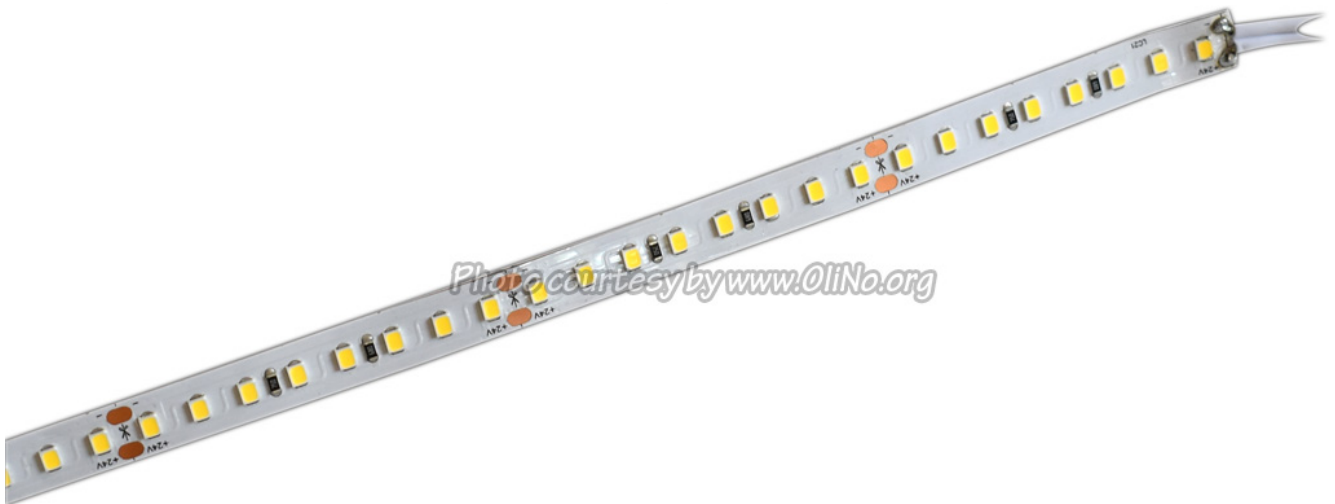


**Lamp measurement report - 3 Sep 2023**  
**Lumently ledvalonauha 7.0W 4000K**

by  
Proled Finland



## Lamp measurement report - 3 Sep 2023

### Summary measurement data dated 2023-05-25

parameter	meas. result	remark
Color temperature	3932 K	warm/neutral white
Luminous intensity I <sub>v</sub>	402.7 Cd	Measured straight underneath the lamp.
Illuminance modulation index	1 %	Measured with a light sensor looking at the lamp (angle not defined). Is a measure for the amount of flickering.
SVM	0.0	Stroboscopic Visibility Measure, and must be $\leq 0.9$ (from September 1, 2024 $\leq 0.4$ ) at full-load for certain (O)LEDs per EU regulation 2019/2020.
Beam angle	119 deg	119 deg is the beam angle for all C-planes since the lamp is symmetrical along its 1st axis.  Flux code: 45 78 96 100 100.
Power P	6.9 W	The net power consumed.
Power Factor	1.00	An electrical load with this power factor means that for every 1 kWh net energy consumed, there has been 0.00 kVAhr for reactive energy.
THD	NaN %	Total Harmonic Distortion, is not present as a DC voltage was used to power the lamp so a DC current resulted which has no THD.
Luminous flux	1233 lm	Measured with photogoniometer, calculation done as described in LM79-08.
Luminous efficacy	178 lm/W	This efficiency is for the LED / lamp only and is without any power supply that must convert the 230 V to DC current.
EU2021-label classification	C	The energy class, from A (more efficient) to G (least efficient). This label is an update of the previous version, and compulsory from Sept 2021.
EU2013-label classification	A++	The energy class, from A++ (more efficient) to E (least efficient). This energy label will be replaced on September 21, 2021.
CRI_Ra	95	Color Rendering Index.
Rf_TM30	90	TM30-15 is an improved indicator (over CRI) of how well colors are rendered.
Rg_TM30	99	Gamut Area Ratio.
Coordinates chromaticity diagram	x=0.3838 en y=0.3799	
Fitting	24V DC	

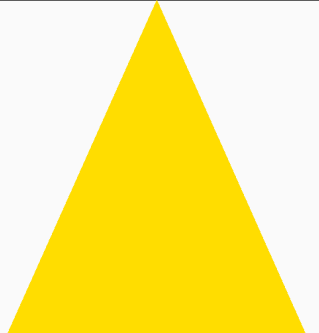
## Lamp measurement report - 3 Sep 2023

parameter	meas. result	remark
Luminous flux for chicken	2178 cLm	Total radiant flux adjusted by color sensitivity curve (from 350 - 780 nm) of chickens ( <i>Gallus domesticus</i> ).
S/P ratio	1.8	This factor indicates the amount of times more efficient the light of this light bulb is perceived under scotopic circumstances (low environmental light level).
L x W x H external dimensions	1000 mm x 10 mm x 2 mm	External dimensions of the lamp.
L x W luminous area	1000 mm x 3 mm	Dimensions of the luminous area (used in Eulumdat file). It is the surface of the smallest rectangle around all LEDs.
General remarks		<p>The ambient temperature during the whole set of illuminance measurements was 24.8 - 25.4 deg C.</p> <p>The temperature of the lamp gets maximally about 13 degrees hotter than ambient temperature.</p> <p>Warm up effect: During the warmup time the illuminance varies during 29 minutes and increases with 5 %.</p> <p>During the warmup time the power varies during 29 minutes and increases with 6 %.</p> <p>The variation in efficacy (calculated as indication by simply dividing the illuminance by the power) during the warming up is -1 %.</p> <p>A very high negative value indicates a significant decrease for instance due to heating up of the lamp (decrease of lifetime).</p> <p>Voltage dependency: There is a constant dependency of the illuminance when the power voltage varies between 22 - 25 V .</p> <p>There is a constant dependency of the consumed power when the power voltage varies between 22 - 25 V .</p> <p>At the end of the article an additional photo.</p>
Eff-variation	-1 %	This is the variation in efficacy (calculated as indication by simply dividing the illuminance by the power) during the warming up. A very high negative value indicates a significant decrease for instance due to heating up of the lamp (decrease of lifetime).
Dimmable	no/not known	Info from manufacturer.
Melanopic effect factor	0.595	According to norm DIN SPEC 5031-100:2015-08.
Melanopic Ratio	0.49	This ratio multiplied with the lux value gives the EML-value (Equivalent Melanopic Value), used in table L2 of WELL std 2019-Q3.

## Lamp measurement report - 3 Sep 2023

parameter	meas. result	remark
Blue Light Hazard risk group	0	0=exempt, 1=low, 2 = moderate, 3=high risk. Indication value only for straight underneath the lamp.
form factor	strip	

### Overview table

m.	Ø 50%		C0-180: 119° C90-270: 119°	E (lux)	Luminaire Efficacy
	C0-180	C90-270			178 (lumen per Watt)
5	17	17		16	Half-peak diam C0-180
7.5	25.5	25.5		7	16.98 x diameter(m)
10	34	34		4	Half-peak diam C90-270
12.5	42.5	42.5		3	16.98 x diameter(m)
15	50.9	50.9		2	Illuminance
17.5	59.4	59.4		1	403 / distance <sup>2</sup> (lux)
20	67.9	67.9		1	Total Output
					1233 (lumen)

Please note that this overview table makes use of calculations, use this data with care as explained on the OLiNo site.



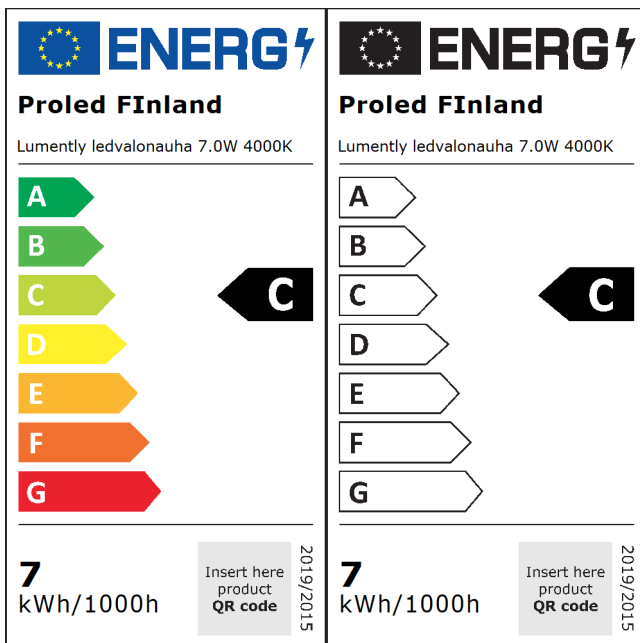
## Lamp measurement report - 3 Sep 2023

### EU 2021 Energy label classification

These energy labels are in force since Sept 2021. They have been drawn up in accordance with the Commission Delegated Regulation (EU) 2019/2015.

It applies to light sources, with requirements for the x, y chromaticity coordinates (is fulfilled), the luminous flux (is fulfilled) and colour rendering index CRI (is fulfilled). These requirements are fulfilled.

The energy efficiency class of light sources shall be determined on the basis of the total mains efficacy  $\eta_{TM}$ . This is calculated by dividing the declared useful luminous flux (1233 lm, flux in a sphere (360°)) by the declared on-mode power consumption  $P_{on}$  (6.9 W) and multiplying by the applicable factor  $F_{TM}$  that depends on the light source type (0.926, type: Non-directional (NDLS) not operating on mains (NMLS)). The result is the total mains efficacy  $\eta_{TM} = 165$  (lm/W).



EU energy label for this light source

## Lamp measurement report - 3 Sep 2023

### EU 2013 Energy label classification

Since Sept 2013 these labels will be needed.

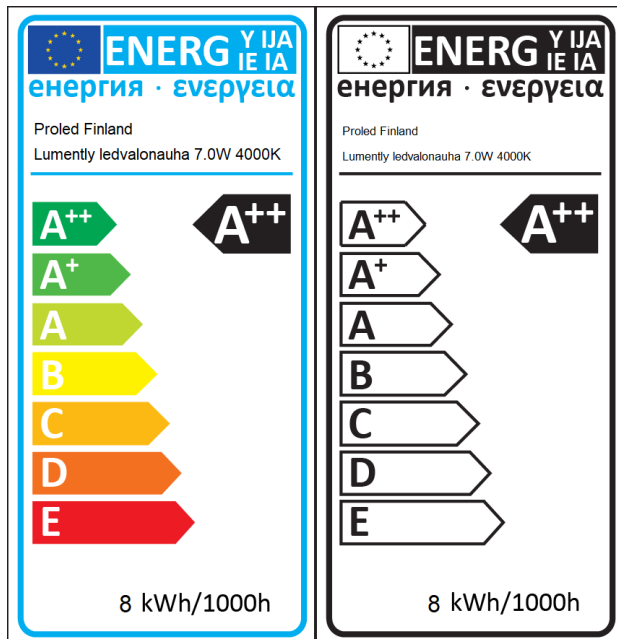
Important for the energy classification are the corrected rated power and the useful luminous flux.

The measured rated power is 6.9 W and might need to be corrected. The correction is dependent from the lamp type and whether or not the lamp control gear is included or not.

The choice for this lamp is the following classification: **Lamps operating on external LED lamp control gear**. As a result the corrected rated power becomes: 7.6 W.

