

RF Exposure evaluation

FCC ID: 2AMJYANYFREEZJ

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

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

Type	Antenna type	Range	Max. Gain
WIFI/BT	External Antenna	2.4-2.5GHz	1.96dBi
		5.1- 5.8GHz	3.02dBi
WLAN ah	External antenna	900-950 MHz	0.52dBi

5. Manufacturing Tolerance

Mode	Channel	Target Power PK (dBm)	Tolorance (dBm)
802.11b	1	16	±1
	6	16	±1
	11	16	±1
802.11g	1	21	±1
	6	21	±1
	11	21	±1
802.11n-HT20	1	21	±1
	6	21	±1
	11	21	±1
802.11n-HT40	3	20	±1
	6	20	±1
	9	20	±1

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Mode	Channel	Target Power AV (dBm)	Tolorance (dBm)
802.11a	36	8	±1
	40	8	±1
	48	10	±1
802.11n(HT20)	36	8	±1
	40	8	±1
	48	10	±1
802.11n(HT40)	38	9	±1
	46	10	±1

U-NII 2A

Mode	Channel	Target Power AV (dBm)	Tolerance (dBm)
802.11a	52	10	± 1
	56	9	± 1
	64	11	± 1
802.11n(HT20)	52	10	± 1
	56	10	± 1
	64	11	± 1
802.11n(HT40)	54	10	± 1
	62	11	± 1

U-NII 2C

Mode	Channel	Target Power AV (dBm)	Tolerance (dBm)
802.11a	100	12	± 1
	120	11	± 1
	140	9	± 1
802.11n(HT20)	100	12	± 1
	120	11	± 1
	140	9	± 1
802.11n(HT40)	102	12	± 1
	118	11	± 1
	134	10	± 1

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Mode	Channel	Target Power AV (dBm)	Tolerance (dBm)
802.11a	149	10	± 1
	157	10	± 1
	165	8	± 1
802.11n(HT20)	149	9	± 1
	157	9	± 1
	165	8	± 1
802.11n(HT40)	151	10	± 1
	159	9	± 1

BT

Mode	Channel	Target Power
BLE 1M	0	0 ± 1 dBm
	19	0 ± 1 dBm
	39	1 ± 1 dBm

WLAN ah

Mode	Channel	Target Power
BW 1M	Low	17 ± 1 dBm
	Middle	17 ± 1 dBm
	High	18 ± 1 dBm
BW 2M	Low	18 ± 1 dBm
	Middle	18 ± 1 dBm
	High	18 ± 1 dBm
BW 4M	Low	18 ± 1 dBm
	Middle	19 ± 1 dBm
	High	16 ± 1 dBm
BW 8M	Low	20 ± 1 dBm
	Middle	20 ± 1 dBm
	High	17 ± 1 dBm

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, $r = 20\text{cm}$, as well as the gain of the used antenna list in section 4, the RF power density can be obtained.

2.4GHz WLAN

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)	MPE Radio
	dBm	mW					
IEEE 802.11b	17.00	50.1187	1.96	1.5704	0.0157	1.0000	0.0157
IEEE 802.11g	22.00	158.4893	1.96	1.5704	0.0495	1.0000	0.0495
IEEE 802.11n HT20	22.00	158.4893	1.96	1.5704	0.0495	1.0000	0.0495
IEEE 802.11n HT40	21.00	125.8925	1.96	1.5704	0.0393	1.0000	0.0393

5GHz WLAN

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)	MPE Radio
	dBm	mW					
IEEE 802.11a	13.00	19.9526	3.02	2.0045	0.0080	1.0000	0.0080
IEEE 802.11n HT20	13.00	19.9526	3.02	2.0045	0.0080	1.0000	0.0080
IEEE 802.11n HT40	13.00	19.9526	3.02	2.0045	0.0080	1.0000	0.0080

BLE

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)	MPE Radio
	dBm	mW					
GFSK	2	1.5849	1.96	1.5704	0.0005	1.0000	0.0005

WLAN ah

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)	MPE Radio
	dBm	mW					
OFDM	21	125.8925	0.52	1.1272	0.0282	0.6100	0.0462

Remark:

1. Output power (Average) including turn-up tolerance;
2. Output power was adjust to duty cycle at 100% if measured duty cycle less than 98%;
3. MPE evaluate distance is 20cm from user manual provide by manufacturer.

7. Summary simultaneous transmission information

The Device WLAN ah and WIFI/BT can transmission simultaneously.

8. Summary simultaneous transmission results

The EUT have two type RF transmitters, WLAN(Wi-Fi)/BT, WLAN ah, and can transmit simultaneously, if the sum of the ratios of all individual transmitters is less than 1, the simultaneously transmit can be exempt.

Max. radio of WLAN ah + Max. radio of WIFI/BT= 0.0462+0.0495=0.0957<1

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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