Test Report for EAC 2005 VVSG Certification Testing Performed on MicroVote EMS 4.1

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REVISIONS

Revision	Reason for Revision	Date
NR	Initial Release	5/29/15
A	Corrected based on EAC comments	6/24/15

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1.0 INTRODUCTION

The purpose of this National Certification Test Report is to document the findings from National Technical Systems, Inc. (NTS) certification testing of the MicroVote General Corporation (MicroVote), herein referred to as manufacturer, Election Management System 4.1 (EMS 4.1) voting system to the requirements set forth for Voting Systems in the U.S. Election Assistance Commission (EAC) 2005 Voluntary Voting System Guidelines (EAC 2005 VVSG). The EMS 4.1 voting system is a modification to the previously certified EMS 4.0B voting system (Certification number: MVTEMS40B), and as such, was tested by NTS Huntsville (NTS) based on the "modified system" requirements set forth in section 4.4.2.3 of the EAC Testing and Certification Program Manual, Version 1.0.

1.1. Description of EAC Certified System Being Modified

The following subsection describes the EAC Certified System that is baseline for the submitted modification. All information was derived from the previous Certification Test Report and/or EAC Certificate of Conformance.

1.1.1. Baseline Certified System

The baseline system for this modification is the EMS 4.0B voting system. Tables 1-1 and 1-2 provide the proprietary and commercial-off-the-shelf (COTS) hardware and software/firmware versions previously certified. For a complete description of the configuration and description of the EMS 4.0B product, refer to the EMS 4.0B Test Report located on the EAC's website at http://www.eac.gov.

Table 1-1. EMS 4.0B Hardware Components

Component	Model	Hardware Version	Firmware Version
Proprietary			
Infinity	VP-01	Rev C	4.0B
COTS			
Central Count Scanner	Chatsworth ACP 2200	605000-190	N/A
Text-to-Speech Device	DoubleTalk LT	LT RC8650	BIOS 0212
Voting Panel Printer	Seiko	Model DPU-414	N/A
		DPU-3445	N/A
Smartcard Reader	GemPlus	GemPC410	N/A
EMS Report Printer	Dell	M5200	N/A
EMS Desktop	Dell	DHM	N/A
EMS Laptop	Dell	PP17L	N/A

Table 1-2. EMS 4.0B Software Components

Component	Software Version
Proprietary	
EMS	4.0.26.0
COTS	
Microsoft .Net Framework	1.1
Microsoft Windows XP	SP2
ComponentOne	3.1
Microsoft SQL Server 2000	N/A

1.2. References

- Election Assistance Commission 2005 Voluntary Voting System Guidelines, Volume I, Version 1.0, "Voting System Performance Guidelines," and Volume II, Version 1.0, "National Certification Testing Guidelines," dated December 2005
- Election Assistance Commission Testing and Certification Program Manual, Version 1.0, effective date January 1, 2007
- Election Assistance Commission Voting System Test Laboratory Program Manual, Version 1.0, effective date July 2008
- National Voluntary Laboratory Accreditation Program NIST Handbook 150, 2006 Edition, "NVLAP Procedures and General Requirements (NIST Handbook 150)," dated February 2006
- National Voluntary Laboratory Accreditation Program NIST Handbook 150-22, 2008 Edition, "Voting System Testing (NIST Handbook 150-22)," dated May 2008
- United States 107th Congress Help America Vote Act (HAVA) of 2002 (Public Law 107-252), dated October 2002
- Test Guidelines Documents: EMI-001A, "NTS Laboratories' Test Guidelines for Performing Electromagnetic Interference (EMI) Testing," and EMI-002A, "Test Procedure for Testing and Documentation of Radiated and Conducted Emissions Performed on Commercial Products"
- NTS Quality Assurance Program Manual, Current Revision
- ANSI/NCSL Z540-1, "Calibration Laboratories and Measuring and Test Equipment, General Requirements"
- ISO 10012-1, "Quality Assurance Requirements for Measuring Equipment"
- EAC Requests for Interpretation (RFI) (listed on www.eac.gov)
- EAC Notices of Clarification (NOC) (listed on www.eac.gov)
- EAC Quality Monitoring Program residing on:

  http://www.eac.gov/testing_and_certification/quality_monitoring_program.aspx
- Wyle Laboratories' Test Report No. T56849-01 Rev. C – National Certification Test Report of the MicroVote General Corporation Election Management System, Version 4.0B (MODIFIED)
- iBeta MicroVote General Corporation Election Management System (EMS) Voting System v. 4.0 VSTL Certification Test Report

1.3. Terms and Abbreviations

Table 1-3 defines all terms and abbreviations applicable to this Test Report.

Table 1-3 Terms and Abbreviations

Term	Abbreviation	Definition
Anomaly	--	A result and/or event that deviates from what is standard, normal, or expected in which no root cause has been determined.
Audio Tactile Interface	ATI	Voter interface designed to not require visual reading of a ballot.
Configuration Management	CM	---
Commercial Off-the-Shelf	COTS	Commercial, readily available hardware devices (such as card readers, printers or personal computers) or software products (such as operating systems, programming language compilers, or database management systems)
Deficiency	--	Any repeatable test result or event that is counter to the expected result or violates the specified requirements.
Direct Record Electronic	DRE	An electronic voting system that utilizes electronic components for the functions of ballot presentation, vote capture, vote recording, and tabulation which are logically and physically integrated into a single unit. A DRE produces a tabulation of the voting data stored in a removable memory component and in printed hardcopy.
United States Election Assistance Commission	EAC	Commission created per the Help America Vote Act of 2002, assigned the responsibility for setting voting system standards and providing for the voluntary testing and certification of voting systems.
Electromagnetic Compatibility	EMC	A branch of electrical sciences that studies the unintentional generation, propagation, and reception of electromagnetic energy.
Election Management System	EMS	An umbrella term for the software application used to define and report election projects.
Equipment Under Test	EUT	Manufactured product undergoing testing
Functional Configuration Audit	FCA	Exhaustive verification of every system function and combination of functions cited in the manufacturer's documentation.
Help America Vote Act	HAVA	Act created by United States Congress in 2002.
National Institute of Standards and Technology	NIST	Government organization created to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhances economic security and improves our quality of life.
Notice of Clarification	NOC	Provides further guidance and explanation on the requirements and procedures of the EAC's Voting System Certification or Voting System Testing Laboratory programs.

Term	Abbreviation	Definition
Operating Procedure	OP	Test Method or Test Procedure.
Physical Configuration Audit	PCA	Review by accredited test laboratory to compare voting system components submitted for certification testing to the manufacturer's technical documentation, and confirmation the documentation meets national certification requirements.
Quality Assurance	QA	---
Request for Interpretation	RFI	A means by which a registered Manufacturer or Voting System Test Laboratory (VSTL) may seek clarification on a specific Voluntary Voting System Guidelines (VVSG) standard.
Security Content Automation Protocol	SCAP	Method for using commonly accepted standards to enable automated vulnerability management and security policy compliance.
Technical Data Package	TDP	Manufacturer documentation related to the voting system required to be submitted as a precondition of certification testing.
Trusted Build	---	Final build of source code performed by a trusted source and overseen by the manufacturer, which is delivered to the EAC designated repository; also referred to as a "Witness Build".
Voluntary Voting System Guidelines	EAC 2005 VVSG	Published by the EAC, the third iteration of national level voting system standards.
Virtual Review Tool	VRT	Test campaign management software used by the EAC.
Voting System Test Laboratory	VSTL	An independent, non-federal laboratory qualified to test voting systems to Federal standards.

2.0 CERTIFICATION TEST BACKGROUND

NTS Huntsville, an independent testing laboratory, assesses systems and components under harsh environments to include dynamic and climatic extremes and test electronic voting systems. NTS Huntsville holds the following accreditations:

- ISO-9001:2000
- NVLAP Accredited ISO 17025:2005
- EAC Accredited VSTL, NIST 150,150-22
- A2LA Accredited (Certification No.'s 0214.40, 0214.41, and 0214.42)
- FCC Approved Contractor Test Site (Part 15, 18)

2.1. Revision History

Table 2-1 describes the version history of the submitted voting system.

Table 2-1. Voting System Revision History

System Version	Certification Type	System Modified	Certification Date	Certification Number
EMS 4.0	New System	Original	02/06/2009	MVTEMS4
EMS 4.0B	Modification	EMS 4.0	08/23/2010	MVTEMS40B
EMS 4.1	Modification	EMS 4.0B	TBD	MVTEMS41

2.2. Scope of Testing

The focus of the MicroVote General Corporation Election Management System (EMS), version 4.1 test campaign was to verify functionality of modifications applied to the previously certified MicroVote EMS v. 4.0B voting system.

This report is valid only for the system identified in Section 1.1 Description of EAC Certified System Being Modified. Any changes, revisions, or corrections not listed in this report or made to the system after this evaluation are required to be submitted to the EAC for assessment.

