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Test Report for EAC 2005 VVSG Certification Testing  
Dominion Voting Systems Democracy Suite (D-Suite) Version 5.5  
Voting System

EAC Project Number: DVS1702

Version: Revision B

Date: 9/17/2018

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U.S. Election Assistance Commission

**VSTL**

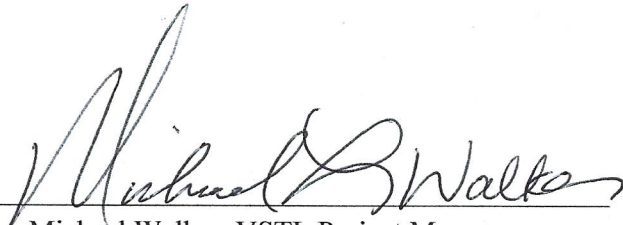
EAC Lab Code 1501



NVLAP LAB CODE 200908-0

**SIGNATURES**

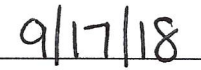
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**REVISIONS**

<b>Revision</b>	<b>Description</b>	<b>Date</b>
NR	Initial Release	8/20/2018
A	Updates EAC Comments	8/31/2018
B	Final version with highlights removed	9/17/2018

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## 1.0 INTRODUCTION

The purpose of this Test Report is to document the procedures that Pro V&V, Inc. followed to perform certification testing during a system modification campaign for the Dominion Voting Systems Democracy Suite (D-Suite) 5.5 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. Certification testing of the D-Suite 5.5 Voting System submitted for evaluation was performed to ensure the applicable requirements of the EAC 2005 VVSG and the EAC Testing and Certification Program Manual, Version 2.0, were met. Additionally, all EAC Request for Interpretations (RFI) and Notices of Clarification (NOC) relevant to the system under test were incorporated in the test campaign.

Prior to submitting the voting system for testing, Dominion Voting Systems submitted an application package to the EAC for certification of the D-Suite 5.5 Voting System. The application was accepted by the EAC and the project was assigned the unique Project Number of DVS1702.

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

The D-Suite 5.5 Voting System is a paper-based optical scan voting system with a hybrid paper/DRE option consisting of the following major components: The Election Management System (EMS), the ImageCast Central (ICC), the ImageCast Precinct (ICP), the ImageCast X (ICX) DRE w/ Reports Printer, ImageCast X (ICX) DRE w/VVPAT, and the ImageCast X (ICX) BMD. The D-Suite 5.5 Voting System configuration is a modification from the EAC approved D-Suite 5.0 system configuration.

The following subsections describe the baselined D-Suite 5.0 Voting System. Detailed descriptions of the D-Suite 5.0 test campaign are contained in Pro V&V Test Report No. TR-01-01-DVS-2016-01.01 Rev. D, which is available for viewing on the EAC's website at [www.eac.gov](http://www.eac.gov).

*The EAC Certified System that is the baseline for the submitted modification is described in the following subsections. All information presented was derived from the previous Certification Test Report, the EAC Certificate of Conformance and/or the System Overview.*

#### **Election Management System (EMS)**

The D-Suite 5.0 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 and ImageCast

Central tabulators. This client component is installed on both the server and the client machines.

- 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
- ImageCast Voter Activation: An application, installed on a workstation or laptop at the polling place, which allows the poll workers to program smart cards for voters. The smart cards are used to activate voting sessions on ImageCast X.
- 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 Election Device Manager: Application used for production and programming of election files, and other accompanying files, for ImageCast X terminals.
- 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.

- Smart Card Helper Service: A service that is installed on a workstation or laptop at the polling place, and provides required data format for programming smart cards for ImageCast devices, or, for jurisdiction's voting registration system in case of integration.

### **ImageCast Precinct (ICP)**

The ICP device is a hybrid precinct optical scan paper/DRE ballot counter designed to provide six major functionalities: ballot scanning, second chance voting, accessible voting, ballot review, tabulation, and poll worker functions.

For ballot scanning functionality the ICP scans marked paper ballots, interprets voter marks on the paper ballots and stores the ballots for tabulation when the polls are closed.

Second Chance voting refers to scenarios in which an error has been detected on the voter's paper ballot (e.g., blank ballot, undervoted ballot, overvoted ballot, misread ballot, cross-over voted ballot), and the ICP notifies the voter by displaying a message or providing an audio visual cue, that one of these situations has been detected, and offers the voter an opportunity to reject and fix their ballot, or to cast the ballot as-is.

Accessible voting allows voters with disabilities to listen to an audio representation of a ballot and use a hand held controller called an Audio Tactile Interface (ATI) to make vote selections, which are then saved directly to the ICP when the voter casts their Accessible Voting ballot.

The Ballot Review feature allows a voter to review their vote selections using an audio or visual representation, which displays or presents the voter with a complete listing of all contests contained on the ballot and an indication of the results which will be recorded for each contest once the voter's ballot is cast.

The Tabulation of paper ballots and Accessible Voting ballots cast by voters is performed when the polls are closed on the ICP unit and the unit tabulates the results, generates results files for aggregation into RTR, and prints a results report containing the results of the ballots cast.

For poll worker functions the ICP contains a small touch-screen LCD to allow the poll worker to initiate polling place activities, diagnostics and reports.

### **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 X (ICX) Ballot Marking Device (BMD)**

The Democracy Suite ImageCast X ballot marking platform is a solution that is used for creation of paper cast vote records. These ballots can be scanned, reviewed, cast and tabulated at the polling location on an ImageCast Precinct device or later scanned and tabulated by the ImageCast Central optical ballot scanner. The ImageCast X also supports enhanced accessibility voting through optional accessories connected to the ImageCast X unit.



The ICX is a proprietary application which runs on any of the tablets listed in Table 1-21.

The tables below describe the certified equipment and firmware versions of the baselined D-Suite 5.0 System. Detailed descriptions of the D-Suite 5.0 test campaign are contained in Pro V&V Report No.TR-01-01-DVS-2016-01.01 Rev. D, which is available for viewing on the EAC's website at [www.eac.gov](http://www.eac.gov).

**Table 1-1. Democracy Suite 5.0 EMS Software Component Descriptions**

Software	Version	Filename	Configuration	
			Standard	Express
EMS Election Event Designer (EED)	5.0.15.1	setup.exe: EED_FED_CERT_Setup_x64.msi	X	X
EMS Results Tally and Reporting (RTR)	5.0.15.1	setup.exe: RTR_FED_CERT_Setup_x64.msi	X	X
EMS Application Server	5.0.15.1	setup.exe: APPS_FED_CERT_Setup_x64.msi	X	X
EMS File System Service (FSS)	5.0.15.1	setup.exe: FSSSetup.msi	X	X
EMS Audio Studio (AS)	5.0.15.1	setup.exe: EMSAudioStudioSetup.msi	X	X
EMS Data Center Manager (DCM)	5.0.15.1	DemocracySuiteEMS_DCM.exe	X	X
EMS Election Data Translator (EDT)	5.0.15.1	setup.exe: EDTSetup_x86.msi EDTSetup_x64.msi	X	X
ImageCast Voter Activation (ICVA)	5.0.15.1	setup.exe: ICVASetup.msi	X	X
EMS Adjudication (Adj.)	5.0.0.17002	DVS ImageCast Adjudication Client Setup.msi	X	X
EMS Adjudication Service	5.0.0.17002	DVS Adjudication Services Setup.msi	X	X
EMS Election Data Manager (EDM)	5.0.6165.23355	setup.exe: EdmInstaller.msi	X	X
Smart Card Helper Service	5.0.6165.23379	setup.exe: SmartCardServiceSetup.msi	X	X

**Table 1-2. Democracy Suite 5.0 ImageCast Precinct Software Component Descriptions**

Firmware/Software	Version	Filename
Election Firmware	5.0.1-US	cf2xx.sig
Firmware Updater	5.0.1-US	firmUp.enc
Firmware Extractor	5.0.1-US	FirmwareExtract.enc
Kernel (uClinux)	5.0.1-US	image.bin.gz

**Table 1-2. Democracy Suite 5.0 ImageCast Precinct Software Component Descriptions** *(continued)*

<b>Firmware/Software</b>	<b>Version</b>	<b>Filename</b>
Boot Loader (COLILO)	20040221	colilo.bin
Asymmetric Key Generator	5.0.1-US	Keygen.enc
Asymmetric Key Exchange Utility	5.0.1-US	KeyExchange.enc
Firmware Extractor (Uses Technician Key)	5.0.1-US	TechExtract.enc

**Table 1-3. Democracy Suite 5.0 ImageCast Central Software Component Descriptions**

<b>Firmware/Software</b>	<b>Version</b>	<b>Filename</b>
ImageCast Central Application	5.0.1-0001	ICCSSetup_v5.0.0.15.exe

**Table 1-4. Democracy Suite 5.0 ImageCast X Software Component Descriptions**

<b>Firmware/Software</b>	<b>Version</b>	<b>Filename</b>
ICX Application	5.0.6149.28963	ICX.apk
ICX Security Certificate	N/A	icx_pkcs12.pfx
ICX Security Certificate Password	N/A	icx_pfx.pwd

**Table 1-5. Democracy Suite 5.0 EMS Client/Server Software Component Descriptions**

<b>Firmware/Software</b>	<b>Version</b>	<b>Filename</b>	<b>Configuration</b>	
			<b>Standard</b>	<b>Express</b>
Microsoft Windows Server	2012 R2 Standard	Physical Media from Microsoft	X	
Microsoft Windows	8.1 Professional	Physical Media from Microsoft	X	X
.NET Framework	3.5	Physical Media from Microsoft	X	X
Microsoft Visual J#	2.0	vjredist64.exe vjredist.exe	X	X
Microsoft Visual C++ 2013 Redistributable	2013	vcredist_x64.exe vcredist_x86.exe	X	X
Java Runtime Environment	7u76	jre-7u76-windows-x64.exe jre-7u76-windows-i586.exe	X	X
Java Runtime Environment	8u77	jre-8u77-windows-x64.exe jre-8u77-windows-i586.exe	X	X
Microsoft SQL Server 2012 Standard	2012 Standard	Physical Media from Microsoft	X	
Microsoft SQL Server 2012 Service Pack 2	2012 SP2	SQLServer2012SP2-KB2958429-x64-ENU.exe	X	
Microsoft SQL Server 2012 SP2 Express with Advanced Services	2012 SP2	SQLEXPADV_x64_ENU.exe		X

**Table 1-5. Democracy Suite 5.0 EMS Client/Server Software Component Descriptions** *(continued)*

Firmware/Software	Version	Filename	Configuration	
			Standard	Express
Cepstral Voices	6.2.3.801	Allison (English): Cepstral_Allison_windows_6.2.3.801.exe Alejandra (Spanish): Cepstral_Alejandra_windows_6.2.3.801.exe	X	X
Arial Narrow Fonts	N/A	ARIALN.TTF ARIALNB.TTF ARIALNBI.TTF ARIALNI.TTF	X	X
Maxim iButton Driver	4.04	install_1_wire_drivers_x86_v404.msi install_1_wire_drivers_x64_v404.msi	X	X
Adobe Reader DC	AcrobatDC	AcroRdrDC1501020060_en_US.exe	X	X
Microsoft Access Database Engine	2010	AccessDatabaseEngine.exe AccessDatabaseEngine_x64.exe	X	X
Open XML SDK 2.0 for Microsoft Office	2.0	OpenXMLSDKv2.msi	X	X

**Table 1-6. Democracy Suite 5.0 EMS Software Platform Unmodified COTS Component Descriptions**

Firmware/Software	Version	Filename
Infragistics NetAdvantage Win Forms 2011.1	2011 Vol.1	NetAdvantage_WinForms_20111.msi
Infragistics NetAdvantage WPF 2012.1	2012 Vol.1	NetAdvantage_WPF_20121.msi
TX Text Control Library for .NET	16.0	TXText Control.NET for Windows Forms 16.0.exe
SOX	14.3.1	sox.exe , libgomp-1.dll, pthreadgc2.dll, zlib1.dll
Log4net	1.2.10	log4net.dll, log4net.xml
NLog	1.0.0.505	NLog.dll
iTextSharp	5.0.5.0	itextsharp.dll
OpenSSL	1.2	openssl.exe, lebeay32.dll, ssleay32.dll
SQLite	1.0.65.0	System.Data.SQLite.DLL (32-bit and 64-bit)
Lame	3.99.4	lame.exe

**Table 1-6. Democracy Suite 5.0 EMS Software Platform Unmodified COTS Component Descriptions (continued)**

<b>Firmware/Software</b>	<b>Version</b>	<b>Filename</b>
Speex	1.0.4	speexdec.exe and speexenc.exe
Ghostscript	9.04	gsdll32.dll (32-bit and 64-bit)
PdfToImage.dll	1.2	PdfToImage.dll
SharpSSh package	1.1.1.13	Tamir.SharpSSH.dll, Diffie.Hellman.dll, Org.Mentalis.Security.dll
One Wire API for .NET	4.0.2.0	OneWireAPI.NET.dll
Avalon-framework-cvs-20020806	20020806	avalon-framework-cvs-20020806.jar
Batik	0.20-5	batik.jar
Fop	0.20-5	fop.jar
Microsoft Visual J# 2.0 Redistributable Package-Second Edition(x64)	2.0	vjc.dll , vjsjbc.dll, vjslibcw.dll, vjsnativ.dll , vjssupuilib.dll , vjsvwauX.dll
Entity framework	4.3.1	EntityFramework.dll
Spreadsheetlight	3.4.3	SpreadsheetLight.dll, SpreadsheetLight.xml
Open XML SDK 2.0 For Microsoft Office	2.0.5022.0	DocumentFormat.OpenXml.dll, DocumentFormat.OpenXml.xml

**Table 1-7. Democracy Suite 5.0 ImageCast Precinct Unmodified COTS Component Descriptions**

<b>Firmware/Software</b>	<b>Version</b>	<b>Filename</b>
OpenSSL	1.1.2	Openssl-1.1.2.tar.gz
PNG Reference Library	1.2.24	libpng-1.2.24.tar.gz
Zlib	1.2.3	Zlib-1.2.3.tar.gz

**Table 1-8. Democracy Suite 5.0 ImageCast X (Includes EDM) Unmodified COTS Component Descriptions**

<b>Firmware/Software</b>	<b>Version</b>	<b>Filename</b>
ASP.NET AJAX Control Toolkit	15.1.4.0	AjaxControlToolkit.Installer.15.1.4.0.exe
Entity Framework	6.1.3.net45	entityframework.6.1.3.nupkg
Ionics Zip Library	1.9.1.8	DotNetZipLib-DevKit-v1.9.zip
NLog Library	1.0.0.505	NLog-1.0-Refresh-bin.zip
SQLite	1.0.98.0	sqlite-netFx451-binary-bundle-x64-2013-1.0.98.0.zip

**Table 1-8. Democracy Suite 5.0 ImageCast X (Includes EDM) Unmodified COTS Component Descriptions** *(continued)*

Firmware/Software	Version	Filename
Google Text-to-Speech Engine	3.8.16	ARM: com.google.android.tts_3.8.16-210308160_minAPI15(armeabi-v7a)(nodpi).apk  x86: com.google.android.ttscom.google.android.tts_3.8.16-210308163_minAPI15(x86)(nodpi).apk

**Table 1-9. Democracy Suite 5.0 ImageCast Central Software Build Library Source Code (Unmodified COTS)**

Firmware/Software	Version	Filename
OpenSSL	1.2.3	openssl-1.2.3.tar.gz

**Table 1-10. Democracy Suite 5.0 ImageCast Central Runtime Software Components (Unmodified COTS)**

Firmware/Software	Version	Filename
1-Wire Driver (x86)	4.04	install_1_wire_drivers_x86_v404.msi
1-Wire Driver (x64)	4.04	install_1_wire_drivers_x64_v404.msi
Kofax VRS	4.5 Build 269	Kofax_VRS4_50_269_DR-G1130.iso
Kofax VRS Service Pack 1	4.5.1	vrs45sp1setup.exe
Canon DR-G1130 Driver	1.2 SP4	Physical Media from Canon
Canon DR-G1130 Component Installer	4.50	CI-DR-G1130.exe
Visual C++ 2013 Redistributable (x86)	12.0.30501	vc_redist_x86.exe

**Table 1-11. Democracy Suite 5.0 ImageCast Precinct Modified COTS Software Component Descriptions**

Firmware/Software	Version	Filename
uClinux	20070130	uClinux-dist-20070130.tar.gz
COLILO Bootloader	20040221	Colilo20040221.tar.gz

**Table 1-12. Democracy Suite 5.0 ImageCast X Modified COTS Software Component Descriptions**

<b>Firmware/Software</b>	<b>Version</b>	<b>Filename</b>
Zxing Barcode Scanner	4.7.5	BS-4.7.5.zip
SoundTouch	1.9.2	Soundtouch-1.9.2.tar.gz

**Table 1-13. Democracy Suite 5.0 EMS Software Build Environment Component Descriptions**

<b>Firmware/Software</b>	<b>Version</b>	<b>Filename</b>
Windows 8.1 Professional	8.1	Physical Media from Microsoft
.NET Framework 3.5	3.5	Physical Media from Microsoft
Internet Information Server (IIS)	6	Physical Media from Microsoft
7-Zip	9.20 (64 Bit)	7z920-x64.msi
Visual Studio 2013 Premium	2013.5	vs2013.5_prem_enu.iso
ImgBurn	2.5.7.0	SetupImgBurn_2.5.7.0.exe
Infragistics NetAdvantage Win Forms 2011.1	2011.1	NetAdvantage_WinForms_20111.msi
Infragistics NetAdvantage – WPF 2012.1	2012.1	NetAdvantage_WPF_20121.msi
TX Text Control 16.0.NET	16	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	vjredist64.exe
iTextSharp	5.0.5	itextsharp-5.0.5-dll.zip
Ghostscript	9.0.4	gs904w32.exe gs904w64.exe
NLog	1.0.0.505	NLog-1.0-Refresh-bin.zip
OneWireAPI.NET	4.0	1-wiresdkver400_beta2.zip
Lame	3.99.4	lame3.99.4-20120130.zip
Sox	14.3.1	sox-14.3.1-win32.zip
Avalon Framework	20020806	avalon-framework-cvs-20020806.jar.zip
Fop	0.20-5	fop-0.20.5.jar
Batik	0.20-5	batik-1.5-fop-0.20-5.jar
SharpSSH	1.1.1.13	SharpSSH.zip
SQLite	1.0.65.0	SQLite-1.0.65.0-binaries.zip
OpenSSL	1.2	openssl-1.2.tar.gz
ActivePerl	5.20.2	ActivePerl-5.20.2.2002-MSWin32-x86-64int-299195.msi

