



## Lamp measurement report – 7 Jan 08 for Technea

### Go Green Soft Classic 9W E27





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### Summary measurement data

parameter	meas. result	remark
Color temperature	2687 K	Bright white
Luminous intensity $I_v$	24 Cd	
Beam angle	320 deg	
Power P	8.4 W	
Power Factor	0.61	For every 1 kWh net power consumed, there has been 1.3 kVAhr for reactive power.
Luminous flux	404 lm	
Luminous efficacy	48 lm/W	
CRI_Ra	80	Color Rendering Index.
Coordinates chromaticity diagram	x=0.4673 and y=0.4216	
Fitting	E27	
D x H external dimensions	62 x 123 mm	External dimensions of the light bulb.
D dimensions luminous area	62 mm	Dimensions of the luminous area (used in Eulumdat file). This is the diameter of the glass.
General remarks		The ambient temperature during the whole set of measurements was 18.5-19.0 deg C.  Warm up effect: after 10 minutes the illuminance is maximal.  Voltage dependency: there are variations in consumed power and illuminance, and these are linearly dependent from the voltage.

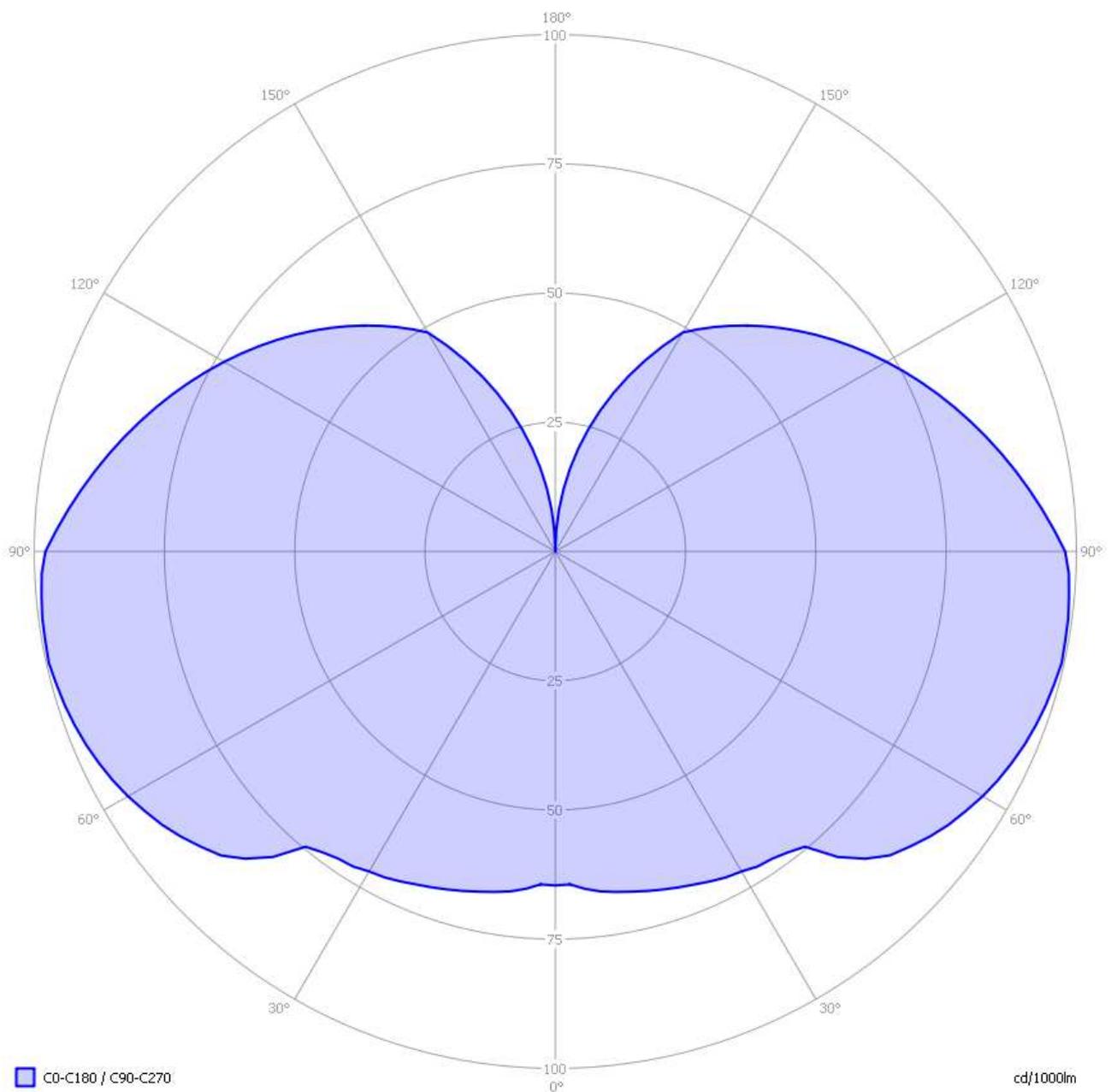


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### Eulumdat light diagram

With this article an eulumdat file is added. This is a file that a.o. indicates the radiation pattern around the light bulb. There are more parameters in the file, and these all can be read with help of the free open source program Qlumedit.

An interesting graph is the light diagram, indicating the intensity in the C0-C180 and the C90-C270 plane.



