Electrical Hardware Test Plan

EAC VVSG 1.0

Document Number HIN-19003-ELETP-01

Prepared for:

Vendor Name	*Hart InterCivic*
Vendor System	*Verity 2.4*
EAC Application No.	*HRT-Verity-2.4*
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NVLAP TESTING
NVLAP Lab Code 200733-0

Accredited by the Election Assistance Commission (EAC) for Selected Voting System Test Methods or Services

Revision History

Date	Release	Author	Revision Summary
September 13, 2019	1.0	Darrick Forester	Initial Release

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1 INTRODUCTION

This test plan covers the EMC (Electromagnetic Compatibility) and EMI (Electromagnetic Interference) test requirements and methods for the Hart InterCivic Verity 2.4 voting system, to the requirements as stated in Election Assistance Commission 2005 Voluntary Voting System Guidelines 1.0 (VVSG 1.0). The devices covered within this test plan are Verity Touch Writer and Controller / Touch / Touch with Access, and will hereafter be referred to as the Unit Under Test (UUT).

1.1 Qualifications

The UUT supplied by Hart InterCivic is representative of product produced in their volume manufacturing process.

1.2 Hardware Test Lab Facility

NTS, EMI / EMC Test Lab
1736 Vista View Drive
Longmont, Colorado 80504

1.3 Reference Documents

1. Election Assistance Commission Voluntary Voting System Guidelines version 1.0 (VVSG 1.0), Volumes I & II.
2. EAC Voting System Testing and Certification Program Manual, United States Election Assistance, v 2.0, May 2015.
3. EAC Voting System Testing Laboratory Program Manual, United States Election Assistance , Commission v 2.0, May 2015.
4. NIST Handbook 150-2016.
5. NIST Handbook 150-22-2017.
6. NOC 2007-05 - Voting System Test Laboratory (VSTL) responsibilities in the management and oversight of third party testing.
7. EAC Notice of Clarification 08-001: Validity of Prior Non-Core Hardware Environmental and EMC Testing.
8. EAC Decision on Request for Interpretation 2007-05 (COTS).
9. EAC Decision on Request for Interpretation 2008-02 Battery Back Up for Op Scan.
10. EAC Decision on Request for Interpretation 2008-10 (EFT) .
11. EAC Decision on Request for Interpretation 2009-03 Battery Back Up for Central Count.
12. EAC Decision on Request for Interpretation 2010-01 Voltage Levels and ESD Test.
13. SLI VSTL Quality System Manual, v 3.1, prepared by SLI, June 28, 2019.

2 Product Description

2.1 Intended Use

The UUT is intended to be used in the polling place environment.

2.2 Unit Under Test

Product / Model	Serial Number	Description	Qty
Touch Writer (38BT), 3005352	W1902352406	Polling Place Ballot Marking Device for voters that require an accessible way to mark a paper ballot.	1
Controller (38BT), 3005825 Touch (38BT), 3005854 Touch w/ Access (38BT), 3005853 Touch daisy chain configuration: 1x Controller 1x Touch 1x Touch with Access	C1801827110 T1902491007 A1902481707	**Controller** - is a poll worker device use for management of voting devices. **Touch** – is a DRE touch screen voting device. **Touch with Access** - is a DRE voting device that is identical to the Touch DRE except it adds a Verity Access controller. Controller, Touch, and Touch with Access are networked together via a daisy-chain network cable (100Mbit Ethernet over a proprietary cable).	1 (ea)

2.3 AC Power Adapter

Product	Manufacturer	Model	Part Number
Touch Writer, Controller, & Touch / Touch with Access	SL Power Electronics	TE60B2449F02	N/A

2.4 Power Requirements

Input Voltage Rating as it appears on unit, power supply, or power brick	100-240VAC, 50-60Hz, 1.5A
Input Current (specify @ 230 Vac/50 Hz)	1.5A (100-240VAC, 50-60Hz)
Input Power	120VAC

