

Light Measurement Report

Print date: 04-09-2024

Measurement date and time: 03-09-2024 11:21:42 – Measurement no. VFR-240903-3746-MS

Operator: Jakob Daugaard Jepsen



Laboratory and Equipment

Laboratory Owner and Location

Goniospectrometer System and Type

Sensor Name, Calibr. Date and Serial No.

Ingemann Components, Denmark

Viso Systems LabSpion – Type C, horizontal

LabSensor – 22-08-2023 – 1130826259

Measurement Conditions

Number of C-planes and Resolution

γ (gamma)-Resolution

Test Distance

Input Power, Power and Displ. Factors

Input RMS Voltage and Current

Frequency of Input Power

Warm-up Time and Variation

24 planes – 15°

5°

8,99 m

4,6 W – PF 0,52 – DPF 0,97

227 V – 0,039 A

49,9 Hz

Lamp stabilized in 19 min 52 sec – 2,0%

Tested Light Source

Product Name

Item No. and Manufacturer

Product Description (line 1)

Compass Pendant 260

Pendant – Hay

Main Light Measurement Results

Output – Total Lumen (Up% / Down%)

Efficiency

Peak Intensity and Beam Angle

Correlated Color Temperature, Target/Measured

Color Rendering Index

Color Rendering TM30-18

Color Shift, CIE duv and MacAdam Steps

Flicker

446 lm – 0,43% / 99,57%

97 lm/W

214 cd – 96,5°

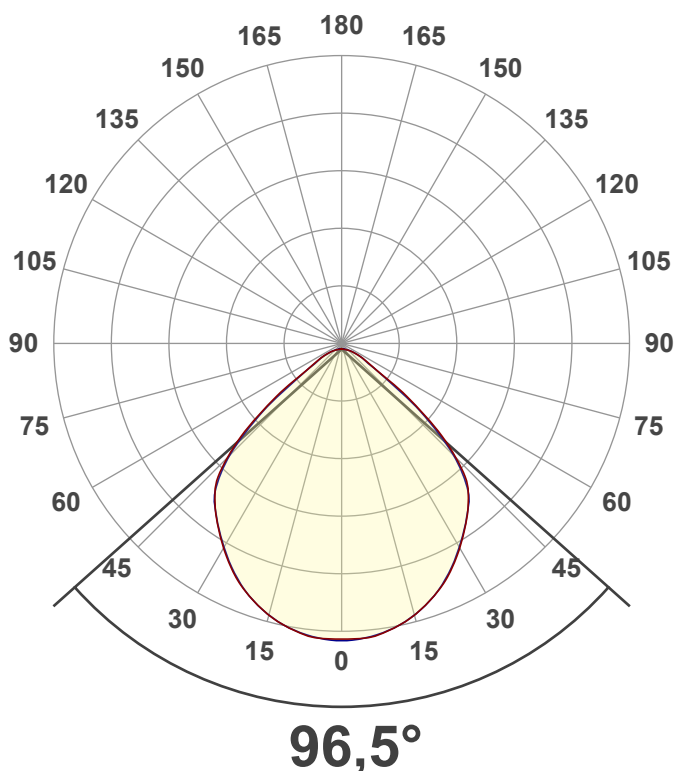
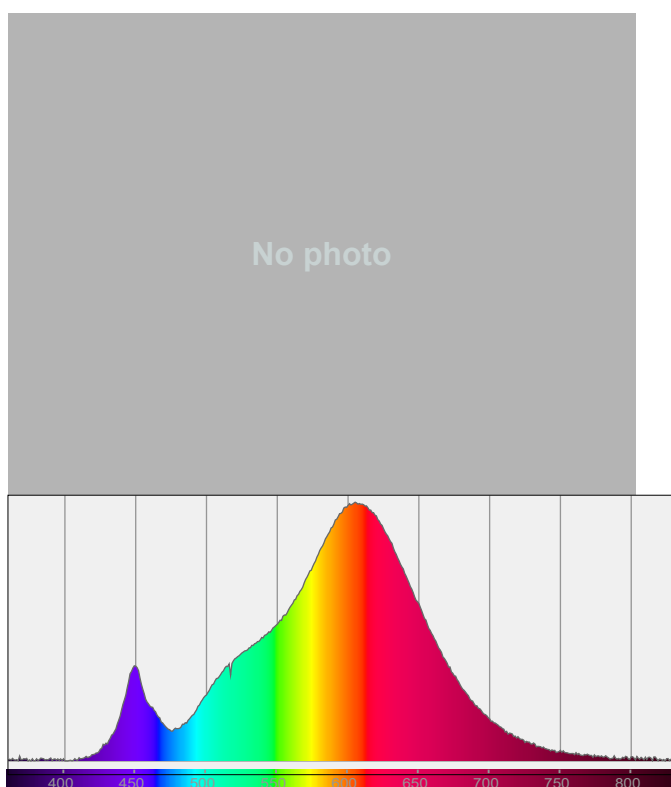
CCT = 2689 K / 2689 K

