RADIATION SCIENCES INC.

TEST REPORT NO. RSI-2069E
ELECTROMAGNETIC INTERFERENCE (EMI)
OF THE
INTERNATIONAL ROLL CALL CORPORATION
MODEL # WS1
FCC PART 15, SUBPART C§15.231
29 JUNE 2000

PREPARED FOR:

International Roll Call Corp.
8346 Old Richfood Road
Mechanicsville, VA 23116

SUBMITTED BY:

Radiation Sciences Inc.
3131 Detwiler Road
Harleysville, PA 19438

PREPARED BY:

Chester B. Kosiorek
EMC Engineer
Radiation Sciences Inc.

REVIEWED BY:

Daniel J. Signore
President
Radiation Sciences Inc.

TABLE OF CONTENTS

LIST OF FIGURES

ADMINISTRATIVE DATA

TEST PERFORMED:

Measurements of radiated RF and conducted emissions.

PURPOSE OF TEST:

To evaluate the ElectroMagnetic Interference (EMI) characteristics of the Equipment Under Test with respect to Subpart B and C of Part 15 of the Federal Communications Commission **(FCC)** Rules for intentional and unintentional radiators.

EQUIPMENT UNDER TEST (EUT):

Model Number: Hand held Transmitter WS1
Serial Number: 42

CONTRACT:

Purchase Order Number: 9026

TEST PERIOD:

April 26, 2000

TEST FACILITY:

Radiation Sciences Incorporated (RSI), EMI/EMC Test Laboratory, located at 3131 Detwiler Road, Harleysville, Pennsylvania 19438.

TEST PERSONNEL AND COORDINATORS:

Radiation Sciences Inc.	**International Roll Call Corp.**
Chet Kosiorek	Terry Wagner
Ron Smith	

SUMMARY OF TEST RESULTS

The Model # WS1, configured as described herein, **FULLY COMPLIES WITH THE REQUIREMENTS SET FORTH IN SUBPART B AND C OF PART 15 OF THE FEDERAL COMMUNICATIONS COMMISSION (FCC) RULES FOR INTENTIONAL AND UNINTENTIONAL RADIATORS.**

1.0 INTRODUCTION

This document is a report of tests to determine the ElectroMagnetic Interference (EMI) characteristics of the **Model # WS1** presented by **International Roll Call** of Mechanicsville, Virginia.

The purpose of the testing was to evaluate the EMI characteristics of the test sample with respect to Subpart B and C of Part 15 of the **FCC** Rules for intentional and unintentional radiators.

Test setups and procedures are described in **RSI's Test Procedures 4963E** (see Appendix A) and test results are summarized herein on graphs.

All test procedures used meet the requirements of the American National Standards Institute Procedure C63.4: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz", dated 17 July 1992.

2.0 DESCRIPTION OF THE TEST SAMPLE:

The system transmits pushbutton voting data from the handsets to the base unit, and lamp control/power management data from the base unit to the handsets. Packets from the handsets are sent only upon request from the base unit, using a simple TDMA time slot scheme. The base unit and handsets transmit data only when a roll-call vote is being recorded. Data packets are 5 bytes in length plus the synchronization preamble, and are approximately 6.5 milliseconds in duration.

3.0 TEST INSTRUMENTATION

RSI INV #	DESCRIPTION	MANUFACTURER	MODEL #	SERIAL #	LAST CAL DATE	CAL DUE DATE	CYCLE	TYPE
32	SPEC. ANALY.	H.P.	8568B	2841A04457	4/27/2000	4/27/2001	12	C
33	SPEC. ANALY.	H.P.	85662A	2848A17406	4/27/2000	4/27/2001	12	C
77	ANTENNA	TENSOR	4108	2011	5/25/1999	5/25/2000	12	UC
83	ANTENNA	EMCO	3146	1554	12/1/1999	12/1/2000	12	V
391	RECEIVER	R & S	ESVP	861744/015	4/18/2000	4/18/2001	12	C

4.0 TEST RESULTS

4.1 Conducted Power Line Measurements, Paragraph 15.107

No measurements were performed on the **Model WS1** because it is a battery-operated unit.

