

***RUBICOM SYSTEMS, INC.***



**EN 55011/FCC TEST REPORT  
FOR THE  
SUN NUCLEAR CORPORATION  
MODEL 1136/1137 WIRELESS rf-IVD<sup>2</sup>**



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EN 55011/FCC REPORT  
INTENTIONAL TRANSMITTER (CFR 47, PART 15.249)  
FOR THE  
SUN NUCLEAR CORPORATION  
rf-IVD<sup>2</sup> WIRELESS DOSIMETRY SYSTEM

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## **ABSTRACT**

This report presents test results of the emanations found emitting from the Sun Nuclear Corporation rf-IVD<sup>2</sup> Wireless Dosimetry System, referred to hereafter as the rf-IVD<sup>2</sup>, and the comparison of these emissions to EN 55011 Class B limits of conducted and radiated requirements, plus radiated emissions in accordance with CFR 47, Part 15.249 for Intentional Transmitter at 917MHz.

This testing was performed on a 3-meter open area test site at Rubicom Systems, Inc. (RSI). The testing was performed for Sun Nuclear Corporation under purchase order P18880. The report is on file at RSI under JA number 2115. The results of this test effort indicate compliance of the system to the EN 55011 requirements when configured as described in Paragraph 5.0.

## 1.0 INTRODUCTION

### 1.1 Purpose

The purpose of this report is to present the results of testing a Sun Nuclear rf-IVD<sup>2</sup> to EN 55011.

### 1.2 Requirements

The test requirements for EN 55011 emissions are as follows:

#### RADIATED

Frequency (MHz)	Distance (Meters)	Field Strength dB $\mu$ V/m	20 Log 3 Meter dB $\mu$ V/m
30-230	10	30	40
230-1000	10	37	47

#### CONDUCTED

Frequency (MHz)	Limits dB $\mu$ V Quasi-Peak	Limits dB $\mu$ V Average
0.15-0.50	66 - 56	56 - 46
0.50-30	56	46
5 - 30	60	50

### 1.3 Unit Under Test Description

The rf-IVD<sup>2</sup> Wireless Dosimetry System is used for verification of patient radiation dosage. The rf-IVD<sup>2</sup> eliminates the wires between the treatment couch and the user interface at the console. The data is transferred via a RF link to the remote display or computer. Attachment A presents a detailed description of the system.

### 1.4 Summary of Results

Power line conducted data is presented in Data Sheets 6.1-1 and 6.1-8. All signals found within 10dB of the EN 55011 Class B requirements are listed in tabular form in Paragraph 6.1. Paragraph 6.2 presents a tabular list of signals detected from the system and the quasi-peak levels. These results were obtained without modifications to

the unit. Peak electric field measurements are presented in Data Sheets 6.3.2-1 through 6.3.2-6.

## **2.0            APPLICABLE DOCUMENTS**

The following documents form a part of this report to the extent expressed herein:

ANSI C63.4-1992

FCC Characteristics of Open Field Test Sites Bulletin  
OET 55, October 1989

CISPR Publication 22

European Standard EN 55011  
European Standard EN 60601-1-2:2002

### **3.0 TEST SITE DESCRIPTION**

This testing was performed at Rubicom Systems, Inc. 3-meter open area test site. The description of the measurement facility was found to be compliant with the requirements of Section 2.948 of the FCC Rules.

#### **3.1 Environmental Conditions**

Environmental conditions during emissions testing of the system were as follows:

Date: May 25, 2005

Temperature: 84°F

Barometer: 29.35 inches

Humidity: 75%



#### 4.0 TEST INSTRUMENTATION

The following test equipment was used to perform the emissions testing.

Qty.	Description	Manufacturer	Model No.	Cal Due Date	Cal Cycle
1	Spectrum Analyzer	Advantest	R3271	08/05/2005	1 Yr.
1	Bi-Log Antenna	Chase	CLB06111B	05/13/2007	1 Yr.
1	Power Line Stab. Network	Solar Electric	8012-50-R-24-BNC	03/14/2006	1 Yr.
1	Plotter	Hewlett Packard	7440A	NCR	1 Yr.
1	Ridged Guide Horn	A.H. Systems	SAS-200/571	04/30/2006	2 Yr.

The Advantest spectrum analyzer uses memory cards programmed with the specification limit. Antenna factors and cable loss are programmed to allow the displayed measured levels to be compared directly with the limit.

## 5.0 TEST SAMPLE SETUP AND CONFIGURATIONS

The rf-IVD™ was configured as presented in Figure 5.0-1. Power to the unit was 220 VAC, 60Hz input. All I/O ports were loaded with the typical cabling that would be used in a regular setup. The system was setup using a RF link between the detector pod and base station. The inputs on the detector pod had patient monitors attached.

