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Test Report for EAC 2005 VVSG Certification Testing  
MicroVote EMS 4.3-A Voting System

EAC Project Number: MVTEMS43A

Version: 00

Date: 10/30/2019

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U.S. Election Assistance Commission

**VSTL**

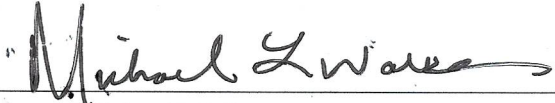
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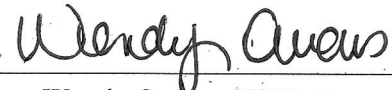
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**REVISIONS**

<b>Revision</b>	<b>Description</b>	<b>Date</b>
00	Initial Release	10/30/2019

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## 1.0 INTRODUCTION

The purpose of this Test Report is to document the procedures that Pro V&V, Inc. followed to perform certification testing during a system modification campaign for the MicroVote EMS 4.3-A Voting System to the requirements set forth for voting systems in the U.S. Election Assistance Commission (EAC) 2005 Voluntary Voting System Guidelines (VVSG), Version 1.0. Certification testing of EMS 4.3-A was performed to ensure the applicable requirements of the EAC VVSG 1.0 and the EAC Testing and Certification Program Manual, Version 2.0 were met. Additionally, all EAC Request for Interpretations (RFI) and Notices of Clarification (NOC) relevant to the system under test were incorporated in the test campaign.

Prior to submitting the voting system for testing, MicroVote submitted an application package to the EAC for certification of the EMS 4.3-A Voting System. The application was accepted by the EAC and the project was assigned the unique Project Number of MVTEMS43A.

### 1.1 Description and Overview of EAC Certified System Being Modified

*The EAC Certified System that is the baseline for the submitted modification is described in the following subsections. All information presented was derived from the previous Certification Test Report, the EAC Certificate of Conformance and/or the System Overview.*

The MicroVote EMS 4.3-A software functionality is divided by activity, based on each stage of the election. These activities are further divided into five modes, all building on each other to complete the election process: Administration, Election Setup, Ballot Setup, Programming & Printing, and Vote Tabulation. Combined, these modes allow for:

- Creating and maintaining default preferences and settings for a specific jurisdiction.
- Creating and maintaining preferences and settings for an election.
- Creating and maintaining security clearances for all users of EMS.
- Creating primary, general or both types of elections or municipal elections.
- Creating offices and filing candidates.
- Creating and maintaining all objects appearing on the ballot.
- Printing ballots.
- Programming voting devices.
- Printing reports of election data.
- Tallying election results.
- Generating reports of election results for state reporting systems, media displays, or printing.
- Creating and restoring backup files of election databases for archival purposes

## **Administration**

The Administration mode is the system setup stage. This mode includes: Preferences, Political Parties, Vote Types, Precincts, Ballot Text, Ballot Graphics, Equipment, Equipment Assignment, and Security. Election Setup Reports reflecting each form are also available.

## **Election Setup**

The Election Setup mode is a mode for pre-election activities. It includes entering offices, filing candidates, creating secondary vote lockouts.

## **Ballot Setup**

The Ballot Setup mode is a mode for pre-election activities. In Ballot Setup, users create and edit ballots, build activations, and assign precincts.

## **Programming & Printing**

The Programming & printing mode is a mode for pre-election activities. Programming & Printing includes programming voting machines and Smart Cards, and previewing and printing ballots

## **Vote Tabulation**

The Vote Tabulation mode is the final mode during which all tabulations and final results are produced. Reports for Vote Tabulation mode reflect the results as they are reported

The EMS software supports the MicroVote Infinity voting panel. This panel is a direct recording electronic (DRE) device, and is connected to EMS via a serial port. Data/Vote tabulations exchange between the EMS and the Infinity machine is done directly through the serial port or via a Smart Card programmed for each election. OMR Ballot Cards, sometimes referred to as Absentee Cards, are optically scanned by a Chatsworth ACP 2200 reader.

