Cert. No. 1152.01
Electrical (EMC)

DATE: 13 March 2008

I.T.L. (PRODUCT TESTING) LTD.

FCC EMC/Radio Test Report

for

Norav Medical Ltd.

Equipment under test:

Wireless ECG Recording System

PCECG1200WR

Written by: _____
D. Shidlowsky, Documentation

Approved by: _____
Y. Mordukhovitch, Test Engineer

Approved by: _____
I. Raz, EMC Laboratory Manager

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This report relates only to items tested.

Measurement/Technical Report for
Norav Medical Ltd.

Equipment under test:

Wireless ECG Recording System

FCC ID: VPP1200WR

DATE: 13 March 2008

This report concerns: Original Grant _x_ Class II change ___

Class B verification ___ Class A verification__ Class I change ____

Equipment type: Radio Transmitter
Request Issue of Grant:
__**x**__Immediately upon completion of review

Limits used:
CISPR 22 _____ Part 15 _x_

Measurement procedure used is ANSI C63.4-2003.

Application for Certification
prepared by:
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Applicant for this device:
(different from "prepared by")
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1. General Information

1.1 Administrative Information

Manufacturer:	Norav Medical Ltd.
Manufacturer's Address:	2 Hamada St. P.O.B. 81 Yokneam 20692 Israel Tel: +972-4-989-3001 Fax: +972-4-989-3004
Manufacturer's Representative:	Alex Kleynzit David Seal
Equipment Under Test (E.U.T):	Wireless ECG Recording System
Equipment Model No.:	PCECG1200WR
Equipment Serial No.:	6003R
Date of Receipt of E.U.T:	02.08.07
Start of Test:	02.08.07
End of Test:	08.08.07
Test Laboratory Location:	I.T.L (Product Testing) Ltd. Kfar Bin Nun, ISRAEL 99780
Test Specifications:	FCC Part 15, Subparts B, C

1.2 List of Accreditations

The EMC laboratory of I.T.L. is accredited by the following bodies:

1. The American Association for Laboratory Accreditation (A2LA) (U.S.A.), Certificate No. 1152.01.
2. The Federal Communications Commission (FCC) (U.S.A.), Registration No. 90715.
3. The Israel Ministry of the Environment (Israel), Registration No. 1104/01.
4. The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) (Japan), Registration Numbers: C-1350, R-1285.
5. Industry Canada (Canada), File No. IC 4025.
6. TUV Product Services, England, ASLLAS No. 97201.
7. Nemko (Norway), Authorization No. ELA 207.

I.T.L. Product Testing Ltd. is accredited by the American Association for Laboratory Accreditation (A2LA) and the results shown in this test report have been determined in accordance with I.T.L.'s terms of accreditation unless stated otherwise in the report.

1.3 Product Description

The Norav Medical PC ECG 1200W system, refered to as EUT in this report, is an ECG and Stress Electrocardiography System. It comprises the data acquisition unit (PCECG 1200W), an RF transceiver (PCECG 1200WR), USB communications cable, software application, and an optional dongle (software security lock) which gives access to the stress testing software functions.

The System is designed to operate in an open architecture using numerous manufacturers making IBM PC or compatible machines. Hardware and software support of many companies in the PC market ensure the success of an open architecture for this system. Instead of designing a computer inside a medical instrument, the medical instrument is delivered as a software and interface assembly to be used with an off the shelf computer system. This technique improves the cost effectiveness and reliability of the system delivered. Accordingly, the System utilizes an IBM PC or compatible and a high resolution printer.

1.4 Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4: 2003. Radiated testing was performed at an antenna to EUT distance of 3 meters.

1.5 Test Facility

The radiated emissions tests were performed at I.T.L.'s testing facility at Kfar Bin-Nun, Israel. This site is a FCC listed test laboratory (FCC Registration No. 90715, date of listing August 22, 2006).
I.T.L.'s EMC Laboratory is also accredited by A2LA, certificate No. 1152.01.

1.6 Measurement Uncertainty

Radiated Emission

The Open Site complies with the ±4 dB Normalized Site Attenuation requirements of ANSI C63.4-2003. In accordance with Paragraph 5.4.6.1 of this standard, this tolerance includes instrumentation calibration errors, measurement technique errors, and errors due to site anomalies.

2. Product Labeling

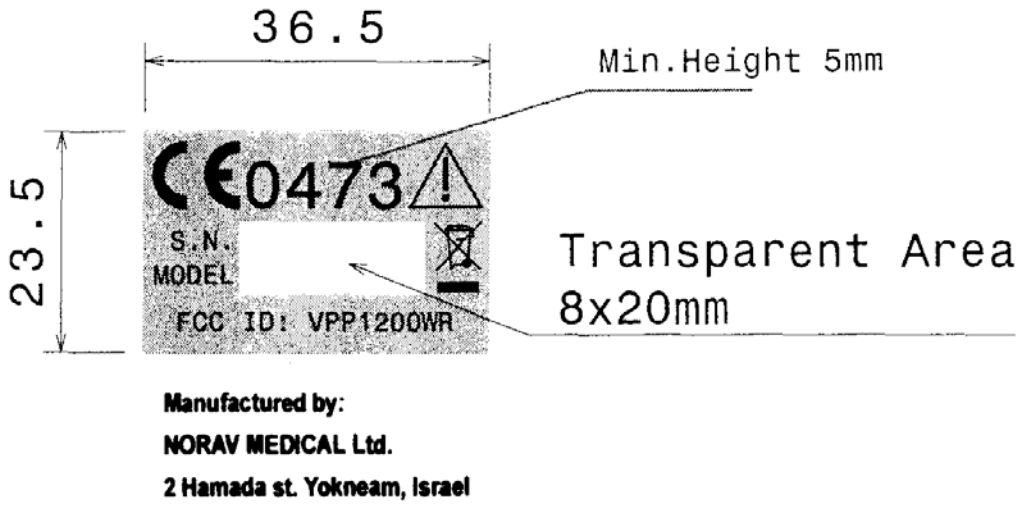


Figure 1. FCC Label

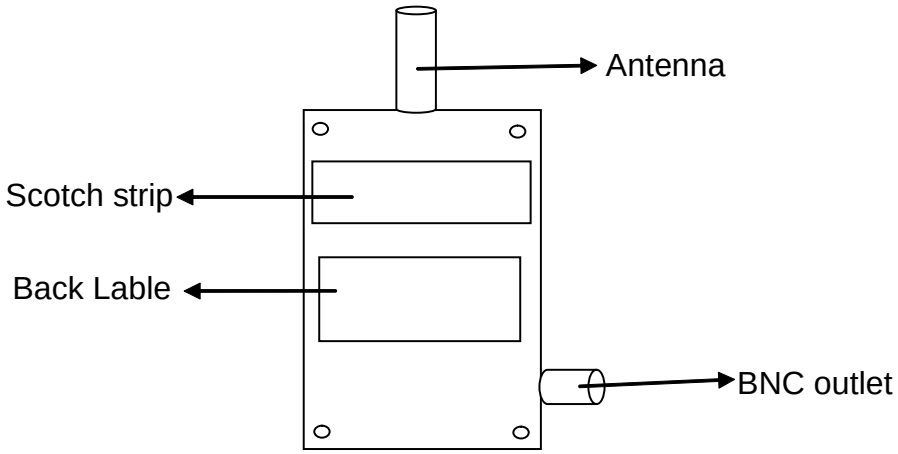


Figure 2. Label Location on EUT

3. System Test Configuration

3.1 Justification

To determine the E.U.T. antenna orientation for the spurious radiated emissions tests, the product carrier field level was measured with the E.U.T. in 3 orthogonal positions.

The horizontal position of the E.U.T. was selected as the worst case final orientation position.

The system was configured for testing in a typical fashion (as a customer would normally use it). The software is installed on the PC under Windows operating system (Windows XP/Vista). Then the 1200WR transceiver is connected to the PC via USB port. The PCECG 1200W acquisition box is connected via 10 patient leads to an ECG simulator. Batteries are inserted to the acquisition box.

The only connection is wireless. The only connection to the PC is of the 1200WR transceiver through USB port only. Therefore, the final test is performed only on this port (USB). The final test also tested RF wireless between the antena of the device and the antena of the transceiver.

The simultaneous testing of this identical port did not increase emissions significantly. Therefore, the final qualification testing was completed with only one port connected to the 1200WR transceiver (USB). The output of the batteries installed in the 1200W acquisition box is not significant. The monitor was investigated as powered from both the wall outlet and computer accessory outlet. The accessory outlet was used for final testing, as it was found to be the worst case operating mode.

3.2 EUT Exercise Software

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. The software, contained on a separate disc, was inserted into CD drive and installed on the PC in a default directory. The program when opened can control the operation of the acquisition box by opening a new test. As soon as pressing on New test button and after inserting the patient details, the command is sent to the unit to start recording ECG data. The data is then transmitted throuth the 1200WR transceiver to the program, which monitors it on the screen as ECG traces. It stops according to the definitions or after pressing Stop button on the screen.
The software can receive data, save, display and print the ECG data with its measurements.

