EMC INTEGRITY INCORPORATED

8475 West I-25 Frontage Road, Suite 200
Longmont, Colorado 80504
Phone: (303) 776-7249
FAX: (303) 776-7314

EMC Immunity Test Report

#TRA10101 for the

TX-1000

Manufactured by

Tensitron, Inc.

Mark Kelley
Tested by

Shanna Custis
Prepared by

Vincent W. Bush
Approved by

19 July 2001

Prepared for:

Tensitron, Inc.
1668 Valtec Lane
Boulder, Colorado 80301
Phone: (303) 444-5383
Fax: (303) 444-0204

Customer Representative:

Stan Saxl
Engineer

Tested at:

EMC Integrity, Inc.
8475 West I-25 Frontage Road, Suite 200
Longmont, Colorado 80504

Tested by:

Mark A. Kelley
EMC Test Engineer

Report Prepared by:

Shauna L. Custer
Administration

Report Approved by:

Vincent W. Greb
President

TABLE OF CONTENTS

LIST OF APPENDICES

Prefatory Note

There are four environments defined by EN 61326-1: 1997. These are

1) the general requirements defined in Part 1
2) the requirements for industrial locations defined in Annex A
3) the requirements defined for controlled EM environments defined in Annex B
4) the requirements defined for portable test and measurement equipment defined in Annex C

This product was tested to the requirements defined in Annex A for industrial locations.

1.0 TEST SUMMARY

1.1 Product Description

The unit under test (UUT) was the TX-1000. The serial number of the device tested was **240XA**. This unit is a tension and speed meter for wire manufacturing. It was tested to the requirements defined in Annex A of EN 61326-1 for use in industrial locations.

1.2 Test Standards Used

The standard applied to this product was EN 61326-1: 1997, which is the product standard for laboratory equipment. Annex A was applied. The normative references of this standard define the test methods used for the immunity testing. This information is summarized in Tables 1-1.

Table 1-1

Requirement	Specification	Test Method	Performance Criteria
EN 61326-1: 1997, Electrical Equipment for Measurement, Control and Laboratory Use - Part 1: General Requirements	Electrostatic Discharge	EN 61000-4-2: 1995	(B) Self-Recovering
	Radiated RF Immunity	EN 61000-4-3: 1995	(A) No Degradation
	Electrical Fast Transient/Burst	EN 61000-4-4: 1995	(B) Self-Recovering
	Surge Immunity	EN 61000-4-5: 1995	(B) Self-Recovering
	Conducted RF Immunity	EN 61000-4-6: 1996	(A) No Degradation
	Voltage Dips, Interrupts	EN 61000-4-11: 1994	(B) Self-Recovering

1.3 Immunity Test Results

The UUT **complied** with all the immunity requirements defined by EN 61326-1: 1997, Annex A. Test results are summarized in Table 1-2.

Table 1-2

Specification	Test Method	Test Conditions	Compliance
Electrostatic Discharge	EN 61000-4-2	± 4 kV Contact / HCP, VCP / ± 8 kV Air	Compliant
Radiated RF Immunity	EN 61000-4-3	80 - 1000 MHz, 10 V/m, 80% 1 kHz AM	Compliant
EFT/Burst	EN 61000-4-4	1.0 kV I/O, 2.0 kV AC mains	Compliant
Surge Immunity	EN 61000-4-5	2.0 kV common mode, 1.0 kV differential mode, AC mains	Compliant
Conducted RF Immunity	EN 61000-4-6	150 kHz to 80 MHz, 3 Vrms, 80% 1 kHz AM, power and I/O > 3 meters	Compliant
Voltage Dips and Interrupts	EN 61000-4-11	100% reduction, 0.5 cycle, positive (90 deg) 100% reduction, 0.5 cycle, negative (270 deg)	Compliant

1.4 Modifications Required for Compliance

All final modifications are listed in Section 5.1 of the Product Data Sheet, contained in Appendix H of this report.

2.0 SCOPE

2.1 Purpose

This report documents the test efforts performed on Sweeper to verify compliance to the 1997 version of EN 61326-1, Electrical Equipment for Measurement, Control and Laboratory Use - Annex A: Industrial Locations. This was a formal qualification test and was conducted on selected days over the period from 8 January through 25 June 2001.

2.2 Test Plan

Testing was performed in accordance with EN 61326-1: 1997. The Product Data Sheet, located in Appendix H of this report, defines the critical operational parameters for testing, and also provides general product information.

2.3 Test Parameters

For radiated RF immunity testing, the UUT was configured in the completely anechoic-lined chamber (CALC) on a non-conductive table 80 cm above the floor of the chamber. The UUT was a stand-alone unit with no support equipment being required.

The critical parameter for this unit was **cable tension**.

2.4 Definition of Performance Criterion for the UUT

The performance criteria for laboratory and measurement equipment are defined as follows:

Level A: During testing, normal performance within specification limits.
Level B: During testing, temporary degradation or loss of function or performance which is self-recovering
Level C: During testing, temporary degradation, or loss of function which requires operator intervention or system reset occurs.
Level D: Degradation or loss of function which is not recoverable due to damage to equipment components, software, or to loss of data.

Performance criteria, as applied to this product are defined follows:

Change in tension readout no greater than ±10 counts.

This information is also contained in Section 4.0 of the Product Data Sheet, contained in Appendix H of this report.

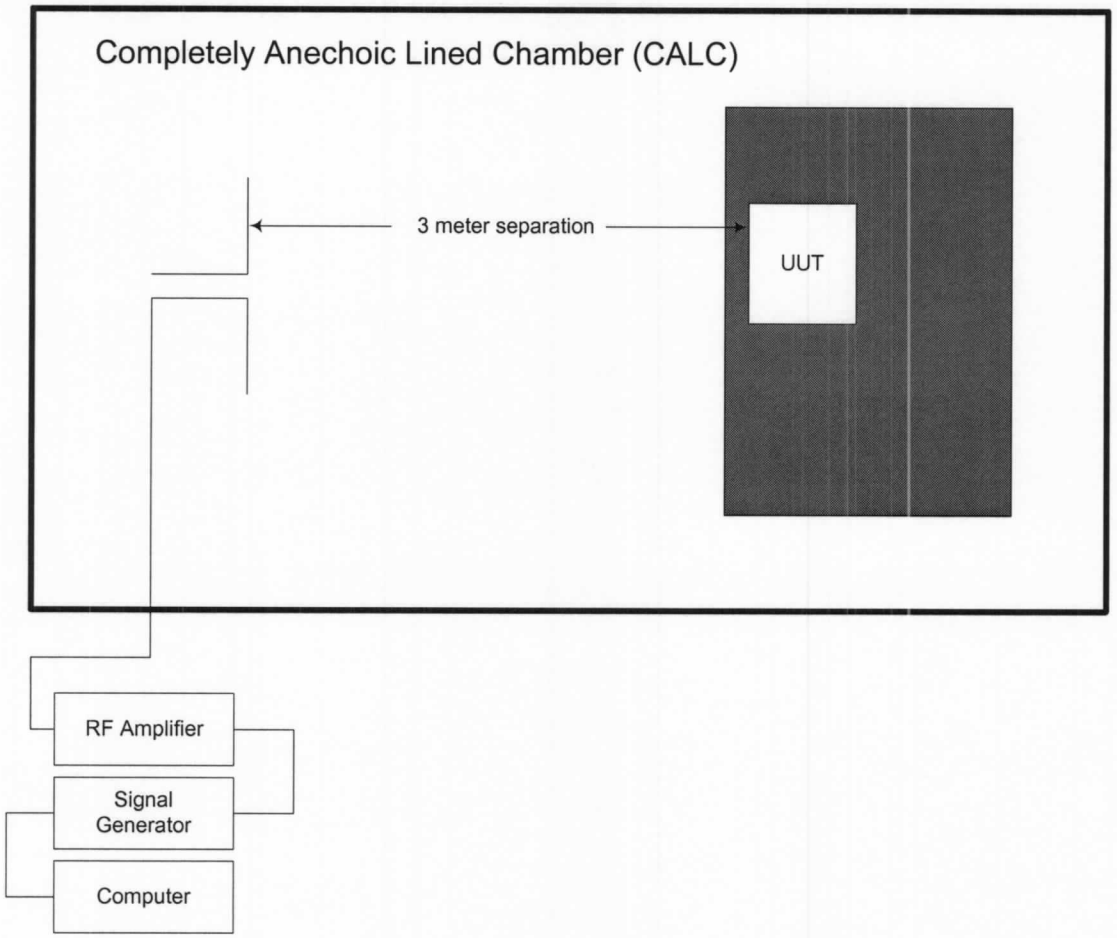


Figure 1. Test Configuration for UUT in CALC.

