

# **FCC ID : 2ABH6-GGMME5**

## **RF EXPOSURE EVALUATION**

According to FCC 1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency(RF) Radiation as specified in §1.1307(b)

Limits for Maximum Permissible Exposure (MPE)

<b>Frequency Range(MHz)</b>	<b>Electric Field Strength(V/m)</b>	<b>Magnetic Field Strength(A/m)</b>	<b>Power Density(mW/cm<sup>2</sup>)</b>	<b>Average Time</b>
<b>(A) Limits for Occupational/Control Exposures</b>				
<b>300-1500</b>	--	--	<b>F/300</b>	<b>6</b>
<b>1500-100000</b>	--	--	<b>5</b>	<b>6</b>
<b>(B) Limits for General Population/Uncontrol Exposures</b>				
<b>300-1500</b>	--	--	<b>F/1500</b>	<b>6</b>
<b>1500-100000</b>	--	--	<b>1</b>	<b>30</b>

### **11.1 Friis transmission formula: $P_d = (P_{out} \cdot G) / (4 \cdot \pi \cdot R^2)$**

Where

$P_d$ = Power density in mW/cm<sup>2</sup>

$P_{out}$ =output power to antenna in mW

$G$ = Numeric gain of the antenna relative to isotropic antenna

$\pi$ =3.1416

$R$ = distance between observation point and center of the radiator in cm

$P_d$  the limit of MPE, 1mW/cm<sup>2</sup>. If we know the maximum gain of the antenna and total power input to the antenna, through the calculation, we will know the distance where the MPE limit is reached.

### **11.2 Measurement Result**

Antenna gain:

2.93 dBi for WIFI Antenna A;

2.93 dBi for WIFI Antenna B;

0 dBi for Bluetooth Antenna;

Array gain:  $\approx 5.94$  dBi for WIFI

## Tune up power

Mode (BT 4.0)	tune-up power
GFSK	2±1dBm

Mode (BT3.0+EDR)	channel	tune-up power
GFSK	0	0±1 dBm
	39	1±1 dBm
	78	1±1 dBm
pi/4-DQPSK	0	-3±1 dBm
	39	1±1 dBm
	78	1±1 dBm
8DPSK	0	-3±1 dBm
	39	1±1 dBm
	78	1±1 dBm

wifi	tune-up power(Ant A)	tune-up power(Ant B)
802.11b	16±1 dBm	16±1 dBm
802.11g	15±1 dBm	15±1 dBm
802.11n (ht20)	15±1 dBm	15±1 dBm
802.11n (ht40)	12±1 dBm	12±1 dBm

## Evaluation result

### BT 4.0

Mode	Channel Freq. (MHz)	Measured power (dBm)	Max tune-up power (dBm)	Antenna Gain Numeric	Evaluation result (mW/cm <sup>2</sup> )	Power density Limits (mW/cm <sup>2</sup> )
GFSK	2402	1.03	3	1	0.0004	1
	2440	2.22	3	1	0.0004	1
	2480	2.11	3	1	0.0004	1

### BT3.0+EDR

Mode	Channel Freq. (MHz)	Measured power (dBm)	Max tune-up power (dBm)	Antenna Gain Numeric	Evaluation result (mW/cm <sup>2</sup> )	Power density Limits (mW/cm <sup>2</sup> )
GFSK	2402	-0.704	1	1	0.00025	1
	2441	1.516	2	1	0.0003	1
	2480	1.622	2	1	0.0003	1
Π/4 - DQPSK	2402	-3.012	-2	1	0.0001	1
	2441	1.474	2	1	0.0003	1
	2480	1.611	2	1	0.0003	1
8DPSK	2402	-2.417	-2	1	0.0001	1
	2441	0.101	2	1	0.0003	1
	2480	0.484	2	1	0.0003	1

### Wifi

#### Antenna A:

Mode	Channel Freq. (MHz)	Measured power (dBm)	Max tune-up power (dBm)	Antenna Gain Numeric	Evaluation result (mW/cm <sup>2</sup> )	Power density Limits (mW/cm <sup>2</sup> )
802.11b	2412	16.63	17	1.963	0.0196	1
	2437	16.43	17	1.963	0.0196	1
	2462	16.78	17	1.963	0.0196	1
802.11g	2412	15.45	16	1.963	0.0155	1
	2437	15.30	16	1.963	0.0155	1
	2462	15.53	16	1.963	0.0155	1
802.11n (HT20)	2412	15.72	16	1.963	0.0155	1
	2437	15.52	16	1.963	0.0155	1
	2462	15.86	16	1.963	0.0155	1
802.11n (HT40)	2422	12.75	13	1.963	0.0078	1
	2437	12.69	13	1.963	0.0078	1
	2452	12.68	13	1.963	0.0078	1

#### Antenna B:

Mode	Channel Freq. (MHz)	Measured power (dBm)	Max tune-up power (dBm)	Antenna Gain Numeric	Evaluation result (mW/cm <sup>2</sup> )	Power density Limits (mW/cm <sup>2</sup> )
802.11b	2412	16.68	17	1.963	0.0196	1
	2437	16.27	17	1.963	0.0196	1
	2462	16.79	17	1.963	0.0196	1
802.11g	2412	15.30	16	1.963	0.0155	1
	2437	15.13	16	1.963	0.0155	1

	2462	15.73	16	1.963	0.0155	1
802.11n (HT20)	2412	15.86	16	1.963	0.0155	1
	2437	15.54	16	1.963	0.0155	1
	2462	15.90	16	1.963	0.0155	1
802.11n (HT40)	2422	12.95	13	1.963	0.0078	1
	2437	12.57	13	1.963	0.0078	1
	2452	12.51	13	1.963	0.0078	1

Antenna A+B:

802.11n HT20: Antenna A+B

Evaluation result (mW/cm <sup>2</sup> ) Ant A	Evaluation result (mW/cm <sup>2</sup> ) Ant B	Evaluation result (mW/cm <sup>2</sup> ) Ant A+B	Power density Limits (mW/cm <sup>2</sup> )
0.0155	0.0155	0.0310	1

802.11n HT40 : Antenna A+B

Evaluation result (mW/cm <sup>2</sup> ) Ant A	Evaluation result (mW/cm <sup>2</sup> ) Ant B	Evaluation result (mW/cm <sup>2</sup> ) Ant A+B	Power density Limits (mW/cm <sup>2</sup> )
0.0078	0.0078	0.0156	1