Line Lite International BV 3 x 2 W GU10 Cree WW

Lamp measurement report – 12 April 09 for Line Lite International BV

Summary measurement data

parameter	meas. result	remark
Color temperature	2638 K	Deep warm white
Luminous intensity I_v	529 Cd	
Beam angle	28 deg	
Power P	4.0 W	
Power Factor	0.46	For every 1 kWh net power consumed, there has been 1.9 kVAhr for reactive power.
Luminous flux	141 lm	
Luminous efficacy	36 lm/W	
CRI_Ra	82	Color Rendering Index.
Coordinates chromaticity diagram	x=0.4594 and y=0.4014	
Fitting	GU10	
D x H external dimensions	50 x 60 mm	External dimensions of the light bulb.
Diameter luminous area	39 mm	Dimensions of the luminous area (used in Eulumdat file). This is the diameter around the three leds in the front of the light bulb.
General remarks		The ambient temperature during the whole set of measurements was 23-26.5 deg C. Warm up effect: the illuminance and power decrease with about 12 % during the warm up time. Voltage dependency: there is a linear dependency of illuminance and power consumption on the voltage. See the website of OliNo for the link to the Eulumdat file.

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Eulumdat light diagram

An interesting graph is the light diagram, indicating the intensity in the C0-C180 and the C90-C270 plane. This light diagram below comes from the program Qlumedit, that extracts these diagrams from an Eulumdat file.
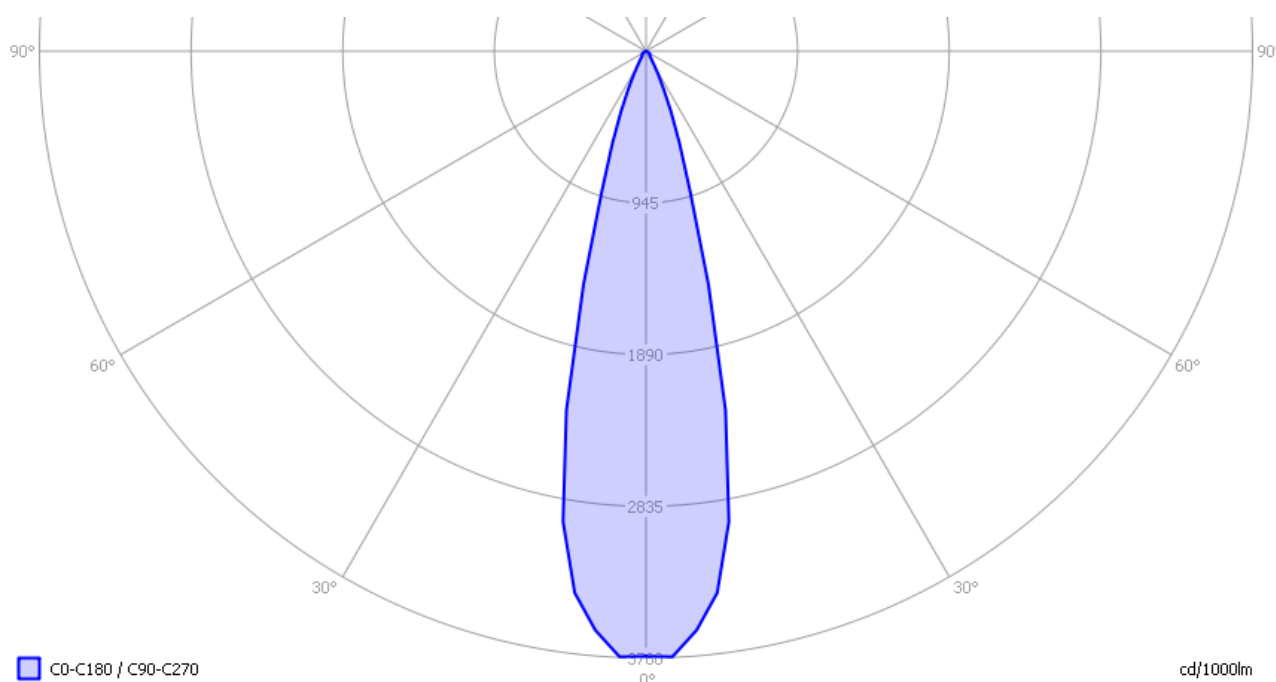
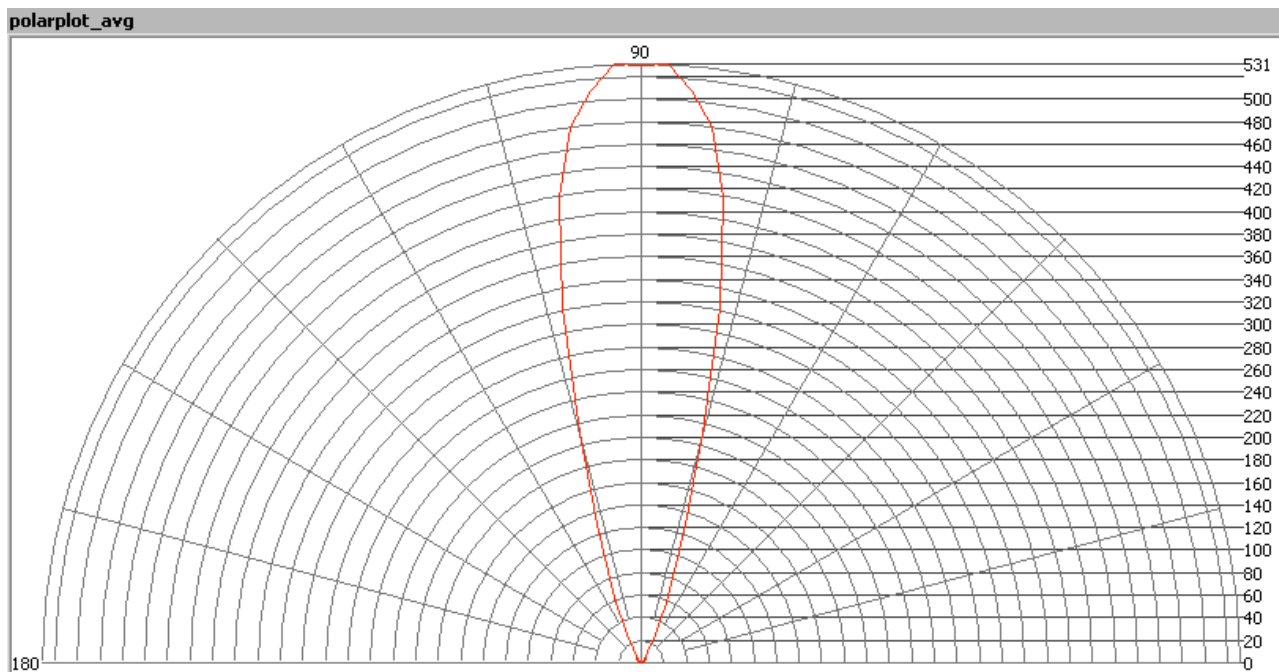*The light diagram giving the radiation pattern.*

