**Exhibit B: Test Report**
**MedDorna, LLC**
**Spirometer Transmitter**

Project Number: 05249-10

Prepared for:
MedDorna, LLC.
20270 Front Street NE Suite 203
Poulsbo, WA 98370

By

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December 2004

# CERTIFICATION
# Electromagnetic Interference Test Report
# MedDorna, LLC.
# Spirometer Transmitter

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| | |
|---|---|
| Applicant: | MedDorna, LLC |
| Applicant's Address: | 20270 Front Street NE Suite 203 |
| | Poulsbo, WA 98370 |
| FCC ID: | SX5-SPIRO18100 |
| Project Number: | 05249-10 |
| Test Dates: | November 12-29, 2004 |

The **, MedDorna, LLC Spirometer Transmitter** was tested to and found to be in compliance with FCC 47 CFR Part 15, Subpart C for a transmitter.

The highest emissions generated by the above equipment are listed below:

| | Frequency (MHz) | Level | Limit | Margin (dB) |
|---|---|---|---|---|
| Peak Power | 2479.9 | 0.13 dBm | +30 dBm | 29.87 |
| Spurious | 7323 | 59.2 dBuV/m | 63.5 dBuV/m | -4.3 |
| Occupied Bandwidth | 999 kHz | | | |

I, Michael A. Royer, for Professional Testing (EMI), Inc., being familiar with the FCC rules and test procedures have reviewed the test setup, measured data and this report. I believe them to be true and accurate.

Michael A. Royer, BSEE, NCE
EMC Department Manager

This report has been reviewed and accepted by **MedDorna, LLC**. The undersigned is responsible for ensuring that**, MedDorna, LLC Spirometer Transmitter** will continue to comply with the FCC rules.

_____

## 1.0 Introduction

### 1.1 Scope

This report describes the extent of the Equipment Under Test (EUT) conformance to the Electromagnetic Compatibility requirements of FCC 47 CFR Subpart C.

### 1.2 EUT Description

The **MedDorna, LLC Spirometer** is a wireless medical device. The device measures the air pressure in a patient's airway during a breathing cycle and transmits the data via a Bluetooth link to a data logger which consists of a Personal Digital Assistant with Bluetooth capabilities. The EUT is a Frequency Hopping Spread Spectrum (FHSS) device that operates in the ISM band of 2400-2483.5 MHz. The EUT employs 79 channels from 2402-2480 MHz each spaced 1 MHz apart. It contains an internal antenna. The device acquires its power from a 4.1 Volt Lithium Ion battery.

### 1.3 EUT Operation

The **MedDorna, LLC Spirometer** was tested while in a continuous transmit mode. The EUT was tuned to a low, middle, and high channel to perform power and occupied bandwidth tests. For spurious/harmonic and conducted emissions the device was tuned to its center frequency. The EUT continuously transmitted a DH5 modulated Bluetooth packet with the PRBS9 format. The system tested consisted of the following:

| Manufacturer & Model | Description |
|---|---|
| MedDorna LLC Spirometer Transmitter | Bluetooth Transmitter |

The following guidelines apply to the operation of the EUT:

| | |
|---|---|
| 47 CFR 15.247 | Transmitter Characteristics |
| 47 CFR 15.205, 15.209, 15.247 | Spurious Radiated Power |
| 47 CFR 15.203 | Antenna Requirements |

## 2.0 Peak Output Power Measurements

Peak power measurements were made on the fundamental transmit frequencies for the **MedDorna, LLC Spirometer**. Measurements of the maximum emission levels for the fundamental of the EUT were made at the Professional Testing "Open Field" Site 3, located in Round Rock, Texas. A "Description of Measurement Facilities" has been submitted to the FCC and approved pursuant to Section 2.948 of CFR 47 of the FCC rules.

Tests of the fundamental emissions of the EUT were made to determine the worse case polarization of the device. The emissions of the device were measured with the EUT in three orthogonal axis.

## 2.1 Test Procedure

The EUT was placed on a non-conductive table 0.8 meters above the ground plane. The table was centered on a motorized turntable, which allows 360-degree rotation. For measurements of the fundamental signal, a measurement antenna was positioned at a distance of 3 meters as measured from the closest point of the EUT. Rotating the EUT maximized the emissions.

A spectrum analyzer with peak detection was used to find the maximum field strength. A calculation was then made to determine the peak power at the antenna terminal. A drawing showing the test setup is given in Appendix A.

## 2.2 Test Criteria

The maximum peak output power is 30 dBm for FHSS devices operating in the frequency range 2400-2483.5 MHz employing at least 75 hopping channels according to 15.247(b)(1).

## 2.3 Test Results

Test setup is included in Appendix A. Peak field strengths for three frequencies and associated calculations are given in Appendix B. The peak power found was 0.13 dBm which is below the 30 dBm average limit. The **MedDorna, LLC Spirometer** complies with 15.247(b)(1).

# 3.0 Occupied Bandwidth Measurements

Occupied bandwidth measurements were performed on the **MedDorna, LLC Spirometer** to determine compliance with 15.247(a)(1)(ii). Measurements of the occupied bandwidth of the EUT were made at the Professional Testing "Open Field" Site 3, located in Round Rock, Texas.

## 3.1 Test Procedure

The occupied bandwidth was measured with a spectrum analyzer connected to a double-ridged guide horn while the EUT was operating in continuous transmit mode at the appropriate center frequency. The analyzer center frequency was set to the EUT carrier frequency. Display line and marker delta functions were used to measure the 20 dB occupied bandwidth of the EUT. Measurements were made at three frequencies. A drawing showing the test setup is given in Appendix A.

## 3.2 Test Criteria

The maximum occupied bandwidth for the EUT is 1 MHz as stated in 15.247(a)(1)(ii).

## 3.3 Test Results

Test setup is included in Appendix A. Occupied bandwidths for three frequencies are given in Appendix B. All occupied bandwidth measurements were below the 1 MHz limit. The **MedDorna, LLC Spirometer** complies with 15.247(a)(1)(ii).

# 4.0 Hopping Channel Separation

Hopping channel separation measurements were performed on the **MedDorna, LLC Spirometer** to determine compliance with 15.247(a)(1). Measurements of the channel separation of the EUT were made at the Professional Testing "Open Field" Site 3, located in Round Rock, Texas.

## 4.1 Test Procedure

The hopping channel separation was measured with a spectrum analyzer connected to a double-ridged guide horn while the EUT was operating in continuous transmit mode on a single channel. The analyzer was placed in max hold mode on trace A to capture the emission. The EUT was then tuned to the next adjacent channel. The analyzer was set to max hold mode on trace B to capture the emission. The separation of the peaks on trace A and B were measured using marker delta functions.

## 4.2 Test Criteria

According to 15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Refering back to the results of section 3 the greatest 20 dB bandwidth is 909 kHz. The minimum channel separation should be greater than 909 kHz.

## 4.3 Test Results

Test setup is included in Appendix A. A plot of hopping channel separation is given in Appendix B. The hopping channel separation was measured at 1 MHz. The **MedDorna, LLC Spirometer** complies with 15.247(a)(1).

## 5.0 Number of Hopping Frequencies Used

A measurement of the number of hopping frequencies used was performed on the **MedDorna, LLC Spirometer** to determine compliance with 15.247(a)(1)(iii). Measurements of the number of hopping frequencies used were made at the Professional Testing "Open Field" Site 3, located in Round Rock, Texas.

