



---

# Test Plan for EAC 2005 VVSG Certification Testing Performed on Election Systems & Software Voting System 5.2.2.0

Issue Date: 12/6/2016

---

Prepared for: **Election Systems & Software, Inc.**  
11208 John Galt Blvd  
Omaha, NE 68137

Prepared by: **National Technical Systems Huntsville**  
7800 Hwy 20 West  
Huntsville, AL 35806



## SIGNATURES

Reviewed by: *Lisa Johnson* Date: 12/06/16  
Lisa Johnson, VSTL Quality Manager

Approved by: *Ryan J. Chambers* Date: 12/06/2016  
Ryan Chambers, Program Manager

Reviewed by: *Brenda Mason* Date: 12/06/16  
*FD* Rick Davis, QA Manager



## TABLE OF CONTENTS

PAGE NO.

<b>1.0</b>	<b>Introduction .....</b>	<b>6</b>
1.1	Description and Overview of EAC Certified System Being Modified .....	6
1.1.1	Baseline Certified System .....	6
1.1.2	Revision History .....	7
1.1.3	Description of Submitted Modifications.....	8
1.1.4	Initial Assessment .....	9
1.2	References.....	11
1.3	Terms and Abbreviations .....	12
1.4	Project Schedule.....	14
1.5	Scope of Test .....	14
1.5.1	Block Diagram.....	14
1.5.2	System Limits.....	17
1.5.3	Supported Languages .....	17
1.5.4	Supported Functionality .....	17
<b>2.0</b>	<b>Pre-Certification Testing and Issues .....</b>	<b>18</b>
2.1	Evaluation of Prior VSTL Testing.....	18
2.2	Evaluation of Prior Non-VSTL Testing.....	18
2.3	Known Field Issues .....	18
<b>3.0</b>	<b>Material Required for Testing .....</b>	<b>19</b>
3.1	Software .....	19
3.2	Hardware.....	20
3.3	Test Materials.....	21
3.4	Deliverables.....	21
3.5	Proprietary Data.....	22
<b>4.0</b>	<b>Test Design and Specifications .....</b>	<b>23</b>
4.1	Requirements.....	23
4.1.1	Requirements Mapping.....	23
4.1.2	Rationale for Excluded Requirements .....	25
4.1.3	NOCs .....	26
4.1.4	RFIs .....	26
4.1.5	Hardware Configuration and Design .....	27
4.2	Software System Functions .....	27
4.3	Test Case Design.....	27
4.3.1	Software Module Test Case Design and Data.....	28
4.3.2	Software Functional Test Case Design and Data .....	29
4.3.3	System-level Test Case Design.....	29
4.4	Test Specifications .....	29
4.4.1	Hardware Test Specifications .....	29
4.4.2	Physical Configuration Audit Specifications .....	32
4.4.3	Functional Configuration Audit Specifications .....	32
4.4.4	Accuracy Test Specifications.....	33
4.4.5	Volume and Stress Test Specifications .....	33

4.4.6	System Integration Test Specifications.....	33
4.4.7	Security Testing Specifications .....	33
4.4.8	TDP Evaluation Specifications.....	33
4.4.9	Source Code Review Specifications .....	34
4.5	Source Code Build Process .....	34
4.6	System Identification Tools Review.....	34
4.7	QA & CM System Review.....	35
<b>5.0</b>	<b>Test Data.....</b>	<b>35</b>
5.1	Test Data Recording .....	35
5.2	Test Data Criteria.....	35
<b>6.0</b>	<b>Test Procedures and Conditions.....</b>	<b>35</b>
6.1	Test Facilities .....	36
6.2	Test Set-up .....	37
6.3	Test Sequence and Description .....	37
6.3.1	Hardware Testing .....	37
6.3.2	Physical Configuration Audit .....	38
6.3.3	Functional Configuration Audit .....	38
6.3.4	Accuracy .....	38
6.3.5	Volume and Stress.....	38
6.3.6	System Integration .....	40
6.3.7	Security.....	46
6.3.8	TDP Review.....	46
6.3.9	System Identification Tools Review.....	46
6.3.10	Source Code Review .....	46
6.4	Test Operations Procedure .....	46
6.4.1	Pass/Fail Criteria .....	47
6.4.2	Anomalies .....	47
6.4.3	Deficiencies and Resolutions.....	47
6.4.4	Test Results and Assessment.....	47
6.4.5	Terms of NTS Huntsville Recommendation for Certification.....	48
	<b>Appendix A – Additional Testing.....</b>	<b>49</b>
	<b>Appendix B – Technical Data Package.....</b>	<b>51</b>
	<b>Appendix C – Project Schedule .....</b>	<b>56</b>

## 1.0 INTRODUCTION

Election Systems & Software (ES&S), herein referred to as manufacturer, submitted the Election Systems & Software Voting System 5.2.2.0 (EVS 5.2.2.0) to the Election Assistance Commission (EAC), for certification testing to the 2005 Voluntary Voting System Guidelines Standards (2005 VVSG). EVS 5.2.2.0 is a modification to the previously 2005 VVSG certified EVS 5.2.1.0 voting system (Certification number: ESSEVS5210), and as such, will be tested by National Technical Systems Huntsville (NTS Huntsville) based on the “modified system” requirements set forth in section 4.6.2.3 of the EAC Testing and Certification Program Manual, Version 2.0, herein referred to as the Program Manual. This National Certification Test Plan, hereafter referred to as the Test Plan, documents the process and test methods that will be used to validate 2005 VVSG compliance of EVS 5.2.2.0.

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

The following subsections describe the EAC Certified System that is the baseline for the submitted modification. All information was derived from the previous EVS 5.2.1.0 Certification Test Report(s) and EAC Certificate of Conformance.

#### 1.1.1 Baseline Certified System

Tables 1-1 and 1-2 describe the hardware and software/firmware versions that were previously certified by the EAC. For a complete description of the configuration and description of the previously certified product, refer to the EVS 5.2.1.0 Test Report located on the EAC’s website at <http://www.eac.gov>.

**Table 1-1. Previously Certified Software**

Software	Software/Firmware Version
<b>Proprietary Software</b>	
Electionware	4.7.1.0
Election Reporting Manager (ERM)	8.12.1.0
Removable Media Services (RMS)	1.4.5.0
Event Log Services (ELS)	1.5.5.0
AutoMARK VAT Previewer	1.8.6.0
ExpressVote Previewer	1.4.1.0
<b>Proprietary Hardening Scripts</b>	
CreateNewUser	3.0.3.0
NoNetwork	3.0.3.0
PreInstall	3.0.5.1
PostInstall	3.0.3.0
ServerShare	3.0.3.0
<b>COTS Software</b>	
Adobe Acrobat Standard	11
Cerberus FTP	6.0.7.1
Microsoft Server 2008 R2	2008 w/ SP1
Microsoft Windows 7	7 w/ SP1
WSUS Microsoft Windows Offline Update Utility	8.8
Symantec Endpoint Protection	12.1.4
Symantec Endpoint Protection Intelligent Updater	20151006-037-v5i64.exe
Micro Focus RM/COBOL Runtime	12.06

### 1.1.1 Baseline Certified System (Continued)

**Table 1-2. Previously Certified Voting System Equipment**

Component	Hardware Version	Firmware Version
<b>Proprietary Hardware</b>		
ExpressVote Accessible Voting Station	1.0	1.4.1.0
ExpressVote Rolling Kiosk	1.0	N/A
DS200 Precinct Count Scanner	1.2.1, 1.2.3, & 1.3	2.12.1.0
DS850 Central Count Scanner	1.0	2.10.1.0
AutoMARK A100	1.0	1.8.6.0
AutoMARK A200 (SBC 2.0 & SBC 2.5)	1.1	1.8.6.0
AutoMARK A300 (SBC 2.0 & SBC 2.5)	1.3	1.8.6.0
Plastic Ballot Box	1.2 & 1.3	N/A
Metal Ballot Box	1.0, 1.1, & 1.2	N/A
<b>COTS Hardware</b>		
EMS Server – Dell	PowerEdge T710	N/A
EMS Reporting Workstation – Dell	Optiplex 980	N/A
EMS Reporting Laptop – Dell	E6410	N/A
Motorola QR Code Scanner	DS9208	N/A
Zebra QR Code Scanner	DS457-SR20009	N/A
Delkin USB Flash Drives	512 MB, 1, 2, 4, & 8 GB	N/A
Delkin Compact Flash	1GB	N/A
DS850 Report Printer	OKI B430dn & B431dn	N/A
DS850 Audit Printer	OKI Microline 420	N/A
Avid Headphones	Avid FV 60	N/A
SanDisk CF Card Reader	018-6305	N/A
Delkin CF Card Reader	6381	N/A

### 1.1.2 Revision History

Table 1-3 describes the version history of the submitted voting system.

**Table 1-3. Voting System Revision History**

System Version	Certification Type	System Modified	Certification Date	Certification Number
EVS 5.0.0.0	New System	N/A	05/16/2013	ESSEVS5000
EVS 5.2.0.0	Modification	EVS 5.0.0.0	07/02/2014	ESSEVS5200
EVS 5.2.1.0	Modification	EVS 5.2.0.0	12/18/2015	ESSEVS5210
EVS 5.2.2.0	Modification	EVS 5.2.1.0	TBD	ESSEVS5220

### 1.1.3 Description of Submitted Modifications

The changes submitted for this modification are presented in this section.

#### Electionware

- Corrected spelling of 'change' in AutoMARK system prompt Excel file
- Corrected enable save button after changes in text box in the Language Additional text area
- Corrected message display when ballot style ID is longer than 8 characters
- Corrected contest order display for ExpressVote in an open primary election to sort by party
- Added the election wide option to enable/disable multi column view on the ExpressVote
- Added the ExpressVote Multi Column Setting to the ExpressVote Settings Report
- Corrected erroneous data fit error message when no nonpartisan contests existed in a closed primary
- Updated copyright to 2016
- Updated user guide help file
- Corrected error displayed when triple clicking Bengali text editor
- Updated the users xml to version 3.0 for compatibility with Cerberus 8.0.6
- Updated to WSUS Microsoft Windows Offline Update Utility 10.7.4
- Updated to Symantec Endpoint Protection 12.1.6 (64-bit)
- Updated to Symantec Endpoint Protection Intelligent Updater 20160829-002-v5i64.exe
- Improved refresh action in the navigator so the data appears correctly
- Added export results from Produce when the last contest is a text only contest

#### Cross Product (Electionware, ERM)

- Renamed "DS850" labels to "Central Count"

#### Cross Product (DS200, DS850, Electionware, ERM, AutoMARK, ExpressVote)

- Updated encryption suites used for security purposes to meet VVSG 1.0, Sections 2.1.4 and 7.5.1



### 1.1.3 Description of Submitted Modifications (Continued)

#### Hardware

- Added a new central count scanner the DS450.
- Power Supply for ExpressVote 1.0 is upgraded to be in compliance with Level Efficiency 6. Because this is not a de minimis change, it will undergo all EMI testing along with the ExpressVote 1.0.

### 1.1.4 Initial Assessment

An initial assessment was performed to determine the scope of testing for the submitted modification. The results of this assessment are presented in the following five categories as specified in the 2005 VVSG Vol. 2 Section 1.3.1: functionality tests, hardware evaluation, software evaluation, system integration tests and technical data package (TDP). Additionally a section of regression testing is included.