CRI 81,9

R_f 84,5 – R_g 96,6

Duv 0,0005 – SDCM n/a

SVM 0 – PstLM 0,02



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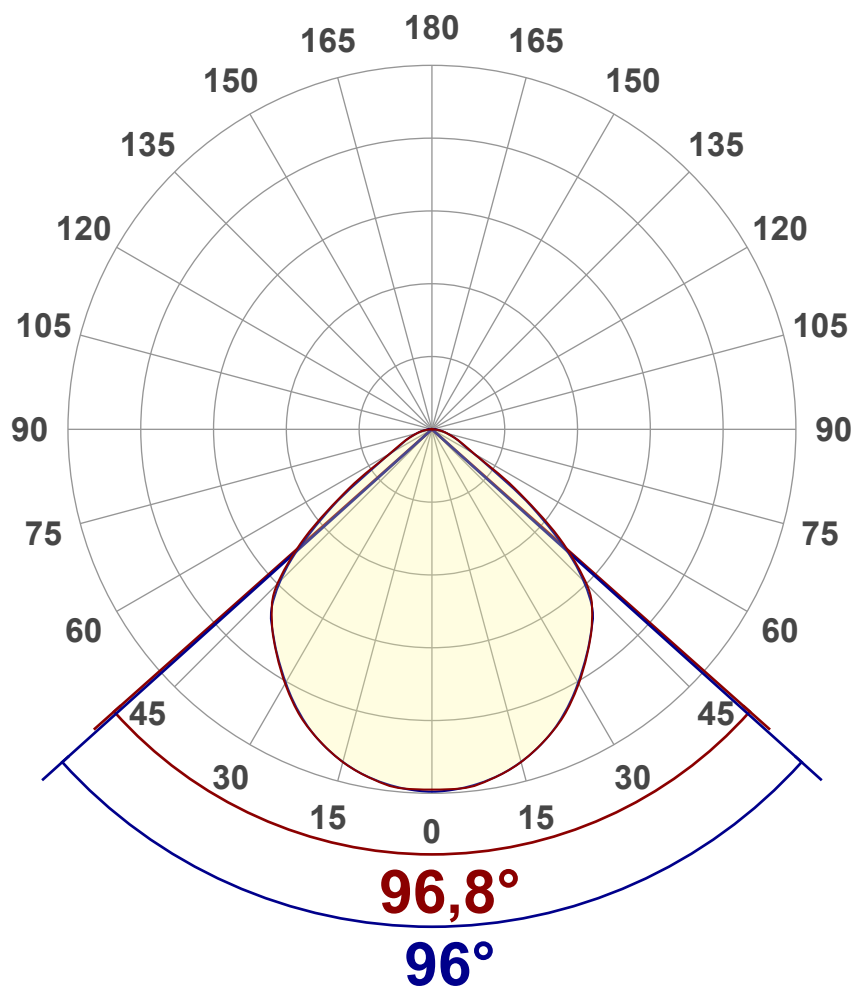
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Luminous Intensity diagram

Unit: 0-100% of peak intensity



Main Values

Output (total Lumen) 446 lm
Lumen Up% / Down% 0,43% / 99,57%
Peak Intensity 214 cd

