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Test Plan for EAC VVSG 1.0 Certification Testing
Election Systems & Software (ES&S)
Voting System (EVS) 5.2.4.0

EAC Project Number: ESSEVS5240

Version: As-Run, Rev. B

Date: 5/30/2018

U.S. Election Assistance Commission
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REVISIONS

Revision	Description	Date
NR	Initial Release	4/13/2018
A	Updated based on EAC comments	4/26/2018
B	Updated based on EAC comments	4/27/2018
As-Run	Updated to As Run	5/15/2018
As-Run Rev. A	Updates per EAC Comments to Test Report and reformatting due to changes	5/24/2018
As-Run Rev. B	Corrected Table 1-2 and removed highlights	5/30/2018

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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 for the Election Systems and Software (ES&S) Voting System (EVS) 5.2.4.0 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. Prior to submitting the voting system for testing, ES&S submitted an application package to the EAC for certification of the EVS 5.2.4.0. The application was accepted by the EAC and the project was assigned the unique Project Number of ESSEVS5240.

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 following subsections describe the baselined EVS 5.2.3.0.

ES&S EVS 5.2.3.0 is comprised of the following components: ExpressVote Universal Voting System version 1.0 (ExpressVote 1.0); AutoMARK Voter Assist Terminal (AutoMARK) versions A100, A200, and A300; DS450 scanner and tabulator (DS450); DS200 precinct-based scanner and tabulator (DS200); DS850 scanner and tabulator (DS850); Electionware Election Management System (Electionware); Election Reporting Manager (ERM); ES&S Event Log Service (ELS); and Removable Media Service (RMS).

- The ExpressVote 1.0 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 other binary tactile device.

- 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. Optionally, this device may be configured to transmit tabulation results to the results server through a closed network connection rather than using physically transported USB flash drives.

- The DS450 scanner and tabulator that simultaneously scans the front and back of a paper ballot and/or vote summary card. It can also handle folded ballots and can read ballots in any of four orientations. The DS450 sorts tabulated ballots into discrete output bins without interrupting scanning. Optionally, this device may be configured to transmit tabulation results to the results server through a closed network connection rather than using physically transported USB flash drives.

- 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.

- 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. 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 5.2.3.0. The tables below describe the certified equipment and firmware versions.

Detailed descriptions of the EVS 5.2.3.0 test campaign are contained in SLI Report No. ESY-009-CTR-01, Rev. 3.0, which is available for viewing on the EAC's website at www.eac.gov.

Table 1-1. EVS 5.2.3.0 EAC Certified System Components

System Component	Software or Firmware Version	Hardware Version(s)	Description
ExpressVote	1.4.1.6	1.0	Universal Voting System.
ExpressVote Rolling Kiosk	---	98-00049	Kiosk for use with ExpressVote
DS200	2.12.2.0	1.2.1, 1.2.3, 1.3	Precinct Count Tabulator
DS200 Ballot Box	---	1.2, 1.3	Plastic Ballot Box
DS200 Ballot Box	---	1.0, 1.1, 1.2	Metal Ballot Box
Auto MARK A100	1.8.6.1	1.0	ADA Ballot Marking Device
AutoMARK A200 (SBC 2.0 and 2.5)	1.8.6.1	1.1	ADA Ballot Marking Device
AutoMARK A300 (SBC 2.0 and 2.5)	1.8.6.1	1.3	ADA Ballot Marking Device
DS850	2.10.2.0	1.0	Central Count Tabulator
DS450	3.0.0.0	1.0	Central Count Tabulator
EMS Client Workstation	---	Dell OptiPlex 980 or 5040	Workstation For EMS Reporting
EMS Server	---	Dell PowerEdge T710	Server For EMS
EMS Client Workstation	---	Dell Latitude E6410	Laptop For EMS Reporting
EMS Standalone Workstation	---	Dell Latitude E6410	Laptop For EMS Reporting
DS850 Report Printer	---	Oki B431dn & Oki B431d	Laser Report Printer
DS850 Audit Printer	---	Oki Microline 420	Dot Matrix Audit Printer
DS450 Report Printer	---	Dell S2810dn	Laser Report Printer
DS450 Audit Printer	---	Oki Microline 420	Dot Matrix Audit Printer
DS450 UPS	---	APC Back-UPS Pro 1500	UPS For DS450
DS850 UPS	---	APC Back-UPS RS 1500 or APC Back-UPS Pro 1500	UPS For DS850
DS450 Surge Protector		Tripp Lite Spike Cube	Surge Protector for DS450
USB Flash Drive	---	Delkin 512MB, 1GB, 2GB, 4GB, 8GB	Storage for election and ballot definition

Table 1-1. EVS 5.2.3.0 System Components *(continued)*

System Component	Software or Firmware Version	Hardware Version(s)	Description
USB Flash Drive	---	Delkin 16 GB	Validation purposes only
Compact Flash	---	Delkin Devices 1.0 GB capacity	Storage for election and ballot definition
CF Card Reader	---	6381	Delkin Compact Flash Reader
CF Card Reader	---	018-6305	Sandisk Compact Flash Reader
USB Flash Drive	---	SanDisk 512MB, 1GB, 2GB	Storage for election and ballot definition
Barcode Scanner	---	DS457-SR20009	Barcode scanner manufactured by Zebra integrated with rolling kiosk
QR Code Scanner	---	DS9208	Barcode scanner manufactured by Symbol
Headphones	---	86002	COTS headphones manufactured by Avid
Electionware	4.7.1.1	---	Election management software that provides end-to-end election management activities
Election Reporting Manager (ERM)	8.12.1.1	---	Election results reporting program
Event Log Service (ELS)	1.5.5.0	---	Service supporting election media programming
Removable Media Service (RMS)	1.4.5.0	---	Service supporting election media programming
ExpressVote Previewer	1.4.1.6	---	Ballot preview for accessible voting equipment
AutoMARK VAT Preview	1.8.6.1	---	Ballot preview for accessible voting equipment
Adobe Acrobat Standard	11	---	Desktop Publishing Software
Cerberus FTP	8.0.6 (x64)	---	File transfer server for or precinct results network
Microsoft Server 2008	R2 w/SP1	---	Operating System for EMS and results servers
Microsoft Windows 7	64-bit/SP1	---	Operating System for standalone and client workstations
WSUS Microsoft Windows Offline Update Utility	10.7.4	---	Software Updates (Update utility)
Micro Focus RM/COBOL Runtime	12.06	---	COBOL Runtime
Symantec Endpoint Protection	12.1.6	---	Anti-Virus

Table 1-1. EVS 5.2.3.0 System Components *(continued)*

System Component	Software or Firmware Version	Hardware Version(s)	Description
Symantec Endpoint Protection Intelligent Updater	20160829-002-v5i64	---	Anti-Virus

1.1.2 Description of Modification

The EVS 5.2.4.0 is a modified voting system configuration that includes upgrades to the components of the EVS 5.2.3.0 and introduces two new hardware versions of the ExpressVote (version 2.1.0.0 and 2.1.2.0). EVS 5.2.4.0 adds four new ExpressVote configuration options: Quad Express Cart, MXB ExpressVote Voting Booth, ExpressVote Single Table and ExpressVote Double Table. EVS 5.2.4.0 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.

