Lamp measurement report – 7 Jan 09 for Led Light Europe

LLE MR16 GU10 3L 3W WW

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Summary measurement data

parameter	meas. result	remark
Color temperature	3020 K	Warm white
Luminous intensity I_v	592 Cd	
Beam angle	17 deg	A focused beam.
Power P	3.73 W	
Power Factor	0.54	For every 1 kWh net power consumed, there has been 1.6 kVAhr for reactive power.
Luminous flux	104 lm	
Luminous efficacy	28 lm/W	
CRI_Ra	85	Color Rendering Index.
Coordinates chromaticity diagram	x=0.4351 and y=0.4033	
Fitting	GU10	
D x H external dimensions	50 x 52 mm	External dimensions of the spot light
D dimensions luminous area	28 mm	Dimensions of the luminous area (used in Eulumdat file). This is the area around the leds including its reflector.
General remarks		The ambient temperature during the whole set of measurements was 18.5-19.0 deg C. Warm up effect: illuminance decreases 12 % in 35 minutes. Voltage dependency: consumed power and illuminance are not dependent from the light bulb voltage.

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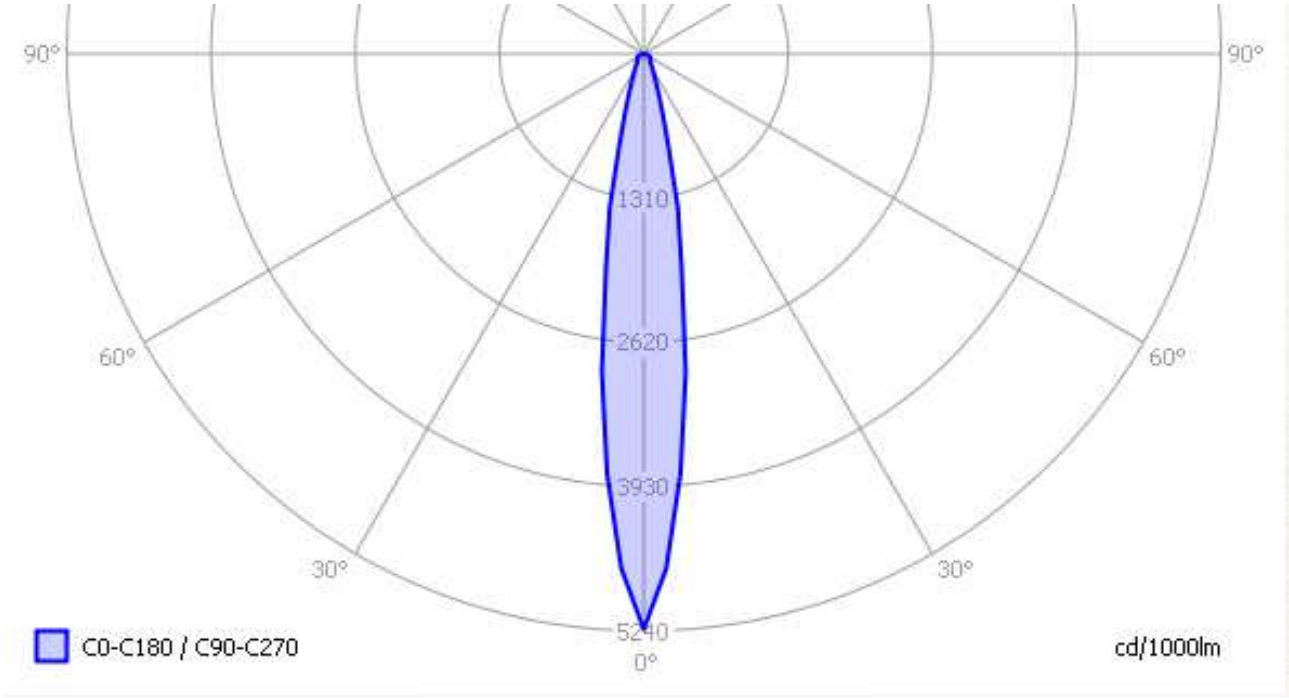
Eulumdat light diagram

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.



*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 spot light has a symmetry over the x-axis.