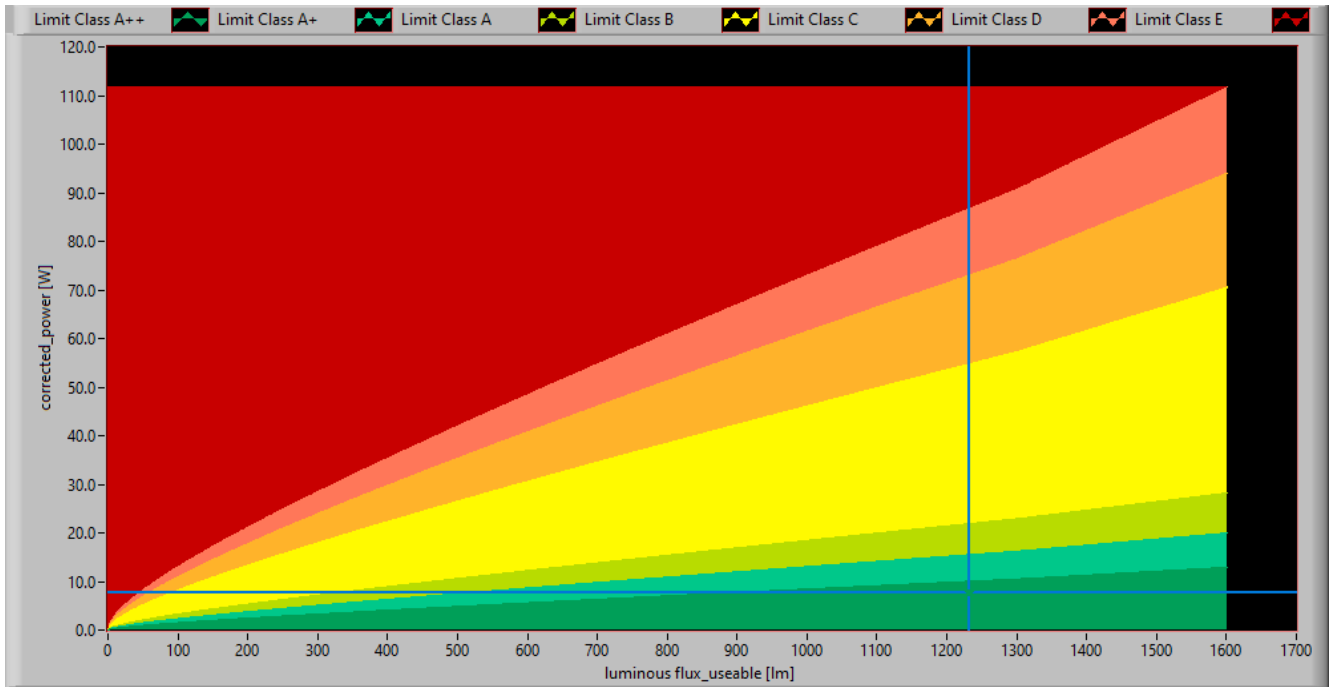
The luminous flux measured is 1233 lm. The classification of this lamp needed to determine the useful flux is: **Non-directional lamps**. Then the useful flux becomes 1233 lm. Now a reference power can be calculated.

The energy efficiency coefficient is  $P_{corr} / P_{ref} = 0.08$ .



EU energy label for this lamp

## Lamp measurement report - 3 Sep 2023

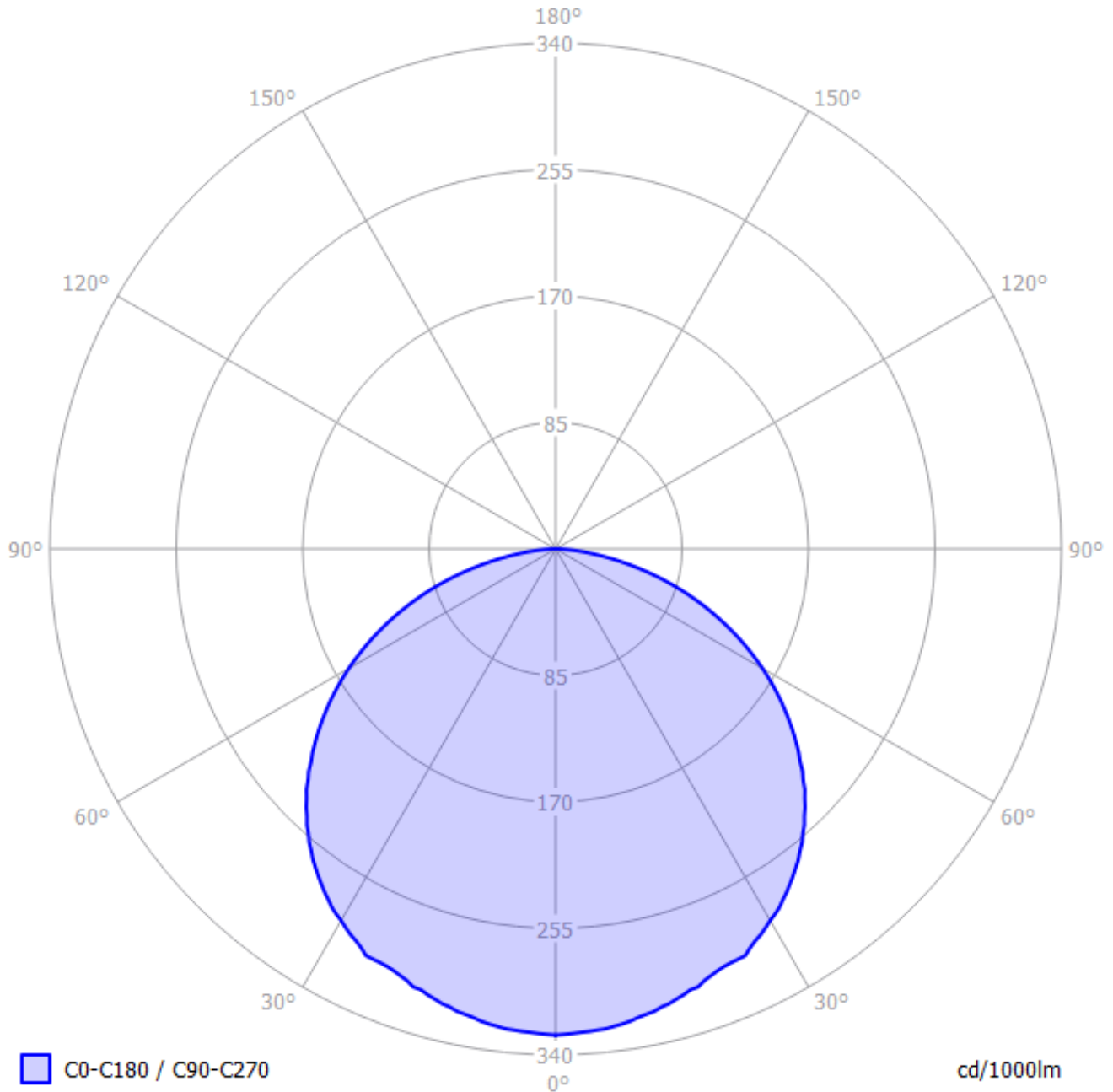


*The lamp's performance in the lumen-Watt field, with the energy efficacy fields indicated.*

## Lamp measurement report - 3 Sep 2023

### Eulumdat light diagram

This light diagram below comes from the program Qlumedit, that extracts these diagrams from an Eulumdat file.



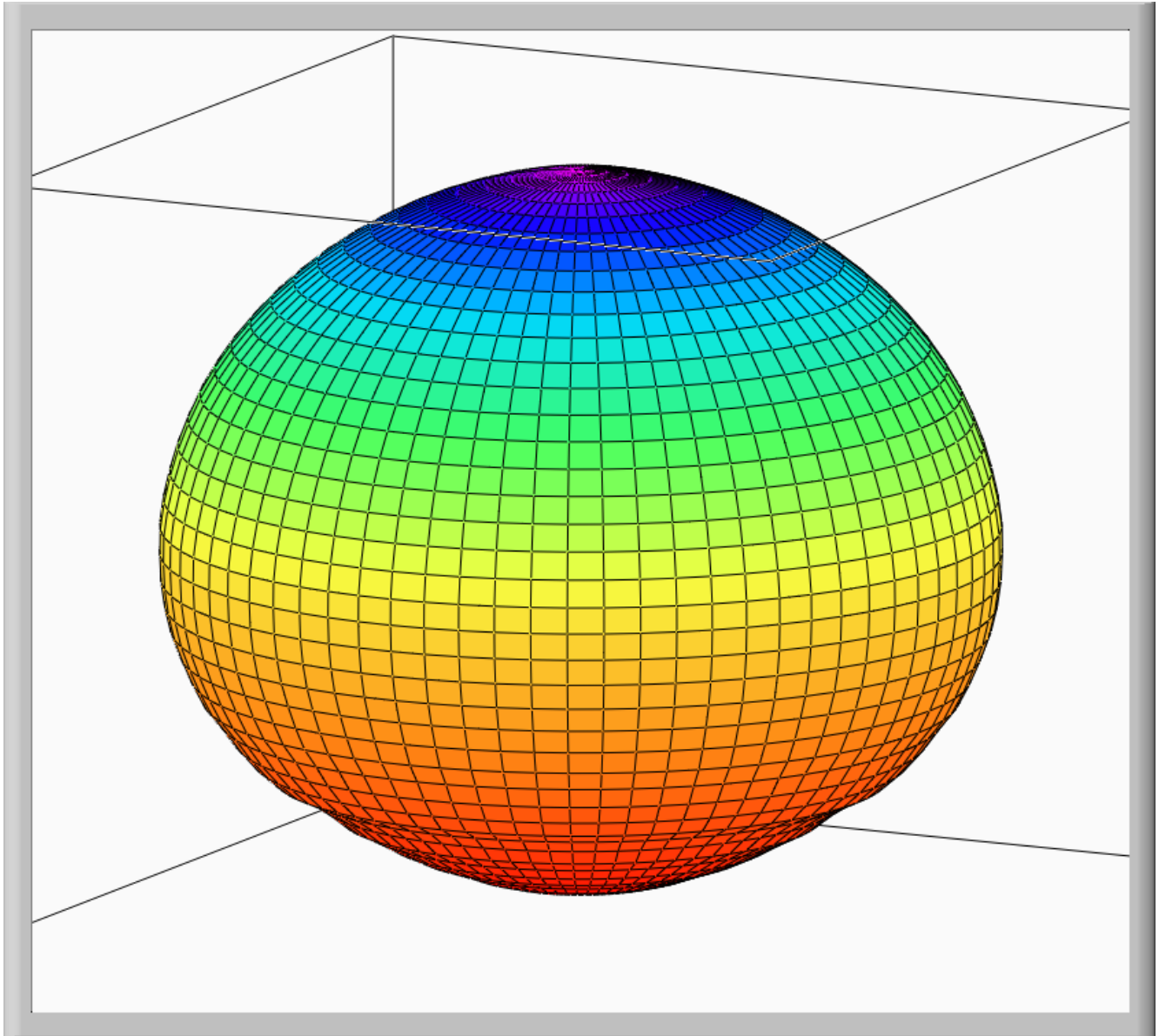
*The light diagram giving the radiation pattern.*

The light diagram indicates the beam in the C0-C180 plane and in the plane perpendicular to that, the C90-C270 plane. These beams are equal as the lamp has symmetry over its first axis (the vertical axis).

When using the Ev or Iv values per inclination angle, the beam angle can be computed, being 119 deg for the C0-C180 plane and 119 deg for the C90-C270 plane.

