**Test Report issued under the responsibility of:**

DEKRA

# TEST REPORT
# IEC TR 62778
# Application of IEC 62471 for the assessment of blue light hazard to light sources and luminaires

| | |
|---|---|
| **Report Number. ..... :** | 6026209.50P |
| **Date of issue ..... :** | 2018-04-17 |
| **Total number of pages ..... :** | 27 |
| **Name of Testing Laboratory preparing the Report ..... :** | DEKRA Testing and Certification (Shanghai) Ltd.<br>3/F, #250, Jiangchangsan Road building 16 Headquater Economy Park Shibei Hi-Tech Park, Zhabei District, Shanghai, P.R.C 200436 |
| **Applicant's name ..... :** | Lumileds Malaysia Sdn. Bhd. |
| **Address..... :** | No. 3 , Lintang Bayan Lepas 8, Phase 4, Bayan Lepas Industrial Park, 11900 Penang, Malaysia |
| **Test specification:** | |
| **Standard ..... :** | IEC TR 62778:2014 (Second Edition) |
| **Test procedure..... :** | Type Test |
| **Non-standard test method..... :** | N/A |
| **Test Report Form No. ..... :** | IEC62778A |
| **Test Report Form(s) Originator.... :** | TÜV SÜD Product Service GmbH |
| **Master TRF ..... :** | Dated 2016-02 |



If this Test Report Form is used by non-IECEE members, the IECEE/IEC logo and the reference to the CB Scheme procedure shall be removed.

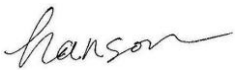
**This report is not valid as a CB Test Report unless signed by an approved CB Testing Laboratory and appended to a CB Test Certificate issued by an NCB in accordance with IECEE 02.**

**General disclaimer:**

The test results presented in this report relate only to the object tested.
This report shall not be reproduced, except in full, without the written approval of the Issuing CB Testing Laboratory. The authenticity of this Test Report and its contents can be verified by contacting the NCB, responsible for this Test Report.

| | |
|---|---|
| **Test item description** | LED chip |
| **Trade Mark** | LUMILEDS |
| **Manufacturer** | Lumileds Malaysia Sdn. Bhd.<br>No. 3 , Lintang Bayan Lepas 8, Phase 4, Bayan Lepas Industrial Park, 11900 Penang, Malaysia |
| **Model/Type reference** | LUXEON CZ series |
| **Ratings** | Max current: 1200mA; Max voltage: 3,5Vdc |

**Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):**

| | | | |
|---|---|---|---|
| ☒ | **CB Testing Laboratory:** | DEKRA Testing and Certification (Shanghai) Ltd. | |
| **Testing location/ address** | | 3/F, #250, Jiangchangsan Road building 16 Headquater Economy Park Shibei Hi-Tech Park, Zhabei District, Shanghai, P.R.C 200436 | |
| ☐ | ~~Associated CB Testing Laboratory:~~ | | |
| ~~Testing location/ address~~ | | | |
| **Tested by (name, function, signature)** | | Yuelie Wu |  |
| **Approved by (name, function, signature)** | | Hanson Zhang |  |
| ☐ | ~~Testing procedure: CTF Stage 1:~~ | | |
| ~~Testing location/ address~~ | | | |
| ~~Tested by (name, function, signature)~~ | | | |
| ~~Approved by (name, function, signature)~~ | | | |
| ☐ | ~~Testing procedure: CTF Stage 2:~~ | | |
| ~~Testing location/ address~~ | | | |
| ~~Tested by (name + signature)~~ | | | |
| ~~Witnessed by (name, function, signature)~~ | | | |
| ~~Approved by (name, function, signature)~~ | | | |
| ☐ | ~~Testing procedure: CTF Stage 3:~~ | | |
| ☐ | ~~Testing procedure: CTF Stage 4:~~ | | |
| ~~Testing location/ address~~ | | | |

| | | |
|---|---|---|
| ~~Tested by (name, function, signature) ...~~ | | |
| ~~Witnessed by (name, function, signature) .....~~ | | |
| ~~Approved by (name, function, signature) .....~~ | | |
| ~~Supervised by (name, function, signature) .....~~ | | |
| | | |

**List of Attachments (including a total number of pages in each attachment):**

- Appendix 1: Photo Documentation
- Appendix 2: Model List
- Appendix 3: Relative Spectrum Of Tested Sample(s)
- Appendix 4: Table 6.1 Based On IEC 62471:2006
- Appendix 5: Table 6.1 Based On EN62471:2008, Attachment To IEC 62471 European Group Differences And National Differences

**Summary of testing:**

| **Tests performed (name of test and test clause):** | **Testing location:** |
|---|---|
| These tests fulfil the requirements of standard ISO/IEC 17025.<br>When determining the test conclusion, the Measurement Uncertainty of test has been considered.<br><br>The tested sample of<br>L1CU-VLT1000000000<br>L1CU-RYL1000000000<br>L1CU-CYN1000000000<br>Have been tested according to the IEC 62471(first edition, 2006-07) **at 200mm** and been classified as **RG 2.**<br>Have been tested according to the EN 62471:2008 **at 200mm** and been classified as **RG 2.**<br>Have been tested according to the IEC/TR 62778:2014 and been classified as **RG 2 for blue light hazard**.<br><br>L1CU-GRN1000000000<br>Have been tested according to the IEC 62471(first edition, 2006-07) **at 200mm** and been classified as **RG 0.**<br>Have been tested according to the EN 62471:2008 **at 200mm** and been classified as **RG 1.**<br>Have been tested according to the IEC/TR 62778:2014 and been classified as **RG 1 Unlimited for blue light hazard**. | DEKRA Testing and Certification (Shanghai) Ltd.<br>3/F, #250, Jiangchangsan Road building 16 Headquater Economy Park Shibei Hi-Tech Park, Zhabei District, Shanghai, P.R.C 200436 |

**Summary of compliance with National Differences (List of countries addressed): EN Standards**

EN 62471:2008

☒ **The product fulfills the requirements**

**Copy of marking plate:**

**The artwork below may be only a draft. The use of certification marks on a product must be authorized by the respective NCBs that own these marks.**

