

Lamp measurement report – 21 Dec 2010

dimmable energy saving lamp XQ09117

by
Tevea



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Summary measurement data


parameter	meas. result	remark
Color temperature	2811 K	Warm white
Luminous intensity I_v	66.6 Cd	Measured straight underneath the lamp.
Illuminance modulation index	14 %	Measured straight underneath the lamp. Is a measure for the amount of flickering.
Beam angle	122 deg	122° for all C-planes since the lamp is symmetrical along its 1st axis.
Power P	9.2 W	
Power Factor	0.65	For every 1 kWh net power consumed, there has been 0.3 kVAh for reactive power.
THD	88 %	Total Harmonic Distortion
Luminous flux	221 Lm	
Luminous efficacy	24 Lm/W	
EU-label classification	B	The energy class, from A (more efficient) to G (least efficient).
CRI_Ra	80	Color Rendering Index.
Coordinates chromaticity diagram	x=0.4577 and y=0.4204	
Fitting	GU10	This lamp is connected to the 230 V grid voltage.
PAR-value	0.5 $\mu\text{Mol/s/m}^2$	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	0.2 $\mu\text{Mol/s/W}_e$	The total emitted number of photons by this light, divided by its consumption in W. It indicates a kind of efficacy in generating photons.

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S/P ratio	1.1	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	46 x 86 mm	External dimensions of the lamp.
D luminous area	40 mm	Dimensions of the luminous area (used in Eulumdat file). This is the surface of the glass at the front.
General remarks		<p>The ambient temperature during the whole set of illuminance measurements was 22.3-24.0 deg C.</p> <p>The temperature of the housing gets maximally about 65 degrees hotter than ambient temperature.</p> <p>Warm up effect: during the warm up time the illuminance increases with 110 %.</p> <p>Voltage dependency: the power consumption and illuminance do vary in a linear way when the power voltage varies between 200-250 V. This lamp has been tested on dim-ability and found to be dimmable, the result depending on the dimmer type.</p> <p>At the end of the article an additional photo.</p>

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Overview table

m.	Ø 50%		CO-180: 122° C90-270: 122° 	E (lux)	Luminaire Efficacy
	CO-180	C90-270			24 (lumen per Watt)
0.25	0.91	0.91		1066	Half-peak diam CO-180
0.5	1.82	1.82		266	3.64 x diameter(m)
1	3.64	3.64		67	Half-peak diam C90-270
1.5	5.46	5.46		30	3.64 x diameter(m)
3	10.91	10.91		7	Illuminance
4	14.55	14.55		4	67 / distance ² (lux)
5	18.18	18.18		3	Total Output
					221 (lumen)

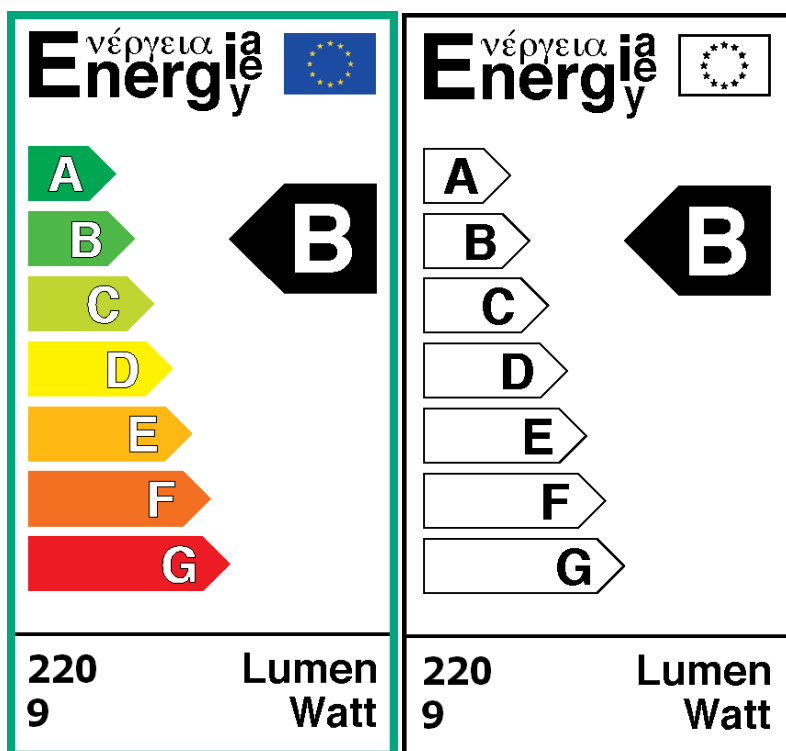
The overview table is explained on the OLiNo website.

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 40 mm ≈ 200 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.

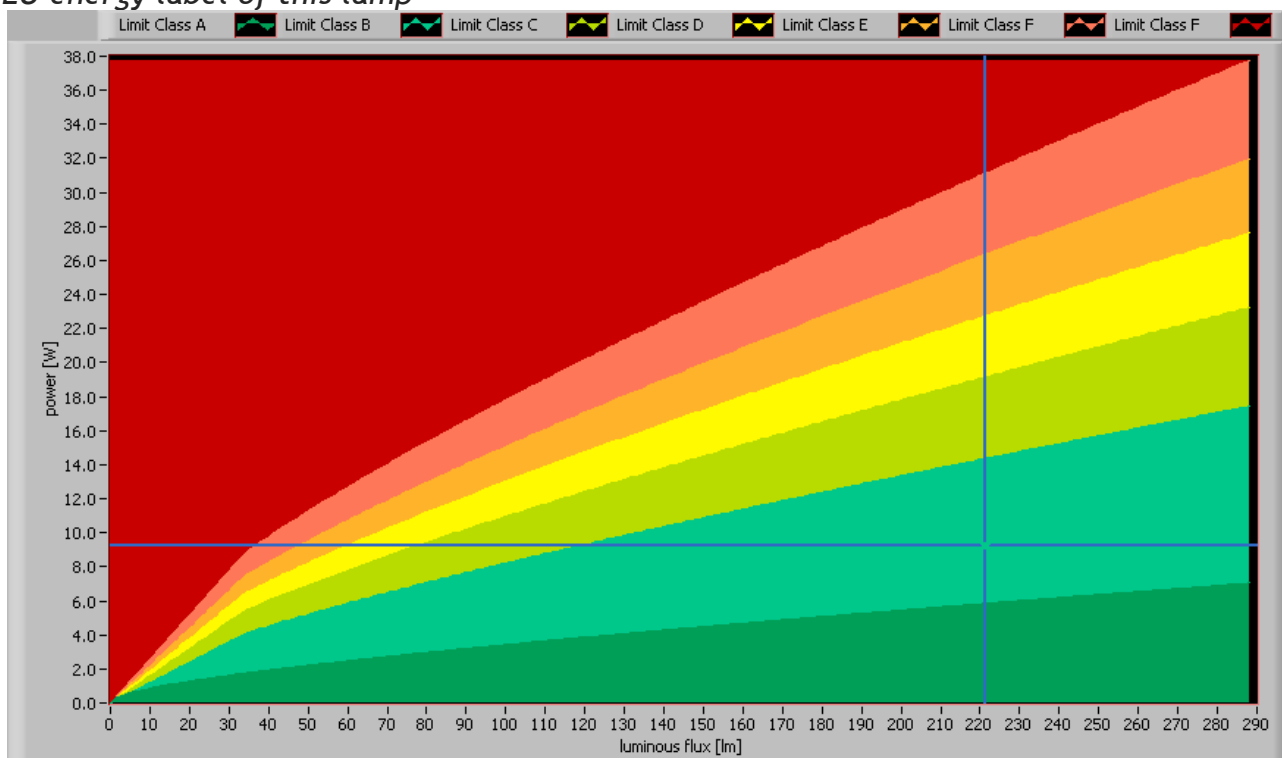
EU Energy label classification

With the measurement results of the luminous flux and the consumed power the classification on energy of this lamp is calculated. This information is requested in the EU for certain household lamps, see also the OLiNo site that explains for which lamps it is requested, how the label looks like and what information it needs to contain. Herewith the labels for this lamp in color and black and white.

