

**APPENDIX B**

**FL EVS 4.5.0.0 HARDWARE TEST REPORT T71013.01-01**



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## TEST REPORT

### HARDWARE COMPLIANCE TESTING OF THE ELECTION SYSTEMS & SOFTWARE FL EVS 4.5.0.0 VOTING SYSTEM DS200 HARDWARE VERSION 1.3

for

Election Systems & Software, LLC  
11208 John Galt Boulevard  
Omaha, NE 68137

STATE OF ALABAMA }  
COUNTY OF MADISON }

Robert R. Bridges, Director being duly sworn,  
deposes and says: The information contained in this report is the result of complete and  
carefully conducted testing and is to the best of his knowledge true and correct in all  
respects.

SUBSCRIBED and sworn to before me this 18 day of Sept to 13

SEAL

Natalie Duck  
Notary Public in and for the State of Alabama at Large  
My Commission expires 3/19/16

Wyle shall have no liability for damages of any kind to person or property, including special  
or consequential damages, resulting from Wyle's providing the services covered by this  
report.

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WYLE LABORATORIES, INC.  
Huntsville Facility

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**1.0 INTRODUCTION**

**1.1 Scope**

This report documents the test procedures followed and the results obtained from the Environmental and Electrical Testing performed on the Florida Election Voting System (FL EVS) 4.5.0.0 for Election Systems & Software (ES&S). Upon receipt by Wyle Laboratories, the systems were inspected and subjected to a Physical Configuration Audit (PCA). All testing was performed at Wyle Laboratories' Huntsville, Alabama, Test Facility.

**1.2 Objective**

The ES&S FL EVS 4.5.0.0 Voting System was tested in reference to the United States Federal Election Commission (FEC) 2002 Voting System Standards (VSS) and all applicable EAC 2005 Voluntary Voting Systems Guidelines (VVSG).

**1.3 Test Report Overview**

This test report consists of four main sections and attachments:

- 1.0 Introduction – Provides the architecture of the National Certification Test Report (hereafter referred to as Test Report); a brief overview of the testing scope of the Test Report; a list of documentation, customer information, and references applicable to the voting system hardware, software, and this test report.
- 2.0 System Identification and Overview – Provides information about the equipment tested.
- 3.0 Test Background – Contains information about the certification test process and a list of terms and nomenclature pertinent to the Test Report and system tested.
- 4.0 Test Procedures and Results – Provides a summary of the results of the testing process.
- Attachments – Information supporting reviews and testing of the voting system are included as attachments to this report.

**1.4 Customer**

Election Systems & Software, LLC  
11208 John Galt Boulevard  
Omaha, NE 68137

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1.0 INTRODUCTION (Continued)

1.5 References

The documents listed were utilized to perform certification testing.

- Election Assistance Commission 2005 Voluntary Voting System Guidelines, Volume I, Version 1.0, "Voting System Performance Guidelines," and Volume II, Version 1.0, "National Certification Testing Guidelines," dated December 2005
- United States Federal Election Commission Voting System Standards Volume I, "Performance Standards" and Volume II, "Test Standards" dated April 2002
- Election Assistance Commission Testing and Certification Program Manual, Version 1.0, effective date January 1, 2007
- Election Assistance Commission Voting System Test Laboratory Program Manual, Version 1.0, effective date July 2008
- Florida Voting System Standards, Form DS-DE 101, 1-12-05
- National Voluntary Laboratory Accreditation Program NIST Handbook 150, 2006 Edition, "NVLAP Procedures and General Requirements (NIST Handbook 150)," dated February 2006
- National Voluntary Laboratory Accreditation Program NIST Handbook 150-22, 2008 Edition, "Voting System Testing (NIST Handbook 150-22)," dated May 2008
- United States 107<sup>th</sup> Congress Help America Vote Act (HAVA) of 2002 (Public Law 107-252), dated October 2002
- Wyle Laboratories' Test Guidelines Documents: EMI-001A, "Wyle Laboratories' Test Guidelines for Performing Electromagnetic Interference (EMI) Testing," and EMI-002A, "Test Procedure for Testing and Documentation of Radiated and Conducted Emissions Performed on Commercial Products"
- Wyle Laboratories' Quality Assurance Program Manual, Revision 5
- ANSI/NCSL Z540-1, "Calibration Laboratories and Measuring and Test Equipment, General Requirements"
- ISO 10012-1, "Quality Assurance Requirements for Measuring Equipment"
- EAC Requests for Interpretation (listed on [www.eac.gov](http://www.eac.gov))
- EAC Notices of Clarification (listed on [www.eac.gov](http://www.eac.gov))

**2.0 SYSTEM IDENTIFICATION AND OVERVIEW**

**2.1 System Overview**

The ES&S FL EVS 4.5.0.0 Voting System is a new system that contains a newly configured DS200 hardware version 1.3. The new DS200 tabulator configuration consists of a new mother board, scanner board, redesigned transport path, and a removable battery access panel. Based on the upgrades and modifications to the DS200 a full hardware testing suite was performed at Wyle. For the ES&S FL EVS 4.5.0.0 Voting System, Wyle subjected the DS200 to: non-operating environmental tests, operating environmental tests and Electromagnetic Compatibility (EMC) tests. The ElectionWare EMS was only utilized to generate election media and verify results. Wyle only documented the configuration used during testing conducted at Wyle.

**2.2 System Identification**

The materials required for testing of the ES&S FL EVS 4.5.0.0 Voting System included software, hardware, test materials, and deliverable materials shipped directly to Wyle by ES&S. The materials documented in the following sections are the materials used during Wyle's testing of only the DS200 and the interface with the EMS.

**2.2.1 Hardware**

This subsection categorizes the equipment the manufacturer submitted for testing and is listed in Table 2-1. Each test element is included in the list of the equipment required for testing of that element, including system hardware, general purpose data processing and communications equipment, and any required test instrumentation.

