Lamp measurement report – 21 Dec 2010

LVS C87 Downlighter

by

Ledverlichting Soest

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Summary measurement data

parameter	meas. result	remark
Color temperature	2904 K	Warm white
Luminous intensity I_v	375 Cd	Measured straight underneath the lamp.
Illuminance modulation index	43 %	Measured straight underneath the lamp. Is a measure for the amount of flickering.
Beam angle	67 deg	67° for all C-planes.
Power P	19.9 W	
Power Factor	0.95	For every 1 kWh net power consumed, there has been 0.3 kVAhr for reactive power.
THD	20 %	Total Harmonic Distortion
Luminous flux	600 Lm	
Luminous efficacy	30 Lm/W	
EU-label classification	B	The energy class, from A (more efficient) to G (least efficient).
CRI_Ra	70	Color Rendering Index.
Coordinates chromaticity diagram	x=0.4479 and y=0.4139	
Fitting	230V	This lamp is connected with help of an external power supply to the 230 V grid voltage.
PAR-value	3.3 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	0.3 µMol/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 (ow environmental light level).
D x H external dimensions	190 x 90 mm	External dimensions of the lamp.
D luminous area	140 mm	Dimensions of the luminous area (used in Eulumdat file). This is the diameter of the reflector at the front.
General remarks		The ambient temperature during the whole set of illuminance measurements was 23.6-25.2 deg C. The temperature of the hottest areas get about 22 degrees hotter. Warm up effect: during the warm up time the illuminance decreases with 11 % and the consumed power with about 2 %. Voltage dependency: the power consumption and illuminance do not vary significantly when the power voltage varies between 200-250 V. At the end of the report an additional photo.

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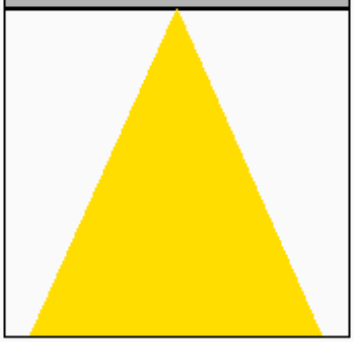
Overview table

m.	Ø 50% C0-180	Ø 50% C90-270
0.25	0.33	0.33
0.5	0.66	0.66
1	1.32	1.32
1.5	1.98	1.98
3	3.97	3.97
4	5.29	5.29
5	6.61	6.61

C0-180: 67°
C90-270: 67°



E (lux)
6006
1502
375
167
42
23
15

Luminaire Efficacy
30 (lumen per Watt)
Half-peak diam C_{0-180}
1.32 x diameter(m)
Half-peak diam C_{90-270}
1.32 x diameter(m)
Illuminance
375 / distance² (lux)
Total Output
600 (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 140 mm ≈ 700 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 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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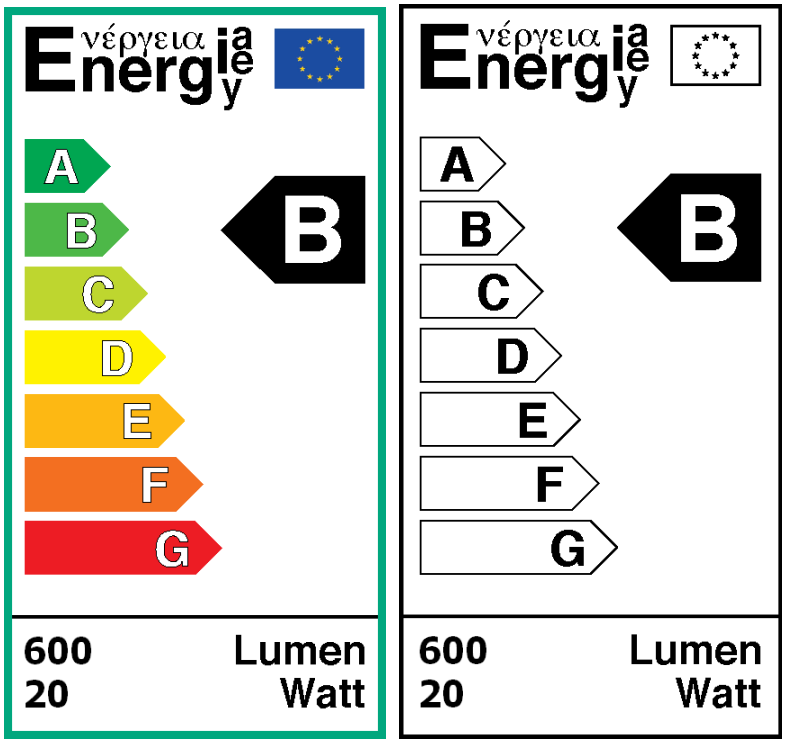
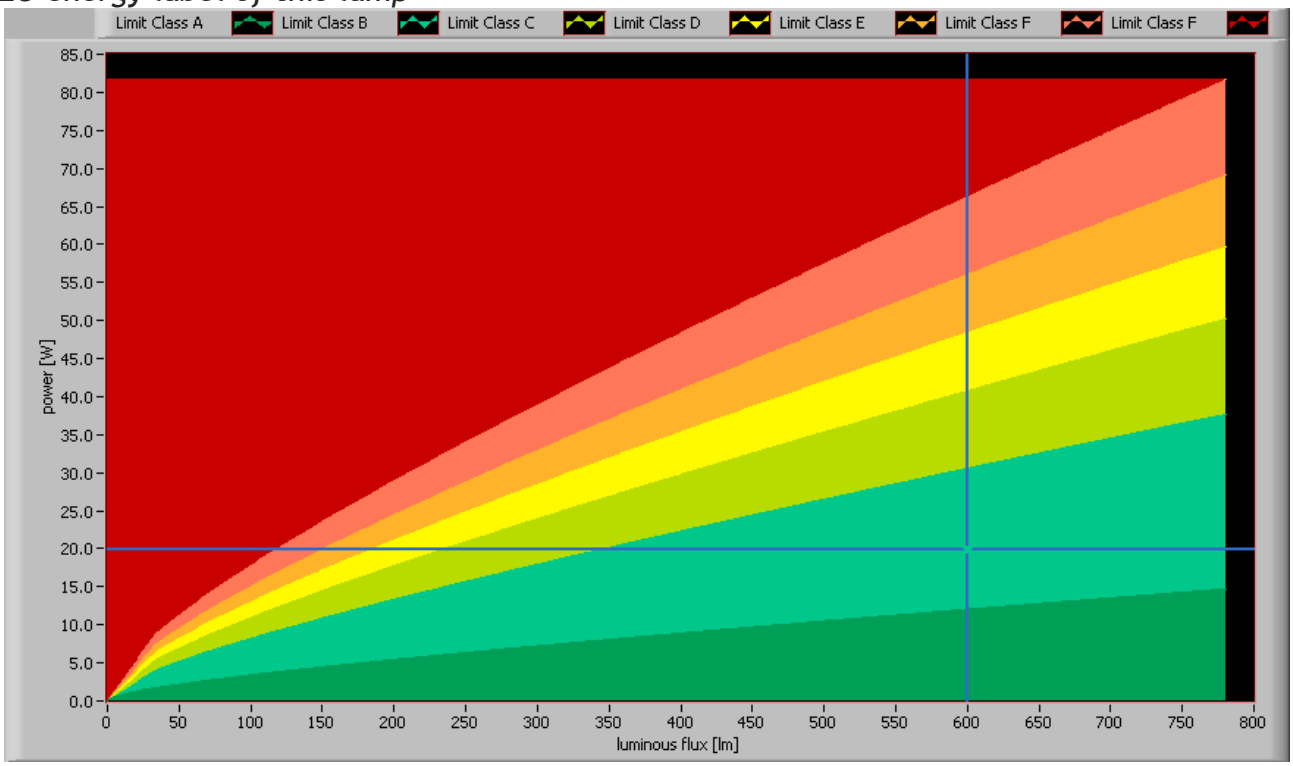


