



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

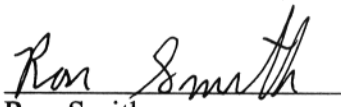
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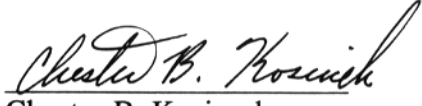

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TABLE OF CONTENTS

| <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 Posing Line Measurements, Paragraph §15.107 | 4 |
| 4.2 | Emission Bandwidth, FCC Part 15, Paragraph 15.231(c) | 5 |
| 4.3 | Radiated Emission Measurements | 9 |
| 5.0 | CONCLUSIONS | 9 |
| APPENDIX A | RSI's TEST PROCEDURES 4963E | ---- |
| APPENDIX B | RSI's CERTIFICATIONS | ---- |

LIST OF FIGURES

| | | |
|----------|--|----|
| FIGURE 1 | Bandwidth Data Sheet | 6 |
| FIGURE 2 | Radiated Emission Test Setup Photograph | 7 |
| FIGURE 3 | Fundamental Frequency Bandwidth Graph | 8 |
| FIGURE 4 | RE for Intentional Radiators (Data Sheet) | 10 |
| FIGURE 5 | RE for Unintentional Radiator (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: **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



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.



2.0 DESCRIPTION OF THE TEST SAMPLE:

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

**3.0 TEST INSTRUMENTATION**

| <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 | 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).

Company: Tactical Technologies Inc.
 Model # TX500

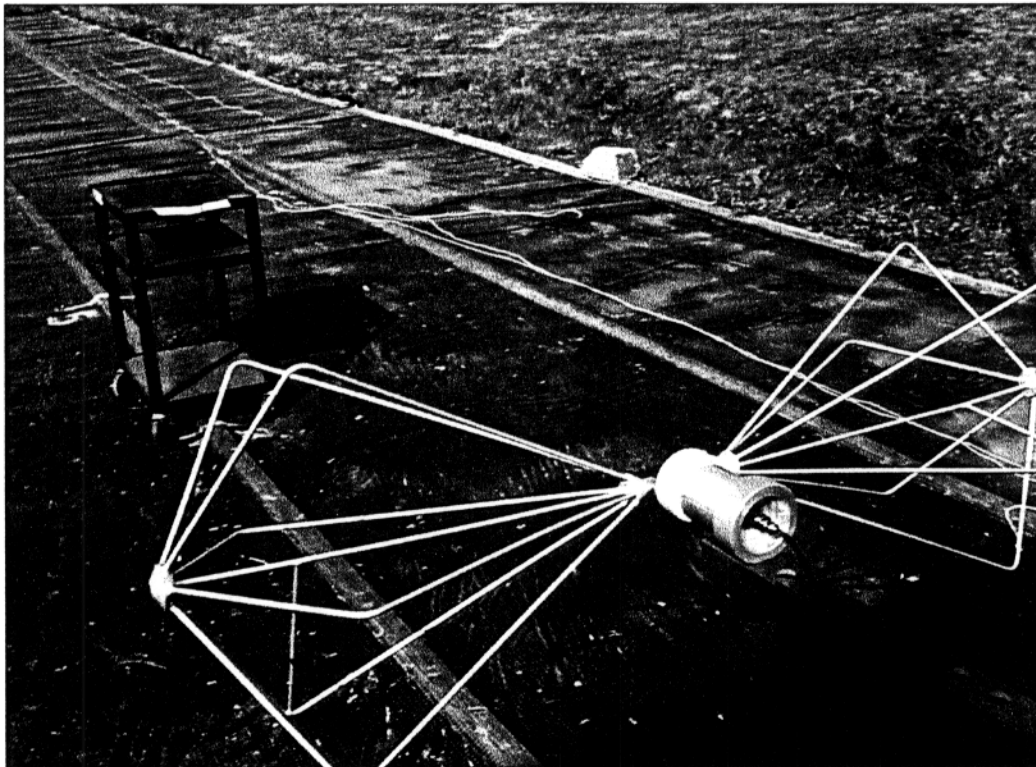
Test Personnel: Chester Kosiorek
 Date: 5/4/00

Bandwidth of Fundamental Frequency

| | Frequency (MHz) | Measurement (dBuV/m) |
|------------------|--------------------|-------------------------|
| Center Frequency | 418.072 | 111.5 |
| 20dB Down | 418.115 | 91.5 |
| 20dB Down | 417.974 | 91.5 |