#### Functional Assessment:

Based on the assessment of submitted changes, NTS determined that for the modifications to the previously certified components, a limited Functional Configuration Audit will be required to verify that the voting system meets 2005 VVSG requirements. "Limited" in this instance refers to only functional changes made in this modification (new features, changes to functions, etc.) or functions that have not changed but may be impacted by the modification or changes. The DS450 will require a full functional review to determine compliance with the 2005 VVSG.

In addition, the voting system will be subjected to a system integration test, defined in section 4.4.6 of this plan, to ensure all components interact properly and to verify that the changes to the voting system do not introduce any nonconformities or instabilities.

#### Hardware Assessment:

There are two hardware changes submitted for 5.2.2.0; the power supply for ExpressVote 1.0 was upgraded to be in compliance with Level Efficiency 6, and a new central count scanner, the DS450, was added to the available configuration.

The modification to the ExpressVote power supply will require the following hardware tests to ensure that the submitted hardware meets the requirements of the 2005 VVSG:

- Electrical Power Disturbance
- Electrical Fast Transient
- Lightning Surge
- Electromagnetic Emissions
- Electromagnetic Susceptibility
- Conducted RF Immunity
- Electrical Supply

The DS450 will require all non-operational and operational hardware tests to ensure that the submitted hardware meets the requirements of the 2005 VVSG.

#### 1.1.4 Initial Assessment (Continued)

##### Software Assessment:

All added or modified Lines of Code (LOC) will require a source code review to ensure the 2005 VVSG requirements are met and that changes to the software do not introduce any new functions or features. In determining the extent of the required source code review, the submitted source code for EVS 5.2.2.0 was compared to the EAC certified EVS 5.2.1.0 source code. Table 1-4 provides the software comparison results. Only the products listed in Table 1-4 were modified.

**Table 1-4. Software Comparison Results**

Product	Baseline	New Version	Lines of Code Changed	
			Files	Lines
Electionware	4.7.1.0	4.7.1.1	149	4790
ERM	8.12.1.0	8.12.1.1	9	1863
DS200	2.12.1.0	2.12.2.0	44	2499
DS850	2.10.1.0	2.10.2.0	6	223
DS450	DS850 2.10.1.0 <sup>1</sup>	3.0.0.0	788	128779
ExpressVote	1.4.1.1	1.4.1.2	39	4042
AutoMARK	1.8.6.0	1.8.6.1	3	31
<b>Totals</b>			1038	142227

##### System Integration Assessment:

System Integration is defined as per 2005 VVSG 1.0 Section 1.3.1.4. System level testing will be conducted to evaluate the functional, hardware, and software aspects jointly, throughout the full range of system operations. The tests will include the fully integrated system components, internal and external system interfaces, usability and accessibility, and security. During this process election management functions, ballot-counting logic, and system capacity will be exercised. The process will also include the Physical Configuration Audit (PCA) and the Functional Configuration Audit (FCA).

##### Security Assessment:

A security assessment will be required to verify that the configuration scripts submitted correctly configure Windows Server 2008 R2 and Windows 7 per the provided documented security checklists (or benchmarks), that the new encryption packages have been implemented correctly, and that the overall security framework matches that of the documentation.

In addition, a windows security patch level assessment will be performed to ensure that any critical security patch that is exploitable locally, meaning without the requirement of external public communications, has been applied.

<sup>1</sup> The DS450 is a derivative product of the DS850 and thus shares most of the same code base. For this code review the DS450 source code package was compared against the previously certified EVS 5.2.1.0 DS850 source code.

#### 1.1.4 Initial Assessment (Continued)

##### TDP Assessment:

The submitted TDP is constructed with the certified EVS 5.2.1.0 TDP and the EVS 5.2.2.0 changes to the certified documents. NTS Huntsville personnel determined that most documents in the submitted TDP will require some level of review. These documents will ensure that all EVS 5.2.2.0 changes are properly documented and compliant with 2005 VVSG.

##### Regression Test

Regression testing shall be conducted on EVS 5.2.2.0 components to establish assurance that the modifications have no adverse impact on the compliance, integrity, or performance of the system as outlined in the 2005 VVSG.

## 1.2 References

- Election Assistance Commission 2005 Voluntary Voting System Guidelines, Volume I, Version 1.0, "Voting System Performance Guidelines," and Volume II, Version 1.0, "National Certification Testing Guidelines," dated December 2005
- Election Assistance Commission Testing and Certification Program Manual, Version 2.0, expiration date June 30, 2018
- Election Assistance Commission Voting System Test Laboratory Program Manual, Version 2.0, expiration date June 30, 2018
- National Voluntary Laboratory Accreditation Program NIST Handbook 150, 2006 Edition, "NVLAP Procedures and General Requirements (NIST Handbook 150)," dated February 2006
- National Voluntary Laboratory Accreditation Program NIST Handbook 150-22, 2008 Edition, "Voting System Testing (NIST Handbook 150-22)," dated May 2008
- United States 107th Congress Help America Vote Act (HAVA) of 2002 (Public Law 107-252), dated October 2002
- NTS Quality Assurance Program Manual, Revision 8
- ANSI/ISO/IEC 17025:2005 and ANSI/NCSL Z540.3, "Calibration Laboratories and Measuring and Test Equipment, General Requirements"
- ISO 10012:2003, "Quality Assurance Requirements for Measuring Equipment"
- EAC Requests for Interpretation (RFI) located at:  
[http://www.eac.gov/testing\\_and\\_certification/request\\_for\\_interpretations1.aspx](http://www.eac.gov/testing_and_certification/request_for_interpretations1.aspx)
- EAC Notices of Clarification (NOC) located at:  
[http://www.eac.gov/testing\\_and\\_certification/notice\\_of\\_clarifications.aspx](http://www.eac.gov/testing_and_certification/notice_of_clarifications.aspx)
- EAC Quality Monitoring Program located at:  
[http://www.eac.gov/testing\\_and\\_certification/quality\\_monitoring\\_program.aspx](http://www.eac.gov/testing_and_certification/quality_monitoring_program.aspx)
- NTS Test Report No. PR039745-01 Rev B – National Certification Test Report for Certification Testing of the Election Systems & Software 5.2.1.0 Voting System
- ES&S EVS 5.2.1.0 Technical Data Package
- ES&S EVS 5.2.2.0 Technical Data Package

### 1.3 Terms and Abbreviations

Table 1-5 defines all terms and abbreviations applicable to this Test Plan.

**Table 1-5. Terms and Abbreviations**

Term	Abbreviation	Definition
Anomaly	--	Any non-repeatable testing event that is not the expected result or interrupts the test operations.
Americans with Disabilities Act 1990	ADA	ADA is a wide-ranging civil rights law that prohibits, under certain circumstances, discrimination based on disability.
Configuration Management	CM	Systems engineering process for establishing and maintaining consistency of a product's performance, functional and physical attributes with its requirements, design and operational information throughout its life.
Commercial Off-the-Shelf	COTS	Commercial, readily available hardware or software.
Deficiency	--	Any repeatable test result that was not the expected result or violates a requirement of the VVSG.
United States Election Assistance Commission	EAC	Commission created per the Help America Vote Act of 2002, assigned the responsibility for setting voting system standards and providing for the voluntary testing and certification of voting systems.
ES&S Event Log Service	ELS	ES&S Event Log Service 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.
Election Management System	EMS	Within the voting system, the EMS is comprised of five components: Electionware, ERM, ES&S Event Log Service, VAT Previewer and ExpressVote Previewer.
Election Reporting Manager	ERM	EMS reporting component.
Election Systems and Software	ES&S	Identified manufacturer dotting the equipment under test as part of this test plan.
Engineering Change Order	ECO	--
Equipment Under Test	EUT	Refers to the individual system component or multiple piece of the same component.
ES&S Voting System	EVS	Proprietary software owned by ES&S.
Functional Configuration Audit	FCA	Verification of system functions and combination of functions cited in the manufacturer's documentation.
Help America Vote Act	HAVA	Act created by United States Congress in 2002.
Institute of Electrical and Electronics Engineers	IEEE	--
Intelligent Mark Recognition	IMR	Visible light scanning technology to detect completed ballot targets.

**1.3 Terms and Abbreviations (Continued)**
**Table 1-5. Terms and Abbreviations (Continued)**

Term	Abbreviation	Definition
National Institute of Standards and Technology	NIST	Government organization created to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhances economic security and improves our quality of life.
Notice of Clarification	NOC	Provides further guidance and explanation on the requirements and procedures of the EAC's Voting System Certification or Voting System Testing Laboratory programs.
Notice of Deviation	NOD	A NTS quality controlled document used to identify, access and describe any identified Anomaly or Deficiency witnessed by the VSTL during testing.
Physical Configuration Audit	PCA	Review by accredited test laboratory to compare voting system components submitted for certification testing to the manufacturer's technical documentation, and confirmation the documentation meets national certification requirements
Personal Computer	PC	Computer component of the voting system.
Quality Assurance	QA	Administrative and procedural activities implemented as a way of preventing mistakes or defects
Quantity	QTY	Number/Count of items
Quick Response Code	QR Code	Two-dimensional barcode
Request for Interpretation	RFI	A means by which a registered Manufacturer or Voting System Test Laboratory may seek clarification on a specific test requirement.
System Under Test	SUT	Refers to the system as a whole (all components).
Technical Data Package	TDP	Manufacturer documentation related to voting system required to be submitted as a precondition of testing.
Trusted Build	---	Final build of source code performed by a trusted source and overseen by the manufacturer which is delivered to the EAC designated repository; also referred to as a "Witness Build".
Underwriters Laboratories Inc.	UL	Safety consulting and certification company
Uninterruptible Power Supply	UPS	Electrical apparatus providing emergency power when an input power source fails.
Voter Assist Terminal	VAT	Electronic ballot marking device component is the ES&S AutoMARK
National Technical Systems, Inc.	NTS	Identified VSTL hosting the testing of the equipment listed in this test plan; facilities located in Huntsville, Alabama.
National Voluntary Laboratory Accreditation Program	NVLAP	Program which provides an unbiased third-party test and evaluation program to accredit laboratories in the respective fields to ISO 17025 standard.
NTS Operating Procedure	OP	NTS Test Method or Test Procedure

### 1.3 Terms and Abbreviations (Continued)

**Table 1-5. Terms and Abbreviations (Continued)**

<b>Term</b>	<b>Abbreviation</b>	<b>Definition</b>
Virtual Review Tool	VRT	Test campaign management software used by the EAC.
Voting System Test Laboratory	VSTL	---
Voluntary Voting System Guidelines	VVSG	---

### 1.4 Project Schedule

The project schedule for the test campaign is in Appendix C – Project Schedule.

### 1.5 Scope of Test

The scope of testing is limited to the modifications to the previously certified EVS 5.2.1.0 voting system as described in Section 1.1.3.

#### 1.5.1 Block Diagram

Figure 1-1 and Figure 1-2 provide a visual overview of the submitted voting system configurations.

(The remainder of this page intentionally left blank)







### 1.5.2 System Limits

System limitations remain unchanged for all previously certified components of the EVS 5.2.1.0 voting system. See Attachment 1 of the System Overview TDP document for detailed information on the system limitations for EVS 5.2.2.0 “EVS 5.2.2.0 Voting System Overview.pdf”.

### 1.5.3 Supported Languages

The submitted voting system supports English, Spanish, Chinese, Korean, Japanese, and Bengali.

### 1.5.4 Supported Functionality

Table 1-7 lists the functionality supported by the submitted voting system.

