Lamp measurement report – 7 Jan 09 for Led Light Europe

LLE MR16 GU5.3 3L 3W CW

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Summary measurement data

parameter	meas. result	remark
Color temperature	7161 K	Bright white
Luminous intensity I_v	340 Cd	
Beam angle	25 deg	A focused beam but less focused than the warm white version.
Power P	3.13 W	
Power Factor	0.68	For every 1 kWh net power consumed, there has been 1.1 kVAhr for reactive power.
Luminous flux	119 lm	
Luminous efficacy	38 lm/W	
CRI_Ra	72	Color Rendering Index.
Coordinates chromaticity diagram	x=0.3043 and y=0.3142	
Fitting	GU5.3/MR16	
D x H external dimensions	50 x 45 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 deg C. Warm up effect: illuminance decreases 14 % in 25 minutes. The color temperature increases with 8 % during this period. Voltage dependency: consumed power and illuminance are not dependent from the light bulb voltage; except when the power voltage falls below 11 V. There is a warm white version of this light bulb, see at the end of this report a close-up of both fronts.

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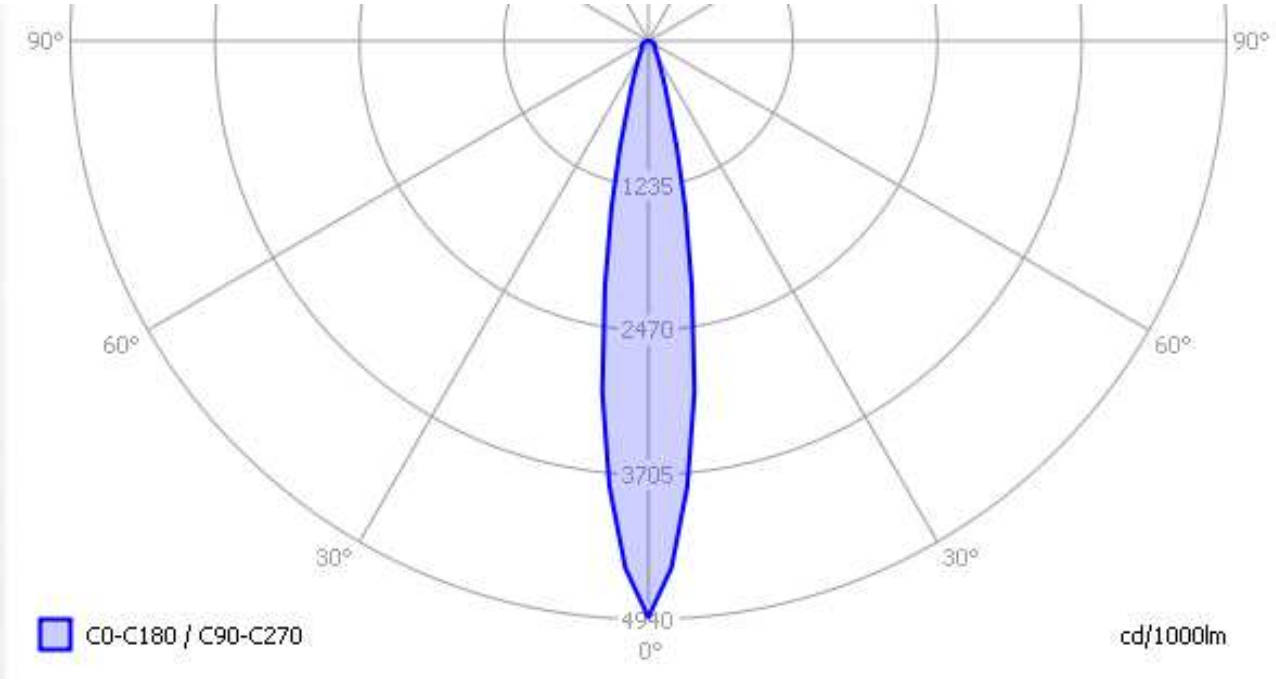
Eulumdat light diagram

