

* 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

Prediction 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]

Mode	Target power [dB]	Tune up tolerance [dB]	Max tune up power [dB]	Max tune up power [mW]	Ant Gain [dBi]	Ant Gain [mW]	Power Density at 20 cm [mW/cm ²]
2.4 GHz_n 20 MIMO	17.51	1.50	19.01	79.62	5.94	3.93	0.062 19
5.0 GHz_n20 MIMO 5 250 Band	17.51	1.50	19.01	79.62	6.00	3.98	0.063 06

* 2.4G & 5.0G can not transmit at the same time.

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

-WiFi 2.4 GHz Band

* 802.11b

Channel	Frequency [MHz]	Ant Gain [dBi]	Ant Gain [mW]	power [dBm]	power [mW]	Power Density at 20 cm [mW/cm ²]
Lowest	2 412	2.93	1.96	19.68	92.90	0.036 29
Middle	2 437	2.93	1.96	19.24	83.95	0.032 79
Highest	2 462	2.93	1.96	18.99	79.25	0.030 95

* 802.11g

Channel	Frequency [MHz]	Ant Gain [dBi]	Ant Gain [mW]	power [dBm]	power [mW]	Power Density at 20 cm [mW/cm ²]
Lowest	2 412	2.93	1.96	24.62	289.73	0.113 17
Middle	2 437	2.93	1.96	24.80	302.00	0.117 96
Highest	2 462	2.93	1.96	24.88	307.61	0.120 15

* 802.11n HT20

Channel	Frequency [MHz]	Ant Gain [dBi]	Ant Gain [mW]	power [dBm]	power [mW]	Power Density at 20 cm [mW/cm ²]
Lowest	2 412	2.93	1.96	24.17	261.22	0.102 03
Middle	2 437	2.93	1.96	24.19	262.42	0.102 50
Highest	2 462	2.93	1.96	23.87	243.78	0.095 22

* 802.11n HT20_MIMO (ANT 1+2)

Channel	Frequency [MHz]	Ant Gain [dBi]	Ant Gain [mW]	power [dBm]	power [mW]	Power Density at 20 cm [mW/cm ²]
Lowest	2 412	5.94	3.93	26.79	477.53	0.373 04
Middle	2 437	5.94	3.93	26.86	485.29	0.379 11
Highest	2 462	5.94	3.93	25.73	374.11	0.292 25

Note: Directional gain = 5.94 dBi (G_{ANT}(2.93 dBi) + Array Gain(3.01 dBi))

*** 802.11n HT40**

Channel	Frequency [MHz]	Ant Gain [dBi]	Ant Gain [mW]	power [dBm]	power [mW]	Power Density at 20 cm [mW/cm ²]
Lowest	2 422	2.93	1.96	24.29	268.53	0.104 89
Middle	2 437	2.93	1.96	23.92	246.60	0.096 32
Highest	2 452	2.93	1.96	23.96	248.89	0.097 21

*** 802.11n HT40_MIMO (ANT 1+2)**

Channel	Frequency [MHz]	Ant Gain [dBi]	Ant Gain [mW]	power [dBm]	power [mW]	Power Density at 20 cm [mW/cm ²]
Lowest	2 422	5.94	3.93	26.66	463.45	0.362 04
Middle	2 437	5.94	3.93	26.72	469.89	0.367 08
Highest	2 452	5.94	3.93	26.55	451.86	0.352 99

Note: Directional gain = 5.94 dBi (GANT(2.93 dBi) + Array Gain(3.01 dBi))

- WiFi 5.0 GHz Band

* 802.11a

5 150 Band

Channel	Frequency [MHz]	Ant Gain [dBi]	Ant Gain [mW]	power [dBm]	power [mW]	Power Density at 20 cm [mW/cm ²]
Lowest	5 180	2.96	1.98	14.39	27.50	0.010 82
Middle	5 200	2.96	1.98	14.51	28.27	0.011 12
Highest	5 240	2.96	1.98	14.61	28.93	0.011 38

5 250 Band

Channel	Frequency [MHz]	Ant Gain [dBi]	Ant Gain [mW]	power [dBm]	power [mW]	Power Density at 20 cm [mW/cm ²]
Lowest	5 260	2.99	1.99	14.58	28.73	0.011 38
Middle	5 280	2.99	1.99	14.68	29.40	0.011 64
Highest	5 320	2.99	1.99	14.83	30.43	0.012 05

