





Test Report issued under the responsibility of:



|  |  |
|--|--|
| <b>TEST REPORT</b><br><b>IEC TR 62778</b><br><b>Application of IEC 62471 for the assessment of blue light hazard to light sources and luminaires</b>   |  |
| <b>Report Number .....</b>   | 6051319.50P  |
| <b>Date of issue.....</b>  | 2019-04-26   |
| <b>Total number of pages .....</b>   | 17   |
| <b>Name of Testing Laboratory preparing the Report.....</b>  | DEKRA Testing and Certification (Shanghai) Ltd.<br>3/F, #250, Jiangchangsan Road building 16 Headquater Economy Park Shibe Hi-Tech Park, Zhabei District, Shanghai, P.R.C 200436 |
| <b>Applicant's name.....</b>   | Lumileds (Shanghai)Management Co., Ltd.  |
| <b>Address .....</b>   | Building 1-A, No.19&20, Lane 299, Wenshui Road, JingAn District, Shanghai, P.R. China  |
| <b>Test specification:</b>   |  |
| <b>Standard .....</b>  | IEC TR 62778:2014 (Second Edition)   |
| <b>Test procedure .....</b>  | CB Scheme  |
| <b>Non-standard test method .....</b>  | N/A  |
| <b>Test Report Form No.....</b>  | IEC62778A  |
| <b>Test Report Form(s) Originator .....</b>  | TÜV SÜD Product Service GmbH   |
| <b>Master TRF .....</b>  | Dated 2016-02  |
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|   |   |  |
|---|---|--|
| <b>Test item description..... :</b>   | LED package   |  |
| <b>Trade Mark..... :</b>  | LUMILEDS  |  |
| <b>Manufacturer..... :</b>  | Lumileds (Shanghai)Management Co., Ltd.<br>Building 1-A, No.19&20, Lane 299, Wenshui Road, JingAn District,<br>Shanghai, P.R. China |  |
| <b>Model/Type reference..... :</b>  | L1MC-RGB3080500MP0  |  |
| <b>Ratings..... :</b>   | Red: 250mA ;Green: 240mA ;Blue: 240mA; White: 200mA   |  |
| <b>Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):</b> |   |  |
| <input checked="" type="checkbox"/>   | <b>CB Testing Laboratory:</b>   | DEKRA Testing and Certification (Shanghai) Ltd.  |
| <b>Testing location/ address.....:</b>  |   | 3/F, #250, Jiangchangsan Road building 16 Headquater<br>Economy Park Shibei Hi-Tech Park, Zhabei District,<br>Shanghai, P.R.C 200436 |
| <input type="checkbox"/>  | <b>Associated CB Testing Laboratory:</b>  |  |
| <b>Testing location/ address.....:</b>  |   |  |
| <b>Tested by (name, function, signature).....:</b>  |   | Yuting Peng<br>                                  |
| <b>Approved by (name, function, signature)....:</b>   |   | Hanson Zhang<br>                                |
| <b>Testing procedure: CTF Stage 1:</b>  |   |  |
| <b>Testing location/ address.....:</b>  |   |  |
| <b>Tested by (name, function, signature).....:</b>  |   |  |
| <b>Approved by (name, function, signature).....:</b>  |   |  |
| <b>Testing procedure: CTF Stage 2:</b>  |   |  |
| <b>Testing location/ address.....:</b>  |   |  |
| <b>Tested by (name + signature).....:</b>   |   |  |
| <b>Witnessed by (name, function, signature) .....</b>   |   |  |
| <b>Approved by (name, function, signature).....:</b>  |   |  |
| <b>Testing procedure: CTF Stage 3:</b>  |   |  |
| <b>Testing procedure: CTF Stage 4:</b>  |   |  |
| <b>Testing location/ address.....:</b>  |   |  |
| <b>Tested by (name, function, signature).....:</b>  |   |  |