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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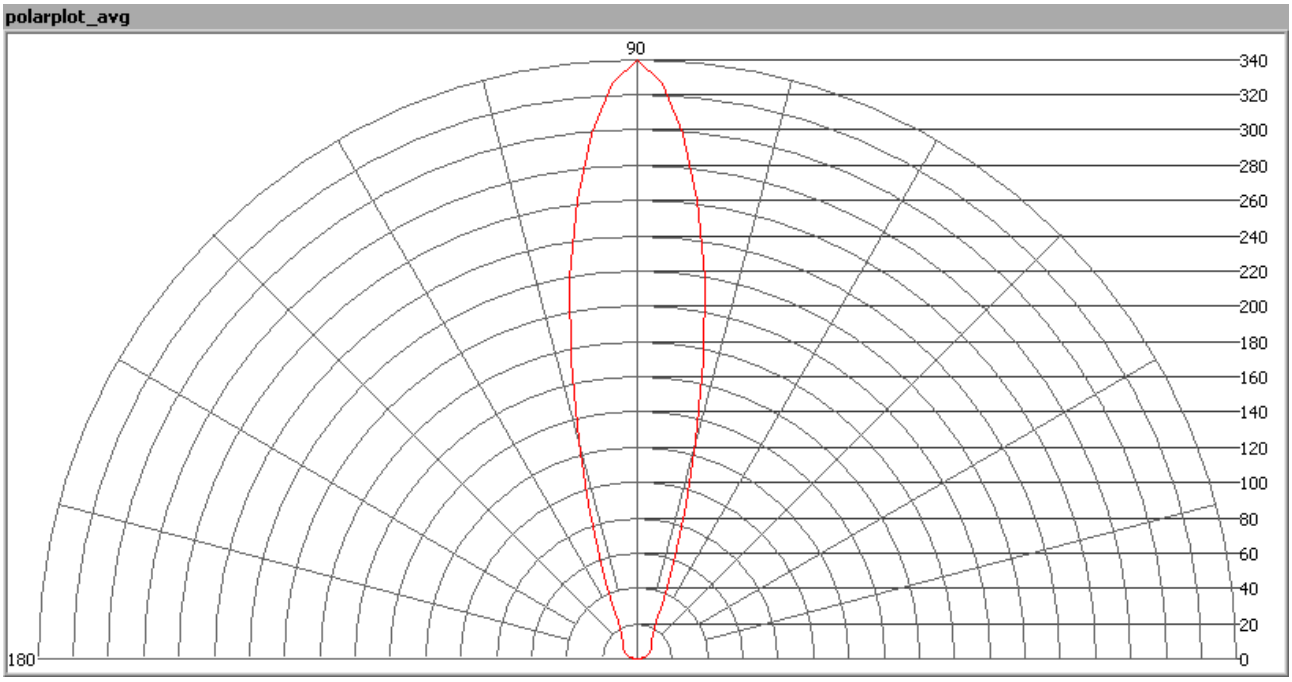
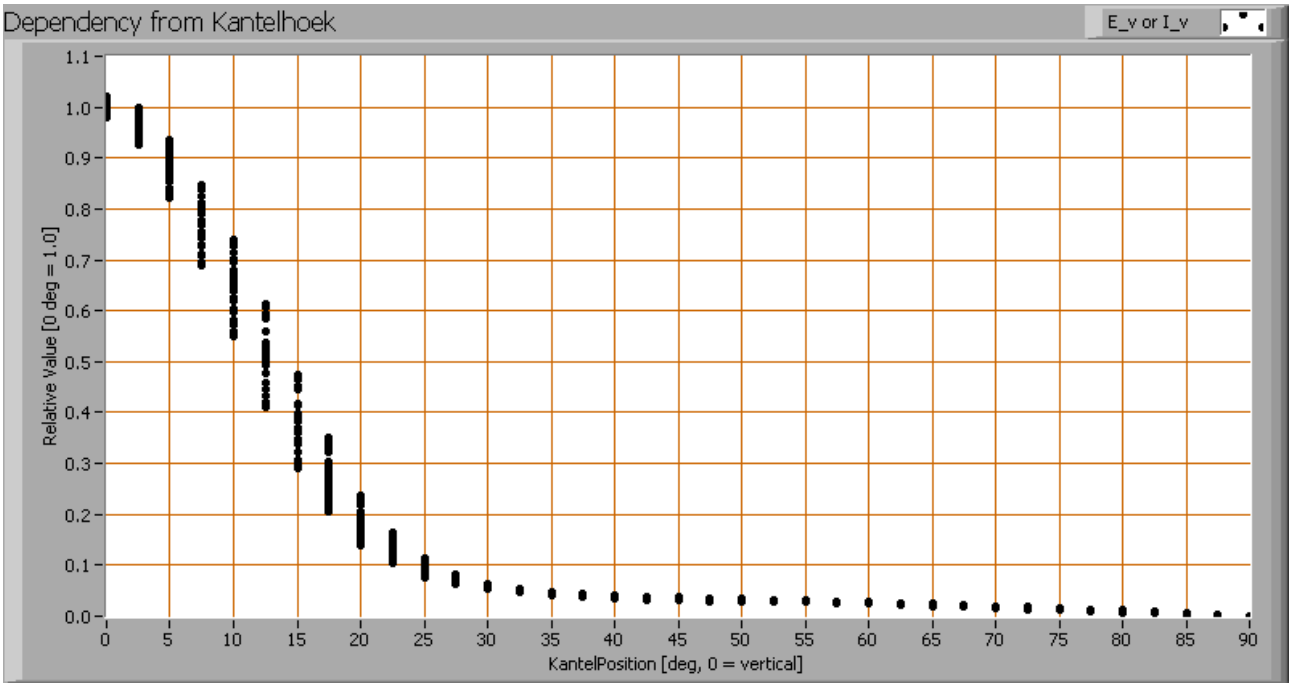


