

**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

RF Exposure evaluation**Report Reference No.....: GTS20210525003-1-22****FCC ID.: 2AL6KBL-M8822BU3**

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Date of issue: Jun.10, 2021

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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: Room 501, Building 3, No. 32, Dafu Road, Zhangge Community, Fucheng Street, Longhua District, Shenzhen City, China

Test specification**47CFR §1.1310**Standard.....: **47CFR §2.1091****KDB447498 D01 General RF Exposure Guidance v06**

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

Master TRF: Dated 2014-12

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Test item description **IEEE 802.11b/g/n/ac(2T2R) USB3.0 WLAN & BT Module**

Trade Mark: N/A

Manufacturer: Shenzhen Bilian Electronic Co.,Ltd.

Model/Type reference: BL-M8822BU3

Listed Models: N/A

Modulation Type.....: IEEE 802.11a /802.11b/802.11g/802.11n/802.11ac

Operation Frequency.....: From 2412MHz to 2462MHz, 5180MHz to 5240MHz, 5745MHz to 5825MHz, 2402MHz to 2480MHz

Hardware Version: V1.0

Software Version: V1.0

Rating: DC 3.3V

Result: **PASS**

TEST REPORT

| | |
|--|---------------|
| Test Report No. : GTS20210525003-1-22 | Jun.10, 2021 |
| | Date of issue |

Equipment under Test : IEEE 802.11b/g/n/ac(2T2R) USB3.0 WLAN & BT Module

Model /Type : BL-M8822BU3

Listed model : N/A

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

Address : Room 501, Building 3, No. 32, Dafu Road, Zhangge Community, Fucheng Street, Longhua District, Shenzhen City, China

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

Address : Room 501, Building 3, No. 32, Dafu Road, Zhangge Community, Fucheng Street, Longhua District, Shenzhen City, China

| | |
|---------------------|-------------|
| Test Result: | PASS |
|---------------------|-------------|

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

| | | |
|-----|--------------|---|
| ● / | Length (m) : | / |
| | Shield : | / |
| | Detachable : | / |

1.2 Product Description

| | |
|-------------------------|--|
| Product Name | IEEE 802.11b/g/n/ac(2T2R) USB3.0 WLAN & BT Module |
| Trade Mark | N/A |
| Model/Type reference | BL-M8822BU3 |
| List Models | N/A |
| Model Declaration | N/A |
| Power supply: | DC 3.3V |
| Sample ID | GTS20210525003-1-1# & GTS20210525003-1-2# |
| Bluetooth | |
| Operation frequency | 2402-2480MHz |
| 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) |
| WIFI(2.4G Band) | |
| Frequency Range | 2412MHz ~ 2462MHz |
| Channel Spacing | 5MHz |
| Channel Number | 11 Channel for 20MHz bandwidth(2412~2462MHz) 7 channels for 40MHz bandwidth(2422~2452MHz) |
| Modulation Type | 802.11b: DSSS; 802.11g/n: OFDM |
| WIFI(5.2G Band) | |
| Frequency Range | 5180MHz ~ 5240MHz |
| Channel Number | 4 channels for 20MHz bandwidth(5180-5240MHz) 2 channels for 40MHz bandwidth(5190~5230MHz) 1 channels for 80MHz bandwidth(5210MHz) |
| Modulation Type | 802.11a/n/ac: OFDM |
| WIFI (5.8G Band) | |
| Frequency Range | 5745MHz ~ 5825MHz |
| Channel Number | 5 channels for 20MHz bandwidth(5745-5825MHz) 2 channels for 40MHz bandwidth(5755~5795MHz) 1 channels for 80MHz bandwidth(5775MHz) |
| Modulation Type | 802.11a/n/ac: OFDM |
| Antenna Description | Three External Antennas respectively.WLAN support 2*2MIMO technology. ANT0 used for WIFI TX/RX, 2.0dBi(Max.) for 2.4G Band and 2.0dBi(Max.) for 5G Band ANT1 used for WIFI TX/RX, 2.0dBi(Max.) for 2.4G Band and 2.0dBi(Max.) for 5G Band ANT2 used for Bluetooth, 2.0dBi(Max.) |

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.

Industry Canada Registration Number. is 24189.

FCC Designation Number is CN1234.

FCC Registered Test Site Number is165725.

2.3 Environmental conditions

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

| | |
|-----------------------|--------------|
| Temperature: | 15-35 ° C |
| Humidity: | 30-60 % |
| Atmospheric pressure: | 950-1050mbar |

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) |

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

According to §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission’s guidelines.

According to §1.1310 and §2.1091 RF exposure is calculated.

KDB447498 D01 General RF Exposure Guidance v06: Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies

3.2 Requirement

Systems operating under the provisions of FCC 47 CFR section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as mobile device whereby a distance of 0.2m normally can be maintained between the user and the device, and below RF Permissible Exposure limit shall comply with.

In accordance with KDB447498 D01 General RF Exposure Guidance v06 for Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneous transmitting antennas incorporated in a host device, based on the calculated/estimated, numerically modeled or measured field strengths or power density, is ≤ 1.0 . The MPE ratio of each antenna is determined at the minimum test separation distance required by the operating configurations and exposure conditions of the host device, according to the ratio of field strengths or power density to MPE limit, at the test frequency. Either the maximum peak or spatially averaged results from measurements or numerical simulations may be used to determine the MPE ratios. Spatial averaging does not apply when MPE is estimated using simple calculations based on far-field plane-wave equivalent conditions. The antenna installation and operating requirements for the host device must meet the minimum test separation distances required by all antennas, in both standalone and simultaneous transmission operations, to satisfy compliance.

