# Test Report for EAC VVSG 1.0 Certification Testing
# Election Systems & Software (ES&S)
# Voting System (EVS) 5.4.1.0

EAC Project Number:  EVS5410

Version: Initial

Date: 4/26/2018

U.S. Election Assistance Commission

**VSTL**

EAC Lab Code 1501

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## SIGNATURES

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# <u>REVISIONS</u>

| Revision | Description | Date |
|----------|-------------|------|
| NR | Initial Release | 4/26/2018 |
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**TABLE OF CONTENTS**

## 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 Election Systems and Software (ES&S) Voting System (EVS) 5.4.1.0 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 EVS 5.4.1.0 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, ES&S submitted an application package to the EAC for certification of the EVS 5.4.1.0. The application was accepted by the EAC and the project was assigned the unique Project Number of ESSEVS5410.

### 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 following subsections describe the baselined EVS 5.4.0.0.

ES&S EVS 5.4.0.0 is comprised of the ExpressVote, AutoMARK, DS200, DS850, Electionware Election Management System (Electionware), Election Reporting Manager (ERM), ES&S Event Log Service (ELS), Removable Media Service (RMS), ExpressVote Previewer and VAT Previewer.

- The ExpressVote is a universal vote capture device designed for all voters, with independent voter-verifiable paper record that is digitally scanned for tabulation. This system combines paper-based voting with touch screen technology. The ExpressVote includes a mandatory vote summary screen that requires voters to confirm or revise selections prior to printing the summary of ballot selections using the internal thermal printer. Once printed, ES&S tabulators process the vote summary card. The ExpressVote can serve all voters, including those with special needs, allowing voters to cast ballots autonomously. ES&S has fully integrated the ExpressVote with the existing suite of ES&S voting system products.

- AutoMARK Voter Assist Terminal enables voters who are visually or physically impaired and voters more comfortable reading or hearing instructions and choices in an alternative language to privately mark optical scan ballots. The AutoMARK supports navigation through touchscreen, physical keypad or ADA support peripheral such as a sip and puff device or two position switch.

- DS200 digital scanner and tabulator is a paper ballot tabulator designed for use as a polling place scanner. After the voter makes their selections on their paper ballot, their ballot and/or vote summary card is inserted into the unit for immediate tabulation.

Both sides of the ballot are scanned at the same time using a high-resolution image-scanning device that produces ballot images.

- The DS850 is a digital scan central ballot tabulator that uses cameras and imaging algorithms to capture voter selections on the front and back of a ballot, evaluate results and then sort ballots into discrete bins without interrupting scanning. A dedicated audit printer generates a continuous event log. Machine level reports are produced from a second, laser printer. The scanner saves voter selections and ballot images to an internal hard disk and exports results to a USB memory stick for processing with ERM.

- Electionware integrates the election administration functionality into a unified application. Its intended use is to define an election and create the resultant media files used by the ExpressVote, DS200, AutoMARK, DS850, and ERM. An integrated ballot viewer allows election officials to view the scanned ballot and captured ballot data side-by-side and produce ballot reports.

- ES&S Event Log Service (ELS) is a Windows Service that runs in the background of any active ES&S Election Management software application to monitor the proper functioning of the Windows Event Viewer. The ELS closes any active ES&S software application if the system detects the improper deactivation of the Windows Event Viewer.

- The ExpressVote Previewer is an application within the EMS program that allows the user to preview audio text and screen layout prior to burning Election Day media for the ExpressVote.

- The VAT Previewer is an application within the EMS program that allows the user to preview audio text and screen layout prior to burning Election Day media for the AutoMARK.

- Removable Media Service (RMS) is an application that runs in the background of the EMS client workstation and supports the installation and removal of election and results media.

- Election Reporting Manager (ERM) generates paper and electronic reports for election workers, candidates, and the media. Jurisdictions can use a separate ERM installation to display updated election totals on a monitor as ballot data is tabulated, and send the results' reports directly to the media outlets. ERM supports accumulation and combination of ballot results data from all ES&S tabulators. Precinct and accumulated total reports provide a means to accommodate candidate and media requests for totals and are available upon demand. Printers are configured as part of the system accumulation/reporting stations PC and related software.

### 1.1.1 Baseline Certified System

The baseline system for this modification is the EVS 5.4.0.0. The tables below describe the certified equipment and firmware versions.

Detailed descriptions of the EVS 5.4.0.0 test campaign are contained in NTS Report No. PR032474-TR-02, Rev. A, which is available for viewing on the EAC's website at www.eac.gov.

**Table 1-1. EVS 5.4.0.0 EAC Certified System Components**

| System Component | Software or Firmware Version | Hardware Version(s) | Description |
|---|---|---|---|
| ExpressVote (Marker) | 2.1.0.0 | 2.1.0.0 | Universal Voting System that combines paper-based voting with touch screen technology. Includes a mandatory vote summary screen that requires voters to confirm or revise selections prior to printing the summary of ballot selections. |
| ExpressVote (Tabulator) | 2.1.0.0 | 2.1.0.0 | Universal Voting System that combines paper-based voting with touch screen technology. Includes all functions of the ExpressVote Marker and also provides the optional capability of tabulating printed vote summary cards. |
| DS200 | 2.14.0.0 | 1.2.1, 1.2.3, 1.3 | Precinct Digital Scanner that scans voter selections from both sides of the ballot simultaneously |
| Auto MARK A100 | 1.8.7.0 | 1.0 | ADA Ballot Marking Device |
| AutoMARK A200 (SBC 2.0) | 1.8.7.0 | 1.1 | ADA Ballot Marking Device |
| AutoMARK A200 (SBC 2.5) | 1.8.7.0 | 1.3 | ADA Ballot Marking Device |
| AutoMARK A300 (SBC 2.0) | 1.8.7.0 | 1.3 | ADA Ballot Marking Device |
| DS850 | 2.11.0.0 | 1.0 | Central Count Scanner |
| Ballot Box Hardware | --- | 1.2, 1.3 | Plastic ballot box |
| Ballot Box Hardware | --- | 1.0, 1.1, 1.2 | Metal ballot box with/without diverter |
| EMS Reporting Workstation | --- | Dell OptiPlex 7010 | Workstation for EMS Reporting |
| EMS Server | --- | Dell PowerEdge T710 | Server for EMS |
| EMS Reporting Laptop | --- | Dell Latitude E6410 | Laptop for EMS Reporting |
| DS850 Report Printer | --- | Oki B430dn & Oki B431dn | Laser report printer |
| DS850 Audit Printer | --- | Oki Microline 420 | Dot Matrix Printer |
| USB Flash Drive | --- | Delkin 512MB | Storage for election and ballot definition |
| USB Flash Drive | --- | Delkin 4GB | Storage for election and ballot definition |
| USB Flash Drive | --- | Delkin 8 GB | Storage for election and ballot definition |

