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Test Report for EAC 2005 VVSG Certification Testing
Unisyn Voting Solutions OpenElect 2.0 Voting System

EAC Project Number: UNS1701

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SIGNATURES

Approved by: Jack Cobb
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Wendy Owens, VSTL Program Manager — 10/11/17 Date

REVISIONS

Revision	Description	Date
NR	Initial Release	9/1/17
A	Updates based on EAC Comments	10/4/17
B	Final Version with all highlights removed	10/11/17

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1.0 INTRODUCTION

The purpose of this Test Report is to document the procedures that Pro V&V, Inc. followed to perform certification testing during a new system campaign for the Unisyn Voting Solutions OpenElect Voting System (OVS) Version 2.0 to the requirements set forth for voting systems in the U.S. Election Assistance Commission (EAC) 2005 Voluntary Voting System Guidelines (VVSG), Version 1.0. Certification testing of the OVS Version 2.0 Voting System submitted for evaluation was performed to ensure the applicable requirements of the EAC 2005 VVSG and the EAC Testing and Certification Program Manual, Version 2.0, were met. Additionally, all EAC Request for Interpretations (RFI) and Notices of Clarification (NOC) relevant to the system under test were incorporated in the test campaign

Prior to submitting the voting system for testing, Unisyn submitted an application package to the EAC for certification of the OpenElect 2.0 Voting System. The application was accepted by the EAC and the project was assigned the unique Project Number of UNS1701.

1.1 System Identification and Overview

The OVS 2.0 is a paper ballot voting system using touch screen and scan technology to scan and validate ballots, provide voter assisted ballots to accommodate voters with special needs, and tabulate results. The OCS, OVO, OVI-VC, and OVCS components of the OVS 2.0 have previously been tested as part of the OVS 1.3.0.2 test campaign. The OVS 2.0 system incorporates the Freedom Vote Tablet (FVT).

The OVS 2.0 consists of the following major components:

- **OpenElect Central Suite (OCS)**
- **OpenElect Voting Optical (OVO)**
- **OpenElect Voting Interface (OVI-VC)**
- **Freedom Vote Tablet (FVT)**
- **OpenElect Voting Central Scan (OVCS)**

The OVO, FVT, and OVI-VC are the OVS components designed to accept voter input. The FVT and OVI are the OVS ballot marking devices (BMDs). The OVO can collect and tally precinct votes, generate reports, and store election data internally. The OVCS is the central tabulation bulk scanner used for mail-in ballots, provisional ballots, and recounts.

Open Elect Central Suite (OCS)

The OCS System supports elections on the OVO, OVI-VC, FVT, and OVCS systems. The EMS consists of the following components running as either a front-end/client application or as a back-end/server application:

Ballot Layout Manager (BLM), Version 2.0 – uses a database to create and store precinct and district information and an interface to create, check, translate, and produce the ballot styles

needed by a jurisdiction for an election. The BLM output is printer ready artwork of all ballots in all languages and the Unisyn election definition file.

Election Manager (EM), Version 2.0 – converts the Unisyn election definition file to a Unisyn-specific XML format and prepares compressed, encrypted election files for output to CD or USB. The EM allows the jurisdiction to add voting device specific options for elections, i.e. whether to check the contests for undervotes, and whether to allow or disallow certain features such as sounds, party icons, reports, etc. The EM also creates and manages Supervisor and Maintenance technician logins and passwords.

Election Server (ES), Version 2.0 – loads the correct system time on the voting devices and uses the Election Definition created by the EM to download new election data, via a closed and secure network, to OVS voting devices.

Tabulator Client (TC), Version 2.0 – retrieves vote files and ballot images from Transport Media (TM) devices, stores them on its disk, and transfers the files to the Tabulator and notifies the Tabulator that a new file is present.

Tabulator, Version 2.0 – receives and validates uploaded voting data and provides a status of uploaded files as well as handling Rank Choice Voting (RCV) functionality. It also updates the database with adjudicated ballots from the Auditor application. The Tabulator maintains the Tabulator database, which stores the results from all precincts.

Auditor, Version 2.0 – accesses ballot images and data from the OVCS and TC PCs to allow jurisdiction personnel to evaluate ballots with questionable or erroneous marks and change votes in accordance to the voter's perceived intent. The Auditor can also be used to process write-in. votes and provide risk-limiting auditing capabilities. All changes uploaded to the Tabulator database and actions are password controlled.

Tabulator Reports (TR), Version 2.0 – accesses data from the Tabulator database to generate the necessary reports

Additionally, the OCS includes the Software Server (SS) system for updating and validating the software on the OVO and the OVI-VC voting devices. The FVT's software is updated manually via a USB thumb drive.

OpenElect Voting Optical (OVO)

The OVO is a full-page dual-sided digital optical scan precinct scanner that scans and validates voter ballot pages and provides a summary of all ballot pages cast. The election is loaded from the OVS Election Server over a secure local network or from the TM. On Election Day, an OVO at each poll location scans and validates voters' ballots, and provides precinct tabulation and reporting. The OVO runs Logic Tests and Training Elections in addition to General and Primary Elections. A Software Server utility is provided to update the OVO with the current level of certificated software. The OVO unit can also paired with OVI-VC and FVT units for early voting to scan and tabulate early voting ballots and election support at voting centers.

OVO units can be used at election headquarters to read absentee, provisional or recount ballots in smaller jurisdictions.

The OVO consists of the following components:

- **Personal Computer (PC) -** Computer component (with a touch panel display) has pre-installed server software (that manages data and communication) and client software that provides a user interface for voting and maintenance. A new election loaded via the Election Server or manually via a Transport Media (TM) sets passwords, parameters, and ballot styles for that election. (Valid ballots for a poll location are reinitialized or set on Election Day startup by scanning a ballot header card).
- **Transport Media (TM)** – 1 GB or larger USB thumb drive that provides the means of transporting audit, optional ballot page images and results files from the precinct on Election Night to Election Headquarters where the central count system resides.
- **Ballot Reader -** Dual-sided scanner connected to the PC to scan data from marked ballot pages. The Ballot Reader ejects accepted ballot pages into an attached ballot box or rejects unaccepted ballot pages back out to the voter.
- **Printer -** 58 mm thermal receipt printer connected to the PC to print voter receipts and reports at the OVO.
- **UPS** - Uninterruptible power supply is provided as part of the system.

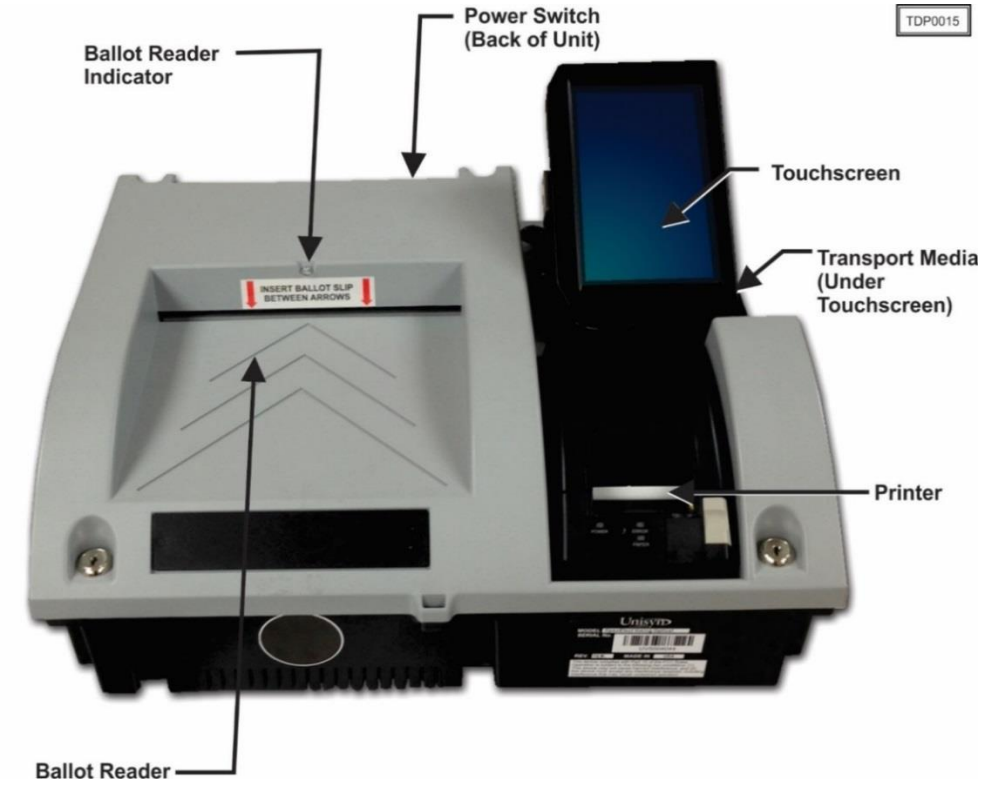

Figure 1-1. OVO

OpenElect Voting Interface – Vote Center (OVI-VC)

The OVI-VC is a ballot marking device (BMD) that supports both ADA and Regional Early Voting requirements. The OVI-VC has a 15-inch display and is equipped to assist voters, with varying abilities, to prepare their ballots independently and privately. It presents each contest on the correct ballot to the voter in visual and, if needed, audio formats. The OVI-VC gives voters the option to use an audio ballot, ADA keypad, sip and puff binary device, and touchscreen with varying font sizes to make their selections. Once the voter has made their selections, they are prompted to review their ballot selections. After the validation process is complete, the OVI-VC then prints the ballot and the voter inserts it into the OVO to cast their vote. When authorized, the OVI-VC provides for write-in candidates.

Each OVI-VC can support multiple languages for both visual and audio ballots, allowing the voter to choose their preferred language.

The OVI-VC consists of the following components:

- **Personal Computer (PC)** - Computer component (with a touch panel display) has pre-installed server software that manages data and communication and client software that provides user interfaces for voting and maintenance. A new election loaded via the Election Server or manually via a Transport Media (TM) sets passwords, parameters, audio, and ballot styles for that election.
- **Transport Media (TM)** - USB device with 1 GB or larger storage provides the means of transporting audit files to the OCS system.
- **Printer –** 82.5 mm thermal receipt printer is connected to the PC to print OVI-VC Ballots and reports at the OVI-VC.
- **UPS** - Uninterruptible power supply is provided as part of the system.

Figure 1-2. OVI-VC

OpenElect Freedom Vote Tablet (FVT)

The FVT is a tablet ballot marking device that enables voters make their vote selections and to print their voted ballot. It can be used on Election Day or during an early voting period. Like the OVI-VC, the FVT is ADA compliant. It assists voters, with varying levels of ability, through the voting process, ballot review, and printing functions. The FVT presents each contest on the ballot style to the voter in visual and/or audio formats. It facilitates special needs voters through a variety of methods including wheelchair access, sip and puff, zoom-in ballot function and audio assistance for the visually impaired. The voter with limited vision can navigate through the ballot using an audio ballot and the ADA keypad or touchscreen to input their selections. Once the ballot is printed, it is taken to the OVO to be cast. Each FVT can support multiple languages for both visual and audio ballots, allowing the voter to choose their preferred language.

The FVT consists of the following components:

- **Tablet** – The Android tablet has a 13.3 in. touchscreen and comes with pre-installed software that provides user interfaces for voting and maintenance. Election files generated by the EM are loaded manually via a USB. The election files will allow the jurisdiction to determine the FVT's mode such as early voting or training, sets passwords, parameters, audio, and ballot styles for that election.

- **Barcode Reader -** 2D USB Barcode reader will read the 2D barcodes produced by the EM such as the initialize barcode and administrative/maintenance barcodes. It will also read the 'populate' barcode produced by other qualified systems.
- **USB Hub –** A four port USB hub is installed in the FVT case to connect the printer, barcode scanner, and keypad to the tablet.
- **Printer –** 82.5 mm thermal receipt printer is connected to the Tablet to print BMD ballots and reports.
- **Optional ADA Devices** – 10-key keypad with Sip and Puff Interface, Headphones, Sip and Puff Device.