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EU energy label of this lamp

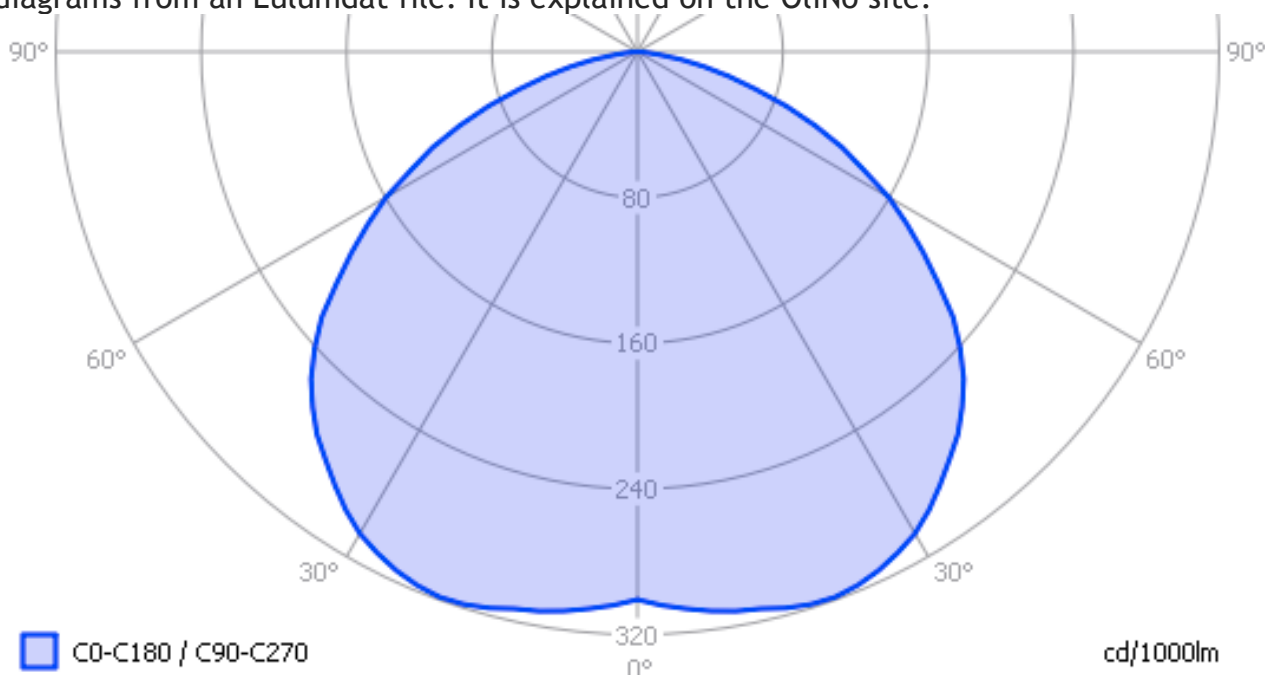


The lamp's performance in the lumen-Watt field, with the energy efficacy fields indicated.

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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.



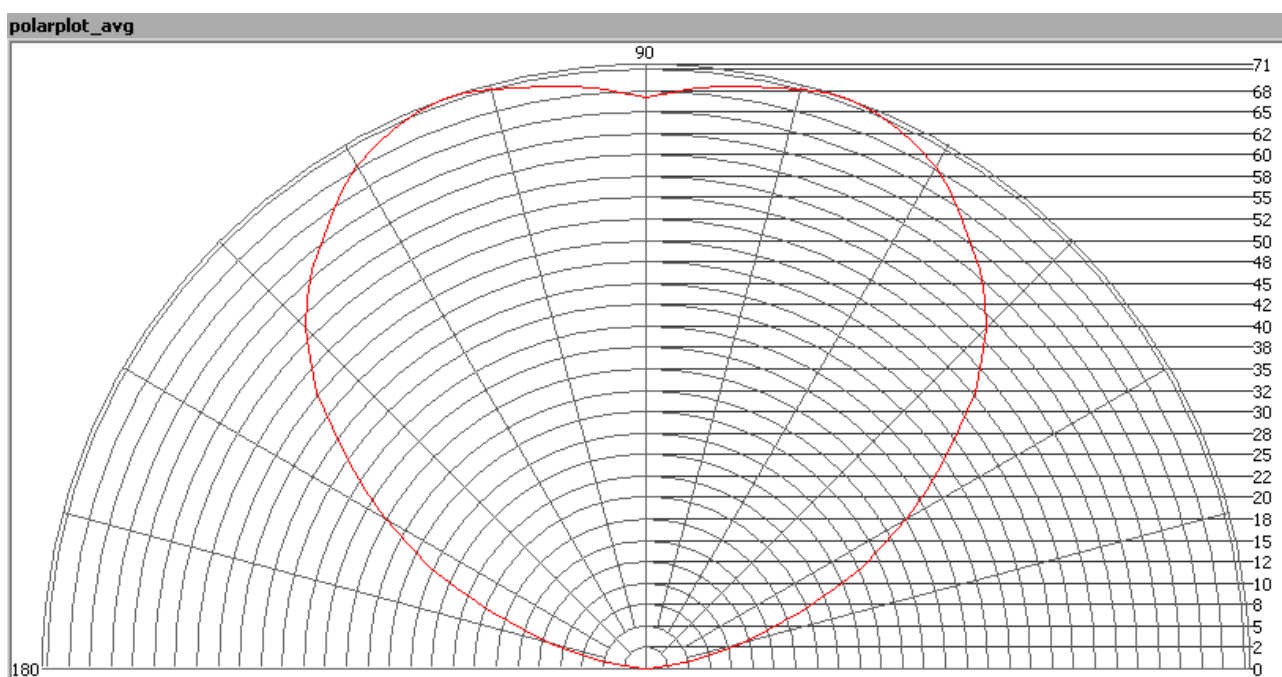
The light diagram giving the radiation pattern.

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.

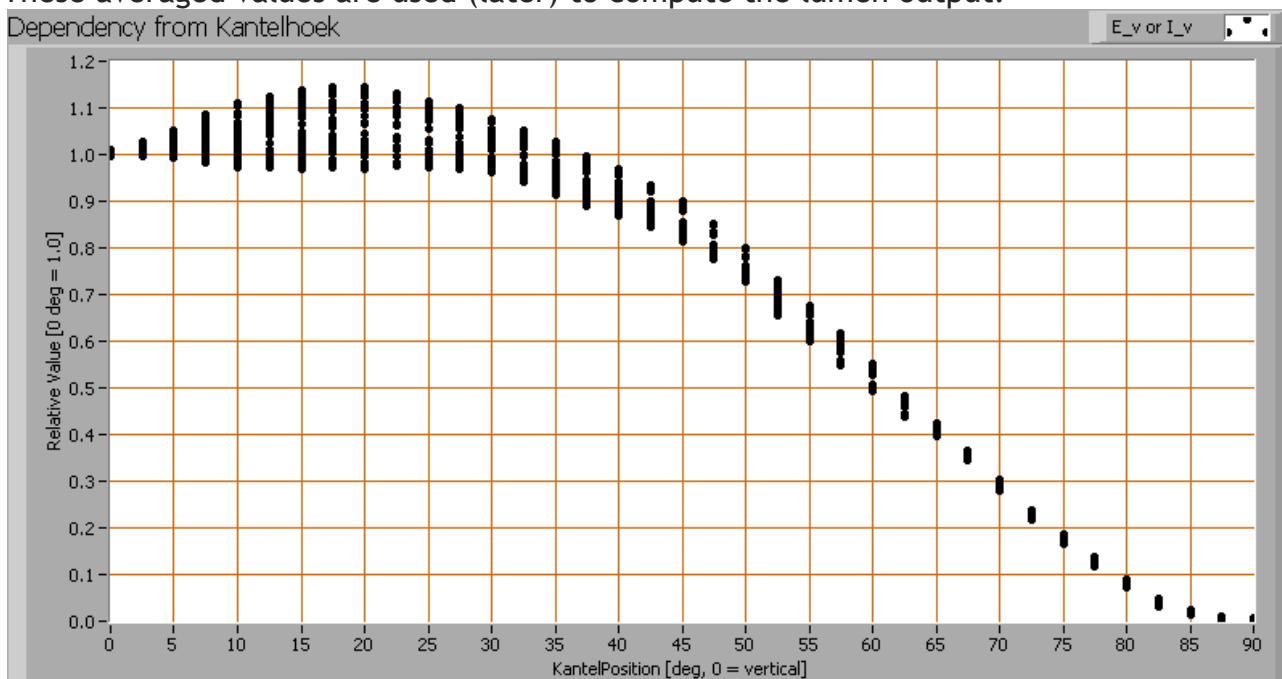
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The radiation pattern of the light bulb.

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.



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



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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 122° 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 221 Lm.

Luminous efficacy

The luminous flux being 221 Lm, and the power of the light bulb being 9.2 W, yields a luminous efficacy of 24 Lm/W.

