



TEST SERVICES

**EMC EVALUATION OF THE
SIEMENS MEDICAL SOLUTIONS
TWELVE LEAD BIOMEDICAL TELEMETRY
608-614MHZ TRANSMITTER/RECEIVER**

Date: AUGUST 9, 2002

Test Report Number: TR3402.US.02

**IN ACCORDANCE WITH
FCC PART 15 SUBPART B AND PART 15.242**

Prepared For: SIEMENS MEDICAL SOLUTIONS
16 ELECTRONICS AVENUE
DANVERS, MASSACHUSETTS 01923
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Test Technician or Engineer: _____

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LIST OF DEFINITIONS/ABBREVIATIONS

AC	Alternating Current
BB	Broadband
BW	Bandwidth
cm	Centimeter
CPU	Calibrate Prior to Use
dB	Decibel
DC	Direct Current
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
ER	Electric Radiation
EUT	Equipment Under Test
GHz	Gigahertz
Hz	Hertz
I-face	Interface
kHz	Kilohertz
m	Meter
MHz	Megahertz
mm	Millimeter
mS	Millisecond
mV	Millivolt
MR	Magnetic Radiation
NB	Narrowband
NCR	No Calibration Required
PLC	Power Line Conduction
PPS	Pulses Per Second
uF	Microfarad
uH	Microhenry
uS	Microsecond
uV	Microvolt
UWC	Use With Calibrated Equipment

1.0 GENERAL**1.1 Introduction****1.1.1 Purpose**

The purpose of this report is to document the performance of the Siemens Medical Solutions Twelve Lead Biomedical Telemetry 608-614MHz Transmitter/Receiver during an electromagnetic interference (EMI) test and record the test requirements and procedures used. At the request of Siemens Medical Solutions, the tests were performed by Chomerics Test Services (CTS) of Woburn, Massachusetts. The assessment will determine the compliance or non-compliance with the requirements set up by the Electromagnetic Interference (EMI) Standard FCC Part 15 Subpart B and Part 15.242.

The Radiated and Conducted Emission Standard FCC Part 15 Subpart B is designated for ITE, Information Technology Equipment. FCC Part 15.242 is designated for Intentional Radiators.

Jim Greco from Siemens Medical Solutions was present during testing. Testing was performed on July 22, 2002 under purchase order number 154884.

1.1.2 Requirements

The requirements for the sequence of tests performed on the Twelve Lead Biomedical Telemetry 608-614MHz Transmitter/Receiver are as follows:

FCC Part 15 Subpart B Radiated and Conducted Electromagnetic Emissions

FCC Part 15 radiated and conducted emissions, Subpart B for Information Technology Equipment.

FCC Part 15.242 Field Strength Measurement

FCC Part 15.242 Intentional Radiators-Medical 608-614MHz Band.

1.2 TEST SUMMARY

The terms "Passed" or "Failed" in this section are intended to guide the reader as to whether or not the EUT met the minimum requirements that can be interpreted from the FCC Part 15 Subpart B and Part 15.242 Standard as defined in Section 1.5. The "Results" paragraph in each test section to follow and the test data sheets will outline specifically how the EUT performed during each test.

FCC Part 15 Subpart B Radiated and Conducted Emissions **PASSED**

FCC Part 15.242 Field Strength Measurement **PASSED**

1.2.1 Summary of Recommendations

The Siemens Medical Solutions Twelve Lead Biomedical Telemetry 608-614MHz Transmitter/Receiver will require not modifications in order to ensure compliance with the Electromagnetic Interference Standard FCC Part 15 Subpart B and Part 15.242.

Please note that if any modifications and or fixes were implemented to the EUT to achieve compliance, other approaches to solving the problem may exist. In addition, any EMI/EMC shielding products listed in this report may be substituted with an equivalent.