The radiation pattern of the light bulb.

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. For the small inclination angles, there is variation in light intensities for different turn-angles.

When using the average values per inclination angle, the beam angle can be computed, being 25 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 119 lm.

Luminous efficacy

The luminous flux being 119 lm, and the power of the lightbulb being 3.13 W, yields a luminous efficacy of 38 lm/W.

A power factor of 0.68 means that for every 1 kWh net power consumed, a reactive component of 1.1 kVAr was needed.

Light bulb voltage	12.0 V
Light bulb current	385 mA
Power P	3.13 W
Apparent power S	4.6 VA
Power factor	0.68

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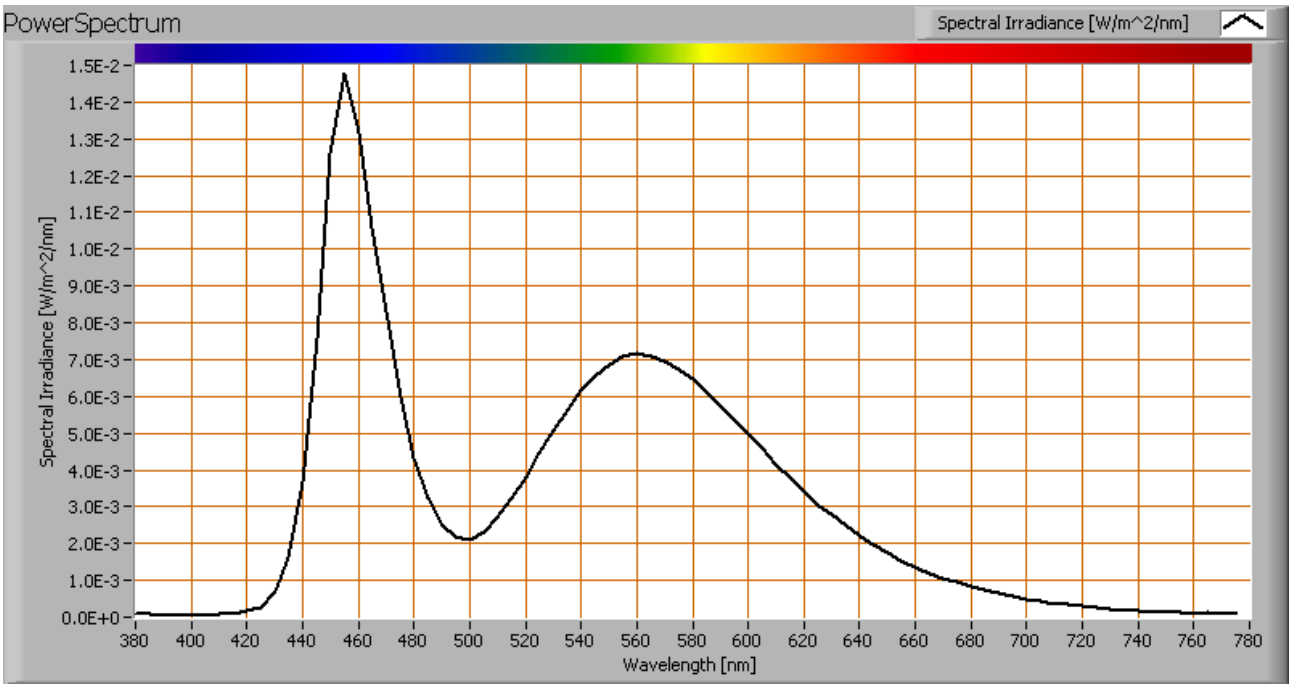
Color temperature and Spectral power distribution



