

**Dominion Voting System for
Assure[®] 1.3 AccuVote[®]-OS MRAM Memory Card
EMC / EMI Test Plan for compliance with the
2005 Voluntary Voting System
Guidelines (VVSG)**

By



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1.0 Introduction

1.1 Overview

This test plan covers the EMC (Electromagnetic Compatibility) and EMI (Electromagnetic Interference) test requirements and methods for the Dominion Assure 1.3 AV-OS MRAM Memory Card, hereafter known as the Unit Under Test (UUT), to the requirements as stated in Election Assistance Commission 2005 Voluntary Voting System Guidelines (VVSG).

1.2 Scope of Testing

Memory cards typically produce a low-level broadband emissions spectrum due to their randomized address and data buss signals and therefore, require radiated emissions and electromagnetic susceptibility testing. Because the memory card is “buried” within the Assure voting system and thus, rather isolated from the AC or DC power supplies, much of the power line voltage and power supply testing may be eliminated.

Because both these product variants have been fully re-qualified to the appropriate EMC standards with the current memory card, as well as the MRAM memory card in previous testing, and the only difference is due to the revised memory card, which is located behind a shielded metal access plate, ESD test is not required. During any ESD test, the current pulses will simply be diverted to the metal chassis before any chance of disruption to the memory card. Similarly for both Radiated Electromagnetic Emissions and Electromagnetic Susceptibility testing is not required to be performed on the MRAM memory card itself.

The appropriate EMC / EMI tests include:

- Radiated Electromagnetic Emissions: FCC Part 15 Class B, ANSI C63.4
- Electromagnetic Susceptibility: IEC 61000-4-3

The device will be configured per the manufacturer documentation and placed into an operational state during hardware testing.

1.3 Qualifications

The UUT supplied by Dominion Voting Systems is representative of product produced in their volume manufacturing process.

1.4 Client

Dominion Voting
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1.5 Company Restricted Information

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1.6 Reference Documents

- 1) Election Assistance Commission 2005 Voluntary Voting System Guidelines Vol I Version 1.0
- 2) Election Assistance Commission 2005 Voluntary Voting System Guidelines Vol II Version 1.0
- 3) NIST Handbook 150-22, 2008 Edition: National Voluntary Laboratory Accreditation Program – Voting System Testing. May 2008
- 4) Election Assistance Commission: NOC 07-05: Voting System Test Laboratory (VSTL) responsibilities in the management and oversight of third party testing.
- 5) Election Assistance Commission: NOC 08-001: Validity of Prior Non-Core Hardware Environmental and EMC Testing.
- 6) Election Assistance Commission: Decision on Request for Interpretation 2010-01 Voltage Levels and ESD Test
- 7) SLP-VC-20 APPROVED Engineering Change Evaluation and Reporting Rev3.3
- 8) SLI Standard Lab Procedure SLP-VC-23: Hardware Test Management
- 9) SLI Standard Lab Procedure SLP-VC-24: Subcontractor Laboratory Management
- 10) DVS ECO# ASR-001 (Signed)
- 11) SLI Evaluation_DVS_ECO ASR-001_v1.1 WTSreview
- 12) SLI Global - EMC Evaluation 20111114
- 13) SLI Global - EMC Evaluation 20120405
- 14) SLI Evaluation_DVS_ECO ASR-001_v1 Models B and D WTSreview

Dominion Assure 1.3 AV-OS
MRAM Memory Card EMC / EMI Test Plan

2.0 EMC / EMI Test Summary

Table 1: EMC / EMI Test Requirements Summary for Dominion, Assure 1.3 AV-OS MRAM Memory Card

Applicable	Test Name	Test Specification	VVSG Reference	Requirement	Comments
Electromagnetic Emissions Tests					
X	Radiated Electromagnetic Emissions	FCC, Part 15 ANSI C63.4	V1, 2.1.4 (c/e) V1, 4.1.2.9 V1, 4.1.7.1 V2, 4.8b	Class B	
Electromagnetic Immunity Tests					
X	Electromagnetic Susceptibility	IEC 61000-4-3 (1996)	V1, 2.1.4 (c/e) V1, 4.1.2.10 V1, 4.1.7.1 V2, 4.8d	A field of 10 V/m modulated by a 1 kHz 80% AM modulation over the frequency range of 80 MHz to 1000 MHz	1 GHz

3.0 Product Description

3.1 Intended Use

For the new AccuVote-OS memory card please refer to EMC Integrity's detailed Product Data Sheets below starting with section 3.3 product information. The Product Data Sheets will be used by EMC Integrity's test technicians during testing and also in writing the test reports.

