

* 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	2 441	-6.00	±2.0	-4.00	0.40	3.49	2.23	0.000 18	1.000 00
WiFi_2.4 GHz_802.11n HT20 (ANT MIMO)	2 462	17.00	±2.0	19.00	79.43	3.49	2.23	0.035 30	1.000 00
WiFi_5.0 GHz_802.11n HT20 (ANT MIMO)	5 200	15.00	±2.0	17.10	31.62	2.64	1.84	0.011 55	1.000 00
WiFi_5.8 GHz_802.11n HT20 (ANT MIMO)	5 745	17.10	±2.0	17.10	51.29	2.64	1.84	0.018 74	1.000 00
Total	WIFI 2.4 GHz + Bluetooth							0.035 48	1.000 00
	WIFI 5 GHz + Bluetooth							0.018 92	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	-11.00	±2.0	-9.00	-10.21
Bluetooth_GFSK Middle	-6.00	±2.0	-4.00	-5.47
Bluetooth_GFSK Highest	-7.00	±2.0	-5.00	-6.46
Bluetooth_π/4QPSK Lowest	-12.00	±2.0	-10.00	-11.54
Bluetooth_π/4QPSK Middle	-10.00	±2.0	-8.00	-9.03
Bluetooth_π/4QPSK Highest	-8.00	±2.0	-6.00	-7.57
Bluetooth_8DPSK Lowest	-12.00	±2.0	-10.00	-11.55
Bluetooth_8DPSK Middle	-10.00	±2.0	-8.00	-9.08
Bluetooth_8DPSK Highest	-8.00	±2.0	-6.00	-7.57

- WiFi 2.4 GHz

ANT 1

Mode	Target power [dBm]	Tolerance [dB]	Max tuneup power [dBm]	Average Power [dBm]
802.11b_Lowest	11.00	±2.0	13.00	11.02
802.11b_Middle	11.00	±2.0	13.00	11.69
802.11b_Highest	11.00	±2.0	13.00	12.26
802.11g_Lowest	11.50	±2.0	13.50	11.76
802.11g_Middle	11.50	±2.0	13.50	12.35
802.11g_Highest	11.50	±2.0	13.50	13.01
802.11n HT20_Lowest	11.50	±2.0	13.50	11.61
802.11n HT20_Middle	11.50	±2.0	13.50	12.34
802.11n HT20_Highest	11.50	±2.0	13.50	12.89

ANT 2

Mode	Target power [dBm]	Tolerance [dB]	Max tuneup power [dBm]	Average Power [dBm]
802.11b_Lowest	12.00	±2.0	14.00	12.41
802.11b_Middle	12.00	±2.0	14.00	12.55
802.11b_Highest	12.00	±2.0	14.00	12.72
802.11g_Lowest	13.00	±2.0	15.00	13.26
802.11g_Middle	13.00	±2.0	15.00	13.37
802.11g_Highest	13.00	±2.0	15.00	13.43
802.11n HT20_Lowest	13.00	±2.0	15.00	13.02
802.11n HT20_Middle	13.00	±2.0	15.00	13.23
802.11n HT20_Highest	13.00	±2.0	15.00	13.51

ANT MIMO

Mode	Target power [dBm]	Tolerance [dB]	Max tuneup power [dBm]	Average Power [dBm]
802.11n HT20_Lowest	17.00	±2.0	19.00	17.19
802.11n HT20_Middle	17.00	±2.0	19.00	17.56
802.11n HT20_Highest	17.00	±2.0	19.00	17.93

- WiFi 5.0 GHz

ANT 1

Mode	Target power [dBm]	Tolerance [dB]	Max tuneup power [dBm]	Average Power [dBm]
802.11a (5 180 MHz)	11.00	±2.0	13.00	12.08
802.11a (5 200 MHz)	11.00	±2.0	13.00	11.97
802.11a (5 240 MHz)	11.00	±2.0	13.00	12.04
802.11n HT20 (5 180 MHz)	11.00	±2.0	13.00	11.87
802.11n HT20 (5 200 MHz)	11.00	±2.0	13.00	11.83
802.11n HT20 (5 240 MHz)	11.00	±2.0	13.00	11.70

ANT 2

Mode	Target power [dBm]	Tolerance [dB]	Max tuneup power [dBm]	Average Power [dBm]
802.11a (5 180 MHz)	9.00	±2.0	11.00	9.89
802.11a (5 200 MHz)	9.00	±2.0	11.00	9.77
802.11a (5 240 MHz)	9.00	±2.0	11.00	9.56
802.11n HT20 (5 180 MHz)	9.00	±2.0	11.00	9.73
802.11n HT20 (5 200 MHz)	9.00	±2.0	11.00	9.58
802.11n HT20 (5 240 MHz)	9.00	±2.0	11.00	9.21

ANT MIMO

Mode	Target power [dBm]	Tolerance [dB]	Max tuneup power [dBm]	Average Power [dBm]
802.11n HT20 (5 180 MHz)	13.00	±2.0	15.00	13.86
802.11n HT20 (5 200 MHz)	13.00	±2.0	15.00	13.86
802.11n HT20 (5 240 MHz)	13.00	±2.0	15.00	13.71

- WiFi 5.8 GHz

ANT 1

Mode	Target power [dBm]	Tolerance [dB]	Max tuneup power [dBm]	Average Power [dBm]
802.11a (5 745 MHz)	14.00	±2.0	16.00	14.87
802.11a (5 785 MHz)	14.00	±2.0	16.00	14.61
802.11a (5 825 MHz)	14.00	±2.0	16.00	14.28
802.11n HT20 (5 745 MHz)	14.00	±2.0	16.00	14.80
802.11n HT20 (5 785 MHz)	14.00	±2.0	16.00	14.35
802.11n HT20 (5 825 MHz)	14.00	±2.0	16.00	14.09

ANT 2

Mode	Target power [dBm]	Tolerance [dB]	Max tuneup power [dBm]	Average Power [dBm]
802.11a (5 745 MHz)	14.00	±2.0	16.00	14.87
802.11a (5 785 MHz)	14.00	±2.0	16.00	14.61
802.11a (5 825 MHz)	14.00	±2.0	16.00	14.28
802.11n HT20 (5 745 MHz)	14.00	±2.0	16.00	14.80
802.11n HT20 (5 785 MHz)	14.00	±2.0	16.00	14.35
802.11n HT20 (5 825 MHz)	14.00	±2.0	16.00	14.09

ANT MIMO

Mode	Target power [dBm]	Tolerance [dB]	Max tuneup power [dBm]	Average Power [dBm]
802.11n HT20 (5 745 MHz)	15.10	±2.0	17.10	17.04
802.11n HT20 (5 785 MHz)	15.10	±2.0	17.10	16.15
802.11n HT20 (5 825 MHz)	15.10	±2.0	17.10	15.13