Lamp measurement report – 21 Dec 2010

high power 3W ledlamp XQ with GU10 fitting

by

Tevea

Lamp measurement report – 21 Dec 2010

Summary measurement data

parameter	meas. result	remark
Color temperature	3028 K	Warm white
Luminous intensity I_v	385 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	36 deg	36° for all C-planes since the lamp is symmetrical along its 1st axis.
Power P	4.0 W	
Power Factor	0.55	For every 1 kWh net power consumed, there has been 1.5 kVAhr for reactive power.
THD	145 %	Total Harmonic Distortion
Luminous flux	196 Lm	
Luminous efficacy	49 Lm/W	
EU-label classification	A	The energy class, from A (more efficient) to G (least efficient).
CRI_Ra	60	Color Rendering Index.
Coordinates chromaticity diagram	x=0.4456 and y=0.4249	
Fitting	GU10	This lamp is connected to the 230 V grid voltage.
PAR-value	2.9 µMol/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	0.4 µMol/s/W_e	The toal 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 – 21 Dec 2010

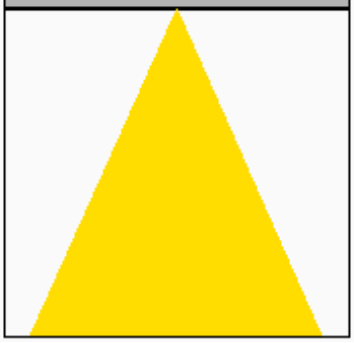
S/P ratio	1.0	This factor indicates the amount of times more efficient the light of this light bulb is perceived under scotopic circumstances (low environmental light level).
D x H external dimensions	50 x 46 mm	External dimensions of the lamp.
D luminous area	25 mm	Dimensions of the luminous area (used in Eulumdat file). This is the surface of the smallest circle around the leds at the front of the lamp.
General remarks		The ambient temperature during the whole set of illuminance measurements was 22.4-24.1 deg C. The temperature of the housing gets maximally about 45 degrees hotter than ambient temperature. Warm up effect: during the warm up time the illuminance decreases with 10 % and the consumed power with 9 %. Voltage dependency: the power consumption and illuminance do not vary significantly when the power voltage varies between 200-250 V.

Lamp measurement report – 21 Dec 2010

Overview table

m.	Ø 50% C0-180	Ø 50% C90-270
0.25	0.16	0.16
0.5	0.32	0.32
1	0.64	0.64
1.5	0.97	0.97
3	1.93	1.93
4	2.58	2.58
5	3.22	3.22

C0-180: 36°
C90-270: 36°



E (lux)
6167
1542
385
171
43
24
15

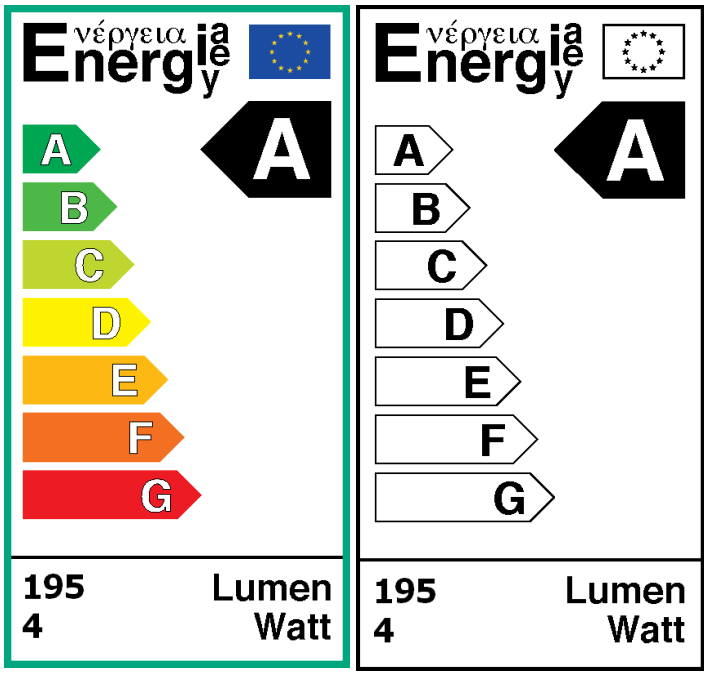
Luminaire Efficacy	
49	(lumen per Watt)
Half-peak diam C_{0-180}	
0.64	x diameter(m)
Half-peak diam C_{90-270}	
0.64	x diameter(m)
Illuminance	
385	/ distance² (lux)
Total Output	
196	(lumen)

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 25 mm ≈ 125 mm. Within this distance from the lamp, the measured lux values willl be less than the computed values in this overview as the measurements are then within the near field of the lamp.

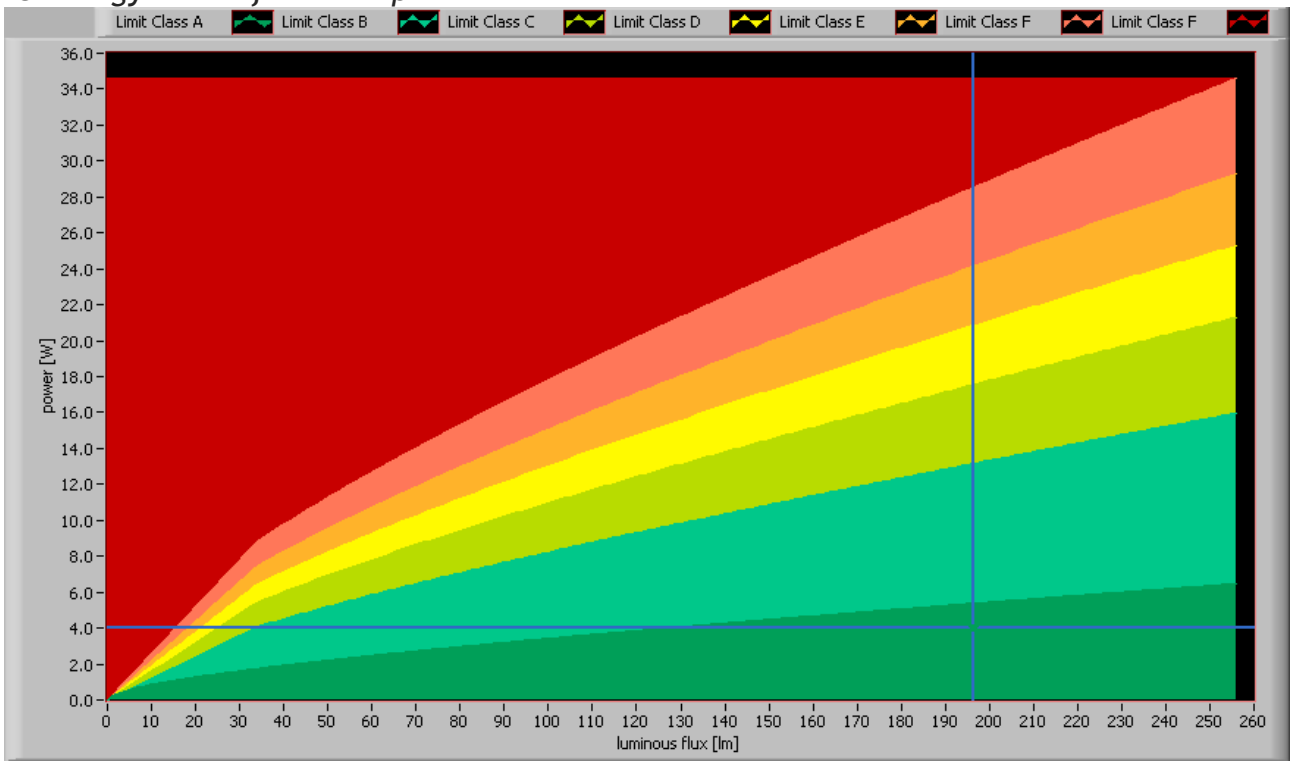
EU Energy label classfication

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.

