

## RF exposure report

**According to the standard:**  
CFR 47 FCC PART 15  
RSS-102 – Issue 5

**Equipment under test:**  
MICRO TRACKER 2

**FCC ID: 2AOSP-U002**  
**IC NUMBER: 23543-U002**

**Company:**  
ABEEWAY

**Distribution:** Mr Danchesi

**(Company:** ABEEWAY)

**Number of pages:** 9

| Ed. | Date     | Modified<br>Page(s) | Technical Verification and<br>Quality Approval |                                                                                       |
|-----|----------|---------------------|------------------------------------------------|---------------------------------------------------------------------------------------|
|     |          |                     | Name and Function                              | Visa                                                                                  |
| 0   | 6-Sep-18 | Creation            | M. DUMESNIL, Radio Technical Manager           |  |

*Duplication of this document is only permitted for an integral photographic facsimile. It includes the number of pages referenced here above.  
This document is the result of testing a specimen or a sample of the product submitted. It does not imply an assessment of the conformity of the whole manufactured products of the tested sample.*



**DESIGNATION OF PRODUCT:** MICRO TRACKER 2

**Serial number (S/N):** 20635F01010001FA

**Reference / model (P/N):** U002-52

**Software version:** actt-micro-mtos-usb-rev1.2-4  
Asset Tracker v1.x (for production)

**MANUFACTURER:** ABEEWAY

**COMPANY SUBMITTING THE PRODUCT:**

**Company:** ABEEWAY

**Address:** 635, ROUTE DES LUCIOLES  
06560 VALBONNE  
FRANCE

**Responsible:** Mrs Denis

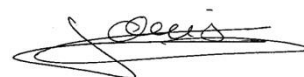
**Person present during the tests:** Mr Danchesi (29 and 30 – august 2018)

**DATES OF TEST:** From 17-Oct-17 to 5-Sep-18

**TESTING LOCATION:** EMITECH ANGERS laboratory at JUIGNE SUR LOIRE (49) FRANCE  
FCC Accredited under US-EU MRA Designation Number: FR0009  
Test Firm Registration Number: 873677

**TESTED BY:** S. LOUIS

**VISA:**



**WRITTEN BY:** S. LOUIS

## CONTENTS

|    | <i><b>TITLE</b></i>              | <i><b>PAGE</b></i> |
|----|----------------------------------|--------------------|
| 1. | <b>INTRODUCTION.....</b>         | <b>4</b>           |
| 2. | <b>PRODUCT DESCRIPTION .....</b> | <b>4</b>           |
| 3. | <b>NORMATIVE REFERENCE.....</b>  | <b>5</b>           |
| 4. | <b>RF EXPOSURE.....</b>          | <b>6</b>           |

## 1. INTRODUCTION

This report presents the results of radio test carried out on the following radio equipment: **Micro Tracker 2**, in accordance with normative reference.

The device under test integrates:

- multifrequencies wireless transceiver LoRa.
- BLE radio transceiver
- WiFi radio transceiver
- GPS receiver.

The transceivers (LoRa, BLE and WiFi) can't emit simultaneously as declared by the manufacturer.  
The applicant declares that radio functions are not operational during the charge of the battery.

## 2. PRODUCT DESCRIPTION

Class: B

Utilization: Residential

Power source: Rechargeable 3.7Vdc Battery.

Power level, frequency range and channels characteristics are not user adjustable.  
The details pictures of the product and the circuit boards are joined with this file.

### LoRa Part:

Antenna type and gain: Integrated antenna, gain declared by the applicant (considered -1.5 dBi)

Power adjusted by software: The power level is tuned to reach max power

Operating frequency range: From 902.3 MHz to 914.9 MHz

Frequency tested: 902.3 MHz, 908.7 MHz, 914.9 MHz for transmission  
923.3 MHz, 925.1 MHz, 927.5 MHz for reception

Frequencies plan detailed transmitter:

| Channel frequencies       | LoRa bandwidth (KHz) | Number of channel | Channel width (KHz) |
|---------------------------|----------------------|-------------------|---------------------|
| 902,3+i*0,2MHz (i=0 à 63) | 125                  | 64                | 200                 |

Frequencies plan detailed receiver:

| Channel frequencies      | LoRa bandwidth (KHz) | Number of channel | Channel width (KHz) |
|--------------------------|----------------------|-------------------|---------------------|
| 923,3+i*0.6MHz (i=0 à 7) | 500                  | 8                 | 600                 |

Number of channels: 64

Channel spacing: 200 kHz

Modulation: LoRa with spread factor:7 and 10

**BLE Part:**

Antenna type and gain: integral antenna (unknown gain); (considered 0 dBi)

Operating frequency range: From 2402 MHz to 2480 MHz

Number of channels: 40

Channel spacing: 2MHz

Modulation: Bluetooth Low Energy

**WiFi Part:**

Antenna type and gain: integral antenna (unknown gain); (considered 0 dBi)

Operating frequency range: From 2412 MHz to 2462 MHz

Number of channels: 11

Channel spacing: 5MHz

Modulation: WiFi 802.11b

**3. NORMATIVE REFERENCE**

The standards and testing methods related throughout this report are those listed below. They are applied on the whole test report even though the extensions (version, date and amendment) are not repeated.