N/A

| | |
|---|---|
| **Test item particulars.....:** | See below |
| **Product evaluated.....:** | ☒ **LED package**<br>☐ **LED module**<br>☐ **Lamp**<br>☐ **Luminaire** |
| **Rated voltage (V) .....:** | 3,5 Vac |
| **Rated current (mA) .....:** | Max current: 1200 mA |
| **Rated CCT (K).....:** | -- |
| **Rated Luminance (Mcd/m$^2$) .....:** | -- |
| **Component report data used .....:** | ☒ **Not applicable**<br>☐ **LED package**<br>☐ **LED module**<br>☐ **Lamp**<br>Report number: -- |
| **Possible test case verdicts:** | |
| **- test case does not apply to the test object.....:** | N/A |
| **- test object does meet the requirement.....:** | P (Pass) |
| **- test object does not meet the requirement.....:** | F (Fail) |
| **Testing.....:** | -- |
| **Date of receipt of test item .....:** | 2018-02-09 |
| **Date (s) of performance of tests.....:** | 2018-02-09 to 2018-04-10 |

**General remarks:**

"(See Enclosure #)" refers to additional information appended to the report.
"(See appended table)" refers to a table appended to the report.

**Throughout this report a ☒ comma / ☐ point is used as the decimal separator.**

The product complied with the following standards:

☒IEC 62471:2006
☒EN 62471:2008
☐IEC/TR 62471-2:2009
☒IEC/TR 62778:2014

**Manufacturer's Declaration per sub-clause 4.2.5 of IECEE 02:**

| | |
|---|---|
| The application for obtaining a CB Test Certificate includes more than one factory location and a declaration from the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided ..... : | ☐ **Yes**<br>☒**Not applicable** |

**When differences exist; they shall be identified in the General product information section.**

| | |
|---|---|
| **Name and address of factory (ies) ..... :** | Lumileds Malaysia Sdn. Bhd.<br>No. 3 , Lintang Bayan Lepas 8, Phase 4, Bayan Lepas Industrial Park, 11900 Penang, Malaysia |

**General product information:**

Full tests were performed on model L1CU-VLT1000000000, L1CU-RYL1000000000, L1CU-GRN1000000000 and L1CU-CYN1000000000.

All the samples were tested at 200mm from the light source.

Base on the Model list which listed on the appendix 2, The tested sample can be considered as
☐ typical product ☒ worst product
Which the results can be reference used for the other models.

Type test was performed according to IEC 62471:2006 procedure.

| IEC TR 62778 | | | |
|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |

| | | | |
|---|---|---|---|
| **7** | **MEASUREMENT INFORMATION FLOW** | | **P** |
| **7.1** | **Basic flow** | | **P** |
| | 'Law of conservation of luminance' applied | | N/A |
| | Use of only true luminance/radiance values | | P |
| | In case of luminaire:<br>The light source is operated in the luminaire under similar conditions as when tested as a component | | N/A |
| | In case $E_{thr}$ value for RG2 was established the peak value was derived from angular light distribution | | N/A |
| **7.2** | **Conditions for the radiance measurement** | | **P** |
| | Standard condition applied<br>(200mm distance, 0,011rad field of view) | | P |
| | Non-standard condition applied | | N/A |
| **7.3** | **Special cases (I): Replacement by a lamp or LED module of another type** | | **N/A** |
| | Light source is a white light source | | N/A |
| | Evaluation done based on highest luminance | | N/A |
| | Evaluation done based on CCT value | | N/A |
| **7.4** | **Special cases (II): Arrays and clusters of primary light sources** | | **N/A** |
| | LED package is evaluated as ..... : | ☐RG0 unlimited<br>☐ RG1 unlimited | N/A |
| | $E_{thr}$ of LED package applies to array | | N/A |
| **8** | **RISK GROUP CLASSIFICATION** | | **P** |
| | Risk group achieved: | | P |
| | - .. Risk Group 0 unlimited | | N/A |
| | - .. Risk Group 1 unlimited | For L1CU-GRN1000000000 | P |
| | - $E_{thr}$ ..... (lx) :<br>Distance to reach RG1 ..... (m) : | For<br>L1CU-RYL1000000000<br>L1CU-CYN1000000000<br>L1CU-VLT1000000000<br><br>Refer to the Supplementary information of **TABLE:Spectroradiometric measurement** as following | P |

| IEC TR 62778 | | | |
|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |

| | | | |
|---|---|---|---|
| | **TABLE:Spectroradiometric measurement** | | |
| | **Measurement performed on:** | ☒ **LED package**<br>☐ **LED module**<br>☐ **Lamp**<br>☐ **Luminaire** | |
| | **Model number** | L1CU-VLT1000000000 | |
| | **Test voltage (V)** | 3,5 Vdc | — |
| | **Test current (mA)** | 1200mA | — |
| | **Test frequency (Hz)** | -- | — |
| | **Ambient, t(°C)** | 25**°C** | — |
| | **Measurement distance** | ☒ 20 cm<br>☐ ... cm | — |
| | **Source size** | ☐ Non-small<br>☒ Small : 2mm x 2mm | — |
| | **Field of view** | ☐ 10 mrad<br>☒ 11 mrad<br>☐ 1,7 mrad (for small sources) | — |

| Item | Symbol | Units | Result | Remark |
|---|---|---|---|---|
| Correlated colour temperature | CCT | K | -- | |
| x/y colour coordinates | | | -- | |
| Blue light hazard radiance | $L_B$ | $W/(m^2 \cdot sr^1)$ | -- | @11mrad |
| Blue light hazard irradiance | $E_B$ | $W/m^2$ | 1,13E+01 | |
| Luminance | L | $cd/m^2$ | 2,01E+06 | @11mrad |
| Illuminance | E | lx | 8,82E+01 | |
| | | | | |

Supplementary information:

Per IEC/TR 62778:2014
Ethr= 8 lx
Dmin= 663 mm

| IEC TR 62778 | | | |
|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |

| | | | |
|---|---|---|---|
| | **TABLE:Spectroradiometric measurement** | | |
| | **Measurement performed on:** | ☒ **LED package**<br>☐ **LED module**<br>☐ **Lamp**<br>☐ **Luminaire** | |
| | **Model number** | L1CU-RYL1000000000 | |
| | **Test voltage (V)** | 3,5Vdc | — |
| | **Test current (mA)** | 1050mA | — |
| | **Test frequency (Hz)** | -- | — |
| | **Ambient, t(°C)** | 25**°C** | — |
| | **Measurement distance** | ☒ 20 cm<br>☐ ... cm | — |
| | **Source size** | ☐ Non-small<br>☒ Small : 2mm x 2mm | — |
| | **Field of view** | ☐ 100 mrad<br>☒ 11 mrad<br>☐ 1,7 mrad (for small sources) | — |

| Item | Symbol | Units | Result | Remark |
|---|---|---|---|---|
| Correlated colour temperature | CCT | K | -- | |
| x/y colour coordinates | | | -- | |
| Blue light hazard radiance | $L_B$ | $W/(m^2 \cdot sr^1)$ | -- | @11mrad |
| Blue light hazard irradiance | $E_B$ | $W/m^2$ | 8,92E+00 | |
| Luminance | L | $cd/m^2$ | 3,77E+06 | @11mrad |
| Illuminance | E | lx | 2,10E+02 | |
| | | | | |

Supplementary information:
Per IEC/TR 62778:2014
Ethr= 24 lx
Dmin= 592 mm

| IEC TR 62778 | | | |
|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |

| | | | |
|---|---|---|---|
| | **TABLE:Spectroradiometric measurement** | | |
| | **Measurement performed on:** | ☒ **LED package**<br>☐ **LED module**<br>☐ **Lamp**<br>☐ **Luminaire** | |
| | **Model number** | L1CU-GRN1000000000 | |
| | **Test voltage (V)** | 3,5Vdc | — |
| | **Test current (mA)** | 1050mA | — |
| | **Test frequency (Hz)** | -- | — |
| | **Ambient, t(°C)** | 25**°C** | — |
| | **Measurement distance** | ☒ 20 cm<br>☐ ... cm | — |
| | **Source size** | ☐ Non-small<br>☒ Small : 2mm x 2mm | — |
| | **Field of view** | ☐ 100 mrad<br>☒ 11 mrad<br>☐ 1,7 mrad (for small sources) | — |

| Item | Symbol | Units | Result | Remark |
|---|---|---|---|---|
| Correlated colour temperature | CCT | K | -- | |
| x/y colour coordinates | | | -- | |
| Blue light hazard radiance | $L_B$ | $W/(m^2 \cdot sr^1)$ | -- | @11mrad |
| Blue light hazard irradiance | $E_B$ | $W/m^2$ | 0,21E+00 | |
| Luminance | L | $cd/m^2$ | 2,56E+07 | @11mrad |
| Illuminance | E | lx | 1,52E+03 | |
| | | | | |
| Supplementary information:<br>N/A | | | | |

| IEC TR 62778 | | | |
|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |

| | | | |
|---|---|---|---|
| | **TABLE:Spectroradiometric measurement** | | |
| | **Measurement performed on:** | ☒ **LED package**<br>☐ **LED module**<br>☐ **Lamp**<br>☐ **Luminaire** | |
| | **Model number** | L1CU-CYN1000000000 | |
| | **Test voltage (V)** | 3,5 Vdc | — |
| | **Test current (mA)** | 1050mA | — |
| | **Test frequency (Hz)** | -- | — |
| | **Ambient, t(°C)** | 25**°C** | — |
| | **Measurement distance** | ☒ 20 cm<br>☐ ... cm | — |
| | **Source size** | ☐ Non-small<br>☒ Small : 2mm x 2mm | — |
| | **Field of view** | ☐ 10 mrad<br>☒ 11 mrad<br>☐ 1,7 mrad (for small sources) | — |

| Item | Symbol | Units | Result | Remark |
|---|---|---|---|---|
| Correlated colour temperature | CCT | K | -- | |
| x/y colour coordinates | | | -- | |
| Blue light hazard radiance | $L_B$ | $W/(m^2 \cdot sr^1)$ | -- | @11mrad |
| Blue light hazard irradiance | $E_B$ | $W/m^2$ | 1,52E+00 | |
| Luminance | L | $cd/m^2$ | 1,71E+07 | @11mrad |
| Illuminance | E | lx | 9,85E+02 | |
| | | | | |

Supplementary information:

Per IEC/TR 62778:2014
Ethr= 648 lx

Dmin= 247 mm

| IEC TR 62778 | | | |
|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |

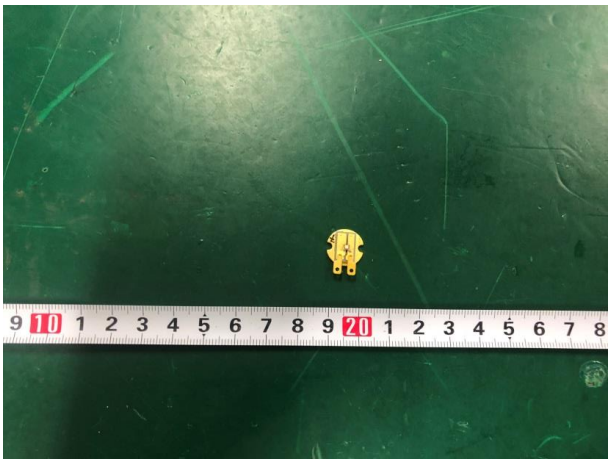
| | **TABLE: Angular light distribution** | **N/A** |
|---|---|---|

**List of test equipment used:**

A completed list of used test equipment shall be provided in the Test Reports when a Manufacturer Testing Laboratory according to CTF stage 1 or CTF stage 2 procedure has been used.
Note: This page may be removed when CTF stage 1 CTF stage 2 are not used. See also clause 4.8 in OD 2020 for more details.

