



RADIATION SCIENCES INC.

TEST REPORT NO. RSI-2063E
ELECTROMAGNETIC INTERFERENCE (EMI)
OF THE
TACTICAL TECHNOLOGIES, INC.
MODEL # TX500
FCC PART 15, SUBPART C §15.231
MAY 2000

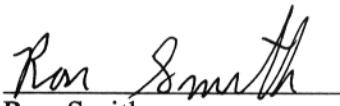
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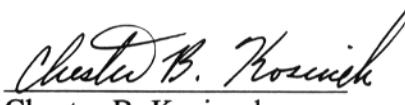

Chester B. Kosiorek
EMC Engineer
Radiation Sciences Inc.



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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: **TX500**

CONTRACT:

Purchase Order Number: 11338

TEST PERIOD:

8/9 May 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



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SUMMARY OF TEST RESULTS

The **Model # TX500**, 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 # TX500** presented by **Tactical Technologies** 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 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.



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2.0 DESCRIPTION OF THE TEST SAMPLE:

The test sample is a saw controlled FM transmitter operating at 418MHz.



3.0 TEST INSTRUMENTATION

RSI INV #	DESCRIPTION	MANUFACTURER	MODEL #	SERIAL #	LAST CAL DATE	CAL DUE DATE	C Y C L E	T Y P E
31	SPEC ANALYZER	ADVANTEST	R3271	J003583	2/23/2000	2/23/2001	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
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
91	ANTENNA	EMCO	3115	2023	5/22/2000	5/22/2001	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 # TX500** 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 # TX500** is 418.072MHz. Thus, the bandwidth cannot exceed 1.04MHz.

The measured bandwidth of the **TX500** is 141kHz 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 (Top) and the hi side 20dB down point (bottom).



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Model # TX500

Test Personnel: Chester Kosiorek
Date: 5/4/00

Bandwidth of Fundamental Frequency

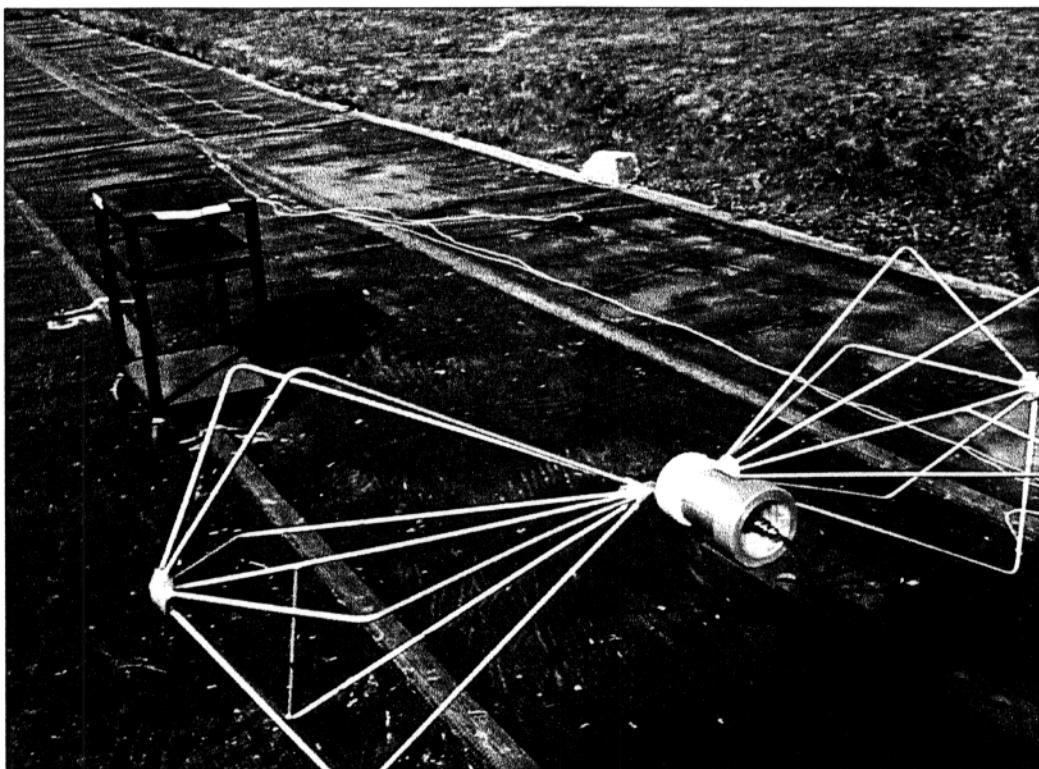
Frequency (MHz)	Measurement (dBuV/m)
Center Frequency	418.072
20dB Down	418.115
20dB Down	417.974

