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EMC TEST REPORT – 349802-2TRFEMC

Applicant:

Nanoptix

Product name:

Thermal Printer

Model:

HSVL Advanced

Model variants:

HSVL Plus

HSVL Plus L

HSVL Plus FS

Specification:

EN 55024:2010

Information technology equipment

Immunity characteristics

Limits and methods of measurement

Date of issue: March 22, 2018

Test engineer(s):	Daniel Hynes, Senior EMC Specialist	Signature:	
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Limits of responsibility

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.
This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contained in this report are within Nemko Canada's ISO/IEC 17025 accreditation.

Copyright notification

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Section 1 Report summary

1.1 Test specifications

EN 55024:2010	Information technology equipment Immunity characteristics Limits and methods of measurement

1.2 Exclusions

None

1.3 Statement of compliance

In the configuration tested, the EUT was found compliant.

Testing was performed against all relevant requirements of the test standard except as noted in section 1.2 above. Results obtained indicate that the product under test complies in full with the requirements tested. The test results relate only to the items tested.

See "Summary of test results" for full details.

1.4 Test report revision history

Table 1.4-1: *Test report revision history*

Revision #	Date of issue	Details of changes made to test report
TRF	March 22, 2018	Original report issued

Section 2 Summary of test results

2.1 Testing period

Test start date	March 7, 2018
Test end date	March 16, 2018

2.2 Test results

Table 2.2-1: *Immunity results*

Test description	Verdict
Enclosure	
Power-frequency magnetic field	Not applicable
Radio-frequency electromagnetic field amplitude modulated	Pass
Electrostatic discharge (ESD)	Pass
Signal ports and telecommunication ports	
Radio-frequency continuous conducted	Pass
Surge (line to ground)	Not applicable
Fast transients	Pass
Input DC power port (excluding equipment marketed with an a.c/d.c, power converter)	
Radio-frequency continuous conducted	Not applicable
Surge (line to ground)	Not applicable
Fast transients	Not applicable
Input AC power ports (including equipment marketed with a separate a.c./d.c power converter)	
Radio-frequency continuous conducted	Pass
Voltage dip	Pass
Voltage interruptions	Pass
Surge	Pass
Fast transients	Pass

Notes: None

Section 3 Equipment under test (EUT) details

3.1 Applicant

Company name	Nanoptix Inc.
Address	699 Champlain Street, Dieppe, NB, E1A 1P6

3.2 Manufacturer

Company name	Nanoptix Inc.
Address	699 Champlain Street, Dieppe, NB, E1A 1P6

3.3 Sample information

Receipt date	March 2, 2018
Nemko sample ID number	Item # 4

3.4 EUT information

Product name	Thermal Printer
Model	HSVL Advanced
Model variants	HSVL Plus, HSVL Plus L, HSVL Plus FS
Serial number	HC00166
Part number	950028
Power requirements	24 V_{DC}, 2.4 A
Description/theory of operation	Thermal printer. To load the paper, power the printer and insert the paper in the green paper in slot. The printer will automatically pull the paper. The printer is used in machines like video lottery terminals to print receipts. It can receive print jobs from either USB full speed or RS-232 serial port.
Operational frequencies	192 MHz internal to the processor and 96 MHz for memory access.
Software details	Firmware version: HSV-6.23B

3.5 EUT setup details

EUT description of the methods used to exercise the EUT and all relevant ports:

- To load the paper, power the printer and insert the paper in the green paper in slot. The printer will automatically pull the paper. It can receive print jobs from either USB full speed or RS-232 serial port. For testing, the printer is connected to a computer with USB cable and RS-232 serial cable. The Nanoptix Printer Status application is run on the computer to send print job every 10 seconds.

EUT setup/configuration rationale:

- The EUT setup in a configuration that was expected to produce the highest amplitude emissions relative to the limit and that satisfy normal operation/installation practice by the end user.
- The type and construction of cables used in the measurement set-up were consistent with normal or typical use. Cables with mitigation features (for example, screening, tighter/more twists per length, ferrite beads) have been noted below:
  - The following deviations were:
  - None
- The EUT was setup in a manner that was consistent with its typical arrangement and use. The measurement arrangement of the EUT, local AE and associated cabling was representative of normal practice. Any deviations from typical arrangements have been noted below:
  - The following deviations were:
  - None

EUT monitoring method:

- The printer prints a ticket every 10 seconds. If an error is detected by the printer, it'll sound a buzzer.

3.5 EUT setup details, continued

Table 3.5-1: *EUT sub assemblies*

Description	Brand name	Model, Part number, Serial number, Revision level
HSVL Advanced Thermal printer	Nanoptix Inc.	MN: HSVL Advanced, PN: 950028, SN: HC00166, Rev. 00
HSVL Plus Thermal printer	Nanoptix Inc.	MN: HSVL Plus, PN: 950024, SN: HP00713, Rev. 00
HSVL Plus L Thermal printer	Nanoptix Inc.	MN: HSVL Plus L, PN: 950029, SN: HL00161, Rev. 00
HSVL Plus FS Thermal printer	Nanoptix Inc.	MN: HSVL Plus FS, PN: 950026, SN: HF00233, Rev. 00
Switching Power Adapter	FSP GROUP INC. / Sparkle Power	MN: FSP060-RAA, PN: 9NA0602814, SN: H2261002837

Table 3.5-2: *EUT interface ports*

Description	Qty.
DC Power Input	1
RS-232 (DB9 Female Connector)	1
USB (mini-B Connector)	1

Table 3.5-3: *Support equipment*

Description	Brand name	Model, Part number, Serial number, Revision level
Laptop Computer	Dell	MN: Latitude D630C, SN: 2HT0CG1

Table 3.5-4: *Inter-connection cables*

Cable description	From	To	Length (m)
2 Conductor DC Power Cable	DC Power Input	Switching Power Adapter	2
DB9 to DB9 Null Cable	RS-232 (DB9 Female Connector)	Laptop Computer	5
Type A to Mini-B USB Cable	USB (mini-B Connector)	Laptop Computer	5

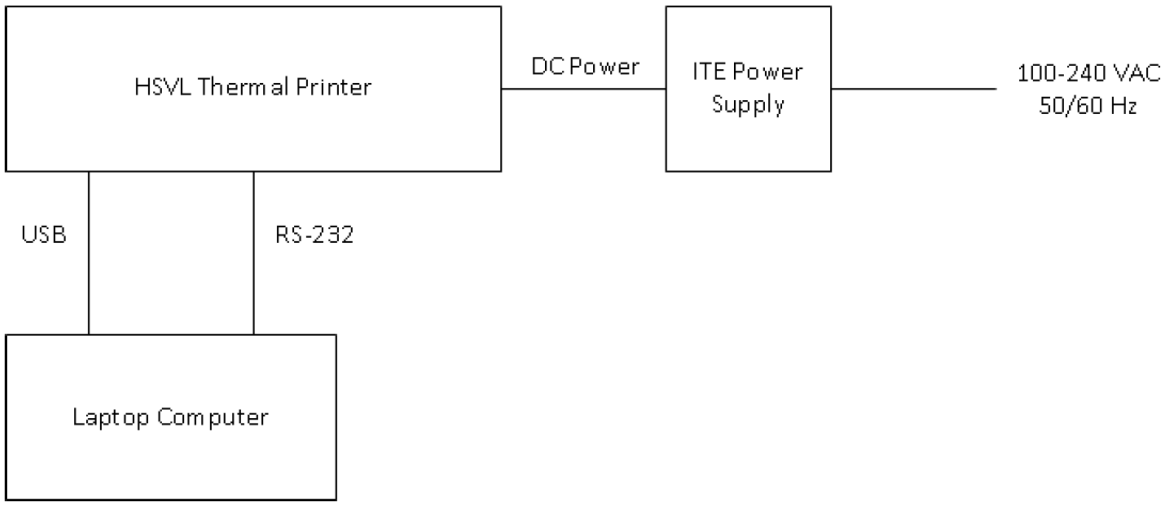

Figure 3.5-1: *block diagram*

Section 4 Engineering considerations

4.1 Modifications incorporated in the EUT

There were no modifications performed to the EUT during this assessment.

4.2 Technical judgment

The HSVL Advanced Thermal Printer was chosen by the customer to be representative of the other HSVL printers. The justification for this choice is as follows:

- The HSVL Advanced is a thermal printer in a plastic frame designed to be used in any kiosk terminal by using innovatively designed movable spindle arms. It's mainly used for printing receipts and/or tickets.

- "HSVL Plus", "HSVL Plus L" and "HSVL Plus FS" are metal frame thermal printers used in kiosk terminal to print receipts and/or tickets. The "HSVL Plus L" is almost a mirror image of the "HSVL Plus". All 3 printers are using the same electronic circuits and cables as the HSVL Advanced. Only the frame (shape and metal vs plastic) differ these printer to the HSVL Advanced. These were initially designed to fit specific kiosk terminals as the HSVL Advanced is designed to adapt to various kiosks.

- In the case of ESD, all printers were assessed.

4.3 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

Section 5 Test conditions

5.1 Atmospheric conditions

Temperature	15–30 °C
Relative humidity	20–75 %
Air pressure	86–106 kPa

When it is impracticable to carry out tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests shall be recorded and stated.

5.2 Power supply range

The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages ±5 %, for which the equipment was designed.

Section 6 Measurement uncertainty

6.1 Uncertainty of measurement

Nemko Canada Inc. has calculated measurement uncertainty and is documented in EMC/MUC/001 "Uncertainty in EMC measurements." Measurement uncertainty was calculated using the methods described in CISPR 16-4 Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC measurements; as well as described in UKAS LAB34: The expression of Uncertainty in EMC Testing. Measurement uncertainty calculations assume a coverage factor of K=2 with 95% certainty.

Section 7 Terms and definitions

7.1 Performance terms and definitions

General performance criteria, Reference Clause 7.1 of EN 55024:2010	The manufacturer has the obligation to express the performance criteria in terms which relate to the performance of his specific product when used as intended. The following performance criteria are applicable, and shall only be evaluated when the functions referred to are implemented. Examples of functions defined by the manufacturer to be evaluated during testing include, but are not limited to, the following: – Essential operational modes and states; – Tests of all peripheral access (hard disks, floppy disks, printers, keyboard, mouse, etc.); – Quality of software execution; – Quality of data display and transmission; – Quality of speech transmission.
Performance criterion A, Reference Clause 7.2 of EN 55024:2010	During and after the test the EUT shall continue to operate as intended without operator intervention. No degradation of performance or loss of function is allowed below a minimum performance level specified by the manufacturer when the EUT is used as intended. The performance level may be replaced by a permissible loss of performance. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the EUT if used as intended.
Performance criterion B, Reference Clause 7.3 of EN 55024:2010	After the test, the EUT shall continue to operate as intended without operator intervention. No degradation of performance or loss of function is allowed, after the application of the phenomena below a performance level specified by the manufacturer, when the EUT is used as intended. The performance level may be replaced by a permissible loss of performance. During the test, degradation of performance is allowed. However, no change of operating state or stored data is allowed to persist after the test. If the minimum performance level (or the permissible performance loss) is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the EUT if used as intended.
Performance criterion C, Reference Clause 7.4 of EN 55024:2010	During and after testing, a temporary loss of function is allowed, provided the function is selfrecoverable, or can be restored by the operation of the controls or cycling of the power to the EUT by the user in accordance with the manufacturer's instructions. Functions, and/or information stored in non-volatile memory, or protected by a battery backup, shall not be lost.

7.2 General definitions

7.2.1 EN 61000-4-2 (Electrostatic discharge)

Electrostatic discharge; ESD	A transfer of electric charge between bodies of different electrostatic potential in proximity or through direct contact.
Contact discharge method	A method of testing, in which the electrode of the test generator is held in contact with the EUT, and the discharge actuated by the discharge switch within the generator.
Air discharge method	A method of testing, in which the charged electrode of the test generator is brought close to the EUT, and the discharge actuated by a spark to the EUT.
Direct application	Application of the discharge directly to the EUT.
Indirect application	Application of the discharge to a coupling plane in the vicinity of the EUT, and simulation of personnel discharge to objects, which are adjacent to the EUT.
Coupling plane	A metal sheet or plate, to which discharges are applied to simulate electrostatic discharge to objects adjacent to the EUT. HCP: Horizontal Coupling Plane; VCP: Vertical Coupling Plane.

7.2.2 EN 61000-4-3: (Radiated, radio-frequency, electromagnetic field)

Continuous waves (CW)	Electromagnetic waves, the successive oscillations of which are identical under steady-state conditions, which can be interrupted or modulated to convey information.
Electromagnetic (EM) wave	Radiant energy produced by the oscillation of an electric charge characterized by oscillation of the electric and magnetic fields.
Field strength	The term “field strength” is applied only to measurements made in the far field. The measurement may be of either the electric or the magnetic component of the field and may be expressed as V/m, A/m or W/m2; any one of these may be converted into the others.
Sweep	Continuous or incremental traverse over a range of frequencies.

7.2.3 EN 61000-4-4 (Electrical fast transient/burst)

Burst	Sequence of a limited number of distinct pulses or an oscillation of limited duration.
Common mode (coupling)	Simultaneous coupling to all lines versus the ground reference plane.
Ground reference plane	Flat conductive surface whose potential is used as a common reference.
Coupling clamp	Device of defined dimensions and characteristics for common mode coupling of the disturbance signal to the circuit under test without any galvanic connection to it.
Transient	Pertaining to or designating a phenomenon or a quantity which varies between two consecutive steady states during a time interval which is short compared with the time-scale of interest.

7.2 General definitions, continued

7.2.4 EN 61000-4-5 (Surge)

Surge	Transient wave of electrical current, voltage, or power propagating along a line or a circuit and characterized by a rapid increase followed by a slower decrease.
Ground (reference)	Part of the Earth considered as conductive, the electrical potential of which is conventionally taken as zero, being outside the zone of influence of any earthing (grounding) arrangement.

7.2.5 EN 61000-4-6 (Immunity to conducted disturbances, induced by radio-frequency fields)

Clamp injection	Clamp injection is obtained by means of a clamp-on “current” injecting device on the cable.
Coupling/decoupling network CDN	Electrical circuit incorporating the functions of both the coupling and decoupling networks.
Sweep	Continuous or incremental traverse over a range of frequencies.

7.2.6 EN 61000-4-8 (Power frequency magnetic field)

Induction coil	Conductor loop of defined shape and dimensions, in which flows a current, generating a magnetic field of defined constancy in its plane and in the enclosed volume.
Immersion method	Method of application of the magnetic field to the EUT, which is placed in the centre of an induction coil.
Proximity method	Method of application of the magnetic field to the EUT, where a small induction coil is moved along the side of the EUT in order to detect particularly sensitive areas.
Ground	A flat conductive surface whose potential is used as a common reference for the magnetic field generator and the auxiliary equipment (the ground plane can be used to close the loop of the induction coil.

7.2.7 EN 61000-4-11 (Voltage dips, short interruptions and voltage variations)

Voltage dip	A sudden reduction of the voltage at a particular point of an electricity supply system below a specified dip threshold followed by its recovery after a brief interval.
Short interruption	A sudden reduction of the voltage on all phases at a particular point of an electric supply system below a specified interruption threshold followed by its restoration after a brief interval.

Section 8 Testing data

8.1 Radio-frequency electromagnetic field amplitude modulated

8.1.1 References and limits

- EN 55024:2010
- EN 61000-4-3:2006 + A1:2008 + A2:2010

Table 8.1-1: *Radio-frequency electromagnetic field amplitude modulated specification*

Test specification	Performance criteria	Basic standard
80–1000 MHz, 3 V/m (unmodulated), 80 % AM (1 kHz)	A	EN 61000-4-3

Notes: The frequency range is scanned as specified. However, when specified in Annex A (EN 55024:2010), an additional comprehensive functional test shall be carried out at a limited number of frequencies. The selected frequencies are: 80, 120, 160, 230, 434, 460, 600, 863 and 900 MHz (±1 %).

