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Test Plan for EAC VVSG 1.1 Certification Testing Everyone Counts eLect Quad Audit v.4.4.0

EAC Project ID: ECI1601

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U.S. Election Assistance Commission

VSTL

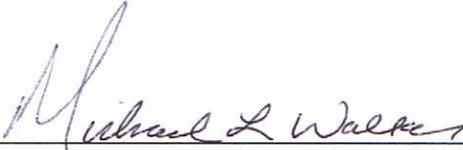
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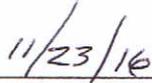
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SIGNATURES

Approved by:



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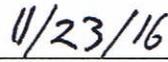


Date

Approved by:



Jack Cobb, Laboratory Director



Date

REVISIONS

Revision	Description	Date
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1.0	INTRODUCTION	1
1.1	References.....	1
1.2	Terms, Abbreviations, and Definitions	2
1.3	Testing Responsibilities	3
1.3.1	Project Schedule.....	3
1.3.1.1	Owner Assignments	3
1.3.1.2	Test Case Development	3
1.3.1.3	Test Procedure Development and Validation	3
1.3.1.4	Third Party Tests.....	4
1.3.1.5	EAC and Manufacturing Dependencies.....	4
1.4	Target of Evaluation Description.....	4
1.4.1	System Overview	4
1.4.2	Block Diagram	15
1.4.3	System Limits	15
1.4.4	Supported Languages.....	17
1.4.5	Supported Functionality.....	17
1.4.5.1	Standard (VVSG) Functionality.....	18
1.4.5.2	Manufacturer Extensions	18
2.0	PRE-CERTIFICATION TESTING AND ISSUES.....	18
2.1	Evaluation of Prior VSTL Testing	19
2.2	Evaluation of Prior Non-VSTL Testing.....	19
2.3	Known Field Issues.....	19
3.0	MATERIALS REQUIRED FOR TESTING.....	20
3.1	Software	20
3.2	Equipment.....	20
3.3	Test Materials.....	25
4.0	TEST SPECIFICATIONS	26
4.1	Requirements	26
4.1.1	Mapping of Requirements to Equipment Type and Features.....	27
4.1.2	Rationale NA Requirements	27
4.2	Hardware Configuration and Design	27
4.3	Software System Functions.....	28

4.4	Test Case Design.....	29
4.4.1	Hardware Qualitative Examination Design	29
4.4.1.1	Mapping of Requirements to Specific Interfaces.....	30
4.4.2	Hardware Environmental Test Case Design	30
4.4.3	Software Module Test Case Design and Data.....	30
4.4.4	Software Functional Test Case Design and Data.....	31
4.4.5	System-Level Test Case Design	31
4.5	Security Functions	31
4.6	TDP Evaluation.....	31
4.7	Source Code Review.....	35
4.8	QA & CM System Review.....	36
5.0	TEST DATA	36
5.1	Test Data Recording	36
5.2	Test Data Criteria.....	36
5.3	Test Data Reduction.....	36
6.0	TEST PROCEDURES AND CONDITIONS.....	36
6.1	Facility Requirements	366
6.2	Test Setup.....	37
6.3	Test Sequence	37
7.0	TEST OPERATIONS PROCEDURES	37
7.1	Proprietary Data	37
	 ATTACHMENT A – PROJECT SCHEDULE	 A-1
	ATTACHMENT B – IMPLEMENTATION STATEMENT.....	B-1

1.0 INTRODUCTION

The purpose of this Test Plan is to document the procedures that Pro V&V, Inc. will follow to perform certification testing of the Everyone Counts eLect Quad Audit v.4.4.0 to the requirements set forth by voting systems in the U.S. Election Assistance Commission (EAC) 2015 Voluntary Voting System Guidelines (VVSG) Version 1.1. Prior to submitting the voting system for testing, Everyone Counts submitted an application package to the EAC for certification of the elect Quad Audit v.4.4.0 to the requirements of the EAC VVSG Version 1.1. The application was accepted by the EAC and assigned the unique application number of ECI1601. In the application, Everyone Counts selected Pro V&V as the lead VSTL for the test engagement.

Pro V&V received its Voting System Testing Accreditation from The National Institute of Standards and Technology's (NIST) National Voluntary Laboratory Accreditation Program (NVLAP) on April 2, 2012 for core test methods. Additionally, Pro V&V was audited by the Election Assistance Commission (EAC) and successfully met all requirements for the EAC Voting System Testing Laboratory (VSTL) accreditation. As a result, Pro V&V was granted accreditation as a VSTL on February 24, 2015.

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

The implementation statement provided by the manufacturer for this test campaign is presented in Attachment B.

1.1 References

This subsection lists all documents relevant to the preparation of this Test Plan.

- Election Assistance Commission 2015 Voluntary Voting System Guidelines (VVSG) Version 1.1, 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, 2006 Edition, "NVLAP Procedures and General Requirements (NIST Handbook 150)", dated February 2006
- National Voluntary Laboratory Accreditation Program NIST Handbook 150-22, 2008 Edition, "Voting System Testing (NIST Handbook 150-22)", dated May 2008
- United States 107th Congress Help America Vote Act (HAVA) of 2002 (Public Law 107-252), dated October 2002
- Pro V&V, Inc. Quality Assurance Manual, Version 7.0
- Election Assistance Commission "Approval of Voting System Testing Application Package" letter dated October 6, 2016
- EAC Requests for Interpretation (RFI) (listed on www.eac.gov)

- EAC Notices of Clarification (NOC) (listed on www.eac.gov)
- Everyone Counts eLect Quad Audit v.4.4.0 Technical Data Package (*A listing of the eLect Quad Audit v.4.4.0 documents submitted for this test campaign is listed in Section 4.6 of this Test Plan*)

1.2 Terms, Abbreviations, and Definitions

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

“ADA” – Americans with Disabilities Act 1990

“CM” – Configuration Management

“COTS” – Commercial Off-The-Shelf

“DRE” – Direct Record Electronic

“EAC” – United States Election Assistance Commission

“EAC VVSG 1.1” – United States Election Assistance Commission 2015 Voluntary Voting System Guidelines, Version 1.1

“EBM” – Electronic Ballot Marker

“EOC” – Everyone Counts

“EMS” – Election Management System

“FCA” – Functional Configuration Audit

“HAVA” – Help America Vote Act

“MPSM” – Master Poll Station Machine

“NIST” – National Institute of Standards and Technology

“NOC” – Notice of Clarification

“PCA” – Physical Configuration Audit

“QA” – Quality Assurance

“RFI” – Request for Interpretation

“TDP” – Technical Data Package

“UPS” – Uninterruptible Power Supply

“NVLAP” – National Voluntary Laboratory Accreditation Program

“VSTL” – Voting System Test Laboratory

“VVSG” – Voluntary Voting Systems Guidelines

1.3 Testing Responsibilities

All testing will be conducted under the guidance of Pro V&V by personnel verified by Pro V&V to be qualified to perform the testing.

1.3.1 Project Schedule

The Project Schedule for the test campaign is located in Attachment A – Project Schedule. The dates on the schedule are not firm dates but planned estimates based on the anticipated project work flow.

1.3.1.1 Owner Assignments

This information is contained in the Project Schedule presented in Attachment A.

1.3.1.2 Test Case Development

Pro V&V will utilize baseline test cases for the Functional Configuration Audit (FCA), Usability, Security, and System Integration Tests. These test cases will be augmented with specially designed test cases tailored to the specific design of the eLect Quad Audit v.4.4.0. Additionally, specific election definitions will be designed for the Operational Status Check.

1.3.1.3 Test Procedure Development and Validation

Pro V&V will utilize VSTL Test Procedures during the duration of the test campaign. These procedures are developed to the EAC 2015 VVSG 1.1 standards. The validation of the VSTL Test Procedures is accomplished by Technical Review and Approval. If necessary and where practical, a validation might include execution to attempt to achieve the expected results using the selected tool of the testing methodology. Test Plans, Test Suites, Test Specifications, and Test Cases will be validated prior to execution. This validation will include the following:

- Confirmation of adequate test coverage of all requirements.
- Confirmation that test case results are not ambiguous and have objective pass/fail criteria.
- Confirmation that any automated test suites will produce valid results.

1.3.1.4 Third Party Tests

Pro V&V will be utilizing third party testing during the performance of hardware testing. All of this testing will be witnessed by Pro V&V personnel at the third party test site.

1.3.1.5 EAC and Manufacturing Dependencies

This information is contained in the Project Schedule presented in Attachment A.

1.4 Target of Evaluation Description

The following sections contain a product description and an overview of the design methodology of the eLect Quad Audit v.4.4.0 Voting System, as taken from the Everyone Counts technical documentation.

1.4.1 System Overview

The eLect Quad Audit 4.4.0 System is a voting system encompassing all aspects of election management, including election definition and configuration, ballot creation, voting, data transmission, vote data management, reporting, and auditing. The eLect Quad Audit 4.4.0 incorporates polling location ballot delivery, ballot marking, vote capture, and vote storage capabilities that operate on commercial off-the-shelf (COTS) hardware located at a Central Office and Poll Station.

The eLect Quad Audit 4.4.0 System consists of the major components listed below:

Software Components:

eLect Quad Audit

The eLect Quad Audit is the software platform that provides election administrators with the tools to manage elections. The software is accessed by means of COTS hardware devices. The eLect Quad Audit user interface (the EMS) is called eLect Administration and it includes the following:

- eLect Central Scanning module
- eLect Quad Audit Voting module
- eLect Security Suite utility application

eLect Administration

The eLect Administration dashboard is the voting system's user interface for the Admin User. It contains the various system modules for all aspects of election creation and management. eLect Administration is used by election administrators to define election criteria, create and set up an election configuration, create ballots, generate reports, and manage the election life cycle.

eLect Security Suite

eLect Security Suite is a utility application that provides encryption and decryption services. There are two modes of operation:

1. Standalone - runs as a desktop application on the eLect Quad Audit solution's Air-Gapped Machine. The election official/administrator creates public and private security keys for vote data encryption in the system.
2. Embedded - The automated utility is directly called by eLect Quad Audit to encrypt cast ballots during the voting session and decrypt encrypted ballots after the voting session

eLect Quad Audit Voting

The eLect Quad Audit voting module is the core software module of the voting system. A voting session is initiated at the EBM once the QR code is scanned; the voter is then served the assigned ballot style. Ballot submissions are saved, transmitted, confirmed, scanned, encrypted, and stored in the Master Poll Station Machine (MPSM) database.

eLect Central Scanning

eLect Central Scanning is a scanning and imaging module incorporated within eLect Administration .eLect Central Scanning supports write-in ballot scanning, imaging and adjudication processes.

eLect Poll Station Management Console

The eLect Poll Station Management Console is the user interface that poll workers access through the Poll Station EBM.

Hardware Components:

Central Server

The Central Server runs on a Linux operating system and is the primary system device that hosts the eLect Quad Audit voting system, including eLect Administration (the EMS) and eLect Voting (for tabulation). The Central Server is located in the Central Office.

eLect Administration Access Machine

The eLect Administration Access Machine (EAAM) runs on a Windows operating system and is connected to the Central Server, the Central Scanner, and a printer. Election management activity is executed using the eLect Administration interface. The EAAM is located in the Central Office.

Air-Gapped Machine

The Air-Gapped Machine is a dedicated COTS laptop that is isolated from the voting system and any network connection. The Air-Gapped Machine hosts eLect Security Suite, which provides ballot encryption and decryption services. The Air-Gapped Machine is located in the Central Office.

Imaging Server

The Imaging Server provides dedicated image processing and character mark recognition for scanned paper ballots only. The Imaging Server runs on a Windows operating system and is used for eLect Central Scanning. The Imaging Server is located in the Central Office.

Central Scanner

The Central Scanner is a COTS imaging scanner that is connected to the eLect Administration Access Machine and performs eLect Central Scanning functions. The Central Scanner is located in the Central Office.

Master Poll Station Machine (MPSM)

The Master Poll Station Machine (MPSM) is a laptop that runs on a Linux operating system and is used to manage the voting process. The election configuration from the Central Server is replicated to each MPSM prior to Poll Station delivery. The MPSM is then wired to the Electronic Ballot Markers (EBMs) using a local network switch. MPSMs are located in the Poll Stations.

Electronic Ballot Marker (EBM)

The Electronic Ballot Marker (EBM) is a COTS tablet that runs on a Windows operating system. The EBM is used to mark the ballot and transmit digital vote data to and from the MPSM. The EBM does not store vote data. EBMs are located in the Poll Stations. The EBM can function in Optical Scan or DRE mode.

Ballot Box

The Ballot Box provides physical security for completed ballots. The Ballot Box includes the secure container and the COTS Ballot Box scanner. The Ballot Box is located in the Poll Station and is used in Optical Scan mode only.

The follow tables provide the software and hardware components of the eLect Quad Audit 4.4.0 System to be tested, identified with version numbers.

