Element Materials Technology Denver-Longmont A.K.A. NTS Labs, LLC Test Report for Electromagnetic Interference (EMI) Testing of the SMARTMATIC VSR1 2.1 BMD + BR1500M2 UPS

Prepared For
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Revision History

Rev.	Description	Issue Date
0	Initial Release	12/13/2023

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1.0 Introduction

This document presents the test procedures used and the results obtained during the performance of an Electromagnetic Interference (EMI) test program at Element Materials Technology Denver-Longmont (hereafter referred to as "Element"). The test program was conducted to assess the ability of the specified Equipment Under Test (EUT) to successfully satisfy the requirements defined in the test specification.

2.0 References

The following references listed below form a part of this document to the extent specified herein.

- Test Specification: See Table 5.0-1
- Pro V&V, Inc Purchase Order 2023-009 dated 03/17/2023.
- Element Quotation OP0636249 dated 03/16/2023.
- ISO/IEC 17025:2017(E) *General Requirements for the Competence of Testing and Calibration Laboratories,* dated 11/2017.

3.0 Product Selection and Description

Pro V&V, Inc selected and provided the following test sample(s) to be used as the Equipment Under Test.

Table 3.0-1: Product Identification – Equipment Under Test (EUT)

Item	Qty.	Name/Description	Part Number	Serial Number
1	2	SMARTMATIC VSR1 2.1 BMD + BR1500M2 UPS	VSR1 2.1 BMD	BDUBMDBRC4000 0006, UPS - 352223X14214, UPS - 5B2339T92762

3.1 Security Classification

Non-classified

4.0 General Test Requirements

4.1 Test Equipment

The instrumentation used in the performance of these tests is periodically calibrated and standardized within manufacturer's rated accuracies and are traceable to the National Institute of Standards and Technology. The calibration procedures and practices are in accordance with ISO 17025:2017. Certification of calibration is on file subject to inspection by authorized personnel.

4.2 Measurement Uncertainties

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below were calculated using the approach described in CISPR 16-4-2:2003 using a coverage factor of k=2, which gives a level of confidence of approximately 95%. The levels were found to be below levels of CISPR and therefore no adjustment of the data for measurement uncertainty is required.

Table 4.2-1: Measurement Uncertainties (Immunity)

Measurement Type	Measurement Unit	Frequency Range	Expanded Uncertainty
Radiated Immunity	V/m	80MHz - 10GHz	.-26.3% to 29.97%
ESD	KV	NA	.+/- 8.6%
Fast Transients	Voltage	NA	.+/- 5.98%
	Time	NA	.+/- 8.6%
Surge	Voltage	NA	.+/- 4.9%
Conducted Immunity (CDN)	Voltage	NA	.-12.6% to 13.3%
Conducted Immunity (BCI)	Voltage	NA	.-13.5% to 15.3%
Voltage Dips / Interrupts	Voltage	NA	.+/- 2.3%
	Time	NA	.+/- 0.08 ms
Magnetic Immunity	Amps	NA	.+/- 0.8%
Pulsed Magnetic Immunity	Amps	NA	.+/- 9.9%

5.0 Test Description and Results

Table 5.0-1: Summary of Test Information & Results

Section	Test	Specification	Test Facility	Test Date	Part #	Serial #	Test Result
5.1	Electrostatic Discharge (4.1.2.8)	IEC 61000-4-2:2008	Longmont	12/04/2023 - 12/11/2023	VSR1 2.1 BMD	BDUBMDBRC 40000006, UPS - 5B2339T92762	Passed
5.2	Radiated RF Immunity (4.1.2.10)	IEC/EN 61000-4-3: 2020	Longmont	12/05/2023 - 12/05/2023	VSR1 2.1 BMD	BDUBMDBRC 40000006, UPS - 5B2339T92762	Passed
5.3	Electrical Fast Transient / Burst (4.1.2.6)	IEC/EN 61000-4-4:2012	Longmont	12/06/2023 - 12/11/2023	VSR1 2.1 BMD	BDUBMDBRC 40000006, UPS - 5B2339T92762	Passed
5.4	Surge Immunity (4.1.2.7)	IEC/EN 6100-4-5:2014+A1:2017	Longmont	12/07/2023 - 12/07/2023	VSR1 2.1 BMD	BDUBMDBRC 40000006, UPS - 5B2339T92762	Passed
5.5	Conducted RF Immunity (4.1.2.11)	IEC/EN 6100-4-6:2013	Longmont	12/07/2023 - 12/11/2023	VSR1 2.1 BMD	BDUBMDBRC 40000006, UPS - 5B2339T92762	Passed
5.6	Voltage Dips and Interruptions (4.1.2.5)	IEC/EN 61000-4-11:2020	Longmont	12/06/2023 - 12/07/2023	VSR1 2.1 BMD	BDUBMDBRC 40000006, UPS - 5B2339T92762	Passed
5.7	Voltage Dips and Interruptions (Inc./Red. of Nom. Voltage) (4.1.2.5)	IEC/EN 61000-4-11:2020	Longmont	12/07/2023 - 12/08/2023	VSR1 2.1 BMD	BDUBMDBRC 40000006, UPS - 5B2339T92762	Passed
5.8	Voltage Dips and Interruptions (Surge of +/- 15%) (4.1.2.5)	IEC/EN 61000-4-11:2020	Longmont	12/07/2023 - 12/08/2023	VSR1 2.1 BMD	BDUBMDBRC 40000006, UPS - 5B2339T92762	Passed

The decision rule for Test Results was based on the Test Specification used for testing.

5.1 Electrostatic Discharge (4.1.2.8)

5.1.1 Test Procedure

The EUT was tested in accordance with IEC 61000-4-2:2008.

5.1.2 Test Result

The EUT passed the defined requirements.

5.1.3 Test Datasheets

Element Materials Technology

Electrostatic Discharge per IEC / EN 61000-4-2

Standard Referenced:	IEC/EN 61000-4-2	Date:	12/12/2023
Temperature:	20°C Humidity: 33%	Pressure:	841 mb
Input Voltage:	120V, 60Hz		
Configuration of Unit:	Normal Operation Scanning Ballots		
Test Engineer:	Corey Shelton		

Date	Time	Log Entries	Initials	Result
12/12/23	0800	Humidifiers On	CS	
	0840	VCP resitors verified 935kOhm	CS	Pass
	0842	Pretest verification complete	CS	Pass
	0948	VCP testing and contact points complete	CS	Pass
	1027	Air discharge points complete	CS	Pass
	1107	Worksheet complete		

