

# FCC ID: OKU-CAW02013

## 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)

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

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

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(20cm)

$P_d$  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.

$mW = 10^{(dBm/10)}$

## 11.2 Measurement Result

Operation Frequency: WIFI 802.11b/g/n HT20: 2412-2462MHz,  
802.11n HT40: 2422-2452MHz,  
BT 2402-2480MHz

Power density limited:  $1\text{mW}/\text{cm}^2$

Antenna Type: Wifi Antenna: FPCB antenna ; BT Antenna: PCB antenna

WIFI antenna gain: 2.9dBi(ANT A), 2.9dBi(ANT B),

For MIMO, Antenna Gain= $2.9+10\log(N)=5.9\text{dBi}$

BT antenna: 1dBi

R=20cm

$\text{mW}=10^{(\text{dBm}/10)}$

### WIFI ANT A (802.11b/g):

Channel Freq. (MHz)	modulation	conducted power (mW)	conducted power (dBm)	Tune-up 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> )
2412	802.11b	38.55	15.860	15±1	16	1.95	0.014955	1
2437	802.11b	38.02	15.800	15±1	16	1.95	0.014749	1
2462	802.11b	34.91	15.430	15±1	16	1.95	0.013543	1
2412	802.11g	21.44	13.312	13±1	14	1.95	0.008317	1
2437	802.11g	22.19	13.462	13±1	14	1.95	0.008608	1
2462	802.11g	23.67	13.742	13±1	14	1.95	0.009183	1

### WIFI ANT B (802.11b/g):

Channel Freq. (MHz)	modulation	conducted power (mW)	conducted power (dBm)	Tune-up 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> )
2412	802.11b	29.03	14.628	14±1	15	1.95	0.011262	1
2437	802.11b	30.12	14.788	14±1	15	1.95	0.011685	1
2462	802.11b	24.59	13.908	14±1	15	1.95	0.009539	1
2412	802.11g	14.85	11.718	12±1	13	1.95	0.005761	1
2437	802.11g	18.53	12.678	12±1	13	1.95	0.007189	1
2462	802.11g	16.63	12.208	12±1	13	1.95	0.006451	1

### WIFI ANT A&B (802.11n-HT20/40):

Channel Freq. (MHz)	modulation	conducted power (mW)	conducted power (dBm)	Tune-up 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> )
2412	802.11n-HT20	40.23	16.046	16±1	17	3.89	0.031134	1
2437	802.11n-HT20	39.88	16.008	16±1	17	3.89	0.030863	1
2462	802.11n-HT20	40.78	16.105	16±1	17	3.89	<b>0.031559</b>	1
2422	802.11n-HT40	33.58	15.261	15±1	16	3.89	0.025987	1
2437	802.11n-HT40	34.84	15.421	15±1	16	3.89	0.026962	1
2452	802.11n-HT40	31.68	15.008	15±1	16	3.89	0.024517	1

## BT ANT

Channel Freq. (MHz)	modulation	conducted power (mW)	conducted power (dBm)	Tune-up 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> )
2.402	GFSK	1.35	1.30	1±1	2	1.26	0.000338	1
2.441	GFSK	1.43	1.54	1±1	2	1.26	<b>0.000358</b>	1
2.480	GFSK	1.19	0.74	1±1	2	1.26	0.000298	1
2.402	π/4-DQPSK	1.26	1.00	1±1	2	1.26	0.000316	1
2.441	π/4-DQPSK	1.25	0.98	1±1	2	1.26	0.000313	1
2.480	π/4-DQPSK	1.33	1.25	1±1	2	1.26	0.000333	1
2.402	8DPSK	1.32	1.19	1±1	2	1.26	0.000331	1
2.441	8DPSK	1.32	1.19	1±1	2	1.26	0.000331	1
2.480	8DPSK	1.39	1.43	1±1	2	1.26	0.000348	1

### CONCLUSION:

Both of Bluetooth and WLAN 2.4GHz can transmit simultaneously, the formula of calculated the MPE is:

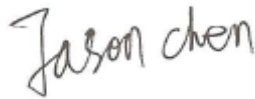
$CPD1 / LPD1 + CPD2 / LPD2 \dots \dots \text{etc.} < 1$

CPD = Calculation power density

LPD = Limit of power density

Therefore, the worst-case situation is  $0.031559/1 + 0.000358/1 = 0.031917$ , which is less than "1".

his confirmed that the device comply with MPE limit, No SAR is required.



**Signature:**

**Date:** 2016-9-5

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