BIOTRONIK, Inc.

Cylos DR-T

June 14, 2005

Report No. BIOT0009

Report Prepared By

www.nwemc.com
1-888-EMI-CERT

EMC Test Report

NORTHWEST EMC

22975 NW Evergreen Parkway
Suite 400
Hillsboro, Oregon 97124

Certificate of Test

Issue Date: June 14, 2005
BIOTRONIK, Inc.
Model: Cylos DR-T

Emissions			
Specification	**Test Method**	**Pass**	**Fail**
FCC 95.639(f)(1) Field Strength of Fundamental:2004	TIA/EIA-603:1998	☒	☐
FCC 95.635(d) Field Strength of Radiated Emission:2004	TIA/EIA-603:1998 & ANSI C63.4:2004	☒	☐
FCC 95.633(e)(1) Occupied Bandwidth:2004	95.633(e)(3) & ANSI C63.4:2004	☒	☐
FCC 95.635(d)(4-5) Emission Mask:2004	95.635(d)(4-5) & ANSI C63.4:2004	☒	☐
FCC 95.628(e)(1) & 2.1055 Frequency Stability:2004	TIA/EIA-603:1993	☒	☐

Modifications made to the product
See the Modifications section of this report

Test Facility

The measurement facility used to collect the data is located at:

Northwest EMC, Inc.
22975 NW Evergreen Parkway, Suite 400; Hillsboro, OR 97124
Phone: (503) 844-4066
Fax: 844-3826

This site has been fully described in a report filed with and accepted by the FCC (Federal Communications Commission) and Industry Canada.

Approved By:

David M. Tolman, QA Manager

This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government of the United States of America.

Product compliance is the responsibility of the client, therefore the tests and equipment modes of operation represented in this report were agreed upon by the client, prior to testing. This Report may only be duplicated in its entirety. The results of this test pertain only to the sample(s) tested, the specific description is noted in each of the individual sections of the test report supporting this certificate of test.

Revision Number	Description	Date	Page Number
00	None		

Accreditations and Authorizations

FCC: Accredited by NVLAP for performance of FCC radio, digital, and ISM device testing. Our Open Area Test Sites, certification chambers, and conducted measurement facilities have been fully described in reports filed with the FCC and accepted by the FCC in letters maintained in our files. Northwest EMC has been accredited by ANSI to ISO / IEC Guide 65 as a product certifier. We have been designated by the FCC as a Telecommunications Certification Body (TCB). This allows Northwest EMC to certify transmitters to FCC specifications in accordance with 47 CFR 2.960 and 2.962.

NVLAP: Northwest EMC, Inc. is recognized under the United States Department of Commerce, National Institute of Standards and Technology, and National Voluntary Laboratory Accreditation Program for satisfactory compliance with the requirements of ISO/IEC 17025 for Testing Laboratories. The NVLAP accreditation encompasses Electromagnetic Compatibility Testing in accordance with the European Union EMC Directive 89/336/EEC, ANSI C63.4, MIL-STD 461E, DO-160D and SAE J1113. Additionally, Northwest EMC is accredited by NVLAP to perform radio testing in accordance with the European Union R&TTE Directive 1999/5/EEC, the requirements of FCC, and the RSS radio standards for Industry Canada.

200629-0
200630-0
200676-0

Industry Canada: Accredited by NVLAP for performance of Industry Canada RSS and ICES testing. Our Open Area Test Sites and certification chambers comply with RSS 212, Issue 1 (Provisional) and have been filed with Industry Canada and accepted. Northwest EMC has been accredited by ANSI to ISO / IEC Guide 65 as a product certifier. We have been designated by NIST and recognized by Industry Canada as a Certification Body (CB) per the APEC Mutual Recognition Arrangement (MRA). This allows Northwest EMC to certify transmitters to Industry Canada technical requirements.

CAB: Designated by NIST and validated by the European Commission as a Conformity Assessment Body (CAB) to conduct tests and approve products to the EMC directive and transmitters to the R&TTE directive, as described in the U.S. - EU Mutual Recognition Agreement.

TÜV Product Service: Included in TUV Product Service Group's Listing of Recognized Laboratories. It qualifies in connection with the TUV Certification after Recognition of Agent's Testing Program for the product categories and/or standards shown in TUV's current Listing of CARAT Laboratories, available from TUV. A certificate was issued to represent that this laboratory continues to meet TUV's CARAT Program requirements. Certificate No. USA0401C.

TÜV Rheinland: Authorized to carryout EMC tests by order and under supervision of TÜV Rheinland. This authorization is based on "Conditions for EMC-Subcontractors" of November 1992.

NEMKO: Assessed and accredited by NEMKO (Norwegian testing and certification body) for European emissions and immunity testing. As a result of NEMKO's laboratory assessment, they will accept test results from Northwest EMC, Inc. for product certification (Authorization No. ELA 119).

Technology International: Assessed in accordance with ISO Guide 25 defining the general international requirements for the competence of calibration and testing laboratories and with ITI assessment criteria LACO196. Based upon that assessment, Interference Technology International, Ltd., has granted approval for specifications implementing the EU Directive on EMC (89/336/EEC and amendments). The scope of the approval was provided on a Schedule of Assessment supplied with the certificate and is available upon request.

Australia/New Zealand: The National Association of Testing Authorities (NATA), Australia has been appointed by the ACA as an accreditation body to accredit test laboratories and competent bodies for EMC standards. Accredited test reports or assessments by competent bodies must carry the NATA logo. Test reports made by an overseas laboratory that has been accredited for the relevant standards by an overseas accreditation body that has a Mutual Recognition Agreement (MRA) with NATA are also accepted as technical grounds for product conformity. The report should be endorsed with the respective logo of the accreditation body (NVLAP).

VCCI: Accepted as an Associate Member to the VCCI, Acceptance No. 564. Conducted and radiated measurement facilities have been registered in accordance with Regulations for Voluntary Control Measures, Article 8. *(Registration Numbers. - Hillsboro: C-1071 and R-1025, Irvine: C-2094 and R-1943, Newberg: C-1877 and R-1760, Sultan: R-871, C-1784 and R-1761).*

BSMI: Northwest EMC has been designated by NIST and validated by C-Taipei (BSMI) as a CAB to conduct tests as described in the APEC Mutual Recognition Agreement. License No.SL2-IN-E-1017.

GOST: Northwest EMC, Inc. has been assessed and accredited by the Russian Certification bodies Certinform VNIINMASH, CERTINFO, SAMTES, and Federal CHEC, to perform EMC and Hygienic testing for Information Technology Products. As a result of their laboratory assessment, they will accept test results from Northwest EMC, Inc. for product certification

SCOPE

For details on the Scopes of our Accreditations, please visit:
http://www.nwemc.com/scope.asp

What is measurement uncertainty?

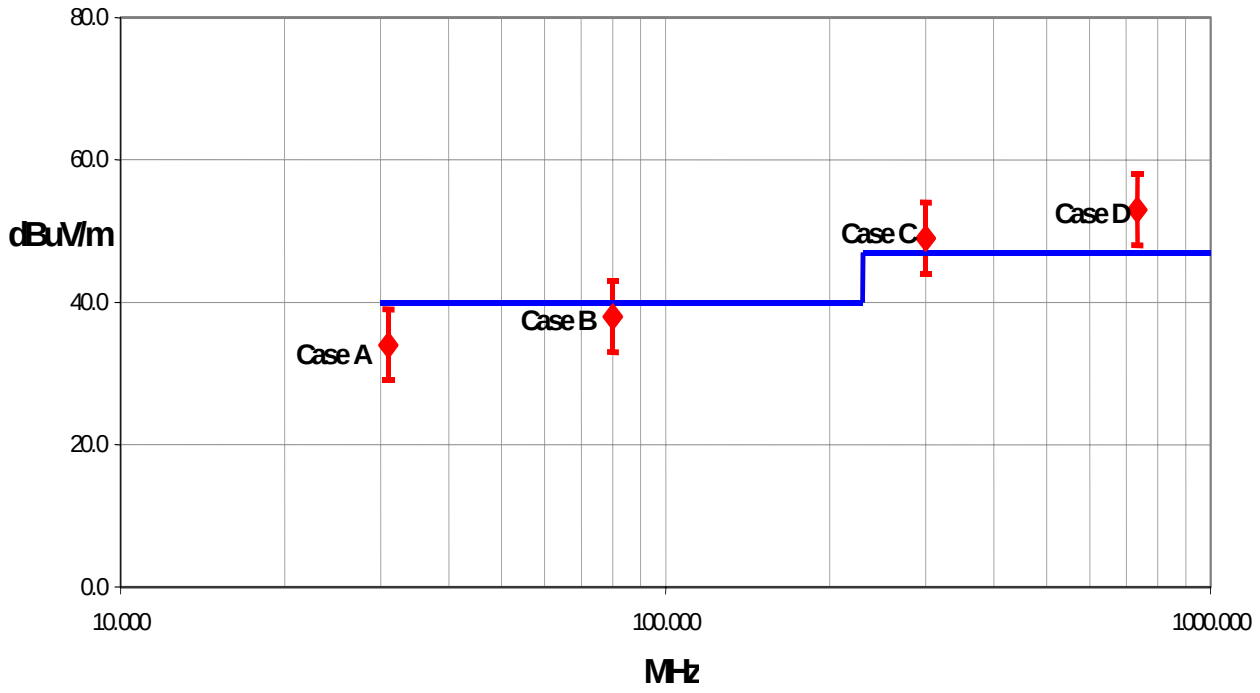
When a measurement is made, the result will be different from the true or theoretically correct value. The difference is the result of tolerances in the measurement system that cannot be completely eliminated. To the extent that technology allows us, it has been our aim to minimize this error. The following statement of measurement uncertainty is used to reflect the accuracy of the measured result as compared with its "true" value. In the case of transient tests (ESD, EFT, Surge, Voltage Dips and Interruptions), the test equipment has been demonstrated by calibration to provide at least a 95% confidence that it complies with the test specification requirements.

The following documents were the basis for determining the uncertainty levels of our measurements:

- "ISO Guide to the Expression of Uncertainty in Measurements", October 1993
- "NIS81: The Treatment of Uncertainty in EMC Measurements", May 1994
- "IEC CISPR 16-3 A1 f1 Ed.1: Radio-interference measurements and statistical techniques", December 2000

How might measurement uncertainty be applied to test results?

If the diamond marks the measured value for the test and the vertical bars bracket the range of + and – measurement uncertainty, then test results can be interpreted from the diagram below.



Test Result Scenarios:
Case A: Product complies.
Case B: Product conditionally complies. It is not possible to say with 95% confidence that the product complies.
Case C: Product conditionally does not comply. It is not possible to say with 95% confidence that the product does not comply.
Case D: Product does not comply.

Radiated Emissions ≤ 1 GHz		Value (dB)					
	Probability Distribution	Biconical Antenna		Log Periodic Antenna		Dipole Antenna	
Test Distance		3m	10m	3m	10m	3m	10m
Combined standard uncertainty $u_c(y)$	normal	+ 1.86 - 1.88	+ 1.82 - 1.87	+ 2.23 - 1.41	+ 1.29 - 1.26	+ 1.31 - 1.27	+ 1.25 - 1.25
Expanded uncertainty ***U*** (level of confidence ≈ 95%)	normal (k=2)	+ 3.72 - 3.77	+ 3.64 - 3.73	+ 4.46 -2.81	+ 2.59 - 2.52	+ 2.61 - 2.55	+ 2.49 - 2.49

Radiated Emissions > 1 GHz	Value (dB)		
	Probability Distribution	Without High Pass Filter	With High Pass Filter
Combined standard uncertainty $u_c(y)$	normal	+ 1.29 - 1.25	+ 1.38 - 1.35
Expanded uncertainty ***U*** (level of confidence ≈ 95%)	normal (k=2)	+ 2.57 - 2.51	+ 2.76 - -2.70

Conducted Emissions		
	Probability Distribution	Value (+/- dB)
Combined standard uncertainty ***uc(y)***	normal	1.48
Expanded uncertainty ***U*** (level of confidence ≈ 95 %)	normal (k = 2)	2.97

Radiated Immunity		
	Probability Distribution	Value (+/- dB)
Combined standard uncertainty ***uc(y)***	normal	1.05
Expanded uncertainty ***U*** (level of confidence ≈ 95 %)	normal (k = 2)	2.11

Conducted Immunity		
	Probability Distribution	Value (+/- dB)
Combined standard uncertainty ***uc(y)***	normal	1.05
Expanded uncertainty ***U*** (level of confidence ≈ 95 %)	normal (k = 2)	2.10

Legend

$u_c(y)$ = square root of the sum of squares of the individual standard uncertainties

U = combined standard uncertainty multiplied by the coverage factor: **k**. This defines an interval about the measured result that will encompass the true value with a confidence level of approximately 95%. If a higher level of confidence is required, then k=3 (CL of 99.7%) can be used. Please note that with a coverage factor of one, uc(y) yields a confidence level of only 68%.

California

Orange County Facility

Labs OC01 – OC13

41 Tesla Ave.
Irvine, CA 92618
(888) 364-2378
FAX (503) 844-3826

Oregon

Evergreen Facility

Labs EV01 – EV10

22975 NW Evergreen Pkwy.
Suite 400
Hillsboro, OR 97124
(503) 844-4066
FAX (503) 844-3826

Oregon

Trails End Facility

Labs TE01 – TE03

30475 NE Trails End Lane
Newberg, OR 97132
(503) 844-4066
FAX (503) 537-0735

Washington

Sultan Facility

Labs SU01 – SU07

14128 339th Ave. SE
Sultan, WA 98294
(888) 364-2378
FAX (360) 793-2536

Party Requesting the Test	
Company Name:	BIOTRONIK, Inc.
Address:	6024 Jean Road
City, State, Zip:	Lake Oswego, OR 97035
Test Requested By:	Brian Sutton
Model:	Cylos DR-T
First Date of Test:	6-10-2005
Last Date of Test:	6-13-2005
Receipt Date of Samples:	6-10-2005
Equipment Design Stage:	Prototype
Equipment Condition:	No visual damage.

Information Provided by the Party Requesting the Test

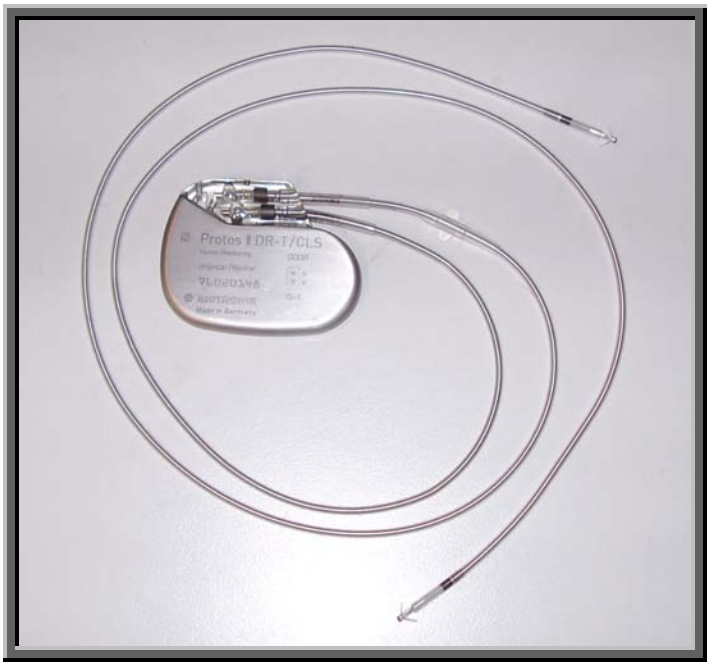
Clocks/Oscillators:	403.6 MHz Transmit Frequency, Internal Clock at 32,768 KHz
I/O Ports:	Implant Leads, Qty=2

Functional Description of the EUT (Equipment Under Test):
Cardiac Pacemaker to be implanted in bradycardia patients. The EUT is designed to transmit medically relevant data.