The list below includes specific changes between EVS 5.2.4.0 and the baseline of the EVS 5.2.3.0:

General

- Security upgrades to third-party EMS COTS products

ExpressVote Universal Voting System

- Introduced two new hardware versions of the ExpressVote (2.1.0.0 and 2.1.2.0). Hardware 2.1.2.0 includes 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 a 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

DS200

- Introduced the collapsible ballot box as a new configuration option

1.1.3 Initial Assessment

An initial assessment on the submitted modifications was performed to determine the scope of testing. Testing from the previous test campaign was used to establish the baseline. Based on the assessment, it was determined the following tasks would be required to verify compliance of the modifications:

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

- System Level Testing

    — System Integration

    — Accuracy

- Technical Documentation Package (TDP) Review

- Functional Configuration Audit (FCA)

- System Loads & Hardening

- Physical Configuration Audit (PCA)

- Regression Testing

- Hardware Testing

  — Operating Environmental Testing

  — Non-Operating Environmental Testing

  — Electrical Testing

- Usability & Accessibility Testing

1.1.4 Regression Test

Regression testing for this test campaign will consist of the execution of the System Integration and Accuracy Tests.

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)

- SLI Report No. ESY-009-CTR-01, Rev. 3.0, "Certification Test Report – Modification ES&S EVS 5.2.3.0"

- EAC Certificate of Conformance ES&S EVS 5.2.3.0, dated February 8, 2018

- ES&S Technical Data Package *(A listing of the EVS 5.2.4.0 documents submitted for this test campaign is listed in Section 4.6 of this Test Plan)*

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

"ELS" – Election Log Service

"EMS" – Election Management System

"ERM" – Election Reporting Manager

"ES&S" – Election Systems and Software

"FCA" – Functional Configuration Audit

"HAVA" – Help America Vote Act

 "NOC" – Notice of Clarification

"PCA" – Physical Configuration Audit

"QA" – Quality Assurance

"RMS" – Removable Media Service

"RFI" – Request for Interpretation

"TDP" – Technical Data Package

 "VAT" – Voting Assist Terminal

"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. 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 focused on evaluating the modifications detailed in Section 1.1.2 of this Test Plan. Primarily, these modifications focused on upgrades to the components of the previously certified EVS 5.2.3.0 and the introduction of two new hardware versions for the ExpressVote (version 2.1.0.0 and 2.1.2.0).

EVS 5.2.4.0 includes the following hardware: ExpressVote Universal Voting System hardware version 1.0 (ExpressVote 1.0), ExpressVote Universal Voting System hardware versions 2.1.0.0 and 2.1.2.0 (ExpressVote HW 2.1), AutoMARK Voter Assist Terminal (AutoMARK), DS200 precinct-based scanner and tabulator (DS200), DS450 scanner and tabulator (DS450), and DS850 central scanner and tabulator (DS850). ExpressVote 1.0 was previously certified with EVS 5.2.3.0 and will remain certified with this system. ExpressVote 2.1 (hardware versions 2.1.0.0 and 2.1.2.0) are being incorporated in the EVS 5.2.4.0 as a modification and will be subjected to testing as part of this test campaign; however, previous results for Hardware Testing and Usability and Accessibility Testing will be utilized to satisfy those requirements. For ExpressVote 2.1 hardware version 2.1.0.0, previous certification testing performed as part of the EVS 5.4.0.0 will be used. For ExpressVote 2.1 hardware version 2.1.2.0, testing performed as part of the EVS 5.4.1.0 test campaign will be used. *Note: Hardware testing on the ExpressVote 2.1.2.0 was performed as part of the EVS 5.4.1.0 test campaign, which is still in process; however, testing was performed pursuant to the EVS 5.2.4.0 EAC Testing and Certification Test Campaign.*

EVS 5.2.4.0 system components submitted for testing are listed in Table 1-2, below.

Table 1-2. EVS 5.2.4.0 System Components

System Component	Software or Firmware Version	Hardware Version(s)	Description
ExpressVote HW 1.0	1.4.1.7	1.0	Universal Voting System
ExpressVote HW 2.1	2.4.2.0	2.1.0.0 2.1.2.0	Universal Voting System
ExpressVote Rolling Kiosk	---	98-00049	Kiosk for use with ExpressVote
ExpressVote Voting Booth	---	87001	Stationary Voting Booth
Quad Express Cart	---	41404	Portable Voting Booth
MXB ExpressVote Voting Booth	---	95000	Stationary Voting Booth
ExpressVote Single Table	---	87033	Voting Table For One Unit
ExpressVote Double Table	---	87032	Voting Table For Two Units
ADA Table	---	87031	Voting Table For One Unit

