

FCC §15.247 (i), §2.1091 – RF Exposure

FCC ID: 2AL8K-OPSI7L711

Applied procedures / limit

According to FCC §15.247(i) and §1.1307(b)(1), 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 level in excess of the Commission's guidelines.

Limits for Occupational / Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842 / f	4.89 / f	(900 / f)*	6
30-300	61.4	0.163	1.0	6
300-1500			F/300	6
1500-100,000			5	6

Note: *f* is frequency in MHz

* = Power density limit is applicable at frequencies greater than 100 MHz

Limits for General Population / Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f)*	30
30-300	27.5	0.073	0.2	30
300-1500			F/1500	30
1500-100,000			1.0	30

Note: *f* = frequency in MHz

* = Plane-wave equivalent power density

MPE PREDICTION

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

$$S = PG/4\pi R^2$$

Where: S = power density

P = power input to antenna

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, R=20cm

Test Result of RF Exposure Evaluation

Antenna 1:

2.4G WLAN

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
802.11b	22.00	158.4893	5.91	3.8994	0.1230	1.0000
802.11g	22.00	158.4893	5.91	3.8994	0.1230	1.0000
802.11n(HT20)	22.00	158.4893	5.91	3.8994	0.1230	1.0000
802.11n(HT40)	22.00	158.4893	5.91	3.8994	0.1230	1.0000
802.11ax(HE20)	22.00	158.4893	5.91	3.8994	0.1230	1.0000
802.11ax(HE40)	22.00	158.4893	5.91	3.8994	0.1230	1.0000

5.2G WLAN

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
802.11a	17.00	50.1187	2.30	1.6982	0.0169	1.0000
802.11n20	16.00	39.8107	2.30	1.6982	0.0135	1.0000
802.11n40	19.00	79.4328	2.30	1.6982	0.0268	1.0000
802.11ac20	16.00	39.8107	2.30	1.6982	0.0135	1.0000
802.11ac40	19.00	79.4328	2.30	1.6982	0.0268	1.0000
802.11ac80	17.00	50.1187	2.30	1.6982	0.0169	1.0000
802.11ax20	16.00	39.8107	2.30	1.6982	0.0135	1.0000
802.11ax40	18.00	63.0957	2.30	1.6982	0.0213	1.0000
802.11ax80	17.00	50.1187	2.30	1.6982	0.0169	1.0000

5.3G WLAN

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MP20 Limits (mW/cm ²)
	dBm	mW				
802.11a	17.00	50.1187	2.30	1.6982	0.0169	1.0000
802.11n20	17.00	50.1187	2.30	1.6982	0.0169	1.0000
802.11n40	18.00	63.0957	2.30	1.6982	0.0213	1.0000
802.11ac20	17.00	50.1187	2.30	1.6982	0.0169	1.0000
802.11ac40	18.00	63.0957	2.30	1.6982	0.0213	1.0000
802.11ac80	18.00	63.0957	2.30	1.6982	0.0213	1.0000
802.11ax20	17.00	50.1187	2.30	1.6982	0.0169	1.0000
802.11ax40	18.00	63.0957	2.30	1.6982	0.0213	1.0000
802.11ax80	18.00	63.0957	2.30	1.6982	0.0213	1.0000

5.7 GWLAN

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MP20 Limits (mW/cm ²)
	dBm	mW				
802.11a	17.00	50.1187	2.30	1.6982	0.0169	1.0000
802.11n20	17.00	50.1187	2.30	1.6982	0.0169	1.0000
802.11n40	16.00	39.8107	2.30	1.6982	0.0135	1.0000
802.11ac20	17.00	50.1187	2.30	1.6982	0.0169	1.0000
802.11ac40	16.00	39.8107	2.30	1.6982	0.0135	1.0000
802.11ac80	16.00	39.8107	2.30	1.6982	0.0135	1.0000
802.11ax20	17.00	50.1187	2.30	1.6982	0.0169	1.0000
802.11ax40	16.00	39.8107	2.30	1.6982	0.0135	1.0000
802.11ax80	16.00	39.8107	2.30	1.6982	0.0135	1.0000

5.8 GWLAN

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
802.11a	16.00	39.8107	2.30	1.6982	0.0135	1.0000
802.11n20	16.00	39.8107	2.30	1.6982	0.0135	1.0000
802.11n40	15.00	31.6228	2.30	1.6982	0.0107	1.0000
802.11ac20	15.00	31.6228	2.30	1.6982	0.0107	1.0000
802.11ac40	15.00	31.6228	2.30	1.6982	0.0107	1.0000
802.11ac80	15.00	31.6228	2.30	1.6982	0.0107	1.0000
802.11ax20	15.00	31.6228	2.30	1.6982	0.0107	1.0000
802.11ax40	15.00	31.6228	2.30	1.6982	0.0107	1.0000
802.11ax80	15.00	31.6228	2.30	1.6982	0.0107	1.0000

Antenna 2:**BT**

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
GFSK	11.00	12.5893	5.91	3.8994	0.0098	1.0000
π/4DQPSK	9.00	7.9433	5.91	3.8994	0.0062	1.0000
8-DPSK	9.00	7.9433	5.91	3.8994	0.0062	1.0000
GFSK(BT LE)	6.00	3.9811	5.91	3.8994	0.0031	1.0000