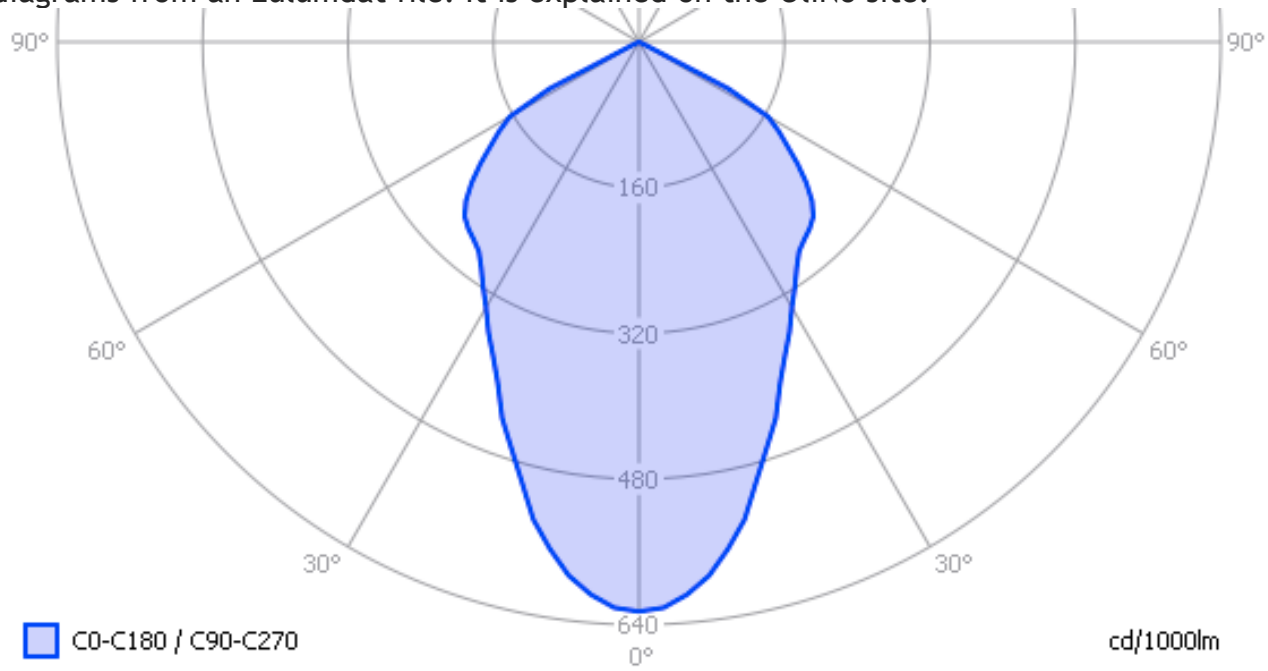
EU energy label of this lamp



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

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.

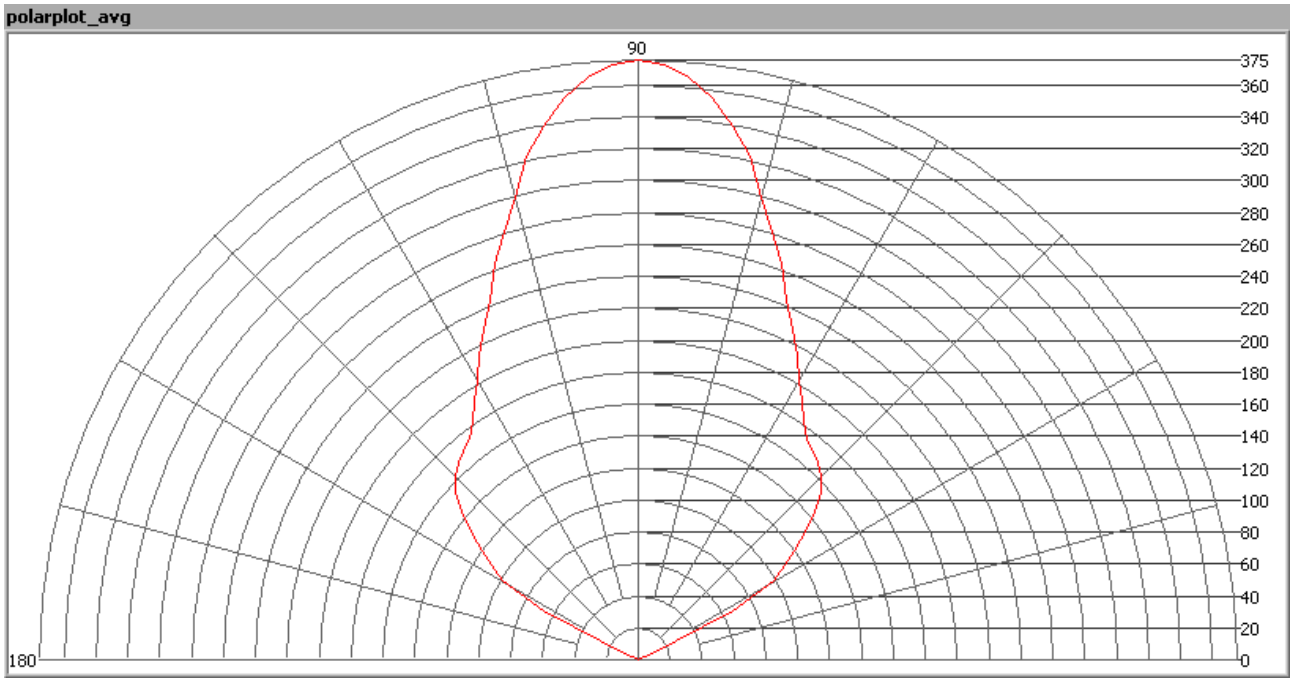


The light diagram giving the radiation pattern.

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.

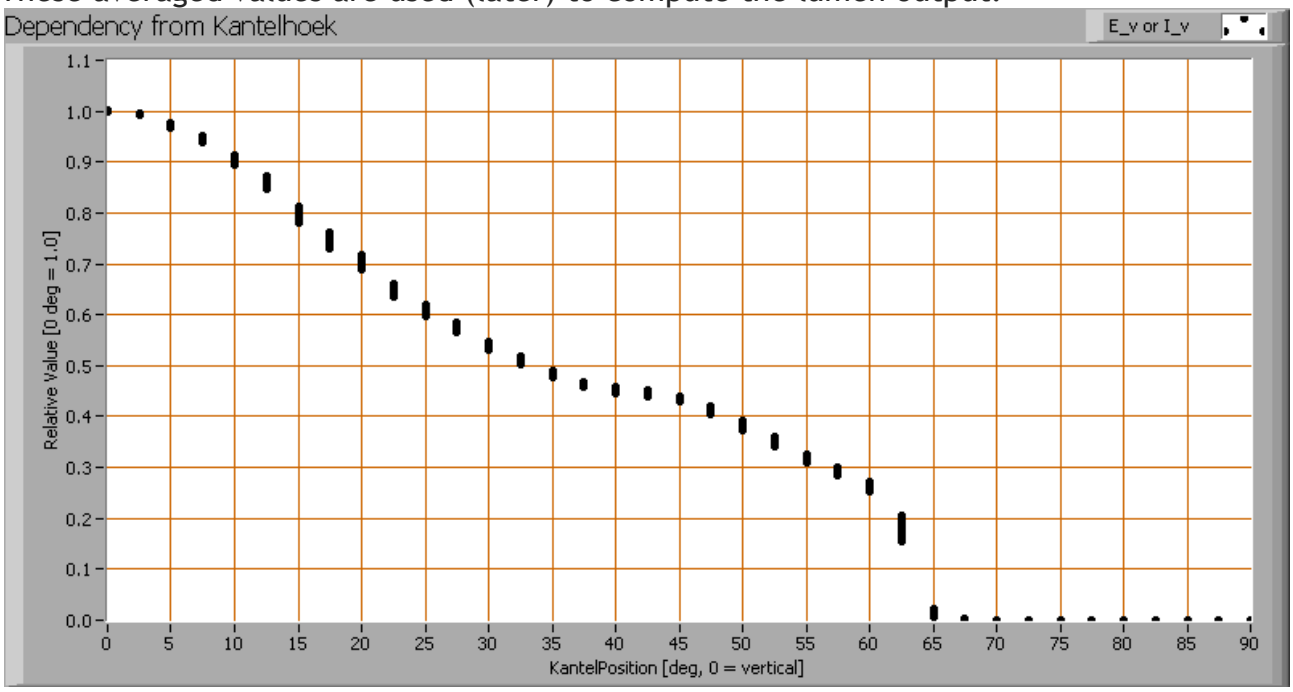
Illuminance Ev at 1 m distance, or luminous intensity Iv

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



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 67° 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 600 Lm.

