
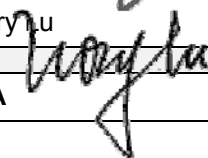




TEST REPORT
IEC 60825-1
Safety of laser products -
Part 1: Equipment classification and requirements

Report Number	GZES160801248631
Date of issue	2016-09-13
Total number of pages	13
Name of Testing Laboratory preparing the Report	SGS-CSTC Standards Technical Services Co., Ltd. Guangzhou Branch 198 Kezhu Road, Science City, Economic & Technology Development Area, Guangzhou, Guangdong, China
Applicant's name	Shanghai Slamtec Co., Ltd.
Address	Room 501, D-Building, No. 666 Shengxia Road, Shanghai, China
Test specification:	
Standard	IEC 60825-1:2014 (Third Edition)
Test procedure	Test Report
Non-standard test method	N/A
Test Report Form No.	IEC60825_1E
Test Report Form(s) Originator	ÖVE
Master TRF	Dated 2014-07
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Test item description	Laser Scanner
Trade Mark	RPLIDAR
Manufacturer	Same as applicant
Model/Type reference	RPLIDAR A2M4-R* (* = 1 ~ 9)
Ratings	5,0 Vd.c. ; 500 mA



Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):	
<input checked="" type="checkbox"/> Testing Laboratory:	SGS-CSTC Standards Technical Services Co., Ltd. Guangzhou Branch
Testing location/ address.....:	198 Kezhu Road, Science City, Economic & Technology Development Area, Guangzhou, Guangdong, China
<input type="checkbox"/> Associated CB Testing Laboratory:	N/A
Testing location/ address.....:	
Tested by (name, function, signature).....:	Change Ye 
Approved by (name, function, signature)....:	Ivory Lu 
<input type="checkbox"/> Testing procedure: TMP/CTF Stage 1:	N/A
Testing location/ address.....:	
Tested by (name, function, signature).....:	
Approved by (name, function, signature)....:	
<input type="checkbox"/> Testing procedure: WMT/CTF Stage 2:	N/A
Testing location/ address.....:	
Tested by (name, function, signature).....:	
Witnessed by (name, function, signature) .:	
Approved by (name, function, signature)....:	
<input type="checkbox"/> Testing procedure: SMT/CTF Stage 3 or 4:	N/A
Testing location/ address.....:	
Tested by (name, function, signature).....:	
Witnessed by (name, function, signature) .:	
Approved by (name, function, signature)....:	
Supervised by (name, function, signature) :	



<p>List of Attachments (including a total number of pages in each attachment): Attachment 1: Photo documentation (total 2 pages). Attachment 2: Differences between IEC 60825 and 21 CFR §1040.10 (total 1 page).</p>	
<p>Summary of testing: Measurement and classification according to clauses 4 and 5 were applied, other clauses were not considered. The pins c/e of Q2 was short-circuited under fault condition. The product fulfils 21 CFR §1040.10</p>	
<p>Tests performed (name of test and test clause): Clause 4 Classification principles Clause 5 Determination of the accessible emission level and product classification</p>	<p>Testing location: SGS-CSTC Standards Technical Services Co., Ltd. Guangzhou Branch 198 Kezhu Road, Science City, Economic & Technology Development Area, Guangzhou, Guangdong, China</p>
<p>Summary of compliance with National Differences: Differences for FDA/21 CFR Part 1040.10: 1985 were taken into account.</p>	
<p>Copy of marking plate N/A</p>	

Test item particulars:	
Classification of installation and use	: Portable
Supply Connection.....	: 5,0 V d.c.
Mass of the equipment	: —
Classification of laser product:	
Laser product class of the equipment.....	: Class 1
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.....	: 2016-08-24
Date (s) of performance of tests.....	: 2016-08-24 to 2016-08-31
General remarks:	
<p>"(See Enclosure #)" refers to additional information appended to the report. "(See appended table)" refers to a table appended to the report.</p> <p>Throughout this report a <input checked="" type="checkbox"/> comma / <input type="checkbox"/> point is used as the decimal separator.</p> <p>When determining for test conclusion, measurement uncertainty of tests has been considered.</p> <p>This document is issued by the Company subject to its General Conditions of Service, available on request or accessible at http://www.sgs.com/en/Terms-and-Conditions.aspx and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at http://www.sgs.com/en/Terms-and-Conditions/Terms-e-Document.aspx. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 30 days only.</p>	
Manufacturer's Declaration per sub-clause 4.2.5 of IEC60825_1E:	
The application for obtaining a CB Test Certificate includes more than one factory location and a declaration from the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> Not applicable

When differences exist; they shall be identified in the General product information section.
Name and address of factory (ies)..... : Same as manufacturer
General product information: The laser product can emit infrared light when powered.

