Lamp measurement report - 18 Feb 2022

Emergency unit for LHB-MD_

by

KLV Ledverlichting

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Summary measurement data dated 2022-02-11

parameter	meas. result	remark
Color temperature	6403 K	cold white
Luminous intensity I_v	1106.2 Cd	Measured straight underneath the lamp.
Illuminance modulation index	0 %	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 <= 0.9 (from September 1, 2024 <= 0.4) at full-load for certain (O)LEDs per EU regulation 2019/2020.
Beam angle	113 deg	113 deg is the beam angle for all C-planes since the lamp is symmetrical along its 1st axis. Flux code: 49 82 98 100 100.
Power P	5.3 W	The net power consumed.
Power Factor	0.37	An electrical load with this power factor means that for every 1 kWh net energy consumed, there has been 2.52 kVAhr for reactive energy.
Displacement factor	0.55	The cosine of the phase angle between the fundamental harmonic of the mains supply voltage and the fundamental harmonic of the mains current (from EU 2019/2020).
THD	110 %	Total Harmonic Distortion.
Luminous flux	3077 lm	Measured with photogoniometer, calculation done as described in LM79-08.
CRI_Ra	84	Color Rendering Index.
Rf_TM30	83	TM30-15 is an improved indicator (over CRI) of how well colors are rendered.
Rg_TM30	94	Gamut Area Ratio.
Coordinates chromaticity diagram	x=0.3136 en y=0.3368	
Fitting	230V	This lamp is connected directly to the grid voltage.
Luminous flux for chicken	5738 cLm	Total radiant flux adjusted by color sensitivity curve (from 350 - 780 nm) of chickens (Gallus domesticus).
S/P ratio	2.3	This factor indicates the amount of times more efficient the light of this light bulb is perceived under scotopic circumstances (low environmental light level).

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parameter	meas. result	remark
L x W x H external dimensions	245 mm x 135 mm x 65 mm	External dimensions of the lamp.
L x W luminous area	140 mm x 70 mm	Dimensions of the luminous area (used in Eulumdat file). It is the surface of the smallest rectangle around all LEDs.
General remarks		The ambient temperature during the whole set of illuminance measurements was 24.5 - 25.1 deg C. At the end of the article an additional photo.
Dimmable	no/not known	Info from manufacturer.
Melanopic effect factor	0.807	According to norm DIN SPEC 5031-100:2015-08.
Melanopic Ratio	0.66	This ratio multiplied with the lux value gives the EML-value (Equivalent Melanopic Value), used in table L2 of WELL std 2019-Q3.
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	module	

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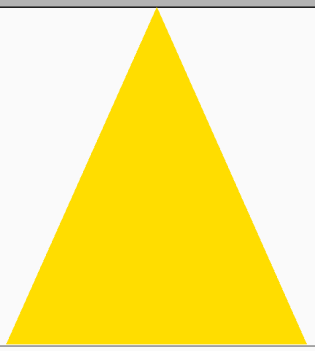
Overview table

m.	Ø 50%	
	C0-180	C90-270
1	3	3
1.5	4.6	4.6
2	6.1	6.1
2.5	7.6	7.6
3	9.1	9.1
3.5	10.6	10.6
4	12.1	12.1

C0-180: 113°
C90-270: 113°



E (lux)
1106
492
277
177
123
90
69

Luminaire Efficacy	
576	(lumen per Watt)
Half-peak diam C_{0-180}	
3.04	x diameter(m)
Half-peak diam C_{90-270}	
3.04	x diameter(m)
Illuminance	
1106	/ distance^2(lux)
Total Output	
3077	(lumen)

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

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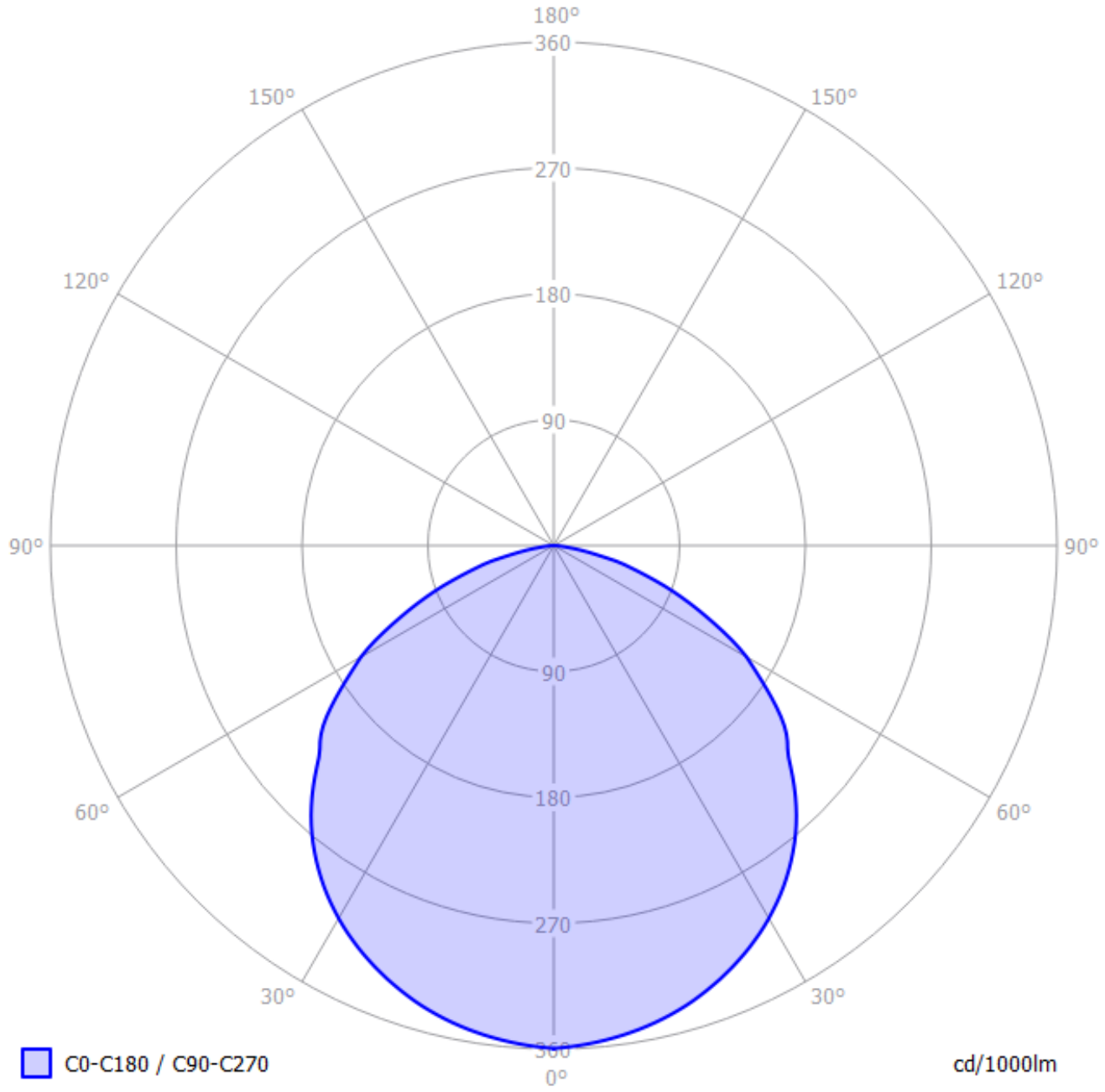
Eulumdat light diagram

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 113 deg for the C0-C180 plane and 113 deg for the C90-C270 plane.

