

Light efficiency:

**115 Lumen/Watt**

Light quality:

**CRI: 85,6**

Color temperature:

**3994 K**

**Output: 2405 lm**

**Peak: 1084 cd**

**Power: 20,9 W**

**PF: 0,94**

No photo

Tracking number: [VT200325-000422](#)

Product name:

**Frontline Beam 21W 4000K RAK90**

Item number:

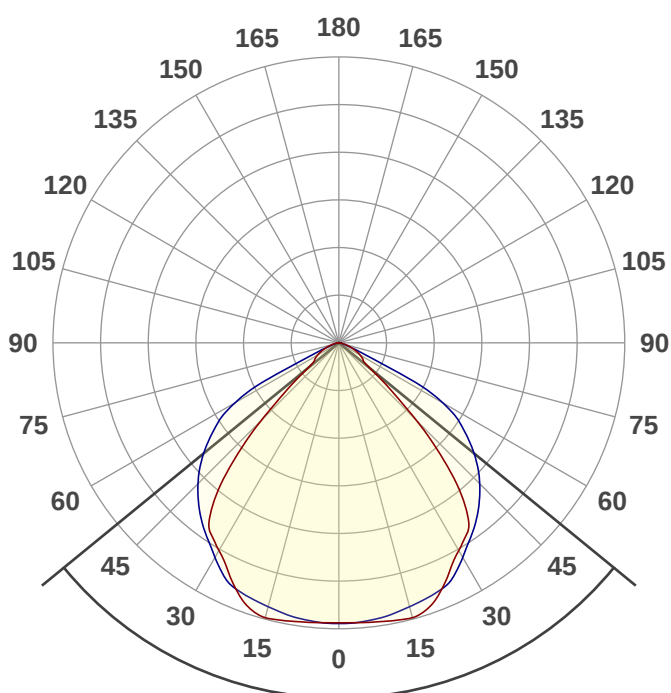
Date and time:

**25-03-2020 09:23:49**

Description:

**Measured by Jakob D. Jepsen**

**Measured in 10 planes.**



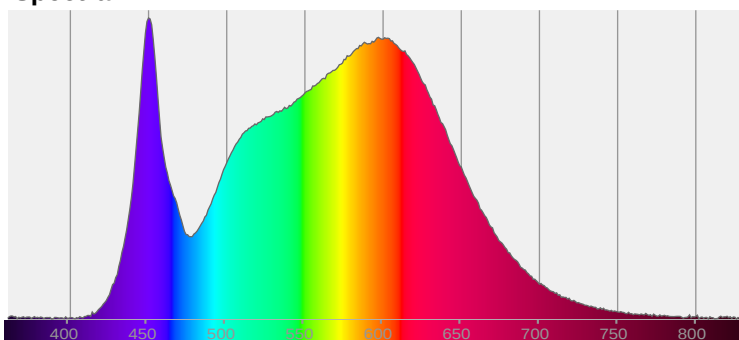
Beam angle

**101,5°**

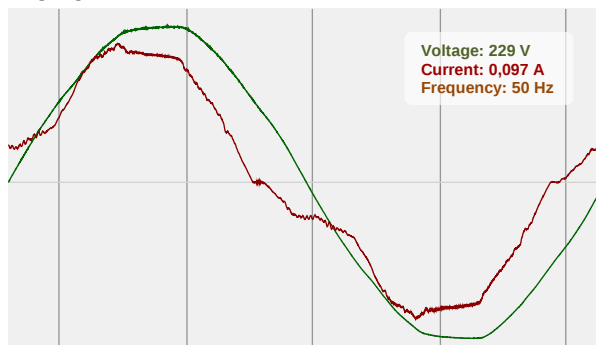


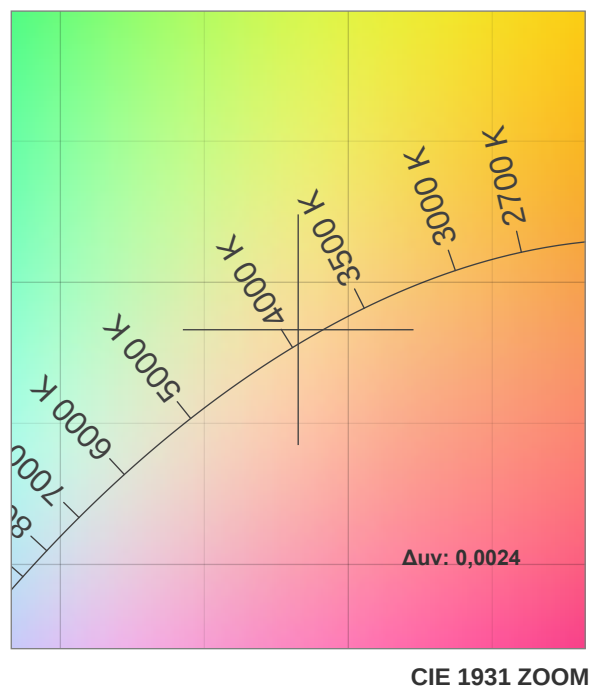
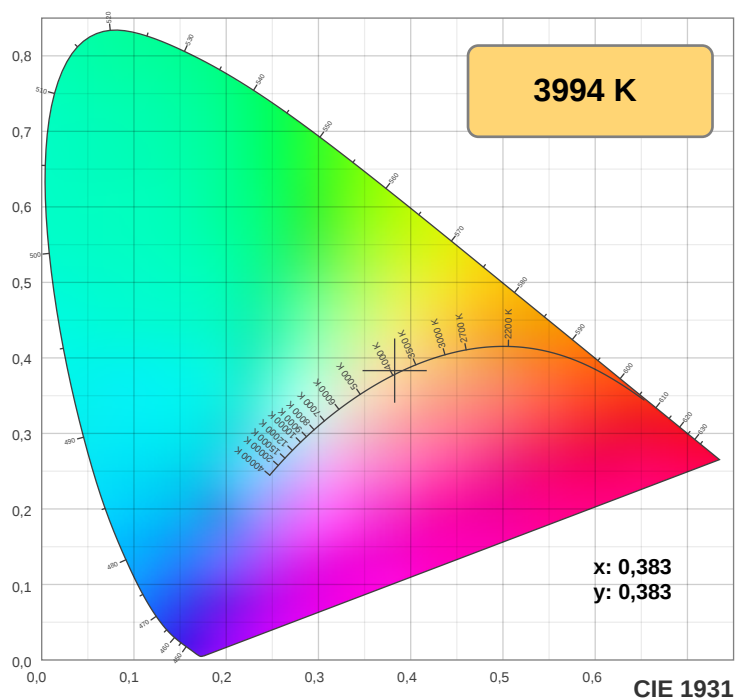
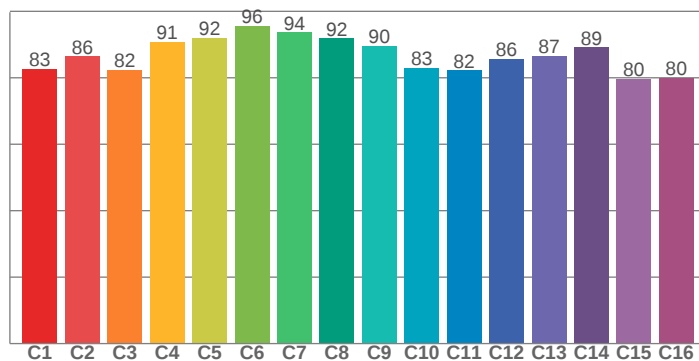
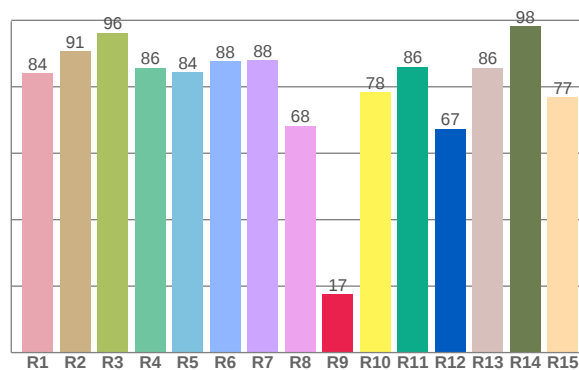
CIE 1931  
x: 0,383  
y: 0,383