**Table 1-7. Supported Functionality**

Functionality	Description
Election Data Management	Managing election data supports all tasks related to the creation of the election database, precinct, office, and candidate information required to configure a jurisdiction’s elections
Ballot Formatting and Printing	Ballot formatting and printing includes activities required for defining the image of a paper ballot, populating that ballot with information imported from the election database, and printing the ballot with ballot style code.
Voting Equipment Configuration	Configuring voting equipment converts election database information into ballot definition parameters for voting equipment. Within this functional subsystem, software users transfer the election rules specific to an election to the memory devices used to program voting equipment.
Voting and Tabulation	Voting and tabulation includes the following: <ul style="list-style-type: none"> <li>• Accessible ballot marking includes all tasks related to preparing, testing and implementing assistive voting devices for use in a polling place environment.</li> <li>• All tasks related to preparing, testing and implementing universal voting devices for use in a polling place environment with the option of precinct vote summary card tabulation.</li> <li>• Precinct ballot tabulation covers the activities required to prepare, test and scan official ballots and/or vote summary cards at a precinct location.</li> <li>• Central ballot tabulation includes all tasks required to prepare, test and scan official ballots and/or vote summary cards at a central count location.</li> </ul>
Results Consolidation and Reporting	Results consolidation and reporting encompasses the functions necessary to gather and combine results from ballot scanners and use that data to generate paper and electronic reports for election workers, candidates and the media.

(The remainder of this page intentionally left blank)

## 2.0 PRE-CERTIFICATION TESTING AND ISSUES

This section describes testing performed by either VSTL or the manufacturer prior to submitting the voting system to the EAC.

### 2.1 Evaluation of Prior VSTL Testing

For the DS450 source code that is deemed identical to that of the DS850, the previous source code review assessments will be reused, as if the DS450 was a modification from the previous certification test campaigns. All new or modified source code will be fully reviewed.

### 2.2 Evaluation of Prior Non-VSTL Testing

No Non-VSTL testing was submitted for re-use consideration.

### 2.3 Known Field Issues

The EVS 5.2.0.0 voting system family has three identified field issues.

- The RSA Crypto suite used by Electionware to generate RSA keys will sometimes create a key that is too short. This causes a key mismatch issue when loading the keys into ExpressVote. The issue was corrected in EVS 5.2.0.3 and the change was incorporated in this release.
- In Electionware, intermittently the tree view indicator is not visible. In addition, sometimes list items, such as created media, do not appear or update in the list. These issues were corrected in EVS 5.2.1.1 and the change was incorporated in the release.
- The RSA Crypto suite used by the voting system has been expired by NIST whereby the voting system did not meet the requirements of VVSG Sections 2.1.4 and 7.5.1. The correction to this issue was submitted in this release.

(The remainder of this page intentionally left blank)

### 3.0 MATERIAL REQUIRED FOR TESTING

The following sections list the materials required to be delivered to facilitate testing of the submitted system.

#### 3.1 Software

Proprietary software and COTS identified in Table 3-1 will be provided by the manufacturer as part of this test campaign.

**Table 3-1. Required Voting System Software**

Software	Software/Firmware Version
<b>Proprietary Software</b>	
Electionware	4.7.1.1
Election Reporting Manager (ERM)	8.12.1.1
Removable Media Service (RMS)	1.4.5.0
ES&S Event Log Service (ELS)	1.5.5.0
AutoMARK VAT Previewer	1.8.6.1
ExpressVote Previewer	1.4.1.2
<b>Proprietary Hardening Scripts</b>	
CreateNewUsers	3.0.3.0
NoNetwork	3.0.3.0
PreInstall	3.0.5.5
PostInstall	3.0.3.0
ServerShare	3.0.3.0
<b>COTS Software</b>	
Adobe Acrobat Standard	11
Cerberus FTP	8.0.6
Microsoft Server 2008	R2 w/ SP1
Microsoft Windows 7	7 w/ SP1
Symantec Endpoint Protection	12.1.6
Symantec Endpoint Protection Intelligent Updater	20160829-002-v5i64.exe
WSUS Microsoft Windows Offline Update Utility	10.7.4
Micro Focus RM/COBOL Runtime	12.06

(The remainder of this page intentionally left blank)

### 3.2 Hardware

Proprietary equipment and COTS identified in Table 3-2 will be provided by the manufacturer as part of this test campaign.

**Table 3-2. Required Voting System Equipment**

Component	Hardware Version	Firmware Version
<b>Proprietary Hardware</b>		
ExpressVote Accessible Voting Station	1.0	1.4.1.2
ExpressVote Rolling Kiosk	1.0	N/A
DS200 Precinct Count Scanner	1.2.1, 1.2.3, & 1.3	2.12.2.0
DS850 Central Count Scanner	1.0	2.10.2.0
DS450 Central Count Scanner	1.0	3.0.0.0
AutoMARK A100	1.0	1.8.6.1
AutoMARK A200 (SBC 2.0 & SBC 2.5)	1.1	1.8.6.1
AutoMARK A300 (SBC 2.0 & SBC 2.5)	1.3	1.8.6.1
Plastic Ballot Box	1.2 & 1.3	N/A
Metal Ballot Box	1.0, 1.1, & 1.2	N/A
<b>COTS Hardware</b>		
EMS Server	Dell PowerEdge T710	N/A
EMS Client Workstation	Dell Optiplex 980 or 5040	N/A
EMS Client Laptop	Dell E6410	N/A
Motorola, Symbol, Zebra QR Code Scanner (External)	DS9208	N/A
Zebra QR Code Scanner (Integrated with Rolling Kiosk)	DS457-SR20009	N/A
Delkin USB Flash Drives	512 MB, 1, 2, 4, & 8 GB	N/A
Delkin Compact Flash	1GB	N/A
DS850 Report Printer	OKI B431dn, and B431d	N/A
DS850 Audit Printer	OKI Microline 420	N/A
DS850 UPS	APC Back-UPS RS 1500 or APC Back-UPS Pro 1500	N/A
DS450 Report Printer	Dell S2810dn	N/A
DS450 Audit Printer	OKI Microline 420	N/A
DS450 UPS	APC Back-UPS Pro 1500	N/A
Avid Headphones	Avid FV 60	N/A
SanDisk CF Card Reader	018-6305	N/A
Delkin CF Card Reader	6381	N/A
Ethernet Switch	N/A	N/A
Surge Protector	Tripp Lite Spike Cube	N/A

(The remainder of this page intentionally left blank)

### 3.3 Test Materials

Test Materials Table 3-3 describes the test materials required to execute the required testing. Test materials may not be fully tested during the campaign, but are used to support the tests conducted during the campaign. The following items listed may not be included in the baseline system or Scope of Certification document.

**Table 3-3. Required Test Materials**

Test Material	Quantity	Make	Model
Ballot Printer	1	OKI Data	C9650

### 3.4 Deliverables

The materials listed in Table 3-4 are identified by the manufacturer as materials deliverable to the end users.

**Table 3-4. Voting System Deliverables**

Deliverable Material	Version	Description
Electionware	4.7.1.1	EMS
ERM	8.12.1.1	EMS
ES&S Event Log Service	1.5.5.0	EMS
Removable Media Services	1.4.5.0	EMS
ExpressVote	Firmware 1.4.1.2; Hardware 1.0	Accessible Voting Station
ExpressVote Rolling Kiosk	Hardware 1.0	Stand
DS200	Firmware 2.12.2.0; Hardware 1.2.1 or 1.2.3 or 1.3	Precinct Ballot Scanner
AutoMARK A100 or A200 or A300	Firmware 1.8.6.1; Hardware 1.0 or 1.1 or 1.3	Voter Assist Terminal
DS850	Firmware 2.10.2.0; Hardware 1.0	Central Ballot Scanner
DS450	Firmware 3.0.0.0; Hardware 1.0	Central Ballot Scanner
OKI Printer	B431dn or B431d	Laser Report Printer
OKI Printer	Microline 420	Dot Matrix Printer
DELL Printer	2810n	Laser Report Printer
Headphones	Avid FV 60	Stereo Headphones
ES&S Pens	N/A	BIC Grip Roller
EVS 5.2.2.0 Voting System Overview	1.7	TDP Document
EVS 5.2.2.0 System Functionality Description	1.3	TDP Document
ES&S Electionware Volume I: Administrator's Guide	1.1	TDP Document
ES&S Electionware Volume II: Define User's Guide	1.1	TDP Document
ES&S Electionware Volume III: Design User's Guide	1.1	TDP Document

### 3.4 Deliverables (Continued)

**Table 3-4. Voting System Deliverables (Continued)**

<b>Deliverable Material</b>	<b>Version</b>	<b>Description</b>
ES&S Electionware Volume IV: Deliver User's Guide	1.1	TDP Document
ES&S Electionware Volume V: Results User's Guide	1.0	TDP Document
Election Reporting Manager User's Guide	1.1	TDP Document
ExpressVote Operator's Guide	1.1	TDP Document
DS200 Operator's Guide	1.2	TDP Document
DS850 Operator's Guide	1.1	TDP Document
DS450 Operator's Guide	1.4	TDP Document
AutoMARK System Operator's Guide	1.0	TDP Document
Voting System Security Specification	1.2	TDP Document
Security Script Description	1.1	TDP Document
EMS Client Workstation Secure Setup & Configuration Guide	1.2	TDP Document
EMS Server Secure Setup & Configuration Guide	1.3	TDP Document
Standalone EMS Workstation Secure Setup & Configuration Guide	1.2	TDP Document
AutoMARK System Security Specification	7	TDP Document

### 3.5 Proprietary Data

All data considered by the manufacturer to be proprietary is marked as such.

(The remainder of this page intentionally left blank)

## 4.0 TEST DESIGN AND SPECIFICATIONS

NTS Huntsville personnel shall ensure that all certification testing conducted on the manufacturer's voting system follows NTS Huntsville's procedures for testing, the requirements of the EAC 2005 VVSG, and the Program Manual.

### 4.1 Requirements

To evaluate the modification test requirements, each section of the EAC 2005 VVSG was analyzed to determine the applicable tests required. The following subsections detail the results of this analysis.

#### 4.1.1 Requirements Mapping

The requirements mapping is provided in conjunction with submitted modifications. NTS Huntsville will verify and validate that the manufacturer is in compliance with stated QA and CM plans.

