





TEST REPORT IEC 60825-1 Safety of laser products - Part 1: Equipment classification and requirements	
Report Number :	452651 _L
Date of issue :	27 December, 2021
Total number of pages	20 pages
Name of Testing Laboratory preparing the Report	Nemko Taiwan 5 Fl., No. 409, Sec.2, Tiding Blvd., Neihu, Taipei 114, Chinese Taipei
Applicant's name	FENIXLIGHT LIMITED
Address :	2F/3F, West of Building A, Xinghong Technology Park, 111 Shuiku Road, Fenghuanggang Community, Xixiang Street, Bao'an District, Shenzhen City, Guangdong Province, China
Test specification:	
Standard	IEC 60825-1:2014
Test procedure	CB Scheme
Non-standard test method	N/A
TRF template used :	IECEE OD-2020-F1:2021, Ed.1.4
Test Report Form No.	IEC60825_1G
Test Report Form(s) Originator :	OVE
Master TRF	Dated 2021-10-05
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Test item description :	Laser electric	
Trade Mark(s)	FENIX	
Manufacturer	Same as Applicant	
Model/Type reference :	TK30	
Ratings	Discharging mode: Lithium-ion battery 3.6 V, 5000 mAh Lithium-ion battery charging mode: 5 Vdc 2 A	
Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):		
<input checked="" type="checkbox"/>	Testing Laboratory:	Nemko Taiwan
	Testing location/ address :	5 Fl., No. 409, Sec.2, Tiding Blvd., Neihu, Taipei 114, Chinese Taipei
	Tested by (name, function, signature) :	Ryan Chen (Project Handler) 
	Approved by (name, function, signature) ... :	Roy Chou (Verifier) 
<input type="checkbox"/>	Testing procedure: CTF Stage 1:	
	Testing location/ address :	
	Tested by (name, function, signature) :	
	Approved by (name, function, signature) ... :	
<input type="checkbox"/>	Testing procedure: CTF Stage 2:	
	Testing location/ address :	
	Tested by (name + signature)	
	Witnessed by (name, function, signature) . :	
	Approved by (name, function, signature) ... :	
<input type="checkbox"/>	Testing procedure: CTF Stage 3:	
<input type="checkbox"/>	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): N/A	
Summary of testing:	
Tests performed (name of test and test clause): The product was tested and classified according to the following clauses. Clause 4: Classification principles Clause 5: Determination of the accessible emission level and product classification	Testing location: Nemko Taiwan 5 Fl., No. 409, Sec.2, Tiding Blvd., Neihu, Taipei 114, Chinese Taipei
Summary of compliance with National Differences (List of countries addressed): <input checked="" type="checkbox"/> The product fulfils the requirements of IEC 60825-1:2014 and EN 60825-1:2014. (The text of the international Standard IEC 60825-1; 2014 was approved by CENELEC as European Standard without any modification)	

Copy of marking plate:

FENIX TK30 WHITE LASER FLASHLIGHT



**LASER CLASSIFICATION:
CLASS I / CLASS 1**

447nm CLASS 1 LASER PRODUCT
Meet EN/IEC 60825-1: 2014 & IEC 60471:
2006/EN 62471: 2008 Standards

- **NEVER SHINE THE LIGHT
DIRECTLY INTO ANYONE'S EYES.**
- **READ THE MANUAL CAREFULLY
BEFORE USE.**

Test item particulars:	
Classification of installation and use:	Transportable equipment, CLASS 1 LASER PRODUCT
Supply Connection	3.6 Vdc, 5000 mAh
.....:	
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	1 December, 2021
Date (s) of performance of tests	1 to 22 December, 2021
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 <input type="checkbox"/> comma / <input checked="" type="checkbox"/> point is used as the decimal separator.	
When differences exist; they shall be identified in the General product information section.	
Name and address of factory (ies)	FENIXLIGHT LIMITED 2F/3F, West of Building A, Xinghong Technology Park, 111 Shuiku Road, Fenghuanggang Community, Xixiang Street, Bao'an District, Shenzhen City, Guangdong Province, China

General product information and other remarks:

The product is a Laser electric, and the laser excites the fluorescent crystal to produce visible light which contain one white laser lighting module included one laser diode, emits 447 nm typical.

There is a switch at the bottom of the product, which can turn on / off the light source.

There is a button on the side of the product, which can adjust the working mode: strong light, weak light, Blasting flash.

