

425948 RF Exposure Technical Brief

FCC 47 CFR 2.1093 SAR Exclusion Calculation

As per FCC KDB 447498 D01 General RF Exposure Guidance v06

FCC 47 CFR 2.1093 SAR Exclusion Calculation as per KDB 447498 D01 General RF Exposure Guidance DR03-41372								
			Maximum Avg Output Power					
Antenna	Tx	Frequency (MHz)	dBm	mW	Separation Distance (mm)	Worst Case	Threshold	Result
1	BLE	2402	2.51	1.78	5	0.56	3.0	Pass by Exclusion; Threshold Value is less than 3.0.

KDB 447498 D01 Example Calculation:

$$\left(\frac{\text{mW}}{\text{mM}}\right) * \sqrt{f_{\text{GHz}}} \leq 3.0$$

mW = Maximum Output Power in milliWatt

mM = Minimum separation distance in milliMeters.

f_{GHz} = Center frequency of channel.

Results below 1.0 are rounded to nearest 1.

Evaluation explanation:

The evaluation was confirmed to be below the limits by taking the BLE Radiated peak RF output power when measured at the highest found output power frequency, which was found at 2.405GHz.

BLE Results: 0.468 dBm TX Results (+antenna gain) @ 2.402GHz = 2.51 mW = 1.78 Worst Case = 0.02 or 0.67% of the limit.

RSS-102 SAR exemption calculation

Summary:

Minimum typical separation distance between the antenna and the user = 5mm

Exemption limit from RSS-102 for routine evaluation based on frequency and separation distance for

2450 MHz @ >5mm = **4mW** (see Appendix A: Table 1)

(see Appendix A: Table 1)

EUT's EIRP With BLE@ 2.402GHz= 1.78 mW (see EIRP calculation below)

1.78 mW < 4 mW, mW therefore the EUT is exempt from routine SAR evaluation.

EIRP calculation:**BLE @2.402GHz**

0.468 dBm Radiated peak RF output power as measured using a method compliant with RSS-210

2.04 dBi peak antenna gain

$EIRP = \text{peak radiated RF power} + \text{peak antenna gain} = 0.468\text{dBm} + 2.04\text{ dBi} = 2.51\text{dBm} = 1.78\text{mW}$

Conclusion:

For our EUT transmitting with BLE at 2402 MHz, if we evaluate the EUT against the exemption limits at a distance of below 5mm (typical use case), the power at this distance must be below 4mW. 309 mW –

1.78 mW = 307.22mW of margin (pass).

Appendix A:

From RSS-102

2.5.1 Exemption Limits for Routine Evaluation — SAR Evaluation

SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance defined in [Table 1](#).

Table 1: SAR evaluation — Exemption limits for routine evaluation based on frequency and separation distance [4](#) [5](#)

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of ≤5 mm	At separation distance of 10 mm	At separation distance of 15 mm	At separation distance of 20 mm	At separation distance of 25 mm
≤300	71 mW	101 mW	132 mW	162 mW	193 mW
450	52 mW	70 mW	88 mW	106 mW	123 mW
835	17 mW	30 mW	42 mW	55 mW	67 mW
1900	7 mW	10 mW	18 mW	34 mW	60 mW
2450	4 mW	7 mW	15 mW	30 mW	52 mW
3500	2 mW	6 mW	16 mW	32 mW	55 mW
5800	1 mW	6 mW	15 mW	27 mW	41 mW

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of 30 mm	At separation distance of 35 mm	At separation distance of 40 mm	At separation distance of 45 mm	At separation distance of ≥50 mm
≤300	223 mW	254 mW	284 mW	315 mW	345 mW
450	141 mW	159 mW	177 mW	195 mW	213 mW
835	80 mW	92 mW	105 mW	117 mW	130 mW
1900	99 mW	153 mW	225 mW	316 mW	431 mW
2450	83 mW	123 mW	173 mW	235 mW	309 mW
3500	86 mW	124 mW	170 mW	225 mW	290 mW
5800	56 mW	71 mW	85 mW	97 mW	106 mW