TEST REPORT

Product Name : **DTOF LiDAR**

Model Number : **LiDAR_LD19_LD, LiDAR_LD12, LiDAR_LD06R, LiDAR_LD06Y_LD,LiDAR_LD06_DM,LiDAR_LD06, LiDAR_LD06_PB**

Prepared for	:	SHENZHEN LDROBOT CO.,LTD
Address	:	16/F,BLOCK A, BUILDING 6,INTERNATIONAL INNOVATION VALLEY,NANSHAN DISTRICT, SHENZHEN,PRC
Prepared by	:	EMTEK(Dongguan) CO., LTD.
Address	:	-1&2F., Building 2, Zone A, Zhongda Marine Biotechnology Research and Development Base, No. 9, Xincheng Avenue, Songshanhu High-technology Industrial Development Zone, Dongguan, Guangdong, China Tel: +86-769-22807078 Fax: +86-769-22807079

Report Number	:	ED210622082L
Date(s) of Tests	:	June 25, 2021
Date of issue	:	August 12, 2021

TEST REPORT

IEC 60825-1

Safety of laser products -

Part 1: Equipment classification and requirements

Report reference No. ..... :	ED210622082L
Tested by ..... :	Tim Zhou
Approved by ..... :	June Luo
Date of issue ..... :	August 12, 2021
Contents ..... :	14 pages

Testing laboratory

Name ..... :	EMTEK(Dongguan) CO., LTD.
Address ..... :	-1&2F., Building 2, Zone A, Zhongda Marine Biotechnology Research and Development Base, No. 9, Xincheng Avenue, Songshanhu High-technology Industrial Development Zone, Dongguan, Guangdong, China
Testing location ..... :	Same as above

Client

Applicant name ..... :	SHENZHEN LDROBOT CO.,LTD
Address ..... :	16/F,BLOCK A, BUILDING 6,INTERNATIONAL INNOVATION VALLEY,NANSHAN DISTRICT, SHENZHEN,PRC
Manufacturer name ..... :	SHENZHEN LDROBOT CO.,LTD
Address ..... :	16/F,BLOCK A, BUILDING 6,INTERNATIONAL INNOVATION VALLEY,NANSHAN DISTRICT, SHENZHEN,PRC
Factory name 1 ..... :	SHENZHEN LDROBOT CO.,LTD
Address ..... :	16/F,BLOCK A, BUILDING 6,INTERNATIONAL INNOVATION VALLEY,NANSHAN DISTRICT, SHENZHEN,PRC

Test specification

Standard ..... :	IEC 60825-1:2014
Test procedure ..... :	Safety

Test item

Product name ..... :	DTOF LiDAR
Trademark ..... :	
Model and/or type reference ..... :	LiDAR_LD19_LD, LiDAR_LD12, LiDAR_LD06R, LiDAR_LD06Y_LD, LiDAR_LD06_DM, LiDAR_LD06,LiDAR_LD06_PB
Rating(s) ..... :	DC5V, 0.2A

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..... : June 22, 2021

Date (s) of performance of tests..... : June 25, 2021

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 ☐ comma / ☒ point is used as the decimal separator.

General product information:

1. BOSA information:

Object No.	Model	Manufacturer	Technical data
Laser Diode	RLD90QZW5-10B	ROHM Co., Ltd.	DC14-20V 895nm-915nm

2.Sample No.: ED210622082L-001
3.The product has a dustproof function.
4. Above models are identical except for model names and appearance. Full tests were performed on LiDAR_LD19_LD.

Copy of marking plate:

N/A

IEC 60825-1			
Clause	Requirement + Test	Result - Remark	Verdict
4	**CLASSIFICATION PRINCIPLES**		
4.3	Classification rules		---
4.3 a	Radiation of a single wavelength		P
4.3 b	Radiation of multiple wavelengths		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)		N/A
4.3 d	Non-uniform, non-circular or multiple apparent source		N/A
4.3 e	Time bases		---
	1) 0,25 s		N/A
	2) 100 s	Class 1	P
	3) 30000 s		N/A
4.3 f	Repetitively pulsed or modulated lasers		P
	1) Any single pulse		P
	2) Average power for pulse trains		P
	3) Pulse duration $t \leq T_i$ ..... : Number of pulses N and C_5..... :		P
	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.		N/A
	measured at 200 mm distance from closest point of human access (α> 5 mrad).		N/A
	Un-weighted radiance L measured at 200 mm distance (comparison with L_T = 1 $MWm^{-2}sr^{-1}/\alpha$) under reasonably foreseeable single fault conditions.		--
	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).		--

