

Hart InterCivic Verity Vanguard 1.0 Electrical Hardware Test Plan

V4.0

HIN-23003-ELHTP-02

Prepared for:

Vendor Name	<i>Hart InterCivic</i>
Vendor System	<i>Verity Vanguard 1.0</i>
EAC Application No.	<i>HRT-VV-1.0</i>

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***Accredited by the Election
Assistance Commission (EAC)
for Selected Voting System Test
Methods or Services***



Revision History

Date	Release	Author	Revision Summary
7/24/2024	1.0	Darrick Forester	Initial Release
8/5/2024	2.0	Darrick Forester	Address EAC comments
12/10/2024	3.0	Darrick Forester	Added Vanguard Imprinter optional accessory used with Vault
4/14/2025	4.0	Darrick Forester	New serial numbers added for Boost / Vault retest

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1 INTRODUCTION

This test plan covers the EMC (Electromagnetic Compatibility) and EMI (Electromagnetic Interference) test requirements and methods for the **Hart InterCivic Verity Vanguard 1.0** voting system, hereafter known as the Equipment Under Test (EUT), to the requirements as stated in Election Assistance Commission Voluntary Voting System Guidelines Version 2.0 (EAC VVSG 2.0).

1.1 Qualifications

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

1.2 Hardware Test Lab Facility

Element Materials Technology Denver-Longmont
1736 Vista View Drive
Longmont, Colorado 80504

1.3 Reference Documents

1. Election Assistance Commission Voluntary Voting System Guidelines 2.0
2. Election Assistance Commission Voluntary Voting System Guidelines (VVSG) v 2.0, Test Assertions v 1.3
3. NIST Handbook 150-2020
4. NIST Handbook 150-22-2021
5. Election Assistance Commission Voting System Testing and Certification Program Manual, United States Election Assistance Commission, v 3.0
6. SLI Compliance VSTL Quality System Manual, Rev. 4.1 Aug. 14, 2023

2 Product Description

2.1 Intended Use

The EUT is intended to be used in the polling place environment.

2.2 Equipment Under Test

Product/Model	Serial Number	Description	Qty
Vanguard Boost	B2520006401	Vanguard Boost (Polling Place Ballot Issuance) is a poll worker facing device designed to improve voter service by optimizing ballot	1



2007020 Rev A Reg: VV-500	B2520006001 (Backup Unit)	issuance in the polling place. Vanguard Boost can be utilized by poll workers in two ways. Boost may be used to print blank paper ballots on demand, using an attached ballot printer. Boost may also be used to issue VotePasses, which allow voters to access, mark, and print a printed vote record using Vanguard Flex or Adapt. Vanguard Boost does not store vote data.	
Vanguard Flex 2007010 Rev A Reg: VV-400	F252000401 (Original Unit) F252000501 (Backup Unit)	Vanguard Flex (Polling Place BMD) is a universal ballot marking device that produces an auditable summary ballot of a voter's choices. Voters can mark their ballots using the touchscreen interface or a wide variety of accessible controls. Printed summary ballots are then scanned in Verity Vault for tabulation.	2
Vanguard Vault with Imprinter 2007030 Rev A Reg: VV-600	V2520003701	Vanguard Vault (Polling Place Precinct Scanner) is a polling place scanning device that captures voter choices whether using ballots marked by hand or machine, including summary ballots (printed vote records (PVRs)).	1
Vanguard Adapt 2007040 Rev A Reg: VV-700	A2520009001	Vanguard Adapt (Polling Place Limited Dexterity Mark, Verify and Cast Device) is an all-in-one voting device that produces an auditable summary ballot of a voter's choices. Voters can mark their ballots using the touchscreen interface or a wide variety of accessible controls. Vanguard Adapt enables voters to mark, verify, and cast their ballot all without touching a piece of paper.	1

2.3 Power Requirements

AC mains	Yes
Input Voltage Rating as it appears on unit, power supply, or power brick	100 ~ 240Vac
Flex - Input Current (specify @ 230 Vac/50 Hz)	0.5 A



Adapt - Input Current (specify @ 230 Vac/50 Hz)	0.5 A
Boost - Input Current (specify @ 230 Vac/50 Hz)	0.25 A, 2.25 A with HP LaserJet Pro 4001dn series printer in BOD mode
Vault - Input Current (specify @ 230 Vac/50 Hz)	0.25 A
Input Current (specify @ 230 Vac/50 Hz)	0.7 A
Single or Multi-Phase (If multi-phase, specify delta or wye)	Single
Input Power connector a 2-prong, 3-prong, 4 prong or 5 prong plug	3-prong
Does UUT have more than 1 power cord? Adapt has 2 power cords. Boost requires 2 power cords in BOD mode.	No