**Table 1-1. EVS 5.4.0.0 System Components** *(continued)*

| System Component | Software or Firmware Version | Hardware Version(s) | Description |
|---|---|---|---|
| USB Flash Drive | --- | Delkin 1 GB | Storage for election and ballot definition |
| USB Flash Drive | --- | Delkin 2 GB | Storage for election and ballot definition |
| USB Flash Drive | --- | Delkin 16 GB | Storage for election and ballot definition |
| Compact Flash | --- | Delkin Devices 1.0 GB capacity | Storage for election and ballot definition |
| Barcode Scanner | --- | DS457-SR20009 | Barcode scanner manufactured by Zebra |
| Electionware | 4.8.0.0 | --- | Election management software that provides end-to-end election management activities |
| Election Reporting Manager (ERM) | 8.13.0.0 | --- | Election results reporting program |
| Event Log Service (ELS) | 1.5.6.0 | --- | Logs users' interactions with EMS. |
| Removable Media Service (RMS) | 1.4.6.0 | --- | Utility that runs in the background of the Windows operating system |
| ExpressVote Previewer | 2.1.0.0 | --- | Application within the EMS program that allows the user to preview audio text and screen layout prior to burning Election Day media for the ExpressVote |
| VAT Preview | 1.8.7.0 | --- | Application within the EMS program |
| Adobe Acrobat Standard | 11 | --- | --- |
| Cerberus FTP | 8.0.6 (x64) | --- | --- |
| Microsoft Server 2008 | R2 w/SP1 | --- | --- |
| Microsoft Windows 7 | 64-bit/SP1 | --- | --- |
| WSUS Microsoft Windows Offline Update Utility | 10.7.4 | --- | --- |
| Micro Focus RM/COBOL Runtime | 12.06 | --- | --- |
| Symantec Endpoint Protection | 12.1.6 | --- | --- |
| Symantec Endpoint Protection Intelligent Updater | 20160829-002-v5i64 | --- | --- |

**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 107th 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)

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

- NTS Report No. PR032474-TR-02, Rev. A, "Test Report of EAC VVSG 1.0 Certification Testing Performed on Election Systems & Software EVS 5.4.0.0"

- EAC Certificate of Conformance ES&S EVS 5.4.0.0, dated February 24, 2017

- Pro V&V Document No. TP-01-01-ESS-2018-01.01, Rev. C, "Test Report for EAC VVSG 1.0 Certification Testing Election Systems & Software (ES&S) Voting System (EVS) 5.4.1.0"

- ES&S Technical Data Package *(A listing of the EVS 5.4.1.0 documents submitted for this test campaign is listed in Section 3.1 of this Test Report)*

**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

"BMD" – Ballot Marking Device

 "CM" – Configuration Management

"COTS" – Commercial Off-The-Shelf

"EAC" – United States Election Assistance Commission

"EMS" – Election Management System

"ES&S" – Election Systems and Software

"FCA" – Functional Configuration Audit

"HAVA" – Help America Vote Act

"ISO" – International Organization for Standardization

"NOC" – Notice of Clarification

"PCA" – Physical Configuration Audit

"QA" – Quality Assurance

"RFI" – Request for Interpretation

"TDP" – Technical Data Package

"VAT" – Voting Assist Terminal

"VSTL" – Voting System Test Laboratory

"VVSG" – Voluntary Voting System Guidelines

## 2.0    CERTIFICATION TEST BACKGROUND

### 2.1    Revision History

Pro V&V evaluated to the published Final Test Report for the EVS 5.4.0.0 in order to baseline the current system under test.

### 2.2    Scope of Testing

The scope of testing focused on evaluating the modifications detailed in Section 2.2.1 of this Test Report.

Primarily, these modifications focused on upgrades to the components of the previously certified EVS 5.4.0.0 and the introduction of a new hardware version for the ExpressVote (version 2.1.2.0). EVS 5.4.1.0 includes the following hardware:

ExpressVote Universal Voting System (ExpressVote) hardware 2.1, AutoMARK Voter Assist Terminal (AutoMARK), DS200 precinct-based scanner and tabulator (DS200), and DS850 central scanner and tabulator (DS850).   There are two separate hardware versions of the ExpressVote hardware 2.1 (2.1.0.0 and 2.1.2.0).

Hardware version 2.1.0.0 was previously certified with EVS 5.4.0.0 and will remain certified with this system. Hardware version 2.1.2.0 was incorporated in this modification and was subjected to testing as part of this test campaign.

To evaluate the EVS 5.4.1.0 test requirements, the submitted modifications were reviewed against each section of the EAC VVSG 1.0 to determine the applicable tests to be performed. Based on this assessment, the following tests were required:

- System Level Testing

    — System Integration Testing

    — Functional Configuration Audit (FCA)

    — Accuracy Testing

- Physical Configuration Audit (PCA), including System Loads & Hardening

- Technical Documentation Package (TDP) Review

- Hardware Testing

    — Non-Operating Environmental Testing

    — Operating Environmental Testing

    — Electrical Hardware Testing

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

### 2.2.1 Modification Overview

The EVS 5.4.1.0 is a modified voting system configuration that includes upgrades to the components of the EVS 5.4.0.0 and introduces a new hardware version for the ExpressVote (version 2.1.2.0). EVS 5.4.1.0 adds four new ExpressVote configuration options: Quad Express Cart, MXB ExpressVote Voting Booth, ExpressVote Single Table and ExpressVote Double Table. EVS 5.4.1.0 also: adds a new ADA table configuration for the AutoMARK; provides security upgrades to third-party EMS COTS products; and contains minor enhancements to Electionware and ExpressVote.

### 2.2.1.1 Detailed List of Changes

The list below includes specific changes between EVS 5.4.1.0 and the baseline of the EVS 5.4.0.0:

General

- Security upgrades to third-party EMS COTS products

ExpressVote Universal Voting System

- Introduced new hardware version of the ExpressVote (Hardware 2.1.2.0; displays 6.4 and 6.8)

  ─ The new hardware version for the ExpressVote addresses end-of-life components as well as improved manufacturability

- Introduced new configuration options for the ExpressVote

  ─ ExpressVote Single Table:  Holds one ExpressVote in place while providing privacy for the voter. The table features a hole for cord management and a privacy screen. With side approach, this table accommodates voters in wheelchairs as well as standing voters.

