Certification Test Report - Modification

Report Number *HRT-18001-CTR-01*

Hart InterCivic Verity Voting 2.2.2

Modification Certification Test Report version 1.1

April 16th, 2018

Prepared for:

Vendor Name	*Hart InterCivic Inc. (Hart)*
Vendor System	*Verity Voting 2.2.2*
EAC Application No.	HRT-Verity-2.2.2
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Accredited by the National Institute of Standards and Technology (NIST) National Voluntary Lab Accreditation Program (NVLAP), and accredited by the Election Assistance Commission (EAC) for VSTL status.

Revision History

Release	Author	Revisions
v1.0	M. Santos	Initial Release; submitted to EAC for approval
v1.1	M. Santos	Updates 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 SLI opinions or interpretations included in this report beyond the final recommendation.

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1 Introduction

SLI Compliance is submitting this test report as a summary of the certification testing efforts for the **Hart Verity Voting 2.2.2** system, a modified system from **Verity Voting 2.2.1**, as detailed in the section System Identification. Versions 2.2.1 and 2.2.2 are both modifications of Verity Voting 2.0. The purpose of this document is to provide an overview of the certification testing effort and the findings of the testing effort for the **Hart Verity Voting 2.2.2** system.

This effort included documentation review of the Technical Data Package, source code review, and testing of the **Hart Verity Voting 2.2.2** voting system**.** Testing consisted of the development of a test plan, managing system configurations, component and system level tests prepared by SLI, and analysis of results. The review and testing was performed at SLI's Denver, Colorado facility.

1.1 References

1. Election Assistance Commission Voluntary Voting System Guidelines version 1.0 (EAC VVSG 1.0), Volumes I & II
2. NIST NVLAP Handbook 150: 2006
3. NIST NVLAP 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. EAC Voting System Test Laboratory Program Manual, United States Election Assistance Commission, v 2.0, May 2015
6. SLI VSTL Quality System Manual, v 2.2, prepared by SLI, Sept. 2016

1.2 Document Overview

This document contains:
- The "Introduction", which discusses the applications tested/reviewed.
- The "Certification Test Background", which discusses the testing process.
- The "System Identification", which identifies hardware and software for the **Hart Verity Voting 2.2.2** system.
- The "System Overview", which discusses the functionality of **Hart Verity Voting 2.2.2** system software and firmware.
- The "Certification Tests Results and Summary", which is a summary of the testing effort.
- The "Recommendations" section, which contains the final analysis of the testing effort.
- "EAC Certification & Voting System Configuration", which summarizes the voting system configuration.

- *Attachments as follows:*
  - o Attachment A – Warrant of Change Control for Verity Voting 2.2.2
  - o *Attachment B - Verity Voting 2.2.2 Attestation of Durability*
  - o *Attachment C - Verity Voting 2.2.2 Attestation of Integrity*
  - o *Attachment D - Attestation of Production Hardware and Software for Verity Voting 2.2.2*
  - o *Attachment E - Record of Trusted Build for Verity Voting 2.2.2*
  - o *Attachment F - Modification of Certified System Analysis Summary Verity 2.2.2*
  - o *Attachment G – As Run Hart Verity 2.2.2 EAC Modification Test Plan v1.2*
  - o *Attachment H1 - HRT_C#_MSAllInOneStandard_SCRF*
  - o *Attachment H2 - HRT_C_&_C++_MSAllInOneStandard_SCRF*
  - o *Attachment I – List of Source Code Reviewed and Results*

2 Certification Test Background

This section provides a brief overview of the EAC Certification Program and the activities involved in order for a voting system to be considered for certification against the VVSG 1.0 and the current EAC program manuals.

2.1 PCA - Document and Source Code Reviews

The Physical Configuration Audit (PCA) review of the **Hart Verity Voting 2.2.2** documentation, submitted in the requisite Technical Data Package (TDP), was performed in order to verify conformance with the VVSG 1.0. Source code was reviewed for each software and firmware application declared within the **Verity Voting 2.2.2** voting system. As this is a modification test campaign, the source code was compared against the final code base of **Verity Voting 2.2.1**, and changes were subject to review.

All PCA reviews were conducted in accordance with *Volume II Section 2* of the VVSG 1.0, to demonstrate that the system meets the requirements. Results of the PCA documentation review can be found in section 5.2 of this Certification Test Report.

All PCA source code reviews were conducted in accordance with *Volume I Section 5.2 and Volume II Section 5* of the VVSG 1.0, to demonstrate that the system meets the requirements. Results of the PCA source code reviews can be found in *Attachment I – List of Source Code Reviewed and Results*. Inconsistencies or errors in the source code were identified to Hart for resolution or comment. Additional details of the source code review criteria can be found in *Attachments H1-H2*.

2.2 FCA - Functional & System Testing and Sampling

The Functional Configuration Audit (FCA) review of the test documentation submitted by Hart in the TDP was reviewed in order to verify testing of the voting system.

SLI's standard Test Suites were customized for the **Hart Verity Voting 2.2.2** voting system and conducted in accordance with *Volume II Section 6 of the VVSG 1.0*. Simulations of elections were conducted to demonstrate a beginning-to-end business use case process for the **Hart Verity Voting 2.2.2** voting system.

2.2.1 Test Methods

All test methods employed are within the scope of SLI's VSTL accreditation.

The following validated test methods were employed during this test campaign:

Table 1 – Test Methods

SLI VSTL Test Method Name
TM_Accuracy v1.0
TM_Basic_Election_Components v1.1
TM_Ballot Formatting and Production v1.1
TM_Maintainability v1.1
TM_Tally_and_Reporting v1.1
TM_Voting_Capabilities v1.3

The above listed test methods are implemented in a complementary fashion: modules are employed from various methods to form suites. Suites included the logical sequence of functionality that was used to validate the requirements addressed by each module within the suite. Please see Table 3 - Terms and Abbreviations below for additional information about Test Modules and Test Suites.

- • ***Deviations from, to, or exclusions from the test methods***
  The test methods listed in Table 1 above, contain the requirements listed in section 4.6 below. The established and validated test methods did not have any deviations. Test cases utilizing those methods were selected and grouped into test suites to validate the requirements in section 4.6.

2.2.2 Terms and Abbreviations

This section details pertinent terms applicable within this report.

