

# Certification Test Plan – Modification

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Prepared for:

<b>Vendor Name</b>	Hart InterCivic (Hart)
<b>Vendor System</b>	Verity Voting 2.4
<b>EAC Application No.</b>	HRT-Verity-2.4
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## Revision History

Date	Version	Author	Revision Summary
September 9 <sup>th</sup> , 2019	1.0	J. Panek	Initial Draft

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## 1 INTRODUCTION

---

This Modification Certification Test Plan outlines the test approach SLI Compliance will follow when performing Certification Testing on the **Hart Verity Voting 2.4** voting system against the Voluntary Voting System Guidelines 1.0 (VVSG 1.0). **Verity Voting 2.4** is a modification of **Verity Voting 2.3**, certified by the EAC on May 3<sup>rd</sup>, 2019, with limited changes. The system will be tested based on the “modified system” requirements, as set forth in section 4.6.2.3 of the “EAC Voting System Testing and Certification Program Manual, version 2.0”. The purpose of this document is to provide a clear understanding of the work SLI will conduct and a detailed plan outlining the test effort.

When the testing is complete, SLI will submit a Certification Test Report that details all test results and findings from the Certification Test effort, as well as a recommendation to the EAC regarding certification.

### 1.1 Description and Overview of the Certified System

This test plan contains a description of the previously certified system, the specific modifications to the current system version, and the impact of those modifications on the system and certification testing.

#### 1.1.1 Definition of the Baseline Certified System

This modification project builds upon the foundation established in **Verity Voting 2.3**, which contains the applications **Verity Data**, **Verity Build**, **Verity Central**, and **Verity Count**, as well as the polling place devices **Verity Controller**, **Verity Scan**, **Verity Print**, **Verity Touch**, **Verity Touch Writer**, and **Verity Touch Writer Duo**

#### 1.1.2 Modifications

**Verity Voting 2.4** is a modification of the EAC certified **Verity Voting 2.3** system and includes features from the EAC certified **Verity Voting 2.2.2** and **2.3.4** voting systems.

The modifications to **Verity Voting 2.4** addresses multiple aspects of the system, including state specific features, new features for all devices and applications, security enhancements, completion of the “Smart Panel” tablet hardware rollout, as well as associated documentation updates.



The following modifications are implemented in this release:

### **Features for all devices and workstations**

- Security enhancements:
  - Added feature for authorized Hart personnel to change the Certificate Set on devices and workstations. The feature will require a valid Certificate Key and Certificate Key password.
    - Feature is activated from a new “Additional Functions” menu on devices.
    - Feature is activated from “Desktop” tile on workstations when user has “Desktop Full Access” permissions.
  - Updated Whitelisting tool, McAfee Solidifier, on OS images from version 6.1 to 8.2.1-140.

### **Michigan-specific features**

- The following features included in Verity 2.2.2 are now supported as an option configurable in Verity Build:
  - Support for MI straight party rules.
  - Support for Uncommitted Candidates.
  - Reopen Polls, supported on all devices except Verity Print, Verity Touch, and Verity Touch Writer Duo.
  - Clear Ballots, supported on all devices except Verity Print, Verity Touch, and Verity Touch Writer Duo.
- Support for the Relay kit for Verity Scan and Relay receiving workstation.

### **Pennsylvania-specific features**

- The following features included in Verity 2.3.4 are now supported as a configurable option in Verity Build:
  - Straight party deselection behavior for Touch Writer and Touch Writer Duo.
  - Straight Party Interface and Messaging on Touch Writer.

### **Features for Devices with Tally Reports**

- New Tally Report Quantity Election Setting in Build for how many copies of the Tally report should automatically print when polls are closed, if the polling place is configured to allow printing of Tally reports.
  - When Scan is equipped with a Relay kit, the device will print one copy of the Tally report, enable the modem and transmit results, then print the remaining copies of the Tally Report.

## **Additional Features for Verity Devices**

### **All Verity Devices**

- Devices now display a “Cancelling” screen when the user requests that a report be cancelled.



- Unnecessary Help button removed when navigating within device menu screens.
- Included a new “Additional Functions” menu on all devices at boot up, activated using the blue Validation button. Menu includes the following functions:
  - “Validate”, to produce device hash files
  - “Change Certificate Set”

### **Complete the Rollout of Updated Smart Panel**

- Rollout of updated COTS Smart Panel that started with the Verity 2.3 release to be completed. Smart Panel is updated by the manufacturer due to Intel chipset obsolescence. The following devices will be updated:
  - Verity Print
  - Verity Touch/Touch with Access
  - Verity Touch Writer

### **Features for devices with the Precinct Selection Screen**

- The device keyboard used on the Precinct selection screen now includes a hyphen (-) key. This screen is used on Controller, Touch Writer, and Print.

### **Features for Verity Scan**

- Relay now includes the ability to manually re-initiate results transmission even when the initial transmission was successful. The feature is protected by an admin passcode and is only available if polls are closed.

### **Features for Verity Print**

- Added support for OKI C844dn due to the manufacturer obsolescence of existing model OKI C831dn.

### **Features for Verity Controller:**

- Added the “Connectivity Report,” which presents information and status about all devices currently assigned a booth number.

## **Additional Features for Verity Workstation Software**

### **Features for All Workstation Software**

- Improved user experience if a server workstation is going through a database recover process at boot. Splash screen now contains text to describe that a recovery is in process and provides the option to cancel the recovery process.
- Added support for printing a specific range of pages from most reports.



### **Features for Workstation Software with Ballot Preview**

- The Ballot Preview screen in Verity Data and Verity Build does NOT automatically load the first Precinct/Split when the screen is loaded.

### **Features for Verity Desktop**

- The “Enter Access Code” screen now displays the current date and time and Workstation ID.

### **Features for Verity Build**

- Extended the Device Reports Signature Text maximum length from 300 to 500 characters.
- Removed redundant Data Validation screen.
- Removed redundant Proof Audio screen.
- Added support for following COTS ballot printers due to manufacturer obsolescence of the existing certified models:
  - OKI C844dn
  - OKI C931e

### **Features for Verity Central**

- Added support for up to 7 networked clients per server.
- All networked clients have access to all Central application functionality.
- Added support for the following COTS central scanners due to manufacturer obsolescence of the existing certified models:
  - Canon DRG-2110
  - Canon DRG-2140
- Changed reporting engine for the Scanned Batch Report, Residual Votes Report.

