Test Plan for EAC 2005 VVSG Certification Testing
MicroVote EMS 4.2 Voting System

EAC Project Number: MVT1601

Version: Rev C

Date: 9/25/17

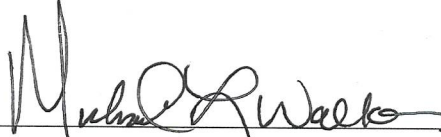U.S. Election Assistance Commission

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SIGNATURES

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REVISIONS

Revision	Description	Date
NR	Initial Release	3/8/16
.02	Test Plan re-write to include testing change of scope	4/25/17
A	Updates based on EAC Comments	6/21/17
B	Removed irrelevant information and made updates based on EAC comments	9/13/17
C	Final version with highlights removed	9/25/17

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1.0   INTRODUCTION

The purpose of this Test Plan is to document the procedures that Pro V&V, Inc. will follow to perform certification testing during a system modification campaign of the MicroVote EMS 4.2 Voting System to the requirements set forth by voting systems in the U.S. Election Assistance Commission (EAC) 2005 Voluntary Voting System Guidelines (VVSG), Version 1.0. Prior to submitting the voting system for testing, MicroVote submitted an application package to the EAC for certification of the EMS 4.2 Voting System modification to the previously certified EMS 4.1 Voting System (Certification Number: MVTEMS41). The application was accepted by the EAC and the project was assigned the unique Project Number of MVT1601.

At test conclusion, the results of all testing performed as part of this test campaign will be submitted to the EAC in the form of a national certification test report.

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 4.2 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. AVG Free anti-virus protection software has been installed. 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 4.1 Voting System. The tables below describe the certified equipment and firmware versions. Detailed descriptions of the EMS 4.1 test campaign are contained in NTS Report No. PR029488-01, Rev. B, which is available for viewing on the EAC's website at www.eac.gov.

Table 1-1. Baseline (EMS 4.1) Software Components

Firmware/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

Table 1-2. Baseline (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	Double Talk LT	LT RC8650	BIOS 0212
Voting Panel Printer	Seiko	Models DPU-414 and DPU-3445	---
Smartcard Reader	GemPlus	IDBridge CT30 Smart	---
EMS Report Printer	Dell	Dell 0P0137	---
EMS Desktop	Dell	Dell Optiplex 3010	---
EMS Laptop	Dell	Dell Latitude E5440	---

1.1.2   Description of Modification

The submitted modifications for the EMS 4.2 test campaign included modifications to the baseline EMS 4.1 system. These modifications consisted of various enhancements and updates to add support and improve voting functions, correct identified defects, one system addition and replacements of end-of-life components. No hardware modifications were submitted.

Descriptions of the submitted modifications are described below:

Enhancements

1. E-01-(EMS/Infinity) – Added support for a third language within an election (in addition to English and Spanish). The optional third language, including pictographic, must be included within the Windows environment.

2. E-02-(EMS) – Modified entry method for ballot style precinct assignment to allow multiple precinct selection (shift-click and control-click).

3. E-03-(EMS) – Improved office-candidate report sorting and ballot sequence number display.

4. E-04-(EMS) – Improved ballot designer functionality when removing last item on a ballot page.

5. E-05-(Infinity) – Improved "No Vote" location appearance and added build number in version display.

6. E-06-(EMS) – Modified All Precincts report to display precinct straight party totals for each precinct rather than county totals to match individual precinct report format.

7. E-07-(EMS) – Enhancement to prevent candidate wrapping when assigning party to candidate record in referendum office.

Defects

The defect listed below was not associated with a vendor root cause analysis and therefore will undergo testing to verify working as designed:

1. D-01-(EMS) – Corrected overwriting of election backup file in database utilities.

Replacement of End-Of-Life Components

A Risk Assessment shall be performed along with SCAP for the items listed below that are being replaced for end of life:

1. R-01-(EMS) – Replaced Windows 7 Pro operating system with Windows 10 Pro.

2. R-02-(EMS) – Replaced Advanced Installer 11.1 with Advanced Installer 13.1.

3. R-03-(EMS) – Replaced SQL Server Express 2012 SP1 with SQL Server Express 2016.

4. R-04-(EMS) – Replaced .Net Framework 3.5 SP1 target with .Net Framework 4.6.

Additions

1. A-02-(EMS) – Added a Dell Latitude E5570 laptop as an alternate component.

1.1.3   Initial Assessment

Prior to development of this Test Plan, Pro V&V performed an evaluation of the results from the previous test campaign along with the changes made to the system to determine the scope of testing required for certification of the EMS 4.2. Based on this evaluation, Pro V&V determined that testing from the previous test campaigns would establish the baseline and that the focus of this test campaign would be on the system updates.