Luminous efficacy

The luminous flux being 600 Lm, and the power of the light bulb being 19.9 W, yields a luminous efficacy of 30 Lm/W.

Electrical properties

A power factor of 0.95 means that for every 1 kWh net power consumed, a reactive component of 0.3 kVAr was needed.

Lamp voltage	230 VAC
Lamp current	91 mA
Power P	19.9 W
Apparent power S	20.9 VA
Power factor	0.95

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.

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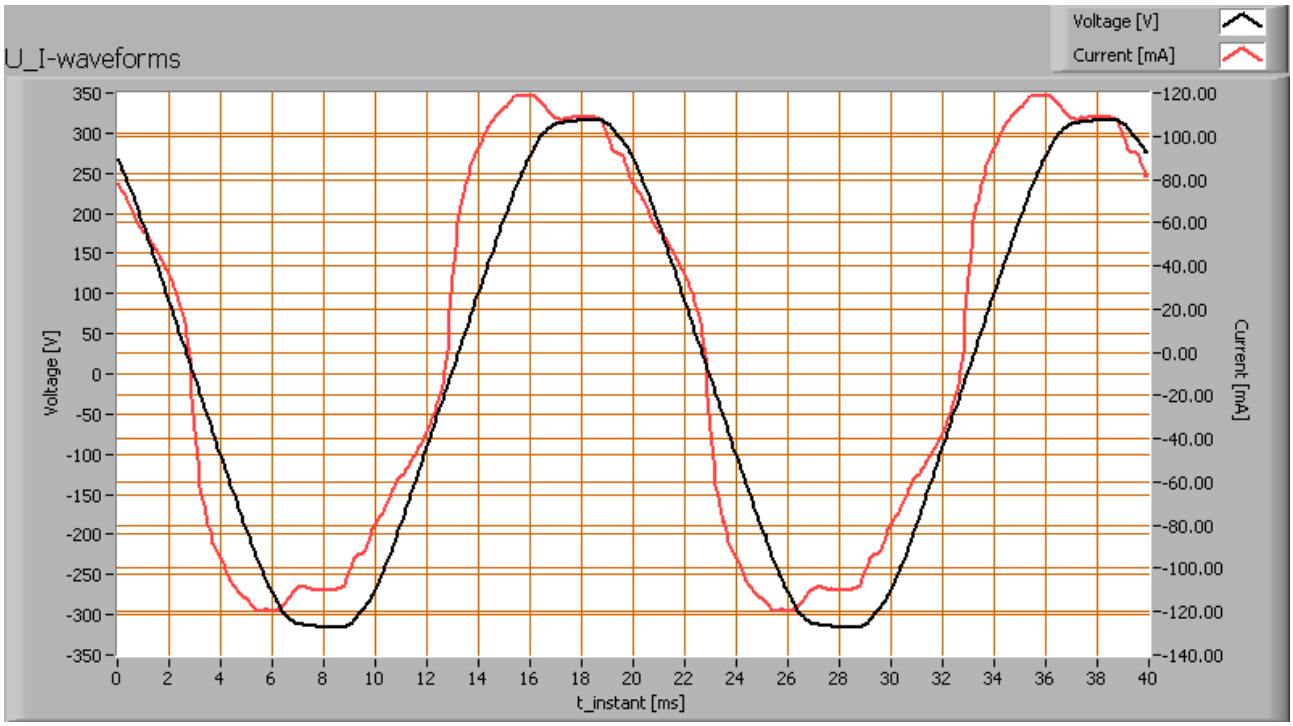
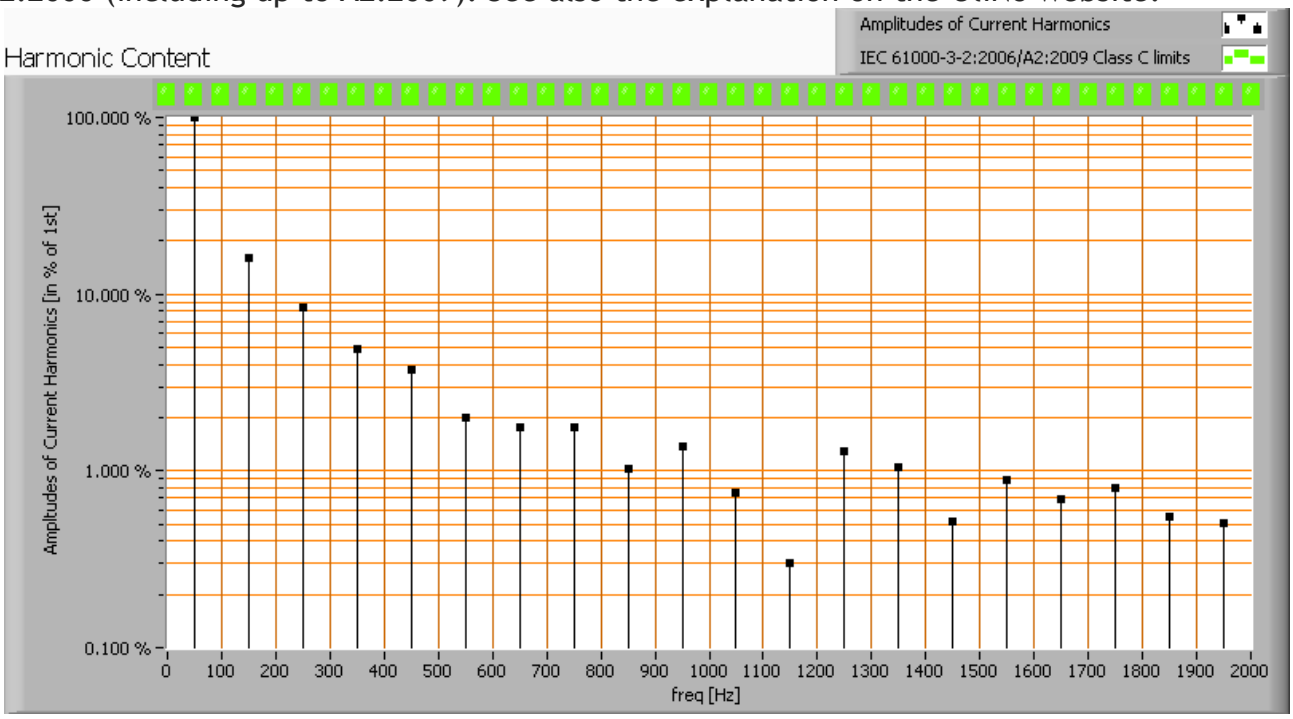