Illuminance Ev at 1 m distance, or the luminous intensity Iv

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

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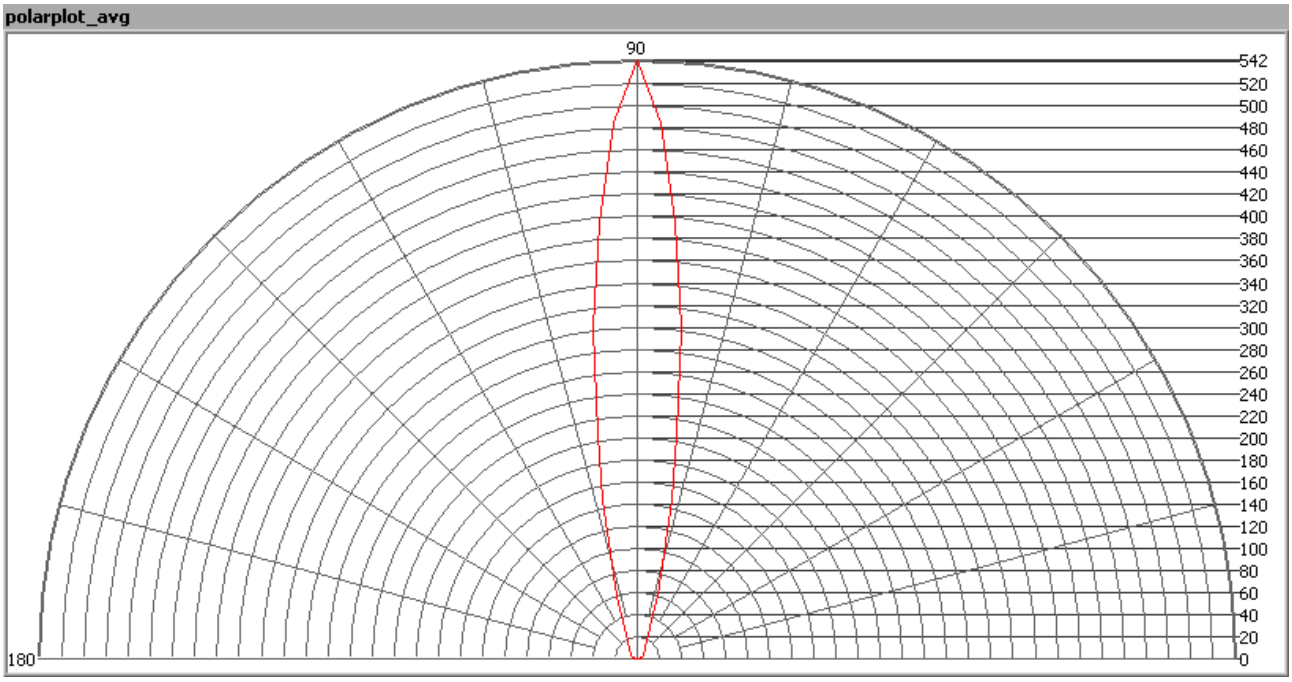
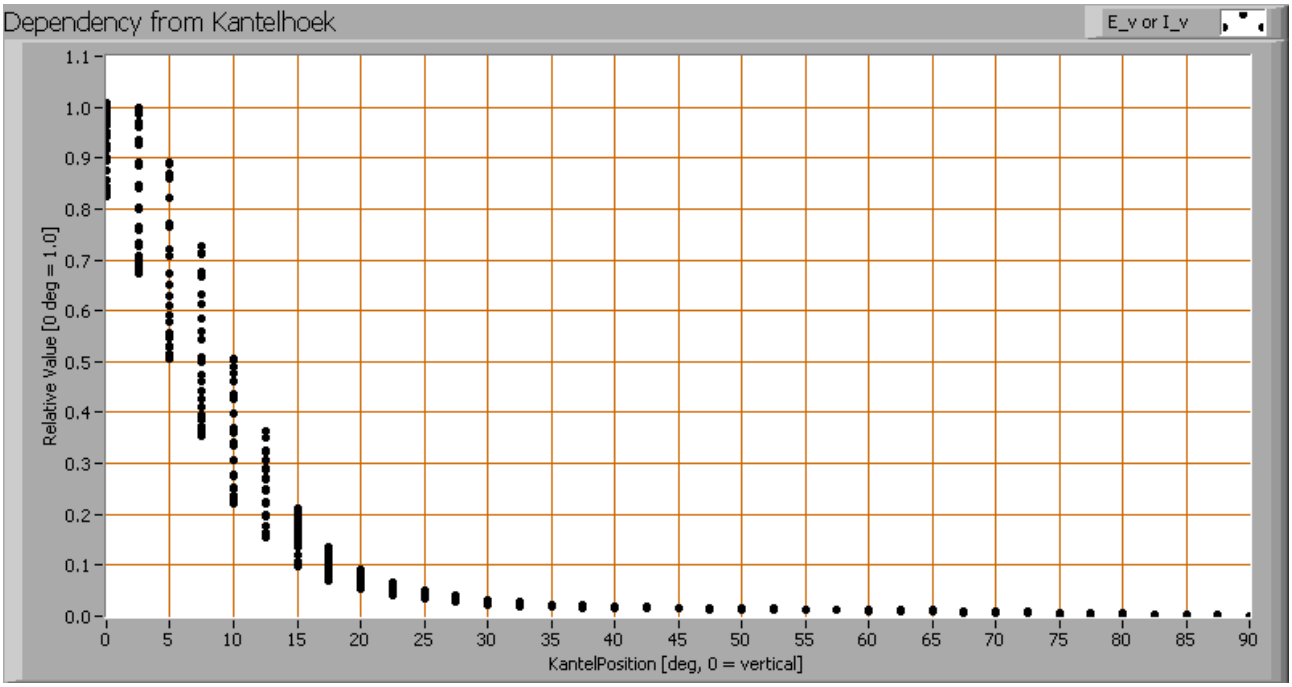