3.3 Limit

Limits for Maximum Permissible Exposure (MPE)/Controlled Exposure

| Frequency Range(MHz) | Electric Field Strength(V/m) | Magnetic Field Strength(A/m) | Power Density (mW/cm ²) | Averaging Time (minute) |
|---|------------------------------|------------------------------|-------------------------------------|-------------------------|
| Limits for Occupational/Controlled Exposure | | | | |
| 0.3 – 3.0 | 614 | 1.63 | (100) * | 6 |
| 3.0 – 30 | 1842/f | 4.89/f | (900/f ²)* | 6 |
| 30 – 300 | 61.4 | 0.163 | 1.0 | 6 |
| 300 – 1500 | / | / | f/300 | 6 |
| 1500 – 100,000 | / | / | 5 | 6 |

Limits for Maximum Permissible Exposure (MPE)/Uncontrolled Exposure

| Frequency Range(MHz) | Electric Field Strength(V/m) | Magnetic Field Strength(A/m) | Power Density (mW/cm ²) | Averaging Time (minute) |
|---|------------------------------|------------------------------|-------------------------------------|-------------------------|
| Limits for Occupational/Controlled Exposure | | | | |
| 0.3 – 3.0 | 614 | 1.63 | (100) * | 30 |
| 3.0 – 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 – 100,000 | / | / | 1.0 | 30 |

F=frequency in MHz

*=Plane-wave equivalent power density

3.4 MPE Calculation Method

Predication of MPE limit at a given distance
Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = \frac{PG}{4\pi R^2}$$

Where: S=power density

P=power input to antenna

G=power gain of the antenna in the direction of interest relative to an isotropic radiator

R=distance to the center of radiation of the antenna

As declared by the Applicant, the EUT transmits with the maximum source-based Duty Cycle of 100%-see the User manual, and the EUT is a wireless device used in a mobile application, at least 20 cm from any body part of the user or nearby persons; from the maximum EUT RF output power, the minimum mobile separation distance, $r = 20\text{cm}$, as well as the gain of the used antenna is 1.06dBi for WLAN, and the power drift from Turn-up Procedure provide by manufacturer as following states, the RF power density can be obtained.

3.5 Antenna Information

BL-M8822BU3 can only use antennas certificated as follows provided by manufacturer;

| Internal Identification | Antenna Identification in Internal photos | Antenna type and antenna number | Operate frequency band | Maximum antenna gain |
|-------------------------|---|---------------------------------|------------------------|----------------------|
| Antenna 0 | WLAN ANT0 | External antenna | 5.0 – 6.0 GHz | 2.00dBi(Max.) |
| Antenna 1 | WLAN ANT1 | External antenna | 5.0 – 6.0 GHz | 2.00dBi(Max.) |
| Antenna 2 | BT ANT2 | External antenna | 2.4 – 2.5 GHz | 2.00dBi(Max.) |

4. Conducted Power Results

Antenna 0:

2.4GWLAN

| Mode | Channel | Frequency (MHz) | Peak Conducted Output Power (dBm) |
|---------------|---------|-----------------|-----------------------------------|
| 802.11b | 01 | 2412 | 17.25 |
| | 06 | 2437 | 17.57 |
| | 11 | 2462 | 17.05 |
| 802.11g | 01 | 2412 | 17.26 |
| | 06 | 2437 | 17.79 |
| | 11 | 2462 | 17.54 |
| 802.11n(HT20) | 01 | 2412 | 17.98 |
| | 06 | 2437 | 17.13 |
| | 11 | 2462 | 17.36 |
| 802.11n(HT40) | 03 | 2422 | 16.64 |
| | 06 | 2437 | 16.34 |
| | 09 | 2452 | 16.80 |

5.2GWLAN

| Mode | Channel | Frequency (MHz) | Average Conducted Output Power (dBm) |
|------------|---------|-----------------|--------------------------------------|
| 802.11a | 36 | 5180 | 14.19 |
| | 40 | 5200 | 14.39 |
| | 48 | 5240 | 14.87 |
| 802.11n20 | 36 | 5180 | 14.41 |
| | 40 | 5200 | 14.83 |
| | 48 | 5240 | 14.02 |
| 802.11ac20 | 36 | 5180 | 14.48 |
| | 40 | 5200 | 14.88 |
| | 48 | 5240 | 14.09 |
| 802.11n40 | 38 | 5190 | 14.13 |
| | 46 | 5230 | 14.03 |
| 802.11ac40 | 38 | 5190 | 14.41 |
| | 46 | 5230 | 14.63 |
| 802.11ac80 | 42 | 5210 | 14.65 |

