§1.1307 (b) (1) & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to subpart 1.1307 (b)(1), 2.1091 systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to RF energy level in excess of the communication guidelines.

Limits for General Population/Uncontrolled Exposure

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

Result

Calculated Formulary:

Predication of MPE limit at a given distance

$$S = \frac{PG}{4\pi R^2}$$

S = 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)

For simultaneously transmit system, the calculated power density should comply with:

$$\sum_i \frac{S_i}{S_{Limit,i}} \leq 1$$

Mode	Frequency (MHz)	Antenna Gain		Max Tune-up Conducted Power		Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
		(dBi)	(numeric)	(dBm)	(mW)			
ZigBee	2405-2480	0	1.00	19	79.43	20	0.016	1
2.4G Wi-Fi	2412-2462	4.5	2.82	25	316.23	20	0.177	1
5G Wi-Fi	5150-5350	3.5	2.24	20.0	100	20	0.045	1
	5725-5850	3.5	2.24	20.0	100	20	0.045	1

Note: 1. the tune up conducted power was declared by the applicant
2. the 2.4G Wi-Fi, 5.2G Wi-Fi, 5.8G Wi-Fi and ZigBee can transmit at the same time.

Simultaneous transmitting consideration:

The ratio=$MPE_{2.4GWi\text{-}Fi}$/limit+ $MPE_{5.2GWi\text{-}Fi}$/limit + $MPE_{5.8GWi\text{-}Fi}$/limit+ MPE_{ZigBee}/limit
=0.177/1+0.045/1+0.045/1+0.016/1=0.283＜1.0

To maintain compliance with the FCC's RF exposure guidelines, place the equipment at least 20cm from nearby persons.

Result: Compliance