

Light Measurement Report

Print date: 10/23/2023

Measurement date and time: 10/20/2023 5:44:30 PM – Measurement no. VFR-231020-0077-MS

Measurement tracking No. and Link: [n/a](#)

Operator:



Laboratory and Equipment

Laboratory Owner and Location

Goniospectrometer System and Type

Sensor Name, Calibr. Date and Serial No.

Spectrometer Manufacturer and Model

Viso Systems, Copenhagen V, Denmark

LabSpion – Type C, horizontal

LabSensor – 6/20/2022 – 0166732104

Ibsen Photonics, Denmark – Freedom VIS (Custom Viso)

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

8 planes – 45°

5°

7.00 m

16.8 W – PF 1.0 – DPF 0.71

24.0 V – 0.698 A

0 Hz

Lamp stabilized in 34 min 46 sec – 0.5%

Tested Light Source

Product Name

Item No. and Manufacturer

Product Description (line 1)

TR1223 Essence Side bend 940K

AB1983-04 LNTT 940K 300LPF WH 0408 2S 24V 2.0IN 5.5WPF SIL –

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

874 lm – 3.02% / 96.98%

52 lm/W

291 cd – 112.3°

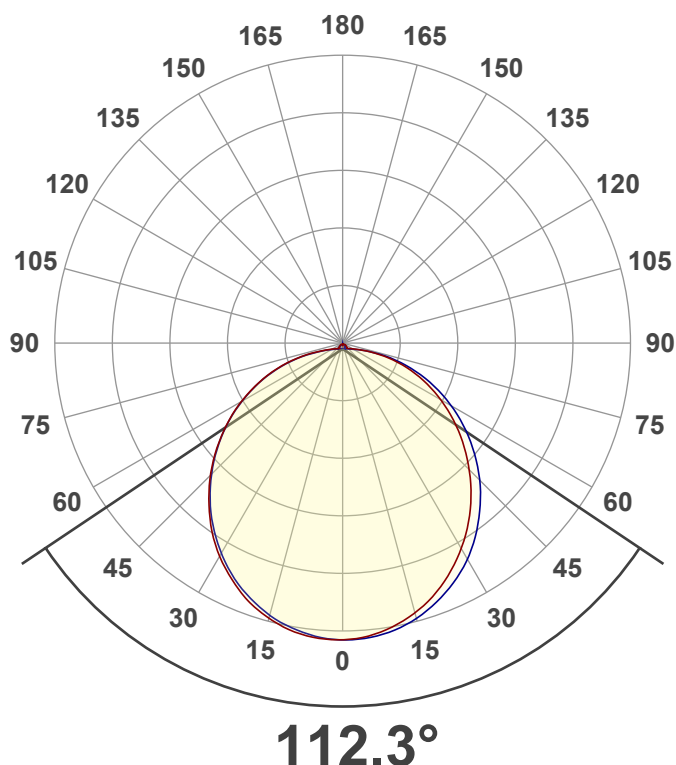
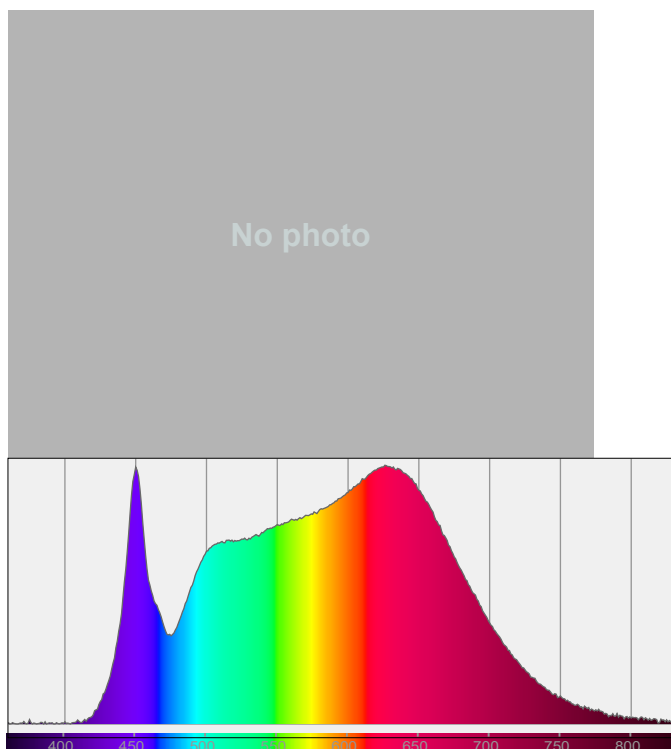
CCT = 3823 K / 3823 K