It was determined the following tasks would be required to verify compliance of the modifications:

- Technical Data Package (TDP) Review

- Physical Configuration Audit (PCA), including Security Testing and SCAP Checklist

- Source Code Review, Compliance Build, Trusted Build, and Build Document Review

- Functional Configuration Audit

- System Integration Testing

- Accuracy Test

- EMS And System Functional Regression Testing

- ECO assessment of baseline system (EMS 4.1) modifications

1.1.4   Regression Test

Regression testing shall be conducted on the EMS to establish assurance that the modifications have no adverse impact on the compliance, integrity, or performance of the system.

1.2   References

- Election Assistance Commission 2005 Voluntary Voting System Guidelines (VVSG) Version 1.0, Volume I, "Voting System Performance Guidelines"

- Election Assistance Commission 2005 Voluntary Voting System Guidelines (VVSG) Version 1.0, 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, "NVLAP Procedures and General Requirements (NIST Handbook 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 107th Congress Help America Vote Act (HAVA) of 2002 (Public Law 107-252), dated October 2002

- Pro V&V, Inc. Quality Assurance Manual, Revision 7.0

- Election Assistance Commission "Approval of Voting System Testing Application Package" letter dated November 12, 2015

- EAC Requests for Interpretation (RFI) (listed on www.eac.gov)

- EAC Notices of Clarification (NOC) (listed on www.eac.gov)

- MicroVote EMS 4.2 Technical Data Package *(A listing of the EMS 4.2 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

- NTS Report No. PR029488-01, Rev. B

1.3   Terms and Abbreviations

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

"ADA" – Americans with Disabilities Act 1990

"CM" – Configuration Management

"COTS" – Commercial Off-The-Shelf

"DRE" – Direct Record Electronic

"EAC" – United States Election Assistance Commission

"ECO" – Engineering Change Order

"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

"OMR" – Optical Mark Recognition

"PCA" – Physical Configuration Audit

"QA" – Quality Assurance

"RAM" – Random Access Memory

"RFI" – Request for Interpretation

"SCAP" – Security Content Automation Protocol

"SQL" – Structured Query Language

"TDP" – Technical Data Package

"UPS" – Uninterruptible Power Supply

"VSTL" – Voting System Test Laboratory

"VVSG" – Voluntary Voting System Guidelines

1.4   Project Schedule

The Project Schedule for the test campaign is located in Appendix A – Project Schedule. The dates on the schedule are not firm dates but planned estimates based on the anticipated project work flow.

1.5   Scope of Testing

The scope of testing is limited to the modifications made to the previously certified EMS 4.1 Voting System, as described in Section 1.1.2. The scope of testing includes:

- TDP Review

- PCA

- Source Code Review

- FCA

- System Integration Testing

- Accuracy Testing

- Regression Testing

1.5.1   Block Diagram

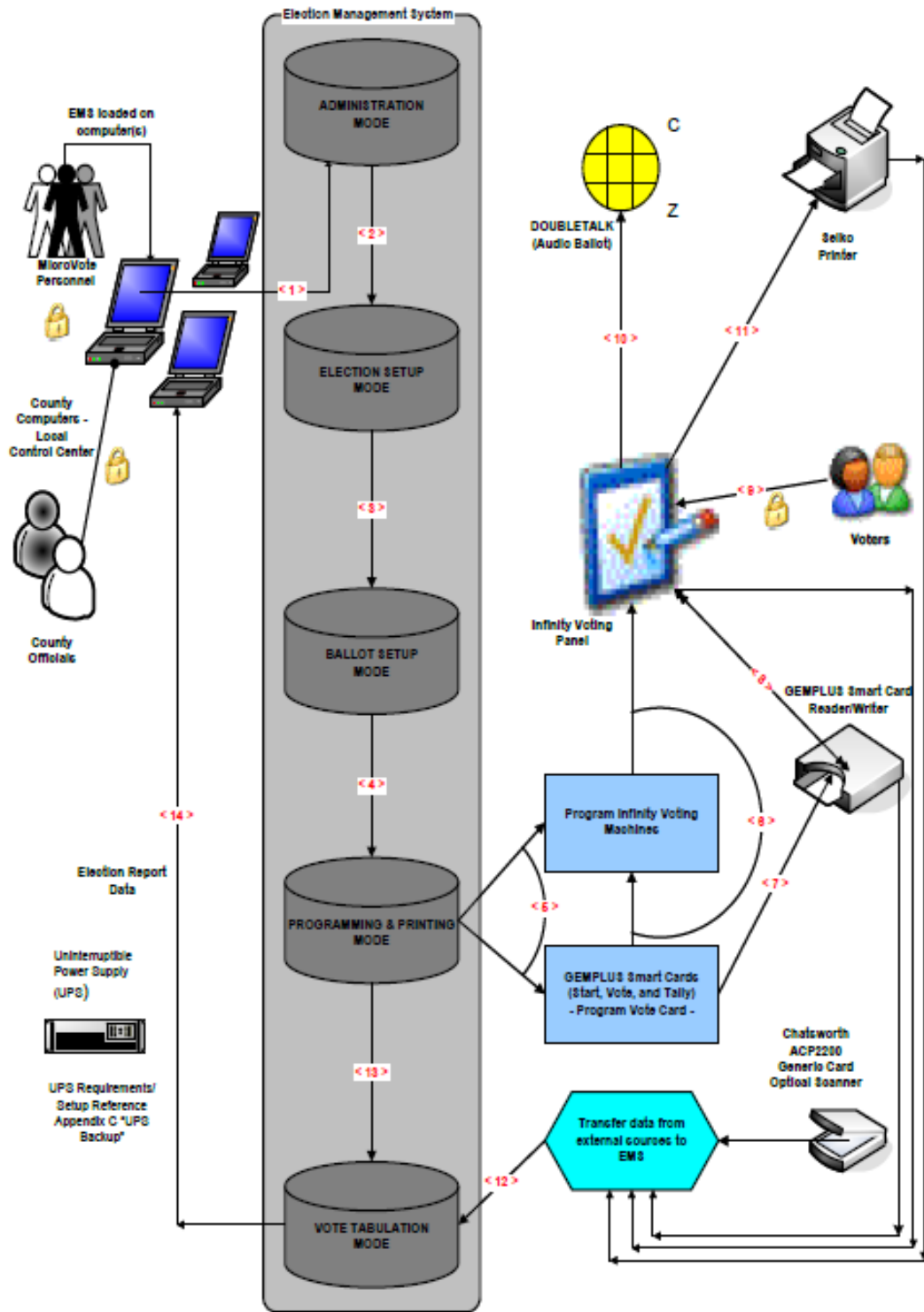The system overview of the submitted voting system is depicted in Figure 1-1.

Figure 1-1. EMS 4.2 System Overview

1.5.2 System Limits

There were no changes made to the system limits. The system limitations remain the same as the previously certified version.

1.5.3 Supported Languages

The submitted voting system supports:

- English
- Spanish

Third language must be available within the Windows environment and includes pictographic languages. For testing and verification purposes Pro V&V will use the following language during testing:

- Chinese
  Testing of the Chinese language will be accomplished through the creation and execution of both a primary and general election verifying the translations can be used by Chinese minority language voters.

1.5.4 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.

1.5.5 VVSG

The EMS 4.2 Voting System shall be evaluated against the relevant requirements contained in the EAC 2005 VVSG, Volumes I and II.

1.5.6 RFIs

All RFIs released by the EAC as of the date of this Test Plan that pertain to this test campaign and were not in effect at the time of the baseline system certification are listed in the table below.

Table 1-3. Applicable RFIs

RFI ID	Name
2007-04	EAC Decision on Presentation of Alternative Language
2008-04	EAC Decision on Supported Languages
2009-02	EAC Decision on Alternate Languages

1.5.7 NOCs

All NOCs released by the EAC as of the date of this Test Plan that pertain to this test campaign and were not in effect at the time of the baseline system certification are listed in the table below.