The spectral power distribution of this light bulb.

The measured color temperature is about 7150 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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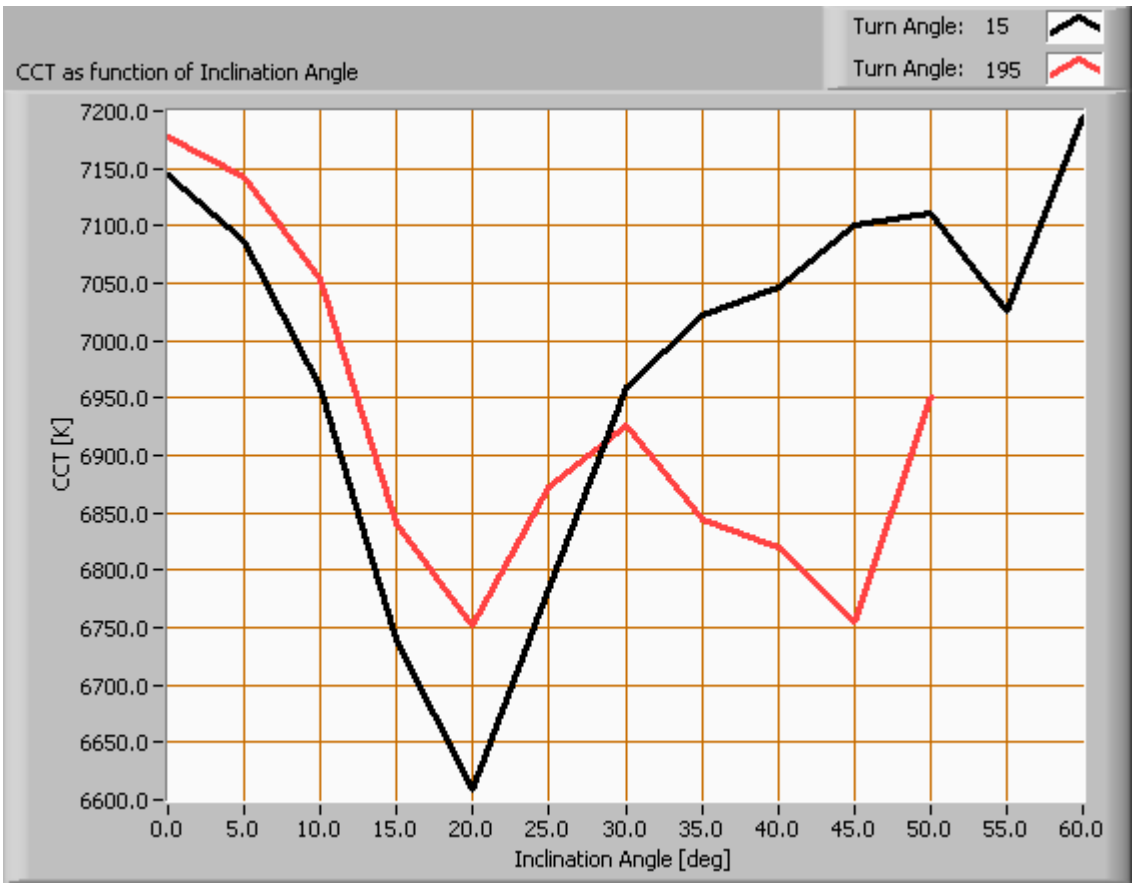

The color temperature dependent from the inclination angle.