CRI 98.5

R_f 95.4 – R_g 101.0

Duv -0.0004 – SDCM n/a

SVM n/a – PstLM n/a



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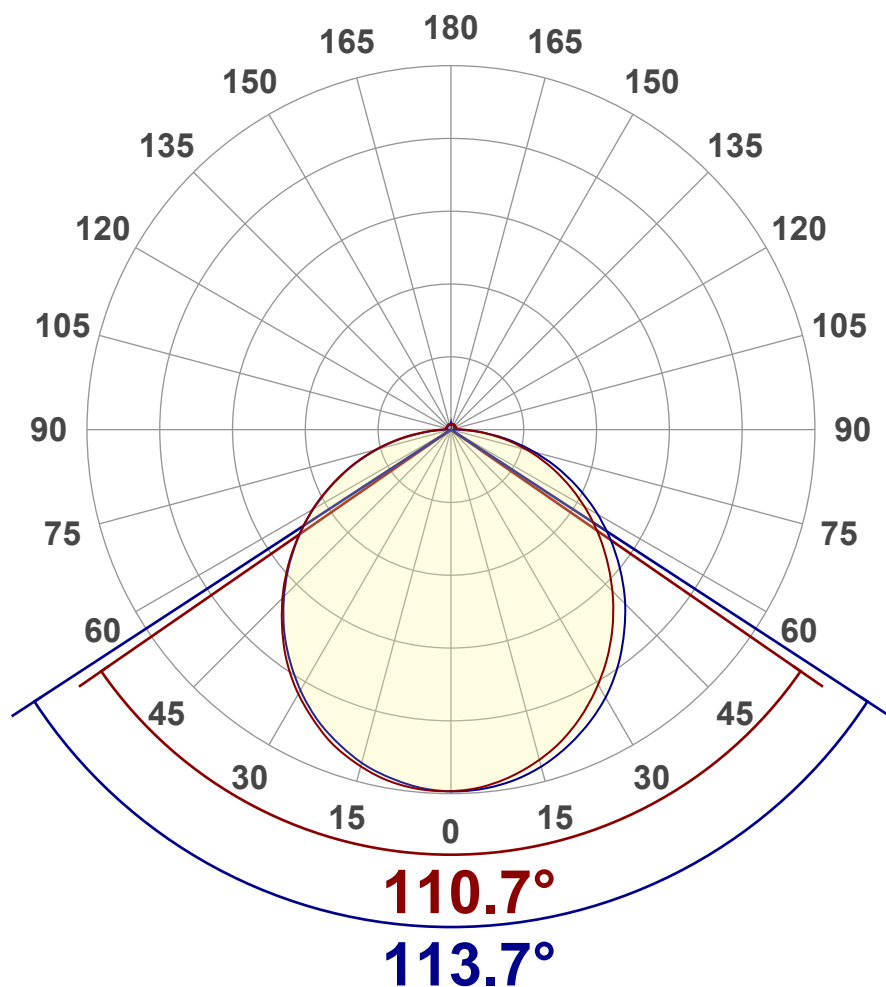
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Luminous Intensity diagram

Unit: 0-100% of peak intensity



Main Values

Output (total Lumen)	874 lm
Lumen Up% / Down%	3.02% / 96.98%
Peak Intensity	291 cd
Beam Angle (50%)	112.3°
Beam Angle (90%)	113.7°
Beam Angle (10%)	110.7°

Cut-off Angle

Average 2,5%	181.3°
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Field Angle

Average 10%	166.8°
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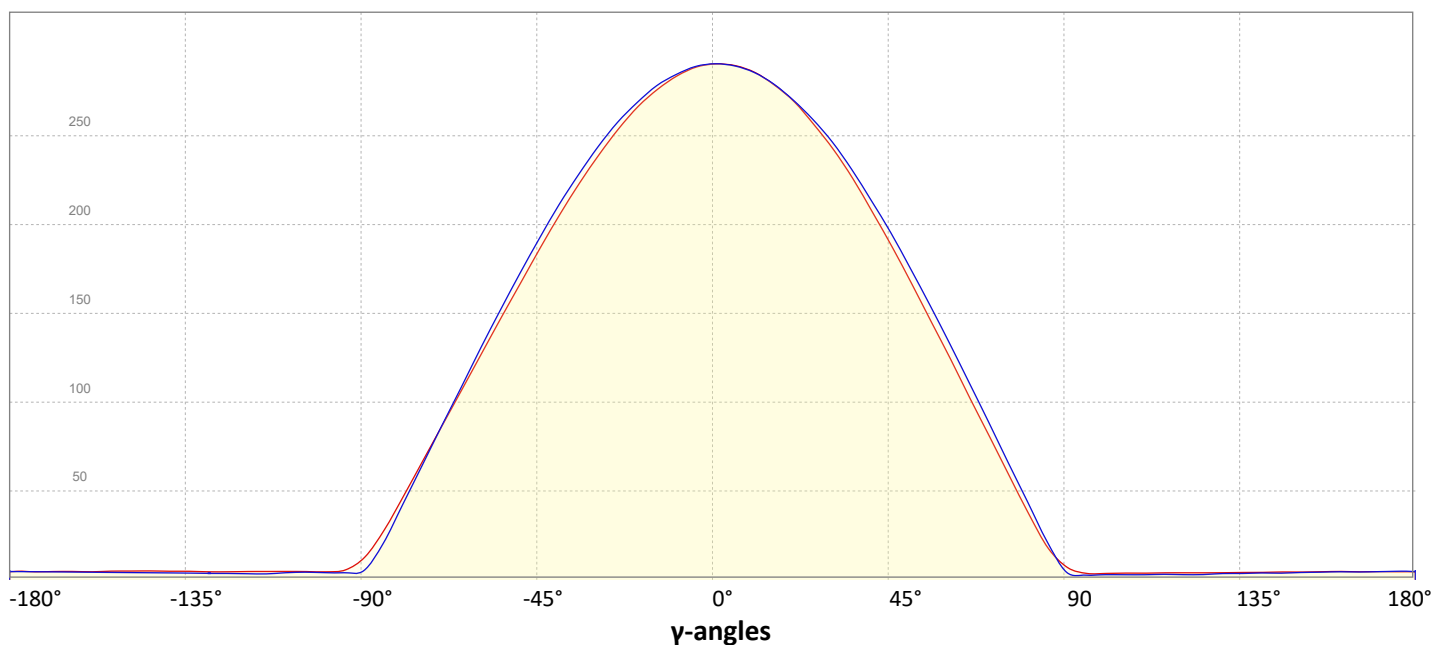
Intensity Ratio