**Table 1-13. Democracy Suite 5.0 EMS Software Build Environment Component Descriptions**  
(continued)

<b>Firmware/Software</b>	<b>Version</b>	<b>Filename</b>
Patch	2.5.9-7	patch-2.5.9-7-bin.zip
ISOnewspaper	30.4	ISOnewspaper30v4_gr.icc.zip
Ogg Vorbis Encoder	2.88	oggenc2.88-1.3.5-generic.zip
Ogg Vorbis Encoder	1.10.1	oggdecV1.10.1.zip
Prism Mvvm	1.1.1	prism.mvvm.1.1.1.nupkg
PDF Printing	2.9.5.2	PDFPrinting.zip
Entity Framework	6.1.3	entityframework.6.1.3.nupkg
WiX	3.10	Wix310.exe
Spreadsheet Light	3.4.3	spreadsheetlight.3.4.3.nupkg
Open XML SDK 2.0 for Microsoft Office	2.0	OpenXMLSDKv2.msi
Acrobat Reader	Acrobat DC	AcroRdrDC1501020060_en_US.exe
Arial Narrow Fonts	N/A	ArialNarrowFonts.zip
PdfToImage	1.2	ConvertPDF_source_1.2.zip

**Table 1-14. Democracy Suite 5.0 ICC Software Build Environment Component Descriptions**

<b>Firmware/Software</b>	<b>Version</b>	<b>Filename</b>
NASM Assembler	2.09.07	nasm-2.09.07-win32.zip
OpenSSL	1.2.3	openssl-1.2.3.tar.gz

**Table 1-15. Democracy Suite 5.0 EDM Software Build Environment Component Descriptions**

<b>Firmware/Software</b>	<b>Version</b>	<b>Filename</b>
Ajax Control Toolkit	15.1.4	AjaxControlToolkit.Installer.15.1.4.0.exe
SQLite	1.0.98.0	sqlite-netFx451-binary-bundle-x64-2013-1.0.98.0.zip
Ionic	1.9.1.8	DotNetZipLib-DevKit-v1.9.zip
Google Text-to-speech Engine – Architecture arm	3.8.16	com.google.android.tts_3.8.16-210308160_minAPI15(armeabi-v7a)(nodpi).apk
Google Text-to-speech Engine – Architecture x86	3.8.16	com.google.android.ttscom.google.android.tts_3.8.16-210308163_minAPI15(x86)(nodpi).apk

**Table 1-16. Democracy Suite 5.0 Adjudication Software Build Environment Component Descriptions**

<b>Firmware/Software</b>	<b>Version</b>	<b>Filename</b>
Microsoft Enterprise Library	5.0	Enterprise Library 5.0.msi
Microsoft Prism	4.0-November 2010	Prismv4.exe
Microsoft Identity Foundation SDK	4.0	WindowsIdentityFoundation-SDK-4.0.msi
Toggle Switch Control Library	1.1.1	ToggleSwitch 1.1.1.zip
Infragistics NetAdvantage Ultimate 2013.1	2013.1	NetAdvantage_dotNet_20131_With SamplesAndHelp.zip
iTextSharp	5.5.1	itextsharp-all-5.5.1.zip
CLR Security	June 2010	clrsecurity_june10.zip
OpenSSL	1.0.2e	openssl-1.0.2e. i386-win32.zip
Community MSI Extensions	1.4	msiext-1.4.zip
TreeViewEx	3.0.0.0	TreeViewEx.dll

**Table 1-17. Democracy Suite 5.0 ImageCast Precinct Election Firmware Compiler Descriptions**

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

**Table 1-18. Democracy Suite 5.0 ImageCast Precinct Firmware Build Environment Component Descriptions**

<b>Firmware/Software</b>	<b>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-1.1.2.tar.gz

**Table 1-19. Democracy Suite 5.0 ImageCast X Firmware Build Environment Component Descriptions**

<b>Firmware/Software</b>	<b>Version</b>	<b>Filename</b>
Ubuntu 14.04.4	14.04.4	ubuntu-14.04.4-desktop-amd64.iso



**Table 1-20. Voting System Equipment**

<b>Component</b>	<b>Serial Number</b>
<b><i>Proprietary Hardware</i></b>	
ImageCast Precinct Optical Scanner PCOS-320C	AAFAJFM0061, AAFAJFN0030, AAFAJGI6764, AAFAJEL0352
ImageCast Precinct Optical Scanner PCOS-320A	AANAGCP0347, AANAGCP0002
ICP Ballot Box BOX-330A	AAUCCFX0083, AAUCCGI0011
ICX Samsung Tablet	[DVS-Samsung ICX-001], RF2GB01W0GD, RF2GB01V4HF, RF2GB01V5RL
ICX Inline EMI Filter	[DVS-EMIFILTER-001] thru [DVS-EMIFILTER-003]
<b><i>COTS Hardware</i></b>	
ICX aValue 15" Tablet (SID-15V)	0E14AF00014, B03G005400006, B033G00540008, 9E274118, 1D274118
ICX aValue 21" Tablet (SID-21V)	0E14AF00027, B03G005500019, 03G005500009, 0039BZ2D, 0039B209
Dell OptiPlex 7440 All In One	HVNRFB2, HVNQFB2, HVNPFB2
Dell PowerEdge R630	4Z07T52
Canon imageFormula DR-G1130 Scanner	GF301092, GF304418
Dell Precision T3420 PC	HS0VFB2, HS0TFB2, HS0RFB2, HS0SFB2
HP LaserJet Pro Printer M402dn	PHBQF20342, PHBQF20345, PHBQC12619, PHBQC19613, PHBQC12519, PHBQD18790, PHBQC12616
Dell OptiPlex 9030 All-In-One	CF73S52
Dell Ultrasharp 24" Monitor U2414H	1PVZ152, 62VZ152

**Table 1-21. Voting System Support Equipment**

<b>Component</b>	<b>Serial Number</b>
Dell Monitor KM632	FYNTY12, CKX6Y12, CN-0524N3-72461-59H-6U5U
Dell Monitor P2414Hb	CN-0524N3-74261-5AH-2DNU, CN-0524N3-74261-5AH-2DAU
ABLENET Jelly Bean Twist 10033400	[DVS-ablenet-001] thru [DVS-ablenet-014]
Tecla ShieldDos KDL-02001	[DVS-Tecla-001] thru [DVS-Tecla-006]
Brother Laser Printer HL-L2300D	U63878K5N281729
Dell DVD Multi Recorder GP60NB60	[DVS-Dell-001]
Dell Latitude E7450 Laptop	30GFH72, 369FH72
Maxim iButton Programmer DS9490R# with DS1402	[DVS-Maxim-001] thru [DVS-Maxim-005]

**Table 1-21. Voting System Support Equipment** *(continued)*

<b>Component</b>	<b>Serial Number</b>
APC Smart-UPS SMT1500	3S1536X06436, 3S1536X06475, 3S1536X06461, 3S1536X06485, 3S1536X06484, 3S1536X06322, 3S1536X07467, 3S1536X06484, 3S1536X06272, 3S1536X06201, 3S1536X07305, 3S1504X00395, 3S1504X00396
Dell X1008 Network Switch	4R8XX42, 26SXX42, 63SXX42
Dell X1018 Network Switch	6TN7Y42
Dell X1026 Network Switch	83D9Y42
Enabling Devices Sip and Puff	[DVS-enabling devices-001] - [DVS-enabling devices-002]
Cyber Acoustics Headphones ACM-70	[DVS-cyber acoustics-001] - [DVS-cyber acoustics-005]
4-Way Joystick Controller S26	PME QC 1550 12, [DVS-JOY-001], [DVS-JOY-002]
Enablemart # 88906 Rocker (Paddle) Switch	[DVS-paddle-001]
Dell PowerConnect 2808 Network Switch	3S2P0Z1
IOGEAR SDHC/microSDHC 0U51USC410 Card Reader	8632, 8633
Lexar USB 3.0 Dual-Slot Reader	24020845007435
Hoodman Steel USB 3.0 UDMA Reader 102015	[DVS-hoodman-001]
ATI Handset	98862010101-035, 98862010103-075, 00659010100-046, 98862010100-232
ATI-USB Handset	02440010100-011, [DVS-ATIUSB-001], [DVS-ATIUSB-002]
ACS PC-Linked Smart Card Reader ACR39U	RR374-006272, RR374-010356, RR374-010365
Lexar Professional CF Card Reader Workflow CFR1	24050361400108, 24050361401994, 24050361401991, 24050361401990
CORCOM Filter P/N#: 15EMC1	[DVS-CorcomEMIFilter-001]
Delta Filter P/N#: 16PDCG5C	[DVS-DeltaEMIFILTER-001]

## 1.2 References

- Dominion Voting Systems Democracy Suite 5.5 Implementation Statement dated 06-21-17
- Election Assistance Commission 2005 Voluntary Voting System Guidelines (VVSG) Version 1.0, Volume I, “Voting System Performance Guidelines”, and Volume II, “National Certification Testing Guidelines”
- Election Assistance Commission Testing and Certification Program Manual, Version 2.0

- Election Assistance Commission Voting System Test Laboratory Program Manual, Version 2.0
- National Voluntary Laboratory Accreditation Program NIST Handbook 150, 2016 Edition, “NVLAP Procedures and General Requirements (NIST HB 150-2016)”, dated July 2016
- National Voluntary Laboratory Accreditation Program NIST Handbook 150-22, 2008 Edition, “Voting System Testing (NIST Handbook 150-22)”, dated May 2008
- United States 107<sup>th</sup> Congress Help America Vote Act (HAVA) of 2002 (Public Law 107-252), dated October 2002
- Pro V&V, Inc. Quality Assurance Manual, Revision 1.0
- Election Assistance Commission “Approval of Voting System Testing Application Package” letter dated May 6, 2016
- EAC Requests for Interpretation (RFI) (listed on [www.eac.gov](http://www.eac.gov))
- EAC Notices of Clarification (NOC) (listed on [www.eac.gov](http://www.eac.gov))
- 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 Voting System”
- Dominion Voting Systems Technical Data Package (*A listing of the D-Suite 5.5 documents submitted for this test campaign is contained in Section 3.1.2 of this Test Report*)

### **1.3 Terms and Abbreviations**

*This subsection lists terms and abbreviations relevant to the hardware, the software, or this Test Plan.*

“ADA” – Americans with Disabilities Act 1990

“BMD” – Ballot Marking Device

“CM” – Configuration Management

“COTS” – Commercial Off-The-Shelf

“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

“ICP” – ImageCast Precinct

“ICX” – ImageCast X

“ISO” – International Organization for Standardization

“NOC” – Notice of Clarification

“PCA” – Physical Configuration Audit

“QA” – Quality Assurance

“RFI” – Request for Interpretation

“TDP” – Technical Data Package

“UPS” – Uninterruptible Power Supply

“VSTL” – Voting System Test Laboratory

“VVPAT” – Voter Verifiable Paper Audit Trail

“VVSG” – Voluntary Voting System Guidelines

## 2.0 CERTIFICATION TEST BACKGROUND

The D-Suite 5.5 is a modification of a previously certified system (D-Suite 5.0). Pro V&V performed an evaluation of results from the previous test campaign to determine the scope of testing required for certification of the D-Suite 5.5. Based on this evaluation, Pro V&V determined that testing from the previous test campaign would establish the baseline and that the focus of this test campaign would be on the documented system updates.

### 2.1 Revision History

The table below details the version history of the D-Suite 5.5 System:

**Table 2.1. D-Suite 5.5 System Revision History**

System Version	Certification Type	Baseline System	Certification Number
D-Suite 5.0	New System	--- (Original System)---	DVS-DemSuite-5.0
D-Suite 5.5	Modification	D-Suite 5.0	DVS-DemSuite5.5*

\*Upon grant of certification by the EAC

### 2.2 Scope of Testing

Testing from the previous test campaign was used to establish the baseline. The scope of testing for this campaign focused on the introduction of the ICX Prime hardware, the addition of a DRE mode to the ICX application which can be configured to generate a paper backup by utilizing a

VVPAT printer or operate in a paperless mode using a Report Printer to print Election Reports (DRE mode is only available on the ICX Prime hardware), the removal of the ICX Samsung configuration from the system, the introduction of the Canon DR-M160II document scanner for use with the ICC, the introduction of the updated OpenSSL FIPS 140-2 validated modules, as well as the updated functionality of the D-Suite 5.5 System components as described in the sections that follow. Based on the submitted changes, the following tasks were required to verify compliance of the modifications:

- Source Code Review, Compliance Build, Trusted Build, and Build Document Review
- System Integration Testing
- Technical Documentation Package (TDP) Review
- Functional Configuration Audit (FCA)
- System Loads & Hardening
- Physical Configuration Audit (PCA)
- Security Testing
- Hardware Testing
- Usability & Accessibility Testing
- Volume & Stress Testing
- Accuracy Testing
- Regression Testing (System Integration Testing)

### **2.2.1 Modification Overview**

The submitted modifications for the D-Suite 5.5 test campaign included modifications to the baseline D-Suite 5.0 system. These modifications consisted of the following:

- Introduction of the ICX Prime hardware
- Addition of a DRE mode to the ICX application which can be configured to generate a paper backup by utilizing a VVPAT printer or operate in a paperless mode using a Report Printer to print Election Reports (DRE mode is only available on the ICX Prime hardware)
- Removal of the ICX Samsung configuration from the system
- Introduction of a new ICC hardware configuration utilizing the Canon DR-M160II document scanner
- Introduction of the updated OpenSSL FIPS 140-2 validated modules

- Various minor enhancements and updates to add support and improve voting functions, correct identified defects, and replacement of end-of-life components
- Updated functionality of the D-Suite 5.5 System components as described in section 2.2.1.1 of this document.

#### **2.2.1.1 Detailed List of Changes**

The Dominion Democracy Suite 5.5 Voting System is a modified voting system configuration that includes upgrades to the components of the D-Suite 5.0 Voting System. The list below includes changes between this system and the baseline of the Democracy Suite 5.0 Voting System:

##### **GENERAL MODIFICATIONS**

- EMS components to utilize Windows Authentication instead of SQL Server Authentication
- Ability for system to utilize self-encrypting drives as an additional security feature
- All components now running on combination of Windows 10, Windows Server 2012R2, with SQL Server 2016 (also included are scripts for security hardening procedures)
- Ability to automatically install and configure Windows-based software components used by the security hardening scripts without user interaction. The security hardening scripts and their associated software are located on the EMS Install disc. In the Democracy Suite 5.0 voting system the user was required to install these software components manually.
- Ability to gather all required logs from system and applications and store them in one zip file.
- Updated hardening scripts for windows 10 to remove preinstalled applications that exist on the system
- Add Unified Installer to code build.
- Updated OpenSSL FIPS 140-2 validated modules to each of the Democracy Suite products that use these cryptographic modules
- Updated expired certificates for build environments (Windows-based and ICX components)

##### **EMS**

- Upgraded EMS Election Event Designer as follows:
  - Ability to configure how common cards are consolidated
  - Ability to create a naming convention for the ballot ID, artwork filename and description
  - Ability to generate one or more ballots without generating all ballots in the election project

- Application produces election definition in final form for the ImageCast X voting application (DRE VVPAT/DRE Reports Printer/BMD)
- Ability to produce and modify a configuration file for ImageCast X (DRE VVPAT/DRE Reports Printer/BMD)
- Ability for the application to program the USB Flash Device with necessary resources used for setting up an ImageCast X voting device. (DRE VVPAT/DRE Reports Printer/BMD)
- Extended styling capabilities for ICX (DRE VVPAT/DRE Reports Printer/BMD)
- Added support for utilizing Legal size paper when printing ballots on an ICX BMD.
- Modified the specification of available area for Write-in detection, which is passed through the election files to the optical scan tabulators
- Ability to generate distinct ballot ID's for Precinct Portions with Identical Ballot Content
- Extending Paragraph Alignment Attributes to allow for more flexibility
- Contest Headings now have a Global Order Field
- Ability to indicate which District Types can appear on Print Tape
- Support for ICX VVPAT Printer (DRE VVPAT)
- Ability to add "strike through" text on ballots
- Ability to specify how many columns the candidates within a contest should occupy when shown on screen, up to a maximum of 6 columns
- Report which displays how contests appear on the ICX platform for use when troubleshooting ballot layouts during the election design process. (DRE VVPAT/DRE Reports Printer/BMD)
- Ability for candidate with multi-party affiliation to be displayed on ballot or screen with single voting box
- Ability to print samples of all touchscreen ballots.
- Ability to set watermark picture for: ballot header, ballot footer and ballot stubs
- Ability to pass the MCF configuration settings to the connected ICX so that those settings that can affect the display/layout of the ballot are presented on the ICX during the ICX preview mode. (DRE VVPAT/DRE Reports Printer/BMD)
- Straight party tickets now include only the parties that are actually used in affiliations on the ballot.