### 5.1 Test Procedure

The ISM band of 2400-2483.5 was segmented into four 21 MHz ranges. The EUT was allowed to operate in its normal frequency hopping state while the spectrum analyzer was in max hold mode. When the signals filled the trace they were plotted. The spectrum analyzer was set to the next 21 MHz range and the procedure repeated until the whole band was covered. The peaks were counted to asses the number of channels used.

### 5.2 Test Criteria

Frequency hopping systems in the 2400-2483.5 MHz range shall use at least 75 hopping channels according to 15.247(a)(1)(iii).

### 5.3 Test Results

Test setup is included in Appendix A. Four plots covering the entire ISM band are included in Appendix B. The number of hopping channels measured was 79. The **MedDorna, LLC Spirometer** complies with 15.247(a)(1)(iii).

## 6.0 Dwell Time On Each Channel and Hop Rate

Dwell time on a channel was performed on **MedDorna, LLC Spirometer** to determine compliance to 15.247(a)(1)(iii). Measurements of the dwell time on each channel of the EUT were made at the Professional Testing "Open Field" Site 3, located in Round Rock, Texas.

### 6.1 Test Procedure

To measure the duration of one pulse the spectrum analyzer is set to the center frequency of any one channel. The resolution bandwidth is set to 100 kHz and video bandwidth is greater than resolution bandwidth. The analyzer is set to zero span with 5 mS sweep time. The duration of one pulse is captured and measured with marker delta functions.

The number of hops rate must also be measured. A ridge guide horn connected through a zero bias schotky diode detector to an oscilloscope was used to measure the number of hops in an interval. The result is then extrapolated to determine the number of hops in one second.

## 6.2 Test Criteria

For frequency hopping systems in the 2400-2483.5 MHz band the average time occupied on one channel may not be greater than 0.4 seconds in a time frame of 0.4 seconds times the number of hopping channels according to 15.247 (a)(1)(iii). The result of section 5 determined the number of hopping channels used. The number of hopping channels from section 5 is 79. 0.4 seconds times 79 hopping channels results in a 31.6 second period. The average time occupied on any one channel shall not be greater than 0.4 seconds in a 31.6 second period.

## 6.3 Test Results

Test setup is included in Appendix A. Plots showing the duration of one pulse and hop rate are included in Appendix B. Calculations for the dwell time on each channel are in Appendix B. The **MedDorna, LLC Spirometer** meets the requirements of 15.247 (a)(1)(iii).

# 7.0 Band Edge Spurious Emissions

Band edge spurious emissions measurements were performed on **MedDorna, LLC Spirometer** to determine compliance to 15.247(c). Measurements of the band edge spurious emissions of the EUT were made at the Professional Testing "Open Field" Site 3, located in Round Rock, Texas.

## 7.1 Test Procedure

The EUT was placed on a non-conductive table 0.8 meters above the ground plane. The table was centered on a motorized turntable, which allows 360-degree rotation. For measurements of the fundamental signal, a measurement antenna was positioned at a distance of 3 meters as measured from the closest point of the EUT. Rotating the EUT maximized the emissions.

The spectrum analyzer was set for peak detection using a 100 kHz resolution bandwidth. The span is set to 10 MHz with the center of the display at the frequency of the band edge. Measurement is made at the band edge to determine if the EUT meets the test criteria.

## 7.2 Test Criteria

According to 15.247(c) the band edge spurious emissions must be 20 dB below the highest peak in the operating band in any 100 kHz bandwidth. If the frequency falls in the restricted bands of 15.205 the maximum permitted average must be below the field strength listed in 15.209.

Alternatively, the band edge spurious emissions will meet criteria if they are attenuated below the limits specified in 15.209.

## 7.3 Test Results

Test setup is included in Appendix A. Plots and associated data sheets are included in Appendix B. The peak and average band edge spurious emissions fall below the limits of 15.209. The **MedDorna, LLC Spirometer** is compliant with 15.247(c).

## 8.0 Out of Band Spurious Emissions

Out of band spurious/harmonic emissions measurements were performed on **MedDorna, LLC Spirometer** to determine compliance to 15.247(c) and 15.209. Measurements of the spurious emissions of the EUT were made at the Professional Testing "Open Field" Site 3, located in Round Rock, Texas.

## 8.1 Test Procedure

The EUT was placed on a non-conductive table 0.8 meters above the ground plane. The table was centered on a motorized turntable, which allows 360-degree rotation. For measurements of the fundamental signal, a measurement antenna was positioned at a distance of 3 meters as measured from the closest point of the EUT. Rotating the EUT maximized the emissions.

For spurious emissions below 1 GHz quasi-peak detection is used with a resolution bandwidth of 120 kHz. For spurious/harmonic emissions above 1 GHz peak detection with a resolution bandwidth of 1 MHz. Average detection above 1 GHz is used to determine compliance of the EUT if the peak does not meet the average limit. A resolution bandwidth of 1 MHz and video bandwidth of 10 Hz is used for average detection.

Testing was completed with a representative frequency in the center of the ISM band to determine compliance. If emissions measured are close to the limit data will be taken at a low, middle, and high channel.

## 8.2 Test Criteria

The radiated limits of 15.209 are shown below. The limits specified are at 3 meters. The limits are quasi-peak for emissions below 1 GHz and average for emissions above 1 GHz. Also above 1 GHz the peak limit is 20 dB above the average limit.

| Frequency MHz | Test Distance (Meters) | Field Strength (uV/m) | (dBuV/m) |
|---|---|---|---|
| 30 to 88 | 3 | 100 | 40.0 |
| 88 to 216 | 3 | 150 | 43.5 |
| 216 to 960 | 3 | 200 | 46.0 |
| Above 960 | 3 | 500 | 54.0 |

Note: Emissions above 1 GHz were measured at a distance of 1 meter. The limit was increased by 9.5 dB.

## 8.3 Test Results

Test setup is included in Appendix A. Data sheets are included in Appendix B. The peak and average out of band spurious/harmonic emissions fall below the limits of 15.209. The **MedDorna, LLC Spirometer** is compliant with 15.247(c).

# 9.0 Antenna Requirements

An antenna evaluation was performed on the **MedDorna, LLC Spirometer** determine compliance with 15.203 and 15.247(b). Evaluation of the antenna requirements of the EUT were made at the Professional Testing "Open Field" Site 3, located in Round Rock, Texas.

## 9.1 Evaluation Procedure

The antenna of the EUT is analyzed with respect to the rules of 15.203. Gain of the antenna is assessed by reviewing the manufacturer's data sheet.

## 9.2 Evaluation Criteria

Section 15.203 of the rules states that the subject device must meet at least one of the following criteria:

a) Antenna be permanently attached to the unit.
b) Antenna must use a unique type of connector to attach to the EUT.
c) Unit must be professionally installed. Installer shall be responsible for verifying that the correct antenna is employed with the unit.

Section 15.247(b)(4)(i) states that if the transmitting antenna has a directional gain greater than 6 dBi the power shall be reduced the amount in dB that the directional gain is greater than 6 dBi.

## 9.3 Evaluation Results

The transmitting antenna is permanently soldered to the board internally. According to the data sheet for the antenna used the gain is 3 dBi maximum. The **MedDorna, LLC Spirometer** is compliant with 15.203 and 15.247(b)(4)(i).

