# Certification Test Report - Modification

**Report Number** *HRT-16009-CTR-01*

## Hart InterCivic Verity Voting 2.2

### Modification Certification Test Report version 1.0

**October 21st, 2016**

Prepared for:

| | |
|---|---|
| **Vendor Name** | *Hart InterCivic Inc.* |
| **Vendor System** | *Verity Voting 2.2* |
| **EAC Application No.** | *HRT1601* |
| **Vendor Address** | *15500 Wells Port Drive*<br>*Austin, TX 78728* |

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NVLAP Lab Code 200733-0

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 |

Opinions and Interpretations
There are no SLI opinions or interpretations included in this report beyond the final recommendation.

## Other Labs Performing Hardware Testing

SLI Compliance is responsible for all core voting system tests as identified in NIST NVLAP Handbook 150-22 (2008). Regarding non-core hardware testing for this certification test campaign, this report contains data that were produced under subcontract by the following lab(s):

## Table 1 – Labs Performing Hardware Testing

| Laboratory | Address | Test(s) | Date(s) |
|------------|---------|---------|---------|
| NTS Longmont formerly EMC Integrity (NVLAP certified for electromagnetic compatibility and telecommunications) | 1736 Vista View Drive Longmont, CO 80504 | **EMC / EMI Tests:** ESD Electromagnetic Susceptibility | October 4th, 2016 |

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# 1    Introduction

SLI Compliance is submitting this test report as a summary of the certification testing efforts for the **Hart InterCivic Verity 2.2** voting system, a modified system from **Verity 2.0**, 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 the **Hart InterCivic Verity 2.2** voting system.

This effort included documentation review of the Technical Data Package, source code review, and testing of the **Hart InterCivic Verity 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 application tested/reviewed
- The Certification Test Background, which discusses the testing process
- The System Identification, which identifies hardware and software for the **Hart InterCivic Verity 2.2 voting** system
- The System Overview, which discusses the functionality of **Hart InterCivic Verity 2.2 voting** system software and firmware
- The Certification Tests, which are 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:
  - Attachment A – Warrant of Change Control for Verity Voting 2.2
  - Attachment B - Record of Trusted Build for Verity Voting 2.2
  - Attachment C – List of Source Code Reviewed and Results
  - Attachment D1 - NTS Longmont_NVLAP_200737-0_Elec_AccredCert_2017

- o Attachment D2 - NTS Longmont_NVLAP_200737-0_Elec_AccredScope_2017
- o Attachment E1 - PCA Doc - System Security Spec Rev02
- o Attachment E2 - PCA Doc - System Overview Rev03
- o Attachment E3 - PCA Doc - System Operations Procs Rev01
- o Attachment E4 - PCA Doc - System Maintenance Procs Rev01
- o Attachment E5 - PCA Doc - System Hardware Spec Rev01
- o Attachment E6 - PCA Doc - System Functionality Desc Rev03
- o Attachment E7 - PCA Doc - Software Design_Spec Rev03
- o Attachment E8 - PCA Doc - Quality Assurance Rev02
- o Attachment E9 - PCA Doc - Personnel Deployment_Training Reqs Rev02
- o Attachment E10 - PCA Doc - Configuration Management Plan Rev01
- o Attachment E11 - PCA Doc - System Test_Verification Spec Rev01
- o Attachment E12 - PCA Doc - System Change Notes Rev02
- o Attachment F1 - Verity Voting 2 2 Scan VVSG EMI Test Plan v1.0
- o Attachment F2 - NTS Verity Voting 2 2 Scan VVSG EMI Test Report v1.0
- o Attachment G - Modification of Certified System Analysis Summary Verity 2.2 Rev01
- o Attachment H - Hart Discrepancy Report Verity 2.2
- o Attachment I - Hart Verity 2.2 EAC Modification Test Plan v1.2
- o Attachment J1 - HRT_C#_MSAllInOneStandard_SCRF
- o Attachment J2 - HRT_C_&_C++_MSAllInOneStandard_SCRF
- o Attachment k - Verity Voting 2.0 Attestation of Durability
- o Attachment L - Verity Voting 2.0 Attestation of Integrity
- o Attachment M - Verity Voting 2.0 Attestation of Production Hardware and Software

# 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 InterCivic Verity Voting 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** voting system. As this is a modification test campaign, the source code was compared against the final code base of **Verity Voting 2.0**, 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. Informational issues, which are errors that don't affect a VVSG 1.0 requirement, such as minor typo's or incorrect labeling of a document (draft versus official), and Discrepancies such as formatting or versioning, incorrect processes, functionality descriptions and/or missing functionality or descriptions, in documentation were identified to Hart for resolution or comment. Additional details of the PCA documentation review can be found in Attachments E1-E12.

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 C – 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 J1-J2.