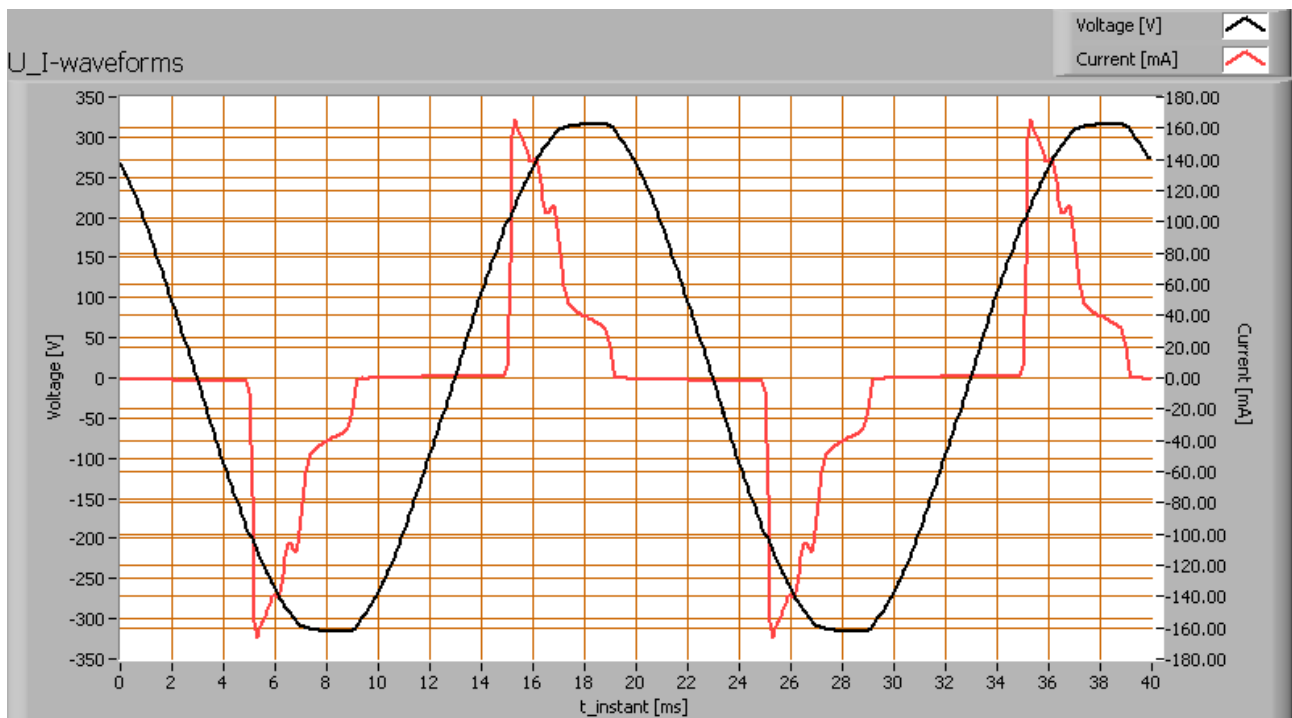
Electrical properties

A power factor of 0.65 means that for every 1 kWh net power consumed, a reactive component of 1.2 kVAr was needed.

Lamp voltage	230 VAC
Lamp current	62 mA
Power P	9.2 W
Apparent power S	14.2 VA
Power factor	0.65

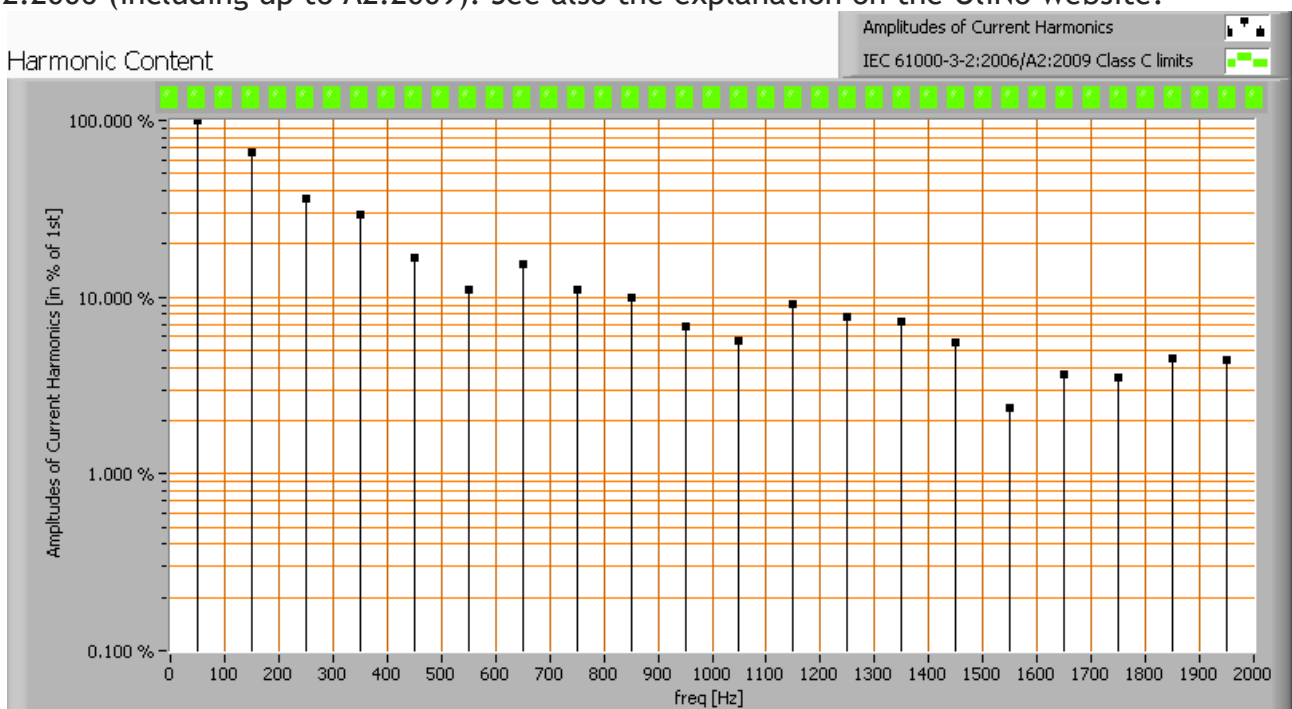
Of this light bulb the voltage across and the resulting current through it are measured and graphed. See the OLiNo site how this is obtained.

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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.



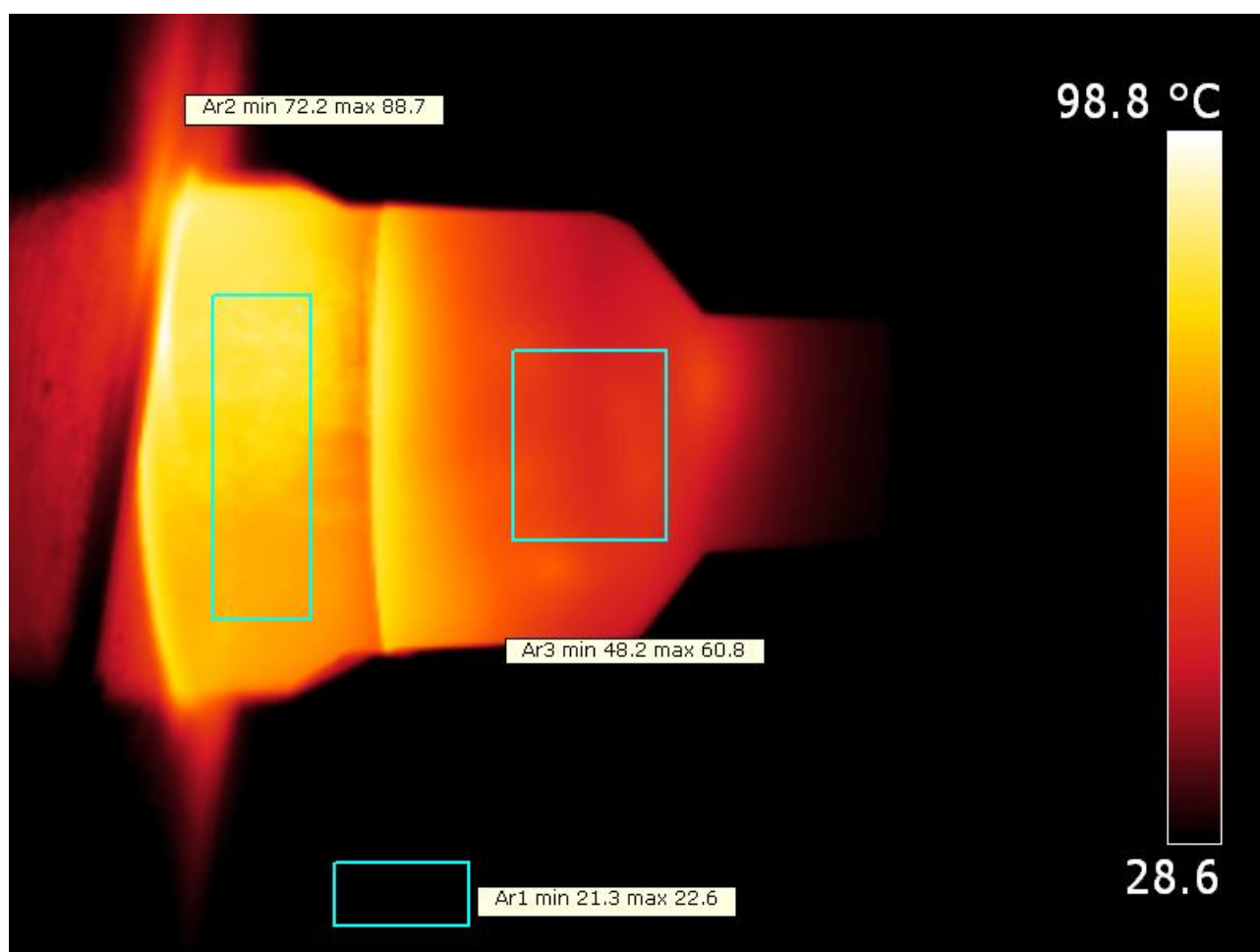
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Harmonics in the current waveform and checked against IEC61000-3-2:2006