5.8GWLAN

| Mode | Channel | Frequency (MHz) | Average Conducted Output Power (dBm) |
|------------|---------|-----------------|--------------------------------------|
| 802.11a | 149 | 5745 | 14.39 |
| | 157 | 5785 | 14.06 |
| | 165 | 5825 | 14.99 |
| 802.11n20 | 149 | 5745 | 14.79 |
| | 157 | 5785 | 14.25 |
| | 165 | 5825 | 14.03 |
| 802.11ac20 | 149 | 5745 | 14.14 |
| | 157 | 5785 | 14.35 |
| | 165 | 5825 | 14.28 |
| 802.11n40 | 151 | 5755 | 14.12 |
| | 159 | 5795 | 14.14 |
| 802.11ac40 | 151 | 5755 | 14.65 |
| | 159 | 5795 | 14.70 |
| 802.11ac80 | 155 | 5775 | 14.35 |

Antenna 1:

2.4GWLAN

| Mode | Channel | Frequency (MHz) | Peak Conducted Output Power (dBm) |
|---------------|---------|-----------------|-----------------------------------|
| 802.11b | 01 | 2412 | 17.36 |
| | 06 | 2437 | 17.22 |
| | 11 | 2462 | 17.55 |
| 802.11g | 01 | 2412 | 17.61 |
| | 06 | 2437 | 17.14 |
| | 11 | 2462 | 17.15 |
| 802.11n(HT20) | 01 | 2412 | 17.43 |
| | 06 | 2437 | 17.65 |
| | 11 | 2462 | 17.95 |
| 802.11n(HT40) | 03 | 2422 | 16.89 |
| | 06 | 2437 | 16.95 |
| | 09 | 2452 | 16.50 |

5.2GWLAN

| Mode | Channel | Frequency (MHz) | Average Conducted Output Power (dBm) |
|------------|---------|-----------------|--------------------------------------|
| 802.11a | 36 | 5180 | 14.15 |
| | 40 | 5200 | 14.04 |
| | 48 | 5240 | 14.19 |
| 802.11n20 | 36 | 5180 | 14.09 |
| | 40 | 5200 | 14.90 |
| | 48 | 5240 | 14.68 |
| 802.11ac20 | 36 | 5180 | 14.53 |
| | 40 | 5200 | 14.08 |
| | 48 | 5240 | 14.24 |
| 802.11n40 | 38 | 5190 | 14.84 |
| | 46 | 5230 | 14.89 |
| 802.11ac40 | 38 | 5190 | 14.38 |
| | 46 | 5230 | 14.74 |
| 802.11ac80 | 42 | 5210 | 14.87 |

5.8GWLAN

| Mode | Channel | Frequency (MHz) | Average Conducted Output Power (dBm) |
|------------|---------|-----------------|--------------------------------------|
| 802.11a | 149 | 5745 | 14.89 |
| | 157 | 5785 | 14.91 |
| | 165 | 5825 | 14.55 |
| 802.11n20 | 149 | 5745 | 14.84 |
| | 157 | 5785 | 14.13 |
| | 165 | 5825 | 14.17 |
| 802.11ac20 | 149 | 5745 | 14.93 |
| | 157 | 5785 | 14.15 |
| | 165 | 5825 | 14.72 |
| 802.11n40 | 151 | 5755 | 14.84 |
| | 159 | 5795 | 14.74 |
| 802.11ac40 | 151 | 5755 | 14.92 |
| | 159 | 5795 | 14.54 |
| 802.11ac80 | 155 | 5775 | 14.33 |

Antenna 2:**Bluetooth**

| Mode | Channel | Frequency (MHz) | Peak Conducted Output Power (dBm) |
|---------------|---------|-----------------|-----------------------------------|
| GFSK | 0 | 2402 | 6.90 |
| | 39 | 2441 | 6.96 |
| | 78 | 2480 | 6.91 |
| $\pi/4$ DQPSK | 0 | 2402 | 6.89 |
| | 39 | 2441 | 6.70 |
| | 78 | 2480 | 6.70 |
| 8DPSK | 0 | 2402 | 6.85 |
| | 39 | 2440 | 6.36 |
| | 78 | 2480 | 6.98 |
| GFSK(BT LE) | 0 | 2402 | 6.80 |
| | 19 | 2440 | 6.55 |
| | 39 | 2480 | 6.25 |

2*2MIMO(2.4GWLAN):

| Mode | Channel | Frequency (MHz) | Peak Conducted Output Power (dBm) |
|---------------|---------|-----------------|-----------------------------------|
| 802.11n(HT20) | 01 | 2412 | 20.72 |
| | 06 | 2437 | 20.41 |
| | 11 | 2462 | 20.68 |
| 802.11n(HT40) | 03 | 2422 | 19.78 |
| | 06 | 2437 | 19.67 |
| | 09 | 2452 | 19.66 |

2*2MIMO(5.2GWLAN):

| Mode | Channel | Frequency (MHz) | Average Conducted Output Power (dBm) |
|------------|---------|-----------------|--------------------------------------|
| 802.11n20 | 36 | 5180 | 17.26 |
| | 40 | 5200 | 17.88 |
| | 48 | 5240 | 17.37 |
| 802.11ac20 | 36 | 5180 | 17.52 |
| | 40 | 5200 | 17.51 |
| | 48 | 5240 | 17.18 |
| 802.11n40 | 38 | 5190 | 17.51 |
| | 46 | 5230 | 17.49 |
| 802.11ac40 | 38 | 5190 | 17.41 |
| | 46 | 5230 | 17.70 |
| 802.11ac80 | 42 | 5210 | 17.77 |

