# 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)

FCC ID：**2AGNC-D1**

## EUT Specification

| EUT | DRUMFIRE D-1 |
|---|---|
| **Frequency band (Operating)** | ☒WLAN: 2.412GHz ~ 2.462GHz<br>☐WLAN: 5.18GHz ~ 5.32GHz / 5.50GHz ~ 5.70GHz<br>☐WLAN: 5.745GHz ~ 5825GHz<br>☐Others |
| **Device category** | ☐Portable (<20cm separation)<br>☒Mobile (>20cm separation)<br>☐Others ___ |
| **Exposure classification** | ☐Occupational/Controlled exposure (S = 5mW/cm2)<br>☒General Population/Uncontrolled exposure (S=1mW/cm2) |
| **Antenna diversity** | ☐Single antenna<br>☒Multiple antennas<br>☐Tx diversity<br>☐Rx diversity<br>☐Tx/Rx diversity |
| **Max. output power** | 14.29dBm for 802.11b;<br>12.14dBm for 802.11g;<br>12.30dBm for 802.11n(HT20);<br>11.34dBm for 802.11n(HT40); |
| **Antenna gain (Max)** | 2.71dBi ( for per antenna port Max)<br>5.72dBi for MIMO(Ant1+Ant2 Directional Gain) |
| **Evaluation applied** | ☒MPE Evaluation<br>☐SAR Evaluation |

Limits for Maximum Permissible Exposure(MPE)

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

# Friis transmission formula: Pd=(Pout*G)\(4*pi*R2)

Where

Pd= Power density in mW/cm$^2$, Pout=output power to antenna in Mw

G= gain of antenna in linear scale, Pi=3.1416

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

Pd 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

| Operation Mode | Channel Number | Channel Frequency (MHz) | Measurement Level (dBm) | | | Limit (dBm) | Verdict |
|---|---|---|---|---|---|---|---|
| | | | Ant1 | Ant2 | Sum | | |
| 802.11b | 1 | 2412 | 14.29 | 13.04 | -- | 30 | PASS |
| | 6 | 2437 | 14.03 | 14.18 | -- | 30 | PASS |
| | 11 | 2462 | 13.18 | 13.69 | -- | 30 | PASS |
| 802.11g | 1 | 2412 | 11.32 | 12.14 | -- | 30 | PASS |
| | 6 | 2437 | 10.19 | 11.25 | -- | 30 | PASS |
| | 11 | 2462 | 10.08 | 10.92 | -- | 30 | PASS |
| 802.11n (HT20) | 1 | 2412 | 9.28 | 9.18 | 12.24 | 30 | PASS |
| | 6 | 2437 | 9.06 | 9.39 | 12.24 | 30 | PASS |
| | 11 | 2462 | 9.11 | 9.46 | 12.30 | 30 | PASS |
| 802.11n (HT40) | 3 | 2422 | 8.47 | 8.19 | 11.34 | 30 | PASS |
| | 6 | 2437 | 8.31 | 7.81 | 11.08 | 30 | PASS |
| | 9 | 2452 | 8.24 | 8.04 | 11.15 | 30 | PASS |

Antenna 1

| Operating Mode | Test Channel | Tune up tolerance (dBm) | Max tune up conducted power(dBm) | Output Peak power (mW) | Ant. Gain (dBi) | Ant. Gain (numeric) | Power density at 20cm (mW/cm$^2$) | Power density Limits (mW/cm$^2$) |
|---|---|---|---|---|---|---|---|---|
| 802.11b | 1 | 14±1 | 15 | 31.623 | 2.71 | 1.866 | 0.01174 | 1 |
| | 6 | 14±1 | 15 | 31.623 | 2.71 | 1.866 | 0.01174 | 1 |
| | 11 | 13±1 | 14 | 25.119 | 2.71 | 1.866 | 0.00933 | 1 |
| 802.11g | 1 | 11±1 | 12 | 15.849 | 2.71 | 1.866 | 0.00588 | 1 |
| | 6 | 10±1 | 11 | 12.589 | 2.71 | 1.866 | 0.00467 | 1 |
| | 11 | 10±1 | 11 | 12.589 | 2.71 | 1.866 | 0.00467 | 1 |
| 802.11n (H20) | 1 | 9±1 | 10 | 10.000 | 2.71 | 1.866 | 0.00371 | 1 |
| | 6 | 9±1 | 10 | 10.000 | 2.71 | 1.866 | 0.00371 | 1 |
| | 11 | 9±1 | 10 | 10.000 | 2.71 | 1.866 | 0.00371 | 1 |
| 802.11n (H40) | 3 | 8±1 | 9 | 7.943 | 2.71 | 1.866 | 0.00295 | 1 |
| | 6 | 8±1 | 9 | 7.943 | 2.71 | 1.866 | 0.00295 | 1 |
| | 9 | 8±1 | 9 | 7.943 | 2.71 | 1.866 | 0.00295 | 1 |