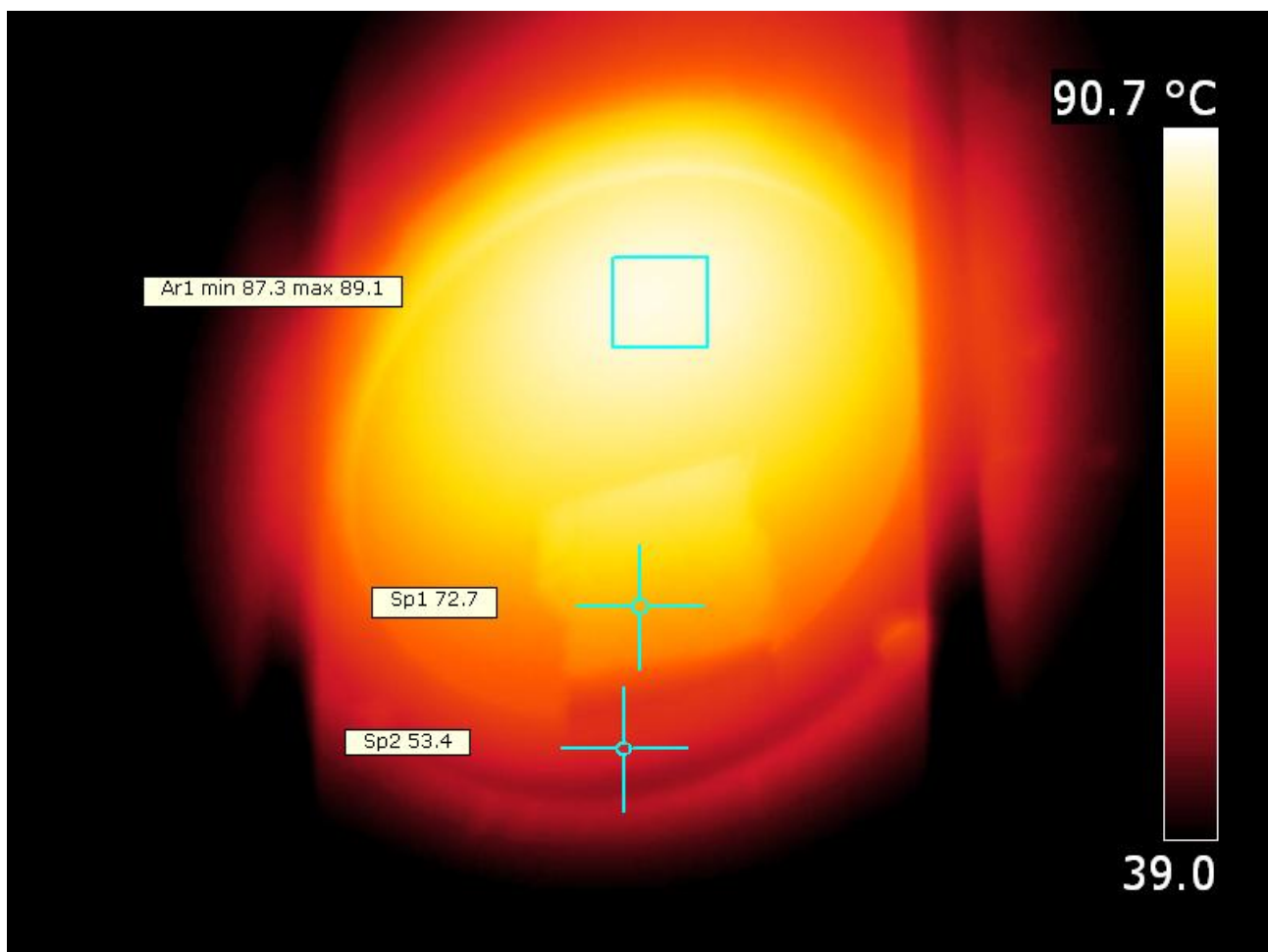
There are no limits for the harmonics for lighting equipment ≤ 25 W.

The Total Harmonic Distortion of the current is computed as 88 %.

Temperature measurements lamp



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IR images from the lamp, the side and the front view.

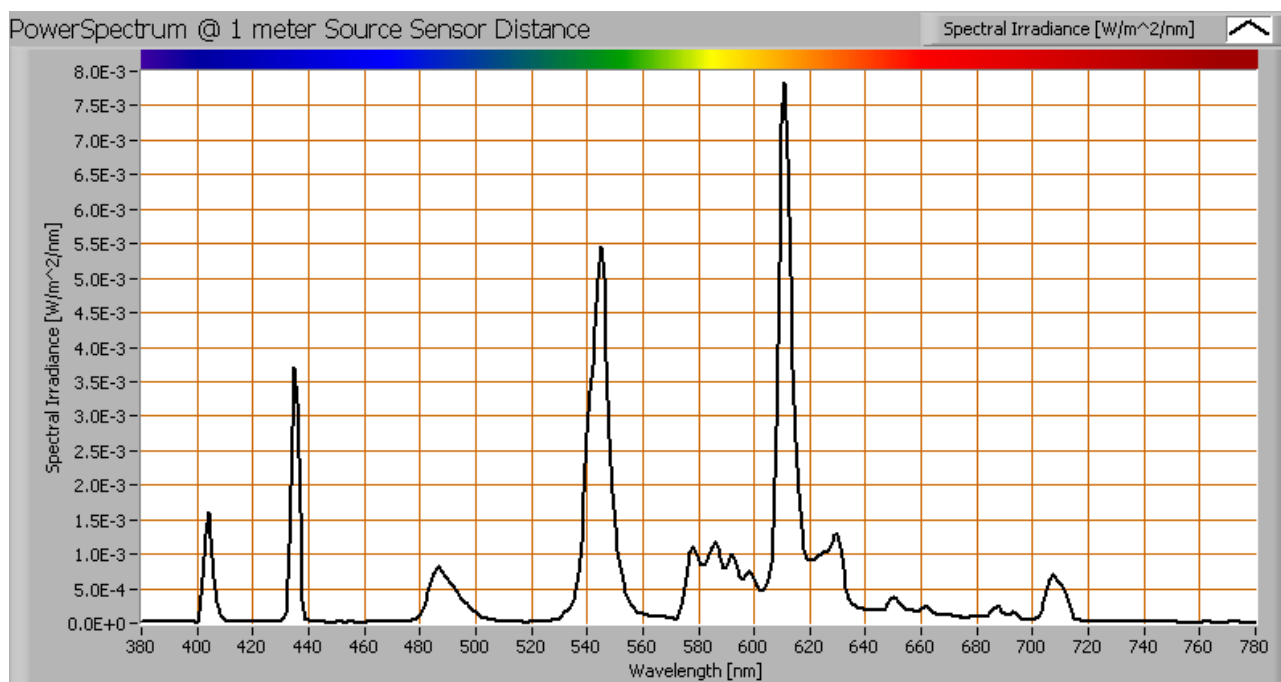
Painting tape was not needed as the housing material can emit well the heat as it is a material with rough surface. It is visible also at the image of the front where the temperature difference between the tape and the material directly is negligible.

status lamp	> 2 hours on
ambient temperature	22 deg C
reflected background temperature	22 deg C
camera	Flir T335
emissivity	0.95 ⁽¹⁾
measurement distance	0.3 m
IFOV _{geometric}	0.136 mm per 0.1 mm distance
NETD (thermal sensitivity)	50 mK

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⁽¹⁾ See text for explanation.

Color temperature and Spectral power distribution

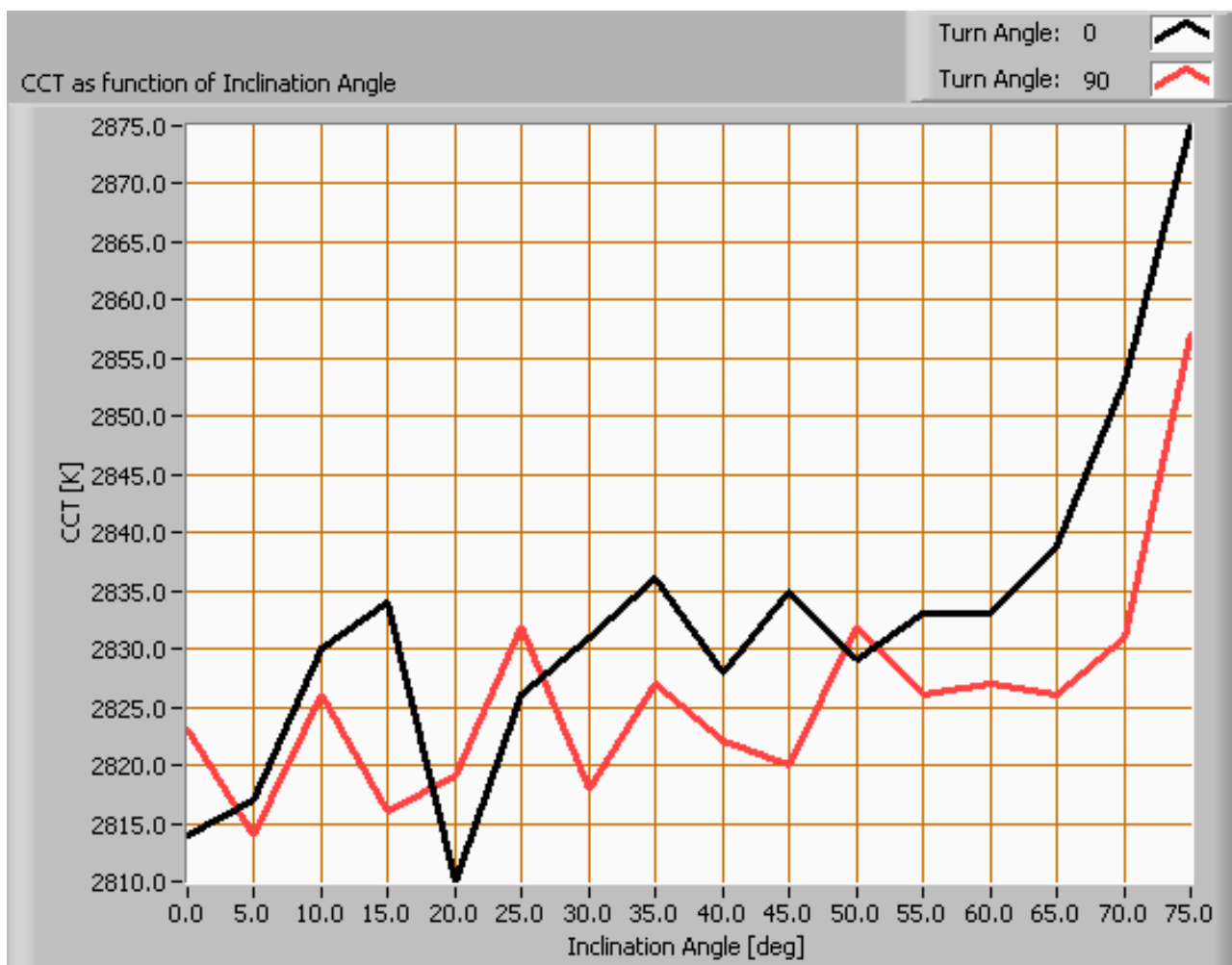


The spectral power distribution of this light bulb, energies on y-axis valid at 1 m distance.