The full system details for the previous test campaign, including system, performance, security, telecommunication, usability, system verification, and TDP deliverables can be reviewed in the EAC test report "MicroVote General Corporation Election Management System (EMS) Voting System v.4.0 VSTL Certification Test Report Version 5" (listed on www.eac.gov).

2.2.1. Modification Overview

The following modifications were submitted by the manufacturer for testing. The modification overview is organized into three categories, Enhancements, Defects, and Replacement of End-Of-Life Components.

Enhancements

E-01-(EMS) - Added support for 115kB tally smart cards. The increased space allows larger jurisdictions to use the tally card feature instead of the direct connect option.

E-02-(EMS) - Increased undervote manual entry capacity. For elections which contain large numbers of undervoted contests (i.e. a large primary election with a combined absentee precinct), this enhancement will allow a single manual vote entry to input the vote totals eliminating the need to split the entry into smaller pieces.

Defects

Defects one thru three were discovered in EMS 4.0B EAC Test Campaign. The EAC allowed EMS 4.0B to be certified on the condition that the defects were corrected with the next certification. Defect four was discovered in the field and is described in the EMS 4.1 Test Plan.

D-01-(EMS) – Audit reporting is now available within the EMS application as a standard report. Previously this was provided via multiple disk files.

2.2.1. Modification Overview (Continued)

D-02-(EMS) – Database version control has been added to prevent the opening of backup elections containing executable code from other versions of the EMS software.

D-03-(EMS) – Method of inserting ballot objects, informational messages and error trapping and logging for the ballot designer have all been improved to address a previously identified ballot designer deficiency.

D-04-(EMS) – The overall election voter turnout percentage on the Election Summary and All Precincts header are reported incorrectly. A modification was made in COTS generated XML code to correct the deficiency.

Replacement of End-Of-Life Components

EOL-1 - New Infinity Panel processor board/bridge/heat sink assembly (PCM-3336-BRIDGE-A03) to replace current EOL processor board.

EOL-2 – Added a LED panel (KOE SP24V01L0ALZZ Rev. A) to the available configuration for the Infinity Panel VP-01.

EOL-3 - Added the Entrust 1500 External UPS to support battery backup functionality for the Infinity Panel VP-01.

EOL-4 - New USB PC/SC compatible smart card reader support to replace EOL serial port smart card reader attached to EMS computer.

EOL-5 - Upgraded Microsoft .Net Framework to version 3.5 SP1 to replace EOL version 1.1.

EOL-6 - Upgraded OS to Microsoft 7 Professional from EOL Windows XP SP2.

EOL-7 - Upgraded ComponentOne library to Ultimate 2013 version 3.1 from EOL Enterprise version.

EOL-8 - Eliminated requirement for EOL Franson Serial Tools assembly as this functionality is built into Visual Studio 2013.

EOL-9 - Upgraded database server to Microsoft SQL Server 2012 Express from EOL Microsoft SQL Server 2000 Desktop Edition (MSDE).

EOL-10 - Added new Dell Latitude E5440 laptop to currently certified laptop and desktop computers.

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2.2.2. Test Materials

EMS 4.1 system proprietary and COTS software and hardware submitted by the manufacturer for testing is listed in Table 2-2 and 2-3 respectively.

Table 2-1. EMS 4.1 Hardware Components

Component	Model	Hardware Version	Firmware Version
Proprietary			
Infinity Voting Panel	VP-01	Rev D.05	4.10-983
COTS			
Central Count Scanner	Chatsworth ACP 2200	605000-190	N/A
Text-to-Speech Device	DoubleTalk LT	LT RC8650	BIOS 0212
Voting Panel Printer	Seiko	Model DPU-414	N/A
		DPU-3445	N/A
Smartcard Reader	GemPlus	IDBridge CT30 Smart	N/A
EMS Report Printer	Dell	Dell 0P0137	N/A
EMS Desktop	Dell	Dell OptiPlex 3010	N/A
EMS Laptop	Dell	Dell Latitude E5440	N/A

Table 2-2. EMS 4.1 Software Components

Component	Software Version
Proprietary	
EMS	4.1.20.0
COTS	
Microsoft .Net Framework	3.5
Microsoft Windows 7	SP1
ComponentOne Ultimate 2013	3.1
Microsoft SQL Server 2012 Express	N/A

2.2.3. Block Diagram

MicroVote General Corporation's EMS 4.1 voting system is a comprehensive suite of vote tabulation equipment and software solutions providing end-to-end election management. Figure 2-1 provides a visual system overview.

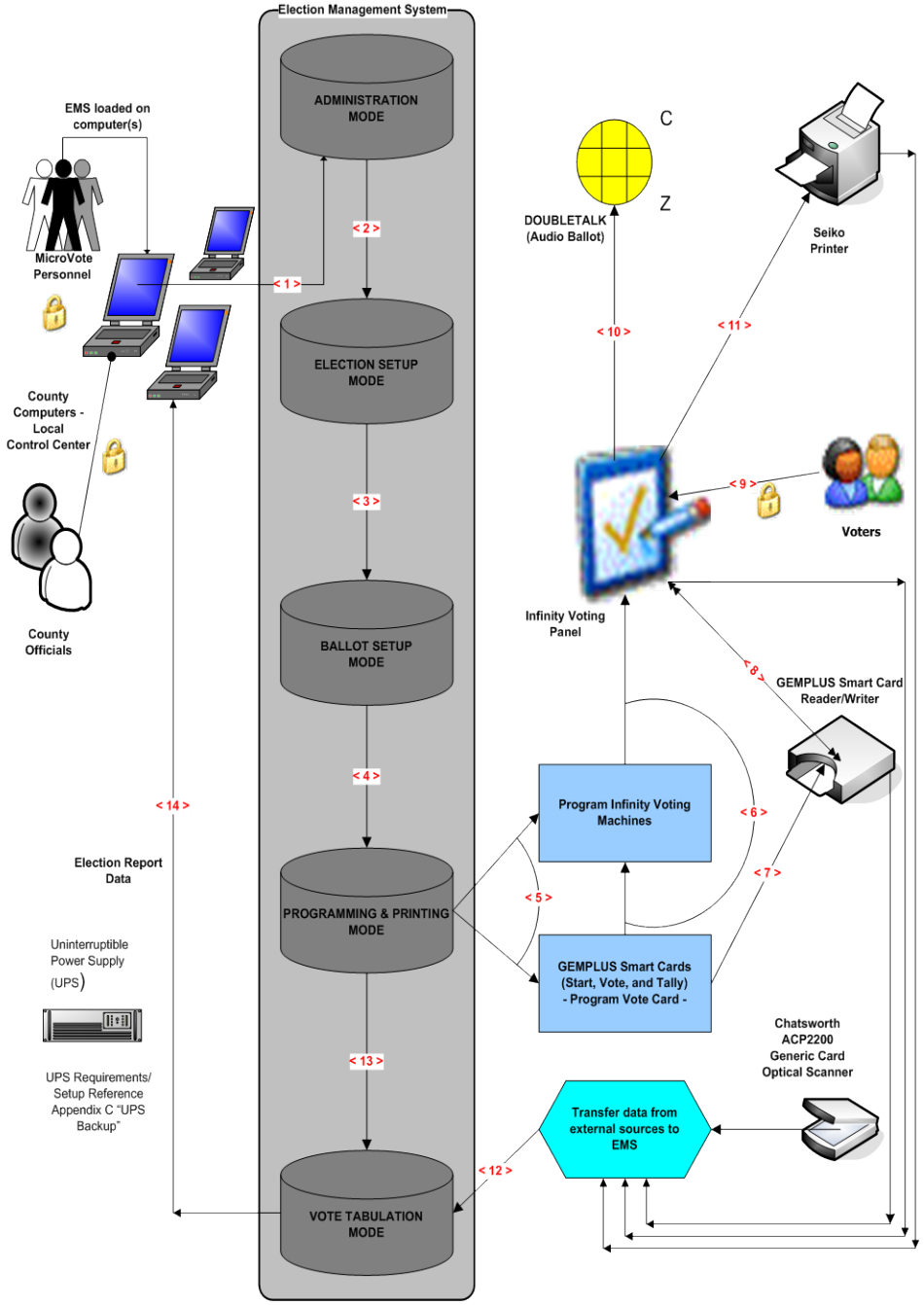

Figure 2-1. System Overview Diagram.

2.2.4. Supported Languages

English and Spanish are the supported languages of the EMS 4.1 voting system.

2.2.5. RFIs

Table 2-2 lists the applicable RFIs the EAC has released as of the date of the Plan as it pertains to this test campaign.

Table 2-2. Applicable RFIs

RFI ID	Name
2007-02	EAC Decision on Variable Names
2007-04	EAC Decision on Presentation of Alternative Languages
2008-01	EAC Decision on Temperature and Power Variation
2008-02	EAC Decision on Battery Backup for Optical Scan Voting Machines
2008-03	EAC Decision on OS Configuration
2008-04	EAC Decision on Supported Languages
2009-04	EAC Decision on Audit Log Events
2010-02	EAC Decision on Coding Conventions
2010-03	EAC Decision on Database Coding Conventions
2010-05	EAC Decision on Testing of Modifications to a Certified System
2010-07	EAC Decision on Module Length
2010-08	EAC Decision on Calling Sequence
2012-04	EAC Decision on Software Setup Validation
2013-03	EAC Decision on Timestamps

2.2.6. NOCs

Table 2-3 lists the applicable NOCs the EAC has released as of the date of the Plan as it pertains to this test campaign.