## 10.0 Radio Frequency Exposure

Radio Frequency exposure was evaluated on the **MedDorna, LLC Spirometer** to determine compliance with 15.247(b)(5). Evaluation of the radio frequency exposure of the EUT was made at the Professional Testing "Open Field" Site 3, located in Round Rock, Texas.

## 10.1 Evaluation Procedure

The Friis transmission formula was applied to the peak power measurements obtained in section 2. The minimum distance from the body is obtained where radio frequency exposure reaches the limit. The distance is compared with the normal distance of operation from the body.

## 10.2 Evaluation Criteria

According to FCC 1.1307(b) the limits for maximum permissible exposure (MPE) from 1.1310 must be used to evaluate the impact of human exposure to radio frequency radiation. The limits from 1.1310 are listed below:

| Frequency MHz | Power Density ($mW/cm^2$) | Average Time (Minutes) |
|---|---|---|
| (B) Limits for Occupational / Controlled Exposures | | |
| 30-300 | 1.0 | 6 |
| 300-1500 | f/300 | 6 |
| 1500-100,000 | 5 | 6 |
| (B) Limits for General Population / Uncontrolled Exposures | | |
| 30-300 | 0.2 | 30 |
| 300-1500 | f/1500 | 30 |
| 1500-100,000 | 1.0 | 30 |

## 10.3 Evaluation Results

Calculations are included in Appendix B. The RF exposure for the EUT falls below the limits in 1.1310. The **MedDorna, LLC Spirometer** is compliant with 15.247(b)(5).

## 11.0 Modifications to EUT

No modifications were made to the EUT.

## 12.0 List of Test Equipment

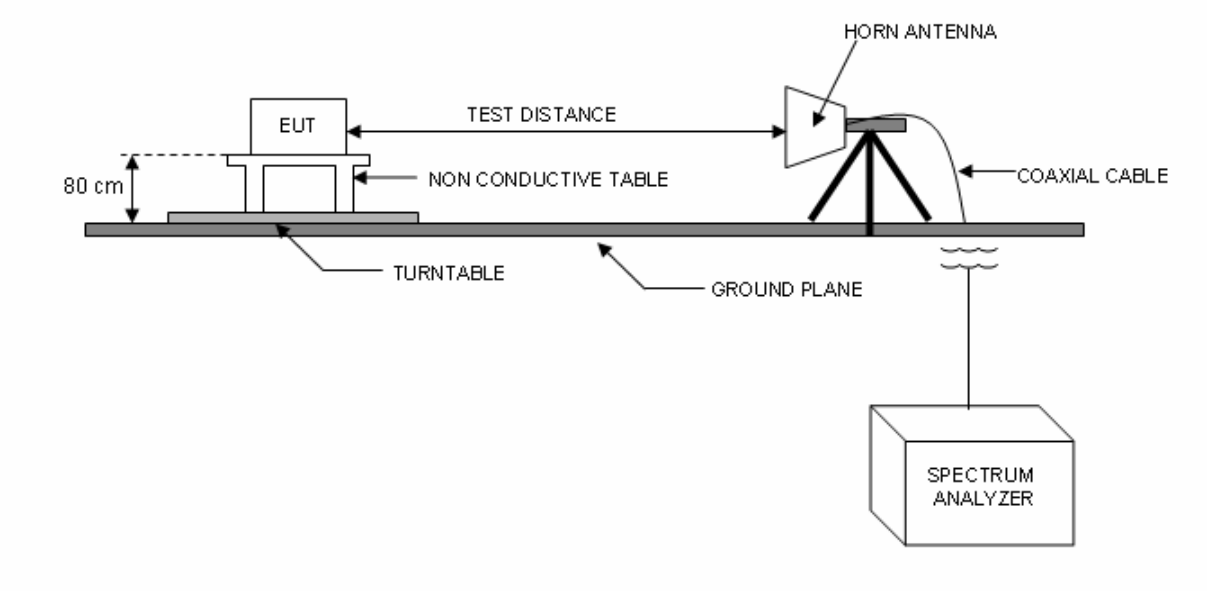
| | Asset # | Equipment | Calibration Date |
|---|---|---|---|
| **Pulse** | | | |
| | 0668 | AEL H-1498 2-18GHz | Not Required |
| | | PE8014 Diode Detector | Calibrated Before Use |
| | 0662 | Tektronix THS720P Oscilloscope | November 2004 |
| | | | |
| **Transmitter Characterization** | | | |
| | 0747 | Advantest R3265 Spectrum Analyzer | November 2005 |
| | C031 | PTI 1.5m Microwave Cable | November 2005 |
| | 0582 | EMCO 3115 1-18GHz Double Ridge Guide Antenna | July 2005 |

| | | | |
|---|---|---|---|
| **Peak Power/ Harmonics** | | | |
| | 0084 | HP 8566B Spectrum Analyzer | January 2005 |
| | 0447 | Miteq 20dB Preamplifier | November 2005 |
| | 0897 | Miteq 30 dB Preamplifier | May 2005 |
| | C030 | PTI 15m Hardline | September 2005 |
| | 0989 | Microtronics HPM 5011 2.5 GHz HPF | Calibrate Before Use |
| | 0267 | EMCO 3115 1-18 GHz Double Ridge Guide Antenna | July 2005 |
| | | | |
| **Spurious Emissions** | | | |
| | 0483 | HP 8447D Preamplifier | January 2005 |
| | 0085 | HP 85650A Quasi-peak Adapter | January 2005 |
| | 0754 | Compliance Design B-100 Biconical Antenna | June 2005 |
| | 0008 | EMCO 3146 Log Periodic Antenna | July 2005 |
| | 0746 | Tektronix 2706 RF Preselector | January 2005 |
| | C005 | PTI Site 3 Cables | January 2005 |
| | | | |
| **Conducted Emissions** | | | |
| | 0978 | HP 8568A Spectrum Analyzer | November 2005 |
| | 0275 | HP 85650A Quasi-peak Adapter | February 2005 |
| | 0474 | PTI Limiter | November 2004 |
| | 0472 | PTI CISPR 16 HPF | November 2004 |
| | 0543 | PTI 10m Cable | November 2004 |
| | 0759 | Solar 8012 LISN | November 2004 |

