Emissions Test Report

EUT Name: Defibtech low-power RF transmitter

EUT Model: DFB-2000A

FCC Title 47, Part 15, SubpartC and RSS-210

Prepared for:

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Report/Issue Date: 18 June 2008
Report Number: 30861614.001

Statement of Compliance

Manufacturer:	Defibtech, LLC 741 Boston Post Road, Suite 201 Guilford, CT 06437 (203) 453-6654
Requester / Applicant:	Ed Naclerio
Name of Equipment:	Defibtech low-power RF transmitter
Operation Frequency Range	433.96 MHz
Type of Equipment:	Intentional Radiator
Application of Regulations:	FCC Title 47, Part 15, SubpartC and RSS-210
Test Dates:	3 June 2008 to 10 July 2008

Guidance Documents:

Emissions: FCC 47 CFR Part 15.231

Test Methods:

Emissions: ANSI C63.4:2003

The electromagnetic compatibility test and documented data described in this report has been performed and recorded by TUV Rheinland of North America, in accordance with the standards and procedures listed herein. As the responsible authorized agent of the EMC laboratory, I hereby declare that a sample of one, of the equipment described above, has been shown to be compliant with the EMC requirements of the stated regulations and standards based on these results. If any special accessories and/or modifications were required for compliance, they are listed in the Executive Summary of this report.

This report must not be used to claim product endorsement by NVLAP or any agency of the U.S. Government. This report contains data that are not covered by NVLAP accreditation. This report shall not be reproduced except in full, without the written authorization of the laboratory.

Michael Moranha
2008.08.28
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NVLAP Signatory

28 August 2008

Date

FC	Industry Canada
90552 and 100881	IC3755

200094-0

1 Executive Summary

1.1 Scope

This report is intended to document the status of conformance with the requirements of the FCC Title 47, Part 15, SubpartC and RSS-210 based on the results of testing performed on *3* June 2008 through *10* July 2008 on the *Defibtech low-power RF transmitter* Model No. *DFB-2000A* manufactured by Defibtech, LLC. This report only applies to the specific samples tested under the stated test conditions. It is the responsibility of the manufacturer to assure that additional production units of this model are manufactured with identical or EMI equivalent electrical and mechanical components. This report is further intended to document changes and modifications to the EUT throughout its life cycle. All documentation will be included as a supplement.

1.2 Purpose

Testing was performed to evaluate the EMC performance of the EUT in accordance with the applicable requirements, procedures, and criteria defined in the application of regulations and application of standards listed in this report.

1.3 Summary of Test Results

Table 1 - Summary of Test Results

Test	Test Method(s)	Test Parameters	Measurement	Result
Deactivation period of transmitter	FCC Part 15.231(a)(2)	Deactivate within 5 seconds	Less than 5 seconds	**compliant**
Bandwidth	FCC Part 15.231(c)	1.08 MHz	383.97 kHz	**compliant**
Band edge Compliance	FCC Part 15.215(c)	Containment of 20 dB bandwidth		**compliant**
Fundamental Frequency Field Strength	FCC Part 15.231(b)(2)	10998.33 uV or 80.83 dBuV/m		**compliant**
Spurious Emissions Field Strength	FCC Part 15.231(b)(3)	10998.33 uV or 80.83 dBuV/m		**compliant**
Spurious Emissions in Restricted Bands	FCC Part 15.231(b)(2)	Table FCC Part 15.209		**compliant**
Input Power Variations	FCC Part 15.31(e)	New Battery		**compliant**

1.4 Special Accessories

No special accessories were necessary in order to achieve compliance.

1.5 Equipment Modifications

No modifications were found to be necessary in order to achieve compliance.

2 Laboratory Information

2.1 Accreditations & Endorsements

2.1.1 US Federal Communications Commission

TUV Rheinland of North America at the 762 Park Ave. Youngsville, N.C 27596, address is accredited by the commission for performing testing services for the general public on a fee basis. This laboratory test facilities have been fully described in reports submitted to and accepted by the FCC (Registration No 90552 and 100881). The laboratory scope of accreditation includes: Title 47 CFR Part 15, 18, and 90. The accreditation is updated every 3 years.

2.1.2 NIST / NVLAP

TUV Rheinland of North America is accredited by the National Voluntary Laboratory Accreditation Program, which is administered under the auspices of the National Institute of Standards and Technology. The laboratory has been assessed and accredited in accordance with ISO Guide 25 and ISO 9002 (Lab code 200094-0). The scope of laboratory accreditation includes emission and immunity testing. The accreditation is updated annually.

2.1.3 Canada – Industry Canada

Registration No. IC3755

2.1.4 Japan - VCCI

The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) is a group that consists of Information Technology Equipment (ITE) manufacturers and EMC test laboratories. The purpose of the Council is to take voluntary control measures against electromagnetic interference from Information Technology Equipment, and thereby contribute to the development of a socially beneficial and responsible state of affairs in the realm of Information Technology Equipment in Japan. TUV Rheinland of North America at the 762 Park Ave. Youngsville, N.C 27596 address has been assessed and approved in accordance with the Regulations for Voluntary Control Measures. (Registration No. R-1174 and C-1236).

2.1.5 Acceptance By Mutual Recognition Arrangement

The United States has an established agreement with specific countries under the Asia Pacific Laboratory Accreditation Corporation (APLAC) Mutual Recognition Arrangement. Under this agreement, all TUV Rheinland of North America at the 762 Park Ave. Youngsville, N.C 27596 address test results and test reports within the scope of the laboratory NIST / NVLAP accreditation will be accepted by each member country.

2.2 Test Facilities

All of the test facilities are located at 762 Park Ave., Youngsville, North Carolina 27596, USA.