8.1.2 Test summary

Verdict	Pass		
Test date	March 7, 2018	Temperature	24.0 °C
Test engineer	Daniel Hynes	Air pressure	1008.8 mbar
Test location	Montreal	Relative humidity	34.8 %

8.1.3 Notes

During the radiated immunity assessment, it was observed that the printer would periodically not properly cut the paper and a paper jam would occur. This observation was inconsistent and difficult to reproduce. Repeatability was not consistent enough to deem the EUT as being susceptible to the radiated immunity fields.

8.1.4 Setup details

Table 8.1-2: *Radio-frequency electromagnetic field amplitude modulated equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
3 m EMI test chamber	TDK	SAC-3	FA002532	1 year	March 25/18
3 Phase AC Power Source	apc AC Power	45 kVA	FA002677	—	VOU
Power Meter	HIOKI	PW3337	FA002727	1 year	July 25/18
Bilog antenna (20–2000 MHz)	Sunol	JB1	FA002517	1 year	Dec. 6/18
Starprobe (2–40000 MHz)	AR	FI7040	FA002592	1 year	Oct. 30/18
Laser probe interface	AR	FI7000	FA002054	—	NCR
Directional coupler (80–1000 MHz)	AR	DC6180	FA001659	1 year	Feb. 8/19
Power meter	Rohde & Schwarz	NRP	FA002485	1 year	Nov. 2/18
Power sensor	Rohde & Schwarz	NRP-Z91	FA002488	1 year	Nov. 3/18
Signal generator	Rohde & Schwarz	SMR 40	FA002698	1 year	May 19/18
Amplifier (80–1000 MHz, 250 W)	AR	250W1000A	FA002088	—	NCR

Notes: NCR - no calibration required
VOU - verify on use

Table 8.1-3: *Radio-frequency electromagnetic field amplitude modulated test software details*

Manufacturer of Software	Details
Rohde & Schwarz	EMC32, Software for EMC Measurements, Version 9.26.01

8.1.5 Test data

Table 8.1-4: *Swept frequency – Radio-frequency electromagnetic field amplitude modulated results*

Step size increment	1 %
Dwell time[1]	5 s
Antenna polarization	Vertical and Horizontal
Modulation	CW signal amplitude modulated (AM) with 80 % depth with a 1 kHz sine wave
EUT setup configuration	Table top
EUT power input during test	230 V_{AC}, 50 Hz
EUT position facing antenna	Front side, back side, left side and right side

Frequency range, MHz		Test level, V/m	Comments
80	1000	3	No degradation[2]

Notes: [1]The dwell time at each frequency shall not be less than the time necessary for the EUT to be exercised and to be able to respond. However, the dwell time shall not exceed 5 seconds at each of the frequencies during the scan. The time to exercise the EUT is not interpreted as a total time of a program or a cycle but related to the reaction time in case of failure of the EUT.
[2]During the radiated immunity assessment, it was observed that the printer would periodically not properly cut the paper and a paper jam would occur. This observation was inconsistent and difficult to reproduce. Repeatability was not consistent enough to deem the EUT as being susceptible to the radiated immunity fields.

8.1.6 Setup photo

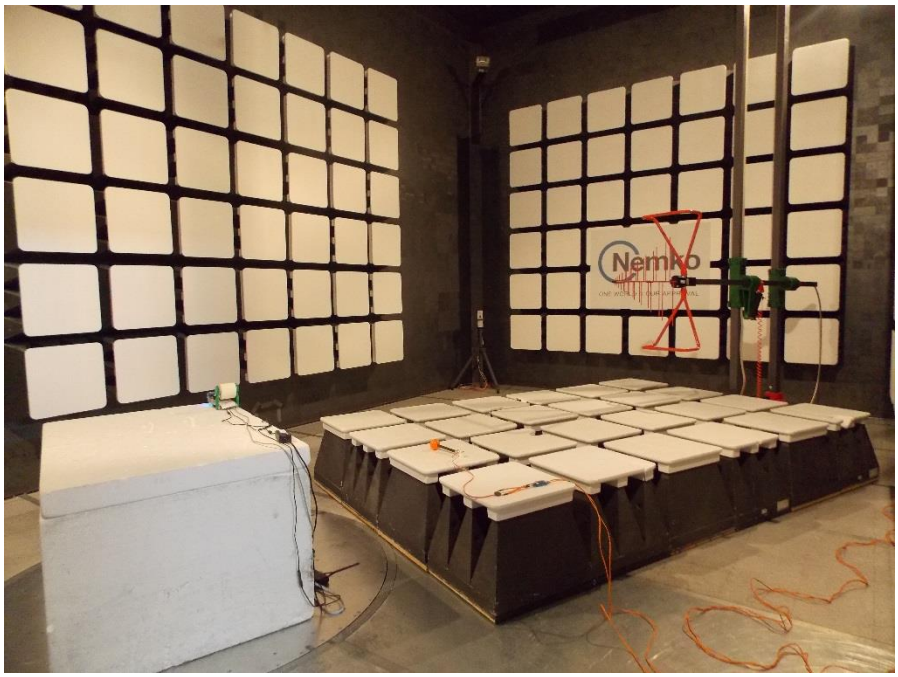

Figure 8.1-1: *Radio-frequency electromagnetic field amplitude modulated setup photo*

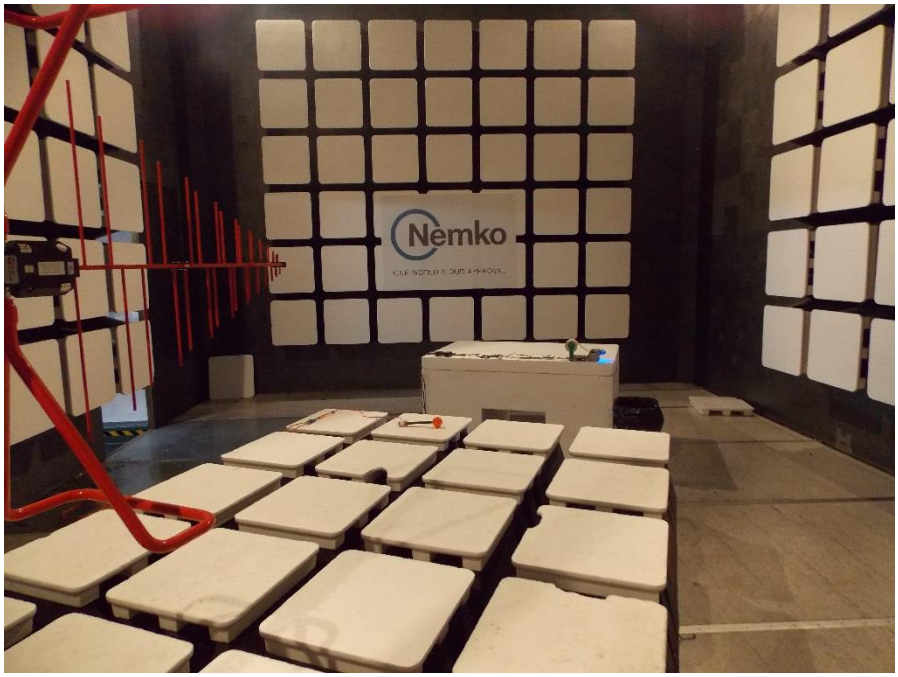

Figure 8.1-2: *Radio-frequency electromagnetic field amplitude modulated setup photo*

8.2 Radio-frequency continuous conducted

8.2.1 References and limits

- EN 55024:2010
- EN 61000-4-6:2009

Table 8.2-1: *Radio-frequency continuous conducted specification*

Test specification	Performance criteria	Basic standard
Signal ports and telecommunication ports [1 and 2]		
0.15–80 MHz, 3 V_{RMS} (unmodulated), 80 % AM (1 kHz)	A	EN 61000-4-6
Input DC power port (excluding equipment marketed with an a.c/d.c, power converter) [1 and 3]		
0.15–80 MHz, 3 V_{RMS} (unmodulated), 80 % AM (1 kHz)	A	EN 61000-4-6
Input AC power ports (including equipment marketed with a separate a.c./d.c power converter) [1]		
0.15–80 MHz, 3 V_{RMS} (unmodulated), 80 % AM (1 kHz)	A	EN 61000-4-6

Notes:
[1] The frequency range is scanned as specified. However, when specified in Annex A (EN 55024:2010), an additional comprehensive functional test shall be carried out at a limited number of frequencies. The selected frequencies for conducted tests are: 0.2, 1, 7.1, 13.56, 21, 27.12 and 40.68 MHz (±1 %).
[2] Applicable only to cables which according to the manufacturer's specification supports communication on cable lengths greater than 3 m.
[3] If d.c. power is fed on conductors included in a signal cable, then the requirements of Signal ports and telecommunication ports only apply to this cable.

8.2.2 Test summary

Verdict	Pass		
Test date	March 15, 2018	Temperature	24.0 °C
Test engineer	Daniel Hynes	Air pressure	992.7 mbar
Test location	Montreal	Relative humidity	34.2 %

8.2.3 Notes

None

8.2.4 Setup details

Table 8.2-2: *Radio-frequency continuous conducted equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
Amplifier	AR	150A220	FA001744	—	NCR
Signal generator	Rohde & Schwarz	SMC100A	FA002484	1 year	Sept. 29/18
6 dB attenuator	Inmet	2N200W-06	FA002482	1 year	Feb. 9/19
50 Ω coax cable	Huber + Suhner	None	FA002557	1 year	Feb. 9/19
CDN-M2	FCC	FCC -801-M2-16A	FA002492	1 year	Oct. 24/18
CDN-M3	FCC	FCC -801-M3-16A	FA002065	1 year	Nov. 14/18
EM injection clamp	FCC	F-2031-23mm	FA002491	1 year	June 12/18
Directional coupler (0.01–250 MHz)	AR	DC2600A	FA001856	1 year	Feb. 9/19
Power meter	Rohde & Schwarz	NRP	FA002486	1 year	Sept. 28/18
Power sensor	Rohde & Schwarz	NRP-Z91	FA002489	1 year	Oct. 3/18

Notes: NCR - no calibration required

Table 8.2-3: *Radio-frequency continuous conducted test software details*

Manufacturer of Software	Details
Rohde & Schwarz	EMC32, Software for EMC Measurements, Version 10.35.02

8.2.5 Test data

Table 8.2-4: *Swept frequency – Radio-frequency continuous conducted results*

Frequency range:	0.15–80 MHz
Step size increment:	1 %
Dwell time[1]:	5 s
Signal level:	3 V_{RMS}
EUT power input during test	230 V_{AC}, 50 Hz
Modulation:	CW signal amplitude modulated (AM) with 80 % depth with a 1 kHz sine wave

Ports investigated	Coupling method	50 Ω termination point	Comments
Power Input	CDN M3	CDN M2 (Support Laptop)	No degradation
RS232	EM Clamp	CDN M3	No degradation
USB	EM Clamp	CDN M3	No degradation

Notes: [1]The dwell time at each frequency shall not be less than the time necessary for the EUT to be exercised and to be able to respond. However, the dwell time shall not exceed 5 seconds at each of the frequencies during the scan. The time to exercise the EUT is not interpreted as a total time of a program or a cycle but related to the reaction time in case of failure of the EUT.

8.2.6 Setup photos

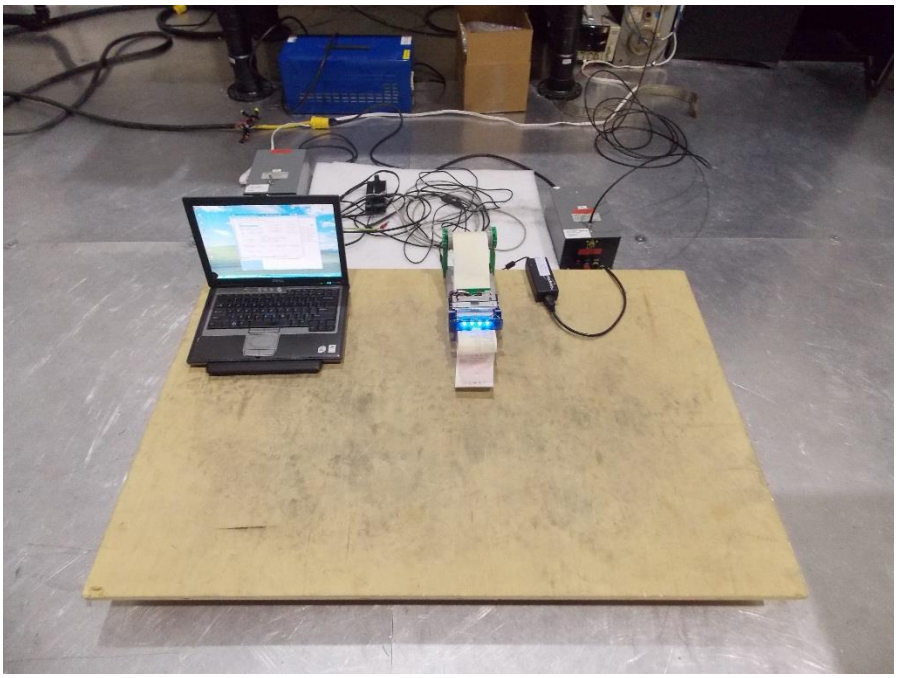

Figure 8.2-1: *Radio-frequency continuous conducted setup photo*

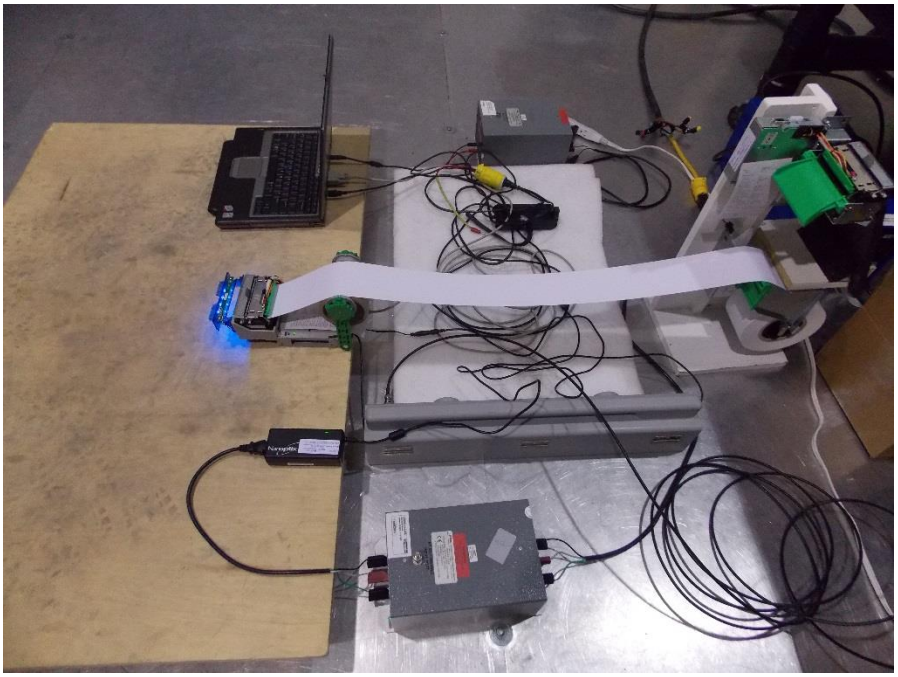

Figure 8.2-2: *Radio-frequency continuous conducted setup photo*

8.3 Electrostatic discharge

8.3.1 References and limits

- EN 55024:2010
- EN 61000-4-2:2009

Table 8.3-1: *Electrostatic discharge specification*

Test specification	Performance criteria	Basic standard
4 (Contact discharge), 8 (Air discharge)	B	EN 61000-4-2

8.3.2 Test summary

Verdict	Pass		
Test date	March 16, 2018	Temperature	23.7 °C
Test engineer	Daniel Hynes	Air pressure	1001.2 mbar
Test location	Montreal	Relative humidity	34.3 %

8.3.3 Notes

The EUT would normally be installed in another device and operators would have limited access to change the paper rolls and to deal with paper jams. During normal operation the EUT would not likely be accessible to the user except for the paper ejection port. ESD has been applied based on reasonable access by the user while avoiding exposed PCBs and other sensitive locations that would not be easily accessed nor touched during normal operations.

