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MPE Calculation

§ 1.1310: The criteria listed in table 1 shall be used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

Part 1.1310 Limits for Maximum Permissible Exposure (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*(900/f^2)	6
30–300	61.4	0.163	1.0	6
300–1500			f/300	6
1500–100,000			5	6
(B) 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
300–1500			f/1500	30
1500–100,000			1.0	30

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

NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

1.1 Test Procedure

An MPE evaluation for was performed in order to show that the device was compliant with §2.1091. The maximum power density was calculated for each transmitter at a separation distance of 20cm.

For each transmitter the maximum RF exposure was calculated at a 20 cm distance using the formula:

$$ConductedPower_{mW} = 10^{ConductedPower(dBm)/10}$$

$$PowerDensity = \frac{ConductedPower_{mW} \times Ant.Gain}{4\pi \times (20_{cm})^2}$$

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1.2 Results (802.11 Radio):

- Maximum Conducted Output Power = 319.2mW
- Maximum Antenna Gain = 2.1dBi

Power Density = (319.2mW x 2.1dBi) / 5025.6

Power Density = 0.133mW/cm^2

Limit at 2.4GHz = 1mW/cm^2

The calculated maximum power density at 20cm distance is less that the limit for general population / uncontrolled exposure.

1.3 Results (Bluetooth Radio):

- Maximum Conducted Output Power = 9.74mW
- Maximum Antenna Gain = 2.1dBi

Power Density = (9.74mW x 2.1dBi) / 5025.6

Power Density = 0.mW/cm^2

Limit at 2.4GHz = 0.004mW/cm^2

The calculated maximum power density at 20cm distance is less that the limit for general population / uncontrolled exposure.

1.4 Results (Simultaneous Transmission)

The sum or the power densities for the Bluetooth and 802.11 radios is less than the MPE limit at 2.4GHz as shown below:

0.133mW/cm^2 + 0.004mW/cm^2 = 0.137 mW/cm^2