1.3 Administrative Data

1.3.1 Test Facility

Chomerics Test Services in Woburn, Massachusetts is an American Association for Laboratory Accreditation (A2LA) accredited facility as defined on Certification Number 1980-01. For Emissions and Immunity testing, the Scope of Accreditation is limited to the following tests: CFR 47, FCC Part 15 Subpart B, CISPR 11, EN 55011, CISPR 13, EN55013, CISPR 14, EN55014-1, CISPR 22, EN55022, AS/NZS 3548, CNS 13438, CNS 13783-1, VCCI, EN 61000-3-2, EN 61000-3-3, EN 50081-1, EN55081-2, EN61000-6-3, EN 61000-6-4, EN 61000-4-2, EN 61000-4-3, EN61000-4-4, EN 61000-4-5, EN 61000-4-6, EN61000-4-8, EN 61000-4-11, EN 50082-1, EN 50082-2, EN 61000-6-1, EN 61000-6-2, IEC/EN 60601-1-2, EN 300 386, EN 61362-1, CISPR 24, EN55024, CISPR 14, EN 55014-2, EN 50083-2, EN 55103-1, and EN 55103-2. Any tests in this report that are not listed above are not covered by the A2LA Accreditation.

Chomerics' Open Area Test Sites A and B are listed by the Federal Communications Corporation (FCC) for Radiated and Conducted Emissions testing under FCC Registration numbers 90498 and 90499 respectively.

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Chomerics' Open Area Test Sites A and B are accredited for Radiated and Conducted Emissions through Industry Canada under file numbers IC2959A and IC2959B respectively.

Chomerics' Open Area Test Site B is accredited to the Voluntary Control Council for Interference (VCCI) for Radiated and Conducted Emissions testing under file R-1508 and C-1589 respectively.

Chomerics test facility operates under the current revision of Chomerics Quality Assurance (QA) Manual Document Number QA002.

The QA Manual has been constructed to reflect a quality program in accordance with the requirements of the National Institute of Standards and Technology (NIST), ISO 9002, ISO Guide 25, NIST Handbook 150, EN 45001, MIL-I-45208A, MIL-STD-461D, 462D and Chomerics Quality Assurance Program (QAP).

The QA Manual outlines and describes the procedures for establishing and maintaining the quality of analysis, research, inspection, and testing within Chomerics Test Service (CTS).

This test report does not represent an endorsement by the U.S. Government.

The results and/or conclusions within this test report refer and/or apply only to the unit(s) tested as defined by this report.

Measurements performed for this test are traceable to the National Institute of Standards and Technology (NIST) based on the fact that all test equipment used for the measurements were previously calibrated using standards traceable to NIST.

No deviations, additions to, or exclusions from the test specification(s) were made.

The system amplitude accuracy for the measurements made during the radiated emission tests was $\pm 3\text{dB}$. Chomerics Test Services measurement uncertainty calculations are available for review upon request.

1.3.2 Equipment Calibration

The calibration of Chomerics test facility equipment is controlled under the current edition of Chomerics Laboratory Test Equipment Calibration Manual Document Number QA001.

The test equipment used throughout this test sequence conforms to laboratory calibration standards, MIL-STD-45662, traceable to the National Institute of Standards and Technology (NIST). The date of the next due scheduled calibration is listed in each test section for the applicable equipment.

All test equipment is calibrated in one year intervals.

1.3.3 Test Personnel

The test personnel performing or supervising the tests are accredited by the National Association of Radio and Telecommunications Engineers, Inc. (NARTE) as Certified Electromagnetic Compatibility Engineers (N.C.E.) and Technicians (N.C.T.).

1.4 Test Set-up

1.4.1 Test Site Matrix

The specific test locations used for the emissions testing of the Siemens Medical Solutions Twelve Lead Biomedical Telemetry 608-614MHz Transmitter/Receiver are as follows: (Refer to Section 1.4.2 for test site descriptions).

Emissions Test

FCC Part 15 Subpart B Radiated/Conducted Emissions and Part 15.242

Test Site

Open Area Test Site A

1.4.2 Test Site Descriptions

The following is a list of test sites and descriptions of each. Refer to Section 1.4.1 for specific test sites used for testing.

Open Area Test Site A: Chomerics' Open Area Test Site "A" if used for this test program is located in the lower parking lot attached to the Seeger Building at Chomerics, 84 Dragon Court, Woburn, Massachusetts (see Figure 1). Parking is permitted on one side of Test Site "A" at a discrete distance from the imaginary ellipse.

The Open Area Test Site "A" enclosure is a wooden structure measuring 56 x 30 x 25 feet in size with galvanized steel sheet metal used as the ground plane. The structure is sized to allow 3 meter measurements and is heated and/or air conditioned.