- Ability for ICP/ICC tabulator platform to implement the straight party logic which takes into account multi-party affiliated voting box
- Ability for ICX tabulator platform to implement the straight party logic which takes into account multi-party affiliated voting box (DRE VVPAT/DRE Reports Printer/BMD)
- Ability for a column on the Ballot Cards screen in EED to show the paper size for each ballot is added in order to determine which ballots are larger or smaller than the allowed size for the election (letter/legal)
- Upgraded EMS Results Tally & Reporting as follows:
  - Ability to break-down results per precinct for consolidated ballots, when reviewing the contents of Results Files
  - New report export, Batches Containing Precincts, provides information on what precincts each batch of results contains
  - Ability to select multiple precincts for the Summary Report
  - Ability to indicate in a project whether disabled contests and candidates should appear in the Election Summary and Statement of Votes Cast reports
  - Ability to track precinct information for consolidated cards, and view the information when reviewing the contents of Results Files
  - Ability to bypass adjudication for early voting results. This ability allows an authorized user to choose to skip Adjudication of election results when importing Early Voting election results into the RTR application. This is accomplished by selecting the option to skip adjudication of these results during the results import process. When this option is selected the Early Voting results cannot be adjudicated as the adjudication process is skipped entirely. If the user later wishes to adjudicate the early voting results, the existing results which were not adjudicated must be purged from the database. The user can then import the early voting results from their original sources, choosing not to skip adjudication. At this point the Early Voting results can then be adjudicated.
  - Refactoring of CVR Service to allow for improved performance and reliability during loading, adjudicating and publishing of results
  - Extended Service to allow Adjudication to retrieve list of Qualified Write-ins, and add new Qualified Write-ins to the master list
  - Refactoring of SQL Server Reporting Service based reports to allow for improved performance and more flexibility in extending reporting capabilities.
  - Ability to generate Statement of Votes Cast report by Ballot Type
  - The existing CVR export can now be generated in Excel format



- The Batches Loaded Report export indicates the date and time when each results batch was loaded into the EMS database.
- Ability to remove provisional votes into a separate results batch in order to allow for adjudication of standard results in a batch
- Ability to export audit images sorted by Candidate
- User is informed if there are pending provisional ballots before pushing results to Adjudication
- Ability to choose whether the system automatically deletes any exported files when clearing all results in the database before the election starts to ensure a zero result state.
- Ability to load results which come from the same logical Tabulator ID definition (i.e., two physically separate ICX machines that were assigned with the same logical Tabulator ID number), and to be sure that results from a single ICX machine are not loaded into the EMS more than once. The results files from the individual ICX machines are assigned unique Batch ID's when they are uploaded to the EMS. Using the Results Files screen and/or the Tabulator screen, instances of more than one results file for the same Tabulator ID can be seen with the unique Batch ID's displayed. The EMS user can procedurally examine the results batches to trace the results files to the original ICX machines which generated them. (DRE VVPAT/DRE Reports Printer)
- When a report is too large to be generated, the system provides a message that filters need to be applied before generating the report.
- The SOVC report has the ability to suppress the vote results from the report where there is low turnout in order to protect voter privacy. The threshold for suppressing the results is configurable.
- Straight party voting rules now take into account multi-party affiliated voting boxes
- Two new fields added to CVR session object: Ballot Type name and Precinct Portion name, in order to support ADJ Hovering on the ballot header black colored
- Evaluation of RTR Cards Cast report when ballots were cast on ICX (DRE VVPAT/DRE Reports Printer)
- Upgraded EMS Election Data Translator as follows:
  - Ability to import subsets of data using the application: New languages and translations, template assignment, and tabulators
  - Modifications to Contest and Contest Heading tables to allow enhance styling capabilities for ICX (DRE VVPAT/DRE Reports Printer/BMD)
  - Ability to export/import data related to composite parties.

- References to party logo images can either be made through an absolute file or through a file name
- On import, the EDT updates the Election Event info using the data in the Election worksheet of the EDT spreadsheet.
- Upgraded EMS Audio Studio as follows:
  - Modifications to application to handle the newly required audio resources for the ICX (DRE VVPAT/DRE Reports Printer/BMD)
- Upgraded EMS Adjudication as follows:
  - The resume function has been made more robust
  - Adjudication Administrator can now perform tasks on a remote client machine, rather than the server
  - Master list of qualified write-ins is now managed by EED
  - 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
  - Ability to prevent a ballot from being completed until all write-ins are resolved
  - The Adjudicator can now see the AuditMark alongside the image of the ballot being adjudicated
  - Adjudicator can now skip a ballot and continue adjudicating remainder of batch
  - When **Continue** is selected in the ballot load error dialog, new ballots with load errors are given a Quarantined status, with the note “Automatically Quarantined due to Load Error”
- Upgraded EMS ICVA as follows:
  - Improved workflow for programming voter cards to allow for faster processing at polling location
  - Added ability to indicate if a card was voted or not
  - Modified the SmartCard timestamp format to exclude the timezone.

## ICC

- Added support for a TWAIN interface
- Added option to force ICC to overrun a preset number of ballots every time scanning stops mid-batch

- Switching election projects in ICC has been simplified
- Improvements to Write-in Area detection
- Application now runs on Windows 10
- Cross-endorsed candidates rule implemented

### **ICX (General)**

- Ability to conduct a vote simulation for use during Logic & Accuracy Testing
- Ability to display more than one contest on the screen
- Ability to display a heading for a single or a group of contests on the screen
- Ability to align the contest cell left, right or center, along with support for font size, bold, italic and underline text
- Ability to playback audio for screen contents for languages that do not have Text-to- Speech support
- Ability to display and record votes for a choice which enables the voter to indicate they do not wish to cast a vote for any of the available choices
- Ability to display a Straight Party ticket and have remaining partisan contests influenced
- Ability to indicate status information using a USB LED poll worker light
- Added manual activation of ballot with alphanumeric codes
- Added option to search for tabulator number
- Added support for changing the background color (contest, choice)
- Added ability for technician to modify brightness for Prime tablet. This functionality is required during the initial setup of the ICX Prime units to establish the default brightness level of the screen based upon brightness values described in the technical documentation used to setup and configure the ICX Prime units. This ability does not preclude a voter from adjusting the contrast ratio of the screen during a voting session.
- Add support for Sunzone SUZCR-R59 smart card reader in ICX
- Ability to display contests in multiple columns, up to a maximum of 6 columns.
- Ability to limit the number of spoiled ballots
- Corrected condition that produced an error message when viewing the lifetime counter in the PollWorker menu.

- Corrected behavior to limit selections in an endorsed partisan contest to the maximum allowed if that partisan contest was on the same screen as the Straight Party selection contest.
- Corrected behavior in AVS sessions to not have text-to-speech read out punctuation characters at the end of contest descriptions.
- Added full support for a Voter Flee situation: warning, alarm sound, LED light ash, timeout, possibility to continue voting or to be re-set by a poll worker for new voter.
- Replaced Android OS accessibility service with custom service in the application to prevent application memory leak (due to Android service) when the Vote Simulator utility uses a navigation bar for administrative tasks during testing.
- Added parameters in the MCF configuration file (Audible Tone group) to allow the duration of the audio tone for error tones to be set (default=15 sec)
- Added scroll bars for when choice font is very large and consumes all of the screen space, to ensure all choices are accessible regardless of font size.
- Added a parameter (AVS > Message Repeat Count) in the MCF configuration file to set the number of times an audio message will repeat in an AVS session.
- Corrected ICX review screen to remove message "Your ballot is blank." in a single contest ballot when a choice is selected, then deselected, another choice is selected.
- Straight party voting now supported
- Corrected smart card access to Pollworker functions when the USB Memory Device is not inserted or for Pollworker smart cards with invalid election codes.
- Corrected ICX application behavior when voter smart card is removed and re-inserted several times in succession.
- Corrected AVS audio to include all ballot information on the review screen.
- Added support for Pennsylvania straight party voting rules
- Corrected missing text in report when printed per contest or per precinct, and when the project contains instructional contests in multiple languages, and at least one ballot in each language is cast.
- Updated MCF to set "Report per Contest" as the default, and to remove the "Report by Activation Code" option.

- Modified label text in the hardware information screen to USB Device ID to identify the contents of the relevant data fields

### **ICX (DRE Mode Specific)**

- Ability to save results in cast vote record format (Applies to both the DRE VVPAT and DRE Reports Printer Configurations)
- Addition of new VVPAT Printer for the ImageCast X voting application
- Addition of new thermal Report Printer for the ImageCast X voting application
- Ability to verify the VVPAT for an accessible voter
- Added MCF option to specify number of copies of zero and results tapes to print (Applies to both the DRE VVPAT and DRE Reports Printer Configurations)
- Modified the application detection of the Report Printer door position so that when the printer door is unlocked or open, the application stops sending data to the printer and resumes once the door is closed and locked
- Corrected behavior of "Reprint Report" and "Cancel Report" when printing a report with a large header and a large precinct/ballot list (Applies to the DRE Report Printer configuration)
- Corrected behavior of Pollworker LED and audio alarm when an error occurs on the info activity screen and is cleared (Applies to the DRE VVPAT configuration)
- Corrected intermittent printing errors that halted the VVPAT printing and displayed the error "There was an error on printing selection on VVPAT printer" (Applies to the DRE VVPAT configuration)
- Corrected communications with printer to more quickly service low paper error messages to prevent issues with displaying that error message to the user and with printing the balance of the current voting session information.
- Improved integrity of USB communication between the ICX and VVPAT printer, modified the ICX application to ping the VVPAT scanner at most every 10 sec. and used new VVPAT printer firmware to enable an existing watchdog timer to reset the scanner controller if there is no data input/output from the scanner in more than 10 sec.
- Adjusted the Warning message in the PollWorker menu to show the Printer status when printer is overheated instead of showing "N/A."
- Added the Tabulator ID to the end barcode to match the text on the VVPAT record.
- Updated MCF to default Start and End barcodes to false.

### **ICX (BMD Mode Specific)**

- Printed QR Ballot now has human readable part printed in an OCR-friendly font
- Ability to have a QR ballot printed on Legal sized paper
- The delay before printing pages printed after the first page is less than 2 seconds

### **ICP**

- Improvements to Write-in Area detection
- ICP is no longer restricted to 10 pre-defined languages
- Now able to print list of admin areas as part of the tape header
- Added Tabulator name to footer section of the tape
- Cross-endorsed candidates rule implemented

## 2.2.2 Block Diagram

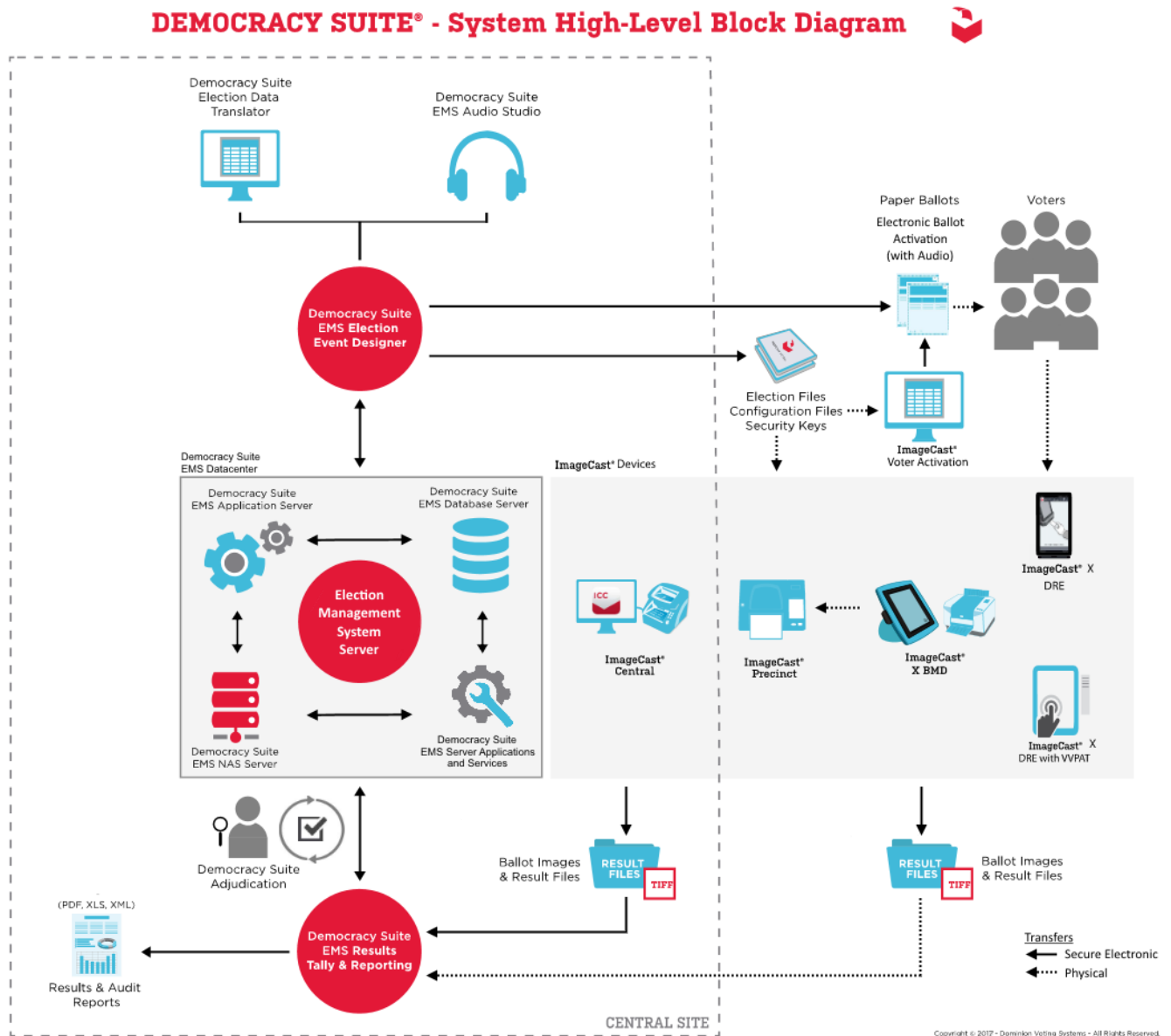


Figure 2-1. D-Suite 5.5 System Overview

### 2.2.3 System Limits

The system limits verified during testing to be supported by the D-Suite 5.5 are provided in the tables below.

**Table 2-2. D-Suite 5.5 System Limits by Configuration (Landscape Ballot Orientation)**

Characteristic	Configuration Values		Limiting Component
	Express	Standard	
Ballot positions	292	292	*22-inch Landscape Ballot (240 candidates + 24 write-ins + 28 Yes/No choices)
Precincts in an election	250	1000	Memory
Contests in an election	250	1000	Memory
Candidates/Counters in an election	2500	10000	Memory
Candidates/Counters in a precinct	240	240	*22-inch Landscape Ballot
Candidates/Counters in a tabulator	2500	10000	Memory
Ballot Styles in an election	750	3000	Memory
Contests in a ballot style	38	38	*22-inch Landscape Ballot (24 candidacy contests + 14 Propositions)
Candidates in a contest	240	240	*22-inch Landscape Ballot
Ballot styles in a precinct	5	5	Memory
Number of political parties	30	30	Memory
“Vote for” in a contest	24	24	*22-inch Landscape Ballot
Supported languages in an election	5	5	Memory
Number of write-ins	24	24	*22-inch Landscape Ballot

\*The 22-inch ballot length applies only to hand-marked paper ballots.



**Table 2-3. D-Suite 5.5 System Limits by Configuration (Portrait Ballot Orientation)**

Characteristic	Configuration Values		Limiting Component
	Express	Standard	
Ballot positions	462	462	*22-inch Portrait Ballot
Precincts in an election	250	1000	Memory
Contests in an election	250	1000	Memory
Candidates/Counters in an election	2500	10000	Memory
Candidates/Counters in a precinct	462	462	*22-inch Portrait Ballot
Candidates/Counters in a tabulator	2500	10000	Memory
Ballot Styles in an election	750	3000	Memory
Contests in a ballot style	156	156	*22-inch Portrait Ballot
Candidates in a contest	231	231	*22-inch Portrait Ballot (Column Span 3)
Ballot styles in a precinct	5	5	Memory
Number of political parties	30	30	No Limitation
“Vote for” in a contest	30	30	No Limitation
Supported languages in an election	5	5	Memory
Number of write-ins	462	462	*22-inch Portrait Ballot

\*The 22-inch ballot length applies only to hand-marked paper ballots.

#### 2.2.4 Supported Languages

The following languages were verified during testing as being supported by the D-Suite 5.5 System:

- Alaska Native
- Apache
- Bengali
- Chinese
- English
- Eskimo
- Filipino
- French
- Hindi
- Japanese

- Jicarilla
- Keres
- Khmer
- Korean
- Navajo
- Seminole
- Spanish
- Thai
- Towa
- Ute
- Vietnamese
- Yuman

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

For the character based language, the ballot was created by Pro V&V and voted utilizing both paper ballots and ADA voting devices along with all applicable peripherals. The Chinese Language for the ballot was created using a readily available online translation tool. The translated language text was entered into the Election Event Designer Application. A ballot preview was generated in the EED application. The Chinese characters displayed in the ballot preview were compared to the characters generated by the online translation tool, to ensure that the characters matched. The ballots were then generated and printed, and the election loaded onto the tabulators and the BMD units. The Chinese characters displayed on both the printed ballots and on the BMD units were compared to the original Chinese Characters generated by the online translation tool to verify that the characters matched.

### **2.2.5 Supported Functionality**

The D-Suite 5.5 was verified during testing to support the following voting variations:

- General Election
- Closed Primary
- Open Primary
- Early Voting
- Partisan/Non-Partisan Offices
- Write-In Voting
- Primary Presidential Delegation Nominations
- Split Precincts

- Vote for N of M
- Ballot Rotation
- Provisional or Challenged Ballots

#### **2.2.6 VVSG**

The D-Suite 5.5 Voting System was evaluated against the relevant requirements contained in the EAC 2005 VVSG, Version 1.0.

