EAC Modification Certification Test Report

Unisyn OpenElect Voting System 2.0.A.2

UNI-20A2-CTR-01

Test Report Version 1.1

Prepared for:

Vendor Name	*Unisyn Voting Solutions, Inc.*
Vendor System	*OpenElect Voting System 2.0.A.2*
EAC Application No.	*UNS10121966-2.0.A.2*
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Accredited by the Election Assistance Commission (EAC) for Selected Voting System Test Methods or Services

Revision History

Date	Release	Author	Revision Summary
October 22nd, 2018	1.0	*M. Santos*	Initial Draft
November 14th, 2018	1.1	*M. Santos*	Updated for EAC comments

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The tests referenced in this document were performed in a controlled environment using specific systems and data sets, and results are related to the specific items tested. Actual results in other environments may vary.

Opinions and Interpretations

There are no opinions or interpretations included in this report, except as noted under Recommendations.

TABLE OF CONTENTS

1   INTRODUCTION

SLI Compliance is submitting this report as a summary of the certification testing efforts for the **Unisyn OVS 2.0.A.2** voting system, as detailed in the section System Identification. The purpose of this document is to provide an overview of the certification testing effort and the findings of the testing effort for **Unisyn OVS 2.0.A.2** voting system.

The ***Unisyn OVS 2.0.A.2*** voting system is a modification of the **OVS 2.0.A** voting system, which consists of two updates. One update is implemented to properly handle an adjustment of write in assignments through the Auditor application which keeps the number of Assigned and Unassigned write-ins balanced for reporting purposes. The second update is implemented to increase the size of extracted bar code images, which are used in the Adjudication screen.

These issues were corrected in this release under review, and were verified

The State of Pennsylvania, for whom this release is developed for, was able to witness the testing performed, from a remote location, via Skype.

This effort included documentation review of the Technical Data Package, source code review, and testing of the **Unisyn OVS 2.0.A.2** voting system.   Testing consisted of the development of a test plan, managing system configurations, executing test suites of functional and system levels tests based on the system's functionality, and analysis of results.   The review and testing was performed at SLI's Wheat Ridge, Colorado facility.

1.1 References

1. Election Assistance Commission Voluntary Voting System Guidelines (EAC VVSG 2005), Version 1.0, 2005
2. NIST Handbook 150: 2016.
3. NIST Handbook and 150-22: 2008.
4. EAC Voting System Testing and Certification Program Manual, United States Election Assistance Commission, v 2.0, May 2015
5. SLI VSTL Quality System Manual, Rev. 2.4, prepared by SLI, dated October 20th, 2017.
6. Conduct Directive Att C - Pennsylvania Method, Pennsylvania Department of State (See Appendix A - Conduct Directive Att C - Pennsylvania Method for detailed explanation of Pennsylvania Straight Party Method)

1.2 Document Overview

This document contains the following sections:

- The Introduction discusses the application tested/reviewed
- The Certification Test Background discusses the testing process
- The Test Findings and Recommendation section contains the results and analysis of the testing effort
- Attachments:
    - Attachment A - As run Unisyn OVS 2.0.A.2 Modification Test Plan v1.1
    - Attachment B – Record of Unisyn 2.0.A.2 OVI Trusted Build
    - Attachment C – Root Cause Analysis of Auditor Imaging Issue

1.3 System Identification

The **Unisyn OVS 2.0.A.2** voting system was submitted for certification testing with the documentation, hardware and software listed below. No other **Unisyn** product was included in this test effort.

1.3.1 Documentation

The following were documents delivered as a part of the **Unisyn OVS 2.0.A.2** system.