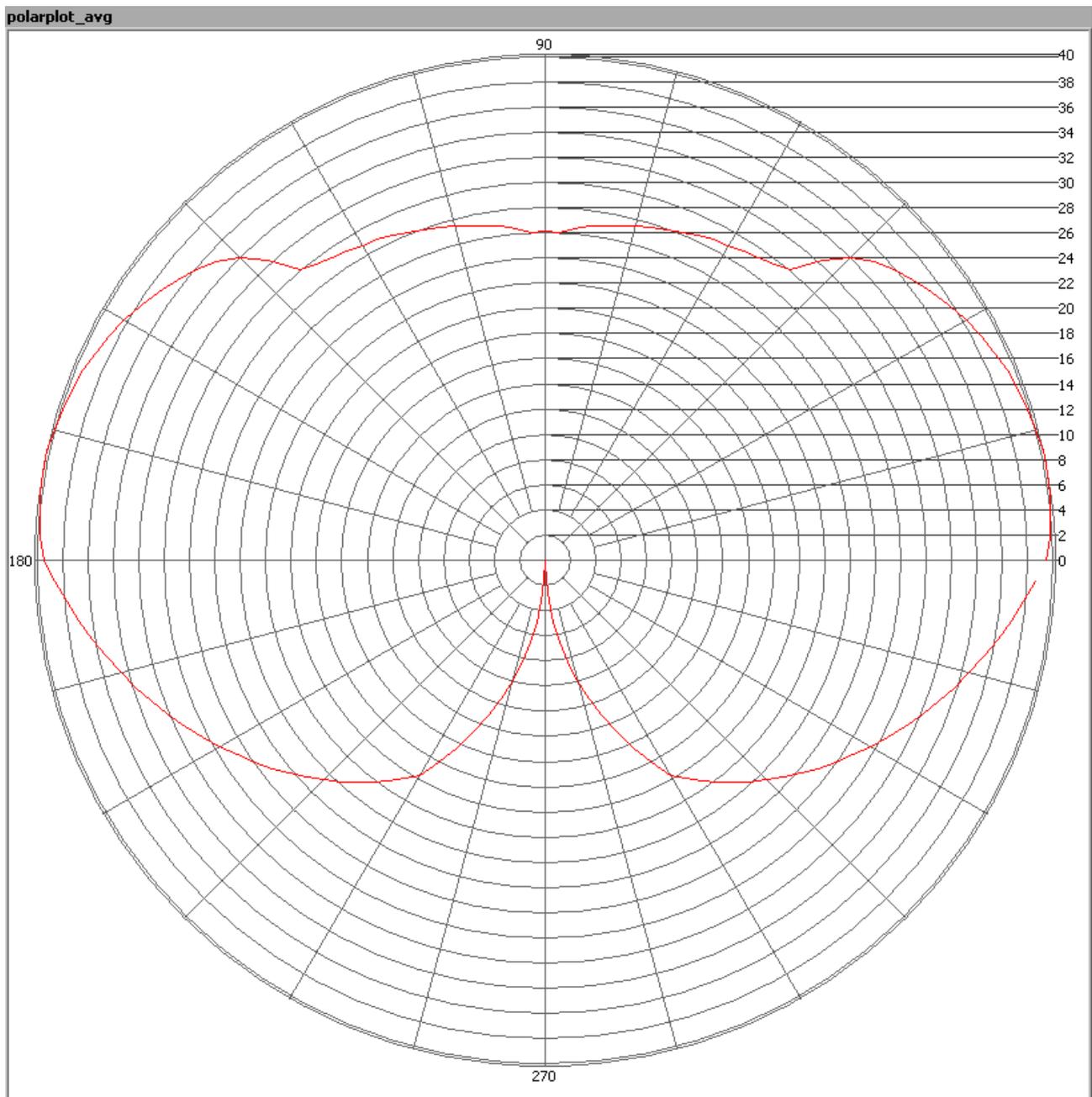


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The light diagram giving the radiation pattern in the C0-C180 and C90-C270 planes. The C0-C180 plane and the C90-C270 planes give the same result, as the light bulb has a symmetry over the x-axis.

### Illuminance $E_v$ at 1 m distance, or the 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.



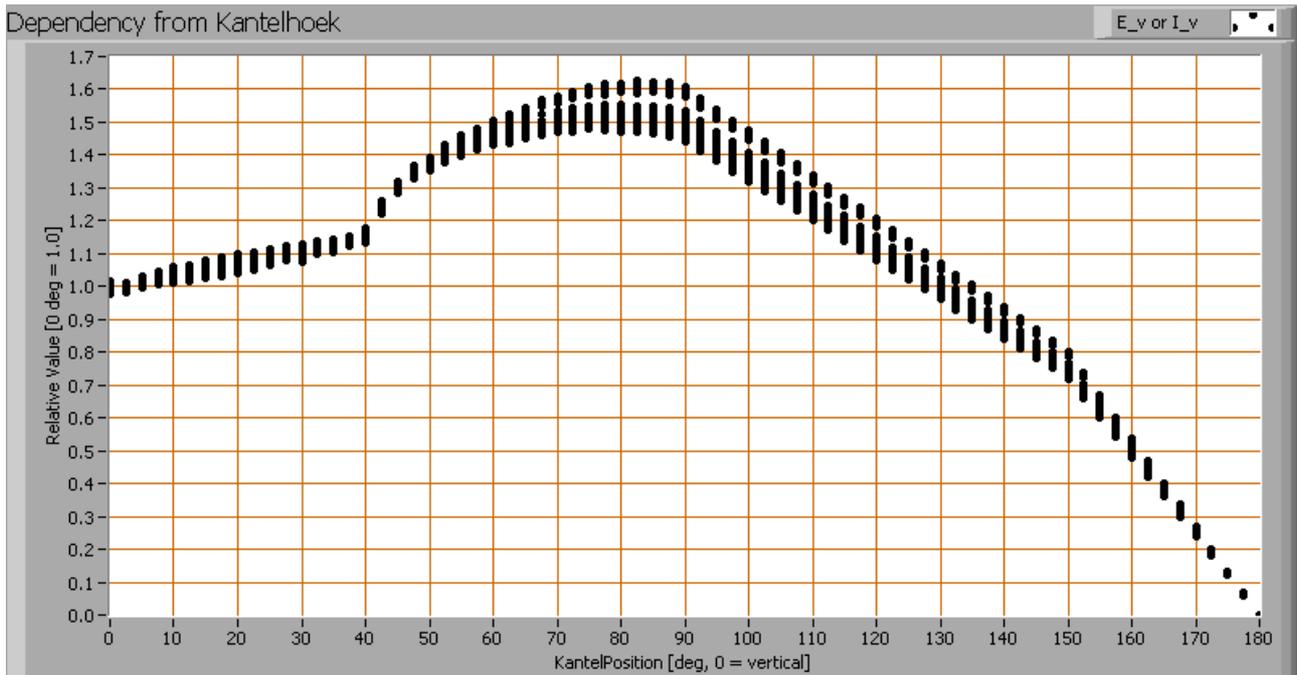


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*The radiation pattern of the light bulb.*

This radiation pattern shows that there is light all around the light bulb.

These averaged values are used (later) to compute the lumen output.



*The intensity measurements (of each turn angle) as function of inclination angle.*

This plot shows per inclination angle the intensity measurement results for each turn angle at that inclination angle. There is little variation in light intensities for different turn-angles, looking at the small inclination angles.

When using the average values per inclination angle, the beam angle can be computed, being 320 degrees.