Several COTS hardware items and software are used with the EMS software. EMS is designed to be used with Microsoft Windows 10 Pro X86/X64, and is installed on a Dell computer desktop and/or laptop. The database software is SQL Server 2016 Express. There is a COTS DOUBLETALK LT text-to-speech converter box attached to the Infinity machine. There are also COTS Smart Cards and Smart Card readers/writers. All OMR/Absentee ballot cards are optically scanned by the ACP 2200 reader.

### **1.1.1 Baseline Certified System**

The baseline system for this modification is the EMS 4.2 Voting System. The tables below describe the certified equipment and firmware versions. Detailed descriptions of the EMS 4.2 test campaign are contained in Pro V&V Report No. TR-01-01-MVT-2016-01.01, Rev. C, which is available for viewing on the EAC's website at [www.eac.gov](http://www.eac.gov).

**Table 1-1. EMS 4.2 System Components**

<b>EMS 4.2 SYSTEM SOFTWARE</b>	
<b>Firmware/Software</b>	<b>Version</b>
<i>Proprietary</i>	
Election Management Software (EMS)	4.2

**Table 1-1. EMS 4.2 System Components** *(continued)*

<b>EMS 4.2 SYSTEM SOFTWARE</b>	
<b>Firmware/Software</b>	<b>Version</b>
<i><b>COTS</b></i>	
Microsoft Windows 10 Professional	1709
Microsoft Visual Studio 2017 Professional	15.5
ComponentOne Ultimate 2014	1
<b>EMS 4.2 SYSTEM HARDWARE</b>	
<b>Component</b>	<b>Serial Number</b>
<i><b>Proprietary</b></i>	
Infinity Voting Panel (VP-1 Rev: D05) w/Power Supply	11588
Infinity Voting Panel (VP-1 Rev: C) w/Power Supply	04689
<i><b>COTS</b></i>	
Dell OptiPlex 3020 w/Power Cord, Keyboard, & Mouse	BSNNK52
Dell OptiPlex 3020 w/Power Cord, Keyboard, & Mouse	FVNNK52
Dell Latitude EMS Computer (Model E5440 or E5570)	---
Dell 15" Monitor (E153FPb)	CN-0D5421-46633-4B8-0GVU T
Seiko Instruments Printer (DPU-3445) w/Power Supply	2008922A
EMS Download Cable	CC06789-06
USB Smart Card Reader (PC USB TR PIV) w/Stand (HWP109380 B)	113101316600170
DoubleTalk LT w/Radio Shack Headphones	[MVT-001]
Gearmo USB to RS-232 Converter (FTDI-LED)	USA000106043

**1.2 References**

- Election Assistance Commission 2005 Voluntary Voting System Guidelines (VVSG) Version 1.0, Volume I, “Voting System Performance Guidelines”, and Volume II, “National Certification Testing Guidelines”
- Election Assistance Commission Testing and Certification Program Manual, Version 2.0
- Election Assistance Commission Voting System Test Laboratory Program Manual, Version 2.0
- National Voluntary Laboratory Accreditation Program NIST Handbook 150, 2016 Edition, “NVLAP Procedures and General Requirements (NIST HB 150-2016)”, dated July 2016
- National Voluntary Laboratory Accreditation Program NIST Handbook 150-22, 2008 Edition, “Voting System Testing (NIST Handbook 150-22)”, dated May 2008



- United States 107<sup>th</sup> Congress Help America Vote Act (HAVA) of 2002 (Public Law 107-252), dated October 2002
- Pro V&V, Inc. Quality Assurance Manual, Revision 1.0
- Election Assistance Commission “Approval of Voting System Testing Application Package” letter dated May 6, 2016
- EAC Requests for Interpretation (RFI) (listed on [www.eac.gov](http://www.eac.gov))
- EAC Notices of Clarification (NOC) (listed on [www.eac.gov](http://www.eac.gov))
- MicroVote EMS 4.3 Technical Data Package (*A listing of the EMS 4.3 documents submitted for this test campaign is listed in Section 4.6 of this Test Plan*)
- MicroVote TDP Section 2.13 System Change Notes, Election Management System, Version 1.13, dated 03/16/2017

### **1.3 Terms and Abbreviations**

*This subsection lists terms and abbreviations relevant to the hardware, the software, or this Test Plan.*

