

Lamp measurement report – 29 July 2010

Flood Light 10 W

by
Glo



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Summary measurement data

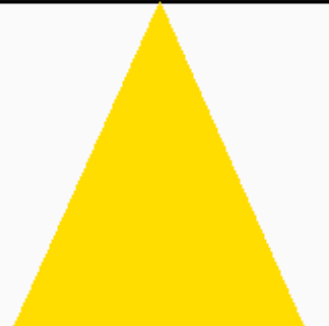
parameter	meas. result	remark
<u>Color temperature</u>	5672 K	Cold white
Luminous intensity I_v	209 Cd	Measured straight underneath the lamp.
Illuminance modulation index	1 %	Measured straight underneath the lamp. Is a measure for the amount of flickering.
Beam angle	112 deg	106° for the C0-C180-plane (crossing the length direction of the lamp, so along the smallest width of the lamp) and 112° for the C90-C270 plane (is along the longest length of the lamp).
Power P	9.3 W	
Power Factor	0.86	For every 1 kWh net power consumed, there has been 0.6 kVAhr for reactive power.
THD	36 %	Total Harmonic Distortion
Luminous flux	496 Lm	
Luminous efficacy	54 Lm/W	
CRI_Ra	68	Color Rendering Index.
Coordinates chromaticity diagram	x=0.3286 and y=0.3518	
Fitting	230V	This lamp is connected to 230 V.
PAR-value	1.8 $\mu\text{Mol/s/m}^2$	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	0.5 $\mu\text{Mol/s/W}_e$	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	1.8	This factor indicates the amount of times more efficient the light of this light bulb is perceived under scotopic circumstances (low environmental light level).
L x W x H external dimensions	114 x 85 x 85 mm	External dimensions of the lamp. Excluding the handle.
W x L luminous area	54 x 44 mm	Dimensions of the luminous area (used in Eulumdat file). This is the surface of the opening of the glassplate at the front, behind which the reflector is seated.
General remarks		<p>The ambient temperature during the whole set of measurements was 25-26 deg C. The temperature of the glass plate gets 15 degrees hotter, the hottest area between the fins of the heatsink gets about 25 degrees hotter, and the side of the housing gets about 22 deg hotter than ambient.</p> <p>Warm up effect: during the warm up time the illuminance decreases with 6 % and the consumed power with almost 5 %.</p> <p>Voltage dependency: the power consumption and illuminance was upon request not tested in a wide range.</p>

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Overview table

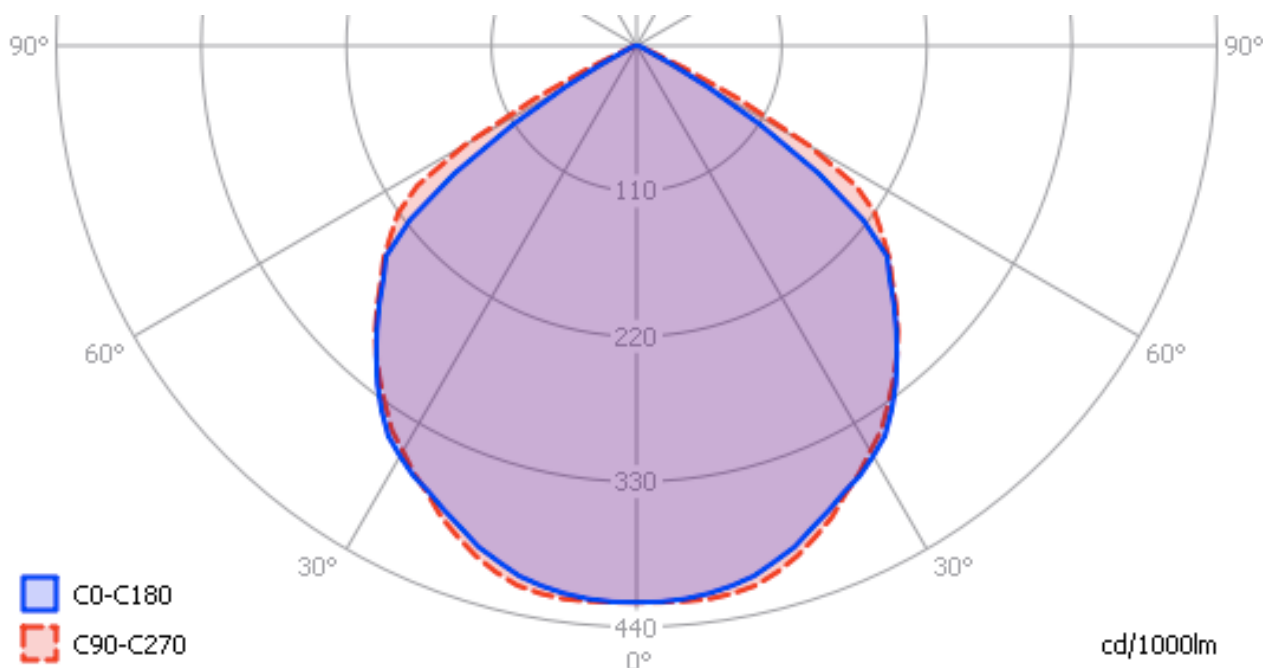
m.	Ø 50%		CO-180: 106° C90-270: 112° 	E (lux)	Luminaire Efficacy
	CO-180	C90-270			54 (lumens per Watt)
0.25	0.66	0.74		3346	Half-peak diam CO-180
0.5	1.32	1.49		837	2.64 x diameter(m)
1	2.64	2.97		209	Half-peak diam C90-270
1.5	3.95	4.46		93	2.97 x diameter(m)
3	7.91	8.91		23	Illuminance
4	10.54	11.88		13	209 / distance ² (lux)
5	13.18	14.85		8	Total Output
					496 (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 70 mm (diagonal length) ≈ 350 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.