## 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 InterCivic Verity Voting 2.2** voting system and conducted in accordance with *Volume II Section 6 of the VVSG 1.0,* in conjunction with the functional testing. Simulations of elections were conducted to demonstrate a beginning-to-end business use case process for the **Hart InterCivic Verity Voting 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 2 – Test Methods

| SLI VSTL Test Method Name |
|---|
| TM_Audit_Record_Data v1.1 |
| TM_Ballot_and_Program_Installation_and_Control v1.1 |
| TM_Ballot_Counter v1.1 |
| TM_Ballot_Formatting_and_Production v1.1 |
| TM_Basic_Election_Components v1.1 |
| TM_Closed_Primary_Election_Creation v 1.2 |
| TM_Closing_the_Polls v1.1 |
| TM_Error Message and Recovery v1.3 |
| TM_HW_Integrity v1.2 |
| TM_Maintainability v1.1 |
| TM_Non-Partisan v1.1 |
| TM_Partisan Offices v1.1 |
| TM_Pre-Voting_Capabilities v1.2 |
| TM_Readiness v1.1 |
| TM_Security_Access_Control v1.1 |
| TM_Security_Access_Control_Measures v1.1 |
| TM_Security_Physical_Security_Measures v1.1 |
| TM_Security_Software_Security v1.1 |
| TM_Security_Telecommunications_and_Data_Transmission v1.2 |
| TM_Security_Transmission_of_Official_Data_over_Public_Networks v1.1 |
| TM_Security_Wireless_Communications v1.2 |
| TM_Split_Precincts v1.1 |
| TM_Standard Open Primary Creation v1.1 |
| TM_Straight_Party_Voting v1.1 |
| TM_System_Audit v1.1 |
| TM_Tally_and_Reporting v1.1 |
| TM_Vote_for_N_of_M v1.1 |
| TM_Voting_Capabilities v1.3 |
| TM_Voting_Non-Partisan v1.1 |
| TM_Voting_Partisan_Offices v1.1 |
| TM_Voting_Precincts_and_Districts v1.1 |
| TM_Voting_Straight_Party v1.1 |
| TM_Voting_Vote_for_N_of_M v1.1 |
| TM_Voting_Write-In v1.1 |
| TM_Write-In v1.1 |

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

Deviations from, additions to, or exclusions from the test methods

The test methods listed in Table 2 above, contain the requirements listed in section 3.6 below. The relevant portions of the test methods, for those listed requirements were utilized to verify and validate that the implemented functionality meets applicable VVSG 1.0 standards. The portions of the test methods not relevant to the listed requirements were not exercised. Additional testing was provided for validation of the Hart internal requirements in order to verify that state specific functionality was correctly implemented.

## 2.2.2 Terms and Abbreviations

This section details pertinent terms applicable within this report.

**Table 3 – Terms and Abbreviations**

| Term | Abbreviation | Description |
|---|---|---|
| Ballot Marking Device | BMD | An accessible computer-based voting system that produces a marked ballot (usually paper) that is the result of voter interaction with visual or audio prompts. |
| Cast Vote Record | CVR | Permanent record of all votes produced by a single voter whether in electronic, paper or other form. Also referred to as 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 |

| Term | Abbreviation | Description |
|---|---|---|
| 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 a database management system used 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. |
| 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. |
| (Verity) Chevron | No Abbreviation | **Verity** components use workflow chevrons. Workflow chevrons, arranged along the top of the screen, identify the function the user is currently viewing. |
| 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.). |

| Term | Abbreviation | Description |
|---|---|---|
| Primary – Closed | | The Closed Primary election segregates each political party onto its own ballot, along with all pertinent non-political contests and referendums. |
| Primary - Open | | 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. |
| (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 | | Typically a convenience 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. |

| Term | Abbreviation | Description |
|---|---|---|
| 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. |
| 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 InterCivic Verity Voting 2.2 Voting System

This section provides a description of the scope of **Hart InterCivic Verity Voting 2.2** voting system components:

- The **Hart Verity Voting 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** 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.
  - 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**
  - o Producing the election definition and auditing reports.
  - o Providing administrative management functions for user, database, networking and system management.
  - o Import or manual data entry 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.
  - o Auditing of election results including ballot images and log files.

- The **Verity Scan** is a digital scan 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. In this version 2.2 of **Verity Voting**, **Verity Scan** is provided the capability of utilizing an optional cellular modem.

- **Verity Relay** provides a remote transmission capability to the **Verity Voting 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**, which is a voting center 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 the custom **Hart** developed ballot processing application software which resides on 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** voting system supports the English and Spanish languages.

## 3.2    Changes from Verity 2.0 to Verity 2.2

### 3.2.1  Features new to Verity 2.2

**Verity Relay** provides a remote transmission capability to the **Verity Voting 2.2** system. Utilizing an optional cellular modem on **Verity Scan**, at close of polls, results are transmitted from the polling place device to the **Verity Relay** station. These results are moved to a **Verity vDrive** and transferred to **Verity Count**.

