



---

Test Plan of  
**EAC 2005 VVSG Certification Testing**  
To Be Performed on Dominion Voting  
Democracy Suite 4.14-D

Issue Date: 10/15/2014

---

Prepared for: **Dominion Voting Systems, Inc.**  
1201 18<sup>th</sup> Street, Suite 210  
Denver, Colorado 80202

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



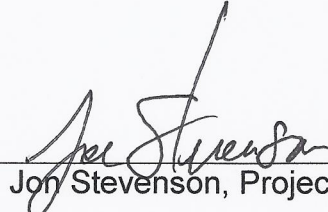
ation contained herein represents the results of testing of only those articles/products identified in re performed to specifications and/or procedures approved by the client. National Technical Syste or implied that such testing fully demonstrates efficiency, performance, reliability, or any other ch being tested, or similar products. This report should not be relied upon as an endorsement or certification by NTS of the equipment tested, nor does it present any statement whatsoever as to the merchantability or fitness of the test article or similar products for a particular purpose. This document shall not be reproduced except in full without written approval from NTS.

U.S. Election Assistance Commission

**VSTL**

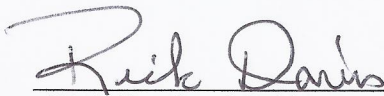
EAC Lab Code 0704

SIGNATURES

Prepared by:  Date: 10/14/2014  
Jon Stevenson, Project Engineer

Approved by:  Date: 10/15/14  
Frank Padilla, Program Manager

Approved by:  Date: 10/15/14  
Robert Hardy, Department Manager

Reviewed by:  Date: 10/15/14  
Rick Davis, QA Manager



**TABLE OF CONTENTS**

	<u>PAGE NO.</u>
<b>1.0 INTRODUCTION.....</b>	<b>7</b>
1.1 Established Baseline System.....	7
1.2 Scope Of Modification.....	8
1.3 Initial Assessment.....	10
1.4 References.....	10
1.5 Terms And Abbreviations.....	11
1.6 Testing Responsibilities.....	13
1.6.1 Project Schedule.....	13
1.6.2 Test Case Development.....	13
1.6.3 Test Procedure Development And Validation.....	13
1.6.4 Third-Party Tests.....	13
1.7 Target Of Evaluation Description.....	13
1.7.1 System Overview.....	13
1.7.2 System Operational Concept.....	19
<b>2.0 PRE-CERTIFICATION TESTING AND ISSUES.....</b>	<b>20</b>
2.1 Evaluation Of Prior Vstl Testing.....	20
2.2 Known Field Issues.....	20
<b>3.0 MATERIALS REQUIRED FOR TESTING.....</b>	<b>20</b>
3.1 Software.....	20
3.2 Equipment.....	21
3.3 Test Tools/Materials.....	24
3.4 Deliverable Materials.....	25
<b>4.0 TEST SPECIFICATIONS.....</b>	<b>27</b>
4.1 Requirements (Strategy Of Evaluation).....	27
4.2 Hardware Configuration And Design.....	30
4.3 Software System Functions.....	31
4.4 Test Case Design.....	31
4.4.1 Hardware Qualitative Examination Design.....	31
4.4.3 Software Module Test Case Design And Data.....	38
4.4.4 Software Functional Test Case Design And Data.....	39
4.4.5 System Level Test Case Design.....	40
4.5 TDP Evaluation.....	41
4.6 Source Code Review.....	43
4.7 QA And CM System Review.....	45

**TABLE OF CONTENTS (Continued)**

	<u>PAGE NO.</u>
<b>5.0 TEST DATA .....</b>	<b>45</b>
5.1 Test Data Recording .....	45
5.2 Test Data Criteria .....	45
5.3 Test Data Reduction .....	45
<b>6.0 TEST PROCEDURE AND CONDITIONS.....</b>	<b>46</b>
6.1 Facility Requirements .....	46
6.2 Test Set-Up.....	47
6.3 Test Sequence.....	54
6.3.1 Hardware Test Descriptions .....	54
6.3.2 Software Test Descriptions.....	56
6.3.3 System Testing.....	59
<b>7.0 TEST OPERATIONS PROCEDURES.....</b>	<b>62</b>
7.1 Proprietary Data.....	62
<b>APPENDIX A PROJECT SCHEDULE .....</b>	<b>63</b>
<b>APPENDIX B CHANGE NOTES.....</b>	<b>65</b>
<b>APPENDIX C SOFTWARE TABLES.....</b>	<b>69</b>

**LIST OF TABLES**

	<u>PAGE NO.</u>
Table 1-1 Democracy Suite 4.14-B Voting System Hardware Components .....	7
Table 1-2 Democracy Suite 4.14-B Voting System Software Components .....	8
Table 1-3 Democracy Suite 4.14-B Voting System EMS Components .....	8
Table 1-4 Terms and Abbreviations .....	11
Table 3-1 Software Utilized for Testing .....	20
Table 3-2 Voting Equipment .....	21
Table 3-3 ICC Equipment .....	21
Table 3-4 COTS Equipment .....	21
Table 3-5 Democracy Suite COTS Equipment .....	22
Table 3-6 Software Build Equipment .....	22
Table 3-7 Test Tools/Materials .....	24
Table 3-8 Deliverable Materials .....	25
Table 4-1 ICP Hardware Test Examination Results .....	31
Table 4-2 ICE Hardware Test Examination Results .....	33
Table 4-3 ICC Hardware Test Examination Results .....	35
Table 4-4 Democracy Suite 4.14D TDP Documents .....	40
Table 6-1 Democracy Suite 4.14D Hardware Test Sequence .....	55
Table 6-2 Democracy Suite 4.14D Software Test Sequence .....	58
Table 6-3 Democracy Suite 4.14D System Test Sequence .....	60

**LIST OF FIGURES**

	<u>PAGE NO.</u>
Figure 1-1 ImageCast Evolution on Plastic Ballot Box .....	15
Figure 1-2 ImageCast Precinct on Metal Ballot Box .....	16
Figure 1-3 Canon DR-G1130 Scanner with ImageCast Central Workstation .....	17
Figure 1-4 PhotScribe Scanner .....	18
Figure 1-5 System Overview Diagram .....	19

**1.0 INTRODUCTION**

The purpose of this National Certification Test Plan (Test Plan) is to document the procedures that National Technical Systems (NTS) will follow to perform certification testing of the Dominion Voting Systems’ Democracy Suite 4.14-D voting system to the requirements set forth in the U.S. Election Assistance Commission (EAC) 2005 Voluntary Voting System Guidelines (EAC 2005 VVSG). Prior to submitting the system for certification testing, Dominion Voting Systems submitted an application to the EAC for certification of the Democracy Suite 4.14-D voting system modification to the previously certified Democracy Suite 4.14-B voting system (Certification number: DemSuite-4-14-B). This test plan follows Notice of Clarification 09-005: Development and Submission of Test Plans for Modifications to EAC Certified Systems and Notice of Clarification 13-02: Detailed Description of Changes for Modifications.

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

**1.1 Established Baseline System**

The baseline system for this modification is the Democracy Suite 4.14-B voting system. Tables 1-1, 1-2, and 1-3 describe the certified equipment and firmware versions. For full details about the Democracy Suite 4.14-B system, refer to the Dominion Voting Systems’ Final Test Report (Rev B) located on the EAC’s website at <http://www.eac.gov>.

**Table 1-1 Democracy Suite 4.14-B Voting System Hardware Components**

<b>Component</b>	<b>Hardware Version</b>	<b>Software/Firmware Version</b>
ICE – Precinct ballot scanner	PCOS-410A	4.14.13
ICP – Precinct ballot scanner	PCOS-320A and PCOS-320C	4.14.9-US
ICC – Ballot scanner	Canon DR-X10C	N/A
ICE – Plastic ballot box	Box-410A	N/A
ICE – Coroplast Ballot Box	Box-420A	N/A
ICP – Metal ballot box	Box-310A	N/A
ICP – Plastic Ballot Box	Box-330C	N/A
ICP – Coroplast Ballot Box	Box-340C	N/A
ICP – Coroplast Ballot Box w/latch	Box-341-C	N/A

(The remainder of this page intentionally left blank)

## 1.0 INTRODUCTION (Continued)

### 1.1 Established Baseline System (Continued)

**Table 1-2 Democracy Suite 4.14-B Voting System Software Components**

Component	Version
Election Event Designer (EED)	4.14.23
Results Tally and Reporting (RTR)	4.14.23
File System Service (FSS)	4.14.23
Audio Studio (AS)	4.14.23
Data Center Manager	4.14.23
Application Server	4.14.23
Network Attached Storage Server	4.14.23
Database Server	4.14.23
Election Data Translator	4.14.23
ImageCast Central	4.14.4

**Table 1-3 Democracy Suite 4.14-B Voting System EMS Components**

Equipment	Description	Serial Number
EMS PC 1	Dell Precision T1500	CP7GGX1
EMS PC 2	Dell OptiPlex 7010	2Y7BGX1
EMS LAPTOP	HP 2000 Notebook PC	2C32NR

### 1.2 Scope of Modification

The scope of this modification includes the following changes to address new system functionality and hardware updates for the Democracy Suite voting system.

1. Introduction of a new optional Adjudication application that allows review of voter intent on a ballot-by-ballot basis from the ImageCast Central device utilized during either absentee voting or post-voting activity phases.
2. In the EMS EED module:
  - a. Added the ability to override global settings for visual elements on the level of contrast.
  - b. Added the ability to print graphics on selected contests in the candidate cell next to the candidate name.
  - c. Added the ability to generate a printer calibration sheet.
  - d. Added the ability to render crop marks on the ballot.
3. In the RTR module, added the ability to manage reporting profiles.
4. Across the system, added support for Open Primary elections.



**1.0 INTRODUCTION (Continued)****1.2 Scope of Modification (Continued)**

5. Updated the Dominion logos used in the applications.
6. In the ICP application:
  - a. Modified code to support firmware changes in the battery voltage table.
  - b. Added support for languages without textual representation (i.e., Navajo).
7. In the ICE application:
  - a. Added MBS (Machine Behavioral Settings) options to report multiple write-in positions separately on zero reports and results reports, to provide Total Cast and Total Voters on the results transfer report, and to support an optional external COTS display for accessible voting sessions.
  - b. Improved presentations of voting rule error messages.
  - c. Added three additional languages to the install package: Hindi, Khmer, and Thai.
  - d. Added the ability to allow unit to scan and cast marked ballots while ballot selections are being made concurrently during an independent accessible voting session, which is using the ATI and the external COTS display.
  - e. Added the ability to enable an external monitor in the diagnostics menu.
  - f. Added additional options to the Print Head Servicing feature: frequency of print head cleaning, and number of servicing routines in the cleaning procedure.
8. In the ICE configuration, added an optional external COTS display to present the ballot image and the voter's selections during an accessible voting session.
9. In the ICC configuration, added the Canon DR-G1130 scanner.
10. In the EMS Standard Server configuration, added a hardware RAID controller to improve the performance of that computer configuration utilizing the following parameters:
  - Raid 1 (system partition) = (2) 1 TB mirrored drives. One disk needed for recovery
  - Raid 10 (data partition) = (4) 1 TB striped drives. Two disks needed for recovery

(The remainder of this page intentionally left blank)

### 1.3 Initial Assessment

All versions of the precinct tabulators were submitted for testing in previous EAC campaigns. NTS personnel have analyzed the results of the ICP and ICE testing to determine prior testing acceptance. Based on this analysis, NTS is applying for reuse of all prior testing within the EAC test campaigns unless otherwise notated within this document. In addition, to verify that the modifications to the voting system do not introduce any nonconformities or instabilities, the Democracy Suite 4.14-D voting system shall be subjected to a system integration test to ensure all components interact properly.

### 1.4 References

The documents listed below were used in the development of the Test Plan and are utilized to perform certification testing.

- 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 1.0, expires July 2017
- Election Assistance Commission Voting System Test Laboratory Program Manual, Version 1.0, expires July 2017
- 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 107<sup>th</sup> Congress Help America Vote Act (HAVA) of 2002 (Public Law 107-252), dated October 2002
- Quality Assurance Program Manual, Revision 5
- ANSI/NCSL Z540-1, “Calibration Laboratories and Measuring and Test Equipment, General Requirements”
- ISO 10012-1, “Quality Assurance Requirements for Measuring Equipment”
- EAC Requests for Interpretation (listed on <http://www.eac.gov>)
- EAC Notices of Clarification (listed on <http://www.eac.gov>)

**1.0 INTRODUCTION (Continued)**

**1.4 References (Continued)**

- EAC Quality Monitoring Program residing at:  
[http://www.eac.gov/testing\\_and\\_certification/quality\\_monitoring\\_program.aspx](http://www.eac.gov/testing_and_certification/quality_monitoring_program.aspx)
- Dominion Voting Systems Democracy Suite 4.14-B VSTL Certification Test Report Rev. B (listed on <http://www.eac.gov>)
- Dominion Voting Systems Democracy Suite 4.14-B Technical Data Package

**1.5 Terms and Abbreviations**

Table 1-4 defines all terms and abbreviations applicable to the development of this Test Plan.

**Table 1-4 Terms and Abbreviations**

<b>Term</b>	<b>Abbreviation</b>	<b>Definition</b>
Americans with Disabilities Act of 1990 (Amended 2008)	ADA	ADA is a wide-ranging civil rights law that prohibits, under certain circumstances, discrimination based on disability.
Audio Studio	AS	EMS application used to record audio files.
Audio Tactile Interface	ATI	Electronic voter interface that does not require visual reading of a ballot. Audio is used to convey information to the voter and sensitive tactile controls allow the voter to convey information to the system.
Configuration Management	CM	---
Commercial Off the Shelf	COTS	Commercial, readily available hardware or software.
Direct Record Electronic	DRE	An electronic voting system that utilizes electronic components for the functions of ballot presentation, vote capture, vote recording, and tabulation which are logically and physically integrated into a single unit. A DRE produces a tabulation of the voting data stored in a removable memory component and in printed hardcopy.
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.
Election Management System	EMS	An umbrella term for the software application used to define and report election projects
Equipment Under Test	EUT	---
Functional Configuration Audit	FCA	Exhaustive verification of every system function and combination of functions cited in the manufacturer's documentation.
Federal Communications Commission	FCC	---
Help America Vote Act	HAVA	Act created by United States Congress in 2002.