The structure used to support equipment under test is an EMCO 4 foot diameter motorized turntable. For tabletop equipment, a wooden table measuring 1.5 x 1 meter in size is positioned at the center of the turntable, at the proper height above the ground plane.

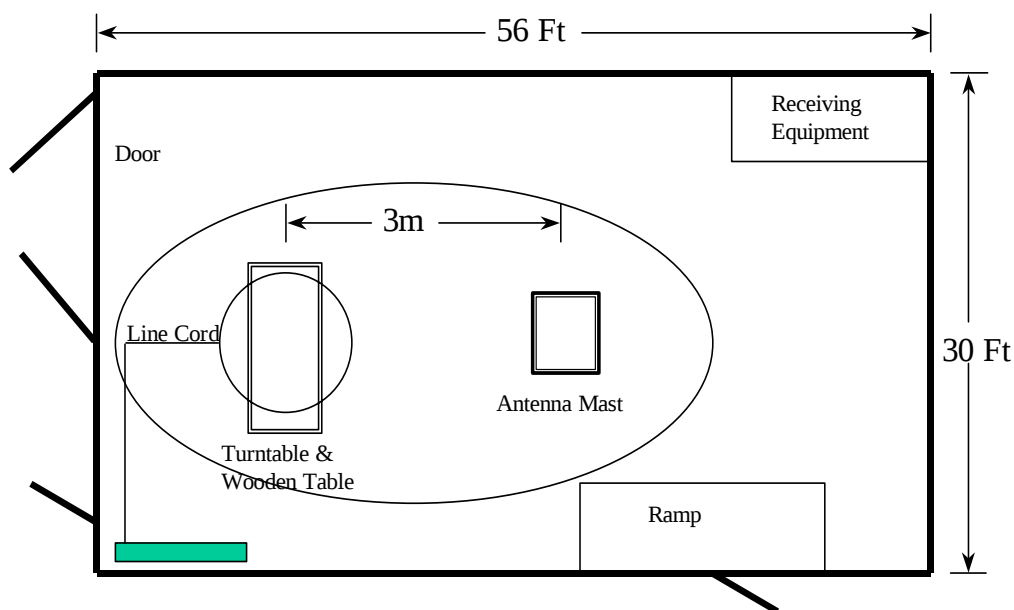
The area at the end of the Open Area Test Site "A" is the location for the test personnel and equipment to ensure they are outside the imaginary ellipse.

The available AC power within Open Area Test Site "A" is 120V 60Hz Single Phase 60Amps; 208V 60Hz Three Phase 60Amps; 208V 60Hz Single Phase 60Amps; 230V 50Hz Single Phase 50Amps.

This Site is listed with the Federal Communications Commission (FCC) and approved by BSMI, AUSTEL and CSA.

OPEN AREA TEST SITE A

Figure 1



Key: = Power board

Open Area Test Site B: Chomerics' Open Area Test Site "B" if used for this test program is located in the lower parking lot behind the Seeger Building at Chomerics, 84 Dragon Court, Woburn, Massachusetts (see Figure 2). Parking is permitted on one side of Test Site "B" at a discrete distance from the imaginary ellipse.

The Open Area Test Site "B" enclosure is a wooden structure measuring 56 x 30 x 25 feet in size with galvanized steel sheet metal used as the ground plane. The structure is sized to allow both 3 and 10 meter measurements and is heated and/or air conditioned.

The structure used to support equipment under test is a 14 foot diameter motorized turntable. The sheet metal surface is flush with the ground plane. To ground the turntable, copper fingers (1" x 1.5") are mounted around the outer edge of the turntable using machine screws. The spring fingers are equally spaced and provide a uniform interface between the turntable metal surface and ground plane. For tabletop equipment, a wooden table measuring 1.5 x 1 meter in size is positioned at the center of the turntable, at the proper height above the ground plane.

