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## **DOMINION VOTING SYSTEMS DEMOCRACY SUITE 5.2**

### **Software Components**

**Election Management System: Software version 5.2.18.2**

**ImageCast Evolution: Software version 5.2.18**

**ImageCast Central: Software version 5.2.0.707**

**ImageCast X: Software version 5.2.6415.22930**

**Adjudication: Software version 5.2.2.4**

**Mobile Ballot Printing: Software version 5.2.18.2**

### **Staff Report**

**Prepared by:**

**Secretary of State's Office of  
Voting Systems Technology Assessment**

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# Table of Contents

<b>I. INTRODUCTION.....</b>	<b>3</b>
<b>II. SUMMARY OF THE SYSTEM.....</b>	<b>4</b>
<b>III. TESTING INFORMATION AND RESULTS.....</b>	<b>7</b>
<b>IV. CONCLUSION.....</b>	<b>21</b>
<b>Appendix A: COMPLIANCE WITH CALIFORNIA ELECTIONS CODE...22</b>	
<b>Appendix B: VOTERS WITH SPECIFIC NEEDS SURVEY RESULTS... 28</b>	

# **I. INTRODUCTION**

## **1. Scope**

This report presents the test results for all phases of the certification test campaign of the Dominion Voting Systems (Dominion) Democracy Suite (DemSuite) 5.2 voting system. The purpose of testing is to test the compliance of the voting system with California Voting Systems Standards, and State and Federal laws. Testing also uncovers other findings, which do not constitute non-compliance, and those findings are reported to the voting system vendor to address the issues procedurally. The procedures for mitigating any additional findings are made to the documentation, specifically the California Use Procedures.

## **2. Summary of the Application**

Dominion submitted an application for the DemSuite 5.2 voting system, which is comprised of the following major software components:

- Election Management System: Software version 5.2.18.2
- ImageCast Evolution: Software version 5.2.18
- ImageCast Central: Software version 5.2.0.707
- ImageCast X: Software version 5.2.6415.22930
- Adjudication: Software version 5.2.2.4
- Mobile Ballot Printing: Software version 5.2.18.2

In addition to the software, which includes the executable code and the source code, Dominion was required to submit the following:

- The Technical Documentation Package (TDP);
- All the hardware components to field two complete working versions of the system, including all peripheral devices, one for the Functional Test Phase and one for the Security Test Phase;
- Twenty (20) ImageCast Evolution voting machines, fifteen (15) ballot boxes and all the peripherals that would be in the polling place;
- Twenty (20) ImageCast X ballot marking machines and all the peripherals that would be in the polling place; and
- The California Use Procedures.

## **3. Contracting and Consultants**

Upon receipt of a complete application, the Secretary of State released a Request for Proposal (RFP) for assistance with the Security Review, both Source Code and Security Testing. The statement of work (SOW) also had an option for the Secretary of State to use the awarded contractor for Functional Testing, if it deemed necessary.

Through the formal California contracting process, the Secretary of State awarded a contract to SLI Compliance (SLI), 4720 Independence Street, Wheat Ridge CO.

## **II. SUMMARY OF THE SYSTEM**

The Democracy Suite 5.2 voting system consists of six major components.

### **1. Election Management System (EMS), v. 5.2.18.2**

EMS is a set of the following applications that are responsible for pre-voting and post-voting activities, including ballot layout, generation of audio files, programming media for voting equipment, importing results data, accumulating and reporting results.

#### **a) EMS-Election Data Translator (EDT), v. 5.2.18.2**

EDT is an application that imports and exports election data, such as districts, precincts, contests, candidates, translations, etc., to and from the election project (a.k.a. election definition).

#### **b) EMS-Election Event Designer (EED), v. 5.2.18.2**

EED is an application that handles the majority of the pre-voting activities. EED is the application that receives the imported data from EDT and Audio Studio in order to generate ballot structure, ballot artwork, and tabulator files, including all the audio for an accessible voting session on the precinct tabulators.

#### **c) EMS-Audio Studio, v. 5.2.18.2**

Audio Studio is an application that assists jurisdictions with the creation of audio files. It can be used to verify, listen and record audio files in EED.

#### **d) EMS-Results Tally Reporting (RTR), v. 5.2.18.2**

RTR is the main application for post-voting activities. It receives election results from the tabulators, allows for validation of the results, and reports the results. RTR can be used for the addition, and deletion of tabulator files. It also allows for manual resolution of qualified write-ins.

#### **e) EMS-File System Service, v. 5.2.18.2**

File System Service is a stand-alone service running on client machines enabling access to low level operating system application programming interface (API) for partitioning compact flash (CF) cards.

#### **f) EMS-Data Center Manager, v. 5.2.18.2**

Data Center Manager is a system-level configuration application used in EMS back-end data center configuration.

#### **g) EMS-Application Server, v. 5.2.18.2**

Application Server is a server side application responsible for executing long running processes, such as rendering ballots, generating audio files and election files.

#### **h) EMS-Adjudication Service, v. 5.2.2.4**

EMS-Adjudication Service is a software service that provides EMS data to the Adjudication Services application.

#### **i) EMS-ImageCast Voter Activation v. 5.2.18.2**

EMS-ImageCast Voter Activation is a software service that allows voter cards to be activated.

## **2. ImageCast Evolution (ICE), v. 5.2.18**

ICE is an all-in-one precinct scan tabulator and ballot marking device. The ICE can accept pre-marked ballots, give voters a second-chance notification on ballot errors, and provide a final ballot review based on the machines interpretation of the hand-marked ballot. The software prevents the scanning and tabulating of a vote with a marginal mark based on thresholds set in EED. The ballot marking capabilities allow a voter to place a blank ballot into the machine and vote using the accessible tactile interface (ATI), sip-n-puff, or paddle switches. When the ballot marking capabilities are turned on the voter also has the capability to use the audio features. The version submitted for California has the audio capability to handle any of the ten languages required by the U.S. Department of Justice (English, Spanish, Chinese, Japanese, Tagalog, Korean, Vietnamese, Thai, Hindi, and Khmer).

## **3. ImageCast X (ICX), v. 5.2.6415.22930**

ICX is an accessible ballot marking device. The ballot marking capabilities allow a voter to vote using the accessible tactile interface (ATI), sip-n-puff, or paddle switches. The ICX requires the voter to insert an activation card which is generated by a poll worker. The activation card can be created with disabled options enabled so that the voter is presented with all of the accessible options when the voting session is initiated. The version submitted for California has the audio capability to handle any of the ten languages required by the U.S. Department of Justice (English, Spanish, Chinese, Japanese, Tagalog, Korean, Vietnamese, Thai, Hindi, and Khmer).

## **4. ImageCast Central (ICC), v. 5.2.0.707**

ICC uses commercial-off-the-shelf (COTS) Canon DR-X10C, or Canon DR-G1130 scanners at the central tabulation location to scan vote by mail ballots and post-voting ballots, such as provisional ballots, vote by mail ballots not delivered until Election Day, ballots that need to be duplicated, and ballots that were scanned into a multi-precinct ICE tabulator. The results from batches scanned through the ICC are dropped into a folder on the server for the Adjudication Client to access.