2.4 Support Equipment (SE)

Product/Model	Serial Number	Description	Qty
Vanguard Imprinter	I2520013501	Optional Vault accessory that is designed to better support a ballot-level risk limiting audit (RLA). The imprinter prints a unique ID onto the ballot after the ballot has been cast. This ID enables searchability and traceability at the individual ballot level.	1
Accessibility Controller	Part No. 2007080-A	Optional accessibility controller for users with low dexterity.	3
Two-button switch	Part No. 10033406	Optional attachment to the accessibility controller for users with greater dexterity challenges.	3
Headphones (COTS)	Part No. HA310	Optional attachment to the accessibility controller for users with visual impairments.	4
Motorola/Zebra DS4308 handheld AutoBallot COTS barcode scanner	N/A	Optional device to activate ballot style is based on the barcode generated by a pollbook on check-in. Used with Vanguard Boost, Flex, and Adapt	3
HP LaserJet Pro 4001dn series mono laser printer (COTS)	VNL0341878	Optional COTS printer for printing blank paper ballots for use with Vanguard Boost .	1
HP Officejet 200 (COTS)	N/A	COTS laser printer for printing blank paper ballots for use with Vanguard Adapt	1



Ballot Box	X2520014901	Purpose made plastic, collapsible ballot box for use with Vanguard Vault .	1
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2.5 EUT Software/Firmware

Name	Version	Functionality
Vanguard Software (all)	1.0	Election software for operational status check.

2.6 Accessories

Type	Model	Function
Test Ballots	N/A	Pre-mark Test Ballots
Verity Key - Security Key	N/A	User authentication and configuration of election security.
Verity vDrive	N/A	Load election definitions, record CVRs and audit logs.

3 Equipment Under Test

Backup units of the same model with unique serial numbers may be used throughout EMC/EMI testing provided the following criteria are met:

- Issue with EUT.
- Identical hardware.
- All hardware components are listed in Manufacturer's BOM or APL.

3.1 Operating Modes and Test Configurations

Prior and during testing, proper operation of the EUT shall be confirmed using **Hart InterCivic** software. An operational status check shall be performed prior to and after each test to fully exercise the EUT and ensure that no damage has occurred as a result of the test.

To fully exercise all the features of each product, test software is run during electrical tests to exercise the model's particular hardware features.

- Vanguard Adapt

- AutoBallot barcode reader connected via obfuscated USB ports
- Remaining external USB ports are covered with USB inserts
- Headphones
- Jelly Switch
- Floor Standing



HP OfficeJet 200 (Support equipment)

- Loaded with Ballot stock
- Mounted on top device

Additional Materials needed during EMC Test

- Test CFast card (Win10 Vanguard MVT 1.0.0)
- vDrive for EMC testing
- USB mouse

Setup for EMC Testing

- Replace the Verity Vanguard 1.0 CFast with the Test CFast card.
- Replace vDrive with election with vDrive for EMC testing.
- Plug in a USB mouse
- Turn on device.
- The display will be flipped. Right-click on the desktop and click on **Display settings** on the pop-up menu.
- Under **Display Orientation** set it for **Portrait (flipped)**
- Open folder on desktop titled **Adapt**
- Double tap button **Run In Seiko Printer** icon. The thermal report printer will print every 300s for up to 40 hours.
- Double tap **File IO Test** icon. The vDrive for EMC testing will have 100 bytes of data written to it every 5 seconds for up to 20 hours.
- Double tap **Audio 8 Hrs.** icon. Audio will play on the headphones for up to 8 hours.
- Double tap **ATI Test** icon. Validate the function of the ATI by pressing buttons using rotating the scroll wheel.
- Double tap **Scanner Diagnostic** icon.
 - Hit **Connect**, located just below the File menu
 - Under **Sides Scanned** set to **Front Only**.
- Double tap **HP OfficeJet 200 – 100 sheets** icon. The laser printer will print a sheet every 5 minutes for up to 8 hours.
- Remove mouse and lock vDrive door.
- Device is now ready for testing.