2*2MIMO(5.8GWLAN):

| Mode | Channel | Frequency (MHz) | Average Conducted Output Power (dBm) |
|------------|---------|-----------------|--------------------------------------|
| 802.11n20 | 149 | 5745 | 17.83 |
| | 157 | 5785 | 17.20 |
| | 165 | 5825 | 17.11 |
| 802.11ac20 | 149 | 5745 | 17.56 |
| | 157 | 5785 | 17.26 |
| | 165 | 5825 | 17.52 |
| 802.11n40 | 151 | 5755 | 17.51 |
| | 159 | 5795 | 17.46 |
| 802.11ac40 | 151 | 5755 | 17.80 |
| | 159 | 5795 | 17.63 |
| 802.11ac80 | 155 | 5775 | 17.35 |

5. Manufacturing Tolerance

Antenna 0:

2.4GWLAN

| IEEE 802.11b (Peak) | | | |
|--------------------------|------------|------------|------------|
| Channel | Channel 01 | Channel 06 | Channel 11 |
| Target (dBm) | 17.0 | 17.0 | 17.0 |
| Tolerance ±(dB) | 1.0 | 1.0 | 1.0 |
| IEEE 802.11g (Peak) | | | |
| Channel | Channel 01 | Channel 06 | Channel 11 |
| Target (dBm) | 17.0 | 17.0 | 17.0 |
| Tolerance ±(dB) | 1.0 | 1.0 | 1.0 |
| IEEE 802.11n HT20 (Peak) | | | |
| Channel | Channel 01 | Channel 06 | Channel 11 |
| Target (dBm) | 17.0 | 17.0 | 17.0 |
| Tolerance ±(dB) | 1.0 | 1.0 | 1.0 |
| IEEE 802.11n HT40 (Peak) | | | |
| Channel | Channel 03 | Channel 06 | Channel 09 |
| Target (dBm) | 16.0 | 16.0 | 16.0 |
| Tolerance ±(dB) | 1.0 | 1.0 | 1.0 |

5.2GWLAN

| IEEE 802.11a (Average) | | | |
|-------------------------------|------------|------------|------------|
| Channel | Channel 36 | Channel 40 | Channel 48 |
| Target (dBm) | 14.0 | 14.0 | 14.0 |
| Tolerance ±(dB) | 1.0 | 1.0 | 1.0 |
| IEEE 802.11n HT20 (Average) | | | |
| Channel | Channel 36 | Channel 40 | Channel 48 |
| Target (dBm) | 14.0 | 14.0 | 14.0 |
| Tolerance ±(dB) | 1.0 | 1.0 | 1.0 |
| IEEE 802.11ac VHT20 (Average) | | | |
| Channel | Channel 36 | Channel 40 | Channel 48 |
| Target (dBm) | 14.0 | 14.0 | 14.0 |
| Tolerance ±(dB) | 1.0 | 1.0 | 1.0 |
| IEEE 802.11n VHT40 (Average) | | | |
| Channel | Channel 38 | Channel 46 | / |
| Target (dBm) | 14.0 | 14.0 | / |
| Tolerance ±(dB) | 1.0 | 1.0 | / |
| IEEE 802.11ac VHT40 (Average) | | | |
| Channel | Channel 38 | Channel 46 | / |
| Target (dBm) | 14.0 | 14.0 | / |
| Tolerance ±(dB) | 1.0 | 1.0 | / |
| IEEE 802.11ac VHT80 (Average) | | | |
| Channel | Channel 42 | / | / |
| Target (dBm) | 14.0 | / | / |
| Tolerance ±(dB) | 1.0 | / | / |

5.8G WLAN

| IEEE 802.11a (Average) | | | |
|-------------------------------|-------------|-------------|-------------|
| Channel | Channel 149 | Channel 157 | Channel 165 |
| Target (dBm) | 14.0 | 14.0 | 14.0 |
| Tolerance ±(dB) | 1.0 | 1.0 | 1.0 |
| IEEE 802.11n HT20 (Average) | | | |
| Channel | Channel 149 | Channel 157 | Channel 165 |
| Target (dBm) | 14.0 | 14.0 | 14.0 |
| Tolerance ±(dB) | 1.0 | 1.0 | 1.0 |
| IEEE 802.11ac VHT20 (Average) | | | |
| Channel | Channel 149 | Channel 157 | Channel 165 |
| Target (dBm) | 14.0 | 14.0 | 14.0 |
| Tolerance ±(dB) | 1.0 | 1.0 | 1.0 |
| IEEE 802.11n VHT40 (Average) | | | |
| Channel | Channel 151 | Channel 159 | / |
| Target (dBm) | 14.0 | 14.0 | / |
| Tolerance ±(dB) | 1.0 | 1.0 | / |
| IEEE 802.11ac VHT40 (Average) | | | |
| Channel | Channel 151 | Channel 159 | / |
| Target (dBm) | 14.0 | 14.0 | / |
| Tolerance ±(dB) | 1.0 | 1.0 | / |
| IEEE 802.11ac VHT80 (Average) | | | |
| Channel | Channel 155 | / | / |
| Target (dBm) | 14.0 | / | / |
| Tolerance ±(dB) | 1.0 | / | / |

Antenna 1:

2.4G WLAN

| IEEE 802.11b (Peak) | | | |
|--------------------------|------------|------------|------------|
| Channel | Channel 01 | Channel 06 | Channel 11 |
| Target (dBm) | 17.0 | 17.0 | 17.0 |
| Tolerance ±(dB) | 1.0 | 1.0 | 1.0 |
| IEEE 802.11g (Peak) | | | |
| Channel | Channel 01 | Channel 06 | Channel 11 |
| Target (dBm) | 17.0 | 17.0 | 17.0 |
| Tolerance ±(dB) | 1.0 | 1.0 | 1.0 |
| IEEE 802.11n HT20 (Peak) | | | |
| Channel | Channel 01 | Channel 06 | Channel 11 |
| Target (dBm) | 17.0 | 17.0 | 17.0 |
| Tolerance ±(dB) | 1.0 | 1.0 | 1.0 |
| IEEE 802.11n HT40 (Peak) | | | |
| Channel | Channel 01 | Channel 06 | Channel 11 |
| Target (dBm) | 16.0 | 16.0 | 16.0 |
| Tolerance ±(dB) | 1.0 | 1.0 | 1.0 |

5.2GWLAN

| IEEE 802.11a (Average) | | | |
|-------------------------------|------------|------------|------------|
| Channel | Channel 36 | Channel 40 | Channel 48 |
| Target (dBm) | 14.0 | 14.0 | 14.0 |
| Tolerance ±(dB) | 1.0 | 1.0 | 1.0 |
| IEEE 802.11n HT20 (Average) | | | |
| Channel | Channel 36 | Channel 40 | Channel 48 |
| Target (dBm) | 14.0 | 14.0 | 14.0 |
| Tolerance ±(dB) | 1.0 | 1.0 | 1.0 |
| IEEE 802.11ac VHT20 (Average) | | | |
| Channel | Channel 36 | Channel 40 | Channel 48 |
| Target (dBm) | 14.0 | 14.0 | 14.0 |
| Tolerance ±(dB) | 1.0 | 1.0 | 1.0 |
| IEEE 802.11n VHT40 (Average) | | | |
| Channel | Channel 38 | Channel 46 | / |
| Target (dBm) | 14.0 | 14.0 | / |
| Tolerance ±(dB) | 1.0 | 1.0 | / |
| IEEE 802.11ac VHT40 (Average) | | | |
| Channel | Channel 38 | Channel 46 | / |
| Target (dBm) | 14.0 | 14.0 | / |
| Tolerance ±(dB) | 1.0 | 1.0 | / |
| IEEE 802.11ac VHT80 (Average) | | | |
| Channel | Channel 42 | / | / |
| Target (dBm) | 14.0 | / | / |
| Tolerance ±(dB) | 1.0 | / | / |

5.8GWLAN

| IEEE 802.11a (Average) | | | |
|-------------------------------|-------------|-------------|-------------|
| Channel | Channel 149 | Channel 157 | Channel 165 |
| Target (dBm) | 14.0 | 14.0 | 14.0 |
| Tolerance ±(dB) | 1.0 | 1.0 | 1.0 |
| IEEE 802.11n HT20 (Average) | | | |
| Channel | Channel 149 | Channel 157 | Channel 165 |
| Target (dBm) | 14.0 | 14.0 | 14.0 |
| Tolerance ±(dB) | 1.0 | 1.0 | 1.0 |
| IEEE 802.11ac VHT20 (Average) | | | |
| Channel | Channel 149 | Channel 157 | Channel 165 |
| Target (dBm) | 14.0 | 14.0 | 14.0 |
| Tolerance ±(dB) | 1.0 | 1.0 | 1.0 |
| IEEE 802.11n VHT40 (Average) | | | |
| Channel | Channel 151 | Channel 159 | / |
| Target (dBm) | 14.0 | 14.0 | / |
| Tolerance ±(dB) | 1.0 | 1.0 | / |
| IEEE 802.11ac VHT40 (Average) | | | |
| Channel | Channel 151 | Channel 159 | / |
| Target (dBm) | 14.0 | 14.0 | / |
| Tolerance ±(dB) | 1.0 | 1.0 | / |
| IEEE 802.11ac VHT80 (Average) | | | |
| Channel | Channel 155 | / | / |
| Target (dBm) | 14.0 | / | / |
| Tolerance ±(dB) | 1.0 | / | / |

Antenna 2:

Bluetooth

| GFSK (Peak) | | | |
|-------------------|-----------|------------|------------|
| Channel | Channel 0 | Channel 39 | Channel 78 |
| Target (dBm) | 6.0 | 6.0 | 6.0 |
| Tolerance ±(dB) | 1.0 | 1.0 | 1.0 |
| π/4DQPSK (Peak) | | | |
| Channel | Channel 0 | Channel 39 | Channel 78 |
| Target (dBm) | 6.0 | 6.0 | 6.0 |
| Tolerance ±(dB) | 1.0 | 1.0 | 1.0 |
| 8DPSK (Peak) | | | |
| Channel | Channel 0 | Channel 39 | Channel 78 |
| Target (dBm) | 6.0 | 6.0 | 6.0 |
| Tolerance ±(dB) | 1.0 | 1.0 | 1.0 |
| GFSK BT LE (Peak) | | | |
| Channel | Channel 0 | Channel 19 | Channel 39 |
| Target (dBm) | 6.0 | 6.0 | 6.0 |
| Tolerance ±(dB) | 1.0 | 1.0 | 1.0 |