Voltage across and current through the lightbulb

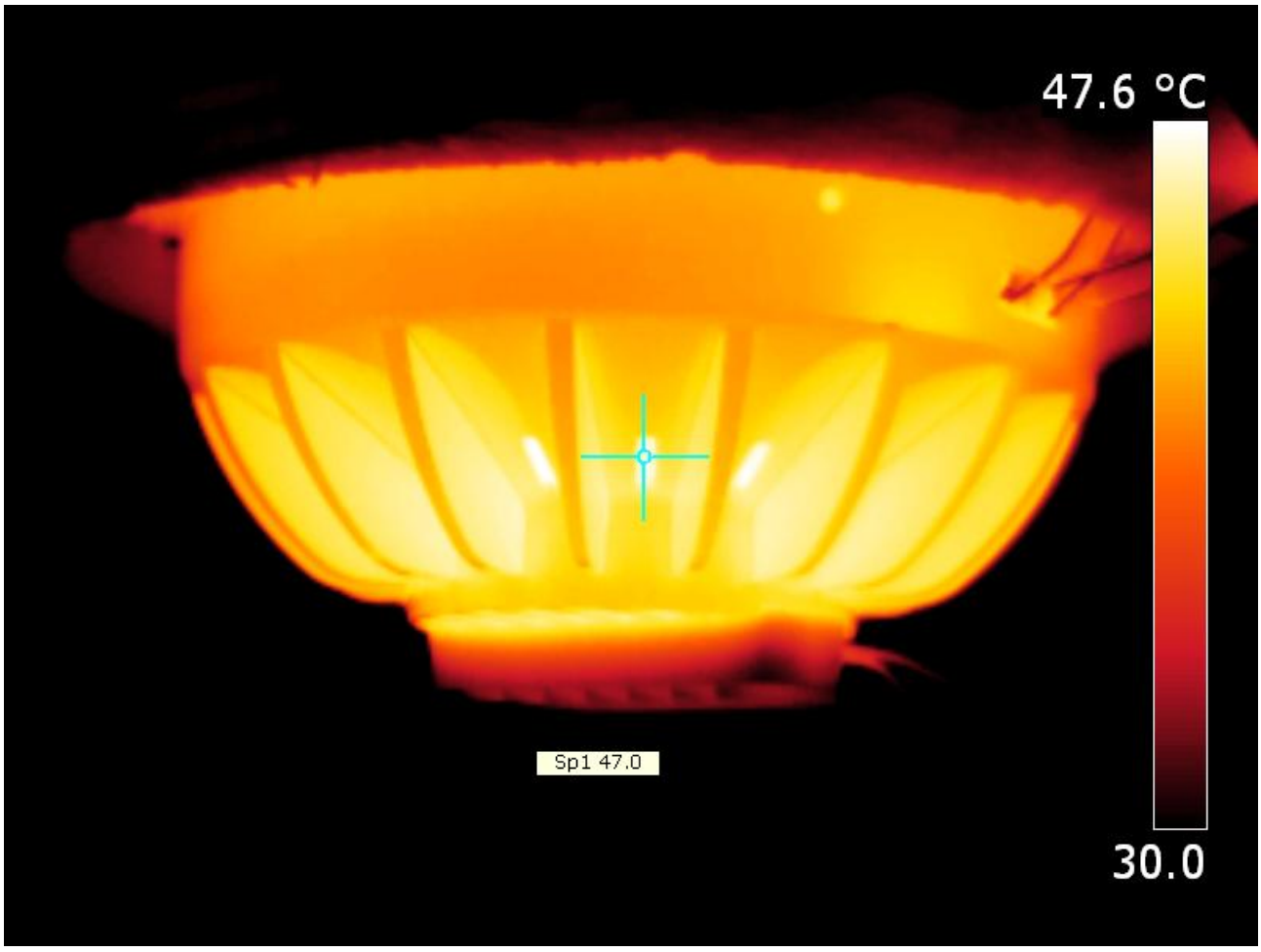
This waveforms have been checked on requirements posed by the norm IEC 61000-3-2:2006 (including up to A2:2009). See also the explanation on the OliNo website.



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 20 %.

Temperature measurements lamp



IR image of the outside of the lamp. It seems to have an emissivity of 0.85.

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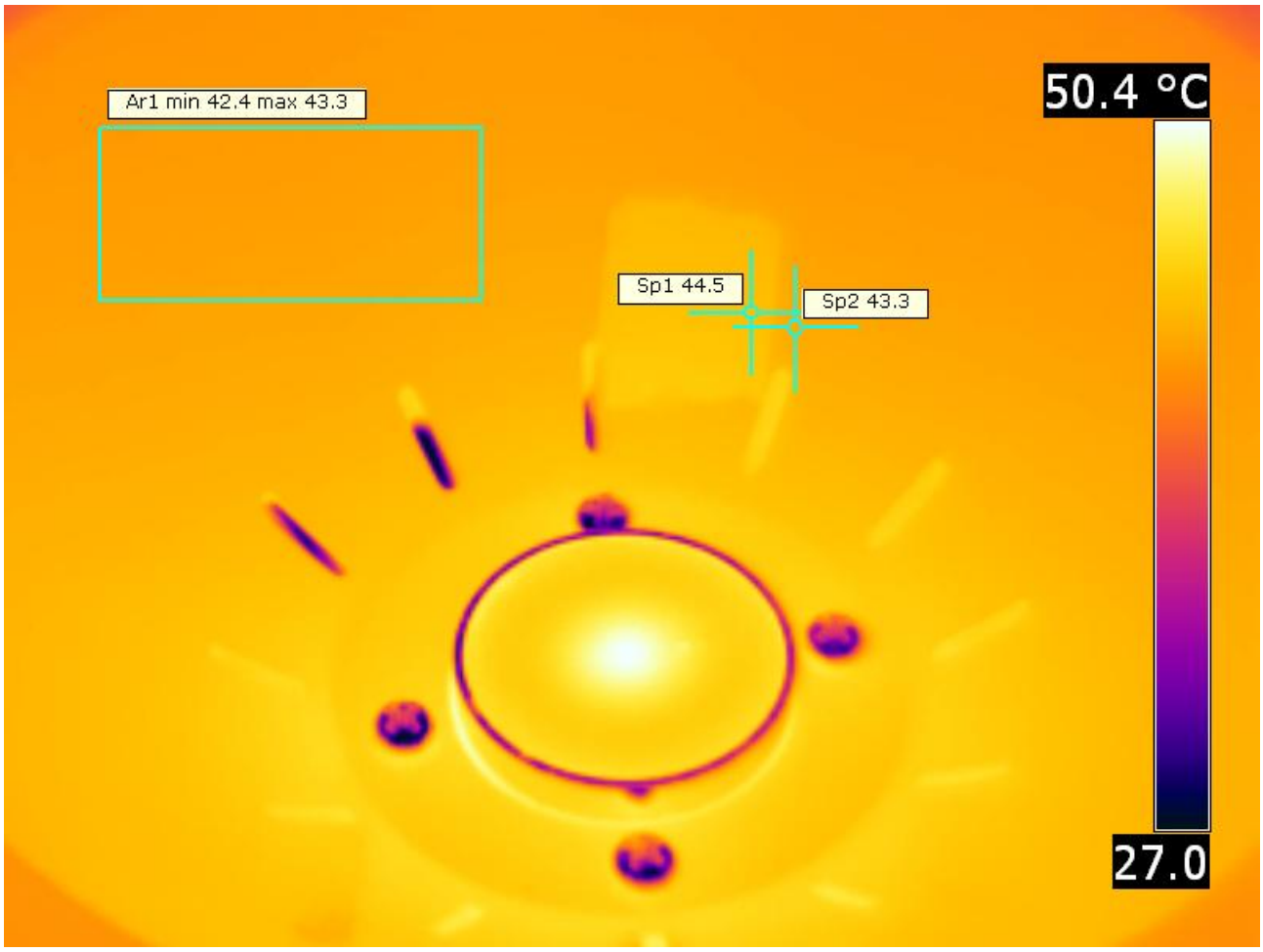
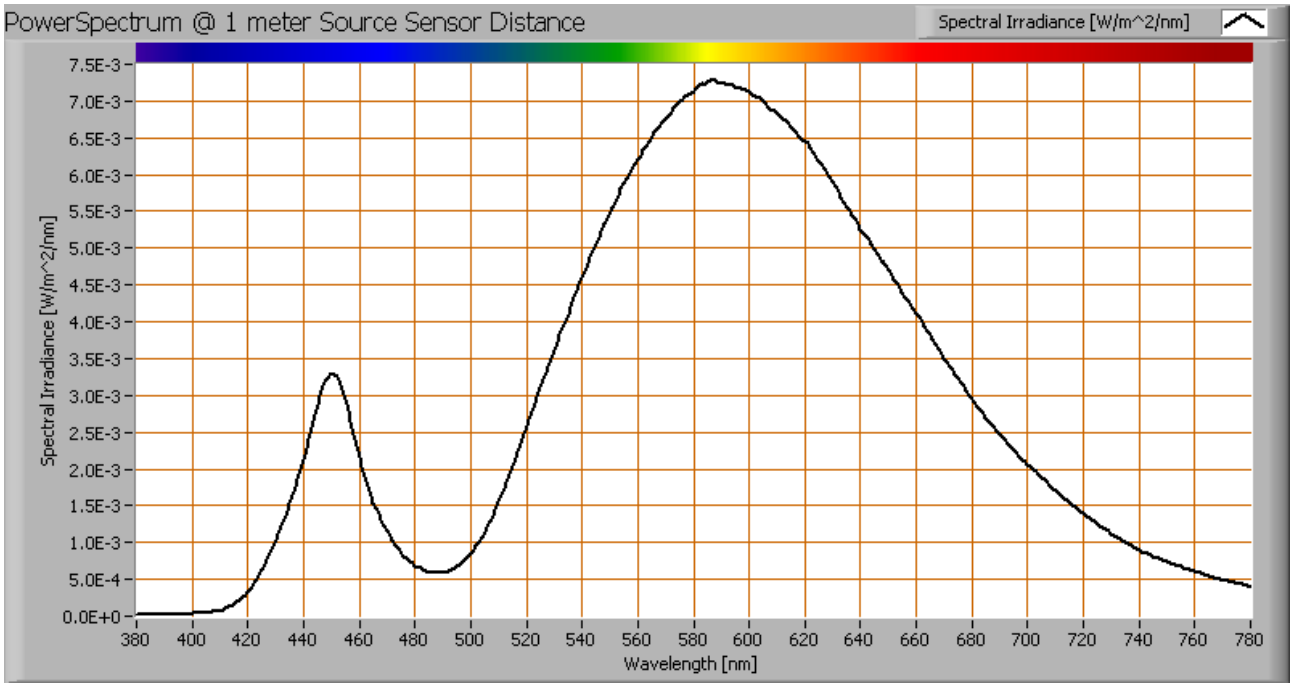


The reflector has an emissivity of about 0.9.

