



REPORT No. : SZ17050133S02

# RF EXPOSURE EVALUATION REPORT

**APPLICANT** : Pycom Ltd

**PRODUCT NAME** : Triple Network (LoRa, WiFi and Bluetooth) IoT development Module powered by MicroPython.

**MODEL NAME** : L01 1.0

**TRADE NAME** : LoPy OEM

**BRAND NAME** : Pycom

**FCC ID** : 2AJMTLOPY01R

**STANDARD(S)** : 47CFR 2.1091  
KDB 447498 D01 General RF Exposure  
Guidance v06

**ISSUE DATE** : 2017-09-12

**SHENZHEN MORLAB COMMUNICATIONS TECHNOLOGY Co., Ltd.**

NOTE: This document is issued by MORLAB, the test report shall not be reproduced except in full without prior written permission of the company. The test results apply only to the particular sample(s) tested and to the specific tests carried out which is available on request for validation and information confirmed at our website.



# DIRECTORY

**TEST REPORT DECLARATION.....3**

**1. TECHNICAL INFORMATION .....3**

1.1. IDENTIFICATION OF APPLICANT.....4

1.2. IDENTIFICATION OF MANUFACTURER.....4

1.3. EQUIPMENT UNDER TEST (EUT) .....4

1.3.1. PHOTOGRAPHS OF THE EUT .....5

1.3.2. IDENTIFICATION OF ALL USED EUT .....7

1.4. APPLIED REFERENCE DOCUMENTS.....7

**2. DEVICE CATEGORY AND RF EXPOSURE LIMIT.....8**

**3. MEASUREMENT OF CONDUCTED PEAK OUTPUT POWER.....9**

**4. RF EXPOSURE EVALUATION ..... 11**

**ANNEX C GENERAL INFORMATION ..... 12**

| Change History |            |                   |
|----------------|------------|-------------------|
| Issue          | Date       | Reason for change |
| 1.0            | 2017-09-12 | First edition     |
|                |            |                   |

**TEST REPORT DECLARATION**

|                      |  |
|----------------------|--|
| Applicant            | Pycom Ltd  |
| Applicant Address    | Registered Office 57 Avenue Road Cranleigh, Surrey GU6 7LJ UK                            |
| Manufacturer         | In-Tech Electronics Ltd  |
| Manufacturer Address | 2/F Rhythm Home,<br>119 Shazui Road, Futian, Shenzhen, Guangdong, P.R. China             |
| Product Name         | Triple Network (LoRa, WiFi and Bluetooth) IoT development Module powered by MicroPython. |
| Model Name           | L01 1.0  |
| Brand Name           | Pycom  |
| HW Version           | 1.0r   |
| SW Version           | 1.0  |
| Test Standards       | 47CFR 2.1091;<br>KDB 447498 D01 General RF Exposure Guidance v06                         |
| Issue Date           | 2017-09-12   |
| SAR Evaluation       | Not Required   |

Tested by

:

\_\_\_\_\_  
Peng Fuwei (Test engineer)

Approved by

:

\_\_\_\_\_  
Peng Huarui (Supervisor)



## 1. TECHNICAL INFORMATION

Note: the following data is based on the information by the applicant.

### 1.1. Identification of Applicant

|               |  |
|---------------|--|
| Company Name: | Pycom Ltd  |
| Address:      | Registered Office 57 Avenue Road Cranleigh, Surrey GU6 7LJ<br>UK |

