Maximum Permissible Exposure Report

1. Product Information

FCC ID:	2AU3Z-VWP-210-16
EUT	Vivi Wireless Presentation
Test Model	VWP-210-16
Power Supply	Input: DC 5V 3A For Adapter: Input: AC 100-240V 50/60Hz 0.8A Output: DC 5V 3A
Hardware Version	V14
Software Version	Android 9.0
Bluetooth	2402MHz ~ 2480MHz
Channel Number	79 channels for Bluetooth V5.1 (BDR/EDR) 40 channels for Bluetooth V5.1 (BT LE)
Channel Spacing	1MHz for Bluetooth V5.1 (BDR/EDR) 2MHz for Bluetooth V5.1 (BT LE)
Modulation Type	GFSK, π/4-DQPSK, 8-DPSK for Bluetooth V5.1 (BDR/EDR) GFSK for Bluetooth V5.1 (BT LE)
Bluetooth Version	V5.1
Antenna Description	External Antenna, 3.0 dBi(Max.)
2.4G WLAN	2412MHz ~ 2462 MHz
Channel Spacing	5MHz
Channel Number	11 Channels for 20MHz bandwidth (2412~2462MHz) 7 Channels for 40MHz bandwidth (2422~2452MHz)
Modulation Type	IEEE 802.11b: DSSS (CCK, DQPSK, DBPSK) IEEE 802.11g: OFDM (64QAM, 16QAM, QPSK, BPSK) IEEE 802.11n: OFDM (64QAM, 16QAM,QPSK,BPSK)
Antenna Description	Antenna 1: External Antenna, 3.0 dBi(Max.) Antenna 2: External Antenna, 3.0 dBi(Max.)
5.2G WLAN	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	IEEE 802.11a/n/ac: OFDM (256QAM, 64QAM, 16QAM, QPSK, BPSK)
Antenna Description	Antenna 1: External Antenna, 3.0 dBi(Max.) Antenna 2: External Antenna, 3.0 dBi(Max.)
5.8G WLAN	5745-5825MHz
Channel Number	5 channels for 20MHz bandwidth(5745-5825MHz) 2 channels for 40MHz bandwidth(5755~5795MHz) 1 channels for 80MHz bandwidth(5775MHz)
Modulation Type	IEEE 802.11a/n/ac: OFDM (256QAM, 64QAM, 16QAM, QPSK, BPSK)
Antenna Description	Antenna 1: External Antenna, 3.0 dBi(Max.) Antenna 2: External Antenna, 3.0 dBi(Max.)
Exposure category	General population/uncontrolled environment
EUT Type	Production Unit
Device Type	Mobile Equipment

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 KDB447498D01 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 ≤ 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 1 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^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

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

VWP-210-16 can only use antennas certificated as follows provided by manufacturer;

Internal Identification	Antenna type and antenna number	Operate frequency band	Maximum antenna gain
Antenna 1	Internal antenna	2402 MHz – 2480 MHz for Bluetooth; 2412 MHz – 2462 MHz for 2.4G WIFI; 5180MHz-5240MHz and 5745MHz-5825MHz for 5G WIFI;	3.0 dBi
Antenna 2	Internal antenna	2412 MHz – 2462 MHz for 2.4G WIFI; 5180MHz-5240MHz and 5745MHz-5825MHz for 5G WIFI;	3.0 dBi

6. Conducted Power

[BT Max Conducted Power]

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)
GFSK	0	2402	1.19
	39	2441	3.74
	78	2480	7.7
π/4DQPSK	0	2402	7.88
	39	2441	7.81
	78	2480	8.42
8DPSK	0	2402	8.02
	19	2440	7.92
	39	2480	8.63

[BLE Max Conducted Power]

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)
BT LE	0	2402	1.43
	19	2440	3.93
	39	2480	7.77
2LE	0	2402	1.42
	19	2440	3.82
	39	2480	7.76

[2.4GWIFI Max Conducted Power]

