

**European Union (EU) Council Directive 89/336/EEC
Electromagnetic Compatibility (EMC) Test Report**

2650 Modular Measurement and Control System

Sensoray

March 31, 2006 – April 4, 2006

Tests Conducted by:

ElectroMagnetic Investigations, LLC

20811 NW Cornell Road, Suite 600, Hillsboro, Oregon 97124, USA
Tele (503) 466-1160 Fax (503) 466-1170 support@emicomply.com

Summary Information

Test Item: 2650 Modular Measurement and Control System

Serial Number:

EU EMC Tests in accordance with EU Council Directive 89/336/EEC

Emissions Tests per EN 61326 Test Standard for measurement, control and laboratory equipment:

| Result | Standard | Description | Port | Comments |
|--------|-----------------|---|-----------|----------|
| Pass | EN55011 Class A | Radiated Emissions | Enclosure | |
| Pass | EN55011 Class A | Conducted Emissions | AC Mains | |
| Pass | EN61000-3-2 | Powerline Harmonics | AC Mains | |
| Pass | EN61000-3-3 | Powerline Voltage Fluctuation & Flicker | AC Mains | |

Immunity Tests per EN 61326 (Industrial Levels)

| Result | Standard | Description | Port | Comments |
|--------|--------------|--|-----------|--|
| Pass | EN61000-4-2 | Electrostatic Discharge Immunity | Enclosure | Tested up to 8 kV air discharge and 4 kV contact discharge |
| Pass | EN61000-4-3 | RF Electromagnetic Field Immunity | Enclosure | 10 V/M, 80 to 1000 MHz |
| Pass | EN61000-4-4 | Electrical Fast Transient/Burst (EFT) Immunity | AC Leads | 2 kV peak |
| Pass | EN61000-4-4 | Electrical Fast Transient/Burst (EFT) Immunity | I/O Leads | 1000 V peak |
| Pass | EN61000-4-5 | Electrical Slow Transient (Surge) Immunity | AC Leads | 1 kV peak - differential mode 2 kV peak - common mode |
| Pass | EN61000-4-6 | RF Conducted Immunity | AC Leads | 10 V RMS, 150 kHz to 80 MHz |
| Pass | EN61000-4-6 | RF Conducted Immunity | AC Leads | 10 V RMS, 150 kHz to 80 MHz |
| Pass | EN61000-4-11 | Voltage Interruption Immunity | AC Leads | 0.5 cycle, 100% dropout |

I, _____, representative for Sensoray verify that the product tested is representative of units to be sold.

(signature)

EN 61326 Emissions

EN61326 Emissions Test Report

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Summary Information

Test Items: 2650 Modular Measurement and Control System

Serial Number:

Requested By: Caleb Streur
Sensoray
7313 SW Tech Center Dr.
Tigard, OR 97223
503.684.8005 Telephone

Tested By: Derick Skouby



Ryan Benitez



Test Date(s): March 31, 2006

Tests Performed:

Radiated and conducted electromagnetic interference measurements as per EN55011 Class A.

Test Locations: ElectroMagnetic Investigations, LLC, Hillsboro, Oregon

Purpose:

The purpose of the testing is to determine if the 2650 Modular Measurement and Control System is compliant to electromagnetic emission limits as specified by EN61326 product family standard for measurement, control and laboratory equipment to support compliance to the European Union EMC Directive 89/336/EEC.

Summary of Results:

EN55011 Class A:

Radiated Emissions: Emissions are within specification limits.

Least Margin:10.4 dB at 170.2 MHz.

Conducted Emissions: : Emissions are within specification limits.

Least Margin:6.9 dB at 27.9 MHz.

EN61000-3-2/3:

Powerline Harmonic Emissions: Emissions are within specification limits.

Test Method

The 2650 Modular Measurement and Control System was tested in accordance with EN61326 standard. Radiated levels were measured at three meters distance in both horizontal and vertical antenna polarizations. The radiated emission measurements were maximized by rotating the device under test 360 degrees and varying the height of the receiving antenna from 1 to 4 meters.

