

***Electromagnetic Emissions Test Report  
and  
Application for Grant of Equipment Authorization  
pursuant to  
FCC Part 15, Subpart C Specifications for an  
Intentional Radiator on the  
St. Jude Medical CRMD  
Model: Housecall 2.0***

FCC ID: LJYTR-3000

GRANTEE: St. Jude Medical CRMD  
701 East Evelyn Avenue  
Sunnyvale, CA 94086

TEST SITE: Elliott Laboratories, Inc.  
684 W. Maude Avenue  
Sunnyvale, CA 94086

REPORT DATE: December 17, 1998

FINAL TEST DATE: October 14 and December 8, 1998

AUTHORIZED SIGNATORY:

  
\_\_\_\_\_  
Mark Briggs  
Manager, EMC Consulting Services

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## **SCOPE**

An electromagnetic emissions test has been performed on the St. Jude Medical CRMD defibrillator interrogator model Housecall 2.0 pursuant to Subpart C of Part 15 of FCC Rules for intentional radiators. Conducted and radiated emissions data has been collected, reduced, and analyzed within this report in accordance with measurement guidelines set forth in ANSI C63.4-1992 as outlined in Elliott Laboratories test procedures.

The intentional radiator above has been tested in a simulated typical installation to demonstrate compliance with the relevant FCC performance and procedural standards.

Final system data was gathered in a mode that tended to maximize emissions by varying orientation of EUT, orientation of power and I/O cabling, antenna search height, and antenna polarization.

Every practical effort was made to perform an impartial test using appropriate test equipment of known calibration. All pertinent factors have been applied to reach the determination of compliance.

The test results recorded herein are based on a single type test of the St. Jude Medical CRMD model Housecall 2.0 and therefore apply only to the tested sample. The sample was selected and prepared by Dean Anderson of St. Jude Medical CRMD.

## **OBJECTIVE**

The primary objective of the manufacturer is compliance with Subpart C of Part 15 of FCC Rules for the radiated and conducted emissions of intentional radiators. Certification of these devices is required as a prerequisite to marketing as defined in Part 2 the FCC Rules.

Certification is a procedure where the manufacturer or a contracted laboratory makes measurements and submits the test data and technical information to the FCC. The FCC issues a grant of equipment authorization upon successful completion of their review of the submitted documents. Once the equipment authorization has been obtained, the label indicating compliance must be attached to all identical units which are subsequently manufactured.

## **STATEMENT OF COMPLIANCE**

The tested sample of St. Jude Medical CRMD model Housecall 2.0 complied with the requirements of Subpart C of Part 15 of the FCC Rules for low power intentional radiators.

Maintenance of FCC compliance is the responsibility of the manufacturer. Any modification of the product which may result in increased emissions should be checked to ensure compliance has been maintained (i.e., printed circuit board layout changes, different line filter, different power supply, harnessing or I/O cable changes, etc.).

**EMISSION TEST RESULTS**

The following emissions tests were performed on the St. Jude Medical CRMD model Housecall 2.0. The actual test results are contained in an exhibit of this report.

**LIMITS OF CONDUCTED INTERFERENCE VOLTAGE**

The EUT tested complied with the limits detailed in FCC Rules Part 15 Section 15.207.

The following measurement was extracted from the data recorded during the conducted emissions scan and represents the highest amplitude emission relative to the specification limit. The actual test data and any correction factors are contained in an exhibit of this report.

## 0.45 - 30 MHz

Frequency MHz	Level dBuV	Power Lead	15.207 Limit	15.207 Margin	Detector Function	Comments
10.6488	42.1	Line 1	48.0	-5.9	QP	

**LIMITS OF RADIATED INTERFERENCE FIELD STRENGTH**

The EUT tested complied with the limits detailed in FCC Rules Part 15 Section 15.209.

The following measurement was extracted from the data recorded during the radiated electric field emissions scan and represents the highest amplitude emission relative to the specification limit. The actual test data and any correction factors are contained in an exhibit of this report.

## 0.1 - 1.0 MHz

Frequency MHz	Level dBuV/m	Pol v/h	15.209 Limit	15.209 Margin	Detector Pk/QP/Avg	Azimuth degrees	Height meters	Comments
0.700	-1.6	-	30.7	-32.3	QP	20	1.0	9KHz RBW

**MEASUREMENT UNCERTAINTIES**

ISO Guide 25 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level and were calculated in accordance with NAMAS document NIS 81.

Measurement Type	Frequency Range (MHz)	Calculated Uncertainty (dB)
Conducted Emissions	0.15 to 30	$\pm 2.4$
Radiated Emissions	30 to 1000	$\pm 3.2$

**COMPLIANCE EXPLANATION**

When the measurement uncertainties (see above section) associated with the emission test methods and equipment used are taken into consideration there are four possible results as detailed below:

**Complied**

All measurements recorded were below the specification limit by a margin greater than the measurement uncertainty.

**Probably Complied**

One or more measurements recorded were below the specification limit by a margin less than the measurement uncertainty. It is not possible to determine that the unit complied with a 95% confidence level from the results. There is a high probability that the product tested does comply.

**Probably Did Not Comply**

One or more measurements recorded were above the specification limit by a margin less than the measurement uncertainty. It is not possible to determine that the unit failed to comply with a 95% confidence level from the results. There is a high probability that the product tested does not comply.

**Did Not Comply**

One or more measurements recorded exceeded the specification limit by a margin greater than the measurement uncertainty.

**EQUIPMENT UNDER TEST (EUT) DETAILS****GENERAL**

The St. Jude Medical CRMD model Housecall 2.0 is a Defibrillator Interrogator which is designed to allow monitoring of the condition of the defibrillator by the physician over the phone line. The sample was received on October 14, 1998 and tested on October 14, 1998. The EUT consisted of the following component(s):

Manufacturer/Model/Description	Serial Number
Ventritex (St. Judes) / Housecall 2 / Defibrillator Interrogator Transmitter	17
Ventritex (St. Judes) / Housecall 2 / Defibrillator Interrogator Wand	12

**INPUT POWER**

The Housecall 2.0 uses an external AC-DC adapter which is rated at 120V / 60 Hz. The Wand transmitter takes power from the main Housecall unit. The EUT used the following AC-DC adapter during emissions testing:

Description	Manufacturer	Model
Power Supply	Ault	P41090650A020G

**PRINTED WIRING BOARDS**

The EUT contained the following printed wiring boards during emissions testing:

Manufacturer/Description	Assembly #	Rev.	Serial #	Crystals (MHz)
Ventritex / TR3000 Main Board	8007669	D	N/A	0.032, 0.983, 35.25
Ventritex / TR3000 Wand Board	8006728	C	N/A	None

**ENCLOSURE**

The EUT main enclosure is primarily constructed of Molded Plastic. It measures approximately 19cm wide by 23 cm deep by 8.5 cm high.

The EUT Wand enclosure is primarily constructed of Molded Plastic. It measures approximately 6 cm wide by 14 cm deep by 4 cm high.

