



RADIATION SCIENCES INC.

TEST REPORT NO RSI-2105
ELECTROMAGNETIC INTERFERENCE (EMI)
FCC PART 15, SUBPART C §15.231
OF THE
TACTICAL TECHNOLOGIES INC.
MODEL # IP9CST703
31 AUGUST 2000

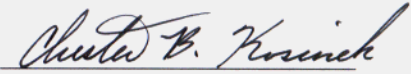
PREPARED FOR:

Tactical Technologies, Inc.
1701 Second Avenue
Folsom, PA 19033

SUBMITTED BY:

Radiation Sciences Inc.
3131 Detwiler Road
Harleysville, PA 19438

PREPARED BY:


Chester B. Kosiorek
EMC Engineer
Radiation Sciences Inc.

REVIEWED BY:

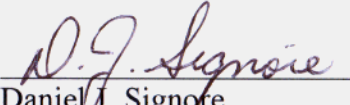

Daniel J. Signore
President
Radiation Sciences Inc.

**TABLE OF CONTENTS**

<u>SECTION</u>	<u>TITLE</u>	<u>PAGE</u>
	Table of Contents	i
	List of Figures	i
	Administrative Data	ii
	Summary of Test Results	iii
1.0	INTRODUCTION	1
2.0	DESCRIPTION OF THE TEST SAMPLE	2
3.0	TEST INSTRUMENTATION	3
4.0	TEST RESULTS	4
4.1	Conducted Power Line Measurements, Paragraph 15.107	4
4.2	Emission Bandwidth, FCC Part 15, Paragraph 15.231	
4.3	Radiated Emission Measurements, Paragraph 15.33, 15.35, 15.109 15.205, 15.209 and 15.231	9
5.0	CONCLUSIONS	12
APPENDIX A	ADDITIONAL TESTS	13-16
APPENDIX B	RSI's TEST PROCEDURES 4963E	----
APPENDIX C	RSI's CERTIFICATIONS	----

LIST OF FIGURES

FIGURE 1	Bandwidth of Fundamental Frequency Data Sheet	6
FIGURE 2	Radiated Test Setup Photograph	7
FIGURE 3	Graph of Fundamental Frequency Bandwidth	8
FIGURE 4	Radiated Emission for Intentional Radiators Data Sheet	10
FIGURE 5	Radiated Emission for Unintentional Radiators Data Sheet	11



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: **IP9CST703**

Serial Number: 101

CONTRACT:

Purchase Order Number: TBD

TEST PERIOD:

August 24 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.

Chet Kosiorek
Ron Smith

Tactical Technologies, Inc.

Jeff Olsen



SUMMARY OF TEST RESULTS

The **Model # IP9CST703**, configured as described herein, **FULLY COMPLIES WITH THE REQUIREMENTS SET FORTH IN SUBPART 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 # IP9CST703** presented by **Tactical Technologies, Inc.** of Folsom, Pennsylvania.

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 B) 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 test sample is a transmitter operating at 1.54.6125MHz.



RADIATION SCIENCES INC.

<u>RSI INV #</u>	<u>DESCRIPTION</u>	<u>MANUFACTURER</u>	<u>MODEL #</u>	<u>SERIAL #</u>	<u>LAST CAL DATE</u>	<u>CAL DUE DATE</u>	<u>C Y C L E</u>	<u>T Y P E</u>
31	SPEC ANALYZER	ADVANTEST	R3271	J003583	6/21/2000	6/21/2001	12	C
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
73	ANTENNA	STODDART	94455-1	6	11/30/1999	11/30/2000	12	V
83	ANTENNA	EMCO	3146	1554	12/1/1999	12/1/2000	12	V
91	ANTENNA	EMCO	3115	2023	6/12/2000	6/12/2001	12	C
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 # IP9CST703** because it is a battery operated unit.



4.2 Emission Bandwidth, FCC Part 15, Paragraph 15.231

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 # IP9CST703** is 154.6125MHz. Thus, the bandwidth cannot exceed 386.53kHz.