Client Justification for EUT Selection:
Random production unit modified to support near continuous RF transmission.

Client Justification for Test Selection:
These tests satisfy the FCC requirements for the US market.

EUT Photo



Equipment modifications					
Item	Test	Date	Modification	Note	Disposition of EUT
1	Field Strength of Fundamental	06/10/2005	No EMI suppression devices were added or modified during this test.	Same configuration as delivered.	EUT remained at Northwest EMC.
2	Emissions Mask (< or = 250kHz)	06/10/2005	No EMI suppression devices were added or modified during this test.	Same configuration as in previous test.	EUT remained at Northwest EMC.
3	Occupied Bandwidth	06/10/2005	No EMI suppression devices were added or modified during this test.	Same configuration as in previous test.	EUT remained at Northwest EMC.
4	Spurious Radiated Emissions	06/10/2005	No EMI suppression devices were added or modified during this test.	Same configuration as in previous test.	EUT remained at Northwest EMC.
5	Frequency Stability	06/13/2005	No EMI suppression devices were added or modified during this test.	Same configuration as in previous test.	EUT was returned to client following testing.

Justification

The individuals and/or the organization requesting the test provided the modes, configurations and settings available to evaluate. While scanning the radiated emissions, all of the EUT parameters listed below were investigated. This includes, but may not be limited to, antennas, tuned transmit frequency ranges, operating modes, and data rates.

Channels in Specified Band Investigated:
Single Channel: 403.62 MHz

Operating Modes Investigated:
Typical

Data Rates Investigated:
Maximum

Output Power Setting(s) Investigated:
Maximum

Power Input Settings Investigated:
Battery

Software\Firmware Applied During Test			
Exercise software	Special Test Software	**Version**	Unknown
Description			
The system was tested using special software developed to test all functions of the device during the test.			

EUT and Peripherals			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
EUT- Cylos DR-T	Biotronik, Inc.	Cylos DR-T	76020147

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
Implant Lead	Yes	approx. 0.	No	EUT- Cylos DR-T	Not connected
Implant Lead	Yes	approx. 0.	No	EUT- Cylos DR-T	Not connected

Measurement Equipment					
Description	**Manufacturer**	**Model**	**Identifier**	**Last Cal**	**Interval**
Spectrum Analyzer	Hewlett-Packard	8566B	AAL	12/02/2004	13 mo
Pre-Amplifier	Amplifier Research	LN1000A	APS	03/01/2005	13 mo
Antenna, Biconilog	EMCO	3141	AXE	12/03/2003	24 mo

Test Description

Requirement: Per 95.639(f)(1), the maximum EIRP for a MICS transmitter is 25uW. This is equivalent to a radiated field strength 85.2 dBuV/m at 3 meters when measured over a reference ground plane.

Configuration: The Field Strength of the Fundamental was measured in the far-field at an FCC Listed Semi-anechoic Chamber. Spectrum analyzer and linearly polarized antennas were used to measure the effective radiated power (EIRP) of the fundamental.

The orientation of the EUT and measurement antenna were manipulated to maximize the level of emissions.

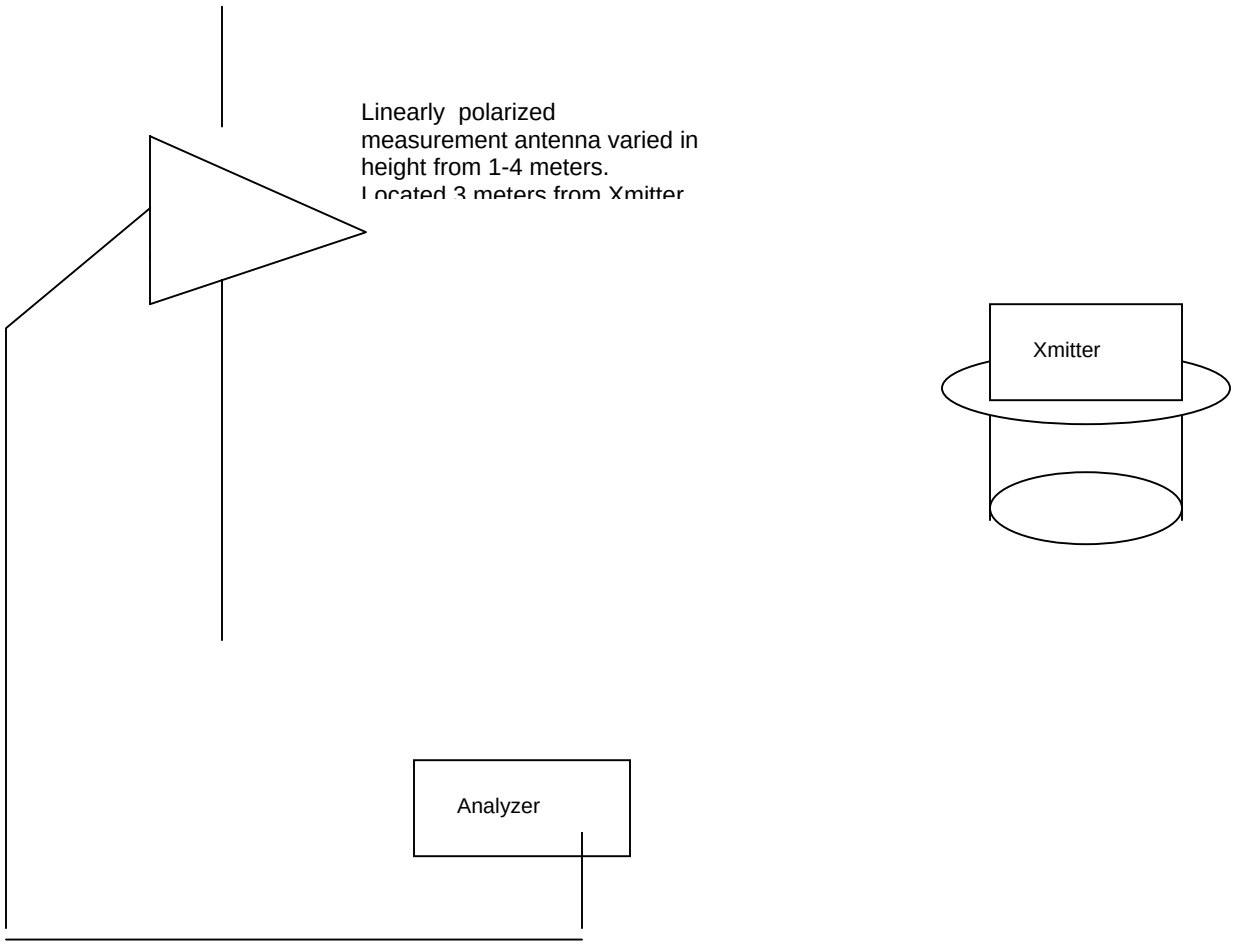
The EUT was configured to transmit in a fixture that simulates the human torso. The dimensions of the test fixture and the characteristics of the tissue substitute material met the requirements of 95.639(f)(2)(i-ii). The dielectric and conductivity properties of the tissue substitute material were verified the morning of the test (see client data for tissue substitute material), and the temperature was measured before and after the test to verify compliance with 95.639(f)(2)(i). At the start of the test, the tissue substitute material was 23.5 degrees centigrade. At the conclusion of testing, it was 23.2 degrees centigrade.

Test Methodology

At an approved test site, the transmitter was placed in the human torso test fixture located on a remotely controlled turntable, and the measurement antenna was placed 3 meters from the transmitter. The height of the transmitter was 1.5-meter above the reference ground plane. The turntable azimuth was varied to maximize the level of radiated emissions. The height of the measurement antenna was also varied from 1 to 4 meters. The amplitude and frequency of the emissions were noted.

Test Setup Diagram

Test Setup for Field Strength Measurements



Completed by:

NORTHWEST EMC

RADIATED EMISSIONS DATA SHEET

ACQ 2005.1.4
EMI 2005.5.05

EUT:	Cylos DR-T			Work Order:	BIOT0009
Serial Number:	76020147			Date:	06/10/05
Customer:	BIOTRONIK, Inc.			Temperature:	23
Attendees:	Brian Sutton			Humidity:	42%
Cust. Ref. No.:				Barometric Pressure	29.95
Tested by:	Rod Peloquin	Power:	Battery	Job Site:	EV01

TEST SPECIFICATIONS

Specification:	FCC 95.639(f)(1):2004	Method:	TIA/EIA-603:1998

SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

Conducted Emissions: Adjusted Level = Measured Level + Transducer Factor + Cable Attenuation Factor + External Attenuator

COMMENTS

EUT horizontal in test fixture at 1.5m height

EUT OPERATING MODES

Transmitting Single channel

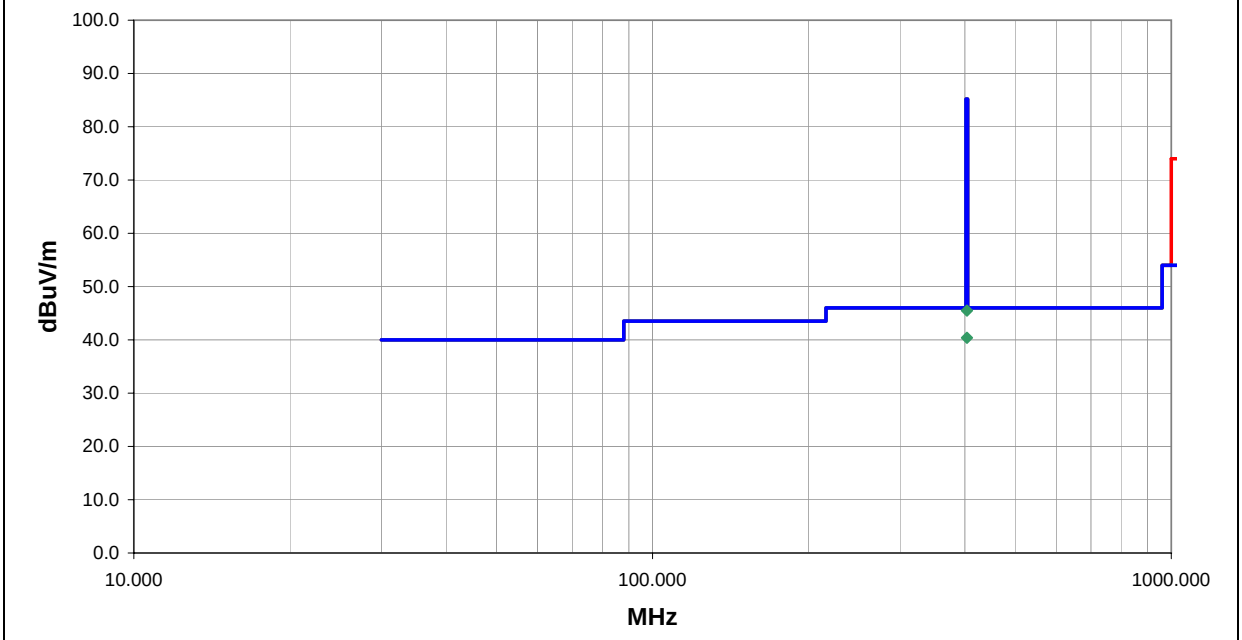
DEVIATIONS FROM TEST STANDARD

No deviations.

RESULTS	Run #
Pass	1

Other

Tested By:



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Azimuth (degrees)	Height (meters)	Distance (meters)	External Attenuation (dB)	Polarity	Detector	Distance Adjustment (dB)	Adjusted dBuV/m	Spec. Limit dBuV/m	Compared to Spec. (dB)
403.617	50.6	-5.1	292.0	2.0	3.0	0.0	V-Bilog	PK	0.0	45.5	85.2	-39.7
403.617	45.5	-5.1	197.0	2.3	3.0	0.0	H-Bilog	PK	0.0	40.4	85.2	-44.8

NORTHWEST EMC

RADIATED EMISSIONS DATA SHEET

ACQ 2005.1.4
EMI 2005.5.05

EUT:	Cylos DR-T			Work Order:	BIOT0009
Serial Number:	76020147			Date:	06/10/05
Customer:	BIOTRONIK, Inc.			Temperature:	23
Attendees:	Brian Sutton			Humidity:	42%
Cust. Ref. No.:				Barometric Pressure	29.95
Tested by:	Rod Peloquin	Power:	Battery	Job Site:	EV01

TEST SPECIFICATIONS

Specification:	FCC 95.639(f)(1):2004	Method:	TIA/EIA-603:1998

SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

Conducted Emissions: Adjusted Level = Measured Level + Transducer Factor + Cable Attenuation Factor + External Attenuator

COMMENTS

EUT vertical in test fixture at 1.5m height

EUT OPERATING MODES

Transmitting Single channel

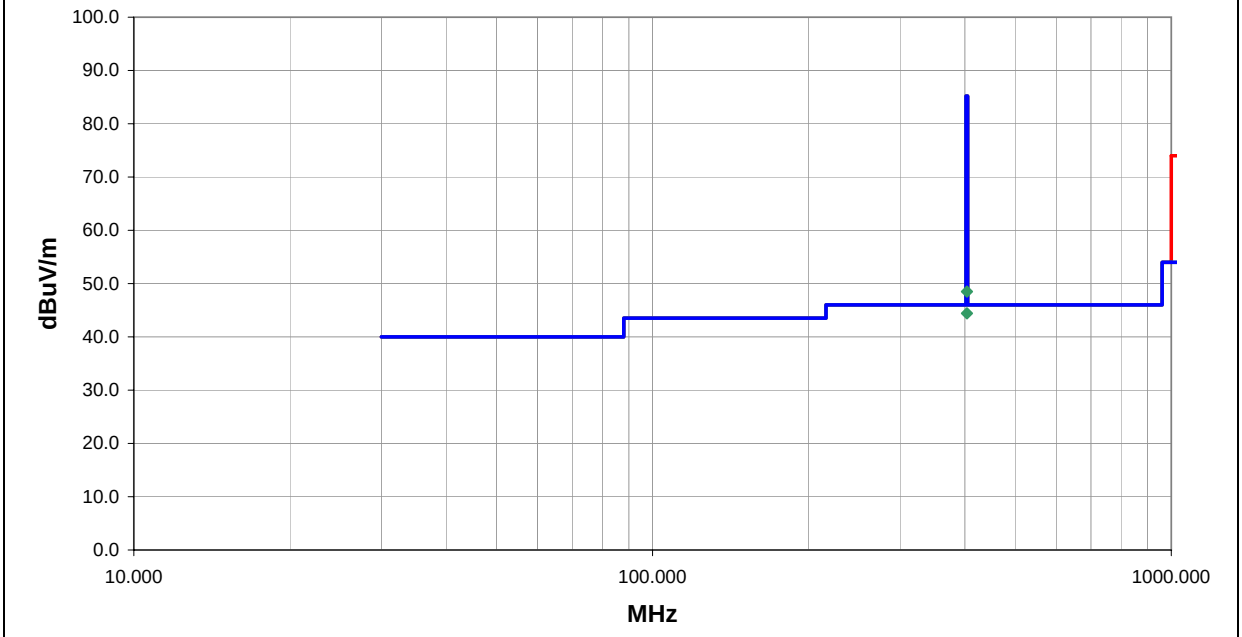
DEVIATIONS FROM TEST STANDARD

No deviations.