The radiation pattern of the light bulb.

This radiation pattern shows a focused beam.

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



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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 relatively high variation in light intensities for different turn-angles, when looking at the small inclination angles.

When using the average values per inclination angle, the beam angle can be computed, being 17 degrees. However, this value is dependent from the plane observed.

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 104 lm.

Luminous efficacy

The luminous flux being 104 lm, and the power of the lightbulb being 3.73 W, yields a luminous efficacy of 28 lm/W.

A power factor of 0.54 means that for every 1 kWh net power consumed, a reactive component of 1.6 kVAr was needed.

Light bulb voltage	230 V
Light bulb current	30 mA
Power P	3.73 W
Apparent power S	7.0 VA
Power factor	0.54

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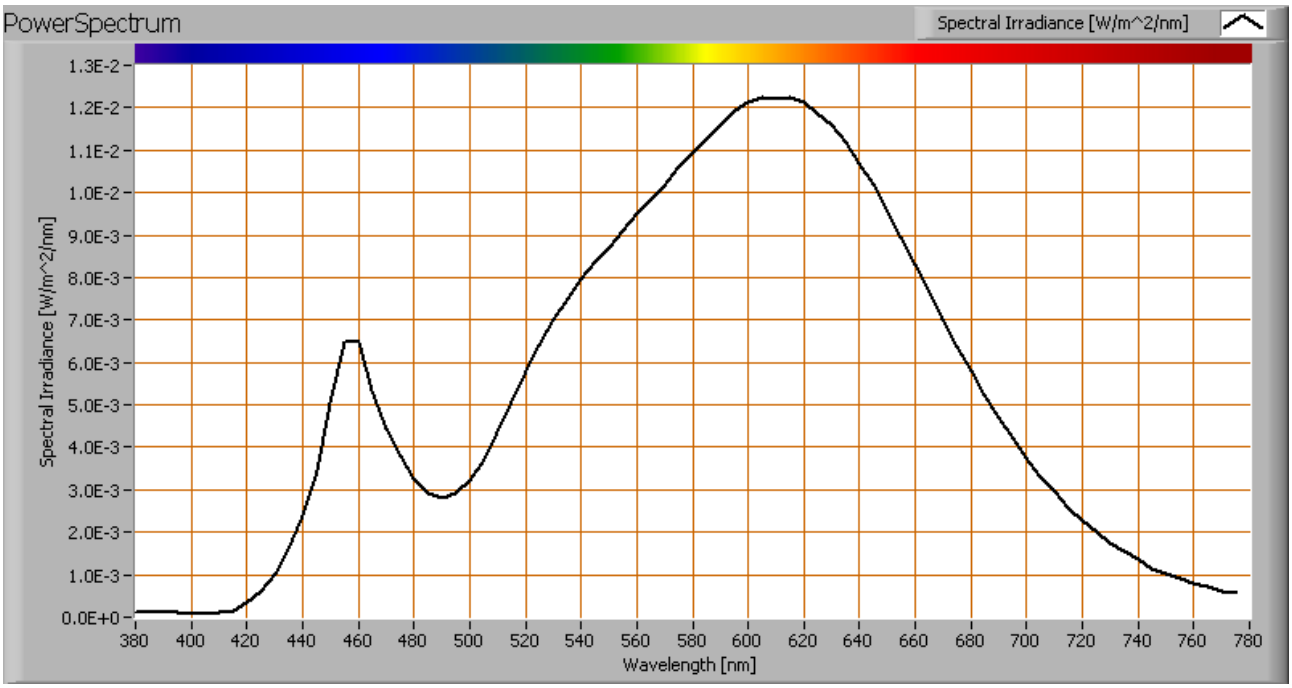
Color temperature and Spectral power distribution