Spectra



Power




**TM-30: 86,9**

**CRI: 85,6 (R1-R8)**

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

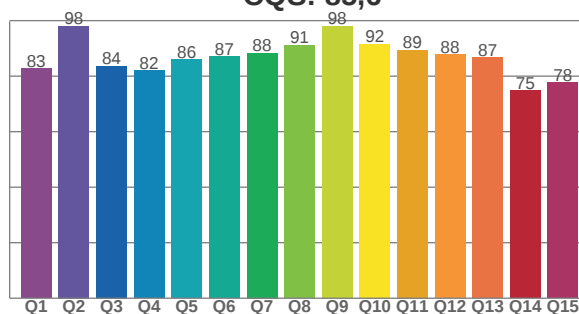
| R1   | R2   | R3   | R4   | R5   | R6   | R7   | R8   | R9   | R10  | R11  | R12  | R13  | R14  | R15  |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 84,1 | 90,7 | 96,3 | 85,7 | 84,3 | 87,8 | 87,9 | 68,3 | 17,5 | 78,4 | 86,0 | 67,3 | 85,7 | 98,1 | 76,8 |

**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  |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 82,6 | 86,5 | 82,3 | 90,8 | 92,0 | 95,7 | 93,7 | 91,9 | 89,6 | 83,0 | 82,3 | 85,8 | 86,5 | 89,2 | 79,7 | 79,9 |

**CQS Q values**

| Q1   | Q2   | Q3   | Q4   | Q5   | Q6   | Q7   | Q8   | Q9   | Q10  | Q11  | Q12  | Q13  | Q14  | Q15  |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 82,7 | 98,1 | 83,7 | 82,0 | 85,9 | 87,1 | 88,3 | 91,1 | 98,0 | 91,6 | 89,4 | 87,7 | 86,7 | 74,9 | 77,7 |

**CQS: 85,6**


### Color parameters

| Color temperature | Color rendering index | Red component | Color fidelity | Color gamut | Color quality scale | Color coordinate cie 1931 | Color coordinate cie 1931 | Color coordinate | Color coordinate | Color deviation from black body |
|-------------------|-----------------------|---------------|----------------|-------------|---------------------|---------------------------|---------------------------|------------------|------------------|---------------------------------|
| CCT               | CRI                   | CRI R9        | TM30 Rf        | TM30 Rg     | CQS                 | x                         | y                         | u                | v                | Δuv                             |
| 3994 K            | 85,6                  | 17,5          | 86,9           | 96,1        | 85,6                | 0,383                     | 0,383                     | 0,224            | 0,336            | 0,0024                          |

