

**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.....: GTS20230105011-1-48****FCC ID. ....: 2BAJO-QOBEII**

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Date of issue .....: Mar. 24, 2023

**Representative Laboratory Name.: Shenzhen Global Test Service Co.,Ltd.**

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.....: Metaverpivot Co.,Ltd**

Address .....: 202, Building 11, Mabian Industrial Zone, District 72, Xingdong Community, Xinan street, Baoan district, Shenzhen, China

**Test specification .....**Standard.....: **47CFR §1.1310 Basis and purpose**  
**47CFR §2.1091 Radiofrequency radiation exposure evaluation:**  
**mobile devices**  
**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 .....**

Trade Mark .....: QOBE

Manufacturer .....: Metaverpivot Co.,Ltd

Model/Type reference .....: QOBE II

Listed Models .....: N/A

Modulation Type.....: IEEE 802.11a /802.11b/802.11g/802.11n/802.11ac  
GFSK, π/4-DQPSK, 8-DPSK

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

Hardware Version .....: N/A

Software Version .....: N/A

Rating.....: DC 19.0V/5.0A by Adapter

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

# TEST REPORT

<b>Test Report No. :</b> GTS20230105011-1-48	Mar. 24, 2023
	Date of issue

Equipment under Test : Mini PC

Model /Type : QOOBE II

Listed model : N/A

**Applicant** : **Metaverpivot Co.,Ltd**

Address : 202, Building 11, Mabian Industrial Zone, District 72, Xingdong Community, Xinan street, Baoan district, Shenzhen, China

**Manufacturer** : **Metaverpivot Co.,Ltd**

Address : 202, Building 11, Mabian Industrial Zone, District 72, Xingdong Community, Xinan street, Baoan district, Shenzhen, China

<b>Test Result:</b>	<b>PASS</b>
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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

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

### 1.2 Product Description

Product Name	Mini PC
Trade Mark	QOOBE
Model/Type reference	QOOBE II
List Models	N/A
Model Declaration	N/A
Power supply:	DC 19.0V/5.0A by Adapter
Sample ID	GTS20230105011-1-S0001-3#& GTS20230105011-1-S0001-4#
<b>Bluetooth</b>	
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, 8-DPSK for Bluetooth (DSS) GFSK for Bluetooth (DTS)
<b>WIFI(2.4G Band)</b>	
Frequency Range	2412MHz ~ 2462MHz
Channel Spacing	5MHz
Channel Number	11 Channel for 20MHz bandwidth(2412~2462MHz) 7 Channel for 40MHz bandwidth(2422~2452MHz)
Modulation Type	802.11b: DSSS; 802.11g/n/ax: OFDM/OFDMA
<b>WIFI(5.2G Band)</b>	
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/ax: OFDM/OFDMA
<b>WIFI (5.8G Band)</b>	
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/ax: OFDM/OFDMA
Antenna Description	Two Internal antennas; support 2*2MIMO technology ANT1 used for BT&WIFI TX/RX, 2.00 dBi(Max.) for 2.4G Band and 2.00dBi(Max.) for 5G Band ANT2 used for WIFI TX/RX, 2.00 dBi(Max.) for 2.4G Band and 2.00dBi (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.

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  $\leq 1.0$ . 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 <sup>2</sup> )	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 <sup>2</sup> )*	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 <sup>2</sup> )	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 <sup>2</sup> )*	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 2.00dBi for BT&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

QOOBE II 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 1	BT&WLAN ANT1	Internal antenna	2.4 – 2.5 GHz 5.0 – 6.0 GHz	2.00dBi(Max.) for 2.4G band 2.00dBi(Max.) for 5G band
Antenna 2	WLAN ANT2	Internal antenna	2.4 – 2.5 GHz 5.0 – 6.0 GHz	2.00dBi(Max.) for 2.4G band 2.00dBi(Max.) for 5G band

## 4. Conducted Power Results

### Antenna 1:

#### Bluetooth

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)
GFSK	0	2402	9.58
	39	2441	10.65
	78	2480	10.48
$\pi/4$ DQPSK	0	2402	7.65
	39	2441	8.88
	78	2480	8.48
8-DPSK	0	2402	7.76
	39	2440	8.94
	78	2480	8.64
GFSK(BT LE)	0	2402	5.37
	19	2440	6.7
	39	2480	6.35

