

**Hart InterCivic Verity 2.0**  
**Verity Controller, Touch, Touch with Access DRE device**  
**EMC / EMI Test Plan for compliance with the**  
**2005 Voluntary Voting System Guidelines**  
**(VVSG)**

Prepared by



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***Accredited by the Election  
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## Revision History

Date	Release	Author	Revision Summary
Jan 06, 2016	1.0	D. Forester	Initial Release
Jan 18, 2016	1.1	D. Forester	Added Block Diagram, Serial Numbers, and Software.
Jan 27, 2016	2.0	D. Forester	Updated section 4.2.1 Operating Mode and block diagram.

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## **1.0 Introduction**

### **1.1 Overview**

This test plan covers the EMC (Electromagnetic Compatibility) and EMI (Electromagnetic Interference) test requirements and methods for the Hart InterCivic Verity Controller, Touch, and Touch with Access DRE device hereafter known as the Unit Under Test (UUT), to the requirements as stated in Election Assistance Commission 2005 Voluntary Voting System Guidelines.

Verity Controller, Touch, and Touch with Access are new Verity models that provide Direct Recording Equipment (DRE) capabilities. Poll workers enable a voting session for a voter on the networked Controller device. The voter then casts his or her vote on a Touch or Touch with Access unit and the electronically recorded cast vote records (CVR) are transferred across the network to the Controller. The Controller then writes the CVR to the vDrive on Controller. The poll worker uses the Verity Controller to manage any combination of Verity Touch or Touch with Access devices, up to a total of 12 DREs.

The DRE devices are connected via a daisy-chain network cable (100Mbit Ethernet over a proprietary cable) to each other and the controller, forming a network. Touch and Touch with Access sit on booths with privacy screens, while Controller sits on a tabletop.

### **1.2 Typical Configuration**

Based on Hart's historical data on DRE system deployments, a typical polling place configuration is one Controller with two DRE voting devices. Due to ADA (Americans with Disabilities Act) requirements, at least one of the DRE units must be accessible. A typical configuration would consist of one Controller with two DRE units; one Touch DRE and one Touch with Access DRE, as shown in figure 1 below.

### **1.3 Qualifications**

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

### **1.4 Client**

Hart InterCivic  
15500 Wells Port Drive  
Austin, TX 78728

### **1.5 Company Information**

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### **1.6 Reference Documents**

- Election Assistance Commission: 2005 Voluntary Voting System Guidelines (EAC VVSG), 2005 Version 1.0, Volumes I and II.
- NIST Handbook 150-22, 2008
- EAC Decision on Request for Interpretation 2007-05 (COTS)
- EAC Decision on Request for Interpretation 2008-02 Battery Back Up for Op Scan
- EAC Decision on Request for Interpretation 2008-10 (EFT)

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- EAC Decision on Request for Interpretation 2009-03 Battery Back Up for Central Count
- EAC Decision on Request for Interpretation 2010-01 Voltage Levels and ESD Test
- EAC Notice of Clarification 07-05: Voting System Test Laboratory (VSTL) responsibilities in the management and oversight of third party testing.
- EAC Notice of Clarification 08-001: Validity of Prior Non-Core Hardware Environmental and EMC Testing.
- SLI Standard Lab Procedure SLP-VC-23: Hardware Test Management
- SLI Standard Lab Procedure SLP-VC-24: Subcontractor Laboratory Management