8.3.4 Setup details

Table 8.3-2: *Electrostatic discharge equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
ESD gun	EMC-Partner	ESD3000	FA002712	1 year	Jan. 3/19

Notes: None

8.3.5 Test data

Table 8.3-3: *Electrostatic discharge results – HSVL Advanced*

EUT setup configuration:	Table top	
EUT power input during test	230 V_{AC}, 50 Hz	
ESD repetition rate:	1 pulse per second	
Discharges:	25 contact discharges and 10 air discharges at each polarity	
Contact discharge[1 and 2]	**Test voltage (±kV)**	**Comments**
Please refer to "Electrostatic discharge test location points" photos of this section	4	Periodic reboot of the EUT was observed. Self-recovery occurred with each reboot.
Indirect discharge[1 and 2]	**Test voltage (±kV)**	**Comments**
HCP (all sides)	4	No degradation
VCP (all sides)	4	No degradation
Air discharge	**Test voltage (±kV)**	**Comments**
Please refer to "Electrostatic discharge test location points" photos of this section	2, 4, 8	No degradation

Notes: [1]For contact discharge, the requirement to apply ESD discharges at lower levels, as defined in Clause 5 of EN 61000-4-2, is not applicable.
[2] The EUT was exposed to at least 200 discharges, 100 each at negative and positive polarity, at a minimum of four test points. For table-top equipment one of the test points was the centre front edge of the horizontal coupling plane, which was subjected to at least 50 indirect discharges (25 of each polarity). All other test points received at least 50 direct contact discharges (25 of each polarity). If no direct contact test points were available, then at least 200 indirect discharges were applied in the indirect mode.

Electrostatic discharges were applied only to those points and surfaces of the EUT which are expected to be touched during usual operation, including user access, as specified in the user manual, for example cleaning or adding consumables when the EUT is powered.

Table 8.3-4: *Electrostatic discharge results – HSVL Plus*

EUT setup configuration:	Table top	
EUT power input during test	230 V_{AC}, 50 Hz	
ESD repetition rate:	1 pulse per second	
Discharges:	25 contact discharges and 10 air discharges at each polarity	
Contact discharge[1 and 2]	**Test voltage (±kV)**	**Comments**
Please refer to "Electrostatic discharge test location points" photos of this section	4	Periodic reboot of the EUT was observed. Self-recovery occurred with each reboot.
Indirect discharge[1 and 2]	**Test voltage (±kV)**	**Comments**
HCP (all sides)	4	No degradation
VCP (all sides)	4	No degradation
Air discharge	**Test voltage (±kV)**	**Comments**
Please refer to "Electrostatic discharge test location points" photos of this section	2, 4, 8	No degradation

Notes: [1]For contact discharge, the requirement to apply ESD discharges at lower levels, as defined in Clause 5 of EN 61000-4-2, is not applicable.
[2] The EUT was exposed to at least 200 discharges, 100 each at negative and positive polarity, at a minimum of four test points. For table-top equipment one of the test points was the centre front edge of the horizontal coupling plane, which was subjected to at least 50 indirect discharges (25 of each polarity). All other test points received at least 50 direct contact discharges (25 of each polarity). If no direct contact test points were available, then at least 200 indirect discharges were applied in the indirect mode.

Electrostatic discharges were applied only to those points and surfaces of the EUT which are expected to be touched during usual operation, including user access, as specified in the user manual, for example cleaning or adding consumables when the EUT is powered.

8.3.5 Test data, continued

Table 8.3-5: *Electrostatic discharge results – HSVL Plus L*

EUT setup configuration:	Table top	
EUT power input during test	230 V_{AC}, 50 Hz	
ESD repetition rate:	1 pulse per second	
Discharges:	25 contact discharges and 10 air discharges at each polarity	
Contact discharge[1 and 2]	**Test voltage (±kV)**	**Comments**
Please refer to "Electrostatic discharge test location points" photos of this section	4	Periodic reboot of the EUT was observed. Self-recovery occurred with each reboot.
Indirect discharge[1 and 2]	**Test voltage (±kV)**	**Comments**
HCP (all sides)	4	No degradation
VCP (all sides)	4	No degradation
Air discharge	**Test voltage (±kV)**	**Comments**
Please refer to "Electrostatic discharge test location points" photos of this section	2, 4, 8	No degradation

Notes: [1]For contact discharge, the requirement to apply ESD discharges at lower levels, as defined in Clause 5 of EN 61000-4-2, is not applicable.
[2] The EUT was exposed to at least 200 discharges, 100 each at negative and positive polarity, at a minimum of four test points. For table-top equipment one of the test points was the centre front edge of the horizontal coupling plane, which was subjected to at least 50 indirect discharges (25 of each polarity). All other test points received at least 50 direct contact discharges (25 of each polarity). If no direct contact test points were available, then at least 200 indirect discharges were applied in the indirect mode.

Electrostatic discharges were applied only to those points and surfaces of the EUT which are expected to be touched during usual operation, including user access, as specified in the user manual, for example cleaning or adding consumables when the EUT is powered.

Table 8.3-6: *Electrostatic discharge results – HSVL Plus FS*

EUT setup configuration:	Table top	
EUT power input during test	230 V_{AC}, 50 Hz	
ESD repetition rate:	1 pulse per second	
Discharges:	25 contact discharges and 10 air discharges at each polarity	
Contact discharge[1 and 2]	**Test voltage (±kV)**	**Comments**
Please refer to "Electrostatic discharge test location points" photos of this section	4	Periodic reboot of the EUT was observed. Self-recovery occurred with each reboot.
Indirect discharge[1 and 2]	**Test voltage (±kV)**	**Comments**
HCP (all sides)	4	No degradation
VCP (all sides)	4	No degradation
Air discharge	**Test voltage (±kV)**	**Comments**
Please refer to "Electrostatic discharge test location points" photos of this section	2, 4, 8	No degradation

Notes: [1]For contact discharge, the requirement to apply ESD discharges at lower levels, as defined in Clause 5 of EN 61000-4-2, is not applicable.
[2] The EUT was exposed to at least 200 discharges, 100 each at negative and positive polarity, at a minimum of four test points. For table-top equipment one of the test points was the centre front edge of the horizontal coupling plane, which was subjected to at least 50 indirect discharges (25 of each polarity). All other test points received at least 50 direct contact discharges (25 of each polarity). If no direct contact test points were available, then at least 200 indirect discharges were applied in the indirect mode.

Electrostatic discharges were applied only to those points and surfaces of the EUT which are expected to be touched during usual operation, including user access, as specified in the user manual, for example cleaning or adding consumables when the EUT is powered.

8.3.5 Test data, continued

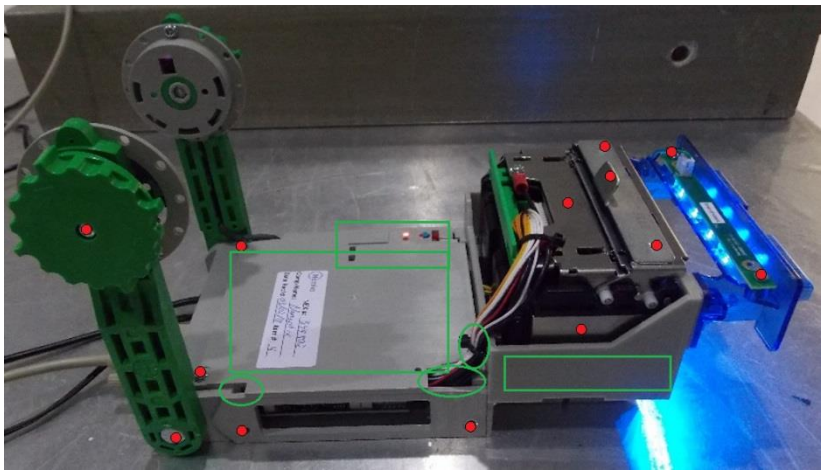

Figure 8.3-1: *Electrostatic discharge test location point's photo – HSVL Advanced*

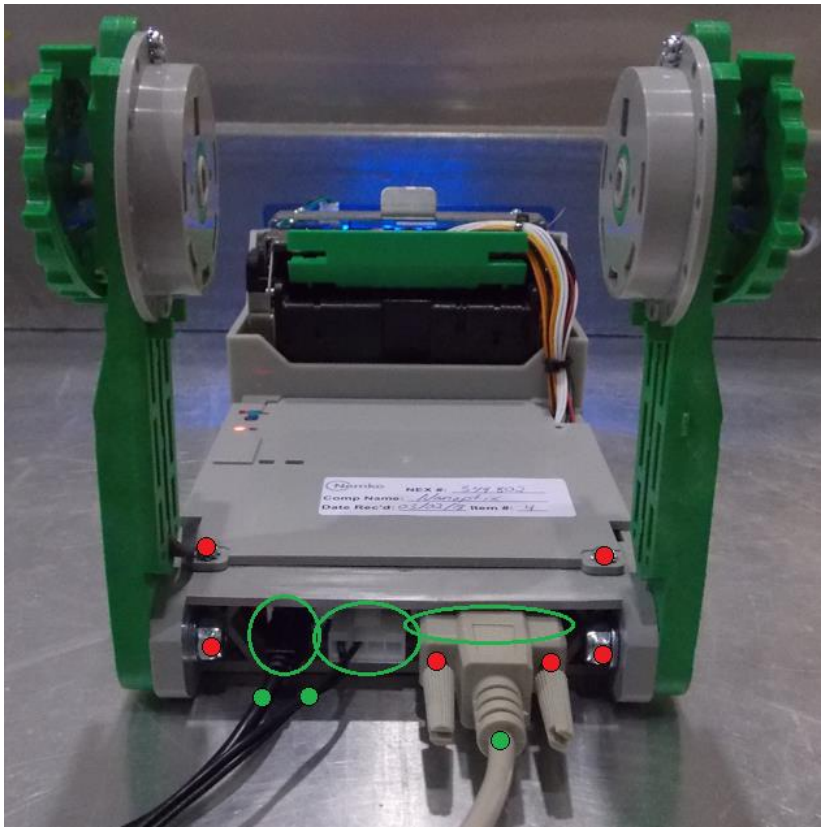

Figure 8.3-2: *Electrostatic discharge test location point's photo – HSVL Advanced*