### 3.2.2 Updates to features from Verity Voting 2.0 to Verity Voting 2.2

**Verity Scan Changes**

- capability to clear a **vDrive** and device counters
- capability to re-open polls after they have been closed

# 4 System Identification

The **Hart InterCivic Verity Voting 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
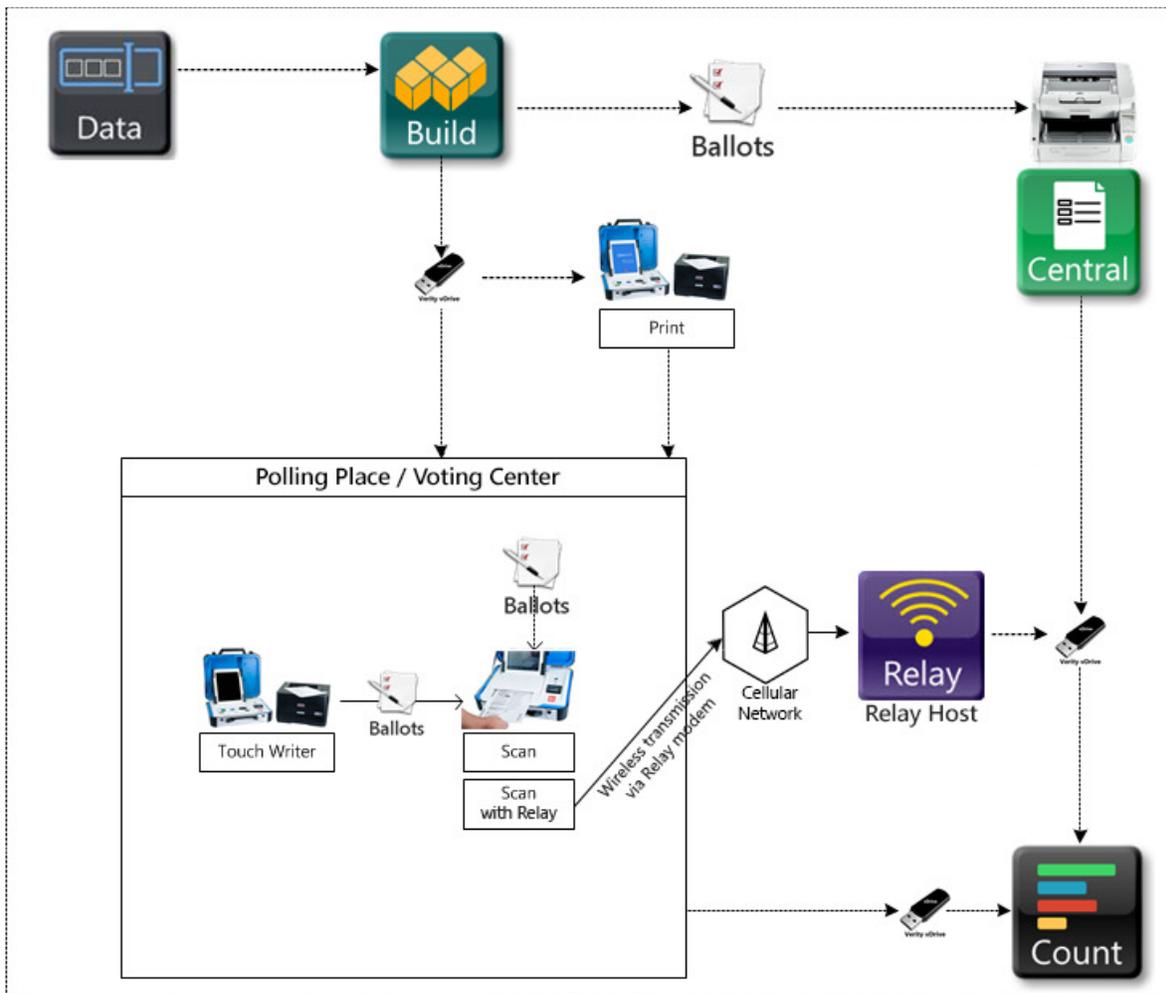
- Overview of the diagram:

- 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 Print** is a ballot production device that provides unmarked printed ballots.

- **Verity Touch Writer** and **Verity Scan** (Verity Voting devices) may be installed in Polling Places.

- **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 TR Supplement
- Verity Scan with Relay TR 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 InterCivic Verity Voting 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. For Software, the software was either obtained directly from the 3$^{rd}$ party manufacturer, or was verified against digital signatures obtained from the 3$^{rd}$ party manufacturer. For Hardware, the hardware was either shipped

directly from the 3<sup>rd</sup> party manufacturer, or the equipment was inspected to verify conformance to the 3<sup>rd</sup> party manufacturer's specifications.

Tables 4 and 5 below detail each application employed by the **Hart InterCivic Verity Voting 2.2** voting system.

**Table 4 – Hart Verity Voting 2.2 Software and Firmware**

| Manufacturer | Application(s) | Version |
|---|---|---|
| Verity Data | Ballot setup software | 2.2.0 |
| Verity Build | EMS software | 2.2.0 |
| Verity Central | High speed digital scanner software | 2.0.2 |
| Verity Count | Central count location accumulation, tallying and reporting software | 2.2.0 |
| Verity Relay (Host) | Data transmission software (receiving station) | 2.2.0 |
| Verity Scan | Digital scanner firmware | 2.2.0 |
| Verity Touch Writer | BMD firmware | 2.0.3 |
| Verity Print | Printer firmware | 2.0.3 |
| Verity Device Microcontroller | Firmware for Verity Devices | V17 |

**Table 5 – COTS Software**

| Manufacturer | Application | Version | Verity Voting 2.0 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 |

## 4.4 Equipment (Hardware)

The hardware employed by **Hart InterCivic Verity Voting 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 6 and 7 below detail each device employed by the **Hart InterCivic Verity Voting 2.2** voting system.