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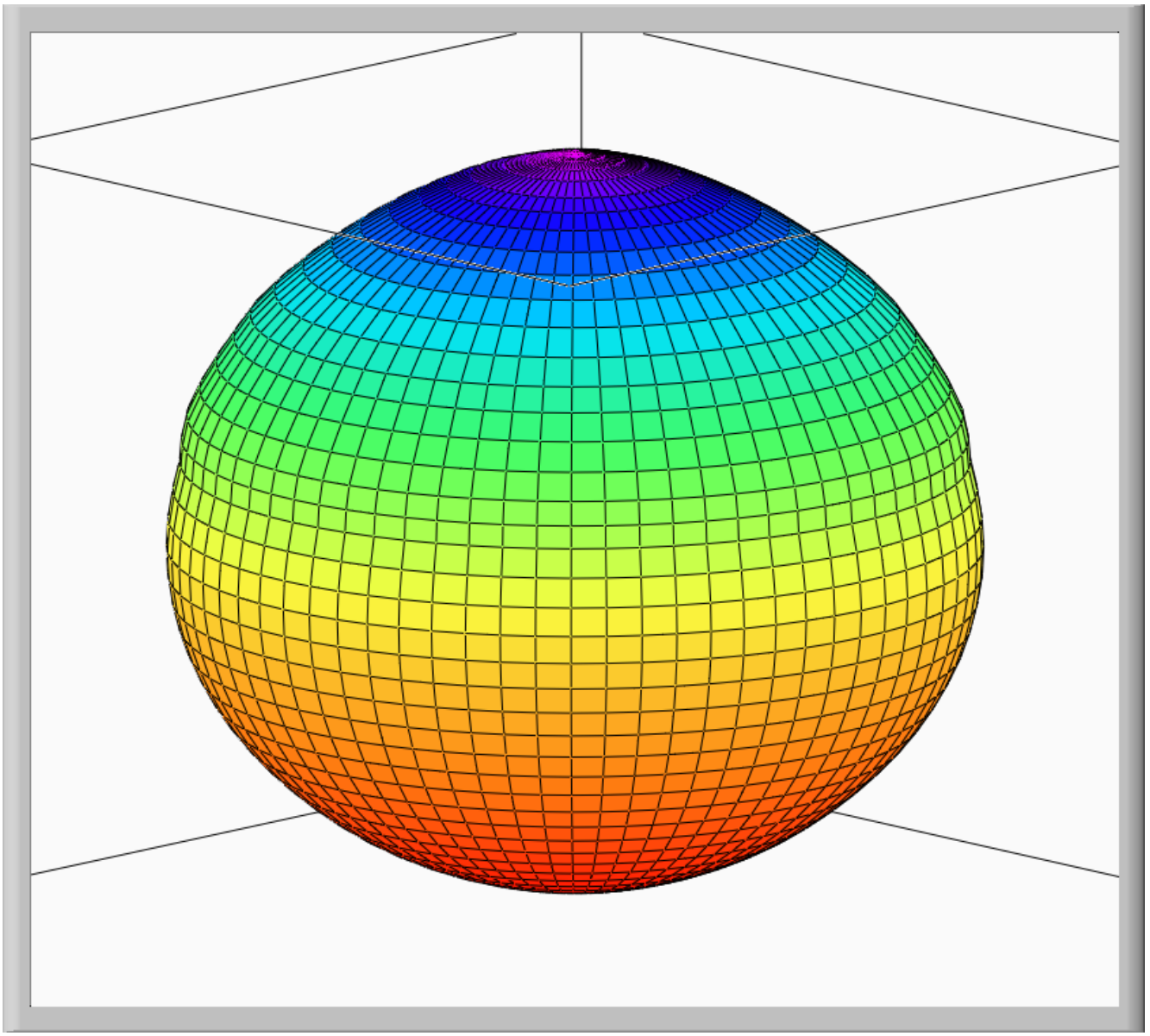

Image of the light distribution pattern in 3D.

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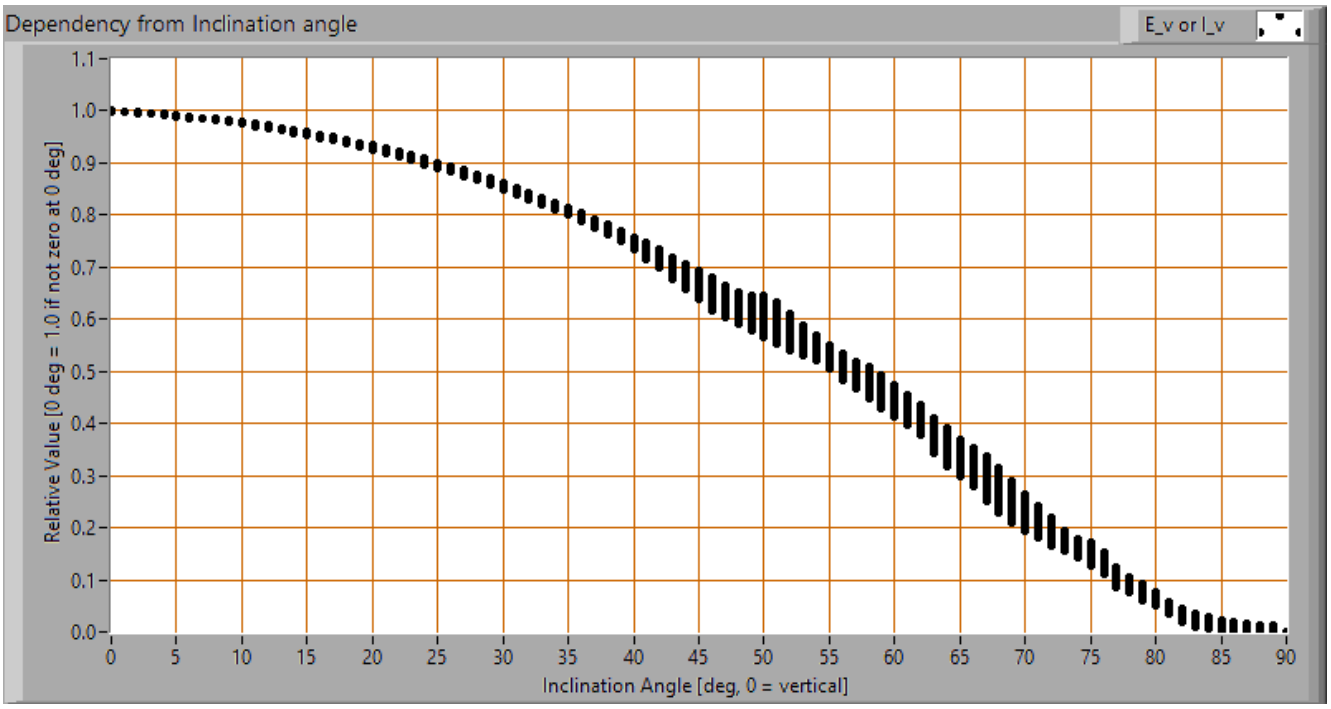

Intensity data of every measured turn angle at each inclination angle.

This plot shows per inclination angle the intensity measurement results for each turn angle at that inclination angle. 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 3077 lm.

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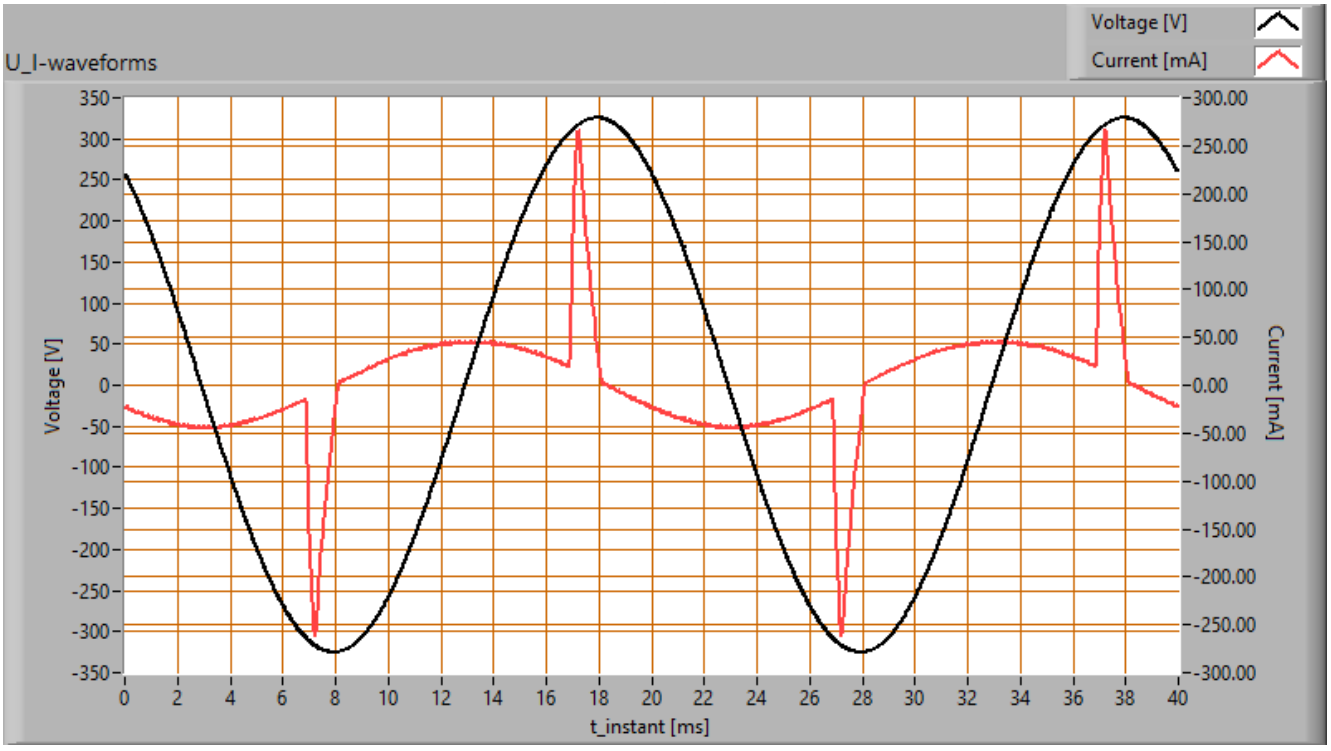
Electrical properties