Table 1-4. Applicable NOCs

NOC ID	Name
2015-01	Test Readiness Review
2016-02	Trusted Build
2016-03	Test Case Upload

2.0 PRE-CERTIFICATION TESTING AND ISSUES

This section describes previous testing performed prior to submitting the voting system to the EAC.

2.1 Evaluation of Prior VSTL Testing

Pro V&V evaluated to the published Final Test Report for the EMS 4.1 System in order to baseline the current system under test.

2.2 Evaluation of Prior Non-VSTL Testing

No prior non-VSTL testing of the EMS 4.2 modifications were considered for this test campaign.

2.3 Known Field Issues

EMS 4.2 is a modification to a previously certified system and has not been fielded. The baseline system (4.1) has been fielded and there are no known field issues reported at the time of this test plan creation. The implemented enhancements are the result of customer feedback. The corrected defects are the result of MicroVote internal testing.

3.0 MATERIALS REQUIRED FOR TESTING

The following sections list all materials needed to enable the test engagement to occur.

The materials required for testing of the MicroVote EMS 4.2 Voting System include all materials to enable the test campaign to occur. This includes the applicable hardware and software as well as the TDP, test support materials, and deliverable materials, as described in the following subsections.

3.1 Software

This subsection lists the proprietary and COTS software to be provided by the manufacturer as part of the test campaign.

Table 3-1. Voting System Software

Firmware/Software	Version
Proprietary	
EMS	4.2
COTS	
Microsoft Windows 10 Professional	SP1
Microsoft Visual Studio 2013 Professional	Update 2
ComponentOne Ultimate 2014	1

3.2 Equipment

This subsection lists the proprietary and COTS equipment to be provided by the manufacturer as part of the test campaign.

For COTS equipment, every effort will be made to verify that the COTS equipment has not been modified for use. This will be accomplished by performing research using the COTS equipment manufacturer's websites based on the serial numbers and service tag numbers for each piece of equipment. Assigned test personnel will evaluate COTS hardware, system software and communications components for proven performance in commercial applications other than voting. For PCs, laptops, and servers, the service tag information will be compared to the system information found on each machine. Physical external and internal examination will also be performed when the equipment is easily accessible without the possibility of damage. Hard drives, RAM memory, and other components will be examined to verify that the components match the information found on the COTS equipment manufacturer's websites.

Table 3-2. Voting System Equipment

Component	Serial Number
Proprietary Hardware	
Infinity Voting Panel (VP-1) w/Power Supply	11588
COTS Hardware	
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]

3.3   Test Materials

This subsection lists the test materials required to execute the required tests throughout the test campaign.

Table 3-3. Required Test Materials

Material	Model/Version	Description
Smart Cards (x6)	N/A	Smart cards for Vote, Start, and Tally functions
Thermal Printer Paper Rolls (x3)	N/A	Paper rolls for the Seiko Instruments Printer

3.4   Deliverables

This subsection lists the materials identified by the manufacturer as materials deliverable to the end user for the system being tested.

Table 3-4. Voting System Deliverables

Material	Version	Description
EMS Software	4.2	Election Management Software
Infinity Panel	Firmware 4.1; Hardware D05	DRE precinct count/accessible voting station

3.5   Proprietary Data

All data and documentation considered by the manufacturer to be proprietary will be identified and documented in an independent submission along with a Notice of Protected Information.

4.0   TEST SPECIFICATIONS

Certification testing of the MicroVote EMS 4.2 Voting System submitted for evaluation will be performed to ensure the applicable requirements of the EAC 2005 VVSG and the EAC Testing and Certification Program Manual are met. Additionally, all EAC Request for Interpretations (RFI) and Notices of Clarification (NOC) relevant to the system under test will be incorporated in the test campaign. A complete listing of the EAC RFIs and NOCs is available on the EAC website.

4.1   Requirements (Strategy of Evaluation)

To evaluate the EMS 4.2 test requirements, the submitted modifications were evaluated against each section of the EAC 2005 VVSG to determine the applicable tests to be performed. Based on this assessment, it was determined the following evaluations would be required to verify compliance of the modifications:

Technical Documentation Package (TDP) Review

A TDP Review will be performed to ensure that all submitted modifications are accurately documented and that the documents meet the requirements of the EAC 2005 VVSG.