## 2.0 EMC / EMI Test Summary

**Table 1: EMC / EMI Test Requirements Summary for Hart InterCivic Verity Controller, Touch and Touch with Access**

Required	Test Name	Test Spec.	VVSG Reference	Requirement	Comments
<b>Electromagnetic Emissions Tests</b>					
<b>X</b>	Radiated Electromagnetic Emissions	FCC, Part 15 ANSI C63.4	V1, 4.1.2.9 V1, 4.1.7.1 V1, 2.1.4 (b) V2, 4.8	Class B	Internal battery connected.
<b>X</b>	Conducted Electromagnetic Emissions	FCC, Part 15 ANSI C63.4	V1, 4.1.2.9 V1, 4.1.7.1 V1, 2.1.4 (b) V2, 4.8	Class B	Internal battery connected.
<b>Electromagnetic Immunity Tests</b>					
<b>X</b>	Electrostatic Disruption	IEC 61000-4-2 (2008-12) Ed.2.0	V1, 4.1.2.8 V1, 4.1.7.1 V1, 2.1.4 (b) V2, 4.8	Vote scanning and counting equipment for paper-based systems, and all DRE equipment, shall be able to withstand $\pm 15$ kV air discharge and $\pm 8$ kV contact discharge 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 means votes that have been completed and confirmed to the voter.	Internal battery connected.  Voting systems are required to be immune to ESD up to the limits of 8 kV, contact discharge, and 15 kV, air discharge. During exploratory pretesting 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. (RFI 2010-01).  The test levels stated in IEC 61000-4-2, Edition 2.0, contact discharge, are the test method and shall be applied at the specified test level only, 8 kV. Air discharge shall be used where contact discharge cannot be applied and all test levels shall be used (2, 4, 8, 15 kV). (RFI 2010-01).
<b>X</b>	Electromagnetic Susceptibility	IEC 61000-4-3 (1996)	V1, 4.1.2.10 V1, 4.1.7.1 V1, 2.1.4 (b) V2, 4.8	A field of 10 V/m modulated by a 1 kHz 80% AM modulation over the frequency range of 80 MHz to 1000 MHz	Internal battery connected.  1 GHz
<b>X</b>	Electrical Fast Transient	IEC 61000-4-4 (2004-07) Ed. 2.0	V1, 4.1.2.6 V1, 4.1.7.1 V1, 2.1.4 (b) V2, 4.8	$\pm 2$ kV AC & DC external power lines.  $\pm 1$ kV on Input / Output lines (signal, data, control lines) longer than 3 meters(signal, data, control lines) longer than 3 meters  Repetition Rate for all transient pulses will be 100 kHz	Internal battery <b>NOT</b> connected per requirement; test with main power brick only.  The Standard specified in Volume II Section 4.8 is mistakenly cited as IEC 61000-4-4 (1995-01), and should instead properly be cited as IEC 61000-4-4 (2004-07) Ed. 2.0 which supports the 100 kHz repetition rate for all transient pulses specified in Volume I, Section 4.1.2.6(c). (RFI 2008-10)
<b>X</b>	Lightning Surge	IEC 61000-4-5 (1995-02)	V1, 4.1.2.7 V1, 4.1.7.1 V1, 2.1.4 (b)	$\pm 2$ kV AC line to line; $\pm 2$ kV AC line to earth; $\pm 0.5$ kV DC line to line >10m;	Internal battery <b>NOT</b> connected per requirement; test with main power brick only.

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Required	Test Name	Test Spec.	VVSG Reference	Requirement	Comments
			V2, 4.8	±0.5 kV DC line to earth >10m; and ±1 kV I/O sig/control >30m.	
<b>X</b>	Conducted RF Immunity	IEC 61000-4-6 (1996-04)	V1, 4.1.2.11 V1, 4.1.7.1 V1, 2.1.4 (b) V2, 4.8	10V rms, 150 KHz to 80 MHz with an 80% AM with a 1 KHz sine wave AC & DC power 10V rms sig/control >3 m, 150 KHz to 80 MHz with an 80% AM with a 1 KHz sine wave	Internal battery connected.
<b>X</b>	Magnetic Fields Immunity	IEC 61000-4-8 (1993-06)	V1, 4.1.2.12 V1, 4.1.7.1 V1, 2.1.4 (b) V2, 4.8	30 A/m at 60 Hz	Internal battery connected.
<b>X</b>	Electrical Power Disturbance	IEC 61000-4-11 (1994-06)	V1, 4.1.2.5 V1, 4.1.7.1 V1, 2.1.4 (b) V2, 4.8	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% line variations of nominal line voltage  Electric power increases of 7.5% and reductions of 12.5% of nominal specified power for a period of up to four hours at each level.	Internal battery connected.



### 3.0 Product Description

#### 3.1 Intended Use

The UUT is intended to be used in the polling place environment. For Verity 2.0 refer to EMC Integrity's detailed Product Data Sheets below starting with section 3.5 Product Information. The Product Data Sheets will be used by EMC Integrity's test technicians during testing and also in writing the test reports.