The software includes several key options which are enablesd according to a software key permission on a dongle. The basic option is Rest application. Additional options (which are compiled in the same package) are Stress, Monitoring, Heart rate variability, Late potential, Database management, Measurements, Interpretation applications.

3.3 Special Accessories

As shown in the configuration of tested system drawing, all interface cables used for compliance testing are shielded, as normally supplied by Norav Medical. These cable model and part numbers are marketed with the Norav Medical peripherals to the end user, and appear on our related product price list supplied to our customers. All cable connectors feature integral metal hoods for shielding. This equipment requires use of a standard USB cable.

3.4 Equipment Modifications

No special modifications were needed to achieve compliance.

3.5 Configuration of Tested System

The configuration of the tested system is described below.

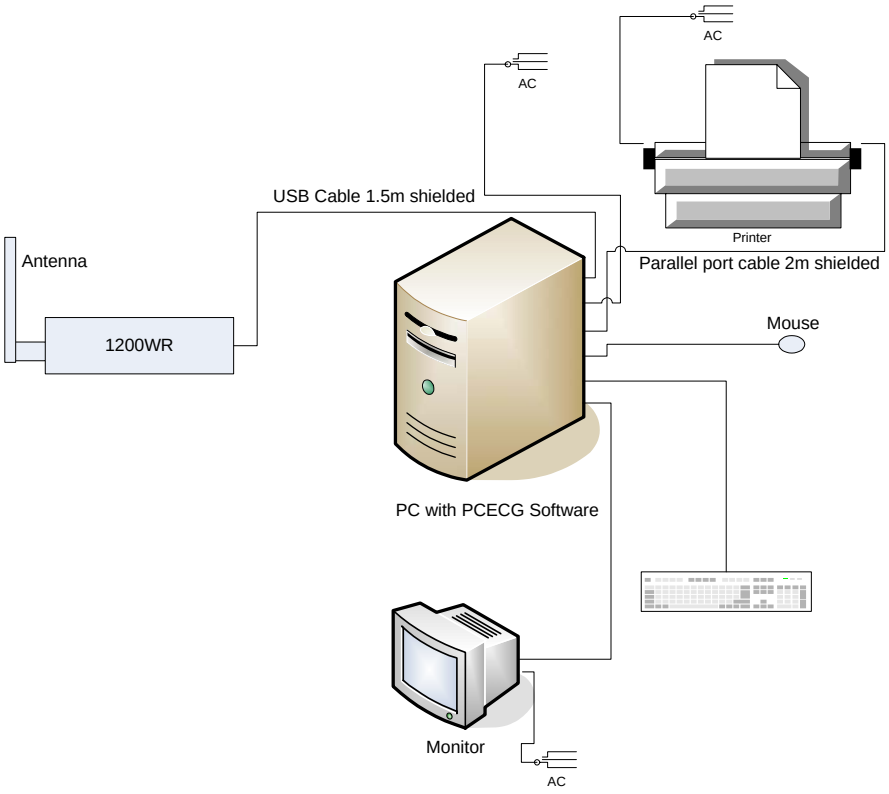
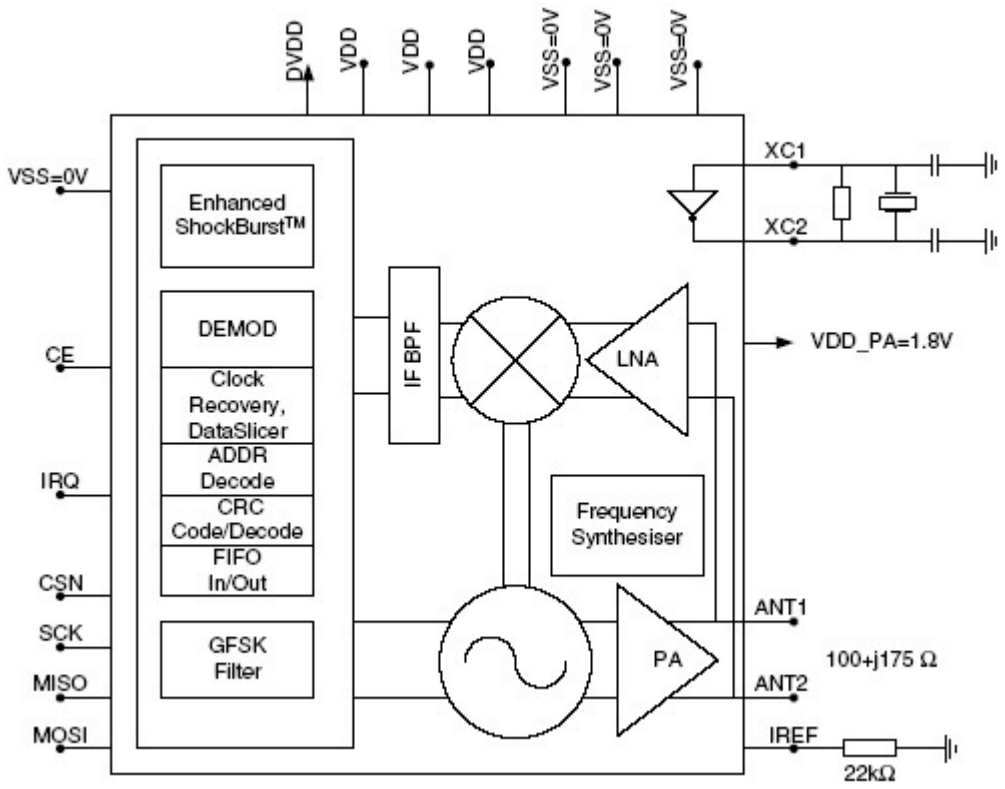


Figure 3. Configuration of Tested System

4. Block Diagram

4.1 Schematic Block/Connection Diagram



4.2 Theory of Operation

On the front panel there is a Green led.

When connected to the USB port, the Green led is ON.

The device waits for “Start” command from the PCECG software. If receives “Start” command from the PC, it tries to send it to the 1200W. On success it starts to receive ECG data from the 1200W and sends it to the PCECG software, The Green led blinks while receiving the ECG data.

5. Field Strength of Fundamental

5.1 Test Specification

F.C.C., Part 15, Subpart C, Section 15.249(a)

5.2 Test Procedure

The E.U.T. operation mode and test set-up are as described in Section 3.

The E.U.T. was placed on a non-conductive table, 0.8 meters above the O.A.T.S. ground plane.
The EMI receiver was set to the E.U.T. Fundamental Frequencies (2402, 2437, and 2477 MHz) and Peak/Average Detection.
The turntable and antenna mast were adjusted for maximum level reading on the EMI receiver.
The measurement was performed for vertical and horizontal polarizations of the test antenna.

5.3 Measured Data

JUDGEMENT: Passed by 21.7 dB

The EUT met the FCC Part 15, Subpart C, Section 15.249(a) specification requirements.

The details of the highest emissions are given in *Figure 4*.

TEST PERSONNEL:

Tester Signature: _____ Date: 06.03.08

Typed/Printed Name: E. Pitt

Field Strength of Fundamental

E.U.T Description	Wireless ECG Recording System
Model Number	PCECG1200WR
Serial Number:	6003R

Specification: F.C.C., Part 15, Subpart C 15.249(a)

Antenna Polarization: Vertical

Test Distance: 3 meters Detector: Peak

Freq. (MHz)	Peak Reading (*) (dBµV/m)	Specification (dBµV/m)	Margin (dB)
2402.00	90.7	114.0	-23.3
2437.00	91.8	114.0	-22.2
2477.00	92.3	114.0	-21.7

Figure 4. Field Strength of Fundamental. Antenna Polarization: VERTICAL. Detector: Peak

Note: Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

* "Peak Amp." includes "Correction Factors.

"Correction Factors" = Antenna Correction Factor + Cable Loss.

Field Strength of Fundamental

E.U.T Description	Wireless ECG Recording System
Model Number	PCECG1200WR
Serial Number:	6003R

Specification: F.C.C., Part 15, Subpart C 15.249(a)

Antenna Polarization: Vertical

Test Distance: 3 meters Detector: Average

Freq. (MHz)	Avg. Reading (*) (dBµV/m)	Specification (dBµV/m)	Margin (dB)
2402.00	64.3	94.0	-29.7
2437.00	67.2	94.0	-26.8
2477.00	66.7	94.0	-27.3

Figure 5. Field Strength of Fundamental. Antenna Polarization: VERTICAL. Detector: Average

Note: Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

* "Avg. Amp." includes "Correction Factors.

"Correction Factors" = Antenna Correction Factor + Cable Loss.

