

*** 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]

* Note: 802.11a/b/g modes are not transmitting simultaneously.

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	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]	Limit [mW/cm ²]
802.11a	14.00	±2.00	16.00	39.81	5.168	3.29	0.026 03	1.000 00
802.11n HT20	14.00	±2.00	16.00	39.81	5.168	3.29	0.026 03	1.000 00
802.11n HT20_2 MIMO	14.01	±2.00	16.01	39.90	8.178	6.57	0.052 19	1.000 00
802.11n HT20_3 MIMO	14.77	±2.00	16.77	47.53	9.939	9.86	0.093 25	1.000 00
802.11n HT40	15.50	±2.00	17.50	56.23	5.168	3.29	0.036 77	1.000 00
802.11n HT40_2 MIMO	15.51	±2.00	17.51	56.36	8.178	6.57	0.073 72	1.000 00
802.11n HT40_3 MIMO	15.52	±2.00	17.52	56.49	9.939	9.86	0.110 83	1.000 00
802.11ac VHT20	14.00	±2.00	16.00	39.81	5.168	3.29	0.026 03	1.000 00
802.11ac VHT20_2 MIMO	14.01	±2.00	16.01	39.90	8.178	6.57	0.052 19	1.000 00
802.11ac VHT20_3 MIMO	14.77	±2.00	16.77	47.53	9.939	9.86	0.093 25	1.000 00
802.11ac VHT40	15.50	±2.00	17.50	56.23	5.168	3.29	0.036 77	1.000 00
802.11ac VHT40_2 MIMO	15.51	±2.00	17.51	56.36	8.178	6.57	0.073 72	1.000 00
802.11ac VHT40_3 MIMO	15.77	±2.00	17.77	59.84	9.939	9.86	0.117 40	1.000 00
802.11ac VHT80	15.50	±2.00	17.50	56.23	4.648	2.92	0.032 62	1.000 00
802.11ac VHT80_2 MIMO	15.51	±2.00	17.51	56.36	4.648	2.92	0.032 70	1.000 00
802.11ac VHT80_3 MIMO	15.77	±2.00	17.77	59.84	9.939	9.86	0.117 40	1.000 00

4. Target power and tolerance, Max tuneup power

- WiFi 5 150 Band

Mode	Target power [dB]	Tune up tolerance [dB]	Max tune up power [dB]	Measured power [dBm]
802.11a_ANT 1	14.00	±2.00	16.00	14.69
802.11a_ANT 2	14.00	±2.00	16.00	14.48
802.11a_ANT 3	14.00	±2.00	16.00	14.44

802.11n HT20_ANT 1	14.00	±2.00	16.00	14.51
802.11n HT20_ANT 2	14.00	±2.00	16.00	14.57
802.11n HT20_ANT 3	14.00	±2.00	16.00	14.53
802.11n HT20_MIMO (ANT 1+2)	14.01	±2.00	16.01	15.34
802.11n HT20_MIMO (ANT 2+3)	14.01	±2.00	16.01	15.12
802.11n HT20_MIMO (ANT 1+3)	14.01	±2.00	16.01	15.25
802.11n HT20_MIMO (ANT 1+2+3)	14.77	±2.00	16.77	15.60
802.11n HT40_ANT 1	15.50	±2.00	17.50	16.18
802.11n HT40_ANT 2	15.50	±2.00	17.50	16.11
802.11n HT40_ANT 3	15.50	±2.00	17.50	16.07
802.11n HT40_MIMO (ANT 1+2)	15.51	±2.00	17.51	16.60
802.11n HT40_MIMO (ANT 2+3)	15.51	±2.00	17.51	16.38
802.11n HT40_MIMO (ANT 1+3)	15.51	±2.00	17.51	16.51
802.11n HT40_MIMO (ANT 1+2+3)	15.52	±2.00	17.52	16.78
802.11ac VHT20_ANT 1	14.00	±2.00	16.00	14.64
802.11ac VHT20_ANT 2	14.00	±2.00	16.00	14.52
802.11ac VHT20_ANT 3	14.00	±2.00	16.00	14.54
802.11ac VHT20_MIMO (ANT 1+2)	14.01	±2.00	16.01	15.67
802.11ac VHT20_MIMO (ANT 2+3)	14.01	±2.00	16.01	15.54
802.11ac VHT20_MIMO (ANT 1+3)	14.01	±2.00	16.01	15.65
802.11ac VHT20_MIMO (ANT 1+2+3)	14.77	±2.00	16.77	15.29
802.11ac VHT40_ANT 1	15.50	±2.00	17.50	16.06
802.11ac VHT40_ANT 2	15.50	±2.00	17.50	15.97
802.11ac VHT40_ANT 3	15.50	±2.00	17.50	15.86
802.11ac VHT40_MIMO (ANT 1+2)	15.51	±2.00	17.51	16.47
802.11ac VHT40_MIMO (ANT 2+3)	15.51	±2.00	17.51	16.44
802.11ac VHT40_MIMO (ANT 1+3)	15.51	±2.00	17.51	16.47
802.11ac VHT40_MIMO (ANT 1+2+3)	15.77	±2.00	17.77	15.98
802.11ac VHT80_ANT 1	15.50	±2.00	17.50	16.29
802.11ac VHT80_ANT 2	15.50	±2.00	17.50	16.21
802.11ac VHT80_ANT 3	15.50	±2.00	17.50	15.93
802.11ac VHT80 MIMO (ANT 1+2)	15.51	±2.00	17.51	16.22
802.11ac VHT80 MIMO (ANT 2+3)	15.51	±2.00	17.51	16.12
802.11ac VHT80 MIMO (ANT 1+3)	15.51	±2.00	17.51	16.37
802.11ac VHT80 MIMO (ANT 1+2+3)	15.77	±2.00	17.77	16.36