Table 1-1: Firmware/Software Versions

eLect Quad Audit 4.4.0 System Component	Manufacturer	Version
<i>Air-Gapped Machine</i>		
OS: Ubuntu	Canonical	12.04.5 LTS
eLect Security Suite (Stand Alone)	Everyone Counts	1.3.0
Chef	Chef	12.4.3
NodeJS	Node.js Foundation	v.4.2.3
OpenSSL	The OpenSSL Project	OPenSSL 1.0.1p-fips 9 Jul 2015

Table 1-1: Firmware/Software Versions (*continued*)

<i>Central Server</i>		
OS: Ubuntu	Canonical	12.04.5 LTS
eLect Security Suite (Embedded)	Everyone Counts	1.3.0
eLect	Everyone Counts	e546052b2ff7093e1b8eb63 df2dG10itL6a9b3e4178830
eLect Admin	Everyone Counts	a743f0307f727360229edd6 7499Sata9sbh0d6b0bf877
MariaDB	MariaDB Corp.	10.0.26
Tomcat	Apache	6.0.35
Apache Webserver	Apache	2.2.22
Perl	Perl	5.14.2
Chef	Chef	12.4.3
Java	Oracle	1.8.0_65
LAME	LAME	3.99.3
Festival	Centre for Speech Technology Research (CSTR), University of Edinburgh, UK	2.1
<i>eLect Administration Access Machine</i>		
OS: Windows	Microsoft	8.1 Pro (64 bit)
Dynamic Web TWAIN HTML5 edition	Dynamsoft	10.2.312
eLect Secure Transfer Installer	Everyone Counts	1.2.1
Chrome	Google	47.0.2526.106
iP110 Printer Driver	Canon	6.3.9600.16384

Table 1-1: Firmware/Software Versions (continued)

eLect Quad Audit 4.4.0 System Component	Manufacturer	Version
<i>eLect Administration Access Machine (continued)</i>		
Management Engine Components	Intel	10.0.30.1060
Network Connections Drivers	Intel	19.2
Kodak i4250 Driver	Kodak	1.2
Kodak i3400 Driver	Kodak	3.0
Kodak i2820 Driver	Kodak	4.5
E5450 Drivers: Chipset Driver	Dell	Chipset_Driver_YVGN8_WN_10.0.30.1060_A01.EXE
E5450 BIOS	Dell	A12
<i>Central Scan Imaging Server</i>		
OS: Windows	Microsoft	8.1 Pro (64 bit)
Visual C++ 2005 Redistributable KB246775	Microsoft	8.0.51011
Visual C++ 2010 x86 Redistributable	Microsoft	10.0.30319
Microsoft.NET Framework	Microsoft	v4.0.30319
Recostar	OpenText	7.0.2
Recostar Patch MSP, Service Pack 1	OpenText	revision #: {7F534C39-D036-42A1-BF60-12971ACF811C}
E1C eLect Central Scanning: Imaging Service exe	Everyone Counts	1.4

Table 1-1: Firmware/Software Versions *(continued)*

eLect Quad Audit 4.4.0 System Component	Manufacturer	Version
<i>Imaging Server (continued)</i>		
Power Chute Business Edition Agent	Schneider Electric	9.1.1.604
Local GPO	Microsoft	3.0.60.0
Enhanced Mitigation Experience Toolkit	Microsoft	5.2
<i>Master Poll Station Machine (MPSM)</i>		
OS: Ubuntu	Canonical	12.01.5 LTS
eLect Security Suite	Everyone Counts	1.3.0
eLect	Everyone Counts	e546052b2ff7093e1b8eb63df2dG10itL6a9b3e4178830
Apache Webserver	Apache	2.2.22
Perl	Perl	5.14.2
Chef	Chef	12.4.3
Java	Oracle	1.8.0_65
MariaDB	MariaDB Corp	10.0.26
LAME	LAME	3.99.3
Festival	Centre for Speech Technology Research (CSTR), University of Edinburgh, UK	2.1
<i>Electronic Ballot Marker (EBM)</i>		
OS: Windows	Microsoft	8.1 Pro (64 bit)
5130 Chipset Driver	Dell	603.9600.1948.34944

Table 1-1: Firmware/Software Versions *(continued)*

eLect Quad Audit 4.4.0 System Component	Manufacturer	Version
<i>Electronic Ballot Marker</i> <i>(continued)</i>		
Dell System BIOS update	Dell	A04
Chrome	Google	47.0.2526.106
i110 Printer Driver	Canon	6.3.9600.16384
EMET	Microsoft	5.2
Local GPO	Microsoft	3.0.60.0
Intel Graphics Driver	Intel	10.18.10.4176
JoyToKey	JoyToKey	5.7
<i>Ballot Box Scanner</i>		
OS: Windows	Microsoft	Microsoft Windows Embedded 8.1 Industry Pro 6.3.9600 Build 9600
Chrome	Google	47.0.2526.106
Everyone Counts Ballot Box Software	Everyone Counts	1.0.0
Twain	TWAIN Working Group	10.5
Pillow	PIL: Python Imaging Library	3.0.60.0
Python	Python software foundation	2.7.10
zbar	Licensed under the GNU Lesser General Public License	0.10

Table 1-2: Hardware Versions

eLect Quad Audit 4.4.0 System Component	Manufacturer	Model Number
<i>Air-Gapped Machine</i>		
Laptop	Dell	Latitude E5450
Removable Storage Device: 128GB USB Flash Drive	PNY	P-FD128TBOP-GE
Surge Protector	Tripp Lite	ISOBAR6ULTRAHG
<i>Central Server</i>		
Server	SuperMicro	SC813MTQ-R400CB
Monitor	Dell	SE2416HX
Keyboard	Logitech	MK120
Mouse	Logitech	MK120
Uninterruptible Power Supply (UPS) with USB connectivity	APC	SMC1500
Local Network Switch	Netgear	JGS516
Uninterruptible Power Supply (UPS)	Eaton	5S700
Cat6 Ethernet Cable 10'	Cable Exchange	CAX-C6-SHLBU- SR-10FT
Removable Storage Device: VEX 128GB USB Flash Drive	Patriot	PSF128GVEX3USB
Removable Storage Device: 128GB USB Flash Drive	PNY	P-FD128TBOP-GE

Table 1-2: Hardware Versions (continued)

eLect Quad Audit 4.4.0 System Component	Manufacturer	Model Number
<i>eLect Administration Access Machine</i>		
Laptop	Dell	Latitude E5450
Printer	Canon	iP110
Cat6 Ethernet Cable 10'	Cable Exchange	CAX-C6-SHLBU-SR-10FT
<i>Central Scan Imaging Server</i>		
Server	SuperMicro	SC813MTQ-R400CB
Uninterruptible Power Supply (UPS) with USB connectivity	APC	SMC1500
Cat6 Ethernet Cable 10'	Cable Exchange	CAX-C6-SHLBU-SR-10FT
Monitor	Dell	SE2416HX
Keyboard	Logitech	MK120
Mouse	Logitech	MK120
<i>Master Poll Station Machine (MPSM)</i>		
Laptop	Dell	Latitude E5450
Removable Storage Device: 128GB USB Flash Drive	PNY	P-FD128TBOP-GE
Laptop Security Bracket	Computer Security Products, Inc.	CSP-4020
Uninterruptible Power Supply (UPS)	Eaton	5S700

Table 1-2: Hardware Versions (continued)

eLect Quad Audit 4.4.0 System Component	Manufacturer	Model Number
<i>Master Poll Station Machine (MPSM)(continued)</i>		
Local Network Switch	Netgear	JGS516
Surge Protector	Tripp Lite	ISOBAR6ULTRAHG
Cat6 Ethernet Cable 10'	Cable Exchange	CAX-C6-SHLBU-SR-10FT
<i>Electronic Ballot Marker (EBM)</i>		
Tablet	Dell	Venue 11 Pro 5130
Dell Venue 11 Pro POS Stand Enclosure	iPadSimple	IBS-002-1004
Activation Token 4-inch Tray	Everyone Counts	002
LED Multi SELCA light	Pickogen	B013U47A5A
USB 3.0 Gigabit Ethernet and 3- port Hub	J5Create	JUH470
1 ft. Extension USB Blue Right Angle USB 3.0 Type A Male to Female Adapter	Smays	GAZEWALL19810035
Headphone Jack Extension Cable	iMBAPrice	iMBA-PS-06MF
Printer	Canon	iP110
Surge Protector	Tripp Lite	ISOBAR6ULTRAHG
Cat6 Ethernet Cable 20'	Cable Exchange	CAX-C6-SHLBU-SR-20FT
Hub Enclosure	Everyone Counts	PVV-EOC001

Table 1-2: Hardware Versions (continued)

eLect Quad Audit 4.4.0 System Component	Manufacturer	Model Number
<i>EBM - Accessibility</i>		
ATI	Storm Interface	EZ05-222013
Sip/Puff Breeze with Headset USB Interface	Origin Instruments	AC-0313-MU
Headphones	Koss	KPH7
Ballot Magnifier	MakExpress	B01AL8J2NQ
<i>Ballot Box</i>		
Ballot Box Container	PakFlatt	Fortress Lander Model: 1.0
Ballot Box Scanner	Kodak	Scan Station 730EX
Uninterruptible Power Supply (UPS)	Eaton	5S700
Cat6 Ethernet Cable 50'	Cable Exchange	CAX-C6-SHLBU- SR-50FT
<i>Ballot Bag</i>		
Provisional Ballot Bag	Election Source	BA-51
<i>Central Scanner</i>		
Large Scanner	Kodak	i4250
Medium Scanner	Kodak	i3400
Small Scanner	Kodak	i2820
Uninterruptible Power Supply (UPS)	APC	SMC1500

1.4.2 Block Diagram

The following diagram provides an overview of the eLect Quad Audit system operations:

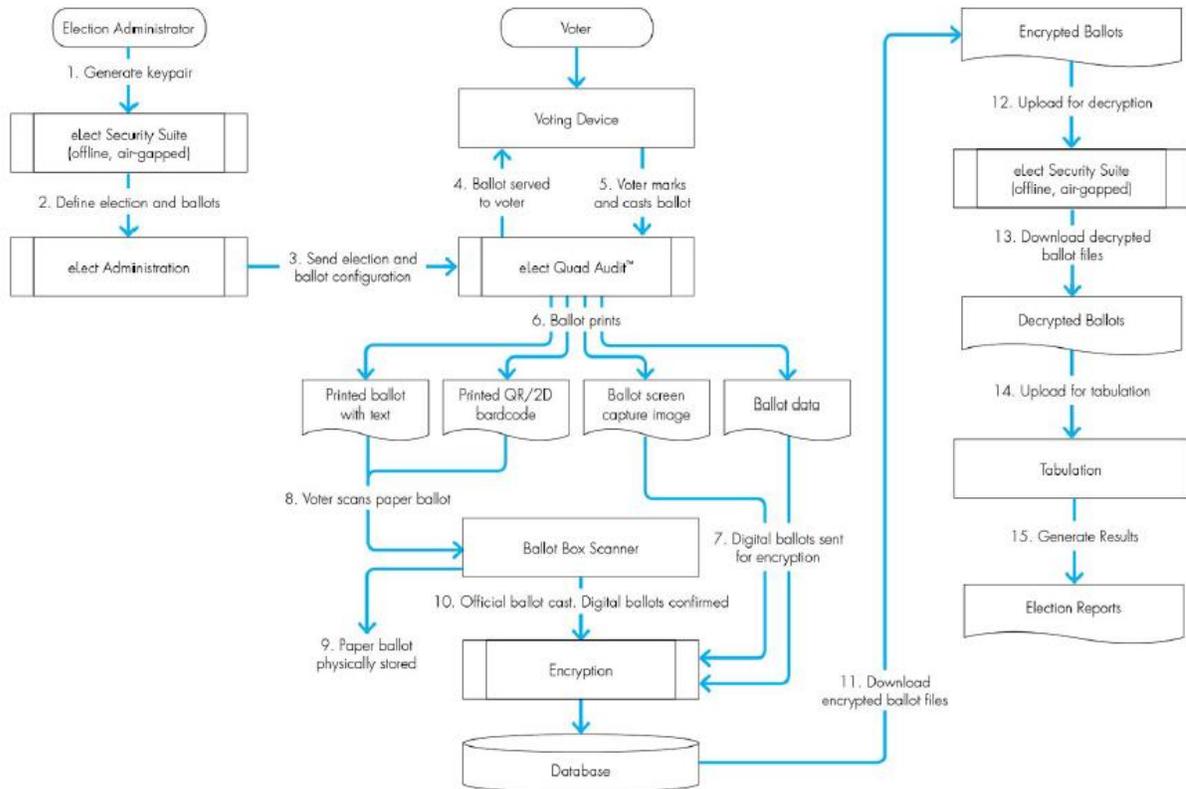


Figure 1.1: eLect Quad Audit System Operations Overview

1.4.3 System Limits

The system limits that Everyone Counts has stated to be supported by the eLect Quad Audit v.4.4.0 are listed in the table below.