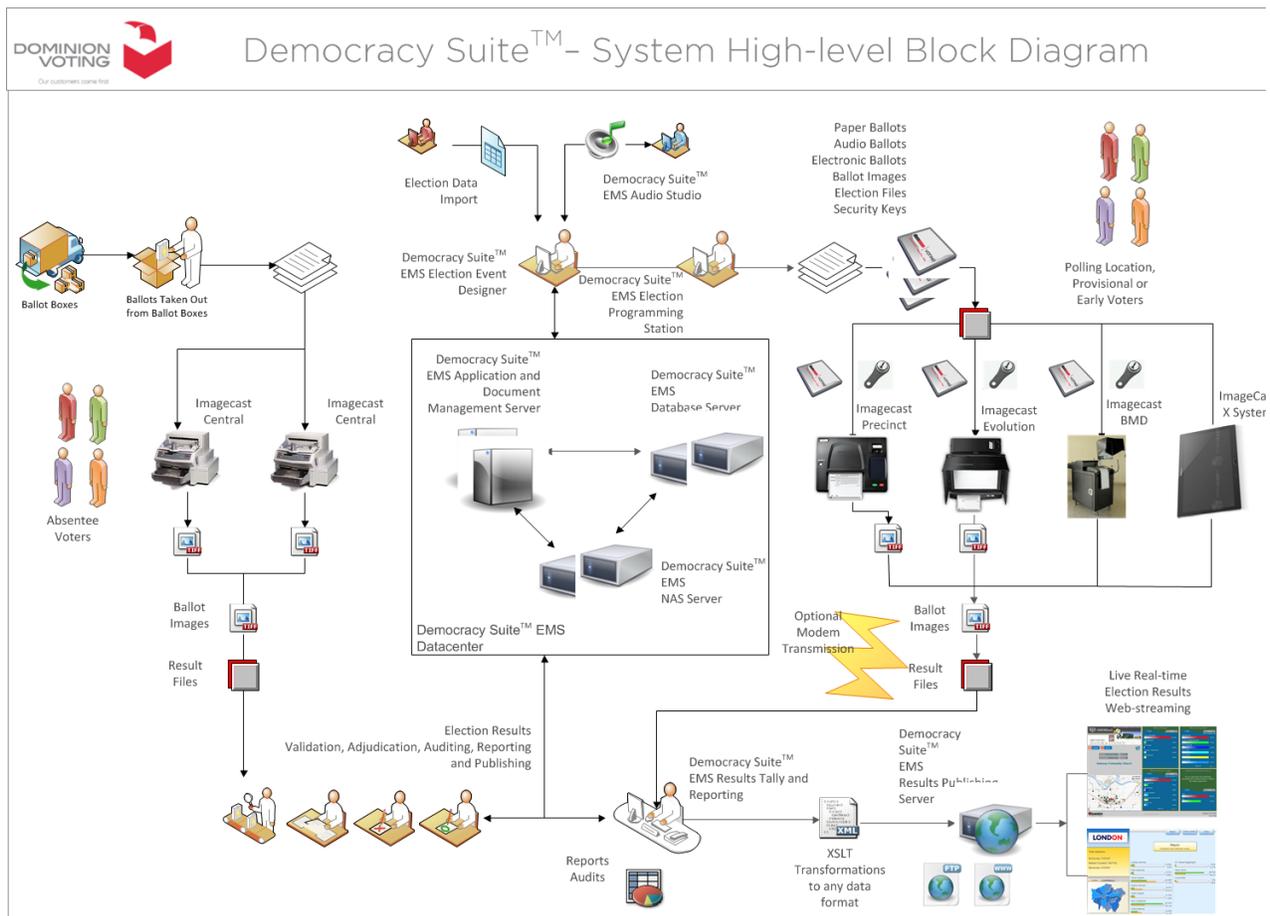
## **5. Adjudication Client, v. 5.2.2.4**

Adjudication Client is an application that allows the jurisdiction to resolve a ballot on screen that would normally be outstaked to be remade or hand counted because it had one or more exception conditions, such as write-ins, over-votes, marginal marks, under-

votes, or because it is a completely blank ballot. The Adjudication Client has two roles, Administration and Ballot Inspection. The functionality of the Administration role is to configure user accounts, exception reasons (e.g. write-ins and over-votes), batch management, and report generation. In the California configuration, the Administration role must be performed directly on the server. Ballot Inspection allows users to review ballots that have at least one exception condition as defined by the Administration role. The user may accept the ballot as is or resolve the ballot pursuant to California law. Each ballot that is adjudicated is stamped with the username of the user who made the change.

## 6. Mobile Ballot Printing (MBP), v. 5.2.18.2

The MBP system operates in conjunction with the the DemSuite 5.2 EMS. The EMS creates MBP ready ballot images in .PDF format complete with tint and watermark. These ballot images are exported to the MBP laptop, and then printed on blank paper. Once setup and configuration is complete, the MBP laptop only contains geopolitical information, and does not contain any voter information. The MBP system will generate many different reports, including total number of ballots printed, and number of each ballot style printed. The reports can be generated in Excel, Word, and PDF formats.



## **III. TESTING INFORMATION AND RESULTS**

### **1. Background**

Dominion submitted an application to the Secretary of State for certification of the DemSuite 5.2 voting system on December 18, 2016. California assigned DemSuite 5.2 the project number CA-DVS5.2. The Elections Assistance Commission (EAC) certified version 5.0 of the system on February 8, 2017, with the EAC Certification Number: DVS-DemSuite-5.0.

California certification testing of the DemSuite 5.2 voting system began in May, 2017. The testing began with the Source Code Review, followed by Functional Testing Phase I & II, Security Review, and finally Volume and Accessibility Testing.

The Secretary of State began the Functional Test phase of testing on DemSuite 5.2 voting system in May, 2017.

### **2. Functional Test Data and Results**

The Functional Test of the Dominion DemSuite 5.2 voting system was conducted by Office of Voting Systems Technology Assessment staff, SLI staff, and Dominion staff at the Secretary of State's Office located at 1500 11<sup>th</sup> Street, Sacramento, California from May 30, 2017, through June 15, 2017. Two additional days of functional testing on August 3 and 4, 2017, were required to test updates to the software provided by Dominion in response to anomalies uncovered during testing.

The Secretary of State ran the Functional Test as if it were a jurisdiction that just purchased the voting system. Testing of the system began with a two pass wipe of all computers in order to clean the existing software from them and begin with five (5) pieces of hardware with no software on them. The five pieces of hardware are the Dell PowerEdge R630 server (EMSServer), Dell Precision Tower 3420 (EMSCClient1), Dell Precision Tower 3420 (AdjudicationClient1), Dell Optiplex 7440 All in One (ICC1), and Dell Optiplex 7440 All in One (ICC2) with touch screen. Following the California Use Procedures, the testing began with the installation of the operating system, commercial-off-the-shelf software, voting system trusted build software, and then continued through the security hardening process. Upon completion of the installation of the system, it was run through an acceptance and readiness test to determine that each piece of equipment was functioning properly and that all networking and permissions were configured correctly.