Test Set-Up

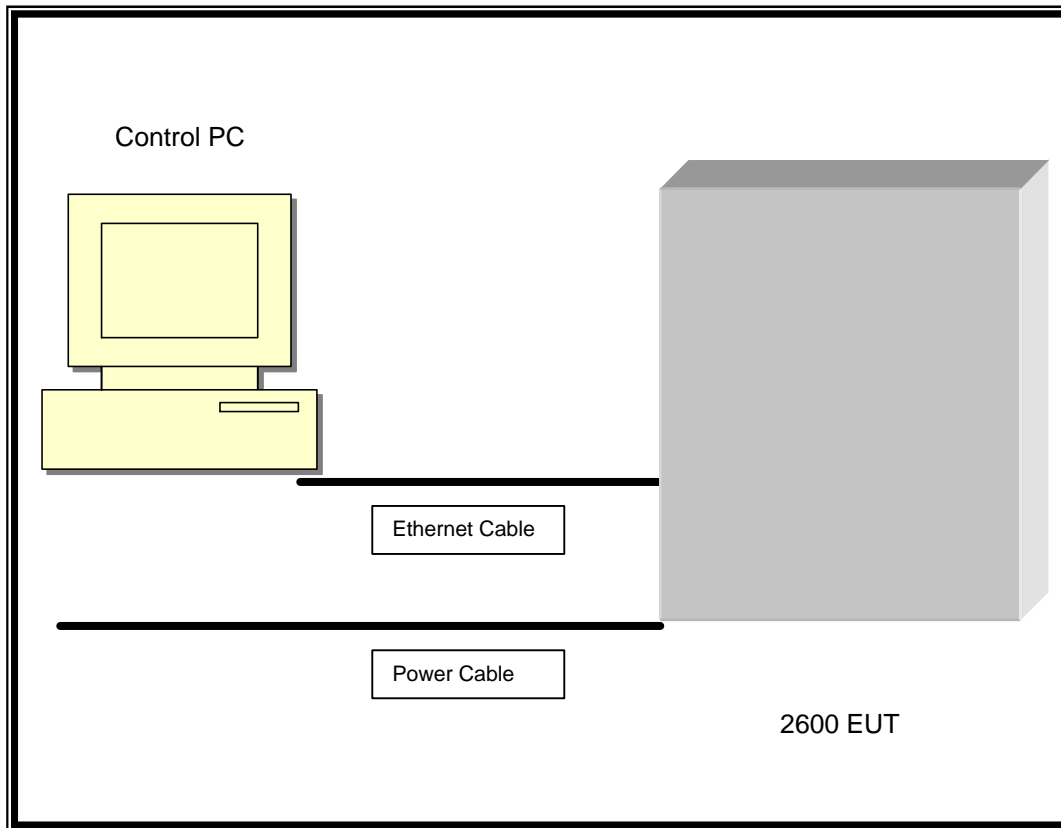


Figure 1

The 2650 (EUT) is connected to the Control PC which is set up outside of the test chamber.

Detector Function:

Peak/Quasi-peak.

Measurement Bandwidths:

150 kHz to 30 MHz: 9 kHz Peak/ 9 kHz Quasi-Peak
30 MHz to 1000 MHz: 120 kHz Peak/120 kHz Quasi-Peak

Test Results:

The 2650 Modular Measurement and Control System unit tested was verified to be compliant with EN55011 class A radiated and conducted emission limits.

The 2650 Modular Measurement and Control System unit tested was verified to be compliant with EN61000-3-2/3 powerline harmonics and powerline fluctuation/flicker specifications.

Test Data:

I. Radiated Emissions (3-Meter Specifications)

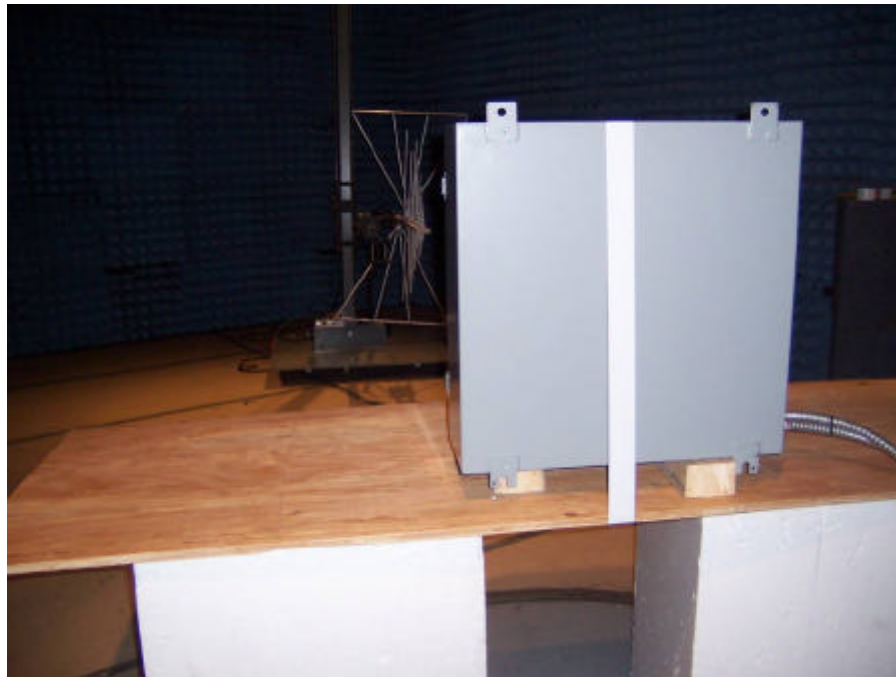
| Frequency (MHz) | Total Level (dBuV/m) | EN55011 Class A Limit (dBuV/m) | Margin (dB) |
|-----------------|----------------------|--------------------------------|-------------|
| 71.7 | 36 | 50.4 | 14.4 |
| 72.3 | 37.3 | 50.4 | 13.1 |
| 76.9 | 34.3 | 50.4 | 16.1 |
| 78.8 | 38.8 | 50.4 | 11.6 |
| 153.8 | 38.8 | 50.4 | 11.6 |
| 170.2 | 40 | 50.4 | 10.4 |

