

Hart InterCivic
Verity Scan, Verity Touch Writer, Ballot Box,
Standard and Accessible Booths
EMC / EMI Test Plan for compliance with the
2005 Voluntary Voting System
Guidelines (VVSG)

By



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5.0	11/3/14	Add ESD Limit Statement	D. Forester

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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 1.0 Scan and Touch Writer, Ballot Box, and Standard / Accessible Booths hereafter known as the Unit Under Test (UUT), to the requirements as stated in Election Assistance Commission 2005 Voluntary Voting System Guidelines (VVSG).

1.2 Qualifications

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

1.3 Client

Hart InterCivic
15500 Wells Port Drive
Austin, TX 78728

1.4 Company Restricted Information

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1.5 Reference Documents

- Election Assistance Commission 2005 Voluntary Voting System Guidelines Vol I Version 1.0
- Election Assistance Commission 2005 Voluntary Voting System Guidelines Vol II Version 1.0
- NIST Handbook 150-22, 2008 Edition: National Voluntary Laboratory Accreditation Program – Voting System Testing. May 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)
- 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: NOC 07-05: Voting System Test Laboratory (VSTL) responsibilities in the management and oversight of third party testing.
- EAC: NOC 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
- Hart InterCivic Verity: EMC/EMI, Environmental, Safety Test Plan, Document Number: 4005516, Rev. A.03

2.0 EMC / EMI Test Summary

Table 1: EMC / EMI Test Requirements Summary for Hart InterCivic Verity Scan and Verity Touch Writer

Required	Test	Test Spec.	VVSG Reference	Requirement	Comments
Electromagnetic Emissions Tests					
X	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 Not Connected
X	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 Not Connected
Electromagnetic Immunity Tests					
X	Electrostatic Disruption	IEC 61000-4-2 (2008) 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 ± 15 kV air discharge and ± 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.	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 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. (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)
X	Electromagnetic Susceptibility	IEC 61000-4-3 (1996)	V14.1.2.10 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	1 GHz
X	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	± 2 kV AC & DC external power lines ± 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 Connected 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)
X	Lightning Surge	IEC 61000-4-5 (1995-02)	V1, 4.1.2.7 V1, 4.1.7.1 V1, 2.1.4 (b) V2, 4.8	± 2 kV AC line to line; ± 2 kV AC line to earth; ± 0.5 kV DC line to line >10m; ± 0.5 kV DC line to earth >10m; and ± 1 kV I/O sig/control >30m.	Internal Battery Connected
X	Conducted RF Immunity	IEC 61000-4-6 (1996-04)	V1, 4.1.2.11 V1, 4.1.7.1	10V rms, 150 KHz to 80 MHz with an 80% AM with a 1 KHz sine wave AC & DC	Internal Battery Connected

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Required	Test	Test Spec.	VVSG Reference	Requirement	Comments
			V1, 2.1.4 (b) V2, 4.8	power 10V rms sig/control >3 m, 150 KHz to 80 MHz with an 80% AM with a 1 KHz sine wave	
X	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
X	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

For the Verity 1.0 refer to EMC Integrity's detailed Product Data Sheets below starting with section 3.4 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 Scan

Part No.	Serial No.	Description	Qty	Revision No.
2005350	S1400005009 S1400005809 S1400005909	Verity Scan - is Verity's polling place scanning solution for paper ballots. Scan is paired with a purpose-built ballot box to ensure accurate, secure, and private ballot scanning and vote casting for each voter.	3	B
2005357	X14000102	Ballot Box – Used with Verity Scan.	1	A

3.3 Unit Under Test – Verity Touch Writer

Part No.	Serial No.	Description	Qty	Revision No.
2005352	W1400006609 W1400007309 W1400007409 W1400007609	Verity Touch Writer - is a polling place ballot marking device solution for paper ballots. Touch Writer is paired with a commercial off the shelf printer to allow the voter to mark then print their vote selections. Using Touch Writer reviewing and acceptance in conjunction with Verity Scan provides the voter with a reviewable paper ballot that is accurately captured through scanning, for tabulation as a voter's cast vote record (CVR).	4	B
2005358	M14000102	Standard Booth - Used with Touch Writer	1	A
2005359	L14000102	Accessible Booth - Used with Touch Writer	1	A

