

## 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 |
|----------------|------------|------------------|-------------------------------------------|-----------------------------------------|-----------------------------------------------|----------------------------------------------|--------------------------------------------------------|--------------------------------|--------|
| BT<br>(BR+EDR) | GFSK       | 2402             | 0.41                                      | 0±1                                     | 1                                             | 1.259                                        | 0.000092                                               | 1.0                            | PASS   |
|                |            | 2441             | 0.01                                      | 0±1                                     | 1                                             | 1.259                                        | 0.000092                                               | 1.0                            | PASS   |
|                |            | 2480             | -0.20                                     | 0±1                                     | 1                                             | 1.259                                        | 0.000092                                               | 1.0                            | PASS   |
|                | π/4-DQPSK  | 2402             | 1.03                                      | 1±1                                     | 2                                             | 1.585                                        | 0.000115                                               | 1.0                            | PASS   |
|                |            | 2441             | 0.90                                      | 1±1                                     | 2                                             | 1.585                                        | 0.000115                                               | 1.0                            | PASS   |
|                |            | 2480             | 0.71                                      | 1±1                                     | 2                                             | 1.585                                        | 0.000115                                               | 1.0                            | PASS   |
|                | 8DPSK      | 2402             | 1.62                                      | 1±1                                     | 2                                             | 1.585                                        | 0.000115                                               | 1.0                            | PASS   |
|                |            | 2441             | 1.51                                      | 1±1                                     | 2                                             | 1.585                                        | 0.000115                                               | 1.0                            | PASS   |
|                |            | 2480             | 1.34                                      | 1±1                                     | 2                                             | 1.585                                        | 0.000115                                               | 1.0                            | PASS   |
| BT<br>(BLE)    | GFSK       | 2402             | 0.26                                      | 0±1                                     | 1                                             | 1.259                                        | 0.000092                                               | 1.0                            | PASS   |
|                |            | 2440             | 0.11                                      | 0±1                                     | 1                                             | 1.259                                        | 0.000092                                               | 1.0                            | PASS   |
|                |            | 2480             | -0.09                                     | 0±1                                     | 1                                             | 1.259                                        | 0.000092                                               | 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             | 8.90                                      | 9±1                                     | 10                                            | 10.000                                       | 0.000727                                               | 1.0                            | PASS   |
|           |                    | 2437             | 9.10                                      | 9±1                                     | 10                                            | 10.000                                       | 0.000727                                               | 1.0                            | PASS   |
|           |                    | 2462             | 8.95                                      | 9±1                                     | 10                                            | 10.000                                       | 0.000727                                               | 1.0                            | PASS   |
|           | 802.11g            | 2412             | 8.99                                      | 9±1                                     | 10                                            | 10.000                                       | 0.000727                                               | 1.0                            | PASS   |
|           |                    | 2437             | 9.39                                      | 9±1                                     | 10                                            | 10.000                                       | 0.000727                                               | 1.0                            | PASS   |
|           |                    | 2462             | 9.18                                      | 9±1                                     | 10                                            | 10.000                                       | 0.000727                                               | 1.0                            | PASS   |
|           | 802.11n<br>(HT20)  | 2412             | 8.52                                      | 9±1                                     | 10                                            | 10.000                                       | 0.000727                                               | 1.0                            | PASS   |
|           |                    | 2437             | 8.95                                      | 9±1                                     | 10                                            | 10.000                                       | 0.000727                                               | 1.0                            | PASS   |
|           |                    | 2462             | 8.76                                      | 9±1                                     | 10                                            | 10.000                                       | 0.000727                                               | 1.0                            | PASS   |