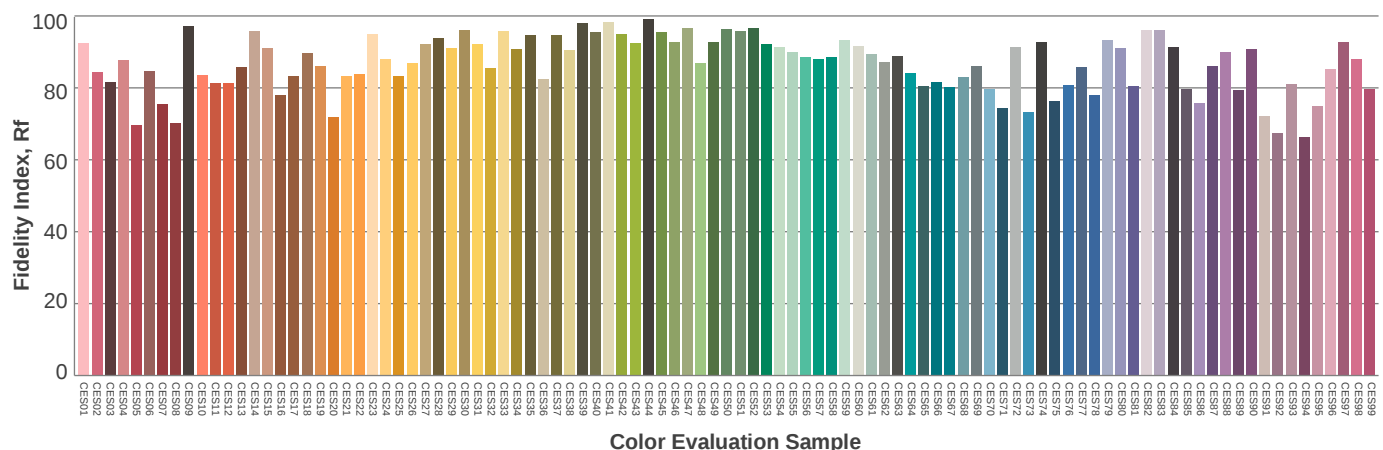
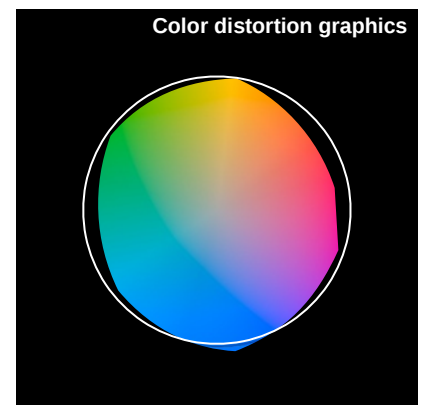
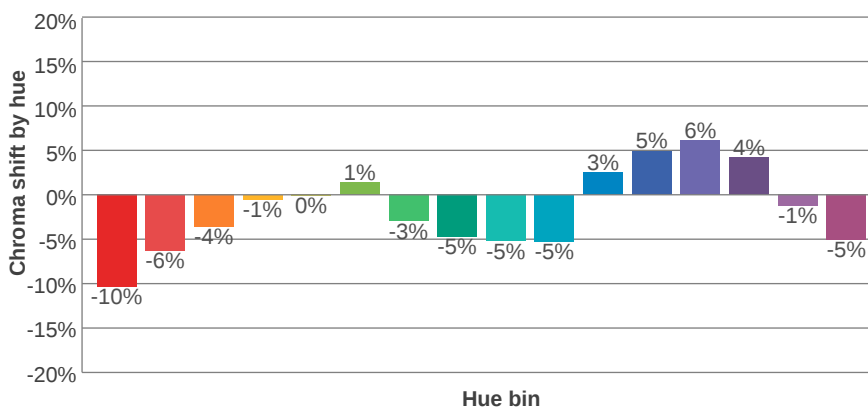
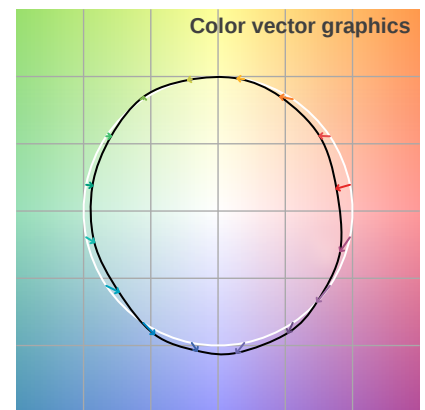
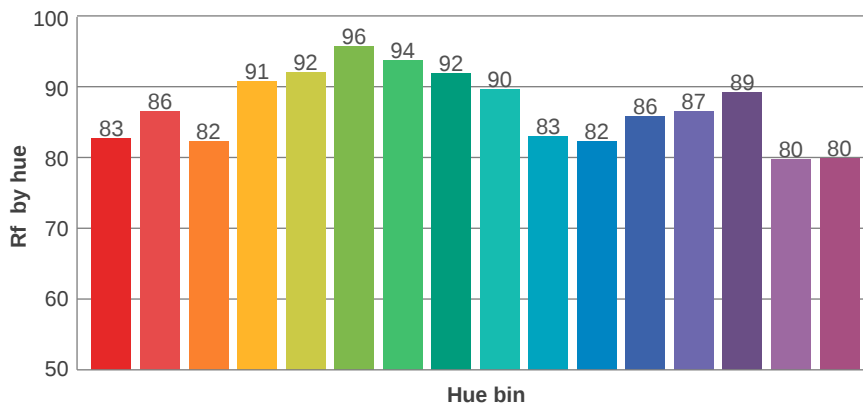
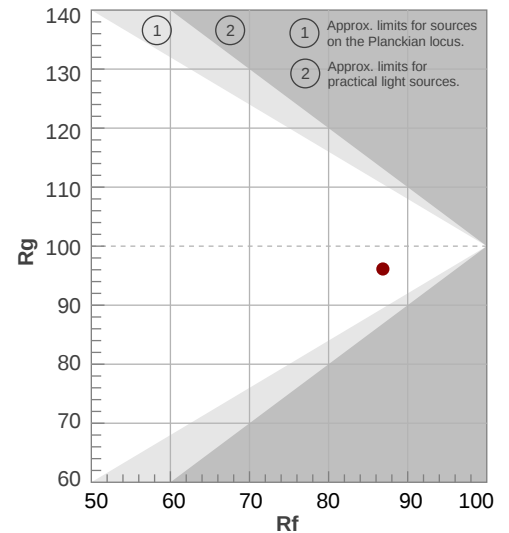
**Rf 86,9**

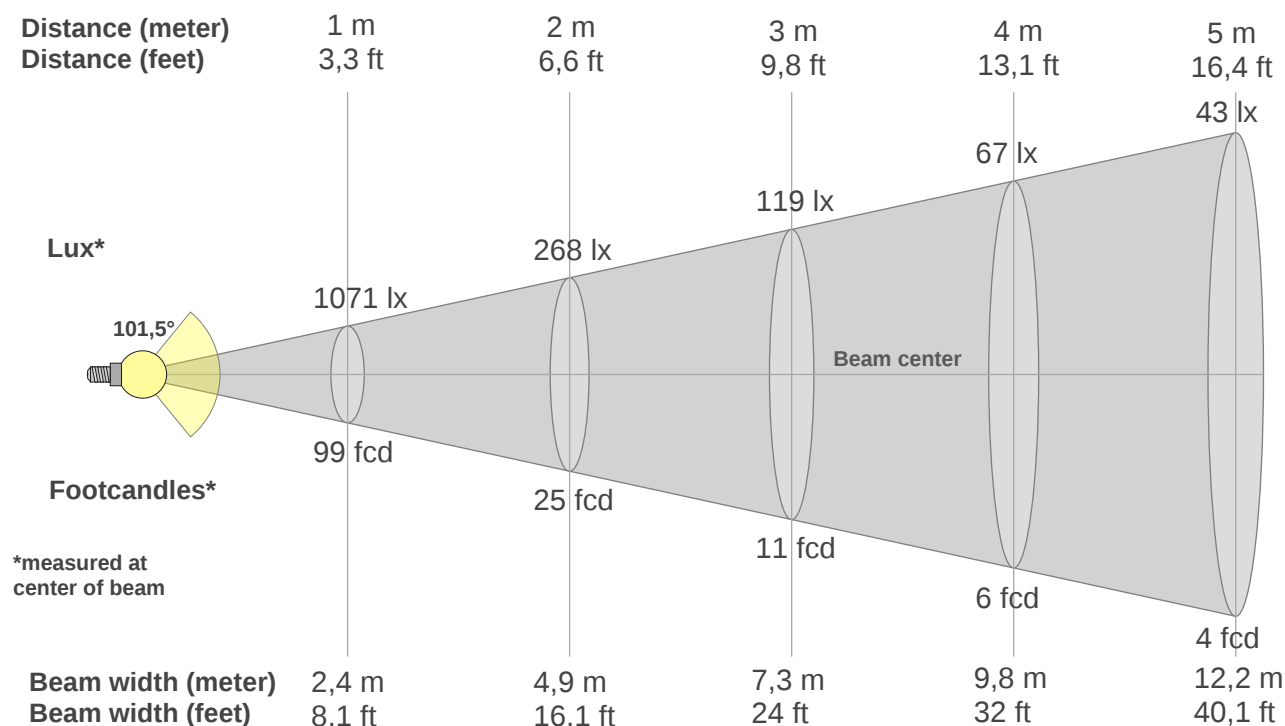
Fidelity index Rf

**Rg 96,1**

Gamut index Rg

| Hue Bin | R <sub>f</sub> | Shifts (%) |      |
|---------|----------------|------------|------|
|         |                | Chroma     | Hue  |
| 1       | 83             | -10%       | -1%  |
| 2       | 86             | -6%        | 5%   |
| 3       | 82             | -4%        | 9%   |
| 4       | 91             | -1%        | 5%   |
| 5       | 92             | 0%         | 3%   |
| 6       | 96             | 1%         | -1%  |
| 7       | 94             | -3%        | -2%  |
| 8       | 92             | -5%        | 0%   |
| 9       | 90             | -5%        | 5%   |
| 10      | 83             | -5%        | 9%   |
| 11      | 82             | 3%         | 11%  |
| 12      | 86             | 5%         | 5%   |
| 13      | 87             | 6%         | -7%  |
| 14      | 89             | 4%         | -7%  |
| 15      | 80             | -1%        | -15% |
| 16      | 80             | -5%        | -12% |