|                                             |                                                                                                                             |
|---------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| CFR 47 FCC Part 15 (2018)                   | Radio Frequency Devices                                                                                                     |
| 447498 D01 General RF Exposure Guidance v06 | RF Exposure procedures and equipment authorization policies for mobile and portable equipment                               |
| RSS-102                                     | Issue 5, March 2015<br>Radio Frequency (RF) Exposure<br>Compliance of Radiocommunication<br>Apparatus (All Frequency Bands) |

#### 4. RF EXPOSURE

##### LoRa Part:

##### Calculus for LoRa with SF7 mode in standalone

**Conducted output power:** 114mW at 914.9MHz

With an antenna gain considered: -1.5 dBi

**Duty Cycle:** (Following Applicant declaration)

12 frames of 35 ms during a period of 6 minutes

⇒ Duty cycle =  $0.0012 = 0.12\%$

**Conducted output power Average =  $114 \times 0.0012 = 0.137mW$**

##### Calculus for LoRa with SF10 mode in standalone

**Conducted output power:** 113mW at 914.9MHz

With an antenna gain considered: -1.5 dBi

**Duty Cycle:** (Following Applicant declaration)

12 frames of 250 ms during a period of 6 minutes

⇒ Duty cycle =  $0.0083 = 0.83\%$

**Conducted output power Average =  $113 \times 0.0083 = 0.938mW$**

The minimum value of 5 mm is considered for the analysis.

### ***Limit following KDB 447498, Paragraph 4.3.1:***

#### **The product must respect the exclusion limit for 10-g extremity SAR.**

$$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] * [\sqrt{f(\text{GHz})}] \leq 7.5$$

According this formula:

$$\text{Power threshold, mW} = [(7.5 * \text{min. test separation distance, mm}) / \sqrt{f(\text{GHz})}]$$

$$\text{Power threshold, mW} = [(7.5 * 5) / \sqrt{0.915}]$$

**Power threshold, mW = 39.2 mW**

**The maximum measured power is lower than 39.2 mW.**

**The equipment fulfils the requirements on maximum conducted or equivalent isotropically radiated power (e.i.r.p) for general population/uncontrolled exposure and therefore fulfils the requirements of 47 CFR §1.1310 at the distance greater than 5 mm between the user and the antenna.**

### ***Limit following RSS 102:***

In accordance with § 2.5.1 of RSS 102 Issue 5 the equipment respect exemption limits for routine evaluation in controlled environment for the limits of maximum conducted or equivalent isotropically radiated power (e.i.r.p) below:

| Frequency<br>(MHz) | Exemption Limits (mW)                 |                                       |                                       |                                       |                                       |
|--------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|
|                    | At separation<br>distance of<br>≤5 mm | At separation<br>distance of<br>10 mm | At separation<br>distance of<br>15 mm | At separation<br>distance of<br>20 mm | At separation<br>distance of<br>25 mm |
| ≤300               | 71 mW                                 | 101 mW                                | 132 mW                                | 162 mW                                | 193 mW                                |
| 450                | 52 mW                                 | 70 mW                                 | 88 mW                                 | 106 mW                                | 123 mW                                |
| 835                | 17 mW                                 | 30 mW                                 | 42 mW                                 | 55 mW                                 | 67 mW                                 |
| 1900               | 7 mW                                  | 10 mW                                 | 18 mW                                 | 34 mW                                 | 60 mW                                 |
| 2450               | 4 mW                                  | 7 mW                                  | 15 mW                                 | 30 mW                                 | 52 mW                                 |
| 3500               | 2 mW                                  | 6 mW                                  | 16 mW                                 | 32 mW                                 | 55 mW                                 |
| 5800               | 1 mW                                  | 6 mW                                  | 15 mW                                 | 27 mW                                 | 41 mW                                 |

For 10-g extremity SAR the value of table above multiplied by a factor of 2.5

For 915MHz, exemption limit is: 16.2mW x 2.5 = 40.5mW.

**The equipment fulfils the requirements on maximum conducted or equivalent isotropically radiated power (e.i.r.p) for general public/uncontrolled environment.**

### BLE Part:

Maximum measured power = 87.5 dB $\mu$ V/m = 0.1687 mW at 2402 MHz  
with  $P = (E \times d)^2 / (30 \times G_p)$  with  $d = 3 \text{ m}$  and  $G_p = 1$

The minimum value of 5 mm is considered for the analysis.