Functional Testing of the system included six (6) main election types, a Presidential Primary, a Presidential General, a Special Recall, a Ranked Choice Voting (RCV), and a Vote Center Election. The specific election definition databases used in testing were based on the 2012 Presidential Primary, the 2012 Presidential General, the 2003 California Statewide Special Recall Election, a fictitious RCV Election with ten candidates, and a modified 2012 Presidential Primary. The Primary and General Elections were configured using actual data that was exported from California counties

election information management systems and/or voting systems. The ability to create/modify an election definition within EED was conducted during testing of the Vote Center election. The Vote Center election was created by modifying the primary election to include fifteen hundred (1500) vote centers, and three (3) languages.

The mock elections were conducted as if the system had just been purchased by a county. Polls were opened and voting at the precincts using the ICE, and ICX on Election Day began. At the close of polls, the memory cards from the ICE voting machines and the electronic files from the ICC were brought into RTR. Ballots containing an exception condition were resolved using adjudication. When the polls closed the results from the ICE voting machines, and the cast vote records from the ICX's, were tabulated, validated and published. After all ballots were tabulated, the Official Canvass Summary report and Statement of Votes Cast report were generated. Additionally, the Secretary of State Statement of Vote (SOV) and Supplemental Statement of Votes (SSOV) reports were generated. CalVoter Template Files were not tested because this functionality has been temporarily disabled in DemSuite 5.2. Note that the above description was followed for all test elections, however, the Recall, Ranked Choice Voting, and Vote Center Elections were used to test specific items, such as ballot layout rules and laws, battery backup capacity, scanner read-head tests to determine the consistency and accuracy of different types of marks using different marking devices simulating actual voters who vote by mail, language tests to determine if the system can populate all fonts used in California correctly and accurately, as well as the capability of the system to operate in a vote center environment that may constitute many more voters both for early voting and on election day.

**Primary Election:** Polls were opened and zero tapes printed. The ICX device was utilized to create voted ballots in English, Spanish, and Chinese, including changing from English to Spanish midway through the ballot being voted. The ICX correctly printed the ballot in whatever language was chosen last. Text size and contrast were verified to meet expected criteria. Testing verified the ability of the ICX to return from the review screen to alleviate any problems, included activation cancellation (fleeting voters). Ballots in English, Spanish, and Chinese were scanned on both the ICX and ICC without problem. Polls were closed in accordance with California Use Procedures, including printing results from ICE and ICC, removing results media to transfer results back to EMS, and then shutting down devices. Post-Election results were consolidated and reported based on the upload of results to EMS from all tabulating (ICE and ICC) units. Both qualified and unqualified write-ins were adjudicated, and results included reconciliation of write-ins as well as generation of final reports and verifying Canvass – SOV, SSOV, precinct results, over-votes, and under-votes.

**General Election:** Polls were opened and zero tapes were printed. The ICE precinct tabulator was utilized to scan the test decks, including ballots created/marked by the ICX, over-voted ballots, ballots with marginal marks, and ballots with write-ins. Ballots from the wrong election and precinct were tested, and were correctly identified by the ICE. Ten ballots with marginal marks were correctly identified and either read, rejected or prompted the voter to correct the error as expected. The ICC central count location scanning devices were utilized to scan voted ballots, including those from the ICX. Included were over-voted ballots, ballots with marginal marks, and ballots with write-ins.

Adjudication was configured to identify ambiguous marks, blank ballots, over-votes, and write-ins, and ballots were adjudicated. The adjudication system correctly identified all marginal marks and performed as expected. The under-votes, over-votes, and qualified write-ins were adjudicated without error. A fully voted ballot (every bubble was marked), and several fully under-voted (blank) ballots were identified correctly by the system. The non-qualified write-in ballots were rejected without error. Polls were closed in accordance with California Use Procedures, including printing results from ICE and ICC, removing results media to transfer results back to EMS, and then shutting down devices. Post-Election results were consolidated and reported based on upload of results to EMS from all tabulating (ICE and ICC) units. Results included reconciliation of write-ins as well as generation of final reports and verifying Canvass – SOV, SSOV, precinct results, over-votes, and under-votes.

**Recall Election:** The recall election was comprised of one ballot style with one contest containing 155 candidates and one write-in. The recall election utilized a 22” ballot. The 156 ballots were marked such that each candidate and the write-in received one vote. The ICX polling place ballot marking device was utilized to create voted ballots which represented the last five ballots in the test deck, including the write-in candidate. While no errors were encountered, the G1130 scanner (ICC) slowed to about 60 ballots per minute, or 3600 per hour while scanning the 22” ballots. All ballots were tabulated correctly.

During the recall election, accessible options on the ICX polling place ballot marking devices were reviewed and verified. All four modes (sip and puff, audio, ATI, and paddles) for accessible access were tested without error. The ICX displays the accessible options when you insert an activation card configured for an accessible voting session. Audio can be enabled by the activation card at the start of the voting session.

During the recall election, activation card functionality was tested. The ICVA was utilized to create all three types of cards: poll worker, technician, and voter. All three types of cards were tested without incident. Activation cards allow only a single use, and are programmed for a specific election (via encryption key). Activation cards cannot be used more than once and could not be used in a subsequent election since the election encryption keys are different. Both accessible access and regular voter cards were created and utilized throughout all elections without error. Polls were closed in accordance with California Use Procedures, including printing results from ICE and ICC, removing results media to transfer results back to EMS, and then shutting down devices. Post-Election results were consolidated and reported based on upload of results to EMS from all tabulating (ICE and ICC) units. Results included reconciliation of write-ins as well as generation of final reports and verifying Canvass – SOV, SSOV, Precinct results, over-votes, and under-votes.

**RCV Election:** One ballot style with one contest containing ranked choice candidates and one (1) write-in was utilized. The ICX device was utilized to create five voted ballots, recreations of five of the original ballots, which were then placed in the deck of twenty four (24), replacing the originals. The test deck of twenty four (24) ballots was tabulated three (3) times for a total of seventy two (72) ballots for nine (9) rounds of

ranked choice voting. Polls were opened in accordance with California Use Procedures. Zero reports for all devices were printed and verified. All ballots were tabulated on both the ICE and ICC. Results were loaded into the EMS, and a simulated coin toss was utilized to advance through the nine rounds of RCV. In the first test, the threshold was 37. The EMS correctly identified all nine rounds of RCV. In the second test, adjudication was configured to accept qualified write-ins, and to filter ambiguous marks, over-votes, unqualified write-ins, and blank ballots. All ballots with write-ins were adjudicated correctly, and results were tabulated correctly through nine (9) rounds of RCV. Polls were closed in accordance with California Use Procedures, including printing results from ICE and ICC, and results media were used to transfer results back to the EMS. Reports were generated printing contest rankings for each round of RCV.

**Vote Center Election (Maximum Ballot Styles):** Both the ICE and ICX were set up with fifteen hundred (1500) vote centers, and twelve thousand (12,000) ballot styles. Then three (3) languages were added to the ICX for a total of thirty six thousand (36,000) unique ballot styles, and two (2) languages were added to the ICE for a total of twenty four thousand (24,000) unique ballot styles. Loading the election took approximately thirty minutes for each device. Polls were opened in accordance with California Use Procedures. Zero reports for all devices were printed and verified. A total of 30 ballots were voted on the ICX in English, Spanish, and Chinese. Utilizing both 1-sided and 2-sided ballots, 169 voted ballots were created. The ICE device was utilized to scan the 169 voted ballots. One additional ballot was created and voted through the ICE AVS, for a total of 170 ballots scanned. The ICC device was utilized to scan the 30 voted ballots from ICX. Polls were closed in accordance with California Use Procedures, including printing results from ICE and ICC, removing results media to transfer results back to EMS, and then shutting down devices. Post-Election results were consolidated and reported based on upload of results to EMS from all tabulating (ICE and ICC) units. Results included reconciliation of write-ins as well as generation of final reports.