Table 1-2. EVS 5.2.4.0 System Components *(continued)*

System Component	Software or Firmware Version	Hardware Version(s)	Description
DS200	2.12.2.0	1.2.1, 1.2.3, 1.3	Precinct Count Tabulator
DS200 Plastic Ballot Box	---	1.2, 1.3, 1.4, 1.5	Cast Ballot Container
DS200 Metal Ballot Box	---	1.0, 1.1, 1.2	Cast Ballot Container
DS200 Collapsible Ballot Box	---	98-00009	Cast Ballot Container
DS200 Tote Bin	---	00074	Cast Ballot Container
AutoMARK A100	1.8.6.1	1.0	ADA Ballot Marking Device
AutoMARK A200	1.8.6.1	1.1, 1.3	ADA Ballot Marking Device
AutoMARK A300	1.8.6.1	1.3	ADA Ballot Marking Device
AutoMARK Table	---	87033	Voting Table
DS850	2.10.2.0	1.0	Central Count Tabulator
DS850 Cart	----	6823	Cart For DS850 and Ancillary Devices
DS450	3.0.0.0	1.0	Central Count Tabulator
DS450 Cart	----	3002	Cart For DS450 and Ancillary Devices
EMS Client Workstation	---	Dell OptiPlex 980 or 5040	Workstation for EMS Reporting
EMS Server	---	Dell PowerEdge T710	Server for EMS
EMS Client Workstation	---	Dell Latitude E6410	Laptop for EMS Reporting
EMS Standalone Workstation	---	Dell Latitude E6410	Laptop for EMS Reporting
DS850 Report Printer	---	Oki B431dn, Oki B431d	Laser Report Printer
DS850 Audit Printer	---	Oki Microline 420	Dot Matrix Audit Printer
DS450 Report Printer	---	Dell S2810dn	Laser Report Printer
DS450 Audit Printer	---	Oki Microline 420	Dot Matrix Audit Printer
DS450 UPS	---	APC Back-UPS, Pro 1500	UPS for DS450
DS850 UPS	---	APC Back-UPS RS 1500, APC Back-UPS Pro 1500	UPS for DS850
DS450 Surge Protector	---	Tripp Lite Spike Cube	Surge Protector
DS850 Surge Protector	---	Tripp Lite Spike Cube	Surge Protector for DS850

Table 1-2. EVS 5.2.4.0 System Components *(continued)*

System Component	Software or Firmware Version	Hardware Version(s)	Description
USB Flash Drive	---	Delkin 512MB, 1GB, 2GB, 4GB, 8GB	Storage for election and ballot definition
USB Flash Drive	---	Delkin 16 GB	Validation purposes only
Flash Memory Card	---	Delkin Devices 1.0 GB capacity	Storage for election and ballot definition
CF Card Reader/Writer	---	6381	Delkin compact flash reader/writer
CF Card Reader/Writer	---	018-6305	SanDisk compact flash reader/writer
Compact Flash Memory Card	---	SanDisk 512MB, 1GB, 2GB	Storage for election and ballot definition
Paper roll (NCR/Nashua)	---	N/A	Paper roll for report printer
Ink Cartridge (DS200)	---	2278	Ink cartridge for ballot stamping
Ink Cartridge (DS850)	---	87002	Ink cartridge for ballot number imprinting
Ink Cartridge (DS450)	---	87002	Ink cartridge for ballot number imprinting
Print Cartridge (AutoMARK)	---	87002	Ink cartridge for ballot marking
QR Scanner	---	DS457-SR20009	Barcode scanner manufactured by Zebra integrated with rolling kiosk
QR / Barcode Scanner	---	DS9208	Barcode scanner manufactured by Symbol
Headphones	---	86002	COTS headphones manufactured by Avid
Electionware	4.7.1.4	---	Election management software that provides end-to-end election management activities
Election Reporting Manager (ERM)	8.12.1.1	---	Election results reporting program
Event Log Service (ELS)	1.5.5.0	---	Logs users' interactions with EMS.
Removable Media Service (RMS)	1.4.5.0	---	Utility that runs in the background of the Windows operating system
ExpressVote HW 1.0 Previewer	1.4.1.7	---	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

Table 1-2. EVS 5.2.4.0 System Components *(continued)*

System Component	Software or Firmware Version	Hardware Version(s)	Description
ExpressVote HW 2.1 Previewer	2.4.2.0	---	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
AutoMARK VAT Preview	1.8.6.1	---	Application within the EMS program
Adobe Acrobat Standard	11	---	Desktop publishing software
Cerberus FTP Server - Enterprise	9.0.3.1 (x64)	---	File transfer server for or precinct results network.
Microsoft Server 2008	R2 w/SP1	---	Operating System for EMS and results servers
Microsoft Windows 7	64-bit/SP1	---	Operating System for standalone and client workstations.
WSUS Microsoft Windows Offline Update Utility	11.1.1	---	Software updates(Update utility)
Micro Focus RM/COBOL Runtime	12.06	---	COBOL runtime
Symantec Endpoint Protection	14.0.1_MP1	---	Anti-Virus
Symantec Endpoint Protection Intelligent Updater (File-Based Protection)	20180227-001-core3sdsv5i64.exe	---	Anti-Virus
Symantec Endpoint Protection Intelligent Updater (Network-Based Protection)	20180226-040-IPS_IU_SEP_14RU1.exe	---	Anti-Virus
Symantec Endpoint Protection Intelligent Updater (Behavior-Based Protection)	20180225-001-SONAR_IU_SEP.exe	---	Anti-Virus
Scanner (Zebra)	DS457-SR20009	---	QR Code Scanner

To determine the EVS 5.2.4.0 test requirements, the submitted modifications were evaluated against each section of the EAC VVSG 1.0 to determine the applicable tests to be performed. Based on this assessment, it was determined that multiple areas within the EAC VVSG 1.0 would be evaluated to encompass the required tests.

A breakdown of the areas and associated tests is listed below:

- EAC VVSG 1.0 Volume 1, Section 2: Functional Requirements

    — System Integration Testing

    — Functional Configuration Audit (FCA)

