REPORT No.: SZ19110224S01

RF EXPOSURE

ASSESSMENT REPORT

APPLICANT	:	Petasense Inc
PRODUCT NAME	:	Industrial asset reliability IOT sensor
MODEL NAME	:	Vibration Mote Model 3
BRAND NAME	:	Petasense
FCC ID	:	2AJW7-00002
STANDARD(S)	:	47CFR 2.1091 KDB 447498
RECEIPT DATE	:	2020-03-16
TEST DATE	:	2020-04-04 to 2020-04-13
ISSUE DATE	:	2020-04-15

Edited by: Peng Mi (Rapporteur)

Approved by: Peng Huarui (Supervisor)

MORLAB

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DIRECTORY

Change history		
Version	**Date**	**Reason of changed**
1.0	2020-04-15	Original

1. Technical Information

Note: Provide by applicant.

1.1 Applicant and Manufacturer Information

Applicant:	Petasense Inc
Applicant Address:	2 North 1st St, 5th Floor, San Jose, California, United States
Manufacturer:	RocketEMS
Manufacturer Address:	2950 Patrick Henry Dr, Santa Clara CA 95054

1.2 Equipment under Test (EUT) Description

Product Name:	Industrial asset reliability IOT sensor
Serial No:	(N/A, marked #1 by test site)
Hardware Version:	1.0
Software Version:	1.0
Frequency Bands:	WLAN 2.4GHz: 2412 MHz ~ 2472 MHz Bluetooth: 2402 MHz ~ 2480 MHz
Modulation Mode:	802.11b: DSSS 802.11a/g/n-HT20: OFDM Bluetooth LE: GFSK
Antenna Type:	WLAN 2.4GHz : Chip Antenna Bluetooth: PCB Antenna
Antenna Gain:	WLAN 2.4GHz:-0.4dBi Bluetooth:2.0dBi

1.3 Applied Reference Documents

Leading reference documents for testing:

No.	Identity	Document Title	Method determination /Remark
1	47 CFR§2.1091	Radio Frequency Radiation Exposure Assessment: mobile devices	No deviation
2	KDB 447498 D01v06	General RF Exposure Guidance	No deviation

Note 1: The test item is not applicable.

Note 2: Additions to, deviation, or exclusions from the method shall be judged in the "method determination" column of add, deviate or exclude from the specific method shall be explained in the "Remark" of the above table.

2. Device Category and RF Exposure Limit

Per user manual, Based on 47CFR 2.1091, this device belongs to mobile device category with General Population/Uncontrolled exposure.

Mobile Devices:

47CFR 2.1091(b)

For purposes of this section, a mobile device is defined as a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons. In this context, the term “fixed location” means that the device is physically secured at one location and is not able to be easily moved to another location. Transmitting devices designed to be used by consumers or workers that can be easily re-located, such as wireless devices associated with a personal computer, are considered to be mobile devices if they meet the 20 centimeter separation requirement.

General Population/Uncontrolled Exposure:

The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity. Warning labels placed on low-power consumer devices such as cellular telephones are not considered sufficient to allow the device to be considered under the occupational/controlled category, and the general population/uncontrolled exposure limits apply to these devices.

Table 1—Limits for Maximum Permissible Exposure (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(B) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*($180/f^2$)	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

3. RF Output Power

<WLAN 2.4GHz>

	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-up Power	Duty Cycle %
2.4GHz WLAN	802.11b 1Mbps	CH 1	2412	**8.50**	9.0	100.00
		CH 7	2442	7.45	7.5	
		CH 13	2472	7.81	8.0	
	802.11g 6Mbps	CH 1	2412	3.17	3.5	98.62
		CH 7	2442	4.13	4.5	
		CH 13	2472	6.22	6.5	
	802.11n-HT20 MCS0	CH 1	2412	2.13	2.5	98.16
		CH 7	2442	2.38	2.5	
		CH 13	2472	4.81	5.0	

<Bluetooth>

Mode	Channel	Frequency (MHz)	Average power (dBm)			
			1Mbps	2Mbps	125Kbps	500Kbps
BLE	CH 00	2402	-4.99	-4.62	-5.05	-4.63
	CH 19	2440	-4.56	-4.18	-4.49	-4.53
	CH 39	2480	-4.14	**-3.80**	-4.04	-4.22
Tune-up Limit			-4.0	-3.0	-4.0	-4.0

Note 1: The output power of WLAN and Bluetooth is derived from the report SZ19110224W01/W02.

4. RF Exposure Assessment

➢ **Standalone Transmission Assessment:**

Bands	Frequency (MHz)	Maximum Tune-up Power (dBm)	Antenna Gain (dBi)	EIRP (mW)	Power Density (mW/cm²)	Limit for MPE (mW/cm²)
WLAN 2.4GHz	2412	9.0	-0.4	7.24	0.001	1.0
Bluetooth	2480	-3.0	2.0	0.79	0.000	1.0

Note:

1. According to KDB 447498, SAR test exclusion conditions are based on source-based time-averaged maximum conducted output power of the RF channel requiring assessment, adjusted for tune-up tolerance, and the minimum test separation distance required for the exposure conditions.
2. MPE calculate method

$$\text{Power Density} = EIRP/4\pi R^2$$

Where: EIRP = P+G

P = Output Power (dBm)

G = Antenna Gain (dBi)

R = Separation Distance (20cm)

➢ **Simultaneous Transmission Assessment:**

Multi-Band Simultaneous Transmission Consideration

Simultaneous Transmission Consideration	Position	Applicable Combination
	Hand/Body	WLAN 2.4GHz+ Bluetooth

1. This device contains transmitters that may operate simultaneously, therefore simultaneous transmission analysis is required.
2. The worst condition for WLAN & Bluetooth will be calculated for transmitting simultaneously.

Formula: Result=Power density$_1$/ limit$_1$ + Power density$_2$/ limit$_2$ ≤1.

Transmission Bands	Power Density/ SAR	Limit	Simultaneous Transmission Result
WLAN 2.4GHz	0.001	1	0.001
Bluetooth	0.000	1	

➢ **Conclusion:**

According to 47 CFR §2.1091, this device complies with human exposure basic restrictions.

Annex A General Information

1. Identification of the Responsible Testing Laboratory

Laboratory Name:	Shenzhen Morlab Communications Technology Co., Ltd. Morlab Laboratory
Laboratory Address:	FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, GuangDong Province, P. R. China
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2. Identification of the Responsible Testing Location

Name:	Shenzhen Morlab Communications Technology Co., Ltd. Morlab Laboratory
Address:	FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, GuangDong Province, P. R. China

END OF REPORT