In 120° cone	74.0%
In 90° cone	50.3%

C000-C180

C090-C270

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



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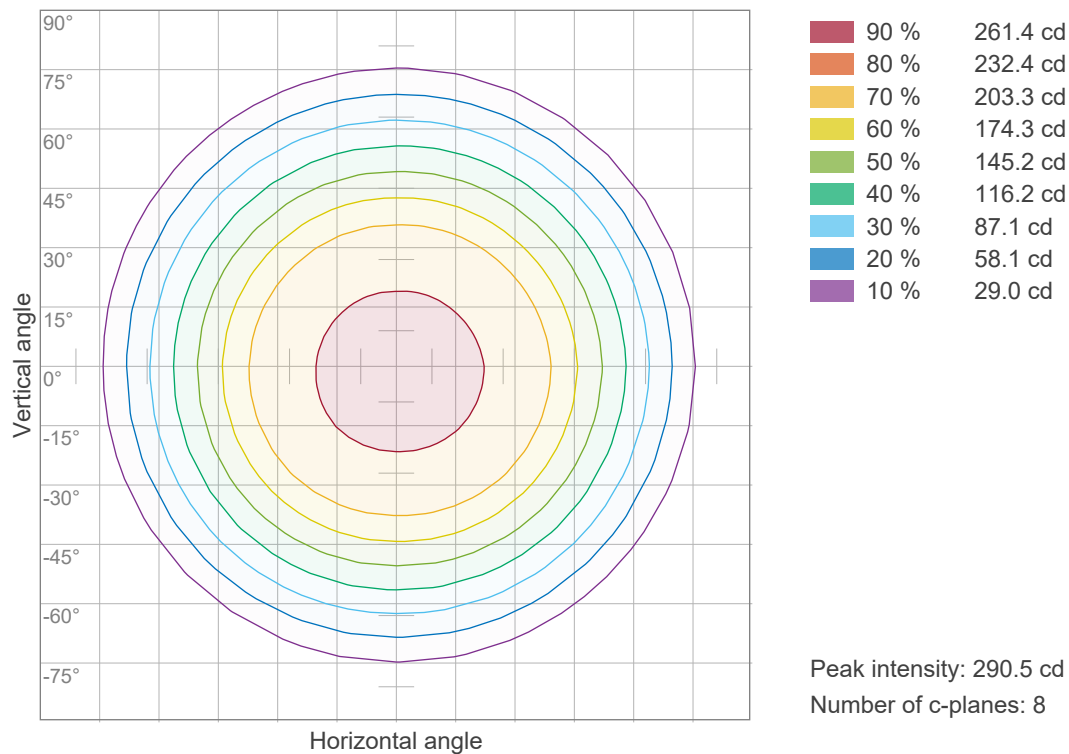
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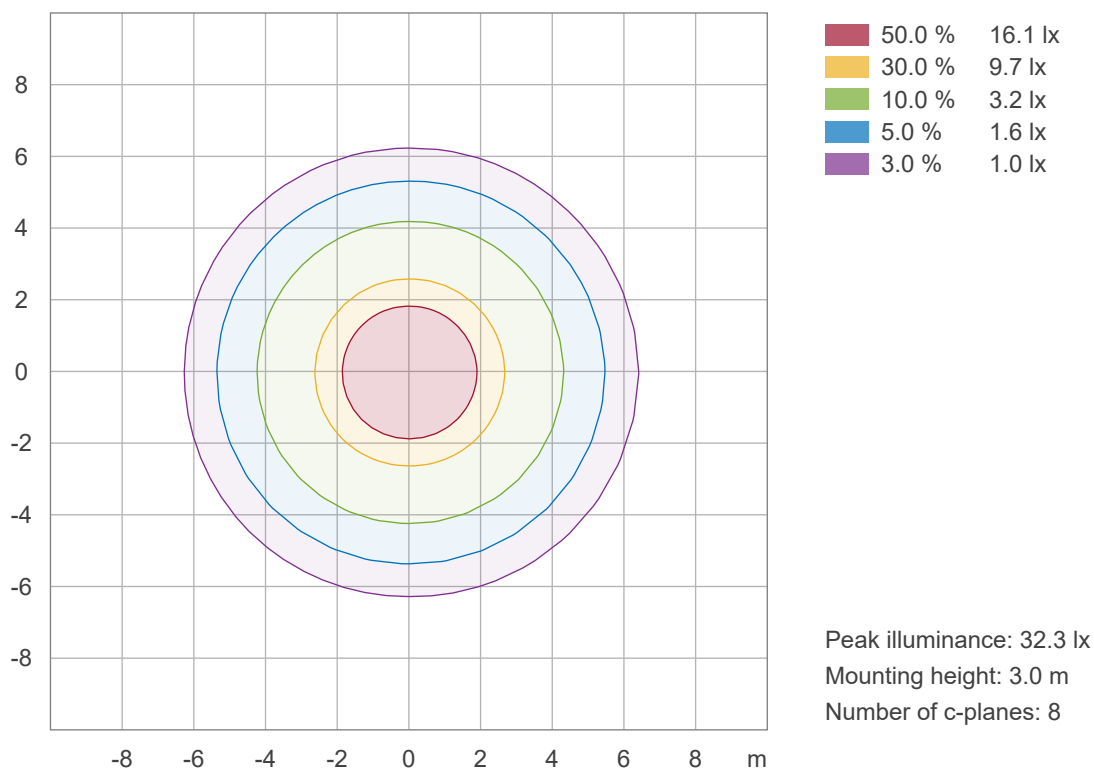
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Iso-intensity Diagram (Iso-candela)



Iso-illuminance Diagram (Iso-lux)



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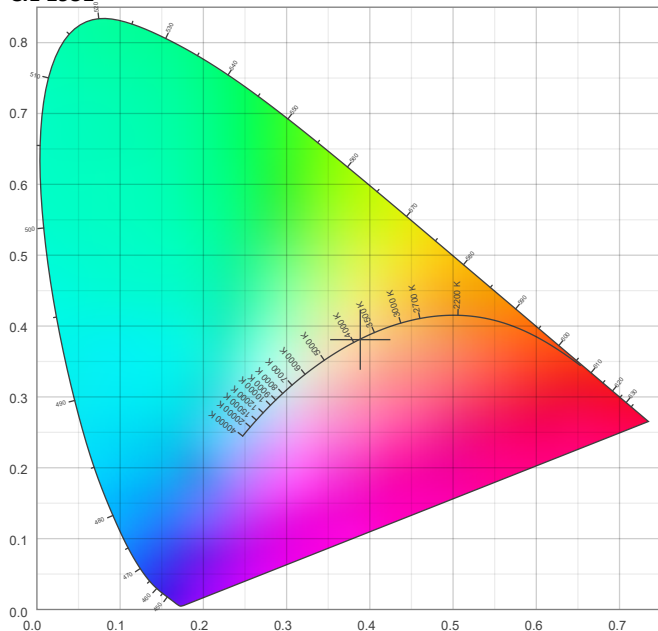


