RF Exposure evaluation

FCC ID: 2AP6W-WIFI1201

Exposure category: General population/uncontrolled environment

EUT Type: Production Unit

Device Type: Portable 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

EUT can only use antennas certificated as follows provided by manufacturer;

Antenna	Model No. of antenna:	Type of antenna:	Gain of the antenna (Max.)	Frequency range:
WIFI	/	External antenna	Antenna 1:4.5dBi;Antenna 2:4.5dBi For 2.4GWIFI Antenna 1:6.7dBi,Antenna 2:6.7dBi for 5GWIFI;	

5. Manufacturing Tolerance

WIFI (Conducted)

Frequency (MHz)	ANT1_11n(HT20) (Peak)			ANT2_11n(HT20)(Peak)		
	2412	2437	2462	2412	2437	2462
Target (dBm)	14	14	14	14	14	14
Tolerance ± (dB)	1.0	1.0	1.0	1.0	1.0	1.0
Frequency (MHz)	ANT1_11n(HT40) (Peak)			ANT2_11n(HT40)(Peak)		
	2422	2437	2452	2422	2437	2452
Target (dBm)	13	13	13	13	13	13
Tolerance ± (dB)	1.0	1.0	1.0	1.0	1.0	1.0
Frequency (MHz)	ANT1_11ax(HT20) (Peak)			ANT2_11ax(HT20)(Peak)		
	2412	2437	2412	2437	2412	2437
Target (dBm)	14	14	14	14	14	14
Tolerance ± (dB)	1.0	1.0	1.0	1.0	1.0	1.0
Frequency (MHz)	ANT1_11ax(HT40) (Peak)			ANT2_11ax(HT40)(Peak)		
	2422	2437	2452	2422	2437	2452
Target (dBm)	13	13	13	13	13	13
Tolerance ± (dB)	1.0	1.0	1.0	1.0	1.0	1.0

5G WIFI (Conducted)

Frequency	ANT 1_IEEE 802.11n20(AV)			ANT 2_IEEE 802.11n20(AV)		
(MHz)	5180	5320	5500	5180	5320	5500
Target (dBm)	15	15	15	14	13	10
Tolerance ± (dB)	1.0	1.0	1.0	1.0	1.0	1.0
Frequency	ANT 1_IEEE 802.11n40(AV)			ANT 2_IEEE 802.11n40(AV)		
(MHz)	5190	5310	5510	5190	5310	5510
Target (dBm)	15	15	14	14	13	10
Tolerance ± (dB)	1.0	1.0	1.0	1.0	1.0	1.0
Frequency	ANT 1_IEEE 802.11ac20(AV)			ANT 2_IEEE 802.11ac20(AV)		
(MHz)	5180	5320	5500	5180	5320	5500
Target (dBm)	15	15	15	14	13	10
Tolerance ± (dB)	1.0	1.0	1.0	1.0	1.0	1.0
Frequency	ANT 1_IEEE 802.11ac40(AV)			ANT 2_IEEE 802.11ac40(AV)		
(MHz)	5190	5310	5510	5190	5310	5510
Target (dBm)	15	15	14	14	13	10
Tolerance ± (dB)	1.0	1.0	1.0	1.0	1.0	1.0
Frequency	ANT 1_IEEE 802.11ax20(AV)			ANT 2_IEEE 802.11ax20(AV)		
(MHz)	5180	5320	5500	5180	5320	5500
Target (dBm)	15	15	15	14	13	10
Tolerance ± (dB)	1.0	1.0	1.0	1.0	1.0	1.0
Frequency	ANT 1_IEEE 802.11ax40(AV)			ANT 2_IEEE 802.11ax40(AV)		
(MHz)	5190	5310	5510	5190	5310	5510
Target (dBm)	15	15	15	14	13	10
Tolerance ± (dB)	1.0	1.0	1.0	1.0	1.0	1.0
Frequency	ANT 1_IEEE 802.11ax80(AV)			ANT 2_IEEE 802.11ax80(AV)		
(MHz)	5210	5290	5530	5210	5290	5530
Target (dBm)	15	14	14	14	13	9.0
Tolerance ± (dB)	1.0	1.0	1.0	1.0	1.0	1.0

5G WIFI (Conducted)

Frequency (MHz)	ANT 1_IEEE 802.11n20(AV)			ANT 2_IEEE 802.11n20(AV)		
	5745	5805	5825	5745	5805	5825
Target (dBm)	14	14	14	13	13	13
Tolerance ± (dB)	1.0	1.0	1.0	1.0	1.0	1.0
Frequency (MHz)	ANT 1_IEEE 802.11n40(AV)			ANT 2_IEEE 802.11n40(AV)		
	5755		5795	5755		5795
Target (dBm)	14		14	13		13
Tolerance ± (dB)	1.0		1.0	1.0		1.0
Frequency (MHz)	ANT 1_IEEE 802.11ac20(AV)			ANT 2_IEEE 802.11ac20(AV)		
	5745	5805	5825	5745	5805	5825
Target (dBm)	14	14	14	13	13	13
Tolerance ± (dB)	1.0	1.0	1.0	1.0	1.0	1.0
Frequency (MHz)	ANT 1_IEEE 802.11ac40(AV)			ANT 2_IEEE 802.11ac40(AV)		
	5755		5795	5755		5795
Target (dBm)	14		14	13		13
Tolerance ± (dB)	1.0		1.0	1.0		1.0
Frequency (MHz)	ANT 1_IEEE 802.11ax20(AV)			ANT 2_IEEE 802.11ax20(AV)		
	5745	5805	5825	5745	5805	5825
Target (dBm)	15	15	15	13	13	13
Tolerance ± (dB)	1.0	1.0	1.0	1.0	1.0	1.0
Frequency (MHz)	ANT 1_IEEE 802.11ax40(AV)			ANT 2_IEEE 802.11ax40(AV)		
	5755		5795	5755		5795
Target (dBm)	14		14	13		13
Tolerance ± (dB)	1.0		1.0	1.0		1.0
Frequency (MHz)	ANT 1_IEEE 802.11ax80(AV)			ANT 2_IEEE 802.11ax80(AV)		
	5775			5775		
Target (dBm)	14			13		
Tolerance ± (dB)	1.0			1.0		

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.

ANT 1

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm^2)	MPE Limits (mW/cm^2)
	dBm	mW				
2.4G WIFI	15	31.6228	4.5	2.8184	0.0177	1.0000
5G WIFI	16	39.8107	6.7	4.6774	0.0370	1.0000

ANT 2

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm^2)	MPE Limits (mW/cm^2)
	dBm	mW				
2.4G WIFI	15	31.6228	4.5	2.8184	0.0177	1.0000
5G WIFI	15	31.6228	6.7	4.6774	0.0294	1.0000

Remark:

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

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

7. Summary simultaneous transmission information

The device two WIFI antenna, WIFI Ant1 and Ant2 can transmit simultaneously in 802.11xx MIMO mode. WIFI 2.4G and WIFI5G cannot transmit simultaneously.

WIFI Antenna 1 and Antenna 2 for 2.4GWLAN

MPE $_{Antenna1}$ (mW/cm^2)	MPE $_{Antenna2}$ (mW/cm^2)	∑MPE ratios	Limit	Results
0.0177	0.0177	0.0354	1.0	PASS

WIFI Antenna 1 and Antenna 2 for 5GWLAN

MPE $_{Antenna1}$ (mW/cm^2)	MPE $_{Antenna2}$ (mW/cm^2)	∑MPE ratios	Limit	Results
0.0370	0.0294	0.0664	1.0	PASS

8. 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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