RESULTS	Run #
Pass	4

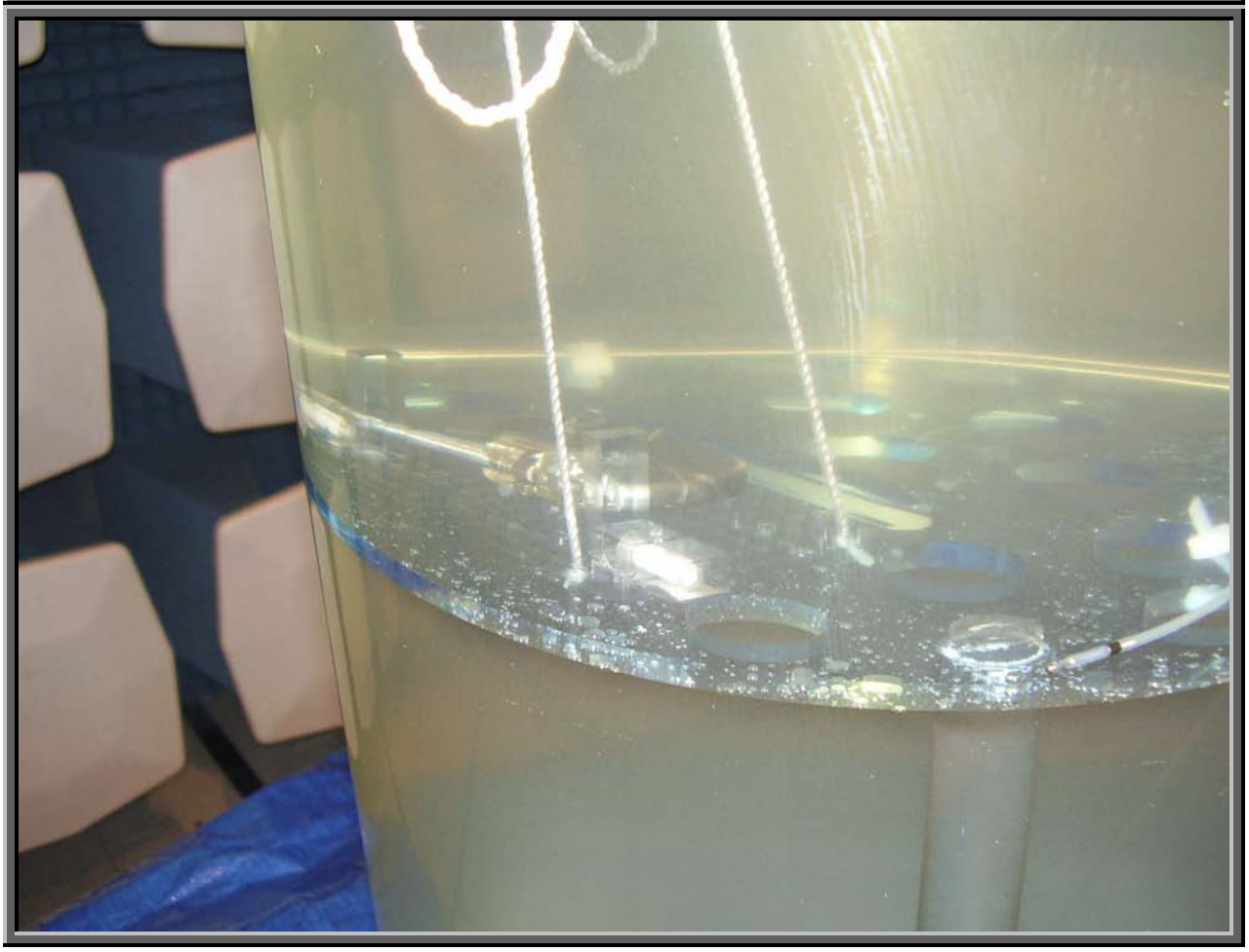
Other

Tested By:

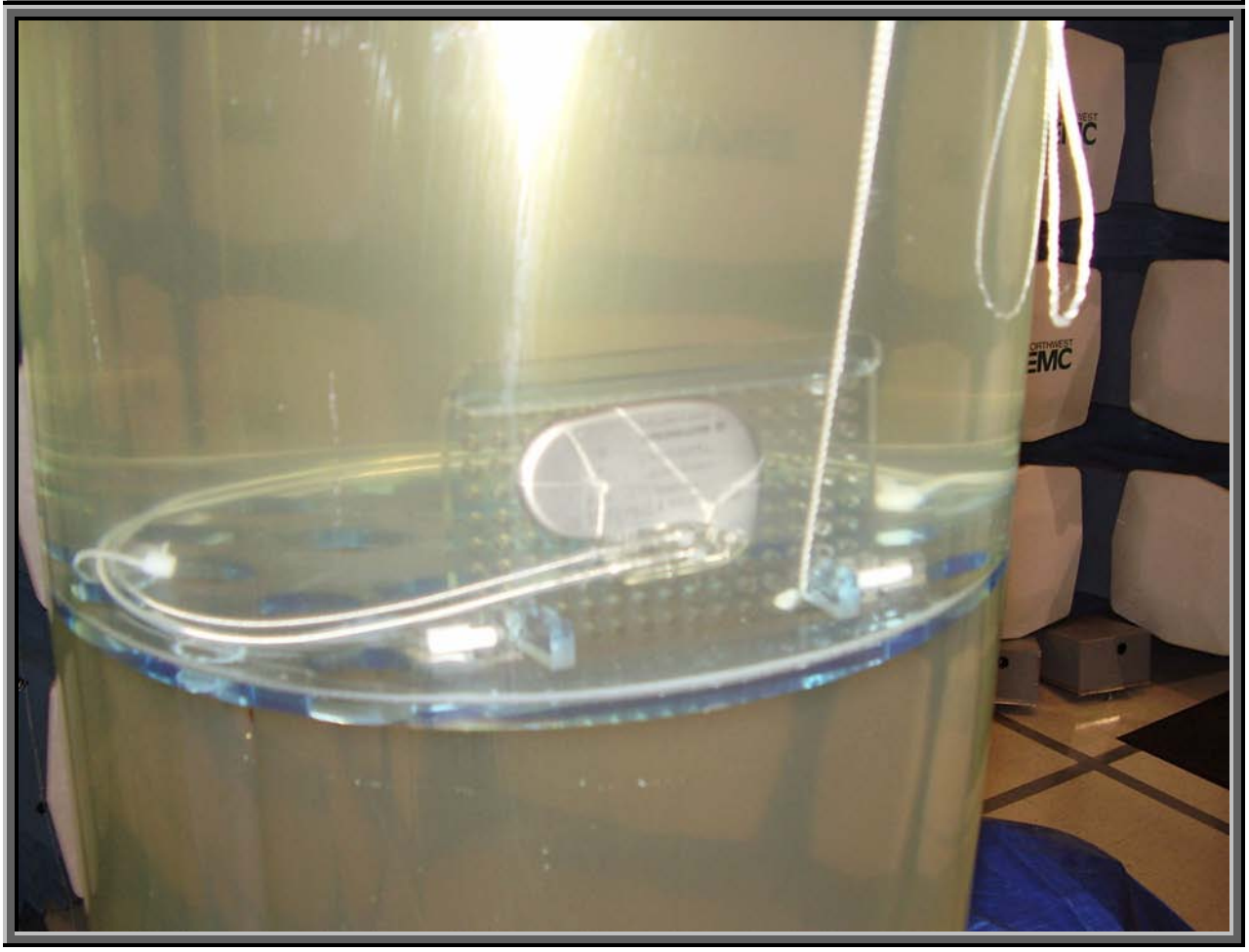


Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Azimuth (degrees)	Height (meters)	Distance (meters)	External Attenuation (dB)	Polarity	Detector	Distance Adjustment (dB)	Adjusted dBuV/m	Spec. Limit dBuV/m	Compared to Spec. (dB)
403.617	53.6	-5.1	0.0	2.0	3.0	0.0	V-Bilog	PK	0.0	48.5	85.2	-36.7
403.617	49.5	-5.1	201.0	2.3	3.0	0.0	H-Bilog	PK	0.0	44.4	85.2	-40.8


NORTHWEST EMC




NORTHWEST
EMC


NORTHWEST
EMC

Justification

The individuals and/or the organization requesting the test provided the modes, configurations and settings available to evaluate. While scanning the radiated emissions, all of the EUT parameters listed below were investigated. This includes, but may not be limited to, antennas, tuned transmit frequency ranges, operating modes, and data rates.

Channels in Specified Band Investigated:
Single Channel: 403.62 MHz

Operating Modes Investigated:
Typical

Data Rates Investigated:
Maximum

Output Power Setting(s) Investigated:
Maximum

Power Input Settings Investigated:
Battery

Software\Firmware Applied During Test			
Exercise software	Special Test Software	**Version**	Unknown
Description			
The system was tested using special software developed to test all functions of the device during the test.			

EUT and Peripherals			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
EUT- Cylos DR-T	Biotronik, Inc.	Cylos DR-T	76020147

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
Implant Lead	Yes	approx. 0.	No	EUT- Cylos DR-T	Not connected
Implant Lead	Yes	approx. 0.	No	EUT- Cylos DR-T	Not connected

Measurement Equipment					
Description	**Manufacturer**	**Model**	**Identifier**	**Last Cal**	**Interval**
Spectrum Analyzer	Agilent	E4446A	AAQ	04/08/2005	13 mo
Pre-Amplifier	Amplifier Research	LN1000A	APS	03/01/2005	13 mo
Antenna, Biconilog	EMCO	3141	AXE	12/03/2003	24 mo

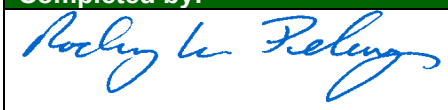
Test Description

Requirement: Per 47 CFR 95.633(e)(1) and 2.1049, the Occupied Bandwidth was measured. The maximum authorized emission bandwidth is 300 kHz.

Configuration: Per 47 CFR 95.633(e)(3), the emission bandwidth was determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 20 dB down relative to the maximum level of the modulated carrier. A spectrum analyzer using a peak detector with no video filtering was used with a resolution bandwidth equal to approximately 1.0 percent of the emission bandwidth of the EUT.

An emission bandwidth measurement was made using a 150 Hz resolution bandwidth (no video filtering) and a peak detector. With these instrument settings, an emission bandwidth of 15.1 kHz was measured. This most closely satisfied the specified measurement criteria. It is important to use a RBW that is sufficiently narrow to plot the actual bandwidth of the signal and not the filter response curve of the spectrum analyzer. However, various plots were made using different frequency spans and resolution bandwidths in an attempt to not only satisfy the measurement criteria, but to also show that all emissions outside of the occupied band are greatly attenuated.

Completed by:



NORTHWEST EMC

OCCUPIED BANDWIDTH DATA SHEET

Rev BETA 01/30/01

EUT:	Cylos DR-T			Work Order:	BIOT0009
Serial Number:	76020147			Date:	06/10/05
Customer:	Biotronik, Inc.			Temperature:	23°C
Attendees:	Brian Sutton	Tested by:	Rod Peloquin	Humidity:	41% RH
Customer Ref. No.:		Power:	Battery	Job Site:	EV01

TEST SPECIFICATIONS

Specification:	47 CFR 95.633(e)(1)	Year:	2004	Method:	95.633(e)(3) & ANSI C63.4	Year:	2004

SAMPLE CALCULATIONS

COMMENTS

EUT Vertical in Test fixture at 1.5m height

EUT OPERATING MODES

Transmitting single channel

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

The maximum authorized emission bandwidth is 300 kHz

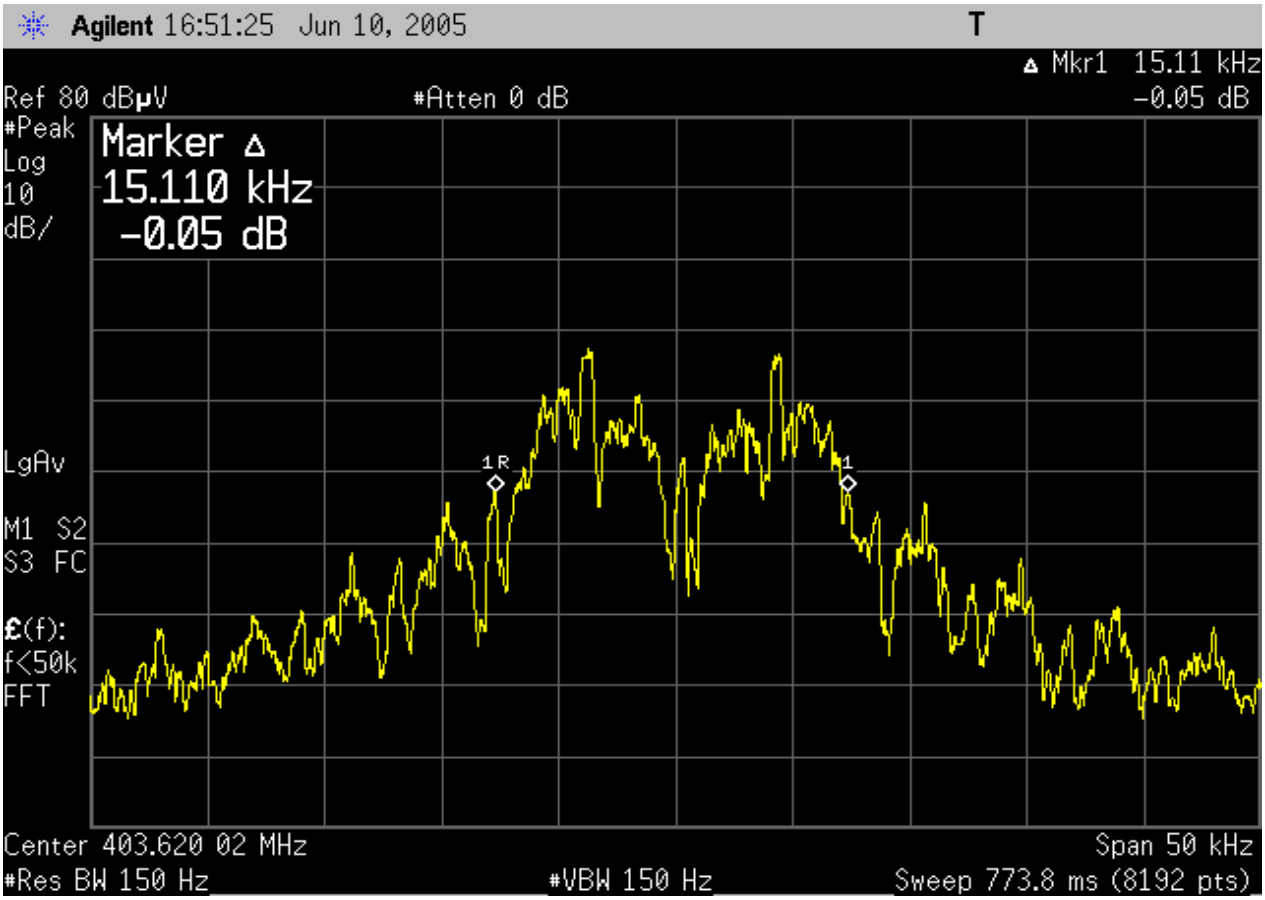
RESULTS	BANDWIDTH
Pass	15.1 kHz

SIGNATURE

Tested By: _____

DESCRIPTION OF TEST

Occupied Bandwidth



NORTHWEST EMC

EMISSIONS DATA SHEET

Rev BETA 01/30/01

EUT:	Cylos DR-T			Work Order:	BIOT0009
Serial Number:	76020147			Date:	06/10/05
Customer:	Biotronik, Inc.			Temperature:	23°C
Attendees:	Brian Sutton	Tested by:	Rod Peloquin	Humidity:	41% RH
Customer Ref. No.:		Power:	Battery	Job Site:	EV01

