

FCC ID: 2AI56-WD65NH4190

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 ²)	Averaging time (minutes)
(A) 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
300-1,500			f/300	6
1,500-100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*100	30
1.34-30	824/f	2.19/f	*180/f ²	30
30-300	27.5	0.073	0.2	30
300-1,500			f/1500	30
1,500-100,000			1.0	30

f = frequency in MHz * = Plane-wave equivalent power density

MPE Calculation Method

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

Where

P_d = Power density in mW/cm²

P_{out} = output power to antenna in mW

G = Numeric gain of the antenna relative to isotropic antenna

π = 3.1415926

R = distance between observation point and center of the radiator in cm (20cm)

P_d the limit of MPE, 1mW/cm². 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.

Measurement Result

WIFI:

Operation Frequency: WIFI 802.11b/g/n HT20: 2412-2462MHz,
802.11n HT40: 2422-2452MHz,
Power density limited: $1\text{mW}/\text{cm}^2$

Antenna Type: Wifi Antenna: Built-in antenna;

WIFI antenna gain: 1.7957dBi (ANT A), 1.7957dBi (ANT B),

R=20cm

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

antenna gain Numeric= $10^{(\text{dBi}/10)}=10^{(1.7957/10)}=1.51$

Condition: SISO

Channel Freq. (MHz)	modulation	conducted power		Tune-up power		Max				Antenna		Evaluation result at 20cm		Power density Limits
		(dBm)		(dBm)		tune-up power				Gain		Power density(mW/cm2)		(mW/cm2)
						(dBm)		(mW)		Numeric				
		Ant A	Ant B	Ant A	Ant B	Ant A	Ant B	Ant A	Ant B	Ant A	Ant B	Ant A	Ant B	
2412	802.11b	13.83	13.47	14±1	14±1	15	15	31.623	31.623	1.51	1.51	0.00950	0.00950	1
2437		14.00	14.54	14±1	14±1	15	15	31.623	31.623	1.51	1.51	0.00950	0.00950	1
2462		14.05	14.83	14±1	14±1	15	15	31.623	31.623	1.51	1.51	0.00950	0.00950	1
2412	802.11g	13.03	13.02	14±1	14±1	15	15	31.623	31.623	1.51	1.51	0.00950	0.00950	1
2437		13.38	13.92	14±1	14±1	15	15	31.623	31.623	1.51	1.51	0.00950	0.00950	1
2462		13.44	14.16	14±1	14±1	15	15	31.623	31.623	1.51	1.51	0.00950	0.00950	1
2412	802.11n H20	13.17	12.53	13±1	13±1	14	14	25.119	25.119	1.51	1.51	0.00755	0.00755	1
2437		13.52	13.27	13±1	13±1	14	14	25.119	25.119	1.51	1.51	0.00755	0.00755	1
2462		13.72	13.7	13±1	13±1	14	14	25.119	25.119	1.51	1.51	0.00755	0.00755	1
2422	802.11n H40	12.11	11.52	12±1	12±1	13	13	19.953	19.953	1.51	1.51	0.00599	0.00599	1
2437		12.31	11.91	12±1	12±1	13	13	19.953	19.953	1.51	1.51	0.00599	0.00599	1
2452		12.32	12.27	12±1	12±1	13	13	19.953	19.953	1.51	1.51	0.00599	0.00599	1

Operation Frequency: WIFI 802.11n HT20: 2412-2462MHz,
802.11n HT40: 2422-2452MHz,
Power density limited: $1\text{mW}/\text{cm}^2$

Antenna Type: Built-in Antenna

Antenna gain:

1.7957dBi (ANT A),

1.7957dBi (ANT B)

For MIMO, Antenna Gain= $1.7957+10\log(N)=4.81\text{dBi}$

R=20cm

802.11n:

MIMO Limit < 1

Channel Freq. (MHz)	modulation	conducted power		Tune-up power		Max				Antenna		Evaluation result at 20cm			Power density Limits
		(dBm)		(dBm)		tune-up power				Gain		Power density(mW/cm2)			(mW/cm2)
						(dBm)		(mW)		Numeric					
		Ant A	Ant B	Ant A	Ant B	Ant A	Ant B	Ant A	Ant B	Ant A	Ant B	Ant A	Ant B	Sum	
2412	802.11n H20	13.17	12.53	13±1	13±1	14	14	25.119	25.119	1.51	1.51	0.00755	0.00755	0.01509	
2437		13.52	13.27	13±1	13±1	14	14	25.119	25.119	1.51	1.51	0.00755	0.00755	0.01509	1
2462		13.72	13.7	13±1	13±1	14	14	25.119	25.119	1.51	1.51	0.00755	0.00755	0.01509	1
2422	802.11n H40	12.11	11.52	12±1	12±1	13	13	19.953	19.953	1.51	1.51	0.00599	0.00599	0.01198	1
2437		12.31	11.91	12±1	12±1	13	13	19.953	19.953	1.51	1.51	0.00599	0.00599	0.01198	1
2452		12.32	12.27	12±1	12±1	13	13	19.953	19.953	1.51	1.51	0.00599	0.00599	0.01198	1

The sum=Power density Ant A/1+Power density Ant b/1

Conclusion:

For the max result : $0.01509 \leq 1.0$ for 1g SAR, No SAR is required.

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Signature:

Date: 2016-09-12

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