**Table 2-1 ES&S FL EVS 4.5.0.0 Test Equipment**

<b>Equipment</b>	<b>Description</b>	<b>Serial Numbers</b>
DS200 (Hardware Revision 1.3)	Precinct Count Digital Scanner	DS0313350006 (ENV) DS0313350010 (ENV) DS0313350009 (EMI)
Ballot Box	Plastic Ballot Box/Plastic Transport Case	T71013-BB-002
Ballot Box	Hard Vinyl Transport Case	T71013-BB-003
Ballot Box	Metal Box with Electromechanical Diverter	T71013-BB-001
Dell Latitude Laptop	CPU: Intel Core i5-2540M 2.60Ghz RAM: 4.00 GB HDD: 250 GB – ST250LT007-9ZV14C OS: Windows 7 Professional SP1 – 64 bit	39CMIS1
Transport Media/ Memory Device/ USB Flash Drive	Approved Manufacturer List: Kingston SanDisk Delkin Approved Capacity List: 512 MB 1 GB 2 GB 4 GB 8GB	Wyle-assigned: TM-XXX*
Compact Flash Card/ CF Card	Approved Manufacturer List: Delkin Approved Capacity List: 1 GB	Wyle-assigned: CF-XXX*

\*Wyle uniquely labels each media device with the information (election, results, test utilized for) loaded on the device.

**2.0 SYSTEM IDENTIFICATION AND OVERVIEW (Continued)**

**2.2 System Identification (Continued)**

**2.2.2 Software**

The software evaluated was limited to ElectionWare, Election Reporting Manager (ERM), and the firmware build for the DS200. Only the changes incorporated since the EVS 5.0.0.0 test campaign were evaluated by Wyle. Wyle utilized an EMS setup with new versions of ElectionWare and ERM to load election information onto transport media. Wyle did not test the EMS for any other functionality.

**Table 2-2 Software Required for Testing**

Software Identification	Version
DS200 Firmware	2.11.0.01
DS200 Scanner Board Firmware	3.0.0.0b
DS200 Power Management Board	1.2.10.0a

**2.3 Test Support Materials**

This subsection enumerates any and all test materials needed to perform voting system testing. The scope of testing determines the quantity of a specific material required.

The following test materials were required to support the ES&S FL EVS 4.5.0.0 test campaign:

**Table 2-3 Test Support Equipment**

Test Material	Quantity
Paper Rolls	25 rolls total
Pre Printed Ballots	1,200 total (14" size)

**2.4 Vendor Technical Data Package**

The Technical Data Package (TDP) contains information about requirements, design, configuration management, quality assurance, and system operations. A scaled version of the TDP was submitted for this campaign due to only Hardware Testing being performed. The table below provides the TDP documents submitted and reviewed for the ES&S FL EVS 4.5.0.0 campaign.

**Table 2-5 ES&S FL EVS 4.5.0.0 Voting System TDP**

ES&S FL EVS 4.5.0.0 TDP Documents	Version	Doc No.	Document Code
<i>System Hardware Specification</i>			
System Hardware Specification – DS200	1.0	03-01	DS200HW_M_SPC_0313_HWSpec
<i>System Test/Verification Specification</i>			
System Operations Procedures – DS200	1.0	07-06	FLEVS4500 SOP_DS200
<i>System Maintenance Manuals</i>			
System Maintenance Manual – DS200	1.0	08-01	FLEVS4500 SMM_DS200

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**3.0 TEST BACKGROUND**

Wyle Laboratories is an independent testing laboratory for systems and components under harsh environments, including dynamic and climatic extremes as well as the testing of electronic voting systems. Wyle holds the following accreditations:

- ISO-9001:2000
- NVLAP Accredited ISO 17025:2005
- EAC Accredited VSTL, NIST 150,150-22
- A2LA Accredited (Certification No.'s 845.01, 845.02, and 845.03)
- FCC Approved Contractor Test Site (Part 15, 18, 68)

**3.1 General Information about the Test Process**

All testing performed as part of the test effort was performed at the Wyle Labs Huntsville, AL facility. Conformance testing was limited to the ES&S FL EVS 4.5.0.0 Voting System component previously identified in this report.

All hardware used during testing for this test campaign was configured "As Used" for voting. Each tabulator was placed on a ballot box and loaded with the proper firmware. The ES&S FL EVS 4.5.0.0 EMS suite was loaded on a COTS PC. All media used during testing was loaded from this EMS PC. All hardware used to build the DS200 firmware was configured by Wyle.

**3.2 Wyle Quality Assurance**

All work performed on this program was in accordance with Wyle Laboratories' Quality Assurance Program and Wyle Laboratories' Quality Program Manual, which conforms to the applicable portions of International Standard Organization (ISO) Guide 17025.

The Wyle Laboratories, Huntsville Facility, Quality Management System is registered in compliance with the ISO-9001 International Quality Standard. Registration has been completed by Quality Management Institute (QMI), a Division of Canadian Standards Association (CSA).

**3.3 Test Equipment and Instrumentation**

All instrumentation, measuring, and test equipment used in the performance of this test program was calibrated in accordance with Wyle Laboratories' Quality Assurance Program, which complies with the requirements of ANSI/NCSL 2540-1, ISO 10012-1, and ISO/IEC 17025. Standards used in performing all calibrations are traceable to the National Institute of Standards and Technology (NIST) by report number and date. When no national standards exist, the standards are traceable to international standards, or the basis for calibration is otherwise documented.

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**3.0 TEST BACKGROUND (Continued)**

**3.4 Terms and Abbreviations**

Table 3-1 in this subsection defines all terms and abbreviations applicable to this Test Report.

**Table 3-1 Terms and Abbreviations**

<b>Term</b>	<b>Abbreviation</b>	<b>Definition</b>
Americans with Disabilities Act of 1990	ADA	ADA is a wide-ranging civil rights law that prohibits, under certain circumstances, discrimination based on disability
Configuration Management	CM	---
Commercial Off the Shelf	COTS	Commercial, readily available hardware or software
Direct Record Electronic	DRE	---
United States Election Assistance Commission	EAC	Commission created per the Help America Vote Act of 2002, assigned the responsibility for setting voting system standards and providing for the voluntary testing and certification of voting systems.
Election Management System	EMS	---
Equipment Under Test	EUT	---
Help America Vote Act	HAVA	Act created by United States Congress in 2002.
National Institute of Standards and Technology	NIST	Government organization created to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhances economic security and improves our quality of life.
Physical Configuration Audit	PCA	Review by accredited test laboratory to compare voting system components submitted for certification testing to the manufacturer's technical documentation, and confirmation the documentation meets national certification requirements. A witnessed build of the executable system is performed to ensure the certified release is built from tested components.
Quality Assurance	QA	---
Technical Data Package	TDP	Manufacturer documentation related to the voting system required to be submitted as a precondition of certification testing.
Voting System Standards	VSS	Published by the FEC, second iteration of national level voting system standards.
Voluntary Voting System Guidelines	2005 VVSG	Published by the EAC, the third iteration of national level voting system standards.
Wyle Operating Procedure	WOP	Wyle Test Method or Test Procedure

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**4.0 TEST FINDINGS AND RECOMMENDATIONS**

The ES&S FL EVS 4.5.0.0 Voting System component, as listed in Section 2.0, were subjected to the tests described in Section 3.2 of this report. The results of those tests are summarized in the sections below. All hard copy data generated by the performance of these tests is retained by Wyle as raw data.