#### 3.2 Unit Under Test – Verity Controller

Part No.	Serial No.	Description	Qty	Revision No.
3005351	C1500204410	Verity Controller - is a poll worker device. Controller is connected to the DRE voting devices via the daisy-chain network. It includes a thermal printer and a vDrive, which is used to store the CVRs of all devices on the daisy-chain. An optional barcode scanner called AutoBallot is also supported.	1	B

#### 3.3 Unit Under Test – Verity Touch

Part No.	Serial No.	Description	Qty	Revision No.
3005355	T1500197810	Verity Touch - is a touch screen DRE voting device. It is networked to the Controller and other DREs on the daisy-chain network.	1	B

#### 3.4 Unit Under Test – Verity Touch with Access

Part No.	Serial No.	Description	Qty	Revision No.
3005353	A1500202910	Verity Touch with Access - is a DRE voting device that is identical to the Touch DRE except it adds a Verity Access controller. The Verity Access controller allows disabled voters to vote independently and discreetly. The Verity Access controller is tethered to the system and includes tactile buttons for voters who can't reach the touchscreen. It also includes headphone audio and an input for jelly buttons or Sip and Puff devices. Touch with Access is connected to the Controller and other DREs on the daisy-chain network.	1	B

#### 3.5 Product Information – General

Product Information	
Product Name (as it should appear on test report)	Verity <b>Controller</b> , <b>Touch</b> , and <b>Touch with Access</b>
Model Number (of UUT to be tested)	<b>Controller</b> (Hart PN 3005351) <b>Touch</b> (Hart PN 3005355) <b>Touch with Access</b> (Hart PN 3005353)
Functional description of product (what is it, what does it do, etc.)	Electronics voting equipment. <b>Controller</b> is a poll worker device, <b>Touch</b> is a voting device, and <b>Touch with Access</b> is a voting device identical to the Touch with the addition of a permanently attached accessible controller (ATI). They are networked together via a daisy-

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	<p>chain network cable (100Mbit Ethernet over a proprietary cable).</p> <p><b>Controller</b> has a Bar Code Scanner attached to one of the USB ports.</p> <p><b>Touch with Access</b> has an accessible controller (ATI) that allows disabled people to vote via audio and tactile buttons.</p>
List all modes of operation	<p>System On. <b>Controller</b>, <b>Touch</b>, and <b>Touch with Access</b> units are daisy-chained via network cables. All ports are active:</p> <ul style="list-style-type: none"> <li>- <b>Controller:</b> <ul style="list-style-type: none"> <li>o Printing to thermal printer</li> <li>o Writing data to USB flash drive</li> <li>o Optional bar code scanner is plugged in and actively scanning (trigger held down).</li> <li>o Network data transfer to/from Touch, and Touch with Access</li> </ul> </li> <li>- <b>Touch:</b> <ul style="list-style-type: none"> <li>o Network data transfer to/from Controller</li> </ul> </li> <li>- <b>Touch with Access</b> <ul style="list-style-type: none"> <li>o ATI: playing audio to headphones</li> <li>o ATI: red/green jelly buttons plugged in</li> <li>o Displaying button presses from ATI</li> <li>o Network data transfer to/from Controller</li> </ul> </li> </ul>
Can modes be operated simultaneously? If so, explain.	Yes, these are multitasking systems
What mode(s) will be used for testing?	The Controller, Touch, and Touch with Access systems will be running diagnostic software which exercises the devices during tests.
Product type (IT, Medical, Scientific, Industrial, etc.)	ITE (industrial)
Is the product an intentional transmitter?	No
Product Dimensions	<p>Storage Dimensions (approx.) 19" wide x 18" deep x 8" high (per device)</p> <p>Operational Dimensions (approx.) 19" wide x 22" deep x 21" high (per device)</p>
Product Weight	28 lb. (per device)
Will fork lift be required?	No
Applicable Standards, if known	<p>Per VVSG 1.0:</p> <p>FCC Class B radiated and conducted emissions per ANSI C63.4.</p> <p>IEC 61000-4-2</p>

