

RF Exposure evaluation

FCC ID: **2AP29-ZMK3-1U**

According to 447498 D01 General RF Exposure Guidance v06

4.3. General SAR test exclusion guidance

4.3.1. Standalone SAR test exclusion considerations

- a) 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: $[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$ for 1-g SAR, and ≤ 7.5 for 10-g extremity SAR,³⁰ where

- $f(\text{GHz})$ is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation³¹
- The result is rounded to one decimal place for comparison
- The values 3.0 and 7.5 are referred to as numeric thresholds in step b) below

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm, and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm according to 4.1 f) is applied to determine SAR test exclusion.

³⁰ This is equivalent to the formula written as: $[(\text{max. power of channel, including tune-up tolerance, mW}) / (60 / \sqrt{f(\text{GHz})} \text{ mW})] \cdot [20 \text{ mm} / (\text{min. test separation distance, mm})] \leq 1.0$ for 1-g SAR; also see Appendix A for approximate exclusion threshold numerical values at selected frequencies and distances.

$$\text{eirp} = \text{pt} \times \text{gt} = (\text{EXd})^2 / 30$$

where:

pt = transmitter output power in watts,

gt = numeric gain of the transmitting antenna (unitless),

E = electric field strength in V/m, --- $10((\text{dBuV/m})/20)/10^6$

d = measurement distance in meters (m)---3m

$$\text{So pt} = (\text{EXd})^2 / 30 \times \text{gt}$$

RF Exposure evaluation

Copied from the FCC test report: clause 7.2 Maximum Peak Output Power

Test Result:

For BLE:

Test Mode	Frequency MHz	Reading dBm	Output Power mW	Limit mW
GFSK(BLE)	2402	0.67	1.17	1000
	2442	0.27	1.06	1000
	2480	1.73	1.49	1000

Note: the antenna gain of 0dB less than 6dBi maximum permission antenna gain value based on 1 watt peak output power limit.

Then we choose Normal mode channel as the worst case of Maximum Peak Output Power:

Test Mode	Frequency MHz	Reading dBm	Output Power mW	Limit mW
GFSK(BLE)	2402	0.67	1.17	1000
	2442	0.27	1.06	1000
	2480	1.73	1.49	1000

$EIRP/ \text{dBm} = \text{Conducted Max Output Power/ dBm} + \text{Antenna gain /dBi}$.

Since the distance from the internal BT-antenna to the outer is more than 10mm, we choose the min. test separation distance = 5mm

General RF Exposure:

$(1.17\text{mW}) / (5.0\text{mm}) \times \sqrt{2.402 \text{ GHz}} = 0.36$

$(1.06\text{mW}) / (5.0\text{mm}) \times \sqrt{2.442 \text{ GHz}} = 0.33$

$(1.49\text{mW}) / (5.0\text{mm}) \times \sqrt{2.480 \text{ GHz}} = 0.47$

SAR requirement: $S=3.0$

General RF Exposure < 3

Then SAR evaluation is not required