**EMI SUPPRESSION DEVICES**

The EUT contained the following EMI suppression devices during emissions testing:

Description	Manufacturer	Part Number
Ferrite (x2) (Internal Wand and Telephone cables)	Steward	28A0392-0A0
Ferrite (Internal DC power cable)	Steward	28B0625-100

**SUPPORT EQUIPMENT**

The following equipment was used as local support equipment for emissions testing:

Manufacturer/Model/Description	Serial #	FCC ID Number
Panasonic KX-TS5-B Phone	none	FCC pt.68 ACJMEX-25607-TE-E REN:1.0B

The following equipment was used as remote support equipment for emissions testing:

Manufacturer/Model/Description	Serial Number	FCC ID Number
Digital Products / Ring It / Phone line Simulator	9803047	None
Compaq DP4000 Host PC	6743BPN3R407	FCC B DoC
Princeton Graphic Ultra51 Multiscan Color Monitor	KNAX1-402912	BVOKD-1525

**EXTERNAL I/O CABLING**

The I/O cabling configuration during emissions testing was as follows:

Cable Description	Length (m)	From Unit/Port	To Unit/Port
RJ-11 Unshielded	40.0	EUT Transmitter	Phone Simulator
RJ-11 Unshielded	2.0	Phone Simulator	Host PC Modem
RJ-11 Unshielded	1.0	Head Set	Base Phone
RJ-11 Unshielded	2.0	Base Phone	EUT Transmitter
Wand Cable Shielded	1.5	EUT Transmitter	EUT Wand

**TEST SOFTWARE**

Firmware in the EUT controls the operation of the wand and modem, gathers, processes and sends (upon request ) the data to the remote computer. The remote computer contains software (Housecall 2.0) which queries the EUT and requests data to be sent to it via the modem and displays the results on the monitor.

## **TEST SITE**

### **GENERAL INFORMATION**

Final test measurements were taken on October 14, 1998 at the Elliott Laboratories Open Area Test Site #3 and on December 8, 1998 at the Elliott Laboratories Open Area Test Site #2. Both sites are at 684 West Maude Avenue, Sunnyvale, California. The test sites contain separate areas for radiated and conducted emissions testing. Pursuant to section 2.948 of the Rules, construction, calibration, and equipment data has been filed with the Commission.

The FCC recommends that ambient noise at the test site be at least 6 dB below the allowable limits. Ambient levels are below this requirement with the exception of predictable local TV, radio, and mobile communications traffic. The test site contains separate areas for radiated and conducted emissions testing. Considerable engineering effort has been expended to ensure that the facilities conform to all pertinent FCC requirements.

### **CONDUCTED EMISSIONS CONSIDERATIONS**

Conducted emissions testing is performed in conformance with ANSI C63.4-1992. Measurements are made with the EUT connected to the public power network through a nominal, standardized RF impedance, which is provided by a line impedance stabilization network, known as a LISN. A LISN is inserted in series with each current-carrying conductor in the EUT power cord.

### **RADIATED EMISSIONS CONSIDERATIONS**

The FCC has determined that radiation measurements made in a shielded enclosure are not suitable for determining levels of radiated emissions. Radiated measurements are performed in an open field environment. The test site is maintained free of conductive objects within the CISPR defined elliptical area incorporated in ANSI C63.4 guidelines.



## MEASUREMENT INSTRUMENTATION

### RECEIVER SYSTEM

An EMI receiver as specified in CISPR 16-1 is used for emissions measurements. The receivers used can measure over the frequency range of 9 kHz up to 2000 MHz. These receivers, allow both ease of measurement and high accuracy to be achieved. The receivers have Peak, Average, and CISPR (Quasi-peak) detectors built into their design so no external adapters are necessary. The receiver automatically sets the required bandwidth for the CISPR detector used during measurements.

For measurements above the frequency range of the receivers, a spectrum analyzer is utilized because it provides visibility of the entire spectrum along with the precision and versatility required to support engineering analysis. Average measurements above 1000MHz are performed on the spectrum analyzer using the linear-average method with a resolution bandwidth of 1 MHz and a video bandwidth of 10 Hz.

### INSTRUMENT CONTROL COMPUTER

The receivers utilize either a Rohde and Schwarz EZM Spectrum Monitor/Controller or contain an internal Spectrum Monitor/Controller to view and convert the receiver measurements to the field strength at an antenna or voltage developed at the LISN measurement port, which is then compared directly with the appropriate specification limit. This provides faster, more accurate readings by performing the conversions described under Sample Calculations within the Test Procedures section of this report. Results are printed in a graphic and/or tabular format, as appropriate. A personal computer is used to record all measurements made with the receivers.

The Spectrum Monitor provides a visual display of the signal being measured. In addition, the controller or a personal computer run automated data collection programs which control the receivers. This provides added accuracy since all site correction factors, such as cable loss and antenna factors are added automatically.

### LINE IMPEDANCE STABILIZATION NETWORK (LISN)

Line conducted measurements utilize a fifty microhenry Line Impedance Stabilization Network as the monitoring point. The LISN used also contains a 250 uH CISPR adapter. This network provides for calibrated radio frequency noise measurements by the design of the internal low pass and high pass filters on the EUT and measurement ports, respectively.

### ***FILTERS/ATTENUATORS***

External filters and precision attenuators are often connected between the receiving antenna or LISN and the receiver. This eliminates saturation effects and non-linear operation due to high amplitude transient events.

### ***ANTENNAS***

A biconical antenna is used to cover the range from 30 MHz to 300 MHz and a log periodic antenna is utilized from 300 MHz to 1000 MHz. Narrowband tuned dipole antennas are used over the entire 30 to 1000 MHz range for precision measurements of field strength. Above 1000 MHz, a horn antenna is used. The antenna calibration factors are included in site factors which are programmed into the test receivers.

### ***ANTENNA MAST AND EQUIPMENT TURNTABLE***

The antennas used to measure the radiated electric field strength are mounted on a non-conductive antenna mast equipped with a motor-drive to vary the antenna height.

ANSI C63.4 specifies that the test height above ground for table mounted devices shall be 80 centimeters. Floor mounted equipment shall be placed on the ground plane if the device is normally used on a conductive floor or separated from the ground plane by insulating material from 3 to 12 mm if the device is normally used on a non-conductive floor. During radiated measurements, the EUT is positioned on a motorized turntable in conformance with this requirement.

### ***INSTRUMENT CALIBRATION***

All test equipment is regularly checked to ensure that performance is maintained in accordance with the manufacturer's specifications. All antennas are calibrated at regular intervals with respect to tuned half-wave dipoles. An exhibit of this report contains the list of test equipment used and calibration information.

## **TEST PROCEDURES**

### **EUT AND CABLE PLACEMENT**

The FCC requires that interconnecting cables be connected to the available ports of the unit and that the placement of the unit and the attached cables simulate the worst case orientation that can be expected from a typical installation, so far as practicable. To this end, the position of the unit and associated cabling is varied within the guidelines of ANSI C63.4, and the worst case orientation is used for final measurements.

### **CONDUCTED EMISSIONS**

Conducted emissions are measured at the plug end of the power cord supplied with the EUT. Excess power cord length is wrapped in a bundle between 30 and 40 centimeters in length near the center of the cord. Preliminary measurements are made to determine the highest amplitude emission relative to the specification limit for all the modes of operation. Placement of system components and varying of cable positions are performed in each mode. A final peak mode scan is then performed in the position and mode for which the highest emission was noted on all current carrying conductors of the power cord.

### **RADIATED EMISSIONS**

Radiated emissions measurements are performed in two phases as well. A preliminary scan of emissions is conducted in which all significant EUT frequencies are identified with the system in a nominal configuration. At least two scans are performed from 30 MHz up to the frequency required by the regulation specified on page 1. One or more of these is with the antenna polarized vertically while the one or more of these is with the antenna polarized horizontally. During the preliminary scans, the EUT is rotated through 360°, the antenna height is varied and cable positions are varied to determine the highest emission relative to the limit.