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

    — Technical Documentation Package (TDP) Review

    — Accuracy Testing

- EAC VVSG 1.0 Volume 1, Section 3: Usability & Accessibility

    — Usability & Accessibility Testing

    — Technical Documentation Package (TDP) Review

- EAC VVSG 1.0 Volume 1, Section 4: Hardware Requirements

    — Hardware Testing

        ▪ Non-Operating Environmental Testing

        ▪ Operating Environmental Testing

        ▪ Electrical Hardware Testing

    — Technical Documentation Package (TDP) Review

- EAC VVSG 1.0 Volume 1, Section 5: Software Requirements

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

    — Technical Documentation Package (TDP) Review

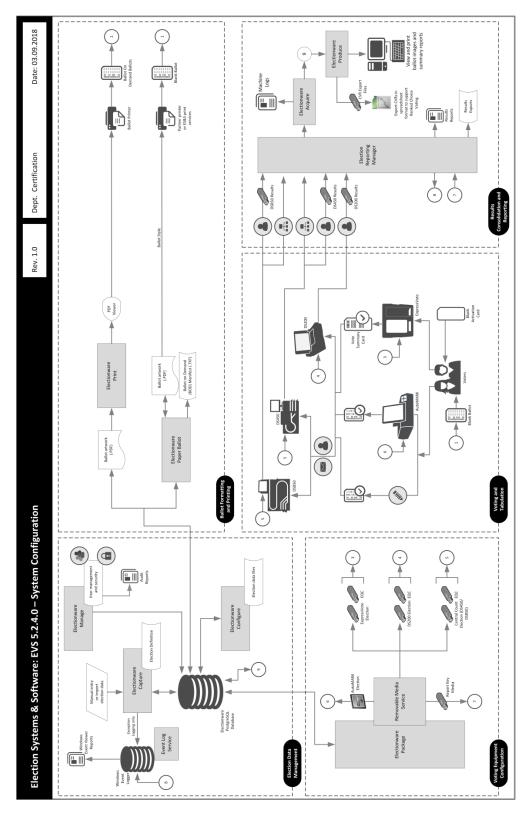   — Functional Configuration Audit (FCA)

1.5.1   Block Diagram

Figure 1-1. EVS 5.2.4.0 System Overview

1.5.2 System Limits

The system limits that ES&S has stated to be supported by the EVS 5.2.4.0 are provided in the table below.

Table 1-3. EVS 5.2.4.0 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 5.2.4.0 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 1-26,839), Type (available codes 1-30) or Split (available codes 1-40).

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 26,000.

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

4. Special characters are not supported and may not appear properly when viewed on equipment displays or reports.

5. Electionware cannot display more than 30,000 images when filtering ballot images for display. Employ one or more filters to ensure that the number of ballots viewed is less than 30,000.

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.

1.5.3   Supported Languages

The following languages are supported by the EVS 5.2.4.0:

- English

- Spanish

- Chinese

- Korean

- Japanese

- Bengali

Support for all stated languages will be verified; however, only English and Spanish language ballots will be cast during the performance of functional testing. Additionally, one character based language (Chinese) will be tested during System Integration Testing.

1.5.4   Supported Functionality

The EVS 5.2.4.0 is designed to support 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

1.5.5 VVSG

The EVS 5.2.4.0 shall be evaluated against the relevant requirements contained in the EAC VVSG 1.0.

1.5.6 RFIs

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

1.5.7 NOCs

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

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 EVS 5.2.3.0 in order to baseline the current system under test. Additionally, to satisfy both the Hardware Test and the Usability and Accessibility Test requirements, test results from testing of the ExpressVote 2.1.2.0 performed as part of the EVS 5.4.1.0 test campaign will be incorporated into this test campaign.

2.2 Evaluation of Prior Non-VSTL Testing

No prior non-VSTL testing of the EVS 5.2.4.0 modifications were considered for this test campaign.

2.3 Known Field Issues

EVS 5.2.4.0 is a modification to a previously certified system and has not been fielded.

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 EVS 5.2.4.0 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.

All software required for testing is identified in Section 1.5 of this test plan. Pro V&V will perform a comparison on the submitted source code against the previously certified versions. Pro V&V will review the submitted modified source code to the EAC VVSG 1.0 and the manufacturer-submitted coding standards.

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.

3.3 Test Materials

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

- ExpressVote Activation Card Printer (Microcom 4200)
- Security Seals/Locks/Sleeves
- CF Card Reader/Writer
- Headphone Covers
- Ethernet Switch
- Printer Paper
- Ballots and blank ballot grade paper
- Activation cards
- Ballot pens
- CF memory cards
- USB flash drives

3.4 **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 EVS 5.2.4.0 submitted for evaluation will be performed to ensure the applicable requirements of the EAC VVSG 1.0 and the EAC Testing and Certification Program Manual, Version 2.0 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 EVS 5.2.4.0 test requirements, the submitted modifications were evaluated against each section of the EAC VVSG 1.0 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:

Section 1: 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 VVSG 1.0. The preliminary TDP is performed to gather information concerning the system under test and its capabilities or design intentions. Additionally, a TDP review will be performed throughout the test campaign. The TDP Review includes the Initial Review, the Regulatory/Compliance Review, and the Final Review. This review is conducted to determine if the submitted technical documentation meets the regulatory, customer-stated, or end-user requirements and includes reviewing the documents for stated functionality and verification.

Section 2: Functional Requirements

The requirements in this section shall be tested during the FCA, Accuracy Test, and System Integration Test. This evaluation will utilize baseline test cases as well as specifically designed test cases and will include predefined election definitions for the input data.

The FCA targets the specific functionality claimed by the manufacturer to ensure the product functions as documented. This testing uses both positive and negative test data to test the robustness of the system. The FCA encompasses an examination of manufacturer 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 (such as system operations, voter manual, maintenance, and diagnostic testing manuals). It includes a test of system operations in the sequence in which they would normally be performed. These system operations and functional capabilities are categorized as follows by the phase of election activity in which they are required:

- Overall System Capabilities: These functional capabilities apply throughout the election process. They include security, accuracy, integrity, system audit ability, election management system, vote tabulation, ballot counters, telecommunications, and data retention.

- Pre-voting Capabilities: These functional capabilities are used to prepare the voting system for voting. They include ballot preparation, the preparation of election-specific software (including firmware), the production of ballots, the installation of ballots and ballot counting software (including firmware), and system and equipment tests.

- Voting System Capabilities: These functional capabilities include all operations conducted at the polling place by voters and officials including the generation of status messages.

- Post-voting Capabilities: These functional capabilities apply after all votes have been cast. They include closing the polling place; obtaining reports by voting machine, polling place, and precinct; obtaining consolidated reports; and obtaining reports of audit trails.

- Maintenance, Transportation and Storage Capabilities: These capabilities are necessary to maintain, transport, and store voting system equipment.

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.

The accuracy test ensures that each component of the voting system can each process 1,549,703 consecutive ballot positions correctly within the allowable target error rate. The Accuracy test is designed to test the ability of the system to "capture, record, store, consolidate and report" specific selections and absences of a selection. The required accuracy is defined as an error rate. This rate is the maximum number of errors allowed while processing a specified volume of data.