Table 1-3. System Limits

Device/Component	Limits
eLect Administration	Candidate names: A limit of 100 characters per candidate name applies. Lengthy candidate names limit ballot style configuration. To accommodate this limitation, users should adjust the candidate name length. Visual inspection and confirmation to verify this is performed during the ballot configuration process on both the digital ballots and the mail-in paper ballots.
Central Server	<ul style="list-style-type: none"> Active Elections: The Central Server has the capability to run one active election. The Central Server cannot run multiple elections. Name cannot exceed a maximum of two (2) digits when naming the Central Server: For example, c01, c20, c99 are acceptable

Table 1-3. System Limits *(continued)*

Device/Component	Limits
Master Poll Station Machine	<ul style="list-style-type: none"> • Cannot alter election data after the configuration is defined and pulled from the Central Server. • Cannot exceed a maximum of 1000 devices names • Cannot exceed a maximum of two mpsm (2) digits when naming the MPSM after naming the central with two (2) digits: For example, cXXpsYY.
Electronic Ballot Marker (EBM)	<ul style="list-style-type: none"> • Two EBMs per MPSM • One surge protector for every two EBM tablets • Cannot store any election data on device • Cannot display the ballot without connection to MPSM • Cannot mark the ballot without connection to MPSM • Cannot review the ballot without connection to MPSM • Cannot alter any election data or settings beyond a single ballot voting session
EBM Printer Paper Limits	<p>Paper Size: US Standard 8.5x11 inches Paper Color: White Paper Weight: 20 lb. minimum to 24 lb. maximum Capacity: 50 sheets in feeder tray</p>
Ballot Box Limits	<ul style="list-style-type: none"> • Cannot reverse roll a paper ballot once accepted from the ballot box scanner • Does not maintain the ballot counter without connection to MPSM (maintained on the MPSM, and displays on ballot box display screen) • Does not store election data or vote data on the device • Cannot operate as a ballot box without connection to the MPSM • Will not duplicate scanning of individual ballots
Central Scan Paper Ballot Limits	<p>Paper Size in inches:</p> <ul style="list-style-type: none"> - U.S. Letter (8.5 x 11) - U.S. Legal (8.5 x 14) - U.S. Ledger (11 x 17) not supported by the Kodak i2820 scanner or i3400 scanner <p>Paper Color: White Paper Weight: 20 lb. minimum to 24 lb. maximum Printing Accuracy: Anchors are expected to be 5mm from the edge of the paper. The system can manage an error of +/-10 mm, and automatically scales the scanned images. It is recommended not to exceed an error of more than +/-5mm.</p>
Central Scan Limits	<ul style="list-style-type: none"> • Depending on the size of the scanner, Central Scan supports maximum batch sizes of up to 500 ballots, and deck loads of 100 sheets or less on the scanner. Batches can be paused between scanner reloads, when image processing continues for the batch, allowing for the display of scanned images to be added to the images in the batch.

Table 1-3. System Limits *(continued)*

Device/Component	Limits
Central Scan Limits (continued)	<ul style="list-style-type: none"> • Additionally, in the creation of the paper ballot, it is important to note that every candidate name and contest name must be uniquely different from all others on the ballot or in the election. For example, if two candidates each have the name John Smith, a differentiator such as middle initial, party affiliation, etc., must be placed with the candidate name to ensure the proper display of tabulation results at the close of the election.
Ballot Pens	Recommended and tested ballot pens for optimal scanning and imaging include: <ul style="list-style-type: none"> • Pilot Precise V7 Rolling Ball Point Pens Black 0.7mm • Papermate InkJoy 300 Ballpoint Pens Black 0.7mm

1.4.4 Supported Languages

The following languages have been stated by Everyone Counts to be supported by the eLect Quad Audit v.4.4.0:

- English
- Spanish
- Bengali
- Korean
- Chinese
- Vietnamese
- Non-written language audio support

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

1.4.5 Supported Functionality

The eLect Quad Audit v.4.4.0 is designed to support the following voting variations:

- General Elections
- Closed Primary
- Open Primary
- Early Voting
- Partisan/Non-Partisan Offices
- Write-In Voting
- Primary Presidential Delegation Nominations
- Straight Party Voting

- Split Precincts
- Vote for N of M
- Ballot Rotation
 - By Precinct
 - Weighted by Number of Registered Voters per Precinct
- Cumulative Voting
- Provisional or Challenged Ballots

As stated in the Implementation Statement, the eLect Quad Audit v.4.4.0 does not include support for Ranked Order Voting, Cross-party Endorsement, Recall Issues with options, or Proportional Representation.

1.4.5.1 Standard (VVSG) Functionality

The eLect Quad Audit v.4.4.0 will be evaluated to all applicable EAC 2015 VVSG 1.1 requirements.

1.4.5.2 Manufacturer Extensions

There are no manufacturer extensions on testing for this test campaign.

2.0 Pre-Certification Testing and Issues

The following pre-certification testing has been performed on an “At-Risk” basis:

Source Code Review

A first pass review has been performed for all source code submitted by Everyone Counts for the eLect Quad Audit v.4.4.0. Any issues discovered were compiled and reported to Everyone Counts for resolution. Subsequent submissions will be reviewed by comparing newly submitted code against previously reviewed code to ensure all documented issues are resolved.

Technical Date Package (TDP) Review

An initial TDP review was performed on the documents submitted for this test campaign. The initial review is an abbreviated review performed in order to determine if the documents contain sufficient information. It was determined that various documents were lacking in information. Additionally, inconsistencies were noted throughout the TDP package. The results of the review were reported to Everyone Counts for resolution. Everyone Counts has subsequently revised and resubmitted the TDP and Pro V&V is currently reviewing these submissions. Specific documents have been reviewed multiple times in order to facilitate performance of the FCA. The findings of each review performed are tracked in the TDP review spreadsheet.

Physical Configuration Audit (PCA)

An initial PCA has been performed to baseline the system prior to test campaign commencement. The PCA was performed by documenting each hardware and software component of the voting system by name, model, serial number, major component, and any other relevant information needed for identification. Photographs of each hardware component were also taken.

Hardware Testing

Pro V&V has initiated Hardware Testing on an at-risk basis. This testing is being conducted at an off-site third party laboratory.

For the FCA, Test Suites are developed to cover the pre-voting, voting, and post-voting phases of the election process including the usability of the system during each phase.

Functional Configuration Audit (FCA)

Pro V&V has begun conducting the FCA for the eLect Quad Audit v.4.4.0. This includes multiple reviews of specific TDP documents to clarify and expand upon information concerning the system functions and design methodology. During the FCA, assigned test personnel mapped the voting system functional options, input data to exercise all system functions, and took note of all program logic and data processing errors (this step will be performed throughout the test campaign in parallel with other examinations as long as all functions are exercised and independently tracked).

Assigned test personnel also reviewed the requirements matrix for completeness, developed and performed system-specific Test Cases for any functions not exercised during other areas of the test campaign or for functions judged to need individual examination, reviewed the manufacturer's test procedures and test results to determine if the voting systems functional capabilities have been adequately tested, and analyzed the results of all testing and verify that all functionality and requirements not satisfied during previous testing have been met.

2.1 Evaluation of Prior VSTL Testing

The eLect Quad Audit v.4.4.0 is a new voting system that has not previously been tested to applicable federal standards in the EAC Program.

2.2 Evaluation of Prior Non-VSTL Testing

Everyone Counts submitted the following summative usability report for review: "Usability Test Report of eLect Quad Audit v. 4.4.0 with 53 Voter Participants and 16 Poll Worker Participants for Requirement VVSG 1.1 Volume I, Section 3, and Volume 2, Section 7" prepared by Mile7, dated November 2, 2015.

2.3 Known Field Issues

This system has never been fielded; therefore, there are no known field issues to consider.

3.0 Materials Required for Testing

The following sections list all materials needed to enable the test engagement to occur.

The materials required for testing of the eLect Quad Audit v.4.4.0 include all materials to enable the test campaign to occur. This includes the applicable software and equipment as well as the TDP, test support materials, and deliverable materials.

3.1 Software

This subsection lists the proprietary and COTS software to be provided by the manufacturer as part of the test campaign. This includes all software required for the performance of hardware, software, telecommunications, security, and system integration tests.

Table 3-1. Voting System Software

Firmware/Software	Manufacturer	Version
Air-Gapped Machine		
OS: Ubuntu	Canonical	12.04.5 LTS
eLect Security Suite (Stand Alone)	Everyone Counts	1.3.0
Chef	Chef	12.4.3
NodeJS	Node.js Foundation	v4.2.3
OpenSSL	The OpenSSL Project	OpenSSL 1.0.1p-fips 9 Jul 2015
Central Server		
OS: Ubuntu	Canonical	12.04.5 LTS
eLect Security Suite (Embedded)	Everyone Counts	1.3.0
eLect	Everyone Counts	e546052b2ff7093e1b8eb63df2
eLect Admin	Everyone Counts	a743f0307f727360229edd6749
MariaDB	MariaDB Corp.	10.0.26
Tomcat	Apache	6.0.35
Apache Webserver	Apache	2.2.22
Perl	Perl	5.14.2
Chef	Chef	12.4.3
Java	Oracle	1.8.0_65
LAME	LAME	3.99.3
Festival	N/A	2.1

Table 3-1. Voting System Software *(continued)*

Firmware/Software	Manufacturer	Version
eLect Administration Access Machine		
OS: Windows	Microsoft	8.1 Pro (64 bit)
Dynamic Web TWAIN HTML5 edition	Dynamsoft	10.2.312
eLect Secure Transfer Installer	Everyone Counts	1.1.2
Chrome	Google	47.0.2526.106
iP110 Printer Driver	Canon	6.3.9600.16384
Management Engine Components	Intel	10.0.30.1060
Network Connections Drivers	Intel	19.2
Kodak i4250 Driver	Kodak	1.2
Kodak i3400 Driver	Kodak	3.0
Kodak i2820 Driver	Kodak	4.5
E5450 Drivers: Chipset Driver	Dell	Chipset_Driver_YVGN8 _WN_ 10.0.30.1060_A01 .EXE
E5450 BIOS	Dell	A12
Central Scan Imagine Server		
OS: Windows	Microsoft	8.1 Pro (64 bit)
Visual C++ 2005 Redistributable KB246775	Microsoft	8.0.51011
Visual C++ 2010 x86 Redistributable	Microsoft	10.0.30319
Microsoft.NET Framework	Microsoft	v4.0.30319
Recostar	OpenText	7.0.2
Recostar Patch MSP, Service Pack 1	OpenText	revision #: {7F534C39- D036-42A1-BF60- 12971ACF811C}
EIC eLect Central Scanning: Imaging Service exe	Everyone Counts	1.4
Power Chute Business Edition Agent	Schneider Electric	9.1.1.604
Local GPO	Microsoft	3.0.60.0
Enhanced Mitigation Experience Toolkit	Microsoft	5.2
MPSM		
OS: Ubuntu	Canonical	12.04.5 LTS
eLect Security Suite	Everyone Counts	1.3.0

Table 3-1. Voting System Software (continued)

Firmware/Software	Manufacturer	Version
MPSM (continued)		
eLect	Everyone Counts	e546052b2ff7093e1b8eb63df2
Apache Webserver	Apache	2.2.22
Perl	Perl	5.14.2
Chef	Chef	12.4.3
Java	Oracle	1.8.0_65
MariaDB	MariaDB Corp	10.0.26
LAME	LAME	3.99.3
Festival	---	2.1
EBM (DRE and/or OpScan)		
OS: Windows	Microsoft	8.1 Pro (64 bit)
5130 Chipset Driver	Dell	603.9600.1948.34944
Dell System BIOS update	Dell	A04
Chrome	Google	47.0.2526.106
i110 Printer Driver	Cannon	6.3.9600.16384
EMET	Microsoft	5.2
Local GPO	Microsoft	3.0.60.0
Intel Graphics Driver	Intel	10.18.10.4176
JoyToKey	JoyToKey	5.7
Ballot Box Scanner (OpScan Mode Only)		
OS: Windows	Microsoft	Microsoft Windows Embedded 8.1 Industry Pro 6.3.9600 Build 9600
Google Chrome	Google	47.0.2526.106
Everyone Counts Ballot Box Software	Everyone Counts	1.0.0
Twain	TWAIN Working Group	1.0.5
Pillow	PIL: Python Imaging Library	2.7.0
Python	Python software foundation	2.7.10
zbar	Licensed under the GNU Lesser General Public License	0.10

3.2 Equipment

This subsection lists the proprietary and COTS equipment to be provided by the manufacturer as part of the test campaign. This includes all equipment required for the performance of hardware, software, telecommunications, security, and system integration tests.

For COTS equipment, every effort will be made to verify that the COTS equipment has not been modified for use. This will be accomplished by performing research using the COTS equipment manufacturer's websites based on the serial numbers and service tag numbers for each piece of equipment. Assigned test personnel will evaluate COTS hardware, system software and communications components for proven performance in commercial applications other than voting. For PCs, laptops, and servers, the service tag information will be compared to the system information found on each machine. Physical external and internal examination will also be performed when the equipment is easily accessible without the possibility of damage. Hard drives, RAM memory, and other components will be examined to verify that the components match the information found on the COTS equipment manufacturers' websites.