Table 2-3. Applicable NOCs

NOC ID	Name
2007-001	Timely Submission of Certification Application
2008-003	EAC Conformance Testing Requirements
2009-002	Laboratory Independence Requirement
2009-005	Development and Submission of Test Plans for Modifications to EAC Certified Systems
2012-02	Clarification of System Identification Tool Functionality
2013-01	Deficiency Listing in Test Report
2013-02	Detailed Description of Changes for Modifications

3.0 TEST FINDINGS

The EMS 4.1 voting system, as identified in Section 1.1 of this report, was subjected to the tests as summarized in this section.

3.1. Summary Finding

NTS Huntsville performed system level testing on hardware and software of the MicroVote's EMS 4.1 Voting System due to modifications made to the EMS 4.0B Voting System. Environmental, electromagnetic compatibility and system level tests were performed. There were no anomalies nor additional findings associated with this test campaign. Source Code Review issues are listed in Section 3.1.3 and details of deficiencies are in the Deficiency Report located in Appendix B. There are no State Test Reports included in this test report.

3.1.1. Hardware Testing

Hardware requirements and environmental condition categories applicable to the design and operation of voting systems are detailed in Table 3-1.

Table 3-1. Voting Systems Hardware Requirements and Environmental Conditions

Hardware Requirements	Environmental Conditions (Applicable to Design and Operation)
Shelter	Natural environment: Including temperature, humidity, and atmospheric pressure
Space	Induced environment: Including proper and improper operation and handling of the system and its components during the election processes
Furnishings and fixtures	
Supplied energy	Transportation and storage
Environmental control	Electromagnetic signal environment: Including exposure to and generation of radio frequency energy
External telecommunications services	

Procedural summaries and summary test results within this report verify that the Equipment Under Test (EUT) submitted for certification testing meets the hardware requirements of the 2005 VVSG.

Receipt inspection and evaluation of voting system documentation was conducted prior to the start of the testing sequence. Operational tests/checks to verify system performance and function were performed throughout testing.

Environmental tests were conducted to ensure that climatic and physical occurrences would not affect system structure or functionality. In addition, Electromagnetic Compatibility (EMC) tests were conducted to ensure continued system operation and reliability in the presence of abnormal electrical events.

3.1.2. Temperature Power Variation

Temperature and Power Variation testing was performed in accordance with Volume I Section 4.1.2.13 and Volume II Section 4.7.1 of the 2005 VVSG, including considerations for RFI 2008-01 and RFI 2009-06. This test is similar to the procedure of MIL-STD-810D, Method 502.2 and 501.2.

The purpose of this test was to simulate stresses associated with operating the EUT at varying temperatures and voltages. EUTs were placed inside a walk-in environmental test chamber and connected to a variable voltage power source. Operational functions were continuously exercised during the test by the casting of ballots.

Three EUTs were utilized for a period of 64 hours, as described in EAC RFI 2008-01 to achieve the cumulative duration of at least 163 hours. The first 48 hours were conducted in the environmental test chamber where hardware was subjected to temperatures inside the chamber ranging from 50°F to 95°F and voltage varied from 105 VAC to 129 VAC. The remaining 16 hours were operated in ambient conditions.

Summary Findings

The EUT experienced three failures during the temperature power test. The first failure was linked to a faulty clock chip on the AAEON processor board. The second failure was caused by a bad solder connection that occurred during the repair of the clock chip. The third failure was with the CCFL display panel; during the hot cycle, the contest headers became unreadable. Upon correction of the issues and retest the EUT met the requirements of the Temperature/Power Variation Test without any degradation to structure and/or performance capability.

3.1.2.1. Low Temperature

Low Temperature testing was performed in accordance with Volume I Section 4.1.2.14 and Volume II Section 4.6.4 of the 2005 VVSG and is equivalent to MIL-STD-810D, Method 502.2, Procedure I-Storage. The test simulated stresses associated with the storage of voting machines and ballot counters with a minimum temperature of -4°F.

The EUT was placed in an environmental test chamber at standard ambient. The chamber temperature was lowered to -4°F at a rate that did not exceed 10°F per minute. Once temperature stabilization was reached, the test temperature was maintained for four hours. At the conclusion of four hours, the chamber temperature was returned to standard laboratory ambient conditions at a rate not exceeding 10°F per minute.

Summary Findings

The EUT met the requirements of the Low Temperature Test without any degradation to structure and/or performance capability.

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3.1.2.2. High Temperature

High Temperature testing was performed IAW Volume I Section 4.1.2.14 and Volume II Section 4.6.5 of the 2005 VVSG and is equivalent to the procedure of MIL-STD-810D, Method 501.2, Procedure I-Storage. The purpose of this test was to simulate stresses associated with the storage of voting machines and ballot counters with a maximum temperature of 140°F.

The EUT was placed in an environmental test chamber at standard ambient. The chamber temperature was raised to 140°F at a rate that did not exceed 10°F per minute. The temperature was maintained for four hours after temperature stabilization was reached. After four hours at 140°F, the temperature was returned to standard laboratory ambient conditions at a rate not to exceed 10°F per minute.

Summary Findings

The EUT met the requirements of the High Temperature Test without any degradation to structure and/or performance capability.

3.1.2.3. Humidity

Humidity testing was performed in accordance with Volume I Section 4.1.2.14 and Volume II Section 4.6.6 of the 2005 VVSG and is similar to the procedure of MIL-STD-810D, Method 507.2, Procedure I-Natural Hot-Humid. The purpose of the test was to simulate stresses encountered during the storage of voting machines. The EUT was placed in an environmental test chamber and was subjected to a 10-day humidity cycle in accordance with the 24-hour cycle values as shown in Table 3-1.

Table 3-1. Humidity Test Cycle Values

Time	Hot-Humid (Cycle 1)			Time	Hot-Humid (Cycle 1)		
	Temperature		RH		Temperature		RH
	°F	°C	%		°F	°C	%
0000	88	31	88	1200	104	40	62
0100	88	31	88	1300	105	41	59
0200	88	31	88	1400	105	41	59
0300	88	31	88	1500	105	41	59
0400	88	31	88	1600	105	41	59
0500	88	31	88	1700	102	39	65
0600	90	32	85	1800	99	37	69
0700	93	34	80	1900	97	36	73
0800	96	36	76	2000	94	34	76
0900	98	37	73	2100	97	33	85
1000	100	38	69	2200	90	32	85
1100	102	39	65	2300	89	32	88

Summary Findings

The EUT met the requirements of the Humidity without any degradation to structure and/or performance capability.

3.1.2.4. Vibration

Vibration testing was performed in accordance with Volume I Section 4.1.2.14 and Volume II Section 4.6.3 of the 2005 VVSG and is equivalent to the procedure of MIL- STD-810D, Method 514.3, Category 1- Basic Transportation, Common Carrier. This test simulated stresses faced during the transport of voting machines and ballot counters between storage locations and polling places.

The EUT was secured to an electrodynamics shaker with one control accelerometer affixed to the shaker table. The EUT was subjected to a frequency ranging from 10 to 500 Hz and overall rms levels of 1.04, 0.74, and 0.20 G for durations of 30 minutes in each orthogonal axis.

Summary Findings

The EUT met the requirements of the Vibration Test without any degradation to structure and/or performance capability.

3.1.2.5. Bench Handling

Bench Handling testing was performed in accordance with Volume I Section 4.1.2.14 and Volume II Section 4.6.2 of the 2005 VVSG and is equivalent to the procedure of MIL-STD-810D, Method 516.3, Procedure VI. This test simulated impacts faced during maintenance and repair of voting machines and ballot counters. The EUT was placed on a standard workbench and each edge of the base was raised to a height of four inches above the surface and allowed to drop freely. This was performed six times per edge, for a total of 24 drops.

Summary Findings

The EUT met the requirements of the Bench Handling Test without any degradation to structure and/or performance capability.

3.1.2.6. Electrical Power Disturbance

Electrical Power Disturbance testing was performed in accordance with Volume I Section 4.1.2.5 and Volume II Section 4.8 of the 2005 VVSG. This testing was performed to ensure that the EUT is able to withstand electrical power line disturbances (dips/surges) without disruption of normal operation or loss of data.

The EUT was subjected to the voltage dips and surges detailed in table 3-2. The power input line was subjected to voltage dips ranging from 30% to more than 95% for periods of 10 milliseconds up to 5 seconds and surges of ±15% for up to 8 hours. Table 3-2 lists power line disturbance dip and surge detail.