Document Number	Description	Version	Release
04-00427	Election Manager User Guide	1.1	2.0.A
04-00428	Ballot Layout Manager User Guide	1.2	2.0.A
04-00431	Tabulator Client User Guide	1.0	2.0.A
04-00432	Tabulator User Guide	1.0	2.0.A
04-00433	Tabulator Reports User Guide	1.1	2.0.A
04-00444	System Functionality Description	1.1	2.0.A
04-00445	Personnel Training and Deployment Requirements	1.0	2.0.A
04-00446	OVS System Overview	1.0	2.0.A.2
04-00447	System Security Specification	1.1	2.0.A
04-00448	Configuration Management Plan	1.0	2.0.A
04-00449	System Coding Standards	1.0	2.0.A
04-00453	System Test and Verification Plan	1.0	2.0.A

04-00454	Quality Assurance Plan	1.0	2.0.A
04-00458	System Hardware Specification	1.0	2.0.A
04-00459	System Maintenance Procedures	1.1	2.0.A
04-00460	Systems Operations Procedure: Warehouse Technician's Guide	1.1	2.0.A
04-00462	Election Day Troubleshooter's Guide	1.0	2.0.A
04-00463	Election Day Poll Worker's Guide	1.0	2.0.A.2
04-00464	Software Design and Specification	1.0	2.0.A
04-00469	Final Quality Assurance Report	1.0	2.0.A
04-00494	OVS Acronyms	1.0	2.0.A
04-00495	OVCS User Guide	1.0	2.0.A
04-00503	OVS Paper Specification	1.0	2.0.A
04-00512	Technical Data Package-Document List and Version Control	1.1	2.0.A
04-00530	Auditor Users Guide	1.0	2.0.A
04-00549	EOS Linux and OCS Installation Guide	1.2	2.0.A

1.3.2   Unisyn Software and Firmware

The software and firmware employed by **Unisyn OVS *2.0.A.2*** consists of 2 types, custom and commercial off the shelf (COTS). COTS applications were verified to be pristine, or were subjected to source code review for analysis of any modifications and verification of meeting the pertinent standards.
The tables below detail each application employed by the **Unisyn OVS *2.0.A.2*** voting system.

Table 1 – Unisyn OVS 2.0.A.2 Software/Firmware

Firmware/Software	Version
OVO	2.0.A
FVT – Tablet Voting Device	2.0.A 2.0.A.1
OVI VC – 15' Screen	2.0.A
OVCS	2.0.A
Ballot Layout Manager(BLM)	2.0.A
Election Manager(EM)	2.0.A
Tabulator Client(TC)	2.0.A
Tabulator(Tab)	2.0.A.2
Tabulator Reports(TR)	2.0.A
Auditor	2.0.A.2
Common	2.0.A
Unisyn Security	2.0.A

Firmware/Software	Version
Logger	2.0.A
Scripter	2.0.A
Validator	2.0.A

COTS Software/Firmware

The following tables provide details of the 2.0.A.2 system and its components.

OVS 2.0.A COTS Software Components

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

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, A, and Tab only)	5.0.45-7
JasperReports	2.0.5
OpenVPN	2.4.4
OpenSSL	1.0.1f
OpenSSL FIPS Object Module	2.0.10 (cert #1747)

1.3.3 Equipment (Hardware)

The hardware employed by **Unisyn OVS 2.0.A.2** voting system consists of 2 types, custom and commercial off the shelf (COTS). COTS hardware was verified to be pristine, or was subjected to review for analysis of any modifications and verification of meeting the pertinent standards.

The following manufacturer equipment was used in testing:

- 1 **OVO** precinct level optical scanner
- 1 **OVI-VC** ballot marking device
- 1 **FVT**
- 1 **OVCS**

The following Commercial Off-the-Shelf equipment was used in testing:
- 1 EMS laptop
- 2 Transport Media thumb drives

COTS HARDWARE

The following tables provide details of the 2.0.A.2 system and its components.