  ─ ExpressVote Double Table: Holds two ExpressVote units in place while providing privacy for each voter. The table features a hole for cord management and a double privacy screen.

  ─ MXB ExpressVote Voting Booth: A configurable voting booth solution that accommodates seated voters on one side and standing voters on the other. Each side of this voting booth includes privacy screens.

  ─ Quad Express Cart:  A rolling cart with four locking caster wheels. It is capable of holding up to four ExpressVote units in place. Three of the units are positioned for standing voters while the fourth accommodates a seated voter. Each of the four stations on this cart include deployable privacy screens.

- Resolved an issue with write-in entries using a binary tactile device in multi-language elections.

- Resolved an issue where very long candidate text can truncate instead of displaying the entire text string.

AutoMARK

- Introduced new configuration option

  ─ AutoMARK Table:  Holds one AutoMARK in place while providing privacy for the voter. The table features a hole for cord management.  With side approach, this table accommodates voters in wheelchairs as well as standing voters.

Electionware

- Updated audio prompts for enhanced support of ADA voting with a binary tactile device

- Updated Users xml export filename
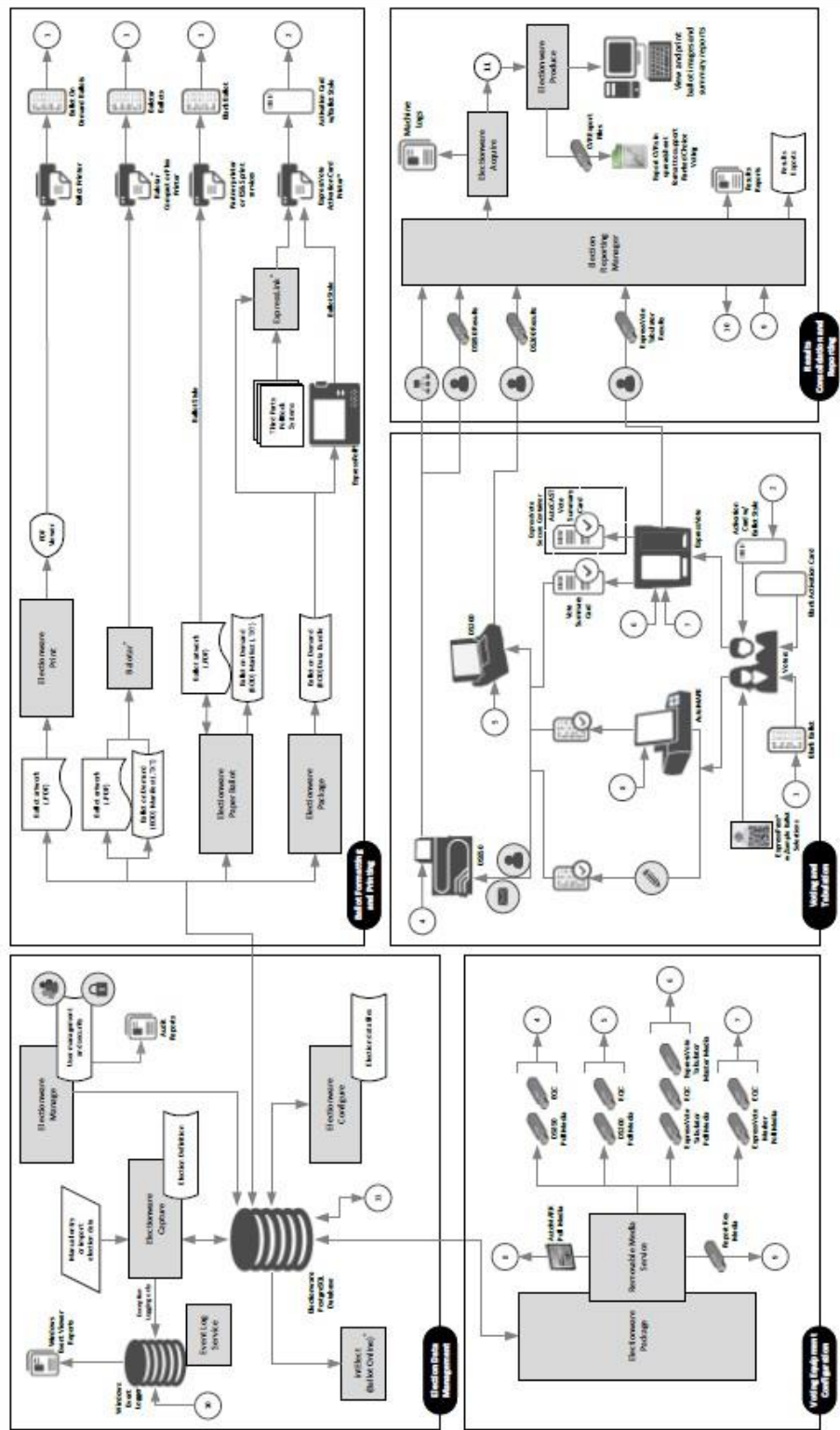
- Updated User Guide

## 2.2.2 Block Diagram



**Figure 1-1. EVS 5.4.1.0 System Overview**

### 2.2.3 Supported Functionality

The EVS 5.4.1.0 supports the following voting variations:

- General Election
- Closed Primary
- Open Primary
- Early Voting
- Partisan/Non-Partisan Offices
- Write-In Voting
- Split Precincts
- Vote for N of M
- Ballot Rotation
- Provisional or Challenged Ballots
- Straight Party Voting
- Cross-party Endorsement

### 2.2.4 Supported Languages

The following languages are supported by EVS 5.4.1.0:

- English
- Spanish
- Chinese
- Korean
- Japanese
- Hindi

Support for all stated languages was verified; however, only 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.

For the character based language, the ballot was created by Pro V&V and voted utilizing both paper ballots and ADA voting devices along with all applicable peripherals.

### 2.2.5 System Limits

The system limits that were verified during testing to be supported by the EVS 5.4.1.0 are provided in the table below.

