Test Report

Dominion Voting Systems
Democracy Suite (D-Suite) System
Version 5.4-NM
Certification Testing

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1 Introduction

The purpose of this Test Report is to document the procedures that Pro V&V, Inc. followed to evaluate the Dominion Democracy Suite (D-Suite) 5.4 Voting System to the requirements set forth for voting systems in the U.S. Election Assistance Commission (EAC) 2005 Voluntary Voting System Guidelines (VVSG), Version 1.0.

1.1 References

The documents listed below were utilized in the development of this Test Report:

- Election Assistance Commission (EAC) 2005 Voluntary Voting System Guidelines (VVSG) Version 1.0, Volume I, "Voting System Performance Guidelines", and Volume II, "National Certification Testing Guidelines"
- Election Assistance Commission Testing and Certification Program Manual, Version 2.0
- Election Assistance Commission Voting System Test Laboratory Program Manual, Version 2.0
- National Voluntary Laboratory Accreditation Program NIST Handbook 150-2016, "NVLAP Procedures and General Requirements (NIST Handbook 150)", dated July 2016
- National Voluntary Laboratory Accreditation Program NIST Handbook 150-22, 2008 Edition, "Voting System Testing (NIST Handbook 150-22)", dated May 2008
- United States 107th Congress Help America Vote Act (HAVA) of 2002 (Public Law 107-252), dated October 2002
- Pro V&V, Inc. Quality Assurance Manual, Version 7.0
- EAC Requests for Interpretation (RFI) (listed on www.eac.gov)
- EAC Notices of Clarification (NOC) (listed on www.eac.gov)
- NTS Test Report No. PR036164-01, Rev. C, "Test Report for EAC 2005 VVSG Certification Testing Performed on Dominion Voting Systems 4.14-E, EAC Certification Number: DVS-DemSuite4.14-E", dated 06/25/2015
- Pro V&V Test Report No. TR-01-01-DVS-2016-01.01, Rev. D, "Test Report for EAC 2005 VVSG 1.0 Certification Testing Dominion Voting Systems Democracy Suite (D-Suite) Version 5.0-A Voting System", EAC Project Number DVS1601, dated 2/7/17
- Pro V&V Test Report No. TR-01-02-DVS-012-2017.01, "Test Report for Dominion Voting Systems Democray Suite (D-Suite) System Version 5.2 Gap Analysis Testing", dated 7/31/17

- Dominion Voting Systems Democracy Suite 5.4-NM Technical Data Package *(A listing of the D-Suite 5.4-NM documents submitted for this test campaign is listed in Section 2.4 of this Test Plan)*

1.2 Terms and Abbreviations

The terms and abbreviations applicable to the development of this Test Report are listed below:

"ADA" – Americans with Disabilities Act 1990

"ATI" – Audio Tactile Interface

"BMD" – Ballot Marking Device

"CM" – Configuration Management

"COTS" – Commercial Off-The-Shelf

"DRE" – Direct Record Electronic

"EAC" – United States Election Assistance Commission

"EMS" – Election Management System

"FCA" – Functional Configuration Audit

"HAVA" – Help America Vote Act

"ICC" – ImageCast Central

"ICE" – ImageCast Evolution

"ICP" – ImageCast Precinct

"ISO" – International Organization for Standardization

"NOC" – Notice of Clarification

"PCA" – Physical Configuration Audit

"PCOS" – Precinct Count Optical Scan

"QA" – Quality Assurance

"RFI" – Request for Interpretation

"RTR" – Results Tally & Reporting

"TDP" – Technical Data Package

"UPS" – Uninterruptible Power Supply

"VSTL" – Voting System Test Laboratory

"VVSG" – Voluntary Voting System Guidelines

1.3 Background

The D-Suite 5.0-A System (the predecessor of the D-Suite 5.4-NM System) was granted certification to the 2005 Voluntary Voting System Guidelines (VVSG) by the Election Assistance Commission (EAC) on August 14, 2017. The D-Suite 5.4-NM System is a modification of the D-Suite 5.0-A system; the ICE component, however, was baselined from the D-Suite 4.14-E System, which was granted EAC certification to the 2005 VVSG by the EAC on July 2, 2015.

The Democracy Suite 5.4-NM Voting System is a paper-based optical scan voting system consisting of the following major components: The Election Management System (EMS), the ImageCast Central (ICC) optical ballot scanner, the ImageCast Precinct (ICP) optical ballot scanner, and the ImageCast Evolution (ICE) optical ballot scanner and ballot marking device.