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	Citizen Printer	28AD4
Computer		
Chassis	Morex	Morex 2699
Power Adapter	DC/DC converter	MX-0608F
Motherboard	Jetway	JNF9D-2550
Memory	SuperTalent - Onboard RAM	3120-21282
Hard Drive	Western Digital	WD5000AZLX
Adapter	EDAC	EA 10951c-120
1 Gb USB TM		
Innodisk	1 Gb USB	DEUA1-01G172AC1SB-B088
Delkin	1 Gb USB	SLC-MLC
Hardware	**Make**	**Model**
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 Adapter	Star	PS60A-24B 1
Computer		
Power Adapter Kit	DC-DC Converter	MX-0608F
Motherboard	Jetway	JNF9D-2550
Memory	SuperTalent - Onboard RAM	3120-21282

Hard Drive	Western Digital	WD5000AZLX
Adapter	EDAC	EA 10951c-120
1 Gb USB TM		
Innodisck	1 Gb USB	DEUA1-01G172AC1SB-B088
Delkin	1 Gb USB	SLC-MLC
AC Power In Module		
AC Power In Module	Delta	Emi 10BEEG3G
OVCS		
Large Volume Scanner		
Large Volume Scanner	Cannon	DR-X10C
Desktop Scanner		
Desktop Scanner	Cannon	DR-M160II
FVT		
13.3 in Touchscreen Tablet		
13.3 in Touchscreen Tablet	Android Tablet	GVision - T13
Tablets Battery Charger	Sager Power System	GC30B-4P1J
82.5 mm Thermal Printer		
82.5 mm Thermal Printer	Star	TSP743IIU-24
Printer Adapter	Lind 60W 24VDC	ST2425-626
Barcode Reader 1D,2D series		
Barcode Reader 1D,2D series	Newland	FM420
Hardware	**Make**	**Model**
USB Hub		
USB Hub	Tripp Lite	USB Hub
Hub Adapter	Meanwell	PSD-15A-05
1 Gb USB TM		
Innodisck	1 Gb USB	DEUA1-01G172AC1SB-B088
Delkin	1 Gb USB	SLC-MLC
Micro SD		
Micro SD	Innodisk Industrial	Micro SD 2.0
Battery		
Battery Pack 12 V 6.0 AH	Powers Sonic	PSH-1255-FR
Adapter	Mean Well	GC30B-4PIL
AC Power In Module		
AC Power In Module	Delta	Emi 10BEEG3G
Sip and Puff (Optional)		
Sip and Puff	Origin Instruments	AirVoter
Headphone (Optional)		
Headphone	Cyber Acoustics	ACM-70

USB to Ethernet RJ45 Adapter (Optional)		
USB to Ethernet RJ45 Adapter	D-Link	DUB-E100
UPS		
Minuteman Power Technologies	Para Systems, Inc.	Entrust

OVCS System COTS Software Components

OVS Hardware	**Version**
Desktop for non-redundant solutions	Dell OptiPlex
Desktop for redundant solutions	Dell Precision
Canon Scanner (OVCS)	Canon DR-X10C or DR-M160II
Laptop	Dell Latitude

1.3.4 Test Materials

The following test materials were required for the performance of testing including, as applicable, test ballot layout and generation materials, test ballot sheets, test ballot cards and control cards, standard and optional output data report formats, and any other materials used in testing.

- Ballots
- Transport Media
- Ballot marking pens
- Printer paper rolls

1.4 System Overview

1.4.1   Scope of the Unisyn OVS 2.0.A.2 Voting System

The **OpenElect Voting System** (**OVS**) is a paper ballot precinct voting system that uses touch screen and scan technology to scan and validate ballots, provides voter assisted ballots for special needs voters, and tabulates precinct results.

The **OVS** consists of:

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

Open<u>Elect</u> Central Suite (OCS)

The **OCS** supports elections on the OVO, OVI-VC, FVT and OVCS systems. It includes Ballot Layout Manager, Election Manager, Election Server, Tabulator Client, Tabulator Server, Adjudicator, and Tabulator Reports. In addition, the OCS includes the Software Server (SS) system for updating and validating the OVO, FVT and the OVI-VC (voting device) software.

