

## Maximum Permissible Exposure Report

### 1. Product Information

FCC ID : 2AVKKG570122

EUT : Wireless network card

Test Model : TXA083

Power Supply : Input: 3.3V

Hardware Version : V00

Software Version : 21.40.2

#### Bluetooth

Frequency Range : 2402MHz ~ 2480MHz

Channel Number : 79 channels for Bluetooth V5.0 (BT Classics)  
40 channels for Bluetooth V5.0 (BT LE)

Channel Spacing : 1MHz for Bluetooth V5.0 (BT Classics)  
2MHz for Bluetooth V5.0 (BT LE)

Modulation Type : GFSK,  $\pi/4$ -DQPSK, 8-DPSK for Bluetooth V5.0 (BT Classics)  
GFSK for Bluetooth V5.0 (BT LE)

Bluetooth Version : V5.0

#### WIFI(2.4G Band)

Frequency Range : 2412MHz-2462MHz

Channel Spacing : 5MHz

Channel Number : 11 channels for 20MHz bandwidth(2412MHz~2462MHz)  
7 channels for 40MHz bandwidth(2422MHz~2452MHz)

Modulation Type : IEEE 802.11b: DSSS(CCK,DQPSK,DBPSK);  
IEEE 802.11g/n: OFDM(64QAM, 16QAM, QPSK, BPSK)

#### WIFI (5.2G Band )

Frequency Range : 5180MHz-5240MHz

Channel Number : 4 channels for 20MHz bandwidth(5180MHz-5240MHz)  
2 channels for 40MHz bandwidth(5190MHz~5230MHz)  
1 channels for 80MHz bandwidth(5210MHz)

Modulation Type : IEEE 802.11A/N/AC/AX: OFDM(64QAM, 16QAM, QPSK, BPSK)

#### WIFI(5.8G Band)

Frequency Range : 5745MHz-5825MHz

Channel Number : 5 channels for 20MHz bandwidth(5745MHz-5825MHz)  
2 channels for 40MHz bandwidth(5755MHz~5795MHz)  
1 channels for 80MHz bandwidth(5775MHz)

Modulation Type : IEEE 802.11A/N/AC/AX: OFDM(64QAM, 16QAM, QPSK, BPSK)

#### Antenna Description

The antennas of BT/2.4G WIFI/5.2G WIFI /5.8G WIFI are the same antennas.

ANT0: External Antenna, 5.0dBi(Max.)

ANT1: External Antenna, 5.0dBi(Max.)

Exposure category : General population/uncontrolled environment

EUT Type : Production Unit

Device Type : Mobile Device

## 2. Evaluation Method

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 modelled 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. Limit

### 3.1 Refer evaluation method

[ANSI C95.1-1999](#): IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.

[FCC KDB publication 447498 D01 General RF Exposure Guidance v06](#): Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies.

[FCC CFR 47 part1 1.1310](#): Radiofrequency radiation exposure limits.

[FCC CFR 47 part2 2.1091](#): Radiofrequency radiation exposure evaluation: mobile devices.

### 3.2 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

#### 4. MPE Calculation Method

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

$$S=PG/4\pi R^2$$

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

#### 5. Antenna Information

Netbox Duo can only use antennas certificated as follows provided by manufacturer;

Internal Identification	Antenna Identification	Antenna type and antenna number	Operate frequency band	Maximum antenna gain
Ant_0	Bluetooth & WIFI	External Antenna	2.4GHz – 2.4835 GHz 5.15GHz -5.85GHz	5.0dBi(Max.)
Ant_1	Wifi	External Antenna	2.4GHz – 2.4835 GHz 5.15GHz -5.85GHz	5.0dBi(Max.)

