

RF Exposure

FCC ID: 2AOL2041115

1.0 SAR EXEMPTION PER KDB 447498 D01 V05R02

Only one 900 MHz channel transmits at a time. Either the 2.4 GHz or the 5 GHz WiFi may transmit at the same time as the 900 MHz channel. The WiFi Module is optional. Although the actual transmit power at 900 MHz is 29.9 dBm, 30 dBm was used for the calculations, since this is a worst case.

1.1 Calculations for Stand alone

In accordance with FCC KDB Publication 447498 D01 V05R02 Clause 4.3.1,
For 900 MHz transmitter, the 1-g SAR test exclusion thresholds for 100 MHz to 6 GHz are determined by:

For transmitters from 100-6000 MHz with a separation less than or equal to 50 mm

$[(\text{max. power of Channel, mW}) / (\text{min. separation distance, mm})] \times [\sqrt{\text{Freq(GHz)}}] \leq 3.0$ for 1-g SAR

Where Freq(GHz) is the RF channel frequency in GHz

This table is for devices with a separation less than 50 mm Section 4.3.1 a)

Note	Freq. (MHz)	Max Power (dBm)	Duty Cycle %	Average Power per channel (mW)	Min Sep (mm)	SAR Calculation as per 4.3.2	Threshold	Result
ANT1	927.25	30.0	2.50	25.0	10	2.407	3.00	Exempt
ANT2	927.25	30.0	2.50	25.0	10	2.407	3.00	Exempt
ANT3	927.25	30.0	2.50	25.0	10	2.407	3.00	Exempt
ANT4	927.25	30.0	2.50	25.0	10	2.407	3.00	Exempt

The 900 MHz channels will not transmit simultaneously.

The transmitter divides its power into the 4 antennas by rapidly switching to each of them, the antennas operate at 1/4th of the 10% duty cycle or 2.5% to each antenna. The four antennas will never transmit simultaneously.

1.2 Calculations for Simultaneous Transmission.

In accordance with FCC KDB Publication 447498 D01 V05R02 Clause 7.2 (a)

From Clause 4.3.2 (b) For distances $\leq 50\text{mm}$

$[(\text{max. power of Channel, mW}) / (\text{min. separation distance, mm})] \times [(\sqrt{\text{Freq(GHz)/7.5}})] \text{ W/kg}$

Where 7.5 is used for 1-g SAR limit

Freq. (MHz)	Max Power (dBm)	Duty Cycle %	Average Power per channel (mW)	Min Sep (mm)	SAR Calculation as per 4.3.2 b)1 W/kg	Limit W/kg	Note
927.25	30.0	2.50	25.0	10	0.321	1.6	ANT1
927.25	30.0	2.50	25.0	10	0.321	1.6	ANT2
927.25	30.0	2.50	25.0	10	0.321	1.6	ANT3
927.25	30.0	2.50	25.0	10	0.321	1.6	ANT4

MPE Calculation from FCC 1.130 for Mobile devices

Band	Freq. (MHz)	Max Power (dBm)	Max Power (mW)	Max Ant Gain (dBi)	Max Ant Gain Above Isotropic (numeric)	Duty Cycle %	Max EIRP (mW)	Power Density at 20 cm (mW/cm ²)	MPE Ratio	(S) GP Limit (mW/cm ²)
2G Wifi	2412	17.5	56.23	3.2	2.09	100.0	117.49	0.0234	0.0234	1.000
5G Wifi	5180	19.5	89.13	4.5	2.82	100.0	251.19	0.0500	0.0500	1.000
Total									0.0733	1.000

Notes on the above table:

In accordance with OET 65, 97-01, Power Density is calculated by

$$S = P \cdot G / (4 \cdot \pi \cdot R^2)$$

Where

S = power density (mW/cm²)

P = power input to the antenna (mW)

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna (cm)

MPE Ratio = Product Power Density / Power Density limit

1.2.1 Final Calculation

From FCC KDB Publication 447498 D01 V05R02 Clause 7.2 (a)

The $[\Sigma \text{ of (the highest measured SAR for each standalone antenna configuration) / 1.6 W/kg}] + [\Sigma \text{ of MPE ratios}]$ shall be ≤ 1.0 .

The sum of the highest measured SAR for each standalone antenna configuration / 1.6 = $0.321/1.6 = 0.201$

Where 0.8024 = highest W/kg for 900 MHz band

The sum of the MPE ratios for the WiFi Mobile device = 0.0830

The sum of the two values = $0.201 + 0.0733 = 0.2743$

Since the final sum is less than 1.0, SAR is not required.