# TEST REPORT

**IEC 62471:2006**

**Photobiological safety of lamps and lamp systems**

| | |
|---|---|
| Report reference No ..... : | SZ2231010-58974E-SF |
| Compiled by (+ signature) ..... : | Engineer: Vic Zhang |
| Approved by (+ signature) ..... : | Team Leader: Harrison Huang |
| Date of issue ..... : | 2023-10-17 |
| Testing laboratory ..... : | Bay Area Compliance Laboratories Corp. (Dongguan) |
| Address ..... : | No.12, Pulong East 1st Road, Tangxia Town, Dongguan, Guangdong, China |
| Testing location ..... : | Same as above |
| Applicant ..... : | Hongli Zhihui Group Co.,Ltd. Guangzhou Branch |
| Address ..... : | Room 316, Building 2, No.1, Xianke Yi Road, Huadong Town, Huadu District, Guangzhou, China |
| Standard ..... : | IEC 62471:2006 |
| Test sample(s) received..... : | 2023-10-11 |
| Test in period..... : | 2023-10-12 |
| Procedure deviation ..... : | N.A. |
| Non-standard test method ..... : | N.A. |
| Type of test object ..... : | LED package |
| Trademark ..... : | N.A. |
| Model/type reference ..... : | HL-LM104H384W-5B2C12 (Ra2)-S |
| Manufacturer..... ..... : | Hongli Zhihui Group Co.,Ltd. Guangzhou Branch<br>Room 316, Building 2, No.1, Xianke Yi Road, Huadong Town, Huadu District, Guangzhou, China |
| Rating ..... : | Input:34-40Vdc,0.200A |

Copy of marking plate:

None

**Test item particulars**

Tested lamp .....: LED package
Tested lamp system .....:N.A

**Lamp classification group.....: Risk Group 1**
Lamp cap .....:N.A
Bulb.....:N.A
Rated of the lamp .....:See rating
Furthermore marking on the lamp.....: N.A.
Seasoning of lamps accordingEN standard .....: No seasoning
Temperature by measurement.....:22°C
Information for safety use.....:N.A

**Possible test case verdicts**:

-test case does not apply to the test object.....:N(.A.)

-test object does meet the requirement.....:P(ass)

-test object does not meet the requirement.....:F(ail)

**General remarks:**

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 testing laboratory.
"(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 point is used as the decimal separator.
List of test equipment must be kept on file and available for review.

**Remark:**
**Appendix A - EUT photos**

**General Product Information:**

"EUT" as referred in this report is LED package.

| IEC 62471:2006 | | | |
|---|---|---|---|
| Clause | Requirement – Test | Result - Remark | Verdict |
| 4 | EXPOSURE LIMITS | | P |
| | Contents of the whole Clause 4 of IEC 62471: 2006moved into a new informative Annex ZB | | P |
| | Clause 4 replaced by the following: | | P |
| | Limits of the Artificial Optical Radiation have been applied instead of those fixed in IEC 62471: 2006 | See Table 6.1 | P |
| Annex ZB | EXPOSURE LIMITS | | P |
| 4.1 | General | | P |
| | The exposure limits in this standard is not less than 0,01 ms and not more than any 8-hour period and should be used as guides in the control of exposure | | P |
| | Detailed spectral data of a light source are generally required only if the luminance of the source exceeds $10^4$ cd·m$^{-2}$ | >$10^4$ | |

| IEC 62471:2006 | | | |
|---|---|---|---|
| Clause | Requirement – Test | Result - Remark | Verdict |
| 4.3.3 | Retinal blue light hazard exposure limit<br><br>To protect against retinal photochemical injury fromchronic blue-light exposure, the integrated spectralradiance of the light source weighted against theblue-light hazard function, B(_), i.e., the blue-lightweighted radiance , LB, shall not exceed | | P |

| IEC 62471:2006 | | | |
|---|---|---|---|
| Clause | Requirement – Test | Result - Remark | Verdict |

| IEC 62471:2006 | | | |
|---|---|---|---|
| Clause | Requirement – Test | Result - Remark | Verdict |

