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|---|---|
| TEST REPORT EN 62031 LED modules for general lighting – Safety specifications EN 62471 Photobiological safety of lamps and lamp systems | |
| Report Reference No.....: | RSZ160901554-03 |
| Compiled by (+ signature) | Park Zeng <i>Park Zeng</i> |
| Approved by (+ signature) | Rick Xiao <i>Rick Xiao</i> |
| Date of issue.....: | 2016-09-14 |
| Testing Laboratory | Bay Area Compliance Laboratories Corp. (Dongguan) |
| Address | No.69,Pulongcun, Puxinhu Industrial Zone Tangxia Town Dongguan, Guangdong 523719 CHINA |
| Testing location.....: | Same as above |
| Applicant's name | Hong Li Zhihui Group Co., Ltd. |
| Address | No.1,Xianke Yi Road, Huadong Town, Huadu District, Guangzhou, China |
| Standard | EN 62031:2008+A1:2013, EN 62471:2008 |
| Test sample(s) received.....: | 2016-09-12 |
| Test in period.....: | 2016-09-12 to 2016-09-14 |
| Procedure deviation | N.A. |
| Non-standard test method.....: | N.A. |
| This test report is for the customer shown above and their specific product only. It may not be duplicated or used in part except in full without prior written consent from Bay Area Compliance Laboratories Corp. (Dongguan). | |
| Test item description.....: | High Power AC LED Module |
| Trade Mark | HONGLIZHIHUI |
| Manufacturer | Hong Li Zhihui Group Co., Ltd. |
| Address | No.1,Xianke Yi Road, Huadong Town, Huadu District, Guangzhou, China |
| Model/Type reference.....: | HL-LE004D46W-30B2C86(Ra2) |
| Ratings | 230Vac 50/60Hz 0.13A 30W |

Copy of marking plate (Representative):



CE marking (height 5 mm min.)



Standard code "IEC 60417-6053"

Symbol for built-in LED modules

Remark:

Marking will be submitted and should be added on the product by manufacture after. Clause 7.1 in EN 62031 would be considered in sales, to meet the comformity.

Test item particulars.....:

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:

"(see remark #)" refers to a remark 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.

The test results presented in this report relate only to the object tested.

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Attachment 1 test report for EN 62471:2008

Result: **Risk group 1**

Attachment 2 EUT Photo

Attachment 3 Circuit diagram

Attachment 4 TEST Equipment List

General product information:

The product is High Power AC LED Module, and the module number is HL-LE004D46W-30B2C86(Ra2). It was a semi-product mounted on PCB and which input 230Vac 50/60Hz 0.13A 30W; for this ope-frame product shall installation with professional person.

The CCT 6500K was submittted as test model. And this models include CCT 2700K / 3000K / 4000K / 5000K / 5700K / 6000K / 6500K.

| EN 62031 | | | |
|----------|--|---|----------|
| Clause | Requirement + Test | Result - Remark | Verdict |
| 4 | GENERAL REQUIREMENTS | | P |
| 4.4 | Integral modules tested assembled in the luminaire | | — |
| 4.5 | Independent modules complies with requirements in IEC 60598-1 | | — |
| 5 | GENERAL TEST REQUIREMENTS | | N |
| 5.5 | SELV-operated LED modules comply with Annex I of IEC 61347-2-13 | | — |
| 6 | CLASSIFICATION | | P |
| | Built-in module : | Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> | — |
| | Independent module..... : | Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> | — |
| | Integral module : | Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> | — |
| | For Integral module; Note to 1.2.1 in IEC 60598-1 applies. | | — |
| 7 | MARKING | | P |
| 7.1 | Mandatory markings | | P |
| | a) mark of origin | | P |
| | b) model number, type reference | | P |
| | c1) constant voltage module; rated supply voltage and supply frequency | | P |
| | c2) constant current module; rated supply current and supply frequency | | P |
| | d) nominal power | | P |
| | e) indication of connections, wiring diagram | | N |
| | f) value of t_c and place on the module | | N |
| | g) eye protection | | N |
| | h) symbol for built-in modules | | P |
| | i) heat transfer temperature t_d | | N |
| | j) power for heat-conduction P_d | | N |
| | k) working voltage for insulation | | P |
| 7.2 | Location of marking | | P |

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|--------------|--|------------------------|----------|
| Clause | Requirement + Test | Result - Remark | Verdict |
| 7.3 | Durable and legibility of marking | | P |
| | Rubbing 15 s water, marking legible | | P |
| 8 | SCREW TERMINALS | | N |
| | Screw terminals according section 14 of IEC 60598-1: | | N |
| | Separately approved; component list | | N |
| | Part of the luminaire | | N |
| | Screwless terminals according section 15 of IEC 60598-1: | | N |
| | Separately approved; component list | | N |
| | Part of the luminaire | | N |
| | Connectors according IEC 60838-2-2: | | N |
| | Separately approved; component list | | N |
| 9 (9) | PROVISION FOR PROTECTIVE EARTHING | Class II module | N |
| - (9.1) | Provisions for protective earthing | | N |
| | Terminal complying with clause 8 | | N |
| | Locked against loosening and not possible to loosen by hand | | N |
| | Not possible to loosen clamping means unintentionally on screwless terminals | | N |
| | Earthing via means of fixing | | N |
| | Earthing terminal only used for the earthing of the control gear | | N |
| | All parts of material minimizing the danger of electrolytic corrosion | | N |
| | Made of brass or equivalent material | | N |
| | Contact surface bare metal | | N |
| - (9.2) | Provision for functional earthing | | N |
| | Comply with clause 8 and 9.1 | | N |
| - (9.3) | Earth contact via the track on the printed board | | N |
| | Test with a current of 25 A between earthing terminal and each of the accessible metal parts; measured resistance (Ω) at ≥ 10 A according 7.2.3 of IEC 60598-1: $< 0,5 \Omega$ | | N |

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| Clause | Requirement + Test | Result - Remark | Verdict |
| - (9.4) | Earthing of built-in lamp controlgear | | N |
| | Earth by means of fixing to earthed metal of luminaire in compliance of 7.2 of IEC 60598-1 | | N |
| | Earthing terminal only for earthing the built-in controlgear | | N |
| - (9.5) | Earthing via independent controlgear | | N |
| - (9.5.1) | Earth connection to other equipment | | N |
| | Looping or through connection, conductor min. 1,5 mm ² and of copper or equivalent | | N |
| | Protective earthing wires in line with 5.3.1.1 and clause 7 | | N |
| - (9.5.2) | Earthing of the lamp compartments powered via the independent lamp controlgear | | N |
| | Test with a current of 25 A between input and output earth terminals; measured resistance (Ω) between earthing terminal and each of the accessible metal parts at ≥ 10 A according 7.2.3 of IEC 60598-1: $< 0,5 \Omega$ | | N |
| | Output earthing terminal marked as in 7.1 t) of IEC 61347-1 | | N |