Lamp measurement report – 21 Dec 2010



EU energy label of this lamp

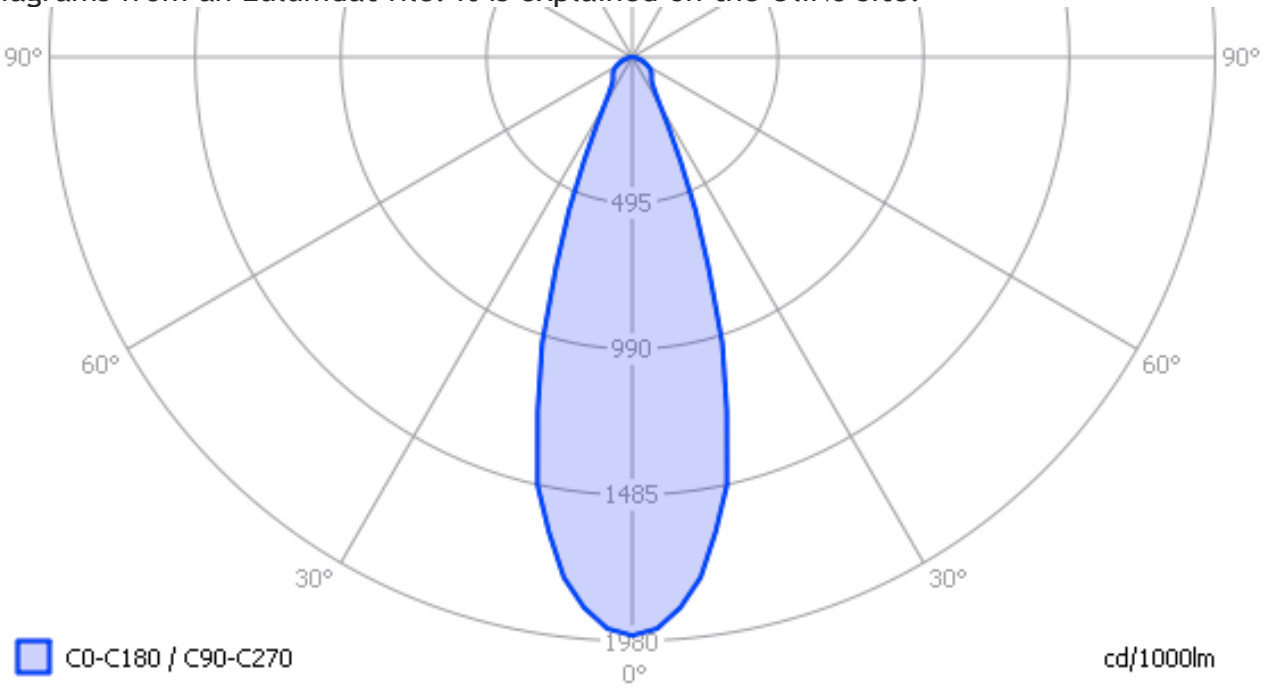


The lamp's performance in the lumen-Watt field, with the energy efficacy fields indicated.

Lamp measurement report – 21 Dec 2010

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.



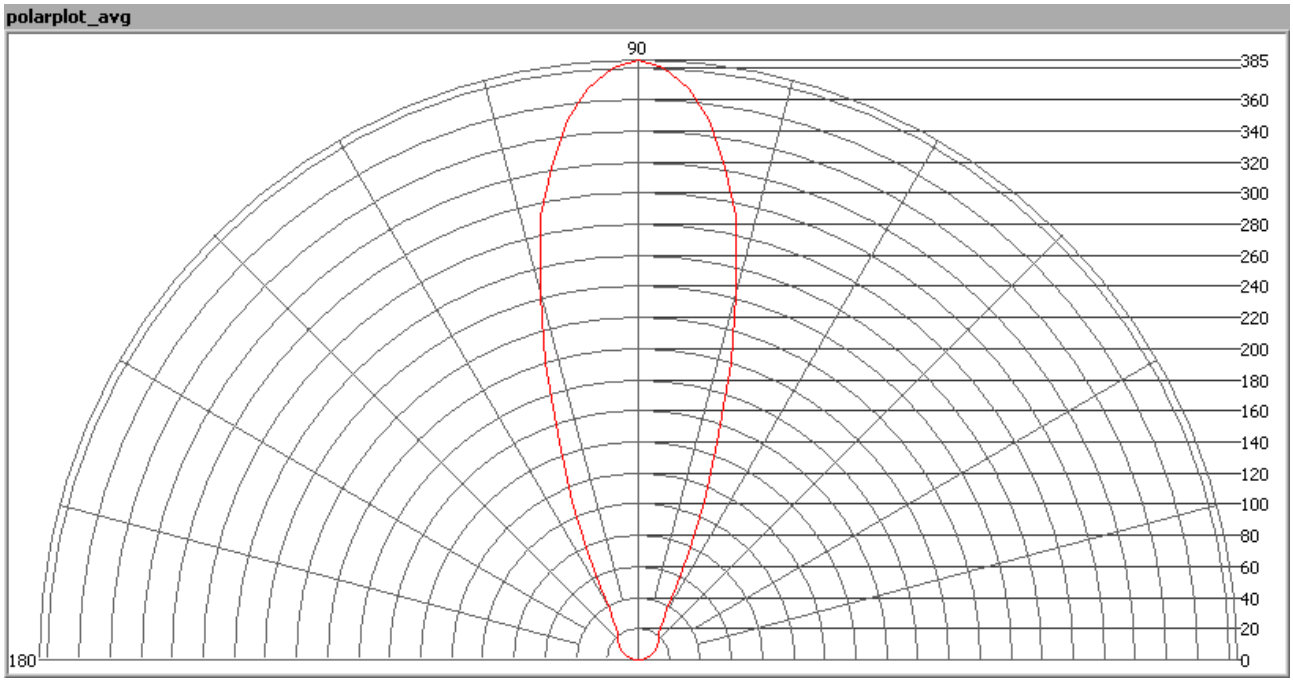
The light diagram giving the radiation pattern.

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 Ev at 1 m distance, or luminous intensity Iv

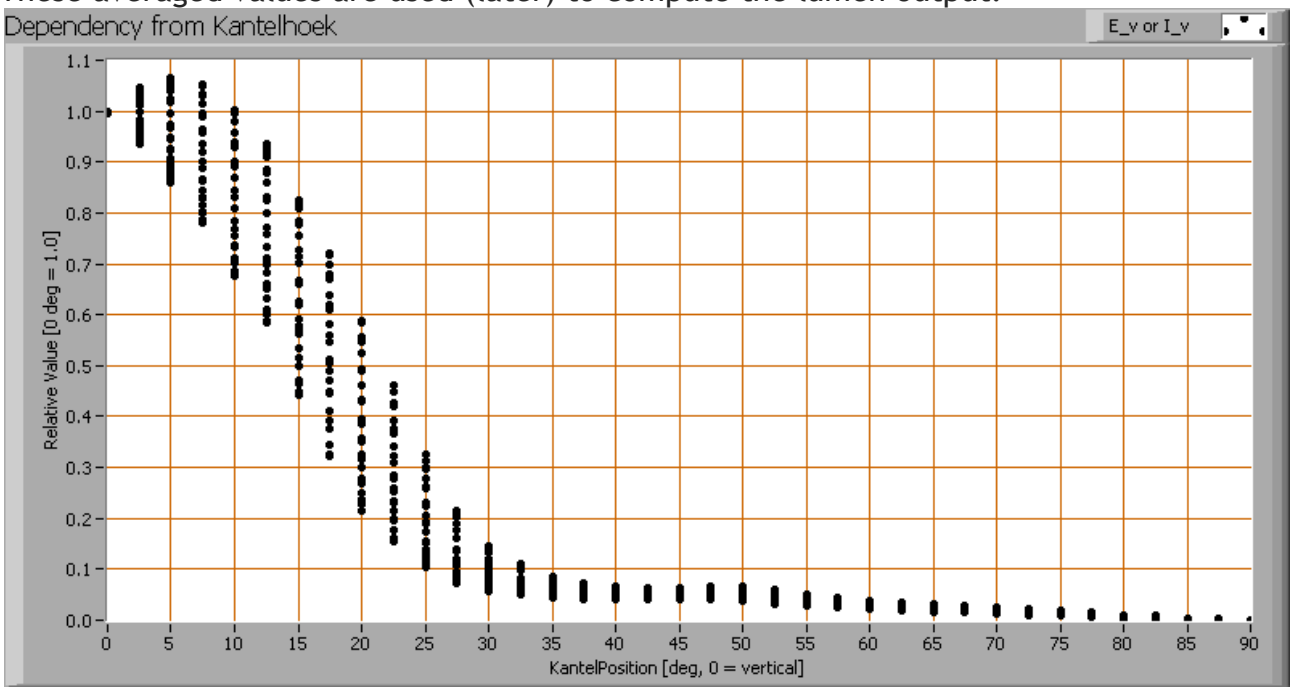
Herewith the plot of the *averaged* luminous intensity Iv as a function of the inclination angle with the light bulb.