3.0 TEST ENVIRONMENT

3.1 Immunity Test Site

The immunity testing was performed at EMCI's test facility in Longmont, Colorado. The radiated field immunity testing was performed in a ferrite lined, shielded enclosure. The enclosure is 10' high x 12' wide x 20' long in size and meets the field uniformity requirements of EN 61000-4-3. The size of the chamber allows 3-meter separation between the antenna and the UUT.

All other immunity testing was performed on a ground plane measuring 3.0 meters by 3.6 meters (10.8 square meters). The ground plane was connected to facility ground via the safety ground of the AC wire and extended beyond the UUT by greater than 0.5 meters, as required by the test standards.

3.2 Harmonics Testing

Power line harmonics testing was also performed on the ground plane. This measurement was performed using a computer-controlled power analyzer which measured the amplitude of current harmonics up to and including the 40th harmonic (i.e., 2 kHz).

3.3 Test Sample Description

The unit under test (UUT) was the TX-1000. It is manufactured by the Tensitron, Inc., located in Boulder, Colorado. During testing, the UUT was continually exercised and monitored for any deviations in performance.

4.0 EN 61000-4-2: 1995, Electrostatic Discharge

4.1 Summary of Test Results

Electrostatic discharge (ESD) testing was performed on the UUT to the levels specified in EN 61000-4-2: 1995. Contact discharge was performed at levels of ± 2 kV and ± 4 kV at applicable (conductive) test points. Air discharge was performed for non-conductive surfaces of the product at levels of ±2 kV, ± 4 kV and ± 8 kV. Indirect discharge to the horizontal coupling plane (HCP) and the vertical coupling plane (VCP) were also performed to levels of ± 2 kV and ± 4 kV.

The UUT exhibited no malfunctions and operated within specified tolerances and therefore, complies with the requirements of this test.

4.2 Test Setup

The UUT was set up per EN 61000-4-2 and tested to the levels specified by EN 61326-1: 1997, Annex A.

4.3 Special Configurations

N/A

4.4 Performance Criteria: Level B

After the test, the equipment shall continue to operate as intended without operator intervention. No degradation of performance or loss of function is allowed after the RF environment has been withdrawn.

4.5 Deviations from Test Procedures

N/A

4.6 Test Data

See APPENDIX A for details.

4.7 Temperature and Humidity

The temperature was 22°C, the relative humidity was 30 % and the barometric pressure was 829.7 millibars.

5.0 EN 61000-4-3: 1995, Radiated RF Immunity

5.1 Summary of Test Results

Radiated RF immunity testing was performed in accordance with EN 61000-4-3: 1995. The UUT was placed on a non-conductive table 80 cm above the floor of the chamber and 3 meters from the radiating antenna; which was 1.5 meters above the floor of the chamber. Testing was performed in both horizontal and vertical antenna polarizations over the frequency range from 80 MHz to 1 GHz. The UUT was rotated on the table so that all four sides were illuminated in the 10 V/m field. The frequency was stepped in 1% increments and a dwell time of 3 seconds was used at each test frequency. The radiated field was amplitude modulated with a 1 kHz sine wave to a depth of 80%. Performance of the unit was monitored with the support equipment, located outside the CALC. During all testing, the UUT exhibited no malfunctions and operated within specified tolerances and therefore, complies with the requirements of this test.

5.2 Test Setup

The UUT was set up per EN 61000-4-3 and tested to the levels specified by EN 61326-1: 1997, Annex A.

5.3 Special Configurations

N/A

5.4 Performance Criteria: Level A

The equipment shall continue to operate as intended without operator intervention. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer when the equipment is used as intended.

5.5 Deviations from Test Procedures

The exception for ITU broadcast bands, defined in EN 61000-6-2: 1999, was invoked for the 470 to 790 MHz range. This was due to the fact that the UUT exhibited a 2 dB non-compliance when exposed to the 10 V/m field from 500 to 550 MHz. Thus, in this frequency range, the UUT complies with the 3 V/m field requirement with 8.5 dB of margin.

5.6 Test Data

See APPENDIX B for details.

5.7 Temperature and Humidity

The temperature was 25° C and the relative humidity was 38 %.

6.0 EN 61000-4-4: 1995, Electrical Fast Transient/Burst

6.1 Summary of Test Results

Electrical fast transient/burst testing was performed on the UUT in accordance with EN 61000-4-4: 1995. The AC power was tested via direct injection to ± 2 kV. As the UUT had no I/O cabling, no capacitive clamp testing was performed. During all testing, the UUT exhibited no malfunctions and operated within specified tolerances and therefore, complies with the requirements of this test.

6.2 Test Setup

The UUT was set up per EN 61000-4-4 and tested to the levels specified by EN 61326-1: 1997, Annex A.

6.3 Special Configurations

N/A

6.4 Performance Criteria: Level B

After the test, the equipment shall continue to operate as intended without operator intervention. No degradation of performance or loss of function is allowed after the RF environment has been withdrawn.

6.5 Deviations from Test Procedures

N/A

6.6 Test Data

See APPENDIX C for details.

6.7 Temperature and Humidity

The temperature was 22° C and the relative humidity was 28 %.

7.0 EN 61000-4-5: 1995, Surge Immunity

7.1 Summary of Test Results

Surge immunity testing was performed on the UUT in accordance with EN 61000-4-5: 1995. The AC power of the UUT was tested via direct injection at levels of ±0.5 kV and ±1.0 kV for differential mode and at levels of ±0.5 kV, ±1.0 kV and ±2.0 kV for common mode. Surges were injected at 0 degrees, 90 degrees and 270 degrees of the input ac waveform at a rate of one pulse per minute. Five pulses were injected for each test configuration. The UUT exhibited no malfunctions or degradations in performance and therefore, passed all requirements of the test.

7.2 Test Setup

The UUT was set up per EN 61000-4-5 and tested to the levels specified by EN 61326-1: 1997, Annex A.

7.3 Special Configurations

N/A

7.4 Performance Criteria: Level B

After the test, the equipment shall continue to operate as intended without operator intervention. No degradation of performance or loss of function is allowed after the RF environment has been withdrawn.

7.5 Deviations from Test Procedures

N/A

7.6 Test Data

See APPENDIX D for details.

7.7 Temperature and Humidity

The temperature was 21° C and the relative humidity was 29 %.

8.0 EN 61000-4-6: 1996, Conducted RF Immunity

8.1 Summary of Test Results

Conducted RF immunity testing was performed on the UUT in accordance with EN 61000-4-6: 1996. The UUT was subjected to injected RF signals on its input AC power cable. Injection on the AC leads was performed via a coupling/decoupling network (CDN). As the UUT had no I/O cabling, EM clamp testing was not performed. The test frequency was stepped in 1% increments with a 3 second dwell time for each injection frequency. Injection levels were 3 Vrms with 1 kHz AM to a depth of 80%.

At no time did the UUT exhibit any malfunctions or degradations in performance; thus, the UUT passed all portions of this test.

8.2 Test Setup

The UUT was set up per EN 61000-4-6 and tested to the levels specified by EN 61326-1: 1997, Annex A.

8.3 Special Configurations

N/A

8.4 Performance Criteria: Level A

The equipment shall continue to operate as intended without operator intervention. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer when the equipment is used as intended.

8.5 Deviations from Test Procedures

N/A

8.6 Test Data

See APPENDIX E for details.

8.7 Temperature and Humidity

The temperature was 22° C and the relative humidity was 28 %.

9.0 EN 61000-4-11: 1994, Voltage Dips and Interrupts

9.1 Summary of Test Results

Voltage dip and interrupt testing was performed on the UUT, in accordance with EN 61000-4-11: 1994. The UUT was subjected to the following voltage fluctuations on its AC power input:

100 % reduction for 0.01 second	dip (positive)
100 % reduction for 0.01 second	dip (negative)

These variations in AC line voltage had no effect on the UUT, which passed the requirements of this test.

9.2 Test Setup

The UUT was set up per EN 61000-4-11 and tested to the levels specified in EN 61326-1: 1997, Annex A.

9.3 Special Configurations

N/A

9.4 Performance Criteria: Level B

Level B. After the test, the equipment shall continue to operate as intended without operator intervention. No degradation of performance or loss of function is allowed after the RF environment has been withdrawn.

9.5 Deviations from Test Procedures

N/A

9.6 Test Data

See APPENDIX F for details.

9.7 Temperature and Humidity

The temperature was 22° C and the relative humidity was 28 %.

10.0 EN 61000-3-2: 1998, Power Line Harmonics

10.1 Summary of Test Results

Power frequency harmonics from the UUT were measured on its AC power input with the unit in normal operating mode. The power source was a 230 Vac/50 Hz source. Integral to the power source was the measurement hardware/firmware and harmonic amplitudes were recorded to the computer and printed out on a hardcopy.

The UUT complied with the harmonic emission limits for Class A hardware.

10.2 Test Setup

The UUT was set up per EN 61000-3-2.

10.3 Special Configurations

N/A

10.4 Performance Criteria

Harmonic emissions were compared to the limit for Class A hardware, as derived from Figure 2 of EN 61000-3-2.

