

# Emissions Test Report

**EUT Name:** Defibtech low-power RF transmitter

**EUT Model:** DFB-2000A

FCC Title 47, Part 15, Subpart B

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# Statement of Compliance

*Manufacturer:* Defibtech, LLC  
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*Requester / Applicant:* Ed Naclerio

*Name of Equipment:* Defibtech low-power RF transmitter  
Model No. DFB-2000A

*Type of Equipment:* Information Technology Equipment (ITE)

*Class of Equipment:* Class B

*Application of Regulations:* FCC Title 47, Part 15, Subpart B

*Test Dates:* 9 July 2008 to 9 July 2008

## *Guidance Documents:*

Emissions: FCC 47 CFR Part 15

## *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.

28 August  
2008

NVLAP Signatory

Date

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## 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, Subpart B based on the results of testing performed on 9 July 2008 through 9 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

Emission	Test Method(s)	Test Parameters	Result
Radiated Emissions	47 CFR 15, ANSI C63.4:2003	30 MHz to 1000 MHz, Class B	compliant
Conducted Emissions	47 CFR 15, ANSI C63.4:2003	150 kHz to 30 MHz, Class B	compliant w/o testing (Battery Operated)

### 1.4 Summary of Evaluation Results

The following equipment was evaluated against the product tested with respect to the electrical, mechanical, and functional similarities found in the EMC Test Plan.

### 1.5 Special Accessories

No special accessories were necessary in order to achieve compliance.

### 1.6 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 C63.4:1992, 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 C63.4:1992, 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 k $\Omega$  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 k $\Omega$  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*, 1<sup>st</sup> 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.

*The Expanded Uncertainty* defines an interval about the result of a measurement that may be expected to encompass a large fraction of the distribution of values that could reasonably be attributed to the measurand. The fraction may be viewed as the coverage probability or level of confidence of the interval.

The test system for conducted emissions is defined as the LISN, spectrum analyzer, coaxial cables, and pads. The test system for radiated emissions is defined as the antenna, spectrum analyzer, pre-amplifier, coaxial cables, and pads. The conducted test system has a combined standard uncertainty of  $\pm 1.2$  dB. The radiated test system has a combined standard uncertainty of  $\pm 1.6$  dB. The expanded uncertainty at a level

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of 95% confidence is obtained by multiplying the combined standard uncertainty by a coverage factor of 2. Compliance criteria are not based on measurement uncertainty.

## **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 17025:1999.

# **3 Product Description**

The information for all equipment used in the tested system, including: descriptions of cables, clock and microprocessor frequencies, EMI critical components, and accessory equipment has been supplied by the manufacturer and is listed in the EMC Test Plan found in Section **Error! Reference source not found.**

## **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. There were no deviations from the description of the Equipment Configuration given in the EMC Test Plan.

## **3.2 Operation Mode**

A description and justification of the operation mode is given in the EMC Test Plan.

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

The final operating mode was selected to produce worse case radiation and place the EUT in the most susceptible state. There were no deviations from the description of the Operation Mode given in the EMC Test Plan.

## 4 Emissions

### 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.

#### 4.1.1 Test Methodology

##### 4.1.1.1 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 no more than 12° 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.

##### 4.1.1.2 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. 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.

##### 4.1.1.3 Deviations

There were no deviations from this test methodology.

#### 4.1.2 Test Results

Section 4.1.2.1 lists the final measurement data under the worst case operating modes, configurations, and/or cable positions. It also reflects the results including any modifications and/or special accessories listed in Sections 1.5 and 1.6.

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

#### **4.1.2.1 Final Data**

The data recorded in this section contains the final results under the worst-case conditions and with any modifications or special accessories implemented as the manufacturer intends.

## SOP 1 Radiated Emissions

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<b>EUT Name</b>	Defibtech low-power RF transmitter	<b>Date</b>	9-July-2008
<b>EUT Model</b>	DFB-2000A	<b>Temp / Hum in</b>	76 degrees F / 50%rH
<b>EUT Serial</b>	N/A	<b>Temp / Hum out</b>	
<b>Standard</b>	FCC 47 CFR Part 15	<b>Line AC / Freq.</b>	N/A
<b>Deg/sweep</b>	12 degrees	<b>RBW / VBW</b>	120khz/300khz
<b>Dist/Ant Used</b>	3m / 6140	<b>Performed by</b>	Randy Sherian
<b>Configuration</b>	Normal Config.		