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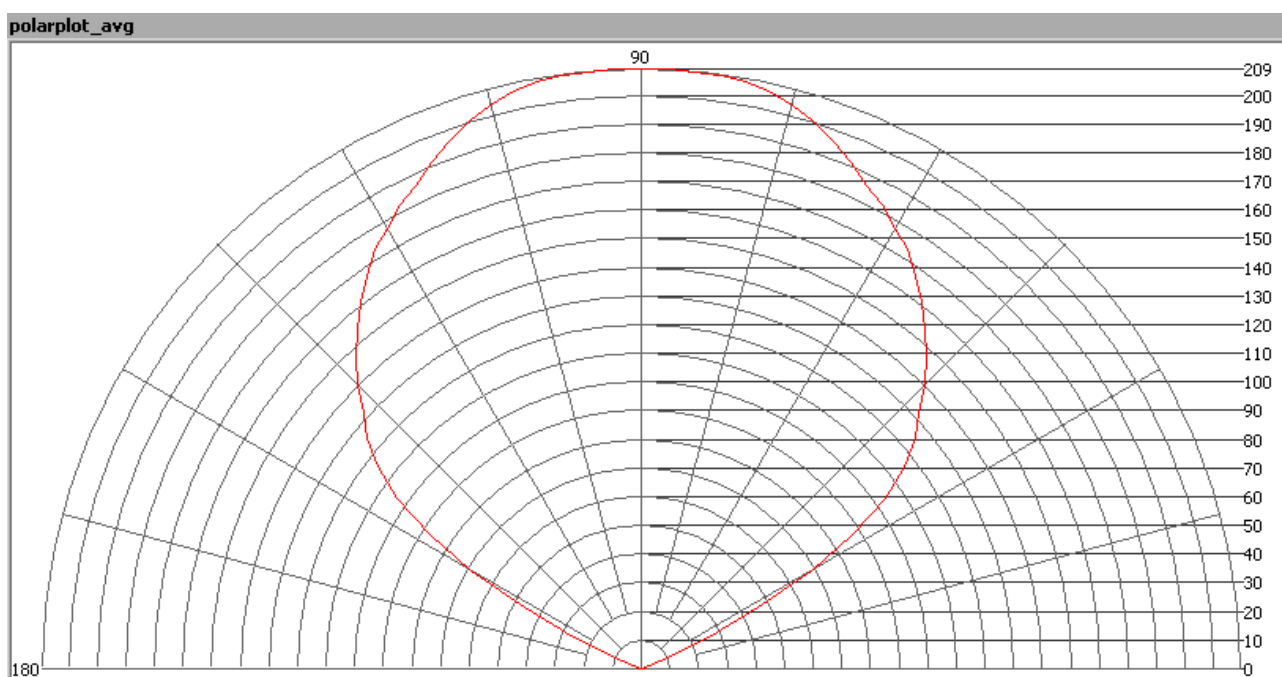
The light diagram giving the radiation pattern.

It indicates the luminous intensity around the light bulb. The plane C90-C270 (along the length direction of the lamp) has a little wider beam than the C0-C180 (crosses the longest side of the lamp).

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.

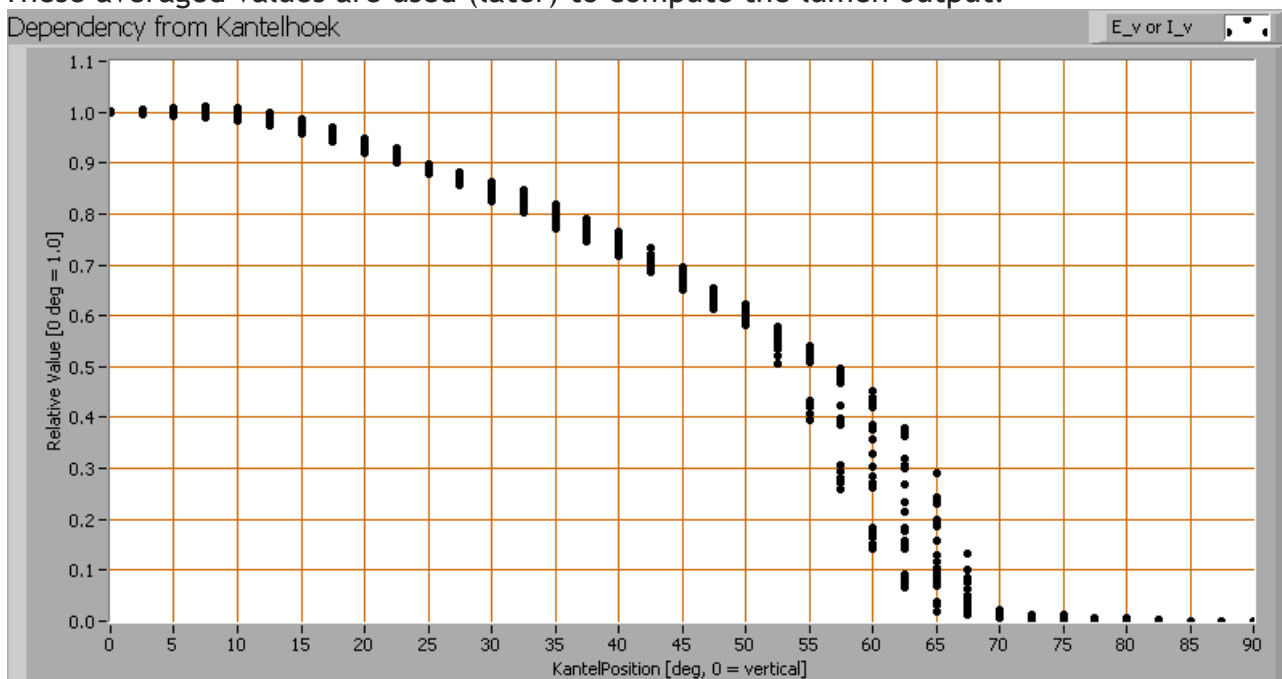
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The radiation pattern of the light bulb.

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 106-112° depending on the C-plane 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 496 Lm.

Luminous efficacy

The luminous flux being 496 Lm, and the power of the light bulb being 9.3 W, yields a luminous efficacy of 54 Lm/W.

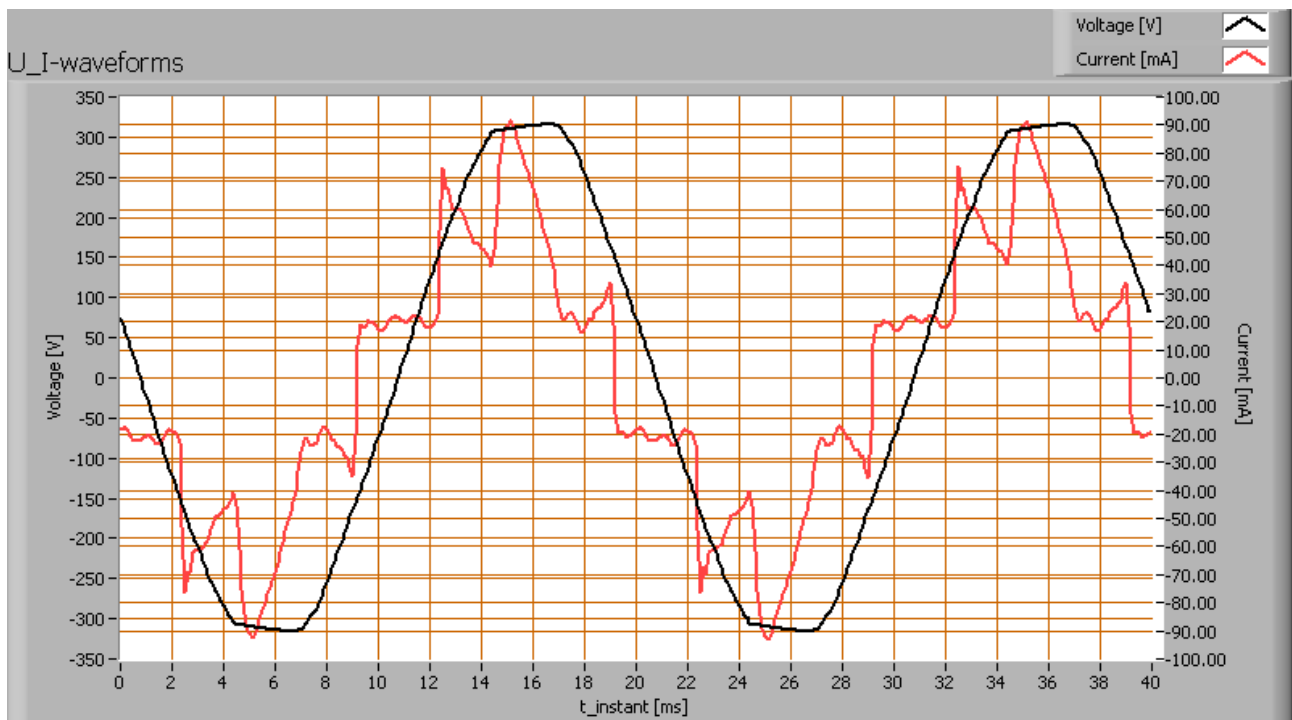
Electrical properties

A power factor of 0.86 means that for every 1 kWh net power consumed, a reactive component of 0.6 kVAr was needed.