IEC 60825-1			
Clause	Requirement + Test	Result - Remark	Verdict
4	CLASSIFICATION PRINCIPLES		
4.3	Classification rules		—
4.3 a	Radiation of a single wavelength		N/A
4.3 b	Radiation of multiple wavelengths		P
	1) Laser product emits at two or more wavelengths shown as additive in Table 1		P
	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		P
	3) 30000 s		N/A
4.3 f	Repetitively pulsed or modulated lasers		N/A
	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.		N/A
	α measured at 200 mm distance from closest point of human access ($\alpha > 5$ mrad).		N/A
	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.		N/A
	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).		N/A

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.		P
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 1 and Condition 3	P
	Aperture diameter	50 mm (for Condition 1) 7 mm (for Condition 3)	P
	Reference point		N/A
	Measurement distance	2000 mm (for Condition 1) 100 mm (for Condition 3)	P
5.4.3	Evaluation condition for extended sources		N/A
	Conditions applied		N/A
	Most restrictive position		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		N/A
7	LABELLING		N/A
8	OTHER INFORMATIONAL REQUIREMENTS		N/A
9	ADDITIONAL REQUIREMENTS FOR SPECIFIC LASER PRODUCTS		N/A

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

TABLE: Critical components information					
Object / part No.	Manufacturer/ trademark	Type / model	Technical data	Standard	Mark(s) of conformity ¹⁾
Pick up Unit	QSI Co., Ltd.	QL78D6SA	5 mW 1,9 V d.c. 770 - 800 nm	IEC 60825-1	Tested with appliance
Supplementary information: ¹⁾ Provided evidence ensures the agreed level of compliance. See OD-CB2039.					

Measured laser radiation, calculations and comparison with AEL limits:

1. TEST CONDITIONS

(1) General

Temperature: 20 – 25 °C
Relative humidity: Max. 75 %
Power supply: Powered by USB charger

(2) Normal operation

The Laser is simulating normal operation to emit intentional optical power.

(3) Fault condition: Refer to measurement results for single fault conditions

2. MEASUREMENT METHOD

(1) Measurement of wavelength

The wavelength of Laser is measured under normal operation.

(2) Calculation of measurement distance

For condition 1: $r = 2000$ mm.
For condition 3: $r = 100$ mm.

(3) Measurement of radiant power

The radiant power emitted from Laser of the equipment is measured under normal operation.

In case of condition 1, the Laser radiation is collected through a circular aperture stop having a diameter 50 mm and its location is 2000 mm away from the closet point of human access.

In case of condition 3, the Laser radiation is collected through a circular aperture stop having a diameter 7 mm and its location is 100 mm away from the apparent source.

The measurement is performed at a position to detect a maximum radiation emitted from the apparent source.

3. TEST RESULT

(1) Measurement of wavelength

$\lambda = 780$ nm

(2) Calculation of measurement distance

For condition 1: $r = 2000$ mm.
For condition 3: $r = 100$ mm.

The condition 3 is obviously severer than condition 1. Therefore, measurement for condition 1 is omitted.

(3) Measurement of radiant power

Condition 3

Normal operation: $r = 100$ mm

Thermal hazard power: $P = 2,1 \mu\text{W}$

Fault condition: s-c pin c /e of Q2

Thermal hazard power: $P = 2,0 \mu\text{W}$

4. CLASSIFICATION OF LASER/LED RADIATION

(1) Compare the accessible emission level of radiation emitted from Laser of the equipment with the accessible emission limit of certain class. This comparison is evaluated using the measurement value under each condition. Accessible emission levels are measurement value or calculated from the measurement value if necessary.

(2) Time base

The time base is 100 s for wavelength greater than 400 nm or 0,25 s is applied for comparison with AEL of Class 2, Class 2M and Class 3R for wavelength from 400 nm to 700 nm by requirement of clause 4.3(e).

(3) Correction factor for Laser

Correction factor C_4 equals 1,44, C_7 equals 1, for simplified (default) method.