Red points = contact discharge
Green points = air discharge

8.3.5 Test data, continued

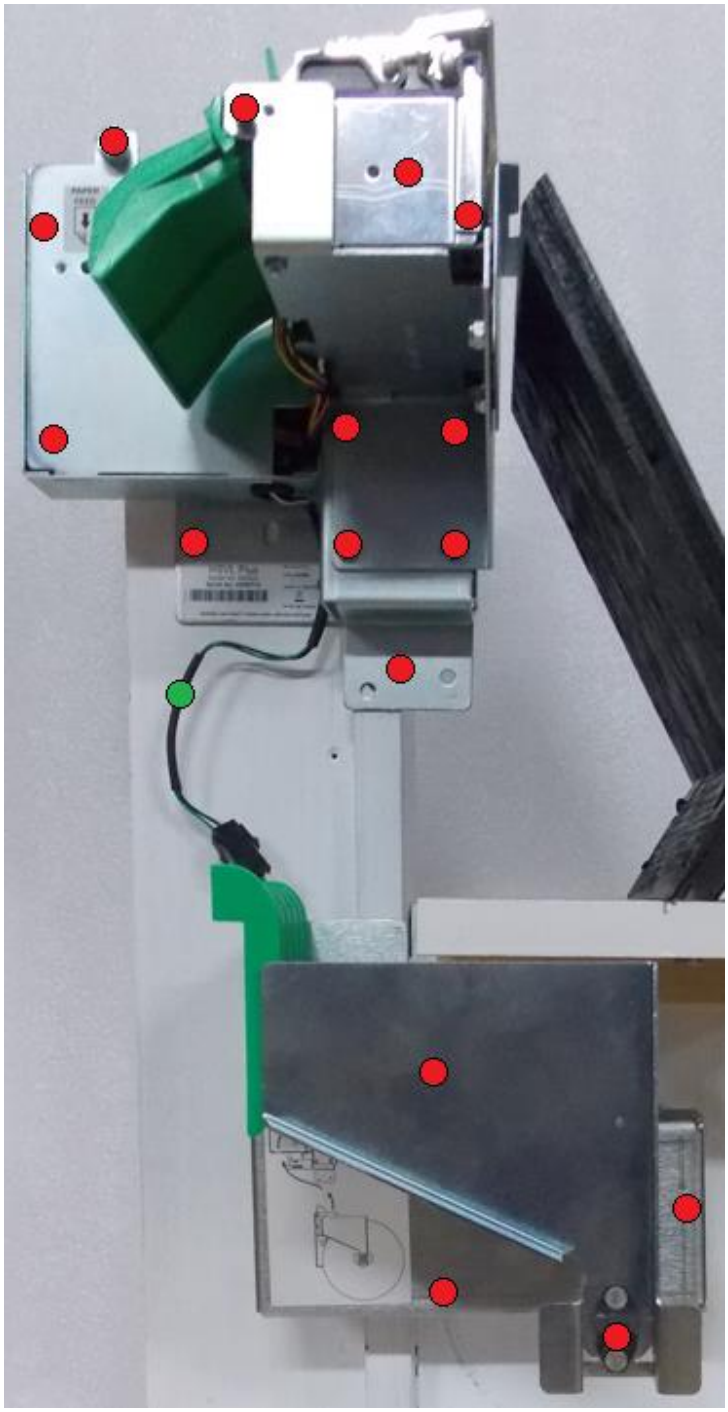

Figure 8.3-3: *Electrostatic discharge test location point's photo – HSVL Plus*

Red points = contact discharge
Green points = air discharge

8.3.5 Test data, continued

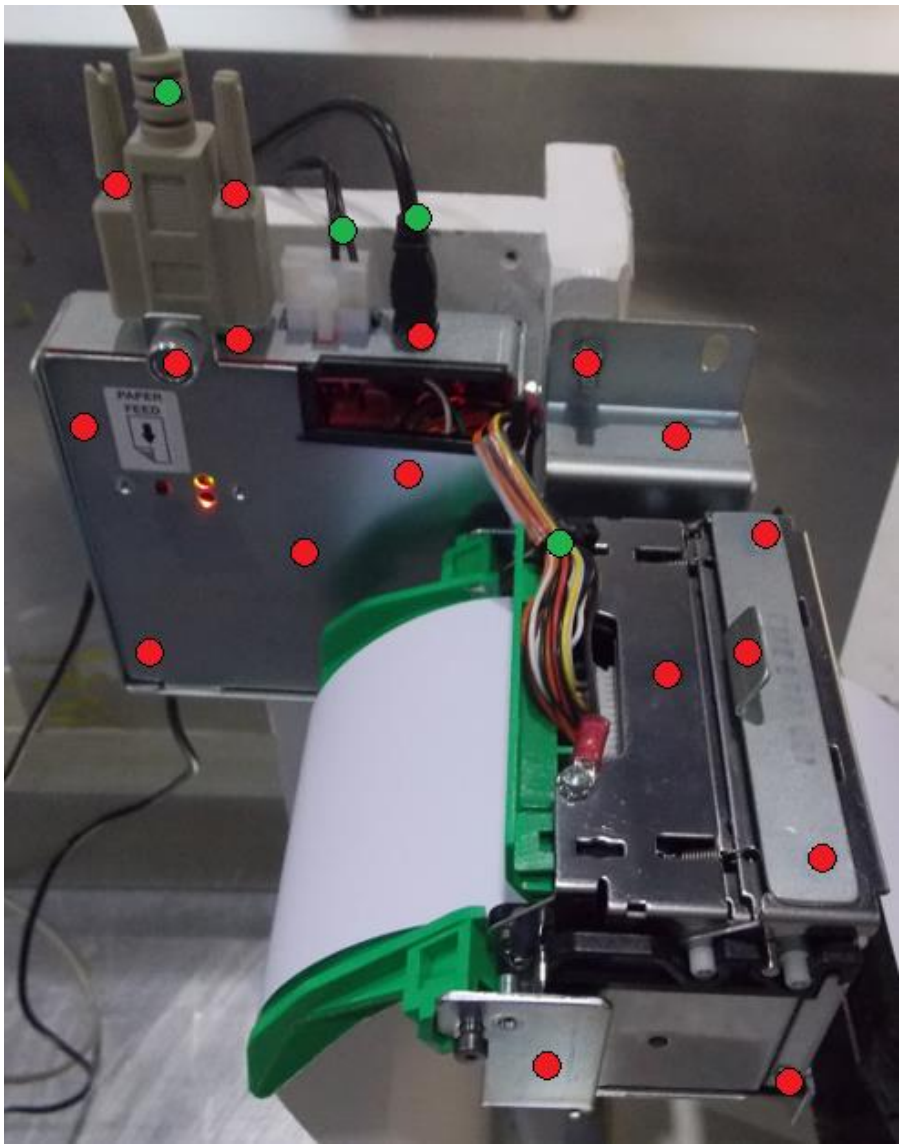

Figure 8.3-4: *Electrostatic discharge test location point's photo – HSVL Plus*

Red points = contact discharge
Green points = air discharge

8.3.5 Test data, continued

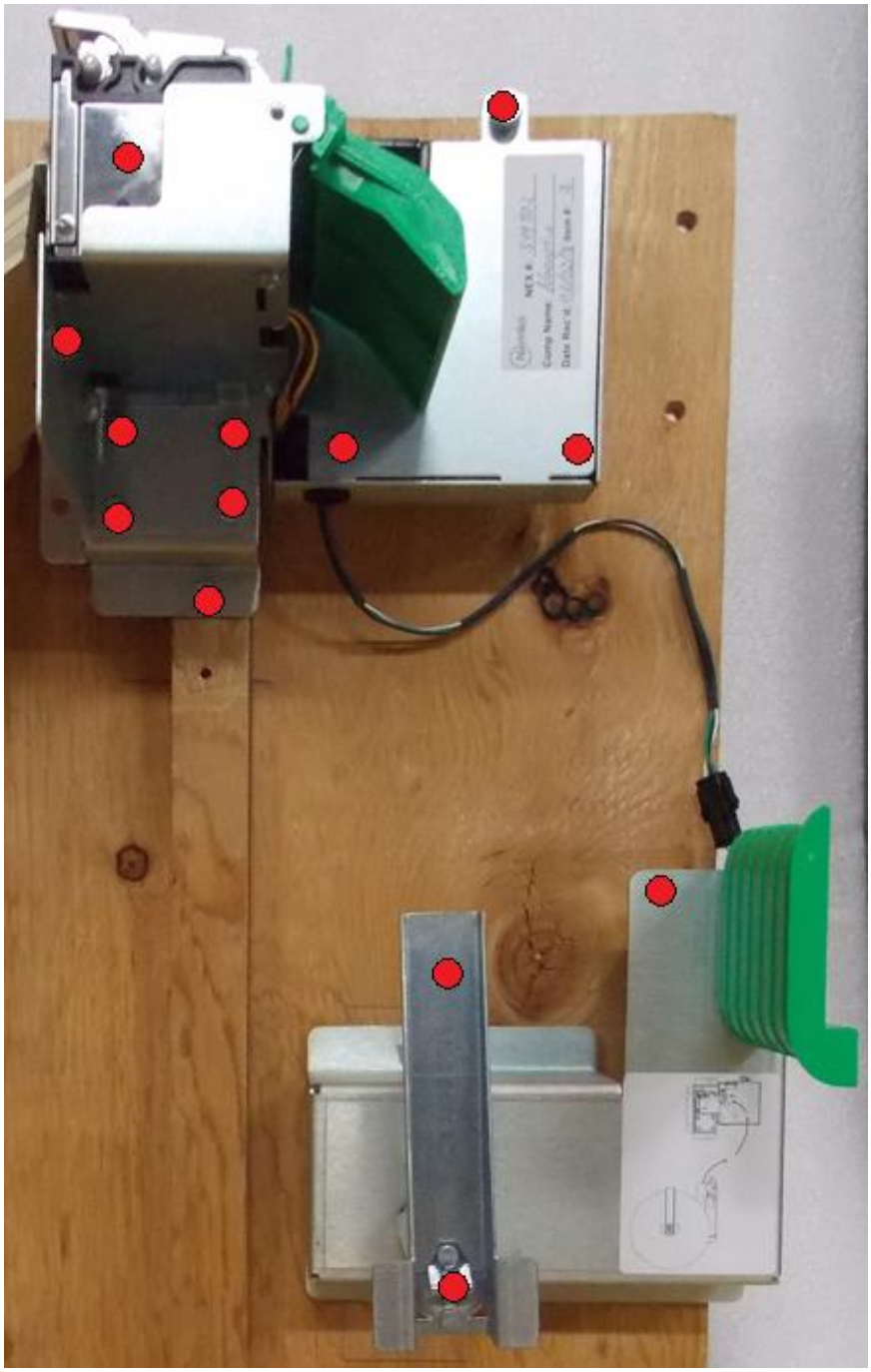

Figure 8.3-5: *Electrostatic discharge test location point's photo – HSVL Plus L*

Red points = contact discharge
Green points = air discharge

8.3.5 Test data, continued

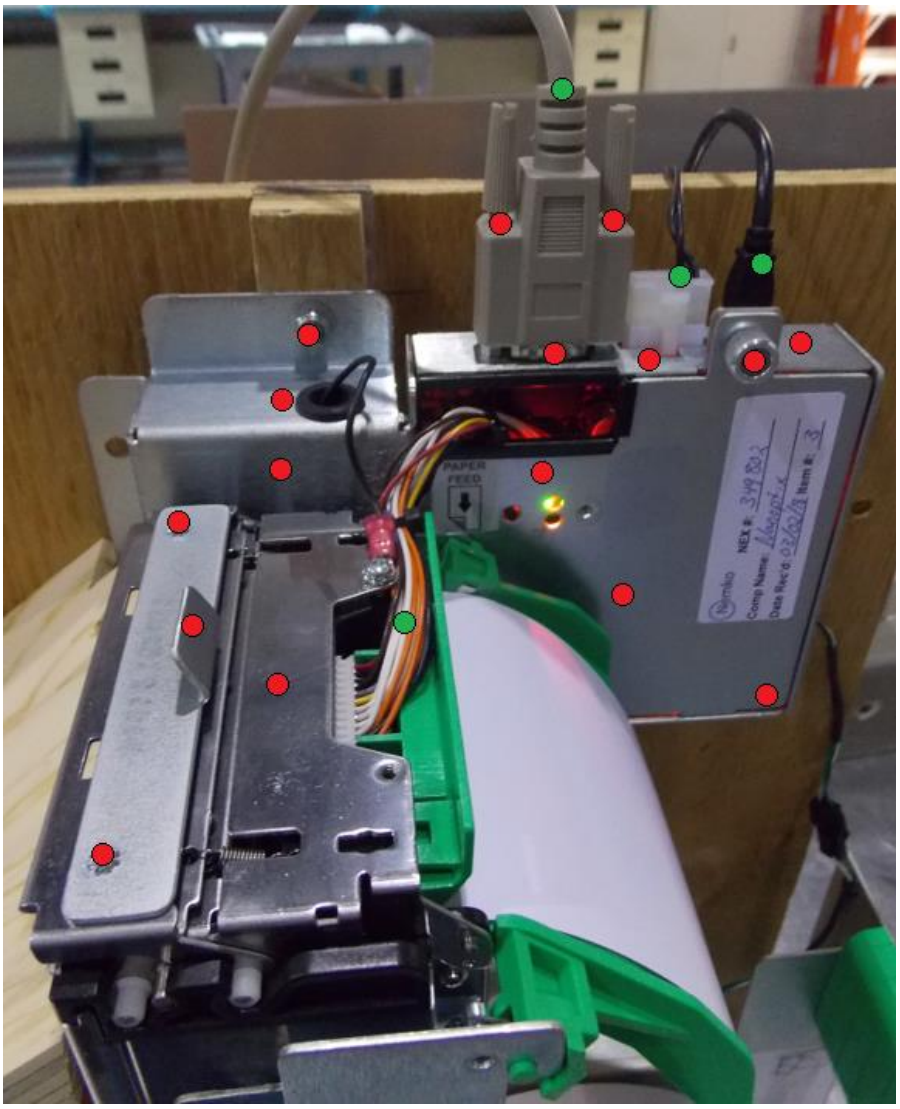

Figure 8.3-6: *Electrostatic discharge test location point's photo – HSVL Plus L*

Red points = contact discharge
Green points = air discharge

8.3.5 Test data, continued

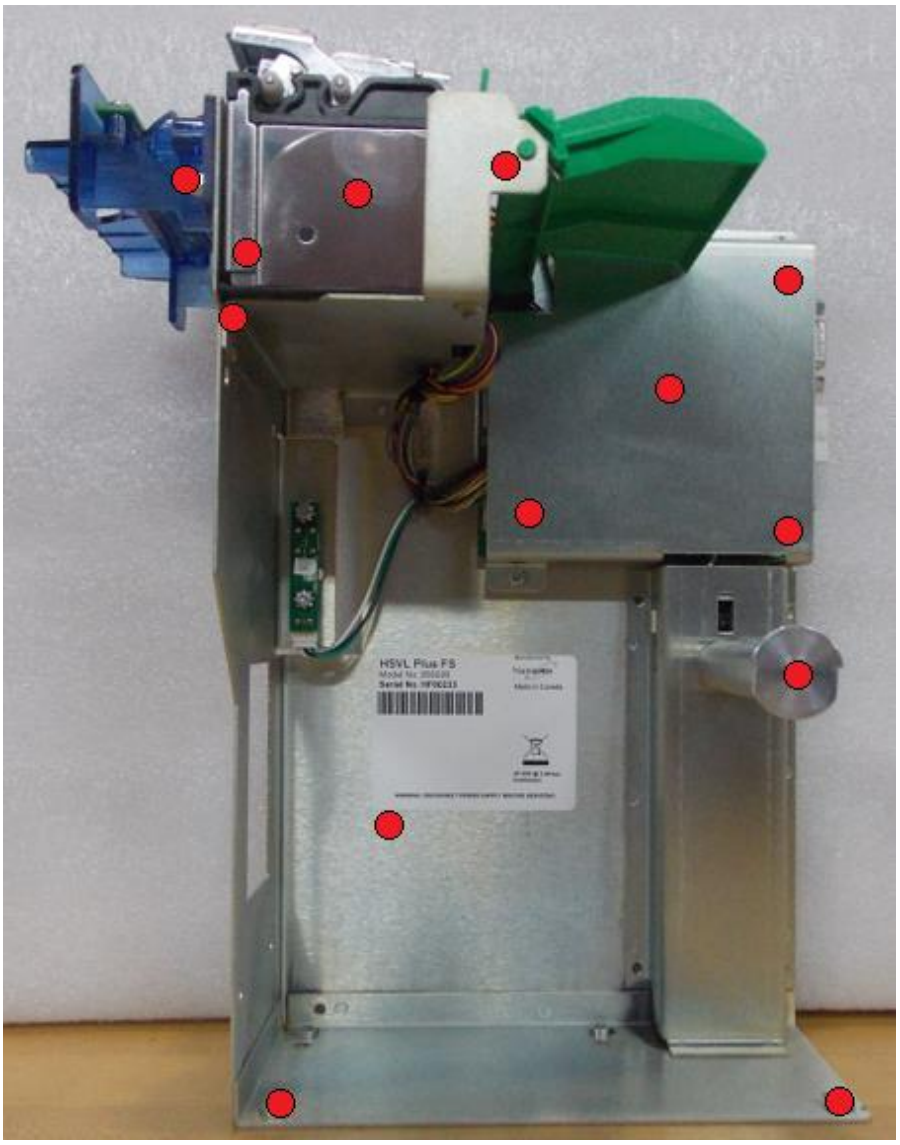

Figure 8.3-7: *Electrostatic discharge test location point's photo – HSVL Plus FS*

Red points = contact discharge
Green points = air discharge

8.3.5 Test data, continued

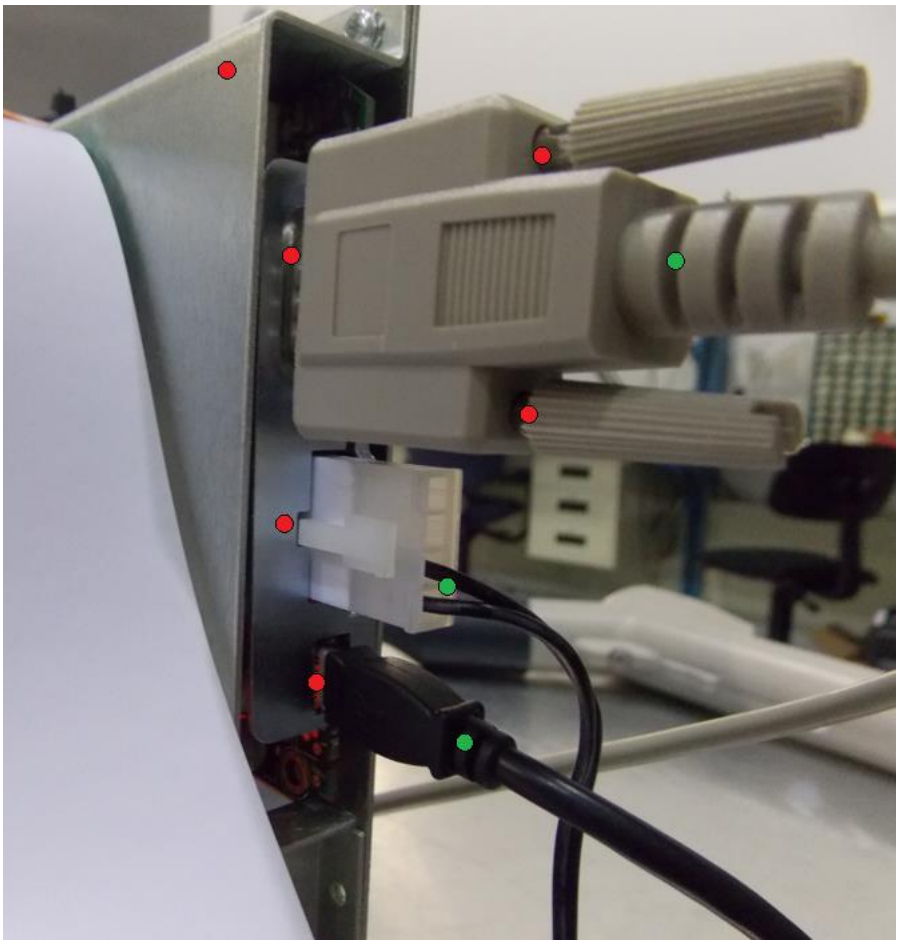

Figure 8.3-8: *Electrostatic discharge test location point's photo – HSVL Plus FS*