“CM” – Configuration Management

“COTS” – Commercial Off-The-Shelf

“DRE” – Direct Record Electronic

“EAC” – United States Election Assistance Commission

“EMS” – Election Management System

“FCA” – Functional Configuration Audit

“HAVA” – Help America Vote Act

“NIST” – National Institute of Standards and Technology

“NOC” – Notice of Clarification

“NVLAP” – National Voluntary Laboratory Accreditation Program

“PCA” – Physical Configuration Audit

“QA” – Quality Assurance

“RFI” – Request for Interpretation

“TDP” – Technical Data Package

“VSTL” – Voting System Test Laboratory

“VVSG” – Voluntary Voting System Guidelines

## 2.0 CERTIFICATION TEST BACKGROUND

The EMS 4.3-A system is a modification of a previously certified system (EMS 4.2). Pro V&V performed an evaluation of results from the previous test campaign to determine the scope of testing required for certification of the EMS 4.3-A. Based on this evaluation, Pro V&V determined that testing from the previous test campaign would establish the baseline and that the focus of this test campaign would be on the documented system updates.

### 2.1 Revision History

The table below details the version history of the EMS 4.3-A System:

**Table 2-1. EMS 4.3-A System Revision History**

System Version	Certification Type	Baseline System	Certification Number
EMS 4.0	New System	--- (Original System)---	MVTEMS4
EMS 4.0B	Modification	EMS 4.0	MVTEMS40B
EMS 4.1	Modification	EMS 4.0B	MVTEMS41
EMS 4.2	Modification	EMS 4.1	MVTEMS42
EMS 4.3-A	Modification	EMS 4.2	MVTEMS43A*

\*Upon grant of certification by the EAC

### 2.2 Scope of Testing

The scope of testing was limited to the modifications made to the previously certified EMS 4.2 Voting System, as described in Section 1.1.2. The scope of testing included:

- Technical Data Package (TDP) Review
- Physical Configuration Audit (PCA)
- Source Code Review, Compliance Build, Trusted Build, and Build Document Review
- System Level Testing (Functional Configuration Audit, System Integration Testing, and Accuracy Test)
- EMS And System Functional Regression Testing

#### 2.2.1 Modification Overview

The submitted modifications for the EMS 4.3-A test campaign included a modification to the baseline EMS 4.2 system. This modification was the added software capability to support VVPAT printing. No hardware modifications were submitted.

##### 2.2.1.1 Detailed List of Changes

Added software capability to support VVPAT printing.