Table 3-2. Power Line Disturbances

Type	Percentage	Duration
Dip	30%	10ms
Dip	60%	100ms and 1sec
Dip	>95%	5sec
Surge	± 15%	8 Hours (4 Each Polarity)

3.1.2.6. Electrical Power Disturbance (Continued)

Summary Findings

The EUT met the requirements of the Electrical Power Disturbance test without any degradation to structure and/or performance capability.

3.1.2.7. Electrical Fast Transient

Electrical Fast Transient (EFT) testing was performed in accordance with Volume I Section 4.1.2.6 and Volume II Section 4.8 of the 2005 VVSG and RFI 2008-10. This testing was performed to ensure that, should an electrical fast transient event occur on a power line, the EUT would continue to operate without disruption of normal operation or loss of data.

Electrical fast transients of ± 2 kV were applied to external AC power lines and the pulse characteristics are listed in Table 3-3.

Table 3-3. EFT Pulse Characteristics

Pulse Description	Requirements	Units
Pulse Amplitude	+/-2.0	kV peak to peak
Pulse Rise Time	5 ±30%	nanoseconds
Pulse Width	50 ±30%	nanoseconds
Pulse Repetition Rate	100	kHz
Pulse Shape	Double exponential	--
Burst Duration	15	milliseconds
Burst Period	300	milliseconds
Test Duration	60	seconds

Summary Findings

The EUT met the requirements of the Electrical Fast Transient Test without any degradation to structure and/or performance capability.

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3.1.2.8. Lightning Surge

Lightning Surge testing was performed in accordance with Volume I Section 4.1.2.7 and Volume II Section 4.8 of the 2005 VVSG. This testing was performed to ensure that, should a surge event occur on a power line due to a lightning strike, the EUT would continue to operate without disruption of normal operation or loss of data. The power input line was subjected to lightning surge testing at levels of ±0.5, ±1.0 and ±2.0 kV applied to its AC power line per the surge characteristics listed in Table 3-4.

Table 3-4. Surge Characteristics

Pulse Description	Test Level			Units
	A	B	C	
Pulse Amplitude	±0.5	±1.0	±2.0	kV
Pulse Rise Time	1.2 ±30%			microseconds
Pulse Width	50 ±20%			microseconds
Pulse Repetition Rate	1			Per minute
Phase Synchronization (Points)	AC Line at zero-crossing of (0°), (90°), (180°) and (270°).			Degrees
Total Pulse to be Injected	± 5			At each point

Summary Findings

One deficiency was discovered during this test. During application of the +0.5 kV AC line to neutral at 180˚, normal operation of the EUT was disrupted. The details of the deficiency and subsequent resolution are described in Appendix B – Deficiency Report.

Upon correction of the deficiency and retest, the EUT met the requirements of the Lightning Surge Test without any degradation to structure and/or performance capability.

3.1.2.9. Electrostatic Disruption

Electrostatic Disruption (ESD) testing was performed in accordance with Volume I Section 4.1.2.8 and Volume II Section 4.8 of the 2005 VVSG and RFI 2010-01. This testing was performed to ensure that should an electrostatic discharge event occur during equipment setup and/or ballot casting, the EUT would continue to operate normally. Momentary interruption is allowed so long as normal operation is resumed without human intervention or loss of data.

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3.1.2.9. Electrostatic Disruption (Continued)

The EUT was subjected to electrostatic discharges, contact, and air as shown in Table 3-5.

Table 3-5. Electrostatic Discharge Test Levels

Characteristic	Resistance				Capacitance						Unit
Pulse Wave Shape (RC Network)	330				150						Ω / pf
Discharge Types	Air Gap				Direct Contact			Indirect Coupling			
Test Levels	A	B	C	D	A	B	C	A	B	C	
	±2	±4	±8	±15	±2	±4	±8	±2	±4	±8	kV
Number of Discharges	20	20	20	20	20	20	20	20	20	20	10 Discharges each polarity

Discharges were performed at areas typical of those that might be touched during normal operation, including the touch screen, user buttons, cables, connectors, and other points of contact used by the voter or poll worker:

- Power lines and power line returns were configured as required by the system configuration.
- Voter selection buttons were configured as required by the system configuration.
- Capture vote button was configured as required by the system configuration.

The EUT was raised approximately 10 cm from the ground using isolated stand-offs. Signal/control test cables were positioned approximately 5 cm (2 in.) above the ground.

Summary Findings

One deficiency was discovered during this test. The EUT stopped functioning and displayed an error during the horizontal coupling portion of the ESD test due to the SATA cable connection to the Carson daughter. The details of the deficiency and subsequent resolution are described in Appendix B – Deficiency Report.

Upon correction and retest, the EUT met the requirements of the Electrostatic Disruption Test without any degradation to structure and/or performance capability.

3.1.2.10. Electromagnetic Radiation

Electromagnetic Radiation emissions testing was performed in accordance with Volume I Section 4.1.2.9 and Volume II Section 4.8 of the 2005 VVSG. This testing was performed to ensure that emissions emanating from the EUT do not exceed the limits of 47 CFR Part 15, Subpart B, Class B Limits. Testing was performed at the NTS Huntsville Open Air Test Site 2 (OATS-2) located in Huntsville, AL. The OATS-2 is fully described in reports provided to the Federal Communication Commission (FCC) (FCC Reference 98597) and the site complies with the requirements of ANSI C63.4-2003.

3.1.2.10. Electromagnetic Radiation Test (Continued)

Table 3-7 list the conducted and radiated emission limits of FCC Part 15, Class B emissions.

Table 3-7. Conducted and Radiated Emissions Requirements

Conducted Emissions			Radiated Emissions	
Frequency Range (MHz)	Limits (dBµV)		Frequency Range (MHz)	3 Meter Test Limit (dBµV)
	Quasi-peak[1]	Average		
0.15 to 0.50	66 to 56	56 to 46	30 to 88	40.0
0.50 to 5.0	56	46	88 to 216	43.5
5.0 to 30.0	60	50	216 to 960	46.0
			960 to 1000	54.0

Summary Findings

Two deficiencies were discovered during this test. In both instances, the EUT exceeded the allowable emissions for FCC Part 15, Class B resulting in a failure to meet requirements. The first failure exceeded the limit at frequencies of 72 and 109.4 MHz and the second failure exceeded at frequencies of 42.53 and 64.04 MHz. Details of the deficiencies and subsequent resolutions are described in Appendix B – Deficiency Report.

Upon correction and retest, the EUT met the requirements of the Electromagnetic Radiation Test without any degradation to structure and/or performance capability.

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[1]Agencies governing the electromagnetic interference (EMI) from commercial products require quasi-peak detection to be used. Even if the emission from a device is over a test limit when measured with peak detection, the device will be considered to pass if the quasi-peak level is below the test limit.

Quasi-peak detection is a form of detection where the result of a quasi-peak measurement depends on the repetition rate of the signal. Signals can be classified into two general categories based upon their repetition rate: narrowband or broadband. A narrowband signal is a signal that can be resolved by the spectrum analyzer. An example of a narrowband signal is a continuous wave (CW) signal. A CW signal is one signal at a fixed frequency. A broadband signal is a signal that cannot be resolved by the spectrum analyzer. An example of a broadband signal is a pulse signal. Peak, quasi-peak, and average detection will yield the same amplitude level for a narrowband signal. A broadband signal will yield a quasi-peak level lower than the peak level. The weighting (accounted for through specific charge and discharge time constants in the quasi-peak detector circuit), is a function of the repetition frequency of the signal being measured. The lower the repetition frequency, the lower the quasi-peak level.

3.1.2.11. Electromagnetic Susceptibility

Electromagnetic Susceptibility testing was performed in accordance with Volume I Section 4.1.2.10 and Volume II Section 4.8 of the 2005 VVSG. This testing was performed to ensure that the EUT was able to withstand a moderate level of ambient electromagnetic fields without disruption of normal operation or loss of data.

The EUT was subjected to ambient electromagnetic fields at 10 V/m with an 80% modulated 1 kHz sine wave over a range of 80 MHz to 1000 MHz, as shown in Table 3-8. Testing was conducted utilizing both horizontally and vertically polarized waves. The limits were measured with a maximum scan rate of 1% of the fundamental frequency and the dwell duration was three seconds.

Table 3-8. Electromagnetic Susceptibility Test Levels

EN61000-4-3 Radiated Immunity				
Frequency (Hz)	**Polarity**		**Dwell Duration**	**Angle (Degree)**
80MHz - 1GHz (80% modulated 1 kHz sine wave)	Vertical	Horizontal	3 seconds	0
				90
				180
				270

Summary Findings

One deficiency was discovered during this test. The EUT failed to communicate with the D: drive when recording a vote session between the ranges of 550MHz and 710MHz on the vertical axis. The details of the deficiency and subsequent resolution are described in Appendix B – Deficiency Report.

Upon correction and retest, the EUT met the requirements of the Electromagnetic Susceptibility Test without any degradation to structure and/or performance capability.

3.1.2.12. Conducted RF Immunity

Conducted RF Immunity testing was performed in accordance with Volume I Section 4.1.2.11.a and Volume II Section 4.8 of the 2005 VVSG. Section 4.1.2.11.b of Volume I was not applicable because the EUT did not have signal/control lines greater than three meters. This testing was performed to ensure that the EUT was able to withstand conducted RF energy onto its power lines without disruption of normal operation or loss of data.

