

# FCC ID: 2BDTM-P01

## RF Exposure Evaluation

According to KDB 447498 D01 General RF Exposure Guidance v06 and part 2.1091, Unless specifically required by the published RF exposure KDB procedures, standalone 1-g head or body and 10-g extremity SAR evaluation for general population exposure conditions, by measurement or numerical simulation, is not required when the corresponding SAR Test Exclusion Threshold condition(s), listed below, is (are) satisfied.

## Limits

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> ) | Averaging time (minutes) |
|---------------------------------------------------------|-------------------------------|-------------------------------|-------------------------------------|--------------------------|
| (A) Limits for Occupational/Controlled Exposures        |                               |                               |                                     |                          |
| 0.3–3.0                                                 | 614                           | 1.63                          | *(100)                              | 6                        |
| 3.0–30                                                  | 1842/f                        | 4.89/f                        | *(900/f <sup>2</sup> )              | 6                        |
| 30–300                                                  | 61.4                          | 0.163                         | 1.0                                 | 6                        |
| 300–1500                                                |                               |                               | f/300                               | 6                        |
| 1500–100,000                                            |                               |                               | 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 <sup>2</sup> )              | 30                       |
| 30–300                                                  | 27.5                          | 0.073                         | 0.2                                 | 30                       |
| 300–1500                                                |                               |                               | f/1500                              | 30                       |
| 1500–100,000                                            |                               |                               | 1.0                                 | 30                       |

f = frequency in MHz

Friis transmission formula:  $Pd = (Pout \cdot G) / (4 \cdot \pi \cdot r^2)$

Where

**Pd** = power density in mW/cm<sup>2</sup>, **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 is the limit of MPE, 1 mW/cm<sup>2</sup>. If we know the maximum gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance r where the MPE limit is reached.

## Test Procedure

Software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel individually.

## Test Result of RF Exposure Evaluation

|     | Modulation | Frequency<br>MHz | Output<br>power<br>to<br>antenna<br>(dBm) | Target<br>power<br>W/tolerance<br>(dBm) | Max<br>Output<br>power to<br>antenna<br>(dBm) | Max<br>Output<br>power to<br>antenna<br>(mW) | Power<br>Density at<br>R=20cm<br>(mW/cm <sup>2</sup> ) | Limit<br>(mW/cm <sup>2</sup> ) | Result |
|-----|------------|------------------|-------------------------------------------|-----------------------------------------|-----------------------------------------------|----------------------------------------------|--------------------------------------------------------|--------------------------------|--------|
| BLE | GFSK       | 2402             | 4.17                                      | 4 ± 1                                   | 5                                             | 3.162                                        | 0.000995                                               | 1.0                            | PASS   |
|     |            | 2440             | 4.58                                      | 4 ± 1                                   | 5                                             | 3.162                                        | 0.000995                                               | 1.0                            | PASS   |
|     |            | 2480             | 4.05                                      | 4 ± 1                                   | 5                                             | 3.162                                        | 0.000995                                               | 1.0                            | PASS   |