| Clause | Measurement / testing | Testing / measuring equipment / material used, (Equipment ID) | Range used | Last Calibration date | Calibration due date |
|---|---|---|---|---|---|
| 7 | Irradiance measurements Radiance measurements | IDR 300 Monochromator (SH 344) | 200-3000nm | / | / |
| 7 | Radiance measurements | S009 Telescope (SH 345) | 300-1400nm | / | / |
| 7 | Radiance measurements | SRS 12 Radiance Standard (SH 348) | 300-1400nm | 2017/4/25 | 2018/4/25 |
| 7 | Irradiance measurements | CL6 Spectral irradiance standard (SH 350) | 300-3000nm | 2017/4/25 | 2018/4/25 |
| 7 | Irradiance measurements | CL7 Spectral irradiance standard (SH 351) | 200-400nm | 2017/4/25 | 2018/4/25 |
| 7 | Irradiance measurements | Photometric detector head (SH 359) | 380nm-800nm | 2017/4/25 | 2018/4/25 |
| 7 | Irradiance measurements Radiance measurements | Wattmeter (SH030) | 500V,40A | 2017/10/09 | 2018/10/09 |

Appendix 1: Photo Documentation



L1CU-VLT1000000000

L1CU-GRN1000000000

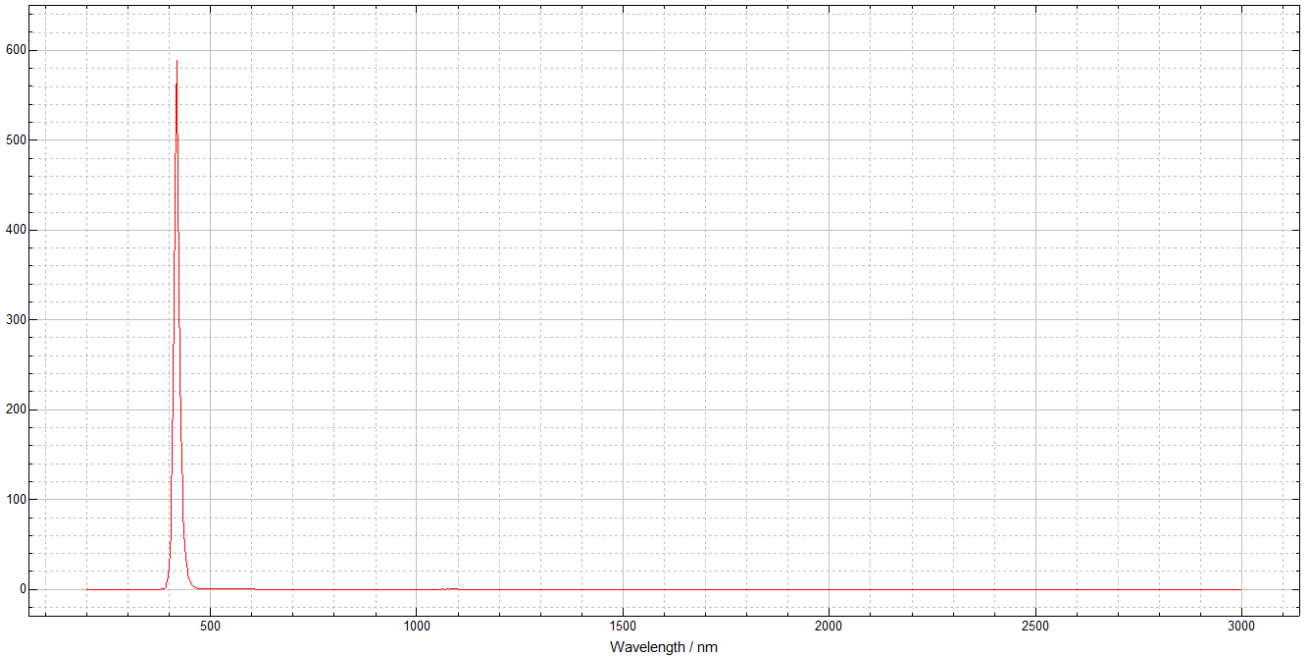