Element Materials Technology

Electrostatic Discharge per IEC / EN 61000-4-2

Standard Referenced: IEC/EN 61000-4-2 Date: 12/12/2023

Temperature: 20˚C Humidity: 33% Pressure: 841 mb

Input Voltage: 120V, 60Hz

Configuration of Unit: Normal Operation Scanning Ballots

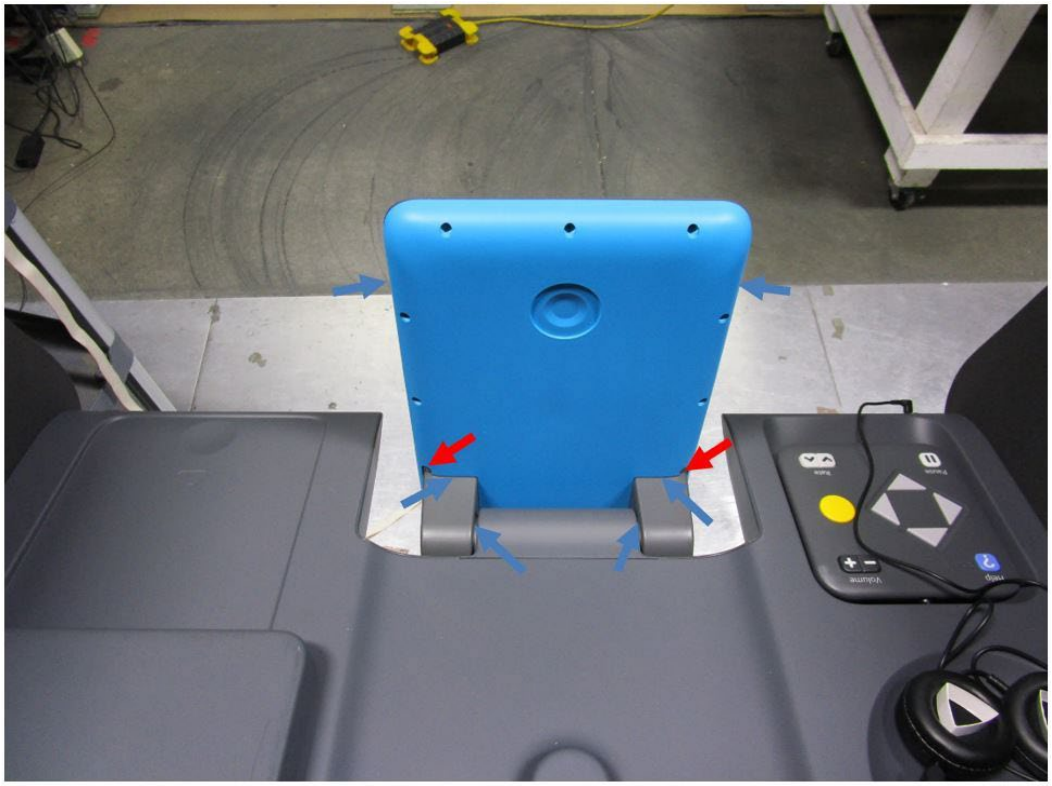
Test Engineer: Corey Shelton

Test Location	Voltage Level	Polarity		Number of Pulses	Pulses Per Second	Comments	Criteria Met	Pass/ Fail
	(kV)	+	-					
Indirect Discharge Points								
VCP	8	X	X	10	1	Front Side	A	Pass
VCP	8	X	X	10	1	Left Side	A	Pass
VCP	8	X	X	10	1	Right Side	A	Pass
VCP	8	X	X	10	1	Back Side	A	Pass
Contact Discharge Points - **RED** Arrows.								
Photo 1.	8	X	X	10	1	None	A	Pass
Photo 2.	8	X	X	10	1	ND	A	Pass
Photo 4.	8	X	X	10	1	ND	A	Pass
Photo 6.	8	X	X	10	1	None	A	Pass
Photo 7.	8	X	X	10	1	None	A	Pass
Photo 8.	8	X	X	10	1	None	A	Pass
Photo 9.	8	X	X	10	1	None	A	Pass
Photo 10.	8	X	X	10	1	None	A	Pass
Air Discharge Points - **BLUE** Arrows.								
Photo 1.	2, 4, 8, 15	X	X	10	1	None	A	Pass
Photo 2.	2, 4, 8, 15	X	X	10	1	ND	A	Pass
Photo 3.	2, 4, 8, 15	X	X	10	1	ND	A	Pass
Photo 5.	2, 4, 8, 15	X	X	10	1	ND	A	Pass
Photo 6.	2, 4, 8, 15	X	X	10	1	ND	A	Pass
Photo 7.	2, 4, 8, 15	X	X	10	1	ND	A	Pass
Photo 8.	2, 4, 8, 15	X	X	10	1	ND	A	Pass
Photo 9.	2, 4, 8, 15	X	X	10	1	ND	A	Pass
Photo 10.	2, 4, 8, 15	X	X	10	1	ND	A	Pass
Photo 11.	2, 4, 8, 15	X	X	10	1	ND	A	Pass
Photo 12.	2, 4, 8, 15	X	X	10	1	ND	A	Pass
ND: No Discharge points found								