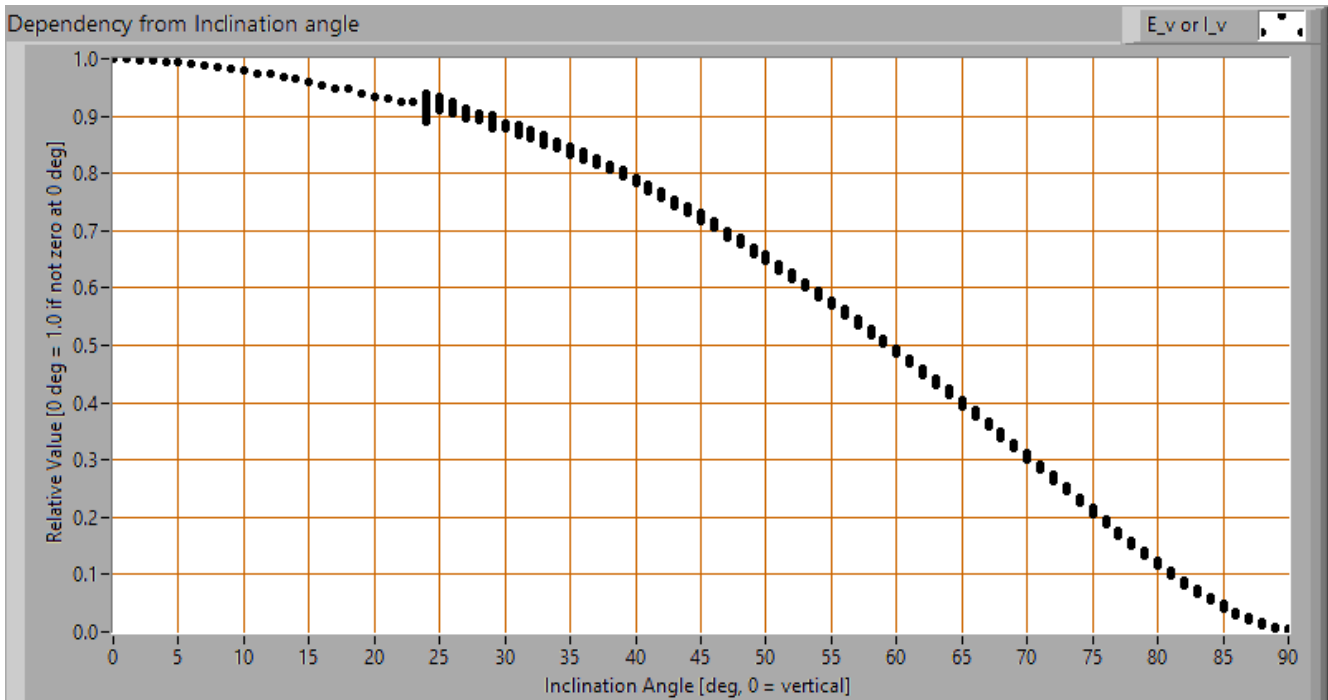


**Lamp measurement report - 3 Sep 2023**



*Image of the light distribution pattern in 3D.*

## Lamp measurement report - 3 Sep 2023



*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.

### 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 1233 lm.

### Luminous efficacy

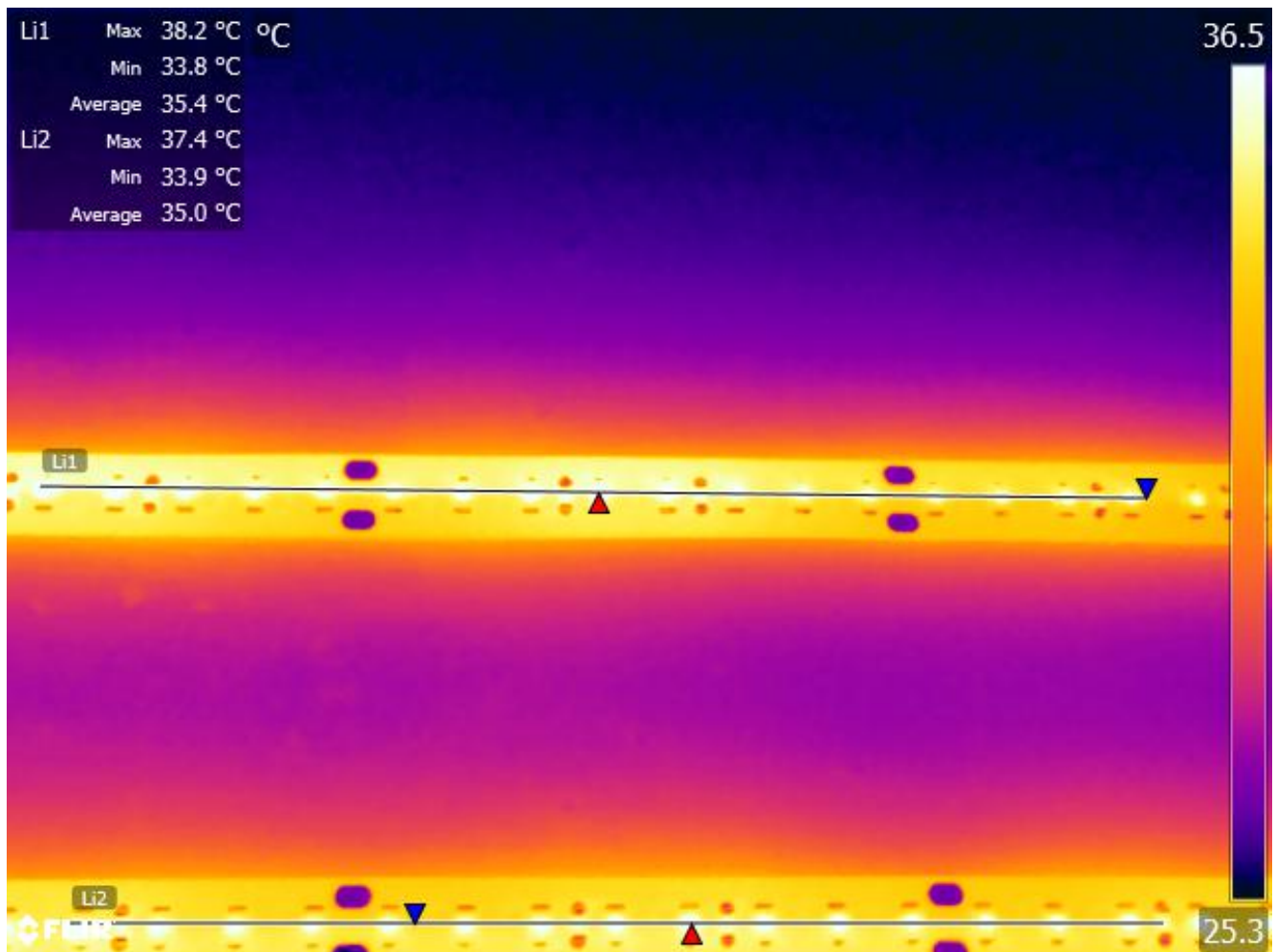
The luminous flux being 1233 lm, and the consumed power of the lamp being 6.9 Watt, results in a luminous efficacy of 178 lm/Watt.

## Lamp measurement report - 3 Sep 2023

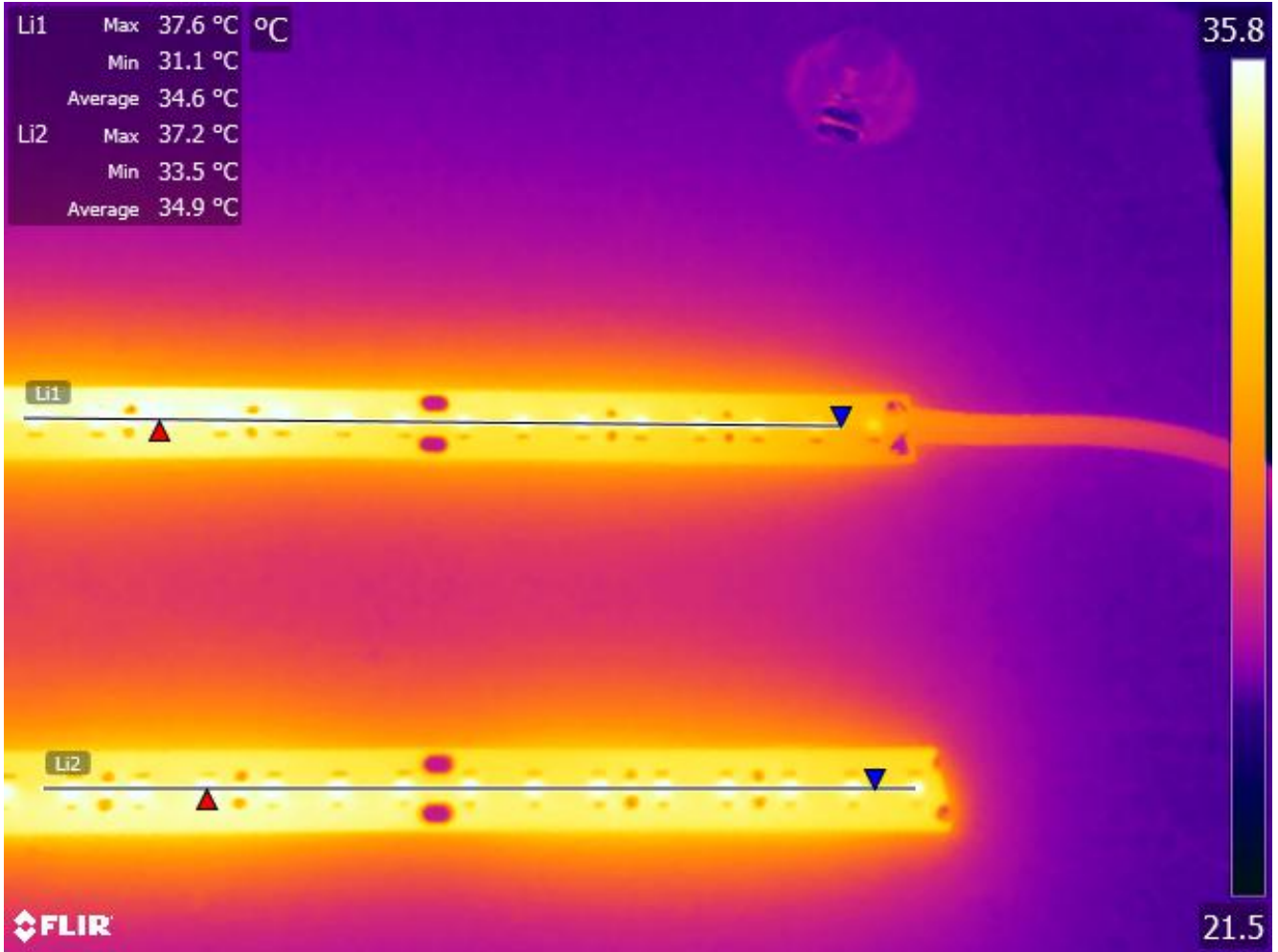
### Electrical properties

Lamp voltage	23.99 V AC
Lamp current	0.289 A
Power P	6.9 W
Apparent power S	6.9 VA
Power factor	1.00