#### 6. Conducted Power

[BT Max Conducted Power]

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)
GFSK	0	2402	3.222
	39	2441	2.411
	78	2480	0.966
$\pi/4$ DQPSK	0	2402	1.600
	39	2441	2.240
	78	2480	0.633
8DPSK	0	2402	1.835
	19	2440	2.500
	39	2480	0.953

[BT LE Max Conducted Power]

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)
GFSK	0	2402	3.424
	19	2440	1.468
	39	2480	0.755

## [2.4GWIFI Max Conducted Power]

Mode	Channel	Frequency (MHz)	Max Conducted Power(dBm)	
			ANT 0	ANT 1
IEEE 802.11b	1	2412	13.91	14.43
	6	2437	13.77	13.99
	11	2462	13.94	13.80
IEEE 802.11g	1	2412	12.17	13.08
	6	2437	12.12	11.99
	11	2462	12.42	12.01
IEEE 802.11n HT20	1	2412	13.05	12.37
	6	2437	12.66	12.1
	11	2462	12.74	12.22
IEEE 802.11n HT40	3	2422	12.28	12.07
	6	2437	12.39	12.02
	9	2452	12.34	11.90

## [5.2GWIFI Max Conducted Power]

Mode	Channel	Frequency (MHz)	Max Conducted Power(dBm)	
			ANT 0	ANT 1
11A	36	5180	12.21	10.74
	40	5200	12.06	11.22
	48	5240	11.67	10.85
11N20 SISO	36	5180	11.66	11.19
	40	5200	11.78	11.15
	48	5240	11.88	11.15
11N40 SISO	38	5190	10.97	10.83
	46	5230	11.19	11.04
11AC20 SISO	36	5180	10.05	10.37
	40	5200	10.21	10.81
	48	5240	10.64	11.11
11AC40 SISO	38	5190	10.80	11.04
	46	5230	10.97	11.70
11AC80 SISO	42	5210	10.84	11.90
11AX20 SISO	36	5180	10.46	10.35
	40	5200	10.79	10.49
	48	5240	10.69	10.69
11AX40 SISO	38	5190	10.28	10.74
	46	5230	10.43	11.16
11AX80 SISO	42	5210	10.69	10.71

## [5.8GWIFI Max Conducted Power]

Mode	Channel	Frequency (MHz)	Max Conducted Power(dBm)	Max Conducted Power(dBm)
			ANT 0	ANT 1
11A	149	5745	11.98	11.46
	157	5785	11.92	11.50
	165	5825	11.99	11.19
11N20 SISO	149	5745	12.29	11.50
	157	5785	11.41	11.46
	165	5825	11.42	11.54
11N40 SISO	151	5755	11.47	11.55
	159	5795	11.44	11.51
11AC20 SISO	149	5745	10.05	10.37
	157	5785	10.21	10.81
	165	5825	10.64	11.11
11AC40 SISO	151	5755	10.80	11.04
	159	5795	10.97	11.70
11AC80 SISO	155	5775	11.14	11.91
11AX20 SISO	149	5745	10.46	10.35
	157	5785	10.79	10.49
	165	5825	10.69	10.69
11AX40 SISO	151	5755	10.28	10.74
	159	5795	10.43	11.16
11AX80 SISO	155	5775	10.91	11.12

## 7. Manufacturing tolerance

BT

GFSK			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	3.0	2.0	0.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
$\pi/4$ DQPSK			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	1.0	2.0	0.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
8DPSK			
Channel	Channel 0	Channel 19	Channel 39
Target (dBm)	1.0	2.0	0.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0

## BLE

BT LE (Peak)			
Channel	Channel 0	Channel 19	Channel 39
Target (dBm)	3.0	1.0	0.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0

## 2.4GWIFI

IEEE 802.11b			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	14.0	14.0	14.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11g			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	12.5	12.5	12.5
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11n20			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	12.5	12.5	12.5
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11n40			
Channel	Channel 3	Channel 6	Channel 9
Target (dBm)	12.5	12.5	12.5
Tolerance $\pm$ (dB)	1.0	1.0	1.0

## 5.2GWIFI

IEEE 802.11a			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	11.5	12.0	11.5
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11n HT20			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	11.5	11.5	11.5
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11ac VHT20			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	11.0	11.0	11.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11n40			
Channel	Channel 38	Channel 46	/
Target (dBm)	11.0	11.0	/
Tolerance $\pm$ (dB)	1.0	1.0	/