1.0 INTRODUCTION (Continued)

1.5 Terms and Abbreviations (Continued)

Table 1-4 Terms and Abbreviations (Continued)

Term	Abbreviation	Definition
ImageCast Precinct	ICP	Precinct-level optical scanner and tabulator with audio voting capabilities.
ImageCast Evolution	ICE	Precinct-level optical scanner, tabulator with audio voting and integrated Ballot-marking Device
ImageCast Central	ICC	COTS High-speed central ballot scan tabulator.
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.
National Technical Systems, Inc.	NTS	---
Machine Behavioral Settings	MBS	The Machine Behavior Settings file (MBS file) represents the XML file that defines the behavior of an ImageCast® Evolution device. This file determines how the ImageCast® Evolution device machine will operate.
NTS Operating Procedure	OP	NTS Test Method or Test Procedure.
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.
Quality Assurance	QA	---
System Under Test	SUT	Refers to the system as a whole (all components)
Test Case Procedure Specifications	TCPS	NTS-developed document that specifies test items, input specifications, output specifications, environmental needs, special procedural requirements, inter-case dependencies, and all validated test cases that will be executed during the area under test.
Technical Data Package	TDP	Manufacturer documentation related to the voting system required to be submitted as a precondition of certification testing.
Underwriters Laboratories Inc.	UL	---
Uninterruptible Power Supply	UPS	---
Voluntary Voting System Guidelines	EAC 2005 VVSG	Published by the EAC, the third iteration of national level voting system standards.

## **1.0 INTRODUCTION (Continued)**

### **1.6 Testing Responsibilities**

Prior to the development of this test plan, NTS evaluated test results from the Democracy Suite 4.14-B test campaign performed by Wyle Laboratories. The purpose of this evaluation was to determine the scope of testing required for system certification. Based on this evaluation, NTS determined that testing from the previous test campaign can be utilized to satisfy some requirements of this test campaign. Sections 2.1 and 4.4.1 contain additional details of this evaluation. All other core and non-core software and hardware certification testing shall be conducted under the guidance of qualified NTS personnel.

#### **1.6.1 Project Schedule**

This information is contained in a NTS-generated Microsoft Project schedule. This schedule is presented in Appendix A, “Dominion Project Schedule.” The dates on the schedule are not firm dates but estimates presented for planning purposes.

#### **1.6.2 Test Case Development**

NTS will utilize the “NTS Baseline Test Cases” for the Functional and System Integration Tests. These will be augmented with specially designed test cases tailored to the Democracy Suite 4.14-D system.

#### **1.6.3 Test Procedure Development and Validation**

NTS will utilize the NTS Operating Procedures (OPs) during the duration of this test program.

#### **1.6.4 Third-Party Tests**

NTS will not utilize any third-party testing during performance of the Democracy Suite 4.14-D test campaign.

## **1.7 Target of Evaluation Description**

The following sections address the design methodology and product description of the Democracy Suite 4.14-D test campaign, as taken from the Dominion Voting Systems’ technical documentation.

### **1.7.1 System Overview**

The Dominion Voting Systems Democracy Suite 4.14-D System is a paper-based optical scan voting system and a modification of the previously-certified Democracy Suite 4.14-B System.

The certified system consists of four major components: the Election Management System (EMS), ImageCast Evolution (ICE) precinct scanner and ballot marking device, ImageCast Precinct (ICP) precinct scanner with audio ballot, and ImageCast Central (ICC) central count scanner.

## 1.0 INTRODUCTION (Continued)

### 1.7.1 System Overview (Continued)

#### Election Management System

The EMS consists of eleven components running as either a front-end/client application or as a back-end/server application. Below is an overview and brief description of each.

- Election Event Designer (EED) client application - integrates election definition functionality and represents a main pre-voting phase end-user application.
- Results Tally and Reporting client application - integrates election results acquisition, validation, tabulation, reporting and publishing capabilities and represents a main post-voting phase end-user application.
- Audio Studio client application - represents an end-user helper application used to record audio files for a given election project. As such, it is utilized during the pre-voting phase of the election cycle.
- Data Center Manager client application - represents a system level configuration application used in EMS back-end data center configuration.
- Application Server application - represents a server side application responsible for executing long running processes, such as rendering ballots, generating audio files and election files, etc.
- Network Attached Storage (NAS) Server application - represents a server side file repository for election project file based artifacts, such as ballots, audio files, reports, log files, election files, etc.
- Database Server application - represents a server side database repository of the election project database which holds all the election project data, including pre-voting and post-voting data.
- Election Data Translator (EDT) – exports and imports data in a format suitable for usage in the Election Event Designer (EED) application.
- EMS Adjudication – Represents the server and client components responsible for adjudication, including reporting and generation of adjudicated result files from ImageCast Central tabulators.
- EMS Adjudication Service – Represents a server side application which provides ballot information such as contests, candidates and their coordinates from EMS to the Adjudication application

## 1.0 INTRODUCTION (Continued)

### 1.7.1 System Overview (Continued)

- EMS File System Service – A stand-alone service that runs on client machines, enabling access to low level operating system API for partitioning CF cards and reading raw partition data on the ICP CF card.

#### **Precinct Ballot Tabulator: ImageCast Evolution (ICE)**

The Dominion Democracy Suite ImageCast Evolution System employs a precinct-level optical scan ballot counter (tabulator) in conjunction with ImageCast compatible ballot storage boxes. This tabulator is designed to mark and/or scan paper ballots, interpret voting marks, communicate these interpretations back to the voter (either visually through the integrated LCD display or optionally an external LCD display, or audibly via integrated headphones), and upon the voter's acceptance, deposit the ballots into the ballot box. The unit also features an Audio Tactile Interface (ATI) which permits voters who cannot negotiate a paper ballot to generate a synchronously human and machine-readable ballot from elector-input vote selections. In this sense, the ImageCast Evolution acts as a ballot marking device.



**Figure 1-1: ImageCast Evolution (ICE) on Plastic Ballot Box**



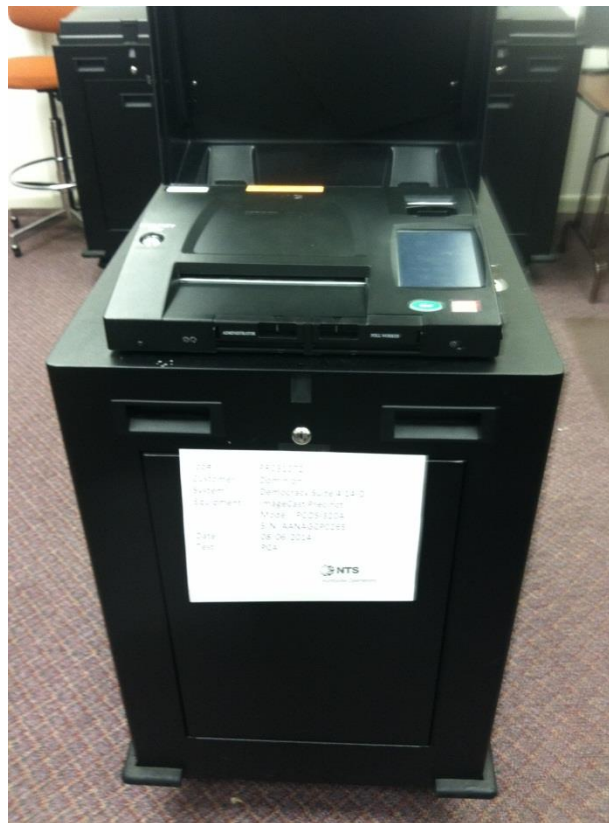
## 1.0 INTRODUCTION (Continued)

### 1.7.1 System Overview (Continued)

#### **Precinct Ballot Tabulator: ImageCast Precinct (ICP)**

The Dominion Democracy Suite ImageCast Precinct ballot counter is a precinct-based optical scan ballot tabulator that is used in conjunction with ImageCast compatible ballot storage boxes. The system is designed to scan marked paper ballots, interpret voter marks on the paper ballot, and store and tabulate each vote from each paper ballot. The ICP contains a small touch-screen LCD to allow the poll worker to access diagnostic and configuration settings.

In addition, enhanced accessibility voting may be accomplished via optional accessories connected to the ImageCast unit. The ICP utilizes an ATI device to allow voters with disabilities to navigate and submit a voted ballot. This is accomplished by presenting the ballot to the voter in an audio format. The ATI is connected to the tabulator and allows the voter to listen to an audio voting session consisting of contest and candidate names. The ATI also allows a voter to adjust the volume and speed of audio playback. The cast vote record is recorded electronically when the ATI is used to cast a ballot. There is no contemporaneous paper ballot or paper record produced when the ATI is utilized for voting. A ballot arising from the voter's choices may be printed from the EMS at a later time.



**Figure 1-2: ImageCast Precinct (ICP) on Metal Ballot Box**



## 1.0 INTRODUCTION (Continued)

### 1.7.1 System Overview (Continued)

#### **Central Tabulator: ImageCast Central Ballot Counter (ICC)**

The Dominion ImageCast Central Ballot Counter system is a central ballot scan tabulator coupled with custom-made ballot processing application used for accurate, and reliable centralized scanning and counting applications of paper ballots.

The ImageCast Central is typically utilized to process absentee ballots, but an entire election can be processed through it. Mail-in ballot elections are an example of a type of election in which the ImageCast Central can be utilized to process the entire population of ballots for that election. The election definition is taken from EMS, using the same data and database that is utilized to program any precinct scanners for a given election. Multiple ImageCast Central scanners can be programmed for use in an election. The ImageCast Central software application is installed and later initialized on a computer attached to the central count scanner.

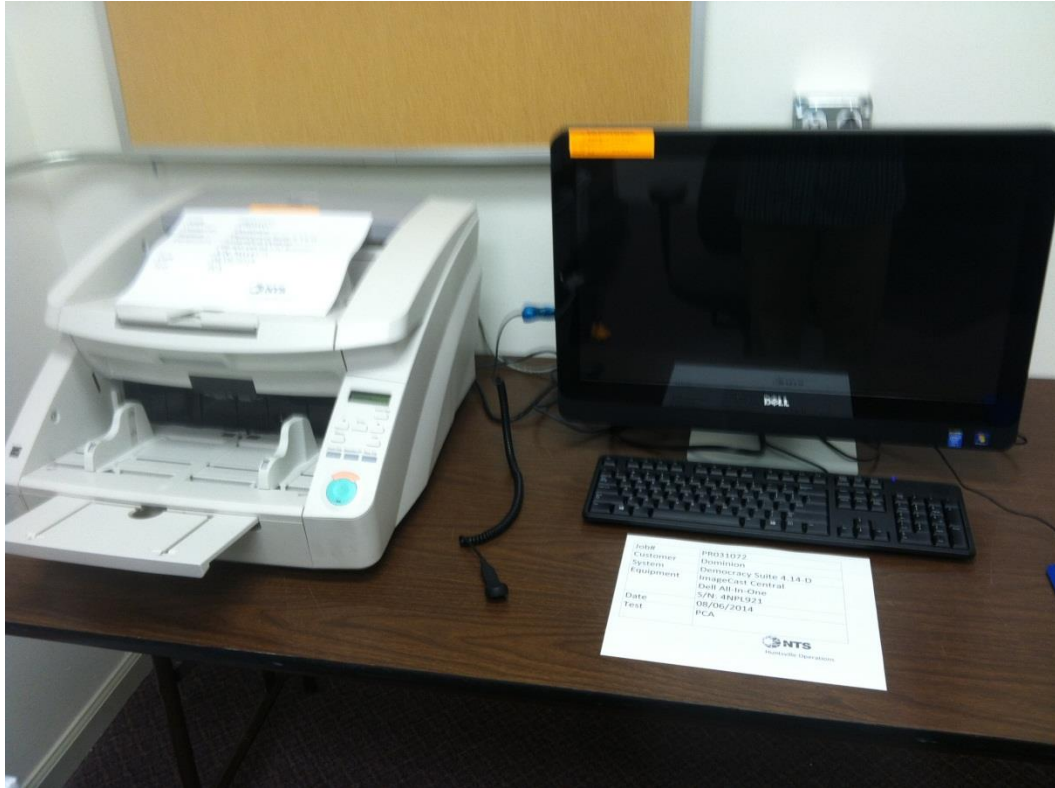
Ballots are processed through the central scanner(s) in batches based on jurisdictional preferences and requirements. Regardless of these preferences, the ImageCast Central stores ballot images by scanning batches. The scanned ballot images are migrated to EMS Adjudication and/or EMS RTR through computer networking or by removable media. EMS Results Transfer and Reporting is the application which processes the results from ICC (and Adjudication), and provides the results reports to the jurisdiction. Batches can be appended, deleted, and processed in a number of ways to suit typical election workflows, intake of ballots before, during, and after Election Day, jurisdiction requirements surrounding absentee ballot tabulation, and Canvassing needs. Note: Optionally, results can be processed by the EMS Adjudication system prior to sending to EMS RTR.

Central scanning system hardware consists of a combination of two COTS devices used together to provide the required ballot scanning processing functionality:

- The Scanner: used to provide accurate ballot scanning and image transfers to the local ImageCast Central Workstation.
- ImageCast Central Workstation PC: used for ballot image and election rules processing and results transferring to the EMS Datacenter. The ImageCast Central Workstation is a Dominion pre-approved PC workstation hardware which executes the image processing and election rules software application.