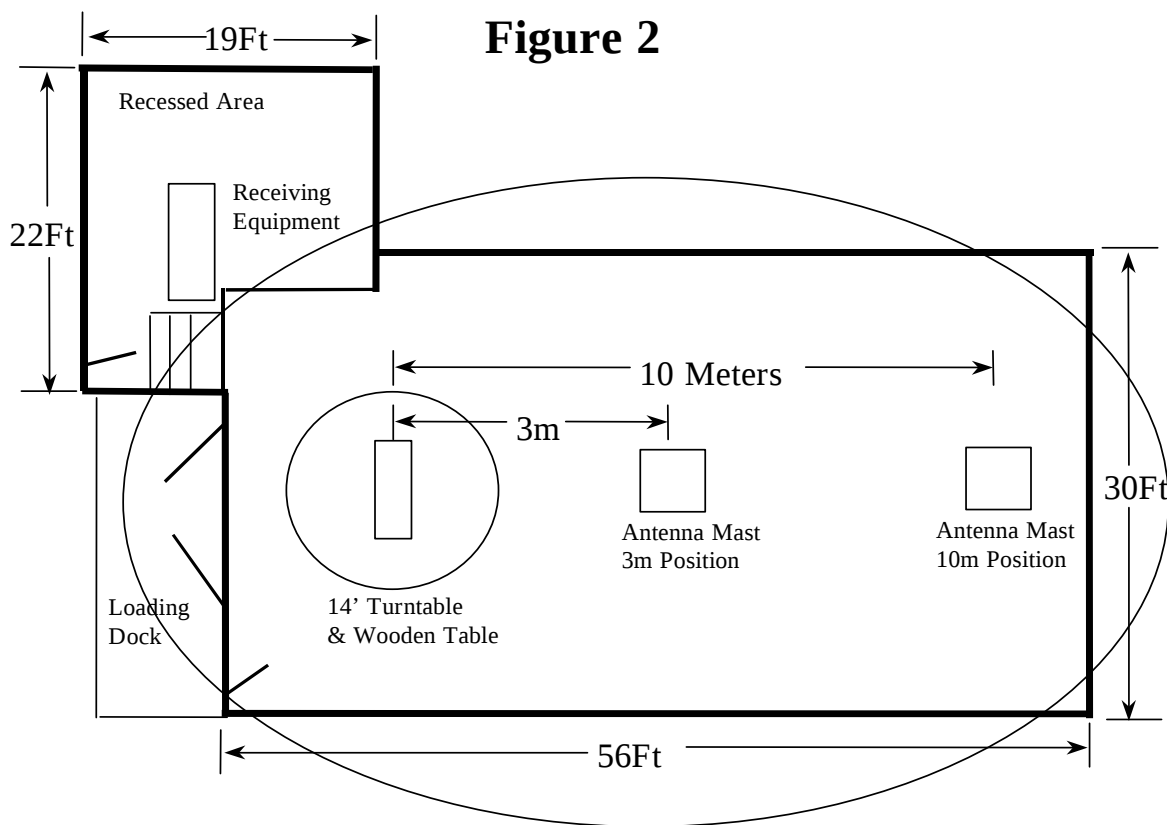
The addition at the end of the Open Area Test Site "B" is the location for the test personnel and equipment to ensure they are outside the imaginary ellipse.

The available AC power within Open Area Test Site "B" is 120V 60Hz Single Phase 60Amps; 208V 60Hz Three Phase 60Amps; 208V 60Hz Single Phase 60Amps; 230V 50Hz Single Phase 50Amps.

This Site is listed with the Federal Communications Commission (FCC) and approved by BSMT, VCCI, AUSTEL and CSA.

OPEN AREA TEST SITE B

Figure 2



1.4.3 Equipment Under Test

The Siemens Medical Solutions Twelve Lead Biomedical Telemetry 608-614MHz Transmitter/Receiver (Serial Number Engineering Prototype) is a wireless system that delivers real-time patient medical parameter values.

The support equipment needed to run the Siemens Medical Solutions Twelve Lead Biomedical Telemetry 608-614MHz Transmitter/Receiver in the normal mode of operation consisted of the following:

- a. Siemens compatible patient coupled cabling

The Twelve Lead Biomedical Telemetry 608-614MHz Transmitter/Receiver operates on 120VAC, 60Hz (9VDC for the transmit module) power supplied by the public utility. The I/O connections are patient coupled inputs.