### 1.2. Identification of Manufacturer

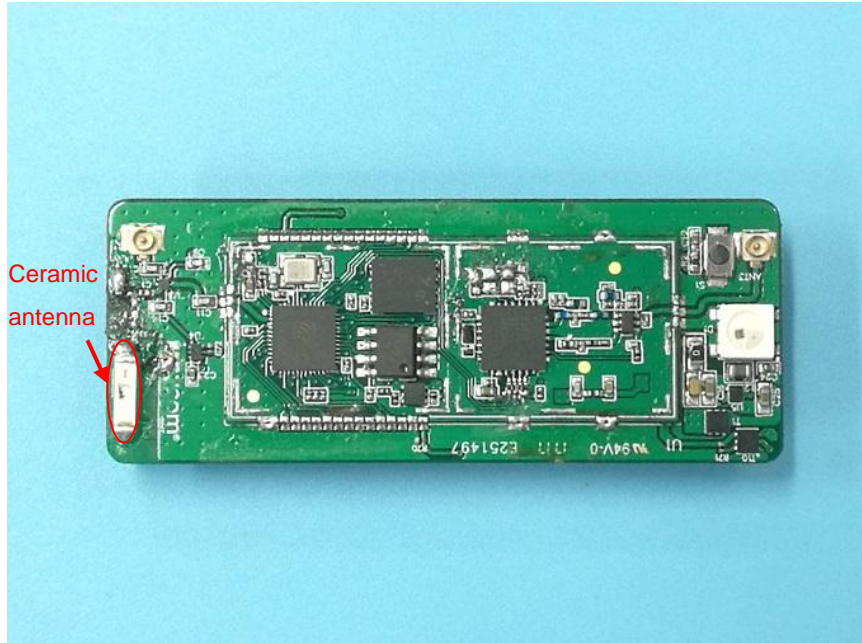
|               |  |
|---------------|--|
| Company Name: | In-Tech Electronics Ltd  |
| Address:      | 2/F Rhythm Home,<br>119 Shazui Road, Futian, Shenzhen, Guangdong, P.R. China |

### 1.3. Equipment Under Test (EUT)

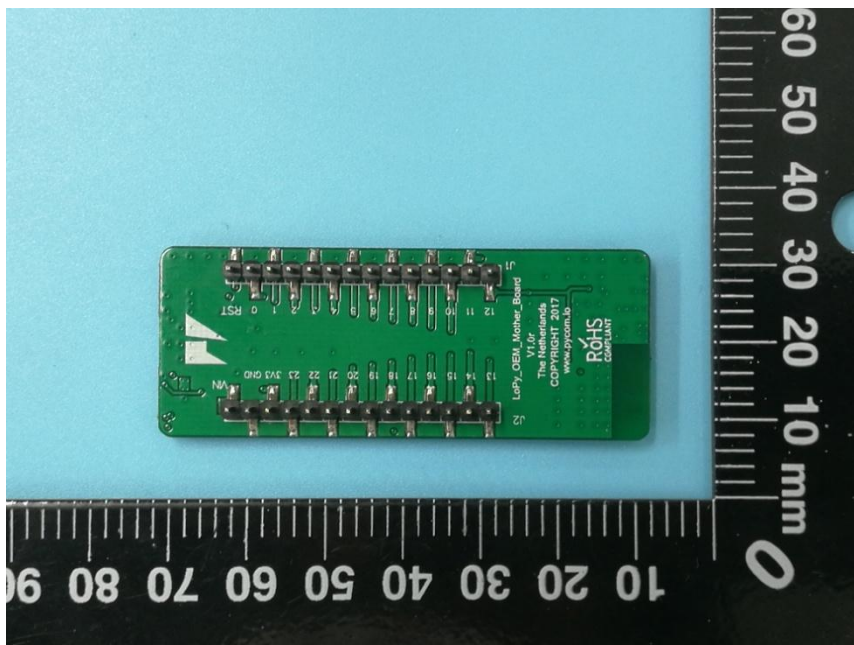
|                           |  |
|---------------------------|--|
| Model Name:               | L01 1.0  |
| Trade Name:               | LoPy OEM   |
| Brand Name:               | Pycom  |
| Hardware Version:         | 1.0r   |
| Software Version:         | 1.0  |
| Frequency Bands:          | Bluetooth 4.0:2402-2480MHz;<br>Wifi802.11b/g/n:2412-2484MHz;<br>LoRa: 902 to 928 MHz |
| Modulation Mode:          | Bluetooth 4.0: GFSK;<br>Wifi802.11b: DSSS; Wifi802.11g/n: OFDM;                      |
| Lora Antenna 1 type:      | External Antenna (P/N" Molex:1052620001")  |
| Lora Antenna 1 Gain:      | 1.4dBi   |
| Lora Antenna 2 type:      | External Antenna   |
| Lora Antenna 2 Gain:      | 0.5dBi   |
| WiFi & BT Antenna 1 type: | Ceramic Antenna  |
| WiFi & BT Antenna 1 Gain: | -0.5dBi  |
| WiFi & BT Antenna 2 type: | External Antenna   |
| WiFi & BT Antenna 2 Gain: | 2.0dBi   |