3.4 Product Information – Verity Scan

Product Information General	
Product Name (as it should appear on test report)	Verity Scan
Model Number (of UUT to be tested)	2005350 (Scan), 2005357 (Ballot Box)
Functional description of product (what is it, what does it do, etc.)	Polling Place Scanning Device – scans paper ballots
List all modes of operation	Ballot Scanner
Can modes be operated simultaneously? If so, explain.	No
What mode(s) will be used for testing?	Ballot Scanning USB Stick Write Test Thermal Printer Test

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Product type (IT, Medical, Scientific, Industrial, etc.)	IT
Is the product an intentional radiator	No
Product Dimensions	<p>Verity Scan Storage/Shipping Carton - 21½"Wx17½"Dx19 ¾"H Device Closed – 18.8"Wx17.39"Dx7.72"H Device Open – 18.8"Wx21.41"Dx20.86"H</p> <p>Ballot Box Collapsed for Storage - 26"Wx5.23"Dx28.25"H Deployed for Use – 26"Wx23.25"Dx28.25"H</p>
Product Weight	<p>Scan - 27lbs Ballot Box - 26.5lbs</p>
Will fork lift be required	No
Applicable Standards, if known	VVSG 2005: FCC Part 15 Class B IEC 61000-4: -2, -3, -4, -5, -6, -8, -11
Describe all environment(s) where product will be used (residential, commercial, industrial, etc.)	<p>Business Recommended Operating Environment Temperature: +50F to +95F Humidity: 10% to 90%</p> <p>Recommended Storage Environment Temperature: -4F to +140F Relative Humidity: <90%</p>
Does product consist of multiple components? (If yes, please describe each system component)	Yes, scanner attaches to ballot box in normal use – it is expected to use this configuration for EMC/EMI testing of Verity Scan
Cycle time > 3 seconds? (If yes, how long?)	<p>Yes for shoeshine testing - ~3 second cycle time Yes for normal usage - ~420 second cycle time</p>
Highest internally generated frequency	Tablet CPU – 1.86GHz
Product Set-up Time	<15 minutes
Boot up time in the event of an unintentional power down	<p>Booting into Windows takes ~60 seconds, we will use simulation tools to exercise the system during testing Booting into Verity Application with polls open takes ~300 seconds</p>

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Identify **ALL** I/O connections on the unit(s) under test, as well as **MAXIMUM** associated cable lengths below

Model No.	Description	I/O Type		Length (m)	Patient Connect? (See Note)	QTY
		UUT-UUT	UUT-SE			
Verity Scan	Polling place scanning device					1
Ballot Box	Ballot Box used with Verity Scan					1

Note: "Patient Connect" column applies only to medical devices.

3.4.1 Power

Power Requirements – Verity Scan	
Does/can product connect to AC mains? (If so, can the UUT function when connected to AC?)	Device is DC powered, there is a 85W AC/DC power supply (Yes)
Input Voltage Rating as it appears on unit, power supply, or power brick	24VDC, 2.4A
Input Current (specify @ 115 VAC/60 Hz)	XP Power AHM85PS24 - 85W, ~1.0A @ 100V – 0.4A @ 240V Power Brick Input ~1.0A
Single or Multi-Phase (If multi-phase, specify delta or wye)	Single
Is input power connector two-prong (Hot & Neutral) or 3-prong (H, N, Ground)	3-prong
Does UUT have more than 1 power cord? (If yes, explain.)	No

3.4.2 Services

Services Requested – Verity Scan		
Testing Required (Formal or Engineering)	Formal	
Special/specific test considerations (i.e. Engineering testing requested, extended range testing, etc.)		
Check all countries/economic areas in which product will be sold.	United States (FCC – emissions only)	X

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	Canada (CSA – emissions only)	
	European Union (CE Mark)	
	Australia/New Zealand (C-tick)	
	Taiwan (BSMI)	
	Korea (KCC)	
	Japan (50 Hz)	
	Japan (60 Hz)	
	China (CCC)	
	Others (please specify)	
If this is for engineering, will a test report be required?	Yes	
Will you require a recommendation for product safety?	TBD	