**Table 4-1. Modification Requirements Mapping**

Change ID	Changed Component	Change Description	Impacted 2005 VVSG Requirement
BUG35826 ENH35226 ENH35227 ENH35228 ENH35229 ENH35230 ENH35260 ENH35369 ENH35617	Electionware and ERM	Renamed "DS850" labels to "Central Count".	Volume II, Section 6.7
ENH35852 ENH35855 ENH35856 ENH35876 ENH35879 ENH35884 ENH35858 ENH35859	DS200 DS850 AutoMARK ExpressVote Electionware ERM	The random number generator, used for security functions to meet VVSG 1.0, Sections 2.1.4 and 7.5.1, has been updated to meet new NIST standards.	Volume I, Section 2.1.4 & Section 7.5.1
BUG35743	Electionware	Corrected spelling of the word 'change' in the AutoMARK system prompt Excel file.	Volume II, Section 6.7
BUG35663	Electionware	Correction to enable the save button after making changes in the text box (...) in the Language Additional text area.	Volume II, Section 6.7
BUG35751	Electionware	Corrected message display from an internal processing error to the 'Import of ballot style alternate ID' error message when the continuous ballot style ID is longer than 8 characters.	Volume II, Section 6.7
ENH35344	Electionware	Correct the contest order display for the ExpressVote in an open primary election to sort by party.	Volume II, Section 6.7

#### 4.1.1 Requirements Mapping (Continued)

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

Change ID	Changed Component	Change Description	Impacted 2005 VVSG Requirement
ENH35533	Electionware	Added the election wide option to enable/disable multi column view on the ExpressVote.	Volume I Section 3.2.2.2 Volume II, Section 6.7
ENH35534	Electionware	Added the ExpressVote Multi Column setting to the ExpressVote Settings Report.	Volume I Section 3.2.2.2 Volume II, Section 6.7
BUG35685	Electionware	Corrected erroneous data fit error message that occurred when no nonpartisan contests existed in a closed primary.	Volume II, Section 6.7
ENH35254	Electionware	Update copyright to 2016.	Volume II, Section 6.7
ENH35255	Electionware	Update user guide help file.	Volume II, Section 6.7
BUG35647	Electionware	Corrected the situation where an error displayed erroneously when triple clicking in the Bengali language text editor.	Volume II, Section 6.7
BUG35633	Electionware	Updated the users.xml to version 3.0 for compatibility with Cerberus version 8.0.0.9 and newer.	Volume II, Section 6.7
ENH35606	Electionware	Improved the refresh action in the navigator so that the data appears correctly.	Volume II, Section 6.7
BUG35850	Electionware	Can now export results from Produce when the last contest is a text only contest.	Volume II, Section 6.7
N/A	DS450	Added the DS450 as a new central count component.	All applicable requirements
ENH35374	ExpressVote	Display candidates in either 1 or 2 columns in a particular contest screen based on a configuration flag from Electionware.	Volume II, Section 6.7
ENH35495	ExpressVote	Support the ability for a poll worker to scan a 128c barcode on the external barcode scanner instead of manually selecting the ballot style on the touch screen.	Volume II, Section 6.7
ENH35612	ExpressVote	Update copyright date (code and splash screen).	Volume II, Section 6.7
N/A	ExpressVote	Power Supply Level Efficiency 6	All applicable requirements



#### 4.1.2 Rationale for Excluded Requirements

EVS 5.2.2.0 is a paper-based system that supports a closed network. All 2005 VVSG requirements will be evaluated as part of this test campaign apart from the following:

- Volume I, Section 2.3.1.3, 2.3.2, and 2.3.3.3 (Functional Requirements for DRE Systems)
- Volume I, Section 3 (Usability and Accessibility Requirements for DRE System)
- Volume I, Section 4.1.4.3 and 4.1.6.2 (Hardware Requirements for DRE Systems)
- Volume I, Section 6.2.6 (Telecommunications Requirements)
- Volume I, Section 7.52-7.54 (Telecommunications and Data Transmission)
- Volume I, Section 7.6 (Use of Public Networks)
- Volume I, Section 7.7 (Wireless Communications)
- Volume I, Section 7.9 (Voter Verifiable Paper Audit Trail Requirements)
- Volume II, Section 4.2.1 (Testing Focus and Applicability)

**Table 4-2. Rationale for Excluded Requirements**

EAC 2005 VVSG Version 1 Volume I, Section	Rationale for Not Applicability
2.3.1.3, 2.3.2, 2.3.3.3	These requirements relate to DRE Systems; the EVS 5.2.2.0 is a paper-based system.
3	These requirements relate to DRE Systems; the EVS 5.2.2.0 is a paper-based system.
4.1.4.3, 4.1.6.2	These requirements relate to DRE Systems; the EVS 5.2.2.0 is a paper-based system
6.2.6	These requirements are written for use of public networks. The EVS 5.2.2.0 does not use public networks.
7.5.2, 7.5.3, 7.5.4	These requirements are written for use of public networks. The EVS 5.2.2.0 does not use public networks.
7.6	EVS 5.2.2.0 does not support transmission over public networks.
7.7	No wireless technology is used in this system.
7.9	This system does not contain a Voter Verifiable Paper Audit Trail (VVPAT).
EAC 2005 VVSG Version 1 Volume II, Section	Rationale for Not Applicability
4.2.1	These requirements relate to elements of the system that are intended for use at poll site voting locations, such as voting machines and precinct counters. The DS450 is a Central Count machine and not located at poll site voting locations.

#### 4.1.3 NOCs

Applicable NOCs released by the EAC as of the date of the Test Plan are listed in Table 4-3.

**Table 4-3. Applicable NOCs**

<b>NOC ID</b>	<b>Name</b>
2016-01	Test Readiness Review
2016-02	Trusted Build
2016-03	Test Case Upload

#### 4.1.4 RFIs

Applicable RFIs released by the EAC as of the date of the Test Plan are listed in Table 4-4.

**Table 4-4. Applicable RFIs**

<b>RFI ID</b>	<b>Name</b>
2007-02	EAC Decision on Variable Names
2007-05	EAC Decision on Testing Focus and Applicability
2007-06	EAC Decision on Recording and Reporting Undervotes
2008-01	EAC Decision on Temperature and Power Variation
2008-03	EAC Decision on OS Configuration
2008-05	EAC Decision on Durability
2008-06	EAC Decision on Battery Backup for Central Count
2008-07	EAC Decision on '0' Count to Start Election
2008-09	EAC Decision on Safety Testing
2008-10	EAC Decision on Electrical Fast Transient
2009-03	EAC Decision on Battery Back Up for Central Count Systems
2009-04	EAC Decision on Audit Log Events
2009-06	EAC Decision on Temperature and Power Variation
2010-01	EAC Decision on Voltage Levels and ESD Test
2010-02	EAC Decision on Coding Conventions
2010-03	EAC Decision on Database Coding Conventions
2010-04	EAC Decision on Functional Requirements with Respect to Security
2010-05	EAC Decision on Testing of Modifications to a Certified System
2010-07	EAC Decision on Module Length Comments and responses
2010-08	EAC Decision on Calling Sequence
2012-01	EAC Decision on Ballot Handling - Multifeed
2012-03	EAC Decision on Configuration Management of COTS Products
2012-04	EAC Decision on Software Setup Validation
2013-03	EAC Decision on Timestamps
2013-04	EAC Decision on Usability Testing
2015-05	EAC Decision on Touchscreen Technology

#### 4.1.5 Hardware Configuration and Design

EVS 5.2.2.0 is an electronic voting system consisting of one precinct paper-based voting system, two central count voting systems, and a voting system application software package. The precinct paper-based voting system is comprised of four voter assistance terminals (AutoMark A100, AutoMark A200, AutoMark A300 and ExpressVote 1.0) and one precinct count scanner (DS200).

The AutoMark is a ballot marking device that prints the voter's choices onto a ballot that is then digitally scanned for tabulation by a precinct count scanner (DS200), or by one of the central count scanners (DS850 or DS450). The ExpressVote produces an independent voter-verifiable paper record that is then digitally scanned for tabulation by the DS200, DS850 or DS450. The Voting System Application Software Package, Election Management System (EMS), is an application suite consisting of Electionware, Election Reporting Manager (ERM), Removable Media Service (RMS), ES&S Event Log Service (ELS), ExpressVote Previewer, and VAT Previewer.

#### 4.2 Software System Functions

The software system functions as described in the manufacturer submitted TDP are unchanged for all previously certified components of the EVS 5.2.2.0 voting system.

#### 4.3 Test Case Design

Test cases are designed around what the voting system is supposed to do (per the manufacturer's design specifications) and what the voting system is required to do (per the guiding standards document). The tests cases used are primarily functional in nature; however, in certain cases, NTS may use non-functional tests. The test designer selects both valid and invalid inputs and determines the correct output without any knowledge of the test object's internal structure. The acceptable range for system performance and the expected results for each test case are derived from the manufacturer's documentation and the 2005 VVSG. All test cases are validated and approved by the project lead or other qualified VSTL personnel, (i.e., VSTL QA Representative). Test cases will be uploaded to the VRT as they are completed for EAC review per the guidance in NOC 2016-03.

(The remainder of this page intentionally left blank)

#### 4.3.1 Software Module Test Case Design and Data

NTS Huntsville personnel implements component level testing during the Functional Configuration Audit (FCA) for each component and subcomponent exercising the functionality of each as designed and documented. NTS Huntsville will utilize limited structural-based techniques (white-box testing) mainly in the area of Source Code Review and Security Testing. NTS Huntsville will depend heavily on specification-based techniques (black-box testing) for the individual software components. The most common specification-based techniques applied to the voting system during software testing will be “equivalence partitioning”, “boundary value”, and “pairwise” testing.

- “Equivalence Partitioning” will be used to evaluate specific software functions and data entry points of the voting system for valid and invalid data during the FCA. For software functions and data entry points, an entry will be made for a valid data requirement and at least one invalid data requirement to test for normal and abnormal conditions.
- “Boundary Value” testing will be used to evaluate specific software functions and data entry points for minimums and maximums during the FCA. For software functions and data entry points, an entry will be made for all minimum and all maximum documented requirements to test for normal and abnormal conditions. This technique will be used for numeric ranges as well as non-numeric ranges.
- “Pairwise” testing is a combinatorial method of software testing that, for each pair of input parameters to a system, tests all possible discrete combinations of those parameters. NTS Huntsville uses combinatorial test design to identify the minimum number of tests needed to get the coverage required to exercise the functionality. Combinatorial test design enables testers to get greater test coverage with fewer tests. Note that "coverage", as used here, is referring to functional combinatorial coverage, not requirements coverage.

(The remainder of this page intentionally left blank)

### 4.3.2 Software Functional Test Case Design and Data

NTS Huntsville personnel shall perform the specification-based technique used at the functional test case level entitled “Use Case.” The identified actors and their responsibilities are listed in Table 4-5.

**Table 4-5. “Use Case” Identified Roles and Responsibilities**

Role/Actor	Responsibility
Election Administrator	Enters the election definition with translation and audio Maintains EMS users and the election database
Warehouse Technician	Loads the election definition onto the voting equipment Runs diagnostic test and maintains the units
Poll Worker	Sets up and closes down the voting equipment on election-day at the precinct location
Voter	Physically casts the ballot on election-day
ADA Voter	Votes unassisted on election-day with special needs
Election Official	Reports and audits the election result post-election day

“Use Case” is utilized during the FCA with a single pass through each component using only valid data. This pass is considered the “Master Copy” of data to be passed between interfacing points of applications during integration level testing. If a component downstream in the test process needs data from previous processes, the “Master Copy” of data can be used or altered to accelerate the test process. Known tests utilizing the “Master Copy” of data at the integration level are Security and Usability.

### 4.3.3 System-level Test Case Design

System-level testing examines the ability of proprietary software, hardware, and peripherals in addition to the COTS software, hardware, and peripherals to operate as a complete system. NTS Huntsville utilizes test cases designed to ensure that integrated components function as specified by the manufacturer’s documentation and meet the requirements of the 2005 VVSG.

## 4.4 Test Specifications

The following subsections provide a brief description of the testing to be performed.

### 4.4.1 Hardware Test Specifications

Hardware tests are divided into two categories: non-operating and operating. The non-operating tests are intended to simulate the storage and transport of equipment between the storage facility and the polling location. The operating tests are intended to simulate conditions that the EUT may encounter during operation. Prior to and immediately following non-operating and operating tests, the EUT shall be subjected to an operational status check.

The non-operating tests include the following:

Low Temperature – This requirement addresses a range of tests for voting machines and precinct counters, as such devices are stored between elections and are transported between the storage facility and polling place, to meet specific minimum performance standards for low temperatures.

#### 4.4.1 Hardware Test Specifications (Continued)

High Temperature – This test addresses a range of tests for voting machines and precinct counters, as such devices are stored between elections and are transported between the storage facility and polling place, to meet specific minimum performance standards for high temperature.

Humidity Test – This requirement addresses a range of tests for voting machines and precinct counters, as such devices are stored between elections and are transported between the storage facility and polling place, to meet specific minimum performance standards.