2.2.1 Emission Test Facility

The Open Area Test Site and AC Line Conducted measurement facility used to collect the radiated and conducted data has been constructed in accordance with ANSI C63.7:1992. The site has been measured in accordance with and verified to comply with the theoretical normalized site attenuation requirements of ANSI C63.4:2005, at a test distance of 3 and 10 meters. This site has been described in reports dated May 12, 1997, submitted to the FCC, and accepted by letter dated June 25, 1997 (31040/SIT 1300F2). The site is listed with the FCC and accredited by NVLAP (code 200094-0). The 5m semi-anechoic chamber used to collect the radiated data has been verified to comply with the theoretical normalized site attenuation requirements of ANSI C63.4:2005, at a test distance of 3 meters. A report detailing this site can be obtained from TUV Rheinland of North America.

2.2.2 Immunity Test Facility

ESD, EFT, Surge, PQF: These tests are performed in an environmentally controlled room with a 3.7m x 3.7m x 3.175mm thick aluminum floor connected to PE ground. For ESD testing, tabletop equipment is placed on an insulated mat with a surface resistivity of 10^9 Ohms/square on a 1.6m x 0.8m x 0.8m high non-conductive table with a 3.175mm aluminum top (Horizontal Coupling Plane). The HCP is connected to the main ground plane via a low impedance ground strap through two 470 kΩ resistors. The Vertical Coupling Plane consists of an aluminum plate 50cm x 50cm x 3.175mm thick. The VCP is connected to the main ground plane via a low impedance ground strap through two 470 kΩ resistors. For each of the other tests, the HCP is removed.

RF Field Immunity testing is performed in a 7.3m x 3.7m x 3.2m anechoic chamber.

RF Conducted and Magnetic Field Immunity testing is performed on a 4.9m x 3.7m x 3.175mm thick aluminum ground plane which is connected to one end of the anechoic chamber.

All test areas allow a minimum distance of 1 meter from the EUT to walls or conducting objects.

2.3 Measurement Uncertainty

Two types of measurement uncertainty are expressed in this report, per *ISO Guide To The Expression Of Uncertainty In Measurement*, 1st addition, 1995.

The Combined Standard Uncertainty is the standard uncertainty of the result of a measurement when that result is obtained from the values of a number of other quantities, equal to the positive square root of a sum of terms, the terms being the variances or co-variances of these other quantities weighted according to how the measurement result varies with changes in these quantities. The term standard uncertainty is the result of a measurement expressed as a standard deviation.

Radiated emissions measurements is ± 3.3 dB
Conducted emissions measurements is ± 2.18 dB
Harmonic current and flicker measurements is ± 5.0 %
ESD immunity measurements is ± 8.2 %
Radiated immunity measurements is ± 4.10 dB
EFT fast transient immunity measurements is ± 5.84 %
Surge immunity measurements is ± 5.84 %
Conducted immunity measurements is ± 3.66 dB
Magnetic field immunity measurements is ± 11.6 %
Voltage variation and interruption measurements is ± 3.48 %

2.4 Calibration Traceability

All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Measurement method complies with ANSI/NCSL Z540-1-1994 and ISO Guide 25.

3 Product Information

3.1 Equipment Configuration

A description and justification of the equipment configuration is given in the EMC Test Plan. The EUT was tested as described in the EMC Test Plan and was configured and operated in a manner consistent with its intended use. The EUT was connected to rated power and allowed to warm up to normal operating conditions. The placement of the EUT system components was guided by the test standard and selected to represent typical installation conditions.

In the case of an EUT that can operate in more than one configuration, preliminary testing was performed to determine the configuration that produced maximum radiation.

The final configuration was selected to produce worse case radiation and place the EUT in the most susceptible state.

4 Part 15.231 Requirements

Testing was performed in accordance with 47 CFR Part 15 and ANSI C63.4:2003. These test methods are listed under the laboratory's NVLAP Scope of Accreditation.

4.1 Deactivation period of transmitter Part 15.231(a)(2)

A transmitter activated automatically shall cease transmission within 5 seconds after activation.