Lamp voltage	230 VAC
Lamp current	47 mA
Power P	9.3 W
Apparent power S	10.8 VA
Power factor	0.86

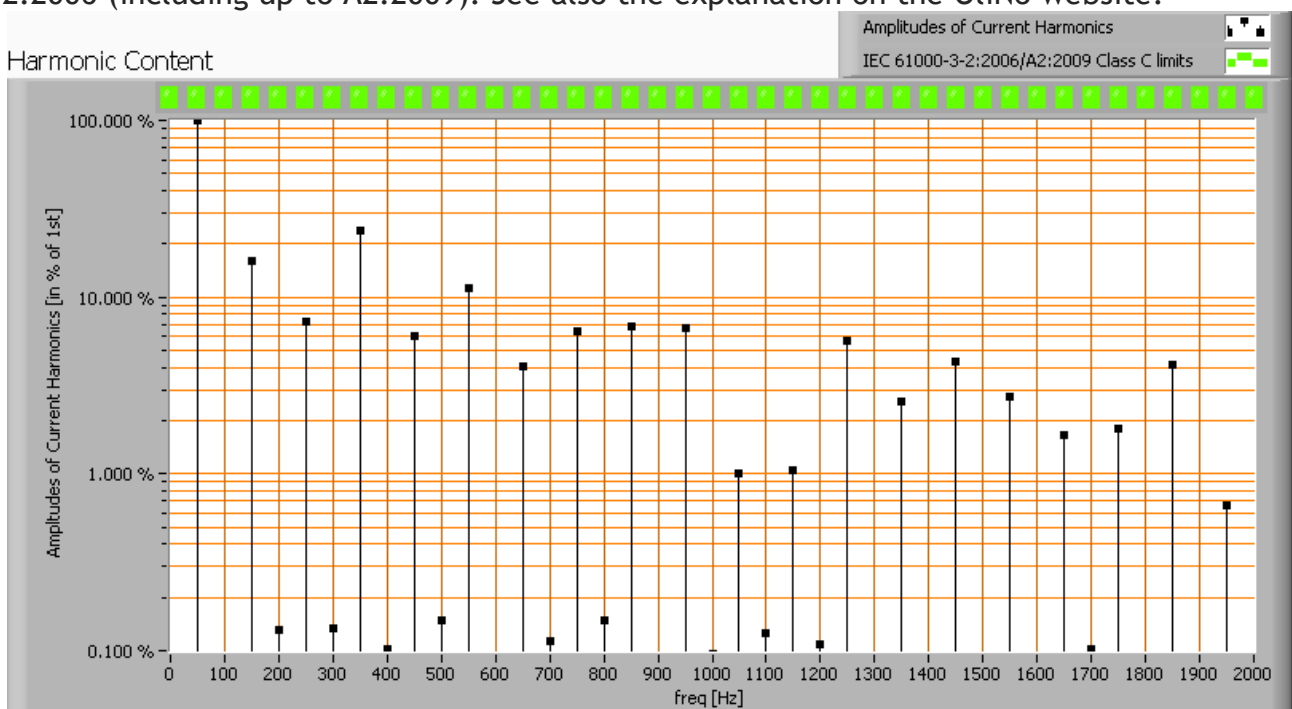
Of this light bulb the voltage across and the resulting current through it are measured and graphed. See the OLiNo site how this is obtained.

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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.



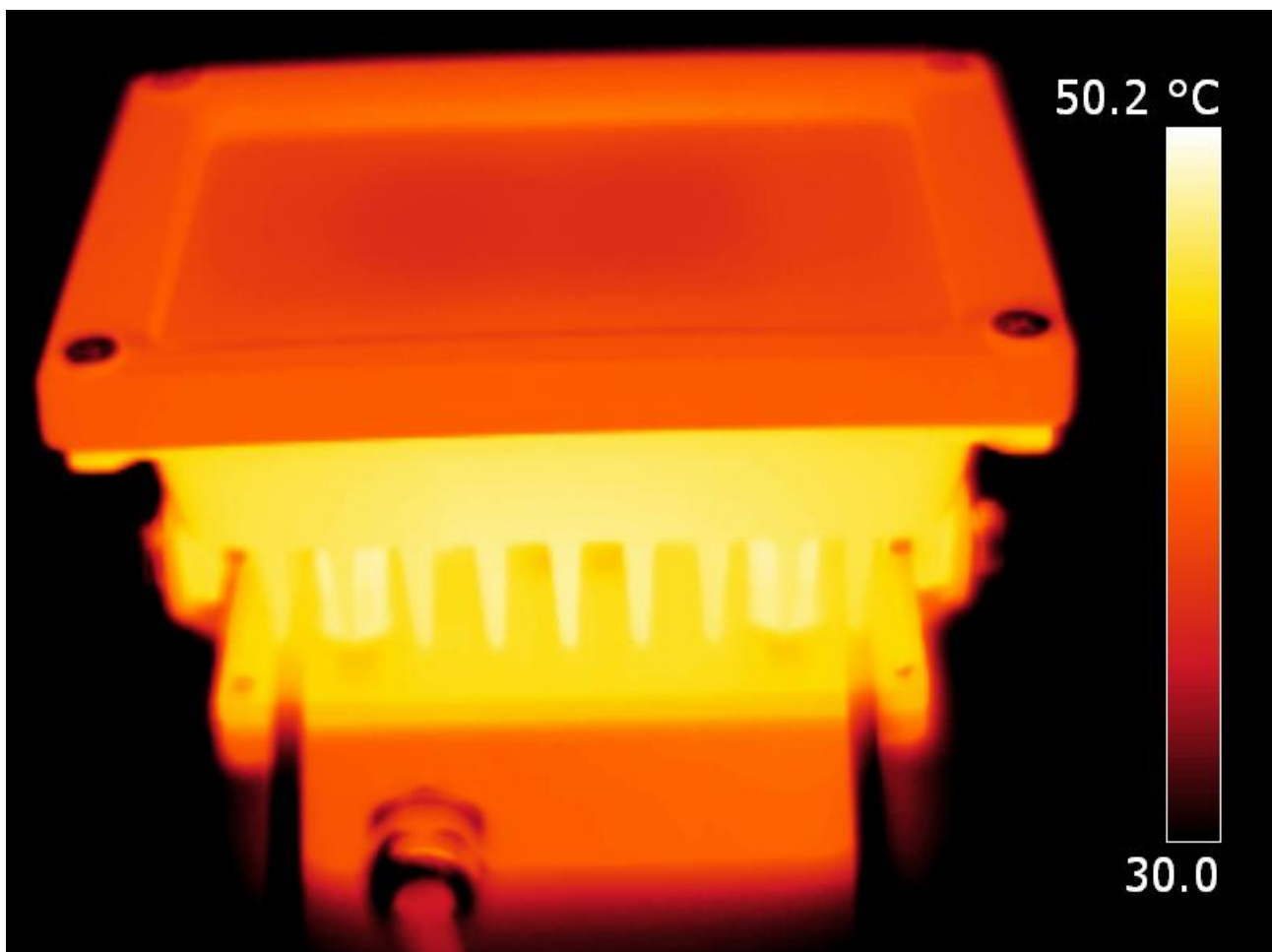
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Harmonics in the current waveform and checked against IEC61000-3-2:2006