Physical Configuration Audit (PCA), including Security and SCAP Checklist

A PCA will be performed to compare the voting system submitted for certification testing to the manufacturer's technical documentation. The purpose of the PCA will be to verify that the submitted hardware is unmodified from the previously certified voting system.

Source Code Review, Compliance Build, Trusted Build, and Build Document Review

Pro V&V will review the submitted source code to the EAC 2005 VVSG and the manufacturer-submitted coding standards. Prior to initiating the software review, Pro V&V shall verify that the submitted documentation is 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 source code review will be based on the source code changes made since the previous system was certified.

Functional Configuration Audit

The FCA for this test campaign will include an assessment of the submitted modifications and will include inputs of both normal and abnormal data during test performance. This evaluation will utilize baseline test cases as well as specifically designed test cases and will include predefined election definitions for the input data. As part of the FCA, one primary and one general election will be executed to verify that each of the submitted modifications have been successfully implemented.

System Integration Test

The system integration tests will be performed to ensure the EMS 4.2 functions as a complete system. The system integration testing addresses the integration of the hardware and software. This testing focuses on the compatibility of the voting system software components and subsystems with one another and with other components of the voting system. During test performance, the system is configured as would be for normal field use.

Accuracy Test

An Accuracy Test will be performed to ensure the EMS 4.2 correctly captures, stores, consolidates, and reports the specific ballot selections, and absence of selections, for each ballot position.

EMS and System Functional Regression Testing

EMS and System Functional Regression Testing will be performed to ensure the modifications do not adversely affect the EMS 4.2 system.

Throughout the test campaign, Pro V&V personnel shall maintain a test log identifying the system and equipment under test and any records of deviations to the test plan along with the rationale for performing the deviations. Pro V&V shall also utilize an internal bug tracking system to record and track all issues and/or discrepancies noted during the test campaign.

4.1.1 Mapping of Requirements to Equipment Type and Features

The submitted modifications, as detailed in Section 1.1.2, are mapped to the 2005 VVSG requirements in Table 4-1, below. Additionally, a cursory evaluation will be performed to verify that the MicroVote QA and CM plans are in compliance.

Table 4-1. Modification Requirements Mapping

Change ID/ Component	Description	Impacted 2005 VVSG Requirement
E-01 (EMS/Infinity)	Added support for a third language within an election (in addition to English and Spanish). The optional third language, including pictographic must be included within the Windows environment. The DoubleTalk text-to-speech device interprets the standard ASCII set of characters and uses the characters to pronounce the different languages, including those that do not use the standard ASCII character set, allowing the system to phonetically spell out words.	Volume I, Section 9.7.2 & Volume II, Section 6.7
E-02 (EMS)	Modified entry method for ballot style precinct assignment to allow multiple precinct selection (shift-click and control-click).	Volume I, Section 9.7.2 & Volume II, Section 6.7
E-03 (EMS)	Improved office-candidate report sorting and ballot sequence number display.	Volume I, Section 9.7.2 & Volume II, Section 6.7
E-04 (EMS)	Improved ballot designer functionality when removing last item on a ballot page.	Volume I, Section 9.7.2 & Volume II, Section 6.7
E-05 (Infinity)	Improved "No Vote" location appearance and added build number in version display.	Volume I, Section 9.7.2 & Volume II, Section 6.7
E-06 (EMS)	Modified All Precincts report to display precinct straight party totals for each precinct rather than county totals to match individual precinct report format.	Volume I, Section 9.7.2 & Volume II, Section 6.7
E-07 (EMS)	Enhancement to prevent candidate wrapping when assigning party to candidate record in referendum office.	Volume I, Section 9.7.2 & Volume II, Section 6.7
D-01 (EMS)	Corrected overwriting of election backup file in database utilities.	Volume I, Section 9.7.2 & Volume II, Section 6.7
R-01 (EMS)	Replaced Windows 7 Pro operating system with Windows 10 Pro.	Volume I, Section 9.7.2 & Volume II, Section 6.7