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| 10 (10) | PROTECTION AGAINST ACCIDENTAL CONTACT WITH LIVE PARTS | | N |
| - (10.1) | Controlgear protected against accidental contact with live parts | | N |
| - (A2) | The current flowing between the part concerned and earth is measured and does not exceed 0,7 mA (peak) or 2 mA d.c. | | N |
| - (A2) | For frequencies above 1 kHz, the current does not exceed 0,7 mA (peak) multiplied by the value of the frequency in kilohertz or 70 mA (peak) | | N |
| - (A3) | The voltage between the part concerned and any accessible part is measured and does not exceed 34 V (peak) | | N |
| - (10.1) | Lacquer or enamel not used for protection or insulation | | N |
| | Adequate mechanical strength on parts providing protection | | N |

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|----------|---|-----------------|---------|
| Clause | Requirement + Test | Result - Remark | Verdict |
| - (10.2) | Capacitors > 0,5 μ F: voltage after 1 min (V): < 50 V | | N |
| - (10.3) | Controlgear providing SELV | | N |
| | Accessible conductive parts are insulated from live parts by double or reinforced insulation in SELV controlgear | | N |
| | No connection between output circuit and the body or protective earthing circuit | | N |
| | No possibility of connection between output circuit and the body or protective earthing circuit through other conductive parts | | N |
| | SELV outputs separated by at least basic insulation | | N |
| | ELV conductive parts insulated as live parts | | N |
| | Tests according Annex L of IEC 61347-1 | | N |
| - (10.4) | Accessible conductive parts in SELV circuits | | N |
| | Output voltage under load ≤ 25 V r.m.s. or ≤ 60 V d.c. | | N |
| | If output voltage > 25 V r.m.s. or > 60 V d.c.; No load output ≤ 35 V peak or ≤ 60 V d.c and touch current does not exceed 0,7 mA (peak) or 2 mA d.c. | | N |
| | One conductive part is insulated if output voltage or current exceeding the values above and withstand test voltage 500 V | | N |
| | Double or reinforced insulation bridged by appropriate and at least two resistors or two Y2 capacitors or one Y1 capacitor | | N |
| | Y1 or Y2 capacitors comply with IEC 60384-14 | | N |
| | Resistors comply with test (a) in 14.1 of IEC 60065 | | N |

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| 11 (11) | MOISTURE RESISTANCE AND INSULATION | | P |
| | After storage 48 h at 91-95% relative humidity and 20-30 °C measuring of insulation resistance with d.c. 500 V (M Ω): | | P |
| | For basic insulation ≥ 2 M Ω | >100 M Ω | P |
| | For double or reinforced insulation ≥ 4 M Ω | | N |

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|----------|--|-----------------|---------|
| Clause | Requirement + Test | Result - Remark | Verdict |
| | Between primary and secondary circuits in controlgear providing SELV, values in Annex L in IEC 61347-1 | | N |

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|----------------|--|-------|----------|
| 12 (12) | ELECTRIC STRENGTH | | P |
| | Immediately after clause 11 electric strength test for 1 min | | P |
| | Basic insulation for SELV, test voltage 500 V | | N |
| | Working voltage ≤ 50 V, test voltage 500 V | | N |
| | Working voltage > 50 V ≤ 1000 V, test voltage (V): | | P |
| | Basic insulation, $2U + 1000$ V | 1460V | P |
| | Supplementary insulation, $2U + 1000$ V | | N |
| | Double or reinforced insulation, $4U + 2000$ V | | N |
| | No flashover or breakdown | | P |
| | Solid or thin sheet insulation for double or reinforced insulation fulfil the requirements in Annex N in IEC 61347-1 | | N |

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| 13 (14) | FAULT CONDITIONS | | P |
| - (14) | When operated under fault conditions the controlgear: | | P |
| | - does not emit flames or molten material | | P |
| | - does not produce flammable gases | | P |
| | - protection against accidental contact not impaired | | P |
| | Thermally protected controlgear does not exceed the marked temperature value | | N |
| | Fault conditions: capacitors, resistors or inductors without proof of compliance with relevant specifications have been short-circuited or disconnected | (see appended table) | P |
| - (14.1) | Short-circuit of creepage distances and clearances if less than specified in clause 16 in Part 1 (except between live parts and accessible metal parts) | (see appended table) | P |
| | Creepage distances on printed boards less than specified in clause 16 in Part 1 provided with coating according to IEC 60664-3 | | N |
| - (14.2) | Short-circuit or interruption of semiconductor devices | (see appended table) | P |

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|-----------|--|---|----------|
| Clause | Requirement + Test | Result - Remark | Verdict |
| - (14.3) | Short-circuit across insulation consisting of lacquer, enamel or textile | | N |
| - (14.4) | Short-circuit across electrolytic capacitors | | N |
| - (14.5) | After the tests has been carried out on three samples: | | P |
| | The insulation resistance $\geq 1 \text{ M}\Omega$ | | P |
| | No flammable gases | | P |
| | No accessible parts have become live | | P |
| | During the tests, a five-layer tissue paper, where the test specimen is wrapped, does not ignite | | P |
| - (14.6) | Relevant fault condition tests with high-power supply | | — |
| 13.2 | Module withstands overpower condition >15 min. | | P |
| | Module with automatic protective device or power limiter, test performed 15 min. at limit. | | N |
| | During the tests, tissue paper, spread below module, does not ignite | | P |
| 15 | CONSTRUCTION | | P |
| | Wood, cotton, silk, paper and similar fibrous material not used as insulation | | P |
| 16 | CREEPAGE DISTANCES AND CLEARANCES | | P |
| | Creepage distances and clearances in compliance with IEC 60598-1 | | P |
| | Working voltage (V) | 230Vac | — |
| | Voltage form | Sinusoidal <input checked="" type="checkbox"/> Non-sinusoidal <input type="checkbox"/> | — |
| | PTI | < 600 <input checked="" type="checkbox"/> ≥ 600 <input type="checkbox"/> | — |
| | Impulse withstand category (Normal category II) (Category III Annex U) | Category II <input checked="" type="checkbox"/> Category III <input type="checkbox"/> | — |
| | Rated pulse voltage (kV) | | — |
| | (1) Current-carrying parts of different polarity: cr (mm); cl (mm) : | cr=cl=5.08mm (Limited cr:2.5mm, cl:1.5mm) | P |
| | (2) Current-carrying parts and accessible parts: cr (mm); cl (mm) | | N |