Two scanners are available for use with Democracy Suite: the Canon DR-X10C and Canon DR-G1130. When using the scanners, the following commercially available software applications and tools are used in order to provide the required ballot scanning processing functionality:

- OpenSSL: A FIPS-compliant security library
- Kofax VRS: An image processing tool

**1.0 INTRODUCTION (Continued)****1.7.1 System Overview (Continued)**

**Figure 1-3: Canon DR-G-1130 Scanner and ImageCast Central Workstation**

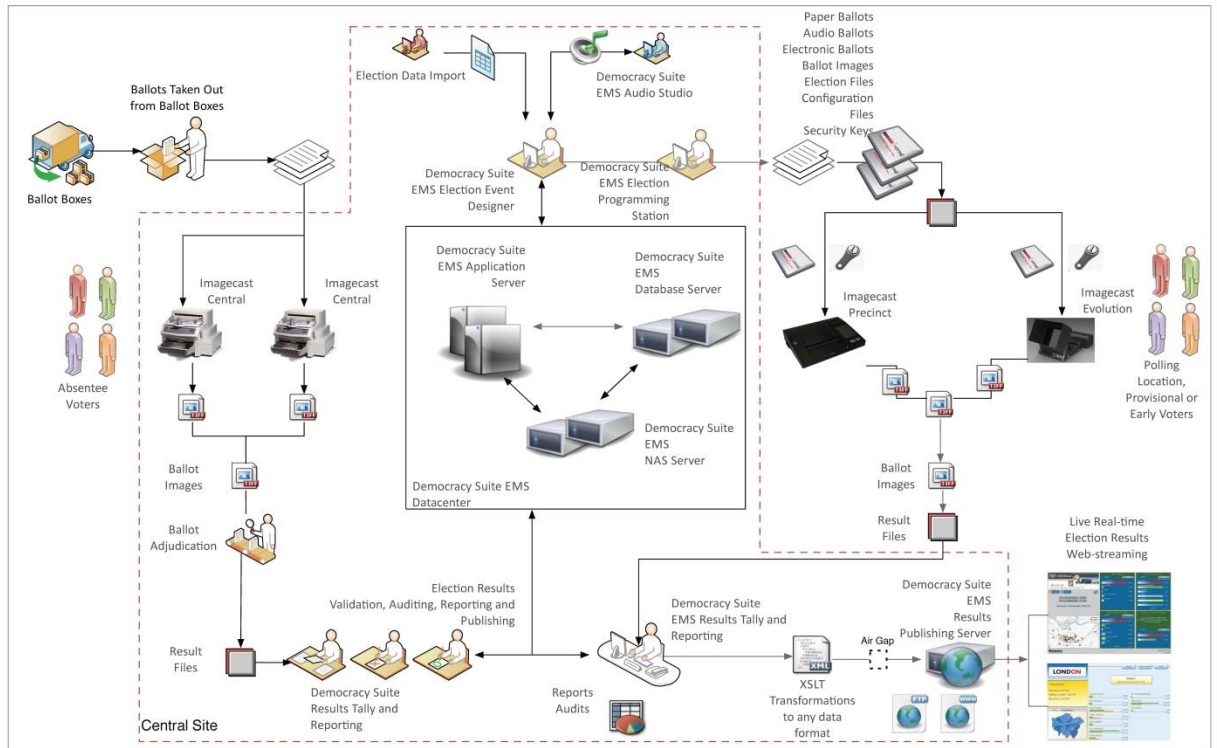
(The remainder of this page intentionally left blank)

**1.0 INTRODUCTION (Continued)**

**1.7 Target of Evaluation Description (Continued)**

**1.7.2 System Operational Concept**

The entire system diagram is presented in Figure 1-5.



**Figure 1-5  
System Overview Diagram**

(The remainder of this page intentionally left blank)

## 2.0 PRE-CERTIFICATION TESTING AND ISSUES

NTS has conducted a pre-certification review, and findings indicate that all system changes are consistent with the change items documented in the EAC Application DVS1402.

### 2.1 Evaluation of Prior VSTL Testing

NTS will reutilize all testing from the previously-certified systems submitted by Dominion Voting Systems. The testing of these systems was conducted by NTS in accordance with the EAC 2005 VVSG, and the EAC Certification Numbers are DVS-40-G-10, DemSuite-4-14, DVS-DemSuite-4-14-A, DVS-DemSuite4.14B, and DVS-DemSuite4.14-A.1.

### 2.2 Known Field Issues

This system is a modification to previously-certified systems. There were no systemic or significant issues traceable to any of the previously certified systems.

## 3.0 MATERIALS REQUIRED FOR TESTING

The materials required for certification testing of the Democracy Suite 4.14-D Voting System include software, hardware, test materials, and deliverable materials. These items were or shall be shipped directly to NTS by Dominion Voting Systems to enable the test campaign to occur.

### 3.1 Software

Table 3-1 lists the software the manufacturer must submit for testing. This section lists all software required for operation and testing of the voting system being certified. This includes the software used for functional and hardware testing. All software utilized in the test campaign is listed in Appendix C, Software Tables.

**Table 3-1 Software Utilized for Testing**

<b>Software Required For Testing</b>	<b>Software Version</b>
Election Event Designer (EED)	4.14.34
Results Tally and Reporting (RTR)	4.14.34
File System Service (FSS)	4.14.34
Audio Studio (AS)	4.14.34
Data Center Manager	4.14.34
Application Server	4.14.34
Results Tally and Reporting (RTR)	4.14.34
EMS Adjudication Service	2.4.1.18011903
EMS Database Server	4.14.34
EMS Election Data Translator (EDT)	4.14.34
EMS NAS Server	4.14.34
ImageCast Evolution	4.14.19
ImageCast Precinct	4.14d15-US
ImageCast Central	4.14.d16

**3.0 MATERIALS REQUIRED FOR TESTING (Continued)**

**3.2 Equipment**

This subsection categorizes the tools and materials the manufacturer submitted for testing listed in Tables 3-2, 3-3, 3-4, 3-5, 3-6, and 3-7. Each test element is included in the list of equipment required for testing of that element, including system hardware, general purpose data processing and communications equipment, and any required test instrumentation.

**Table 3-2 Voting Equipment**

<b>Equipment</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Serial Number</b>
ICE	Dominion	PCOS 410-A	AAFEBDZ0068
ICE	Dominion	PCOS 410-A	AAFEBEC0097
ICE	Dominion	PCOS 410-A	CAFEBDC0015
ICP	Dominion	PCOS 320-C	WLDAFBH0018
ICP	Dominion	PCOS 320-A	AANAGCP0265
ICP	Dominion	PCOS 320-A	WLDAFBH0023
ICE Ballot Box	Dominion	Plastic	AAUCBEJ0120
ICE Ballot Box	Dominion	Plastic	AAUCBEG0018
ICE Ballot Box	Dominion	Plastic	AAUCBEA0043
ICP Ballot Box	Dominion	Metal	57381-012
ICP Ballot Box	Dominion	Metal	57381-014
ICP Ballot Box	Dominion	Metal	57381-011

**Table 3-3 ICC Equipment**

<b>Equipment</b>	<b>Manufacturer/Model</b>	<b>Specifications</b>	<b>Serial Number</b>
ICC Workstation	Dell OptiPlex 9020	Processor: Intel Core i7-4770S@3.1 GHz Memory: 8GB 1333 MHz DDR3 Hard Drive Capacity: 500 GB	4NPL9Z1
ICC Workstation	Dell OptiPlex 9030	Processor: Intel Core i5-4590S@3.0 GHz Memory: 8GB 1333 MHz DDR3 Hard Drive Capacity: 500 GB	FYNTY12
COTS Scanner	Canon DR-G1130	N/A	GF301677
COTS Scanner	Canon DR-G1130	N/A	M111171

**3.0 MATERIALS REQUIRED FOR TESTING (Continued)**

**3.2 Equipment (Continued)**

**Table 3-4 COTS Equipment**

Equipment	Manufacturer / Model	Hardware Specifications	Serial Number
PC 1	Dell Precision T1700	Processor: Intel Core i5-4570 @ 3.20 GHz Memory: 8 GB 1600Mhz RAM Hard Drive Capacity: 500GB	4QGQY12
Laptop 1	Dell Latitude E6540	Processor: Intel Core i7-4810MQ @ 2.80 GHz Memory: 8 GB 1600Mhz RAM Hard Drive Capacity: 500GB	FRB8H12
PC2	Dell PowerEdge T620	Intel Xeon CPU E-52640v2 @ 2.00 GHz Memory: 32 GB 1600Mhz RAM Hard Drives: (6) 1 TB (PERC H710 RAID Controller)	J8H9H02

**Table 3-5 Democracy Suite COTS Equipment**

Test Material	Make	Model	Quantity	Serial Number
iButton (SHA-1) with USB Reader/Writer	Maxim	USB R/W: DS9490R iButton: DS1963S	3	4D027C, 4C9CF5, 514DFD
iButton (SHA-1)	Maxim	DS1963S	2	4CE4C9, 4D064A
LCD Monitor	Soyo	18.5" wide LCD	1	DYLM19R6-KLE-10202
LCD Monitor	Samsung	23" wide LCD	1	MY23HVMS701197B
LCD Monitor	Dell	1909W	4	07E-4EUS, 07F-071S, 07F-06US, 07F-074S
LCD Monitor	Dell	N445N	3	2TWC, 2UOC, 2U6C
Audio Adapter	Soundwave	USB Soundwave 7.1 Audio Adapter	2	SW-57381-001, SW-57381-002
PCI Software	Soundwave	Soundwave 7.1 PCI Software	2	n/a
USB Software	Soundwave	USB Soundwave 7.1 Software	1	n/a
Networking Switch	D-Link	D-Link DES-1105 5-Port Switch	1	DRL728A001397
Mouse	Dell	USB w/rollerball	4	G1A00M0M, 10203JTI, LZA30491960, 438027372

**3.0 MATERIALS REQUIRED FOR TESTING (Continued)**

**3.2 Equipment (Continued)**

**Table 3-5 Democracy Suite COTS Equipment (Continued)**

Test Material	Make	Model	Quantity	Serial Number
Mouse	Microsoft	USB w/rollerball	1	X800898
Keyboard	Kensington	USB	1	D0713000487
Keyboard	Microsoft	USB	1	6968200717217
ICE external LCD monitor	AOC	E1649FWU	3	D2RE4HA020348, D2RE4HA017467, D2RE4HA017592
Compact Flash Reader	SanDisk	USB	3	0171618, 0201833, 0171631
Card Reader	GGI Gear	Compact Flash Card Reader	4	CFRW-57381-001 thru 004
Cyber Acoustics Headphone	Cyber Acoustics	ACM-70	2	DVS23000048
Sip & Puff	Origin Instruments	Air Voter	7	AV-57381-001 thru 003, 002251, 002268, 002267
Footswitch Pair	--	Kinesis	4	FS-57381-001 thru 004
#970 Armrest Sip & Puff Attachment	--	Enabling Devices	6	AR-57381-001 thru 006
Compact Flash	RiData	CFC-14A	50	NTS-assigned numbers: CF-XXX
Compact Flash	RiData Industrial	RDCF8G-233XMCB2-1	2	NTS-assigned numbers: CF-XXX
Compact Flash	RiData Industrial	RDCF16G-233XMCB2-1	2	NTS-assigned numbers: CF-XXX
Compact Flash	RiData Industrial	RDCF32G-233XMCB2-1	2	NTS-assigned numbers: CF-XXX
Compact Flash	Cactus	KC4GR-220	4	NTS-assigned numbers: CF-XXX
Compact Flash	Cactus	KC8GR-220	4	NTS-assigned numbers: CF-XXX
Compact Flash	Cactus	KC16GR-220	4	NTS-assigned numbers: CF-XXX
Compact Flash	Cactus	KC32GR-220	2	NTS-assigned numbers: CF-XXX
Compact Flash	SanDisk Extreme	SDCFX-016G	2	NTS-assigned numbers: CF-XXX



Compact Flash	SanDisk Extreme	SDCFX-032G	2	NTS-assigned numbers: CF-XXX
---------------	-----------------	------------	---	------------------------------

### 3.0 MATERIALS REQUIRED FOR TESTING (Continued)

### 3.2 Equipment (Continued)

**Table 3-6 Software Build Equipment**

Equipment and Operating System	Manufacturer	Version/Model	Serial Number	COTS /Non-COTS
Build 1	Super Micro	SuperServer	BM-57381-001	COTS

### 3.3 Test Tools/Materials

This subsection enumerates any and all test materials needed to perform voting system testing in Table 3-7. The scope of testing determines the quantity of a specific material required.

**Table 3-7 Test Tools/Material**

Test Tool/Material	Quantity
Black Privacy Panels (set of 2 pieces)	as required
Security Keys	as required
Thermal Printer Rolls	as required
Dominion Cleaning Kit	as required
Sharpie Permanent Markers	as required
Ballots	as required

(The remainder of this page intentionally left blank)



**3.0 MATERIALS REQUIRED FOR TESTING (Continued)**

**3.4 Deliverable Materials**

The materials listed in Table 3-8 are to be delivered as part of the Democracy Suite 4.14-D voting system to the users:

**Table 3-8 Deliverable Materials**

<b>Deliverable Material</b>	<b>Version</b>	<b>Description</b>
Election Event Designer	4.14.37	EMS client application
Results Tally and Reporting	4.14.37	EMS client application
File System Service	4.14.37	EMS client application
Audio Studio	4.14.37	EMS client application
Application Server	4.14.37	EMS server application
Datacenter Manager	4.14.37	EMS server application
Adjudication	2.4.1.18011903	EMS client application
Adjudication Service	4.14.37	EMS server application
Database Server	4.14.37	EMS server application
Election Data Translator	4.14.37	EMS client application
NAS Server	4.14.37	EMS server application
ImageCast Evolution (with optional external monitor)	410A w/Firmware version 4.14.20	Precinct ballot scanner and ADA accessible voting device
ImageCast Precinct	320A w/Firmware version 4.14d.15	Precinct ballot scanner and ADA accessible voting device
ImageCast Central Count (Central Count Scanners listed are all options and dependent upon the vendor contract on which is included)	Canon DR-X10C w/firmware version 4.14.d16_140808	Central ballot scanner
	Canon DR-G1130 w/Firmware version 4.14.d16_140808	
ImageCast Evolution Plastic Ballot Box	BOX-410A	ICE Plastic Ballot box
ImageCast Precinct Metal Ballot Box	BOX-310A	ICP Metal Ballot box

(The remainder of this page intentionally left blank)

**3.0 MATERIALS REQUIRED FOR TESTING (Continued)**

**3.4 Deliverable Materials (Continued)**

**Table 3-8 Deliverable Materials (Continued)**

<b>Deliverable Material</b>	<b>Version</b>	<b>Description</b>
ImageCast Precinct Plastic Ballot Box	BOX-330A	ICP Plastic Ballot box
Rocstor Encrypted NAS	Dell PowerEdge R610	Encrypted Network Attached Storage module for server and data backup
Rocstor Portable Hard Drive	Rocstor Commander 2UE Portable Hard Drive	Encrypted and ruggedized external hard drive
iButton with Reader/Writer	Maxim USB R/W: DS9490R iButton: DS1963S	Security authentication token with programmer
Gigabit Network Switch	D-Link DGS-2208 8-Port Switch	Network switch for standard or enterprise configuration
ICE/ICP Headphones	Cyber Acoustics	Headphones used for audio voting
Sip/Puff Device	Origin Instruments Air Voter	Binary input device for disabled voters
ICP System Operation Procedures	4.14.D::197	TDP Document
EMS System Operation Procedures	4.14.D::511	TDP Document
ICE System Operation Procedures	4.14.D::145	TDP Document
ICC System Operation Procedures	4.14.D::118	TDP Document
ICP System Maintenance Manual	1.1.0::66	TDP Document
ICE System Maintenance Manual	1.1.0::115	TDP Document
EMS System Maintenance Manual	1.0.0::50	TDP Document
Election Event Designer User's Guide	1.0.0::61	TDP Document
Results Tally and Reporting User's Guide	1.0.0::67	TDP Document
Audio Studio User's Guide	1.0.0::24	TDP Document
ImageCast Adjudication User's Guide	4.14.D::41	TDP Document

(The remainder of this page intentionally left blank)

#### 4.0 TEST SPECIFICATIONS

Modification testing of the Democracy Suite 4.14-D will be performed on the configuration submitted in the EAC application DVS1402. NTS' qualified personnel will ensure that all certification testing performed on the manufacturer's voting system follows NTS' procedures for testing, and the specific test cases developed for this campaign meet the requirements of the EAC 2005 VVSG and EAC Testing and Certification Program Manual.