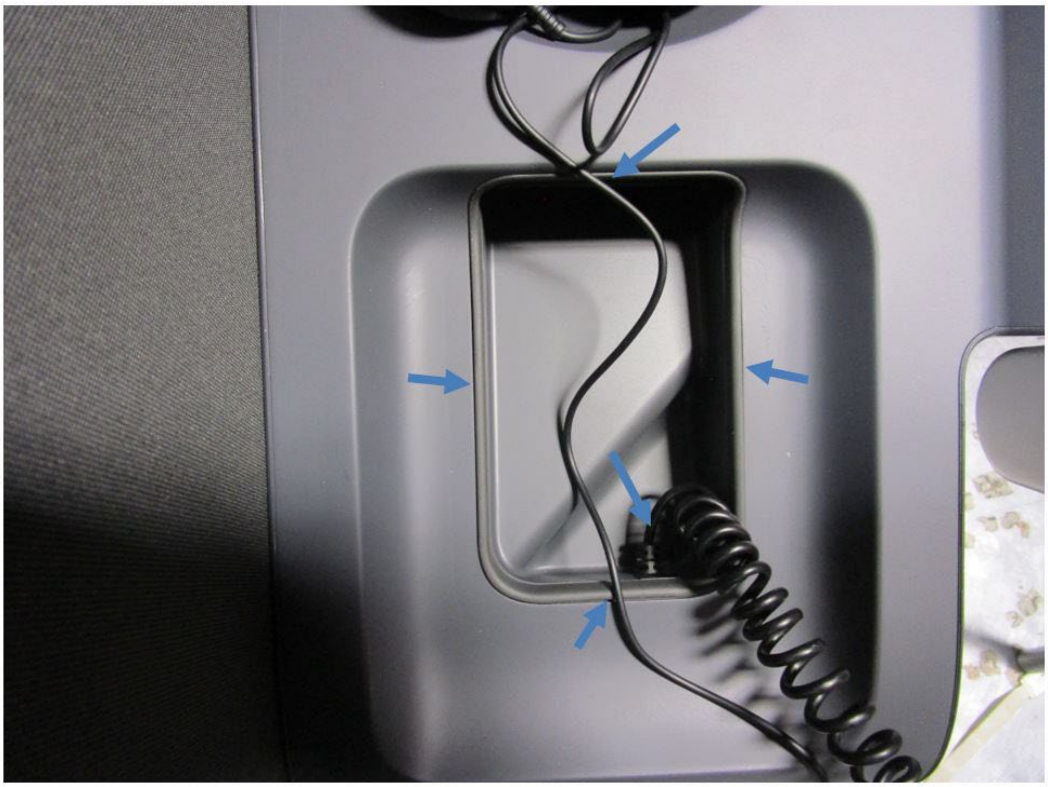
5.1.4 Test Photographs

ESD - General Setup

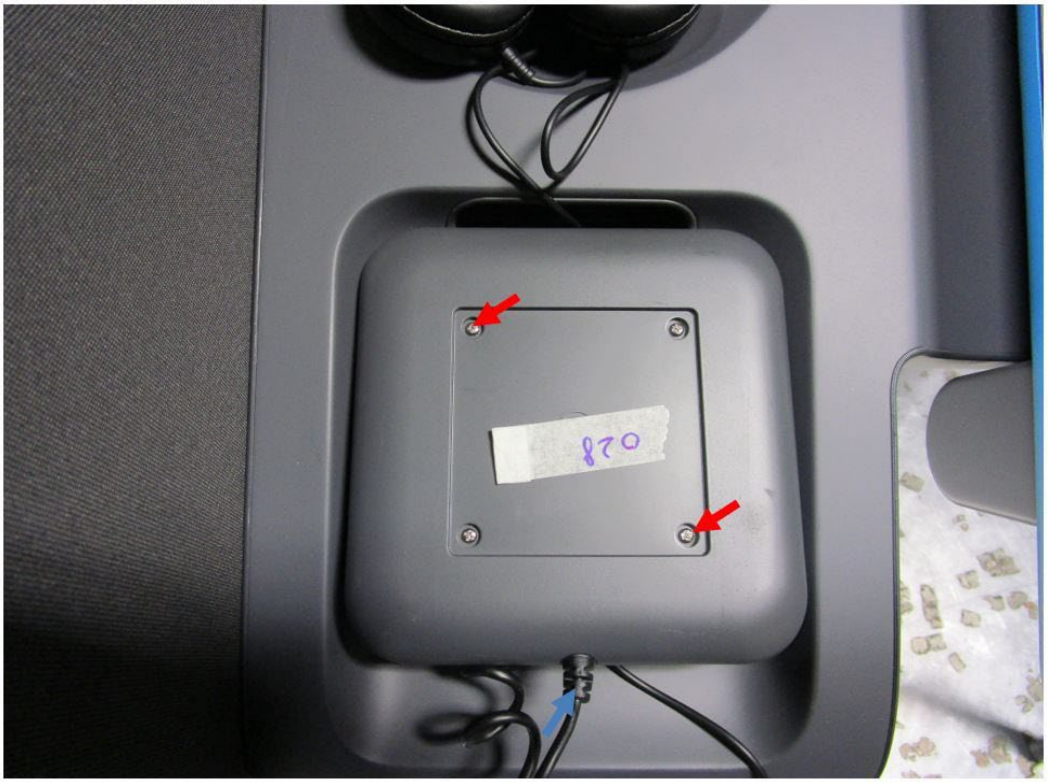
ESD -1 Front Panel



ESD -Front Panel

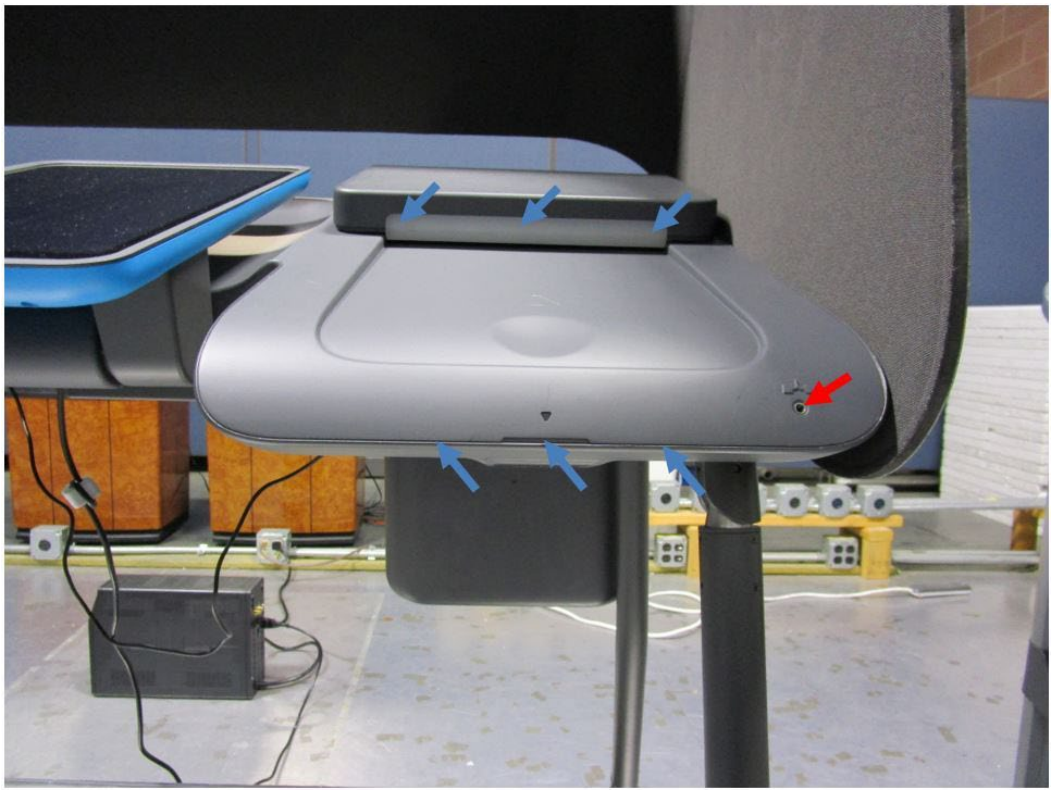


ESD Front Panel



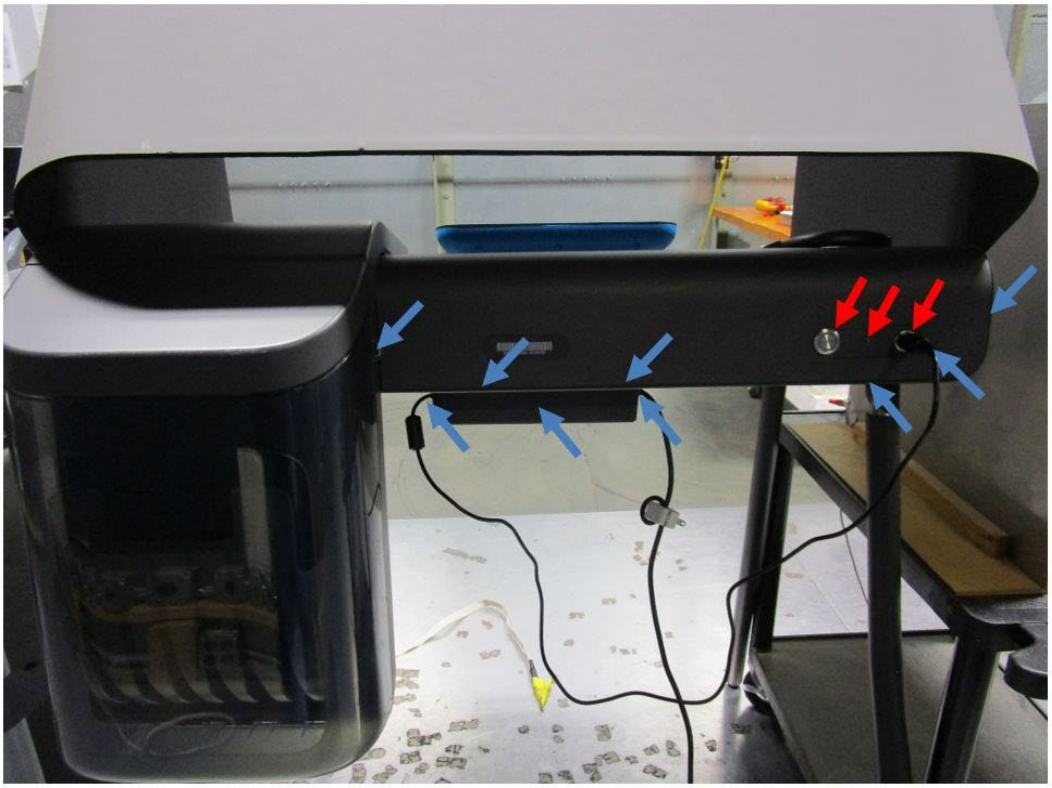
ESD Front Panel

ESD Front Panel

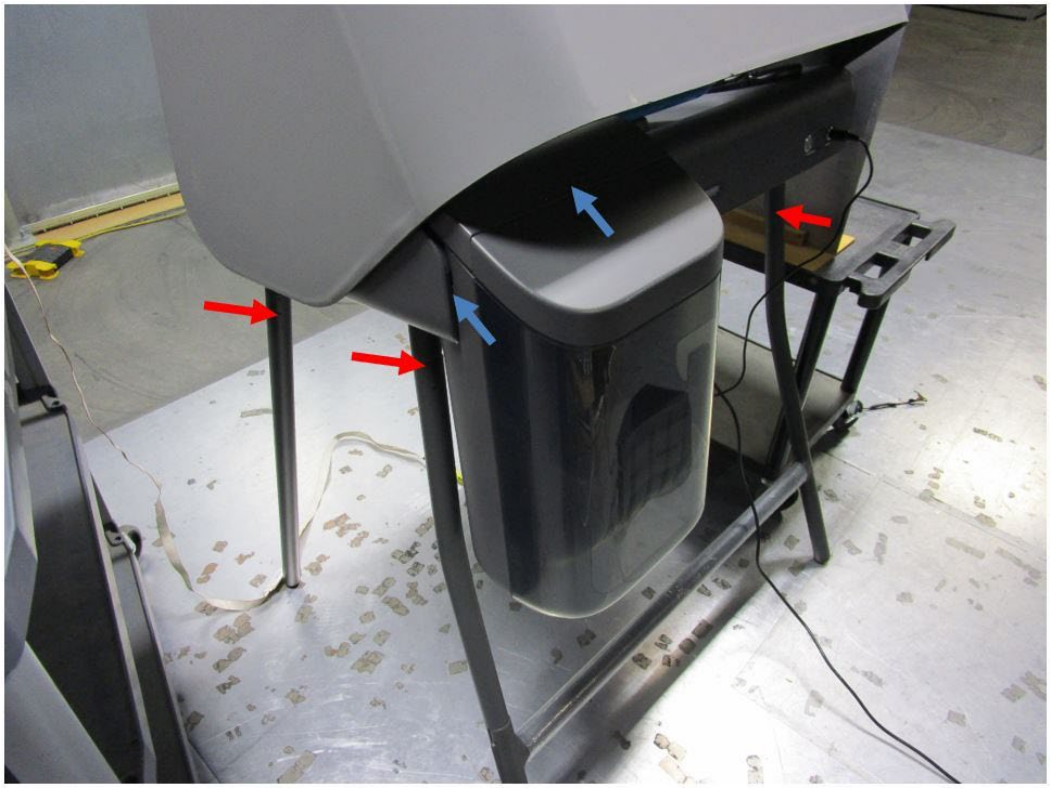


ESD Front Panel

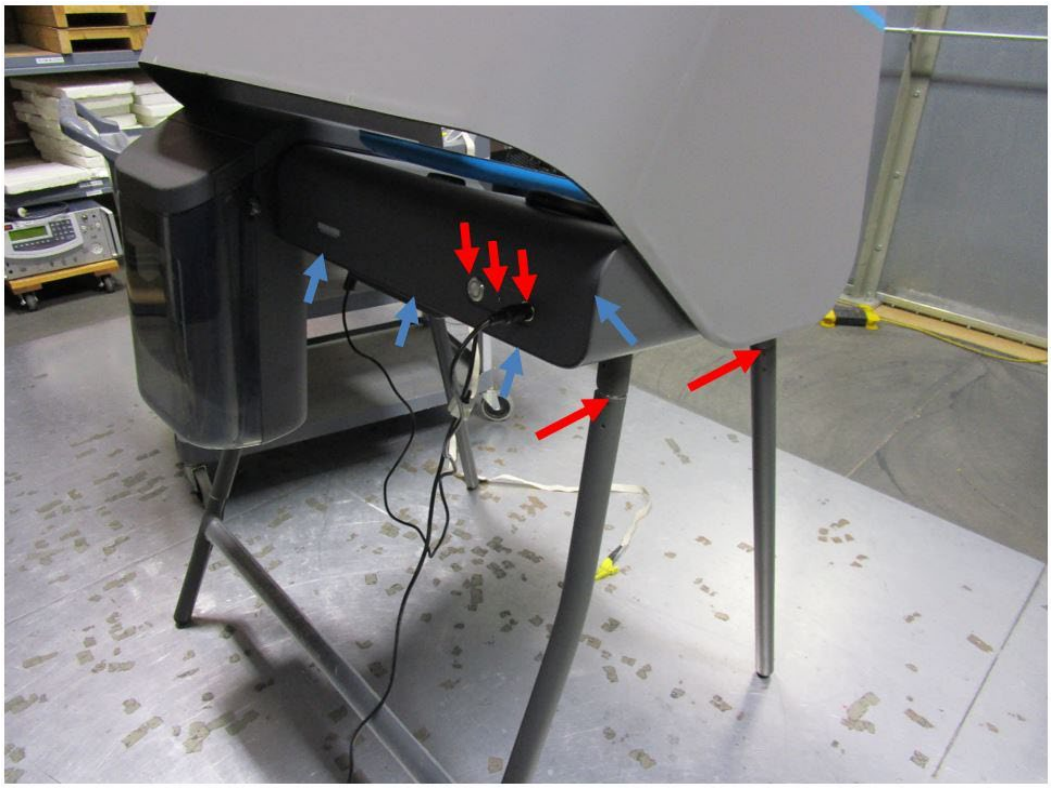
ESD Front Panel



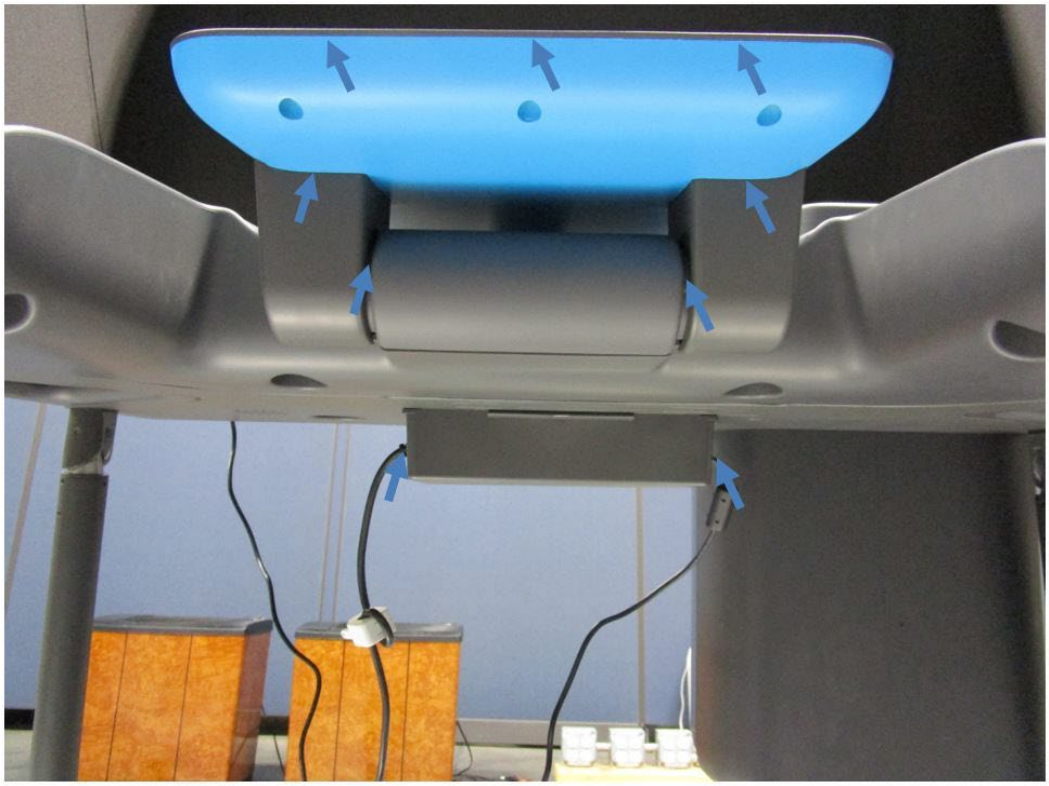
ESD Back Panel



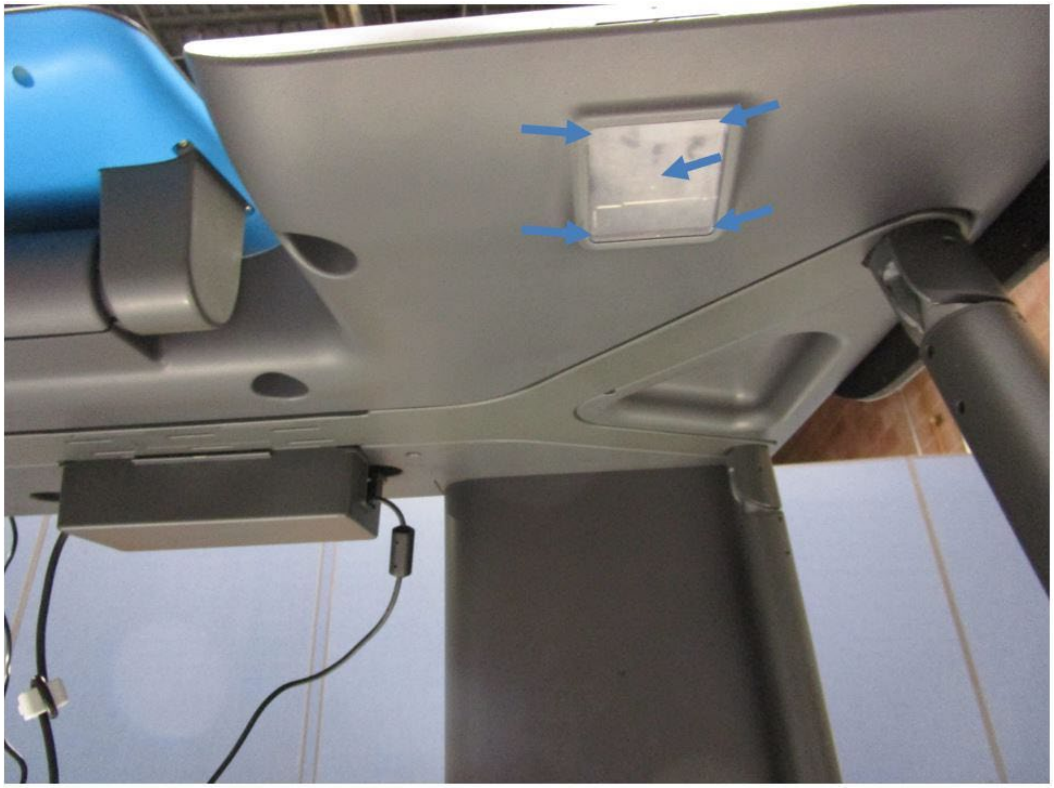
ESD Back Panel



ESD Back Panel



ESD Bottom Panel



ESD 12 Bottom Panel

5.1.5 Test Equipment List

Table 5.1-1: Electrostatic Discharge Test Equipment List

Asset Number	Asset Type	Manufacturer	Model	Calibrated	Due
WC059918	Ground Plane (Fixed)	National Technical Systems	GP2	NCR	NCR
WC059439	Meter (Digital Multimeter)	Fluke	85	08/28/2023	08/28/2024
WC059665	Gun (ESD Simulator)	EMC-Partner	ESD3000	07/21/2023	07/31/2024
WC078490	Meter (Hydrometer)	Extech Instruments	Datalogger 42270	02/15/2023	02/15/2024

Calibration Abbreviations