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

5	**DETERMINATION OF THE ACCESSIBLE EMISSION LEVEL and PRODUCT CLASSIFICATION**		
5.1	Tests		---
	Compliance under reasonably foreseeable single fault conditions.		N/A
5.3	Determination of the class of the laser product ... : For Class 1C: vertical safety standard applied with requirements for Class 1C.		---
5.4	Measurement geometry		---
5.4.1	General		---
5.4.2	Default (simplified) evaluation		P
	Conditions applied ..... :	Condition 3	P
	Aperture diameter ..... :	Condition 3: 7 mm	P
	Reference point : ..... :	Focal point	P
	Measurement distance ..... : (for each condition)	Condition 3: 100 mm	P
5.4.3	Evaluation condition for extended sources		N/A
	Conditions applied ..... :		N/A
	Most restrictive position ..... : (distance from reference point)		N/A
	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

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.		N/A
	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

IEC 60825-1			
Clause	Requirement + Test	Result - Remark	Verdict
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).		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
	Visible or audible warning for override mode.		N/A
6.4	Remote interlock connector		N/A
6.5	Manual reset		N/A
6.6	Key control		N/A
6.7	Laser radiation emission warning		---
6.7.1	Laser product is a 3R (λ<400 nm; λ>700 nm), 1C, 3B or 4 laser systems.		N/A
6.7.2	Audible or visible warning.		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		N/A
6.9	Controls		N/A

IEC 60825-1			
Clause	Requirement + Test	Result - Remark	Verdict
6.10	Viewing optics		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		P
6.12	Safeguard for Class 1C products		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
	a) Means provided so that any person inside the housing can prevent activation of Class 3B or 4 laser hazards.		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		N/A
	- vibration and shock		N/A
6.15	Protection against other hazards		---
6.15.1	Non-optical hazards (product safety standard)		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;		N/A
	- explosion;		N/A
6.15.2	Collateral radiation		N/A
6.16	Power limiting circuit		N/A

IEC 60825-1			
Clause	Requirement + Test	Result - Remark	Verdict
7	**LABELLING**		
7.1	General		---
	Labels durable, permanently affixed		N/A
	Labels clearly visible		N/A
	Reading of labels is possible without exposure to laser radiation in excess of AEL for Class 1.		N/A
	Colour combination		N/A
	Labelling impractical due to the size or design of the product.	Class 1	P
	Warning label – Hazard symbol (Figure 3)		N/A
7.2 - 7.7	Text on explanatory label or pictogram (laser class, warning text)		N/A
7.8	Aperture label		N/A
7.9	Radiation output and standards information		P
	Max output of laser radiation ..... :	Provide in user manual	P
	Pulse duration ..... :	Provide in user manual	P
	Emitted wavelength(s) ..... :	Provide in user manual	P
	Name and publication date of the standard..... :	Provide in user manual	P
7.10	Labels for access panels		---
7.10.1 a) – f)	Labels for panels - warning wording used ..... :		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.	895-915mm	P
	b) additional warning for Class 1M and 2M		N/A
	c) laser beam parameters for radiation above the AEL of Class 1		---
	• Wavelength ..... :		P
	• Beam divergence ..... :		N/A

IEC 60825-1			
Clause	Requirement + Test	Result - Remark	Verdict
	• Pulse pattern ..... : (pulse duration, repetition rate, …)	1ns, 4500Hz	P
	• Maximum power or energy output ..... :		P
	d) safety instruction for embedded laser products and other incorporated laser products.		N/A
	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.		N/A
	h) location of laser apertures		P
	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.		N/A
	l) Information for Class 1C products (e.g. warning that repeated application may pose a risk).		N/A
8.2	Purchasing and service information		P
	a) safety classification of each laser product stated in all descriptive material (e.g. brochures).		P
	b) adequate instructions for servicing available: • 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		N/A

9	ADDITIONAL REQUIREMENTS FOR SPECIFIC LASER PRODUCTS		
9.1	Applicable other parts of the standard series IEC60825		---
	IEC 60825-2 (Safety of optical communication systems)		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