**Beam intensities from 1-20m**

| 1m      | 2m      | 3m      | 4m     | 5m     | 6m     | 7m   | 8m     | 9m     | 10m    | 11m    | 12m    | 13m    | 14m    | 15m    | 16m    | 17m    | 18m    | 19m    | 20m    |
|---------|---------|---------|--------|--------|--------|------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 3,3ft   | 6,6ft   | 9,8ft   | 13,1ft | 16,4ft | 19,7ft | 23ft | 26,2ft | 29,5ft | 32,8ft | 36,1ft | 39,4ft | 42,7ft | 45,9ft | 49,2ft | 52,5ft | 55,8ft | 59,1ft | 62,3ft | 65,6ft |
| 1071lx  | 268lx   | 119lx   | 67lx   | 43lx   | 30lx   | 22lx | 17lx   | 13lx   | 11lx   | 9lx    | 7lx    | 6lx    | 5lx    | 5lx    | 4lx    | 4lx    | 3lx    | 3lx    | 3lx    |
| 99,5fcd | 24,9fcd | 11,1fcd | 6,2fcd | 4fcd   | 2,8fcd | 2fcd | 1,6fcd | 1,2fcd | 1fcd   | 0,8fcd | 0,7fcd | 0,6fcd | 0,5fcd | 0,4fcd | 0,4fcd | 0,3fcd | 0,3fcd | 0,3fcd | 0,2fcd |

**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° |
|------|------|------|------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 1071 | 1071 | 1078 | 1083 | 1054 | 983 | 915 | 856 | 695 | 425 | 194 | 115 | 94  | 70  | 48  | 28  | 12  | 3   | 0   | 0   |
| 100% | 100% | 101% | 101% | 98%  | 92% | 85% | 80% | 65% | 40% | 18% | 11% | 9%  | 7%  | 4%  | 3%  | 1%  | 0%  | 0%  | 0%  |

**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° |
|------|------|------|------|------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 1071 | 1067 | 1058 | 1042 | 1027 | 1004 | 945 | 887 | 828 | 759 | 679 | 583 | 449 | 174 | 34  | 17  | 6   | 1   | 1   | 1   |
| 100% | 100% | 99%  | 97%  | 96%  | 94%  | 88% | 83% | 77% | 71% | 63% | 54% | 42% | 16% | 3%  | 2%  | 1%  | 0%  | 0%  | 0%  |

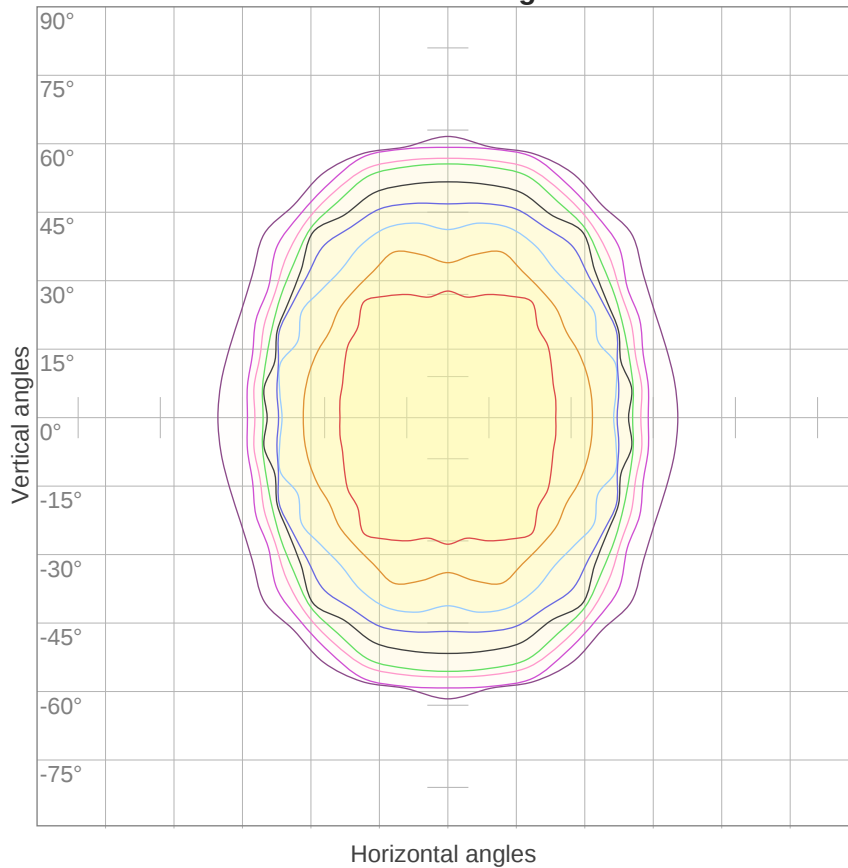
**Intensities in 180° c-plane**

| 0°   | 5°   | 10°  | 15°  | 20°  | 25° | 30° | 35° | 40° | 45° | 50° | 55° | 60° | 65° | 70° | 75° | 80° | 85° | 90° | 95° |
|------|------|------|------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 1071 | 1071 | 1078 | 1083 | 1054 | 983 | 915 | 856 | 695 | 425 | 194 | 115 | 94  | 70  | 48  | 28  | 12  | 3   | 0   | 0   |
| 100% | 100% | 101% | 101% | 98%  | 92% | 85% | 80% | 65% | 40% | 18% | 11% | 9%  | 7%  | 4%  | 3%  | 1%  | 0%  | 0%  | 0%  |

**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° |
|------|------|------|------|------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 1071 | 1067 | 1058 | 1042 | 1027 | 1004 | 945 | 887 | 828 | 759 | 679 | 583 | 449 | 174 | 34  | 17  | 6   | 1   | 1   | 1   |
| 100% | 100% | 99%  | 97%  | 96%  | 94%  | 88% | 83% | 77% | 71% | 63% | 54% | 42% | 16% | 3%  | 2%  | 1%  | 0%  | 0%  | 0%  |

| Beam angle 50% | Field angle 10% | Cutoff angle 2,5% | Intensity ratio in 120° cone | Intensity ratio in 90° cone |
|----------------|-----------------|-------------------|------------------------------|-----------------------------|
| 101,5°         | 123,1°          | 149,1°            | 93,3%                        | 70,5%                       |

