RF Exposure evaluation

FCC ID: **2AKBS-GE0003**

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: [(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)] · [√f(GHz)] ≤ 3.0 for 1-g SAR, and ≤ 7.5 for 10-g extremity SAR, [30] where
   - f(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: [(max. power of channel, including tune-up tolerance, mW)/(60/√f(GHz) mW)]·[20 mm/(min. test separation distance, mm)] ≤ 1.0 for 1-g SAR; also see Appendix A for approximate exclusion threshold numerical values at selected frequencies and distances.

eirp = pt x gt = $(EXd)^2/30$

where:

pt = transmitter output power in watts,

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

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

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

So pt = $(EXd)^2/30$ x gt

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RF Exposure evaluation

Copied from the FCC test report: clause 9.4 Maximum Peak Output Power

Test Result:

For BLE:

Test Mode	Frequency MHz	Reading dBm	Output Power mW	Limit mW
GFSK(BLE)	2402	0.93	1.24	1000
	2442	1.65	1.46	1000
	2480	1.12	1.29	1000

Note: the antenna gain of 0.5dB 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	0.93	1.24	1000
	2442	1.65	1.46	1000
	2480	1.12	1.29	1000

EIRP/ dBm= Conducted Max Output Power/ dBm+ 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:
(1.43mW)/5.0mm)x √2.402 GHz = 0.431
(2.15mW)/5.0mm)x √2.442 GHz = 0.513
(1.62mW)/5.0mm)x √2.480 GHz = 0.457

SAR requirement: S=3.0
General RF Exposure<3
Then SAR evaluation is not required

For BLE:

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

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Test Mode	Frequency MHz	Reading dBm	Output Power mW	Limit mW
802.11b _ 11Mbps	2412	7.25	5.31	1000
	2437	7.02	5.04	1000
	2462	6.88	4.88	1000
802.11g_54Mbps	2412	7.54	5.68	1000
	2437	7.30	5.37	1000
	2462	6.64	4.61	1000
802.11n HT20_MCS7	2412	6.91	4.91	1000
	2437	6.25	4.22	1000
	2462	6.88	4.88	1000
802.11n HT40_MCS7	2422	7.12	5.15	1000
	2437	7.66	5.83	1000
	2452	7.00	5.01	1000

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
802.11b _ 11Mbps	2412	7.25	5.31	1000
802.11g_54Mbps	2412	7.54	5.68	1000
802.11n HT20_MCS7	2412	6.91	4.91	1000
802.11n HT40_MCS7	2437	7.66	5.83	1000

EIRP/ dBm= Conducted Max Output Power/ dBm+ 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:
(8.25mW)/5.0mm)x √2.412 GHz = 2.076
(8.54mW)/5.0mm)x √2.412 GHz = 2.219
(7.91mW)/5.0mm)x √2.412 GHz = 1.920
(8.66mW)/5.0mm)x √2.437 GHz = 2.293

SAR requirement: S=3.0
General RF Exposure<3
Then SAR evaluation is not required

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