## 2.2.2 Block Diagram

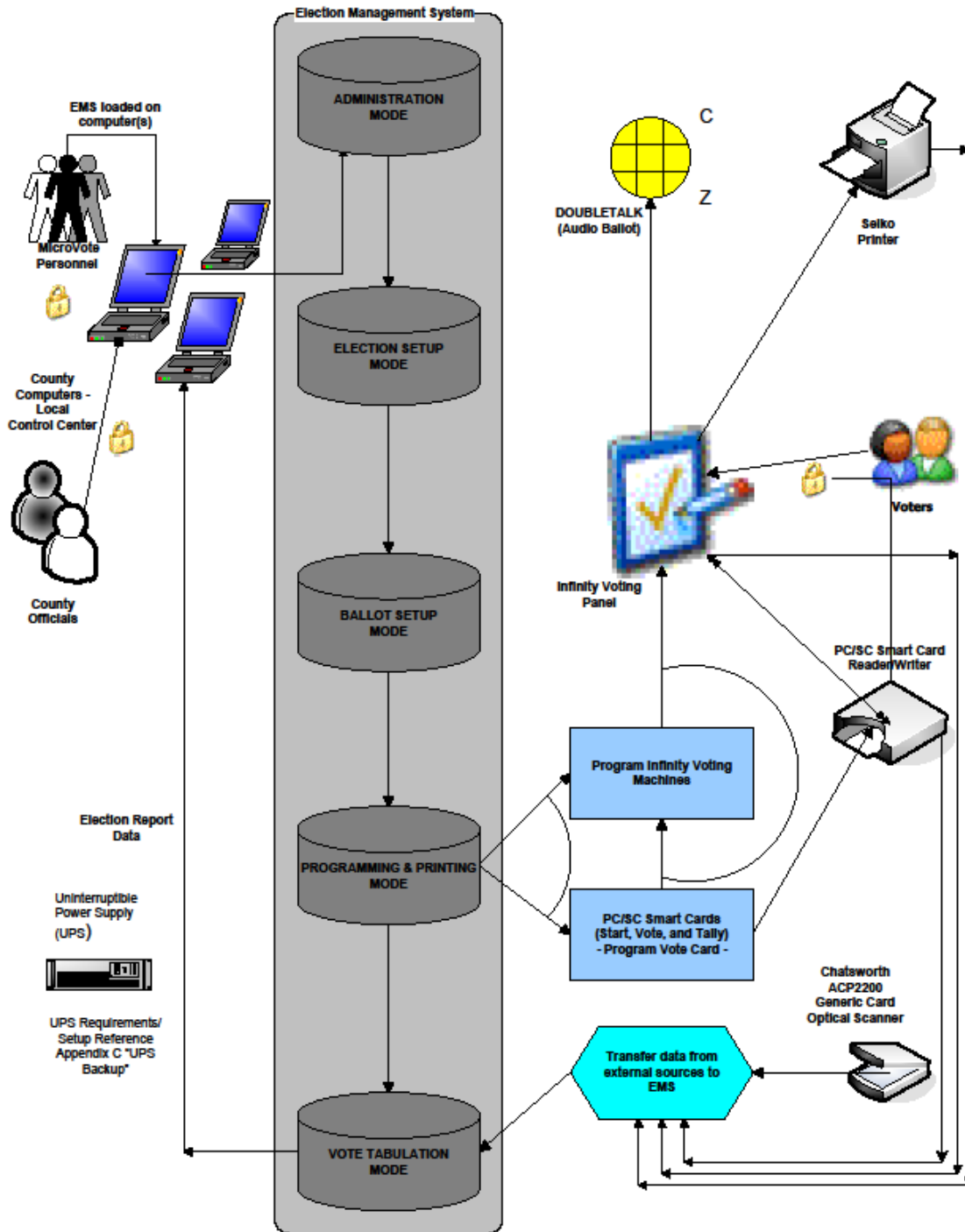


Figure 1-1. EMS 4.3-A System Overview

### 2.2.3 System Limits

There were no changes made to the system limits. The system limitations for the baselined system, as taken from the Certificate of Conformance, are detailed below:

**Table 2-2. EMS 4.2 System Limitations**

Characteristic	Limiting Component	Evaluated	Manufacturer Calculated		
			EMS	Infinity	ACP 2200
Maximum Ballot Positions	Ballot Design Form	150	600	600	402
Maximum Precincts in Election	Precinct Number	559	9,999	9,999	9,999
Maximum Contests in Election	Contests in Ballot Style * Ballot Styles/Election	100	300,000	2,999,700	2,009,799
Maximum Candidates/ Counters in Election	Precinct Counters * Total Precincts	300	5,989,401	5,989,401	4,019,598
Maximum Candidates/ Counters in Precinct	Ballot Design Form	125	599	599	402
Maximum Candidates/ Counters in Activation	Ballot Design Form	125	599	599	402
Maximum Ballot Styles in Election	Ballot Style Number	270	1000	9999	1000
Maximum Contests in a Ballot Style	Ballot Design Form	50	300	300	201
Maximum Candidates in a Contest	Ballot Design Form	68	599	599	401
Maximum Count for any Precinct Element	Transact-SQL Bigint	600	<i>Note 1</i>	65,000	<i>Note 1</i>
Maximum Ballot Styles in a Precinct	Precinct Style Assignment Form	1	1	1	1
Maximum Activations per Ballot Style	Build Activations Form	15	99	30	99
Maximum Activations per Election	Act/Ballot Style * Ballot Style/Elec	1300	99,000	299,970	299,970
Maximum Number of Parties	Party Code Combinations	8	50,653	598	400
Maximum Vote For in Contest	Office Vote Limit	56	99	64	99

*Note 1: 9,223,372,036,854,770,000*

#### **2.2.4 Supported Languages**

The submitted voting system supports:

- English
- Spanish
- optional third language, including pictographic

Support for each stated languages was verified. Both English and Spanish language ballots were cast during the performance of functional testing. Additionally, one character based language (Chinese) was tested during System Integration Testing.