### 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 lamp is a luminous flux of 404 lm.



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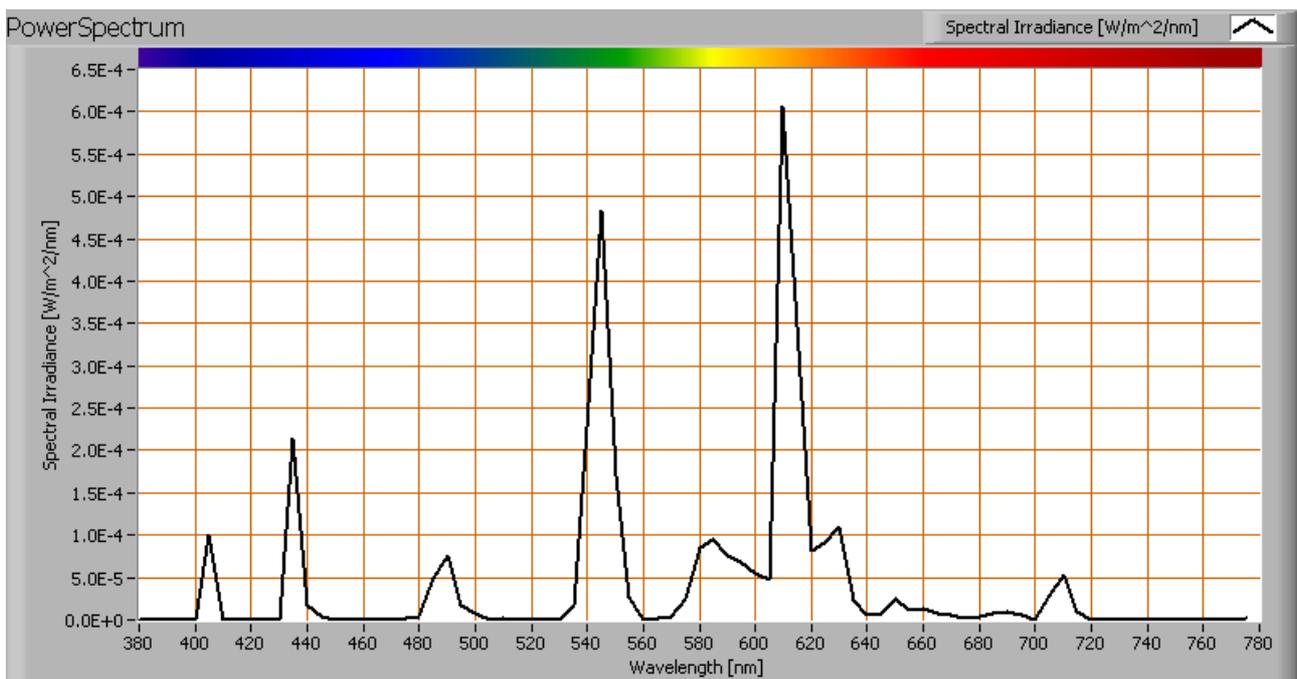
### Luminous efficacy

The luminous flux being 404 lm, and the power of the lightbulb being 8.4 W, yields a luminous efficacy of 48 lm/W.

A power factor of 0.61 means that for every 1 kWh net power consumed, a reactive component of 1.3 kVAr was needed.

Light bulb voltage	230.0 V
Light bulb current	60 mA
Power P	8.4 W
Apparent power S	13.8 VA
Power factor	0.61