Red points = contact discharge
Green points = air discharge

8.3.5 Test data, continued

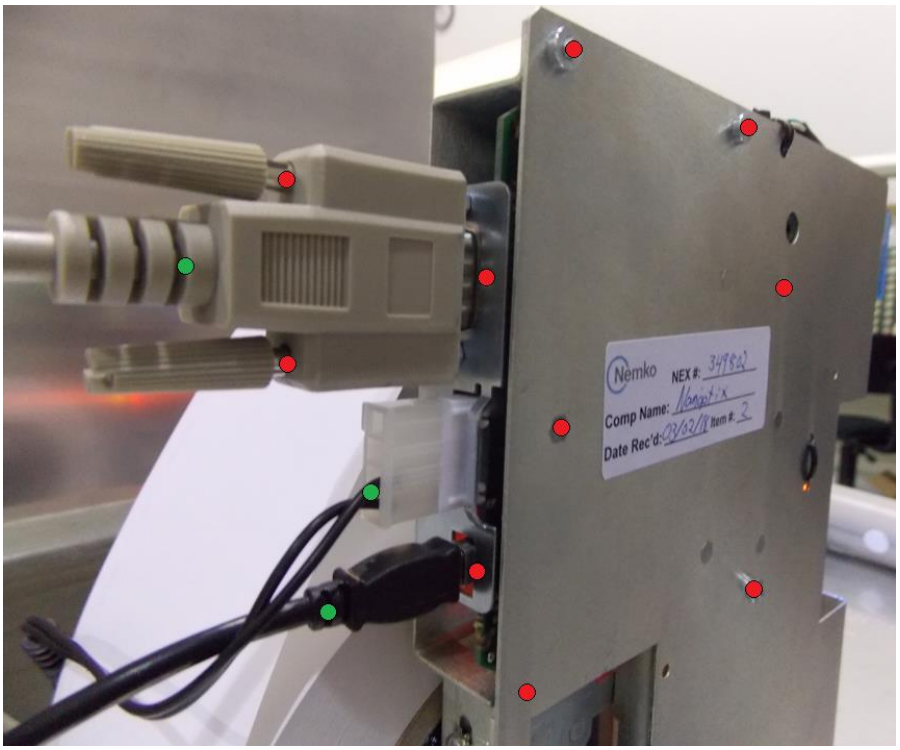

Figure 8.3-9: *Electrostatic discharge test location point's photo – HSVL Plus FS*

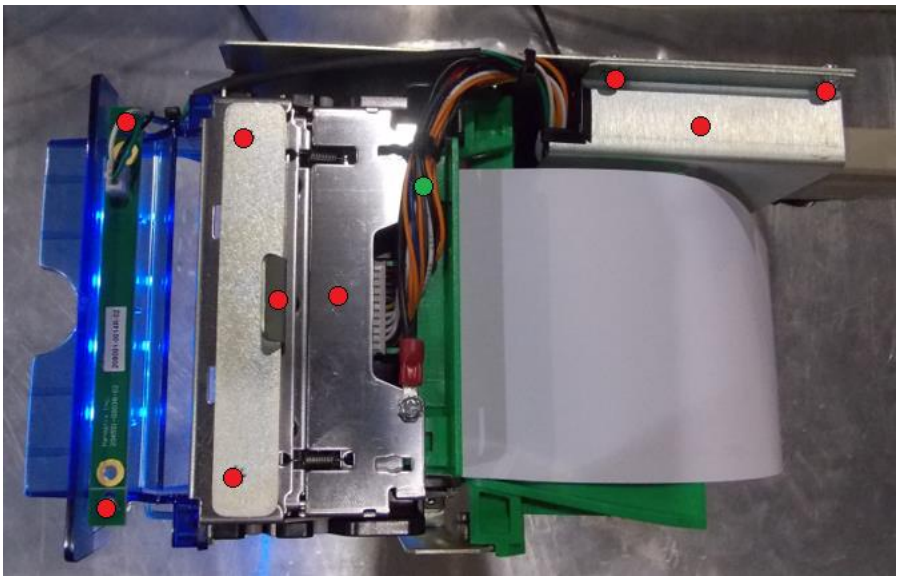

Figure 8.3-10: *Electrostatic discharge test location point's photo – HSVL Plus FS*

Red points = contact discharge
Green points = air discharge

8.3.6 Setup photos

Figure 8.3-11: *Electrostatic discharge setup photo – HSVL Advanced*

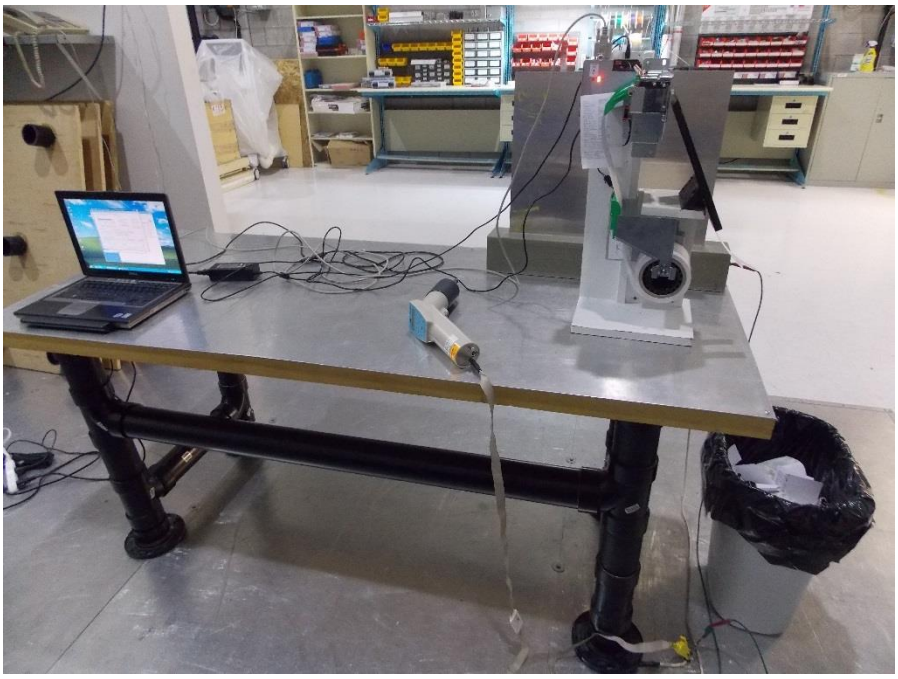

Figure 8.3-12: *Electrostatic discharge setup photo – HSVL Plus*

8.3.6 Setup photos, continued

Figure 8.3-13: *Electrostatic discharge setup photo – HSVL Plus L*

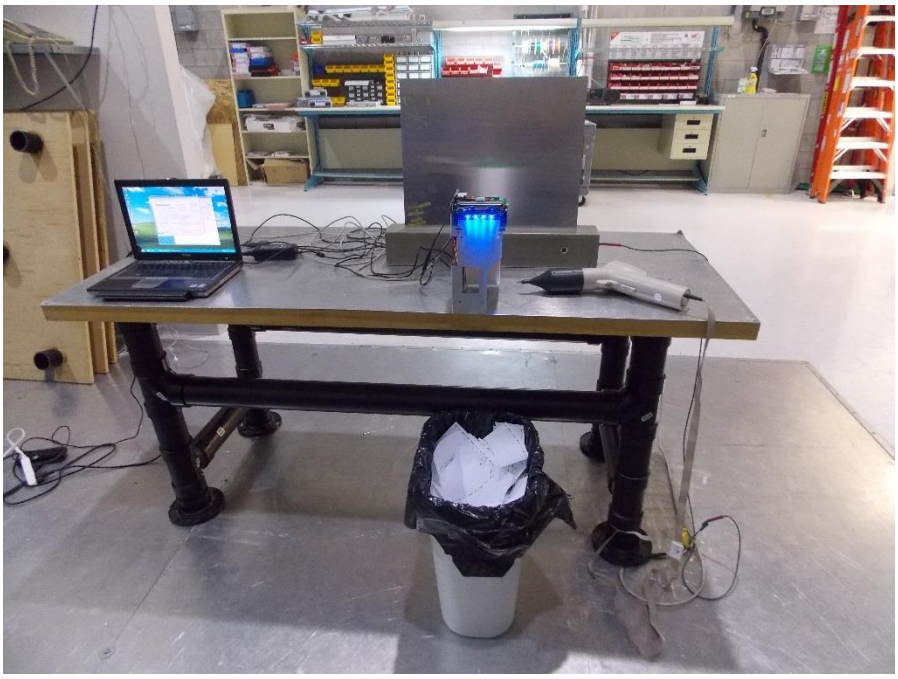

Figure 8.3-14: *Electrostatic discharge setup photo – HSVL Plus FS*

8.4 Surge

8.4.1 References and limits

- EN 55024:2010
- EN 61000-4-5:2014 (Special Note: A more relevant publication of EN 61000-4-4 has been applied for this assessment.)

Table 8.4-1: *Surge specification*

Test specification	Performance criteria	Basic standard
Signal ports and telecommunication ports [1, 2, 3, and 4]		
1.0 or 4.0 kV (line to ground), 10/700 Tr/Th µs	C	EN 61000-4-5
Input DC power port (excluding equipment marketed with an a.c/d.c, power converter) [1]		
0.5 kV (line to ground), 1.2/50 (8/20) Tr/Th µs	B	EN 61000-4-5
Input AC power ports (including equipment marketed with a separate a.c./d.c power converter) [5]		
1.0 kV (line to line), 1.2/50 (8/20) Tr/Th µs 2.0 kV (line to ground), 1.2/50 (8/20) Tr/Th µs	B	EN 61000-4-5

Notes:
[1] Applicable only to ports which according to the manufacturer's specification may connect directly to outdoor cables.
[2] For ports where primary protection is intended, surges are applied at voltages up to 4 kV with the primary protectors fitted. Otherwise the 1 kV test level is applied without primary protection in place.
[3] Test applied to all lines simultaneously to earth (ground).
[4] Where the coupling network for the 10/700 µs waveform affects the functioning of high speed data ports, the test shall be carried out using a 1,2/50 (8/20) µs waveform and appropriate coupling network.
[5] When the manufacturer specifies protection measures and it is impractical to simulate these measures during the tests, then the applied test levels shall be reduced to 0.5 kV (line to line) and 1 kV (line to earth (ground)).

8.4.2 Test summary

Verdict	Pass		
Test date	March 12, 2018	Temperature	24.7 °C
Test engineer	Daniel Hynes	Air pressure	1004.2 mbar
Test location	Montreal	Relative humidity	34.6 %

8.4.3 Notes

None

8.4.4 Setup details

Table 8.4-2: *Surge equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
Surge/EFT generator	TESEQ	NSG 3060	FA002495	1 year	May 31/18
Surge/EFT coupler/decoupler	TESEQ	NSG 3063	FA002497	1 year	May 31/18

Notes: None

Table 8.4-3: *Surge test software details*

Manufacturer of Software	Details
TESEQ	WIN 3000, Version 1.3.2

8.4.5 Test data

Table 8.4-4: *Surge at AC power ports results*

Open circuit voltage (T_1 / T_2):	1.2/50 µs (T_1 = front time, T_2= time to half value)
Short circuit curent (T_1 / T_2):	8/20 µs (T_1 = front time, T_2= time to half value)
Surge pulse interval:	30 s
Number of pulses:	5 positive and 5 negative
EUT power input during test	230 V_{AC}, 50 Hz

Test port	Coupling	Test voltage (±kV)	Comments
Power Input	Phase to Neutral	0.5, 1	No degradation
	Phase to ground	0.5, 1, 2	No degradation
	Neutral to ground	0.5, 1, 2	No degradation

Notes:
- **Phase to neutral coupling :** Surge applied with generator output impedance set to 2 Ω
- **Phase/neutral to ground coupling :** Surge applied with generator output impedance set to 12 Ω
- Surge applied synchronous (relation to power supply): 0, 90, 180, and 270°

8.4.6 Setup photo

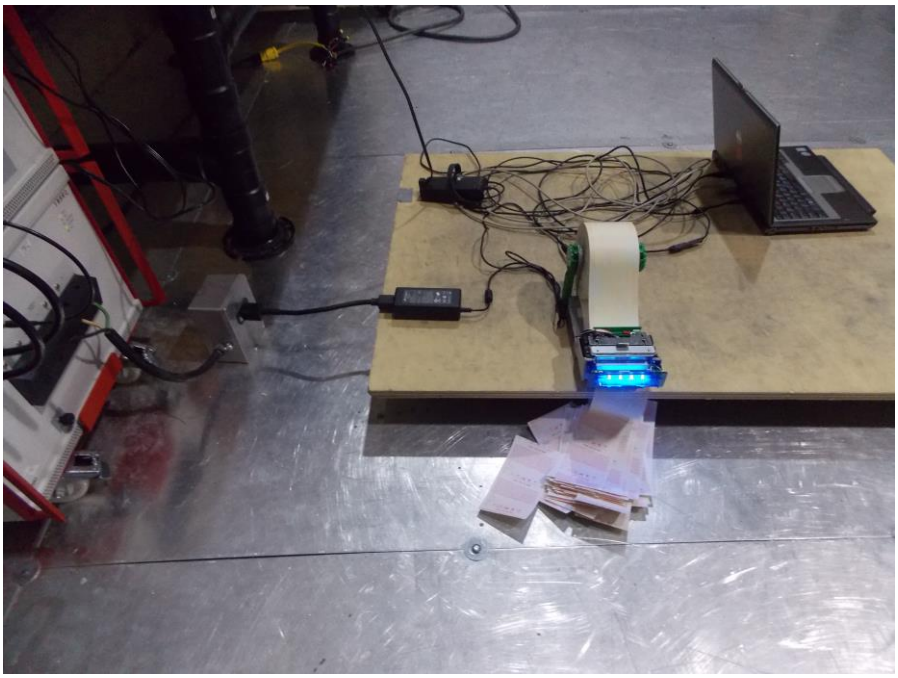

Figure 8.4-1: *Surge setup photo*

8.5 Fast transients

8.5.1 References and limits

- EN 55024:2010
- EN 61000-4-4:2012 (Special Note: A more relevant publication of EN 61000-4-4 has been applied for this assessment.)

Table 8.5-1: *Fast transients specification*

Test specification	Performance criteria	Basic standard
Signal ports and telecommunication ports [1, 2, and 3]		
0.5 kV (peak), 5/50 Tr/Th ns, 5 kHz (repetition rate)	B	EN 61000-4-4
Input DC power port (excluding equipment marketed with an a.c/d.c, power converter) [4]		
0.5 kV (peak), 5/50 Tr/Th ns, 5 kHz (repetition rate)	B	EN 61000-4-4
Input AC power ports (including equipment marketed with a separate a.c./d.c power converter) [1]		
1.0 kV (peak), 5/50 Tr/Th ns, 5 kHz (repetition rate)	B	EN 61000-4-4

Notes:
[1] Applicable only to cables which according to the manufacturer's specification supports communication on cable lengths greater than 3 m.
[2] Test applied to all lines simultaneously to earth (ground).
[3] For xDSL equipment, the repetition frequency for EFT testing shall be 100 kHz (See EN 55024:2010 Annex H).
[4] If d.c. power is fed on conductors included in a signal cable, then the requirements of Signal ports and telecommunication ports only apply to this cable.

