



TEST REPORT NO. RSI-2067E
ELECTROMAGNETIC INTERFERENCE (EMI)
OF THE
TACTICAL TECHNOLOGIES, INC.
MODEL # CST-2001/V
4 AUGUST 2000

PREPARED FOR:

TacticalTechnologies, Inc.
1701 Second Avenue
Folsom, PA 19033

SUBMITTED BY:

Radiation Sciences Inc.
3131 Detwiler Road
Harleysville, PA 19438

PREPARED BY:

Ron Smith
EMC Test Technician
Radiation Sciences Inc.

REVIEWED BY:

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: **CST-2001/V**

CONTRACT:

Purchase Order Number: 1121

TEST PERIOD:

30-31 March 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.

Chet Kosiorek
Ron Smith

Tactical Technical, Inc.

Jeff Olsen



SUMMARY OF TEST RESULTS

The **Model CST-2001/V**, 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 CST-2001/V** 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 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 2 channel synthesized transmitter operating at 154.6MHz (250NW Voice).

**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 measures were performed on the **Model # CST-2001/V** because it is a battery operated unit.



4.2 Emission Bandwidth, FCC Part 15, §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 CST-2001/V** is 154.6MHz. Thus, the bandwidth cannot exceed 411.5kHz.

The measured bandwidth of the **CST-2001/V** is 34.5kHz 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: Tactical Technologies Inc.
Model # CST2001/V

Test Personnel: Chester Kosiorek
Date: 3/30/00

Bandwidth of Fundamental Frequency

	Frequency (MHz)	Measurement (dBuV/m)
Center Frequency	154.6	121
20dB Down	154.6167	101
20dB Down	154.5822	101

Bandwidth is 34.5KHz

FIGURE 1



Radiated Emissions Test Setup Photographs

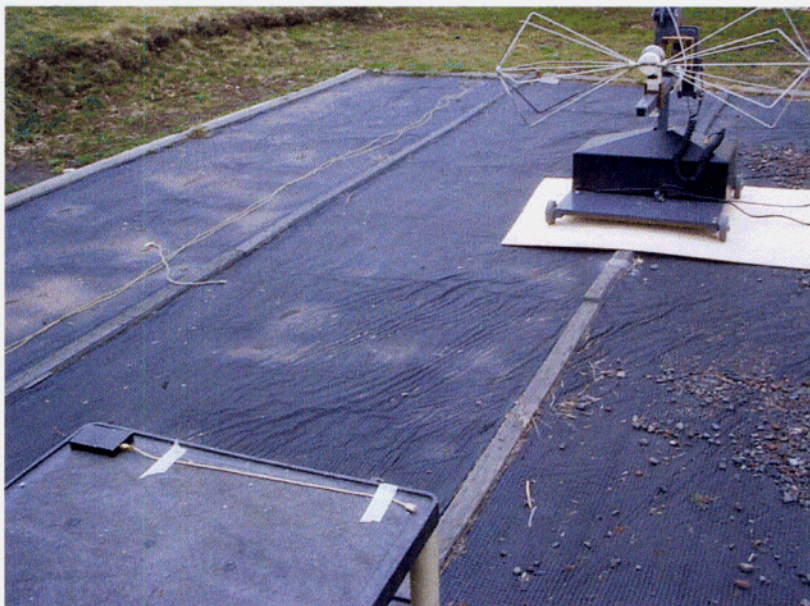
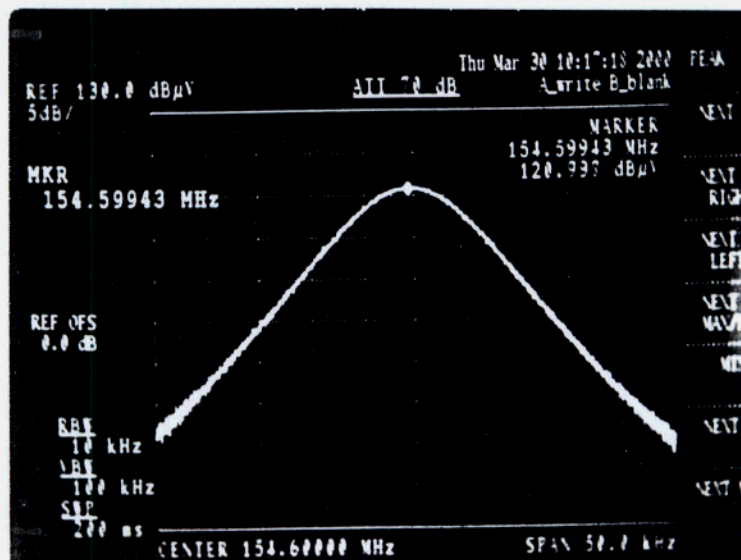