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|----------|---|-----------------|---------|
| Clause | Requirement + Test | Result - Remark | Verdict |
| | (3) Parts becoming live due to breakdown of basic insulation and metal parts: cr (mm); cl (mm) | | N |
| | (4) Outer surface of cable where it is clamped and metal parts: cr (mm); cl (mm) | | N |
| | (6) Current-carrying parts and supporting surface: cr (mm); cl (mm) | | N |

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| 17 (17) | SCREWS, CURRENT-CARRYING PARTS AND CONNECTIONS | | N |
| | Screws, current-carrying parts and connections in compliance with IEC 60598-1 (clause numbers between parentheses refer to IEC 60598-1) | | N |
| (4.11) | Electrical connections | | P |
| (4.11.1) | Contact pressure | | N |
| (4.11.2) | Screws: | | N |
| | - self-tapping screws | | N |
| | - thread-cutting screws | | N |
| (4.11.3) | Screw locking: | | N |
| | - spring washer | | N |
| | - rivets | | N |
| (4.11.4) | Material of current-carrying parts | | N |
| (4.11.5) | No contact to wood or mounting surface | | N |
| (4.11.6) | Electro-mechanical contact systems | | N |
| (4.12) | Mechanical connections and glands | | N |
| (4.12.1) | Screws not made of soft metal | | N |
| | Screws of insulating material | | N |
| | Torque test: torque (Nm); part..... | | N |
| | Torque test: torque (Nm); part..... | | N |
| | Torque test: torque (Nm); part..... | | N |
| (4.12.2) | Screws with diameter < 3 mm screwed into metal | | N |
| (4.12.4) | Locked connections: | | N |
| | - fixed arms; torque (Nm) | | N |
| | - lampholder; torque (Nm) | | N |
| | - push-button switches; torque 0,8 Nm | | N |

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|----------|--------------------|-----------------|---------|
| Clause | Requirement + Test | Result - Remark | Verdict |

| | | | |
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| (4.12.5) | Screwed glands; force (Nm)..... : | | N |
|----------|-----------------------------------|--|---|

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| 18 (18) | RESISTANCE TO HEAT, FIRE AND TRACKING | | N |
| | Resistance to Heat, Fire and Tracking in compliance with IEC 61347-1 (clause numbers between parentheses refer to IEC 61347-1) | | N |
| (18.1) | Ball-pressure test: | | N |
| | - part tested; temperature (°C)..... : | | N |
| | - part tested; temperature (°C)..... : | | N |
| | - part tested; temperature (°C)..... : | | N |
| (18.2) | Test of printed boards | | N |
| | - part tested..... : | | N |
| | - part tested..... : | | N |
| (18.3) | Glow-wire test (650°C): | | N |
| | - part tested..... : | | N |
| | - part tested..... : | | N |
| (18.4) | Needle flame test (10 s): | | N |
| | - part tested..... : | | N |
| | - part tested..... : | | N |
| (18.5) | Tracking test: | | N |
| | - part tested..... : | | N |
| | - part tested..... : | | N |

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| 19 (19) | RESISTANCE TO CORROSION | | N |
| | Rust protection: | | N |
| | - test according 4.18.1 of IEC 60598-1 | | N |
| | - adequate varnish on the outer surface | | N |

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| 20 | INFORMATION FOR LUMINAIRE DESIGN | | N |
| | Information in Annex D | | — |

| | | | |
|-----------|------------------------|--|----------|
| 21 | HEAT MANAGEMENT | | N |
| 21.1 | General | | N |

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| Clause | Requirement + Test | Result - Remark | Verdict |
| | Exchangeability is safeguarded by cap or base | | N |
| 21.2 | Heat-conducting foil and paste | | N |
| | Heat-conducting foil delivered with the module if necessary | | N |
| 21.4 | Construction | | N |
| | Electrical connection and mechanical holding are separate | | N |

| 14 | TABLE: tests of fault conditions | P |
|---------------------|--|----------|
| Test voltage 230Vac | | |
| Part | Simulated fault | Hazard |
| BD1 | S-C, Unit shut down immediately. F1 open, Unrecoverable. No damage | No |
| MOV | S-C, Unit shut down immediately. F1 open, Unrecoverable. No damage | No |
| C1 | S-C, Unit work normal. No damage | No |
| RX2 | S-C, Unit work normal. No damage | No |
| RES1 | S-C, Unit work normal. No damage | No |
| Output load | Adjust to 1.5 times with rated power, 15 minutes; the temperature does not change by more than 5 K in 1 h. LED bead 67.2°C, spread below the module shall not ignite | No |

| ANNEX 1: components | | | | | | |
|---------------------|------|--|------------|----------------|-----------|-----------------------|
| object/part No. | Code | manufacturer/ trademark | type/model | technical data | standard | mark(s) of conformity |
| MOV | B | Guangdong South Hongming Electronic Science and Technology Co., Ltd. | ZVR-07D471 | 250Vac | IEC 61051 | VDE 40027789 |
| PCB | B | ACCELERATED PRINTED CIRCUIT BOARD CO LTD | APC-TC-1 | V-0, 160°C | UL 796 | UL E248209 |
| Fuse | B | AEM Components (Suzhou) Co. Ltd. | MF2410 | AC250V, 1A | IEC 60127 | VDE 40034853 |

The codes above have the following meaning:

- A - The component is replaceable with another one, also certified, with equivalent characteristics
- B - The component is replaceable if authorised by the test house
- C - Integrated component tested together with the appliance
- D - Alternative component

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|----------|--------------------|-----------------|---------|
| Clause | Requirement + Test | Result - Remark | Verdict |