### Temperature measurements lamp

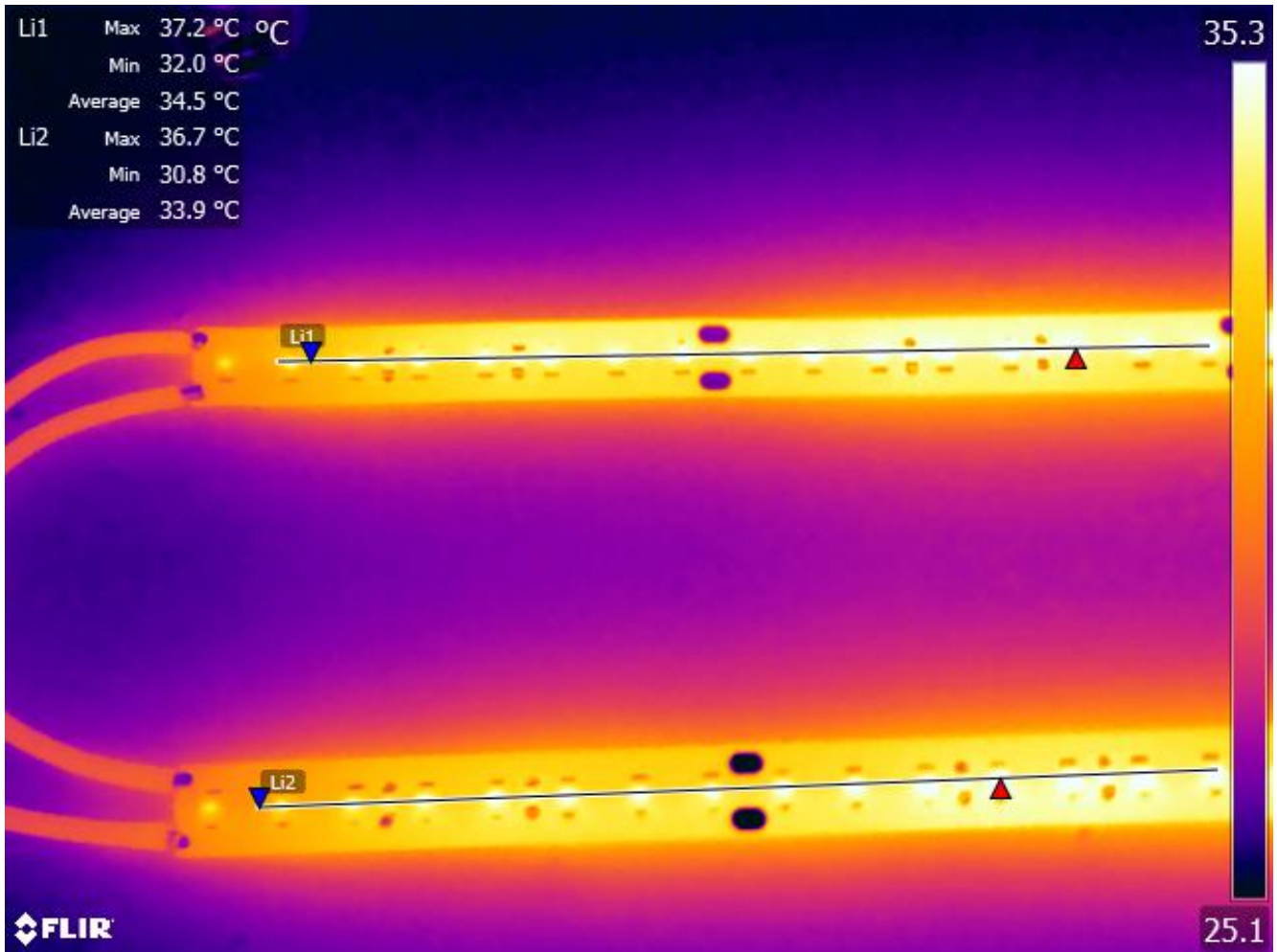


### Lamp measurement report - 3 Sep 2023





## Lamp measurement report - 3 Sep 2023

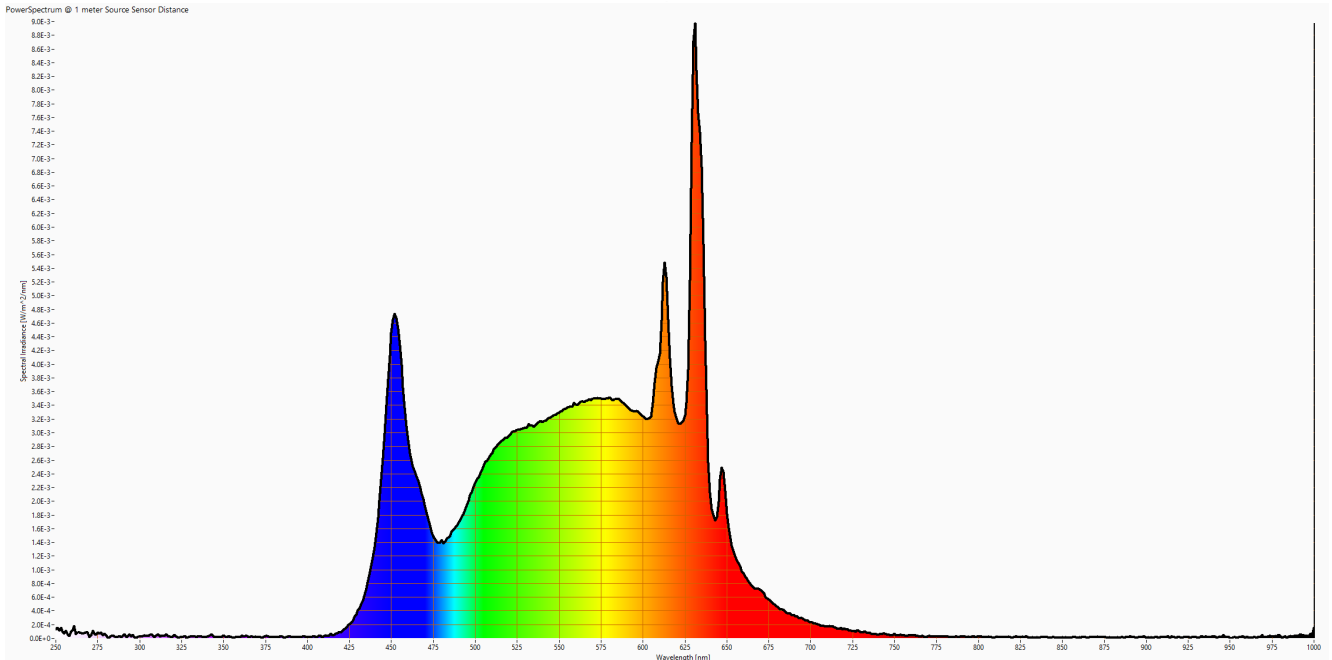


Temperature image(s).

status lamp	> 2 hours on
ambient temperature	25 deg C
reflected background temperature	25 deg C
camera	Flir T335
emissivity	0.95
measurement distance	0.5 m
IFOV_geometric	0.136 mm per 0.1 m distance
NETD (thermal sensitivity)	50 mK

## Lamp measurement report - 3 Sep 2023

### Color temperature and Spectral power distribution

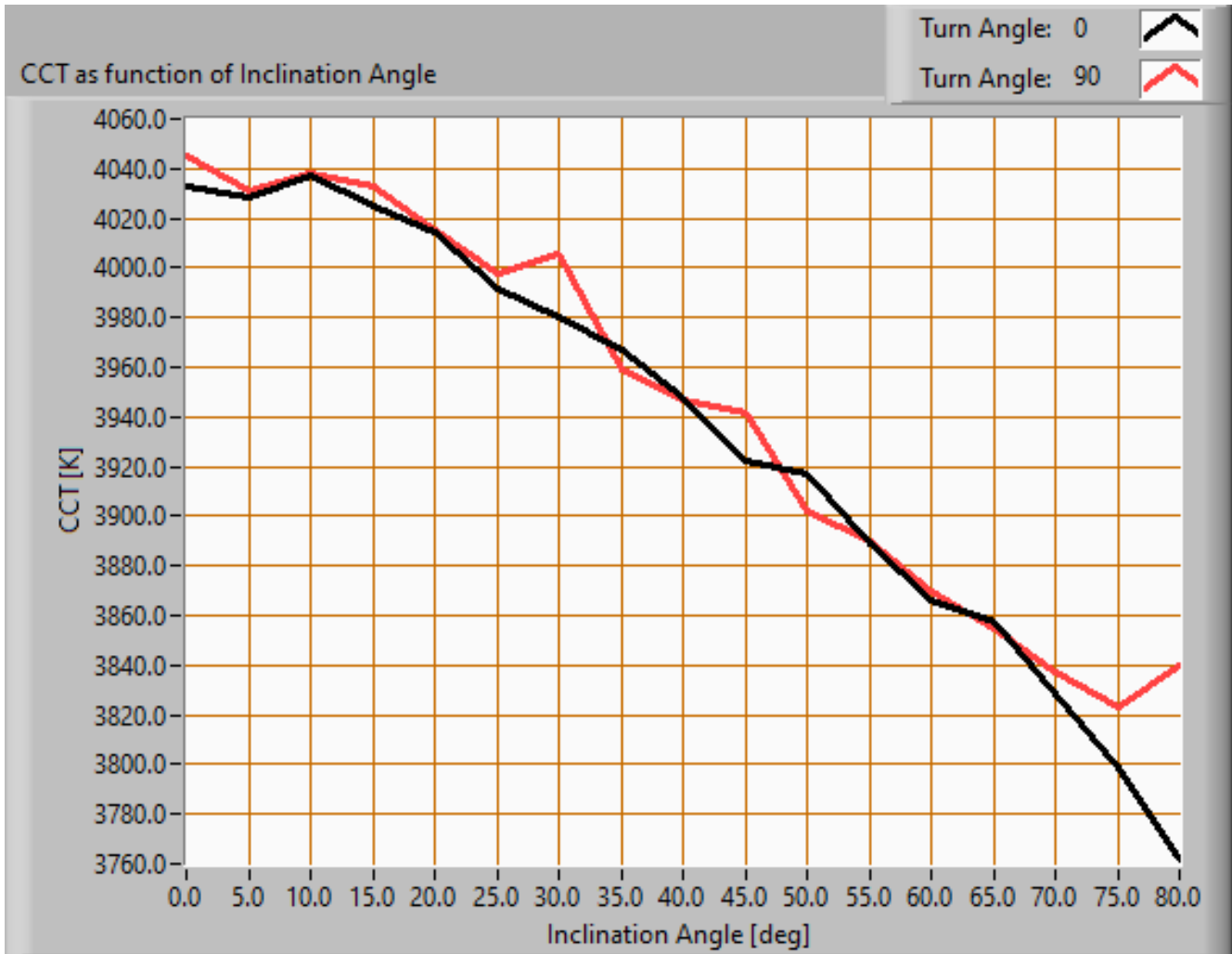


*The spectral power distribution of this light bulb, energies on y-axis valid at 1 m distance.*

The measured color temperature is 3932 K which is warm/neutral white.

This color temperature is measured straight underneath the light bulb. Below a graph showing the color temperature for different inclination angles.