Beam angle

Average (50%) 96,5°

Cut-off Angle

Average 2,5% 162,2°

Field Angle

Average 10% 127,2°

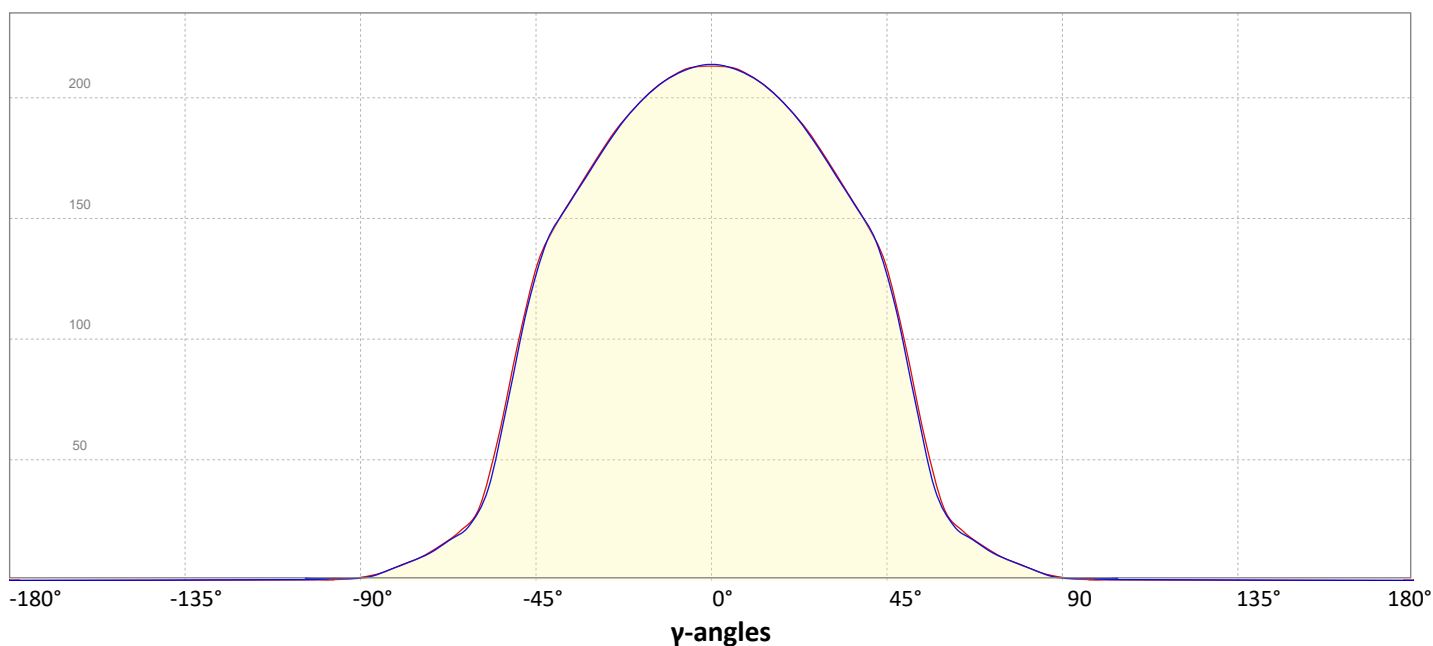
Intensity Ratio

In 120° cone 92,1%
In 90° cone 70,5%

C000-C180

C090-C270

Linear distribution diagram - Intensity (candela) vs γ-angle



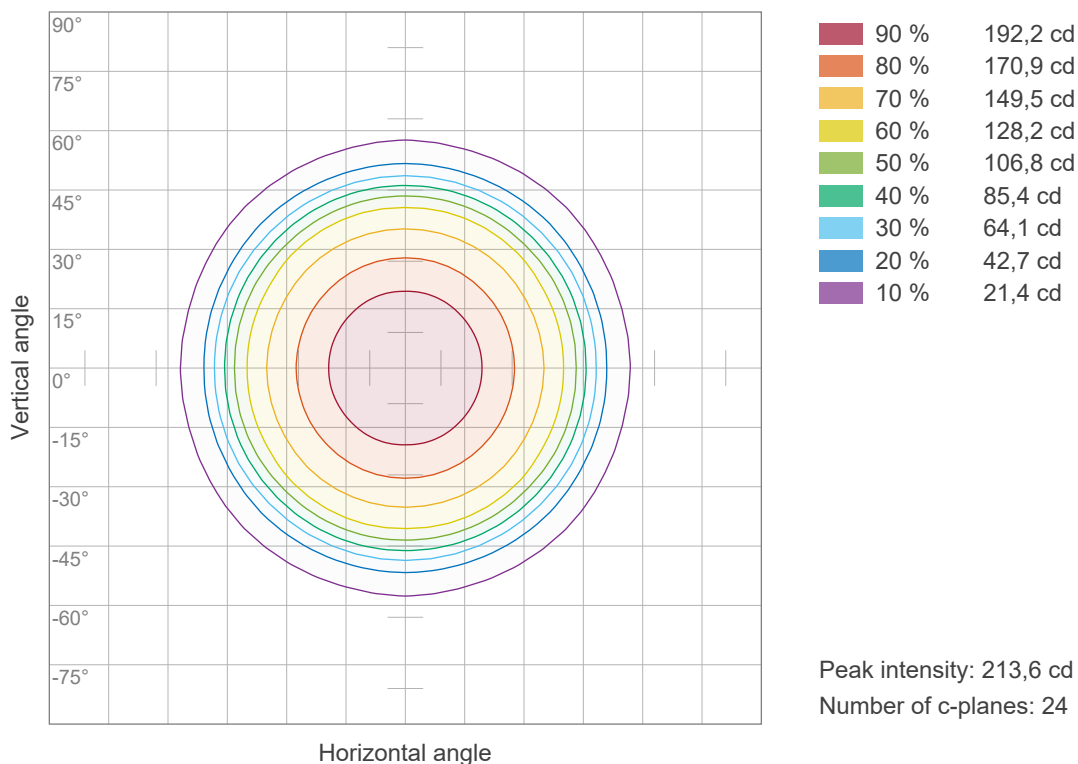
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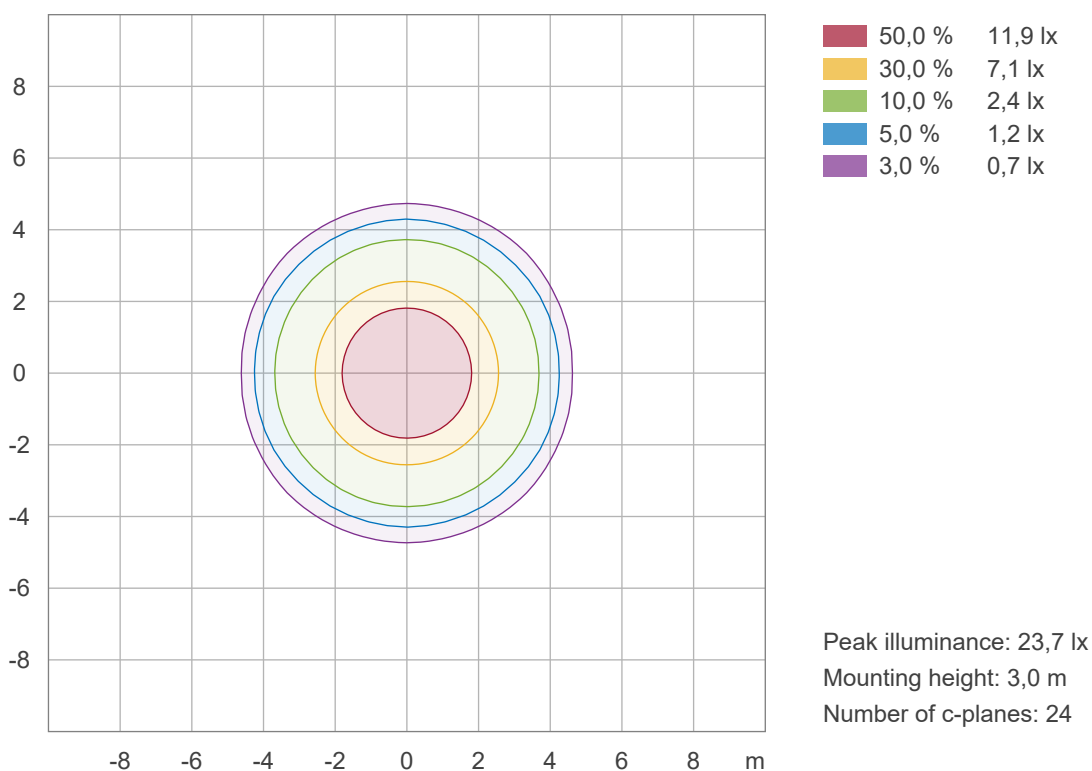
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Iso-intensity Diagram (Iso-candela)



Iso-illuminance Diagram (Iso-lux)



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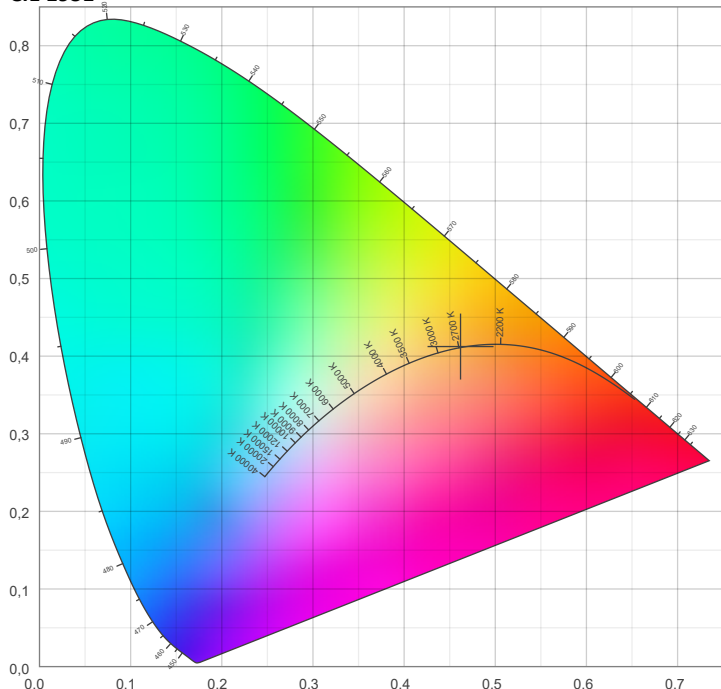


