

# FCC ID: P53-EMC3589

## 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 |
|-------------------------------------------------------|------------------------------|------------------------------|------------------------------------|--------------|
| (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           |

### 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.

mW = 10<sup>^</sup>( dBm/10)

### 11.2 Measurement Result

Operation Frequency: 2412MHz-2462MHz;

Antenna gain: -0.19 dBi;

R=20cm

2.4G WIFI

| Channel Freq. (MHz) | modulation    | Measured 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       | 23.59                | 23±1                | 24                      | 0.96                 | 0.043524033                             | 1                                          |
| 2437                |               | 23.86                | 23±1                | 24                      | 0.96                 | 0.046315796                             | 1                                          |
| 2462                |               | 23.26                | 23±1                | 24                      | 0.96                 | 0.040339372                             | 1                                          |
| 2412                | 802.11g       | 25.02                | 25±1                | 26                      | 0.96                 | 0.060496344                             | 1                                          |
| 2437                |               | 24.76                | 24±1                | 25                      | 0.96                 | 0.056980877                             | 1                                          |
| 2462                |               | 25.10                | 25±1                | 26                      | 0.96                 | 0.061621055                             | 1                                          |
| 2412                | 802.11n(HT20) | 25.19                | 25±1                | 26                      | 0.96                 | 0.062911368                             | 1                                          |
| 2437                |               | 25.06                | 25±1                | 26                      | 0.96                 | 0.061056110                             | 1                                          |
| 2462                |               | 25.39                | 25±1                | 26                      | 0.96                 | 0.065876289                             | 1                                          |
| 2422                | 802.11n(HT40) | 25.31                | 25±1                | 26                      | 0.96                 | 0.064673912                             | 1                                          |
| 2437                |               | 25.02                | 25±1                | 26                      | 0.96                 | 0.060496344                             | 1                                          |
| 2452                |               | 25.12                | 25±1                | 26                      | 0.96                 | 0.061905485                             | 1                                          |

Operation Frequency: 2402MHz-2480MHz;  
Antenna gain: -0.19 dBi;  
R=20cm  
BLE

| Channel Freq. (MHz) | modulation | Measured power (dBm) | Tune-up power (dBm) | Max tune-up power (dBm) | Antenna Gain Numeric | Evaluation result (mW/cm2) | Power density Limits (mW/cm2 ) |
|---------------------|------------|----------------------|---------------------|-------------------------|----------------------|----------------------------|--------------------------------|
| 2402                | BLE_1M     | 11.39                | 11±1                | 12                      | 0.96                 | 0.002622582                | 1                              |
| 2440                |            | 11.30                | 11±1                | 12                      | 0.96                 | 0.002568793                | 1                              |
| 2480                |            | 11.45                | 11±1                | 12                      | 0.96                 | 0.002659066                | 1                              |
| 2404                | BLE_2M     | 11.21                | 11±1                | 12                      | 0.96                 | 0.002516107                | 1                              |
| 2440                |            | 11.15                | 11±1                | 12                      | 0.96                 | 0.002481585                | 1                              |
| 2480                |            | 11.26                | 11±1                | 12                      | 0.96                 | 0.002545242                | 1                              |

Operation Frequency: 5180MHz-5825MHz;  
Antenna gain: -0.31 dBi;  
R=20cm  
5G WiFi

| Channel Freq. (MHz) | modulation    | Measured power (dBm) | Tune-up power (dBm) | Max tune-up power (dBm) | Antenna Gain Numeric | Evaluation result (mW/cm2) | Power density Limits (mW/cm2 ) |
|---------------------|---------------|----------------------|---------------------|-------------------------|----------------------|----------------------------|--------------------------------|
| 5180                | 802.11b       | 14.96                | 14±1                | 15                      | 0.96                 | 0.005966630                | 1                              |
| 5200                |               | 14.85                | 14±1                | 15                      | 0.96                 | 0.005817403                | 1                              |
| 5240                |               | 14.98                | 14±1                | 15                      | 0.96                 | 0.005994171                | 1                              |
| 5260                |               | 15.56                | 15±1                | 16                      | 0.96                 | 0.006850608                | 1                              |
| 5280                |               | 15.27                | 15±1                | 16                      | 0.96                 | 0.006408098                | 1                              |
| 5320                |               | 14.21                | 14±1                | 15                      | 0.96                 | 0.005020294                | 1                              |
| 5500                |               | 15.54                | 15±1                | 16                      | 0.96                 | 0.006819132                | 1                              |
| 5580                |               | 15.58                | 15±1                | 16                      | 0.96                 | 0.006882229                | 1                              |
| 5700                |               | 15.64                | 15±1                | 16                      | 0.96                 | 0.006977970                | 1                              |
| 5745                |               | 15.31                | 15±1                | 16                      | 0.96                 | 0.006467391                | 1                              |
| 5785                |               | 15.26                | 15±1                | 16                      | 0.96                 | 0.006393360                | 1                              |
| 5825                |               | 15.45                | 15±1                | 16                      | 0.96                 | 0.006679272                | 1                              |
| 5180                | 802.11n(HT20) | 15.28                | 15±1                | 16                      | 0.96                 | 0.006422870                | 1                              |
| 5200                |               | 15.00                | 15±1                | 16                      | 0.96                 | 0.006021839                | 1                              |
| 5240                |               | 15.18                | 15±1                | 16                      | 0.96                 | 0.006276668                | 1                              |
| 5260                |               | 15.74                | 15±1                | 16                      | 0.96                 | 0.007140508                | 1                              |
| 5280                |               | 15.18                | 15±1                | 16                      | 0.96                 | 0.006276668                | 1                              |
| 5320                |               | 13.58                | 13±1                | 14                      | 0.96                 | 0.004342393                | 1                              |
| 5500                |               | 15.70                | 15±1                | 16                      | 0.96                 | 0.007075044                | 1                              |
| 5580                |               | 15.81                | 15±1                | 16                      | 0.96                 | 0.007256532                | 1                              |
| 5700                |               | 14.28                | 14±1                | 15                      | 0.96                 | 0.005101867                | 1                              |
| 5745                |               | 15.18                | 15±1                | 16                      | 0.96                 | 0.006276668                | 1                              |
| 5785                |               | 15.24                | 15±1                | 16                      | 0.96                 | 0.006363985                | 1                              |
| 5825                |               | 15.66                | 15±1                | 16                      | 0.96                 | 0.007010179                | 1                              |
| 5190                | 802.11n(HT40) | 12.52                | 12±1                | 13                      | 0.96                 | 0.003401959                | 1                              |
| 5230                |               | 14.98                | 14±1                | 15                      | 0.96                 | 0.005994171                | 1                              |
| 5270                |               | 15.09                | 15±1                | 16                      | 0.96                 | 0.006147933                | 1                              |
| 5310                |               | 10.41                | 10±1                | 11                      | 0.96                 | 0.002092807                | 1                              |
| 5510                |               | 13.17                | 13±1                | 14                      | 0.96                 | 0.003951201                | 1                              |
| 5550                |               | 14.42                | 14±1                | 15                      | 0.96                 | 0.005269011                | 1                              |
| 5670                |               | 14.48                | 14±1                | 15                      | 0.96                 | 0.005342311                | 1                              |
| 5755                |               | 15.84                | 15±1                | 16                      | 0.96                 | 0.007306832                | 1                              |
| 5795                |               | 15.88                | 15±1                | 16                      | 0.96                 | 0.007374441                | 1                              |

\*\*\* End of Report \*\*\*