RUBICOM SYSTEMS, INC.

FCC TEST RECORD

FOR THE

SUN NUCLEAR CORPORATION

RF-IVD WIRELESS DOSIMETRY SYSTEM

SEPTEMBER 2000

Rubicom Systems, Inc.
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FCC EMISSIONS REPORT

FOR THE

SUN NUCLEAR CORPORATION

rf-IVD™ WIRELESS DOSIMETRY SYSTEM

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Completed: September 7, 2000

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ABSTRACT

This report presents test results of the emanations found emitting from the Sun Nuclear Corporation rf-IVD™ Wireless Dosimetry System, referred to hereafter as the system, and the comparison of these emissions to the FCC rules stated in 47 CFR, Part 15, Subpart C, specifically 15.249, 15.205, 15.207 and 15.209.

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 13504. The report is on file at RSI under JA number 1755. The results of this test effort indicate compliance of the system to the FCC requirements when configured as described in Paragraph 5.0.

1.0 INRODUCTION

1.1 Purpose

The purpose of this report is to present the results of testing a Sun Nuclear rf-IVD™ to the FCC requirements of 15.249, 15.205, 15.207 and 15.209.

1.2 Requirements

The test requirements for emissions are as follows:

RADIATED 15.209

Frequency (MHz)	Distance (Meters)	Field Strength dBµV	20 Log 3 Meter dBµV/m
30 - 88	3	100	40
88 - 216	3	150	43.5
216 - 960	3	200	46
Above 960	3	500	54

RADIATED 15.249

Intentional Radiator 916MHz
Field Strength of Fundamental - 50 Millivolts/Meter = 94dBµV/m
Field Strength of Harmonics - 500µ Volts/Meter = 54dBµV/m (Avg.)

CONDUCTED 15.207

Frequency (MHz)	Limits dBµV Quasi-Peak
.45 - 30	48

1.3 Unit Under Test Description

The rf-IVD™ Wireless Dosimetry System is used for verification of patient radiation dosage. The rf-IVD™ 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. The transmitter frequency is 916MHz. 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 6.1.2. No signals were measured within 18dB of the requirement. Only the transmit frequency was found in the radiated scans and found to be within the requirements. No harmonics were detected above the receiving system in average or peak detectors.

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

Code of Federal Regulations - 47 Part 15 (October 1998)

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: September 7, 2000

Temperature: 85°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	02/01/2001	1 Yr.
1	Bi-Log Antenna	Chase	CLB06111B	07/17/2001	1 Yr.
1	Power Line Stab. Network	Solar Electric	8012-50-R-24-BNc	09/06/01	1 Yr.
1	Plotter	Hewlett Packard	7440A	NCR	

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. A dosage simulator was attached to one input on the detector pod. The remaining two inputs had patient monitors attached.

Photos one and two present the conducted and radiated setup.

