

TEST REPORT

of

RE Directive (2014/53/EU) EN50566: 2017 / EN50663: 2017

Product : Bluetooth 5.3 module

Brand Name: Fanstel

Model: BT840N; BT840NE

Model Difference: Antenna. Please see page 5 for detail

Applicant: Fanstel Corporation, Taipei

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Test Performed by:



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Report No.: **ISL-23LR0074EMPE**

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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. This test report shall not be reproduced except in full, without the written approval of International Standards Laboratory Corp.

VERIFICATION OF COMPLIANCE

Applicant: Fanstel Corporation, Taipei
Equipment Under Test: Bluetooth 5.3 module
Brand Name: Fanstel
Model Number: BT840N; BT840NE
Model Different: Antenna. Please see page 5 for detail
Date of Test: May 30, 2023 ~ September 11, 2023
Date of EUT Received: May 30, 2023

APPLICABLE STANDARDS	
STANDARD	TEST RESULT
EN50566: 2017 EN50663: 2017	Complied

The above equipment was tested by International Standards Laboratory Corp. for compliance with the requirements set forth in the European Standard EN 50566: 2017 and EN 50663: 2017 under 3.1 (a) of RE Directive 2014/53/EU & The Radio Equipment Regulations 2017 of UK. The results of in this report apply to the product system that was used only.

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Version

Version No.	Date	Description
00	September 11, 2023	Initial creation of document

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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:	8.04dBm
Channel number:	40 channels
Modulation type:	GFSK
IEEE 802.15.4 (Thread, Zigbee) Information	
Frequency Range:	2405 – 2475MHz
Max Output Power:	9.57dBm
Channel number:	16 channels
Modulation type:	FSK

	Antenna Type	Brand	Model	Peak Gain	Frequency Range	Connector Type
1	Dipole	Fanstel	ANT000	0dBi	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

This test report applies for Bluetooth BLE and IEEE 802.15.4 (Thread, Zigbee).

Remark: The above DUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

2. Description of Test Modes

The EUT has been tested under Operating condition. And used to control the EUT for staying in continuous transmitting mode is programmed. Channel low, mid, and High for each modulation type are chosen for testing.

3. General Description of Applied Standards

The EUT According to the Specifications, it must comply with the requirements of the following standards:

EN 50566:2017 – Product standard to demonstrate the compliance of wireless communication devices with the basic restrictions and exposure limit values related to human exposure to electromagnetic fields in the frequency range from 30 MHz to 6 GHz: hand-held and body mounted devices in close proximity to the human body

EN 50663:2017 – Generic standard for assessment of low power electronic and electrical equipment related to human exposure restrictions for electromagnetic fields (10 MHz - 300 GHz)

EN 62311:2008 – Generic standard to demonstrate the compliance of electrical apparatus with the basic restrictions related to human exposure to electromagnetic fields (0Hz-300GHz)

EN 62479:2010 – Assessment of the compliance of low power electronic and electrical equipment with the basic restrictions related to human exposure to electromagnetic fields (10MHz to 300GHz)

4. RF Exposure Evaluations

4.1. Standards:

According to section 4.2 Low-power exclusion level (P_{\max}) of EN 62479: 2010 and Annex A, Table A.1 – Example values of SAR-based P_{\max} for some cases described by ICNIRP, IEEE Std C95.1-1999 and IEEE Std C95.1-2005

Table A.1 – Example values of SAR-based P_{\max} for some cases described by ICNIRP, IEEE Std C95.1-1999 and IEEE Std C95.1-2005