Vibration – This requirement addresses a range of tests for voting machines and precinct counters, as such devices are stored between elections and are transported between the storage facility and polling place, to meet specific minimum performance standards for vibration.

Bench Handling – The bench handling test simulates stresses faced during maintenance and repair of voting machines and ballot counters.

The operating tests include the following:

Electromagnetic Radiation – This test verifies that radiated and conducted emissions from the voting system hardware do not exceed the allowable limits of Title 47CFR, Part 15, Class B. The test for electromagnetic radiation shall be conducted in compliance with the FCC Part 15 Class B requirements by testing per ANSI C63.4 (Volume II, Section 4.8.b).

Lightning Surge – This test demonstrates the voting system's hardware to withstand power line lightning surges during normal operation. This test is equivalent to the procedure of IEC 61000-4-5:1995-02. The test for lightning surge protection shall be conducted in compliance with the test specified in IEC 61000-4-5: 1995-02 (Volume II, Section 4.8.f).

Electrical Fast Transient – This test demonstrates the voting system's hardware to withstand electrical fast transients during normal operation. This test is equivalent to the procedure of IEC 61000-4-4:1995-01. The test for electrical fast transient protection shall be conducted in compliance with the test specified in IEC 61000-4-4:1995-01 (Volume II, Section 4.8.e, RFI 2008-10).

Electrostatic Disruption – This test demonstrates the voting system's hardware to withstand electrostatic discharges during normal operation. This test is equivalent to the procedure of IEC 61000-4-2. The test for electrostatic disruption shall be conducted in compliance with the test specified in IEC 61000-4-2 (Volume II, Section 4.8.c, RFI 2010-01).

Electromagnetic Susceptibility – This test demonstrates the voting system's hardware to withstand radiated electromagnetic fields during normal operation. This test is equivalent to the procedure of IEC 61000-4-3:1996. The test for electromagnetic susceptibility shall be conducted in compliance with the test specified in IEC 61000-4-3:1996 (Volume II, Section 4.8.d.).

Conducted RF Immunity – This test demonstrates the voting system's hardware ability to withstand conducted RF energy on power and I/O lines during normal operation. This test is equivalent to the procedure of IEC 61000-4-6:1996-04. The test for conducted RF immunity shall be conducted in compliance with the test specified in IEC 61000-4-6:1996-04 (Volume II, Section 4.8.g).

#### **4.4.1 Hardware Test Specifications (Continued)**

Electrical Power Disturbance – This test demonstrates the voting system’s hardware to withstand power disturbances during normal operation. This test is equivalent to the procedure of IEC 61000-4-11:1994-06 (Volume I, Section 4.1.2.5). The test for power disturbance disruption shall be conducted in compliance with the test specified in IEC61000-4-11:1994-06 (Volume II, Section 4.8.a).

Magnetic Fields Immunity – This test demonstrates the voting system’s hardware ability to withstand Magnetic Fields during normal operation. This test is equivalent to the procedure of IEC 61000-4-8. The test for AC magnetic fields RF immunity shall be conducted in compliance with the test specified in IEC 61000-4-8 (Volume II, Section 4.8.h).

Temperature Power Variation – The Environmental Test, Operating, subjects the system hardware to varying temperatures (50°F to 95°F) and voltages (105vac to 129vac), demonstrating hardware/data recording accuracy reliability Mean-Time-Between-Failure (MTBF) of 163 hours.

Maintainability – Maintainability represents the ease with which preventive and corrective maintenance actions can be performed based on the design characteristics of equipment and software and the processes the manufacturer and election officials have in place for preventing failures and for reacting to failures.

Electrical Supply – This requirement addresses the battery power source for providing electrical supply during a power failure (Volume II, Section 4.1.2.4, RFI 2008-02, RFI 2008-06, RFI 2009-03).

(The remainder of this page intentionally left blank)

#### 4.4.2 Physical Configuration Audit Specifications

The Physical Configuration Audit 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, NTS Huntsville will 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.

#### 4.4.3 Functional Configuration Audit Specifications

The functional configuration audit encompasses an examination of manufacturer's tests and the conduct of additional VSTL tests to verify the system performs all the functions as described in the manufacturer's documentation. In addition to functioning according to the manufacturer's documentation, tests will be conducted to ensure that requirements of Volume II section 6.7 and all other applicable EAC 2005 VVSG requirements are met. This testing is accomplished through a process called sequencing.

Sequencing is the act of navigating through the user interface to verify that the system performs as described by the manufacturer and does not violate any of the 2005 VVSG requirements. The path that the tester navigates follows the logical flow of accomplishing task required to conduct an election. For example, a task in conducting an election is to add a candidate. The tester will follow the flow of the user interface to add the candidate to a contest. If there are multiple ways to achieve this, then each method will be tested. This process will continue until all tasks for conducting an election are completed. Any paths, or combination of paths, that have revealed failures will be further tested to determine the scope of the failure. These will be handled on an individual basis.

(The remainder of this page intentionally left blank)



#### **4.4.4 Accuracy Test Specifications**

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.

#### **4.4.5 Volume and Stress Test Specifications**

The volume and stress test investigates the system’s response to conditions that tend to overload the system’s capacity to process, store, and report data. The test parameters will focus on the system’s stated limits and the ballot logic for areas such as the maximum number of active voting positions, maximum number of ballot styles, maximum candidates, maximum contests, and stated limits within the EMS. This test will be utilized to ensure the system can achieve the manufacturer’s TDP claims of what the system can support. Testing will be performed by exercising an election definition and test cases developed specifically to test for volume and stress conditions of the system being tested.

#### **4.4.6 System Integration Test Specifications**

The system integration test addresses the integration of both hardware and software, along with any telecommunication capabilities. 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. The testing process utilizes functional testing to execute the operations required to design an election, facilitate voting, and tabulate results.

#### **4.4.7 Security Testing Specifications**

The purpose of security testing is to evaluate the effectiveness of the voting system in detecting, preventing, logging, reporting, and recovering from any security risks identified by simulating attacks on the system. NTS Huntsville personnel have developed internal operating procedures to evaluate the voting system against the security requirements set forth in the 2005 VVSG.

#### **4.4.8 TDP Evaluation Specifications**

NTS Huntsville qualified personnel utilize a TDP Review Matrix which lists every EAC 2005 VVSG requirement pertaining to TDP review. NTS Huntsville will review the modified documents listed in Section 1.1.3 and other documents required to execute testing. NTS Huntsville will record the results of the review of each document to the applicable requirements listed in the TDP Review Matrix.

During the TDP review process, each document will be reviewed for completeness, clarity, correctness, and continuity. The review results will be formally reported to manufacturer. If a revised document is received, it will be re-reviewed as discussed in this section. The TDP will be continued to be reviewed during the entire testing process as these documents will be utilized to set up the systems, verify correct operational results and in other tests as needed. At the end of the TDP review process, a Deficiency Report will be issued listing the non-compliant items on a document-by-document basis, if applicable.

#### **4.4.9 Source Code Review Specifications**

Upon receipt of the source code, a SHA256 hash value will be created for each file. NTS Huntsville will verify that every line of modified source code is compliant to the 2005 VVSG coding requirements. In circumstances where the coding language facilitates the use of automated tools, NTS will develop a process for conducting the source code review with an automated tool. In addition, NTS Huntsville personnel will perform a manual 10% review of all automated source code review to verify that the automated tool was configured properly.

A technical report of all identified violations will be sent to the manufacturer for resolution per review / re-review basis. All revised source code will be checked for compliance until all issues are resolved. All iterative review results shall be included in the final test report.

Unmodified non-voting COTS software (e.g., operating systems, programming language compilers, database management systems, and web browsers) is not subject to the detailed review process specified in this section. However, NTS Huntsville personnel will use one of the following methods to verify that the COTS software has not been modified; independently download an original copy of the COTS software from a 3rd party site, obtain an original OEM disc(s), or receive an original COTS software package sent from the 3rd party manufacturer directly to NTS. Utilizing binary comparison or sha256 hash values the COTS software shall be verified as unmodified.

COTS software that has been modified by the manufacturer in any manner is subject to review. Source code generated by a COTS package and embedded in software modules for compilation or interpretation will be provided in human readable form to NTS Huntsville personnel to enable review.

#### **4.5 Source Code Build Process**

NTS Huntsville utilizes two build processes, a compliance build and a trusted build. Compliance builds for all software builds that are not required to be witnessed by the manufacturer. This build process follows the documented procedures of a "Trusted Build" in the Program Manual, with two exceptions: The image products will not be submitted to the EAC, and no manufacturer representative shall be required to be present or on-site for these builds. The "Trusted Build" process is described in section 5.6 of the EAC Program Manual and further clarified in NOC 16-02: Trusted Build.

#### **4.6 System Identification Tools Review**

System Identification tools are defined by the Program Manual as "Tools created by a Manufacturer of voting systems which allow elections officials to verify that the hardware and software of systems purchased are identical to the systems certified by the EAC." Section 2.14 of the Voting System Test Laboratory Manual requires that VSTLs test system identification tools during the test campaign to make sure they function properly and as intended. The manufacturer submitted system identification tools will be review for compliance with the 2005 VVSG Volume I Section 7.4.6 and RFI 2012-04.

#### **4.7 QA & CM System Review**

The manufacturer submitted QA Plan and CM Plan will be reviewed. The review will be limited to the changes within this modification to determine compliance with EAC 2005 VVSG Volume II Sections 2.11 and 2.12, and Volume I Sections 8 and 9, EAC stated requirements, and with the requirements of the internal manufacturer documentation. In addition, the manufacturer TDP documentation package will be reviewed to determine if the manufacturer's QA Plan and the CM Plan are being followed. The results of the TDP review shall be entered on a spreadsheet as previously described in Section 4.6 of this test plan. The results of the TDP review, including the QA and CM compliance results of the Technical Data Package Review, will be included in the final test report.

### **5.0 TEST DATA**

#### **5.1 Test Data Recording**

All equipment utilized for test data recording shall be identified in the test data package. For hardware environmental and operational testing, the equipment shall be listed on the Instrumentation Equipment Sheet for each test. 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 output reports and submitted to the manufacturer for resolution.

Additionally, all test results, including functional test data, will be recorded on the relevant NTS Huntsville Operating Procedures and Test Cases. Results will also be recorded real-time in engineering log books. Incremental reports will be submitted to the manufacturer and the EAC at the completion of major test areas to communicate progress and results as deemed necessary by the stakeholders.

#### **5.2 Test Data Criteria**

NTS Huntsville will evaluate all test data against the manufacturer provided TDP and the requirements set forth in the EAC 2005 VVSG. Per the EAC 2005 VVSG, these parameters shall encompass the test tolerances and samples to define the minimum number of combinations or alternatives of input and output conditions that can be exercised to constitute an acceptable test of the parameters involved. The parameters will also include events with criteria defining the maximum number of interrupts, halts, or other system breaks that may occur due to non-test conditions. The maximum number shall not include events from which recovery occurs automatically or where a relevant status message is displayed.

### **6.0 TEST PROCEDURES AND CONDITIONS**

NTS Huntsville is an independent testing laboratory for systems and components under harsh environments, including dynamic and climatic extremes as well as the testing of electronic voting systems. NTS Huntsville holds the following accreditations:

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

## 6.1 Test Facilities

All testing will be conducted at the NTS Huntsville, AL facility unless otherwise noted. Environmental non-operating (storage) and operating hardware testing will be conducted utilizing an adequately sized environmental test chamber or dynamic vibration (shaker) system equipped with the required data gathering support equipment. All remaining operating hardware tests will be conducted at the appropriate test site with the required support equipment. All instrumentation, measuring, and test equipment used in the performance of this test program will be listed on the Instrumentation Equipment Sheet for each test and shall be calibrated in accordance with NTS Quality Assurance Program, which complies with the requirements of ANSI/ISO/IEC 17025:2005 and ANSI/NCSL Z540.3 and ISO 10012:2003.

