

TEST REPORT

of

FCC/IC MPE REQUIREMENT

Product : Bluetooth 5.1, 802.15.4 module

Brand Name: Fanstel


Model: BT40; BT40E; BT40F

Model Difference: Antenna difference

Applicant: Fanstel Corporation, Taipei

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Test Performed by:

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Report No.: **ISL-23LR0012FMPE**
Issue Date :**2023/03/22**



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 5.1, 802.15.4 module
Brand Name: Fanstel
Model No.: BT40; BT40E; BT40F
Model Difference: Antenna difference
Date of test: 2023/01/13 ~ 2023/03/22
Date of EUT Received: 2023/01/13

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:

2023/03/22

Weitin Chen / Senior Engineer

Prepared By:

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Date:

2023/03/22

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Approved By:

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Date:

2023/03/22

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1. Description of Equipment under Test (EUT)

General Information	
Product Name:	Bluetooth 5.1, 802.15.4 module
Brand Name:	Fanstel
Model Name for FCC:	BT40; BT40F; BT40E
Model Name for IC:	BT40-1; BT40F-1; BT40E-1
Model Difference:	Antenna. Please see table below for detail.
Temperature Range	-45°C to +105°C
Power Supply:	5Vdc from USB (JIG)
IEEE 802.15.4 (Thread, Zigbee) Information	
Frequency Range:	2405 – 2480MHz
Max Output Power:	1.681dBm
Channel number:	16 channels
Modulation type:	GFSK
PMN (Product Marketing Name)	BT40
HVIN (Hardware Version Identification Number)	BT40-V2
FVIN (Firmware Version Identification Number)	nRF Connect SDK 1.4.99
Test SW Version:	Putty 0.60.0.0
RFpower setting:	Pos0dBm

Model Summaries:

module	BT40F (PCB Ant.)	BT40	BT40E (Dipole Ant.)
SoC	nRF5340 QKAA	nRF5340 QKAA	nRF5340 QKAA
Size	15x20.8x1.9mm	14x16x1.9mm	14x16x1.9mm
32 MHz and 32.768 kHz crystals	Integrated	Integrated	Integrated
DC converter inductors, VDD, VDDH	Integrated	Integrated	Integrated
BT Antenna	PCB ANT 0.88dBi	PCB ANT -3.37dBi	Dipole ANT 6dBi
Max TX			
Operating temp.	-40°C to +105°C	-40°C to +105°C	-40°C to +105°C
Availability	Sample	Sample 1Q21	Sample

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 Permissible 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:

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	2.624	6	2	10.624	0.00229684	1
PIFA	2405-2480	2.624	0.88	2	5.504	0.00070653	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:

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	2.624	6	2	10.624	0.023	5.366
PIFA	2405-2480	2.624	0.88	2	5.504	0.007	5.366

~ End ~