L1CU-CYN1000000000


L1CU-RYL1000000000
Overview

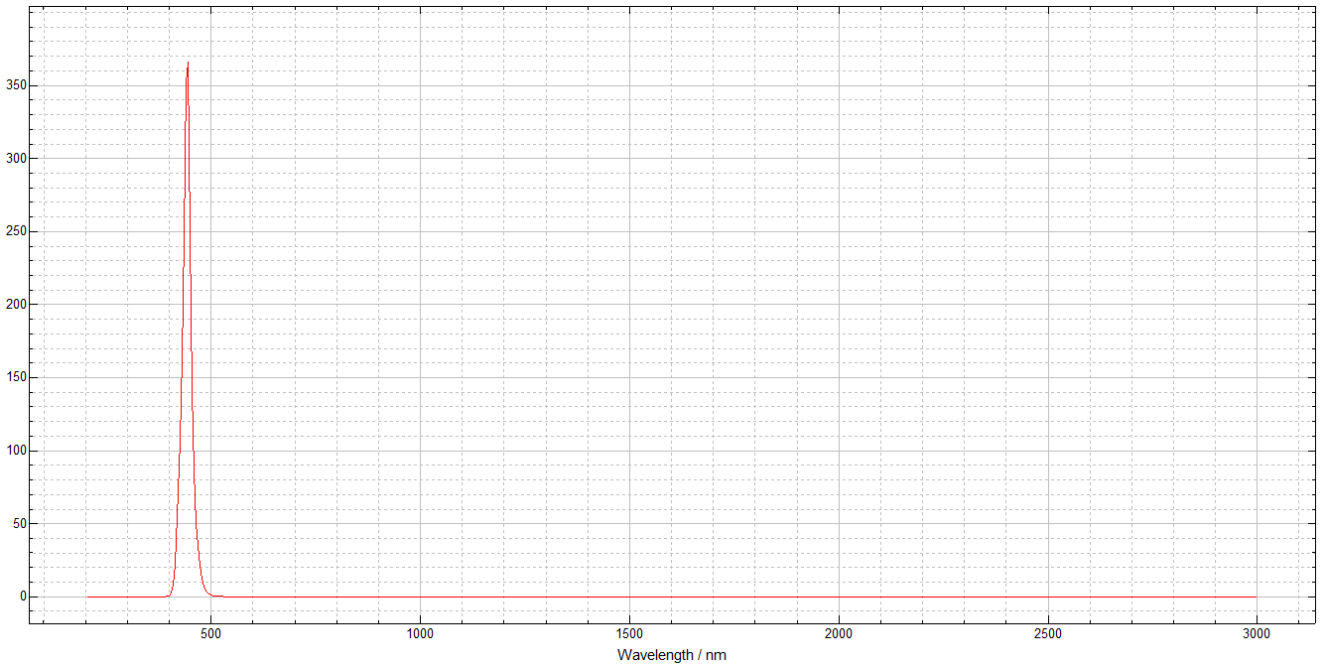
Appendix 2: Model List

| Commercial Part Number | Color | PBS rating |
|---|---|---|
| L1CU-VLT1000000000 | Violet | RG2 |
| L1CU-RYL1000000000 | Royal Blue | RG2 |
| L1CU-BLU1000000000 | Blue | RG2 |
| L1CU-CYN1000000000 | Cyan | RG2 |
| L1CU-GRN1000000000 | Green | RG1 |
| L1CU-LME1000000000 | Lime | RG1 |
| L1CU-MNT1000000000 | Mint | RG1 |
| L1CU-AMB1000000000 | Amber | RG1 |
| L1CU-PCA1000000000 | PC Amber | RG1 |
| L1CU-RNG1000000000 | Red-Orange | RG1 |
| L1CU-RED1000000000 | Red | RG1 |
| L1CU-DRD1000000000 | Deep Red | RG1 |
| L1CU-FRD1000000000 | Far Red | RG1 |

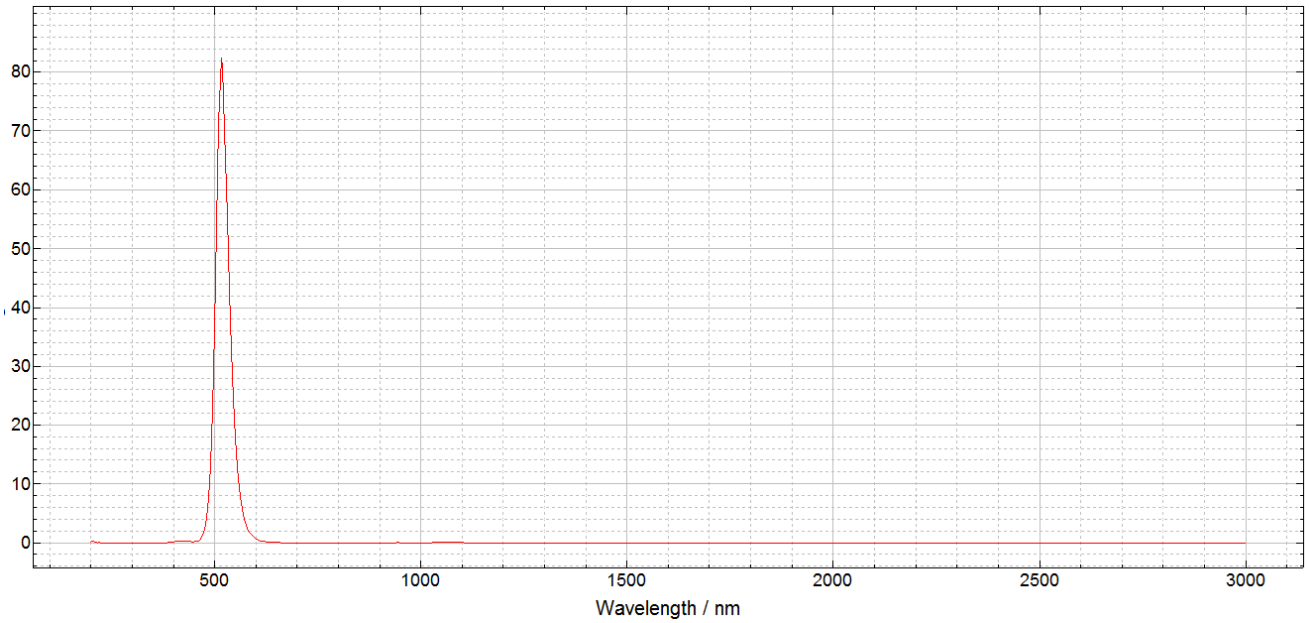
Appendix 3: Relative Spectrum Of Tested Sample(s)



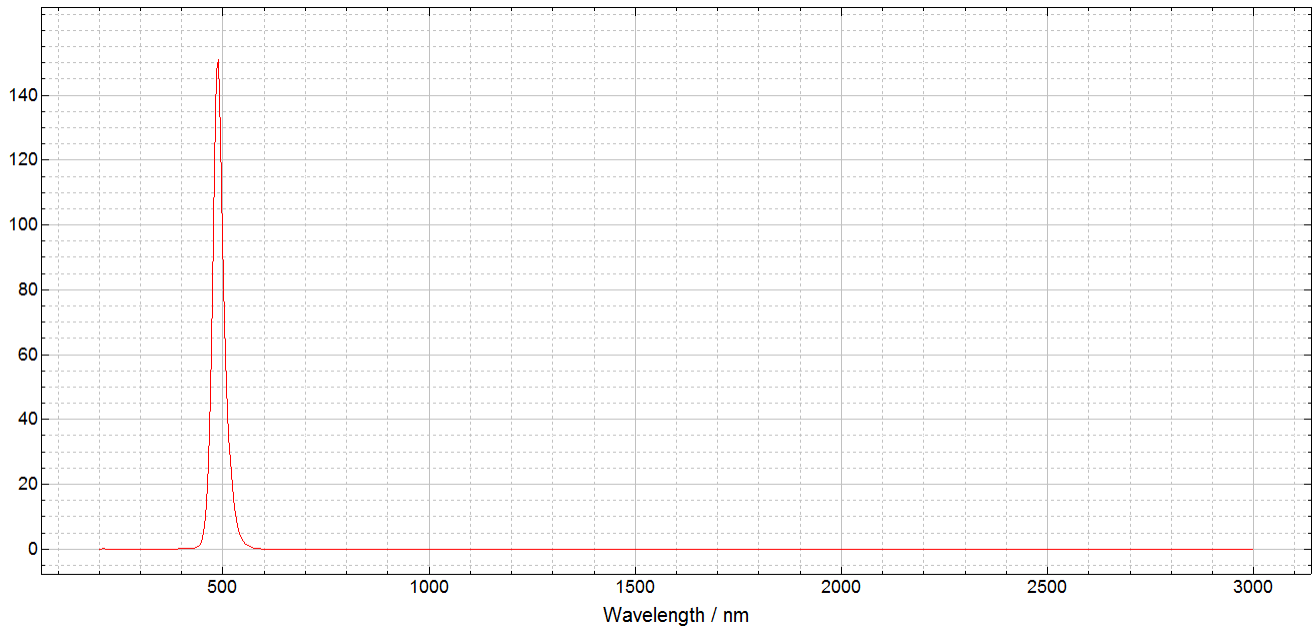

L1CU-VLT1000000000




L1CU-RYL1000000000




L1CU-GRN1000000000




L1CU-CYN1000000000

Appendix 4: Table 6.1 Based On IEC 62471:2006

DUT: L1CU-VLT1000000000, Evaluation Distance: 200mm, Angular subtense of the apparent source α: 10 mrad