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	IEC 61000-4-3 IEC 61000-4-4 IEC 61000-4-5 IEC 61000-4-6 IEC 61000-4-8 IEC 61000-4-11					
Describe all environment(s) where product will be used (residential, commercial, office, industrial, etc.)	Office, industrial					
Does product consist of multiple components? (If yes, please describe each system component)	Yes, there are 3 Verity units connected together via daisy-chain network cables. Each unit has its own power supply. The <b>Touch</b> unit will sit on a Standard Booth; the <b>Touch with Access</b> unit will sit on an Accessible Booth, while the <b>Controller</b> will be used on a tabletop. The <b>Controller</b> system has a thermal printer. An optional Motorola DS4208 Bar Code scanner will also be connected to a USB port. The <b>Touch with Access</b> voting unit has COTS Headphones and Red/Green Jelly switches connected to the Access Controller (ATI).					
Cycle time > 3 seconds? (If yes, how long?)	Tests running continuously					
Highest internally generated frequency	1.86GHz Also has 0.307MHz, 10MHz, 12MHz, 24MHz, 25MHz crystals/oscillators.					
Product Set-up Time	10-15 minutes					
Boot up time in the event of an unintentional power down	~4 minutes (to tests running again)					
Identify <b>ALL</b> I/O connections on the unit(s) under test, as well as <b>MAXIMUM</b> associated cable lengths below						
Model No.	Description	I/O Type		Length (m)	Patient Connected? (See Note)	QTY
		UUT - UUT	UUT - SE			
<b>Controller</b>	Daisy-chain Network (100Mbit Ethernet) Note: this is Ethernet over a USB 3.0 cable One cable to/from Touch One cable bundled and unterminated	X		5		2
<b>Controller</b>	USB A to RJ50 Cable to Bar Code scanner		X	1.8		1
<b>Touch</b>	Daisy-chain Network (100Mbit Ethernet) Note: this is Ethernet over a USB 3.0 cable One cable to/from Controller One cable to/from Touch with Access	X		5		2

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<b>Touch with Access</b>	Daisy-chain Network (100Mbit Ethernet) Note: this is Ethernet over a USB 3.0 cable One cable to/from Touch One cable bundled and unterminated	X		5		2
<b>Touch with Access</b>	Headphones to Touch with Access accessibility controller		X	1.8		1
<b>Touch with Access</b>	Red/Green Jelly switches to Touch with Access accessibility controller		X	1.5		1
<i>Note: "Patient Connect" column applies only to medical devices.</i>						

### 3.6 Power

Power Requirements	
Does/can product connect to AC mains?	No, the UUT itself does not connect to the AC mains. An approved AC/DC desktop style power supply on each unit connects to the 120VAC mains. The desktop style AC/DC power supply is an SL Power TE60 series supply (24VDC, 2.7A output) or approved equivalent.
If so, can the UUT function when connected to AC mains?	See explanation above.
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)
Single or Multi-Phase (If multi-phase, specify delta or wye)	Single Phase
Is input power connector two-prong (Hot & Neutral) or 3-prong (H, N, GND)	3-prong (IEC320-C14)

### 3.7 Services

Services Requested			
Will test be formal or engineering level?	Formal		
Special/specific test considerations (i.e., extended test levels, ranges, etc.)	N/A		
Is IECEE CB Scheme Certificate testing required?	No		
If the IECEE CB Scheme is required, check the applicable standards. If national deviations are needed, indicate for which countries in the box below right.	IEC 60601-1-2: 4th Ed., 2014		N/A
	IEC 60601-1-2: 3rd Ed., 2007-03		N/A
	IEC 60601-1-2: 2nd Ed. 2001 +:A1:2004		N/A
Check all countries/economic areas in which product will be sold.	United States	X	Taiwan
	Canada		Korea
	European Union		Japan (50 Hz)

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	Australia/New Zealand		Japan (60 Hz)	
	China		Vietnam	
	Others (please specify)			
Do you...	Require a test report (Y/N)?			Y
	Require a recommendation for product safety (Y/N)?			N