Field Strength of Fundamental

E.U.T Description	Wireless ECG Recording System
Model Number	PCECG1200WR
Serial Number:	6003R

Specification: F.C.C., Part 15, Subpart C 15.249(a)

Antenna Polarization: Vertical
Operation Frequency: 2402.00 MHz
Test Distance: 3 meters
Detector: Peak, Average

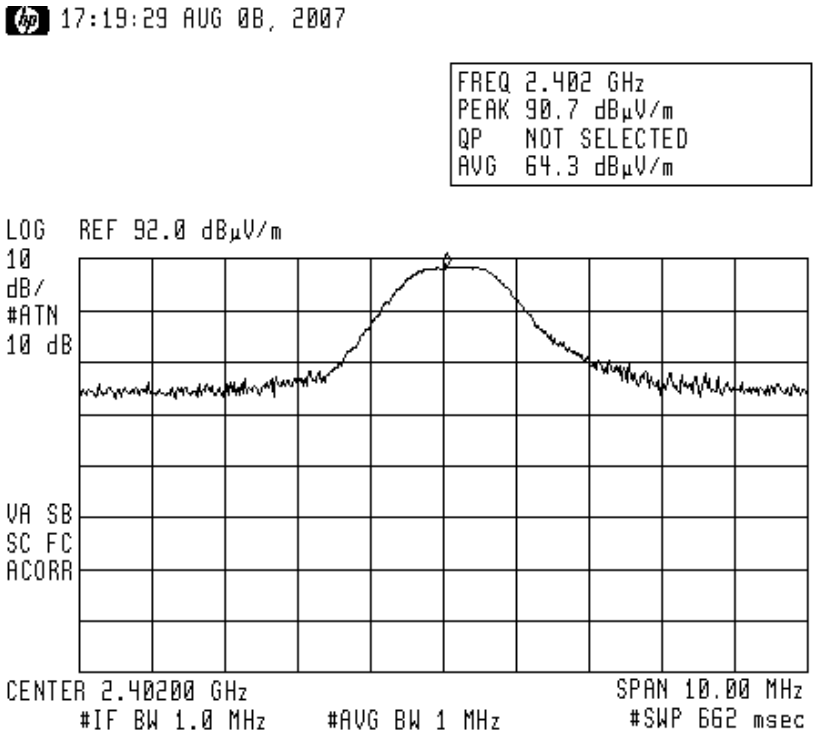


Figure 6. Field Strength of Fundamental Antenna Polarization: VERTICAL Detector: Peak, Average

Field Strength of Fundamental

E.U.T Description	Wireless ECG Recording System
Model Number	PCECG1200WR
Serial Number:	6003R

Specification: F.C.C., Part 15, Subpart C 15.249(a)

Antenna Polarization: Vertical
Operation Frequency: 2437.00 MHz
Test Distance: 3 meters
Detector: Peak, Average

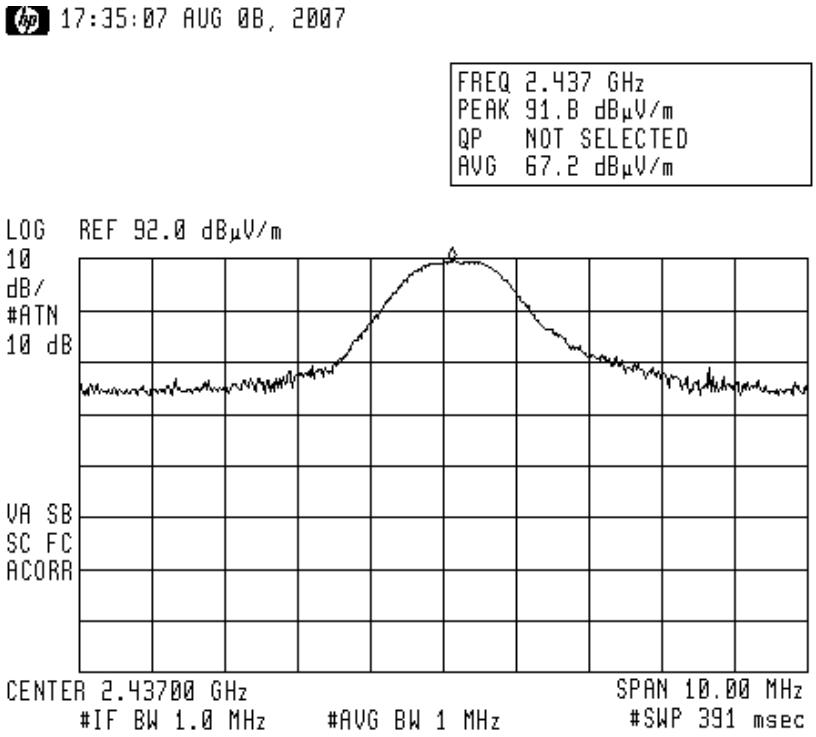


Figure 7. Field Strength of Fundamental Antenna Polarization: VERTICAL Detector: Peak, Average

Field Strength of Fundamental

E.U.T Description	Wireless ECG Recording System
Model Number	PCECG1200WR
Serial Number:	6003R

Specification: F.C.C., Part 15, Subpart C 15.249(a)

Antenna Polarization: Vertical
Operation Frequency: 2477.00 MHz
Test Distance: 3 meters
Detector: Peak, Average

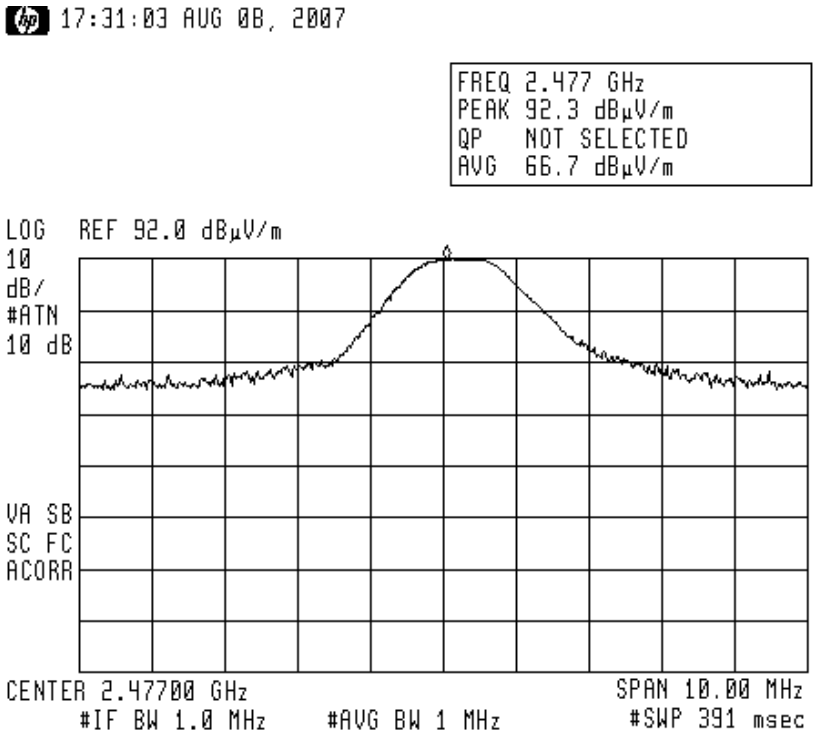


Figure 8. Field Strength of Fundamental Antenna Polarization: VERTICAL Detector: Peak, Average

5.4 Test Instrumentation Used, Field Strength of Fundamental

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3411A00102	November 22, 2006	1 year
RF Section	HP	85420E	3427A00103	November 22, 2006	1 year
Antenna Log Periodic	ARA	LPD-2010/A	1038	November 30, 2006	1 year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	ThinkJet 2225	2738508357.0	N/A	N/A

6. Radiated Measurement Photos

Figure 9. Radiated Emission Test Front

Figure 10. Radiated Emission Test Side

7. Conducted Emission Test Data

7.1 Test Specification

0.15 - 30 MHz, FCC Part 15, Subpart B, CLASS B, Subpart C

7.2 Test Procedure

The E.U.T operation mode and test configuration are as described in Sections 3 and 4. In order to minimize background noise interference, the conducted emission testing was performed inside a shielded room, with the E.U.T placed on an 0.8 meter high wooden table, 0.4 meter from the room's vertical wall.

The E.U.T was powered from 115 V AC / 60 Hz via 50 Ohm / 50 µHn Line Impedance Stabilization Network (LISN) on the phase and neutral lines. The LISN's were grounded to the shielded room ground plane (floor), and were kept at least 0.8 meters from the nearest boundary of the E.U.T

The center of the E.U.T.'s AC cable was folded back and forth, in order to form a bundle less than 0.40 meters and a total cable length of 1 meter.

The effect of varying the position of the cables was investigated to find the configuration that produces maximum emission. The configuration tested is shown in the photograph, Figure 9. Radiated Emission Test.

The emission voltages at the LISN's outputs were measured using a computerized receiver, complying to CISPR 16 requirements. The specification limits are loaded to the receiver via a 3.5" floppy disk and are displayed on the receiver's spectrum display.

A frequency scan between 0.15 and 30 MHz was performed at 9 kHz I.F. band width, using peak detection.

The spectral components having the highest level on each line were measured using a quasi-peak and average detector.

7.3 Test Data

JUDGEMENT: Passed by 10.8 dB

The E.U.T met the requirements of the FCC Part 15, Subpart B, Class B ; Sub-part C specification.

The margin between the emission levels and the specification limit is, in the worst case, 17.0 dB for the phase line at 9.96 MHz and 10.8 dB at 0.26 MHz for the neutral line.

The details of the highest emissions are given in *Figure 11* to *Figure 14*.