1.4 Scope

The scope of the test campaign included tests designed to verify that certain D-Suite 5.4-NM features and applications, which have been modified from the EAC certified 5.0-A and 4.14-E baselines, conform to the applicable EAC 2005 VVSG 1.0 requirements. The D-Suite 5.4-NM includes functional and usability enhancements to the baselined D-Suite 4.14-E and 5.0-A Systems, as summarized below (for a detailed list of modifications, refer to Dominion TDP Document *2.13 System Change Notes*):

Election Management System

General

1. EMS components to utilize Windows Authentication instead of SQL Server Authentication

2. Ability for system to utilize self-encrypting drives as an additional security feature

3. All components now running on combination of Windows 10, Windows Server 2012R2, with SQL Server 2016. Also included are scripts for security hardening procedures.

Election Event Designer

1. Ability to configure how common cards are consolidated
2. Ability to create a convention for the ballot ID, artwork file name and description
3. Ability to generate one or more ballots without generating all ballots in the election project
4. Modified the specification of available area for Write-in detection, which is passed through the election files to the optical scan tabulators.
5. Ability to generate distinct ballot ID's for Precinct Portions with Identical Ballot Content
6. Extending Paragraph Alignment Attributes to allow for more flexibility
7. Contest Headings now have a Global Order Field
8. Ability to indicate which District Types can appear on Print Tape

Results Tally & Reporting

1. Ability to break-down results per precinct for consolidated ballots
2. New report export providing information on what precincts each batch of results contains
3. Ability to select multiple precincts for the Summary Report
4. Ability to indicate in a project whether disabled contests and candidates should appear in the Election Summary and Statement of Votes Cast reports
5. Improvements in reporting
6. Ability to track precinct information for consolidated cards
7. Ability to bypass adjudication for early voting results
8. Refactoring of CVR Service to allow for improved performance and reliability during loading, adjudicating and publishing of results

9. Extended Service to allow Adjudication to retrieve list of Qualified Write-ins, and add new Qualified Write-ins to the master list

10. Refactoring of SQL Server Reporting Service based reports to allow for improved performance and more flexibility in extending reporting capabilities.

11. Ability to generate Statement of Votes Cast report by Ballot Type

12. The existing CVR export can now be generated in Excel format

13. A report indicating the date and time when each results batch was loaded into the EMS database

14. Ability to remove provisional votes into a separate results batch in order to allow for adjudication of standard results in a batch

15. Ability to export audit images sorted by Candidate

16. User is informed if there are pending provisional ballots before pushing results to Adjudication

Election Data Translator

1. Ability to import subsets of data using the application: New languages and translations, template assignment, and tabulators.

Adjudication

1. The resume function has been made more robust

2. Adjudication Administrator can now perform tasks on a remote client machine, rather than the server

3. Master list of qualified write-ins is now managed by Election Event Designer

4. Admin can add a new write-in "on the fly" after the project has been created. Write-ins will be added to master list and will be synchronized for all adjudicators

5. Ability to prevent a ballot from being completed until all write-ins are resolved

6. The Adjudicator can now see the AuditMark alongside the image of the ballot being adjudicated

7. Adjudicator can now skip a ballot and continue adjudicating remainder of batch

ICC

1. Added support for a TWAIN interface
2. Added option to force to ICC to overrun a preset number of ballots every time scanning stops mid-batch
3. Switching election projects in ICC has been simplified
4. Improvements to Write-in Area detection
5. Application now runs on Windows 10
6. Added support for processing RCV contests

ICP

1. Improvements to Write-in Area detection
2. ICP is no longer restricted to 10 pre-defined languages
3. Now able to print list of admin areas as part of the tape header
4. Added Tabulator name to footer section of the tape
5. Added support for processing RCV contests

ICE

1. Added support for Cast Vote Record format
2. Improved ink cartridge management of interval between print head servicing routines
3. Added support for printing test page from Pollworker menu
4. Added MBS options to Advance Administration node
5. Added support for printing write in image on the thermal tape
6. Improved instructions related to AVS write in session
7. Added MBS options to enable vote verification for standard and QR ballot types
8. Added support for processing RCV contest in Standard and AVS

9. Improved AuditMark synchronization between ICC and ICE (font and header content)
10. Improvements to Write-in Area detection
11. Support image splitting metadata so when using a single PNG image for ballots, heights of the ballot front, back, and AuditMark are now embedded as tags so that it can be easily split