The test of the product was carried out on strong light mode.

The tested sample are complied with the requirements IEC 60825-1:2014 and EN 60825-1:2014, with alternative testing method be evaluated under the IEC 62471:2006 and EN 62471:2008 standards, photobiological safety of lamps systems.

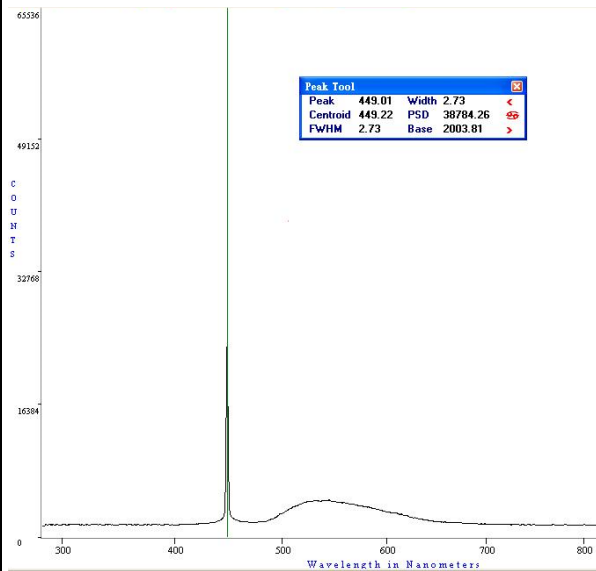
IEC 60825-1			
Clause	Requirement + Test	Result - Remark	Verdict
4	CLASSIFICATION PRINCIPLES		
4.3	Classification rules		---
4.3 a	Radiation of a single wavelength	Single wavelength when configure different laser diode within optic engine, see table of "Measured accessible laser radiation and comparison with AEL".	P
4.3 b	Radiation of multiple wavelengths	Not applicable.	N/A
	1) Laser product emits at two or more wavelengths shown as additive in Table 1		N/A
	2) Laser product emits at two or more wavelengths not shown as additive in Table 1		N/A
4.3 c	Radiation from extended sources (see 5.4.3)	Extended source, see 5.4.3.	P
4.3 d	Non-uniform, non-circular or multiple apparent source		N/A
4.3 e	Time bases		---
	1) 0,25 s	Not applicable.	N/A
	2) 100 s	Applicable time base.	P
	3) 30000 s	Not intentional long-term viewing in the design of function of the product.	P
4.3 f	Repetitively pulsed or modulated lasers	See table of "Measured accessible laser radiation and comparison with AEL".	P
	1) Any single pulse		N/A
	2) Average power for pulse trains		N/A
	3) Pulse duration $t \leq T_i$: Number of pulses N and C_5 :		N/A
	3) Pulse duration $t > T_i$: Number of pulses N and C_5 :		N/A
4.4	Laser products designed to function as conventional lamps.	See below,	P
	α measured at 200 mm distance from closest point of human access ($\alpha > 5$ mrad).	See test report: 448817 TRFPHO of IEC 62471.	P
	Un-weighted radiance L measured at 200 mm distance (comparison with $L_T = 1 \text{ MWm}^{-2}\text{sr}^{-1}/\alpha$) under reasonably foreseeable single fault conditions.	See test report: 448817 TRFPHO of IEC 62471.	P

IEC 60825-1			
Clause	Requirement + Test	Result - Remark	Verdict
	Evaluation of emission according to IEC 62471 series (optional): Standard applied (IEC 62471 series).....: Risk Group.....: Labelling.....: Classification of product based on accessible laser radiation (if no laser radiation accessible: Class 1).	See test report: 448817 of IEC 62471. Compliance with RG1 Group. Laser power measured at the gap of external enclosure shows compliance with Class 1 laser product.	P

5 DETERMINATION OF THE ACCESSIBLE EMISSION LEVEL and PRODUCT CLASSIFICATION			
5.1	Tests	See below,	---
	Compliance under reasonably foreseeable single fault conditions.	See test report: 448817 of IEC 62471	P
5.3	Determination of the class of the laser product ... : For Class 1C: vertical safety standard applied with requirements for Class 1C.	Class 1 laser product.	---
5.4	Measurement geometry		---
5.4.1	General	See test report: 448817 of IEC 62471	---
5.4.2	Default (simplified) evaluation		N/A
	Conditions applied		N/A
	Aperture diameter		N/A
	Reference point :.....		N/A
	Measurement distance		N/A
	(for each condition)		
5.4.3	Evaluation condition for extended sources	See test report: 448817 of IEC 62471	P
	Conditions applied		N/A
	Most restrictive position		N/A
	(distance from reference point)		
	Angular subtense of the apparent source α and C_6 : (for each condition)		N/A
5.4.3 a	Aperture diameters (for each condition).		N/A
5.4.3 b	Angle of acceptance (for each condition).....		N/A