Lamp measurement report – 21 Dec 2010



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.

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 36° 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 196 Lm.

Luminous efficacy

The luminous flux being 196 Lm, and the power of the light bulb being 4.0 W, yields a luminous efficacy of 49 Lm/W.

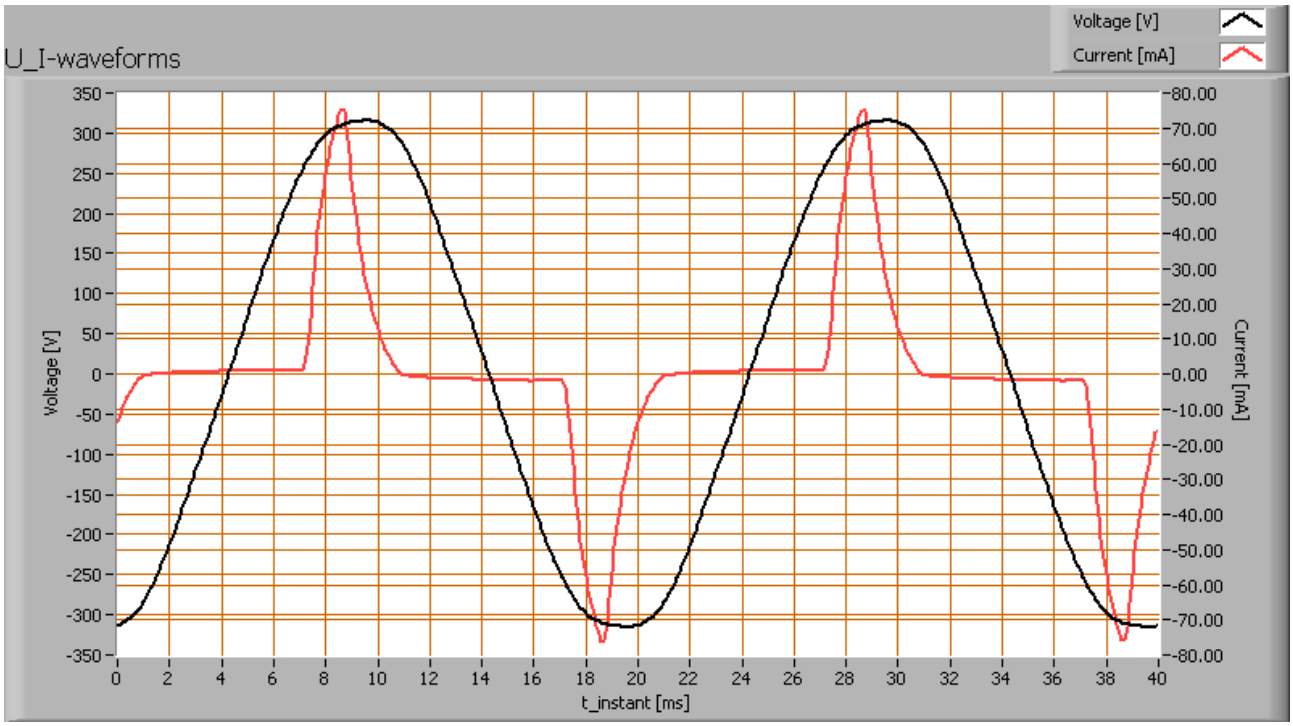
Electrical properties

A power factor of 0.55 means that for every 1 kWh net power consumed, a reactive component of 1.5 kVAr was needed.

Lamp voltage	230 VAC
Lamp current	32 mA
Power P	4.0 W
Apparent power S	7.4 VA
Power factor	0.55

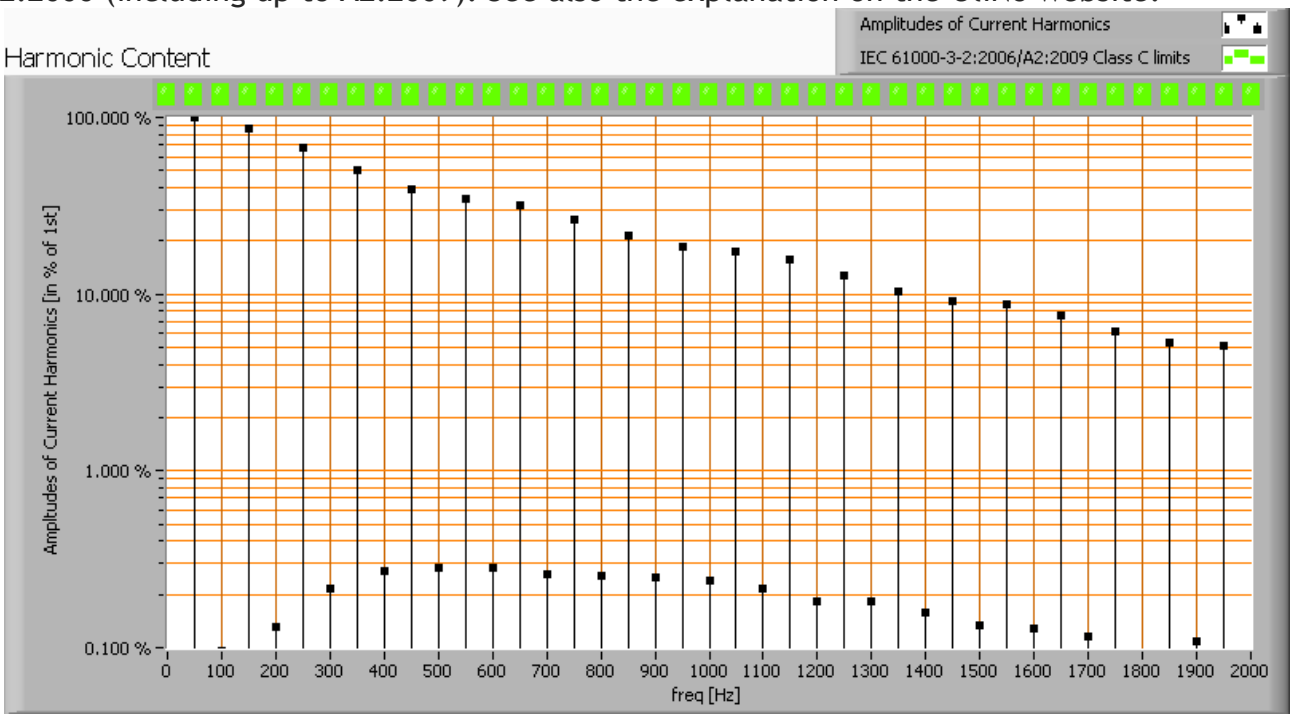
Of this light bulb the voltage across ad the resulting current through it are measured and graphed. See the OliNo site how this is obtained.

Lamp measurement report – 21 Dec 2010



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.