2 Testing Overview

The evaluation of the D-Suite 5.4-NM System was designed to evaluate the voting system to the requirements set forth for voting systems in the EAC 2005 VVSG. The goals were constructed to verify that certain D-Suite 5.4-NM features and applications, which have been modified from the EAC certified 5.0-A and 4.14-E baselines, conform to the applicable EAC 2005 VVSG 1.0 requirements. The evaluation addressed each of the following test goals in the following manner:

Table 2-1: Testing Overview

Test Goal	Testing Response
Perform TDP Modification Review	A cursory review of the modified documents was performed to ensure that adequate system information exists.
Perform PCA & Receipt Inspection	A PCA and Receipt Inspection was performed to compare the voting system components and materials submitted for testing against the manufacturer's technical documentation to ensure everything was in agreement and correct.
Perform Source Code Review, Compliance Builds, and Documentation Review	Trusted Builds were generated during the test campaign. The source code submitted by Dominion was reviewed by PRO V&V and was successfully built using the submitted COTS and third party software products. Additionally, build documentation was reviewed.

Table 2-1: Testing Overview *(continued)*

Verified that the D-Suite 5.4-NM System meets the applicable requirements of the EAC 2005 VVSG 1.0.	This was tested by evaluating the D-Suite 5.4-NM System to specific election scenarios using a combination of different ballot programming approaches, ballot designs, ballot sizes, languages, and tabulators.
Perform System Setup, Loads, and Hardening	The system setup, loads, and hardening was tested by comparing the voting system submitted for certification testing to the manufacturer's technical documentation.
Simulated pre-election, Election Day, absentee, recounts, and post-election activities on the D-Suite 5.4-NM System during Functional Configuration Audit (FCA).	The components of the D-Suite System were tested in pre-election, Election Day, post-election and recount situations and evaluated against documented behavior and expected results for all scenarios.
Perform Regression Security Testing	The security assessment performed by Pro V& V consisted of a physical security review on the ICE.
Perform Modification Usability & Accessibility Testing	A Usability and Accessibility evaluation was performed on the ICE modifications.
Perform FCA-Regression Testing	FCA functional regression testing was performed on all submitted modifications to the baselined systems.
Perform Accuracy Testing	Performed accuracy testing that included over 1,549,703 ballot positions on the ICE, ICP, & ICC each.

Table 2-1: Testing Overview *(continued)*

Perform Volume/Stress testing	Ran Max Contests, Max Candidate, and System Limits elections on ICE, ICP, & ICC each
Complete System Integration Testing	The components of the D-Suite System were tested to address the integration of hardware and software. This testing focused on the compatibility of the voting system software components and subsystems with one another and with other voting system components. Accuracy Testing was performed to verify that the voting system components could process ballot positions within the allowable target error rate by testing the ability of the system to "capture, record, store, consolidate, and report" specific voter selections and absences of a selection.

2.1 Test Candidate

The Democracy Suite 5.4-NM Voting System is a paper-based optical scan voting system consisting of the following major components: The Election Management System (EMS), the ImageCast Central (ICC) optical ballot scanner, the ImageCast Precinct (ICP) optical ballot scanner, and the ImageCast Evolution (ICE) ballot marking device.

Election Management System (EMS)

The Democracy Suite 5.4-NM EMS consists of various components running as either a front-end/client application or as a back-end/server application. A listing of the applications and a brief description of each is presented below.

Front-end/Client applications:

- EMS Adjudication: Represents the client component responsible for adjudication, including reporting and generation of adjudicated result files from ImageCast Central tabulators and adjudication of write-in selections from ImageCast Precinct, ImageCast Evolution, and ImageCast Central tabulators. This client component is installed on both the server and the client machines. *(Note: The EMS Adjudication feature is optional)*

- EMS Audio Studio: A client application that 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.

- EMS Election Data Translator: End-user application used to export election data from election project and import election data into election project.

- EMS Election Event Designer: A client application that integrates election definition functionality together with ballot styling capabilities and represents a main pre-voting phase end-user application.

- EMS Results Tally and Reporting: A client application that integrates election results acquisition, validation, tabulation, reporting, and publishing capabilities and represents the main post-voting phase end-user application.

Back-end/Server applications:

- 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.

- EMS Application Server: Represents a server side application responsible for executing long running processes, such as rendering ballots, generating audio files and election files, etc.

- EMS Database Server: Represents a server side RDBMS repository of the election project database which holds all the election project data, including pre-voting and post-voting data.

- EMS Data Center Manager: A server application that represents a system level configuration application used in EMS back-end data center configuration.