A speaker is provided in the receiver to aid in discriminating between EUT and ambient emissions. Other methods used during the preliminary scan for EUT emissions involve scanning with near field magnetic loops, monitoring I/O cables with RF current clamps, and cycling power to the EUT.

Final maximization is a phase in which the highest amplitude emissions identified in the spectral search are viewed while the EUT azimuth angle is varied from 0 to 360 degrees relative to the receiving antenna. The azimuth which results in the highest emission is then maintained while varying the antenna height from one to four meters. The result is the identification of the highest amplitude for each of the highest peaks. Each recorded level is corrected in the receiver using appropriate factors for cables, connectors, antennas, and preamplifier gain. Emissions which have values close to the specification limit may also be measured with a tuned dipole antenna to determine compliance.

**SPECIFICATION LIMITS AND SAMPLE CALCULATIONS**

The limits for conducted emissions are given in units of microvolts, and the limits for radiated emissions are given in units of microvolts per meter at a specified test distance. Data is measured in the logarithmic form of decibels relative to one microvolt, or dB microvolts (dBuV). For radiated emissions, the measured data is converted to the field strength at the antenna in dB microvolts per meter (dBuV/m). The results are then converted to the linear forms of uV and uV/m for comparison to published specifications.

For reference, converting the specification limits from linear to decibel form is accomplished by taking the base ten logarithm, then multiplying by 20. These limits in both linear and logarithmic form are as follows:

**CONDUCTED EMISSIONS SPECIFICATION LIMITS, SECTION 15.207**

Frequency Range (MHz)	Limit (uV)	Limit (dBuV)
0.450 to 30.000	250	48

**RADIATED EMISSIONS SPECIFICATION LIMITS, SECTION 15.209**

Frequency Range (MHz)	Limit (uV/m @ 3m)	Limit (dBuV/m @ 3m)
0.009-0.490	$2400/F_{\text{KHz}} @ 300\text{m}$	$67.6-20*\log_{10}(F_{\text{KHz}}) @ 300\text{m}$
0.490-1.705	$24000/F_{\text{KHz}} @ 30\text{m}$	$87.6-20*\log_{10}(F_{\text{KHz}}) @ 30\text{m}$
1.705 to 30	30 @ 30m	29.5 @ 30m
30 to 88	100	40
88 to 216	150	43.5
216 to 960	200	46.0
Above 960	500	54.0

**SAMPLE CALCULATIONS - CONDUCTED EMISSIONS**

Receiver readings are compared directly to the conducted emissions specification limit (decibel form) as follows:

$$R_r - B = C$$

and

$$C - S = M$$

where:

$R_r$  = Receiver Reading in dBuV

B = Broadband Correction Factor\*

C = Corrected Reading in dBuV

S = Specification Limit in dBuV

M = Margin to Specification in +/- dB

\* Broadband Level - Per ANSI C63.4, 13 dB may be subtracted from the quasi-peak level if it is determined that the emission is broadband in nature. If the signal level in the average mode is six dB or more below the signal level in the peak mode, the emission is classified as broadband.

**SAMPLE CALCULATIONS - RADIATED EMISSIONS**

Receiver readings are compared directly to the specification limit (decibel form). The receiver internally corrects for cable loss, preamplifier gain, and antenna factor. The calculations are in the reverse direction of the actual signal flow, thus cable loss is added and the amplifier gain is subtracted. The Antenna Factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements. A distance factor, when used for electric field measurements, is calculated by using the following formula:

$$F_d = C * \text{LOG}_{10} (D_m / D_s)$$

where:

$$F_d = \text{Distance Factor in dB}$$

$$D_m = \text{Measurement Distance in meters}$$

$$D_s = \text{Specification Distance in meters}$$

$$A = \text{Correction Factor of 20dB per decade for frequencies above 30MHz or 40 dB per decade for frequencies below 30 MHz (per FCC §15.31)}$$

Measurement Distance is the distance at which the measurements were taken and Specification Distance is the distance at which the specification limits are based. The antenna factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements.

The margin of a given emission peak relative to the limit is calculated as follows:

$$R_c = R_r + F_d$$

and

$$M = R_c - L_s$$

where:

$$R_r = \text{Receiver Reading in dBuV/m}$$

$$F_d = \text{Distance Factor in dB}$$

$$R_c = \text{Corrected Reading in dBuV/m}$$

$$L_s = \text{Specification Limit in dBuV/m}$$

$$M = \text{Margin in dB Relative to Spec}$$

***EXHIBIT 1: Test Equipment Calibration Data***

## Test Equipment List - SVOATS#3

<u>Manufacturer/Description</u>	<u>Model</u>	<u>Asset #</u>	<u>Interval</u>	<u>Last Cal</u>	<u>Cal Due</u>	
<input checked="" type="checkbox"/> Eliott Laboratories	Biconical Antenna, 30-300 MHz	EL30.300	54, (F131)	12	11/24/97	11/24/98
<input checked="" type="checkbox"/> Eliott Laboratories	500-1000 MHz Log Periodic	EL300.1000	297, (F113)	12	11/10/97	11/10/98
<input type="checkbox"/> EMCO	Double Ridge Horn Antenna, 1-18	3115	487	12	6/18/98	6/18/99
<input type="checkbox"/> EMCO	Double Ridge Horn Antenna, 1-18	3115	786	12	11/13/97	5/13/99
<input checked="" type="checkbox"/> Fischer	LISN	FCC-LISN-50/2	810	12	1/29/98	1/29/99
<input type="checkbox"/> Hewlett Packard	Power Meter	432A	259, (F304)	12	3/10/98	3/10/99
<input type="checkbox"/> Hewlett Packard	Spectrum Analyzer	8563E	284, (F194)	24	1/14/98	1/14/2000
<input type="checkbox"/> Hewlett Packard	Microwave Preamplifier, 1-26.5	8449B	263, (F303)	12	6/8/98	6/8/99
<input type="checkbox"/> Hewlett Packard	Thermistor Mount	478A	652	12	3/10/98	3/10/99
<input type="checkbox"/> Hewlett Packard	EMC Receiver /Analyzer	8595EM	780	24	10/24/97	10/24/99
<input type="checkbox"/> Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	785	12	11/10/97	11/10/98
<input type="checkbox"/> Hewlett Packard	EMC Receiver /Analyzer	8595EM	787	12	10/27/97	10/27/98
<input type="checkbox"/> Narda-West	EMI Filter 5.6 GHz, High Pass	60583 HXP370	247	12	8/10/98	8/10/99
<input type="checkbox"/> Narda-West	EMI Filter 2.4 GHz, High Pass	60583 HPT-161	248	12	8/10/98	8/10/99
<input checked="" type="checkbox"/> Rohde & Schwarz	Test Receiver, 20-1300MHz	ESVP	213, (F196)	12	10/4/98	10/4/99
<input checked="" type="checkbox"/> Rohde & Schwarz	Test Receiver, 0.009-30 MHz	ESH3	274	12	4/8/98	4/8/99
<input type="checkbox"/> Rohde & Schwarz	Pulse Limiter	ESH321	812	12	2/5/98	2/5/99
<input checked="" type="checkbox"/> Solar Electronics	High Pass Filter, fc = 8 kHz	7930-B.0	223	12	7/27/98	7/27/99