TEST PERSONNEL:

Tester Signature: _____ Date: 06.03.08

Typed/Printed Name: Y. Mordukhovitch

Conducted Emission

E.U.T Description	Wireless ECG Recording System
Type	PCECG1200WR
Serial Number:	6003R

Specification: FCC Part 15, Subpart B, Class **B;** Sub-part C
Lead: Phase
Detectors: Peak, Quasi-peak, Average

Signal Number	Frequency (MHz)	Peak (dBuV)	QP (dBuV)	QP Delta L 1 (dB)	Avg (dBuV)	Av Delta L 2 (dB)	Corr (dB)
1	0.262005	38.1	34.9	-26.5	32.4	-19.0	0.1
2	0.393014	31.9	30.5	-27.5	29.2	-18.8	0.2
3	0.656191	34.9	32.6	-23.4	28.3	-17.7	0.2
4	6.163715	39.7	34.5	-25.5	26.8	-23.2	0.7
5	9.436860	40.5	37.6	-22.4	32.2	-17.8	0.8
6	9.960780	40.1	36.7	-23.3	33.0	-17.0	0.8

Figure 11. Detectors: Peak, AVERAGE .

Note: QP Delta/Av Delta refer to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Conducted Emission

E.U.T Description	Wireless ECG Recording System
Type	PCECG1200WR
Serial Number:	6003R

Specification: FCC Part 15, Subpart B, Class **B;** Sub-part C
Lead: Phase
Detectors: Peak, Quasi-peak, Average

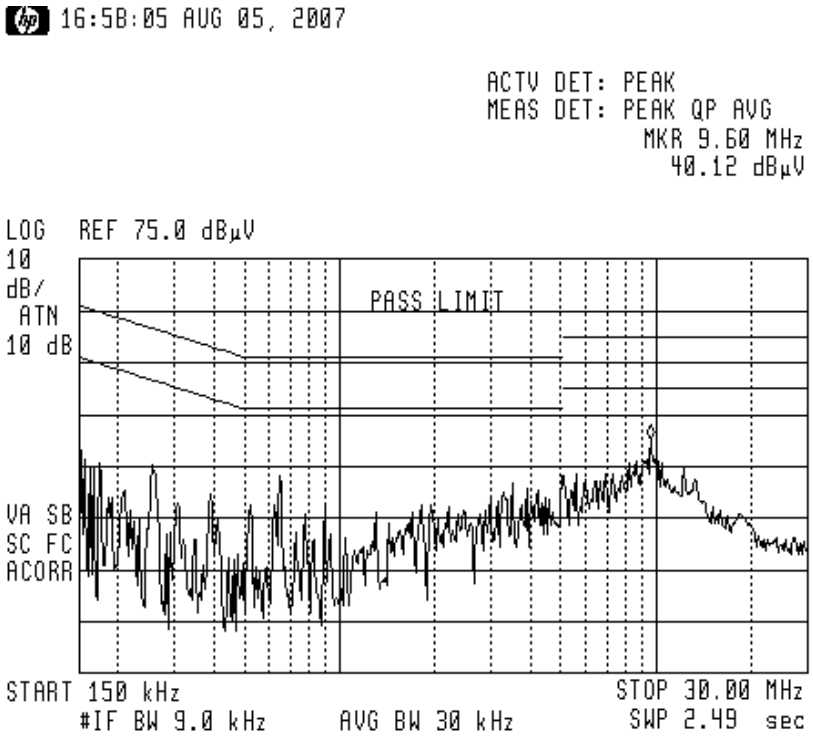


Figure 12. Detectors: Peak, Quasi-peak, Average

Conducted Emission

E.U.T Description	Wireless ECG Recording System
Type	PCECG1200WR
Serial Number:	6003R

Specification:	FCC Part 15, Subpart B, Class **B;** Sub-part C
Lead:	Neutral
Detectors:	Peak, Quasi-peak, Average

Signal Number	Frequency (MHz)	Peak (dBuV)	QP (dBuV)	QP Delta L 1 (dB)	Avg (dBuV)	Av Delta L 2 (dB)	Corr (dB)
1	0.262170	43.5	41.7	-19.7	40.6	-10.8	0.1
2	0.393982	38.3	36.7	-21.3	35.7	-12.3	0.2
3	6.163750	41.5	37.6	-22.4	34.2	-15.8	0.7
4	6.264575	38.3	35.1	-24.9	32.0	-18.0	0.7
5	9.831750	41.7	39.0	-21.0	36.4	-13.6	0.8
6	9.964205	41.1	38.6	-21.4	35.8	-14.2	0.8
7	10.094313	41.2	38.3	-21.7	35.6	-14.4	0.8

Figure 13. Detectors: Peak, AVERAGE

Note: QP Delta/Av Delta refer to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Conducted Emission

E.U.T Description	Wireless ECG Recording System
Type	PCECG1200WR
Serial Number:	6003R

Specification: FCC Part 15, Subpart B, Class **B;** Sub-part C
Lead: Neutral
Detectors: Peak, Quasi-peak, Average

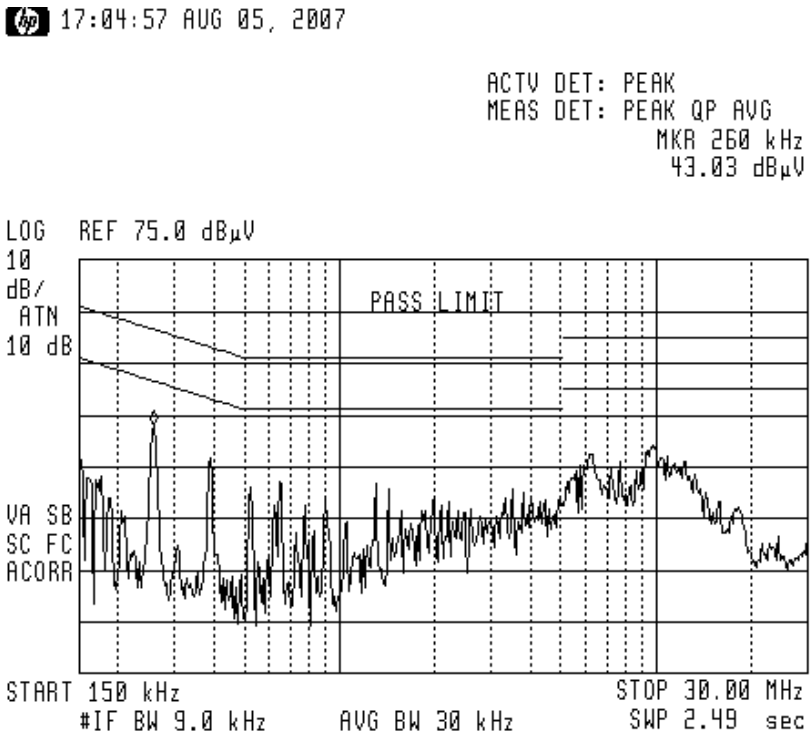


Figure 14 Conducted Emission: NEUTRAL
Detectors: Peak, Quasi-peak, Average

7.4 Test Instrumentation Used, Conducted Measurement

Instrument	Manufacturer	Model	Serial No.	Calibration	Period
LISN	Fischer	FCC-LISN-2A	127	March 8, 2007	1 Year
LISN	Fischer	FCC-LISN-2A	128	March 8, 2007	1 Year
EMI Receiver	HP	85422E	3906A00276	November 22, 2006	1Year
RF Filter Section	HP	85420E	3705A00248	November 22, 2006	1Year
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A

8. Spurious Radiated Emission 30MHz-1000 MHz

8.1 Test Specification

30 - 1000 MHz, FCC Part 15, Subpart B, CLASS B, Subpart C

The E.U.T. operation mode and test set-up are as described in Section 3.

A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The configuration tested is shown in *Figure 3*.

The frequency range 30-1000 MHz was scanned, and the list of the highest emissions was verified and updated accordingly.
The emissions were measured using a computerized EMI receiver complying to CISPR 16 requirements. The specification limits and applicable correction factors are loaded to the receiver via a 3.5" floppy disk.
In the frequency range 30-1000 MHz, the readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.
Verification of the E.U.T emissions was based on the following methods:

Turning the E.U.T on and off.
Using a frequency span less than 10 MHz.
Observation of the signal level during turntable rotation. Background noise is not affected by the rotation of the E.U.T.

During this test the E.U.T. was operated in continuous transmission to enable better detection of signals.

8.2 Measured Data

JUDGEMENT: Passed by 7.5 dB

The margin between the emission level and the specification limit is 7.5 dB in the worst case at the frequency of 688.50 MHz, horizontal polarization.

The EUT met the requirements of the F.C.C. Part 15, Subparts B Section 15.109; Sub-part C, Section 15.249 specification.