TEST SPECIFICATIONS

Specification:	47 CFR 95.633(e)(1)	Year:	2004	Method:	95.633(e)(3) & ANSI C63.4	Year:	2004

SAMPLE CALCULATIONS

COMMENTS

EUT Vertical in Test fixture at 1.5m height

EUT OPERATING MODES

Transmitting single channel

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

The maximum authorized emission bandwidth is 300 kHz

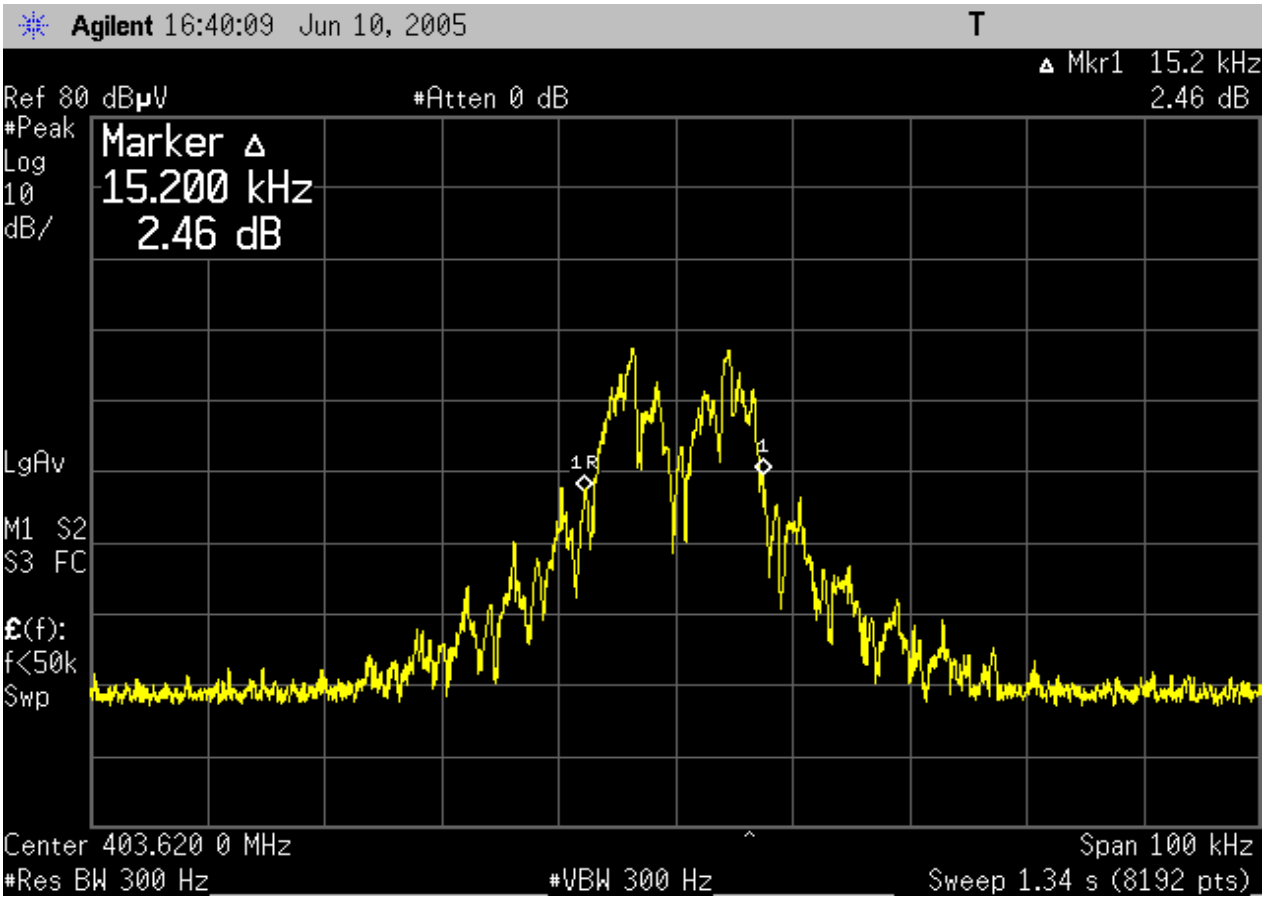
RESULTS	BANDWIDTH
Pass	15.2 kHz

SIGNATURE

Tested By: Rodney Lee Peloquin

DESCRIPTION OF TEST

Occupied Bandwidth



NORTHWEST EMC

EMISSIONS DATA SHEET

Rev BETA 01/30/01

EUT:	Cylos DR-T			Work Order:	BIOT0009
Serial Number:	76020147			Date:	06/10/05
Customer:	Biotronik, Inc.			Temperature:	23°C
Attendees:	Brian Sutton	Tested by:	Rod Peloquin	Humidity:	41% RH
Customer Ref. No.:		Power:	Battery	Job Site:	EV01

TEST SPECIFICATIONS

Specification:	47 CFR 95.633(e)(1)	Year:	2004	Method:	95.633(e)(3) & ANSI C63.4	Year:	2004

SAMPLE CALCULATIONS

COMMENTS

EUT Vertical in Test fixture at 1.5m height

EUT OPERATING MODES

Transmitting single channel

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

The maximum authorized emission bandwidth is 300 kHz

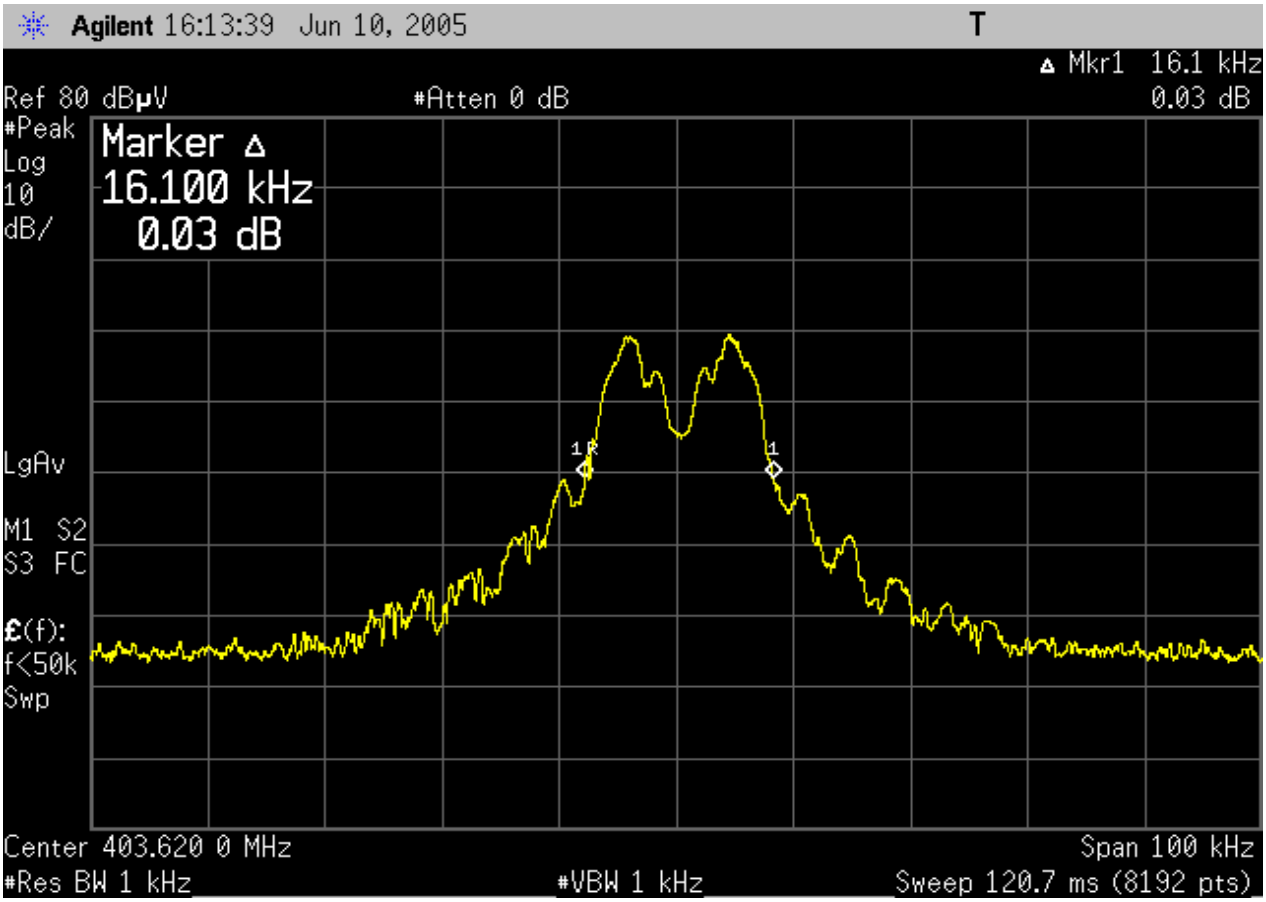
RESULTS	BANDWIDTH
Pass	16.1 kHz

SIGNATURE

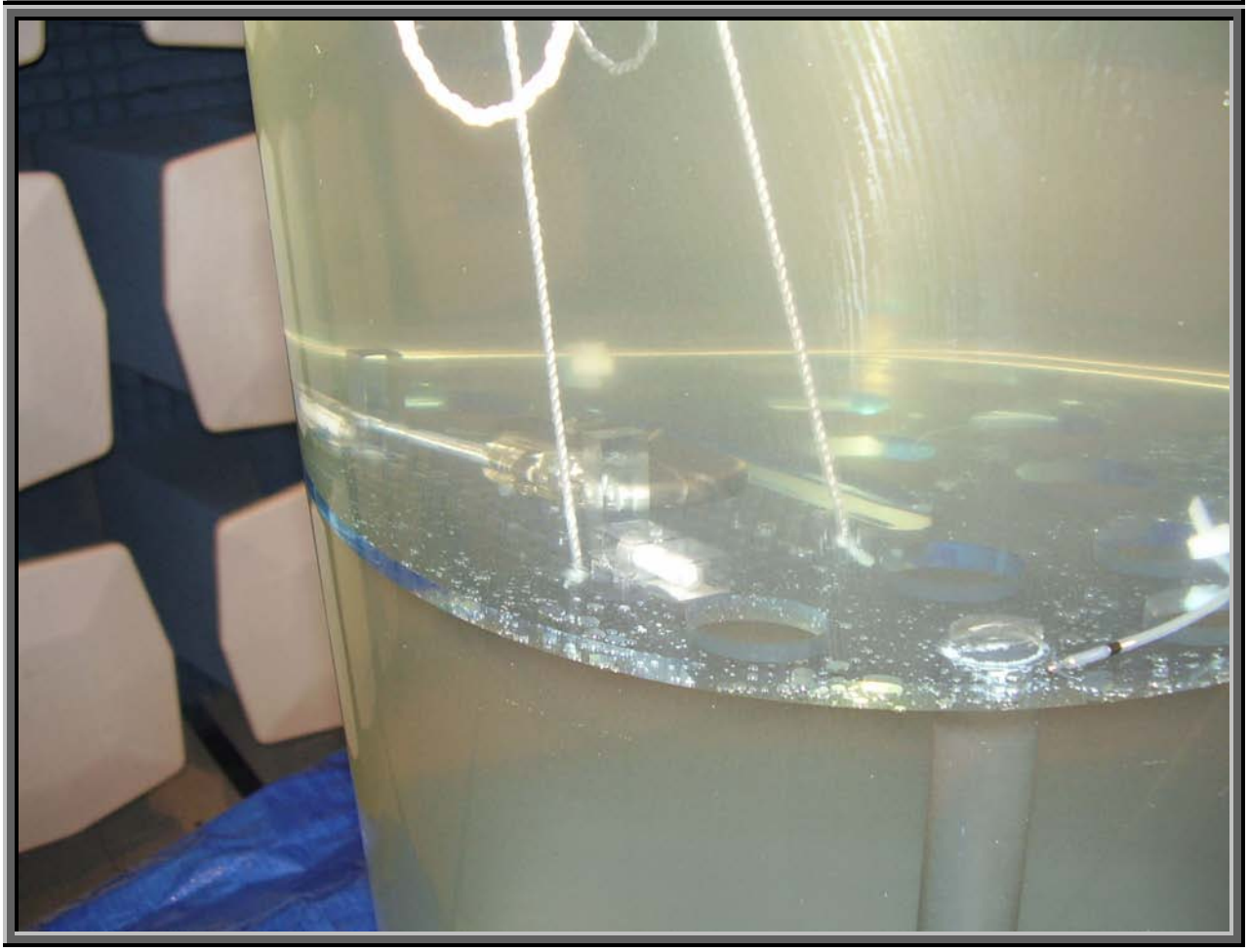
Tested By: Rodney Lee Peloquin

DESCRIPTION OF TEST

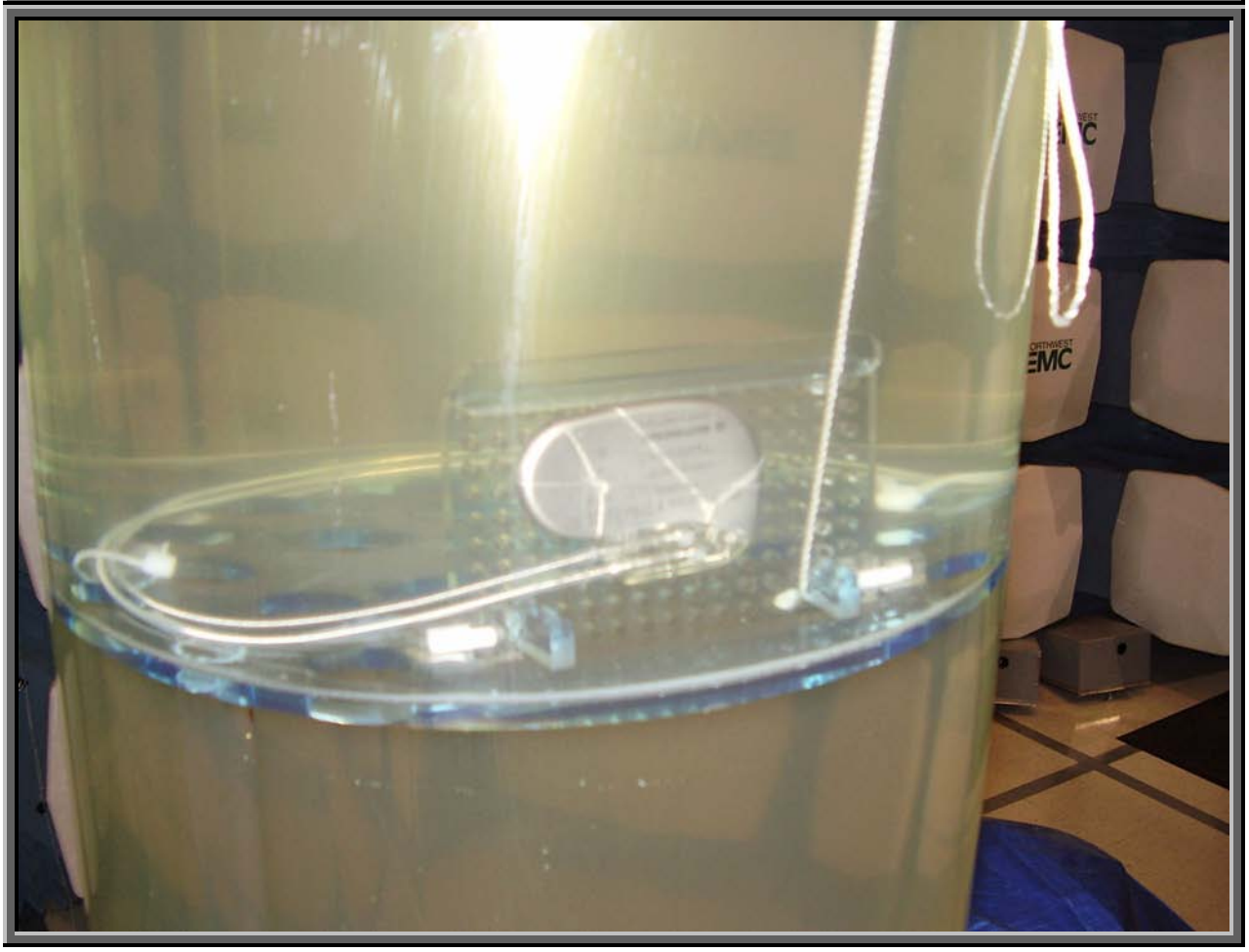
Occupied Bandwidth




NORTHWEST
EMC




NORTHWEST
EMC



Justification

The individuals and/or the organization requesting the test provided the modes, configurations and settings available to evaluate. While scanning the radiated emissions, all of the EUT parameters listed below were investigated. This includes, but may not be limited to, antennas, tuned transmit frequency ranges, operating modes, and data rates.