Photos one and two present the conducted and radiated setup.

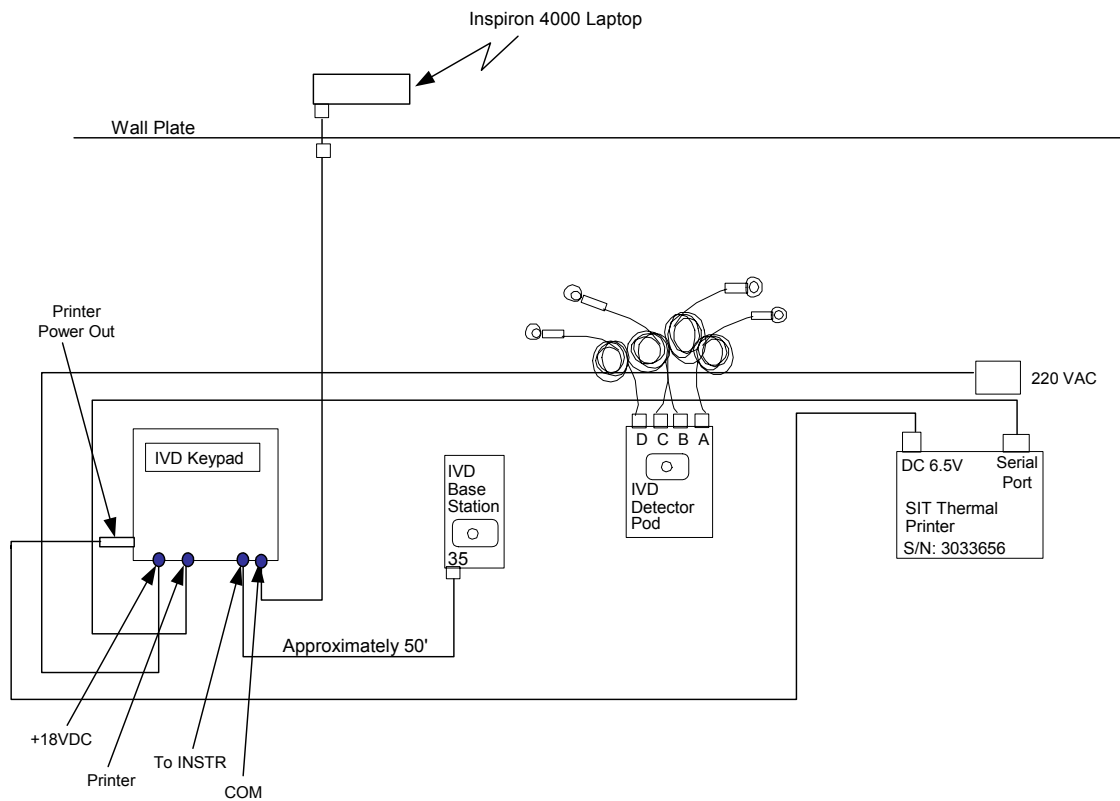


FIGURE 5.0-1

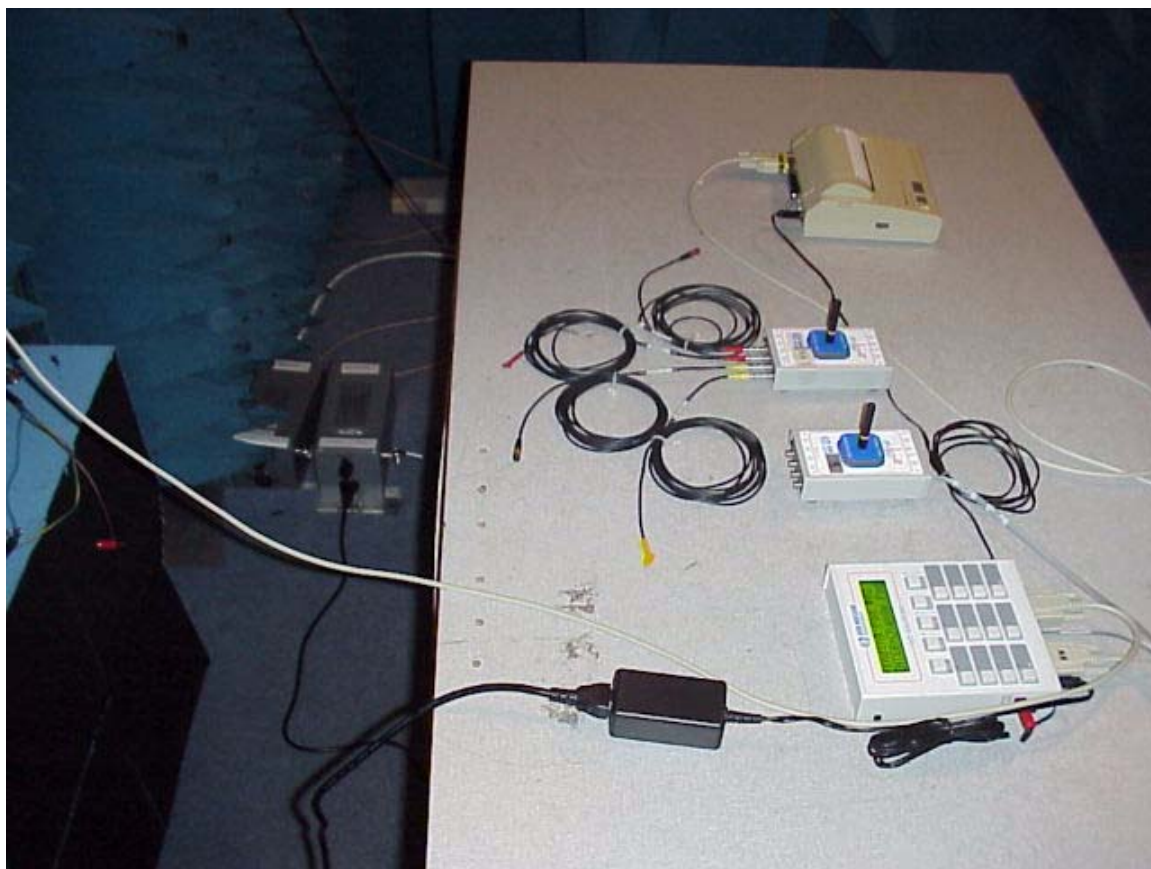


PHOTO 1



PHOTO 2

## 6.0 PROCEDURES AND RESULTS

### 6.1 Power Line Conducted Results

The unit was tested in the shielded enclosure using the Solar Model 8012-50-R-24-BNC PLISN (50 $\mu$ H/50ohm). Both the phase and neutral leads were tested. As can be seen in the conducted data sheets, Data Sheets 6.1-1 through 6.1-8, no signals were found above the EN 55011 Class B limit, on either phase or neutral.

### 6.2 Radiated Emissions Results

No radiated signals were found except the transmitter at 917.1MHz. The following table presents the levels measured up to the 10<sup>th</sup> harmonic per the FCC requirements of 15.249, using the procedures of clause 8 of ANSI 63.4-2003.

FREQUENCY (MHz)	ANTENNA POL..	ELEVATION	AZIMUTH	MEASURED (dB $\mu$ V/m )	Q.P. LIMIT (dB $\mu$ V/m @ 3 METERS)	MARGIN (dB)
917.1	H	0-4M	0-360°	78.2	94	15.8
917.1	V	"	"	86.8	94	7.2
1834.2	H & V	"	"	38	54	16
2751.3	H & V	"	"	41.5	54	12.5
3668.4	H & V	"	"	43	54	11
4585.5	H & V	"	"	44	54	10
5502.6	H & V	"	"	46	54	8
6419.7	H & V	"	"	49	54	5
7336.8	H & V	"	"	51	54	3
8253.9	H & V	"	"	52	54	2
9171	H & V	0-4M	0-360°	52	54	2

### 6.3 Procedures

#### 6.3.1 Pretest

An initial pretest for electric field signals is performed inside a shielded room to identify frequencies emanating from the equipment under test (EUT) without the test site ambient interference. This data is presented in Data Sheets 6.3.1-1 through 6.3.1-6.

#### 6.3.2 Official Quasi-Peak Scans

This testing involves maximizing the radiated emissions for peak amplitude levels in antenna height and equipment under test azimuth. This peaking is

performed using the frequencies noted during pretest. The maximized height and azimuth are noted on each frequency band. The maximization is performed for each polarization and frequency band. This peak data is presented in Data Sheets 6.3.2-1 through 6.3.2-6. EUT signals are identified on the plots by circles on the signals. These signals are individually maximized and measured with the quasi-peak detector and documented. The data would be listed in Paragraph 6.2. There were no signals other than the transmitter detected above the receiving system capability. The receiving capacity is presented at each harmonic (2-10) in the tabular listing above.

6.3.3        Quasi-Peak Ambient (EUT Off/Support Equipment On)

Quasi-peak ambient data is presented in Data Sheets 6.3.3-1 through 6.3.3-6. This data is used to compare the peak EUT data to the environmental ambient and determined true EUT signals. The tester uses a more detailed procedure to analyze signals by investigating frequency bands of 25MHz. The ambient is displayed and saved on the analyzer screen, then the unit is turned on and the true EUT signals are maximized.