Table 3-2. Voting System Equipment

Component	Manufacturer	Model #
Air-Gapped Machine		
Laptop	Dell	Latitude E5450
Removable Storage Device: 128GB USB Flash Drive	PNY	P-FD128TBOPGE
Surge Protector	Tripp Life	ISOBAR6ULTRA HG
Central Server		
Server	SuperMicro	SC813MTQ-R400CB
Smart-UPS 1000 Watts/1500VA LCD 230V	APC	SMC1500
Local Network Switch	Netgear	JGS516
UPS	Eaton	5S700
Monitor	Dell	SE2416HX
Keyboard	Logitech	MK120
Mouse	Logitech	MK120
Cat6 Ethernet Cable 10'	Cable Exchange	CAX-C6-SHLBU- SR-10FT
Removable Storage Device: VEX 128GB USB Flash Drive	Patriot	PSF128GVEX3 USB
Removable Storage Device: 128GB USB Flash Drive	PNY	P-FD128TBOPGE
eLect Administration Access Machine		
Laptop	Dell	Latitude E5450
Printer	Canon	iP110
Cat6 Ethernet Cable 10'	Cable Exchange	CAX-C6-SHLBU- SR-10FT

Table 3-2. Voting System Equipment (continued)

Component	Manufacturer	Model #
Central Scan Imaging Server		
Server	SuperMicro	SC813MTQ-R400CB
Smart-UPS 1000 Watts/1500VA LCD 230V	APC	SMC1500
Cat6 Ethernet Cable 10'	Cable Exchange	CAX-C6-SHLBU- SR-10FT
Monitor	Dell	SE2416HX
Keyboard	Logitech	MK120
Mouse	Logitech	MK120
MPSM		
Laptop	Dell	Latitude E5450
Removable Storage Device: 128GB USB Flash Drive	PNY	P-FD128TBOPGE
Laptop Security Bracket	Computer Security Products, Inc	CSP-4020
5S700	Eaton	5S700
Local Network Switch	Netgear	JGS516
Surge Protector	Tripp-Lite	ISOBAR6ULTRAHG
Cat6 Ethernet Cable 10'	Cable Exchange	CAX-C6-SHLBU- SR-10FT
EBM (DRE and/or OpScan)		
Tablet	Dell	Venue 11 Pro 5130
Dell Venue 11 Pro POS Stand Enclosure	iPadSimple	IBS-002-1004
Activation 4-inch Token Tray	Everyone Counts	002
LED Light	Pickogen	B013U47A5A
USB 3.0 Gigabit Ethernet and 3-port Hub	J5Create	JUH470
1 ft Extension USB Blue Right Angle USB 3.0 Type A Male to Female Adapt	Smays	GAZEWALL19810035
Headphone Extension Cable	iMBAPrice	iMBA-PS-06MF
Printer	Canon	iP110
Surge Protector	Tripp-Lite	ISOBAR6ULTRAHG
Cat6 Ethernet Cable 10'	Cable Exchange	CAX-C6-SHLBU- SR-10FT
Hub Enclosure	Everyone Counts	PVV-EOC001
EBM-Accessibility		
ATI	Storm Interface	EZ05-222013
Sip/Puff Device	Origin Instruments	AC-0313-MU
Headphones	Koss	KPH7
USB/Ethernet Hub	J5Create	JUH470

Table 3-2. Voting System Equipment (continued)

Component	Manufacturer	Model #
Ballot Box		
Ballot Box Container	PakFlatt	Fortress Lander Model: 1.0
Ballot Box Scanner	Kodak	Scan Station 730EX
Uninterruptible Power Supply (UPS)	Eaton	5S700
Cat6 Ethernet Cable 50'	Cable Exchange	CAX-C6-SHLBU- SR-50FT
Ballot Bag		
Provisional Ballot Bag	Election Source	BA-51
Central Scanning Scanner		
Scanner	Kodak	i4250
Scanner	Kodak	i3400
Scanner	Kodak	i2820
Uninterruptible Power Supply (UPS)	APC	SMC1500

3.3 Test Materials

This subsection lists all test materials required for the performance of the test campaign.

The materials required for testing of the eLect Quad Audit v.4.4.0 include all materials to enable the test campaign to occur. This includes the applicable software and equipment as well as the TDP, test support materials, and deliverable materials. A detailed list of the consumables required for each implementation of the eLect Quad Audit v.4.4.0 system is contained in the Everyone Counts document RF-1505 Consumables.

3.4 Deliverable Materials

This subsection lists all materials delivered as part of the voting system to the users.

All materials delivered to the end user as part of the eLect Quad Audit v.4.4.0 System are detailed in the Everyone Counts Configuration Items Register (Document No. DOC-1101). This document provides detailed information for all software, hardware, and TDP documents.

4.0 Test Specifications

Certification testing of the eLect Quad Audit v.4.4.0 submitted for evaluation will be performed to ensure the applicable requirements of the EAC 2015 VVSG 1.1 and the EAC Testing and Certification Program Manual are met. Additionally, all EAC Request for Interpretations (RFI) and Notices of Clarification (NOC) relevant to the system under test will be incorporated in the test campaign. A complete listing of the EAC RFIs and NOCs is available on the EAC website.

4.1 Requirements

To evaluate the eLect Quad Audit v.4.4.0 test requirements, each section of the EAC 2015 VVSG 1.1 will be analyzed to determine the applicable tests. The EAC 2015 VVSG 1.1 Volume I Sections, along with the strategy of evaluation, are described below:

Section 2: Functional Requirements

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

Section 3: Usability and Accessibility Requirements

The requirements in this section shall be tested during the Usability and Accessibility Testing. This evaluation will utilize baseline test cases as well as specifically designed test cases and will include predefined election definitions for the input data. Pro V&V will review the results of Summative Usability Testing performed on the system.

Section 4: Hardware Requirements

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

Section 5: Software Requirements

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

Section 6: Telecommunications Requirements

The requirements in this section shall be tested utilizing baseline test cases as well as specifically designed test cases.

Section 7: Security Requirements

The requirements in this section shall be tested during the Source Code Review, Security Tests, and FCA.

Section 8: Quality Assurance and Configuration Management

The requirements in this section shall be tested throughout the test campaign. This testing will utilize a TDP Review in conjunction with the Source Code Review and PCA to determine compliance to the EAC 2015 VVSG 1.1 requirements and the requirements stated in the Everyone Counts technical documentation. The review of the Quality Assurance and Configuration Management documentation will focus on Everyone Counts' adherence to its stated QA and CM processes.

Throughout the test campaign, Pro V&V personnel shall maintain a test log identifying the system and equipment under test and any records of deviations to the test plan along with the rationale for performing the deviations. Pro V&V shall also utilize an internal bug tracking system to record and track all issues and/or discrepancies noted during the test campaign.

4.1.1 Mapping of Requirements to Equipment Type and Features

This information shall be included in the EAC online matrix tool (VRT).

4.1.2 Rationale NA Requirements

All EAC 2015 VVSG 1.1 requirements, with the exceptions listed below, will be evaluated as part of this test campaign.

- Volume I, Section 7.6 (Use of Public Networks)
- Volume I, Section 7.7 (Wireless Communications)
- Volume I, Section 7.8 (Voter Verifiable Paper Audit Trail Requirements)

The rationale for not evaluating the eLect Quad Audit v.4.4.0 to the indicated sections is described in following table. Specific requirements that are excluded from this test campaign are identified in the EAC online matrix tool.

Table 4-1. Not Applicable Requirements

EAC 2015 VVSG Version 1.1 Volume I, Section	Rationale for ‘Not Applicable’
7.6	This system does not support transmission over public networks.
7.7	No wireless technology is utilized in this system.
7.8	This system does not contain a Voter Verifiable Paper Audit Trail (VVPAT).

4.2 Hardware Configuration and Design

The eLect Quad Audit v.4.4.0 system operates in two environments/locations: the central location and the polling place. Each location type utilizes a distinct hardware set. Each location incorporates servers or laptops containing versions of eLect Quad Audit and associated election settings/data.

The following six devices run different functions within the voting system:

- Central Server
The Central Server at the central location is the primary system device and runs eLect Quad Audit (Voting) and eLect Administration. All official tabulation occurs on the Central Server. The Central Server is comprised of COTS hardware and is connected to COTS UPS devices for soft shutdown during power interruptions.

- **Central Scan Imaging Server**
The Central Scan Imaging Server is a COTS rack server attached to the Central Server and is used solely for software image processing of centrally scanned mail-in ballots.
- **Master Poll Station Machine (MPSM)**
MPSM laptops are located at the polling place and contain the same version of the election configuration, but are not configured with eLect Administration; therefore, they do not contain the full eLect Quad Audit voting system.
- **Air-Gapped Encryption/Decryption Device**
An air-Gapped COTS laptop running eLect Security Suite only on Ubuntu desktop is used to generate encryption key pairs during the pre-election setup stage and used to decrypt vote data during post-election processing
- **eLect Administration Access Machine**
The eLect Administration Access Machine is the COTS laptop that provides access to the eLect Administration and is the user interface for all election management functionality in the eLect Quad Audit voting system.
- **Local Network Switch**
The Local Network Switch is a COTS network switch that provides Ethernet communications between the Central Server, Central Scan Imaging Server and the eLect Administration Access Machine.

4.3 Software System Functions

The eLect Quad Audit v.4.4.0 system includes the following proprietary software components:

- **eLect Quad Audit**
The eLect Quad Audit voting system is the platform that provides election administrators with the tools to manage elections.
- **eLect Administration Dashboard**
eLect Administration is the user interface for the Admin User. It contains various system modules for election creation and management.
- **Poll Station Management Console**
The eLect Poll Station Management Console is the user interface that is accessed through the poll station EBM to the poll worker.
- **eLect Central Scanning**
eLect Central Scanning is incorporated within eLect Administration.
- **eLect Quad Audit**
eLect Quad Audit is the core software module of the voting system.
- **eLect Security Suite**
eLect Security Suite is a utility application that provides encryption and decryption services.

The eLect Quad Audit v.4.4.0 system also includes modified and unmodified third-party components, and external library items, as previously detailed in Table 3-1.

4.4 Test Case Design

Test cases are designed based on the manufacturer's design specifications and the relevant technical requirements set forth by the VVSG. Test cases shall be examined based on the following aspects of the voting system:

- Hardware qualitative examination design
- Hardware environmental test case design
- Software module test case design and data
- Software functional test case design
- System level test case design

Test cases shall provide information regarding the sequence of actions to be performed for the execution of a test, the requirements being met, the test objective, test configuration, equipment needed, special requirements, assumptions, and pass/fail criteria. Once the test cases are finalized, they will be validated and published for use in the test campaign. The validation of the test case will be accomplished by Technical Review and Approval. This validation will include the following: confirmation of adequate test coverage of all requirements; confirmation that test case results are not ambiguous and gave objective pass/fail criteria; and conformation that any automated test suites will produce valid results.

4.4.1 Hardware Qualitative Examination Design

The voting system hardware with the exception of COTS Central Count shall be subjected to the tests specified below. Testing will be performed by personnel verified by Pro V&V to be qualified to perform the test. Pro V&V will utilize a third-party test facility for performance of the majority of the electrical and environmental tests. All pre/post-tests shall be conducted by Pro V&V personnel.

Electrical Tests:

- Electrical Power Disturbance
- Electromagnetic Emissions (Radiated & Conducted)
- Electrostatic Disruption
- Electromagnetic Susceptibility
- Electrical Fast Transient
- Lightning Surge
- Conducted RF Immunity
- Magnetic Fields Immunity
- Electrical Supply

Environmental Tests:

- Bench Handling
- Vibration
- Low Temperature Non-Operational
- High Temperature Non-Operational
- Low Temp Operational
- High Temp Operational
- Humidity Non-Operational
- Humidity Operational
- Acoustic

4.4.1.1 Mapping of Requirements to Specific Interfaces

This information shall be contained in the EAC online matrix tool.

4.4.2 Hardware Environmental Test Case Design

No previous examinations have been performed on the eLect Quad Audit v.4.4.0. The voting system hardware shall be subjected to the tests specified in section 4.4.1. Testing will be performed by personnel verified by Pro V&V to be qualified to perform the test. Pro V&V will utilize a third-party test facility for performance of the electrical and environmental tests. All pre/post-tests shall be conducted by Pro V&V personnel.

4.4.3 Software Module Test Case Design and Data

Pro V&V shall review the manufacturer's program analysis, documentation, and module test case design and shall evaluate the test cases for each module with respect to flow control parameters and entry/exit data. As needed, Pro V&V shall design additional test cases to satisfy the coverage criteria specified in Volume II, Section 7.2.1.

Component Level Testing will be implemented during the FCA for each component and subcomponent. During the Source Code Review, Compliance Builds, and Security Testing, Pro V&V will utilize limited structural-based techniques (white-box testing). Additionally, specification-based techniques (black-box testing) will be utilized for the individual software components.

Pro V&V shall define the expected result for each test and the ACCEPT/REJECT criteria for certification. If the system performs as expected, the results will be accepted. If the system does not perform as expected, an analysis will be performed to determine the cause. The test will be repeated in an attempt to reproduce the results. If the failure can be reproduced and the expected results are not met, the system will have failed the test. If the results cannot be reproduced, the test will continue. All errors encountered will be documented and tracked through resolution.

4.4.4 Software Functional Test Case Design and Data

Pro V&V shall review the manufacturer-submitted test plans and data to verify that the individual performance requirements specified in the EAC 2015 VVSG 1.1 and the TDP are reflected in the software. As part of this process, Pro V&V shall review the manufacturer's test case design and prepare a detailed matrix of system functions and the test cases that exercise them. Pro V&V shall also prepare a test procedure describing all test ballots, operator procedures, and the data content of output reports. Pro V&V shall define abnormal input data and operator actions and design test cases to verify that the system is able to handle and recover from these abnormal conditions. During this review, emphasis shall be placed on those functions where the manufacturer data on module development reflects significant debugging problems, and on functional tests that resulted in high error rates.

Pro V&V shall define the expected result for each test and the ACCEPT/REJECT criteria for certification. If the system performs as expected, the results will be accepted. If the system does not perform as expected, an analysis will be performed to determine the cause. The test will be repeated in an attempt to reproduce the results. If the failure can be reproduced and the expected results are not met, the system will have failed the test. If the results cannot be reproduced, the test will continue. All errors encountered will be documented and tracked through resolution.

4.4.5 System-Level Test Case Design

System Level testing will be implemented to evaluate the complete system. This testing will include all proprietary components (software, hardware, and peripherals) and COTS components (software, hardware, and peripherals) in a configuration of the system's intended use. For software system tests, the tests shall be designed according to the stated design objective without consideration of its functional specification. The system level hardware and software test cases shall be prepared independently to assess the response of the hardware and software to a range of conditions. These tests include: Volume, Stress, Usability, Accessibility, Security, Performance, and Recovery.

