

TEST REPORT

Report Number: 3036798-37-1-0

Project Number: 3036798

February 24, 2003

Testing performed on the
Wireless ECG Monitor Transceiver
Model Number: A2006
to

FCC Part 15.247

For GMP Wireless Medical, Inc.

Test Performed by:

Intertek Testing Services
1950 Evergreen Blvd., Suite 100
Duluth, GA 30096

Test Authorized by:

GMP Wireless Medical, Inc.
One East Broward Blvd.
Fort Lauderdale, FL 33301

Prepared by: _____

Jeremy O. Pickens

Date: _____

Reviewed by: _____

Jeffrey D. Hiday

Date: _____

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1 Summary of Tests

MODEL: A2006
FCC ID: QXQ-A2006-MT01

TEST	REFERENCE	RESULTS
Output power	15.247(b)	Complies
Channel Separation	15.247(a)(1)	Complies
Occupancy	15.247(a)(1)(iii)	Complies
Out-of-band Antenna Conducted Emission	15.247(c)	Not Applicable. The EUT uses a permanently fixed PCB antenna.
Out-of-band Radiated Emission (except emissions in restricted bands)	15.247(c)	Complies
Radiated Emission in Restricted Bands	15.209, 15.205	Complies
AC Line-conducted Emission	15.207	Complies
Radiated Emission from Digital Part	15.109	Complies
Radiated Emission from Receiver L.O.	15.109	Not Applicable. The operating frequency is above 960 MHz
RF Exposure Requirement	2.1091	Complies, see exhibit "RF Exposure"
Antenna Requirement	15.203	Complies. The EUT uses a permanently connected antenna

Test Engineer: _____
Jeremy O. Pickens

Date: _____

Approved by: _____
Jeffrey D. Hiday

Date: _____

2 General Description

2.1 Product Description

Overview of Wireless ECG Monitor Transceiver

Applicant	GMP Wireless Medical, Inc.
Trade Name & Model No.	Same / A2006
FCC Identifier	QXQ-A2006-MT01
Use of Product	The GMP Wireless electrocardiograph is intended to replace the present wired connection between a patient and an existing ECG device.
Manufacturer & Model of Spread Spectrum Module	ALPS, M/N: UGPZ2, Bluetooth Module
Type of Transmission	Frequency Hopping
Rated RF Output	+4dBm
Frequency Range	2.402 GHz – 2.480 GHz
Number of Channel(s)	79
Antenna(s) & Gain,	PCB
Antenna Requirement	☒ The EUT uses a permanently connected antenna. ☐ The antenna is affixed to the EUT using a unique connector which allows for replacement of a broken antenna, but DOES NOT use a standard antenna jack or electrical connector. ☐ The EUT requires professional installation (attach supporting documentation if using this option).
Manufacturer name & address	GMP Wireless Medical, Inc., One East Broward Blvd., Fort Lauderdale, FL 33301

A Production version of the EUT was received on February 3, 2003 in good operating condition.

2.2 Related Submittal(s) Grants

This report is for use with an application for certification of a low power transmitter. One transmitter is included in the application.

2.3 Test Methodology

Both AC mains line-conducted and radiated emissions measurements were performed according to the procedures in ANSI C63.4 (1992). Radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "**Data Sheet**" of this Application. All other measurements were made in accordance with the procedures in part 2 of CFR 47.

2.4 Test Facility

The Duluth 10-meter chamber site is located at 1950 Evergreen Blvd., Suite 100, Duluth, Georgia. The test site is a 10-meter semi-anechoic chamber. The site meets the characteristics of CISPR 16-1: 1993 and ANSI C63.4: 1992. For measurements, a remotely controlled flush-mount metal-top turntable is used to rotate the EUT a full 360 degrees. A remote controlled non-conductive antenna mast is used to scan the antenna height from one to four meters.

The A2LA accreditation code for this site is 121624 under certificate number 1455.01.

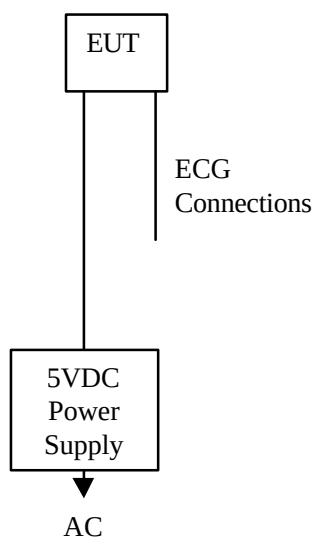
The Industry Canada file number for this site is IC 2077.