The measured bandwidth of the **IP9CST703** is 30.6kHz 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 and the low side 20dB down point (Bottom).



Company: Tactical Technologies Inc.
Model # IP9CST709
S/N: 101

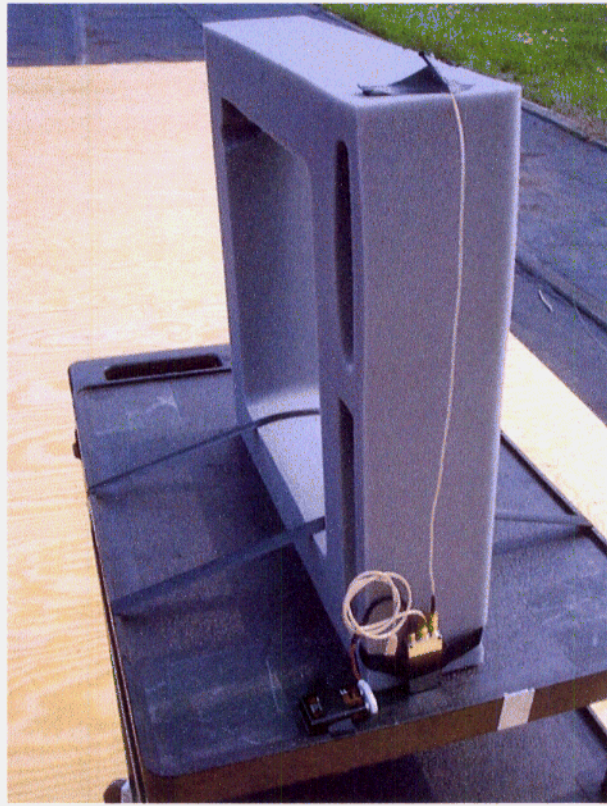
Test Personnel: Chester Kosiorek
Date: 8/24/00

Bandwidth of Fundamental Frequency

	Frequency (MHz)	Measurement (dBuV/m)
Center Frequency	154.6125	106.5
20dB Down	154.5972	86.67
20dB Down	154.6278	86.62