Table 2 – Terms and Abbreviations

Term	Abbreviation	Description
Ballot Marking Device	BMD	An accessible computer-based voting system that produces a marked paper ballot that is the result of voter interaction with visual or audio prompts.
Cast Vote Record	CVR	Record of all selections made by a single voter whether in electronic or paper. Also referred to as a ballot image when used to refer to electronic ballots.
Central Count Scanner	CCS	High Speed Digital Scanner is a ballot scanning device typically located at a central count facility and is operated by an automated multi-sheet feeding capability.
Chevron (Arrows at top of current screen)	No Abbreviation	Verity software applications are organized around easy-to-follow workflows, with specific activities associated with "chevrons" or "arrows" in the application user interface.
Compact Flash card	CF	This is a type of flash memory card in a standardized enclosure often used in voting systems to store ballot and/or vote results data.
Compact Flash AST	CFAST	A compact flash media based on the Serial ATA bus rather than the Parallel ATA bus, used by the original Compact Flash.
Commercial Off the Shelf	COTS	Commercial, readily available hardware devices (such as card readers, printers or personal computers) or software products (such as operating systems, programming language compilers, or database management systems).
Election Assistance Commission	EAC	An independent, bipartisan commission created by the Help America Vote Act (HAVA) of 2002 that operates the federal government's voting system certification program.
Election Management System	EMS	Typically utilizes a database management system to enter jurisdiction information (district, precincts, languages, etc.) as well as election specific information (races, candidates, voter groups (parties), etc.). In addition, the EMS is also used to lay out the ballots, download the election data to the voting devices, upload the results and produce the final results reports.

Term	Abbreviation	Description
Electromagnetic Compatibility	EMC	The goal of EMC is to validate the correct functioning of different equipment in the same environment and the avoidance of any interference effects between them.
Functional Configuration Audit	FCA	Exhaustive verification of every system function and combination of functions cited in the vendor's documentation. The FCA verifies the accuracy and completeness of the system's Voter Manual, Operations Procedures, Maintenance Procedures, and Diagnostic Testing Procedures.
National Institute of Standards and Technology	NIST	A non-regulatory federal agency within the U.S. Dept. of Commerce. Its mission is to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve our quality of life.
National Voluntary Laboratory Accreditation Program	NVLAP	A division of NIST that provides third-party accreditation to testing and calibration laboratories.
Physical Configuration Audit	PCA	The testing activities associated with the physical aspects of the system (hardware, documentation, builds, source code, etc.).
Primary – Closed	No Abbreviation	The Closed Primary election segregates each political party onto its own ballot, along with all pertinent non-political contests and referendums.
Primary - Open	No Abbreviation	The Open Primary election combines all political parties' contests onto a single ballot, along with all pertinent non-political contests and referendums.
Precinct Count Scanner	PCS	A precinct-count optical scanner is a mark sense-based ballot and vote counting device located at a precinct and is typically operated by scanning one ballot at a time.
Request For Information	RFI	A form used by testing laboratories to request, from the EAC, interpretation of a technical issue related to testing of voting systems.
Requirements Matrix	N/A	This is the matrix created by the EAC and maintained by SLI that traces the requirements to the various test modules and test methods.
Standard Lab Procedure	SLP	SLI's quality system documentation is made up of standard lab procedures (SLPs), which are procedures required to ensure a systematic, repeatable and accurate approach to voting systems testing and governing the actual performance of SLI's work.

Term	Abbreviation	Description
(Verity) Tab	No Abbreviation	Verity software applications are organized around easy-to-follow workflows and activities; a "Tab" provides specific activities associated with "chevron" workflows in the application user interface.
Voting Center	No Abbreviation	Typically, a convenient voting location that manages multiple ballot styles.
Technical Data Package	TDP	This is the data package that is supplied by the vendor and includes: Functional Requirements, Specifications, End-user documentation, Procedures, System Overview, Configuration Management Plan, Quality Assurance Program, and manuals for each of the required hardware, software, firmware components of each voting system.
Test Method	No Abbreviation	SLI proprietary documents which are designed to group sets of EAC VVSG requirements in a logical manner that can be utilized to efficiently validate where and how requirements, or portions of a requirement, are met.
Test Module	No Abbreviation	An actionable component of a Test Method, that functionally verifies that a requirement is met within a voting system. Test Modules are at a generic level within the Test Method, and are customized for a particular voting system, within a Test Suite.
Test Suite	No Abbreviation	An actionable grouping of test modules designed to test a set of functions of a voting system or component in a specific way.
Validation	No Abbreviation	Confirmation by examination and through provision of objective evidence that the requirements for a specific intended use or application have been fulfilled (ISO 9000).
Verification	No Abbreviation	Confirmation by examination and through provision of objective evidence that specified requirements have been fulfilled (ISO 9000).
Voluntary Voting Systems Guidelines Volumes I & II	VVSG	A set of specifications and requirements against which voting systems can be tested to determine if the systems provide all of the basic functionality, accessibility and security capabilities required of these systems.
Voting System Test Lab	VSTL	The accredited lab where the voting system is being tested.
Voting System Under Test	VSUT	The designation for a voting system that is currently being tested.

Term	Abbreviation	Description
Voting Test Specialist	VTS	An SLI Compliance employee who has been qualified to perform EAC voting system certification testing.

3 System Overview

3.1 Scope of the Hart Verity Voting 2.2.2 Voting System

This section provides a description of the scope of **Hart Verity Voting 2.2.2** voting system components:

- The **Hart Verity Voting 2.2.2** voting system represents a set of software applications for pre-voting, voting and post-voting election project activities for jurisdictions of various sizes and political division complexities. **Verity Voting 2.2.2** functions include:
  - o Defining the political divisioning of the jurisdiction and organizing the election with its hierarchical structure, attributes and associations.
  - o Defining the election events with their attributes such as the election name, date and type, as well as contests, candidates, referendum questions, voting locations and their attributes.
  - o Preparing and producing ballots for polling place and absentee voting or by-mail voting.
  - o Preparing media for precinct voting devices and central count devices.
  - o Configuring and programming the **Verity Scan** digital scanners.
  - o Configuring and programming the **Verity Touch Writer** BMD devices.
  - o Transmission of election results via **Verity Relay** (optional).
  - o Producing the election definition and auditing reports.
  - o Providing administrative management functions for user, database, networking and system management.
  - o Import of the Cast Vote Records from **Verity Scan** devices and **Verity Central**.
  - o Preview and validation of the election results.
  - o Producing election results tally according to voting variations and election system rules.
  - o Producing a variety of reports of the election results in the desired format.
  - o Publishing of the official election results. Auditing of election results including ballot images and log files.
- **Verity Scan** is a digital scan precinct ballot counter (tabulator) that is used in conjunction with an external ballot box. The unit is designed to scan marked paper ballots, interpret and record voter marks on the paper ballot and deposit the ballots into the secure ballot box.