| IEC 62471:2006 | | | |
|---|---|---|---|
| Clause | Requirement – Test | Result - Remark | Verdict |
| | Lamps that emit infrared radiation without a strong visual stimulus and do not pose a near-infrared retinal hazard (LIR), within 100 s are in Risk Group 1. | | P |
| 6.1.3 | Risk Group 2 (Moderate-Risk) | | N |
| | This requirement is met by any lamp that exceeds the limits for Risk Group 1, but that does not pose: | | N |
| | an actinic ultraviolet hazard (ES) within 1000 s exposure, nor | | N |
| | a near ultraviolet hazard (EUVA) within 100 s, nor | | N |
| | a retinal blue-light hazard (LB) within 0,25 s (aversion response), nor | | N |
| | a retinal thermal hazard (LR) within 0,25 s (aversion response), nor | | N |
| | an infrared radiation hazard for the eye (EIR) within 10 s | | N |
| | Lamps that emit infrared radiation without a strong visual stimulus and do not pose a near-infrared retinal hazard (LIR), within 10 s are in Risk Group 2. | | N |
| 6.1.4 | Risk Group 3 (High-Risk) | | N |
| | Lamps which exceed the limits for Risk Group 2 are in Group 3. | | N |
| 6.2 | Pulsed lamps | | N |
| | Pulse lamp criteria shall apply to a single pulse andto any group of pulses within 0,25 s. | | N |
| | A pulsed lamp shall be evaluated at the highest nominal energy loading as specified by the manufacturer. | | N |
| | The risk group determination of the lamp being tested shall be made as follows: | | N |
| | a lamp that exceeds the exposure limit shall be classified as belonging to Risk Group 3 (High-Risk) | | N |
| | for single pulsed lamps, a lamp whose weighted radiant exposure or weighted radiance does is below the EL shall be classified as belonging to the Exempt Group | | N |
| | for repetitively pulsed lamps, a lamp whose weighted radiant exposure or weighted radiance dose is below the EL, shall be evaluated using the continuous wave risk criteria discussed in clause 6.1, using time averaged values of the pulsed emission | | N |

| IEC 62471:2006 | | | |
|---|---|---|---|
| Clause | Requirement – Test | Result - Remark | Verdict |

| **Table 4.1** | Spectral weighting function for assessing ultraviolet hazards for skin and eye | | - |
|---|---|---|---|
| **Wavelength[1] λ, nm** | **UV hazard function $S_{UV}(\lambda)$** | **Wavelength λ, nm** | **UV hazard function $S_{UV}(\lambda)$** |
| 200 | 0,030 | 313* | 0,006 |
| 205 | 0,051 | 315 | 0,003 |
| 210 | 0,075 | 316 | 0,0024 |
| 215 | 0,095 | 317 | 0,0020 |
| 220 | 0,120 | 318 | 0,0016 |
| 225 | 0,150 | 319 | 0,0012 |
| 230 | 0,190 | 320 | 0,0010 |
| 235 | 0,240 | 322 | 0,00067 |
| 240 | 0,300 | 323 | 0,00054 |
| 245 | 0,360 | 325 | 0,00050 |
| 250 | 0,430 | 328 | 0,00044 |
| 254* | 0,500 | 330 | 0,00041 |
| 255 | 0,520 | 333* | 0,00037 |
| 260 | 0,650 | 335 | 0,00034 |
| 265 | 0,810 | 340 | 0,00028 |
| 270 | 1,000 | 345 | 0,00024 |
| 275 | 0,960 | 350 | 0,00020 |
| 280* | 0,880 | 355 | 0,00016 |

| IEC 62471:2006 | | | |
|---|---|---|---|
| Clause | Requirement – Test | Result - Remark | Verdict |

| **Table 4.2** | Spectral weighting functions for assessing retinal hazards from broadband opticalsources | - |
|---|---|---|

| **Wavelength nm** | **Blue-light hazard function B()** | **Burn hazard function R()** |
|---|---|---|
| 300 | 0,01 | - |
| 305 | 0,01 | - |
| 310 | 0,01 | - |
| 315 | 0,01 | - |
| 320 | 0,01 | - |
| 325 | 0,01 | - |
| 330 | 0,01 | - |
| 335 | 0,01 | - |
| 340 | 0,01 | - |
| 345 | 0,01 | - |
| 350 | 0,01 | - |
| 355 | 0,01 | - |
| 360 | 0,01 | - |
| 365 | 0,01 | - |
| 370 | 0,01 | - |
| 375 | 0,01 | - |
| 380 | 0,01 | 0,1 |
| 385 | 0,013 | 0,13 |
| 390 | 0,025 | 0,25 |
| 395 | 0,05 | 0,5 |
| 400 | 0,10 | 1,0 |
| 405 | 0,20 | 2,0 |
| 410 | 0,40 | 4,0 |
| 415 | 0,80 | 8,0 |
| 420 | 0,90 | 9,0 |
| 425 | 0,95 | 9,5 |
| 430 | 0,98 | 9,8 |
| 435 | 1,00 | 10,0 |
| 440 | 1,00 | 10,0 |
| 445 | 0,97 | 9,7 |
| 450 | 0,94 | 9,4 |
| 455 | 0,90 | 9,0 |
| 460 | 0,80 | 8,0 |
| 465 | 0,70 | 7,0 |
| 470 | 0,62 | 6,2 |
| 475 | 0,55 | 5,5 |
| 480 | 0,45 | 4,5 |
| 485 | 0,40 | 4,0 |
| 490 | 0,22 | 2,2 |
| 495 | 0,16 | 1,6 |
| 500-600 | $10^{[(450-}$ | 1,0 |
| 600-700 | 0,001 | 1,0 |
| 700-1050 | 0,013 | $10^{[(700-}$ |
| 1050-1150 | 0,025 | 0,2 |
| 1150-1200 | 0,05 | $0,2.^{100.02(1150-}$ |
| 1200-1400 | 0,10 | 0,02 |

