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EMC TEST REPORT – 349802-1TRFEMC

Applicant:

Nanoptix

Product name:

Thermal Printer

Model:

HSVL Advanced

HSVL Plus

HSVL Plus L

HSVL Plus FS

Specifications:

- EN 55032:2012/AC:2013
- CISPR 32: Edition 2.0 2015-03
- AS/NZS CISPR 32:2015
- EN 61000-3-2:2014
- EN 61000-3-3:2013
- FCC 47 CFR Part 15, Subpart B – Verification
- ICES-003 Issue 6 January 2016

Date of issue: March 22, 2018

Test engineer(s):	Daniel Hynes, Senior EMC Specialist	Signature:	
Reviewed by:	Avul Nzenza, EMC/Wireless Specialist	Signature:	

Lab and test locations

Company name	Nemko Canada Inc.		
Facilities	Ottawa site: 303 River Road, Ottawa, ON, Canada, K1V 1H2 Tel: +1 613 737 9680 Fax: +1 613 737 9691	Montreal site: 292 Labrosse Avenue, Pointe-Claire, QC, Canada, H9R 5L8 Tel: +1 514 694 2684 Fax: +1 514 694 3528	Almonte site: 1500 Peter Robinson Road, West Carleton, ON, Canada, K0A 1L0 Tel: +1 613 256-9117 Fax: +1 613 256-8848
Test site registration	**Organization**	**Recognition numbers and location**	
	FCC	CA2040 (Ottawa); CA2041 (Montreal)	
	ISED	CA2040A-4 (Ottawa); CA2040G-5 (Montreal); CA2040A-3 (Almonte)	
Website	www.nemko.com		

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

Table of Contents

Section 1 Report summary

1.1 Test specifications

EN 55032:2012/AC:2013	Electromagnetic compatibility of multimedia equipment – Emission requirements
AS/NZS CISPR 32:2015	Electromagnetic compatibility of multimedia equipment – Emission requirements
CISPR 32:2015	Electromagnetic compatibility of multimedia equipment – Emission requirements
FCC 47 CFR Part 15, Subpart B – Verification	Title 47: Telecommunication; Part 15—Radio Frequency Devices
ICES-003 Issue 6 January 2016	Information Technology Equipment (ITE) – Limits and methods of measurement
EN 61000-3-2:2014	Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)
EN 61000-3-3:2013	Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤ 16 A per phase and not subject to conditional connection

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 2, 2018
Test end date	March 14, 2018

2.2 International test results

Table 2.2-1: *Result summary for Class B equipment (Equipment intended primarily for use in a residential environment)*

