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August 8, 2013

Mr. Kevin Kennedy
Wisconsin Government Accountability Board (G.A.B.)
212 East Washington Street
Madison, WI 53707

RE: Election Systems & Software (ES&S) Petition for Approval of Unity 3.4.0.1

Dear Mr. Kennedy,

In response to your Memorandum regarding the petition for approval of the Unity 3.4.0.1 Election Management System, ES&S would like to update your organization of additional testing ES&S and the Counties recently completed. ES&S feels a commitment to the G.A.B to determine the root cause of various issues encountered during the onsite field modem testing performed by your staff during the weeks of July 8 and 15, 2013 in the Counties of Brown, Dane, Marathon, and Rock. While your report concedes that overall the initial testing was generally successful, we believe the new information with this letter will be important to share with the Board at the August 13, 2013 meeting and alleviate any concerns the GAB staff and Board members may have with approving this technology.

In our desire to determine the root cause of each of the items identified in your report, ES&S sent four telecommunications engineers to the previously tested sites, arriving at Dane County on July 31 and concluding our testing on August 2 in Rock County. Our goal was to determine the root cause for each issue encountered in the original tests, retest at those same sites, and provide the results to the G.A.B. and Counties to assist in the Board's decision for certifying this valuable modeming feature and enabling the counties a more efficient method to receiving unofficial results on election night.

We were very pleased with the outcome of this retesting effort. With the Counties participation, the ES&S test team concluded three days of diagnostic analysis and retesting at the four sites in the four respective counties without incident. The team experienced 100% connectivity and successful delivery of results in multiple tests at each location. With these results, we are not aware of any of the 16 locations where results have not been successfully transmitted. It was unfortunate the G.A.B. staff was not available to participate in the retesting effort. Valuable information was ascertained that will be incorporated into our recommended procedures for telecommunications integration. This information will help the counties in their efforts to ensure quality telephone lines are available prior to every election.

ES&S wishes to thank the G.A.B. staff and the Counties of Brown, Dane, Marathon, and Rock for their cooperation and support in these and the original tests performed. With this information, we believe any concerns that the G.A.B. staff or Board may have regarding the use of this technology should be alleviated.

Thank you for your consideration and support in our efforts to provide our Wisconsin customers with this valuable modeming feature.

Sincerely,



Steve M. Pearson
Vice President, Voting Systems
Election Systems & Software, LLC

cc: Sherri Ann Charleston, Voting Systems Specialists, Wisconsin G.A.B.
Sandy Juno, Brown County Clerk, Wisconsin
Nan Kottke, Marathon County Clerk, Wisconsin
Scott McDonell, Dane County Clerk, Wisconsin
Lori Stottler, Rock County Clerk, Wisconsin
Mark Manganaro, Wisconsin State Certification Manager, ES&S
Kathy Rogers, Sr. Vice President, Government Affairs, ES&S

Background

As stated in the G.A.B. Memorandum report, Unity 3.4.0.1 is a modification to the Unity 3.4.0.0 (EAC#ESSUNITY3400) release certified by the G.A.B. for use in the State on February 12, 2013. Other than the enabling of the modemming function during the final trusted build of the DS200 firmware performed by the Wyle Laboratories, the EAC accredited VSTL who performed the standards testing for these two releases, all software and firmware components are identical to the Unity 3.4.0.0 release.

Also as stated in the G.A.B. Memorandum report, Unity 3.4.0.1 is currently approved for use in the states of Iowa and Minnesota. Testing has now been successfully completed in Illinois, North Carolina, and Virginia with state board approvals expected in the month of August for all three. It is our intent to continue to offer these same VSTL tested modem capabilities in future releases of the Unity 3.4.x.x platform ensuring these state customers with continued support of this highly requested feature.