Attachment 1: Attachment according to EN 62471

| | | | |
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| 4 | EXPOSURE LIMITS | | P |
| | Contents of the whole Clause 4 of IEC 62471: 2006 moved into a new informative Annex ZB | | P |
| | Clause 4 replaced by the following: | | P |
| | Limits of the Artificial Optical Radiation Directive(2006/25/EC) have been applied instead of those fixed in IEC 62471: 2006 | See the 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 $10^4 \text{ cd}\cdot\text{m}^{-2}$ | $>10^4 \text{ cd}\cdot\text{m}^{-2}$ | P |
| 4.3 | Hazard exposure limits | | P |
| 4.3.1 | Actinic UV hazard exposure limit for the skin and Eye | | P |
| | The exposure limit for effective radiant exposure is $30 \text{ J}\cdot\text{m}^{-2}$ within any 8-hour period | | P |
| | To protect against injury of the eye or skin from ultraviolet radiation exposure produced by a broadband source, the effective integrated spectral irradiance, E_s , of the light source shall not exceed the levels defined by: | $E_s=4.0\times 10^{-4} \text{ W}\cdot\text{m}^{-2}$ | P |
| | <p>400</p> $E_s \cdot t = \sum_{200}^{\infty} E_{\lambda}(\lambda, t) \cdot s_{UV}(\lambda) \cdot \Delta\lambda \leq 30 \text{ J}\cdot\text{m}^{-2}$ | | P |
| | The permissible time for exposure to ultraviolet radiation incident upon the unprotected eye or skin shall be computed by: | | P |
| | $t_{\max}=30/E_s$ | $t_{\max}=30/(4.0\times 10^{-4})=7.5\times 10^4 \text{ s}$ | P |
| 4.3.2 | Near-UV hazard exposure limit for eye | | P |

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| Clause | Requirement + Test | Result - Remark | Verdict |
| | For the spectral region 315 nm to 400 nm (UV-A) the total radiant exposure to the eye shall not exceed 10000 J.m ⁻² for exposure times less than 1000s. For exposure times greater than 1000 s (approximately 16 minutes) the UV-A irradiance for the unprotected eye, E _{UVA} , shall not exceed 10 W.m ⁻² | E _{UVA} =1.8×10 ⁻⁴ W.m ⁻² | P |
| | The permissible time for exposure to ultraviolet radiation incident upon the unprotected eye for time less than 1000 s, shall be computed by: | | N |
| | $t_{\max} \leq 10000/E_{UVA} \text{ s}$ | | N |
| 4.3.3 | Retinal blue light hazard exposure limit | $\alpha=0.011\text{rad}$ | P |
| | To protect against retinal photochemical injury from chronic blue-light exposure, the integrated spectral radiance of the light source weighted against the blue-light hazard function, B(λ), i.e., the blue-light weighted radiance, LB, shall not exceed the levels defined by: | | P |
| | $LB \cdot t = \sum_{300}^{700} L(\lambda, t) \cdot B(\lambda) \cdot \Delta\lambda \leq 10^6 \text{ J} \cdot \text{m}^{-2} \cdot \text{sr}^{-1}$ | | N |
| | $LB = \sum_{300}^{700} L \cdot B(\lambda) \cdot \Delta\lambda \leq 100 \text{ W} \cdot \text{m}^{-2} \cdot \text{sr}^{-1}$ | L _B =7.56×10 ³ W.m ⁻² .sr ⁻¹ | P |
| 4.3.4 | Retinal blue light hazard exposure limit - small source | | N |
| | Thus the spectral irradiance at the eye E _λ , weighted against the blue-light hazard function B(λ) shall not exceed the levels defined by: see table 4.2 | | N |
| | $EB \cdot t = \sum_{300}^{700} E(\lambda, t) \cdot B(\lambda) \cdot \Delta\lambda \leq 100 \text{ J} \cdot \text{m}^{-2}$ | | N |
| | $EB = \sum_{300}^{700} E \cdot B(\lambda) \cdot \Delta\lambda \leq 1 \text{ W} \cdot \text{m}^{-2}$ | | N |
| 4.3.5 | Retinal thermal hazard exposure limit | | P |

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| Clause | Requirement + Test | Result - Remark | Verdict |
| | To protect against retinal thermal injury, the integrated spectral radiance of the light source, L_{λ} , weighted by the burn hazard weighting function $R(\lambda)$ (from Figure 4.2 and Table 4.2), i.e., the burn hazard weighted radiance, shall not exceed the levels defined by: | | P |
| | $L_R = \sum_{380}^{1400} L_{\lambda} \cdot R(\lambda) \cdot \Delta\lambda \leq \frac{50000}{\alpha \cdot t^{0,25}} \quad \text{W} \cdot \text{m}^{-2} \cdot \text{sr}^{-1}$ | $L_R = 9.0 \times 10^4 \text{ W} \cdot \text{m}^{-2} \cdot \text{sr}^{-1}$ | P |
| 4.3.6 | Retinal thermal hazard exposure limit – weak visual stimulus | | P |
| | For an infrared heat lamp or any near-infrared source where a weak visual stimulus is inadequate to activate the aversion response, the near infrared (780 nm to 1400 nm) radiance, L_{IR} , as viewed by the eye for exposure times greater than 10 s shall be limited to: | | P |
| | $L_{IR} = \sum_{780}^{1400} L_{\lambda} \cdot R(\lambda) \cdot \Delta\lambda \leq \frac{6000}{\alpha} \quad \text{W} \cdot \text{m}^{-2} \cdot \text{sr}^{-1}$ | $t > 10\text{s}, L_{IR} = 17 \text{ W} \cdot \text{m}^{-2} \cdot \text{sr}^{-1}$ | P |
| 4.3.7 | Infrared radiation hazard exposure limits for the eye | | P |
| | The avoid thermal injury of the cornea and possible delayed effects upon the lens of the eye (cataractogenesis), ocular exposure to infrared radiation, E_{IR} , over the wavelength range 780 nm to 3000 nm, for times less than 1000 s, shall not exceed: | | N |
| | $E_{IR} = \sum_{780}^{3000} E_{\lambda} \cdot \Delta\lambda \leq 18000 \cdot t^{-0,75} \quad \text{W} \cdot \text{m}^{-2}$ | | N |
| | For times greater than 1000 s the limit becomes: | | P |
| | $E_{IR} = \sum_{780}^{3000} E_{\lambda} \cdot \Delta\lambda \leq 100 \quad \text{W} \cdot \text{m}^{-2}$ | $E_{IR} = 3.8 \text{ W} \cdot \text{m}^{-2}$ | P |
| 4.3.8 | Thermal hazard exposure limit for the skin | | P |