Color details

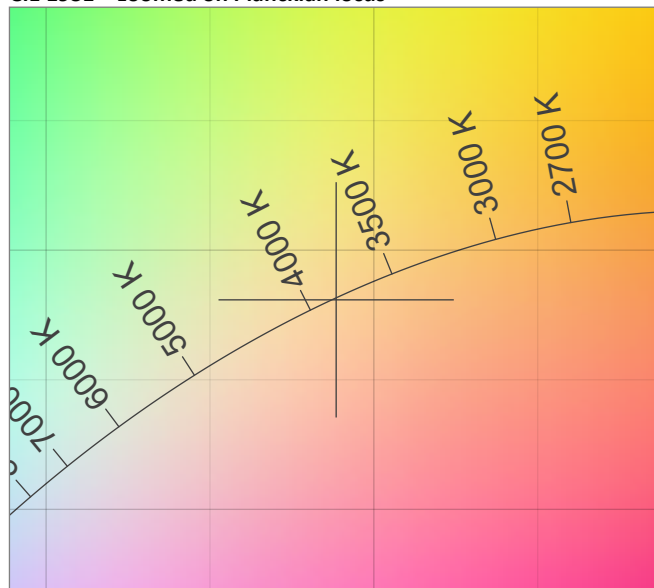
Correlated Color Temperature, Target CCT = 3823 K
Correlated Color Temperature, Measured CCT = 3823 K
Color Rendering Index CRI 98.5
Color Rendering Index, R9 (red component) R9 = 93.6
Color Rendering TM30-18 R_f 95.4 – R_g 101.0
Color Quality Scale CQS = 97.6

MacAdam Steps
Color coordinates CIE 1931 (x;y) = (0.389;0.381)
Color coordinate CIEs 1960 (u;v) = (0.229;0.336)
Color deviation from BBL Duv = -0.0004
Color coordinate CIEs 1976 (CIELUV) (u';v') = (0.229;0.505)

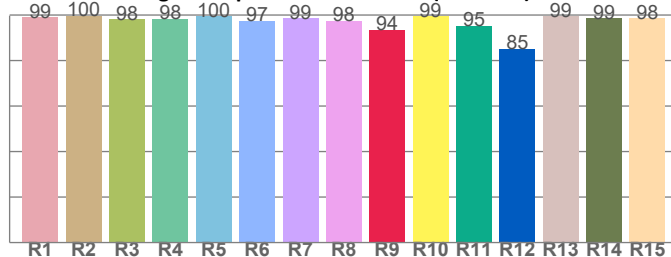
CIE 1931



CIE 1931 – zoomed on Planckian locus



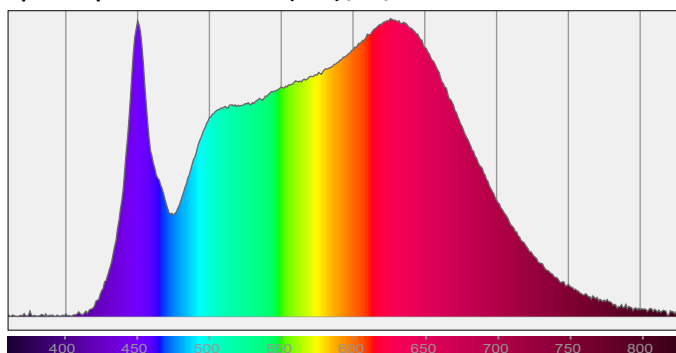
Color Rendering Index per reference color (CIE 1995)



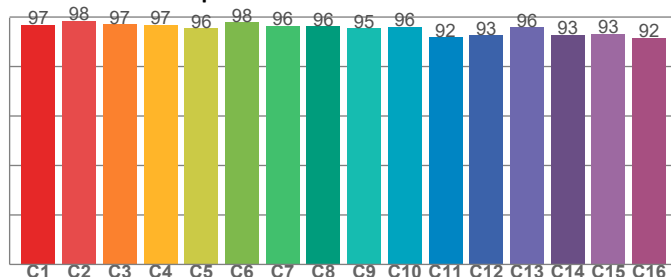
CRI R values, only R1-R8 are used to calculate final CRI value

R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
99.1	99.8	98.2	98.2	99.5	97.4	98.6	97.5	93.6	99.4	95.3	85.2	99.4	98.6	98.5

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



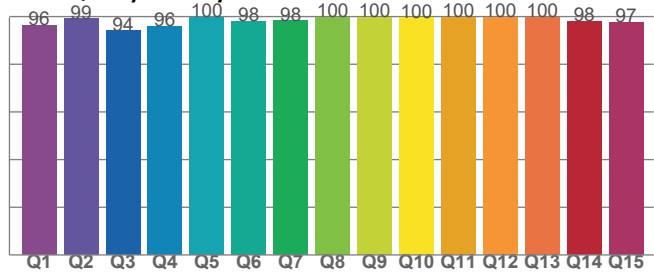
TM30-18 R_f-values per hue bin



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
96.8	98.5	97.2	96.9	95.5	97.9	96.5	96.3	95.4	96.1	91.8	92.6	95.9	92.9	93.1	91.5