3 System Test Configuration

3.1 Support Equipment and description

Item #	Description	Model No.	Serial No.
1	Jerome Industries, Corp. AC/DC Converter	RPHN50-02M	Sample 1

3.2 Block Diagram of Test Setup



3.3 Justification

For emission testing, the test procedures, as described in American National Standards Institute C63.4-1992, were employed. The equipment under test (EUT) was configured for testing in a typical fashion (as a customer would normally use it).

The EUT was rotated such that it was positioned in each of 3 axes. The tabular data reflect only the highest result for each orientation.

3.4 Software Exercise Program

The EUT exercise program used during radiated and conducted testing was designed to exercise the various system components in a manner similar to a typical use. Three samples were provided by GMP Wireless Medical, Inc. High, middle, and low channels were each represented. For emissions testing, each unit was setup to transmit continuously to simplify the measurement methodology. The EUT was powered from a 5VDC power supply during testing.

3.5 Mode of Operation During Test

All three samples were configured to transmit continuously at full power.

3.6 Modifications Required for Compliance

No modifications were installed by Intertek Testing Services during compliance testing in order to bring the product into compliance (Please note that this does not include changes made specifically by GMP Wireless Medical, Inc. prior to compliance testing)

3.7 Additions, deviations and exclusions from standards

No additions, deviations or exclusions from the standard were made.

4 Measurement Results

4.1 Conducted Output Power at Antenna Terminals FCC Rules 15.247(b):

4.1.1 Requirements

Except for Systems that are used exclusively for fixed, point-to-point operations, the maximum peak output power shall not exceed 1 W for antennas with gain of 6 dBi or less. For antennas with gain greater than 6 dBi, the maximum peak output power must be reduced by an amount equal to (GAIN - 6) dB.

For Systems operating in the band 2400-2483.5 MHz that are used exclusively for fixed, point-to-point operations and employ antennas with gain greater than 6 dBi, maximum peak output power must be reduced below 1 W by an amount equal to (GAIN - 6) /3 dB.

For Systems operating in the band 5725-5850 MHz that are used exclusively for fixed, point-to-point operations and employ antennas with gain greater than 6 dBi, maximum peak output power shall not exceed 1 Watt.

4.1.2 Procedure

Testing of the conducted output power was not applicable because the antenna was a permanently connected PCB antenna. Radiated power was measured instead using the substitution method.

4.1.3 Test Results

Refer to the following tables for the radiated power results:

Table 1: Radiated Power

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Table 1: Radiated Power

Company: **GMP Wireless Medicine, Inc.**
Model: **Wireless ECG, DP2**
Project Number: **3036798**
Date: 02/28/03
Notes: Monitor Transceiver

Tested by: Matthew Van Steen
Location: Duluth

RX Antenna: AH Sys 571
TX Antenna: EMCO 3115

Ant. Pol. (V/H)	Frequency MHz	EUT Orientation	EUT Reading dBm S1	Reading from Subs Antenna S2	Sig Gen Output dBm SG	Path Loss dB SG-S2	Antenna Gain dBi	Radiated Power dBm ERP
H	2405.000	X-axis	-46.4	-37.5	-1.5	36.1	7.5	-2.8
H	2437.000	X-axis	-47.3	-37.9	-1.7	36.2	7.5	-3.6
H	2479.000	X-axis	-47.3	-38.5	-1.8	36.8	7.5	-3.0

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4.2 Channel separation FCC Rule 15.247(a)(1)

4.2.1 Requirements

Frequency hopping systems shall have channel carrier frequencies separated by a minimum of 25 kHz or the 20dB bandwidth of the hopping channel, whichever is greater.

4.2.2 Procedure

A near field probe placed in close proximity to the EUT was connected to the input of a spectrum analyzer. Analyzer RES BW was set to 100 kHz. For each RF output channel investigated, the spectrum analyzer center frequency was set to the channel carrier. A PEAK output reading was taken, and a marker frequency DELTA reading was taken across the carrier at 20dB down from the PEAK level.

For channel spacing readings, the spectrum analyzer SPAN was set to 5 MHz, and the RES BW was set to 300 kHz. A PEAK output reading was taken, and a marker frequency DELTA reading was taken between the two nearest peaks.