TEST PERSONNEL:

Tester Signature: _____ Date: 06.03.08

Typed/Printed Name: Y. Mordukhovitch

Radiated Emission

E.U.T Description	Wireless ECG Recording System
Type	PCECG1200WR
Serial Number:	6003R

Specification: FCC Part 15, Subparts B; C

Antenna Polarization: Horizontal
Antenna: 3 meters distance

Frequency range: 30 MHz to 1000 MHz
Detectors: Peak, Quasi-peak

Signal Number	Frequency (MHz)	Peak (dBuV)	QP (dBuV)	QP Delta L 1 (dB)	Avg (dBuV)	Av Delta L 2 (dB)	Corr (dB)
1	44.911399	36.3	31.0	-9.0			12.5
2	46.681135	37.4	30.4	-9.6			12.2
3	48.005000	35.1	29.8	-10.2			11.9
4	576.548975	39.3	36.5	-9.5			23.7
5	688.501956	40.5	38.5	-7.5			25.2
6	719.928300	38.9	34.2	-11.8			25.5
7	720.682500	39.6	36.3	-9.7			25.5

Figure 15. Radiated Emission. Antenna Polarization: HORIZONTAL. Detectors: Peak, Quasi-peak

Note: QP Delta refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Radiated Emission

E.U.T Description	Wireless ECG Recording System
Type	PCECG1200WR
Serial Number:	6003R

Specification: FCC Part 15, Subparts B; C

Antenna Polarization: Horizontal
Antenna: 3 meters distance

Frequency range: 30 MHz to 1000 MHz
Detectors: Peak, Quasi-peak

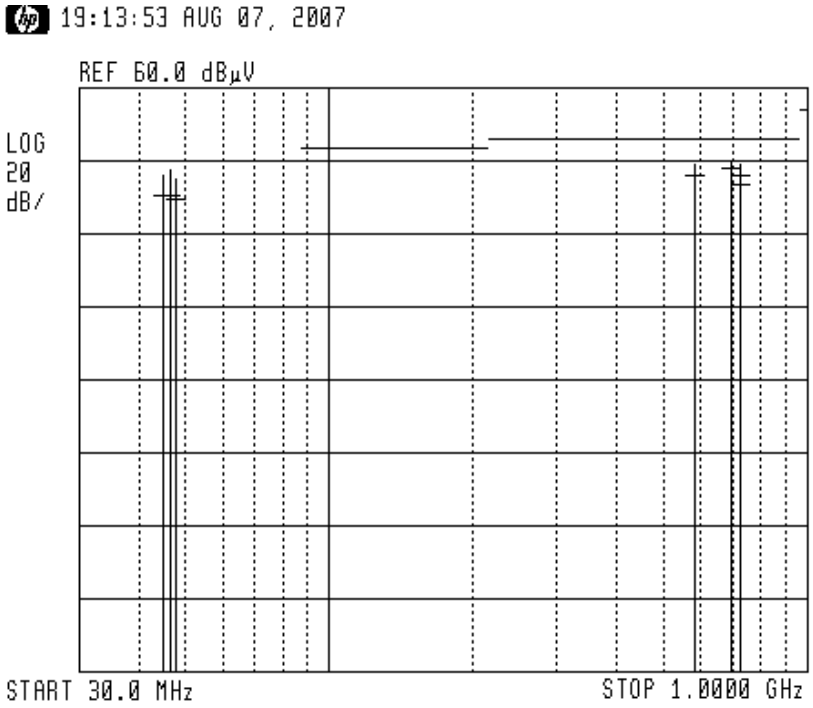


Figure 16. Radiated Emission. Antenna Polarization: HORIZONTAL Detectors: Peak, Quasi-peak

Note:

1. *Horizontal axis shows logarithmic frequency scale.*
2. *The vertical axis shows amplitude (in dB µV/m).*
3. *Peak detection is designated by the top of each vertical line.*
4. *Quasi-peak detection is designated by the first dash mark (from the top) of each vertical line.*

Radiated Emission

E.U.T Description	Wireless ECG Recording System
Type	PCECG1200WR
Serial Number:	6003R

Specification: FCC Part 15, Subparts B; C

Antenna Polarization: Vertical
Antenna: 3 meters distance

Frequency range: 30 MHz to 1000 MHz
Detectors: Peak, Quasi-peak

Signal Number	Frequency (MHz)	Peak (dBuV)	QP (dBuV)	QP Delta L 1 (dB)	Avg (dBuV)	Av Delta L 2 (dB)	Corr (dB)
1	47.996113	35.2	28.3	-11.7			11.9
2	78.387900	29.2	24.6	-15.4			10.4
3	144.126900	29.7	27.4	-16.1			14.6
4	503.238450	34.2	31.0	-15.0			21.1
5	575.991325	37.1	33.6	-12.4			23.6
6	768.686900	36.1	31.6	-14.4			25.9
7	829.879325	34.1	29.8	-16.2			26.7

Figure 17. Radiated Emission. Antenna Polarization: VERTICAL. Detectors: Peak, Quasi-peak

Note: QP Delta refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Radiated Emission

E.U.T Description	Wireless ECG Recording System
Type	PCECG1200WR
Serial Number:	6003R

Specification: FCC Part 15, Subparts B; C

Antenna Polarization: Vertical
Antenna: 3 meters distance

Frequency range: 30 MHz to 1000 MHz
Detectors: Peak, Quasi-peak

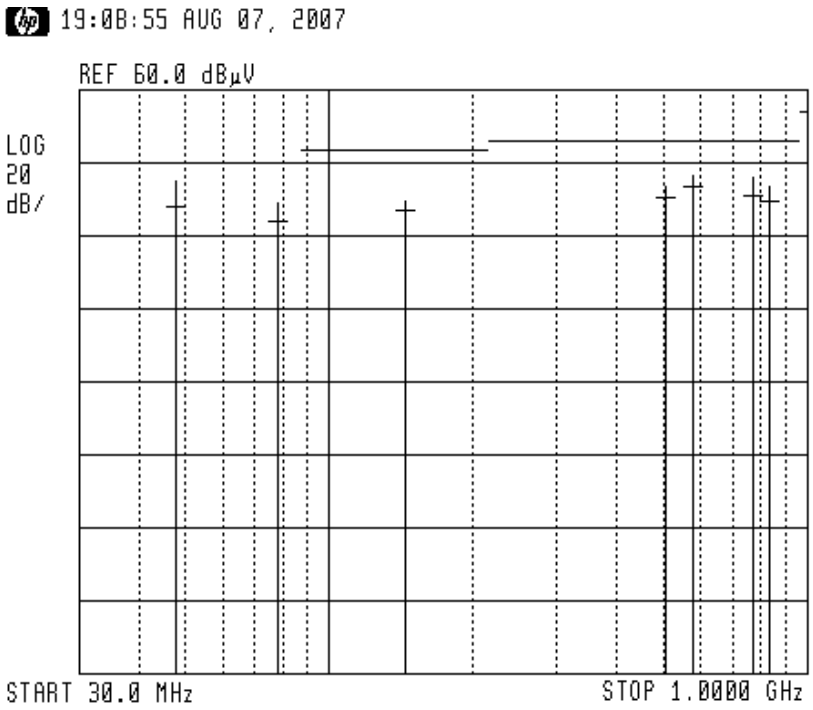


Figure 18. Radiated Emission. Antenna Polarization: VERTICAL
Detectors: Peak, Quasi-peak

Note:

1. *Horizontal axis shows logarithmic frequency scale.*
2. *The vertical axis shows amplitude (in dB µV/m).*
3. *Peak detection is designated by the top of each vertical line.*
4. *Quasi-peak detection is designated by the first dash mark (from the top) of each vertical line.*

8.3 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3411A00102	November 22, 2006	1 year
RF Section	HP	85420E	3427A00103	November 22, 2006	1 year
Antenna Bioconical	ARA	BCD 235/B	1041	March 22, 2007	1 year
Antenna Log Periodic	ARA	LPD-2010/A	1038	November 30, 2006	1 year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A

8.4 Field Strength Calculation

The field strength is calculated directly by the EMI Receiver software, and a "Correction Factors" data disk, using the following equation:

$$[dB\mu v/m]\ FS = RA + AF + CF$$

FS: Field Strength [dBμv/m]
RA: Receiver Amplitude [dBμv]
AF: Receiving Antenna Correction Factor [dB/m]
CF: Cable Attenuation Factor [dB]

9. Radiated Emission Test Data Above 1 GHz; Sub-part B

9.1 Test Specification

1.0-13.0 GHz, FCC Part 15, Subpart B, CLASS B

9.2 Test Procedure

The E.U.T operation mode and test configuration are as described in section 3.

A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The effect of varying the position of the cables was investigated to find the configuration that produces maximum emission.

The E.U.T. highest frequency source or used frequency is 2.6 GHz.

The frequency range 1.0-13.0 GHz was scanned, and the list of the highest emissions was verified and updated accordingly.

The emissions were measured using a computerized EMI receiver complying to CISPR 16 requirements. The specification limits and applicable correction factors are loaded to the receiver via a 3.5" floppy disk.

In the frequency range 2.9-13.0 GHz, a spectrum analyzer including a low noise amplifier was used. The test distance was 3 meters. During peak measurements, the I.F. bandwidth was 1 MHz, and video bandwidth 3 MHz. During average measurements, the I.F. bandwidth was 1 MHz and video bandwidth was 100 Hz.

The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization. Verification of the E.U.T emissions was based on the following methods: turning the E.U.T on and off; using a frequency span less than 10 MHz; observation of the signal level during turntable rotation. (Background noise is not affected by the rotation of the E.U.T.)