The EUT was subjected to conducted RF energy of 10 V rms applied to its power lines over a frequency range of 150 kHz to 80MHz.

Summary Findings

The EUT met the requirements of the Conducted RF Immunity test without any degradation to structure and/or performance capability.

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3.1.2.13. Electrical Supply

Electrical Supply testing was performed in accordance with Volume I Section 4.1.2.4 of the 2005 VVSG including considerations for RFI 2008-02 and RFI 2008-06.

The test was performed to ensure that the EUT would continue to operate a minimum of two hours when power is lost. It was required that the voting system perform a successful shutdown without loss or degradation of the voting and audit data and allow voters to resume voting once the voting system had reverted back to primary power.

To perform the test, both components were configured for normal operation. The components were then operated as designed for fifteen minutes prior to the removal of the AC input power. Once AC power was interrupted, the EUT was continuously operated for a minimum period of two hours. At the conclusion of two hours, the EUT was powered down. The AC power was restored and the EUT was operated for an additional fifteen minutes.

Summary Findings

The EUT met the requirements of the Electrical Supply Test without any degradation to structure and/or performance capability.

3.1.3. System Level Testing

System-level testing examines the ability of proprietary software, hardware, and peripherals in addition to the COTS software, hardware, and peripherals to operate as a complete system. NTS Huntsville utilizes test cases designed to ensure that integrated components function as specified by the manufacturer's documentation and meet the requirements of the VVSG.

3.1.3.1. Technical Data Package Review

The EMS 4.1 Voting System TDP was reviewed to the 2005 VVSG. This review is performed as part of the testing activities. The TDP review only included the revised and new documents submitted for this testing campaign. The documents were reviewed for accuracy, completeness, and compliance to the 2005 VVSG.

Summary Findings

A total of ten TDP deficiencies were discovered during testing. The deficiencies were as follows:

- Some required documents were missing.
- Some documents included were older versions.
- Some content needed to be updated to properly describe the submitted modifications.

All identified TDP deficiencies exempting Quality Assurance and Configuration Management deficiencies were resolved prior to the conclusion of the TDP review process.

3.1.3.2. Volume and Stress Test

The EMS 4.1 voting system was subjected to a modified Volume and Stress Test. Volume and Stress testing assesses the system's response to transient overload conditions and its ability to maintain data without failure or degradation in performance. The purpose of the test was to verify that the new 115k Tally smart card was capable of recording results from large elections. The file structure of the results file is based on a fixed memory allocation for each of the results file attributes. Due to this architecture, it was only necessary to cast a single ballot in each precinct. The test election contained 529 precincts.

In addition, the Tally card was subjected to conditions that attempted to overload the system's capacity to process, store, and report data. NTS added an additional twenty precincts to the test election to exceed the system's ability to write the data to the Tally card.

Summary Findings

The Infinity Panel successfully wrote results data to the Tally card when the size of the data was less than the capacity of the card. In instances where the results data exceeded the capacity of the Tally card the system notified the user and directed them to connect the Infinity Panel directly to the EMS.

At the conclusion of the Volume and Stress Test re-test, it was determined that the EUT successfully met the test requirements.

3.1.3.3. System Integration Test

System Integration Testing was performed to test all system hardware, software, and peripherals. System Integration Testing focused on the complete system, including all proprietary and COTS software, hardware, and peripherals configured as described in the MicroVote-submitted TDP for the EMS 4.1 voting system. To perform the System Integration Testing, NTS developed specific procedures and test cases designed to test the system as a whole. These procedures demonstrated compliance of the modified EMS 4.1 to Sections 2, 3, 4, 5, and 6 of Volume I of the VVSG.

In order to verify compatibility between the system in scope, ballots were presented across the system and all results verified against the expected results matrix. The created test deck for system integration included hand marked ballots and ADA generated ballots.

The two election definitions exercised during the System Integration Testing are listed below:

- GEN-01. The Gen-01 is a basic election held in four precincts, one of which is a split precinct, containing nineteen contests compiled into four ballot styles. Five of the contests are in all four ballot styles. The other fourteen contests are split between at least two of the precincts with a maximum of four different contests spread across the four precincts. This election was designed to functionally test the handling of multiple ballot styles, support for at least two languages, support for common voting variations, and audio support for at least two languages.
- PRIM-01. The Prim-01 is a closed primary election in two precincts (one precinct is a split), containing thirty contests compiled into five ballot styles. Each ballot style contains six contests. This election was designed to functionally test an open primary with multiple ballot styles, support for two languages, and support for common voting variations.

3.1.3.3. System Integration Test (Continued)

Summary Findings

Through System Integration Testing, it was demonstrated that the system performed as documented with all components performing their intended functions. The system experienced three deficiencies that are outlined below.

- The system does not support pictographic based languages due to a limitation in the Infinity Panel Software
- The EMS system will crash if the OMR reader is started without the central count scanner attached. No error message is provide to the user.
- The "Lighten" and "Darken" buttons on the Infinity Panel were mislabeled.

Further details regarding the deficiencies are noted in Appendix B (ID 128, 129, and 130). Testing and necessary retests due to deficiencies were completed and the system met the requirements of the 2005 VVSG.

3.1.3.4. Data Accuracy

The modified EMS v. 4.1 was subjected to a Data Accuracy Test in accordance with the requirements of Section 4.7.1.1 of the Volume II of the VVSG. Per the VVSG, data accuracy is defined in terms of ballot position error rate. This rate applies to the voting functions and supporting equipment that capture, record, store, consolidate, and report the selections (or absence thereof) made by the voter for each ballot position. To meet the requirements of this test, the voting system must be subjected to the casting of a large number of ballots to verify vote recording accuracy, i.e. at least 1,549,703 ballot positions correctly read and recorded. An accuracy test was performed on the Infinity Panel VP-01. In an effort to achieve this and to verify the proper functionality of the units under test, the following methods will be used to test components of the voting system:

- 85% of the necessary ballots will be cast using an external auto casting tool. The tool uses a script to mimic the actions of the voter. This reduces the risk of human error.
- 15% of the votes will be cast via user interface.

During the Data Accuracy Test, the EMS (with autovote capabilities) was connected to the Infinity Panel and transmitted a defined set of “button selections” to the Infinity Panel via a serial connect. This simulation mimicked the “button selections” for candidate selection and screen navigation. The Infinity Panel cast a total of 6,400 autovote ballots and 5,168 user interface ballots containing 134 ballot positions each to verify vote recording accuracy. Testing was performed by exercising an election definition developed specifically to test for logic and accuracy.

Summary Findings

The EUT successfully met the requirements of the Data Accuracy Test by scanning and processing a minimum of 1,549,703 ballot positions.

3.1.3.5. Physical Configuration Audit

A Physical Configuration Audit (PCA) of the EMS 4.1 voting system was performed as part of the testing activities in accordance with Volume II, Section 6.6 of Volume II of the EAC 2005 VVSG. The PCA compares the voting system components submitted for certification with the vendor's technical documentation and confirms that the documentation submitted meets the requirements of the Guidelines. The PCA included the following activities:

- Establishing a configuration baseline of software and hardware to be tested; confirm whether manufacturer's documentation is sufficient for the user to install, validate, operate, and maintain the voting system;
- Verifying software conforms to the manufacturer's specifications; inspect all records of manufacturer's release control system; if changes have been made to the baseline version, verify manufacturer's engineering and test data are for the software version submitted for certification;
- Reviewing drawings, specifications, technical data, and test data associated with system hardware, and to establish system baseline;
- Reviewing manufacturer's documents of user acceptance test procedures and data against system's functional specifications; resolve any deficiency or inadequacy in manufacturer's plan or data prior to beginning system integration functional and performance tests;
- Subsequent changes to baseline software configuration made during testing, as well as system hardware changes that may produce a change in software operation are subject to re-examination.

The PCA performed consisted of inspecting the following:

- Infinity Panel VP-01 software platform
- Infinity Panel VP-01 Rev. C
- Infinity Panel VP-01 Rev. D04
- MinuteMan Entrust 1500
- Chatsworth ACP2200

Summary Findings

A PCA was performed to baseline the system's hardware and software components that were used during the test campaign. It was determined that the Infinity Panel VP-01 Rev. C and Chatsworth ACP2200 were unmodified from the certified version.

One deficiency was discovered. MicroVote failed to meet the requirements of Volume I Section 9.3.2 and 9.4 of the 2005 VVSG. The 2005 VVSG requires that all components and subsequent modifications to components be uniquely numbered or otherwise identified by version. The modified submission of the Infinity Panel VP-01 retained the original certified classification of Rev. C. MicroVote corrected this issue by changing the revision number of the modified Infinity Panel VP-01 to Rev. D. With this correction, MicroVote met the PCA requirements.