- EMS File System Service: A back-end application that acts as a stand-alone service that runs on client machines, enabling access to low level operating system API for partitioning CF cards, reading raw partition on ICP CF card, etc.

- EMS NAS Server: Represents a server side file repository of the election project file based artifacts, such as ballots, audio files, reports, log files, election files, etc.

ImageCast Central (ICC) Count Scanner

The ICC is a high-speed, central ballot scan tabulator based on Commercial off the Shelf (COTS) hardware, coupled with the custom-made ballot processing application software. It is used for high speed scanning and counting of paper ballots.

ImageCast Precinct (ICP) - BMD Audio

The ICP device is a hybrid precinct optical scan paper/DRE ballot counter designed to provide three major functionalities: ballot scanning and tabulation, ballot review and second chance voting, and accessible voting and ballot marking with one of the optional external HP printers.

The ICP also allows a voter to cast a ballot via an audio device. The audio voting capability of the tabulator allows the voter to listen to and vote for all names on the ballot. Using the audio assisting device (which is connected to the tabulator), the voter listens to an audio voting session. The audio assisting device allows the voter to adjust the volume of the audio, change the speed of the audio playback, jump to the next and go back to the previous name, and to cast a vote.

ImageCast Central (ICC) Count Scanner

The ICC is a high-speed, central ballot scan tabulator based on Commercial off the Shelf (COTS) hardware, coupled with the custom-made ballot processing application software. It is used for high speed scanning and counting of paper ballots.

ImageCast Evolution (ICE) Count Scanner

The ICE is a precinct-level, optical scan, ballot counter (tabulator) designed to perform three major functions: ballot scanning and tabulation, ballot review and second chance voting, accessible voting and ballot marking.

2.1.1 Configuration Components

Election Administration

Democracy Suite Election Management System (EMS)

- Dominion Voting Systems Democracy Suite EMS 5.4.17.5 containing:
    - Election Event Designer
    - Results Tally and Reporting
    - Audio Studio
    - Application Server
    - Data Center Manager
    - File System Service

- Adjudication Service
- Election Data Translator
- Adjudication

- DCF Version 50401
- MBS Version 5.2.17-New Mexico
- Optional Adjudication 5.4.17.3

COTS Hardware and Software

- EMS Standard Configuration
  - Microsoft Windows Server 2012 R2
  - Microsoft SQL Server 2016 Standard
  - Server computer system per *2.02 Democracy Suite System Configuration Overview*
- EMS Express Server Configuration
  - Microsoft Windows 10 Professional
  - Microsoft SQL Server 2016 Express with Advanced Services
  - Desktop computer system per *2.02 Democracy Suite System Configuration Overview*
- Client Workstation Configuration
  - Microsoft Windows 10 Professional
  - Desktop computer system per 2.02 Democracy Suite System Configuration Overview
- EMS COTS Software common to Standard and Express configurations
  - Microsoft.Net Framework 4.5
  - Microsoft.Net Framework 3.5

        - Microsoft IIS (part of the Windows installation, not a separate item)
        - Microsoft Visual J# 2.0
        - Microsoft Visual C++ 2015 Redistributable
        - Java SE Runtime Environnent 6.0 Update 20 or later
        - Dallas 1-Wire Device Driver version 4.03 or newer
        - RAID utility
        - Adobe Reader DC
    - Optional COTS Software for Standard and Express configurations
        - Microsoft Windows Defender (Express Server)
        - Avast! anti-virus software (Standard Server)
        - Cepstral Voices (English, Spanish, etc.) 6.2.3
        - Microsoft Excel 2010 or later
        - Additional Fonts (Arial narrow fonts, 2.37a)
        - UPS drivers
        - Printer drivers
- Auxiliary Equipment
    - iButton (SHA-1) with USB Reader/Writer: Maxim DS9490R#
    - Compact Flash Reader: Lexar Professional USB 3.0 Dual-Slot Card Reader or equivalent
    - LCD monitor, keyboard, mouse, headset, audio adapter, networking switch – COTS computing accessories
- Election media
    - iButton: Maxim DS1963S-F5+

- DVS Compact Flash Memory Cards: 4GB, 8GB, 16GB, or 32GB
- USB Memory Device: 4GB, 8GB, or 16GB
- Smart Cards: ACOS-6-64

Central Count

ImageCast Central Count (ICC)

- ICC software application: version 5.4.2.1

COTS Software:

- ICC COTS computer operating system: Windows 10 (64-bit) Professional edition
- Microsoft Windows Defender
- Microsoft Visual C++ 2015 Redistributable
- Dallas Maxim: 1-wire driver - version 4.03 or newer, 64 bit (32 bit as needed)
- Canon: DR-G1130 driver - version 1.3.6157