II. Conducted Emissions

| Frequency (MHz) | Total Level (dBuV/m) | EN55011 Class A Limit (dBuV/m) | Margin (dB) |
|-----------------|----------------------|--------------------------------|-------------|
| 1.315 | 47.6 | 60 | 12.4 |
| 1.316 | 48 | 60 | 12 |
| 25.95 | 50.3 | 60 | 9.7 |
| 26.93 | 49 | 60 | 11 |
| 27.42 | 48.1 | 60 | 11.9 |
| 27.9 | 53.1 | 60 | 6.9 |

Test Setup Photographs:

Radiated Emissions



Conducted Emissions



Powerline Harmonics/Powerline Fluctuations



Additional Test Data

EN 61326 Immunity

EN61326 Immunity Test Report

2650 Modular Measurement and Control System

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March 31, 2006 – April 4, 2006

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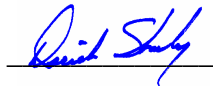
Summary Information

Test Items: 2650 Modular Measurement and Control System

Serial Number:

Requested By: Caleb Streur
Sensoray
7313 SW Tech Center Dr.
Tigard, OR 97223
503.684.8005 Telephone

Tested By: Derick Skouby



Ryan Benitez



Test Date(s): March 31, 2006 – April 4, 2006

Tests Performed:

Air, Contact and Indirect Electrostatic Discharge Immunity per basic standard EN61000-4-2 in accordance with EN61326 product family standard requirements.

RF Electromagnetic Field Immunity per basic standard EN61000-4-3 in accordance with EN61326 product family standard requirements.

Electrical Fast Transient Immunity per basic standard EN61000-4-4 in accordance with EN61326 product family standard requirements.

Electrical Slow Transient Immunity per basic standard EN61000-4-5 in accordance with EN61326 product family standard requirements.

RF Conducted Immunity per basic standard EN61000-4-6 in accordance with EN61326 product family standard requirements.

RF Powerline Interruption Immunity per basic standard EN61000-4-11 in accordance with EN61326 product family standard requirements.

Test Location: ElectroMagnetic Investigations, LLC, Hillsboro, Oregon

Purpose

The purpose of the testing is to determine if the 2650 Modular Measurement and Control System is compliant to immunity specifications as per EN61326 product family standard for measurement, control and laboratory equipment to support compliance to the European Union EMC Directive 89/336/EEC. Heavy industrial environmental levels were tested.

Summary of Results

EN61000-4-2 RF Electrostatic Discharge Immunity – Pass (performance criteria B)

The 2650 Modular Measurement and Control System complies with performance criteria B as specified by the manufacturer after subjected to electrostatic discharge. No degradation of performance was observed after application of electrostatic discharge.

EN61000-4-3 RF Fields Immunity – Pass (performance criteria A)

The 2650 Modular Measurement and Control System operated within the performance criteria while subjected to an electromagnetic field of 10 V/m with 80% 1 kHz amplitude modulation in the frequency range from 80 MHz to 1000 MHz. No degradation of performance was observed beyond performance criteria.

EN61000-4-5 Electrical Fast Transient Immunity – Pass (performance criteria B)

The 2650 Modular Measurement and Control System operated within the performance criteria after subjected to electrical slow transient to the AC mains. No degradation of performance was observed.

EN61000-4-5 Electrical Slow Transient Immunity – Pass (performance criteria B)

The 2650 Modular Measurement and Control System operated within the performance criteria after subjected to electrical slow transient to the AC mains. No degradation of performance was observed.

EN61000-4-6 RF Conducted Immunity – Pass (performance criteria A)

The 2650 Modular Measurement and Control System operated within the performance criteria when subjected to an RF conducted signals injected onto the AC mains. No degradation of performance was observed.

EN61000-4-11 Powerline Voltage Interruption – Pass (performance criteria B)

The 2650 Modular Measurement and Control System operated within the performance criteria after subjected to powerline interruptions to the AC mains. No degradation of performance was observed.

Description of product:

The 2650 is a modular measurement and control system designed for applications such as machine control, industrial process control, building automation and remote data acquisition. It uses Ethernet to connect a LAN to I/O measurement and control points.

Test Methods

EN61000-4-2 Electrostatic Discharge Immunity

The 2650 Modular Measurement and Control System was tested in accordance with EN61000-4-2 per the methods and limits specified in EN61326.