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

|  |  |
|--|--|
| <b>List of Attachments (including a total number of pages in each attachment):</b> <ul style="list-style-type: none"> <li>● Appendix 1: Photo Documentation</li> <li>● Appendix 2: Model List</li> <li>● Appendix 3: Relative Spectrum Of Tested Sample(s)</li> <li>● Appendix 4: Table 6.1 Based On IEC 62471:2006</li> <li>● Appendix 5: Table 6.1 Based On EN62471:2008, Attachment To IEC 62471 European Group Differences And National Differences</li> <li>● Appendix 6: Blue light hazard at low current</li> </ul> |  |
| <b>Summary of testing:</b>   |  |
| <b>Tests performed (name of test and test clause):</b><br><br>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 L1MC-RGB3080500MP0<br>Have been tested according to the IEC/TR 62778:2014 and been classified as <b>RG 2 for blue light hazard</b> .<br><br>Current at RG1 to RG2 boundary was deduced to be <b>200mA</b> with blue led.<br>(See appendix 6 for detail).        | <b>Testing location:</b><br><br>DEKRA Testing and Certification (Shanghai) Ltd.<br>3/F, #250, Jiangchangsan Road building 16<br>Headquater Economy Park Shibe Hi-Tech Park,<br>Zhabei District, Shanghai, P.R.C 200436 |
| <b>Summary of compliance with National Differences (List of countries addressed): EN Standards</b><br><br>EN 62471:2008<br><br><input checked="" type="checkbox"/> <b>The product fulfills the requirements</b>  |  |

**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

|  |   |
|--|---|
| <b>Test item particulars .....</b>   |   |
| <b>Product evaluated .....</b>   | <input checked="" type="checkbox"/> LED package<br><input type="checkbox"/> LED module<br><input type="checkbox"/> Lamp<br><input type="checkbox"/> Luminaire                           |
| <b>Rated voltage (V).....</b>  | Red: 2,5V ;Green: 3,9V ;Blue: 3,36V;<br>White: 3,5V   |
| <b>Rated current (mA).....</b>   | Red: 250mA ;Green: 240mA ;Blue: 240mA;<br>White: 200mA  |
| <b>Rated CCT (K) .....</b>   | --  |
| <b>Rated Luminance (Mcd/m<sup>2</sup>).....</b>  | --  |
| <b>Component report data used .....</b>  | <input checked="" type="checkbox"/> Not applicable<br><input type="checkbox"/> LED package<br><input type="checkbox"/> LED module<br><input type="checkbox"/> Lamp<br>Report number: -- |
| <b>Possible test case verdicts:</b>  |   |
| - 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)  |   |
| <b>Testing .....</b> : --  |   |
| <b>Date of receipt of test item.....</b> : 2019-04-04  |   |
| <b>Date (s) of performance of tests .....</b> : 2019-04-04 to 2019-04-24   |   |
| <b>General remarks:</b>  |   |
| "(See Enclosure #)" refers to additional information appended to the report.<br>"(See appended table)" refers to a table appended to the report.<br><br><b>Throughout this report a <input checked="" type="checkbox"/> comma / <input type="checkbox"/> point is used as the decimal separator.</b><br><br>The product complied with the following standards:<br><input checked="" type="checkbox"/> IEC 62471:2006<br><input checked="" type="checkbox"/> EN 62471:2008<br><input type="checkbox"/> IEC/TR 62471-2:2009<br><input checked="" type="checkbox"/> IEC/TR 62778:2014 |   |
| <b>Manufacturer's Declaration per sub-clause 4.2.5 of IEC 62471-2:</b>   |   |
| 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.....   | <input type="checkbox"/> Yes<br><input checked="" type="checkbox"/> Not applicable  |

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

**Name and address of factory (ies)..... :** Lumileds (Shanghai)Management Co., Ltd.  
Building 1-A, No.19&20, Lane 299, Wenshui Road,  
JingAn District, Shanghai, P.R. China

**General product information:**

Full tests were performed on model L1MC-RGB3080500MP0.

The products considered as worst case which should be evaluated at 200mm.

The sample of L1MC-RGB3080500MP0 was tested at 200mm from the light source. CCT of spectral irradiance was found at 4948 K.

According to the client's requirement, the blue light hazard of the samples at low current has been tested. The sample of L1MC-RGB3080500MP0 was classified as **RG1** at 200mA with blue led. Please refer to appendix 6 for details.

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 |

|            |   |   |            |
|------------|---|---|------------|
| <b>7</b>   | <b>MEASUREMENT INFORMATION FLOW</b>   |   | <b>P</b>   |
| <b>7.1</b> | <b>Basic flow</b>   |   | <b>P</b>   |
|            | '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        |
| <b>7.2</b> | <b>Conditions for the radiance measurement</b>  |   | <b>P</b>   |
|            | Standard condition applied<br>(200mm distance, 0,011rad field of view)  |   | P          |
|            | Non-standard condition applied  |   | N/A        |
| <b>7.3</b> | <b>Special cases (I): Replacement by a lamp or LED module of another type</b>   |   | <b>N/A</b> |
|            | 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        |
| <b>7.4</b> | <b>Special cases (II): Arrays and clusters of primary light sources</b>   |   | <b>N/A</b> |
|            | LED package is evaluated as ..... : <input type="checkbox"/> RG0 unlimited<br><input type="checkbox"/> RG1 unlimited          |   | N/A        |
|            | $E_{thr}$ of LED package applies to array   |   | N/A        |
| <b>8</b>   | <b>RISK GROUP CLASSIFICATION</b>  |   | <b>P</b>   |
|            | Risk group achieved:  |   | P          |
|            | -...Risk Group 0 unlimited  |   | N/A        |
|            | -...Risk Group 1 unlimited  |   | N/A        |
|            | - $E_{thr}$ ..... (lx) :<br>Distance to reach RG1 ..... (m) :   | Refer to the<br>Supplementary information<br>of<br><b>TABLE: Spectroradiometric<br/>measurement</b><br>as following | P          |