CAL: Calibration
NCR: No Calibration Required

5.2 Radiated RF Immunity (4.1.2.10)

5.2.1 Test Procedure

The EUT was tested in accordance with IEC/EN 61000-4-3: 2020.

5.2.2 Test Result

The EUT passed the defined requirements.

5.2.3 Test Datasheets

Element Materials Technology

Radiated RF Immunity per: FCC PART 15 Class B

Standard Referenced: FCC Part 15 Class B — Date: 12/6/2023
Temperature: 22°C — Humidity: 19% — Pressure: 841 mb
Input Voltage: 120Vac/60Hz
Configuration of Unit: Normal operating Mode Scanning Ballots
Test Engineer: Mike Tidquist

Date	Time	Log Entries	Initials	Result
12/6/23	1000-1500	Radiated RF Immunity: 10V/m, 80 – 1000 MHz, 1% Step, 80% AM, 1kHz sine, 3s dwell 120 VAC / 60 Hz	MT	Pass

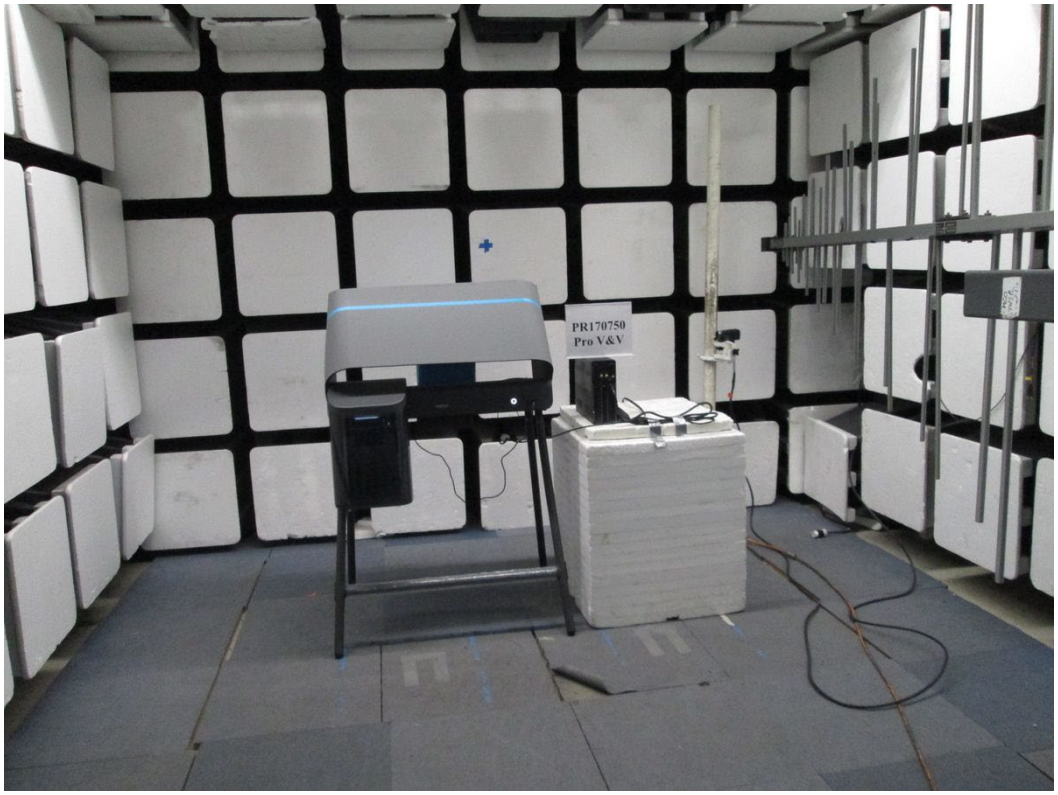
Element Materials Technology

Radiated RF Immunity per: FCC PART 15 Class B

Standard Referenced: FCC Part 15 Class B
Date: 12/6/2023
Temperature: 22°C Humidity: 19.00%
Pressure: 841 mb
Input Voltage: 120Vac/60Hz
Configuration of Unit: Normal operating Mode Scanning Ballots
Test Engineer: Mike Tidquist