The 2650 Modular Measurement and Control System, configured as described in Test Setup, was placed on an insulating support resting on a conductive table 0.8 meters in height. The 2650 Modular Measurement and Control System was subjected to electrostatic discharges from an Electrostatic Discharge Simulator.

Contact discharges were applied to accessible metal areas of the 2650 Modular Measurement and Control System, to horizontal coupling plan and to vertical coupling plane placed 10 cm away from each side of the 2650 Modular Measurement and Control System. Air discharges were applied to non-metallic areas.

EN61000-4-3 RF Fields Immunity

The 2650 Modular Measurement and Control System was tested in accordance with EN61000-4-3 per the methods and limits specified in EN61326.

The 2650 Modular Measurement and Control System, configured as described in Test Setup, was placed on a non-conductive table 1.0 meter in height inside a shielded enclosure. Electromagnetic fields were generated by antennas placed 3.0 meters in front of the 2650 Modular Measurement and Control System.

While the 2650 Modular Measurement and Control System was monitored for degradation of performance, the electromagnetic field was maintained at 10 V/m with 80% 1 kHz amplitude modulation while scanning the frequency range from 80 MHz to 1000 MHz.

EN61000-4-4 Electrical Fast Transient Immunity

The 2650 Modular Measurement and Control System was tested in accordance with EN61000-4-4 per the methods and limits specified in EN61326.

The 2650 Modular Measurement and Control System configured as described in Test Setup, was placed 10 cm above a conductive surface. The 2650 Modular Measurement and Control System was subjected to electrical transients/bursts (EFT/B) injected capacitively through a Mains Coupler/Decoupler onto each of the line, neutral and earth conductors of the EUT power input. The EFT/B consists of 5 nS rise time, 50 nS duration pulses with a repetition frequency of 5 kHz. The pulses are delivered in 15 mS bursts with a burst repetition period of 300mS. Both positive and negative pulses are applied at 1 kV and 2.0 kV peak to each of the conductors described above for a period of at least 1 minute. The burst transient was injected onto the I/O line at a level of ± 500 V and ± 1000 V by a capacitive clamp.

EN61000-4-5 Electrical Slow Transient Immunity

The 2650 Modular Measurement and Control System configured as described in Test Setup, was placed on a non-conductive table 0.8 meter in height. The 2650 Modular Measurement and Control System was subjected to electrical power line surge transients injected capacitively through a Mains Coupler/Decoupler onto the conductors of the EUT power input. The surges have an open circuit voltage waveform with a rise time of 1.2 μ S and duration of 50 μ S, and a short circuit waveform with a rise time of 8 μ S and duration of 20 μ S.. Surges are applied to each of the line and neutral conductors with respect to earth ground (common mode) at 0.5 kV, 1 kV and 2 kV. Surges are also applied differentially across the line and neutral conductors at 0.5 kV and 1 kV. Both 5 positive and 5 negative surges are applied at 0°, 90°, 180°, and 270° phase angles for each voltage and configuration.

EN61000-4-6 RF Conducted Immunity

The 2650 Modular Measurement and Control System configured as described in Test Setup, was placed .1 meters above a conductive table. The 2650 Modular Measurement and Control System AC mains lines and I/O were subjected to 10 Vrms RF signals swept from 150 kHz to 80 MHz with 80% amplitude modulation with a 1 kHz sine wave.

EN61000-4-11 RF Voltage Interruption

The 2650 Modular Measurement and Control System configured as described in Test Setup, was placed on a non-conductive table 0.80 meter in height. The 2650 Modular Measurement and Control System AC mains lines were subjected to 100% interruption of the powerline voltage for a period of 0.5 cycles.

Performance Criteria

A – No degradation of performance during application of EMC phenomena. (EN61000-4-3, EN61000-4-6).

B - No degradation of performance after application of EMC phenomena. (EN61000-4-2, EN61000-4-4, EN61000-4-5, EN61000-4-11).