File Number: 728715

Date: 10/14/98

Engr: Rudolf Sney



# Test Equipment List - SVOATS#2

December 2, 1998

<u>Manufacturer/Description</u>	<u>Model</u>	<u>Asset #</u>	<u>Interval</u>	<u>Last Cal</u>	<u>Cal Due</u>
<input type="checkbox"/> Elliott Laboratories 2 x (Solar 8028 LISN + 6512 Caps)	LISN-5,	379	12	6/26/98	6/26/99
<input type="checkbox"/> Elliott Laboratories FCC / CISPR LISN	LISN-4, OATS	362	12	6/30/98	6/30/99
<input type="checkbox"/> EMCO Antenna, Log Periodic	3146A	802	12	6/13/97	12/13/98
<input type="checkbox"/> EMCO Biconical Antenna, 30-300 MHz	3110B		12	11/18/98	11/18/99
<input type="checkbox"/> EMCO D. Ridge Horn Antenna, 1-18GHz	3115	487	12	6/18/98	6/18/99
<input type="checkbox"/> EMCO D. Ridge Horn Antenna, 1-18GHz	3115	786	12	11/13/97	5/13/99
<input type="checkbox"/> Hewlett Packard EMC Receiver /Analyzer	8595EM	780	24	10/24/97	10/24/99
<input type="checkbox"/> Hewlett Packard EMC Receiver /Analyzer	8595EM	787	12	11/23/98	11/23/99
<input type="checkbox"/> Hewlett Packard Microwave Preamp, 1-26.5GHz	8449B	263, (F303)	12	6/8/98	6/8/99
<input type="checkbox"/> Hewlett Packard Microwave Preamp, 1-26.5GHz	8449B	785	12	11/25/98	11/25/99
<input type="checkbox"/> Hewlett Packard Microwave Preamp, 1-26.5GHz	8449B	870	12	11/12/98	11/12/99
<input type="checkbox"/> Hewlett Packard Power Meter	432A	259, (F304)	12	3/10/98	3/10/99
<input type="checkbox"/> Hewlett Packard Spectrum Analyzer	8563E	284, (F194)	24	1/14/98	1/14/2000
<input type="checkbox"/> Hewlett Packard Spectrum Analyzer, 9 KHz-6.5 GHz	8595E-041-103-	Metric, 885	12	5/11/98	5/11/99
<input type="checkbox"/> Hewlett Packard Thermistor Mount	478A	652	12	3/10/98	3/10/99
<input type="checkbox"/> Narda-West EMI Filter 2.4 GHz, High Pass	60583 HPF-161	248	12	8/10/98	8/10/99
<input type="checkbox"/> Narda-West EMI Filter 5.6 GHz, High Pass	60583 HXF370	247	12	8/10/98	8/10/99
<input type="checkbox"/> Rohde & Schwarz Pulse Limiter	ESH3Z2	811	12	2/5/98	2/5/99
<input checked="" type="checkbox"/> Rohde & Schwarz Test Receiver	ESN	775	12	6/22/98	6/22/99
<i>EMCO</i> Loop Ant	6502	296	12	10/11/98	10/11/99

File Number: T-29471

Date: 12/9/98  
 Engr: John Hill

*EXHIBIT 2: Test Data Log Sheets*

*ELECTROMAGNETIC EMISSIONS*

*TEST LOG SHEETS*

*AND*

*MEASUREMENT DATA*

*T28175 9 Pages*

*T29471 5 Pages*

Client:	Ventritex	Date:	10/14/98	Test Engr:	Rudy Suy
Product:	Housecall 2.0 Transmitter	File:	T28715	Proj. Eng:	Mark Briggs
Objective:	Final Qualification	Site:	SVOATS #3	Contact:	Rich Kelley
Spec:	FCC B	Page:	1 of 4	Approved:	
Revision	1.0				

Ambient Conditions	
Temperature:	8 °C
Humidity:	70 %

## Test Objective

The objective of this test session is to perform final qualification testing the EUT defined below relative to the specification(s) defined above.

## Test Summary

Run #1 - Unmaximized Preliminary Radiated Emissions Scan, 30-1000 MHz

Results: FCC B                    -5.4 dB QP    @    299.698 MHz    Horizontal

Run #2 - Maximized Radiated Emissions from Run #1

**PASS** Results: FCC B                    -4.8 dB QP    @    74.900 MHz    Vertical

Run #3 - Conducted Emissions Scan of EUT, 0.15-30.00 MHz, **120V, 60Hz**

**PASS** Results: FCC B                    -5.9 dB QP    @    10.6488 MHz Line

## Equipment Under Test (EUT) General Description

The EUT is a Defibrillator Interrogator which is designed to allow monitoring of the condition of the defibrillator by the physician over the phone line . Normally, the EUT would be placed on a table top during operation. The EUT was, therefore, placed in this position during testing to simulate the end user environment. The electrical rating of the EUT is 120 V, 60 Hz, 600 milliAmps.

## Equipment Under Test (EUT)

Manufacturer/Model/Description	Serial Number	FCC ID Number
Ventritex (St. Judes) / Housecall 2 / Defibrillator Interrogator Transmitter	17	
Ventritex (St. Judes) / Housecall 2 / Defibrillator Interrogator Wand	12	

Client:	Ventritex	Date:	10/14/98	Test Engr:	Rudy Suy
Product:	Housecall 2.0 Transmitter	File:	T28715	Proj. Eng:	Mark Briggs
Objective:	Final Qualification	Site:	SVOATS #3	Contact:	Rich Kelley
Spec:	FCC B	Page:	2 of 4	Approved:	
Revision	1.0				

## Power Supply and Line Filters

The EUT used the following external AC-DC adapter:

Description	Manufacturer	Model
Power Supply	Ault	P41090650A020G

## Printed Wiring Boards in EUT

Manufacturer/Description	Assembly #	Rev.	Serial Number	Crystals (MHz)
Ventritex / TR3000 Main Board	8007669	D	N/A	0.032, 0.983, 35.25
Ventritex / TR3000 Wand Board	8006728	C	N/A	None

## Subassemblies in EUT

Manufacturer/Description	Assembly Number	Rev.	Serial Number
None	-	-	-

## EUT Enclosure(s)

The EUT Main Unit enclosure is primarily constructed of Molded Plastic. It measures approximately 19cm wide by 23 cm deep by 8.5 cm high.

The EUT Wand enclosure is primarily constructed of Molded Plastic. It measures approximately 6 cm wide by 14 cm deep by 4 cm high.

## EMI Suppression Devices (filters, gaskets, etc.)

Description	Manufacturer	Part Number
Ferrite (x2) (Internal Wand and Telephone cables)	Steward	28A0392-0A0
Ferrite (Internal DC power cable)	Steward	28B0625-100

Client:	Ventritex	Date:	10/14/98	Test Engr:	Rudy Suy
Product:	Housecall 2.0 Transmitter	File:	T28715	Proj. Eng:	Mark Briggs
Objective:	Final Qualification	Site:	SVOATS #3	Contact:	Rich Kelley
Spec:	FCC B	Page:	3 of 4	Approved:	
Revision	1.0				

## Local Support Equipment

Manufacturer/Model/Description	Serial Number	FCC ID Number
Panasonic KX-TS5-B Phone	none	FCC pt.68 ACJMEX-25607-TE-E REN:1.0B

## Remote Support Equipment

Manufacturer/Model/Description	Serial Number	FCC ID Number
Digital Products / Ring It / Phone line Simulator	9803047	None
Compaq DP4000 Host PC	6743BPN3R407	FCC B DoC
Princeton Graphic Ultra51 Multiscan Color Monitor	KNAX1-402912	BVOKD-1525