The spectral power distribution of this light bulb.

The measured color temperature is about 3000 K, warm 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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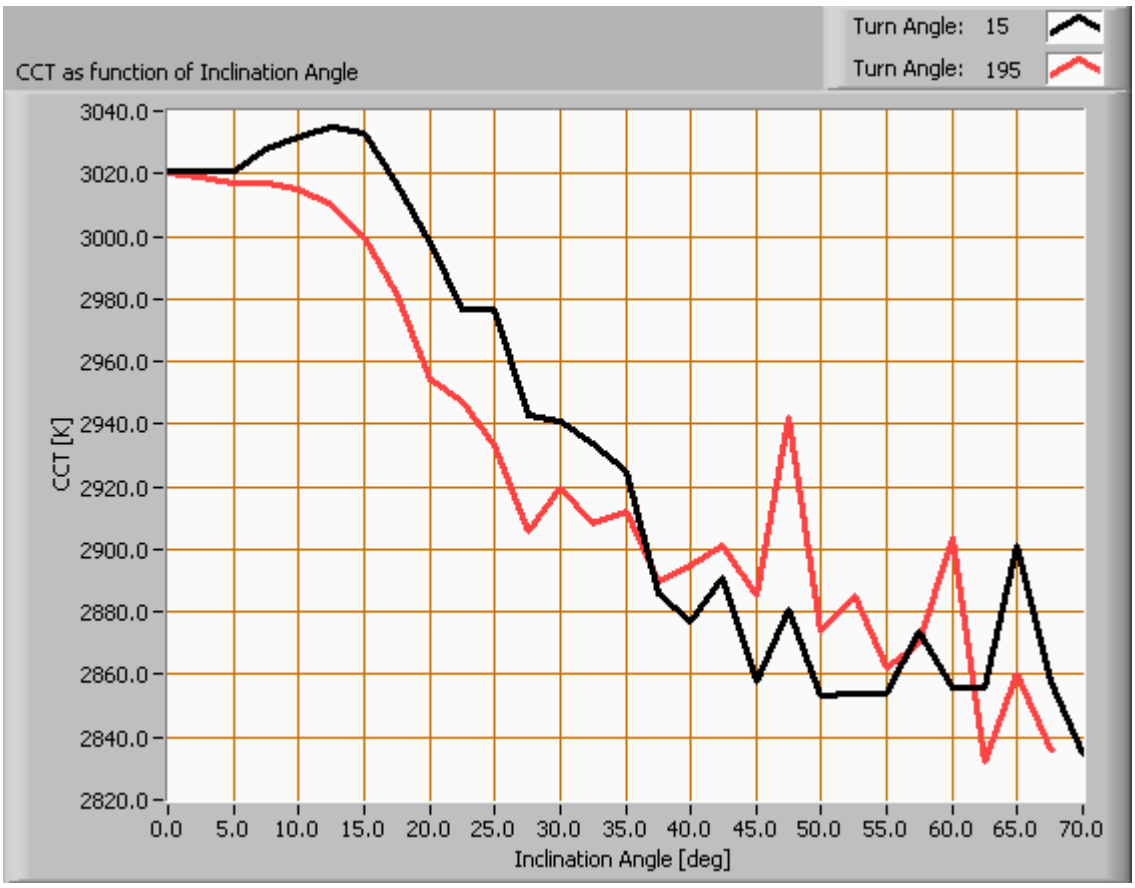

The color temperature dependent from the inclination angle.