4.2 Emission Bandwidth, FCC Part 15, Paragraph 15.231(c)

The bandwidth requirement for intentional transmitters operating above 70MHz is that the bandwidth of the emission shall be no wider than 0.25% of the center frequency of the device measured at the 20dB points.

The center frequency of the **Model # WS1** is 418.018MHz. Thus, the bandwidth cannot exceed 1.04MHz.

The measured bandwidth of the **WS1** is 273kHz as shown on the bandwidth data sheet, Figure 1.

Figure 2 is a photograph of the test setup and Figure 3 is a photograph showing the fundamental emission.

Company: Int'l Roll Call
Model# WS1

Test Personnel: Chester Kosiorek
Date: 4/26/00

Bandwidth of Fundamental Frequency

	Frequency (MHz)	Measurement (dBuV/m)
Center Frequency	418.018	52.8
20dB Down	417.874	32.8
20dB Down	418.147	32.8

Bandwidth is 273 kHz

FIGURE 1

Name: DCP01437.JPG
Dimensions: 1152 x 864 pixels

RADIATED EMISSIONS TEST SETUP PHOTOGRAPH

FIGURE 2

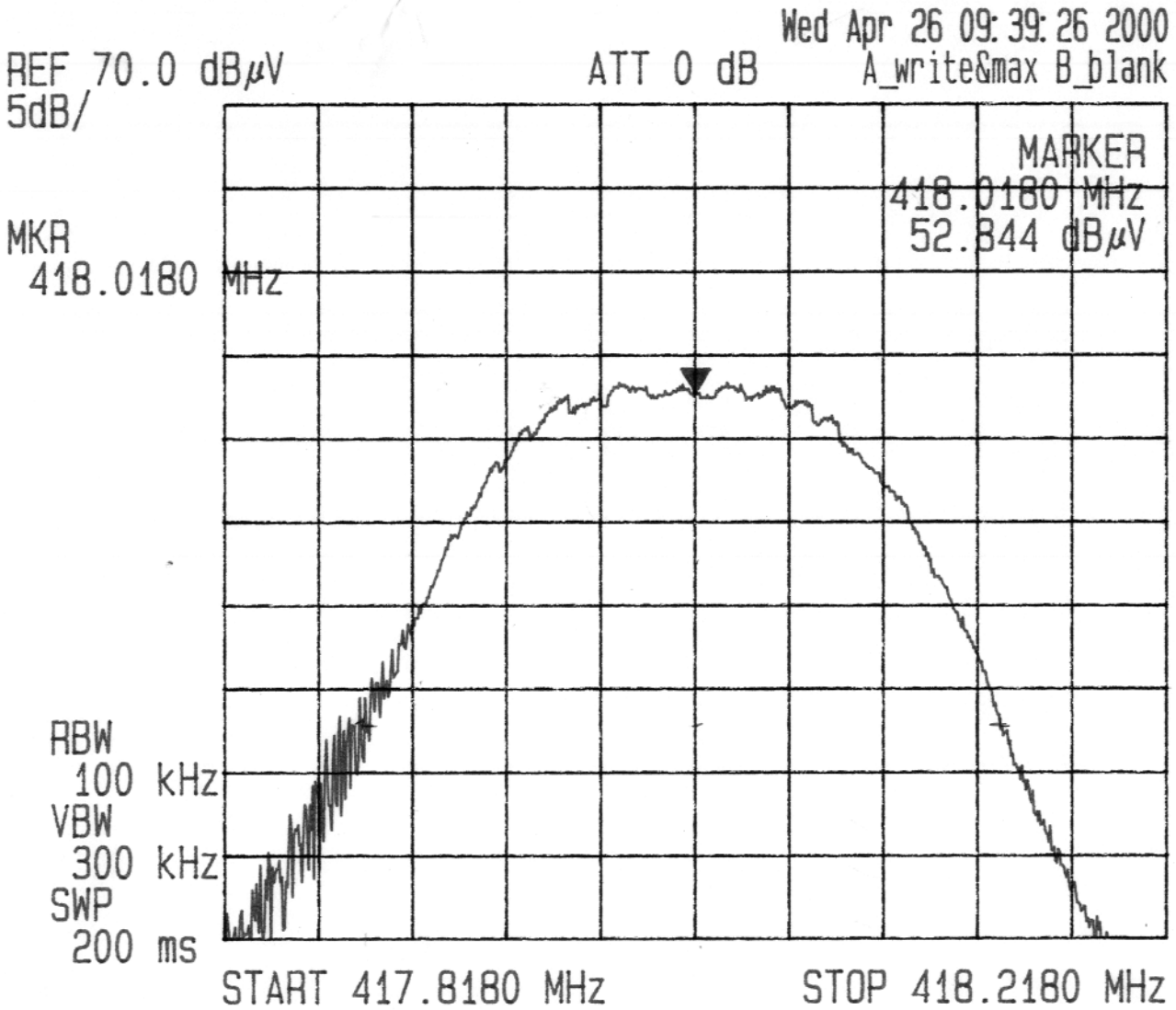
Wed Apr 26 09:39:26 2000
REF 70.0 dBμV
ATT 0 dB
A_write&max B_blank
5dB/
MARKER
418.0180 MHz
52.844 dBμV
MKR
418.0180 MHz
RBW
100 kHz
VBW
300 kHz
SWP
200 ms
START 417.8180 MHz
STOP 418.2180 MHz