Bandwidth is 30.6 KHz

FIGURE 1



a.) EUT setup for test



b.) Radiated Emissions test setup

FIGURE 2

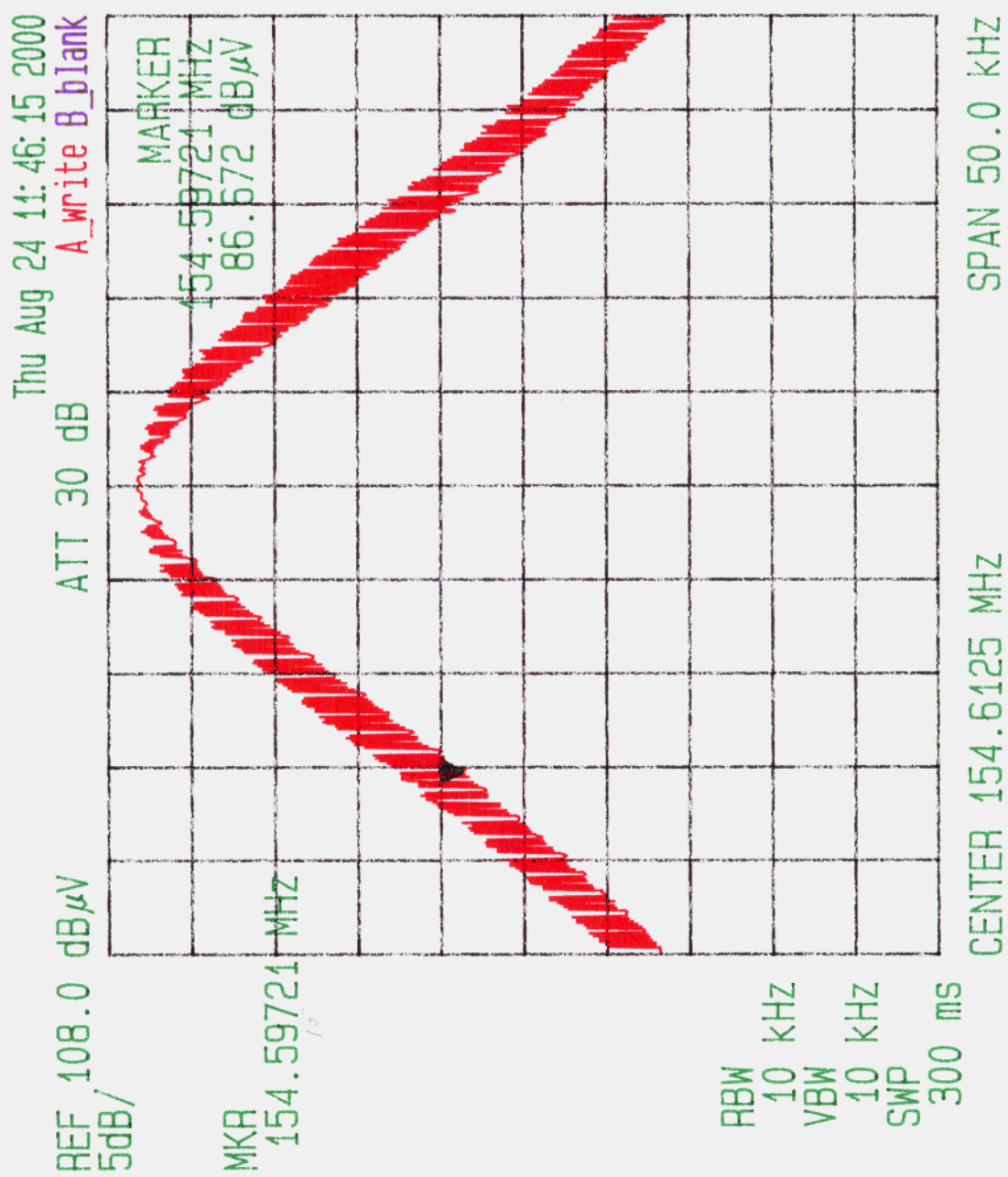


FIGURE 3



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 for intentional radiators and Figure 5 for 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 1.546GHz (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 WITH THE EXCEPTION OF ONE OUTAGE AT 154.6MHz. (Intentional Fundamental)



Company: Tactical Technologies Inc.
 Model # IP9CST703
 S/N: 101

Test Personnel: Chester Kosiorek
 Date: 9/1/00

Radiated Emission for Intentional Radiators

Frequency (MHz)	Polarity	Antenna Height (Meters)	Antenna 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)
154.61	Vert	2.00	0	100.0	18.0	0.0	1.6	-20.0	99.6	61.2	95499	1122	38.4
309.23	Vert	1.25	0	34.0	14.0	0.0	2.0	-20.0	30.0	47.0	32	223.9	-17.0
463.82	Vert	1.55	0	28.0	17.0	0.0	3.0	-20.0	28.0	54.0	25	500	-26.0
618.45	Vert	1.45	0	39.0	19.0	0.0	4.0	-20.0	42.0	54.0	126	500	-12.0
773.05	Vert	1.30	0	26.0	22.0	0.0	4.0	-20.0	32.0	54.0	40	500	-22.0
927.66	Vert	1.00	0	26.0	23.0	0.0	4.0	-20.0	33.0	54.0	45	500	-21.0
1082.29	Vert	1.00	0	16.0	21.0	0.0	3.0	-20.0	20.0	54.0	10	500	-34.0
1236.9	Vert	1.00	0	18.0	21.5	0.0	4.0	-20.0	23.5	54.0	15	500	-30.5
1391.51	Vert	1.00	0	18.0	22.0	0.0	4.0	-20.0	24.0	54.0	16	500	-30.0
1546.1	Vert	1.00	0	18.0	22.0	0.0	4.0	-20.0	24.0	54.0	16	500	-30.0
154.61	Horiz	1.30	0	88.0	17.5	0.0	1.6	-20.0	87.1	61.2	22646	1122	25.9
309.23	Horiz	1.00	0	39.0	14.0	0.0	2.0	-20.0	35.0	47.0	56	223.9	-12.0
463.82	Horiz	1.50	0	22.0	17.0	0.0	4.0	-20.0	23.0	54.0	14	500	-31.0
618.45	Horiz	1.00	0	29.0	19.0	0.0	4.0	-20.0	32.0	54.0	40	500	-22.0
773.05	Horiz	1.00	0	21.0	22.0	0.0	4.0	-20.0	27.0	54.0	22	500	-27.0
927.66	Horiz	1.20	0	23.0	24.0	0.0	3.0	-20.0	30.0	54.0	32	500	-24.0
1082.29	Horiz	1.00	0	19.0	21.0	0.0	4.0	-20.0	24.0	54.0	16	500	-30.0
1236.9	Horiz	1.00	0	18.0	21.5	0.0	4.0	-20.0	23.5	54.0	15	500	-30.5
1391.51	Horiz	1.00	0	18.0	22.0	0.0	4.0	-20.0	24.0	54.0	16	500	-30.0
1546.1	Horiz	1.00	0	23.0	22.0	0.0	4.0	-20.0	29.0	54.0	28	500	-25.0