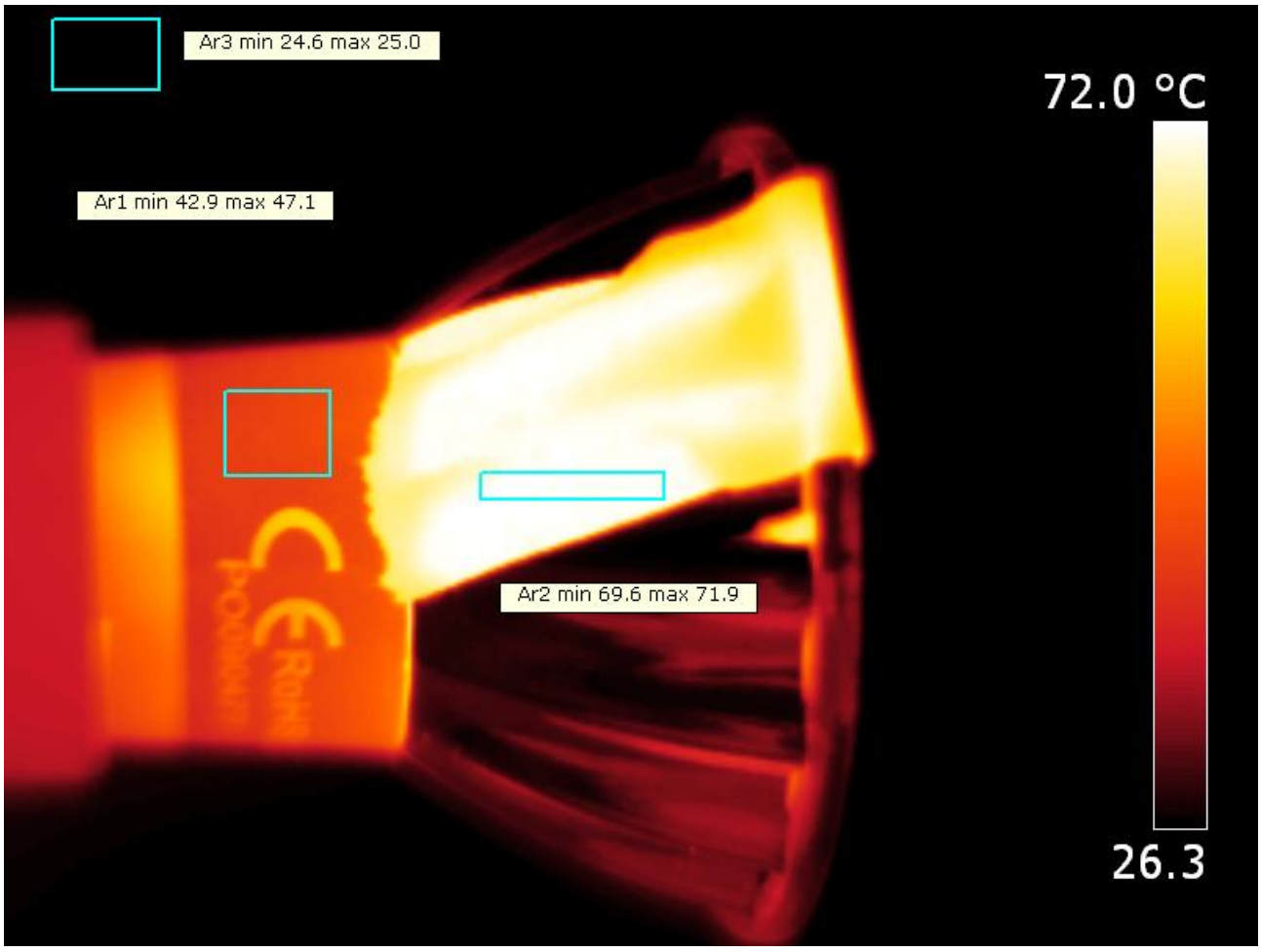


Lamp measurement report – 21 Dec 2010

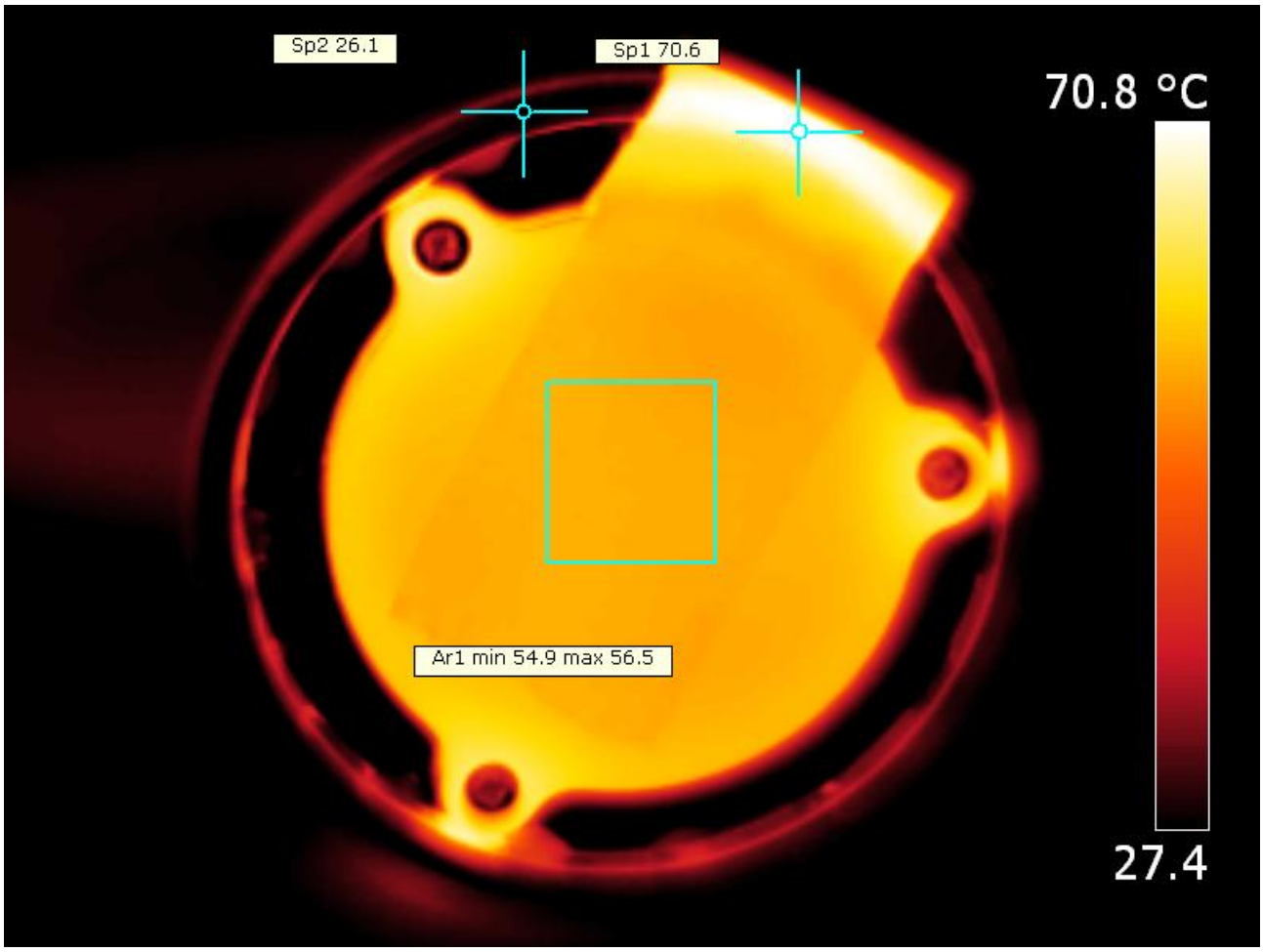
Harmonics in in the current waveform and checked against IEC61000-3-2:2006

There are no limits for the harmonics for lighting equipment <= 25 W.
The Total Harmonic Distortion of the current is computed as 145 %.

