

EMF TEST REPORT

Test Report No. : OT-21N-RWD-032

Reception No. : 2110004435

Applicant : Union Community

Address : 12F, Munjeong Daemyeong Valeon bldg, 127 Beobwon-ro Songpa-gu, Seoul, South Korea

Manufacturer : Union Community

Address : 12F, Munjeong Daemyeong Valeon bldg, 127 Beobwon-ro Songpa-gu, Seoul, South Korea

Type of Equipment : Bluetooth Module

FCC ID. : XX2-F1DC2706-A

Model Name : F1DC2706-A

Multiple Model Name : N/A

Serial number : N/A

Total page of Report : 7 pages (including this page)

Date of Incoming : October 11, 2021

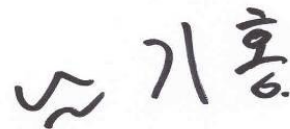
Date of issue : November 15, 2021

SUMMARY

The equipment complies with the regulation; *FCC 47 CFR Part 1, 1.1310*

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.



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Revision History

Rev. No.	Issue Report No.	Issued Date	Revisions	Section Affected
0	OT-21N-RWD-032	November 15, 2021	Initial Release	All

1. VERIFICATION OF COMPLIANCE

Applicant : Union Community
 Address : 12F, Munjeong Daemyeong Valeon bldg, 127 Beobwon-ro Songpa-gu, Seoul, South Korea
 Contact Person : Dong Ho Lee
 Telephone No. : +82-2-6488-3054
 FCC ID : XX2-F1DC2706-A
 Model Name : F1DC2706-A
 Brand Name : -
 Serial Number : N/A
 Date : November 15, 2021

EQUIPMENT CLASS	DTS – DIGITAL TRNSMISSION SYSTEM DSS – PART 15 SPREAD SPECTRUM TRANSMITTER
E.U.T. DESCRIPTION	Bluetooth Module
THIS REPORT CONCERNS	Original Grant
MEASUREMENT PROCEDURES	ANSI C63.10: 2020
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
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 Union Community, Model F1DC2706-A (referred to as the EUT in this report) is a Bluetooth Module. The product specification described herein was obtained from product data sheet or user's manual.

DEVICE TYPE	Bluetooth Module		
Temperature Range	-30 °C ~ 85 °C		
OPERATING FREQUENCY	Bluetooth LE	2 402 MHz ~ 2 480 MHz	
	Bluetooth	2 402 MHz ~ 2 480 MHz	
MODULATION TYPE	Bluetooth LE	GFSK for 1 Mbps	
	Bluetooth	GFSK for 1Mbps, $\pi/4$ -DQPSK for 2Mbps, 8-DPSK for 3Mbps	
RF OUTPUT POWER	Bluetooth LE	-1.95 dBm	
	Bluetooth	1 Mbps	-11.17 dBm
		2 Mbps	-11.34 dBm
		3 Mbps	-10.78 dBm
ANTENNA TYPE	Chip Antenna		
ANTENNA GAIN	0.8 dBi		
List of each Osc. or crystal Freq. (Freq. \geq 1 MHz)	24 MHz		

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

-. None

3. EUT MODIFICATIONS

-. None

4. RF EXPOSURE EVALUATION

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 $f/1500$ mW/cm² for the frequency range between 300 MHz and 1 500 MHz and 1.0 mW/cm² for the frequency range between 1 500 MHz and 100 000 MHz.

The electric field generated for a 1 mW/cm² 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/cm², Z = Impedance of free space, 377 Ω

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 (mW) = P (W) / 1 000, d (cm) = 0.01 * d (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/cm²

4.2 EUT Description

Kind of EUT	Bluetooth Module
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"/> SAR Test Exclusion Evaluation

4.3 Calculated MPE Safe Distance

4.3.1 Bluetooth

According to above equation, the following result was obtained.

Operating Freq. Band (MHz)	Operating Mode	Target Power W/tolerance (dBm)	Max tune up power		Antenna Gain		Safe Distance (cm)	Power Density (mW/cm ²) @ 20 cm Separation	Limit (mW/cm ²)
			(dBm)	(mW)	Log	Linear			
2 402 ~ 2 480	1 Mbps	-11.17 ± 1.0	-10.17	0.10	0.80	1.202	0.10	0.000 023	1.00
	2 Mbps	-11.34 ± 1.0	-10.34	0.09			0.09	0.000 022	1.00
	3 Mbps	-10.78 ± 1.0	-9.78	0.11			0.10	0.000 025	1.00

According to above table, for 2 402 ~ 2480 MHz Band(1 Mbps), safe distance,

$$D = 0.282 * \sqrt{(0.11 * 1.202)/1.00} = 0.10 \text{ cm.}$$

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

$$S = P * G / (4\pi * R^2) = 0.11 * 1.202 / (4 * \pi * 20^2) = 0.000 0025$$

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

4.3.2 Bluetooth LE

According to above equation, the following result was obtained.

Operating Freq. Band (MHz)	Operating Mode	Target Power W/tolerance (dBm)	Max tune up power		Antenna Gain		Safe Distance (cm)	Power Density (mW/cm ²) @ 20 cm Separation	Limit (mW/cm ²)
			(dBm)	(mW)	Log	Linear			
2 402 ~ 2 480	1 Mbps	-1.95 ± 1.0	-0.95	0.80	0.80	1.202	0.28	0.000 19	1.00

According to above table, for 2 402 ~ 2480 MHz Band(1 Mbps), safe distance,

$$D = 0.282 * \sqrt{(0.80 * 1.202)/1.00} = 0.28 \text{ cm.}$$

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

$$S = P * G / (4\pi * R^2) = 0.80 * 1.202 / (4 * \pi * 20^2) = 0.000 19$$

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