

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

Test Report No. : OT-199-RWD-039
AGR No. : A197A-116
Applicant : BITFINDER, INC.
Address : 40 boardman pl, 2F, San Francisco, California, 94103, United States
Manufacturer : BITFINDER, INC.
Address : 13F WeWork, 343 Samil-daero, Jung-Gu, Seoul, Republic of Korea
Type of Equipment : AWAIR ELEMENT
FCC ID. : 2AF65AWAIR0HD3E
Model Name : AWAIR Rev3E
Serial number : N/A
Total page of Report : 8 pages (including this page)
Date of Incoming : August 02, 2019
Date of issue : September 24, 2019

SUMMARY

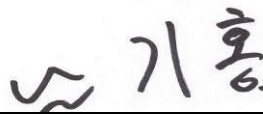
The equipment complies with the regulation; *FCC PART 15 SUBPART C Section 15.249, 15.247*
 This test report only contains the result of a single test of the sample supplied for the examination.
 It is not a generally valid assessment of the features of the respective products of the mass-production.

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-199-RWD-039	September 24, 2019	Initial Release	All

1. VERIFICATION OF COMPLIANCE

Applicant : BITFINDER, INC.
 Address : 40 boardman pl, 2F, San Francisco, California, 94103, United States
 Contact Person : Kevin, Cho / CTO
 Telephone No. : 408-930-9235
 FCC ID : 2AF65AWAIR0HD3E
 Model Name : AWAIR Rev3E
 Brand Name : -
 Serial Number : N/A
 Date : September 24, 2019

EQUIPMENT CLASS	DTS – DIGITAL TRNSMISSION SYSTEM
E.U.T. DESCRIPTION	AWAIR ELEMENT
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 15.247 558074 D01 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 BITFINDER, INC., Model AWAIR Rev3E (referred to as the EUT in this report) is an AWAIR ELEMENT, Product specification information described herein was obtained from product data sheet or user’s manual.

DEVICE TYPE	AWAIR ELEMENT	
Temperature Range	-10 °C ~ 50 °C	
OPERATING FREQUENCY	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	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	Bluetooth LE	-1.05 dBm
	WLAN 2.4 GHz	7.51 dBm(802.11b) 10.75 dBm(802.11g) 9.78 dBm(802.11n_HT20)
ANTENNA TYPE	PCB Antenna	
ANTENNA GAIN	5.049 dBi	
List of each Osc. or crystal Freq.(Freq. >= 1 MHz)	26 MHz, 37.4 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	AWAIR ELEMENT
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 Low Channel	-1.0 ± 0.5	-0.50	0.89	5.049	3.20	0.48	0.000 6	1.00
	Bluetooth LE Middle Channel	-1.5 ± 0.5	-1.00	0.79			0.45	0.000 5	1.00
	Bluetooth LE High Channel	-2.0 ± 0.5	-1.50	0.71			0.42	0.000 5	1.00

According to above table, for 2 402 MHz ~ 2 480 MHz Band(Low Channel), safe distance,

$$D = 0.282 * \sqrt{(0.89 * 3.20) / 1.00} = 0.48 \text{ cm}$$

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

$$S = P * G / (4\pi * R^2) = 0.89 * 3.20 / (4 * 3.14 * 20^2) = 0.000 6$$

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	7.5 ± 0.5	8.00	6.31	5.049	3.20	1.27	0.004 0	1.00
	802.11g	10.5 ± 0.5	11.00	12.59			1.79	0.008 0	1.00
	802.11n_HT20	9.5 ± 0.5	10.00	10.00			1.59	0.006 4	1.00

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

$$D = 0.282 * \sqrt{(12.59 * 3.20)/1.00} = 1.79 \text{ cm}$$

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

$$S = P * G / (4\pi * R^2) = 12.59 * 3.20 / (4 * 3.14 * 20^2) = 0.008 0$$

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