

TEST REPORT

of

FCC/IC MPE REQUIREMENT

Product : Bluetooth 5.3 module

Brand Name: Fanstel

Model: BT840N; BT840NE

Model Difference: Antenna difference

Applicant: Fanstel Corporation, Taipei

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Test Performed by:

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Report No.: **ISL-23LR0074FMPE**

Issue Date : **September 11, 2023**



Test results given in this report apply only to the specific sample(s) tested and are traceable to national or international standard through calibration of the equipment and evaluating measurement uncertainty herein.

The uncertainty of the measurement does not include in consideration of the test result unless the customer required the determination of uncertainty via the agreement, regulation or standard document specification.

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VERIFICATION OF COMPLIANCE

Applicant: Fanstel Corporation, Taipei
Product Description: Bluetooth 5.3 module
Brand Name: Fanstel
Model No.: BT840N; BT840NE
Model Difference: Antenna difference
Date of test: May 30, 2023 ~ September 11, 2023
Date of EUT Received: May 30, 2023

We hereby certify that:

All the tests in this report have been performed and recorded in accordance with the standards described above and performed by an independent electromagnetic compatibility consultant, International Standards Laboratory Corp.

The test results contained in this report accurately represent the measurements of the characteristics and the energy generated by sample equipment under test at the time of the test. The sample equipment tested as described in this report is in compliance with the limits of above standards.

Test By:

Weitin Chen

Date:

September 11, 2023

Weitin Chen / Senior Engineer

Prepared By:

Gigi yeh

Date:

September 11, 2023

Gigi Yeh / Senior Engineer

Approved By:

Jerry Liu

Date:

September 11, 2023

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1. Description of Equipment under Test (EUT)

General Information	
Product Name:	Bluetooth 5.3 module
Brand Name:	Fanstel
Model Name:	BT840N; BT840NE
Model Difference:	Antenna. Please see table below for detail.
Temperature Range	-40°C to +105°C
Power Supply:	5VDC
BLE Information	
Frequency Range:	2402 – 2480MHz
Max Output Power:	20.593dBm
Channel number:	40 channels
Modulation type:	GFSK
IEEE 802.15.4 (Thread, Zigbee) Information	
Frequency Range:	2402 – 2480MHz
Max Output Power:	21.685dBm
Channel number:	16 channels
Modulation type:	FSK

	Antenna Type	Brand	Model	Peak Gain	Frequency Range	Connector Type
1	Dipole	Fanstel	ANT060	6dBi	2400-2485 MHz	MMCX
2	PCB	Fanstel	F type	0.88dBi	2400-2485 MHz	MMCX

Model Summaries

module	BT840N	BT840NE
SoC	nRF52840	nRF52840
Size, mm	15x29.9x2.0	15x29.9x2.0
32M,32.768kHz crystals	Integrated	Integrated
DCDC inductors,VDD,VDDH	Integrated	Integrated
BT Antenna	PA+PCB	PA+PCB+u.FL
Operating temp.	-40oC to +85oC	-40oC to +85oC
Evaluation board	EV-BT840NE	EV-BT840NE

2. Maximum Permissible Exposure (MPE)

2.1 Standard Applicable

According to §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

This is a Mobile device, the MPE is required.

According to §1.1310 and §2.1091 RF exposure is calculated.

Limits for Maximum Permissive Exposure (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (minute)
Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f ²)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	F/1500	30
1500-15000	/	/	1.0	30

F = frequency in MHz

* = Plane-wave equipment power density

According to RSS 102 issue 5.

2.5.2 Exemption Limits for Routine Evaluation – RF Exposure Evaluation

RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:

- below 20 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);
- at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $4.49/f^{0.5}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);
- at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \times 10^{-2} f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).

In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the e.i.r.p. was derived.

3. Evaluation Result:

FCC:

BLE Mode:

20 cm

Ant type	Frequency band	Conducted power (dBm)	Antenna gain (dBi)	Tune-Up Tolerance (dB)	EIRP (dBm)	MPE (mW/cm ²)	LIMIT (mW/cm ²)
Dipole	2405-2480	20.593	6	2	28.593	0.14388984	1
PCB	2405-2480	20.593	0.88	2	23.473	0.04426191	1

Zigbee Mode:

20 cm

Ant type	Frequency band	Conducted power (dBm)	Antenna gain (dBi)	Tune-Up Tolerance (dB)	EIRP (dBm)	MPE (mW/cm ²)	LIMIT (mW/cm ²)
Dipole	2405-2480	21.685	6	2	29.685	0.18502489	1
PCB	2405-2480	21.685	0.88	2	24.565	0.05691545	1

$$\text{Max Power(mW)} = 10^{((\text{Max Power(dBm)} + \text{Tune-up tolerance(dB)})/10)}$$

$$\text{Result} = \text{Max Power (mW)} / \text{min. distance(mm)} * \sqrt{f(\text{GHz})}$$

IC EIRP level:

BLE Mode:

20 cm

Ant type	Frequency band	Conducted power (dBm)	Antenna gain (dBi)	Tune-Up Tolerance (dB)	EIRP (dBm)	MPE (W/m ²)	LIMIT (W/m ²)
Dipole	2405-2480	20.593	6	2	28.593	1.439	5.366
PCB	2405-2480	20.593	0.88	2	23.473	0.443	5.366

Zigbee Mode:

20 cm

Ant type	Frequency band	Conducted power (dBm)	Antenna gain (dBi)	Tune-Up Tolerance (dB)	EIRP (dBm)	MPE (W/m ²)	LIMIT (W/m ²)
Dipole	2405-2480	21.685	6	2	29.685	1.850	5.366
PCB	2405-2480	21.685	0.88	2	24.565	0.569	5.366

~ End ~