There are changes in the color temperature when looking at the tube under different inclination angles. These variations are in the order of 7 - 8 %.

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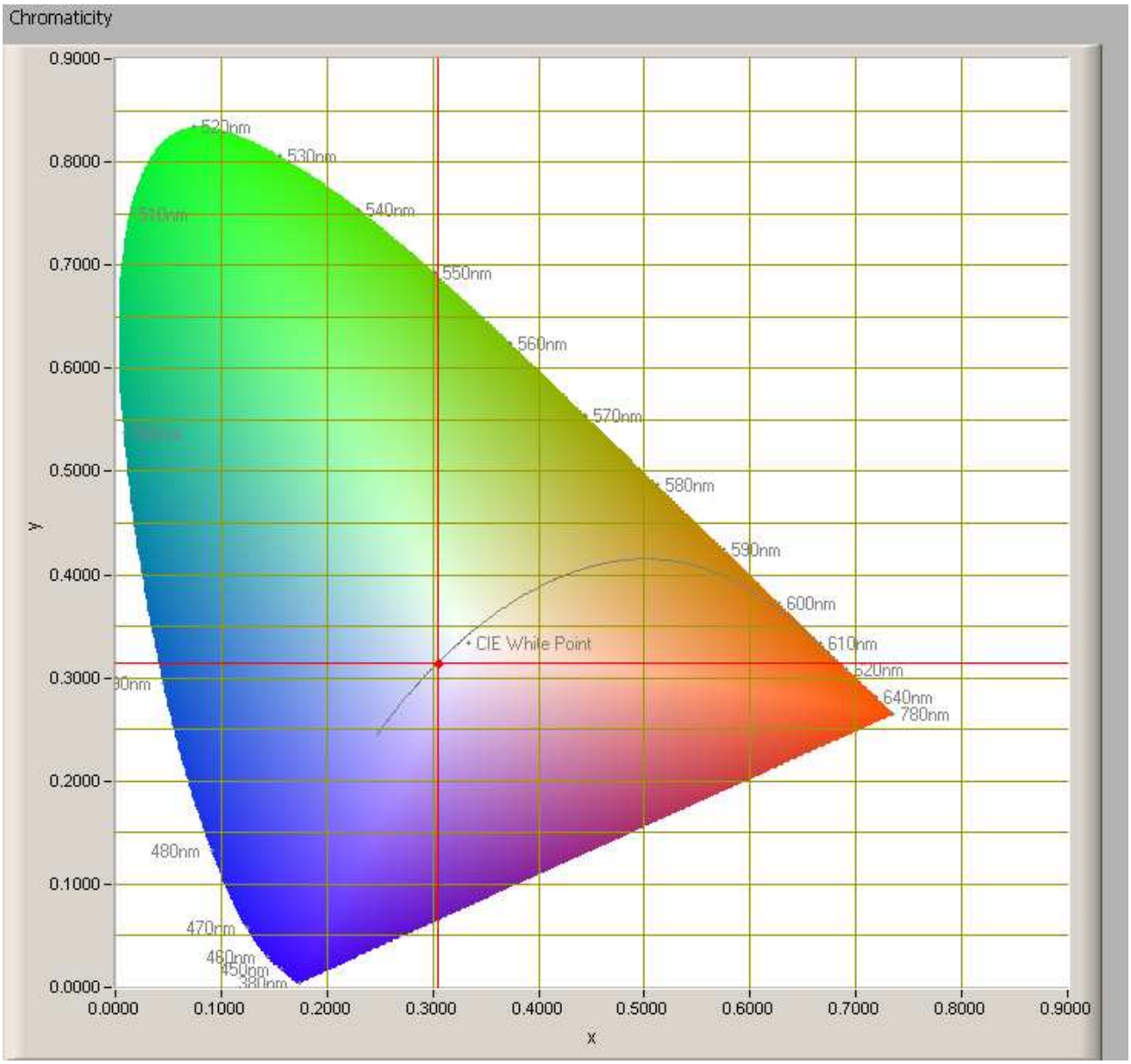
Chromaticity diagram



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=0.3043 and y=0.3142.