**4.1 System Level Baseline**

A System Level Baseline was performed to evaluate the system being submitted for testing in comparison to the system TDP. A Physical Configuration Audit was performed on the ES&S FL EVS 4.5.0.0 submitted for Hardware Testing.

**4.1.1 Physical Configuration Audit**

A focused Physical Configuration Audit (PCA) of the ES&S FL EVS 4.5.0.0 Voting System was performed in accordance with Section 6.6 of Volume II of the VVSG. The PCA compares the voting system components submitted for certification with the vendor's technical documentation and confirms that the documentation submitted meets the requirements of the Guidelines. The purpose of the PCA is to: establish a configuration baseline (both hardware and software) of the system to be tested; verify that the reviewed source code conforms to the vendor's specification; and assess the adequacy of user acceptance test procedures and data.

The PCA performed on the ES&S FL EVS 4.5.0.0 Voting System consisted of inspecting the DS200 scanner, firmware/software, and the TDP used in the ES&S FL EVS 4.5.0.0 Voting System.

**Summary Findings:** A focused PCA was performed to baseline the system's hardware and software components prior to commencement of the test campaign. No discrepancies were noted during the PCA.

**4.2 Technical Data Package Review**

The ES&S FL EVS 4.5.0.0 Voting System Technical Data Package (TDP) was not reviewed to the 2005 VVSG. The supplied TDP documents were only utilized as reference material for EUT configuration and test set-up.

**Summary Findings:** TDP was not performed.

**4.3 Hardware Testing**

Hardware testing included: the inspection and evaluation of voting system documentation; tests of voting system under conditions simulating the intended storage, operation, and transportation; and operational tests verifying system performance and function under normal and abnormal conditions. Hardware testing was limited to the ES&S FL EVS 4.5.0.0 Voting System. Hardware Testing Data can be located in Attachments A - G of this document for additional information

The DS200 was subjected to hardware tests as summarized in Table 4-1.

**Table 4-1 Test Program Requirements**

REPORT SECTION	VVSG VOL. I SECTION	VVSG VOL. II SECTION	TEST DESCRIPTION
4.5.1	N/A	4.6.4	Low Temperature Test
4.5.1	N/A	4.6.5	High Temperature Test
4.5.1	N/A	4.6.3	Vibration Test

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**4.0 TEST FINDINGS AND RECOMMENDATIONS (Continued)**

**4.3 Hardware Testing (Continued)**

**Table 4-1 Test Program Requirements (Continued)**

REPORT SECTION	VVSG VOL. I SECTION	VVSG VOL. II SECTION	TEST DESCRIPTION
4.5.1	N/A	4.6.2	Bench Handling Test
4.5.1	N/A	4.6.6	Humidity Test
4.5.2	N/A	4.7.1	Temperature/Power Variation Test
4.6.1	4.1.2.5	4.8A	Electrical Power Disturbance Test
4.6.2	4.1.2.9	4.8B	Electromagnetic Radiation Test
4.6.3	4.1.2.8	4.8C	Electrostatic Disruption Test
4.6.4	4.1.2.10	4.8D	Electromagnetic Susceptibility Test
4.6.5	4.1.2.6 (a)	4.8E	Electrical Fast Transient Test
4.6.6	4.1.2.7 (a) (b)	4.8F	Lightning Surge Test
4.6.7	4.1.2.11 (a)	4.8G	Conducted RF Immunity Test
4.6.8	4.1.2.12	4.8H	Magnetic Fields Immunity Test
4.6.9	4.3.8	N/A	Product Safety Review, UL60950-1

**4.4 Environmental Tests**

Environmental tests were performed to ensure that the EUT and associated machine resident firmware were in compliance with the VVSG.

During test performance, the EUT was configured as it would be for use in an election precinct.

**4.4.1 Non-Operating Environmental Tests**

The EUT was subjected to various Non-Operating Environmental Tests. Prior to and immediately following each test environment, the EUT was powered on and subjected to operability functional checks to verify continued proper operation. The EUT was not powered on during the performance of any of the non-operating tests.

**Low Temperature Test**

The EUT was subjected to a Low Temperature Test in accordance with section 4.6.4 of Volume II of the VVSG. The purpose of this test is to simulate stresses associated with the storage of voting machines and ballot counters. This test is equivalent to the procedure of MIL-STD-810D, Method 502.2, Procedure I-Storage, with a minimum temperature of -4°F.

Prior to test initiation, the EUT was subjected to a baseline operability checkout to verify system readiness. The EUT was then placed in an environmental test chamber and the chamber temperature was lowered to -4°F and allowed to stabilize. Upon temperature stabilization, the temperature was maintained for an additional four hours. The temperature was then returned to standard laboratory ambient conditions at a rate not exceeding 10°F per minute.

During the Low Temperature Test there was one anomaly encountered (reference Notice of Anomaly No. 7 in Attachment A for further reference). This anomaly required testing to be repeated.

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**4.0 TEST FINDINGS AND RECOMMENDATIONS (Continued)**

**4.4.1 Non-Operating Environmental Tests (Continued)**

Upon completion of the second attempt the EUT was removed from the chamber and inspected for any obvious signs of degradation and/or damage. None were observed. The EUT was successfully subjected to a post-test operability checkout.

The EUT successfully completed the requirements of the Low Temperature Test. The Test Data Sheet, Photographs, and Instrumentation Equipment Sheet are contained in Attachments B, C, and G of this report.

**High Temperature Test**

The EUT was subjected to a High Temperature Test in accordance with section 4.6.5 of Volume II of the VVSG. The purpose of this test is to simulate stresses associated with the storage of voting machines and ballot counters. This test is equivalent to the procedure of MIL-STD-810D, Method 501.2, Procedure I-Storage, with a maximum temperature of 140°F.

Prior to test initiation, the EUT was subjected to a baseline operability checkout to verify system readiness. The EUT was then placed in an environmental test chamber and the chamber temperature was raised to 140°F and allowed to stabilize. Upon temperature stabilization, the temperature was maintained for an additional four hours. The temperature was then returned to standard laboratory ambient conditions at a rate not exceeding 10°F per minute.