Color details

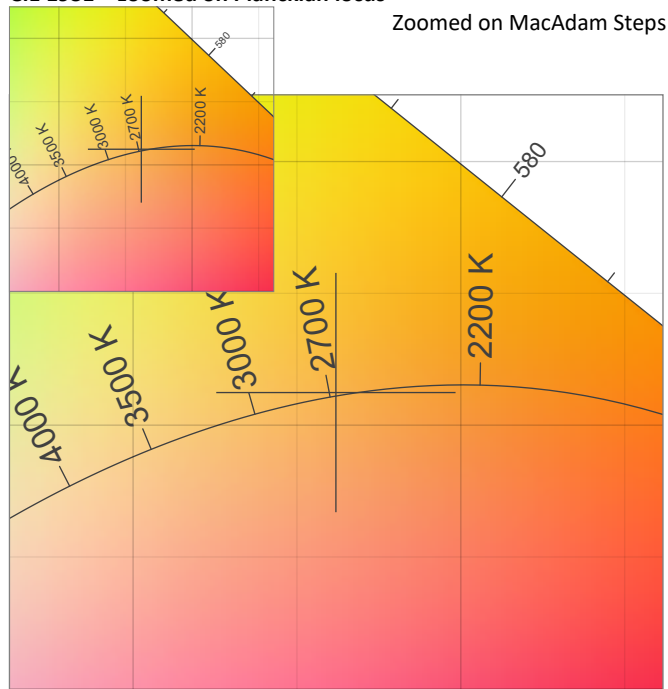
Correlated Color Temperature, Target CCT = 2689 K
Correlated Color Temperature, Measured CCT = 2689 K
Color Rendering Index CRI 81,9
Color Rendering Index, R9 (red component) R9 = 3,9
Color Rendering TM30-18 R_f 84,5 – R_g 96,6
Color Quality Scale CQS = 81,3

MacAdam Steps
Color coordinates CIE 1931 (x;y) = (0,462;0,412)
Color coordinate CIEs 1960 (u;v) = (0,263;0,352)
Color deviation from BBL Duv = 0,0005
Color coordinate CIEs 1976 (CIELUV) (u';v') = (0,263;0,528)

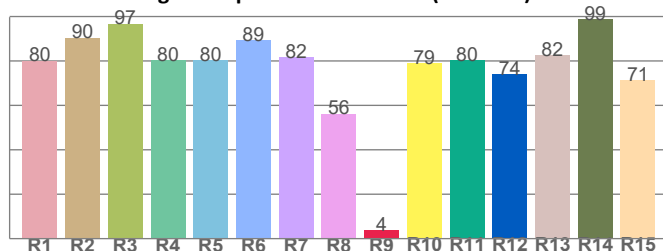
CIE 1931



CIE 1931 – zoomed on Planckian locus



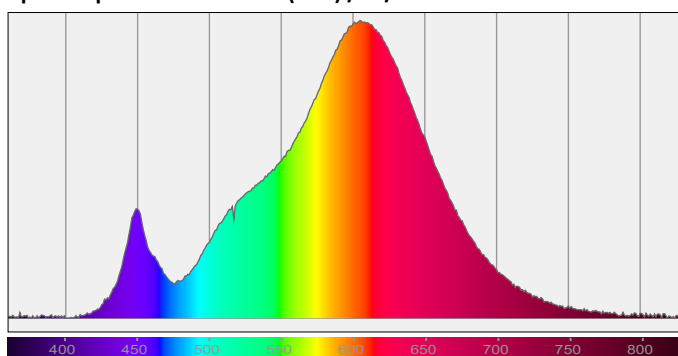
Color Rendering Index per reference color (CIE 1995)



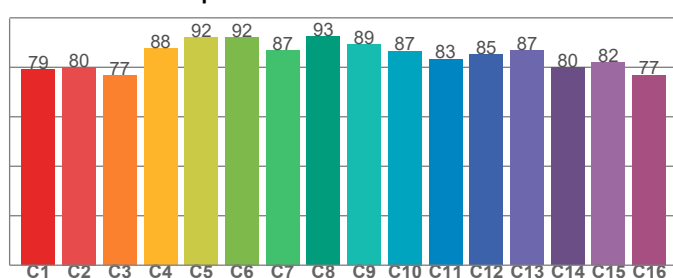
CRI R values, only R1-R8 are used to calculate final CRI value

R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
80,1	90,4	96,7	80,5	80,2	89,4	81,6	56,2	3,9	78,8	80,4	74,0	82,5	98,9	71,2

Spectral power distribution (SPD) / W/nm – 0-100%



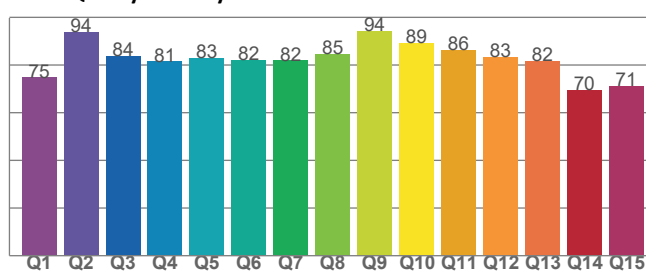
TM30-18 Rf-values per hue bin



TM30 C values, 16 binned values out of total of 99 C values

C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16
79,2	80,1	76,7	87,5	92,0	92,1	87,0	92,5	89,2	86,6	83,4	85,1	86,7	79,8	82,1	77,0