#### **2.2.7 RFIs**

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

#### **2.2.8 NOCs**

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

### **3.0 TEST FINDINGS AND RECOMMENDATIONS**

The D-Suite 5.5 Voting System was evaluated against the relevant requirements contained in the EAC 2005 VVSG, Volumes I and II. The focus of this test campaign was on the modifications made to the baselined certified system. The summary findings and recommendations for each area of testing are provided in the following sections.

#### **3.1 Summary Findings and Recommendations**

Summary findings for the System Level Testing (System Integration Testing, Hardware Testing, Accuracy Test, Volume & Stress, and FCA), Security Testing, and Source Code Review are detailed in the relevant sections of this report. In addition to these areas of testing, a PCA, a limited TDP Review, and a QA & CM System Review were performed, as described below.

##### **3.1.1 Physical Configuration Audit (PCA)**

The Physical Configuration Audit (PCA) compares the voting system components submitted for qualification to the manufacturer's technical documentation. The execution of the PCA included the following activities:

- Establish a configuration baseline of software and hardware to be tested; confirm whether manufacturer's documentation is sufficient for the user to install, validate, operate, and maintain the voting system
- Verify software conforms to the manufacturer's specifications; inspect all records of manufacturer's release control system; if changes have been made to the baseline version, verify manufacturer's engineering and test data are for the software version submitted for certification

- If the hardware is non-COTS, Pro V&V shall review drawings, specifications, technical data, and test data associated with system hardware to establish system hardware baseline associated with software baseline
- Review manufacturer's documents of user acceptance test procedures and data against system's functional specifications; resolve any discrepancy or inadequacy in manufacturer's plan or data prior to beginning system integration functional and performance tests
- Subsequent changes to baseline software configuration made during testing, as well as system hardware changes that may produce a change in software operation are subject to re-examination

#### Summary Findings

During execution of the PCA, the components of the D-Suite 5.5 System were documented by component name, model, serial number, major component, and any other relevant information needed to identify the component. For COTS equipment, every effort was made to verify that the COTS equipment had not been modified for use. Additionally, each technical document submitted in the TDP was recorded by document name, description, document number, revision number, and date of release. At the conclusion of the test campaign, test personnel verified that any changes made to the software, hardware, or documentation during the test process were fully and properly documented.

### **3.1.2 TDP Review**

In order to determine compliance of the modified TDP documents with the EAC 2005 VVSG, a limited TDP review was conducted. This review focused on TDP documents that have been modified since the certification of the baseline system. The review consisted of a compliance review to determine if each regulatory, state, or manufacturer-stated requirement has been met based on the context of each requirement. Results of the review of each document were entered on the TDP Review Checklist and reported to the manufacturer for disposition of any anomalies. This process was ongoing until all anomalies were resolved.

Any revised documents during the TDP review process were compared with the previous document revision to determine changes made, and the document was re-reviewed to determine whether subject requirements had been met.

#### Summary Findings

The submitted TDP was determined to be in compliance with the requirements set forth in the EAC 2005 VVSG. A listing of all documents contained in the D-Suite 5.5 TDP is provided in Table 3-1.

**Table 3-1. D-Suite 5.5 TDP Documents**

<b>Document Number</b>	<b>Description</b>	<b>Version</b>
<i>Adjudication Documents</i>		
2.05	Democracy Suite Adjudication Software Design and Specification	5.5::98
2.08	Democracy Suite Adjudication System Operation Procedures	5.5::136
2.09	Democracy Suite Adjudication System Maintenance Manual	5.5::71
<i>D-Suite Documents</i>		
2.02	Democracy Suite System Overview	5.5::146
2.06	Democracy Suite System Security Specification	5.5::539
2.07	Democracy Suite System Test and Verification	5.5::163
2.10	Democracy Suite Personnel Deployment and Training Requirements	5.5::105
2.11	Democracy Suite Configuration Management Process	5.5::364
2.12	Democracy Suite Quality Assurance Program	5.5::126
2.13	Democracy Suite System Change Notes	5.5::144
<i>EMS Documents</i>		
2.03	Democracy Suite EMS Functional Description	5.5::351
2.05	Democracy Suite EMS Software Design and Specification	5.5::302
2.08	Democracy Suite EMS System Operations Procedures	5.5::697
2.09	Democracy Suite EMS System Maintenance Manual	5.5::113
<i>ImageCast Central Documents</i>		
2.03	Democracy Suite ImageCast Central Functionality Description	5.5::153
2.05	Democracy Suite ImageCast Central Software Design and Specification	5.5::91
2.08	Democracy Suite ImageCast Central System Operation Procedures	5.5::180
<i>ImageCast Precinct Documents</i>		
2.03	Democracy Suite ImageCast Precinct Functionality Description	5.5::160
2.04	Democracy Suite ImageCast Precinct System Hardware Specification	5.5::127
2.04.1	Democracy suite ImageCast Precinct System Hardware Characteristics	5.5::78
2.05	Democracy Suite ImageCast Precinct Software Design and Specification	5.5::135
2.08	Democracy Suite ImageCast Precinct System Operation Procedures	5.5::259
2.09	Democracy Suite ImageCast Precinct System Maintenance Manual	5.5::108
<i>ImageCast X Documents</i>		
2.03	Democracy Suite ImageCast X Functionality Description	5.5::79

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

<b>Document Number</b>	<b>Description</b>	<b>Version</b>
2.05	Democracy Suite ImageCast X Software Design and Specification	5.5::87
2.08	Democracy Suite ImageCast X System Operation Procedures	5.5::83
2.09	Democracy Suite ImageCast X System Maintenance Manual	5.5::75
<i>User Guides</i>		
---	Democracy Suite ImageCast Adjudication User Guide	5.5::141
---	Democracy Suite Election Data Translator User Guide	5.5::88
---	Democracy Suite EMS Audio Studio User Guide	5.5::38
---	Democracy Suite EMS Election Event Designer User Guide	5.5::240
---	Democracy Suite EMS Results Tally and Reporting User Guide	5.5::139
---	Democracy Suite ImageCast Central User Guide	5.5::118
---	Democracy Suite ImageCast Precinct User Guide	5.5::56
---	Democracy Suite ImageCast Voter Activation User Guide	5.5::53
---	Democracy Suite ImageCast X User Guide	5.5::214
<i>COTS Supplementary Documents</i>		
---	Cyber Acoustics ACM-70B Stereo Headphones Product Sheet	---
---	APC User Manual Back-UPS BE600M1	---
---	Canon DR-G1130 User Manual	---
---	Canon DR-M160II User Guide	---
---	RP-D10 Series Thermal Printer User's Guide	---
---	Dell OptiPlex 3050 AIO Product Safety, EMC & Environmental Datasheet	A11
---	Dell OptiPlex 9020 AIO Product Safety, EMC & Environmental Datasheet	A09
---	Dell OptiPlex 9030 AIO Product Safety, EMC & Environmental Datasheet	A09
---	Dell Latitude E7450 Product Safety, EMC & Environmental Datasheet	A09
---	Dell Networking X-Series Specification Sheet	Ver. 1.9
---	Dell OptiPlex 9020 All-in-One Technical Specification Sheet	---
---	Dell OptiPlex 9030 All-in-One Technical Specification Sheet	---
---	YEDU.E95463 Uninterruptible Power-supply Equipment Sheet	---
---	Dell Latitude E7440 Regulatory Compliance Sheet	Rev. A09
---	Dell Latitude 3480 Regulatory Compliance Sheet	---

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

<b>Document Number</b>	<b>Description</b>	<b>Version</b>
---	Dell PowerEdge R630 Regulatory Compliance Sheet	Rev. A10
---	Dell PowerEdge R640 Technical Guide	Rev. A00
---	Dell Precision T1700 MT Product Safety, EMC & Environmental Datasheet	Rev. A09
---	Dell PowerConnect 2808 Product Safety, EMC, and Environmental DataSheet	---
---	Dell PowerConnect 2816 Product Safety, EMC, and Environmental DataSheet	---
---	Smart Pro SM1500 Datasheet	---
---	SMC1500 APC Smart-UPS C Product Data Sheet	---
---	APC Smart-UPS 230V Product Information Sheet	---
---	HP M402dn Datasheet	---
---	HP LaserJet Pro M402dne Datasheet	---
---	Dell Latitude 3470 Owner's Manual	---
---	Dell Latitude 3480 Owner's Manual	---
---	Dell Latitude E7470 Owner's Manual	---
---	Dell Latitude E7450 Owner's Manual	---
---	Dell Precision T3420 Owner's Manual	---
---	aValue HID-21V-BTX-A1R User Manual	---
---	aValue SID-15V-Z37-A1R Data Sheet	---
---	aValue SID-21V-Z37-A1R Data Sheet	---
---	APC Installation and Operation Back-UPS Pro BR1000G	---
---	APC Smart-UPS SMT1500 Operation Manual	---
---	Dell OptiPlex 7440 All-In-One Owner's Manual	---
---	Dell OptiPlex 3050 All-In-One Owner's Manual	---
---	Dell P2417H Monitor User's Guide	---
---	Dell P2217H Monitor User's Guide	---
---	Dell PowerEdge R630 Owner Manual	---
---	Dell PowerEdge R640 Owner Manual	---
---	Lexar Pro USB 3.0 Dual Slot Reader Quick Start Guide	---
---	aValue SID-15V 15.6" Open Frame Tablet with Cover/Stand/Smart Card Reader/Battery Spec Sheet	---

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

<b>Document Number</b>	<b>Description</b>	<b>Version</b>
---	aValue SID-15V 21.5" Open Frame Tablet with Cover/Stand/Smart Card Reader/Battery Spec Sheet	---
<i>DVS Supplementary Documents</i>		
---	Democracy Suite ImageCast C++ Coding Standard	5.5::33
---	Democracy Suite C# Automated Code Review Process	5.5::28
---	Dominion Voting Systems Java Coding Standards	1.0
---	Dominion Voting Systems JavaScript Coding Standards	1.0
---	Google Java Style Dominion XML	---
---	Democracy Suite ImageCast Device Configuration Files	5.5::76
---	Democracy Suite ImageCast Precinct Election Definition Files	5.5::47
---	Democracy Suite ImageCast Printing and Finishing Specification	5.5::72
---	Democracy Suite ImageCast Total Results File Format	5.5::36
---	Democracy Suite ImageCast Precinct Extracting Firmware Contents	5.5::24
---	Democracy Suite ImageCast Precinct Firmware Update Procedure	5.5::53
---	Democracy Suite ImageCast Precinct Level One (L1) Maintenance Manual	5.5::49
---	Democracy Suite ImageCast Precinct Technical Guide	5.5::33
---	ICX Machine Configuration File (MCF) Parameters Settings	5.5::24
---	Voter-Verified Paper Audit Trail (VVPAT) Model: VRP3 User Manual	07/2018
<i>Usability Studies</i>		
----	Common Industry Format for Usability Test Report ImageCast X 5.2 with VVPAT	5.5::1
---	Usability Test Report of ImageCast Precinct 5.0 with 36 Participants for VVSG 1.0	5.0::14
---	Usability Test Report of ImageCast X 5.0 with 36 Participants for VVSG 1.0	5.0::13
<i>Build Documents</i>		
---	Democracy Suite EMS Windows Build Document	5.5::32
---	Democracy Suite EMS System Installation and Configuration Procedure	5.5::281
---	Democracy Suite ImageCast Central Installation and Configuration Procedure	5.5::127
---	Democracy Suite ImageCast X System Installation and Configuration	5.5::73
---	Democracy Suite ImageCast Precinct Firmware Build and Install	5.5::62
---	Democracy Suite ImageCast X Build	5.5::28



### 3.1.3 QA & CM System Review

The Dominion Voting Systems Quality and Configuration Management Manuals were reviewed for their fulfillment of Volume I, Sections 8 and 9, and the requirements specified in Volume II, Section 2. The requirements for these sections establish the quality assurance and configuration standards for voting systems to which manufacturers must conform and require voting system manufacturers to implement a quality assurance and configuration management program that is conformant with recognized ISO standards. As part of the review process, the Dominion TDP documents were reviewed to determine if the stated policies are being followed.

#### Summary Findings

This testing utilized the TDP Review in conjunction with the PCA to determine compliance to the EAC 2005 VVSG requirements and the requirements stated in the Dominion technical documentation. The review of the Quality Assurance and Configuration Management documentation focused on Dominion's adherence to its stated QA and CM processes. No discrepancies were noted during the reviews.

### 3.1.4 Source Code Review, Compliance Build, Trusted Build, and Build Document Review

Pro V&V reviewed the submitted source code to the EAC 2005 VVSG and the manufacturer-submitted coding standards using both Automated Source Code Review and Manual Review methods. Prior to initiating the software review, Pro V&V verified that the submitted documentation is sufficient to enable: (1) a review of the source code and (2) Pro V&V to design and conduct tests at every level of the software structure to verify that design specifications and performance guidelines are met.

#### Summary Findings

- Automated Source Code Review: The Automated Source Code Review was performed to review the changes in the source code from the previously certified Democracy Suite 5.0 voting system. No source code issues were found during the Automated Source Code review.
- Manual Source Code Review: The Manual Source Code review was performed in on 10% of the comments for compliance to VVSG Volume Section 5.2.7. No source code issues were found during the Manual Source Code review.
- Compliance Build: The compliance build was performed following the compliance review. Once the compliance review was performed and the source was deemed stable enough to proceed with testing, the source code and all additional packages were compiled into a Compliance Build.

Trusted Build: The trusted build consisted of inspecting customer submitted source code, COTS, and Third Party software products and combining them to create the executable code. This inspection followed the documented process from the "United States Election Assistance Commission Voting System Test Laboratory Program Manual" Section 5.5 – 5.7. Performance

of the trusted build includes the build documentation review. The Trusted Build was performed following the completion of the Functional Configuration Audit.

### **3.1.5 Hardware Testing**

The D-Suite 5.5 Voting System is a hybrid paper-based optical scan/DRE voting system which consists of the following major components: the EMS, the ImageCast Central (ICC), the ImageCast Precinct (ICP), and the ImageCast X (ICX). The Democracy Suite is comprised of one proprietary hardware component (ICP), two COTS hardware components (ICC and ICX). All EMS functions are managed by proprietary software running on COTS PCs/servers. The ICX Prime aValue is a new ICX hardware model which was introduced in this modification. The ICX Prime aValue can be configured as either a BMD or as a DRE. In DRE mode, the ICX Prime aValue can be configured with either a VVPAT printer or a Reports Printer. The ICX Samsung was not included in this modification. The Canon DR-M160II was a newly introduced COTS document scanner for use with the ICC.

Previous hardware examinations were performed on the certified baseline system (D-Suite 5.0); the results of which were applied to this campaign to meet the environmental hardware test requirements for the ICX Prime aValue BMD as well as the environmental and electrical hardware test requirements for the ICC Cannon DR-M160II Scanner component. The additional updates to the modified system (D-Suite 5.5) required the full suite of hardware and electrical testing as detailed in the 2005 VVSG. Environmental Testing for the ICX Prime aValue DRE configuration was performed at the NTS Huntsville facility located in Huntsville, Alabama (*Reference NTS Test Data Package for Job No. PR066450, presented as Attachment A-1 of this report*). Re-testing of the Temperature Power Variation Test was performed at the NTS Longmont facility located in Longmont, Colorado (*Reference NTS Test Report No. PR068888, presented as Attachment A-2 of this report*). Electrical Testing for the ICX Prime aValue BMD and DRE configurations was performed at the TUV SUD Canada facility located in Gormley, Ontario, Canada (*Reference TUV EMC/EMI Test Report File #. 7169002989-000, presented as Attachment A-3 of this report*).

The tests performed are listed below:

#### **Electrical Tests:**

- Electrical Power Disturbance
- Electromagnetic Radiation
- Electrostatic Disruption
- Electromagnetic Susceptibility
- Electrical Fast Transient
- Lightning Surge
- Conducted RF Immunity
- Magnetic Fields Immunity

- Electrical Supply

#### **Environmental Tests:**

- Bench Handling
- Vibration
- Low Temperature
- High Temperature
- Humidity
- Temperature Power Variation
- Acoustuc

Testing was performed by personnel verified by Pro V&V to be qualified to perform the test. Pro V&V utilized third-party test facilities for performance of the electrical and environmental tests. All pre- and post-operational status checks were conducted by Pro V&V personnel.