IEC 60825-1			
Clause	Requirement + Test	Result - Remark	Verdict

Measured accessible laser radiation and comparison with AEL:



Measurement distance is 200 mm. LT is radiance dose.

When the product is normal working, the result of Angular Subtense of Apparent Source α is 100 mrad.

$$LT = (1 \text{ MW} \cdot \text{m}^{-2} \cdot \text{sr}^{-1}) / \alpha = 10 \text{ MW} \cdot \text{m}^{-2} \cdot \text{sr}^{-1}$$

Single fault condition conducted when lens breakdown, the test result still under Class 1 laser product.

Supplementary information:

White laser lighting is suitable for the design of traditional lighting products. It contains laser components inside.

1. Energy density change: inside the module, the laser is absorbed by the lens, diffuser, and phosphor, the optical power is reduced from 3.85W to 0.35W, and the optical power density of blue light is reduced from 128333W/mm² to 1.47W/mm², eliminating the laser characteristics of high energy density, and dropped to a lower level than most blue LEDs.
2. Changes in coherence, directionality, and luminescence properties: After the diffuser and the Lambertian diffusion of the phosphor, the luminescent point formed on the surface of the phosphor, the blue light emission is changed from the previous 1° Gaussian beam to the 180° Lambertian Luminous, and from the consistent wave direction in the previous spectrum propagation process, it becomes disordered.
3. Monochromaticity: Since the unabsorbed blue light of 0.35W has not undergone a substantial change in the color of the spectrum, the wavelength has not changed.

Sum up: after the internal optical path is processed, the blue light in the emitted light has a particularly low energy density, which belongs to the monochromatic beam of Lambertian luminescence, and does not have the characteristics of laser high energy density, coherence, directionality, and high risk. Similar to a steel sword, due to the danger of the sharpness of the tip and blade, it is a controlled knife, but it has been melted and re-made into a steel bowl for eating. It has lost its danger and cannot be used as a controlled knife. The standard of the tool is controlled. Before and after the change, the only thing in common is that the inherent property (steel) of the material itself has not changed.

IEC 60825-1			
Clause	Requirement + Test	Result - Remark	Verdict
6	ENGINEERING SPECIFICATIONS		
6.2	Protective housing		---
6.2.1	General		---
	Protective housing prevents access to energy levels in excess of the AEL for Class 1.	Equipment configures with total enclosure for protective housing prevent access to energy levels to excess AEL of Class 1 laser, single fault condition conducted when lens breakdown, the test result still under Class 1 laser product.	P
	Protective housing prevents access to energy levels equivalent to Class 4 and withstands exposures under reasonably foreseeable single fault conditions.		N/A
	Maintenance of Class 1, 1C, 1M, 2, 2M, or 3R (access to emissions of Class 3B or 4 is prevented).		N/A
	Maintenance of Class 3B product (access to emission of Class 4 is prevented).		N/A
6.2.2	Service		N/A
6.2.3	Removable laser system (laser system complies with requirements of Clauses 6 and 7).		N/A
6.3	Access panels and safety interlocks		---
6.3.1	Panel is intended to be removed during operation (or maintenance) and would give access to higher energy levels (see Table 13).	Not applicable.	N/A
	Accessible emission (after removal of the panel) corresponds to product Class (designated by "X" in Table 13)		N/A
	Emission through the opening if interlocked panel of Class 1, 1C, 1M, 2, or 2M is removed (Emission < AEL of Class 1M or 2M).		N/A
	Emission through the opening if interlocked panel of Class 3R, 3B, or 4 is removed (Emission < AEL of Class 3R).		N/A
	Requirements regarding reasonably foreseeable single fault condition.		N/A
6.3.2	Override mechanism		N/A
	Behaviour of override in operation when the panel is replaced.		N/A