Temperature measurements lamp



Lamp measurement report – 21 Dec 2010



IR images from the lamp

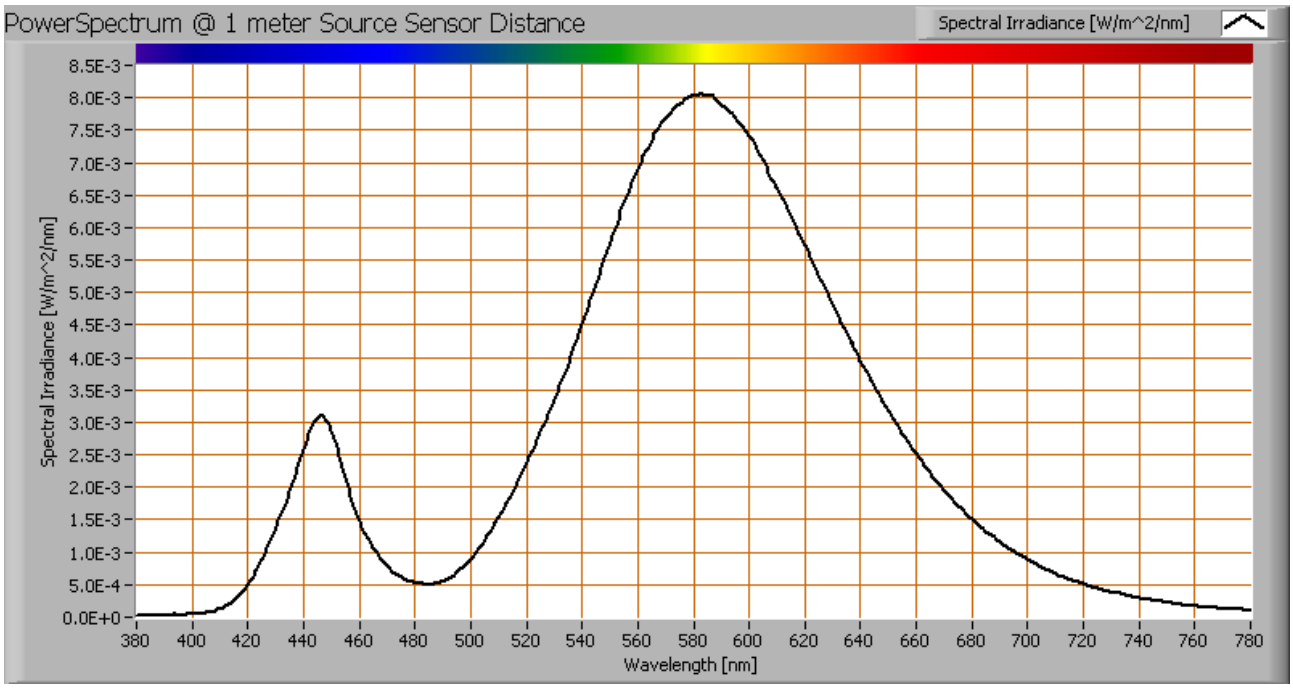
Painting tape was needed as the housing material that is made of polished aluminum is reflecting more the ambient temperature than that it is capable of emitting its own heat. This is visible on the difference in temperature when measured directly on the material and when measured on a piece of painting tape stuck on it.
The metal gets hot up to 70 degrees C which can be lowered by treatment of the outer layer of the aluminum, from polished into rough or matte surface.

status lamp	> 2 hours on
ambient temperature	25 deg C
reflected background temperature	25 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

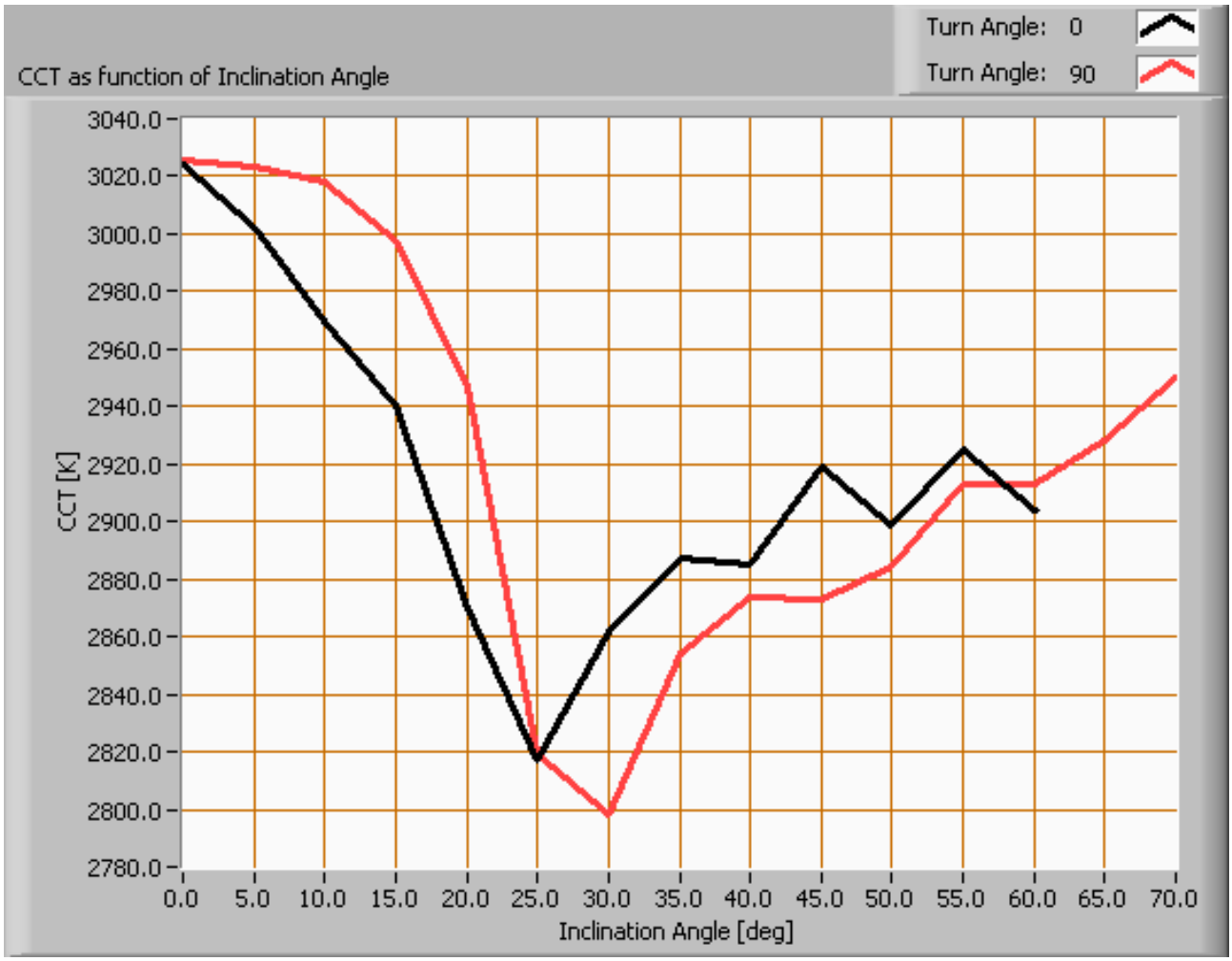
(1) See text for explanation.

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 3025 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.