There are changes in the color temperature when looking at the tube under different inclination angles. These variations are in the order of 5 %.

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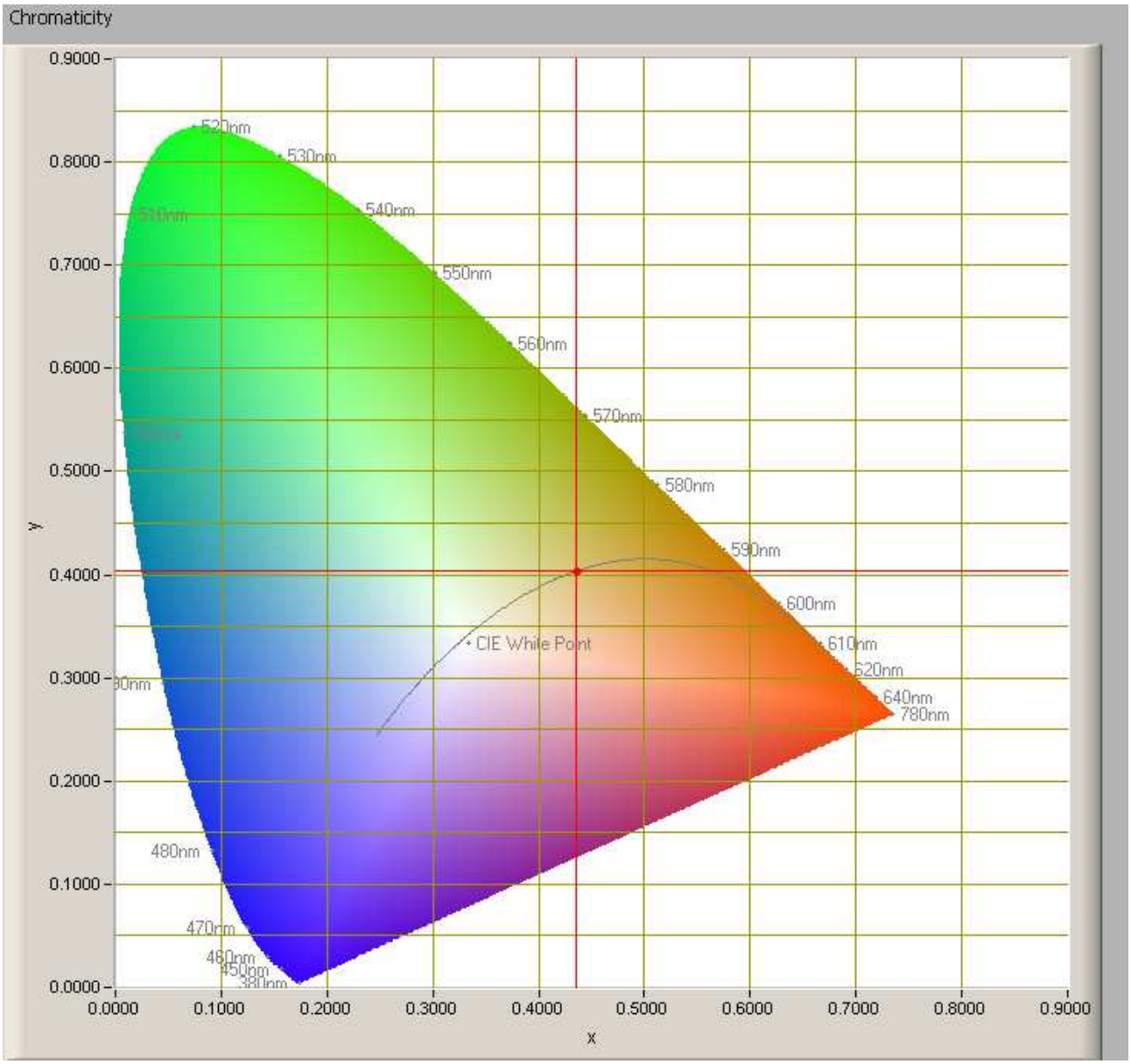
Chromaticity diagram



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

The light coming from this lamp is on top of the Planckian Locus (the black path in the graph).