FIGURE 3

4.3 Radiated Emission Measurements, Paragraph 15.33, 15.35, 15.109, 15.205 15.209 and 15.231

Radiated emission measurements were recorded for the test sample at a distance of 3 meters unless otherwise stated. The results of field strength measurements are illustrated on Figure 4 and 5 for intentional radiators and Figure 6 and 7 of unintentional radiators. Radiated emissions were measured with the antenna in both the horizontal and vertical polarizations. The antenna was raised 1 to 4 meters in height and the equipment under test **(EUT)** was rotated 360° to maximize the emission.

During radiated emissions testing the **EUT** was scanned from 30MHz to 4.18GHz (10 times the fundamental).

An average factor of 20dB was applied to the level of the fundamental emission when compared to the **FCC** limit.

ALL LEVELS COMPLY WITH APPLICABLE LIMITS FOR INTENTIONAL AND UNINTENTIONAL RADIATORS.

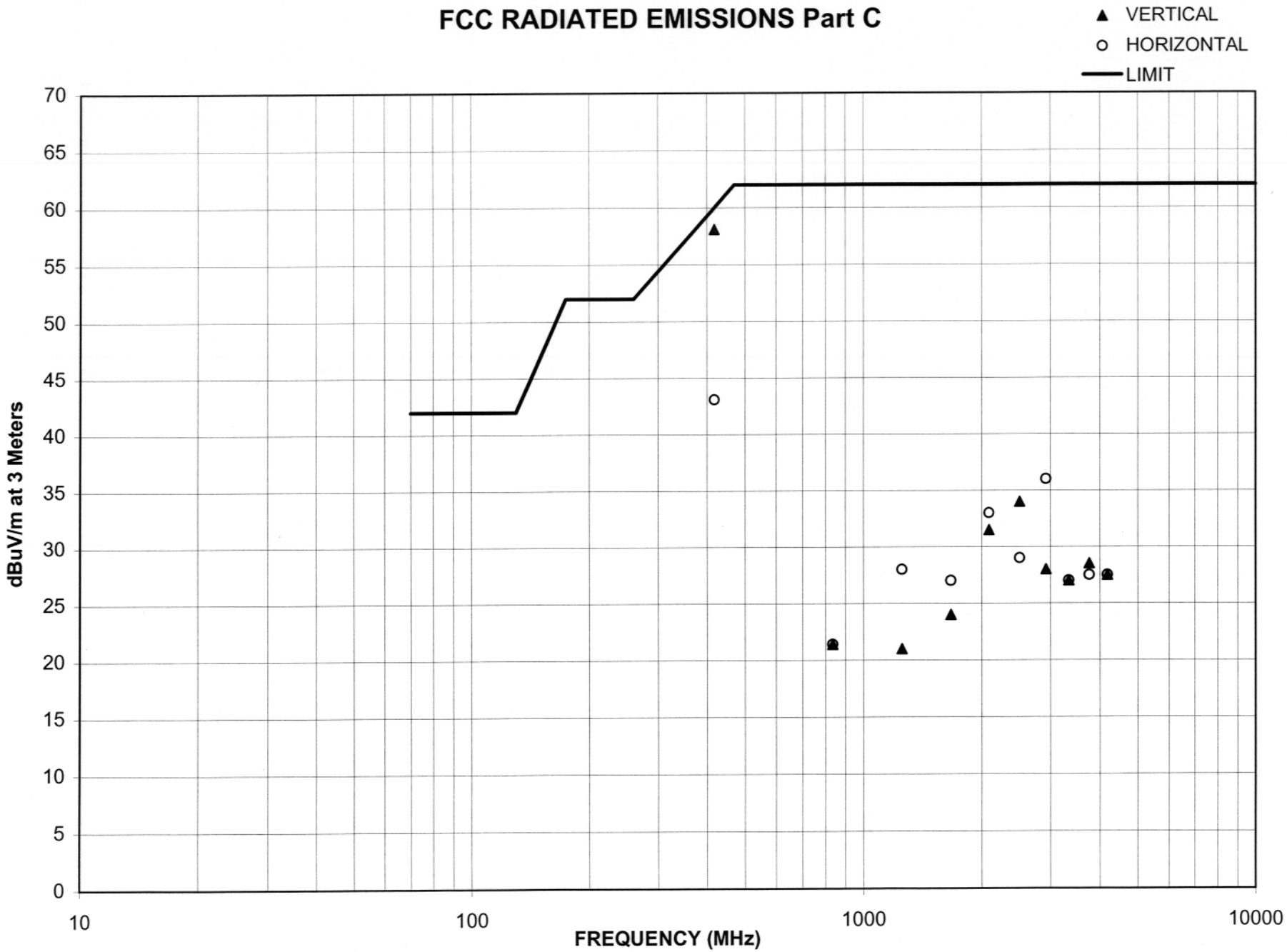
FCC RADIATED EMISSIONS Part C
VERTICAL
HORIZONTAL
LIMIT
dBuV/m at 3 Meters
FREQUENCY (MHz)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
10
100
1000
10000