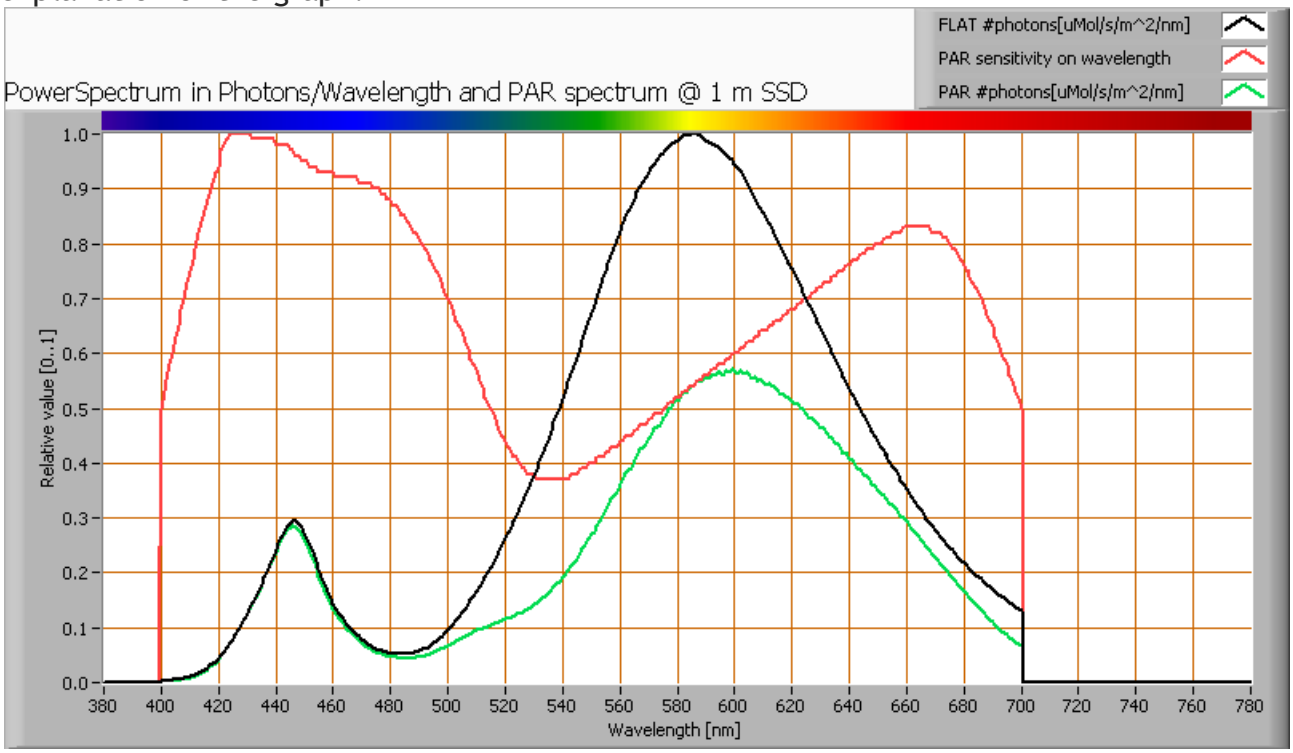
Color temperature as a function of inclination angle.

The measurement of CCT is measured for inclination angles up to 60°. Beyond that angle the illuminance was very low (< 5 lux).
The beam angle is 36°, meaning a 18° inclination angle. In this area most of the light is present. The variation in correlated color temperature in this area is about 5 %.

Lamp measurement report – 21 Dec 2010

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.



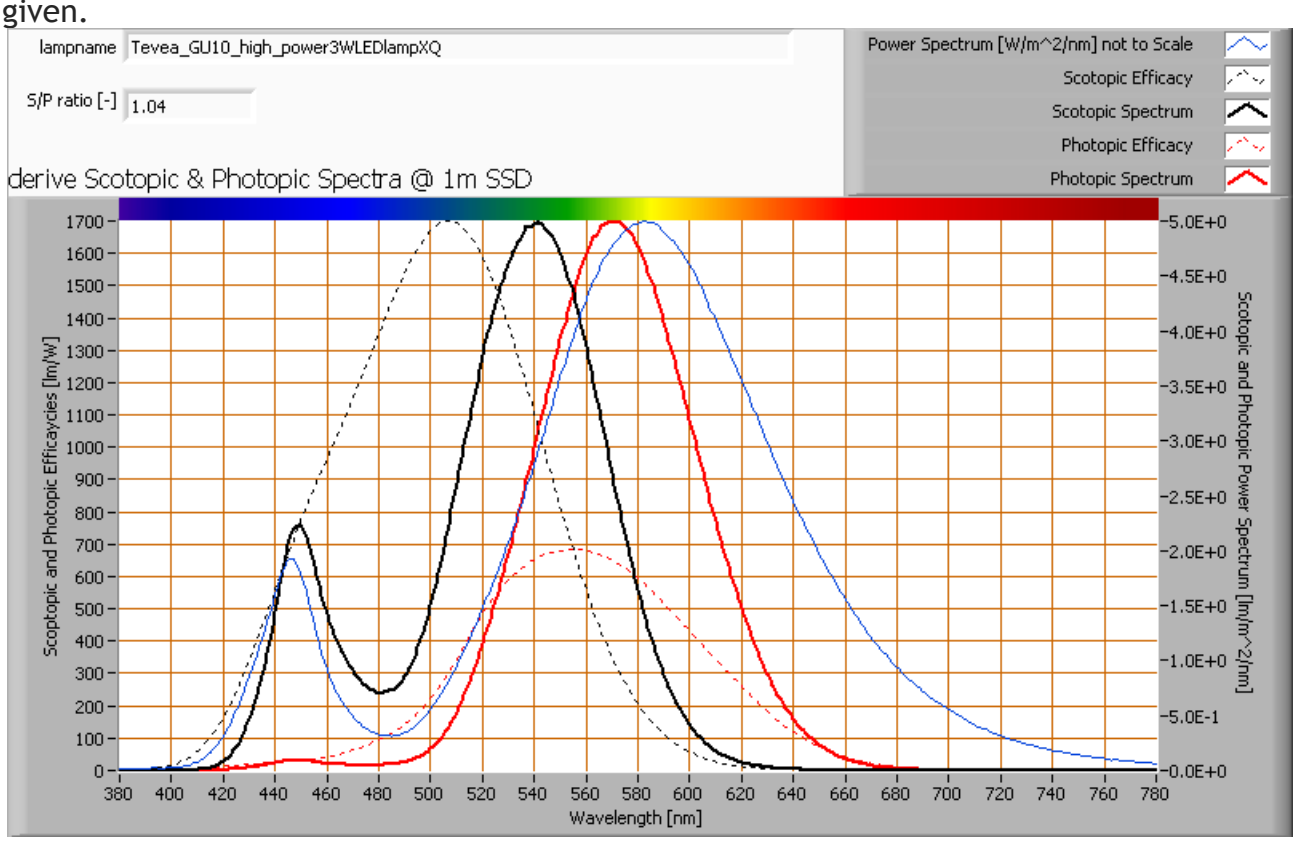
The photon spectrum, then the sensitivity curve and as result the final PAR spectrum of the light of this light bulb

parameter	value	unit
PAR-number	2.9	µMol/s/m²
PAR-photon current	1.5	µMol/s
PAR-photon efficacy	0.4	µMol/s/W

The PAR efficiency is 61 % (valid for the PAR wave length range of 400 – 700 nm). So maximally 61 % 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 %).