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

|   | <b>TABLE:Spectroradiometric measurement</b> |   |                                      |                 |         |
|---|---|---|--------------------------------------|-----------------|---------|
|   | Measurement performed on:                   | <input checked="" type="checkbox"/> LED package<br><input type="checkbox"/> LED module<br><input type="checkbox"/> Lamp<br><input type="checkbox"/> Luminaire |                                      |                 |         |
|   | Model number .....                          | L1MC-RGB3080500MP0  |                                      |                 |         |
|   | Test voltage (V) .....                      | Red: 2,5V; Green: 3,9V<br>Blue: 3,36V; White: 3,5V<br>(for reference)   |                                      |                 | —       |
|   | Test current (mA) .....                     | Red: 250mA ;Green: 240mA ;<br>Blue: 240mA ;White: 200mA   |                                      |                 | —       |
|   | Test frequency (Hz) .....                   | --  |                                      |                 | —       |
|   | Ambient, t(°C).....                         | 25°C  |                                      |                 | —       |
|   | Measurement distance.....                   | <input checked="" type="checkbox"/> 20 cm<br><input type="checkbox"/> ... cm  |                                      |                 | —       |
|   | Source size .....                           | <input checked="" type="checkbox"/> Non-small<br><input type="checkbox"/> Small :   |                                      |                 | —       |
|   | Field of view .....                         | <input type="checkbox"/> 100 mrad<br><input checked="" type="checkbox"/> 11 mrad<br><input type="checkbox"/> 1,7 mrad (for small sources)                     |                                      |                 | —       |
| Item  |   | Symb<br>ol  | Units                                | Result          | Remark  |
| Correlated colour temperature   |   | CCT   | K                                    | 4948            |         |
| x/y colour coordinates  |   |   |                                      | 0,3424 / 0,3108 |         |
| Blue light hazard radiance  |   | L <sub>B</sub>  | W/(m <sup>2</sup> •sr <sup>1</sup> ) | 1,15E+04        | @11mrad |
| Blue light hazard irradiance  |   | E <sub>B</sub>  | W/m <sup>2</sup>                     | --              |         |
| Luminance   |   | L   | cd/m <sup>2</sup>                    | 3,09E+06        | @11mrad |
| Illuminance   |   | E   | lx                                   | 1,31E+03        |         |
|   |   |   |                                      |                 |         |
| Supplementary information:<br>Per IEC/TR 62778:2014<br>Ethr= 269 lx<br>Dmin= 441 mm |   |   |                                      |                 |         |

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

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

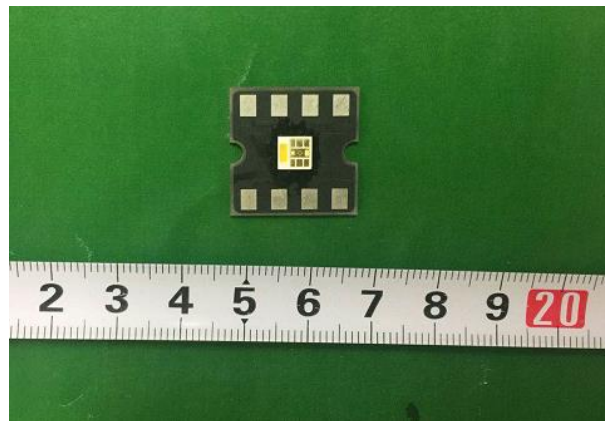
**List of test equipment used:**

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<br>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  | 2019/2/27             | 2019/2/26            |
| 7      | Irradiance measurements                          | CL6 Spectral irradiance standard (SH 350)                     | 300-3000nm  | 2019/2/27             | 2019/2/26            |
| 7      | Irradiance measurements                          | CL7 Spectral irradiance standard (SH 351)                     | 200-400nm   | 2019/2/27             | 2019/2/26            |
| 7      | Irradiance measurements                          | Photometric detector head (SH 359)                            | 380nm-800nm | 2019/2/26             | 2019/2/25            |
| 7      | Irradiance measurements<br>Radiance measurements | Wattmeter (SH030)   | 500V,40A    | 2018/10/09            | 2019/10/09           |