5 470 Band

Channel	Frequency [MHz]	Ant Gain [dBi]	Ant Gain [mW]	power [dBm]	power [mW]	Power Density at 20 cm [mW/cm ²]
Lowest	5 500	2.97	1.98	15.13	32.61	0.012 85
Middle	5 580	2.97	1.98	14.83	30.43	0.012 00
Highest	5 700	2.97	1.98	15.22	33.29	0.013 12

5 725 Band

Channel	Frequency [MHz]	Ant Gain [dBi]	Ant Gain [mW]	power [dBm]	power [mW]	Power Density at 20 cm [mW/cm ²]
Lowest	5 745	2.91	1.95	15.06	32.09	0.012 48
Middle	5 785	2.91	1.95	15.08	32.23	0.012 53
Highest	5 825	2.91	1.95	14.96	31.36	0.012 19

*** 802.11n HT20**

5 150 Band

Channel	Frequency [MHz]	Ant Gain [dBi]	Ant Gain [mW]	power [dBm]	power [mW]	Power Density at 20 cm [mW/cm ²]
Lowest	5 180	2.96	1.98	13.56	22.70	0.008 93
Middle	5 200	2.96	1.98	13.62	23.01	0.009 05
Highest	5 240	2.96	1.98	13.81	24.04	0.009 46

5 250 Band

Channel	Frequency [MHz]	Ant Gain [dBi]	Ant Gain [mW]	power [dBm]	power [mW]	Power Density at 20 cm [mW/cm ²]
Lowest	5 260	2.99	1.99	13.69	23.39	0.009 26
Middle	5 280	2.99	1.99	14.02	25.23	0.009 99
Highest	5 320	2.99	1.99	14.09	25.64	0.010 16

5 470 Band

Channel	Frequency [MHz]	Ant Gain [dBi]	Ant Gain [mW]	power [dBm]	power [mW]	Power Density at 20 cm [mW/cm ²]
Lowest	5 500	2.97	1.98	14.90	30.90	0.012 18
Middle	5 580	2.97	1.98	14.56	28.58	0.011 26
Highest	5 700	2.97	1.98	14.72	29.65	0.011 69

5 725 Band

Channel	Frequency [MHz]	Ant Gain [dBi]	Ant Gain [mW]	power [dBm]	power [mW]	Power Density at 20 cm [mW/cm ²]
Lowest	5 745	2.91	1.95	14.57	28.64	0.011 14
Middle	5 785	2.91	1.95	14.66	29.24	0.011 37
Highest	5 825	2.91	1.95	14.53	28.38	0.011 03

*** 802.11n HT20_MIMO (ANT 1+2)**

5 150 Band

Channel	Frequency [MHz]	Ant Gain [dBi]	Ant Gain [mW]	power [dBm]	power [mW]	Power Density at 20 cm [mW/cm ²]
Lowest	5 180	5.97	3.95	16.80	47.86	0.037 65
Middle	5 200	5.97	3.95	16.60	45.71	0.035 96
Highest	5 240	5.97	3.95	16.54	45.08	0.035 46

Note: Directional gain = 5.97 dBi (G_{ANT}(2.96 dBi) + Array Gain(3.01 dBi))

5 250 Band

Channel	Frequency [MHz]	Ant Gain [dBi]	Ant Gain [mW]	power [dBm]	power [mW]	Power Density at 20 cm [mW/cm ²]
Lowest	5 260	6.00	3.98	16.42	43.85	0.034 73
Middle	5 280	6.00	3.98	16.43	43.95	0.034 81
Highest	5 320	6.00	3.98	16.38	43.45	0.034 42

Note: Directional gain = 6.00 dBi (G_{ANT}(2.99 dBi) + Array Gain(3.01 dBi))

5 470 Band

Channel	Frequency [MHz]	Ant Gain [dBi]	Ant Gain [mW]	power [dBm]	power [mW]	Power Density at 20 cm [mW/cm ²]
Lowest	5 500	5.98	3.96	17.09	51.17	0.040 34
Middle	5 580	5.98	3.96	17.15	51.88	0.040 90
Highest	5 700	5.98	3.96	17.52	56.49	0.044 54