10.5 Deviations from Test Procedures

N/A

10.6 Test Data

See APPENDIX G for data sheets and test setup pictures.

10.7 Temperature and Humidity

The temperature was 22° C and the relative humidity was 30 %.

APPENDIX A

Electrostatic Discharge Test Data

EMC Integrity, Inc.

8475 W. I-25 Frontage Rd.
Longmont, CO 80504

Electrostatic Discharge Immunity

Customer Name: TENSITRON, INC. Project Number: A10101

Customer Representative: Stan Saxl Test Area: GP #1

Model: TX-1000 S/N: 240 XA

Date: 10 JAN 01 Temperature: 22 deg C Humidity: 30 % Pressure: 829.7 mBar

Test Specification: EN 61000-4-2:1995 REF: EN 61326-1/A1:1997

Input AC Voltage: ☐ 115 Vac/60 Hz ☐ 230 Vac/50 Hz ☑ Other: 7.5 V DC Picture ✓

Test Location	Voltage Level (kV)	Polarity +	Polarity -	Number of Pulses	Pulses Per Second	Comments	Pass/ Fail
						Contact Discharge	P
VCP	2.0	*	*	10	1		
HCP	4.0	*	*	10	1		
Front	2.0	*	*	10	1		
2 pts	4.0	*	*	10	1		
Right/Left	2.0	*	*	10	1		
3 pts/side	4.0	*	*	10	1		
Back	2.0	*	*	10	1		
4 pts	4.0	*	*	10	1		
						Air Discharge	
Display	2.0	*	*	N/D	-		
Panel	4.0	*		3	1		
	4.0		*	N/D	-		
Panel	8.0	*		8	1		
	8.0		*	N/D	-		✓

Test Engineer Mark Kelley

Figure A1. Electrostatic Discharge Test Setup. (esd.jpg)

APPENDIX B

Radiated RF Immunity Test Data

EMC Integrity, Inc.

8475 W. I-25 Frontage Rd.
Longmont, CO 80504

Radiated RF Field Immunity

Customer Name: TENSITRON, INC. Project Number: A10101

Customer Representative: Stan Saxl Test Area: CALC

Model: TX-1000 S/N: 240 XA

Date: 25 JUN 01 Temperature: 25 deg C Humidity: 38 %

Test Specification: EN 61000-4-3:1997 REF: EN 61326-1/A1:1997 Picture(s) ✓✓✓✓

Input AC Voltage: ☐ 115 Vac/60 Hz ☐ 230 Vac/50 Hz ☑ Other: 7.5 V DC

Frequency (MHz)	Modulation Type	%	Freq.	Field (V/m)	Polarity V or H	Dwell (sec.)	Comments	Pass/ Fail
80	AM	80	1kHz	10	H	3	Front	P
~								
200								
80					V			
~								
200								
200					H			
~								
1000								
200					V			
~								
1000								
200	AM	80	1kHz	10	V	3	Left	P
~								
1000								
200					H			
~								
1000								
80					H			
~								
200								
80					V			
~								
200								

Test Engineer Mark Kelley

EMC Integrity, Inc.

8475 W. I-25 Frontage Rd.
Longmont, CO 80504

Radiated RF Field Immunity

Customer Name: TENSITRON, INC. Project Number: A10101

Customer Representative: Stan Saxl Test Area: CALC

Model: TX-1000 S/N: 240 XA

Date: 25 JUN 01 Temperature: 25 deg C Humidity: 38 %

Test Specification: EN 61000-4-3:1997 REF: EN 61326-1/A1:1997

Input AC Voltage: ☐ 115 Vac/60 Hz ☐ 230 Vac/50 Hz ☑ Other: 7.5 v DC

Frequency (MHz)	Modulation Type	%	Freq.	Field (V/m)	Polarity V or H	Dwell (sec.)	Comments	Pass/ Fail
80	AM	80	1kHz	10	V	3	Right	P
~								
200								
80					H			
~								
200								
200					H			
~								
1000								
200					V			
~								
1000								√
200	AM	80	1kHz	10	V	3	Back	P
~								
1000								
200					H			
~								
1000								
80					H			
~								
200								
80					V			
~								
200								√

Test Engineer Mark Kelley

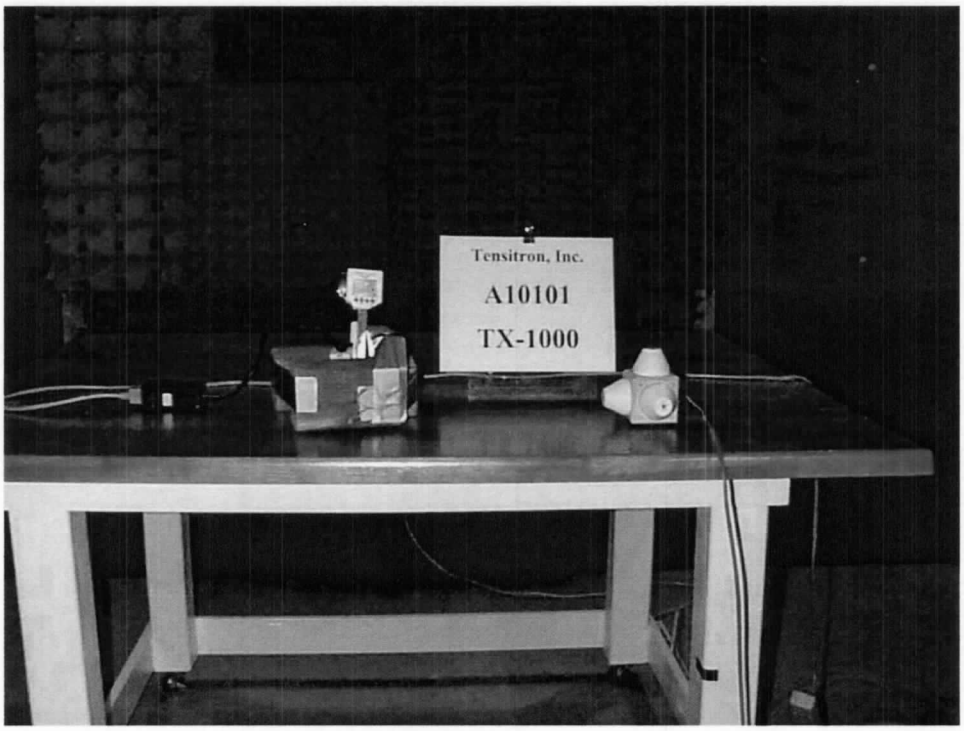


Figure B1. Radiated RF Immunity Test Setup: Front Side. (ri_a.jpg)

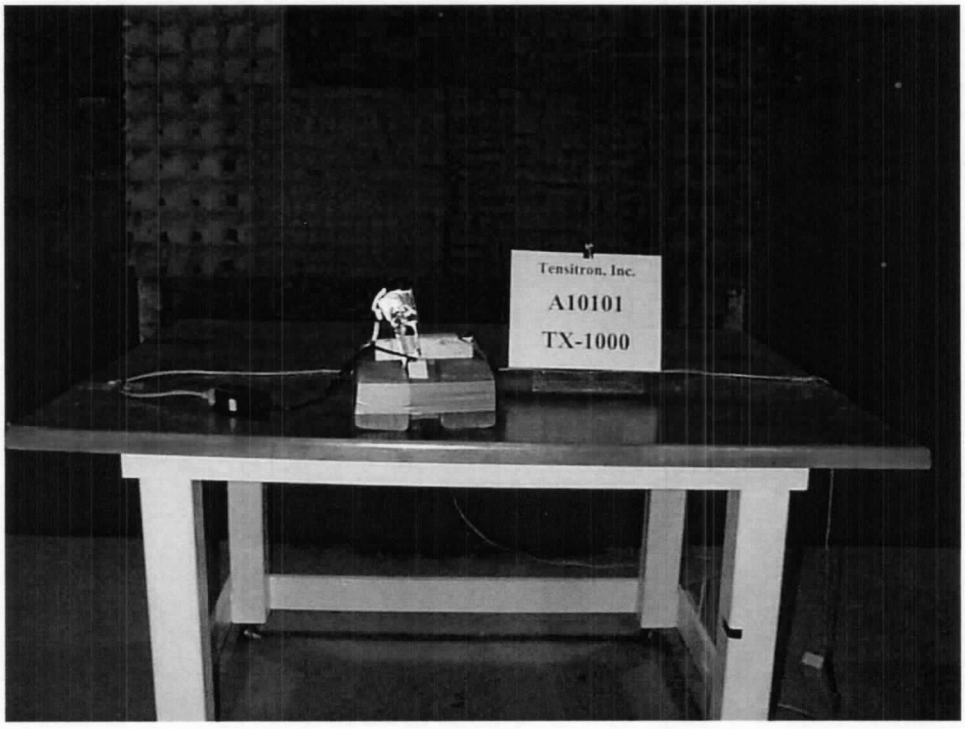


Figure B2. Radiated RF Immunity Test Setup: Left Side. (ri_b.jpg)