Figure 1-3. FVT

Note: The addition of the 2D Barcode Reader component of the FVT was tested throughout the test campaign. The FVT was inspected during the PCA, subjected to hardware testing as part of the test configuration, and functionally tested during throughout the FCA. Additionally, the Barcode Reader was used to activate ballots for the Accuracy and Volume & Stress Tests and the FVT was utilized (along with manual activation) to activate ballots over the duration of the test campaign.

OpenElect Voting Central Scan (OVCS)

The OVCS units reside at election headquarters designated to read absentee, provisional or recount ballots in large jurisdictions or read the entire election's ballots at a central count location in smaller jurisdictions. The OVCS also captures Write-In data images and produces a Write-In image report for manual processing upon request. The OVCS system consists of the following components:

- **PC Desktop** – A desktop PC configuration with the following minimum characteristics:
  - PC: 1.8 GHz Processor, 2 GB RAM, 250GB (or larger) Hard Drive, USB Ports, Network Interface Port (Ethernet), CDRW/DVD, Video Port
  - 16:9 LCD
  - Keyboard and Mouse
- **Bulk Scanner** – A dual-sided scanner (either Canon model DR-M160II or model DR-X10C) that is connected to the PC to scan data from marked ballots.

Figure 1-4. OVCS

1.1.1 Software

This subsection lists the proprietary and COTS software provided by the manufacturer as part of the test campaign.

The OCS/OVO/OVI-VC/OVCS software is a set of Java applications that utilize open source libraries and run on a customized Linux operating system to take advantage of that platform's security and performance. The OVO and OVCS use the Java Native Interface (JNI) classes, which are C++ classes, to communicate with the native drivers (also C++) provided by the hardware manufacturer. This is required by the Optical Scanner in the OVO and the OVCS. The OpenElect system is designed for use in two distinct locales: Central Processing and In-Precinct Systems. The FreedomVote Tablet (FVT) product is also written in Java, but compiled for use on the Google Android operating system, using different core libraries.

Table 1-1. OVS 2.0 Proprietary Software Components

OCS Software System Component	Version	Hash Value (SHA256)
Ballot Layout Manager	2.0	f275eb85d6be2700ef3e4ac962eab1f3e469eead0a682be7f019011ecf0a2cc3
Election Manager	2.0	0c262c63724e9da02809386ed203d64e0d4e90ba2691d9ca9c72902b172460bb
Election Server	2.0	6a4ab5a562cd7f8a9da30fd1d92276478359c5aa830ef2202117897043ab4752
Tabulator Client	2.0	f92e1e29f3d04ee9667e4da5614b9184123c2204ab701dfd7ba9fe75bcf692d6
Tabulator	2.0	a7b8d6121e799466520f31a8e950777c32c6fe0659457a89e9e5f13a47adc009
Auditor	2.0	20999796ee66fd63c5237bce771e3e889f734701c8886ffa9084129a78997aec
Tabulator Reports	2.0	87a72f46e22562103757a4ac59a53125042f02b84e0f96ef7ab4e79f14f8435d
Software Server	2.0	381712a6066374473f68882fc4cf4960167477ed7cfacc8286cde27d395a42c7
OVCS Application	2.0	f500a358383d8aa75def11c93affb0771dedfc8ec825df71cca2e0b1174a5d52
OVI-VC (Release.zip)	2.0	b58d497e4a99d8a52b09c6c0aee36adcd017d69ad491317801f94aa3cb0adf7a
OVI-VC (Release.zip.sig)	2.0	8ad3a8e013fd88759aa4a60be3dacb394f25083c00295f095b654b3c4dc76c37
FVT	2.0	6e6ff64e7626c5608f16ddf7498cc85875ed45fe0761c8fd19025387d73dc230
OVO (Release.zip)	2.0	7e589bf08765f33ae4ed7165a99884d9c2673720ecdf3789da77a0dbafab04f8
OVO (Release.zip.sig)	2.0	a61fb9a563cd7b3df2f3537d0fe4f818991c1c4f224ffad81bf75d4251907316
OCS-CD Image\TOC	2.0	1d79b564b0590819c2d1e0449391754fa96ee02aef482cf3ed0513c4021b5216
OCS-CD Image\TOC.sig	2.0	331f73a9b278829dae63e264d4b6bf48a96f47d922842e9c6302c8007b1bec42
OCSInstaller\Java.security	2.0	a75ba699f9996fc23ef8d0b74319068c67ee65a20a9817254f4d3ad51134e9f7
OCSInstaller.jar	2.0	385183b95b92bc2a8c88b1243dd5fd28de13925a032551dd983124d1a409228d
OCSInstaller\TOC	2.0	a3da43892d39845108db7bb0ba151793310426b919c30ba4dcbcc333c7563c72
OCSInstaller\TOC.sig	2.0	8b75609353a5b7785a8bbdddbc1d460c82e2e095234211f0c6570a61a996968b
OCSInstaller\update	2.0	6d4e57ffac56d5146744a7f287b6ba40ecfc0390b7e0b5a6bdf1bd3d5d2f696e

Table 1-2. OVS 2.0 COTS Software Components

FVT, OVO and OVI Device Software	Version
CentOS Linux (OVO and OVI)	6.3
Java JRE + Unlimited Cryptographic Extension	1.6.0_02
Android OS (FVT)	4.4.4

Table 1-3. OCS and OVCS COTS Software Components

OCS and OVCS Device Software	Version
CentOS Linux	6.5 and 6.8
Java JRE + Unlimited Cryptographic Extension	1.6.0_02
Apache-Tomcat Application Server	6.0.13
MySQL Database (BLM, EM, Aud, and Tab only)	5.0.45-7
JasperReports	2.0.5

1.1.2 Hardware

This subsection lists the proprietary and COTS equipment provided by the manufacturer as part of the test campaign.

The Unisyn OVS 2.0 is a paper-based optical scan voting system. The OVS 2.0 consists of the following major components: the OCS, OVO precinct scanner, OVI-VC precinct voting interface, FVT precinct voting tablet, and OVCS central count scanner. All components of the OVO, excluding the case, are COTS. All components of the OVI-VC, excluding the case and keypad, are COTS. All components of the FVT, excluding the case, tablet enclosure, and keypad, are COTS. All components of the OVCS are COTS. All OCS functions are handled by proprietary software running on COTS PS/laptop/servers.

For COTS equipment, every effort was made to verify that the COTS equipment had not been modified for use. This was 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 evaluated 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 was compared to the system information found on each machine. Physical external and internal examinations were also performed when the equipment was easily accessible without the possibility of damage. Hard drives, RAM memory, and other components were examined to verify that the components matched the information found on the COTS equipment manufacturer's websites.

Table 1-4. Voting System COTS Hardware

Hardware	Make	Model
OVO		
Duplex Ballot Scanner		
Duplex Ballot Scanner	PDI Scan	Pagescan III
Scanner Power Adapter	eUrasia Power	uA36-1024
58 mm Thermal Printer		
58 mm Thermal Printer	Citizen Printer	CT-5281
Printer Power Adapter	---	28AD4

Table 1-4. Voting System COTS Hardware *(continued)*

Hardware	Make	Model
Computer		
Chassis	Morex	Morex 2699
AC Adapter	EDAC	EA 10951C-120
DC-DC Converter	Morex	MX-0608F
Chassis Fans	Young Lin Tech	DFB4011012M
Motherboard	Jetway	JNF9D-2550
Memory	SuperTalent - Onboard RAM	W1333SA2GV
Hard Drive	Western Digital	WD5000AZLX
1 Gb USB TM		
1 Gb USB	Innodisk	DEUA1-01GI72AC1SB-B88
1 Gb USB	Delkin	UY0GTFLSY-XN000-D
7" LCD Touchscreen Display		
7" LCD Touchscreen Display	Xenarc Technologies	700TSV
AC Power In Module		
AC Power In Module	Delta	Emi 10BEEG3G
OVI-VC		
Sip and Puff (Optional)		
Sip and Puff (Optional)	Origin Instruments	AirVoter
Headphone (Optional)		
Headphone (Optional)	Koss On-Ear Headphones	KPH5
15 in LCD Touchscreen Display		
15 in LCD Touchscreen Display	GVision	P15BX 2450-30120
82.5 mm Thermal Printer		
82.5 mm Thermal Printer	Star	TSP743IID-24, serial interface
Printer Power Adapter	Star	PS60A-24B 1
Computer		
Power Adapter Kit	Morex	MX-0608F, DC-DC converter
Motherboard	Jetway	JNF9D-2550
Memory	SuperTalent - Onboard RAM	W1333SA2GV
Hard Drive	Western Digital	WD5000AZLX
AC Adapter	EDAC	EA 10951c-120
DC-DC Converter	Morex	MX-0608F
Chassis Fans	Young Lin Tech	DFB4011012M
1 Gb USB TM		
1 Gb USB	Innodisk	DEUA1-01GI72AC1SB-B88
1 Gb USB	Delkin	UY0GTFLSY-XN000-D
AC Power In Module		
---	Delta	Emi 10BEEG3G

Table 1-4. Voting System COTS Hardware *(continued)*

Hardware	Make	Model
OVCS		
Large Volume Scanner		
Large Volume Scanner	Cannon	DR-X10C
Desktop Scanner		
Portable Desktop Scanner ("Mini" OVCS)	Cannon	DR-M160II
Laptop		
Laptop	Dell	Dell Precision
Desktop PC		
PC	Dell	Dell OptiPlex
FVT		
13.3 in Touchscreen Tablet		
13.3 in Touchscreen Tablet	Android Tablet	GVision - T13
82.5 mm Thermal Printer		
82.5 mm Thermal Printer	Star	TSP743IIU-24
Printer Power Adapter	Star	PS60A-24B 1
Barcode Reader 1D,2D series		
Barcode Reader 1D,2D series	Newland	FM420
USB 2.0 Hub		
USB Hub	D-Link 4Port USB 2.0 Hub	DUB-H4 w/+5V Power Supply and USB cable
Micro SD		
Micro SD	San Disk	4 GB Edge
AC Power In Module		
AC Power In Module	Delta	Emi 10BEEG3G
Sip and Puff (Optional)		
Sip and Puff	Origin Instruments	AirVoter
Headphone (Optional)		
Headphone	Koss On-Ear Headphones	KPH5
Headphone	Sony	MDR-210LP
USB to Ethernet RJ45 Adapter (Optional)		
USB to Ethernet RJ45 Adapter	D-Link	DUB-E100
UPS		
Minuteman Power Technologies	Para Systems, Inc.	Entrepid Series EP1500 LCD
Surgecube – Surge Protector	Belkin	F9H100-CW