## Lamp measurement report - 3 Sep 2023



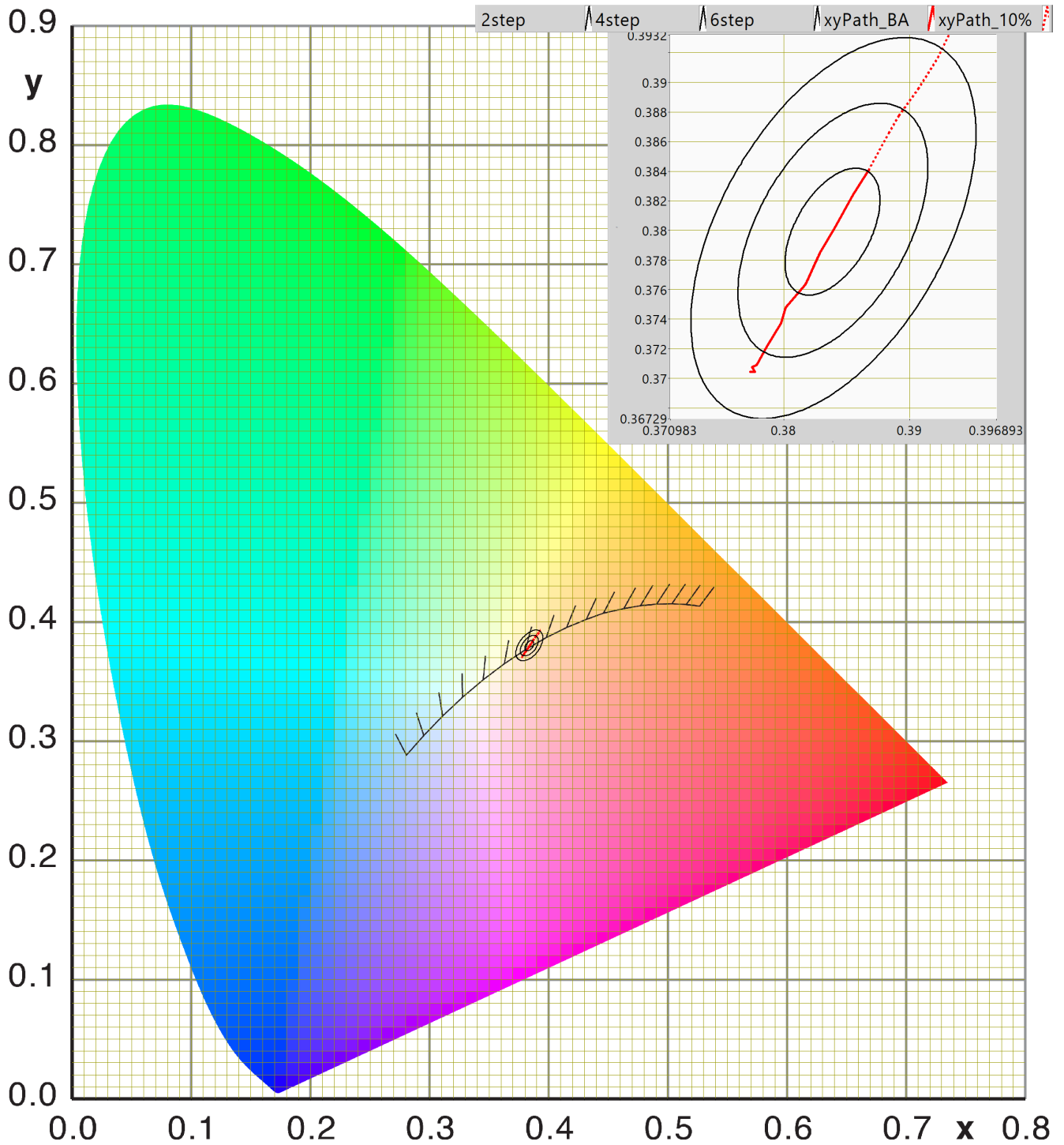
*Color temperature as a function of inclination angle.*

The color temperature is given for inclination angles up to 80 deg. Beyond that value the illuminance is lower than 10%% of Ev straight underneath the lamp, that it has not been used for color determination of the light.

For the C0-C180 plane: the beam angle of 119 deg is equivalent to 59.5 deg inclination angle, which is the area where most of the light falls within. The maximum variation of color temperature in this inclination area is about 4 %.

For the C90-C270 plane: the beam angle of 119 deg is equivalent to 59.5 deg inclination angle, which is the area where most of the light falls within. The maximum variation of color temperature in this inclination area is about 4 %.

### Lamp measurement report - 3 Sep 2023



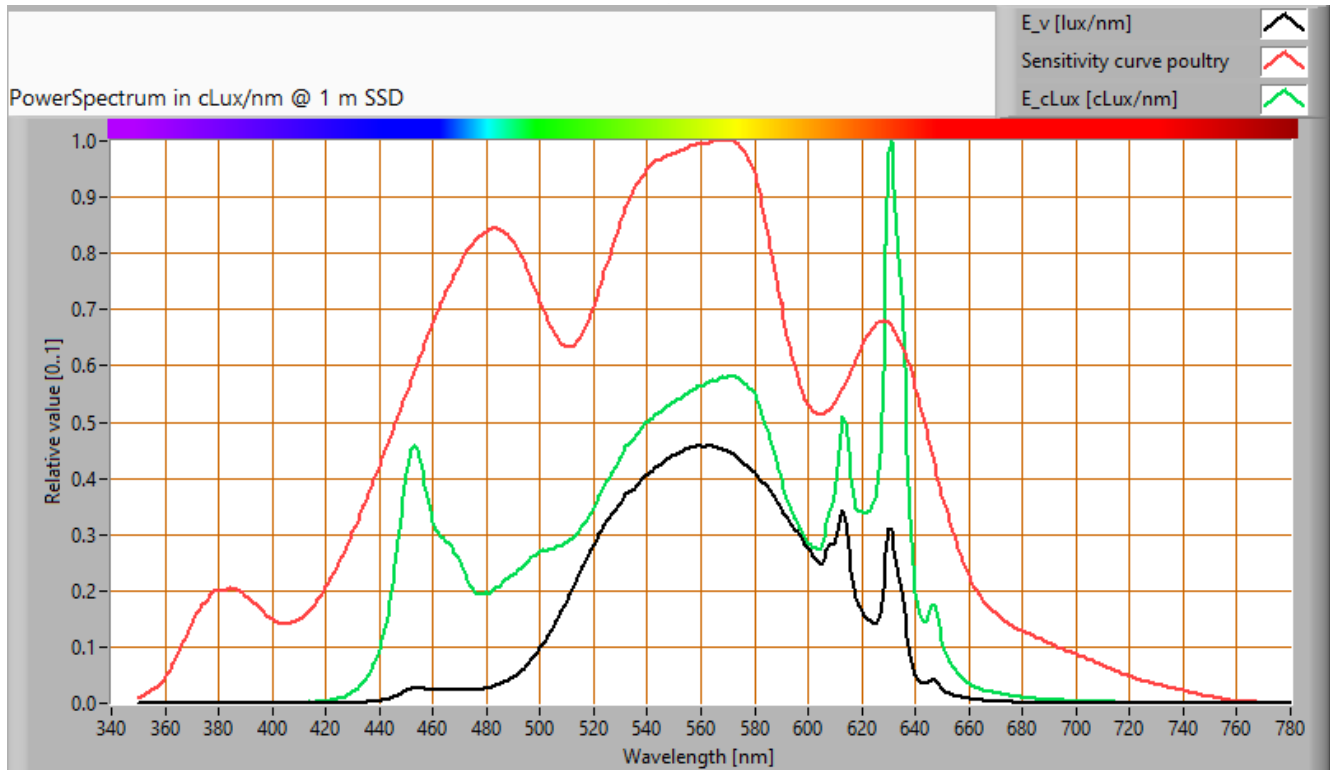
*Color point dependent on inclination angle related to 2, 4 and 6 step MacAdam ellipse, for all angles within the beam angle (solid line) and for all angles where  $E_v$  dropped to 10 % value (dotted line)*



## Lamp measurement report - 3 Sep 2023

### Luminous flux for chicken

The energy in the spectrum of the light of the lamp can be evaluated by the spectral sensitivity of the eye of chicken (N.B. Prescott and C.M. Wathes, 1999 and J. E. Saunders, J. R. Jarvis and C. M. Wathes, 2008).

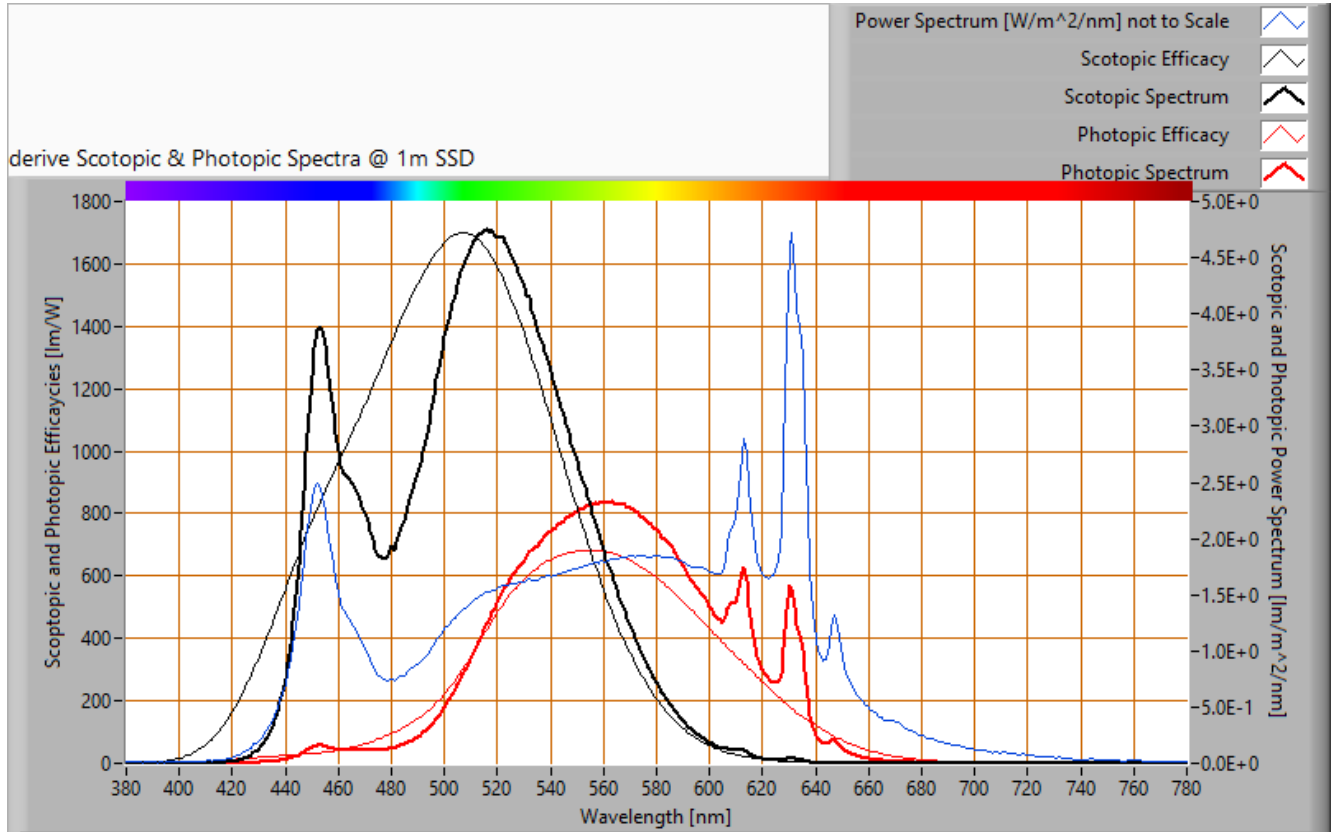


The spectrum of the light, multiplied by the spectral sensitivity of the human eye and the eye of a chicken.

parameter [unit]	value	explanation
Luminous flux [lm]	1233	The light of the lamp evaluated for a human eye.
Luminous flux chicken [cLm]	2178	The light of the lamp evaluated for the eye of a chicken.
Factor from lux to cLux	1.77	With this factor, the lux value of this light can be converted to the cLux value.