Bandwidth is 141 KHz

FIGURE 1



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Name: DCP01449.JPG
Dimensions: 1152 x 864 pixels

RADIATED EMISSION TEST SETUP PHOTOGRAPH

FIGURE 2

TX-500

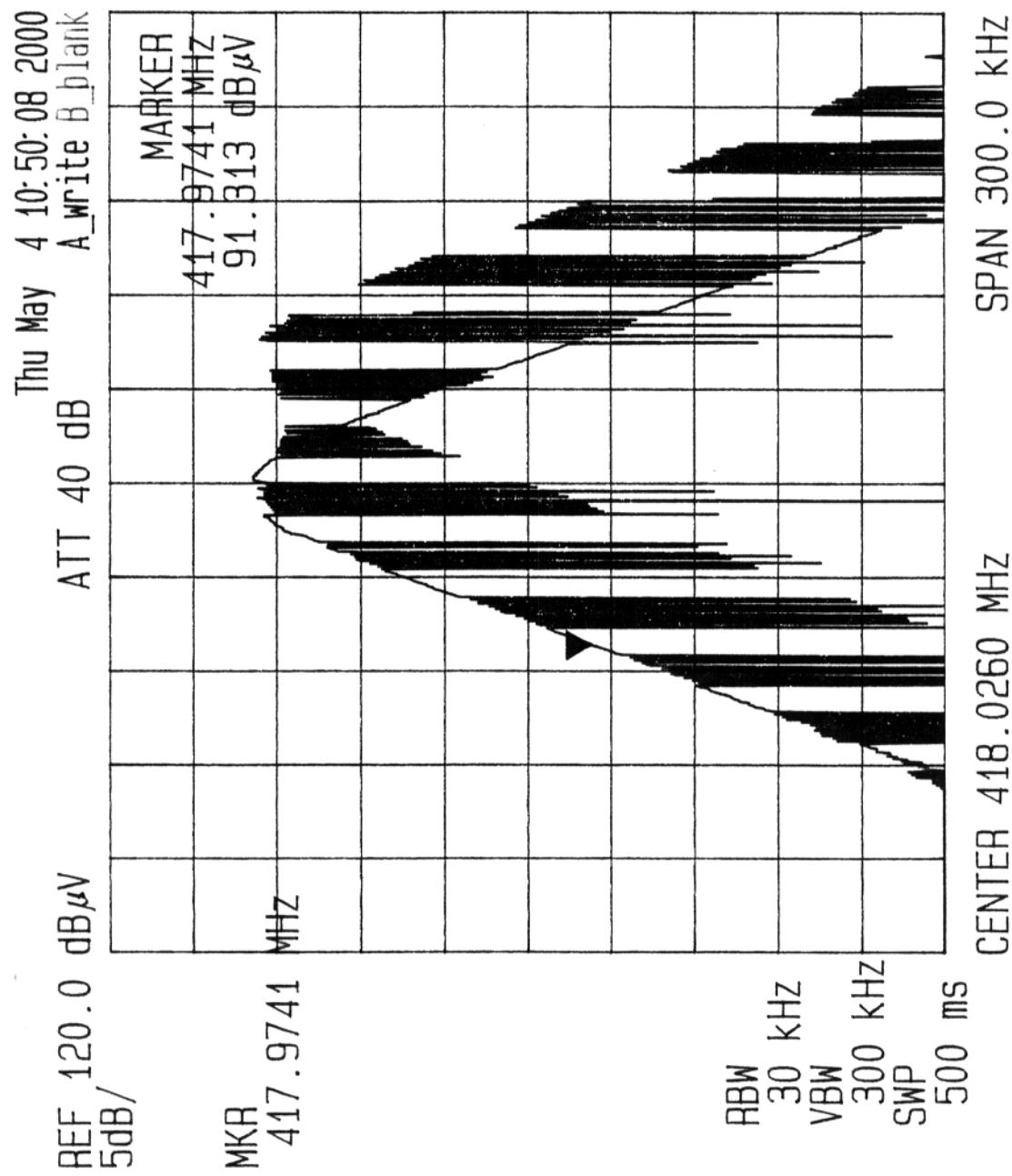


FIGURE 3



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 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 WITH THE EXCEPTION OF A MINOR OUTAGE AT 387.2MHZ IN HORIZONTAL ANTENNA PLANE IS 6dB OVER THE LIMIT FOR UNINTENTIONAL RADIATORS.