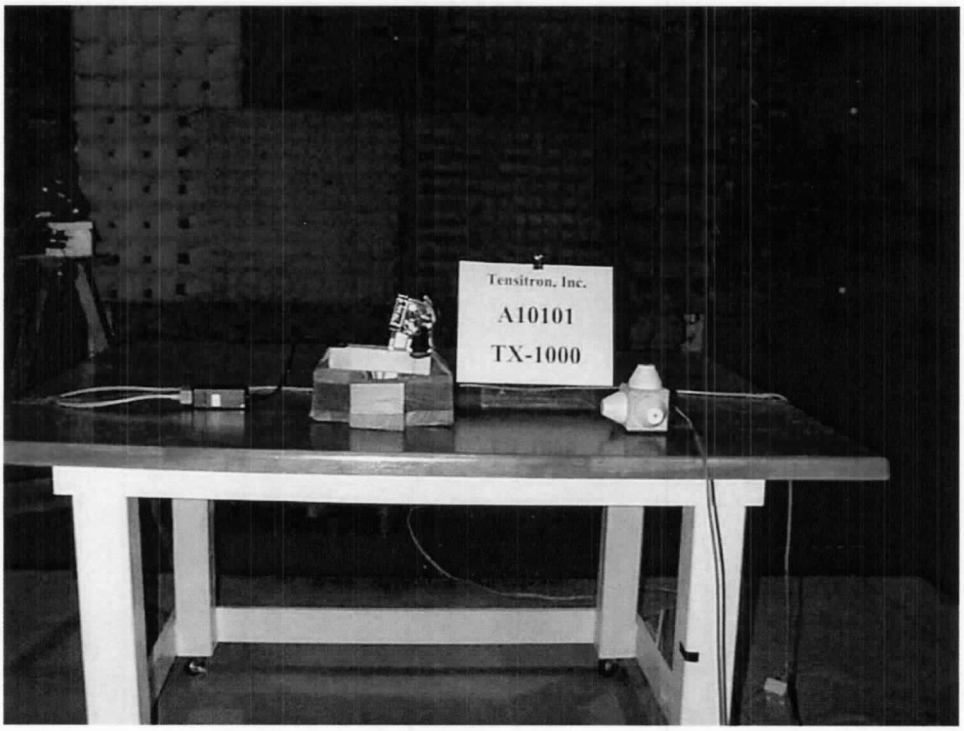


Figure B3. Radiated RF Immunity Test Setup: Right Side. (ri_c.jpg)

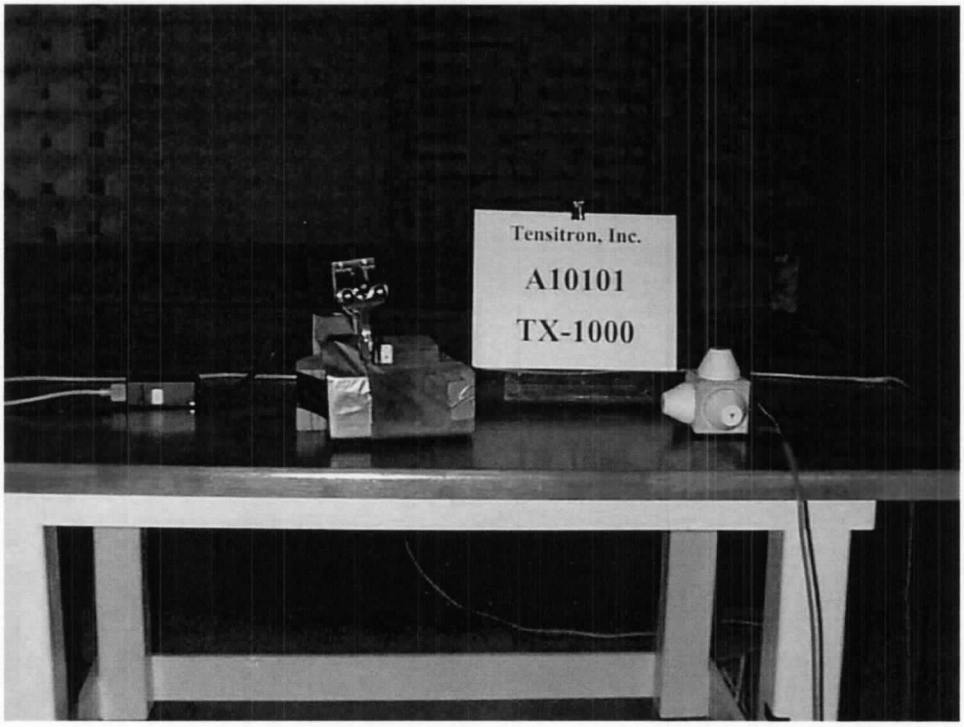


Figure B4. Radiated RF Immunity Test Setup: Back Side. (ri_d.jpg)

APPENDIX C

Electrical Fast Transients/Burst Test Data

EMC Integrity, Inc.

8475 W. I-25 Frontage Rd.
Longmont, CO 80504

Electrical Fast Transient/Burst Immunity

Customer Name: TENSITRON, INC. Project Number: A10101

Customer Representative: Stan Saxl Test Area: GP #1

Model: TX-1000 S/N: 240 XA

Date: 08 JAN 01 Temperature: 22 deg C Humidity: 28 %

Test Specification: EN 61000-4-4:1995 REF: EN 61326-1/A1:1997

Input AC Voltage: ☐ 115 Vac/60 Hz ☐ 230 Vac/50 Hz ☑ Other: 7.5 v DC Pictures: ✓

Voltage (kV)	Polarity +	Polarity -	Time (sec)	Injection Type	L 1	L 2	L 3	N	P E	R P	Comments	Pass/ Fail
0.5	*	*	60	MAINS					*	*	AC/DC Power Converter	P
1.0	*	*	60	MAINS	*					*	AC/DC Power Converter	
1.0	*	*	60	MAINS		*				*	"	
1.0	*	*	60	MAINS					*	*	"	
2.0	*	*	60	MAINS	*					*	AC/DC Power Converter	
2.0	*	*	60	MAINS		*				*	"	
2.0	*	*	60	MAINS					*	*	"	✓

Test Engineer: Mark Kelley

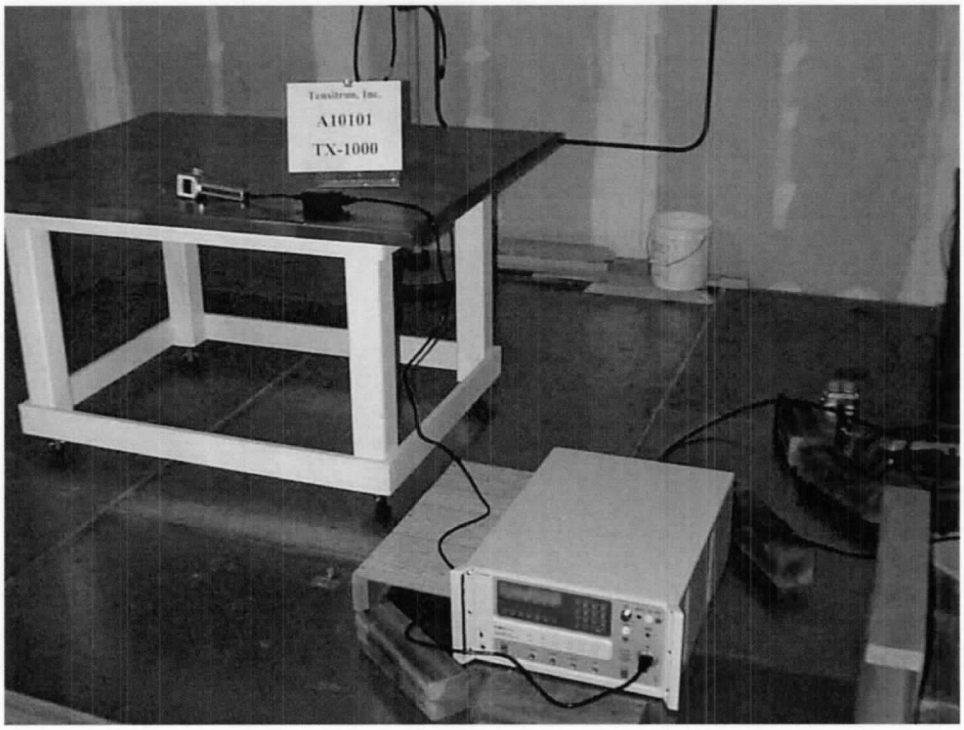


Figure C1. Electrical Fast Transients/Burst Test Setup: AC Mains. (eft_a.jpg)

APPENDIX D

Surge Immunity Test Data

EMC Integrity, Inc.