#### 2.4GWLAN

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)
802.11b	01	2412	19.99
	06	2437	17.40
	11	2462	17.75
802.11g	01	2412	21.07
	06	2437	21.37
	11	2462	21.73
802.11n(HT20)	01	2412	21.09
	06	2437	21.33
	11	2462	21.65
802.11n(HT40)	03	2422	21.42
	06	2437	21.59
	09	2452	21.82
802.11ax(HE20)	01	2412	21.46
	06	2437	21.59
	11	2462	21.98
802.11ax(HE40)	03	2422	21.75
	06	2437	19.11
	09	2452	19.15



**5.2GWLAN**

Mode	Channel	Frequency (MHz)	Average Conducted Output Power (dBm)
802.11a	36	5180	14.56
	40	5200	14.67
	48	5240	14.51
802.11n20	36	5180	14.38
	40	5200	14.38
	48	5240	14.56
802.11n40	38	5190	13.85
	46	5230	13.06
802.11ac20	36	5180	11.68
	40	5200	11.88
	48	5240	11.42
802.11ac40	38	5190	12.19
	46	5230	12.91
802.11ac80	42	5210	11.93
802.11ax20	36	5180	11.35
	40	5200	11.59
	48	5240	11.21
802.11ax40	38	5190	11.59
	46	5230	12.81
802.11ax80	42	5210	11.57

**5.8GWLAN**

Mode	Channel	Frequency (MHz)	Average Conducted Output Power (dBm)
802.11a	149	5745	11.12
	157	5785	11.63
	165	5825	11.27
802.11n20	149	5745	11.04
	157	5785	11.64
	165	5825	11.39
802.11n40	151	5755	12.08
	159	5795	13.04
802.11ac20	149	5745	11.34
	157	5785	11.81
	165	5825	11.68
802.11ac40	151	5755	12.40
	159	5795	13.18
802.11ac80	155	5775	12.78
802.11ax20	149	5745	11.12
	157	5785	11.60
	165	5825	11.58
802.11ax40	151	5755	12.21
	159	5795	12.77
802.11ax80	155	5775	12.39

## Antenna 2:

## 2.4GWLAN

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)
802.11b	01	2412	18.32
	06	2437	19.13
	11	2462	19.74
802.11g	01	2412	22.17
	06	2437	20.27
	11	2462	20.84
802.11n(HT20)	01	2412	15.84
	06	2437	16.77
	11	2462	17.23
802.11n(HT40)	03	2422	16.27
	06	2437	16.98
	09	2452	17.38
802.11ax(HE20)	01	2412	16.28
	06	2437	17.14
	11	2462	17.59
802.11ax(HE40)	03	2422	16.51
	06	2437	17.08
	09	2452	17.48

## 5.2GWLAN

Mode	Channel	Frequency (MHz)	Average Conducted Output Power (dBm)
802.11a	36	5180	11.86
	40	5200	11.95
	48	5240	11.77
802.11n20	36	5180	11.53
	40	5200	11.72
	48	5240	11.55
802.11n40	38	5190	11.37
	46	5230	11.76
802.11ac20	36	5180	11.54
	40	5200	11.73
	48	5240	11.71
802.11ac40	38	5190	11.56
	46	5230	11.65
802.11ac80	42	5210	11.81
802.11ax20	36	5180	11.36
	40	5200	11.53
	48	5240	11.49
802.11ax40	38	5190	11.26
	46	5230	11.52
802.11ax80	42	5210	11.38

**5.8GWLAN**

Mode	Channel	Frequency (MHz)	Average Conducted Output Power (dBm)
802.11a	149	5745	10.46
	157	5785	11.75
	165	5825	12.18
802.11n20	149	5745	10.66
	157	5785	11.64
	165	5825	12.32
802.11n40	151	5755	12.27
	159	5795	13.33
802.11ac20	149	5745	10.64
	157	5785	11.44
	165	5825	12.49
802.11ac40	151	5755	12.19
	159	5795	13.48
802.11ac80	155	5775	11.83
802.11ax20	149	5745	10.29
	157	5785	11.31
	165	5825	12.21
802.11ax40	151	5755	10.87
	159	5795	12.04
802.11ax80	155	5775	11.49