2*2MIMO(2.4GWLAN):

| IEEE 802.11n HT20 (Peak) | | | |
|--------------------------|------------|------------|------------|
| Channel | Channel 01 | Channel 06 | Channel 11 |
| Target (dBm) | 20.0 | 20.0 | 20.0 |
| Tolerance ±(dB) | 1.0 | 1.0 | 1.0 |
| IEEE 802.11n HT40 (Peak) | | | |
| Channel | Channel 01 | Channel 06 | Channel 11 |
| Target (dBm) | 19.0 | 19.0 | 19.0 |
| Tolerance ±(dB) | 1.0 | 1.0 | 1.0 |

2*2MIMO(5.2GWLAN):

| IEEE 802.11n HT20 (Average) | | | |
|-------------------------------|------------|------------|------------|
| Channel | Channel 36 | Channel 40 | Channel 48 |
| Target (dBm) | 17.0 | 17.0 | 17.0 |
| Tolerance ±(dB) | 1.0 | 1.0 | 1.0 |
| IEEE 802.11ac VHT20 (Average) | | | |
| Channel | Channel 36 | Channel 40 | Channel 48 |
| Target (dBm) | 17.0 | 17.0 | 17.0 |
| Tolerance ±(dB) | 1.0 | 1.0 | 1.0 |
| IEEE 802.11n VHT40 (Average) | | | |
| Channel | Channel 38 | Channel 46 | / |
| Target (dBm) | 17.0 | 17.0 | / |
| Tolerance ±(dB) | 1.0 | 1.0 | / |
| IEEE 802.11ac VHT40 (Average) | | | |
| Channel | Channel 38 | Channel 46 | / |
| Target (dBm) | 17.0 | 17.0 | / |
| Tolerance ±(dB) | 1.0 | 1.0 | / |
| IEEE 802.11ac VHT80 (Average) | | | |
| Channel | Channel 42 | / | / |
| Target (dBm) | 17.0 | / | / |
| Tolerance ±(dB) | 1.0 | / | / |

2*2MIMO(5.8GWLAN):

| IEEE 802.11n HT20 (Average) | | | |
|-------------------------------|-------------|-------------|-------------|
| Channel | Channel 149 | Channel 157 | Channel 165 |
| Target (dBm) | 17.0 | 17.0 | 17.0 |
| Tolerance ±(dB) | 1.0 | 1.0 | 1.0 |
| IEEE 802.11ac VHT20 (Average) | | | |
| Channel | Channel 149 | Channel 157 | Channel 165 |
| Target (dBm) | 17.0 | 17.0 | 17.0 |
| Tolerance ±(dB) | 1.0 | 1.0 | 1.0 |
| IEEE 802.11n VHT40 (Average) | | | |
| Channel | Channel 151 | Channel 159 | / |
| Target (dBm) | 17.0 | 17.0 | / |
| Tolerance ±(dB) | 1.0 | 1.0 | / |
| IEEE 802.11ac VHT40 (Average) | | | |
| Channel | Channel 151 | Channel 159 | / |
| Target (dBm) | 17.0 | 17.0 | / |
| Tolerance ±(dB) | 1.0 | 1.0 | / |
| IEEE 802.11ac VHT80 (Average) | | | |
| Channel | Channel 155 | / | / |
| Target (dBm) | 17.0 | / | / |
| Tolerance ±(dB) | 1.0 | / | / |

6. Measurement Results

6.1 Standalone MPE Evaluation

As declared by the Applicant, the EUT is a wireless device used in a fix application, at least 20 cm from any body part of the user or nearby persons; from the maximum EUT RF output power, the minimum separation distance, $r = 20\text{cm}$, as well as the gain of the used antenna refer to antenna information, the RF power density can be obtained.

Antenna 0:

2.4G WLAN

| Modulation Type | Output power | | Antenna Gain (dBi) | Antenna Gain (linear) | MPE (mW/cm^2) | MPE Limits (mW/cm^2) |
|-----------------|--------------|---------|--------------------|-----------------------|---------------------------------|--|
| | dBm | mW | | | | |
| 802.11b | 18.00 | 63.0957 | 2.00 | 1.5849 | 0.0199 | 1.0000 |
| 802.11g | 18.00 | 63.0957 | 2.00 | 1.5849 | 0.0199 | 1.0000 |
| 802.11n(HT20) | 18.00 | 63.0957 | 2.00 | 1.5849 | 0.0199 | 1.0000 |
| 802.11n(HT40) | 17.00 | 50.1187 | 2.00 | 1.5849 | 0.0158 | 1.0000 |

5.2G WLAN

| Modulation Type | Output power | | Antenna Gain (dBi) | Antenna Gain (linear) | MPE (mW/cm^2) | MPE Limits (mW/cm^2) |
|-----------------|--------------|---------|--------------------|-----------------------|---------------------------------|--|
| | dBm | mW | | | | |
| 802.11a | 15.00 | 31.6228 | 2.00 | 1.5849 | 0.0100 | 1.0000 |
| 802.11n20 | 15.00 | 31.6228 | 2.00 | 1.5849 | 0.0100 | 1.0000 |
| 802.11ac20 | 15.00 | 31.6228 | 2.00 | 1.5849 | 0.0100 | 1.0000 |
| 802.11n40 | 15.00 | 31.6228 | 2.00 | 1.5849 | 0.0100 | 1.0000 |
| 802.11ac40 | 15.00 | 31.6228 | 2.00 | 1.5849 | 0.0100 | 1.0000 |
| 802.11ac80 | 15.00 | 31.6228 | 2.00 | 1.5849 | 0.0100 | 1.0000 |