#### **Summary Findings**

Electrical Testing was performed on the D-Suite 5.5 components as described above. The procedures and results for this testing are included in TÜV SÜD Canada Inc. EMC/EMI Test Report File#: 7169002989-000, presented in Attachment A-3. The test results from this testing are summarized below:

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

Standard/Method	Description	Criteria	Class/Level	Result
FCC 15.107 ICES-003 VMSG Vol. 1 4.1.2.9	Power Line Conducted Emissions	N/A	Class B	Pass
FCC 15.109 ICES-003 VMSG Vol. 1 4.1.2.9	Radiated Emissions	N/A	Class B	Pass
EN61000-4-11 VMSG Vol. 1 4.1.2.5	Electrical Power Disturbance	Normal Operation & No Data Loss	Various	Pass
EN61000-4-4 VMSG Vol. 1 4.1.2.6	Electrical Fast Transient	Normal Operation & No Data Loss	±2kV - Mains	Pass
EN61000-4-5 VMSG Vol. 1 4.1.2.7	Lightning Surge	Normal Operation & No Data Loss	±2kV Line - Line ±2kV Line - Ground	Pass

**Table 3-2. Hardware Test Results (continued)**

Standard/Method	Description	Criteria	Class/Level	Result
EN61000-4-2 VMSG Vol. 1 4.1.2.8	Electrostatic Disruption	Normal Operation & No Data Loss	$\pm 8\text{kV}$ Contact $\pm 15\text{kV}$ Air	Pass
EN61000-4-3 VMSG Vol. 1 4.1.2.10	Electromagnetic Susceptibility	Normal Operation & No Data Loss	10 V/m, 80 MHz – 1 GHz	Pass
EN61000-4-6 VMSG Vol. 1 4.1.2.11	Conducted RF Immunity	Normal Operation & No Data Loss	10 Vrms, 150 kHz – 80 MHz	Pass
EN61000-4-8 VMSG Vol. 1 4.1.2.12	Magnetic Immunity	Normal Operation & No Data Loss	30 A/m	Pass
Overall Result				Pass

Environmental Testing was performed on the D-Suite 5.5 components as previously defined. The procedures and results for this testing are included in NTS Test Data Package for Job No. PR066450, presented as Attachment A-1 of this report, and NTS Test Report No. PR068888, presented as Attachment A-2 of this report. The test results from this testing are summarized below:

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

The D-Suite 5.5 system components were subjected to Shock – Bench Handling Testing. Using one edge as a pivot, the opposite edge of the chassis of each unit was lifted until the face reached 45° with horizontal bench top, or 4 inches above bench top (whichever occurred first). This was repeated with each practical edge, of the same horizontal face. At the conclusion of testing, the components were subjected to a visual inspection and an operational status check was performed. Test Result – PASS

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

The D-Suite 5.5 system components were subjected to Vibration – Basic Transportation Testing. Testing was performed at ambient/room temperature (20°C +/-3 °C) in the X, Y and Z axis at the levels identified in Table 3-3. At the conclusion of testing, a visual inspection and an operational status check was performed. Test Result – PASS

**Table 3-3. Vibration Test Profiles**

Axis	Profile	
X	Breakpoints	
	Frequency	PSD Value
	10	.00013
	20	.00065
	30	.00065
	78	.00002
	79	.00019
	120	.00019
	500	.00001
Y	Breakpoints	
	Frequency	PSD Value
	10	.00650
	20	.00650
	120	.00020
	121	.00300
	200	.00300
	240	.00150
	340	.00003
	500	.00015
Z	Breakpoints	
	Frequency	PSD Value
	10	.01500
	40	.01500
	500	.00015

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

The D-Suite 5.5 system components were subjected to Low Temperature – Storage Testing. Samples were subjected to a temperature of -4°F (-20°C +/-3 °C) for a duration of 4 hours, after which operation was confirmed by Pro V&V. Samples were not powered, and were left in their packaging for the duration of the test. They were removed from the boxes for operational verification after the test. At the conclusion of testing, a visual inspection and an operational status check was performed. Test Result – PASS

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

The D-Suite 5.5 system components were subjected to High Temperature – Storage Testing. Samples were subjected to a temperature of 140°F (60°C +/-3 °C) for a duration of 4 hours, after which operation was confirmed by Pro V&V. Samples were not powered, and were left in their packaging for the duration of the test. They were removed from the boxes for operational verification after the test. At the conclusion of testing, a visual inspection and an operational status check was performed. Test Result – PASS

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

The D-Suite 5.5 system components were subjected to Humidity – Hot/Humid Testing. Samples were subjected as per Table 507.2-I, Hot-Humid (Cycle 1), for a duration of 240 hours (10 days), after which operation was confirmed by Pro V&V. Samples were not powered/operational, and were left in their packaging for the duration of the test, and were removed from the boxes for operational verification. At the conclusion of testing, a visual inspection and an operational status check was performed. Test Result – PASS

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

The D-Suite 5.5 system components were subjected to Temperature/Power Variation Testing. Samples completed 85 hours per the following environment profile:

**Table 3-4. Temperature/Power Variation Profile**

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

The D-Suite 5.5 system components were powered and being operated by Pro V&V for the duration of the environmental profile, to confirm operation. Testing was initially conducted at the NTS Huntsville test facility. During test performance, an issue was detected in which an ICX Prime unit with a VVPAT attached was running a vote simulation of 100 ballots an hour, an error occurred where the ICX Prime provided an error message that indicated that the connection to the VVPAT printer was terminated, thus halting the test and preventing the vote simulation from continuing. Dominion was notified of the issue and performed a Root Cause Analysis of the occurrence. Based on this investigation, the root cause of the problem was found to be a combination of a short delay between ballots and intermittent false positive failure conditions that were causing the ICX application to be unable to process the status information and thus causing the ICX application to terminate its connection to the VVPAT printer. Dominion implemented the following two part solution:

1. The VVPAT vendor was asked to add to their product's firmware a logical de-bouncing filter to the output signal for the paper low sensor and the cover open sensor before outputting error conditions to our application. In response to this request, the vendor added a majority filter of 10 reads, which makes the output 100% stable.

2. The vote simulator and application logic were adjusted to work in lock-step to ensure synchronization so that a five (5) second or even zero (0) second delay between ballot printing can be accommodated

The updated versions of the ICX Prime unit and VVPAT were successfully re-tested at the NTS Longmont test facility. Regression testing was performed on the system to verify that the change did not adversely impact previous test results. Test Result – PASS

### **3.1.6 System Level Testing**

System Level testing was implemented to evaluate the complete system. This testing included all proprietary components and COTS components (software, hardware, and peripherals) in a configuration of the system's intended use. For software system tests, the tests were designed according to the stated design objective without consideration of its functional specification. The system level hardware and software test cases were prepared independently to assess the response of the hardware and software to a range of conditions. Pro V&V reviewed the manufacturer's program analysis, documentation, and module test case design and evaluated the test cases for each module with respect to flow control parameters and entry/exit data.

The software system functions for the previously certified voting system (D-Suite 5.0) remained unchanged for the submitted modifications. The Democracy Suite Election Management System (EMS) consists of a set of applications responsible for all pre-voting and post-voting activities used in election definition and management process. The Democracy Suite EMS applications are as follows:

- EMS Election Event Designer
- EMS Results Tally and Reporting
- EMS Audio Studio
- EMS Adjudication Application
- EMS Adjudication Service
- EMS File System Service
- EMS Election Data Translator
- Smart Card Helper Service
- ImageCast Voter Activation
- EMS Data Center Manager
- EMS Application Server
- EMS Database Server
- EMS NAS Server

The D-Suite 5.5 voting system consists of one software application for all central count tabulator hardware, one software application to run the ICX ballot marking and DRE devices, and a firmware application to run the hybrid ICP precinct tabulator/DRE.

System Level Testing included the evaluations of the following test areas: Security Review, FCA, Volume & Stress Testing, Accuracy Testing, and System Integration Testing. Each of these areas is reported in detail in the subsections that follow.

Component Level Testing was implemented during the FCA for each component and subcomponent. During the source code review, compliance builds, and security testing, Pro V&V utilized limited structural-based techniques (white-box testing). Additionally, specification-based techniques (black-box testing) were utilized for the individual software components.

Pro V&V defined the expected result for each test and the ACCEPT/REJECT criteria for certification. If the system performed as expected, the results were accepted. If the system did not perform as expected, an analysis was performed to determine the cause. If needed, the test was repeated in an attempt to reproduce the results. If the failure could be reproduced and the expected results were not met, the system was determined to have failed the test. If the results could not be reproduced, the test continued. All errors encountered were documented and tracked through resolution.

#### **3.1.6.1 Security Functions**

The objective of the Security Testing was to evaluate the effectiveness of the voting system in detecting, preventing, recording, reporting, and recovering from security threats. To evaluate the integrity of the system, Pro V&V developed specifically designed test cases in an attempt to defeat the access controls and security measures documented in the system TDP as well verifying compliance to EAC RFI 2012-05. A threat matrix was created to determine the risks and vulnerabilities. An evaluation of the system was accomplished by utilizing a combination of functional testing, source code review, and static code analyzers. All findings were reported to the EAC and Dominion Voting Systems.

##### **Summary Findings**

The system was inspected for various physical, logical, and administrative controls to measure their effectiveness in meeting 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.

The security evaluation was conducted by a credentialed security expert utilizing voting system components that had been configured during other phases of their certification process. The examiner assessed the systems which were installed, configured, and hardened during FCA following the documented vendor procedures. The system state at the time of security evaluation represents the configuration achieved by following all documented recommendations found in the TDP.



The test methods for performing the security testing were execution, review, and analysis utilizing both manual and automated techniques. The evaluation of the system was accomplished by utilizing a combination of documentation review, functional testing, source code review, artifacts from automated network and vulnerability scanners, as well as manual test execution and results inspection.

The examination was conducted to verify that the combination of administrative, physical, and logical security controls 1) recommended to the procurer, or 2) implemented by the vendor as part of the build were adequate to meet stated requirements.

- Administrative Security was evaluated by examining the system's documented security recommendations for effectiveness and breadth. The controls documented that were implemented during the design were verified in the stated configuration.
- Physical Security was tested by setting up the system as described in the TDP and then examining the effectiveness and comprehensiveness of physical security measures.
- Logical Security Testing was performed using the following tests on system components:
  - Authentication bypass attempts (OS and application)
  - FIPS 140-2 cryptographic compliance and proper utilization
  - OS Vulnerability Scanning
  - OS configuration compliance using a subset of applicable CCE's from CIS and DISA benchmarks

Security Testing was completed successfully with no anomalies or deficiencies witnessed that prevent the system from meeting stated requirements.

### **3.1.6.2 Functional Configuration Audit (FCA)**

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 as a system. The FCA is a verification of every system function cited in the manufacturer's documentation. It verifies the accuracy and completeness of the system Technical Data Package (TDP). In addition to functioning according to the manufacturer's documentation, tests were conducted to insure all applicable EAC 2005 VVSG requirements are met.

Also the various options of software counting logic that are claimed in the manufacturer's documentation were tested during the system-level FCA. Generic test ballots or test entry data for voting, representing particular sequences of ballot-counting events, were used in conjunction with other testing to examine the counting logic during this audit. The error recovery capabilities of the system were assessed to ensure that the voting system could recover from a non-catastrophic failure of a device or any error or malfunction within the operator's ability to correct. The voting systems' error messaging was also assessed to ensure that the voting system generated error messages, logged them, and reported them to the user. This assessment verified that the error messaging provided to the user described the error condition, provided clear messaging regarding the error encountered, and instructed the user on what actions to take to address the error.

condition. Copies of all of the manufacturer's test cases generated for module or unit testing, integration testing, and system testing were submitted to the VSTL for review. Relevant FCA results also acted as exploratory assessments for other testing.

For this campaign FCA testing included several exhaustive paths applied in concert:

- FCA-VVSG Testing: Each component of the system was evaluated against a standardized test-case suite centered upon requirements stated in the VVSG and administered through a test-management software tool. All applicable tests-cases were performed while any non-applicable test-cases (e.g. VVPAT requirements, etc.) were logged as "n/a" for substantiation. The system operations and functional capabilities were categorized in the tool as follows by the phase of election activity in which they are required:
  - o Pre-voting Capabilities: These functional capabilities are used to prepare the voting system for voting. They include ballot preparation, the preparation of election-specific software (including firmware), the production of ballots, the installation of ballots and ballot counting software (including firmware), and system and equipment tests.
  - o Voting System Capabilities: These functional capabilities include all operations conducted at the polling place by voters and officials including the generation of status messages.
  - o Post-voting Capabilities: These functional capabilities apply after all votes have been cast. They include closing the polling place; obtaining reports by voting machine, polling place, and precinct; tabulation of paper ballots at the central location; accumulation of results from all voting methods; obtaining consolidated reports; and obtaining reports of audit trails.
- FCA-Limits Testing: System limits as defined in the TDP and/or COTS manuals were tested and verified.
- FCA-Claims Testing: System user instructions and procedures found in the TDP were followed to verify their accuracy and completeness. In addition any functional claims discovered in the TDP that were not specifically examined in other areas or that were items of interest were also tested.
- FCA-Mapping: All functional paths (buttons, dropdowns, etc.) were mapped by qualified VSTL personnel, to help ensure all functional options had been noted and exercised. Any items of interest were examined and/or tested.

Issues found during these efforts were tracked using an issue tracking software program and issue tracking spreadsheets.

### Summary Findings

All functional tests were successfully executed. During execution of the test procedure, it was verified that the D-Suite 5.5 System successfully completed the system level integration tests with all actual results obtained during test execution matching the expected results. At the conclusion

of the test campaign, it was determined that all issues communicated to Dominion had been successfully reconciled.

### **3.1.6.3 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.

In an effort to achieve this and to verify the proper functionality of the units under test, the following methods were used to test components of the D-Suite 5.5 voting system:

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 accuracy requirements for the ICP and the ICC units were met by the execution of the standard accuracy test utilizing pre-marked and hand-marked ballots of each ballot length supported by the system, and ballots produced by the ICX BMD.

For DRE-based voting systems the system must correctly capture, store, and report the specific ballot selections, and absence of selections, for each ballot position. DRE configurations which include a VVPAT must also correctly print the ballot selections made by the voter. The accuracy requirements for the ICX DRE were met by loading elections for each ballot length supported by the system onto DRE units, and using the built-in vote simulation tool, cast votes on the device using predetermined marking patterns. Accuracy testing was performed on both DRE configurations, one of which included a connected VVPAT and the other which included a connected Reports printer. Barcodes printed on VVPAT receipts were scanned to ensure that the information included within the barcodes correctly matched vote selections.

#### **Summary Findings**

The ICP and ICC units were tested by utilizing a combination of hand marked (70%) and pre-marked (30%) ballots to achieve an accuracy rate greater than 1,549,703 correct ballot positions. The ICX DRE units were tested by using the built-in vote simulation tool to cast a sufficient number of ballots to achieve an accuracy rate greater than 1,549,703 correct ballot positions.

The D-Suite 5.5 System successfully passed the Accuracy Test. All deficiencies encountered during the Accuracy Test, which are noted in Attachment B, were successfully resolved. During execution of the test procedure, it was verified that the D-Suite 5.5 System successfully completed the test with all actual results obtained during test execution matching the expected results.

#### 3.1.6.4 Volume & Stress

The Volume & Stress Test consisted of tests designed 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 focused 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 was utilized to ensure the system could achieve the manufacturer's TDP claims of what the system can support. Testing was performed by exercising an election definition and test cases developed specifically to test for volume and stress conditions of the D-Suite 5.5 system being tested.

##### Summary Findings

During test performance, four issues were encountered which required a root cause analysis to be performed. The issues, along with the resolutions, are summarized below:

- ICX Prime configured with VVPAT and dual USB memory devices

It was found that during the test, one ICX unit lost power and another ICX unit froze. When both of the units were restarted, the ICX units displayed a "storage media" error. The polls were then closed on the units, at which time the units failed to print the results report. The units also displayed the message "Write to all results files failed." The problem was investigated by Dominion, who determined that the Machine Configuration File (MCF) was not configured correctly to match the number of USB Memory Devices used on the ICX units for results storage. The MCF was configured to store results on one USB Memory Device, yet two USB Memory Devices were installed on both ICX units. This configuration mismatch in conjunction with the Android operating system's (Android OS) method of designating IDs to USB devices was the cause of the errors.

Dominion determined that the solution could be implemented in either of the following three ways:

1. Remove all extra USB memory devices and only leave a single USB memory device connected to the ICX unit, and then restart the unit, or
2. Change the ICX application configuration under >Tech menus >Edit Configuration >Result Paths, and manually select the correct device ID of the USB memory device that contains the election files and results, or
3. Setup the MCF configuration for dual USB memory devices.

- ICX Prime error after ~75 ballots cast

During test performance utilizing a vote simulation, two ICX Prime DRE units with the Report Printer displayed the following error message: "Unfortunately something went wrong. Please call authorized person for assistance." after approximately 75 ballots were cast. Shortly thereafter, three ICX Prime DRE units equipped with a VVPAT exhibited the same error as the Report Printer units. This error occurred after 75 ballots were cast. The problem

was investigated by Dominion, and it was determined that all units ran out of memory during the voting simulation. The root cause of the problem was found to be the ICX application's use of the Android OS accessibility service (which was toggled ON to provide the Custom Navigation bar features when the system navigation bar was disabled) generating a memory leak when there was activity through the user interface.

The solution was implemented in the following way: Dominion discontinued using the accessibility service provided by the Android OS framework. A Custom Service was developed by Dominion and implemented in the ICX application software that is always turned ON when the application is running. The Custom Service mimics the portion of the Android accessibility feature to send global key presses, but does not incorporate the whole Android accessibility feature. Additionally, a button was added to the Custom Navigation bar to toggle the system navigation bar visibility so that, in an administrative mode when the ICX application is not running, the system navigation bar could be visible.

- ICX Prime DRE with VVPAT/Report Printer

During test performance, using manual session activation, it was noticed that units were printing random Unicode characters in between valid report lines on the VVPAT unit. Based on Dominion's investigation, the root cause of the issue was determined to be the buffer overflow caused by the memory limitations of the printer input buffer, and a short timeout (200ms) on the host side of the USB data transmission.

The solution was to increase the timeout to five (5) seconds on the host side, so that the function that transmits data to the printer waits long enough to allow the printer to sufficiently empty its buffer so that it has room to receive the next data packet, regardless of the printer speed setting.

- ICX Prime DRE with VVPAT/Report Printer paper jam

During test performance, using vote simulation activation, it was noticed that a VVPAT printer had a paper jam, described as an accordion shaped jam. The root cause of the issue was determined to be paper dust that built up on the top surface of paper path, which increased the drag on the overall system causing the rewinder motor to slip occasionally and, in some situations, cause an accordion paper jam. It was noted that the original cleaning procedure defined in Dominion documentation did not include cleaning of the rewinder gears or the top edge of on inversion plane. It also did not specify the use of a lint-free cloth for cleaning. To remedy the issue, Dominion implemented an updated cleaning procedure that included specified cleaning cycles of the additional areas and the use of a lint-free cloth.

Following resolution of the identified issues, the D-Suite 5.5 System successfully passed the Volume & Stress Test. During execution of the test procedure, it was verified that the D-Suite 5.5 System successfully completed the test with all actual results obtained during test execution matching the expected results.