4.2.3 Test Result

Frequency MHz	20-dB Bandwidth MHz
2405.0	0.368

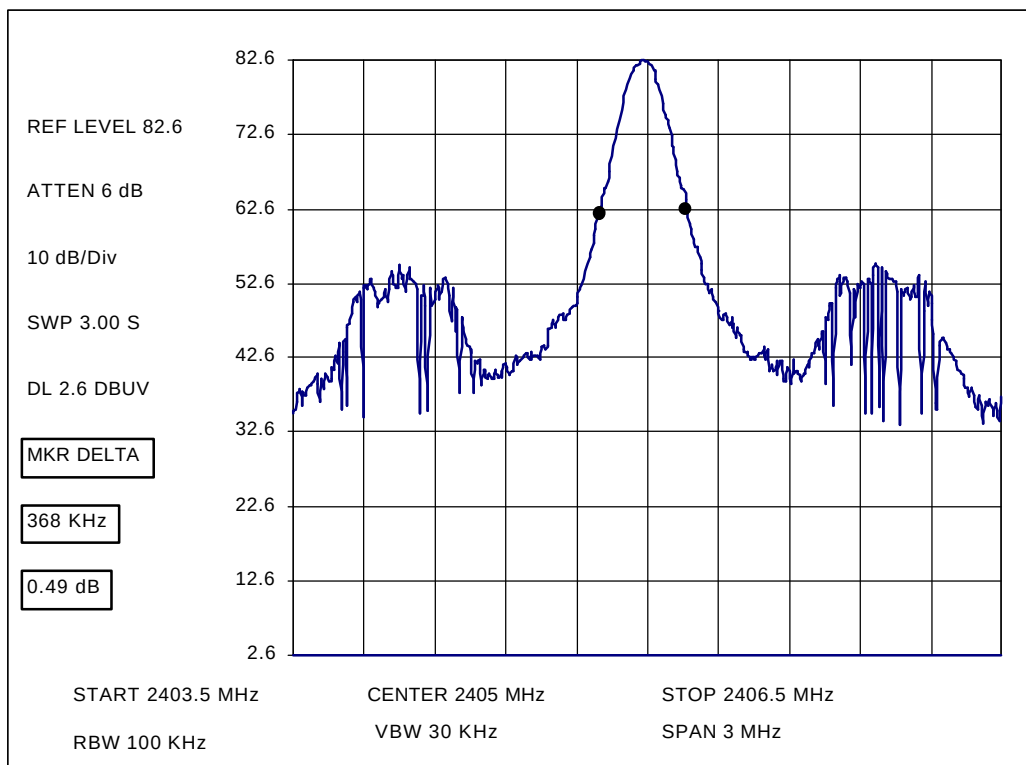
Frequency MHz	Channel Spacing MHz
2447.5 – 2452.5	1.0

Refer to the following plots:

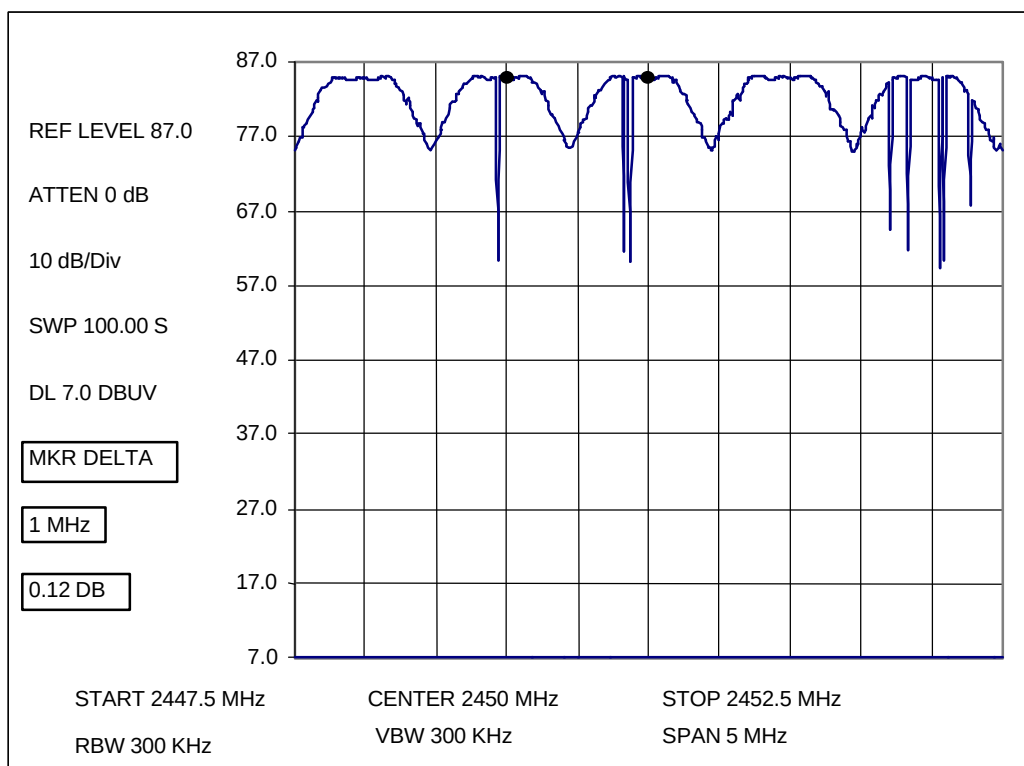
Plot 1: Low Channel 20 dB RF Bandwidth

Plot 2: Channel spacing

Plot 1: Low Channel 20 dB RF Bandwidth



Plot 2: Channel spacing



4.3 Channel Occupancy FCC Rule 15.247(a)(1)(iii)

4.3.1 Requirements

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

4.3.2 Procedure

The spectrum analyzer was set to a SPAN of 0 and centered on a single hopping channel of the EUT. The spectrum analyzer RES BW was set to 1 MHz. The sweep was set to 0.4 multiplied by the number of hopping channels: $0.4 \times 79 = 31.6$ seconds. One sweep was recorded. Due to the lack of resolution, the occupancy time could not be determined. The sweep time was reduced by a factor of 20 to 1.58 seconds, and the number of pulses was counted. The resolution and sweep time were further adjusted until a single pulse could be captured. The time on for a single pulse was then measured. The occupancy for a single channel was calculated as follows:

$$\begin{aligned}\text{OCCUPANCY (SEC)} &= (T_{\text{pulse}} * N_{\text{pulses}}) * [(0.4 * N_{\text{channels}}) / T_{\text{sweep}}] \\ &= (0.0009 * 19) * [(0.4 * 79) / 1.58] = 0.342 \text{ seconds}\end{aligned}$$