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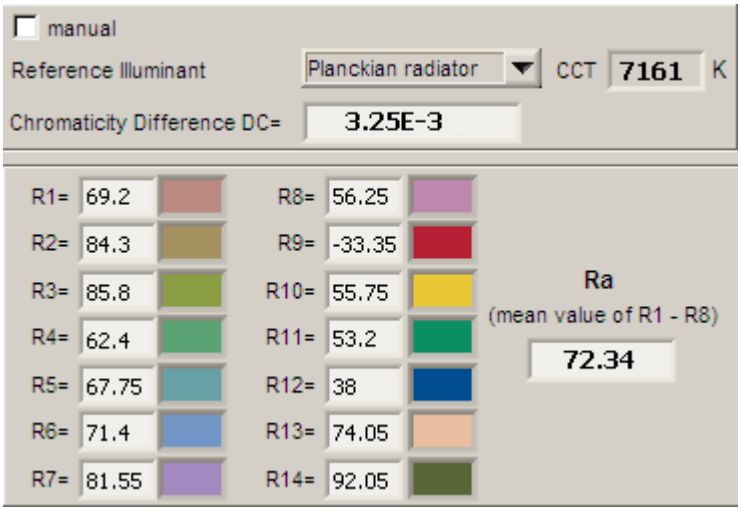
Color Rendering Index (CRI) or also Ra

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 72 is lower than 80 which is considered a minimum value for indoor usage.

Note: the chromaticity difference is 0.0033 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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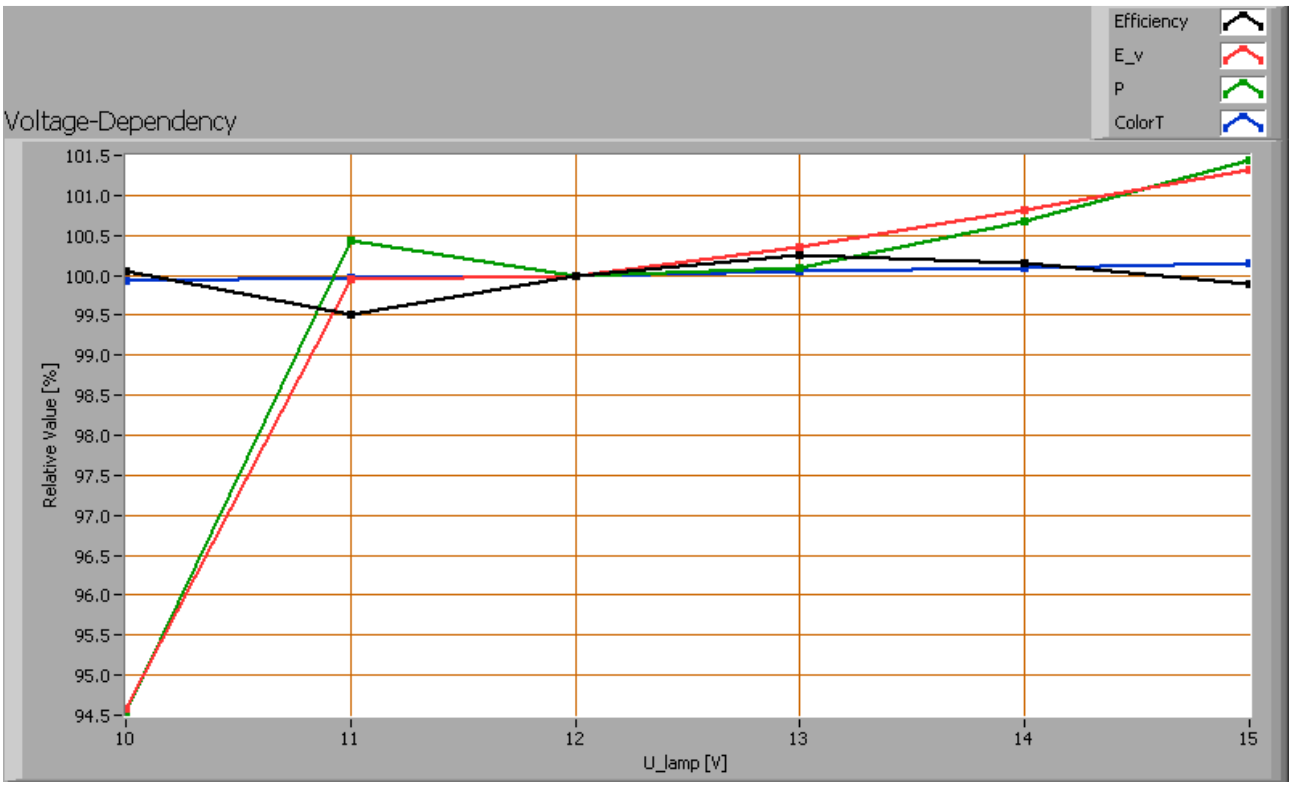
Voltage dependency