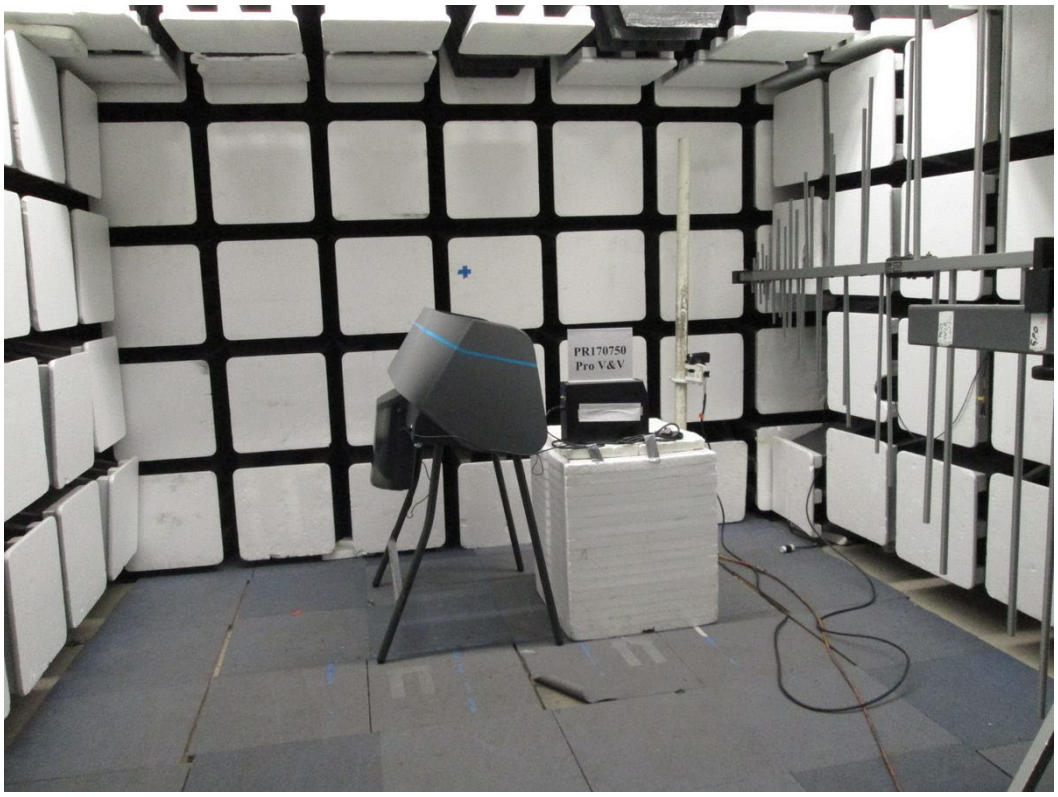
Frequency	Modulation				Step Size	Field	Polarity	Dwell	Comments	Criteria Met	Pass / Fail
(MHz)	Type	%	Freq	Form	(%)	(V/m)	(V or H)	(sec)			
80 - 1000	AM	80	1kHz	Sine	1	10	V	3	Front	A	Pass
80 - 1000	AM	80	1kHz	Sine	1	10	H	3		A	Pass
80 - 1000	AM	80	1kHz	Sine	1	10	V	3	Right	A	Pass
80 - 1000	AM	80	1kHz	Sine	1	10	H	3		A	Pass
80 - 1000	AM	80	1kHz	Sine	1	10	V	3	Back	A	Pass
80 - 1000	AM	80	1kHz	Sine	1	10	H	3		A	Pass
80 - 1000	AM	80	1kHz	Sine	1	10	V	3	Left	A	Pass
80 - 1000	AM	80	1kHz	Sine	1	10	H	3		A	Pass

5.2.4 Test Photographs



Radiated RF Immunity Back

Radiated RF Immunity Front



Radiated RF Immunity Left

Radiated RF Immunity Right

5.2.5 Test Equipment List

Table 5.2-1: Radiated RF Immunity Test Equipment List

Asset Number	Asset Type	Manufacturer	Model	Calibrated	Due
WC059916	Chamber (EMI, Semi-Anechoic)	National Technical Systems	GP0	NCR	NCR
WC059439	Meter (Digital Multimeter)	Fluke	85	08/28/2023	08/28/2024
WC059457	Coupler (Bi-Directional)	Werlatone	C3908-10	08/21/2020	NCR
WC059553	Probe (E-Field/Near Field)	ETS-Lindgren	HI-6053	05/04/2022	05/04/2024
WC059710	Amplifier (Pre/RF/Low Noise)	Ophir RF	5127F	09/17/2012	NCR
WC059805	Antenna (Log Periodic)	ETS-Lindgren	3142B	NCR	NCR
WC059852	Generator (Signal)	Anritsu Wiltron	69367B	02/24/2023	02/24/2024
WC070467	Meter (Power)	Agilent Technologies	E4418B	04/11/2023	04/11/2024
WC070506	Sensor (Power)	Hewlett Packard	E4421A	04/14/2023	04/14/2024
WC078470	Software	ETS-Lindgren	C47213	NCR	NCR
WC078489	Meter (Hydrometer)	Extech Instruments	Datalogger 42270	07/26/2023	07/31/2024

Calibration Abbreviations
CAL: Calibration
NCR: No Calibration Required

5.3 Electrical Fast Transient / Burst (4.1.2.6)

5.3.1 Test Procedure

The EUT was tested in accordance with IEC/EN 61000-4-4:2012.

5.3.2 Test Result

The EUT passed the defined requirements.

5.3.3 Test Datasheets

Element Materials Technology

Electrical Fast Transient/Burst per IEC / EN 61000-4-4

Standard Referenced: EN 61000-4-4 Date: 12/8/2023

Temperature: 26°C Humidity: 12% Pressure: 829 mb

Input Voltage: 120Vac/60Hz

Configuration of Unit: Normal Operation scanning ballots

Test Engineer: Mike Tidquist

Date	Time	Log Entries	Initials	Result
12/8/23	1500-1600	Electrical Fast Transient / Burst: Mains: +/2kV, I/O: +/1kV. 120 VAC / 60 Hz	MT	Pass

Element Materials Technology

Electrical Fast Transient/Burst per IEC / EN 61000-4-4

Standard Referenced: EN 61000-4-4 Date: 12/8/2023

Temperature: 26˚C Humidity: 12% Pressure: 829 mb

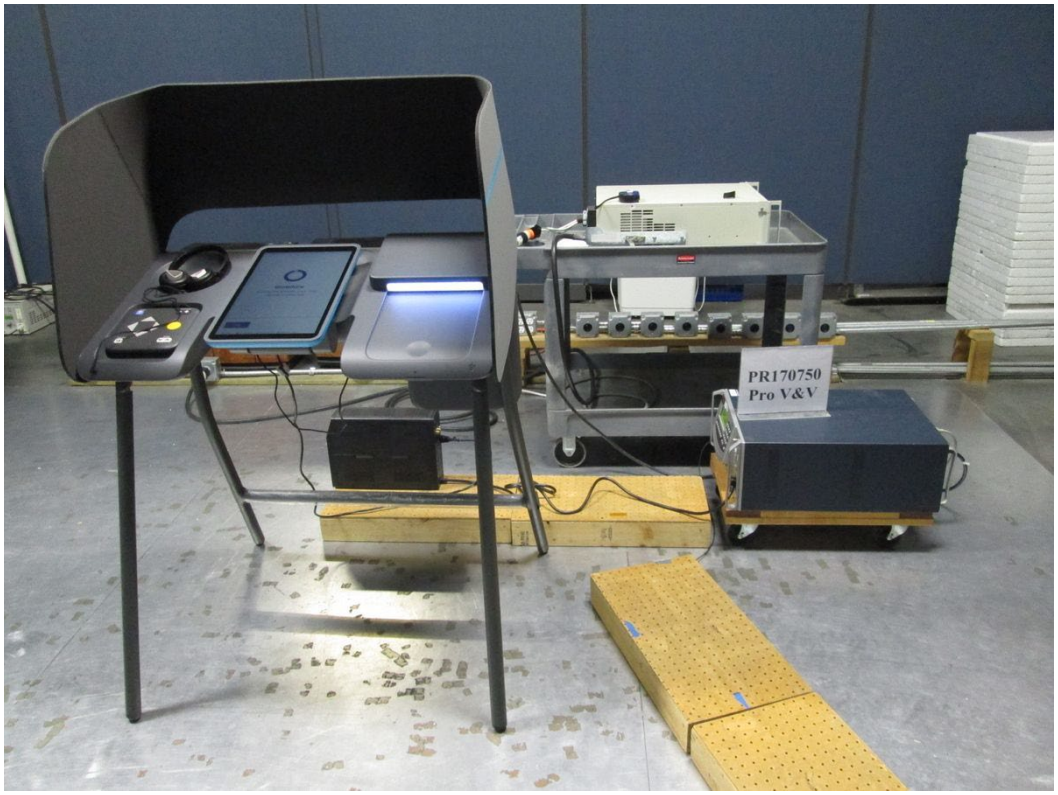
Input Voltage: 120Vac/60Hz Capacitive Coupling Clamp Verification Yes