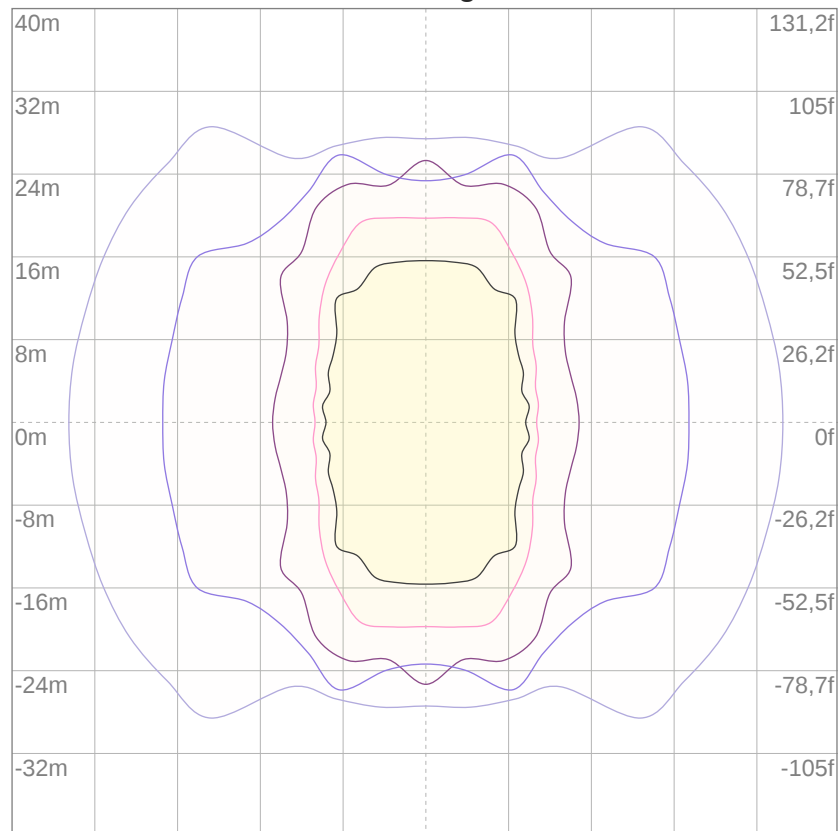
**iso-candela diagram**


|     |        |
|-----|--------|
| 10% | 107 cd |
| 20% | 214 cd |
| 30% | 321 cd |
| 40% | 428 cd |
| 50% | 535 cd |
| 60% | 642 cd |
| 70% | 750 cd |
| 80% | 857 cd |
| 90% | 964 cd |

**Conditions:**

Number of c-planes: 20

Candela at center: 1071 cd

**iso-lux diagram**


|     |          |
|-----|----------|
| 3%  | 0,321 lx |
| 5%  | 0,535 lx |
| 10% | 1,07 lx  |
| 30% | 3,21 lx  |
| 50% | 5,35 lx  |

**Conditions:**

Number of c-planes: 20

Lux at center: 10,7 lx

*Lux distribution on a surface  
when lamp is mounted at 10  
meters from the surface.*