It indicates the luminous intensity around the light bulb. This light diagram is symmetrical around the z-axis.
The unit is Cd/1000lm, meaning the intensity in Cd assuming there would be 1000 lumen in the measured light bulb. This enables comparing different types of light bulbs.

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.

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The radiation pattern of the light bulb.

This radiation pattern is the same as the one given earlier. This is because in this light bulb's case, the radiation pattern is symmetric around the z-axis, meaning that the averaged pattern given here is the same as the extraction of the Eulumdat file. These averaged values are used (later) to compute the lumen output.

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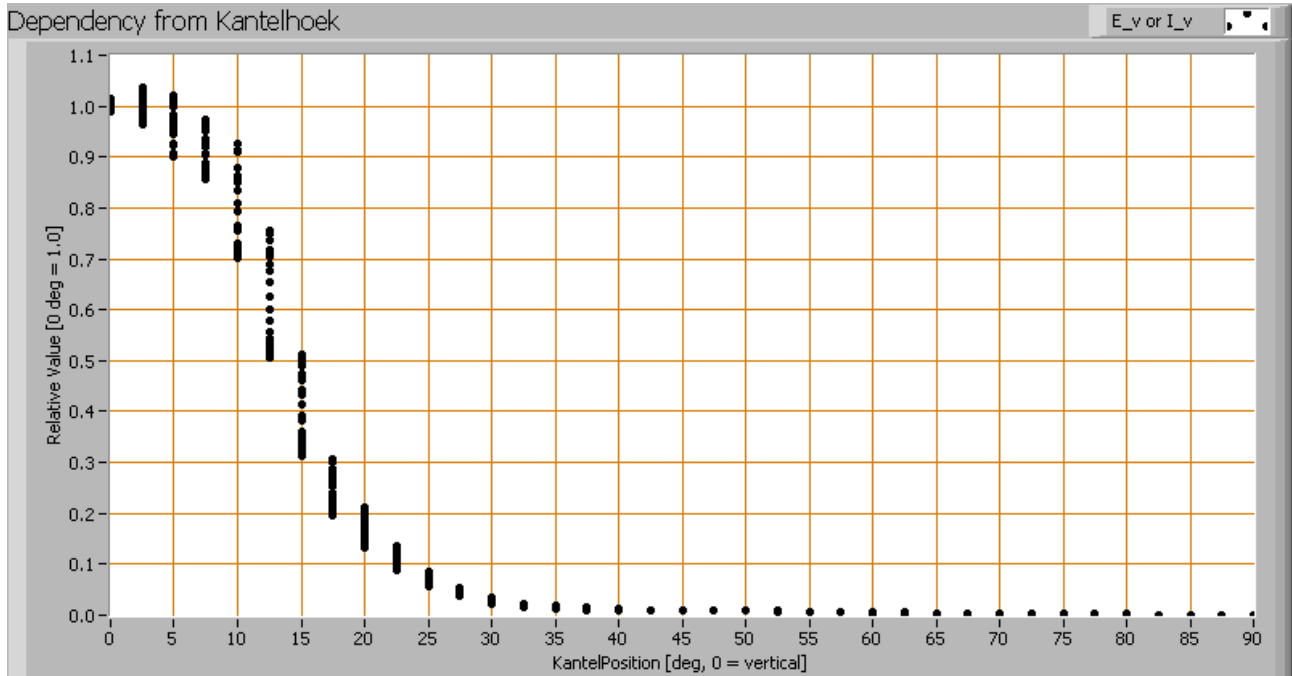
Intensity data of every measured turn angle at each inclination angle.