1.1.3 Block Diagram

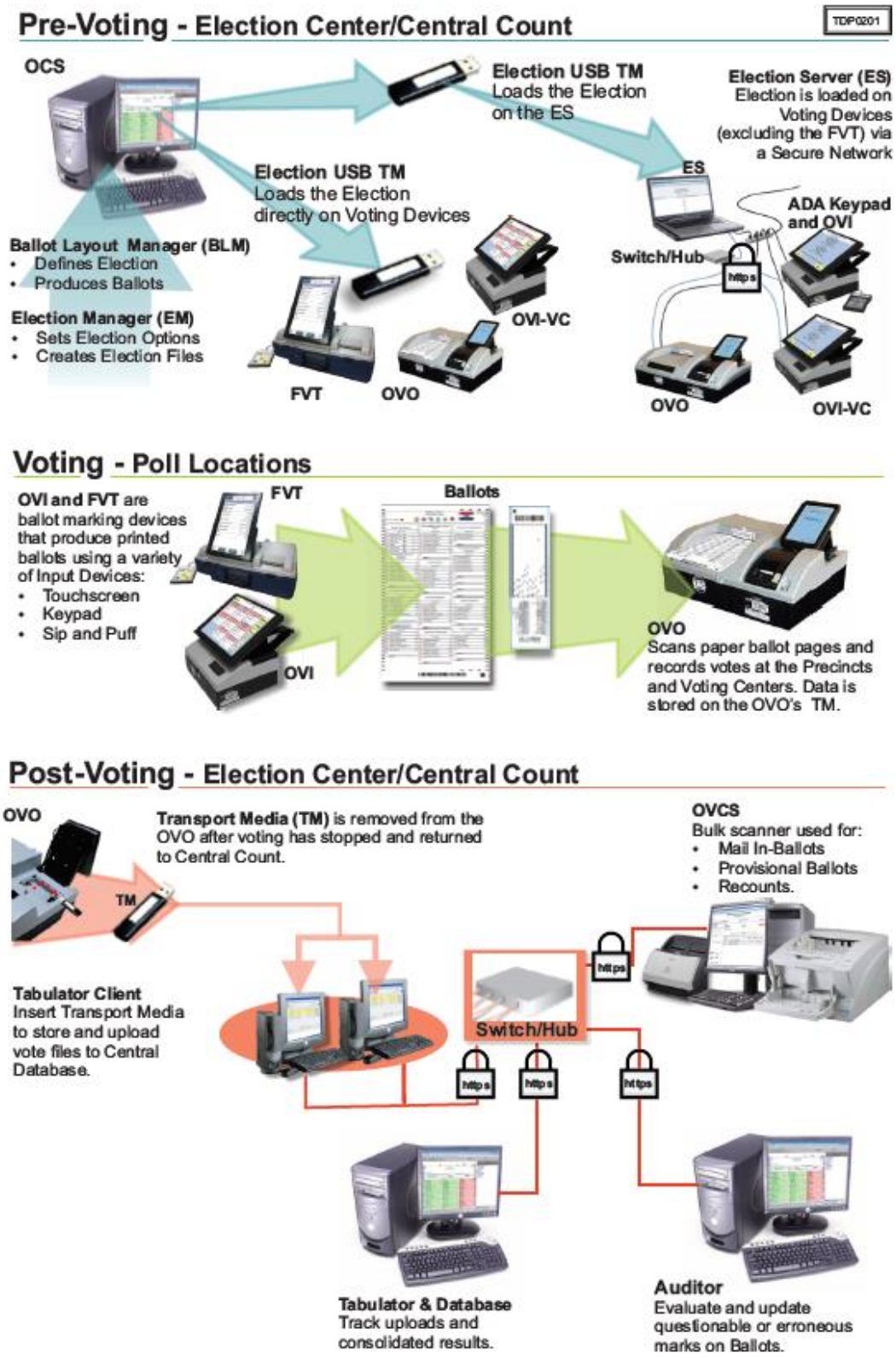

Figure 1-5. OVS 2.0 System Components Overview

1.1.4 System Limits

The system limits that Unisyn has stated to be supported by the OVS 2.0 and that were tested as part of this test campaign are listed below. During system limits testing, double-sided ballots were utilized. Rank Choice Voting (RCV) and its associated options were tested as they were documented in the TDP. Testing included all options for tie-breaking options. In addition, RCV was tested during System Integration as part of the General Election.

Per the TDP, Rank Choice Voting can be performed using 2 Ranks or 3 Ranks. Multiple options exist for handling of Invalid Rankings which include Skipped Rankings, Duplicate Rankings, and Candidates Ranked on more than one rank. These options include "Go To Next Valid Ranking" where invalid ranks are skipped and the RCV tally process proceeds to the next valid ranking on the ballot, and "Exhausting Ballot" where the RCV tally process for a ballot ends when an Invalid Rank is reached. Multiple options also exist for performing tie breaking, when multiple candidates have the same number of votes at the end of a round. These options include "Manual Selection" where tie breaking is performed manually, "Previous Round" where ties are resolved in favor of the candidate with the most votes in the previous round, and "Multiple Deletions" where ties are resolved by eliminating all tied last place candidates in a round unless all continuing candidates are tied.

- The OCS and OVCS Software are intended for use by a single jurisdiction with one set of districts, voting centers, and precincts at any given time.
- The OCS and OVCS designed for handling up to 20 consecutive elections.
- Ten elections may be stored in the OCS database simultaneously.
- The system allows 400 ballot styles for an election.
- A single OVO can be initialized to support ballots for up to 50 distinct precincts. In early voting and absentee modes, it can be configured to support all precincts simultaneously.
- An OVI-VC and FVT can present all precincts to the voter.
- The system allows voting by precinct and split precinct.
- The OVO provides several voting sessions to accommodate different ballot counting purposes. Only one session can be used at a time:
  - **Election Day** voting at the polls and voting centers
  - **Training Election** voting for training or sales purposes
  - **Logic Test** voting to test data and tabulation
  - **Absentee** session
  - **Recount** session
  - **Provisional** session
  - **Regional Early Voting** session
- The OVO provides the following System Performance:
  - Expected speed (per ballot page) 5 seconds to ballot page confirm
  - Throughput capacity (per ballot page) 6 ballot pages per minute

- Maximum Volume 5,000 ballot pages
- Ballot Pages
  - 11” ballot page:
    - Maximum number of voting positions per ballot page (11 inch ballot pages, without Rank Choice Voting): 228
    - Maximum number of voting positions per ballot page (11 inch ballot pages, with Rank Choice Voting): 456
  - 14” ballot page:
    - Maximum number of voting positions per ballot page (14 inch ballot pages, without Rank Choice Voting): 300
    - Maximum number of voting positions per ballot page (14 inch ballot pages, with Rank Choice Voting): 600
  - 17” ballot page:
    - Maximum number of voting positions per ballot page (17 inch ballot pages, without Rank Choice Voting): 372
    - Maximum number of voting positions per ballot page (17 inch ballot pages, with Rank Choice Voting): 744
  - 19” ballot page:
    - Maximum number of voting positions per ballot page (19 inch ballot pages, without Rank Choice Voting): 420
    - Maximum number of voting positions per ballot page (19 inch ballot pages, with Rank Choice Voting): 840

- Maximum number of ballot styles: 50 ballot styles per OVO session if individually entered with a maximum of 400 ballot style choices. For All Precinct sessions, all ballot styles are accepted by the OVO.
- The OVCS provides several voting sessions to accommodate different ballot counting purposes. Only one session can be used at a time:
  - Normal - Election Day Tabulation
    - Election Day Tabulation
    - Recount
    - Training
  - LAT - Logic and Accuracy Test (LAT) voting to test data and tabulation
  - Absentee session
  - Provisional session
  - Write-In only session

- The OVCS provides the following System Performance:
  - Max Ballot pages per batch 500
  - Max Ballot pages per session 5,000
  - Expected speed (ballot pages per hour) 500 ballot pages per hour
  - Maximum number of ballot styles: 400 ballot style choices

In the end-to-end OVS, a single election is limited to:

- Up to 12 political parties (including non-partisan) voting their own ballot in a Primary Election. Up to 12 political parties (including non-partisan) voting in a General Straight Ticket Election. Twenty-four parties may appear on the ballot for candidates.
- Up to 2,000 precincts.
- Up to 120 candidates per contest, with a limit of 3,000 combined count of candidates and contests.
- Up to 8 language translations (applies to ballot pages).
- Up to 3 ballot pages per ballot.
- Up to 5,000 ballot pages processed (cast votes) at an OVO during a single voting session.

1.1.5 Supported Languages

During the test campaign, it was verified that the OVS 2.0 System supported the following languages:

- Armenian
- Chinese
- English
- Japanese
- Korean
- Russian
- Spanish
- Thai
- Hindi

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

For the character based language the ballot was created by Pro V&V and voted utilizing both paper ballots and ADA voting devices along with all applicable peripherals. The Chinese Language for the ballot was created using a readily available online translation tool. The Chinese characters output by the translation tool were then processed through an online tool which

converted the characters to Unicode. The Unicode information was then entered into the Ballot Layout Manager application. A ballot preview was then generated in the Ballot Layout Manager application. The Chinese characters displayed in the ballot preview were then compared to the characters generated by the online translation tool, to ensure that the characters matched. The ballots were then generated and printed, and the election was loaded onto the tabulators and the BMD units. The Chinese characters displayed on both the printed ballots and displayed on the BMD units, were both compared to the original Chinese Characters generated by the online translation tool, to verify that the characters match.

1.1.6 Supported Functionality

During the test campaign, it was verified that the OVS 2.0 System supported the following voting variations:

- Closed Primary
- Open Primary
- Partisan/Non-Partisan Offices
- Write-In Voting
- Primary Presidential Delegation Nominations
- Straight Ticket Voting (*including Pennsylvania and Indiana Rules*)
- Split Precincts
- Multiple Selection Contests: Vote for N of M
- Ballot Rotation
- Cross Party Endorsement
- Multi-Page Ballots
- Provisional or Challenged Ballots
- Absentee Ballots
- Recount Tabulation
- Ranked Choice Voting (RCV)
- Recall Issues, with Options

1.1.7 Deliverable Materials

This subsection lists the materials identified by the manufacturer as materials deliverable to the end user for the system being tested.

Table 3-5. Voting System Deliverables

Material	Version	Description
OCS	2.0	EMS Software Suite
OVO	2.0	Precinct Ballot Scanner
OVI-VC	2.0	Accessible Voting Station

Table 3-5. Voting System Deliverables *(continued)*

Material	Version	Description
OVCS	2.0	Central Count Scanner
FVT	2.0	Ballot Marking Device
Ballot Box	---	OVO Ballot Receptacle
Transport Media	1 GB	USB Flash Drive
Minuteman UPS	Entrust	UPS
Headphones (optional)	Koss, Sony	Stereo headphones
Sip and Puff (optional)	Origin AirVoter	Binary Input Device
OVS 2.0 TDP*	2.0	OVS Technical Data Package

* Listed in Section 3.1.2.2

1.2 References

- Election Assistance Commission 2005 Voluntary Voting System Guidelines (VVSG) Version 1.0, Volume I, "Voting System Performance Guidelines", and Volume II, "National Certification Testing Guidelines"
- Election Assistance Commission Testing and Certification Program Manual, Version 2.0
- Election Assistance Commission Voting System Test Laboratory Program Manual, Version 2.0
- National Voluntary Laboratory Accreditation Program NIST Handbook 150-2016, "NVLAP Procedures and General Requirements (NIST Handbook 150)", dated July 2016
- National Voluntary Laboratory Accreditation Program NIST Handbook 150-22, 2008 Edition, "Voting System Testing (NIST Handbook 150-22)", dated May 2008
- United States 107th Congress Help America Vote Act (HAVA) of 2002 (Public Law 107-252), dated October 2002
- Pro V&V, Inc. Quality Assurance Manual, Revision 1.0
- Election Assistance Commission "Approval of Voting System Testing Application Package" letter dated January 25, 2017
- EAC Requests for Interpretation (RFI) (listed on www.eac.gov)
- EAC Notices of Clarification (NOC) (listed on www.eac.gov)
- Unisyn Voting Solutions Technical Data Package *(A listing of the OpenElect 2.0 documents submitted for this test campaign is listed in Section 3.1.2.2 of this Test Report)*

1.3 Terms and Abbreviations

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

"ADA" – Americans with Disabilities Act 1990

"BLM" – Ballot Layout Manager

"BMD" – Ballot Marking Device

"CM" – Configuration Management

"COTS" – Commercial Off-The-Shelf

"DRE" – Direct Record Electronic

"EAC" – United States Election Assistance Commission

"EM" – Election Manager

"EMS" – Election Management System

"ES" – Election Server

"FCA" – Functional Configuration Audit

"FVT" – Freedom Vote Tablet

"LAT" – Logic and Accuracy Test

"NOC" – Notice of Clarification

"OCS" – OpenElect Central Suite

"OVCS" – OpenElect Voting Central Scan

"OVI-VC" – OpenElect Voting Interface

"OVO" – OpenElect Voting Optical

"OVS" – OpenElect Voting System

"PC" – Personal Computer

"PCA" – Physical Configuration Audit

"QA" – Quality Assurance

"RFI" – Request for Interpretation

"TC" – Tabulator Client

"TDP" – Technical Data Package

"TM" – Transport Media (USB Thumb Drive)

"TR" – Tabulator Reports

"UPS" – Uninterruptible Power Supply

"VSTL" – Voting System Test Laboratory

"VVSG" – Voluntary Voting System Guidelines

2.0 CERTIFICATION TEST BACKGROUND

2.1 Revision History

The OVS 2.0 is a new voting system that has not previously been tested in the EAC Program. The previous Unisyn OVS system, release 1.3 was certified by the EAC. The report is available for viewing on the EAC's website at www.eac.gov (Reference NTS Report No. TPR030407-01 Rev. B). The OVS 2.0 System contains many of the same components, however, in some instances, these components have been modified for performance enhancement.