2.5 Support Equipment (SE)

Product / Model	Serial Number	Description	Qty
AutoBallot (barcode scanner) Hart P/N 3005174 Motorola/Zebra DS4308-SR7U2100AZW	TBD	Optional COTs barcode scanner. This is an option for and does not ship with the unit as a default configuration.	1
Red/Green Jelly Switches	N/A	Red/Green jelly switches for disabled use. These are COTS switches that do not ship with the unit and are typically provided by an accessible user	1
Headphones Hart: P/N 2005230 v7 brand HA300-2NP	N/A	Optional COTS Headphones for listening to audio.	1
Laser Printer Hart: P/N 3005534 OKI Data B432dn	AK77024728A0		1
Hart Verity ATI Module	TBD	Audio-Tactile Interface (ATI) intended for voters that cannot, or prefer not to, use the touch screen.	1
Accessible Booth w/ ATI Tray	N/A	For Touch and Touch w/Access	2
Standard Booth	N/A	For Touch and Touch w/Access	1

2.6 UUT Software / Firmware

Name	Version / Revision	Functionality
Test Software	2.4.0 (Trusted Build)	Election software for operational status check.
Firmware	v17	Verity Device Microcontroller.
Firmware	v17	Verity Touch Writer Microcontroller.

2.7 Accessories

Type	Model	Function
Test Ballots	N/A	Mark / View Ballots
Verity Key - Security Key	N/A	User authentication and configuration of election security.
Verity vDrive	N/A	Load election definitions, record CVRs and audit logs.

2.8 Engineering Changes

Hardware changes include the following:

- Updated “Smart Panel” (38BT), which is the top tablet used in all the Verity devices, is being added to the Controller, Touch, and Touch with Access device configurations.

NOTE: The same updated Smart Panel has already been incorporated into the Touch Writer, Touch, and Touch with Access device configurations. These were tested and certified by the EAC as part of the Verity 2.3 voting system.

3 Operating Modes and Test Configuration

3.1 Operating Modes

Prior and during testing, proper operation of the UUT shall be confirmed using Hart InterCivic software. An operational status check shall be performed prior to and after each test to fully exercise the UUT and ensure that no damage has occurred as a result of the test.

To fully exercise all the features of each product, diagnostic software is run during electrical tests to exercise the model’s particular hardware features.

Touch Writer with OKI B432DN COTS printer:

- Printing to thermal printer
- Writing data to USB flash drive
- Bar code scanner plugged in and actively scanning (trigger held down).
- Printing to laser printer (SE)

Controller, **1 Touch, 1 Touch with Access** units are daisy-chained via network cables.

Controller:

- Printing to thermal printer
- Writing data to USB flash drive
- Bar code scanner plugged in and actively scanning (trigger held down).
- Network data transfer to/from Touch/Touch with Access devices.

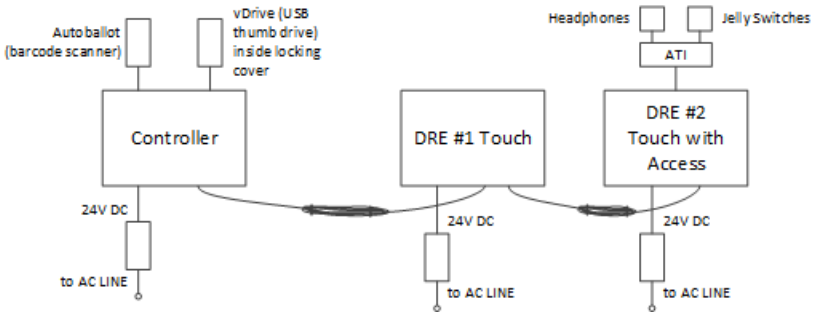
Touch (unit 1):

- Network data transfer to/from Controller

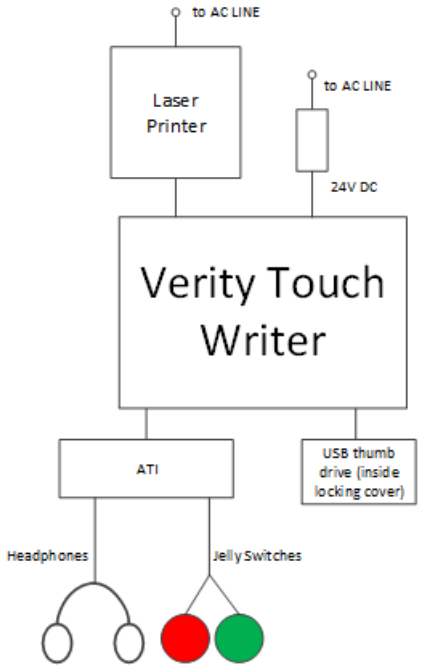
Touch with Access (unit 2):

- Network data transfer to/from Controller

3.2 Block Diagram



Verity Controller / Touch / Touch with Access



Verity Touch Writer

3.3 Treatment of Test Failures

Failures of electrical tests or failures of the exercising software to perform shall be documented in the electrical test report.