### **Features for Verity Count**

- Improved “Write-in Candidates” screen.
- Redesigned “Write-in Assignment” workflow
- Supports the following write-in assignment features:
  - Reject all write-ins for a contest
  - Revert all assigned or rejected write-ins in a contest
- Added a proofing report for Write-in assignments. This report lists each entered write-in for a specific contest, ordered by tabulation time. Each write-in includes the following:
  - The Write-in image snippet
  - The Write-in image ID
  - The Write-in status
  - If assigned to a Write-in Candidate, the Write-in Candidate name
- Count will now ask if the user wants to check for additional ballots on the vDrive when a duplicate vDrive is read. The user must enter administrator credentials to add those ballots to the vote totals if additional ballots are found.





- Performance improvements to Provisional ballot resolution.

### Corrected Defects

The following defects found in Verity 2.3 have been corrected in the Verity Voting 2.4 modification:

Product	Description of Verity Voting 2.3 Defect	Resolution/Results In Verity Voting 2.4
Verity Data	Newly created polling places are not associated with any parties in a CPE election. This has a usability impact as most users will associate all polling places with all parties.	All newly created polling places are now associated with all parties by default.
Verity Data	When navigating to the Translations screen, the spinner starts spinning and then pauses until the translation screen is loaded	Spinning now continues to spin during screen load, as expected.
Verity Build	After an election is selected, the spinner stops prior to the election opening	Corrected. The election now opens immediately after the spinner goes down.
Verity Central	The Accept button at the bottom of the screen is disabled for Voter intent issue ballots on the Ballot review window at page level. The user instead must click on the Action drop down then click Accept Page to proceed.	The Accept button at the bottom of screen is now active and usable.
Polling Place Devices (all)	There are situations where the period (".") symbol appears at the end of a sentence for languages that do not use this punctuation, resulting in two sentence ending symbols.	A hardcoded period symbol has been removed, which has corrected the double sentence ending symbols.

### 1.1.3 Initial Assessment of Impact of the Modifications

Review of the modifications listed in section 1.1.2 indicates the need for hardware testing, as well as limited Physical and Functional Configuration Audits, in order to verify that the system continues to meet VVSG 1.0 requirements.

A full suite of EMC/EMI hardware tests will be performed on the **Verity Touch/Touch with Access** and **Verity Touch Writer** due to the introduction of the COTS smart panel for those devices. The same COTS smart panel was initially introduced in the **Verity Voting 2.3** system configuration. It was subject to full



operational and non-operational environmental testing at that time, and therefore will not be subject to additional operational and non-operational environmental testing during this test campaign.

Temperature and power variation environmental testing will be performed on both of the new COTS central scanner models, which are being updated in this system configuration due to the currently certified COTS central scanners going end-of-life.

All software and firmware modifications will be verified by execution of elections that incorporate steps to verify the modifications, or via test suites designed to specifically focus on the functional changes made to the applicable devices and applications.

### 1.1.4 Regression Testing

The limited FCA will consider functions that have not changed but may be impacted by the modifications. Each modified component of the system will require a new build. This will be subjected to FCA review at an appropriate level of scrutiny.

All modified components of **Verity Voting 2.4** will be regression tested in order to verify continued compliance to VVSG 1.0. Additionally, end-to-end system level general and open primary elections will be performed to verify proper system operation.

## 1.2 References

The following key documents were used in preparing this Modification Test Plan:

1. Election Assistance Commission Voluntary Voting System Guidelines (EAC VVSG), Version 1.0 Volumes I and II.
2. NIST Handbook 150: 2016.
3. NIST Handbook 150-22: 2017.
4. EAC Voting System Testing and Certification Program Manual, United States Election Assistance Commission, v 2.0, May 2015.
5. SLI VSTL Quality System Manual, Rev. 3.1, prepared by SLI, dated June 28<sup>th</sup>, 2019.

## 1.3 Attachments

The following attachments apply to this Modification Test Plan:

1. Attachment A - Hart Verity Voting 2.4 Electrical Hardware Test Plan v1.0
2. Attachment B - Hart Verity Voting 2.4 Environmental Hardware Test Plan v1.0



## 1.4 Terms and Abbreviations

The following terms and abbreviations will be used throughout this document:

**Table 1 – Terms and Abbreviations**

Term	Abbreviation	Description
American Association for Laboratory Accreditation	A2LA	A nonprofit, non-governmental, public service, membership society whose mission is to provide comprehensive services in laboratory accreditation and laboratory-related training.
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.
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 CompactFlash.
Commercial Off the Shelf	COTS	Term used to designate computer software, hardware or accessories that are ready-made and available for sale, lease, or license to the general public.
Direct Recording Electronic	DRE	Voting systems that, using Touch Screen or other user interfaces, directly record the voter's selections in each race or contest on the ballot in electronic form.
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 layout the ballots, download the election data to the voting devices, upload the results and produce the final results reports.
Electromagnetic Compatibility / Electromagnetic Interference	EMC/EMI	The goal of EMC/EMI 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	The testing activities associated with the functional testing of the system.



Term	Abbreviation	Description
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.).
Precinct Count Scanner	PCS	A digital scanner is a mark sense-based ballot and vote counting device located at a polling place and is typically operated by scanning one ballot at a time.
Request For Interpretation	RFI	A means used by testing laboratories and manufacturers to request that the EAC provide an interpretation of a technical issue related to testing of voting systems.
Requirements Matrix	N/A	A matrix that traces the VVSG requirements to the various test modules and test methods.
Technical Data Package	TDP	The data package supplied by the vendor, which 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 a voting system.
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).
Verity vDrive	vDrive	Media used for transportation of voting system data.
Voluntary Voting System Guidelines	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 for EAC certification.



Term	Abbreviation	Description
Voter Verifiable Paper Audit Trail	VVPAT	An independent verification system for voting machines designed to allow voters to verify that their vote was cast correctly, to detect possible election fraud or malfunction, and to provide a means to audit the stored electronic results.
Voting System Test Lab	VSTL	An independent testing organization accredited by NVLAP and the EAC to conduct voting system testing for EAC certification.

## 1.5 Testing Responsibilities

This section describes the project responsibilities.

- System Analysis and Review will be conducted by Source Code Review, Security and Voting Test Engineers, with oversight by the Test Manager.
- Source code review will be conducted by Voting Test Engineers (Source Code Review Specialists), with oversight by the Test Manager.
- Documentation review will be conducted by Security and Voting Test Engineers, with oversight by the Test Manager.
- Test Module Development will be conducted by Security and Voting Test Engineers, with oversight by the Test Manager.
- Test Suite Development will be conducted by Security and Voting Test Engineers, utilizing SLI's formal Test Methods, with oversight by the Test Manager.
- Formal Test Execution will be conducted by Security and Voting Test Engineers, with oversight by the Test Manager.
- Third party testing will be conducted by the subcontracting third party hardware laboratories, with oversight by the Hardware Test Engineer.