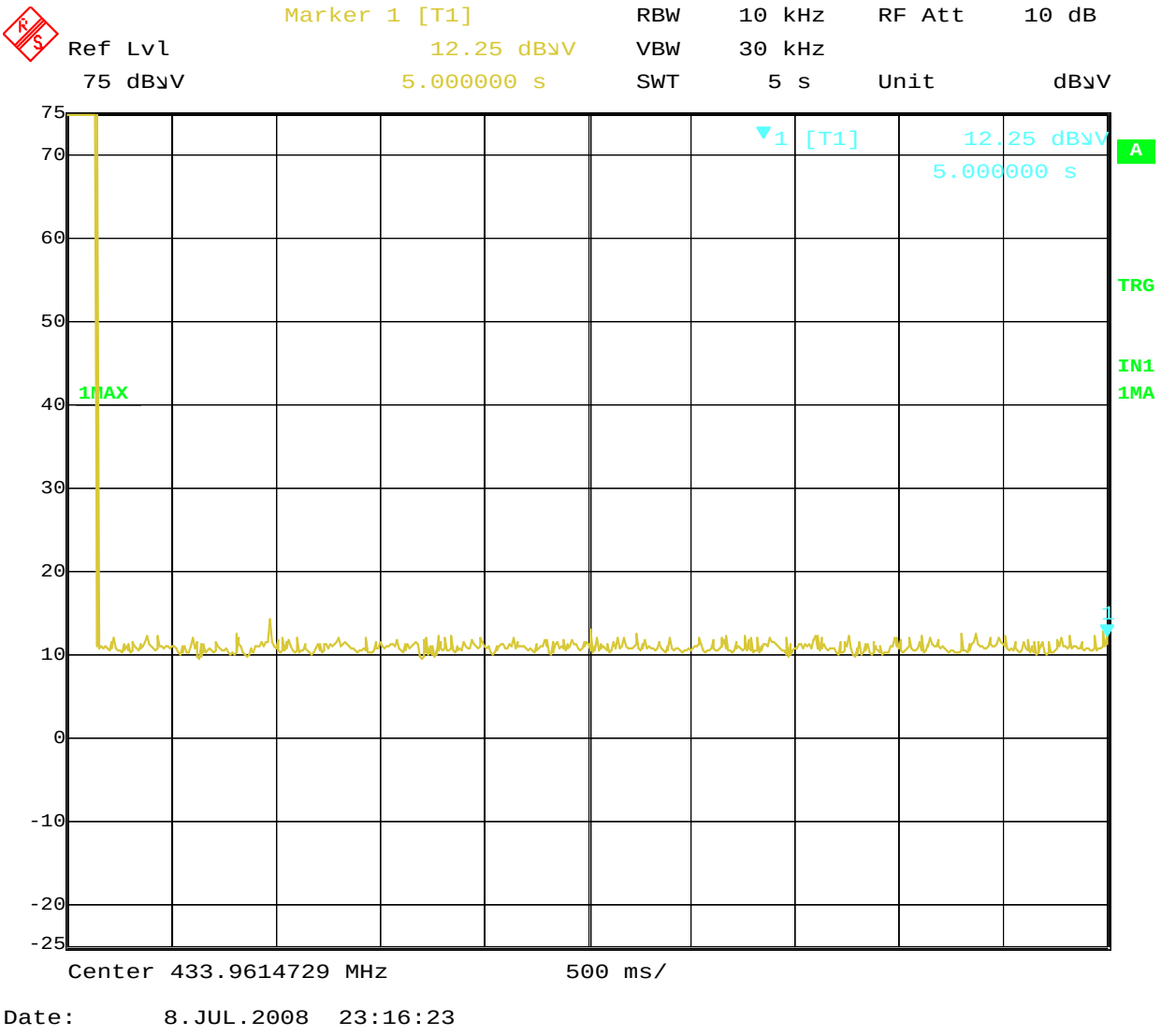

Figure 1 – Deactivation Period

4.2 Bandwidth FCC Part 15.231(c)

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

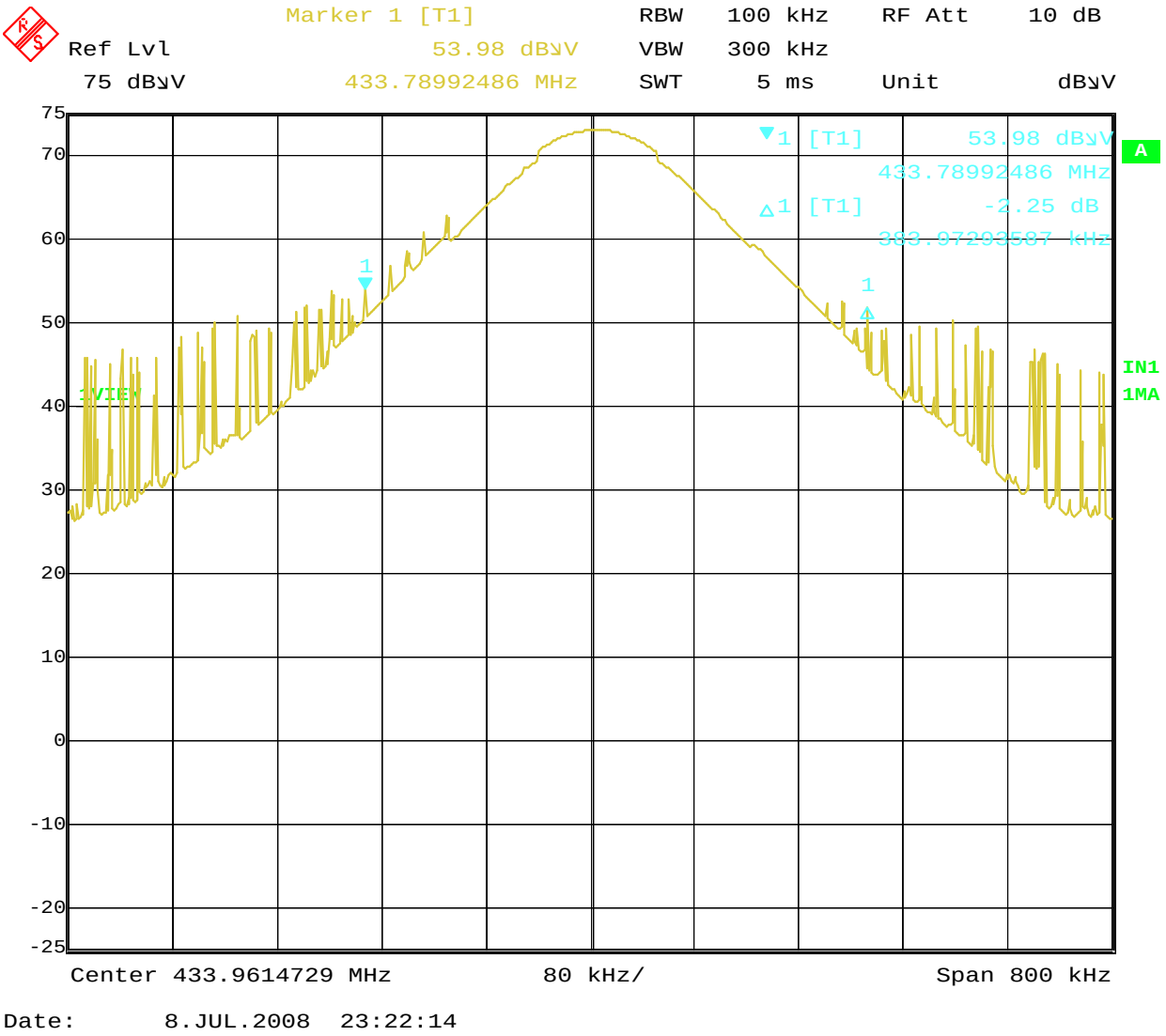

Figure 2 - Bandwidth

4.3 Band Edge Compliance FCC Part 15.215(c)

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

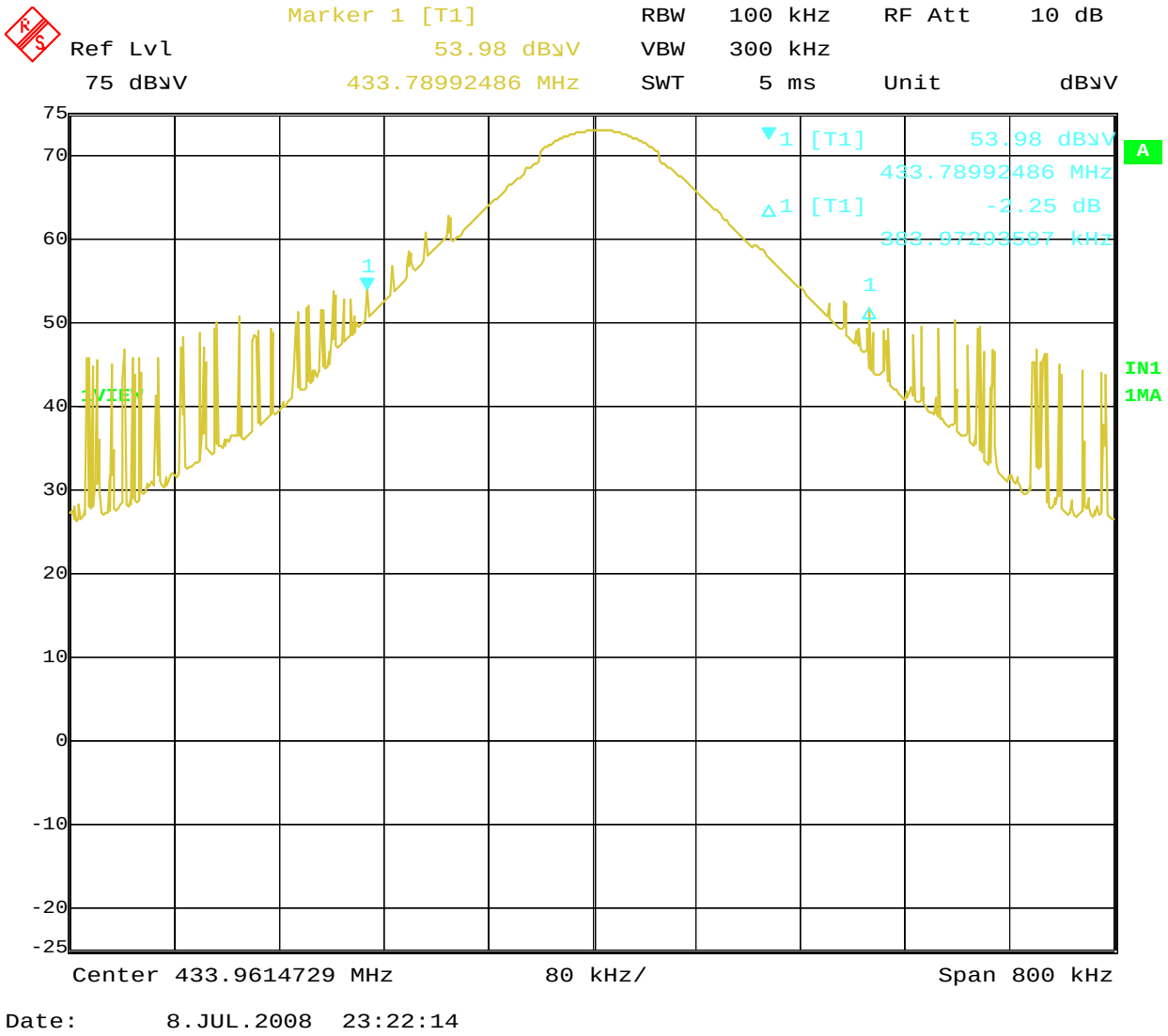

Figure 3 Band edge Compliance

4.4 Fundamental and Spurious Emissions

4.4.1 Radiated Emissions

Testing was performed in accordance with 47 CFR 15, ANSI C63.4:2003. These test methods are listed under the laboratory's NVLAP Scope of Accreditation. This test measures the levels emanating from the EUT, thus evaluating the potential for the EUT to cause radio frequency interference to other electronic devices.

4.4.1.1 Test Methodology

4.4.1.1.1 Final Test

For each frequency measured, the peak emission was maximized by manipulating the receiving antenna from 1 to 4 meters above the ground plane and placing it at the position that produced the maximum signal strength reading. The turntable was then rotated through 360° while observing the peak signal and placing the EUT at the position that produced maximum radiation. The six highest emissions relative to the limit were measured unless such emissions were more than 20 dB below the limit. If less than six emissions are within 20 dB of the limit, than the noise level of the receiver is measured at frequencies where emissions are expected. Multiples of all oscillator and microprocessor frequencies were also checked.

Final testing was performed on an NSA compliant test site. The EUT was placed on a 1.0m x 1.5m non-conductive table 80cm above the ground plane. The placement of EUT and cables were the same as for preliminary testing and is shown in the setup photographs.

4.4.1.1.2 Deviations

There were no deviations from this test methodology.

4.4.1.2 Test Results

It also reflects the results including any modifications and/or special accessories listed in Sections 1.4 and 1.5.

