

* RF Exposure

1. Regulation

According to §15.247(i), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines. See § 1.1307(b)(1) of this Chapter.

Limits for Maximum Permissible Exposure: RF exposure is calculated.

Frequency Range	Electric Field Strength [V/m]	Magnetic Field Strength [A/m]	Power Density [mW/cm ²]	Averaging Time [minute]
Limits for General Population / Uncontrolled Exposure				
0.3 ~ 1.34	614	1.63	*(100)	30
1.34 ~ 30	824/f	2.19/f	*(180/f ²)	30
30 ~ 300	27.5	0.073	0.2	30
300 ~ 1 500	/	/	f/1 500	30
1 500 ~ 15 000	/	/	1.0	30

f=frequency in MHz, *= plane-wave equivalent power density

MPE (Maximum Permissible Exposure) Prediction

Predication of MPE limit at a given distance: Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2 \quad (\Rightarrow R = \sqrt{PG/4\pi S})$$

S = power density [mW/cm²]

P = Power input to 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]

2. RF Exposure Compliance Issue

The information should be included in the user's manual:

This appliance and its antenna must not be co-located or operation in conjunction with any other antenna or transmitter. A minimum separation distance of 20 cm must be maintained between the antenna and the person for this appliance to satisfy the RF exposure requirements.

3. Calculation Result of RF Exposure

Mode	Frequency [MHz]	Target power [dBm]	Tune up tolerance [dB]	Max tune up power [dBm]	Max tune up power [mW]	Ant Gain [dBi]	Ant Gain [mW]	Power Density at 20 cm [mW/cm ²]	Limit [mW/cm ²]
Bluetooth_GFSK	2 402	2.00	±2.0	4.00	2.51	4.07	2.55	0.001 28	1.000 00
Bluetooth Low Energy Lowest	2 402	1.00	±2.0	3.00	2.00	4.07	2.55	0.001 01	1.000 00
WiFi_2.4 GHz_ 802.11b	2 442	17.00	±2.0	19.00	79.43	4.07	2.55	0.040 34	1.000 00
WiFi_UNII-1_ 802.11a	5 200	15.00	±2.0	17.00	50.12	4.57	2.86	0.028 56	1.000 00
WiFi_UNII-3_ 802.11a	5 785	15.00	±2.0	17.00	50.12	4.57	2.86	0.028 56	1.000 00
Total	WIFI 2.4 GHz (802.11b) + Bluetooth(BDR)							0.041 62	1.000 00
	WIFI UNII-3 (802.11a) + Bluetooth(BDR)							0.029 83	1.000 00

4. Target power and tolerance, Max tuneup power

- Bluetooth -

Mode	Target power [dBm]	Tolerance [dB]	Max tuneup power [dBm]	Average Power [dBm]
Bluetooth_GFSK Lowest	2.00	±2.0	4.00	3.18
Bluetooth_GFSK Middle	2.00	±2.0	4.00	3.03
Bluetooth_GFSK Highest	2.00	±2.0	4.00	2.21
Bluetooth_π/4DQPSK Lowest	0	±2.0	2.00	1.73
Bluetooth_π/4DQPSK Middle	0	±2.0	2.00	1.51
Bluetooth_π/4DQPSK Highest	0	±2.0	2.00	0.98
Bluetooth_8DPSK Lowest	1.00	±2.0	3.00	2.00
Bluetooth_8DPSK Middle	1.00	±2.0	3.00	1.79
Bluetooth_8DPSK Highest	1.00	±2.0	3.00	1.25

- Bluetooth Low Energy-

Mode	Target power [dBm]	Tolerance [dB]	Max tuneup power [dBm]	Average Power [dBm]
Bluetooth Low Energy_Lowest	1.00	±2.00	3.00	2.82
Bluetooth Low Energy_Middle	1.00	±2.00	3.00	2.50
Bluetooth Low Energy_Highest	1.00	±2.00	3.00	1.84

- WiFi 2.4 GHz-

Mode	Target power [dBm]	Tolerance [dB]	Max tuneup power [dBm]	Average Power [dBm]
802.11b_Lowest	15.00	±2.0	17.00	16.17
802.11b_Middle	17.00	±2.0	19.00	18.12
802.11b_Highest	15.00	±2.0	17.00	16.33
802.11g_Lowest	13.00	±2.0	15.00	13.80
802.11g_Middle	14.00	±2.0	16.00	15.00
802.11g_Highest	13.00	±2.0	15.00	13.90
802.11n HT20_Lowest	11.00	±2.0	13.00	12.70
802.11n HT20_Middle	13.00	±2.0	15.00	14.70
802.11n HT20_Highest	11.00	±2.0	13.00	11.70
802.11n HT40_Lowest	13.00	±2.0	15.00	13.60
802.11n HT40_Middle	13.00	±2.0	15.00	13.90
802.11n HT40_Highest	10.00	±2.0	12.00	10.90

- WiFi 5.2 GHz_UNII-1-

Mode	Target power [dBm]	Tolerance [dB]	Max tuneup power [dBm]	Average Power [dBm]
802.11a (5 180 MHz)	11.00	±2.0	17.00	15.96
802.11a (5 200 MHz)	11.00	±2.0	17.00	15.95
802.11a (5 240 MHz)	11.00	±2.0	17.00	16.06
802.11n HT20 (5 180 MHz)	15.00	±2.0	17.00	16.22
802.11n HT20 (5 200 MHz)	15.00	±2.0	17.00	16.27
802.11n HT20 (5 240 MHz)	15.00	±2.0	17.00	16.15
802.11n HT40 (5 190 MHz)	12.00	±2.0	14.00	12.75
802.11n HT40 (5 230 MHz)	12.00	±2.0	14.00	12.50

- WiFi 5.8 GHz_UNII-3-

Mode	Target power [dBm]	Tolerance [dB]	Max tuneup power [dBm]	Average Power [dBm]
802.11a (5 745 MHz)	15.00	±2.0	17.00	16.13
802.11a (5 785 MHz)	15.00	±2.0	17.00	16.28
802.11a (5 825 MHz)	15.00	±2.0	17.00	16.04
802.11n HT20 (5 745 MHz)	15.00	±2.0	17.00	16.07
802.11n HT20 (5 785 MHz)	15.00	±2.0	17.00	16.07
802.11n HT20 (5 825 MHz)	15.00	±2.0	17.00	16.16
802.11n HT40 (5 755 MHz)	12.00	±2.0	14.00	13.66
802.11n HT40 (5 795 MHz)	12.00	±2.0	14.00	13.40