IEC 60825-1			
Clause	Requirement + Test	Result - Remark	Verdict
	Visible or audible warning for override mode.		N/A
6.4	Remote interlock connector	Class 1 laser product.	N/A
6.5	Manual reset	Class 1 laser product.	N/A
6.6	Key control	Class 1 laser product.	N/A
6.7	Laser radiation emission warning		---
6.7.1	Laser product is a 3R ($\lambda < 400$ nm; $\lambda > 700$ nm), 1C, 3B or 4 laser systems.	Class 1 laser product.	N/A
6.7.2	Audible or visible warning.	Class 1 laser product.	N/A
	Warning is failsafe or redundant.		N/A
	Viewing of the visible warning does not require exposure to emissions > AEL for Class 1M and 2M.		N/A
6.7.3	Operational control and laser aperture are provided with a warning device when they are separated more than 2 m from warning device.		N/A
6.7.4	Visible indication of output aperture if laser emission may be distributed through more than one output.		N/A
6.7.5	Switch for handheld Class 3R device must be depressed for emission (in lieu of emission indicator).		N/A
6.8	Beam stop or attenuator	Class 1 laser product.	N/A
6.9	Controls	Class 1 laser product.	N/A
6.10	Viewing optics	Class 1 laser product, not applicable.	N/A
	a) Human access to laser radiation in excess of Class 1M prevented when the shutter is opened or attenuation varied.		N/A
	b) Opening of the shutter or variation of the attenuation prevented when exposure to laser radiation in excess of Class 1M is possible.		N/A
6.11	Scanning safeguard	No scanning laser.	N/A
6.12	Safeguard for Class 1C products	Class 1 laser product, not applicable.	N/A
	a) Human access to laser radiation in excess of AEL for Class 1 measured under Condition 3 is prevented.		N/A
	b) Human access to laser radiation in excess of AEL for Class 3B measured through 3,5 mm aperture at 5 mm distance from applicator is prevented.		N/A
6.13	Walk-in access		N/A

IEC 60825-1			
Clause	Requirement + Test	Result - Remark	Verdict
	a) Means provided so that any person inside the housing can prevent activation of Class 3B or 4 laser hazards.	Class 1 laser product, not applicable.	N/A
	b) A warning device provides adequate warning of emission to any person within the housing.		N/A
	c) Where "walk-in" access during operation is intended or reasonably foreseeable, emission of laser radiation that is equivalent to Class 3B or 4 while someone is present inside the enclosure of Class 1, Class 2 or Class 3R product is prevented by engineering means.		N/A
6.14	Environmental conditions		---
	- climatic conditions	The environmental conditions do not have influence to the laser safety result.	P
	- vibration and shock	See above.	P
6.15	Protection against other hazards		---
6.15.1	Non-optical hazards (product safety standard)	No such non-optical hazards.	N/A
	- electrical hazards;		N/A
	- excessive temperature;		N/A
	- spread of fire from the equipment;		N/A
	- sound and ultrasonics;		N/A
	- harmful substances;	No harmful substances.	N/A
	- explosion;		N/A
6.15.2	Collateral radiation	No collateral radiation.	N/A
6.16	Power limiting circuit		N/A

7	LABELLING		
7.1	General		---
	Labels durable, permanently affixed	Considered.	P
	Labels clearly visible	Considered.	N/A
	Reading of labels is possible without exposure to laser radiation in excess of AEL for Class 1.	Not applicable for Class 1 laser product.	N/A
	Colour combination	Class 1 laser product.	N/A
	Labelling impractical due to the size or design of the product.	Class 1 laser product.	N/A
	Warning label – Hazard symbol (Figure 3)	Class 1 laser product.	N/A


IEC 60825-1			
Clause	Requirement + Test	Result - Remark	Verdict
7.2 - 7.7	Text on explanatory label or pictogram (laser class, warning text)	See Copy of marking plate.	P
7.8	Aperture label	Not applicable for Class 1 laser product.	N/A
7.9	Radiation output and standards information	The Class 1 laser product information and Name and publication date of the standard are provided in the user manual.	---
	Max output of laser radiation	Not applicable for Class 1 laser product.	N/A
	Pulse duration	Continuous radiation.	N/A
	Emitted wavelength(s)	447 nm typical.	P
	Name and publication date of the standard	IEC 60825-1: 2014	P
7.10	Labels for access panels		---
7.10.1 a) – f)	Labels for panels - warning wording used	Class 1 laser product, not applicable.	N/A
7.10.2	Labels for safety interlocked panels - Warning wording used		N/A
7.11	Warning for invisible laser radiation		N/A
7.12	Warning for visible laser radiation		N/A
7.13	Warning for potential hazard to the skin or anterior parts of the eye - warning wording used		N/A