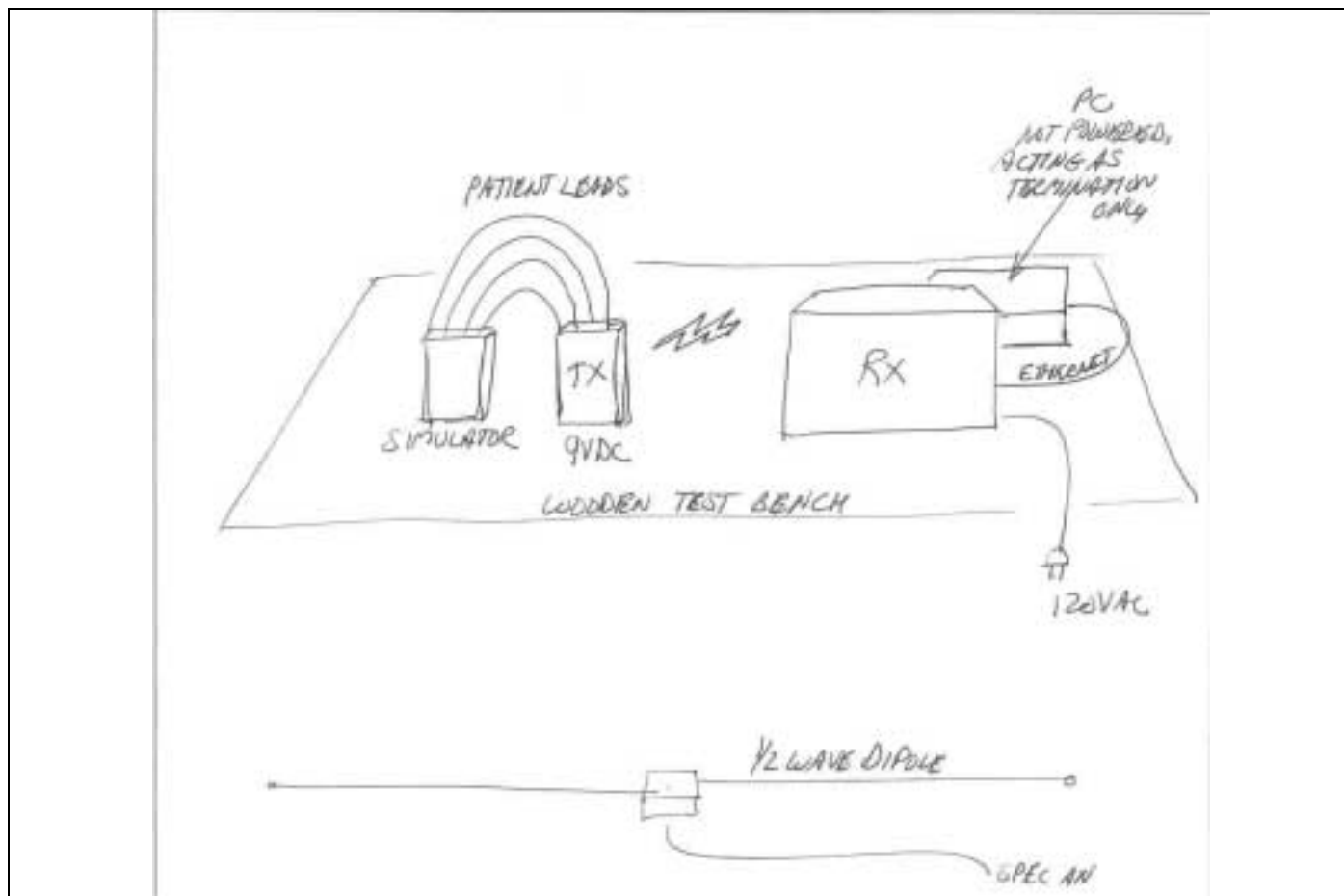
The normal mode of operation was used for emissions tests. The Twelve Lead Biomedical Telemetry 608-614MHz Transmitter/Receiver was monitored during the tests by Jim Greco of Siemens Medical Solutions.

The equipment under test was setup as illustrated on CTS-Form-014.

1.4.4 Block Diagram

CUSTOMER: SIEMENS MEDICAL SOLUTIONS
EQUIPMENT: TWELVE LEAD BIOMEDICAL TELEMETRY
608-614MHZ TRANSMITTER/RECEIVER

DATE: 22 JULY 2002
TESTED BY: RONALD H. CROOKER



System Configuration Block Diagram – Provide a line drawing identifying the EUT, simulators, support equipment, I/O cables, and any other pertinent components to be used during testing. Use a dashed line to separate the equipment in the testing field versus equipment outside the testing field.