Test results showed that the voting system performed in a manner consistent with California Voting System Standards and all test cases were executed successfully and accurately. The testing did uncover several issues in the California Use Procedures. All were clarity issues and each of the issues discovered was resolved by editing the California Use Procedures.

### **3. Volume and Accessibility Test**

As part of its test protocol, the Secretary of State conducts a Volume Test on all voting machines under test with which the voters will directly interact. Because the Dominion DemSuite 5.2 voting system only contains the ICE and the ICX ballot marking device machines at the precinct or vote center, the Secretary of State determined that it would do a combined Volume and Accessibility Test. The Volume Test took place between July 17, 2017, and July 18, 2017. The Accessibility Test took place between July 18, 2017, and July 20, 2017. The Secretary of State partnered with volunteers from the voters with disabilities communities to complete the heuristic evaluation of the accessibility features of the ICE and ICX, as well as to provide findings in this report.

Both the Volume and Accessibility Tests used a modified version of the 2012 Presidential General Election as the basis for the election definition files. The Volume and Accessibility Tests were setup in a vote center model, with all ballot styles available on all ICEs and ICXs, as opposed to being loaded with a single precinct, similar to that of a polling place.

### **3.a. Volume Test**

The ICE precinct tabulators presented for the DemSuite 5.2 test are identical to the hardware that has been previously tested with the DemSuite 4.14-A1 voting system, but with new firmware. Per the California Volume Test Protocol, the Volume Test consisted of a total of twenty (20) ICE precinct tabulators, and twenty (20) ICX ballot marking machines, as well as two (2) ICC central tabulators and scanners. Consistent with functional testing, one ICC utilized a Canon X10 scanner, and one utilized a Canon G1130 scanner. The Secretary of State used a total of fifteen (15) voters, ranging in age, skill, and voting experience, to vote ballots on the machines. The twenty ICE machines were labeled in numerical order of #1 through #20, and the twenty ICX machines were labeled in numerical order of #1 through #20 for proper identification.

Dominion provided twenty (20) test decks, each with one thousand (1000) ballots for the ICE machines. The ICE machines were tested first, and a total of one thousand (1000) ballots were tabulated by each machine to simulate the voters a precinct or vote center would have on Election Day. Because of a packaging error, one ICE tabulated nine hundred fifty (950) ballots, and one ICE tabulated one thousand and fifty (1050) ballots. As the test was being conducted, anytime there was an incident that took “poll worker” assistance, the incident was documented. There were no incidents recorded on the ICE precinct tabulators. The zero tapes created when the polls were opened were kept on the machines, and along with the results after the polls were closed, were saved as artifacts.

The ICX ballot marking machines were tested next. One thousand (1000) activation cards were created, and used to generate fifty (50) ballots on each ICX machine, for a total of one thousand (1000) activation cards, and one thousand (1000) ballots created. One incident was reported on the ICX machines. ICX #18 froze after seventeen (17) ballots had been created. The machine was rebooted and performed without incident after the reboot. Out of the one thousand (1000) ballots generated on the ICX machines, there was one incident (excluding incidents caused by human error) for an error rate of .001.

When testing was completed on the precinct machines, twenty thousand (20,000) ballots from the ICEs, one thousand (1000) ballots from the ICXs, and twenty thousand (20,000) ballots from the ICE flash cards were tabulated, for a total of forty one thousand (41,000) ballots. Every report the EMS can generate, including SOV, and SSOV were created and saved.

After the test concluded, the Secretary of State verified the results of vote totals both locally, off of the ICE results tapes, and then overall, out of RTR. The verification

resulted in a 100% accuracy rate. Based on the fact that the ICE performed with a 100% accuracy rate and the incidents and poll worker intervention rates were well below the 2% ballot rejection rate allowed by the California Voting System Standards, the Volume Test for the precinct count scan functionality of the ICE, and the ballot marking functionality of the ICX was deemed successful.

### **3.b. Accessibility Test**

The Accessibility Test consisted of two (2) ICE precinct tabulators, which also function as accessible machines, and two (2) ICX ballot marking machines. The machines were setup in voting stations, which were placed throughout the Secretary of State's multi-purpose room, giving enough space in between to allow some privacy. Each voting station contained one ICE or ICX voting unit, one video recording camera with microphone, one table, two chairs and a laptop for note taking by Secretary of State Staff.

Voters who were voting an Accessible Voting Session (AVS) had the ability to use any of the following components: the Audio Tactile Interface (ATI), lap pad, adaptive/paddle switches, headphones, sip and puff device, or rubber coated lap pad with ATI.

The ICE has the capability to support voters with the following disabilities:

- Cognitive - ballot display via paper and large LCD screen;
- Perceptual and Partial Vision - ability to change screen color scheme, contrast, and font size;
- Low or No Vision - audio, tactile interface;
- Dexterity - integrated ballot marking device that does not require the voter to manipulate the ballot, low force buttons for voter interface;
- Mobility –California Voting System Standards required reaches and wheelchair access. The ICE product allows voters to avoid manipulating the ballot to go from the ballot marker to the scanner, and then into the ballot box;
- Hearing - audio interface, same as for low/no vision; and
- Speech - no speech is required to operate the voting system.

The ICX ballot marking machine has the capability to support voters with the following disabilities:

- Cognitive - ballot display via paper and very large LCD screen;
- Perceptual and Partial Vision - ability to change screen color scheme, contrast, and font size;
- Low or No Vision - audio, tactile interface;
- Dexterity - ballot marking device that does not require the voter to manipulate the ballot, low force buttons for voter interface;
- Mobility –California Voting System Standards required reaches and wheelchair access. The ICX product allows voters to mark the ballot, which must then be inserted into a tabulator or ballot box;
- Hearing - audio interface, same as for low/no vision; and

- Speech - no speech is required to operate the voting system.

Activation cards for the ICX machine must be generated with the accessible option turned on for voters who are voting an Accessible Voting Session (AVS).

The Secretary of State tested the voting system for usability and accessibility with six (6) volunteer voters from the general population with the various disabilities mentioned above. Of the six (6) voters, one identified that they are visually impaired, four (4) identified dexterity problems, and one (1) did not identify a disability. These volunteer voters were asked to vote four (4) separate ballots, two (2) each on the ICE and ICX.

The Secretary of State also had the assistance of three (3) staff members who documented the test process and experience for each volunteer tester, and two Dominion representatives, who acted as poll workers. The voters were trained by Dominion personnel on the system and how to use the accessible features.

The Secretary of State provided a two part survey for each voter. Part one of the survey was filled out during the check-in process and asked a series of questions related to the voter themselves and of their experience with the voting process. Part two of the survey asked twelve (12) questions describing the voter's experience with the voting system. To categorize responses, the first ten (10) questions were specific to the voting system. The questions and responses can be viewed in Appendix B.