Appendix 1: Photo Documentation



L1MC-RGB3080500MP0  
(LED package component mounted on black PCB)

Overview

**Appendix 2: Model List**

Part numbers cover by this result:

L1MC-RGBxxyy50zMPz

where

xx = nominal CCT (30 = 3000K or less)

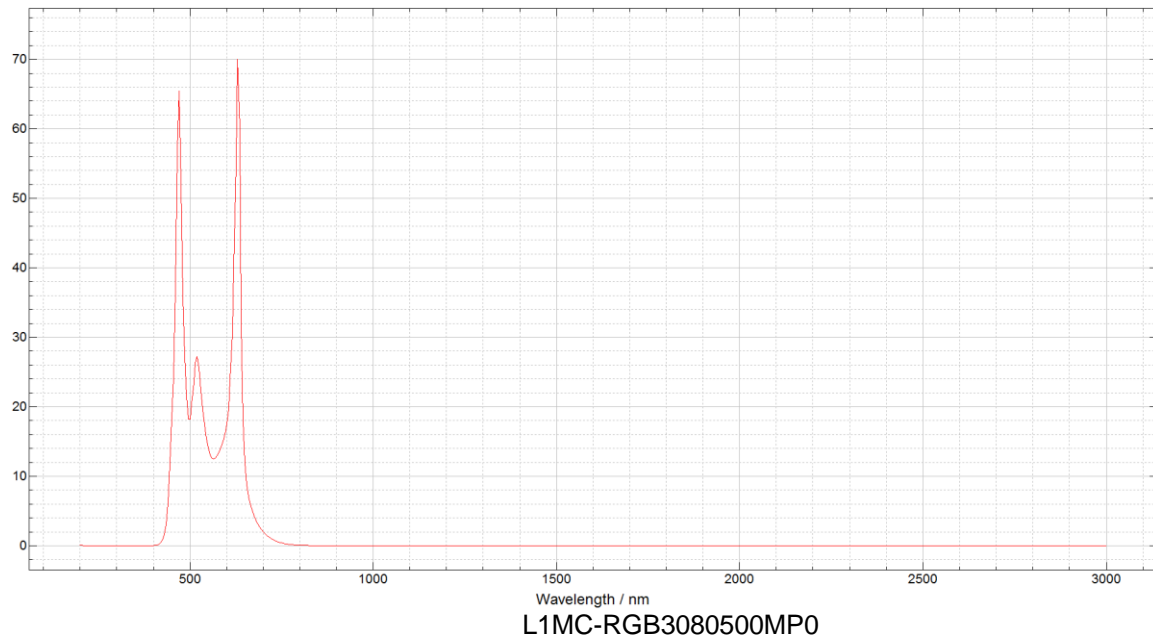
yy = CRI (e.g. 70 = 70 CRI, 80 = 80 CRI, etc)

z = custom binning

Blue light hazard risk group RG1/RG2 threshold current

| Risk group number             | Red | Green | Blue       | White |
|-------------------------------|-----|-------|------------|-------|
| Current at RG2 [mA]           | 250 | 240   | <b>240</b> | 200   |
| Threshold current at RG1 [mA] | 250 | 240   | <b>200</b> | 200   |