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 12 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 1.5 % of the value at 12 V. Except for voltage values below 11 V there is a sharp decline of the power consumed as well as the illuminance.

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 12 V + and - 1 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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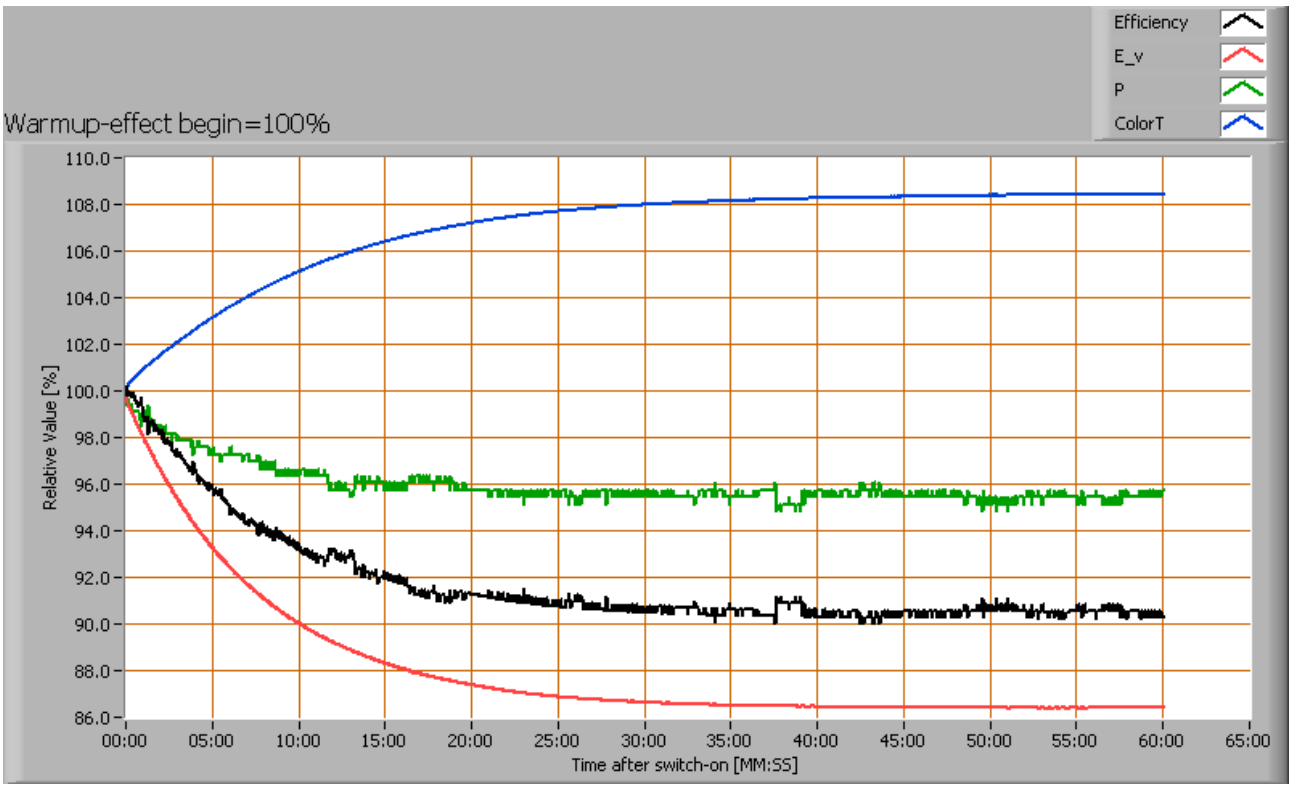