The measured color temperature is about 2800 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.

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Color temperature as a function of inclination angle.

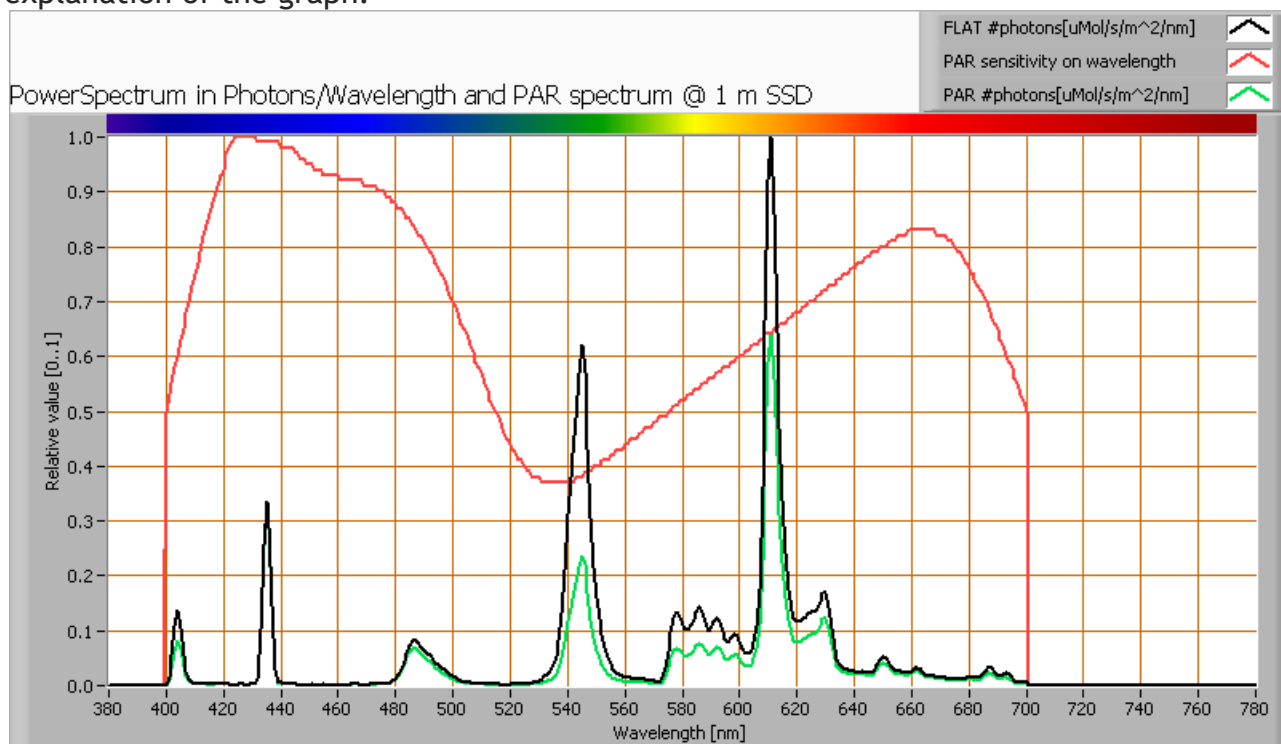
The measurement of CCT is measured for inclination angles up to 75°. Beyond that angle the illuminance value is very low (< 5 lux).

The beam angle is 122°, meaning a 61° inclination angle. In this area most of the light is present. The variation in correlated color temperature in the area measured (inclination angles up to 90°) is < 1 %.

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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.



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

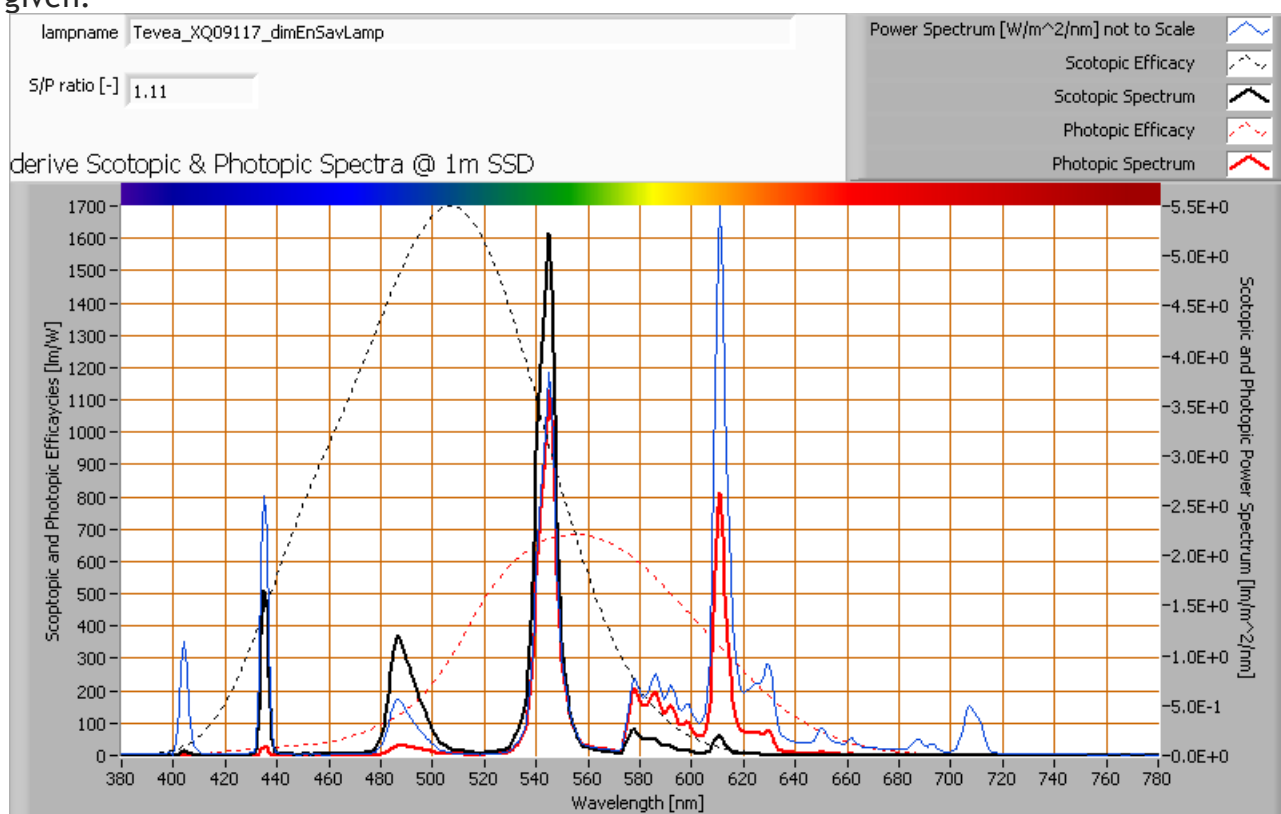
parameter	value	unit
PAR-number	0.5	μMol/s/m ²
PAR-photon current	1.7	μMol/s
PAR-photon efficacy	0.2	μMol/s/W

The PAR efficiency is 60 % (valid for the PAR wave length range of 400 - 700 nm). So maximally 60 % 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 %).