Antenna 2:

| Operating Mode | Test Channel | Tune up tolerance (dBm) | Max tune up conducted power(dBm) | Output Peak power (mW) | Ant. Gain (dBi) | Ant. Gain (numeric) | Power density at 20cm (mW/cm$^2$) | Power density Limits (mW/cm$^2$) |
|---|---|---|---|---|---|---|---|---|
| 802.11b | 1 | 13±1 | 14 | 15.849 | 2.71 | 1.866 | 0.00933 | 1 |
| | 6 | 14±1 | 15 | 19.953 | 2.71 | 1.866 | 0.01174 | 1 |
| | 11 | 13±1 | 14 | 19.953 | 2.71 | 1.866 | 0.00933 | 1 |
| 802.11g | 1 | 12±1 | 13 | 12.589 | 2.71 | 1.866 | 0.00741 | 1 |
| | 6 | 11±1 | 12 | 12.589 | 2.71 | 1.866 | 0.00588 | 1 |
| | 11 | 11±1 | 12 | 12.589 | 2.71 | 1.866 | 0.00588 | 1 |
| 802.11n (HT20) | 1 | 9±1 | 10 | 12.589 | 2.71 | 1.866 | 0.00371 | 1 |
| | 6 | 9±1 | 10 | 10.000 | 2.71 | 1.866 | 0.00371 | 1 |
| | 11 | 9±1 | 10 | 10.000 | 2.71 | 1.866 | 0.00371 | 1 |
| 802.11n (HT40) | 3 | 8±1 | 9 | 7.943 | 2.71 | 1.866 | 0.00295 | 1 |
| | 6 | 8±1 | 9 | 6.310 | 2.71 | 1.866 | 0.00295 | 1 |
| | 9 | 8±1 | 9 | 7.943 | 2.71 | 1.866 | 0.00295 | 1 |

MPE Result:

| Operation Mode | Channel Number | Channel Frequency (MHz) | Power density at 20cm (mW/ cm$^2$ ) | | | Power density Limits (mW/cm$^2$ ) | Verdict |
|---|---|---|---|---|---|---|---|
| | | | Ant1 | Ant2 | Sum | | |
| 802.11b | 1 | 2412 | 0.01174 | 0.00933 | -- | 1 | PASS |
| | 6 | 2437 | 0.01174 | 0.01174 | -- | 1 | PASS |
| | 11 | 2462 | 0.00933 | 0.00933 | -- | 1 | PASS |
| 802.11g | 1 | 2412 | 0.00588 | 0.00741 | -- | 1 | PASS |
| | 6 | 2437 | 0.00467 | 0.00588 | -- | 1 | PASS |
| | 11 | 2462 | 0.00467 | 0.00588 | -- | 1 | PASS |
| 802.11n (HT20) | 1 | 2412 | 0.00371 | 0.00371 | 0.00742 | 1 | PASS |
| | 6 | 2437 | 0.00371 | 0.00371 | 0.00742 | 1 | PASS |
| | 11 | 2462 | 0.00371 | 0.00371 | 0.00742 | 1 | PASS |
| 802.11n (HT40) | 3 | 2422 | 0.00295 | 0.00295 | 0.0059 | 1 | PASS |
| | 6 | 2437 | 0.00295 | 0.00295 | 0.0059 | 1 | PASS |
| | 9 | 2452 | 0.00295 | 0.00295 | 0.0059 | 1 | PASS |

Signature:

Print:    Lisa Wang
Title:    Manager
Date:    2017-11-10