- Vanguard Boost

- AutoBallot barcode reader connected via obfuscated USB port
- ATI Connected via obfuscated USB port
 - Headphones
 - Jelly Switch
- Tabletop

HP Laser Jet Pro 4001dn series mono laser printer (support equipment)



- Loaded with Ballot stock
- Tabletop

Additional Materials needed during EMC Test

- Test CFast card (Win10 Vanguard MVT 1.0.0)
- vDrive for EMC testing

Setup for EMC Testing

- Replace the Verity Vanguard 1.0 CFast with the Test CFast card.
- Replace vDrive with election with vDrive for EMC testing and lock vDrive door.
- Turn on device.
- Open folder on desktop titled **Boost**
- Double tap button **RunIn Seiko Printer** icon. The thermal report printer will print every 300s for up to 40 hours.
- Double tap **File IO Test** icon. The vDrive for EMC testing will have 100 bytes of data written to it every 5 seconds for up to 20 hours.
- Double tap **Audio 8 Hrs.** icon. Audio will play on the headphones for up to 8 hours.
- Double tap **ATI Test** icon. Validate the function of the ATI by pressing buttons using rotating the scroll wheel.
- Double tap **HP Laser Jet Pro 4001dn – 100 sheets** icon. The laser printer will print a sheet every 5 minutes for up to 8 hours.
- Device is now ready for testing.

- Vanguard Flex

- AutoBallot barcode reader connected via obfuscated USB
- ATI Connected via obfuscated USB
 - Headphones
 - Jelly Switch
- Remaining external USB port is covered with a USB insert
- Floor Standing on Accessible Booth

Additional Materials needed during EMC Test

- Test CFast card (Win10 Vanguard MVT 1.0.0)
- vDrive for EMC testing
- PVR Stock
- USB keyboard

Setup for EMC Testing

- Replace the Verity Vanguard 1.0 CFast with the Test CFast card.
- Replace vDrive with election with vDrive for EMC testing.
- Insert keyboard into a USB port in vDrive Bay.
- Turn on device.



- Open folder on desktop titled **Flex**
- Double tap button **RunIn Seiko Printer** icon. The thermal report printer will print every 300s for up to 40 hours.
- Double tap **File IO Test** icon. The vDrive for EMC testing will have 100 bytes of data written to it every 5 seconds for up to 20 hours.
- Double tap **Audio 8 Hrs.** icon. Audio will play on the headphones for up to 8 hours.
- Double tap **ATI Test** icon. Validate the function of the ATI by pressing buttons using rotating the scroll wheel.
- Prepare the internal PVR printer for shoeshine printing
 - Double click on the TP850 shortcut. The PVR Batch Printing screen displays.
 - Within the PVR Batch Printing application hit the Connect button and wait for the “Connected” status on the bottom left to become green.
 - Hit Set Defaults.
 - Check that the **Paper Size** radio button is 11” or 14”, depending on the PVR blank sheet you will be using. Either is fine.
 - Under **Paper Handling**, select **Stop**, and then hit **Set**.
 - Hit **Enable** and wait for the “Enabled” to become green.
 - Hit **Shoeshine** button and hit OK on the paper exit handling prompt.
 - Set the **Frequency** to 300 seconds.
 - Set the **Reverse Line Count** to 5.
 - Set the **Repeat** to 5.
 - Hit **Start Print Test**. Insert paper with the arrows facing the screen and hit **OK** on the prompt.
 - The printer will print and work the motors every 5 minutes until the **Stop** button is pressed.
- Remove keyboard and lock vDrive door.
- Device is now ready for testing.

- Vanguard Vault with optional Imprinter accessory

- Floor Standing on Ballot Box
- ATI Connected via obfuscated USB
 - Headphones
 - Jelly Switch
- Remaining external USB ports are covered with USB inserts

Additional Materials needed during EMC Test

- Test CFast card (Win10 Vanguard MVT 1.0.0)
- vDrive for EMC testing
- Ballot Stock