Color Quality Scale by reference color



CQS Q values

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15
74,7	93,8	83,8	81,4	82,9	82,2	81,9	84,7	94,2	89,1	86,3	83,4	81,8	69,6	71,2

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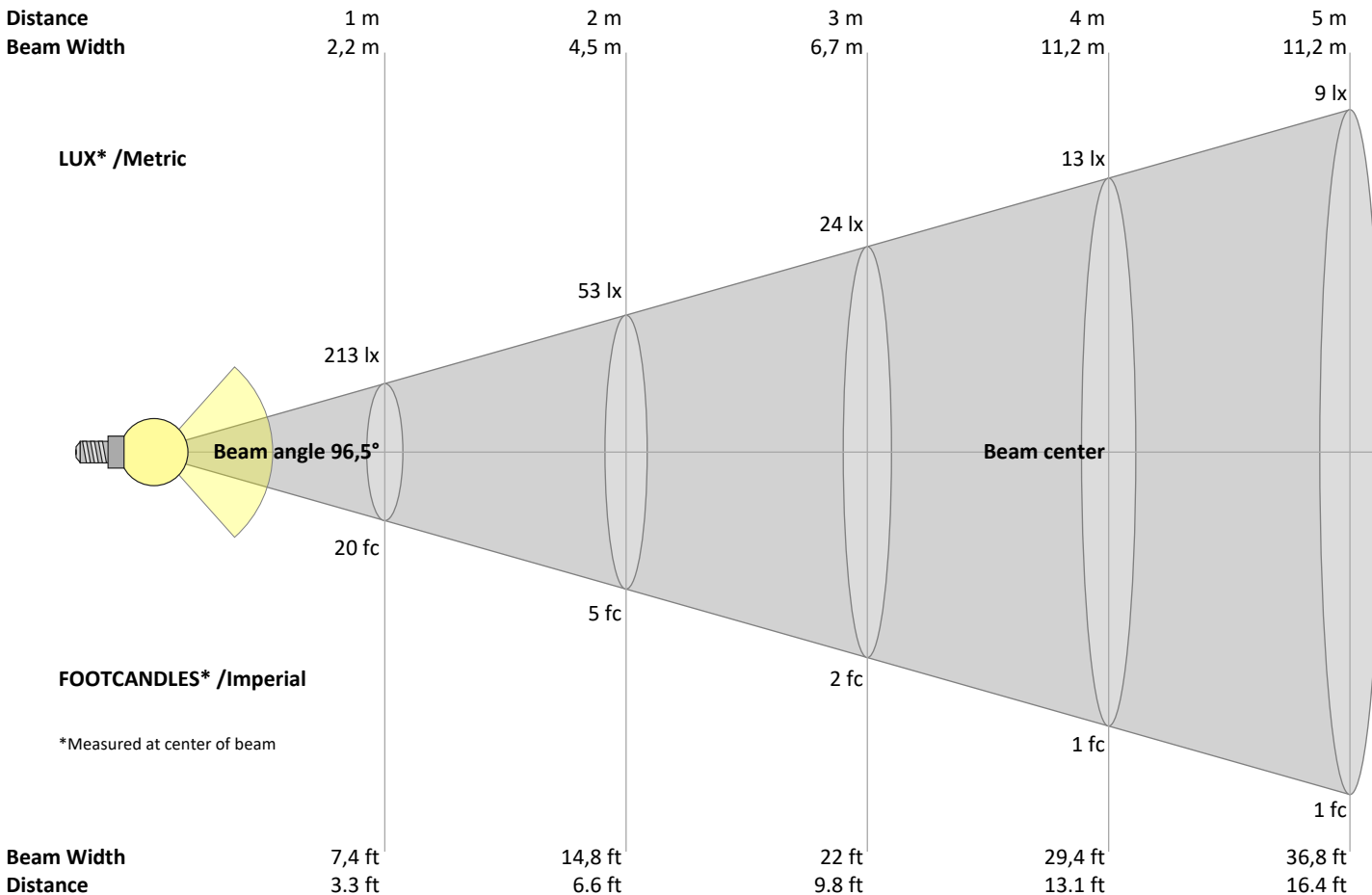
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Beam Details



Beam intensities from 1 – 20 m

[illegible]

Intensities in 0° c-plane

0°	5°	10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°	75°	80°	85°	90°	95°	γ
213	212	209	203	195	185	173	160	147	129	95	57	29	20	14	9	6	3	1	0	cd
100%	100%	98%	95%	91%	87%	81%	75%	69%	60%	45%	27%	14%	9%	7%	4%	3%	1%	1%	0%	of 0°va

Intensities in 90° c-plane

0°	5°	10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°	75°	80°	85°	90°	95°	γ
213	212	209	203	195	185	173	160	147	125	91	54	29	19	14	9	6	3	1	1	cd
100%	99%	98%	95%	91%	87%	81%	75%	69%	59%	43%	25%	14%	9%	6%	4%	3%	1%	1%	0%	of 0°va

Intensities in 180° c-plane

0°	5°	10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°	75°	80°	85°	90°	95°	γ
213	212	209	203	195	185	173	160	147	129	95	57	29	20	14	9	6	3	1	0	cd
100%	100%	98%	95%	91%	87%	81%	75%	69%	60%	45%	27%	14%	9%	7%	4%	3%	1%	1%	0%	of 0°va

Intensities in 270° c-plane

0°	5°	10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°	75°	80°	85°	90°	95°	γ
213	212	209	203	195	185	173	160	147	125	91	54	29	19	14	9	6	3	1	1	cd
100%	99%	98%	95%	91%	87%	81%	75%	69%	59%	43%	25%	14%	9%	6%	4%	3%	1%	1%	0%	of 0°va

