

## Prediction of MPE at a given distance

### 1. 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)

| Frequency range<br>(MHz)                                | Electric field strength<br>(V/m rms) | Magnetic field strength<br>(A/m rms) | Power density<br>(mW/cm <sup>2</sup> ) | Averaging time<br>(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                                      | 30                          |

### 2. Test Procedure

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = \frac{P \times G}{4 \times \pi \times R^2}$$

Where:

S = power density

P = power input to the antenna

G = numeric gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the centre of radiation of the antenna

### 3. Result for Transmitters used in mobile exposure conditions for standalone operations

| Frequency (MHz)           | Maximum Output power (dBm) | Maximum Output power (mW) | Antenna Gain (dBi) | Antenna Gain (numeric) | Distance (cm) | Result (mW/cm <sup>2</sup> ) | Limits for General Population/ Uncontrolled Exposure (mW/cm <sup>2</sup> ) |
|---------------------------|----------------------------|---------------------------|--------------------|------------------------|---------------|------------------------------|--|
| BLE (worse case)          |                            |                           |                    |                        |               |                              |  |
| 2480                      | -4.10                      | 0.39                      | 2.5                | 1.78                   | 20.00         | 0.000138                     | 1  |
| Bluetooth (worse case)    |                            |                           |                    |                        |               |                              |  |
| 2441                      | -2.33                      | 0.58                      | 2.5                | 1.78                   | 20.00         | 0.000205                     | 1  |
| 2.4 GHz WIFI (worse case) |                            |                           |                    |                        |               |                              |  |
| 2462                      | 13.74                      | 23.66                     | 2.5                | 1.78                   | 20.00         | 0.00838                      | 1  |
| 5.8 GHz WIFI (worse case) |                            |                           |                    |                        |               |                              |  |
| 5825                      | 10.82                      | 12.08                     | 2.5                | 1.78                   | 20.00         | 0.00428                      | 1  |

### 4. Results for Transmitters used in mobile exposure conditions for simultaneous transmission operations

According to KDB 447498 D01v05r02 section 7.2, simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneous transmitting antennas incorporated in a host device, based on the calculated/estimated, numerically modeled or measured field strengths or power density, is  $\leq 1.0$ . The MPE ratio of each antenna is determined at the minimum test separation distance required by the operating configurations and exposure conditions of the host device, according to the ratio of field strengths or power density to MPE limit, at the test frequency.

| MPE Ratios (MPE/MPE Limit) | BLE      | Bluetooth | 2.4GHz WiFi | 5.8GHz WiFi |
|----------------------------|----------|-----------|-------------|-------------|
|                            | 0.000138 | 0.000205  | 0.00838     | 0.00428     |

For this device, 2.4GHz WiFi, Bluetooth and BLE share the same antenna, and so, they cannot simultaneous transmission with each other. And 2.4GHz WiFi cannot simultaneous transmission with 5.8GHz WiFi. The simultaneous transmission combinations see below table.

**Worse case :**

$$0.00838 + 0.00428 = 0.013 < 1$$