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

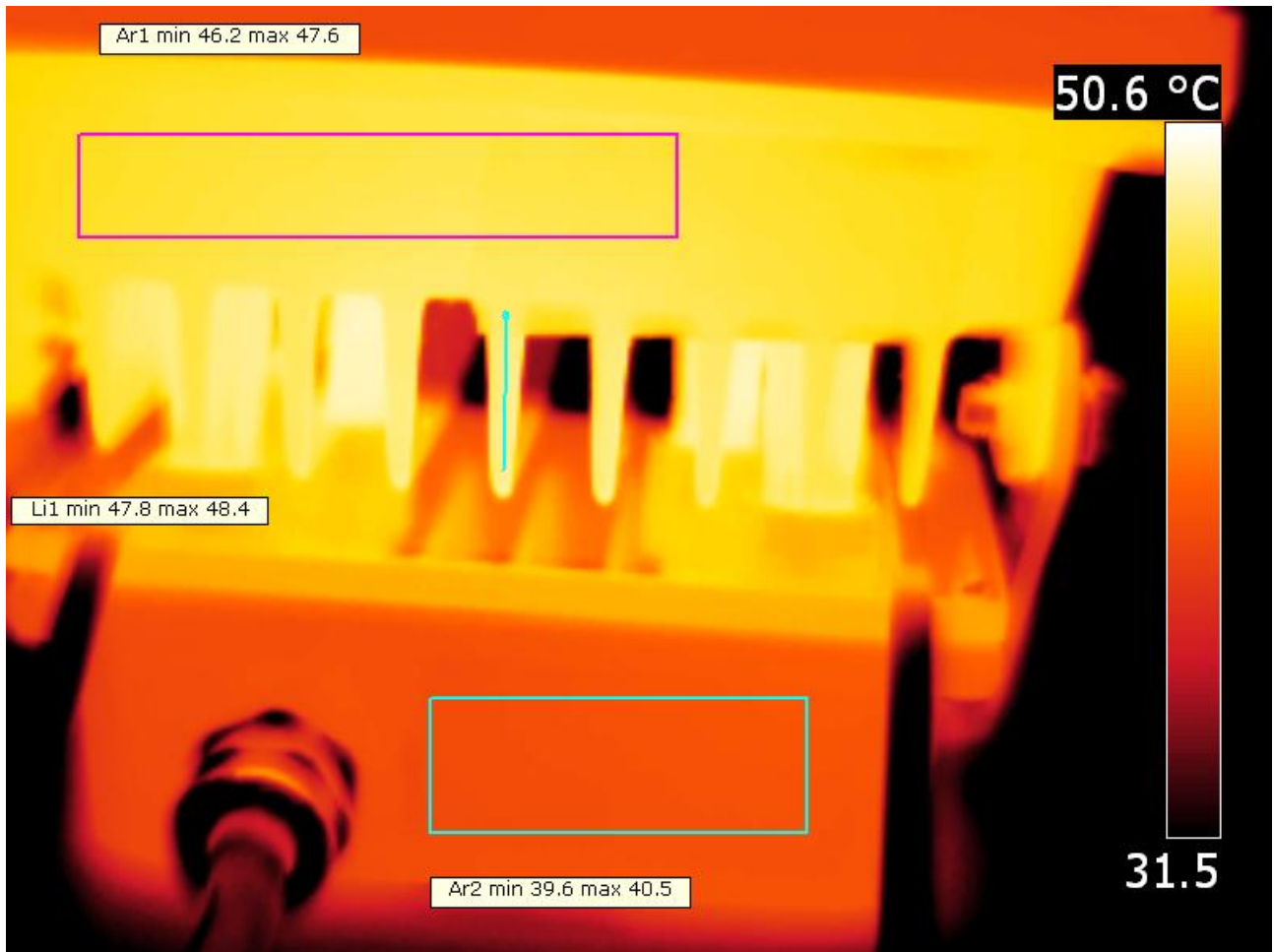
The Total Harmonic Distortion of the current is computed as 36 %.

