

TEST REPORT

of

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

Product : Bluetooth 5.0, 802.15.4 module

Brand Name: Fanstel

Model: BT840, BT840F, BT840E, BT840H

Model Difference: Antenna. Please see page 5 for detail

Applicant: Fanstel Corporation, Taipei

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Test Performed by:

International Standards Laboratory Corp.

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Report No.: ISL-19LR205EMPE

Issue Date : 2019/09/02

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.


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VERIFICATION OF COMPLIANCE

Applicant: Fanstel Corporation, Taipei
Equipment Under Test: Bluetooth 5.0, 802.15.4 module
Brand Name: Fanstel
Model Number: BT840, BT840F, BT840E, BT840H
Model Different: Antenna. Please see page 5 for detail
Date of Test: 2019/8/6 ~2019/8/27
Date of EUT Received: 2019/8/5

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 results of in this report apply to the product system that was used only.

Test By:		Date:	2019/09/02
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Version

Version No.	Date	Description
00	2019/09/02	Initial creation of document

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1. Description of Equipment under Test (EUT)

General:

Product Name:	Bluetooth 5.0, 802.15.4 module
Brand Name:	Fanstel
Model Name:	BT840, BT840F, BT840E, BT840H
Model Difference:	Antenna. Please see table below for detail.
Type of Equipment:	Stand-alone equipment
Temperature Range:	-40°C to +85°C
Simultaneous transmissions:	Yes
Geo-location capability:	No
Power Supply	5Vdc by USB port

Model Summaries

module	BT840F	BT840	BT840E	BT840H
SoC	nRF52840-QIAA	nRF52840-QIAA	nRF52840-QIAA	nRF52840-QIAA
Size	15x20.8x1.9mm	14x16x1.9mm	14x16x1.9mm	14x16x1.9mm
BT Antenna	PCB trace	PCB trace	u.FL	MHF4
BT range at 1Mbps	510 meters	180 M, estimated		
BT range at 125 Kbps	930 meters		>1000 M	>1000 M

	BT 4.0	IEEE 802.15.4 (Thread, Zigbee)
Frequency Range:	2402 – 2480MHz	2405 – 2480MHz
Channel number:	40 channels	16 channels
Modulation type:	Wide band Modulation	Wide band Modulation
Transmit Power: (EIRP)	BT840E : 8.20 dBi BT840F : 8.20 dBi	BT840E : 8.30 dBi BT840F : 8.30 dBi
Dwell Time	N/A	
Operating Mode	Point-to-Point	
Adaptive/ Non-Adaptive	Non-Adaptive	
LBT (Listen Before Talk)	Yes	
	<input checked="" type="checkbox"/> Adaptive Frequency Hopping using LBT based DAA <input type="checkbox"/> Adaptive Frequency Hopping using other forms of DAA (non-LBT based) <input type="checkbox"/> Short Control Signaling Transmissions	
Occupied Channel Bandwidth	Within 2400-2483.5MHz	
Duty Cycle	N/A	
Antenna Beam forming	No	
Antenna Designation:	Type: PCB Antenna, BT840F : 0.34 dBi Type: PCB Antenna, BT840: -3.52 dBi Type: Dipole Antenna, BT840E : 0 dBi Type: Dipole Antenna, BT840H : 0 dBi	

The EUT is compliance with BLE and IEEE 802.15.4 (Thread, Zigbee) Standard.

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.

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:

E-Field Strength Calculation: EN 62311: 2008

Mode: BLE with Dipole Antenna

Ambient temperature: 25°C

Relative humidity: 60%

Test Date: 2019/08/15

Antenna Gain= 0.00 dBi
Distance to human body= 20 cm
Duty Cycle= 0.99

Frequency	EIRP (dBm)	EIRP (mW)	E-Field Strength (V/m)	E-Field Strength Limit (V/m)	PASS/ FAIL
2402.00	8.20	6.61	2.21	61.00	PASS
2442.00	8.20	6.61	2.21	61.00	PASS
2480.00	8.20	6.61	2.21	61.00	PASS

Mode: IEEE 802.15.4 (Thread, Zigbee) with Dipole Antenna

Ambient temperature: 25°C

Relative humidity: 60%

Test Date: 2019/08/15

Antenna Gain= 0.00 dBi
Distance to human body= 20 cm
Duty Cycle= 0.99

Frequency	EIRP (dBm)	EIRP (mW)	E-Field Strength (V/m)	E-Field Strength Limit (V/m)	PASS/ FAIL
2402.00	8.30	6.76	2.24	61.00	PASS
2442.00	8.30	6.76	2.24	61.00	PASS
2480.00	8.30	6.76	2.24	61.00	PASS

Evaluation Results:

The Calculation of E-Field Strength is less than EN 62311 E-Field Strength limit 61V/m at 2.4GHz.

E-Field Strength Calculation: EN 62311: 2008

Mode: BLE with PCB Antenna

Ambient temperature: 25°C Relative humidity: 60% Test Date: 2019/08/15

Antenna Gain= 0.34 dBi
Distance to human body= 20 cm
Duty Cycle= 0.99

Frequency	EIRP (dBm)	EIRP (mW)	E-Field Strength (V/m)	E-Field Strength Limit (V/m)	PASS/ FAIL
2402.00	8.20	6.61	2.21	61.00	PASS
2442.00	8.20	6.61	2.21	61.00	PASS
2480.00	8.20	6.61	2.21	61.00	PASS

Mode: IEEE 802.15.4 (Thread, Zigbee) with PCB Antenna

Ambient temperature: 25°C Relative humidity: 60% Test Date: 2019/08/15

Antenna Gain= 0.34 dBi
Distance to human body= 20 cm
Duty Cycle= 0.99

Frequency	EIRP (dBm)	EIRP (mW)	E-Field Strength (V/m)	E-Field Strength Limit (V/m)	PASS/ FAIL
2402.00	8.30	6.76	2.24	61.00	PASS
2442.00	8.30	6.76	2.24	61.00	PASS
2480.00	8.30	6.76	2.24	61.00	PASS

Evaluation Results:

The Calculation of E-Field Strength is less than EN 62311 E-Field Strength limit 61V/m at 2.4GHz.

APPENDIX 1

Photographs of EUT

Refer to ISL-19LR205E328

~ End of Report ~