**Table 6 – Hart Verity Voting 2.2 Custom Voting Equipment**

| Hardware | Use | Model |
|---|---|---|
| **Verity Scan** (digital scanner) | Precinct polling place digital scanner | Revision B |
| **Verity Scan with optional cellular modem** | Precinct polling place digital scanner with optional cellular modem | Revision A |
| **Verity Touch Writer** (BMD) | Precinct polling place Ballot Marking Device | Revision C |
| **Verity Print** | Ballot production device | Revision C |
| **Verity Key** | Security key used within the voting system | N/A |
| **Verity vDrive** | Media used for transportation of voting system data | N/A |

**Table 7 – Hart Verity Voting 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 | B431d |
| OKIDATA (for **Verity Print, Verity Build**) | Ballot Printer | C831dn |
| OKIDATA (for **Verity Print, Verity Build**) | Ballot Printer | C911dn |
| OKIDATA (for **Verity Count**) | Ballot Printer | ML-1121 |
| Eaton | UPS for Verity Touch Writer printer | 5P1500 |
| PC Workstation - Various (for **Verity Data, Verity Build**, **Verity Central** and **Verity Count**) | Processor – Intel Core i7-4790 3.6 8M GT2 4C CPU Memory – 32GB DDR3-1600 nECC (4x8GB) RAM | |

| Manufacturer | Hardware | Model |
|---|---|---|
| | Hard Drive – 2x1 TB RAID-Level 1, Removable w/ key lock<br>USB Ports – 4 ports<br>Video Card - Integrated Graphics<br>Keyboard - USB Keyboard<br>Mouse - USB Mouse | |
| PC Display - Various<br>(for **Verity Data, Verity Build**, **Verity Central** and **Verity Count**) | **Monitor (Minimum Requirements)**<br>Panel Size - 50.8 cm<br>Aspect Ratio - Widescreen (16:9)<br>Optimal Resolution - 1600 x 900 at 60Hz<br>Contrast Ratio - 1000: 1<br>Brightness - 250 cd/m2 (typical) | |
| Kodak (for **Verity Central**) | Ballot Scanner | i5600 |
| 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  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
- Ballot marking pens
- Printer paper rolls

## 4.6  Requirements

### 4.6.1 VVSG Requirements

The **Verity Voting 2.2** modifications were tested to applicable 2005 VVSG 1.0 requirements. This section details the requirements reviewed for **Verity Voting 2.2**.

**Verity Scan's** modification to provide the capability to clear a **vDrive** and device counters is an isolated update that affects only the **Verity Scan** device.

Pertinent VVSG requirements reviewed:

- 2.1.1.a,b,c,f,g
- 2.1.4.h,i
- 2.1.8.a-d
- 2.2.4.d,f

**Verity Scan's** modification to provide the capability to re-open polls after they have been closed has impact on both the **Verity Scan** device and **Verity Count**.

Pertinent VVSG requirements reviewed:

- 2.1.1.a,b,c,f,g
- 2.1.4.h,i
- 2.1.2.c
- 2.2.4.d
- 2.1.4.a,e

With the new ability to re-open polls, **Verity Count** will potentially have multiple iterations of results sent by the same device.

Pertinent VVSG requirements reviewed:

- 2.1.2.c
- 2.2.4.d

**Verity Relay** provides a remote transmission capability to the **Verity Voting 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.

Pertinent VVSG requirements reviewed:

- 2.1.1.a,b,c,f,g
- 2.1.4.h,i
- 2.1.9
- 2.2.4.d
- 4.1.2.15
- 6
- 7.5.1-3,5
- 7.6.1
- 7.6.2
- 7.7

As all **Verity Voting** applications, including **Verity Relay**, reside in a dedicated workstation "kiosk" environment that does not allow any non-voting applications or processes to run, section 7.5.4 is deemed not applicable to this test effort."

## 4.7  Additional Functionality/Requirements

A review of the Hart Technical Requirements Documentation (TRDs) resulted in SLI's identification of some Hart functionality/requirements that are considered beyond the scope of the VVSG 1.0, but since they are in the declared system, required (Volume II section 3.2.2 of the VVSG 1.0) review and verification. Additional functionality/requirements audited within the scope of this certification are detailed below.

The requirements in this section were provided in order to clearly specify the modifications implemented to satisfy state jurisdiction requests for additional functionality.

Two modifications were implemented, one of which allows **Verity Scan** to clear vDrives and device counters, under proper conditions. The second modification allows **Verity Scan** to re-open polls, with proper credentials.

The following requirements represent Hart internally developed specifications designed to satisfy these jurisdictional requests.

**Verity Scan's** modification to provide the capability to clear a **vDrive** and device counters is an isolated update that affects only the **Verity Scan** device

Pertinent Hart requirements are:

**4.7.1.1**   [MUST] The vDrive used for the test must be the same vDrive used in the election.

**4.7.1.2**   [MUST] When the Verity Scan tabulator is in a "Polls Closed" state, it shall have the capability to "Clear ballots and counters."

**4.7.1.3**   [MUST] When the Verity Scan tabulator is in "Polls Suspended" state, it shall have the capability to "Clear ballots and counters."