8475 W. I-25 Frontage Rd.
Longmont, CO 80504

Surge Immunity

Customer Name: TENSITRON, INC. Project Number: A10101
Customer Representative: Stan Saxl Test Area: GP #1
Model: TX-1000 S/N: 240 XA
Date: 23 MAR 01 Temperature: 21 deg C Humidity: 29 %
Test Specification: EN 61000-4-5:1995 REF: EN 61326-1/A1:1997
Input AC Voltage: ☐ 115 Vac/60 Hz ☐ 230 Vac/50 Hz ☑ Other: 7.5 V DC Picture: ✓

Voltage (kV)	Polarity +	Polarity -	L 1	L 2	L 3	N	PE	Phase (deg)	Pulses (#)	Delay (sec)	Comments	Pass/ Fail
0.5		*	*				*	0	5	60	12 ohm L1/PE L2/PE COM	P
		*	*				*	90				
		*	*				*	270				
	*		*				*	0				
	*		*				*	90				
	*		*				*	270				
		*		*			*	0				
		*		*			*	90				
		*		*			*	270				
	*			*			*	0				
	*			*			*	90				
	*			*			*	270				✓
1.0		*	*				*	0	5	60	12 ohm L1/PE L2/PE COM	P
		*	*				*	90				
		*	*				*	270				
	*		*				*	0				
	*		*				*	90				
	*		*				*	270				
		*		*			*	0				
		*		*			*	90				
		*		*			*	270				
	*			*			*	0				
	*			*			*	90				
	*			*			*	270				✓
0.5		*	*	*				0	5	60	2 ohm L1/L2 DIFF	P
		*	*	*				90				
		*	*	*				270				
	*		*	*				0				
	*		*	*				90				
	*		*	*				270				✓

Test Engineer Mark Kelley

EMC Integrity, Inc.

8475 W. I-25 Frontage Rd.
Longmont, CO 80504

Surge Immunity

Customer Name: TENSITRON, INC. Project Number: A10101

Customer Representative: Stan Saxl Test Area: GP #1

Model: TX-1000 S/N: 240 XA

Date: 23 MAR 01 Temperature: 21 deg Humidity: 29 %

Test Specification: EN 61000-4-5:1995 REF: EN 61326-1/A1:1997

Input AC Voltage: ☐ 115 Vac/60 Hz ☐ 230 Vac/50 Hz ☑ Other: 7.5 v DC

Voltage (kV)	Polarity +	Polarity -	L 1	L 2	L 3	N	PE	Phase (deg)	Pulses (#)	Delay (sec)	Comments	Pass/ Fail
2.0		*	*				*	0	5	60	12 ohm L1/PE L2/PE COM	P
		*	*				*	90				
		*	*				*	270				
	*		*				*	0				
	*		*				*	90				
	*		*				*	270				
		*		*			*	0				
		*		*			*	90				
		*		*			*	270				
	*			*			*	0				
	*			*			*	90				
	*			*			*	270				V
1.0		*	*	*				0	5	60	2 ohm L1/L2 DIFF	P
		*	*	*				90				
		*	*	*				270				
	*		*	*				0				
	*		*	*				90				
	*		*	*				270				V

Test Engineer Mark Kelley

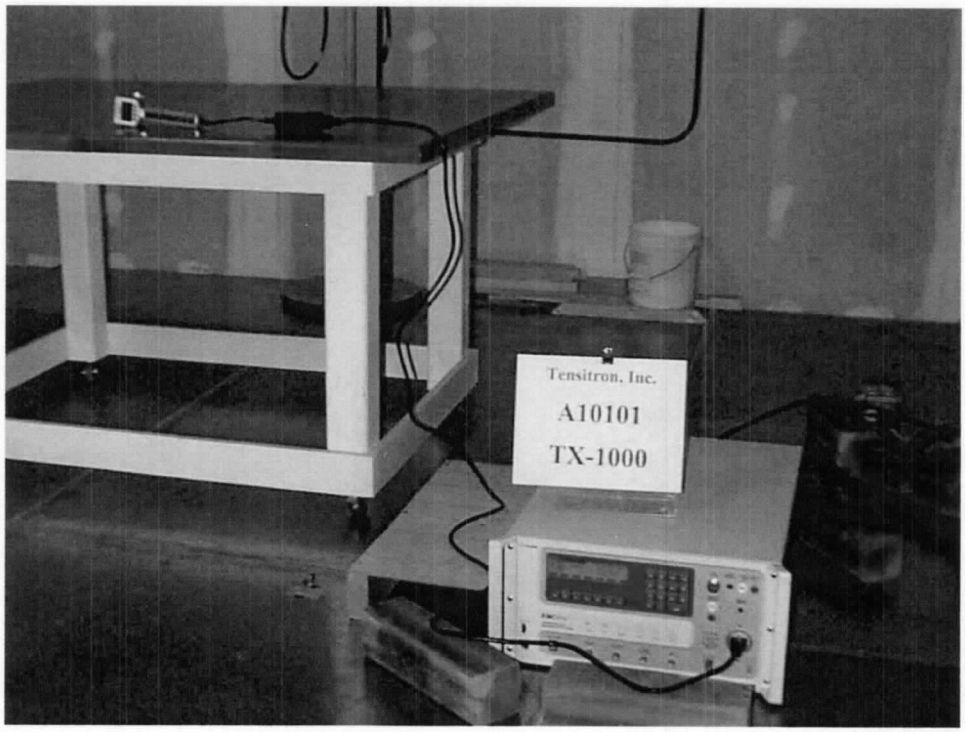


Figure D1. Surge Immunity Test Setup. (surge.jpg)

APPENDIX E

Conducted RF Immunity Test Data

EMC Integrity, Inc.

8475 W. I-25 Frontage Rd.
Longmont, CO 80504

Conducted RF Immunity

Customer Name: TENSITRON, INC. Project Number: A10101

Customer Representative: Stan Saxl Test Area: GP #1

Model: TX-1000 S/N: 240 XA

Date: 08 JAN 01 Temperature: 22 deg C Humidity: 28 %

Test Specification: EN 61000-4-6:1996 REF: EN 61326-1/A1:1997

Input AC Voltage: ☐ 115 Vac/60 Hz ☐ 230 Vac/50 Hz ☑ Other: 7.5V DC Pictures: ✓

Frequency (MHz)	Modulation Type	%	Freq.	Field (Vrms)	Comments	Pass/ Fail
0.15	AM	80	1 kHz	3	AC Power Cable	P
~	AM	80	1 kHz	3		↓
80	AM	80	1 kHz	3		↓

Test Engineer Mark Kelley

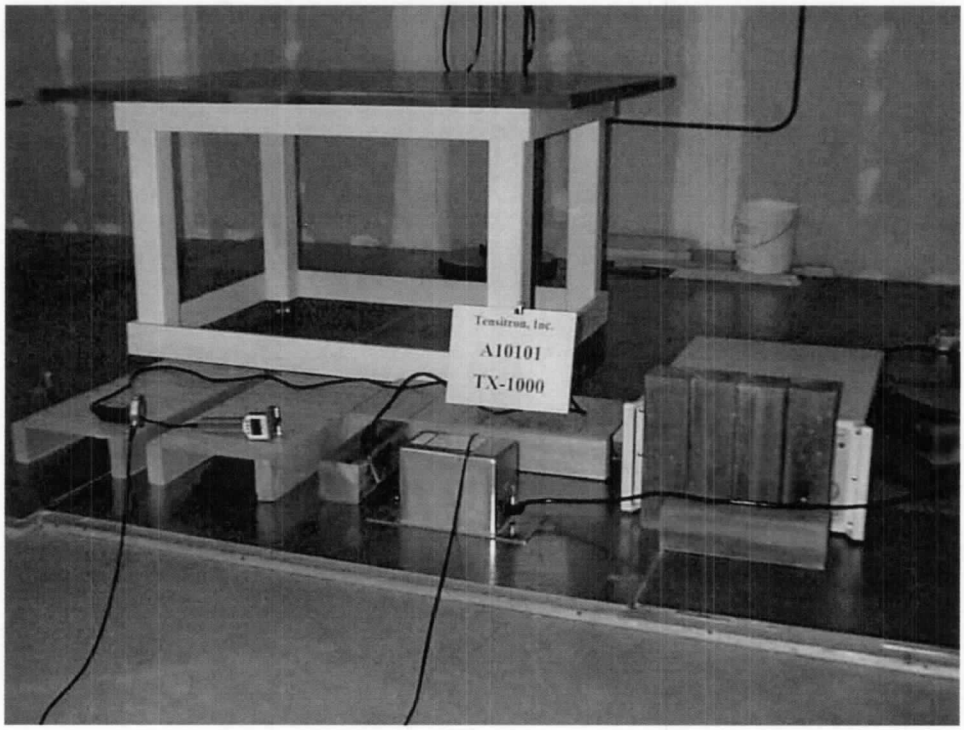


Figure E1. Conducted RF Immunity Test Setup: CDN Method. (ci_a.jpg)

APPENDIX F

Voltage Dip and Interrupts Test Data

EMC Integrity, Inc.

