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Federal Communications Commission
Maximum Permissible Exposure Assessment
for the
Metricom GT modem, GNW 22131

In accordance with

FCC REPORT AND ORDER 96-326
Adopted: August 1, 1996

Background:

The Metricom GS wireless modem is a frequency hopping spread spectrum radio-modem that operates within the 902-928 MHz band. The peak transmit output power of the radio is 1 Watt. The modem is capable of communicating with either Micro-Cellular Data Network (MCDN) microcell radios (GNW 21000) that make up the MCDN network or other MCDN compatible wireless modems.

The modem uses a 1 dBi gain omni-directional monopole antenna. Testing has determined that the typical Tx duty cycle for a modem communicating over the MCDN network is less than 5%. Even though the 5% level is at the upper limit of typical operation, a duty cycle of 100% is used here to yield a worst case analysis. The modem is a classified as a mobile device and is intended to be mounted to the back of a laptop computer display or sit on the desk next to the laptop computer.

MPE Calculations.

The environment in which the modem operates is "uncontrolled". The definitions of controlled and uncontrolled environments are included below from the FCC Report and Order

96-326:B. Definitions of Controlled and Uncontrolled Environments

35. The 1992 ANSI/IEEE guidelines specify two sets of exposure limits based on the "environment" in which the exposure takes place. These environments are classified as either "controlled" or "uncontrolled." Controlled environments are defined as locations where "there is exposure that may be incurred by persons who are aware of the potential for exposure as a concomitant of employment, by other cognizant persons, or as the incidental result of transient passage through areas where analysis shows the exposure levels may be above [the exposure and induced current levels permitted for uncontrolled environment but not those permitted for controlled environments]." Uncontrolled environments are defined as "locations where there is the exposure of individuals who have no knowledge or control of their exposure. The exposures may occur in living quarters or workplaces where there are no expectations that the exposure levels may exceed [the exposure and induced current levels permitted for uncontrolled environments]."

Uncontrolled Environment Spec: $f(\text{MHz})/1500 \text{ mW/cm}^2$
 $902/1500 = .6 \text{ mW/cm}^2$

In this case the modem may be mounted behind the monitor of a laptop or sitting on the desk next to the laptop that it is connected to. If the modem is on the desk next to the laptop, then the minimum distance between the users hand would typically be 5 inches. If the unit were mounted on the back of a laptop display, the typical minimum distance would be approximately 12 to 15 inches.

$$\text{MPE Distance (cm)} = \sqrt{\frac{\text{Antenna Gain (as a ratio)} * \text{Pout(mw)} * \text{Duty Cycle}}{\text{Exposure Limit (mw/cm}^2\text{)} * 4 * \pi}}$$

Calculation:

$$\begin{aligned} \text{MPE Dist(cm)} &= \text{SQRT}((\text{Ant Gain(Ratio)} * \text{Pout(mw)} * \text{Duty Cycle}) / (\text{Limit(mw/cm}^2\text{)} * 4 * \pi)) \\ &= \text{SQRT}((1.25 * 1000 * 1 / .6 * 4 * \pi)) \\ &= \text{SQRT}(1046.25 / 7.534) \\ &= \text{SQRT}(165.870) \end{aligned}$$

$$\text{MPE Dist(cm)} = 12.87 \text{ cm}$$

$$\text{MPE Dist(in)} = 5.07 \text{ in}$$

Conclusion:

The typical distance between the user of the modem is approximately 3 to 4 times greater than the MPE distance under typical use.

Since the modem is a mobile device, and the MPE distance is below the minimum separation distance required of a mobile device, a statement will appear in the modem user manual that will require users to maintain a minimum 20 cm distance between the modem antenna and all persons, during modem operation.

Exposure Limits from FCC96-326 Report and Order, Appendix C, Final Rules is given below.

Table 1. Limits for Maximum Permissible Exposure (MPE)

(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/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.