## 1.5.1 Project Schedule

The following schedule outlines the expected timeline for this project.

ID	Notes	Task Name	Start	Finish
1		<b>Hart Verity 2.4 Federal Certification Project Plan</b>	<b>Wed 7/31/19</b>	<b>Wed 2/5/20</b>
2		<b>Test Readiness Review (TRR)</b>	<b>Mon 9/9/19</b>	<b>Tue 9/10/19</b>
12		<b>Phase 1 Initiation</b>	<b>Wed 7/31/19</b>	<b>Mon 11/11/19</b>
13		<b>Project Initiation</b>	<b>Fri 9/13/19</b>	<b>Fri 9/13/19</b>
15		<b>TDP Deliver/Receive Vendor Package</b>	<b>Mon 9/9/19</b>	<b>Fri 9/13/19</b>
46		<b>TDP Review</b>	<b>Wed 7/31/19</b>	<b>Tue 10/1/19</b>
47		<b>Review - Source Code</b>	<b>Wed 7/31/19</b>	<b>Mon 8/26/19</b>
64		<b>PCA Document Review</b>	<b>Fri 9/13/19</b>	<b>Tue 10/1/19</b>
99		<b>FCA Assessment</b>	<b>Tue 9/24/19</b>	<b>Wed 9/25/19</b>
104		<b>Hardware</b>	<b>Wed 9/11/19</b>	<b>Thu 11/7/19</b>
105		<b>HW / SW Configuration Audit</b>	<b>Wed 9/11/19</b>	<b>Wed 9/11/19</b>
109		<b>Develop HW TestPlan</b>	<b>Thu 9/12/19</b>	<b>Fri 9/13/19</b>
111		<b>Hardware Test Execution</b>	<b>Fri 9/20/19</b>	<b>Thu 11/7/19</b>
117		<b>Test Plan Development</b>	<b>Thu 9/19/19</b>	<b>Mon 11/11/19</b>
123		<b>Phase 2 Preparation</b>	<b>Tue 9/17/19</b>	<b>Wed 9/25/19</b>
124		<b>Training</b>	<b>Tue 9/17/19</b>	<b>Tue 9/17/19</b>
126		<b>Test Suite Development</b>	<b>Wed 9/25/19</b>	<b>Wed 9/25/19</b>
128		<b>Phase 3 Create/Validate</b>	<b>Tue 9/17/19</b>	<b>Tue 10/15/19</b>
129		<b>Vendor Specific Module and Suite Creation/Validation</b>	<b>Tue 9/17/19</b>	<b>Tue 10/15/19</b>
233		<b>Phase 4 Trusted Build</b>	<b>Mon 9/9/19</b>	<b>Thu 9/12/19</b>
234		<b>Trusted Build</b>	<b>Mon 9/9/19</b>	<b>Thu 9/12/19</b>
241		<b>Phase 5 Official Execution</b>	<b>Thu 9/12/19</b>	<b>Fri 12/6/19</b>
242		<b>Official Test Execution of Test Suites</b>	<b>Thu 9/12/19</b>	<b>Fri 12/6/19</b>
349		<b>Phase 6 Reporting to EAC</b>	<b>Mon 11/18/19</b>	<b>Tue 1/21/20</b>
350		<b>Certification Test Report and Final Test Plan</b>	<b>Wed 11/27/19</b>	<b>Mon 1/20/20</b>
355		<b>Delivery of Artifacts to EAC Repository</b>	<b>Mon 1/20/20</b>	<b>Tue 1/21/20</b>
358		<b>Project Management</b>	<b>Mon 11/18/19</b>	<b>Mon 12/30/19</b>
360		<b>Phase 7</b>	<b>Mon 1/20/20</b>	<b>Wed 2/5/20</b>
361		<b>Return Equipment to Vendor</b>	<b>Mon 2/3/20</b>	<b>Wed 2/5/20</b>
364		<b>Archive Test Materials</b>	<b>Mon 1/20/20</b>	<b>Tue 1/21/20</b>

## 1.5.2 Test Module Development and Validation

Test Modules will be developed and/or modified to provide repeatable detailed test steps. The Modules are defined at a basic level in SLI's formal Test Methods and are designed for use in any suite that employs their functionality. This reusability reduces the development time associated with creating Modules. The Modules will be validated prior to Formal Test Execution to ensure accurate testing of the voting system. Additionally, the Test Modules will provide traceability to SLI's formal Test Methods, as well as the VVSG 1.0 requirements.



### 1.5.3 Test Suite Development

Test Suites will be developed to group and focus testing around key areas of the voting system. Each Test Suite will contain multiple test modules providing clear and traceable test scripts and information. Potentially, variations of the same suite may be run multiple times to verify different configurations.

### 1.5.4 Trusted Build

Prior to Formal Test Execution, a Trusted Build will be performed, producing software and firmware components for **Verity Data, Verity Build, Verity Print, Verity Controller, Verity Touch, Verity Touch Writer, Verity Touch Writer Duo, Verity Scan, Verity Central, Verity Count, and Verity Relay** in order to include modifications made to those applications.

### 1.5.5 Formal Test Execution

Formal Test Execution of the validated Test Suites will be conducted against the declared voting system, to verify the system’s compliance with the VVSG 1.0 requirements.

### 1.5.6 Third Party Hardware Testing

Hardware testing will be conducted by 3rd Party accredited hardware test laboratories to verify the voting system devices are compliant with the VVSG hardware requirements.

#### Other Labs Performing Non-Core Hardware Testing

SLI Compliance is responsible for all core voting system tests as identified in the NIST NVLAP Handbook 150-22 (2017). The labs listed below will perform non-core hardware testing for this certification test campaign.