## Interface Cabling

Cable Description	Length (m)	From Unit/Port	To Unit/Port
RJ-11 Unshielded	40.0	EUT Transmitter	Phone Simulator
RJ-11 Unshielded	2.0	Phone Simulator	Host PC Modem
RJ-11 Unshielded	1.0	Head Set	Base Phone
RJ-11 Unshielded	2.0	Base Phone	EUT Transmitter
Wand Cable Shielded	1.5	EUT Transmitter	EUT Wand

## Test Software

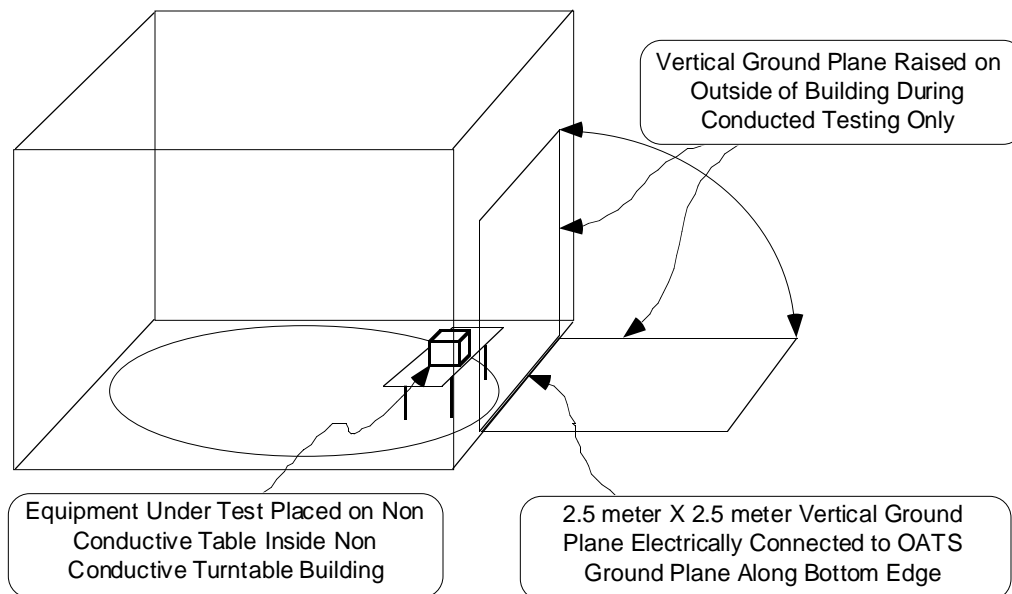
Firmware in the EUT controls the operation of the wand and modem, gathers, processes and sends (upon request ) the data to the remote computer. The remote computer contains software (Housecall 2.0) which queries the EUT and requests data to be sent to it via the modem and displays the results on the monitor.

Client:	Ventritex	Date:	10/14/98	Test Engr:	Rudy Suy
Product:	Housecall 2.0 Transmitter	File:	T28715	Proj. Eng:	Mark Briggs
Objective:	Final Qualification	Site:	SVOATS #3	Contact:	Rich Kelley
Spec:	FCCB	Page:	4 of 4	Approved:	
Revision	1.0				

## General Test Conditions

During radiated testing, the EUT was connected to 120V, 60Hz power input. The EUT and all local support equipment were located on the turntable for radiated testing and conducted testing. All remote support equipment was located approximately 30 meters from the EUT with all I/O connections running under the groundplane.

During conducted emissions testing, the EUT was connected to 120V, 60Hz power input as noted. A 2.5 meter X 2.5 meter ground plane was raised to a vertical position 40 cm from the EUT as shown below:



## Test Data Tables

See attached data



# Emissions Test Data

Client:	Ventritex	Date:	10/14/98	Test Engr:	Rudy Suy
Product:	Housecall 2.0 Transmitter	File:	D28715	Proj. Engr:	Mark Briggs
Objective	Final Qualification	Site:	SVOATS #3	Contact:	Dean Anderson
Spec:	FCC B	Distance:	3m	Approved:	

## Ambient Conditions

Temperature: 8 °C  
Humidity: 70 %

## Run #1: Initial radiated scan, 30-1000 MHz

Frequency	Level	Pol	FCC B	FCC B	Detector	Azimuth	Height	Comments
MHz	dBuV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
299.698	40.6	h	46.0	-5.4	QP	70	1.2	
74.900	34.2	v	40.0	-5.8	QP	160	1.0	
74.900	33.0	h	40.0	-7.0	QP	70	1.2	
157.300	36.3	v	43.5	-7.2	QP	80	1.0	
118.000	35.5	v	43.5	-8.0	QP	100	1.0	
87.800	31.6	v	40.0	-8.4	QP	140	1.0	
127.800	35.1	v	43.5	-8.4	QP	130	1.0	
184.430	35.0	v	43.5	-8.5	QP	230	1.0	
172.900	35.0	v	43.5	-8.5	QP	140	1.0	
373.581	37.5	h	46.0	-8.5	QP	200	1.1	
83.200	31.4	v	40.0	-8.6	QP	230	1.0	
300.000	37.4	h	46.0	-8.6	QP	80	1.2	
60.100	31.3	v	40.0	-8.7	QP	210	1.0	
49.155	31.2	v	40.0	-8.8	QP	260	1.0	
254.011	37.0	v	46.0	-9.0	QP	160	1.0	
161.404	34.3	v	43.5	-9.2	QP	120	1.0	
207.731	34.2	h	43.5	-9.3	QP	260	1.5	
253.627	36.6	h	46.0	-9.4	QP	210	1.4	
276.625	36.5	h	46.0	-9.5	QP	0	1.4	
56.600	30.4	v	40.0	-9.6	QP	160	1.0	
275.300	36.1	v	46.0	-9.9	QP	90	1.0	
59.900	30.0	v	40.0	-10.0	QP	0	1.0	
115.300	33.4	v	43.5	-10.1	QP	90	1.0	
73.800	29.6	v	40.0	-10.4	QP	170	1.0	
69.241	29.4	v	40.0	-10.6	QP	340	1.0	
322.711	35.4	h	46.0	-10.6	QP	110	1.2	
314.600	34.9	h	46.0	-11.1	QP	90	1.2	
353.915	34.9	h	46.0	-11.1	QP	130	1.1	
46.156	28.6	v	40.0	-11.4	QP	0	1.0	
39.300	28.6	v	40.0	-11.4	QP	160	1.0	
393.241	34.6	h	46.0	-11.4	QP	310	1.0	
55.500	28.3	v	40.0	-11.7	QP	240	1.0	
334.255	34.1	h	46.0	-11.9	QP	110	1.2	
69.222	28.0	h	40.0	-12.0	QP	190	2.4	
294.900	34.0	v	46.0	-12.0	QP	70	1.0	
300.000	34.0	v	46.0	-12.0	QP	200	1.0	
137.634	31.2	v	43.5	-12.3	QP	120	1.0	
253.900	33.5	h	46.0	-12.5	QP	210	1.4	
108.141	31.0	v	43.5	-12.5	QP	210	1.0	
645.624	33.4	h	46.0	-12.6	QP	50	1.4	



