

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

Test Report No. : OT-196-RWD-017
AGR No. : A194A-065
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 : ATOZ
FCC ID. : 2AS9T-SB52SW
Model Name : SB52-SW
Serial number : N/A
Total page of Report : 8 pages (including this page)
Date of Incoming : May 21, 2019
Date of issue : June 10, 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.

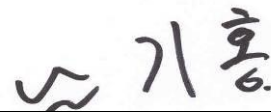
It is not a generally valid assessment of the features of the respective products of the mass-production.

Reviewed by:



Tae-Ho, Kim / Senior Manager
ONETECH Corp.

Approved by:



Ki-Hong, Nam / Chief Engineer
ONETECH Corp.

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Revision History

Rev. No.	Issue Report No.	Issued Date	Revisions	Section Affected
0	OT-196-RWD-017	June 10, 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
 Factory : AMO VINA CO.,LTD
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 Telephone No. : +82-010-4948-5676
 FCC ID : 2AS9T-SB52SW
 Model Name : SB52-SW
 Brand Name : -
 Serial Number : N/A
 Date : June 10, 2019

EQUIPMENT CLASS	DTS – DIGITAL TRNSMISSION SYSTEM
E.U.T. DESCRIPTION	ATOZ
THIS REPORT CONCERNS	Original Grant
MEASUREMENT PROCEDURES	ANSI C63.10: 2013
TYPE OF EQUIPMENT TESTED	Pre-Production
KIND OF EQUIPMENT AUTHORIZATION REQUESTED	Certification
EQUIPMENT WILL BE OPERATED UNDER FCC RULES PART(S)	FCC PART 15 SUBPART C Section 15.225, 15.247 558074 D01 15.225, 15.247 Meas Guidance v05r02
Modifications on the Equipment to Achieve 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 SB52-SW (referred to as the EUT in this report) is a ATOZ. The product specification described herein was obtained from product data sheet or user’s manual.

DEVICE TYPE	ATOZ	
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
	WLAN 2.4 GHz	2 412 MHz ~ 2 462 MHz (802.11b/g/n(HT20))
MODULATION TYPE	NFC	ASK
	Sig Fox	DBPSK
	Bluetooth LE	GFSK
	WLAN 2.4 GHz	802.11b: DSSS Modulation(DBPSK/DQPSK/CCK) 802.11g/n(HT20): OFDM Modulation(BPSK/QPSK/16QAM/64QAM)
RF OUTPUT POWER'	NFC	38.11 dBμV/m
	Sig Fox	21.04 dBm
	Bluetooth LE	0.18 dBm
	WLAN 2.4 GHz	2.52 dBm(802.11b) 1.02 dBm(802.11g) 0.84 dBm(802.11n_HT20)
ANTENNA TYPE	NFC: PCB Antenna Sig Fox : Chip Antenna WLAN 2.4 GHz / Bluetooth LE : Chip Antenna	
ANTENNA GAIN	WLAN 2.4 GHz / Bluetooth LE : 3.3 dBi Sig Fox : 0.4 dBi	
List of each Osc. or crystal Freq.(Freq. >= 1 MHz)	26 MHz, 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 mW/cm^2 for the frequency range between 1 500 MHz and 100 000 MHz.

The electric field generated for a 1 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 mW/cm^2 , Z = Impedance of free space, 377Ω

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 mW/cm^2

Kind of EUT	ATOZ
Device Category	<input type="checkbox"/> Portable (< 20 cm separation) <input type="checkbox"/> Mobile (> 20 cm separation) <input checked="" type="checkbox"/> Others
Exposure Evaluation Applied	<input checked="" type="checkbox"/> MPE <input type="checkbox"/> SAR <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 ²) @ 20 cm Separation	Limit (mW/cm ²)
		(dBm)	(dBm)	(mW)	Log	Linear			
2 402 ~ 2 480	Bluetooth LE	0.0 ± 0.5	0.50	1.12	3.30	2.14	0.44	0.000 5	1.00

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

$$D = 0.282 * \sqrt{(1.12 * 2.14)} / 1.00 = 0.44 \text{ cm}$$

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

$$S = P * G / (4\pi * R^2) = 1.12 * 2.14 / (4 * 3.14 * 20^2) = 0.000 5$$

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 WLAN 2.4 GHz

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 ²) @ 20 cm Separation	Limit (mW/cm ²)
		(dBm)	(dBm)	(mW)	Log	Linear			
2 400 ~ 2 483.5	802.11b	2.0 ± 1.0	3.00	2.00	3.30	2.14	0.58	0.000 8	1.00
	802.11g	0.5 ± 1.0	1.50	1.41			0.49	0.000 6	1.00
	802.11n_HT20	0.0 ± 1.0	1.00	1.26			0.46	0.000 5	1.00

According to above table, for 2 400 ~ 2 483.5 MHz Band(802.11b), safe distance,

$$D = 0.282 * \sqrt{(2.00 * 2.14)/1.00} = 0.58 \text{ cm}$$

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

$$S = P * G / (4\pi * R^2) = 2.00 * 2.14 / (4 * 3.14 * 20^2) = 0.000 8$$

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