§1.1310& §2.1091 - MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to subpart 15.247(i) and subpart §1.1310, 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 Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

(B) Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	**Electric Field Strength (V/m)**	**Magnetic Field Strength (A/m)**	**Power Density (mW/cm^2)**	**Averaging Time (minutes)**
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
300-1500	/		f/1500	30
1500-100,000	/		1.0	30

f = frequency in MHz; * = Plane-wave equivalent power density;

According to §1.1310 and §2.1091 RF exposure is calculated.

Calculated Formulary:

Predication of MPE limit at a given distance
$S = PG/4\pi R^2$ = power density (in appropriate units, e.g. mW/cm^2);
P = power input to the antenna (in appropriate units, e.g., mW);
G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

Calculated Data:

Mode	Frequency Range (MHz)	Antenna Gain		Tune-up Conducted Power		Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)	MPE Ratio
		(dBi)	(numeric)	(dBm)	(mW)				
802.11b	2412~2462	3.67	2.33	24	251.19	20	0.1164	1.0	0.1164
802.11g		3.67	2.33	24	251.19	20	0.1164	1.0	0.1164
802.11n-HT20		3.67	2.33	29	794.33	20	0.3682	1.0	0.3682
802.11n-HT40	2422~2452	3.67	2.33	28	630.96	20	0.2924	1.0	0.2924
802.11a	5150~5250	5.13	3.26	25	316.23	20	0.2051	1.0	0.2051
	5725~5850	5.13	3.26	25	316.23	20	0.2051	1.0	0.2051
802.11ac20	5150~5250	5.13	3.26	28	630.96	20	0.4092	1.0	0.4092
	5725~5850	5.13	3.26	28	630.96	20	0.4092	1.0	0.4092
802.11n20	5150~5250	5.13	3.26	28	630.96	20	0.4092	1.0	0.4092
	5725~5850	5.13	3.26	28	630.96	20	0.4092	1.0	0.4092
802.11ac40	5150~5250	5.13	3.26	28	630.96	20	0.4092	1.0	0.4092
	5725~5850	5.13	3.26	28	630.96	20	0.4092	1.0	0.4092
802.11n40	5150~5250	5.13	3.26	28	630.96	20	0.4092	1.0	0.4092
	5725~5850	5.13	3.26	28	630.96	20	0.4092	1.0	0.4092
802.11ac80	5210	5.13	3.26	21	125.89	20	0.0816	1.0	0.0816
	5775	5.13	3.26	24	251.19	20	0.1629	1.0	0.1629

Note:
(1) The Tune-up output power was declared by the Manufacturer.
(2) 2.4GWi-Fi and 5G Wi-Fi can transmit simultaneously, The worst condition is 802.11n-HT20 Wi-Fi & 5G Wi-Fi, as below:

$$\sum_i \frac{S_i}{S_{Limit,i}} = 0.3682/1.00+0.4092/1.00=0.3682+0.4092=0.7774 < 1.0$$

Conclusion: The device meets MPE at distance 20cm.