Some additional information relevant to any possible concerns related to load and volume testing of modemming function as implemented in Unity 3.4.0.1 system, with EAC approval, ES&S hosted a volume test in our Omaha certification test lab facility that was witnessed by personnel from Wyle Laboratories. This test consisted of the simultaneous transmission of election results from sixteen (16) modem equipped DS200 units via the SFTP network into the ERM results module. All transmissions were completed successfully on the first attempt with all results verified for accuracy. Due to the number of DS200 units required for the test, it was determined the test being observed by Wyle test personnel was sufficient for this testing rather than in the Wyle test facility.

Retest Setup and Results

The ES&S personnel that proceeded to Wisconsin for this testing included:

- Brian Wilkins – Certification Testing Specialist
- Paul Huffman – ES&S DS200 Product Engineer
- Bob Sullivan – Sr. Software Engineer, DS200
- Dave Herrera – Manager, Security, Network Architecture and Configuration Management

For the retesting effort, the ES&S team used the identical test configuration and equipment that was used in the original testing performed by the G.A.B. staff consisting of three (3) of the original six (6) DS200 modem equipped units (w/original modems) used in the initial testing, and the same portable Election Management environment consisting of the SFTP (Secure File Transfer Protocol) client, firewall, and Election Reporting Manager (“ERM”) software. Two DS200 units were used in all of the retesting. The third and spare unit was not used.

In all test locations, the following steps were performed:

1. Line quality tested
2. Open and Close Polls, print zero report, transmitted zero report results, and verified ERM results
3. Reopen the Polls, scanned 25 voted ballots, closed Polls, transmitted unofficial voted results
4. Verified ERM results for accuracy
5. Re-sent same results multiple times at each location from each DS200
6. Verified ERM results for accuracy for no duplication of votes

Following are the components of the ES&S Unity 3.4.0.1 voting system and the test equipment used in this round of testing:

Unity 3.4.0.1	
Election Management Software	Version
Audit Manager	7.5.2.0
Election Data Manager	7.8.1.0
ESS Image Manager	7.7.1.0
Hardware Programming Manager	5.8.0.0
Election Reporting Manager	7.8.0.0
AutoMark Information Management System (AIMS)	1.3.257
VAT Previewer	1.3.2907
Log Monitor	1.0.0.0
Tabulator	Version
DS200	1.6.0.0

Test Equipment Used:
Fluke 52 Lineman's handset
Modem Filter
Analog phone line current regulator
Analog phone line current tester
RJ banjo for using Lineman's handset
Multimeter
Outlet Tester
Analog Phone

Dane County

On July 15th, ES&S personnel and G.A.B. staff performed a series of tests in Dane County for the certification of Unity 3.4.0.1. During this testing, the City of Sun Prairie, Town of Middleton, Town of Blooming Grove, and Town of Verona were used as sending locations to test the modeming functionality. During this testing, each township was successful in sending in results. In Verona, one DS200 was not able to send in results, while another DS200 was used and successfully sent in results.

On July 31st, ES&S sent in a team of engineers and network experts to determine the root cause and cure of the issue encountered in Verona in the original G.A.B. testing.

Dane County Clerk's Office

ES&S personnel arrived onsite on July 31, 2013 equipped with a Lineman's handset and a multimeter to measure the line noise and connectivity, as well as the voltage for the phone jack to be used to receive the transmission of unofficial results on election day. Once the phone line quality analysis was complete, the SFTP server and Unity ERM client were set up to receive results.

County Clerk's Office Findings

In the County Clerk's Office the ES&S team determined the line was reading at normal voltage levels for an analog line being used for receiving data transmissions. The team noticed however that the phone jack had reverse polarity, causing some concern for how well it would receive data.

The voltage readings Dane County Clerk's office were:

	Range	Office
On Hook DCV	24~50VDC	44
Off Hook DCV	5~15VDC	7.3
Loop Current	23~35ma	40
On Hook ACV T to R	less than .5 VAC	0
On Hook ACV T to G	less than .5 VAC	0
On Hook ACV R to G	less than .5 VAC	0

Town of Verona

ES&S then proceeded to the Town of Verona's office where they evaluated the condition of the phone jack to be used in the testing. No issues were found and the setup of the DS200 units to transmit vote data was completed. Two DS200 units were successful on first attempt for all transmissions.