8	OTHER INFORMATIONAL REQUIREMENTS		
8.1	Information for the user		---
	a) adequate instructions for assembly, maintenance and safe use and description of the classification limitations, if appropriate.	Adequate laser safety related information and instructions are provided in product manual	P
	b) additional warning for Class 1M and 2M	Class 1 laser product.	N/A
	c) laser beam parameters for radiation above the AEL of Class 1	Class 1 laser product.	---
	• Wavelength	447 nm typical	P
	• Beam divergence	Not applicable.	N/A
	• Pulse pattern (pulse duration, repetition rate, ...)		N/A
	• Maximum power or energy output		N/A

IEC 60825-1			
Clause	Requirement + Test	Result - Remark	Verdict
	d) safety instruction for embedded laser products and other incorporated laser products.	Provided in the user manual.	P
	e) MPE and NOHD for Class 3B and 4 laser products; For collimated beam Class 1M and 2M lasers the extended NOHD (ENOHD).		N/A
	f) information for the selection of eye protection.		N/A
	g) reproduction of all required labels and warnings.	See clause 7.2 for Class 1 laser product	P
	h) location of laser apertures		N/A
	i) list of controls, adjustments of procedures for operation and maintenance - and warning statement.		N/A
	j) information (compatibility requirements) about laser energy source if not incorporated.		N/A
	k) additional warning for Class 1, 1M, 2, 2M, and 3R regarding skin or corneal burns.	See clause 7.2 for Class 1 laser product	P
	l) Information for Class 1C products (e.g. warning that repeated application may pose a risk).		N/A
8.2	Purchasing and service information	Provided in the user manual.	P
	a) safety classification of each laser product stated in all descriptive material (e.g. brochures).		P
	b) adequate instructions for servicing available: <ul style="list-style-type: none"> warnings and precautions regarding exposure of laser emission above Class 1 maintenance schedule list of controls and procedures that could increase accessible emissions description of displaceable parts protective procedures for service personnel reproduction of labels and hazard warnings 		P

9 ADDITIONAL REQUIREMENTS FOR SPECIFIC LASER PRODUCTS			
9.1	Applicable other parts of the standard series IEC 60825		---
	IEC 60825-2 (Safety of optical communication systems)	Not applicable.	N/A
	IEC 60825-4 (Laser guards)		N/A
	IEC 60825-12 (Safety of free space optical communication systems used for transmission of information)		N/A

IEC 60825-1			
Clause	Requirement + Test	Result - Remark	Verdict
9.2	Medical laser products: Class 3B and Class 4 medical laser products comply with IEC 60601-2-22		N/A
9.3	Laser processing machines: Comply with IEC/ISO 11553 series.		N/A
9.4	Electric toys: Comply with IEC 62115		N/A
9.5	Consumer electronic products: Comply with IEC 60950 (IT-equipment) or IEC 60065 (AV equipment)		N/A