### 1.3.1. Photographs of the EUT

#### 1. EUT front view



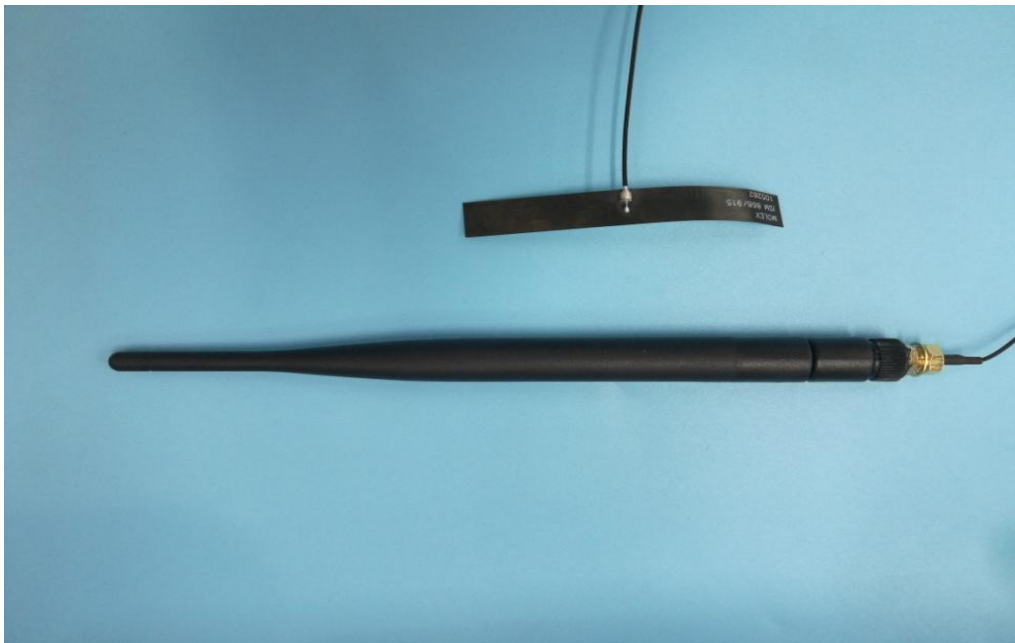
#### 2. EUT rear view



3. EUT External antenna view



4. LoRa antenna view





### 1.3.2. Identification of all used EUT

The EUT identity consists of numerical and letter characters, the letter character indicates the test sample, and the following two numerical characters indicate the software version of the test sample.

| EUT Identity | Hardware Version | Software Version |
|--------------|------------------|------------------|
| 1#           | 1.0r             | 1.0              |

### 1.4. Applied Reference Documents

Leading reference documents for testing:

| No. | Identity                 | Document Title   |
|-----|--------------------------|--|
| 1   | <b>47 CFR§2.1091</b>     | Radiofrequency Radiation Exposure Evaluation: mobile devices |
| 2   | <b>KDB 447498 D01v06</b> | General RF Exposure Guidance                                 |



## 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 <sup>2</sup> ) | Averaging time (minutes) |
|--|-------------------------------|-------------------------------|-------------------------------------|--------------------------|
| <b>(B) Limits for General Population/Uncontrolled Exposure</b> |                               |                               |                                     |                          |
| 0.3-1.34   | 614                           | 1.63                          | *(100)                              | 30                       |
| 1.34-30  | 824/f                         | 2.19/f                        | *(180/f <sup>2</sup> )              | 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. MEASUREMENT OF CONDUCTED PEAK OUTPUT POWER