# Emissions Test Data

Client:	Ventritex	Date:	10/14/98	Test Engr:	Rudy Suy
Product:	Housecall 2.0 Transmitter	File:	D28715	Proj. Engr:	Mark Briggs
Objective	Final Qualification	Site:	SVOATS #3	Contact:	Dean Anderson
Spec:	FCC B	Distance:	3m	Approved:	

continue

161.377	30.8	h	43.5	-12.7	QP	90	1.0
299.700	33.3	v	46.0	-12.7	QP	70	1.0
344.100	33.3	h	46.0	-12.7	QP	270	1.1
353.915	33.3	v	46.0	-12.7	QP	210	1.0
207.497	30.6	v	43.5	-12.9	QP	240	1.0
363.800	32.9	h	46.0	-13.1	QP	200	1.1
738.500	32.8	h	46.0	-13.2	QP	190	1.0
116.200	30.1	v	43.5	-13.4	QP	90	1.0
412.901	32.4	h	46.0	-13.6	QP	190	1.0
369.000	32.4	h	46.0	-13.6	QP	200	1.1
373.581	32.2	v	46.0	-13.8	QP	210	1.0
59.000	26.2	v	40.0	-13.8	QP	190	1.0
345.759	32.0	h	46.0	-14.0	QP	90	1.2
393.241	32.0	v	46.0	-14.0	QP	200	1.0
245.800	31.8	v	46.0	-14.2	QP	260	1.0
383.411	31.8	h	46.0	-14.2	QP	190	1.1
391.892	31.8	h	46.0	-14.2	QP	30	1.2
422.700	31.8	h	46.0	-14.2	QP	180	1.0
462.057	31.7	h	46.0	-14.3	QP	140	1.0
442.395	31.6	h	46.0	-14.4	QP	150	1.0
253.643	31.4	v	46.0	-14.6	QP	270	1.0
276.710	31.3	v	46.0	-14.7	QP	170	1.0
230.564	31.2	h	46.0	-14.8	QP	330	1.4
530.873	31.0	h	46.0	-15.0	QP	310	1.0
334.255	30.8	v	46.0	-15.2	QP	200	1.0
138.441	28.1	v	43.5	-15.4	QP	100	1.0
314.600	30.5	v	46.0	-15.5	QP	220	1.0
324.425	30.3	h	46.0	-15.7	QP	0	1.2
30.000	24.0	v	40.0	-16.0	QP	300	1.0
322.711	30.0	v	46.0	-16.0	QP	180	1.0
619.343	29.8	h	46.0	-16.2	QP	270	1.0

**Run #2: Maximized readings from run #1**

Frequency	Level	Pol	FCC B	FCC B	Detector	Azimuth	Height	Comments
MHz	dBuV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
74.900	35.2	v	40.0	-4.8	QP	230	1.0	
299.698	41.0	h	46.0	-5.0	QP	70	1.2	
74.900	34.9	h	40.0	-5.1	QP	190	1.2	
87.800	33.1	v	40.0	-6.9	QP	140	1.0	
157.300	36.5	v	43.5	-7.0	QP	100	1.0	
118.000	36.0	v	43.5	-7.5	QP	100	1.0	





## Emissions Test Data

Client:	Ventritex	Date:	10/14/98	Test Engr:	Rudy Suy
Product:	Housecall 2.0 Transmitter	File:	D28715	Proj. Engr:	Mark Briggs
Objective	Final Qualification	Site:	SVOATS #3	Contact:	Dean Anderson
Spec:	FCC B	Distance:	3m	Approved:	

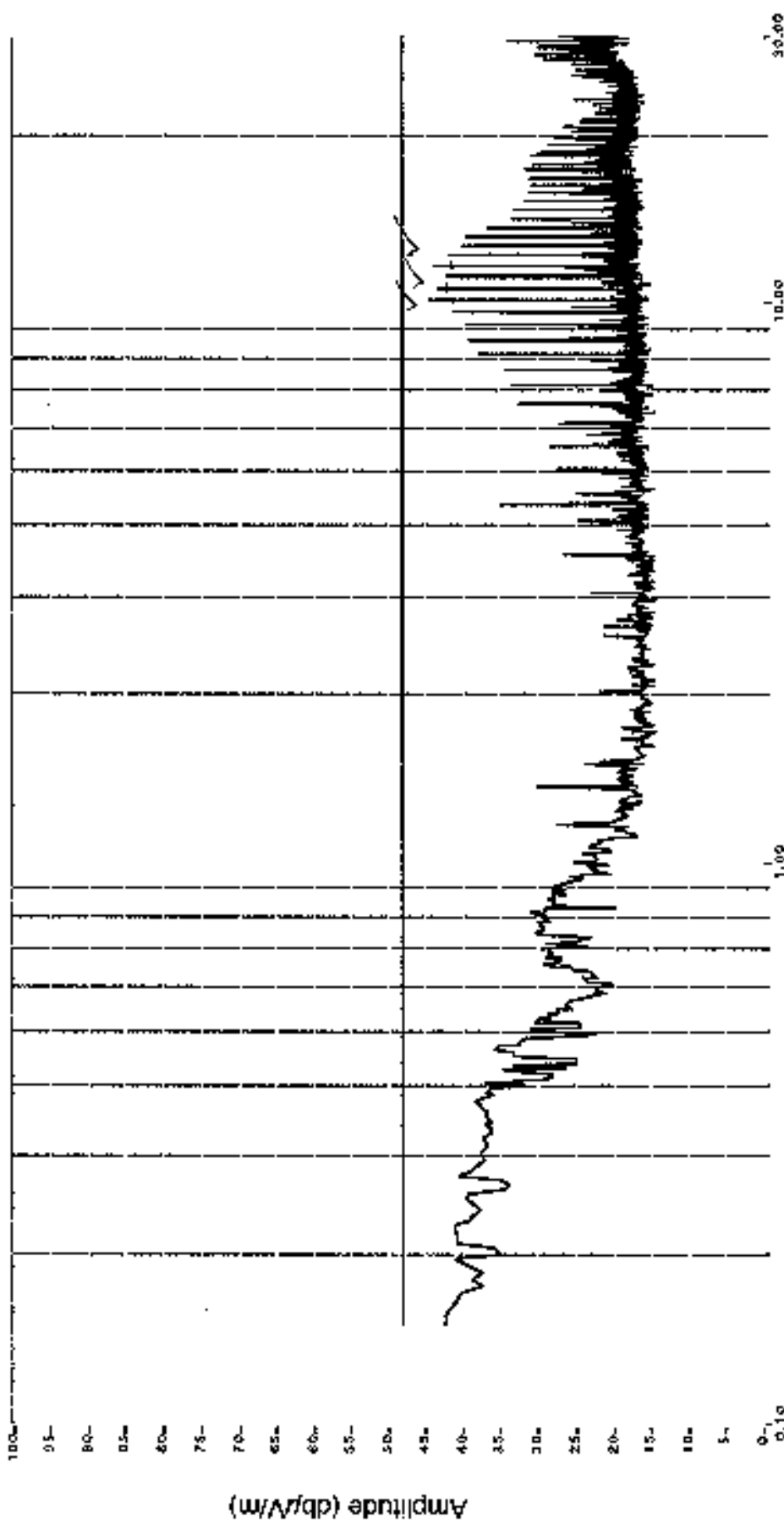
### Run #3: Conducted Emissions, 120V/60Hz

Frequency	Level	Power	FCC B	FCC B	Detector	Comments
MHz	dBuV	Lead	Limit	Margin	Function	
10.6488	42.1	Line 1	48.0	-5.9	QP	
11.1602	42.1	Neutral	48.0	-5.9	QP	
11.6662	41.9	Neutral	48.0	-6.1	QP	
10.1452	41.8	Neutral	48.0	-6.2	QP	
11.6629	41.4	Line 1	48.0	-6.6	QP	
10.1433	41.2	Line 1	48.0	-6.8	QP	