4.5 Security Functions

The objective of the Security Testing is 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 shall develop specifically designed test cases in an attempt to defeat the access controls and security measures documented in the system TDP. A threat matrix shall be created to determine the risks and vulnerabilities. An evaluation of the system shall be accomplished by utilizing a combination of functional testing, source code review, and Fortify SCA. All findings will be reported to the EAC and Everyone Counts.

4.6 TDP Evaluation

In order to determine full compliance with the EAC 2015 VVSG 1.1, three phases of TDP review shall be conducted:

- **Initial TDP Review:** The first review is performed to determine whether the TDP submitted is complete enough to perform TDP review. This is an abbreviated review. Each document is read to determine whether it provides enough description of the submitted voting system components and whether it at least generically addresses VVSG requirements. The results of the review are used in determining contractual requirements for the test campaign.
- **Compliance Review:** This review is conducted on a document-by-document basis to determine if every regulatory, state, or manufacturer-stated requirement has been met based on the context of each requirement. This review does not address consistency or completeness of documents. The review is more complex than the initial TDP review. Results of the review of each document are entered on the TDP Review Checklist and are reported to the manufacturer for disposition of any anomalies. This process is ongoing until all anomalies are resolved. Any revised documents during the TDP review process are compared with the previous document revision to determine changes made, and the document is re-reviewed to determine whether subject requirements have been met.
- **Consistency/Completeness Review:** The third TDP review is completed after the review for compliance has been performed (the Consistency/Completeness TDP Review may overlap the Compliance Review in part). This review is to ensure the information included in the TDP documents is consistent across documents, especially in component naming, software and firmware versioning, and the hardware, software, and firmware included with the voting system submitted for testing. Any revisions to a document during the TDP review process which affect other documents must also be revised. As with the other TDP reviews, the TDP Review Checklist is utilized to report any anomalies to the manufacturer for resolution, if required. The TDP review continues until all anomalies have been satisfactorily resolved.

A listing of all documents contained in the eLect Quad Audit v.4.4.0 TDP is provided in Table 4-2.

Table 4-2. eLect Quad Audit v.4.4.0 TDP Documents

Title	Document Rev.
DOC-1101 Quad Audit 4.4.0 Configuration Items Register	v4.4.0, r1.8
ST-1202 System Setup Overview	v.4.4.0, r1.1
ST-1205 eLect Administration Access Machine Setup	v.4.4.0, r1.0
ST-1206-OPS Dell Venue 11 EBM Setup Instructions	v.4.4.0, r1.1
ST-1206-DRE Dell Venue 11 EBM Setup Instructions	v.4.4.0, r1.0
ST-1207-OPS Ballot Box Setup	v.4.4.0, r1.0
ST-1208 Building the Imaging and Transfer Service Files	v.4.4.0, r1.0
ST-1209 Building an Imaging Server on Supermicro	v.4.4.0, r1.0
ST-1210 Installing Ubuntu	v.4.4.0, r1.0
ST-1212 Building an Ubuntu Linux ISO	v.4.4.0, r1.0
ST-1214 Deploying the Air-Gapped Machine with eLect Security Suite	v.4.4.0, r1.0
ST-1215 Deploying the Master Poll Station Machine	v.4.4.0, r1.0
ST-1216 Deploying the Central Server	v.4.4.0, r1.0

Table 4-2. eLect Quad Audit v.4.4.0 TDP Documents (continued)

Title	Document Rev.
OP-1312 System Operations	v.4.4.0, r1.0
UG-1400 User Guide: Central Office Hardware Setup	v.4.4.0, r1.0
UG-1402 User Guide: Using the Correct Documentation Set	v.4.4.0, r1.0
UG-1405 User Guide: Pre-Voting eLect Administration	v.4.4.0, r1.0
UG-1406 User Guide: Appendix to User Guide: Pre-Voting eLect Administration	v.4.4.0, r1.0
UG-1410 User Guide: Pre-Voting Central Scan Configuration	v.4.4.0, r1.0
UG-1415-DRE User Guide: Poll Station Management	v.4.4.0, r1.0
UG-1415-OPS User Guide: Poll Station Management	v.4.4.0, r1.0
UG-1420 User Guide: Central Scan Ballot Processing	v.4.4.0, r1.0
UG-1425-DRE User Guide: Voter Manual	v.4.4.0, r1.0
UG-1425-OPS User Guide: Voter Manual	v.4.4.0, r1.0
UG-1430-DRE User Guide: Post-Voting Poll Station Management	v.4.4.0, r1.0
UG-1430-OPS User Guide: Post-Voting Poll Station Management	v.4.4.0, r1.0
UG-1435 User Guide: Post-Voting eLect Administration	v.4.4.0, r1.0
UG-1440 User Guide: Quick Reference for System Reports	v.4.4.0, r1.0
UG-1445 User Guide: Accessing Audit Events	v.4.4.0, r1.0
UG-1450 User Guide: Backing Up and Restoring MPSM Data and the Election Server	v.4.4.0, r1.0
RF-1500 eLect Security Manual	v.4.4.0, r1.0
RF-1505 Consumables	v.4.4.0, r1.0
RF-1510 System Maintenance Manual	v.4.4.0, r1.0
RF-1511 System Personnel and Training Manual	v.4.4.0, r1.0
RF-1515 COTS Manuals	v.4.4.0
RF-1520 Environmental Data Sheets	v.4.4.0
QA-1605 Quality Manual	v.4.4.0, r1.0
QA-1610 Configuration Management Plan	v.4.4.0, r1.1
QA-1615 System Test Specification	v.4.4.0, r1.0
QA-1616 System Test Reports	v.4.4.0, r1.0
DS-1705 Implementation Statement	v.4.4.0, r1.0
DS-1705a Implementation Statement Supplemental: Accuracy Attestation	v.4.4.0, r1.0
DS-1710 System Overview	v.4.4.0, r1.3
DS-1715 System Functionality Description	v.4.4.0, r1.0

Table 4-2. eLect Quad Audit v.4.4.0 TDP Documents (continued)

Title	Document Rev.
DS-1720 Usability Testing Report	v.4.4.0, r1.0
SP-1805 System Hardware Specifications	v.4.4.0, r1.1
SP-1806 System Hardware Supplement	v.4.4.0, r1.0
SP-1810 Software Design Specifications	v.4.4.0, r1.0
SP-1811 Software Design Specifications: General Appendix A	v.4.4.0, r1.0
SP-1811 Software Design Specifications Appendix B: Interface Description	v.4.4.0, r1.0
SP-1811 Software Design Specifications Appendix C : Database Entities	v.4.4.0, r1.0
SP-1812 Software Design Specifications Appendix D: Introduction	v.4.4.0, r1.0
SP-1812 Software Design Specifications Appendix E: eLect Security Suite	v.4.4.0, r1.0
SP-1812 Software Design Specifications Appendix F: ASYNC	v.4.4.0, r1.0
SP-1812 Software Design Specifications Appendix G: Interface Audit Log Service	v.4.4.0, r1.0
SP-1812 Software Design Specifications Appendix H: Interface Bridge Web Service	v.4.4.0, r1.0
SP-1812 Software Design Specifications Appendix I: Interface Configuration Service	v.4.4.0, r1.0
SP-1812 Software Design Specifications Appendix J: Ballot Builder Module	v.4.4.0, r1.0
SP-1812 Software Design Specifications Appendix K: Administrative Web Service	v.4.4.0, r1.0
SP-1812 Software Design Specifications Appendix L: Batch Manager	v.4.4.0, r1.0
SP-1812 Software Design Specifications Appendix M: Notification Services	v.4.4.0, r1.0
SP-1812 Software Design Specifications Appendix N: Storage Web Service	v.4.4.0, r1.0
SP-1812 Software Design Specifications Appendix O: Interface User Manager	v.4.4.0, r1.0
SP-1812 Software Design Specifications Appendix P: Core: General	v.4.4.0, r1.0
SP-1812 Software Design Specifications Appendix Q: Core: System	v.4.4.0, r1.0
SP-1812 Software Design Specifications Appendix R: Core: Authentication	v.4.4.0, r1.0
SP-1812 Software Design Specifications Appendix S: Core: Election Content	v.4.4.0, r1.0
SP-1812 Software Design Specifications Appendix T: Core - Vote Data	v.4.4.0, r1.0
SP-1812 Software Design Specifications Appendix U: Management Election	v.4.4.0, r1.0
SP-1812 Software Design Specifications Appendix V: Voting: Ballot Storage And Backup	v.4.4.0, r1.0

Table 4-2. eLect Quad Audit v.4.4.0 TDP Documents (continued)

Title	Document Rev.
SP-1812 Software Design Specifications Appendix W: Results Auditing and Logging	v.4.4.0, r1.0
SP-1812 Software Design Specifications Appendix X: Results Tabulation	v.4.4.0, r1.0
SP-1812 Software Design Specifications Appendix Y: Imaging and Transfer Service Program Specification Part 1 of 2	v.4.4.0, r1.0
SP-1812 Software Design Specifications Appendix Y: Imaging and Transfer Service Program Specification Part 2 of 2	v.4.4.0, r1.0
SP-1812 Software Design Specifications Appendix Z Management: Poll Station	v.4.4.0, r1.0
SP-1812 Software Design Specifications Appendix AA: Voting Session Management	v.4.4.0, r1.0
SP-1812 Software Design Specifications Appendix AB: Voting: Ballot Rendering And Navigation	v.4.4.0, r1.0
SP-1812 Software Design Specifications Appendix AC: Voting Accessibility	v.4.4.0, r1.0
SP-1812 Software Design Specifications Appendix AD: Javascript Code	v.4.4.0, r1.0
SP-1812 Software Design Specifications Appendix AE: Perl Code	v.4.4.0, r1.0
SP-1812 Software Design Specifications Appendix AF: Voting: Ballot Box (Optical scan only)	v.4.4.0, r1.0
SP-1812 Software Design Specifications Appendix AG: Voting Ballot Printing (opscan only)	v.4.4.0, r1.0
SP-1812 Software Design Specifications Appendix AH - Voting - EBM Barcode Scanner	v.4.4.0, r1.0
SP-1812 Software Design Specifications Appendix AI: eLect Administration JavaScript Interfaces	v.4.4.0, r1.0
SP-1812 Software Design Specifications Appendix AJ: eLect Administration Architecture Overview	v.4.4.0, r1.0
SP-1812 Software Design Specifications Appendix AK: eLect Administration Groovy Interfaces	v.4.4.0, r1.0
SP-1813 Third Party Software License Agreements	v.4.4.0
SP-1815 System Security Specifications	v.4.4.0, r1.0

4.7 Source Code Review

Pro V&V will review the submitted source code to the EAC 2015 VVSG 1.1 and the manufacturer-submitted coding standards. Prior to initiating the software review, Pro V&V shall verify that the submitted documentation is sufficient to enable: (1) a review of the source code and (2) Pro V&V to design and conduct tests at every level of the software structure to verify that design specifications and performance guidelines are met.

4.8 QA & CM System Review

The Everyone Counts Quality and Configuration Management Manual shall be reviewed for its fulfillment of Volume I, Section 8.1.a and the requirements specified in Volume II, Section 2.1. The requirements for these sections establish the quality assurance and configuration standards for voting systems to which manufacturers must conform. The requirements also 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 Everyone Counts TDP documents will be reviewed to determine if the stated policies are being followed.

5.0 Test Data

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

5.1 Test Data Recording

All equipment utilized for test data recording shall be identified in the test data package. The output test data shall be recorded in an appropriate manner as to allow for data analysis. For source code and TDP reviews, results shall be compiled in reports and submitted to Everyone Counts for resolution.

5.2 Test Data Criteria

The eLect Quad Audit v.4.4.0 shall be evaluated against all applicable requirements contained in the EAC 2015 VVSG 1.1. The acceptable range for system performance and the expected results for each test case shall be derived from the manufacturer-submitted technical documentation and the EAC 2015 VVSG 1.1.

5.3 Test Data Reduction

Test data shall be processed and recorded in the test log book and the relevant Test Cases.

6.0 Test Procedure and Conditions

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

6.1 Facility Requirements

Unless otherwise annotated, all testing shall be conducted at the Pro V&V test facility located in Huntsville, AL, by personnel verified by Pro V&V to be qualified to perform the test. Unless otherwise specified herein, testing shall be performed at the following standard ambient conditions and tolerances:

- Temperature: 68-75° F ($\pm 3.6^\circ\text{F}$)
- Relative Humidity: Local Site Humidity
- Atmospheric Pressure: Local Site Pressure
- Time Allowable Tolerance: $\pm 5\%$

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

6.2 Test Setup

All voting system equipment shall be received and documented using Pro V&V proper QA procedures. Upon receipt of all hardware, an inspection will be performed to verify that the equipment received is free from obvious signs of damage and/or degradation that may have occurred during transit. If present, this damage shall be recorded, photographed, and reported to the Everyone Counts Representative. Additionally, a comparison shall be made between the recorded serial numbers/part numbers and those listed on shipper's manifest and any discrepancies shall be reported to the Everyone Counts Representative. TDP items and all source code received shall be inventoried and maintained by Pro V&V during the test campaign.

During test performance, the system shall be configured as would be for normal field use. This includes connecting all supporting equipment and peripherals.

