

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 50mm, the 1-g and 10-g SAR test exclusion thresholds are determined by the following:

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