IEEE 802.11ac VHT40			
Channel	Channel 38	Channel 46	/
Target (dBm)	11.0	11.0	/
Tolerance $\pm$ (dB)	1.0	1.0	/
IEEE 802.11ac VHT80			
Channel	Channel 42	/	/
Target (dBm)	11.0	/	/
Tolerance $\pm$ (dB)	1.0	/	/
IEEE 802.11ax HE20			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	11.0	11.0	11.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11 ax HE40			
Channel	Channel 38	Channel 46	/
Target (dBm)	11.0	11.0	/
Tolerance $\pm$ (dB)	1.0	1.0	/
IEEE 802.11 ax HE80			
Channel	Channel 42	/	/
Target (dBm)	11.0	/	/
Tolerance $\pm$ (dB)	1.0	/	/

## 5.8GWIFI

IEEE 802.11a			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	12.0	12.0	12.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11n HT20			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	12.0	12.0	12.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11ac VHT20			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	11.0	11.0	11.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11n40			
Channel	Channel 151	Channel 159	/
Target (dBm)	12.0	12.0	/
Tolerance $\pm$ (dB)	1.0	1.0	/
IEEE 802.11ac VHT40			
Channel	Channel 151	Channel 159	/
Target (dBm)	11.0	11.0	/
Tolerance $\pm$ (dB)	1.0	1.0	/

IEEE 802.11ac VHT80			
Channel	Channel 155	/	/
Target (dBm)	11.5	/	/
Tolerance $\pm$ (dB)	1.0	/	/
IEEE 802.11ax HE20			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	11.0	11.0	11.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11ax HE40			
Channel	Channel 151	Channel 159	/
Target (dBm)	11.0	11.0	/
Tolerance $\pm$ (dB)	1.0	1.0	/
IEEE 802.11ax HE80			
Channel	Channel 155	/	/
Target (dBm)	11.0	/	/
Tolerance $\pm$ (dB)	1.0	/	/



## 8. Measurement Results

### 8.1 Standalone MPE

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.

Mode	RF output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm <sup>2</sup> )	MPE Limits (mW/cm <sup>2</sup> )
	dBm	mW				
BT	4	2.5119	5.0	3.1623	0.0016	1.0000
BT LE	4	2.5119	5.0	3.1623	0.0016	1.0000
2.4G WIFI	15	31.6228	5.0	3.1623	0.0199	1.0000
5.2G WIFI	13	19.9526	5.0	3.1623	0.0126	1.0000
5.8G WIFI	13	19.9526	5.0	3.1623	0.0126	1.0000

*Remark:*

1. Output power including turn-up tolerance;
2. MPE evaluate distance is 20cm from user manual provide by manufacturer.
3. MPE values =  $PG/4\pi R^2$ ;

### 8.2 Simultaneous Transmission MPE

The sample supports 2 antennas.

Bluetooth and WIFI can simultaneous transmit, the WIFI mode of 802.11n/ac can simultaneous transmit. According to KDB447498 D01 General RF Exposure Guidance v06 for Transmitters used in mobile exposure conditions for simultaneous transmission operations;

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

Mode	MPE1 (mW/cm <sup>2</sup> )	MPE2 (mW/cm <sup>2</sup> )	$\Sigma$ MPE ratios	Limit	Results
BT & 2.4G WIFI	0.0016	0.0199	0.0215	1.0000	PASS
BT & 5.2G WIFI	0.0016	0.0126	0.0142	1.0000	PASS
BT & 5.8G WIFI	0.0016	0.0126	0.0142	1.0000	PASS
2.4G WIFI & 2.4G WIFI	0.0199	0.0199	0.0398	1.0000	PASS
5.2G WIFI & 5.2G WIFI	0.0126	0.0126	0.0252	1.0000	PASS
5.8G WIFI & 5.8G WIFI	0.0126	0.0126	0.0252	1.0000	PASS
5.2G WIFI & 5.8G WIFI	0.0126	0.0126	0.0252	1.0000	PASS

Note: The 2.4G WIFI and 5G WIFI can't transmit at the same time.

## 9. Conclusion

The measurement results comply with the FCC Limit per 47 CFR 2.1091 for the uncontrolled RF Exposure of mobile device.

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