FIGURE 4

WS1

Compan Int'l Roll Call
Model # WS1

Test Personnel: Chester Kosiorek
Date: 4/28/00

Radiated Emission for Intentional Radiators

Frequency (MHz)	Polarity	Antenna Height (Meters)	Azimuth (Degrees)	Indicated Level (dBuV)	Antenna Factor (dB)	Distance Factor 1m to 3m (dB)	Cable Loss (dB)	Averaging Factor (dB)	Field Strength @ 3m (dBuV/m)	Limits @ 3m (dBuV/m)	Field Strength @ 3m (uV/m)	Limits @ 3m (uV/m)	Margin (dB)
418	Vert	1.00	0	60.0	16.5	0.0	1.6	-20.0	58.1	72.3	804	4133.3	-14.2
836	Vert	1.00	0	17.0	22.4	0.0	2.0	-20.0	21.4	54.0	12	500	-32.6
1254	Vert	1.00	0	18.0	19.0	0.0	4.0	-20.0	21.0	54.0	11	500	-33.0
1672	Vert	1.00	0	24.0	26.0	-10.0	4.0	-20.0	24.0	54.0	16	500	-30.0
2090	Vert	1.00	0	29.5	28.0	-10.0	4.0	-20.0	31.5	54.0	38	500	-23.5
2508	Vert	1.00	0	31.0	29.0	-10.0	4.0	-20.0	34.0	54.0	50	500	-20.0
2926	Vert	1.00	0	23.0	30.5	-10.0	4.5	-20.0	28.0	54.0	25	500	-26.0
3344	Vert	1.00	0	20.0	32.0	-10.0	5.0	-20.0	27.0	54.0	22	500	-27.0