## Appendix 3: Relative Spectrum Of Tested Sample(s)



## Appendix 4: Table 6.1 Based On IEC 62471:2006

DUT: L1MC-RGB3080500MP0, Evaluation Distance: 200mm, Angular subtense of the apparent source  $\alpha$ : 24,45 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  | $B(\lambda)$   | $L_B$     | $W \cdot m^{-2} \cdot sr^{-1}$ | 100                  | 1,23E+02 | 10000           | 1,15E+04 | 4000000         | 2,76E+04 |
| Blue light, small source  | $B(\lambda)$   | $E_B$     | $W \cdot m^{-2}$               | 1,0*                 | --       | 1,0             |          | 400             |          |
| Retinal thermal   | $R(\lambda)$   | $L_R$     | $W \cdot m^{-2} \cdot sr^{-1}$ | 28000/ $\alpha$      | 1,06E+05 | 28000/ $\alpha$ |          | 71000/ $\alpha$ |          |
| Retinal thermal, weak visual stimulus**   | $R(\lambda)$   | $L_{IR}$  | $W \cdot m^{-2} \cdot sr^{-1}$ | 6000/ $\alpha$       | --       | 6000/ $\alpha$  |          | 6000/ $\alpha$  |          |
| IR radiation, eye   |  | $E_{IR}$  | $W \cdot m^{-2}$               | 100                  | 0,04     | 570             |          | 3200            |          |
| * Small source defined as one with $\alpha < 0,011$ 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: L1MC-RGB3080500MP0, Evaluation Distance: 200mm, Angular subtense of the apparent source  $\alpha$ : 24,45 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 <sub>UV</sub> (λ)   | E <sub>s</sub>   | W•m <sup>-2</sup>                   | 0,001                       | 0,0000   | --       | --       | --       | --       |
| Near UV  |   | E <sub>UVA</sub> | W•m <sup>-2</sup>                   | 0,33                        | 0,0000   | --       | --       | --       | --       |
| Blue light   | B(λ)  | L <sub>B</sub>   | W•m <sup>-2</sup> •sr <sup>-1</sup> | 100                         | 1,23E+02 | 10000    | 1,15E+04 | 4000000  | 2,76E+04 |
| Blue light, small source   | B(λ)  | E <sub>B</sub>   | W•m <sup>-2</sup>                   | 0,01*                       | --       | 1,0      |          | 400      |          |
| Retinal thermal  | R(λ)  | L <sub>R</sub>   | W•m <sup>-2</sup> •sr <sup>-1</sup> | 28000/α                     | 1,06E+05 | 28000/α  |          | 71000/α  |          |
| Retinal thermal, weak visual stimulus**  | R(λ)  | L <sub>IR</sub>  | W•m <sup>-2</sup> •sr <sup>-1</sup> | 545000<br>0,0017≤ α ≤ 0,011 | --       |          |          |          |          |
|  |   |                  |                                     | 6000/α<br>0,011≤ α ≤ 0,1    | --       |          |          |          |          |
| IR radiation, eye  |   | E <sub>IR</sub>  | W•m <sup>-2</sup>                   | 100                         | 0,04     | 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<br>The applicable aperture diameters: see 4.2.1<br>The limitations for the angular subtenses: see 4.2.2<br>The related measurement condition 5.2.3 and the range of acceptance angles: see Table 5.5. |   |                  |                                     |                             |          |          |          |          |          |



## Appendix 6: Blue light hazard at low current

| TABLE: Spectroradiometric measurement |                |   |                 |         |
|---------------------------------------|----------------|---|-----------------|---------|
| Measurement performed on:             |                | <input checked="" type="checkbox"/> LED package<br><input type="checkbox"/> LED module<br><input type="checkbox"/> Lamp<br><input type="checkbox"/> Luminaire |                 |         |
| Model number .....                    |                | L1MC-RGB3080500MP0  |                 |         |
| Test voltage (V) .....                |                | Red: 2,5V; Green: 3,9V<br>Blue: 3,3V; White: 3,5V<br>(for reference)  |                 |         |
| Test current (mA) .....               |                | Red: 250mA ;Green: 240mA ;<br>Blue: 200mA ;White: 200mA   |                 |         |
| Test frequency (Hz) .....             |                | --  |                 |         |
| Ambient, t(°C) .....                  |                | 25°C  |                 |         |
| Measurement distance .....            |                | <input checked="" type="checkbox"/> 20 cm<br><input type="checkbox"/> ... cm  |                 |         |
| Source size .....                     |                | <input checked="" type="checkbox"/> Non-small<br><input type="checkbox"/> Small :   |                 |         |
| Field of view .....                   |                | <input type="checkbox"/> 100 mrad<br><input checked="" type="checkbox"/> 11 mrad<br><input type="checkbox"/> 1,7 mrad (for small sources)                     |                 |         |
| Item                                  | Symbol         | Units   | Result          | Remark  |
| Correlated colour temperature         | CCT            | K   | 4445            |         |
| x/y colour coordinates                |                |   | 0,3552 / 0.3245 |         |
| Blue light hazard radiance            | L <sub>B</sub> | W/(m <sup>2</sup> •sr <sup>1</sup> )  | 9,96E+03        | @11mrad |
| Blue light hazard irradiance          | E <sub>B</sub> | W/m <sup>2</sup>  | --              |         |
| Luminance                             | L              | cd/m <sup>2</sup>   | 2,82E+06        | @11mrad |
| Illuminance                           | E              | lx  | 1,29E+03        |         |
| Supplementary information:<br>N/A     |                |   |                 |         |

---The End---