

5.6 RF Exposure

5.6.1 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]

EUT: Maximum peak output power = 15.96 [mW] (12.03 dBm) Antenna gain = 2.03 (3.08 [dBi])	
100 mW, at 20 cm from an antenna 6 [dBi]	$S = PG/4\pi R^2 = 100 \times 3.98 / (4 \times \pi \times 400) = 0.07918 \text{ [mW/cm}^2\text{]} < 1.0 \text{ [mW/cm}^2\text{]}$
15.96 mW, at 20 cm from an antenna 3.08 [dBi]	$S = PG/4\pi R^2 = 0.00645 \text{ [mW/cm}^2\text{]} < 1.0 \text{ [mW/cm}^2\text{]}$
15.96 mW, at 2.5 cm from an antenna 3.08 [dBi]	$S = PG/4\pi R^2 = 0.41296 \text{ [mW/cm}^2\text{]} < 1.0 \text{ [mW/cm}^2\text{]}$

5.6.2 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.

5.6.3 Calculation Result of RF Exposure

*** 802.11b**

Channel	Frequency [MHz]	Ant Gain [mW]	power [dBm]	power [mW]	Power Density at 20 cm [mW/cm ²]
Lowest	2 412	2.03	12.03	15.96	0.006 45
Middle	2 437	2.03	11.75	14.96	0.006 05
Highest	2 462	2.03	11.67	14.69	0.005 94

*** 802.11g**

Channel	Frequency [MHz]	Ant Gain [mW]	power [dBm]	power [mW]	Power Density at 20 cm [mW/cm ²]
Lowest	2 412	2.03	7.89	6.15	0.002 49
Middle	2 437	2.03	7.69	5.87	0.002 38
Highest	2 462	2.03	7.56	5.70	0.002 31

*** 802.11n HT20**

Channel	Frequency [MHz]	Ant Gain [mW]	power [dBm]	power [mW]	Power Density at 20 cm [mW/cm ²]
Lowest	2 412	2.03	7.62	5.78	0.002 34
Middle	2 437	2.03	7.42	5.52	0.002 23
Highest	2 462	2.03	7.48	5.60	0.002 26

RF Exposure Compliance for simultaneous operations

*** configurations for simultaneous operations**

configuration 1 : CDMA 1x + 2.4 GHz WLAN + Bluetooth

configuration 2 : CDMA EVDO + 2.4 GHz WLAN + Bluetooth

RF funtion	CDMA EVDO		CDMA 1x		802.11b	802.11g	802.11n	BT	Total Power Densityc (mW/cm2)
Band	Cellular	PCS	Cellular	PCS	2.4 GHz	2.4 GHz	2.4 GHz	2.4 GHz	
Power Density (mW/cm2)	0.125 24	0.203 11	0.125 24	0.203 11	0.006 45	0.002 49	0.002 34	0.000 15	
Configuration 1				0.20311	0.00645			0.00015	0.20971
Configuration 2		0.20311			0.00645			0.00015	0.20971