* Wavelengths chosen are representative: other values should be obtained by logarithmic interpolationat intermediate wavelengths.
*Emission lines of a mercury discharge spectrum.

| IEC 62471:2006 | | | |
|---|---|---|---|
| Clause | Requirement – Test | Result - Remark | Verdict |

| **Table 5.4** | Summary of the ELs for the surface of the skin or cornea (irradiance based values) | | | | - |
|---|---|---|---|---|---|
| **Hazard Name** | **Relevant equation** | **Wavelength Range nm** | **Explosure aperture rad(deg)** | **Limiting aperture rad(deg)** | **EL in items of constant irradiance $W.m^{-2}$** |
| Actinic UV skin & eye | $E_S$ | 200 400 | < 30000 | 1,4 (80) | 30/t |
| Eye UV-A | $E_{UVA}$ | 315 400 | >1000 | 1,4 (80) | 10000/t<br>10 |
| Blue-light small source | $E_B$ | 300 700 | >100 | < 0,011 | 100/t<br>1,0 |
| Eye IR | $E_{IR}$ | 780 3000 | >1000 | 1,4 (80) | $18000/t^{0,75}$<br>100 |
| Skin thermal | $E_H$ | 380 3000 | < 10 | | $20000/t^{0,75}$ |

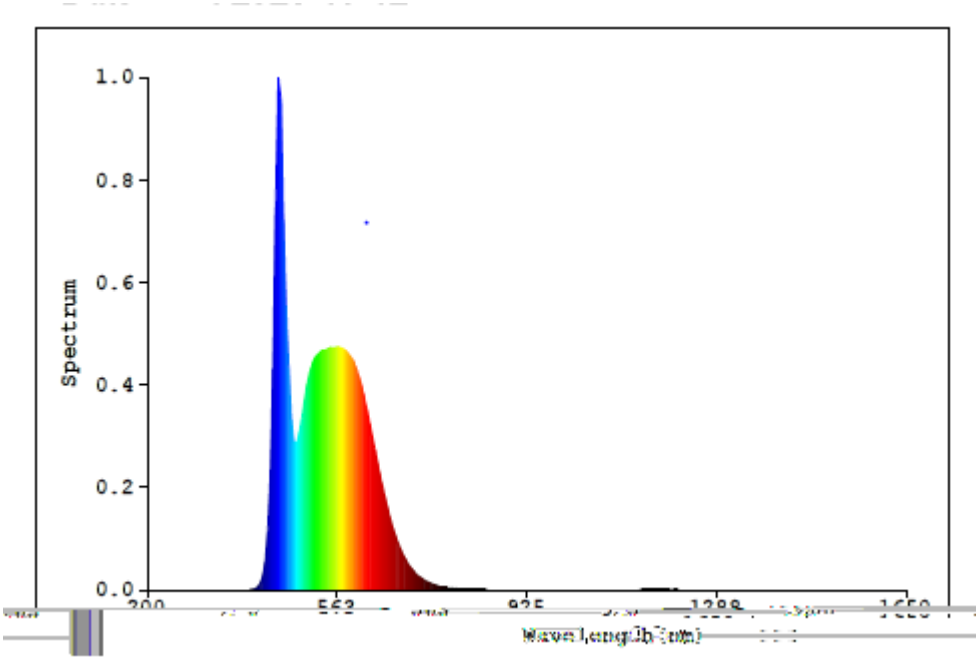
| **Table 5.5** | Summary of the ELs for the retina (radiance based values) | | | | - |
|---|---|---|---|---|---|
| **Hazard Name** | **Relevant equation** | **Wavelength Range nm** | **Explosure duration Sec** | **Field of view radians** | **EL in terms of constant radiance $W.m^{-2}.sr^{-1}$)** |
| Blue light | $L_B$ | 300 700 | 0,25 10<br>10-100<br>100-10000 | 0,011<br><br>0,1 | $10^6/t$<br>$10^6/t$<br>$10^6/t$<br>100 |
| Retinal thermal | $L_R$ | 380 1400 | < 0,25<br>0,25 10 | 0,0017 | $^{0,25}$)<br>$^{0,25}$) |
| Retinal thermal (weak visual stimulus) | $L_{IR}$ | 780 1400 | > 10 | 0,011 | |