FIGURE 4

Company: Tactical Technologies
 Model # IP9CST703
 S/N:101

Test Personnel: Chester B Kosiorek
 Date: 9/2 8
 Frequency Range Tested: 30 MHz - 1000MHz

Radiated Emission for Unintentional Radiators

Frequency (MHz)	Polarity	Antenna Height (Meters)	Antenna 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	10.0	12.0	0.8	22.8	40.0	14	100	-17.2	
110	Vert	1.00	0	12.0	12.0	1.3	25.3	43.5	18	150	-18.2	
200	Vert	1.00	0	7.0	17.0	2.4	26.4	46.0	21	200	-19.6	
500	Vert	1.00	0	8.0	19.0	3.4	30.4	46.0	33	200	-15.6	
700	Vert	1.00	0	11.0	21.0	4.0	36.0	46.0	63	200	-10.0	
1000	Vert	1.00	0	12.0	25.0	4.0	41.0	54.0	112	500	-13.0	
30	Horiz	1.00	0	10.0	13.0	0.8	23.8	40.0	15	100	-16.2	
110	Horiz	1.00	0	12.0	12.0	1.3	25.3	43.5	18	150	-18.2	
200	Horiz	1.00	0	8.0	17.0	2.4	27.4	46.0	23	200	-18.6	
500	Horiz	1.00	0	9.0	19.0	3.4	31.4	46.0	37	200	-14.6	
700	Horiz	1.00	0	10.0	22.0	4.0	36.0	46.0	63	200	-10.0	
1000	Horiz	1.00	0	12.0	25.0	4.0	41.0	54.0	112	500	-13.0	

FIGURE 5



5.0 CONCLUSIONS

The evaluation of the **Model # IP9CST703**, configured as described herein, indicated that the unit complies with the requirements 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 10dB under the limits.
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 24.6dB over the limit.
3. The **EUT** meets the bandwidth requirements set forth in §15.231.



APPENDIX A

ADDITIONAL TESTS



Occupied Bandwidth - Paragraphs [2.989(c) (1), 90.209(c)]

Figures A1 and A2 contain plots taken from the ADVANTEST R3271 Spectrum Analyzer. The transmitter was modulated with a sine wave tone at 2500Hz at a level 16dB above that required producing 50% modulation at the frequency of maximum response. Paragraph 90.209(c) requires that the mean power of emissions shall be attenuated below the mean output power of the transmitter by the following amounts:

- (a) On any frequency removed from the assigned frequency by more than 50% but not more than 100% of the authorized bandwidth (at least 25dB). - Figure A1.
- (b) On any frequency removed from the assigned frequency by more than 100% but not more than 250% of the authorized bandwidth (at least 35dB). - Figure A2.