8.5.2 Test summary

Verdict	Pass		
Test date	March 14, 2018	Temperature	24.5 °C
Test engineer	Daniel Hynes	Air pressure	990.6 mbar
Test location	Montreal	Relative humidity	34.2 %

8.5.3 Notes

None

8.5.4 Setup details

Table 8.5-2: *Fast transients equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
Surge/EFT generator	TESEQ	NSG 3060	FA002495	1 year	May 31/18
Surge/EFT coupler/decoupler	TESEQ	NSG 3063	FA002497	1 year	May 31/18
Capacitive coupling clamp	TESEQ	CDN 3425	FA002498	—	NCR

Notes: NCR - no calibration required

Table 8.5-3: *Fast transients test software details*

Manufacturer of Software	Details
TESEQ	WIN 3000, Version 1.3.2

8.5.5 Test data

Table 8.5-4: *Fast transients results*

Wave shape (Tr / Td):	5/50 ns (Tr = rise time, Td= duration time)
Repetition frequency[4]:	5 kHz
Burst duration:	15 ms
Burst period:	300 ms
Test duration:	60 s
EUT power input during test	230 V_{AC}, 50 Hz

Test port	Test voltage (±kV)	Comments
Power Input[1]	0.5, 1	Interruption in USB print commands, self-recovered at the end of the test
RS-232[3]	0.5	Interruption in USB print commands, self-recovered at the end of the test
USB[3]	0.5	EUT reboot, self-recovered at the end of the test

Notes:
[1]Transient applied asynchronous (relation to power supply)
[2]The test voltage was applied simultaneously between a ground reference plane and all of the power supply terminals and the protective or functional earth port on the EUT cabinet
[3]The test voltage was applied via capacitive coupling clamp
[4] For xDSL equipment, the repetition frequency for EFT testing was 100 kHz

– If the EUT contained several ports with the same particular interface, only one was tested
– Multiconductor cables, such as a 50-pair telecommunication cable, were tested as a single cable.

8.5.6 Setup photos

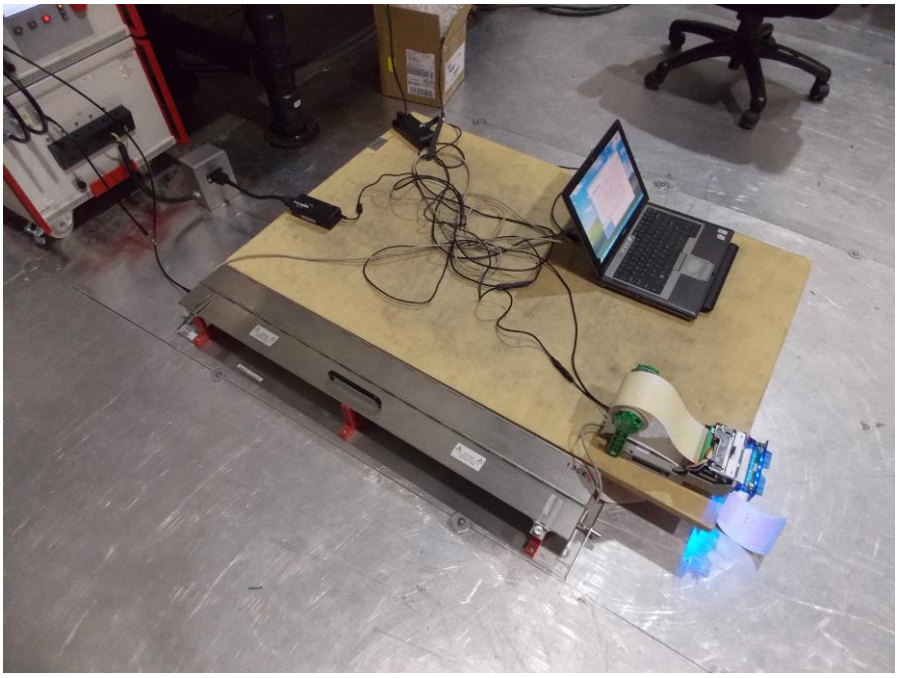

Figure 8.5-1: *Fast transients setup photo*

8.6 Voltage dips and voltage interruptions

8.6.1 References and limits

- EN 55024:2010
- EN 61000-4-11:2004

Table 8.6-1: *Voltage dips and voltage interruptions specification*

Test specification	Performance criteria	Basic standard
Input AC power ports (including equipment marketed with a separate a.c./d.c power converter)		
100 % reduction, 0.5 period (Voltage dip) 30 % reduction, 25 period (Voltage dip)	B	EN 61000-4-11
100 % reduction 250 period (Voltage interruption)	C	EN 61000-4-11

Notes: Changes to occur at 0 degree crossover point of the voltage waveform.

8.6.2 Test summary

Verdict	Pass		
Test date	March 8, 2018	Temperature	24.7 °C
Test engineer	Daniel Hynes	Air pressure	1004.7 mbar
Test location	Montreal	Relative humidity	34.5 %

8.6.3 Notes

None

8.6.4 Setup details

Table 8.6-2: *Voltage dips and voltage interruptions equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
Three phase power system	TESEQ	ProfLine 2115-400	FA002516	1 year	Aug. 21/18

Notes: None

Table 8.6-3: *Voltage dips and voltage interruptions test software details*

Manufacturer of Software	Details
TESEQ	WIN2110SII, P/N CIC924, Version 2.2.0.8, July 15, 2010

8.6.5 Test data

Table 8.6-4: *Voltage dips results*

Variation/dip repetition:	Sequence of three dips/interruptions with an interval of 10 seconds between each test		
EUT power input during test	230 V_{AC}, 50 Hz		
Test port	**Voltage reduction (%)**	**Periods**	**Comments**
Power Input	100	0.5	No degradation
	30	25	No degradation

Notes: Changes occurred at the 0 crossings of the voltage waveform

Table 8.6-5: *Voltage interruptions results*

Variation/dip repetition:	Sequence of three dips/interruptions with an interval of 10 seconds between each test		
EUT power input during test	230 V_{AC}, 50 Hz		
Test port	**Voltage reduction (%)**	**Periods**	**Comments**
Power Input	100	250	EUT power cycled