**4.7.1.4**   [MUST] When the option to "Clear ballots and counters" is selected, the user shall be prompted to confirm "yes" to proceed, or "no" to cancel.

**4.7.1.5**   [MUST] If the user selects, "Yes, clear ballots and counters," the user shall be prompted to insert the Verity Key.

**4.7.1.6**   [MUST] When the Verity Key is inserted, the user shall be prompted to enter the Verity Key passcode.

**4.7.1.7**   [MUST] The "clear" function shall be executed only if the Key validation is successful.

4.7.1.8   [MUST] When the clear function is executed:
4.7.1.8.1          [MUST] "Clear ballots and counters" is logged in audit logs
4.7.1.8.2          [MUST] Device public counter is set to zero
4.7.1.8.3          [MUST] Device sheet counter is set to zero
4.7.1.8.4          [MUST] All CVRs on vDrive are deleted
4.7.1.8.5          [MUST] CVRs from this session on internal memory (CFast) are deleted
4.7.1.8.6          [MUST] CVR data in database is deleted
4.7.1.8.7          [MUST] Scanned ballot images on vDrive are deleted, if they exist
4.7.1.8.8          [MUST] State of election is set back to "Configured" on vDrive, CFast, and in DB

**4.7.1.9**   [MUST] When the LAT ballots and counters are cleared, the polling place assignment must not be altered or deleted.

**4.7.1.10** [MUST] When the LAT ballots and counters are cleared, the audit log entries must not be altered or deleted.

**Verity Scan's** modification to provide the capability to re-open polls after they have been closed has impact on both the **Verity Scan** device and **Verity Count**.

Pertinent **Hart** requirements are:

**4.7.1.11** [MUST] When the Verity Scan tabulator is in a "polls closed" state, the tabulator shall allow users to "re-open" the polls to process additional ballots.

**4.7.1.12** [MUST] When additional ballots are processed, the results of those ballots shall be combined with results of ballots previously processed on the same vDrive.

**4.7.1.13** [MUST] The Scan tabulator shall require a reboot to re-open the polls.

**4.7.1.14** [MUST] The Scan tabulator shall require the user to enter the Open Polls passcode to re-open the polls.

**4.7.1.15** [MUST] When the polls are re-opened, the Scan tabulator shall retain all previous data associated with the configured election definition.

**4.7.1.16** [MUST] When the polls are re-opened, the Scan tabulator shall retain all prior data associated with the tabulator's polling place assignment (configuration).

**4.7.1.17** [MUST] When the polls are re-opened, the Scan tabulator shall retain all data associated with previous ballot scanning sessions, including:
4.7.1.17.1        [MUST] CVRs
4.7.1.17.2        [MUST] Audit log data
4.7.1.17.3        [MUST] Public counter

**4.7.1.18**   [MUST] When the polls have been re-opened, the Scan tabulator shall allow users to scan additional ballots.

**4.7.1.19** [MUST] If the Scan tabulator is configured to allow users to print a Tally tape, the device shall generate a consolidated Tally tape that includes one combined total for each candidate/proposal on the ballot for all ballots processed in that precinct.

**4.7.1.20** [MUST] This feature shall support a user's ability to repeat the cycle of scanning, closing, printing Tally reports, re-opening, scanning more ballots, and printing new Tally reports for as long as the original vDrive remains installed in the Verity Scan device.
4.7.1.20.1        [MUST] If a new vDrive is installed, the Scan tabulator shall follow the typical workflow to load a new election and clear counters.

**4.7.1.21**   [MUST] If Verity Scan is configured with the Relay option for remote transmission, the capability to re-open polls shall not limit a user's ability to remotely transmit results multiple times.

# 5 Certification Test Results Summary

## 5.1 Source Code Review Summary

SLI has reviewed the software source code for each application in the **Hart InterCivic Verity Voting 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 InterCivic**'s internally developed coding standards. **Verity Voting 2.2** is implemented with the C, C++ and C# languages.  Results of the source code review are detailed in Attachment C. – 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** code base was reviewed using the final **Verity Voting 2.0** code base as the initial drop, to which the initial **Verity Voting 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 written adequately in terms of the VVSG 1.0, and Hart declared industry standards.

## 5.2 Technical Data Package Review Summary

SLI reviewed the *Hart InterCivic Verity* **Voting 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 Security Specification:** (Attachment E1) Access control policy and measures, equipment and data security, software installation, telecommunications and data transmission security, elements of an effective security program.

- **System Overview:**  (Attachment E2) System description and performance are adequately described.

- **System Operations Procedures:**  (Attachment E3**)** Operation environment, system installation and test specifications, operational features, operating procedures, operations support.

- **System Maintenance Procedures:** (Attachment E4) Preventative and corrective maintenance procedures, maintenance equipment, facilities and support.

- **System Hardware Specification:** (Attachment E5) System Hardware Characteristics, Design and Construction.

- **System Functionality Description:** (Attachment E6) System functional processing capabilities, encompassing capabilities required by the Standards and any additional capabilities provided by the system, including a simple description of each capability.

- **Software Design and Specification:** (Attachment E7) Purpose and scope, applicable documents, software overview, software standards and conventions, software operating environment, software functional specification, programming specifications, system database, interfaces and appendices.