Standards used in performing all calibrations are traceable to the National Institute of Standards and Technology (NIST) by report number and date. When no national standards exist, the standards are traceable to international standards or the basis for calibration is otherwise documented.

Unless otherwise specified herein, all remaining tests, including system level functional testing, shall be performed at standard ambient conditions outlined in Table 6-1.

**Table 6-1. Standard Ambient Conditions**

Event	Ambient Range
Temperature	68 to 75 degrees (°) Fahrenheit (F)
Relative Humidity	Local Site Humidity
Atmospheric Pressure	Local Site Pressure

The following tolerances listed in Table 6-2 shall be used unless otherwise specified herein.

**Table 6-2. Test Tolerances**

Phenomena	Tolerance Allowance
Temperature	± 3.6°F (2°C)
Vibration Amplitude	± 10%
Vibration Frequency	± 2%
Random Vibration Acceleration	20 to 500 Hertz ± 1.5 dB
	500 to 2000 Hertz ± 3.0 dB
Random Overall grms	± 1.5 dB
Acoustic Overall Sound Pressure Level	+4/-2 dB

Deviations to the above tolerances may be submitted by the responsible test laboratory with sufficient engineering information to substantiate the deviation request, but only when best effort technique and system limitations indicate the need for a deviation.

## 6.2 Test Set-up

All voting system components (hardware and software), will be received and documented utilizing NTS Huntsville Receiving Ticket (QP HSV-150, 05/04/15) and proper QA procedures. When voting system hardware is received, each test article will be unpacked and inspected for obvious signs of degradation and/or damage that may have occurred during transit. Noticeable degradation and/or damage, if present, will be recorded, photographed, and the manufacturer shall be notified. NTS Huntsville VSTL personnel will notify NTS Huntsville QA personnel that the equipment is ready for receipt inspection. QA personnel shall record the serial numbers and part numbers. Comparison shall be made between those numbers recorded and those listed on the shipper’s manifest. Any discrepancies noted will be brought to the attention of the manufacturer representative for resolution. All TDP and source code modules received will be inventoried and maintained by the Project Lead assigned to testing.

For test setup, the system will be configured as it would for normal field use. This includes connecting all supporting equipment and peripherals. NTS Huntsville will properly configure and initialize the system, and verify that it is ready to be tested by following the procedures detailed in the voting system TDP.

## 6.3 Test Sequence and Description

The components of the voting system will undergo testing to verify that the modification performs as described by the manufacturer and meets the requirements of the 2005 VVSG. The required hardware and functional tests are outlined in the subsections below. The sequence will follow the schedule in Appendix C – Project Schedule.

### 6.3.1 Hardware Testing

All hardware testing will be performed as described by the 2005 VVSG and RFIs issued at the time of this test campaign. Descriptions of these tests are located in section 4.5.1. As part of the test campaign, the DS450 and ExpressVote 1.0 shall be subjected to the hardware tests outlined in Table 6-3. No hardware testing is required for the DS200, DS850 or AutoMARK.

**Table 6-3. Hardware Tests**

Test	Equipment	
	DS450	ExpressVote 1.0 <sup>2</sup>
Conducted RF Immunity	X	X
Electrical Fast Transient	X	X
Electrical Power Disturbance	X	X
Electrical Supply	X	X
Electromagnetic Radiation	X	X
Electromagnetic Susceptibility	X	X
Electrostatic Disruption	X	X
Lightning Surge	X	X
Magnetic Fields Immunity	X	
Product Safety	X	
Temperature Power	X	

<sup>2</sup> Hardware testing will be performed on the three configurations of ExpressVote 1.0; tabletop, booth, and rolling kiosk. Testing is being conducted to verify that the new power supply, that is required to meet the US Department of Energy Level VI Efficiency Standard, meets the requirements of the 2005 VVSG.

### 6.3.2 Physical Configuration Audit

NTS Huntsville will perform a physical configuration audit on the submitted hardware to verify that it is unmodified from the certified EVS 5.2.2.0 hardware.

### 6.3.3 Functional Configuration Audit

The FCA for the EVS 5.2.2.0 campaign will include review of: DS450, DS850, DS200, ExpressVote 1.0, AutoMARK and modified elements of the EMS. The FCA tests will be designed per the specifications in Section 4.4.3 of this plan. Test cases will be created to verify that the modifications detailed in section 1.1.3 and 4.1.1 of this test plan meet the requirements of the 2005 VVSG and the manufacturer stated operations:

During the FCA, both normal and abnormal data will be input into the system to attempt to introduce errors and test for error recovery.

### 6.3.4 Accuracy

The accuracy requirements for the DS450 will be met by the execution of the standard accuracy test. The D450 will be tested by utilizing a combination of hand marked (70%) and pre-marked (30%) ballots to achieve accuracy rate greater than 1,549,703 correct ballot positions.

### 6.3.5 Volume and Stress

The volume and stress test investigates the system's response to conditions that tend to overload the system's capacity to process, store, and report data. The test parameters will focus on the system's stated limits and the ballot logic for areas such as the maximum number of active voting positions, maximum number of ballot styles, maximum candidates, maximum contests, and stated limits within the EMS. This test will be utilized to ensure the system can achieve the manufacturer's TDP claims of what the system can support. Testing will be performed by exercising an election definition and test cases developed specifically to test for volume and stress conditions of the system being tested.

#### V&S A:

Election A tests the maximum precincts (9900) and maximum ballot styles (9900) in an election.

#### V&S B:

Election B tests the maximum precinct elements in a tabulator (65,500) and the maximum precinct elements in ERM (500,000).

#### V&S C:

Election C tests the maximum candidate counters per election (21,000), the maximum contests allowed in an election (21,000), maximum candidates per contest (175), maximum "vote for" per contest (98) and the maximum number of parties in a general election (75).

#### V&S D:

Election D tests the maximum number of parties in a primary election (20 including nonpartisan party).

#### V&S E:

Election E tests the maximum district types (20) and the maximum district names (40) in an election.

#### V&S F:

Election F tests the maximum candidate\counters allowed per precinct (1,000) and maximum contests allowed per ballot style (200)

**6.3.5 Volume and Stress (Continued)**

V&amp;S F:

Election F tests the maximum candidate\counters allowed per precinct (1,000) and maximum contests allowed per ballot style (200)

(The remainder of this page intentionally left blank)

### 6.3.6 System Integration

All submitted hardware and software components will be included in the system integration test. Six elections will be created to test the voting systems ability to function as an integrated system. The design parameters of each election are included in this section.

#### **General Election: GEN-01**

The Gen-01 is a basic election held in four precincts, one of which is a split precinct, containing nineteen contests compiled into four ballot styles. Five of the contests are in all four ballot styles. The other fourteen contests are split between at least two of the precincts with a maximum of four different contests spread across the four precincts. This election was designed to functionally test the handling of multiple ballot styles, support for at least two languages, support for common voting variations, and audio support for at least two languages.

The parameters of this election are listed below:

- Closed Primary: No
- Open Primary: No
- Partisan offices: Yes
- Non-Partisan offices: Yes
- Write-in voting: Yes
- Primary presidential delegation nominations: No
- Ballot Rotation: Yes
- Straight Party voting: Yes
- Cross-party endorsement: No
- Split Precincts: Yes
- Vote for N of M: Yes
- Recall issues, with options: No
- Cumulative voting: No
- Ranked order voting: No
- Provisional or challenged ballots: Yes
- Early Voting: No

In addition to the parameters listed above, the following will also be tested:

- Audio input in an alternative language for basic voting pattern using an ADA device
- Audio input for write-in voting using an ADA device
- Spanish language input for a basic voting pattern
- Input for write-in voting using Spanish language



### 6.3.6 System Integration (Continued)

#### General Election: GEN-02

The Gen-02 is a basic election held in three precincts. This election contains fifteen contests compiled into three ballot styles. Ten of the contests are in all three ballot styles with the other five split across the three precincts. This election was designed to functionally test the handling of multiple ballot styles, support for ballot rotation, support for two languages, support for complex voting variations, and audio support for multiple languages.

The parameters of this election are listed below:

- Closed Primary: No
- Open Primary: No
- Partisan offices: Yes
- Non-Partisan offices: Yes
- Write-in voting: Yes
- Primary presidential delegation nominations: No
- Ballot Rotation: Yes
- Straight Party voting: No
- Cross-party endorsement: No
- Split Precincts: No
- Vote for N of M: Yes
- Recall issues, with options: Yes
- Cumulative voting: No
- Ranked order voting: No
- Provisional or challenged ballots: No
- Early Voting: Yes

In addition to the parameters listed above, the following will also be tested:

- Early voting election with at least one unit in all precincts
- Voting options for over-voting
- Voting options for under-voting
- Spanish language ballots
- Audio ballots utilizing ADA capabilities

### 6.3.6 System Integration (Continued)

#### General Election: GEN-03

The Gen-03 is a basic election held in two precincts. This election contains eight contests 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 was 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 parameters of this election are listed below:

- Closed Primary: No
- Open Primary: No
- Partisan offices: Yes
- Non-Partisan offices: Yes
- Write-in voting: Yes
- Primary presidential delegation nominations: No
- Ballot Rotation: No
- Straight Party voting: No
- Cross-party endorsement: No
- Split Precincts: No
- Vote for N of M: Yes
- Recall issues, with options: No
- Cumulative voting: No
- Ranked order voting: No
- Provisional or challenged ballots: Yes
- Early Voting: No

In addition to the parameters listed above, the following will also be tested:

- Spanish language ballot with a basic voting pattern and write-in candidates
- Spanish audio input to simulate ADA device with write-in option
- Character based language with basic voting pattern
- Character based language utilizing an ADA option
- Binary input to support ADA option
- Binary input to support ADA audio device

### 6.3.6 System Integration (Continued)

#### Primary Election: PRIM-01

The Prim-01 is a closed primary election in two precincts (one precinct is a split), containing thirty contests compiled into five ballot styles. Each ballot style contains six contests. This election was designed to functionally test an open primary with multiple ballot styles, support for two languages, and support for common voting variations.

The parameters of this election are listed below:

- Closed Primary: Yes
- Open Primary: No
- Partisan offices: Yes
- Non-Partisan offices: Yes
- Write-in voting: Yes
- Primary presidential delegation nominations: No
- Ballot Rotation: No
- Straight Party voting: No
- Cross-party endorsement: No
- Split Precincts: Yes
- Vote for N of M: Yes
- Recall issues, with options: No
- Cumulative voting: No
- Ranked order voting: No
- Provisional or challenged ballots: Yes
- Early Voting: No

In addition to the parameters listed above, the following will also be tested:

- ADA audio device utilized with a write-in option

(The remainder of this page intentionally left blank)

### 6.3.6 System Integration (Continued)

#### Primary Election: PRIM-02

The Prim-02 is a basic election held in two precincts. This election contains thirteen contests compiled into three ballot styles. One contest is in all three ballot styles and all other contests are independent. This election was designed to functionally test the handling of multiple ballot styles, support for Primary presidential delegation nominations, support for two languages, support for complex voting variations, and audio support for multiple languages.