3.2 Unit Under Test

Model No.	Serial No.	Description	Qty	Revision / Version
181-001004	N/A	AV-OS Memory Card, 128KB, MRAM The new AccuVote-OS MRAM memory card is programmed with ballot and election information pertaining to the vote center once ballot layout has been completed. Election results are tallied to the memory card as ballots are counted.	2	Rev 1

3.3 Product Information - General

Product Information	
Product Name (as it should appear on test report)	Assure 1.3 AccuVote-OS MRAM Memory Card
Model Number	181-001004
Functional description of product(Detailed)	128Kb data storage card using MRAM based memory and specifically designed for use with the Dominion's AccuVote-OS optical scan unit with its 40-pin card edge connector interface.
Product type (IT, Medical, Scientific, Industrial, etc.)	IT
Is the product an intentional radiator	No
Product Dimensions	Approx. 87mmL x 54mmW x 2.25mmH (5mm at grip)
Product Weight	Approx. 1 oz.
Will fork lift be required	No
Applicable Standards, if known	VVSG 2005, VSS 2002
Describe all environment(s) where product will be used	Operating Environment: Temperature +5 to +38 °C, Relative Humidity 30% - 90% (non-condensing). Storage environment: Temperature -15 to +40 °C, Relative Humidity 5% to 95% (non-condensing).
Does product consist of multiple components? (If yes, please describe each system component)	No

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Cycle time > 3 seconds? (If yes, How long?)	Ballot scan cycle is approx... 3 seconds.			
Highest internally generated frequency	None in memory card product. Supporting equip (AV-OS units) can generate 32.7MHz.			
Product Set-up Time	Approx. 10 minutes			
Boot up time in the event of an unintentional power down	Approx. 1 minute (including stepping through the program to get to the test point.)			
Identify all I/O Connections as well as maximum associated cable lengths below				
Model No.	Description	Shielded?	Length	Quantity
N/A				

3.4 Power

Power Requirements	
Input Voltage Rating as it appears on unit, power supply, or power brick	Supporting equip (AV-OS units, model B/D) uses 120Vac.
Input Current (specify @ 230 Vac/50 Hz)	Supporting equip (AV-OS units, model B/D) uses 0.3Amps @120Vac 60/50Hz.
Single or Multi-Phase (If multi-phase, specify delta or wye)	Supporting equip (AV-OS units, model B/D) uses single phase power.
Is input power connector two-prong (Hot & Neutral) or 3-prong (H, N, Ground)	Supporting equip (AV-OS units, model B/D) uses a 3-prong input power connector.
Does UUT have more than 1 power cord? (If yes, explain.)	No. Supporting equip (AV-OS units, model B/D) uses only one power cord.

3.5 Unit Under Test (UUT) – Detailed Information

UUT Hardware			
Condition	Normal operation.		
Configuration During Test	Unit prepared with programming to match test ballot layout. Supporting equipment configured in Test Election mode, scanning a test ballot in recirculation mode.		
Input Power	Supporting equip (AV-OS units, model B/D) uses 120Vac.		
UUT Components			
Name	Model No.	Serial No.	Description
AV-OS Memory Card	181-001004	n/a	AV-OS Memory Card, 128KB, MRAM
I/O Cabling			
See Section 3.3, Product Information for details			

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UUT Software/Firmware		
Name	Version/Revision	Functionality
N/A		
UUT Operating Conditions		
List all frequencies the product generates/uses		Memory card product uses the supporting equipment's address/data bus clock cycle frequency of 7.5MHz. The supporting equipment generates the following frequencies: 32.7MHz Scanner Module Clock Crystal 15MHz CPU Clock Crystal 52KHz Power Supply Switching Frequency
How will product be exercised during test?		Recalculating test ballot scan.
How will product be monitored during test?		Visually. During testing, the ballot will continue to recalculate through the supporting equipment.
What are the product's critical parameters?		
Specify tolerance of all critical parameters.		

3.6 Support Equipment (SE) – Detailed Information

Support Equipment (SE)				
Name	Model No.	Serial No.	Description	
AccuVote-OS Unit	Model B MN: 79811-04 00-103384-000B	35930	Optical scan unit with EAC certified hardware configuration.	
AccuVote-OS Unit	Model B MN: 79811-04 00-103384-000B	35935	Optical scan unit with EAC certified hardware configuration.	
AccuVote-OS Unit	Model D MN: 79811-04 00-103384-000D	42170	Optical scan unit with EAC certified hardware configuration.	
AccuVote-OS Unit	Model D MN: 79811-04 00-103384-000D	43653	Optical scan unit with EAC certified hardware configuration.	
SE I/O Cabling				
Model No.	Description	Shielded?	Length	Quantity
Belden 17250 or equivalent	AC Power Cable		6.7 FT (2m)	1

SE Software/Firmware		
Name	Version/Revision	Functionality
AV-OS	PC 1.96.14	Precinct Count optical scan tabulator programming.