Section 3: Usability and Accessibility Requirements

The requirements in this section shall be tested during the Usability and Accessibility Testing. This evaluation will utilize baseline test cases as well as specifically designed test cases and will include predefined election definitions for the input data.

The usability testing focuses on the usability of the system being tested. Usability is defined generally as a measure of the effectiveness, efficiency, and satisfaction achieved by a specified set of users with a given product in the performance of specified tasks. In the context of voting, the primary user is the voter, the product is the voting system, and the task is the correct recording of the voter ballot selections. Additional requirements for task performance are independence and privacy: the voter should normally be able to complete the voting task without assistance from others, and the voter selections should be private. Accessibility evaluates the requirements for accessibility. These requirements are intended to address HAVA 301 (a) (3) (B).

Section 4: Hardware Requirements

The hardware tests specified in the VVSG are divided into two categories: non-operating and operating. The non-operating tests apply to the elements of the system that are intended for use at poll site locations and are intended to simulate the storage and transport of equipment between the storage facility and the polling location. The operating tests apply to the entire system, including hardware components that are used as part of the voting system telecommunications capability, and are intended to simulate conditions that the voting system may encounter during operation. Prior to and immediately following each required non-operating and operating test, the system shall be subjected to an operational status check.

The requirements in this section shall be tested and/or evaluated by personnel verified by Pro V&V to be qualified to perform the testing.

Section 5: Software Requirements

The requirements in this section shall be tested utilizing a combination of review and functional testing during the source code review, TDP review, and FCA.

To perform the source code review, Pro V&V will review 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 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 includes a compliance build and a trusted build of the submitted source code.

4.1.1 Rationale for 'Not Applicable' Requirements

All requirements that were excluded from the previous test campaign (EVS 5.2.3.0) were also deemed not applicable to this test campaign due to the submitted modifications not impacting the specific requirements.

4.2 Hardware Configuration and Design

The EVS 5.2.4.0 is an electronic voting system consisting of the following hardware: ExpressVote 1.0, ExpressVote 2.1 (2.1.0.0 and 2.1.2.0), AutoMARK, DS200, DS450, and DS850.   ExpressVote hardware version 1.0 was previously certified with EVS 5.2.3.0 and will remain certified with this system.   ExpressVote 2.1 (versions 2.1.0.0 and 2.1.2.0) is being incorporated in EVS 5.2.4.0 as a modification and will be subjected to testing as part of this test campaign.

4.3 Software System Functions

The EVS 5.2.4.0 EMS is an application suite consisting of Electionware, Election Reporting Manager (ERM), Removable Media Service (RMS), Event Log Service (ELS), ExpressVote Previewer (1.0 and 2.1), and VAT Previewer.

Electionware

Electionware is the election management software that provides end-to-end election management activities (from creating the ballots to reporting the voting results) through user interface.

Election Reporting Manager (ERM)

ERM is an election results reporting program used to generate paper and electronic reports for poll workers, candidates, and the media. ERM is designed to display updated election totals on a monitor as ballot data is tabulated.

Removable Media Service (RMS)

RMS is a utility that runs in the background of the Windows Operating System. RMS reads specific information from any attached USB flash drives so that ES&S applications such as Electionware and ERM can use that information for flash drive validation purposes.

Event Log Service (ELS)

ELS is an application that logs users' interactions with the EMS.

ExpressVote Previewer

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.

VAT Previewer

VAT Previewer is an application within the EMS program.

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 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 confirmation that any automated test suites will produce valid results.

4.4.1 Hardware Qualitative Design

The ExpressVote 2.1 (hardware versions 2.1.0.0 and 2.1.2.0) updates to the modified system will require hardware testing to be performed; however, previous results for Hardware Testing will be utilized to satisfy those requirements.

4.4.2 Hardware Environmental Test Case Design

For ExpressVote 2.1 hardware version 2.1.0.0, previous certification testing performed as part of the EVS 5.4.0.0 will be used. For ExpressVote 2.1 hardware version 2.1.2.0, testing performed as part of the EVS 5.4.1.0 test campaign will be used. *Note: Hardware testing on the ExpressVote 2.1.2.0 was performed as part of the EVS 5.4.1.0 test campaign, which is still in process; however, testing was performed pursuant to the EVS 5.2.4.0 EAC Testing and Certification Test Campaign.*

4.4.3 Software Module Test Case Design and Data

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 and Data

Pro V&V shall review the manufacturer-submitted test plans and data to verify that the individual performance requirements specified in the EAC VVSG 1.0 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, such as the system release notes and comments within the source code, 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 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 Test Specifications

Descriptions of the tests required to evaluate the EVS 5.2.4.0 to the scope defined in Section 1.5 are provided in the subsections below.

4.5.1 TDP Evaluation

In order to determine compliance of the modified TDP documents with the EAC VVSG 1.0, 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 EVS 5.2.4.0 TDP is provided in Table 4-1.

Table 4-1. EVS 5.2.4.0 TDP Documents

Document ID	Description	Document Revision
Preface		
EVS5240_C_L_Requirements Matrix	Requirements of the 2005 VVSG Trace to Vendor Testing	1.0
System Overview		
EVS5240_C_D_0100_SYSOVR	ES&S Voting System 5.2.4.0 System Overview	1.3
System Functionality Description		
EVS5240_C_D_0200_SFD	ES&S Voting System 5.2.4.0 System Functionality Description	1.0
System Hardware Specification		
AQS-18-5000-001-F	AutoMARK System Hardware Specification	6
AQS-18-5002-000-S	AutoMARK System Hardware Overview	9
DS200HW_M_SPC_0312_HW SPEC	DS200 Hardware Specification, Hardware Revision 1.2	3.4
DS200HW_M_SPC_0313_HW SPEC	DS200 Hardware Specification, Hardware Revision 1.3	4.5
DS450_1'0_SPC_HWSPEC	DS450 Hardware Specification, Hardware Revision 1.0	1.6
DS850HW_M_SPC_0310_HW SPEC	DS850 Hardware Specification, Hardware Revision 1.0	1.6
EVOTEHW_M_SPC_0310_H WSPEC	ExpressVote Hardware Specification, Hardware Revision 1.0	3.10
EVOTEHW_M_SPC_0321_H WSPEC	ExpressVote Hardware Specification, Hardware Revision 2.1	1.3
AutoMARKHW_M_SPC_A10 0_BOM	AutoMARK A100 Approved Parts List	2.0
AutoMARKHW_M_SPC_A20 0_BOM	AutoMARK A200 Approved Parts List	2.0
AutoMARKHW_M_SPC_A30 0_BOM	AutoMARK A300 Approved Parts List	2.0
DS200HW_M_SPC_0312_APL	DS200 Approved Parts List	1.2
DS200HW_M_SPC_0313_APL	Approved Parts List: DS200 HW Rev 1.3	1.1
DS450HW_M_SPC_0310_APL	Approved Parts List: DS450 HW Rev 1.0	1.1
DS850HW_M_SPC_0310_APL	Approved Parts List: DS850 HW Rev 1.0	1.1
ExpressVoteHW_M_SPC_0310 _APL	Approved Parts List: ExpressVote HW Rev 1.0	1.1
ExpressVoteHW_M_SPC_0321 _APL	Approved Parts List: ExpressVote HW 2.1	2.3
Software Design and Specification		

