



**NOVATEL WIRELESS.**

## RF Exposure Report

**MIFI-2352**

Equipment:	MIFI2352 Hotspot
Trade Name:	Novatel MIFI2352
Model No:	MIFI2352
FCC ID:	NBZNRM-MIFI2352
Filing Type:	Original Certification
Applicant:	Novatel Wireless Inc. 9645 Scranton Rd Suite 205 San Diego, Ca 92121-3030

# Table of Contents

1.0 Introduction.....	3
1.1. FCC Definitions.....	3
1.2. MPE Calculation Formula.....	4
1.3. EUT Information.....	4
1.4. Operational Summary .....	5
1.5 .MPE Figures .....	5
1.6. Co-Location MPE Figures .....	6
2.0 Conclusion .....	7

## 1.0 Introduction

This report has been issued to show compliance of the Novatel Wireless MIFI2352 to the FCC Maximum Permissible Exposure limits as specified in CFR 47 §2.1091. The MIFI2352 is a Cellular/PCS + 802.11 “Hotspot”.

The MIFI2352 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.

The MIFI2352 is defined as having radios operating in a co-location mode therefore the individual MPE values are added together in the calculations and expressed as a overall percentage of the co-located MPE values per band/mode of operational pairs.

### 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  $\geq 2$  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 have an awareness of the potential exposure to RF energy or have no control of said exposure.

For purposes of this investigation, the MIFI2352 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<sup>2</sup>
- For the PCS Band – 1.000 mW/cm<sup>2</sup>
- For the ISM Band (2.4 GHz) – 1.000 mW/cm<sup>2</sup>

The calculation is made using the Friis transmission equation:

$$S = EIRP/4\pi R^2$$

Where:

S = Power Density

EIRP – Effective Isotropic Radiated Power

R = 20 cm distance

## **1.3. EUT Information**

Equipment Under Test: Novatel Wireless MIFI-2352

Hardware Revision: F2

Firmware/Software Revision: 5.7.00-0

Serial Number: N/A (Production Grade Sample)

## 1.4. Operational Summary

The MIFI2352 is capable of transmitting in the Cellular/PCS and ISM (2.4 GHz) frequency bands and features GPRS/EDGE and WCDMA modulation schemes for WWAN, DSSS/ OFDM for 802.11 b/g operation . 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 NTS Report No: CG-1161-RA-1-0 for the Cellular/PCS bands and PCTEST report No. 0812101726.NBZ for the 802.11 ISM band.

Note that the function of the MIFI2352 allows for simultaneous transmission of the following radio pairs:

- Cellular/802.11 b/g
- PCS/802.11 b/g

For the co-locations calculations, the radio pairs will be assessed independently.

Antenna Gain Parameters:

Cellular/PCS (Typical): N/A, measured value in reports  
802.11 : 2.2 dBi (Peak)

## 1.5 .MPE Figures

Case One: GSM 850

Maximum EIRP = 34.71 dBm (2958.012 mW)

Worst Case = 4 Up slots = 50% Duty Cycle.

$$\text{Power Density} = \text{EIRP} * \text{DutyCycle} / 4\pi R^2$$

$$= 2958.012 * .50 / (4 * \pi * 20^2) = 1479.006 \text{ mW/cm}^2$$

Maximum EIRP	Calculated RF Exposure D = 20 cm	Limit (mW/cm <sup>2</sup> )	% of Total
1479.006	0.2943 mW/cm <sup>2</sup>	0.558 mW/cm <sup>2</sup>	52.7%

Case Two: PCS 1900

Maximum EIRP (mw)	Calculated RF Exposure D = 20 cm	Limit (mW/cm <sup>2</sup> )	% of Total
1949.844	0.388 mW/cm <sup>2</sup>	1.000 mW/cm <sup>2</sup>	38.8%

Case Three: 802.11 (g)

Note: For purposes of calculating co-located MPE figures, the calculated value for the 802.11 device will be expressed as a percentage of the limit defined per the operating band of the Cellular and PCS radios.

Calculation One : PCS Band

Maximum EIRP (mw)	Calculated RF Exposure D = 20 cm	Limit (mW/cm <sup>2</sup> )	% of Total
45.08	0.009 mW/cm <sup>2</sup>	0.558 mW/cm <sup>2</sup>	0.016%

Calculation Two : PCS Band

Maximum EIRP (mw)	Calculated RF Exposure D = 20 cm	Limit (mW/cm <sup>2</sup> )	% of Total
45.08	0.009 mW/cm <sup>2</sup>	1.000 mW/cm <sup>2</sup>	0.009%

**1.6. Co-Location MPE Figures**

Radio Operational Pair Cellular (GSM) and 802.11 (g)

Radio	% of Limit
Cellular	52.7
802.11(g)	0.016

Total Co-location MPE % = 52.716

Radio Operational Pair PCS (GSM) and 802.11 (g)

Radio	% of Limit
PCS	38.8
802.11(g)	0.009

Total Co-location MPE % = 38.809

## 2.0 Conclusion

As presented in the previous section, the MIFI2352 “Hotspot” complies with all requirements for Maximum Permissible Exposure per CFR 47 §2.1093, defined as Mobile equipment with a minimum separation distance between the end user and the antenna(s) of 20cm.