# TEST REPORT NO. RSI-2061E
# ELECTROMAGNETIC INTERFERENCE (EMI)
# OF THE
# TACTICAL TECHNOLOGIES INC.
# MODEL # ECHO 2W
# FCC PART 15, SUBPART C §15.231
# 11 MAY 2000

**PREPARED FOR:**

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**SUBMITTED BY:**

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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: **ECHO 2W**

**CONTRACT:**

Purchase Order Number: 1121

**TEST PERIOD:**

11 May 2000

**TEST FACILITY:**

**Radiation Sciences Incorporated (RSI)**, EMI/EMC Test Laboratory, located at: 651 North Cannon Avenue, Lansdale, PA 19446.

**TEST PERSONNEL AND COORDINATORS:**

| **Radiation Sciences Inc.** | **Tactical Technologies, Inc.** |
|---|---|
| Chet Kosiorek | Jeff Olsen |
| Ron Smith | |

## SUMMARY OF TEST RESULTS

The **Model # ECHO 2W**, 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 # ECHO 2W** 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 to40GHz", dated 17 July 1992.

## 2.0 DESCRIPTION OF THE TEST SAMPLE:

The test sample is a transmitter operating at 163.91MHz.

## 4.0 TEST RESULTS

### 4.1 Conducted Power Line Measurements, Paragraph §15.107

No measurements were performed on the **Model # ECHO 2W** 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 # ECHO 2W** is 164.9MHz. Thus, the bandwidth cannon exceed 411.5kHz.

The measured bandwidth of the **ECHO 2W** is 33.9kHz 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 # ECHO 2 W

Test Personnel: Chester Kosiorek
Date: 5/11/00

## Bandwidth of Fundamental Frequency

| | Frequency (MHz) | Measurement (dBuV/m) |
|---|---|---|
| Center Frequency | 163.91 | 91.1 |
| 20dB Down | 163.9288 | 70.75 |
| 20dB Down | 163.8949 | 70.75 |

Bandwidth is 33.9 KHz

FIGURE 1

**Radiated Emissions Test Setup Photographs**

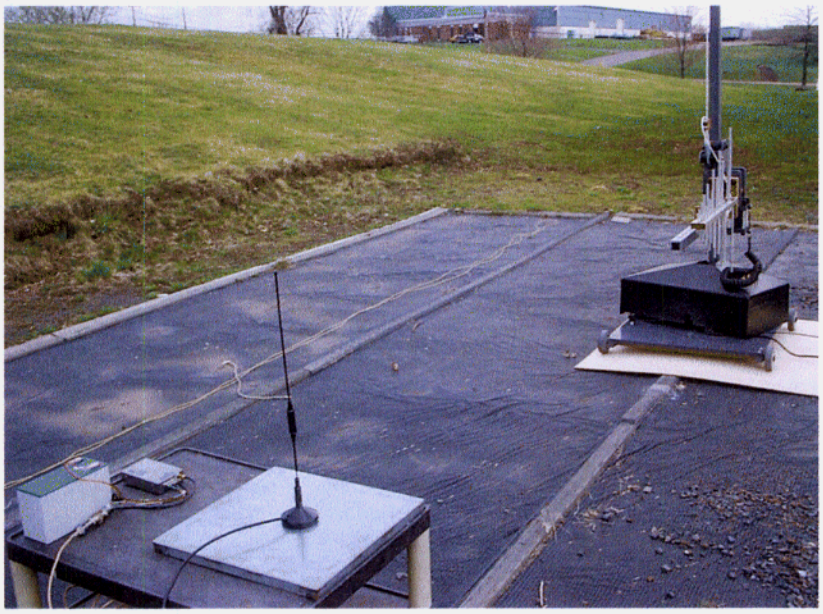
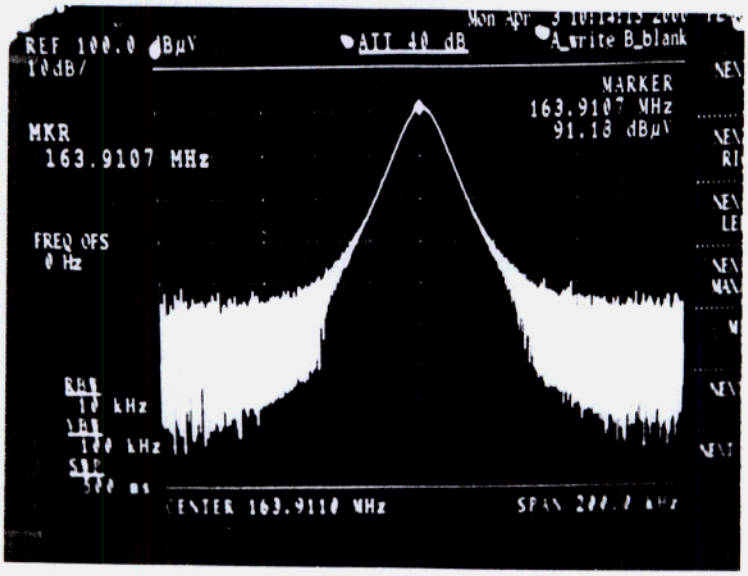
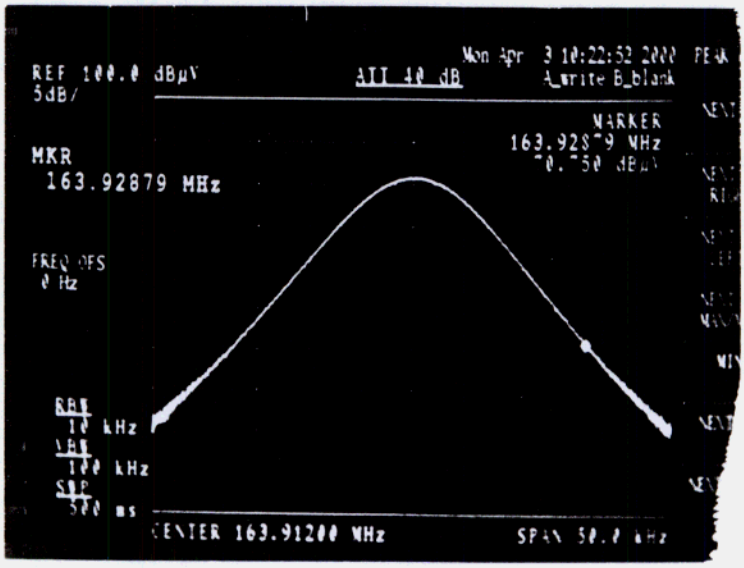