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|----------|---|--|---------|
| Clause | Requirement + Test | Result - Remark | Verdict |
| | Visible and infrared radiant exposure (380 nm to 3000 nm) of the skin shall be limited to: | | P |
| | $E_H \cdot t = \sum_{380}^{3000} \sum_t E_{\lambda}(\lambda, t) \cdot \Delta t \cdot \Delta \lambda \leq 20000 \cdot t^{0,25} \quad \text{J} \cdot \text{m}^{-2}$ | $E_H \cdot t = 6.3 \text{ W} \cdot \text{m}^{-2} \times 10 \text{ s} = 63 \text{ J} \cdot \text{m}^{-2}$ | P |
| 5 | MEASUREMENT OF LAMPS AND LAMP SYSTEMS | | P |
| 5.1 | Measurement conditions | | P |
| | Measurement conditions shall be reported as part of the evaluation against the exposure limits and the assignment of risk classification. | | P |
| 5.1.1 | Lamp ageing (seasoning) | | N |
| | Seasoning of lamps shall be done as stated in the Appropriate EN lamp standard. | | N |
| 5.1.2 | Test environment | 25.0°C | P |
| | For specific test conditions, see the appropriate EN lamp standard or in absence of such standards, the appropriate national standards or manufacturer's recommendations. | | P |
| 5.1.3 | Extraneous radiation | | P |
| | Careful checks should be made to ensure that extraneous sources of radiation and reflections do not add significantly to the measurement results. | | P |
| 5.1.4 | Lamp operation | | P |
| | Operation of the test lamp shall be provided in accordance with: | | P |
| | – the appropriate EN lamp standard, or | | P |
| | – the manufacturer' s recommendation | | N |
| 5.1.5 | Lamp system operation | | N |
| | The power source for operation of the test lamp shall be provided in accordance with: | | N |

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|----------|--|-----------------|---------|
| Clause | Requirement + Test | Result - Remark | Verdict |
| | – the appropriate EN standard, or | | N |
| | – the manufacturer' s recommendation | | N |
| 5.2 | Measurement procedure | | P |
| 5.2.1 | Irradiance measurements | | P |
| | Minimum aperture diameter 7mm. | | P |
| | Maximum aperture diameter 50 mm. | | P |
| | The measurement shall be made in that position of the beam giving the maximum reading. | | P |
| | The measurement instrument is adequate calibrated. | | P |
| 5.2.2 | Radiance measurements | | P |
| 5.2.2.1 | Standard method | | P |
| | The measurements made with an optical system. | | P |
| | The instrument shall be calibrated to read in absolute radiant power per unit receiving area and per unit solid angle to acceptance averaged over the field of view of the instrument. | | P |
| 5.2.2.2 | Alternative method | | N |
| | Alternatively to an imaging radiance set-up, an irradiance measurement set-up with a circular field stop placed at the source can be used to perform radiance measurements. | | N |
| 5.2.3 | Measurement of source size | | P |
| | The determination of α , the angle subtended by a source, requires the determination of the 50% emission points of the source. | | P |
| 5.2.4 | Pulse width measurement for pulsed sources | | N |
| | The determination of Δt , the nominal pulse duration of a source, requires the determination of the time during which the emission is > 50% of its peak value. | | N |
| 5.3 | Analysis methods | | P |
| 5.3.1 | Weighting curve interpolations | | P |
| | To standardize interpolated values, use linear interpolation on the log of given values to obtain intermediate points at the wavelength intervals desired. | | P |

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|----------|---|---------------------|---------|
| Clause | Requirement + Test | Result - Remark | Verdict |
| 5.3.2 | Calculations | | P |
| | The calculation of source hazard values shall be performed by weighting the spectral scan by the appropriate function and calculating the total weighted energy. | | P |
| 5.3.3 | Measurement uncertainty | | P |
| | The quality of all measurement results must be quantified by an analysis of the uncertainty. | | P |
| 6 | LAMP CLASSIFICATION | | P |
| | For the purposes of this standard it was decided that the values shall be reported as follows: | | P |
| | – for lamps intended for general lighting service, the hazard values shall be reported as either irradiance or radiance values at a distance which produces an illuminance of 500 lux, but not at a distance less than 200 mm | 500 lux at 1530.0mm | P |
| | – for all other light sources, including pulsed lamp sources, the hazard values shall be reported at a distance of 200 mm | | N |
| 6.1 | Continuous wave lamps | | P |
| 6.1.1 | Exempt Group | | N |
| | In the exempt group are lamps, which does not pose any photobiological hazard. The requirement is met by any lamp that does not pose: | | N |
| | – an actinic ultraviolet hazard (ES) within 8-hours exposure (30000 s), nor | | N |
| | – a near-UV hazard (EUVA) within 1000 s, (about 16 min), nor | | N |
| | – a retinal blue-light hazard (LB) within 10000 s (about 2,8 h), nor | | N |
| | – a retinal thermal hazard (LR) within 10 s, nor | | N |
| | – an infrared radiation hazard for the eye (EIR) within 1000 s | | N |
| 6.1.2 | Risk Group 1 (Low-Risk) | | P |

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|----------|---|-----------------|---------|
| Clause | Requirement + Test | Result - Remark | Verdict |
| | In this group are lamps, which exceeds the limits for the except group but that does not pose: | | P |
| | – an actinic ultraviolet hazard (ES) within 10000 s, nor | | P |
| | – a near ultraviolet hazard (EUVA) within 300 s, nor | | P |
| | – a retinal blue-light hazard (LB) within 100 s, nor | | P |
| | – a retinal thermal hazard (LR) within 10 s, nor | | P |
| | – an infrared radiation hazard for the eye (EIR) within 100 s | | P |
| | 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 and to any group of pulses within 0,25 s. | | N |

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|----------|--|-----------------|---------|
| Clause | Requirement + Test | Result - Remark | Verdict |
| | 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 |

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|----------|--------------------|-----------------|---------|
| 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 | |
| 285 | 0,770 | 360 | 0,00013 | |
| 290 | 0,640 | 365* | 0,00011 | |
| 295 | 0,540 | 370 | 0,000093 | |
| 297* | 0,460 | 375 | 0,000077 | |
| 300 | 0,300 | 380 | 0,000064 | |
| 303* | 0,120 | 385 | 0,000053 | |
| 305 | 0,060 | 390 | 0,000044 | |
| 308 | 0,026 | 395 | 0,000036 | |
| 310 | 0,015 | 400 | 0,000030 | |
| ¹ Wavelengths chosen are representative: other values should be obtained by logarithmic interpolation at intermediate wavelengths. * Emission lines of a mercury discharge spectrum. | | | | |

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

| Table 4.2 | Spectral weighting functions for assessing retinal hazards from broadband optical sources | | - |
|------------------|---|------------------------------|---|
| 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 | |