**Table 3 – Labs Performing Hardware Testing**

Laboratory	Address	Test(s)	Date(s)
NTS EMC / EMI	1736 Vista View Dr. Longmont, CO 80504	<b><u>EMC / EMI Tests:</u></b> Radiated Emissions, Conducted Emissions, ESD, Electromagnetic Susceptibility, Electrical Fast Transient, Lightning Surge, Conducted RF Immunity, Magnetic Fields Immunity, Electrical Power Disturbance	9/23/2019 – 10/1/2019
NTS Environmental / Dynamic	1601 Dry Creek Drive Suite 200 Longmont, CO 80503	<b><u>MIL-STD-810D Tests:</u></b> Temperature/Power Variation and Reliability	10/14/2019 – 10/17/2019



Please see “Attachment A - Hart Verity Voting 2.4 Electrical Hardware Test Plan v1.0” and “Attachment B - Hart Verity Voting 2.4 Environmental Hardware Test Plan v1.0” for more information regarding hardware testing that will be performed.

### **1.5.7 EAC & Manufacturer Dependencies**

The Test Plan will require EAC approval prior to finalization.

**Hart** will be required to provide all source code, documentation, equipment and supporting materials identified as part of the voting system.

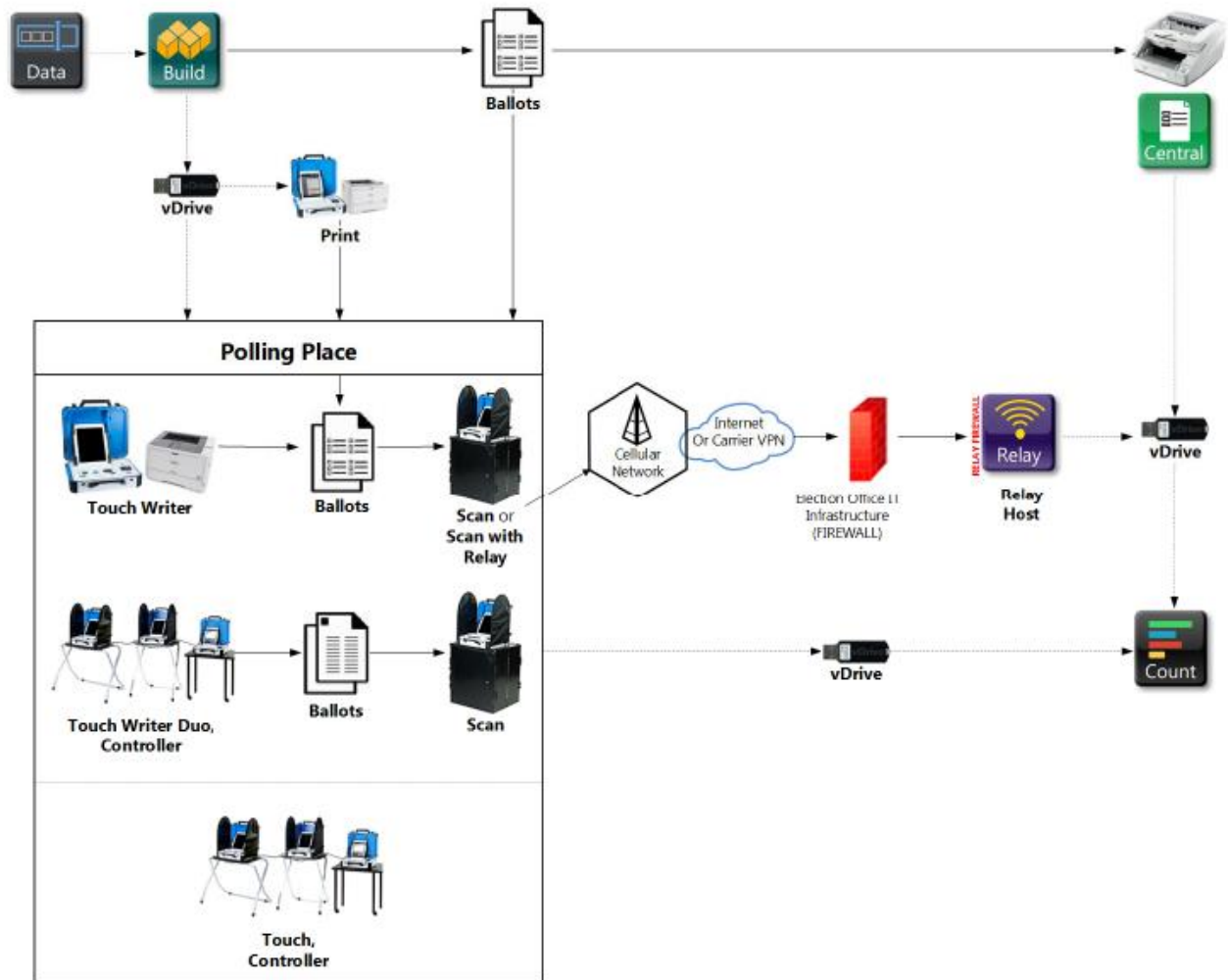
The source code must have all discrepancies resolved, be able to be built successfully, and installed.

In addition, **Hart** is required to provide training on the voting system and support throughout the life of the project.



## 1.6 Scope of Testing

### 1.6.1 Block 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 vDrives and are also used to separate the deployment models shown within the polling place.
- Verity Print is a ballot production device that provides unmarked printed ballots.
- Verity Touch Writer and Scan may be installed in polling places to support paper-based voting.
- Verity Controller, Touch Writer Duo, and Scan may be installed in polling



places to support paper-based voting.

- Verity Controller and Touch may be installed in polling places to support DRE voting.
- Verity Relay is a remote transmission software application that receives election data transmissions sent by Verity Scan devices equipped with an optional Relay modem accessory.
- Verity Key (not shown) is required for user access into components to load elections, use critical features, and to generate reports. Feature access depends on the roles applied to user accounts.

### 1.6.2 EAC Request For Interpretation – RFI

EAC RFI 2010-01 is relevant to this modification project.

### 1.6.3 EAC Notices of Clarification - NOC

This Certification Test Plan and the execution of tests for the voting system identified in this plan account for the following NOCs:

- NOC 13-02: Detailed Description of Changes for Modifications
- NOC 09-005: Development and Submission of Test Plans for Modifications to EAC Certified Systems.
- NOC 09-002: Clarification of EAC Laboratory Independence Requirement
- NOC 09-001: Clarification of the Requirements for Voting System Test Laboratories (VSTLs) Development and Submission of Test Plans
- NOC 08-003: Clarification of EAC Conformance Testing Requirements for Voting System Test Laboratories (VSTLs)

## 2 PRE-CERTIFICATION TESTING AND ISSUES

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### 2.1 Evaluation of prior VSTL testing

Prior VSTL testing has been performed on predecessor versions of the **Hart Verity Voting 2.4** voting system. A full test campaign was done by SLI during the **Verity Voting 2.0** EAC certification project. The **Verity Voting 2.3** release, which was VSTL tested and EAC certified, constitutes the main code base used for the **Verity Voting 2.4** release. In addition, features from VSTL tested and EAC certified **Verity Voting 2.2.2** and **Verity Voting 2.3.4** releases are included in the modifications for this test campaign.