6.3 Test Sequence

The eLect Quad Audit v.4.4.0 will be evaluated against all applicable requirements in the EAC 2015 VVSG 1.1. There is no required sequence for test performance.

7.0 TEST OPERATIONS PROCEDURES

Pro V&V will identify PASS/FAIL criteria for each executed test case. The PASS/FAIL criteria will be based on the specific expected results of the system. In the case of an unexpected result that deviates from what is considered standard, normal, or expected, a root cause analysis will be performed.

Pro V&V will evaluate every EAC 2015 VVSG 1.1 requirement applicable to the eLect Quad Audit v.4.4.0 voting system. Any deficiencies noted will be reported to the EAC and the manufacturer. If it is determined that there is insufficient data to determine compliance, this test plan will be altered and additional testing will be performed.

7.1 Proprietary Data

All data and documentation considered by the manufacturer to be proprietary will be identified and documented in an independent submission along with a Notice of Protected Information.

Attachment A – Project Schedule

Task Name	Start Date	End Date	Assigned To	% Complete	Duration
TDP	10/06/16	03/06/17		0%	103d
Initial Review	10/06/16	10/19/16	Diane	0%	10d
Compliance Review	10/20/16	03/01/17	Diane	0%	90d
Final review	03/02/17	03/06/17	Diane	0%	3d
Test Plan	10/24/16	01/16/17		0%	56d
Test Plan Creation	10/24/16	11/21/16	Wendy	0%	21d
Vendor Review & Comments	11/22/16	11/23/16	Wendy	0%	2d
EAC Review	11/28/16	12/23/16	Wendy	0%	20d
Test Plan Comment Review & Update	12/27/16	12/28/16	Wendy	0%	2d
EAC Resubmission Review	12/29/16	01/13/17	Wendy	0%	10d
EAC Approved Test Plan	01/16/17	01/16/17	Wendy	0%	1d
Source Code	09/16/16	09/27/16		0%	8d
Source Code Delivered	09/16/16	09/16/16	Jack	0%	1d
Source Code Review	09/19/16	09/23/16	Jack	0%	5d
Document Review	09/26/16	09/26/16	Jack	0%	1d
Compliance Build	09/27/16	09/27/16	Jack	0%	1d
System Delivery & Setup	08/29/16	10/04/16		0%	27d
Equipment Delivered	08/29/16	08/29/16	Alan	0%	0
PCA	08/29/16	08/29/16	Alan	0%	1d
System Loads & Hardening	09/28/16	10/04/16	Alan	0%	5d
Hardware Testing	11/03/16	12/09/16		0%	25d
Electrical Testing	11/03/16	11/16/16	Walker	0%	10d
Environmental Testing	11/08/16	12/09/16	Walker	0%	22d
System Level Testing	11/07/16	02/14/17		0%	67d
FCA	11/07/16	12/20/16	Alan	0%	30d
Telecommunications	12/21/16	12/28/16	Alan	0%	5d
Security	12/29/16	01/13/17	Alan	0%	10d
Usability	01/16/17	01/17/17	Alan	0%	2d
Accessibility	01/16/17	01/17/17	Alan	0%	2d
Volume & Stress (System Limits)	01/18/17	01/24/17	Alan	0%	5d
Pen Test (Multiple Colors)	01/25/17	01/26/17	Alan	0%	2d
Maintainability	01/25/17	01/27/17	Alan	0%	3d
Accuracy	01/30/17	02/01/17	Alan	0%	3d
Regression Testing	02/02/17	02/03/17	Alan	0%	2d
Trusted Build	02/06/17	02/07/17	Jack	0%	2d
System Integration	02/08/17	02/14/17	Alan	0%	5d
Test Report	02/02/17	04/17/17		0%	53d
Test Report Creation	02/02/17	02/22/17	Wendy	0%	15d
Vendor Review & Comments	02/23/17	02/24/17	Wendy	0%	2d
EAC Review	02/27/17	03/24/17	Wendy	0%	20d
Test Report Comment Review & Update	03/27/17	03/31/17	Wendy	0%	5d
EAC Resubmission Review	04/03/17	04/14/17	Wendy	0%	10d
EAC Approved Test Report	04/17/17	04/17/17	Wendy	0%	1d

Attachment B – Implementation Statement



EVERYONE COUNTS
eLect Quad Audit v.4.4.0

DS-1705 IMPLEMENTATION STATEMENT

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Abstract

Implementation Statement identifies and details all products, voting system devices, and voter accessibility components required for administration of the *eLect Quad Audit Voting System*. The *Implementation Statement* additionally lists device capacities and limits. This document fulfills the requirements in Subsection 3.1.1 of the VVSG 1.1 - V.2.

Table of Contents

[Abstract](#)

[Table of Contents](#)

[1.0 Introduction](#)

[1.1 Related Documentation](#)

[1.2 System Software Components](#)

[1.2.1 System Software](#)

[1.3 System Hardware Components](#)

[1.3.1 System Hardware](#)

[2.0 Voting System Component Descriptions](#)

[2.1 eLect Administration and the Central Server](#)

[2.2 eLect Security Suite and the Air-Gapped Machine](#)

[2.3 eLect Central Scanning and the Imaging Server](#)

[2.4 eLect Quad Audit Voting and Poll Station Components](#)

[2.4.1 Master Poll Station Machine](#)

[2.4.2 Electronic Ballot Marker](#)

[2.4.3 Ballot Box \(Optical Scan Mode Only\)](#)

[3.0 VVSG Conformity Assessment](#)

[4.0 Voting Variations Supported](#)

[4.1 Voting Variations Not Supported](#)

[5.0 Device Capacities and Limits](#)

[5.1 Central Server Capacities and Limits](#)

[5.1.1 Central Server Capacities](#)

[5.1.2 Central Server Limits](#)

[5.1.3 eLect Administration Limits](#)

[5.2 Air-Gapped Machine Capacities](#)

[5.2.1 eLect Security Suite Capacities](#)

[5.3 Master Poll Station Machine Capacities and Limits](#)

[5.3.1 Master Poll Station Machine Capacities](#)

[5.3.2 Master Poll Station Machine Limits](#)

[5.4 Electronic Ballot Marker Capacities and Limits](#)

[5.4.1 Electronic Ballot Capacities](#)

[5.4.2 EBM Limits](#)

[5.5 Poll Station Report Printer and Ballot Printer Capacities and Limits](#)

Everyone Counts, Inc.

eLect Quad Audit v.4.4.0 DS-1705 Implementation Statement r1.2

Page 3 of 28

Confidential and Proprietary

[5.6 Ballot Box Capacities and Limits \(Optical Scan Mode Only\)](#)

[5.6.1 Ballot Box Scanner Capacities](#)

[5.6.2 Ballot Box Scanner Limits](#)

[5.7 Imaging Server Capacities and Limits](#)

[5.7.1 Imaging Server Capacities](#)

[5.7.2 Kodak Scanner Capacities](#)

[5.7.2.1 Kodak I4250 Capacities](#)

[5.7.2.2 Kodak B400 Capacities](#)

[5.7.2.3 Kodak I2820 Capacities](#)

[5.7.3 Central Scanning Paper Ballot Limits](#)

[5.7.4 Central Scanning Limits](#)

[5.7.5 Ballot Pens](#)

[6.0 Supported Languages Identification](#)

[7.0 Voter Accessibility Components Identification](#)

[7.1 Voter Accessibility Components Capacities and Limits](#)

[7.1.1 Voter Accessibility Component Capacities](#)

[7.1.2 Voter Accessibility Components Limits](#)

[Appendix A: Device Capabilities Table](#)

[A1.1 Candidates per Contest on Scanned Paper and Digital Ballots](#)

[Revision History](#)

1.0 Introduction

eLect Quad Audit 4.4.0 is an integrated voting system used to administer all aspects of election management and tabulation. The system runs on commercial off-the-shelf (COTS) hardware located at a Central Office and Poll Stations. To ensure the integrity and security capabilities of all system functionality, *eLect Quad Audit* applies a multilevel approach to system access and security. *eLect Quad Audit* is available in either Optical Scan mode or DRE mode. Additionally, jurisdictions using Optical Scan mode may choose to allow their voters with disabilities to use DRE mode.

1.1 Related Documentation

The following documents are either referenced in or were used in preparation of this document:

- *DOC-1101 Quad Audit 4.4.0 Configuration Items*
- *SP-1805 System Hardware Specifications*

1.2 System Software Components

The following table lists the primary *eLect Quad Audit* voting system software components and capabilities.

Component	Software Description
eLect Administration	The <i>eLect Administration</i> application is the gateway to the <i>eLect Quad Audit</i> voting system. Election officials access specific modules in the user interface to manage the election lifecycle and all essential elements of the election.
eLect Central Scanning	<i>eLect Central Scanning</i> is the <i>eLect Administration</i> scanning module used to configure and control paper ballot content, scanning and processing. The settings in this module define how paper ballots are processed.
eLect Security Suite	<i>eLect Security Suite</i> is an application utility that provides ballot encryption and decryption services. The application is used in two (2) modes of operation, <i>Stand-Alone</i> and <i>Embedded</i> .
eLect Voting	<i>eLect Voting</i> is an <i>eLect Quad Audit</i> component that runs on the <i>Central Server</i> at the Central Office and the <i>Master Poll Station Machine (MPSM)</i> at the Poll Station. In the Poll Station, <i>eLect Voting</i> is used to collect votes and tabulate <i>Unofficial</i> results. In the Central Office, <i>eLect Voting</i> is used to

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	build elections prior to voting, receive votes collected from Poll Stations, and to accumulate and tabulate both <i>Unofficial</i> and <i>Official</i> results after the election.
--	--

Software version component numbers are available in *DOC-1101 Quad Audit 4.4.0 Configuration Items Register*.

1.2.1 System Software

For a complete list of all proprietary and third-party system software components and version numbers, refer to *DOC-1101 Quad Audit 4.4.0 Configuration Items Register*

1.3 System Hardware Components

The following table provides a list of primary system hardware components for *eLect Quad Audit*.

Central Server	The <i>Central Server</i> runs on a Linux operating system and is the primary system device that hosts the <i>eLect Quad Audit</i> voting system, including <i>eLect Administration</i> (the EMS) and <i>eLect Voting</i> (for tabulation). The <i>Central Server</i> is located in the Central Office.
Imaging Server	The <i>Imaging Server</i> provides dedicated image processing and character mark recognition for scanned paper ballots only. The <i>Imaging Server</i> runs on a Windows operating system and is used for <i>eLect Central Scanning</i> . The <i>Imaging Server</i> is located in the Central Office.
eLect Administration Access Machine	The <i>eLect Administration Access Machine</i> (EAAM) runs on a Windows operating system and is connected to the <i>Central Server</i> , the <i>Central Scanner</i> , and a printer. Election management activity is executed using the <i>eLect Administration</i> interface. The EAAM is located in the Central Office.
Air-Gapped Machine	The <i>Air-Gapped Machine</i> is a dedicated COTS laptop that is isolated from the voting system and any network connection. The <i>Air-Gapped Machine</i> hosts <i>eLect Security Suite</i> , which provides ballot encryption and decryption services. The <i>Air-Gapped Machine</i> is located in the Central Office.
Master Poll Station Machine (MPSM)	The <i>Master Poll Station Machine</i> (MPSM) is a laptop that runs on a Linux operating system and is used to manage the voting process. The election configuration from the <i>Central Server</i> is replicated to each MPSM prior to Poll Station delivery. The MPSM is then wired to the <i>Electronic Ballot</i>

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eLect Quad Audit v.4.4.0 DS-1705 Implementation Statement r1.2

	Markers (EBMs) using a local network switch. MPSMs are located in the Poll Stations.
Central Scanner	The <i>Central Scanner</i> is a COTS imaging scanner that is connected to the <i>eLect Administration Access Machine</i> and performs <i>eLect Central Scanning</i> functions. The <i>Central Scanner</i> is located in the <i>Central Office</i> .
Electronic Ballot Marker (EBM)	The <i>Electronic Ballot Marker (EBM)</i> is a COTS tablet that runs on a Windows operating system. The EBM is used to mark the ballot and transmit digital vote data to and from the MPSM. The EBM does not store vote data. EBMs are located in the <i>Poll Stations</i> .
Ballot Box	The <i>Ballot Box</i> provides physical security for completed ballots. The <i>Ballot Box</i> is located in the <i>Poll Station</i> and is used in <i>Optical Scan</i> mode only. The <i>Ballot Box</i> is used as one (1) unit and consists of three (3) elements: <ul style="list-style-type: none"> • <i>Ballot Box Scanner</i> • <i>Ballot Box Container</i> • <i>Emergency Ballot Container</i>

1.3.1 System Hardware

For a complete list of all system COTS hardware components and version numbers, refer to *DOC-1101 Quad Audit 4.4.0 Configuration Items Register*.

2.0 Voting System Component Descriptions

This section outlines and details the separate hardware components of the *eLect Quad Audit* solution. For information on peripheral accessories refer to *SP-1805 System Hardware Specifications*.

2.1 eLect Administration and the Central Server

The *Central Server* is the Linux Ubuntu operating system server for the *eLect Quad Audit* solution. This server hosts *eLect Administration*, the *eLect Security Suite*, and *eLect Central Scanning*. Access to *eLect Administration* is initiated when the *Central Server* is connected to the *eLect Administration Access Machine*. The *Central Server* also deploys the election configuration to the MPSMs; uploads saved and encrypted vote data from the MPSMs; and tabulates, reports, and stores vote data.