Notes: Changes occurred at the 0 crossings of the voltage waveform

8.6.6 Setup photo

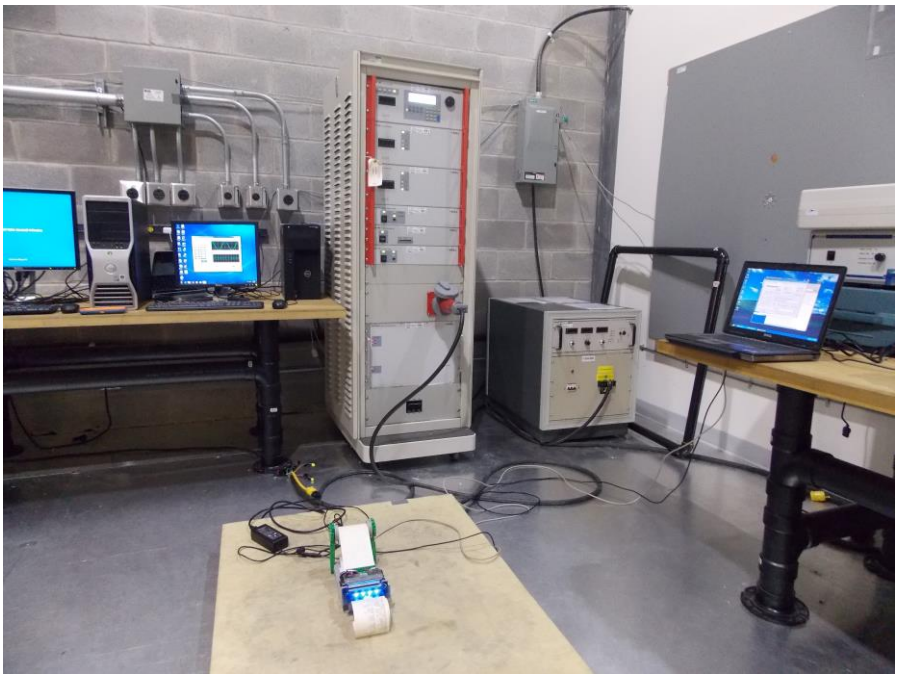

Figure 8.6-1: *Voltage dips and voltage interruptions setup photo*

Section 9 EUT photos

9.1 External photos

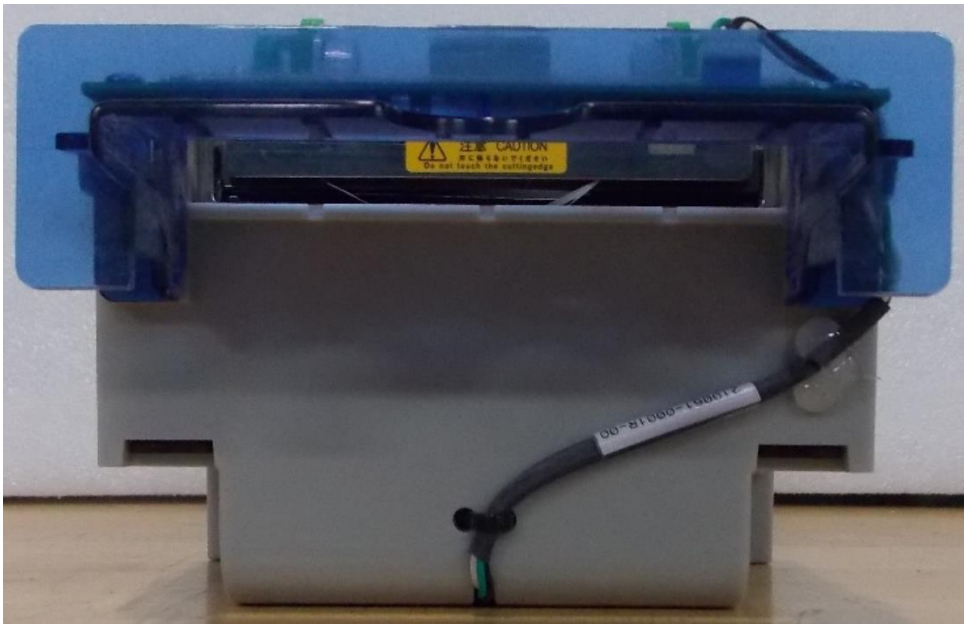

Figure 9.1-1: *Front view photo – HSVL Advanced*

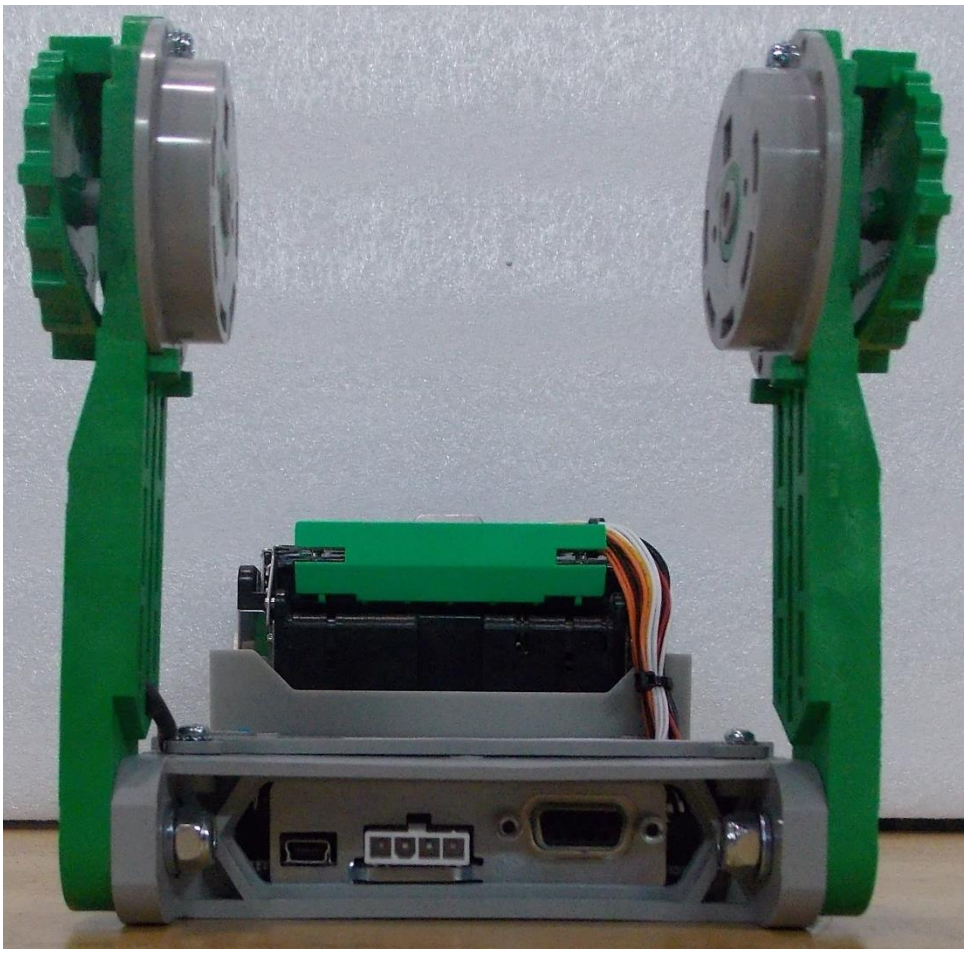

Figure 9.1-2: *Rear view photo – HSVL Advanced*

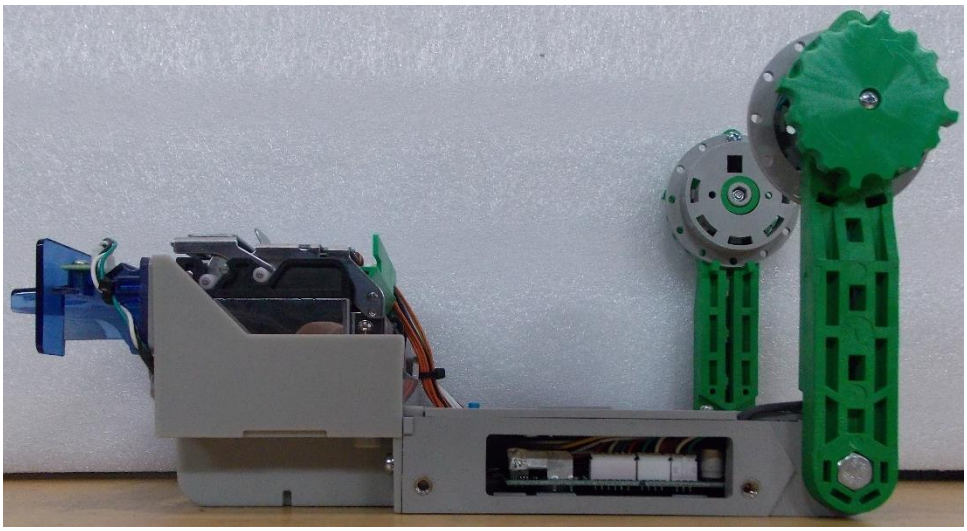

Figure 9.1-3: *Side view photo – HSVL Advanced*

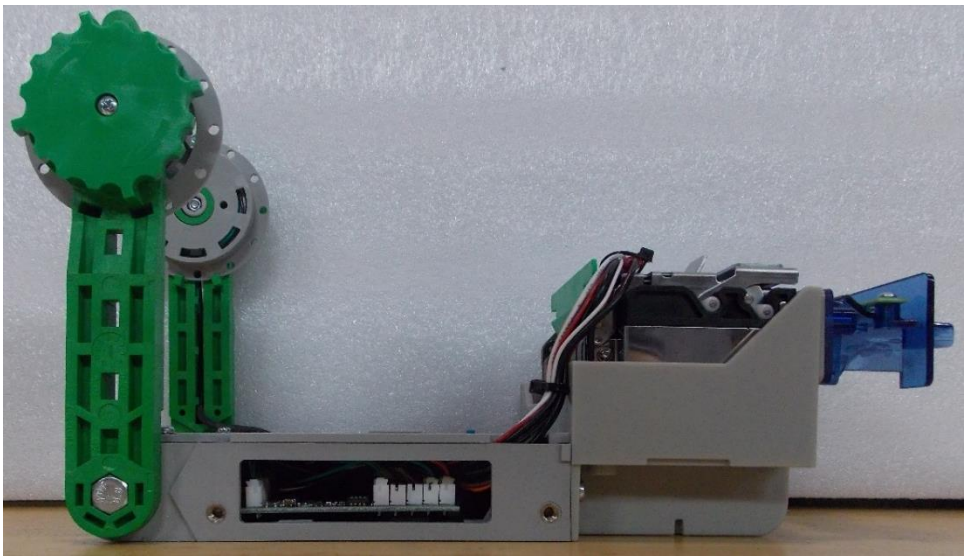

Figure 9.1-4: *Side view photo – HSVL Advanced*

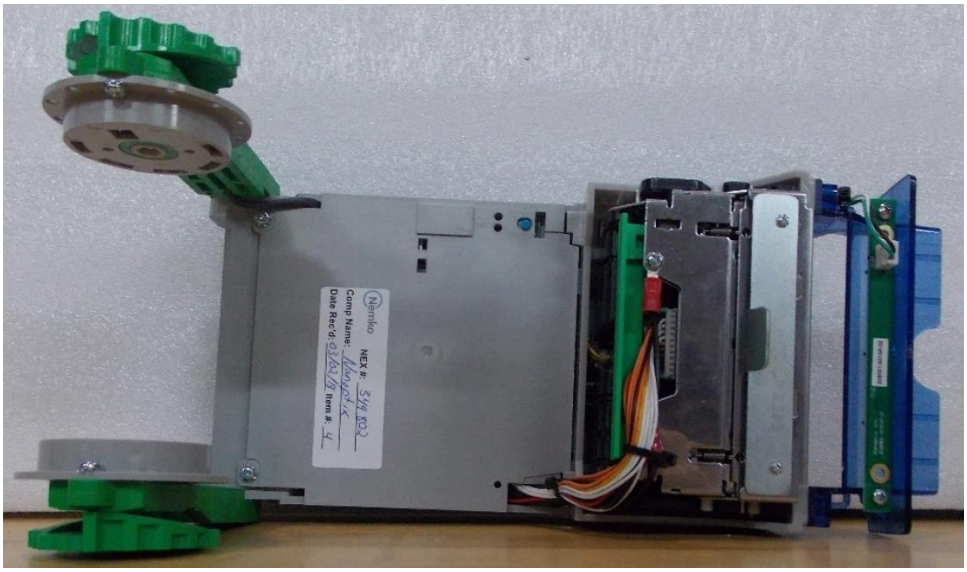

Figure 9.1-5: *Top view photo – HSVL Advanced*

Figure 9.1-6: *Bottom view photo – HSVL Advanced*

Figure 9.1-7: *Front view photo – HSVL Plus*

Figure 9.1-8: *Rear view photo – HSVL Plus*

Figure 9.1-9: *Side view photo – HSVL Plus*

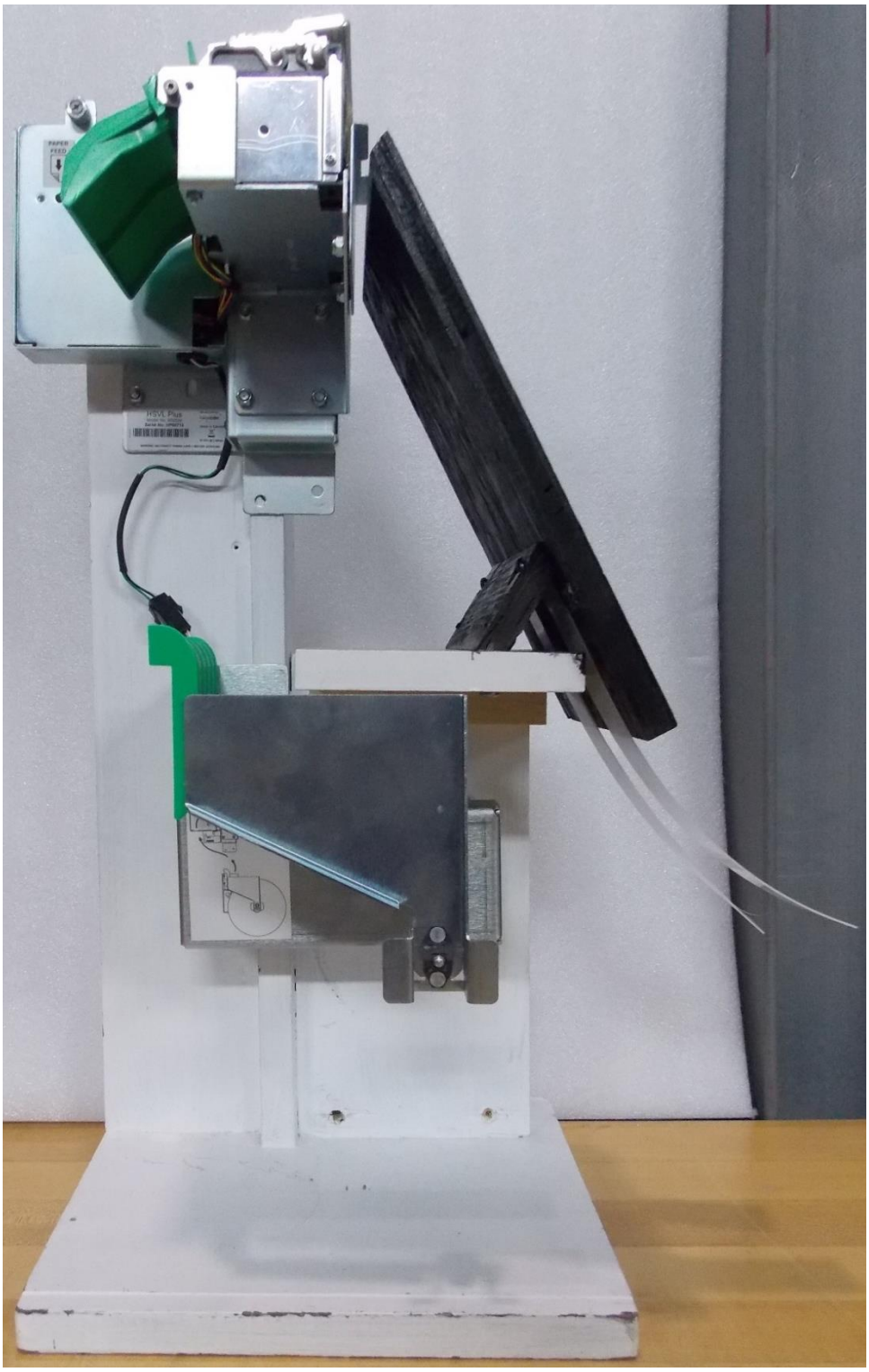

Figure 9.1-10: *Side view photo – HSVL Plus*

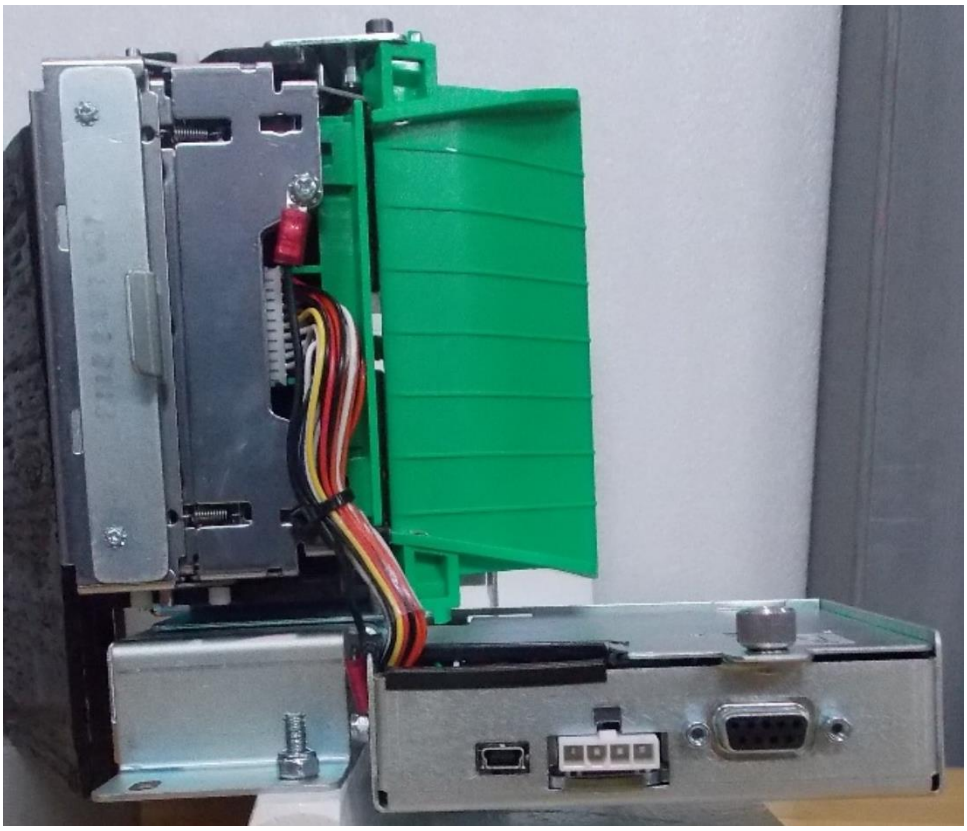

Figure 9.1-11: *Top view photo – HSVL Plus*

