

## RF Exposure Evaluation

According to KDB 447498 D01 General RF Exposure Guidance v06 and part 2.1093, 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             | -0.68                                     | $0 \pm 1$                               | 1                                             | 1.259                                        | 0.000398                                               | 1.0                            | PASS   |
|                |            | 2441             | -0.82                                     | $0 \pm 1$                               | 1                                             | 1.259                                        | 0.000398                                               | 1.0                            | PASS   |
|                |            | 2480             | -0.82                                     | $0 \pm 1$                               | 1                                             | 1.259                                        | 0.000398                                               | 1.0                            | PASS   |
|                | π/4-DQPSK  | 2402             | -0.50                                     | $0 \pm 1$                               | 1                                             | 1.259                                        | 0.000398                                               | 1.0                            | PASS   |
|                |            | 2441             | -0.65                                     | $0 \pm 1$                               | 1                                             | 1.259                                        | 0.000398                                               | 1.0                            | PASS   |
|                |            | 2480             | -0.64                                     | $0 \pm 1$                               | 1                                             | 1.259                                        | 0.000398                                               | 1.0                            | PASS   |
|                | 8DPSK      | 2402             | 0.06                                      | $0 \pm 1$                               | 1                                             | 1.259                                        | 0.000398                                               | 1.0                            | PASS   |
|                |            | 2441             | -0.11                                     | $0 \pm 1$                               | 1                                             | 1.259                                        | 0.000398                                               | 1.0                            | PASS   |
|                |            | 2480             | -0.05                                     | $0 \pm 1$                               | 1                                             | 1.259                                        | 0.000398                                               | 1.0                            | PASS   |
| BT<br>(BLE)    | GFSK       | 2402             | 0.17                                      | $0 \pm 1$                               | 1                                             | 1.259                                        | 0.000398                                               | 1.0                            | PASS   |
|                |            | 2440             | -0.08                                     | $0 \pm 1$                               | 1                                             | 1.259                                        | 0.000398                                               | 1.0                            | PASS   |
|                |            | 2480             | 0.03                                      | $0 \pm 1$                               | 1                                             | 1.259                                        | 0.000398                                               | 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             | 10.73                                     | $10 \pm 1$                              | 11                                            | 12.589                                       | 0.003979                                               | 1.0                            | PASS   |
|           |                   | 2437             | 8.66                                      | $8 \pm 1$                               | 9                                             | 7.943                                        | 0.002510                                               | 1.0                            | PASS   |
|           |                   | 2462             | 10.50                                     | $10 \pm 1$                              | 11                                            | 12.589                                       | 0.003979                                               | 1.0                            | PASS   |
|           | 802.11g           | 2412             | 11.66                                     | $11 \pm 1$                              | 12                                            | 15.849                                       | 0.005009                                               | 1.0                            | PASS   |
|           |                   | 2437             | 9.79                                      | $9 \pm 1$                               | 10                                            | 10.000                                       | 0.003160                                               | 1.0                            | PASS   |
|           |                   | 2462             | 11.64                                     | $11 \pm 1$                              | 12                                            | 15.849                                       | 0.005009                                               | 1.0                            | PASS   |
|           | 802.11n<br>(HT20) | 2412             | 11.50                                     | $11 \pm 1$                              | 12                                            | 15.849                                       | 0.005009                                               | 1.0                            | PASS   |
|           |                   | 2437             | 9.58                                      | $9 \pm 1$                               | 10                                            | 10.000                                       | 0.003160                                               | 1.0                            | PASS   |
|           |                   | 2462             | 11.46                                     | $11 \pm 1$                              | 12                                            | 15.849                                       | 0.005009                                               | 1.0                            | PASS   |
|           | 802.11n<br>(HT40) | 2422             | 9.63                                      | $9 \pm 1$                               | 10                                            | 10.000                                       | 0.003160                                               | 1.0                            | PASS   |
|           |                   | 2437             | 9.62                                      | $9 \pm 1$                               | 10                                            | 10.000                                       | 0.003160                                               | 1.0                            | PASS   |
|           |                   | 2452             | 10.41                                     | $10 \pm 1$                              | 11                                            | 12.589                                       | 0.003979                                               | 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/cm <sup>2</sup> ) | Limit<br>(mW/cm <sup>2</sup> ) | Result |
|--------------|-------------|------------------|-------------------------------------------|-----------------------------------------|--------------------------------------------------|-------------------------------------------------|--------------------------------------------------------|--------------------------------|--------|
| Wifi<br>5.2g | 802.11a     | 5180             | 5.86                                      | $5 \pm 1$                               | 6                                                | 3.981                                           | 0.001383                                               | 1.0                            | PASS   |
|              |             | 5200             | 7.24                                      | $7 \pm 1$                               | 8                                                | 6.310                                           | 0.002191                                               | 1.0                            | PASS   |
|              |             | 5240             | 6.43                                      | $6 \pm 1$                               | 7                                                | 5.012                                           | 0.001741                                               | 1.0                            | PASS   |
|              | 802.11n(20) | 5180             | 6.66                                      | $6 \pm 1$                               | 7                                                | 5.012                                           | 0.001741                                               | 1.0                            | PASS   |
|              |             | 5200             | 6.82                                      | $6 \pm 1$                               | 7                                                | 5.012                                           | 0.001741                                               | 1.0                            | PASS   |
|              |             | 5240             | 7.30                                      | $7 \pm 1$                               | 8                                                | 6.310                                           | 0.002191                                               | 1.0                            | PASS   |
|              | 802.11n(40) | 5190             | 6.58                                      | $6 \pm 1$                               | 7                                                | 5.012                                           | 0.001741                                               | 1.0                            | PASS   |
|              |             | 5230             | 6.91                                      | $6 \pm 1$                               | 7                                                | 5.012                                           | 0.001741                                               | 1.0                            | PASS   |
| Wifi<br>5.8g | 802.11a     | 5745             | 5.29                                      | $5 \pm 1$                               | 6                                                | 3.981                                           | 0.001317                                               | 1.0                            | PASS   |
|              |             | 5785             | 4.66                                      | $4 \pm 1$                               | 5                                                | 3.162                                           | 0.001046                                               | 1.0                            | PASS   |
|              |             | 5825             | 2.28                                      | $2 \pm 1$                               | 3                                                | 1.995                                           | 0.000660                                               | 1.0                            | PASS   |
|              | 802.11n(20) | 5745             | 5.67                                      | $5 \pm 1$                               | 6                                                | 3.981                                           | 0.001317                                               | 1.0                            | PASS   |
|              |             | 5785             | 5.10                                      | $5 \pm 1$                               | 6                                                | 3.981                                           | 0.001317                                               | 1.0                            | PASS   |
|              |             | 5825             | 2.64                                      | $2 \pm 1$                               | 3                                                | 1.995                                           | 0.000660                                               | 1.0                            | PASS   |
|              | 802.11n(40) | 5755             | 5.44                                      | $5 \pm 1$                               | 6                                                | 3.981                                           | 0.001317                                               | 1.0                            | PASS   |
|              |             | 5795             | 3.66                                      | $3 \pm 1$                               | 4                                                | 2.512                                           | 0.000831                                               | 1.0                            | PASS   |

Remark: 1. BT+wifi 2.4g Antenna gain is 2.01dBi, wifi 5.2g Antenna gain is 2.42 dBi  
wifi 5.8g Antenna gain is 2.21 dBi

2. Wifi2.4g, wifi5.2g and wifi5.8g donot 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: 0.000398, Wifi: 0.005009

BT and Wifi:  $0.000398 + 0.005009 = 0.008989 \leq 1$

So a SAR test is not required