8475 W. I-25 Frontage Rd.
Longmont, CO 80504

Voltage Dips, Short Interruptions and Voltage Variations Immunity

Customer Name: TENSITRON, INC. Project Number: A10101

Customer Representative: Stan Saxl Test Area: GP #1

Model: TX-1000 S/N: 240 XA

Date: 08 JAN 01 Temperature: 22 deg C Humidity: 28 %

Test Specification: EN 61000-4-11:1994 REF: EN 61326-1/A1:1997

Input AC Voltage: ☐ 115 Vac/60 Hz ☐ 230 Vac/50 Hz ☑ Other: 7.5 v DC Picture ✓

For EN 50082-1: 1997

Test Sequence Name	Test Duration	Failure Criteria	Comments	Pass/ Fail
0% Open	5.00 sec	C	(variation)	
0% Open	5.00 sec	C	(variation)	
40%	0.10 sec	C	(dip)	
70%	0.01 sec	B	(dip)	

For EN 55024: 1998

Test Sequence Name	Test Duration	Failure Criteria	Comments	Pass/ Fail
>95% Reduction	5.00 sec	C	(3 variation)	
30% Reduction	0.50 sec	C	(2 dip)	
>95% Reduction	0.01 sec	B	(1 dip)	

For EN 61326-1: 1997

Test Sequence Name	Test Duration	Failure Criteria	Comments	Pass/ Fail
100% Reduction	0.01 sec	B	(dip / positive = 90)	P
100% Reduction	0.01 sec	B	(dip / negative = 270)	P
100% Reduction	0.02 sec	B	(dip / positive = 90)	
100% Reduction	0.02 sec	B	(dip / negative = 270)	

Test Engineer Mark Kelley

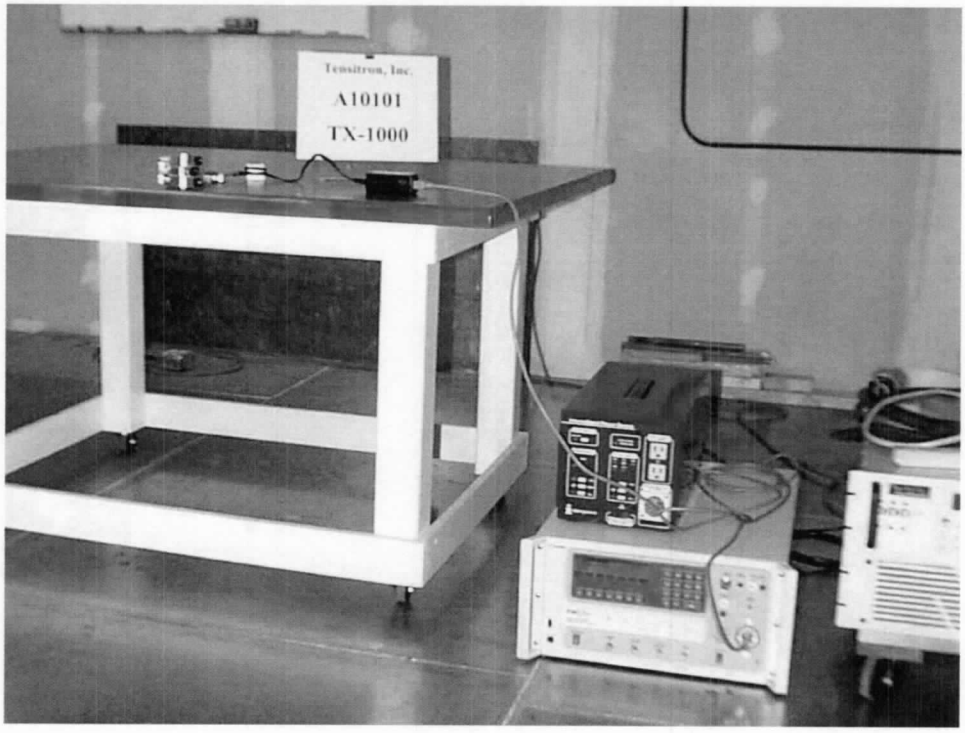


Figure F1. Voltage Dip and Interrupts Test Setup. (pqf.jpg)

APPENDIX G

Power Line Harmonics Test Data

IEC 1000-3-2 TEST REPORT

REPORT # **TRA10101**

TEST EQUIPMENT

PACIFIC POWER SOURCE

15122 BOLSA CHICA St.
HUNTINGTON BEACH, CA. 92649
phone (714) 898-2691 fax (714) 891-1928

MODEL/SERIAL NUMBER	125-TMX S/N 0207
LAST CALIBRATION DATE	8/15/2000
CALIBRATION DUE DATE	8/15/2001

TEST RECORD # 21

TEST DATE / TIME	Wednesday, January 10, 2001 1:39 PM
TEST LOCATION	EMC Integrity, Inc. 8475 W. I-25 Frontage Rd., Suite 200 Longmont, CO 80504 Proj. Number: A10101
OPERATOR NAME	Test Engineer: Mark Kelley
UUT MANUFACTURER	Tensitron, Inc. 1668 Valtec Lane Boulder, CO 80301
UUT MODEL #	TX-1000
UUT SERIAL #	240 XA
COMMENTS	Wire tension/speed tester

IEC 1000-3-2 TEST REPORT

REPORT # **TRA10101**

SUMMARY RESULT	PASS
POWER SOURCE CALIBRATED?	YES
CLASSIFICATION	CLASS A
TEST TYPE	STEADY STATE
MOTOR DRIVEN with PHASE ANGLE CONTROL?	NO
TEST CONDITIONS	STANDARD TEST CONDITIONS
TEST FREQ	50.00
TEST VOLTS	230.00
WAVEFORM	SINE
PROG. Zo	0.000 OHMS
PROG. Zo ENABLED?	YES
IMPEDANCE SELECTED	DIRECT
RESISTANCE	0.380 INDUCTANCE 460.000
SYNTHETIC R+L ENABLED?	NO
TEST TIME	2.5 MINUTES
MAX WATTS	2.7

IEC 1000-3-2 TEST REPORT

REPORT # **TRA10101**

HARMONIC CURRENT RESULTS

Hn	AMPS	LO LIMIT	HI LIMIT	RESULT
0	0.000	0.000	0.000	PASS
1	0.016	NaN	NaN	PASS
2	0.000	1.080	1.080	PASS
3	0.006	2.300	2.300	PASS
4	0.000	0.430	0.430	PASS
5	0.006	1.140	1.140	PASS
6	0.000	0.300	0.300	PASS
7	0.006	0.770	0.770	PASS
8	0.000	0.230	0.230	PASS
9	0.006	0.400	0.400	PASS
10	0.000	0.184	0.184	PASS
11	0.005	0.330	0.330	PASS
12	0.000	0.153	0.153	PASS
13	0.005	0.210	0.210	PASS
14	0.000	0.131	0.131	PASS
15	0.005	0.150	0.150	PASS
16	0.000	0.115	0.115	PASS
17	0.005	0.132	0.132	PASS
18	0.000	0.102	0.102	PASS
19	0.004	0.118	0.118	PASS
20	0.000	0.092	0.092	PASS
21	0.004	0.107	0.107	PASS
22	0.000	0.084	0.084	PASS
23	0.004	0.098	0.098	PASS
24	0.000	0.077	0.077	PASS
25	0.003	0.090	0.090	PASS
26	0.000	0.071	0.071	PASS
27	0.003	0.083	0.083	PASS
28	0.000	0.066	0.066	PASS
29	0.002	0.078	0.078	PASS
30	0.000	0.061	0.061	PASS
31	0.002	0.073	0.073	PASS
32	0.000	0.058	0.058	PASS
33	0.002	0.068	0.068	PASS
34	0.000	0.054	0.054	PASS
35	0.001	0.064	0.064	PASS
36	0.000	0.051	0.051	PASS
37	0.001	0.061	0.061	PASS
38	0.000	0.048	0.048	PASS
39	0.001	0.058	0.058	PASS
40	0.000	0.046	0.046	PASS