**Table 2-1. EVS 5.4.1.0 System Limits**

| System Characteristic | Boundary or Limitation | Limiting System Component |
|---|---|---|
| Max. precincts allowed in an election | 9,900 | ERM |
| Max. count for any precinct element | 500,000 (99,990 from any tabulator media) | ERM report (ERM results import) |
| Max. candidates allowed per election | Depends on election content (limited by 21,000 maximum counters) | ERM |
| Max. contests allowed in an election | Depends on election content (limited by 21,000 maximum counters) | ERM |
| Max. counters allowed per precinct | Limits candidates and contests assigned to a precinct to 1,000 | ERM |
| Max. contests allowed per ballot style | 200 or # of positions on ballot | N/A |
| Max. candidates (ballot choices) allowed per contest | 175 | ERM (database create) |
| Max. number of parties allowed | General election: 75 Primary election: 20 (including nonpartisan party) | ERM (database create) |
| Max. 'vote for' per contest | 98 | ERM (database create) |
| Ballot formats | All paper ballots used in an election must be the same size. Votable paper ballots must contain the same number of rows | Ballot scanning equipment |
| Max. Ballot Styles | 9,900 | ERM |
| Max. District Types/Groups | 20 | ERM |
| Max. districts of a given type | 40 | --- |

Additionally, the following EVS 5.4.1.0 component limitations have been identified:

Paper Ballot Limitations

1. The paper ballot code channel, which is the series of black boxes that appear between the timing track and ballot contents, limits the number of available ballot variations depending on how a jurisdiction uses this code to differentiate ballots. The code can be used to differentiate ballots using three different fields defined as: Sequence (available codes 1-16,300), Type (available codes 1-30) or Split (available codes 1-18).

2. For paper ballots, if Sequence is used as a ballot style ID, it must be unique election-wide and the Split code will always be 1. In this case the practical style limit would be 16,300.

3. The ExpressVote activation card has a ballot ID consisting of three different fields defined as: Sequence (available codes 1-16,300), Type (available codes 1-30) or Split (available codes 1-18).

DS200

1. The DS200 configured for an early vote station does not support precinct level results reporting. An election summary report of tabulated vote totals is supported.

2. The DS200 storage limitation for write-in ballot images is 3,600 images. Each ballot image includes a single ballot face, or one side of one page.

3. Write-in image review requires a minimum 1GB of onboard RAM.

4. To successfully use the write-in report, ballots must span at least three vertical columns. Using two columns or fewer results in the write-in area being too large to print on the report tape.

AutoMARK Voter Assist Terminal

1. AutoMARK capacities exceed all documented limitations for the ES&S election management, vote tabulation and reporting system. For this reason, Election Management System and ballot tabulator limitations define the boundaries and capabilities of the AutoMARK system as the maximum capacities of the ES&S AutoMARK are never approached during testing.

Electionware

1. Electionware capacities exceed the boundaries and limitations documented for ES&S voting equipment and election reporting software. For this reason, ERM and ballot tabulator limitations define the boundaries and capabilities of the Electionware system.

2. Limits were calculated using default text sizes for ballot and report elements. Some uses and conditions, such as magnified ballot views or combining elements on printed media or ballot displays, may result in limits lower than those listed. Check printed media and displays before finalizing the election.

3. The Electionware Export Ballot Images function is limited to 250 districts per export.

4. Electionware supports the language special characters listed in the System Overview. Language special characters other than those on this list may not appear properly when viewed on equipment displays or reports.

5. The Straight Party feature must not be used in conjunction with the single or Multiple Target Cross Endorsement features.

ExpressVote

1. ExpressVote capacities exceed all documented limitations for the ES&S election management, vote tabulation and reporting system.
For this reason, Election Management System and ballot tabulator limitations define the boundaries and capabilities of the ExpressVote system as the maximum capacities of the ES&S ExpressVote are never approached during testing.

Election Reporting Manager (ERM)

1. ERM requires a minimum monitor screen resolution of 800x600.

2. ERM Database Create allows 1,600 Precincts per Ballot Style.

3. There is a limit of 3,510 precincts in the precincts counted/not counted display.

4. There is a limit of 3,000 precincts in the precincts counted/not counted scrolling display.

5. Contest/Precinct selection pop up display limited to 3,000 contests/precincts.

6. Non-English characters are not supported in ERM. This has to do with the creation of the XML results file out of ERM.

7. ERM's maximum page size for reports is 5,000 pages.

### 2.2.6 VVSG

The EVS 5.4.1.0 was evaluated against the relevant requirements contained in the EAC VVSG 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 RECOMMENDATIONS

The EVS 5.4.1.0 was evaluated against the relevant requirements contained in the EAC 2005 VVSG, Volumes I and II. The focus of this test campaign was on the modifications to the voting system configuration that included upgrades to the components of the baselined system and the introduction of the new hardware version for the ExpressVote (version 2.1.2.0). 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, and Limited FCA), PCA, Hardware Testing, and Source Code Review are detailed in the relevant sections of this report. In addition to these areas of testing, a TDP Review was performed, as described below.

Technical Documentation Package (TDP) Review

In order to determine compliance of the modified TDP documents with the EAC VVSG 1.0, 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 verify that 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. Any revised documents during the TDP review process were compared with the previous document revision to determine changes made, and the document was re-reviewed to determine whether subject requirements had been met. A listing of all documents contained in the EVS 5.4.1.0 TDP is provided in Table 3-1.

**Table 3-1. TDP Documents**

| Document ID | Description | Document Revision |
|---|---|---|
| *Preface* | | |
| ESSSYS_5'4'1'0_L_RequirementsMatrix_QA | Requirements of the EAC VVSG 1.0 Trace to Vendor Testing | 1.0 |
| ESSSYS_5'4'1'0_L_RequirementsMatrix_TDP | Requirements of the EAC VVSG 1.0 Trace to Technical Data Package | 1.0 |
| *System Overview* | | |
| ESSSYS_5'4'1'0_D_SYSOVR | ES&S Voting System 5.4.1.0 System Overview | 1.2 |
| *System Functionality Description* | | |
| ESSSYS_5'4'1'0_D_SFD | ES&S Voting System 5.4.1.0 System Functionality Description | 1.0 |
| AQS-17-5001-001-R | AutoMARK(i) System Functionality | 2 |
| *System Hardware Specification* | | |
| AQS-18-5000-001-F | AutoMARK System Hardware Specification | 6 |
| AQS-18-5002-000-S | AutoMARK System Hardware Overview | 8 |
| DS200_1'2_SPC_HWSPEC | DS200 Hardware Specification, Hardware Revision 1.2 | 3.5 |
| DS200_1'3_SPC_HWSPEC | DS200 Hardware Specification, Hardware Revision 1.3 | 4.6 |
| DS850_1'0_SPC_HWSPEC | DS850 Hardware Specification, Hardware Revision 1.0 | 1.7 |
| EVOTE_2'1_SPC_HWSPEC | ExpressVote Hardware Specification, Hardware Revision 2.1 | 1.3 |
| EVOTE_2'1_L_APL | Approved Parts List: ExpressVote HW 2.1 | 2.3 |
| *Software Design and Specification* | | |
| DS200_2'14'0'0_SDS | DS200 - Software Design Specification | 1.3 |
| DS850_2'11'0'0_SDS | DS850 – Software Design Specification | 1.1 |
| ELS_1'5'6'0_SDS | ES&S Software Design Specifications Event Log Service ES&S Voting System | 1.2 |
| ERM_8'13'0'0_SDS | ES&S Software Design Specifications Election Reporting Manager (ERM) ES&S Voting System | 1.1 |
| ERM_8'13'0'0_SDS_APPENDICES | ES&S Software Design Specifications ERM Appendices ES&S Voting System | 1.0 |