# Appendix A Test Setup Diagrams

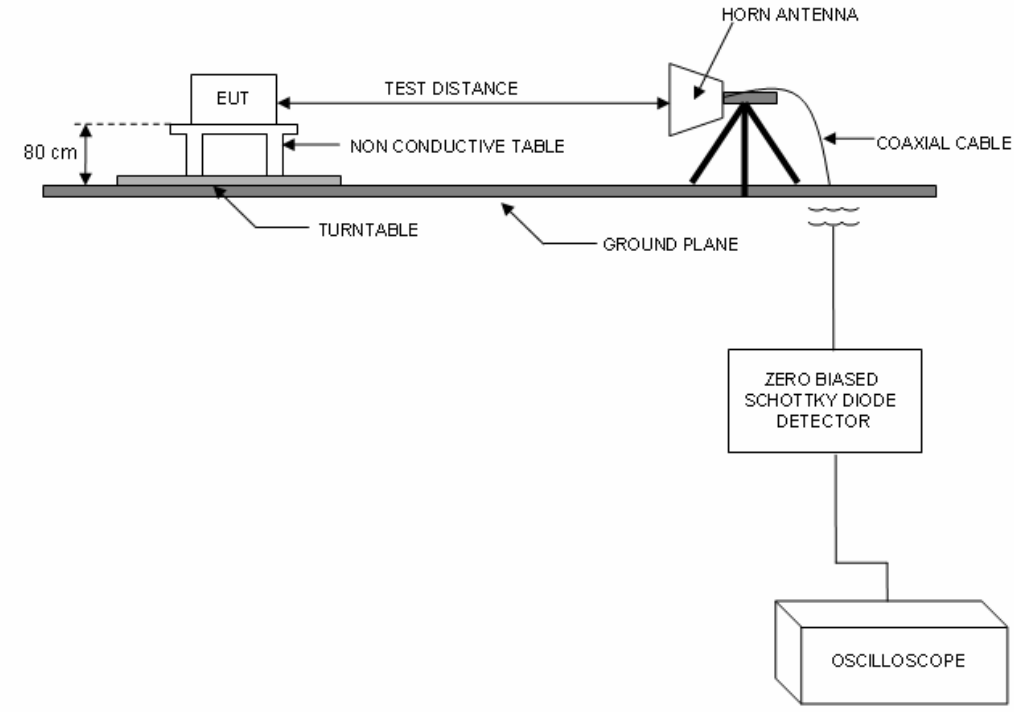
**Radiated Test Setup**

Peak Power, Occupied Bandwidth, Channel Separation, Number of Hopping Frequencies, Pulse Duration, Band Edge Spurious

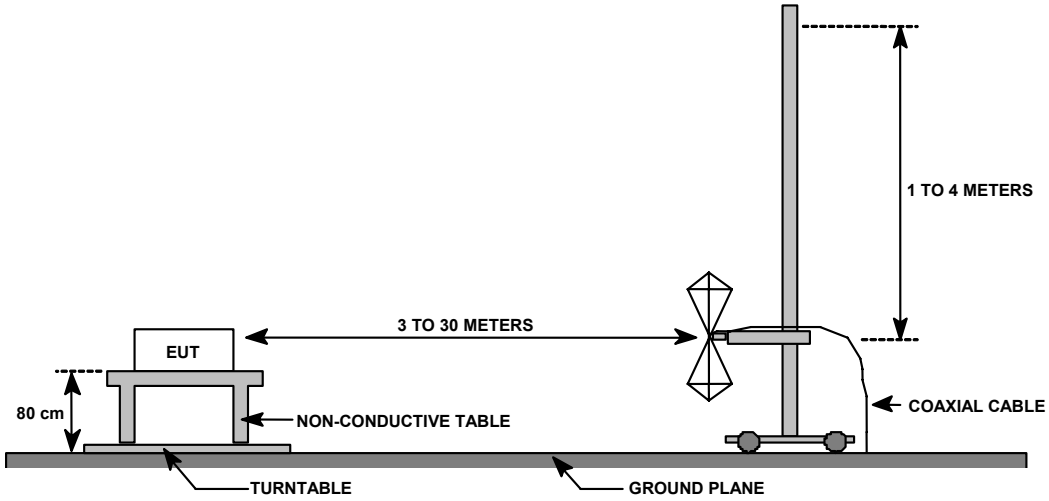



**Radiated Test Setup**

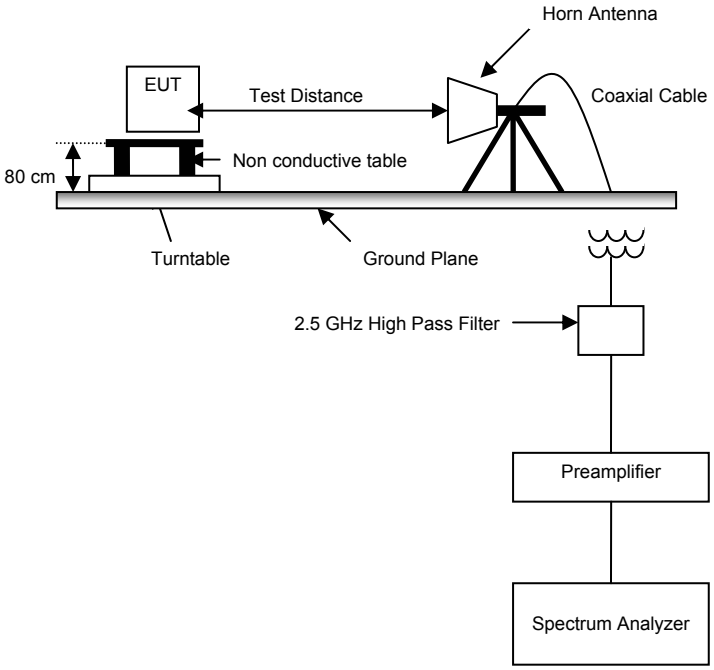
Hop Rate



**Radiated Test Setup**
Spurious




**Radiated Test Setup**
Harmonics



# Appendix B Data Sheets and Calculations

**Peak Power**
**MedDorna, LLC Spirometer**
**Peak Detection, RBW = 1 MHz**
**Test Distance 3 meters**

Test Date: November 12, 2004

**All Orientations**

| Freq. (MHz) | EUT Dir (Deg.) | Antenna Elevation (Meters) | Recorded Level (dBuV) | Amplifier Gain (dB) | Antenna Factor (dB/M) | Cable Loss (dB) | Corrected Level (dBuV/M) |
|---|---|---|---|---|---|---|---|
| 2402.8 | max | level | 60.3 | 0.0 | 28.2 | 5.3 | 93.8 |
| 2441.8 | max | level | 60.6 | 0.0 | 28.2 | 5.4 | 94.2 |
| 2479.9 | max | level | 61.6 | 0.0 | 28.3 | 5.5 | 95.3 |

**Calculations**

$$P = \frac{(E * d)^2}{30 * G}$$

P=Power in watts, E=measured maximum field strength in V/m, d=distance in meters,
G=numeric gain of transmitting antenna

Distance=3 meters
Gain=0 dBi

**Calculated Result**

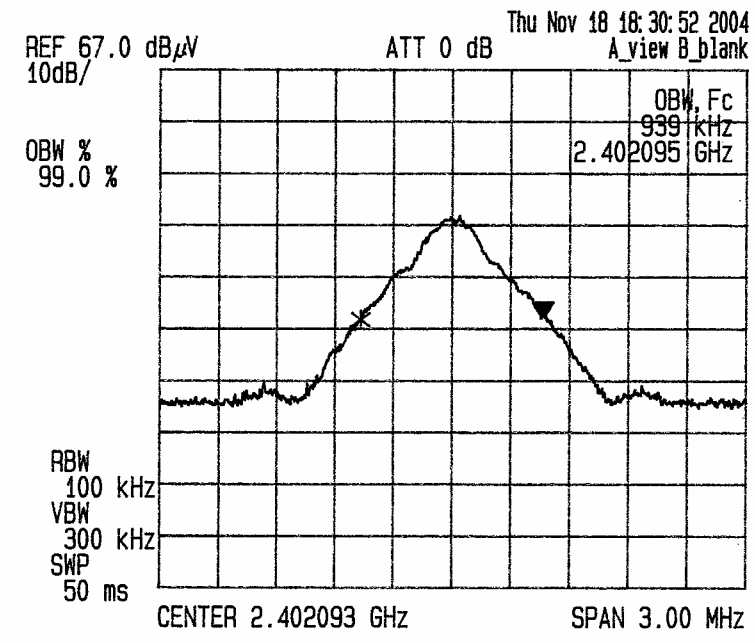
| Frequency (MHz) | Field Strength (dB/uV) | Power (dBm) | Limit (dBm) |
|---|---|---|---|
| 2402.8 | 93.8 | -1.43 | 30 |
| 2441.8 | 94.2 | -1.03 | 30 |
| 2479.9 | 95.3 | 0.13 | 30 |