Standard	Clause	Test description	Verdict
EN 55032: 2012 + AC: 2013, AS/NZS CISPR 32: 2015 and CISPR 32: 2015	A4.1	Radiated emissions at frequencies up to 1 GHz measured at 10 m distance (Facility OATS/SAC)	Not applicable
EN 55032: 2012 + AC: 2013, AS/NZS CISPR 32: 2015 and CISPR 32: 2015	A4.2	Radiated emissions at frequencies up to 1 GHz measured at 3 m distance (Facility OATS/SAC)	Pass
AS/NZS CISPR 32: 2015 and CISPR 32: 2015	A4.3	Radiated emissions at frequencies up to 1 GHz measured at 10 m distance (FAR)	Not applicable
AS/NZS CISPR 32: 2015 and CISPR 32: 2015	A4.4	Radiated emissions at frequencies up to 1 GHz measured at 3 m distance (FAR)	Not applicable
EN 55032: 2012 + AC: 2013, AS/NZS CISPR 32: 2015 and CISPR 32: 2015	A5.1 and A5.2	Radiated emissions at frequencies above 1 GHz measured at 3 m distance	Pass
EN 55032: 2012 + AC: 2013	A9.1 and A9.2	Conducted emissions from AC mains power ports	Pass
AS/NZS CISPR 32: 2015 and CISPR 32: 2015	A10.1 and A10.2	Conducted emissions from AC mains power ports	Pass
EN 55032: 2012 + AC: 2013	A11.1	Conducted asymmetric mode emissions measured with AAN	Not applicable
EN 55032: 2012 + AC: 2013	A11.2	Conducted asymmetric mode emissions measured with CVP and current probe	Not applicable
EN 55032: 2012 + AC: 2013	A11.3	Conducted asymmetric mode emissions measured with Current probe	Not applicable
AS/NZS CISPR 32: 2015 and CISPR 32: 2015	A12.1	Conducted asymmetric mode emissions measured with AAN	Not applicable
AS/NZS CISPR 32: 2015 and CISPR 32: 2015	A12.2	Conducted asymmetric mode emissions measured with CVP and current probe	Not applicable
AS/NZS CISPR 32: 2015 and CISPR 32: 2015	A12.3	Conducted asymmetric mode emissions measured with Current probe	Not applicable
EN 55032: 2012 + AC: 2013	A12.1	Conducted differential voltage emissions for Television receivers (analogue or digital), video recorders and PC TV broadcast receiver tuner cards working in channels between 30 MHz and 1 GHz, and digital audio receivers.	Not applicable
EN 55032: 2012 + AC: 2013	A12.2	Conducted differential voltage emissions for Tuner units (not the LNB) for satellite signal reception	Not applicable
EN 55032: 2012 + AC: 2013	A12.3	Conducted differential voltage emissions for Frequency modulation audio receivers and PC tuner cards	Not applicable
EN 55032: 2012 + AC: 2013	A12.4	Conducted differential voltage emissions for Frequency modulation car radios	Not applicable
EN 55032: 2012 + AC: 2013	A12.5	Conducted differential voltage emissions for EUTs with RF modulator output ports (for example DVD equipment, video recorders, camcorders and decoders etc.) designed to connect to TV broadcast receiver tuner ports	Not applicable
AS/NZS CISPR 32: 2015 and CISPR 32: 2015	A13.1	Conducted differential voltage emissions for Television receivers (analogue or digital), video recorders and PC TV broadcast receiver tuner cards working in channels between 30 MHz and 1 GHz, and digital audio receivers.	Not applicable
AS/NZS CISPR 32: 2015 and CISPR 32: 2015	A13.2	Conducted differential voltage emissions for Tuner units (not the LNB) for satellite signal reception	Not applicable
AS/NZS CISPR 32: 2015 and CISPR 32: 2015	A13.3	Conducted differential voltage emissions for Frequency modulation audio receivers and PC tuner cards	Not applicable
AS/NZS CISPR 32: 2015 and CISPR 32: 2015	A13.4	Conducted differential voltage emissions for Frequency modulation car radios	Not applicable
AS/NZS CISPR 32: 2015 and CISPR 32: 2015	A13.5	Conducted differential voltage emissions for EUTs with RF modulator output ports (for example DVD equipment, video recorders, camcorders and decoders etc.) designed to connect to TV broadcast receiver tuner ports	Not applicable

Notes: Apply only A4.1 or A4.2 or A4.3 or A4.4 for radiated emissions at frequencies up to 1 GHz

2.2 International test results, continued

Table 2.2-2: *EN 61000-3-2:2014 results*

Test description	Verdict
Harmonic current emissions[1]	Pass

Notes: [1] Harmonic classification A

Table 2.2-3: *EN 61000-3-3:2013 results*

Test description	Verdict
Voltage fluctuations and flicker[1]	Pass

Notes: [1] None

2.3 North America test results

Table 2.3-1: *Result summary for emissions*

Standard	Clause	Test description	Verdict
FCC 47 CFR Part 15, Subpart B	§15.109	Radiated emissions limits[1]	Pass
FCC 47 CFR Part 15, Subpart B	§15.107	Conducted emissions limits (AC mains) [1]	Pass
ICES-003 Issue 6	6.1	AC Power Line Conducted Emissions Limits[1]	Pass
ICES-003 Issue 6	6.2	Radiated Emissions Limits[1]	Pass