Lamp voltage	230.00 V AC
Lamp current	0.063 A
Power P	5.3 W
Apparent power S	14.5 VA
Power factor	0.37
Displacement factor DF	0.55

EU 2019/2020: For LED and OLED, DF >= 0,5 at 5 W < P_on = 10 W, DF >= 0,7 at 10 W < P_on = 25 W, DF >= 0,9 at 25 W < P_on.

Of this lamp the voltage across and the resulting current through it are measured and graphed.



Voltage across and current through the lightbulb

This current waveform has been checked on requirements posed by the norm IEC 61000-3-2:2018. This norm contains requirements for lamps with a power 5 W, 5 - 25 W and > 25 W. This lamp consumes 5.3 W.
NOTE: standard only applies to lamps with supply voltages higher than 220 V AC.

When power is from 5 to and including 25 W there are requirements for the current. At least one of the three requirements given below, must be passed.

1) Requirement for harmonics and form of the current:

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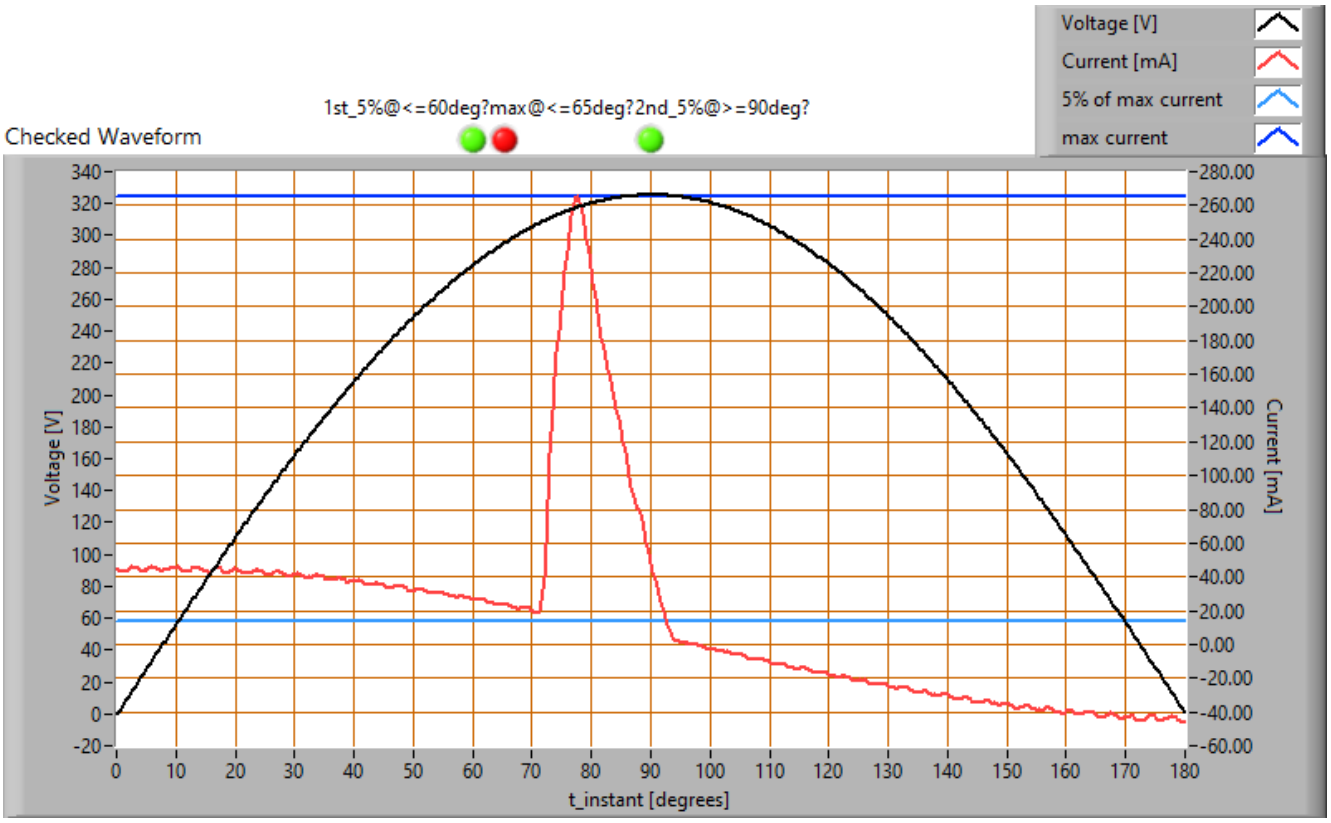
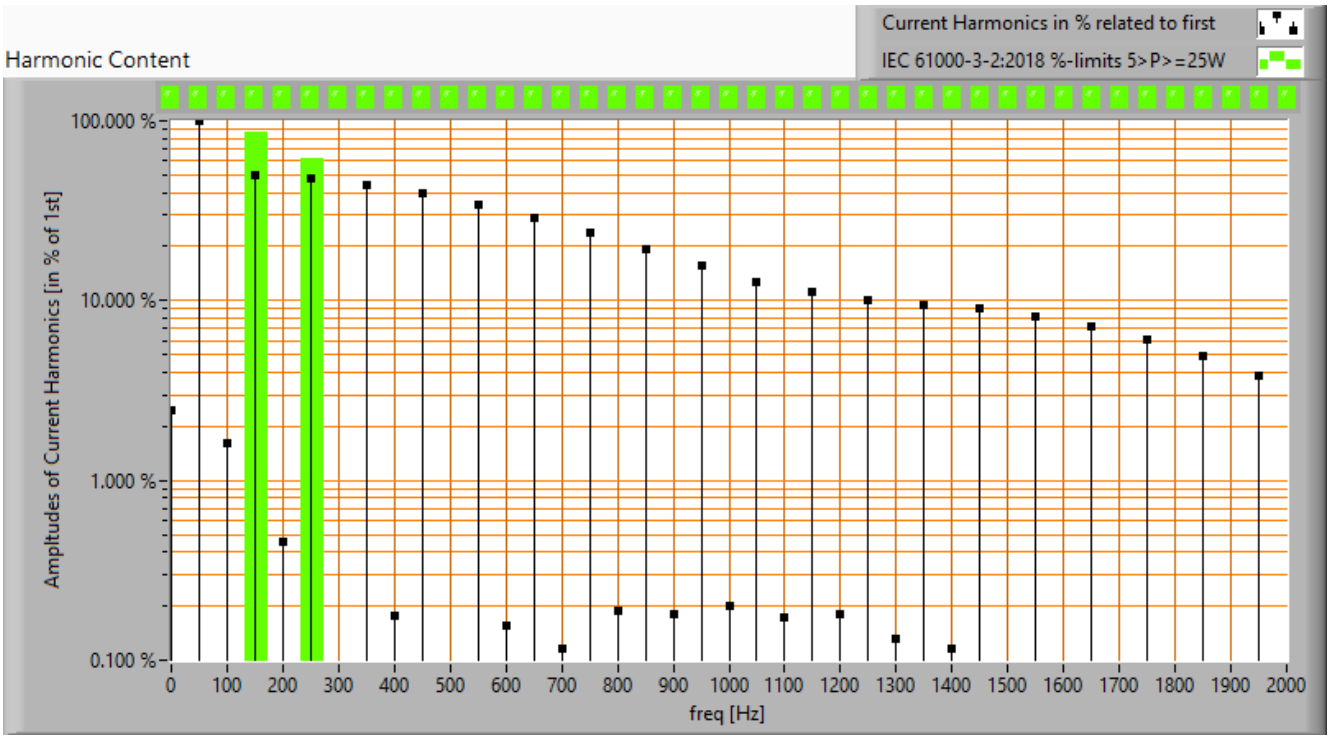


Requirements on the form of the current in IEC61000-3-2:2018



The harmonics in the current compared to requirements in IEC61000-3-2:2018, that belong to the requirement of the form of the current.