Figure 2



FUNDAMENTAL FREQUENCY BANDWIDTH PHOTOGRAPH

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 minimize the emission.

During radiated emissions the EUT was scanned from 30MHz to 1.54GHz (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.

NOTE:

During the intentional radiated emissions test of the fundamental signal (154.6MHz) a level of 26.7dB above the limit was recorded while the antenna was positioned horizontally.

Company: Tactical Technologies Inc.
Model # CST2001/V

Test Personnel: Chester Kosiorek
Date: 3/31/00

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)
154.6	Vert	1.20	0	79.0	13.0	0.0	0.2	-20.0	72.2	60.5	4074	1059.091	11.7
309.2	Vert	1.00	0	15.5	15.5	0.0	2.0	-20.0	13.0	47.3	4	232	-34.3
463.8	Vert	2.10	0	17.0	18.5	0.0	3.5	-20.0	19.0	54.0	9	500	-35.0
618.4	Vert	1.00	0	14.5	19.0	0.0	4.0	-20.0	17.5	54.0	7	500	-36.5
927.6	Vert	1.00	0	15.0	24.0	0.0	4.0	-20.0	23.0	54.0	14	500	-31.0
1082.2	Vert	1.90	0	13.0	26.0	0.0	4.0	-20.0	23.0	54.0	14	500	-31.0
154.6	Horiz	1.90	0	94.0	13.0	0.0	0.2	-20.0	87.2	60.5	22909	1059.091	26.7
309.2	Horiz	1.00	0	29.0	16.0	0.0	2.0	-20.0	27.0	47.3	22	232	-20.3
463.8	Horiz	1.00	0	23.0	19.5	0.0	4.0	-20.0	26.5	53.8	21	489.66	-27.3
618.4	Horiz	1.50	0	23.5	20.0	0.0	4.0	-20.0	27.5	54.0	24	500	-26.5
927.6	Horiz	1.00	0	23.0	24.0	0.0	4.0	-20.0	31.0	54.0	35	500	-23.0
1082.2	Horiz	1.00	0	14.0	26.0	0.0	4.0	-20.0	24.0	54.0	16	500	-30.0

FIGURE 4

Company: Tactical Technologies
 Model # CST2001/V
 Serial # 114

Test Personnel: Chester B Kosiorek
 Date: 3/31/00
 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	7.6	11.0	0.8	19.4	40.0	9	100	-20.6	
109	Vert	1.00	0	12.0	11.0	1.3	24.3	43.5	16	150	-19.2	
219	Vert	1.00	0	9.0	15.0	2.1	26.1	46.0	20	200	-19.9	
30	Horiz	1.00	0	5.4	11.0	0.8	17.2	40.0	7	100	-22.8	
109	Horiz	1.00	0	14.0	11.0	1.3	26.3	43.5	21	150	-17.2	
219	Horiz	1.00	0	10.0	15.0	2.1	27.1	46.0	23	200	-18.9	

FIGURE 5



5.0 CONCLUSIONS

The evaluation of the **Model # CST-2001/V**, 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.
2. The **EUT** did not meet the radiated emission limits for intentional radiators set forth in §15.205, §15.209 and §15.231. The highest measurement was over the limit (26.7dB) at 154.6MHz.
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.