|           | Modulation        | Frequency<br>MHz | Output<br>power<br>to<br>antenna<br>(dBm) | Target<br>power<br>W/tolerance<br>(dBm) | Max<br>Output<br>power to<br>antenna<br>(dBm) | Max<br>Output<br>power to<br>antenna<br>(mW) | Power<br>Density at<br>R=20cm<br>(mW/cm <sup>2</sup> ) | Limit<br>(mW/cm <sup>2</sup> ) | Result |
|-----------|-------------------|------------------|-------------------------------------------|-----------------------------------------|-----------------------------------------------|----------------------------------------------|--------------------------------------------------------|--------------------------------|--------|
| WIFI 2.4G | 802.11b           | 2412             | 18.91                                     | 18 ± 1                                  | 19                                            | 79.433                                       | 0.024988                                               | 1.0                            | PASS   |
|           |                   | 2437             | 18.48                                     | 18 ± 1                                  | 19                                            | 79.433                                       | 0.024988                                               | 1.0                            | PASS   |
|           |                   | 2462             | 18.22                                     | 18 ± 1                                  | 19                                            | 79.433                                       | 0.024988                                               | 1.0                            | PASS   |
|           | 802.11g           | 2412             | 18.17                                     | 18 ± 1                                  | 19                                            | 79.433                                       | 0.024988                                               | 1.0                            | PASS   |
|           |                   | 2437             | 17.82                                     | 18 ± 1                                  | 19                                            | 79.433                                       | 0.024988                                               | 1.0                            | PASS   |
|           |                   | 2462             | 17.34                                     | 18 ± 1                                  | 19                                            | 79.433                                       | 0.024988                                               | 1.0                            | PASS   |
|           | 802.11n<br>(HT20) | 2412             | 17.68                                     | 18 ± 1                                  | 19                                            | 79.433                                       | 0.024988                                               | 1.0                            | PASS   |
|           |                   | 2437             | 17.25                                     | 18 ± 1                                  | 19                                            | 79.433                                       | 0.024988                                               | 1.0                            | PASS   |
|           |                   | 2462             | 17.07                                     | 18 ± 1                                  | 19                                            | 79.433                                       | 0.024988                                               | 1.0                            | PASS   |
|           | 802.11n<br>(HT40) | 2422             | 16.56                                     | 17 ± 1                                  | 18                                            | 63.096                                       | 0.019849                                               | 1.0                            | PASS   |
|           |                   | 2437             | 16.39                                     | 17 ± 1                                  | 18                                            | 63.096                                       | 0.019849                                               | 1.0                            | PASS   |
|           |                   | 2452             | 16.28                                     | 17 ± 1                                  | 18                                            | 63.096                                       | 0.019849                                               | 1.0                            | PASS   |