All Requests for Interpretation (RFIs) and Notices of Clarification (NOCs) applicable as of the date of this document shall apply to this test campaign unless otherwise noted.

#### 4.1 Requirements (Strategy of Evaluation)

To evaluate the system test requirements, each section of the EAC 2005 VVSG will be analyzed to determine the applicable tests. The EAC 2005 VVSG requirements, along with the strategy for evaluation, are described below:

**Section 2: Functional Requirements** – The requirements in this section will be tested during the FCA and System Integration tests utilizing the “NTS Baseline Test Cases” along with test cases specially designed for the Democracy Suite 4.14-D per sections 4.4.3 and 4.4.4.

**Section 3: Usability and Accessibility** – The requirements in this section will be tested during this test campaign on the ICE with an optional COTS external monitor. During this test campaign, the ICE with an optional COTS external monitor will be verified that it meets the Usability and Accessibility requirements of the 2005 VVSG.

**Section 4: Hardware Requirements** – The requirements in this section will be tested and/or evaluated by trained NTS personnel per sections 4.4.1 and tables 6-1 and 6-3.

**Section 5: Software Requirements** – The requirements in this section will be tested during source code review, TDP review, and FCA. A combination of review and functional testing will be performed to ensure these requirements are met.

**Section 6: Telecommunication** – The requirements in this section will not be tested during this test campaign because no changes were included in this modification to the Standard Networking Configuration from the original Democracy Suite 4.14-B EAC-certified system.

**Section 7: Security Requirements** – The requirements in this section will be tested during source code review, FCA, and security tests.

(The remainder of this page intentionally left blank)

#### 4.0 TEST SPECIFICATIONS (Continued)

#### 4.1 Requirements (Strategy of Evaluation) (Continued)

**Section 8: Quality Assurance (QA) Requirements** – The requirements in this section shall be tested throughout the test campaign using various methods. A TDP review shall be performed on Dominion QA documentation to determine compliance to EAC 2005 VVSG requirements. All source code shall be checked to ensure that proper QA documentation has been completed. All equipment received for initial testing and follow-up testing shall be checked against Dominion documentation to ensure their QA process is being followed. NTS personnel will complete the requirements of EAC 2005 VVSG Vol. 2, Section 7, “Quality Assurance Testing” and Section 1.3.1.5, “Focus of Vendor Documentation” that requires NTS personnel to physically examine documents at Dominion’s location or conduct an external evaluation utilizing equipment, documents, and support information provided by Dominion during the test campaign. NTS may also choose to interview Dominion’s QA staff for further evaluation.

**Section 9: Configuration Management (CM) Requirements** – The requirements in this section shall be tested throughout the test campaign. The TDP review shall be performed on the Dominion configuration management documentation to determine EAC 2005 VVSG compliance and to further determine whether Dominion is following its documented CM requirements within the TDP. Any anomalies shall be formally reported to Dominion and the EAC. NTS personnel will conduct an audit of the Dominion CM Program at the Dominion facility at the conclusion of the test campaign.

NTS personnel shall maintain a test log of the procedure(s) employed. This log identifies the system and equipment by model and serial number. In the event that the project engineer deems it necessary to deviate from requirements pertaining to the test environment, the equipment arrangement and method of operation, the specified test procedure, or the provision of test instrumentation and facilities, the deviation shall be recorded in the test log. A discussion of the reasons for the deviation and the effect of the deviation on the validity of the test procedure shall also be completed by the Project Engineer and Program Manager.

NTS personnel utilize an internal issue tracking system in order to capture and track all issues and discrepancies found during the testing campaign. This allows for all issues and discrepancies to be monitored for reoccurrence, tracks the root cause analysis, and provides a resolution status. NTS personnel shall verify all items logged into the issues tracking system are resolved prior to the completion of testing and before any recommendation may be made for certification.

(The remainder of this page intentionally left blank)

**4.0 TEST SPECIFICATIONS (Continued)****4.1 Requirements (Strategy of Evaluation) (Continued)**

The specific NTS OPs to be used during testing include the following:

OP 1 Operational Status Checks	OP 21 Temperature Power Variation
OP 2 Receipt Inspection	OP 24-1 Usability
OP 3 Technical Data Package Review	OP 24-2 Accessibility
OP 4 Test Plan Preparation	OP 25 Physical Configuration Audit
OP 5a-d Source Code Review	OP 26 Functional Requirements
OP 7 & 7a Trusted Build	OP 27 Maintainability
OP 7b & 7c Compliance Build	OP 29 Electrical Supply
OP 9 Electromagnetic Emissions	OP 30 System Integration Test
OP 10 Electrostatic Disruption	OP 34 Test Report
OP 11 Electromagnetic Susceptibility	OP 41 Logic and Accuracy
OP 14 Conducted RF Immunity	

(The remainder of this page intentionally left blank)

#### **4.0 TEST SPECIFICATIONS (Continued)**

#### **4.2 Hardware Configuration and Design**

The Democracy Suite system consists of four major components: the EMS, ICE precinct scanner and ballot marking device, ICP precinct scanner, and ICC central count scanner. The Democracy Suite is comprised of two proprietary pieces of hardware (ICE and ICP) and one piece of COTS hardware (ICC). All EMS functions are handled by proprietary software running on COTS PCs/laptops/servers. NTS has determined that these COTS PC/laptops/servers are not subject to hardware testing per the EAC 2005 VVSG. The provided PC/laptops/servers documented in “Section 3 - Materials Required For Testing” contain CE, UL, and FCC labeling.

ICP – A PCA was performed on the ICP component to verify the changes and effects caused by the changes to the unit. No additional hardware testing will be required based on the findings of the evaluation. Wyle Laboratories previously performed testing to the EAC 2005 VVSG during the Democracy Suite 4.0 approved certification testing (EAC CERTIFICATION NUMBER – DVS-40-G). NTS will be utilizing the data obtained during that test effort to satisfy requirements for this modification test campaign.

ICE – The tabulators will be mounted on the ballot box to simulate the actual election configuration. During operational tests the unit will be in auto-feed mode (“Shoe-Shine”) and scan test ballots for the duration of the operational test.

Each unit will be loaded with the Operational Status Check Hardware election definition configured for early voting. This will allow all the data generated for the Pre-operational, Operational, and Post-operational test to be further analyzed, compiled, and included in the Reliability and Availability Test results.

ICC – This tabulator consists of the following COTS scanners and COTS workstation PCs: The Canon DR-X10C and Canon DR-G1130 scanners, and the Dell OptiPlex 9020 and Dell OptiPlex 9030 workstation PCs. Workstation PCs contain CE, UL, and FCC labeling. The Canon DR-G1130 will be submitted for Temperature and Power Variation testing during this test campaign, and the hardware testing for the Canon DR-X10C scanner will be accepted from the original Democracy Suite 4.0 (EAC CERTIFICATION NUMBER – DVS-40-G).

(The remainder of this page intentionally left blank)

### 4.3 Software System Functions

The Dominion Democracy Suite 4.14-D system software is written in the C, C++, C# (C Sharp) programming languages. The system software is broken into three areas: EMS, precinct tabulator software acting as firmware, and central count application running on a COTS workstation.

The Democracy Suite EMS software consists of the eleven components listed below:

- Election Event Designer
- Results Tally and Reporting
- Audio Studio
- Adjudication
- Adjudication Service
- Election Data Translator
- File System Service
- Datacenter Manager
- Application Server
- Network Attached Storage Server
- Database Server

The Democracy Suite 4.14-D contains two precinct tabulators, the ICE and ICP. Both tabulators run Dominion-proprietary software that is treated as firmware. The software applications are ICP and ICE.

The Democracy Suite 4.14-D also includes a COTS PC workstation running Dominion-proprietary software called the ICC application. This software provides the central tabulation function for the system.

### 4.4 Test Case Design

NTS uses the V-Model Life Cycle as defined by the Institute of Electrical and Electronics Engineers (IEEE). The IEEE definition of the V-Model Life Cycle uses two concepts “Verification” and “Validation.” NTS’ test approach is to incorporate the use of both “Verification” and “Validation.” There are four basic levels of testing in the V-Model Life Cycle: Component, Integration, System, and Acceptance. NTS will be evaluating the Dominion Democracy Suite 4.14-D to all four levels.

#### 4.4.1 Hardware Qualitative Examination Design

Dominion submitted the results of previous testing in the form of the following test reports:

- Certification Testing of the Dominion Voting Systems Democracy Suite 4.0, Wyle Laboratories Test Report No. T57381-01
- Certification Testing of the Dominion Voting Systems Democracy Suite 4.14, Wyle Laboratories Test Report No. T70251-01
- Certification Testing of the Dominion Voting Systems Democracy Suite 4.14-A, Wyle Laboratories Test Report No. T71120-01

#### **4.0 TEST SPECIFICATIONS (Continued)**

##### **4.4.1 Hardware Qualitative Examination Design (Continued)**

- Certification Testing of the Dominion Voting Systems Democracy Suite 4.14-B, Wyle Laboratories Test Report No. T71372-01
- Certification Testing of the Dominion Voting Systems Democracy Suite 4.14-A.1, NTS Test Report No. T71615-01

NTS personnel performed a hardware qualitative examination to 1) assess if the testing was performed under the guidelines of the EAC program, 2) assess if the tests were performed per the EAC 2005 VVSG, and 3) determine if the scope of the engineering changes were implemented since test performance. The results from this examination deemed that the hardware testing performed under the Democracy Suite 4.0, 4.14, 4.14-A, 4.14-B, and 4.14-A.1 campaigns were tested to the EAC 2005 VVSG and in accordance with the EAC Testing and Certification Program Manual. NTS recommends that reuse be approved for all test requirements in Tables 4-1, 4-2, and 4-3 labeled as “Accept” underneath the component being tested.

##### ICP Testing

A PCA was performed on the ICP component to verify the changes and effects caused by the changes to the unit therefore no additional hardware testing will be required based on the findings of the evaluation. Wyle Laboratories previously performed testing to the EAC 2005 VVSG during the Democracy Suite 4.0 approved certification testing (EAC CERTIFICATION NUMBER – DVS-40-G). NTS will be utilizing the data obtained during that test effort to satisfy requirements for this modification test campaign.

(The remainder of this page intentionally left blank)



#### 4.0 TEST SPECIFICATIONS (Continued)

##### 4.4.1 Hardware Qualitative Examination Design (Continued)

The summary of acceptable testing is provided in the table below. The details of those tests are presented in Section 6.0.

**Table 4-1 ICP Hardware Test Examination Results**

Test/EAC 2005 VVSG Section	Procedure/Description	Configuration Tested	Status
<i>Usability/3.1</i>	Measure of the effectiveness, efficiency, and satisfaction achieved by a specified set of users	ICP	Accept
<i>Accessibility/3.2</i>	Tests the voting system to ensure accessibility for individuals with disabilities to include, but not limited to visually impaired voters by providing the same access and participation opportunity.	ICP	Accept
<i>Security/7</i>	Tests the ability of the system to detect, prevent, log, and recover from a broad range of security risks identified.	ICP	Accept
<i>Maintainability/4.3.4</i>	Tests the ease in which preventative and corrective maintenance actions can be performed based on design, software, and documentation.	ICP	Accept
<i>Availability/4.3.5</i>	Tests the voting system to help ensure the probability that the equipment will be operational and accomplish set functions. This shall be calculated using the following formula at a 99% availability rate: $A_i = (MTBF) / (MTBF + MTTR)$	ICP	Accept
<i>Safety/4.3.8</i>	UL 60950-1 product safety review	ICP	Accept*
<i>Electrical Supply/4.1.2.4</i>	Meets voltage and power requirements of EAC 2005 VVSG Vol. 1 Section 4.1.2.4	ICP	Accept
<i>Electromagnetic Radiation/4.1.2.9</i>	FCC Part 15 Class B for both radiated and conducted emissions	ICP	Accept
<i>Electromagnetic Susceptibility/4.1.2.10</i>	IEC 61000-4-3 electromagnetic field of 10V/m modulated by a 1kHz, 80% AM modulation at 80MHz to 1000MHz frequency	ICP	Accept
<i>Temperature/Power Variation/4.1.2.13</i>	MIL-STD-810D, Method 502.2 and Method 501.2 163 hours at 50 degrees to 95 degrees	ICP	Accept
<i>High Temperature/4.1.2.14</i>	MIL-STD-810D, Method 501.2 maximum temperature shall be 140 degrees F	ICP	Accept
<i>Low Temperature/4.1.2.14</i>	MIL-STD-810D minimum temperature shall be -4 degrees F	ICP	Accept

**4.0 TEST SPECIFICATIONS (Continued)**

**4.4.1 Hardware Qualitative Examination Design (Continued)**

**Table 4-1 ICP Hardware Test Examination Results (Continued)**

<i>Bench Handling</i>	MIL-STD-810D, Method 516.3 Procedure VI six 4” drops on each edge totaling 24 drops	ICP	Accept
<i>Vibration/4.1.2.14</i>	MIL-STD-810D, Method 514.3 physical shock and vibration during handling and transport	ICP	Accept
<i>Humidity Test/4.1.2.14</i>	MIL-STD-810D, Method 501.2 ten 24 hour humidity cycles	ICP	Accept
<i>Electrical Power Disturbance/4.1.2.5</i>	IEC 61000-4-11 (1994-06) power surges and dips	ICP	Accept
<i>Electrical Fast Transient/4.1.2.6</i>	IEC 61000-4-4 (1995-01)	ICP	Accept
<i>Lightning Surge/4.1.2.7</i>	IEC 61000-4-5 (1995-02)	ICP	Accept
<i>Electrostatic Disruption/4.1.2.8</i>	IEC 61000-4-2 (1995-01) 15kV air discharge and 8kV contact discharge	ICP	Accept
<i>Conducted RF Immunity/4.1.2.11</i>	IEC 61000-4-6 (1996-04) conducted radio frequency energy	ICP	Accept
<i>Magnetic Fields Immunity/4.1.2.12</i>	IEC 61000-4-8 (1993-06) AC magnetic fields of 30 A/m at 60Hz	ICP	Accept

\*Safety testing was witnessed by Wyle Laboratories at a third party laboratory

ICE Testing

The Dominion Democracy Suite 4.14-D ICE hardware will be tested by the NTS Laboratories’ EMI, Dynamics, and Environmental test facilities for testing to the hardware requirements in accordance with NTS A2LA certifications 845.01-.03. All EMI testing will be performed per the following NTS Test Guidelines Documents: EMI-001A, “Test Guidelines for Performing Electromagnetic Interference (EMI) Testing”, and EMI-002A, “Test Procedure for Testing and Documentation of Radiated and Conducted Emissions Performed on Commercial Products”. These proprietary documents shall be submitted under separate cover for reference.