**Glare Evaluation According to UGR**

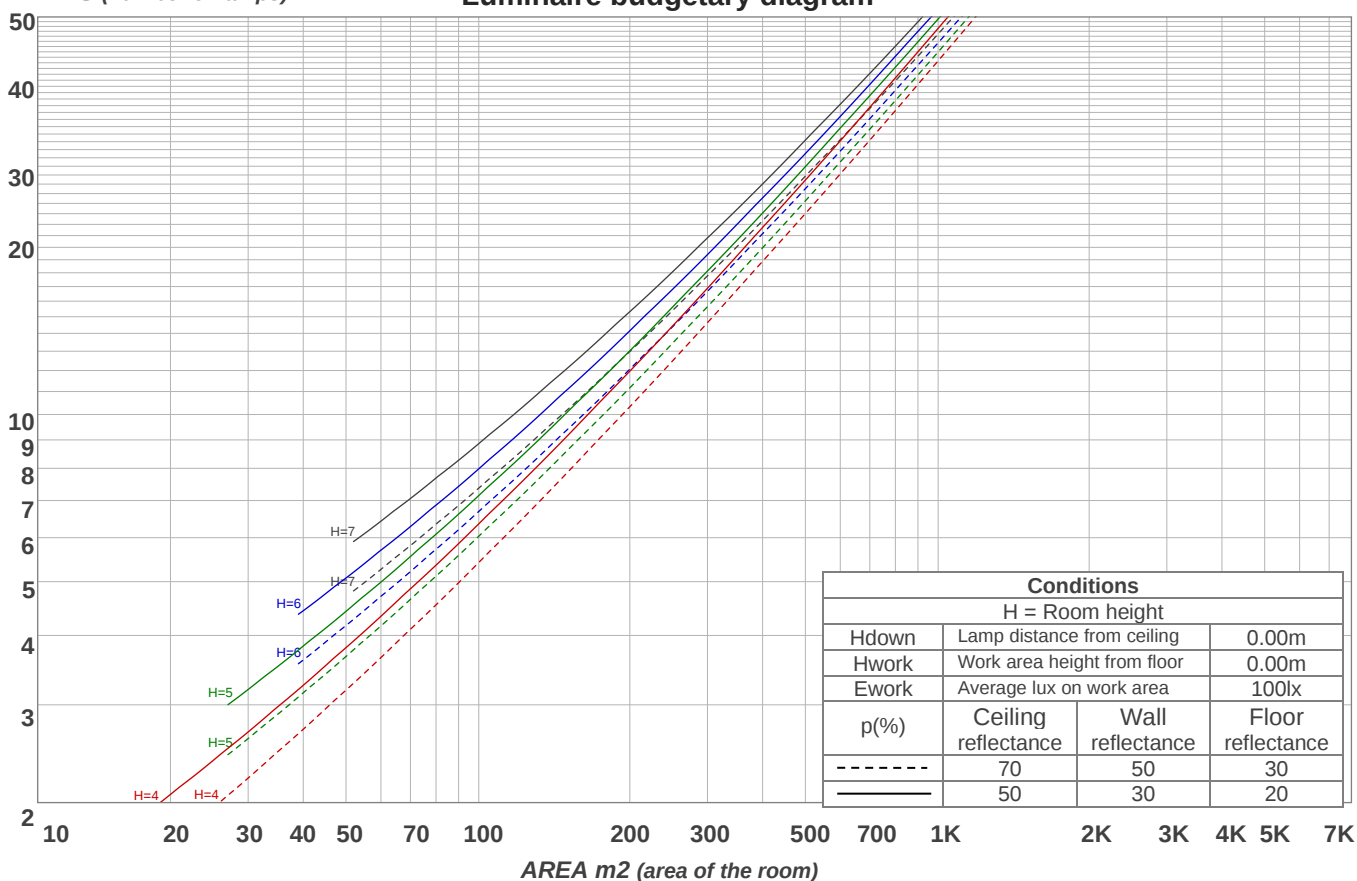
|                                                                  |     |                                                   |      |      |      |      |                                         |      |      |      |      |
|------------------------------------------------------------------|-----|---------------------------------------------------|------|------|------|------|-----------------------------------------|------|------|------|------|
| 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<br>X      Y                                            |     | Viewing direction at right angles to<br>lamp axis |      |      |      |      | Viewing direction parallel to lamp axis |      |      |      |      |
| 2H                                                               | 2H  | 25,5                                              | 26,5 | 25,7 | 26,8 | 27,0 | 30,7                                    | 31,7 | 30,9 | 31,9 | 32,1 |
|                                                                  | 3H  | 25,5                                              | 26,6 | 25,9 | 26,8 | 27,0 | 30,7                                    | 31,7 | 31,1 | 32,0 | 32,1 |
|                                                                  | 4H  | 25,6                                              | 26,6 | 26,0 | 26,8 | 27,1 | 30,6                                    | 31,6 | 31,0 | 31,8 | 32,1 |
|                                                                  | 6H  | 25,6                                              | 26,5 | 25,9 | 26,8 | 27,1 | 30,6                                    | 31,4 | 30,9 | 31,7 | 32,1 |
|                                                                  | 8H  | 25,6                                              | 26,4 | 25,9 | 26,7 | 27,1 | 30,6                                    | 31,4 | 30,9 | 31,7 | 32,1 |
|                                                                  | 12H | 25,5                                              | 26,3 | 25,9 | 26,7 | 27,1 | 30,5                                    | 31,3 | 30,9 | 31,6 | 32,1 |
| 4H                                                               | 2H  | 25,9                                              | 26,9 | 26,3 | 27,2 | 27,4 | 30,4                                    | 31,4 | 30,8 | 31,7 | 31,9 |
|                                                                  | 3H  | 26,2                                              | 27,0 | 26,6 | 27,3 | 27,8 | 30,6                                    | 31,4 | 31,0 | 31,8 | 32,2 |
|                                                                  | 4H  | 26,2                                              | 26,9 | 26,6 | 27,3 | 27,9 | 30,5                                    | 31,2 | 30,9 | 31,7 | 32,2 |
|                                                                  | 6H  | 26,2                                              | 26,9 | 26,7 | 27,3 | 27,6 | 30,4                                    | 31,2 | 30,9 | 31,5 | 31,9 |
|                                                                  | 8H  | 26,2                                              | 26,8 | 26,7 | 27,2 | 27,6 | 30,4                                    | 31,1 | 30,9 | 31,4 | 31,8 |
|                                                                  | 12H | 26,1                                              | 26,7 | 26,6 | 27,1 | 27,6 | 30,3                                    | 30,9 | 30,8 | 31,3 | 31,8 |
| 8H                                                               | 4H  | 26,2                                              | 26,8 | 26,7 | 27,2 | 27,6 | 30,4                                    | 31,1 | 30,9 | 31,4 | 31,8 |
|                                                                  | 6H  | 26,2                                              | 26,7 | 26,7 | 27,2 | 27,7 | 30,4                                    | 30,8 | 30,9 | 31,3 | 31,8 |
|                                                                  | 8H  | 26,2                                              | 26,6 | 26,8 | 27,2 | 27,8 | 30,4                                    | 30,8 | 30,9 | 31,3 | 31,9 |
|                                                                  | 12H | 26,2                                              | 26,5 | 26,8 | 27,0 | 27,7 | 30,3                                    | 30,6 | 30,9 | 31,2 | 31,8 |
| 12H                                                              | 4H  | 26,1                                              | 26,7 | 26,6 | 27,1 | 27,5 | 30,4                                    | 30,9 | 30,9 | 31,3 | 31,8 |
|                                                                  | 6H  | 26,2                                              | 26,6 | 26,7 | 27,1 | 27,8 | 30,4                                    | 30,8 | 30,9 | 31,3 | 31,9 |
|                                                                  | 8H  | 26,2                                              | 26,5 | 26,8 | 27,0 | 27,7 | 30,3                                    | 30,6 | 30,9 | 31,2 | 31,8 |
| Variation of the observer position for the luminaire distance S  |     |                                                   |      |      |      |      |                                         |      |      |      |      |
| S = 1.0H                                                         |     | 1,5 / -3,1                                        |      |      |      |      | 0,5 / -0,6                              |      |      |      |      |
| S = 1.5H                                                         |     | 2,7 / -3,9                                        |      |      |      |      | 1,1 / -1,5                              |      |      |      |      |
| S = 2.0H                                                         |     | 4,0 / -4,5                                        |      |      |      |      | 2,7 / -7,2                              |      |      |      |      |
| Standard table                                                   |     | n/a                                               |      |      |      |      | n/a                                     |      |      |      |      |
| Correction<br>summand                                            |     | n/a                                               |      |      |      |      | n/a                                     |      |      |      |      |
| Corrected glare indices referring to 2405 lm total luminous flux |     |                                                   |      |      |      |      |                                         |      |      |      |      |

## 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 Lumens 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                                                                                                      | 108 | 104 | 101 | 109 | 105 | 102 | 100 | 101 | 99  | 96  | 97  | 95  | 94  | 94  | 92  | 91  | 89  |
| 2                   | 103                                                                                                      | 96  | 91  | 86  | 101 | 95  | 90  | 85  | 91  | 87  | 83  | 88  | 85  | 81  | 85  | 82  | 80  | 78  |
| 3                   | 95                                                                                                       | 86  | 80  | 74  | 93  | 85  | 79  | 74  | 82  | 77  | 72  | 79  | 75  | 71  | 77  | 73  | 70  | 68  |
| 4                   | 88                                                                                                       | 78  | 70  | 65  | 86  | 77  | 70  | 64  | 74  | 68  | 63  | 72  | 67  | 62  | 70  | 65  | 62  | 60  |
| 5                   | 82                                                                                                       | 70  | 62  | 57  | 80  | 69  | 62  | 56  | 67  | 61  | 56  | 65  | 60  | 55  | 64  | 59  | 55  | 53  |
| 6                   | 76                                                                                                       | 64  | 56  | 50  | 74  | 63  | 55  | 50  | 61  | 55  | 50  | 60  | 54  | 49  | 58  | 53  | 49  | 47  |
| 7                   | 71                                                                                                       | 58  | 50  | 45  | 69  | 58  | 50  | 45  | 56  | 49  | 44  | 55  | 49  | 44  | 53  | 48  | 44  | 42  |
| 8                   | 66                                                                                                       | 53  | 46  | 40  | 64  | 53  | 45  | 40  | 52  | 45  | 40  | 50  | 44  | 40  | 49  | 44  | 40  | 38  |
| 9                   | 62                                                                                                       | 49  | 42  | 36  | 60  | 49  | 41  | 36  | 48  | 41  | 36  | 47  | 40  | 36  | 46  | 40  | 36  | 34  |
| 10                  | 58                                                                                                       | 46  | 38  | 33  | 57  | 45  | 38  | 33  | 44  | 38  | 33  | 43  | 37  | 33  | 42  | 37  | 33  | 31  |

LAMPS (number of lamps)