COTS Hardware:

- ICC Scanner: Canon DR-G1130
- Desktop or All-in-One computer
    - Microsoft Windows 10 Professional
    - Desktop computer system per *2.02 Democracy Suite System Configuration Overview*

Precinct Vote Capture

ImageCast Precinct (ICP)

- ICP Firmware: version 5.4.2.001
- Hardware version: PCOS-320A, PCOS-320C
    - HW Board Revision: 1072

- IR Sensor Board Firmware version: 1.0.003
- LCD Firmware version: 122
- LCD Bitmap version: 38
- CPLD version: 8
- PSU Hardware version: 4
- PSU Firmware version: 39
- w/ Ballot Box (stackable or foldable)
- Optional Accessible Tactile Interface (ATI) box, version 1.10

Optional Software

- Boot Loader (COLILO) 20040221

Optional COTS Software

- None

Optional COTS products

- HP-7110 Printer
- Headphone: Cyber Acoustics ACM-70 or equivalent
- Sip & puff enabling device #972
- Sip & puff straws #970K (Pkg of 10)
- Hand paddle switches (aka tactile buttons) enabling device #971

ImageCast Evolution (ICE)

- ICE Firmware: version 5.4.8.3
- Hardware version: PCOS 410A (includes IR Security Sensor) and PCOS 410A Rev 39
    - IR Sensor Board Firmware version: 1.0.003

- Motherboard FPGA version: 1.1.5
- Scanner Board FPGA version: 1.1.2
- Logger Controller version: 2.02
- Power Controller version: 3.0.4
- Integrated Printer Controller version: 4.1.6
- Bootloader version : 1.3.4.61
- w/ Ballot Box (stackable or foldable)
- Optional Light Pole for Ballot Boxes
- Optional Accessible Tactile Interface (ATI) box, version 1.10

COTS Software

- None

Optional COTS Software

- None

Optional COTS products

- Headphone: Cyber Acoustics ACM-70 or equivalent
- Sip & puff enabling device #972
- Sip & puff straws #970K (Pkg of 10)
- Hand paddle switches (aka tactile buttons) enabling device #971

2.1.2 Supported Languages

The following languages have been stated to be supported by the by D-Suite 5.4-NM System:

- Alaskan Native
- Bengali

- Chinese
- English
- Eskimo
- Filipino
- French
- Hindi
- Japanese
- Khmer
- Korean
- Spanish
- Thai
- Vietnamese
- Native American
    - Apache, Jicarilla, Keres, Navajo, Seminole, Towa, Ute, Yuman

Due to the limited scope of the testing, only English, Spanish, and Chinese ballots were cast during testing. The accuracy of the translations between languages was not verified.

2.1.3 Supported Functionality

The Democracy Suite 5.4-NM is designed to support the following voting variations:

- General Election
- Closed Primary
- Partisan/Non-Partisan Offices
- Write-In Voting
- Primary Presidential Delegation Nominations

- Ballot Rotation
- Straight Party Voting
- Cross-party Endorsement
- Split Precincts
- Vote for N of M
- Recall issues, with options
- Cumulative voting
- Ranked order voting
- Provisional or Challenged Ballots

2.2 Testing Configuration

The testing event utilized one setup of the D-Suite 5.4-NM System and its components as configured for normal use. The following is a breakdown of the D-Suite 5.4-NM System components and configurations for the test setup:

Standard Testing Platform:

The central count location utilized a Canon DR-G1130 scanner connected to an ICC workstation. Additionally, the central count location housed a standard and an EMS express server containing all of the D-Suite Express Server components listed above.

The polling locations utilized three ICP precinct scanners with one set up with the external HP printers to act as an accessibility station; and three ICE precinct scanners with accessibility equipment.

2.3 Test Support Equipment/Materials

All test support equipment and materials required to facilitate testing were supplied by Dominion.

2.4 Technical Data Package

This subsection lists all manufacturer provided documentation that is relevant to the system being tested.