### 3.1.6.5 System Integration

System Integration is a system level test for the integrated operation of both hardware and software. System Integration evaluates the compatibility of the voting system software components or subsystems with one another, and with other components of the voting system environment. This compatibility was determined through functional tests integrating the voting system software with the remainder of the system. During test performance, the system was configured exactly as it would for normal field use as detailed in the D-Suite 5.5 voting system technical documentation. This included connecting all supporting equipment and peripherals including ballot boxes, voting booths (regular and accessible), and any physical security equipment such as locks and ties.

#### Summary Findings

During System Integration testing, three General Elections and three Primary Elections were successfully exercised on the voting system, as described below:

Three general elections with the following breakdowns:

- General Election GEN-01: A basic election held in 4 precincts, one of which is a split precinct. This election contains 19 contests compiled into 4 ballot styles. 5 of the contests are in all 4 ballot styles. The other 15 contests are split between at least 2 of the precincts with a maximum of 4 different contest spread across the 4 precincts.
- General Election GEN-02: A basic election held in 3 precincts. This election contains 15 contests compiled into 3 ballot styles. 10 of the contests are in all 3 ballot styles with the other five split across the 3 precincts.
- General Election GEN-03: A basic election held in 2 precincts. This election contains 8 contests and compiled into 2 ballot styles. 4 of the contests are in both ballot styles. The other 4 contests are split between the two precincts. This election is designed to functionally test the handling of multiple ballot styles, support for at least three languages including a character-based language, support for common voting variations, and audio support for at least three languages and an ADA binary input device.

Three primary elections with the following breakdowns:

- Primary Election PRIM-01: Open Primary Election in two precincts. This election contained thirty contests compiled into five ballot styles. Each ballot style contains 6 contests.
- Primary Election PRIM-02: Open 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 PRIM-03: A basic election held in 2 precincts. This election contains 10 contests and is compiled into 2 ballot styles. 2 of the contests are in both ballot styles. The other 8 contests are split between the two parties' ballots. This Primary Election is designed to functionally test the handling of multiple ballot styles, support for at least three languages

including a character-based language, support for common voting variations, and audio support for at least three languages and an ADA binary input device.

The D-Suite 5.5 System successfully passed the System Integration Test. All deficiencies encountered during the System Integration test, which are noted in Attachment B, were successfully resolved. During execution of the test procedure, it was verified that the D-Suite 5.5 System successfully completed the system level integration tests with all actual results obtained during test execution matching the expected results.

### 3.2 Anomalies and Resolutions

When a result is encountered during test performance that deviates from what is standard or expected, a root cause analysis is performed. Pro V&V considers it an anomaly if no root cause can be determined. In instances in which a root cause is established, the results are then considered deficiencies. A root cause was determined for each anomaly which made them deficiencies.

Throughout the test campaign, five anomalies were encountered. Four issues were discovered during performance of the Volume & Stress Test, as detailed in Section 3.1.6.4 of this report. One issue was discovered during the Temperature/Power Variation Test, as detailed in Section 3.1.5 of this report. Dominion performed a root cause analysis for each issue. All issues were successfully resolved.

### 3.3 Deficiencies and Resolutions

Any violation of the specified requirement or a result is encountered during test performance that deviates from what is standard or expected in which a root cause is established is considered to be a deficiency. Deficiencies are logged throughout the test campaign in to Pro V&V tracking system (Mantis) and are provided to the EAC for disposition and resolution. All deficiencies encountered during the Democracy Suite 5.5 test campaign were successfully resolved and are presented in Attachment B of this report.

## 4.0 RECOMMENDATION FOR CERTIFICATION

The D-Suite 5.5 Voting System, as presented for testing, successfully met the requirements set forth for voting systems in the U.S. Election Assistance Commission (EAC) 2005 Voluntary Voting System Guidelines (VVSG), Version 1.0. Additionally, Pro V&V, Inc. has determined that the D-Suite 5.5 functioned as a complete system during System Integration Testing. Based on the test findings, Pro V&V recommends the EAC grant the D-Suite 5.5 system, as identified in Tables 4-1 through 4-21, certification to the EAC 2005 VVSG.

**Table 4-1. Democracy Suite 5.5 EMS Software Component Descriptions**

Software	Version	Filename	Configuration	
			Standard	Express
EMS Election Event Designer (EED)	5.5.12.1	setup.exe: EED_FED_CERT_Setup_x64.m si	X	X

**Table 4-1. Democracy Suite 5.5 EMS Software Component Descriptions** *(continued)*

Software	Version	Filename	Configuration	
			Standard	Express
EMS Results Tally and Reporting (RTR)	5.5.12.1	setup.exe: RTR_FED_CERT_Setup_x64.msi	X	X
EMS Application Server	5.5.12.1	setup.exe: APPS_FED_CERT_Setup_x64.msi	X	X
EMS File System Service (FSS)	5.5.12.1	setup.exe: FSSSetup.msi	X	X
EMS Audio Studio (AS)	5.5.12.1	setup.exe: EMSAudioStudioSetup.msi	X	X
EMS Data Center Manager (DCM)	5.5.12.1	DemocracySuiteEMS_DCM.exe	X	X
EMS Election Data Translator (EDT)	5.5.12.1	setup.exe: EDTSetup_x86.msi EDTSetup_x64.msi	X	X
ImageCast Voter Activation (ICVA)	5.5.12.1	setup.exe: ICVASetup.msi	X	X
EMS Adjudication (Adj.)	5.5.8.1	DVS ImageCast Adjudication Client Setup.msi	X	X
EMS Adjudication Service	5.5.8.1	DVS Adjudication Services Setup.msi	X	X
Smart Card Helper Service	5.5.12.1	setup.exe: SmartCardServiceSetup.msi	X	X

**Table 4-2. Democracy Suite 5.5 ImageCast Precinct Software Component Descriptions**

Firmware/Software	Version	Filename
Election Firmware	5.5.3-0002	cf2xx.sig
Firmware Updater	5.5.3-0002	firmUp.enc
Firmware Extractor	5.5.3-0002	FirmwareExtract.enc
Kernel (uClinux)	5.5.3-0002	image.bin.gz
Boot Loader (COLILO)	20040221	colilo.bin
Asymmetric Key Generator	5.5.3-0002	Keygen.enc
Asymmetric Key Exchange Utility	5.5.3-0002	KeyExchange.enc
Firmware Extractor (Uses Technician Key)	5.5.3-0002	TechExtract.enc

**Table 4-3. Democracy Suite 5.5 ImageCast Central Software Component Descriptions**

Firmware/Software	Version	Filename
ImageCast Central Application	5.5.3.0002	ICCSetup.exe



**Table 4-4. Democracy Suite 5.5 ImageCast X Software Component Descriptions**

<b>Firmware/Software</b>	<b>Version</b>	<b>Filename</b>
ICX Application	5.5.10.25	ICX.apk

**Table 4-5. Democracy Suite 5.5 EMS Client/Server Software Component Descriptions**

<b>Firmware/Software</b>	<b>Version</b>	<b>Filename</b>	<b>Configuration</b>	
			<b>Standard</b>	<b>Express</b>
Microsoft Windows Server	2012 R2 Standard	Physical Media from Microsoft	X	
Microsoft Windows	10 Professional	Physical Media from Microsoft	X	X
.NET Framework	3.5	Physical Media from Microsoft	X	X
Microsoft Visual J#	2.0	vjredist64.exe vjredist.exe	X	X
Microsoft Visual C++ 2013 Redistributable	2013	vcredist_x64.exe vcredist_x86.exe	X	X
Microsoft Visual C++ 2015 Redistributable	2015	vc_redist.x64.exe vc_redist.x86.exe	X	X
Java Runtime Environment	7u80	jre-7u80-windows-x64.exe jre-7u80-windows-i586.exe	X	X
Java Runtime Environment	8u144	jre-8u144-windows-x64.exe jre-8u144-windows-i586.exe	X	X
Microsoft SQL Server 2016 Standard	2016 Standard	Physical Media from Microsoft	X	
Microsoft SQL Server 2016 Service Pack 1	2016 SP1	SQLServer2016SP1- KB3182545-x64-ENU.exe	X	
Microsoft SQL Server 2016 SP1 Express	2016 SP1	SQLEXPADV_x64_ENU.exe		X
Cepstral Voices	6.2.3.801	Allison (English): Cepstral_Allison_windows_6.2. 3.801.exe Alejandra (Spanish): Cepstral_Alejandra_windows_6 .2.3.801.exe	X	X
Arial Narrow Fonts	2.37a	ARIALN.TTF ARIALNB.TTF ARIALNBI.TTF ARIALNI.TTF	X	X
Maxim iButton Driver	4.05	install_1_wire_drivers_x86_v4 05.msi install_1_wire_drivers_x64_v4 05.msi	X	X
Adobe Reader DC	AcrobatDC	AcroRdrDC1501020060_en_U S.exe	X	X
Microsoft Access Database Engine	2010	AccessDatabaseEngine.exe AccessDatabaseEngine_x64.ex e	X	X

**Table 4-5. Democracy Suite 5.5 EMS Client/Server Software Component Descriptions** *(continued)*

Firmware/Software	Version	Filename	Configuration	
			Standard	Express
Open XML SDK 2.0 for Microsoft Office	2.0	OpenXMLSDKv2.msi	X	X

**Table 4-6. Democracy Suite 5.5 EMS Software Platform Unmodified COTS Component Descriptions**

Firmware/Software	Version	Filename
Infragistics NetAdvantage Win Forms 2011.1	2011 Vol.1	NetAdvantage_WinForms_20111.msi
Infragistics NetAdvantage WPF 2012.1	2012 Vol.1	NetAdvantage_WPF_20121.msi
TX Text Control Library for .NET	16.0	TXText Control.NET for Windows Forms 16.0.exe
SOX	14.3.1	sox.exe , libgomp-1.dll, pthreadgc2.dll, zlib1.dll
NLog	1.0.0.505	NLog.dll
iTextSharp	5.0.5	itextsharp.dll
OpenSSL	1.0.2k & 2.0.14 FIPS	openssl.exe, libeay32.dll, ssleay32.dll
SQLite	1.0.103.0	System.Data.SQLite.DLL (32-bit and 64-bit)
Lame	3.99.4	lame.exe
Speex	1.0.4	speexdec.exe and speexenc.exe
Ghostscript	9.04	gsdll32.dll (32-bit and 64-bit)
One Wire API for .NET	4.0.2.0	OneWireAPI.NET.dll
Avalon-framework-cvs-20020806	20020806	avalon-framework-cvs-20020806.jar
Batik	0.20-5	batik.jar
Fop	0.20-5	fop.jar
Microsoft Visual J# 2.0 Redistributable Package- Second Edition(x64)	2.0	vjc.dll , vjsjbc.dll, vjslibcw.dll, vjsnativ.dll , vjssupuilib.dll , vjswaux.dll
Entity framework	6.1.3	EntityFramework.dll
Spreadsheetlight	3.4.3	SpreadsheetLight.dll, SpreadsheetLight.xml
Open XML SDK 2.0 For Microsoft Office	2.0.5022.0	DocumentFormat.OpenXml.dll, DocumentFormat.OpenXml.xml

**Table 4-7. Democracy Suite 5.5 ImageCast Precinct Unmodified COTS Component Descriptions**

<b>Firmware/Software</b>	<b>Version</b>	<b>Filename</b>
OpenSSL 1.0.2k	1.0.2k	openssl-1.0.2k.tar.gz
OpenSSL FIPS 2.0.10	2.0.10	openssl-fips-2.0.10.tar.gz
Zlib	1.2.3	Zlib-1.2.3.tar.gz

**Table 4-8. Democracy Suite 5.5 ImageCast X Unmodified COTS Component Descriptions**

<b>Firmware/Software</b>	<b>Version</b>	<b>Filename</b>
Google Text-to-Speech Engine	3.11.12	ARM: com.google.android.tts_3.11.12-210311121_minAPI19(armeabi-v7a)(nodpi).apk  x86: com.google.android.tts_3.11.12-210311123_minAPI15(x86)(nodpi).apk
ICX Prime Android 5.1.1 Image	0405	0405_5.1.1-01.12_user_android_x86.iso
ICX Classic Android 4.4.4 Image	0.0.98	byt_t_crv2_64-ota-BCX18-V0.0.98.zip

**Table 4-9. Democracy Suite 5.5 ImageCast Central Software Build Library Source Code (Unmodified COTS)**

<b>Firmware/Software</b>	<b>Version</b>	<b>Filename</b>
OpenSSL 1.0.2k	1.0.2k	openssl-1.0.2k.tar.gz
OpenSSL FIPS 2.0.10	2.0.10	openssl-fips-2.0.10.tar.gz

**Table 4-10. Democracy Suite 5.5 ImageCast Central Runtime Software Components (Unmodified COTS)**

<b>Firmware/Software</b>	<b>Version</b>	<b>Filename</b>
1-Wire Driver (x86)	4.05	install_1_wire_drivers_x86_v405.msi
1-Wire Driver (x64)	4.05	install_1_wire_drivers_x64_v405.msi
Canon DR-G1130 TWAIN Driver	1.2 SP6	G1130_DRIT_V12SP6.exe
Canon DR-M160II TWAIN Driver	1.2 SP6	M160II_DRIT_V12SP6.exe
Visual C++ 2013 Redistributable (x86)	12.0.30501	vcredist_x86.exe

**Table 4-11. Democracy Suite 5.5 ImageCast Precinct Modified COTS Software Component Descriptions**

<b>Firmware/Software</b>	<b>Version</b>	<b>Filename</b>
uClinux	20070130	uClinux-dist-20070130.tar.gz
COLILO Bootloader	20040221	Colilo20040221.tar.gz

**Table 4-12. Democracy Suite 5.5 ImageCast X Modified COTS Software Component Descriptions**

<b>Firmware/Software</b>	<b>Version</b>	<b>Filename</b>
Zxing Barcode Scanner	4.7.5	BS-4.7.5.zip
SoundTouch	1.9.2	Soundtouch-1.9.2.tar.gz

**Table 4-13. Democracy Suite 5.5 EMS Software Build Environment Component Descriptions**

<b>Firmware/Software</b>	<b>Version</b>	<b>Filename</b>
Windows 10 Professional	10 Professional	Physical Media from Microsoft
.NET Framework 3.5	3.5	Physical Media from Microsoft
Internet Information Server (IIS)	10.0	Physical Media from Microsoft
7-Zip	9.20 (64 Bit)	7z920-x64.msi
Visual Studio 2015 Professional with Update 3	2015 Update 3	en_visual_studio_professional_2015_with_update_3_x86_x64_web_installer_8922978.exe
.NetDiscUtils	0.10	DiscUtilsBin-0.10.zip
Infragistics NetAdvantage Win Forms 2011.1	2011.1	NetAdvantage_WinForms_20111.msi
Infragistics NetAdvantage – WPF 2012.1	2012.1	NetAdvantage_WPF_20121.msi
TX Text Control 16.0.NET	16	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	vjredist64.exe
iTextSharp	5.0.5	itextsharp-5.0.5-dll.zip
Ghostscript	9.0.4	gs904w32.exe gs904w64.exe
Nlog	1.0.0.505	NLog-1.0-Refresh-bin.zip
OneWireAPI.NET	4.0	1-wiredkver400_beta2.zip
Lame	3.99.4	lame3.99.4-20120130.zip
Sox	14.3.1	sox-14.3.1-win32.zip
Avalon Framework	20020806	avalon-framework-cvs-20020806.jar.zip

**Table 4-13. Democracy Suite 5.5 EMS Software Build Environment Component Descriptions**  
(continued)

Firmware/Software	Version	Filename
Fop	0.20-5	fop-0.20.5.jar
Batik	0.20-5	batik-1.5-fop-0.20-5.jar
SQLite	1.0.103.0	sqlite-netFx46-setup-bundle-x64-2015-1.0.103.0.exe
OpenSSL 1.0.2k	1.0.2k	openssl-1.0.2k.tar.gz
OpenSSL FIPS 2.0.10	2.0.10	openssl-fips-2.0.10.tar.gz
Strawberry Perl	5.24.1.1	strawberry-perl-5.24.1.1-64bit.msi
Patch	2.5.9-7	patch-2.5.9-7-bin.zip
ISONewspaper	30.4	ISONewspaper30v4_gr.icc.zip
Ogg Vorbis Encoder	2.88	oggenc2.88-1.3.5-generic.zip
Ogg Vorbis Encoder	1.10.1	oggdecV1.10.1.zip
Prism Mvvm	1.1.1	prism.mvvm.1.1.1.nupkg
Bitmiracle.libtiff.net	2.4.560	Bitmiracle.libtiff.net.2.4.560.nupkg
Prism	4.0.0	prism.4.0.0.nupkg
Prism.UnityExtensions	4.0.0	prism.unityextensions.4.0.0.nupkg
PDF Printing	2.9.5.2	PDFPrinting.zip
Entity Framework	6.1.3.net45	entityframework.6.1.3.nupkg
WiX	3.10	Wix310.exe
Spreadsheet Light	3.4.3	spreadsheetlight.3.4.3.nupkg
Open XML SDK 2.0 for Microsoft Office	2.0	OpenXMLSDKv2.msi
Adobe Reader DC	AcrobatDC	AcroRdrDC1501020060_en_US.exe
Arial Narrow Fonts	2.37a	ArialNarrowFonts.zip
SSH.NET	2016.1.0	SSH.NET-2016.1.0-bin.zip
SSMS	14.0.17119.0	SSMS-Setup-ENU.exe
TwainDSM	2.3.0	Twaindsm-2.3.0.win.bin

**Table 4-14. Democracy Suite 5.5 ICC Software Build Environment Component Descriptions**

Firmware/Software	Version	Filename
NASM Assembler	2.12.02	nasm-2.12.02-win32.zip
OpenSSL 1.0.2k	1.0.2k	openssl-1.0.2k.tar.gz
OpenSSL FIPS 2.0.10	2.0.10	openssl-fips-2.0.10.tar.gz

**Table 4-14. Democracy Suite 5.5 ICC Software Build Environment Component Descriptions**  
(continued)

Firmware/Software	Version	Filename
CSC3-2010	N/A	CSC3-2010.crl
tss-ca-g2	N/A	tss-ca-g2.crl