FORM CTS-014

1.5 Pass/Fail Criteria

For the FCC Part 15 Subpart B radiated and conducted emissions must not exceed the Class B limits when tested in Open Area Test Site A. The EUT must also meet the requirements for the field strength measurement FCC Part 15.242.

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2.0 EMISSIONS TESTS PERFORMED**2.1 FCC Part 15 Subpart B Radiated Electromagnetic Emissions and Part 15.242 Field Strength Measurement****2.1.1 Equipment Used**

	Test Equipment	Asset #	Serial #	Cal Date
	Tektronix 496 Spectrum Analyzer	1	B010559	10/02
	Tektronix 496 Spectrum Analyzer	77	B020852	1/03
X	Tektronix 494 AP Spectrum Analyzer	543	B010201	9/02
	Rhode and Schwartz ESV Test Receiver	15	875931049	9/02
X	Rhode and Schwartz ESV Test Receiver	521	979531/031	1/03
	Hewlett Packard 8447D Pre Amp (Site B)	12	2944A06414	1/03
	Hewlett Packard 8447F Pre Amp (Site A)	633	2805A3022	1/03
	Electro Metrics ALR-25M Loop Antenna	17	4706	1/03
X	EMCO 3120 Tuned Dipole Antenna B1 (Site A)	474	21	1/03
X	EMCO 3121 Tuned Dipole Antenna B2 (Site A)	475	177	1/03
X	EMCO 3121 Tuned Dipole Antenna B3 (Site A)	476	698	1/03
	EMCO 3120 Tuned Dipole Antenna B1 (Site B)	453	42	1/03
	EMCO 3121 Tuned Dipole Antenna B2 (Site B)	478	176	1/03
	EMCO 3121 Tuned Dipole Antenna B3 (Site B)	455	9501-1101	1/03
X	EMCO 3115 Microwave Horn Antenna	376	2796	1/03
	EMCO 3105 Microwave Horn Antenna	78	2118	1/03
	Polarad MDS21 Absorbing Clamp	435	301404/003	NCR
	Log Periodic Antenna 3146	80	3381	1/03
	Biconical Antenna 3109	116	2415	1/03

2.1.2 Test Conditions

Radiated emissions testing was performed with the EUT set up on a wooden table above the turntable at a distance of three meters from the tuned dipole antennas within Open Area Test Site A.

The Siemens Medical Solutions Twelve Lead Biomedical Telemetry 608-614MHz Transmitter/Receiver was configured to operate in the normal mode of operation to maximize the emissions. The Twelve Lead Biomedical Telemetry 608-614MHz Transmitter/Receiver was set up and powered by 120VAC, 60Hz (9VDC for the transmit module) for radiated emission tests. The worst case signals detected were recorded.

2.1.3 Test Method

The test method of ANSI C63.4 was followed for the Siemens Medical Solutions Twelve Lead Biomedical Telemetry 608-614MHz Transmitter/Receiver equipment. For the radiated emission measurements, a manual scan was performed from 30-6180MHz (up to the tenth harmonic of the fundamental). During this scan, the antenna, turntable and the EUT's cable positions were manipulated to maximize the emission levels in a given frequency band displayed on the spectrum analyzer. The fundamental power and harmonics measurements were taken at the low mid and high channel capabilities of the transmitter.

The frequency range was not scanned based on the fact that the device under test does not operate with methods and frequencies that would generate signals at this frequency.

2.1.4 Results

The Siemens Medical Solutions Twelve Lead Biomedical Telemetry 608-614MHz Transmitter/Receiver meets the requirements for radiated emissions as required by FCC Part 15 Subpart B, Class B equipment and Part 15.242.

2.1.5 Test Data

RADIATED E FIELD EMISSION MEASUREMENTS & FIELD STRENGTH MEASUREMENT

CUSTOMER: SIEMENS MEDICAL SOLUTIONS
EQUIPMENT: TWELVE LEAD BIOMEDICAL TELEMETRY 608-614MHz TRANSMITTER/RECEIVER
TESTED BY: RONALD H. CROOKER
OPERATING MODE: NORMAL
BANDWIDTH: [X] 100 KHz (PEAK)/120 KHz (QP)
FREQUENCY RANGE: [X] 30MHz – 1 GHz
[] 11.76 GHz – 12.7 GHz
OTHER (SPECIFY) AND 1000-6180MHz