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S/P ratio

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



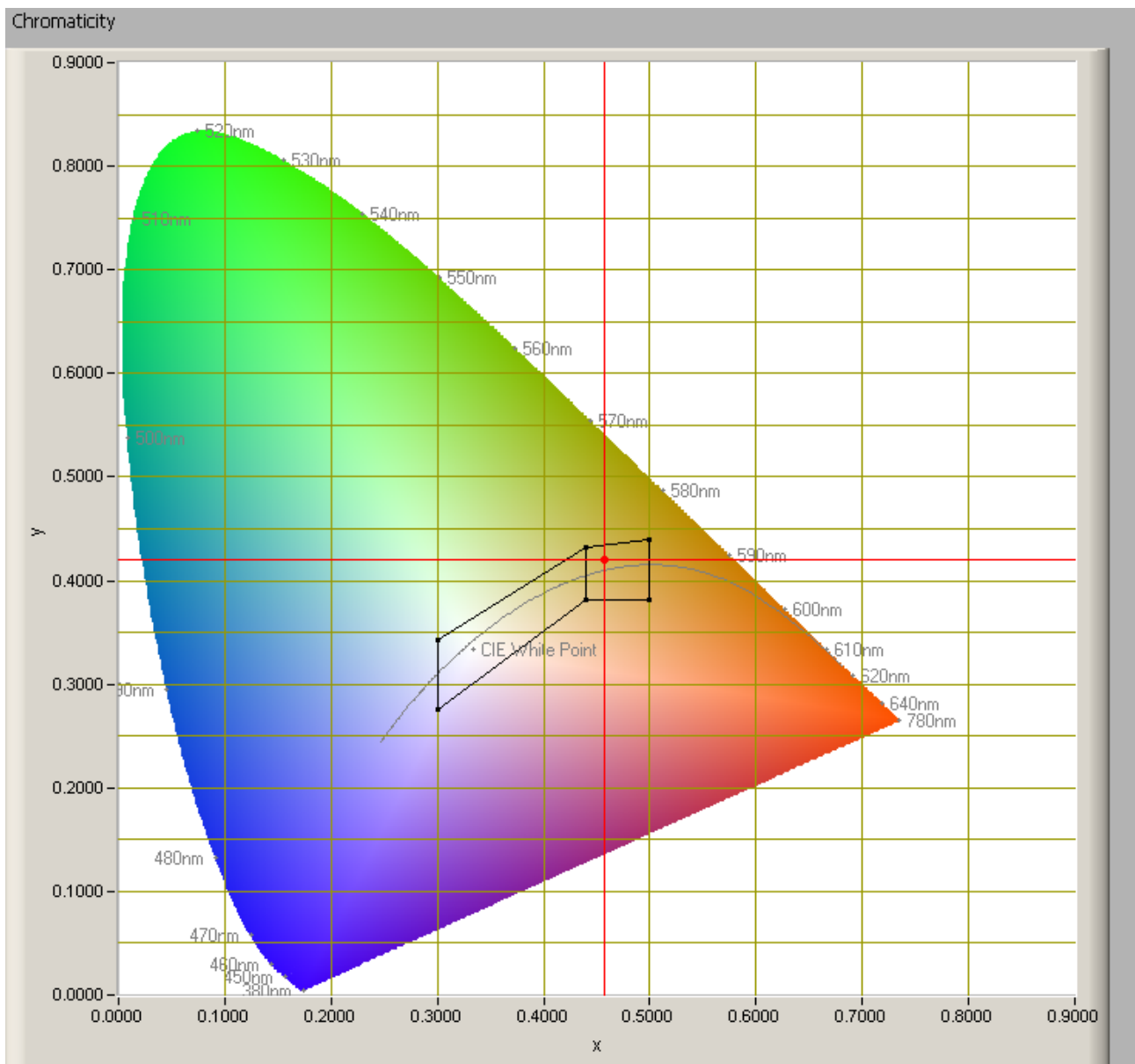
The power spectrum, sensitivity curves and resulting scotopic and photopic spectra (spectra energy content defined at 1 m distance).

The S/P ratio is 1.1.

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

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Chromaticity diagram



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

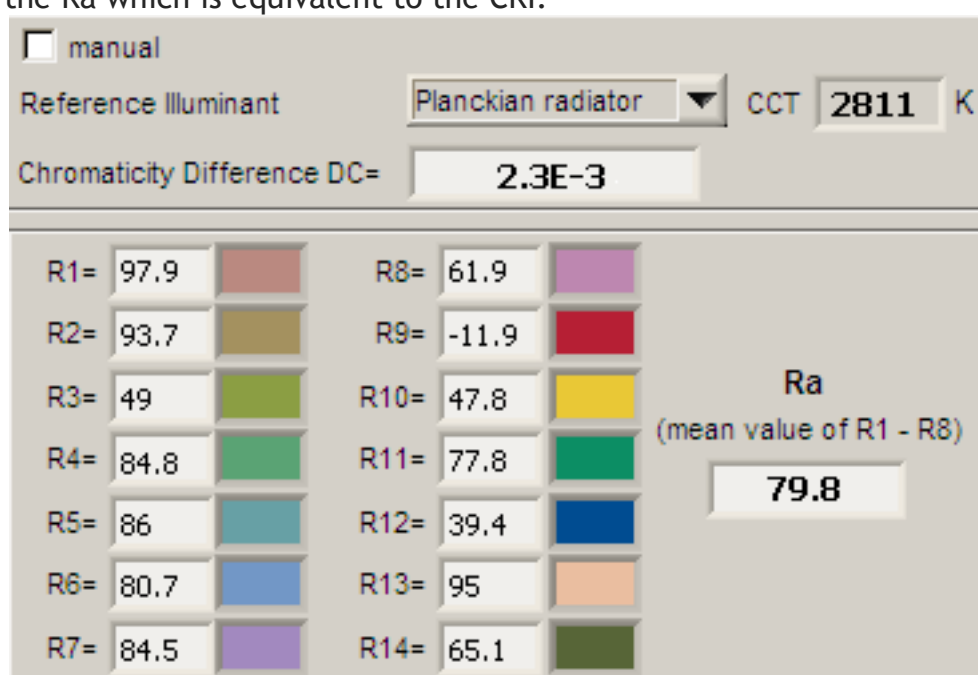
The light coming from this lamp is inside area of class B (white-yellow). This class indicates an area that is defined for signal lamps, see also the article on signal lamps and color areas on the OliNo website.

Its coordinates are $x=0.4577$ and $y=0.4204$.

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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 80 is equal to 80 which is considered a minimum value for indoor usage.

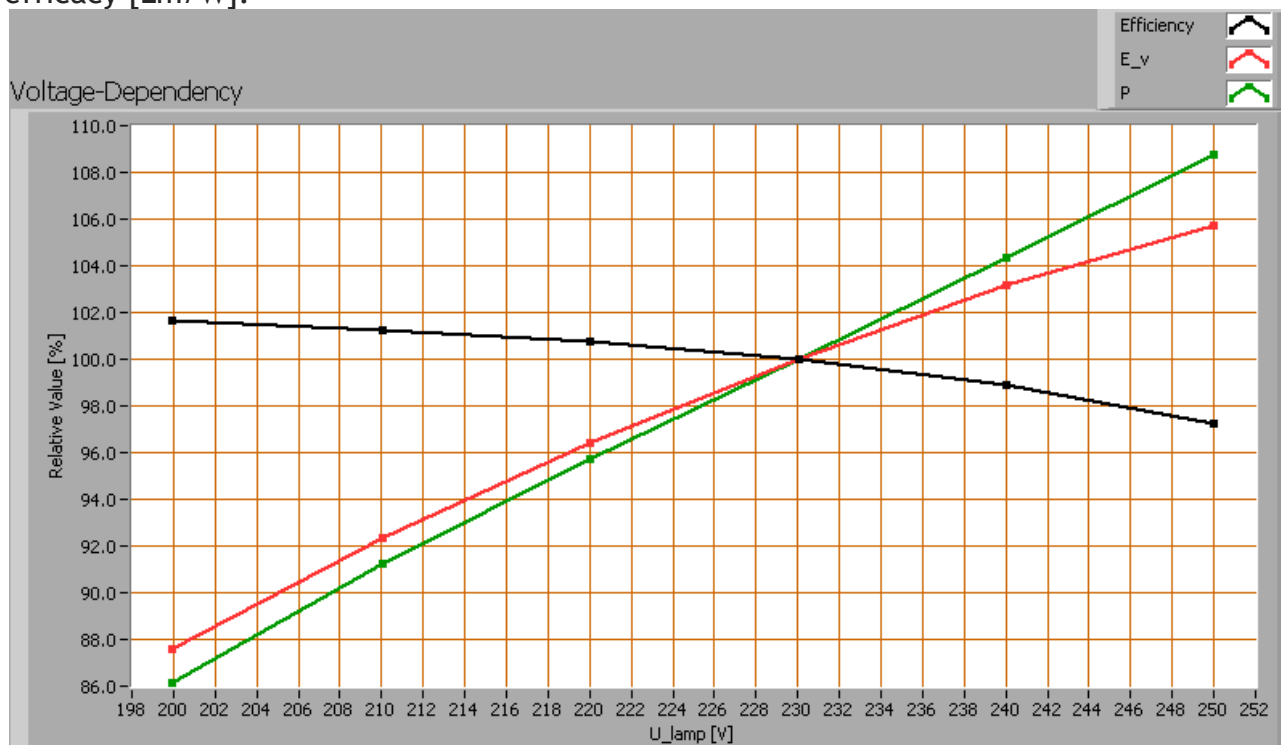
Note: the chromaticity difference is 0.0023 indicates the distance to the Planckian Locus. There is no norm yet that states what the max deviation from white light is allowed to be. A reference with signal lights as a reference is given in the chromaticity diagram.

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

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efficacy [lm/W].