The EUT was removed from the chamber and inspected for any obvious signs of degradation and/or damage. None were observed. The EUT was successfully subjected to a post-test operability checkout.

The EUT successfully completed the requirements of the High Temperature Test. The Test Data Sheet, Photographs, and Instrumentation Equipment Sheet are contained in Attachments B, C, and G of this report.

**Vibration Test**

The EUT was subjected to a Vibration Test in accordance with section 4.6.3 of Volume II of the VVSG. The purpose of this test is to simulate stresses faced during transport of voting machines and ballot counters between storage locations and polling places. This test is equivalent to the procedure of MIL-STD-810D, Method 514.3, Category I- Basic Transportation, Common Carrier.

Prior to test initiation, the EUT was subjected to a baseline operability checkout to verify system readiness. Upon completion, the EUT was secured to an electro dynamics shaker. One control accelerometer was affixed to the shaker table. The EUT was subjected to the Basic Transportation, Common Carrier profile as depicted in Mil-Std-810D, Method 514.3, Category I, with a frequency range from 10 to 500 Hz and an overall rms level of 1.04, 0.74, and 0.20 G for durations of 30 minutes in each orthogonal axis.

The DS200 successfully completed the requirements of the Vibration Test. The Test Data Sheet, Photographs, and Instrumentation Equipment Sheet are contained in Attachments B, C, and G of this report.

**4.0 TEST FINDINGS AND RECOMMENDATIONS (Continued)**

**4.4 Environmental Tests (Continued)**

**4.4.1 Non-Operating Environmental Tests (Continued)**

**Bench Handling Test**

The EUT was subjected to a Bench Handling Test in accordance with section 4.6.2 of Volume II of the VVSG. The purpose of this test is to simulate stresses faced during maintenance and repair of voting machines and ballot counters. This test is equivalent to the procedure of MIL-STD-810D, Method 516.3, Procedure VI.

Prior to performance of the test, the EUT was subjected to a baseline operability checkout. Following the checkout, each edge of the base of the machine was raised to a height of four inches above the surface and allowed to drop freely. This was performed six times per edge, for a total of 24 drops.

Upon test completion, the EUT was inspected for any obvious signs of degradation and/or damage. None were observed. The EUT was subjected to a post-test operability checkout and continued operability verified.

The EUT successfully completed the requirements of the Bench Handling Test. The Test Data Sheet, Photographs, and Instrumentation Equipment Sheet are contained in Attachments B, C, and G of this report.

**Humidity Test**

The EUT was subjected to a Humidity Test in accordance with section 4.6.6 of Volume II of the VVSG. The purpose of the test was to simulate stresses encountered during storage of voting machines and ballot counters. This test is similar to the procedure of MIL-STD-810D, Method 507.2, Procedure I-Natural Hot-Humid.

The EUT was subjected to a baseline operability checkout to verify system readiness. Upon completion, the EUT was placed in an environmental test chamber and was subjected to a 10-day humidity cycle in accordance with the 24-hour cycle values as shown in Table 4-2.

Upon test completion, the EUT was inspected for any obvious signs of degradation and/or damage. The DS200 successfully completed the requirements of the Humidity Test. The Test Data Sheet, Photographs, and Instrumentation Equipment Sheet are contained in Attachments B, C, and G of this report.

**Table 4-2 Humidity Test Cycle Values**

Time	Hot-Humid (Cycle 1)			Time	Hot-Humid (Cycle 1)		
	Temperature		RH		Temperature		RH
	°F	°C	%		°F	°C	%
0000	88	31	88	1200	104	40	62
0100	88	31	88	1300	105	41	59
0200	88	31	88	1400	105	41	59
0300	88	31	88	1500	105	41	59
0400	88	31	88	1600	105	41	59
0500	88	31	88	1700	102	39	65
0600	90	32	85	1800	99	37	69
0700	93	34	80	1900	97	36	73
0800	96	36	76	2000	94	34	76
0900	98	37	73	2100	97	33	85
1000	100	38	69	2200	90	32	85
1100	102	39	65	2300	89	32	88

4.0 TEST FINDINGS AND RECOMMENDATIONS (Continued)

4.4 Environmental Tests

4.4.2 Operating Environmental Tests

Temperature/Power Variation Test

The DS200 was subjected to a Temperature and Power Variation Test in accordance with section 4.7.1 of Volume II of the VVSG. The purpose of this test was to evaluate system operation under various environmental conditions. The cumulative duration of at least 163 hours was achieved by utilizing three units for a period of 64 hours based on the (EAC RFI 2008-01), with 48 hours in the environmental test chamber. For the remaining hours, the equipment was operated at room temperature. This test is similar to the low temperature and high temperature tests of MIL-STD-810-D, Method 502.2 and Method 501.2.

To perform the test, the EUTs were placed inside an environmental walk-in test chamber and connected to a variable voltage power source. The temperature inside the chamber and the voltage supplied to the hardware varied from 50°F to 95°F and from 105 VAC to 129 VAC (as depicted in Figures 4-1 through 4-4). During test performance, the operational functions were continuously exercised by the scanning of ballots. A minimum of 100 ballots per hour were scanned.

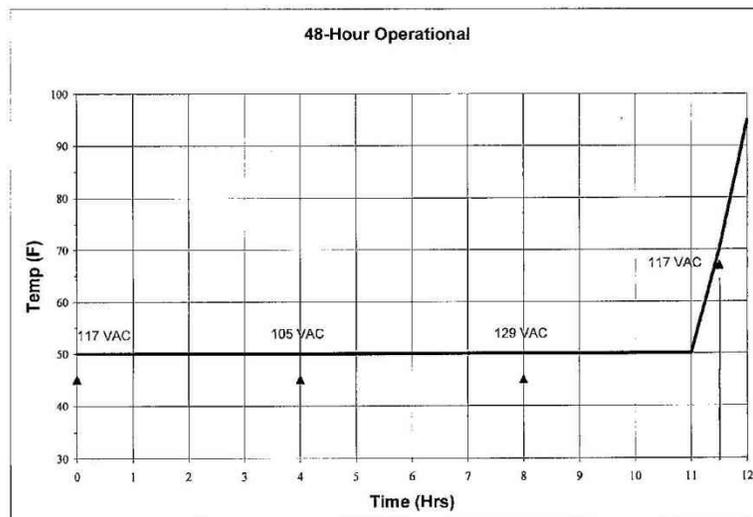


Figure 4-1 Temperature/Power Variation Profile Hours 0-12

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4.0 TEST FINDINGS AND RECOMMENDATIONS (Continued)