- **Verity Relay** provides an optional remote transmission capability to the **Verity Voting 2.2.2** system. Utilizing an optional modem on **Verity Scan**, at close of polls, results are transmitted from the polling place device to the **Verity Relay** station.

- The **Verity Touch Writer** is a standalone precinct level Ballot Marking Device (BMD) which also includes an Audio Tactile Interface (ATI), which allows voters who cannot complete a paper ballot to generate a machine-readable and human readable paper ballot, based on vote selections made, using the ATI.

- **Verity Print** is an on-demand ballot production device for unmarked paper ballots.

- **Verity Election Management** allows users with the Administrator role to import and manage election definitions. Imported election definitions are available through the Elections chevron in Build. Users can also delete, archive, and manage the election definitions.

- **Verity User Manager** enables users with the correct role and permissions to create and manage user accounts within the **Verity Voting** system for the local workstation in a standalone configuration, or for the network in a networked configuration.

- **Verity Desktop** enables users, with the correct roles, to set the workstations' date and time, gather **Verity** application hash codes (in order to validate the correctness of the installed applications), and access to Windows desktop.

- **Verity Data** provides the user with controls for entering and proofing data and audio. **Verity Data** also performs validation on the exported information to ensure that it will successfully import into **Verity Build**.

- **Verity Build** opens the election to proof data, view reports, and print ballots, and allows for configuring and programming the **Verity Scan** digital scanners, and **Verity Touch Writer** BMD devices, as well as producing the election definition and auditing reports.

- **Verity Central** is a high-speed, central digital ballot scanning system used for high-volume processing of ballots (such as vote by mail). The unit is based on COTS scanning hardware coupled with custom **Hart-**developed ballot processing application software which resides on an attached work-station.

- **Verity Count** is an application that tabulates election results and generates reports. **Verity Count** can be used to collect and store all election logs from every **Verity** component/device used in the election, allowing for complete election audit log reviews.

3.1.1   Supported Languages

The **Hart Verity Voting 2.2.2** voting system supports English and Spanish.

3.2   Changes from Verity 2.2.1 to Verity 2.2.2

3.2.1 Modifications new to Verity 2.2.2

Verity Voting 2.2.2 is a modification of the EAC-certified **Verity Voting 2.2.1** system. Versions 2.2.1 and 2.2.2 are both modifications of the EAC-certified Verity Voting 2.0

The modifications to **Verity 2.2.2** addresses adding support for 8.5" x 20" ballots, support for uncommitted choices in a contest, and enhancements to touch screen device calibration procedures.

- ### *8.5" x 20" Ballot Support*

Support for 8.5" x 20" ballots is added throughout the Verity system.

- ### *Optimize Loading of an Election*

Optimizations have been made to the process of setting up an election in a device, prior to Open Polls.

- ### *Tablet Touchscreen Calibration Enhancement*

Touchscreen calibration is enhanced with the addition of an additional calibration confirmation point that must be pressed within 20 seconds to confirm the calibration. The addition of this screen prevents a bad or invalid calibration from being saved to the device.

- ### *Uncommitted Choices in a Contest*

This voting variation is the ability to create a ballot choice that is excluded from ballot rotation in a contest where other choices do rotate. This functionality is used in Presidential Primary elections. An "uncommitted" vote means:

> Each party ballot has a vote position for "uncommitted." When a voter selects "uncommitted," it indicates the voter is exercising a vote for that political party but is not committed to any of the candidates listed on the ballot. If enough voters cast "uncommitted" votes, the party may send delegates to the national nominating convention who are not committed to a specific candidate."

3.2.2 Impact to Verity 2.2.2

Verity Voting 2.2.2's modification for 8.5" x 20" ballot affects **Verity Data**, **Verity Build, Verity Touch Writer, Verity Print, Verity Scan** and **Verity Central**.

Verity Voting 2.2.2's modification for "Uncommitted Choices" affects **Verity Data**, **Verity Build, Verity Touch Writer, Verity Scan, Verity Central**, **Verity Count** and cast vote records, when an uncommitted choice is marked.

Verity Voting 2.2.2's modification for "Touch Screen Calibration" affects **Verity Build, Verity Touch Writer,** and **Verity Print**.

Verity Voting 2.2.2's modification for "Device Election Loading Optimization" affects **Verity Scan**, **Verity Touch Writer,** and **Verity Print**.

4 System Identification

The **Hart Verity Voting 2.2.2** voting system was submitted for certification testing with the documentation, hardware and software listed below. No other Hart product was included in this test effort.