### 3.8 Support Equipment (SE) – Detailed Information

Name	Model / Part No.	Serial No.	Description	
Bar Code Scanner (COTS equipment)	Motorola DS4208	N/A	AutoBallot Option (bar code scanner + custom drive bay door with cables.) This is an option for the <b>Controller</b> and does not ship with the unit as a default configuration.	
Red/Green Jelly Switches	N/A	N/A	Red/Green jelly switches for disabled use with Access controller on the <b>Touch with Access</b> unit. These are COTS switches that do not ship with the unit and are supplied by the voter.	
Koss Headphones	CL4	N/A	Headphones for listening to audio from Access controller on the <b>Touch with Access</b> unit – ship with unit.	
<b>SE I/O Cabling</b>				
Model No.	Description	Shielded?	Length	Qty
N/A				
<b>SE Software / Firmware</b>				
Name	Version / Revision	Functionality		
Test Software	N/A	To fully exercise all the features of each Verity model, test software is run during EMC tests to exercise the model's particular hardware features.		

### 3.9 Engineering Changes

Engineering Change (EC)#	Description
N/A	

### 3.10 Power Supply

Manufacturer	Model	Input	Output and Type
SL Power Electronics	TE60B2449F02	100-240VAC, 50-60Hz, 1.5A Inlet: 3 Prong (IEC320-C14)	24V DC, 2.7A, 4-pin DIN with Earth GND

### 3.11 Accessories

Type	Model	Function
Standard Booth	2005358 / M14000102	The <b>Touch</b> unit will sit on the Standard Booth.
Accessible Booth	2005359 / L14000102	The <b>Touch with Access</b> unit will sit on the Accessible Booth
Verity Keys		Load Election
Verity vDrives (Apacer / AMP)		Write data to vDrive
USB Drives		
Thermal paper		

### 3.12 Interconnecting Cables

Type	Description	Shielded?	Length	Qty
N/A				

### 3.13 Software

Type	Version	Description
Verity Controller	20.1.24366	Election software for operational status check
Verity Touch	20.1.24366	Election software for operational status check
Verity Touch with Access	20.1.24366	Election software for operational status check

## 4.0 Test Plan

### 4.1 Units Under Test

Multiple Units Under of the same model with unique serial numbers may use throughout EMC/EMI testing meeting the following criteria:

- To maximum scheduling flexibility
- UUT are identical models
- All hardware components are listed in Vendor's BOM.

List of Units Under Test can be found in sections 3.2 – 3.4 of this document.

### 4.2 Operating Modes and Configurations for EMC Testing

#### 4.2.1 Operating Mode

Prior to 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. Run the Verity software and use the system to cast a ballot.

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

During EMC testing, the hardware is exercised via test software as follows:

Verity Controller:

- Check Status LEDs / Switches (before and after test)
  - Run Platform Configuration Utility (and leave it running)
  - Set poll worker LED to flashing (blue)
  - Set power source LED to amber
  - Check buttons/switches (before and after test)
    - Tablet Lock switch
    - Poll worker push button (on rear I/O panel)
    - Validation push button (in vDrive bay)
- Bar code scanner
  - Run notepad, make sure it is the active app
  - Scan a bar code before and after the test – the text should show up in Notepad
  - The bar code scanner remains plugged in during the test
- Thermal Printer (during test)
  - Run Thermal Printer EMI test – it should print the time/date on a new line about every 15 seconds
- File I/O test (during test)
  - Run the File I/O test – it writes data to the USB flash drive (vDrive) – the USB drive's status LED should flash RED while data is being written
- Network Ping Test – sends 65,500 byte ICMP ping packets over the network to the Touch and Touch with Access (during test)

- The Controller is IP Address: 192.168.0.100
- ping 192.168.0.102 (the Touch)
- ping 192.168.0.104 (the Touch with Access)

Verity Touch:

- Check Status LEDs / Switches (before and after test)
  - Run Platform Configuration Utility (and leave it running)
  - Set poll worker LED to flashing (blue)
  - Set power source LED to amber
  - Check buttons/switches (before and after test)
    - Tablet Lock switch
    - Poll worker push button (on rear I/O panel)
    - Validation push button (in vDrive bay)
- Network Ping Test – sends 65,500 byte ICMP ping packets over the network to the Controller and Touch with Access units (during test)
  - The Touch's IP Address: 192.168.0.102
  - ping 192.168.0.100 (the Controller)
  - ping 192.168.0.104 (the Touch with Access)

Verity Touch with Access:

- Check Status LEDs / Switches (before and after test)
  - Run Platform Configuration Utility (and leave it running)
  - Set poll worker LED to flashing (blue)
  - Set power source LED to amber
  - Check buttons/switches (before and after test)
    - Tablet Lock switch
    - Poll worker push button (on rear I/O panel)
    - Validation push button (in vDrive bay)
- Test ATI functionality (before and after test)
  - Run ATI Test program, verify it's the active window and then test the buttons and rotary on the ATI and also verify the Red Green Jelly Switches are working.
- Audio Test – plays an audio clip repeatedly to the headphones that are attached to the ATI (during test)
- Network Ping Test – sends 65,500 byte ICMP ping packets over the network to the Controller and Touch units (during test)
  - The Touch with Access's IP Address: 192.168.0.104
  - ping 192.168.0.100 (the Controller)
  - ping 192.168.0.102 (the Touch)

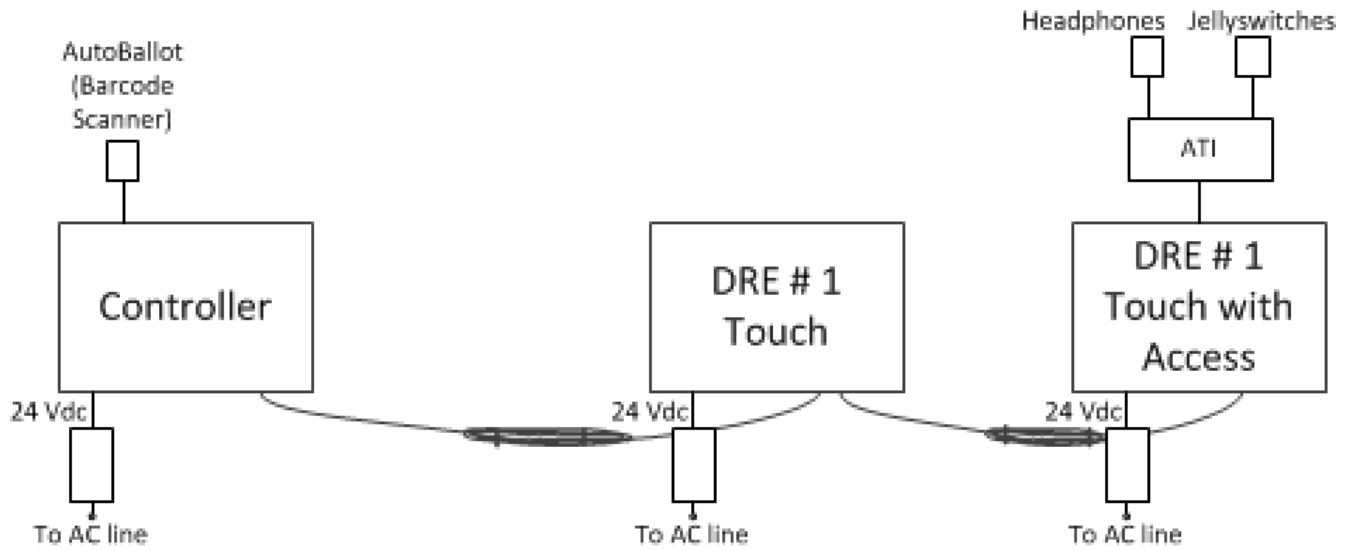
#### **4.2.2 Device Test Configuration**

The Verity 2.0 Electronic Voting System is a typical polling place configuration. It consists of 1 Controller, 1 Touch DRE device and 1 Touch with Access DRE device. This configuration has every peripheral, accessory and device available to Controller, Touch, and Touch with Access.