SVOATS# 3: Ventritex Housecall 2 Run 3

Spec:  
102 B  
Meins Lead  
Line 1



Scan  
Peak  
Quasi-peak  
Average  
QuasiPeak  
Limit 2  
10/15/98  
Rudy Buy

120V, 60Hz Line

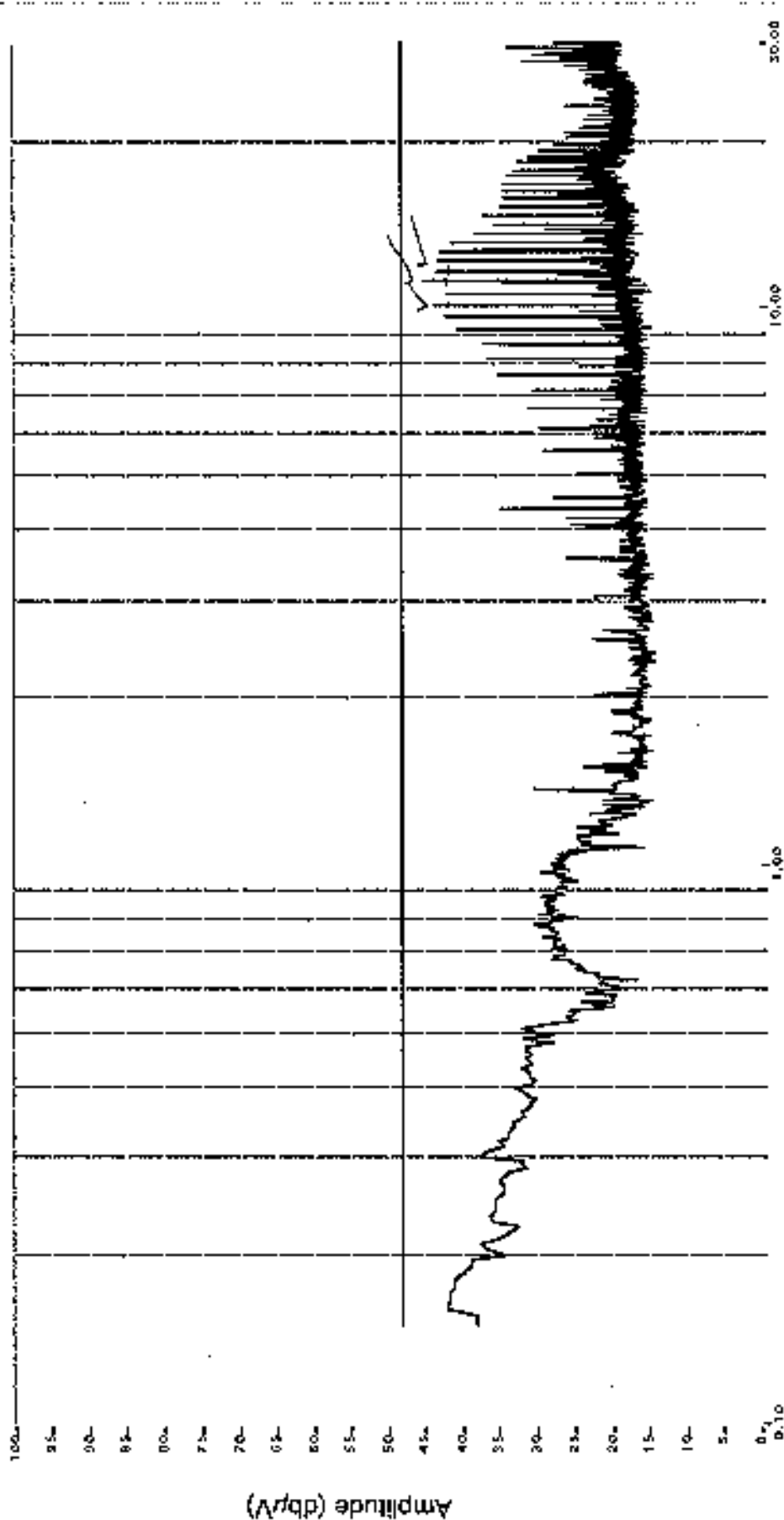
V = EUT



SVCATS# 3: Ventitex Housecall 2 Run 3

Spec:  
RCCA

Me Ina Load  
Neutral



Frequency (MHz)

120V, 60Hz Neutral

*VENT*

Scan  
Peak  
Quasi-peak  
Average  
Quasi-peak  
Limit 2  
10N1608  
Rudy Buy

Client:	Ventritex	Date:	12/8/98	Test Engr:	Jerry Hill
Product:	Housecall 2.0 Transmitter	File:	T29471	Proj. Eng:	Mark Briggs
Objective:	Final Qualification	Site:	SVOATS #2	Contact:	Rich Kelley
Spec:	FCC para. 15.209	Page:	1 of 4	Approved:	
Revision	1.0				

Ambient Conditions	
Temperature:	8 °C
Humidity:	70 %

## Test Objective

The objective of this test session is to perform final qualification testing the EUT defined below relative to the specification(s) defined above.

## Test Summary

Run #1 - Maximized Magnetic Radiated Emissions Scan, .1 - 1.0 MHz

**PASS** Results: FCC para. 15.209 -32.3 QP @0.700MHz n/a

## Equipment Under Test (EUT) General Description

The EUT is a Defibrillator Interrogator which is designed to allow monitoring of the condition of the defibrillator by the physician over the phone line . Normally, the EUT would be placed on a table top during operation. The EUT was, therefore, placed in this position during testing to simulate the end user environment. The electrical rating of the EUT is 120 V, 60 Hz, 600 milliAmps.

## Equipment Under Test (EUT)

Manufacturer/Model/Description	Serial Number	FCC ID Number
Ventritex (St. Judes) / Housecall 2 / Defibrillator Interrogator Transmitter	15	
Ventritex (St. Judes) / Housecall 2 / Defibrillator Interrogator Wand	15	

Client:	Ventritex	Date:	12/8/98	Test Engr:	Jerry Hill
Product:	Housecall 2.0 Transmitter	File:	T29471	Proj. Eng:	Mark Briggs
Objective:	Final Qualification	Site:	SVOATS #2	Contact:	Rich Kelley
Spec:	FCC para. 15.209	Page:	2 of 4	Approved:	
Revision	1.0				

## Power Supply and Line Filters

The EUT used the following external AC-DC adapter:

Description	Manufacturer	Model
Power Supply	Ault	P41090650A020G

## Printed Wiring Boards in EUT

Manufacturer/Description	Assembly #	Rev.	Serial Number	Crystals (MHz)
Ventritex / TR3000 Main Board	8007669	D	N/A	0.032, 0.983, 35.25
Ventritex / TR3000 Wand Board	8006728	C	N/A	None

## Subassemblies in EUT

**None**

## EUT Enclosure(s)

The EUT Main Unit enclosure is primarily constructed of Molded Plastic. It measures approximately 19cm wide by 23 cm deep by 8.5 cm high.

The EUT Wand enclosure is primarily constructed of Molded Plastic. It measures approximately 6 cm wide by 14 cm deep by 4 cm high.