Town of Verona Findings

As in the Dane County Clerk’s office, reverse polarity was found on the phone jack used for the testing, but did not appear to have any impact on the modem transmission in this series of tests.

The voltage readings from the Town of Verona were:

	Range	Town of Verona
On Hook DCV	24~50VDC	33
Off Hook DCV	5~15VDC	6.2
Loop Current	23~35ma	20
On Hook ACV T to R	less than .5 VAC	0
On Hook ACV T to G	less than .5 VAC	0.12
On Hook ACV R to G	less than .5 VAC	0

Test Results

Two DS200’s were successfully tested on the line dedicated by Verona for election night reporting. Two tests were performed with each machine without issues.

MUNICIPALITY	ABLE TO CONNECT	ABLE TO TRANSMIT	(LOAD) SUCCESS RATE CONNECTS/ATTEMPTS
Town of Verona	Machine #1 – Yes	Yes	2/2
	Machine #2 – Yes	Yes	2/2

Recommendations

While ES&S is not aware of any impact that reverse polarity may have on data transmission, we recommend the County and Town offices may wish to investigate this finding further.

Brown County

On July 9 & 10, 2013 ES&S and G.A.B. staff performed modem testing in four locations: the City of Green Bay, City of De Pere, Village of Ashwaubenon, and the Town of Morrison. While the testing team was able to transmit results successfully from the four selected municipalities into the central location, two anomalies were observed; 1) ES&S declared one modem inoperable and 2) the team was unable to successfully transmit results on the line identified for transmission on election night, requiring the test to be moved to a secondary line to complete test.

With respect to anomaly #1 above, extensive follow up testing was performed in our Certification test lab with the modem that was declared inoperable in the original testing. ES&S technicians determined that a poor modem connection was the cause for the failure, requiring only that the modem be reseated for normal operation to resume. Lab testing confirmed the diagnosis.

On August 1, 2013, ES&S sent in a team of engineers and network experts to determine the root cause and cure of the anomalies encountered in the Village of Ashwaubenon from the original G.A.B. testing.

Brown County Clerk's Office

The ES&S test team arrived onsite on August 1st to diagnose anomaly #2 above pertaining to the inability to send results from Ashwaubenon and the County Clerk's office in Green Bay from the line designated for election night reporting. Before setting up the SFTP server and client, the phone jack was tested for the correct voltages, as well as line noise and connectivity. Once the phone line quality analysis was complete, the SFTP server and Unity ERM client were set up to receive results.

County Clerk's Office Findings

Both phone lines in the hunt group in the Clerk's office measured in the acceptable range for voltage. The lines were clear of noise and distortion. There is also a hunt group setup using 2 different lines. Both of these lines were connected into the SFTP server for data receiving.

The voltage readings for the Brown County Clerk's office were:

	Range	Office
On Hook DCV	24~50VDC	42
Off Hook DCV	5~15VDC	6.5
Loop Current	23~35ma	24
On Hook ACV T to R	less than .5 VAC	0
On Hook ACV T to G	less than .5 VAC	0
On Hook ACV R to G	less than .5 VAC	0

Village of Ashwaubenon

In Ashwaubenon, Sandy Juno, Brown County County Clerk, and the Brown County phone technician accompanied the ES&S technicians to the site.

After testing the phone line, the DS200 was setup and the standard test procedure was performed. The DS200 was able to make a connection and transmit data each time on the first attempt. All tests were successful using the line designated for use on election night.