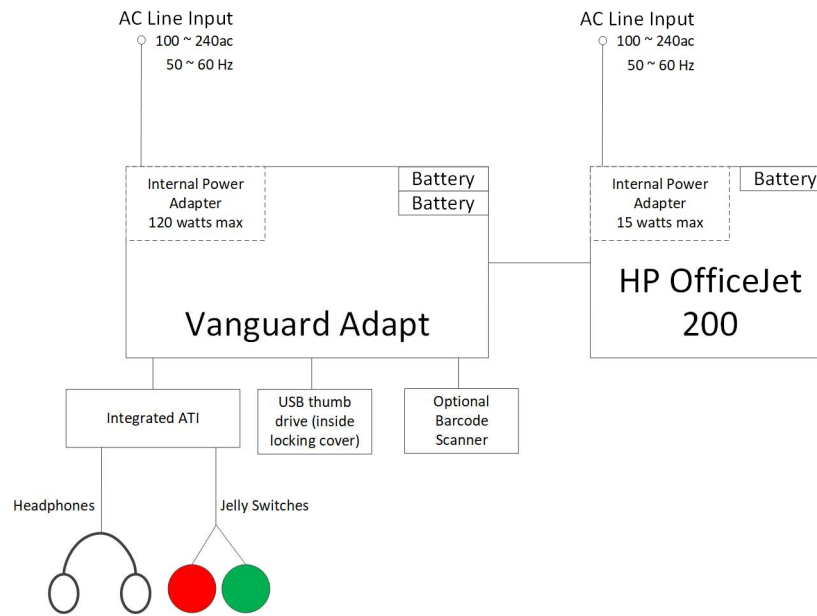
- USB keyboard

Setup for EMC Testing

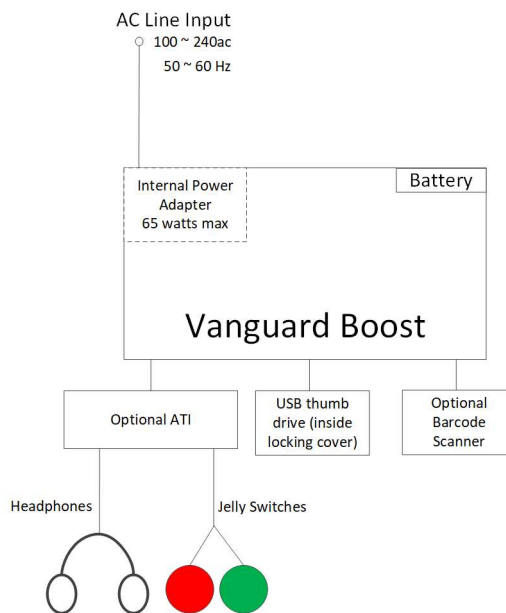
- Replace the Verity Vanguard 1.0 CFast with the Test CFast card.
- Replace vDrive with election with vDrive for EMC testing.
- Insert keyboard into a USB port in vDrive Bay.
- Turn on device.
- Open folder on desktop titled **Vault**.
- Double tap **File IO Test** icon. The vDrive for EMC testing will have 100 bytes of data written to it every 5 seconds for up to 20 hours.
- Double tap **Audio 8 Hrs.** icon. Audio will play on the internal speaker for up to 8 hours.
- Double tap **RunIn Seiko Printer** icon. The thermal report printer will print every 300s for up to 40 hours.
- Double tap **Platform Manager Tests** icon. Wait for window to open and tap the Radio button under Scanner LEDs **Set Ready to Scan**.
- Double Tap **Scanner Diagnostic** icon.
 - a. Hit **“Connect”**, located just below the **“File”** menu.
 - b. Hit the **Options** tab.
 - c. Hit the checkbox **Enable Recycle Mode**.
 - d. Hit the checkbox **No Image Display**.
 - e. Use the keyboard to change **Rescan delay** to **15500**
 - f. Place a ballot into to Verity Vanguard Vault. It will repeatedly feed the same ballot (shoeshine) without fully dropping it into the box.
- Remove keyboard and close cover of vDrive bay and lock vDrive door.
- Device is now ready for testing