Testing of the Chinese language was accomplished through the creation and execution of both a primary and general election verifying the translations can be used by Chinese minority language voters. The translations themselves were taken from an online translator (Google Translate). The translations were copied and pasted into the qualified EMS ballot text fields using Windows Notepad. In order for the Infinity Panel to recognize the Chinese characters, a number of special reserved ballot text objects needed to be activated, as covered in *MicroVote TDP Appendix B: Third Language Support of the EMS User Manual*.

#### **2.2.5 Supported Functionality**

There were no changes made to the supported functionality of the voting system. The supported functionality for the submitted voting system remains unchanged from the previously certified version.

#### **2.2.6 VVSG**

The EMS 4.3-A Voting System was evaluated against the relevant requirements contained in the EAC 2005 VVSG, Version 1.0.

#### **2.2.7 RFIs**

There are no RFIs released by the EAC as of the date of this Test Report that pertain to this test campaign that were not in effect at the time of the baseline system certification.

#### **2.2.8 NOCs**

There are no NOCs released by the EAC as of the date of this Test Report that pertain to this test campaign that were not in effect at the time of the baseline system certification.

### **3.0 TEST FINDINGS AND RECOMMENDATION**

The EMS 4.3-A Voting System was evaluated against the relevant requirements contained in the EAC 2005 VVSG, Volumes I and II. The focus of this test campaign is the addition of the software capability to support VVPAT printing. The summary findings and recommendations for each area of testing are provided in the following sections.

### **3.1 Summary Findings and Recommendation**

Summary findings for the System Level Testing (System Integration Testing, Accuracy Test, and FCA) and Source Code Review are detailed in the relevant sections of this report. In addition to these areas of testing, a PCA (including System Loads & Hardening) and a TDP Review were performed, as described below.

#### **3.1.1 Physical Configuration Audit (PCA)**

The Physical Configuration Audit (PCA) compares the voting system components submitted for qualification to the manufacturer's technical documentation, and shall include the following activities:

- Establish 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
- Verify 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
- If the hardware is non-COTS, Pro V&V shall review drawings, specifications, technical data, and test data associated with system hardware to establish system hardware baseline associated with software baseline
- Review manufacturer's documents of user acceptance test procedures and data against system's functional specifications; resolve any discrepancy 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

#### **Summary Findings**

During execution of the PCA, the components of the EMS 4.3-A were documented by component name, model, serial number, major component, and any other relevant information needed to identify the component. For COTS equipment, every effort was made to verify that the COTS equipment had not been modified for use. Additionally, each technical document submitted in the TDP was recorded by document name, description, document number, revision number, and date of release. At the conclusion of the test campaign, test personnel verified that any changes made to the software, hardware, or documentation during the test process were fully and properly documented.

### 3.1.2 TDP Review

In order to determine compliance of the modified TDP documents with the EAC 2005 VVSG, a limited TDP review was conducted. This review focused on TDP documents that have been modified since the certification of the baseline system. The review consisted of a compliance review to determine if each regulatory, state, or manufacturer-stated requirement had been met based on the context of each requirement. Results of the review of each document were entered on the TDP Review Checklist and reported to the manufacturer for disposition of any anomalies. This process was ongoing until all anomalies were resolved.

#### Summary Findings

The submitted TDP was determined to be in compliance with the requirements set forth in the EAC 2005 VVSG. A listing of all documents contained in the EMS 4.3-A TDP is provided in Table 3-1.