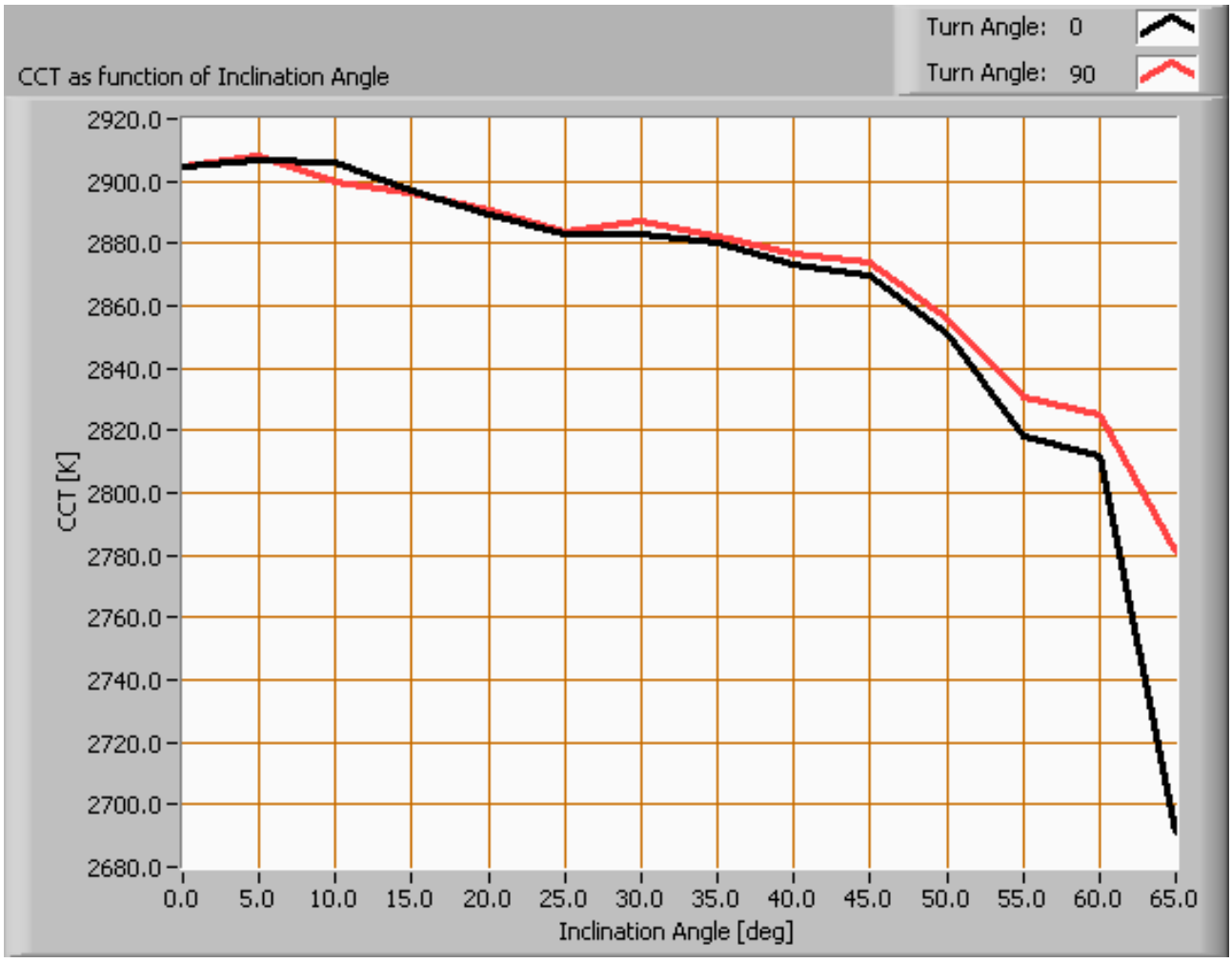
status lamp	> 2 hours on
ambient temperature	23 deg C
reflected background temperature	23 deg C
camera	Flir T335
emissivity	0.85, 0.90
measurement distance	1 m
$IFOV_{geometric}$	0.136 mm for each 0.1 mm distance
NETD (thermal sensitivity)	50 mK

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 2900 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 65°. Beyond that angle the illuminance value was very low (< 5 lx).
The maximum beam angle is 67°, meaning a 33.5° inclination angle. In this area most of the light is present. The variation in correlated color temperature in this area is < 1 %.

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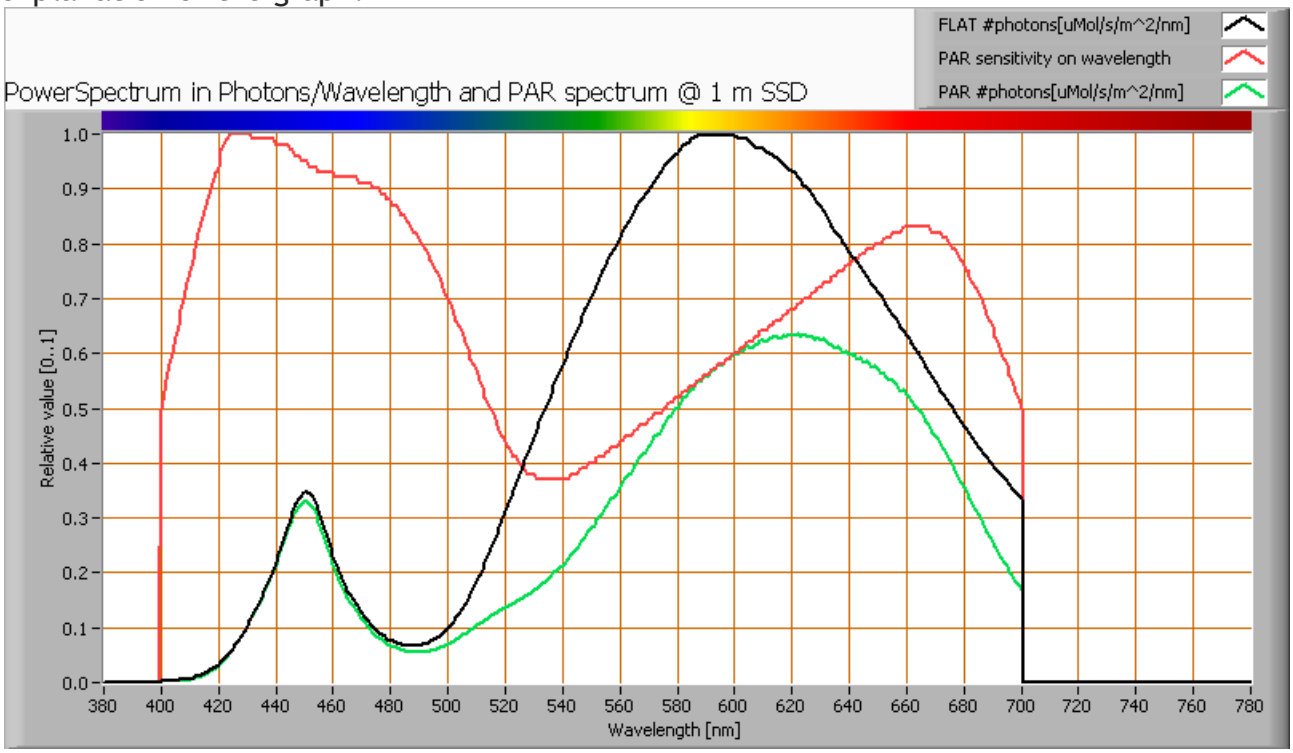
PAR value and PAR spectrum

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.