2) Harmonic currents less than power-threshold values:

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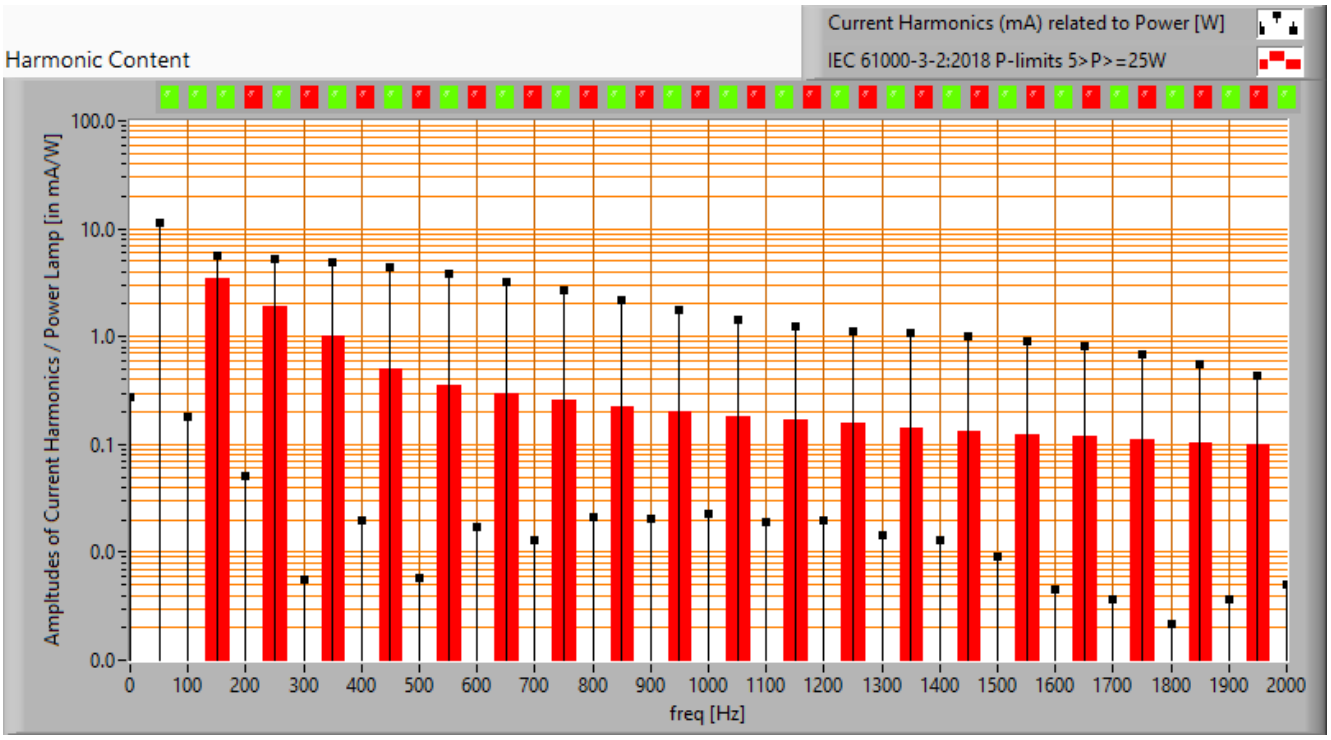
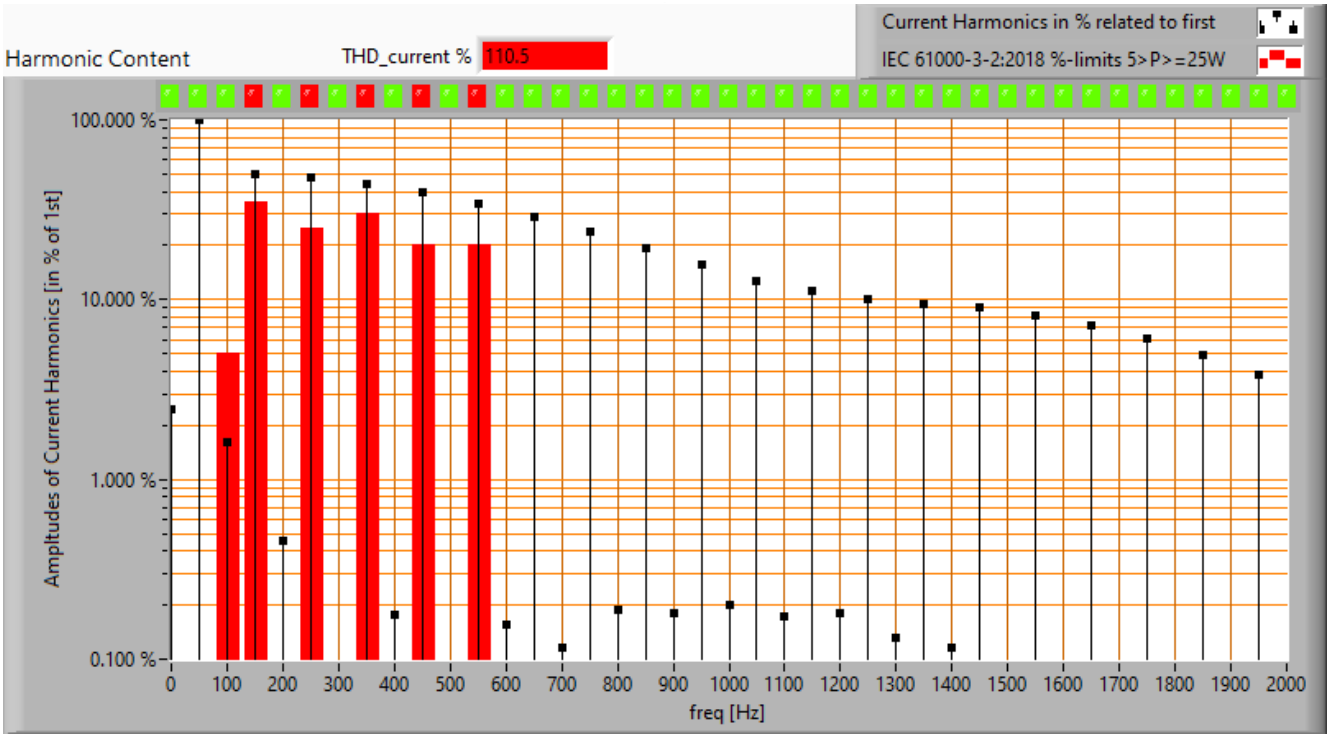


The harmonics in the current compared with maximum values in mA per Watt, as given in IEC61000-3-2:2018.

3) Maximum value for THD (= 70 %) and for harmonics:



The harmonics of the current compared to maximum levels in IEC61000-3-2:2018, these levels belong together with the requirement of the maximum THD value.

The requirements in norm IEC61000-3-2:2018 are NOT met (note: standard only applies to lamps with supply voltages higher than 220 V AC).