Table 4-1. Modification Requirements Mapping *(continued)*

Change ID/ Component	Description	Impacted 2005 VVSG Requirement
R-02 (EMS)	Replaced Advanced Installer 11.1 with Advanced Installer 13.1.	Volume I, Section 9.7.2 & Volume II, Section 6.7
R-03 (EMS)	Replaced SQL Server Express 2012 SP1 with SQL Server Express 2016.	Volume I, Section 9.7.2 & Volume II, Section 6.7
R-04 (EMS)	Replaced .Net Framework 3.5 SP1 target with .Net Framework 4.6.	Volume I, Section 9.7.2 & Volume II, Section 6.7
TDP	Section 2.2: SYSTEM OVERVIEW, Election Management System, Version 1.13	Volume II, Section 2.2
TDP	Section 2.11: CONFIGURATION MANAGEMENT PLAN, Election Management System, Version 1.6	Volume II, Section 2.11
TDP	Section 2.13: SYSTEM CHANGE NOTES, Election Management System, Version 1.10	Volume II, Section 2.13

4.1.2 Rationale for 'Not Applicable' Requirements

All requirements that were excluded from the previous test campaign (EMS 4.1) were also deemed not applicable to this test campaign due to the submitted modifications not impacting the specific requirements. These requirements are listed below:

- Volume I, Section 6.2.6 (Telecommunications Requirements): These requirements are written for use of public networks. The EMS 4.2 does not utilize public networks.

- Volume I, Section 7.52-7.54 (Telecommunications and Data Transmission): These requirements are written for use of public networks. The EMS 4.2 does not utilize public networks.

- Volume I, Section 7.6 (Use of Public Networks): These requirements are written for use of public networks. The EMS 4.2 does not utilize public networks.

- Volume I, Section 7.7 (Wireless Communications): No wireless technology is utilized in this system.

- Volume I, Section 7.9 (Voter Verifiable Paper Audit Trail Requirements): This system does not contain a Voter Verifiable Paper Audit Trail (VVPAT).

4.2 Hardware Configuration and Design

The hardware configuration and design for the modification remain unchanged from the baseline system.

4.3   Software System Functions

The software system functions for the previously certified voting system (EMS 4.1) remain unchanged for the submitted modifications.

4.4   Test Case Design

Test cases are designed based on the manufacturer's design specifications and the relevant technical requirements set forth by the VVSG. Test cases shall be examined based on the following aspects of the voting system:

- Hardware qualitative examination design

- Hardware environmental test case design

- Software module test case design and data

- Software functional test case design

- System level test case design

Test cases shall provide information regarding the sequence of actions to be performed for the execution of a test, the requirements being met, the test objective, test configuration, equipment needed, special requirements, assumptions, and pass/fail criteria. Once the test cases are finalized, they will be validated and published for use in the test campaign. The validation of the test case will be accomplished by Technical Review and Approval. This validation will include the following: confirmation of adequate test coverage of all requirements; confirmation that test case results are not ambiguous and gave objective pass/fail criteria; and conformation that any automated test suites will produce valid results.

4.4.1   Hardware Qualitative Design

Previous hardware examinations were performed on the certified baseline system (EMS 4.1). The updates to the modified system (EMS 4.2) do not require additional hardware testing to be performed.

4.4.2   Hardware Environmental Test Case Design

Previous hardware examinations were performed on the certified baseline system (EMS 4.1). The updates to the modified system (EMS 4.2) do not require additional hardware testing to be performed.

4.4.3   Software Module Test Case Design

Pro V&V shall review the manufacturer's program analysis, documentation, and module test case design and shall evaluate the test cases for each module with respect to flow control parameters and entry/exit data. As needed, Pro V&V shall design additional test cases to satisfy the coverage criteria specified in Volume II, Section 7.2.1.

Component Level Testing will be implemented during the FCA for each component and subcomponent. During the Source Code Review, Compliance Builds, and Security Testing, Pro V&V will utilize limited structural-based techniques (white-box testing). Additionally, specification-based techniques (black-box testing) will be utilized for the individual software components.

Pro V&V shall define the expected result for each test and the ACCEPT/REJECT criteria for certification. If the system performs as expected, the results will be accepted. If the system does not perform as expected, an analysis will be performed to determine the cause. The test will be repeated in an attempt to reproduce the results. If the failure can be reproduced and the expected results are not met, the system will have failed the test. If the results cannot be reproduced, the test will continue. All errors encountered will be documented and tracked through resolution.