## Lamp measurement report - 3 Sep 2023

### S/P ratio

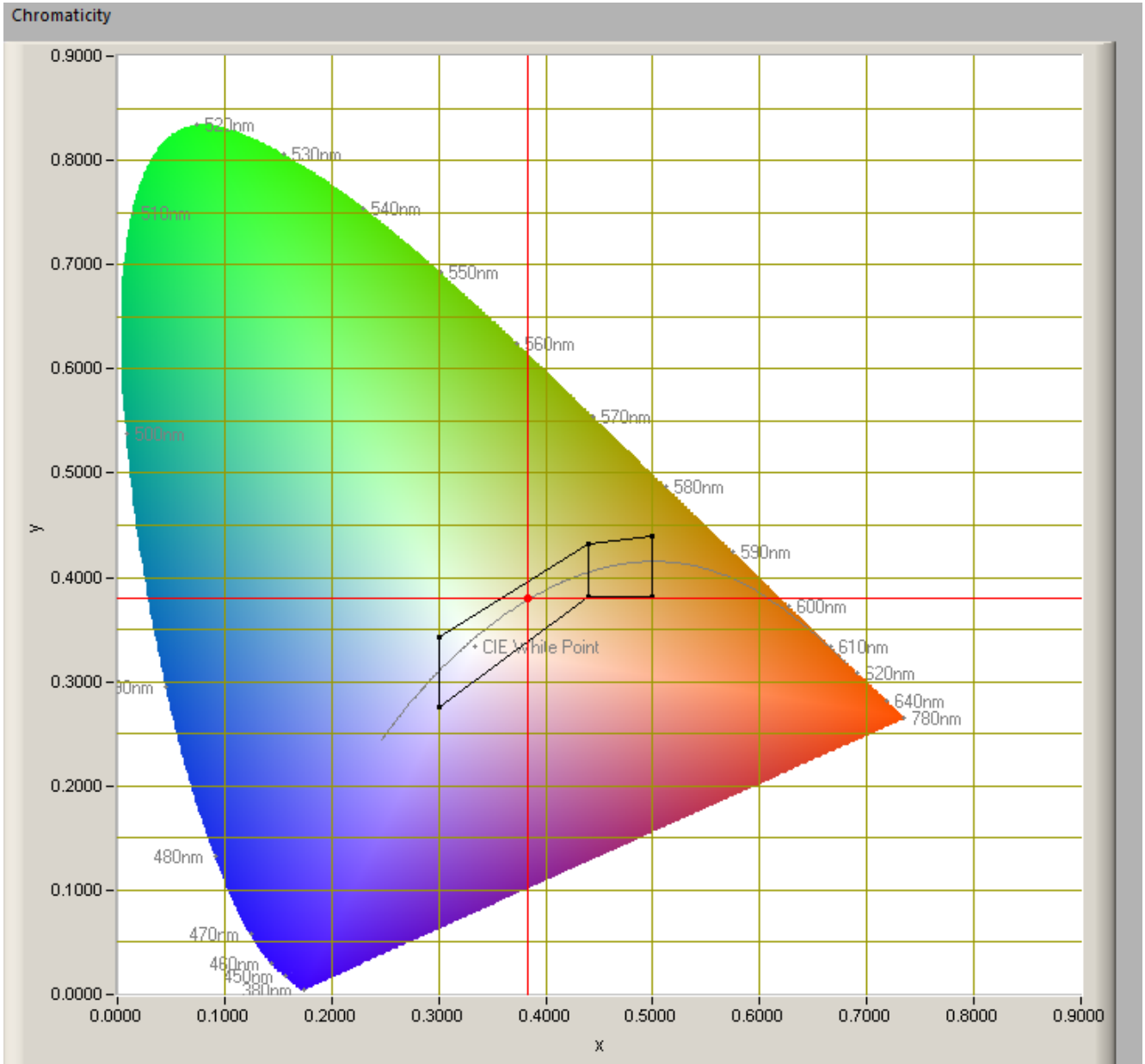


The power spectrum, sensitivity curves and resulting scotopic and photopic spectra (spectra energy content defined at 1 m distance).

The S/P ratio of the light coming from this lamp is 1.8.

## Lamp measurement report - 3 Sep 2023

### Chromaticity diagram



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

The point of the light in this diagram is inside the area indicated with class A. The areas A and B indicate areas for signal lamps.

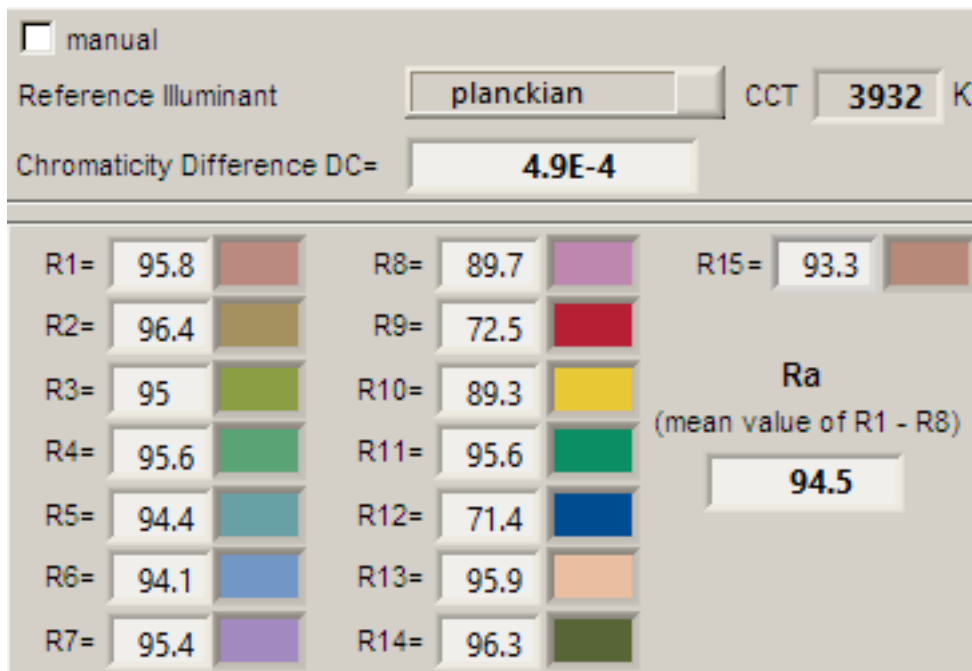
The color coordinates are  $x=0.3838$  and  $y=0.3799$ .

## Lamp measurement report - 3 Sep 2023

### 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 ( $R_1 \dots R_8$ ) are averaged to compute the  $R_a$  which is equivalent to the CRI.



*CRI of the light of this lightbulb.*

This value of 95 indicates how well the light of this lamp can render well a set of reference colors, this in comparison with the light of a reference source (for color temperatures  $< 5000\text{K}$  a black radiator is used as reference and for color temperatures  $> 5000\text{K}$  the sun or the light outside during the day).

The value of 95 is much bigger than the value of 80 that is considered as a minimum for working areas in general.

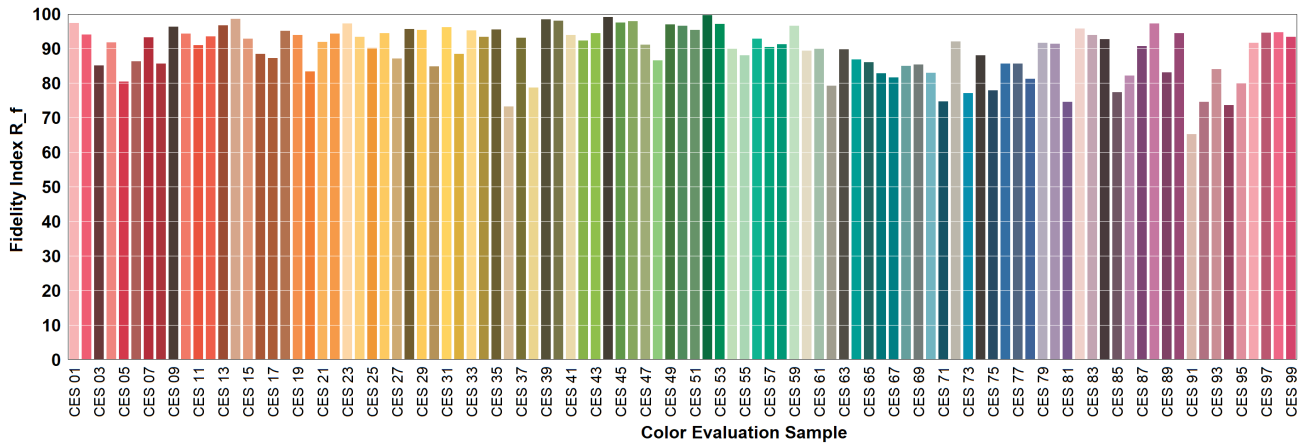
Note: the chromaticity difference is 0.0005 and indicates the distance to the Planckian Locus. There is a value mentioned of max  $5.4\text{E-}3$  in section 5.3 of CIE 13.3-1995 however no further explanation of it.

An other reference with signal lights as a reference is given in the chromaticity diagram.

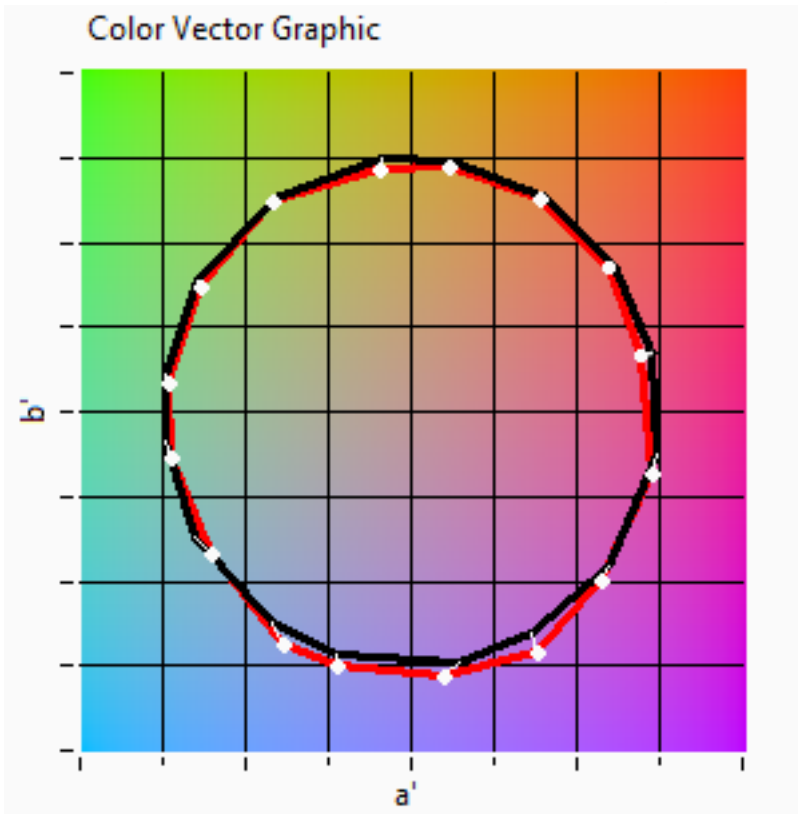
## Lamp measurement report - 3 Sep 2023

### Color quality scale TM-30-15

TM-30-15 is an improved indicator (over CRI) of how well colors are rendered. TM30-15 R<sub>f</sub> = 90, R<sub>g</sub> = 99.