Table 2-2. TDP Documents

Document Number	Description	Version
Adjudication Documents		
2.05	Democracy Suite Adjudication Software Design and Specification	5.4-NM::92
2.08	Democracy Suite Adjudication System Operation Procedures	5.4-NM::140
2.09	Democracy Suite Adjudication System Maintenance Manual	5.4-NM::74
Democracy Suite Documents		
2.02	Democracy Suite System Overview	5.4-NM::107
2.06	Democracy Suite System Security Specification	5.4-NM::504
2.07	Democracy Suite System Test and Verification	5.4-NM::161
2.10	Democracy Suite Personnel Deployment and Training Requirements	5.4-NM::103
2.11	Democracy Suite Configuration Management Process	5.4-NM::331
2.12	Democracy Suite Quality Assurance Program	5.4-NM::130
2.13	Democracy Suite System Change Notes	5.4-NM::81
EMS Documents		
2.03	Democracy Suite EMS Functional Description	5.4-NM::340
2.05	Democracy Suite EMS Software Design and Specification	5.4-NM::288
2.08	Democracy Suite EMS System Operations Procedures	5.4-NM::695
2.09	Democracy Suite EMS System Maintenance Manual	5.4-NM::120
---	Democracy Suite EMS System Installation and Configuration Procedure	5.4-NM::227
ImageCast Central Documents		
2.03	Democracy Suite ImageCast Central Functionality Description	5.4-NM::151
2.05	Democracy Suite ImageCast Central Software Design and Specification	5.4-NM::95
2.08	Democracy Suite ImageCast Central System Operation Procedures	5.4-NM::183
---	Democracy Suite ImageCast Central Installation and Configuration Procedure	5.4-NM::120
ImageCast Evolution		
2.03	Democracy Suite ImageCast Evolution Functionality Description	5.4-NM::110
2.04	Democracy Suite ImageCast Evolution System Hardware Specications	5.4-NM::323
2.05	Democracy Suite ImageCast Evolution System Hardware Specications	5.4-NM::160

Table 2-2. TDP Documents *(continued)*

Document Number	Description	Version
2.08	Democracy Suite ImageCast Evolution System Operation Procedures	5.4-NM::227
2.09	Democracy Suite ImageCast Evolution System Maintenance Manual	5.4-NM::155
ImageCast Precinct		
2.03	Democracy Suite ImageCast Precinct Functionality Description	5.4-NM::163
2.04.01	Democracy Suite ImageCast Precinct System Hardware Characteristics	5.4-NM::81
2.04	Democracy Suite ImageCast Precinct System Hardware Specifications	5.4-NM::130
2.05	Democracy Suite ImageCast Precinct Software Design and Specification	5.4-NM::138
2.08	Democracy Suite ImageCast Precinct System Operation Procedures	5.4-NM::257
2.09	Democracy Suite ImageCast Precinct System Maintenance Manual	5.4-NM::111
User Guides		
---	Democracy Suite ImageCast Adjudication User Guide	5.4-NM::5
---	Automated Test Deck User guide	5.4-NM::7
---	Audio Studio User Guide	5.4-NM::5
---	Election Data Translator User Guide	5.4-NM::7
---	Democracy Suite EMS Election Event Designer User Guide	5.4-NM::196
---	Mobile Ballot Production User Guide	5.4-NM::5
---	Results Tally and Reporting User Guide	5.4NM.9
---	Democracy Suite ImageCast Central User Guide	5.4-NM::7
---	Democracy Suite ImageCast Voter Activation User Guide	5.4-NM::60
---	Democracy Suite ImageCast Precinct User Guide	5.4-NM:5
Supplementary Documents		
---	Democracy Suite ImageCast Evolution Firmware Installation Procedure	5.4-NM::84
---	Democracy Suite ImageCast Evolution Machine Behavior Settings	5.4-NM::85
---	Democracy Suite ImageCast Evolution Level One (L1) Maintenance Manual	5.4-NM::123
---	Usability Study of Dominion Voting Systems ImageCast Evolution Versions 4.1.1.1 and 4.6.1.1	5.4-NM::37
---	Democracy Suite ImageCast Precinct Extracting Firmware Contents	5.4-NM::27
---	Democracy Suite ImageCast Precinct Firmware Update Procedure	5.4-NM::43