Configuration of Unit: Normal Operation scanning ballots

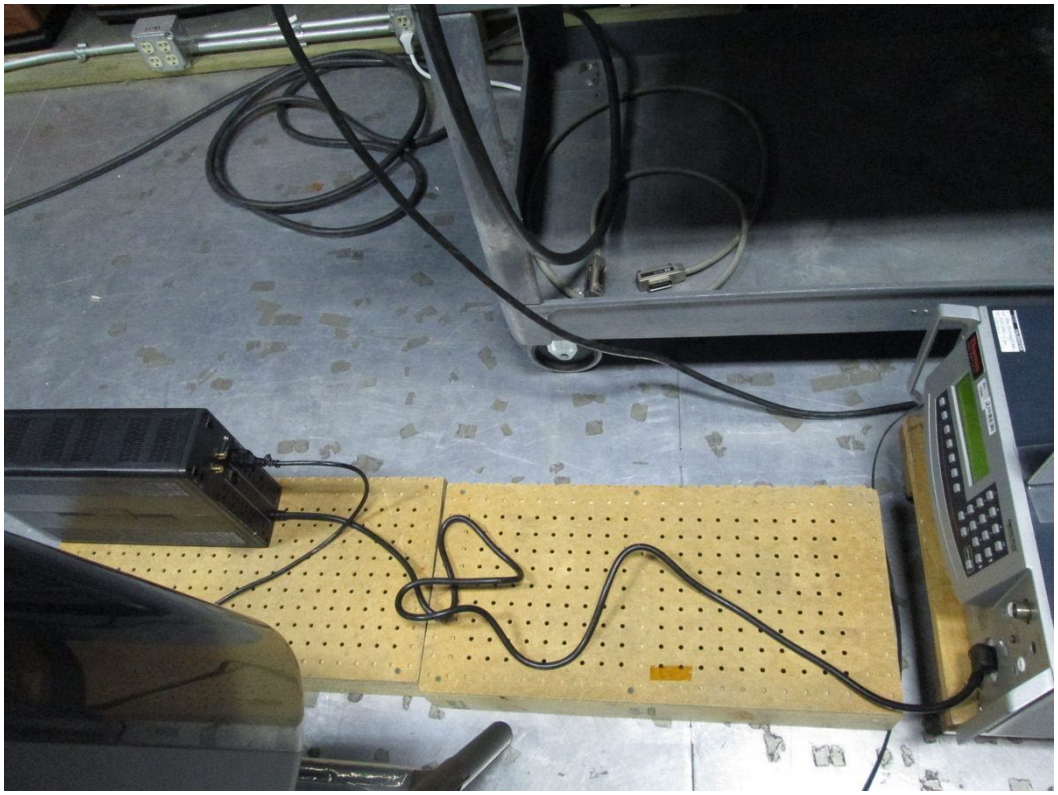
Test Engineer: Mike Tidquist

Voltage (kV)	Polarity +/-	Time (sec)	Injection Type	L1	L2	L3	N	PE	Rep Freq.	Comments	Criteria Met	Pass/ Fail
2.0	±	60	CDN	X					5kHz	AC	A	Pass
2.0	±	60	CDN		X				5kHz	AC	A	Pass
2.0	±	60	CDN					X	5kHz	AC	A	Pass
2.0	±	60	CDN	X	X			X	5kHz	AC	A	Pass

5.3.4 Test Photographs



EFT Setup



EFT AC Mains

5.3.5 Test Equipment List

Table 5.3-1: Electrical Fast Transient / Burst Test Equipment List

Asset Number	Asset Type	Manufacturer	Model	Calibrated	Due
WC059918	Ground Plane (Fixed)	National Technical Systems	GP2	NCR	NCR
WC059439	Meter (Digital Multimeter)	Fluke	85	08/28/2023	08/28/2024
WC059683	Oscilloscope (Digital)	Tektronix	TDS2002B	08/29/2023	08/29/2024
WC059768	Generator (Spike/Transient)	Thermo Fisher Scientific	EMC Pro Plus	12/05/2023	12/05/2024
WC059770	Power Supply (AC)	California Instruments	5001IX-CTS	03/30/2018	NCR
WC070497	Probe (High Voltage)	Tektronix	P5100	NCR	NCR
WC070508	Software	Keytek	CEWare	NCR	NCR
WC078488	Meter (Hydrometer)	Extech Instruments	Datalogger 42270	02/15/2023	02/15/2024

Calibration Abbreviations
CAL: Calibration
NCR: No Calibration Required

5.4 Surge Immunity (4.1.2.7)

5.4.1 Test Procedure

The EUT was tested in accordance with IEC/EN 6100-4-5:2014+A1:2017.

5.4.2 Test Result

The EUT passed the defined requirements.

5.4.3 Test Datasheets

Element Materials Technology

Surge Immunity per IEC / EN 61000-4-5

Standard Referenced:	EN 61000-4-5	Date:	12/8/2023
Temperature:	21˚C Humidity: 16%	Pressure:	829 mb
Input Voltage:	120Vac/60Hz		
Configuration of Unit:	Normal Operation scanning ballots		
Test Engineer:	Mike Tidquist		

Date	Time	Log Entries	Initials	Result
12/8/23	0800-1400	Surge Immunity: Mains: +/2kV CM, +/2kV DM, (0, 90, 180, 270) 120 VAC / 60 Hz	MT	Pass

Element Materials Technology

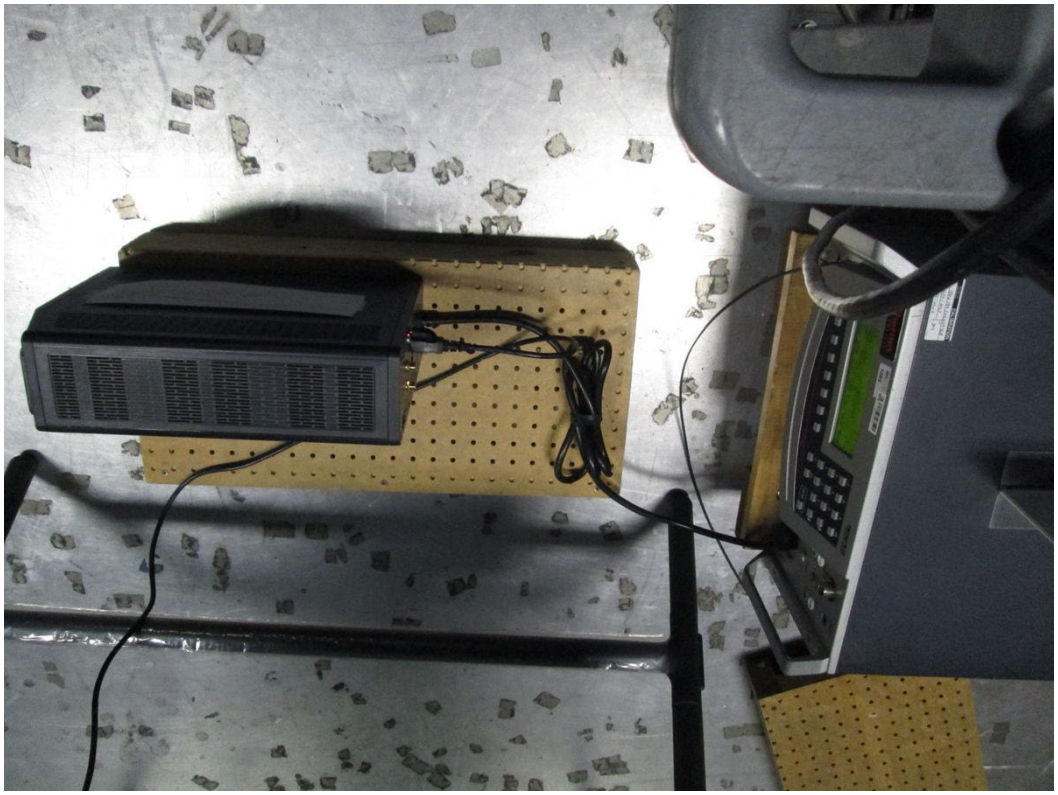
Surge Immunity per IEC / EN 61000-4-5

Standard Referenced: EN 61000-4-5
Date: 12/8/2023
Temperature: 21°C Humidity: 16%
Pressure: 829 mb
Input Voltage: 120Vac/60Hz
Configuration of Unit: Normal Operation scanning ballots
Test Engineer: Mike Tidquist

Voltage (kV)	Polarity +/-	L1	L2	L3	N	PE	Phase (deg)	Number of Pulses	Delay (sec)	Comments	Criteria Met	Pass/ Fail
0.5	±	X	X				0	5	30	Differential Mode	A	Pass
0.5	±	X	X				90	5	30		A	Pass
0.5	±	X	X				180	5	30		A	Pass
0.5	±	X	X				270	5	30		A	Pass
0.5	±	X				X	0	5	30	Common Mode Line	A	Pass
0.5	±	X				X	90	5	30		A	Pass
0.5	±	X				X	180	5	30		A	Pass
0.5	±	X				X	270	5	30		A	Pass
0.5	±		X			X	0	5	45	Common Mode Neutral	A	Pass
0.5	±		X			X	90	5	45		A	Pass
0.5	±		X			X	180	5	45		A	Pass
0.5	±		X			X	270	5	45		A	Pass
1.0	±	X	X				0	5	60	Differential Mode	A	Pass
1.0	±	X	X				90	5	60		A	Pass
1.0	±	X	X				180	5	60		A	Pass
1.0	±	X	X				270	5	60		A	Pass
1.0	±	X				X	0	5	60	Common Mode Line	A	Pass
1.0	±	X				X	90	5	60		A	Pass
1.0	±	X				X	180	5	60		A	Pass
1.0	±	X				X	270	5	60		A	Pass
1.0	±		X			X	0	5	60	Common Mode Neutral	A	Pass
1.0	±		X			X	90	5	60		A	Pass
1.0	±		X			X	180	5	60		A	Pass
1.0	±		X			X	270	5	60		A	Pass
2.0	±	X	X				0	5	60	Differential Mode	A	Pass
2.0	±	X	X				90	5	60		A	Pass
2.0	±	X	X				180	5	60		A	Pass
2.0	±	X	X				270	5	60		A	Pass
2.0	±	X				X	0	5	60	Common Mode Line	A	Pass
2.0	±	X				X	90	5	60		A	Pass
2.0	±	X				X	180	5	60		A	Pass
2.0	±	X				X	270	5	60		A	Pass

5.4.4 Test Photographs

Surge Setup



Surge AC Mains

5.4.5 Test Equipment List

Table 5.4-1: Surge Immunity Test Equipment List

Asset Number	Asset Type	Manufacturer	Model	Calibrated	Due
WC059918	Ground Plane (Fixed)	National Technical Systems	GP2	NCR	NCR
WC059439	Meter (Digital Multimeter)	Fluke	85	08/28/2023	08/28/2024
WC059683	Oscilloscope (Digital)	Tektronix	TDS2002B	08/29/2023	08/29/2024
WC059768	Generator (Spike/Transient)	Thermo Fisher Scientific	EMC Pro Plus	12/05/2023	12/05/2024
WC059770	Power Supply (AC)	California Instruments	5001IX-CTS	03/30/2018	NCR
WC070508	Software	Keytek	CEWare	NCR	NCR
WC078488	Meter (Hydrometer)	Extech Instruments	Datalogger 42270	02/15/2023	02/15/2024

Calibration Abbreviations
CAL: Calibration
NCR: No Calibration Required

5.5 Conducted RF Immunity (4.1.2.11)

5.5.1 Test Procedure

The EUT was tested in accordance with IEC/EN 6100-4-6:2013.