Color Quality Scale by reference color



CQS Q values

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15
96.4	99.1	94.0	96.0	99.7	97.9	98.3	99.6	99.8	99.5	99.8	99.8	99.8	98.1	97.5

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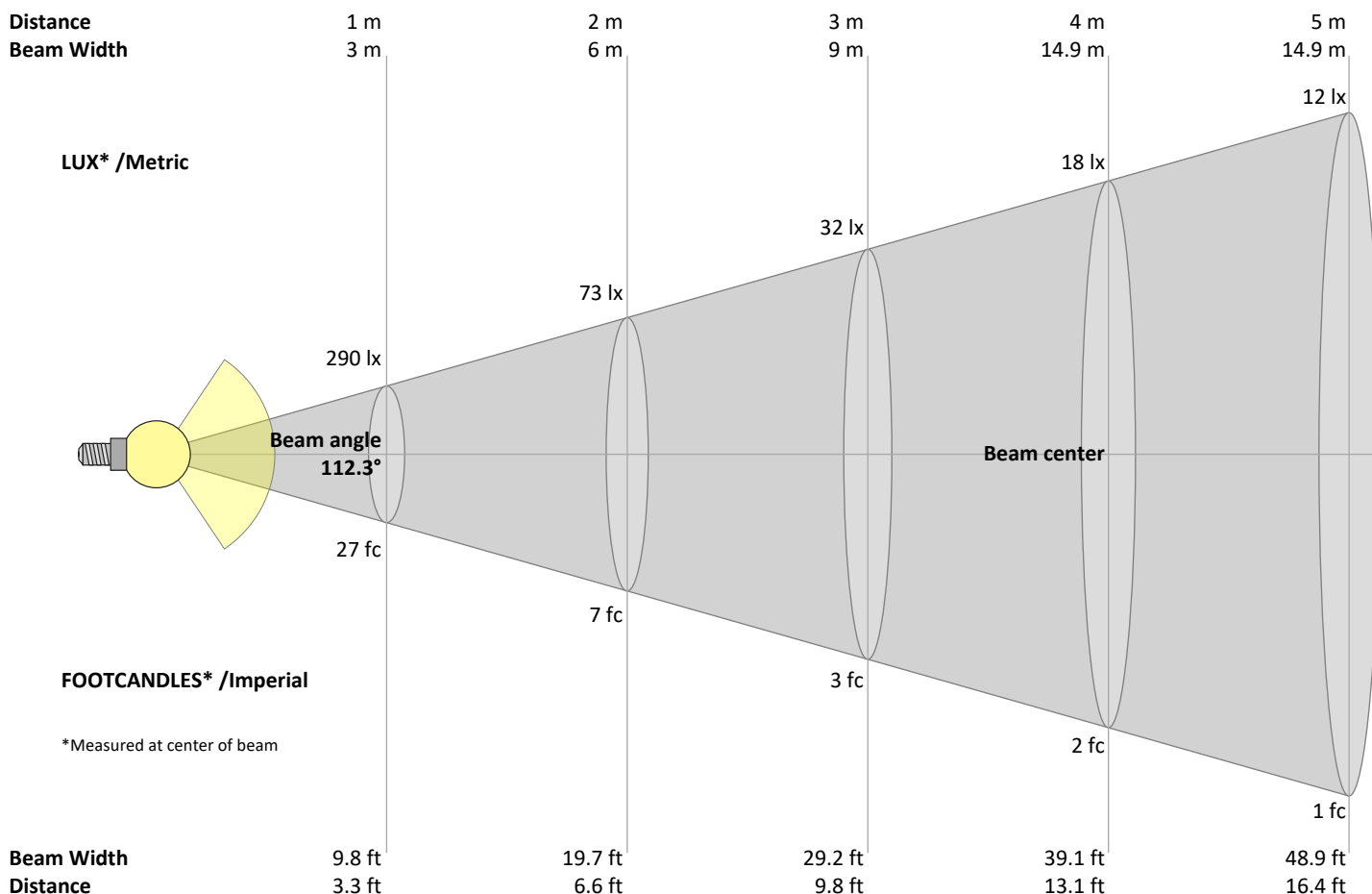
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Operator:



Beam Details



Beam intensities from 1 – 20 m

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	m
3.3	6.6	9.8	13.1	16.4	19.7	23	26.2	29.5	32.8	36.1	39.4	42.7	45.9	49.2	52.5	55.8	59.1	62.3	65.6	ft
290	73	32	18	12	8	6	5	4	3	2	2	2	1	1	1	1	1	1	1	lux
27	6.7	3	1.7	1.1	0.7	0.6	0.4	0.3	0.3	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	fc

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
290	288	282	274	264	251	236	220	202	183	164	144	124	104	84	64	44	25	11	5	cd
100%	99%	97%	95%	91%	87%	81%	76%	70%	63%	56%	50%	43%	36%	29%	22%	15%	9%	4%	2%	of 0°val

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
290	289	286	280	271	261	248	233	216	198	178	157	136	114	92	69	47	25	7	3	cd
100%	100%	99%	96%	93%	90%	86%	80%	74%	68%	61%	54%	47%	39%	32%	24%	16%	8%	2%	1%	of 0°val

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
290	290	286	280	271	259	245	229	211	191	171	150	128	106	85	63	41	21	9	4	cd
100%	100%	99%	96%	93%	89%	84%	79%	73%	66%	59%	52%	44%	37%	29%	22%	14%	7%	3%	1%	of 0°val

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
290	288	284	277	267	256	242	226	209	190	170	149	128	105	84	61	39	18	5	4	cd
100%	99%	98%	95%	92%	88%	83%	78%	72%	65%	58%	51%	44%	36%	29%	21%	14%	6%	2%	1%	of 0°val

