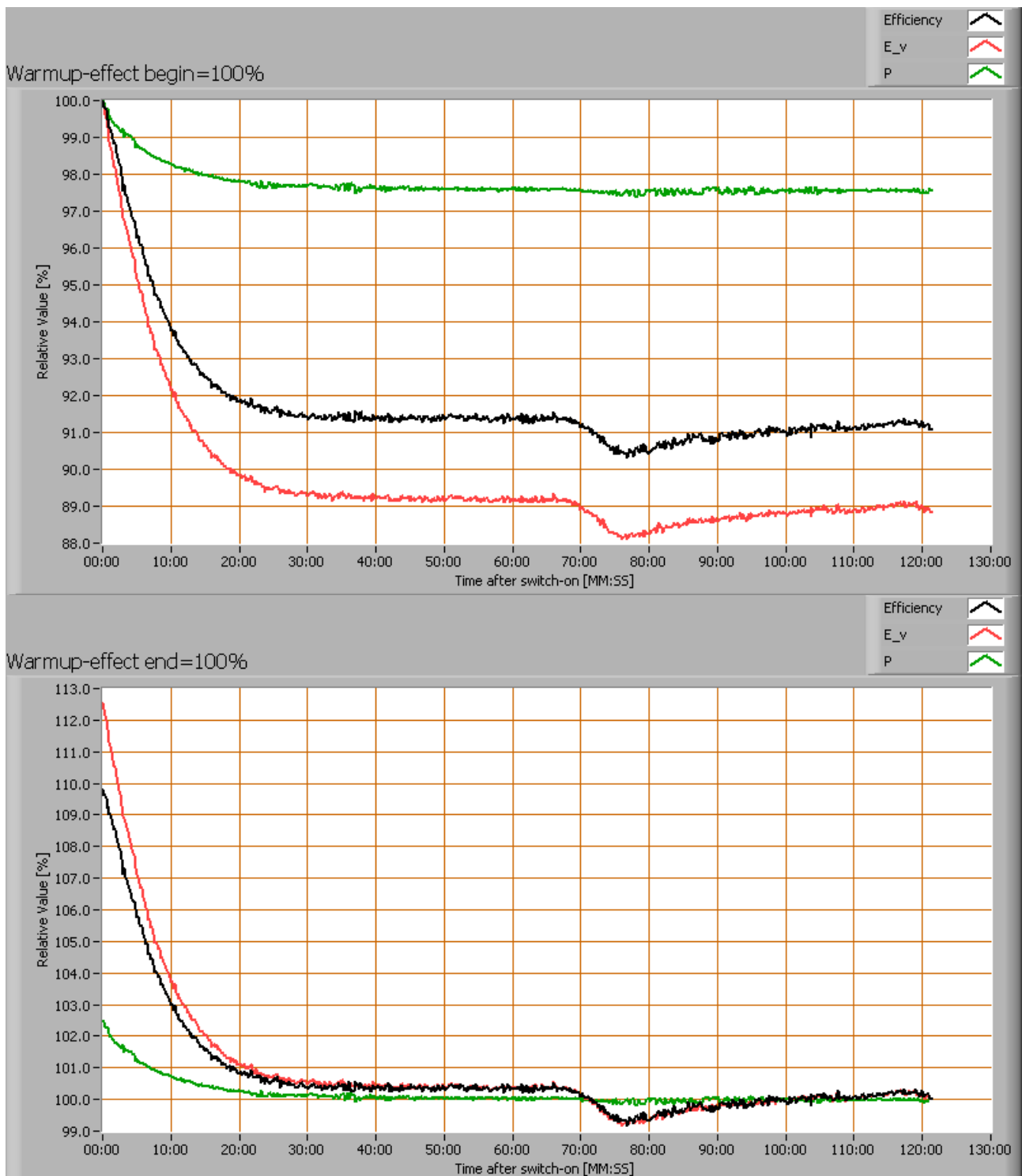
The illuminance and consumed power do not vary significantly when the voltage is varied.