5.5.2 Test Result

The EUT passed the defined requirements.

5.5.3 Test Datasheets

Element Materials Technology

Conducted RF Immunity per IEC / EN 61000-4-6

Standard Referenced: IEC / EN 61000-4-6 Date: 12/11/2023

Temperature: 21°C Humidity: 17% Pressure: 838 mb

Input Voltage: 120Vac/60Hz

Configuration of Unit: Normal Operation Scanning Ballots

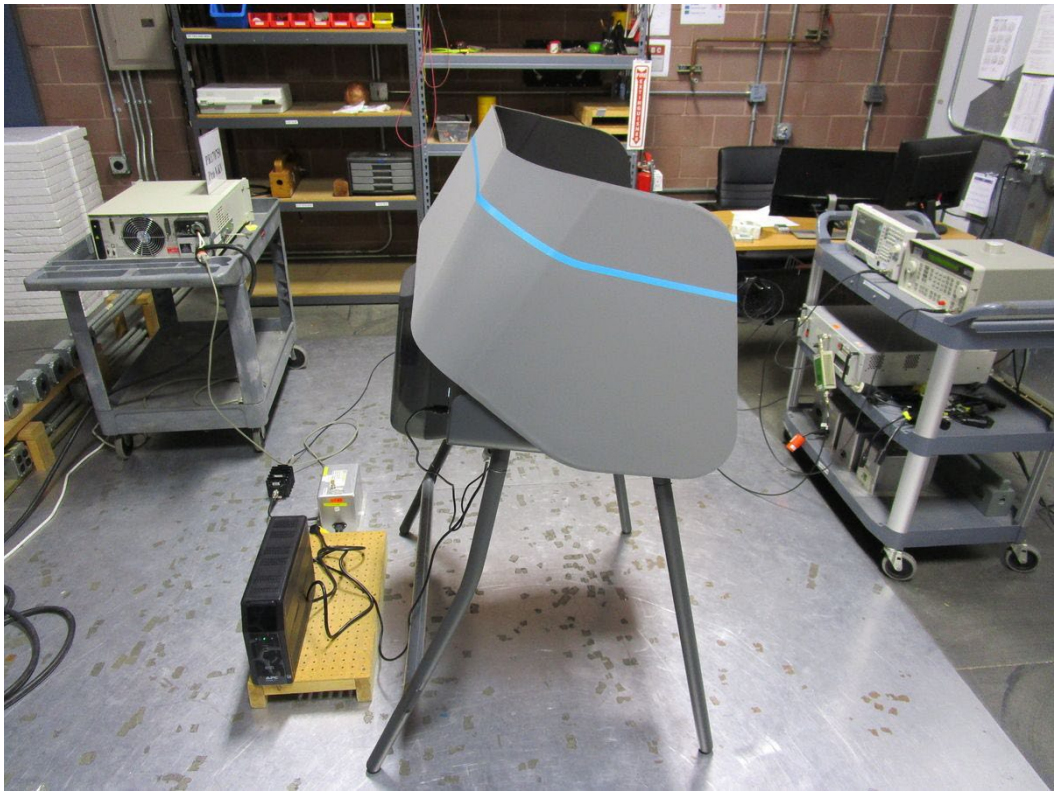
Test Engineer: Corey Shelton

Date	Time	Log Entries	Initials	Result
12/11/23	0800	Begin measurement equipment warmup	CS	
	0837	4-6 test started 10Vrms AC Mains	CS	
	0924	4-6 test complete 10Vrms AC Mains	CS	Pass

Element Materials Technology					
Conducted RF Immunity per IEC / EN 61000-4-6					
Standard Referenced:	IEC / EN 61000-4-6			Date:	12/11/2023
Temperature:	21˚C	Humidity:	17%	Pressure:	838 mb
Input Voltage:	120Vac/60Hz				
Configuration of Unit:	Normal Operation Scanning Ballots				
Test Engineer:	Corey Shelton				

Frequency (MHz)	Modulation			Level	Dwell	Comments	Criteria Met	Pass/ Fail
	Type	%	Freq	(V/m)	(sec)			
0.150 - 80.0	AM	80	1KHz	10	3	AC Mains	A	Pass

5.5.4 Test Photographs



CRF - AC Mains

5.5.5 Test Equipment List

Table 5.5-1: Conducted RF Immunity Test Equipment List

Asset Number	Asset Type	Manufacturer	Model	Calibrated	Due
WC059918	Ground Plane (Fixed)	National Technical Systems	GP2	NCR	NCR
WC059657	Amplifier (Pre/RF/Low Noise)	Instruments For Industry	M100	NCR	NCR
WC059658	Coupler (Bi-Directional)	Werlatone	C9475	08/25/2023	08/25/2024
WC059661	Network (Coupling/Decoupling)	EMC Integrity	EMCI-CDN-M3-16	02/24/2023	03/03/2024
WC059694	Generator (Signal)	Hewlett Packard	8648C	04/11/2023	04/11/2024
WC059765	Meter (Digital Multimeter)	Fluke	87/5 Multimeter	05/11/2023	05/11/2024
WC059772	Analyzer (Spectrum)	Rigol Technologies	DSA815	06/29/2023	06/30/2024
WC078469	Software	ETS-Lindgren	C47213	NCR	NCR
WC078489	Meter (Hydrometer)	Extech Instruments	Datalogger 42270	07/26/2023	07/31/2024

Calibration Abbreviations
CAL: Calibration
NCR: No Calibration Required

5.6 Voltage Dips and Interruptions (4.1.2.5)

5.6.1 Test Procedure

The EUT was tested in accordance with IEC/EN 61000-4-11:2020.

5.6.2 Test Result

The EUT passed the defined requirements.

5.6.3 Test Datasheets

Element Materials Technology

Voltage Dips and Interrupts per IEC / EN 61000-4-11

Standard Referenced: EN 61000-4-11 Date: 12/8/2023

Temperature: 27˚C Humidity: 12% Pressure: 829 mb

Input Voltage: 120Vac/60Hz

Configuration of Unit: Normal Operation scanning ballots

Test Engineer: Mike Tidquist

Date	Time	Log Entries	Initials	Result
12/8/23	1400-1500	Voltage Dips and Interruptions: 70% nom, 0.6 cycles / 40% nom, 6 cycles & 1 sec. / 0% nom, 300 cycles. 120 VAC / 60 Hz	MT	Pass