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Company: Tactical Technologies Inc.
Model # TX500

Test Personnel: Chester Kosiorek
Date: 5/9/00

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 (uV/m)	Field Strength @ 3m (uV/m)	Limits @ 3m (uV/m)	Margin (dB)
418.0	Vert	1.20	0	51.5	18.0	0.0	1.6	-20.0	51.1	72.3	359	4133.3	-21.2
836	Vert	1.20	0	16.0	23.0	0.0	4.0	-20.0	23.0	54.0	14	500	-31.0
1254	Vert	1.00	0	17.0	23.0	0.0	4.0	-20.0	24.0	54.0	16	500	-30.0
1672	Vert	1.00	0	24.0	24.0	0.0	4.0	-20.0	32.0	54.0	40	500	-22.0
2090	Vert	1.00	0	24.0	27.0	0.0	4.0	-20.0	35.0	54.0	56	500	-19.0
2508	Vert	1.00	0	23.5	28.0	0.0	4.0	-20.0	35.5	54.0	60	500	-18.5
2926	Vert	1.00	0	16.5	29.0	0.0	4.0	-20.0	29.5	54.0	30	500	-24.5
3344	Vert	1.00	0	17.5	31.0	0.0	4.0	-20.0	32.5	54.0	42	500	-21.5
3762	Vert	1.00	0	15.0	32.0	0.0	4.0	-20.0	31.0	54.0	35	500	-23.0
4180	Vert	1.00	0	18.5	33.0	0.0	4.0	-20.0	35.5	54.0	60	500	-18.5
418.0	Horiz	1.00	0	34.0	19.0	0.0	1.6	-20.0	34.6	72.3	54	4133.3	-37.7
836	Horiz	1.00	0	17.0	23.0	0.0	4.0	-20.0	24.0	54.0	16	500	-30.0
1254	Horiz	1.20	0	15.5	23.0	0.0	4.0	-20.0	22.5	54.0	13	500	-31.5
1672	Horiz	1.00	0	20.5	24.0	0.0	4.0	-20.0	28.5	54.0	27	500	-25.5
2090	Horiz	1.00	0	16.0	27.0	0.0	4.0	-20.0	27.0	54.0	22	500	-27.0
2508	Horiz	1.00	0	20.0	28.0	0.0	4.0	-20.0	32.0	54.0	40	500	-22.0
2926	Horiz	1.00	0	18.0	29.0	0.0	4.0	-20.0	31.0	54.0	35	500	-23.0
3344	Horiz	1.00	0	17.0	31.0	0.0	4.0	-20.0	32.0	54.0	40	500	-22.0
3762	Horiz	1.00	0	17.5	32.0	0.0	4.0	-20.0	33.5	54.0	47	500	-20.5
4180	Horiz	1.00	0	19.0	33.0	0.0	4.0	-20.0	36.0	54.0	63	500	-18.0

FIGURE 4



Company: Tactical Technologies
Model # TX500

Test Personnel: Chester B Kosiorek
Date: 5/4/00
Frequency Range Tested: 30 MHz - 1000MHz

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	10.0	11.0	0.8	21.8	40.0	12	100	-18.2	
60	Vert	1.00	0	11.0	10.0	1.3	22.3	40.0	13	100	-17.7	
120	Vert	1.00	0	8.0	12.0	2.4	22.4	43.5	13	150	-21.1	
200	Vert	1.00	0	9.0	15.0	3.4	27.4	43.5	23	150	-16.1	
300	Vert	1.00	0	8.0	15.5	4.0	27.5	46.0	24	200	-18.5	
387.2	Vert	1.00	0	26.0	20.0	4.0	50.0	46.0	316	200	4.0	
30	Horiz	1.00	0	10.0	11.0	0.8	21.8	40.0	12	100	-18.2	
60	Horiz	1.00	0	9.0	10.0	1.3	20.3	40.0	10	100	-19.7	
120	Horiz	1.00	0	11.0	12.0	2.4	25.4	43.5	19	150	-18.1	
200	Horiz	1.00	0	8.0	15.0	3.4	26.4	43.5	21	150	-17.1	
300	Horiz	1.00	0	9.0	15.0	4.0	28.0	46.0	25	200	-18.0	
387.2	Horiz	1.00	0	26.0	22.0	4.0	52.0	46.0	398	200	6.0	



5.0 CONCLUSIONS

The evaluation of the **Model # TX500**, 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 over 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 18dB 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.