Temperature measurements lamp



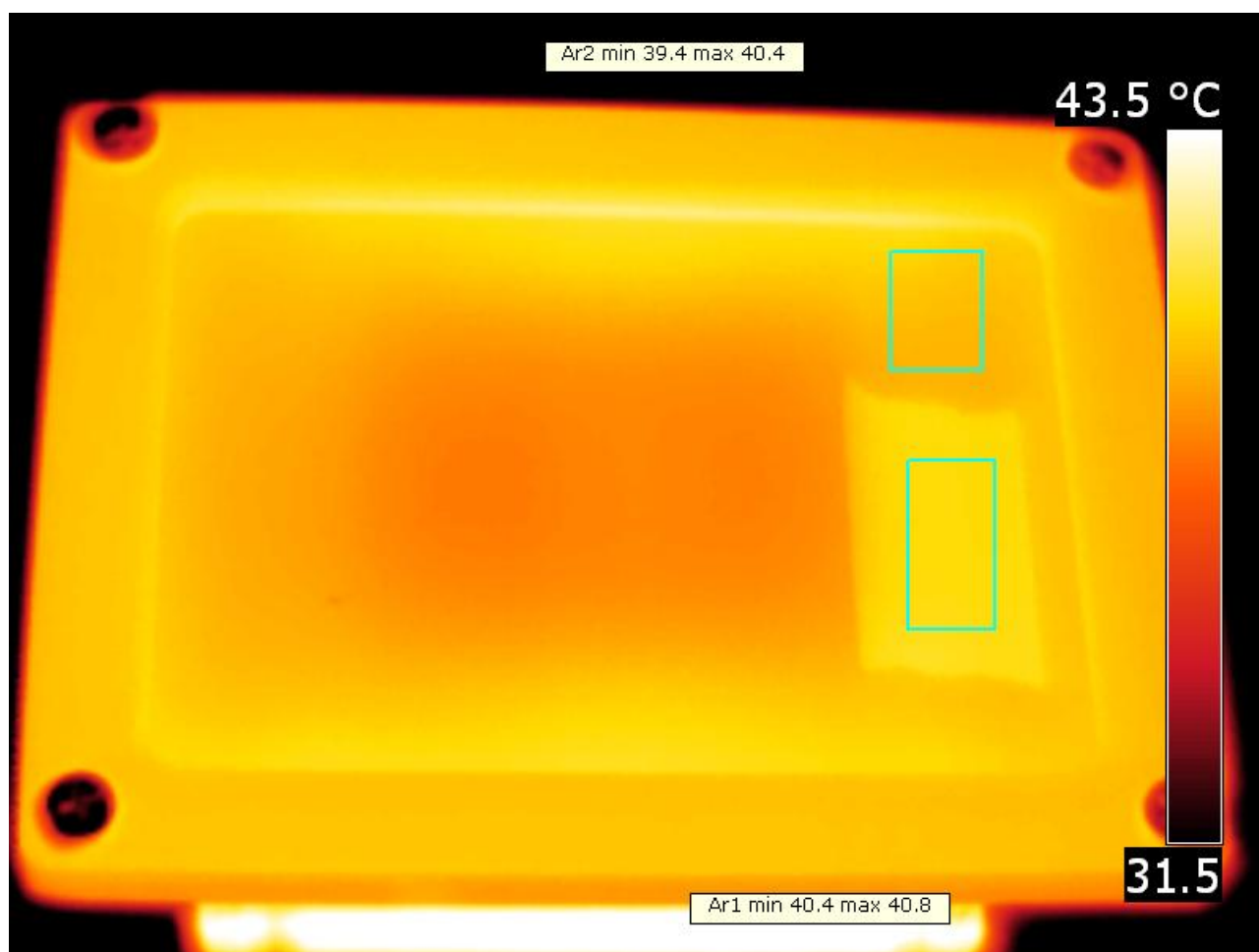
Overview image

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The resulting temperature image of the side of the housing and the fins of the heatsink.

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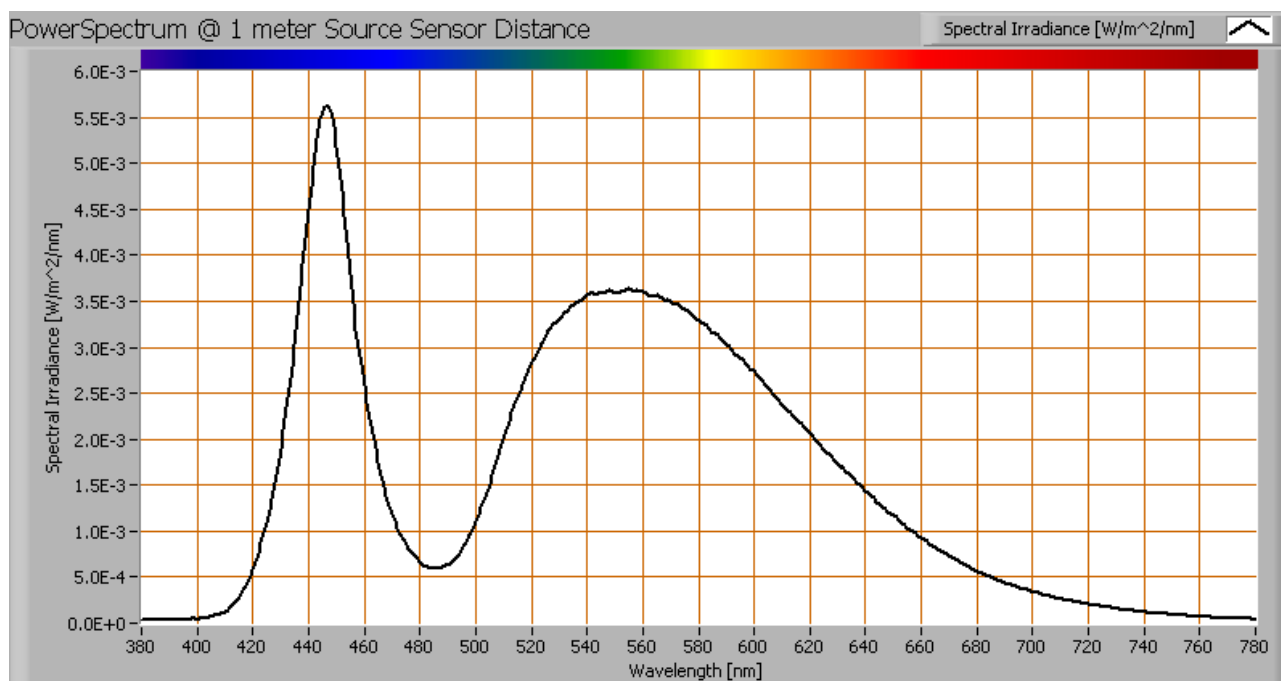
The glassplate has an emissivity of 0.95, only looked at the sides of the glass area.

status lamp	> 2 hours on
ambient temperature	25 deg C
reflected background temperature	25 deg C
camera	Flir T335
emissivity	0.95
measurement distance	0.2 m (heatsink)
IFOV _{geometric}	0.3 mm
NETD (thermal sensitivity)	50 mK

The hottest temperature on the lamp is at the heatsink.

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Color temperature and Spectral power distribution