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

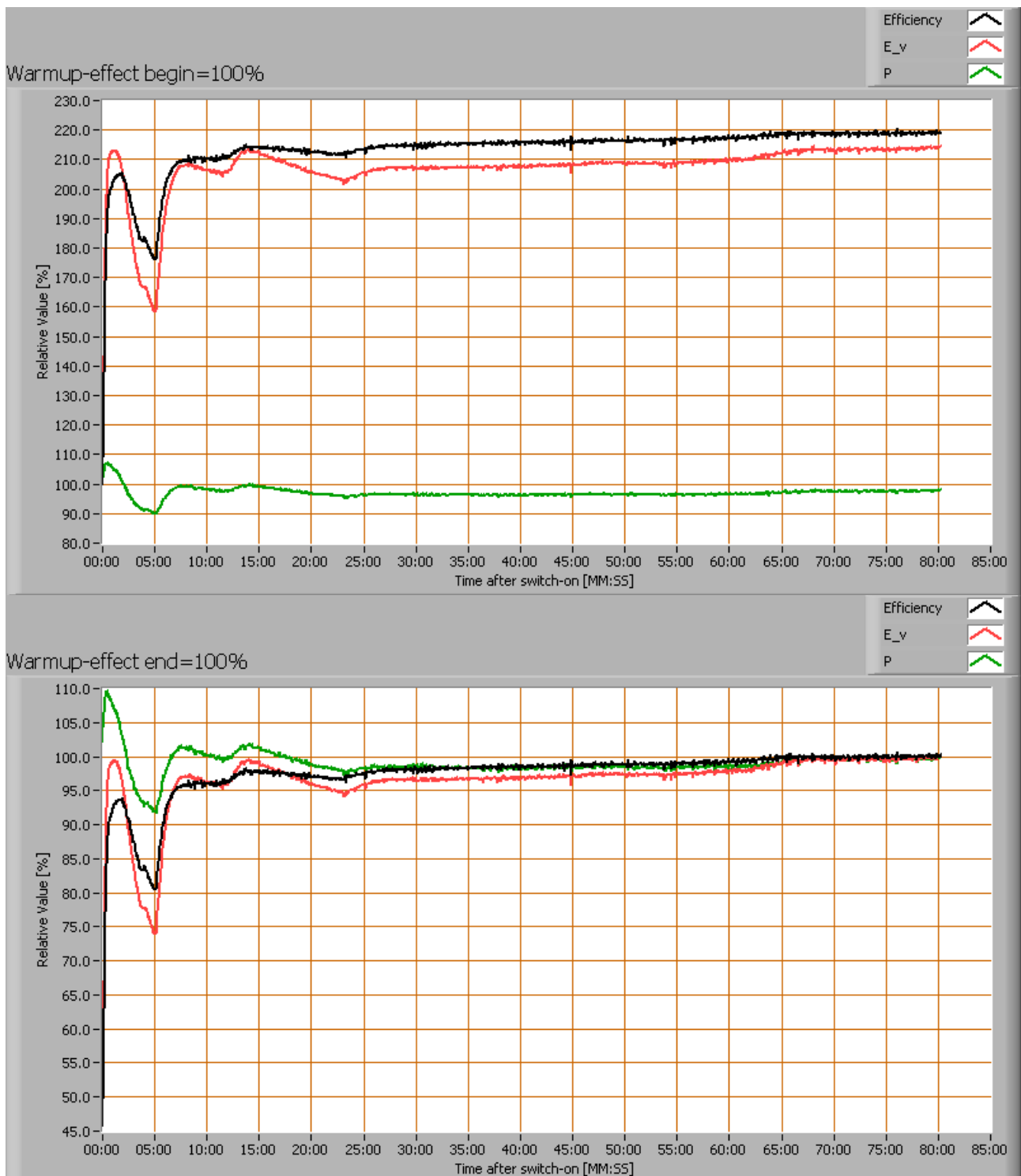
The illuminance and consumed power do vary in a linear way when the voltage is varied between 200 - 250 V.

When the voltage at 230 V varies with + and - 5 V, then the illuminance varies $\approx 2\%$, 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].

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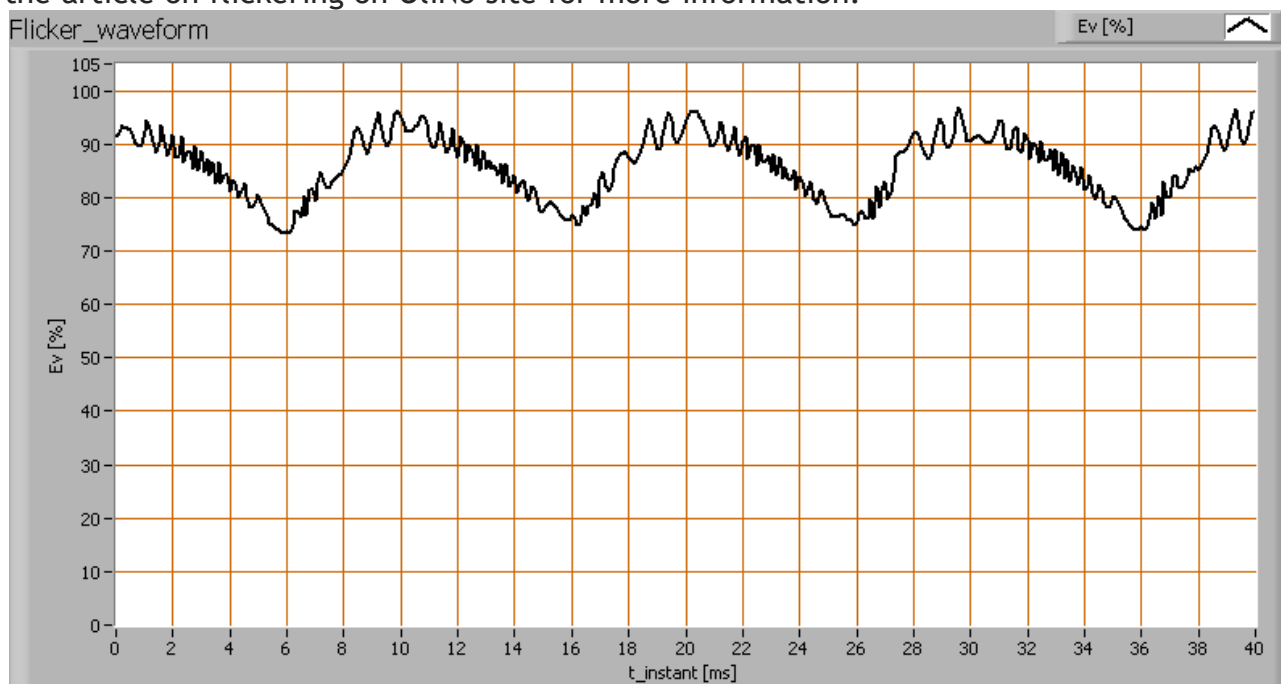
Effect of warming up on different light bulb parameters. At top the 100 % level is put at begin, and at bottom at the end.

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The warm up time is about 5 minutes, during which the illuminance increases with 110 %.

Measure of flickering

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



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

parameter	waarde	eenheid
Flicker frequency	100.9	Hz
Illuminance modulation index	14	%

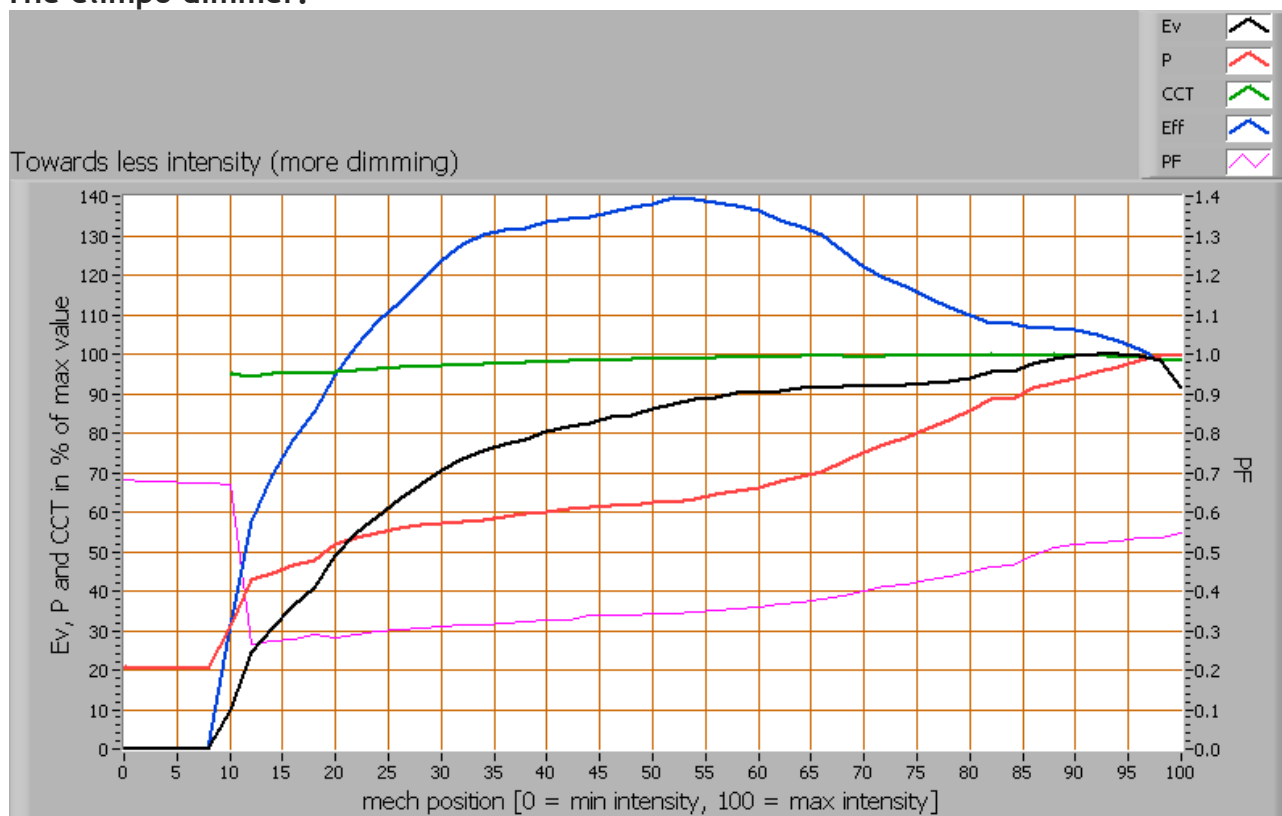
The illuminance modulation index is computed as: $(\max_Ev - \min_Ev) / (\max_Ev + \min_Ev)$.