**2\*2MIMO(2.4GWLAN):**

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)
802.11n(HT20)	01	2412	22.22
	06	2437	22.63
	11	2462	22.99
802.11n(HT40)	03	2422	22.58
	06	2437	22.88
	09	2452	23.15
802.11ax(HE20)	01	2412	22.61
	06	2437	22.92
	11	2462	23.33
802.11ax(HE40)	03	2422	22.89
	06	2437	21.22
	09	2452	21.41

**2\*2MIMO(5.2GWLAN):**

Mode	Channel	Frequency (MHz)	Average Conducted Output Power (dBm)
802.11n20	36	5180	16.20
	40	5200	16.26
	48	5240	16.32
802.11n40	38	5190	15.79
	46	5230	15.47
802.11ac20	36	5180	14.62
	40	5200	14.82
	48	5240	14.58
802.11ac40	38	5190	14.90
	46	5230	15.34
802.11ac80	42	5210	14.88
802.11ax20	36	5180	14.37
	40	5200	14.57
	48	5240	14.36
802.11ax40	38	5190	14.44
	46	5230	15.22
802.11ax80	42	5210	14.49

**2\*2MIMO(5.8GWLAN):**

Mode	Channel	Frequency (MHz)	Average Conducted Output Power (dBm)
802.11n20	149	5745	13.86
	157	5785	14.65
	165	5825	14.89
802.11n40	151	5755	15.19
	159	5795	16.20
802.11ac20	149	5745	14.01
	157	5785	14.64
	165	5825	15.11
802.11ac40	151	5755	15.31
	159	5795	16.34
802.11ac80	155	5775	15.34
802.11ax20	149	5745	13.74
	157	5785	14.47
	165	5825	14.92
802.11ax40	151	5755	14.60
	159	5795	15.43
802.11ax80	155	5775	14.97

## 5. Manufacturing Tolerance

### Antenna 1:

#### Bluetooth

GFSK (Peak)			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	9.0	10.0	10.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
$\pi/4$ DQPSK (Peak)			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	7.0	8.0	8.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
8-DPSK (Peak)			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	7.0	8.0	8.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
GFSK BT LE (Peak)			
Channel	Channel 0	Channel 19	Channel 39
Target (dBm)	5.0	6.0	6.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0

#### 2.4GWLAN

IEEE 802.11b (Peak)			
Channel	Channel 01	Channel 06	Channel 11
Target (dBm)	19.0	17.0	17.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11g (Peak)			
Channel	Channel 01	Channel 06	Channel 11
Target (dBm)	21.0	21.0	21.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11n HT20 (Peak)			
Channel	Channel 01	Channel 06	Channel 11
Target (dBm)	21.0	21.0	21.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11n HT40 (Peak)			
Channel	Channel 03	Channel 06	Channel 09
Target (dBm)	21.0	21.0	21.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11ax HE20 (Peak)			
Channel	Channel 01	Channel 06	Channel 11
Target (dBm)	21.0	21.0	21.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11ax HE40 (Peak)			
Channel	Channel 03	Channel 06	Channel 09
Target (dBm)	21.0	19.0	19.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0

**5.2G WLAN**

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 802.11n VHT40 (Average)			
Channel	Channel 38	Channel 46	/
Target (dBm)	13.0	13.0	/
Tolerance ±(dB)	1.0	1.0	/
IEEE 802.11ac VHT20 (Average)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	11.0	11.0	11.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11ac VHT40 (Average)			
Channel	Channel 38	Channel 46	/
Target (dBm)	12.0	12.0	/
Tolerance ±(dB)	1.0	1.0	/
IEEE 802.11ac VHT80 (Average)			
Channel	Channel 42	/	/
Target (dBm)	11.0	/	/
Tolerance ±(dB)	1.0	/	/
IEEE 802.11ax HE20 (Average)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	11.0	11.0	11.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11ax HE40 (Average)			
Channel	Channel 38	Channel 46	/
Target (dBm)	11.0	12.0	/
Tolerance ±(dB)	1.0	1.0	/
IEEE 802.11ax HE80 (Average)			
Channel	Channel 42	/	/
Target (dBm)	11.0	/	/
Tolerance ±(dB)	1.0	/	/