#### 1. Bluetooth Average output power

| Band  | Channel | Frequency (MHz) | Output Power(dBm) |                |        |
|-------|---------|-----------------|-------------------|----------------|--------|
|       |         |                 | GFSK              | $\pi/4$ -DQPSK | 8-DPSK |
| BT2.1 | 0       | 2402            | -2.02             | -0.53          | -0.25  |
|       | 19      | 2440            | -1.73             | -0.08          | 0.19   |
|       | 39      | 2480            | -2.15             | -0.34          | -0.03  |

| Band  | Channel | Frequency (MHz) | Output Power(dBm) |
|-------|---------|-----------------|-------------------|
|       |         |                 | GFSK              |
| BT4.0 | 0       | 2402            | -0.95             |
|       | 19      | 2440            | 0.54              |
|       | 39      | 2480            | 2.09              |

#### 2. Wifi 2.4G Conducted Average Output Power

| Band | Channel | Frequency (MHz) | Output Power(dBm) |         |            |
|------|---------|-----------------|-------------------|---------|------------|
|      |         |                 | 802.11B           | 802.11G | 802.11N 20 |
| Wifi | 1       | 2412            | 12.68             | 8.88    | 8.98       |
|      | 6       | 2437            | 11.82             | 8.51    | 8.62       |
|      | 11      | 2462            | 10.93             | 7.93    | 8.01       |

| Band | Channel | Frequency (MHz) | Output Power(dBm) |
|------|---------|-----------------|-------------------|
|      |         |                 | 802.11n40         |
| Wifi | 3       | 2422            | 8.93              |
|      | 6       | 2437            | 8.41              |
|      | 9       | 2452            | 7.91              |



3. LoRa Conducted Peak Output Power

| Band | Channel | Frequency (MHz) | Output Power (dBm) |
|------|---------|-----------------|--------------------|
| LoRa | 64      | 903.0           | 19.43              |
|      | 68      | 909.4           | 19.37              |
|      | 71      | 914.2           | 19.28              |



## 4 RF EXPOSURE EVALUATION

### Standalone transmission MPE evaluation

#### Antenna 1:

| Bands  | Frequency (MHz) | Antenna Gain (dBi) | Conducted Average Power (dBm) | Time-averaging EIRP (mW) | Power density (mW/cm <sup>2</sup> ) | Limit for MPE (mW/cm <sup>2</sup> ) |
|--------|-----------------|--------------------|-------------------------------|--------------------------|-------------------------------------|-------------------------------------|
| BT     | 2480            | -0.5               | 2.09                          | 0.04                     | 0.00001                             | 2.736                               |
| 2.4GHz | 2412            | -0.5               | 12.68                         | 16.52                    | 0.00329                             | 2.684                               |
| Lora   | 903             | 1.4                | 19.43                         | 121.06                   | 0.02410                             | 0.602                               |

#### Antenna 2:

| Bands  | Frequency (MHz) | Antenna Gain (dBi) | Conducted Average Power (dBm) | Time-averaging EIRP (mW) | Power density (mW/cm <sup>2</sup> ) | Limit for MPE (mW/cm <sup>2</sup> ) |
|--------|-----------------|--------------------|-------------------------------|--------------------------|-------------------------------------|-------------------------------------|
| BT     | 2480            | 2.0                | 2.09                          | 0.58                     | 0.00012                             | 2.736                               |
| 2.4GHz | 2412            | 2.0                | 12.68                         | 29.38                    | 0.00585                             | 2.684                               |
| Lora   | 903             | 0.5                | 19.43                         | 98.40                    | 0.01959                             | 0.602                               |



## ANNEX C GENERAL INFORMATION

### 1. Identification of the Responsible Testing Laboratory

|                               |  |
|-------------------------------|--|
| Company Name:                 | Shenzhen Morlab Communications Technology Co., Ltd.  |
| Department:                   | Morlab Laboratory  |
| Address:                      | FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, GuangDong Province, P. R. China |
| Responsible Test Lab Manager: | Mr. Su Feng  |
| Telephone:                    | +86 755 36698555   |
| Facsimile:                    | +86 755 36698525   |

### 2. Identification of the Responsible Testing Location

|          |  |
|----------|--|
| Name:    | Shenzhen Morlab Communications Technology Co., Ltd.<br>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 \*\*\*\*\*