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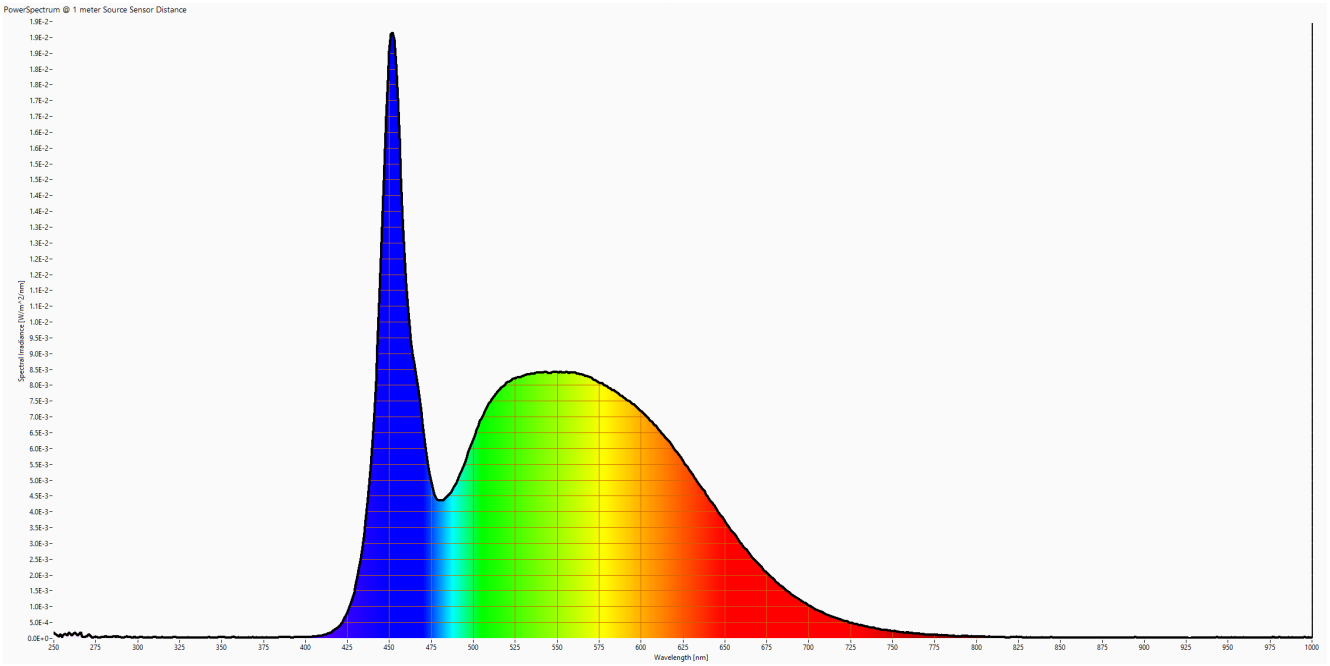
Note: the used lampvoltage in this test is clean enough to be able to well evaluate the results of the current harmonics according to this norm. Herewith the image showing the harmonic content of the voltage used.

<img class="alignnone size-medium wp-image-186929"

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 6403 K which is cold 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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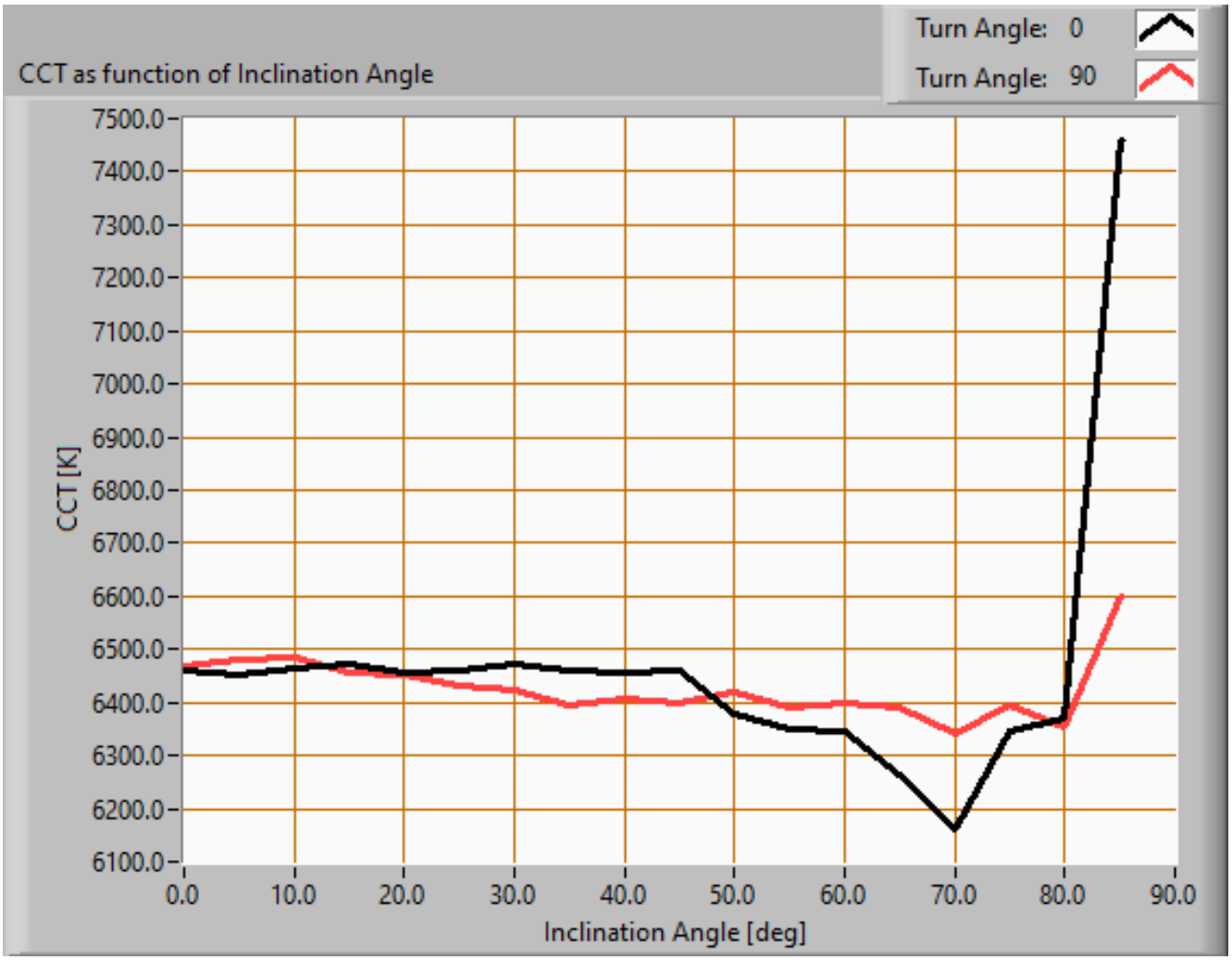

Color temperature as a function of inclination angle.

The color temperature is given for inclination angles up to 85 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 113 deg is equivalent to 56.6 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 1 %.

For the C90-C270 plane: the beam angle of 113 deg is equivalent to 56.6 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 2 %.

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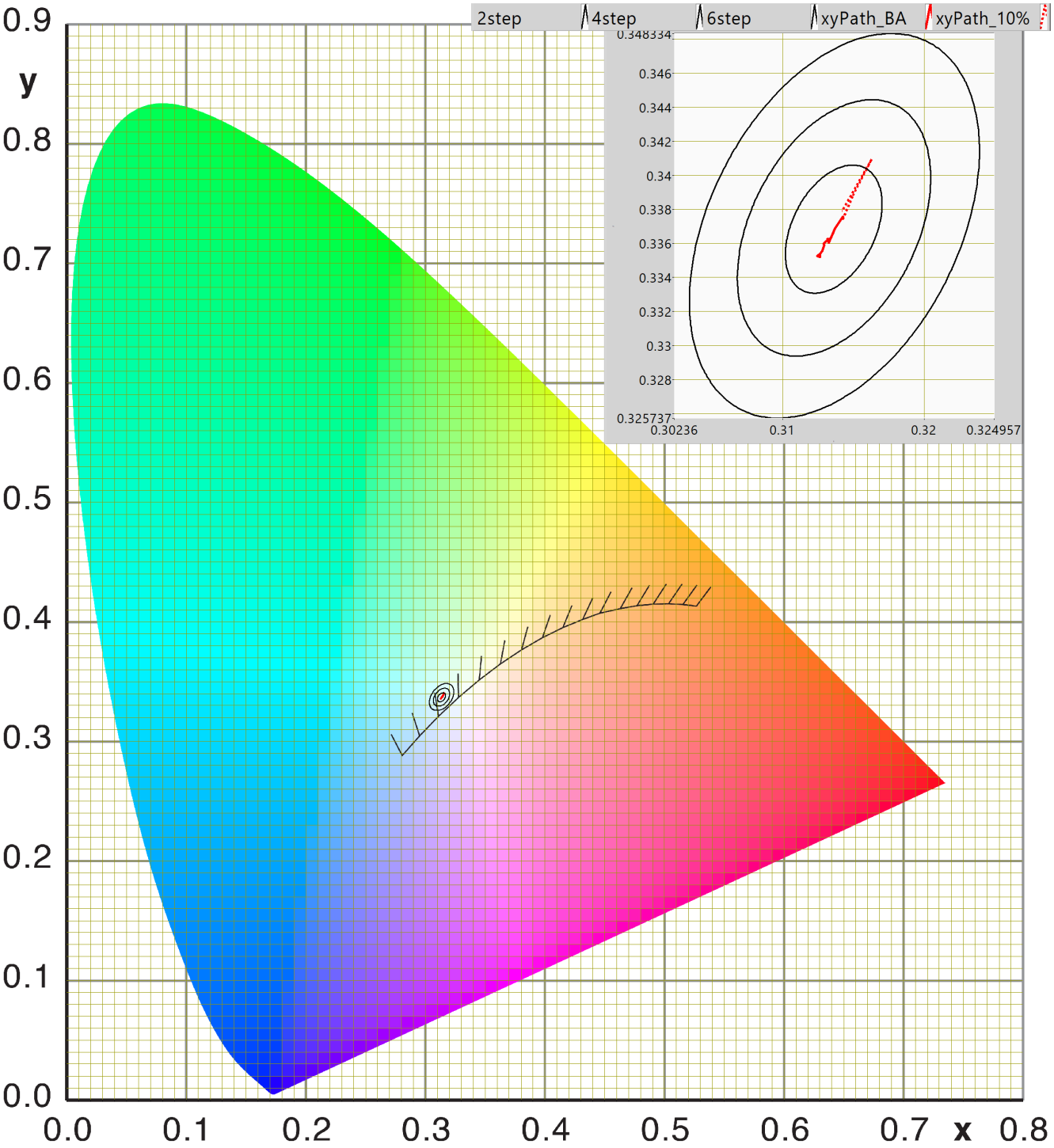