For components that were not modified, the TDP review that was previously performed was utilized to meet the requirements of the required TDP review. All updated portions of the TDP were subjected to a full TDP review as part of this test program.

Additionally, the previously certified versions of the OVS system (1.1, 1.2, and 1.3) that contain the OVO, OVI-VC, and OVCS components were subjected to functional regression testing with the 2.0 version firmware (Reference Wyle Test Reports T58650.01-01 Rev. A and T70987.01-01 Rev. B, and NTS Test Report No. PR030407-01 Rev. B, respectively, which are available for viewing on the EAC's website, for further details).

Full functional and hardware testing was performed on the entire OVS 2.0 configuration that included the previously tested components as well as the FVT. A diagram representing the functional testing performed is presented in Figure 2-1.

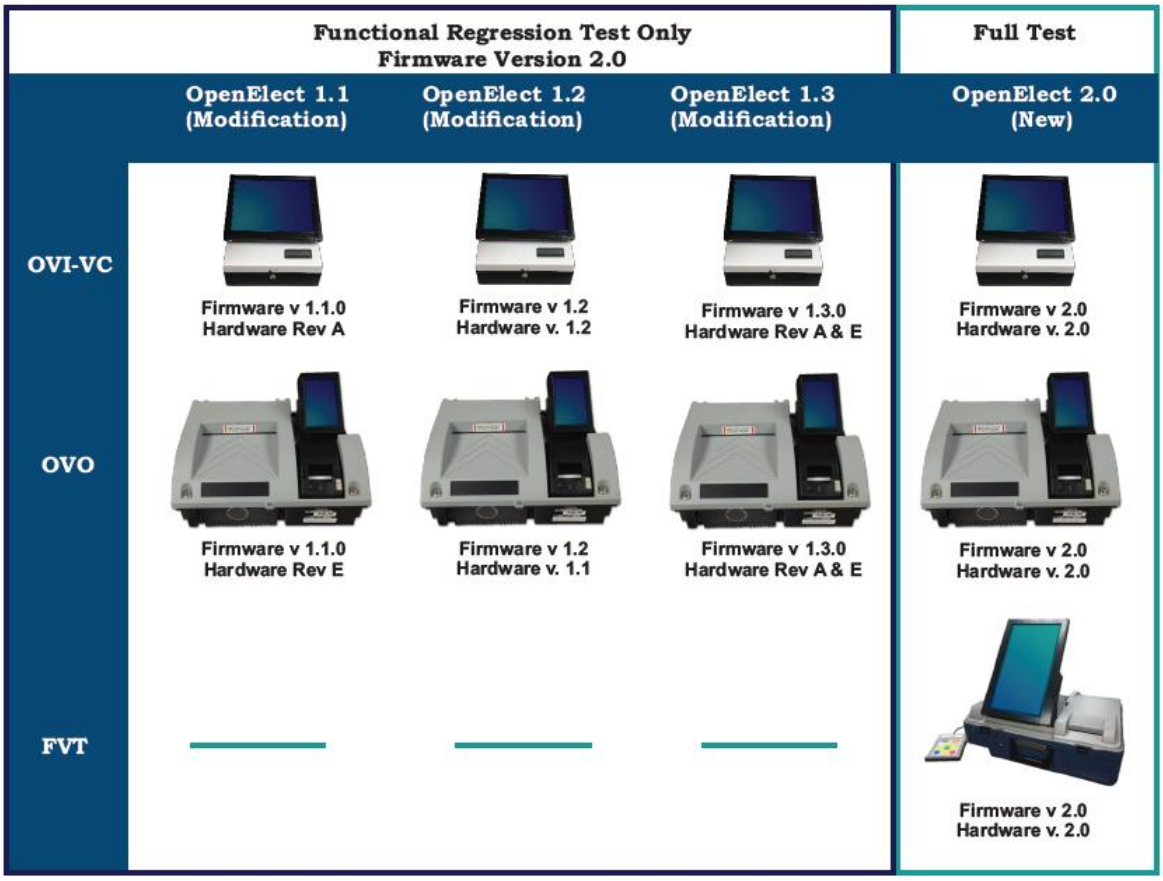

Figure 2-1. Functional Test Diagram

2.2 Implementation Statement

The Implementation Statement document for the OVS 2.0 is contained in the application submitted for certification testing.

3.0 TEST FINDINGS AND RECOMMENDATION

To evaluate the OVS 2.0 test requirements, each section of the EAC 2005 VVSG was analyzed in conjunction with a preliminary TDP review to determine the applicable tests. The preliminary TDP was performed to gather information concerning the system under test and its capabilities or design intentions. Additionally, a TDP review was performed throughout the test campaign. The TDP Review included the Initial Review, the Regulatory/Compliance Review, and the Final Review. This review was conducted to determine if the submitted technical documentation meets the regulatory, customer-stated, or end-user requirements and included reviewing the documents for stated functionality review and verification.

The EAC 2005 VVSG Volume I Sections, along with the strategy of evaluation, are described below:

Section 2: Functional Requirements

The requirements in this section were tested during the FCA and System Integration Test. This evaluation utilized baseline test cases as well as specifically designed test cases and included predefined election definitions for the input data.

The FCA targeted the specific functionality claimed by the manufacturer to ensure the product functions as documented. This testing used both positive and negative test data to test the robustness of the system. The FCA encompassed an examination of manufacturer tests, and the conduct of additional tests, to verify that the system hardware and software perform all the functions described in the manufacturer's documentation submitted in the TDP (such as system operations, voter manual, maintenance, and diagnostic testing manuals). It included a test of system operations in the sequence in which they would normally be performed. These system operations and functional capabilities are categorized as follows by the phase of election activity in which they are required:

- Overall System Capabilities: These functional capabilities apply throughout the election process. They include security, accuracy, integrity, system audit ability, election management system, vote tabulation, ballot counters, telecommunications, and data retention.

- Pre-voting Capabilities: These functional capabilities are used to prepare the voting system for voting. They include ballot preparation, the preparation of election-specific software (including firmware), the production of ballots, the installation of ballots and ballot counting software (including firmware), and system and equipment tests.

- Voting System Capabilities: These functional capabilities include all operations conducted at the polling place by voters and officials including the generation of status messages.

- Post-voting Capabilities: These functional capabilities apply after all votes have been cast. They include closing the polling place; obtaining reports by voting machine, polling place, and precinct; obtaining consolidated reports; and obtaining reports of audit trails.

- Maintenance, Transportation and Storage Capabilities: These capabilities are necessary to maintain, transport, and store voting system equipment.

The system integration testing addressed the integration of the hardware and software. This testing focused on the compatibility of the voting system software components and subsystems with one another and with other components of the voting system. During test performance, the system was configured as would be for normal field use.

Section 3: Usability and Accessibility Requirements

The requirements in this section were tested during the Usability and Accessibility Testing. This evaluation utilized baseline test cases as well as specifically designed test cases and included predefined election definitions for the input data.

The usability testing focused on the usability of the system being tested. Usability was defined generally as a measure of the effectiveness, efficiency, and satisfaction achieved by a specified

set of users with a given product in the performance of specified tasks. In the context of voting, the primary user is the voter, the product is the voting system, and the task is the correct recording of the voter ballot selections. Additional requirements for task performance are independence and privacy: the voter should normally be able to complete the voting task without assistance from others, and the voter selections should be private. Accessibility evaluates the requirements for accessibility. These requirements are intended to address HAVA 301 (a) (3) (B).

Additionally, Pro V&V reviewed the results of summative usability testing performed by Mile7 on the OVS 2.0, to verify that the submitted test results were in common industry format.

Section 4: Hardware Requirements

The hardware tests specified in the VVSG are divided into two categories: non-operating and operating. The non-operating tests apply to the elements of the system that are intended for use at poll site locations and are intended to simulate the storage and transport of equipment between the storage facility and the polling location. The Operating tests apply to the entire system, including hardware components that are used as part of the voting system telecommunications capability, and are intended to simulate conditions that the voting system may encounter during operation. Prior to and immediately following each required non-operating and operating test, the system was subjected to an operational status check.

The requirements in this section were 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 were tested utilizing a combination of review and functional testing during the source code review, TDP review, and FCA.

To perform the source code review, Pro V&V reviewed the submitted source code to the EAC 2005 VVSG and the manufacturer-submitted coding standards. Prior to initiating the software review, Pro V&V verified that the submitted documentation was 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. The source code review included a compliance build and a trusted build of the submitted source code.

Section 6: Telecommunications Requirements

The requirements set forth for telecommunications represent acceptable levels of combined telecommunications hardware and software function and performance for the transmission of data that is used to operate the system and report election results. The requirements addressed in this section are intended to complement the network security requirements identified in Section 7, which include requirements for voter and administrator access, availability of network service, data confidentiality, and data integrity.

The telecommunications components the voting system were tested during various aspects of the test campaign, such as accuracy, durability, reliability, maintainability, and availability.

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

Section 7: Security Requirements

The requirements in this section were tested during the source code review, security tests, and FCA.

To evaluate the integrity of the system, Pro V&V developed specifically designed test cases in an attempt to defeat the access controls and security measures documented in the system TDP as well verifying compliance to EAC RFI 2012-05. The Unisyn matrix of addressed threats was reviewed to evaluate the identified risks and vulnerabilities. An evaluation of the system was accomplished by utilizing a combination of functional testing, source code review, and automated vulnerability scanners.

During the security testing, the system was inspected for various controls and measure that are in place to meet the objectives of the security standards which include: protection of the critical elements of the voting system; establishing and maintaining controls to minimize errors; protection from intentional manipulation, fraud and malicious mischief; identifying fraudulent or erroneous changes to the voting system; and protecting the secrecy in the voting process.

Section 8: Quality Assurance Requirements

The requirements in this section were tested throughout the test campaign. This testing utilized a TDP Review in conjunction with the source code review and PCA to determine compliance to the EAC 2005 VVSG requirements and the requirements stated in the Unisyn technical documentation. The review of the quality assurance documentation focused on Unisyn's adherence to its stated QA processes.

Section 9: Configuration Management Requirements

The requirements in this section were tested throughout the test campaign.

This testing utilized a TDP Review in conjunction with the source code review and PCA to determine compliance to the EAC 2005 VVSG requirements and the requirements stated in the Unisyn technical documentation. The review of the configuration management documentation focused on Unisyn's adherence to its stated CM processes.

Throughout the test campaign, Pro V&V personnel maintained 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 also utilized an internal bug tracking system to record and track all issues and/or discrepancies noted during the test campaign.

3.1 Summary of Findings and Recommendation

3.1.1 Hardware Testing

The OVS 2.0 hardware consists of the following major components: the OCS, OVO precinct scanner, OVI-VC precinct voting interface, FVT precinct voting tablet, and OVCS central count

scanner. All OCS functions are handled by proprietary software running on COTS PS/laptop/servers, which are excluded from hardware testing.

OVO - All components of the OVO, excluding the case, are COTS.

OVI-VC - All components of the OVI-VC, excluding the case and keypad, are COTS.

FVT - All components of the FVT, excluding the case, tablet enclosure, and keypad, are COTS.

OVCS - All components of the OVCS are COTS.

The OVS 2.0 was evaluated as a new system; therefore the full suite of hardware and electrical testing, as detailed in the 2005 VVSG, was required. These tests are listed below:

Electrical Tests:

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

Environmental Tests:

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

Pro V&V utilized third party testing during the performance of hardware testing. All hardware testing was performed at the TÜV SÜD Canada Inc. facility located in Ontario, Canada. All testing was witnessed on-site by Pro V&V personnel, with the exception of Temperature Power Variation in which Pro V&V qualified staff executed all testing at the TÜV SÜD Canada Inc. facility.