3.5 Product Information - Verity Touch Writer

Product Information General	
Product Name (as it should appear on test report)	Verity Touch Writer
Model Number (of UUT to be tested)	2005352 (Touch Writer) 2005358 (Standard Booth) 2005359 (Accessible Booth)
Functional description of product (what is it, what does it do, etc.)	Polling Place Ballot Marking Device
List all modes of operation	Ballot Marking,
Can modes be operated simultaneously? If so, explain.	No
What mode(s) will be used for testing?	USB Stick Write Test Audio Playing Test USB Printer Test Thermal Printer Test Ballot Marking (Post-test)
Product type (IT, Medical, Scientific, Industrial, etc.)	IT
Is the product an intentional radiator	No
Product Dimensions	Touch Writer Storage/Shipping Carton - 21½"Wx17½"Dx19¾"H

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	<p>Device Closed – 18.8"Wx17.39"Dx7.72"H Device Open – 18.8"Wx21.41"Dx20.86"H Standard Booth Collapsed for Storage – 28.72"Wx5.57"Dx39.69"H Deployed for Use – 28.54"Wx23.17"Dx33.56"H Privacy Screen – adds 23.31" to Height Accessible Booth Collapsed for Storage 38.8"Wx5.83"Dx33"H Deployed for Use – 38.8"Wx25.45"Dx30.19"H Privacy Screen – adds 23.31" to Height</p>
Product Weight	<p>Touch Writer - 27lbs Standard Booth w/ storage bag - 13lbs Accessible Booth w/ storage bag - 14lbs</p>
Will fork lift be required	No
Applicable Standards, if known	<p>VVSG 2005: FCC Part 15 Class B IEC 61000-4: -2, -3, -4, -5, -6, -8, -11</p>
Describe all environment(s) where product will be used (residential, commercial, industrial, etc.)	<p>Business Recommended Operating Environment Temperature: +50F to +95F Humidity: 10% to 90% Recommended Storage Environment Temperature: -4F to +140F Relative Humidity: <90%</p>
Does product consist of multiple components? (If yes, please describe each system component)	<p>Yes – Touch Writer attaches to ballot booth in normal use – it is expected to use this configuration only for EMC/EMI testing of Verity Touch Writer OKI Data Printer – B431d</p>
Cycle time > 3 seconds? (If yes, how long?)	Yes for normal usage - ~420 second cycle time
Highest internally generated frequency	Tablet CPU – 1.86GHz
Product Set-up Time	<15 minutes
Boot up time in the event of an unintentional power down	<p>Booting into Windows takes ~60 seconds, testing with simulation applications takes ~60 seconds. Booting into Verity Application with polls open takes ~600 seconds</p>

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Identify **ALL** I/O connections on the unit(s) under test, as well as **MAXIMUM** associated cable lengths below

Model No.	Description	I/O Type		Length (m)	Patient Connect? (See Note)	QTY
		UUT-UUT	UUT-SE			
Verity Touch Writer	Polling place scanning device	USB	USB		n/a	1
Verity Access	Audio-Tactile Interface (ATI) module	USB		2m	n/a	1
OKI B431d	Printer		USB	2m	n/a	1
Standard Booth	Standard Booth used with Verity Touch Writer				n/a	1
Accessible Booth	Accessible Booth used with Verity Touch Writer				n/a	1

Note: "Patient Connect" column applies only to medical devices.

3.5.1 Power

Power Requirements Verity Touch Writer	
Does/can product connect to AC mains? (If so, can the UUT function when connected to AC?)	Yes (Yes)
Input Voltage Rating as it appears on unit, power supply, or power brick	24VDC, 2.4A
Input Current (specify @ 120 Vac/60 Hz)	XP Power AHM85PS24 - 85W, ~1.0A @ 100V – 0.4A @ 240V Power Brick Input ~1.0A
Single or Multi-Phase (If multi-phase, specify delta or wye)	Single
Is input power connector two-prong (Hot & Neutral) or 3-prong (H, N, Ground)	3-prong
Does UUT have more than 1 power cord? (If yes, explain.)	No

3.5.2 Services

Services Requested Verity Touch Writer		
Testing Required (Formal or Engineering)	Formal	
Special/specific test considerations (i.e. Engineering testing requested, extended range testing, etc.)		
Check all countries/economic areas in which	United States (FCC – emissions)	X

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product will be sold.	only)	
	Canada (CSA – emissions only)	
	European Union (CE Mark)	
	Australia/New Zealand (C-tick)	
	Taiwan (BSMI)	
	Korea (KCC)	
	Japan (50 Hz)	
	Japan (60 Hz)	
	China (CCC)	
	Others (please specify)	
If this is for engineering, will a test report be required?		
Will you require a recommendation for product safety?		