Channels in Specified Band Investigated:
Single Channel: 403.62 MHz

Operating Modes Investigated:
Typical

Data Rates Investigated:
Maximum

Output Power Setting(s) Investigated:
Maximum

Power Input Settings Investigated:
Battery

Software\Firmware Applied During Test			
Exercise software	Special Test Software	**Version**	Unknown
Description			
The system was tested using special software developed to test all functions of the device during the test.			

EUT and Peripherals			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
EUT- Cylos DR-T	Biotronik, Inc.	Cylos DR-T	76020147

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
Implant Lead	Yes	approx. 0.	No	EUT- Cylos DR-T	Not connected
Implant Lead	Yes	approx. 0.	No	EUT- Cylos DR-T	Not connected

Measurement Equipment					
Description	**Manufacturer**	**Model**	**Identifier**	**Last Cal**	**Interval**
Spectrum Analyzer	Tektronix	2784	AAO	01/02/2005	12 mo
Chamber, Temp./Humidity Chamber	Cincinnati Sub Zero (CSZ)	ZH-32-2-2-H/AC	TBA	09/07/2004	12 mo
Chamber Temp. & Humidity Controller	ESZ / Eurotherm	Dimension II	TBC	09/07/2004	12 mo
Near Field Probe	EMCO	7405	IPD	NCR	NA

Test Description

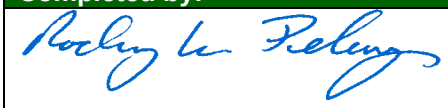
Requirement: Per 47 CFR 95.628(e)(1) and 2.1055, the Frequency Stability was measured. The transmitter must maintain a frequency stability of +/- 100 parts per million (ppm), or better, for variations of temperature over the range of 25 to 45 degrees centigrade.

Configuration: The Frequency Stability was measured using a near-field probe and a spectrum analyzer. The spectrum analyzer is configured with a precision frequency reference that exceeds the stability requirement of the transmitter.

The EUT was placed inside a temperature / humidity chamber. The near-field probe was placed near the transmitter. A low-loss coaxial cable connected the near-field probe to the spectrum analyzer outside of the chamber.

The transmit frequency was recorded at the extremes of the specified temperature range (+25° to +45° C) and at 10°C intervals.

Completed by:



NORTHWEST
EMC

FREQUENCY STABILITY DATA SHEET

Rev BETA
01/30/01

EUT:	Cylos DR-T			Work Order:	BIOT0009
Serial Number:	76020147			Date:	06/13/05
Customer:	Biotronik, Inc.			Temperature:	See Below
Attendees:	Brian Sutton	Tested by:	Rod Peloquin	Humidity:	35% RH
Customer Ref. No.:		Power:	Battery	Job Site:	EV09

TEST SPECIFICATIONS

Specification:	95.628(e)(1) & 2.1055	Year:	Most Current	Method:	TIA/EIA - 603	Year:	1993

SAMPLE CALCULATIONS

COMMENTS

EUT OPERATING MODES

Transmitting single channel

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

Must maintain a frequency stability of +/- 100 parts per million (ppm) or better for variations of temperature over the range of 25 to 45 degrees centigrade

RESULTS	WORST CASE FREQUENCY STABILITY
Pass	9.04 ppm

SIGNATURE

Tested By: _____

DESCRIPTION OF TEST

Frequency Stability

Temp (°C)	Assigned Frequency (MHz)	Measured Frequency (MHz)	Tolerance (ppm)	Specification (ppm)
25	403.626290	403.626370	0.20	100
35	403.626290	403.626290	0.00	100
45	403.626290	403.622640	9.04	100


Z32

Justification

The individuals and/or the organization requesting the test provided the modes, configurations and settings available to evaluate. While scanning the radiated emissions, all of the EUT parameters listed below were investigated. This includes, but may not be limited to, antennas, tuned transmit frequency ranges, operating modes, and data rates.

Channels in Specified Band Investigated:
Single Channel: 403.62 MHz

Operating Modes Investigated:
Typical

Data Rates Investigated:
Maximum

Output Power Setting(s) Investigated:
Maximum

Power Input Settings Investigated:
Battery

Software\Firmware Applied During Test			
Exercise software	Special Test Software	**Version**	Unknown
Description			
The system was tested using special software developed to test all functions of the device during the test.			

EUT and Peripherals			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
EUT- Cylos DR-T	Biotronik, Inc.	Cylos DR-T	76020147

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
Implant Lead	Yes	approx. 0.	No	EUT- Cylos DR-T	Not connected
Implant Lead	Yes	approx. 0.	No	EUT- Cylos DR-T	Not connected

Measurement Equipment					
Description	**Manufacturer**	**Model**	**Identifier**	**Last Cal**	**Interval**
Spectrum Analyzer	Agilent	E4446A	AAQ	04/08/2005	13 mo
Pre-Amplifier	Amplifier Research	LN1000A	APS	03/01/2005	13 mo
Antenna, Biconilog	EMCO	3141	AXE	12/03/2003	24 mo

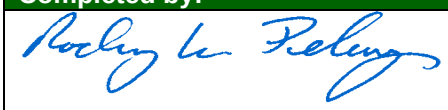
Bandwidths Used for Measurements			
Frequency Range (MHz)	**Peak Data (kHz)**	**Quasi-Peak Data (kHz)**	**Average Data (kHz)**
0.01 – 0.15	1.0	0.2	0.2
0.15 – 30.0	10.0	9.0	9.0
30.0 – 1000	100.0	120.0	120.0
Above 1000	1000.0	N/A	1000.0
Measurements were made using the bandwidths and detectors specified. No video filter was used.			

Requirement: Per 47 CFR 95.635(d)(4-5) the emission mask was measured. Emissions more than 150 kHz away from the center frequency must be attenuated below the transmitter output power by at least 20 dB. In addition, emissions 250 kHz or less above and below the MICS band (402-405 MHz) must be attenuated below the maximum permitted output power by at least 20 dB.

Configuration: The emission mask was measured in the same configuration as radiated spurious emissions. All emissions measurements were made with the EUT placed in the tissue substitute material. First, the EUT orientation (horizontal or vertical), the turntable azimuth and measurement antenna height, were maximized to achieve the maximum field strength of the fundamental transmit frequency.

Then, a spectrum analyzer was used to measure the emission mask. A spectrum analyzer using a peak detector with no video filtering was used with a resolution bandwidth equal to approximately 1.0 percent of the emission bandwidth of the EUT. However, various plots were made using different frequency spans and resolution bandwidths in an attempt to not only satisfy the measurement criteria, but to also show that all emissions outside of the occupied band are greatly attenuated.

Completed by:



NORTHWEST
EMC

EMISSIONS

Rev BETA
01/30/01

EUT:	Cylos DR-T			Work Order:	BIOT0009
Serial Number:	76020147			Date:	06/10/05
Customer:	Biotronik, Inc.			Temperature:	23°C
Attendees:	Brian Sutton	Tested by:	Rod Peloquin	Humidity:	41% RH
Customer Ref. No.:		Power:	Battery	Job Site:	EV01

TEST SPECIFICATIONS

Specification:	47 CFR 95.635(d)(4)	Year:	2004	Method:	95.635(d)(4) & ANSI C63.4	Year:	2004

SAMPLE CALCULATIONS

COMMENTS

EUT Vertical in Test fixture at 1.5m height

EUT OPERATING MODES

Transmitting single channel

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

Emissions more than 150 kHz away from the center frequency must be attenuated below the transmitter ouput power by at least 20 dB

RESULTS

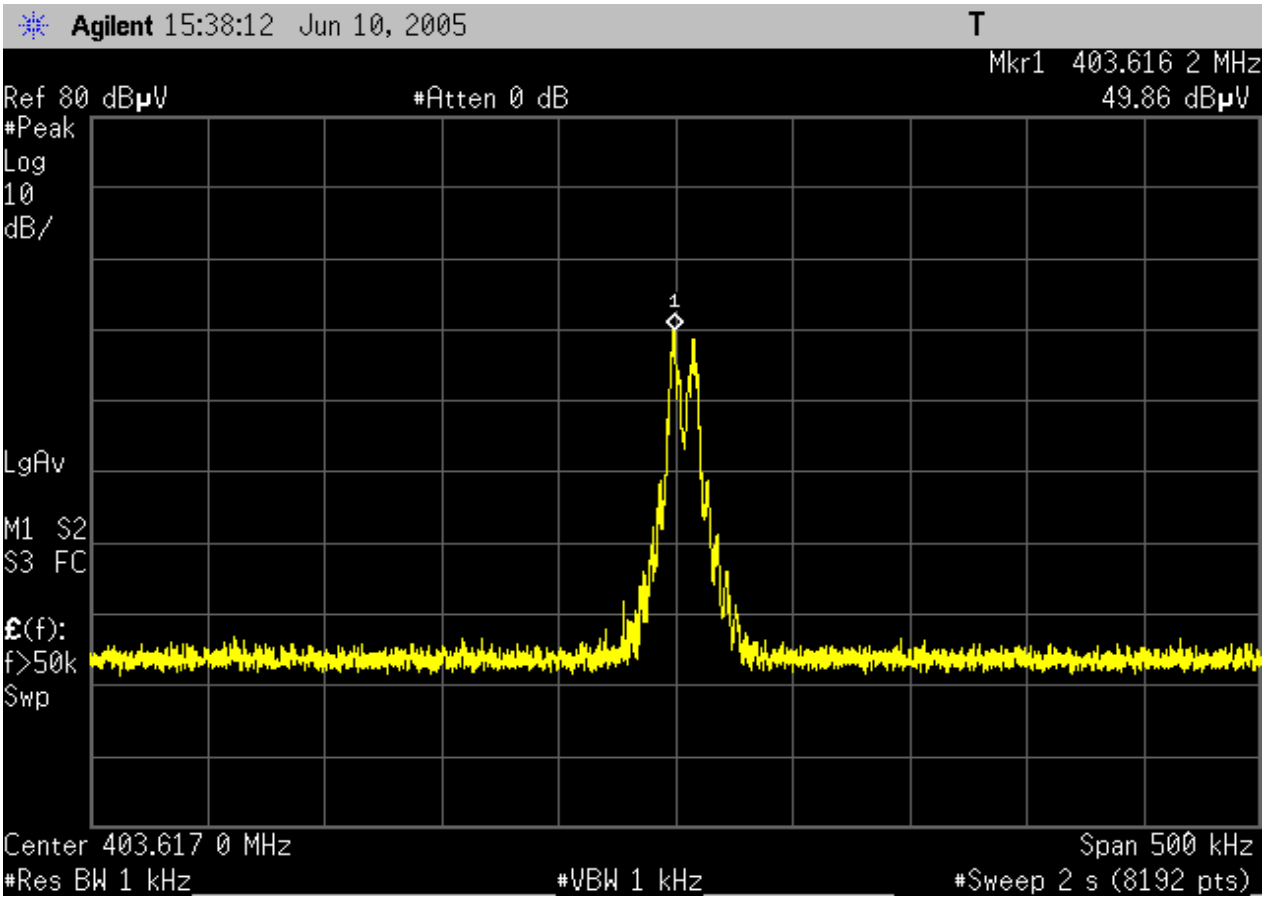
Pass

SIGNATURE

Tested By: _____

DESCRIPTION OF TEST

Emission Mask



NORTHWEST EMC

EMISSIONS

Rev BETA 01/30/01

EUT:	Cylos DR-T			Work Order:	BIOT0009
Serial Number:	76020147			Date:	06/10/05
Customer:	Biotronik, Inc.			Temperature:	23°C
Attendees:	Brian Sutton	Tested by:	Rod Peloquin	Humidity:	41% RH
Customer Ref. No.:		Power:	Battery	Job Site:	EV01

TEST SPECIFICATIONS

Specification:	47 CFR 95.635(d)(4)	Year:	2004	Method:	95.635(d)(4) & ANSI C63.4	Year:	2004

SAMPLE CALCULATIONS

COMMENTS

EUT Vertical in Test fixture at 1.5m height

EUT OPERATING MODES

Transmitting single channel

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

Emissions more than 150 kHz away from the center frequency must be attenuated below the transmitter ouput power by at least 20 dB