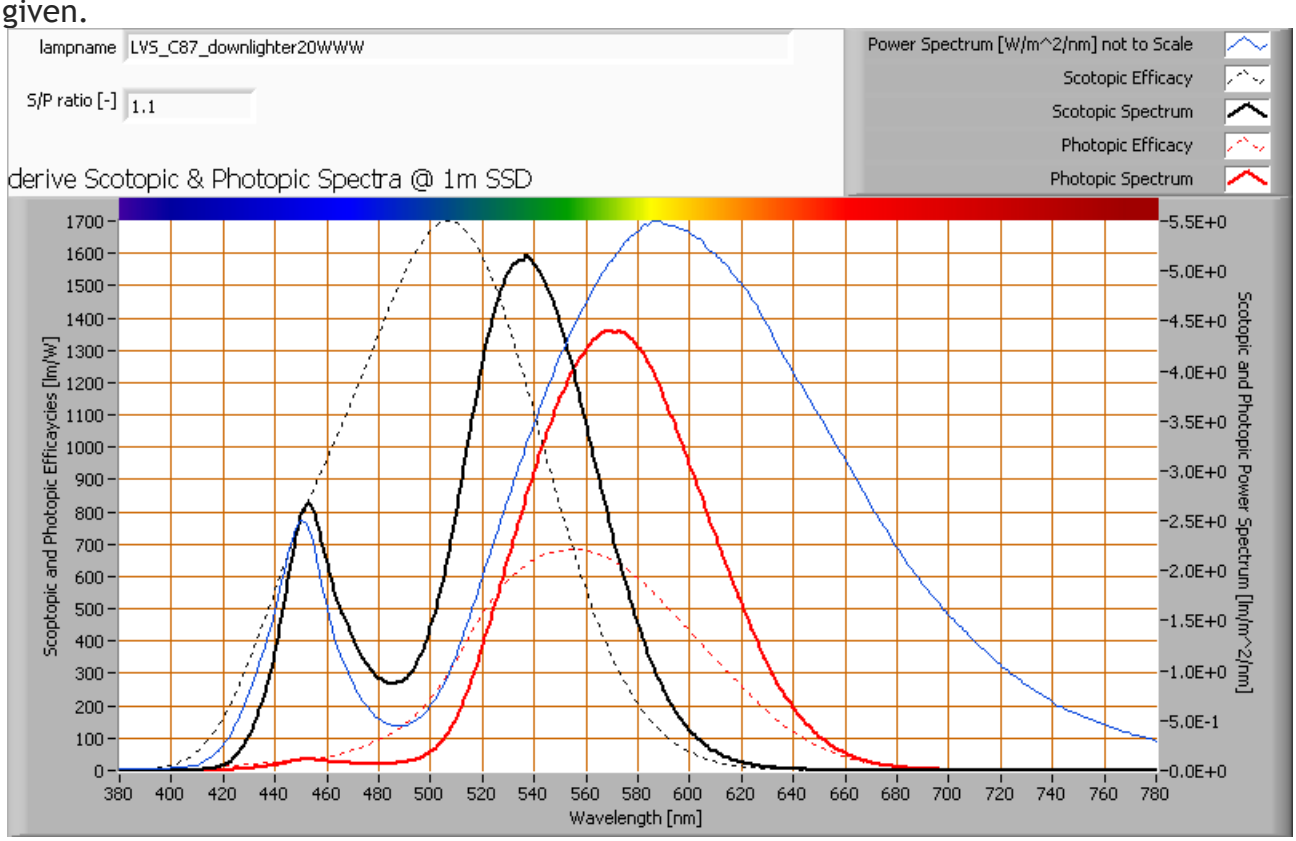
The photon spectrum, then the sensitivity curve and as result the final PAR spectrum of the light of this light bulb

parameter	value	unit
PAR-number	3.3	µMol/s/m²
PAR-photon current	5.3	µMol/s
PAR-photon efficacy	0.3	µMol/s/W

The PAR efficiency is 63 % (valid for the PAR wave length range of 400 – 700 nm). So maximally 63 % 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 1.1.
More info on S/P ratio can be found on the OliNo website.

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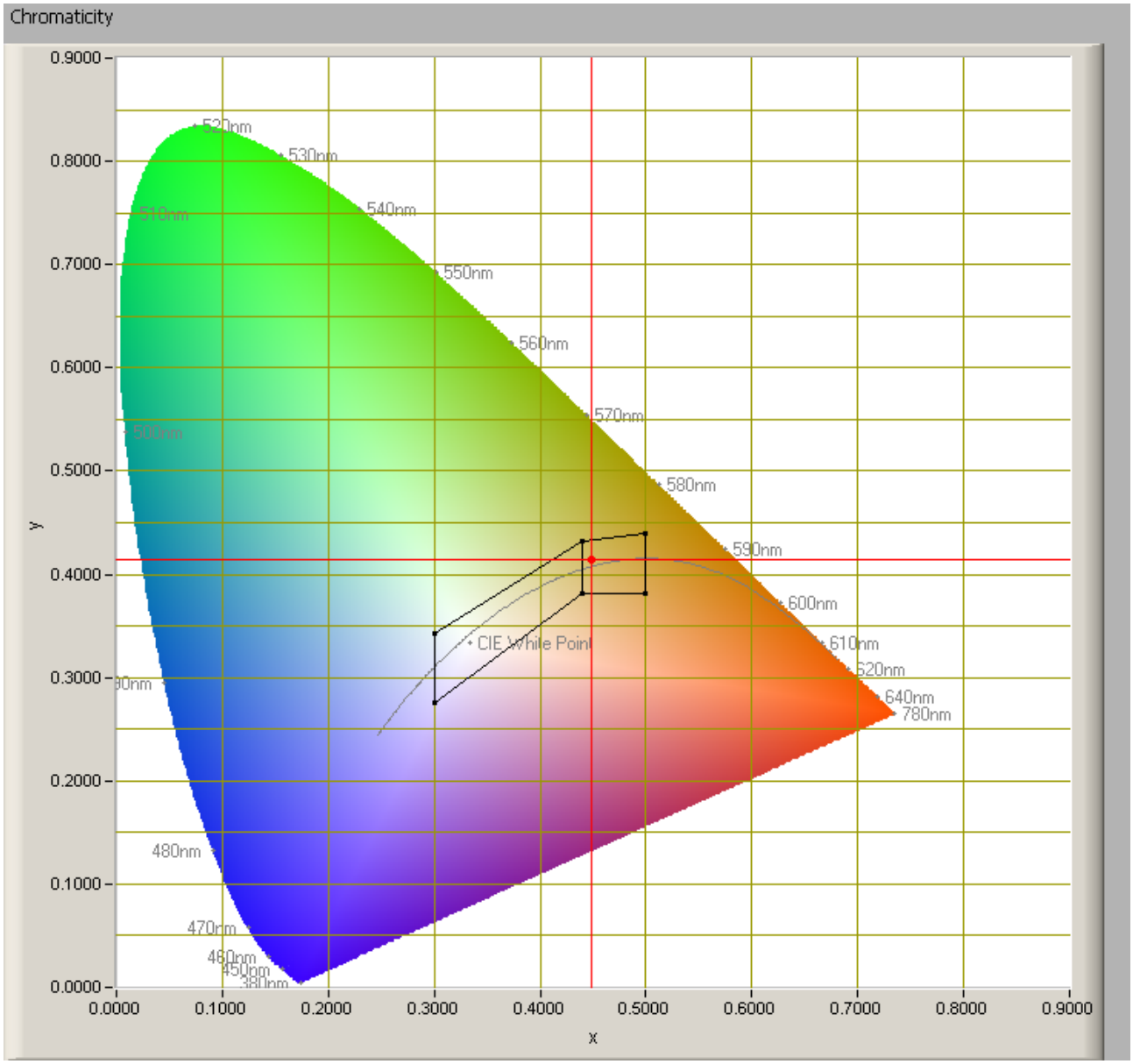
Chromaticity diagram