## EMI Suppression Devices (filters, gaskets, etc.)

Description	Manufacturer	Part Number
Ferrite (x2) (Internal Wand and Telephone cables)	Steward	28A0392-0A0
Ferrite (Internal DC power cable)	Steward	28B0625-100

Client:	Ventritex	Date:	12/8/98	Test Engr:	Jerry Hill
Product:	Housecall 2.0 Transmitter	File:	T29471	Proj. Eng:	Mark Briggs
Objective:	Final Qualification	Site:	SVOATS #2	Contact:	Rich Kelley
Spec:	FCC para. 15.209	Page:	3 of 4	Approved:	
Revision	1.0				

## Local Support Equipment

Manufacturer/Model/Description	Serial Number	FCC ID Number
Panasonic KX-TS5-B Phone	8HBAA004313	FCC pt.68 ACJMEX-25607-TE-E REN:1.0B

## Remote Support Equipment

Manufacturer/Model/Description	Serial Number	FCC ID Number
Digital Products / Ring It / Phone line Simulator	9803052	None
Compaq DesckPro /DP4000 / Host PC	6743BPN30267	FCC B DoC
Princeton Graphic Ultra51 Multiscan Color Monitor	KNAX1401907	EVOKD-1525
Compaq / 166516-001 / Keyboard	BOB930B39FKAG8	AQ6-72BC15
Compaq / M-S34 / Mouse	None	DZL211029

## Interface Cabling

Cable Description	Length (m)	From Unit/Port	To Unit/Port
RJ-11 Unshielded	40.0	EUT Transmitter	Phone Simulator
RJ-11 Unshielded	2.0	Phone Simulator	Host PC Modem
RJ-11 Unshielded	1.0	Head Set	Base Phone
RJ-11 Unshielded	2.0	Base Phone	EUT Transmitter
Wand Cable Shielded	1.5	EUT Transmitter	EUT Wand

## Test Software

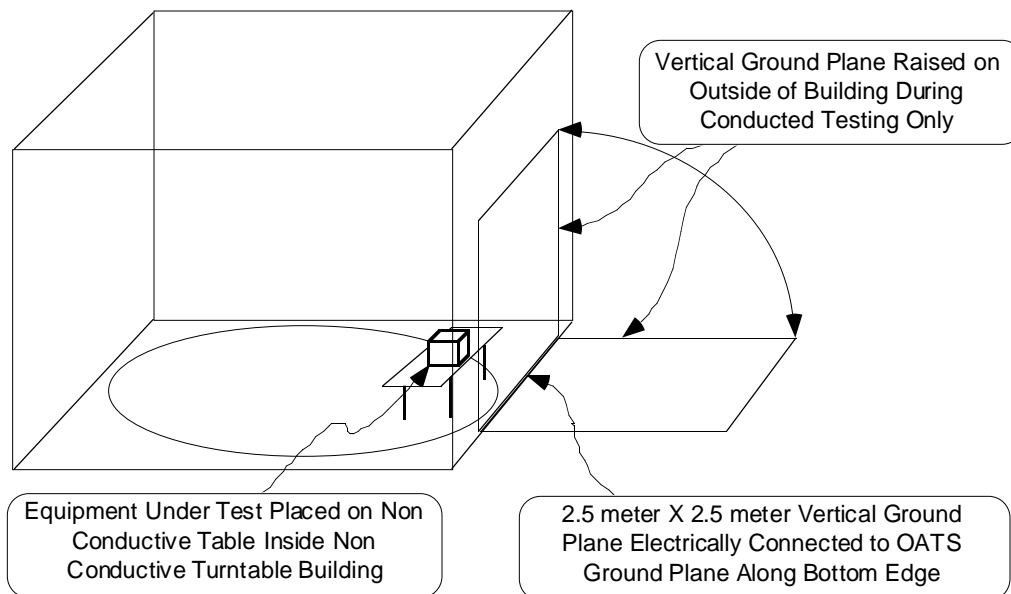
Firmware in the EUT controls the operation of the wand and modem, gathers, processes and sends (upon request ) the data to the remote computer. The remote computer contains software (Housecall 2.0) which queries the EUT and requests data to be sent to it via the modem and displays the results on the monitor.

Client:	Ventritex	Date:	12/8/98	Test Engr:	Jerry Hill
Product:	Housecall 2.0 Transmitter	File:	T29471	Proj. Eng:	Mark Briggs
Objective:	Final Qualification	Site:	SVOATS #2	Contact:	Rich Kelley
Spec:	FCC para. 15.209	Page:	4 of 4	Approved:	
Revision	1.0				

## General Test Conditions

During radiated testing, the EUT was connected to 120V, 60Hz power input. The EUT and all local support equipment were located on the turntable for radiated testing and conducted testing. All remote support equipment was located approximately 30 meters from the EUT with all I/O connections running under the groundplane.

During conducted emissions testing, the EUT was connected to 120V, 60Hz power input as noted. A 2.5 meter X 2.5 meter ground plane was raised to a vertical position 40 cm from the EUT as shown below:



## Test Data Tables

See attached data



# Emissions Test Data

Client:	Ventritex	Date:	12/8/98	Test Engr:	Jerry Hill
Product:	Housecall 2.0 Transmitter	File:	T29471	Proj. Engr:	Mark Briggs
Objective:	Final Qualification	Site:	SVOATS #2	Contact:	Rich Kelley
Spec:	FCC para. 15.209	Distance:	3m*	Approved:	

### Ambient Conditions

Temperature: 8 °C

Humidity: 75 %

### Run #1: Maximized magnetic radiated scan, 100kHz to 1MHz. Fundamental approx 100kHz.

EUT Emissions were below the noise floor as verified by cycling power.

Measurements taken at 3m extrapolated to 300m using -80dB factor (frequencies below 490 KHz).

Measurements taken at 3m extrapolated to 30m using -40dB factor (frequencies from 0.49 - 30 MHz).

Frequency	Level	Pol	FCC	FCC	Detector	Azimuth	Height	Comments
MHz	dBuV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
0.700	-1.6	-	30.7	-32.3	QP	20	1.0	9kHz bw <b>Ambient</b>
1.000	-6.4	-	27.6	-34.0	QP	20	1.0	9kHz bw <b>Ambient</b>
0.100	-17.6	-	27.6	-45.2	QP	20	1.0	200Hz bw - fundamental signal.
0.150	-47.8	-	24.1	-71.9	Avg	0	1.0	9kHz bw <b>Ambient</b>
0.400	-62.0	-	15.6	-77.6	Avg	0	1.0	9kHz bw <b>Ambient</b>



*EXHIBIT 3: Radiated Emissions Test Configuration Photographs*

*EXHIBIT 4: Conducted Emissions Test Configuration Photographs*

*EXHIBIT 5: Proposed FCC ID Label & Label Location*

*EXHIBIT 6: Detailed Photographs of St. Jude Medical CRMD Model Housecall 2.0 Construction*

*4 Pages*

The detailed pictures do not include a view of the non-component side of the Wand's Printed Circuit Board. The view of the Wand PCB and transmit/receive coils shows all significant features of that side of the PCB assembly.

*EXHIBIT 7: Operator's Manual for St. Jude Medical CRMD Model Housecall 2.0*

*Pages*

***EXHIBIT 8:Block Diagram of St. Jude Medical CRMD Model Housecall 2.0***

***2 Pages***

(Taken from Theory Of Operations - refer to Exhibit 10)

*EXHIBIT 9: Schematic Diagram for St. Jude Medical CRMD Model Housecall 2.0*

*1 Page*

*EXHIBIT 10: Theory of Operation for St. Jude Medical CRMD Model Housecall 2.0*

*8 Pages*