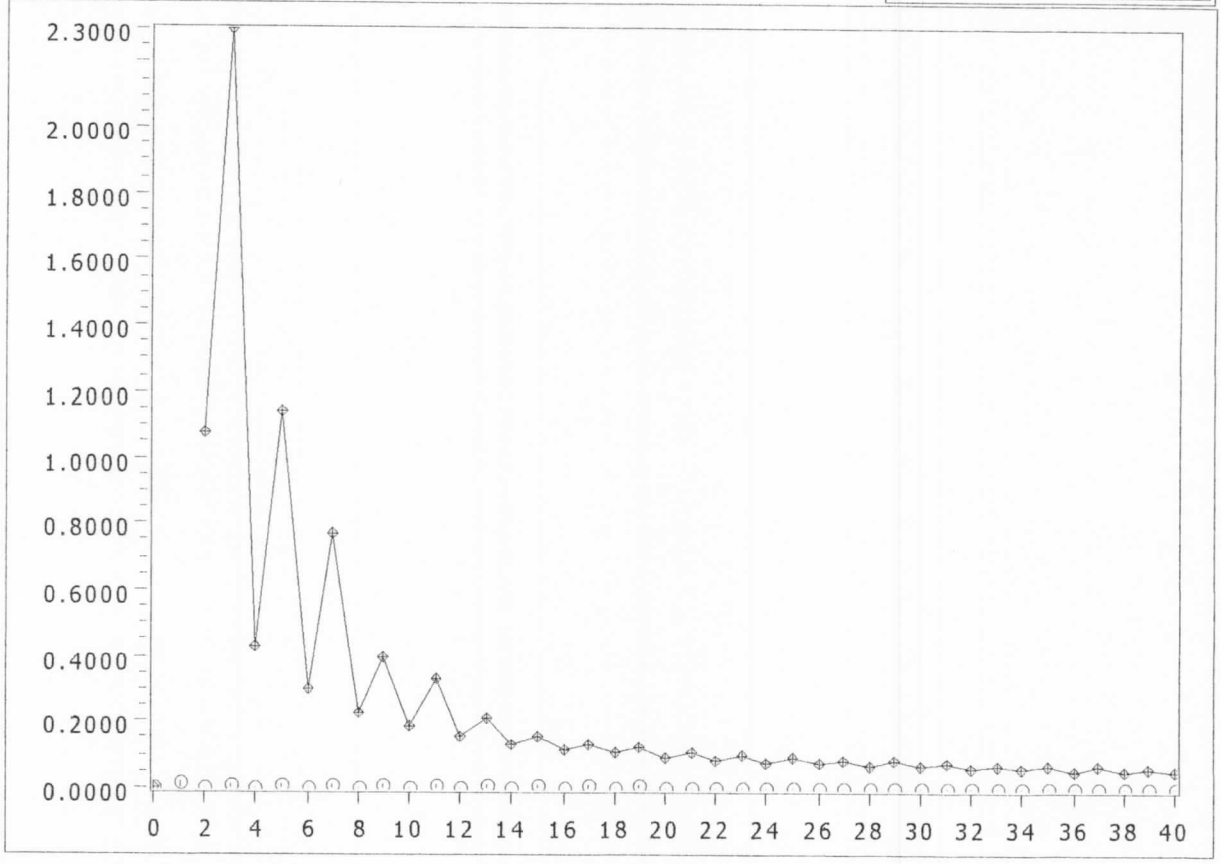
HARMONIC VOLTAGE RESULTS

	%FUND.	LIMIT	RESULT
(	0.000	NaN	PASS
	100.000	100.001	PASS
	0.006	0.200	PASS
	0.007	0.900	PASS
	0.002	0.200	PASS
	0.006	0.400	PASS
(	0.002	0.200	PASS
	0.001	0.300	PASS
	0.002	0.200	PASS
	0.004	0.200	PASS
	0.001	0.200	PASS
	0.001	0.100	PASS
	0.004	0.100	PASS
	0.002	0.100	PASS
	0.004	0.100	PASS
	0.003	0.100	PASS
	0.004	0.100	PASS
	0.001	0.100	PASS
	0.003	0.100	PASS
	0.002	0.100	PASS
	0.002	0.100	PASS
	0.002	0.100	PASS
	0.003	0.100	PASS
	0.002	0.100	PASS
	0.005	0.100	PASS
	0.001	0.100	PASS
	0.002	0.100	PASS
	0.001	0.100	PASS
	0.002	0.100	PASS
	0.001	0.100	PASS
	0.001	0.100	PASS
	0.004	0.100	PASS
	0.001	0.100	PASS
	0.001	0.100	PASS
	0.003	0.100	PASS
	0.002	0.100	PASS
	0.003	0.100	PASS
	0.001	0.100	PASS
	0.003	0.100	PASS

IEC 1000-3-2 TEST REPORT

REPORT # **TRA10101**

CURRENT HARMONIC SPECTRUM



END OF REPORT

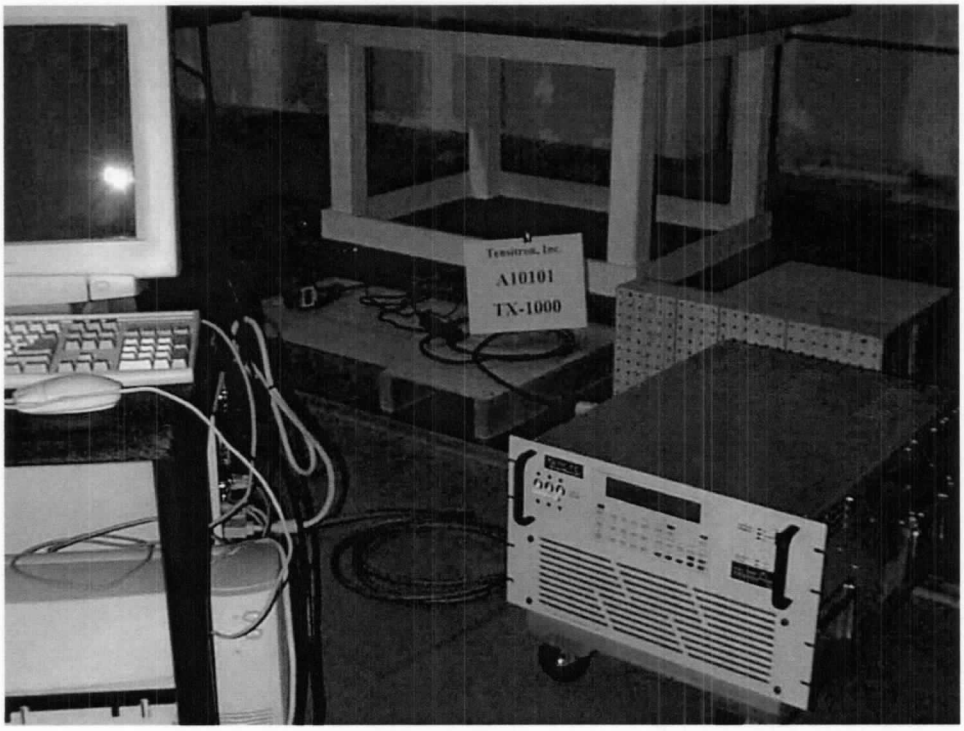


Figure G1. Power Line Harmonics Test Setup. (harmonics.jpg)

APPENDIX H

Product Data Sheet

Product Data Sheet

EMC Integrity, Inc.
Phone (303) 776-7249
Fax: (303) 776-7314
Email: emci@emcinteg.com

A10101

Product data sheet (PDS) must be filled out completely ***prior*** to testing. Please attach additional information (e.g.,block diagrams, product specifications, etc.) Only a completely detailed test plan may be used in lieu of a PDS.

1.0 Client Information

Company Name TENSITRON, INC. Customer Representative STAN SAXL
Address 1668 VALTEC LANE Title
City, State, ZIP BOULDER CO 80301 Phone/Fax/email 303·444·5383 / 303·444·0204

2.0 Product Information

2.1 Formal name of product (to appear on Test Report): TX-1000
2.2 Model Number TX-1000
2.3 Serial Number 240 XA
2.4 Describe function of product: TENSION/SPEED METER FOR WIRE MNFG.
2.5 Is product table top, rack mount or floor-standing? PORTABLE
2.6 Is cycle time for product less than 3 seconds? YES
(**Important note**: If "no", longer dwell times may be required for radiated and conducted RF immunity testing. It is important that this question be resolved prior to testing as it will affect not only test time but also test integrity.)
2.7a Product power (check all that apply):
✓ 115 Vac/60 Hz
✓ 230 Vac/50 Hz
✓ DC input from external AC/DC brick, sold with unit
___ DC input from external AC/DC brick, *not* sold with unit
✓ Internal battery
2.7b. If internal battery, can unit connect to external AC mains via a charger? (describe) YES
2.8 List all I/O *cables and types* connected to product: N/A
2.9 Check product type:

Check all That apply	General Product Description	Applicable EN	
	Information Technology Equipment (ITE)	EN 55024: 98	EN 55022
	(Heavy) Industrial	EN 61000-6-2: 99	EN 55011
✓	Scientific instrument or measurement apparatus	EN 61326-1: 97	EN 55011/22
	Medical	EN 60601-1-2: 95	EN 55011
	Audio/Visual Equipment	EN 55103-2: 98	EN 55103-1
	Generic Light Industrial Product	EN 50082-1: 97	EN 50081-1
	Generic Industrial Product	EN 50082-2: 95	EN 50082-1
	Other (please specify)		

Note: Products should be tested to the *product standard*, if one exists.