3762	Vert	1.00	0	21.0	32.5	-10.0	5.0	-20.0	28.5	54.0	27	500	-15.5
4180	Vert	1.00	0	19.0	33.0	-10.0	5.5	-20.0	27.5	54.0	24	500	-16.5
418	Horiz	1.10	0	45.0	16.5	0.0	1.6	-20.0	43.1	72.3	143	4133.3	-29.2
836	Horiz	1.00	0	17.0	22.4	0.0	2.0	-20.0	21.4	54.0	12	500	-32.6
1254	Horiz	1.00	0	19.0	25.0	0.0	4.0	-20.0	28.0	54.0	25	500	-26.0
1672	Horiz	1.00	0	27.0	26.0	-10.0	4.0	-20.0	27.0	54.0	22	500	-27.0
2090	Horiz	1.00	0	31.0	28.0	-10.0	4.0	-20.0	33.0	54.0	45	500	-21.0
2508	Horiz	1.00	0	26.0	29.0	-10.0	4.0	-20.0	29.0	54.0	28	500	-15.0
2926	Horiz	1.00	0	21.0	30.5	-10.0	4.5	-20.0	36.0	54.0	36	500	-18.0
3344	Horiz	1.00	0	20.0	32.0	-10.0	5.0	-20.0	27.0	54.0	22	500	-27.0
3762	Horiz	1.00	0	20.0	32.5	-10.0	5.0	-20.0	27.5	54.0	24	500	-26.5
4180	Horiz	1.00	0	19.0	33.0	-10.0	5.5	-20.0	27.5	54.0	24	500	-26.5

FIGURE 5

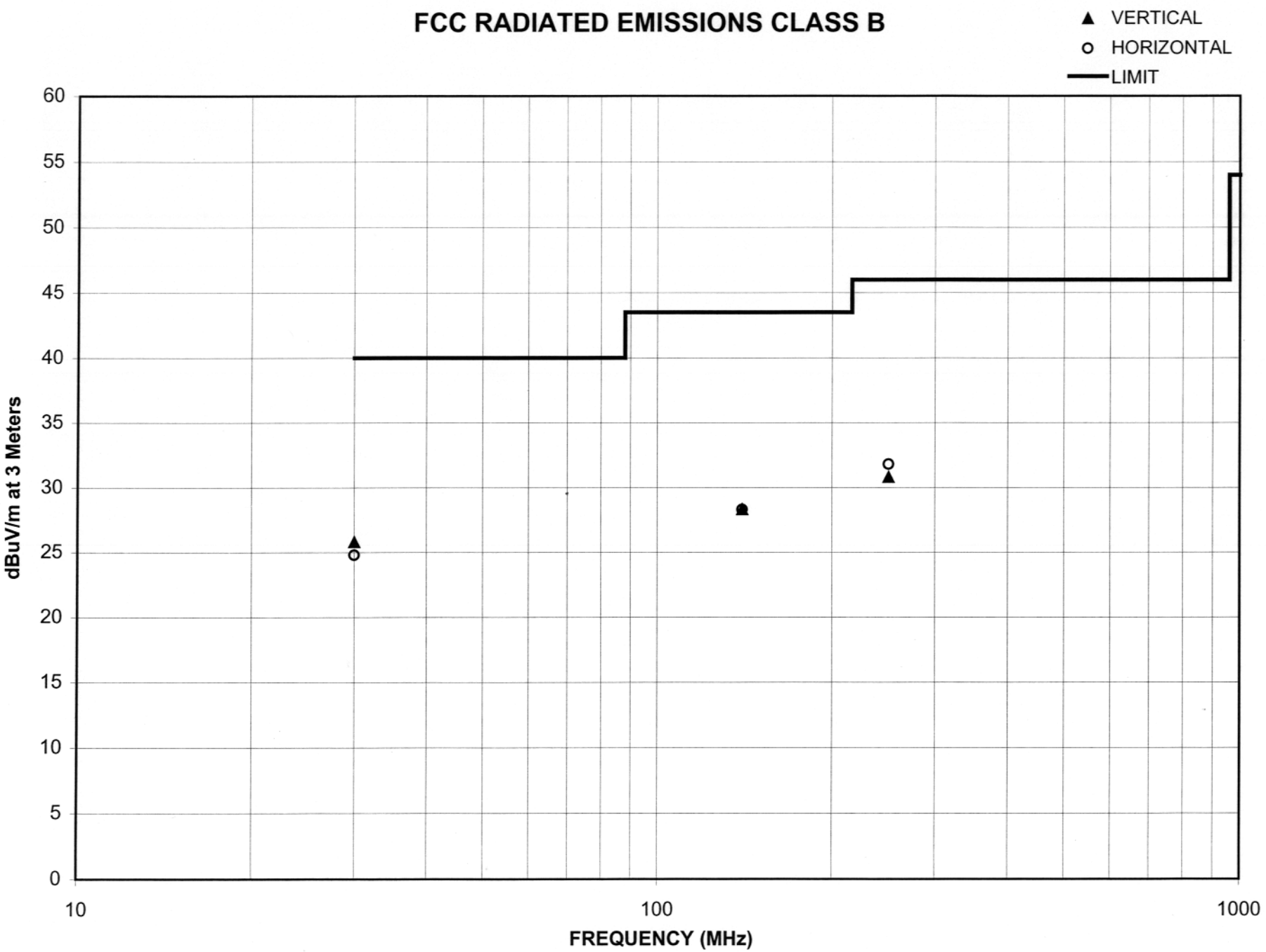
FCC RADIATED EMISSIONS CLASS B
VERTICAL
HORIZONTAL
LIMIT
dBuV/m at 3 Meters
60
55
50
45
40
35
30
25
20
15
10
5
0
10
100
1000
FREQUENCY (MHz)