**Table 3-1. EMS 4.3-A TDP Documents**

<b>Section</b>	<b>Description</b>	<b>Version</b>
---	Technical Data Package (TDP) TABLE OF CONTENTS Election Management System	1.1
2.1	SCOPE Election Management System	1.1
2.2	SYSTEM OVERVIEW Election Management System	1.15
2.3	SYSTEM FUNCTIONALITY DESCRIPTION Election Management System	1.2
2.4	SYSTEM HARDWARE SPECIFICATION Election Management System	1.4
2.5	SOFTWARE DESIGN AND SPECIFICATION Election Management System	2.10
2.6	SYSTEM SECURITY SPECIFICATION Election Management System	1.9
2.7	SYSTEM TEST AND VERIFICATION SPECIFICATION Election Management System	1.2
2.8	SYSTEM OPERATION PROCEDURES Election Management System	1.3
2.9	SYSTEM MAINTENACE PROCEDURES Election Management System	1.3
2.10	PERSONNEL DEPOYMENT AND TRAINING REQUIREMENTS Election Management System	1.1
2.11	CONFIGURATION MANAGEMENT PLAN Election Management System	1.6
2.12	QUALITY ASSURANCE PROGRAM Election Management System	1.3
2.13	SYSTEM CHANGE NOTES Election Management System	1.16
---	Appendices TABLE OF CONTENTS Election Management System	1.8

### 3.1.3 Source Code Review, Compliance Build, Trusted build, and Build Documentation Review

Pro V&V reviewed the submitted source code to the EAC 2005 VVSG and the manufacturer-submitted coding standards. Prior to initiating the software review, Pro V&V verified that the submitted documentation was sufficient to enable: (1) a review of the source code and (2) Pro V&V to design and conduct tests at every level of the software structure to verify that design specifications and performance guidelines are met.

The submitted source code was compared to the previously certified versions to determine the changes, if any. A combination of Automated Source Code Review and Manual Source Code Review methods were used to review the changes in the source code from the previously certified EMS 4.2 voting system. In addition, 10% of the source code comments were manually reviewed.

#### Summary Findings

- Automated Source Code Review: The Automated Source Code Review was performed to review the changes in the source code from the previously certified voting system. No source code issues were found during the Automated Source Code review.
- Manual Source Code Review: The Manual Source Code review was performed on 10% of the comments for compliance to VVSG Volume 1 Section 5.2.7. No source code issues were found during the Manual Source Code review.
- Compliance Build: The compliance build was performed following the compliance review. Once the compliance review was performed and the source was deemed stable enough to proceed with testing, the source code and all additional packages were compiled into a Compliance Build.
- Trusted Build: The trusted build consisted of inspecting customer submitted source code, COTS, and Third Party software products and combining them to create the executable code. This inspection followed the documented process from the “United States Election Assistance Commission Voting System Testing and Certification Program Manual” Section 5.5 – 5.7. Performance of the trusted build includes the build documentation review. The Trusted Build was performed following the completion of the Functional Configuration Audit.

### 3.1.4 System Level Testing

System Level Testing included the Functional Configuration Audit (FCA), the Accuracy Test, and the System Integration Tests. The Accuracy Test and the System Integration tests were performed as part of the regression test requirements for this campaign. System Level testing was implemented to evaluate the complete system. This testing included all proprietary components and COTS components (software, hardware, and peripherals). For software system tests, the tests were designed according to the stated design objective without consideration of its functional specification.

The system level hardware and software test cases were prepared independently to assess the response of the hardware and software to a range of conditions.



The FCA for this test campaign included an assessment of the submitted modification and included inputs of both normal and abnormal data during test performance. This evaluation utilized baseline test cases as well as specifically designed test cases and included predefined election definitions for the input data. As part of the FCA, three primary and three general elections were executed to verify that each of the submitted modifications had been successfully implemented. The System Integration Tests were performed to verify the EMS 4.3-A functioned as a complete system.

During System Level Testing, the system was configured exactly as it would for normal field use per the procedures detailed in the EMS 4.3-A technical documentation. This included connecting all supporting equipment and peripherals as well as any physical security equipment such as locks and ties.

#### **3.1.4.1 Functional Configuration Audit (FCA)**

The functional configuration audit encompasses an examination of manufacturer's tests, and the conduct of additional tests, to verify that the system hardware and software perform all the functions described in the manufacturer's documentation submitted in the TDP.