## Luminaire budgetary diagram



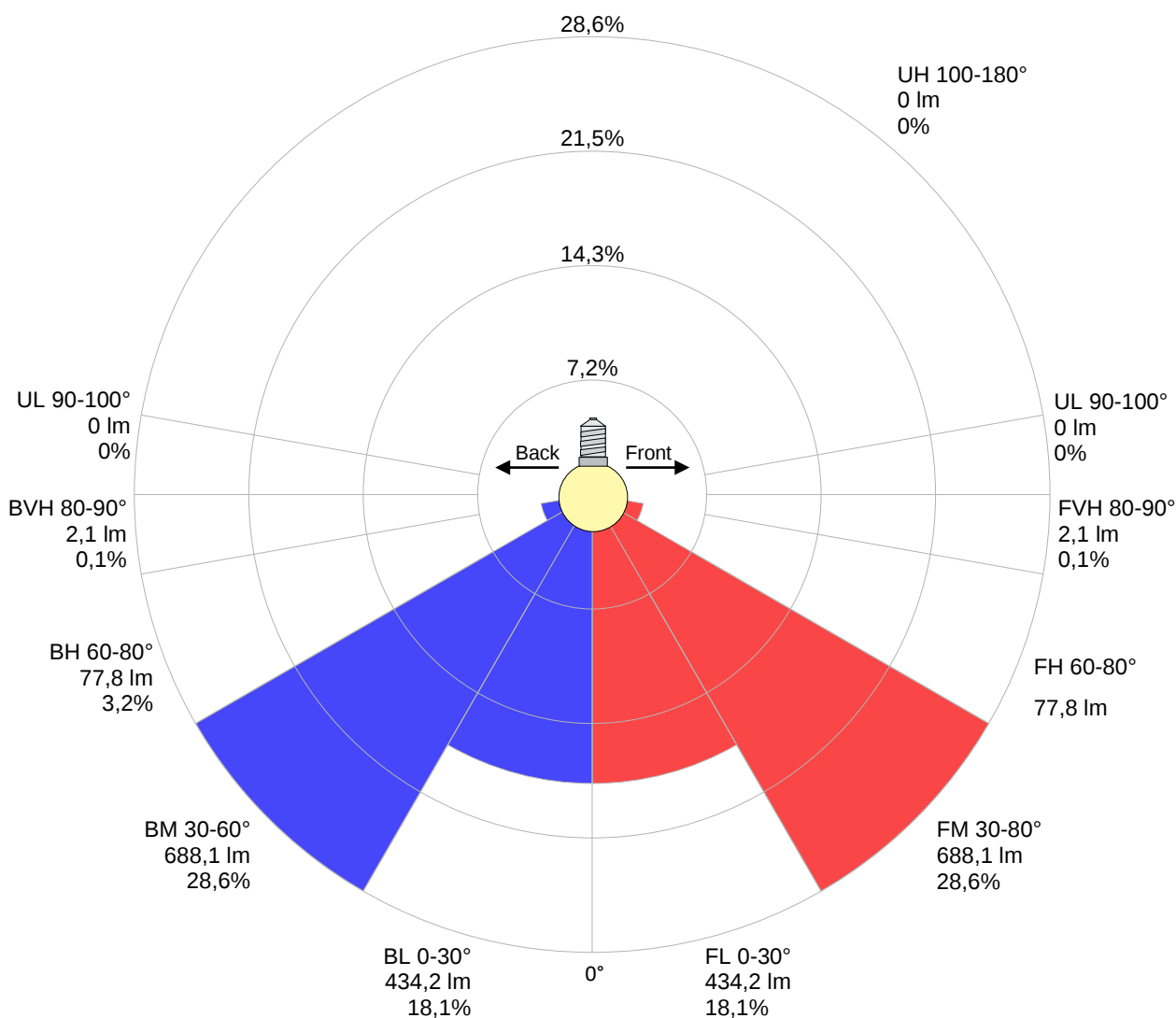
## Zonal Lumen Summary

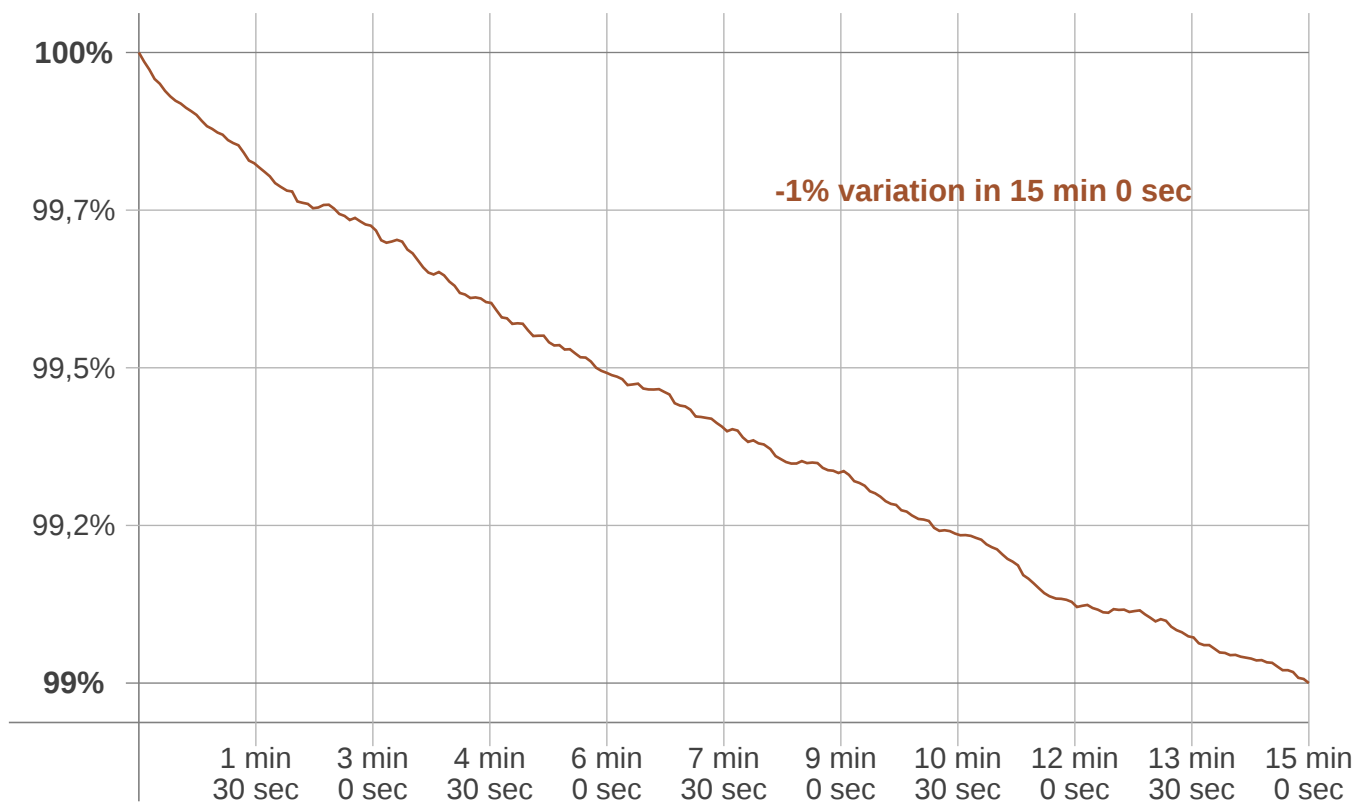
| 0°-10°    | 10°-20°   | 20°-30°   | 30°-40°   | 40°-50°   | 50°-60°   | 60°-70°   | 70°-80°   | 80°-90°   |
|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| {LUM0-10} | 301 lm    | 467 lm    | 553 lm    | 510 lm    | 312 lm    | 127 lm    | 27,6 lm   | 3,99 lm   |
| 90°-100°  | 100°-110° | 110°-120° | 120°-130° | 130°-140° | 140°-150° | 150°-160° | 160°-170° | 170°-180° |
| 0,535 lm  | 0,398 lm  | 0,246 lm  | 0,193 lm  | 0,122 lm  | 0,069 lm  | 0,051 lm  | 0,031 lm  | 0,010 lm  |