Ashwaubenon Office Findings

As reported in the G.A.B. Memorandum test report, the tests attempted by the G.A.B. staff on Ashwaubenon's "dedicated" line used for transmitting results on election night (located in the Boardroom), the G.A.B. test team was unable to connect and transmit despite "the Village's telecommunications expert verifying the lines were operable and analog." In these tests, the ES&S test team, with assistance from the Brown County phone technician confirmed the Boardroom line was inactive and not connected in the phone closet panel, and determined to be the cause for the inability for the G.A.B. team to complete their testing as reported in anomaly #2 above.

Like in the original testing, the retest activities had to be performed on the same secondary line that was used in the original G.A.B. set of tests. The ES&S personnel tested the secondary phone line and determined it to be within acceptable ranges and suitable for use.

The voltage readings for the Ashwaubenon office were:

	Range	Ashwaubenon
On Hook DCV	24~50VDC	45
Off Hook DCV	5~15VDC	6.5
Loop Current	23~35ma	25
On Hook ACV T to R	less than .5 VAC	0
On Hook ACV T to G	less than .5 VAC	0
On Hook ACV R to G	less than .5 VAC	0

Test Results

Both DS200's were used in this testing and we were able to send in twice from each machine successfully and without issue.

MUNICIPALITY	ABLE TO CONNECT	ABLE TO TRANSMIT	(LOAD) SUCCESS RATE CONNECTS/ATTEMPTS
Village of Ashwaubenon	Line 1 (boardroom) –	N/A	Not used for sending results
	No	Machine 1 – Yes	2/2
	Line 2 (Office) – Yes	Machine 2 – Yes	2/2

Recommendations

Both lines of the hunt group should be connected into the SFTP server in the Central Office to avoid any connection issues. ES&S recommends that there be a dedicated line in the Village's office for data transmissions only.

Marathon County

On July 11th, ES&S and the G.A.B. staff proceeded to Marathon County to test the modem function of Unity 3.4.0.1 for certification. While using the Marathon County Clerk's office as the central site, four municipalities were used as sending sites: The Towns of Edgar and Bevent, the City of Mosinee, and the Village of Stratford. Testing success in the City of Mosinee was partially successful with the transmission of the initial zero report, but was unable to successfully transmit subsequent results. No determination for the limited success could be made at that time. In addition, as reported in the G.A.B. Memorandum report two DS200 units "crashed" while attempting to transmit results in the Town of Bevent and the Village of Stratford. All other locations had successful test results.

With respect to the reports of DS200 units "crashing" while attempting to transmit results, it was determined that the two DS200 units that encountered this condition were not loaded with a new paper roll prior to the testing and ran out of paper either prior to modem transmission or during transmission. When a DS200 runs out of paper during transmission, the user is notified that the system is out of paper and to replace the paper roll. Should the user choose to not load a new paper roll by overriding this option three times in succession, the system will shut down. This sequence of events is logged in the audit log on the DS200. This does not lead to any data lost on the votes or audit data. This explains the "crashed" anomalies encountered in the Town of Bevent and the Village of Stratford.

On August 1st, the ES&S team proceeded to the Marathon County Clerk's office to investigate the root cause and cure of the additional anomaly reported from the City of Mosinee from the original G.A.B. testing.

Marathon County Clerk's Office

When the ES&S team arrived on August 1st, they first brought in their equipment and tested the hunt group lines. The SFTP server was then set up and connected using all 4 lines from the hunt group.

County Clerk's Office Findings

The Marathon County Clerk's office uses a hunt group set up with 4 separate phone lines. All lines were determined to be within the acceptable range for data receiving.

It was discovered during the retesting in the Marathon County office, that the ES&S SFTP server was improperly connected to the County hunt group, resulting in numerous unsuccessful attempts to transmit from the remote sending site locations. This same error in setup was determined to also be the cause for transmission issues experienced in Brown County.

For the retest, all lines from the hunt group were properly connected to the ES&S SFTP server in the County Clerk's offices Marathon County (and Brown). Not having all the lines connected into the SFTP server from the hunt group explains why there were issues receiving data from the sending sites.