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|--|---------------------------|-------------------------------------|---------|
| Clause | Requirement + Test | Result - Remark | Verdict |
| 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 | $10^{[(450-\lambda)/50]}$ | 1,0 | |
| 600-700 | 0,001 | 1,0 | |
| 700-1050 | 0,013 | $10^{[(700-\lambda)/500]}$ | |
| 1050-1150 | 0,025 | 0,2 | |
| 1150-1200 | 0,05 | $0,2 \cdot 100.02^{(1150-\lambda)}$ | |
| 1200-1400 | 0,10 | 0,02 | |
| <p>* 1 Wavelengths chosen are representative: other values should be obtained by logarithmic interpolation at intermediate wavelengths.</p> <p>* Emission lines of a mercury discharge spectrum.</p> | | | |

| EN 62471 | | | |
|----------|--------------------|-----------------|---------|
| 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 sec | Limiting aperture rad(deg) | EL in items of constant irradiance $W.m^{-2}$ |
| Actinic UV skin & eye | $E_S = \sum E_\lambda \cdot S(\lambda) \cdot \Delta\lambda$ | 200 – 400 | < 30000 | 1,4 (80) | 30/t |
| Eye UV-A | $E_{UVA} = \sum E_\lambda \cdot \Delta\lambda$ | 315 – 400 | ≤ 1000 >1000 | 1,4 (80) | 10000/t 10 |
| Blue-light small source | $E_B = \sum E_\lambda \cdot B(\lambda) \cdot \Delta\lambda$ | 300 – 700 | ≤ 100 >100 | < 0,011 | 100/t 1,0 |
| Eye IR | $E_{IR} = \sum E_\lambda \cdot \Delta\lambda$ | 780 – 3000 | ≤ 1000 >1000 | 1,4 (80) | 18000/t ^{0,75} 100 |
| Skin thermal | $E_H = \sum E_\lambda \cdot \Delta\lambda$ | 380 – 3000 | < 10 | 2π sr | 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 | $L_B = \sum L_\lambda \cdot B(\lambda) \cdot \Delta\lambda$ | 300 – 700 | 0,25 – 10 10-100 100-10000 ≥ 10000 | $0,011 \cdot \sqrt{(t/10)}$ 0,011 $0,0011 \cdot \sqrt{t}$ 0,1 | $10^6/t$ $10^6/t$ $10^6/t$ 100 |
| Retinal thermal | $L_R = \sum L_\lambda \cdot R(\lambda) \cdot \Delta\lambda$ | 380 – 1400 | < 0,25 0,25 – 10 | 0,0017 $0,011 \cdot \sqrt{(t/10)}$ | $50000/(\alpha \cdot t^{0,25})$ $50000/(\alpha \cdot t^{0,25})$ |
| Retinal thermal (weak visual stimulus) | $L_{IR} = \sum L_\lambda \cdot R(\lambda) \cdot \Delta\lambda$ | 780 – 1400 | > 10 | 0,011 | 6000/α |

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| Clause | Requirement + Test | Result - Remark | Verdict |
|--------|--------------------|-----------------|---------|
|--------|--------------------|-----------------|---------|

| Table 6.1 | Emission limits for risk groups of continuous wave lamps base on Directive(2006/25/EC) | | | | | | | | P |
|---|--|-------------------------------------|------------------|-----------------------------------|--------|-----------------------------------|----------------------|-----------------------------------|--------|
| Risk | Action spectrum | Units | Symbol | Exempt | | Low risk | | Mod risk | |
| | | | | Limit | Result | Limit | Result | Limit | Result |
| Actinic UV | Suv(λ) | W.m ⁻² | E _S | 0.001 | -- | 0.003 | 4.0×10 ⁻⁴ | 0.03 | -- |
| Near UV | | W.m ⁻² | E _{UVA} | 0.33 | -- | 33 | 1.8×10 ⁻⁴ | 100 | -- |
| Blue light | B(λ) | W.m ⁻² .sr ⁻¹ | L _B | 100 | -- | 10000 | 7.56×10 ³ | 4000000 | -- |
| Blue light,small source | B(λ) | W.m ⁻² | E _B | 0.01 | -- | 1.0 | - | 400 | -- |
| Retinal thermal | R(λ) | W.m ⁻² .sr ⁻¹ | L _R | 28000/ α $\alpha=0.011$ | -- | 28000/ α $\alpha=0.011$ | 9.0×10 ⁴ | 71000/ α $\alpha=0.011$ | -- |
| Retinal thermal, Weak visual stimulus** | R(λ) | W.m ⁻² .sr ⁻¹ | L _{IR} | 6000/ α $\alpha=0.011$ | -- | 6000/ α $\alpha=0.011$ | 17 | 28000/ α $\alpha=0.011$ | -- |
| IR radiation Eye | | W.m ⁻² | E _{IR} | 100 | -- | 570 | 3.8 | 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

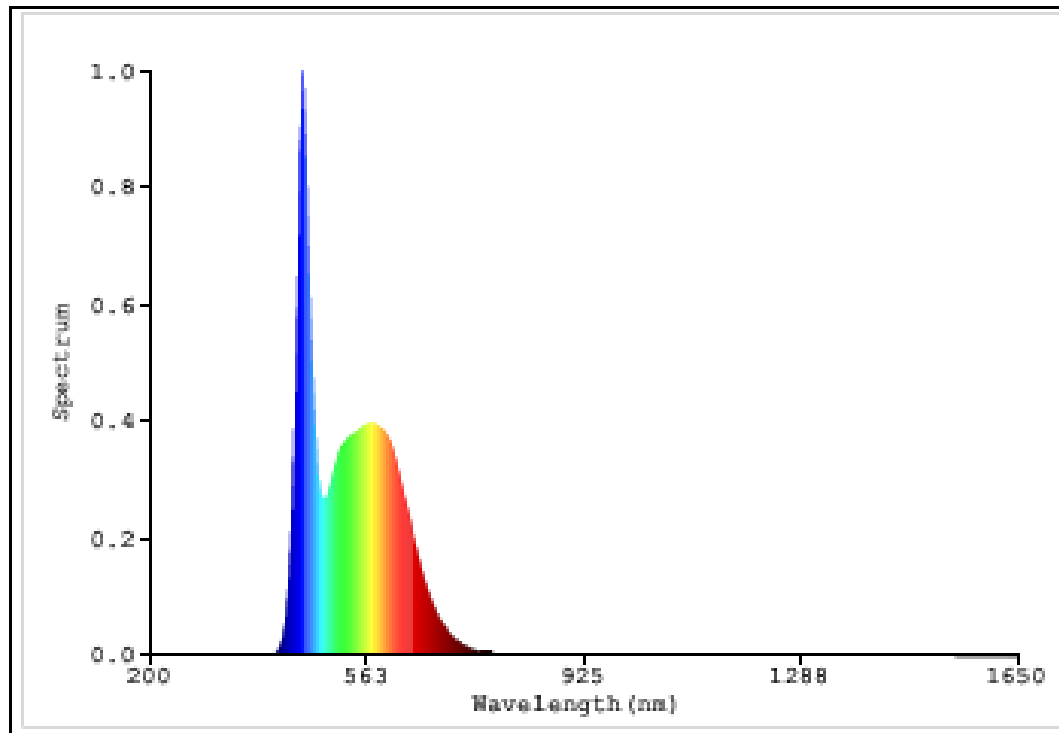
NOTE The action functions: see Table 4.1 and Table 4.2