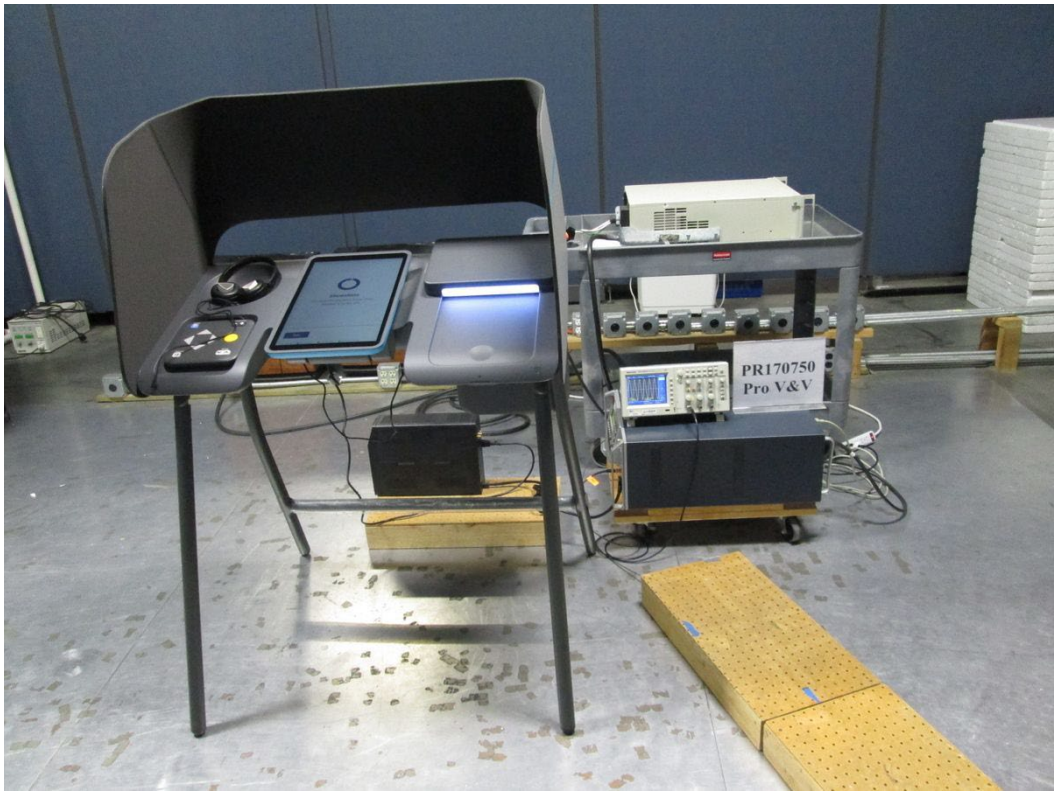
Element Materials Technology

Voltage Dips and Interrupts per IEC / EN 61000-4-11

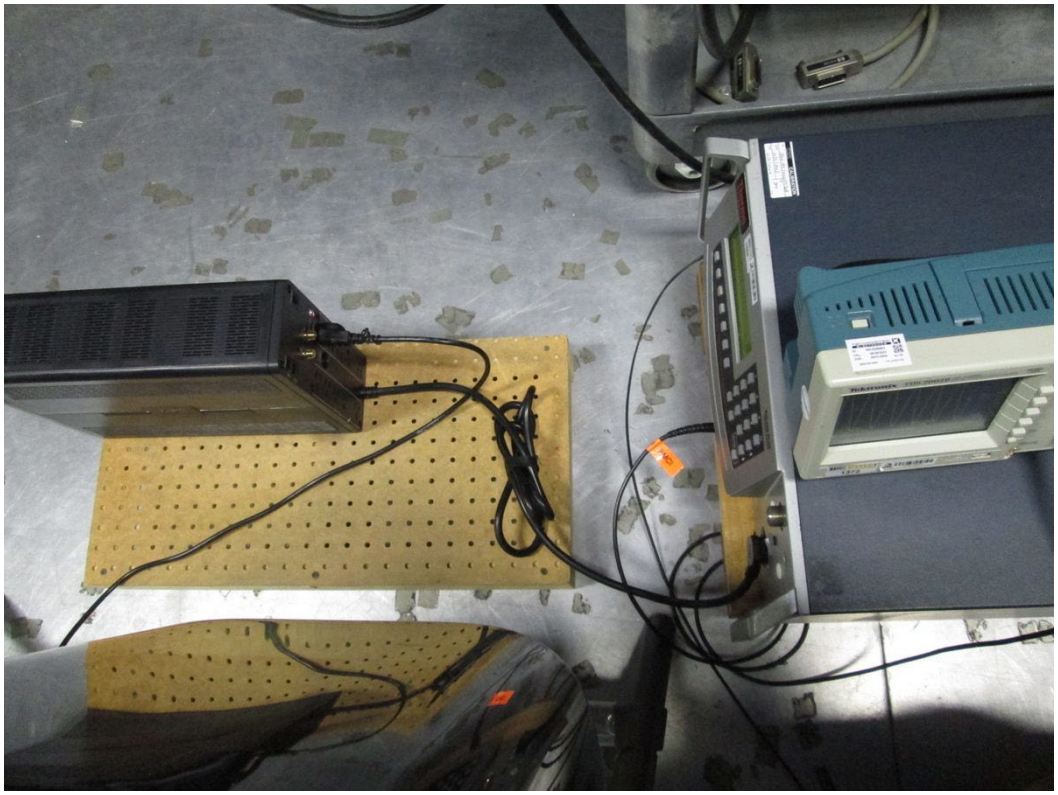
Standard Referenced: EN 61000-4-11
Date: 12/8/2023
Temperature: 27˚C Humidity: 12% Pressure: 829 mb
Input Voltage: 120Vac/60Hz
Configuration of Unit: Normal Operation scanning ballots
Test Engineer: Mike Tidquist

% Nominal	No. of Cycles	Phase Angle (deg)				Time between dropouts (sec)	Number of tests	Comments	Criteria Met	Pass/ Fail
		0	90	180	270					
70%	0.6	X				10	3		A	Pass
70%	0.6		X			10	3		A	Pass
70%	0.6			X		10	3		A	Pass
70%	0.6				X	10	3		A	Pass
40%	6	X				10	3		A	Pass
40%	6		X			10	3		A	Pass
40%	6			X		10	3		A	Pass
40%	6				X	10	3		A	Pass
40%	60	X				10	3		A	Pass
40%	60		X			10	3		A	Pass
40%	60			X		10	3		A	Pass
40%	60				X	10	3		A	Pass
0%	300	X				10	3		A	Pass
0%	300			X		10	3		A	Pass

5.6.4 Test Photographs



PQF Setup



PQF AC Mains

5.6.5 Test Equipment List

Table 5.6-1: Voltage Dips and Interruptions Test Equipment List

Asset Number	Asset Type	Manufacturer	Model	Calibrated	Due
WC059918	Ground Plane (Fixed)	National Technical Systems	GP2	NCR	NCR
WC059439	Meter (Digital Multimeter)	Fluke	85	08/28/2023	08/28/2024
WC059683	Oscilloscope (Digital)	Tektronix	TDS2002B	08/29/2023	08/29/2024
WC059768	Generator (Spike/Transient)	Thermo Fisher Scientific	EMC Pro Plus	12/05/2023	12/05/2024
WC059770	Power Supply (AC)	California Instruments	5001IX-CTS	03/30/2018	NCR
WC070508	Software	Keytek	CEWare	NCR	NCR
WC078488	Meter (Hydrometer)	Extech Instruments	Datalogger 42270	02/15/2023	02/15/2024

Calibration Abbreviations
CAL: Calibration
NCR: No Calibration Required

5.7 Voltage Dips and Interruptions (Inc./Red. of Nom. Voltage) (4.1.2.5)

5.7.1 Test Procedure

The EUT was tested in accordance with IEC/EN 61000-4-11:2020.

5.7.2 Test Result

The EUT passed the defined requirements.

5.7.3 Test Datasheets

Element Materials Technology

Voltage Dips and Interrupts per IEC / EN 61000-4-11

Standard Referenced: EN 61000-4-11 Date: 12/1/2023, 12/7/2023

Temperature: 22˚C Humidity: 16% Pressure: 829 mb

Input Voltage: 129Vac/60Hz, 105Vac/60Hz

Configuration of Unit: Normal Operation scanning ballots

Test Engineer: Mike Tidquist

Date	Time	Log Entries	Initials	Result
12/1/23	1100-1300	Voltage Dips and Interruptions. Electric power increases of 7.5% and reductions of 12.5% of nominal specified power. 120 VAC / 60 Hz (Inc./Red. of Nom. Voltage) Finished the + 7.5% increase test. Client had to leave	MT	Continue
Client Chnged out UPS will need to rerun tests				
12/7/23	0800-1200	Voltage Dips and Interruptions. Electric power increases of 7.5% and reductions of 12.5% of nominal specified power. 120 VAC / 60 Hz (Inc./Red. of Nom. Voltage)	MT	Pass

Element Materials Technology

Voltage Dips and Interrupts per IEC / EN 61000-4-11

Standard Referenced:	EN 61000-4-11	Date:	12/1/2023, 12/7/2023
Temperature:	22˚C Humidity: 16%	Pressure:	829 mb
Input Voltage:	129Vac/60Hz, 105Vac/60Hz		
Configuration of Unit:	Normal Operation scanning ballots		
Test Engineer:	Mike Tidquist		

Line Voltage Variation	Criteria Met	Pass/Fail
129Vac Line Voltage Variations (+7.5% of nominal 120V) 2 hrs.	A	Pass
105Vac Line Voltage Variations (-12.5% of nominal 120V) 2 hrs.	A	Pass

5.7.4 Test Photographs

Voltage Variations

5.7.5 Test Equipment List

Table 5.7-1: Voltage Dips and Interruptions Test Equipment List

Asset Number	Asset Type	Manufacturer	Model	Calibrated	Due
WC059918	Ground Plane (Fixed)	National Technical Systems	GP2	NCR	NCR
WC059439	Meter (Digital Multimeter)	Fluke	85	08/28/2023	08/28/2024
WC059770	Power Supply (AC)	California Instruments	5001IX-CTS	03/30/2018	NCR
WC078486	Meter (Hydrometer)	Extech Instruments	Datalogger 42270	07/26/2023	07/31/2024

Calibration Abbreviations
CAL: Calibration
NCR: No Calibration Required

5.8 Voltage Dips and Interruptions (Surge of +/- 15%) (4.1.2.5)

5.8.1 Test Procedure

The EUT was tested in accordance with IEC/EN 61000-4-11:2020.

5.8.2 Test Result

The EUT passed the defined requirements.

5.8.3 Test Datasheets

Element Materials Technology

Voltage Dips and Interrupts per IEC / EN 61000-4-11

Standard Referenced: EN 61000-4-11 Date: 12/7/2023

Temperature: 26˚C Humidity: 13% Pressure: 827 mb

Input Voltage: 1380Vac/60Hz, 102Vac/60Hz

Configuration of Unit: Normal Operation scanning ballots

Test Engineer: Mike Tidquist

Date	Time	Log Entries	Initials	Result
12/7/23	1200-1600	Voltage Dips and Interruptions: Surge of +/15% line variation of nominal line voltage. 120 VAC / 60 Hz (Surge of +/15%)	MT	Pass

Element Materials Technology

Voltage Dips and Interrupts per IEC / EN 61000-4-11

Standard Referenced:	EN 61000-4-11	Date:	12/7/2023
Temperature:	26˚C Humidity: 13%	Pressure:	827 mb
Input Voltage:	1380Vac/60Hz, 102Vac/60Hz		
Configuration of Unit:	Normal Operation scanning ballots		
Test Engineer:	Mike Tidquist		

Line Voltage Variation	Criteria Met	Pass/Fail
Surges of +15% line variations of nominal voltage (138V) 2 hrs.	A	Pass
Surges of -15% line variations of nominal voltage (102V) 2 hrs.	A	Pass

5.8.4 Test Photographs

Voltage Variations

5.8.5 Test Equipment List

Asset Number	Asset Type	Manufacturer	Model	Calibrated	Due
WC059918	Ground Plane (Fixed)	National Technical Systems	GP2	NCR	NCR
WC059439	Meter (Digital Multimeter)	Fluke	85	08/28/2023	08/28/2024
WC059770	Power Supply (AC)	California Instruments	5001IX-CTS	03/30/2018	NCR
WC078488	Meter (Hydrometer)	Extech Instruments	Datalogger 42270	02/15/2023	02/15/2024

Calibration Abbreviations
CAL: Calibration
NCR: No Calibration Required

End of Test Report