3.4 Backup Units

Backup units of the same model with unique serial numbers may be used throughout EMC/EMI testing provided the following criteria are met:

- There is an issue with the primary UUT
- The backup unit is identical to the primary UUT
- All hardware components are listed in Manufacturer's BOM or APL

3.5 Test Documentation

A test report shall be obtained from the test lab that meets the pertinent requirements of EN45001, and ISO/IEC17025, "General Requirements of Testing and Calibration Laboratories".

4 EMC / EMI Test Requirements

4.1 Electromagnetic Emissions

Objective: To verify that the electromagnetic emissions generated by the product under normal use and in the product's intended environment are below a level as specified by the 2005 VVSG 1.0.

4.1.1 Radiated Electromagnetic Emissions

Test Method: FCC Part 15, Radio Frequency Devices

Deviations from Test Method: None

Exit Criteria: The UUT shall meet the following emissions limits:

Frequency Band (MHz)	Class B Equipment 10m Measurement Distance (dBuV/m)
30 – 88	29.5
88-216	33.1
216 – 960	36.6
960-1000	43.5
1000-5000 (GHz)	43.5

4.1.2 Conducted Electromagnetic Emissions

Test Method: FCC Part 15, Radio Frequency Devices

Deviations from Test Method: None

Exit Criteria: The UUT shall meet the following emissions limits:

Frequency Band (MHz)	Class B Equipment	
	Quasi-Peak Measurement (dBuV)	Average Measurement (dBuV)
0.15 – 0.5	66 decreasing with the log of the frequency to 56	56 decreasing with the log of the frequency to 46
0.5 – 5.0	56	46
5.0 – 30	60	50

4.2 Electromagnetic Immunity

Objective: To verify that the product performs as intended when exposed to different types of electromagnetic energies that may be encountered under normal use in the product's intended environment.

4.2.1 Immunity Compliance Criteria

Criteria A: The UUT shall be able to withstand the test without disruption of normal operation or loss of data.

Criteria B: The UUT shall be able to withstand the test without damage or loss of data. The equipment may reset or have momentary interruption so long as normal operation is resumed without human intervention or loss of data. Loss of data refers to votes that have been completed and confirmed to the voter.

Criteria C: The COTS and support equipment may have temporary loss of function or degradation of performance, where the correction **does not require** operator intervention or system reset.

4.2.2 Electrostatic Disruption

The test for electrostatic disruption **shall** be conducted in compliance with the test specified in IEC 61000-4-2 (2008-12) Ed. 2.0. *Contact discharge at the 8 kV level is the preferred test method. Where contact discharge cannot be applied, air discharge **shall** be used at all four identified test levels (2 kV, 4 kV, 8 kV, 15 kV). During exploratory pre-testing, investigation of the possibility of windowing effects should be explored. If there are indications that a unit has sensitivity at a lower voltage but not at a higher voltage, test levels **shall** be added to evaluate the immunity at lower voltage levels*

Test Method: IEC61000-4-2, Ed. 2, Electrostatic Disruption Test, (2008)

Test Levels: Will not exceed the required ESD limits for all ESD test levels:

Test Location	Discharge Voltage (+/- kV)
Indirect Contact: HCP	8.00
Indirect Contact: VCP	8.00
Direct Contact to Metallic Surfaces	8.00
Air Discharges to Insulated Surfaces	2.00, 4.00, 8.00, 15.00

Deviations from Test Method: None

Exit Criteria: B

4.2.3 Electromagnetic Susceptibility

Test Method: IEC61000-4-3, Radiated, Radio-Frequency, Electromagnetic Field Immunity Test, (1996)

Test Levels:

Frequency Range (MHz)	Test Level (V/m)	Modulation / Sweep
80 to 1000	10 V/m	1 kHz 80% AM, 1% steps with 3s dwell
Clock Frequencies	10 V/m	1 kHz 80% AM, 1% steps with 3s dwell

Deviations from Test Method: None

Exit Criteria: A

4.2.4 Electrical Fast Transient

Test Method: IEC61000-4-4, Electrical Fast Transient Test, (1995-01)