4.4.2 Operating Environmental Tests (Continued)

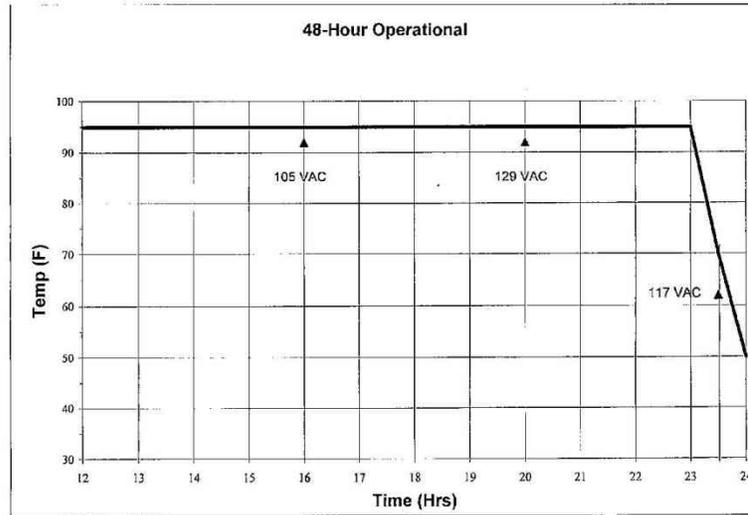


Figure 4-2 Temperature/Power Variation Profile Hours 12-24

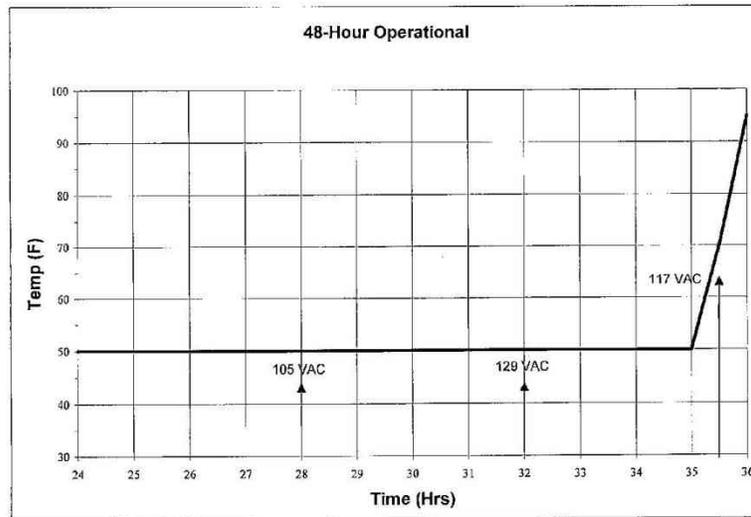


Figure 4-3 Temperature/Power Variation Profile Hours 24-36

4.0 TEST FINDINGS AND RECOMMENDATIONS (Continued)

4.4.2 Operating Environmental Tests (Continued)

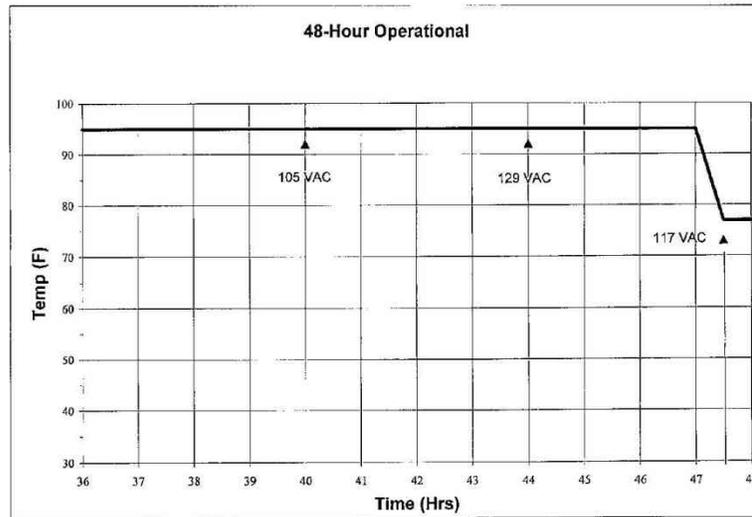


Figure 4-4 Temperature/Power Variation Profile Hours 36-48

Summary Findings

The DS200 successfully completed the requirements of the Temperature/Power Variation Test on the first attempt without issue.

4.5 Electrical Tests

Electrical tests were performed to ensure that the EUT and associated machine resident firmware were in compliance with the VVSG.

During test performance, the EUT was configured as it would be for use in an election precinct.

The EUT was subjected to various electrical tests to ensure continued system operation and reliability in the presence of abnormal electrical events. The EUT was powered and actively counting ballots during all electrical tests. Prior to and immediately following each electrical test, an operational status check was performed. The Test Data Sheets, Photographs, and Instrumentation Equipment Sheets are contained in Attachments B, D, and G of this report.

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**4.0 TEST FINDINGS AND RECOMMENDATIONS (Continued)**

**4.5.1 Electrical Power Disturbance**

Electrical Power Disturbance testing was performed in accordance with sections 4.1.2.5 of Volume I and 4.8 of Volume II of the VVSG. This testing was performed to ensure that the EUT was able to withstand electrical power line disturbances (dips/surges) without disruption of normal operation or loss of data.

The EUT was configured to run in an automated ballot count test mode, where continual ballot processing would occur during the testing, and subjected to the voltage dips and surges over periods ranging from 20ms to four hours.

The EUT successfully met the requirements of the Electrical Power Disturbance Test. The Test Data Sheet, Photographs, and Instrumentation Equipment Sheet are contained in Attachments B, D, and G of this report.

**4.5.2 Electromagnetic Radiation Test (FCC Part 15 Emissions)**

Electromagnetic Radiation emissions measurements were performed in accordance with sections 4.1.2.9 of Volume I and 4.8 of Volume II of the VVSG. This testing was performed to ensure that emissions emanating from the unit do not exceed the limits of 47 CFR Part 15, Subpart B, Class B Limits.

The EUT was configured to run in an automated ballot count test mode, where continual ballot processing would occur during the testing. The DS200 was subjected to the test requirements detailed in Table 4-3.