Table 4-1. EVS 5.2.4.0 TDP Documents *(continued)*

Document ID	Description	Document Revision
EVS5240_D_SDS00_DS200	DS200 - Software Design Specification	1.0
EVS5240_D_SDS00_DS450	DS450 - Software Design Specification	1.0
EVS5240_D_SDS00_DS850	DS850 – Software Design Specification	1.0
EVS5240_D_SDS00_ELS	ES&S Software Design Specifications Event Log Service ES&S Voting System	1.0
EVS5240_D_SDS00_ERM	ES&S Software Design Specifications Election Reporting Manager (ERM) ES&S Voting System	1.0
EVS5240_D_SDS00_ExpressVote_HW1'0	ExpressVote Software Design and Specification	1.1
EVS5240_D_SDS00_ExpressVote_HW2'1	ExpressVote (Hardware Version 2.1) Software Design Specification	1.2
ESSSYS_D_P_0400_CODING STANDARDS	Coding Standards	1.2
ESSSYS_1'0_P_SYSDEVPROGRAM	System Development Program	1.5
ESSSYS_1'0_SPC_LicenseAgreements	License Agreements for Procured Software	1.3
EVS5240_D_SDS00_ELECTIONWARE	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	6
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	5
AQS-18-5001-011-R	AutoMARK Programming Specifications Details	6
AQS-18-5001-004-S	AutoMARK Software Design Specifications	7
---	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		

Table 4-1. EVS 5.2.4.0 TDP Documents *(continued)*

Document ID	Description	Document Revision
EVS5240_QA_D_0500_SYSTESTPLAN	ES&S Voting System 5.2.4.0 System Test Plan	1.0
AMVATHW_P_D_0510_CIFRptAMVAT	Usability Test Report ES&S AutoMARK Voter Assist Terminal (VAT) Version 1.X	---
DS200HW_P_D_0512_CIFRptDS200	Usability Test Report DS200 Precinct Ballot Scanner Version 1.2.1	---
ExpressVoteHW_P_D_0509_CIFRptExpressVote	ExpressVote Usability Report ES&S Voting System 5.2.0.0	---
System Security Specification		
AQS-18-5002-001-S	AutoMARK System Security Specifications	7
EVS5240_CM_SPC00_SysSecuritySpec	ES&S Voting System Security Specification	1.0
EVS5240_CM_SPC_CLIENTWORKSTATIONSETUPCONFIGGUIDE	ES&S Voting System 5.2.4.0 EMS Client Workstation Secure Setup & Configuration Guide	1.1
EVS5240_CM_SPC_EMSSERVERSETUPCONFIGGUIDE	ES&S Voting System 5.2.4.0 EMS Server Secure Setup & Configuration Guide	1.1
EVS5240_CM_SPC02_SECSCRIPTDESC	ES&S Voting System 5.2.4.0 Security Script Description	1.0
EVS5240_CM_SPC_STANDALONEWORKSTATIONSETUPCONFIGGUIDE	ES&S Voting System 5.2.4.0 Standalone EMS Workstation Secure Setup & Configuration Guide	1.1
EVS5240_CM_D_1000_VERPROC_VERIFICATIONPC	Verification Procedure: Verification PC Setup	1.0
EVS5240_CM_D_2010_EMSVERIFICATIONPROCEDURE	Verification Procedure: Election Management System	1.2
EVS5240_CM_D_2021_AutoMARKVerificationProcedure	Verification Procedure: AutoMARK Ballot Marking Device	1.2
EVS5240_CM_D_2050_DS850VERIFICATIONPROCEDURE	Verification Procedure: DS850 Central Scanner & Tabulator	1.2
EVS5240_CM_D_2060_DS450VERIFICATIONPROCEDURE	Verification Procedure: DS450 Central Scanner & Tabulator	1.2
EVS5240_CM_D_2070_DS200VERIFICATIONPROCEDURE	Verification Procedure: DS200 Precinct Scanner & Tabulator	1.2
EVS5240_CM_D_2081_ExpressVoteHW1'0VerificationProcedure	Verification Procedure: ExpressVote Universal Voting System	1.0
EVS5240_CM_D_2081_ExpressVoteHW2'1VerificationProcedure	Verification Procedure: ExpressVote Hardware 2.1	1.0
EVS5240_D_L01_StaticDynamicFileList_Electionware	Validation File List: Electionware	1.0
EVS5240_D_L02_StaticDynamicFileList_ExpressVote_HW1'0	Validation File List: ExpressVote HW1.0	1.0