4.3.3 Test Result

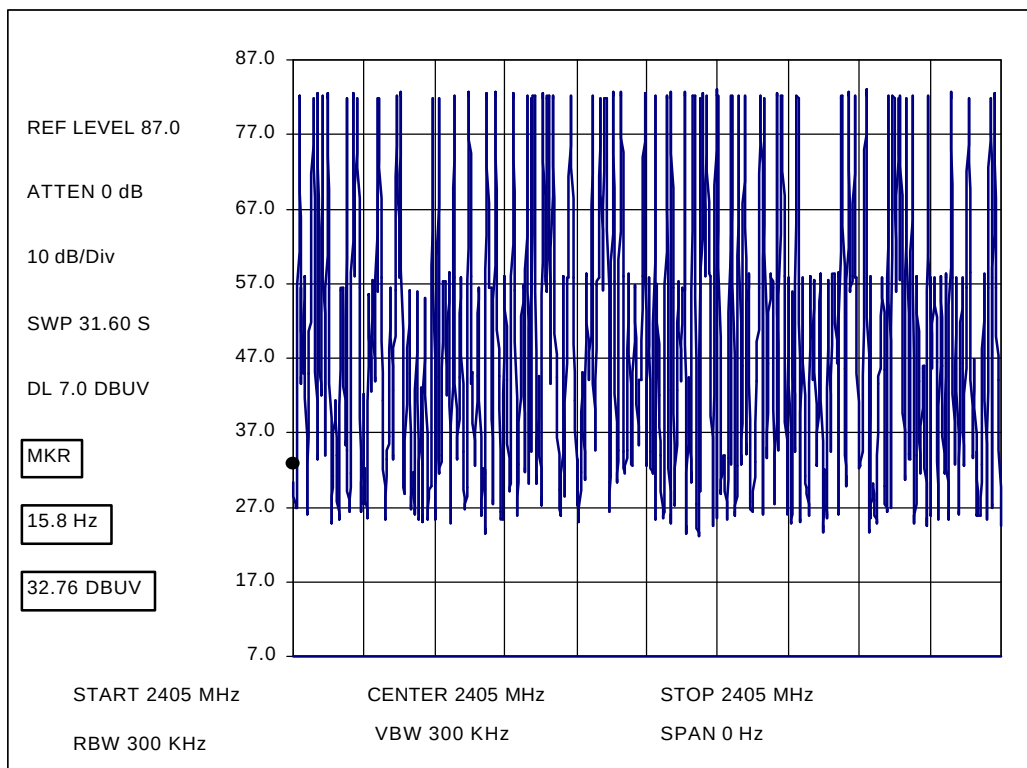
Frequency MHz	Occupancy Sec
2405	0.342

Refer to the following plots for occupancy data:

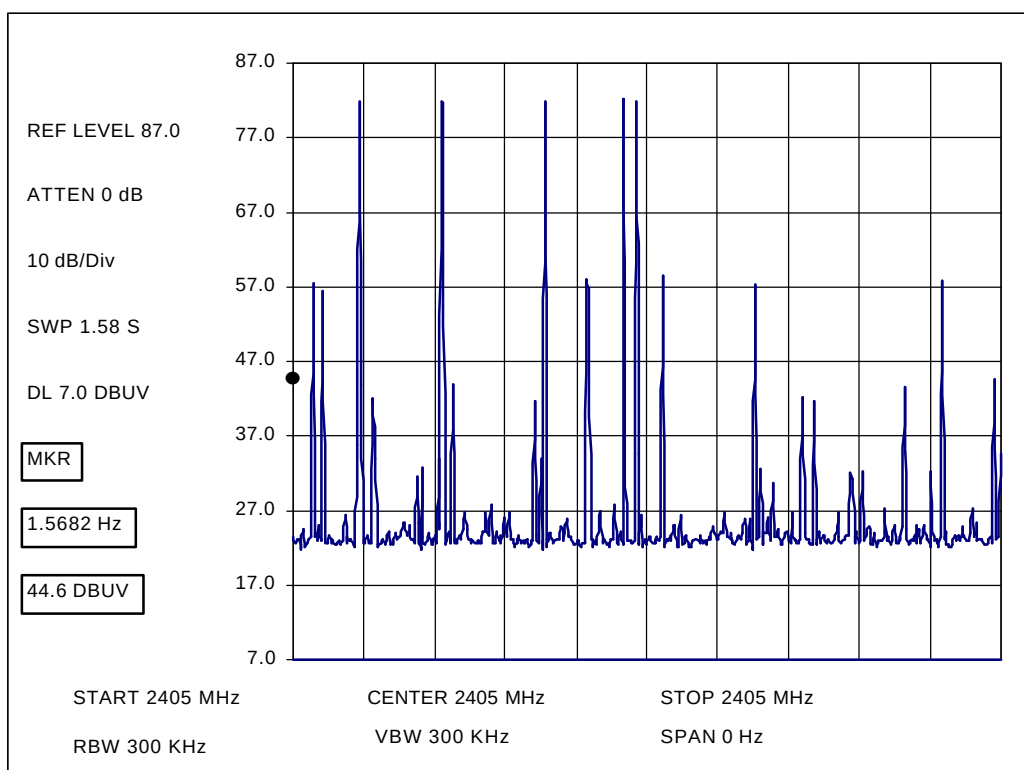
Plot 3: Channel occupancy with full sweep time

Plot 4: Channel frequency with sweep time divided by 20

Plot 3: Channel occupancy with full sweep time



Plot 4: Channel frequency with sweep time divided by 20



4.4 Out-of-Band Conducted Emissions FCC Rule 15.247(c)

4.4.1 Requirements

In any 100 kHz bandwidth outside the EUT passband, the RF power shall be at least 20 dB below that of the maximum in-band 100 kHz emission.

4.4.2 Procedure

Testing of the out-of-band conducted emissions was not applicable because the antenna was a permanently connected PCB antenna.

4.5 Out-of-Band Radiated Emissions (except emissions in Restricted Bands) FCC Rule 15.247(c)

4.5.1 Requirements

In any 100 kHz bandwidth outside the EUT passband, the radiated emission shall be at least 20 dB below that of the maximum in-band 100 kHz emission.