**5.8G WLAN**

IEEE 802.11a (Average)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	11.0	11.0	11.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11n HT20 (Average)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	11.0	11.0	11.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11n VHT40 (Average)			
Channel	Channel 151	Channel 159	/
Target (dBm)	12.0	13.0	/
Tolerance ±(dB)	1.0	1.0	/
IEEE 802.11ac VHT20 (Average)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	11.0	11.0	11.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11ac VHT40 (Average)			
Channel	Channel 151	Channel 159	/
Target (dBm)	12.0	13.0	/
Tolerance ±(dB)	1.0	1.0	/
IEEE 802.11ac VHT80 (Average)			
Channel	Channel 155	/	/
Target (dBm)	12.0	/	/
Tolerance ±(dB)	1.0	/	/
IEEE 802.11ax HE20 (Average)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	11.0	11.0	11.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11ax HE40 (Average)			
Channel	Channel 151	Channel 159	/
Target (dBm)	12.0	12.0	/
Tolerance ±(dB)	1.0	1.0	/
IEEE 802.11ax HE80 (Average)			
Channel	Channel 155	/	/
Target (dBm)	12.0	/	/
Tolerance ±(dB)	1.0	/	/

**Antenna 2:**

**2.4GWLAN**

IEEE 802.11b (Peak)			
Channel	Channel 01	Channel 06	Channel 11
Target (dBm)	18.0	19.0	19.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11g (Peak)			
Channel	Channel 01	Channel 06	Channel 11
Target (dBm)	22.0	20.0	20.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11n HT20 (Peak)			
Channel	Channel 01	Channel 06	Channel 11
Target (dBm)	15.0	16.0	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	17.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11ax HE20 (Peak)			
Channel	Channel 01	Channel 06	Channel 11
Target (dBm)	16.0	17.0	17.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11ax HE40 (Peak)			
Channel	Channel 01	Channel 06	Channel 11
Target (dBm)	16.0	17.0	17.0
Tolerance ±(dB)	1.0	1.0	1.0



**5.2GWLAN**

IEEE 802.11a (Average)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	11.0	11.0	11.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11n HT20 (Average)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	11.0	11.0	11.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11n VHT40 (Average)			
Channel	Channel 38	Channel 46	/
Target (dBm)	11.0	11.0	/
Tolerance ±(dB)	1.0	1.0	/
IEEE 802.11ac VHT20 (Average)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	11.0	11.0	11.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11ac VHT40 (Average)			
Channel	Channel 38	Channel 46	/
Target (dBm)	11.0	11.0	/
Tolerance ±(dB)	1.0	1.0	/
IEEE 802.11ac VHT80 (Average)			
Channel	Channel 42	/	/
Target (dBm)	11.0	/	/
Tolerance ±(dB)	1.0	/	/
IEEE 802.11ax HE20 (Average)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	11.0	11.0	11.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11ax HE40 (Average)			
Channel	Channel 38	Channel 46	/
Target (dBm)	11.0	11.0	/
Tolerance ±(dB)	1.0	1.0	/
IEEE 802.11ax HE80 (Average)			
Channel	Channel 42	/	/
Target (dBm)	11.0	/	/
Tolerance ±(dB)	1.0	/	/

**5.8G WLAN**

IEEE 802.11a (Average)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	10.0	11.0	12.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11n HT20 (Average)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	10.0	11.0	12.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11n VHT40 (Average)			
Channel	Channel 151	Channel 159	/
Target (dBm)	12.0	13.0	/
Tolerance ±(dB)	1.0	1.0	/
IEEE 802.11ac VHT20 (Average)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	10.0	11.0	12.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11ac VHT40 (Average)			
Channel	Channel 151	Channel 159	/
Target (dBm)	12.0	13.0	/
Tolerance ±(dB)	1.0	1.0	/
IEEE 802.11ac VHT80 (Average)			
Channel	Channel 155	/	/
Target (dBm)	11.0	/	/
Tolerance ±(dB)	1.0	/	/
IEEE 802.11ax HE20 (Average)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	10.0	11.0	12.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11ax HE40 (Average)			
Channel	Channel 151	Channel 159	/
Target (dBm)	10.0	12.0	/
Tolerance ±(dB)	1.0	1.0	/
IEEE 802.11ax HE80 (Average)			
Channel	Channel 155	/	/
Target (dBm)	11.0	/	/
Tolerance ±(dB)	1.0	/	/