## 2.2 Evaluation of prior non-VSTL testing

No prior state or non-VSTL lab testing has been performed on the **Hart Verity Voting 2.4** voting system. Review of Hart’s internal testing will be performed during the FCA review.

## 2.3 Known Field Issues

Review of the “Known Vulnerabilities” database, maintained by SLI, has provided 53 known vulnerabilities to all previous versions of Hart systems. These vulnerabilities are accounted for in SLI’s Test Methods.

# 3 MATERIALS REQUIRED FOR TESTING

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Any materials that are used in an election cycle must be provided to SLI to facilitate testing of the voting system. This section outlines these required materials.

## 3.1 Software/Firmware

All software and 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 following software/firmware is required. This includes all supporting software such as operating systems, compilers, assemblers, application software and firmware, any applications used for burning of media, transmission of data or creation/management of databases.

### 3.1.1 Hart Verity Voting 2.4 Software/Firmware

**Hart Verity Voting 2.4** voting system consists of the following software and firmware components:

- **Verity Data** EMS software
- **Verity Build** EMS software
- **Verity Central** high-speed optical scanner software
- **Verity Count** central count location tabulation and reporting software
- **Verity Relay** data transmission software
- **Verity Scan** optical scanner firmware
- **Verity Touch Writer** BMD firmware
- **Verity Touch Writer Duo** BMD firmware
- **Verity Controller** firmware
- **Verity Touch** DRE firmware
- **Verity Print** printer firmware
- **Verity** device microcontroller firmware for **Verity** devices



Note: Versions for each will be available after execution of the Trusted Build and will be listed in the Test Report.

### 3.1.2 COTS Software/Firmware

This section details the Commercial Off The Shelf software and firmware utilized within the **Verity Voting 2.4** system.

**Table 2 – COTS Software/Firmware**

Manufacturer	Application	Version	Verity Voting 2.4 Component
Microsoft	Microsoft Windows Embedded Standard 7 with Service Pack 1	6.1.7601	Data/Build, Data/Build + Count, Central, Count, Print, Touch Writer, Scan, Touch Writer Duo, Controller, Touch, Touch with Access
Microsoft	Microsoft SQL Server 2012 for Embedded Systems	11.0.2100	Data/Build, Data/Build + Count, Central, Count
Microsoft	Microsoft SQL Server 2012 Express	11.0.2100	Print, Touch Writer, Scan, Touch Writer Duo, Controller, Touch, Touch with Access
McAfee	McAfee Application Control for Devices	8.2.1-140	Data/Build, Data/Build + Count, Central, Count, Print, Touch Writer, Scan, Touch Writer Duo, Controller, Touch, Touch with Access
Nuance Communications	Nuance Western OCR, Desktop, OEM	V20	Verity Scan

### 3.1.3 Additional Supporting Test Software

This section outlines all test specific software that will be used in the certification campaign.

**Table 3 – Additional Supporting Test Software**

Manufacturer	Application
LocMetrics	<u>LocMetrics Line Counter</u> , a commercial application used to determine the counts of executable and comment lines
SLI	<u>Module Finder</u> , a SLI proprietary application used to parse module names from C/C++, Java and VB code and populate the identified module names into the review documents
PrestoSoft	<u>ExamDiff Pro</u> : a commercial application used to compare revised code to previously reviewed code

## 3.2 Equipment

The following equipment is required for the execution of the hardware, software



and security tests. This includes system hardware, general purpose data processing and communications equipment, and any test instrumentation required.

### 3.2.1 Hart Verity Voting 2.4 Equipment

The following **Hart Verity Voting 2.4** equipment will be used in testing:

**Table 4 – Hart Verity Voting 2.4 Equipment**

Hardware
Verity Scan (digital scanner)
Verity Touch (DRE)
Verity Touch Writer (BMD)
Verity Touch Writer Duo (BMD)
Verity Print
Verity Controller

### 3.2.2 COTS Equipment

The following Commercial Off-the-Shelf equipment will be used in testing:

**Table 5 – COTS Equipment**

Manufacturer	Hardware	Model
OKIDATA (for <b>Verity Data, Verity Build, Verity Print, Verity Central, Verity Touch Writer, Verity Touch Writer Duo and Verity Count</b> )	Ballot and Report Printer	B432dn
OKIDATA (for <b>Verity Print, Verity Build</b> )	Ballot Printer	C844dn
OKIDATA (for <b>Verity Build</b> )	Ballot Printer	C931e
Various (for <b>Verity Data, Verity Build, Verity Central and Verity Count</b> )	Intel-Windows Workstation ( <b>Minimum Requirements</b> ) Processor – Intel Celeron D 420 3.06GHz Dual Core Memory – 2GB Hard Drive – 120 GB Removable Storage – 8xDVD+/-RW Slim line USB Ports – 4 ports Video Card - Integrated Graphics Keyboard - USB Keyboard Mouse - USB Mouse	
Various (for <b>Verity Data, Verity Build, Verity Central, Verity Count,</b>	<b>Monitor (Minimum Requirements)</b> Panel Size - 50.8 cm Aspect Ratio - Widescreen (16:9)	



Manufacturer	Hardware	Model
Verity Relay)	Optimal Resolution - 1600 x 900 at 60Hz Contrast Ratio - 1000: 1 Brightness - 250 cd/m2 (typical)	
Canon (for Verity Central)	Ballot Scanner	DR-G1100 DR-G1130 DR-G2110 DR-G2140

### 3.3 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, test ballot cards and control cards, standard and optional output data report formats, and any other materials used in testing.