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

SOP 1 Radiated Emissions

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EUT Name	Defibtech low-power RF transmitter	**Date**	1 July 2008
EUT Model	DFB-2000A	**Temp / Hum in**	74 deg. F / 41 %rh
EUT Serial	N/A	**Temp / Hum out**	N/a
Standard	FCC 47 CFR Part 15.231	**Line AC / Freq.**	Internal Battery
Deg/sweep	12 degrees	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3 meters / 6140	**Performed by**	Randy Sherian
Configuration	Z-plane Fundamental Emissions		

Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
Peak Measurements										
433.96	H	2.29	0	54.02	0.00	2.29	16.12	72.44	100.83	
433.96	V	1.0	104	65.71	0.00	2.29	16.84	84.84	100.83	
Average based on pulse averaging										
				Peak E-Field Value			Correction Factor	Corrected Value		
433.96	H	2.29	0	72.44			-5.78	66.66	80.83	-14.17
433.96	V	1.0	104	84.84			-5.78	79.06	80.83	-1.77

Peak Sample calculation
Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty
Average Sample Calculation
Spec Margin = Corrected Value – Limit, Corrected Value = Peak E-Field Value + Correction Factor

Notes: Testing was performed in the 3 orthogonal planes to determine worse case.
Calculation for Pulsed devices.
Short pulses =79 pulses at 521 uSec in 100 mSec period
Long pulses=10 pulses at 1.022 mSec in 100 mSec period

Short pulses = 41.159 mSec in 100 mSec = (79 * 521 uSec)
Long pulses = 10.22 mSec in 100 mSec = (10 * 1.022mSec)

Total on time in 100 mSec: 51.379 mSec = (0.22 + 41.159)

Duty Cycle = 51.379 / 100
Duty Cycle = 51.379 %
Correction Factor = 20 log (.51379)
Correction Factor = -5.78 dB
See plots below for supporting documentation