**Table 4-3 Conducted and Radiated Emissions Requirements**

Conducted Emissions			Radiated Emissions	
Frequency Range (MHz)	Limits (dBuV)		Frequency Range (MHz)	3 Meter Test Limit (dBuV)
	Quasi-peak	Average		
0.15 to 0.50	66 to 56	56 to 46	30 to 88	40.0
0.50 to 5.0	56	46	88 to 216	43.5
5.0 to 30.0	60	50	216 to 960	46.0
			960 to 1000	54.0

Testing was performed at the Wyle Laboratories' Open Air Test Site 2 (OATS-2) located on the Intergraph Complex in Huntsville, AL. The OATS-2 is fully described in reports provided to the Federal Communication Commission (FCC) (FCC Reference 98597). The site was tested and complies with the requirements of ANSI C63.4-2003.

To perform the Conducted Emissions portion of the test, the DS200 was set up as depicted in Figure 4-5.

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4.0 TEST FINDINGS AND RECOMMENDATIONS (Continued)

4.5.2 Electromagnetic Radiation Test (FCC Part 15 Emissions) (Continued)

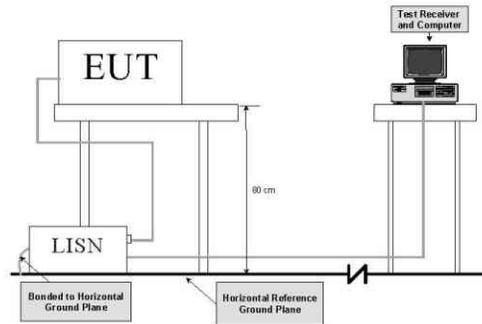


Figure 4-5 Conducted Emissions Test Setup

The DS200 was then subjected to the following test procedure:

1. The DS200 was placed on a non-metallic table 0.8 meters above the turntable and reference ground plane at the Open-Area Test Site.
2. The DS200 AC/DC Power Adapter was connected to the power mains through a Line Impedance Stabilization Network (L.I.S.N.). Other support units were connected to the power mains through another L.I.S.N. The L.I.S.Ns provided 50 ohm/50  $\mu$ H of coupling impedance for the measuring instrument.
3. The DS200 was placed in an active state and monitored for functionality throughout testing.
4. Both Line and Neutral of the power mains connected to the DS200 were checked for maximum conducted interference.
5. The frequency range from 150 kHz to 30 MHz was evaluated and recorded. Emissions levels below -20 dB were not recorded.

To perform the Radiated Emissions portion of the test, the DS200 was set up as depicted in Figure 4-6.

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4.0 TEST FINDINGS AND RECOMMENDATIONS (Continued)

4.5.2 Electromagnetic Radiation Test (FCC Part 15 Emissions) (Continued)

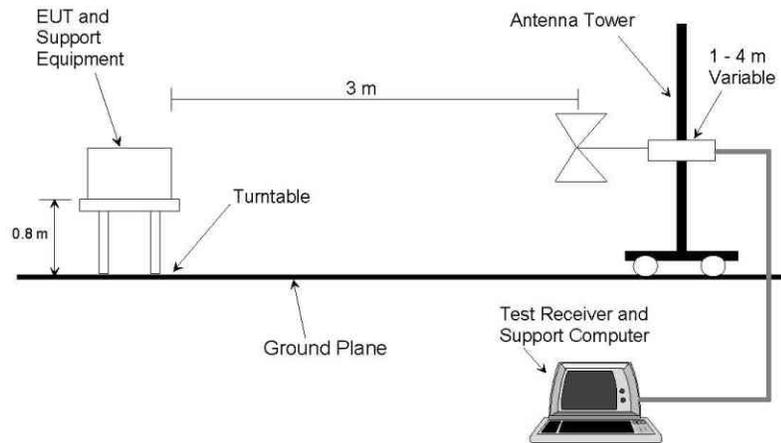


Figure 4-6 Radiated Emissions Test Setup

The DS200 was then subjected to the following test procedure:

1. The DS200 was placed on a non-metallic turn-table 0.8 meters above the reference ground plane at the Open-Area Test Site.
2. The DS200 was placed 3 meters away from the interference-receiving antenna, which was mounted on a variable-height antenna tower. The interference-receiving antenna used was a broadband antenna.
3. For each suspected emissions point, the DS200 was arranged in a worst case configuration. The table was rotated from 0 to 360 degrees and the antenna height was varied from one (1) to four (4) meters to identify the maximum reading.
4. All emissions points identified within 20 dB of the specified limit were tested individually using the quasi-peak method as specified and then reported in the tabular data.

The EUT was found to comply with the required emissions limits. The Test Data Sheet, Photographs, and Instrumentation Equipment Sheet are contained in Attachments B, D, and G of this report.

**4.0 TEST FINDINGS AND RECOMMENDATIONS (Continued)**

**4.5 Electrical Tests (Continued)**

**4.5.3 Electrostatic Disruption**

Electrostatic Disruption testing was performed in accordance with sections 4.1.2.8 of Volume I and 4.8 of Volume II of the VVSG to ensure that should an electrostatic discharge event occur during equipment setup and/or ballot counting, that the EUT would continue to operate normally. A momentary interruption is allowed so long as normal operation is resumed without human intervention or loss of data.

The EUT was configured to run in an automated ballot count test mode, where continual ballot processing would occur during the testing without operator intervention. The EUT was then subjected to electrostatic discharges of +/- 8 kV contact and +/- 15 kV air as shown in Table 4-4. Discharges were performed at areas typical of those which might be touched during normal operation, including the touch screen, user buttons, and other likely points of contact. The DS200 was then setup per the following conditions:

1. Power lines and power line returns were configured as required by the system configuration.
2. The EUT was raised approximately 10 cm from the ground using isolated stand-offs.
3. Signal/control test cables were positioned approximately 5 cm (2 in.) above the ground.

**Table 4-4 Electrostatic Discharge Transients**

Characteristic	Requirements		Value
	Capacitance	Resistance	
Pulse Wave Shape (RC Network)	150	330	pf / Ω
Test Levels	Discharge Types		Value
	Air Gap	Direct Contact	
	±15	±8	
Rise Time	≤1		nanosecond
Pulse Decay Time	≈30 at 50% height		nanosecond
Pulse Repetition	≥1		per second
Total Injected Pulse at each Test Point	10		per polarity (±)
Temperature	≥15 to ≤35		°C
Relative Humidity	≥30 to ≤60		%

During the ESD Test there was one anomaly encountered (reference Notice of Anomaly No. 8 in Attachment A for further reference).

During the second attempt the EUT successfully met the requirements of the ESD Test. The Test Data Sheet, Photographs, and Instrumentation Equipment Sheet are contained in Attachments B, D, and G of this report.