**Table 3-1. TDP Documents** *(continued)*

| Document ID | Description | Document Revision |
|---|---|---|
| ESSSYS_1'0_P_CODINGST ANDARDS | Coding Standards | 1.1 |
| ESSSYS_1'0_P_SYSDEVPR OGRAM | System Development Program | 1.3 |
| EVOTE_2'1'1'0_SDS | ExpressVote - Software Design Specification | 1.1 |
| EWARE_4'8'1'0_SDS | Electionware – Software Design Specification | 1.0 |
| AQS-18-5002-003-S | AutoMARK Ballot Image Processing Specifications | 6 |
| AQS-18-5002-007-S | AutoMARK Ballot Scanning and Printing Specification | 5 |
| AQS-18-5000-002-F | AutoMARK Driver API Specification | 5 |
| AQS-18-5002-005-S | AutoMARK ESS Embedded Database Interface Specifications | 5 |
| AQS-18-5001-005-R | AutoMARK Graphical User Interface Design Specifications | 6 |
| AQS-18-5001-002-R | AutoMARK Operating Software (AMOS) Design Specifications | 5 |
| AQS-18-5002-004-S | AutoMARK Operations and Diagnostic Log Specifications | 6 |
| AQS-18-5001-011-R | AutoMARK Programming Specifications Details | 5 |
| AQS-18-5001-004-S | AutoMARK Software Design Specifications | 6 |
| --- | Software Design and Specifications Overview AutoMARK Voter Assist Terminal (VAT) | N/A |
| AQS-18-5001-006-R | AutoMARK Software Development Environment Specifications | 5 |
| AQS-18-5000-004-F | AutoMARK Software Diagnostics Specification | 5 |
| AQS-18-4000-000-S | AutoMARK ESS Software Standards Specification | 5 |
| *System Test and Verification* | | |
| ESSSYS_5'4'1'0_D_TESTPL AN | ES&S Voting System 5.4.1.0 System Test Plan | 1.0 |
| AMVAT_1'X_D_CIFRpt | Usability Test Report ES&S AutoMARK Voter Assist Terminal (VAT) Version 1.X | --- |
| DS200_1'2'1_D_CIFRpt | Usability Test Report DS200 Precinct Ballot Scanner Version1.2.1 | --- |
| EVOTE_1'0_D_CIFRpt | ExpressVote Usability Report ES&S Voting System 5.2.0.0 | --- |
| *System Security Specification* | | |
| AQS-18-5002-001-S | AutoMARK System Security Specifications | 7 |
| ESSSYS_1'0_SPC_SYSTEM SECURITY_LOCAL | ES&S Voting System Security Specification | 1.5 |

**Table 3-1. TDP Documents** *(continued)*

| Document ID | Description | Document Revision |
|---|---|---|
| ESSSYS_5'4'1'0_SPC_CLIENTWORKSTATIONSETUPCONFIGGUIDE | ES&S Voting System 5.4.1.0 EMS Client Workstation Secure Setup & Configuration Guide | 1.1 |
| ESSSYS_5'4'1'0_SPC_EMSSERVERSETUPCONFIGGUIDE | ES&S Voting System 5.4.1.0 EMS Server Secure Setup & Configuration Guide | 1.1 |
| ESSSYS_5'4'1'0_SPC_SECSCRIPTDESC | ES&S Voting System 5.4.1.0 Security Script Description | 1.1 |
| ESSSYS_5'4'1'0_SPC_STANDALONEWORKSTATIONSETUPCONFIGGUIDE | ES&S Voting System 5.4.1.0 Standalone EMS Workstation Secure Setup & Configuration Guide | 1.1 |
| AMVAT_1'8_L_ValFileList | Validation File List: AutoMARK | 1.2 |
| AMVATP_1'8_L_ValFileList | Validation File List: AutoMARK Previewer | 1.2 |
| DS200_2'14_L_ValFileList | Validation File List: DS200 | 1.1 |
| DS850_2'11_L_ValFileList | Validation File List: DS850 | 1.1 |
| ELS_1'5_L_ValFileList | Validation File List: Event Log Service | 1.1 |
| ERM_8'13_L_ValFileList | Validation File List: Election Reporting Manager | 1.2 |
| RMS_1'4_L_ValFileList | Validation File List: RMS | 1.1 |
| EVOTE_2'1_L_ValFileList | Validation File List: EVOTE | 1.2 |
| EVOTEP_2'1_L_ValFileList | Validation File List: EVOTE | 1.0 |
| EWARE_4'8_L_ValFileList | Validation File List: EWARE | 1.0 |
| *System Operations Procedures* | | |
| AMVAT_1'8'7'0_SOP | AutoMARK Operator's Guide, Firmware Version 1.8 | 1.4 |
| DS200_2'14'0'0_SOP | DS200 Operator's Guide. Firmware Version 2.14 | 1.8 |
| DS200_2'14'0'0_SOP_Appendices | DS200 Operator's Guide Appendices, Firmware Version 2.14 | 1.0 |
| DS850_2'11'0'0_SOP | DS850 Operator's Guide, Firmware Version 2.11 | 1.7 |
| DS850_2'11'0'0_SOP_Appendices | DS850 Operator's Guide Appendices, Firmware Version 2.11 | 1.0 |
| ELS_1'5'6'0_SOP | EVS Event Logging Service User's Guide, Software Version 1.5 | 1.2 |
| ERM_8'13'0'0_SOP | Election Reporting Manager User's Guide, Software Version 8.13 | 1.6 |
| ERM_8'13'0'0_SOP_APPX | Election Reporting Manager User's Guide Appendices, Software Version | 1.2 |
| EVOTE_2'1'1'0_SOP | ExpressVote Operator's Guide, Firmware Version 2.1 | 1.2 |