All hardware testing will be performed per the guidelines of ANSI/NCSL Z540-1, “Calibration Laboratories and Measuring and Test Equipment, General Requirements”, and ISO 10012-1, “Quality Assurance Requirements for Measuring Equipment” and the governing MIL-STD to which the test is required. All hardware testing will be conducted by NTS-qualified personnel at NTS facilities.

A PCA was performed on the ICE component to verify the changes and effects caused by the changes to the unit.

#### 4.0 TEST SPECIFICATIONS (Continued)

##### 4.4.1 Hardware Qualitative Examination Design (Continued)

NTS previously performed testing to the EAC 2005 VVSG during the Democracy Suite 4.0 approved certification testing (EAC CERTIFICATION NUMBER – DVS-40-G). NTS will be utilizing a portion of the data obtained during that test effort to satisfy requirements for this modification test campaign. Additional testing as documented in table 4-2 will be required based on the introduction of a new COTS external monitor.

The summary of acceptable testing is provided in the table below. The details of those tests are presented in Section 6.0.

**Table 4-2 ICE Hardware Test Examination Results**

Test/EAC 2005 VVSG Section	Procedure/Description	Configuration Tested	Status
<i>Usability/3.1</i>	Measure of the effectiveness, efficiency, and satisfaction achieved by a specified set of users	ICE	Reject
<i>Accessibility/3.2</i>	Tests the voting system to ensure accessibility for individuals with disabilities to include, but not limited to visually impaired voters by providing the same access and participation opportunity.	ICE	Reject
<i>Security/7</i>	Tests the ability of the system to detect, prevent, log, and recover from a broad range of security risks identified.	ICE	Reject
<i>Maintainability/4.3.4</i>	Tests the ease in which preventative and corrective maintenance actions can be performed based on design, software, and documentation.	ICE	Reject
<i>Availability/4.3.5</i>	Tests the voting system to help ensure the probability that the equipment will be operational and accomplish set functions. This shall be calculated using the following formula at a 99% availability rate: $A_i = (MTBF) / (MTBF + MTTR)$	ICE	Reject
<i>Safety/4.3.8</i>	UL 60950-1 product safety review	ICE	Accept*

\*Safety testing was witnessed by Wyle Laboratories at a third party laboratory

(The remainder of this page intentionally left blank)

#### 4.0 TEST SPECIFICATIONS (Continued)

#### 4.4.1 Hardware Qualitative Examination Design (Continued)

**Table 4-2 ICE Hardware Test Examination Results (Continued)**

<i>Electrical Supply/4.1.2.4</i>	Meets voltage and power requirements of EAC 2005 VVSG Vol. 1 Section 4.1.2.4	ICE	Reject
<i>Electromagnetic Radiation/4.1.2.9</i>	FCC Part 15 Class B for both radiated and conducted emissions	ICE	Reject
<i>Electromagnetic Susceptibility/4.1.2.10</i>	IEC 61000-4-3 electromagnetic field of 10V/m modulated by a 1kHz, 80% AM modulation at 80MHz to 1000MHz frequency	ICE	Reject
<i>Temperature/Power Variation/4.1.2.13</i>	MIL-STD-810D, Method 502.2 and Method 501.2 163 hours at 50 degrees to 95 degrees	ICE	Reject
<i>High Temperature/4.1.2.14</i>	MIL-STD-810D, Method 501.2 maximum temperature shall be 140 degrees F	ICE	Accept
<i>Low Temperature/4.1.2.14</i>	MIL-STD-810D minimum temperature shall be -4 degrees F	ICE	Accept
<i>Bench Handling</i>	MIL-STD-810D, Method 516.3 Procedure VI six 4" drops on each edge totaling 24 drops	ICE	Accept
<i>Vibration/4.1.2.14</i>	MIL-STD-810D, Method 514.3 physical shock and vibration during handling and transport	ICE	Accept
<i>Humidity Test/4.1.2.14</i>	MIL-STD-810D, Method 501.2 ten 24 hour humidity cycles	ICE	Accept
<i>Electrical Power Disturbance/4.1.2.5</i>	IEC 61000-4-11 (1994-06) power surges and dips	ICE	Accept
<i>Electrical Fast Transient/4.1.2.6</i>	IEC 61000-4-4 (1995-01)	ICE	Accept
<i>Lightning Surge/4.1.2.7</i>	IEC 61000-4-5 (1995-02)	ICE	Accept
<i>Electrostatic Disruption/4.1.2.8</i>	IEC 61000-4-2 (1995-01) 15kV air discharge and 8kV contact discharge	ICE	Reject
<i>Conducted RF Immunity/4.1.2.11</i>	IEC 61000-4-6 (1996-04) conducted radio frequency energy	ICE	Reject
<i>Magnetic Fields Immunity/4.1.2.12</i>	IEC 61000-4-8 (1993-06) AC magnetic fields of 30 A/m at 60Hz	ICE	Accept

\*Safety testing was witnessed by Wyle Laboratories at a third party laboratory

(The remainder of this page intentionally left blank)

**4.0 TEST SPECIFICATIONS (Continued)**

**4.4.1 Hardware Qualitative Examination Design (Continued)**

ICC Testing

The ImageCast Central system consisting of COTS scanners and COTS Workstation PCs will be submitted for the following hardware tests during this test campaign: Maintainability, Electrical Supply, and Temperature and Power Variation. These hardware tests were successfully performed on the Canon DR-X10C scanner and the results of those tests will be accepted for the current test campaign.

**Table 4-3 ICC Hardware Test Examination Results**

<b>Test/EAC 2005 VVSG Section</b>	<b>Procedure/Description</b>	<b>Configuration Tested</b>	<b>Status</b>
<i>Maintainability/4.3.4</i>	Tests the ease in which preventative and corrective maintenance actions can be performed based on design, software, and documentation.	ICC	Accept for Canon DR-X10C only
<i>Electrical Supply/4.1.2.4</i>	Meets voltage and power requirements of EAC 2005 VVSG Vol. 1 Section 4.1.2.4	ICC	Accept for Canon DR-X10C only
<i>Temperature/Power Variation/4.1.2.13</i>	MIL-STD-810D, Method 502.2 and Method 501.2 163 hours at 50 degrees to 95 degrees	ICC	Accept for Canon DR-X10C only
<i>Availability/4.3.5</i>	Tests the voting system to help ensure the probability that the equipment will be operational and accomplish set functions. This shall be calculated using the following formula at a 99% availability rate: $A_i = (MTBF) / (MTBF + MTTR)$	ICC	Accept for Canon DR-X10C only

COTS Equipment

NTS has determined that the Democracy Suite 4.14 System’s COTS PCs/laptops/servers are not required to undergo the hardware tests required per the EAC’s “2007-05 Decision on Testing Focus and Applicability” based on the CE, UL, and FCC labeling of the equipment.

#### **4.0 TEST SPECIFICATIONS (Continued)**

##### **4.4.2 Software Module Test Case Design and Data**

NTS implements Component Level Testing during the FCA for each component and subcomponent exercising the functionality of each as designed and documented. NTS will utilize limited structural-based techniques (white-box testing) mainly in the area of Source Code Review, Compliance Builds, and Security Testing and Review. NTS will depend heavily on specification-based techniques (black-box testing) for the individual software components. The most common specification-based techniques applied to the Dominion Democracy Suite 4.14-D during software testing will be “equivalence partitioning” and “boundary value testing.”

- “Equivalence partitioning” will be used to evaluate specific software functions and data entry points of the Democracy Suite 4.14-D 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.

NTS personnel will develop an expected result for each test. The PASS/FAIL criteria at the Component Level will be based on the expected result. If the System Under Test (SUT) meets the expected results, the test will be considered passed. If the SUT does not perform as expected, the test will be evaluated for tester errors, test procedure errors, or test equipment errors. If it is determined there was no tester error, the test will be repeated in an attempt to reproduce the results. If the results can be reproduced and the expected results are not met, the SUT will have failed the test. If the results cannot be reproduced, the manufacturer will be responsible for determining the root cause of the error. Upon correction of the failure a regression test will be performed. If the issue is found to be resolved, then the test will be considered passed, else the test will be considered failed until regression testing finds the issue resolved.

NTS personnel will document the error and track the error through resolution. NTS personnel will not move to the next level of testing until all documented errors are resolved to try and minimize errors that might occur farther along in the test campaign. 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.

(The remainder of this page intentionally left blank)

#### **4.0 TEST SPECIFICATIONS (Continued)**

##### **4.4.3 Software Functional Test Case Design and Data**

The test approach to be used for the Dominion Democracy Suite 4.14-D will be a bottom-up approach where the lower-level components will be tested first and then used to facilitate the testing of higher-level components. The specification-based technique used by NTS personnel at the Integration Level is “Use Case.” The actors that have been identified to use the Dominion Democracy Suite 4.14-D are:

- Election Administrator – The actor with responsibility of entering the election definition including alternative languages and audio. This actor is also responsible for maintaining EMS users and the election database.
- Warehouse Technician – The actor responsible for loading the election definition onto the ICE and ICP units. This actor also runs diagnostic tests and maintains the units.
- Poll Worker – The actor at the precinct location to set up and close down the ICE and ICP units on Election Day.
- Voter – The actor who physically casts the ballot on Election Day.
- ADA Voter – The actor with special needs who has to vote unassisted on Election Day.
- Election Official – The actor who reports and audits the election result post-election day.

“Use Case” will be utilized during the FCA with a single pass through each component using only valid data. This pass will be 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 that will utilize the “Master Copy” of data at the Integration Level are Security and Usability. Where applicable, NTS testers will introduce negative testing to ensure that submitted system either prevents the negative actions or handles the action in an appropriate manner.

If an error occurs between data interfaces or in the process flow, an engineering analysis will be performed to determine if the result of the error is caused by data, the process, or tester error. The ACCEPT/REJECT criteria for Integration Level testing is dependent on whether the components and applications interfaces follow the vendor’s documented process for each actor. If there is an error interfacing between components, the error shall be documented and tracked through resolution. An engineering analysis shall 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.

(The remainder of this page intentionally left blank)



## **4.0 TEST SPECIFICATIONS (Continued)**

### **4.4.4 System Level Test Case Design**

During system level testing, NTS personnel will test the ability of proprietary software, hardware, and peripherals in addition to the COTS software, hardware, and peripherals as a complete system in a configuration of the systems for intended use. The Democracy Suite 4.14-D voting system is intended to support both large and small jurisdictions. NTS personnel's approach for the Democracy Suite 4.14-D voting system will be to execute System Level Testing with a variety of elections that include various combinations of jurisdictions, parties, and ballot styles.

The ACCEPT/REJECT criteria for system level testing determines whether the system can continue in testing. The two conditions for ACCEPT include 1) no errors are observed, or 2) an error is observed and the system continues to operate, and an engineering analysis determines that the root cause does not affect the functionality of the system. The REJECT criteria applies to error conditions that are encountered causing the system to become unstable or unusable, and/or an engineering analysis of an error condition is determined to negatively affect further testing. If an error occurs during System Level testing, the error shall be documented. If the Democracy Suite 4.14-D voting system is able to recover and continue, the test will continue. If the error causes the system to become unstable or unusable, the test shall be halted. All errors documented during System Level Testing shall be tracked through resolution.

An engineering analysis shall be performed to determine what effect the resolution has on the system. A determination shall be made by NTS senior-level engineers whether Regression Testing shall be sufficient or a complete re-test is necessary.

NTS personnel will implement Acceptance Level testing focusing on all the data collected during the entire test campaign along with performing the "Trusted Build" for the system. All data from hardware testing, software testing, functional testing, security testing, volume testing, stress testing, usability testing, accessibility testing, and reliability testing activities will be reviewed to ensure all functions supported by the Democracy Suite 4.14-D voting system have been tested. The EAC 2005 VVSG requirements will be checked against the test data to ensure all applicable requirements are met. Items not supported by the Democracy Suite 4.14-D voting system will be documented. All issues identified during testing will be resolved and annotated in the Test Report prior to its issuance.

NTS personnel will test every EAC 2005 VVSG requirement impacted by the Democracy Suite 4.14-D voting System modification. NTS personnel will report all issues discovered during this test campaign to Dominion and the EAC. If NTS determines there is not enough data to ensure a requirement was met, the test plan will be altered and further testing will be done. The EAC has the final decision as to whether the system meets all the requirements for an EAC-certified system. NTS will either recommend approval, if the system meets all applicable sections of the VVSG, or recommend disapproval if the system does not meet all applicable sections of the VVSG.

(The remainder of this page intentionally left blank)



#### **4.0 TEST SPECIFICATIONS (Continued)**

#### **4.5 TDP Evaluation**

NTS qualified personnel will perform a comprehensive review of the Dominion TDP to determine compliance to the EAC 2005 VVSG requirements and Dominion specific requirements.

NTS qualified personnel utilize a TDP Review Matrix which lists every EAC 2005 VVSG requirement pertaining to TDP review. NTS qualified personnel 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 Dominion. 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 numerous other tests. At the end of the TDP review process, a Discrepancy Report will be issued listing the non-compliant items on a document-by-document basis, if applicable. A listing of all documents contained in the Democracy Suite 4.14-D voting system TDP is provided in Table 4-4.