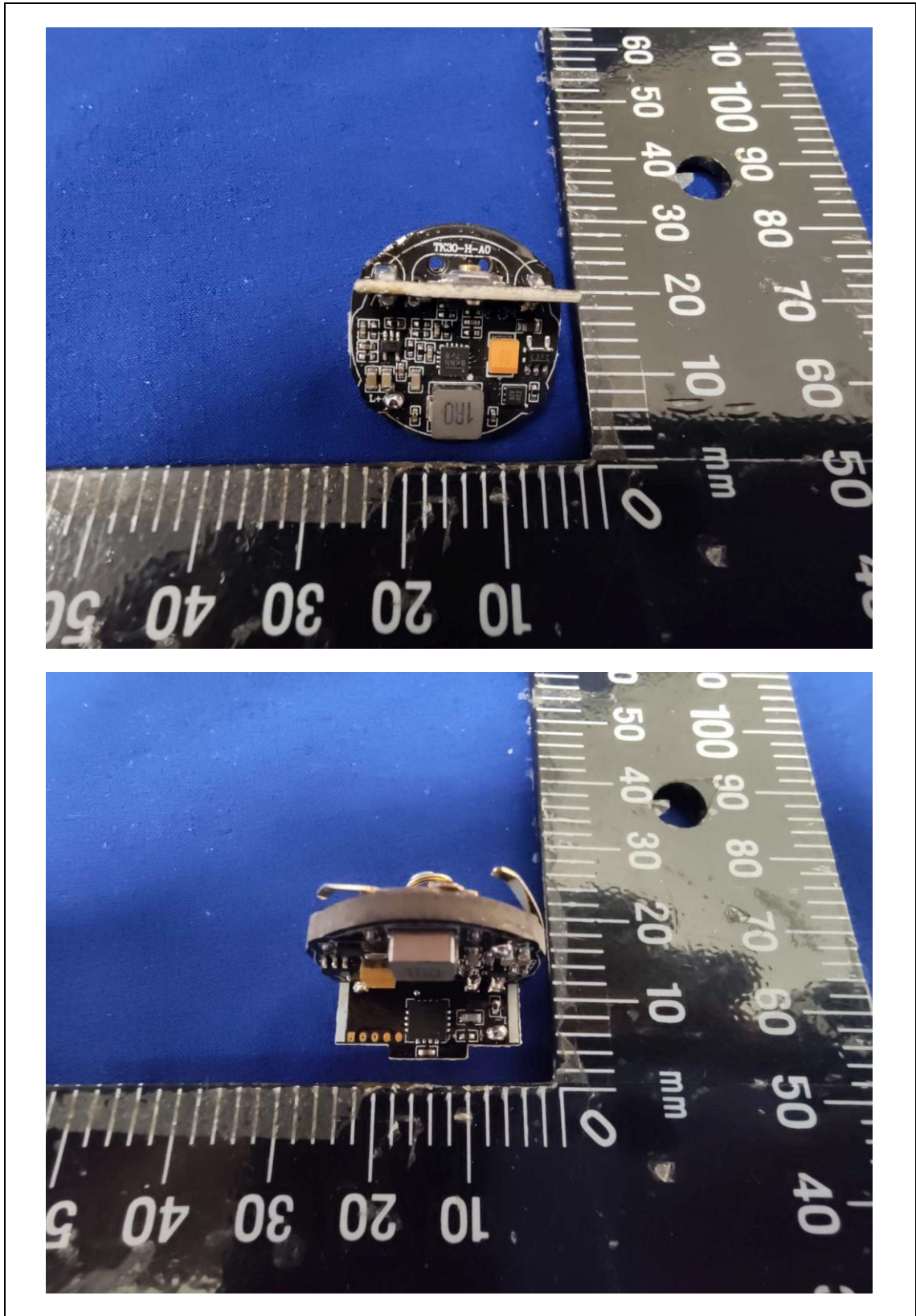
TABLE: Critical components information					
Object / part No.	Manufacturer/ trademark	Type / model	Technical data	Standard	Mark(s) of conformity ¹⁾
- Description:					
White laser lighting module	Shanghai Blue Lake Lighting Technology Co., Ltd.	WP-RX	Input 4-4.8V @ 2.5A, DC 0.5~2.5A constant current power consumption: 10.5W 2.5A	IEC 60825-1: 2014	Test in equipment.
- Laser diode		PLPT9 450LA_E	Wavelength: 447 nm typical, 437 nm min. 460 nm max. optical output: power: (3.0) W (typ.)	IEC 60825-1: 2014	Test in equipment.
Supplementary information: ¹⁾ Provided evidence ensures the agreed level of compliance. See OD-CB2039.					