<u>OpenElect Voting Optical (OVO)</u>
The OVO is a full-page dual-sided optical scan precinct scanner that scans and validates voter ballot pages and provides a summary of all ballot pages cast. The OVO consists of the following components:

- **Personal Computer (PC) -** The PC utilizes a Mini-ITX form factor motherboard and is configured with either a VIA C7 motherboard or an Intel Atom. Computer component (with a touch panel display) has Unisyn pre-installed server software (that manages data and communication) and Unisyn pre-installed 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 vote 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 receipts and reports at the OVO.
- **UPS** - Uninterruptible power supply is provided as part of the system.

<u>OpenElect Voting Interface (OVI-VC)</u>
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 consists of the following components:

- **Personal Computer (PC)** - The PC utilizes a Mini-ITX form factor motherboard and is configured with either a VIA C7 motherboard or an Intel

Atom. Computer component (with a touch panel display) has Unisyn pre-installed 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 printer is connected to the PC to print OVI Ballots and reports at the OVI.
- **UPS** - Uninterruptible power supply is provided as part of the system.

OpenElect FreedomVote Tablet (FVT)

The FVT is a tablet ballot marking device that enables voters to make their vote selections and to print their voted ballot. 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.

OpenElect Voting Central Scan (OVCS)

The OVCS units reside at election headquarters and are 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 that is connected to the PC to scan data from marked ballots. Scanners used are the Canon DR-X10C and Canon M160 COTS scanners.

2 Certification Test Background

2.1 Scope of Testing

The test engagement described in this Certification Test Report utilized only standard VSTL test methods that conform to the EAC Testing and Certification Program Manual and the identified voting system standard.

2.1.1 Modifications

An issue was found with the Tabulator application, when managing write-ins and needing to commit changes more than once. An algorithm being utilized was being applied inappropriately, after the first commit, causing subtraction operations to be applied to counts in summary reports, which resulted in incorrect values being reported.

The change incorporated utilizes the algorithm only when appropriate.
A fix for this issue is implemented in the release under review, and was verified that multiple commits are able to be performed, with correct values continuing to be reported.

A second issue was found that was manifested within the Auditor application, where the extracted barcode area, which is used to detect front and back barcodes on ballots, in one instance was insufficient for proper detection, which resulted in the images being transposed.

A change was incorporated to increase the size of the extracted barcode area, which now provides sufficient image area for proper detection of the front and back barcodes on the ballot.

The system was regression tested to verify the fix put in place for providing sufficient image area for proper detection of the front and back barcodes on the ballot.

2.2 PCA - Document and Source Code Reviews

The Physical Configuration Audit (PCA) review of the **Unisyn OVS 2.0.A.2** documentation submitted in the Technical Data Package (TDP) was performed in order to verify conformance with the Election Assistance Commission Voluntary Voting System Guidelines (EAC VVSG) 2005. Source code was reviewed for each software and firmware application declared within the **OVS 2.0.A.2** voting system.

All PCA documentation reviews were conducted in accordance with Vol. 2 Section 2 of the EAC VVSG 2005, to demonstrate that the system documentation updates meet the requirements.

All PCA source code reviews were conducted in accordance with Vol. 1 Section 5.2 and Vol. 2 Section 5 of the EAC VVSG, to demonstrate that the system meets the requirements. A total of 58 lines of code were modified in this release. The delivered code base was compared to the previous code base, **OVS 2.0.A.2**, with only modified modules being reviewed.

No Inconsistencies or errors were found in the modified source code.

2.3 FCA - Functional & System Testing

Simulation of a General election was conducted to demonstrate a beginning-to-end business use case process for the **Unisyn OVS 2.0.A.2** voting system.

2.3.1 Acceptance of Prior Testing

SLI evaluated the published Final Test Report for the **OVS 2.0.A** voting system in order to baseline the current system under test.

No prior non-VSTL testing of the OVS **2.0.A** voting system was considered for this test campaign.

2.4 Testing Performed

2.4.1 Configuration Tested

The **Unisyn OVS 2.0.A.2** as declared in the application for certification submitted to the EAC, consists of:
- An EMS workstation.
- At the precinct level, optical scanners (OVO) and ballot marking devices (OVI-VC and FVT).