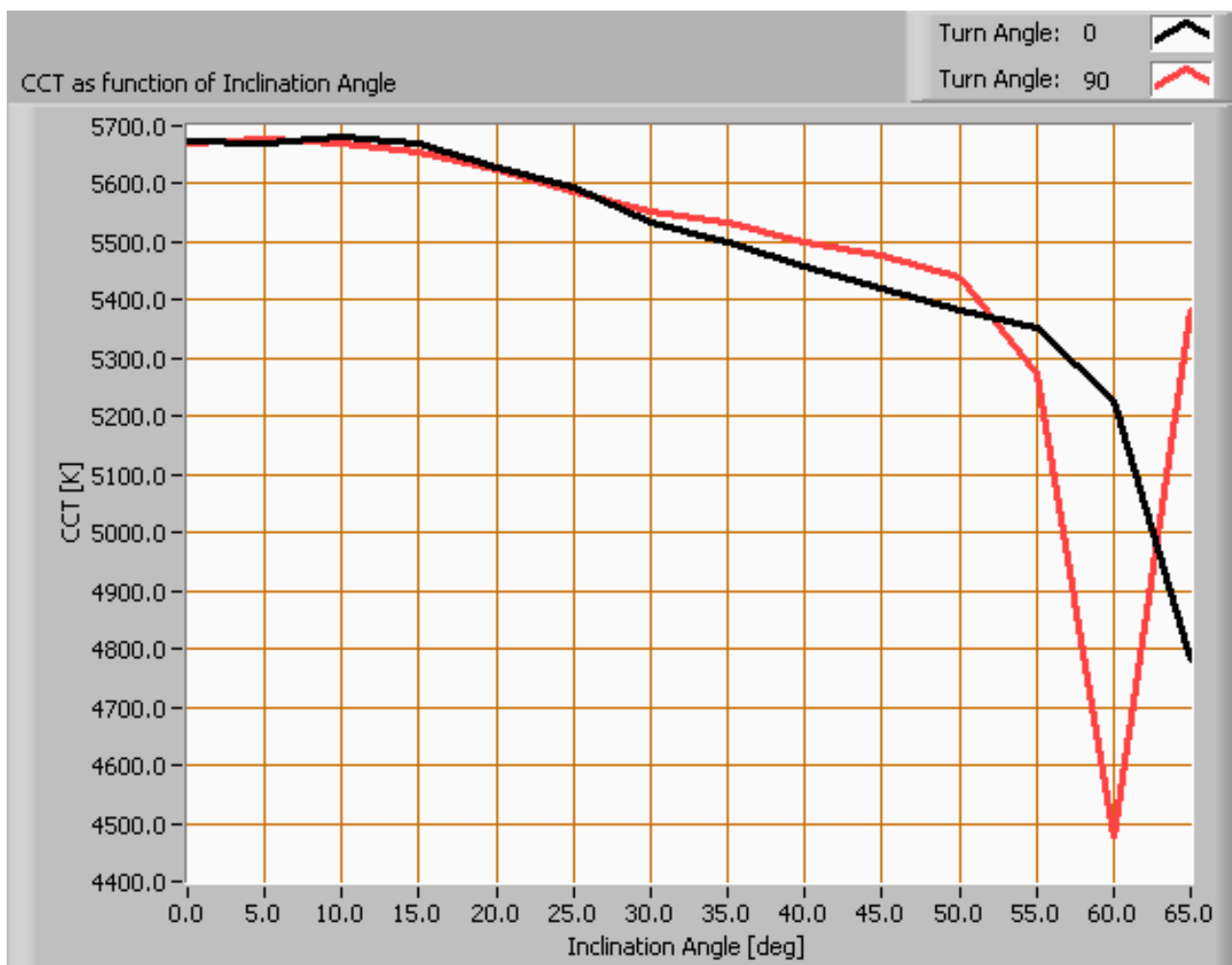


The spectral power distribution of this light bulb, energies on y-axis valid at 1 m distance.

The measured color temperature is about 5675 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.

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Color temperature as a function of inclination angle.

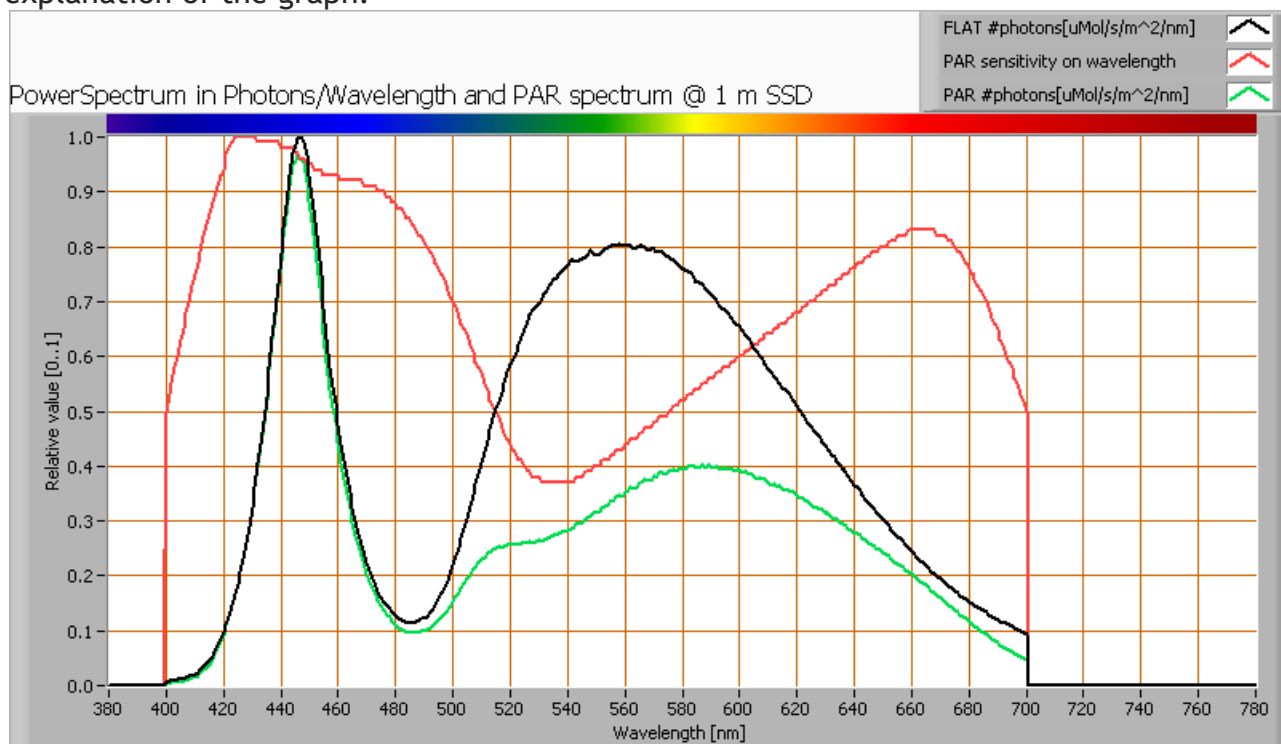
The measurement of CCT is measured for inclination angles up to 65° and beyond the illuminance value gets very low (< 5 lux).

The maximum beam angle is 112°, meaning a 56° inclination angle. In this area most of the light is present. The variation in correlated color temperature in this area is about 7 %.

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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