(The remainder of this page intentionally left blank)

**4.0 TEST SPECIFICATIONS (Continued)**

**4.5 TDP Evaluation (Continued)**

**Table 4-4 Democracy Suite 4.14-D TDP Documents**

<b>Democracy Suite 4.14-D Voting System TDP Documents</b>	<b>Version</b>	<b>Date</b>	<b>Document Number</b>
System Overview	4.14.D::297	7/30/14	2.02
System Security Specification	4.14.D::349	7/28/14	2.06
Configuration Management Plan	4.14.D::196	8/5/14	2.11
Quality Assurance Plan	1.2.0::80	10/16/12	2.12
System Test and Verification Plan	1.1.0::104	10/16/12	2.07
System Test and Verification Suites	2.0.0::1	2/27/13	2.07
Personnel Training and Deployment Requirements	1.1.0::53	4/9/13	2.10
EMS Functionality Description	4.14.D::251	7/22/14	2.03
ICE Functionality Description	4.14.D::78	7/28/14	2.03
ICP Functionality Description	4.14.D::123	7/28/14	2.03
ICC Functionality Description	4.14.D::84	7/22/14	2.03
ICE System Hardware Specification	1.2.0::290	9/19/13	2.04
ICP System Hardware Specification	1.1.0::91	9/19/13	2.04
ICE System Hardware Characteristics	1.2.0::80	9/19/13	2.04.1
ICP System Hardware Characteristics	1.1.0::50	9/19/13	2.04.1
EMS Software Design and Specification	4.14.D::219	7/22/14	2.05
ICE Software Design and Specification	4.14.D::112	7/28/14	2.05
ICP Software Design and Specification	4.14.D::110	7/28/14	2.05
ICC Software Design and Specification	1.0.0::34	11/30/12	2.05
ICP System Operation Procedures	4.14.D::197	7/28/14	2.08
EMS System Operation Procedures	4.14.D::511	7/22/14	2.08
ICE System Operation Procedures	4.14.D::145	7/22/14	2.08
ICC System Operation Procedures	4.14.D::118	7/22/14	2.08
ICP System Maintenance Manual	1.1.0::66	10/16/12	2.09
ICE System Maintenance Manual	1.1.0::115	10/16/12	2.09
EMS System Maintenance Manual	1.0.0::50	10/16/12	2.09
EMS Election Event Designer User's Guide	1.0.0::61	10/16/12	N/A
EMS Results Tally & Reporting User's Guide	1.0.0::67	10/16/12	N/A
EMS Audio Studio User's Manual	1.0.0::24	10/16/12	N/A
EMS Build and Install	2.1.0::5	10/3/12	N/A
ICP Device Configuration Files	1.0.0::22	7/27/12	N/A
ImageCast Election Definition Files	3.0.13	4/9/14	N/A
ICP Firmware Build and Install	4.2.14	10/3/12	N/A
ICP Firmware Update Procedure	1.0.0::12	2/11/13	N/A
ICP Technical Guide	1.0.0::9	10/17/12	N/A
ICE Technical Guide	1.0.0::60	10/17/12	N/A
ICE Build Procedure	1.0.0::36	7/27/12	N/A
ICE Firmware Installation Procedure	1.0.0::27	7/27/12	N/A
Dominion Voting C++ Coding Standard	1.0.0::8	7/27/12	N/A
Dominion Voting Usability Study – ICP	1.0.0::26	7/27/12	N/A
Dominion Voting Usability Study – ICE	1.0.0::36	7/13/12	N/A

#### **4.0 TEST SPECIFICATIONS (Continued)**

#### **4.6 Source Code Review**

As part of the testing activities, the Dominion Democracy Suite 4.14-D source code will be reviewed to the EAC 2005 VVSG coding standards and the manufacturer supplied coding standards. The reviews will be conducted to identify any violation of EAC 2005 VVSG coding standards or manufacturer supplied coding standards. These reviews will be performed per the guidelines described in the following paragraphs by means of either a manual code review, or by utilizing an automated source code review tool.

##### Manual Source Code Review

The source code team will conduct a visual scan of every line of source code. Each identified violation will be recorded by identifying the standards violation, file location within the source code package, file name, and specific line number.

##### Automated Source Code Review

For the portion of source code that is written in C#, an automated source code review will be performed on 90% of the code along with a manual review of 10%. Each identified violation will be recorded by identifying the standards violation, file location within the source code package, file name, and specific line number.

Upon receipt of the source code, a SHA256 hash value will be created for each file. The initial review will include an NTS peer-review on all of the discrepancies identified within the code prior to being returned to the manufacturer. This shall be done to evaluate the correctness of the initial review, along with ensuring all standards violations were identified.

Afterwards, a report of all identified violations will be sent to Dominion for resolution. Once the revised source code has been verified for correctness, a discrepancy report detailing all code-related violations will be issued to the EAC and Dominion. This report will also be included in the final Test Report.

The “Trusted Build” for the Dominion Democracy Suite 4.14-D includes source code, data, and script files in clear text form. The build also includes COTS software on commercially available media, COTS software downloaded by the VSTL, COTS software verified with SHA256 values from the software supplier, and picture and sound files in binary format provided by Dominion Voting Systems.

The final step of the Source Code Review process includes the creation of a “Trusted Build” from the verified source code. The “Trusted Build” will be performed by completing the following tasks in the order listed:

#### **4.0 TEST SPECIFICATIONS (Continued)**

#### **4.6 Source Code Review (Continued)**

- Scrub the build machine's hard drive
- Retrieve the compliant source code
- Construct the build environment
- Create digital signatures of the build environment
- Load the compliant source code into the build environment
- Create a digital signature of the pre-build environment
- Create a disk image of the pre-build environment
- Build executable code
- Create a digital signature of executable code
- Create a disk image of the post-build environment
- Create installation media
- Create a digital signature of the installation media
- Install and verify executable software/firmware on the designated hardware
- Deliver source code with digital signature, disk image of pre-build environment with digital signatures, disk image of post-build environment with digital signatures, executable code with digital signatures, and installation media with signatures to the EAC-Approved Repository.

(The remainder of this page intentionally left blank)

#### **4.0 TEST SPECIFICATIONS (Continued)**

#### **4.7 QA and CM System Review**

Both the Dominion QA Plan and CM Plan will be reviewed. The review will be limited to only the changes within this modification to determine compliance with EAC 2005 VVSG Volume II Section 2, and Volume I Sections 8 and 9, EAC stated requirements, and with the requirements of the internal Dominion documentation. Also, the Dominion TDP documentation package will be reviewed to determine if the Dominion 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 4.5 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 Dominion for resolution.

Additionally, all test results, including functional test data, will be recorded on the relevant NTS Operating Procedure and Test Cases. Results will also be recorded real-time in engineering log books. Incremental reports will be submitted to Dominion 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 personnel will evaluate all test results against the Dominion provided technical documentation for Democracy Suite 4.14-D and the requirements set forth in the EAC 2005 VVSG. The acceptable range for system performance and the expected results for each test case shall be derived from the Democracy Suite 4.14-D documentation. 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 (excluding events from which recovery occurs automatically or where a relevant status message is displayed).

#### **5.3 Test Data Reduction**

Test data shall be processed and recorded in the relevant NTS Operating Procedures and Test Cases. Results will also be recorded real-time in engineering log books.

## 6.0 TEST PROCEDURE AND CONDITIONS

The following subsections describe test procedures and a statement of the criteria by which readiness and successful completion shall be indicated and measured.

### 6.1 Facility Requirements

All testing will be conducted at the NTS Huntsville, AL, facility unless otherwise annotated. 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/NCSL Z540-1 and ISO 10012-1.

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:

- Temperature: 68 to 75 degrees Fahrenheit ( $\pm 4^{\circ}\text{F}$ )
- Relative Humidity: 20 to 90%
- Atmospheric Pressure: Local Site Pressure

Unless otherwise specified herein, the following tolerances shall be used:

- Time  $\pm 5\%$
- Temperature  $\pm 3.6^{\circ}\text{F}$  ( $2^{\circ}\text{C}$ )
- Vibration Amplitude  $\pm 10\%$
- Vibration Frequency  $\pm 2\%$
- Random Vibration Acceleration
  - 20 to 500 Hertz  $\pm 1.5\text{ dB}$
  - 500 to 2000 Hertz  $\pm 3.0\text{ dB}$
- Random Overall grms  $\pm 1.5\text{ dB}$
- Acoustic Overall Sound Pressure Level  $+4/-2\text{ dB}$

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.

(The remainder of this page intentionally left blank)

## **6.0 TEST PROCEDURE AND CONDITIONS (Continued)**

### **6.2 Test Set-Up**

All voting machine equipment (hardware and software), shall be received and documented utilizing NTS' Receiving Ticket (WL-218, Nov 1985) and proper QA procedures. When voting system hardware is received, NTS personnel will notify NTS QA personnel. With NTS QA personnel present, 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, shall be recorded, photographed, and the Dominion Representative shall be notified. NTS 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 shall be brought to the attention of the Dominion Representative for resolution. All TDP and source code modules received will be inventoried and maintained by the NTS Project Engineer 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 personnel will properly configure and initialize the system, and verify that it is ready to be tested by following the procedures detailed in the Democracy Suite 4.14-D voting system technical documentation. NTS personnel will develop an Operational Status Check to be performed prior to and immediately following each hardware test. NTS personnel will develop the system performance levels to be measured during operational tests.

NTS personnel have developed eight election definitions that shall be used during this test campaign:

#### **Operational Status Check**

This election definition will exercise the operational status of the equipment during the operational tests and prior to and immediately following the non-operational hardware tests.

#### **Accuracy**

The accuracy test ensures that each component of the voting system can 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 measured 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.

(The remainder of this page intentionally left blank)

## 6.0 TEST PROCEDURE AND CONDITIONS (Continued)

### 6.2 Test Set-Up (Continued)

#### **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



## 6.0 TEST PROCEDURE AND CONDITIONS (Continued)

### 6.2 Test Set-Up (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

## 6.0 TEST PROCEDURE AND CONDITIONS (Continued)

### 6.2 Test Set-Up (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

## 6.0 TEST PROCEDURE AND CONDITIONS (Continued)

### 6.2 Test Set-Up (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 a closed 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:

- Alternative language utilized with a write-in option
- ADA audio device utilized with a write-in option

## 6.0 TEST PROCEDURE AND CONDITIONS (Continued)

### 6.2 Test Set-Up (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:

- Over-voting
- Under-voting
- Write-in voting
- Spanish language
- Casting of ballots using the ADA Audio capability

## 6.0 TEST PROCEDURE AND CONDITIONS (Continued)

### 6.2 Test Set-Up (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-in 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

## 6.0 TEST PROCEDURE AND CONDITIONS (Continued)

### 6.3 Test Sequence

The components of the Democracy Suite 4.14-D voting system will undergo testing to verify that the modification performs as described by Dominion and meets the requirements of the 2005 VVSG. The following sections provide a list of each test and a brief description of each test. NTS personnel will utilize a combination of functional testing and TDP reviews to evaluate the system performance. (The tests are not in a specific sequence.)

#### 6.3.1 Hardware Test Descriptions

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 test, the EUT shall be subjected to an operational status check.

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).

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).

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. The test for electromagnetic susceptibility shall be conducted in compliance with the test specified in IEC 61000-4-3 (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. The test for conducted RF immunity shall be conducted in compliance with the test specified in IEC 61000-4-6 (Volume II, Section 4.8.g).

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

**6.0 TEST PROCEDURES AND CONDITIONS (Continued)**

**6.3.1 Hardware Test Descriptions (Continued)**

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.

**Table 6-1 Democracy Suite 4.14-D Hardware Test Sequence**

<b>Test</b>	<b>Description</b>	<b>Procedure</b>	<b>Test Level</b>	<b>Specimen</b>
Electromagnetic Radiation	FCC Part 15 Class B for both radiated and conducted emissions	OP 9	Component	ICE w/optional external monitor
Electrostatic Disruption	IEC 61000-4-2 (1995-01) 15kV air discharge and 8kV contact discharge	OP 10	Component	ICE w/optional external monitor
Electromagnetic Susceptibility	IEC 61000-4-3 electromagnetic field of 10V/m modulated by a 1kHz, 80% AM modulation at 80MHz to 1000MHz frequency	OP 11	Component	ICE w/optional external monitor
Conducted RF Immunity	IEC 61000-4-6 (1996-04) conducted radio frequency energy	OP 14	Component	ICE w/optional external monitor
Temperature Power Variation	MIL-STD-810D, Method 502.2 and Method 501.2 163 hours at 50 degrees to 95 degrees	OP 21	Component	Canon DR-G1130

## 6.0 TEST PROCEDURES AND CONDITIONS (Continued)

### 6.3.1 Hardware Test Descriptions (Continued)

**Table 6-1 Democracy Suite 4.14-D Hardware Test Sequence (Continued)**

Maintainability	The ease with which preventive maintenance actions can be performed	OP 27	Component & Document	ICE w/optional external monitor, Canon DR-G1130, & TDP
Electrical Supply	Meets voltage and power requirements of 2005 VVSG Vol. 1 Section 4.1.2.4	OP 29	Component	ICE w/optional external monitor, Canon DR-G1130

### 6.3.2 Software Test Descriptions

The software tests include the following:

Source Code Compliance Review – NTS qualified personnel will compare the source code to the manufacturer's software design documentation to ascertain how completely the software conforms to the manufacturer's specifications. Source code inspection shall also assess the extent to which the code adheres to the requirements in Section 5 of the EAC 2005 VVSG Volumes I and II.

Compliance Build of the System Software, Firmware, and Utilities – Before testing can begin, compliance builds of all the applications will be constructed by NTS personnel using the build environment, build documentation, and reviewed source code. This is to ensure the software being tested is constructed from the same source code that was reviewed.



## 6.0 TEST PROCEDURES AND CONDITIONS (Continued)

### 6.3.2 Software Test Descriptions (Continued)

COTS Source Code Review – Unmodified, general purpose COTS non-voting software (e.g., operating systems, programming language compilers, database management systems, and web browsers) are not subject to the detailed examinations specified in this section; however, NTS personnel will examine such software to ensure that the specific version of software being used is identical to the design specification in order to confirm that the software has not been modified. NTS will verify by downloading the software directly from the manufacturer site, verifying against NRSLS, or by being provided original OEM discs.

NTS qualified personnel may inspect the COTS generated software source code in preparation of test plans and to provide some minimal scanning or sampling to check for embedded code or unauthorized changes. For purposes of code analysis, the COTS units shall be treated as unexpanded macros.

The portions of COTS software that have been modified by the manufacturer in any manner are 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 personnel to enable review.

Baseline of EMS Operating and Build Machine OS – NTS personnel will review the submitted NIST SCAP FDCC checklist for the EMS Operating System and Build Machine OS. The review will be performed for completeness, clarity, and consistency.

Security Source Code Review – The security source code review is a detailed review of the functionality of the source code that has been submitted. Both automated and manual reviews of the source code will be performed.