5.8G WLAN

| Modulation Type | Output power | | Antenna Gain (dBi) | Antenna Gain (linear) | MPE (mW/cm^2) | MPE Limits (mW/cm^2) |
|-----------------|--------------|---------|--------------------|-----------------------|---------------------------------|--|
| | dBm | mW | | | | |
| 802.11a | 15.00 | 31.6228 | 2.00 | 1.5849 | 0.0100 | 1.0000 |
| 802.11n20 | 15.00 | 31.6228 | 2.00 | 1.5849 | 0.0100 | 1.0000 |
| 802.11ac20 | 15.00 | 31.6228 | 2.00 | 1.5849 | 0.0100 | 1.0000 |
| 802.11n40 | 15.00 | 31.6228 | 2.00 | 1.5849 | 0.0100 | 1.0000 |
| 802.11ac40 | 15.00 | 31.6228 | 2.00 | 1.5849 | 0.0100 | 1.0000 |
| 802.11ac80 | 15.00 | 31.6228 | 2.00 | 1.5849 | 0.0100 | 1.0000 |

Antenna 1:**2.4G WLAN**

| Modulation Type | Output power | | Antenna Gain (dBi) | Antenna Gain (linear) | MPE (mW/cm ²) | MPE Limits (mW/cm ²) |
|-----------------|--------------|---------|--------------------|-----------------------|---------------------------|----------------------------------|
| | dBm | mW | | | | |
| 802.11b | 18.00 | 63.0957 | 2.00 | 1.5849 | 0.0199 | 1.0000 |
| 802.11g | 18.00 | 63.0957 | 2.00 | 1.5849 | 0.0199 | 1.0000 |
| 802.11n(HT20) | 18.00 | 63.0957 | 2.00 | 1.5849 | 0.0199 | 1.0000 |
| 802.11n(HT40) | 17.00 | 50.1187 | 2.00 | 1.5849 | 0.0158 | 1.0000 |

5.2G WLAN

| Modulation Type | Output power | | Antenna Gain (dBi) | Antenna Gain (linear) | MPE (mW/cm ²) | MPE Limits (mW/cm ²) |
|-----------------|--------------|---------|--------------------|-----------------------|---------------------------|----------------------------------|
| | dBm | mW | | | | |
| 802.11a | 15.00 | 31.6228 | 2.00 | 1.5849 | 0.0100 | 1.0000 |
| 802.11n20 | 15.00 | 31.6228 | 2.00 | 1.5849 | 0.0100 | 1.0000 |
| 802.11ac20 | 15.00 | 31.6228 | 2.00 | 1.5849 | 0.0100 | 1.0000 |
| 802.11n40 | 15.00 | 31.6228 | 2.00 | 1.5849 | 0.0100 | 1.0000 |
| 802.11ac40 | 15.00 | 31.6228 | 2.00 | 1.5849 | 0.0100 | 1.0000 |
| 802.11ac80 | 15.00 | 31.6228 | 2.00 | 1.5849 | 0.0100 | 1.0000 |

5.8G WLAN

| Modulation Type | Output power | | Antenna Gain (dBi) | Antenna Gain (linear) | MPE (mW/cm ²) | MPE Limits (mW/cm ²) |
|-----------------|--------------|---------|--------------------|-----------------------|---------------------------|----------------------------------|
| | dBm | mW | | | | |
| 802.11a | 15.00 | 31.6228 | 2.00 | 1.5849 | 0.0100 | 1.0000 |
| 802.11n20 | 15.00 | 31.6228 | 2.00 | 1.5849 | 0.0100 | 1.0000 |
| 802.11ac20 | 15.00 | 31.6228 | 2.00 | 1.5849 | 0.0100 | 1.0000 |
| 802.11n40 | 15.00 | 31.6228 | 2.00 | 1.5849 | 0.0100 | 1.0000 |
| 802.11ac40 | 15.00 | 31.6228 | 2.00 | 1.5849 | 0.0100 | 1.0000 |
| 802.11ac80 | 15.00 | 31.6228 | 2.00 | 1.5849 | 0.0100 | 1.0000 |

Antenna 2:**BT**

| Modulation Type | Output power | | Antenna Gain (dBi) | Antenna Gain (linear) | MPE (mW/cm ²) | MPE Limits (mW/cm ²) |
|-----------------|--------------|--------|--------------------|-----------------------|---------------------------|----------------------------------|
| | dBm | mW | | | | |
| GFSK | 7.00 | 5.0119 | 2.00 | 1.5849 | 0.0016 | 1.0000 |
| π/4DQPSK | 7.00 | 5.0119 | 2.00 | 1.5849 | 0.0016 | 1.0000 |
| 8DPSK | 7.00 | 5.0119 | 2.00 | 1.5849 | 0.0016 | 1.0000 |
| GFSK(BT LE) | 7.00 | 5.0119 | 2.00 | 1.5849 | 0.0016 | 1.0000 |