4.5.2 Procedure

For out-of-band conducted emissions that are close to or that exceed the 20 dB attenuation requirement described in the section 4.4, radiated measurements were performed at a 3 m separation distance to determine whether these emissions complied with the 20 dB attenuation requirement.

4.5.3 Test Result

The EUT met the out-of-band radiated emissions requirements.

Refer to the following data table(s) for radiated emissions data:

Table 2: Fundamental and Harmonics Field Strength Measurements

4.6 Transmitter Radiated Emissions in Restricted Bands FCC Rules 15.205, 15.209

4.6.1 Requirements

The emission shall not exceed the Field Strength levels specified in 15.209.

4.6.2 Procedure

For radiated emission measurements, the EUT is attached to a cardboard box (if necessary) and placed on the wooden turntable. The signal is maximized through rotation and placement in the three orthogonal axes.

During the test the EUT is rotated and the antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters.

Radiated emissions are taken at three meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance. All readings are extrapolated back to the equivalent three-meter reading using inverse scaling with distance.

Radiated emission measurements were performed from 30 MHz to 25000 MHz.

Analyzer resolution is:

- 100 kHz or greater for frequencies 1000 MHz and below,
- 1 MHz for frequencies above 1000 MHz. For those frequencies peak and average values were measured.

Data is included of the worst case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs and data tables of the emissions are included.

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation is as follows:

$$FS = RA + AF + CF - AG$$

Where FS = Field Strength in dB (μV/m)

RA = Receiver Amplitude (including preamplifier) in dB (μV)

CF = Cable Attenuation Factor in dB

AF = Antenna Factor in dB(1/m)

AG = Amplifier Gain in dB

If the EUT is operating in the 2.4 - 2.4835 GHz band, the Band-edge radiated emission measurements were performed using the "Marker-delta" method.

4.6.3 Test Result

Refer to Table 2 for a list of the emission frequencies, the limit, and the margin of compliance.

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Table 2: Fundamental and Harmonics Field Strength Measurements

Company: **GMP Wireless Medicine, Inc.**
 Model: **Wireless ECG Monitor Transceiver**
 Project No.: **3036798**
 Date: 02/04/03
 Standard: Res-Bands
 Class: B Group: None
 Notes: Monitor Transceiver

Tested by: Jeremy O. Pickens
 Location: Duluth
 Detector: HP8546
 Antenna: AH571
 PreAmp: HP8449B
 Cable(s): Cable TW3 HS7000 N-SMA
 Distance: **1 or 3**

Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB
TX: 2405MHz, S/N: 80000-A2006-0019									
Fundamental Readings (3 meter measurement distance)									
H, X-Axis	2405.000	60.6	29.2	9.2	0.0	0.0	99.0	137.0	-38.0
H, Y-Axis	2405.000	54.6	29.2	9.2	0.0	0.0	93.0	137.0	-44.0
H, Z-Axis	2405.000	55.4	29.2	9.2	0.0	0.0	93.8	137.0	-43.2
Harmonic Readings: Taken at worst-case orientation - X-axis, 1m Test Distance									
h	4810.000	41.6	34.1	12.6	34.9	9.5	43.8	54.0	-10.2
v	4810.000	43.2	34.1	12.6	34.9	9.5	45.4	54.0	-8.6
No other harmonics detected.									
TX: 2437MHz, S/N: 80000-A2006-0020									
Fundamental Readings (3 meter measurement distance)									
H, X-Axis	2437.000	59.7	29.2	9.2	0.0	0.0	98.1	137.0	-38.9
H, Y-Axis	2437.000	53.8	29.2	9.2	0.0	0.0	92.2	137.0	-44.8
H, Z-Axis	2437.000	50.8	29.2	9.2	0.0	0.0	89.2	137.0	-47.8
Harmonic Readings: Taken at worst-case orientation - X-axis, 1m Test Distance									
h	4874.000	40.7	34.3	12.7	34.9	9.5	43.2	54.0	-10.8
v	4874.000	42.4	34.3	12.7	34.9	9.5	44.9	54.0	-9.1
No other harmonics detected.									
TX: 2479MHz, S/N: 80000-A2006-0021									
Fundamental Readings (3 meter measurement distance)									
H, X-Axis	2479.000	59.7	29.1	9.3	0.0	0.0	98.1	137.0	-38.9
H, Y-Axis	2479.000	53.8	29.1	9.3	0.0	0.0	92.2	137.0	-44.8
H, Z-Axis	2479.000	50.8	29.1	9.3	0.0	0.0	89.2	137.0	-47.8
Harmonic Readings: Taken at worst-case orientation - X-axis, 1m Test Distance									
h	4958.000	40.7	34.6	12.8	34.8	9.5	43.7	54.0	-10.3
v	4958.000	43.4	34.6	12.8	34.8	9.5	46.4	54.0	-7.6
No other harmonics detected.									