Summary Findings

Electrical Testing was performed on the components listed above. The procedures and results for this testing are included in TÜV SÜD Canada Inc. EMC Test Report File#: 7169002414-000, presented in Attachment A, Part 1. The test results from this testing are summarized below:

Table 3-1. Hardware Test Results

Standard/Method	Description	Criteria	Class/Level	Result
FCC 15.107 ICES-003 VVSG Vol. 1 4.1.2.9	Power Line Conducted Emissions	N/A	Class B	Pass
FCC 15.109 ICES-003 VVSG Vol. 1 4.1.2.9	Radiated Emissions	N/A	Class B	Pass
EN61000-4-11 VVSG Vol. 1 4.1.2.5	Electrical Power Disturbance	Normal Operation & No Data Loss	Various	Pass
EN61000-4-4 VVSG Vol. 1 4.1.2.6	Electrical Fast Transient	Normal Operation & No Data Loss	±2kV - Mains	Pass
EN61000-4-5 VVSG Vol. 1 4.1.2.7	Lightning Surge	Normal Operation & No Data Loss	±2kV Line - Line ±2kV Line - Ground	Pass*
EN61000-4-2 VVSG Vol. 1 4.1.2.8	Electrostatic Disruption	Normal Operation & No Data Loss	±8kV Contact ±15kV Air	Pass
EN61000-4-3 VVSG Vol. 1 4.1.2.10	Electromagnetic Susceptibility	Normal Operation & No Data Loss	10 V/m, 80 MHz – 1 GHz	Pass
EN61000-4-6 VVSG Vol. 1 4.1.2.11	Conducted RF Immunity	Normal Operation & No Data Loss	10 Vrms, 150 kHz – 80 MHz	Pass
EN61000-4-8 VVSG Vol. 1 4.1.2.12	Magnetic Immunity	Normal Operation & No Data Loss	30 A/m	Pass
Overall Result				Pass

* During test performance, an issue was detected with the EP1500LCD UPS module that was between the AC source and the OVI-VC voting device (for battery backup purposes). Unisyn was notified of the issue and performed a Root Cause Analysis of the occurrence and

implemented a corrective action of adding a dedicated surge protection device, rated at 1000 Joules or more, between the Input line voltage (120VAC) and the UPS. This device would be installed at the wall socket input line voltage (120VAC) and the UPS would be plugged into the device. This configuration was successfully tested and regression testing was performed on the system to verify that the change did not adversely impact previous test results.

Environmental Testing was performed on the components listed above. The procedures and results for this testing are included in TÜV SÜD Canada Inc. Report/Quotation Number: PVV-5331.00 (300056294.2), presented in Attachment A, Part 2. The test results from this testing are summarized below:

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

The OVS 2.0 OVO, OVI-VC, and FVT system components were subjected to Shock – Bench Handling Testing. Using one edge as a pivot, the opposite edge of the chassis of each unit was lifted until the face reached 45° with horizontal bench top, or 4 inches above bench top (whichever occurred first). This was repeated with each practical edge, of the same horizontal face. At the conclusion of testing, the components were subjected to a visual inspection and an operational status check was performed. Result – PASS

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

The OVS 2.0 OVO, OVI-VC, and FVT system components were subjected to Vibration – Basic Transportation Testing. Testing was performed at ambient/room temperature (20ºC +/-3 ºC) in the X, Y and Z axis at the levels identified in Figure 3-1. At the conclusion of testing, a visual inspection and an operational status check was performed. Test Result - PASS

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

Figure 3-1. Vibration Test Profiles

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

The OVS 2.0 OVO, OVI-VC, and FVT system components were subjected to Low Temperature – Storage Testing. Samples were subjected to a temperature of -4ºF (-20ºC +/-3 ºC) for a duration of 4 hours, after which operation was confirmed by Pro V&V. Samples were not powered, and were left in their packaging for the duration of the test. They were removed from the boxes for operational verification after the test. At the conclusion of testing, a visual inspection and an operational status check was performed. Test Result – PASS

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

The OVS 2.0 OVO, OVI-VC, and FVT system components were subjected to High Temperature – Storage Testing. Samples were subjected to a temperature of 140ºF (60ºC +/-3 ºC) for a duration of 4 hours, after which operation was confirmed by Pro V&V. Samples were not powered, and were left in their packaging for the duration of the test. They were removed from the boxes for operational verification after the test. At the conclusion of testing, a visual inspection and an operational status check was performed. Test Result – PASS

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

The OVS 2.0 OVO, OVI-VC, and FVT system components were subjected to Humidity – Hot/Humid Testing. Samples were subjected as per Table 507.2-I, Hot-Humid (Cycle 1), for a duration of 240 hours (10 days), after which operation was confirmed by Pro V&V. Samples were not powered/operational, and were left in their packaging for the duration of the test, and were removed from the boxes for operational verification. At the conclusion of testing, a visual inspection and an operational status check was performed. Test Result – PASS

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

The OVS 2.0 OVO, OVI-VC, and FVT system components were subjected to Temperature/Power Variation Testing. Samples completed 85 hours per the following environment profile:

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

Figure 3-2. Temperature/Power Variation Profile

The OVS 2.0 system components were powered and being operated by Pro V&V for the duration of the environmental profile, to confirm operation. Three issues were encountered during test performance, as described below:

- A ballot was introduced to the OVO that was returned to the operator and the system reported a 902 error, which is failure to write to the BACKUP media, as opposed to Hard Drive (HD) or Transport Media (TM). Following the documented procedures, the operators restarted the system and allowed it to recover. Upon restart, the ballot was found to have been cast and the public count incremented. Unisyn was notified of the issue and performed a Root Cause Analysis of the occurrence and implemented a corrective action of revising the processing around managing errors in ballot handling and adjusting the order of precedence of critical errors. These changes were integrated into the system and tested.
- One of two Canon X10c units returned an error upon completing a batch of ballots. After the error was received, while the ballots were read and could be accepted, the scanner stopped responding to commands. The software needed to be restarted in order to reestablish connection to the scanner. Unisyn was notified of the issue and performed a Root Cause Analysis of the occurrence and implemented a corrective action of modifying the scanner driver software to retry establishing connection to the scanner in the event of this failure. These changes were integrated into the system and tested.
- On the OVCS unit, after handling a series of error notifications; double feed and paper jam, correctly, the application became unresponsive, where the buttons to control the scanner were disabled ("greyed out"). Unisyn was notified of the issue and performed a Root Cause Analysis of the occurrence and implemented a corrective action of updating the software so that the scanner control buttons were disabled before the command was actually sent to the scanner to start the reading process, where previously they were disabled at the end of the method, after the command was sent to the scanner. This ensured that the buttons are in the correct state and that the disable command does not occur after the scanner has already sent back a response. These changes were integrated into the system and tested.

Test Result – PASS

3.1.2 System Level Testing

System Level testing was implemented to evaluate the complete system. This testing included all proprietary components and COTS components (software, hardware, and peripherals) of the OVS 2.0 Voting System. For software system tests, the tests were designed according to the stated design objective without consideration of its functional specification. The system level hardware and software test cases were prepared independently to assess the response of the hardware and software to a range of conditions. Pro V&V reviewed the manufacturer's program analysis, documentation, and module test case design and evaluated the test cases for each module with respect to flow control parameters and entry/exit data.

The OCS System supports elections on the OVO, OVI-VC, FVT, and OVCS systems. The EMS consists of the following components running as either a front-end/client application or as a back-end/server application:

- Ballot Layout Manager

- Election Manager
- Election Server
- Tabulator Client
- Tabulator
- Auditor
- Tabulator Reports
- Software Server
    - System for updating and validating the OVO and OVI-VC software

System Level Testing included the evaluations of the following test areas: PCA, TDP Review, Security Review, Source Code Review, FCA, Volume & Stress Testing, Accuracy Testing, System Integration Testing, Usability & Accessibility, and QA & CM System Review. Each of these areas is reported in detail in the subsections that follow.

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

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

3.1.2.1 Physical Configuration Audit (PCA)

The physical configuration audit compares the voting system components submitted for qualification to the manufacturer's technical documentation, and shall include the following activities:

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

- Review manufacturer's documents of user acceptance test procedures and data against system's functional specifications; resolve any discrepancy or inadequacy in manufacturer's plan or data prior to beginning system integration functional and performance tests
- Subsequent changes to baseline software configuration made during testing, as well as system hardware changes that may produce a change in software operation are subject to re-examination

Summary Findings

During execution of the test procedure, the components of the OVS 2.0 System were documented by component name, model, serial number, major component, and any other relevant information needed to identify the component. For COTS equipment, every effort was made to verify that the COTS equipment had not been modified for use. Additionally, each technical document submitted in the TDP was recorded by document name, description, document number, revision number, and date of release. At the conclusion of the test campaign, test personnel verified that any changes made to the software, hardware, or documentation during the test process were fully and properly documented.

3.1.2.2 Technical Data Package (TDP) Review

In order to determine full compliance with the EAC 2005 VVSG, three phases of TDP review were conducted:

- Initial TDP Review: The first review was performed to determine whether the TDP submitted was complete enough to perform TDP review. This was an abbreviated review. Each document was read to determine whether it provided enough description of the submitted voting system components and whether it at least generically addressed VVSG requirements. The results of the review were used in determining contractual requirements for the test campaign.

- Compliance Review: This review was conducted on a document-by-document basis to determine if every Federal, State, or manufacturer-stated requirement had been met based on the context of each requirement. This review did not address consistency or completeness of documents. The review was more complex than the initial TDP review. Results of the review of each document were entered on the TDP Review Checklist and were reported to the manufacturer for disposition of any anomalies. This process was ongoing until all anomalies are resolved.

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

- Consistency/Completeness Review: The third TDP review was completed after the review for compliance had been performed. This review was to ensure the information included in the TDP documents was 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. As with the other TDP reviews, the TDP Review Checklist was utilized to report any anomalies to the manufacturer for resolution, if required. The TDP review continued until all anomalies had been satisfactorily resolved

A listing of all documents contained in OVS 2.0 TDP is provided in Table 3-2.

Table 3-2. TDP Documents

Document Number	Description	Version	Release
04-00512	Technical Data Package-Document List and Version Control	1.2	2.0
04-00446	OVS System Overview	1.7	2.0
04-00444	System Functionality Description	1.5	2.0
04-00458	System Hardware Specification	1.3	2.0
04-00464	Software Design and Specification	1.5	2.0
04-00447	System Security Specification	1.1	2.0
04-00453	System Test and Verification Plan	1.1	2.0
04-00460	Systems Operations Procedure: Warehouse Technician's Guide	1.4	2.0
04-00459	System Maintenance Procedures	1.1	2.0
04-00445	Personnel Training and Deployment Requirements	1.2	2.0
04-00448	Configuration Management Plan	1.2	2.0
04-00454	Quality Assurance Plan	1.0	2.0
04-00427	Election Manager User Guide	1.3	2.0
04-00428	Ballot Layout Manager User Guide	1.6	2.0
04-00429	Election Server User Guide	1.3	2.0
04-00430	Software Server User Guide	1.4	2.0
04-00431	Tabulator Client User Guide	1.2	2.0
04-00432	Tabulator User Guide	1.3	2.0
04-00433	Tabulator Reports User Guide	1.5	2.0
04-00495	OVCS User Guide	1.3	2.0
04-00530	Auditor Users Guide	1.5	2.0
04-00549	EOS Linux and OCS Installation Guide	1.3	2.0
04-00449	System Coding Standards	1.1	2.0
04-00462	Election Day Troubleshooter's Guide	1.2	2.0
04-00463	Election Day Pollworker's Guide	1.2	2.0
04-00494	OVS Acronyms	1.1	2.0
04-00503	OVS Paper Specification	1.1	2.0
04-00469	Final Quality Assurance Report	1.0	2.0
04-00513	System Hardware Verification	1.2	2.0

Summary Findings

- Initial TDP Review: The first review (Initial TDP Review) was performed to determine whether the TDP for the submitted system was complete enough to perform TDP review.

Although this was an abbreviated review, it was determined that the TDP, as submitted, contained adequate information that was necessary to begin the Compliance Review. One document, System Design and Specification, was submitted incomplete in Draft form. Unisyn was notified of the deficiency and produced the completed document as soon as it was released internally.

- Regulatory/Compliance Review: This review was conducted on a document-by-document basis to determine if every regulatory or customer-stated requirement had been met based on the context of each requirement. This review did not address consistency or completeness of documents. The review was more complex than the initial TDP review. Any discrepancies noted were reported to Unisyn for resolution. During the test campaign, any revised documents were viewed and any discrepancies noted were reported to Unisyn for disposition.
- Complete/Final Review: This review was performed to determine whether the information contained in the documents was described consistently and completely throughout all documents. Some consistency issues were noted, and these were reported to Unisyn for resolution. Examples included: the OVI was changed to OVI-VC; Tabulator Cluster was revised to Tabulator system; and languages were revised to delete Vietnamese and to add Hindi and Thai. All outstanding issues were resolved during the TDP review.