**Result: Pass**

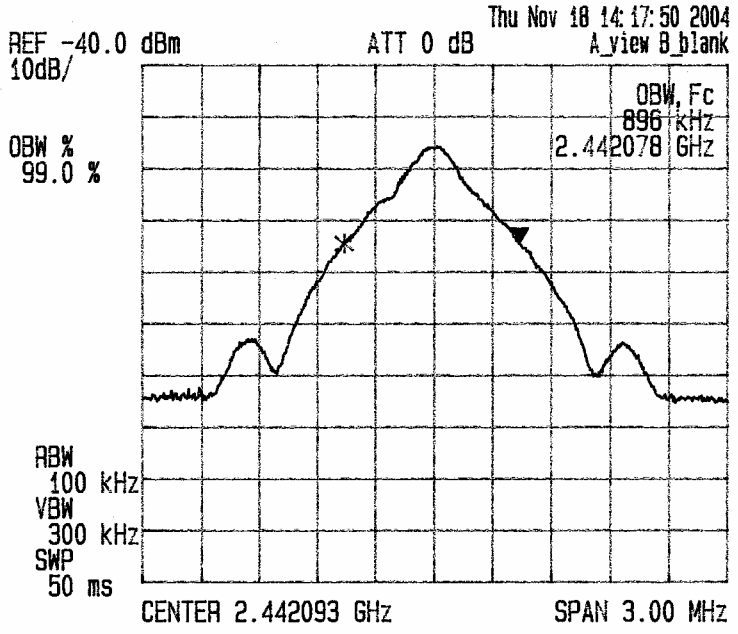
**Occupied Bandwidth**
**MedDorna, LLC Spirometer**
**Peak Detection, RBW = 100 kHz**