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

### 3.4 Deliverable Documents

The following are documents to be delivered as a part of the **Hart Verity Voting 2.4** system:

- All-In-One Code Framework Coding Standards.pdf
- Configuration Management Process 1001074 D01.pdf
- Continual Improvement Process 1000550 E02.pdf
- Control of Nonconforming Product Procedure 1000657 B02.pdf
- Device Configuration Process Document 4005523 B00.pdf
- Device OS Creation and Configuration Process Document Verity 2.4 4005563 A01.pdf
- Device WES7 Creation Process Document Verity 4005562 A01.pdf
- Document Control Procedure 1000538 E05.pdf
- Factory TUV SUD inspection 2019 June report signed.pdf
- Hardware 2005713-CFAST Door Security Kit Design.pdf
- Hardware 3005018-ATI Kit Design.pdf
- Hardware 3005174-AutoBallot Kit Design.pdf
- Hardware 3005350-Scan Design.pdf
- Hardware 3005351-Controller Design.pdf
- Hardware 3005352-Touch Writer Design.pdf
- Hardware 3005353-Touch with Access Design.pdf
- Hardware 3005355-Touch Design.pdf



- Hardware 3005356-Print Design.pdf
- Hardware 3005357-Ballot Box Design.pdf
- Hardware 3005358-Standard Booth Design.pdf
- Hardware 3005359-Accessible Booth Design.pdf
- Hardware 3005700-Touch Writer Duo Design.pdf
- Hardware 3005800-Scan Design.pdf
- Hardware 3005801-Accessible Booth With ATI Tray Design.pdf
- Hardware 3005825-Controller Design.pdf
- Hardware 3005852-Touch Writer Design.pdf
- Hardware 3005853-Touch with Access Design.pdf
- Hardware 3005854-Touch Design.pdf
- Hardware 3005856-Print Design.pdf
- Hardware Design Development Procedure 1000513 D01.pdf
- Hardware PCB Photos.pdf
- Hardware Verification and Validation Process 1000514 D01.pdf
- Hart Safety Certificate U8 17 10 90917 004.pdf
- Hart Safety Certificate U8 090917 0005.pdf
- Hart Secure Ballot Stock Specification 4005526 A01.pdf
- HPQC Test Cases
- Quality Manual 1000490 D04.pdf
- Record Retention Matrix 1000510 E02.pdf
- Software Design Development Procedure 1000566 D02.pdf
- Software Production 1000551 E01.pdf
- Software Test Design Development 1000508 D02.pdf
- Software Verification and Validation Process 1000560 D02.pdf
- Software Versioning Procedure 1001070 C04.pdf
- SQA Requirements Management Process 1000540 A02.pdf
- Supplier Qualification and Management 1000563 C02.pdf
- The Creation and Configuration of the Access Build Environment 4005517 A01.pdf
- The Creation and Configuration of the MCU Build Environment 4005519 A02.pdf
- The Creation and Configuration of the Trusted Build Environment 4005518 A02.pdf
- Verity 2.4 Implementation Statement 4005652 A01.pdf
- Verity 2.4 Notice of Protected Information 1000778 A00.pdf
- Verity 2.4 TDP Abstract 1000779 A00.pdf
- Verity 2.4 VVSG 1.0 TDP Trace.pdf
- Verity 2.4.X COTS List.pdf
- Verity Airgap Interface Technical Reference 4005512 A02.pdf
- Verity Application Framework TRD 4005634 A00.pdf



- Verity Application Installer Build Process Document Verity 2.4.0 4005656 A00.pdf
- Verity Application Programming Interface Specification 4005604 A04.pdf
- Verity Ballot Creation TRD 4005636 A00.pdf
- Verity Base Station Microcontroller Specification 4005462 A01.pdf
- Verity Build TRD 4005628 A00.pdf
- Verity Central TRD 4005632 A00.pdf
- Verity Coding Standard 4005498 A14.pdf
- Verity Controller TRD 4005624 A01.pdf
- Verity Count TRD 4005629 A01.pdf
- Verity Data TRD 4005627 A00.pdf
- Verity Database Attributes 4005543 C03.pdf
- Verity Device Suite TRD 4005621 A00.pdf
- Verity Election Definition Data TRD 4005639 A01.pdf
- Verity Election Management TRD 4005631 A00.pdf
- Verity Electronics Specification 4005461 A18.pdf
- Verity Entity Relationship Diagram Database - Devices.pdf
- Verity Entity Relationship Diagram Database - Servers (Count Only).pdf
- Verity Entity Relationship Diagram Database - Servers (No Count).pdf
- Verity Key Design 4005514 A02.pdf
- Verity Logging Design NR 103.pdf
- Verity Logging TRD 4005635 A00.pdf
- Verity Omni Modification TRD 4005655 A01.pdf
- Verity Operational Environment 4005515 C09.pdf
- Verity PC Application Framework User Interface Design Document.pdf
- Verity Performance Characteristics 4005497 C03.pdf
- Verity Print TRD 4005626 A00.pdf
- Verity Relay Theory of Operations 4005571 A03.pdf
- Verity Risk and Threat Assessment 4005513 C03.pdf
- Verity Scan TRD 4005623 A00.pdf
- Verity Security Requirements 4005464 A07.pdf
- Verity Shared Device User Interface Design Document.pdf
- Verity Software Architecture-Design 4005463 B01.pdf
- Verity Summative Usability Report 4005496 A00.pdf
- Verity Summative Usability Test Plan 4005495 A01.pdf
- Verity Supply Chain PRD 4005302 C01.pdf
- Verity System Limits 4005470 C02.pdf
- Verity Touch TRD 4005633 A00.pdf
- Verity Touch Writer Duo Base Station Microcontroller Specification 4005638 A00.pdf
- Verity Touch Writer Duo TRD 4005625 A00.pdf
- Verity Touch Writer TRD 4005622 A00.pdf





- Verity User Management TRD 4005630 A00.pdf
- Verity Vote Counting and Cast Vote Records TRD 4005640 A00.pdf
- Verity Voting 2.4 Change Notes 4005653 A01.pdf
- Verity Voting 2.4 Usability Impact Statement.pdf
- Verity Voting National Certification Test Specification 4005527 B03.pdf
- Verity Workstation Manufacturing 4005525 B02.pdf
- Verity\_2.4\_Administrators Guide\_Build 6641-031 A00.pdf
- Verity\_2.4\_Administrators Guide\_Central 6641-032 A00.pdf
- Verity\_2.4\_Administrators Guide\_Count 6641-033 A00.pdf
- Verity\_2.4\_Administrators Guide\_Data 6641-030 A00.pdf
- Verity\_2.4\_Administrators Guide\_Relay 6641-034 A00.pdf
- Verity\_2.4\_Device Troubleshooting Field Guide 6653-007 A00.pdf
- Verity\_2.4\_Polling Place Field Guide - CDS 6651-021 A00.pdf
- Verity\_2.4\_Polling Place Field Guide - CT 6651-023 A00.pdf
- Verity\_2.4\_Polling Place Field Guide - SW 6651-022 A00.pdf
- Verity\_2.4\_Polling Place Field Guide - SW-Relay 6651-024 A00.pdf
- Verity\_2.4\_Support Procedures Guide 6643-007 A00.pdf
- Verity\_2.4\_System Administrators Guide 6641-035 A00.pdf
- Verity\_2.4\_Verity Print Field Guide 6651-025 A00.pdf
- Verity\_2.4\_Verity Scan Field Guide - Central 6651-026 A00.pdf
- VirTex Q01 Quality Manual Rev R.pdf
- Voting System Implementation and Maintenance 1000745 C02.pdf
- VSTL Product Submission Procedure 1000565 D02.pdf
- Workstation Configuration Process Document Verity 2.4 4005564 A02.pdf
- Workstation WES7 Creation Process Document Verity 2.0 4005565 A00.pdf