3.2 Block Diagram

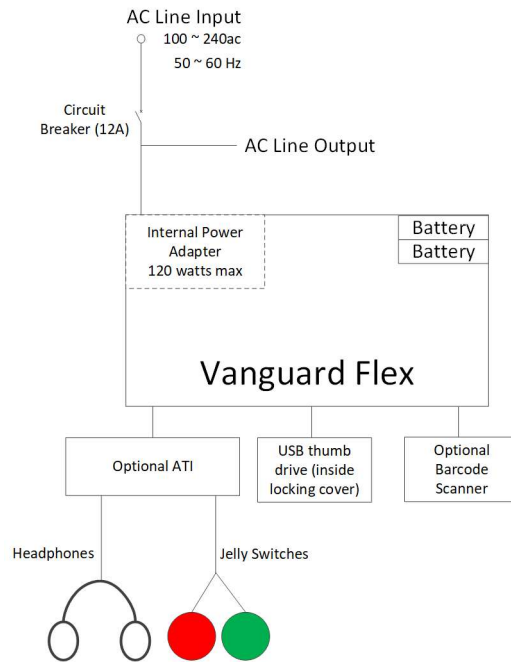
Verity Vanguard Adapt



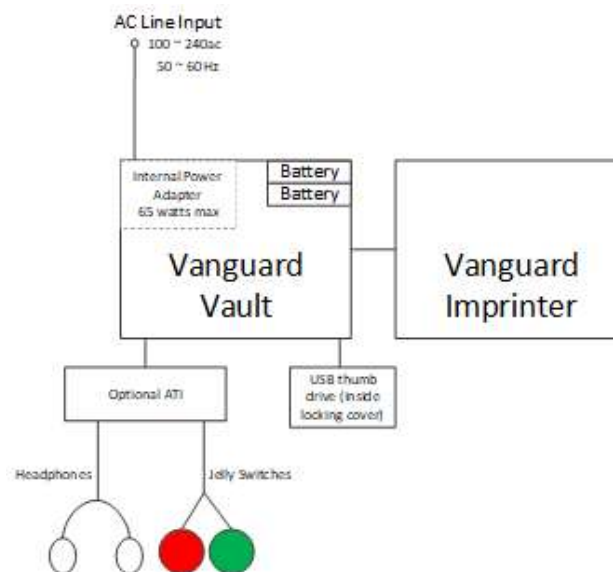
Verity Vanguard Boost



Verity Vanguard Flex



Verity Vanguard Vault





3.3 Treatment of Test Failures

Failures of electrical tests or failures of the exercising software to perform shall be documented in the electrical test report.

3.4 Backup Unit

Backup unit of the same model with unique serial numbers may be used throughout EMC/EMI testing provided the following criteria are met:

- Issue with the EUT.
- Backup unit is identical to the EUT.
- All hardware components are listed in Manufacturer's BOM or APL.

3.5 Test Documentation

A test report shall be obtained from the test lab that meets the pertinent requirements ISO/IEC17025 (E), "General Requirements for the Competence of Testing and Calibration Laboratories", 2017-11.

4 EMC/EMI Test Requirements

4.1 Electromagnetic Emissions

Objective: To verify that the electromagnetic emissions generated by the product under normal use and in the product's intended environment are below a level as specified by FCC Federal Communications Commission, Part 15; Class A or B requirements for radiated emissions by testing per ANSI C63.4-2014.

Class A is utilized for non-polling locations, and Class B is utilized for polling locations.

1.2-I – FCC Part 15 Class A and B Conformance

The voting system MUST comply with the Rules and Regulations of the Federal Communications Commission, Part 15; Class A or Class B requirements for radiated and conducted emissions by testing per ANSI C63.4-2014.

The voting system documentation MUST indicate whether devices comprising the system are intended to be located in non-polling places (Class A) or polling places (Class B).



4.1.1 Radiated Electromagnetic Emissions

Frequency Bands:

30 MHz - 1 GHz, FCC Part 15. Class B.

1 GHz - 10 GHz, FCC Part 15. Class B.

Deviations from Test Method: None

4.1.2 Conducted Electromagnetic Emissions

Frequency Bands:

150 kHz - 30 MHz, FCC Part 15. Class B.

Deviations from Test Method: None

4.2 Electromagnetic Immunity

Objective: To verify that the product performs as intended when exposed to different types of electromagnetic energies that may be encountered under normal use in the product's intended environment.

4.2.1 Electrostatic Disruption

2.7-K – Electrostatic discharge immunity

The voting system MUST be able to withstand testing in accordance with the latest IEC 61000-4-2 (2008), level 4, applying an air discharge or a contact discharge according to the nature of the enclosure of the voting system, and without damage, disruption of normal operation, or loss of data.

Application of electrostatic discharge points to COTS components MAY be performed.

The voting system may cycle power or have momentary interruption of power provided that normal operation is resumed without human intervention or loss of data.

Test Level 4:

Will not exceed the required ESD limits for all ESD test levels.

Test Location	Test Voltage +/- (kV)
Indirect Contact: HCP	8.00
Indirect Contact: VCP	8.00
Direct Contact to Metallic Surfaces	8.00
Air Discharges to Insulated Surfaces	2.00, 4.00, 8.00, 15.00

Deviations from Test Method: None

4.2.2 Electromagnetic Susceptibility (Radiated RF Immunity)

2.7-G – Electrical disturbance

The voting system MUST be able to withstand testing in accordance with the latest IEC 61000-4-3 (2020) standard for radiated immunity, without disruption of normal operation or loss of data.

