

## 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:  $Pd = (P_{out} * G) / (4 * \pi * r^2)$

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 |
|-----------|--------------------|------------------|-------------------------------------------|-----------------------------------------|-----------------------------------------------|----------------------------------------------|--------------------------------------------------------|--------------------------------|--------|
| WIFI 2.4G | 802.11b            | 2412             | 17.98                                     | 18±1                                    | 19                                            | 79.433                                       | 0.001976                                               | 1.0                            | PASS   |
|           |                    | 2437             | 18.91                                     | 18±1                                    | 19                                            | 79.433                                       | 0.001976                                               | 1.0                            | PASS   |
|           |                    | 2462             | 19.45                                     | 19±1                                    | 20                                            | 100.000                                      | 0.002487                                               | 1.0                            | PASS   |
|           | 802.11g            | 2412             | 19.03                                     | 20±1                                    | 21                                            | 125.893                                      | 0.003131                                               | 1.0                            | PASS   |
|           |                    | 2437             | 20.12                                     | 20±1                                    | 21                                            | 125.893                                      | 0.003131                                               | 1.0                            | PASS   |
|           |                    | 2462             | 20.37                                     | 20±1                                    | 21                                            | 125.893                                      | 0.003131                                               | 1.0                            | PASS   |
|           | 802.11n<br>(HT20)  | 2412             | 18.67                                     | 19±1                                    | 20                                            | 100.000                                      | 0.002487                                               | 1.0                            | PASS   |
|           |                    | 2437             | 19.69                                     | 19±1                                    | 20                                            | 100.000                                      | 0.002487                                               | 1.0                            | PASS   |
|           |                    | 2462             | 19.98                                     | 19±1                                    | 20                                            | 100.000                                      | 0.002487                                               | 1.0                            | PASS   |
|           | 802.11ax<br>(HT20) | 2412             | 19.74                                     | 19±1                                    | 20                                            | 100.000                                      | 0.002487                                               | 1.0                            | PASS   |
|           |                    | 2437             | 19.68                                     | 19±1                                    | 20                                            | 100.000                                      | 0.002487                                               | 1.0                            | PASS   |
|           |                    | 2462             | 19.44                                     | 19±1                                    | 20                                            | 100.000                                      | 0.002487                                               | 1.0                            | PASS   |
|           | 802.11n<br>(HT40)  | 2422             | 19.04                                     | 20±1                                    | 21                                            | 125.893                                      | 0.003131                                               | 1.0                            | PASS   |
|           |                    | 2437             | 19.86                                     | 20±1                                    | 21                                            | 125.893                                      | 0.003131                                               | 1.0                            | PASS   |
|           |                    | 2452             | 20.18                                     | 20±1                                    | 21                                            | 125.893                                      | 0.003131                                               | 1.0                            | PASS   |
|           | 802.11ax<br>(HT40) | 2422             | 19.90                                     | 19±1                                    | 20                                            | 100.000                                      | 0.002487                                               | 1.0                            | PASS   |
|           |                    | 2437             | 19.83                                     | 19±1                                    | 20                                            | 100.000                                      | 0.002487                                               | 1.0                            | PASS   |
|           |                    | 2452             | 19.56                                     | 19±1                                    | 20                                            | 100.000                                      | 0.002487                                               | 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<br>5.2g | 802.11a      | 5180             | 14.26                                     | $14 \pm 1$                              | 15                                               | 31.623                                          | 0.004224                                  | 1.0               | PASS   |
|              |              | 5200             | 15.00                                     | $14 \pm 1$                              | 15                                               | 31.623                                          | 0.004224                                  | 1.0               | PASS   |
|              |              | 5240             | 14.21                                     | $14 \pm 1$                              | 15                                               | 31.623                                          | 0.004224                                  | 1.0               | PASS   |
|              | 802.11n(20)  | 5180             | 13.72                                     | $13.5 \pm 1$                            | 14.5                                             | 28.184                                          | 0.003765                                  | 1.0               | PASS   |
|              |              | 5200             | 14.08                                     | $13.5 \pm 1$                            | 14.5                                             | 28.184                                          | 0.003765                                  | 1.0               | PASS   |
|              |              | 5240             | 13.39                                     | $13.5 \pm 1$                            | 14.5                                             | 28.184                                          | 0.003765                                  | 1.0               | PASS   |
|              | 802.11ac(20) | 5180             | 14.32                                     | $14 \pm 1$                              | 15                                               | 31.623                                          | 0.004224                                  | 1.0               | PASS   |
|              |              | 5200             | 14.78                                     | $14 \pm 1$                              | 15                                               | 31.623                                          | 0.004224                                  | 1.0               | PASS   |
