RF Exposure Report

MC1000

Equipment:	MC1000 USB Modem
Trade Name:	Novatel MC1000
Model No:	MC1000D
FCC ID:	PKRNVWMC1000
Filing Type:	Class II Permissive Change
Applicant:	Novatel Wireless Inc. 9645 Scranton Road San Diego, California 92121

Table of Contents

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REVISION HISTORY

Rev.	Date	Brief Description of Change	Originator	Approved by
1	03-02-09	Initial Revision	JT	PCTEST Inc.
2	24-04-09	Changed all calculations based on Conducted power figures per compliance report. Changed max antenna gain from 3 dBi to 2.2 dBi.	JT	PCTEST Inc.
3	03-05-09	Changed all product references to MC1000. Revised all MPE figures to account for SBTA.	JT	PCTEST Inc.

1.0 Introduction

This report has been issued to show compliance of the Novatel Wireless MC1000 to the FCC Maximum Permissible Exposure limits as specified in CFR 47 §2.1091 when using the external antenna port and defined as Mobile equipment . The MC1000 is a Cellular/PCS + EV-DO USB modem.

When the external antenna is used the MC1000 is defined as a Mobile configuration as per the FCC Rules, and the user documentation that is available to consumers indicates that the modem must not be used closer than 20 cm to the head or body to ensure safe operation of the device. Also, the maximum gain of an external antenna connected to the antenna port has been defined in the user documentation as 2.2 dBi in both the Cellular and PCS Bands.

1.1. FCC Definitions

As per OET Bulletin 65, three (3) categories of transmitters are defined, these are:

a) **Fixed Installation** – Defined as a fixed location for the transmitter and it's antenna that is physically secured at a permanent location and cannot easily be moved. Typical user distance to the transmitting antenna is ≥ 2 meters.

b) **Mobile Installation** –A mobile device is defined as a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons. In this context, the term ''fixed location'' means that the device is physically secured at one location and is not able to be easily moved to another location. Transmitting devices designed to be used by consumers or workers that can be easily re-located, such as wireless devices associated with a personal computer, are considered to be mobile devices if they meet the 20 centimeter separation requirement.

c) **Portable Installation** - A portable device is defined as a transmitting device designed to be used so that the radiating structure(s) of the device is/are within 20 centimeters of the body of the user.

The FCC categorizes the use of any device based upon the users awareness and ability to exercise control over exposure. The definitions of exposure categories are as follows:

a) **Occupational/Controlled Exposure** – Applicable to situations where the end users are exposed to RF energy during routine daily workplace conditions and are fully aware of said exposure.

b) **General Population/Uncontrolled Exposure** – Applicable to situations where the end users are do not a have an awareness of the potential exposure to RF energy or have no control of said exposure.

For purposes of this investigation, the MC1000 is evaluated using the exposure limits for General Population/Uncontrolled Exposure.

1.2. MPE Calculation Formula

Per FCC §1.1310, the Power Density limit for General Population/Uncontrolled Exposure is:

- For the Cellular Band – 0.558 mW/cm^2
- For the PCS Band – 1.000 mW/cm^2

The calculation is made using the Friis transmission equation:

$$S = EIRP*Duty\ Cycle/4\pi R^2$$

Where:

S = Power Density
EIRP – Effective Isotropic Radiated Power
R = 20 cm distance

1.3. EUT Information

Equipment Under Test: Novatel MC1000
Hardware Revision: Rev 1
Firmware/Software Revision: 6.0.5.1.
Serial Number: N/A (Production Grade Sample)

1.4. Operational Summary

The MC1000 is capable of transmitting in the Cellular/PCS frequency bands and features GPRS/EDGE/WCDMA and EV-DO modulation schemes for WWAN. For purposes of this report, MPE figures for each band is presented operating in the worst case (highest power) mode.

All measurements taken are worst case per band investigated, detailed results can be seen in Report No: 0808191138-R1.PKR, available at:

https://gullfoss2.fcc.gov/oetcf/eas/reports/GenericSearch.cfm (MC1000)

1.5 .MPE Figures

Maximum Antenna Gain = 2.2 dBi

Case One: GSM 850

Maximum Conducted RF Power Cellular Band: 32.20 dBm

a) Configuration: 1 slot up = 12.5% Duty Cycle

32.20dBm + 2.2 dBi (antenna) = 34.40 dBm
34.40dBm = 2754.228 mW
2754.228 mW * 0.125 = 344.2785 mW

Maximum EIRP (mw)	Calculated RF Exposure D = 20 cm	Limit (mW/cm^2)
344.2785	0.0685 mW/cm^2	0.558

b) Configuration: 2 slot up = 25 % Duty Cycle

32.20dBm + 2.2 dBi (antenna) = 34.40 dBm
34.40dBm = 2754.228 mW
2754.228 mW * 0.25 = 688.557 mW

Maximum EIRP (mw)	Calculated RF Exposure D = 20 cm	Limit (mW/cm^2)
688.557	0.137 mW/cm^2	0.558

c) Configuration: 4 slot up = 50 % Duty Cycle

32.20dBm + 2.2 dBi (antenna) = 34.40 dBm
34.40dBm = 2754.228 mW
2754.228 mW * 0.50 = 1377.114 mW

Maximum EIRP (mw)	Calculated RF Exposure D = 20 cm	Limit (mW/cm^2)
1377.114	0.274 mW/cm^2	0.558

Case Two: PCS 1900

Maximum Conducted RF Power PCS Band: 29.10 dBm

a) Configuration: 1 slot up: = 12.5 % Duty Cycle

29.10 dBm + 2.2 dBi (antenna) = 31.3 dBm
31.30 dBm = 1348.962 mW
1348.962 mW* 0.125 = 168.62 mW

Maximum EIRP (mw)	Calculated RF Exposure D = 20 cm	Limit (mW/cm^2)
168.62	0.034 mW/cm^2	1.000

b) Configuration: 2 slot up: = 25 % Duty Cycle

29.10 dBm + 2.2 dBi (antenna) = 31.3 dBm
31.30 dBm = 1348.962 mW
1348.962 mW* 0.25 = 337.24 mW

Maximum EIRP (mw)	Calculated RF Exposure D = 20 cm	Limit (mW/cm^2)
337.24	0.067 mW/cm^2	1.000

c) Configuration: 4 slot up = 50 % Duty Cycle

29.10 dBm + 2.2 dBi (antenna) = 31.3 dBm
31.30 dBm = 1348.962 mW
1348.962 mW* 0.50 = 674.481 mW

Maximum EIRP (mw)	Calculated RF Exposure D = 20 cm	Limit (mW/cm^2)
674.481	0.134 mW/cm^2	1.000

2.0 Conclusion

As presented in the previous section, the MC1000 complies with all requirements for Maximum Permissible Exposure per CFR 47 §2.1091 defined as Mobile equipment with a minimum separation distance between the end user and the antenna(s) of 20cm.