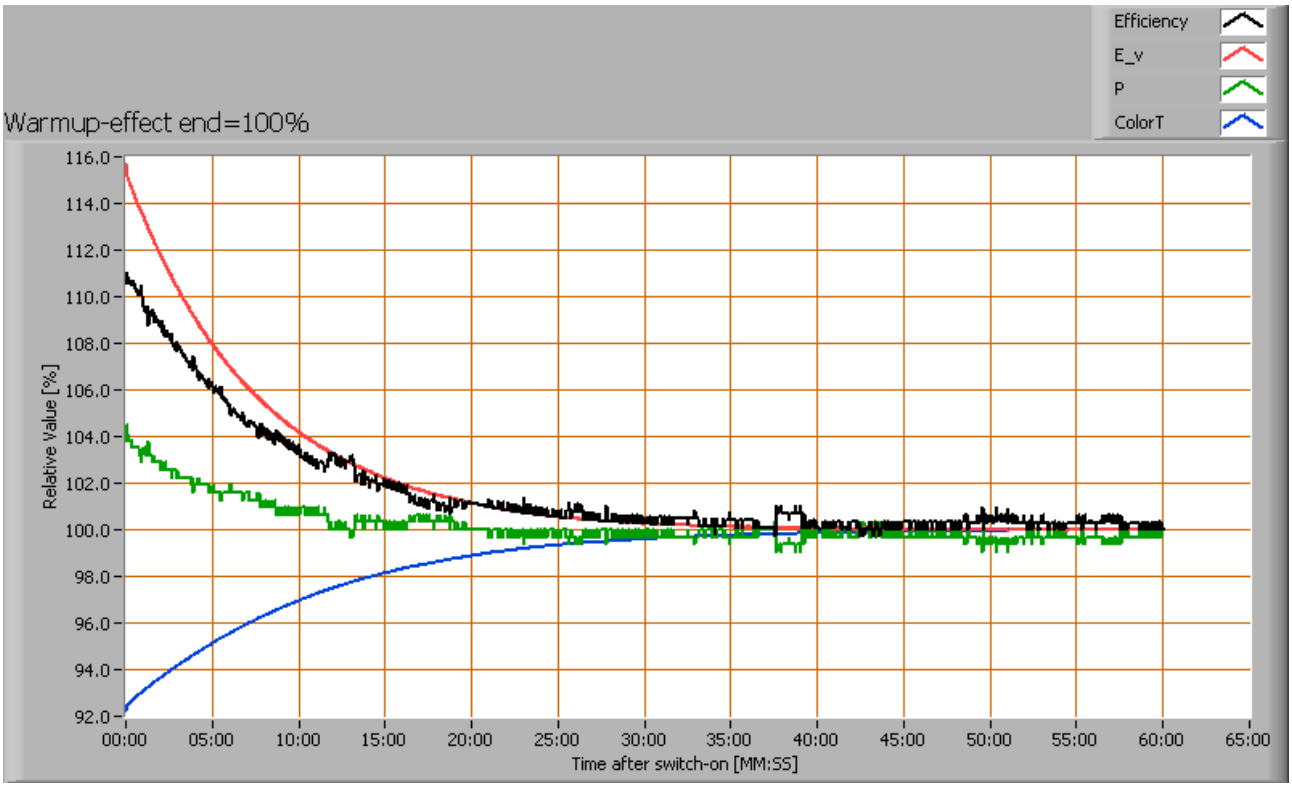

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Effect of warming up on different light bulb parameters. The 100 % level is put at begin (top) and at the end (bottom).

The illumination decreases with about 14 % over a warm-up time of 25 minutes. The color temperature increases 8 % in this time period.

Close up of front side of warm white and cold white

Close-up for the front side of warm white (left) and cold white (right) version

The warm white led light spot shows the leds with more yellow hue. It is clear that there is more phosphorescent used.

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