This plot shows per inclination angle the intensity measurement results for each turn angle at that inclination angle. So at 12.5 degrees inclination angle, all the measurement results of illuminance for all measured turn angles are in the range of 50-76 % of the illuminance value at 0 degrees inclination angle.

When using the average values per inclination angle, the beam angle can be computed, being 28 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 light spot is a luminous flux of 141 lm.

Luminous efficacy

The luminous flux being 141 lm, and the power of the lightbulb being 4.0 W, yields a luminous efficacy of 36 lm/W.

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A power factor of 0.46 means that for every 1 kWh net power consumed, a reactive component of 1.9 kVAr was needed.

Light bulb voltage	230 V
Light bulb current	38 mA
Power P	4.0 W
Apparent power S	8.6 VA
Power factor	0.46

## Color temperature and Spectral power distribution
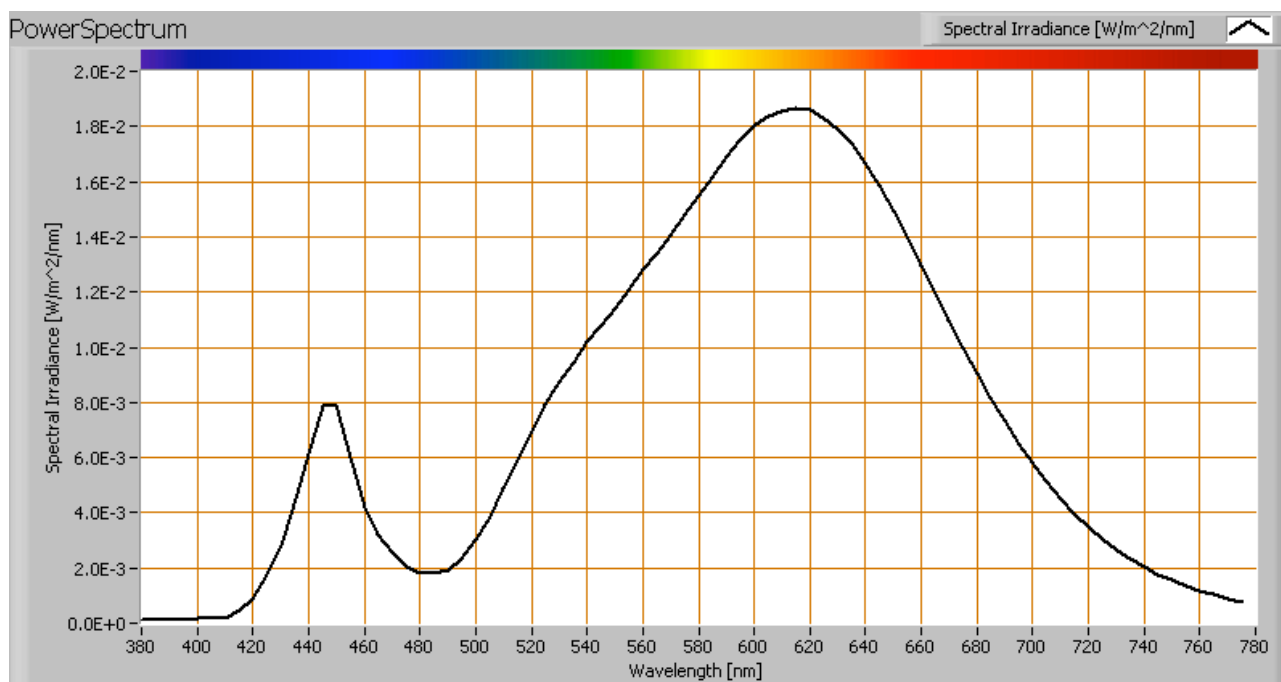
The spectral power distribution of this light bulb.