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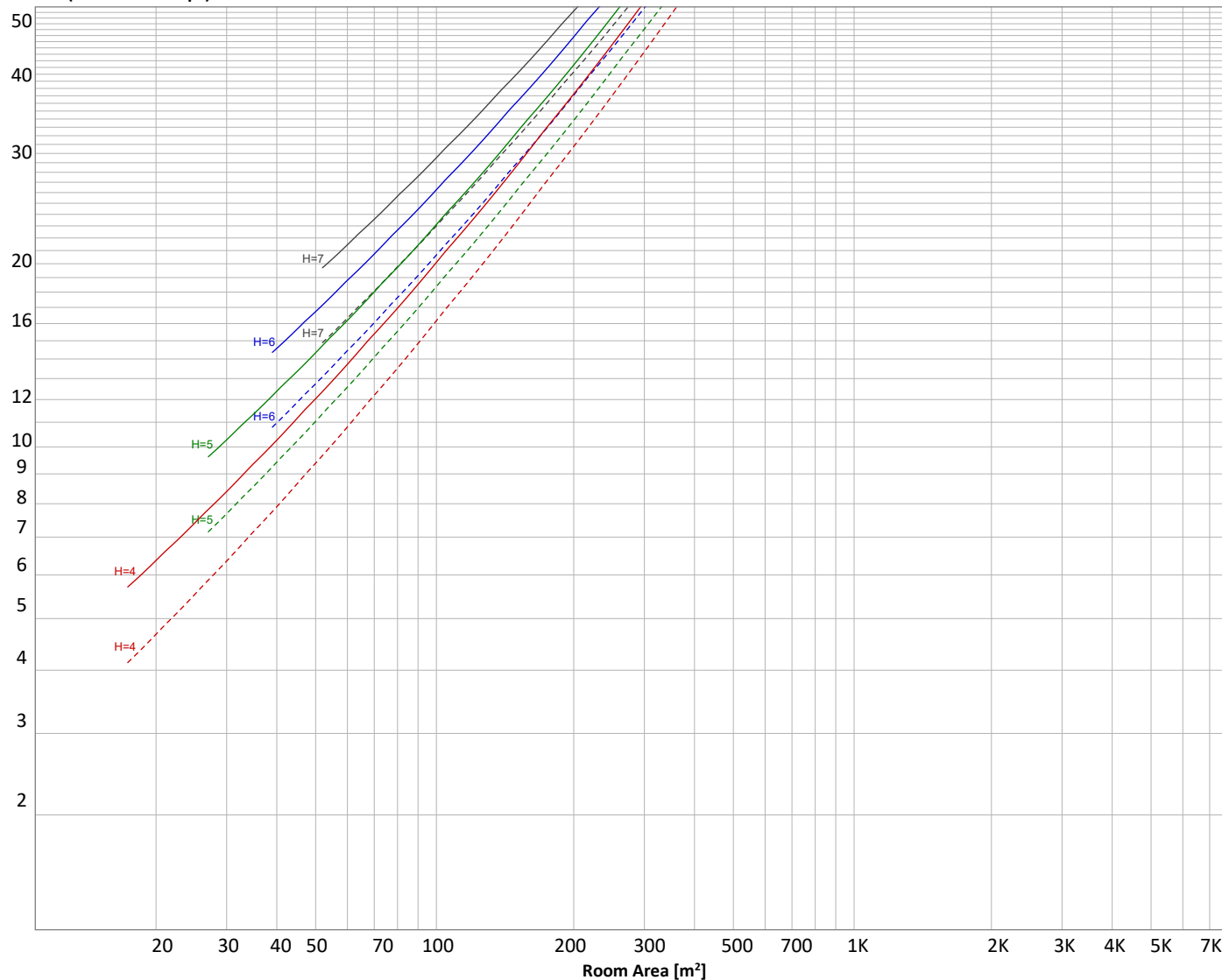
Operator:



Luminaire budgetary diagram

Uncorrected, comprehensive UGR table according to 117-1995

LAMPS (number of lamps)



Conditions

H = Room height	Flux = 874 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°
27.4 lm	78.3 lm	118 lm	142 lm	147 lm	134 lm	107 lm	68.2 lm	25.8 lm
90°-100°	100°-110°	110°-120°	120°-130°	130°-140°	140°-150°	150°-160°	160°-170°	170°-180°
5.21 lm	4.12 lm	3.86 lm	3.60 lm	3.22 lm	2.68 lm	2.03 lm	1.28 lm	0.439 lm

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Outdoor Light Planning

Lumen per Zone

Zone (y)	Lumen	% Total
0-10°	27 lm	3.1%
10-20°	78 lm	9.0%
20-30°	118 lm	13.5%
30-40°	142 lm	16.2%
40-50°	147 lm	16.8%
50-60°	134 lm	15.4%
60-70°	107 lm	12.2%
70-80°	68 lm	7.8%
80-90°	26 lm	3.0%
90-100°	5 lm	0.6%
100-110°	4 lm	0.5%
110-120°	4 lm	0.4%
120-130°	4 lm	0.4%
130-140°	3 lm	0.4%
140-150°	3 lm	0.3%
150-160°	2 lm	0.2%
160-170°	1 lm	0.1%
170-180°	0 lm	0.1%
Total	874 lm	100.0%

Intensity peaks

Max intensity	291 cd
Intensity, 90°	11 cd
Intensity, 0°	290 cd

Zonal Lumen summary

Zone (y)	Lumen	% Total
0-30°	224 lm	25.6%
0-40°	366 lm	41.9%
0-60°	647 lm	74.0%
60-90°	201 lm	23.0%
70-100°	99 lm	11.4%
90-120°	13 lm	1.5%
0-90°	848 lm	97.0%
90-180°	26 lm	3.0%
0-180°	874 lm	100.0%