Test Set-Up

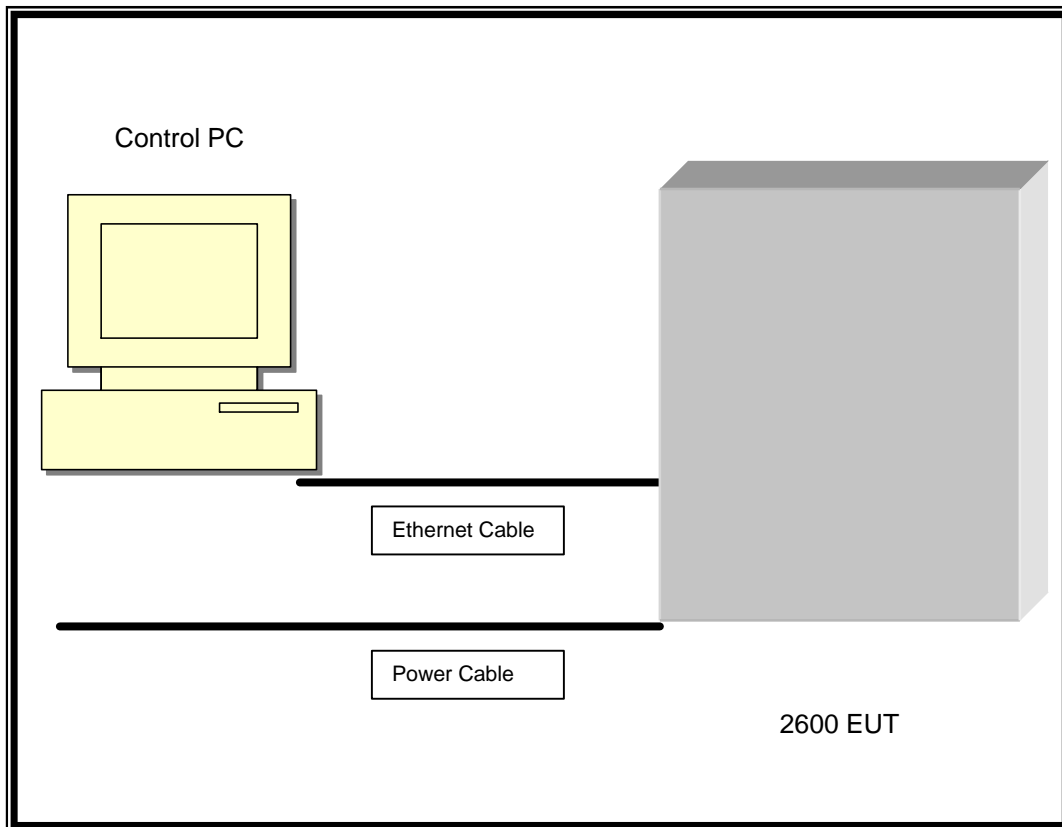


Figure 1

The 2650 (EUT) is connected to the Control PC which is set up outside of the test chamber.

Test Results

EN61000-4-2 per EN61326 product family requirements (Electrostatic Discharge)

No degradation of operation was observed after the test.

EN61000-4-3 per EN61326 product family requirements(RF Fields)

No degradation of operation was observed during or after the test.

EN61000-4-4 per EN61326 product family requirements(EFT/B)

No degradation of operation was observed during or after the test.

EN61000-4-5 per EN61326 product family requirements(Surge)

No degradation of operation was observed during or after the test.

EN61000-4-6 per EN61326 product family requirements(RF Conducted)

No degradation of operation was observed during or after the test.

EN61000-4-11 per EN61326 product family requirements (Voltage Interruption)

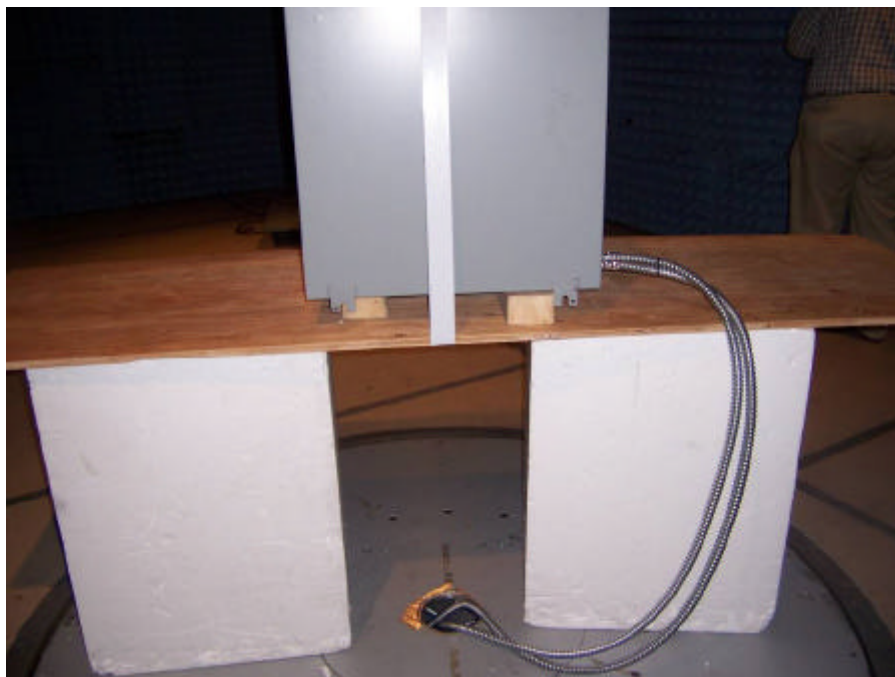
No degradation of operation was observed during or after the test.