**Figure 2**




**PHOTOGRAPHS OF FUNDAMENTAL FREQUENCY BANDWIDTH AND AT 20dB DOWN**

**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 1.64GHz (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 TWO OUTAGES AT 136.6MHz AND 163.91MHz.**

Company: Tactical Technolgies Inc.
Model # ECHO2W

Test Personnel: Chester Kosiorek
Date: 5/11/00

## 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) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 163.91 | Vert | 1.00 | 0 | 97.0 | 13.0 | 0.0 | 1.6 | -20.0 | 91.6 | 70.5 | 38019 | 3349.6 | 21.1 |
| 327.83 | Vert | 1.90 | 0 | 22.0 | 15.0 | 0.0 | 2.0 | -20.0 | 19.0 | 48.4 | 9 | 263.05 | -29.4 |
| 655.65 | Vert | 2.90 | 0 | 16.0 | 19.0 | 0.0 | 4.0 | -20.0 | 19.0 | 54.0 | 9 | 500 | -35.0 |
| 819.56 | Vert | 1.40 | 0 | 12.0 | 22.0 | 0.0 | 4.0 | -20.0 | 18.0 | 54.0 | 8 | 500 | -36.0 |
| 1147.0 | Vert | 1.40 | 0 | 11.0 | 26.0 | 0.0 | 4.0 | -20.0 | 21.0 | 54.0 | 11 | 500 | -33.0 |
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| 163.91 | Horiz | 1.80 | 0 | 91.0 | 13.0 | 0.0 | 1.6 | -20.0 | 85.6 | 70.5 | 19055 | 3349.6 | 15.1 |
| 327.83 | Horiz | 1.90 | 0 | 26.0 | 15.0 | 0.0 | 2.0 | -20.0 | 23.0 | 48.4 | 14 | 263.05 | -25.4 |
| 655.65 | Horiz | 1.30 | 0 | 17.0 | 20.0 | 0.0 | 4.0 | -20.0 | 21.0 | 54.0 | 11 | 500 | -33.0 |
| 819.56 | Horiz | 1.30 | 0 | 15.0 | 22.0 | 0.0 | 4.0 | -20.0 | 21.0 | 54.0 | 11 | 500 | -33.0 |
| 1147.0 | Horiz | 1.30 | 0 | 9.0 | 26.0 | 0.0 | 4.0 | -20.0 | 19.0 | 54.0 | 9 | 500 | -35.0 |
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FIGURE 4

Company: Tactical Technologies
Model # ECHO2W

Test Personnel: Chester B Kosiorek
Date: 5/11/00
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 | 9.0 | 11.0 | 0.8 | 20.8 | 40.0 | 11 | 100 | -19.2 | |
| 136.6 | Vert | 1.00 | 0 | 38.5 | 13.0 | 1.3 | 52.8 | 43.5 | 437 | 150 | 9.3 | |
| 350.19 | Vert | 1.00 | 0 | 8.0 | 17.0 | 2.4 | 27.4 | 46.0 | 23 | 200 | -18.6 | |
| 560.30 | Vert | 1.00 | 0 | 15.0 | 18.0 | 3.4 | 36.4 | 46.0 | 66 | 200 | -9.6 | |
| 700.04 | Vert | 1.00 | 0 | 11.0 | 21.0 | 4.0 | 36.0 | 46.0 | 63 | 200 | -10.0 | |
| 1000 | Vert | 1.00 | 0 | 12.5 | 25.0 | 4.0 | 41.5 | 54.0 | 119 | 500 | -12.5 | |
| | | | | | | | | | | | | |
| 30 | Horiz | 1.00 | 0 | 11.0 | 11.0 | 0.8 | 22.8 | 40.0 | 14 | 100 | -17.2 | |
| 136.6 | Horiz | 1.00 | 0 | 38.5 | 13.0 | 1.3 | 52.8 | 43.5 | 437 | 150 | 9.3 | |
| 350.19 | Horiz | 1.00 | 0 | 8.0 | 22.0 | 2.4 | 32.4 | 46.0 | 42 | 200 | -13.6 | |
| 560.30 | Horiz | 1.00 | 0 | 20.0 | 19.5 | 3.4 | 42.9 | 46.0 | 140 | 200 | -3.1 | |
| 700.04 | Horiz | 1.00 | 0 | 11.0 | 21.0 | 4.0 | 36.0 | 46.0 | 63 | 200 | -10.0 | |
| 1000 | Horiz | 1.00 | 0 | 12.5 | 25.0 | 4.0 | 41.5 | 54.0 | 119 | 500 | -12.5 | |



FIGURE 5

## 5.0 CONCLUSIONS

The evaluation of the **Model # ECHO 2W**, 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 9.3dB 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 36.6dB over 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.

A

# APPENDIX B

## RSI'S TEST PROCEDURES 4963E

Appendix B

Certs