**Table 4-15. Democracy Suite 5.5 Adjudication Software Build Environment Component Descriptions**

Firmware/Software	Version	Filename
Microsoft Enterprise Library	5.0	Enterprise Library 5.0.msi
Microsoft Prism	4.0.0	Prism.4.0.0.nupkg
Microsoft Identity Foundation SDK	4.0	WindowsIdentityFoundation-SDK-4.0.msi
Toggle Switch Control Library	1.1.1	ToggleSwitch 1.1.1.zip
Infragistics NetAdvantage Ultimate 2013.1	2013.1	NetAdvantage_20131_PlatformInstaller.zip
iTextSharp	5.5.1	itextsharp-all-5.5.1.zip
CLR Security	June 2010	clrsecurity_june10.zip
OpenSSL 1.0.2k	1.0.2k	openssl-1.0.2k.tar.gz
OpenSSL FIPS 2.0.10	2.0.10	openssl-fips-2.0.10.tar.gz
Community MSI Extensions	1.4	msiext-1.4.zip
TreeViewEx	3.0.0.0	TreeViewEx.dll

**Table 4-16. Democracy Suite 5.5 ImageCast Precinct Election Firmware Compiler Descriptions**

Firmware/Software	Version	Filename
g++ (GNU C++ compiler)	gcc3.4.0-20040603	m68k-uclinux-tools-c++-gcc3.4.0-20040603.sh

**Table 4-17. Democracy Suite 5.5 ImageCast Precinct Firmware Build Environment Component Descriptions**

Firmware/Software	Version	Filename
Ubuntu 16.04.1	16.04.1	ubuntu-16.04.1-desktop-i386.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

**Table 4-17. Democracy Suite 5.5 ImageCast Precinct Firmware Build Environment Component Descriptions** *(continued)*

Firmware/Software	Version	Filename
OpenSSL 1.0.2k	1.0.2k	openssl-1.0.2k.tar.gz
OpenSSL FIPS 2.0.10	2.0.10	openssl-fips-2.0.10.tar.gz

**Table 4-18. Democracy Suite 5.5 ImageCast X Firmware Build Environment Component Descriptions**

Firmware/Software	Version	Filename
Ubuntu 14.04.4	14.04.4	ubuntu-14.04.4-desktop-amd64.iso

**Table 4-19. D-Suite 5.5 Configuration Files**

Configuration File	Version	Filename
Machine Configuration File (MCF)	5.5.10.20_20180806	MCF_5.5.10.20_20180806.mcf
Device Configuration File (DCF)	5.4.01_20170521	DCF_5.4.01_20170521.dcf

**Table 4-20. D-Suite 5.5 Voting System Equipment**

Component	Serial Number
<b><i>Proprietary Hardware</i></b>	
ImageCast Precinct Optical Scanner PCOS-320C	AAFAJFM0061, AAFAJFN0030, AAFAJGI6764, AAFAJEL0352
ImageCast Precinct Optical Scanner PCOS-320A	AANAGCP0347, AANAGCP0002
ICP Ballot Box BOX-330A	AAUCCFX0083, AAUCCGI0011
ICX Inline EMI Filter	[DVS-EMIFILTER-001] thru [DVS-EMIFILTER-003]
<b><i>COTS Hardware</i></b>	
ICX aValue 15" Tablet (SID-15V)	0E14AF00014, B03G005400006, B033G00540008, 9E274118, 1D274118, Baytrail98D750C0, Baytrail12034DCC, Baytrail9A6550C8
ICX aValue 21" Tablet (SID-21V)	0E14AF00027, B03G005500019, 03G005500009, 0039BZ2D, 0039B209, Baytrail0039B22D, BaytrailF1B2587F, BaytrailF1B25983
A Value 21" ICX DRE (Prime)	1707101522, 1707101789, 1707101730, 1707101887, 1707101710, 1707101725, 1707101731, 1708100916, 1708100876, 1708100915, 1707101845, 1707101778, 1717101720, 1707101845, 1707101722, 1707202552, 1711300282, 1707100089, 1707101795, 1707101793, 17101793
SII Thermal Printer	1115271A, 1115273A, 115270A, 1115275A

**Table 4-20. D-Suite 5.5 Voting System Equipment** *(continued)*

<b>Component</b>	<b>Serial Number</b>
KFI VRP3 Thermal Printer (VVPAT)	KPR000000715, KPR0000078339, KPR0000078377, KRP000000711, KPR000000712, KPR170900010119, KPR0000078337, KPR0000078364, KPR170900008115, KPR0000078339, KPR170900008116, KPR170900010347, KPR170900009733, KPR170900010120, KPR170900010119, KPR170900010337, KPR170900010338, KPR170900010348
Dell OptiPlex 7440 All In One	HVNRFB2, HVNQFB2, HVNPF2
Dell PowerEdge R630	4Z07T52
Dell PowerEdge R640	JMP9CM2
Canon imageFormula DR-G1130 Scanner	GF301092, GF304418
Canon DR-M160II Scanner	GX333569, GX333573, GX324846, GX326272, GX319353
Dell Precision T3420 PC	HS0VFB2, HS0TFB2, HS0RFB2, HS0SFB2, 4TB3MN2, F575HH2
HP LaserJet Pro Printer M402dn	PHBQF20342, PHBQF20345, PHBQC12619, PHBQC19613, PHBQC12519, PHBQD18790, PHBQC12616, PHBQG09329
HP LaserJet Pro Printer M402dne	PHB5D00782, PHB5D04714, PHB5F04770, PHB5B18304, PHB5D04713
Dell OptiPlex 9030 All-In-One	CF73S52
Dell Ultrasharp 24" Monitor U2414H	1PVZ152, 62VZ152
Dell OptiPlex 3050 All-In-One	19YWWK2
Smart Card Reader ACR39	RR374-010362

**Table 4-21. D-Suite 5.5 Voting System Support Equipment**

<b>Component</b>	<b>Serial Number</b>
Dell Monitor KM632	FYNTY12, CKX6Y12, CN-0524N3-72461-59H-6U5U
Dell Monitor P2414Hb	CN-0524N3-74261-5AH-2DNU, CN-0524N3-74261-5AH-2DAU
Dell DVD Multi Recorder GP60NB60	[DVS-Dell-001]
Dell Latitude E7450 Laptop	30GFH72, 369FH72
Dell Latitude e3480 Laptop	1VD3NJ2
Maxim iButton Programmer DS9490R# with DS1402	[DVS-Maxim-001] thru [DVS-Maxim-006]



**Table 4-21. D-Suite 5.5 Voting System Support Equipment** *(continued)*

<b>Component</b>	<b>Serial Number</b>
APC Smart-UPS SMT1500	3S1536X06436, 3S1536X06475, 3S1536X06461, 3S1536X06485, 3S1536X06484, 3S1536X06322, 3S1536X07467, 3S1536X06485, 3S1536X06272, 3S1536X06201, 3S1536X07305, 3S1504X00395, 3S1504X00396, 351716X02289, W51530180004, 3S171X06059
Dell X1008 Network Switch	4R8XX42, 26SXX42
Dell X1018 Network Switch	6TN7Y42, 63SXX42
Enabling Devices Sip and Puff	[DVS-enabling devices-001] - [DVS-enabling devices-002]
Cyber Acoustics Headphones ACM-70	[DVS-cyber acoustics-001] - [DVS-cyber acoustics-005]
4-Way Joystick Controller S26	PME QC 1550 12, [DVS-JOY-001], [DVS-JOY-002]
Enablemart # 88906 Rocker (Paddle) Switch	[DVS-paddle-001]
Dell PowerConnect 2808 Network Switch	3S2P0Z1
IOGEAR SDHC/microSDHC 0U51USC410 Card Reader	8632, 8633
Lexar USB 3.0 Dual-Slot Reader	24020845007435
Hoodman Steel USB 3.0 UDMA Reader 102015	[DVS-hoodman-001]
ATI Handset	98862010101-035, 98862010103-075, 00659010100-046, 98862010100-232, 093015-1-1, 00659010100-035
ATI-USB Handset	02440010100-011, [DVS-ATIUSB-001], [DVS-ATIUSB-002], B104326-1-4-040, B104326-1-4-035
ACS PC-Linked Smart Card Reader ACR39U	RR374-006272, RR374-010356, RR374-010365
Lexar Professional CF Card Reader Workflow CFR1	24050361400108, 24050361401994, 24050361401991, 24050361401990
CORCOM Filter P/N#: 15EMC1	[DVS-CorcomEMIFilter-001]
Delta Filter P/N#: 16PDCG5C	[DVS-DeltaEMIFILTER-001]
Kingston Card Reader FCR-HS4	08738174208132

## **ATTACHMENT A**

### **HARDWARE TEST REPORTS**

*Attachment A-1: NTS Test Data Package for Job No. PR066450*

*Attachment A-2: NTS Test Report No. PR068888*

*Attachment A-3: TUV EMC/EMI Test Report File #. 7169002989-000*

**ATTACHMENT B**  
**DEFECIENCIES AND RESOLUTIONS**

**Table B-1. Deficiencies and Resolutions**

<b>VRT ID #</b>	<b>Deficiency</b>	<b>Resolution</b>
403	At Review Selections screen on an ICX in DRE mode, the button for casting a ballot says "Print Ballot" in text, and for the Audio it also says "Print Ballot." Per the ICX User Guide, the button should say Cast Ballot and its associated audio file should say Cast Ballot. The final "Cast Ballot" button however, is displayed correctly and its associated audio file also says "Cast ballot."	A new source code submission was reviewed and a new compliance build performed. Regression Test performed using EMS 5.5.9.1 and ICX 5.5.8.13.
404	At Review Selections screen on an ICX in BMD mode, the button for printing a ballot says "Print Ballot" in text, and for the Audio it also says "Print Ballot". This is the correct behavior. The final "Print Ballot" button however, is displayed incorrectly as "Cast Ballot" and its associated audio file says "Print ballot" which is incorrect. Per the ICX User Guide the final button should say Print Ballot and its associated audio file should say Print Ballot.	A new source code submission was reviewed and a new compliance build performed. Regression Test performed using EMS 5.5.9.1 and ICX 5.5.8.13.
407	When viewing the PollWorker menu on the ICX Classic BMD units, in the space for LifeTime Counter, the message "Persistence Media Not Found" is displayed.	Received a Letter from A-Value via Dominion, which states that during A-Value's analysis of the unit, they found that the EEPROM which serves as the Persistence Media, was not present on the motherboard, as the unit was an early production model.
414	When generating a "Ballot Text for Contest Report" through the EED application, if the election has no contest text, the report will never timeout.	Addressed via a documentation update to the EMS EED User Guide, Appendix G.
415	While voting an audio ballot using the ATI handset on the ICX Prime DRE/BMD, the instructions provided to the voter do not notify them of how to access the options above the ballot, specifically the Language, Text Size, Audio, and View buttons.	A new source code submission was reviewed and a new compliance build performed. Regression testing performed using EMS 5.5.9.1.
418	When generating a Ballot Troubleshooting Report, the Default Title on the Report says "Results Pair Report" instead of Ballot Troubleshooting Report.	A new source code submission was reviewed and a new compliance build performed. Regression Testing performed using EED 5.5.9.1.
419	An election with multiple columns displaying on the ICX was created. When 6 columns were used,	This item was addressed via a documentation update to the EMS

	the actual text for the choices was cut in half and barely readable.	EED User Guide.
420	When attempting to connect Accessible Devices to the ICX Classic 15" unit, selecting AVS controller does not display a popup menu from which to select ATI or Tecla. As a result the Tecla cannot be used on the ICX Classic 15" rendering it unusable as an accessible device.	This item was addressed via updates to the TDP. The Tecla Shield device (which is used only with the Samsung ICX) has been added to the Relevant Disclaimers section of the TDP documentation as not being a component of the Democracy Suite 5.5 voting system.
421	An election was being performed on the ICX Prime BMD. On the Info Screen on the ballot, when Audio Visual Mode is being used, the Election Name is spoken, followed by "Less Than Repeat Greater Than" followed by the Election Name again. This situation does not appear to occur when using the ATI.	A new source code submission was reviewed and a new compliance build performed. Regression testing performed using ICX Ver 5.5.8.15 and EMS Ver 5.5.9.1.
422	While loading an election on the ICX Prime BMD the user was required to swap between the Techadvisor and PollWorker user (smart cards) multiple times to load the election, select the tabulator, then edit the Configuration options, then return to the pollworker menu to open the polls. Before the polls could be opened, the Smart Card Reader stopped working.	A new source code submission was reviewed and a new compliance build performed. Regression testing performed using ICX Ver 5.5.8.15.
423	While generating Statement of Votes Cast Reports, the Default District Type "County" displayed multiple times in the District Types filtering options list. Attempts were being made to test the Voter Privacy modification, when this was noticed. At one point, up to 7 copies of the district type "county" were present in the list.	A new source code submission was reviewed and a new compliance build performed. Regression Testing performed on RTR 5.5.9.1.
426	<p>The ICX Prime DRE w/ Reports Printer S/N 1707101845 froze up during the Volume and Stress Test. The unit was marking a ballot and during the transition between contests the unit froze and became unresponsive. As no resolution was available, the unit had to be restarted, and the polls closed so as to allow for the Audit Logs to be provided to Dominion for resolution. As a result the ICX Prime DRE w/ Reports Printer configuration has failed the Volume and Stress Test.</p> <p>The unit was restarted using the Power button. Once the unit rebooted the user was notified that there was an error with the storage media. The polls were then closed at which time the unit failed to print the results report and prompted the user to</p>	<p>A new source code submission was reviewed and a new compliance build performed. Additionally, the ICX Prime Android build was updated.</p> <p>Regression Testing was performed using ICX Version 5.5.9.1 with Android build 0207_5.1.1-01.10_user_android_x86.</p> <p>The Volume and Stress Test for the ICX Prime DRE w/ Reports Printer configuration successfully completed Volume and Stress Test Attempt #4.</p>

	<p>reprint or save the report. The report was saved. The unit also displayed a message saying: "Write to all result files failed." "File 1_333333_1007_1_CVR.res was found on some of the locations but not all." After Dev Logs and Audit Logs were exported to thumbdrive, it was noticed that only one of the two USB thumbdrives used in the ICX Prime DRE unit, had the result file on it. The second USB did not have the CVR file. It should also be noted that the USB which did not have the CVR file on it, was the USB to which the Audit logs were exported.</p>	
427	<p>The ICX Prime DRE w/ VVPAT S/N 1707101778 showed a blank (black) screen during the Volume and Stress Test. The power light under the lower right hand door was not lit up. Pressing the power button did not cause the unit to respond or turn on. The power cord was then removed from the power jack next to the power button then re-plugged in, with no result. The AC power plug at the other end of the power cord (other side of the power brick from the unit) was then unplugged and re-plugged in to the power socket on the UPS. At this time the unit emitted a beep and started to power up. When the android OS started up and the ICX application opened it was noticed that the battery indicator was at 0 and was starting to charge.</p> <p>Once the unit rebooted the user was notified that there was an error with the storage media. The polls were then closed at which time the unit failed to print the results report and prompted the user to reprint or save the report. The report was saved. The unit also displayed a message saying: "Write to all result files failed." "File 1_333333_9998_1_CVR.res was found on some of the locations but not all." After Developer Logs and Audit Logs were exported to the thumbdrive, it was noticed that only one of the two USB thumbdrives used in the ICX Prime DRE VVPAT unit, had the CVR results file on it. The second USB did not have the CVR results file. It should also be noted that the USB which did not have the CVR results file on it, was the USB to which the Audit logs were exported.</p>	<p>A documentation change was made to clarify the process for using a Multiple USB stick configuration on the ICX Prime DRE, and to clarify which units need to be connected to UPS backups. When the Android OS is booting up, if the MCF indicated that it expects 2 USB sticks to be used, their order is not critical, as their contents will be identical. The issue exists only when the MCF expects 1 USB stick, and 2 are physically plugged in, as results will be written only to one of them. This information was added to version 5.5::95 (12/29/17) of the ICX User guide, section 3.13 "Setting up the Equipment. The following note was added:</p> <p>Please make sure that the inserted USB sticks have mapped locations in the MCF. If an inserted USB stick isn't being used as a result location, please remove the USB stick from the ImageCast® X Classic/Prime Device.</p> <p>By clarifying in the documentation how to setup the ICX Prime DRE for usage with multiple USB sticks, the situation encountered in the deficiency will not occur.</p> <p>As of the passing of Volume and</p>

		Stress Attempt #12, the issue is resolved.
428	During the Volume and Stress Test, ICX Prime BMD S/N 1707100089 displayed an error that there was an error while casting the ballot, please contact the officer for more information. When the Poll Worker card was inserted into the unit, the message to reprint the ballot was displayed. The error message displayed the printer status which said: Error Printing: HP LaserJet Pro M402dn: Connection to device has been terminated." The issue with this message is that the attached printer is actually an "HP LaserJet Pro M402dne" which is a slightly different model. If the error message is going to display the Model Number of the printer, then it needs to specify the exact model of the printer being used.	A new source code submission was reviewed and a new compliance build performed. Regression Testing performed using ICX 5.5.8.15.
429	During review of the Audit Logs and Developer logs of the ICX Prime DRE units which failed the Volume and Stress Test, it was noticed that neither log lists the Serial Number of the ICX unit. This needs to be included in the Audit Log at a minimum, for traceability reasons.	A new source code submission was reviewed and a new compliance build performed. Regression Testing performed using ICX 5.5.8.15.
430	<p>During the Volume and Stress Test it was noticed that the Time displayed on the ICX Prime units, was ahead of the clock which was referenced when setting the time on the units. During the setup for the Volume and Stress Testing on the ICX Prime units, the Time and date were set using the prompt when the ICX application opens. The time on the units was set to the same time displayed on a Cellphone which uses the cellular network to set its date and time. The time was set on 12/19/17. On 12/28/17 it was noticed that the time on the ICX units, with the exception of the ICX Prime DRE VVPAT unit which lost power, was ahead by roughly 19-20 minutes.</p> <p>When the ICX Prime units were powered off and then powered back on, the time displayed in the ICX application accurately reflected the time on the Cellular device used as a reference when the time was set. Therefore it appears that the Clock on the ICX application is gaining time while the application is open/active.</p>	A new source code submission was reviewed and a new compliance build performed. Regression Testing performed using ICX 5.5.8.15. Later re-verified that this issue no longer occurs, using ICX 5.5.9.3.
431	During setup for the Volume and Stress Test Attempt #2, the lid on the ICX Prime DRE Reports printer was popped open using the lever on the front of the printer. The ICX Prime unit did not register that the lid was open and thus did not stop	A new source code submission was reviewed and a new compliance build performed. Regression Testing performed using ICX 5.5.9.1.

