

FCC – Maximum Permissible Exposure (MPE) Estimation Report

Report Number	:	60.790.24.079.01S02	Date of Issue:	<u>April 22, 2025</u>
Model/HVIN	:	<u>Bluetooth CAM Lock, Bluetooth Plunger Lock</u>		
Product Type	:	<u>Twist Lock</u>		
Applicant	:	<u>Mobile Technologies Inc.</u>		
Address	:	<u>2345 NE Overlook Drive, Hillsboro OR 97006 United States of America.</u>		
Production Facility (1)	:	<u>Shenzhen Maxway Technology CO., LTD</u>		
Address	:	<u>3F, Building 4, Section A, 3rd Industrial Zone of Tangtou, Shiyan Town, Bao'an District, Shenzhen, China.</u>		
Production Facility (2)	:	<u>Well Star Precision Technology Limited</u>		
Address	:	<u>24 Bao Ta Road, Bao Tang Community, Hou Jie Town, Dongguan City, Guangdong Province, China</u>		
Production Facility (3)	:	<u>VIETNAM IBE LASER TECHNOLOGY COMPANY LIMITED</u>		
Address	:	<u>lot CN-34 and Lot CN-39, Thuan Thanh II industrial zone, An Binh & Mao Dien commune, Thuan Thanh district, Bac Ninh province, Vietnam</u>		
Test Result	:	<input checked="" type="radio"/> Positive <input type="radio"/> Negative		
Total pages including Appendices	:	<u>9</u>		

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2 Details about the Test Laboratory

Details about the Test Laboratory

Test Site 1

Company name: TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch
Building 12 & 13, Zhiheng Wisdomland Business Park, Guankou Erlu, Nantou, Nanshan District
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FCC Registration No.: 514049

FCC Deignation No.: CN5009

IC Registration No.: 10320A

ISED CAB Identifier: CN0077

3 Description of the Equipment Under Test

Description of the Equipment Under Test

Product:	Twist Lock
Model no.:	Bluetooth CAM Lock, Bluetooth Plunger Lock
Hardware Version Identification No. (HVIN)	Bluetooth CAM Lock, Bluetooth Plunger Lock
Product Marketing Name (PMN)	Twist Lock
Brand name:	N/A
FCC ID:	2AA2X-15000333V2
IC:	24439-15000333V2
Rating:	3.0 VDC (CR2477 Button Cell)
RF Transmission Frequency:	Zigbee: 2405MHz – 2480MHz RFID: 125 kHz Bluetooth: 2402 – 2480 MHz
No. of Operated Channel:	Zigbee:16 RFID: 1 BLE: 40
Modulation:	Zigbee: O-QPSK RFID: AM BLE: GFSK
Antenna Type:	Zigbee: Patch Antenna, SMD RFID: Coil Antenna BLE: Integral Antenna
Antenna Gain	Zigbee: 3.5 dBi RFID: 0 dBi BLE: 2.3 dBi
Description of the EUT:	The Equipment Under Test (EUT) is a Twist Lock which support Bluetooth (BLE) function, Zigbee function and 125 kHz near field card access function.

NOTE:

1. The above EUT's information is declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.
2. This report contains above antennas and the evaluating only performed at the antenna support higher gain.

4 Test Standards

Test Standards	
ANSI Std C95.1-2019	Safety Levels with Respect to Human Exposure to Electric, Magnetic, and Electromagnetic Fields, 0 kHz – 300 GHz. (IEEE Std C95.1-2019)
KDB 447498 D01	General RF Exposure Guidance v06

5 General Information

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Applicant informs that the model **Bluetooth Plunger Lock** have the same technical construction including circuit diagram, PCB Layout, components and component layout, all electrical construction and mechanical construction, with **Twist Lock, Bluetooth CAM Lock**.