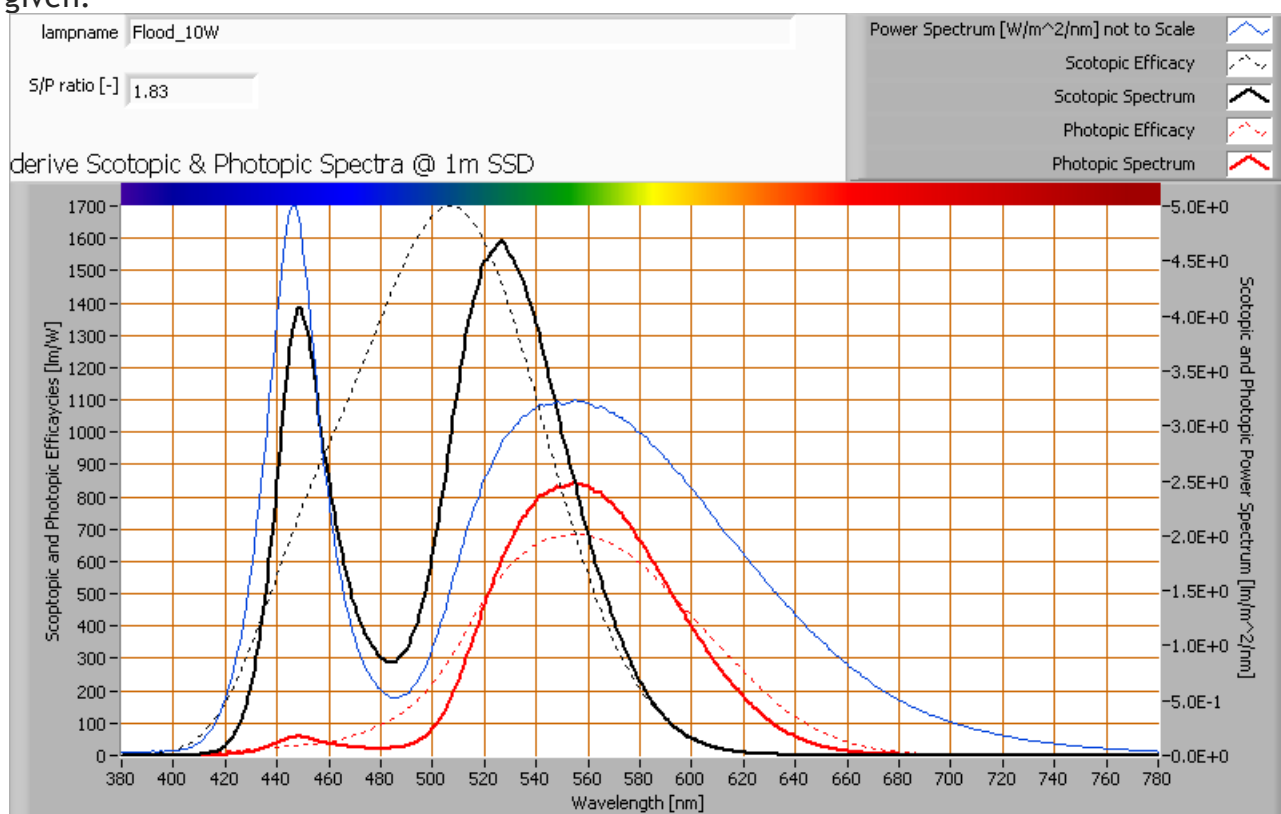
parameter	value	unit
PAR-number	1.8	$\mu\text{Mol/s/m}^2$
PAR-photon current	4.2	$\mu\text{Mol/s}$
PAR-photon efficacy	0.5	$\mu\text{Mol/s/W}$

The PAR efficiency is 64 % (valid for the PAR wave length range of 400 - 700 nm). So maximally 64 % 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.



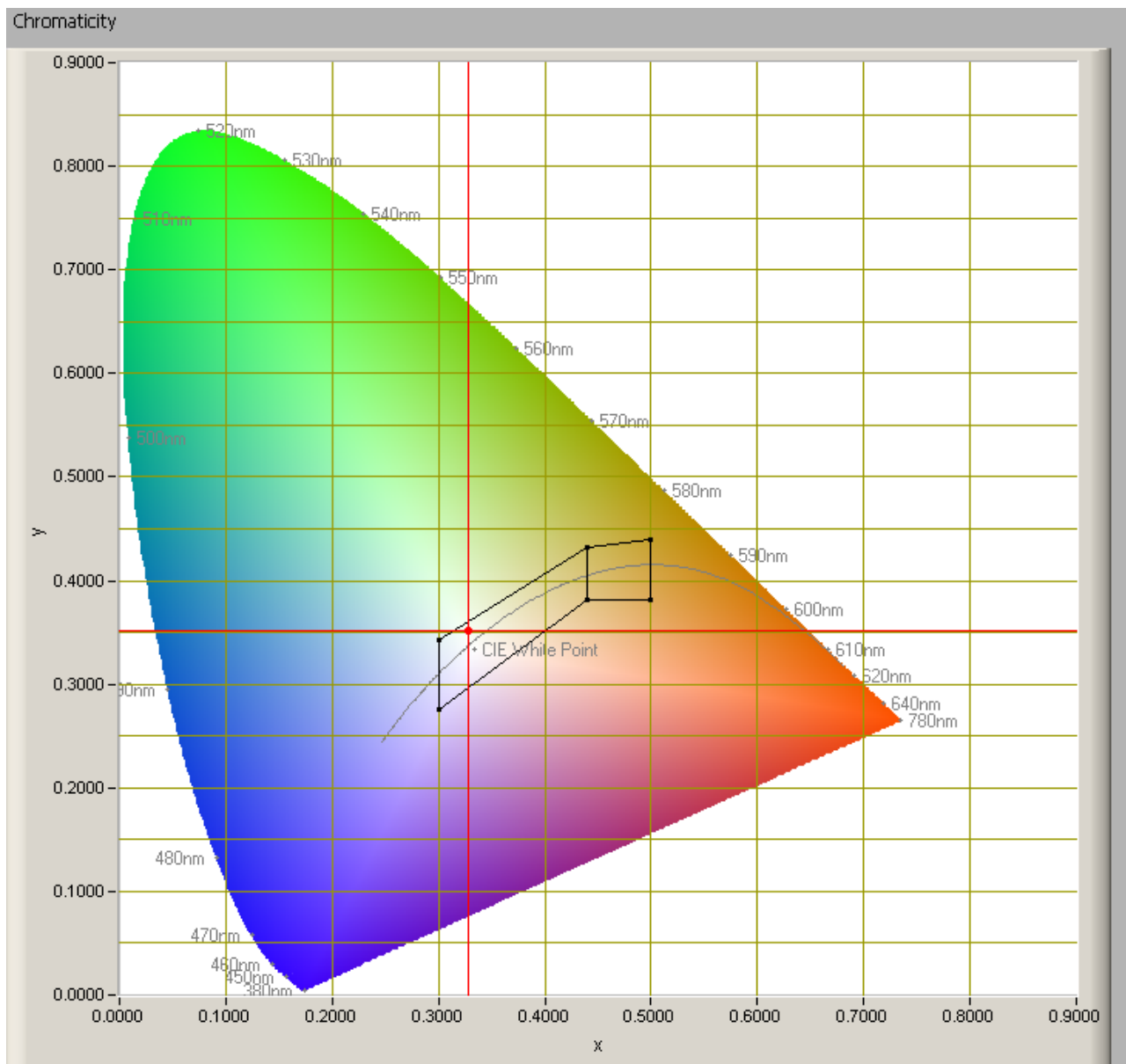
The power spectrum, sensitivity curves and resulting scotopic and photopic spectra (spectra energy content defined at 1 m distance).

The S/P ratio is 1.8.

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 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 $x=0.3286$ and $y=0.3518$.

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

☐ manual

Reference Illuminant: Planckian radiator CCT: 5672 K

Chromaticity Difference DC= 4.1E-3

R1= 65.2		R8= 56.3	
R2= 71.8		R9= -39.9	
R3= 76		R10= 32.6	
R4= 69.4		R11= 65.7	
R5= 66.5		R12= 36.9	
R6= 62		R13= 65.4	
R7= 78.9		R14= 86.4	

Ra
(mean value of R1 - R8)
68.3

CRI of the light of this lightbulb.

The value of 68 is lower than 80 which is considered a minimum value for indoor usage.

Note: the chromaticity difference is 0.0041 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.

