

# ELECTROMAGNETIC EMISSION COMPLIANCE REPORT FOR LOW-POWER, NON-LICENSED TRANSMITTER

Test Report No. : OT-19D-RWD-019

AGR No. : A19NA-198

Applicant : AMOSENSE

Address : 56 Naruteo-ro, Seocho-gu, SEOUL, South Korea

Manufacturer : AMOSENSE

Address : 56 Naruteo-ro, Seocho-gu, SEOUL, South Korea

Type of Equipment : MUSE-R

FCC ID. : 2AS9T-SB12

Model Name : SB12

Serial number : N/A

Total page of Report : 8 pages (including this page)

Date of Incoming : November 25, 2019

Date of issue : December 06, 2019

## SUMMARY

The equipment complies with the regulation; **FCC PART 15 SUBPART C Section 15.225, 15.247**

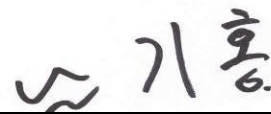
This test report only contains the result of a single test of the sample supplied for the examination.

It is not a generally valid assessment of the features of the respective products of the mass-production.

Reviewed by:

  
Tae-Ho, Kim / Senior Manager  
ONETECH Corp.

Approved by:

  
Ki-Hong, Nam / Chief Engineer  
ONETECH Corp.

## CONTENTS

**PAGE**

|                                                                                |          |
|--------------------------------------------------------------------------------|----------|
| <b>1. VERIFICATION OF COMPLIANCE .....</b>                                     | <b>4</b> |
| <b>2. GENERAL INFORMATION .....</b>                                            | <b>5</b> |
| <b>2.1 PRODUCT DESCRIPTION.....</b>                                            | <b>5</b> |
| <b>2.2 ALTERNATIVE TYPE(S)/MODEL(S); ALSO COVERED BY THIS TEST REPORT.....</b> | <b>5</b> |
| <b>3. EUT MODIFICATIONS.....</b>                                               | <b>5</b> |
| <b>4. MAXIMUM PERMISSIBLE EXPOSURE .....</b>                                   | <b>6</b> |
| <b>4.1 RF EXPOSURE CALCULATION .....</b>                                       | <b>6</b> |
| <b>4.2 TEST RESULT FOR BLUETOOTH LE .....</b>                                  | <b>7</b> |
| <b>4.3 TEST RESULT FOR SIG FOX .....</b>                                       | <b>8</b> |

**Revision History**

| Rev. No. | Issue Report No. | Issued Date       | Revisions       | Section Affected |
|----------|------------------|-------------------|-----------------|------------------|
| 0        | OT-19D-RWD-019   | December 06, 2019 | Initial Release | All              |
|          |                  |                   |                 |                  |
|          |                  |                   |                 |                  |

## 1. VERIFICATION OF COMPLIANCE

Applicant : AMOSENSE  
Address : 56 Naruteo-ro, Seocho-gu, SEOUL, South Korea  
Manufacturer : AMOSENSE  
Address : 56 Naruteo-ro, Seocho-gu, SEOUL, South Korea  
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FCC ID : 2AS9T-SB12  
Model Name : SB12  
Brand Name : -  
Serial Number : N/A  
Date : December 06, 2019

|                                                         |                                                                                |
|---------------------------------------------------------|--------------------------------------------------------------------------------|
| EQUIPMENT CLASS                                         | DTS – DIGITAL TRNSMISSION SYSTEM                                               |
| E.U.T. DESCRIPTION                                      | MUSE-R                                                                         |
| THIS REPORT CONCERNS                                    | Original Grant                                                                 |
| MEASUREMENT PROCEDURES                                  | ANSI C63.10: 2013                                                              |
| TYPE OF EQUIPMENT TESTED                                | Pre-Production                                                                 |
| KIND OF EQUIPMENT<br>AUTHORIZATION REQUESTED            | Certification                                                                  |
| EQUIPMENT WILL BE OPERATED<br>UNDER FCC RULES PART(S)   | FCC PART 15 SUBPART C Section 15.247<br>558074 D01 15.247 Meas Guidance v05r02 |
| Modifications on the Equipment to Achieve<br>Compliance | None                                                                           |
| Final Test was Conducted On                             | 3 m, Semi Anechoic Chamber                                                     |

-. The above equipment was tested by ONETECH Corp. for compliance with the requirement set forth in the FCC Rules and Regulations. This said equipment in the configuration described in this report, shows the maximum emission levels emanating from equipment are within the compliance requirements.

## 2. GENERAL INFORMATION

### 2.1 Product Description

The AMOSENSE, Model SB12 (referred to as the EUT in this report) is a MUSE-R. Product specification information described herein was obtained from product data sheet or user's manual.

|                                                    |                                                                                    |                               |
|----------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------|
| DEVICE TYPE                                        | MUSE-R                                                                             |                               |
| Temperature Range                                  | -20 °C ~ 50 °C                                                                     |                               |
| OPERATING FREQUENCY                                | NFC                                                                                | 13.56 MHz                     |
|                                                    | Sig Fox                                                                            | 902.137 5 MHz ~ 904.662 5 MHz |
|                                                    | Bluetooth LE                                                                       | 2 402 MHz ~ 2 480 MHz         |
| MODULATION TYPE                                    | NFC                                                                                | ASK                           |
|                                                    | Sig Fox                                                                            | DBPSK                         |
|                                                    | Bluetooth LE                                                                       | GFSK                          |
| RF OUTPUT POWER                                    | NFC                                                                                | 39.79 dBuV/m at 3 M           |
|                                                    | Sig Fox                                                                            | 22.14 dBm                     |
|                                                    | Bluetooth LE                                                                       | 0.84 dBm                      |
| ANTENNA TYPE                                       | NFC: FPCB Antenna<br>Sig Fox : Chip + Metal Antenna<br>Bluetooth LE : Chip Antenna |                               |
| ANTENNA GAIN                                       | Bluetooth LE : -0.02 dBi<br>Sig Fox : 0.57 dBi                                     |                               |
| List of each Osc. or crystal Freq.(Freq. >= 1 MHz) | 32.768 kHz, 32 MHz, 50 MHz                                                         |                               |