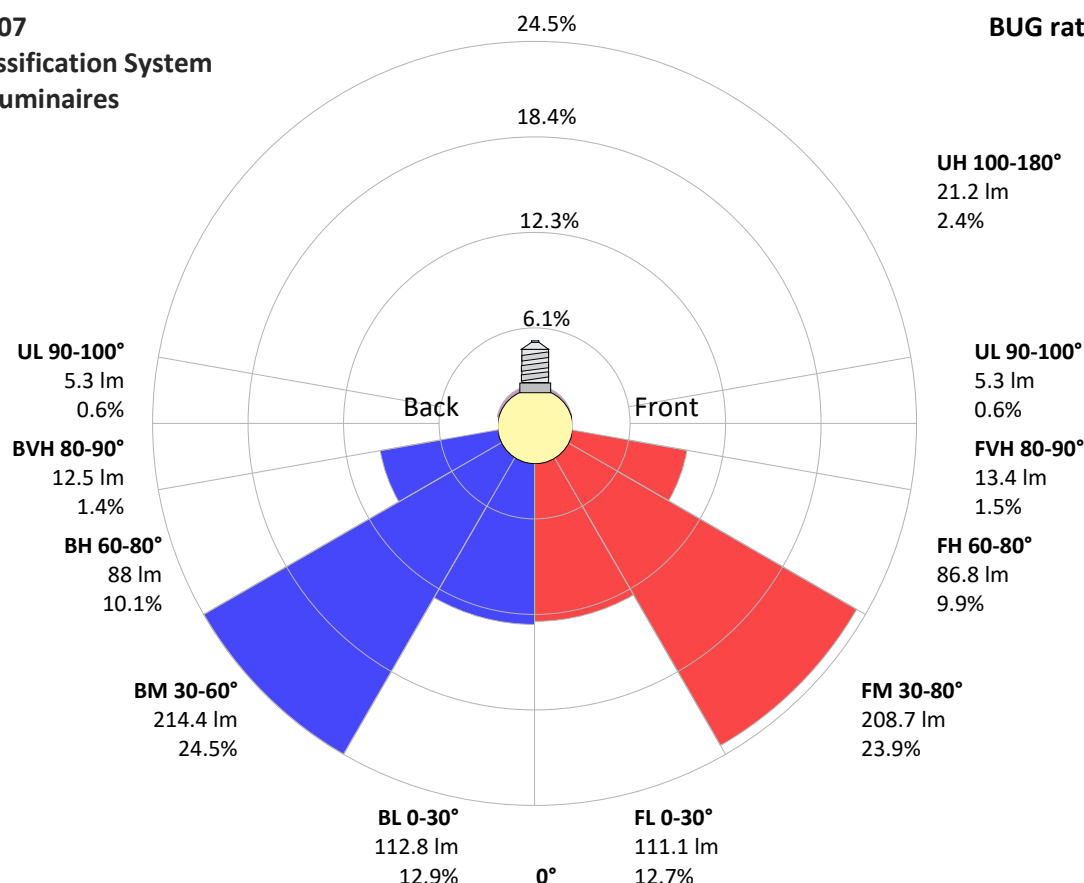
BUG rating

	Lumen	% Total
Forward light		
Low(0-30°)	111 lm	12.7%
Medium(30-60°)	209 lm	23.9%
High(60-80°)	87 lm	9.9%
Very high(80-90°)	13 lm	1.5%
Back light		
Low(0-30°)	113 lm	12.9%
Medium(30-60°)	214 lm	24.5%
High(60-80°)	88 lm	10.1%
Very high(80-90°)	13 lm	1.4%
Uplight		
Low(90-100°)	5 lm	0.6%
High(100-180°)	21 lm	2.4%

IESNA TM-15-07

Luminaire Classification System For Outdoor Luminaires

BUG rating B1 U2 G1



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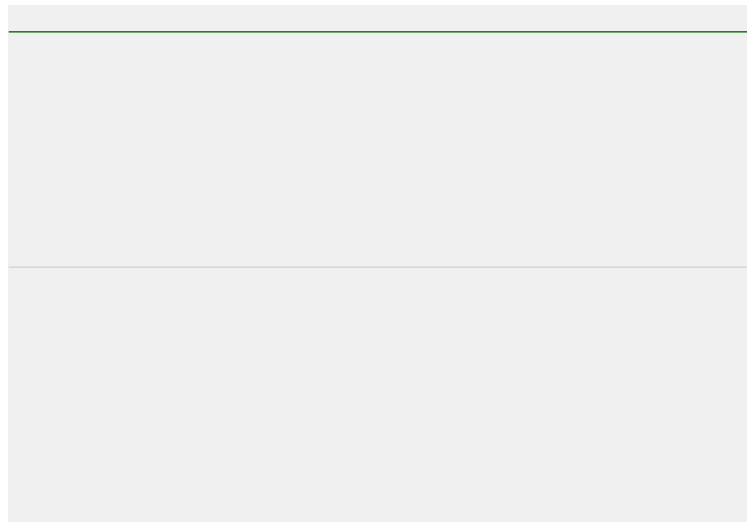


Power Details

Input Power

Power feed to light source	16.8 W
Frequency of input power	0 Hz
RMS Input voltage feed, V_{RMS}	24.0 V
RMS Input current feed, I_{RMS}	0.698 A
Volt-Ampere or apparent power = $V_{RMS} * I_{RMS}$	16.76 VA
Displacement factor of AC power feed	0.71
Power factor of AC current feed	1.0
Total harmonic distortion of the current	0%
Total harmonic distortion of the voltage	0%