3.1.2.3 Source Code Review

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

Summary Findings

- Automated Source Code Review: The Automated Source Code Review was performed during the OCS applications, OVO, OVI, FVT, and OVCS Compliance and Trusted Builds. No source code issues were found during the Automated Source Code review.
- Manual Source Code Review: The Manual Source Code review was performed in on 10% of the comments for compliance to VVSG Volume Section 5.2.7. No source code issues were found during the Manual Source Code review.
- Compliance Build: The compliance build was performed following the compliance review. Once the compliance review was performed and the source was deemed stable enough to proceed with testing, the source code and all additional packages were compiled into a Compliance Build.
- Trusted Build: The trusted build consisted of inspecting customer submitted source code, COTS, and Third Party software products and combining them to create the executable code. This inspection followed the documented process from the "United States Election

Assistance Commission Voting System Test Laboratory Program Manual" Section 5.5 – 5.7. Performance of the trusted build includes the build documentation review. The Trusted Build was performed following the completion of the Functional Configuration Audit. See Attachment C of this document for details.

3.1.2.4 Security Functions

The objective of the security testing was to evaluate the effectiveness of the voting system in detecting, preventing, recording, reporting, and recovering from security threats and to determine the overall security posture of each system component. During the security evaluation of the system, test cases were specifically designed to evaluate the following:

- confirm compliance with Telecommunication and Security Sections of the VVSG 1.0 (2005), including EAC RFI 2012-05 and EAC RFI 2008-03.
- verify depth, breadth, completeness, clarity, and conformance in the manufacturer's TDP System Security Specification
- verify implementation of the security mechanisms specified in the TDP System Security Specification on each system component
- attempt to defeat the access controls and security measures documented in the system TDP

The evaluation of the system was accomplished by utilizing a combination of documentation review, functional testing, source code review, automated network and vulnerability scanners, as well as manual inspection. Test cases were developed in an attempt to defeat the access controls and security measures documented in the system TDP. Tests conducted verified that the security mechanisms specified in the TDP Security Specification were implemented and adequately protect the system.

During the execution of these test procedures physical, technical, and administrative security controls were evaluated to determine if the security posture of the system components meet the objectives of the security standards which include: protection of the critical elements of the voting system; establishing and maintaining controls to minimize errors; protection from intentional manipulation, fraud and malicious mischief; identifying fraudulent or erroneous changes to the voting system; and protecting the secrecy in the voting process.

The security evaluation was conducted by a credentialed security expert utilizing voting systems that had been configured during other phases of their certification process. The security assessor evaluated the voting system for use and functionality to verify that the documented controls were in place, adequate, and met the stated requirements.

Physical Security was tested by setting up the system as described in the TDP and then examining the effectiveness and comprehensiveness of physical security measures.

Administrative Security was tested by examining the system's documented security instructions and procedures for effectiveness and breadth.

Logical Security was tested as part of FCA by conducting the following tests on system components: Vulnerability Scans, SCAP Scans, and Physical Bypass Attempts.

Summary Findings

Configuration Compliance Checking: An attempt was made to utilize the OpenSCAP Workbench utility to test the evaluation targets against the SCAP Checklists developed for Red Hat Enterprise Linux (RHEL). The RHEL content was used since there are no SCAP content specifications available for CentOS. It is common industry practice to substitute the RHEL SCAP content in evaluating CentOS.

During the testing, it was discovered that the security features that had been implemented on the Unisysn systems prohibited the use of the OpenSCAP Workbench tool. An attempt was made to manually obtain the packages needed for offline installation. However, the systems also do not have a compiler resident in order to make the package. The automated scans could not be conducted without significant modification to the systems which revert the security mechanisms in place; therefore, the SCAP checklists where evaluated manually. The assessor obtained the vendor's compliance checklist matrix (USGCB-RHEL5-DesktopSetting-Version-1.2.5.0-Report-EOS-OVO-OVI-2.0-Cent.xlsx), evaluated its content completeness to the published checklists, and verified that the systems implemented all items as stated.

FIPS 140-2 / EAC RFI 2012-05 Compliance – Cryptography: An analysis was performed to verify if libraries providing cryptographic functions were compliant to EAC RFI 2012-05. This was evaluated by verifying providers of documented cryptographic functions, examining source code and system settings as configured per the manufacturer's documentation. Testing determined that the system and components used are not fully compliant to VVSG 1.0, Section 7 and RFI 2012-05. Issues were discovered with the Java Application and OpenSSH. Java utilizes the Java Crytographic Architecture to define an open API for cryptographic functions. This is a provider-based architecture. The Service Provider Interface SPI is responsible for the implementing the cryptographic functions outlined in the JCA API. This architecture allows for the selection of the provider which is specified in the java.security configuration file. From the build scripts, it was determined that the cryptographic library utilized by Unisyn was BouncyCastle 1.5.4 which currently is not considered to be validated in the NIST CMVP. The deficiency with respect to OpenSSL is the use of the 1.0.1e-fips version of the library which is also not considered to be validated in the NIST CMVP. The EAC has worked with Unisyn and a modification resolving these non-compliances will be submitted within 30 days of certification to correct this issue.

Database Security Testing: The MySQL database was tested by utilizing a subset of General Security Issues listed in MySQL reference manual to derive testable requirements on common security issues. A subset of code was reviewed for input validation. It was determined that each suggested security best practice, as published in the MySQL reference manual, was successfully addressed.

Any concerns noted were reported to the manufacturer and successfully addressed, with the exception of the FIPS 140-2 deficiency described above, which was not addressed prior to test completion.

3.1.2.5 Functional Configuration Audit (FCA)

The functional configuration audit encompasses an examination of manufacturer's tests, and the conduct of additional tests, to verify that the system hardware and software perform as a system. The FCA is a verification of every system function cited in the manufacturer's documentation. It verifies the accuracy and completeness of the system Technical Data Package (TDP). In addition to functioning according to the manufacturer's documentation, tests were conducted to insure all applicable EAC 2005 VVSG requirements are met.

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

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

- FCA-VVSG Testing: Each component of the system was evaluated against a standardized test-case suite centered upon requirements stated in the VVSG and administered through a test-management software tool. All applicable tests-cases were performed while any non-applicable test-cases (e.g. VVPAT requirements, etc.) were logged as "n/a" for substantiation. The system operations and functional capabilities were categorized in the tool as follows by the phase of election activity in which they are required:
    - Pre-voting Capabilities: These functional capabilities are used to prepare the voting system for voting. They include ballot preparation, the preparation of election-specific software (including firmware), the production of ballots, the installation of ballots and ballot counting software (including firmware), and system and equipment tests.
    - Voting System Capabilities: These functional capabilities include all operations conducted at the polling place by voters and officials including the generation of status messages.
    - Post-voting Capabilities: These functional capabilities apply after all votes have been cast. They include closing the polling place; obtaining reports by voting machine, polling

place, and precinct; tabulation of paper ballots at the central location; accumulation of results from all voting methods; obtaining consolidated reports; and obtaining reports of audit trails.

- FCA-Limits Testing: System limits as defined in the TDP and/or COTS manuals were tested verified.

- FCA-Claims Testing: System user instructions and procedures found in the TDP were followed to verify their accuracy and completeness. In addition any functional claims discovered in the TDP that were not specifically examined in other areas or that were items of interest were also tested.

- FCA-Mapping: All functional paths (buttons, dropdowns, etc.) were mapped by qualified VSTL personnel, to help ensure all functional options had been noted and exercised. Any items of interest were examined and/or tested.

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

Summary Findings

All functional tests were successfully executed. During execution of the test procedure, it was verified that the OVS 2.0 System successfully completed the system level integration tests with all actual results obtained during test execution matching the expected results. At the conclusion of the test campaign, it was determined that all issues had been communicated to Unisyn and had been successfully addressed.

3.1.2.6 Volume & Stress

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

Summary Findings

Volume and stress testing was successfully performed on the Unisyn OpenElect 2.0 voting system. No issues were encountered during the test.

3.1.2.7 Accuracy

The accuracy test ensured that each component of the voting system could each process 1,549,703 consecutive ballot positions correctly within the allowable target error rate. The Accuracy test was designed to test the ability of the system to "capture, record, store, consolidate

and report" specific selections and absences of a selection. The required accuracy was defined as an error rate. This rate is the maximum number of errors allowed while processing a specified volume of data. For paper-based voting systems, such as the OVS, the ballot positions on a paper ballot must be scanned to detect selections for individual candidates and contests and the conversion of those selections detected on the paper ballot converted into digital data.

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

The accuracy requirements for the OVO and OVCS were met by the execution of the standard accuracy test utilizing pre-marked ballots of each ballot length supported, OVI produced ballots, and FVT produced ballots. For the accuracy test, voting sessions were started using manual session activation.

The OVO and OVCS were tested by utilizing a combination of hand marked (70%) and pre-marked (30%) ballots to achieve accuracy rate greater than 1,549,703 correct ballot positions.

Summary Findings

The OVO and the OVCS Canon DR-M160II units successfully passed the Accuracy test. The OVCS Canon DR-X10C (S/N ED300631) failed the Accuracy test. Two more attempts were made to pass the Accuracy test for the OVCS Canon DR-X10C (S/N ED30063); however, the unit failed both attempts. The unit was replaced as the issues encountered during testing suggested that the scanner unit itself was exhibiting non-standard behaviors. The new OVCS Canon DR-X10C (S/N ED301608) scanner was used to perform the Accuracy Test, and successfully passed. Unisyn conducted a Root Cause Analysis and determined that ballot and roller conditions caused an inconsistent path across the read heads and that the issue could be prevented through procedural changes *(Reference "Root Cause Analysis OVCS Scanner (DR-X10C) Recorded Additional Mark on Ballot OpenElect 2.0", dated 7/20/2017).*

3.1.2.8 System Integration

System Integration is a system level test for the integrated operation of both hardware and software. Compatibility of the voting system software components or subsystems with one another, and with other components of the voting system environment, were determined through functional tests integrating the voting system software with the remainder of the system. During performance of the System Integration, the OVS 2.0 system was configured as it would be for normal field use. This included connecting all supporting equipment and peripherals including ballot boxes, voting booths (regular and accessible), and any physical security equipment such as locks and ties. Pro V&V personnel configured and tested the system by following the procedures detailed in the OVS 2.0 voting system technical documentation.

Summary Findings

Three General Elections and three Primary Elections were successfully exercised on the voting system, as described below:

Three general elections with the following breakdowns:

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

Three primary elections with the following breakdowns:

- Primary Election PRIM-01: Open Primary Election in two precincts. This election contained thirty contests compiled into five ballot styles. Each ballot style contains 6 contests.
- Primary Election PRIM-02: Open Primary Election held in two precincts. This election contained thirteen contests compiled into three ballot styles. One contest is in all three ballot styles; all other contests are independent.
- Primary Election PRIM-03: A basic election held in 2 precincts. This election contains 10 contests and is compiled into 2 ballot styles. 2 of the contests are in both ballot styles. The other 8 contests are split between the two parties' ballots. This Primary Election is designed to functionally test the handling of multiple ballot styles, support for at least three languages including a character-based language, support for common voting variations, and audio support for at least three languages and an ADA binary input device.

The OVS 2.0 System successfully passed the System Integration Test. All deficiencies encountered during the System Integration test, which are noted in Table 3-3, were successfully resolved. During execution of the test procedure, it was verified that the OVS 2.0 System successfully completed the system level integration tests with all actual results obtained during test execution matching the expected results.

3.1.2.9 Usability & Accessibility

Usability & Accessibility testing was performed to evaluate the OVS 2.0 System to the applicable requirements. The usability testing focused on the usability of the OVS 2.0 system. Usability was defined generally as a measure of the effectiveness, efficiency, and satisfaction achieved by a specified set of users with a given product in the performance of specified tasks. The

Accessibility portion of testing evaluated the requirements for accessibility. These requirements are intended to address HAVA 301 (a) (3) (B).