S/P ratio

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

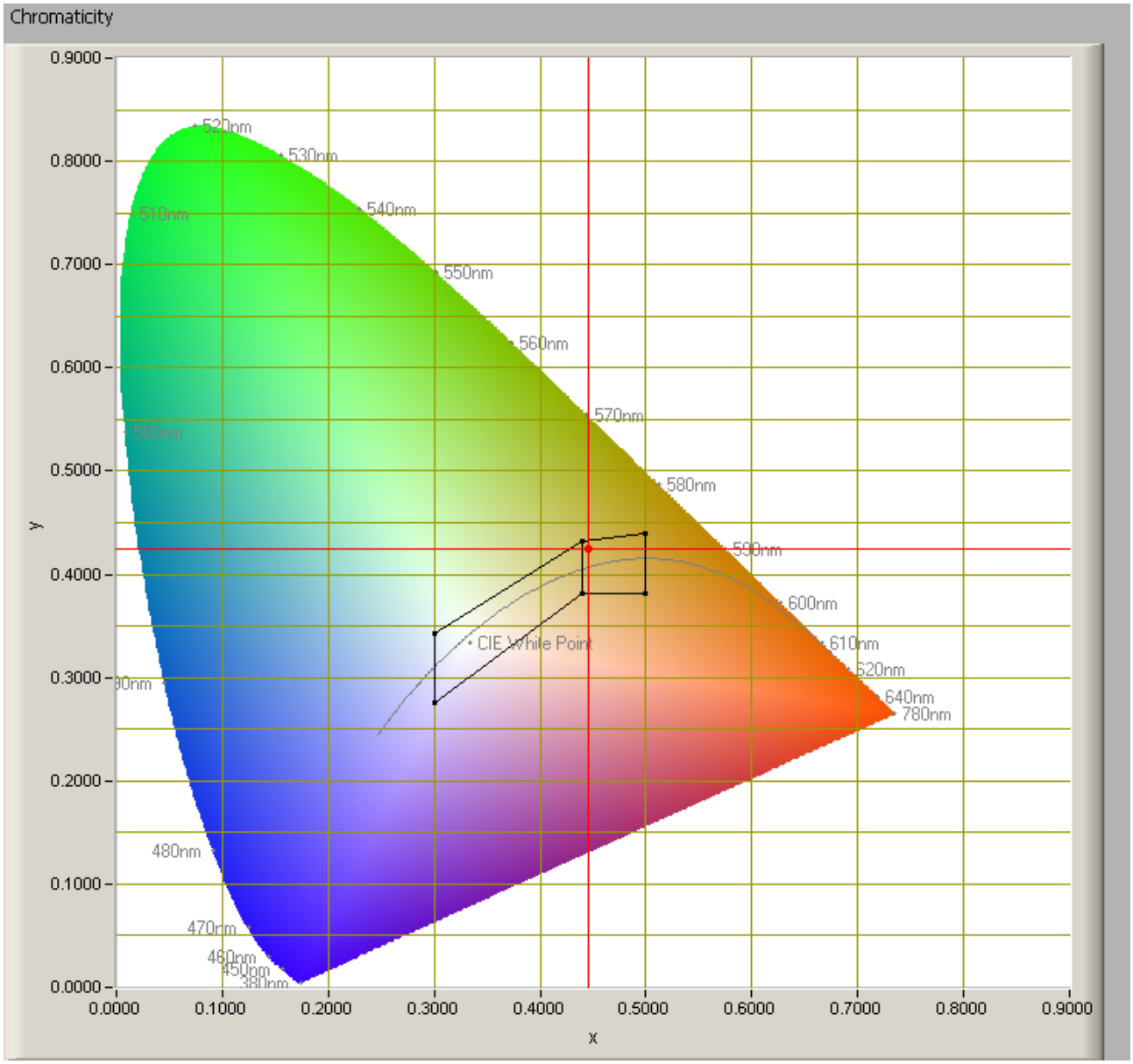


The power spectrum, sensitivity curves and resulting scotopic and photopic spectra (spectra energy content defined at 1 m distance).

The S/P ratio is 1.0.
More info on S/P ratio can be found on the OliNo website.

Lamp measurement report – 21 Dec 2010

Chromaticity diagram

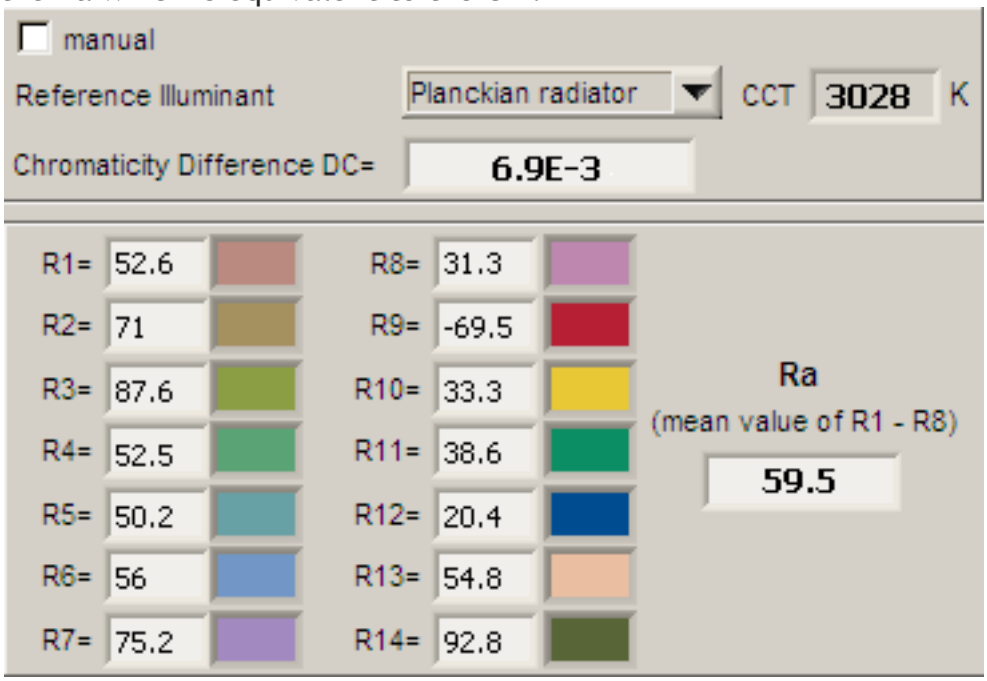


The chromaticity space and the position of the lamp's color coordinates in it.

The light coming from this lamp is inside area of class B (yellow-white). 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=0.4456 and y=0.4249.

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



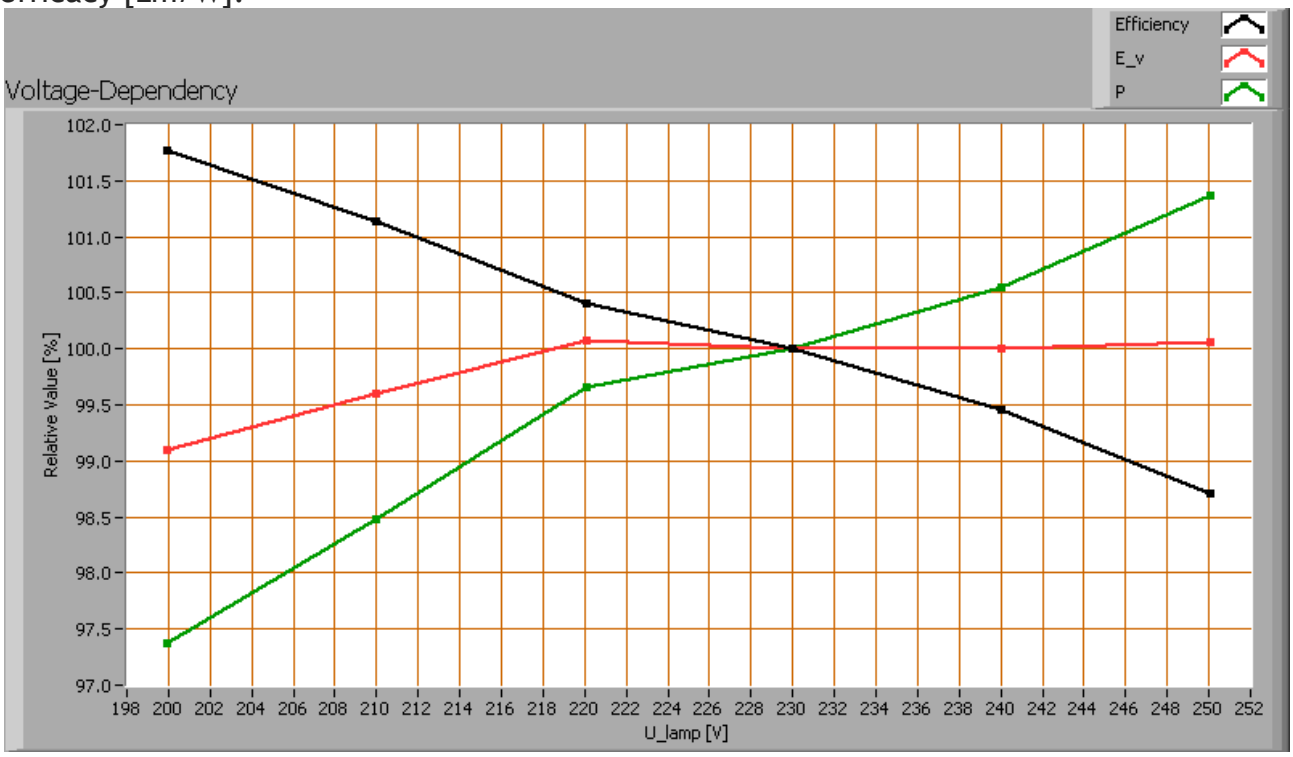
CRI of the light of this lightbulb.

The value of 60 is lower than 80 which is considered a minimum value for indoor usage. Note: the chromaticity difference is 0.0069 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 lamppower P [W] and the luminous

efficacy [Lm/W].