|           | 802.11ax<br>(HT20) | 2412             | 8.22                                      | 8±1                                     | 9                                             | 7.943                                        | 0.000578                                               | 1.0                            | PASS   |
|           |                    | 2437             | 8.92                                      | 9±1                                     | 10                                            | 10.000                                       | 0.000727                                               | 1.0                            | PASS   |
|           |                    | 2462             | 8.31                                      | 8±1                                     | 9                                             | 7.943                                        | 0.000578                                               | 1.0                            | PASS   |
|           | 802.11n<br>(HT40)  | 2422             | 8.95                                      | 9±1                                     | 10                                            | 10.000                                       | 0.000727                                               | 1.0                            | PASS   |
|           |                    | 2437             | 9.17                                      | 9±1                                     | 10                                            | 10.000                                       | 0.000727                                               | 1.0                            | PASS   |
|           |                    | 2452             | 8.25                                      | 8±1                                     | 9                                             | 7.943                                        | 0.000578                                               | 1.0                            | PASS   |
|           | 802.11ax<br>(HT40) | 2422             | 8.76                                      | 9±1                                     | 10                                            | 10.000                                       | 0.000727                                               | 1.0                            | PASS   |
|           |                    | 2437             | 9.02                                      | 9±1                                     | 10                                            | 10.000                                       | 0.000727                                               | 1.0                            | PASS   |
|           |                    | 2452             | 8.54                                      | 9±1                                     | 10                                            | 10.000                                       | 0.000727                                               | 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             | 5.84                                      | $6 \pm 1$                               | 7                                                | 5.012                                           | 0.002778                                  | 1.0               | PASS   |
|              |              | 5200             | 4.71                                      | $5 \pm 1$                               | 6                                                | 3.981                                           | 0.002207                                  | 1.0               | PASS   |
|              |              | 5240             | 4.01                                      | $4 \pm 1$                               | 5                                                | 3.162                                           | 0.001753                                  | 1.0               | PASS   |
|              | 802.11n(20)  | 5180             | 5.64                                      | $5 \pm 1$                               | 6                                                | 3.981                                           | 0.002207                                  | 1.0               | PASS   |
|              |              | 5200             | 5.05                                      | $5 \pm 1$                               | 6                                                | 3.981                                           | 0.002207                                  | 1.0               | PASS   |
|              |              | 5240             | 4.20                                      | $4 \pm 1$                               | 5                                                | 3.162                                           | 0.001753                                  | 1.0               | PASS   |
|              | 802.11ac(20) | 5180             | 5.43                                      | $5 \pm 1$                               | 6                                                | 3.981                                           | 0.002207                                  | 1.0               | PASS   |
|              |              | 5200             | 4.72                                      | $5 \pm 1$                               | 6                                                | 3.981                                           | 0.002207                                  | 1.0               | PASS   |
|              |              | 5240             | 4.26                                      | $4 \pm 1$                               | 5                                                | 3.162                                           | 0.001753                                  | 1.0               | PASS   |
|              | 802.11ax(20) | 5180             | 3.25                                      | $3 \pm 1$                               | 4                                                | 2.512                                           | 0.001392                                  | 1.0               | PASS   |
|              |              | 5200             | 2.84                                      | $3 \pm 1$                               | 4                                                | 2.512                                           | 0.001392                                  | 1.0               | PASS   |
|              |              | 5240             | 3.93                                      | $4 \pm 1$                               | 5                                                | 3.162                                           | 0.001753                                  | 1.0               | PASS   |
|              | 802.11n(40)  | 5190             | 4.89                                      | $5 \pm 1$                               | 6                                                | 3.981                                           | 0.002207                                  | 1.0               | PASS   |
|              |              | 5230             | 4.28                                      | $4 \pm 1$                               | 5                                                | 3.162                                           | 0.001753                                  | 1.0               | PASS   |
|              | 802.11ac(40) | 5190             | 5.29                                      | $5 \pm 1$                               | 6                                                | 3.981                                           | 0.002207                                  | 1.0               | PASS   |