| IEC 62471 | | | |
|---|---|---|---|
| Clause | Requirement + Test | Result – Remark | Verdict |

| **Table 6.1** | Emission limits for risk groups of continuous wave lamps | | | | | | | | | P |
|---|---|---|---|---|---|---|---|---|---|---|
| Risk | Action spectrum | Symbol | Units | Emission Measurement | | | | | | |
| | | | | Exempt | | Low risk | | Mod risk | | |
| | | | | Limit | Result | Limit | Result | Limit | Result | |
| Actinic UV | $S_{UV}(\lambda)$ | $E_s$ | $W \cdot m^{-2}$ | 0,001 | 0,0000 | 0,003 | | 0,03 | | |
| Near UV | | $E_{UVA}$ | $W \cdot m^{-2}$ | 10 | 0,0000 | 33 | | 100 | | |
| Blue light | B(λ) | $L_B$ | $W \cdot m^{-2} \cdot sr^{-1}$ | 100 | -- | 10000 | | 4000000 | | |
| Blue light, small source | B(λ) | $E_B$ | $W \cdot m^{-2}$ | 1,0* | 1,13E+01 | 1,0 | 1,13E+01 | 400 | 1,13E+01 | |
| Retinal thermal | R(λ) | $L_R$ | $W \cdot m^{-2} \cdot sr^{-1}$ | 28000/α | 3,54E+06 | 28000/α | | 71000/α | | |
| Retinal thermal, weak visual stimulus** | R(λ) | $L_{IR}$ | $W \cdot m^{-2} \cdot sr^{-1}$ | 6000/α | -- | 6000/α | | 6000/α | | |
| IR radiation, eye | | $E_{IR}$ | $W \cdot m^{-2}$ | 100 | 0,02 | 570 | | 3200 | | |

* Small source defined as one with α < 0,011 radian. Averaging field of view at 10000 s is 0,1 radian.
** Involves evaluation of non-GLS source

DUT:L1CU-RYL1000000000,Evaluation Distance: 200mm, Angular subtense of the apparent source α: 10mrad

| IEC 62471 | | | |
|---|---|---|---|
| Clause | Requirement + Test | Result – Remark | Verdict |

| **Table 6.1** | Emission limits for risk groups of continuous wave lamps | | | | | | | | | P |
|---|---|---|---|---|---|---|---|---|---|---|
| Risk | Action spectrum | Symbol | Units | Emission Measurement | | | | | | |
| | | | | Exempt | | Low risk | | Mod risk | | |
| | | | | Limit | Result | Limit | Result | Limit | Result | |
| Actinic UV | $S_{UV}(\lambda)$ | $E_s$ | $W \cdot m^{-2}$ | 0,001 | 0,0000 | 0,003 | | 0,03 | | |
| Near UV | | $E_{UVA}$ | $W \cdot m^{-2}$ | 10 | 0,0000 | 33 | | 100 | | |
| Blue light | B(λ) | $L_B$ | $W \cdot m^{-2} \cdot sr^{-1}$ | 100 | -- | 10000 | | 4000000 | | |
| Blue light, small source | B(λ) | $E_B$ | $W \cdot m^{-2}$ | 1,0* | 8,92E+00 | 1,0 | 8,92E+00 | 400 | 8,92E+00 | |
| Retinal thermal | R(λ) | $L_R$ | $W \cdot m^{-2} \cdot sr^{-1}$ | 28000/α | 1,62E+06 | 28000/α | | 71000/α | | |
| Retinal thermal, weak visual stimulus** | R(λ) | $L_{IR}$ | $W \cdot m^{-2} \cdot sr^{-1}$ | 6000/α | -- | 6000/α | | 6000/α | | |
| IR radiation, eye | | $E_{IR}$ | $W \cdot m^{-2}$ | 100 | 0,00 | 570 | | 3200 | | |

* Small source defined as one with α < 0,011 radian. Averaging field of view at 10000 s is 0,1 radian.
** Involves evaluation of non-GLS source

DUT: L1CU-GRN1000000000, Evaluation Distance: 200mm, Angular subtense of the apparent source α: 10 mrad

| IEC 62471 | | | |
|---|---|---|---|
| Clause | Requirement + Test | Result – Remark | Verdict |

| **Table 6.1** | Emission limits for risk groups of continuous wave lamps | | | | | | | | | P |
|---|---|---|---|---|---|---|---|---|---|---|
| Risk | Action spectrum | Symbol | Units | Emission Measurement | | | | | | |
| | | | | Exempt | | Low risk | | Mod risk | | |
| | | | | Limit | Result | Limit | Result | Limit | Result | |
| Actinic UV | $S_{UV}(\lambda)$ | $E_s$ | $W \cdot m^{-2}$ | 0,001 | 0,0000 | 0,003 | | 0,03 | | |
| Near UV | | $E_{UVA}$ | $W \cdot m^{-2}$ | 10 | 0,0000 | 33 | | 100 | | |
| Blue light | B(λ) | $L_B$ | $W \cdot m^{-2} \cdot sr^{-1}$ | 100 | | 10000 | | 4000000 | | |
| Blue light, small source | B(λ) | $E_B$ | $W \cdot m^{-2}$ | 1,0* | 0,21E+00 | 1,0 | | 400 | | |
| Retinal thermal | R(λ) | $L_R$ | $W \cdot m^{-2} \cdot sr^{-1}$ | 28000/α | 6,48E+04 | 28000/α | | 71000/α | | |
| Retinal thermal, weak visual stimulus** | R(λ) | $L_{IR}$ | $W \cdot m^{-2} \cdot sr^{-1}$ | 6000/α | -- | 6000/α | | 6000/α | | |
| IR radiation, eye | | $E_{IR}$ | $W \cdot m^{-2}$ | 100 | 0,01 | 570 | | 3200 | | |
| * Small source defined as one with α < 0,011 radian. Averaging field of view at 10000 s is 0,1 radian.<br>** Involves evaluation of non-GLS source | | | | | | | | | | |