FIGURE 6

WS1

Company: Int'l Roll Call
Model# WS!
Serial # 42

Test Personnel: Chester B Kosiorek
Date: 4/28/00
Frequency Range Tested: 30 MHz - 1300MHz

Radiated Emission for Unintentional Radiators

Frequency (MHz)	Polarity	Antenna Height (Meters)	Azimuth (Degrees)	Indicated Level (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Field Strength @ 3m (dBuV/m)	Limits @ 3m (dBuV/m)	Field Strength @ 3m (uV/m)	Limits @ 3m (uV/m)	Margin (dB)	Remarks
30	Vert	1.00	0	14.0	11.0	0.8	25.8	40.0	19	100	-14.2	
140	Vert	1.00	0	16.0	11.0	1.3	28.3	43.5	26	150	-15.2	
250	Vert	1.00	0	13.0	15.7	2.1	30.8	46.0	35	200	-15.2	
30	Horiz	1.00	0	13.0	11.0	0.8	24.8	40.0	17	100	-15.2	
140	Horiz	1.00	0	16.0	11.0	1.3	28.3	43.5	26	150	-15.2	
250	Horiz	1.00	0	14.0	15.7	2.1	31.8	46.0	39	200	-14.2	

FIGURE 7

5.0 CONCLUSIONS

The evaluation of the **Model # WS1**, configured as described herein, indicated that the unit complies with the required set forth in Subpart B and C of Part 15 of the **FCC** Rules for unintentional and intentional radiators.

1. The **EUT** meets the radiated emission limits for unintentional radiators set forth in §15.109. The closest measurement was 4dB under the limit.
2. The **EUT** meets the radiated emission limits for intentional radiators set forth in §15.205, §15.209 and §15.231. The closest measurement was 14dB under the limit.
3. The **EUT** meets the bandwidth requirements set forth in §15.231(c).

Certification by the Federal Communications Commission **(FCC)** is required. This report, **RSI's Test Procedure 4963E** and **FCC Form 731** must be submitted to the **FCC** for approval.