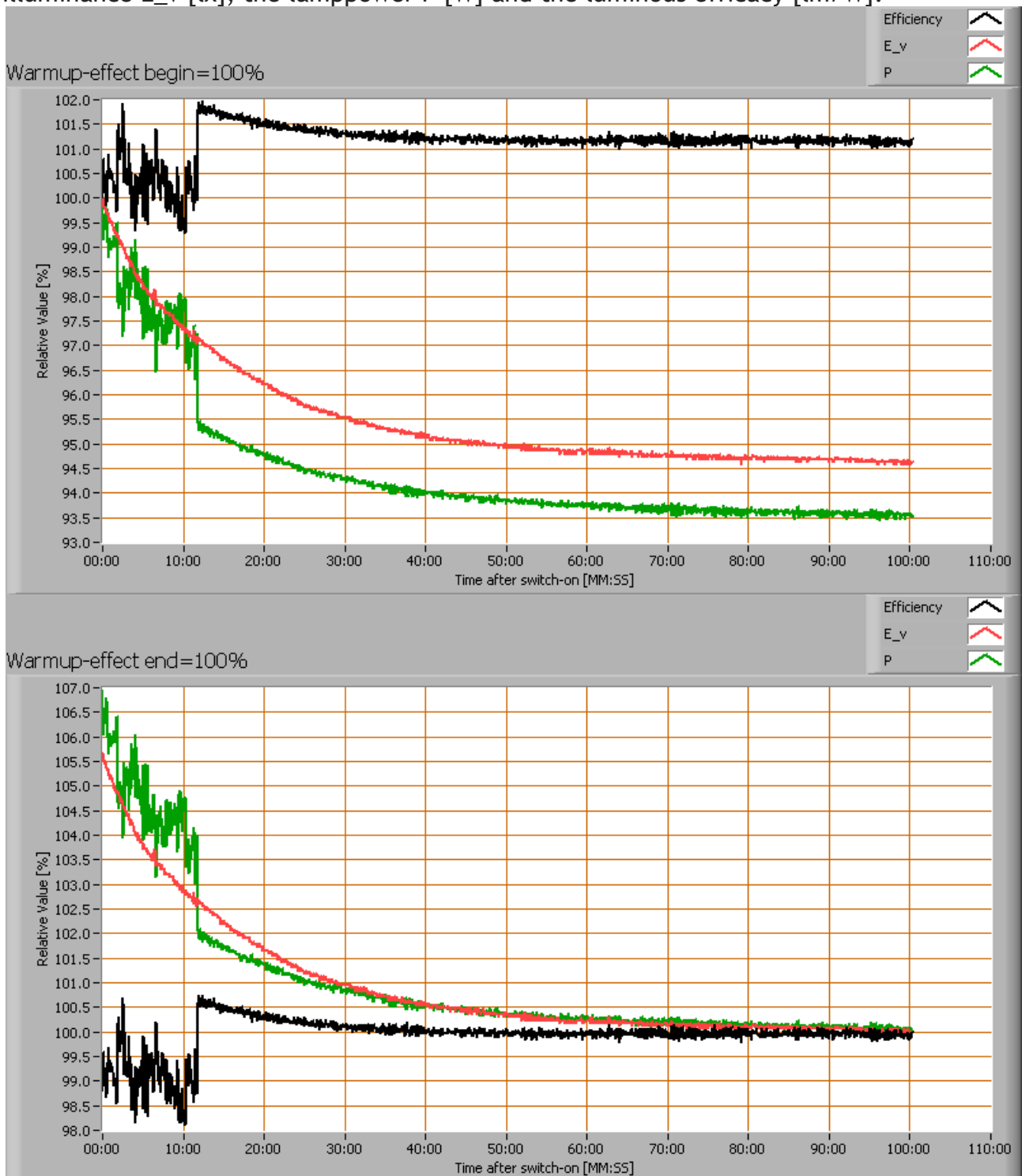
Voltage dependency

The dependency of a number of lamp parameters on the lamp voltage is not determined.

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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].



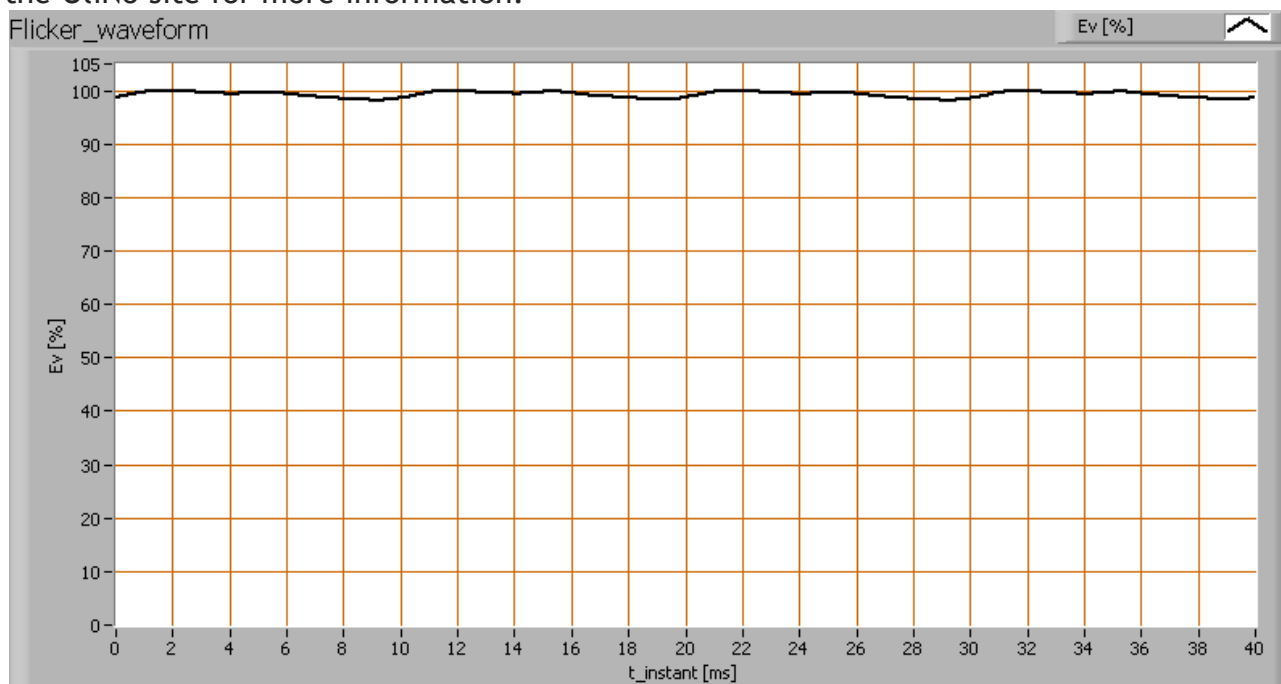
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Effect of warming up on different light bulb parameters. At top the 100 % level is put at begin, and at bottom at the end.

The warm up time is about 40 minutes. During that time the illuminance decreases with 6 % and the consumed power with about 5 %.

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: $(\max_Ev - \min_Ev) / (\max_Ev + \min_Ev)$.



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