### Color temperature and Spectral power distribution



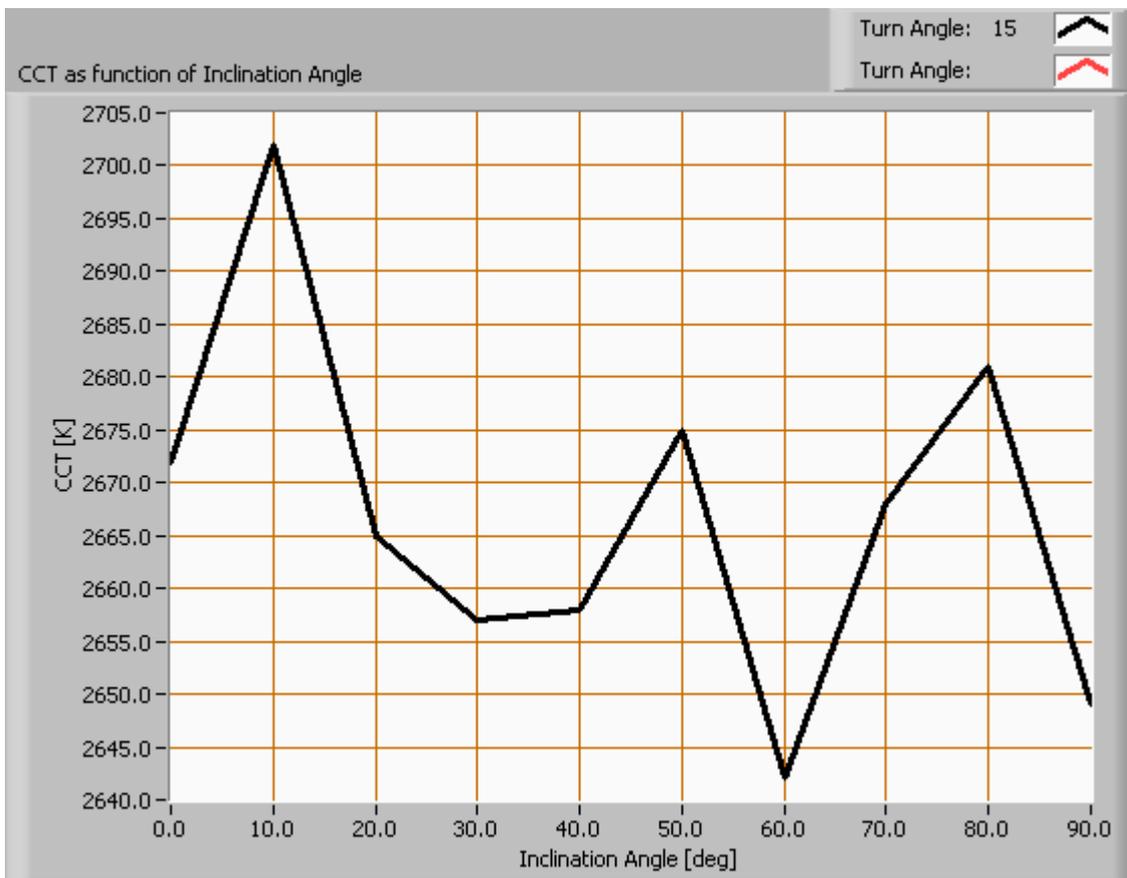
*The spectral power distribution of this light bulb.*

The measured color temperature is about 2700 K, bright white.

This measurement is done straight underneath the light bulb. This color temperature can also be measured when looking at the light bulb under different inclination angles.