- **Quality Assurance Program:** (Attachment E8) Quality assurance policy, parts and materials special testing and examination, quality conformance inspections.

- **Personnel Deployment and Training Requirements:** (Attachment E9) Personnel resources and training required to operate and maintain the system.

- **Configuration Management:** (Attachment E10) Configuration management policy, configuration identification, procedures for baseline, promotion, demotion and configuration control, release process, configuration audits and management resources.

- **System Test and Verification Specifications:** (Attachment E11) Development and certification test specifications that **Hart** applied to their testing efforts.

- **System Change Notes:** (Attachment E12) Changes to a previously certified system (Verity 2.0).

### Evaluation of TDP

Once initially identified, all TDP discrepancies were resolved. The Technical Data Package for the **Hart InterCivic Verity Voting 2.2** voting system was found to sufficiently comply with the standards such that a jurisdiction would be able appropriately deploy the **Hart InterCivic Verity Voting 2.2** voting system. Results of the PCA documentation review are detailed in Attachments E1-E12.

## 5.3  Hardware Testing

Hardware testing conducted specifically for this test campaign involved the **Verity Scan** with optional Modem. Testing involved verification of the following requirements:

- VVSG 1.0 Vol. 1, Section 4 Hardware Requirements
- VVSG 1.0 Vol. 2, Section 4 Hardware Testing

SLI and their third-party certified hardware test laboratory, NTS Longmont (formerly EMC Integrity), performed an analysis and review of the **Verity Voting 2.2** voting system hardware component, namely **Verity Scan** with optional modem

During execution of testing performed at the labs, an SLI representative was present to oversee the testing.

The test methodologies for all tests are identified in the following hardware test plan and hardware test report:

- Attachment F1 - Hart InterCivic Verity Voting 2.2 VVSG EMC EMI Test Plan

- Attachment F2 - NTS Longmont_TRB60122 revA_ Electro Susceptibility _ESD Test Report for Verity Voting 2.2

Conclusion: All components comply with relevant VVSG standards.

### 5.3.1  Operating Mode

Prior to and during testing, proper operation of the equipment was confirmed. An operational status check was successfully performed prior to and after each test, verifying the equipment is within acceptable performance limits. Equipment was inspected for damages after each test. No issues were found.

The Verity software was not used during EMC tests because the hardware is only fully exercised while people are voting and casting their ballots. To exercise some of the features of each new Verity hardware device, test software was run during EMC tests to exercise the model's particular hardware features.

## 5.4  Known Vulnerabilities Testing

**Hart Verity Voting 2.2** is a modification of **Verity Voting 2.**0, which has had only limited exposure in the field.

There are no known vulnerabilities to this particular system, the **Hart Verity** voting system (**Verity Voting 1.0, Verity Voting 2.0** and **Verity Voting 2.2**), 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.

Within the declared system, the only public facing components are the **Verity Scan** precinct optical scanner, which processes ballots marked by voters in a public polling place, and **Verity Touch Writer**, a precinct place ballot marking device. These devices are included as part of the **Verity Voting 1.0** & **2.0** voting systems. The production device **Verity Print** is not a public facing component.

**Verity Central** and **Verity Count** are central count location components, which are implemented in a secure environment.

## 5.5  Functional Testing Summary

Functionality was tested as identified below for the **Hart InterCivic Verity 2.2 voting** system.

### 5.5.1 How Each Device was Tested

5.5.1.1 Verity Scan

- o **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 modem provides the capability to also transmit election results data over a cellular modem, to the Relay workstation.
- o **Verity Scan** was tested first as an individual component in order to verify that all declared functionality is present and working 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 State specific requirements that introduce the capability to clear a **Verity vDrive** and **Verity Scan** counters, as well as there-opening of polls, were tested within this test suite.
- 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.

5.5.1.2 Verity Print

- o **Verity Print** is a standalone central location ballot production device. 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**.

5.5.1.3 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, where it accepted user input instructions, prior to producing marked ballots that mirror user intent.

### 5.5.1.4  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**.

### 5.5.1.5  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

### 5.5.2.1  Verity Relay

- o **Verity Relay** provides a remote transmission capability to the Verity Voting 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.
- o **Verity Relay** was tested first as an individual component in order to verify that all declared functionality is present and working as documented, with media and data produced in **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 **Verity Scan** to **Verity Relay**.
- o **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 inputted into **Verity Count** for accumulation and tallying.

### 5.5.2.2  Verity Data

- o **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.**
- o **Verity Data** was also tested as an integrated piece of the voting system where it outputs election data to be used by **Verity Build.**

### 5.5.2.3 Verity Build

- o **Verity Build** accepts imported election information and produces ballots, election information, **Verity vDrives** and **Verity Keys**.
- o **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**.

### 5.5.2.4 Verity Central

- o **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.
- o **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.

### 5.5.2.5 Verity Count

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

### 5.5.2.6 Verity Election **Management**

- o **Verity Election Management** is the **Verity** application used for importing, exporting, archiving and restoring elections into and from **Verity Build, Central and Count**.
- o **Verity Election Management** was also tested as an integrated piece of the larger voting applications where it resides (**Verity Build**, **Central** and **Count**), verifying that it performed the appropriate functions for the parent application.