**Table 3-1. TDP Documents** *(continued)*

| Document ID | Description | Document Revision |
|---|---|---|
| EVOTE_2'1'1'0_SOP_Appendices | ExpressVote Operator's Guide Appendices, Firmware Version 2.1 | 1.0 |
| EWARE_4'8'1'0_SOP_01Admin | Electionware Vol. I: Administrator Guide, Software Version 4.8 | 1.0 |
| EWARE_4'8'1'0_SOP_02Define | Electionware Vol. II: Define User Guide, Software Version 4.8 | 1.0 |
| EWARE_4'8'1'0_SOP_03Design | Electionware Vol. III: Design User Guide, Software Version 4.8 | 1.0 |
| EWARE_4'8'1'0_SOP_04Deliver | Electionware Vol. IV: Deliver User Guide, Software Version 4.8 | 1.0 |
| EWARE_4'8'1'0_SOP_05Results | Electionware Vol. V: Results User Guide, Firmware Version 4.8 | 1.0 |
| EWARE_4'8'1'0_SOP_Appendices | Electionware Vol. VI: Appendices, Firmware Version 4.8 | 1.0 |
| *System Maintenance Manuals* | | |
| AMVAT_1'8'7'0_SMM | AutoMARK Maintenance Manual, Firmware Version 1.8 | 1.3 |
| DS200_2'14'0'0_SMM | DS200 Maintenance Manual, Firmware Version 2.14 | 1.3 |
| DS850_2'11'0'0_SMM | DS850 Maintenance Manual, Firmware Version 2.11 | 1.3 |
| EVOTE_2'1'1'0_SMM | ExpressVote Maintenance Manual, Firmware Version 2.1 | 1.0 |
| *Personnel Deployment and Training* | | |
| ESSSYS_1'0_P_TRAININGPROGRAM | Personnel Deployment and Training Program | 1.0 |
| *Configuration Management Plan* | | |
| ESSSYS_1'0_P_CMPROGRAM | Configuration Management Program | 1.1 |
| ESSSYS_1'0_P_TDPROGRAM | Technical Documentation Program | 1.1 |
| *QA Program* | | |
| ESSSYS_5'4'1'0_P_MNFQAPROGRAM | Manufacturing Quality Assurance Program | 1.0 |
| ESSSYS_5'4'1'0_P_SWQAPROGRAM | Software Quality Assurance Program | 1.0 |
| *System Change Notes* | | |
| ESSSYS_5'4'1'0_D_CHANGENOTES | ES&S Voting System 5.4.1.0 System Change Notes | 1.1 |
| *Attachments* | | |
| BPG_1'0_SOP | Ballot Production Guide for EVS | 3.0 |

### 3.1.1 Hardware Testing

The updates to the modified system required the full suite of hardware testing. This included both environmental and electrical testing as detailed in the EAC VVSG 1.0. This determination was based on the following changes to the ExpressVote:

- Motherboard update - The Eurotech TC RL replaced the RG model.

- Display update - implemented AUO displays

- IOB and PMB respin - replaced "cuts & jumpers" introduced to address ESD susceptibility with identical permanent changes to boards

The EVS 5.4.1.0 was subjected to the hardware tests listed below:

**Electrical Tests:**

- Electrical Power Disturbance

- Electromagnetic Radiation

- Electrostatic Disruption

- Electromagnetic Susceptibility

- Electrical Fast Transient

- Lightning Surge

- Conducted RF Immunity

- Magnetic Fields Immunity

**Environmental Tests:**

- Bench Handling

- Vibration

- Low Temperature

- High Temperature

- Humidity

- Temperature Power Variation

Pro V&V utilized third party testing during the performance of hardware testing. All hardware testing was performed at the NTS Longmont facility located in Longmont, Colorado. All testing was witnessed on-site by Pro V&V personnel, with the exception of Temperature Power Variation in which Pro V&V qualified staff executed all testing at the NTS Longmont facility.

Summary Findings

Electrical Testing was performed on the components listed above. The procedures and results for this testing are included in NTS Test Report No: TR-PR075829, presented in Attachment A, Part 1, and NTS Test Report No. ETR-PR075829, presented in Attachment A, Part 2. The test results from this testing are summarized below:

**Table 3-2. Electrical Hardware Test Results**

| Standard/Method | Description | Criteria | Class/Level | Result |
|---|---|---|---|---|
| FCC 15.107 ICES-003 VVSG Vol. 1 4.1.2.9 | Power Line Conducted Emissions | N/A | Class B | Compliant |
| FCC 15.109 ICES-003 VVSG Vol. 1 4.1.2.9 | Radiated Emissions | N/A | Class B | Compliant |
| EN61000-4-11 VVSG Vol. 1 4.1.2.5 | Electrical Power Disturbance | Normal Operation & No Data Loss | Various | Compliant |
| EN61000-4-4 VVSG Vol. 1 4.1.2.6 | Electrical Fast Transient | Normal Operation & No Data Loss | ±2kV - Mains | Compliant |
| EN61000-4-5 VVSG Vol. 1 4.1.2.7 | Lightning Surge | Normal Operation & No Data Loss | ±2kV Line - Line ±2kV Line - Ground | Compliant |
| EN61000-4-2 VVSG Vol. 1 4.1.2.8 | Electrostatic Disruption | Normal Operation & No Data Loss | ±8kV Contact ±15kV Air | Compliant |
| EN61000-4-3 VVSG Vol. 1 4.1.2.10 | Electromagnetic Susceptibility | Normal Operation & No Data Loss | 10 V/m, 80 MHz – 1 GHz | Compliant |
| EN61000-4-6 VVSG Vol. 1 4.1.2.11 | Conducted RF Immunity | Normal Operation & No Data Loss | 10 Vrms, 150 kHz – 80 MHz | Compliant |
| EN61000-4-8 VVSG Vol. 1 4.1.2.12 | Magnetic Immunity | Normal Operation & No Data Loss | 30 A/m | Compliant |
| Overall Result | | | | Pass/Compliant |

Environmental Testing was performed on the components listed above. The procedures and results for this testing are included in NTS Test Report No: TR-PR075783, presented in Attachment A, Part 3. The test results from this testing are summarized below:

*Shock - Bench Handling (MIL-STD-810D, 516.3, I-3.8)*

The ExpressVote was subjected to Shock – Bench Handling Testing. Using one edge as a pivot, the opposite edge of the chassis of each unit was lifted until the face reached 45° with horizontal bench top, or 4 inches above bench top (whichever occurred first). This was repeated with each practical edge, of the same horizontal face. At the conclusion of testing, the components were subjected to a visual inspection and an operational status check was performed.  Result – PASS