Its coordinates are x=0.4351 and y=0.4033.

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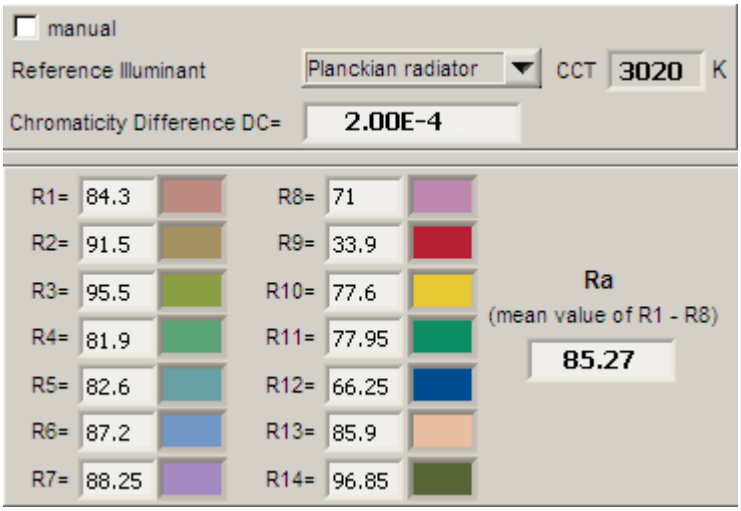
Color Rendering Index (CRI) or also Ra

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 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 85 is higher than 80 which is considered a minimum value for indoor usage.

Note: the chromaticity difference is 0.0020 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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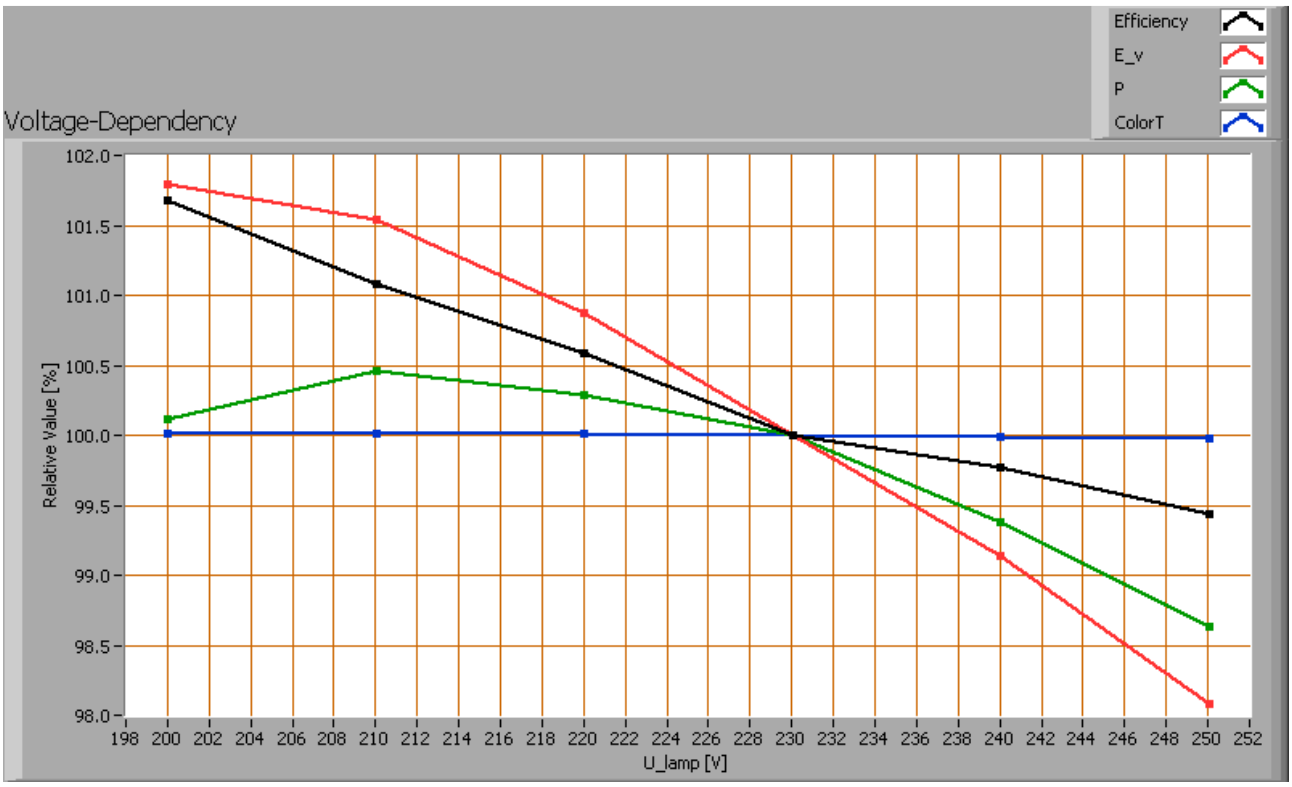
Voltage dependency