**2\*2MIMO(2.4GWLAN):**

IEEE 802.11n HT20 (Peak)			
Channel	Channel 01	Channel 06	Channel 11
Target (dBm)	22.0	22.0	22.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11n HT40 (Peak)			
Channel	Channel 01	Channel 06	Channel 11
Target (dBm)	22.0	22.0	23.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11ax HE20 (Peak)			
Channel	Channel 01	Channel 06	Channel 11
Target (dBm)	22.0	22.0	23.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11ax HE40 (Peak)			
Channel	Channel 01	Channel 06	Channel 11
Target (dBm)	22.0	21.0	21.0
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)	16.0	16.0	16.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11n VHT40 (Average)			
Channel	Channel 38	Channel 46	/
Target (dBm)	15.0	15.0	/
Tolerance ±(dB)	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 802.11ac VHT40 (Average)			
Channel	Channel 38	Channel 46	/
Target (dBm)	14.0	15.0	/
Tolerance ±(dB)	1.0	1.0	/
IEEE 802.11ac VHT80 (Average)			
Channel	Channel 42	/	/
Target (dBm)	14.0	/	/
Tolerance ±(dB)	1.0	/	/
IEEE 802.11ax HE20 (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 802.11ax HE40 (Average)			
Channel	Channel 38	Channel 46	/
Target (dBm)	14.0	15.0	/
Tolerance ±(dB)	1.0	1.0	/
IEEE 802.11ax HE80 (Average)			
Channel	Channel 42	/	/
Target (dBm)	14.0	/	/
Tolerance ±(dB)	1.0	/	/

2\*2MIMO(5.8GWLAN):

IEEE 802.11n HT20 (Average)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	13.0	14.0	14.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11n VHT40 (Average)			
Channel	Channel 151	Channel 159	/
Target (dBm)	15.0	16.0	/
Tolerance ±(dB)	1.0	1.0	/
IEEE 802.11ac VHT20 (Average)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	14.0	14.0	15.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11ac VHT40 (Average)			
Channel	Channel 151	Channel 159	/
Target (dBm)	15.0	16.0	/
Tolerance ±(dB)	1.0	1.0	/
IEEE 802.11ac VHT80 (Average)			
Channel	Channel 155	/	/
Target (dBm)	15.0	/	/
Tolerance ±(dB)	1.0	/	/
IEEE 802.11ax HE20 (Average)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	13.0	14.0	14.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11ax HE40 (Average)			
Channel	Channel 151	Channel 159	/
Target (dBm)	14.0	15.0	/
Tolerance ±(dB)	1.0	1.0	/
IEEE 802.11ax HE80 (Average)			
Channel	Channel 155	/	/
Target (dBm)	14.0	/	/
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 1:

##### BT

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm <sup>2</sup> )	MPE Limits (mW/cm <sup>2</sup> )
	dBm	mW				
GFSK	11.00	12.5893	2.00	1.5849	0.0040	1.0000
$\pi/4$ DQPSK	9.00	7.9433	2.00	1.5849	0.0025	1.0000
8-DPSK	9.00	7.9433	2.00	1.5849	0.0025	1.0000
GFSK(BT LE)	7.00	5.0119	2.00	1.5849	0.0016	1.0000

##### 2.4G WLAN

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm <sup>2</sup> )	MPE Limits (mW/cm <sup>2</sup> )
	dBm	mW				
802.11b	20.00	100.0000	2.00	1.5849	0.0315	1.0000
802.11g	22.00	158.4893	2.00	1.5849	0.0500	1.0000
802.11n(HT20)	22.00	158.4893	2.00	1.5849	0.0500	1.0000
802.11n(HT40)	22.00	158.4893	2.00	1.5849	0.0500	1.0000
802.11ax(HE20)	22.00	158.4893	2.00	1.5849	0.0500	1.0000
802.11ax(HE40)	22.00	158.4893	2.00	1.5849	0.0500	1.0000