Color point dependent on inclination angle related to 2, 4 and 6 step MacAdam ellipse, for all angles within the beam angle (solid line) and for all angles where Ev dropped to 10 % value (dotted line)

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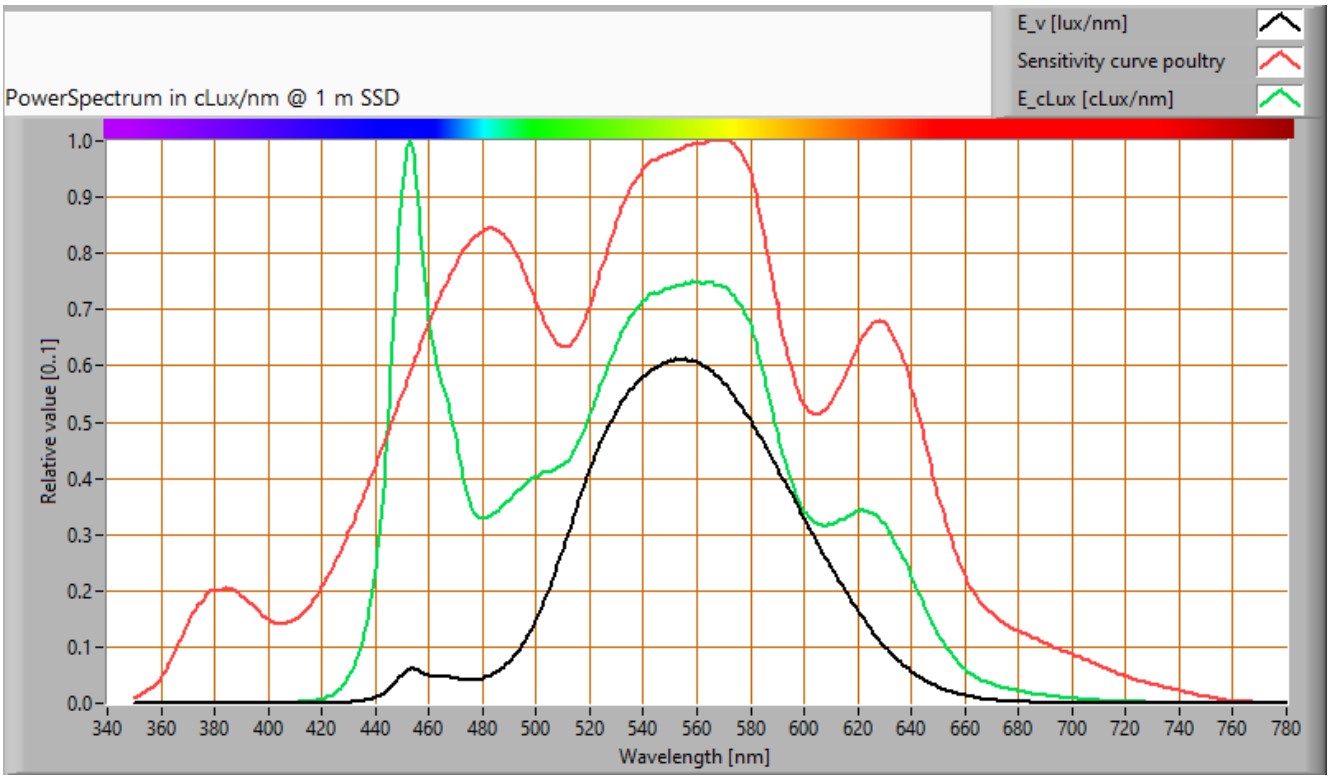
Luminous flux for chicken

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]	3077	The light of the lamp evaluated for a human eye.
Luminous flux chicken [cLm]	5738	The light of the lamp evaluated for the eye of a chicken.
Factor from lux to cLux	1.86	With this factor, the lux value of this light can be converted to the cLux value.

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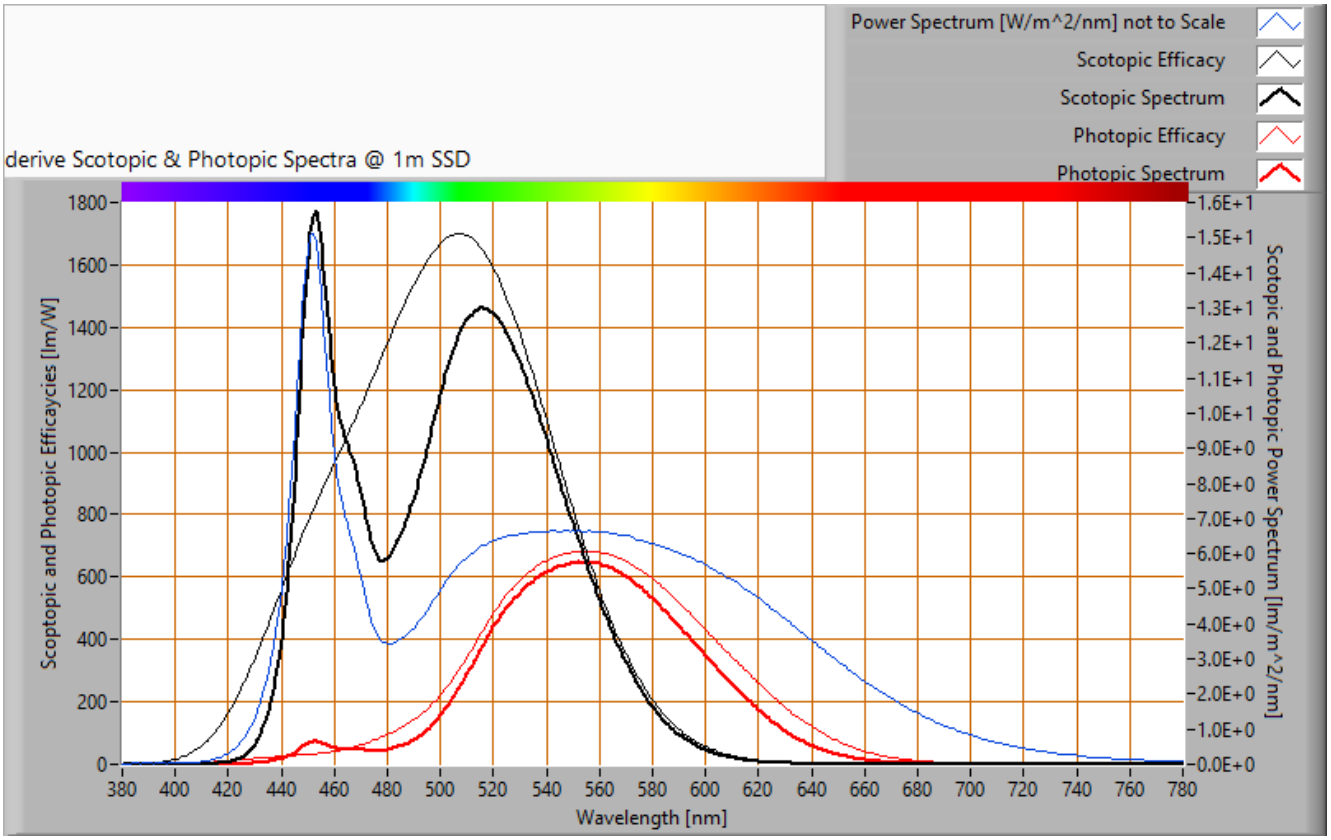
S/P ratio



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 2.3.