### 5.5.2.7 Verity User **Management**

- o **Verity User Management** is the **Verity** application used for creating and managing all user roles and accounts within each of the parent applications, **Verity Build, Central and Count**.
- o **Verity User Management** was also tested as an integrated piece of the larger voting applications where it resides (**Verity Build**, **Central** and

**Count**), verifying that it performed the appropriate functions and managed the pertinent roles for the parent application.

### 5.5.2.8  Verity Desktop

- o **Verity Desktop** is the **Verity** application used for setting workstation date/time, accessing the desktop and gathering hash codes for **Verity Build, Central and Count**.
- o **Verity Desktop** was tested as an integrated piece of the larger voting applications where it resides (**Verity Build**, **Central** and **Count**), verifying that it performed the appropriate functions for the parent application.

## 5.5.3  Test Suites Utilized

The following test suites were executed:

### 5.5.3.1  Verity Count test suite

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

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

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

### 5.5.3.2  Verity Scan with optional modem test suite

All functionality, including administrative, maintenance as well as election day poll worker functionality, present in **Verity Scan** 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.

### 5.5.3.3  Verity Relay test suite

All functionality, including administrative, maintenance as well as election day poll worker functionality, present in **Verity Relay** 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.

### 5.5.3.4  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, as well as Tally and Reporting functionality.

This test covered **Verity User Management, Verity Election Management, Verity Desktop**, **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**.

Languages implemented in the suite included English, Spanish and (English/Spanish).

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

### 5.5.3.5  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, as well as Tally and Reporting functionality.

This test covered **Verity User Management, Verity Election Management, Verity Desktop**, **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**.

Languages implemented in the suite included English, Spanish and (English/Spanish).

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

### 5.5.3.6  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, as well as Tally and Reporting functionality

Languages implemented in the suite included English, Spanish and (English/Spanish).

This test covered **Verity User Management, Verity Election Management, Verity Desktop**, **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.

### 5.5.3.7  Error Messaging and Recovery test suite

Testing in this suite focused on Error Messaging and Recovery in key areas of the system modified within this release. **Verity Scan, Verity Relay** and **Verity Count** were focused on in order to validate that the recoveries were adequate, the system and audit log's validity of content, and that any downstream process were not negatively affected by errors.

This test covered **Verity Data**, **Verity Build**, **Verity Relay**, **Verity Touch Writer**, **Verity Scan**, **Verity Central** as well as **Verity Count**.

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

### 5.5.3.8   Audit test suite

Audit records are used to track what system functions have been executed, what data has been modified, as well as by whom and when. Election audit trails provide the supporting documentation for verifying the accuracy of reported election results.  They present a concrete, indestructible archival record of all system activity related to the vote tally, and are essential for public confidence in the accuracy of the tally, for recounts, and for evidence in the event of criminal or civil litigation. Additionally, audit record data content can be a key factor in identifying system anomalies and provide assistance in troubleshooting system errors.

Testing in this suite focused on Audit logging in key areas of the system modified within this release. **Verity Scan, Verity Relay** and **Verity Count** were focused on in order to validate that the auditing functionality were adequate, the system and for the audit log's validity of content.

This test covered **Verity Data**, **Verity Build**, **Verity Relay**, **Verity Touch Writer**, **Verity Scan**, **Verity Central** as well as **Verity Count**.

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

### 5.5.3.9   Data Retention and Hardware Integrity testing

Integrity requirements ensure the physical stability and function of the vote recording and counting processes, such that the system is not prone to a single point of failure that would prevent voting at a polling place. Testing verified prevention of failure of data input or storage, in terms of data retention, as well as confirming that appropriate audit records are maintained and cannot be modified.

The requirements related to this testing were incorporated into other test suites for validation. A review of all testing performed and notation of any pertinent issues encountered also factored into the requirements validation consideration.

This testing covered, **Verity Scan** with optional modem, **Verity vDrive**, **Verity Relay** and **Verity Count**.

This testing was completed without issue, and each device and application.

### 5.5.3.10 Security Access Control test suite

Access control testing verifies procedures and system capabilities that detect or limit access to system components in order to guard against loss of system integrity, availability, confidentiality, and accountability.  This testing verified that system resources such as data files, application programs and computer-related facilities and equipment are protected against unauthorized operation, modification, disclosure, loss or impairment.  Unauthorized operations include modification of compiled or interpreted code, run-time alteration of flow control logic or of data, and abstraction of raw or processed voting data in any form other than a standard output report by an authorized operator.

This testing covered **Verity Relay, Verity Scan** with optional modem, and **Verity Count**.

This test was completed without issue, and each device and application passed.

### 5.5.3.11 Security Software test suite

Software security testing was conducted to verify the installation procedures and ongoing foreign software detection, prevention of unauthorized updates and mitigation abilities of the voting system in order to protect against the modification of the software and/or the insertion of malicious software during the installation and during ongoing operations.

Hart's Devices and Desktop systems rely upon a security in depth posture that includes Whitelisting, utilizing McAfee Solidifier, implementing a kiosk mode for all devices and workstations, restricted operating system access, utilization of MS EWF, checksum checks, secured BIOS, prevention of boot to external devices, encrypted transmissions, proprietary USB components, digital signatures and pared down operating systems.