The consensus of the volunteers was that they felt the technologies implemented for accessibility and usability improved the experience for voters that are most in need of them. From a privacy point of view, all volunteers seemed to feel that their privacy was kept intact and none expressed any issue or concern.

### **Anomalies Identified During Accessibility Testing**

Four (4) software anomalies were identified during accessibility testing:

- The ICE machine referred the voter to an error message on the screen, when the machine was in audio mode with no screen display to refer to;
- The ICE machine did not provide the voter with a clear option for reviewing/casting the ballot when used in audio mode with the screen blanked for privacy. The voter was required to first click on a contest, then the review button in order to finally cast their ballot;
- During a write-in, if you have to go into help, when coming back to the keyboard the focus is not on the keyboard; and,
- The ICX machine would sporadically reboot when using the ATI interface device.

All four anomalies were referred to Dominion for mitigation, and were resolved by editing the software. These changes required new source code and a new trusted build to be generated. At this time, Dominion also offered five enhancements to the original system as a result of Functional Testing, as well as the addition of Mobile Ballot Printing (MBP) functionality:

- System will prevent the resolution of the same qualified write-in candidate to more than one voting position within the same contest (on ranked choice voting contests).  
Expected Result: Adjudication client should prevent assigning the same qualified write-in to multiple ranks;
- ICX Vote simulator for ranked choice voting contest.  
Expected Result: ICX should cast the ballot;
- Ability to use different paper sizes for hand marked and machine generated ballots without full ballot review.  
Expected Result: ICE should cast both ballots without full ballot review;
- Ability to set watermark background picture for ballot headers, footers and ballot stubs.  
Expected Result: Ballots are cast correctly and they have the watermark image on the ballot; and,
- Correct display of ICX marked ballot images scanned by ICE within adjudication.  
Expected Result: Ballot appears complete in adjudication display.

The new source code was delivered to both the California SOS and SLI so that a new trusted build could be generated. The new trusted build necessitated two additional days of Functional Testing on August 3 and 4, 2017, along with regression testing for approximately fifteen hundred (1500) lines of additional code. At this time, a demonstration was conducted by Dominion for the added functionality of Mobile Ballot Printing, and functional testing was conducted to test all border device connections to the EMS, as well as tabulating MBP ballots in all tabulators. Functional Testing of the Mobile Ballot Printing addition was completed without error.

#### **4. Security Review**

The Secretary of State contracted with SLI to conduct the Security Review. The Security Review took place at SLI's office between July and August, 2017.

The Security Review covered top-level system design and architecture, system documentation and procedures, testing of relevant software and operating system configuration for pertinent vulnerabilities, testing of hardware, and testing of system communications, including encryption of data as well as protocols and procedures for access authorization. The review was divided into three (3) phases:

Phase I included review of all pertinent documents for appropriate processes and procedures for implementing a secure system. This included review of the system design and architecture.

Phase II included testing of relevant software, operating systems, and hardware configurations.

Phase III included testing of all telecommunications aspects of the system.

## **PHASE I**

During Phase I testing, review of the TDP validated that all requirements were satisfactorily covered.

## **PHASE II**

During Phase II testing, it was discovered that most requirements were satisfactorily covered. The following issues were noted related to audit logging, passwords, anti-virus, and installation aspects of the voting system. None of these issues directly affect the functioning of the voting systems and could potentially be alleviated with manual processes.

### **In-process Audit Records**

Testing performed: As all other requirements were being tested, the audit log was reviewed to verify that appropriate records were recorded for the events occurring.

Applicable to: EMS, Adjudication, ICC, ICE, and ICX.

The EMS work stations utilize the Windows Operating System Audit logs. Auditable events like unauthorized login attempts are recorded in the Application's Windows Event Log.

Review of the requirement showed that Adjudication is controlled strictly by the Windows Operating System login credentials. ADJ is specified to be installed on machines that grant specific access through Windows login credential/groups.

The ICC log is only able to be cleared by authorized personnel with elevated permission levels, utilizing two-factor authentication. Audit logs contain both date and time information allowing the system to continue logging throughout scanning during an election.

Review of the requirement showed that the ICX device does not provide monitoring of physical security. However, the ICX is a ballot marking device (BMD) that does not store votes cast. The ICX BMD allows the voter the opportunity to not only review their paper ballot prior to printing, but also to review the paper ballot itself once printed prior to casting on any ImageCast tabulator in the polling place.

The Windows Operating System contains a full featured security system, including invalid login attempts, user lockout after set number of invalid attempts, lockout time, and file permissions. The Windows Operating System also contains a full featured auditing system, which will audit all system functions. The Windows Operating System auditing can be setup in a checks and balances configuration, so that the same user that creates and configures auditing cannot modify anything else on the system, and an administrative user cannot modify auditing.

## **Access Control Authentication**

Testing performed: Tests were performed to verify that the administrator group or role is able to perform all the functions listed in the requirements above. Tests were performed that verify that users are authenticated properly prior to being allowed access, and that all private access data is secured properly. Tests were performed to verify that usernames are not allowed to be part of the password.

Applicable to: EMS, Adjudication, ICC, ICE, and ICX.

Review of the requirements showed that access control authentication is accomplished through the Windows Operating System.

Activation cards allow only a single use and are programmed for a specific election (via encryption key). ICX activation cards cannot be used more than once and could not be used in a subsequent election since the election encryption keys are different.

The ICX passcode length field on the ICX is limited to eight characters. There is the ability to set ibutton and activation card passcode length to between four and eight characters. The ICX is a ballot marking device (BMD) that does not store votes cast. The ICX BMD allows the voter the opportunity to not only review their paper ballot prior to printing, but also to review the paper ballot itself once printed prior to casting on any imagecast tabulator in the polling place.

The EMS system EED and RTR currently are forced to have ten-character complex passwords. The Windows Operating System is used to set expiration of accounts, password history, and password complexity.

Review of the requirement showed that EMS and EED/RTR user accounts password complexity can be changed utilizing the Windows Operating System which includes the ability to set password complexity requirements.

Review of the requirement showed that password history functionality is provided through the Windows Operating Systems.

Review of the requirement showed that SLI was able to enable random generation of ibutton and activation card pin numbers of between four and eight characters. In the EED and RTR user accounts, SLI was able to create user accounts with passwords that contained usernames, however, Windows Operating System based authentication can prohibit username as part of the password.

Review of the requirement showed that the Windows Operating System has the ability to expire passwords/passcodes or user accounts.

## **Protection Against Malicious Software**

The ICX system is currently an android tablet device and contains no form of anti-virus (AV) protection. However, the ICX provides a metal cover that can be locked over all

ports to prevent unauthorized access, thereby preventing the introduction of malicious software. In addition, the ICX is a ballot marking device that does not store any voter information, and does not tabulate votes. A voter can review their ballot both before and after printing to verify that their selections are correct.

The ICE system is a proprietary system that utilizes firmware and compact flash cards to run, load, and store election based software. This system contains no AV protection. However, the ICE utilizes proprietary firmware that is not susceptible to malicious software attack. Additionally, the DemSuite 5.2 technical documentation specifies that only trusted media be introduced to the system from the outside sources.

## **Software Setup Validation**

Testing performed: Tests were performed to verify that the installation process for each system component is robust and maintains the integrity of the voting system.

Applicable to: EMS, Adjudication, ICC, ICE, and ICX.