Test Level 3:

Test field strength (V/m)	Frequency Range (MHz)	Modulation/Sweep
10 V/m	80 to 1000	1 kHz 80% AM, 1% steps with 3s dwell

Deviations from Test Method: None

4.2.3 Electrical Fast Transient (EFT)

2.7-I – Withstand conducted electrical disturbances

The voting system MUST be able to withstand testing in accordance with the latest IEC 61000-4-4 (2012) standard for electrical fast transient protection, without disruption of normal operation or loss of data.

Note: Repetition Rate for all transient pulses will be 100 kHz

Test Level 3:

- +2 kV and –2 kV on External Power lines (both AC and DC)
- +1 kV and –1 kV on Input/Output lines (signal, data, and control lines) longer than 3 meters
- Repetition Rate for all transient pulses will be 100 kHz

Deviations from Test Method: None

4.2.4 Lightning Surge

2.7-I – Withstand conducted electrical disturbances

The voting system MUST be able to withstand testing in accordance with the latest IEC 61000-4-5 (2014) standard for lightning surge protection, without disruption of normal operation or loss of data.

Test Levels 3-4: Differential Mode – 2kV, Level 3. Common Mode – 2kV, Level 4.

Test Voltage: +/- kV	Coupling Mode
+/- 2 kV	AC line to line (Differential Mode)

+/- 2 kV	AC line to earth (Common Mode)
+/- 0.5 kV	DC line to line >10m (Differential Mode)
+/- 0.5 kV	DC line to earth >10m (Common Mode)
+/- 1 kV	I/O signal/control >30m

Deviations from Test Method: None

4.2.5 Electrical Power Disturbance (Voltage Dips)

2.7-I – Withstand conducted electrical disturbances

The voting system MUST be able to withstand testing in accordance with the latest IEC61000-4-11 (2020) standard for power dips, interruptions, and variations immunity, without disruption of normal operation or loss of data.

Test Class 1:

Electrical Power Disturbance
Voltage dip of 30% of nominal @10 MS;
Voltage dip of 60% of nominal @100 mms & 1 sec
Voltage dip of >95% interrupt @5 sec
Surges of + 15% and – 15% line variations of nominal line voltage
Electric power increases of 7.5% and reductions of 12.5% of nominal specified power supply for a period of up to four hours at each power level

Deviations from Test Method: None

The voting system MUST not be disturbed by a temporary overvoltage of 120 % normal line voltage lasting from 3 mess to 0.5 s, applied in gradual steps of overvoltage across the line and neutral terminals.

The voting system MUST not be disturbed nor overheat for a permanent overvoltage of 10% above the nominal 120 V rating of the voting system, applied in gradual steps of overvoltage across the line and neutral terminals.

4.2.6 Conducted RF Immunity

2.7-J – Emissions from other connected equipment

The voting system MUST be able to withstand testing in accordance with the latest IEC 61000-4-6 (2013) standard for conducted immunity, without disruption of normal operation or loss of data.



Test Level 3:

Conducted RF Energy
10V rms over the frequency range 150 KHz to 80 MHz with an 80% amplitude modulation with a 1 KHz sine wave AC & DC power.
10V sig/control >3 m over the frequency range 150 KHz to 80 MHz with an 80% amplitude modulation with a 1 KHz sine wave

Deviations from Test Method: None

5 EMC/EMI Test Summary

The following Table shows the tests to be performed on the UUT.

Test	Test Specification	VVSG 2.0	Comments
Electromagnetic Emissions Tests			
Radiated Electromagnetic Emissions	FCC, Part 15 Class A/B ANSI C63.4-2014. Class B [FCC19a]	1.2-I.1, 1.2-I.2	
Conducted Electromagnetic Emissions	FCC, Part 15 Class A/B ANSI C63.4-2014. Class B [FCC19a]	1.2-I.1, 1.2-I.2	
Electromagnetic Immunity Tests			
Electrostatic Disruption	IEC 61000-4-2	2.7-K	
Electromagnetic Susceptibility	IEC 61000-4-3	2.7-G	
Electrical Fast Transient	IEC 61000-4-4	2.7-I	
Lightning Surge	IEC 61000-4-5	2.7-I	
Electrical Power Disturbance	IEC 61000-4-11	2.7-I	
Conducted RF Immunity	IEC 61000-4-6	2.7-J	

End of ELEC Hardware Test Plan