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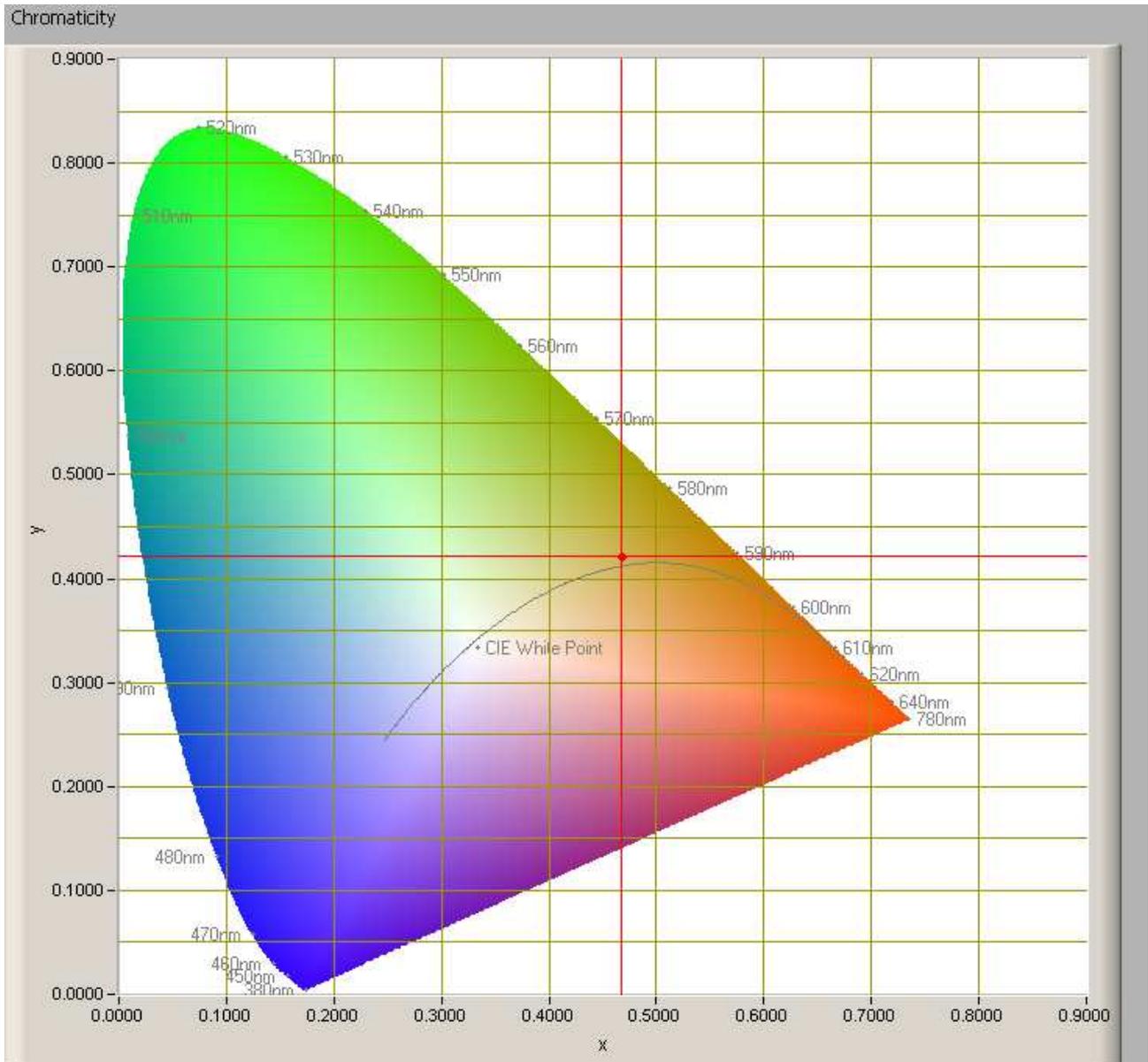
*The color temperature dependent from the inclination angle.*

There are changes in the color temperature when looking at the light bulb under different inclination angles. These variations are in the order of 2 %.



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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 close to the Planckian Locus (the black path in the graph).

Its coordinates are  $x=0.4673$  and  $y=0.4216$ .

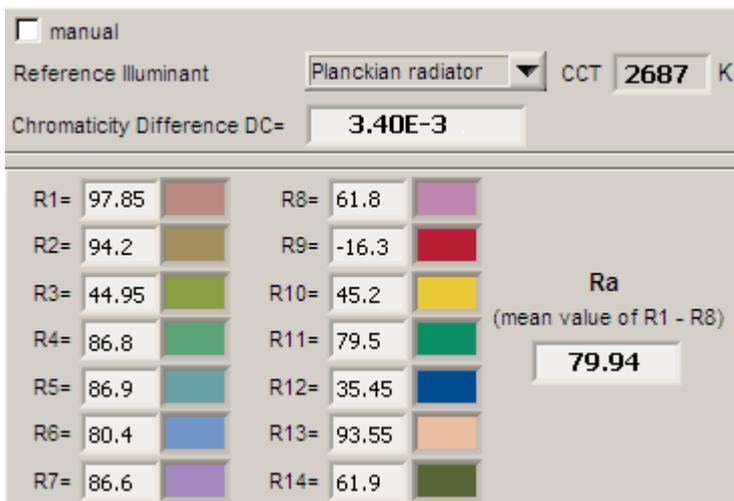


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### Color Rendering Index (CRI) or also Ra

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).

Each color has an index  $R_x$ , and the first 8 indexes ( $R_1 .. R_8$ ) 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.