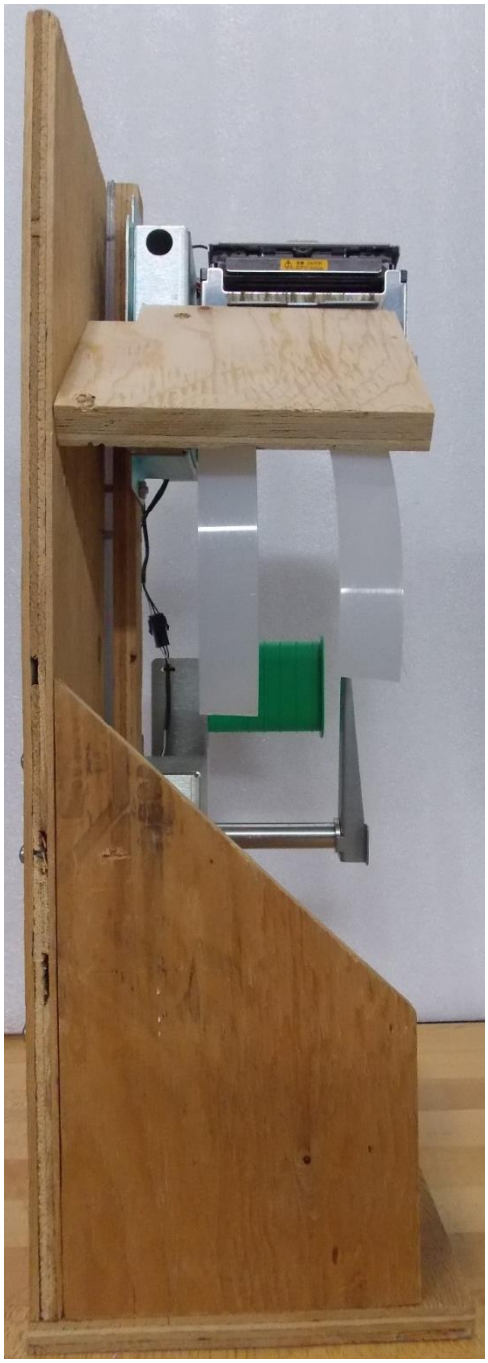

Figure 9.1-12: *Front view photo – HSVL Plus L*

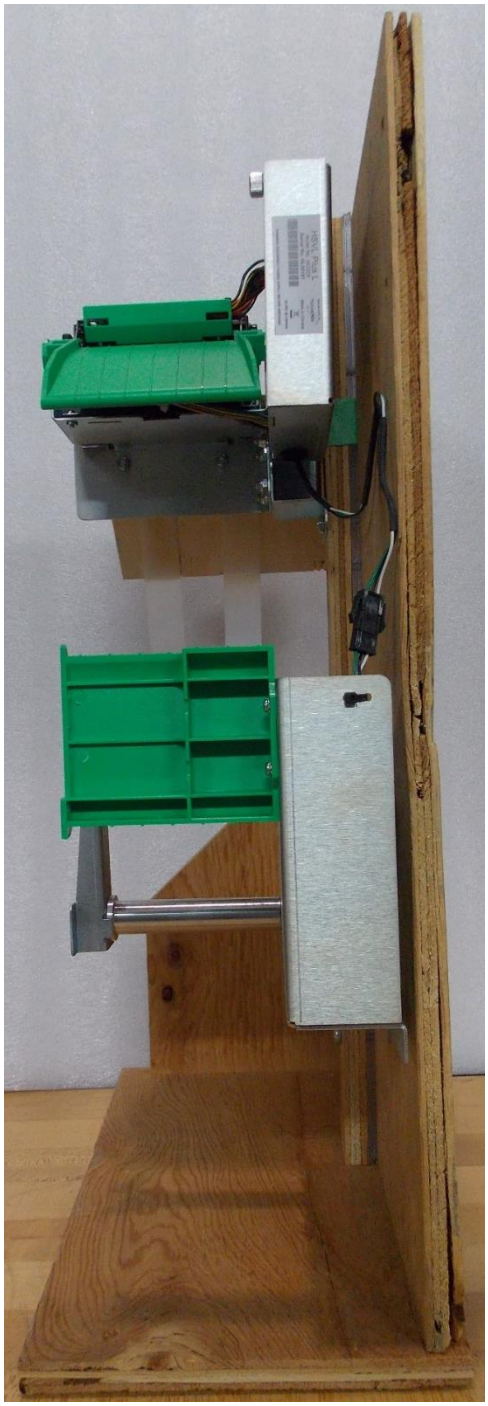

Figure 9.1-13: *Rear view photo – HSVL Plus L*

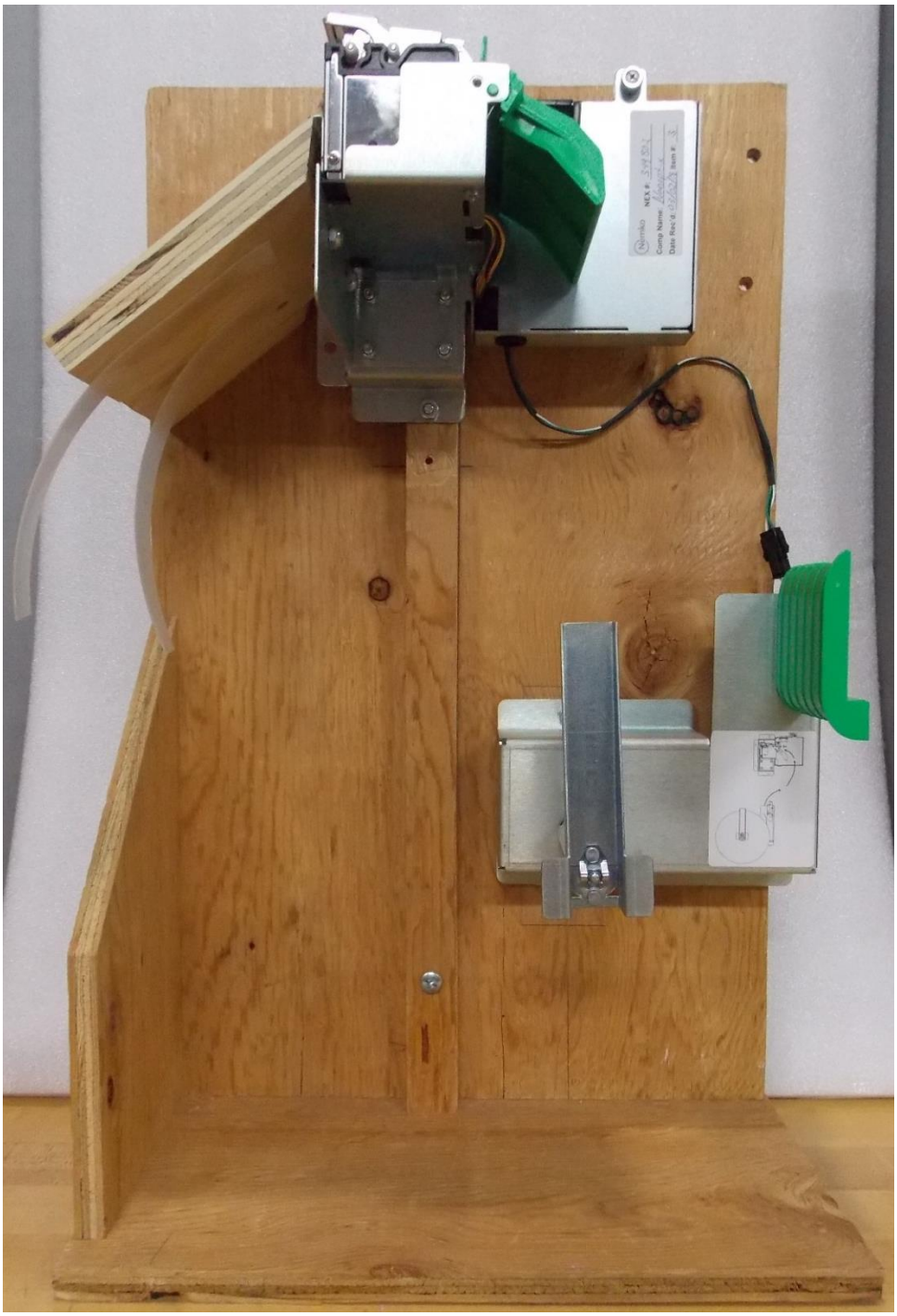

Figure 9.1-14: *Side view photo – HSVL Plus L*

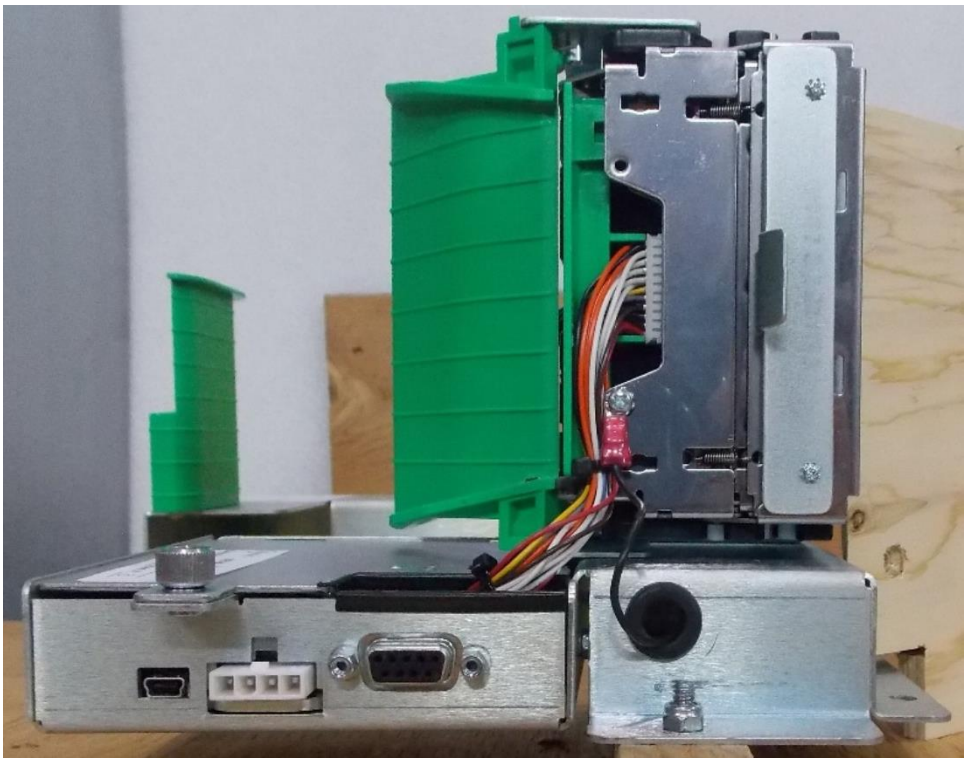

Figure 9.1-15: *Top view photo – HSVL Plus L*

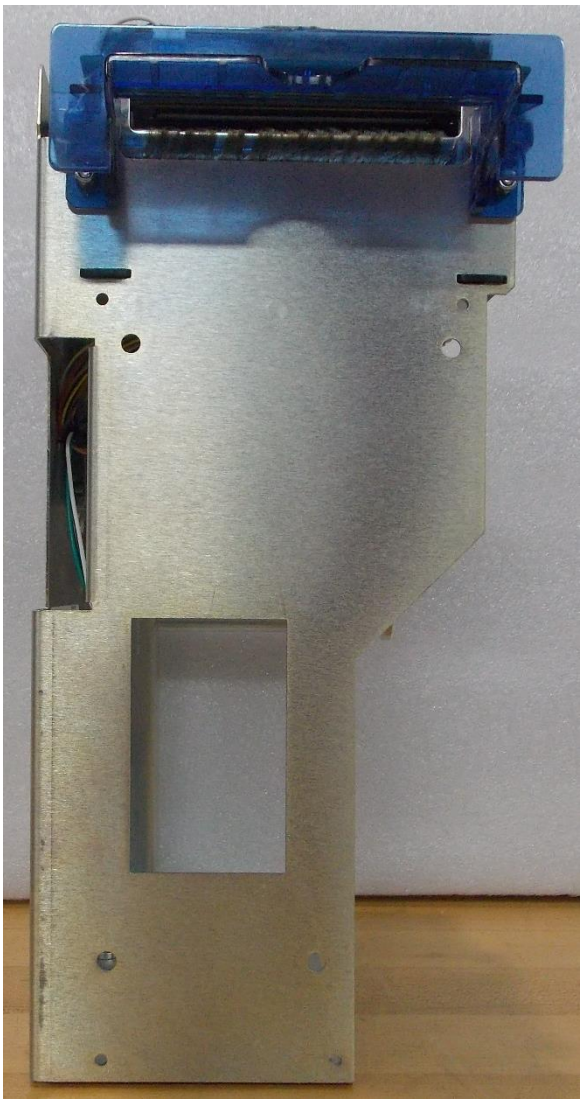

Figure 9.1-16: *Front view photo – HSVL Plus FS*

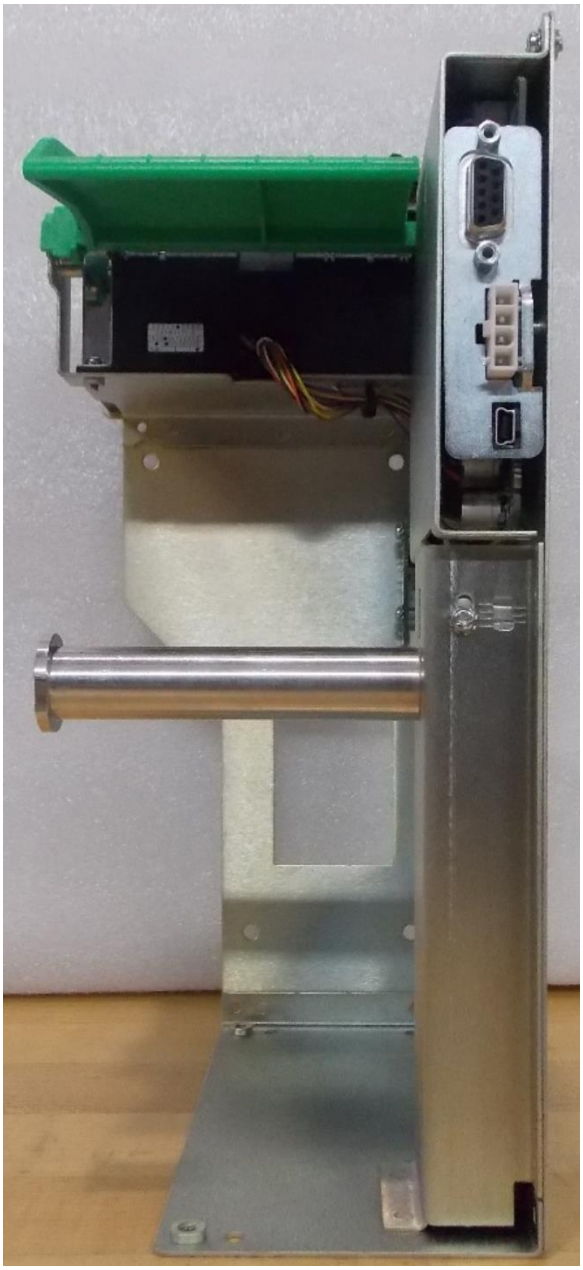

Figure 9.1-17: *Rear view photo – HSVL Plus FS*

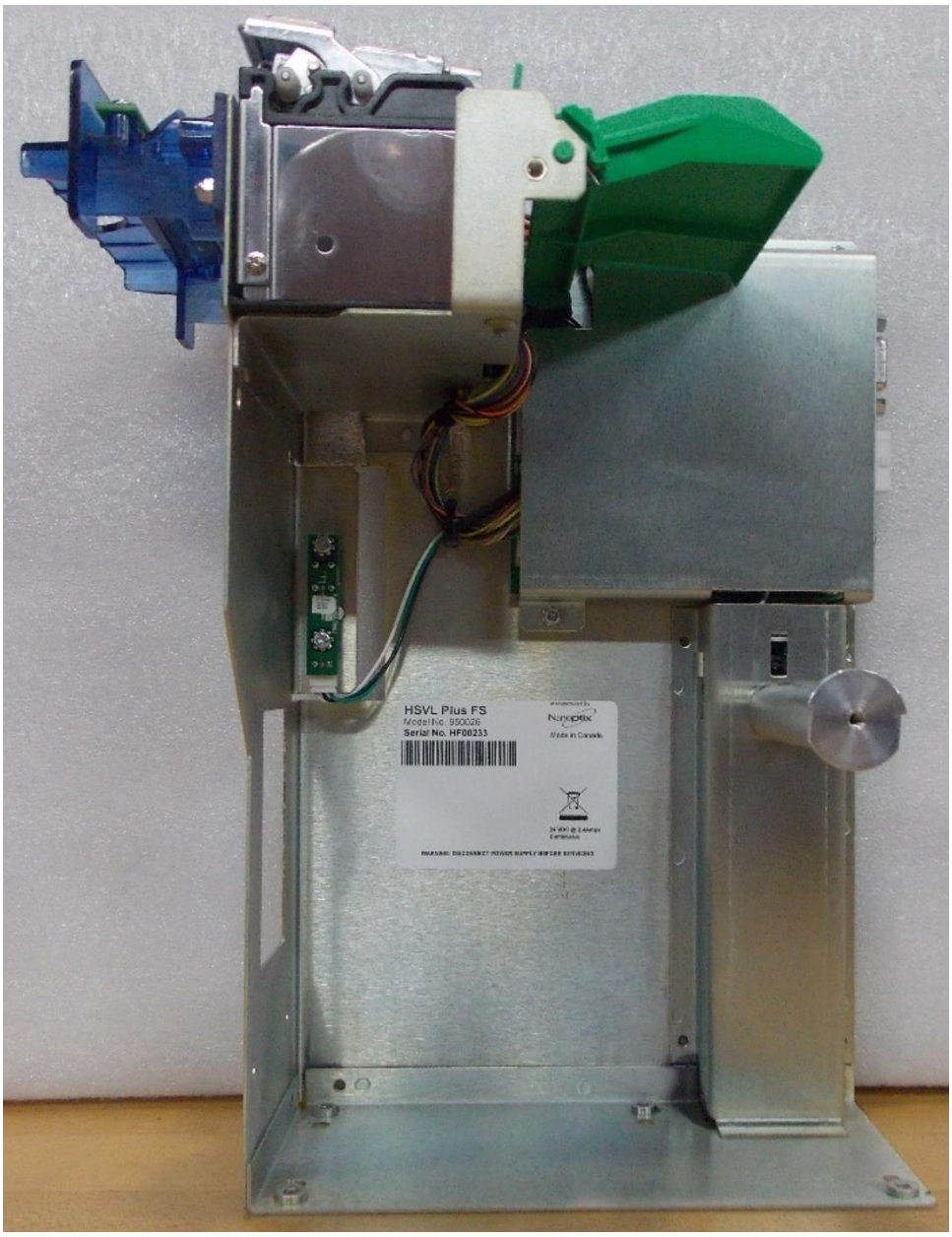

Figure 9.1-18: *Side view photo – HSVL Plus FS*

Figure 9.1-19: *Side view photo – HSVL Plus FS*

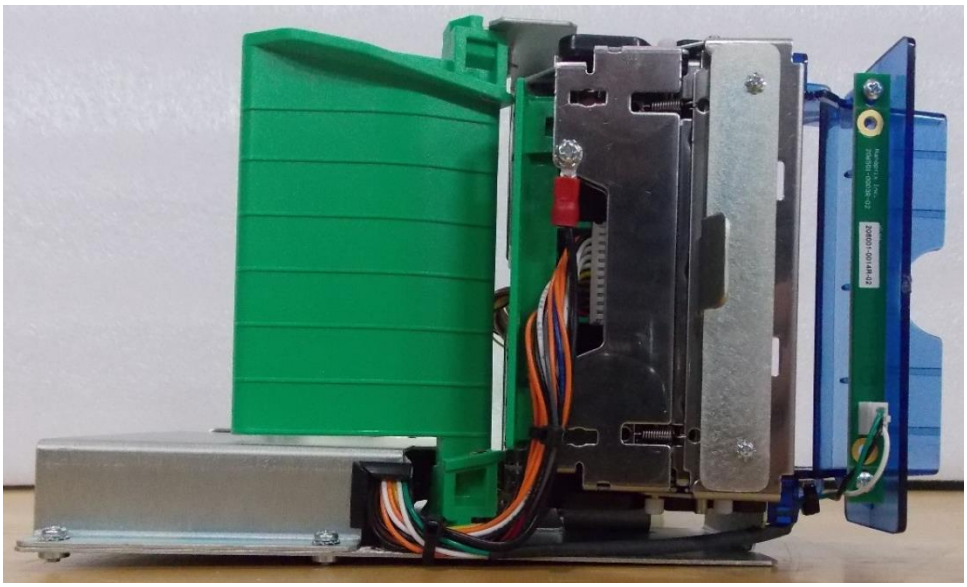

Figure 9.1-20: *Top view photo – HSVL Plus FS*

Figure 9.1-21: *Bottom view photo – HSVL Plus FS*

Figure 9.1-22: *Power supply*

Figure 9.1-23: *Power supply*

Figure 9.1-24: *Power supply*

Figure 9.1-25: *Power supply*

Figure 9.1-26: *Power supply*

Figure 9.1-27: *Power supply*

End of the test report