Central Server

- SuperMicro Server; Model: SC813MTQ-R400CB

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eLect Quad Audit v.4.4.0 DS-1705 Implementation Statement r1.2

2.2 eLect Security Suite and the Air-Gapped Machine

The Air-Gapped Machine is the COTS laptop that runs the eLect *Security Suite* software on Linux Ubuntu. The eLect *Security Suite* is used to generate encryption key pairs during the pre-election setup stage and to decrypt encrypted vote data during post-election data processing. The Air-Gapped Machine is a dedicated machine that is never connected to another device beyond the approved data transfer using removable flash drives. It is isolated from the rest of the voting system, and from any network connection.

Air-Gapped Machine

- Dell Latitude Laptop; Model E5450

2.3 eLect Central Scanning and the Imaging Server

The Imaging Server runs on a Windows 8.1 Pro operating system and is a dedicated server for eLect *Central Scanning* functionality. It is used to run *Recostar* (a third-party optical character recognition [OCR] image processing software) in conjunction with eLect *Central Scanning* to provide image processing and character mark recognition for scanned paper ballots only.

All scanning device components are COTS hardware and are connected to COTS Uninterruptable Power Source (UPS) devices to provide power in the event of a power interruption. These UPS devices send a signal to the servers for a graceful shutdown in the event of a power interruption.

Imaging Server

- SuperMicro SC813MTQ-R400CB

Scanners

The eLect *Central Scanning* functionality supports three (3) levels of scanners depending on throughput and overall volume needs of the client. The client can choose one (1) of the scanner models listed below.

- Kodak Scanners:
 - Model: I4250 - Recommended for large counties (100,000+ voters)
 - Model: I3400 - Recommended for small and medium counties (25,000 to 100,000 voters)
 - Model: I2820 - Recommended for small counties (25,000 or fewer voters)

2.4 eLect Quad Audit Voting and Poll Station Components

The primary Poll Station hardware devices used by eLect *Quad Audit Voting* are the Master Poll Station Machine (MPSM), the Electronic Ballot Marker (EBM), and the Ballot Box. The Ballot Box is used only for Optical Scan mode.

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2.4.1 Master Poll Station Machine

The MPSM operates on a Linux Ubuntu operating system and connects directly to the EBMs.

MPSM functions:

- Scans the *Manage Poll Station* token on the EBM to open the Poll Station and display the Poll Station Management Console menu
- Generates the Diagnostic Report to review system status before the start of a voting session
- Displays an election-specific ballot with a defined ballot style to the EBM after the poll worker scans the *Voting Session Initiation* token for the voter
- Receives, encrypts, and stores digital vote data from the EBM in DRE mode and additionally from the Ballot Box in Optical Scan mode.
- Contains the Poll Station database and replicates vote data to the Central Server database after close of the Poll Station
- Closes the election by means of the Poll Station Management Console
- Tabulates votes for an unofficial result and exports *Audit Events* from the Poll Station

Master Poll Station Machine

- Dell Latitude Laptop
 - Model: E5450

2.4.2 Electronic Ballot Marker

The EBM operates on a COTS tablet using a Windows operating system and is connected to the MPSM via ethernet. In the Poll Station, every two (2) EBMs are plugged into a surge protector, which is plugged into a grounded wall outlet. A poll worker initiates operation by scanning the *Manage Poll Station* token. The poll worker can then scan a *Voting Session Initiation* token to display a ballot for a voter.

The proper ballot style displays for the voter who then marks the ballot using the touchscreen and/or peripheral device(s) for accessibility. Voters approve and submit their ballot choices by interacting with the EBM tablet. In Optical Scan mode, the voter prints the ballot and scans it on the Ballot Box scanner, where it is fed into the Ballot Box container.

Optical Scan Mode Only

The ballot print event is recorded as an unconfirmed vote awaiting Ballot Box validation. After the ballot is printed, the voter places the ballot in the privacy sleeve provided and moves to the Ballot Box. At the Ballot Box, the voter inserts the printed paper ballot into the Ballot Box Scanner. The scanned ballot automatically feeds from the scanner into the Ballot Box.

When voters complete their selections and submit their ballots, the EBM sends vote data to the MP3M, where a screen capture of the completed ballot is taken. The system then resets the EBM to its initial state while waiting for the poll worker to scan the next *Voting Session Initiation* token.

Electronic Ballot Marker (EBMs)

- Dell Venue Pro 11 Tablet
 - Model: 5130
- Canon PIXMA Printer
 - Model: IP110

2.4.3 Ballot Box (Optical Scan Mode Only)

The COTS Ballot Box combination is designed to provide physical security for all ballots. Cast ballots are only accessible if the security seals are removed, and the Ballot Box lid with the attached scanner is lifted, or if the emergency ballot container is unlocked for use by approved personnel. The Ballot Box contains its own UPS.

Ballot Box Hardware

- PakFlat Fortress Lander
 - Model: 1.0
- Kodak® Scan Station
 - Model: 730EX

3.0 VVSG Conformity Assessment

All system components recorded in this Implementation Statement conform to VVSG 1.1, 2015 standards.

4.0 Voting Variations Supported

The *eLect Administration* dashboard is the system's user interface containing the functionality for managing voting variations. These voting variations are controlled by tools provided in *eLect Administration* for creating elections and specific settings within individual elections.

All election settings from any previously created election can be copied and imported into newly created elections while maintaining the functionality to change any available setting to support the following variations:

- Ballot rotation supports two (2) methods only:
 - Rotation set by Precinct
 - Rotation weighted by number of registered voters per Precinct
- Closed Primaries

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- Nonpartisan Offices
- Open Primaries
- Partisan Offices
- Primary Presidential Delegation Nominations
- Provisional or Challenged Ballots
- Split Precincts
- Straight Party Voting
- Vote for N of M
- Write-In Voting

4.1 Voting Variations Not Supported

The following voting variations are not supported by tools in *eLect Administration*:

- Cumulative
- Cross-Party Endorsement
- Proportional Representation
- Ranked Order Voting
- Recall Issues, with options

5.0 Device Capacities and Limits

This section provides information about system device capacities and limits.

5.1 Central Server Capacities and Limits

This section describes Central Server capacities and limits.

5.1.1 Central Server Capacities

The Central Server contains all centralized *eLect Quad Audit* voting system software, including the *eLect Administration* dashboard, which is the election management user interface for *eLect Quad Audit* functionality. The Central Server also runs *eLect Central Scanning*, and hosts election management tools and the election configuration in *eLect Administration*. The Central Server also serves as the primary host for all election and vote data.

Central Server Functions:

- Accesses the functionality of the *Central Scanning* module in *eLect Administration* for scanning of paper absentee, provisional, and other scanned paper ballot types
- Archives election information
- Assigns candidates to contests
- Counts and tabulates:
 - Ballots
 - Official vote totals
- Creates:
 - Roles/users and defines permissions

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- Creates ballot layouts for paper and digital
 - Creates ballot map for digital ballots
 - Barcoded *Voting Session Initiation* tokens
 - Barcoded *Manage Poll Station* tokens
- Creates and edits:
 - Contests
 - Candidates
- Creates reports for:
 - Audit Events
 - Pre-Election
 - System
 - Audit
 - Filtered Results
 - Contest/Candidate
 - Contest/Candidate detailed
 - Precinct
 - District
 - Poll Station
 - Poll Station reports are generated per MPSM. If there is more than one (1) MPSM In a Poll Station, the reports are not aggregated.
 - Voter Participation
- Defines and configures the election
- Exports encrypted vote files for transfer to the Air-Gapped Machine
- Generates:
 - System-wide Audit and Event logs and codes
 - System notifications and status messages for the system and database
- Imports:
 - Ballot data
 - Decrypted vote files for tabulation
- Imports and aggregates Poll Station databases from MPSMs
- Monitors system
- Previews ballots
- Provides data preview
- Replicates and exports election configuration to each MPSM in the jurisdiction
- Sets:
 - Voting periods
 - Voting process
 - Voting rules
 - Scanning rules

5.1.2 Central Server Limits

The Central Server can run only one (1) active election; it cannot run multiple active elections. Central Server names cannot exceed a maximum of two (2) numeric digits. For example, c01, c20, or c99 are acceptable.

5.1.3 eLect Administration Limits

Candidate names have a limit of 100 characters per candidate name. Long candidate names limit ballot style configuration. To accommodate this limitation, users should adjust the candidate name length. Visual inspection and confirmation to verify name display is performed during the ballot configuration process on both the digital ballots and the scanned paper ballots.

5.2 Air-Gapped Machine Capacities

This section describes the capacities of the Air-Gapped Machine.

5.2.1 eLect Security Suite Capacities

The Air-Gapped Machine hosts eLect Security Suite, which is the security application and user interface for encryption and decryption.

Air-Gapped Machine functions:

- Creates encryption/decryption key pairs
- Imports encrypted vote data downloaded from votes file
- Stores encryption key pairs for vote encryption
- Stores security keys and vote data on files using Advanced Encryption Standard (AES) and RSA techniques
 - Unlocks and downloads the election configuration in the MPSM with the security keys
 - Encrypts vote ballots as they are stored in the MPSM
 - Generates Votes.egd file to collect and store votes during the election
 - Decrypts vote data post election
 - Stores decrypted vote data in an XML file for transfer to the Central Server for tabulation

5.3 Master Poll Station Machine Capacities and Limits

This section describes the capacities and limits of the Master Poll Station Machine.

5.3.1 Master Poll Station Machine Capacities

The MPSM connects to the Poll Station network for communication to the EBMs (for Optical Scan mode and DRE mode) and Ballot Box Scanner (for Optical Scan mode only), and contains the eLect Quad Audit voting application.

MPSM functions:

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- Stores election data including ballot styles, contests, candidates, voters, vote data, election ID, date and time
- Opens the Poll Station
- Delivers proper ballot style to EBMs
- Initiates voting sessions with input from the EBM
- Collects ballot marking data
- Authenticates ballots submitted
- Closes the Poll Station
- Displays reports
- Encrypts and stores votes and ballots and screen capture images from the EBMs
- Authenticates ballots submitted to the Ballot Box (Optical Scan mode only)
- Encrypts and stores scanned paper vote copies from the Ballot Box scanner (Optical Scan mode only)
- Replicates encrypted data back to the Central Server
- Tabulates the unofficial results of the associated Poll Station
- Zeroes the ballot counter

5.3.2 Master Poll Station Machine Limits

The MPSM cannot alter election data after the configuration is defined and pulled from the Central Server.

The MPSM cannot exceed the following limitations:

- A maximum of 1,000 devices (named 000 to 999)
- A maximum of three (3) digits when naming the MPSM after naming the Central Server with two (2) digits, for example, cXX-psYYY

5.4 Electronic Ballot Marker Capacities and Limits

This section describes the capacities and limits of the Electronic Ballot Marker.

5.4.1 Electronic Ballot Capacities

The EBM connects to the MPSM via ethernet.

EBM functions:

- Scans Manage Poll Station tokens
 - Initializes the Poll Station Management console
 - Opens the Poll Station
 - Displays reports
 - Toggles between Optical Scan paper ballot printing mode and Accessible DRE mode.

Ballot printer functions:

- In Optical Scan mode, the Ballot Printer prints a paper copy of the voter's digital ballot selections with the associated barcode.
- In Optical Scan mode, the poll worker also uses the printer to print device and Poll Station reports from an EBM.

Poll Station report printer:

- In DRE mode, the poll worker uses the Poll Station Report Printer to print device and Poll Station reports from an EBM.

5.6 Ballot Box Capacities and Limits (Optical Scan Mode Only)

This section describes the capacities and limits of the Ballot Box, which is the combination scanning device and Ballot Box container receptacle for paper ballot copies.

5.6.1 Ballot Box Scanner Capacities

The following list outlines Ballot Box Scanner tasks:

- Accepts paper copies of digital ballots printed from the EBM
- Approves or denies Poll Station paper ballots using scanned information in the printed QR barcode on the Poll Station paper ballot
- Prevents entry of any unscanned ballots to Ballot Box
- Provides a separate locked emergency ballot container that holds up to 300 ballots
- Displays the count of submitted Poll Station paper ballots with input from MPSPM
This count includes all scanned ballots and DRE (paperless) submissions in Optical Scan mode.

5.6.2 Ballot Box Scanner Limits

The following list describes Ballot Box limitations:

- Cannot reverse roll a paper ballot once accepted from the Ballot Box scanner and passed into the Ballot Box Container
- Does not maintain the ballot counter without connection to MPSPM (maintained on the MPSPM, and displays on Ballot Box display screen)
 - Keeps device lifetime counter for maintenance purposes that is not displayed on screen
- Does not store election data or vote data on the device
- Will not duplicate scanning of individual ballots
- Cannot operate as a Ballot Box Scanner without connection to the MPSPM
- The Emergency Ballot Container is accessible with proper security protocols at any time

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5.7 Imaging Server Capacities and Limits

The following sections describe capacities and limits for the Imaging Server, which runs in a Windows operating system environment.

5.7.1 Imaging Server Capacities

The following list describes the functions of the Imaging Server functions:

- Decodes and analyzes Batch Control Sheets
- Determines the marks on a ballot
- Generates
 - Ballot Tester Sheets
 - PDF files for Batch Control Sheets
- Handles conversion of images to various formats for presentation in the user interface
- Identifies
 - Ballot Styles with the barcode on each ballot
 - Any low confidence marks
- Reads and verifies ballot markings after ballot scanning
- Performs
 - Image registration, rotation, deskewing, and alignment for ballots
 - Sanity checks to ensure each ballot has been captured successfully

5.7.2 Kodak Scanner Capacities

The following sections provide specific capacities for each Kodak scanner supported.