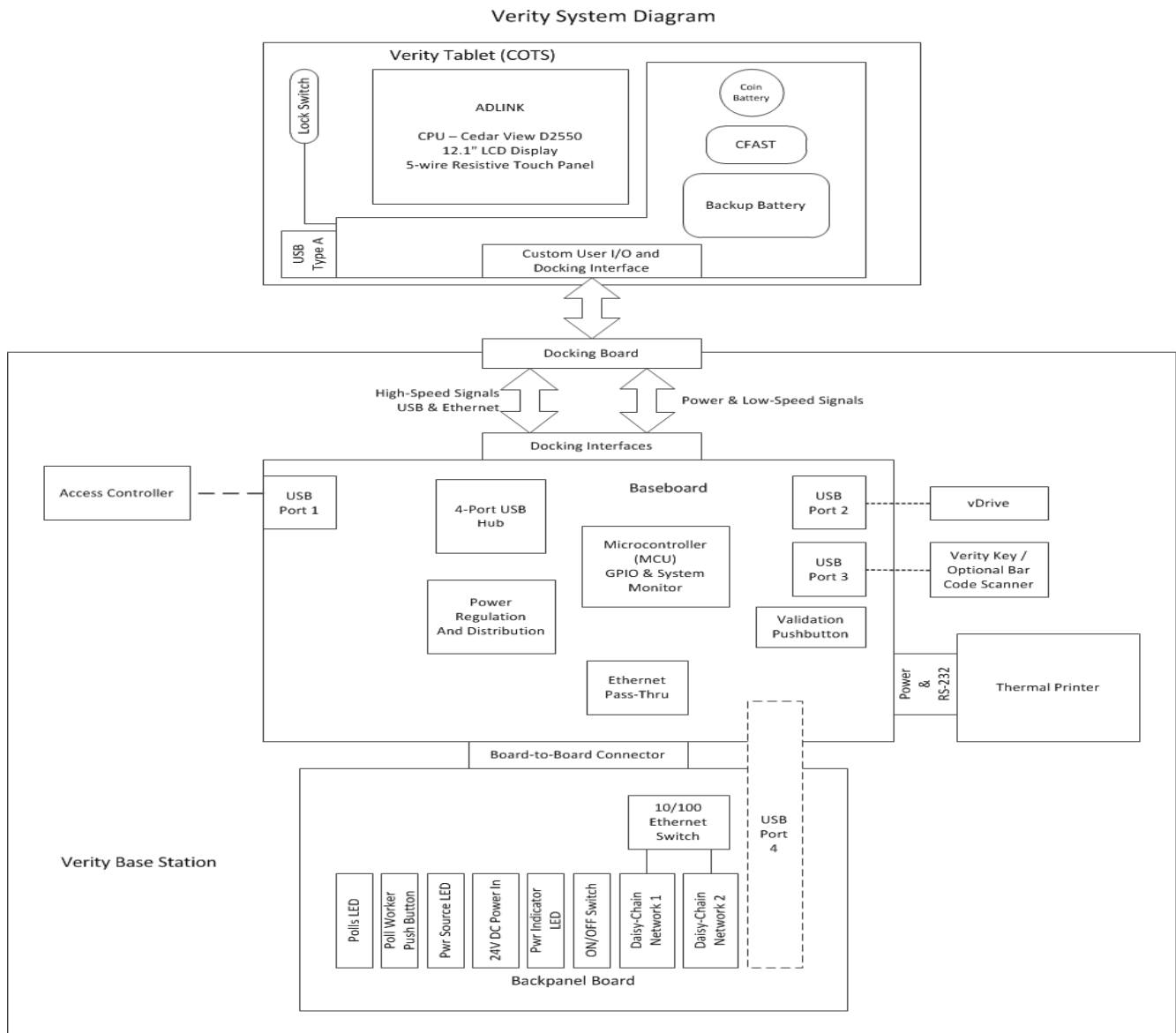


Each Verity device is powered by its own AC-DC desktop style power supply. An outlet will be required for each device. The configuration is as shown in the following block diagram.

**Figure 1: Configuration Block Diagram**



# Hart InterCivic Verity 2.0 EMC / EMI Test Plan



## 4.3 Treatment of Test Failures

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

## 4.4 Test Documentation

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

## 4.5 Test Facility Location

EMC Integrity, 1736 Vista View Drive, Longmont CO 80504

## 5.0 EMC / EMI Tests

### 5.1 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.

#### 5.1.1 Radiated Electromagnetic Emissions

**Test Method:** FCC Part 15, Radio Frequency Devices per ANSI C63.4

**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
(GHz) 1000-5000	43.5

#### 5.1.2 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

### 5.2 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.

#### 5.2.1 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 means 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, the correction of which requires operator intervention or system reset.