Table 4-1. EVS 5.2.4.0 TDP Documents *(continued)*

Document ID	Description	Document Revision
EVS5240_D_L02_StaticDynamicFileList_ExpressVote_HW2'1	Validation File List: ExpressVote HW 2.1	1.3
EVS5240_D_L03_StaticDynamicFileList_DS450	Validation File List: DS450	1.0
EVS5240_D_L04_StaticDynamicFileList_DS200	Validation File List: DS200	1.0
EVS5240_D_L05_StaticDynamicFileList_DS850	Validation File List: DS850	1.0
EVS5240_D_L06_StaticDynamicFileList_AutoMARK	Validation File List: AutoMARK	1.0
EVS5240_D_L08_StaticDynamicFileList_ERM	Validation File List: ERM	1.0
EVS5240_D_L11_StaticDynamicFileList_ExpressVotePreviewer_HW1'0	Validation File List: ExpressVote HW1.0 Previewer	1.0
EVS5240_D_L11_StaticDynamicFileList_ExpressVotePreviewer_HW2'1	Validation File List: ExpressVote HW 2.1 Previewer	1.1
EVS5240_D_L15_StaticDynamicFileList_ELS	Validation File List: ELS	1.0
EVS5240_D_L16_StaticDynamicFileList_RMS	Validation File List: RMS	1.0
EVS5240_D_L19_StaticDynamicFileList_VATPreviewer	Validation File List: VAT Previewer	1.0
ESSSYS_EVS5230_BP_EMSBUILDENVIRONMENT	Build Environment Construction, Election Management System	1.4
ESSSYS_EVS5230_BP_EXPRESSVOTEUVS-V1VMTRUSTEDBUILD1	Build Procedure: ExpressVoteUVS-v1 and ExpressVoteUVS-v1 Previewer Trusted Build 1	2.0
ESSSYS_5'2'4'0_BP_EMSTrustedBuild1	Build Procedure, Election Management System Trusted Build 1	1.0
ESSSYS_5'2'4'0_BP_ExpressVoteUVS-v1VMTrustedBuild1	Build Procedure: ExpressVoteUVS-v1 and ExpressVoteUVS-v1 Previewer Trusted Build 1	1.0
ESSSYS_5'2'4'0_BP_EXPRESSVOTEUVS-V2TRUSTEDBUILD1	Build Procedure: ExpressVoteUVS-v2 and ExpressVoteUVS-v2 Previewer Trusted Build 1	1.0
System Operations Procedures		
EVS5240_DOC_SOP_AMVAT	AutoMARK Operator's Guide, Firmware Version 1.8	1.1
EVS5240_DOC_SOP_DS200	DS200 Operator's Guide. Firmware Version 2.12	1.0
EVS5240_DOC_SOP_DS200_APPX	DS200 Operator's Guide Appendices, Firmware Version 2.12	1.0
EVS5240_DOC_SOP_DS450	DS450 Operator's Guide, Firmware Version 3.0	1.0

Table 4-1. EVS 5.2.4.0 TDP Documents *(continued)*

Document ID	Description	Document Revision
EVS5240_DOC_SOP_DS450_APPX	DS450 Operator's Guide Appendices, Firmware Version 3.0	1.0
EVS5240_DOC_SOP_DS850	DS850 Operator's Guide, Firmware Version 2.10	1.1
EVS5240_DOC_SOP_DS850_APPX	DS850 Operator's Guide Appendices, Firmware Version 2.10	1.0
EVS5240_DOC_SOP_ELS	EVS Event Logging Service User's Guide, Software Version 1.5	1.0
EVS5240_DOC_SOP_ERM	Election Reporting Manager User's Guide, Software Version 8.12	1.0
EVS5240_DOC_SOP_ERM_APPX	Election Reporting Manager User's Guide Appendices, Software Version 8.12	1.0
EVS5240_DOC_SOP_ExpressVote_HW1'0	ExpressVote Operator's Guide, Firmware Version 1.4	1.1
EVS5240_DOC_SOP_ExpressVote_HW1'0_APPX	ExpressVote Operator's Guide Appendices, Firmware Version 1.4	1.0
EVS5240_DOC_SOP_EW01Admin	Electionware Vol. I: Administrator Guide, Software Version 4.7	1.0
EVS5240_DOC_SOP_EW02Define	Electionware Vol. II: Define User Guide, Software Version 4.7	1.0
EVS5240_DOC_SOP_EW03Design	Electionware Vol. III: Design User Guide, Software Version 4.7	1.0
EVS5240_DOC_SOP_EW04Deliver	Electionware Vol. IV: Deliver User Guide, Software Version 4.7	1.0
EVS5240_DOC_SOP_EW05Results	Electionware Vol. V: Results User Guide, Firmware Version 4.7	1.0
EVS5240_DOC_SOP_EW06Appendix	Electionware Vol. VI: Appendices, Firmware Version 4.7	1.0
EVS5240_DOC_SOP_ExpressVote_HW2'1	ExpressVote Operator's Guide, Hardware Version 2.1, Firmware Version 2.4	1.1
System Maintenance Manuals		
EVS5240_DOC_SMM_AMVAT	AutoMARK Maintenance Manual, Firmware Version 1.8	1.0
EVS5240_DOC_SMM_DS200	DS200 Maintenance Manual, Firmware Version 2.12	1.0
EVS5240_DOC_SMM_DS450	DS450 Maintenance Manual, Firmware Version 3.0	1.0
EVS5240_DOC_SMM_DS850	DS850 Maintenance Manual, Firmware Version 2.10	1.0
EVS5240_DOC_SMM_ExpressVote_HW1'0	ExpressVote Maintenance Manual, Firmware Version 1.4	1.0
EVS5240_DOC_SMM_ExpressVote_HW2'1	ExpressVote Maintenance Manual, Firmware Version 2.4, Hardware Version 2.1	1.0
Personnel Deployment and Training		

Table 4-1. EVS 5.2.4.0 TDP Documents *(continued)*

Document ID	Description	Document Revision
ESSSYS_T_D_0900_TRAININGPROGRAM	Personnel Deployment and Training Program	1.1
Configuration Management Plan		
SSSYS_CM_P_1000_CMProgram	Configuration Management Program	2.1
EVS5240_DOC_P_1000_TDPROGRAM	Technical Documentation Program	1.0
QA Program		
EVS5240_M_P_1100_MNFQAPROGRAM	Manufacturing Quality Assurance Program	1.0
ESSSYS_QA_P_1100_SWQAPROGRAM	Software Quality Assurance Program	1.2
System Change Notes		
EVS5240_DOC_D_1200_ChangeNotes	ES&S Voting System 5.2.4.0 System Change Notes	1.0
Attachments		
BPG_1'0_SOP	Ballot Production Guide for EVS	2.9

4.5.2 Source Code Review

Pro V&V will review 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 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.

A combination of Automated Source Code Review and Manual Source Code Review methods will be used to review the changes in the source code from the previously certified EVS 5.2.3.0 voting system. In addition, 10% of the source code comments will be manually reviewed.