Dimmability

The lamp has been tested on the following dimmers: the elimpo, Gira RL, Berker RC and the low power LRC dimmer. See for a description and their specification the practical dimmer explanation article on OliNo.

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The elimpo dimmer.



Dimming with the elimpo dimmer

The intensity is set-able within the 10 - 100 % mechanical range, and the intensity is settable between 0 - 100 % of its maximum value.

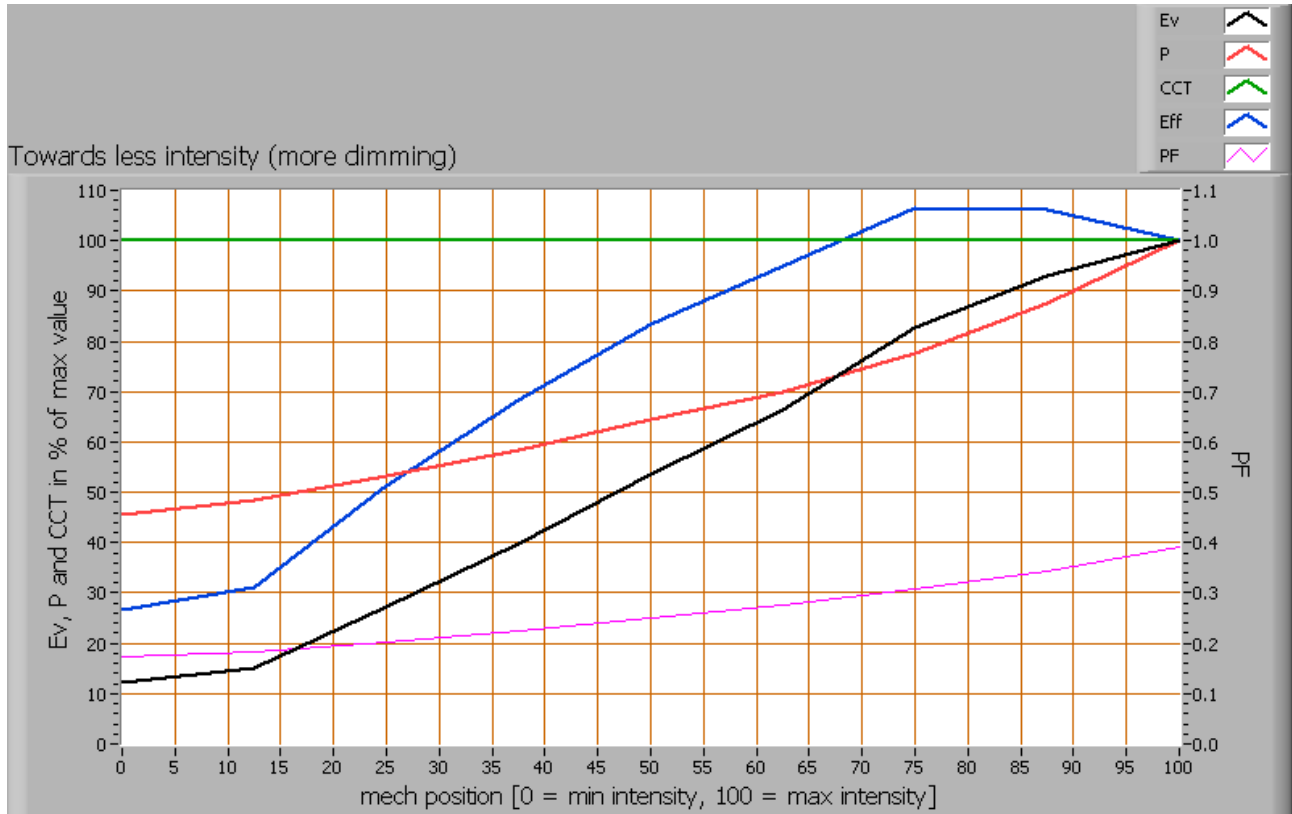
De color temperature slowly decreases (to warmer colors) when more dimming is used.

The total gets even more efficient when dimming, as the consumed power decreases more than the illuminance.

When inserting the elimpo dimmer and comparing with the situation without dimmer, then the illuminance decreases with 2.5 % and the consumed power increases with 10 %.

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The GIRA LR dimmer



Dimming with the Gira LR dimmer

Dim function works for 0 % - 100 % of the mechanical settable range. The illuminance varies between 12 - 100 %.

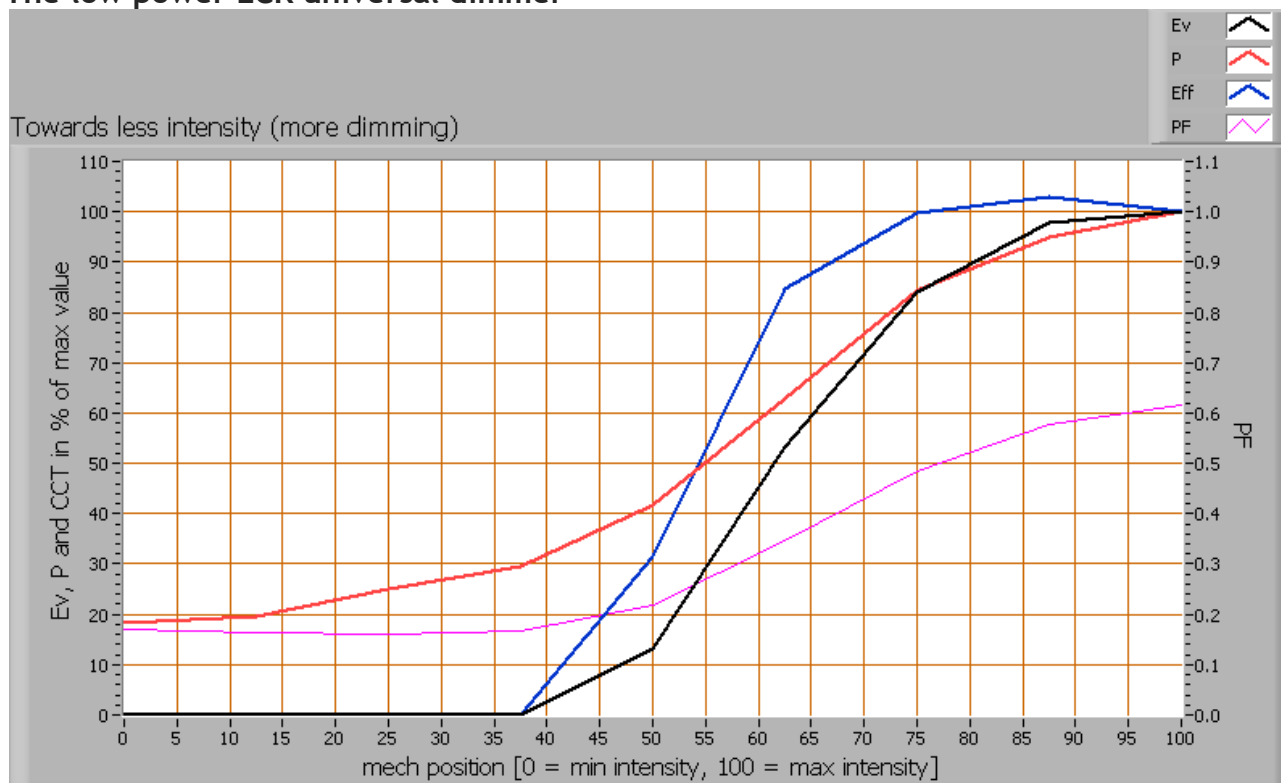
The consumed power drops at first quicker than the illuminance, resulting in more efficacy. When more dimming then the efficacy decreases as illuminance is more decreasing than the consumed power.

The color temperature does not change due to dimming.

When the dimmer is inserted and a comparison is made between no dimmer and dimmer at 100 %, then the power is decreased by 10 % and the illuminance is decreases by 5 %.

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The low power LCR universal dimmer



Dimming with the low power LCR dimmer

The mechanical useful range is from 40 % to 100 %.

The intensity is variable between 0 - 100 %.

Power consumption decreases faster at the beginning than the illuminance and at last the remaining power consumption is minimally 2.0 W.

Inserting this dimmer when set at 100, results in a decrease of illuminance of 4 % and an increase of consumed power of 12 % compared to the situation without dimmer.

The Berker RC dimmer

The dimming function did not work with the LC dimmer (tronic dimmer).

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Additional photo



Photo courtesy by www.OliNo.org

Front view of the lamp.

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