##### 5.2G WLAN

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm <sup>2</sup> )	MPE Limits (mW/cm <sup>2</sup> )
	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
802.11n40	14.00	25.1189	2.00	1.5849	0.0079	1.0000
802.11ac20	12.00	15.8489	2.00	1.5849	0.0050	1.0000
802.11ac40	13.00	19.9526	2.00	1.5849	0.0063	1.0000
802.11ac80	12.00	15.8489	2.00	1.5849	0.0050	1.0000
802.11ax20	12.00	15.8489	2.00	1.5849	0.0050	1.0000
802.11ax40	13.00	19.9526	2.00	1.5849	0.0063	1.0000
802.11ax80	12.00	15.8489	2.00	1.5849	0.0050	1.0000

**5.8G WLAN**

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm <sup>2</sup> )	MPE Limits (mW/cm <sup>2</sup> )
	dBm	mW				
802.11a	12.00	15.8489	2.00	1.5849	0.0050	1.0000
802.11n20	12.00	15.8489	2.00	1.5849	0.0050	1.0000
802.11n40	14.00	25.1189	2.00	1.5849	0.0079	1.0000
802.11ac20	12.00	15.8489	2.00	1.5849	0.0050	1.0000
802.11ac40	14.00	25.1189	2.00	1.5849	0.0079	1.0000
802.11ac80	13.00	19.9526	2.00	1.5849	0.0063	1.0000
802.11ax20	12.00	15.8489	2.00	1.5849	0.0050	1.0000
802.11ax40	13.00	19.9526	2.00	1.5849	0.0063	1.0000
802.11ax80	13.00	19.9526	2.00	1.5849	0.0063	1.0000

**Antenna 2:**

**2.4G WLAN**

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm <sup>2</sup> )	MPE Limits (mW/cm <sup>2</sup> )
	dBm	mW				
802.11b	20.00	100.0000	2.00	1.5849	0.0315	1.0000
802.11g	23.00	199.5262	2.00	1.5849	0.0629	1.0000
802.11n(HT20)	18.00	63.0957	2.00	1.5849	0.0199	1.0000
802.11n(HT40)	18.00	63.0957	2.00	1.5849	0.0199	1.0000
802.11ax(HE20)	18.00	63.0957	2.00	1.5849	0.0199	1.0000
802.11ax(HE40)	18.00	63.0957	2.00	1.5849	0.0199	1.0000

**5.2G WLAN**

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm <sup>2</sup> )	MPE Limits (mW/cm <sup>2</sup> )
	dBm	mW				
802.11a	12.00	15.8489	2.00	1.5849	0.0050	1.0000
802.11n20	12.00	15.8489	2.00	1.5849	0.0050	1.0000
802.11n40	12.00	15.8489	2.00	1.5849	0.0050	1.0000
802.11ac20	12.00	15.8489	2.00	1.5849	0.0050	1.0000
802.11ac40	12.00	15.8489	2.00	1.5849	0.0050	1.0000
802.11ac80	12.00	15.8489	2.00	1.5849	0.0050	1.0000
802.11ax20	12.00	15.8489	2.00	1.5849	0.0050	1.0000
802.11ax40	12.00	15.8489	2.00	1.5849	0.0050	1.0000
802.11ax80	12.00	15.8489	2.00	1.5849	0.0050	1.0000

**5.8G WLAN**

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm <sup>2</sup> )	MPE Limits (mW/cm <sup>2</sup> )
	dBm	mW				
802.11a	13.00	19.9526	2.00	1.5849	0.0063	1.0000
802.11n20	13.00	19.9526	2.00	1.5849	0.0063	1.0000
802.11n40	14.00	25.1189	2.00	1.5849	0.0079	1.0000
802.11ac20	13.00	19.9526	2.00	1.5849	0.0063	1.0000
802.11ac40	14.00	25.1189	2.00	1.5849	0.0079	1.0000
802.11ac80	12.00	15.8489	2.00	1.5849	0.0050	1.0000
802.11ax20	13.00	19.9526	2.00	1.5849	0.0063	1.0000
802.11ax40	13.00	19.9526	2.00	1.5849	0.0063	1.0000
802.11ax80	12.00	15.8489	2.00	1.5849	0.0050	1.0000