The appliance apertuer diameters: see 4.2.1

The limitations for the angular subtenses: see 4.2.2

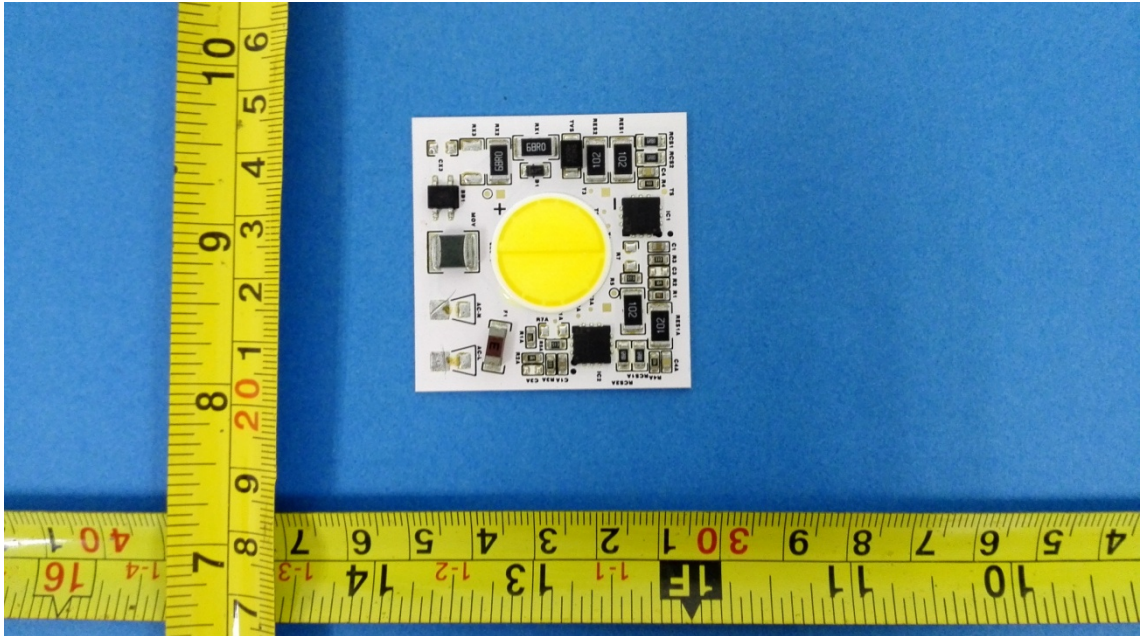
The related measurement condition 5.2.3 and the range of acceptance angles: see Table 5.5