Notes: [1] Product classification B

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	Items # 1, 2, 3 and 4

3.4 EUT information

Product name	Thermal Printer
Model	HSVL Advanced, HSVL Plus, HSVL Plus L, HSVL Plus FS
Serial number	HSVL Advanced: HC00166 HSVL Plus: HP00713 HSVL Plus L: HL00161 HSVL Plus FS: HF00233
Part number	HSVL Advanced: 950028 HSVL Plus: 950024 HSVL Plus L: 950029 HSVL Plus FS: 950026
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

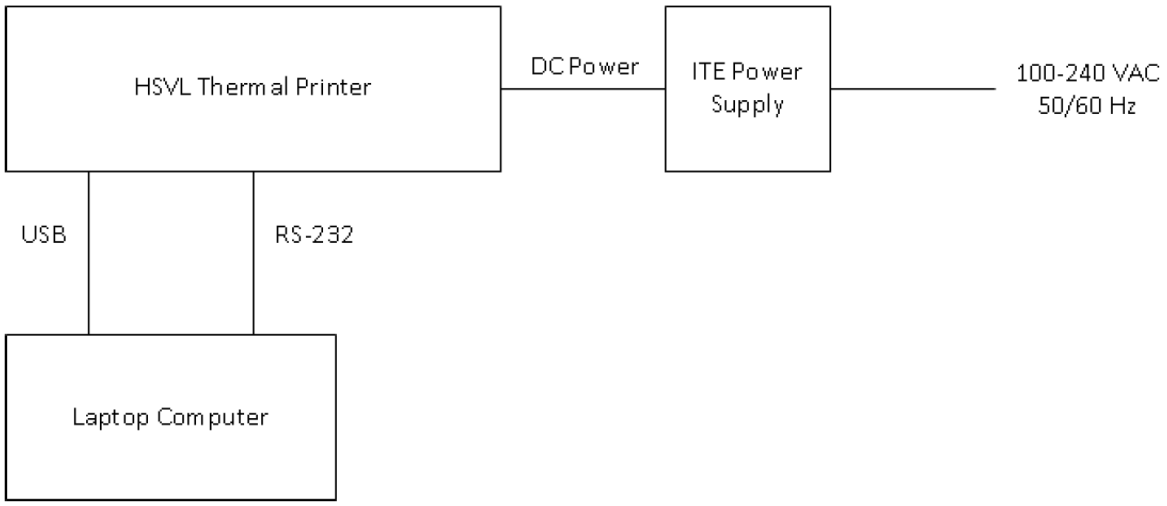


Figure 3.5-1: *block diagram*

Section 4 Engineering considerations

4.1 Modifications incorporated in the EUT for compliance

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

4.2 Technical judgment

None

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 Product classifications definitions

7.1.1 EN 55032, AS/NZS CISPR 32 and CISPR 32 – Equipment classification

Equipment classification	Equipment intended primarily for use in a residential environment shall meet the Class B limits. All other equipment shall comply with the Class A limits. Broadcast receiver equipment is class B equipment. The user documentation and/or manual shall contain details of any special measures required to be taken by the purchaser or user to ensure EMC compliance of the EUT with the requirements of this publication (EN 55032). One example would be the need to use shielded or special cables. Class A equipment shall have the following warning in the instructions for use, to inform the user of the risk of operating this equipment in a residential environment: Warning: This equipment is compliant with Class A of CISPR 32. In a residential environment this equipment may cause radio interference.

7.1.2 Title 47: Telecommunication – Part 15-Radio Frequency devices, Subpart A – General – Equipment classification

Class A digital device	A digital device that is marketed for use in a commercial, industrial or business environment, exclusive of a device which is marketed for use by the general public or is intended to be used in the home.
Class B digital device	A digital device that is marketed for use in a residential environment notwithstanding use in commercial, business and industrial environments. Examples of such devices include, but are not limited to, personal computers, calculators, and similar electronic devices that are marketed for use by the general public. Note: The responsible party may also qualify a device intended to be marketed in a commercial, business or industrial environment as a Class B device, and in fact is encouraged to do so, provided the device complies with the technical specifications for a Class B digital device. In the event that a particular type of device has been found to repeatedly cause harmful interference to radio communications, the Commission may classify such a digital device as a Class B digital device, regardless of its intended use.