	"printing". When the lid was fully closed and the "printing" resumed on the paper, the Ballot ID's being listed had jumped from Ballot ID 57 up to Ballot ID 863.	
432	While running the Maximum Candidates election on the ICX Prime DRE w/ Reports printer configuration during Volume and Stress Testing, upon closing the polls the Report Printer printed the Report heading, total cast and total voters values, and listed the Ballot ID's and the number of ballots cast for each, but did not include the actual results. The report says printed successfully, and reprinting the report gives the same results. An attempt was then made to save the report to a file, however this process ultimately failed as the ICX units popped up a message saying: "Saving to file error."	<p>A new source code submission was reviewed and a new compliance build performed. Additionally, the ICX Prime Android build was updated.</p> <p>Regression Testing was performed using ICX Version 5.5.9.1 with Android build 0207_5.1.1-01.10_user_android_x86.</p> <p>Volume and Stress Test the ICX Prime DRE w/ Reports Printer configuration completed successfully on Attempt #4.</p>
433	While performing the physical security audit on the ICX Prime units, pull tight style seals were applied to all four doors on the unit. Once the seals are securely in place and an individual attempts to open the doors, there is a noticeable gap of roughly a centimeter in which individuals could possibly gain access to the USB ports and other interfaces.	<p>Addressed through a documentation change to the 2.08 Democracy Suite ImageCast X System Operations Procedures document.</p> <p>Used new Pull Tight seals Model SE-34 from Election Source, and Stick on Seals to verify that the door no longer has a gap which is accessible to possible insertion of a USB thumbdrive.</p>
434	<p>When opening the polls on ICX Prime DRE w/ VVPAT units for the Maximum Contests election, the Zero Report did not always automatically print when the polls were Opened. The ICX Prime DRE w/ VVPAT serial numbers 1707101778 and 17071017 had the Maximum Contests election loaded, and the polls were opened on both units. When the polls were opened, neither unit printed the Zero Proof Report to the VVPAT printer. Polls were then closed (which began printing, so user canceled the printing) and checked the settings in the Techadvisor menu. The system was configured to print the Zero Reports when polls opened and configured to use the VVPAT as the printer. User then ran the "Clear all election data" function then reloaded the election onto the units.</p> <p>The polls were then opened on both units and the unit with serial number 1707101778 began printing</p>	<p>A new source code submission was reviewed and a new compliance build performed. Regression Testing performed using ICX 5.5.8.15.</p> <p>Issue resolved as of the passing of the Volume and Stress Test Attempt #12.</p>



	<p>the zero report to the VVPAT, while the unit with serial number 1707101720 did no print the zero report to the VVPAT. User then closed the polls as had previously (it started printing the results report on both units and so user canceled the process.) User then ran the "Clear all election data" command on both units then reloaded the election files again.</p> <p>User attempted to open the polls for a third time, and when user did so, the Zero Proof Report began printing on the VVPAT for both units. See this information detail in the in the table below:  S/N 1707101778 S/N 1707101720  1st Attempt - Did Not Print; Did Not Print  2nd Attempt - Printed; Did Not Print  3rd Attempt - Printed; Printed</p>	
435	<p>When importing results into RTR from ICX DRE units, when a single Tabulator ID (Number) is being used, allows for results from multiple units to be imported, however, system logs from multiple units cannot be imported for a single tabulator ID (Number). As a result only the logs from one of the multiple units can be imported into RTR.</p>	<p>A new source code submission was reviewed and a new compliance build performed. Regression Testing performed using RTR 5.5.10.1.</p>
436	<p>An error displayed on both of the ICX Prime DRE w/ Report Printer units. The error message said: "Unfortunately something went wrong. Please call authorized person for assistance." The Continue button at the bottom of the screen was pressed and the ICX software Ver 5.5.8.15 restarted. ICX unit S/N 1707101722 had this issue with 78 ballots cast and the other unit S/N 1707100089 had the issue with 77 ballots cast.</p> <p>Later ICX Prime DRE w/ VVPAT unit S/N 1707101720 exhibited the same issue as the Report Printer units. This occurred with 75 ballots cast. The Continue button was pressed, however unlike the Report Printer units, this unit did not respond. The unit is completely frozen and unresponsive.</p> <p>A few minutes later ICX Prime DRE w/ VVPAT units S/N 1710100795 and S/N 1711300282 both exhibited the same issue as the other units at a total of 75 ballots cast. When an attempt was made to press the Continue button, the units did not respond and are frozen and unresponsive.</p> <p>A preliminary inspection of the Audit Logs shows the following entry for one of the ICX Prime DRE w/ Report Printer units: "2018-02-05 11:41:33 - ---</p>	<p>A new source code submission was reviewed and a new compliance build performed. Regression Testing performed using RTR 5.5.9.1. The Android built-in Accessibility service is no longer used and was replaced with a custom service built by Dominion Voting Systems.</p> <p>Issue resolved as of the passing of the Volume and Stress Test Attempt #12.</p>

	<p>----- ICX unhandled error-----Exception: OutOfMemoryError: Failed to allocate a 8294412 byte allocation with 7942588 free bytes and 7MB until OOM”</p> <p>The election database being used at the time was the System Limits election database, during the Volume and Stress Test.</p>	
440	<p>When restarting ICX Prime unit s/n1707101722 booted to a black screen with white text. The unit would not boot to the ICX application. The only way to get the unit to boot properly was to turn off the power to the unit the power the unit back on. The unit then booted to the ICX application.</p> <p>This behavior was seen previously on multiple units while loading the updated Android build: 0207_5.1.1-01.10_user_android_x86</p>	<p>Addressed using the updated Android Build 0403_5.1.1.-01.12_user_android-x86. Regression testing performed using ICX 5.5.9.3.</p>
441	<p>While performing Volume and Stress Test Attempt #4 in the System Limits election, ICX Prime DRE (S/N: 1711300282) w/ VVPAT (S/N: KPR0000078337), the unit halted the printing of the VVPAT record and displayed an error which said: "There was an error on printing selection on VVPAT printer. Please go to the officer for more info." When the VVPAT Printer was opened, the printing process stopped after page 3 of 5 was printed and a message said: "Error casting ballot, vote was not counted."</p> <p>This issue had occurred on 3/16/18, was logged in the engineering notebook, and the voting process was resumed. A note was made to observe the unit to see if this issue reappeared. On 3/19/2018 at 11:54am the issue occurred a second time. The issue was logged, and the printing process was resumed. On 3/19/2018 around 1:00pm CDT the issue occurred a third time.</p>	<p>A new source code submission was reviewed and a new compliance build performed. Regression Testing performed using RTR 5.5.9.3.</p> <p>Issue resolved as of the passing of the Volume and Stress Test Attempt #12.</p>
443	<p>In the process of updating the ICX application from 5.5.9.1 to 5.5.9.2, the Nav Bar Service was toggled off, to regain access to the Android Navigation Bar. On ICX Prime DRE S/N 1707101720, during the mandatory Restart of the unit after toggling Off the Nav Bar Service, the unit booted into the screen seen in VRT ID 440. As a result the unit had to be power cycled again, at which time it booted into the Android OS. When the "desktop" was accessed, the screen orientation was rotated (this occurred on all units after the service was turned off) so the "Screen Orientation" button from the pull down menu was used, to</p>	<p>Addressed using the updated Android Build 0403_5.1.1.-01.12_user_android-x86. Regression testing performed using ICX 5.5.9.3.</p>

	<p>adjust the screen orientation. When the Screen Orientation button was pressed, the unit did not respond. An attempt was then made to access the Configuration menu, however the unit would not open the Configuration menu and Android stated that Configuration app would not open. At this point the unit was then restarted via the pull down menu. When the unit booted, the Dominion screen displayed, followed by a black screen, and the unit was no longer responsive. Currently the unit will only boot into the screen from VRT ID 440, or to the Dominion screen followed by the Black Screen. When the black screen is showing, the Power Light on the unit is Green, and the screen does not respond to touch, nor do Smart Cards have any effect.</p>	
444	<p>During the execution of Volume and Stress Attempt #5 on the D-Suite 5.5 voting system, issues occurred on multiple units which necessitated that testing be halted. ICX Prime DRE S/N 1711300282 connected to VVPAT S/N KPR000000711 had 3 recorded instances where the simulation halted due to an issue printing the VVPAT ballot. The unit displayed the message: Error printing selections on VVPAT. Once the Pollworker Card was inserted, the error message updated to say: QR Code Scan fail for 6 times. The simulation was resumed 2 more times, and both times received the same error again. The unit was voting the System Limits election.</p> <p>ICX Prime DRE S/N 1707101720 connected to VVPAT S/N KR170900008115 encountered an error during the execution of the test. The unit was executing the Max Candidates election. During the execution of the simulation, the VVPAT printer jammed and the VVPAT paper accorded in the printer. The jam was cleared and inspected to verify that the Paper Roll had been installed correctly, which it had. When the Pollworker menu was accessed the following error displayed: QR Code Scan fail for 6 times. A few minutes after the first jam, a second jam occurred. It was again verified that the paper had been correctly seated, so the cause of the jam is unknown. Shortly after this second jam, the test was halted due to all the errors encountered.</p>	<p>Implemented Preventive Maintenance procedures for cleaning the VVPAT Print Head and Scanner Glass.</p> <p>Issue resolved as of the passing of the Volume and Stress Test Attempt #12.</p>
445	<p>During the execution of the Volume and Stress Test Attempt #7 on the ICX Prime DRE w/ VVPAT configuration, errors were encountered on the System Limits election and the Maximum</p>	<p>A new source code submission was reviewed and a new compliance build performed. Regression Testing performed</p>

	<p>Candidates election.</p> <p>On the ICX Prime DRE S/N 1707101778 connected to VVPAT S/N KPR0000078377, during the System Limits election, the unit lost connection to the printer. The unit displayed a message that there was an error printing selections. The VVPAT printed about 1/3rd of a barcode and then printed the final barcode with a message saying "Error Casting ballot, vote was not counted." When the Pollworker Card was applied, the error which displayed said: "Error while printing selections on VVPAT printer. Connection to device has been terminated." The unit was able to be recovered without restarting the unit or VVPAT, however another issue was soon found which necessitated the halting of the test.</p> <p>ICX Prime DRE S/N 1707101720 w/ VVPAT S/N KR170900008115 running the Maximum Candidates Election was found to be printing erroneous data on the VVPAT printer. While the ballots cast successfully, while changing the paper roll it was noticed that the barcodes for each "page" were preceded by multiple lines of characters which were illegible. As this erroneous data was printed and not considered to be invalid data by the system, the testing has been halted as a result of the issues encountered on both units.</p>	<p>using ICX 5.5.9.5.</p> <p>Issue resolved as of the passing of the Volume and Stress Test Attempt #12.</p>
446	<p>During the performance of the Pre-Op Status Check for Volume and Stress, ICX Prime DRE w/ VVPAT S/N 1707101789 encountered an error while activating a ballot. A previous ballot had been cast and the Pollworker card was removed then quickly reinserted into the unit to activate a new manual vote session. At this point the unit displayed an error which stated that 'something went wrong.' Once the Pollworker card was reinserted to clear the error, upon logging in with the pollworker ID, the ICX application restarted itself and the VVPAT printer printed a status that it was 'powered on.' The Pre-Op status check was then halted and the logs were sent to Dominion for analysis.</p>	<p>A new source code submission was reviewed and a new compliance build performed. Regression Testing performed using ICX 5.5.9.6.</p> <p>Issue resolved as of the passing of the Volume and Stress Test Attempt #12.</p>
447	<p>While performing the Pre Operational Status Check for Volume and Stress Testing on the ICX Prime DRE S/N 1707101722 paired with VVPAT S/N KPR0000078339, the unit output junk text to the VVPAT Printer while printing the Results Report.</p>	<p>A new source code submission was reviewed and a new compliance build performed. Regression Testing performed using ICX 5.5.10.15.</p> <p>Issue resolved as of the passing of</p>

		the Volume and Stress Test Attempt #12.
449	During the Volume and Stress Test Attempt 10, the ICX Prime S/N 1707101778 w/ VVPAT S/N KPR0000078377, jammed and displayed an error which stated that: "There was an error on printing selections on VVPAT Printer. Please see the officer for more info. The VVPAT door was opened, and the paper had accorded in the print head causing a jam. At the time this error occurred, it was decided to resume the test to see if the error occurred again. This error occurred on the 2nd Run (3rd roll of paper). During the 3rd run (3rd roll of paper), ICX Prime S/N 1711300282 w/ VVPAT S/N KPR0000078337, encountered the same error, and the VVPAT paper was accorded as well. At this point, the test was halted and deemed a failure.	<p>All 6 VVPAT printers that were being tested in the Volume and Stress test were replaced with new units.</p> <p>As of the passing of Volume and Stress Attempt #12 this issue is Resolved.</p>
450	While ICX Prime S/N 1710100793 was in testing in Volume and Stress testing, it was noticed that the Android Battery warning displayed on the unit, and said 0% battery life remaining. The battery indicator in the ICX application however said 98% battery charge remaining.	<p>Documentation change was made to the ICX System Installation and Configuration Guide document, which includes instructions for disabling the battery notifications.</p> <p>Regression testing performed using ICX 5.5.10.15.</p>
451	When the Hardware Info screen is displayed via TechAdvisor or PollWorker menu, the Serial Number for the VVPAT Printer is always displayed as 0000005C100000. This was verified on 3 separate ICX Prime VVPAT units. As such this window is displaying incorrect information and must be addressed.	<p>A new source code submission was reviewed and a new Trusted Build was performed. The Hardware Info screen now includes the correct label for the value, which is USB Device ID.</p> <p>Regression Testing performed using ICX 5.5.10.25.</p>
452	During the performance of the Volume and Stress Test Attempt #11, ICX Prime DRE S/N 1710100793 connected to VVPAT S/N KPR170900010347 stopped reading the Smart Cards. A preventive maintenance had been performed a few minutes before the Vote Simulation was to be resumed. When attempting to resume the simulation, the Card Reader would not read the Technicians card, or any other smart cards. At this point the test was deemed a failure. The unit was power cycled after which the Smart Card Reader resumed operating.	<p>A new source code submission was reviewed and a new compliance build performed. Regression Testing performed using ICX 5.5.10.19.</p> <p>As of the passing of Volume and Stress Attempt #12 on 7-18-18, this issue is Resolved.</p>
453	While changing out the paper roll in the VVPAT, it was noticed that the green light inside the VVPAT was not blinking and that the Paper Feed button did	This issue was addressed by performing the Accuracy Test a second time, during which the

	<p>not cause the VVPAT printer to advance the paper. To address this, it was required that the VVPAT printer be power cycled, to resume printing functionality.</p> <p>The unit in question is ICX Prime S/N 1711300282 connected to VVPAT S/N KPR170900009733.</p>	issue was not replicated.
454	VVPAT QR Code that is created once the ballot is accepted does not contain the tabulator number inside the QR Code.	A new source code submission was reviewed and a new compliance build performed. Regression Testing performed using ICX 5.5.10.23.
455	<p>During the scanning of the VVPAT barcodes for the Accuracy Test, it was noticed the ICX Prime DRE S/N 1711300282 connected to VVPAT S/N KPR170900009733, printed barcodes that were squashed and distorted, thus being unreadable, and was printing junk characters to the VVPAT Printer Tape. As a result the Accuracy Test has been deemed a failure. This issue appeared in the paper rolls from the first "Run" of ballots printed. This unit was voting the 17" ballots during the test.</p>	<p>To address the issue of the Junk Text, a second Accuracy Test was performed, during which the issue was not replicated.</p> <p>To address the Squashed QR codes issue, a new MCF (Machine Configuration File ver. 5.5.10.20) was imported into the election. This new MCF file was updated to change the default behavior of the VVPAT, to remove the Start and End barcodes from the VVPAT. Regression testing using the new MCF was used to verify that the system no longer printed squashed and deformed barcodes.</p>
457	<p>While attempting to close out the Mantis Issue 450, we attempted to check if the battery saver popup allowed access for voters to the Android System from the battery saver warning popup, while in the ICX application. When doing so, the user managed to get to the Battery menu, then the Battery Saver submenu, and finally was able to do a search in Android and Access the System Menu. User then verified Kiosk mode was on, then made 5 more attempts to repeat the process again, and got it to happen a second time. This issue was observed on ICX Prime DRE w/ VVPAT, S/N 1707101778.</p>	A documentation change was made to the ICX System Installation and Configuration Guide which provides instructions for Disabling the Battery Notifications. Once this process is executed, Low battery warnings are no longer presented to the voter. As a result, the user can no longer access the Android System Menu.
458	While performing the System Integration Test, ICX Prime BMD and ICX Classic BMD ballots were input into both ICC Central Scan tabulators and ICP tabulators, however the ballots were rejected by the system as Misread Ballots.	<p>A new source code submission was reviewed and a new Trusted build performed.</p> <p>This issue was tested by running the System Integration Test a second time using ICX 5.5.10.24.</p>

**ATTACHMENT C**  
**AS-RUN TEST PLAN**