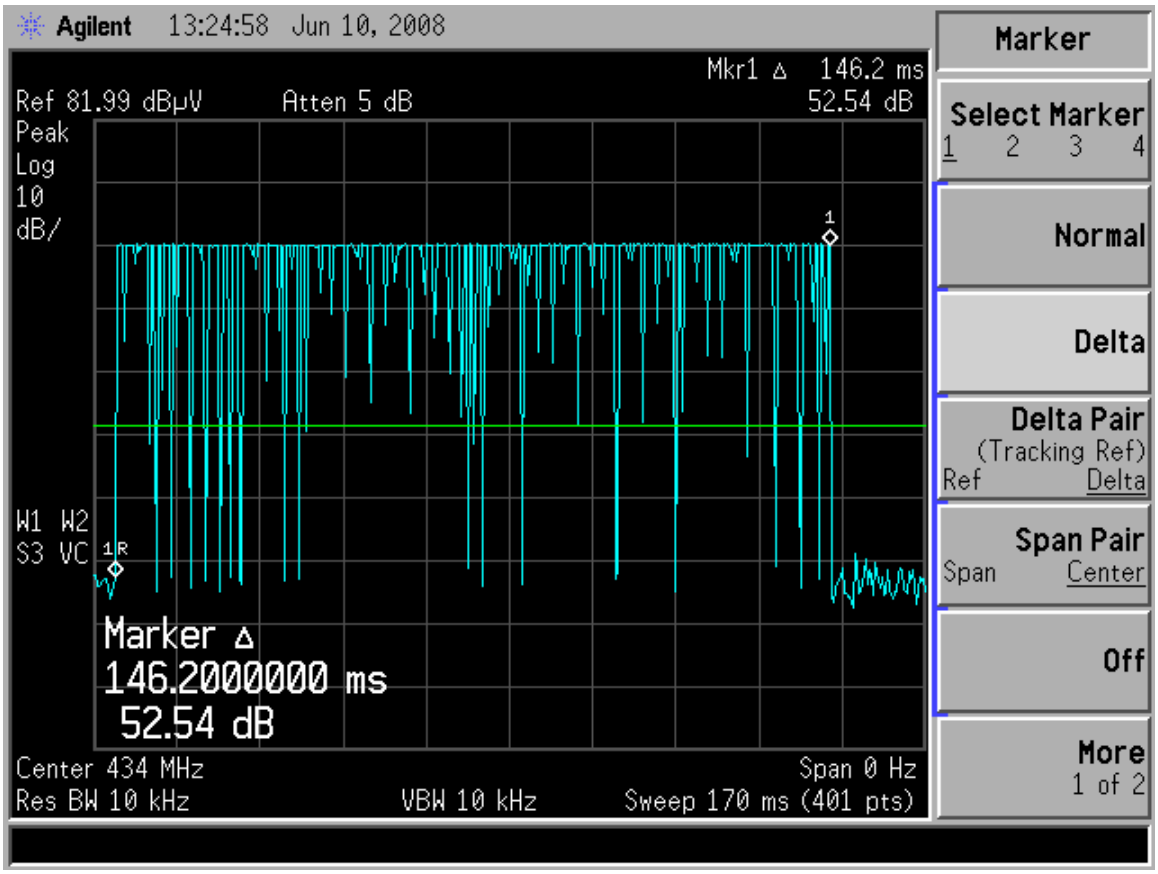

Figure 4 Length of Pulse Train

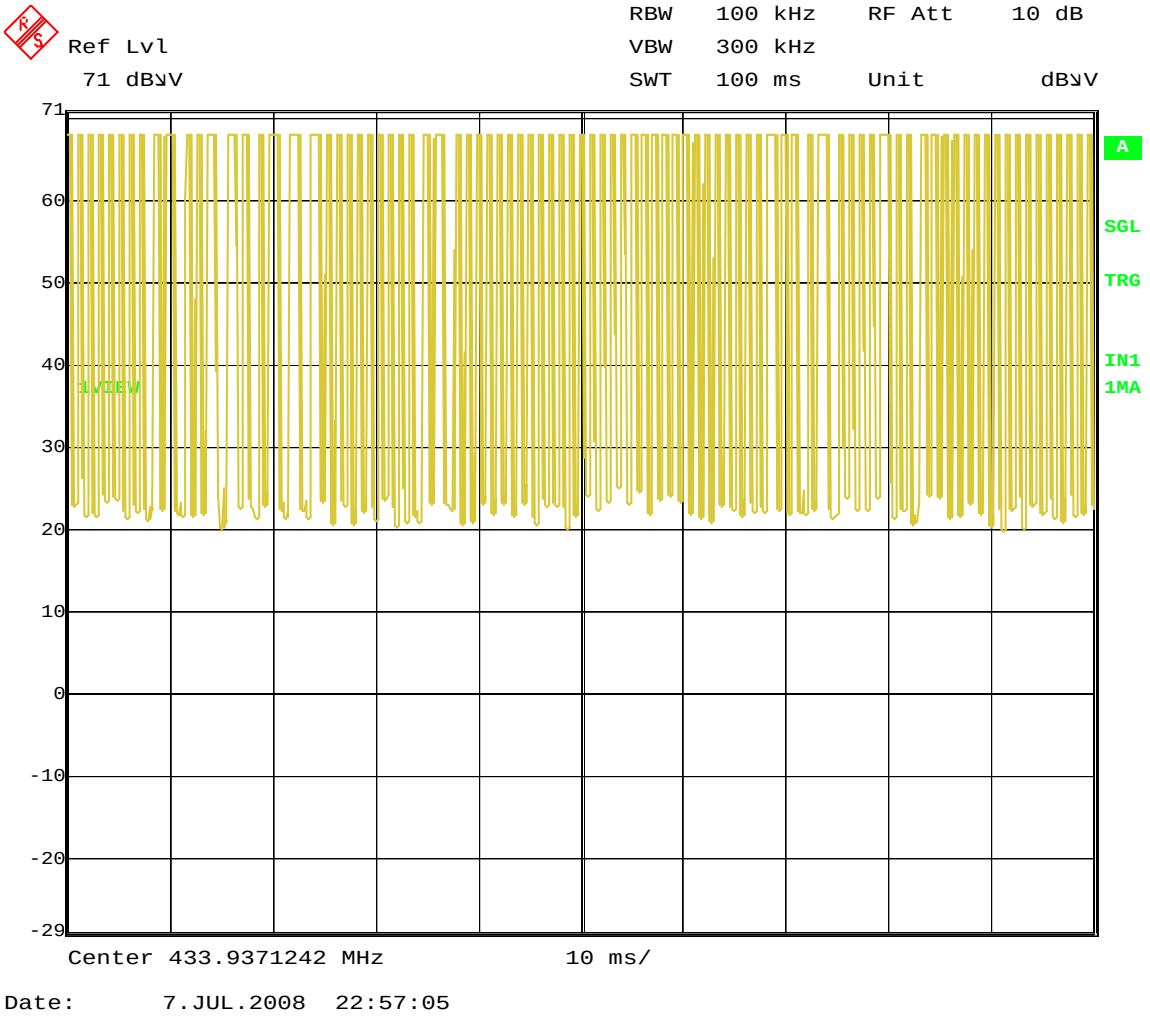

Figure 5 Worse Case in 100 ms

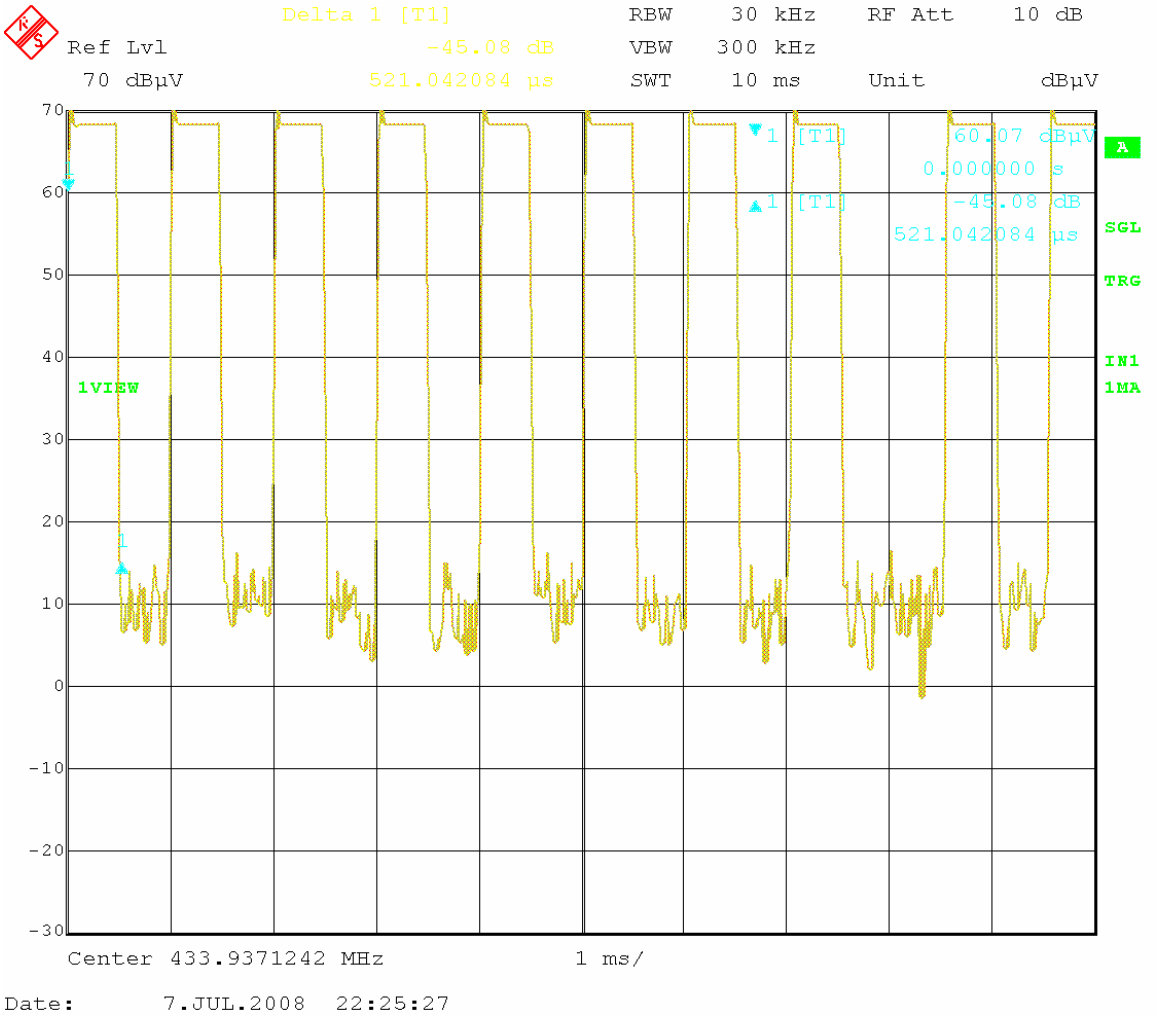

Figure 6 Short Pulse

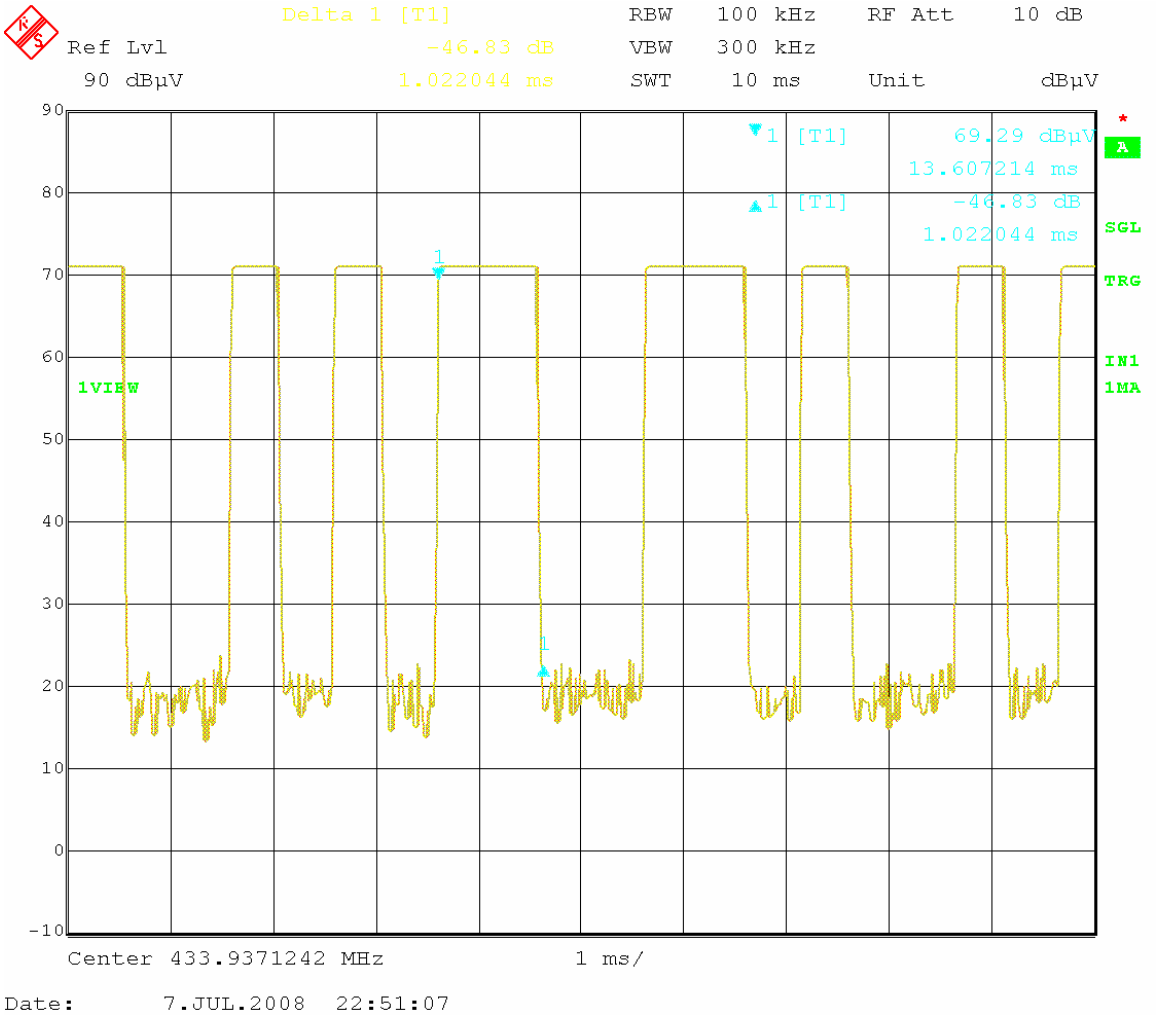

Figure 7 Long Pulse

SOP 1 Radiated Emissions

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EUT Name	Defibtech low-power RF transmitter	**Date**	1 July 2008
EUT Model	DFB-2000A	**Temp / Hum in**	74 deg. F / 41 %rh
EUT Serial	N/A	**Temp / Hum out**	N/a
Standard	FCC 47 CFR Part 15.231	**Line AC / Freq.**	Internal Battery
Deg/sweep	12 degrees	**RBW / VBW**	See notes below
Dist/Ant Used	3 meters / 6140	**Performed by**	Randy Sherian