The voltage findings for the Marathon County hunt group tested were:

	Range	County Clerk's Office
On Hook DCV	24~50VDC	41
Off Hook DCV	5~15VDC	6.5
Loop Current	23~35ma	23
On Hook ACV T to R	less than .5 VAC	0
On Hook ACV T to G	less than .5 VAC	0.2
On Hook ACV R to G	less than .5 VAC	0.2

City of Mosinee Office

The ES&S team then proceeded to the City of Mosinee to investigate the anomalies reported from the original tests. After conferring with Bruce Jamroz, Mosinee City Clerk, he confirmed the original testing performed by the G.A.B. staff was conducted from the City's conference room rather than the line they normally use on election night located in Clerk Jamroz's office. All retesting activities were performed from the desired line used on election night located in Clerk Jamroz's office.

Once the ES&S test team confirmed availability and assessed the quality of the line, and the correct phone number was entered (tester error), the standard test protocol was followed.

City of Mosinee Office Findings

The ES&S test results indicated that the voltage of the phone line in Clerk Jamroz’s office is very high. Readings at this level can lead to a loss of data transmission or poor quality connections. During the testing the test team experienced two failed connection attempts initially, but was successful on all 19 subsequent connection and transmission attempts.

The voltage readings for the City of Mosinee were:

	Range	City of Mosinee
On Hook DCV	24~50VDC	43
Off Hook DCV	5~15VDC	6.4
Loop Current	23~35ma	22
On Hook ACV T to R	less than .5 VAC	0.1
On Hook ACV T to G	less than .5 VAC	13.7
On Hook ACV R to G	less than .5 VAC	13.7

Test Results

Both DS200’s were used in this testing and we were able to send in a combined total of 19 times successfully.

MUNICIPALITY	ABLE TO CONNECT	ABLE TO TRANSMIT	(LOAD) SUCCESS RATE <i>CONNECTS/ATTEMPTS</i>
City of Mosinee	Machine 1 – Yes Machine 2 – Yes	Yes Yes	13/13 6/6

Recommendations

Due to the high voltage reading found on the City of Mosinee’s desired transmission line, ES&S recommends the City of Mosinee to have their local phone company test and condition the desired line to recommended range levels for analog phone data transmission. Also, when using the hunt group, ensure all four (4) lines be connected into the SFTP server to avoid any connections not being made.

Rock County

On July 17th, ES&S personnel and G.A.B. staff performed a series of tests in Rock County for the certification of Unity 3.4.0.1. During this testing, the Towns of Avon and Turtle and the Cities of Beloit and Milton were used as sending locations to test the modeming functionality. The G.A.B. was able to consistently transmit results from three (3) of the four (4) selected municipality test locations and was able to successfully complete all load and stress tests as well. One anomaly was encountered in the Town of Turtle where the test team was unable to transmit on either the phone line dedicated for election night reporting or a secondary fax line using either of the DS200 systems at this location.

On August 2, 2013, ES&S sent in a team of engineers and network experts to determine the root cause and cure of the anomaly encountered in the Town of Turtle from the original G.A.B. testing.

County Clerk's Office

When ES&S personnel arrived on site at Rock County, the phone line normally used for receiving results on election night was tested for the voltage and line noise and connectivity. Once the phone line quality analysis was complete, the SFTP server and Unity ERM client were set up to receive results. All readings appeared to be normal.

County Clerk's Office Findings

The voltage readings for Rock County were:

	Range	Office
On Hook DCV	24~50VDC	23
Off Hook DCV	5~15VDC	6.5
Loop Current	23~35ma	25
On Hook ACV T to R	less than .5 VAC	0
On Hook ACV T to G	less than .5 VAC	0
On Hook ACV R to G	less than .5 VAC	0

Town of Turtle City Office

The team then went to the Town of Turtle. At the time of the test, the outside temperature was 78 degrees with low humidity. The line was tested for the voltage and noise. The DS200 was then set up and the ballots were then run through. The results were then sent into the County Clerk's office.