4.1 System Topology Diagram
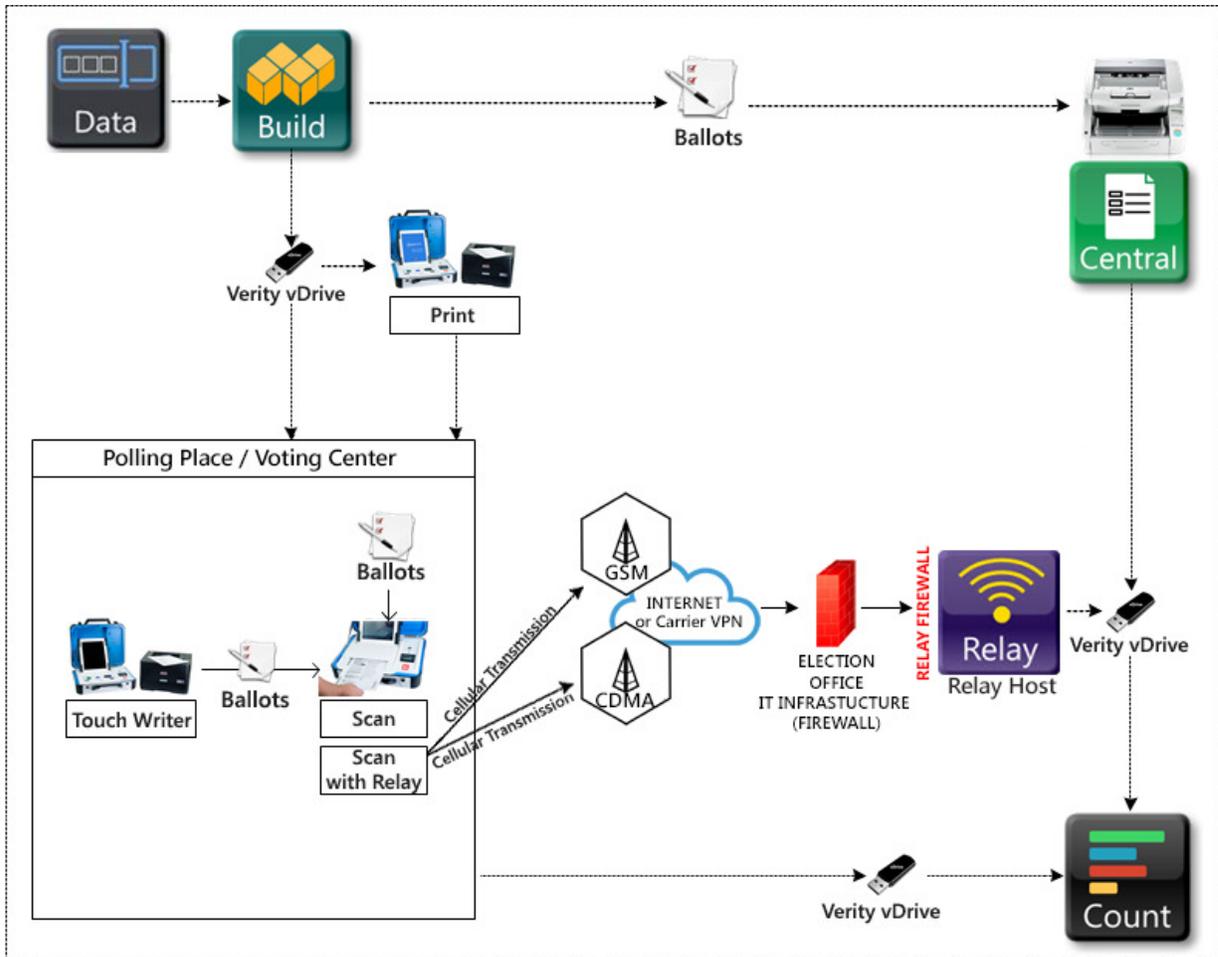
Overview of the diagram:
- The components are displayed as touch points of data access, transfers, and verification.
- Dotted lines show the flow of data and air gaps using **Verity vDrives**.
- **Verity vDrive** is media used for transportation of voting system data.
- **Verity Print** is a ballot production device that provides unmarked printed ballots.
- **Verity Touch Writer** and **Verity Scan** (**Verity Voting** devices) are used in any polling location.

- **Verity Key** (not shown) is required for user access into components to load election elections, use features, and generate reports. Feature access depends on the roles applied to user accounts.
- **Verity Relay** is a transmission option within the Verity Voting system.

4.2 Documentation

The TDP User/Owner manuals that are deliverables of the certified system delivered to a purchaser of the system are as follows:

- Verity Build Technical Reference Manual
- Verity Central Technical Reference Manual
- Verity Count Technical Reference Manual
- Verity Data Technical Reference Manual
- Verity Polling Place Operations Technical Reference Manual
- Verity Print Technical Reference Manual
- Verity Relay Technical Reference Manual
- Verity Service and Maintenance Operations Technical Reference Manual
- Verity Operational Guide
- Verity Count Technical Reference Supplement
- Verity Scan with Relay Technical Reference Supplement

4.3 Software and Firmware

Any and all software/firmware that is to be used by the declared voting system whether directly or indirectly, in a production environment, must be validated during the certification process.

The software and firmware employed by **Hart Verity Voting 2.2.2** 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 COTS software and firmware was either obtained directly from the 3rd party manufacturer, or was verified against digital signatures obtained from the 3rd party manufacturer. No modified COTS were implemented. For hardware, the hardware was either shipped directly from the 3rd party manufacturer, or the equipment was inspected to verify conformance to the 3rd party manufacturer's specifications.

Tables 3 and 4 below detail each application employed by the **Hart Verity Voting 2.2.2** voting system.

Table 3 – Hart Verity Voting 2.2.2 Software and Firmware

Manufacturer	Application(s)	Version
Verity Data	Ballot setup software – new build	2.2.2.31174
Verity Build	EMS software – new build	2.2.2.31174
Verity Central	High speed digital scanner software	2.2.2.31174

Manufacturer	Application(s)	Version
Verity Count	Central count location accumulation, tallying and reporting software – new build	2.2.2.31174
Verity Relay (Host)	Data transmission software (receiving station)	2.2.2.31174
Verity Scan	Digital scanner firmware – new build	2.2.2.31174
Verity Touch Writer	BMD firmware	2.2.2.31174
Verity Print	Printer firmware	2.2.2.31174
Verity Device Microcontroller	Firmware for Verity Devices	V17

Table 4 – COTS Software

Manufacturer	Application	Version	Verity Voting 2.2.2 Component
Microsoft	Microsoft Windows Embedded Standard 7 with Service Pack 1 – 64bit	6.1.7601	Data/Build, Data/Build + Count, Central, Count, Print, Relay, Scan, Touch Writer
Microsoft	Microsoft SQL Server 2012 for Embedded Systems	11.00.2100	Data/Build, Data/Build + Count, Relay, Central, Count
Microsoft	Microsoft SQL Server 2012 Express	11.00.2100	Print, Scan, Touch Writer,
McAfee	McAfee Application Control for Devices	6.1.1.369	Data/Build, Data/Build + Count, Central, Count, Relay, Print, Scan, Touch Writer
Microsoft	Windows Communication Foundation (WCF)	4.5	Relay host, Scan
Canon	DR-G1100 Scanner Driver	1.0.0.1	Verity Central
Canon	DR-G1130 Scanner Driver	1.0.0.1	Verity Central
OKIDATA	Universal Printer Driver	1.6.4.0	Verity Data, Verity Build, Verity Print, Verity Central, Verity Touch Writer and Verity Count
OKIDATA	B431d, B432dn Printer Driver	1.0.0.0	Verity Data, Verity Build, Verity Print, Verity Central, Verity Touch Writer and Verity Count
OKIDATA	C831dn Printer Driver	1.0.0.0	Verity Print, Verity Build