|           | Modulation   | Frequency<br>MHz | Output<br>power<br>to<br>antenna<br>(dBm) | Target<br>power<br>W/tolerance<br>(dBm) | Max<br>Output<br>power<br>to<br>antenna<br>(dBm) | Max<br>Output<br>power<br>to<br>antenna<br>(mW) | Power<br>Density at<br>R=20cm<br>(mW/cm2) | Limit<br>(mW/cm2) | Result |
|-----------|--------------|------------------|-------------------------------------------|-----------------------------------------|--------------------------------------------------|-------------------------------------------------|-------------------------------------------|-------------------|--------|
| Wifi 5.2g | 802.11a      | 5180             | 10.92                                     | $10 \pm 1$                              | 11                                               | 12.589                                          | 0.004929                                  | 1.0               | PASS   |
|           |              | 5200             | 10.00                                     | $10 \pm 1$                              | 11                                               | 12.589                                          | 0.004929                                  | 1.0               | PASS   |
|           |              | 5240             | 9.28                                      | $10 \pm 1$                              | 11                                               | 12.589                                          | 0.004929                                  | 1.0               | PASS   |
|           | 802.11n(20)  | 5180             | 10.84                                     | $10 \pm 1$                              | 11                                               | 12.589                                          | 0.004929                                  | 1.0               | PASS   |
|           |              | 5200             | 10.37                                     | $10 \pm 1$                              | 11                                               | 12.589                                          | 0.004929                                  | 1.0               | PASS   |
|           |              | 5240             | 9.81                                      | $10 \pm 1$                              | 11                                               | 12.589                                          | 0.004929                                  | 1.0               | PASS   |
|           | 802.11ac(20) | 5180             | 10.86                                     | $10 \pm 1$                              | 11                                               | 12.589                                          | 0.004929                                  | 1.0               | PASS   |
|           |              | 5200             | 10.32                                     | $10 \pm 1$                              | 11                                               | 12.589                                          | 0.004929                                  | 1.0               | PASS   |
|           |              | 5240             | 9.91                                      | $10 \pm 1$                              | 11                                               | 12.589                                          | 0.004929                                  | 1.0               | PASS   |
|           | 802.11n(40)  | 5190             | 10.44                                     | $10 \pm 1$                              | 11                                               | 12.589                                          | 0.004929                                  | 1.0               | PASS   |
|           |              | 5230             | 9.85                                      | $10 \pm 1$                              | 11                                               | 12.589                                          | 0.004929                                  | 1.0               | PASS   |
|           | 802.11ac(40) | 5190             | 10.56                                     | $10 \pm 1$                              | 11                                               | 12.589                                          | 0.004929                                  | 1.0               | PASS   |
|           |              | 5230             | 9.87                                      | $10 \pm 1$                              | 11                                               | 12.589                                          | 0.004929                                  | 1.0               | PASS   |
|           | 802.11ac(80) | 5210             | 10.31                                     | $10 \pm 1$                              | 11                                               | 12.589                                          | 0.004929                                  | 1.0               | PASS   |
| Wifi 5.8g | 802.11a      | 5745             | 5.43                                      | $5 \pm 1$                               | 6                                                | 3.981                                           | 0.001376                                  | 1.0               | PASS   |
|           |              | 5785             | 5.71                                      | $5 \pm 1$                               | 6                                                | 3.981                                           | 0.001376                                  | 1.0               | PASS   |
|           |              | 5825             | 4.79                                      | $5 \pm 1$                               | 6                                                | 3.981                                           | 0.001376                                  | 1.0               | PASS   |
|           | 802.11n(20)  | 5745             | 5.68                                      | $5 \pm 1$                               | 6                                                | 3.981                                           | 0.001376                                  | 1.0               | PASS   |
|           |              | 5785             | 5.95                                      | $5 \pm 1$                               | 6                                                | 3.981                                           | 0.001376                                  | 1.0               | PASS   |
|           |              | 5825             | 5.05                                      | $5 \pm 1$                               | 6                                                | 3.981                                           | 0.001376                                  | 1.0               | PASS   |
|           | 802.11ac(20) | 5745             | 5.69                                      | $5 \pm 1$                               | 6                                                | 3.981                                           | 0.001376                                  | 1.0               | PASS   |
|           |              | 5785             | 5.92                                      | $5 \pm 1$                               | 6                                                | 3.981                                           | 0.001376                                  | 1.0               | PASS   |
|           |              | 5825             | 5.07                                      | $5 \pm 1$                               | 6                                                | 3.981                                           | 0.001376                                  | 1.0               | PASS   |
|           | 802.11n(40)  | 5755             | 5.50                                      | $5 \pm 1$                               | 6                                                | 3.981                                           | 0.001376                                  | 1.0               | PASS   |
|           |              | 5795             | 5.33                                      | $5 \pm 1$                               | 6                                                | 3.981                                           | 0.001376                                  | 1.0               | PASS   |
|           | 802.11ac(40) | 5755             | 5.63                                      | $5 \pm 1$                               | 6                                                | 3.981                                           | 0.001376                                  | 1.0               | PASS   |
|           |              | 5795             | 5.48                                      | $5 \pm 1$                               | 6                                                | 3.981                                           | 0.001376                                  | 1.0               | PASS   |
|           | 802.11ac(80) | 5755             | 6.34                                      | $6 \pm 1$                               | 7                                                | 5.012                                           | 0.001733                                  | 1.0               | PASS   |

Remark: 1. BT Antenna & wifi 2.4g Antenna gain is 1.99dBi,  
wifi 5.2g Antenna gain is 2.94 dBi, wifi 5.8g Antenna gain is 2.40 dBi

2. Wifi 2.4g, wifi 5.2g and wifi 5.8g do not transmit at the same time  
BT and wifi can transmit at the same time

3. In the case of simultaneous launches for wifi and BT:  
The Max Calc. Thresholds : BT: 0.000995, Wifi: 0.024988

BT and Wifi:  $0.000995 + 0.024988 = 0.025983 \leq 1$

So a SAR test is not required