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Federal Communications Commission
Maximum Permissible Exposure Assessment
For the
Novatel Wireless Technologies LTD.
'Merlin for Ricochet' modem, NBZ NRM R900

In accordance with

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

Background:

The Novatel Wireless Technologies 'Merlin for Ricochet' device is a frequency hopping spread spectrum radio-modem that operates within the 902-928 MHz band. The maximum rated transmit output power of the radio is 1 Watt. The modem is designed to operate on Metricom's Micro-Cellular Data Network (MCDN) by communicating with Metricom's microcell radios (GNW 21000).

The modem uses a custom developed Centurion dipole antenna that was measured to have a peak gain of 0 dBi. While a typical Tx duty cycle for a modem communicating over the MCDN network is less than 5% a duty cycle of 100% is used to yield a worst case analysis. The modem is classified as a mobile device and is intended to be inserted into a laptop PCMCIA port.

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 Specification:

$$f(\text{MHz})/1500 \text{ mW/cm}^2 = 902/1500 = .6013 \text{ mW/cm}^2$$

MPE Calculation:

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

Calculation:

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MPE Dist(cm)= SQRT( (Ant Gain(Ratio)*Pout(mw)*Duty Cycle)/(Limit(mw/cm^2) *4 * PI) )
              = SQRT( (      1      *      1000      *      1      /      .6013      *4 * PI) )
              = SQRT( (      1000      /      7.556      ) )
              = SQRT (132.34516)
MPE Dist(cm) = 11.504 centimeters
MPE Dist(in) = 4.529 inches

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Typical Distance to User:

The antenna will typically be separated from the body of the user by 25 or more centimeters (9.84 inches).

Conclusion:

The modem is a mobile device and the MPE distance is well below the minimum required distance required of a mobile device (20 centimeters). **A statement will appear in the modem user manual that will require users to maintain a minimum distance of 20 centimeters between the modem antenna and all persons during device operation.**

Exposure Limits from FCC96-326 Report and Order, Appendix C, Final Rules are presented 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.