3.5.3 Support Equipment (SE) – Detailed Information

Support Equipment (SE)					
Name	Model No.	Serial No.	Description		
OKIDATA	B431d	AK43004558A0 AK46022060A0 AK46022066A0 AK47007784A0 AK47007789A0	Ballot Printer		
SE I/O Cabling					
Model No.	Description		Shielded?	Length	Quantity
N/A					
SE Software/Firmware					
Name	Version/Revision	Functionality			

3.6 Engineering Changes

Engineering Change (EC)#	Description
N/A	

3.7 Power Supplies

Manufacturer	Model	Serial No.	Input	Output and Type
XP Power	AHM85PS24 – 85W	K12460073 / 2005415	~1.0A	@ 100V – 0.4A @ 240V

3.8 Accessories

Type	Model	Function
Verity Test Ballots		
Verity Keys		Load Election
Verity vDrives (Apacer / AMP)		Write Data to vDrive
USB Drives (2 per device)		
Thermal paper (1 extra per device)		
Scanner cleaning kit		

3.9 Oscillator Frequencies

Frequency	Description of Use
0.307Mhz	
12Mhz	
240Mhz	
12Mhz	ATI, Base Board
24Mhz	ATI, PDI Scanner
1.86GHz	CPU

3.10 Interconnecting Cables

Type	Description	Shielded?	Length	Quantity

3.11 Software

Type	Version	Description
Verity Scan	0.17.11.16874	For Verity Scan
Verity Touch Writer	0.17.11.16874	For Verity Touch Writer

4.0 Test Plan

4.1 Units Under Test

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

- To maximum scheduling flexibility
- UUT are identical models
- All hardware components are list in Vendor's bill of materials

List of Units Under Test can be found in section 3.2 and 3.3 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 fully exercise the UUT and ensure that no damage has occurred as a result of the test.

Verity Scan and Very Touch Writer will be in a test election mode and the following Verity applications will be executed:

- Shoe Shine test application – provides a method of exercising the integrated scanner in Verity Scan. When application runs a sheet of paper is inserted into the scanner and the scanner will continuously scan the inserted paper through its paper feeder, the scanned images are not saved. To stop the scanning process the paper must be grabbed and pulled out of the scanner. The scan rate is approximately once every 15 seconds
- Audio Test application – is used to test the Audio playback in Verity Touch Writer. This requires the Verity Access audio-tactile interface device be plugged into the Access port on the Verity Touch Writer and headsets or speakers be plugged in to the audio out port on the Access device. The audio played is a file that is specified in the applications folder. The audio track should be short, less than 5 seconds long; the audio application will play the MP4 audio file every 23 seconds with 17 second delay until the application is closed.
- USB Stick Test – is an application to write data to either of the USB ports that are inside Verity Scan and Touch Writers secure device compartment. This application uses a command line to specified location of the file to write and how often to write, the data written is Date-Time; by default the Date-Time is written at an approximate once an minute rate.
- Printer Test - is an application to print to the thermal printer integrated into Verity Scan and Touch Writers, in addition it can be configured, thru a configuration file, to print data to a USB printer connected to the Touch Writers printer port. The data printed is Date-Time; by default the Date-Time is printed at an approximate once a minute rate and once a five minute rate.

4.2.2 *Device Setup*

- Touch Writer will include OKI B431d COTS printer
- Prior to each test Scan will have scanner cleaned prior to running Verity Scan application
- Run Verity Scan application:

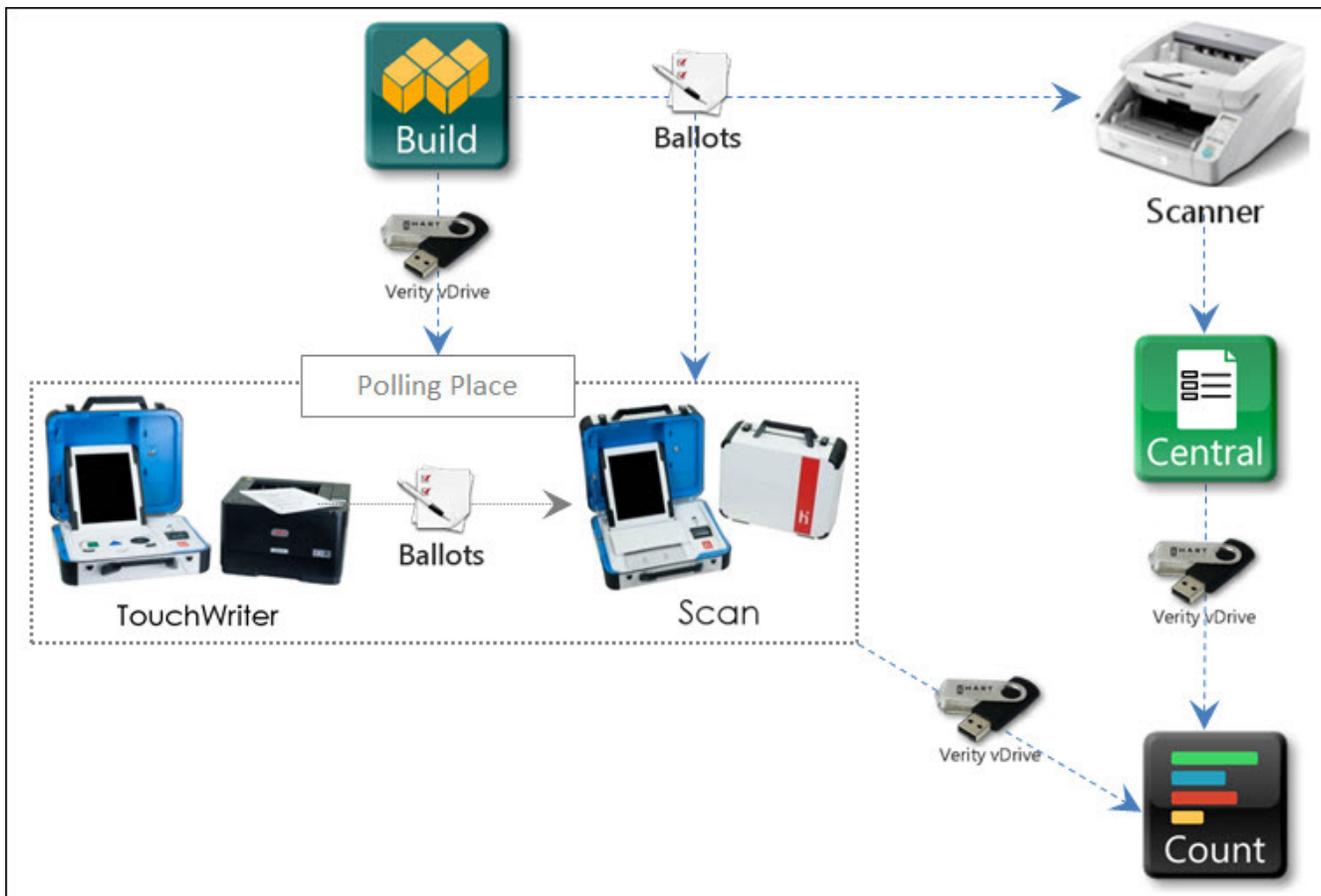
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- Configure C:\Verity directory with proper database
- Load election
- Scan ballots (5 each)
- Suspend or Close election
- Run Verity Touch Writer application:
 - Load election
 - Print 1 ballot
- Run test applications:
 - Verity Scan:
 - Shoeshine (configure C:\Verity directory with proper database), USB Stick Test, Printer Test
 - Verity Touch Writer:
 - USB Stick Test, Audio Test, Printer Test, Mark / Print Ballot

4.2.3 Configurations

The following image is a general workflow of all Verity Voting system components working together.

Figure 1: Verity Voting Configuration



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 VVSG.

5.1.1 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
(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.

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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.

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, 8.00
Air Discharges to Insulated Surfaces	2.00, 4.00, 8.00, 15.00

Deviations from Test Method: None

Exit Criteria: B

5.2.2 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

5.2.3 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

5.2.4 **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

5.2.5 **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

5.2.6 **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

5.2.7 **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
> 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, and the ECO database under Hardware Incident. 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 re-start. **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 ECO database under the "Hardware Test Incident" category. The incident number will be tracked along with the equipment that is taken out of testing due to the failure.