DATE: 22 JULY 2002
TEST NUMBER: 1
COUPLING DEVICE: EMCO DIPOLES
TEST SPEC: FCC PART 15 SUBPART B AND PART 15.242
PROCEDURE: ANSI C63.4
ANTENNA DISTANCE: [X] 3 METERS
[] 10 METERS

FREQUENCY MHz	PEAK MEASURED LEVEL -dBm	QUASI-PEAK MEASURED LEVEL dBuV	ANTENNA HEIGHT (METERS)	TURNTABLE AZIMUTH (DEGREES)	ANTENNA H/V	ANTENNA FAC/CABLE LOSS dB	FIELD LEVEL dBuV/m ✧	LIMIT dBuV/m (QP)
608		64	1.5	0	V	27.5	91.5	106
1216	See note	32	1.0	0	V	-	-	
1824	See note	15	1.0	0	V	-	-	
611		53	1.5	0	V	27.5	80.5	106
1222	See note	27	1.0	0	V	-	-	
1833	See note	10	1.0	0	V	-	-	
614		58	1.5	0	V	27.5	85.5	106
1228	See note	28	1.0	0	V	-	-	
1842	See note	17	1.0	0	V	-	-	

✧All signals greater than 3dB from the limit are calculate to the nearest whole number.

✧Field Level (dBuV/m) = [107 – Measured level (dBm)] + Antenna Factor/Cable Loss (dB)

Ambient Temperature: 74 °F Humidity: 68 % Atmospheric Pressure: 29.6 "

NOTES: No other signals within 15dB of the limits (Subpart B or Part 15.242)—Signals above 1GHz were detected at 10cm distance, not seen at three meters.

FORM CTS-DS-001R

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2.1.6 Photographic Documentation

CUSTOMER: SIEMENS MEDICAL SOLUTIONS
EQUIPMENT: TWELVE LEAD BIOMEDICAL TELEMETRY
608-614MHZ TRANSMITTER/RECEIVER
TESTED BY: RONALD H. CROOKER
OPERATING MODE: NORMAL

DATE: 22 JULY 2002
TEST NUMBER: 1
COUPLING DEVICE: EMCO
TEST SPEC: FCC PART 15 SUBPART B AND
PART 15.242



Photograph Description: Radiated set-up

FORM CTS-PHOTO

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Photographic Documentation

CUSTOMER: SIEMENS MEDICAL SOLUTIONS
EQUIPMENT: TWELVE LEAD BIOMEDICAL TELEMETRY
608-614MHZ TRANSMITTER/RECEIVER
TESTED BY: RONALD H. CROOKER
OPERATING MODE: NORMAL

DATE: 22 JULY 2002
TEST NUMBER: 1
COUPLING DEVICE: EMCO
TEST SPEC: FCC PART 15 SUBPART B AND
PART 15.242



Photograph Description: Radiated set-up

FORM CTS-PHOTO

Siemens Medical Solutions
Twelve Lead Biomedical Telemetry 608-614MHz Transmitter/Receiver
Document #: TR3402.US.02
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2.2 FCC Part 15 Subpart B Conducted Electromagnetic Emissions**2.2.1 Equipment Used**

	Test Equipment	Asset #	Serial #	Cal Date
	Tektronix 496 Spectrum Analyzer	1	B010559	10/02
X	Tektronix 496 Spectrum Analyzer	77	B020852	1/03
X	Rhode and Schwartz ESH-2 Test Receiver	16	8799631020	9/02
	Rhode and Schwartz ESH-2 Test Receiver	488	879575/006	2/03
	Polarad ESH2-25 Artificial Mains Network	23	890484/016	1/03
X	EMCO 3810/2NM L.I.S.N.	601	9612-1740	1/03
	EMCO Voltage Probe 3701	499	9604-1130	4/03

2.2.2 Test Conditions

Conducted emissions testing was performed with the EUT placed on the table and the test receiver connected to the Artificial Mains Network or Line Impedance Stabilization Network (LISN).

The Siemens Medical Solutions Twelve Lead Biomedical Telemetry 608-614MHz Transmitter/Receiver was configured to operate in the normal mode of operation to maximize the emissions. The Twelve Lead Biomedical Telemetry 608-614MHz Transmitter/Receiver was set up and powered by 120VAC, 60Hz (9VDC for the transmit module) for conducted emission tests. The worst case signals detected were recorded.