When the voltage at 230 V varies with + and - 5 V, then the illuminance varies < 0.1 %, 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_v [lx], the lamp power P [W] and the luminous efficacy [lm/W].

Lamp measurement report – 11 June 2010



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

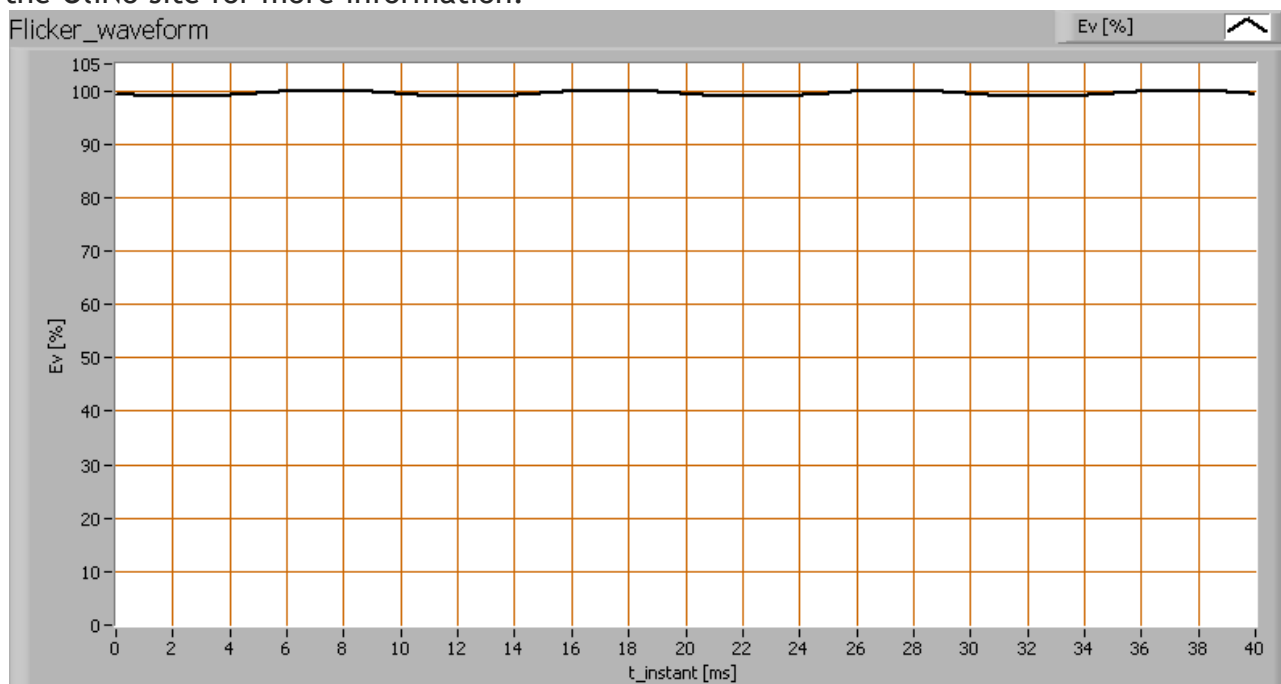


Lamp measurement report – 11 June 2010

The warm up time is about 30 minutes. During that time the illuminance decreases with 23 % and the consumed power with about 11 %.

Measure of flickering

An analysis is done on the measure of flickering of the light output by this light bulb. See the OliNo site for more information.