Manufacturer	Application	Version	Verity Voting 2.2.2 Component
OKIDATA	C911dn Printer Driver	1.0.3.0	Verity Print, Verity Build
MultiTech	MTD Series Modem Driver	8.00.04	Verity Scan with modem
TWAIN Working Group	Twacker 32 Scanner Driver	2.0.1	Verity Central

4.4 Equipment (Hardware)

The hardware employed by **Hart Verity Voting 2.2.2** consists of 2 types, custom and commercial off the shelf (COTS). COTS hardware was verified to be unmodified, or was subjected to review for analysis of any modifications and verification of meeting the pertinent standards.

Tables 5 and 6 below detail each device employed by the **Hart Verity Voting 2.2.2** voting system.

Table 5 – Hart Verity Voting 2.2.2 Custom Voting Equipment

Hardware	Use	Model	Revision
Verity Scan (digital scanner)	Precinct polling place digital scanner	3005368	Revision C
Verity Scan optional cellular modem kit	Precinct polling place digital scanner with modem	3005143	Revision A
Verity Touch Writer (BMD)	Precinct polling place Ballot Marking Device	3005352	Revision C
Verity Print	Ballot production device	3005356	Revision C
Verity Key	Security key, in the form of a USB dongle, used within the voting system	N/A	N/A
Verity vDrive	Media, in the form of a USB thumb drive, used for transportation of voting system data	N/A	N/A

Table 6 – Hart Verity Voting 2.2.2 COTS Equipment

Manufacturer	Hardware	Model
OKIDATA (for **Verity Data, Verity Build**, **Verity Print, Verity Central, Verity Touch Writer** and **Verity Count**)	Ballot and Report Printer	B432dn
OKIDATA (for **Verity Print, Verity Build**)	Ballot Printer	C831dn
OKIDATA (for **Verity Print, Verity Build**)	Ballot Printer	C911dn
OKIDATA (for **Verity Count**)	Report Printer	ML-1121
Eaton	UPS for Verity Touch Writer printer	5P1500
PC Workstation - Various (for **Verity Data, Verity Build**, **Verity Central** and **Verity Count**)	Minimum Requirements: Processor – Intel Core i7-4790 3.6 8M GT2 4C CPU Memory – 32GB DDR3-1600 nECC (4x8GB) RAM Hard Drive – 2x1 TB RAID-Level 1, Removable w/ key lock USB Ports – 4 ports Video Card - Integrated Graphics Keyboard - USB Keyboard Mouse - USB Mouse	
PC Display - Various (for **Verity Data, Verity Build**, **Verity Central** and **Verity Count**)	**Monitor (Minimum Requirements)** Panel Size - 50.8 cm Aspect Ratio - Widescreen (16:9) Optimal Resolution - 1600 x 900 at 60Hz Contrast Ratio - 1000: 1 Brightness - 250 cd/m2 (typical)	
Canon (for **Verity Central**)	Ballot Scanner	DR-G1100
Canon (for **Verity Central**)	Ballot Scanner	DR-G1130
QuickCarrier® USB-D by MultiTech Systems cellular modem	Aeris cellular modem	MTD-EV3-N16
QuickCarrier® USB-D by MultiTech Systems cellular modem	Sprint cellular modem	MTD-EV3-N2
QuickCarrier® USB-D by MultiTech Systems cellular modem	Verizon cellular modem	MTD-EV3-N3
QuickCarrier® USB-D by MultiTech Systems cellular modem	Global (AT&T, T-Mobile, etc…) cellular modem	MTD-H5-2.0

4.5 Test Materials

The following test materials are required for the performance of testing including, as applicable, test ballot layout and generation materials, test ballot sheets, and any other materials used in testing.

- Ballots & Blank Ballot grade paper
- Thumb Drives
- USB Dongle
- Ballot marking pens
- Printer paper rolls

4.6 Requirements

4.6.1 VVSG Requirements

The **Verity Voting 2.2.2** modifications were tested to applicable 2005 VVSG 1.0 requirements. This section details the requirements reviewed for **Verity Voting 2.2.2**.

Verity Voting 2.2.2's modification for 8.5" x 20" ballot affect the following pertinent VVSG requirements:

- 2.1.6 (bullets 3,4,5)
- 2.2.1.2.b

Verity Voting 2.2.2's modification for "Uncommitted Choices" affects affect the following pertinent VVSG requirements:

- 2.1.2.c
- 2.1.7.1.c
- 2.1.7.2 (bullet 7)
- 2.3.3.1.c
- 2.3.3.2.a,b

Verity Voting 2.2.2's modification for "Touch Screen Calibration" affects **Verity Build, Verity Touch Writer, Verity Print** and **Verity Touch**.

- 4.3.4 (bullet 2)

Verity Voting 2.2.2's modification for "Device Election Loading Optimization" affects **Verity Scan, Verity Touch Writer, Verity Print** and **Verity Touch**.

- 2.2.3.b

4.7 Hart State Specific Modification Requirements

Pertinent Hart requirements, with Hart internal numbering are:

8.5"x20" ballot support

Data

- 4.1.1.1 Data shall support selecting this paper size on the Select Templates screen.
- 4.1.1.2 Data shall support displaying this paper size on the ballot preview screen.
- 4.1.1.3 Data shall support this paper size in ballot layout validation.
- 4.1.1.4 If stubs are included when this paper size is selected:
    - o 4.1.1.4.1 If Number of Stubs is 2, each stub's height shall be 1".
    - o 4.1.1.4.2 If Number of Stubs is 1, the stub height shall be 2".

Build

- 4.1.2.1 Build shall support displaying this paper size on the ballot preview screen.
- 4.1.2.2 Build shall support printing this paper size from the Print Ballots screen.
- 4.1.2.3 Build shall support this paper size in ballot layout validation.