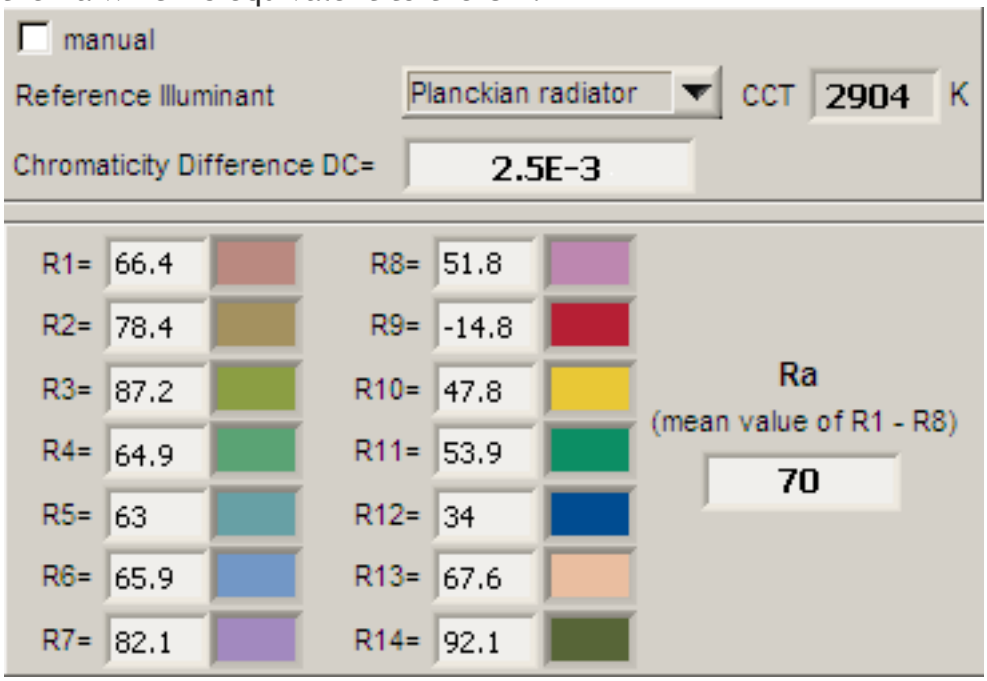


The chromaticity space and the position of the lamp's color coordinates in it.

The light coming from this lamp is just outside the area designated with class B (yellow-white). This class is an area that is defined for signal lamps, see also the OliNo website. Its coordinates are x=0.4479 and y=0.4139.

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.



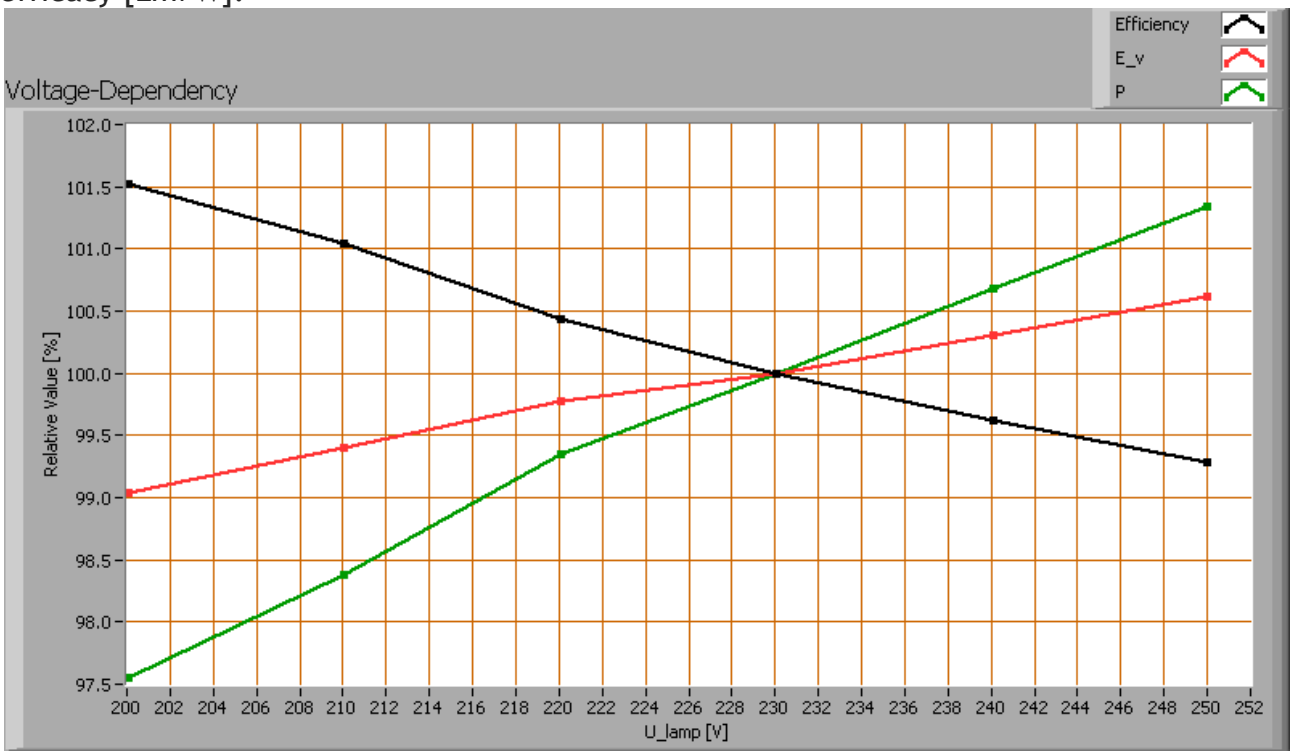
CRI of the light of this lightbulb.

The value of 70 is lower than 80 which is considered a minimum value for indoor usage.
Note: the chromaticity difference is 0.0025 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

This voltage dependency is measured once with a Luxo lamp and taken to be the same for the other Luxo lamps where only the lense has been changed.
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 < 0.5 %, so when abrupt voltage changes occur this effect is not visible in the illuminance output.

Warm up effects

This warm up effect is measured once with a Luxo lamp and taken to be the same for the other Luxo lamps where only the lense has been changed.
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].