Test Date: November 19-22, 2004

**Low Channel**



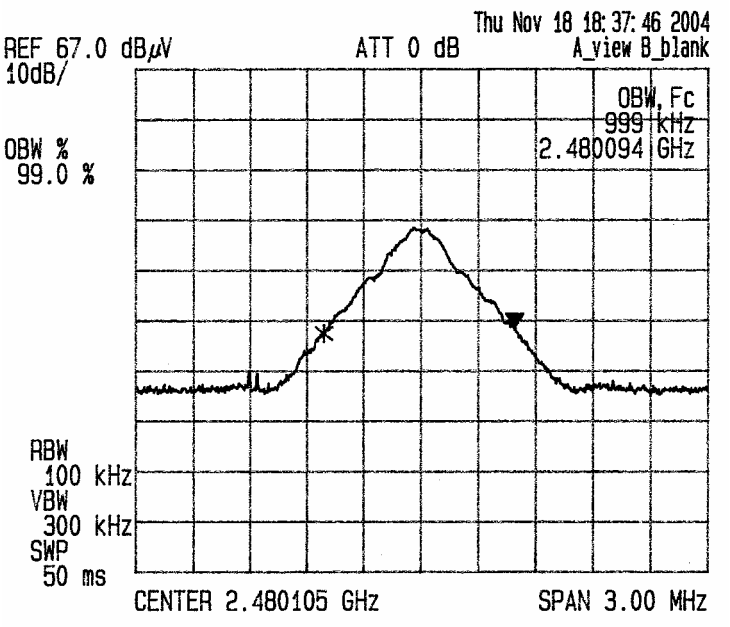

**Middle Channel**



**Occupied Bandwidth**
**MedDorna, LLC Spirometer**
**Peak Detection, RBW = 100 kHz**

Test Date: November 19-22, 2004

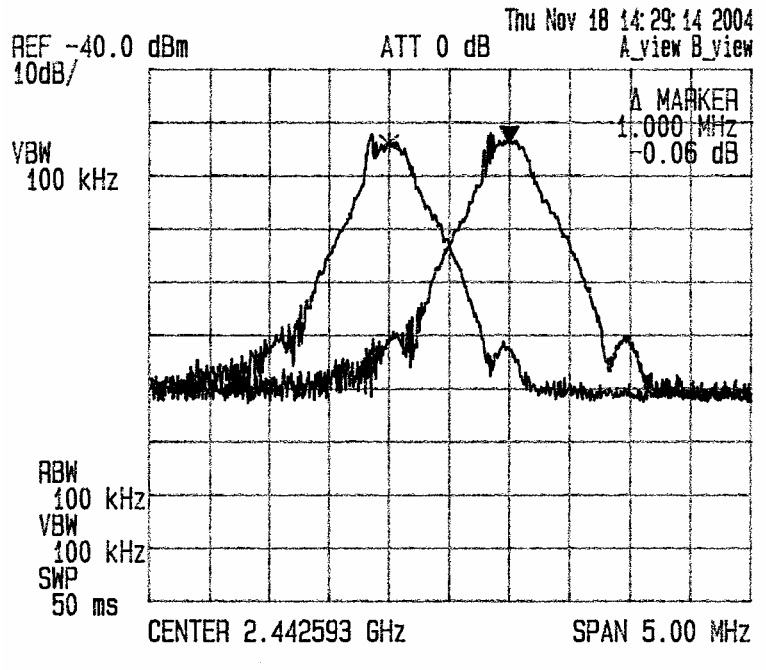
**High Channel**



**Hopping Channel Separation**
**MedDorna, LLC Spirometer**
**Peak Detection, RBW = 100 kHz**

Test Date: November 22, 2004

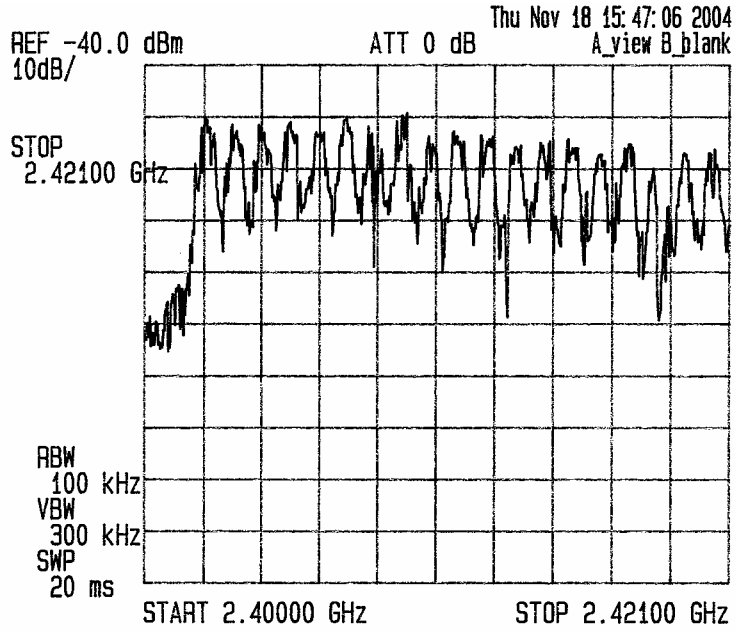
**Channel Separation**



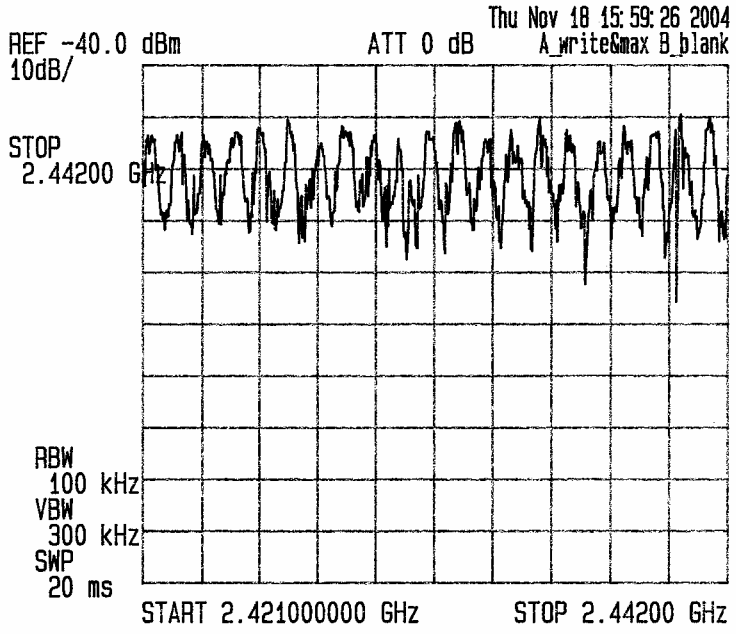
**Number of Hopping Frequencies**
**MedDorna, LLC Spirometer**
**Peak Detection, RBW = 100 kHz**

Test Date: November 22, 2004

**Number of Hopping Frequencies (2400-2421 MHz)**



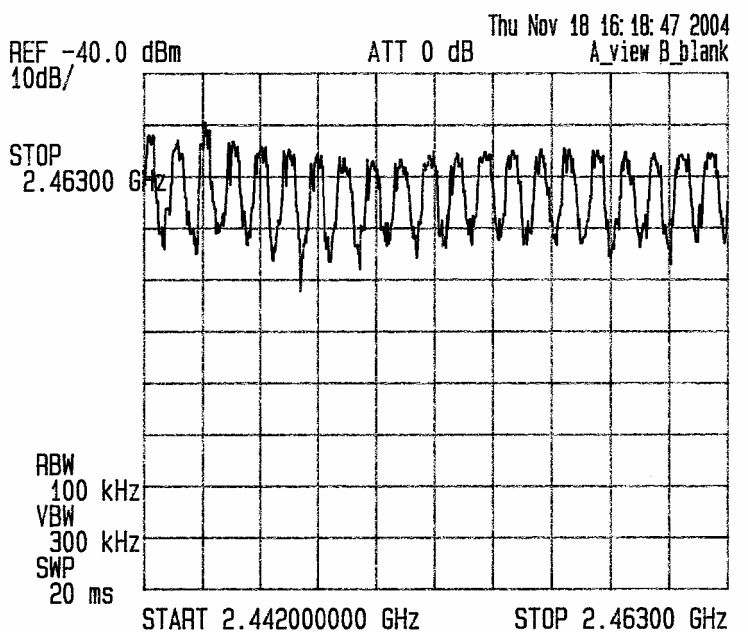

**Number of Hopping Frequencies (2421-2442 MHz)**



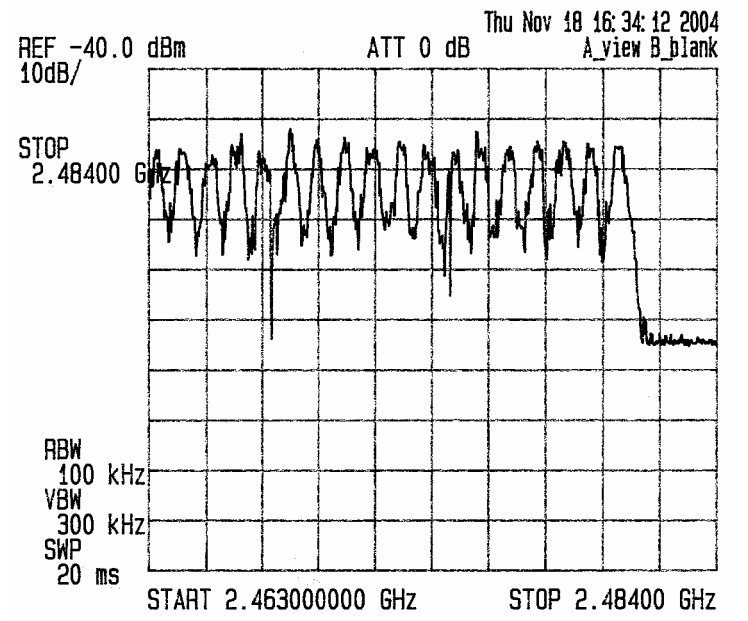
**Number of Hopping Frequencies**
**MedDorna, LLC Spirometer**
**Peak Detection, RBW = 100 kHz**

