

**47 C.F.R. Part 1, Subpart I, Section 1.1310  
47 C.F.R. Part 2, Subpart J, Section 2.1091  
47 C.F.R. Part 2, Subpart J, Section 2.1093  
KDB 447498 D01 General RF Exposure Guidance v06  
Maximum Permissible Exposure Calculations**

**For: Essex Electronics  
FCC ID: 2ANAC-ER-02**

EUT Device Category = General Population/Uncontrolled Exposure

EUT consists of the following:

**Bluetooth LE transceiver operating from 2402 MHz to 2480 MHz**

**RFID/NFC transmitter operating at 13.56 MHz**

**RFID/NFC transmitter operating at 125 kHz**

The distance used for separation in all cases is 5 mm even though in real use the separation should be much greater. If compliant at the worst possible case of 5 mm, the device is assumed to comply at greater separation distances.

**Bluetooth LE MPE Calculations:**

Limits for General Population/Uncontrolled Exposure

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

$((\text{max power} + \text{tune up tolerance, mW}) / (\text{min separation, mm})) * \sqrt{f_{\text{GHz}}} \leq 3.0$  for 1-g SAR and  $\leq 7.5$  for 10-g SAR

**MPE and Limit are calculated as follows:**

Frequency (GHz)	Max Power (mW)	Separation (mm)	Density	Limit 1-g	Result	Limit 10-g	Result
2.402	1.84	5	0.57	3.0	EXEMPT	7.5	EXEMPT
2.440	1.84	5	0.57	3.0	EXEMPT	7.5	EXEMPT
2.480	1.98	5	0.62	3.0	EXEMPT	7.5	EXEMPT

**Result:** The BLE meets SAR exclusion thresholds for General Population/Uncontrolled Exposure.

For devices operating below 100 MHz, the MPE limits for SAR exclusion are set by first calculating the limit for 100 MHz and a separation distance >50 mm. Then the limit is found for the frequency below 100 MHz and a separation distance of >50 mm and <200 mm. Finally, the limit for the frequency below 100 MHz at >50 mm and <200 mm is multiplied by 0.5 to get the limit for SAR exclusion for the frequency below 100 MHz at a 5 mm separation distance. The equations used:

$$P = 150 / \sqrt{F_{(\text{GHz})}}$$

$$LB100 = L100M5mm \times (1 + \log (100 / F_{(\text{MHz})}))$$

$$\text{Limit} = LB100 \times 0.5$$

P = Maximum allowed power for 100 MHz at distances >50 mm

LB100 = Limit for the frequency below 100 MHz at >50 mm and <200 mm

Limit = Limit for frequency below 100 MHz at 5 mm

#### **13.56 MHz RFID/NFC Calculations:**

$$P = 150 / \sqrt{0.1} = 474.3 \text{ mW}$$

$$LB100 = 474.3 \times (1 + \log (100 / 13.56)) = 878.3 \text{ mW}$$

$$\text{Limit} = 878.3 \times 0.5 = 439.1 \text{ mW}$$

$$\text{Transmitter Power} = 0.0095 \text{ mW}$$

$$\text{Margin} = 878.3 - 0.0095 = 878.29 \text{ mW}$$

**Result:** The 13.56 MHz transmitter meets SAR exclusion thresholds for General Population/Uncontrolled Exposure.

#### **125 kHz RFID/NFC Calculations:**

$$P = 150 / \sqrt{0.1} = 474.3 \text{ mW}$$

$$LB100 = 474.3 \times (1 + \log (100 / 0.125)) = 1851.1 \text{ mW}$$

$$\text{Limit} = 1851.1 \times 0.5 = 925.5 \text{ mW}$$

$$\text{Transmitter Power} = 0.0004 \text{ mW}$$

$$\text{Margin} = 925.5 - 0.0004 = 925.4996$$

**Result:** The 125 kHz transmitter meets SAR exclusion thresholds for General Population/Uncontrolled Exposure.