|              |              | 5240             | 13.98                                     | $14 \pm 1$                              | 15                                               | 31.623                                          | 0.004224                                  | 1.0               | PASS   |
|              | 802.11ax(20) | 5180             | 14.49                                     | $14 \pm 1$                              | 15                                               | 31.623                                          | 0.004224                                  | 1.0               | PASS   |
|              |              | 5200             | 14.98                                     | $14 \pm 1$                              | 15                                               | 31.623                                          | 0.004224                                  | 1.0               | PASS   |
|              |              | 5240             | 14.12                                     | $14 \pm 1$                              | 15                                               | 31.623                                          | 0.004224                                  | 1.0               | PASS   |
|              | 802.11n(40)  | 5190             | 12.75                                     | $12 \pm 1$                              | 13                                               | 19.953                                          | 0.002665                                  | 1.0               | PASS   |
|              |              | 5230             | 12.89                                     | $12 \pm 1$                              | 13                                               | 19.953                                          | 0.002665                                  | 1.0               | PASS   |
|              | 802.11ac(40) | 5190             | 11.96                                     | $12 \pm 1$                              | 13                                               | 19.953                                          | 0.002665                                  | 1.0               | PASS   |
|              |              | 5230             | 12.91                                     | $12 \pm 1$                              | 13                                               | 19.953                                          | 0.002665                                  | 1.0               | PASS   |
|              | 802.11ax(40) | 5190             | 12.48                                     | $12 \pm 1$                              | 13                                               | 19.953                                          | 0.002665                                  | 1.0               | PASS   |
|              |              | 5230             | 12.91                                     | $12 \pm 1$                              | 13                                               | 19.953                                          | 0.002665                                  | 1.0               | PASS   |
| Wifi<br>5.8g | 802.11a      | 5745             | 7.72                                      | $7 \pm 1$                               | 8                                                | 6.310                                           | 0.000928                                  | 1.0               | PASS   |
|              |              | 5785             | 5.43                                      | $5 \pm 1$                               | 6                                                | 3.981                                           | 0.000586                                  | 1.0               | PASS   |
|              |              | 5825             | 4.62                                      | $5 \pm 1$                               | 6                                                | 3.981                                           | 0.000586                                  | 1.0               | PASS   |
|              | 802.11n(20)  | 5745             | 6.73                                      | $6 \pm 1$                               | 7                                                | 5.012                                           | 0.000737                                  | 1.0               | PASS   |
|              |              | 5785             | 5.67                                      | $5 \pm 1$                               | 6                                                | 3.981                                           | 0.000586                                  | 1.0               | PASS   |
|              |              | 5825             | 4.64                                      | $5 \pm 1$                               | 6                                                | 3.981                                           | 0.000586                                  | 1.0               | PASS   |
|              | 802.11ac(20) | 5745             | 8.41                                      | $8 \pm 1$                               | 9                                                | 7.943                                           | 0.001169                                  | 1.0               | PASS   |
|              |              | 5785             | 6.06                                      | $6 \pm 1$                               | 7                                                | 5.012                                           | 0.000737                                  | 1.0               | PASS   |
|              |              | 5825             | 5.19                                      | $6 \pm 1$                               | 7                                                | 5.012                                           | 0.000737                                  | 1.0               | PASS   |
|              | 802.11ax(20) | 5745             | 8.65                                      | $8 \pm 1$                               | 9                                                | 7.943                                           | 0.001169                                  | 1.0               | PASS   |
|              |              | 5785             | 6.29                                      | $6 \pm 1$                               | 7                                                | 5.012                                           | 0.000737                                  | 1.0               | PASS   |
|              |              | 5825             | 5.40                                      | $6 \pm 1$                               | 7                                                | 5.012                                           | 0.000737                                  | 1.0               | PASS   |
|              | 802.11n(40)  | 5755             | 8.03                                      | $8 \pm 1$                               | 9                                                | 7.943                                           | 0.001169                                  | 1.0               | PASS   |
|              |              | 5795             | 5.56                                      | $5 \pm 1$                               | 6                                                | 3.981                                           | 0.000586                                  | 1.0               | PASS   |
|              | 802.11ac(40) | 5755             | 7.79                                      | $7 \pm 1$                               | 8                                                | 6.310                                           | 0.000928                                  | 1.0               | PASS   |
|              |              | 5795             | 5.83                                      | $5 \pm 1$                               | 6                                                | 3.981                                           | 0.000586                                  | 1.0               | PASS   |
|              | 802.11ax(40) | 5755             | 8.05                                      | $8 \pm 1$                               | 9                                                | 7.943                                           | 0.001169                                  | 1.0               | PASS   |
|              |              | 5795             | 5.79                                      | $5 \pm 1$                               | 6                                                | 3.981                                           | 0.000586                                  | 1.0               | PASS   |

Remark: 1. wifi 2.4g Antenna gain is -9.03dBi,

wifi 5.2g Antenna gain is -1.73 dBi, wifi 5.8g Antenna gain is -1.31 dBi

2. Wifi2.4g, wifi5.2g and wifi5.8g donot transmit at the same time

3. In the case of simultaneous launches for wifi :

The Max Calc. Thresholds : Wifi2.4g: 0.003131 , Wifi5.2g: 0.004224, Wifi5.8g: 0.001169

So a SAR test is not required