Note: Repetition Rate for all transient pulses will be 100 kHz

Test Levels:

a. +2 kV and −2 kV on External Power lines (both AC and DC)
b. +1 kV and −1 kV on Input/Output lines (signal, data, and control lines) longer than 3 meters
c. Repetition Rate for all transient pulses will be 100 kHz

Deviations from Test Method: None

Exit Criteria: A

4.2.5 Lightning Surge

Test Method: IEC61000-4-5, Lightning Surge Test, (1995-02)

Test Levels:

Test Voltage (+/- kV):	Coupling Mode
+/- 2 kV	AC line to line (Differential Mode)
+/- 2 kV	AC line to earth (Common Mode)
+ or - 0.5 kV	DC line to line >10m (Differential Mode)
+ or - 0.5 kV	DC line to earth >10m (Common Mode)
+/- 1 kV	I/O sig/control >30m

Deviations from Test Method: None

Exit Criteria: A

4.2.6 Conducted RF Immunity

Test Method: IEC61000-4-6, Immunity to Conducted Disturbances, Induced by Radio-Frequency Fields, (1996-04)

Test Levels:

Conducted RF Energy
10V rms over the frequency range 150 KHz to 80 MHz with an 80% amplitude modulation with a 1 KHz sine wave AC & DC power.
10V sig/control >3 m over the frequency range 150 KHz to 80 MHz with an 80% amplitude modulation with a 1 KHz sine wave

Deviations from Test Method: None

Exit Criteria: A

4.2.7 Magnetic Fields Immunity

Test Method: IEC61000-4-8, Power Frequency Magnetic Field Immunity Test, (1993-06)

Test Levels:

AC magnetic fields of: 30 A/m at 60 Hz.

Deviations from Test Method: None

Exit Criteria: A

4.2.8 Electrical Power Disturbance

Test Method: IEC61000-4-11, Voltage Dips, Short Interruptions and Voltage Variations Immunity Tests, (1994-06)

Test Levels:

Electrical Power Disturbance
Voltage dip of 30% of nominal @10 ms;
Voltage dip of 60% of nominal @100 ms & 1 sec
Voltage dip of >95% interrupt @5 sec
Surges of + 15% and – 15% line variations of nominal line voltage
Electric power increases of 7.5% and reductions of 12.5% of nominal specified power supply for a period of up to four hours at each power level

Deviations from Test Method: None

Exit Criteria: A

5 EMC / EMI Test Summary

The following Table shows the tests to be performed on the UUT.

Test	Test Specification	VVSG 1.0	Comments
Electromagnetic Emissions Tests			
Radiated Electromagnetic Emissions	FCC, Part 15 Class B ANSI C63.4	**V1:** 2.1.4 (b,c), 4.1.2.9, 4.1.7.1 **V2**: 4.8	
Conducted Electromagnetic Emissions	FCC, Part 15 Class B ANSI C63.4	**V1:** 2.1.4 (b,c), 4.1.2.9, 4.1.7.1 **V2**: 4.8	
Electromagnetic Immunity Tests			
Electrostatic Disruption	IEC 61000-4-2 (2008-12) Ed.2.0	**V1:** 2.1.4 (b), 4.1.2.8, 4.1.7.1 **V2**: 4.8	See RFI 2010-01
Electromagnetic Susceptibility	IEC 61000-4-3 (1996)	**V1:** 2.1.4 (b), 4.1.2.10, 4.1.7.1 **V2**: 4.8	
Electrical Fast Transient	IEC 61000-4-4 (2004-07) Ed.2.0	**V1:** 2.1.4 (b), 4.1.2.6, 4.1.7.1 **V2**: 4.8	
Lightning Surge	IEC 61000-4-5 (1995-02)	**V1:** 2.1.4 (b), 4.1.2.7, 4.1.7.1 **V2**: 4.8	
Conducted RF Immunity	IEC 61000-4-6 (1996-04)	**V1:** 2.1.4 (b), 4.1.2.11, 4.1.7.1 **V2**: 4.8	
Magnetic Fields	IEC 61000-4-8 (1993-06)	**V1:** 2.1.4 (b), 4.1.2.12, 4.1.7.1 **V2**: 4.8	
Electrical Power Disturbance	IEC 61000-4-11 (1994-06)	**V1:** 2.1.4 (b), 4.1.2.5, 4.1.7.1 **V2**: 4.8	60 Hz input of 120/60 (0.6 cycles, 6 cycles, 300 cycles)

End of Electrical Hardware Test Plan