- The central count location employs a high speed COTS scanner OVCS for tabulation of absentee ballots.
- The consolidation, tally and reporting location employs a workstation as well as a printer.

2.4.2 Testing Performed

System level test suites included the following:

o **General Election, Pennsylvania Straight Party Method**

This is a General election that included N of M voting, partisan offices, non-partisan offices, Pennsylvania straight party method voting (utilizing "Conduct Directive Att C - Pennsylvania Method", ballot formatting, precincts and districts, and precinct level voting on the OVI-VC, FVT, OVO and OVCS as well as tally and reporting functionality.

Regression testing of fixes included verifying that performing multiple commits result in accurate recording and reporting of vote data, as well as that the extracted barcode area is significantly increased, such that the area being utilized to determine front versus back side of a sheet will be adequate for making the determination.

3 Test Summary and Recommendation

3.1 Summary

Modification testing of the **Unisyn OVS 2.0.A.2** voting system was successfully completed. All aspects of the system under examination, as per the accepted test plan, met the criteria of the VVSG 1.0.

3.1.1 Source Code Review Summary

Source code review for each application in the **Unisyn OVS 2.0.A.2** voting system was completed and determined the code's compliance with the VVSG 2005, Vol. 1 Sections 5, 9 and Vol. 2 Section 5.4 and for compliance with **Unisyn**'s internally developed coding standards.
No anomalies or deficiencies were found during source code review.

3.1.2 Technical Data Package Review Summary

SLI has reviewed the *Unisyn OVS 2.0.A.2* TDP for compliance with the VVSG 2005 Vol. 2 Section 2. Two documents were updated for the 2.0.A.2 release.

The modifications implemented for the Technical Data Package for the **Unisyn OVS 2.0.A.2** voting system was found to sufficiently comply with the standards.
No anomalies or deficiencies were found during TDP documentation review.

3.1.3 Functional Testing Summary

SLI performed tests on the system configuration identified above. The testing incorporated an end-to-end election scenario testing the functionality updated to satisfactorily implement the fixes defined in the test plan.

3.1.3.1 Evaluation of Testing

The following test suites were executed:

General Election, Pennsylvania Straight Party Method

> The execution of the General election exhibited the expected behavior of the system, with all expected results matching actual results.

Regression Testing

> The algorithm utilization modification was tested against the following requirements:

- 2.1.2.c Accuracy – Record each voter precisely as indicated by the voter and produce an accurate report of all votes cast
- 2.4.3.d Producing Reports – Produce a consolidated printed report of the results for each contest of all votes case that includes the votes cast for each selection, the count of undervotes and the count of overvotes.

Testing verified that performing multiple commits resulted in accurate recording and reporting of vote data.

The extracted barcode area modification, which is used to detect front and back barcodes on ballots, will be tested against the following requirement:

- 2.4.2 Consolidating Vote Data – All systems shall provide a means to consolidate vote data from all polling places, and optionally from other sources such as absentee ballots, provisional ballots, and voted ballots requiring human review (e.g., write-in votes)

Testing verified that the extracted barcode area is significantly increased, such that the area being utilized to determine front versus back side of a sheet will be adequate for making the determination.

The above tests were successfully conducted using the executables delivered in the final Trusted Build, in association with the appropriate hardware versions as declared in this Test Report for the **Unisyn OVS 2.0.A.2** voting system. The issues being addressed were successfully resolved.
No new anomalies or deficiencies were found during testing.

3.2 Recommendation

Testing of the **Unisyn OVS 2.0.A.2** voting system was successfully completed.

This recommendation reflects the opinion of SLI Compliance based on testing scope and results. It is SLI's recommendation based on this testing effort that the EAC grant certification of the **Unisyn OVS 2.0.A.2** voting system.

4   Approval Signatures

SLI:

VSTL Director
November 15th, 2018

End of Certification Test Report