RF Exposure evaluation

FCC ID: 2BDZ7-VX1000A

Exposure category: General population/uncontrolled environment

EUT Type: Production Unit

Device Type: Mobile Device

1. Reference

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: Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies

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^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. 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

4. Antenna Information

VX1000-A can only use antennas certificated as follows provided by manufacturer;

Antenna No.	Model No. of antenna:	Type of antenna:	Gain of the antenna (Max.)	Frequency range:
BT	/	External antenna	4.38dBi for 2400-2500MHz	
2.4GWIFI	/	External antenna	4.38dBi for 2400-2500MHz	
5GWIFI	/	External antenna	2.51dBi for 5000-6000MHz	

5. Manufacturing Tolerance

Mode	Max. Peak Conducted Output Power (dBm)	Max. tune-up
BT	6.75	6.0±1
BLE	6.10	6.0±1
2.4GWIFI	17.06	17.0±1

Mode	Max. Average Conducted Output Power (dBm)	Max. tune-up
5.2GWIFI	13.18	13.0±1
5.3GWIFI	13.38	13.0±1
5.5GWIFI	13.52	13.0±1
5.8GWIFI	10.83	10.0±1

LTE Power: Contains FCC ID: 2AJYU-8PYA007.

LTE

Mode	LTE Band 2:1850~1910MHz LTE Band 4:1710~1755MHz LTE Band 5:824~849MHz LTE Band 12:699~716MHz LTE Band 13:777~787MHz LTE Band 25:1850~1915MHz LTE Band 26:814~849MHz LTE Band 41:2496~2690MHz LTE Band 66:1710~1780MHz
Detector	PEAK
Band 2	21±1dBm
Band 4	22±1dBm
Band 5	24±1dBm
Band 12	23±1dBm
Band 13	20±1dBm
Band 25	22±1dBm
Band 26	22±1dBm
Band 26(Part 90)	22±1dBm
Band 41	21±1dBm
Band 66	21±1dBm

ANT Gain (G)

Antenna gain :

Band 2:1.87dBi (gain of antenna in linear scale=1.54)

Band 4:3.12dBi (gain of antenna in linear scale=2.05)

Band 5:0.91dBi (gain of antenna in linear scale=1.23)

Band 12:0.95dBi (gain of antenna in linear scale=1.24)

Band13:2.23dBi (gain of antenna in linear scale=1.67)

Band 25:1.87dBi (gain of antenna in linear scale=1.54)

Band 26:0.91dBi (gain of antenna in linear scale=1.23)

Band 41:2.9dBi (gain of antenna in linear scale=1.94)

Band 66:3.12dBi (gain of antenna in linear scale=2.05)

Protocol	ANT Gain(gain of antenna in linear scale)	Channel Frequency (MHz)	Output Power to Antenna (dBm)	Output Power to Antenna (mW)	Power Density (mW/cm^2)	Limit (mW/cm^2)
Band2	1.54	1910	22	158.49	0.05	1.00
Band4	2.05	1755	23	199.53	0.06	1.00
Band5	1.23	849	25	316.23	0.13	1.00
Band12	1.24	716	24	251.19	0.06	0.48
Band13	1.67	787	21	158.49	0.03	0.52
Band25	1.54	1915	23	125.89	0.07	1.00
Band26	1.23	849	23	199.53	0.05	0.57
Band26(Part90)	1.23	849	23	199.53	0.05	0.57
Band41	1.94	2690	22	158.49	0.04	1.00
Band66	2.05	1780	22	158.49	0.07	1.00

6. Standalone MPE Result

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 =20cm, as well as the gain of the used antenna is refer to section 4, the RF power density can be obtained.

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm^2)	MPE Limits (mW/cm^2)
	dBm	mW				
BT	6.0	3.9811	4.38	2.7416	0.0022	1.0000
BLE	6.0	3.9811	4.38	2.7416	0.0022	1.0000
2.4GWIFI	18.0	63.0957	4.38	2.7416	0.0344	1.0000
5.2GWIFI	14.0	25.1189	2.51	1.7824	0.0089	1.0000
5.3GWIFI	14.0	25.1189	2.51	1.7824	0.0089	1.0000
5.5GWIFI	14.0	25.1189	2.51	1.7824	0.0089	1.0000
5.8GWIFI	11.0	12.5893	2.51	1.7824	0.0045	1.0000

Remark:

1. Output power (Peak) including turn-up tolerance;

2. MPE evaluate distance is 20cm from user manual provide by manufacturer.

7. simultaneous MPE Result

2.4GWIFI MPE (Ratio)	LTE MPE (Ratio)	simultaneous MPE (Ratio)	MPE Limits (Ratio)
0.0344	0.13	0.1644	1.0000

8. Conclusion

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

----------THE END OF REPORT----------