Trusted Build – The trusted build is a process of converting the reviewed source code into machine-readable binary instructions for a computer. This test will follow Section 5.6 of the EAC Testing and Certification Program manual.

(The remainder of this page intentionally left blank)

**6.0 TEST PROCEDURES AND CONDITIONS (Continued)**

**6.3.2 Software Test Descriptions (Continued)**

**Table 6-2 Democracy Suite 4.14-D Software Test Sequence**

<b>Test</b>	<b>Description</b>	<b>Procedure</b>	<b>Test Level</b>	<b>Specimen</b>
Compliance Source Code Review	Source code review for compliance	NTSHVS14.2 OP 5a	Component	Source Code
Compliance Build	Using the build documents and source code to construct the EMS	NTSHVS14.3 OP 7b, OP 7c	Component	Source Code
Source Code COTS Review	Source code review to examine 3 <sup>rd</sup> party products for modification and versions	NTSHVS14.2 OP 5d	Component	COTS Source Code
Baseline OS	RFI 2008-03 OS Configuration	NTSHVS14.3 OP 25	Component	NIST SCAP FDCC Checklist
Source Code Functional Review	Source code review for functionality and high level software design	NTSHVS14.2 OP 5b	Component & Integration	Source Code
Source Code Security Review (manual)	Source code review for specific security concerns augmented by an automated review	NTSHVS14.2 OP 5c OP 6a	Component & Integration	Source Code
Trusted Build	Creation and installation of the final system software	NTSHVS14.6 OP 7, OP 7a	Component	System software

(The remainder of this page intentionally left blank)

## 6.0 TEST PROCEDURES AND CONDITIONS (Continued)

### 6.3.3 System Testing

Physical Configuration Audit – 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 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

Functional Configuration Audit – The functional configuration audit encompasses an examination of manufacturer’s tests, and the conduct of additional tests, to verify that the system hardware and software perform all the functions described in the manufacturer’s documentation submitted in the TDP. In addition to functioning according to the manufacturer’s documentation, tests will be conducted to ensure all 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 VVSG requirements. The path that the tester navigates follows the logical flow of accomplishing tasks 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 are determined to be at risk for failure that are outside of the normal flow of the interface will be tested on an individual basis.

## 6.0 TEST PROCEDURES AND CONDITIONS (Continued)

### 6.3.3 System Testing (Continued)

In addition to verifying the functional modifications being introduced, the ICE with optional external monitor will be subjected to a functional reliability test. This test will be designed to mimic the ballot requirements of the Temperature and Power Variation test, except the test will be conducted outside of chamber environment, and the ballots will be cast continually instead of on an hourly basis.

TDP Review – The technical data package must be submitted as a precondition of national certification testing. These items are necessary to define the product and its method of operation; to provide technical and test data supporting the manufacturer’s claims of the system’s functional capabilities and performance levels; and to document instructions and procedures governing system operation and field maintenance. Any information relevant to the system evaluation shall be submitted to include source code, object code, and sample output report formats.

Usability – The usability test is a measure of the effectiveness, efficiency, and satisfaction achieved by a specified set of users with a given product in the performance of specified tasks. This test applies to the requirements for Volume I, Section 3 of the EAC 2005 VVSG. Usability testing shall take place on the ICE with optional external monitor being introduced into the system configuration.

Volume/Stress – Tests to investigate 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.

The central count scanners shall be subjected to the test as outlined in the EAC 2005 VVSG as follows:

- The ICC shall be subjected to overload conditions

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

(The remainder of this page intentionally left blank)

## 6.0 TEST PROCEDURES AND CONDITIONS (Continued)

### 6.3.3 System Testing (Continued)

In an effort to achieve this and to verify the proper functionality of the units under test, the following methods will be used to test components of the voting system:

The accuracy requirements for the ICE with external monitor will be met by the execution of the standard accuracy test.

- Stand-Alone Precinct Scanner – 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.

The accuracy requirements for Canon DR-G1130 will be met by the execution of the standard accuracy test.

- Central Count Scanner – Tested per model 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.

System Integration – System Level certification tests address the integrated operation of both hardware and software, along with any telecommunication capabilities. Compatibility of the voting system software components or subsystems with one another, and with other components of the voting system environment, shall be determined through functional tests integrating the voting system software with the remainder of the system.

Additionally, the system shall be configured exactly as it would for normal field use. This includes connecting all supporting equipment and peripherals including ballot boxes, voting booths (regular and accessible), and any physical security equipment such as locks and ties. NTS personnel will properly configure and test the system by following the procedures detailed in the Democracy Suite 4.14-D voting system technical documentation.

Regression Testing – Regression Testing will be performed on all system components to verify all functional and firmware modifications made during the test campaign did not adversely affect the system and its operation.

NTS will verify the audit log records for error and exception activity to verify proper documentation and recovery action for all functional tests performed. A detailed listing of all audit log entries shall be provided by Dominion in the TDP submitted. During testing, audit log entries will be compared to this list to ensure that all expected events are recorded. To ensure the system's ability to gracefully shutdown and recover from error conditions, negative test cases will be performed to introduce such error conditions. The error conditions introduced will be based on the system limits specified within the vendors TDP documentation.

(The remainder of this page intentionally left blank)

**6.0 TEST PROCEDURES AND CONDITIONS (Continued)**

**6.3.3 System Testing (Continued)**

**Table 6-3 Democracy Suite 4.14-D System Test Sequence**

<b>Test</b>	<b>Description</b>	<b>Procedure</b>	<b>Test Level</b>	<b>Specimen</b>
Physical Configuration Audit	Audit hardware and software models and versions	NTSHVS14.3 OP 25	Component & System	System hardware and software
Functional Configuration Audit	Functional testing to the system documentation and EAC 2005 VVSG requirements	NTSHVS14.4 OP 26	Component & Integration	EMS, ICC, ICE with optional external monitor
Technical Data Package (TDP) Review	Documentation review for compliance, correctness, and completeness	NTSHVS14.1 OP 3	Document	TDP package
Accuracy	Test of accuracy to ~1.6 million ballot positions per system component.	NTSHVS14.9 OP 41	System	System
System Integration	Test of all system hardware, software and peripherals.	OP 30	System	System
Usability/ Accessibility	Testing to the system documentation and EAC 2005 VVSG requirements	OP 22 OP 24-1 a-g OP 24-2 a-f	Integration	ICE with optional external monitor
Volume & Stress	Test to investigate the system's response to larger amounts of data than it is expecting.	OP 26 OP 30	System	Canon DR-G1130

**7.0 TEST OPERATIONS PROCEDURES**

**7.1 Proprietary Data**

All proprietary data that is marked will be distributed only to those persons that the manufacturer or EAC identifies as needing the information to conduct qualification testing. The manufacturer is required to mark all proprietary documents as such. All organizations and individuals receiving proprietary documents will ensure those documents are not available to non-authorized persons.

**APPENDIX A**  
**PROJECT SCHEDULE**

Task Name	Duration	Start	Finish
EAC Application and Approval	3 days	7/14/2014	7/16/2014
NTS Receive Equipment	6 days	7/17/2014	7/24/2014
<b>Test Plan</b>	<b>45 days</b>	<b>7/28/2014</b>	<b>9/29/2014</b>
Test Plan Development	10 days	8/4/2014	8/15/2014
Test Plan to Dominion for Review	3 days	8/18/2014	8/20/2014
Test Plan Update	1 day	8/21/2014	8/21/2014
EAC Review	20 days	8/22/2014	9/19/2014
NTS Review and Update	2 days	9/22/2014	9/23/2014
EAC Approval of Test Plan	10 days	9/24/2014	10/8/2014
Source Code Review	16 days	7/23/2014	8/13/2014
Compliance Builds	2 days	8/14/2014	8/15/2014
Network Setup And Software Installation	3 days	8/18/2014	8/20/2014
TDP Review	15 days	7/24/2014	8/13/2014
Physical Configuration Audit	7 days	7/25/2014	8/4/2014
Electrical Supply	1 day	8/21/2014	8/21/2014
Hardware - EMC Testing for ICE Monitor	5 days	8/18/2014	8/22/2014
Temperature and Power Variation - Central Count	4 days	8/20/2014	8/25/2014
Reliability Test - New ICE Monitor	5 days	9/24/2014	9/30/2014
Maintainability	1 day	8/22/2014	8/22/2014
Functional Testing - Central Count, EMS, ICP, ICE with monitor	20 days	8/26/2014	9/23/2014
Usability	2 days	9/24/2014	9/25/2014
Accessibility	2 days	9/26/2014	9/29/2014
Accuracy	4 days	9/15/2014	9/18/2014
Volume and Stress	3 days	9/19/2014	9/23/2014
System Integration	6 days	9/30/2014	10/7/2014
Trusted Builds	5 days	10/8/2014	10/14/2014
Regression Testing	3 days	10/15/2014	10/17/2014
Build and Tool Validation	5 days	10/15/2014	10/21/2014
<b>Test Report</b>	<b>47 days</b>	<b>10/8/2014</b>	<b>12/15/2014</b>
Test Report Development	11 days	10/8/2014	10/22/2014
Test Report to Dominion for Review	2 days	10/23/2014	10/24/2014
Test Report Update	1 day	10/27/2014	10/27/2014
EAC Review	20 days	10/28/2014	11/24/2014
NTS Review and Update	3 days	11/25/2014	12/1/2014
EAC Approval of Test Report	10 days	12/2/2014	12/15/2014



**APPENDIX B**  
**CHANGE NOTES**

<b>Item</b>	<b>Description</b>	<b>Product</b>
1	Introduction of Adjudication 2.0	Adjudication
2	Added ability to override global settings for visual elements on the level of contrast. Added ability to print graphics in candidate cell, next to candidate name, on selected contests. Added basic control of the layout and content of Write-in cells.	EED
3	Added ability to generate printer calibration sheet. Added ability to render crop marks on ballots.	EED
4	Changes in code to support FW changes to the battery voltage table	ICP
5	Extended election files for ICP with list of audio languages per Ballot Manifestation. Support for languages without textual representation, i.e. audio-only languages (Navajo)	EED
6	MBS enhancements are improved in the following ways: 1. Reports multiple write-in positions separately on zero and result tape 2. Total cast and Total Voters numbers are available on the results transfer tape	ICE
7	Override functionality enables improved configurability in the following ways: New translation adding, Translation files overriding, Static audio files overriding	ICE
8	Improvements regarding presentations of voting rules errors	ICE
9	Ability to Manage Reporting Profiles on SOVC, ESR, Cards Cast. Ability to Import/Export Reporting Profiles	RTR
10	Added DCF Option to Format Zero Totals Tape Separate From Format of Results Tape.	ICP
11	Support for audio notification when voting error occurs in Standard session only. Added MBS option enables/disables audio. Added MBS option supports volume adjustment.	ICE

Item	Description	Product
12	The following logos are updated: Boot Startup Logo, Linux Startup Logo, Application Startup Logo, Verification Screen displays the new logo and a new monochrome hourglass widget	ICE
13	Ability to Use Canon DR-G1130 with ICC application	ICC
14	Open Primary including the Pick-A-Party variant as required for WI	ICP
15	<p>Added ability to respond to cross-over ballot errors. New MBS options introduced:</p> <ul style="list-style-type: none"> <li>- Show/hide Partisan contests on the reports</li> <li>- Show/hide Elector Groups on the reports</li> </ul> <p>Ballot Review improvements:</p> <ul style="list-style-type: none"> <li>- If there are no votes on entire Open Primary ballot, for the contest that belongs to an Elector Group, report it as NO VOTES CAST</li> </ul>	ICE
16	<p>New Office Type Party Preference. Added ability to render Party Preference Contests on ballot. Added ability to pass Party Preference Contest Information to tabulators via election files</p>	EED
17	Support for Party Preference rule in Standard and AVS. Added ability to report Party Preference Contest on the tape	ICE
18	Added ability to handle Party Preference Contest Results	RTR
19	Added support for Cross-Over rule for Open Primaries into the spreadsheet.	EDT

Item	Description	Product
20	Added support for Undeclared Open Primaries into election files for tabulators. Added ability to apply Cross-Over rule to Elector Groups. Added support for creation of audio for Electoral Groups.	EED
21	Ability to apply Open Primary voting rules (e.g. Stop on Cross Votes)	ICC
22	Support for Open Primaries including a DCF option to group per election group on the report tape	ICP
23	Added support for Undeclared Open Primary voting rules.	RTR
24	Adjudication PDF reports are digitally signed: Reports exported from the Adjudication system are digitally signed so that the user is assured that the reports are authentic.	Adjudication
25	Adjudication User choices logged during installation: Items are logged for each choice made by a user during the installation process so that the options chosen are available for troubleshooting.	Adjudication
26	All report timestamps updated to ISO 8601 format: All reports(activity and log) adhere to ISO 8601 format ex. yyyy-mm-ddTHH:mm:ss.s-7:00	Adjudication
27	Bug Fix: Resolved issue resulting in BallotPreparer using incorrect calculation when setting vote marks based on marginal mark threshold, causing discrepancies when bringing results into RTR.	Adjudication

**APPENDIX C**  
**SOFTWARE TABLES**

**Democracy Suite 4.14-D EMS Software Platform Components**

<b>Software Required For Testing</b>	<b>Software Version</b>	<b>Filename</b>
Democracy Suite EMS EED Client Application	4.14.37	setup.exe, EED_FED_CERT.Setup_64b.msi
Democracy Suite EMS RTR Client Application	4.14.37	setup.exe, RTR_FED_CERT.Setup_x64.Setup.msi
Democracy Suite EMS File System Service Client Application	4.14.37	setup.exe, DemocracySuiteEMS_FSS_Setup.msi
Democracy Suite EMS Audio Studio Client Application	4.14.37	setup.exe, EMSAS2010Setup.msi
Democracy Suite EMS Data Center Manager	4.14.37	DemocracySuiteEMS_DCM.exe
Democracy Suite EMS Application Server	4.14.37	setup.exe, EMSApplicationServer_FED_CERT.Setup_x64.Setup.msi

**Democracy Suite 4.14-D ImageCast Precinct Software Components**

<b>Software Required For Testing</b>	<b>Software Version</b>	<b>Filename</b>
Election Firmware	4.14d.17-US	cf2xx.sig
Firmware Updater	4.14d.17-US	firmUp.enc
Firmware Extractor	4.14d.17-US	FirmwareExtract.enc
Kernel (uClinux)	4.14d.17-US	Image.bin.gz
Boot Loader (COLILO)	20040221	colilo.bin