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Light Planning – UGR table

Uncorrected, comprehensive UGR table according to 117-1995

Reflectances											
p Ceiling		70	70	50	50	30	70	70	50	50	30
p Walls		50	30	50	30	30	50	30	50	30	30
p Floor		20	20	20	20	20	20	20	20	20	20
Room size											
H = mounting height above eye level											
X	Y	Viewed Crosswise					Viewed Endwise				
		(Viewing direction orthogonal to lamp length axis)					(Viewing direction parallel to lamp length axis)				
2H	2H	14,4	15,4	14,6	15,7	15,9	14,3	15,3	14,5	15,6	15,8
	3H	14,5	15,6	14,9	15,8	16,0	14,4	15,5	14,8	15,8	16,0
	4H	14,6	15,6	15,0	15,9	16,2	14,6	15,6	15,0	15,8	16,1
	6H	14,8	15,7	15,1	16,0	16,3	14,7	15,6	15,0	15,9	16,3
	8H	14,8	15,7	15,2	16,0	16,4	14,8	15,6	15,1	15,9	16,3
	12H	14,8	15,6	15,2	16,0	16,4	14,8	15,6	15,1	15,9	16,4
4H	2H	14,4	15,4	14,8	15,6	15,9	14,3	15,3	14,7	15,6	15,8
	3H	14,8	15,6	15,1	15,9	16,4	14,7	15,5	15,1	15,9	16,3
	4H	14,9	15,6	15,3	16,1	16,6	14,8	15,6	15,3	16,0	16,5
	6H	15,1	15,8	15,6	16,2	16,5	15,0	15,7	15,5	16,1	16,5
	8H	15,1	15,8	15,7	16,2	16,6	15,1	15,7	15,6	16,1	16,5
	12H	15,2	15,7	15,7	16,2	16,6	15,1	15,7	15,6	16,1	16,6
8H	4H	14,9	15,6	15,4	15,9	16,3	14,9	15,5	15,4	15,9	16,3
	6H	15,2	15,7	15,7	16,2	16,7	15,1	15,6	15,6	16,1	16,6
	8H	15,4	15,8	15,9	16,3	16,9	15,3	15,7	15,8	16,2	16,9
	12H	15,5	15,8	16,1	16,3	16,9	15,4	15,8	16,0	16,3	16,9
12H	4H	14,9	15,4	15,4	15,9	16,3	14,8	15,4	15,3	15,8	16,3
	6H	15,2	15,7	15,8	16,2	16,8	15,2	15,6	15,7	16,1	16,8
	8H	15,4	15,7	16,0	16,2	16,9	15,3	15,7	15,9	16,2	16,8
Variations with the observer position for the luminaire spacings, S:											
S = 1.0H		0,6 / -0,8					0,6 / -0,8				
S = 1.5H		1,5 / -2,1					1,4 / -2,0				
S = 2.0H		2,8 / -2,7					2,7 / -2,6				

Coefficients of Utilization

Ceiling reflectance	80			70			50			30			10			0		
Wall reflectance	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	0
Floor reflectance	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	0
RCR		(RCR: Room Cavity Ratio)			Room Values are expressed as percentage of Lumen delivered to the task surface													
0	119	119	119	119	116	116	116	116	111	111	111	106	106	106	102	102	102	100
1	111	107	104	100	108	105	102	99	101	98	96	97	95	93	93	91	90	88
2	103	96	90	86	100	94	89	85	91	86	83	87	84	81	84	81	79	77
3	95	86	79	74	93	85	78	73	82	76	72	79	74	71	77	73	69	67
4	88	78	70	64	86	76	69	64	74	68	63	72	66	62	70	65	61	59
5	82	70	62	57	80	69	62	56	67	61	56	65	60	55	63	59	55	53
6	76	64	56	50	74	63	56	50	61	55	50	60	54	49	58	53	49	47
7	71	58	51	45	69	58	50	45	56	49	45	55	49	44	53	48	44	42
8	66	54	46	41	65	53	46	40	52	45	40	50	44	40	49	44	40	38
9	62	49	42	37	60	49	42	37	48	41	36	47	41	36	46	40	36	34
10	58	46	38	34	57	45	38	33	44	38	33	43	37	33	42	37	33	31

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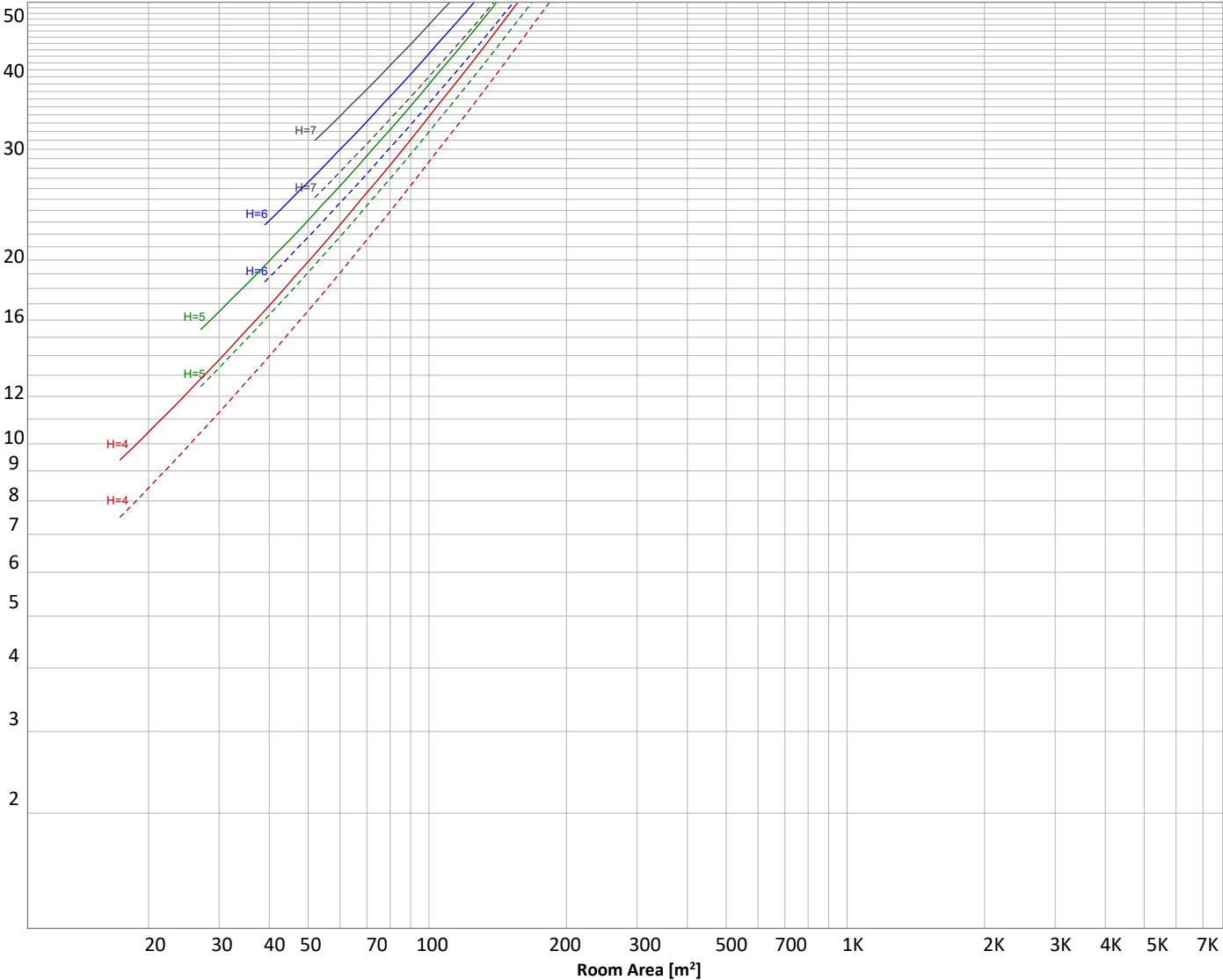
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Luminaire budgetary diagram