### Limit following KDB 447498, Paragraph 4.3.1:

#### The product must respect the exclusion limit for 10-g extremity SAR.

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] * [\sqrt{f(\text{GHz})}] \leq 7.5$

According this formula:

Power threshold, mW =  $[(7.5 * \text{min. test separation distance, mm}) / \sqrt{f(\text{GHz})}]$

Power threshold, mW =  $[(7.5 * 5) / \sqrt{(2.402)}]$

**Power threshold, mW = 24.2 mW**

**The maximum measured power is lower than 24.2 mW.**

**The equipment fulfils the requirements on maximum conducted or equivalent isotropically radiated power (e.i.r.p) for general population/uncontrolled exposure and therefore fulfils the requirements of 47 CFR §1.1310 at the distance greater than 5 mm between the user and the antenna.**

### Limit following RSS 102:

In accordance with § 2.5.1 of RSS 102 Issue 5 the equipment respect exemption limits for routine evaluation in controlled environment for the limits of maximum conducted or equivalent isotropically radiated power (e.i.r.p) below:

| Frequency<br>(MHz) | Exemption Limits (mW)                               |                                       |                                       |                                       |                                       |
|--------------------|-----------------------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|
|                    | At separation<br>distance of<br>$\leq 5 \text{ mm}$ | At separation<br>distance of<br>10 mm | At separation<br>distance of<br>15 mm | At separation<br>distance of<br>20 mm | At separation<br>distance of<br>25 mm |
| $\leq 300$         | 71 mW                                               | 101 mW                                | 132 mW                                | 162 mW                                | 193 mW                                |
| 450                | 52 mW                                               | 70 mW                                 | 88 mW                                 | 106 mW                                | 123 mW                                |
| 835                | 17 mW                                               | 30 mW                                 | 42 mW                                 | 55 mW                                 | 67 mW                                 |
| 1900               | 7 mW                                                | 10 mW                                 | 18 mW                                 | 34 mW                                 | 60 mW                                 |
| 2450               | 4 mW                                                | 7 mW                                  | 15 mW                                 | 30 mW                                 | 52 mW                                 |
| 3500               | 2 mW                                                | 6 mW                                  | 16 mW                                 | 32 mW                                 | 55 mW                                 |
| 5800               | 1 mW                                                | 6 mW                                  | 15 mW                                 | 27 mW                                 | 41 mW                                 |

For 10-g extremity SAR the value of table above multiplied by a factor of 2.5

For 2402MHz, exemption limit is: 4.3mW x 2.5 = 10.75mW.

**The equipment fulfils the requirements on maximum conducted or equivalent isotropically radiated power (e.i.r.p) for general public/uncontrolled environment.**

### WiFi Part:

In accordance with KDB 447498 D01 General RF Exposure Guidance v06, Paragraph 4.3.1.

Maximum measured power = 1.216 mW at 2437 MHz

with  $P = (E \times d)^2 / (30 \times G_p)$  with  $d = 3 \text{ m}$  and  $G_p = 1$

The minimum value of 5 mm is considered for the analysis.

### **Limit following KDB 447498, Paragraph 4.3.1:**

#### **The product must respect the exclusion limit for 10-g extremity SAR.**

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] * [\sqrt{f(\text{GHz})}] \leq 7.5$

According this formula:

Power threshold, mW =  $[(7.5 * \text{min. test separation distance, mm}) / \sqrt{f(\text{GHz})}]$

Power threshold, mW =  $[(7.5 * 5) / \sqrt{(2.437)}]$

**Power threshold, mW = 24 mW**

**The maximum measured power is lower than 24 mW.**

The equipment fulfils the requirements on maximum conducted or equivalent isotropically radiated power (e.i.r.p) for general population/uncontrolled exposure and therefore fulfils the requirements of 47 CFR §1.1310 at the distance greater than 5 mm between the user and the antenna.

### **Limit following RSS 102:**

In accordance with § 2.5.1 of RSS 102 Issue 5 the equipment respect exemption limits for routine evaluation in controlled environment for the limits of maximum conducted or equivalent isotropically radiated power (e.i.r.p) below:

| Frequency<br>(MHz) | Exemption Limits (mW)                 |                                       |                                       |                                       |                                       |
|--------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|
|                    | At separation<br>distance of<br>≤5 mm | At separation<br>distance of<br>10 mm | At separation<br>distance of<br>15 mm | At separation<br>distance of<br>20 mm | At separation<br>distance of<br>25 mm |
| ≤300               | 71 mW                                 | 101 mW                                | 132 mW                                | 162 mW                                | 193 mW                                |
| 450                | 52 mW                                 | 70 mW                                 | 88 mW                                 | 106 mW                                | 123 mW                                |
| 835                | 17 mW                                 | 30 mW                                 | 42 mW                                 | 55 mW                                 | 67 mW                                 |
| 1900               | 7 mW                                  | 10 mW                                 | 18 mW                                 | 34 mW                                 | 60 mW                                 |
| 2450               | 4 mW                                  | 7 mW                                  | 15 mW                                 | 30 mW                                 | 52 mW                                 |
| 3500               | 2 mW                                  | 6 mW                                  | 16 mW                                 | 32 mW                                 | 55 mW                                 |
| 5800               | 1 mW                                  | 6 mW                                  | 15 mW                                 | 27 mW                                 | 41 mW                                 |

For 10-g extremity SAR the value of table above multiplied by a factor of 2.5

For 2437MHz, exemption limit is: 4.1mW x 2.5 = 10.25mW.

**The equipment fulfils the requirements on maximum conducted or equivalent isotropically radiated power (e.i.r.p) for general public/uncontrolled environment.**