In addition to functioning according to the manufacturer's documentation, tests will be conducted to insure all applicable EAC 2005 VVSG requirements are met.

For this campaign FCA testing included several exhaustive paths applied in concert:

- FCA-VVSG Testing: Each component of the system was evaluated against a standardized test-case suite centered upon requirements stated in the VVSG and administered through a test-management software tool. All applicable tests-cases were performed while any non-applicable test-cases were logged as "n/a" for substantiation. The system operations and functional capabilities were categorized in the tool as follows by the phase of election activity in which they are required:
  - o Pre-voting Capabilities: These functional capabilities are used to prepare the voting system for voting. They include ballot preparation, the preparation of election-specific software (including firmware), the production of ballots, the installation of ballots and ballot counting software (including firmware), and system and equipment tests.
  - o Voting System Capabilities: These functional capabilities include all operations conducted at the polling place by voters and officials including the generation of status messages.
  - o Post-voting Capabilities: These functional capabilities apply after all votes have been cast. They include closing the polling place; obtaining reports by voting machine, polling place, and precinct; tabulation of paper ballots at the central location; accumulation of results from all voting methods; obtaining consolidated reports; and obtaining reports of audit trails.
- FCA-Claims Testing: System user instructions and procedures found in the TDP were followed to verify their accuracy and completeness. In addition any functional claims discovered in the

TDP that were not specifically examined in other areas or that were items of interest were also tested.

- FCA-Mapping: Any modified functional paths (buttons, dropdowns, etc.) were mapped by qualified VSTL personnel, to help ensure all functional options had been noted and exercised. Any items of interest were examined and/or tested.

All issues (if any) found during these efforts are detailed in Section 3.3. Any issues noted were tracked using an issue tracking software program and issue tracking spreadsheets.

#### Summary Findings

All functional tests were successfully executed. During execution of the test procedure, it was verified that the EMS 4.3-A System successfully completed the system level integration tests with all actual results obtained during test execution matching the expected results.

### **3.1.4.2 Accuracy**

The accuracy test ensures that each component of the voting system can each process 1,549,703 consecutive ballot positions correctly within the allowable target error rate. The Accuracy test is designed to test the ability of the system to “capture, record, store, consolidate and report” specific selections and absences of a selection. The required accuracy is defined as an error rate. This rate is the maximum number of errors allowed while processing a specified volume of data. For paper-based voting systems the ballot positions on a paper ballot must be scanned to detect selections for individual candidates and contests and the conversion of those selections detected on the paper ballot converted into digital data.

#### Summary Findings

The accuracy requirements for the MicroVote EMS 4.3-A were accomplished by the execution of the standard accuracy test utilizing a voting script. The EMS 4.3 software successfully passed the Accuracy Test without issue. A total of 1,569,500 voting positions were voted on the Infinity Voting Panel with all actual results obtained during test execution matching the expected results.

### **3.1.4.3 System Integration**

System Integration is a system level test for the integrated operation of both hardware and software. System Integration evaluates the compatibility of the voting system software components or subsystems with one another, and with other components of the voting system environment. This compatibility was determined through functional tests integrating the voting system software with the remainder of the system.

During test performance, the system was configured exactly as it would for normal field use. This included connecting all supporting equipment and peripherals including ballot boxes, voting booths (regular and accessible), and any physical security equipment such as locks and ties.

## Summary Findings

Three General Elections and three Primary Elections were successfully exercised on the voting system, as described below:

General elections with the following breakdown:

- General Election GEN-01: A basic election held in 4 precincts, one of which is a split precinct. This election contains 19 contests compiled into 4 ballot styles. 5 of the contests are in all 4 ballot styles. The other 15 contests are split between at least 2 of the precincts with a maximum of 4 different contest spread across the 4 precincts.
- General Election GEN-02: A basic election held in 3 precincts. This election contains 15 contests compiled into 3 ballot styles. 10 of the contests are in all 3 ballot styles with the other five split across the 3 precincts.
- General Election GEN-03: A basic election held in two precincts. This election contains eight contests and is compiled into two ballot styles. Four of the contests are in both ballot styles. The other four contests are split between the two precincts. This election is designed to functionally test the handling of multiple ballot styles, support for at least three languages including a character-based language, support for common voting variations, and audio support for two languages (English and Spanish).