RESULTS

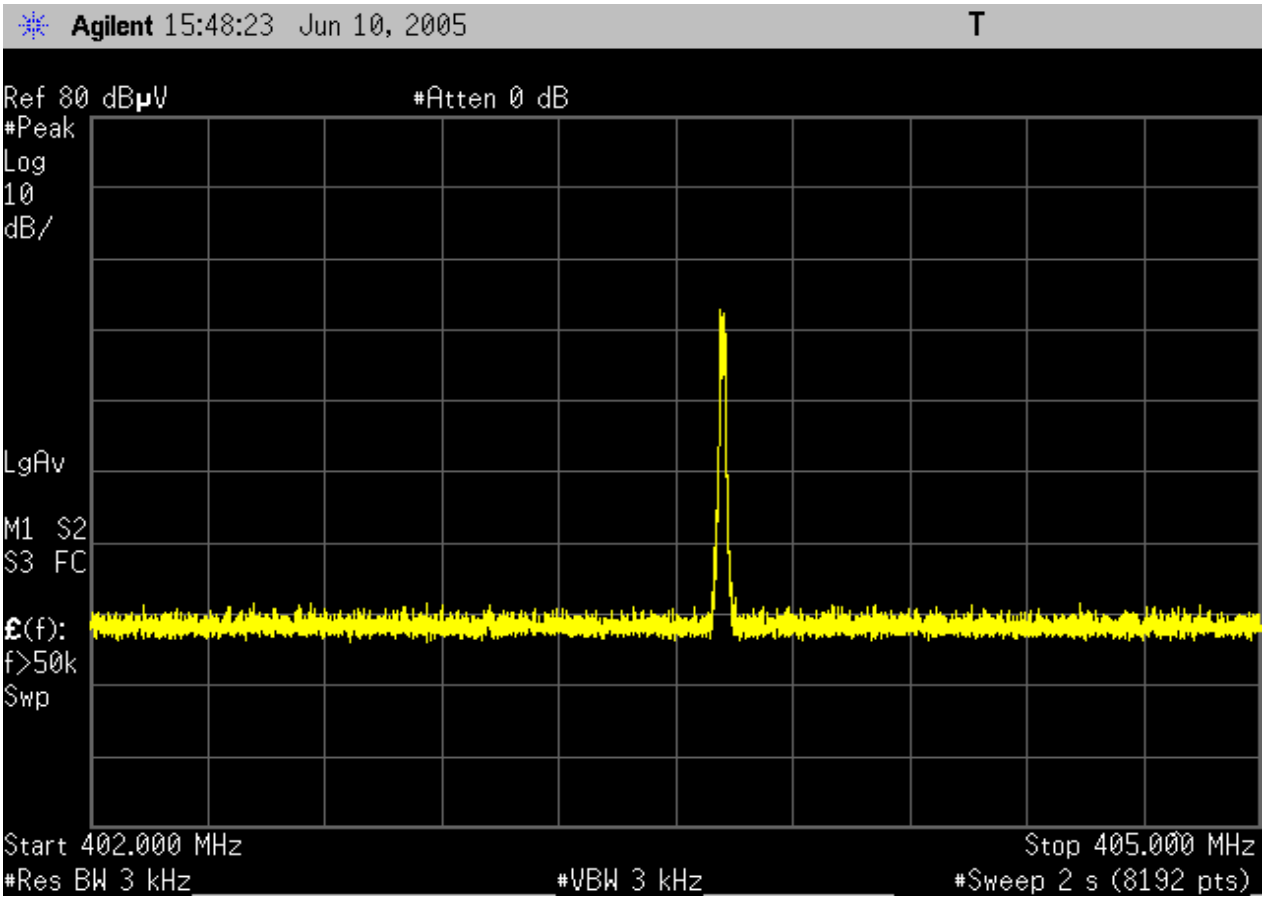
Pass

SIGNATURE

Tested By: _____

DESCRIPTION OF TEST

Emission Mask



NORTHWEST EMC

EMISSION MASK DATA SHEET

Rev BETA 01/30/01

EUT:	Cylos DR-T			Work Order:	BIOT0009
Serial Number:	76020147			Date:	06/10/05
Customer:	Biotronik, Inc.			Temperature:	23°C
Attendees:	Brian Sutton	Tested by:	Rod Peloquin	Humidity:	41% RH
Customer Ref. No.:		Power:	Battery	Job Site:	EV01

TEST SPECIFICATIONS

Specification:	47 CFR 95.635(d)(5)	Year:	2004	Method:	95.635(d)(5) & ANSI C63.4	Year:	2004

SAMPLE CALCULATIONS

COMMENTS

EUT Vertical in Test fixture at 1.5m height

EUT OPERATING MODES

Transmitting single channel

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

Emissions 250 kHz or less above and below the MICS band (402-405 MHz) must be attenuated below the maximum permitted ouput power by at least 20 dB

RESULTS

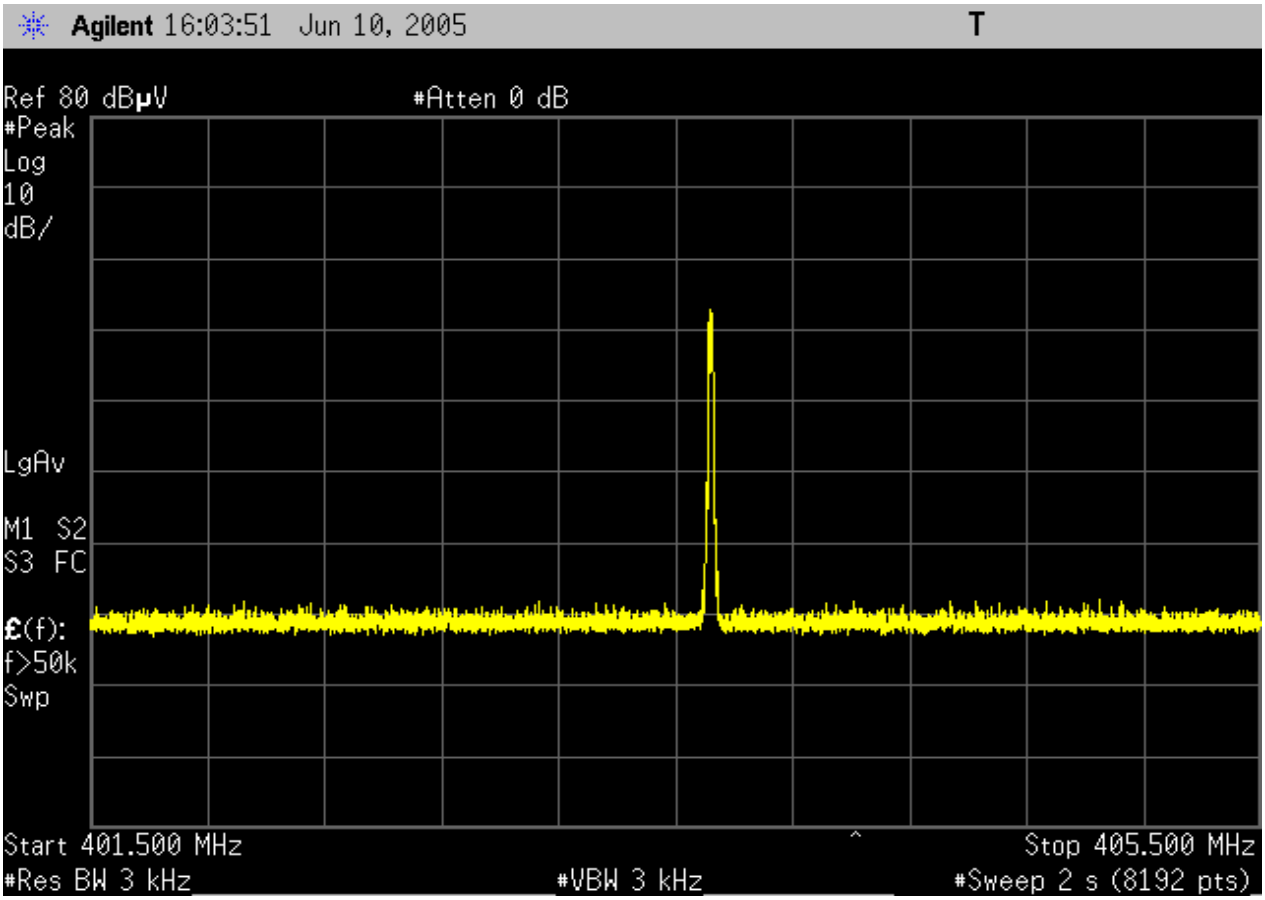
Pass

SIGNATURE

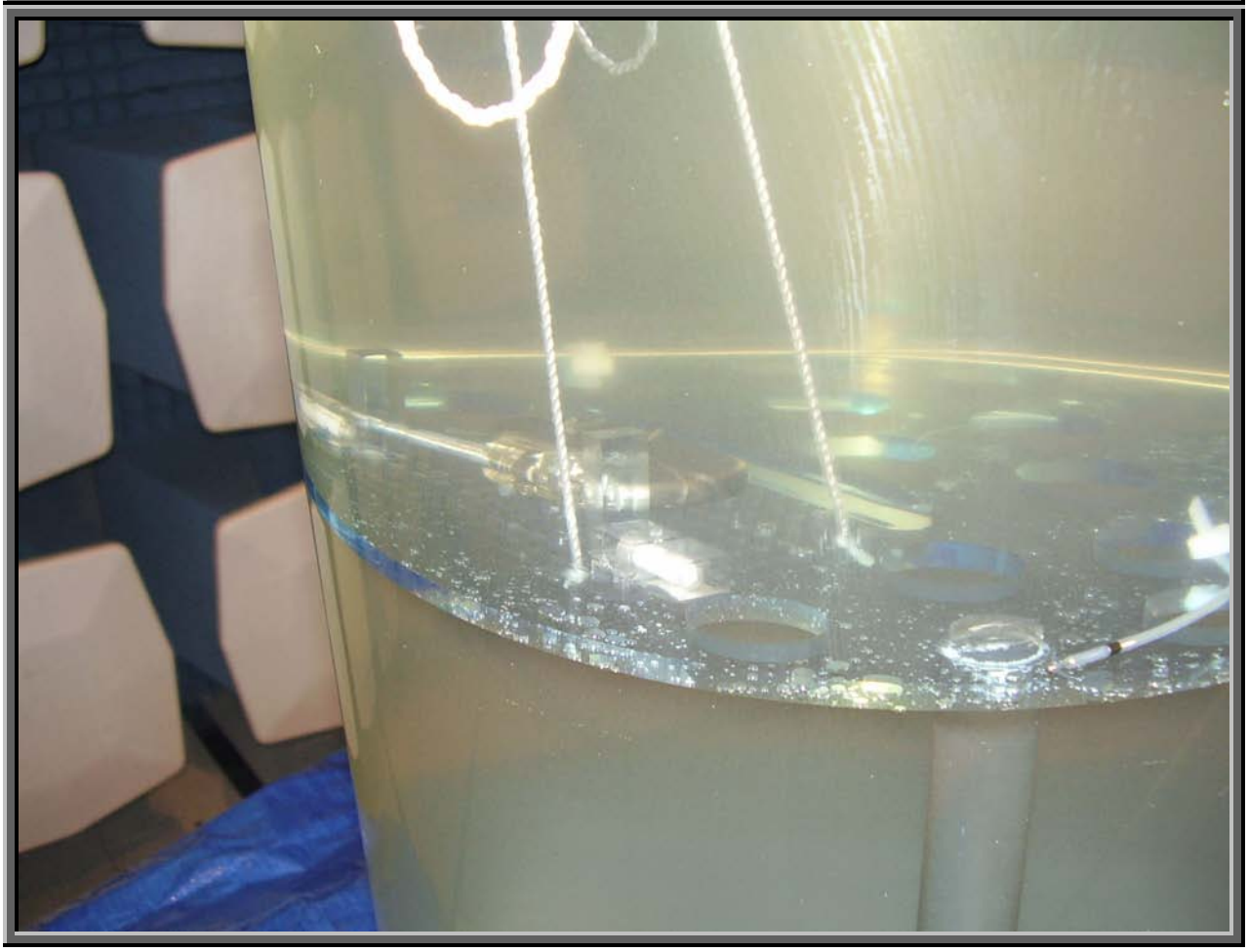
Tested By: _____

DESCRIPTION OF TEST

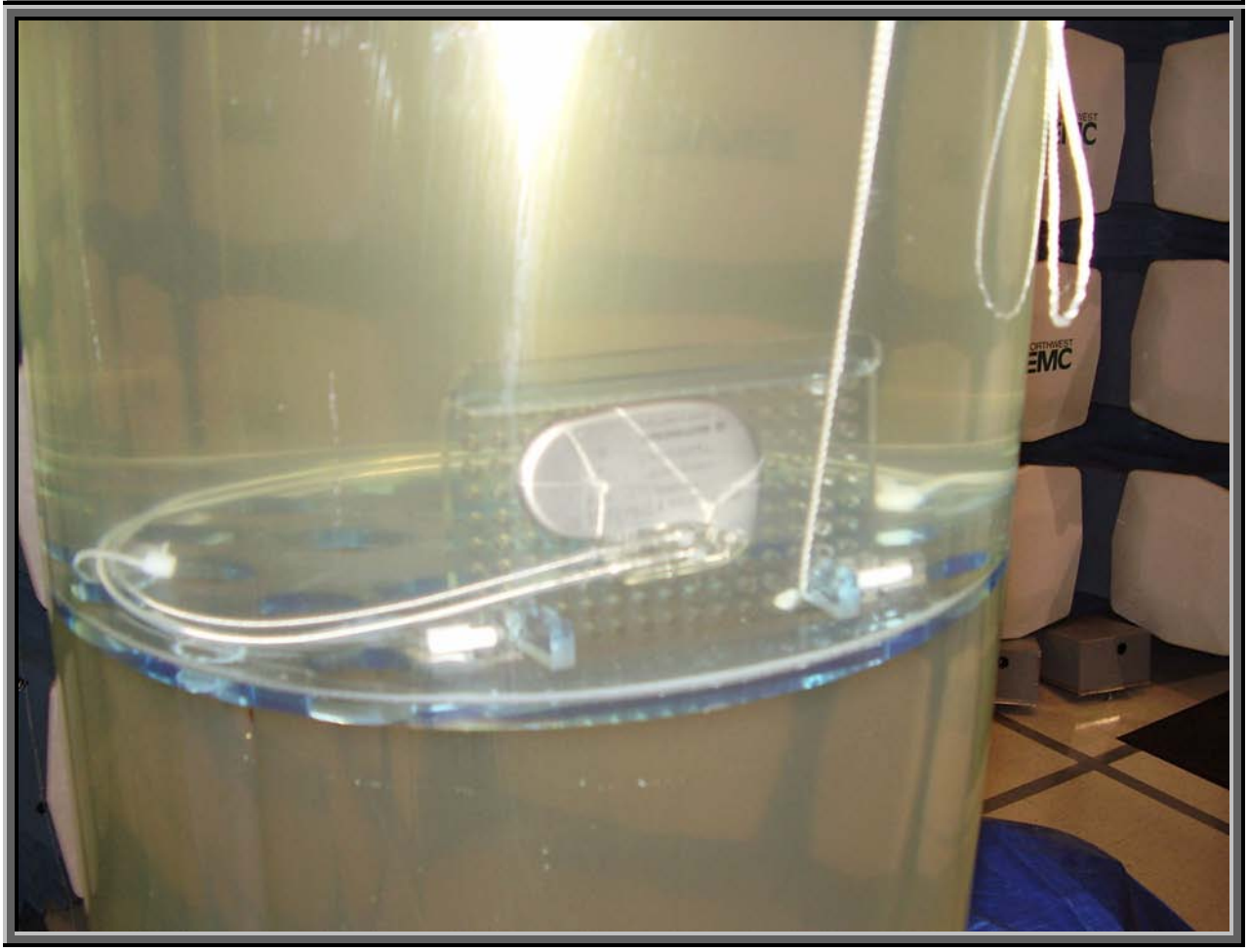
Emission Mask




NORTHWEST EMC




NORTHWEST
EMC



Justification

The individuals and/or the organization requesting the test provided the modes, configurations and settings available to evaluate. While scanning the radiated emissions, all of the EUT parameters listed below were investigated. This includes, but may not be limited to, antennas, tuned transmit frequency ranges, operating modes, and data rates.

Channels in Specified Band Investigated:
Single Channel: 403.62 MHz

Operating Modes Investigated:
Typical

Data Rates Investigated:
Maximum

Output Power Setting(s) Investigated:
Maximum

Power Input Settings Investigated:
Battery

Software\Firmware Applied During Test			
Exercise software	Special Test Software	**Version**	Unknown
Description			
The system was tested using special software developed to test all functions of the device during the test.			

