Metricom®

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To: Federal Communications Commission
Equipment Authorization Division
Applications Processing Branch
Errol Chang
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Re: 731 Conf. number: EA95065
FCC ID: GNW21100
Correspondence Ref Number: 10187

Below are Metricom's replies to the FCC's comments regarding the above application.

FCC COMMENT
1. The filing is requesting for 1.0 W. Maximum measured output is 837 mW at the antenna terminal. Requested output needs revision.
Metricom Reply
A new 731 form will be submitted with the RF output power specified at 837 mW.

FCC COMMENT
2. The user manual is indicating "device does not comply with Part 15 Rules". The RF exposure statement at the end of this section needs revision , it has the wrong separation distance (see below).
Metricom Reply
The manual that was submitted in the application was the manual that was printed up for the Beta test users. At that time, since certification had not been granted, the statement said that the device did not comply with the FCC specifications. The statement that will appear in the final version of the user manual is below.

FCC Compliance
This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause unwanted operation

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following safety measures.

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Consult the dealer or an experienced radio/modem technician for help.

To comply with FCC RF exposure limits, during normal operation, the user should maintain a minimum separation distance of 8 inches between all persons and the antenna of this device.

FCC COMMENT

3. The distance determined by the MPE estimates is 12.87 cm, rounding up to 13 cm, which is inconsistent with the distance indicated in the operators manual. Metricom has declared this to be a "mobile" transmitter for mounting behind lap-top computer displays or on desk-top next to lap-top computers, and estimated RF exposure compliance with respect to MPE limits. A minimum separation distance of 20 cm is required with respect to 2.1091 of FCC Rules. The manual instructions/statements should be revised accordingly; otherwise, compliance must be estimated with respect to 2.1093 using SAR limits (when less than 20 cm).

Metricom Reply

Since classifying the modem as a “mobile” device results in a required minimum separation distance of 20 cm. (approx. 8 inches) even though the MPE distance is less that 20 cm, Metricom will modify the users manual to reflect this 20 cm minimum distance. (See the statement above)

Additionally Metricom has recalculated the MPE distance using the corrected RF power output of 837 mw and the new MPE estimate is in this document as well.

FCC COMMENT

4. The RF exposure statement/instruction indicated in the manual should indicated that when this device is operating, a separation distance of 20 cm or more must be maintained between its antenna and all persons, including users and bystanders, to satisfy FCC RF Exposure requirements. Time-averaging according to typical usage, such as "continuous or extended data transmission" (currently indicated) for purpose of RF exposure is only allowed for controlled exposure environment, which does not apply to this device. The separation distance is a requirement for device operating as a mobile transmitter, not a recommendation as currently indicated in the manual. The statement should be revised accordingly.

Metricom Reply

The statement in the manual has been revised as suggested above.

FCC COMMENT

5. As proposed in the MPE estimates, the device is for lap-top computer use either attached to the back of the display or on desk-top next to the lap-top computer. Operating instructions and procedures, including the required separation distance, should be included in the users manual for these proposed operating conditions for satisfying 15.247(b)(4).

Metricom Reply

The statement in the front of the manual has been revised (See statement above). Additionally, a note informing the user of the minimum separation distance has been placed in the manual within the instructions where the user is instructed to turn the modem on. The note that will appear in the final version of the manual is below.

Note: To comply with FCC RF exposure limits, during normal operation, the user should maintain a minimum separation distance of 8 inches between all persons and the antenna of this device.

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Federal Communications Commission
Maximum Permissible Exposure Assessment
for the
Metricom GS modem, GNW 21100

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(MHz)/1500 mW/cm^2
902/ 1500 = **.6 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 user 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.

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

Calculation:

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MPE Dist(cm)= SQRT( (Ant Gain(Ratio)*Pout(mw)*Duty Cycle)/(Limit(mw/cm^2) *4 * PI) )
            =  SQRT( (       1.25        *  837   *  1    /  .6           *4 * PI) )
            =  SQRT( (                  1046.25       /  7.534          ) )
            =  SQRT (138.87)
MPE Dist(cm) = 11.78 cm
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MPE Dist(in) = 4.63 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/cm2)	Averaging Time (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f2)*	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.