**Democracy Suite 4.14-D ImageCast Evolution Software Components**

<b>Software Required For Testing</b>	<b>Software Version</b>	<b>Filename</b>
Voting Machine	4.14.19	GApplication-4.14.21.vhd.7z
Election Application	4.14.19	dvs
Linux Kernel	2.6.30.9-dvs- 21.3	uImage
Linux Device File	1.3	mpc8347dvs.dtb

**Democracy Suite 4.14-D ImageCast Evolution Software Components (Continued)**

<b>Software Required For Testing</b>	<b>Software Version</b>	<b>Filename</b>
Root File System	1.0.21	rfs
Ram Disk	1.0.1	initrd.img
Boot Startup Logo	5.0.0	logo_platform.bmp
Linux Startup Logo	5.0.0	logo_os.bmp
Boot Loader	1.3.4.29	u-boot.bin
Motherboard FPGA	1.1.5	ice2_mc_p1.bit
Scanner Board FPGA	1.1.2	ice2_scb_p2.bit
Logger Controller	1.0.11	logger.bin
Power Controller	2.0.7	power.bin
Integrated Printer	4.1.6	integratedPrinter.hex, printerFont.hex

**Democracy Suite 4.14-D ImageCast Central Software Components**

<b>Software Required For Testing</b>	<b>Software Version</b>	<b>Filename</b>
ImageCast Central Application	4.14.d16	ImageCast Central.exe
Image-Analysis DLL	4.14.4	ImgProc.dll
Windows 7	COTS	Operating System for COTS ICC computer when using Canon DR-X10C and DR-G1130 scanners

**Democracy Suite 4.14-D EMS Software Platform Third Party Software Components**

<b>Software Required For Testing</b>	<b>Software Version</b>	<b>Filename</b>
Infragistics NetAdvantage Win Forms 2011.1	2011 Vol.1	NetAdvantage_WinForms_20111.msi
TX Text Control Library for .NET	16.0	TX Text Control.NET for Windows Forms 16.0.exe

**Democracy Suite 4.14-D EMS Client Application Software Components**

<b>Software Required For Testing</b>	<b>Software Version</b>	<b>Filename</b>
Microsoft Windows 7 x64	6.1	Microsoft DVD provided
Windows Server 2008 R2 x64	6.1	Microsoft DVD provided
Adobe Reader	10.1.1	AdbeRdr1011_en_US.exe
Microsoft .NET Framework 4.0	4.0	dotNetFx40_Full_x86_x64.exe
Microsoft SQL Server 2008 R2 x64	10.0	Microsoft DVD provided
Microsoft SQL Server 2008 Express R2 x64	10.50.4000.0	SQLXPRAADV_x64_ENU.exe
Microsoft SQL Server 2008 R2 SP1 x64	10.51.4000.0	SQLServer2008R2SP1-KB2528583-x64-ENU.exe
Microsoft Visual J# 2.0 Redistributable Package – Second Edition (x64)	2.0	vjredist64.exe
1-Wire Driver version 4.0.3b x64	4.0.3	install_1_wire_drivers_x64_v403beta.msi
Java Runtime Environment 6.0 x64	6.0.290	jre-6u29-windows-x64.exe
Microsoft Visual C++ 2010 SP1 Redistributable Package(x86)	10.0.40219	vc redistrib_x86.exe
Microsoft Access Database Engine 2010 Redistributable	1 (published 12/16/2010)	AccessDatabaseEngine.exe AccessDatabaseEngine_x64.exe

**Democracy Suite 4.14-D EMS Software Platforms Unmodified COTS Components**

<b>Software Required For Testing</b>	<b>Software Version</b>	<b>Filename</b>
Infragistics NetAdvantage Win Forms 2011.1	2011 Vol.1	NetAdvantage_WinForms_20111.msi (for details see document Components_3rdParty_1.0.xlsx)
TX Text Control Library for .NET	16.0	TX Text Control.NET for Windows Forms 16.0.exe (for details see document Components_3rdParty_1.0.xlsx)
Microsoft.Net Framework Library	4.0	dotNetFx40_Full_x86_x64.exe (for details see document Components_3rdParty_1.0.xlsx)
Sox	14.3.1	sox.exe,libgomp-1.dll,pthreadgc2.dll,zlib1.dll (for details see document Components_3rdParty_1.0.xlsx)



**Democracy Suite 4.14-D EMS Software Platforms Unmodified COTS Components (Continued)**

Log4net	1.2.10	log4net.dll, log4net.xml (for details see document Components_3rdParty_1.0.xlsx)
NLog	1.0.0.505	NLog.dll (for details see document Components_3rdParty_1.0.xlsx)
iTextSharp	5.0.5.0	itextsharp.dll (for details see document Components_3rdParty_1.0.xlsx)
OpenSSL	1.2.3	openssl.exe, lebeay32.dll, ssleay32.dll (for details see document Components_3rdParty_1.0.xlsx)
SQLite	1.0.65.0	System.Data.SQLite.DLL 32-bit and 64-bit (for details see document Components_3rdParty_1.0.xlsx)
Lame	3.99.4	lame.exe (for details see document Components_3rdParty_1.0.xlsx)
Speex	1.0.4	speexdec.exe and speexenc.exe (for details see document Components_3rdParty_1.0.xlsx)
Ghostscript	9.04	gsdll32.dll – both 32-bit and 64-bit (for details see document Components_3rdParty_1.0.xlsx)
PdfToImage	1.2	PdfToImage.dll (for details see document Components_3rdParty_1.0.xlsx)
SharpSSH package	1.1.1.13	Tamir.SharpSSH.dll, Diffie.Hellman.dll, Org.Mentalis.Security.dll (for details see document Components_3rdParty_1.0.xlsx)
One Wire API for .NET	4.0.2.0	OneWireAPI.NET.dll (for details see document Components_3rdParty_1.0.xlsx)
Avalon-framework-cvs- 20020806	20020806	avalon-framework-cvs-20020806.jar (for details see document Components_3rdParty_1.0.xlsx)
Batik	0.20-5	batik.jar (for details see document Components_3rdParty_1.0.xlsx)

**Democracy Suite 4.14-D EMS Software Platforms Unmodified COTS Components (Continued)**

Software Required For Testing	Software Version	Filename
Fop	0.20-5	fop.jar (for details see document Components_3rdParty_1.0.xlsx)
Microsoft Visual J# 2.0 Redistributable Package – Second Edition (x64)	2.0	vjc.dll,vjsjbc.dll,vjslibcw.dll,vjsnativ.dll,vjssupuili b.dll,vjstvwaux.dll (for details see document Components_3rdParty_1.0.xlsx)

**Democracy Suite 4.14-D ImageCast Precinct Unmodified COTS Software Components**

Software Required For Testing	Software Version	Filename
PNG Reference Library	1.2.24	libpng-1.2.24.tar.gz
OpenSSL	1.1.2	Openssl-fips-1.1.2.tar.gz
Zlib	1.2.3	Zlib-1.2.3.tar.gz

**Democracy Suite 4.14-D ImageCast Evolution Unmodified COTS Software Components**

Software Required For Testing	Software Version	Filename
busybox	1.20.2	busybox-1.20.2.tar.bz2
e2fsprogs	1.42.4	e2fsprogs-1.42.4.tar.gz
expat	2.1.0	expat-2.1.0.tar.gz
fontconfig	2.9.0	fontconfig-2.9.0.tar.gz
freetype	2.4.9	freetype-2.4.9.tar.bz2
i2c-tools	3.1.0	i2c-tools-3.1.0.tar.bz2
libjpeg	v8d	jpegsrc.v8d.tar.gz
libogg	1.3.0	libogg-1.3.0.tar.gz
libpng	1.5.10	libpng-1.5.10.tar.gz
libusb	1.0.8	libusb-1.0.8.tar.bz2
libusb-compat	0.1.3	libusb-compat-0.1.3.tar.bz2
linux	2.6.30.9	linux-2.6.30.9.tar.bz2
openssl-fips	1.2.3	openssl-fips-1.2.3.tar.gz
ppp	2.4.5	ppp-2.4.5.tar.gz
qt-everywhere	4.7.3	qt-everywhere-opensource-src-4.7.3.tar.gz
skell	1.19	skell-1.19.tar.gz

**Democracy Suite 4.14-D ImageCast Evolution Unmodified COTS Software Components  
(Continued)**

soundtouch	1.6.0	soundtouch-1.6.0.tar.gz
speex	1.2rc1	speex-1.2rc1.tar.gz
sqlite	3.7.13	sqlite-autoconf-3071300.tar.gz
sysfsutils	2.1.0	sysfsutils-2.1.0.tar.gz
tiff	4.0.1	tiff-4.0.1.tar.gz
tzcode	2012b	tzcode2012b.tar.gz
tzdata	2012c	tzdata2012c.tar.gz
usb-modeswitch	1.2.4	usb-modeswitch-1.2.4.tar.bz2
usb-modeswitch-data	20120815	usb-modeswitch-data-20120815.tar.bz2
zlib	1.2.7	zlib-1.2.7.tar.bz2
log4cplus	1.0.4.1	log4cplus-1.0.4.1.tar.bz2
quazip	0.5	quazip-0.5.tar.gz

**Democracy Suite 4.14-D ImageCast Central Build Environment Software Build Components  
(Unmodified COTS)**

<b>Software Required For Build</b>	<b>Software Version</b>	<b>Filename</b>
Windows 7	Home Premium	OEM installed, or full CD from Microsoft
Windows XP	Professional	OEM installed, or full CD from Microsoft
Visual Studio	2005	Full CD from Microsoft

**Democracy Suite 4.14-D ImageCast Central Build Environment Setup Software Utilities  
(Unmodified COTS)**

<b>Software Required For Build</b>	<b>Software Version</b>	<b>Filename</b>
7-Zip	9.20	7z920.exe
Active Perl 64-bit	5.12.4.1205	ActivePerl-5.12.4.1205-MSWin32-x64-294981.msi
Nasm	2.09.07	nasm-2.09.07-win32.zip

**Democracy Suite 4.14-D ImageCast Central Software Build Library Source Code  
(Unmodified COTS)**

<b>Software Required For Build</b>	<b>Software Version</b>	<b>Filename</b>
OpenSSL	FIPS 1.2.3	openssl-fips-1.2.3.tar.gz

**Democracy Suite 4.14-D ImageCast Central Runtime Software Components (Unmodified COTS)**

<b>Software Required For Testing ICC application</b>	<b>Software Version</b>	<b>Filename</b>
Imgcomp.dll	2.11	apiman.zip
1 Wire driver 64-bit	4.03	install_1_wire_drivers_x64_v403.msi
Kofax VRS	4.50	Full CD from Kofax
VCredist	4/10/2006	vcredist_x86.exe

**Democracy Suite 4.14-D ImageCast Precinct Modified COTS Software Components**

<b>Software Required For Testing</b>	<b>Software Version</b>	<b>Filename</b>
uClinux	20070130	uClinux-dist-20070130.tar.gz
COLILO Boot Loader	20040221	Colilo20040221.tar.gz

**Democracy Suite 4.14-D ImageCast Evolution Modified COTS Software Components**

<b>Software Required For Testing</b>	<b>Software Version</b>	<b>Filename</b>
Kernel	2.6.30.9-dvs-21.3	uImage
U-BOOT	1.3.4.29	u-boot.bin

**Democracy Suite 4.14-D EMS Software Build Environment Components**

<b>Software Required For Testing</b>	<b>Software Version</b>	<b>Filename</b>
Microsoft Windows Server 2008 R2 x64	6.1	Microsoft DVD provided
7-Zip	9.20	7z920-x64.msi
Microsoft Visual Studio 2010	10.0	Microsoft DVD provided
Microsoft SDK for Windows 7	7.1	GRMSDKX_EN_DVD.iso
Microsoft.NET Framework Library	4.0	
Microsoft Visual Studio 2010 Service Pack 1	10.0 SP1	VS2010SP1dvd1.iso
Microsoft patch KB2286556	N/A	VS10-KB2286556-x86.exe
ImgBurn	2.5.7.0	SetupImgBurn_2.5.7.0.exe
Infragistics NetAdvantage Win Forms 2011.1	2011 Vol.1	NetAdvantage_WinForms_20111.msi
TX Text Control Library for .NET	16.0	TX Text Control.NET for Windows Forms 16.0.exe
Speex	1.0.4	speex_win32_1.0.4_setup.exe
Microsoft Visual J# 2.0 Redistributable Package – Second Edition (x64)	2.0	vjredist64.exe
ActivePerl	5.12.4	ActivePerl-5.12.4.1205-MSWin32-x64-294981.msi

**Democracy Suite 4.14-D ImageCast Precinct Election Firmware Compiler**

<b>Software Required For Testing</b>	<b>Software Version</b>	<b>Filename</b>
g++ (GNU C++ compiler)	gcc3.4.0-20040603	m68k-uclinux-tools-c++-gcc3.4.0-20040603.sh

**Democracy Suite 4.14-D ImageCast Evolution Election Firmware Compiler**

<b>Software Required For Testing</b>	<b>Software Version</b>	<b>Filename</b>
g++ (GNU C++ compiler)	gcc-4.5.38-eglibc-2.11.38	freescale-powerpc-linux-gnu-2011.03-38.i686.rpm

**Democracy Suite 4.14-D ImageCast Precinct Firmware Build Environment Components**

<b>Software Required For Testing</b>	<b>Software Version</b>	<b>Filename</b>
Ubuntu 10.04 LTS – Long-term support	10.04	ubuntu-10.04.2-desktop-amd64.iso
Toolchain Installation Script	N/A	Toolchain.sh
m68k uClinux tools base gcc	3.4.0-20040603	m68k-uclinux-tools-base-gcc3.4.0-20040603.sh
m68k uClinux tools c++ gcc	3.4.0-20040603	m68k-uclinux-tools-c++-gcc3.4.0-20040603.sh
m68k uClinux tools gdb	20040603	m68k-uclinux-tools-gdb-20040603.sh
OpenSSL	1.1.2	Openssl-fips-1.1.2.tar.gz

**Democracy Suite 4.14-D ImageCast Evolution Firmware Build Environment Components**

<b>Software Required For Testing</b>	<b>Software Version</b>	<b>Filename</b>
Ubuntu	10.04 LTS	ubuntu-10.04.3-desktop-i386.iso
LTIB	10.1.1a	ltib-10-1-1a-sv.tar.gz
g++ (GNU C++ compiler)	gcc-4.5.38-eglibc-2.11.38	freescale-powerpc-linux-gnu-2011.03-38.i686.rpm