Guideline / Standard	SAR limit, SAR_{\max} W/kg	Averaging mass, m g	P_{\max} mW	Exposure tier ^a	Region of body ^a
ICNIRP [1]	2	10	20	General public	Head and trunk
	4	10	40	General public	Limbs
	10	10	100	Occupational	Head and trunk
	20	10	200	Occupational	Limbs
IEEE Std C95.1-1999 [2]	1,6	1	1,6	Uncontrolled environment	Head, trunk, arms, legs
	4	10	40	Uncontrolled environment	Hands, wrists, feet and ankles
	8	1	8	Controlled environment	Head, trunk, arms, legs
	20	10	200	Controlled environment	Hands, wrists, feet and ankles
IEEE Std C95.1-2005 [3]	2	10	20	Action level	Body except extremities and pinnae
	4	10	40	Action level	Extremities and pinnae
	10	10	100	Controlled environment	Body except extremities and pinnae
	20	10	200	Controlled environment	Extremities and pinnae
^a Consult the appropriate standard for more information and definitions of terms.					

According to EN 62311: 2008, the criteria listed in the bellowing table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified 1999/519/EC.

Reference levels for electric, magnetic and electromagnetic fields
(0 Hz to 300 GHz, unperturbed rms values)

Frequency Range	E-field Strength (V/m)	H-Field Strength (A/m)	B-field (uT)	Equivalent plane wave power density S (W/m ²)
0-1 Hz	--	3.2×10^4	4×10^4	--
1-8 Hz	10000	$3.2 \times 10^4 / f^2$	$4 \times 10^4 / f^2$	--
8-25 Hz	10000	$4000/f$	$5000/f$	--
0.025-0.8kHz	$250/f$	$4/f$	$5/f$	--
0.8-3kHz	$250/f$	5	6.25	--
3-150kHz	87	5	6.25	--
0.15-1MHz	87	$0.73/f$	$0.92/f$	--
1-10MHz	$87/f^{1/2}$	$0.073/f$	$0.92/f$	--
10-400MHz	28	0.073	0.092	2
400-2000MHz	$1.375 f^{1/2}$	$0.0037 f^{1/2}$	$0.0046 f^{1/2}$	$f/200$
2-300GHz	61	0.16	0.20	1.0

Notes:

1. f as indicated in the frequency range column.

4.2. Classification of the assessment method:

The antenna of the product, under normal use condition is at least 20cm away from the body of the user. Warning statement to the user for keeping at least 20 cm separation distance and the prohibition of operating to a person has been printed on the user's manual. So, this product under normal use is located on electromagnetic far field between the human body.

Far Field Calculation Formula

$$E = \frac{\sqrt{30PG(\theta, \phi)}}{r}$$

G = antenna gain relative to an isotropic antenna
 θ, ϕ = elevation and azimuth angles to point of investigation
r = distance from observation point to the antenna

4.3. EUT operating condition:

The software provided by Manufacturer enabled the EUT to transmit and receive data at lowest, middle and highest channel individually.

4.4. Test Results:

EIRP Measurement: EN 62479: 2010

BLE Mode:

Dipole Ant.

Frequency Band (MHz)	Max. EIRP (dBm)	Max. EIRP (W)	Field Strength (V/m)	Field Strength Limit (V/m)	Result
2400 - 2480	7.16	0.00655	2.216	61	Pass

PCB Ant.

Frequency Band (MHz)	Max. EIRP (dBm)	Max. EIRP (W)	Field Strength (V/m)	Field Strength Limit (V/m)	Result
2400 - 2480	8.04	0.00655	2.216	61	Pass

IEEE 802.15.4 (Thread, Zigbee) Mode:

Dipole Ant.

Frequency Band (MHz)	Max. EIRP (dBm)	Max. EIRP (W)	Field Strength (V/m)	Field Strength Limit (V/m)	Result
2400 - 2480	8.69	0.00740	2.355	61	Pass

PCB Ant.

Frequency Band (MHz)	Max. EIRP (dBm)	Max. EIRP (W)	Field Strength (V/m)	Field Strength Limit (V/m)	Result
2400 - 2480	9.57	0.00906	2.606	61	Pass

APPENDIX 1

Photographs of EUT

Refer to ISL-23LR0074P

~ End of Report ~