

RF Exposure evaluation

FCCID:2ABCD-F4

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: clause9.4 Maximum Peak Output Power

Test Result:

For GFSK

Channel	Frequency MHz	Measured Value dBm	Output Power mW	Limit mW
Low Channel	2402	0.13	1.03	125
Middle Channel	2441	1.11	1.29	125
High Channel	2480	3.08	2.03	125

For Pi/4 QDPSK

Channel	Frequency MHz	Measured Value dBm	Output Power mW	Limit mW
Low Channel	2402	-3.0	0.50	125
Middle Channel	2441	-1.65	0.68	125
High Channel	2480	0.89	0.81	125

For 8DPSK

Channel	Frequency MHz	Measured Value dBm	Output Power mW	Limit mW
Low Channel	2402	-2.63	0.55	125
Middle Channel	2441	-0.92	0.81	125
High Channel	2480	-1.28	0.74	125

Note: the antenna gain of 1dBi 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:

Channel	Frequency MHz	Measured Value dBm	Output Power mW	Limit mW
Low Channel	2402	0.13	1.03	125
Middle Channel	2441	1.11	1.29	125
High Channel	2480	3.08	2.03	125

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

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:

$$(1.03\text{mW})/(5.0\text{mm}) \times \sqrt{2.402 \text{ GHz}} = 0.319$$

$$(1.29\text{mW})/(5.0\text{mm}) \times \sqrt{2.441 \text{ GHz}} = 0.403$$

$$(2.03\text{mW})/(5.0\text{mm}) \times \sqrt{2.480 \text{ GHz}} = 0.639$$

SAR requirement: S=3.0

General RF Exposure<3

Then SAR evaluation is not required