**2\*2MIMO(2.4GWLAN):**

Modulation Type	Output power		Directional Gain (dBi)	Directional Gain (linear)	MPE (mW/cm <sup>2</sup> )	MPE Limits (mW/cm <sup>2</sup> )
	dBm	mW				
802.11n20	23.00	199.5262	5.01	3.1696	0.1258	1.0000
802.11n40	24.00	251.1886	5.01	3.1696	0.1584	1.0000
802.11ax20	24.00	251.1886	5.01	3.1696	0.1584	1.0000
802.11ax40	23.00	199.5262	5.01	3.1696	0.1258	1.0000

**2\*2MIMO(5.2GWLAN):**

Modulation Type	Output power		Directional Gain (dBi)	Directional Gain (linear)	MPE (mW/cm <sup>2</sup> )	MPE Limits (mW/cm <sup>2</sup> )
	dBm	mW				
802.11n20	17.00	50.1187	5.01	3.1696	0.0316	1.0000
802.11n40	16.00	39.8107	5.01	3.1696	0.0251	1.0000
802.11ac20	15.00	31.6228	5.01	3.1696	0.0199	1.0000
802.11ac40	16.00	39.8107	5.01	3.1696	0.0251	1.0000
802.11ac80	15.00	31.6228	5.01	3.1696	0.0199	1.0000
802.11ax20	15.00	31.6228	5.01	3.1696	0.0199	1.0000
802.11ax40	16.00	39.8107	5.01	3.1696	0.0251	1.0000
802.11ax80	15.00	31.6228	5.01	3.1696	0.0199	1.0000

**2\*2MIMO(5.8GWLAN):**

Modulation Type	Output power		Directional Gain (dBi)	Directional Gain (linear)	MPE (mW/cm <sup>2</sup> )	MPE Limits (mW/cm <sup>2</sup> )
	dBm	mW				
802.11n20	15.00	31.6228	5.01	3.1696	0.0199	1.0000
802.11n40	17.00	50.1187	5.01	3.1696	0.0316	1.0000
802.11ac20	16.00	39.8107	5.01	3.1696	0.0251	1.0000
802.11ac40	17.00	50.1187	5.01	3.1696	0.0316	1.0000
802.11ac80	16.00	39.8107	5.01	3.1696	0.0251	1.0000
802.11ax20	15.00	31.6228	5.01	3.1696	0.0199	1.0000
802.11ax40	16.00	39.8107	5.01	3.1696	0.0251	1.0000
802.11ax80	15.00	31.6228	5.01	3.1696	0.0199	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;

$\Sigma$  of MPE ratios  $\leq 1.0$

### 8.2.1 Summary simultaneous transmission information

Modulation Type	Work Frequency Band	Transmit Antenna		Antenna 1 Antenna 2 Synchronization transmit
		Antenna 1	Antenna 2	
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
802.11ax(HE20)	2.4G WLAN	Yes	Yes	Yes
802.11ax(HE40)	2.4G WLAN	Yes	Yes	Yes

Modulation Type	Work Frequency Band	Transmit Antenna		Antenna 1 Antenna 2 Synchronization transmit
		Antenna 1	Antenna 2	
802.11a	UNII Band 1 / Band 4	Yes	Yes	No
802.11n20	UNII Band 1 / Band 4	Yes	Yes	Yes
802.11n40	UNII Band 1 / Band 4	Yes	Yes	Yes
802.11ac20	UNII Band 1 / Band 4	Yes	Yes	Yes
802.11ac40	UNII Band 1 / Band 4	Yes	Yes	Yes
802.11ac80	UNII Band 1 / Band 4	Yes	Yes	Yes
802.11ax20	UNII Band 1 / Band 4	Yes	Yes	Yes
802.11ax40	UNII Band 1 / Band 4	Yes	Yes	Yes
802.11ax80	UNII Band 1 / Band 4	Yes	Yes	Yes

### 8.2.2 Summary simultaneous transmission results

Maximum Simultaneous transmission MPE Ratios for **MIMO(2.4GWLAN)**, **MIMO(5.2GWLAN)**, **MIMO(5.8GWLAN)**, **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	$\Sigma$ MPE ratios	Limit	Results
0.1584	0.0316	0.0316	0.0040	0.2256	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.....**