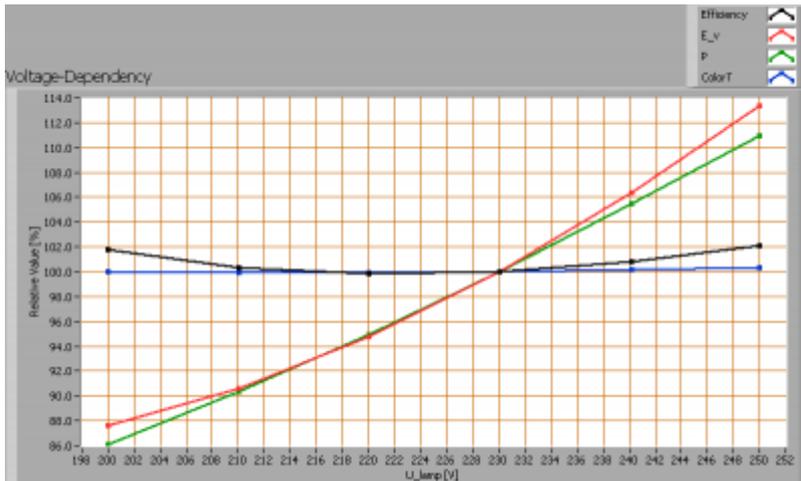
Note: the chromaticity difference is 0.0034 indicates the distance to the Planckian Locus. Its value is lower than 0.0054, which means that the calculated CRI result is meaningful.



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### 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 lamp parameters measured: illuminance  $E_v$  [lx], color temperature CT or correlated color temperature CCT [K], the lamp power  $P$  [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 power consumed and the illuminance measurements do depend linearly on the light bulb voltage applied. Their variation stays within 3 % which means the dependency can be neglected.

