

**Shenzhen Global Test Service Co.,Ltd.**

No.7-101 and 8A-104, Building 7 and 8, DCC Cultural and Creative Garden, No.98, Pingxin North Road, Shangmugu Community, Pinghu Street, Longgang District, Shenzhen, Guangdong

EMF ASSESSMENT REPORT**EN 62311:2008****Report Reference No.: GTS20191209006-2-33**

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Date of issue.....: Dec.23, 2019

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Address.....: No.7-101 and 8A-104, Building 7 and 8, DCC Cultural and Creative Garden, No.98, Pingxin North Road, Shangmugu Community, Pinghu Street, Longgang District, Shenzhen, Guangdong

Applicant's name ..: Shenzhen Bilian Electronic Co.,Ltd.

Address ..: Building B1, Zhongxing Industrial Zone, Juling, Jutang Community, Guanlan street, LongHua district, Shenzhen, China

Test specification ..:Standard ..: **EN 62311:2008**

TRF Originator ..: Shenzhen Global Test Service Co.,Ltd.

Master TRF.....: Dated 2014-12

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Test item description ..: IEEE 802.11a/b/g/n/ac(1T1R)USB WIFI+BT Combo Module

Trade Mark ..: N/A

Manufacturer ..: Shenzhen Bilian Electronic Co.,Ltd.

Model/Type reference.....: BL-M8821CU1

Listed model ..: N/A

Hardware version ..: 1.1

Software version.....: V1.1

Ratings ..: DC 3.3V

Result.....: **PASS**

EMF ASSESSMENT REPORT

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		Date of issue

Equipment under Test : IEEE 802.11a/b/g/n/ac(1T1R)USB WIFI+BT Combo Module

Model /Type : BL-M8821CU1

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Applicant : **Shenzhen Bilian Electronic Co.,Ltd.**

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Guanlan street, LongHua district, Shenzhen, China

Manufacturer : **Shenzhen Bilian Electronic Co.,Ltd.**

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Guanlan street, LongHua district, Shenzhen, China

Test Result:	PASS
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The test report merely corresponds to the test sample.

It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

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1. SUMMARY

1.1. EUT configuration

The following peripheral devices and interface cables were connected during the measurement:

● - supplied by the manufacturer

○ - supplied by the lab

●	/	M/N:	/
		Manufacturer:	/

1.2. Product Description

Product Name:	IEEE 802.11a/b/g/n/ac(1T1R)USB WIFI+BT Combo Module
Trade Mark:	N/A
Model/Type reference:	BL-M8821CU1
List Model:	N/A
Model Declaration	N/A
Power supply:	DC 3.3V
Hardware Version	1.1
Software Version	V1.1
Bluetooth	
Frequency Range	2402MHz ~ 2480MHz
Channel Number	79 channels for Bluetooth (DSS) 40 channels for Bluetooth (DTS)
Channel Spacing	1MHz for Bluetooth (DSS) 2MHz for Bluetooth (DTS)
Modulation Type	GFSK, $\pi/4$ -DQPSK, 8DPSK for Bluetooth (DSS) GFSK for Bluetooth (DTS)
2.4G WLAN	
WLAN CE Operation frequency	IEEE 802.11b:2412-2472MHz IEEE 802.11g:2412-2472MHz IEEE 802.11n HT20:2412-2472MHz IEEE 802.11n HT40:2422-2462MHz
WLAN CE Modulation Type	IEEE 802.11b: DSSS(CCK,DQPSK,DBPSK) IEEE 802.11g: OFDM(64QAM, 16QAM, QPSK, BPSK) IEEE 802.11n HT20: OFDM (64QAM, 16QAM, QPSK,BPSK) IEEE 802.11n HT40: OFDM (64QAM, 16QAM, QPSK,BPSK)
Channel number:	13 Channel for IEEE 802.11b/g/n(HT20) 9 Channel for IEEE 802.11n(HT40)
Channel separation:	5MHz
WIFI(5G Band)	
WLAN CE Operation frequency	5180-5240MHz
WLAN CE Modulation Type	802.11a/n/ac: OFDM
Channel number:	4 Channels for 20MHz bandwidth(5180-5240MHz) 2 channels for 40MHz bandwidth(5190~5230MHz) 1 channels for 80MHz bandwidth(5210MHz)
SRD(5.8G Band)	
WLAN CE Operation frequency	5745-5825MHz
WLAN CE Modulation Type	802.11a/n/ac: OFDM
Channel Number	5 channels for 20MHz bandwidth(5745-5825MHz) 2 channels for 40MHz bandwidth(5755~5795MHz) 1 channels for 80MHz bandwidth(5775MHz)
Antenna Description	External Antenna, used for Bluetooth & WIFI TX/RX, 2.0dBi(Max.) for 2.4G Band and 2.0dBi(Max.) for 5G Band