Central

- Central shall support scanning 8.5"x20" ballots
- Central shall support displaying 8.5"x20" ballots for review
- Central shall support printing images from 8.5"x20" ballots
- Central shall support exporting images from 8.5"x20" ballots

Devices

- 4.1.4.1 Scan shall support scanning 8.5"x20" ballots
- 4.1.4.2 Touch Writer and Print shall support printing 8.5"x20" ballots

Uncommitted Choices

General

- 4.2.1.1 The system shall allow an uncommitted choice to be added to a contest if:
- 4.2.1.1.1 The contest type is "Office"
- 4.2.1.1.2 The election type is "Closed Primary" or "Open Primary"

Verity Data

- 4.2.2.1 Contest entries on the Contests screen shall include a checkbox indicating whether an uncommitted choice should be added to this contest:
    - o 4.2.2.1.1 This checkbox shall only appear if the contest is allowed to have an uncommitted choice.
    - o 4.2.2.1.2 By default, this option shall be unchecked.
- 4.2.2.2 The All Contests report shall include an uncommitted choice in contests that have an uncommitted choice.
- 4.2.2.3 The Contests Import shall include a field for indicating if an uncommitted choice is included:
    - o 4.2.2.3.1 The import functionality shall validate that the contest is allowed to have an uncommitted choice.

- 4.2.2.4 The Contests Export shall include a field for indicating if an uncommitted choice is included.
- 4.2.2.5 Uncommitted choices shall be included on the Rotation Report.
- 4.2.2.6 The Data Validation that ensures there are not more valid choices than ballot choices shall be modified to account for uncommitted choices.
- 4.2.2.6.1 This Data Validation shall return an error if the number of choices + the uncommitted choice + the number of write-ins is less than the Number of Valid. Choices.

Election Definition

- 4.2.3.1 The election definition shall include data indicating whether a contest includes an uncommitted choice.

Election Management

- 4.2.4.1 The unsigned export shall include data indicating whether a contest includes an uncommitted choice.
- 4.2.4.2 The signed export shall include data indicating whether a contest includes an uncommitted choice.
- 4.2.4.3 The archive format shall include data indicating whether a contest includes an uncommitted choice.

Ballot Layout (Paper, Electronic, and Electronic Preview)

- 4.2.5.1 If a contest includes an uncommitted choice:
  - o 4.2.5.1.1 Ballots shall include an uncommitted choice in this contest
    - ▪ 4.2.5.1.1.1 The Choice Name for all uncommitted choices shall be "Uncommitted".
    - ▪ 4.2.5.1.1.1.1 This choice name shall have audio and translations for all languages.
  - o 4.2.5.1.2 The uncommitted choice shall always appear after the ballot choices and before any write-in lines, regardless of whether rotation is applied.
    - ▪ 4.2.5.1.2.1 This Choice shall NOT have a party affiliation.
    - ▪ 4.2.5.1.2.2 This Choice shall NOT have any additional text.

Cast Vote Records

- 4.2.6.1 Cast Vote Records shall include uncommitted choices when they are marked.

Verity Device Reports

- 4.2.7.1 For any contest that includes an uncommitted choice subtotals for the uncommitted choice shall appear after the ballot choices and before any write-in data, regardless of whether rotation is applied to the report.

Verity Central

- 4.2.8.1 Verity Central shall treat the uncommitted choice the same way it treats any other choice.

Verity Count

- 4.2.9.1 For any contest that includes an uncommitted choice subtotals for the uncommitted choice shall appear after the ballot choices and before any write-in data, regardless of whether rotation is applied to the report.
- 4.2.9.2 The Detailed Vote Totals Export shall include rows for uncommitted choice subtotals in all contests where an uncommitted choice exists.
- 4.2.9.3 Uncommitted choices shall always appear after the ballot choices and before any write-in entries in the Vote Recording wizard.

5 Certification Test Results Summary

5.1 Source Code Review Summary

SLI reviewed the software source code for each application in the **Hart Verity Voting 2.2.2** voting system to determine the code's compliance with Volume I Sections 5, 9 and Volume II Section 5.4 of the VVSG 1.0 and for compliance with **Hart'**s internally developed coding standards. **Verity Voting 2.2.2** is implemented with the C, C++ and C# languages. Results of the source code review are detailed in *Attachment I – List of Source Code Reviewed and Results*.

5.1.1 Evaluation of Source Code

The source code was reviewed for compliance per the guidelines defined in *Volume II, Section 5.4* of the VVSG 1.0. As a modification project, the **Verity Voting 2.2.2** code base was reviewed using the final **Verity Voting 2.2.1** code base as the initial drop, to which the initial **Verity Voting 2.2.2** code base was compared. The differences found between those two code bases served as the starting point of the code review. The source code was found to be in compliance with the terms of the VVSG 1.0, and Hart declared industry standards.

5.2 Technical Data Package Review Summary

SLI reviewed the **Hart Verity Voting 2.2.2** TDP, as detailed in sections 3.1 and 3.4, for compliance according to *Volume II Section 2* of the VVSG 1.0.
The review was conducted for the required content and format of:

- **System Change Notes:** Changes to certified system **Verity Voting 2.2.1.**
- **System Test and Verification Specifications:** Development and certification test specifications that **Hart** applied to their testing efforts.
- **Application Usability Impact statement**: Updated for Verity 2.2.2.
- **Performance Characteristics:** Updated to add support for 8.5" x 20" ballots.
- **System Description:** Updated to add support for 8.5" x 20" ballots.
- **Verity System Limits:** Updated to add support for 8.5" x 20" ballots.
- **Verity Operational Environment:** Updated to new OKIDATA B431d/B432dn driver
- **Verity COTS List**: Updated to account for de minimis changes executed between Verity 2.2.1 and Verity 2.2.2 certification campaigns.
- **Verity Data Technical Reference**: Updated to add support for 8.5" x 20" ballots.

- **Verity Build Technical Reference Manual**: Updated to add support for 8.5" x 20" ballots.
- **Verity Central Technical Reference Manual**: Update to add support for 8.5" x 20" ballots.
- **Verity Count Technical Reference Manual**: Update Information Security Policy and block diagram.
- **Verity Service and Maintenance Operations Technical Reference Manual**: Add clarity to COTS scanner cleaning procedures.