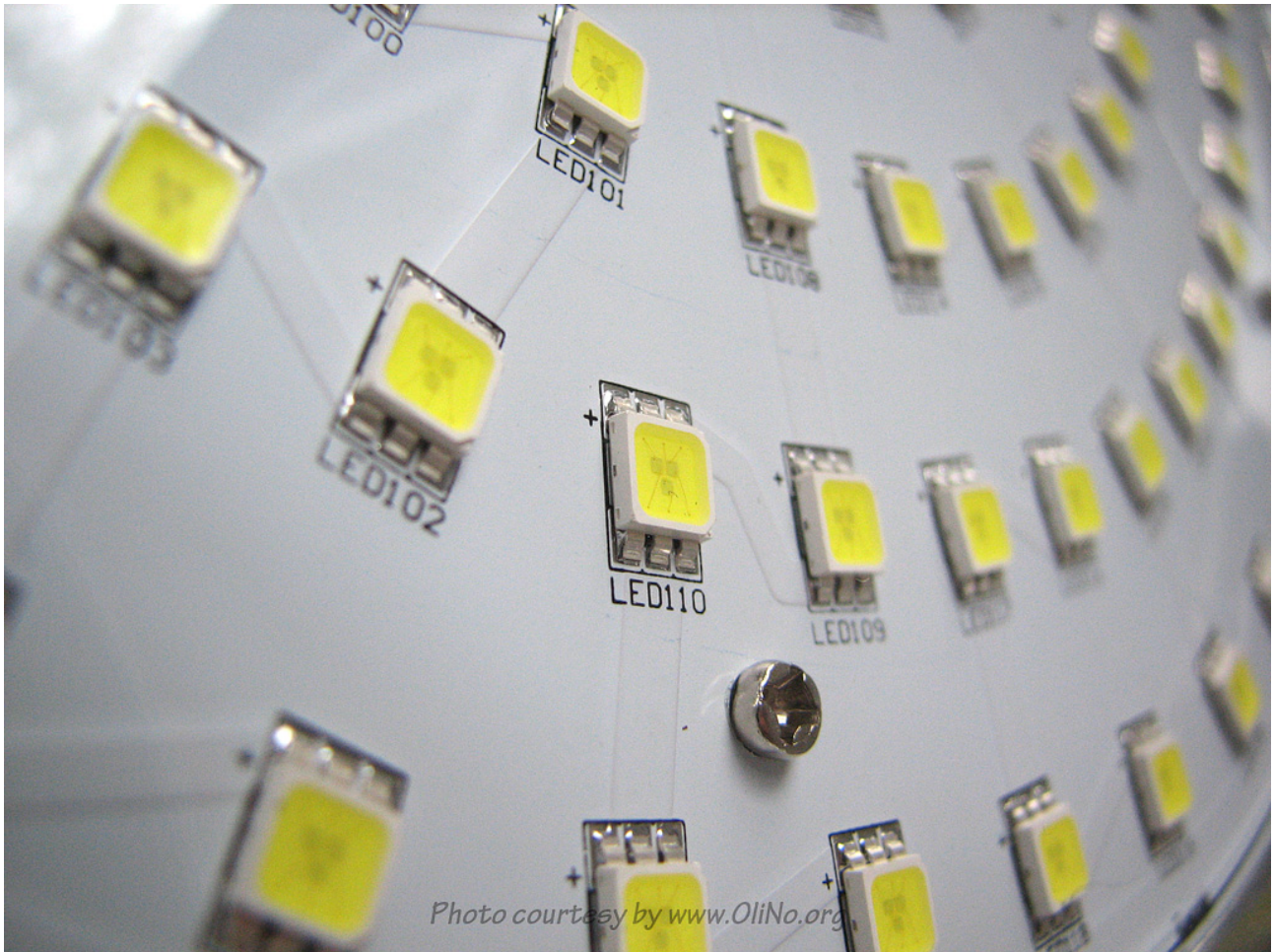
The measure of fast illuminance variation of the light of the light bulb

parameter	waarde	eenheid
Flicker frequency	100	Hz
Illuminance modulation index	1	%

The illuminance modulation index is computed as: $(\max_Ev - \min_Ev) / (\max_Ev + \min_Ev)$.

Lamp measurement report – 11 June 2010

Photos



Zoomed in on the used leds

Lamp measurement report – 11 June 2010



A comparison with a lamp with E27 fitting



Lamp measurement report – 11 June 2010

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.