Uncorrected, comprehensive UGR table according to 117-1995

LAMPS (number of lamps)



Conditions

H = Room height	Flux = 446 lm	p(%)		
H _{down} = Lamp distance from ceiling =	0.00 m	Line type	Ceiling reflectance	Wall reflectance
H _{work} = Work area height from floor =	0.00 m	-----	70	50
E _{work} = Average lux on work area =	100 lx	-----	50	30
				Floor reflectance
				20

Zonal Lumen Summary

0°-10°	10°-20°	20°-30°	30°-40°	40°-50°	50°-60°	60°-70°	70°-80°	80°-90°
20,2 lm	57,3 lm	85,2 lm	100 lm	96,6 lm	51,0 lm	19,5 lm	10,1 lm	3,55 lm
90°-100°	100°-110°	110°-120°	120°-130°	130°-140°	140°-150°	150°-160°	160°-170°	170°-180°
0,864 lm	0,481 lm	0,216 lm	0,127 lm	0,102 lm	0,057 lm	0,038 lm	0,024 lm	0,008 lm

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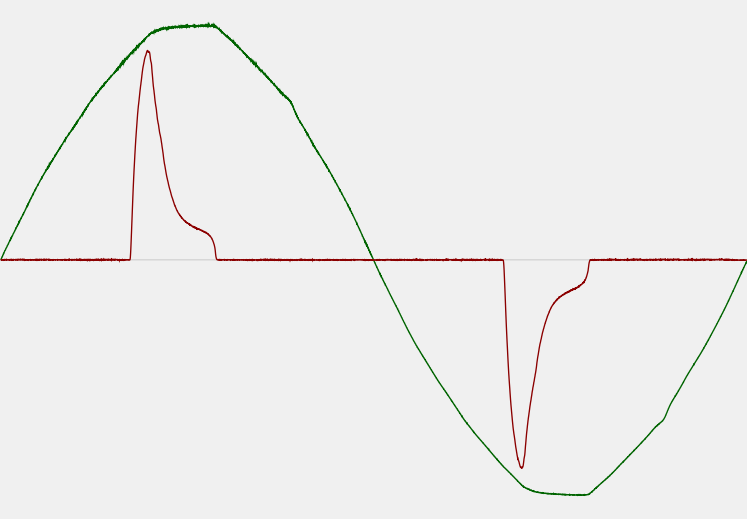


Power Details

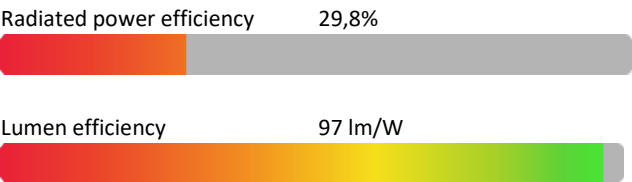
Input Power

Power feed to light source	4,6 W
Frequency of input power	49,9 Hz
RMS Input voltage feed, V_{RMS}	227 V
RMS Input current feed, I_{RMS}	0,039 A
Volt-Ampere or apparent power = $V_{RMS} * I_{RMS}$	8,88 VA
Displacement factor of AC power feed	0,97
Power factor of AC current feed	0,52
Total harmonic distortion of the current	157,75%
Total harmonic distortion of the voltage	1,42%

