8. MAXIMUM PERMISSIBLE EXPOSURE

<u>LIMIT</u>

§1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (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/cm²)	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/f²)	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/f²)	30

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)—Continued

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm²)	Averaging time (minutes)
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.

CALCULATIONS

Given

$E = \sqrt{(30 * P * G)} / d$

and

$S = E^2 / 3770$

where

E = Field Strength in Volts/meter
P = Power in Watts
G = Numeric antenna gain
d = Distance in meters
S = Power Density in milliwatts/square centimeter

Combining equations, rearranging the terms to express the distance as a function of the remaining variables, changing to units of Power to mW and Distance to cm, and substituting the logarithmic form of power and gain yields:

$d = 0.282 * 10^{((P + G) / 20)} / \sqrt{S}$

where

d = MPE distance in cm
P = Power in dBm
G = Antenna Gain in dBi
S = Power Density Limit in mW/cm^2

Rearranging terms to calculate the power density at a specific distance yields

$S = 0.0795 * 10^{((P + G) / 10)} / (d^2)$

The power density in units of mW/cm^2 is converted to units of W/m^2 by multiplying by a factor of 10.

LIMITS

Controlled Exposure Limit:

From FCC §1.1310 Table 1 (A), the maximum value of S = 2.563354 mW/cm^2 (769.00625MHz) & 2.720042 mW/cm^2 (816.0125MHz)

From IC Safety Code 6, Section 2.2 Table 5 Column 4, S = 25.633542 mW/cm^2 (769.00625MHz) & 27.200417 mW/cm^2 (816.0125MHz)

Uncontrolled Exposure Limit:

From FCC §1.1310 Table 1 (B), the maximum value of S = 0.512671 mW/cm^2 (769.00625MHz) & 0.5440083 mW/cm^2 (816.0125MHz)

From IC Safety Code 6, Section 2.2 Table 5 Column 4, S = 5.126708 mW/cm^2 (769.00625MHz) & 5.4400833 mW/cm^2 (816.0125MHz)

RESULTS

Band (MHz)	Frequency (MHz)	FCC Limit (mW/cm^2)	IC Limit (W/m^2)	Output (dBm)	Antenna (dBi)	MPE Distance (cm)
R(Safe) Controlled Environment						
700.0	769.00625	2.56	25.6	**42.20**	4.65	38.76
800.0	816.01250	2.72	27.2	**45.39**	4.65	54.32
R(Safe) Uncontrolled Environment						
700.0	769.00625	0.51	5.13	**42.20**	4.65	86.66
800.0	816.01250	0.54	5.44	**45.39**	4.65	121.46