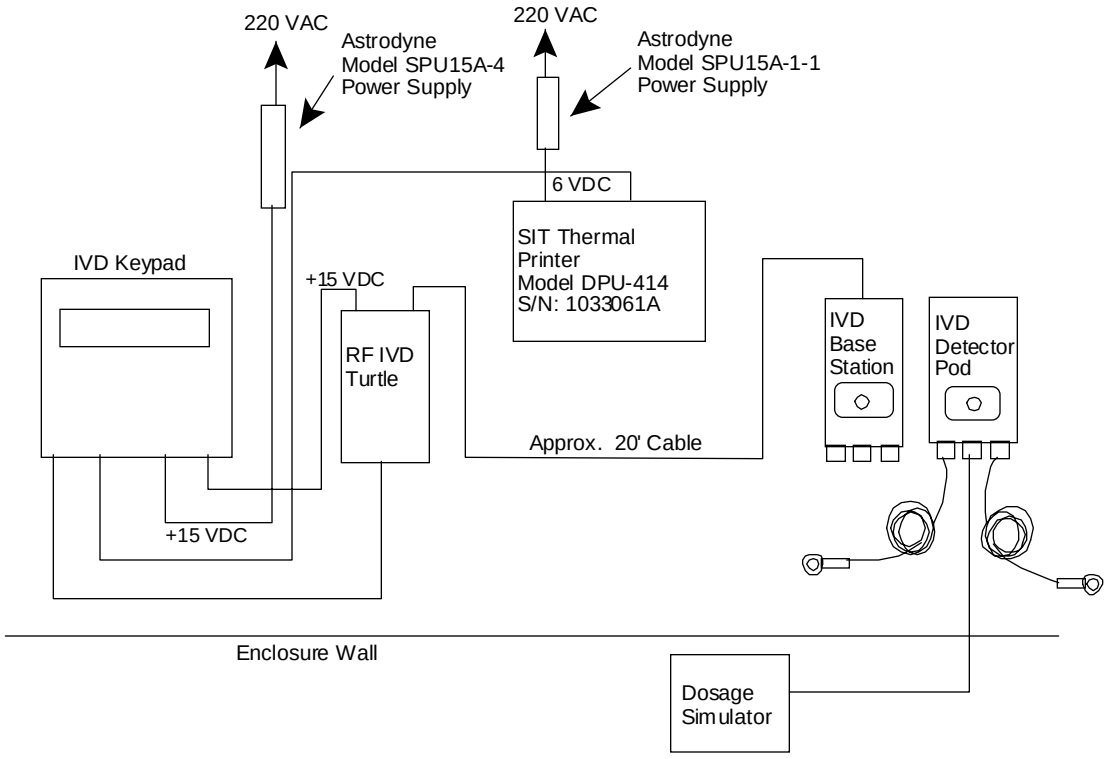

FIGURE 5.0-1

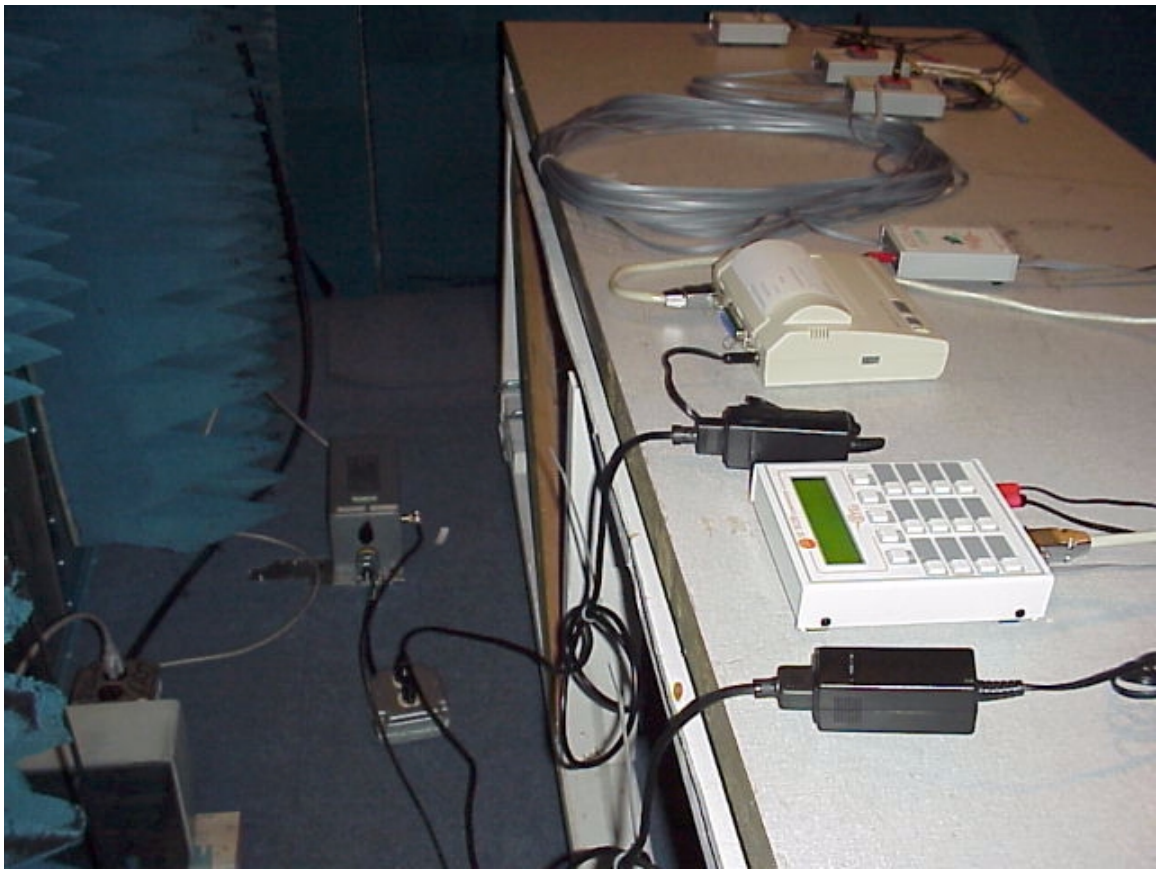

PHOTO 1

PHOTO 2

6.0 PROCEDURES AND RSULTS

6.1 Power Line Conducted Results

The unit was tested in the shielded enclosure using the Solar Model 8012-50-R-24-BNC PLISN (50µH/50ohm). Both the phase and neutral leads were tested. As can be seen in the conducted data sheets, Data Sheets 6.1-1 through 6.1-2, no signals were found within 18dB of the FCC requirement on either phase or neutral.

6.2 Radiated Emissions Results

No radiated signals were found except the transmitter at 916MHz. Harmonics were below the detection system capabilities. Listed below are the 916.5MHz peaked values for horizontal and vertical planes.

FREQUENCY (MHz)	ANTENNA POL..	ELEVATION	AZIMUTH	MEASURED (dBµV/m)	Q.P. LIMIT (dBµV/m @ 3 METERS)	MARGIN (dB)
916.5	V	1.5M	202°	90.25	94	-3.75
916.5	H	1.5M	202°	88.5	94	-5.5

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 6.3.1-8. Data Sheets 7 and 8 are performed with the transmitter on. No significant signals were found except the transmit signal at 916.5MHz.

6.3.2 Official Quasi-Peak, Peak and Average 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 6.3.2-8. 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 if signals were detected. There were no signals other than the transmitter detected above the receiving system capability. Quasi-peak scans to 1GHz and peak scans (1-10GHz) are presented in Data Sheets 6.3.2-1 through 6.3.2-8. Average scans (1-10GHz) are presented in Data Sheets 6.3.2-9 through 6.3.2-14.

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 signal levels. 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. Data Sheets 6.3.3-1 through 6.3.3-14 present the 1-10GHz peak and average ambients.

6.3.4 Normalized EUT Scan (EUT and Support On)

A normalized procedure is also used to identify EUT signals, especially in the 85MHz to 110MHz frequency range. The spectrum analyzer normalized the environmental ambient signals. The unit is turned on and delta signals found can be attributed to the EUT.