4.0 TEST FINDINGS AND RECOMMENDATIONS (Continued)

4.5 Electrical Tests (Continued)

4.5.4 Electromagnetic Susceptibility

Electromagnetic Susceptibility testing was performed in accordance with sections 4.1.2.10 of Volume I and 4.8 of Volume II of the 2005 VVSG. This testing was performed to ensure that the EUT was able to withstand a moderate level of ambient electromagnetic fields without disruption of normal operation or loss of data.

The EUT was configured to run in an automated ballot count test mode, where continual ballot processing would occur during the testing without operator intervention. The DS200 was then subjected to ambient electromagnetic fields at 10 V/m over a range of 80 MHz to 1000 MHz, as shown in Figure 4-7. Testing was conducted utilizing both horizontally and vertically polarized waves. The limits were measured with a maximum scan rate of 1% of the fundamental frequency and the dwell duration was three seconds.

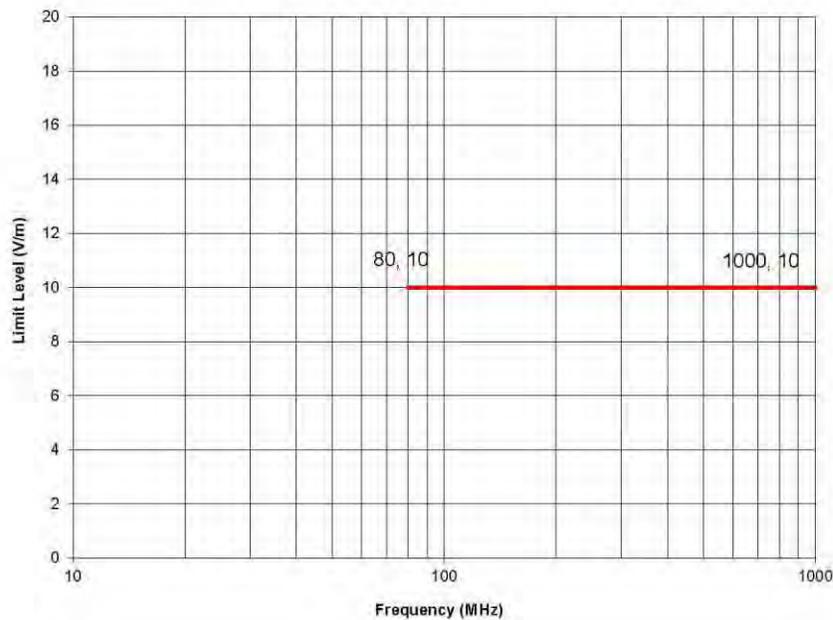


Figure 4-7 Radiated Susceptibility Limit

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**4.0 TEST FINDINGS AND RECOMMENDATIONS (Continued)**

**4.5 Electrical Tests (Continued)**

**4.5.4 Electromagnetic Susceptibility**

During the Susceptibility Test there were three anomalies encountered (reference Notice of Anomaly Nos. 4, 5 and 6 in Attachment A). During the fourth attempt there was no loss of normal operation or loss of data as a result of the applied electromagnetic fields.

On the fourth attempt the EUT successfully met the requirements of the Electromagnetic Susceptibility Test. The Test Data Sheet, Photographs, and Instrumentation Equipment Sheet are contained in Attachments B, D, and G of this report.

**4.5.5 Electrical Fast Transients**

Electrical Fast Transients (EFT) testing was performed in accordance with sections 4.1.2.6 (a) of Volume I and 4.8 of Volume II of the 2005 VVSG to ensure that, should an electrical fast transient event occur on a power line, the EUT would continue to operate without disruption of normal operation or loss of data. Section 4.1.2.6 (b) of Volume I is not applicable because there are no I/O lines greater than three meters.

The EUT was configured to run in an automated ballot count test mode, where continual ballot processing would occur during the testing without operator intervention. The EUT was then subjected to electrostatic fast transients of 2 kV applied to its AC power lines. The pulse characteristics are listed in Table 4-5.

**Table 4-5 EFT Pulse Characteristics**

Pulse Description	Requirements	Units
Pulse Amplitude	+/-2.0	kV peak to peak
Pulse Rise Time	5 ±30%	nanoseconds
Pulse Width	50 ±30%	nanoseconds
Pulse Repetition Rate	100	kHz
Pulse Shape	Double exponential	N/A
Burst Duration	15	milliseconds
Burst Period	300	milliseconds
Test Duration	60	seconds

There was no loss of normal operation or loss of data as a result of the applied transients. The EUT successfully met the requirements of the Electrical Fast Transients Test. The Test Data Sheet, Photographs, and Instrumentation Equipment Sheet are contained in Attachments B, D, and G of this report.

**4.5.6 Lightning Surge**

Lightning Surge testing was performed in accordance with sections 4.1.2.7 (a), (b) of Volume I and 4.8 of Volume II of the 2005 VVSG to ensure that, should a surge event occur on a power line due to a lightning strike, the EUT will continue to operate without disruption of normal operation or loss of data. Sections 4.1.2.7 (c), (d), and (e) are not applicable because there are no DC lines greater than 10 meters and no I/O lines greater than 30 meters.

**4.0 TEST FINDINGS AND RECOMMENDATIONS (Continued)**

**4.5 Electrical Tests (Continued)**

**4.5.6 Lightning Surge (Continued)**

The EUT was configured to run in an automated ballot count test mode, where continual ballot processing would occur during the testing. The EUT power input lines were then subjected to lightning surge testing at a level of 2 kV applied to its AC power line per the surge characteristics listed in Table 4-6.

**Table 4-6 Surge Characteristics**

Test I.D.	Cable Type	Number of Interfacing Cables	Description	Injection Signals Summary Characteristics
Surge	Line (L) to Neutral (N)	1	120 VAC Power Lines	Injection at Power Input Sinewave: 0°, 90°, and 270°  Combination Wave Test Levels: ±2.0 kV and Ring Wave Test Level = ±2.0 kV
	Line (L) to Ground (G)	1		
	Neutral (N) to Ground (G)	1		
	Line (L) & Neutral (N) to Ground (G)	1		

During the Lightning Surge Test there were two anomalies encountered (reference Notice of Anomaly Nos. 1 and 2 in Attachment A).

During the third attempt the EUT successfully met the requirements of the Lightning Surge Test. The Test Data Sheet, Photographs, and Instrumentation Equipment Sheet are contained in Attachments B, D, and G of this report.