3.1.3.6. Functional Configuration Audit (FCA)

A Functional Configuration Audit of the EMS 4.1 was performed in accordance with Section 6.7 of Volume II of the VVSG. The purpose of the FCA was to verify that the EMS 4.1 system under scope performed as documented in the manufacturer supplied technical documentation during pre-voting, voting, and post-voting activities and validated that the EMS 4.1 meets the requirements of the EAC 2005 VVSG. The FCA tests were designed to ensure compatibility of voting machine functions using the referenced firmware. During the FCA, both normal and abnormal data was input into the system to attempt to introduce errors and test for error recovery.

Summary Findings

The FCA was conducted without incident and produced no anomalies or deficiencies.

3.1.3.7. Security Testing

EMS 4.1 was subjected to a Security Content Automation Protocol (SCAP) Security review. The review was conducted to verify that the operating environment (Windows 2007) was configured to match industry recognized security protocol. The MicroVote TDP was utilized during this portion of testing to ensure the proper configuration of the operating environment.

Summary Findings

NTS determined that the submitted voting system is compliant with the security requirements of the EAC 2005 VVSG.

3.1.3.8. Quality Assurance/Configuration Management Test

As part of the modification, NTS Huntsville personnel conducted a QA/CM review to verify that the manufacturer correctly followed their documented processes for a modified system. The QA/CM requirements were spot checked and limited to only the changes included within this modification. NTS Huntsville provided MicroVote a quality assurance audit list in which MicroVote was required to complete and deliver within 24 hours. The quality assurance audit utilized the following guidelines as the focus of the review:

The basis of this examination is to ensure:

- Conformance with the requirements to provide information on vendor practices required by these Guidelines.
- Conformance of system documentation and other information provided by the vendor with the documented practices for quality assurance and configuration management.

3.1.3.8. Quality Assurance/Configuration Management Test (Continued)

The focus of this examination is to assess whether the vendor's quality assurance program provide:

- Clearly measurable quality standards.
- An effective testing program throughout the system development life cycle.
- Comprehensive monitoring of system performance in the field and diagnosis of system failures
- Effective record keeping of system failures to support analysis of failure patterns and potential causes
- Effective processes for notifying customers of system failures and corrective measures are taken

Summary Findings

MicroVote supplied NTS Huntsville with the requested documentation and answers within the allowed 24-hour window. NTS Huntsville determined that MicroVote's QA and CM programs did not meet the requirements of 2005 VVSG after a review of the information provided. Further details regarding the deficiency are noted in Appendix B (ID 175).

3.1.4. Source Code Review

As part of testing activities, the source code submitted for the modified EMS 4.1 System was compared to the baseline version included in the EMS 4.0B System. Any code changes were reviewed by NTS to determine its compliance to the 2005 VVSG and manufacturer coding standards.

Summary Findings

Three software suites were examined: EMS, ICE, and ICP. This is a summary of the issues discovered.

EMS:		Infinity:	
Header Inputs or Outputs	3	Header Inputs or Outputs	1
Units Called	12	Header Revision History	2
Header Revision History	1	Header Globals Missing	4
Units Called	3	Units Called	6
		Inconsistent Indenting	3
		Records With Comments	1
		Inconsistent Indenting	1

All identified source code issues were resolved prior to the conclusion of the source code review process.

3.2. Anomalies and Resolutions

NTS Huntsville defines an anomaly as any unexpected result and/or event that deviates from what is standard, normal, or expected in which no root cause has been determined. All anomalies are logged and monitored throughout the test campaign and subsequent testing efforts. Anomalies may become deficiencies when a root cause is established.

No anomalies occurred during testing of the MicroVote EMS 4.1 voting system.

3.3. Deficiencies and Resolutions

NTS Huntsville defines a deficiency as any repeatable test result or event that is counter to the expected result or violates the specified requirements. Deficiencies are placed into the NTS deficiency tracking system (Mantis) and the EAC's Virtual Review Tool (VRT) for disposition and resolution.

Deficiencies are summarized in the summary findings of the respective test section of the test report and their resolutions are presented in their entirety in Appendix B – Deficiency Report. Two deficiencies, 131 and 175, were not corrected prior to completion of testing and remain as an outstanding deficiency that was accepted by the EAC to be addressed in a later test campaign. All other deficiencies encountered during testing were successfully resolved prior to test completion.

4.0 RECOMMENDATION FOR CERTIFICATION

NTS Huntsville performed conformance testing on all modifications submitted for the MicroVote General Corporation Election Management System, identified as version 4.1. The submitted modifications met the requirements of the 2005 VVSG with the following exceptions:

- EMS 4.1 does not support the use of pictographic based languages as required by Volume I Section 2.2.1.3 of the 2005 VVSG
- MicroVote's QA and CM programs did not meet the requirements of Volume I Sections 8 and 9 of the 2005 VVSG

Per Volume 2 Appendix B.5 "…any uncorrected deficiency that does not involve the loss or corruption of voting data shall not necessarily be cause for rejection." Therefore, NTS Huntsville recommends the EAC grant the EMS 4.1 voting system certification to the EAC 2005 VVSG.

Any changes, revisions, or corrections made to the system after this evaluation are required to be submitted to the EAC to determine if the modified system requires a new application, or can be submitted as a modified system. The scope of testing required will be determined based upon the degree of modification.

Due to the varying requirements of individual jurisdictions, it is recommended by the EAC 2005 VVSG that local jurisdictions perform acceptance tests on all systems prior to their use in an election within their jurisdiction.

APPENDIX A - ADDITIONAL FINDINGS

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APPENDIX B – DEFICIENCY REPORT

B.1 APPENDIX B - DEFICIENCY REPORT

Table B-1 describes the deficiencies and resolutions discovered during the MicroVote EMS 4.1 test campaign.

Table B-1. Deficiency Report

EAC VRT ID[2]	Deficiency Summary	Resolution
82	A failure of the initially supplied battery backup unit to adequately protect an Infinity voting panel against a simulated lightning surge electrical disruption	MicroVote submitted the MinuteMan Entrust 1500 UPS as the new battery backup solution. Upon retest, NTS found that the Infinity Panel successfully completed the lightning surge test.
83	The Infinity Panel, Rev D, exceeded the radiated emission limits of FCC Part B. In the vertical antenna polarization, radiated radiofrequency emissions exceeded the limit at the frequencies of 72 and 109.4 MHz at a maximum of 6dbµV/m	MicroVote submitted revision D03 of the Infinity Panel to NTS for retest. MicroVote introduced a new baseboard to the Infinity panel. Upon retest, NTS found that the revision D03 version of the Infinity Panel successfully completed electromagnetic emissions testing.
85	The Infinity Panel, Rev D02, exceeded the radiated emission limits of FCC Part 15 Class B. In the vertical antenna polarization, radiated RF emissions exceeded the limit at the frequencies of 42.53 and 64.04 MHz at a maximum of 1dbµV/m and 13dbµV/m respectively	MicroVote submitted revision D03 of the Infinity Panel to NTS for retest. MicroVote introduced a new baseboard to the Infinity panel. Upon retest, NTS found that the revision D03 version of the Infinity Panel successfully completed electromagnetic emissions testing.
123	The Infinity Panel, Rev D03, failed to remain functional during the electromagnetic susceptibility test. There were two hardware configurations submitted for this testing. •Infinity Panel with the new universal baseboard, new processor, and LED screen. •Infinity Panel with the new universal baseboard, new processor, and CCFL screen. Between the ranges of 550mhz and 710mhz, on the vertical axis, the unit would fail to communicate with the D: drive when recording a vote session. This caused the unit to freeze. Power cycling was required to return the unit to a functional state	MicroVote made the following modifications to the system BIOS: •Disabled the Direct Memory Access. •Enabled the CPU throttle functions. ◦CPU throttle setting was configured to 25% Upon retest, the Infinity Panel Rev D03 successfully completed the electromagnetic susceptibility test.

[2] The ID numbers may not be sequential. The deficiency tracking system (VRT) that is utilized by the EAC creates unique ID numbers based on overall entries within the database and not within individual projects.

