8. Maximum Permissible Exposure (MPE)

8.1. Radiofrequency radiation exposure limits. : § 1.1310

§ 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.

Table 1--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	0.613	1.0	6
300-1500	-	-	f/300	6
1500-100,000	-	-	5	6
(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/300	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.

8. 2 MPE Calculations

$$S = P * G/(4 * \pi * R^2) \quad [mW/ cm^2]$$

where S = power density
P = power input to the antenna
G = antenna gain of an isotropic radiator
R = distance to the center of radiation of the antenna

P_t= P + G =27.33 [dBm] + (-4.72).[dBi] = 22.61 [dBm] = 0.182 [W] $[10^{(27.33/10)} * 10^{-3}]$

S = P_t / (4 * π * 0.2^2) = 0.182 / 0.502 [W/m^2] = **0.036 [mW/cm^2]**

8.3 Results

MPE Distance (cm)	Output Power (dBm)	Antenna Gain (dBi)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
20	27.33	-4.72	0.036	0.2