The emissions were measured at a distance of 3 meters.

9.3 Test Data

JUDGEMENT: Passed

The signals in the band 1.0 – 13.0 GHz were at least 20dB below the specification limit.

The E.U.T met the requirements of the FCC Part 15, Subpart B, Class B specification.

TEST PERSONNEL:

Tester Signature: _____ Date: 06.03.08

Typed/Printed Name: Y. Mordukhovitch

9.4 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
Receiver	HP	85422E	3411A00102	November 22, 2006	1 year
RF Section	HP	85420E	3427A00103	November 22, 2006	1 year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	ThinkJet2225	2738508357	N/A	N/A
Antenna-Log Periodic	A.H.System	SAS-200/511	253	February 4, 2007	2 years
Double Ridged Waveguide Horn Antenna	EMCO	3115	29845	March 15, 2006	2 years
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	013	November 2, 2006	1 year
Spectrum Analyzer	HP	8592L	3926A01204	November 21, 2006	1 year
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A

9.5 Field Strength Calculation

The field strength is calculated directly by the EMI Receiver software, and a "Correction Factors" data disk, using the following equation:

$$FS = RA + AF + CF$$

Where:

FS:	Field strength [dBμV/m]
RA:	Receiver Amplitude [dBμV]
AF:	Receiving Antenna Correction Factor [dB/m]
CF:	Cable attenuation Factor [dB]

No external pre-amplifiers are used.

10. Spurious Radiated Emission Above 1 GHz

10.1 Spurious Radiated Emission Above 1 GHz

The E.U.T operation mode and test set-up are as described in Section 3.

A preliminary measurement to characterize the E.U.T was performed inside the shielded room, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The configuration tested is shown in Figure 3.

The frequency range 1 –25.0 GHz was scanned, and the list of the highest emissions was verified and updated accordingly.

The emission levels were compared to the requirement of Section 15.249.

In the frequency range 1-25.0 GHz, a computerized EMI receiver complying to CISPR 16 requirements was used. The test distance was 3 meters.

In the frequency range 2.9-25.0 GHz, a spectrum analyzer including a low noise amplifier was used. The test distance was 3 meters. During peak measurements, the I.F. bandwidth was 1 MHz, and video bandwidth 3 MHz. During average measurements, the I.F. bandwidth was 1 MHz and video bandwidth was 100 Hz.

The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.

Verification of the E.U.T emissions was based on the following methods: turning the E.U.T on and off; using a frequency span less than 10 MHz; observation of the signal level during turntable rotation. (Background noise is not affected by the rotation of the E.U.T.).

10.2 Test Data

JUDGEMENT: Passed by 12.1 dB

The margin between the emission level and the specification limit is 14.3 dB in the worst case at the frequency of 7206.43 MHz, horizontal and vertical polarizations for the operation frequency 2402 MHz.

The margin between the emission level and the specification limit is 13.0 dB in the worst case at the frequency of 7311.42 MHz, horizontal polarization for the operation frequency 2437 MHz.

The margin between the emission level and the specification limit is 13.0 dB in the worst case at the frequency of 2483.50 MHz, vertical polarization for the operation frequency 2477 MHz.

All other signals not included in the result tables are at least 20dB below the specification limit.

The EUT met the requirements of the F.C.C. Part 15, Subpart C Section 15.249, specification.

The details of the highest emissions are given in *Figure 19* to *Figure 22*.

TEST PERSONNEL:

Tester Signature: _____ Date: 06.03.08

Typed/Printed Name: Y. Mordukhovitch

Spurious Radiated Emission Above 1 GHz

E.U.T Description	Wireless ECG Recording System
Model Number	PCECG1200WR
Serial Number:	6003R

Specification: F.C.C., Part 15, Subpart C, 15.249

Antenna Polarization: Horizontal/Vertical

Frequency range: 1.0 GHz to 25.0 GHz

Test Distance: 3 meters

Detector: Peak

Operation Freq. (MHz)	Freq. (MHz)	Peak Result* (dBµV/m)	Polarization (H/L)	Peak. Specification (dB µV/m)	Peak. Margin (dB)
2402.00	4804.29	51.8	H	74.0	-22.2
	7206.43	55.4	H	74.0	-18.6
	4804.29	56.2	V	74.0	-17.8
	7206.43	56.3	V	74.0	-17.7
2437.00	4874.36	53.0	H	74.0	-21.0
	7311.42	55.8	H	74.0	-18.2
	4874.36	53.1	V	74.0	-20.9
	7311.42	56.5	V	74.0	-17.5

Figure 19. Spurious Radiated Emission. Antenna Polarization: HORIZONTAL/Vertical. Detector: Peak

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

*"Peak Result" includes correction factor.

"Correction Factor" = Antenna Factor + Cable Loss – Amplifier Gain

Spurious Radiated Emission Above 1 GHz

E.U.T Description	Wireless ECG Recording System
Model Number	PCECG1200WR
Serial Number:	6003R

Specification: F.C.C., Part 15, Subpart C, 15.249

Antenna Polarization: Horizontal/Vertical

Frequency range: 1.0 GHz to 25.0 GHz

Test Distance: 3 meters

Detector: Peak

Operation Freq. (MHz)	Freq. (MHz)	Peak Result (dBµV/m)	Polarization (H/L)	Peak. Specification (dB µV/m)	Peak. Margin (dB)
2477.00	2483.50	60.9*	H	74.0	-13.1
	4954.27	49.7**	H	74.0	-24.3
	7431.43	58.1**	H	74.0	-15.9
	2483.50	61.0*	V	74.0	-13.0
	4954.27	54.4**	V	74.0	-19.6
	7431.43	58.9**	V	74.0	-15.1

Figure 20. Spurious Radiated Emission. Antenna Polarization: HORIZONTAL/Vertical. Detector: Peak

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Peak Result" includes correction factor.

*"Correction Factor" = Antenna Factor + Cable Loss

**"Correction Factor" = Antenna Factor + Cable Loss – Amplifier Gain

Spurious Radiated Emission Above 1 GHz

E.U.T Description	Wireless ECG Recording System
Model Number	PCECG1200WR
Serial Number:	6003R

Specification: F.C.C., Part 15, Subpart C, 15.249

Antenna Polarization: Horizontal/Vertical

Frequency range: 1.0 GHz to 25.0 GHz

Test Distance: 3 meters

Detector: Average

OperationFreq.	Freq.	Average Result	Polarization	Average Specification	Average Margin
(MHz)	(MHz)	(dBµV/m)	(H/L)	(dB µV/m)	(dB)
2402.00	4804.29	30.5**	H	54.0	-23.5
	7206.43	39.7**	H	54.0	-14.3
	4804.29	30.0**	V	54.0	-24.0
	7206.43	39.7**	V	54.0	-14.3
2437.00	4874.36	28.6**	H	54.0	-25.4
	7311.42	41.0**	H	54.0	-13.0
	4874.36	29.6**	V	54.0	-24.4
	7311.42	40.8**	V	54.0	-13.2

Figure 21. Spurious Radiated Emission. Antenna Polarization: HORIZONTAL/Vertical. Detector: Peak

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Average Result" includes correction factor.

*"Correction Factor" = Antenna Factor + Cable Loss

**"Correction Factor" = Antenna Factor + Cable Loss – Amplifier Gain

Spurious Radiated Emission Above 1 GHz

E.U.T Description	Wireless ECG Recording System
Model Number	PCECG1200WR
Serial Number:	6003R

Specification: F.C.C., Part 15, Subpart C, 15.249

Antenna Polarization: Horizontal/Vertical

Frequency range: 1.0 GHz to 25.0 GHz

Test Distance: 3 meters

Detector: Average

Operation Freq. (MHz)	Freq. (MHz)	Average Result (dBµV/m)	Polarization (H/L)	Average Specification (dB µV/m)	Average Margin (dB)
2477.00	2483.50	40.5*	H	54.0	-13.5
	4954.27	30.3**	H	54.0	-23.7
	7431.43	39.7**	H	54.0	-14.3
	2483.50	40.5*	V	54.0	-13.5
	4954.27	30.2**	V	54.0	-23.8
	7431.43	39.6**	V	54.0	-14.4

Figure 22. Spurious Radiated Emission. Antenna Polarization: HORIZONTAL/Vertical. Detector: Average

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Average Result" includes correction factor.