Table B-1. Deficiency Report (Continued)

EAC VRT ID	Deficiency Summary	Resolution
125	During the horizontal coupling portion of the ESD test the Infinity Panel stopped functioning and displayed the following error: "Unknown unit error writing drive D. Abort, Retry, Fail?" The unit was positioned on an insulating pad 10cm distant from the front edge of the table with the unit rotated counter clockwise by 90 degrees from the normal voting position	The issue was traced to the SATA cable that connects the processor assembly to the Carson daughter. MicroVote submitted an ECO for the SATA cable. This ECO added EMI Foil shielding and a heat shrink rubber sleeve to the cable. Upon retest, the Infinity Panel Rev D03 successfully completed the electromagnetic susceptibility test.
126	During preparation for the Temperature Power test, the Infinity Panel experienced a hardware failure. At random times during the autovoting session the panel would freeze and display the message "Not ready error reading drive C." The issue is not present on any of the other 3 panels	MicroVote determined the root cause to be a defective chip on the Aaeon motherboards. The defective chips were replaced and NTS was able to complete the Temperature Power test preparations.
127	During preparation for the Temperature Power test, the Infinity Panel Rev D03 experienced a hardware failure. Portions of the LED panel stopped functioning properly	NTS Replaced the LED panel and the issue was resolved.
128	During preparation for System Integration, an anomaly was discovered. When selecting the Libertarian straight party option the Republican candidate for President is selected. This only occurs in Precinct 1 and only for the Libertarian selection	The issue was caused by re-sequencing the candidates on the Candidate Filing screen for President And Vice President and re-sequenced the candidates. When attempting to alter the filing sequence a message box opens informing the operator that the ballot styles need to be re-saved. All of the styles were re-saved (for the other precincts) except ballot style 001. The ballot style was re-saved and the issue was resolved.
129	During preparation for System Integration, an anomaly was discovered. Upon booting, the Infinity Panel beeped three times and froze on a solid brownish screen. The Unit was power cycled. When the unit reached the start screen the message "fatal error" was displayed. The unit was power cycled again and the message reappeared.	The BIOS system settings within the old processor board for one or both of the two serial ports were corrupted or lost during the "three beep" power-on event. The BIOS was accessed and the settings for Serial Port 1 and Serial Port 2 were refreshed. Upon restart the fatal error did not appear.
130	During preparation for System Integration, the message "fatal error" was displayed during the initial boot process.	The issue was linked to a defective internal smart card reader. The reader was replaced and the system booted.
131	The EMS 4.1 voting system does not support pictographic based languages as required by Volume I Section 2.2.1.3 of the 2005 VVSG.	This issue was not resolved prior to test campaign completion.

Table B-1. Deficiency Report (Continued)

EAC VRT ID	Deficiency Summary	Resolution
168	During preparations for System Integration the EMS program crashed. The OMR reader was started without the central count scanner attached. This cause an error message to appear notifying the user that the scanner is not attached. The scanner was attached and the error message accepted. When the first ballot was processed the EMS program crashed without presenting an error	The Microsoft drivers for the serial port were causing the system to become unstable while opening and closing the port during the detected (intentional) error and crashing the program. Various software changes were implemented to instantiate a new serial object that prevents recurrence and allows the physical port to remain stable. Upon retest the issue did not re-appear.
169	During the hot cycle (95 degrees F) between runs 39 and 40, the Infinity Panel displayed a fatal error. According to the log, the error happened approximately 30 minutes after the last user action. The unit was power cycled. Upon restart, the unit froze on the infinity splash screen. The unit was power cycled again. Upon restart, the fatal error message appeared again.	Root cause analysis by Aaeon determined that when the processor board was previously repaired to replace a defective clock chip the hand repaired solder joint failed. The clock chip was repaired and the testing was completed.
170	During the hot cycle (95 degrees F), testers noticed that the contest headers were becoming unreadable on the KOE SP24V001 Rev. E CCFL display. By then end of the 12 hr cycle the contests headers were unreadable. As the chamber switched to the cold cycle (50 degrees F) the contest headers became viable again as the temperature dropped	KOE SP24V001 Rev. E CCFL displays were removed from Infinity Rev. D hardware configuration.
171	During the root cause assessment for deficiency ID 170, NTS discovered that the "Lighten" and "Darken" buttons on the Infinity Panel were mislabeled	Infinity firmware was modified to reverse the functionality of the buttons so they operate as expected.
172	The contest headers did not meet the 3:1 contrast ratio requirement for all text and informational graphics intended for the voter	Contest headers modified through the Infinity firmware to remove the background color of the contest header.
175	MicroVote supplied NTS Huntsville with the requested documentation and answers within the allowed 24-hour window. NTS Huntsville determined that MicroVote's QA and CM programs did not meet the requirements of 2005 VVSG after a review of the information provided.	This issue was not resolved prior to test campaign completion.

APPENDIX C - ANOMALY REPORT

This page INTENTIONALLY LEFT BLANK as there were no ANOMALIES associated with this Test Report.

APPENDIX D - TEST PLAN

D.1 AS-RUN TEST PLAN

The following change was made to the test plan as a result of testing:

- Section 1.2 – Added E-02 to the enhancements list
  - Increased undervote manual entry capacity. For elections which contain large numbers of undervoted contests (i.e. a large primary election with a combined absentee precinct), this enhancement will allow a single manual vote entry to input the vote totals eliminating the need to split the entry into smaller pieces.
- Section 1.7.1 - Modified table 1-5 as follows:
  - Changed Infinity Panel hardware version to VP-1 D.05
  - Changed Infinity Voting Panel to Firmware to 4.10-983
  - Changed Chatsworth ACP 2200 firmware to N/A
- Section 1.7.1 - Modified table 1-6 as follows:
  - Changed software version to 4.1.20.0
- Section 3.1 - Modified table 3-1 as follows:
  - Changed MicroVote EMS software version to 4.1.20.0
  - Changed Infinity Panel Software version to 4.10-983
- Section 3.3 – Updated TDP items in table 3-3 to the tested versions listed in Appendix E of this report
- Section 6.2 – Removed the following election descriptions:
  - General Election: GEN-02
  - General Election: GEN-03
  - Primary Election: PRIM-02
  - Primary Election: PRIM-03

APPENDIX E. TECHNICAL DATA PACKAGE

E.1 EMS 4.1 TECHNICAL DATA PACKAGE

The documents listed in Table E-1 comprise the EMS 4.1 Voting System TDP

Table 3-9. EMS 4.1 Voting System TDP

Document Title	Version	Document Number
System Overview	1.12	DO1.12TDP
System Functionality Description	1.2	DO1.2TDP
Software Design Specification	2.8	DO2.8TDP
System Security Specification	1.8	DO1.8TDP
System Maintenance Procedures	1.9	DO1.9TDP
Personal Deployment and Training Requirements	1.1	DO1.1TDP
Configuration Management Plan	1.5	DO1.5TDP
Infinity Panel Manual	4.0	DO4.0TDP
Infinity Firmware Functional Specification	4.0	DO4.0TDP
COTS Specifications	1.5	DO1.5TDP -
Glossary of Terms	1.1	DO1.1TDP
Voting Variations	1.5	DO1.5TDP
ACP2200 Readme	1.0	DO1.0TDP
ACP2200 Manual	1.0	DO1.0TDP
Seiko 3445 Manual	1.0	DO1.0TDP
Seiko 414 Manual	1.0	DO1.0TDP
DoubleTalk Manual	1.0	DO1.0TDP
StarTech USB Card Reader Manual	1.0	DO1.0TDP
Appendix P – Checklist	1.0	DO1.0TDP
GUI Specifications	1.6	DO1.6TDP
Poll Workers Manual	1.9	DO1.9TDP
User Manual	2.9	DO2.9TDP
Machine Technician Manual	0.2	DO0.2TDP
MicroVote System Identification Tool	1.6	DO1.6TDP
App	1.5	DO1.5TDP
Apptblcont.doc	1.5	DO1.5TDP
AppAppA_test cases	1.5	DO1.5TDP
AppAppB_Carson_Mfg_Docs	1.5	DO1.5TDP
AppAppE_COTSTestForms	1.5	DO1.5TDP
AppAppH_ACP2200_README	1.5	DO1.5TDP
AppAppI_ACP2200_Manual	1.5	DO1.5TDP
AppAppJ_Seiko3445_Manual	1.5	DO1.5TDP
AppAppK_Seiko414_Manual	1.5	DO1.5TDP
AppAppN_DOUBLETALK _Manual	1.5	DO1.5TDP
AppAppO_BAY 7-IN-1 USB 2.0 Flash Card Reader	1.5	DO1.5TDP
AppAppP_Checklists	1.5	DO1.5TDP
AppAppQ_Defect_Tracking	1.5	DO1.5TDP
AppAppW_CountyInvoice	1.5	DO1.5TDP
AppAppX_SourceCode_List	1.5	DO1.5TDP
AppDO0.2TDP-Z.doc	1.5	DO1.5TDP
AppDO1.1TDP-D.doc	1.5	DO1.5TDP
AppDO1.1TDP-G.doc	1.5	DO1.5TDP
AppDO1.2TDP-T.doc	1.5	DO1.5TDP
AppDO1.5TDP-C.doc	1.5	DO1.5TDP
AppDO1.5TDP-F.doc	1.5	DO1.5TDP
AppDO1.6TDP-AA.DOC	1.5	DO1.5TDP

3.1.2.1 Technical Data Package Review (Continued)

Table 3-9. EMS 4.1 Voting System TDP (Continued)