Bandwidth is 141 KHz

FIGURE 1



Name: DCP01449.JPG
Dimensions: 1152 x 864 pixels

RADIATED EMISSION TEST SETUP PHOTOGRAPH

FIGURE 2

TX-500

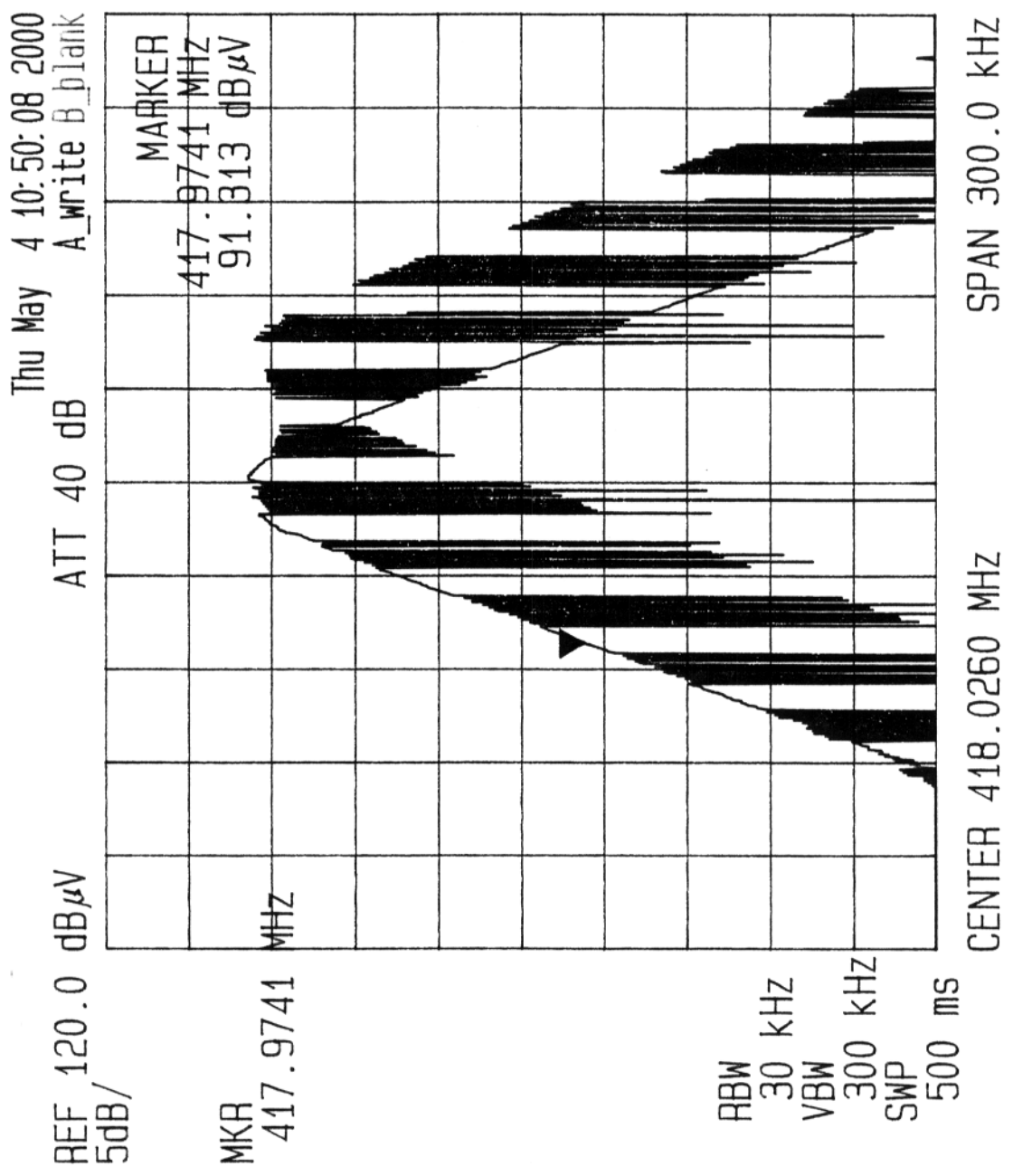


FIGURE 3



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.



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) | 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) |
|--------------------|----------|-------------------------------|---------------------------------|------------------------------|---------------------------|--|-----------------------|-----------------------------|---------------------------------------|----------------------------|-------------------------------------|--------------------------|----------------|
| 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 | |

FIGURE 5



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.