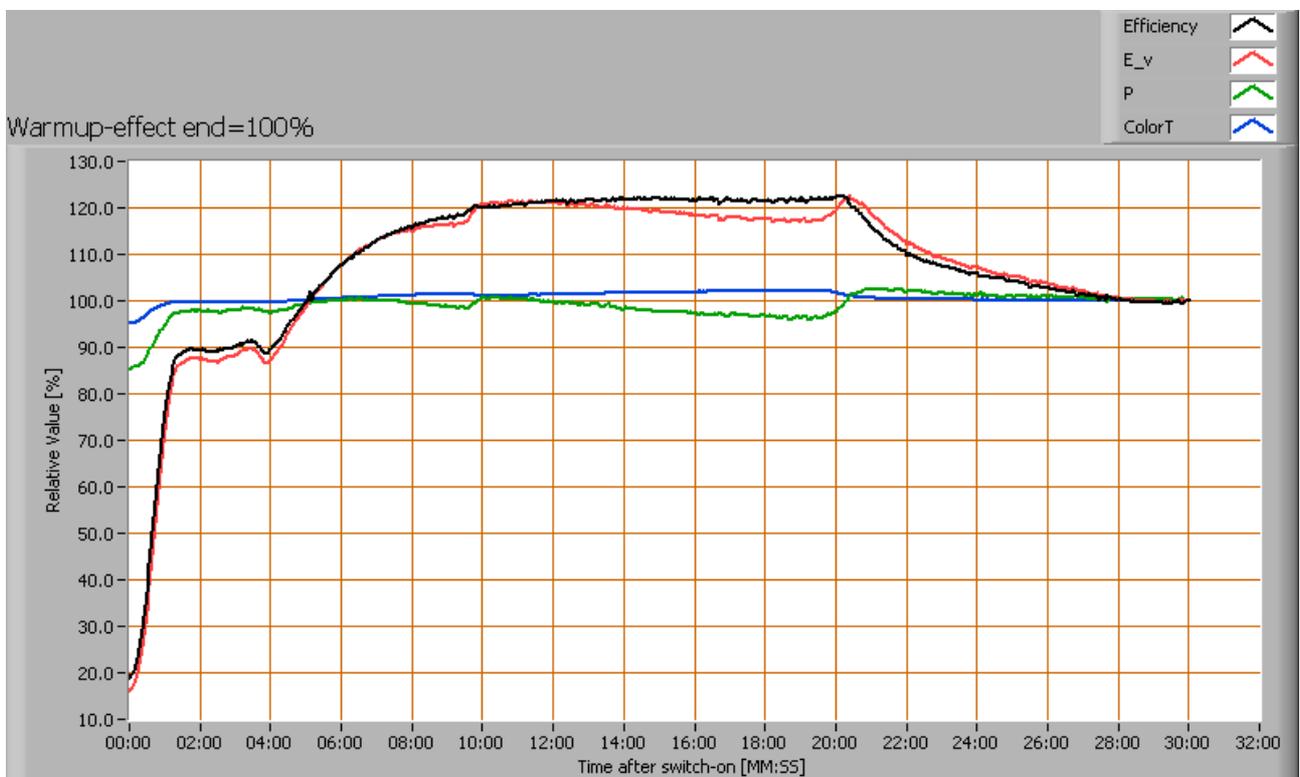
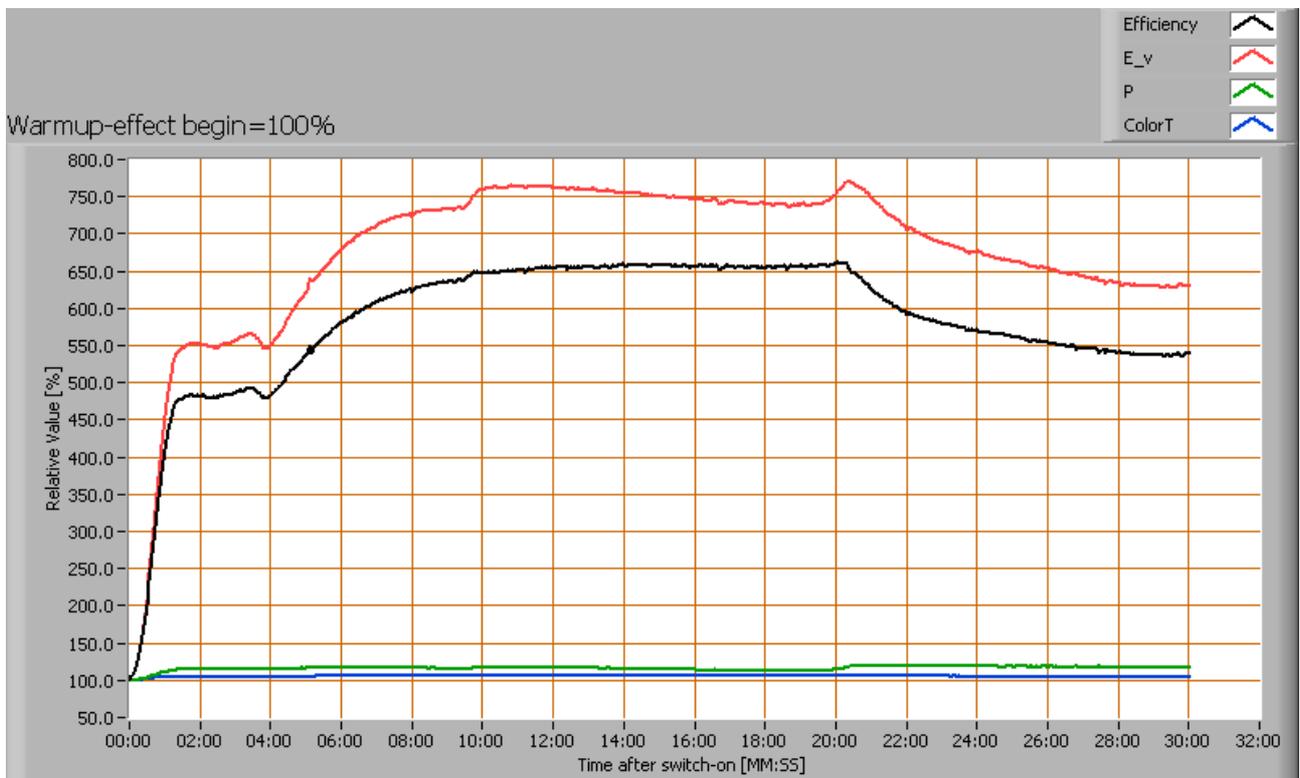
To check whether this dependency can lead to visible changes in illuminance for possible grid voltage changes, it is noted what variations occur when the lamp voltage varies around 230 V + and - 5 V then the illuminance varies with < 3 % which will not be remarked.

### 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], color temperature CT or correlated color temperature CCT [K], the lamp power  $P$  [W] and the luminous efficacy [lm/W].



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*Effect of warming up on different light bulb parameters. The 100 % level is put at begin (top) and at the end (bottom).*

During initial warm-up the light bulb gives much more light output. This warming up period takes about 10 minutes.

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