Review of the requirement shows that Dominion specifies what is required to complete software validation but does not specifically supply the required software or hardware to do so. In the case of the ICX third party, Android developer tools were required to pull packages from the ICX device for hashing. Dominion specifies that third party developer tools should be obtained from trusted locations for software validation. This provides stronger confidence that the correct software is installed as it is verified by third party tools with no link to the provider of the installed software.

Review of the requirement shows that Dominion specifies what is required to complete software validation but does not specifically supply the required software or hardware to do so. In the case of the ICX, third party Android developer tools were required to pull packages from the ICX device for hashing.

Review of the requirement shows that the ICX hardware is set to not allow unsigned Android Package Kit's (APK) from being installed; however, with the Tech Card there is nothing voting system specific that prevents additional package files from being installed. However, the Tech Card provides elevated permissions required to install and configure the ICX machine. Voters are prevented from accessing any open application other than the ICX software and do not have access to ICX Tech Cards.

Review of the requirement, shows that SLI was able to replace digitally signed application installers with renamed executables without the installation package failing. SLI was able to modify election specific installers utilizing a hex editor to change minor things including mouse over text and digital signature names. SLI was able to take installers from previous versions of the installation package and use them to install older versions of the software from the Democracy Suite installation. SLI believes it would be possible to inject more lethal payloads into the installers given the opportunity. However, manipulating files with a hex editor would change their hash values and invalidate the software when utilizing the software installation validation specified in the systems technical documentation package.

Review of the requirement shows that SLI was able to install the newer version of the ICX software without having to uninstall the older version. SLI was able to update the ICE without having to uninstall the older version. Updating the software to a newer version is allowed by the system design and installed versions can be checked utilizing software installation validation procedures detailed in the technical documentation package.

Review of the requirement shows that SLI review of system logs on ICE, ICX, and EMS systems was not able to locate entries that dealt with a failed or successful installation of software, however, these can be found in operating system logs on each device. The application cannot store its own record of installation or uninstallation.

Review of the requirement shows that SLI review of system logs on ICE, ICX, and EMS systems revealed that failed installations are logged to the appropriate operating system logs.

Review of the requirement shows that SLI review of system logs on ICE, ICX, and EMS systems was not able to verify these specific details because there was no visual representation of the actions performed; not every application had these specific details provided.

Review of the requirement shows that SLI review was unable to verify that the ICX has visual indicators showing if the port is enabled or disabled, however, the ICX is a COTS tablet device, and the ports are physically protected and sealed.

Review of the requirement shows that SLI review was unable to verify that the ICX has visual indicators showing that the port is disabled during voting, however, the ICX is a COTS tablet device and the ports are physically protected and sealed.

Review of the requirement shows that the SLI review was unable to verify that there was a specific method to be able to verify or determine exactly all contents on the system. As specified in the California Use Procedures document, all software is loaded utilizing hashed golden images produced under trusted conditions and installing known software configurations. Elevated permissions would be required to alter the golden image configurations and would be detectable utilizing software installation validation procedures outlined above.

### **PHASE III**

Phase III testing determined that telecommunications tests were not applicable for this system. The DemSuite 5.2 voting system is a contained system that operates on a closed network. There are no connections to public networks.

## **5. Source Code Review**

The Secretary of State contracted with SLI to conduct the Source Code Review. The Source Code Review took place at SLI between June and August, 2017. The Dominion

DemSuite 5.2 voting system includes proprietary software and firmware. The Dominion DemSuite 5.2 voting system code base was tested to the applicable CVSS requirements.

### **ADJ Source Code Vulnerability Review**

No vulnerabilities were found within the ADJ source code base reviewed, as a result, no findings were written against the code base.

### **EMS Source Code Vulnerability Review**

No vulnerabilities were found within the EMS source code base reviewed, as a result, no findings were written against the code base.

### **ICC Source Code Vulnerability Review**

No vulnerabilities were found within the ICC source code base reviewed, as a result, no findings were written against the code base.

### **ICE Source Code Vulnerability Review**

The following potential vulnerabilities were found within the ICE source code base:

#### **SQL Statements**

Five instances of SQL statements that hold the possibility of being injected into were observed within the ICE source code base. It was noted, however, that these statements are inside private functions and can only be accessed by appropriate function calls.

As a result of the placement of the SQL statements in question, the level of access required to take advantage of this potential vulnerability would be that of a Vendor insider, someone with great knowledge of, and access to, the voting machine design and configuration.

#### **strcpy**

It was noted that 44 instances of the “strcpy” function are being used. It is recommended not to use strcpy as it does not protect against out of bounds issues.

The strings being acted on are normally bounds-checked either on entry into or before being passed by the receiving or calling function.

For the “strcpy” statements in question, the level of access required to take advantage of this potential vulnerability would be that of a Vendor insider, someone with great knowledge of, and access to, the voting machine design and configuration.

## **memcpy**

It was noted that six instances of the “memcpy” function are being used. Use of the memcpy function is prone to buffer overflow. The data being acted on is normally bounds-checked on entry into or before being passed by the receiving or calling function.

For the “memcpy” statements in question, the level of access required to take advantage of this potential vulnerability would be that of a Vendor insider, someone with great knowledge of, and access to, the voting machine design and configuration.

## **strcmp**

It was noted that one instance of the “strcmp” function is being used. Use of the “strcmp” function is prone to buffer overflow. Values being passed into the strcmp function are bounds-checked before being passed to the strcmp function. For the “strcmp” statements in question, the level of access required to take advantage of this potential vulnerability would be that of a Vendor insider, someone with great knowledge of, and access to, the voting machine design and configuration.

## **ICX Source Code Vulnerability Review**

One potential vulnerability was found within the ICX source code base reviewed. Potentially, whenever a USB drive is inserted into the ICX machine it is automatically loaded, without a security check of the contents. This could mean that regardless of what is on that thumb drive it will be read and if an “.exe” file exists, it will be run. This potential vulnerability is of minimal concern because the USB ports on the ICX are covered by a metal lid that can be locked with a small padlock type locking device, thereby preventing unauthorized access.

## **Security and Source Code Review Findings**

Within the Dominion DemSuite 5.2 ICE code base, all findings were low risk vulnerabilities that would require an in-depth knowledge of the ICE code base and how it operates to be able to successfully subvert the system. To exploit them successfully, it would require modifying the code before any build.

During the ICX source code vulnerability review, one potential vulnerability was discovered and the level of access required to take advantage of this potential vulnerability would be open to a variety of actors including a voter, a poll worker, an election official insider, and a vendor insider. This potential vulnerability has a more widespread potential. Polling place procedures are one method of mitigating this issue, with poll workers actively verifying that the USB ports are covered and the covers sealed to prevent access. OVSTA recommends that if this system is certified, a condition of use be for the metal covers on the USB ports to be closed and locked.

## **IV. CONCLUSION**

The Dominion Democracy Suite 5.2 voting system, in the configuration tested and documented by the Installation and Use Procedures, meets all applicable California Voting System Standards and Elections Code requirements. Appendix A contains a detailed chart of the Elections Code sections that the Secretary of State tested the system against.

## Appendix A: COMPLIANCE WITH CALIFORNIA ELECTIONS CODE

The following are the California Elections Code sections that the Secretary of State tested the Dominion Democracy Suite 5.2 voting system against. The list is broken down by Elections Code Section, language quoted from the section and how the system complies with the section.