During test performance, the OVS 2.0 System was configured as per the Unisyn TDP. The configured system was tested to the VVSG 1.0 requirements utilizing TestLink which maintains all applicable test cases. Utilization of both negative and positive inputs were entered into the system and documented into TestLink to allow for traceability and reproducibility. All components were evaluated for applicable requirements in which all deficiencies were documented within TestLink and Mantis for tracking purposes. Regression testing was performed on all identified issues to ensure resolution and compliance to the requirements.

Summary Findings

The OVS 2.0 System successfully met the requirements of the Usability & Accessibility evaluation. All deficiencies encountered during testing, which are noted in Table 3-3, were successfully resolved.

3.1.2.10QA & CM System Review

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

Summary Findings

An assessment of the CM/QA processes and procedures was performed for the OVS 2.0 System. The assessment showed that the voting system follows the stated processes and procedures.

3.2 Anomalies and Resolutions

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

3.3 Correction of Deficiencies

Any violation of the specified requirement or a result is encountered during test performance that deviates from what is standard or expected in which a root cause is established was considered to be a deficiency. Deficiencies were logged throughout the test campaign into the Pro V&V tracking system (Mantis) for disposition and resolution. All deficiencies encountered during the Unisyn OVS 2.0 test campaign were successfully resolved. In each instance, the resolutions were

verified to be resolved through all required means of testing (regression testing, source code review, TDP update) as needed.

The noted deficiencies are listed in Table 3-3.

Table 3-3. Noted Deficiencies

ID #	Test Category	Deficiency	Resolution
354	Usability/ Accessibility	OVI-VC: Instructions for repeating audio are not provided to the voter and voter is unable to make audio playback repeat	This issue was addressed using a source code update. Functional regression testing was performed using OVI version 2.0_R8.
304	FCA	BLM: Contest Header did not prompt the user to confirm the deletion of the contest header contrary to BLM User Guide	This issue was addressed using an update to the Ballot Layout Manager User Guide Rev. 2.0, Ver. 1.6.
353	Usability/ Accessibility	OVI-VC: Audio instructions for Canceling Casting(Printing) of a Ballot are not provided to the voter	This issue was addressed using a source code update. Functional regression testing was performed using OVI version 2.0_R7.
335	FCA	EM/OVI-VC/OVO: Clear USB Election Files after Load option from EM, does not work as described in the TDP when election loaded	This issue was addressed using a source code update. Functional regression testing was performed using version 2.0_R7 of the EM, OVI, and OVO software.
337	FCA	AUD: Retraction ID's field when Filtering Ballot Retraction list, does not have a specified limit, nor can one be discerned	This issue was addressed using an update to the Auditor User Guide Rev. 2.0, Ver. 1.5.
373	System Integration	BLM: Contests assigned to (Contest) Header with Background Color and Show Text Options Active, Inherit Background Color	This issue was addressed using an update to the Ballot Layout Manager User Guide Rev. 2.0, Ver. 1.4.
361	FCA	OVCS/DR-M160II: DR-M160II Scanner disconnecting from OVCS. Requires OVCS application to be Closed, then opened again	This issue was addressed using an update to the OVCS User Guide Rev. 2.0, Ver. 1.3.
370	System Integration	BLM/System-wide: Ballot Measures do not state the Vote for Value of the contest	This issue was addressed using an update to the Ballot Layout Manager User Guide Rev. 2.0, Ver. 1.4.

Table 3-3. Noted Deficiencies *(continued)*

ID #	Test Category	Deficiency	Resolution
383	Hardware	Lightning Surge: The OVI-VC unit failed Lightning Surge testing	This issue was addressed by the addition of an inline surge protector. The OVI-VC unit was then subjected to a second Lightning Surge Test, which was successfully completed.
359	Usability/ Accessibility	FVT: Unable to resume audio playback, after it has been paused, while voting on the FVT	This issue was addressed using a source code update. Functional regression testing was performed using FVT version 2.0_R6.
381	FCA	OVI-VC: If keypad isn't working, election is still allowed to be loaded and used for marking ballots	This issue was addressed using a source code update. Functional regression testing was performed using OVI version 2.0_R6.
382	Accuracy	OVCS-Canon DR-X10C: Canon DR-X10C S/N ED300631 recorded multiple overvotes and has therefore Failed Accuracy Test Attempt 3	This issue was addressed by the completion of the Accuracy Test, Attempt 4. The original OVCS unit was determined to be damaged and was replaced with a working unit.
379	Accuracy	OVCS-Canon DR-X10C: Canon DR-X10C S/N ED300631 recorded 5 overvotes and has therefore Failed Accuracy Test Attempt 2	This issue was addressed by the completion of the Accuracy Test, Attempt 4. The original OVCS unit was determined to be damaged and was replaced with a working unit.
377	Accuracy	Accuracy-OVCS: OVCS Canon DR-X10C unit with S/N ED300361, had an overvote in Contest 1 of the 11" Ballot Election	This issue was addressed by the completion of the Accuracy Test, Attempt 4. The original OVCS unit was determined to be damaged and was replaced with a working unit.
334	FCA	EM: System Code field in Machine Log menu/window does not have a discernible or stated limit	This issue was addressed using an update to the Election Manager User Guide Rev. 2.0, Ver. 1.3.
313	FCA	BLM: Measure ID, Affirmative ID, and Negative ID lower field limits violated	This issue was addressed using an update to the Ballot Layout Manager User Guide Rev. 2.0, Ver. 1.3.

Table 3-3. Noted Deficiencies *(continued)*

ID #	Test Category	Deficiency	Resolution
339	FCA	FVT: Diagnostics tests are not performed during startup and as such are not meeting requirements for the System Readiness Audit Record	This issue was addressed using a source code update. Functional regression testing was performed using FVT version 2.0_R6.
378	FCA	FVT: Reconnect Printer function then Turn Off Screen function, causes the Audit Log to update with Printer Model <Not Found>	This issue was addressed using a source code update. Functional regression testing was performed using FVT version 2.0_R6.
372	System Integration	BLM: District Contest Preview does not display translation of Contest Title, always displays English Text	This issue was addressed using a source code update. Functional regression testing was performed using BLM version 2.0_R6.
358	Usability/ Accessibility	FVT: Write-in text does not magnify while the information in candidate field does. Write-In text remains the same size always	This issue was addressed using a source code update. Functional regression testing was performed using FVT version 2.0_R6.
349	FCA	OVO: In Admin Log, entry included which says Machine Name: Machines used: null	This issue was addressed using a source code update. Functional regression testing was performed using OVO version 2.0_R5.
331	FCA	OVCS: Session Type dropdown window shows two instances of the Write-In Only Option	This issue was addressed using a source code update. Functional regression testing was performed using OVCS version 2.0_R5.
362	FCA	OVCS: Audit Trail Exception error in OVCS Application Log	This issue was addressed using a source code update. Functional regression testing was performed using OVCS version 2.0_R5.
371	Volume & Stress	OVI-VC: After Volume and Stress test, OVI-VC cannot load a new election or open a new session	This issue was addressed using a source code update. Functional regression testing was performed using OVI version 2.0_R5.
343	FCA	SS: Validator Log file cannot be saved to TM	This issue was addressed using a source code update. Functional regression testing was performed using SS version 2.0_R5.

Table 3-3. Noted Deficiencies *(continued)*

ID #	Test Category	Deficiency	Resolution
345	FCA	OVI-VC/FVT: BMD's are handling N of M contests linked to Straight Ticket Contests, differently	This issue was addressed using a source code update. Functional regression testing was performed using OVI version 2.0_R5 and FVT version 2.0_R5.
380	Usability/ Accessibility	FVT: The Forward button in keypad navigation in a group contests goes to next page not the next contest	This issue was addressed using a source code update. Functional regression testing was performed using FVT version 2.0_R5.
344	FCA	OVI-VC/FVT: Candidate and Party-Vertical Candidate Layout, does not display properly on BMDs. The party name is not shown	This issue was addressed using a source code update. Functional regression testing was performed using OVI version 2.0_R5 and FVT version 2.0_R5.
338	FCA	OVI-VC: Top of screen overlays the word ballot over two other copies of the word ballot. Review selections does the same thing	This issue was addressed using a source code update. Functional regression testing was performed using OVI version 2.0_R5.
336	FCA	AUD: Password field when unlocking a locked session, does not have a discernible field limit, nor is one listed in the TDP	This issue was addressed using an update to the Auditor User Guide Rev. 2.0, Ver. 1.4. Functional regression testing was performed using ES version 2.0_R5.
376	Hardware	Temp Power: The OVCS DR-X10C, DR-M160II, and OVO failed the Temp Power Variation Test, Attempt 1	This issue was addressed using a source code update. The retest was performed using version 2.0_R3 of the OVO and OVCS software. The Temperature Power Variation Test was performed a second time and the OpenElect 2.0 voting system successfully completed the test.
367	FCA	FVT: Change Poll Close Time function can be changed, in an Override session, when it is Not Election Day, contrary to other OVD's	This issue was addressed using a source code update. Functional regression testing was performed using FVT version 2.0_R5.

Table 3-3. Noted Deficiencies *(continued)*

ID #	Test Category	Deficiency	Resolution
348	FCA	FVT: Error code [364] in Admin log says that XML file has invalid data, however election loads and runs correctly	This issue was addressed using a source code update. Functional regression testing was performed using FVT version 2.0_R5.
350	FCA	FVT/EM: Admin log exported from FVT unit gives an error when an attempt is made to import log file into EM. Says Invalid USB	This issue was addressed using a source code update. Functional regression testing was performed using FVT version 2.0_R5 and EM version 2.0_R5.
366	FCA	FVT: Party Selection screen when activating a ballot in Open Primary, lists Parties in different order than OVI-VC and Election Order	This issue was addressed using a source code update. Functional regression testing was performed using FVT version 2.0_R5.
365	FCA	FVT: Header (Contests menu) which includes the "<PARTY>" tag displays on OVI-VC but does not display on FVT	This issue was addressed using a source code update. Functional regression testing was performed using FVT version 2.0_R5.
364	FCA	FVT: Auto Test diagnostic says battery disconnected during battery test. However regular battery test works correctly	This issue was addressed using a source code update. Functional regression testing was performed using FVT version 2.0_R5.
363	FCA	FVT: Auto Test diagnostic instructions say to press Back button to cancel test. Back button does not exist, only Cancel button	This issue was addressed using a source code update. Functional regression testing was performed using FVT version 2.0_R5.
340	FCA	ES: Select or Type fields for Machine Log and Election Log in Election Server do not have a stated or discernible limit	This issue was addressed using an update to the Election Server User Guide Rev. 2.0, Ver. 1.1. Functional regression testing was performed using ES version 2.0_R5.
333	FCA	TAB: County Code field in Export Data window, does not have a stated or discernible limit	This issue was addressed using an update to the Tabulator User Guide Rev. 2.0, Ver. 1.2. Functional regression testing was performed using TAB version 2.0_R5.

Table 3-3. Noted Deficiencies *(continued)*

ID #	Test Category	Deficiency	Resolution
327	FCA	EM: Machine Group Report fails to list machines assigned to groups, always says 0 machines present	This issue was addressed using a source code update. Functional regression testing was performed using EM version 2.0_R5.
328	FCA	EM: Assigning and un-assigning Machines to/from Machine Groups, is not logged in Application Log	This issue was addressed using a source code update. Functional regression testing was performed using EM version 2.0_R5.
332	FCA	TAB: When exporting election data to XML, status dropdown window has 2 instances of "unofficial-complete"	This issue was addressed using a source code update. Functional regression testing was performed using TAB version 2.0_R5.
346	FCA	FVT: Open and Close Reports on the FVT does not include a listing of the OS Version, unlike other OVD units	This issue was addressed using a source code update. Functional regression testing was performed using FVT version 2.0_R5.
323	FCA	BLM: Radius Field, Font Field, and Text field(in Add Text Popup window) do not have Limits in Graphics Menu	This issue was addressed using an update to the Ballot Layout Manager User Guide Rev. 2.0, Ver. 1.3. Functional regression testing was performed using BLM version 2.0_R5.
319	FCA	BLM: Radius Field, Font Field, and Text field(in Add Text Popup window) do not have Limits in Header Template Setup	This issue was addressed using an update to the Ballot Layout Manager User Guide Rev. 2.0, Ver. 1.3. Functional regression testing was performed using BLM version 2.0_R5.
310	FCA	SS: Select or Type field in Machine Log and Release Log windows, has no discernible limit	This issue was addressed using an update to the Software Server User Guide Rev. 2.0, Ver. 1.2. Functional regression testing was performed using SS version 2.0_R5.