Test Setup Photographs:

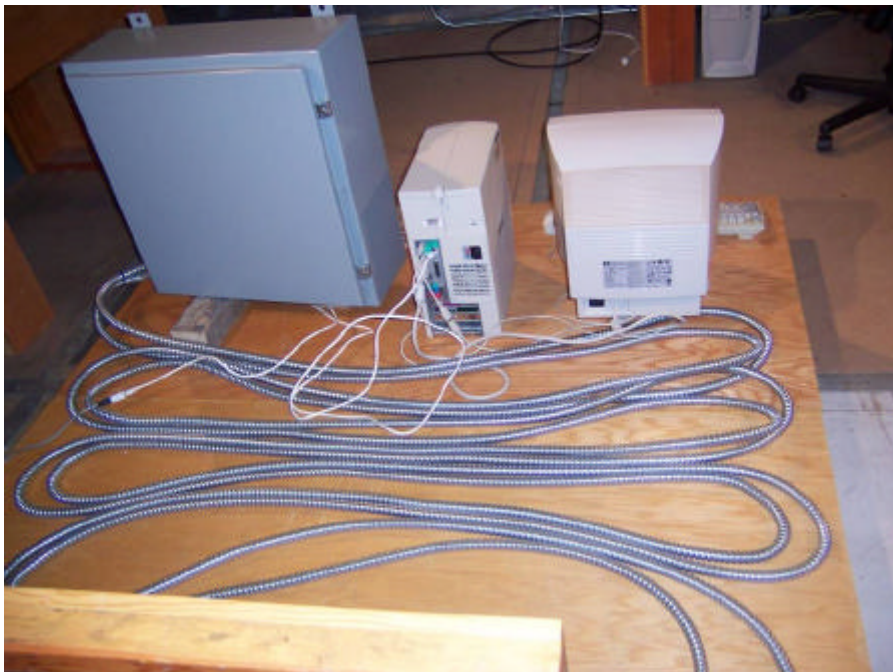
Electrostatic Discharge Immunity



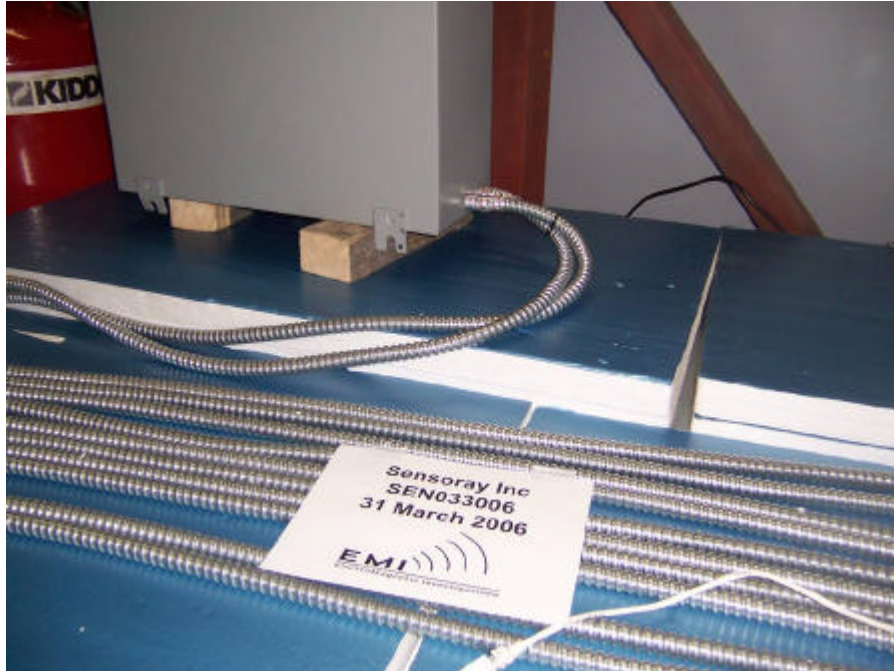
RF Radiated Immunity



Powerline Immunity Electrical Fast & Slow Transient & Dropouts



RF Conducted Immunity



EN61326 EMC Test Plan

Sensoray

EMC Test Plan

Product Model Number: 2600 Series

Products included in this product group: 2601, 2608, 2610, 2620, 2650, 2652

Description of product:

The 2600 is a modular measurement and control system designed for applications such as machine control, industrial process control, building automation and remote data acquisition. It uses Ethernet to connect a LAN to I/O measurement and control points.

Revision History

| Rev | Date | Reason for Amendment – description of change |
|-----|-----------|--|
| 1.0 | 3/22/2006 | First Issue |
| | | |

Author: Caleb Streur, Applications Engineer

Introduction

This document contains the proposed EMC test procedure and method of evaluation for the product described above. Testing will be per EN61326 electromagnetic compatibility product family test standard for measurement, control and laboratory equipment.

Test Configurations, Procedures and Performance Criteria

Non-Industrial Class

In the following tests, we are using the non-industrial class specifications.

Test & Measurement Type

This EUT is considered to be a Test & Measurement type of equipment, and follows the specifications for this type of device.