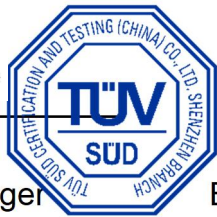
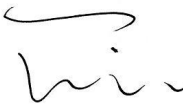
The difference lies only in outlook / mechanical switch activation of the different models.

- TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch -

Reviewed by:

Prepared by:

Tested by:



Eric LI
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EMC Project Engineer

Carry Cai
Test Engineer

6 RF Exposure Requirements

An estimation of MPE in this application for product is used to ensure if it complies with the rules of the standard in the regulation list above.

Maximum permissible exposure (MPE) refers to the RF energy that is acceptable for human exposure. It is broken down into two categories, Occupational/controlled and General population/uncontrolled.

Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or cannot exercise control over their exposure.

A rough estimation of the expected exposure in power flux density on a given point can be made with the following equation:

$$S = \frac{P \times G}{4 \times \pi \times R^2}$$

Where:

S = power density

P = power input to the antenna

G = numeric gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the centre of radiation of the antenna

EIRP = P * G

The antenna of the product, under normal use condition is at least 20 cm away from the body of the user. Warning statement to the user for keeping at least 20cm separation distance and the prohibition of operating to a person has been printed on the user's manual. Therefore, the S of the device is calculated with R=20cm, and if it is below the limit S, then we can conclude the device complies with the rules.

7 FCC MPE Limits

We analysis if it complies with the limits for General population/uncontrolled exposure. The FCC MPE limits for field strength and power density are given in 47CFR 1.1310(Table below). These limits are generally based on recommended exposure guidelines published by the National Council on Radiation Protection and Measurements (NCRP), and also partly based on guidelines recommended by the American National Standards Institute (ANSI) in Section 4.1 of ANSI/IEEE C95.1.

(A) Limits for Occupational/controlled Exposure				
Frequency Range(MHz)	Electric Field Strength(E)(V/m)	Magnetic Field Strength(H)(A/m)	Power Density (S)(mW/cm ²)	Averaging Time (minute) E ² , H ² or S
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842/f	4.89/f	(900/f ²)*	6
30-300	61.4	0.163	1.0	6
300-1500	--	--	f/300	6
1500-100,000	--	--	5	6
(B) Limits for General Population/uncontrolled Exposure				
Frequency Range(MHz)	Electric Field Strength(E)(V/m)	Magnetic Field Strength(H)(A/m)	Power Density (S)(mW/cm ²)	Averaging Time (minute) E ² , H ² or S
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f)*	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30
f=frequency in MHz			*Plane-wave equivalent power density	

8 RF Exposure Evaluation (FCC)

8.1.1 Calculation of Power Density for Single Chain Transmitters

Mode	EIRP (dBm)	EIRP (mW)	R (m)	S (W/m ²)	Limit (W/m ²)
Zigbee	6.20	4.17	0.2	0.0083	1.0
BLE	6.13	4.10	0.2	0.0082	1.0

8.1.2 Calculation of Simultaneous Transmission

For the multiple transmitter product:

In order to ensure compliance with the EMF for a controlled environment, the sum of the ratios of the power density to the corresponding EMF should not exceed unity. That is

$$\sum_i \frac{S_i}{S_{Limit,i}} \leq 1$$

The simultaneous transmission possibilities are as below:

Mode	S _i	S _{Limit}	Ratio
Zigbee	0.0083	1.0	0.0083
BLE	0.0082	1.0	0.0082
RFID	1.8180	614	0.0030

- The Max Power of RFID is according to the RF Exposure Report (NS) (Report No.: 60.960.24.079.01S01)

No.	Simultaneous Tx Combination	S _{sum}	Limit
1	Zigbee + BLE + RFID	0.0195	≤ 1
2	Zigbee + BLE	0.0165	≤ 1
3	Zigbee + RFID	0.0113	≤ 1
4	BLE + RFID	0.0112	≤ 1

8.1.3 Conclusion

According to the table above, we can conclude that the product meets the requirements.