Appendix I Figure of Spectral distribution

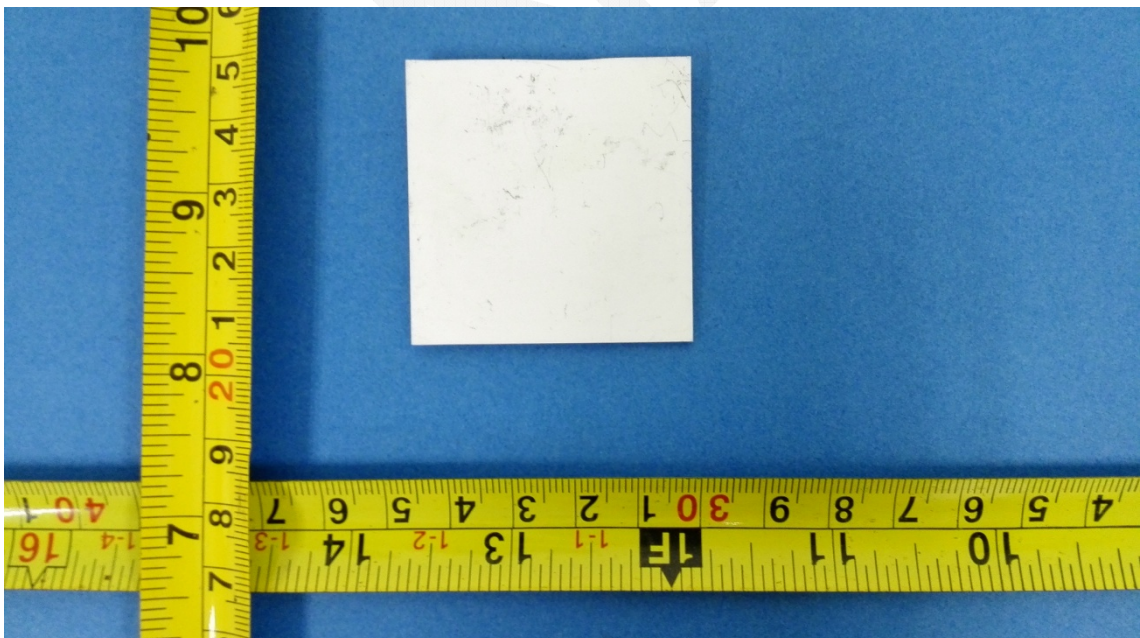


Attachment 2 EUT Photos

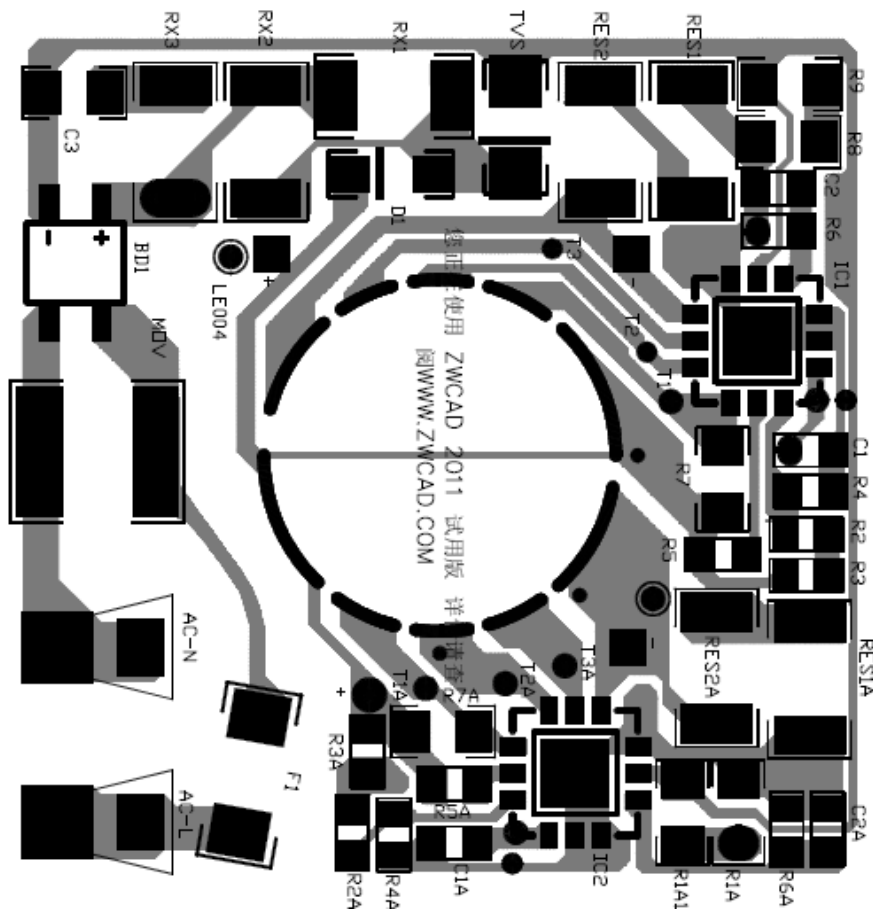
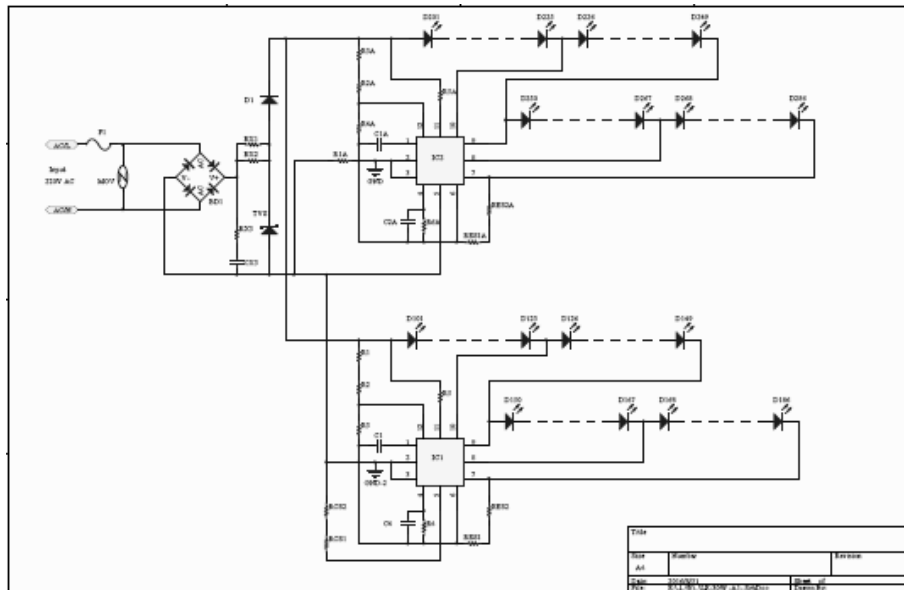
Top view of unit



Bottom view of unit



Attachment 3 Circuit diagram



Attachment 4 Test Equipment List

| BACL# | Equipment Description | Serial No | Model No | Last Cal | Cal Due |
|------------|--------------------------------|-----------------|----------|------------|------------|
| T-08-SF001 | High temperature test chamber | 201105083-3 | DP1000 | 2016-08-29 | 2017-08-29 |
| T-08-SF008 | Hybrid Recorder | 4# | DR240 | 2016-03-04 | 2017-03-03 |
| T-08-SF033 | Joint test finger | 1108039 | FZ-1101A | 2016-05-21 | 2017-05-21 |
| T-08-SF034 | Ball pressure fixture | 1108049 | FZ-1104 | 2016-03-04 | 2017-03-03 |
| T-08-SF077 | Electron Balance | A06AI03094 | 3710A | 2015-11-11 | 2016-11-10 |
| T-08-SF036 | Power meter | 118706019 | AN8721P | 2015-11-03 | 2016-11-02 |
| T-08-SF037 | Needle wire Tester | N/A | FZ-5301A | 2016-03-04 | 2017-03-03 |
| T-08-SF039 | Glow wire tester | N/A | 5101A | 2015-10-30 | 2016-10-29 |
| T-08-SF040 | Humidity tester | 018 463 | ESX-4CA | 2016-03-04 | 2017-03-03 |
| T-08-SF041 | INSULATION TESTER | NH001899 | T0S7200 | 2015-10-30 | 2016-10-29 |
| T-08-SF064 | Torque drive | N/A | 50DPSK | 2015-11-06 | 2016-11-05 |
| T-08-SF068 | AC LEAKAGE CURRENT TESTER | --- | 228 | 2016-07-07 | 2017-07-07 |
| T-08-SF070 | Spring hammer | 1109023 | FZ-1103A | 2015-12-01 | 2016-11-30 |
| T-08-SF071 | Wind cap | FTR0371209 | FTR-3301 | 2015-01-22 | 2020-01-21 |
| T-08-SF072 | Digital Multi meter | 17961914 | 15B | 2016-03-04 | 2017-03-03 |
| T-08-SF074 | Digital Caliper | C10120 15085 | 0-150mm | 2016-03-04 | 2017-03-03 |
| T-08-SF081 | Hi-pot Tester | 1110006-022 | CS2672C | 2016-03-04 | 2017-03-03 |
| T-08-SF191 | AC POWER SUPPLY | N/A | HPC-3145 | 2016-04-01 | 2017-03-31 |
| T-08-SF086 | Stop watch | N/A | TA228 | 2016-03-04 | 2017-03-03 |
| T-08-SF142 | Digital real-time oscilloscope | B035221 | TDS 220 | 2015-11-12 | 2016-11-11 |

-*** End of the report ***