The parameters of this election are listed below:

- Closed Primary: No
- Open Primary: Yes
- Partisan offices: Yes
- Non-Partisan offices: Yes
- Write-in voting: Yes
- Primary presidential delegation nominations: No
- Ballot Rotation: No
- Straight Party voting: No
- Cross-party endorsement: Yes
- Split Precincts: No
- Vote for N of M: Yes
- Recall issues, with options: No
- Cumulative voting: No
- Ranked order voting: No
- Provisional or challenged ballots: No
- Early Voting: No

In addition to the parameters listed above, the following will also be tested:

- Open primary election with at least one machine in each precinct
- Voting options for over-voting
- Voting options for under-voting
- Voting option for write-ins
- Spanish language ballot
- Voting option utilizing ADA audio device

### 6.3.6 System Integration (Continued)

#### Primary Election: PRIM-03

The Prim-03 is 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 party ballots. This election was designed to functionally test the handling of multiple ballot styles, support for at least three languages including an Ideographic based language, support for common voting variations, and audio support for at least three languages and an ADA binary input device.

The parameters of this election are listed below:

- Closed Primary: Yes
- Open Primary: No
- Partisan offices: Yes
- Non-Partisan offices: Yes
- Write-in voting: Yes
- Primary presidential delegation nominations: No
- Ballot Rotation: No
- Straight Party voting: No
- Cross-party endorsement: No
- Split Precincts: No
- Vote for N of M: Yes
- Recall issues, with options: No
- Cumulative voting: No
- Ranked order voting: No
- Provisional or challenged ballots: Yes
- Early Voting: No

In addition to the parameters listed above, the following will also be tested:

- Spanish ballot with basic voting pattern and write-in option
- Spanish language ballot using ADA audio device with write-n option
- Character based language ballot with basic voting pattern
- Character based language utilizing ADA device
- Binary input to support ADA option
- Binary input to support ADA audio device

### 6.3.7 Security

The security test is designed and performed to verify compliance with the requirements defined in 2005 VVSG Volume I, Section 7. The range of risks tested is determined by the design of the system and potential exposure to risk. For EVS 5.2.2.0, the security testing will be limited to the following:

- Review of hardening Scripts for the following:
  - Compliance to the submitted security checklists (or benchmarks) for the Windows Server 2008 R2 (Microsoft Secure Configuration Manger v 3.0 – Member Server) and Window 7 (USGCB v. 1.2).
- Basic vulnerability scans on the EMS components to verify that the Operating System and Anti-Virus software are up-to-date as of the test execution date and that no locally exploitable vulnerabilities are detected.
- Analysis of the system's use of the RSA encryption library. This will be performed using a combination of:
  - Source code which will be reviewed to ensure that the source code contains comments and calls to enforce the use of FIPS140 functionality.
  - Dynamic analysis will be performed to see if the application utilizes the target libraries during execution.
  - Observations will be made to determine if the results data transferring between the client and voting machines is encrypted and contained in an encrypted file using the Windows File Share.

### 6.3.8 TDP Review

NTS Huntsville will ensure that all submitted modifications are accurately documented and that the documents adhere to the requirements of the 2005 VVSG. A complete listing of the EVS 5.2.2.0 TDP is located in Appendix B – Technical Data Package.

### 6.3.9 System Identification Tools Review

NTS Huntsville will use the results of the trusted build process and the EVS 5.2.2.0 system identification tools to verify that the tools provided function as described by ES&S and meet the requirements of the Program Manual and Volume I Section 7.4.6 of the 2005 VVSG.

### 6.3.10 Source Code Review

All lines of source code that are new or were modified from EVS 5.2.1.0 to EVS 5.2.2.0 will be reviewed. This encompasses code for the DS450, which is a new component to EVS 5.2.2.0. A portion of the DS450 code was re-used from the previously certified DS850 code base as they are both central count scanners and share a significant amount of identical capabilities and functionality. The DS450 code that was newly developed or modified will be reviewed using VSTL source code review procedures and standards.

## 6.4 Test Operations Procedure

These subsections address the procedures that NTS will follow during this modification testing campaign.

#### **6.4.1 Pass/Fail Criteria**

The PASS/FAIL criteria at the Component Level will be based on the expected result. If the Equipment Under Test (EUT) performs as expected, the test is considered as passed. If the EUT does not perform as expected, the test will be evaluated for tester, test procedure, or test equipment errors. If it is determined there were no tester, test procedure, or test equipment errors, the test will be repeated in an attempt to reproduce the results. If the results cannot be reproduced, the anomaly will be logged and monitored throughout the test campaign and subsequent testing efforts. If the results can be reproduced and the expected results are not met, the EUT will have failed the test. NTS Huntsville personnel will document the error and track the error through resolution.

The PASS/FAIL criteria at the System Level will be based on the expected result. If the System Under Test (SUT) performs as expected, the test is considered as passed if either 1) no errors are found, or 2) an error is encountered but the system continues to operate and engineering analysis determines that the root cause does not affect system level testing. The system level test is considered failed when an error is encountered and the system is too unstable to continue or engineering analysis determines the root cause could affect further testing. If an error occurs during system level testing, the error shall be documented. If the voting system is able to recover and continue, the test will continue. If the error causes the system to become unstable, the test shall be halted. All errors documented during System Level Testing shall be tracked through resolution.

#### **6.4.2 Anomalies**

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

#### **6.4.3 Deficiencies and Resolutions**

NTS Huntsville defines a deficiency as any repeatable test result or event that is counter to the expected result or violates the specified requirements. Deficiencies are placed into JIRA and the EAC's Virtual Review Tool (VRT) for disposition and resolution. The manufacturer will be required to submit a root cause analysis and correct any deficiency before testing can be resumed. Engineering analysis will be performed to determine what effect the resolution has on the component. A determination will be made whether Regression Testing will be sufficient or a complete re-test is necessary. All deficiencies and their resolutions will be documented on the NTS Huntsville Deficiency tracking system and the EAC Virtual Review Tool.

#### **6.4.4 Test Results and Assessment**

NTS Huntsville personnel will test every EAC 2005 VVSG requirement impacted by the submitted modification. NTS Huntsville personnel will report all deficiencies discovered during this test campaign to the manufacturer and the EAC. If NTS Huntsville determines there is not enough data to ensure a requirement was met, the test plan will be altered and further testing will be done.

#### **6.4.5 Terms of NTS Huntsville Recommendation for Certification**

The EAC has the final decision as to whether the system meets all the requirements for an EAC-certified system. NTS Huntsville will recommend approval, if the modifications meet all applicable sections of the 2005 VVSG. If the modifications do not meet all applicable sections of the 2005 VVSG, NTS will report the non-conformities to EAC.

(The remainder of this page intentionally left blank)



## **APPENDIX A – ADDITIONAL TESTING**

**A.1 Manufacturer Requested Additional Testing**

The following tests will be performed by NTS Huntsville at the request of the manufacturer. These modifications or additions represent functionality or tools that are outside the scope of the certification.

**A.1.2 Election Support Software and Hardware**

The following software and hardware components are used to support the operations of the EMS and ExpressVote:

- ExpressLink – ExpressLink is a Windows PC application that can run in either a standalone mode, or in a monitor mode, where the application monitors requests from a voter registration (VR) system over a shared network folder. The application imports an election definition from Electionware, accepts requests to print a voter’s ExpressVote activation card, determines the voter’s ballot style and then prints the activation card on the ExpressVote Activation Card Printer.
- ExpressVote Activation Card Printer – The ExpressVote Activation Card Printer is a small, thermal, on demand printer used to print the ballot activation code on the ExpressVote activation card.
- Electionware Toolbox – Electionware Toolbox is a set of utilities that can be integrated into the Electionware EMS to enhance the software usability experience and streamline various processes. These add-on utilities are called Test Deck and Text to Speech.
- Ballot Online ExpressPass – Ballot Online is an optional system that allows a user to access their ballot online and make sample ballot selections on any device connected to the Internet. When finished, the output from this system is the ExpressPass – a selection summary with scannable QR code that the user can either print or save in an electronic format on their mobile device. If submitting the vote selections for official tabulation, the user is required to go to the polling place to submit the vote selections on their ExpressPass, following standard voter authentication at the polling place. The voter operates the ExpressVote to scan, review and validate vote selections. The vote summary card may then be submitted for tabulation on an ES&S tabulator: DS200, DS850, or DS450.

NTS Huntsville will perform limited testing as requested by the manufacturer. Table A-1 outlines the requested testing.

**Table A-1. Manufacturer Requested Testing Outside of Certification**

Component	Version	Requested Testing
ExpressLink	1.3.0.0	2005 VVSG Source code Compliance, Functional Integration Test
ExpressVote Activation Card Printer	N/A	Functional Integration Test
Electionware Toolbox	3.1.0.0	Functional Integration Test
Ballot Online ExpressPass	N/A	Functional Integration Test

**APPENDIX B – TECHNICAL DATA PACKAGE**

## B.1 Technical Data Package

The documents listed in Table B-1 comprise the EVS 5.2.2.0 TDP.

**Table B-1. EVS 5.2.2.0 TDP**

<b>EVS 5.2.2.0 TDP Documents</b>	<b>Version</b>	<b>Doc No.</b>	<b>Document Code</b>
<b>System Overview</b>			
Voting System Overview	1.7	01-01	EVS5220_C_D_0100_SysOvr
<b>System Functionality Description</b>			
System Functionality Description	1.3	02-01	EVS5220_C_D_0200_SFD
<b>System Hardware Specification</b>			
AutoMARK System Hardware Overview	8	03-06-01	AutoMARK_System_Hardware_Overview_AQS-18-5002-000-S
AutoMARK System Hardware Specification	6	03-06-02	AutoMARK_System Hardware Specification_AQS-18-5000-001-F
System Hardware Specification – DS200 HW Rev 1.2	3.2	03-01	DS200HW_M_SPC_0312_HWSpec
System Hardware Specification – DS200 HW Rev 1.3	4.3	03-02	DS200HW_M_SPC_0313_HWSpec
System Hardware Specification – DS850 HW Rev 1.0	1.4	03-04	DS850HW_M_SPC_0310_HWSpec
System Hardware Specification – DS450 HW Rev 1.0	1.4	03-03	DS450HW_M_SPC_0310_HWSpec
System Hardware Specification – ExpressVote HW Rev 1.0	3.5	03-05	ExpressVoteHW_M_SPC_0310_HWSpec
Approved Parts Lists	--	03-07	Approved Parts Lists (folder)
Bill of Materials AutoMARK	2.0	03-07-06	AutoMARKHW_M_SPC_A100_BOM
Bill of Materials AutoMARK	2.0	03-07-07	AutoMARKHW_M_SPC_A200_BOM
Bill of Materials: AutoMARK A300	2.0	03-07-08	AutoMARKHW_M_SPC_A300_BOM
Approved Parts List: DS200 HW Rev 1.2	1.1	03-07-01	DS200HW_M_SPC_0312_APL
Approved Parts List: DS200 HW Rev 1.3	1.1	03-07-02	DS200HW_M_SPC_0313_APL
Approved Parts List: DS450 HW Rev 1.0	1.1	03-07-03	DS450HW_M_SPC_0310_APL
Approved Parts List: DS850 HW Rev 1.0	1.1	03-07-04	DS850HW_M_SPC_0310_APL
Approved Parts List: ExpressVote HW Rev 1.0	1.1	03-07-05	ExpressVoteHW_M_SPC_0310_APL
<b>Software Design and Specification</b>			
ES&S Coding Standards	1.1	04-10	ESSSYS_D_P_0400_CodingStandards
ES&S System Development Program	1.2	04-09	ESSSYS_SG_P_0400_SystemDevProgram
Software Design Specifications DS200	1.1	04-06	EVS5220_D_SDS00_DS200
Software Design Specifications DS450	1.0	04-04	EVS5220_D_SDS00_DS450
Software Design Specifications DS850	1.0	04-05	EVS5220_D_SDS00_DS850
Software Design Specifications Electionware	1.2	04-02	EVS5220_D_SDS00_Electionware
Software Design and Specification – ELS	1.0	04-01	EVS5220_D_SDS00_ELS
Software Design and Specification – ERM	1.2	04-03	EVS5220_D_SDS00_ERM
Software Design and Specification – ERM Appendices	1.1	04-03-01	EVS5220_D_SDS00_ERM01_Appendices
Software Design and Specification – ExpressVote	1.1	04-07	EVS5220_D_SDS00_ExpressVote
AutoMark Software Design and Specifications	--	04-08	AutoMARK SDS (Folder)
AutoMARK Ballot Image Processing Specifications	6	04-08-01	AutoMARK ESS Ballot Image Processing Specification AQS-18-5002-003-S
AutoMARK Ballot Scanning and Printing Specification	5	04-08-02	AutoMARK ESS Ballot Scanning and Printing Specification AQS-18-5002-007-S
AutoMARK Driver API Specification	5	04-08-03	AutoMARK ESS Driver API Specification AQS-18-5000-002-F