Mode	Channel	Frequency (MHz)	Max Conducted Power(dBm) (Antenna 1)	Max Conducted Power(dBm) (Antenna 2)
11B	1	2412	15.28	15.86
	6	2437	15.34	15.14
	11	2462	15.26	14.83
11G	1	2412	11.77	12.48
	6	2437	11.05	11.91
	11	2462	10.87	11.42
11N20SISO	1	2412	11.52	12.44
	6	2437	11.13	11.53
	11	2462	10.66	11.03
11N40SISO	3	2422	11	12.01
	6	2437	11.14	12.14
	9	2452	11.43	11.67

[5.2GWIFI Max Conducted Power]

Mode	Channel	Frequency (MHz)	Max Conducted Power(dBm) (Antenna 1)	Max Conducted Power(dBm) (Antenna 2)
11A	36	5180	4.46	7.71
	40	5200	6.44	8.16
	48	5240	9.59	8.50
11N20 SISO	36	5180	4.47	7.59
	40	5200	6.39	8.19
	48	5240	9.32	8.32
11N40 SISO	38	5190	5.73	7.03
	46	5230	8.92	6.78
11AC20 SISO	36	5180	4.43	6.12
	40	5200	6.34	6.53
	48	5240	9.34	6.76
11AC40 SISO	38	5190	5.73	6.54
	46	5230	8.96	6.98
11AC80 SISO	42	5210	6.51	6.60

[5.8WIFI Max Conducted Power]

Mode	Channel	Frequency (MHz)	Max Conducted Power(dBm) (Antenna 1)	Max Conducted Power(dBm) (Antenna 2)
11A	149	5745	8.21	6.95
	157	5785	8.57	7.10
	165	5825	9.15	9.55
11N20 SISO	149	5745	8.17	6.14
	157	5785	8.45	6.02
	165	5825	9.15	6.19
11N40 SISO	151	5755	8.75	5.00
	159	5795	9.41	6.11
11AC20 SISO	149	5745	8.26	5.86
	157	5785	8.64	5.70
	165	5825	9.30	6.99
11AC40 SISO	151	5755	8.73	4.87
	159	5795	9.34	5.56
11AC80 SISO	155	5775	9.01	5.02

7. Manufacturing Tolerance

BT

GFSK (Peak)			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	1.0	3.0	7.0
Tolerance ±(dB)	1.0	1.0	1.0
π/4DQPSK (Peak)			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	8.0	8.0	8.0
Tolerance ±(dB)	1.0	1.0	1.0
8DPSK (Peak)			
Channel	Channel 0	Channel 19	Channel 39
Target (dBm)	8.0	8.0	8.0
Tolerance ±(dB)	1.0	1.0	1.0

BLE

BT LE (Peak)			
Channel	Channel 0	Channel 19	Channel 39
Target (dBm)	1.0	3.0	7.0
Tolerance ±(dB)	1.0	1.0	1.0
2LE (Peak)			
Channel	Channel 0	Channel 19	Channel 39
Target (dBm)	1.0	3.0	7.0
Tolerance ±(dB)	1.0	1.0	1.0

2.4GWIFI(Antenna 1)

11B (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	15.0	15.0	15.0
Tolerance ±(dB)	1.0	1.0	1.0
11G (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	11.0	11.0	11.0
Tolerance ±(dB)	1.0	1.0	1.0
11N20SISO (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	11.0	11.0	11.0
Tolerance ±(dB)	1.0	1.0	1.0
11N40SISO (Peak)			
Channel	Channel 3	Channel 6	Channel 9
Target (dBm)	11.0	11.0	11.0
Tolerance ±(dB)	1.0	1.0	1.0

2.4GWIFI(Antenna 2)

11B (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	15.0	15.0	15.0
Tolerance ±(dB)	1.0	1.0	1.0
11G (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	12.0	12.0	12.0
Tolerance ±(dB)	1.0	1.0	1.0
11N20SISO (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	12.0	12.0	12.0
Tolerance ±(dB)	1.0	1.0	1.0
11N40SISO (Peak)			
Channel	Channel 3	Channel 6	Channel 9
Target (dBm)	12.0	12.0	12.0
Tolerance ±(dB)	1.0	1.0	1.0

5.2GWIFI(Antenna 1)