Table 2-2. TDP Documents *(continued)*

Document Number	Description	Version
---	Democracy Suite ImageCast C++ Coding Standard	5.4-NM::36
---	Democracy Suite C# Automated Code Review Process	5.4-NM::31
---	Dell Latitude E7470 Owner's Manual	Rev. A02
---	Cyber Acoustics ACM-70B Stereo Headphones Product Sheet	---
---	Dell P2417H Monitor User's Guide	Rev. A01
---	Dell Networking X-Series Specification Sheet	Ver. 1.9
---	Canon DR-G1130 User Manual	---
---	Democracy Suite ImageCast Device Configuration Files	5.4-NM::79
---	Democracy Suite ImageCast Printing and Finishing Specification	55.4-NM::69
---	Democracy Suite ImageCast Total Results File Format	5.4-NM::39
---	Democracy Suite ImageCast Election Definition Files	5.4-NM::50
---	ImageCast Precinct Level One (L1) Maintenance Manual	5.4-NM::52
---	ImageCast Precinct Technical Guide	5.4-NM::36
---	HP OfficeJet Pro 8210 User Guide	---
---	HP OfficeJet 7110 User Guide	---
---	Dell Precision Tower 3420 Owner's Manual	Rev. A00
---	Dell Latitude 3470 Owners Manual	Rev. A00
---	Dell Latitude 3480 Owners Manual	---
---	Dell PowerEdge R630 Owners Manual	Rev. A03
---	APC Back-UPS BE600M1 User Manual	---
---	APC Back-UPS Pro BR1000G User Manual	---
---	APC Back-UPS SMT1500 User Manual	---
---	Tripp Lite SmartPro SM1500RMXL2UTAA Datasheet	---
---	Dell Optiplex 3050 AiO Owners Manual	---
---	Dell Optiplex 7440 AiO Owner's Manual	---
---	Lexar Pro USB 3.0 Dual Slot Reader Quick Start Guide	---
---	Usability Test Report of ImageCast Precinct 5.0 with 36 Participants for VVSG 1.0	5.0::10
Build Documents		
---	Democracy Suite EMS Software Build Document	5.4NM::1

Table 2-2. TDP Documents *(continued)*

Document Number	Description	Version
---	Democracy Suite ImageCast Evolution Firmware Build, Prerequisites Setup and Installation	5.4-NM::83
---	Democracy Suite ImageCast Precinct Firmware Build and Install	5.4-NM::60

3 Test Process and Results

The following sections outline the test process that was followed to evaluate the D-Suite 5.4-NM System under the scope defined in Section 1.4.

3.1 General Information

All testing was conducted under the guidance of Pro V&V by personnel verified by Pro V&V to be qualified to perform the testing. The examination was performed at the Pro V&V, Inc. test facility located in Huntsville, AL.

3.2 Test Cases/Procedures

To verify that the system met the applicable requirements, Pro V&V utilized baseline test cases augmented with supplemental test cases designed specifically for the system being evaluated in this test campaign.

Prior to execution of the required test cases/procedures, the system under test was subjected to testing initialization to establish the baseline for testing and ensure that the testing candidate matched the expected testing candidate and that all equipment and supplies were present.

The following tasks were completed during the testing initialization:

- Ensured proper system of equipment. Checked power cords, keys, etc.
- Checked version numbers of (system) software and firmware on all components.
- Verified the presence of the documented EUT.
- Ensured removable media is clean.
- Ensured batteries are fully charged.
- Inspected supplies and test decks.

- Checked protective counters on all tabulators.
- Reviewed physical security measures of modifications.
- Recorded basic observations of the testing setup and review.
- Recorded serial numbers of equipment.
- Retained proof of version numbers.

3.3 Test Results

The procedures that were utilized during the test engagement and the results obtained are summarized in the following paragraphs. During the evaluation, the test team made observations of general system behavior.

Source Code Review/Trusted Build – A source code review was performed in order to review the submitted source code to the specific requirements. Both manual and automated review techniques were used per EAC approved procedures. The Source Code Review included a Compliance Build and a Trusted Build of the submitted source code. To perform the Trusted Build, Dominion-submitted source code, COTS, and Third Party software products were inspected and combined to create the executable code. Additionally, during the performance of the Trusted Build, the build documentation was reviewed.

Summary Findings:

At the conclusion of the Source Code Review, compliant source code was available for performance of the Trusted Build process. During execution of the Trusted Build, the source code submitted by Dominion and reviewed by PRO V&V was successfully built using the submitted COTS and third party software products, and the reviewed build documentation.

Functional Configuration Audit (FCA) Regression Testing – During this area of testing, the specific functionality of the modified system under evaluation that is claimed by the manufacturer in their supplied Change Notes and Scope was targeted to ensure the product functions as documented. This testing used both positive and negative test data to test the robustness of the system.

Regression testing was performed an all system components to verify that all functional and/or firmware modifications made during the test campaign did not adversely affect the system and its operation.

Summary Findings:

The FCA was completed successfully with no anomalies or deficiencies noted. The modifications were against baseline test cases supplemented with specifically designed test cases. The FCA testing included verification of the submitted modifications detailed in the change notes.