*Vibration – Basic Transportation (MIL-STD-810D, 514.3, I-3.2.1)*

The ExpressVote was subjected to Vibration – Basic Transportation Testing. Testing was performed at ambient/room temperature (20ºC +/-3 ºC) in the X, Y and Z axis at the levels identified in Figure 3-1. At the conclusion of testing, a visual inspection and an operational status check was performed.  Test Result - PASS

| Axis | Profile |
|------|---------|
| X | BREF.POINTS<br>FREQ   PSD VALU<br>10   .00013<br>20   .00065<br>30   .00065<br>78   .00002<br>79   .00019<br>120   .00019<br>500   .00001 |
| Y | BREAKPOINTS<br>FREQ   PSD VALUE<br>10   .00650<br>20   .00650<br>120   .00020<br>121   .00300<br>200   .00300<br>240   .00150<br>340   .00003<br>500   .00015 |
| Z | BREAKPOINTS<br>FREQ   PSD VALUE<br>10   .01500<br>40   .01500<br>500   .00015 |

**Figure 3-1. Vibration Test Profiles**

*Low Temperature - Storage (MIL-STD-810D, 502.2, II-3)*

The ExpressVote was subjected to Low Temperature – Storage Testing. Samples were subjected to a temperature of -4ºF (-20ºC +/-3 ºC) for a duration of 4 hours, after which operation was confirmed by Pro V&V. Samples were not powered, and were left in their packaging for the duration of the test. They were removed from the boxes for operational verification after the test.

At the conclusion of testing, a visual inspection and an operational status check was performed. Test Result – PASS

*High Temperature - Storage (MIL-STD-810D, 501.2, I-3.2)*

The ExpressVote was subjected to High Temperature – Storage Testing.  Samples were subjected to a temperature of 140ºF (60ºC +/-3 ºC) for a duration of 4 hours, after which operation was confirmed by Pro V&V. Samples were not powered, and were left in their packaging for the duration of the test. They were removed from the boxes for operational verification after the test. At the conclusion of testing, a visual inspection and an operational status check was performed. Test Result – PASS

*Humidity – Hot/Humid (MIL-STD-810D, 507.2, I-3.2)*

The ExpressVote was subjected to Humidity – Hot/Humid Testing. Samples were subjected as per Table 507.2-I, Hot-Humid (Cycle 1), for a duration of 240 hours (10 days), after which operation was confirmed by Pro V&V. Samples were not powered/operational, and were left in their packaging for the duration of the test, and were removed from the boxes for operational verification.  At the conclusion of testing, a visual inspection and an operational status check was performed. Test Result – PASS

*Temp-Power Variation Testing (MIL-STD-810D, 501.2/502.2)*

The ExpressVote was subjected to Temperature/Power Variation Testing. The ExpressVote components were powered and being operated by Pro V&V for the duration of the environmental profile, to confirm operation.

Test Result – PASS

| |
|---|
| 1- Ramp to 10°C |
| 2- Hold 10°C for 12 hours |
| 3- Ramp to 35°C over 1 hour |
| 4- Hold 35°C for 12 hours |
| 5- Ramp to 10°C over 1 hour |
| 6- Repeat until 85 hours cycling at profile is achieved |
| 7- Ramp to 35°C over 1 hour |
| 8- Hold 35°C for 12 hours |
| 9- Ramp to 23°C over 1 hour |
| 10- Hold for duration of test |

**Figure 3-2. Temperature/Power Variation Profile**

### 3.1.2 Source Code Review

Pro V&V reviewed the submitted source code to the EAC VVSG 1.0 and the manufacturer-submitted coding standards. Prior to initiating the software review, Pro V&V verified 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.

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 EVS 5.4.0.0 voting system. In addition, 10% of the source code comments were manually reviewed.

<u>Summary Findings</u>

- <u>Automated Source Code Review</u>: The Automated Source Code Review was performed during the EVS 5.4.1.0 Compliance and Trusted Builds. No source code issues were found during the Automated Source Code review.

- <u>Manual Source Code Review</u>: The Manual Source Code review was performed on 10% of the comments for compliance to VVSG Volume Section 5.2.7. No source code issues were found during the Manual Source Code review.

- <u>Compliance Build</u>: 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.

- <u>Trusted Build</u>: 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 Test Laboratory 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.

### 3.1.3 Physical Configuration Audit (PCA)

The Physical Configuration Audit (PCA) compares the voting system components submitted for qualification to the manufacturer's technical documentation, and included 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 reviewed 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

<u>Summary Findings</u>

During execution of the test procedure, the components of the EVS 5.4.1.0 system 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.

### 3.1.4 System Level Testing

System Level Testing included the Limited Functional Configuration Audit (FCA), the Accuracy Test, and the System Integration Tests. It also included a limited Accessibility/Usability Review on the Quad Express Cart. 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 modifications 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. The System Integration Tests were performed to verify the EVS 5.4.1.0 functioned as a complete system.

Additionally, the system was configured exactly as it would for normal field use per the procedures detailed in the EVS 5.4.1.0 technical documentation. 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.

The EVS 5.4.1.0 EMS is an application suite consisting of Electionware, ERM, RMS, ELS, ExpressVote Previewer, and VAT Previewer.

### 3.1.4.1 Functional Configuration Audit (FCA)

The Functional Configuration Audit (FCA) 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 were conducted to ensure all applicable EAC VVSG 1.0 requirements were met.

Summary Findings

All functional tests were successfully executed.

### 3.1.4.2 Accuracy

The Accuracy test ensured that each component of the voting system could 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. In an effort to achieve this and to verify the proper functionality of the units under test, the following methods were used to test components of the voting system:

The accuracy requirements for the ExpressVote hardware 2.1.0.0, DS200, DS850, and AutoMark were met as part of the previous EVS 5.4.0.0 test campaign. Only the ExpressVote hardware 2.1.2.0 was subjected to the Accuracy Test as part of this test campaign. Testing of the ExpressVote hardware 2.1.2.0 was accomplished by the execution of the standard accuracy test utilizing pre-marked vote summary cards of each card length supported.

Summary Findings

The ExpressVote units successfully passed the Accuracy test without issue. A total of 1,600,000 voting positions were scanned into the ExpressVote with all actual results obtained during test execution matching the expected results.

### 3.1.4.3 System Integration

System Level test for the integrated operation of both hardware and software.

Compatibility of the voting system software components or subsystems with one another, and with other components of the voting system environment, were determined through functional tests integrating the voting system software with the remainder of the system.

<u>Summary Findings</u>

A General Election and a Primary Election were successfully exercised on the voting system, as described below:

General election with the following breakdown:

— General Election GEN-03: A basic election held in two precincts. This election contains eight contests and 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 at least three languages and an ADA binary input device.

Primary election with the following breakdown:

— 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 at least three languages and an ADA binary input device.