3.7 Engineering Changes (Assure 1.2 Evaluation)

Engineering Change (EC)#	Description
ECO ASR-001 – (New AccuVote-OS Memory Card Proto4 “Pre-production Model”)	Dominion has added a new AccuVote-OS memory card product to the Assure product line.
ECO ASR-002 – (New AccuVote-OS Memory Card Proto5 “Production Model”)	Modification from Proto5 (received 12/13/11): Rework PCB with bridge across Pins 39 and 40 on J1 connector via solder side.

4.0 Test Plan

4.1 Operating Modes and Configurations for EMC Testing

4.1.1 Operating Mode

The new Assure 1.3 AV-OS MRAM memory card will be tested as part of the AccuVote-OS unit configuration. The AccuVote-OS scanner Models B / D (supporting equipment) will be configured in Test Election mode, scanning a test ballot in recirculation mode and writing results to the new Assure 1.3 AV-OS MRAM memory card.

Prior to each test the zero report is printed to ensure that no votes have been counted before the start of the test. At the completion of each test, election results will be validated by reviewing the election summary reports against the public counter on the AccuVote-OS optical scanner's LCD panel display to verify if any data was lost during testing. Reports can only be generated when a memory card is installed on the unit.

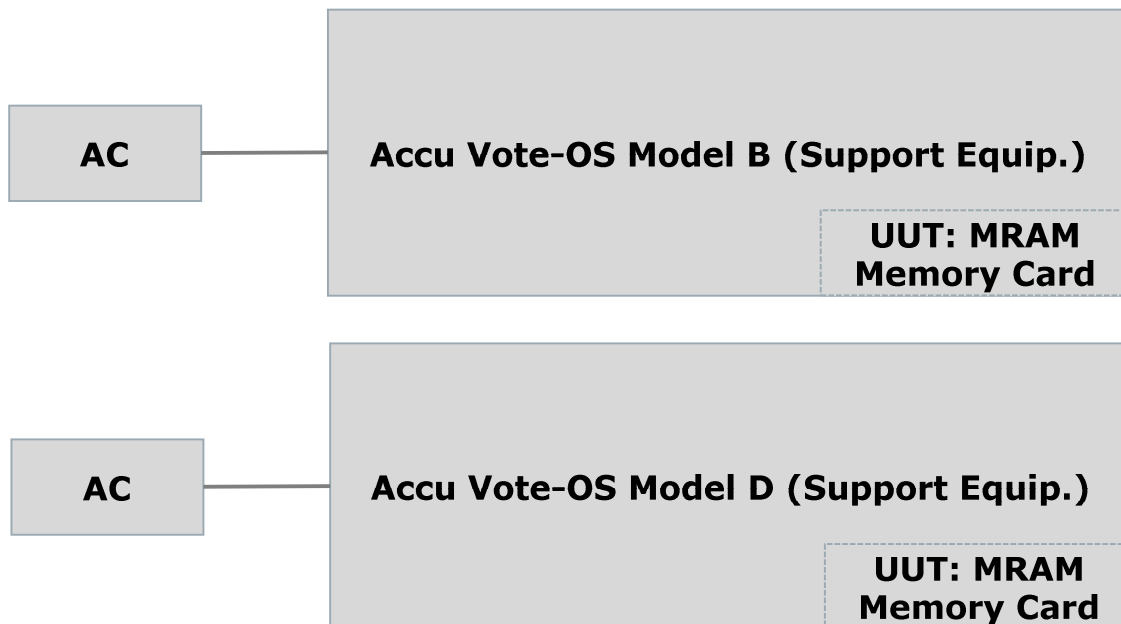
○ Example:

- LCD panel display "Start Count = 0" (Start of test)
- LCD panel display "Finish Count = 250" (Completion of test)
- Printed Summary Report – "Total Ballots = 250"

4.1.2 Configurations

The configuration is as shown in the following block diagram.

Figure 1: EUT Block Diagram



4.1.3 Exercising Software

Prior to and during testing, proper operation of the UUT shall be confirmed using Dominion software. An operational status check shall be performed prior to and at the completion of testing to fully exercise the UUT and ensure that no damage has occurred as a result of the test.