| IEC 62471:2006 | | | |
|---|---|---|---|
| Clause | Requirement – Test | Result - Remark | Verdict |

| Table 6.1 | Emission limits for risk groups of continuous wave lamps | | | | | | | | P |
|---|---|---|---|---|---|---|---|---|---|
| Risk | Action spectrum | Units | Symbol | Exempt | | Low risk | | Mod risk | |
| | | | | Limit | Result | Limit | Result | Limit | Result |
| Actinic UV | | $W.m^{-2}$ | $E_S$ | 0.001 | - | 0.003 | $1.693\times10^{-8}$ | 0.03 | - |
| Near UV | | $W.m^{-2}$ | $E_{UVA}$ | 10 | - | 33 | $5.123\times10^{-4}$ | 100 | - |
| Blue light | | $W.m^{-2}.sr^{-1}$ | $L_B$ | 100 | - | 10000 | $9.265\times10^{3}$ | 4000000 | - |
| Blue light,small source | | $W.m^{-2}$ | $E_B$ | 1.0 | - | 1.0 | - | 400 | - |
| Retinal thermal | | $W.m^{-2}.sr^{-1}$ | $L_R$ | ( 0.0265) | - | ( 0.0265) | $1.129x10^{5}$ | ( 0.0265) | - |
| Retinal thermal, Weak visual stimulus** | | $W.m^{-2}.sr^{-1}$ | $L_{IR}$ | ( 0.0265) | - | ( 0.0265) | $1.119x10^{1}$ | ( 0.0265) | - |
| IR radiation Eye | | $W.m^{-2}$ | $E_{IR}$ | 100 | - | 570 | 0 | 3200 | - |

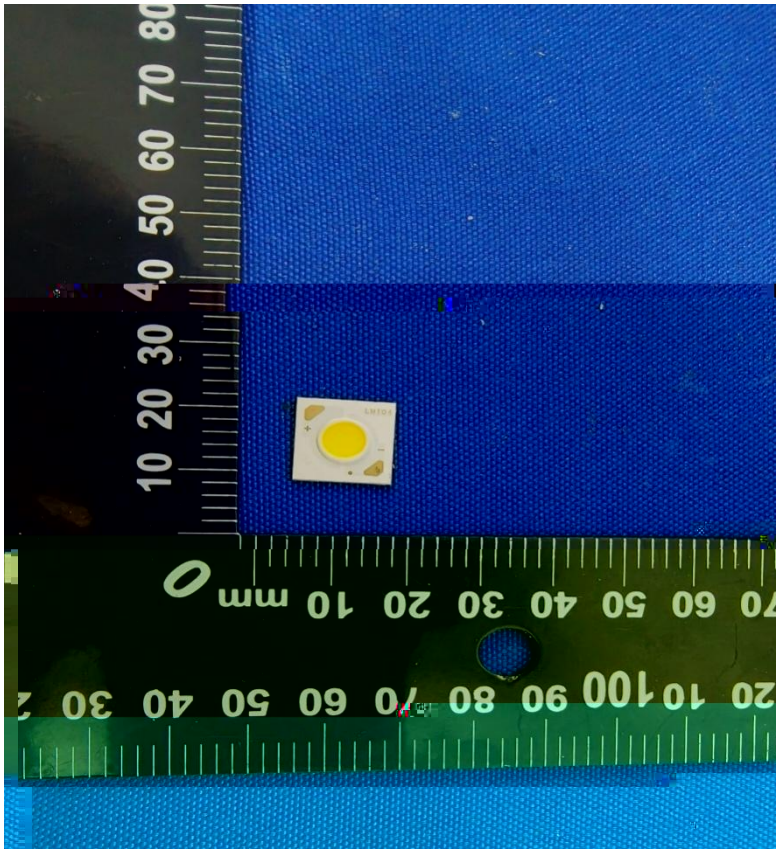
** Involves evaluation of non-GLS source
NOTE The action functions: see Table 4.1 and Table 4.2
The applicance apertuer diameters: see 4.2.1
The limitations for the angular subtenses: see 4.2.2
The related measurement condition 5.2.3 and the range of acceptance angles: see Table 5.5

Figure of Spectral distribution



Appendix A - EUT Photos

**The overall view of EUT**



**Directions**

1.The information marked # is provided by the applicant, the laboratory is not responsible for its authenticity and this information can affect the validity of the result in the test report.

2.Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.

3.Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

4.The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval.

5.This report cannot be reproduced except in full, without prior written approval of the Company.