



**FCC ID:2BYGS-HARKN-88039**

## **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.

### ***SAR Test Exclusion Thresholds for 100 MHz – 6 GHz and ≤ 50 mm***

Approximate SAR Test Exclusion Power Thresholds at Selected Frequencies and Test Separation Distances are illustrated in the following Table. The equation and threshold in 4.3.1 must be applied to determine SAR test exclusion.

| MHz  | 5  | 10 | 15  | 20  | 25  | mm                                               |
|------|----|----|-----|-----|-----|--------------------------------------------------|
| 150  | 39 | 77 | 116 | 155 | 194 | <i>SAR Test<br/>Exclusion<br/>Threshold (mW)</i> |
| 300  | 27 | 55 | 82  | 110 | 137 |                                                  |
| 450  | 22 | 45 | 67  | 89  | 112 |                                                  |
| 835  | 16 | 33 | 49  | 66  | 82  |                                                  |
| 900  | 16 | 32 | 47  | 63  | 79  |                                                  |
| 1500 | 12 | 24 | 37  | 49  | 61  |                                                  |
| 1900 | 11 | 22 | 33  | 44  | 54  |                                                  |
| 2450 | 10 | 19 | 29  | 38  | 48  |                                                  |
| 3600 | 8  | 16 | 24  | 32  | 40  |                                                  |
| 5200 | 7  | 13 | 20  | 26  | 33  |                                                  |
| 5400 | 6  | 13 | 19  | 26  | 32  |                                                  |
| 5800 | 6  | 12 | 19  | 25  | 31  |                                                  |

For 100 MHz to 6 GHz and test separation distances ≤ 50 mm, the 1-g and 10-g SAR test exclusion thresholds are determined by the following:

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] * [\sqrt{f_{(\text{GHz})}}] \leq 3.0$  for 1-g SAR, and  $\leq 7.5$  for 10-g extremity SAR, where

$f_{(\text{GHz})}$  is the RF channel transmit frequency in GHz

Power and distance are rounded to the nearest mW and mm before calculation

The result is rounded to one decimal place for comparison



Here,

| For BLE |                    |                          |                           |                               |                              |                          |                     |       |
|---------|--------------------|--------------------------|---------------------------|-------------------------------|------------------------------|--------------------------|---------------------|-------|
| Mode    | Frequency<br>(MHz) | Output<br>power<br>(dBm) | Tune-up<br>power<br>(dBm) | Max tune-up<br>power<br>(dBm) | Max tune-up<br>power<br>(mW) | Min.<br>Distance<br>(mm) | Calc.<br>thresholds | limit |
| GFSK    | 2440               | 0.613                    | 0±1                       | 1                             | 1.26                         | 5                        | 0.3936              | 3.0   |

| For 2.4G WLAN |                    |                          |                           |                               |                              |                          |                     |       |
|---------------|--------------------|--------------------------|---------------------------|-------------------------------|------------------------------|--------------------------|---------------------|-------|
| Mode          | Frequency<br>(MHz) | Output<br>power<br>(dBm) | Tune-up<br>power<br>(dBm) | Max tune-up<br>power<br>(dBm) | Max tune-up<br>power<br>(mW) | Min.<br>Distance<br>(mm) | Calc.<br>thresholds | limit |
| 802.11b       | 2412               | 7.262                    | 7±1                       | 8                             | 6.31                         | 5                        | 1.9600              | 3.0   |
| 802.11g       | 2412               | 6.656                    | 6±1                       | 7                             | 5.01                         | 5                        | 1.5562              | 3.0   |
| 802.11n20     | 2462               | 6.729                    | 6±1                       | 7                             | 5.01                         | 5                        | 1.5722              | 3.0   |
| 802.11n40     | 2452               | 6.951                    | 6±1                       | 7                             | 5.01                         | 5                        | 1.5690              | 3.0   |