|              |              | 5230             | 4.32                                      | $4 \pm 1$                               | 5                                                | 3.162                                           | 0.001753                                  | 1.0               | PASS   |
|              | 802.11ax(40) | 5190             | 4.80                                      | $5 \pm 1$                               | 6                                                | 3.981                                           | 0.002207                                  | 1.0               | PASS   |
|              |              | 5230             | 3.89                                      | $4 \pm 1$                               | 5                                                | 3.162                                           | 0.001753                                  | 1.0               | PASS   |
|              | 802.11ac(80) | 5210             | 4.56                                      | $5 \pm 1$                               | 6                                                | 3.981                                           | 0.002207                                  | 1.0               | PASS   |
|              | 802.11ax(80) | 5210             | 5.07                                      | $5 \pm 1$                               | 6                                                | 3.981                                           | 0.002207                                  | 1.0               | PASS   |
| Wifi<br>5.8g | 802.11a      | 5745             | 0.44                                      | $0 \pm 1$                               | 1                                                | 1.259                                           | 0.000314                                  | 1.0               | PASS   |
|              |              | 5785             | 1.98                                      | $2 \pm 1$                               | 3                                                | 1.995                                           | 0.000497                                  | 1.0               | PASS   |
|              |              | 5825             | 1.64                                      | $2 \pm 1$                               | 3                                                | 1.995                                           | 0.000497                                  | 1.0               | PASS   |
|              | 802.11n(20)  | 5745             | 0.27                                      | $0 \pm 1$                               | 1                                                | 1.259                                           | 0.000314                                  | 1.0               | PASS   |
|              |              | 5785             | 1.23                                      | $1 \pm 1$                               | 2                                                | 1.585                                           | 0.000395                                  | 1.0               | PASS   |
|              |              | 5825             | 0.95                                      | $1 \pm 1$                               | 2                                                | 1.585                                           | 0.000395                                  | 1.0               | PASS   |
|              | 802.11ac(20) | 5745             | 0.12                                      | $0 \pm 1$                               | 1                                                | 1.259                                           | 0.000314                                  | 1.0               | PASS   |
|              |              | 5785             | 1.19                                      | $1 \pm 1$                               | 2                                                | 1.585                                           | 0.000395                                  | 1.0               | PASS   |
|              |              | 5825             | 0.98                                      | $1 \pm 1$                               | 2                                                | 1.585                                           | 0.000395                                  | 1.0               | PASS   |
|              | 802.11ax(20) | 5745             | 1.02                                      | $1 \pm 1$                               | 2                                                | 1.585                                           | 0.000395                                  | 1.0               | PASS   |
|              |              | 5785             | 2.05                                      | $2 \pm 1$                               | 3                                                | 1.995                                           | 0.000497                                  | 1.0               | PASS   |
|              |              | 5825             | 1.86                                      | $2 \pm 1$                               | 3                                                | 1.995                                           | 0.000497                                  | 1.0               | PASS   |
|              | 802.11n(40)  | 5755             | 0.31                                      | $0 \pm 1$                               | 1                                                | 1.259                                           | 0.000314                                  | 1.0               | PASS   |
|              |              | 5795             | 0.63                                      | $0 \pm 1$                               | 1                                                | 1.259                                           | 0.000314                                  | 1.0               | PASS   |
|              | 802.11ac(40) | 5755             | 0.29                                      | $0 \pm 1$                               | 1                                                | 1.259                                           | 0.000314                                  | 1.0               | PASS   |
|              |              | 5795             | 0.76                                      | $1 \pm 1$                               | 2                                                | 1.585                                           | 0.000395                                  | 1.0               | PASS   |

|  |              |      |      |           |   |       |          |     |      |
|--|--------------|------|------|-----------|---|-------|----------|-----|------|
|  | 802.11ax(40) | 5755 | 1.22 | $1 \pm 1$ | 2 | 1.585 | 0.000395 | 1.0 | PASS |
|  |              | 5795 | 1.61 | $2 \pm 1$ | 3 | 1.995 | 0.000497 | 1.0 | PASS |
|  | 802.11ac(80) | 5775 | 1.61 | $2 \pm 1$ | 3 | 1.995 | 0.000497 | 1.0 | PASS |
|  | 802.11ax(80) | 5775 | 2.84 | $3 \pm 1$ | 4 | 2.512 | 0.000626 | 1.0 | PASS |

Remark: 1. BT Antenna & wifi 2.4g Antenna gain is -4.37dBi,  
wifi 5.2g Antenna gain is 4.45 dBi, wifi 5.8g Antenna gain is 0.98 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: 0.000115, Wifi: 0.002778

BT and Wifi:  $0.000115 + 0.002778 = 0.002893 \leq 1$

So a SAR test is not required