**4.5.7 Conducted RF Immunity**

Conducted RF Immunity testing was performed in accordance with sections 4.1.2.11 (a) of Volume I and 4.8 of Volume II of the 2005 VVSG. Section 4.1.2.11 (b) of Volume I is not applicable because there are no signal/control lines greater than three meters. This testing was performed to ensure that the EUT was able to withstand conducted RF energy onto its power lines without disruption of normal operation or loss of data.

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**4.0 TEST FINDINGS AND RECOMMENDATIONS (Continued)**

**4.5 Electrical Tests (Continued)**

**4.5.7 Conducted RF Immunity**

The EUT was configured to run in an automated ballot count test mode, where continual ballot processing would occur during the testing without operator intervention. The EUT was then subjected to conducted RF energy of 10 V rms applied to its power lines over a frequency range of 150 kHz to 80 MHz.

There was no loss of normal operation or loss of data as a result of the applied conducted RF energy. The EUT successfully met the requirements of the Conducted RF Immunity Test. The Test Data Sheet, Photographs, and Instrumentation Equipment Sheet are contained in Attachments B, D, and G of this report.

**4.5.8 Magnetic Fields Immunity**

Magnetic Fields Immunity testing was performed in accordance with sections 4.1.2.12 of Volume I and 4.8 of Volume II of the 2005 VVSG. This testing was performed to ensure that the EUT was able to withstand AC magnetic fields without disruption of normal operation or loss of data.

The EUT was configured to run in an automated ballot count test mode, where continual ballot processing would occur during the testing. The EUT was then subjected to AC magnetic fields of 30 A/m at a 60 Hz power line frequency.

There was no loss of normal operation or loss of data as a result of the applied magnetic field.

The EUT successfully met the requirements of the Magnetic Fields Immunity Test. The Test Data Sheet, Photographs, and Instrumentation Equipment Sheet are contained in Attachments B, D, and G of this report.

**4.5.9 Product Safety Review**

The VVSG states that all voting systems shall meet the following requirements for safety:

All voting systems and their components shall be designed to eliminate hazards to personnel or to the equipment itself.

Defects in design and construction that can result in personal injury or equipment damage must be detected and corrected before voting systems and components are placed into service.

Equipment design for personnel safety shall be equal to or better than the appropriate requirements of the Occupational Safety and Health Act, Code of Federal Regulations, Title 29, Part 1910.

To satisfy these requirements, the voting system was subjected to a Product Safety Review in accordance with UL 60950-1, "Safety of Information Technology Equipment".

Attachment F of this report contains the Product Safety Certificate of Conformance.

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**4.0 TEST FINDINGS AND RECOMMENDATIONS (Continued)**

**4.6 Anomalies and Resolutions**

Eight Notices of Anomalies were issued during the test campaign. A Notice of Anomaly (NOA) is generated upon occurrence of a verified failure, an unexpected test result, or any significant unsatisfactory condition. The Notices of Anomaly generated during testing are presented in their entirety in ATTACHMENT A and are summarized below.

Notice of Anomaly No. 1: Lightning Surge Test

After being subjected to the Lightning Surge Test, the AC Power Adapter ceased to function. As a result, the FL EVS 4500 system did not successfully pass the Lightning Surge Test.

Resolution to Notice of Anomaly No. 1

ES&S acknowledged the nonconformance observation and resubmitted a replacement AC Power Adapter for testing as part of the DS200.

Notice of Anomaly No. 2: Lightning Surge Test

After being subjected to the Lightning Surge Test, the AC Power Adapter ceased to function. As a result, the FL EVS 4500 system did not successfully pass the Lightning Surge Test.

Resolution to Notice of Anomaly No. 2

ES&S modified the FL EVS 4500 system to include an in-line COTS surge suppressor and resubmitted a replacement AC Power Adapter for testing as part of the DS200.

Notice of Anomaly No. 4: Electromagnetic Susceptibility Test

After being subjected to the Electromagnetic Susceptibility Test, the DS200 suffered disruption of normal operation. As a result, the FL EVS 4500 system did not successfully pass the Electromagnetic Susceptibility Test.

Resolution to Notice of Anomaly No. 4

ES&S acknowledged the nonconformance observation and provided a root cause analysis.

Notice of Anomaly No. 5: Electromagnetic Susceptibility Review

After being subjected to the Electromagnetic Susceptibility Test, the DS200 suffered disruption of normal operation. As a result, the FL EVS 4500 system did not successfully pass the Electromagnetic Susceptibility Test.

Resolution to Notice of Anomaly No. 5

ES&S acknowledged the nonconformance observation and provided a root cause analysis.

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**4.0 TEST FINDINGS AND RECOMMENDATIONS (Continued)**

**4.6 Anomalies and Resolutions (Continued)**

Notice of Anomaly No. 6: Electromagnetic Susceptibility Review

After being subjected to the Electromagnetic Susceptibility Test, the DS200 suffered disruption of normal operation. As a result, the FL EVS 4500 system did not successfully pass the Electromagnetic Susceptibility Test.

Resolution to Notice of Anomaly No. 6

ES&S acknowledged the nonconformance observation and provided a root cause analysis.

Notice of Anomaly No. 7: Low Temperature Test

After being subjected to the Low Temperature Test, the DS200 was damaged due to human error during testing. As a result, the FL EVS 4500 system did not successfully pass the Low Temperature Test.

Resolution to Notice of Anomaly No. 7

Wyle counseled and retrained all technicians on the associated Wyle Operating Procedure and performed the test correctly, at which time the DS200 successfully completed the Low Temperature Test.

Notice of Anomaly No. 8: Electrostatic Disruption Test (ESD)

After being subjected to the Electrostatic Disruption, the DS200 ceased to function and required human intervention in the form of a power cycle, during testing. As a result, the FL EVS 4500 system did not successfully pass the Electrostatic Disruption.

Resolution to Notice of Anomaly No. 8

ES&S acknowledged the nonconformance observation; Wyle performed the Electrostatic Disruption Test a second time and the EUT successfully passed.

**4.7 Test Summary and Conclusion**

Wyle performed conformance testing on all modifications submitted for the ES&S FL EVS 4.5.0.0 Voting System. Wyle only tested the DS200 for the modifications. Modifications of the DS200 met all applicable requirements in the EAC 2005 VVSG.

This report is valid only for the system identified in Section 2 of this report. Any changes, revisions, or corrections made to the system after this evaluation shall be submitted to Wyle to determine the scope of testing for the modified system. The scope of testing required will be determined based upon the degree of modification.