| For U-NII-1 |                    |                          |                           |                               |                              |                          |                     |       |
|-------------|--------------------|--------------------------|---------------------------|-------------------------------|------------------------------|--------------------------|---------------------|-------|
| Mode        | Frequency<br>(MHz) | Output<br>power<br>(dBm) | Tune-up<br>power<br>(dBm) | Max tune-up<br>power<br>(dBm) | Max tune-up<br>power<br>(mW) | Min.<br>Distance<br>(mm) | Calc.<br>thresholds | limit |
| 802.11a     | 5240               | 6.917                    | 6±1                       | 7                             | 5.01                         | 5                        | 2.2937              | 3.0   |
| 802.11n20   | 5240               | 6.826                    | 6±1                       | 7                             | 5.01                         | 5                        | 2.2937              | 3.0   |
| 802.11n40   | 5230               | 6.775                    | 6±1                       | 7                             | 5.01                         | 5                        | 2.2915              | 3.0   |
| 802.11ac20  | 5240               | 6.838                    | 6±1                       | 7                             | 5.01                         | 5                        | 2.2937              | 3.0   |
| 802.11ac40  | 5230               | 6.613                    | 6±1                       | 7                             | 5.01                         | 5                        | 2.2915              | 3.0   |
| 802.11ac80  | 5210               | 6.474                    | 6±1                       | 7                             | 5.01                         | 5                        | 2.2871              | 3.0   |

| For U-NII-3 |                    |                          |                           |                               |                              |                          |                     |       |
|-------------|--------------------|--------------------------|---------------------------|-------------------------------|------------------------------|--------------------------|---------------------|-------|
| Mode        | Frequency<br>(MHz) | Output<br>power<br>(dBm) | Tune-up<br>power<br>(dBm) | Max tune-up<br>power<br>(dBm) | Max tune-up<br>power<br>(mW) | Min.<br>Distance<br>(mm) | Calc.<br>thresholds | limit |
| 802.11a     | 5825               | 5.922                    | 5±1                       | 6                             | 3.98                         | 5                        | 1.9211              | 3.0   |
| 802.11n20   | 5785               | 5.879                    | 5±1                       | 6                             | 3.98                         | 5                        | 1.9145              | 3.0   |
| 802.11n40   | 5795               | 4.704                    | 4±1                       | 5                             | 3.16                         | 5                        | 1.5214              | 3.0   |
| 802.11ac20  | 5825               | 5.859                    | 5±1                       | 6                             | 3.98                         | 5                        | 1.9211              | 3.0   |
| 802.11ac40  | 5755               | 5.158                    | 5±1                       | 6                             | 3.98                         | 5                        | 1.9096              | 3.0   |
| 802.11ac80  | 5775               | 4.804                    | 4±1                       | 5                             | 3.16                         | 5                        | 1.5188              | 3.0   |



| For BT    |                    |                          |                           |                               |                              |                          |                     |       |
|-----------|--------------------|--------------------------|---------------------------|-------------------------------|------------------------------|--------------------------|---------------------|-------|
| Mode      | Frequency<br>(MHz) | Output<br>power<br>(dBm) | Tune-up<br>power<br>(dBm) | Max tune-up<br>power<br>(dBm) | Max tune-up<br>power<br>(mW) | Min.<br>Distance<br>(mm) | Calc.<br>thresholds | limit |
| GFSK      | 2402               | 1.789                    | 1±1                       | 2                             | 1.58                         | 5                        | 0.4897              | 3.0   |
|           | 2441               | 2.988                    | 2±1                       | 3                             | 2.00                         | 5                        | 0.6249              | 3.0   |
|           | 2480               | 1.524                    | 1±1                       | 2                             | 1.58                         | 5                        | 0.4976              | 3.0   |
| π/4-DQPSK | 2402               | 0.886                    | 0±1                       | 1                             | 1.26                         | 5                        | 0.3906              | 3.0   |
|           | 2441               | 2.273                    | 2±1                       | 3                             | 2.00                         | 5                        | 0.6249              | 3.0   |
|           | 2480               | 0.651                    | 0±1                       | 1                             | 1.26                         | 5                        | 0.3968              | 3.0   |
| 8-DPSK    | 2402               | 0.998                    | 0±1                       | 1                             | 1.26                         | 5                        | 0.3906              | 3.0   |
|           | 2441               | 2.365                    | 2±1                       | 3                             | 2.00                         | 5                        | 0.6249              | 3.0   |
|           | 2480               | 0.717                    | 0±1                       | 1                             | 1.26                         | 5                        | 0.3968              | 3.0   |

Note:

The same antenna cannot transmit at the same time, but BT and BLE or 2.4G WLAN or U-NII-1 or U-NII-3 can transmit at the same time, so the worst simultaneous transmitting consideration:

The ratio =  $BT_{MPE(Max)} / \text{limit} + U-NII-1_{MPE(Max)} / \text{limit}$

$$= 0.6249 / 3 + 2.2937 / 3$$

$$= 0.9729 < 1.0$$

#### Conclusion:

1.  $[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] * [\sqrt{f(\text{GHz})}] < 3.0$ .
2. SAR Test Exclusion Thresholds is 3.0 for separation distance 5mm. Therefore, SAR test is not required.