Input Power Curve



Efficiency



Stabilization Details

Warmup Conditions

Stable period	15 min
Stable change max	2,0%
Minimum time	15 min

Color Temperature Change

CCT start	2674 K
CCT shift	+15 K
CCT end	2689 K

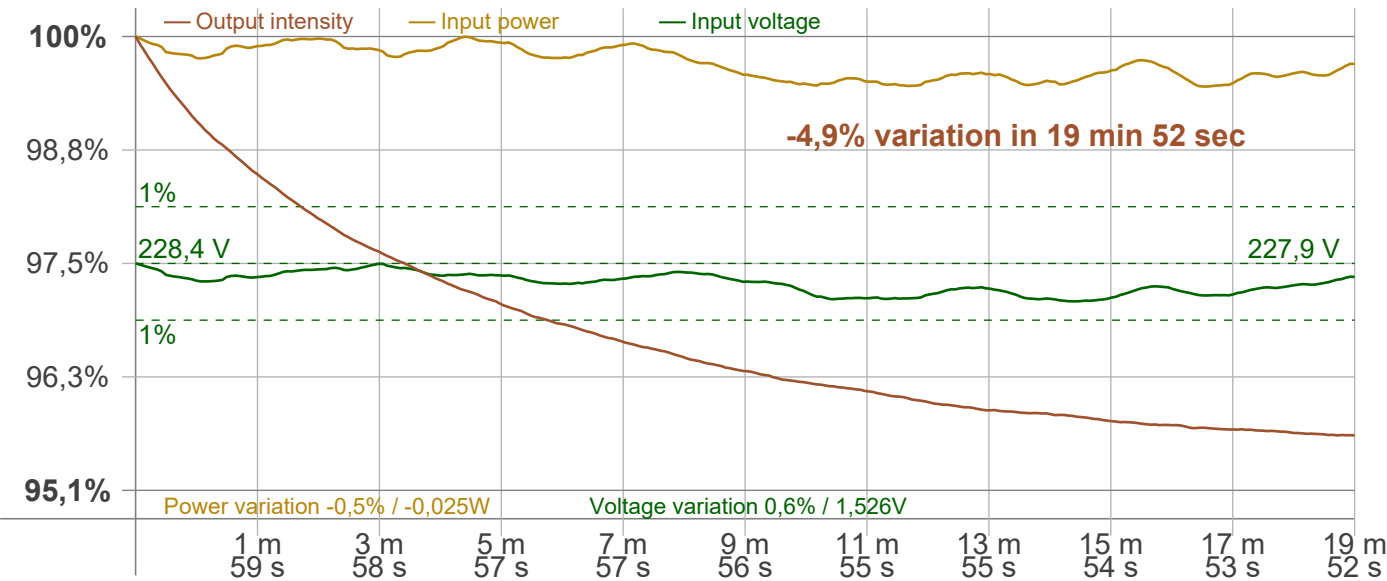
Warmup Result

Total warmup time	Lamp stabilized in 19 min 52 sec
Warmup variation	-4,9%

Output Change

Output start	467 lm
Output change	-22 lm
Output end	446 lm

Stabilization Curve



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Flicker /TLA details

Flicker Meter Type	Viso Systems LabFlicker
Frequency of input power	49,9 Hz
Flicker/TLA sample rate	20000 samples/s

Measurement time

PstLM	180 sec
All other indices	1,2 sec

Flicker indices according to Illuminating Engineering Society (IES)

Flicker frequency	102,04 Hz
Percent Flicker	0,1 %
Flicker index	0

Flicker indices according to California Energy Commission (CEC) 2016b

JA8/10 40 Hz	0,02 %
JA8/10 90 Hz	0,02 %
JA8/10 200 Hz	0,04 %
JA8/10 400 Hz	0,06 %
JA8/10 1000 Hz	0,08 %

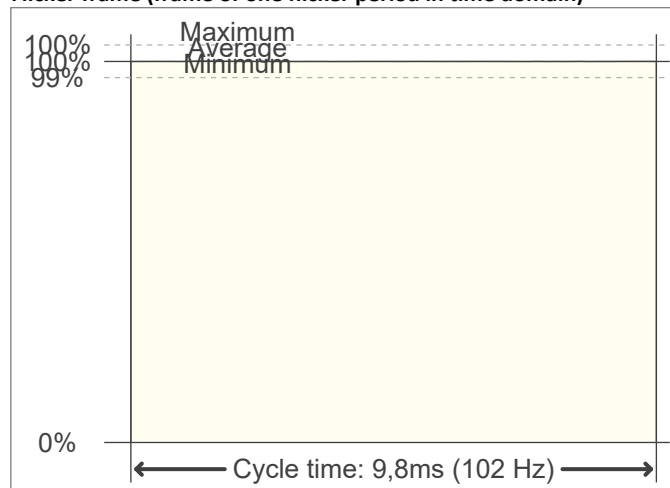
Flicker indices according to Lighting Research Center (2015)

Perception metric, Assist Mp	0,01
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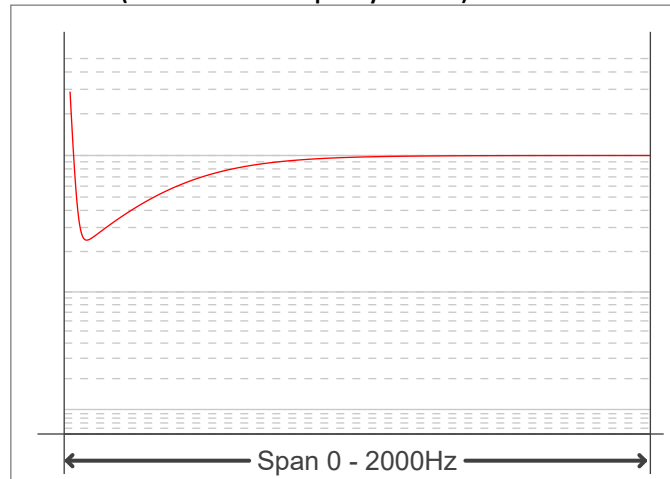
TLA indices (re IEC TR 61547-1, IEC 61000-3-3 and IEC 61000-4-15)

PstLM value ($F < 80$ Hz)	0,02
SVM value ($80 < F < 2000$ Hz)	0

Flicker frame (frame of one flicker period in time domain)



Flicker FFT (flicker curve in frequency domain)



Compliance with EU Ecodesign directive

Regulation EU 2019/2020 on Directive 2009/125/EC (Ecodesign Directive) defines two evaluation variables for Temporal Light Artefacts (TLA): The PstLM for the evaluation of visible flicker in the frequency range 0.3Hz to 80Hz. "st" stands for "short term", and "LM" stands for "light flicker meter method". The "stroboscopic visibility measure" SVM for evaluating the stroboscopic effect on moving objects in the frequency range 80Hz to 2000Hz. For both parameters, a value of 1 means that an average observer recognises the flicker with a probability of 50%. The permissible limits are 1 for PstLM and 0.4 for SVM.

PstLM value	0,02 Compliant
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SVM value	0,00 Compliant
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Product total	Compliant
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