TM-30-15-values for 99 samples for the light of this light bulb. The closer the value for a testcolor comes to 100, the more its rendition resembles that of a reference lightsource.

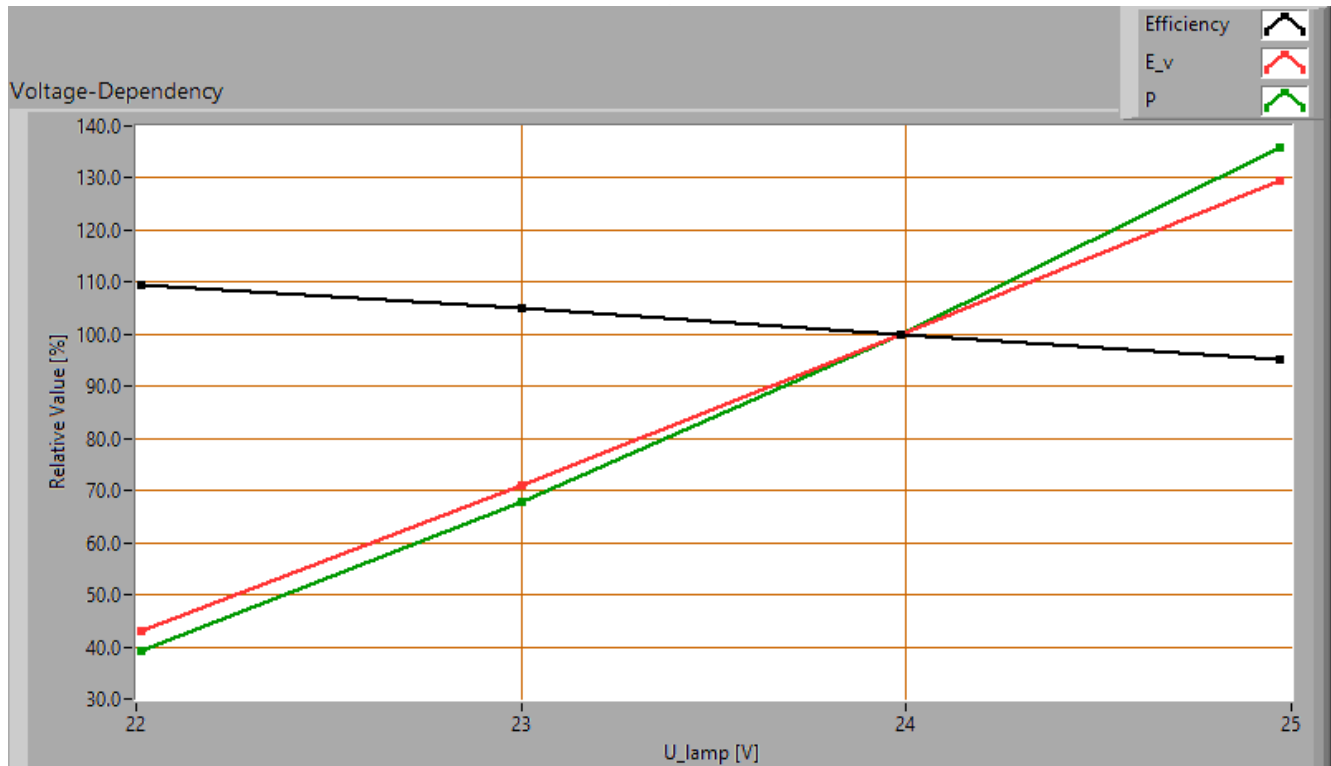


Graphical view of averaged color points for this light bulb compared to a reference source with the same color temperature.

## Lamp measurement report - 3 Sep 2023

### 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 light bulb parameters measured: illuminance  $E_v$  [lx], the lamp power  $P$  [W] and the luminous efficacy [lm/W] (this latter is estimated here by dividing the found  $E_v$  value by  $P$ ).



*Lamp voltage dependencies of certain light bulb parameters*

There is a constant dependency of the illuminance when the power voltage varies between 22 - 25 V .

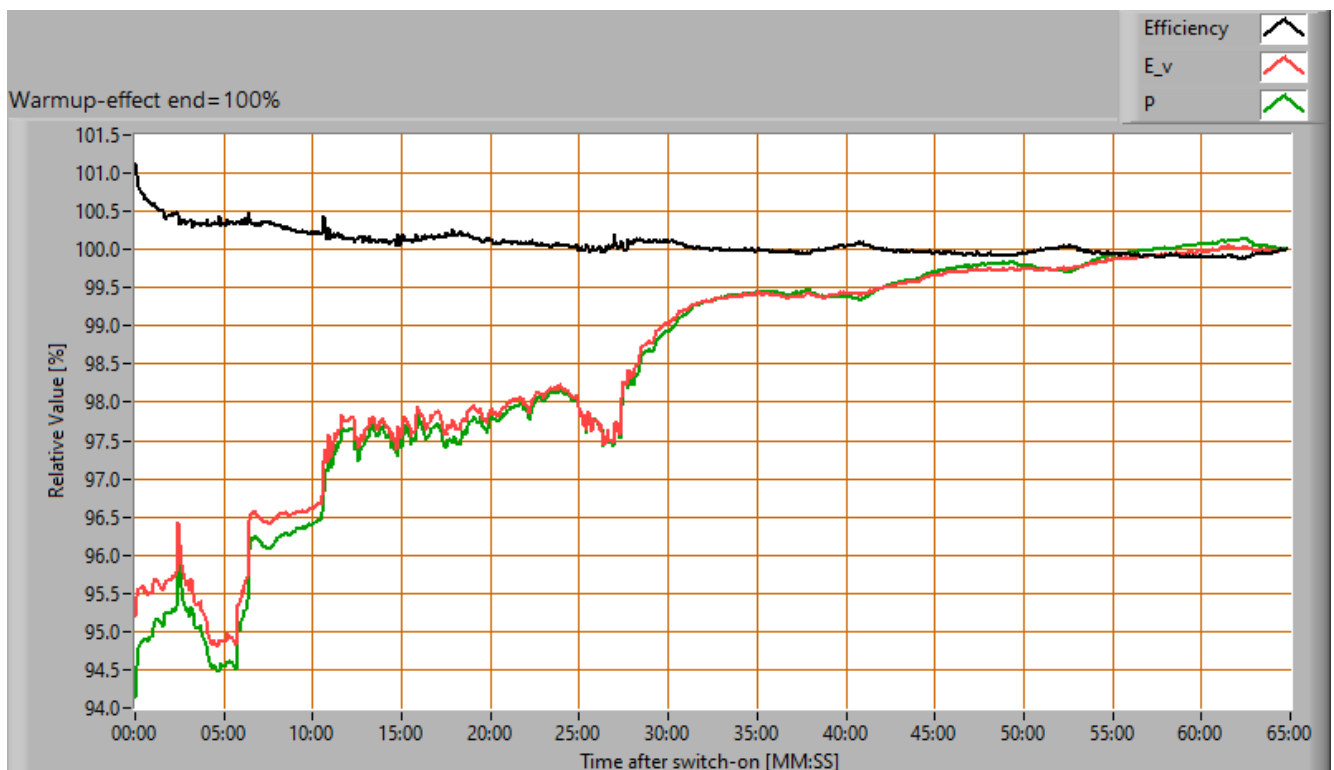
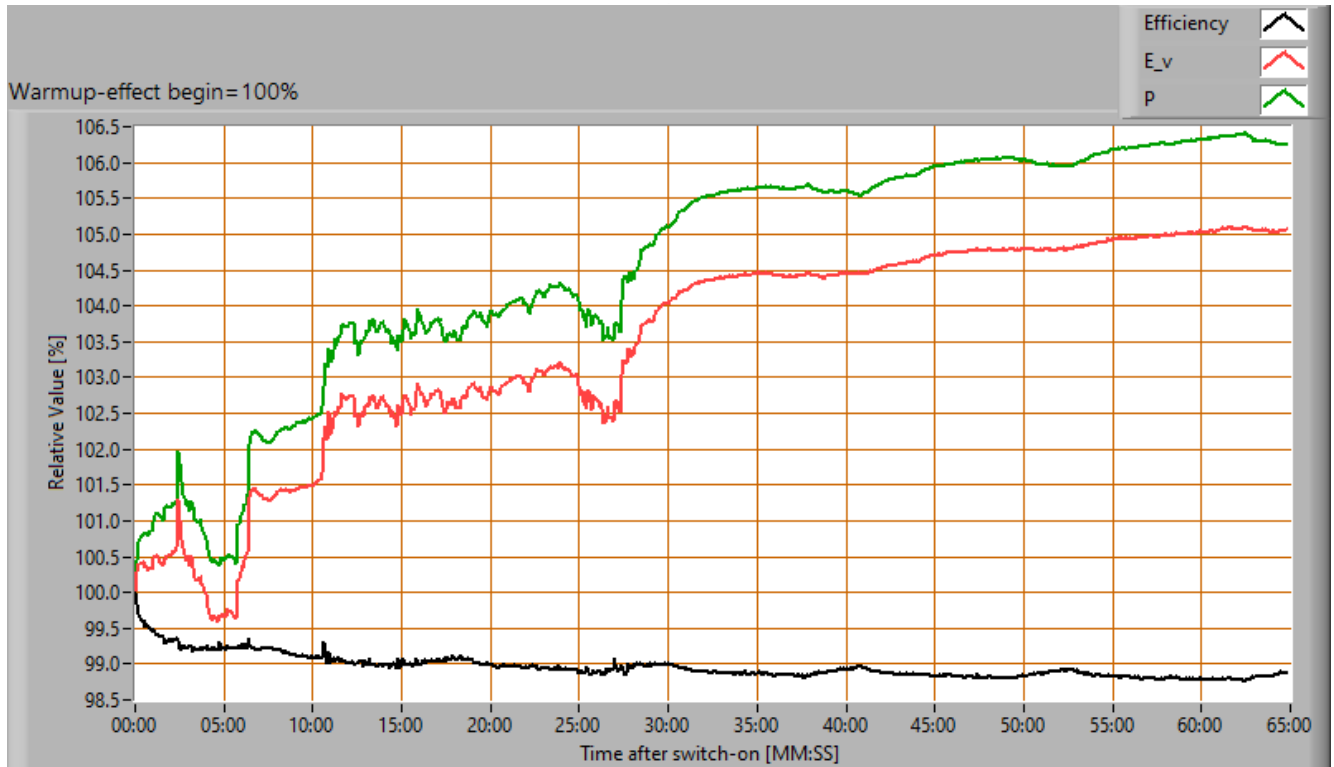
There is a constant dependency of the consumed power when the power voltage varies between 22 - 25 V .

When the voltage varies abruptly with + or - 0.5 V then this results in a variation of the illuminance of maximally 14.9 %. This difference in illuminance is possibly visible (when it occurs abruptly).

## Lamp measurement report - 3 Sep 2023

### 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], the lamp power  $P$  [W] and the luminous efficacy [lm/W].



Effect of warming up on different light bulb parameters. In the first graph the 100 % level is put at begin, and in the last graph the 100 % level is put at the end.