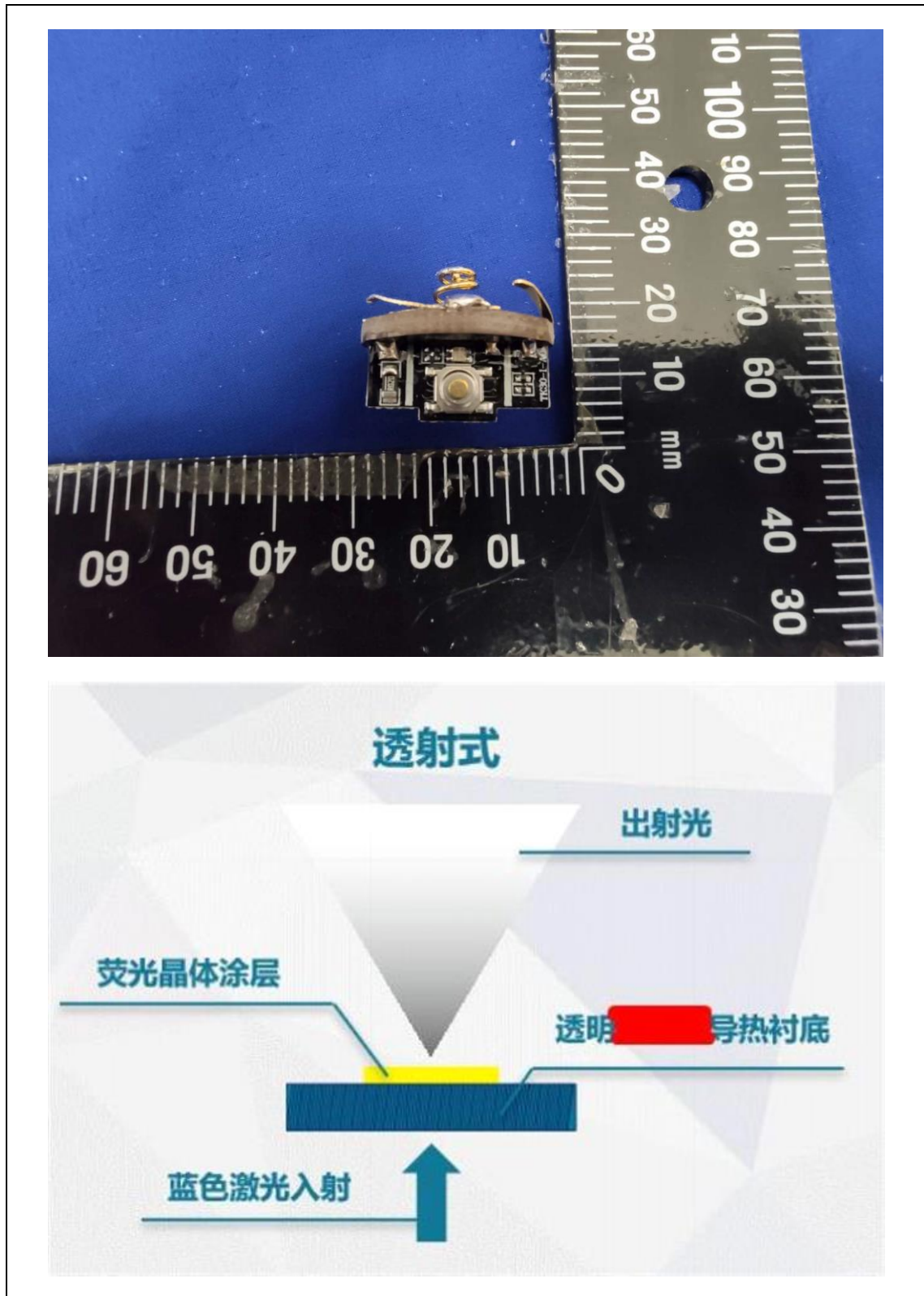
Further remarks:

N/A

ANNEX A (Photos):







ANNEX B: Laser diode specification

PLPT9 450LA_E

Characteristics

$P_{opt} = 3.0 \text{ W}$; $T_{case} = 25 \text{ °C}$

Parameter	Symbol		Values
Operating current ¹⁾	I_{op}	typ. max.	2.0 A 2.4 A
Centroid wavelength	$\lambda_{centroid}$	min. typ. max.	437 nm 447 nm 460 nm
Optical output power	P_{opt}	typ.	3.0 W
Beam divergence ($1/e^2$) parallel to pn-junction	$\Theta_{ }$	min. typ. max.	6 ° 8.5 ° 12 °
Beam divergence ($1/e^2$) perpendicular to pn-junction	Θ_{\perp}	min. typ. max.	40 ° 48 ° 55 °
Threshold current	I_{th}	typ. max.	0.27 A 0.35 A
Forward voltage ²⁾	V_F	typ. max.	4.3 V 5 V
Total power dissipation	P_{tot}	typ.	5.5 W
TE polarization	P_{TE}	typ.	100:1
Thermal resistance junction case real	R_{thJC}	typ.	10 K / W

- End of test report -