#### 5.2.2 Electrostatic Disruption

**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	2.00, 4.00, 8.00
Indirect Contact: VCP	2.00, 4.00, 8.00
Direct Contact to Metallic Surfaces	2.00, 4.00, 6.00, 8.00
Air Discharges to Insulated Surfaces	2.00, 4.00, 8.00, 15.00

**Deviations from Test Method:** None

**Exit Criteria:** B

#### 5.2.3 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
80.0 to 1000.0	10	80% AM at 1.0kHz 1% steps with 3s dwell
Clock Frequencies	10	80% AM at 1.0kHz 1% steps with 3s dwell

**Deviations from Test Method:** None

**Exit Criteria:** A

#### 5.2.4 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:**

Coupling Mode	Test Voltage +/- kV
AC & DC Line Cord	2.0
All external wires >3m no control	1.0

**Deviations from Test Method:** None

**Exit Criteria:** B

### 5.2.5 Lightning Surge

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

**Test Levels:**

Coupling Mode	Test Voltage +/- kV
Differential Mode	2
Common Mode	2
Differential Mode >10m	0.5
Common Mode >10m	0.5
I/O sig/control >30m	1

**Deviations from Test Method:** None

**Exit Criteria:** B

### 5.2.6 Conducted RF Immunity

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

**Test Levels:**

Test Point	Frequency Range (MHz)	Test Level (Vrms)	Modulation / Sweep
AC & DC Power >3m in length	0.150Khz to 80Mhz	10	80% AM at 1.0kHz 1% steps with 3s dwell
I/O cables >3M in length	Clock Frequencies	10	80% AM at 1.0kHz 1% steps with 3s dwell

**Deviations from Test Method:** None

**Exit Criteria:** A

### 5.2.7 Magnetic Fields Immunity

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

**Test Levels:** 30 A/m at 60 Hz

**Deviations from Test Method:** None

**Exit Criteria:** A

### 5.2.8 Electrical Power Disturbance

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

**Test Levels:**

Electrical Power Disturbance
30% dip @ 10ms
60% dip @ 100 ms and 1 sec

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> 95% interrupt @ 5 sec
Surges of $\pm 15\%$ 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

## 6.0 Handling Hardware Anomalies and Incidents

### 6.1 Hardware Test Anomalies

An anomaly with the subcontractor's test equipment or a procedural misstep can cause a test to fail. For any suspected test equipment issue or procedural error, analysis will be performed and the decision whether to continue testing based on the severity of the anomaly will be appropriately tracked. The subcontractor test lab will issue a corrective action to address any test equipment and/or procedure errors. This is part of the hardware test subcontractor's quality system process that allows the hardware test lab to train all personnel, repair/calibrate equipment, and prevent any recurrence.

### 6.2 Hardware Incident Process

For every test failure of any voting system component at the hardware test lab, the lab completes a data sheet (per their laboratory procedures and templates) and immediately informs the SLI Hardware Specialist. This can be communicated in the daily status update, with the data sheet attached.

- Failure Analysis: Once a failure has occurred, the SLI Hardware Specialist will be involved with the subcontractor test lab(s) to identify the hardware discrepancy in the device. The results of the analysis will be documented and tracked in the discrepancy reporting tool used for the test campaign. The analysis will focus on the failure, what caused the failure, the severity (minor or major), and possible impacts to other testing.
- Mitigation: The SLI Hardware Specialist monitors any work done by the manufacturer, with the full understanding of what is occurring and why.
  - The Manufacturer will document what work is done and the SLI Hardware Specialist will sign off on or can stop the work at any time.
  - The Hardware Specialist will determine the number of "minor" fixes the manufacturer can incorporate without a re-start of the test.
  - A **minor** change made by the manufacturer can include grounding the chassis or adding ferrites.
  - Any **major** component replacement is cause for failing a test and requiring a restart. Example: Bad motherboard. Analysis: What was the cause; did the ESD test cause the motherboard to malfunction? Does this impact other hardware tests? The Manufacturer can only replace like for like components and this process must be monitored by the SLI Hardware Specialist.
  - Any modification to the equipment is followed up with the related manufacturer EC(s). All related ECs must be entered into the hardware test report and the certification test report.

When issues are identified during hardware environmental testing, they result in discrepancies. Discrepancies are tracked in the discrepancy reporting tool.