All functional tests were successfully executed. During execution of the test procedure, it was verified that the D-Suite 5.4-NM System successfully completed the system level integration tests with all actual results obtained during test execution matching the expected results. Results were also verified back through the EMS.

Accuracy – An accuracy test was performed to ensure that the voting system components could process ballot positions within the allowable target error rate. This test was designed to test the ability of the system to "capture, record, store, consolidate, and report" specific voter selections and absences of a selection.

Summary Findings:

To perform the Accuracy Test, ballots were scanned by the ICC, ICP & ICE and a results report was generated. Sufficient ballots were scanned to ensure each component accurately scanned at least a total of 1,575,000 ballot positions. During execution of the test procedure, it was verified that the D-Suite 5.4-NM System successfully completed the accuracy test with all actual results obtained during test execution matching the expected results. Results were also verified back through the EMS.

System Integration – System level certification tests were performed to address the integration of the hardware and software. This testing focused on the compatibility of the voting system software components and subsystems with one another and with other components of the voting system. During test performance, the system was configured as would be for normal field use.

Summary Findings:

System Integration was performed on the entire Democracy Suite 5.4-NM system. To perform the System Integration test, three General Elections and three Primary Elections were designed in the EED application. The elections were then loaded onto ICE and ICP ballot marking devices. Ballots were marked using the ICE and ICP units and were read by the ICC. The results were sent to RTR for results reporting. The System Integration included the elections described below, which were run from end-to-end:

Three general elections with the following breakdowns:

— General Election held in three precincts (one of which was a split precinct resulting in four jurisdictional divides) with nineteen contests

— General Election held in three precincts. This election contained fifteen contests compiled into three ballot styles.

— General Election 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.

Three primary elections with the following breakdowns:

— Open Primary Election in two precincts. This election contained thirty contests compiled into five ballot styles.

— Primary Election held in two precincts. This election contained thirteen contests compiled into three ballot styles. One contest is in all three ballot styles; all other contests are independent.

— Primary Election 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.

Note: As part of the previous test campaign (Democracy Suite (D-Suite) System Version 5.2 VVSG 1.0 Gap Analysis Test Report), Ranked Choice Voting was successfully tested.

During execution of the test procedure, it was verified that the D-Suite 5.4-NM System successfully completed the system level integration tests with all actual results obtained during test execution matching the expected results.

Physical Configuration Audit (PCA) – A PCA was performed to compare the voting system components submitted for testing to the manufacturer's technical documentation. The PCA was conducted in two phases: Initial and Final. The Initial PCA was conducted in order to baseline the system prior to test campaign commencement. The Final PCA was conducted in order to verify the final software and hardware configurations.

Summary Findings:

During execution of the test procedure, the components of the D-Suite 5.4-NM System were documented by component name, model, serial number, major component, and any other relevant information needed to identify the component. For COTS equipment, every effort was made to verify that the COTS equipment had not been modified for use. Additionally, each technical document submitted in the TDP was recorded by document name, description,

document number, revision number, and date of release. At the conclusion of the test campaign, test personnel verified that any changes made to the software, hardware, or documentation during the test process were fully and properly documented.

Usability & Accessibility – Usability and Accessibility Testing was performed per the applicable requirements of the EAC 2005 VVSG 1.0. For this portion of the test campaign, results from the previous state effort and the EAC certification effort were reused as applicable. The system was then subjected to testing as needed.

Summary Findings:

The D-Suite 5.4-NM System successfully completed the applied Usability and Accessibility testing.

Security – During the execution of a security penetration evaluation, the system modifications were inspected to verify that various controls and measures were in place in order to meet the objectives of the security standards which include: protection of the critical elements of the voting system; establishing and maintaining controls to minimize errors; protection from intentional manipulation, fraud and malicious mischief; identifying fraudulent or erroneous changes to the voting system; and protecting the secrecy in the voting process.

Summary Findings:

The D-Suite 5.4-NM System successfully completed the applied Physical Security testing.

4 Conclusions

Based on the results obtained during the test campaign and the re-use of testing from the previous D-Suite 5.0-A and 4.14-E EAC certification test campaigns, where applicable, Pro V&V determines the D-Suite 5.4-NM System, as presented for evaluation, meets the requirements set forth for voting systems in the U.S. Election Assistance Commission (EAC) 2005 Voluntary Voting System Guidelines (VVSG), Version 1.0. Throughout the test campaign, as tests were executed, resultant data was inspected and technical documentation reviews were performed to ensure that each applicable requirement was met; therefore, fulfilling the test goals.