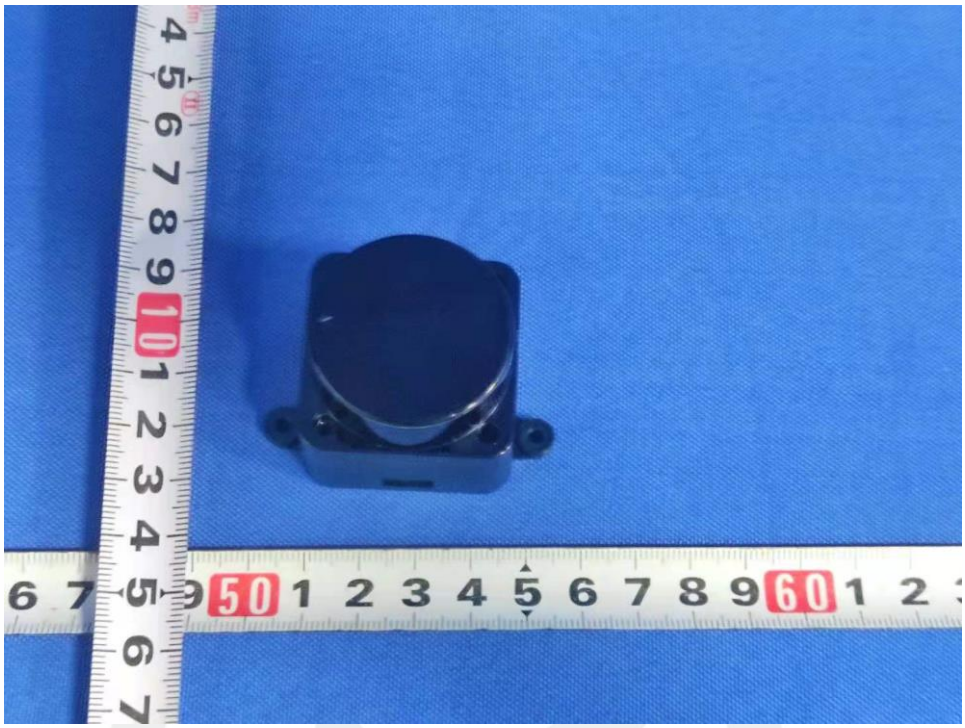
Data:

For Condition 3:

LED Color	Infrared Laser Light
Measurement distance	100 mm
Wavelength	898.0 nm
α	1.5 mrad
C4	2.49
C5	0.122
C6	1
C7	1
Measured maximum emission power / energy on normal condition	5.68×10^{-6} W

Clause	Emission duration	AE (Accessible emission)	AEL
4.3.f.1	1 ns	1.26×10^{-8} J	7.7×10^{-8} C4 J $= 7.7 \times 10^{-8} \times 2.56$ J $= 1.92 \times 10^{-7}$ J
4.3.f.2	100 s	0.0568 mW	3.9×10^{-4} C4 C7 W $= 3.9 \times 10^{-4} \times 2.56 \times 1$ W = 0.971 mW
4.3.f.3	1 ns	1.26×10^{-8} J	1.92×10^{-7} J x C5 $= 1.97 \times 10^{-7}$ J x 0.122 $= 2.34 \times 10^{-8}$ J

Photos:



Overview

Part view

*** End of Report ***

声 明
Statement

1. 本报告无授权批准人签字及“检验报告专用章”无效；
   This report will be void without authorized signature or special seal for testing report.

2. 未经许可本报告不得部分复制；
   This report shall not be copied partly without authorization.

3. 本报告的检测结果仅对送测样品有效，委托方对样品的代表性和资料的真实性负责；
   The test results or observations are applicable only to tested sample. Client shall be responsible for representativeness of the sample and authenticity of the material.

4. 本检测报告中检测项目标注有特殊符号则该项目不在资质认定范围内，仅作为客户委托、科研、教学或内部质量控制等目的使用；

The observations or tests with special mark fall outside the scope of accreditation, and are only used for purpose of commission, research, training, internal quality control etc.

5. 本检测报告以实测值进行符合性判定，未考虑不确定度所带来的风险，本实验室不承担相关责任，特别约定、标准或规范中有明确规定的除外；
The test results or observations are provided in accordance with measured value, without taking risks caused by uncertainty into account. Without explicit stipulation in special agreements, standards or regulations, EMTEK shall not assume any responsibility.

6. 对本检测报告若有异议，请于收到报告之日起 20 日内提出；
Objections shall be raised within 20 days from the date receiving the report.