(4) Comparison with AEL

Normal operation:

Type of hazard limit	Measured distance	Wavelength	Emission Duration	Accessible Emission Level	Accessible Emission Limit	Class
Thermal	100 mm	785 nm	100 s	$P = 2,1 \mu\text{W}$	$P = 3,9 \times C_4 C_7 \times 10^{-4} \text{ W}$ $P = 564 \mu\text{W}$	1

Therefore, the Laser product is Class 1 under normal operation.

Fault condition: s-c pin c /e of Q2

Type of hazard limit	Measured distance	Wavelength	Emission Duration	Accessible Emission Level	Accessible Emission Limit	Class
Thermal	100 mm	785 nm	100 s	$P = 2,0 \mu\text{W}$	$P = 3,9 \times C_4 C_7 \times 10^{-4} \text{ W}$ $P = 564 \mu\text{W}$	1

Therefore, the Laser product is Class 1 under fault condition.

Attachment 1: Photo documentation

Details of: [View for the product](#)



Details of: [View for the product](#)

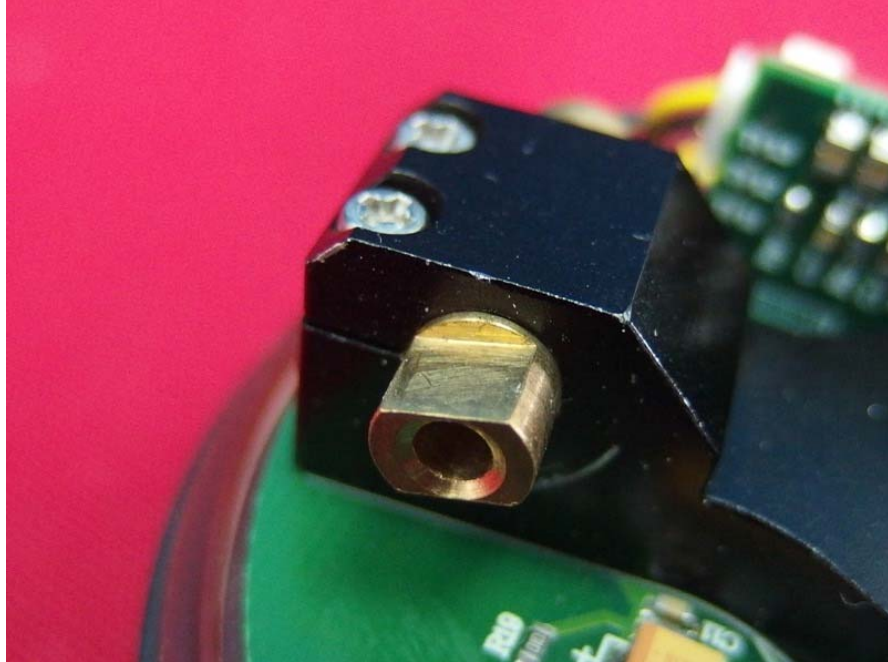


Attachment 1: Photo documentation

Details of: View for the laser module

View:

- general
- front
- rear
- right
- left
- top
- bottom
- internal



Attachment 2: Differences between IEC 60825 and 21 CFR §1040.10

ATTACHMENT TO TEST REPORT IEC 60825 Guidance for Industry and FDA Staff (Laser Notice No. 50) Laser Products	
Differences according to.....:	FDA/21 CFR Part 1040.10: 1985
Attachment Form No.:	IEC60825_1D
Attachment Originator	SGS-CSTC
Master Attachment.....:	2012-08

Classification of laser product:
Laser product class of the equipment: Class I

Comparison with AEL of 21 CFR §1040.10

$k_1 = 1,43$; $k_2 = 80$

Normal operation:

Type of hazard limit	Measured distance	Wavelength	Emission Duration	Accessible Emission Level	Accessible Emission Limit	Class
Thermal	200 mm	780 nm	10000 s	$P = 1,1 \mu W$	$P = 3,9 \times 10^{-7} k_1 k_2 W$ $P = 44,6 \mu W$	I

Therefore, the Laser product is Class I under normal operation.

Fault condition: s-c pin c /e of Q2

Type of hazard limit	Measured distance	Wavelength	Emission Duration	Accessible Emission Level	Accessible Emission Limit	Class
Thermal	200 mm	780 nm	10000 s	$P = 1,0 \mu W$	$P = 3,9 \times 10^{-7} k_1 k_2 W$ $P = 44,6 \mu W$	I

Therefore, the Laser product is Class I under fault condition.

- - - END OF REPORT - - -