2*2MIMO(2.4GWLAN):

| Modulation Type | Output power | | Directional Gain (dBi) | Directional Gain (linear) | MPE (mW/cm ²) | MPE Limits (mW/cm ²) |
|-----------------|--------------|----------|------------------------|---------------------------|---------------------------|----------------------------------|
| | dBm | mW | | | | |
| 802.11n20 | 21.00 | 125.8925 | 5.01 | 3.1696 | 0.0794 | 1.0000 |
| 802.11n40 | 20.00 | 100.0000 | 5.01 | 3.1696 | 0.0631 | 1.0000 |

2*2MIMO(5.2GWLAN):

| Modulation Type | Output power | | Directional Gain (dBi) | Directional Gain (linear) | MPE (mW/cm ²) | MPE Limits (mW/cm ²) |
|-----------------|--------------|---------|------------------------|---------------------------|---------------------------|----------------------------------|
| | dBm | mW | | | | |
| 802.11n20 | 18.00 | 63.0957 | 5.01 | 3.1696 | 0.0398 | 1.0000 |
| 802.11ac20 | 18.00 | 63.0957 | 5.01 | 3.1696 | 0.0398 | 1.0000 |
| 802.11n40 | 18.00 | 63.0957 | 5.01 | 3.1696 | 0.0398 | 1.0000 |
| 802.11ac40 | 18.00 | 63.0957 | 5.01 | 3.1696 | 0.0398 | 1.0000 |
| 802.11ac80 | 18.00 | 63.0957 | 5.01 | 3.1696 | 0.0398 | 1.0000 |

2*2MIMO(5.8GWLAN):

| Modulation Type | Output power | | Directional Gain (dBi) | Directional Gain (linear) | MPE (mW/cm ²) | MPE Limits (mW/cm ²) |
|-----------------|--------------|---------|------------------------|---------------------------|---------------------------|----------------------------------|
| | dBm | mW | | | | |
| 802.11n20 | 18.00 | 63.0957 | 5.01 | 3.1696 | 0.0398 | 1.0000 |
| 802.11ac20 | 18.00 | 63.0957 | 5.01 | 3.1696 | 0.0398 | 1.0000 |
| 802.11n40 | 18.00 | 63.0957 | 5.01 | 3.1696 | 0.0398 | 1.0000 |
| 802.11ac40 | 18.00 | 63.0957 | 5.01 | 3.1696 | 0.0398 | 1.0000 |
| 802.11ac80 | 18.00 | 63.0957 | 5.01 | 3.1696 | 0.0398 | 1.0000 |

Remark:

1. Output power including tune-up tolerance;
2. MPE evaluate distance is 20cm from user manual provide by manufacturer;

6.2 Simultaneous Transmission MPE

The sample support one Bluetooth & WLAN modular and one Bluetooth antenna, and two WLAN antennas, WLAN support MIMO, Need consider simultaneous transmission ;

The sample supports 2T2R MIMO technology for WLAN.

According to KDB447498 D01 General RF Exposure Guidance v06 for Transmitters used in mobile exposure conditions for simultaneous transmission operations;

\sum of MPE ratios \leq 1.0

8.2.1 Summary simultaneous transmission information

| Modulation Type | Work Frequency Band | Transmit Antenna | | Antenna 0 Antenna 1 Synchronization transmit |
|-----------------|---------------------|------------------|-----------|--|
| | | Antenna 0 | Antenna 1 | |
| 802.11b | 2.4G WLAN | Yes | Yes | No |
| 802.11g | 2.4G WLAN | Yes | Yes | No |
| 802.11n(HT20) | 2.4G WLAN | Yes | Yes | Yes |
| 802.11n(HT40) | 2.4G WLAN | Yes | Yes | Yes |

| Modulation Type | Work Frequency Band | Transmit Antenna | | Antenna 0 Antenna 1 Synchronization transmit |
|-----------------|-------------------------|------------------|-----------|--|
| | | Antenna 0 | Antenna 1 | |
| 802.11a | UNII Band 1 / Band 3 | Yes | Yes | No |
| 802.11n20 | UNII Band 1 / Band 3 | Yes | Yes | Yes |
| 802.11ac20 | UNII Band 1 / Band 3 | Yes | Yes | Yes |
| 802.11n40 | UNII Band 1 / Band 3 | Yes | Yes | Yes |
| 802.11ac40 | UNII Band 1 / Band 3 | Yes | Yes | Yes |
| 802.11ac80 | UNII Band 1 / Band 3 | Yes | Yes | Yes |

8.2.2 Summary simultaneous transmission results

Maximum Simultaneous transmission MPE Ratios for **MIMO(2.4G WLAN)**, **MIMO(5.2G WLAN)**, **MIMO(5.8G WLAN)**, **BT** .

| Maximum MPE ratio MIMO(2.4G WLAN) | Maximum MPE ratio MIMO(5.2G WLAN) | Maximum MPE ratio MIMO(5.8G WLAN) | Maximum MPE ratio BT | \sum MPE ratios | Limit | Results |
|-----------------------------------|-----------------------------------|-----------------------------------|----------------------|-------------------|-------|---------|
| 0.0794 | 0.0398 | 0.0398 | 0.0016 | 0.1606 | 1.0 | PASS |

7. Conclusion

The measurement results comply with the FCC Limit per 47 CFR 2.1091 for the uncontrolled RF Exposure and SAR Exclusion Threshold per KDB447498 D01 General RF Exposure Guidance v06, No SAR is required.

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