11A (Average)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	4.0	6.0	9.0
Tolerance ±(dB)	1.0	1.0	1.0
11N20 SISO (Average)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	4.0	6.0	9.0
Tolerance ±(dB)	1.0	1.0	1.0
11N40 SISO (Average)			
Channel	Channel 38	Channel 46	
Target (dBm)	5.0	9.0	
Tolerance ±(dB)	1.0	1.0	
11AC20 SISO (Average)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	5.0	6.0	9.0
Tolerance ±(dB)	1.0	1.0	1.0
11AC40 SISO (Average)			
Channel	Channe38	Channel 46	
Target (dBm)	5.0	9.0	
Tolerance ±(dB)	1.0	1.0	
11AC80 SISO (Average)			
Channel	Channel 42		
Target (dBm)	6.0		
Tolerance ±(dB)	1.0		

5.2GWIFI(Antenna 2)

11A (Average)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	8.0	8.0	8.0
Tolerance ±(dB)	1.0	1.0	1.0
11N20 SISO (Average)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	8.0	8.0	8.0
Tolerance ±(dB)	1.0	1.0	1.0
11N40 SISO (Average)			
Channel	Channel 38	Channel 46	
Target (dBm)	7.0	6.0	
Tolerance ±(dB)	1.0	1.0	
11AC20 SISO (Average)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	6.0	6.0	6.0
Tolerance ±(dB)	1.0	1.0	1.0
11AC40 SISO (Average)			
Channel	Channe38	Channel 46	
Target (dBm)	6.0	6.0	
Tolerance ±(dB)	1.0	1.0	
11AC80 SISO (Average)			
Channel	Channel 42		
Target (dBm)	6.0		
Tolerance ±(dB)	1.0		

5.8GWIFI(Antenna 1)

11A (Average)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	9.0	9.0	9.0
Tolerance ±(dB)	1.0	1.0	1.0
11N20 SISO (Average)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	9.0	9.0	9.0
Tolerance ±(dB)	1.0	1.0	1.0
11N40 SISO (Average)			
Channel	Channel 151	Channel 159	
Target (dBm)	9.0	9.0	
Tolerance ±(dB)	1.0	1.0	
11AC20 SISO (Average)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	9.0	9.0	9.0
Tolerance ±(dB)	1.0	1.0	1.0
11AC40 SISO (Average)			
Channel	Channe151	Channel 159	
Target (dBm)	9.0	9.0	
Tolerance ±(dB)	1.0	1.0	
11AC80 SISO (Average)			
Channel	Channel 155		
Target (dBm)	9.0		
Tolerance ±(dB)	1.0		

5.8GWIFI(Antenna 2)

11A (Average)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	6.0	7.0	9.0
Tolerance ±(dB)	1.0	1.0	1.0
11N20 SISO (Average)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	6.0	6.0	6.0
Tolerance ±(dB)	1.0	1.0	1.0
11N40 SISO (Average)			
Channel	Channel 151		Channel 159
Target (dBm)	6.0		6.0
Tolerance ±(dB)	1.0		1.0
11AC20 SISO (Average)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	6.0	6.0	6.0
Tolerance ±(dB)	1.0	1.0	1.0
11AC40 SISO (Average)			
Channel	Channe151		Channel 159
Target (dBm)	5.0		6.0
Tolerance ±(dB)	1.0		1.0
11AC80 SISO (Average)			
Channel	Channel 155		
Target (dBm)	6.0		
Tolerance ±(dB)	1.0		

8. Measurement Results

8.1 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 =20cm, as well as the gain of the used antenna refer to antenna information, the RF power density can be obtained.

Antenna 1:

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	Duty Cycle	MPE (mW/cm^2)	MPE Limits (mW/cm^2)
	dBm	mW					
GFSK	8	6.31	3.0	2.0	100%	0.0025	1.0000
π/4DQPSK	9	7.94	3.0	2.0	100%	0.0032	1.0000
8DPSK	9	7.94	3.0	2.0	100%	0.0032	1.0000
BT LE	8	6.31	3.0	2.0	100%	0.0025	1.0000
IEEE 802.11b	16	39.81	3.0	2.0	100%	0.0158	1.0000
IEEE 802.11g	12	15.85	3.0	2.0	100%	0.0063	1.0000
IEEE 802.11n HT20	12	15.85	3.0	2.0	100%	0.0063	1.0000
IEEE 802.11n HT40	12	15.85	3.0	2.0	100%	0.0063	1.0000
IEEE 802.11a (5.2G)	10	10.00	3.0	2.0	100%	0.0040	1.0000
IEEE 802.11n20 (5.2G)	10	10.00	3.0	2.0	100%	0.0040	1.0000
IEEE 802.11n40 (5.2G)	10	10.00	3.0	2.0	100%	0.0040	1.0000
IEEE 802.11ac20 (5.2G)	10	10.00	3.0	2.0	100%	0.0040	1.0000
IEEE 802.11ac40 (5.2G)	10	10.00	3.0	2.0	100%	0.0040	1.0000
IEEE 802.11ac80 (5.2G)	7	5.01	3.0	2.0	100%	0.0020	1.0000
IEEE 802.11a (5.8G)	10	10.00	3.0	2.0	100%	0.0040	1.0000
IEEE 802.11n20 (5.8G)	10	10.00	3.0	2.0	100%	0.0040	1.0000
IEEE 802.11n40 (5.8G)	10	10.00	3.0	2.0	100%	0.0040	1.0000
IEEE 802.11ac20 (5.8G)	10	10.00	3.0	2.0	100%	0.0040	1.0000
IEEE 802.11ac40 (5.8G)	10	10.00	3.0	2.0	100%	0.0040	1.0000
IEEE 802.11ac80 (5.8G)	10	10.00	3.0	2.0	100%	0.0040	1.0000

Antenna 2:

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	Duty Cycle	MPE (mW/cm^2)	MPE Limits (mW/cm^2)
	dBm	mW					
IEEE 802.11b	16	39.81	3.0	2.0	100%	0.0158	1.0000
IEEE 802.11g	13	19.95	3.0	2.0	100%	0.0079	1.0000
IEEE 802.11n HT20	13	19.95	3.0	2.0	100%	0.0079	1.0000
IEEE 802.11n HT40	13	19.95	3.0	2.0	100%	0.0079	1.0000
IEEE 802.11a (5.2G)	9	7.94	3.0	2.0	100%	0.0032	1.0000
IEEE 802.11n20 (5.2G)	9	7.94	3.0	2.0	100%	0.0032	1.0000
IEEE 802.11n40 (5.2G)	8	6.31	3.0	2.0	100%	0.0025	1.0000
IEEE 802.11ac20 (5.2G)	7	5.01	3.0	2.0	100%	0.0020	1.0000
IEEE 802.11ac40 (5.2G)	7	5.01	3.0	2.0	100%	0.0020	1.0000
IEEE 802.11ac80 (5.2G)	7	5.01	3.0	2.0	100%	0.0020	1.0000
IEEE 802.11a (5.8G)	10	10.00	3.0	2.0	100%	0.0040	1.0000
IEEE 802.11n20 (5.8G)	7	5.01	3.0	2.0	100%	0.0020	1.0000
IEEE 802.11n40 (5.8G)	7	5.01	3.0	2.0	100%	0.0020	1.0000
IEEE 802.11ac20 (5.8G)	7	5.01	3.0	2.0	100%	0.0020	1.0000
IEEE 802.11ac40 (5.8G)	7	5.01	3.0	2.0	100%	0.0020	1.0000
IEEE 802.11ac80 (5.8G)	7	5.01	3.0	2.0	100%	0.0020	1.0000

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

8.2 Simultaneous Transmission MPE

The sample support one Bluetooth, WIFI(2.4G Band), WIFI 5GWLAN modular and two External Antenna which not support MIMO technology, need consider simultaneous transmission;

The EUT operating at 2.4GWIFI has the highest emission measured value,
$MPE_{Antenna\ 1}$ = 0.0158; $MPE_{Antenna\ 2}$ = 0.0158;

$\sum$MPE = $\sum$ of (the highest measured or estimated $MPE_{Antenna\ 1}$+ $MPE_{Antenna\ 2}$) = (0.0158+0.0158) = 0.0316 < 1.0;

9. 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----------