## 4 TEST SPECIFICATIONS

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The following are the specifications for testing to be conducted on the **Hart Verity Voting 2.4** system. The specifications contain details on the focus of testing, configuration(s), and the functions to be tested.

### 4.1 VVSG Requirements

#### 4.1.1 Functional Requirements

The **Verity Voting 2.4** modification will be tested to the VVSG 1.0 requirements listed below:

##### Volume I:

- 2.1.1.a-c,e Security
- 2.1.2.a,b,c Accuracy



- 2.1.7.1.b,c Functions
- 2.1.7.2 Voting Variations
- 2.1.9 Telecommunications
- 2.2.2.d Election Programming
- 2.2.4.a-e Readiness Testing
- 2.3.1.3.a DRE System Requirements
- 2.3.3.1.c,d Common Requirements
- 2.3.3.2.b,e,f-h Paper based System Requirements
- 2.3.3.3.c,d,e,f,h,j,k,o DRE System Requirements
- 2.4 Post Voting Capabilities
- 2.4.2 Consolidating Vote Data
- 4.1.1 Accuracy Requirements
- 4.1.5.2 Ballot Reading Accuracy
- 6 Telecommunications Requirements
- 6.1.3 Data Transmission
- 6.2.1 Accuracy
- 7 Security Requirements
- 7.5.1.a Maintaining Data Integrity

#### Volume II

- 3.2.3 Testing to Reflect Additional Capabilities
- 3.2.4 Testing to Reflect Previously Tested Capabilities

### 4.1.2 Hardware Requirements

#### Volume I:

- 2.1.4.b,c,d Integrity
- 4.1.2.4-12 Environmental Requirements
- 4.1.7.2 Printers
- 4.3.3 Reliability

#### Volume II:

- 4.7.1 Temperature and Power Variation Tests
- 4.7.3 Reliability Test
- 4.8 Other Environmental Tests

## 4.2 Hardware Configuration and Design

The **Hart Verity Voting 2.4** system, as declared in the application for certification submitted to the EAC, consists of:

- A **Verity Data/Build** workstation to create all election information and election media.



- **Verity Print** is a pre-voting ballot production device that is paired with a COTS printer to produce unmarked paper ballots.
- At the precinct level, **Verity Scan** optical scanners, **Verity Touch DRE** and **Verity Touch Writer BMD**, and **Verity Touch Writer Duo BMD** configurations are employed.
- The central count location employs a high-speed COTS scanner, in combination with a workstation that utilizes the **Verity Central** software, for tabulation of paper ballots.
- The consolidation, tally and reporting location employs a workstation with **Verity Count** software as well as a printer.
- **Verity Relay** is a remote transmission software application that receives election data transmissions sent by Verity Scan devices equipped with an optional Relay modem accessory.

## 4.3 Test Suite Design

### 4.3.1 Software Functional Test Design and Data

SLI will prepare functional test modules using the operator/user procedures specified in the TDP. Functionality provided by the **Verity Voting 2.4** voting system is exercised in order to verify that each functional component performs as expected. Accept/reject criteria are based on requirements of the VVSG and the system specification documents provided within the TDP. As many of the individual functional components rely on preceding functionality within the system, SLI incorporates system level suites that employ modules that exercise the individual functional components of the system.

Following analysis of the changes incorporated into the **Verity Voting 2.4** voting system, the following tests will be implemented:

Modification test suite – The modifications to each component and software application will be given focused testing in order to verify that the modifications implemented, and the subsequent Trusted Build of the software, do not adversely affect operations.

General Election Variation 1 - A general election definition will be designed to test the Michigan Straight Party method to ensure all Michigan specific modifications and Straight Party functionality are working correctly as documented and in accordance with the VVSG 1.0 requirements.

General Election Variation 2 – A general election definition will be designed to test the Pennsylvania Straight Party method to ensure all Pennsylvania specific modifications and Straight Party functionality are working correctly as documented and in accordance with the VVSG 1.0 requirements.



General Election Variation 3 – The full **Verity Voting 2.4** voting system will be reviewed in order to verify proper integration of the voting system and that all components continue to work as expected.

Open Primary Election test suite – The full **Verity Voting 2.4** voting system will be reviewed in order to verify proper integration of the voting system and that all components continue to work as expected.

Accuracy test suite – **Verity Central** will be tested for accuracy of ballot marks reading in association with updated hardware.

**Telecommunications** test suite - The **Verity Relay** component will be given focused testing in order to verify the full functionality of the application, in accordance with VVSG 1.0 requirements for telecommunications.

## 4.4 Security Functions

### 4.4.1 Security Test Suite

The Security Test Suites are SLI's tests for verifying that a voting system will correspond to requirements in VVSG Volume 1, Section 7. These suites incorporate system security provisions, unauthorized access, deletion or modification of data, audit trail data, and modification or elimination of security mechanisms. These tests will be selectively utilized to focus on the modifications from section 1.1.2 that relate to physical security measures, telecommunications, access control, and software/firmware security.

In its security testing SLI identifies the specific threats that are tested for and the associated risk if a flaw or exception is identified in a voting system. The tests used by SLI are designed to ensure that the voting system meets or exceeds the requirements in the VVSG. In any instance where an anomaly or possible security flaw is identified, the potential risk is reported and evaluated.

## 4.5 TDP Evaluation

SLI is completing an assessment of the deliveries of the Technical Data Package for **Verity Voting 2.4** against the **Verity Voting 2.3** TDP. Any modification to previously reviewed documentation will be evaluated. Any subsequent re-deliveries of the TDP items will be solely the result of fixes to discrepancies identified in the remaining FCA or PCA activities.