LCS table

| BUG rating:       | B1 U1 G0 |          |
|-------------------|----------|----------|
| Forward light     | Lumens   | Lumens % |
| Low(0-30):        | 434,2    | 18,1%    |
| Medium(30-60):    | 688,1    | 28,6%    |
| High(60-80):      | 77,8     | 3,2%     |
| Very high(80-90): | 2,1      | 0,1%     |
| Back light        |          |          |
| Low(0-30):        | 434,2    | 18,1%    |
| Medium(30-60):    | 688,1    | 28,6%    |
| High(60-80):      | 77,8     | 3,2%     |
| Very high(80-90): | 2,1      | 0,1%     |
| Uplight           |          |          |
| Low(90-100):      | 0        | 0%       |
| High(100-180):    | 0        | 0%       |

LCS graph



**Warmup curve**

**Warmup result**

|                         |                     |
|-------------------------|---------------------|
| <b>Warmup time:</b>     | <b>15 min 0 sec</b> |
| <b>Warmup variation</b> | <b>-1,0%</b>        |

**Warmup conditions**

|                           |               |
|---------------------------|---------------|
| <b>Stable period:</b>     | <b>15 min</b> |
| <b>Stable change max:</b> | <b>2,0%</b>   |
| <b>Minimum time:</b>      | <b>15 min</b> |

**Color temperature change**

|                  |                   |                |
|------------------|-------------------|----------------|
| <b>CCT start</b> | <b>CCT change</b> | <b>CCT end</b> |
| <b>3976 K</b>    | <b>+18 K</b>      | <b>3994 K</b>  |

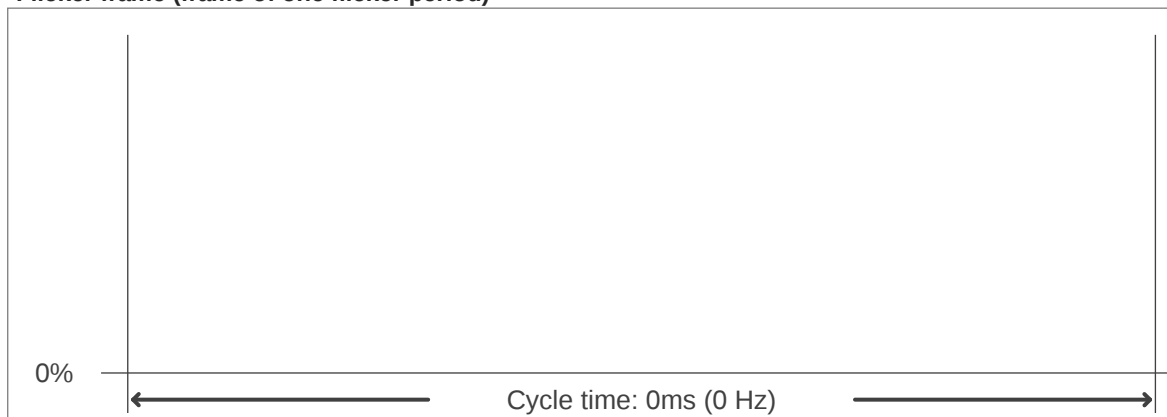
**Output change**

|                     |                      |                   |
|---------------------|----------------------|-------------------|
| <b>Output start</b> | <b>Output change</b> | <b>Output end</b> |
| <b>2427 lm</b>      | <b>-22 lm</b>        | <b>2405 lm</b>    |

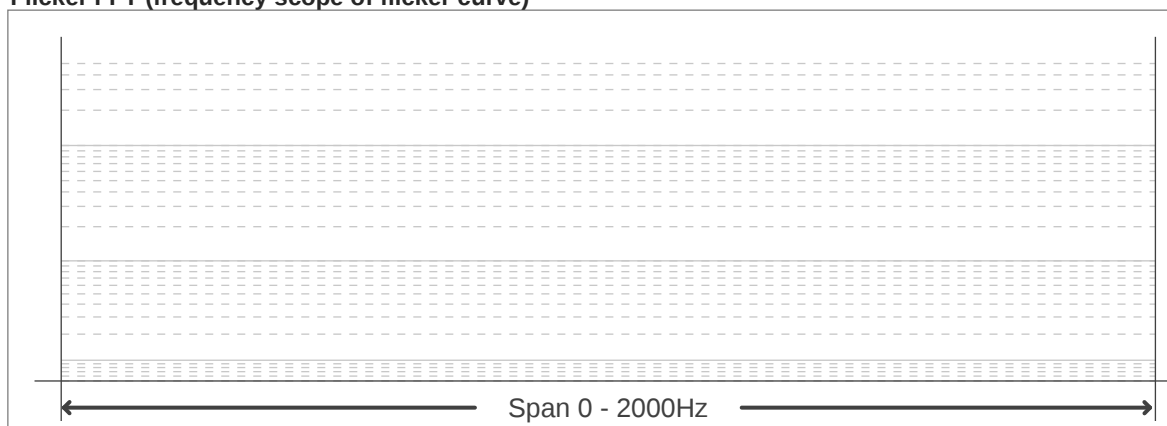
Flicker curve (complete sampled flicker signal)



Flicker frame (frame of one flicker period)



Flicker FFT (frequency scope of flicker curve)



Flicker results:

|                       |        |               |       |
|-----------------------|--------|---------------|-------|
| Flicker frequency:    | n/a Hz | JA8/10 40Hz   | n/a % |
| Flicker index:        | n/a    | JA8/10 90Hz   | n/a % |
| Flicker percentage:   | n/a %  | JA8/10 200Hz  | n/a % |
| SVM: (Visual flicker) | n/a    | JA8/10 400Hz  | n/a % |
| PstLM                 | n/a    | JA8/10 1000Hz | n/a % |

Flicker conditions:

|              |                  |
|--------------|------------------|
| Sample rate: | 0 samples/second |
|--------------|------------------|