5.2.1 Evaluation of TDP

The Technical Data Package for the **Hart Verity Voting 2.2.2** voting system was found to comply with the standards. A jurisdiction would be able to deploy the **Hart Verity Voting 2.2.2** voting system using the TDP.

5.3 Hardware Testing

No hardware testing was conducted for this test campaign.

5.4 Known Vulnerabilities Testing

Hart Verity Voting 2.2.2 is a modification of the **Verity Voting 2.2.1** and **Verity Voting 2.2**.

There are no known vulnerabilities to the **Verity Voting** system family (**Verity Voting 1.0, Verity Voting 2.0, Verity Voting 2.2** and **Verity Voting 2.2.1**), at this time.

Review of the "Known Vulnerabilities" database, maintained by SLI, has provided 14 known vulnerabilities to previous Hart (non-Verity, rather HVS 6.2.1) systems already accounted for in SLI's Test Methods.

5.5 Functional Testing Summary

Functionality was tested as identified below for the **Verity Voting 2.2.2** system.

5.5.1 How Each Device was Tested

- *Verity Scan*
    - ○ **Verity Scan** is a standalone precinct level scanning device. It accepts and records votes from voter hand marked ballots, as well as from **Verity Touch Writer** marked ballots. Data from the votes cast is stored in a **Verity vDrive** and transported to central count locations for accumulation and tallying in **Verity Count**. In this release, **Verity Scan** with optional modem provides the capability to also transmit election results data over a cellular modem, to the Relay workstation.
    - ○ **Verity Scan** was tested first as an individual component in order to verify that it works as documented, with media and data produced by **Verity Build**. All documented features were tested, and all functional features were verified to be documented. This included election data being stored on the **Verity vDrive**, as well as being transmitted to **Verity Relay**.

- o **Verity Scan** was also tested as an integrated piece of the voting system in several different system level test suites, where it inputs media and data produced in **Verity Build**, then accepts user marked ballots as well as **Verity Touch Writer** machine marked ballots within the polling place, prior to producing all defined output media.

- *Verity Print*
  - o **Verity Print** is a standalone ballot production device for poll worker use. Once the ballot is printed and marked, the voter can cast the ballot through **Verity Scan** or through **Verity Central**.
  - o **Verity Print** was tested as an integrated piece of the voting system, in several different system level test suites, where it accepted user input instructions, prior to producing ballots which were then marked and cast through both **Verity Scan** and **Verity Central**.

- *Verity Touch Writer*
  - o **Verity Touch Writer** is a standalone precinct level ballot marking device. It assists voters in marking their ballot and prints it out for them. Once the ballot is printed, **Verity Touch Writer** erases all memory components of that session.
  - o **Verity Touch Writer** was tested as an integrated piece of the voting system, in several different system level test suites. The tests verified that it accepted voter selections, and produced marked ballots that mirrored the voter's intent.

- *Verity vDrive*
  - o **Verity vDrive** is a Verity memory device. It carries information from **Verity Build** to each of the components within the **Verity** system during the pre-voting phase of an election. On Election Day data from the votes cast in **Verity Scan,** and **Verity Central** as well as those transmitted to **Verity Relay,** and are stored in a **Verity vDrive** and transported to **Verity Count** for accumulation and tallying.
  - o **Verity vDrive** was tested as an integrated piece of the voting system where it inputs **Verity Build** produced media and data, then accepts and transports cast vote record data and ballot images from the polling place to **Verity Count**.

- *Verity Key*
  - o **Verity Key** is a **Verity** security device. It carries security information from **Verity Build** to each of the components within the **Verity** system.
  - o **Verity Key** was tested as an integrated piece of the voting system, where it is utilized for authorizing loading election information onto **Verity Touch Writer, Verity Print, Verity Relay, Verity Scan** and **Verity Central**, as well as accumulating vote data into **Verity Count**.

5.5.2 How each Application was Tested

- *Verity Relay*
  - **Verity Relay** provides a remote transmission capability to the **Verity Voting 2.2.2** system. Utilizing an optional modem on **Verity Scan**, at close of polls, results are transmitted from the polling place device to the **Verity Relay** workstation.
  - **Verity Relay** was tested as an integrated piece of the voting system where it inputs media and data produced in **Verity Build**, then accepts transmitted data from **Verity Scan** devices, transferring data to **Verity vDrives**, which are input into **Verity Count** for accumulation and tallying.

- *Verity Data*
  - **Verity Data** accepts imported election data and produces contests, choices, precincts, districts, ballots, and all other data needed to accept an election in **Verity Build.**
  - **Verity Data** was also tested as an integrated piece of the voting system where it outputs election data to be used by **Verity Build.**

- *Verity Build*
  - **Verity Build** accepts imported election information and produces ballots, election information, **Verity vDrives** and **Verity Keys**.
  - **Verity Build** was tested as an integrated piece of the voting system where it outputs media and data (via **Verity Key** and **Verity vDrive**), which feed into **Verity Print, Verity Touch Writer**, **Verity Scan**, **Verity Relay, Verity Central** and **Verity Count**.

- *Verity Central*
  - **Verity Central** is a central count location system that utilizes high speed scanners to scan large volumes of voted ballots, which are recorded onto a **Verity vDrive** for transportation to **Verity Count** for accumulation and tallying.
  - **Verity Central** was tested first as an individual component in order to verify that all declared functionality is present and working as documented. All functional features were tested and verified to be correctly documented.
  - **Verity Central** was tested as an integrated piece of the voting system where it inputs media and data produced in **Verity Build**, then accepts user marked ballots as well as **Verity Print**, **Verity Touch Writer** ballots, prior to producing all defined output medias.

- *Verity Count*
  - **Verity Count** is the **Verity** application used for accumulation and tallying of voted ballots, transported via **Verity vDrive**, from **Verity Scan** and **Verity Central**.
  - **Verity Count** was tested first as an individual component in order to verify that all declared functionality is present and working as documented. All functional features were tested and verified to be correctly documented.

o **Verity Count** was also tested as an integrated piece of the voting system where it inputs media and data produced in **Verity Build**, then accepts **Verity vDrive** data from **Verity Scan** and **Verity Central**, prior to tabulating results and producing all defined output reports.