**B.1 Technical Data Package (Continued)**
**Table B-1. EVS 5.2.2.0 TDP (Continued)**

<b>EVS 5.2.2.0 TDP Documents</b>	<b>Version</b>	<b>Doc No.</b>	<b>Document Code</b>
AutoMARK Embedded Database Interface Specification	6	04-08-04	AutoMARK ESS Embedded Database Interface Specifications AQS-18-5002-005-S
AutoMARK GUI Design Specifications	6	04-08-05	AutoMARK ESS GUI Design Specifications AQS-18-5001-005-R
AutoMARK Operating Software Design Specifications	5	04-08-06	AutoMARK ESS Operating Software Design Specifications AQS-18-5001-002-R
AutoMARK Operations and Diagnostic Log Specifications	5	04-08-07	AutoMARK Operations and Diagnostic Log Specs AQS-18-5002-004-S
AutoMARK Programming Specifications Details	6	04-08-08	AutoMARK ESS Programming Specifications Details AQS-18-5001-011-R
AutoMARK Software Design Specifications	7	04-08-09	AutoMARK ESS Software Design Specs AQS-18-5001-004-S
AutoMARK Software Design Specification Overview	N/A	04-08-10	AutoMARK ESS Software Design Spec Overview
AutoMARK Software Development Environment	5	04-08-11	AutoMARK ESS Software Development Environment AQS-18-5001-006-R
AutoMARK Software Diagnostics Specifications	5	04-08-12	AutoMARK ESS Software Diagnostics Specifications AQS-18-5000-004-F
AutoMARK Software Standards Specification	5	04-08-13	AutoMARK ESS Software Standards Specification AQS-18-4000-000-S
Electionware PostgreSQL Table and Field Descriptions	--	04-02-01	EVS5220_D_SDS00_Electionware04_PostgreSQL Table and Field Descriptions.zip
Readme Election_ware_4_7_1_2	--	N/A	Election_ware_4_7_1_2
Readme Election_ware_admin_4_7_1_2	--	N/A	Election_ware_admin_4_7_1_2
AutoMARK Embedded Database Interface Specification	6	04-08-04	AutoMARK ESS Embedded Database Interface Specifications AQS-18-5002-005-S
<b>System Test/Verification Specification</b>			
Voting System Test Plan ES&S Voting System 5.2.2.0	1.0	05-01	EVS5220_QA_D_0500_SysTestPlan
Usability Test	--	05-02	Usability Test Reports (folder)
Common Industry Format Usability Test Report – AutoMARK (VAT)	1.X	05-02-02	AMVATHW_P_D_0510_CIFRptAMVAT
CIF Usability Test Report – DS200	1.2.1	05-02-03	DS200HW_P_D_0512_CIFRptDS200
CIF Usability Test Report – ExpressVote	N/A	05-02-01	ExpressVoteHW_P_D_0509_CIFRptExpressVote
<b>System Security Specification</b>			
AutoMARK System Security Specification	7	06-06	AutoMARK ESS System Security Specification AQS-18-5002-001-S
EMS Client Workstation Secure Setup & Configuration Guide	1.2	06-02	EVS5220_CM_SPC_ClientWorkstationSetupConfigGuide
EMS Server Secure Setup & Configuration Guide	1.3	06-03	EVS5220_CM_SPC_EMSServerSetupConfigGuide
Standalone EMS Workstation Secure Setup & Configuration Guide	1.2	06-04	EVS5220_CM_SPC_StandaloneWorkstationSetupConfigGuide
System Security Specification	1.2	06-01	EVS5220_CM_SPC00_SysSecuritySpec
Security Script Description	1.1	06-05	EVS5220_CM_SPC02_SecScriptDesc
Validation Procedures & Scripts		06-07	01_ValidationProcedures&Scripts (folder)
Verification Procedure: Election Management System	1.0	06-07-01	EVS5220_CM_D_2010_EMVerificationProcedure

**B.1 Technical Data Package (Continued)**
**Table B-1. EVS 5.2.2.0 TDP (Continued)**

<b>EVS 5.2.2.0 TDP Documents</b>	<b>Version</b>	<b>Doc No.</b>	<b>Document Code</b>
Verification Procedure: AutoMARK Ballot Marking Device	1.0	06-07-02	EVS5220_CM_D_2021_AutoMARKVerificationProcedure
Verification Procedure: DS850 Central Scanner & Tabulator	1.0	06-07-03	EVS5220_CM_D_2050_DS850VerificationProcedure
Verification Procedure: DS450 Central Scanner & Tabulator	1.0	06-07-04	EVS5220_CM_D_2060_DS450VerificationProcedure
Verification Procedure: DS200 Precinct Scanner & Tabulator	1.0	06-07-05	EVS5220_CM_D_2070_DS200VerificationProcedure
Verification Procedure: ExpressVote Universal Voting System	1.0	06-07-06	EVS5220_CM_D_2081_ExpressVoteVerificationProcedure
Validation File Lists		06-08	02_ValidationFileLists (folder)
ElectionWare Static File List	1.1	06-08-01	EVS5220_D_L01_StaticDynamicFileList_Electionware
ExpressVote Static Files	1.1	06-08-02	EVS5220_D_L02_StaticDynamicFileList_ExpressVote
DS450 Static File List	1.0	06-08-03	EVS5220_D_L03_StaticDynamicFileList_DS450
DS200 Static File List	1.0	06-08-04	EVS5220_D_L04_StaticDynamicFileList_DS200
DS850 Static File List	1.0	06-08-05	EVS5220_D_L05_StaticDynamicFileList_DS850
AutoMARK Static File List	1.1	06-08-06	EVS5220_D_L06_StaticDynamicFileList_AutoMARK
ERM Static File List	1.1	06-08-07	EVS5220_D_L08_StaticDynamicFileList_ERM
ExpressVote Previewer Static File List	1.0	06-08-08	EVS5220_D_L11_StaticDynamicFileList_ExpressVotePreviewer
Event Logging Service Static Files	1.0	06-08-09	EVS5220_D_L15_StaticDynamicFileList_ELS
Removable Media Service Static File List	1.0	06-08-10	EVS5220_D_L16_StaticDynamicFileList_RMS
VAT Previewer Static File List	1.1	06-08-11	EVS5220_D_L19_StaticDynamicFileList_VATPreviewer
<b>System Operations Procedure</b>			
AutoMARK System Operator's Guide	1.0	07-01	EVS5220_DOC_SOP_AMVAT
DS200 Operator's Guide	1.2	07-02	EVS5220_DOC_SOP_DS200
DS200 Operator's Guide Appendices	1.0	07-02-01	EVS5220_DOC_SOP_DS200_APPX
DS450 Operator's Guide	1.2	07-03	EVS5220_DOC_SOP_DS450
DS450 Operator's Guide Appendices	1.4	07-03-01	EVS5220_DOC_SOP_DS450_APPX
DS850 Operator's Guide	1.1	07-04	EVS5220_DOC_SOP_DS850
DS850 Operator's Guide Appendices	1.0	07-04-01	EVS5220_DOC_SOP_DS850_APPX
EVS Event Logging Service User's Guide	1.0	07-05	EVS5220_DOC_SOP_ELS
Election Reporting Manager User's Guide	1.1	07-06	EVS5220_DOC_SOP_ERM
Election Reporting Manager User's Guide Appendices	1.0	07-06-01	EVS5220_DOC_SOP_ERM_APPX
Electionware Vol.1: Administrator Guide	1.1	07-07	EVS5220_DOC_SOP_EW01Admin
Electionware Vol.2: Define User Guide	1.1	07-08	EVS5220_DOC_SOP_EW02Define
Electionware Vol.3: Design User Guide	1.0	07-09	EVS5220_DOC_SOP_EW03Design
Electionware Vol.4: Deliver User Guide	1.1	07-10	EVS5220_DOC_SOP_EW04Deliver
Electionware Vol.5: Results User Guide	1.0	07-11	EVS5220_DOC_SOP_EW05Results
Electionware Vol.6: Appendices	1.0	07-11-01	EVS5220_DOC_SOP_EW06Appendix
ExpressVote Operator's Guide	1.1	07-12	EVS5220_DOC_SOP_ExpressVote
ExpressVote Operator's Guide Appendices	1.0	07-12-01	EVS5220_DOC_SOP_ExpressVote_APPX

**B.1 Technical Data Package (Continued)**
**Table B-1. EVS 5.2.2.0 TDP (Continued)**

<b>EVS 5.2.2.0 TDP Documents</b>	<b>Version</b>	<b>Doc No.</b>	<b>Document Code</b>
<b><i>System Maintenance Manuals</i></b>			
AutoMARK System Maintenance Manual	1.0	08-01	EVS5220_DOC_SMM_AMVAT
DS200 Maintenance Manual	1.1	08-02	EVS5220_DOC_SMM_DS200
DS450 Maintenance Manual	1.3	08-03	EVS5220_DOC_SMM_DS450
DS850 Maintenance Manual	1.2	08-03	EVS5220_DOC_SMM_DS850
ExpressVote Maintenance Manual	1.1	08-04	EVS5220_DOC_SMM_ExpressVote
<b><i>Personnel Deployment and Training</i></b>			
Personnel Deployment and Training Program	1.1	09-01	ESSSYS_T_D_0900_TrainingProgram
<b><i>Configuration Management Plan</i></b>			
Configuration Management Program	2.1	10-01	ESSSYS_CM_P_1000_CMProgram
Technical Documentation Program	1.0	10-02	EVS5220_DOC_P_1000_TDProgram
<b><i>QA Program</i></b>			
Manufacturing Quality Assurance Program	1.2	11-01	ESSSYS_M_P_1100_MNFQualityAssurancePlan
Software Quality Assurance Program	1.2	11-02	ESSSYS_QA_P_1100_SWQAProgram
<b><i>System Change Notes</i></b>			
System Change Notes	1.3	12-01	EVS5220_DOC_D_1200_ChangeNotes
System Change Notes with QA Test Notes	1.1	12-02	EVS5220_DOC_D_1200_ChangeNotes_QA
<b><i>Other TDP Documents</i></b>			
Ballot Production Guide for EVS	2.5	13-01	ESSSYS_DOC_SOP_BPG

(The remainder of this page intentionally left blank)

## **APPENDIX C – PROJECT SCHEDULE**