2.2.3 Test Method

The test method of FCC Part 15 Subpart B was followed for Class B equipment. A manual scan was performed from .150-30MHz with the Siemens Medical Solutions Twelve Lead Biomedical Telemetry 608-614MHz Transmitter/Receiver powered through the Artificial Mains Network or Line Impedance Stabilization Network (LISN).

2.2.4 Results

The Siemens Medical Solutions Twelve Lead Biomedical Telemetry 608-614MHz Transmitter/Receiver meets the requirements for conducted emissions as required by FCC Part 15 Subpart B Class B equipment.

2.2.5 Test Data

CONDUCTED EMISSION MEASUREMENTS

CUSTOMER: SIEMENS MEDICAL SOLUTIONS

DATE: 22 JULY 2002

EQUIPMENT: TWELVE LEAD BIOMEDICAL TELEMETRY 608-614MHz TRANSMITTER/RECEIVER

TEST NUMBER: 2

TESTED BY: RONALD H. CROOKER

COUPLING DEVICE: LISN

OPERATING MODE: NORMAL

TEST SPEC: FCC PART 15 SUBPART B

BANDWIDTH: [] 200 Hz [] 9 kHz [X] 10 kHz

PROCEDURE: ANSI C63.4

FREQUENCY RANGE: [] 10 kHz – 30 MHz

[X] 150 kHz – 30 MHz

[] 450 kHz – 30 MHz

[X] 110/208 V AC [] 240 V AC [] OTHER

[] 50 Hz [X] 60 Hz [X] SINGLE Ø [] 3Ø

FREQUENCY MHz	PEAK MEASURED LEVEL dBuV				AVERAGE MEASURED LEVEL dBuV				QUASI-PEAK MEASURED LEVEL dBuV				LIMIT dBuV	
	AØ	BØ	CØ	NØ	AØ	BØ	CØ	NØ	AØ	BØ	CØ	NØ	Average	Quasi-Peak
.150									50			49		66
.185									51			52		65
.370									38			39		58
1.966									39			39		56
4.972									25			25		56
9.58									26			26		60

✧All signals greater than 3dB from the limit are calculated to the nearest whole number.

Ambient Temperature: 72 °F

Humidity: 68 %

Atmospheric Pressure: 29.6 "

FORM CTS-DS-002C

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2.2.6 Photographic Documentation

CUSTOMER: SIEMENS MEDICAL SOLUTIONS
EQUIPMENT: TWELVE LEAD BIOMEDICAL TELEMETRY
608-614MHZ TRANSMITTER/RECEIVER
TESTED BY: RONALD H. CROOKER
OPERATING MODE: NORMAL

DATE: 22 JULY 2002
TEST NUMBER: 2
COUPLING DEVICE: LISN
TEST SPEC: FCC PART 15 SUBPART B



Photograph Description: Conducted set-up

FORM CTS-PHOTO

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APPENDIX A

TEST LOG

TEST SERVICES

TEST LOG

CUSTOMER: SIEMENS MEDICAL SOLUTIONS

PROGRAM: MEDICAL

EQUIPMENT: TWELVE LEAD BIOMEDICAL TELEMETRY 608-614MHZ TRANSMITTER/RECEIVER

TESTED BY: RONALD H. CROOKER

Pre-Test Checklist	Date	Comments					
	7/22/02	Test Plan/Procedure: ANSI C63.4 Test Specification: FCC Part 15 Subpart B Class B, FCC Part 15.242 Chomerics Procedure: CHO TPEC T1, T2 EUT Power Requirement Verified: 120VAC, 60Hz (9VDC Transmitter) EUT Functional Operational Check: [X] Pass [] Fail Environmental: Bonding/Grounding: N/A Safety Issues: N/A					
In-Process Test Checklist	Date	Test #	Test Type	Test Equipment Calibrated	Test Performed Properly – Data Accepted	EUT Set-up Check/Operational Check	EUT Pass/Fail
	7/22/02	1	Rad Emissions	X	X	X	P
	7/22/02	2	Cond Emissions	X	X	X	P
Post Test Checklist	Date: 7/22/02	EUT Functional Operation Check: [X] Pass [] Fail		_____ Test Engineer/Tech _____ Approved Signatory			

FORM CTS-010

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