7.1.3 ICES-003 – Equipment classification

Class B ITE	limits of radio noise for ITE for residential operation
Class A ITE	limits of radio noise for ITE for non-residential operation
Conditions	Only ITE intended strictly for non-residential use in commercial, industrial or business environments, and whose design or other characteristics strongly preclude the possibility of its use in a residential environment, shall be permitted to comply with the less stringent Class A limits. All ITE that cannot meet the conditions for Class A operation shall comply with the Class B limits. The ITE shall comply with both the power line – conducted and the radiated emissions limits within the same Class, with no intermixing.

7.1 Product classifications definitions, continued

7.1.4 EN 61000-3-2 – Equipment classification

For the purpose of harmonic current limitation, equipment is classified as follows:

Class A	– Balanced three-phase equipment; – Household appliances excluding equipment identified as Class D; – Tools excluding portable tools; – Dimmers for incandescent lamps; – Audio equipment. Equipment not specified in one of the three other classes shall be considered as Class A equipment.
Class B	– Portable tools; – Arc welding equipment, which is not professional equipment.
Class C	– Lighting equipment.
Class D	Equipment having a specified power according to 6.2.2 less than or equal to 600 W, of the following types: – Personal computers and personal computer monitors; – Television receivers.

7.2 General definitions

7.2.1 EN 55032, AS/NZS CISPR 32 and CISPR 32 – Equipment type

Multimedia Equipment (MME)	Equipment that is information technology equipment, audio equipment, video equipment, broadcast receiver equipment, entertainment lighting control equipment or combinations of these.
Information technology equipment [ITE]	Equipment having a primary function of either (or a combination of) entry, storage, display, retrieval, transmission, processing, switching, or control of data and/or telecommunication messages and which may be equipped with one or more ports typically for information transfer. - Examples include data processing equipment, office machines, electronic business equipment and telecommunication equipment.
Audio equipment	Equipment which has a primary function of either (or a combination of) generation, input, storage, play, retrieval, transmission, reception, amplification, processing, switching or control of audio signals
Video equipment	Equipment which has a primary function of either (or a combination of) generation, input, storage, display, play, retrieval, transmission, reception, amplification, processing, switching, or control of video signals.
Broadcast receiver equipment	Equipment containing a tuner that is intended for the reception of broadcast services - These broadcast services are typically television and radio services, including terrestrial broadcast, satellite broadcast and/or cable transmission.
Entertainment lighting control equipment	Equipment generating or processing electrical signals for controlling the intensity, color, nature or direction of the light from a luminaire, where the intention is to create artistic effects in theatrical, televisual or musical productions and visual presentations.

7.2 General definitions, continued

7.2.2 EN 55032, AS/NZS CISPR 32 and CISPR 32 – Port type

FAR	Fully Anechoic Room
FSOATS	Free Space Open Area Test Site
OATS	Open Area Test Site
SAC	SAC Semi Anechoic Chamber
AC mains power port	Port used to connect to the mains supply network - Equipment with a DC power port which is powered by a dedicated AC/DC power converter is defined as AC mains powered equipment
Antenna port	Port, other than a broadcast receiver tuner port (3.1.8), for connection of an antenna used for intentional transmission and/or reception of radiated RF energy.
Broadcast receiver tuner port	Port intended for the reception of a modulated RF signal carrying terrestrial, satellite and/or cable transmissions of audio and/or video broadcast and similar services - This port may be connected to an antenna, a cable distribution system, a VCR or similar device.
DC network power port	Port, not powered by a dedicated AC/DC power converter and not supporting communication, that connects to a DC supply network. - Equipment with a DC power port which is powered by a dedicated AC/DC power converter is considered to be AC mains powered equipment. - DC power ports supporting communications are considered to be wired networks ports, for example Ethernet ports which include Power Over Ethernet (POE).
Enclosure port	Physical boundary of the EUT through which electromagnetic fields may radiate.
Optical fibre port	Port at which an optical fibre is connected to an equipment.
RF modulator output port	Port intended to be connected to a broadcast receiver tuner port in order to transmit a signal to the broadcast receiver.
Signal/control port	Port intended for the interconnection of components of an equipment under test, or between an equipment under test and local associated equipment and used in accordance with relevant functional specifications (for example for the maximum length of cable connected to it) - Examples include RS-232, Universal Serial Bus (USB), High-Definition Multimedia Interface (HDMI), IEEE Standard 1394 (“Fire Wire”)
Wired network port	Point of connection for voice, data and signaling transfers intended to interconnect widely-dispersed systems by direct connection to a single-user of multi-user communication network (for example CATV, PSTN, ISDN, xDSL, LAN and similar networks) - These ports may support screened or unscreened cables and may also carry AC or DC power where this is an integral part of the telecommunication specification.