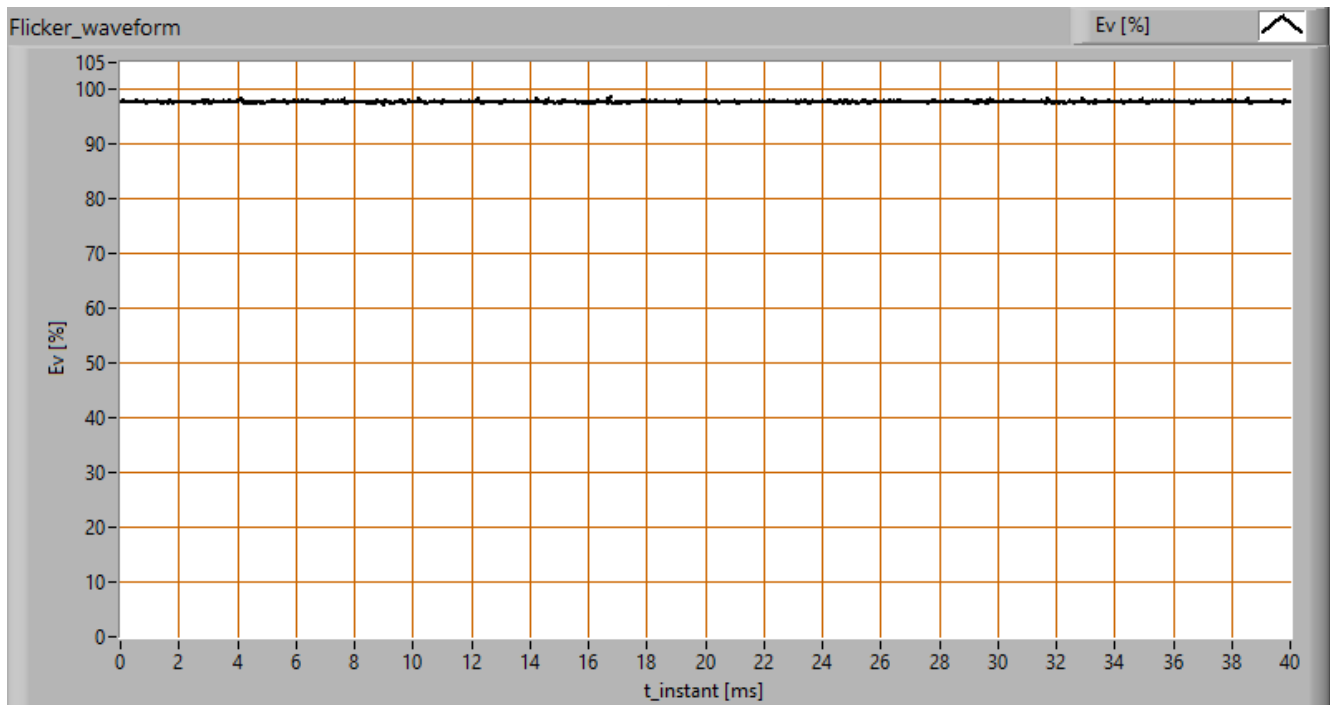


## Lamp measurement report - 3 Sep 2023

During the warmup time the illuminance varies during 29 minutes and increases with 5 %. During the warmup time the power varies during 29 minutes and increases with 6 %. The variation in efficacy (calculated as indication by simply dividing the illuminance by the power) during the warming up is -1 %. A very high negative value indicates a significant decrease for instance due to heating up of the lamp (decrease of lifetime).

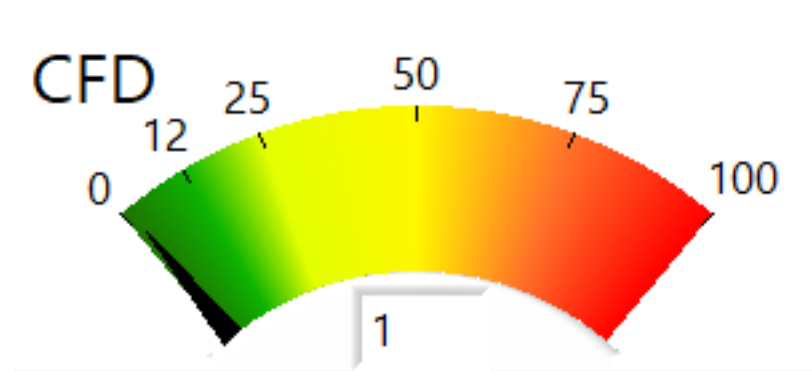
### Measure of flickering

An analysis is done on the measure of flickering of the light output by this light bulb.



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

parameter	value	unit
Flicker frequency	10984.5	Hz
Illuminance modulation index	1	%
Flicker index	0.001	[-]
SVM	0.0	[-]
Compact Flicker Degree	1	%



The illuminance modulation index is computed as:  $(\max_{Ev} - \min_{Ev}) / (\max_{Ev} + \min_{Ev})$ .



## Lamp measurement report - 3 Sep 2023

### Melanopic effect

The melanopic effect shows the level of impact the light of this lamp can have on the day-night rhythm of human beings (as well as the suppression of melatonin production). The important parameters (according to norm DIN SPEC 5031-100:2015-08):

melanopic effect factor	0.595
k_mel trans (25 years)	1.046
k_mel trans (32 years)	1.000
k_mel trans (50 years)	0.850
k_mel trans(75 years)	0.617
k_mel trans(90 years)	0.490
k_pupil(25 years)	1.088
k_pupil(32 years)	1.000
k_pupil(50 years)	0.792
k_pupil(75 years)	0.543
k_pupil(90 years)	0.416

## Lamp measurement report - 3 Sep 2023

### Circadian Stimulus (CS)

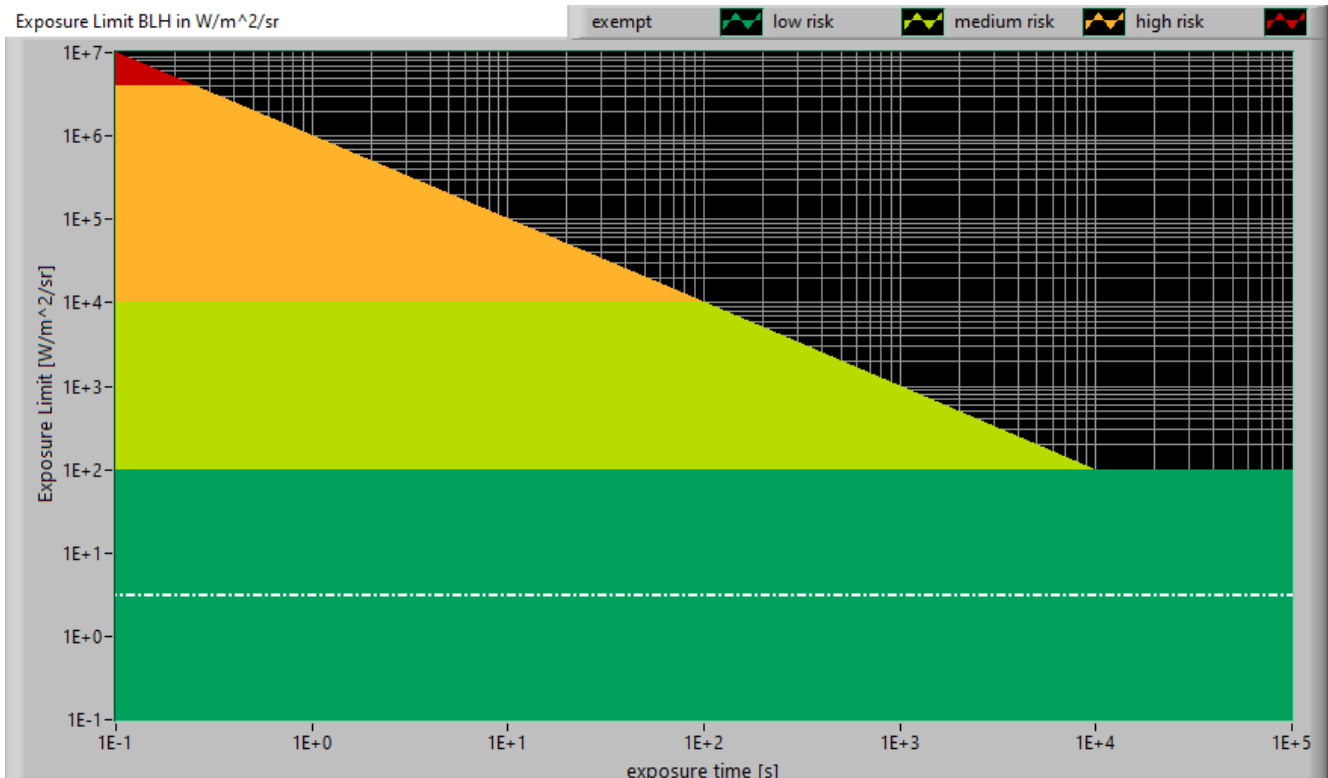
The circadian stimulus indicates the degree of influence that the light of this lamp has on the human circadian rhythm. In addition to the melanopic effect of Ganglion cells, the contributions of S-cones and rods are also included. A CS value of 0.1 has hardly any effect and a value > 0.3 has an effect (0.7 is the maximum, saturated, value). The CS value depends on the spectrum of the light and also on the amount of it (received on the eye).

Ev [lux]	CL__A	CS
20.0	12.5	0.02
30.0	18.7	0.03
50.0	31.2	0.04
75.0	47.0	0.07
100.0	62.8	0.09
150.0	94.6	0.13
300.0	192.2	0.24
500.0	326.5	0.33
750.0	501.2	0.42
1000.0	683.1	0.47
1500.0	1067.5	0.54
2000.0	1477.6	0.58

## Lamp measurement report - 3 Sep 2023

### Blue Light Hazard

The amount of blue light and the harm it can cause on the retina has been determined. Herewith the results.



The level of blue light of this lamp related to the exposure limit and the different classification areas.

L_lum0 [mm]	3	Dimension of brightest part of lamp in C0-C180 direction.
L_lum90 [mm]	1000	Dimension of brightest part of lamp in C90-C270 direction.
SSD_500lx [mm]	930	Calculated distance where $E_v = 500$ lux. This computation is valid when it is in the far field of the lamp. Note: if this value 200 mm then the distance of 200 mm is taken as proposed in the norm IEC 62471:2006.
Start of far field [mm]	5000	Minimum distance at which the lamp can be seen as a point source. In this area the $E_v$ is linearly dependent from $(1/\text{distance})^2$ .
300-350 nm values stuffed with 0s	no	In the event OliNo has measured with a SpB1211 spectrometer without UV option then the irradiance data of 300-349 nm is missing. For lamps where there is already no energy content near 350 nm, the values 300-349 can also be set at zero then.
alpha_C0-C180 [rad]	0.100	(Apparent) source angle in C0-C180 direction.
alpha_C90-C270 [rad]	0.100	(Apparent) source angle in C90-C270 direction.

## Lamp measurement report - 3 Sep 2023

alpha_AVG [rad]	0.100	Average (apparent) source angle. If average $\geq 0.011$ rad then the exposure limit is computed with radiance $L_b$ . Otherwise with irradiance $E_b$ .
Exposure value [ $W/m^2/sr$ ]	3.10E+0	Blue Light Hazard value for this lamp, measured straight underneath the lamp. Computation is referenced to $L_b$ . Because the distance at 500 lux is in the near field, then this exposure value is too pessimistic and should be lower.
Blue Light Hazard risk group	0	0=exempt, 1=low, 2 = moderate, 3=high risk.

### Extra



Additional photos.

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