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 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 power consumed and the illuminance measurements do depend little on the light bulb voltage applied; all variations are within 2.0 % of the value at 230 V.

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 less than 0.5 %.

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 lamppower P [W] and the luminous efficacy [lm/W].

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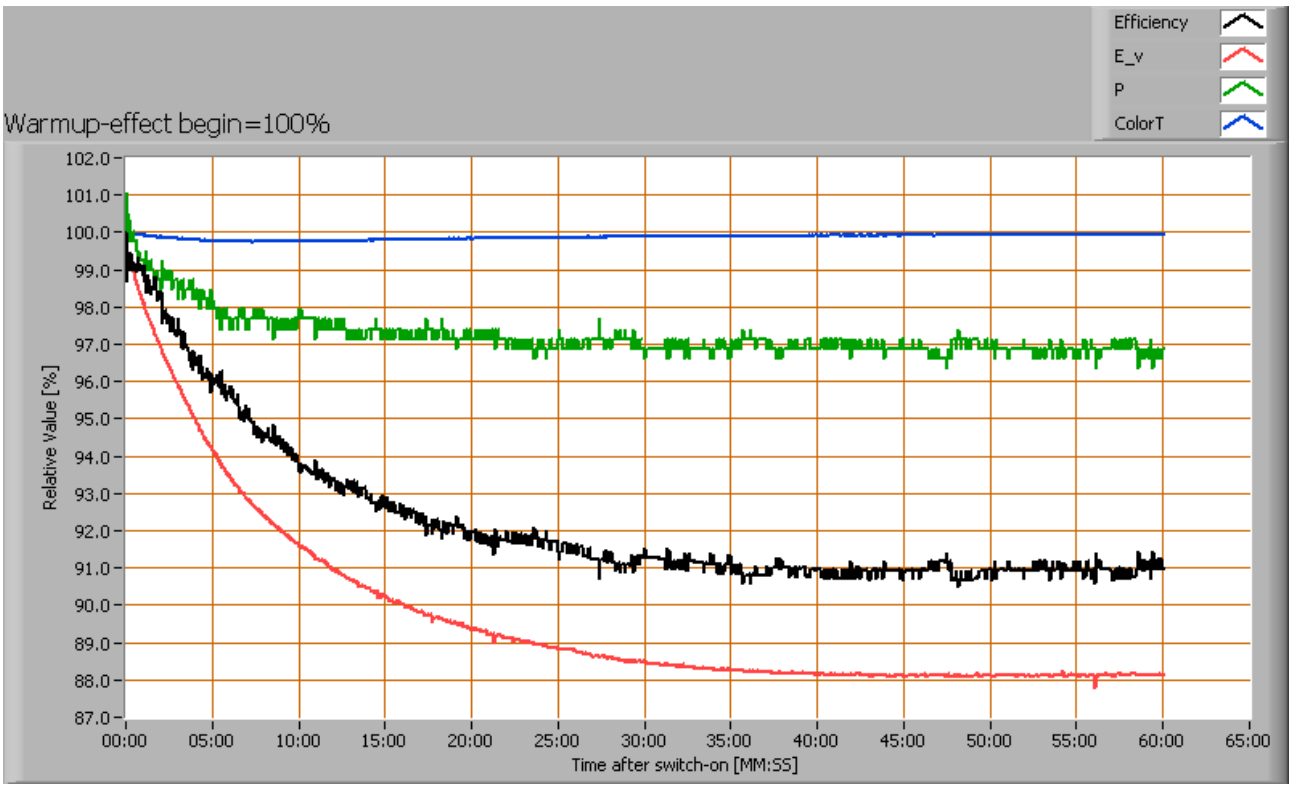