Document Title	Version	Document Number
AppDO1.6TDP-R.doc	1.5	DO1.5TDP
AppDO1.9TDP-U.DOC	1.5	DO1.5TDP
AppDO2.6TDP-Y.doc	1.5	DO1.5TDP
AppDO2.9TDP-V.doc	1.5	DO1.5TDP
AppAppA_test casesExecuted Test Cases1ST Passt.txt	1.5	DO1.5TDP-
AppAppB_Carson_Mfg_DocsAppB1_Infinity_Manual	1.5	DO1.5TDP-
AppAppB_Carson_Mfg_DocsAppB2_QA	1.5	DO1.5TDP-
AppAppB_Carson_Mfg_DocsAppB3_Firmware_Spec	1.5	DO1.5TDP-
AppAppB_Carson_Mfg_DocsAppB4_Communications_Spec	1.5	DO1.5TDP-
AppAppB_Carson_Mfg_DocsAppB5_Encryption_Algorithm	1.5	DO1.5TDP-
AppAppB_Carson_Mfg_DocsAppB6_Technical_Bulletin_ECN1408	1.5	DO1.5TDP-
AppAppB_Carson_Mfg_DocsAppB7_Infinity_Smart_Card_Spec	1.5	DO1.5TDP-
AppAppB_Carson_Mfg_DocsAppB8_Aaeon_Processor_Assembly	1.5	DO1.5TDP-
AppAppB_Carson_Mfg_DocsDO0.6TDP-Btblcont.doc	1.5	DO1.5TDP-
AppAppB_Carson_Mfg_DocsAppB1_Infinity_ManualDO0.8TDP-B1.doc	1.5	DO1.5TDP-
AppAppB_Carson_Mfg_DocsAppB1_Infinity_ManualDO0.8TDP-B1cvr.doc	1.5	DO1.5TDP-
AppAppB_Carson_Mfg_DocsAppB2_QADO0.1TDP-B2.doc	1.5	DO1.5TDP-
AppAppB_Carson_Mfg_DocsAppB2_QADO0.2TDP-B2cvr.doc	1.5	DO1.5TDP-
AppAppB_Carson_Mfg_DocsAppB3_Firmware_SpecDO0.5TDP-B3.doc	1.5	DO1.5TDP-
AppAppB_Carson_Mfg_DocsAppB3_Firmware_SpecDO0.6TDP-B3cvr.doc	1.5	DO1.5TDP-
AppAppB_Carson_Mfg_DocsAppB4_Communications_SpecDO0.1TDP-B4.doc	1.5	DO1.5TDP-
AppAppB_Carson_Mfg_DocsAppB4_Communications_SpecDO0.2TDP-B4cvr.doc	1.5	DO1.5TDP-
AppAppB_Carson_Mfg_DocsAppB5_Encryption_AlgorithmDO0.1TDP-B5.doc	1.5	DO1.5TDP-
AppAppB_Carson_Mfg_DocsAppB5_Encryption_AlgorithmDO0.1TDP-B5cvr.doc	1.5	DO1.5TDP-
AppAppB_Carson_Mfg_DocsAppB6_Technical_Bulletin_ECN1408De Minimis FINAL- MicroVote ECN 103.pdf	1.5	DO1.5TDP-
AppAppB_Carson_Mfg_DocsAppB6_Technical_Bulletin_ECN1408DO0.3TDP-B6-Addendum.doc	1.5	DO1.5TDP-
AppAppB_Carson_Mfg_DocsAppB6_Technical_Bulletin_ECN1408DO0.3TDP-B6cvr.doc	1.5	DO1.5TDP-
AppAppB_Carson_Mfg_DocsAppB6_Technical_Bulletin_ECN1408ECN103 - Large flash drives in early voting panels.doc	1.5	DO1.5TDP-
AppAppB_Carson_Mfg_DocsAppB6_Technical_Bulletin_ECN1408ECN103 - Large flash drives in early voting panels.pdf	1.5	DO1.5TDP-
AppAppB_Carson_Mfg_DocsAppB6_Technical_Bulletin_ECN1408ECN1408.pdf	1.5	DO1.5TDP-
AppAppB_Carson_Mfg_DocsAppB6_Technical_Bulletin_ECN1408Technical Bulletin - ECN1408 Field Implementation.pdf	1.5	DO1.5TDP-
AppAppB_Carson_Mfg_DocsAppB7_Infinity_Smart_Card_SpecDO1.3TDP-B7.doc	1.5	DO1.5TDP-
AppAppB_Carson_Mfg_DocsAppB7_Infinity_Smart_Card_SpecDO1.3TDP-B7cvr.doc	1.5	DO1.5TDP-
AppAppB_Carson_Mfg_DocsAppB8_Aaeon_Processor_AssemblyDO0.1TDP-B8cvr.doc	1.5	DO1.5TDP-
AppAppB_Carson_Mfg_DocsAppB8_Aaeon_Processor_AssemblyECN #1505.pdf	1.5	DO1.5TDP-
AppAppB_Carson_Mfg_DocsAppB8_Aaeon_Processor_AssemblyECN #1510.pdf	1.5	DO1.5TDP-

3.1.2.1 Technical Data Package Review (Continued)

Table 3-9. EMS 4.1 Voting System TDP (Continued)

Document Title	Version	Document Number
AppAppE_COTSTestFormsDO1.0TDP-E.PDF	1.5	DO1.5TDP-
AppAppE_COTSTestFormsDO1.1TDP-Ecvr.doc	1.5	DO1.5TDP-
AppAppH_ACP2200_READMEDO1.0TDP-H.PDF	1.5	DO1.5TDP-
AppAppH_ACP2200_READMEDO1.1TDP-Hcvr.doc	1.5	DO1.5TDP-
AppAppI_ACP2200_ManualDO1.0TDP-I.pdf	1.5	DO1.5TDP-
AppAppI_ACP2200_ManualDO1.1TDP-Icvr.doc	1.5	DO1.5TDP-
AppAppJ_Seiko3445_ManualDO1.0TDP-J.pdf	1.5	DO1.5TDP-
AppAppJ_Seiko3445_ManualDO1.1TDP-Jcvr.doc	1.5	DO1.5TDP-
AppAppK_Seiko414_ManualDO1.0TDP-K.pdf	1.5	DO1.5TDP-
AppAppK_Seiko414_ManualDO1.1TDP-Kcvr.doc	1.5	DO1.5TDP-
AppAppN_DOUBLETALK _ManualDO1.0TDP-N.pdf	1.5	DO1.5TDP-
AppAppN_DOUBLETALK _ManualDO1.0TDP-N.txt	1.5	DO1.5TDP-
AppAppN_DOUBLETALK _ManualDO1.1TDP-Ncvr.doc	1.5	DO1.5TDP
AppAppO_BAY 7-IN-1 USB 2.0 Flash Card ReaderAppO1_CardReaderSpec	1.5	DO1.5TDP
AppAppO_BAY 7-IN-1 USB 2.0 Flash Card ReaderAppO2_CardReader_Manual	1.5	DO1.5TDP
AppAppO_BAY 7-IN-1 USB 2.0 Flash Card ReaderDO1.1TDP-Otblcont.doc	1.5	DO1.5TDP
AppAppO_BAY 7-IN-1 USB 2.0 Flash Card ReaderAppO1_CardReaderSpecDO1.0TDP-O1.pdf	1.5	DO1.5TDP
AppAppO_BAY 7-IN-1 USB 2.0 Flash Card ReaderAppO1_CardReaderSpecDO1.0TDP-O1cvr.doc	1.5	DO1.5TDP
AppAppO_BAY 7-IN-1 USB 2.0 Flash Card ReaderAppO1_CardReaderSpecDO1.1TDP-O1cvr.doc	1.5	DO1.5TDP
AppAppO_BAY 7-IN-1 USB 2.0 Flash Card ReaderAppO2_CardReader_ManualDO1.0TDP-O2.pdf	1.5	DO1.5TDP
AppAppO_BAY 7-IN-1 USB 2.0 Flash Card ReaderAppO2_CardReader_ManualDO1.1TDP-O2cvr.doc	1.5	DO1.5TDP
AppAppP_ChecklistsAppP3_Infinity_Prog_Chklst	1.5	DO1.5TDP
AppAppP_ChecklistsDO1.1TDP-P1.doc	1.5	DO1.5TDP-
AppAppP_ChecklistsDO1.1TDP-P2.doc	1.5	DO1.5TDP
AppAppP_ChecklistsDO1.1TDP-P4.doc	1.5	DO1.5TDP
AppAppP_ChecklistsDO1.1TDP-Ptblcont.doc	1.5	DO1.5TDP
AppAppP_ChecklistsAppP3_Infinity_Prog_ChklstDO1.0TDP-P3.doc	1.5	DO1.5TDP
AppAppP_ChecklistsAppP3_Infinity_Prog_ChklstDO1.1TDP-P3cvr.doc	1.5	DO1.5TDP
AppAppQ_Defect_TrackingDO0.2TDP-Q.mdb	1.5	DO1.5TDP
AppAppQ_Defect_TrackingDO0.3TDP-Qcvr.doc	1.5	DO1.5TDP
AppAppW_CountyInvoiceDO1.0TDP-W.PDF	1.5	DO1.5TDP
AppAppW_CountyInvoiceDO1.1TDP-Wcvr.doc	1.5	DO1.5TDP
AppAppX_SourceCode_ListDO1.1TDP-X.xls	1.5	DO1.5TDP
AppAppX_SourceCode_ListDO1.2TDP-Xcvr.doc	1.5	DO1.5TDP