EUT and Peripherals			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
EUT- Cylos DR-T	Biotronik, Inc.	Cylos DR-T	76020147

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
Implant Lead	Yes	approx. 0.	No	EUT- Cylos DR-T	Not connected
Implant Lead	Yes	approx. 0.	No	EUT- Cylos DR-T	Not connected

Measurement Equipment					
Description	**Manufacturer**	**Model**	**Identifier**	**Last Cal**	**Interval**
Antenna, Biconilog	EMCO	3141	AXE	12/03/2003	24 mo
Pre-Amplifier	Amplifier Research	LN1000A	APS	03/01/2005	13 mo
Pre-Amplifier	Miteq	AMF-4D-005180-24-10P	APJ	05/05/2005	3 mo
Antenna, Horn	EMCO	3115	AHC	09/07/2004	12 mo
Quasi-Peak Adapter	Hewlett-Packard	85650A	AQF	12/02/2004	13 mo
Spectrum Analyzer	Hewlett-Packard	8566B	AAL	12/02/2004	13 mo
Spectrum Analyzer Display	Hewlett Packard	85662A	AALD	12/02/2004	13 mo

Test Description

Requirement: Per 95.635(d) and 2.1053, the Field Strength of Radiated Emissions more than 250 kHz outside the MICS band (402-405 MHz) shall be attenuated to a level no greater than that shown in 90.635(d)(1). The emission limits shown in 95.635(d)(1) are based upon measurements employing a CISPR quasi-peak detector except that above 1 GHz, the limit is based on measurements employing an average detector. Measurements above 1 GHz shall be performed using a minimum resolution bandwidth of 1 MHz.

Configuration: The Field Strength of Radiated Emissions were measured in the far-field at an FCC Listed Semi-anechoic Chamber. Spectrum analyzer and linearly polarized antennas were used to measure the unwanted radiated harmonics and spurious emissions.

The orientation of the EUT and measurement antenna were manipulated to maximize the level of emissions.

The EUT was configured to transmit in a fixture that simulates the human torso. The dimensions of the test fixture and the characteristics of the tissue substitute material met the requirements of 95.639(f)(2)(i-ii). The dielectric and conductivity properties of the tissue substitute material were verified the morning of the test (see client data for tissue substitute material), and the temperature was measured before and after the test to verify compliance with 95.639(f)(2)(i). At the start of the test, the tissue substitute material was 23.5 degrees centigrade. At the conclusion of testing, it was 23.2 degrees centigrade.

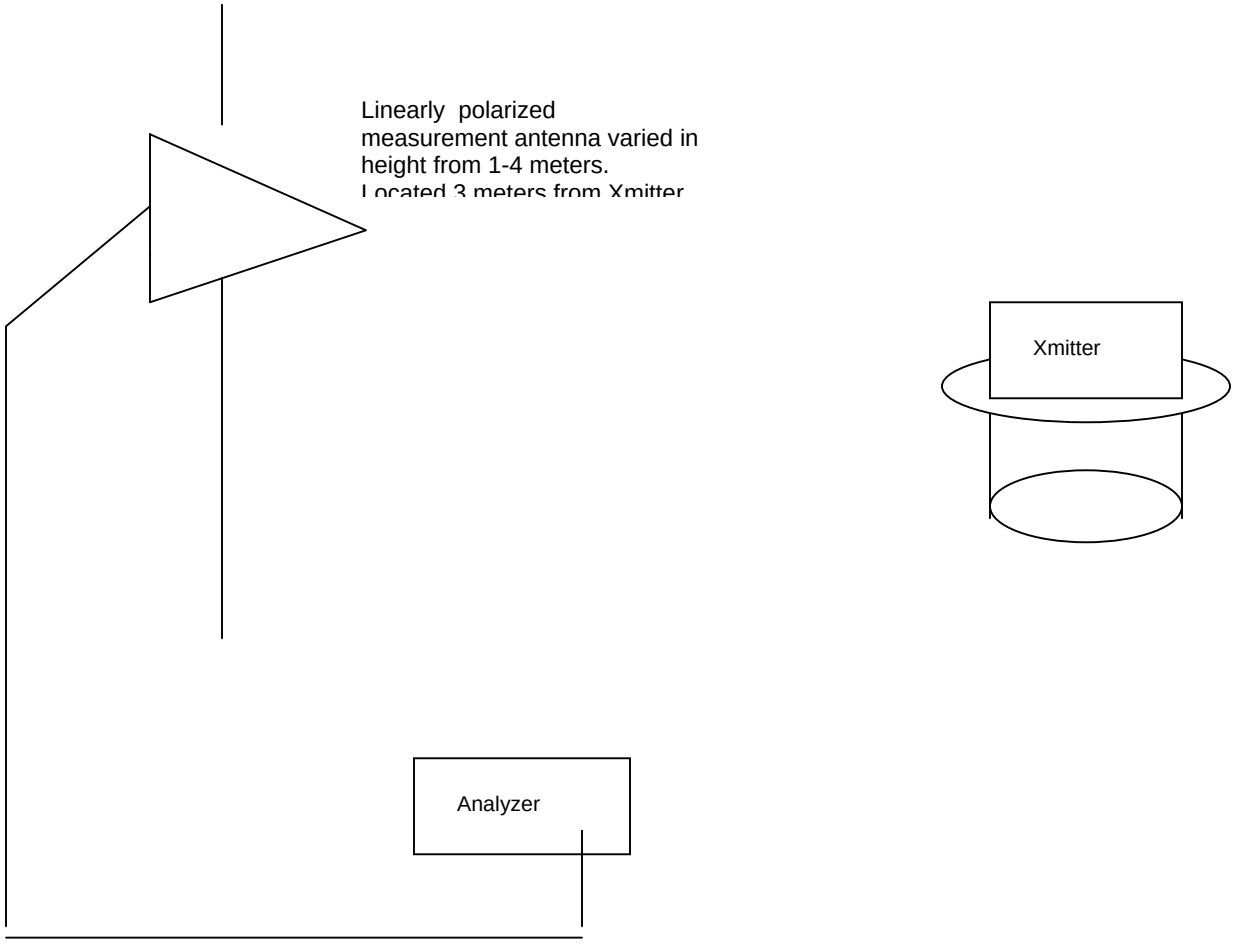
Test Methodology

At an approved test site, the transmitter was placed in the human torso test fixture located on a remotely controlled turntable, and the measurement antenna was placed 3 meters from the transmitter. The height of the transmitter was 1.5-meter above the reference ground plane. The turntable azimuth was varied to maximize the level of radiated emissions. The height of the measurement antenna was also varied from 1 to 4 meters. The amplitude and frequency of the emissions were noted.

Bandwidths Used for Measurements			
Frequency Range (MHz)	**Peak Data (kHz)**	**Quasi-Peak Data (kHz)**	**Average Data (kHz)**
0.01 – 0.15	1.0	0.2	0.2
0.15 – 30.0	10.0	9.0	9.0
30.0 – 1000	100.0	120.0	120.0
Above 1000	1000.0	N/A	1000.0
Measurements were made using the bandwidths and detectors specified. No video filter was used.			

Test Setup Diagram

Test Setup for Field Strength Measurements



Completed by:

Holly Dellinger

NORTHWEST EMC

RADIATED EMISSIONS DATA SHEET

ACQ 2005.1.4
EMI 2005.5.05

EUT:	Cylos DR-T			Work Order:	BIOT0009
Serial Number:	76020147			Date:	06/10/05
Customer:	BIOTRONIK, Inc.			Temperature:	23
Attendees:	Brian Sutton			Humidity:	42%
Cust. Ref. No.:				Barometric Pressure	29.95
Tested by:	Rod Peloquin	Power:	Battery	Job Site:	EV01

TEST SPECIFICATIONS

Specification:	FCC 95.635:2004	Method:	TIA/EIA-603:1998

SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

Conducted Emissions: Adjusted Level = Measured Level + Transducer Factor + Cable Attenuation Factor + External Attenuator

COMMENTS

EUT horizontal in test fixture at 1.5m height

EUT OPERATING MODES

Transmitting Single channel

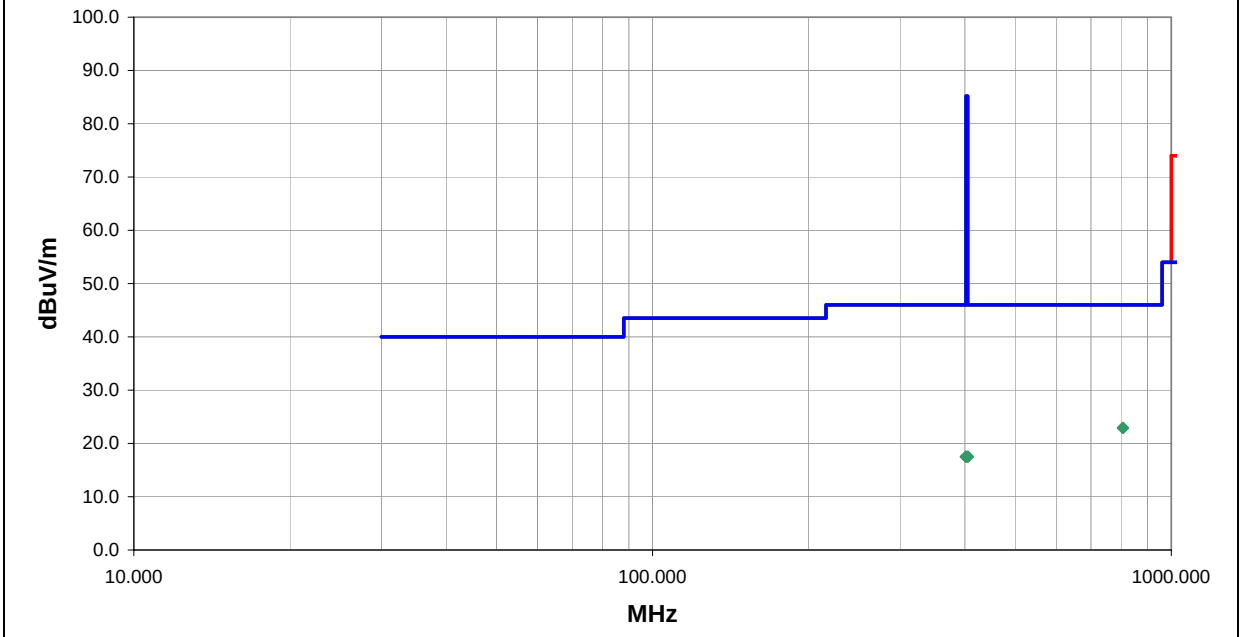
DEVIATIONS FROM TEST STANDARD

No deviations.

RESULTS	Run #
Pass	2

Other

Tested By:



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Azimuth (degrees)	Height (meters)	Distance (meters)	External Attenuation (dB)	Polarity	Detector	Distance Adjustment (dB)	Adjusted dBuV/m	Spec. Limit dBuV/m	Compared to Spec. (dB)
806.933	23.2	-0.3	23.0	1.2	3.0	0.0	V-Bilog	QP	0.0	22.9	46.0	-23.1
807.099	23.2	-0.3	168.0	1.9	3.0	0.0	H-Bilog	QP	0.0	22.9	46.0	-23.1
401.750	22.6	-5.1	333.0	1.6	3.0	0.0	V-Bilog	QP	0.0	17.5	46.0	-28.5
405.250	22.6	-5.1	306.0	1.7	3.0	0.0	H-Bilog	QP	0.0	17.5	46.0	-28.5
401.750	22.6	-5.1	248.0	1.6	3.0	0.0	V-Bilog	QP	0.0	17.5	46.0	-28.5
405.250	22.6	-5.1	328.0	1.0	3.0	0.0	H-Bilog	QP	0.0	17.5	46.0	-28.5

NORTHWEST EMC

RADIATED EMISSIONS DATA SHEET

ACQ 2005.1.4
EMI 2005.5.05

EUT:	Cylos DR-T			Work Order:	BIOT0009
Serial Number:	76020147			Date:	06/10/05
Customer:	BIOTRONIK, Inc.			Temperature:	23
Attendees:	Brian Sutton			Humidity:	42%
Cust. Ref. No.:				Barometric Pressure	29.95
Tested by:	Rod Peloquin	Power:	Battery	Job Site:	EV01

TEST SPECIFICATIONS

Specification:	FCC 95.635:2004	Method:	TIA/EIA-603:1998

SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

Conducted Emissions: Adjusted Level = Measured Level + Transducer Factor + Cable Attenuation Factor + External Attenuator

COMMENTS

EUT horizontal in test fixture at 1.5m height

EUT OPERATING MODES

Transmitting Single channel

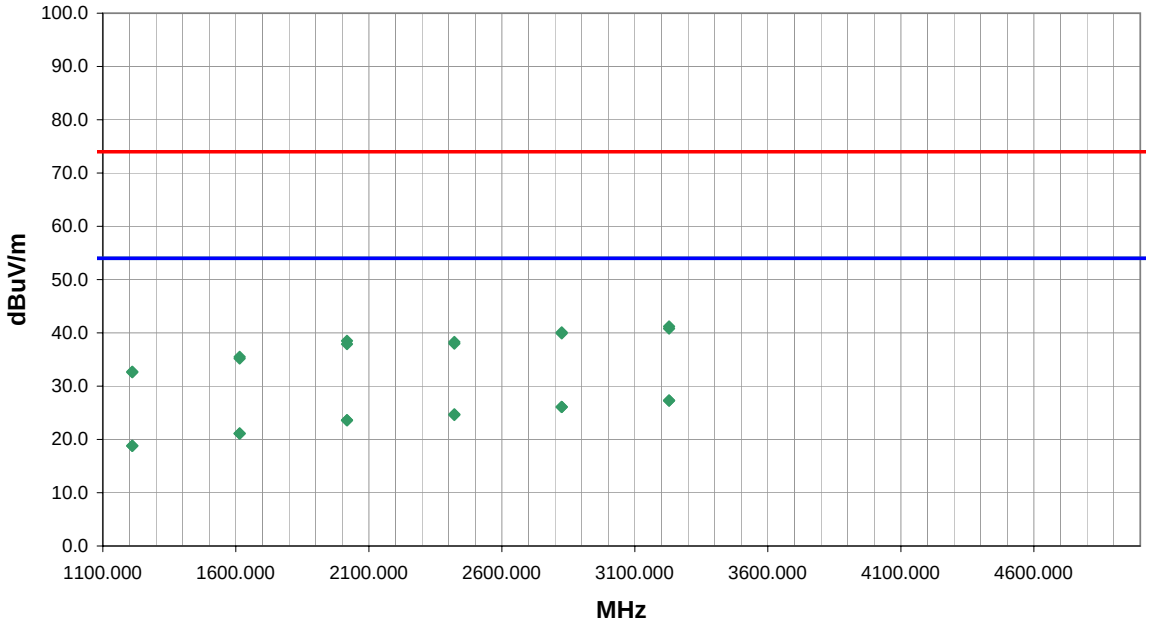
DEVIATIONS FROM TEST STANDARD

No deviations.