*"Correction Factor" = Antenna Factor + Cable Loss

**"Correction Factor" = Antenna Factor + Cable Loss – Amplifier Gain

10.3 Test Instrumentation Used, Spurious Radiated Measurements Above 1 GHz

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
Receiver	HP	85422E	3411A00102	November 22, 2006	1 year
RF Section	HP	85420E	3427A00103	November 22, 2006	1 year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	ThinkJet2225	2738508357	N/A	N/A
Antenna-Log Periodic	A.H.System	SAS-200/511	253	February 4, 2007	2 years
Double Ridged Waveguide Horn Antenna	EMCO	3115	29845	March 15, 2006	2 years
Horn Antenna	ARA	SWH-28	1008	December 8, 2006	2 Years
Horn Antenna	Narda	V637	0410	December 8, 2006	2 Years
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	013	November 2, 2006	1 year
Spectrum Analyzer	HP	8592L	3926A01204	November 21, 2006	1 year
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A

11. Photographs of Tested E.U.T.

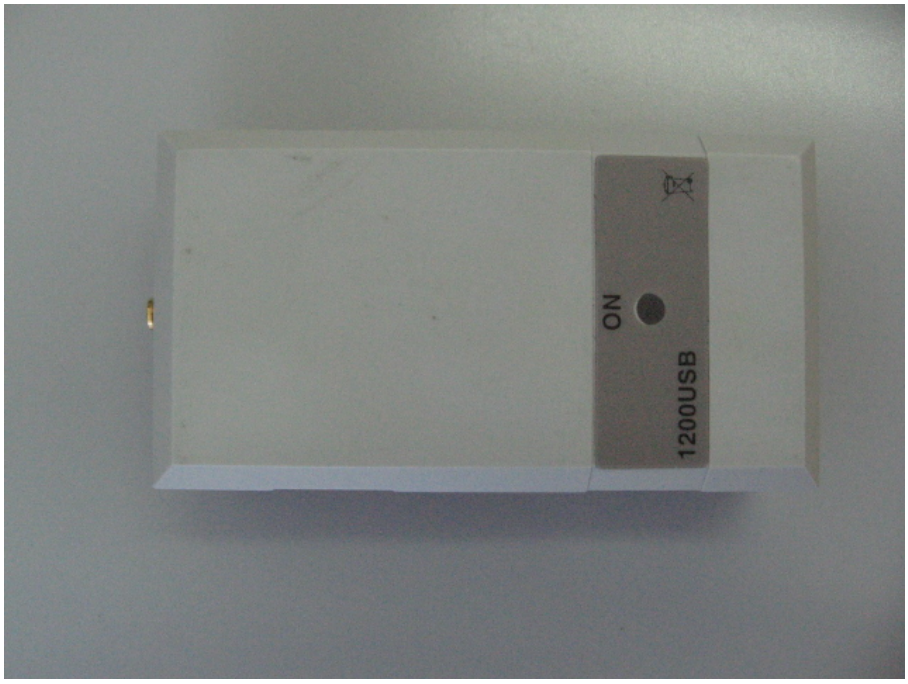


Figure 23 Top View

Figure 24 Bottom View

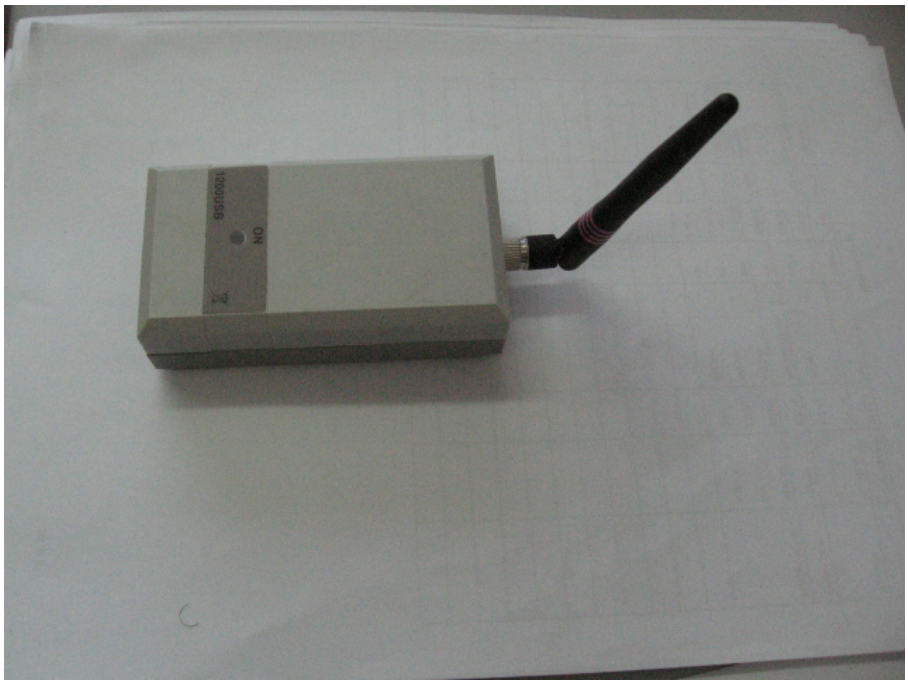


Figure 25 Top View With Antenna

Figure 26 Antenna Connector

Figure 27 USB Port

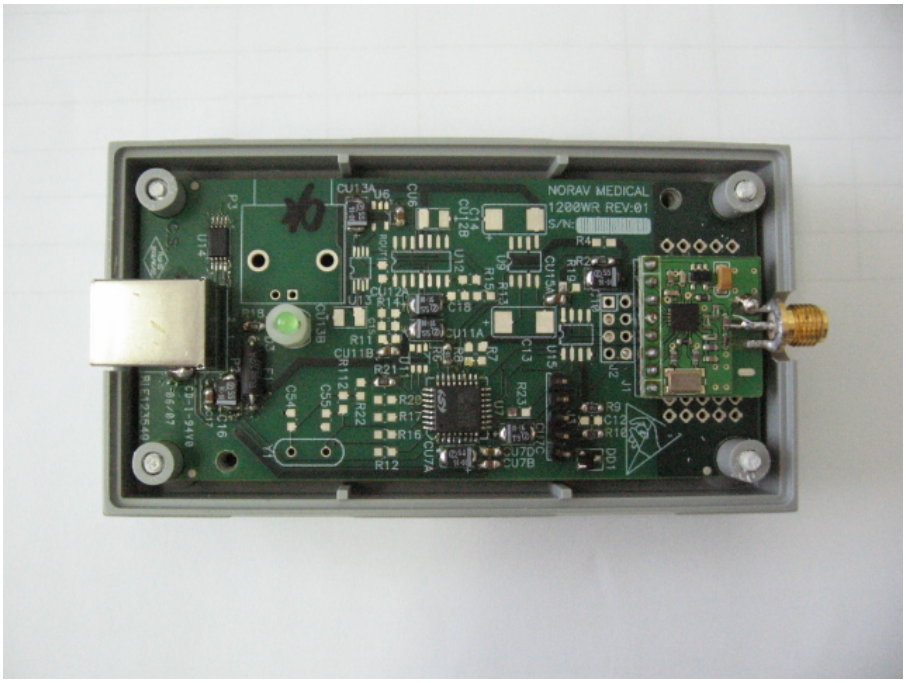


Figure 28 PCB in Case

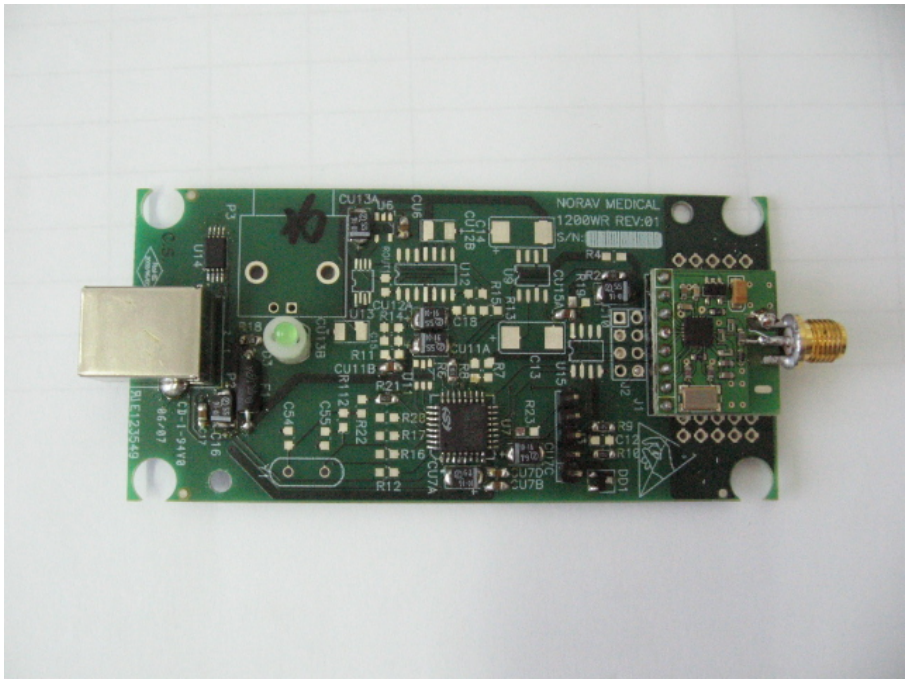


Figure 29 PCB Side 1

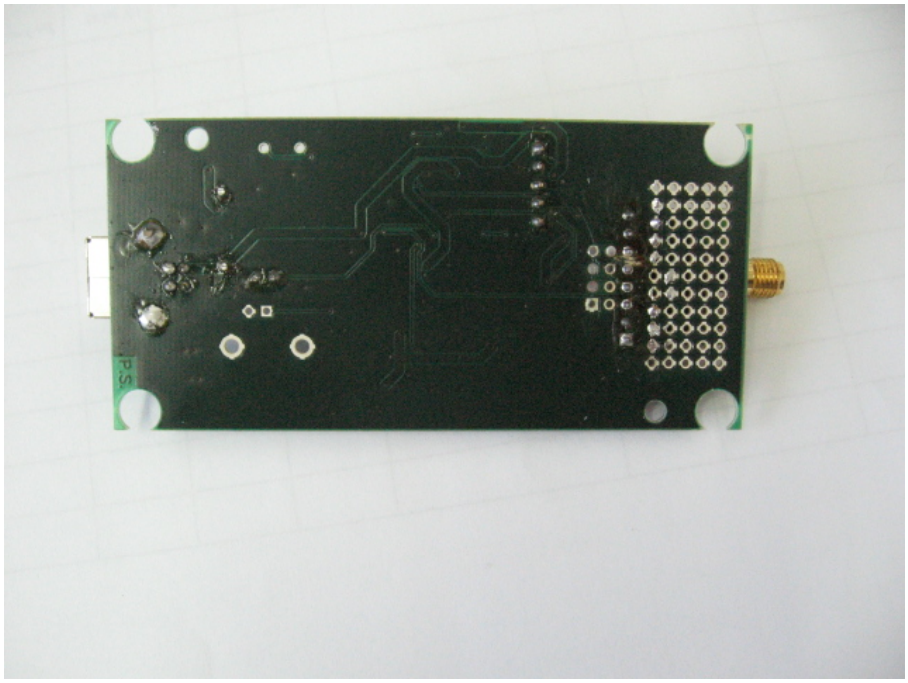


Figure 30 PCB Side 2

12. APPENDIX A - CORRECTION FACTORS

12.1 Correction factors for CABLE

from EMI receiver to test antenna at 3 meter range.

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
10.0	0.5
20.0	0.7
30.0	1.0
40.0	1.2
50.0	1.3
60.0	1.5
70.0	1.6
80.0	1.7
90.0	1.8
100.0	1.9
150.0	2.4
200.0	2.7
250.0	3.0
300.0	3.3
350.0	3.7
400.0	4.0
450.0	4.3
500.0	4.7
600.0	4.9
700.0	5.4
800.0	5.8
900.0	6.3
1000.0	6.7

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
1200.0	7.5
1400.0	8.2
1600.0	9.0
1800.0	9.6
2000.0	10.7
2300.0	11.1
2600.0	11.8
2900.0	12.8

NOTES:

1. The cable type is RG-214.

2. The overall length of the cable is 27 meters.

3. The above data is located in file 27MO3MO.CBL on the disk marked "Radiated Emission Tests EMI Receiver".

12.2 Correction factors for CABLE

from EMI receiver to test antenna at 3 meter range.

FREQUENCY (GHz)	CORRECTION FACTOR (dB)
1.0	1.2
2.0	1.6
3.0	2.0
4.0	2.4
5.0	3.0
6.0	3.4
7.0	3.8
8.0	4.2
9.0	4.6
10.0	5.0
12.0	5.8

NOTES:

1. The cable type is RG-8.

2. The overall length of the cable is 10 meters.

12.3 Correction factors for CABLE

from spectrum analyzer to test antenna above 2.9 GHz

FREQUENCY (GHz)	CORRECTION FACTOR (dB)	FREQUENCY (GHz)	CORRECTION FACTOR (dB)
1.0	1.9	14.0	9.1
2.0	2.7	15.0	9.5
3.0	3.5	16.0	9.9
4.0	4.2	17.0	10.2
5.0	4.9	18.0	10.4
6.0	5.5	19.0	10.7
7.0	6.0	20.0	10.9
8.0	6.5	21.0	11.2
9.0	7.0	22.0	11.6
10.0	7.5	23.0	11.9
11.0	7.9	24.0	12.3
12.0	8.3	25.0	12.6
13.0	8.7	26.0	13.0

NOTES:

1. The cable type is SUCOFLEX 104 E manufactured by SUHNER.

2. The cable is used for measurements above 2.9 GHz.

3. The overall length of the cable is 10 meters.

12.4 Correction factors for LOG PERIODIC ANTENNA

Type LPD 2010/A
at 3 and 10 meter ranges.