Primary elections with the following breakdown:

- Primary Election PRIM-01: Open Primary Election in two precincts. This election contained thirty contests compiled into five ballot styles. Each ballot style contains 6 contests.
- Primary Election PRIM-02: Open Primary Election held in two precincts. This election contained thirteen contests compiled into three ballot styles. One contest is in all three ballot styles; all other contests are independent.
- Primary Election PRIM-03: A basic election held in two precincts. This election contains ten contests and is compiled into two ballot styles. Two of the contests are in both ballot styles. The other eight contests are split between the two parties' ballots. This Primary Election is designed to functionally test the handling of multiple ballot styles, support for at least three languages including a character-based language, support for common voting variations, and audio support for two languages (English and Spanish).

The EMS 4.3-A successfully passed the System Integration Test. During execution of the test procedure, it was verified that the EMS 4.3-A successfully completed the system level integration tests with all actual results obtained during test execution matching the expected results.

### **3.1.4.4 Regression Testing**

Regression testing was conducted on the EMS to establish assurance that the modifications had no adverse impact on the compliance, integrity, or performance of the system. No new faults or issues were found during regression testing.

### 3.2 Anomalies and Resolutions

When a result is encountered during test performance that deviates from what is standard or expected, a root cause analysis is performed. Pro V&V considers it an anomaly if no root cause can be determined. In instances in which a root cause is established, the results are then considered deficiencies.

#### Summary Findings

There were no anomalies encountered during this test campaign.

### 3.3 Deficiencies and Resolutions

Any violation of the specified requirement or a result encountered during test performance that deviates from what is standard or expected in which a root cause is established was considered to be a deficiency. Any deficiencies encountered were logged throughout the test campaign into the Pro V&V tracking system (Mantis) for disposition and resolution. In each instance, if applicable, the resolutions were verified to be resolved through all required means of testing (regression testing, source code review, and TDP update) as needed.

#### Summary Findings

There were no deficiencies encountered during this test campaign.

### 4.0 RECOMMENDATION FOR CERTIFICATION

The EMS 4.3-A Voting System, as presented for testing, successfully met the requirements set forth for voting systems in the U.S. Election Assistance Commission (EAC) 2005 Voluntary Voting System Guidelines (VVSG), Version 1.0. Additionally, Pro V&V, Inc. has determined that the EMS 4.3-A functioned as a complete system during System Integration Testing. Based on the test findings, Pro V&V recommends the EAC grant the EMS 4.3-A System, as identified in Tables 4-1 and 4-2, certification to the EAC 2005 VVSG.

**Table 4-1. MicroVote EMS 4.3-A Software**

Firmware/Software	Version
<i>Proprietary</i>	
EMS	4.3
Infinity Panel	4.3
<i>COTS</i>	
Microsoft Windows 10 Professional	1809
Microsoft Visual Studio Professional 2017	15.9
ComponentOne Ultimate 2014	1
Advanced Installer	14.8

**Table 4-2. MicroVote EMS 4.3-A Hardware**

<b>Component</b>	<b>Serial Number</b>
<i><b>Proprietary Hardware</b></i>	
Infinity Voting Panel (VP-1) w/Power Supply	11588
Infinity Voting Panel (VP-1) w/Power Supply	04689
<i><b>COTS Hardware</b></i>	
Dell OptiPlex 3020 w/Power Cord, Keyboard, & Mouse	BSNNK52
Dell OptiPlex 3020 w/Power Cord, Keyboard, & Mouse	FVNNK52
Dell 15" Monitor (E153FPb)	CN-0D5421-46633-4B8-0GVU T
Seiko Instruments Printer (DPU-3445) w/Power Supply	2008922A
EMS Download Cable	CC06789-06
USB Smart Card Reader (PC USB TR PIV) w/Stand (HWP109380 B)	113101316600170
DoubleTalk LT w/Radio Shack Headphones	[MVT-001]

**ATTACHMENT A**

**As-Run Test Plan**

*(provided as separate document)*