5.5.3 Test Suites Utilized

The following test suites were executed:

- *Verity Data/Build Test Suite*

Functionality present in **Verity Data/Build** was verified to work as documented, and functionality is appropriately documented.

This test covered **Verity Data/Build** and focused on functionality within the application.

This test was completed without issue, and each device and application passed the tests in this suite.

- *Verity Central Test Suite*

All functionality present in **Verity Central** was verified to work as documented, and all functionality is appropriately documented.

This test covered **Verity Central** and focused on functionality within the application.

This test was completed without issue, and each device and application passed the tests in this suite.

- *Verity Count Test Suite*

Functionality present in **Verity Count** was verified to work as documented, and functionality is appropriately documented.

This test covered **Verity Count** and focused on functionality within the application.

This test was completed without issue, and each device and application passed the tests in this suite.

- *Verity Touch Writer Test Suite*

Functionality, including administrative, and maintenance options, present in **Verity Touch Writer**, including the 8.5"x20" ballot and uncommitted choices voting variation, was verified to work as documented, and functionality is appropriately documented.

This test was completed without issue, and each device and application passed the tests in this suite.

- *Verity Print*

Functionality, including administrative, and maintenance options, present in **Verity Print**, including the 8.5"x20" ballot and uncommitted choices voting variation, was verified to work as documented, and functionality is appropriately documented.

This test was completed without issue, and each device and application passed the tests in this suite.

- *Verity Scan with Optional Modem Test Suite*

Functionality, including administrative, and maintenance options, present in **Verity Scan with optional modem**, including the 8.5"x20" ballot and uncommitted choices voting variation, was verified to work as documented, and all functionality is appropriately documented.

This test was completed without issue, and each device and application passed the tests in this suite.

- *General Election Test Suite*

The focus of this suite was validating N of M voting, Partisan offices, Non-Partisan Offices, Ballot Rotations, Write-Ins, Ballot Formatting, precincts and split precincts, Tally and Reporting functionality, as well including the 8.5"x20" ballot and uncommitted choices voting variation.

This test covered **Verity Election Management, Verity Data, Verity Build**, **Verity Print, Touch Writer**, **Verity Scan** with optional modem, **Verity Relay**, **Verity Central** as well as **Verity Count**. Vote counts were accumulated from both **Verity Central** and **Verity Scan** into **Verity Count**.

This test was completed without issue, and each device and application passed the tests in this suite.

- *Closed Primary Test Suite*

The focus of this suite was an election designed to conform to a Closed Primary election with N of M voting, Partisan offices, Non-Partisan Offices, Ballot Formatting, precincts and split precincts, including the 8.5"x20" ballot and uncommitted choices voting variation, as well as Tally and Reporting functionality.

This test covered **Verity Election Management, Verity Data, Verity Build**, **Verity Print, Verity Scan, Verity Central** as well as **Verity Count**. Vote counts were accumulated from both **Verity Central** and **Verity Scan** into **Verity Count**.

This test was completed without issue, and each device and application passed the tests in this suite.

- *Open Primary Test Suite*

The focus of this suite was an election designed to conform to an Open Primary election with focus on validating primary presidential delegation nominations, N of M voting, Partisan offices, Non-Partisan Offices, Ballot Formatting, precincts and split precincts, including the 8.5"x20" ballot and uncommitted choices voting variation, as well as Tally and Reporting functionality.

This test covered **Verity Election Management, Verity Data, Verity Build, Verity Scan**, **Verity Central** as well as **Verity Count**. Vote counts were accumulated from both **Verity Central** and **Verity Scan** into **Verity Count**.

This test was completed without issue, and each device and application passed the tests in this suite.

5.6 Evaluation of Testing

The above tests were successfully conducted using the executables created in the final Trusted Build, in association with the appropriate hardware versions as declared in this Test Report for the **Hart Verity Voting 2.2.2** voting system.

No issues were found during functional testing. This resulted in only 1 Trusted Build being required.

5.7 Quality Assurance and Configuration Management Audits

The review process verified that the manufacturer has written processes and procedures for Quality Assurance and Configuration Management. The processes and procedures were implemented within the software development life cycle used to produce the **Hart Verity Voting 2.2.2** system.

Coverage of tests employed by **Hart** was deemed satisfactory for meeting the requirements of the VVSG 1.0, as well Hart internal requirements for state specific feature implementations.

The CM portion of the review focused on the organization's understanding and implementation of the declared configuration management processes, procedures and policies. Deliverables were reviewed against all pertinent CM processes employed by **Hart**.

Implementation of the **Hart** configuration processes was adequately documented and followed throughout the course of the **Verity Voting 2.2.2** project, and no issues were encountered.

5.8 Discrepancies Found During Testing

Discrepancies found fall into 4 major categories, Hardware, Documentation, Source Code, and Functional. Hardware discrepancies are issues that occur specifically in the hardware arena, and are usually found during the hardware testing phase. Documentation discrepancies are issues that occur during the PCA documentation (TDP) review phase and are issues that are resolved by updates to the documentation. Source Code discrepancies are issues that occur during source code review and are issues that must be fixed in the source code prior to the Trusted Build. Functional discrepancies are issues that occur during functional testing and can be related to any software or firmware within the system. Functional discrepancies often lead to source code modifications, additional source code review and an additional Trusted Build.

5.8.1 Documentation Discrepancies

No documentation discrepancies were written during this campaign

5.8.2 Source Code Discrepancies

11 source code discrepancies were written during this campaign, all were satisfactorily resolved.

5.8.3 Hardware Discrepancies

No hardware discrepancies were written during this campaign.

5.8.4 Functional Discrepancies

No functional discrepancies were encountered during this campaign.

5.9 Deficiencies Resolution

SLI has determined that there are no unresolved deficiencies against the requirements tested.

6 Recommendations

SLI has successfully completed the testing of the **Hart Verity Voting 2.2.2** voting system. It has been determined that the **Verity Voting 2.2.2** voting system meets the required acceptance criteria of the Election Assistance Commission Voluntary Voting System Guidelines 1.0 (2005).

It is SLI's recommendation that the EAC grant certification of **Hart Verity Voting 2.2.2** voting system. This recommendation reflects the opinion of SLI Compliance based on the testing scope and results.

SLI:

Traci Mapps
Director
April 16th, 2018