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.

Test Procedure

An MPE evaluation 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 20 cm.

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

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

$$PowerDensity = \frac{ConductedPower(mW) * Ant.Gain}{4\pi * (20cm)^2}$$

Results

The device contains DMP Wireless and 802.11 transmitters which can transmit simultaneously. The following calculations show that the total power density for each transmitter at 20 cm is less than the limit for general population / un-controlled exposure. With the worst case DMP Wireless and 802.11 radios transmitting simultaneously, the MPE calculations are less than the applicable limit. The device meets the RF exposure limit at a 20 cm separation distance as required by part 2.1091 of the FCC rules with all radios transmitting simultaneously.

The sum total of the ratio of the power densities to the corresponding limit for all radios capable of transmitting simultaneously was computed as follows:

Total = (DMP Wireless Power Density / Limit DMP Wireless) + (802.11 Power Density / Limit 802.11)

Total = 0.02 + 0.01 = 0.03

Compliance is shown by the sum of the ratio of the power densities for all radios that can transmit simultaneously being less than 1.

Individual Radio Test Results:

DMP Wireless 915 Band Transmitter:

Frequency	915 MHz
Limit	0.61 mW/cm^2
Distance	20 cm
Maximum Scaled Power	19.01 dBm = 79.6 mW
TX Ant Gain	2.14 dBi
EIRP	21.15 dBm = 130.3 mW
Source Based Duty Cycle	0.47
Source Based Output Power	59.9 mW
Power Density	**12.19 uW / cm^2 at 20 cm**
MPE / Limit Ratio	**0.02**

802.11b/g/n:

Frequency	2442 MHz
Limit	1.0 mW/cm^2
Distance	20 cm
Maximum Scaled Power	23.03 dBm = 200.9 mW
TX Ant Gain	-6.16 dBi
EIRP	16.87 dBm = 48.6 mW
Power Density	**9.68 uW / cm^2 at 20 cm**
MPE / Limit Ratio	**0.01**