10264

As soon as the result of the election is declared, the elections official of the governing body shall enter on its records a statement of the result. The statement shall show: (a) The whole number of votes cast in the city. (b) The names of the persons voted for. (c) The measures voted upon. (d) For what office each person was voted for. (e) The number of votes given at each precinct to each person and for and against each measure. (f) The number of votes given in the city to each person and for and against each measure.

The voting system has the capability to produce the required report(s).

10550

As soon as the result of the canvass by the county elections official is declared, the county elections official shall prepare and mail a statement of the result to the secretary of each district participating in the general district election. The statement shall be signed by the county elections official, authenticated by the seal of the county and shall show: (a) The number of ballots cast for elective offices of that district and, when directors of that district are elected by divisions, the number of ballots cast in each division. (b) The name of each candidate for an elective office of that district voted for and the office. (c) The number of votes cast in each precinct for each candidate. (d) When directors are elected by divisions, the number of votes cast in each division for each candidate for the office of director from that division. (e) The number of votes cast in the district for all other elective offices of that district.

The voting system has the capability to produce the required report(s).

14433

If ballots are counted at precincts pursuant to Article 3 (commencing with Section 15340) or Article 5 (commencing with Section 15360) of Chapter 4 of Division 15, the precinct board immediately shall transmit, unsealed, to the elections official a statement showing the result of the votes cast at the polling place. The statement shall be open to public inspection.

The voting system has the capability to produce the required report(s).

15101(b)

Any jurisdiction having the necessary computer capability may start to process vote by mail ballots on the seventh business day prior to the election. Processing vote by mail ballots includes opening vote by mail ballot return envelopes, removing ballots,

duplicating any damaged ballots, and preparing the ballots to be machine read, or machine reading them, but under no circumstances may a vote count be accessed or released until 8 p.m. on the day of the election. All other jurisdictions shall start to process vote by mail ballots at 5 p.m. on the day before the election.

The voting system has the capability to meet this requirement.

#### 15101 (c)

Results of any vote by mail ballot tabulation or count shall not be released prior to the close of the polls on the day of the election.

The voting system has the capability to scan, but not tabulate or report the results prior to the close of polls on Election Day.

#### 15109

Except as otherwise provided in this chapter, the counting and canvassing of vote by mail ballots shall be conducted in the same manner and under the same regulations as used for ballots cast in a precinct polling place.

The voting system has the capability to meet this requirement.

#### 15110

Reports to the Secretary of State of the findings of the canvass of vote by mail ballots shall be made by the elections official pursuant to Chapter 3 (commencing with Section 15150) and Chapter 4 (commencing with Section 15300).

The voting system has the capability to produce the required report(s).

#### 15150

For every election, the elections official shall conduct a semifinal official canvass by tabulating vote by mail and precinct ballots and compiling the results. The semifinal official canvass shall commence immediately upon the close of the polls and shall continue without adjournment until all precincts are accounted for.

The voting system has the capability to meet this requirement.

#### 15151 (a)

The elections official shall transmit the semifinal official results to the Secretary of State in the manner and according to the schedule prescribed by the Secretary of State prior to each election, for the following: (1) All candidates voted for statewide office. (2) All candidates voted for the following offices: (A) State Assembly. (B) State Senate. (C) Member of the United States House of Representatives. (D) Member of the State Board of Equalization. (E) Justice of the Court of Appeals. (3) All persons voted for at the presidential primary or for electors of President and Vice President of the United States. (4) Statewide ballot measures.

The voting system has the capability to produce the required report(s).

15152

Neither the elections official, any member of a precinct board, nor any other person shall count any votes, either for a ballot proposition or candidate, until the close of the polls in that county. After that time, the ballots for all candidates and ballot propositions voted upon solely within the county shall be counted and the results of the balloting made public. However, the results for any candidate or ballot proposition also voted upon in another county or counties shall not be made public until after all the polls in that county and the other county or counties have closed. This paragraph applies regardless of whether the counting is done by manual tabulation or by a vote tabulating device.

The voting system has the capability to scan, but not tabulate or report the results prior to the close of polls on Election Day.

15153

During the semifinal official canvass, write-in votes shall be counted in accordance with Article 3 (commencing with Section 15340) of Chapter 4.

The voting system has the capability to meet this requirement.

15212

If voting at all precincts within a county is not conducted using the same voting system, the result as to the precincts not subject to this article shall be determined in accordance with other provisions of this code and the result of the vote at precincts subject to this article shall be determined as provided in this article. The statement of the vote in that case shall represent the consolidation of all the results and the results of the canvass of all vote by mail voter ballots.

The voting system has the capability to produce the required report(s).

15302 (e), (f), (g), (h)

The official canvass shall include, but not be limited to, the following tasks: (e) Processing and counting any valid vote by mail and provisional ballots not included in the semifinal official canvass. (f) Counting any valid write-in votes. (g) Reproducing any damaged ballots, if necessary. (h) Reporting final results to the governing board and the Secretary of State, as required.

The voting system has the capability to produce the required report(s).

15342 (a)

Any name written upon a ballot for a qualified write-in candidate, including a reasonable facsimile of the spelling of a name, shall be counted for the office, if it is written in the blank space provided and voted as specified below: (a) For voting systems in which write-in spaces appear directly below the list of candidates for that office and provide a voting space, no write-in vote shall be counted unless the voting space next to the write-in space is marked or slotted as directed in the voting instructions, except as provided in subdivision (f). (d) Neither a vote cast for a candidate whose name appears on the ballot nor a vote cast for a write-in candidate shall be counted if the voter has indicated,

by a combination of marking and writing, a choice of more names than there are candidates to be nominated or elected to the office. (e) All valid write-in votes shall be tabulated and certified to the elections official on forms provided for this purpose, and the write-in votes shall be added to the results of the count of the ballots at the counting place and be included in the official returns for the precinct.

The voting system has the capability to meet this requirement.

15372

(a) The elections official shall prepare a certified statement of the results of the election and submit it to the governing body within 28 days of the election or, in the case of school district, community college district, county board of education, or special district elections conducted on the first Tuesday after the first Monday in November of odd-numbered years, no later than the last Monday before the last Friday of that month. (b) The elections official shall post the certified statement of the results of the election on his or her Internet Web site in a downloadable spreadsheet format that may include, but is not limited to, a comma-separated values file or a tab-separated values file and that is compatible with a spreadsheet software application that is widely used at the time of the posting. The certified statement of the election results shall be posted and maintained on the elections official's Internet Web site for a period of at least 10 years following the election. This subdivision shall apply only to an elections official who uses a computer system that has the capability of producing the election results in a downloadable spreadsheet format without requiring modification of the computer system.

The voting system has the capability to produce the required report(s).

15374

(a) The statement of the result shall show all of the following: (1) The total number of ballots cast. (2) The number of votes cast at each precinct for each candidate and for and against each measure. (3) The total number of votes cast for each candidate and for and against each measure. (b) The statement of the result shall also show the number of votes cast in each city, Assembly district, congressional district, senatorial district, State Board of Equalization district, and supervisorial district located in whole or in part in the county, for each candidate for the offices of presidential elector and all statewide offices, depending on the offices to be filled, and on each statewide ballot proposition.