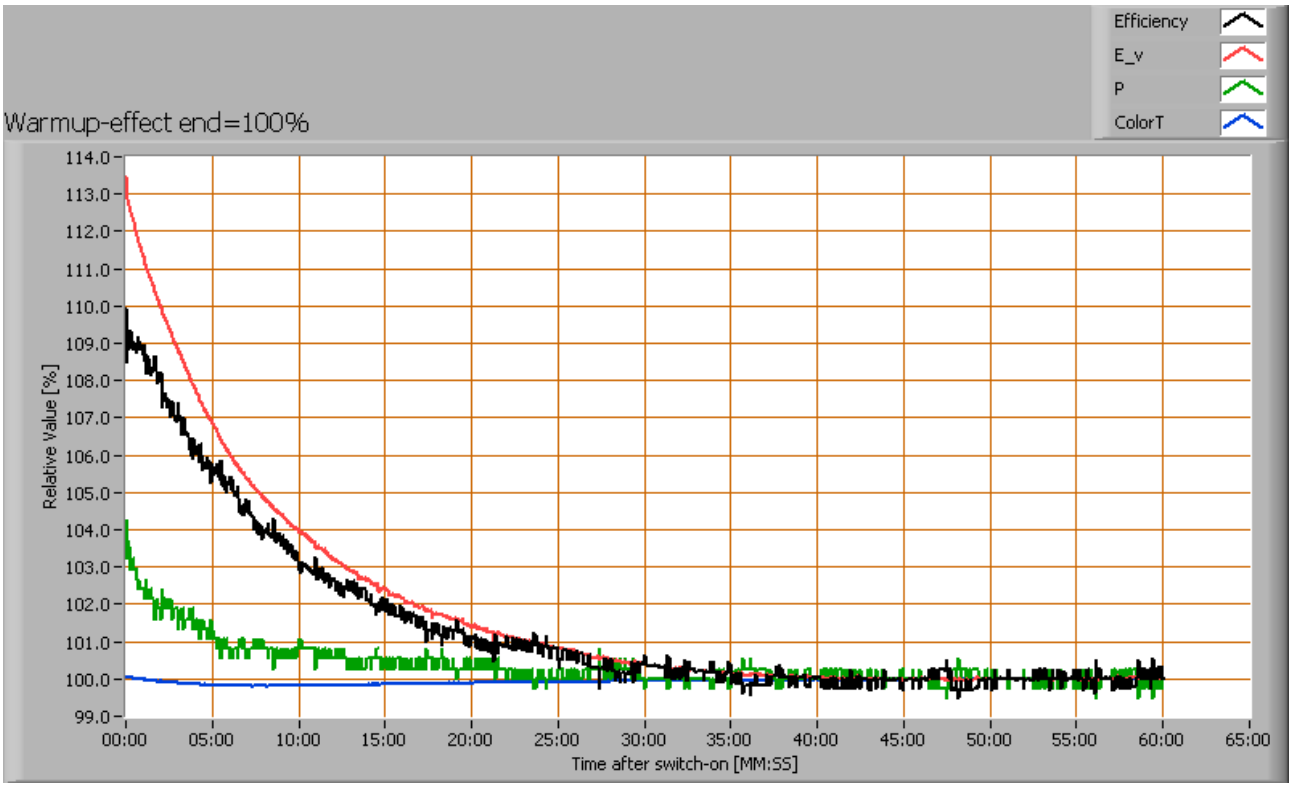

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Effect of warming up on different light bulb parameters. The 100 % level is put at begin (top) and at the end (bottom).

The illumination decreases with about 12 % over a warm-up time of 35 minutes.

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