Table 3-3. Noted Deficiencies *(continued)*

ID #	Test Category	Deficiency	Resolution
309	FCA	SS: Release Key field has no discernible limit	This issue was addressed using an update to the Software Server User Guide Rev. 2.0, Ver. 1.2. Functional regression testing was performed using BLM version 2.0_R5.
329	FCA	BLM: Circle was added to a Header Template, once saved input code displays Circle. If Save Changes pressed again, becomes "?"	This issue was addressed using a source code update. Functional regression testing was performed using BLM version 2.0_R5.
324	FCA	BLM: Add Image function in Image popup window for Graphics menu, doesn't display any available image files, in file browser	This issue was addressed using a source code update. Functional regression testing was performed using BLM version 2.0_R5.
320	FCA	BLM: Add Image function in Image popup window for Header Templates, doesn't display any available image files, in file browser	This issue was addressed using a source code update. Functional regression testing was performed using BLM version 2.0_R5.
369	System Integration	BLM/System-wide: Precinct Names, related header text, and static text are not translatable	This issue was addressed using a source code update. Functional regression testing was performed using version 2.0_R5 of the OpenElect software suite.
347	FCA	FVT: Cannot initialize session using Initialization tokens from Precinct Barcode Report Generated in EM	This issue was addressed using a source code update. Functional regression testing was performed using FVT version 2.0_R5.
308	FCA	SS: Cannot navigate Help document as navigation controls are hidden beneath bottom EOS Linux Panel	This issue was addressed using a source code update. Functional regression testing was performed using SS version 2.0_R5.
360	Usability/ Accessibility	FVT: Unable to access instructions for using the FVT using the ATI. Can only access instructions using touchscreen	This issue was addressed using a source code update. Functional regression testing was performed using FVT version 2.0_R5.

Table 3-3. Noted Deficiencies *(continued)*

ID #	Test Category	Deficiency	Resolution
352	Usability/ Accessibility	OVO: OVO does not provide the voter with the minimum of 20 seconds, when a response is required from voter	This issue was addressed using a source code update. Functional regression testing was performed using OVO version 2.0_R5.
351	Usability/ Accessibility	OVO: User is not notified of the effect of casting an overvoted ballot	This issue was addressed using a source code update. Functional regression testing was performed using OVO version 2.0_R5.
318	FCA	BLM: Formatting Codes in Instruction Blocks not displaying properly in Preview tab for Alternate Language	This issue was addressed using a source code update. Functional regression testing was performed using BLM version 2.0_R5.
317	FCA	BLM: Deleting Instruction Blocks with "Available to other election" option active, will delete them from other elections too	This issue was addressed using a source code update. Functional regression testing was performed using BLM version 2.0_R5.
316	FCA	BLM: Available to Other Elections Option for Instruction Blocks does not work with "All Districts" option selected	This issue was addressed using a source code update. Functional regression testing was performed using BLM version 2.0_R5.
374	System Integration	EOS Linux: On Statrup OS shows an error which says: "Starting NFS Quotas: [FAILED]"	This issue was addressed using an update to the EOS Linux OS. Functional Regression was performed using EOS Linux 2.1.01.
315	FCA	BLM: Adding, Editing, or Deleting an Instruction Block in an election is not logged by the Real Time Audit Log	This issue was addressed using a source code update. Functional regression testing was performed using BLM version 2.0_R5.
314	FCA	BLM: Ballot Measure Preview window does not properly display translated Description Text	This issue was addressed using a source code update. Functional regression testing was performed using BLM version 2.0_R5.
306	FCA	BLM: Using the Move H, Move V, and Apply Move commands when editing Graphics on ballot provides inconsistent behavior	This issue was addressed using a source code update. Functional regression testing was performed using BLM version 2.0_R5.

Table 3-3. Noted Deficiencies *(continued)*

ID #	Test Category	Deficiency	Resolution
305	FCA	BLM: Using the Move H, Move V, and Apply Move commands when editing a Ballot Header Template provides inconsistent behavior	This issue was addressed using a source code update. Functional regression testing was performed using BLM version 2.0_R5.
307	FCA	BLM: Creating BLANK Candidates on the ballot while a Straight Ticket Group is included in election, causes Ballots to not build	This issue was addressed using a source code update. Functional regression testing was performed using BLM version 2.0_R5.
311	FCA	BLM: Ranked Choice option greyed out while adding new contest unless Allow Straight Ticket is selected then deselected	This issue was addressed using a source code update. Functional regression testing was performed using BLM version 2.0_R5.
302	FCA	BLM: When deleting parties, the user is not prompted to confirm the deletion, as described in the TDP	This issue was addressed using an update to the BLM User Guide Rev. 2.0, Ver. 1.3 and a source code update. Functional regression testing was performed using BLM version 2.0_R5.
303	FCA	BLM: Exported precinct file not exporting split precincts correctly, causing errors when file is used for importing precincts	This issue was addressed with a source code update. Functional regression testing was performed using BLM version 2.0_R5.

APPENDIX A

HARDWARE TEST REPORTS

Part 1: TÜV SÜD Canada Inc. EMC Test Report File#: 7169002414-000

Part 2: TÜV SÜD Canada Inc. Report/Quotation Number: PVV-5331.00 (300056294.2)

APPENDIX B

WARRANT OF ACCEPTING CHANGE CONTROL RESPONSIBILITY

2310 Cousteau Court
Vista, CA 92081, USA
Telephone: 1 (760) 734-3233
Fax: 1 (760) 598-0219

August 29, 2017

Warranty of Accepting Change Control Responsibility

Unisyn Voting Solutions, Inc. (Unisyn) understands its responsibility to ensure that any system bearing the U.S. Election Assistance Commission (EAC) mark of certification, or otherwise represented as EAC certified, is configured consistent with the system certified by the EAC and EAC certification documentation. Specifically, it is warranted that any Unisyn OpenElect 2.0 voting systems subsequently delivered to a customer after receiving EAC certification (as an EAC Certified System) will meet all configuration requirements at the time of delivery as set forth by EAC's certification documentation. It is further warranted that any fielded system modified by Unisyn for the purposes of becoming an EAC certified system will also will meet the configuration requirements as set forth by the same certification documentation. Voting system configurations tested and certified by the EAC may contain alternative configurations composed of varying, approved components.

Modifications inconsistent with the EAC's Certification documentation shall not be made by Unisyn, unless authorized by the EAC as a de minimis change (per section 3.5. of the Voting System Testing and Certification Program Manual) or a certified modification (per section 3.4.3 of the Voting System Testing and Certification Program Manual).

Attested by: Unisyn Voting Solutions, Inc.

Signed: Chris Ortiz Digitally signed by Chris Ortiz DN: cn=Chris Ortiz, o=Unisyn Voting Solutions, ou, email=cortiz@unisynvoting.com, c=US Date: 2017.08.30 08:54:39 -07'00' Date: 8/29/17

Printed Name: Chris Ortiz Date: 8/29/17

APPENDIX C

TRUSTED BUILD

The OVS 2.0 Voting System Trusted Build was performed using the steps described in section 5.5 of the EAC Voting System Testing and Certification Program Manual, Version 2.0. The Trusted Build yielded the following software outputs which are described below along with their associated Filenames and Hash Values in SHA 256 format:

The OVS 2.0 Applications trusted build was performed using the "OpenElect Voting System Release 2.0 Trusted Build – Applications – 2.0" Document Number 04-00553, Version 2.2, dated 07/27/2017, provided by Unisyn Voting Solutions. The OVS contains the OCS, OVO, OVI-VC, OVCS, and FVT components. The trusted build yielded the following output files and their associated Hash Values:

- **FVT\FVT_2.0\fvt.apk**

  SHA256 - 6e6ff64e7626c5608f16ddf7498cc85875ed45fe0761c8fd19025387d73dc230

- **OCS\2.0\CD Image\Adjudicator.zip *(Auditor)***

  SHA256 - 20999796ee66fd63c5237bce771e3e889f734701c8886ffa9084129a78997aec

- **OCS\2.0\CD Image\BallotLayout.zip**

  SHA256 - f275eb85d6be2700ef3e4ac962eab1f3e469eead0a682be7f019011ecf0a2cc3

- **OCS\2.0\CD Image\ElectionManager.zip**

  SHA256 - 0c262c63724e9da02809386ed203d64e0d4e90ba2691d9ca9c72902b172460bb

- **OCS\2.0\CD Image\ElectionServer.zip**

  SHA256 - 6a4ab5a562cd7f8a9da30fd1d92276478359c5aa830ef2202117897043ab4752

- **OCS\2.0\CD Image\OVCS.zip**

  SHA256 - f500a358383d8aa75def11c93affb0771dedfc8ec825df71cca2e0b1174a5d52

- **OCS\2.0\CD Image\SoftwareServer.zip**

  SHA256 - 381712a6066374473f68882fc4cf4960167477ed7cfacc8286cde27d395a42c7

- **OCS\2.0\CD Image\TabulatorClient.zip**

  SHA256 - f92e1e29f3d04ee9667e4da5614b9184123c2204ab701dfd7ba9fe75bcf692d6

- **OCS\2.0\CD Image\TabulatorMonitor.zip**

  SHA256 - a7b8d6121e799466520f31a8e950777c32c6fe0659457a89e9e5f13a47adc009

- **OCS\2.0\CD Image\TabulatorReports.zip**

  SHA256 - 87a72f46e22562103757a4ac59a53125042f02b84e0f96ef7ab4e79f14f8435d

- **OCS\2.0\CD Image\TOC**

  SHA256 - 1d79b564b0590819c2d1e0449391754fa96ee02aef482cf3ed0513c4021b5216

- **OCS\2.0\CD Image\TOC.sig**

  SHA256 - 331f73a9b278829dae63e264d4b6bf48a96f47d922842e9c6302c8007b1bec42

- **OCS\2.0\OCSInstaller\java.security**

  SHA256 - a75ba699f9996fc23ef8d0b74319068c67ee65a20a9817254f4d3ad51134e9f7

- **OCS\2.0\OCSInstaller\OCSInstaller.jar**

  SHA256 - 385183b95b92bc2a8c88b1243dd5fd28de13925a032551dd983124d1a409228d

- **OCS\2.0\OCSInstaller\TOC**

  SHA256 - a3da43892d39845108db7bb0ba151793310426b919c30ba4dcbcc333c7563c72

- **OCS\2.0\OCSInstaller\TOC.sig**

  SHA256 - 8b75609353a5b7785a8bbdddbc1d460c82e2e095234211f0c6570a61a996968b

- **OCS\2.0\OCSInstaller\update**

  SHA256 - 6d4e57ffac56d5146744a7f287b6ba40ecfc0390b7e0b5a6bdf1bd3d5d2f696e

- **OVI\2.0\CD_Image\Release.zip**

  SHA256 - b58d497e4a99d8a52b09c6c0aee36adcd017d69ad491317801f94aa3cb0adf7a

- **OVI\2.0\CD_Image\Release.zip.sig**

  SHA256 - 8ad3a8e013fd88759aa4a60be3dacb394f25083c00295f095b654b3c4dc76c37

- **OVO\2.0\CD_Image\Release.zip**

  SHA256 - 7e589bf08765f33ae4ed7165a99884d9c2673720ecdf3789da77a0dbafab04f8

- **OVO\2.0\CD_Image\Release.zip.sig**

  SHA256 - a61fb9a563cd7b3df2f3537d0fe4f818991c1c4f224ffad81bf75d4251907316

APPENDIX D

AS-RUN TEST PLAN

Pro V&V Document No. TP-01-01-UNI-2017-01.01 As-Run, "Test Plan for EAC 2005 VVSG Certification Testing Unisyn Voting Solutions OpenElect 2.0 Voting System"