The voting system has the capability to produce the required report(s).

19203

The Secretary of State shall not certify or conditionally approve a voting system or a part of a voting system that uses paper ballots unless the paper used for the ballots is of sufficient quality that it maintains its integrity and readability throughout the retention period specified in Chapter 4 (commencing with Section 17300) of Division 17.

According to the documentation submitted with the voting system, the voting system has the capability to meet this requirement.

19204

The Secretary of State shall not certify or conditionally approve any voting system that includes features that permit a voter to produce, and leave the polling place with, a copy or facsimile of the ballot cast by the voter at that polling place.

The voting system has the capability to meet this requirement.

19205

A voting system shall comply with all of the following: (a) No part of the voting system shall be connected to the Internet at any time. (b) No part of the voting system shall electronically receive or transmit election data through an exterior communication network, including the public telephone system, if the communication originates from or terminates at a polling place, satellite location, or counting center. (c) No part of the voting system shall receive or transmit wireless communications or wireless data transfers.

The voting system has the capability to meet this requirement.

19240

It is the intent of the Legislature that California voting system standards and elections comply with the provisions of the federal Help America Vote Act of 2002 (42 U.S.C. Sec. 15301 et seq.) that require voting systems be accessible for individuals with disabilities, including nonvisual accessibility for the blind and visually impaired, in a manner that provides the same opportunity for access and participation, including privacy and independence, as provided to other voters who are not disabled.

The voting system has the capability to meet this requirement.

19242 (b)

At each polling place, at least one voting unit certified or conditionally approved by the Secretary of State shall provide voters with disabilities the access required under the federal Help America Vote Act of 2002 (42 U.S.C. Sec. 15301 et seq.).

The voting system has the capability to meet this requirement.

19300

A voting machine shall, except at a direct primary election or any election at which a candidate for voter-nominated office is to appear on the ballot, permit the voter to vote for all the candidates of one party or in part for the candidates of one party and in part for the candidates of one or more other parties.

The voting system has the capability to meet this requirement.

19301

(a) A voting machine shall provide in the general election for grouping under the name of the office to be voted on, all the candidates for the office with the designation of the parties, if any, by which they were respectively nominated or which they designated pursuant to Section 8002.5. (b) With respect to a party-nominated office, the

designation may be by usual or reasonable abbreviation of party names. With respect to a voter-nominated office, the voting machine shall conform to the format specified in subdivision (a) of Section 13105.

The voting system has the capability to meet this requirement.

19303

If the voting machine is so constructed that a voter can cast a vote in part for presidential electors of one party and in part for those of one or more other parties or those not nominated by any party, it may also be provided with: (a) one device for each party for voting for all the presidential electors of that party by one operation, (b) a ballot label therefor (sic) containing only the words "presidential electors" preceded by the name of the party and followed by the names of its candidates for the offices of President and Vice President, and (c) a registering device therefor (sic) which shall register the vote cast for the electors when thus voted collectively. If a voting machine is so constructed that a voter can cast a vote in part for delegates to a national party convention of one party and in part for those of one or more other parties or those not nominated by any party, it may be provided with one device for each party for voting by one operation for each group of candidates to national conventions that may be voted for as a group according to the law governing presidential primaries. No straight party voting device shall be used except for delegates to a national convention or for presidential electors.

The voting system has the capability to meet this requirement.

19322

When a voting machine has been properly prepared for an election, it shall be locked against voting and sealed. After that initial preparation, a member of the precinct board or some duly authorized person, other than the one preparing the machines, shall inspect each machine and submit a written report. The report shall note the following: (1) Whether all of the registering counters are set at zero (000), (2) whether the machine is arranged in all respects in good order for the election, (3) whether the machine is locked, (4) the number on the protective counter, (5) the number on the seal. The keys shall be delivered to the election board together with a copy of the written report, made on the proper blanks, stating that the machine is in every way properly prepared for the election.

The voting system has the capability to meet this requirement, including the generation of an electronic report that meets numbers (1) and (4).

# Appendix B: VOTERS WITH SPECIFIC NEEDS SURVEY RESULTS

## 1. Survey Results

The Secretary of State conducted an exit survey on the voters who participated in the Accessibility Test regarding their voting experience utilizing the ImageCast Evolution (ICE), and ImageCast X (ICX). The majority of participants found that the voting system would allow them to vote privately and independently; that the voting instructions were clear and complete; the display was easy to read; the speech output was understandable; the assistive devices were easy to reach and use; the system was not confusing to use; and that the time it took to vote was within their expected timeframe. All participants related that they preferred the ICX over the ICE.

### **Question # 1: The voting method was private.**

ICE: 100% of participants agreed strongly that the voting method was private.

ICX: The majority of participants agreed somewhat with the statement. All agreed that with the privacy screen in place, their voting experience was private. However, most chose to use the ICX which was setup on a table without the privacy screen to make it more comfortable to reach the ICX machine.

### **Question # 2: I feel I can use this system to vote independently.**

ICE: 75% of participants agreed strongly with this statement. One participant disagreed strongly.

ICX: All but one participant agreed strongly that the voting machine allowed them to vote independently. One participant agreed somewhat with the statement. Individuals with all types of disabilities agreed that the system allowed them to vote independently.

### **Question #3: I am confident that my vote was recorded accurately.**

ICE: Most participants agree somewhat with this statement, however, it is not possible for voters using the ICE to verify their actual paper ballot after voting because it has been dropped into the ballot box.

ICX: All participants agree strongly that their vote had been recorded accurately.

### **Question # 4: The voting instructions were clear and complete.**

ICE: 100% of participants agreed strongly or agreed somewhat with this statement.

ICX: 75% of participants agreed strongly or somewhat, while one participant disagreed somewhat with this statement.

Although most of the survey respondents either agreed strongly or agreed somewhat that the voting instructions were clear and complete, they were able to utilize the voting machines much better the second time they voted on the machine.

**Question # 5: The voting method was easy to use.**

ICE: 100% of survey respondents agreed that the voting method was easy to use.

ICX: 100% of survey respondents agreed that the voting method was easy to use.

**Question # 6: I could read the display easily.**

ICE: Two participants with visual impairments rated this N/A. 100% of the other participants agreed with this statement.

ICX: Two participants with visual impairments rated this N/A. 100% of the other participants agreed with this statement.

**Question # 7: I could understand the speech output.**

ICE: 50% of participants agreed with this statement. Two participants disagreed with this statement and one felt the speech output was too fast, even after she slowed it down.

ICX: 50% of participants agreed with this statement. Two participants disagreed with this statement.

**Question # 8: The assistive device(s) were easy to reach and use.**

ICE: 50% of participants agreed with this statement. Two participants disagreed. One participant had trouble voting using the ATI, until we put the ATI device on a table next to him, he was then able to vote without assistance.

ICX: 75% of participants agreed with this statement. One rated this as N/A.

**Question # 9: I found the system was confusing to use.**

ICE: 50% of participants disagreed with this statement. One had no opinion, and one agreed with this statement.

ICX: 75% of participants strongly disagreed with this statement. One participant agreed with this statement.

**10: The timeframe it took to vote was what I expected.**

All participants (100%) agreed that the time it took them to vote on both machines was expected.