1. MAXIMUM PERMISSIBLE EXPOSURE (MPE)

1.1 Standard Applicable

According to § 1.1307(b)(1), system operating under the provisions of this section shall be operating in a manner that the public is not exposed to radio frequency energy level in excess limit for maximum permissible exposure.

(a) 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 Times $\|E\|^2$, $\|H\|^2$ 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
1500-100000	/	/	5	6

(b) 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 Times $\|E\|^2$, $\|H\|^2$ 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
1500-100000	/	/	1	30

Note: f = frequency in MHz: * = Plane-wave equivalents power density

1.2 MPE Calculation Method

$S = (30*P*G) / (377*R^2)$

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 (in appropriate units, e.g., cm)

1.3 MPE Calculation Result

Wifi:
Since the maximum eirp power is used as the output power to antenna, so the Gain of the antenna can be assumed as 0dBi.
Maximum peak output power: 19.90 (dBm)
Maximum peak output power at antenna input terminal: 97.7237(mW)
Prediction distance: >20 (cm)
Prediction frequency: 2442 (MHz)
Antenna gain (typical): 0 (dBi)
Antenna gain (typical): 1 (numeric)
The worst case is power density at prediction frequency at 5cm: 0.0194(mw/cm^2)
MPE limit for general population exposure at prediction frequency: 1 (mw/cm^2)

0.0194(mw/cm^2) < 1 (mw/cm^2)

Zigbee:
Since the maximum eirp power is used as the output power to antenna, so the Gain of the antenna can be assumed as 0dBi.
Maximum peak output power: 12.15 (dBm)
Maximum peak output power at antenna input terminal: 16.4059(mW)
Prediction distance: >20 (cm)
Prediction frequency: 2405 (MHz)
Antenna gain (typical): 0 (dBi)
Antenna gain (typical): 1 (numeric)
The worst case is power density at prediction frequency at 5cm: 0.0033 (mw/cm^2)
MPE limit for general population exposure at prediction frequency: 1 (mw/cm^2)

0.0033 (mw/cm^2) < 1 (mw/cm^2)

Result: Pass