5.7.2.1 Kodak i4250 Capacities

- 8.5 x 11 Inch ballots
- 8.5 x 14 Inch ballots
- 11 x 17 Inch ballots
- Duplex scan supported
- Input Capacity: Up to 500 sheets

5.7.2.2 Kodak i3400 Capacities

- 8.5 x 11 Inch ballots
- 8.5 x 14 Inch ballots
- Duplex scan supported
- Input Capacity: Up to 150 sheets

5.7.2.3 Kodak i2820 Capacities

- 8.5 x 11 Inch ballots
- 8.5 x 14 Inch ballots
- Duplex scan supported
- Input Capacity: Up to 50 sheets

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5.7.3 Central Scanning Paper Ballot Limits

This section provides specific paper ballot limitations for the Central Scanner.

Paper Size

- U.S. Letter (8.5 x 11 Inches)
- U.S. Legal (8.5 x 14 Inches)
- U.S. Ledger (11 x 17 Inches)
 - This size is only supported by the Kodak I4250 scanner.

Paper Color

- White
 - Recycled paper is not accepted due to imperfections in the paper color

Paper Weight

The eLect Central Scanning module operates with the following recommended and tested paper types to reduce bleed-through:

- Hewlett Packard: U.S. Letter, Bright White, Inkjet, 24lb
- Hammermill: U.S. Letter, White, 28lb
- Hammermill: U.S. Legal, White, 28lb
- Office Depot: U.S. Ledger, White, 20lb

Printing Accuracy

Anchors are expected to be 5 mm from the edge of the paper. The system can manage an error of +/- 10 mm and automatically scales the scanned images, but it is recommended not to exceed an error of more than +/- 5 mm.

5.7.4 Central Scanning Limits

Central Scanning supports maximum batch sizes of up to 500 ballots, and deck loads of 100 sheets or fewer on the scanner. Batches can be paused between scanner reloads, or when image processing continues for the batch, allowing for the display of scanned images to be added to the images in the batch.

Paper Ballot Limits:

- Every candidate name and contest name must be uniquely different from all others on the ballot or in the election.
 - If two candidates have the same first and last name, a differentiator such as middle initial, party affiliation, etc. must be placed with the candidate name to ensure the proper display of tabulation results at the close of the election.

For example, if two candidates have the name, John Smith, the names can display as John E. Smith and John R. Smith.

5.7.5 Ballot Pens

Tested ballot pens for optimal scanning and Imaging include:

- Paper Mate InkJoy 300 Ballpoint Pen
 - Fine Pen Point Type
 - 0.7 mm Pen Point Size
 - Black Ink
 - Transparent Barrel
 - 12 / Dozen per box
 - Part Number PAP1766482
- Pilot Precise V7 Premium Rolling Ball Stick Pen
 - Fine Point
 - Black Ink
 - 0.7 mm
 - Part Number 26020

6.0 Supported Languages Identification

The following languages are supported in written, digital, and audio formats by the eLect Quad Audit voting system:

- English
- Spanish
- Bengali
- Korean
- Chinese
- Vietnamese
- Non-written language audio support

7.0 Voter Accessibility Components Identification

The following voter accessibility components are supported by the eLect Quad Audit voting system:

- Storm Interface Switch, Keypad; Model EZ05-222013
- Origin Instruments Multi-User Sip/Puff Breeze with Headset, Model AC-0313-MU
- Koss KPH7 On-Ear Headphones

7.1 Voter Accessibility Components Capacities and Limits

The eLect Quad Audit serves assigned ballot styles to the EBM, presenting a visually accessible ballot with options for visually impaired users and an audio ballot with audible user-driven options for blind voters. When voters interact on the touchscreen and/or on accessibility

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devices, the interface marks the ballot on the EBM. The vote data is encrypted using the Integrated eLect Security Suite tool and then sent to the MPSM.

7.1.1 Voter Accessibility Component Capacities

The following list describes the capacity of accessibility support components available to voters on the EBM:

- Visual Impairments
Headphones and the 5-button switch provides visually impaired voters with audible instructions for navigating the ballot, selecting candidates, and confirming and casting votes.
- Hearing Impairments
Headphones support hearing impaired voters by allowing volume control and adjustment to convey audible instructions and feedback used to navigate the ballot, selecting candidates, confirm selections, and casting the ballot.
- Cognitive Impairments
Headphones are used to support voters who may be illiterate, cognitively impaired, or lack English proficiency. Audible instructions and feedback are provided to navigate the ballot, select candidates, confirm selections, and cast the ballot.
- Physical Impairments
The sip and puff device with Headset with USB interface and the 5-button switch is used to support physically impaired voters by providing a method for the voter to navigate the ballot, select candidates, confirm selections, cast the ballot, and receive feedback.
- All Voters
Digital and audio voter instructions are provided in natural and plain language with the options to select a larger font size and to allow the voter to control the rate of instructions, feedback, pausing, and repetition

NOTE

- The audio ballot instructions, feedback, and messaging use the text that displays on the digital ballot instructions, feedback, and messaging.

7.1.2 Voter Accessibility Components Limits

This section provides system component limitations for accessibility devices used with the Electronic Ballot Marker (EBM) in the Poll Station.

EBM Limits:

- Supports only English and Spanish for text to speech audio; all other languages supported by user uploaded pre-recorded audio
- Headphones and digital ballot display only
- Does not support voters who are both blind and deaf

Appendix A: Device Capabilities Table

The following table provides a description of device characteristics and associated capabilities.

System Limits		
#	Characteristics	Limit
1	Active Elections (Central Server-Based)	1
2	Number of Precincts In Election	3000
3	Splits per Precinct (Not exceeding Total Precinct splits)	10
4	Number of Districts In Election (Not exceeding 35 precincts assigned to one(1) District)	400
5	Total Precinct splits In Election	3500
6	Parties In General Election	24
8	Parties In Primary Election - with crossover on EBM	10
9	Number of Languages In one (1) election (Supported languages include English, Spanish, Bengali, Korean, Chinese, Vietnamese, non-written)	7
10	Contest per Ballot Style (not exceeding Contests per election)	150
11	Measures per Election	60
12	Character Limit per Measure Description	1,800 (25 character limit before a space is required for print layout)

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		purposes on the Central Scan Ballots)
13	Character Limit per Candidate	100 total characters (15 character limit before a space is required for print layout purpose on the precinct ballot); Central Scan ballot layout length of single candidate names will wrap to multiple lines, limiting the number of candidates displaying per contest.
14	Character Limit per Write-In Candidate	50
15	Instruction Blocks per Election	20
16	Character Limit per Instruction Box (text block)	1,000; Instruction block on any page of Central Scan ballot reduces column length of that contest, thus having impact on the candidates per contest that can be displayed.
17	Character Limit per Paper Ballot (Instructions)	1,250; Instruction block on front page of Central Scan ballot reduces column length of front page contests, thus having impact on the candidates per contest that can be displayed on the same page.
18	Headers per Election	100
19	Candidates per election (max candidate Name lines per contest limit mentioned in Item #15)	3,000
20	Lines for Candidate Names: For digital and scanned paper ballots, limitations on the number of candidate names per contest are the same.	8.5 x 11 Inches - 25 lines for candidate names 8.5 x 14 Inches - 38 lines for candidate names

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		11 x 17 Inches - 175 lines for candidate names with contest column wrapping
21	Vote for N of M	20
22	Printer Paper - Voting Station (EBM Ballot Paper) In the Poll Station, printer paper is used at the EBM for ballots and the MPSM for reports for Optical Scan mode only. In DRE mode, printer paper is only used for reports.	8.5 in x 11 in
23	Poll Station Ballots Processed (Maximum volume per Ballot Box) The Inner Ballot Box can be removed and replaced with replacement Inner Ballot Box mid election if needed. The Ballot Box and Inner Ballot Box is used for Optical Scan mode only, the Ballot Box is not used for DRE mode.	2,000
24	Emergency Ballot Container (mounted on side of Ballot Box) The Emergency Ballot Container is used in Optical Scan mode only.	300
25	MPSMs Simultaneously Loading	3
26	File size upload limit for previously saved elections	80909 KB
27	Central Server ID naming Digital Limit	2 digits (cXX)
28	MPSM ID naming digital limit	3 digits (psYYY)
29	Number of unique MPSM names allowed in single election (Example: c01-ps000 to c01-ps999)	1,000

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30	Air-Gapped Machine Stored Election Limit	1,000
31	EBM response time, in seconds	2
32	Elections per MPSP	1
33	Elections per USB (backup to MPSP)	1
34	EBMs per Poll Station	2
35	Character Limit per Measure (Contest) title	125 (15 character limit before a space is required for print layout purpose on the precinct ballot)
36	Character Limit for Ballot Title	254 (25 character limit before a space is required for print layout purposes on the Central Scan Ballots)
37	Character Limit for Header	125 (15 character limit before a space is required for print layout purpose on the precinct ballot)
38	Parties in Primary Election - with Crossover on Central Scan	3
39	Number of Total Contests in Election	200
40	Number of Poll Stations in Election (Not exceeding number of Precincts in election)	1000
<p>NOTES</p> <ul style="list-style-type: none"> • The limits defined in this table cannot be applied simultaneously at maximum levels. • In some cases, conflicts may exist between the maximum limits stated. 		

A1.1 Candidates per Contest on Scanned Paper and Digital Ballots

A user can only get the true limit by observing the paper ballot layout; the number of candidates is dictated by the total number of lines in a single column.

- Limitations to the number of candidate names per contest are based on the following assumptions:
 - Each name takes only one (1) line in the contest column
 - An 8-point font size
 - One (1) line for a contest header
 - One (1) line for a contest description
- If a candidate name wraps into a second line, the total number of candidate names is reduced by one (1) for each wrapped line.
- Additional text in a column, for example in the Ballot header and ballot description, further limits the number of possible candidates.

Revision History

Revision	Revision Date	Sections Affected & Description of Change	Author
1.0	09/14/2016	Initial Draft	Everyone Counts
1.1	09/26/2016	<p>Updated EBM limits in the following sections:</p> <ul style="list-style-type: none"> • 2.4.2 Electronic Ballot Marker • 5.4.2 EBM Limits • Appendix A: System Limits Table, Row 34 <p>1.1 Related Documentation</p> <ul style="list-style-type: none"> • Added this section <p>2.0 Voting System Component Descriptions</p> <ul style="list-style-type: none"> • Added sentence referring to SP-1805 to Introductory paragraph <p>5.3.1 Master Poll Station Machine Capacities</p> <ul style="list-style-type: none"> • Edited Introductory sentence <p>5.5 Poll Station Report Printer and Ballot Printer Capacities and Limits</p> <ul style="list-style-type: none"> • Edited paper weight to say 24 lb instead of a range 	M. Hillman T. Perry T. Fellows
1.2	11/22/2016	<p>1.2 System Software Components</p> <ul style="list-style-type: none"> • Appended document name with "Register for " DOC-1101 Quad Audit 4.4.0 Configuration Items Register" • Updated eLect Voting definition <p>1.3 System Hardware Components</p> <ul style="list-style-type: none"> • Updated Ballot Box description <p>2.3 eLect Central Scanning and the Imaging Server</p>	T. Tallafiero E. Cosgrove

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eLect Quad Audit v.4.4.0 DG-1705 Implementation Statement r1.2

		<ul style="list-style-type: none"> Removed last two sentences of 2nd paragraph Updated section to differentiate the Imaging Server and scanning device components (Scanners) <p>2.4.2 Electronic Ballot Marker</p> <ul style="list-style-type: none"> Modified second sentence in first paragraph to clarify two EBMs per surge protector <p>5.1.1 Central Server Capacities</p> <ul style="list-style-type: none"> Updated Filtered Results sub-bullets to correctly reflect current options <p>5.4.1 Electronic Ballot Capacities</p> <ul style="list-style-type: none"> Changed "Poll Station Management console and menu of commands" to "Poll Station Management console" in bullet item 1 Added information to <i>Manage Poll Station</i> tokens bullet item to clarify Accessible (paperless) option in Optical Scan mode in bullet item 4 <p>5.4.2 EBM Limits</p> <ul style="list-style-type: none"> Updated bullets Added the word "that" to second introductory sentence <p>5.8.1 Ballot Box Scanner Capacities</p> <ul style="list-style-type: none"> Modified bullet items 1, 3, and 5 <p>5.7.3 Central Scanning Paper Ballot Limits</p> <ul style="list-style-type: none"> Updated bullet item 3 to clarify U.S. Ledger support <p>7.1 Voter Accessibility Components Capacities and Limits</p> <ul style="list-style-type: none"> Updated last sentence in first paragraph <p>Appendix A - Device Capabilities Table</p>	
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		<ul style="list-style-type: none"> ● Changed section name from <i>Appendix A: System Limits Table</i> and modified opening paragraph ● Removed "per County" from row 1 ● Updated limits for the following characteristics: <ul style="list-style-type: none"> ○ <i>Number of Precincts In Election</i> ○ <i>Number of Districts In Election</i> ○ <i>Total Precinct splits In Election</i> ○ <i>Number of Languages In one (1) election</i> ○ <i>Lines for Candidate Names</i> ○ <i>Number of Poll Stations In Election</i> ● Updated example in <i>Number of unique MPSM names allowed in single election</i> ● Added Notes to bottom of table 	
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