Distance of 3 meters

FREQUENCY (MHz)	AFE (dB/m)
200.0	9.1
250.0	10.2
300.0	11.4
400.0	14.5
500.0	15.2
600.0	17.3
700.0	19.0
850.0	20.1
1000.0	22.2

Distance of 10 meters

FREQUENCY (MHz)	AFE (dB/m)
200.0	9.0
250.0	10.1
300.0	11.2
400.0	14.4
500.0	15.2
600.0	17.2
700.0	19.0
850.0	20.1
1000.0	22.1

NOTES:

1. *Antenna serial number is 1038.*
2. *The above lists are located in file number 38M3O.ANT for a 3 meter range, and file number 38M100.ANT for a 10 meter range.*
3. *The files mentioned above are located on the disk marked "Radiated Emission Test EMI Receiver".*

12.5 Correction factors for LOG PERIODIC ANTENNA

Type SAS-200/511
at 3 meter range.

FREQUENCY (GHz)	ANTENNA FACTOR (dB)
1.0	24.9
1.5	27.8
2.0	29.9
2.5	31.2
3.0	32.8
3.5	33.6
4.0	34.3
4.5	35.2
5.0	36.2
5.5	36.7
6.0	37.2
6.5	38.1

FREQUENCY (GHz)	ANTENNA FACTOR (dB)
7.0	38.6
7.5	39.2
8.0	39.9
8.5	40.4
9.0	40.8
9.5	41.1
10.0	41.7
10.5	42.4
11.0	42.5
11.5	43.1
12.0	43.4
12.5	44.4
13.0	44.6

NOTES:

1. Antenna serial number is 253.

2. The above lists are located in file number SAS3M0.ANT for a 3 meter range.

3. The files mentioned above are located on the disk marked "Antenna Factors".

12.6 Correction factors for BICONICAL ANTENNA

Type BCD-235/B, at 3 meter range

FREQUENCY (MHz)	AFE (dB/m)
20.0	19.4
30.0	14.8
40.0	11.9
50.0	10.2
60.0	9.1
70.0	8.5
80.0	8.9
90.0	9.6
100.0	10.3
110.0	11.0
120.0	11.5
130.0	11.7
140.0	12.1
150.0	12.6
160.0	12.8
170.0	13.0
180.0	13.5
190.0	14.0
200.0	14.8
210.0	15.3
220.0	15.8
230.0	16.2
240.0	16.6
250.0	17.6
260.0	18.2
270.0	18.4
280.0	18.7
290.0	19.2
300.0	19.9
310	20.7
320	21.9
330	23.4
340	25.1
350	27.0

NOTES:

1. Antenna serial number is 1041.

2. The above list is located in file 19BC10M1.ANT on the disk marked "Radiated Emissions Tests EMI Receiver".

12.7 Correction factors for Double-Ridged Waveguide Horn

Model: 3115, S/N 29845
at 3 meter range.

FREQUENCY (GHz)	ANTENNA FACTOR (dB 1/m)	ANTENNA Gain (dBi)	FREQUENCY (GHz)	ANTENNA FACTOR (dB 1/m)	ANTENNA Gain (dBi)
1.0	24.8	5.4	10.0	38.8	11.4
1.5	26.1	7.6	10.5	38.9	11.8
2.0	28.6	7.7	11.0	39.0	12.1
2.5	29.8	8.4	11.5	39.6	11.8
3.0	31.4	8.4	12.0	39.8	12.0
3.5	32.4	8.7	12.5	39.6	12.5
4.0	33.7	8.6	13.0	40.0	12.5
4.5	33.4	9.9	13.5	39.8	13.0
5.0	34.5	9.7	14.0	40.2	13.0
5.5	35.1	9.9	14.5	40.6	12.9
6.0	35.4	10.4	15.0	41.3	12.4
6.5	35.6	10.8	15.5	39.5	14.6
7.0	36.2	10.9	16.0	38.8	15.5
7.5	37.3	10.4	16.5	40.0	14.6
8.0	37.7	10.6	17.0	41.4	13.4
8.5	38.3	10.5	17.5	44.8	10.3
9.0	38.5	10.8	18.0	47.2	8.1
9.5	38.7	11.1			

12.8 Correction factors for Horn Antenna

Model: SWH-28
at 1 meter range.

FREQUENCY (GHz)	AFE (dB /m)	Gain (dB1)
18.0	40.3	16.1
19.0	40.3	16.3
20.0	40.3	16.1
21.0	40.3	16.3
22.0	40.4	16.8
23.0	40.5	16.4
24.0	40.5	16.6
25.0	40.5	16.7
26.0	40.6	16.4

12.9 Correction factors for Horn Antenna

Model: V637

FREQUENCY (GHz)	AFE (dB /m)	Gain (dB1)
26.0	43.6	14.9
27.0	43.7	15.1
28.0	43.8	15.3
29.0	43.9	15.5
30.0	43.9	15.8
31.0	44.0	16.0
32.0	44.1	16.2
33.0	44.1	16.4
34.0	44.1	16.7
35.0	44.2	16.9
36.0	44.2	17.1
37.0	44.2	17.4
38.0	44.2	17.6
39.0	44.2	17.8
40.0	44.2	18.0