- WiFi 5 725 Band

Mode	Target power [dB]	Tune up tolerance [dB]	Max tune up power [dB]	Measured power [dBm]
802.11a_ANT 1	14.00	± 2.00	16.00	14.77
802.11a_ANT 2	14.00	± 2.00	16.00	15.03
802.11a_ANT 3	14.00	± 2.00	16.00	14.50
802.11n HT20_ANT 1	14.00	± 2.00	16.00	14.79
802.11n HT20_ANT 2	14.00	± 2.00	16.00	15.08
802.11n HT20_ANT 3	14.00	± 2.00	16.00	14.48
802.11n HT20_MIMO (ANT 1+2)	14.01	± 2.00	16.01	15.23
802.11n HT20_MIMO (ANT 2+3)	14.01	± 2.00	16.01	15.01
802.11n HT20_MIMO (ANT 1+3)	14.01	± 2.00	16.01	15.12
802.11n HT20_MIMO (ANT 1+2+3)	14.77	± 2.00	16.77	15.69
802.11n HT40_ANT 1	15.50	± 2.00	17.50	16.18
802.11n HT40_ANT 2	15.50	± 2.00	17.50	16.45
802.11n HT40_ANT 3	15.50	± 2.00	17.50	16.19
802.11n HT40_MIMO (ANT 1+2)	15.51	± 2.00	17.51	16.85
802.11n HT40_MIMO (ANT 2+3)	15.51	± 2.00	17.51	16.56
802.11n HT40_MIMO (ANT 1+3)	15.51	± 2.00	17.51	16.67
802.11n HT40_MIMO (ANT 1+2+3)	15.52	± 2.00	17.52	16.79
802.11ac VHT20_ANT 1	14.00	± 2.00	16.00	14.59
802.11ac VHT20_ANT 2	14.00	± 2.00	16.00	14.96
802.11ac VHT20_ANT 3	14.00	± 2.00	16.00	14.45
802.11ac VHT20_MIMO (ANT 1+2)	14.01	± 2.00	16.01	15.67
802.11ac VHT20_MIMO (ANT 2+3)	14.01	± 2.00	16.01	15.47
802.11ac VHT20_MIMO (ANT 1+3)	14.01	± 2.00	16.01	15.43
802.11ac VHT20_MIMO (ANT 1+2+3)	14.77	± 2.00	16.77	15.42
802.11ac VHT40_ANT 1	15.50	± 2.00	17.50	16.02
802.11ac VHT40_ANT 2	15.50	± 2.00	17.50	16.09
802.11ac VHT40_ANT 3	15.50	± 2.00	17.50	15.93
802.11ac VHT40_MIMO (ANT 1+2)	15.51	± 2.00	17.51	16.69
802.11ac VHT40_MIMO (ANT 2+3)	15.51	± 2.00	17.51	16.60
802.11ac VHT40_MIMO (ANT 1+3)	15.51	± 2.00	17.51	16.80
802.11ac VHT40_MIMO (ANT 1+2+3)	15.77	± 2.00	17.77	15.94
802.11ac VHT80_ANT 1	15.50	± 2.00	17.50	16.02
802.11ac VHT80_ANT 2	15.50	± 2.00	17.50	16.30
802.11ac VHT80_ANT 3	15.50	± 2.00	17.50	15.79
802.11ac VHT80 MIMO (ANT 1+2)	15.51	± 2.00	17.51	16.27
802.11ac VHT80 MIMO (ANT 2+3)	15.51	± 2.00	17.51	16.30
802.11ac VHT80 MIMO (ANT 1+3)	15.51	± 2.00	17.51	16.18
802.11ac VHT80 MIMO (ANT 1+2+3)	15.77	± 2.00	17.77	16.16