1) Electrostatic Discharge (ESD) Immunity

The Test Setup is described in the Appendix in *Figure 1*, and is further described as follows: The 2600 (EUT) is connected to a PC via an Ethernet cable. All three devices are on the ESD Test Table and insulated from the surface. The ESD Test Table has a conductive table top and is connected to

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EMC Test Plan

Earth ground via a test standard specified resistor. The ESD Simulator is connected to the surface of the ESD table.

We will note any reaction by the unit to the conducted & radiated energy by observing the display of the control PC.

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EMC Test Plan

Performance Criteria - ESD

Performance Criteria B, as described in the Appendix of this Test Plan, will be used for this test.

The ESD Immunity test requirements are described by the EN61000-4-2 specification. The test consists of simulated ESD events by contact & air discharge to the EUT case. Discharges within 10cm of the EUT will also be performed on the horizontal & vertical planes of the ESD Test Table. Discharges of positive & negative voltages of 2kV and 4kV are required by the standard (non-industrial class).

To provide a level of margin, we will also test the EUT at positive and negative 6kV and 8kV levels. Any degradation of performance at these elevated levels will not be considered a failure, but will be noted in the Test Results.

We do not expect any significant change in performance. Acceptable performance will be that the measured energy may only change during the ESD event. For this test the measured energy may exceed the probe specifications during the ESD event. The EUT will not change states and will not require user intervention to resume making accurate measurements after the ESD event.

2) Radiated Immunity

We will use the Test Setup as described in the Appendix of this Test Plan as in *Figure 1*. This setup is considered worst case for this test.

We will note any reaction by the EUT to the RF field by observing the display of the control PC.

Performance Criteria – Radiated Immunity

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EMC Test Plan

Performance Criteria A, as described in the Appendix of this Test Plan, will be used for this test.

The Radiated Immunity test requirements are defined by the EN61000-4-3 specification. The test consists of an RF signal from 80 to 1,000MHz modulated 80% AM @ 1 kHz sine wave. The signal strength at the EUT shall 3V/m at horizontal and vertical polarizations.

We do not expect any significant change in performance. Acceptable performance will be a reading on the EUT that is within 5% of the expected result while the system is exposed to the RF field.

3) Conducted Immunity

We will use the Test Setup as described in the Appendix of this Test plan as in *Figure 1*. This setup is considered to represent a typical user setup.

Performance Criteria – Conducted Immunity

Performance Criteria B, as described in the Appendix of this Test Plan, will be used for this test.

The Conducted Immunity test requirements are defined by the EN61000-4-6 specification. The test consists of the injection of a 10 Vrms 80% AM sine from 150 kHz to 80MHz signal.

We do not expect any significant change in performance. Acceptable performance will be a reading on the EUT that is within 5% of the expected result while the system is exposed to the RF field.

4) Electrical Fast Transient Immunity (Burst)

We will use the Test Setup as described in the Appendix of this Test plan as in *Figure 1*. This setup is considered to represent a typical user setup.

Performance Criteria – EFT Immunity (Burst)

Performance Criteria B, as described in the Appendix of this Test Plan, will be used for this test.

The EFT Immunity test requirements are defined by the EN61000-4-4 specification. The test consists of the injection of 1.0kV onto the AC line.

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EMC Test Plan

We do not expect any significant change in performance. Acceptable performance will be a reading on the EUT that is within 5% of the expected result after the system is exposed to the RF energy.

5) Electrical Slow Transient Immunity (Surge)

We will use the Test Setup as described in the Appendix of this Test plan as in *Figure 1*. This setup is considered to represent a typical user setup.

Performance Criteria – Electrical Slow Transient Immunity (Surge)

Performance Criteria B, as described in the Appendix of this Test Plan, will be used for this test.

The Electrical Slow Transient Immunity test requirements are defined by the EN61000-4-5 specification. The test consists of the injection of 500V Line to Line & 1kV Line to Earth onto the AC line.

We do not expect any significant change in performance. Acceptable performance will be a reading on the EUT that is within 5% of the expected result after the system is exposed to the RF energy.

6) Voltage Interrupt Immunity

We will use the Test Setup as described in the Appendix of this Test plan as in *Figure 1*. This setup is considered to represent a typical user setup.

Performance Criteria – Voltage Interrupt Immunity

Performance Criteria B, as described in the Appendix of this Test Plan, will be used for this test.

The Voltage Interrupt Immunity test requirements are defined by the EN61000-4-11 specification. The test consists of removing power for one complete cycle (50Hz).

We do not expect any significant change in performance. Acceptable performance will be a reading on the EUT that is within 5% of the expected result after the system is exposed to the Voltage Interrupt.

7) Radiated Emissions

We will use the Test Setup as described in the Appendix of this Test plan as in *Figure 1*. This setup is considered to represent a typical user setup.

We will observe the emissions radiated from this EUT with a recording spectrum analyzer and note in the Test Results, the levels of emissions and their frequency.