City Office Findings

The ES&S engineers found during testing the Loop Current of the phone line that the AC voltage rose dramatically, and that both offices had a buzz while the phones were not in use. Also, multiple phones were using the same line that was being used to send data transmissions. In Turtle, it was noticed that the phone lines were all copper, rather than coming from a phone switch or digital box.

The voltage readings for the Town of Turtle office were found to be high for analog data communications:

	Range	Turtle
On Hook DCV	24~50VDC	47
Off Hook DCV	5~15VDC	6
Loop Current	23~35ma	24
On Hook ACV T to R	less than .5 VAC	0
On Hook ACV T to G	less than .5 VAC	4.8
On Hook ACV R to G	less than .5 VAC	4.2

Additional information received subsequent to the testing performed by the G.A.B. staff, it was confirmed by the Town of Turtle local phone company that the phone line used during the original testing was inoperable due to extreme heat and humidity. It was also learned that the line had been serviced since the original testing performed on July 17, 2013.

Test Results

MUNICIPALITY	ABLE TO CONNECT	ABLE TO TRANSMIT	(LOAD) SUCCESS RATE CONNECTS/ATTEMPTS
Town of Turtle	Machine 1 – Yes	Yes	5/5
	Machine 2 – Yes	Yes	5/5

Recommendations

Due to the high voltage reading found on the Town of Turtle’s desired transmission line, ES&S recommends the Town to have their local phone company reassess and condition the desired line to recommended range levels for analog phone data transmission.

It is also recommended the Town of Turtle install an analog phone line exclusively for sending in results/data transmissions.

ES&S Summary of Findings

Following is a summary of findings and conclusions to the anomalies encountered in the initial testing performed by the G.A.B. and ES&S staffs and reported in the Memorandum dated August 13, 2013 and released pertaining to the Petition for Approval of Election System & Software's Unity 3.4.0.1 voting system:

- Test Network Setup - The ES&S test team determined during the retesting performed of the Brown County and Marathon County original tests that the ES&S SFTP server was not correctly configured with the counties' respective telephone hunt group systems in these two central site locations. Not having all the lines connected into the SFTP server from the County hunt group explains why there were issues receiving data from the sending sites tested in the original tests performed.
- DS200 "Crashed" – The G.A.B. reported incidents of two DS200 units that "crashed" while attempting to transmit results during tests in the Town of Bevent and Village of Stratford. The DS200 is designed to shut down in the event that paper is not available in the systems to enable it to complete required audit logging and printing of certain critical functions. In both of these incidents the DS200 was indeed out of paper and the warnings provided were overridden, resulting in a designed shutdown of the units. At no time is any of the vote or audit data at risk of being lost.
- Modem Equipment Failure – Due to the inability of one of the DS200 units used in the initial G.A.B. testing in the Town of Morrison to function, the onsite ES&S test team removed the unit from further testing until a technician could analyze the cause for failure. This failure was later determined to having a modem that was not seated properly and lost suitable connectivity. After reseating this modem, the DS200 was used in subsequent ES&S lab testing worked with no issues.
- Town of Turtle Line Unavailable - In the Town of Turtle, it was later determined by the local phone company that the phone line was down at the time of the original G.A.B. testing due to the extreme heat and humidity. Repairs were made to the line since the initial testing performed on July 17th. Due to high voltage readings the ES&S test team observed, it is recommended the Town engage the local phone system provider to ensure the line selected for use on election night is brought into the appropriate ranges of performance for a data transmission analog line.
- Dedicated Lines - ESS& recommends all municipalities identify and dedicate lines to be used on election night for unofficial results transmission. Doing so, will better ensure availability, quality, and reliability when needed for election use.

- Election Preparation Testing - Line and DS200 unit testing prior to each election is essential to ensure reliable and efficient data transmissions on election night. These tests should include line specification and quality tests along with operational verification testing of each modem equipped DS200 scanner.