4.4.4   Software Functional Test Case Design

Pro V&V shall review the manufacturer-submitted test plans and data to verify that the individual performance requirements specified in the EAC 2005 VVSG and the TDP are reflected in the software. As part of this process, Pro V&V shall review the manufacturer's test case design and prepare a detailed matrix of system functions and the test cases that exercise them. Pro V&V shall also prepare a test procedure describing all test ballots, operator procedures, and the data content of output reports. Pro V&V shall define abnormal input data and operator actions and then design test cases to verify that the system is able to handle and recover from these abnormal conditions. During this review, emphasis shall be placed on those functions where the manufacturer data on module development reflects significant debugging problems, and on functional tests that resulted in high error rates.

Pro V&V shall define the expected result for each test and the ACCEPT/REJECT criteria for certification. If the system performs as expected, the results will be accepted. If the system does not perform as expected, an analysis will be performed to determine the cause. The test will be repeated in an attempt to reproduce the results. If the failure can be reproduced and the expected results are not met, the system will have failed the test. If the results cannot be reproduced, the test will continue. All errors encountered will be documented and tracked through resolution.

4.4.5   System-Level Test Case Design

System Level testing will be implemented to evaluate the complete system. This testing will include all proprietary components (software, hardware, and peripherals) and COTS components (software, hardware, and peripherals) in a configuration of the system's intended use. For software system tests, the tests shall be designed according to the stated design objective without consideration of its functional specification. The system level hardware and software test cases shall be prepared independently to assess the response of the hardware and software to a range of conditions.

4.5   Security Functions

The system security functions for the modification remain unchanged from the previously certified system.

4.6   TDP Evaluation

In order to determine compliance of the modified TDP documents with the EAC 2005 VVSG, a limited TDP review shall be conducted. This review will focus on TDP documents that have been modified since the certification of the baseline system. The review will consist of a compliance review to determine if each regulatory, state, or manufacturer-stated requirement has been met based on the context of each requirement. Results of the review of each document will be entered on the TDP Review Checklist and reported to the manufacturer for disposition of any anomalies. This process will be ongoing until all anomalies are resolved. Any revised documents during the TDP review process will be compared with the previous document revision to determine changes made, and the document will be re-reviewed to determine whether subject requirements have been met.

A listing of all documents contained in the EMS 4.2 TDP is provided in Table 4-2.

Table 4-2. TDP Documents

Section	Description	Version
---	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	1.13
2.3	SYSTEM FUNCTIONALITY DESCRIPTION Election Management System	1.2
2.4	SYSTEM HARDWARE SPECIFICATION Election Management System	1.3
2.5	SOFTWARE DESIGN AND SPECIFICATION Election Management System	2.8
2.6	SYSTEM SECURITY SPECIFICATION Election Management System	1.8
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	1.13
---	Appendices TABLE OF CONTENTS Election Management System	1.7

4.7   Source Code Review

Pro V&V will review the submitted source code to the EAC 2005 VVSG and the manufacturer-submitted coding standards. Prior to initiating the software review, Pro V&V shall verify that the submitted documentation is 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.

4.8   QA and CM System Review

The MicroVote Quality and Configuration Management Manuals shall be reviewed for their fulfillment of Volume I, Sections 8 and 9, and the requirements specified in Volume II, Section 2. The requirements for these sections establish the quality assurance and configuration standards for voting systems to which manufacturers must conform and require voting system manufacturers to implement a quality assurance and configuration management program that is conformant with recognized ISO standards. As part of the review process, the MicroVote TDP documents will be reviewed to determine if the stated policies are being followed.

5.0   TEST DATA

The following subsections provide information concerning test data recording, criteria, and reduction.

5.1   Test Data Recording

All equipment utilized for test data recording shall be identified in the test data package. The output test data shall be recorded in an appropriate manner as to allow for data analysis. For source code and TDP reviews, results shall be compiled in reports and submitted to MicroVote for resolution.

5.2   Test Data Criteria

The EMS 4.2 Voting System shall be evaluated against all applicable requirements contained in the EAC 2005 VVSG. The acceptable range for system performance and the expected results for each test case shall be derived from the manufacturer-submitted technical documentation and the EAC 2005 VVSG.