The measured color temperature is about 2650 K which is deep warm 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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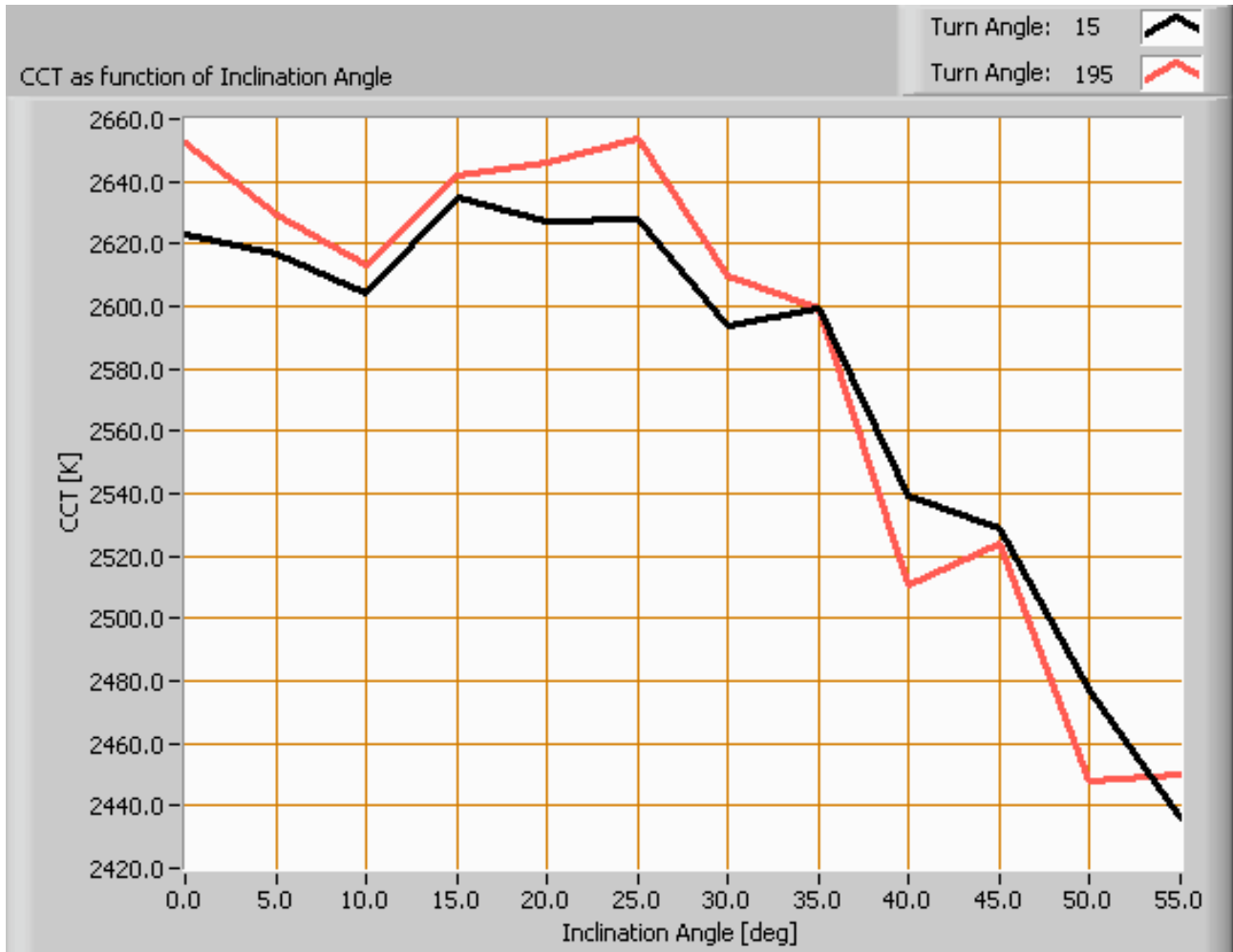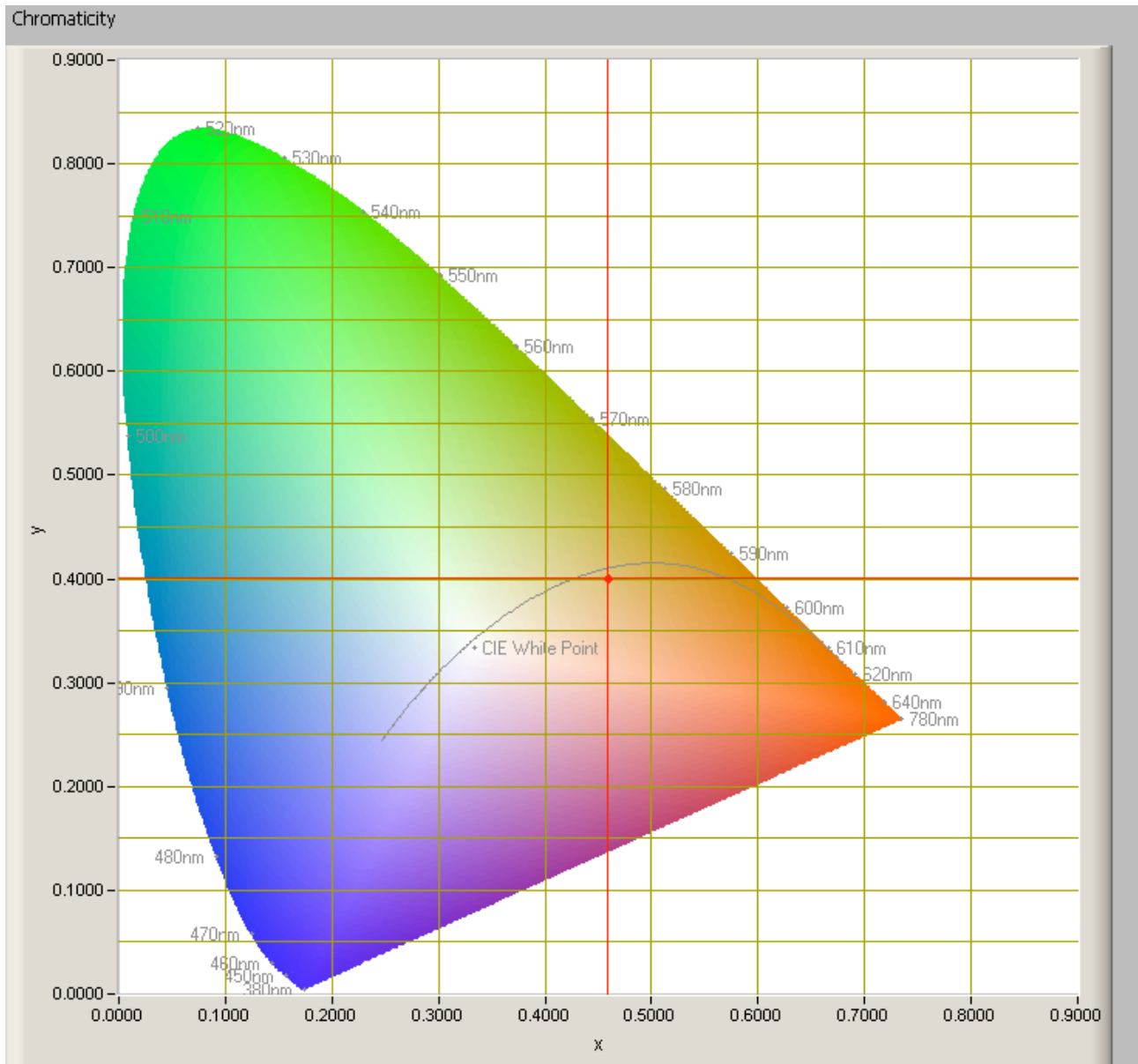