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4.7 AC Line Conducted Emission FCC Rule 15.207

AC line conducted emission test was performed according the ANSI C63.4 standard. The EUT was connected to AC Line through the LISNs.

A complete scan from 0.15 - 30 MHz was made.

For the test results, refer to Table 3.

Table 3: AC Line Conducted Emission

Company: **GMP Wireless Medicine, Inc.**
Model: **Wireless ECG, DP2**
Job No.: **3036798**
Date: 02/05/03
Standard: FCC Part 15 (CISPR 22)
Class: B Group: None
Notes:

Tested by: Matthew Van Steen
Location: Duluth
Detector: HP8546
Cable(s): Cable TT4
Limiter: no

Frequency MHz	Reading Side A dB	Reading Side B dB	Attenuator Factor dB	System Loss dB	Quasi-Peak		
					Net dB(uV)	Limit dB(uV)	Margin dB
0.150	27.6	28.0	0.0	1.7	29.7	66.0	-36.3
0.207	53.8	54.0	0.0	1.2	55.2	63.3	-8.2
0.249	49.5	49.8	0.0	1.0	50.8	61.8	-11.0
0.373	34.6	35.1	0.0	0.8	35.9	58.4	-22.5
0.575	18.8	19.8	0.0	0.8	20.6	56.0	-35.4
1.156	7.4	7.9	0.0	0.9	8.8	56.0	-47.2

Frequency MHz	Reading Side A dB	Reading Side B dB	Attenuator Factor dB	System Loss dB	Average		
					Net dB(uV)	Limit dB(uV)	Margin dB
0.150	25.0	25.4	0.0	1.7	27.1	56.0	-28.9
0.207	20.3	20.7	0.0	1.2	21.9	53.3	-31.5
0.249	17.1	17.5	0.0	1.0	18.5	51.8	-33.3
0.373	2.1	2.7	0.0	0.8	3.5	48.4	-44.9
0.575	-8.9	-8.7	0.0	0.8	-7.9	46.0	-53.9
1.156	-8.5	-8.9	0.0	0.9	-7.6	46.0	-53.6

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4.8 Radiated Emissions from Digital Section of Transceiver

- ☐ Not required - No digital part
- ☐ Test results are attached
- ☒ Included in the separate verification report.

4.9 Radiated Emissions from Receiver Section of Transceiver (L.O. Radiation) FCC Rule 15.109, 15.111

- ☒ Not required - EUT operation above 960 MHz only
- ☐ Not required - EUT is transmitter only
- ☐ Test results are attached

5 Antenna Requirement

X	The transmitter uses a permanently connected antenna.
	The antenna is affixed to the EUT using a unique connector, which allows for replacement of a broken antenna, but does NOT use a standard antenna jack or electrical connector.
	The EUT requires professional installation.

Please refer to the attached documentation for details.

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6 List of test equipment

Description	Make	Model	Serial #	Cal Date
EMI Receiver	HP	85462A	3410A00173	3/28/02
RF Filter Selector	HP	85460A	3348A00203	3/28/02
PreAmp	HP	8449B	3008A0089	10/24/02
PreAmp	HP	8447D	2648A04296	8/9/02
BiLog Antenna	Chase	CBL6112B	2622	8/26/02
Horn Antenna	EMCO	3115	9208-3919	2/20/02
Horn Antenna	AH Systems	SAS200/571	246	1/31/03
Cable	Huber-Suhner	HS7000N-SMA	211266	12/4/02
Cable	Andrews	CableTW2	211411	12/4/02
Cable	Andrews	CableTW3	211412	12/4/02
LISN	Fischer	FCC-LISN-50-50-M	2019	8/6/02
Cable	Andrews	Cable TT4	ITS# 211404	12/4/02

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7 Document History

Revision/ Job Number	Writer Initials	Date	Change
1.0 / 3036798		February 24, 2003	Original document