Performance Criteria – Radiated Emissions

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EMC Test Plan

The Radiated Emissions test limits are defined by the EN61326 Class A specification. We will be measuring RF Emissions from the EUT at 3 meters.

8) Conducted Emissions

We will use the Test Setup as described in the Appendix of this Test plan as in *Figure 1*. This setup is considered to represent a typical user setup.

We will observe the emissions radiated from this EUT with a recording spectrum analyzer and note in the Test Results, the levels of emissions and their frequencies.

Performance Criteria – Conducted Emissions

The Conducted Emissions test limits are defined by the EN61326 Class A specification.

**End of
Test Configurations, Procedures and Performance Criteria**

Sensoray EMC Test Plan

Appendix

Test Setups

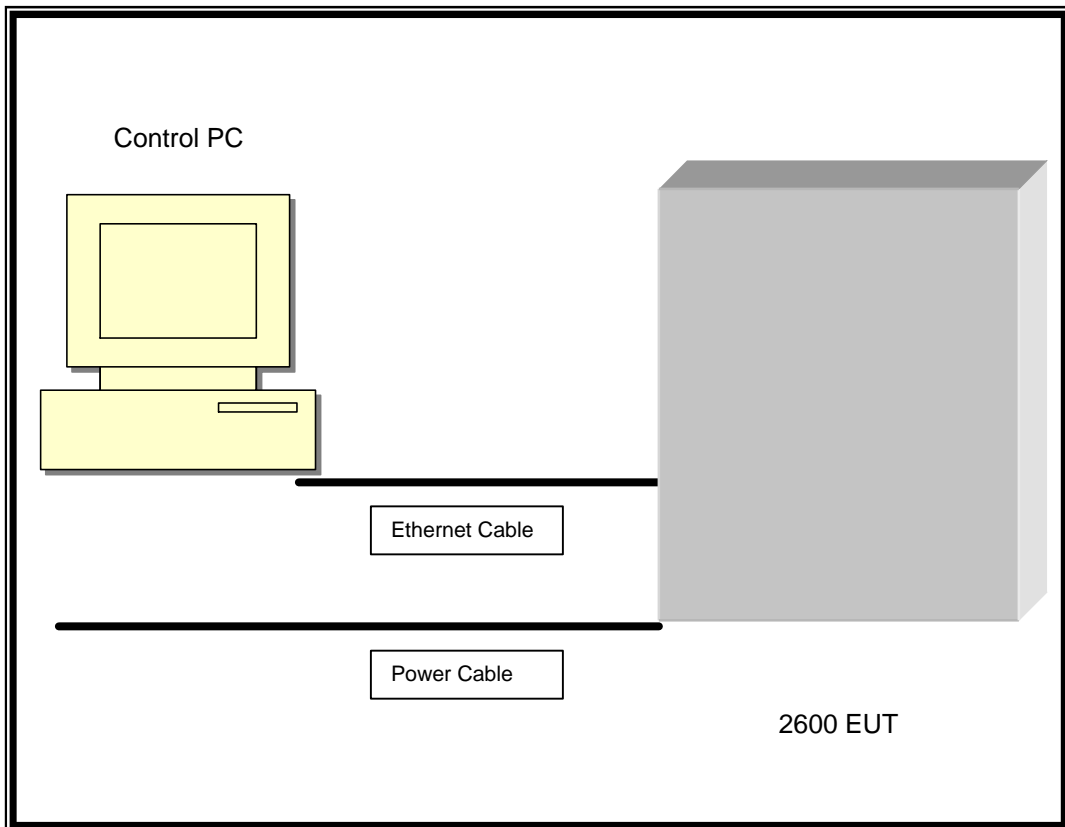


Figure 1

The 2600 (EUT) is connected to the Control PC which is set up outside of the test chamber. The EUT is monitored for any changes during the EMI events.

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EMC Test Plan

Performance Criteria A Definition

The EUT (Equipment Under Test) may react to the EMI energy but may not change states or require user intervention to continue making accurate measurements after the EMI event. No degradation of the product tolerances or specifications is allowed. The output measurement of the EUT shall be within 5% of the expected result, while being exposed to the EMI energy, and return to normal upon removal of the EMI energy.

Performance Criteria B Definition

The EUT may react to the EMI energy during the event (ESD), but may not change states or require user intervention to continue making accurate measurements after the EMI event. If the output measurement of the EUT is beyond 5% of the expected results during a continuous EMI test (i.e. Radiated or Conducted RF Immunity), this information is to be declared on the product or in the User Manual for the product.

Performance Criteria C Definition

The EUT temporarily stops functioning and requires user intervention to bring it back to a normal operating condition (during or after the EMI energy exposure).

Performance Criteria D Definition

The EUT permanently stops functioning, or is permanently damaged by the EMI energy. Degradation or loss of function which is not recoverable due to damage to equipment, components, or the software. Any EUT that falls into this category is not CE compliant.