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

Combined Standard Uncertainty  $U_c(v) = \pm 1.6\text{dB}$  Expanded Uncertainty  $U = ku_c(v)$   $k = 2$  for 95% confidence

### Notes:

#### 4.1.3 Sample Calculation

The field strength is calculated by subtracting the Amplifier Gain and adding the Cable Loss and Antenna Correction Factor to the measured reading. The basic equation is as follows:

$$\text{Field Strength (dB}\mu\text{V/m)} = \text{FIM} - \text{AMP} + \text{CBL} + \text{ACF}$$

Where: FIM = Field Intensity Meter (dB $\mu$ V)

AMP = Amplifier Gain (dB)

CBL = Cable Loss (dB)

ACF = Antenna Correction Factor (dB/m)

$$\mu\text{V/m} = 10^{\frac{\text{dB}\mu\text{V/m}}{20}}$$

### 4.2 Conducted Emissions

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

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.

#### 4.2.1 Test Methodology

A test program that controls instrumentation and data logging was used to automate the AC Power Line Conducted emission test procedure. The frequency range of interest was divided into sub-ranges such as to yield a frequency resolution of 9 kHz. For each frequency sub-range, each phase and neutral of the AC power line were measured with respect to ground. Measurements were performed using a set of 50 $\mu$ H / 50 $\Omega$  LISNs.

Testing is either performed in the anechoic chamber or on PLC Site 2. The setup photographs clearly identify which site was used. The vertical ground plane used in the anechoic chamber is a 2m x 2m wooden frame that is covered with 1/4 inch hardware cloth and is bonded to the horizontal ground plane.

In the case of tabletop equipment, the EUT is placed on a 1.0m x 1.5m non-conductive table 80cm above the ground plane and 40cm from a vertical ground reference plane. The rear of the EUT was positioned flush with the backside of the table and directly over the LISNs. The power and I/O cables were routed over the edge of the table and bundled approximately 40cm from the ground plane. Support equipment was powered from a separate LISN. Floor-standing equipment is placed directly on the ground plane.

##### 4.2.1.1 Deviations

There were no deviations from this test methodology.

#### 4.2.2 Test Results

Section 4.2.2.1 lists the final measurement data under the worst case operating modes, configurations, and/or cable positions. It also reflects the results including any modifications and/or special accessories listed in Sections 1.5 and 1.6.

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

Plots of the EUT's AC Line Conducted emissions are contained in the following sections. The plots show peak and/or average emissions and the corresponding peak and/or average limits. If the peak emissions

are below the average limit, then the EUT is considered to pass and no average measurements are made. If the peak emissions are below the quasi-peak limit and the average emissions are below the average limit, then the EUT is considered to pass and no further measurements are made. Otherwise, individual frequencies are measured and compared to the corresponding limit for the detector used (quasi-peak or average).

#### 4.2.2.1 Final Data

The data recorded in this section contains the final results under the worst-case conditions and with any modifications or special accessories implemented as the manufacturer intends.

#### 4.2.3 Sample Calculation

The signal strength is calculated by adding the LISN Correction Factor and Cable Loss to the measured reading. The basic equation is as follows:

$$\text{Field Strength (dB}\mu\text{V/m)} = \text{FIM} + \text{CBL} + \text{LCF}$$

Where: FIM = Field Intensity Meter (dB $\mu$ V)

CBL = Cable Loss (dB)

LCF = LISN Loss (dB)

$$\mu\text{V/m} = 10^{\frac{\text{dB}\mu\text{V / m}}{20}}$$

### 5 Test Equipment Use List

#### 5.1 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)					
Ant. BiconiLog	Chase	CBL6140A	1108	13-Jun-2008	13-Jun-2010
Receiver, EMI	Rohde & Schwarz	ESIB40	100043	12-Jul-2007	12-Jul-2008
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

\* Calibration of equipment past due for re-calibration will be performed expeditiously. If any equipment is found to be out of tolerance at that time, affected customers will be notified accordingly.