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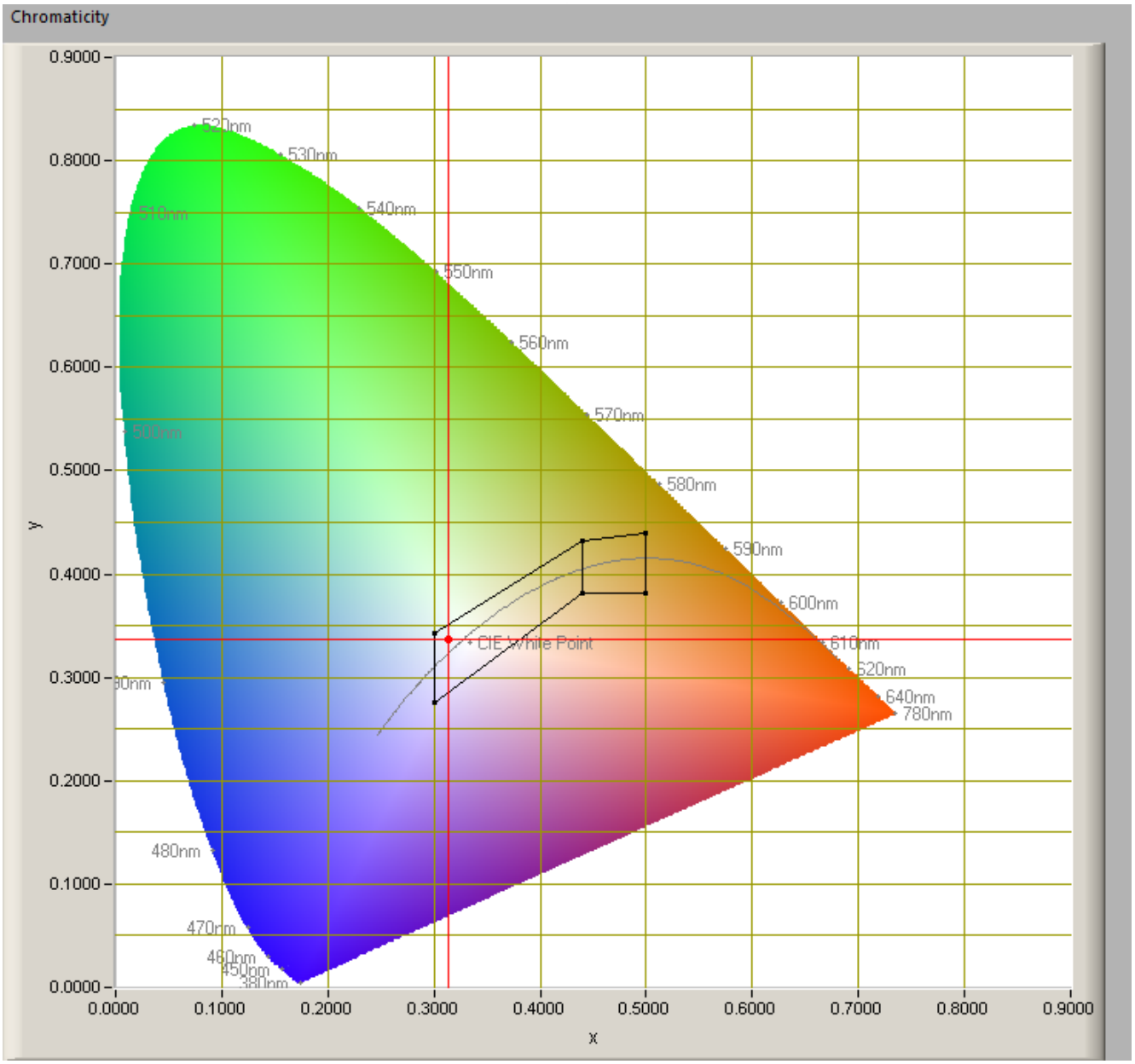
Chromaticity diagram



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=0.3136 and y=0.3368.

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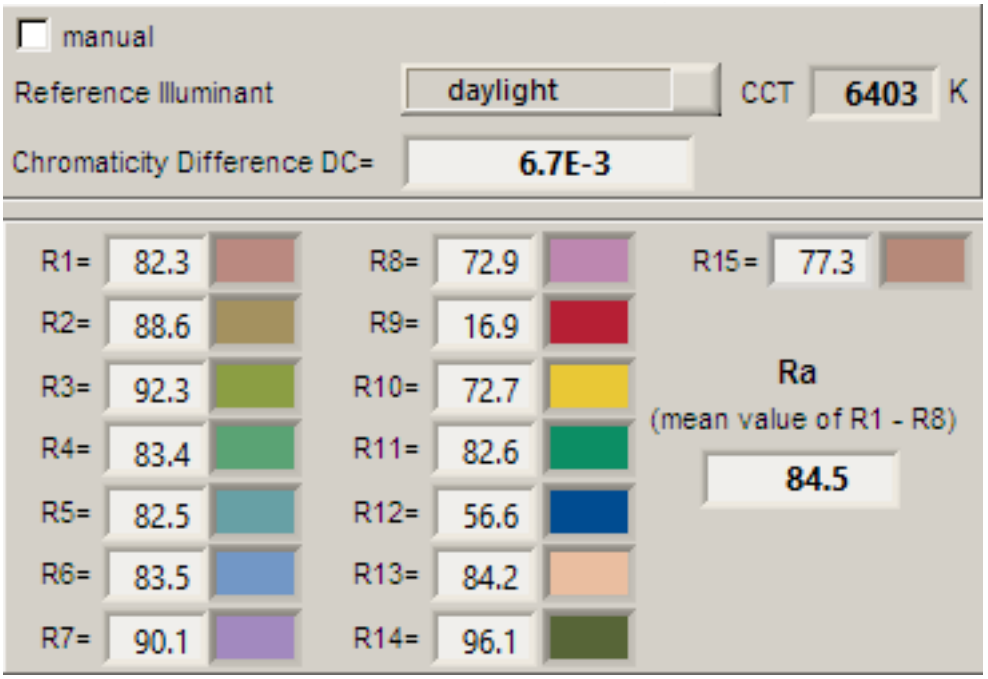
Color Rendering Index (CRI) or also Ra

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.

This value of 84 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 5000K a black radiator is used as reference and for color temperatures 5000K the sun or the light outside during the day).

The value of 84 is bigger than the value of 80 that is considered as a minimum for working areas in general.

Note: the chromaticity difference is 0.0067 and indicates the distance to the Planckian Locus. There is a value mentioned of max 5.4E-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.