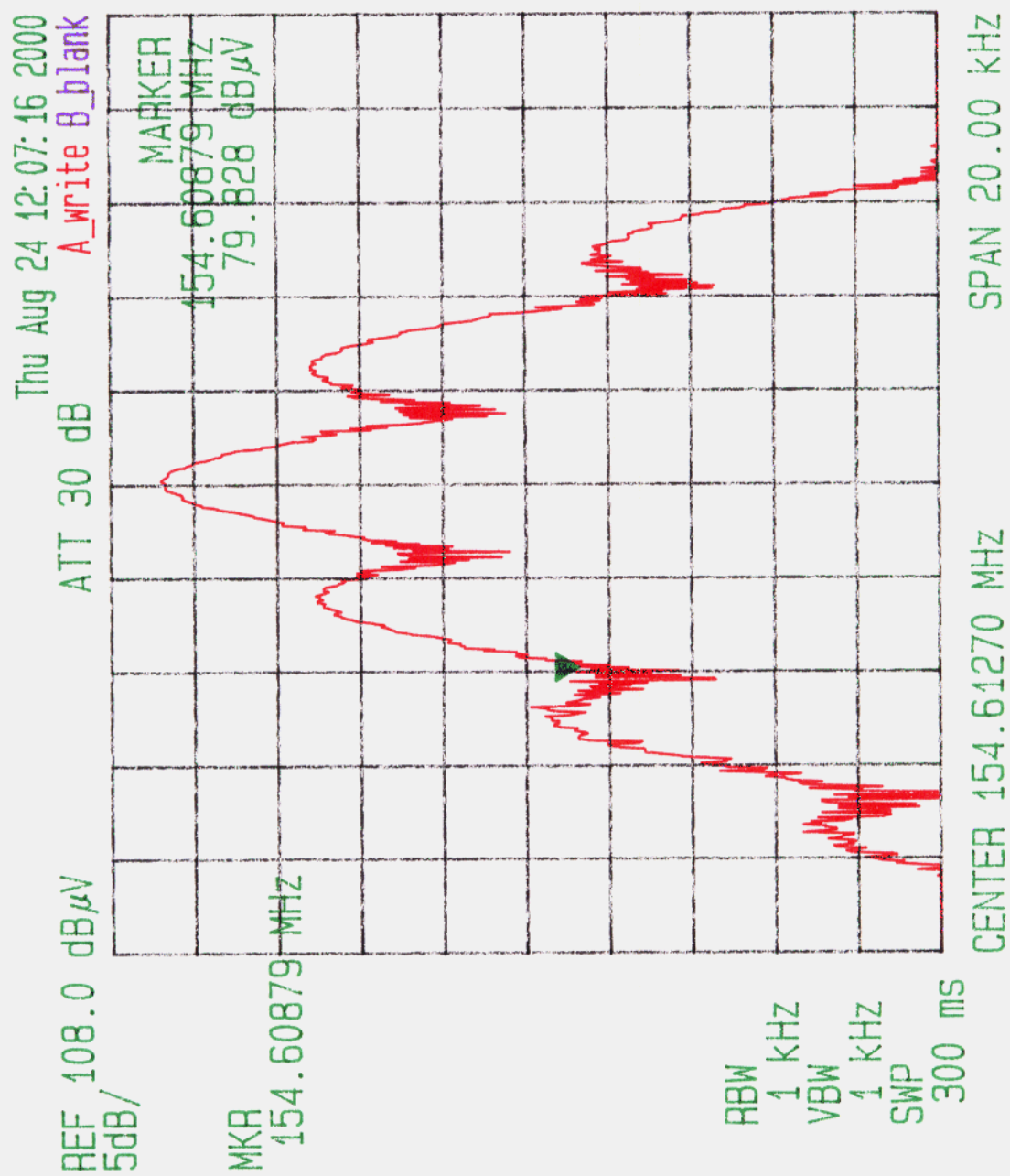


FIGURE A1

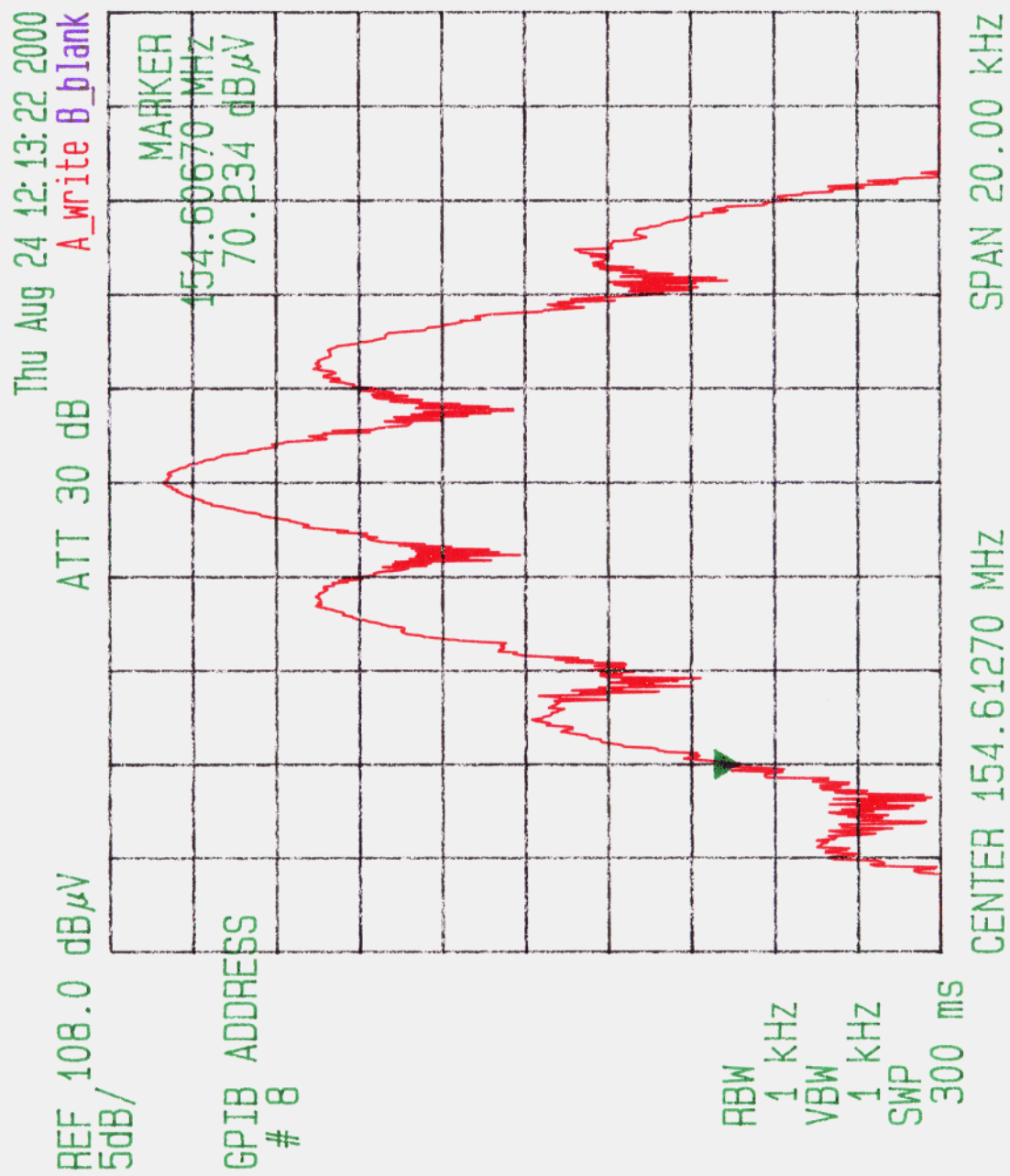


FIGURE A2



RADIATION SCIENCES INC.

APPENDIX B
RADIATION SCIENCES INC.
TEST REPORT NO. RSI-4963E
OPEN AREA TEST SITE
FCC PART 15 AND 18

APPENDIX C

**RADIATION SCIENCES INC.
CERTIFICATIONS AND ACCREDITATIONS**