9. RF EXPOSURE

FCC RULES

§15.255 (g) Regardless of the power density levels permitted under this section, devices operating under the provisions of this section are subject to the radiofrequency radiation exposure requirements specified in §§1.1307(b), 2.1091 and 2.1093 of this chapter, as appropriate. Applications for equipment authorization of devices operating under this section must contain a statement confirming compliance with these requirements for both fundamental emissions and unwanted emissions. Technical information showing the basis for this statement must be submitted to the Commission upon request.

§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/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

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/cm^2)	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.

TECHNICAL INFORMATION IN ACCORDANCE WITH 15.255 (g) SHOWING BASIS OF UPPER BOUND RESULTS FOR BOTH FUNDAMENTAL AND UNWANTED EMISSIONS

Worst-case possible Integrated Band Power, assuming unwanted emissions encompass the entire band and the power density at every frequency is equal to the spurious emissions average limit								
Band	Start (MHz)	Stop (MHz)	Limit (dBuV/m at 3m)	Limit (dBm EIRP)	Limit (mW EIRP)	RBW (MHz)	Num Intervals (stop-start)/(RBW)	Integrated Band Power (mW EIRP)
30 to 88 MHz	30	88	40	-55.2	3.01995E-06	0.1	580	0.002
88 to 216 MHz	88	216	43.5	-51.7	6.76083E-06	0.1	1280	0.009
216 to 960 MHz	216	960	46	-49.2	1.20226E-05	0.1	7440	0.089
960 to 1000 MHz	960	1000	54	-41.2	7.58578E-05	0.1	400	0.030
1 to 40 GHz	1000	40000	55	-40.2	9.54993E-05	1	39000	3.724
30 MHz to 40 GHz								3.855

Integrated Band Power, equal to the sum of the power of all measured emissions within the band. Unwanted emissions measurements are peak, thus will over-estimate the average level. Fundamental emissions measurements are average								
Freq or Band (GHz)	EUT Channel			Actual Emissions (dBm EIRP)	Actual Power (mW EIRP)			Integrated Band Power (mW EIRP)
58.32	1			23.7	234.423			
40 to 200 GHz	1							234.423
60.48	2			29.8	954.993			
40 to 200 GHz	2							954.993
62.64	3			28.7	741.310			
40 to 200 GHz	3							741.310

Total Integrated Band Power, equal to the worst-case possible 30 MHz to 40 GHz band power plus the measured 40 to 200 GHz band power								
Band	EUT Channel							Integrated Band Power (mW EIRP)
30 MHz to 200 GHz	1							238.278
30 MHz to 200 GHz	2							958.847
30 MHz to 200 GHz	3							745.165

CALCULATIONS

EIRP is converted to Power Density using the equation:

P_D = EIRP / (4 * Pi * D_S^2)

where:

P_D = power density in mW/m^2
EIRP = Equivalent Isotropic Radiated Power in mW
D_S = separation distance in cm

RESULTS FOR FUNDAMENTAL EMISSIONS

Channel	Average EIRP (dBm)	Average EIRP (mW)	Separation Distance (cm)	Power Density (mW/cm^2)	FCC Limit (mW/cm^2)
1	23.7	234.423	20	0.05	1
2	29.8	954.993	20	0.19	1
3	28.7	741.310	20	0.15	1

UPPER BOUND RESULTS FOR BOTH FUNDAMENTAL AND UNWANTED EMISSIONS

Channel	Integrated EIRP (mW)	Separation Distance (cm)	Power Density (mW/cm^2)	FCC Limit (mW/cm^2)
1	238.278	20	0.05	1
2	958.847	20	0.19	1
3	745.165	20	0.15	1