RESULTS	Run #
Pass	3

Other

Tested By:



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Azimuth (degrees)	Height (meters)	Distance (meters)	External Attenuation (dB)	Polarity	Detector	Distance Adjustment (dB)	Adjusted dBuV/m	Spec. Limit dBuV/m	Compared to Spec. (dB)
3228.936	26.5	0.8	23.0	1.3	3.0	0.0	H-Horn	AV	0.0	27.3	54.0	-26.7
3228.936	26.5	0.8	260.0	1.3	3.0	0.0	H-Horn	AV	0.0	27.3	54.0	-26.7
2825.319	26.9	-0.8	10.0	1.3	3.0	0.0	H-Horn	AV	0.0	26.1	54.0	-27.9
2825.319	26.9	-0.8	347.0	1.2	3.0	0.0	V-Horn	AV	0.0	26.1	54.0	-27.9
2421.704	27.0	-2.3	156.0	1.2	3.0	0.0	V-Horn	AV	0.0	24.7	54.0	-29.3
2421.704	26.9	-2.3	152.0	1.3	3.0	0.0	H-Horn	AV	0.0	24.6	54.0	-29.4
2018.085	27.3	-3.7	60.0	1.2	3.0	0.0	H-Horn	AV	0.0	23.6	54.0	-30.4
2018.085	27.3	-3.7	46.0	3.0	3.0	0.0	V-Horn	AV	0.0	23.6	54.0	-30.4
3228.936	40.4	0.8	260.0	1.3	3.0	0.0	H-Horn	PK	0.0	41.2	74.0	-32.8
1614.468	27.0	-5.9	243.0	1.3	3.0	0.0	H-Horn	AV	0.0	21.1	54.0	-32.9
1614.468	27.0	-5.9	196.0	1.2	3.0	0.0	V-Horn	AV	0.0	21.1	54.0	-32.9
3228.936	40.0	0.8	23.0	1.3	3.0	0.0	H-Horn	PK	0.0	40.8	74.0	-33.2
2825.319	40.9	-0.8	10.0	1.3	3.0	0.0	H-Horn	PK	0.0	40.1	74.0	-33.9
2825.319	40.7	-0.8	347.0	1.2	3.0	0.0	V-Horn	PK	0.0	39.9	74.0	-34.1
1210.851	26.8	-8.0	195.0	3.4	3.0	0.0	H-Horn	AV	0.0	18.8	54.0	-35.2
1210.851	26.8	-8.0	192.0	1.2	3.0	0.0	V-Horn	AV	0.0	18.8	54.0	-35.2
2018.085	42.2	-3.7	46.0	3.0	3.0	0.0	V-Horn	PK	0.0	38.5	74.0	-35.5
2421.704	40.6	-2.3	156.0	1.2	3.0	0.0	V-Horn	PK	0.0	38.3	74.0	-35.7
2421.704	40.3	-2.3	152.0	1.3	3.0	0.0	H-Horn	PK	0.0	38.0	74.0	-36.0
2018.085	41.6	-3.7	60.0	1.2	3.0	0.0	H-Horn	PK	0.0	37.9	74.0	-36.1
1614.468	41.4	-5.9	196.0	1.2	3.0	0.0	V-Horn	PK	0.0	35.5	74.0	-38.5

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Azimuth (degrees)	Height (meters)	Distance (meters)	External Attenuation (dB)	Polarity	Detector	Distance Adjustment (dB)	Adjusted dBuV/m	Spec. Limit dBuV/m	Compared to Spec. (dB)
1614.468	41.1	-5.9	243.0	1.3	3.0	0.0	H-Horn	PK	0.0	35.2	74.0	-38.8
1210.851	40.7	-8.0	192.0	1.2	3.0	0.0	V-Horn	PK	0.0	32.7	74.0	-41.3
1210.851	40.6	-8.0	195.0	3.4	3.0	0.0	H-Horn	PK	0.0	32.6	74.0	-41.4

NORTHWEST EMC

RADIATED EMISSIONS DATA SHEET

ACQ 2005.1.4
EMI 2005.5.05

EUT:	Cylos DR-T			Work Order:	BIOT0009
Serial Number:	76020147			Date:	06/10/05
Customer:	BIOTRONIK, Inc.			Temperature:	23
Attendees:	Brian Sutton			Humidity:	42%
Cust. Ref. No.:				Barometric Pressure	29.95
Tested by:	Holly Ashkannejhad	Power:	Battery	Job Site:	EV01

TEST SPECIFICATIONS

Specification:	FCC 95.635:2004	Method:	TIA/EIA-603:1998

SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

Conducted Emissions: Adjusted Level = Measured Level + Transducer Factor + Cable Attenuation Factor + External Attenuator

COMMENTS

EUT vertical in test fixture at 1.5m height

EUT OPERATING MODES

Transmitting Single channel

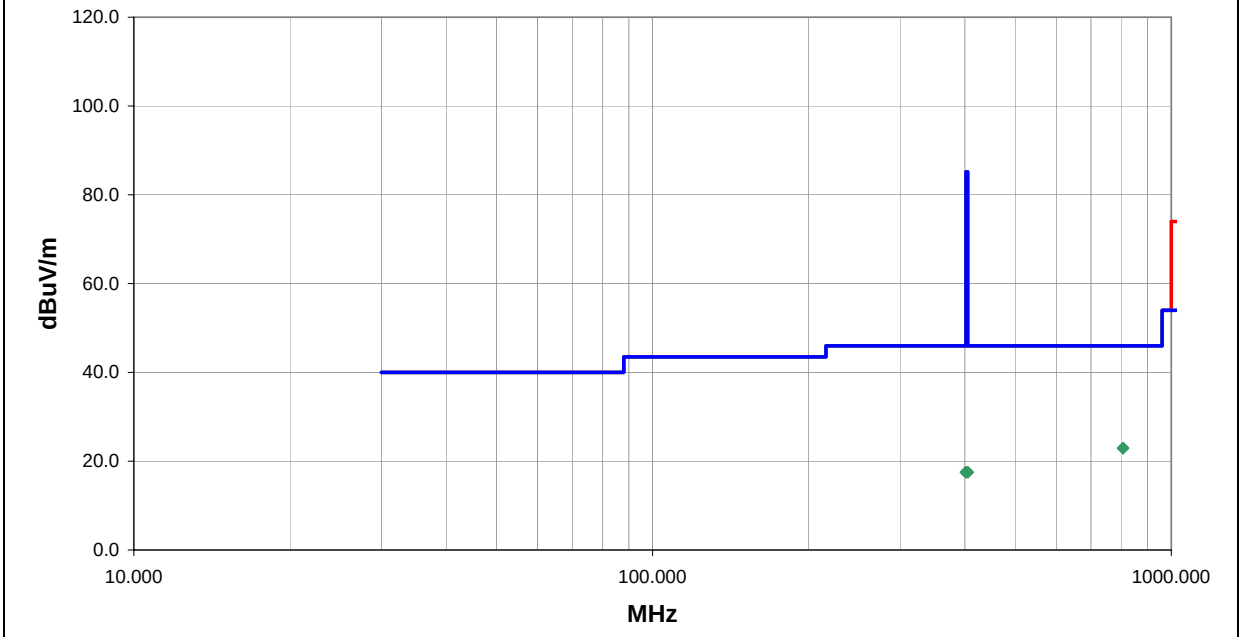
DEVIATIONS FROM TEST STANDARD

No deviations.

RESULTS	Run #
Pass	5

Other

Tested By:



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Azimuth (degrees)	Height (meters)	Distance (meters)	External Attenuation (dB)	Polarity	Detector	Distance Adjustment (dB)	Adjusted dBuV/m	Spec. Limit dBuV/m	Compared to Spec. (dB)
807.555	23.2	-0.2	213.0	2.0	3.0	0.0	H-Bilog	QP	0.0	23.0	46.0	-23.0
806.904	23.2	-0.3	311.0	1.2	3.0	0.0	V-Bilog	QP	0.0	22.9	46.0	-23.1
401.750	22.6	-5.1	278.0	2.6	3.0	0.0	H-Bilog	QP	0.0	17.5	46.0	-28.5
401.750	22.6	-5.1	32.0	3.0	3.0	0.0	V-Bilog	QP	0.0	17.5	46.0	-28.5
405.250	22.6	-5.1	106.0	1.6	3.0	0.0	V-Bilog	QP	0.0	17.5	46.0	-28.5
405.250	22.6	-5.1	179.0	3.5	3.0	0.0	H-Bilog	QP	0.0	17.5	46.0	-28.5

NORTHWEST EMC

RADIATED EMISSIONS DATA SHEET

ACQ 2005.1.4
EMI 2005.5.05

EUT:	Cylos DR-T			Work Order:	BIOT0009
Serial Number:	76020147			Date:	06/10/05
Customer:	BIOTRONIK, Inc.			Temperature:	23
Attendees:	None			Humidity:	42%
Cust. Ref. No.:				Barometric Pressure	29.95
Tested by:	Holly Ashkannejhad	Power:	Battery	Job Site:	EV01

TEST SPECIFICATIONS

Specification:	FCC 15.247(d) Spurious Radiated Emissions:2005-04	Method:	ANSI C63.4:2003

SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

Conducted Emissions: Adjusted Level = Measured Level + Transducer Factor + Cable Attenuation Factor + External Attenuator

COMMENTS

EUT vertical in test fixture at 1.5m height

EUT OPERATING MODES

Transmitting Single channel

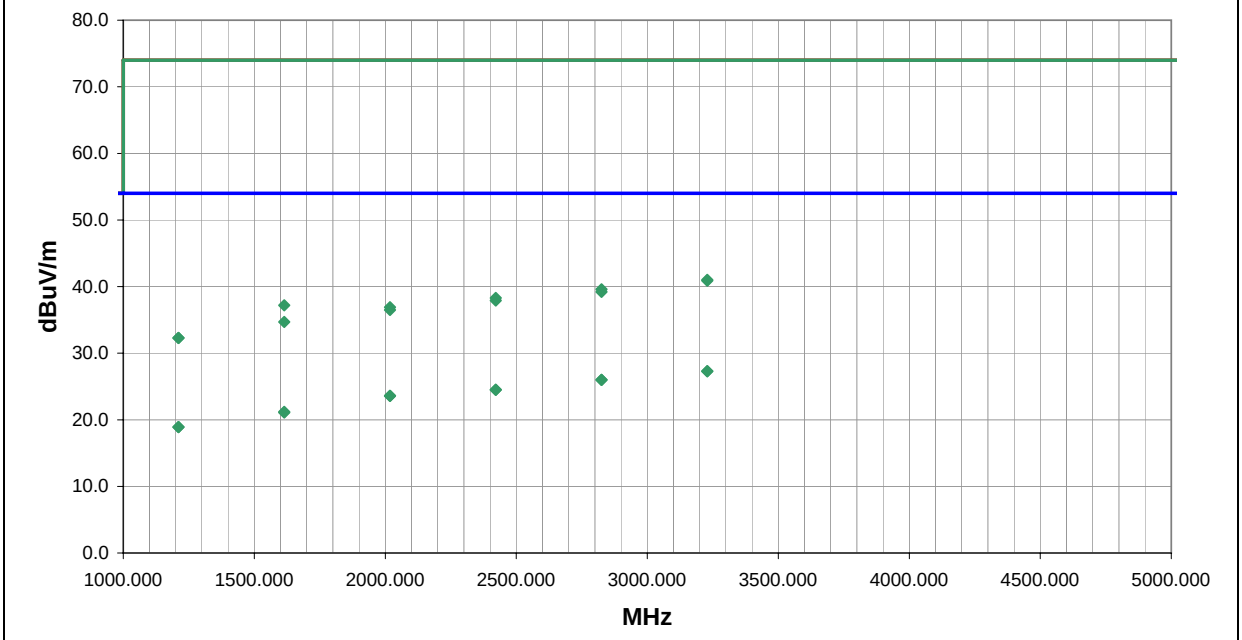
DEVIATIONS FROM TEST STANDARD

No deviations.

RESULTS	Run #
Pass	6

Other

Tested By: Holly Ashkannejhad



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Azimuth (degrees)	Height (meters)	Distance (meters)	External Attenuation (dB)	Polarity	Detector	Distance Adjustment (dB)	Adjusted dBuV/m	Spec. Limit dBuV/m	Compared to Spec. (dB)
3228.936	26.5	0.8	20.0	1.3	3.0	0.0	H-Horn	AV	0.0	27.3	54.0	-26.7
3228.936	26.5	0.8	201.0	1.3	3.0	0.0	H-Horn	AV	0.0	27.3	54.0	-26.7
2825.319	26.8	-0.8	114.0	1.5	3.0	0.0	H-Horn	AV	0.0	26.0	54.0	-28.0
2825.319	26.8	-0.8	288.0	1.7	3.0	0.0	V-Horn	AV	0.0	26.0	54.0	-28.0
2421.704	26.8	-2.3	30.0	3.5	3.0	0.0	H-Horn	AV	0.0	24.5	54.0	-29.5
2421.704	26.8	-2.3	284.0	1.2	3.0	0.0	V-Horn	AV	0.0	24.5	54.0	-29.5
2018.085	27.3	-3.7	246.0	1.3	3.0	0.0	H-Horn	AV	0.0	23.6	54.0	-30.4
2018.085	27.3	-3.7	315.0	1.2	3.0	0.0	V-Horn	AV	0.0	23.6	54.0	-30.4
1614.468	27.1	-5.9	155.0	1.9	3.0	0.0	H-Horn	AV	0.0	21.2	54.0	-32.8
1614.468	27.0	-5.9	229.0	1.6	3.0	0.0	V-Horn	AV	0.0	21.1	54.0	-32.9
3228.936	40.2	0.8	201.0	1.3	3.0	0.0	H-Horn	PK	0.0	41.0	74.0	-33.0
3228.936	40.1	0.8	20.0	1.3	3.0	0.0	H-Horn	PK	0.0	40.9	74.0	-33.1
2825.319	40.4	-0.8	114.0	1.5	3.0	0.0	H-Horn	PK	0.0	39.6	74.0	-34.4
2825.319	40.0	-0.8	288.0	1.7	3.0	0.0	V-Horn	PK	0.0	39.2	74.0	-34.8
1210.851	26.9	-8.0	101.0	1.5	3.0	0.0	H-Horn	AV	0.0	18.9	54.0	-35.1
1210.851	26.9	-8.0	167.0	1.1	3.0	0.0	V-Horn	AV	0.0	18.9	54.0	-35.1
2421.704	40.6	-2.3	284.0	1.2	3.0	0.0	V-Horn	PK	0.0	38.3	74.0	-35.7
2421.704	40.2	-2.3	30.0	3.5	3.0	0.0	H-Horn	PK	0.0	37.9	74.0	-36.1
1614.468	43.1	-5.9	229.0	1.6	3.0	0.0	V-Horn	PK	0.0	37.2	74.0	-36.8
2018.085	40.6	-3.7	246.0	1.3	3.0	0.0	H-Horn	PK	0.0	36.9	74.0	-37.1
2018.085	40.2	-3.7	315.0	1.2	3.0	0.0	V-Horn	PK	0.0	36.5	74.0	-37.5

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Azimuth (degrees)	Height (meters)	Distance (meters)	External Attenuation (dB)	Polarity	Detector	Distance Adjustment (dB)	Adjusted dBuV/m	Spec. Limit dBuV/m	Compared to Spec. (dB)
1614.468	40.6	-5.9	155.0	1.9	3.0	0.0	H-Horn	PK	0.0	34.7	74.0	-39.3
1210.851	40.3	-8.0	101.0	1.5	3.0	0.0	H-Horn	PK	0.0	32.3	74.0	-41.7
1210.851	40.3	-8.0	167.0	1.1	3.0	0.0	V-Horn	PK	0.0	32.3	74.0	-41.7