2.10 Into what markets will this product be sold (check all that apply)
Office ___ Industrial ✓ Commercial ✓ Residential ___ Other
2.11 Please list all major components of the Unit Under Test in Table P-2.1.

UUT Component	Manufacturer	Model Number	Serial Number
TX-1000	TENSITRON, INC.	TX-1000	240 XA
AC/DC ADAPTER	VOLGEN	SPU 15A-1-1	-

Table P-2.1. Components Comprising the Unit Under Test (UUT).

EMC Integrity, Inc.
Phone (303) 776-7249
Fax: (303) 776-7314
Email: emci@emcinteg.com

3.0 Support Peripherals

Please list all support equipment/peripherals used to exercise the UUT in Table P-3.1.

UUT Component	Manufacturer	Model Number	Serial Number
N/A			

Table P-3.1. Support Equipment Used with UUT.

4.0 Definition of Critical Parameters

4.1 What is (are) the critical parameter(s) to be monitored during test (i.e., accuracy, flow rate, etc.)? CABLE TENSION

4.2 Define acceptable limits for all critical parameters (e.g., accuracy within +1%) +/- 10 COUNTS

4.3 How will critical parameters be monitored? VIDEO OR VISUAL MONITORING OF LCD

4.4 List all software (name and revision number) used to exercise test hardware TENSITRON FIRMWARE REV W

5.0 Modifications Required for Compliance

5.1 List all changes made to the product for compliance with immunity
1. FAIR-RITE # 2643250402 OR EQUIV. ADDED TO TOP OF POWER CABLE
2. Cu TAPE OVER BATTERY, STRAIN & 7.5 VOLT POWER LEADS
3. FAIR-RITE 2643102002 ADDED TO BRICK
4. CAPACITORS ON Tx 80 BOARD MOVED CLOSER TO TOP OF BOARD. 5. Cu TAPE AROUND PERIMETER OF

5.2 List all changes made to the product for compliance with emissions HEAD COVERING, PCB.

APPENDIX I

Test Equipment List

Commercial Equipment List
Project #: A10101

Manufacturer		M/N	S/N	Description	Last Cal	Cal Due	Code
Abbeon Cal. Inc	✓	HTAB-176	9942	Hygrometer and Temperature Indicator	10/4/00	10/4/01	A
Abbeon Cal. Inc	✓	HTAB-176	30173	Hygrometer and Temperature Indicator	3/15/01	3/15/02	A
AH Systems	✓	SAS-200/512	172	Log Periodic Antenna (200 MHz - 1800 MHz)	None	None	B
Amplifier Research	✓	75A250	28844	75 Watt Amplifier (10 kHz - 250 MHz)	None	None	B
Amplifier Research		FP4000	18358	Isotropic Field Probe (10 kHz - 1 GHz)	8/1/00	8/1/01	A
EMCI	✓	M3-15	EMCI 008	CDN (15 A)	8/2/00	8/2/01	A
EMCI		BNC	001	CDN BNC-type	8/2/00	8/2/01	A
EMCI		DPS	EMCI00111	Dual Pulse Shaper Circuit	None	None	B
EMCI		DPS	EMCI00211	Dual Pulse Shaper Circuit	None	None	B
EMCI Software	✓	Marconi	None	EMCTEST.EXE Marconi	None	None	B
EMCO	✓	3109	9607-3006	High Field Biconical Antenna (20 MHz - 300 MHz)	None	None	B
EMCO		3109xP	9607-3006xp	High Field Biconical Antenna (26 - 80 MHz)	None	None	B
EMCO	✓			Tripod	none	none	C
Fischer Communications		F-120-9	152	Current Injection Probe	9/21/00	9/21/01	A
Fischer Communications		F-2031	320	EM Injection Clamp	8/2/00	8/2/01	A
Fischer Communications	✓	F-33-2	268	Current Probe, 10 kHz - 250 MHz	9/21/00	9/21/01	A
Fischer Communications		F-1000-4-8/9/10-L-1M	2068	Power Frequency H-field 1 Meter Loop	9/8/00	9/8/01	A
Fluke		83-3	69811230	Multimeter/Frequency Meter	10/11/00	10/11/01	A
Fluke		83-3	70130434	Multimeter/Frequency Meter	10/11/00	10/11/01	A
Fluke		83-3	69811227	Multimeter/Frequency Meter	9/13/00	9/13/01	A
Fluke		85	66180455	Multimeter/Frequency Meter	9/13/00	9/13/01	A
Hewlett Packard	✓	8591A	2943A00554	Spectrum Analyzer	1/3/01	1/3/02	A
Hewlett Packard		8082A	2608G05241	Pulse Generator	9/26/00	9/26/01	A
IFR	✓	2023B	202302/817	Signal Generator (9 kHz - 2 GHz)	8/30/00	8/30/01	A
Instruments for Industry	✓	SMX-100	1662-0396	100W Wideband Power Amplifier (10 kHz-1 GHz)	None	None	B
Interpower	✓	125IPC	L40374	Power Source	None	None	B
Keytek	✓	EMC Pro	8347	Advanced EMC Immunity Tester	10/6/00	10/6/01	A
Keytek	✓	MZ-15/EC	10280	Mini Zap ESD Gun	10/5/00	10/5/01	A
Marconi	✓	2024	112113/027	Signal Generator	9/26/00	9/26/01	A
McIntosh		MC2200	AU2901	Stereo Power Amplifier	None	None	B
Pacific Power Source	✓	TMX-125	207	50 Hz Power Source, Harmonics/Flicker	8/15/00	8/15/01	A
Ray Proof	✓	RF Shield Room	6698	Completely Anechoic Lined Chamber	6/15/00	6/15/01	A
Schaffner		CDN 125	445	Coupling Clamp	None	None	C
Stanford Research Sys.		DS345/1	29373	30 MHz Function Generator	2/20/01	2/20/02	A

Code Notes:
A=Calibration Required
B=Used With Calibrated Equipment
C=No Calibration Required

APPENDIX J

Laboratory Certification

Schedule of Assessment

EMC Integrity, Inc., has been approved as a provider of EMC testing services to Technology International (Europe) Ltd[1] with a Scope of Approval as described below.

This Scope of Approval is valid from the date of signature on the accompanying assessment certificate.

Generic/Product Specific Standards

Classification	Test Standard
Emission (by authorized subcontract to approved vendor)	EN50081-1 (R,C&LI Generic), EN50081-2 (Industrial Generic) EN55103-1 (audio visual..)
Immunity	EN50082-1 (R,C&LI Generic), EN50082-2, EN61000-6-2 (Industrial Generics)
IT specific emission	EN55022
ISM Emission	EN55011
IT specific immunity	EN55024
Medical (collateral Standard)	EN60601-1-2
Audio, Visual and Lighting Control	EN55103-2
Measurement, Control and Laboratory Equipment	EN61326

Basic Standards

Electrical/Electromagnetic Phenomenon	Test Standard
Mains Harmonics	IEC/EN61000-3-2
Mains Flicker	IEC/EN61000-3-3
Electrostatic Discharge (ESD)	IEC/EN61000-4-2
Radiated Immunity	IEC/EN61000-4-3, EN50204
Electrical Fast Transient (EFT)	IEC/EN61000-4-4
Lightning Surge	IEC/EN61000-4-5
Conducted RF Immunity	IEC/EN61000-4-6
Power Frequency Magnetic Field	IEC/EN61000-4-8
Voltage Dips and Interruptions	IEC/EN61000-4-11

[1] Technology International (Europe) Ltd., (*formerly Interference Technology International Ltd*) is a UK appointed competent body under the EU Directive for Electromagnetic Compatibility, 89/336/EEC.

Certificate of Assessment

Presented by

Technology International (Europe) Ltd.

EMC Integrity, Inc.
8475 W. I-25 Frontage Road
Suite 200
Longmont, CO 80504

Accent Europe Ltd

Certificate #01-035

*This assessment was performed in accordance with **ISO Guide 25** defining the general international requirements for the competence of calibration and testing laboratories and with TI(E) assessment criteria LAC0196*

This approval is granted for specifications implementing the EU Directives on EMC (89/336/EEC and amendments). The scope of approval is given in the Schedule of Assessment supplied with this certificate.

John P. Flood,. Lead Assessor
Manager, NETLAB

Martin Green, Managing Director
Technology International (Europe) Ltd.

TECHNOLOGY INTERNATIONAL (EUROPE) LIMITED

19th April 2001

Date of issue

Technology International (Europe), Ltd. 41-42 Shrivenham Hundred Business Park, Shrivenham, Swindon, Wilts., SN6 8TZ ,UK Tel: + 44 (1793) 783137

Accent Europe Ltd., 22A Leicester Road, Shepshed, Leics., LE12 9DQ, UK Tel: +44 (1509) 507721