Color temperature as a function of inclination angle.

The maximum value of inclination angle is 55 degrees. Beyond that value there is virtually no intensity anymore. The color temperature shows about -8 % deviation from its value at 0 % inclination angle.

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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 at a distance from the Planckian Locus (the black path in the graph).

Its coordinates are x=0.4594 and y=0.4014.

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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 light2 of this lightbulb.

The value of 82 is higher than 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.

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

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CCT [K], the lamppower P [W] and the luminous efficacy [lm/W].
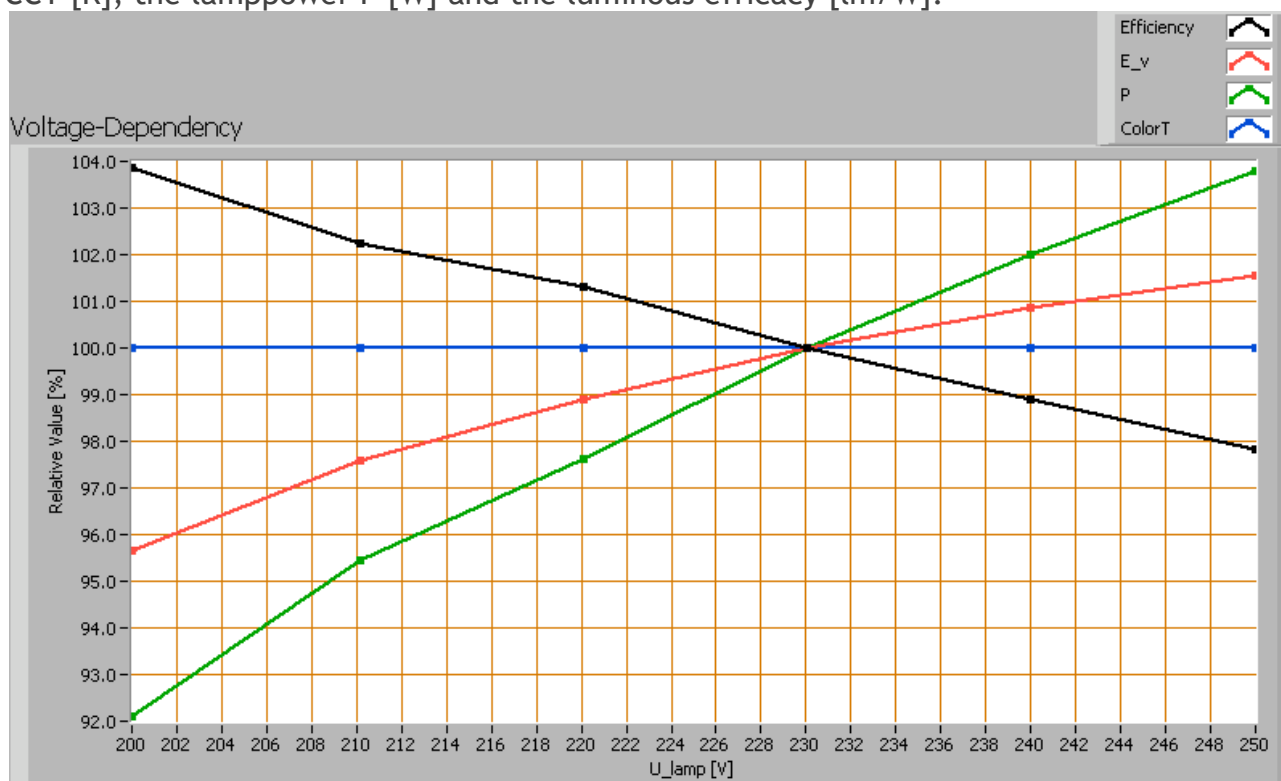
Lamp voltage dependencies of certain light bulb parameters, where the value at 230 V is taken as 100 %.