This testing covered **Verity Relay, Verity Scan** with optional modem, and **Verity Count**.

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

### 5.5.3.12 Physical Security Measures test suite

Physical security testing verified monitoring and control of the environment of the work place and computing facilities. It also verified control of access to and from such facilities. Controls separating the network and work place into functional areas are also physical controls. Some portions of physical security are functional while other portions are procedural. Functional portions were tested as appropriate while procedural portions were verified to be documented as prescribed by the VVSG 1.0. For polling place devices, **Verity Scan** with modem and the accompanying ballot box, were inspected for the **Hart** prescribed locks and seals, as well as confirming that the physical device and accompanying ballot box were resistant to unauthorized access and provided for detection of tampering.

This testing covered **Verity Relay, Verity Scan** with optional modem, and **Verity Count**.

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

### 5.5.3.13 Security of Transmissions test suite

Transmission security testing verified appropriate mechanisms are provided for with respect to access control, data integrity, detection and prevention of data interception, and protection against external threats. Verification of appropriate encryption, digital signatures and handshaking protocols were reviewed for between the **Verity Scan** with optional modem, and **Verity Relay**.

This testing covered **Verity Relay** and **Verity Scan** with optional modem.

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

### 5.5.3.14 Maintainability test suite

Maintainability encompasses a range of maintenance actions that examine all scheduled and unscheduled events in place for preventing failures on all hardware devices. Testing verifies the ease with which maintenance actions can be performed based on the design characteristics of the equipment and software. Non-technical election workers are to be able to be made aware of the problem through the equipment and software's ability to correctly self-diagnose problems.

This test included review of Hart documentation for maintenance actions as well as performance of those maintenance actions for ease of use and understandability.

This test covered **Verity Scan** with optional modem

This test was completed without issue.

## 5.6  Evaluation of Testing

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 **Hart InterCivic Verity Voting 2.2** voting system.

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

## 5.7  Hardware Test Summary

SLI and its third-party certified hardware test laboratory, NTS Longmont formerly EMC Integrity,  executed Hardware testing on the **Verity Scan** with optional modem.

The testing consisted of:

- Electromagnetic Emissions / Immunity Tests:
  - VVSG requirement 4.1.2.8, ESD – IEC 61000-4-2 (2008) Ed. 2.0.
  - VVSG requirement 4.1.2.10, Electromagnetic Susceptibility – IEC 61000-4-3 (1996).

### 5.7.1  Evaluation of Hardware Testing

No issues were found. Attachments G contain the hardware reports from SLI's EAC approved Hardware Environmental Test Subcontractor, NTS Longmont. These reports detail specific information on the hardware testing.  As of the writing of this report, **Verity Scan** with optional modem has successfully passed all tests.

## 5.8 Quality Assurance and Configuration Management Audits

The review processes employed verified that the manufacturer not only has written processes and procedures in both the Quality Assurance and Configuration Management arenas, but that those processes and procedures were actually implemented within the software development life cycle that is used to produce the **Hart Verity Voting 2.2** version that is submitted for certification.

Coverage of tests employed by **Hart** was deemed satisfactory for appropriate robustness of **Verity Voting 2.2** in 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 InterCivic**.

Implementation of the **Hart** configuration processes was adequately documented and followed throughout the course of the **Verity Voting 2.2** project, and no issues were encountered.

## 5.9 Deficiencies 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 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.

### 5.9.1 Documentation Discrepancies and Informationals

Discrepancy issues included:

- System change notes did not encompass documentation changes (#2,3,4)

- Requirement coverage not found (#1,19,21,22,23,24,25)

- Missing features (#5,8,13,16,17)

- Outdated information included (#6,7,9,10,11,12,14,15,16,18)

Informational issues included:

- Documents that were labeled with incorrect version.  (#20)

### 5.9.2  Source Code Discrepancies

Source code review generated 124 discrepancies during the review process.

Basic formatting and naming convention issues accounted for 117 of the issues.

Basic programming construct issues were addressed in 7 of the discrepancies.

All issues were addressed prior to performing the initial Trusted Build

### 5.9.3  Hardware Discrepancies

No hardware discrepancies were written during this campaign.

### 5.9.4  Functional Discrepancies

No functional discrepancies were encountered during this campaign.

### 5.9.5  Hardware Anomalies

**Hardware Anomalies**

No hardware anomalies were written during this campaign.

### 5.9.6  Functional Anomalies

No functional anomalies were encountered during this campaign.

## 5.10 Deficiencies Resolution

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

# 6   Recommendations

SLI has successfully completed the testing of the **Hart InterCivic Verity Voting 2.2** voting system.   It has been determined that the **Verity Voting 2.2** voting system meets the required acceptance criteria of the Election Assistance Commission Voluntary Voting System Guidelines 2005.

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 **Hart InterCivic Verity Voting 2.2** voting system.

**SLI:**

Traci Mapps
VSTL Director/Director of Operations
October 21st, 2016

# 7   EAC Certification & Voting System Configuration

This report has been submitted to the Election Assistance Commission on October 14th, 2016. Upon acceptance of this report by the EAC technical committee, a certification number will be issued for this modification.

This certification is for the **Hart InterCivic Verity Voting 2.2** voting system, configured as detailed in section 3 of this document.

End of Certification Test Report