2. TEST ENVIRONMENT

2.1. Address of the test laboratory

Shenzhen Global Test Service Co.,Ltd.

No.7-101 and 8A-104, Building 7 and 8, DCC Cultural and Creative Garden, No.98, Pingxin North Road, Shangmugu Community, Pinghu Street, Longgang District, Shenzhen, Guangdong

2.2. Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

CNAS (No. CNAS L8169)

Shenzhen Global Test Service Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC 17025: 2019 General Requirements) for the Competence of Testing and Calibration Laboratories.

A2LA (Certificate No. 4758.01)

Shenzhen Global Test Service Co., Ltd. has been assessed by the American Association for Laboratory Accreditation (A2LA). Certificate No. 4758.01.

2.3. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature:	<u>15-35 ° C</u>
Humidity:	<u>30-60 %</u>
Atmospheric pressure:	<u>950-1050mbar</u>

2.4. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to TR-100028-01 "Electromagnetic compatibility and Radio spectrum Matters (ERM);Uncertainties in the measurement of mobile radio equipment characteristics; Part 1" and TR-100028-02 "Electromagnetic compatibility and Radio spectrum Matters (ERM);Uncertainties in the measurement of mobile radio equipment characteristics; Part 2 " and is documented in the Shenzhen Global Test Service Co.,Ltd. quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for Shenzhen GTS laboratory is reported:

Test Items	Measurement Uncertainty	Notes
Transmitter power conducted	0.57 dB	(1)

- (1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

3. Method of measurement

3.1. Applicable Standard

EN 62311: Assessment of electronic and electrical equipment related to human exposure restrictions for electromagnetic fields (0 Hz – 300 GHz)

Council Recommendation 1999/519/EC of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0Hz to 300GHz) (Official Journal L 197 of 30 July 1999).

3.2. Introduction

This International Standard provides simple conformity assessment methods for low-power electronic and electrical equipment to an exposure limit relevant to electromagnetic fields (EMF). If such equipment cannot be shown to comply with the applicable EMF exposure requirements using the methods included in this standard for EMF assessment, then other standards, including IEC 62311 or other (EMF) product standards, may be used for conformity assessment.

3.3. Limit

Basic restriction for electric, magnetic and electromagnetic fields (0Hz to 300GHz)

Frequency range	Magnetic flux density (mT)	Current density (mA/m ²)	Whole body average SAR(W/kg)	Localised SAR (head and trunk)(W/kg)	Localised SAR (limbs) (W/kg)	Power density, S (W/m ²)
0Hz	40	--	--	--	--	--
>0-1Hz	--	8	--	--	--	--
1-4Hz	--	8/f	--	--	--	--
4-1000Hz	--	2	--	--	--	--
1000Hz-100kHz	--	f/500	--	--	--	--
100kHz-10MHz	--	f/500	0.08	2	4	--
10MHz-10GHz	--	--	0.08	2	4	--
10-300GHz	--	--	--	--	--	10

Notes:

1. f is the frequency in Hz.
2. The basic restriction on the current density is intended to protect against acute exposure effects on central nervous system tissues in the head and trunk of the body and includes a safety factor. The basic restrictions for ELF fields are based on established adverse effects on the central nervous system. Such acute effects are essentially instantaneous and there is no scientific justification to modify the basic restrictions for exposure of short duration. However, since the basic restriction refers to adverse effects on the central nervous system, this basic restriction may permit higher current densities in body tissues other than the central nervous system under the same exposure conditions.
3. Because of electrical inhomogeneity of the body, current densities should be averaged over a cross section of 1cm² perpendicular to the current direction.
4. For frequencies up to 100 kHz, peak current density values can be obtained by multiplying the rms value by $\sqrt{2}$ (=1.414). For pulses of duration t_p the equivalent frequency to apply in the basic restrictions should be calculated as $1/(2t_p)$.
5. For frequencies up to 100 kHz and for pulsed magnetic fields, the maximum current density associated with the pulses can be calculated from the rise/fall times and the maximum rate of change of magnetic flux density. The induced current density can then be compared with the appropriate basic restriction.
6. All SAR values are to be averaged over any six-minute period.
7. Localised SAR averaging mass is any 10g of contiguous tissue; the maximum SAR so obtained should be the value used for the estimation of exposure. These 10g of tissue are intended to be a mass of contiguous tissue with nearly homogeneous electrical properties. In specifying a contiguous mass of tissue, it is recognised that this concept can be used in computational dosimeter but may present difficulties for direct physical measurements. A simple geometry such as cubic tissue mass can be used provided that the calculated dissymmetric quantities have conservation values relative to the exposure guidelines.
8. For pulses of duration t_p the equivalent frequency to apply in the basic restrictions should be calculated as $1/(2t_p)$. Additionally, for pulsed exposures, in the frequency range 0.3 to 10GHz and for localised exposure

of the head, in order to limit and avoid auditory effects caused by thermoplastic expansion, an additional basic restriction is recommended. This is that SA should not exceed 2mJ kg⁻¹ averaged over 10g of tissue.

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

Frequency range	E-field strength (V/m)	H-field strength (A/m)	B-field (uT)	Equivalent plane wave power density $S_{eq}(W/m^2)$
0-1Hz	--	3.2×10^4	4×10^4	--
1-8Hz	10000	$3.2 \times 10^4 / f^2$	$4 \times 10^4 / f^2$	--
8-25Hz	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	$87/f^{1/2}$	0.73/f	0.92/f	--
10-400MHz	28	0.073	0.092	2
400-2000MHz	$1.375f^{1/2}$	$0.0037f^{1/2}$	$0.0046f^{1/2}$	f/200
2-300GHz	61	0.16	0.20	10

Notes: 1. As indicated in the frequency range column.

2. For frequencies between 100 kHz and 10GHz, S_{eq} , E^2 , H^2 and B^2 are to be averaged over any six-minute period.

3. For frequencies exceeding 10GHz, S_{eq} , E^2 , H^2 and B^2 are to be averaged over any $68/f^{1.05}$ -minute period (.in GHz).

4. No E-field value is provided for frequencies <1Hz, which are effectively static electric fields. For most people the annoying perception of surface electric charges will not occur at field strengths less than 20kV/m. Spark discharges causing stress or annoyance should be avoided.

3.4. EMF Assessment Method

Predication of EMF limit at a given distance

Equation from page 26 of EN 62311, Edition 2008

$$E = \eta_0 H = \frac{\sqrt{30PG(\theta, \phi)}}{r}$$

Where:

E: E-field strength (V/m)

P: power input to antenna (Watt)

G: is the antenna gain relative to an isotropic antenna;

θ, ϕ : are elevation and azimuth angles to point of investigation;

r: is the distance from observation point to the antenna;

η_0 : is the characteristic impedance of free space.

As declared by the Applicant, the EUT transmits with the maximum source-based Duty Cycle of 100%, and the EUT is a wireless device used in a medical application, at least 20cm from any body part of the user or nearby persons; from the maximum EUT RF output power, the minimum separation distance, $r=20$ cm, as well as the gain of the used antenna is 2.0dBi for WLAN and BT, the RF power density can be obtained.

4. Test Result

Mode	Maximum Output Power(EIRP) (dBm)	Maximum Output Power (W)	Antenna Gain (Nemeric)	Minimum Separation Distance (cm)	E-field strength Limit (V/m)	E-field strength At 20 cm (V/m)
BT-EDR	3.90	0.0025	1.58	20	61	1.708
BT-BLE	3.96	0.0025	1.58	20	61	1.720
2.4GWLAN	16.94	0.0494	1.58	20	61	7.665
5.2GWLAN	14.00	0.0251	1.58	20	61	5.464
5.8G	11.00	0.0126	1.58	20	61	3.868

5. Conclusion

The measurement results comply with the relevant limits for general public exposure specified as reference levels in the Council Recommendation 1999/519/EC.

.....End of Report.....