Input Power Curve



Efficiency

Radiated power efficiency 19.1%



Lumen efficiency 52 lm/W



Stabilization Details

Warmup Conditions

Stable period	15 min
Stable change max	0.5%
Minimum time	30 min

Color Temperature Change

CCT start	3848 K
CCT shift	-25 K
CCT end	3823 K

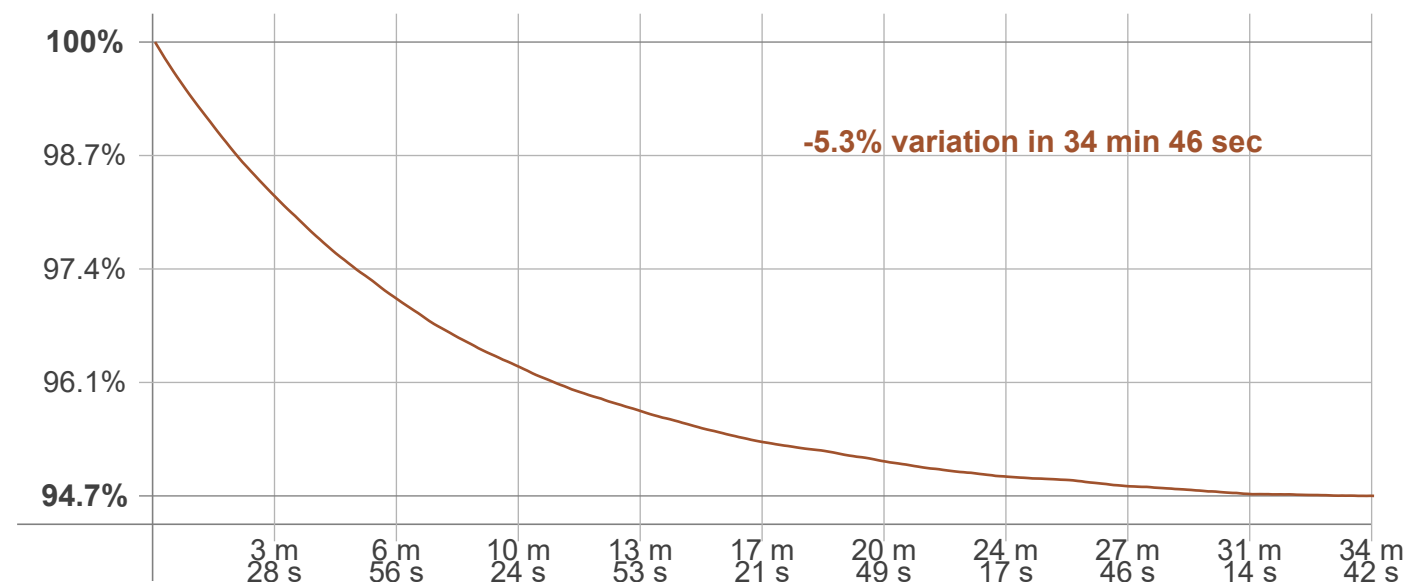
Warmup Result

Total warmup time	Lamp stabilized in 34 min 46 sec
Warmup variation	-5.3%

Output Change

Output start	922 lm
Output change	-48 lm
Output end	874 lm

Stabilization Curve



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Flicker /TLA details

Flicker Meter Type Viso Systems LabFlicker
Frequency of input power 0 Hz
Flicker/TLA sample rate n/a samples/s

Measurement time
PstLM 180 sec
All other indices 1,2 sec

Flicker indices according to Illuminating Engineering Society (IES)

Flicker frequency n/a Hz
Percent Flicker n/a %
Flicker index n/a

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

JA8/10 40 Hz n/a %
JA8/10 90 Hz n/a %
JA8/10 200 Hz n/a %
JA8/10 400 Hz n/a %
JA8/10 1000 Hz n/a %

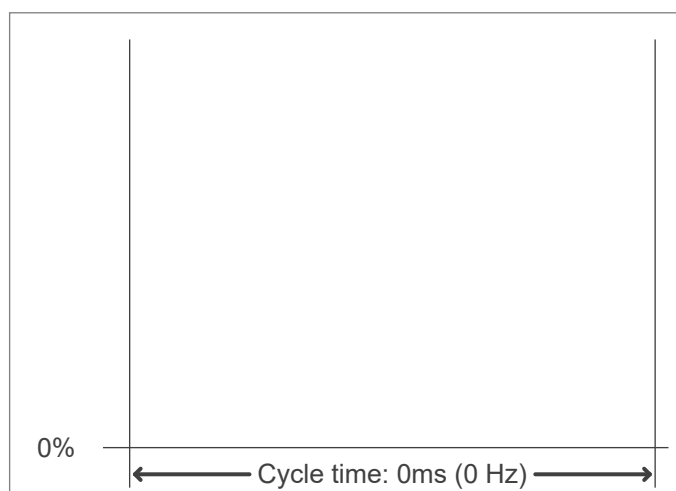
TLA indices (re IEC TR 61547-1, IEC 61000-3-3 and IEC 61000-4-15)

PstLM value ($F < 80$ Hz) n/a
SVM value ($80 < F < 2000$ Hz) n/a

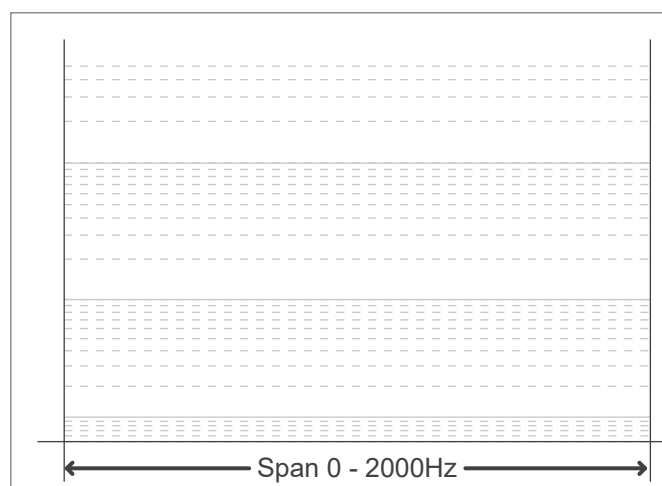
Flicker indices according to Lighting Research Center (2015)

Perception metric, Assist Mp n/a

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



Flicker FFT (flicker curve in frequency domain)



IEEE 1789 Frequency/modulation plot