SLI will conduct a PCA review of all vendor traced documents submitted for review in the delivery of the **Verity Voting 2.4** TDP. Documents are verified for compliance to the VVSG 1.0, Volume 2, Sections 2.2 through 2.13 and Volume 2, Section 6.6.



## 4.6 Source Code Review

The certification campaign for the **Hart Verity Voting 2.4** voting system includes proprietary software and firmware that have been created/modified by **Hart**. SLI has conducted a source code review of all modified proprietary source code submitted in the delivery of the voting system for compliance to the VVSG 1.0, Volume 2, Section 6.6.

The coding languages involved in the vendor's applications include:

- C
- C++
- C#

Source Code Review Tools utilized by SLI include:

- Practiline Line Counter: a commercial application used to determine the counts of executable and comment lines
- Module Finder: an SLI proprietary application used to parse module names from C/C++ and VB code and populate the identified module names into the review documents
- ExamDiff Pro: a commercial application used to compare revised code to previously reviewed code

Any subsequent re-reviews of source code will be the result of fixes to discrepancies identified in the FCA activities.

COTS operating systems and software used in the voting system have been verified as authentic and unmodified in the **Verity Voting 2.4** test campaign.

## 4.7 Trusted Build

The Trusted Build will be conducted prior to SLI's official testing and will be completed on site at SLI's facility. SLI will use its approved standard lab procedure that details the processes for controlling, managing, and conducting the Trusted Build. This process includes the following:

- Preparation for the Trusted Build – Obtaining and reviewing Hart's procedure for constructing the build platform, verifying the target build platform, and acquiring and verifying the necessary materials, if rebuild of the existing environment is needed.
- Execution of the Trusted Build – SLI will perform the Trusted Build by using the step-by-step build procedure, as provided by **Hart** to create a pristine build environment. SLI ascertains and records the following items throughout the build process:
  - Build environment images at various key points
  - Build environment and file hashes at various key points



- Build environment hardware characteristics
  - Build results from code compilation and file hashes
  - Final software install files and file hashes
  - Build virtual machine files
- Deliverables to Testing – Upon completion of the Trusted Build, certain items are sent to the SLI test group. The final result will be a media containing the following:
    - Final software install files
    - Hash values to validate install files
  - Final Record Keeping and Archiving Procedures – At the conclusion of the Trusted Build process, SLI completes all final record keeping and archiving procedures at SLI’s facility. This record keeping includes any unique identifiers, results of the build with version numbers and dates, and descriptions of all hashes and images in the repository.

## 4.8 Standard VSTL Test Methods and Uncertainty of Test Data Measurement

This test campaign utilizes Standard VSTL test methods and election specific type test data only.

## 5 TEST DATA

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Test data for the **Hart Verity Voting 2.4** voting system will be compiled such that all functionality declared will be tested to determine conformance to the standards.

### 5.1 Data Recording

SLI will evaluate the system functionality, as described by **Hart** technical documentation, as well as requirements as listed in the EAC VVSG 1.0, and make determinations as to expected results of all data inputs into the **Hart Verity Voting 2.4** voting system. This includes:

- Election type
- Precincts of all types
- Districts
- Offices
- Contests
- Candidates
- Parties
- Devices used
- Voting variations employed



- Issues/Referendums
- Votes cast for each candidate/issue/referendum

Testing information will be recorded in the test suites, as well as in test notebooks, which are utilized according to SLI's corresponding standard lab procedure.

## 5.2 Test Data Criteria

SLI will evaluate the system functionality as described by Hart technical documentation, as well as requirements as listed in the EAC VVSG 1.0, and make determinations as to expected output of all data inputs into the **Hart Verity Voting 2.4** voting system. The system's execution shall be measured against the expected results.

## 6 TEST PROCEDURE AND CONDITIONS

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This section describes the test conditions and procedures for execution of test suites. Additionally, this section is used to describe procedures for setting up equipment that will be utilized in the execution of the test suites.

### 6.1 Facility Requirements

Testing will be performed on-site at SLI in Wheat Ridge, Colorado.

Secure labs are available with appropriate power supply and space to accommodate the various configurations defined within this test plan. Temperature/humidity gauges will be employed to determine whether the appropriate conditions exist during testing.

Unless otherwise specified herein, all remaining tests, including system level functional testing, shall be performed at standard ambient conditions:

- Temperature: 64°F - 79°F (17.7°C - 26.1°C)
- Relative Humidity: 20 to 90%
- Atmospheric Pressure: Local Site Pressure

All TDP and test documentation is stored on site at SLI's facility in a secure project directory on SLI's secure "Voting" and "TDP" servers.

Electrical hardware testing for hardware components of the **Hart Verity Voting 2.4** voting system will be performed at either NVLAP or A2LA accredited testing laboratories or at laboratories audited by SLI to NVLAP Handbook 150-22 requirements.



## 6.2 Test Setup

Configurations of **Verity Voting 2.4** will be deployed that conform to each specific test suite's needs. In all instances **Verity Voting 2.4** documentation will be followed in the setup of the configurations.

## 6.3 Test Sequence

While there is no required sequence for performing voting system certification testing and audits, there are prerequisite tasks for some testing. Any needed prerequisites are contained within the suite for that test.

## 6.4 Test Operations Procedures

An inventory has been performed to verify the voting equipment received contains hardware and software elements as defined in the TDP prior to commencement of testing.

Throughout the testing effort, test suites and modules will be marked as follows:

- **Accept** – Test is accepted as successful.
- **Reject** – Test is rejected as unsuccessful.
- **NT** – Not Testable is used for test modules that cannot be completed. For example, if failure of one test modules failure precludes attempting subsequent test modules, the latter will be marked as NT.

Test results **Reject** and **NT** will include comments by the VTS explaining the reason for the result.

Issues encountered during review and testing will be documented on the Discrepancy Report. Test findings showing that an aspect of the voting system does not conform to the requirements of the identified test standard will be marked as Documentation Discrepancies, Source Code Review Discrepancies, Hardware Discrepancies, or Functional Discrepancies.

Issues that are encountered during testing or documentation review but are not addressed by the applicable standard will be added to the Discrepancy report and noted as Informational. The vendor has the option whether to address Informational issues. All responses provided by the vendor are noted in the Discrepancy Report attachment to the Certification Test Report.





## 7 Approval Signatures

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SLI:

A handwritten signature in blue ink, appearing to read 'Traci Mapps'.

Traci Mapps  
Director, SLI Compliance  
September 26<sup>th</sup>, 2019

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End of Verity Voting 2.4 Modification Test Plan

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