### 2.2 Alternative type(s)/model(s); also covered by this test report.

-. None

## 3. EUT MODIFICATIONS

-. None

## 4. MAXIMUM PERMISSIBLE EXPOSURE

### 4.1 RF Exposure Calculation

According to the FCC rule 1.1310 table 1B, the limit for the maximum permissible RF exposure for an uncontrolled environment are  $f/1500 \text{ mW/cm}^2$  for the frequency range between 300 MHz and 1 500 MHz and  $1.0 \text{ mW/cm}^2$  for the frequency range between 1 500 MHz and 100 000 MHz.

The electric field generated for a  $1 \text{ mW/cm}^2$  exposure is calculated as follows:

$$E = \sqrt{(30 * P * G) / d}, \text{ and } S = E^2 / Z = E^2 / 377, \text{ because } 1 \text{ mW/cm}^2 = 10 \text{ W/m}^2$$

Where

S = Power density in  $\text{mW/cm}^2$ , Z = Impedance of free space,  $377 \Omega$

E = Electric field strength in V/m, G = Numeric antenna gain, and d = distance in meter

Combining equations and rearranging the terms to express the distance as a function of the remaining variable

$$d = \sqrt{(30 * P * G) / (377 * 10 S)}$$

Changing to units of mW and cm, using  $P (\text{mW}) = P (\text{W}) / 1\,000$ ,  $d (\text{cm}) = 0.01 * d (\text{m})$

$$d = 0.282 * \sqrt{(P * G) / S}$$

Where

d = distance in cm, P = Power in mW, G = Numeric antenna gain, and S = Power density in  $\text{mW/cm}^2$

|                             |                                                                                                                                                              |
|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Kind of EUT                 | MUSE-R                                                                                                                                                       |
| Device Category             | <input type="checkbox"/> Portable (< 20 cm separation)<br><input type="checkbox"/> Mobile (> 20 cm separation)<br><input checked="" type="checkbox"/> Others |
| Exposure Evaluation Applied | <input checked="" type="checkbox"/> MPE<br><input type="checkbox"/> SAR<br><input type="checkbox"/> N/A                                                      |

  
 Tested by: Hyung-Kwon, Oh / Assistant Manager

## 4.2 Test Result for Bluetooth LE

According to above equation, the following result was obtained.

| Operating Freq. Band (MHz) | Operating Mode | Target Power W/tolerance | Max tune up power |      | Antenna Gain |        | Safe Distance (cm) | Power Density (mW/cm <sup>2</sup> ) @ 20 cm Separation | Limit (mW/cm <sup>2</sup> ) |
|----------------------------|----------------|--------------------------|-------------------|------|--------------|--------|--------------------|--------------------------------------------------------|-----------------------------|
|                            |                | (dBm)                    | (dBm)             | (mW) | Log          | Linear |                    |                                                        |                             |
| 2 402 ~ 2 480              | Bluetooth LE   | 1.0 ± 0.5                | 1.50              | 1.41 | -0.02        | 1.00   | 0.33               | 0.000 3                                                | 1.00                        |

According to above table, for 2 402 MHz ~ 2 480 MHz Band, safe distance,

$$D = 0.282 * \sqrt{(1.41 * 1.00)} / 1.00 = 0.33 \text{ cm}$$

For getting power density at 20 cm separation in above table, following formula was used.

$$S = P * G / (4\pi * R^2) = 1.41 * 1.00 / (4 * 3.14 * 20^2) = 0.000 3$$

Where:

S = Power Density,

P = Power input to the external antenna (Output power from the EUT antenna port (dBm) – cable loss (dB)),

G = Gain of Transmit Antenna (linear gain), R = Distance from Transmitting Antenna



Tested by: Hyung-Kwon, Oh / Assistant Manager

### 4.3 Test Result for Sig Fox

According to above equation, the following result was obtained.

| Operating Freq. Band (MHz) | Operating Mode | Target Power W/tolerance | Max tune up power |        | Antenna Gain |        | Safe Distance (cm) | Power Density (mW/cm <sup>2</sup> ) @ 20 cm Separation | Limit (mW/cm <sup>2</sup> ) |
|----------------------------|----------------|--------------------------|-------------------|--------|--------------|--------|--------------------|--------------------------------------------------------|-----------------------------|
|                            |                | (dBm)                    | (dBm)             | (mW)   | Log          | Linear |                    |                                                        |                             |
| 902 ~ 928                  | Sig Fox        | 22.5 ± 0.5               | 23.00             | 199.53 | 0.57         | 1.14   | 4.25               | 0.0453                                                 | 1.00                        |

According to above table, for 902 MHz ~ 928 MHz Band, safe distance,

$$D = 0.282 * \sqrt{(199.53 * 1.14)} / 1.00 = 4.25 \text{ cm}$$

For getting power density at 20 cm separation in above table, following formula was used.

$$S = P * G / (4\pi * R^2) = 199.53 * 1.14 / (4 * 3.14 * 20^2) = 0.0453$$

Where:

S = Power Density,

P = Power input to the external antenna (Output power from the EUT antenna port (dBm) – cable loss (dB)),

G = Gain of Transmit Antenna (linear gain), R = Distance from Transmitting Antenna



Tested by: Hyung-Kwon, Oh / Assistant Manager