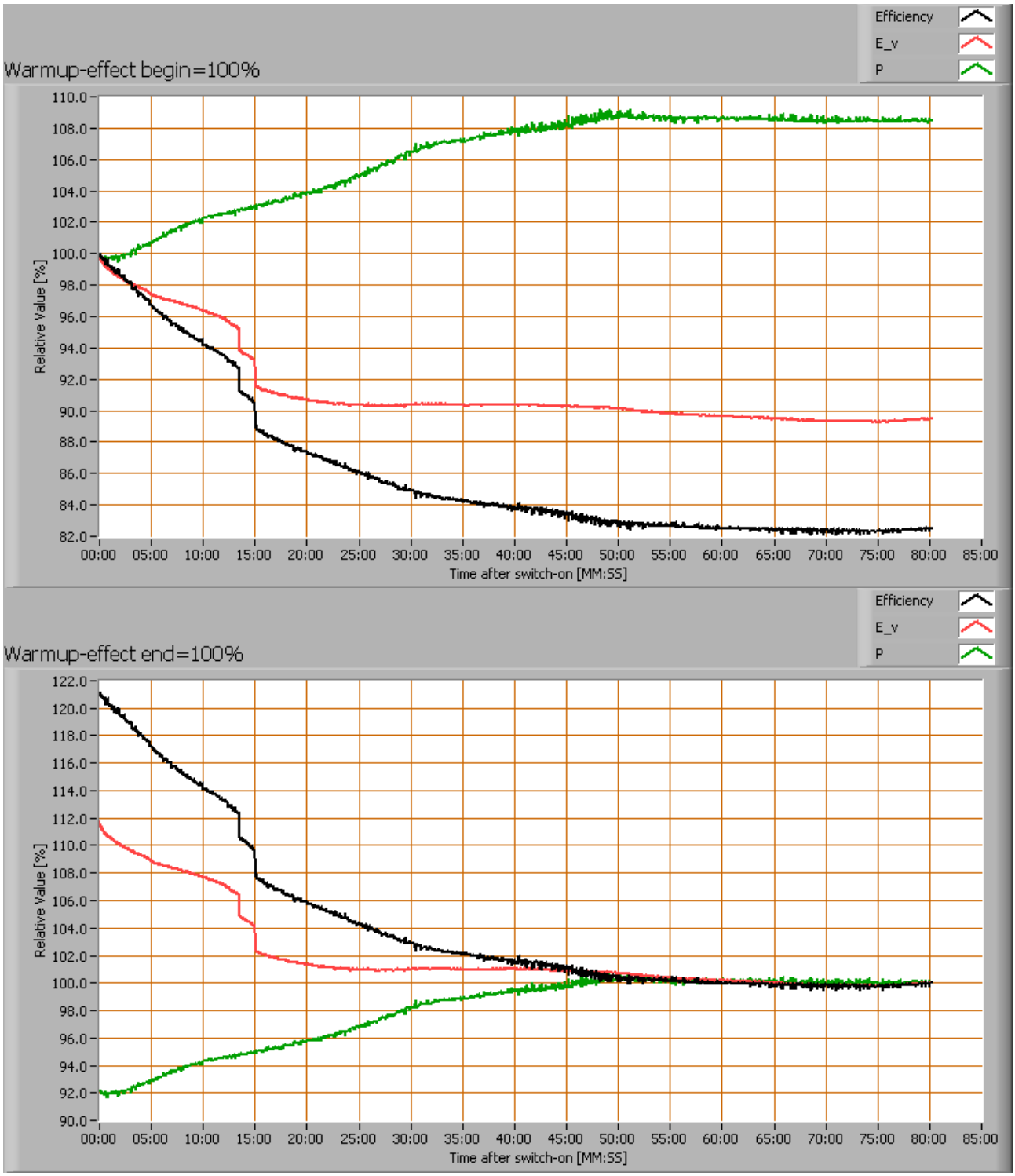
Lamp voltage dependencies of certain light bulb parameters, where the value at 230 V is taken as 100 %.

The illuminance and consumed power do not vary significantly when the voltage is varied between 200 – 250 V.
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 lamppower P [W] and the luminous efficacy [lm/W].

Lamp measurement report – 21 Dec 2010

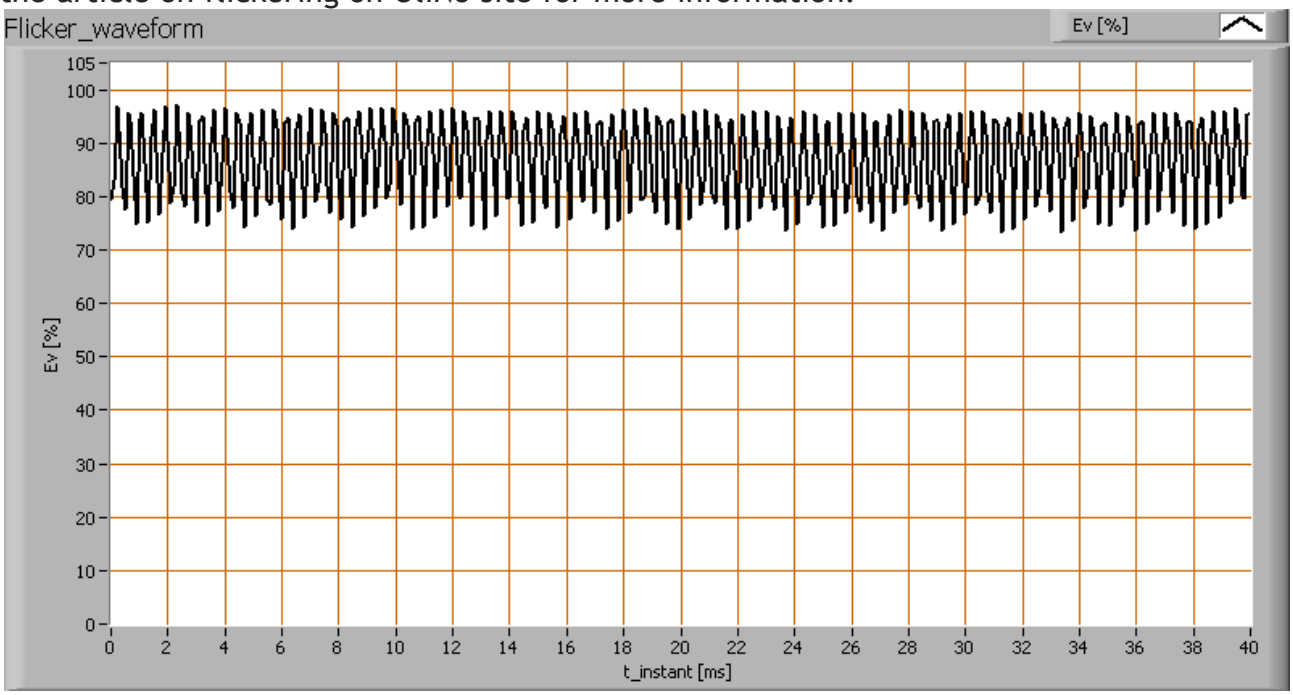


Effect of warming up on different light bulb parameters. At top the 100 % level is put at begin, and at bottom at the end.

The warm up time is about 40 minutes, during which the illuminance decreases with 10 % and the consumed power with 9 %.

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 variartion of the light of the light bulb

parameter	waarde	eenheid
Flicker frequency	2366	Hz
Illuminance modulation index	14	%

The illuminance modulation index is computed as: (max_Ev - min_Ev) / (max_Ev + min_Ev).
Note: a flickering frequency of more than 2000 Hz is not visible at all.

Lamp measurement report – 21 Dec 2010

Disclaimer

The information in this OliNo report is created with the utmost care. Despite this, the information could contain inaccuracies. OliNo cannot be held liable in this instance nor can the data in this report be legally binding.

We strive to adhere to all of the conditions of any copyright holder in the publication of any illustration/article or item. In the event that we unintentionally violate said copyright holder's conditions in our articles, we kindly ask to be contacted here at OliNo so that we can resolve any disputes, issues or misunderstandings.

License