DUT: L1CU-CYN1000000000, Evaluation Distance: 200mm, Angular subtense of the apparent source α: 10 mrad

| IEC 62471 | | | |
|---|---|---|---|
| Clause | Requirement + Test | Result – Remark | Verdict |

| **Table 6.1** | Emission limits for risk groups of continuous wave lamps | | | | | | | | | P |
|---|---|---|---|---|---|---|---|---|---|---|
| Risk | Action spectrum | Symbol | Units | Emission Measurement | | | | | | |
| | | | | Exempt | | Low risk | | Mod risk | | |
| | | | | Limit | Result | Limit | Result | Limit | Result | |
| Actinic UV | $S_{UV}(\lambda)$ | $E_s$ | $W \cdot m^{-2}$ | 0,001 | 0,0000 | 0,003 | | 0,03 | | |
| Near UV | | $E_{UVA}$ | $W \cdot m^{-2}$ | 10 | 0,0000 | 33 | | 100 | | |
| Blue light | B(λ) | $L_B$ | $W \cdot m^{-2} \cdot sr^{-1}$ | 100 | -- | 10000 | | 4000000 | | |
| Blue light, small source | B(λ) | $E_B$ | $W \cdot m^{-2}$ | 1,0* | 1,52E+00 | 1,0 | 1,52E+00 | 400 | 1,52E+00 | |
| Retinal thermal | R(λ) | $L_R$ | $W \cdot m^{-2} \cdot sr^{-1}$ | 28000/α | 2,68E+05 | 28000/α | | 71000/α | | |
| Retinal thermal, weak visual stimulus** | R(λ) | $L_{IR}$ | $W \cdot m^{-2} \cdot sr^{-1}$ | 6000/α | -- | 6000/α | | 6000/α | | |
| IR radiation, eye | | $E_{IR}$ | $W \cdot m^{-2}$ | 100 | 0,00 | 570 | | 3200 | | |

* Small source defined as one with α < 0,011 radian. Averaging field of view at 10000 s is 0,1 radian.
** Involves evaluation of non-GLS source

Appendix 5: Table 6.1 Based On EN62471:2008, Attachment To IEC 62471 European Group Differences And National Differences

DUT: L1CU-VLT1000000000, Evaluation Distance: 200mm, Angular subtense of the apparent source α: 10 mrad

| EN 62471 | | | |
|---|---|---|---|
| **Clause** | Requirement + Test | Result – Remark | Verdict |

| **Table 6.1** | Emission limits for risk groups of continuous wave lamps (based on EU Directive 2006/25/EC) | | | | | | | | | P |
|---|---|---|---|---|---|---|---|---|---|---|
| Risk | Action spectrum | Symbol | Units | Emission Measurement | | | | | |
| | | | | Exempt | | Low risk | | Mod risk | |
| | | | | Limit | Result | Limit | Result | Limit | Result |
| Actinic UV | $S_{UV}(\lambda)$ | $E_s$ | $W \cdot m^{-2}$ | 0,001 | 0,0000 | -- | -- | -- | -- |
| Near UV | | $E_{UVA}$ | $W \cdot m^{-2}$ | 0,33 | 0,0000 | -- | -- | -- | -- |
| Blue light | B(λ) | $L_B$ | $W \cdot m^{-2} \cdot sr^{-1}$ | 100 | -- | 10000 | | 4000000 | |
| Blue light, small source | B(λ) | $E_B$ | $W \cdot m^{-2}$ | 0,01* | 1,13E+01 | 1,0 | 1,13E+01 | 400 | 1,13E+01 |
| Retinal thermal | R(λ) | $L_R$ | $W \cdot m^{-2} \cdot sr^{-1}$ | 28000/α | 3,54E+06 | 28000/α | | 71000/α | |
| Retinal thermal, weak visual stimulus** | R(λ) | $L_{IR}$ | $W \cdot m^{-2} \cdot sr^{-1}$ | 545000<br>0,0017≤ α ≤ 0,011 | -- | | | | |
| | | | | 6000/α<br>0,011≤ α ≤ 0,1 | -- | | | | |
| IR radiation, eye | | $E_{IR}$ | $W \cdot m^{-2}$ | 100 | 0,02 | 570 | | 3200 | |

* Small source defined as one with α < 0,011 radian. Averaging field of view at 10000 s is 0,1 radian.
** Involves evaluation of non-GLS source

NOTE The action functions: see Table 4.1 and Table 4.2
The applicable aperture diameters: see 4.2.1
The limitations for the angular subtenses: see 4.2.2
The related measurement condition 5.2.3 and the range of acceptance angles: see Table 5.5.

DUT:L1CU-RYL1000000000, Evaluation Distance: 200mm, Angular subtense of the apparent source α: 10mrad

| EN 62471 | | | |
|---|---|---|---|
| **Clause** | Requirement + Test | Result – Remark | Verdict |