6.0   TEST PROCEDURES AND CONDITIONS

The following subsections detail the facility requirements, test setup conditions, and sequence of testing.

6.1   Test Facilities

Unless otherwise annotated, all testing shall be conducted at the Pro V&V test facility located in Huntsville, AL, by personnel verified by Pro V&V to perform the test.

Unless otherwise specified herein, testing shall be performed at standard ambient conditions.

6.2   Test Set-Up

All voting system equipment shall be received and documented using Pro V&V proper QA procedures. Upon receipt of all hardware, an inspection will be performed to verify that the equipment received is free from obvious signs of damage and/or degradation that may have occurred during transit. If present, this damage shall be recorded, photographed, and reported to the MicroVote Representative. Additionally, a comparison shall be made between the recorded serial numbers/part numbers and those listed on shipper's manifest and any discrepancies shall be reported to the MicroVote Representative. TDP items and all source code received shall be inventoried and maintained by Pro V&V during the test campaign.

During test performance, the system shall be configured as would be for normal field use. This includes connecting all supporting equipment and peripherals.

6.3   Test Sequence

The EMS 4.2 Voting System will be evaluated against all applicable requirements in the EAC 2005 VVSG. There is no required sequence for test performance.

6.4   Test Operations Procedure

Pro V&V will identify PASS/FAIL criteria for each executed test case. The PASS/FAIL criteria will be based on the specific expected results of the system. In the case of an unexpected result that deviates from what is considered standard, normal, or expected, a root cause analysis will be performed.

Pro V&V will evaluate every EAC 2005 VVSG requirement impacted by the submitted modification. Any deficiencies noted will be reported to the EAC and the manufacturer. If it is determined that there is insufficient data to determine compliance, this test plan will be altered and additional testing will be performed.

APPENDIX A

PROJECT SCHEDULE

Task Name	Start Date	End Date	Assigned To	Duration	Predecessors
TDP	**04/17/17**	**05/22/17**		**26d**	
Initial Review	04/17/17	04/17/17	Diane	1d	
Compliance Review	04/18/17	05/15/17	Diane	20d	3
Final review	05/16/17	05/22/17	Diane	5d	4
Test Plan	**04/10/17**	**06/13/17**		**47d**	
Test Plan Creation	04/10/17	04/21/17	Wendy	10d	
Vendor Review & Comments	04/24/17	04/25/17	Wendy	2d	7
EAC Submission & Review	04/26/17	05/23/17	Wendy	20d	8
EAC Comment Review & Update	05/24/17	05/29/17	Wendy	4d	9
EAC Submission & Review of Revision	05/30/17	06/12/17	Wendy	10d	10
EAC Approved Test Plan	06/13/17	06/13/17	Wendy	1d	11
Source Code	**04/17/17**	**04/21/17**		**5d**	
Manual Review	04/17/17	04/17/17		1d	
Source Code Review	04/18/17	04/18/17	Jack	1d	14
Source Code Re-Review	04/19/17	04/19/17	Jack	1d	15
Document Review	04/18/17	04/18/17	Jack	1d	14
Compliance Build	04/20/17	04/21/17	Jack	2d	16
System Delivery & Setup	**04/24/17**	**04/26/17**		**3d**	
System Loads & Hardening	04/24/17	04/26/17	Mancy	3d	18
System Level Testing	**06/14/17**	**07/03/17**		**14d**	
FCA	06/14/17	06/27/17	Mancy	10d	12
Security & SCAP	06/20/17	06/27/17	Mancy	6d	
Accuracy	06/28/17	07/03/17	Mancy	4d	22
System Integration	07/04/17	07/07/17	Mancy	4d	24
Test Report	**07/04/17**	**08/31/17**		**43d**	
Test Report Creation	07/10/17	07/19/17	Wendy	8d	25
Vendor Review & Comments	07/20/17	07/20/17	Wendy	1d	27
EAC Submission & Review	07/21/17	08/17/17	Wendy	20d	28
EAC Comment Review & Update	08/18/17	08/22/17	Wendy	3d	29
EAC Submission & Review of Revision	08/23/17	09/05/17	Wendy	10d	30
EAC Approved Test Report	09/06/17	09/06/17	Wendy	1d	31