4.2 Treatment of Test Failures

Failures of EMC tests or failures of the exercising software to perform shall be documented in the EMC test report.

4.3 Test Documentation

A test report shall be attained from the test lab that meets the pertinent requirements of EN45001, and ISO/IEC17025, "General Requirements of Testing and Calibration Laboratories".

4.4 Test Facility Location

EMC Integrity, 1736 Vista View Drive, Longmont CO 80504

5.0 EMC / EMI Tests

5.1 Electromagnetic Emissions

Objective: To verify that the electromagnetic emissions generated by the product under normal use and in the product's intended environment are below a level as specified by the VVSG.

5.1.1 Radiated Electromagnetic Emissions

Test Method: FCC Part 15, Radio Frequency Devices

Deviations from Test Method: None

Exit Criteria: The UUT shall meet the following emissions limits:

Note 2: The UUT shall be able to withstand the test without damage or loss of data. The equipment may reset or have momentary interruption so long as normal operation is resumed without human intervention or loss of data. Loss of data means votes that have been completed and confirmed to the voter.

Frequency Band (MHz)	Class B Equipment 10m Measurement Distance (dBuV/m)
30 – 88	40
88-216	43.5
216 – 960	46
960-1000	54
1000-5000	54

5.2 Electromagnetic Immunity

Objective: To verify that the product performs as intended when exposed to different types of electromagnetic energies that may be encountered under normal use in the product's intended environment.

5.2.1 Immunity Compliance Criteria

Note 1: The UUT shall be able to withstand the test without disruption of normal operation or loss of data.

Note 2: The UUT shall be able to withstand the test without damage or loss of data. The equipment may reset or have momentary interruption so long as normal operation is resumed without human intervention or loss of data. Loss of data means votes that have been completed and confirmed to the voter.

5.2.2 *Electromagnetic Susceptibility*

Test Method: IEC61000-4-3, Radiated, Radio-Frequency, Electromagnetic Field Immunity Test, (1996)

Test Levels:

Frequency Range (MHz)	Test Level (V/m)	Modulation / Sweep
80.0 to 1000.0	10	80% AM at 1.0kHz 1% steps with 3s dwell
Clock Frequencies	10	80% AM at 1.0kHz 1% steps with 3s dwell

Deviations from Test Method: None

Exit Criteria:

Note 1: The UUT shall be able to withstand the test without disruption of normal operation or loss of data.

6.0 Handling Hardware Anomalies and Incidents

6.1 Hardware Test Anomalies

An anomaly with the subcontractor's test equipment or a procedural misstep can cause a test to fail. For any suspected test equipment issue or procedural error, analysis will be performed and the decision whether to continue testing based on the severity of the anomaly will be appropriately tracked. The subcontractor test lab will issue a corrective action to address any test equipment and/or procedure errors. This is part of the hardware test subcontractor's quality system process that allows the hardware test lab to train all personnel, repair/calibrate equipment, and prevent any recurrence.

6.2 Hardware Incident Process

For every test failure of any voting system component at the hardware test lab, the lab completes a data sheet (per their laboratory procedures and templates) and immediately informs the SLI Hardware Specialist. This can be communicated in the daily status update, with the data sheet attached.

- Failure Analysis: Once a failure has occurred, the SLI Hardware Specialist will be involved with the subcontractor test lab(s) to identify the hardware discrepancy in the device. The results of the analysis will be documented and tracked in the discrepancy reporting tool, and the ECO database under Hardware Incident. The analysis will focus on the failure, what caused the failure, the severity (minor or major), and possible impacts to other testing.
- Mitigation: The SLI Hardware Specialist monitors any work done by the manufacturer, with the full understanding of what is occurring and why.
 - The Manufacturer will document what work is done and the SLI Hardware Specialist will sign off on or can stop the work at any time.
 - The Hardware Specialist will determine the number of "minor" fixes the manufacturer can incorporate without a re-start of the test.
 - A **minor** change made by the manufacturer can include grounding the chassis or adding ferrites.
 - Any **major** component replacement is cause for failing a test and requiring a re-start. Example: Bad motherboard. Analysis: What was the cause; did the ESD test cause the motherboard to malfunction? Does this impact other hardware tests? The Manufacturer can only replace like for like components and this process must be monitored by the SLI Hardware Specialist.
 - Any modification to the equipment is followed up with the related manufacturer EC(s). All related ECs must be entered into the hardware test report and the certification test report

When issues are identified during hardware environmental testing, they result in discrepancies. Discrepancies are tracked in JIRA and the ECO database under the "Hardware Test Incident" category. The incident number will be tracked along with the equipment that is taken out of testing due to the failure.