



**HYPER CORP**

**"Wireless that Works"™**

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# **MPE Safe Distance Calculation**

**Report No.: 138-0210004-BTMOD**

**Product Name: Wilcoxon Bluetooth Radio Module**

**Issued Date: January 23, 2003**

**Applicant:**

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## Signature Page

**The below listed Hyper Corporation Personnel takes responsibility  
for the contents of this Test Report.**

### Signatures

**Test Engineer(s):**

Original signature on file

**01.23.03**

**William Elliott**

**Date**

**Reviewed by**

**Technical**

**Manager:**

Original signature on file

**01.23.03**

**Kevin Marquess**

**Date**



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## 1. List of Revisions

Version	Date	Author(s)	Description
001	January 23, 2003	William Elliott	Initial Version



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### 2. Disclaimer Notice

This test report applies only to the EUT (Equipment Under Test) and the results of the specifications called out in this report.

The test results contained herein relate only to the model(s) identified. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical characteristics.

This Report must not be used to claim product endorsement by A2LA or any agency of the U.S. Government.

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## 4. General Information

### 4.1 Identification of the EUT

Manufacturer: Wilcoxon Research

Model No.: Wilcoxon Research's C1B

Hardware Version: V6

Software Version: Ver 443 BC02X\_HCI\_(V)\_15.3\_56

FCC ID: QAQMAYMAN

Frequency Range: 2402 MHz ~ 2480 MHz

Channel Number: 79

Frequency of Each Channel:  $2402 + k$  (MHz),  $k=0\sim78$

Type of Modulation: GFSK

Manufacturer Specified Max. Power Output: +11.8 +/- 2 dBm

Sample Received Date: December 15, 2002

Test Dates: January 14, 2003

Test Facility: Hyper Corporation

1279 Quarry Lane, Suite B  
Pleasanton, CA 94566, USA

### 4.2 Antenna Description

Antenna(e):

1) 1 Wavelength PCB Patch Antenna  
Peak gain: 2.43 dBi

2) Half-Wavelength Center-feed Balanced Dipole  
Peak gain: 2.20 dBi



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## 4.3 Maximum Permissible Exposure

### 4.3.1 Calculations

$$E = \text{SQR ROOT } (30 * P * G) / d$$

And

$$S = E^2 / 3770$$

Where

E = Field Strength in Volts/meter  
P = Power In Watts  
G = Numeric Antenna Gain  
d = Distance in Meters  
S = Power Density in mW / square cm

Combining equations and rearranging the terms to express d as a function of the other variables yields:

$$d = \text{SQR ROOT } (30 * P * G) / (3770 * S)$$

Changing to units of mW and cm::

$$P(\text{mW}) = P(\text{W}) / 1000$$

And

$$d(\text{cm}) = 100 * d(\text{m})$$

Yields

$$d = 100 * \text{SQR ROOT } ((30 * P * G) / (3770 * S))$$

Therefore

$$d = 0.282 * \text{SQR ROOT } (P * G / S)$$



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Where

d = Distance in Meters  
P= Power In mW  
G = Numeric Antenna Gain  
S= Power Density in mW / cm<sup>2</sup>

Substituting the log form of gain and power:

$$P \text{ (mW)} = 10^{(P(\text{dBm})/10)}$$

And

$$G \text{ (numeric)} = 10^{(G(\text{dBi}) / 10)}$$

Yields

$$\underline{d = .282 * 10^{((P+G) / 20)} / (\text{SQR ROOT } (S))}$$

Where

d = MPE Safe Distance in cm  
P= Power In dBm  
G = Antenna Gain in dBi  
S= Power Density Limit in mW / cm<sup>2</sup>

#### 4.3.2 Results

#### 2.4 GHz Bluetooth Transceiver

EUT Output Power = +11.83 (Section 4.1)  
Antenna Gain = 2.43 dBi (Section 4.2)  
S = 1.0 mW / cm<sup>2</sup> (CFR 47 Part 1.1310)

Minimum MPE safe distance (using equation above) = **1.46 cm**

Safe distance compliant with 20 cm separation distance mandatory for mobile transmitters.

Unit is compliant



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