# FCC ID: 2AI8ADSR51XR1MTPLA

## 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: $Pd = (Pout*G)\backslash(4*pi*R^2)$

Where
Pd= Power density in mW/cm$^2$
Pout=output power to antenna in mW
G= Numeric gain of the antenna relative to isotropic antenna
Pi=3.14115926
R= distance between observation point and center of the radiator in cm(20cm)
Pd the limit of MPE, 1mW/cm$^2$. 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: 1mW/ cm$^2$

Antenna Type:  External antenna

WIFI antenna gain: 5.0dBi (ANT A), 5.0dBi (ANT B),

For MIMO, Antenna Gain=5.0+10log(N)=8.01dBi

R=20cm

mW=10^(dBm/10)

antenna gain Numeric=10^(dBi/10)= 10^(5.0/10)=3.16

| Channel Freq. (MHz) | modulation | conducted power (dBm) | | Tune-up power (dBm) | | Max | | | | Antenna Gain Numeric | | Evaluation result at 20cm Power density(mW/cm2 ) | | | Power density Limits (mW/cm2) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | tune-up power | | | | | | | | | |
| | | | | | | (dBm) | | (mW) | | | | | | | |
| | | 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 | 802.11b | 14.18 | 14.12 | 14±1 | 14±1 | 15 | 15 | 31.623 | 31.623 | 3.16 | 3.16 | 0.01988 | 0.01988 | / | 1 |
| 2437 | | 13.85 | 13.83 | 14±1 | 14±1 | 15 | 15 | 31.623 | 31.623 | 3.16 | 3.16 | 0.01988 | 0.01988 | / | 1 |
| 2462 | | 13.89 | 13.87 | 14±1 | 14±1 | 15 | 15 | 31.623 | 31.623 | 3.16 | 3.16 | 0.01988 | 0.01988 | / | 1 |
| 2412 | 802.11g | 13.07 | 13 | 13±1 | 13±1 | 14 | 14 | 25.119 | 25.119 | 3.16 | 3.16 | 0.01579 | 0.01579 | / | 1 |
| 2437 | | 12.65 | 12.62 | 13±1 | 13±1 | 14 | 14 | 25.119 | 25.119 | 3.16 | 3.16 | 0.01579 | 0.01579 | / | 1 |
| 2462 | | 12.46 | 12.7 | 13±1 | 13±1 | 14 | 14 | 25.119 | 25.119 | 3.16 | 3.16 | 0.01579 | 0.01579 | / | 1 |
| 2412 | 802.11n H20 | 10.42 | 10.61 | 10±1 | 10±1 | 11 | 11 | 12.589 | 12.589 | 3.16 | 3.16 | 0.00791 | 0.00791 | 0.01583 | 1 |
| 2437 | | 10.22 | 10.16 | 10±1 | 10±1 | 11 | 11 | 12.589 | 12.589 | 3.16 | 3.16 | 0.00791 | 0.00791 | 0.01583 | 1 |
| 2462 | | 10.14 | 10.12 | 10±1 | 10±1 | 11 | 11 | 12.589 | 12.589 | 3.16 | 3.16 | 0.00791 | 0.00791 | 0.01583 | 1 |
| 2422 | 802.11n H40 | 10.1 | 10.17 | 10±1 | 10±1 | 11 | 11 | 12.589 | 12.589 | 3.16 | 3.16 | 0.00791 | 0.00791 | 0.01583 | 1 |
| 2437 | | 10.06 | 10.07 | 10±1 | 10±1 | 11 | 11 | 12.589 | 12.589 | 3.16 | 3.16 | 0.00791 | 0.00791 | 0.01583 | 1 |
| 2452 | | 9.91 | 9.98 | 10±1 | 10±1 | 11 | 11 | 12.589 | 12.589 | 3.16 | 3.16 | 0.00791 | 0.00791 | 0.01583 | 1 |

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

Therefore, the worst-case situation is 0.01988, which is less than "1".

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

*Jason chen*

**Signature:**                                                    **Date:**  2016-10-08


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