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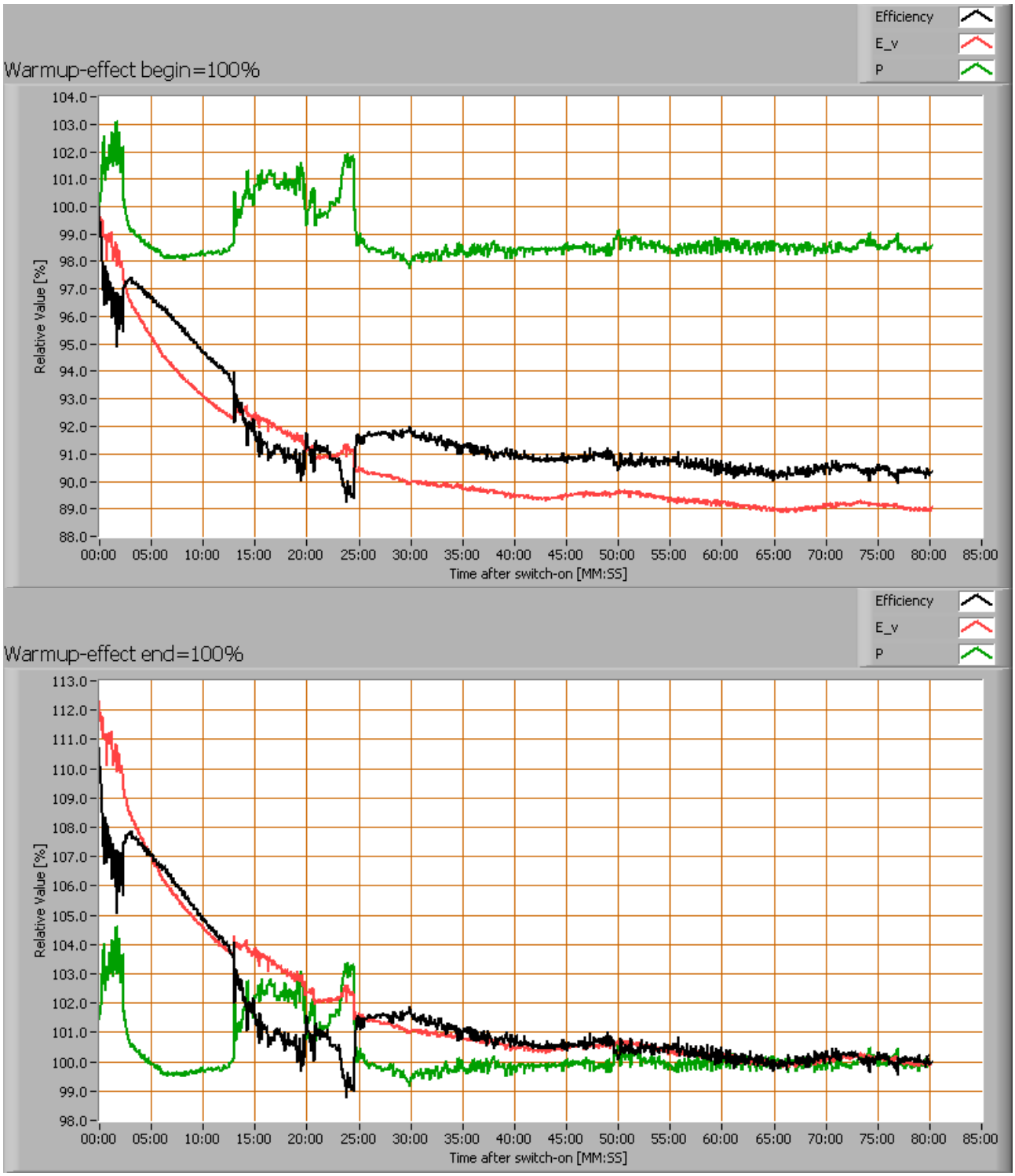
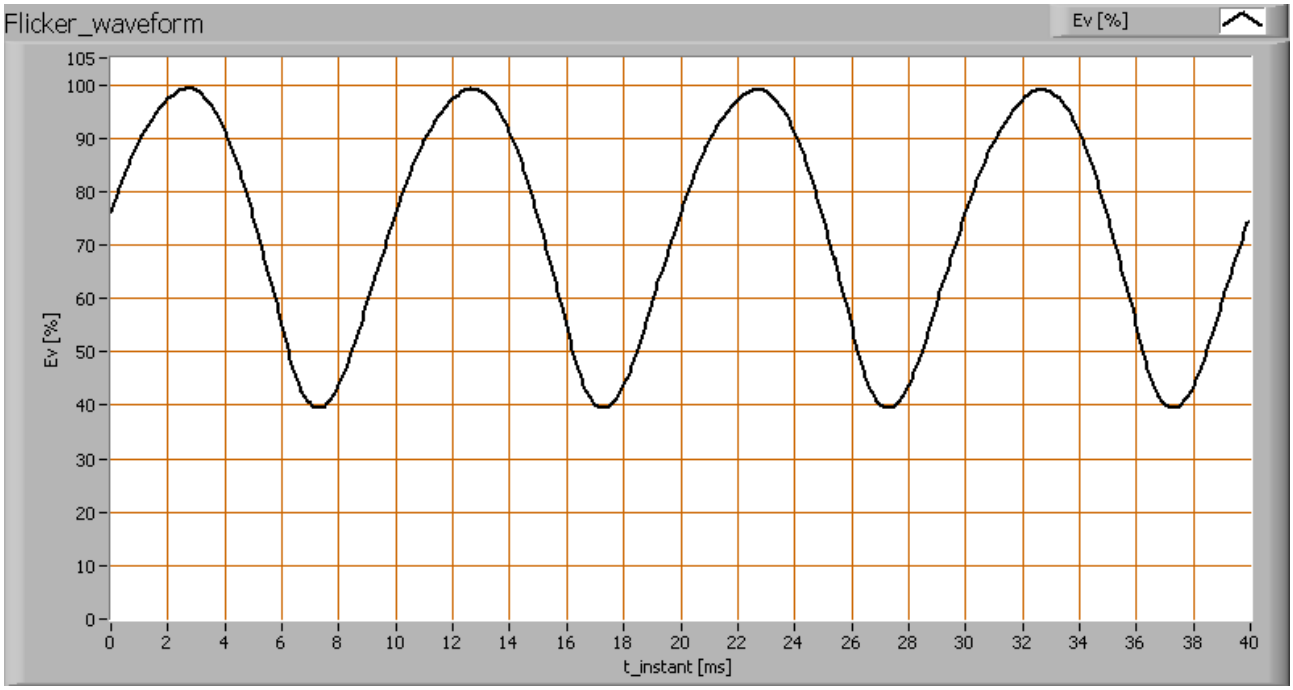


Effect of warming up on different light bulb parameters. At top the 100 % level is put at begin, and at bottom at the end.

The warm up time is about 30 minutes. During that time the illuminance decreases with 11 % and the consumed power with about 2 %.

Measure of flickering

This flickering is measured once with a Luxo lamp and taken to be the same for the other Luxo lamps where only the lense has been changed.
An analysis is done on the measure of flickering of the light output by this light bulb. See the OliNo site for more information.

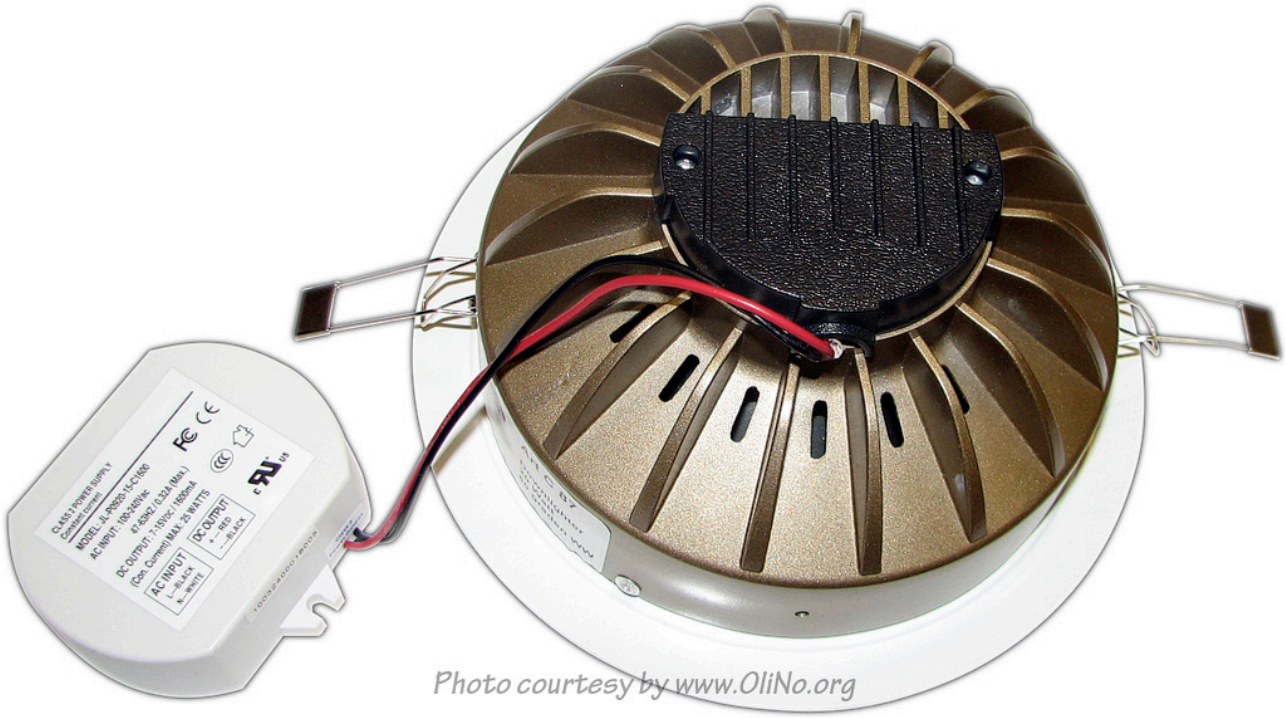


The measure of fast illuminance variartion of the light of the light bulb

parameter	value	unit
Flicker frequency	100	Hz
Illuminance modulation index	43	%

The illuminance modulation index is computed as: (max_Ev – min_Ev) / (max_Ev + min_Ev).

Additional photo



Back view

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