Test Date: November 22, 2004

**Number of Hopping Frequencies (2442-2463 MHz)**



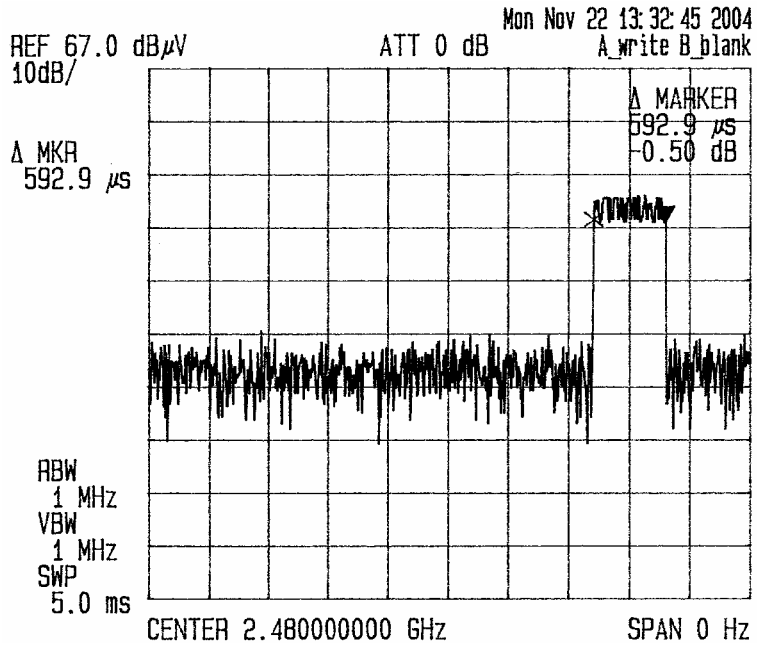

**Number of Hopping Frequencies (2463-2484 MHz)**



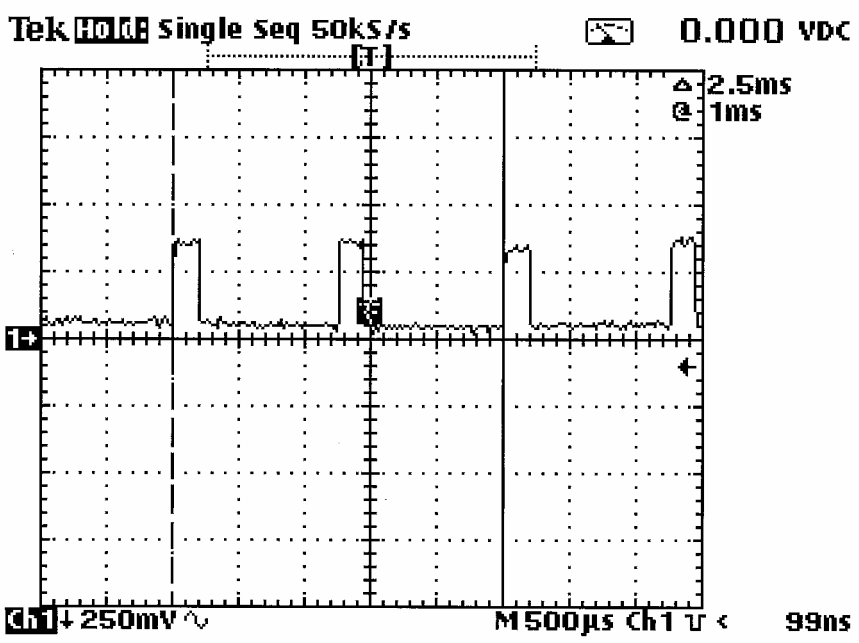
**Dwell Time On Each Channel**
**MedDorna, LLC Spirometer**
**Peak Detection, RBW = 1 MHz**

Test Date: November 22, 2004

**Pulse Duration**




**Hopping Rate**



**Dwell Time On Each Channel**
**MedDorna, LLC Spirometer**
**Calculations**

Test Date: November 22, 2004

## Hops per Second

$$HopRate = \frac{1000}{Interval(ms)} * Hops/Interval$$

$$HopRate = \frac{1000}{2.5} * 2 = 800 hops/\sec$$

## Dwell Time On One Channel

$$DwellTime = \frac{HopRate * period}{NumberofChannels} * PulseDuration$$

$$DwellTime = \frac{800 * 31.6}{79} * 592.9 * 10^{-6}$$

$$DwellTime = 190 ms$$

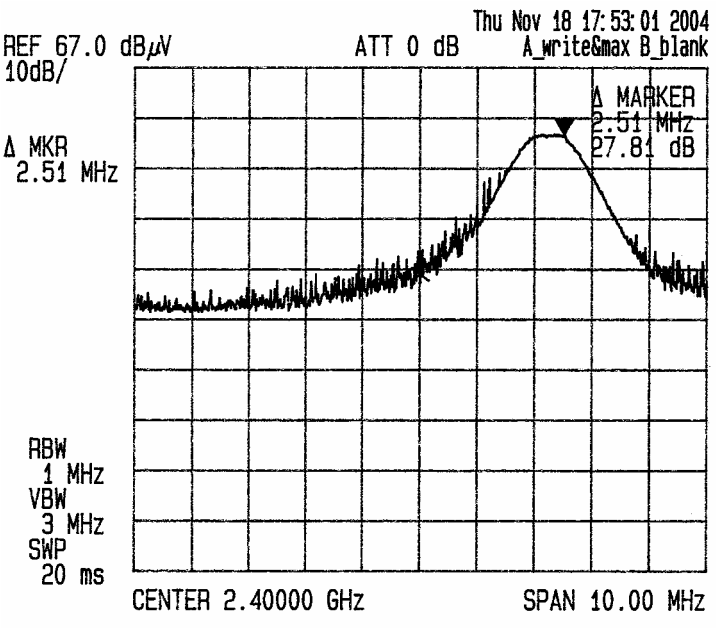
## Results Table

| Dwell Time (ms) | Limit (ms) | Result Pass/Fail |
|---|---|---|
| 190 | 400 | Pass |

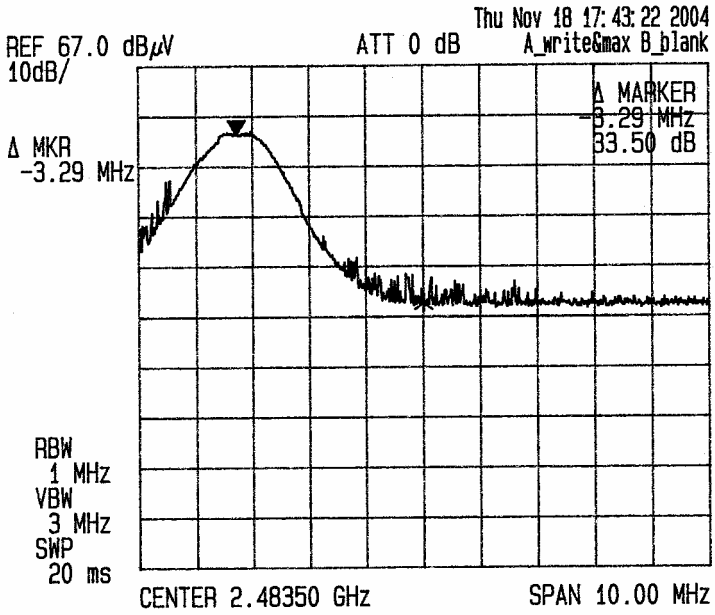
**Band Edge Spurious Emissions**
**MedDorna, LLC Spirometer**
**Peak Detection, RBW = 1 MHz**

Test Date: November 18-19, 2004

**Band Edge Plot Low**




**Band Edge Plot High**



**Band Edge Spurious Emissions**
**MedDorna, LLC Spirometer**
**Peak Detection, RBW = 1 MHz**
**Test Distance 3 meters**

Test Date: November 18-19, 2004

## Band Edge Data

| Freq. (MHz) | EUT Dir (Deg.) | Antenna Elevation (Meters) | Recorded Level (dBuV) | Amplifier Gain (dB) | Antenna Factor (dB/M) | Cable Loss (dB) | Corrected Level (dBuV/M) | Limit (dBuV/M) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 2400 | max | peak | 30.34 | 0.0 | 28.2 | 5.3 | 63.8 | 74 | -10.2 |
| 2400 | max | average | 16.59 | 0.0 | 28.2 | 5.3 | 50.1 | 54 | -3.9 |
| 2483.5 | max | peak | 24.72 | 0.0 | 28.3 | 5.5 | 58.5 | 74 | -15.5 |
| 2483.5 | max | average | 13.09 | 0.0 | 28.3 | 5.5 | 46.8 | 54 | -7.2 |

**Out of Band Spurious/Harmonic Emissions**
**MedDorna, LLC Spirometer**
**Quasi-Peak Detection, RBW = 120 kHz**
**Test Distance 3 meters**