2.4GWLAN

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
802.11b	20.00	100.0000	5.91	3.8994	0.0776	1.0000
802.11g	24.00	251.1886	5.91	3.8994	0.1949	1.0000
802.11n(HT20)	24.00	251.1886	5.91	3.8994	0.1949	1.0000
802.11n(HT40)	24.00	251.1886	5.91	3.8994	0.1949	1.0000
802.11ax(HE20)	24.00	251.1886	5.91	3.8994	0.1949	1.0000
802.11ax(HE40)	24.00	251.1886	5.91	3.8994	0.1949	1.0000

5.2 GWLAN

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
802.11a	16.00	39.8107	2.30	1.6982	0.0135	1.0000
802.11n20	16.00	39.8107	2.30	1.6982	0.0135	1.0000
802.11n40	18.00	63.0957	2.30	1.6982	0.0213	1.0000
802.11ac20	16.00	39.8107	2.30	1.6982	0.0135	1.0000
802.11ac40	18.00	63.0957	2.30	1.6982	0.0213	1.0000
802.11ac80	17.00	50.1187	2.30	1.6982	0.0169	1.0000
802.11ax20	16.00	39.8107	2.30	1.6982	0.0135	1.0000
802.11ax40	18.00	63.0957	2.30	1.6982	0.0213	1.0000
802.11ax80	17.00	50.1187	2.30	1.6982	0.0169	1.0000

5.3 GWLAN

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MP20 Limits (mW/cm ²)
	dBm	mW				
802.11a	17.00	50.1187	2.30	1.6982	0.0169	1.0000
802.11n20	17.00	50.1187	2.30	1.6982	0.0169	1.0000
802.11n40	18.00	63.0957	2.30	1.6982	0.0213	1.0000
802.11ac20	17.00	50.1187	2.30	1.6982	0.0169	1.0000
802.11ac40	18.00	63.0957	2.30	1.6982	0.0213	1.0000
802.11ac80	17.00	50.1187	2.30	1.6982	0.0169	1.0000
802.11ax20	16.00	39.8107	2.30	1.6982	0.0135	1.0000
802.11ax40	18.00	63.0957	2.30	1.6982	0.0213	1.0000
802.11ax80	17.00	50.1187	2.30	1.6982	0.0169	1.0000

5.7 GWLAN

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MP20 Limits (mW/cm ²)
	dBm	mW				
802.11a	17.00	50.1187	2.30	1.6982	0.0169	1.0000
802.11n20	17.00	50.1187	2.30	1.6982	0.0169	1.0000
802.11n40	19.00	79.4328	2.30	1.6982	0.0268	1.0000
802.11ac20	16.00	39.8107	2.30	1.6982	0.0135	1.0000
802.11ac40	16.00	39.8107	2.30	1.6982	0.0135	1.0000
802.11ac80	16.00	39.8107	2.30	1.6982	0.0135	1.0000
802.11ax20	16.00	39.8107	2.30	1.6982	0.0135	1.0000
802.11ax40	16.00	39.8107	2.30	1.6982	0.0135	1.0000
802.11ax80	16.00	39.8107	2.30	1.6982	0.0135	1.0000

5.8 GWLAN

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
802.11a	16.00	39.8107	2.30	1.6982	0.0135	1.0000
802.11n20	16.00	39.8107	2.30	1.6982	0.0135	1.0000
802.11n40	15.00	31.6228	2.30	1.6982	0.0107	1.0000
802.11ac20	16.00	39.8107	2.30	1.6982	0.0135	1.0000
802.11ac40	15.00	31.6228	2.30	1.6982	0.0107	1.0000
802.11ac80	15.00	31.6228	2.30	1.6982	0.0107	1.0000
802.11ax20	16.00	39.8107	2.30	1.6982	0.0135	1.0000
802.11ax40	15.00	31.6228	2.30	1.6982	0.0107	1.0000
802.11ax80	15.00	31.6228	2.30	1.6982	0.0107	1.0000

Remark:

1. Output power including tune-up tolerance;
2. MPE evaluate distance is 20cm from user manual provide by manufacturer;

Simultaneous Transmission MPE

Modulation Type	Work Frequency Band	Transmit Antenna		Antenna 1 Antenna 2 Synchronization transmit *
		Antenna 1	Antenna 2	
802.11b	2.4G WLAN	Yes	Yes	No
802.11g	2.4G WLAN	Yes	Yes	No
802.11n(HT20)	2.4G WLAN	Yes	Yes	No
802.11n(HT40)	2.4G WLAN	Yes	Yes	No
802.11ax(HE20)	2.4G WLAN	Yes	Yes	No
802.11ax(HE40)	2.4G WLAN	Yes	Yes	No

Modulation Type	Work Frequency Band	Transmit Antenna		Antenna 1 Antenna 2 Synchronization transmit*
		Antenna 1	Antenna 2	
802.11a	UNII Band 1 / Band 2 / Band 3 / Band 4	Yes	Yes	No
802.11n20	UNII Band 1 / Band 2 / Band 3 / Band 4	Yes	Yes	No
802.11n40	UNII Band 1 / Band 2 / Band 3 / Band 4	Yes	Yes	No
802.11ac20	UNII Band 1 / Band 2 / Band 3 / Band 4	Yes	Yes	No
802.11ac40	UNII Band 1 / Band 2 / Band 3 / Band 4	Yes	Yes	No
802.11ac80	UNII Band 1 / Band 2 / Band 3 / Band 4	Yes	Yes	No
802.11ax20	UNII Band 1 / Band 2 / Band 3 / Band 4	Yes	Yes	No
802.11ax40	UNII Band 1 / Band 2 / Band 3 / Band 4	Yes	Yes	No
802.11ax80	UNII Band 1 / Band 2 / Band 3 / Band 4	Yes	Yes	No

No need consider Simultaneous transmission.