The EVS 5.4.1.0 system successfully passed the System Integration Test. During execution of the test procedure, it was verified that the EVS 5.4.1.0 system successfully completed the system level integration tests with all actual results obtained during test execution matching the expected results.

**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. No anomalies occurred during the testing of the EVS 5.4.1.0 System.

**3.3    Deficiencies and Resolutions**

Any violation of the specified requirement or a result is encountered during test performance that deviates from what is standard or expected in which a root cause is established is considered to be a deficiency. Upon occurrence, deficiencies are logged throughout the test campaign for disposition and resolution. No deficiencies were encountered during testing of the EVS 5.4.1.0.

## 4.0 RECOMMENDATION FOR CERTIFICATION

The EVS 5.4.1.0, 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 EVS 5.4.1.0 functioned as a complete system during System Integration Testing. Based on the test findings, Pro V&V recommends the EAC grant the EVS 5.4.1.0 system identified in Table 4-1 certification to the EAC 2005 VVSG.

### Table 4-1. EVS 5.4.1.0 System Components

| System Component | Software or Firmware Version | Hardware Version(s) | Description |
|---|---|---|---|
| ExpressVote (Marker) | 2.1.1.0 | 2.1.0.0, 2.1.2.0 | Universal Voting System that combines paper-based voting with touch screen technology. Includes a mandatory vote summary screen that requires voters to confirm or revise selections prior to printing the summary of ballot selections. |
| ExpressVote (Tabulator) | 2.1.1.0 | 2.1.0.0, 2.1.2.0 | Universal Voting System that combines paper-based voting with touch screen technology. Includes all functions of the ExpressVote Marker and also provides the optional capability of tabulating printed vote summary cards. |
| DS200 | 2.14.0.0 | 1.2.1, 1.2.3, 1.3 | Precinct Digital Scanner that scans voter selections from both sides of the ballot simultaneously |
| Auto MARK A100 | 1.8.7.0 | 1.0 | ADA Ballot Marking Device |
| AutoMARK A200 | 1.8.7.0 | 1.1 | ADA Ballot Marking Device |
| AutoMARK A200 | 1.8.7.0 | 1.3 | ADA Ballot Marking Device |
| AutoMARK A300 | 1.8.7.0 | 1.3 | ADA Ballot Marking Device |
| DS850 | 2.11.0.0 | 1.0 | Central Count Scanner |
| Ballot Box Hardware | --- | 1.2, 1.3,1.4,1.5 | Plastic ballot box |
| Tote bin | --- | 1.0 | Plastic Tote bin |
| Collapsible ballot box | --- | 1.0 | Collapsible ballot box |
| Ballot Box Hardware | --- | 1.0, 1.1, 1.2 | Metal ballot box with/without diverter |
| EMS Reporting Workstation | --- | Dell OptiPlex 5050 | Workstation for EMS Reporting |
| EMS Server | --- | Dell PowerEdge T630 | Server for EMS |

**Table 4-1. EVS 5.4.1.0 System Components** *(continued)*

| System Component | Software or Firmware Version | Hardware Version(s) | Description |
|---|---|---|---|
| DS850 Report Printer | --- | Oki B430dn & Oki B431dn | Laser report printer |
| DS850 Audit Printer | --- | Oki Microline 420 | Dot Matrix Printer |
| Uninterruptible Power Supply | --- | APC 1500 | APC Back UPS RS 1500 |
| USB Flash Drive | --- | Delkin 512MB | Storage for election and ballot definition |
| USB Flash Drive | --- | Delkin 4GB | Storage for election and ballot definition |
| USB Flash Drive | --- | Delkin 8 GB | Storage for election and ballot definition |
| USB Flash Drive | --- | Delkin 1 GB | Storage for election and ballot definition |
| USB Flash Drive | --- | Delkin 2 GB | Storage for election and ballot definition |
| USB Flash Drive | --- | Delkin 16 GB | Validation purposes only |
| Compact Flash | --- | Delkin Devices 512KB, 1GB, 2GB | Storage for election and ballot definition |
| Compact Flash | --- | Delkin 6381 | Reader/Writer |
| Compact Flash | --- | SanDisk 018-6305 | Reader/Writer |
| Barcode Scanner | --- | DS457-SR20009 | Barcode scanner manufactured by Zebra |
| Electionware | 4.8.1.0 | --- | Election management software that provides end-to-end election management activities |
| Election Reporting Manager (ERM) | 8.13.0.0 | --- | Election results reporting program |
| Event Log Service (ELS) | 1.5.6.0 | --- | Logs users' interactions with EMS. |
| Removable Media Service (RMS) | 1.4.6.0 | --- | Utility that runs in the background of the Windows operating system |
| ExpressVote Previewer | 2.1.1.0 | --- | Application within the EMS program that allows the user to preview audio text and screen layout prior to burning Election Day media for the ExpressVote |
| VAT Preview | 1.8.7.0 | --- | Application within the EMS program |
| Adobe Acrobat Standard | 11 | --- | --- |
| Cerberus FTP | 9.0.3.1 (x64) | --- | --- |
| Microsoft Server 2008 | R2 w/SP1 | --- | --- |
| Microsoft Windows 7 | 64-bit/SP1 | --- | --- |

**Table 4-1. EVS 5.4.1.0 System Components** *(continued)*

| System Component | Software or Firmware Version | Hardware Version(s) | Description |
|---|---|---|---|
| WSUS Microsoft Windows Offline Update Utility | 11.1.1 | --- | --- |
| Micro Focus RM/COBOL Runtime | 12.06 | --- | --- |
| Symantec Endpoint Protection | 14.0.1 | --- | --- |
| Symantec Endpoint Protection Intelligent Updater (File-Based Protection) | 20180220-002-core3sdsv5i64.exe | --- | --- |
| Symantec Endpoint Protection Intelligent Updater (Network-Based Protection) | 20180219-040-IPS_IU_SEP_14RU1.exe | --- | --- |
| Symantec Endpoint Protection Intelligent Updater (Behavior-Based Protection) | 20180215-001-SONAR_IU_SEP.exe | --- | --- |

# APPENDIX A

# HARDWARE TEST REPORTS

*Part 1: NTS Longmont, Colorado: Immunity Test Report – TR-PR075829*

*Part 2: NTS Longmont, Colorado: Emissions Test Report – ETR-PR075829*

*Part 3: NTS Longmont, Colorado: Immunity Test Report – TR-PR075783*

**APPENDIX C**

**AS-RUN TEST PLAN**

*Pro V&V Document No. TP-01-01-ESS-2018-01.01 As-Run, "Test Plan for EAC VVSG 1.0 Certification Testing Election Systems and Software (ES&S) Voting System (EVS) 5.4.1.0"*