4.5.3 Physical Configuration Audit (PCA)

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

• Establish a configuration baseline of software and hardware to be tested; confirm whether manufacturer's documentation is sufficient for the user to install, validate, operate, and maintain the voting system

• Verify software conforms to the manufacturer's specifications; inspect all records of manufacturer's release control system; if changes have been made to the baseline version, verify manufacturer's engineering and test data are for the software version submitted for certification

• If the hardware is non-COTS, Pro V&V shall review drawings, specifications, technical data, and test data associated with system hardware to establish system hardware baseline associated with software baseline

• Review manufacturer's documents of user acceptance test procedures and data against system's functional specifications; resolve any discrepancy or inadequacy in manufacturer's plan or data prior to beginning system integration functional and performance tests

• Subsequent changes to baseline software configuration made during testing, as well as system hardware changes that may produce a change in software operation are subject to re-examination

4.5.4 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 will be conducted to ensure all applicable EAC VVSG 1.0 requirements are met.

4.5.5 Accuracy

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

The accuracy requirements for the ExpressVote 1.0, DS200, DS450, DS850, and AutoMark were met as part of the previous EVS 5.2.3.0 test campaign. Only the ExpressVote 2.1 (versions 2.1.0.0 and 2.1.2.0) will be subjected to the Accuracy Test as part of this test campaign. Testing of the ExpressVote 2.1 will be accomplished by the execution of the standard accuracy test utilizing pre-marked vote summary cards of each card length supported.

4.5.6 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, shall be determined through functional tests integrating the voting system software with the remainder of the system.

Additionally, the system shall be configured exactly as it would for normal field use. This includes connecting all supporting equipment and peripherals including ballot boxes, voting booths (regular and accessible), and any physical security equipment such as locks and ties.

Pro V&V personnel shall properly configure and test the system by following the procedures detailed in the EVS 5.2.4.0 technical documentation.

5.0 TEST DATA

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

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 ES&S for resolution.

5.2 Test Data Criteria

The EVS 5.2.4.0 shall be evaluated against all applicable requirements contained in the EAC VVSG 1.0. 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 VVSG 1.0.

6.0 TEST PROCEDURE AND CONDITIONS

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

6.1 Facility Requirements

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 be qualified to perform the test.

Unless otherwise specified herein, testing shall be performed at the following standard ambient conditions and tolerances:

- Temperature: 68-75∘ F (±3.6∘F)
- Relative Humidity: Local Site Humidity
- Atmospheric Pressure: Local Site Pressure
- Time Allowable Tolerance: ±5%

Testing performed at third-party laboratories will be subjected to the test parameters and tolerances defined by the test facility and will be reported in the final Test Report.

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 ES&S 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 ES&S 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 it would be for normal field use. This includes connecting all supporting equipment and peripherals.

6.3   Test Sequence

The EVS 5.2.4.0 will be evaluated against all applicable requirements in the EAC VVSG 1.0. 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 VVSG 1.0 requirement applicable to the EVS 5.2.4.0. 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
Project Start Point	**04/02/18**	**05/01/18**		**22d**	
EAC Application Submitted	04/02/18	04/02/18	Stephen Han	1d	
Equipment Delivered for TRR	04/02/18	04/02/18	Stephen Han	1d	
TDP Delivered for TRR	03/23/18	03/23/18	Alan Simmons	1d	
Source Code Delivered for TRR	03/28/18	03/28/18	Jack Cobb	1d	
Election Provided by ES&S for TRR	04/02/18	04/02/18	Stephen Han	1d	
System Setup for TRR	04/02/18	04/02/18	Stephen Han	1d	
Mark Test Performed	04/02/18	04/02/18	Stephen Han	1d	
TRR Approval Submitted to EAC	04/03/18	04/03/18	Stephen Han	1d	
EAC Application Approved	04/03/18	04/03/18	Stephen Han	1d	
TDP	**03/23/18**	**04/23/18**		**22d**	
Initial Review	03/23/18	03/27/18	Alan Simmons	3d	
Compliance Review	03/28/18	04/17/18	Alan Simmons	15d	12
Final review	04/18/18	04/23/18	Alan Simmons	4d	13
Test Plan	**04/06/18**	**05/10/18**		**25d**	
Test Plan Creation	04/06/18	04/12/18	Wendy Owens	5d	
Vendor Review & Comments	04/12/18	04/12/18	Wendy Owens	1d	
EAC Submission and Review	04/13/18	04/23/18	Wendy Owens	7d	17
EAC Comment Review & Update	04/24/18	04/25/18	Wendy Owens	2d	18
EAC Submission & Review of Revision	04/26/18	05/09/18	Wendy Owens	10d	19
EAC Approved Test Plan	05/10/18	05/10/18	Wendy Owens	1d	20
Source Code	**04/02/18**	**04/04/18**		**3d**	
Automated Review	04/02/18	04/02/18	Jack Cobb	1d	
Source Code Review	04/02/18	04/02/18	Jack Cobb	1d	
Source Code Re-Review	04/03/18	04/03/18	Jack Cobb	1d	24
Document Review	04/02/18	04/02/18	Jack Cobb	1d	
Compliance Build	04/03/18	04/04/18	Jack Cobb	2d	26
System Delivery & Setup	**04/02/18**	**04/06/18**		**5d**	
PCA	04/02/18	04/03/18	Stephen Han	2d	
System Setup	04/04/18	04/04/18	Stephen Han	1d	29
System Loads & Hardening	04/05/18	04/06/18	Stephen Han	2d	30
System Level Testing	**04/09/18**	**04/23/18**		**11d**	
FCA	04/09/18	04/10/18	Stephen Han	2d	31
Accuracy	04/11/18	04/12/18	Stephen Han	2d	
Trusted Build	04/17/18	04/17/18	Jack Cobb	1d	
System Loads & Hardening	04/18/18	04/19/18	Stephen Han	2d	35
System Integration	04/20/18	04/23/18	Stephen Han	2d	36
Test Report	**04/24/18**	**06/26/18**		**46d**	
Test Report Creation	04/24/18	05/09/18	Wendy Owens	12d	37
Vendor Review & Comments	05/10/18	05/10/18	Wendy Owens	1d	39
EAC Submission & Review	05/11/18	06/07/18	Wendy Owens	20d	40
EAC Comment Review & Update	06/08/18	06/11/18	Wendy Owens	2d	41
EAC Submission & Review of Revision	06/12/18	06/25/18	Wendy Owens	10d	42
EAC Approved Test Report	06/26/18	06/26/18	Wendy Owens	1d	43