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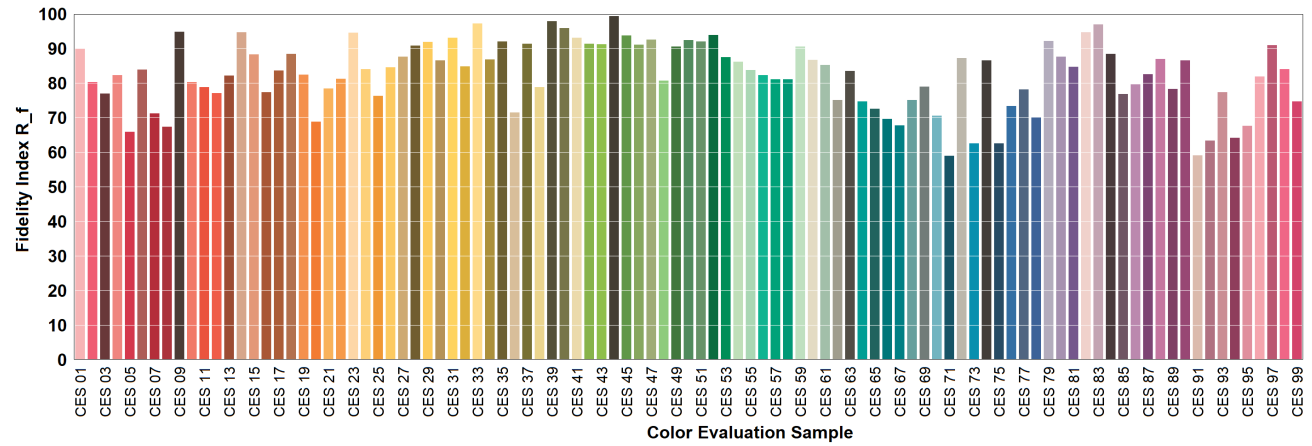
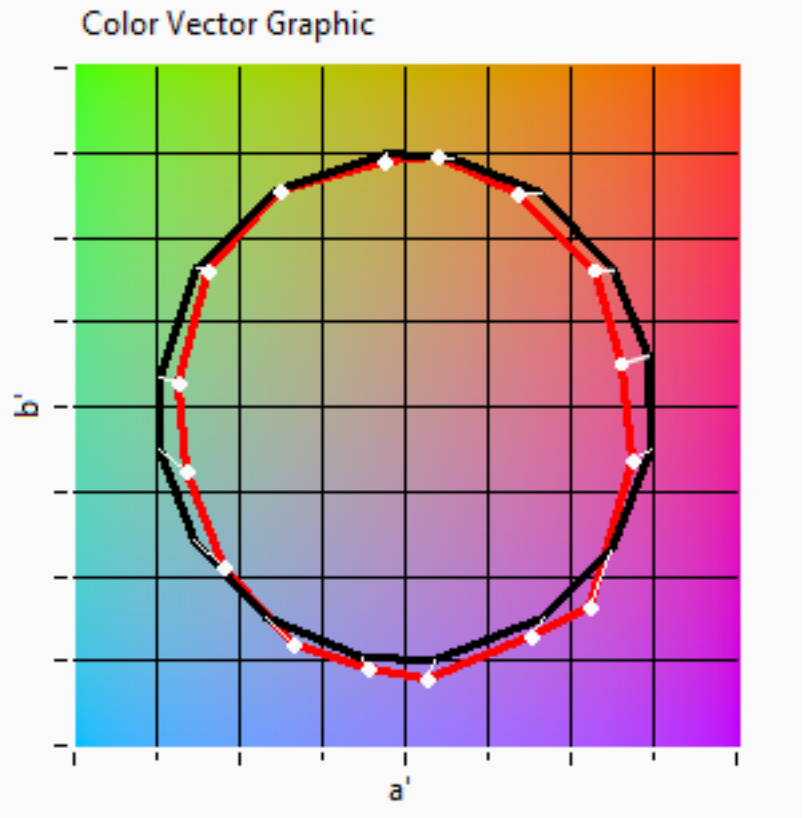
Color quality scale TM-30-15

TM-30-15 is an improved indicator (over CRI) of how well colors are rendered.
TM30-15 Rf = 83, Rg = 94.



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.

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Measure of flickering

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

<img class="alignnone size-medium wp-image-186930"

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parameter	value	unit
Flicker frequency	0.0	Hz
Illuminance modulation index	0	%
Flicker index	0.000	[-]
SVM	0.0	[-]

The illuminance modulation index is computed as: (max_Ev - min_Ev) / (max_Ev + min_Ev).

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	0.807
k_mel trans (25 years)	1.051
k_mel trans (32 years)	1.000
k_mel trans (50 years)	0.836
k_mel trans(75 years)	0.588
k_mel trans(90 years)	0.456
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

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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	25.5	0.04
30.0	38.3	0.06
50.0	64.0	0.09
75.0	96.2	0.13
100.0	128.5	0.17
150.0	193.6	0.24
300.0	391.8	0.37
500.0	663.2	0.47
750.0	1013.1	0.53
1000.0	1374.5	0.57
1500.0	2129.2	0.61
2000.0	2923.2	0.64

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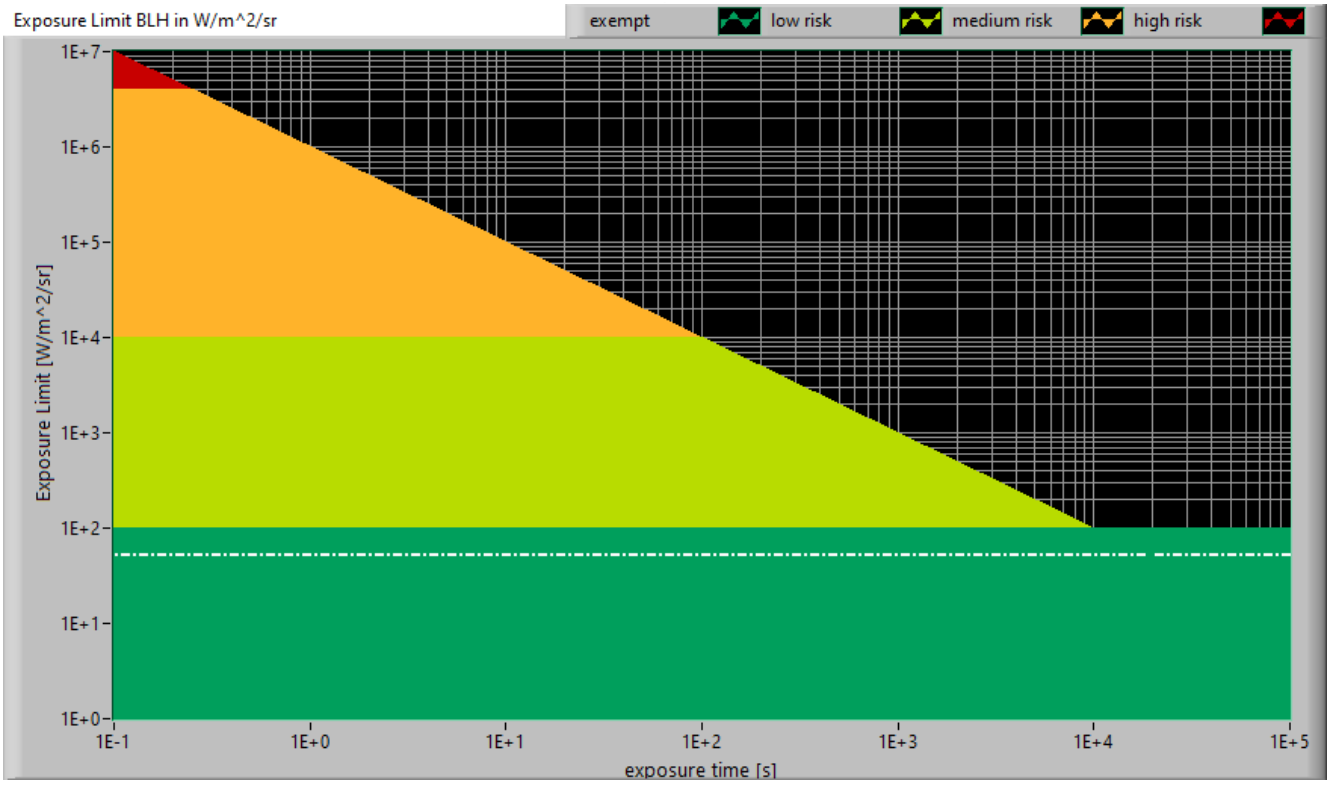
Blue Light Hazard

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]	70	Dimension of brightest part of lamp in C0-C180 direction.
L_lum90 [mm]	140	Dimension of brightest part of lamp in C90-C270 direction.
SSD_500lx [mm]	1496	Calculated distance where Ev = 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]	783	Minimum distance at which the lamp can be seen as a point source. In this area the Ev is linearly dependent from (1/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.

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alpha_AVG [rad]	0.100	Average (apparent) source angle. If average >= 0.011 rad then the exposure limit is computed with radiance Lb. Otherwise with irradiance Eb.
Exposure value [W/m^2/sr]	5.13E+1	Blue Light Hazard value for this lamp, measured straight underneath the lamp. Computation is referenced to Lb.
Blue Light Hazard risk group	0	0=exempt, 1=low, 2 = moderate, 3=high risk.

Extra

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Additional photos.

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