Test Date: November 15, 2004

## 30-1000 MHz Vertical

| Freq. (MHz) | EUT Dir (Deg.) | Antenna Elevation (Meters) | Recorded Level (dBuV) | Amplifier Gain (dB) | Antenna Factor (dB/m) | Cable Loss (dB) | Corrected Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 43 | noise | floor | 23.7 | 26.4 | 11.9 | 3.1 | 12.3 | 40 | -27.7 |
| 127 | noise | floor | 21.9 | 26.4 | 12.2 | 5.7 | 13.5 | 43.5 | -30.0 |
| 219 | noise | floor | 23.5 | 26.7 | 11.3 | 7.3 | 15.4 | 43.5 | -28.1 |
| 441 | noise | floor | 23.8 | 27.1 | 16.4 | 9.6 | 22.7 | 46 | -23.3 |
| 611 | noise | floor | 23.1 | 26.7 | 19.1 | 10.9 | 26.4 | 46 | -19.6 |
| 833 | noise | floor | 22.2 | 26.1 | 22.3 | 13.1 | 31.5 | 46 | -14.5 |
| 905 | noise | floor | 22.4 | 25.9 | 22.4 | 13.8 | 32.7 | 46 | -13.3 |
| 980 | noise | floor | 22.7 | 26.6 | 24.2 | 16.3 | 36.7 | 54 | -17.3 |

## 30-1000 MHz Horizontal

| Freq. (MHz) | EUT Dir (Deg.) | Antenna Elevation (Meters) | Recorded Level (dBuV) | Amplifier Gain (dB) | Antenna Factor (dB/m) | Cable Loss (dB) | Corrected Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 43 | noise | floor | 23.7 | 26.4 | 11.9 | 3.1 | 12.3 | 40 | -27.7 |
| 127 | noise | floor | 21.9 | 26.4 | 12.2 | 5.7 | 13.5 | 43.5 | -30.0 |
| 219 | noise | floor | 23.5 | 26.7 | 11.3 | 7.3 | 15.4 | 43.5 | -28.1 |
| 441 | noise | floor | 23.8 | 27.1 | 16.4 | 9.6 | 22.7 | 46 | -23.3 |
| 611 | noise | floor | 23.1 | 26.7 | 19.1 | 10.9 | 26.4 | 46 | -19.6 |
| 833 | noise | floor | 22.2 | 26.1 | 22.3 | 13.1 | 31.5 | 46 | -14.5 |
| 905 | noise | floor | 22.4 | 25.9 | 22.4 | 13.8 | 32.7 | 46 | -13.3 |
| 980 | noise | floor | 22.7 | 26.6 | 24.2 | 16.3 | 36.7 | 54 | -17.3 |

**Out of Band Spurious/Harmonic Emissions**
**MedDorna, LLC Spirometer**
**Peak Detection, RBW = 1 MHz**
**Test Distance 1 meter**

Test Date: November 29, 2004

**1-25 GHz Vertical**

| Freq. (MHz) | EUT Dir (Deg.) | Antenna Elevation (Meters) | Recorded Level (dBuV) | Amplifier Gain (dB) | Antenna Factor (dB/M) | Cable Loss (dB) | Corrected Level (dBuV/M) | Limit (dBuV/M) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 4882 | max | level | 43.2 | 31.1 | 34.2 | 3.8 | 50.1 | 63.5 | -13.4 |
| 7323 | max | level | 48.8 | 30.9 | 36.9 | 4.4 | 59.2 | 63.5 | -4.3 |
| 9764 | max | level | 42.3 | 30.8 | 37.9 | 4.5 | 53.9 | 63.5 | -9.6 |
| 12205 | noise | floor | 41 | 30.4 | 39.4 | 5.0 | 54.9 | 63.5 | -8.6 |
| 14646 | noise | floor | 42.7 | 29.3 | 40.5 | 4.8 | 58.7 | 63.5 | -4.8 |
| 17087 | noise | floor | 42.6 | 31.3 | 42.8 | 5.1 | 59.3 | 63.5 | -4.2 |
| 19528 | noise | floor | 37.7 | 0.0 | 37.0 | 0.0 | 74.7 | 83.5 | -8.8 |
| 21969 | noise | floor | 37.5 | 0.0 | 37.0 | 0.0 | 74.5 | 83.5 | -9.0 |
| 24410 | noise | floor | 37.6 | 0.0 | 37.0 | 0.0 | 74.6 | 83.5 | -8.9 |

**1-25 GHz Horizontal**

| Freq. (MHz) | EUT Dir (Deg.) | Antenna Elevation (Meters) | Recorded Level (dBuV) | Amplifier Gain (dB) | Antenna Factor (dB/M) | Cable Loss (dB) | Corrected Level (dBuV/M) | Limit (dBuV/M) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 4882 | max | level | 39.8 | 31.1 | 34.2 | 3.8 | 46.7 | 63.5 | -16.8 |
| 7323 | max | level | 46.5 | 30.9 | 36.9 | 4.4 | 56.9 | 63.5 | -6.6 |
| 9764 | max | level | 43 | 30.8 | 37.9 | 4.5 | 54.6 | 63.5 | -8.9 |
| 12205 | noise | floor | 41 | 30.4 | 39.4 | 5.0 | 54.9 | 63.5 | -8.6 |
| 14646 | noise | floor | 42.7 | 29.3 | 40.5 | 4.8 | 58.7 | 63.5 | -4.8 |
| 17087 | noise | floor | 42.6 | 31.3 | 42.8 | 5.1 | 59.3 | 63.5 | -4.2 |
| 19528 | noise | floor | 37.7 | 0.0 | 37.0 | 0.0 | 74.7 | 83.5 | -8.8 |
| 21969 | noise | floor | 37.5 | 0.0 | 37.0 | 0.0 | 74.5 | 83.5 | -9.0 |
| 24410 | noise | floor | 37.6 | 0.0 | 37.0 | 0.0 | 74.6 | 83.5 | -8.9 |

**Note: The test was performed at 1 meter and the associated 3 meter limits were increased by 9.5 dB. Emissions above 18 GHz were tested at 10 cm and the associated 3 meter limit was increased by 29.5 dB.**

**Radio Frequency Exposure**
**MedDorna, LLC Spirometer**
**Calculations**

Test Date: November 12, 2004

## Friis Transmission Formula

$$PowerDensity = \frac{P_t * G}{4 * \pi * r^2}$$

## Results Table

| Frequency (MHz) | Power (dBm) | Gain (dBi) | Distance (cm) | Power Density (mW/cm²) | Limit (mW/cm²) |
|---|---|---|---|---|---|
| 2402.8 | -1.43 | 0 | 1 | .057 | 1.0 |
| 2441.8 | -1.03 | 0 | 1 | .063 | 1.0 |
| 2479.9 | 0.13 | 0 | 1 | .107 | 1.0 |

## Limits for Waiver of SAR Evaluation

| Tunable Range | | Center of Band | 60/f SAR Limit |
|---|---|---|---|
| Low (GHz) | High (GHz) | (GHz) | (mW) |
| 2402 | 2480 | 2441 | 24.58 |

## Maximum Transmitter Output Power

| Frequency (MHz) | Field Strength (dB/uV) | E.I.R.P (dBm) | E.I.R.P (mW) |
|---|---|---|---|
| 2402.8 | 93.8 | -1.43 | 0.719 |
| 2441.8 | 94.2 | -1.03 | 0.789 |
| 2479.9 | 95.3 | 0.13 | 1.349 |

**Result: The Threshold for no SAR evaluation is 24.56 mW. The EUT exhibited a maximum output power of 1.349 mW. No SAR evaluation is required since the maximum EIRP is below the threshold.**