Note: Directional gain = 5.98 dBi (G_{ANT}(2.97 dBi) + Array Gain(3.01 dBi))

5 725 Band

Channel	Frequency [MHz]	Ant Gain [dBi]	Ant Gain [mW]	power [dBm]	power [mW]	Power Density at 20 cm [mW/cm ²]
Lowest	5 745	5.92	3.91	17.64	58.08	0.045 16
Middle	5 785	5.92	3.91	17.59	57.41	0.044 64
Highest	5 825	5.92	3.91	17.59	57.41	0.044 64

Note: Directional gain = 5.92 dBi (G_{ANT}(2.91 dBi) + Array Gain(3.01 dBi))

*** 802.11an HT40**

5 150 Band

Channel	Frequency [MHz]	Ant Gain [dBi]	Ant Gain [mW]	power [dBm]	power [mW]	Power Density at 20 cm [mW/cm ²]
Lowest	5 190	2.96	1.98	13.28	21.28	0.008 37
Highest	5 230	2.96	1.98	13.5	22.39	0.008 81

5 250 Band

Channel	Frequency [MHz]	Ant Gain [dBi]	Ant Gain [mW]	power [dBm]	power [mW]	Power Density at 20 cm [mW/cm ²]
Lowest	5 270	2.99	1.99	13.49	22.34	0.008 85
Highest	5 310	2.99	1.99	13.07	20.28	0.008 03

5 470 Band

Channel	Frequency [MHz]	Ant Gain [dBi]	Ant Gain [mW]	power [dBm]	power [mW]	Power Density at 20 cm [mW/cm ²]
Lowest	5 510	2.97	1.98	14.06	25.47	0.010 04
Middle	5 590	2.97	1.98	13.06	20.23	0.007 97
Highest	5 670	2.97	1.98	11.75	14.96	0.005 90

5 725 Band

Channel	Frequency [MHz]	Ant Gain [dBi]	Ant Gain [mW]	power [dBm]	power [mW]	Power Density at 20 cm [mW/cm ²]
Lowest	5 755	2.91	1.95	11.37	13.71	0.005 33
Highest	5 795	2.91	1.95	11.51	14.16	0.005 50

*** 802.11an HT40_MIMO (ANT 1+2)**

5 150 Band

Channel	Frequency [MHz]	Ant Gain [dBi]	Ant Gain [mW]	power [dBm]	power [mW]	Power Density at 20 cm [mW/cm ²]
Lowest	5 190	5.97	3.95	16.23	41.98	0.033 02
Highest	5 230	5.97	3.95	16.12	40.93	0.032 19

Note: Directional gain = 5.97 dBi (GANT(2.96 dBi) + Array Gain(3.01 dBi))

5 250 Band

Channel	Frequency [MHz]	Ant Gain [dBi]	Ant Gain [mW]	power [dBm]	power [mW]	Power Density at 20 cm [mW/cm ²]
Lowest	5 270	6.00	3.98	16.03	40.09	0.031 75
Highest	5 310	6.00	3.98	15.89	38.82	0.030 74

Note: Directional gain = 6.00 dBi (GANT(2.99 dBi) + Array Gain(3.01 dBi))

5 470 Band

Channel	Frequency [MHz]	Ant Gain [dBi]	Ant Gain [mW]	power [dBm]	power [mW]	Power Density at 20 cm [mW/cm ²]
Lowest	5 510	5.98	3.96	16.66	46.34	0.036 54
Middle	5 590	5.98	3.96	16.38	43.45	0.034 26
Highest	5 670	5.98	3.96	16.17	41.40	0.032 64

Note: Directional gain = 5.98 dBi (GANT(2.97 dBi) + Array Gain(3.01 dBi))

5 725 Band

Channel	Frequency [MHz]	Ant Gain [dBi]	Ant Gain [mW]	power [dBm]	power [mW]	Power Density at 20 cm [mW/cm ²]
Lowest	5 755	5.92	3.91	15.71	37.24	0.028 96
Highest	5 795	5.92	3.91	15.68	36.98	0.028 76

Note: Directional gain = 5.92 dBi (GANT(2.91 dBi) + Array Gain(3.01 dBi))