

TEST REPORT

of

FCC/IC MPE REQUIREMENT

Product : Bluetooth 5.3, 802.15.4 module

Brand Name: Fanstel

Model: BT40N; BT40NE

Model Difference: Antenna difference

Applicant: Fanstel Corporation, Taipei

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Test Performed by:

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Report No.: **ISL-23LR0019FMPE**
Issue Date :**2023/04/11**



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, 802.15.4 module
Brand Name: Fanstel
Model No.: BT40N; BT40NE
Model Difference: Antenna difference
Date of test: 2023/02/02 ~ 2023/04/11
Date of EUT Received: 2023/02/02

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:

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Date:

2023/04/11

Weitin Chen / Senior Engineer

Prepared By:

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Date:

2023/04/11

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Date:

2023/04/11

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1. Description of Equipment under Test (EUT)

General Information	
Product Name:	Bluetooth 5.3, 802.15.4 module
Brand Name:	Fanstel
Model Name:	BT40N; BT40NE
Model Difference:	Antenna. Please see table below for detail.
Temperature Range	-40°C to +105°C
Power Supply:	5VDC
Information	
Frequency Range:	2402 – 2480MHz
Max Output Power:	19.137dBm
Channel number:	40 channels
Modulation type:	GFSK
PMN (Product Marketing Name)	BT40N
HVIN (Hardware Version Identification Number)	BT40N; BT40NE
FVIN (Firmware Version Identification Number)	Nrf Connect SDK 1.4.99
Test SW Version:	Putty 0.60.0.0
RFpower setting:	Pos0dBm

	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	BT40N	BT40NE
SoC	nRF5340	nRF5340
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 +105oC	-40oC to +105oC
Evaluation board	EV-BT40NE	EV-BT40NE

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	19.137	6	2	27.137	0.10290350	1
PIFA	2405-2480	19.137	0.88	2	22.017	0.03165411	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	2405-2475	17.256	6	2	25.256	0.06673139	1
PIFA	2405-2475	17.256	0.88	2	20.136	0.02052722	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	19.137	6	2	27.137	1.029	5.366
PIFA	2405-2480	19.137	0.88	2	22.017	0.317	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	2405-2475	17.256	6	2	25.256	0.667	5.366
PIFA	2405-2475	17.256	0.88	2	20.136	0.205	5.366

~ End ~