| **Table 6.1** | Emission limits for risk groups of continuous wave lamps (based on EU Directive 2006/25/EC) | | | | | | | | P |
|---|---|---|---|---|---|---|---|---|---|
| Risk | Action spectrum | Symbol | Units | Emission Measurement | | | | | |
| | | | | Exempt | | Low risk | | Mod risk | |
| | | | | Limit | Result | Limit | Result | Limit | Result |
| Actinic UV | $S_{UV}(\lambda)$ | $E_s$ | $W \cdot m^{-2}$ | 0,001 | 0,0000 | -- | -- | -- | -- |
| Near UV | | $E_{UVA}$ | $W \cdot m^{-2}$ | 0,33 | 0,0000 | -- | -- | -- | -- |
| Blue light | B(λ) | $L_B$ | $W \cdot m^{-2} \cdot sr^{-1}$ | 100 | -- | 10000 | | 4000000 | |
| Blue light, small source | B(λ) | $E_B$ | $W \cdot m^{-2}$ | 0,01* | 8,92E+00 | 1,0 | 8,92E+00 | 400 | 8,92E+00 |
| Retinal thermal | R(λ) | $L_R$ | $W \cdot m^{-2} \cdot sr^{-1}$ | 28000/α | 1,62E+06 | 28000/α | | 71000/α | |
| Retinal thermal, weak visual stimulus** | R(λ) | $L_{IR}$ | $W \cdot m^{-2} \cdot sr^{-1}$ | 545000<br>0,0017≤ α ≤ 0,011 | -- | | | | |
| | | | | 6000/α<br>0,011≤ α ≤ 0,1 | -- | | | | |
| IR radiation, eye | | $E_{IR}$ | $W \cdot m^{-2}$ | 100 | 0,00 | 570 | | 3200 | |

* Small source defined as one with α < 0,011 radian. Averaging field of view at 10000 s is 0,1 radian.
** Involves evaluation of non-GLS source

NOTE The action functions: see Table 4.1 and Table 4.2
The applicable aperture diameters: see 4.2.1
The limitations for the angular subtenses: see 4.2.2
The related measurement condition 5.2.3 and the range of acceptance angles: see Table 5.5.

DUT: L1CU-GRN1000000000, Evaluation Distance: 200mm, Angular subtense of the apparent source α: 10 mrad

| EN 62471 | | | |
|---|---|---|---|
| **Clause** | Requirement + Test | Result – Remark | Verdict |

| **Table 6.1** | Emission limits for risk groups of continuous wave lamps (based on EU Directive 2006/25/EC) | | | | | | | | P |
|---|---|---|---|---|---|---|---|---|---|
| Risk | Action spectrum | Symbol | Units | Emission Measurement | | | | | |
| | | | | Exempt | | Low risk | | Mod risk | |
| | | | | Limit | Result | Limit | Result | Limit | Result |
| Actinic UV | $S_{UV}(\lambda)$ | $E_s$ | $W \cdot m^{-2}$ | 0,001 | 0,0000 | -- | -- | -- | -- |
| Near UV | | $E_{UVA}$ | $W \cdot m^{-2}$ | 0,33 | 0,0000 | -- | -- | -- | -- |
| Blue light | B(λ) | $L_B$ | $W \cdot m^{-2} \cdot sr^{-1}$ | 100 | | 10000 | | 4000000 | |
| Blue light, small source | B(λ) | $E_B$ | $W \cdot m^{-2}$ | 0,01* | 0,21E+00 | 1,0 | 0,21E+00 | 400 | |
| Retinal thermal | R(λ) | $L_R$ | $W \cdot m^{-2} \cdot sr^{-1}$ | 28000/α | 6,48E+04 | 28000/α | | 71000/α | |
| Retinal thermal, weak visual stimulus** | R(λ) | $L_{IR}$ | $W \cdot m^{-2} \cdot sr^{-1}$ | 545000<br>0,0017≤ α ≤ 0,011 | -- | | | | |
| | | | | 6000/α<br>0,011≤ α ≤ 0,1 | -- | | | | |
| IR radiation, eye | | $E_{IR}$ | $W \cdot m^{-2}$ | 100 | 0,01 | 570 | | 3200 | |

* Small source defined as one with α < 0,011 radian. Averaging field of view at 10000 s is 0,1 radian.
** Involves evaluation of non-GLS source

NOTE The action functions: see Table 4.1 and Table 4.2
The applicable aperture diameters: see 4.2.1
The limitations for the angular subtenses: see 4.2.2
The related measurement condition 5.2.3 and the range of acceptance angles: see Table 5.5.

DUT: L1CU-CYN1000000000, Evaluation Distance: 200mm, Angular subtense of the apparent source α: 10 mrad

| EN 62471 | | | |
|---|---|---|---|
| **Clause** | Requirement + Test | Result – Remark | Verdict |

| **Table 6.1** | Emission limits for risk groups of continuous wave lamps (based on EU Directive 2006/25/EC) | | | | | | | | P |
|---|---|---|---|---|---|---|---|---|---|
| Risk | Action spectrum | Symbol | Units | Emission Measurement | | | | | |
| | | | | Exempt | | Low risk | | Mod risk | |
| | | | | Limit | Result | Limit | Result | Limit | Result |
| Actinic UV | $S_{UV}(\lambda)$ | $E_s$ | $W \cdot m^{-2}$ | 0,001 | 0,0000 | -- | -- | -- | -- |
| Near UV | | $E_{UVA}$ | $W \cdot m^{-2}$ | 0,33 | 0,0000 | -- | -- | -- | -- |
| Blue light | B(λ) | $L_B$ | $W \cdot m^{-2} \cdot sr^{-1}$ | 100 | -- | 10000 | | 4000000 | |
| Blue light, small source | B(λ) | $E_B$ | $W \cdot m^{-2}$ | 0,01* | 1,52E+00 | 1,0 | 1,52E+00 | 400 | 1,52E+00 |
| Retinal thermal | R(λ) | $L_R$ | $W \cdot m^{-2} \cdot sr^{-1}$ | 28000/α | 2,68E+05 | 28000/α | | 71000/α | |
| Retinal thermal, weak visual stimulus** | R(λ) | $L_{IR}$ | $W \cdot m^{-2} \cdot sr^{-1}$ | 545000<br>0,0017≤ α ≤ 0,011 | -- | | | | |
| | | | | 6000/α<br>0,011≤ α ≤ 0,1 | -- | | | | |
| IR radiation, eye | | $E_{IR}$ | $W \cdot m^{-2}$ | 100 | 0,00 | 570 | | 3200 | |

* Small source defined as one with α < 0,011 radian. Averaging field of view at 10000 s is 0,1 radian.
** Involves evaluation of non-GLS source

NOTE The action functions: see Table 4.1 and Table 4.2
The applicable aperture diameters: see 4.2.1
The limitations for the angular subtenses: see 4.2.2
The related measurement condition 5.2.3 and the range of acceptance angles: see Table 5.5.

----------The End----------