Configuration Z-plane Spurious Emissions

Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
Peak Measurements										
867.92	H	1.0	341	40.96	0.00	3.35	22.10	66.41	80.83	-14.42
867.92	V	1.09	140	43.89	0.00	3.35	21.80	69.04	80.83	-11.79
1735.84	H	1.0	233	44.99	36.28	6.13	26.48	41.33	80.83	-39.5
1735.84	V	1.08	149	48.33	36.28	6.13	26.30	44.48	80.83	-36.35
Average Measurements										
867.92	H	1.0	341	33.13	0.00	3.35	22.10	58.58	60.83	-2.25
867.92	V	1.09	140	35.50	0.00	3.35	21.80	60.65	60.83	-0.18
1735.84	H	1.0	233	33.51	36.28	6.13	26.48	29.85	60.83	-30.98
1735.84	V	1.08	149	37.19	36.28	6.13	26.30	33.34	60.83	-27.49

Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

Notes: Testing was performed in the 3 orthogonal planes to determine worse case.
The RBW / VBW during measurements above 1GHz was 1 MHz / 3 MHz
The RBW / VBW during measurements below 1GHz was 120 kHz / 300 kHz

4.4.2 Restricted Band Measurements

4.4.2.1 Test Methodology

4.4.2.1.1 Preliminary Test

A test program that controls instrumentation and data logging was used to automate the preliminary RF emission test procedure. The frequency range of interest was divided into sub-ranges to yield a frequency resolution of approximately 300 kHz and provide a reading at each frequency for each 6° of turntable rotation. For each frequency sub-range the turntable was rotated 360° while peak emission data was recorded and plotted over the frequency range of interest in horizontal and vertical antenna polarization's.

Preliminary emission profile testing was performed inside the anechoic chamber. The EUT was placed on a 1.0m x 1.5m non-conductive table 80cm above the floor. The EUT was positioned as shown in the setup photographs. The receiving antenna was placed at a distance of 3m at a fixed height of 1m. Measurement equipment was located outside of the chamber. A video camera was placed inside the chamber to view the EUT.

4.4.2.1.2 Final Test

For each frequency measured, the peak emission was maximized by manipulating the receiving antenna from 1 to 4 meters above the ground plane and placing it at the position that produced the maximum signal strength reading. The turntable was then rotated through 360° while observing the peak signal and placing the EUT at the position that produced maximum radiation.

Final testing was performed on an NSA compliant test site. The EUT was placed on a 1.0m x 1.5m non-conductive table 80cm above the ground plane. The placement of EUT and cables were the same as for preliminary testing and is shown in the setup photographs.

4.4.2.1.3 Deviations

There were no deviations from this test methodology.

4.4.2.2 Test Results

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

SOP 1 Radiated Emissions

Tracking # 30861614.001 Page 1 of 1

EUT Name	Defibtech low-power RF transmitter	**Date**	1 July 2008
EUT Model	DFB-2000A	**Temp / Hum in**	74 deg. F / 41 %rh
EUT Serial	N/A	**Temp / Hum out**	N/a
Standard	FCC 47 CFR Part 15.231	**Line AC / Freq.**	Internal Battery
Deg/sweep	12 degrees	**RBW / VBW**	1 MHz / 3MHz
Dist/Ant Used	3 meters / 3115	**Performed by**	Randy Sherian
Configuration	Z-plane		

Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
Peak										
1301.88	H	1.09	186	62.90	36.58	5.26	24.81	56.39	74.00	-17.61
1301.88	V	1.0	262	69.18	36.58	5.26	24.85	62.71	74.00	-11.29
Average										
1301.88	H	1.09	186	55.06	36.58	5.26	24.81	48.55	54.00	-5.45
1301.88	V	1.0	262	60.40	36.58	5.26	24.85	53.93	54.00	-0.07

Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

Notes: Testing was performed in the 3 orthogonal planes to determine worse case.

4.4.3 Containment of the Emission during Variations in Voltage Part 15.31(e)

For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery.

Voltage	Peak E-Field Reading Before New Battery	Peak E-Field Reading After New Battery	Results
New Internal Battery	84.84 dBuV/m	84.83 dBuV/m	Pass

Spectrum Analyzer Parameters:

RBW=120kHz

VBW= 3 time RBW

Span=200kHz

LOG dB/div.= 10dB

Sweep = 5 mS

5 Conducted Emissions

The EUT is battery operated, therefore testing in accordance with 47 CFR 15, ANSI C63.4:2003 is not required.

6 Test Equipment Use List

6.1 Test Equipment use list

Equipment	Manufacturer	Model #	Serial/Inst #	Last Cal dd/mm/yy	Next Cal dd/mm/yy
SOP 1 - Radiated Emissions (5 Meter Chamber)					
Amplifier, preamp	Agilent Technologies	8449B	3008A01480	30-Jan-2008	30-Jan-2009
Antenna Horn 1-18GHz	EMCO	3115	2236	25-Jan-2007	25-Jan-2009
Ant. BiconiLog	Chase	CBL6140A	1108	13-Jun-2008	13-Jun-2010
Receiver, EMI	Rohde & Schwarz	ESIB40	100043	9-Jun-2008	9-Jun-2009
Spectrum Analyzer	Agilent Tec.	E7405A	US394401	4-Dec-2008	4-Dec-2009
Cable, Coax	Andrew	FSJ1-50A	003	30-Jan-2008	30-Jan-2009
Cable, Coax	Andrew	FSJ1-50A	030	30-Jan-2008	30-Jan-2009
Cable, Coax	Andrew	FSJ1-50A	045	30-Jan-2008	30-Jan-2009
General Laboratory Equipment					
Meter, Multi	Fluke	79-3	69200606	3-Dec-07	3-Dec-08
Meter, Temp/Humid/Barom	Fisher	02-400	01	3-Dec-07	3-Dec-08