The consumed power and the illuminance vary max 8 % when the voltage varies between 200 - 250 V. This variation is linear.

When the voltage at 230 V varies with + and - 5 V, then the illuminance varies with less than + and - 0.5 %, which is not visible, also not when this illuminance changes abruptly.

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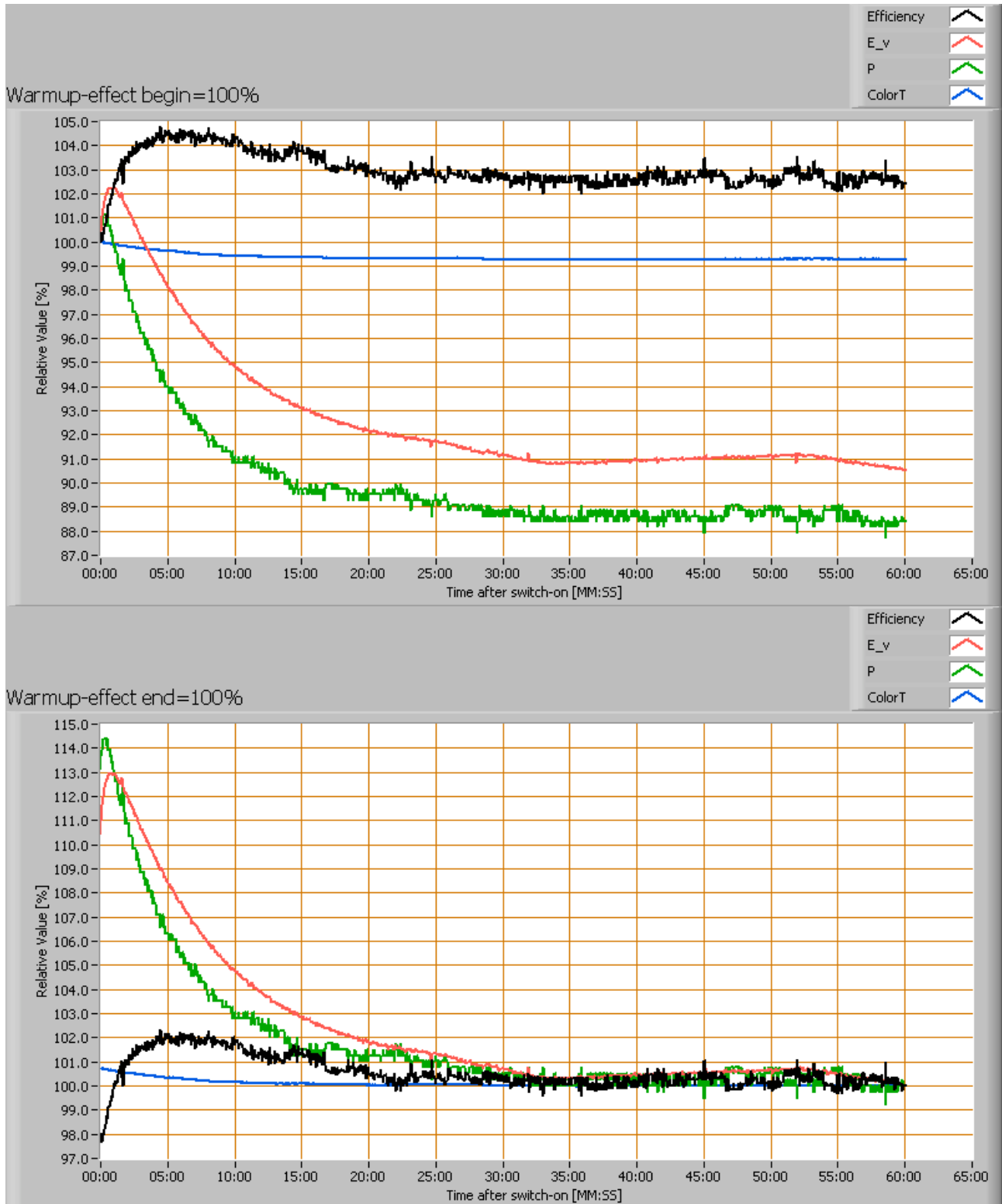
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Effect of warming up on different light bulb parameters. At top the 100 % level is put at begin, and at bottom at the end.

The illuminance and the power decrease about 12 % during the warmup time of 30 minutes.

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