

RF exposure

According to FCC part 1.1310 : The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in § 1.1307(b)

Limits for Maximum Permissible Exposure (MPE)

Frequency range (MHz)	Electric field strength(V/m)	Magnetic field strength (A/m)	Power density (mW/cm²)	Average time
(A) Limits for Occupational / Control Exposures				
300 – 1 500	--	--	f/300	6
1 500 - 100000	--	--	5	6
(B) Limits for General Population / Uncontrol Exposures				
300 – 1 500	--	--	f/1500	6
1 500 – 100 000	--	--	<u>1</u>	<u>30</u>

f= frequency in MHz

Friis transmission formula: $P_d = (P_{out} \times G) / (4 \times \pi \times R^2)$

Where,

P_d = power density in mW/cm²

P_{out} = output power to antenna in mW

G = gain of antenna in linear scale

π = 3.1416

R = distance between observation point and center of the radiator in cm

P_d the limit of MPE, 1 mW/cm². If we know the maximum gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance where the MPE limit is reached.

Results

- Bluetooth

Operation mode	Max tune-up Average power (dBm)	Antenna gain (dBi)	Power density at 20 cm(mW/cm²)	Limit (mW/cm²)
LE	8.70	-0.23	0.001 40	1

- WLAN 2.4G

Operation mode		Max tune-up Average power (dBm)	Antenna gain (dBi)	Power density at 20 cm(mW/cm ²)	Limit (mW/cm ²)
802.11b	SISO	20.57	-3.60	0.009 90	1
802.11g	SISO	16.78	-3.60	0.004 14	1
802.11n(HT20)	SISO	15.84	-3.60	0.003 33	1
802.11n(HT40)	SISO	13.49	-3.60	0.001 94	1

- WLAN 5G_UNII-1

Operation mode		Max tune-up Average power (dBm)	Antenna gain (dBi)	Power density at 20 cm(mW/cm ²)	Limit (mW/cm ²)
802.11a	MIMO	17.24	0.70	0.012 38	1
802.11an(HT20)	MIMO	16.11	0.70	0.009 54	1
802.11an(HT40)	MIMO	16.31	0.70	0.009 99	1

- WLAN 5G_UNII-2A

Operation mode		Max tune-up Average power (dBm)	Antenna gain (dBi)	Power density at 20 cm(mW/cm ²)	Limit (mW/cm ²)
802.11a	MIMO	18.72	1.70	0.021 91	1
802.11an(HT20)	MIMO	21.14	1.70	0.038 26	1
802.11an(HT40)	MIMO	19.46	1.70	0.025 99	1

- WLAN 5G_UNII-2C

Operation mode		Max tune-up Average power (dBm)	Antenna gain (dBi)	Power density at 20 cm(mW/cm ²)	Limit (mW/cm ²)
802.11a	MIMO	13.41	-0.60	0.003 80	1
802.11an(HT20)	MIMO	17.26	-0.60	0.009 22	1
802.11an(HT40)	MIMO	16.24	-0.60	0.007 29	1

- WLAN 5G_UNII-3

Operation mode		Max tune-up Average power (dBm)	Antenna gain (dBi)	Power density at 20 cm(mW/cm ²)	Limit (mW/cm ²)
802.11a	MIMO	11.60	0.50	0.003 23	1
802.11an(HT20)	MIMO	19.14	0.50	0.018 31	1
802.11an(HT40)	MIMO	19.01	0.50	0.017 77	1