7.2.3 Title 47: Telecommunication – Part 15-Radio Frequency devices, Subpart A – General – Digital device definitions

Digital device (Previously defined as a computing device)	An unintentional radiator (device or system) that generates and uses timing signals or pulses at a rate in excess of 9,000 pulses (cycles) per second and uses digital techniques; inclusive of telephone equipment that uses digital techniques or any device or system that generates and uses radio frequency energy for the purpose of performing data processing functions, such as electronic computations, operations, transformations, recording, filing, sorting, storage, retrieval, or transfer. A radio frequency device that is specifically subject to an emanation requirement in any other FCC Rule part or an intentional radiator subject to subpart C of this part that contains a digital device is not subject to the standards for digital devices, provided the digital device is used only to enable operation of the radio frequency device and the digital device does not control additional functions or capabilities. Note: Computer terminals and peripherals that are intended to be connected to a computer are digital devices.

7.2 General definitions, continued

7.2.4 EN 55032, AS/NZS CISPR 32 and CISPR 32 – Definitions

Information technology equipment (ITE)	Any equipment: a) Which has a primary function of either (or a combination of) entry, storage, display, retrieval, transmission, processing, switching, or control, of data and of telecommunication messages and which may be equipped with one or more terminal ports typically operated for information transfer; b) With a rated supply voltage not exceeding 600 V. It includes, for example, data processing equipment, office machines, electronic business equipment and telecommunication equipment.
Telecommunications/network port	Point of connection for voice, data and signaling transfers intended to interconnect widely dispersed systems via such means as direct connection to multi-user telecommunications networks (e.g. public switched telecommunications networks (PSTN) integrated services digital networks (ISDN), x-type digital subscriber lines (xDSL), etc.), local area networks (e.g. Ethernet, Token Ring, etc.) and similar networks NOTE A port generally intended for interconnection of components of an ITE system under test (e.g. RS-232, IEEE Standard 1284 (parallel printer), Universal Serial Bus (USB), IEEE Standard 1394 ("Fire Wire"), etc.) and used in accordance with its functional specifications (e.g. for the maximum length of cable connected to it), is not considered to be a telecommunications/network port under this definition.

7.2.5 ICES-003 – Definitions

Information technology equipment (ITE)	Information Technology Equipment (ITE) is defined as devices or systems that use digital techniques for purposes such as data processing and computation. ITE is any unintentional radiator (device or system) that generates and/or uses timing signals or pulses having a rate of at least 9 kHz and employs digital techniques for purposes such as computation, display, data processing and storage, and control.

7.2.6 EN 61000-3-3 – Definitions

Voltage fluctuation	Series of changes of r.m.s voltage evaluated as a single value for each successive half-period between zero-crossings of the source voltage.
Flicker	Impression of unsteadiness of visual sensation induced by a light stimulus whose luminance or spectral distribution fluctuates with time.
Short-term flicker indicator, *P*st	The flicker severity evaluated over a short period (in minutes); *P*st = 1 is the conventional threshold of irritability.
Long-term flicker indicator, *P*lt	The flicker severity evaluated over a long period (a few hours) using successive *P*st values.

Section 8 Testing data

8.1 Radiated emissions

8.1.1 References and limits

- CISPR 32:2015: Section A.2
- AS/NZS CISPR 32:2015: Section A.2
- EN 55032:2012/AC:2013: Section A.2
- FCC 47 CFR Part 15, Subpart B: Clause §15.109 (Test method ANSI C63.4:2014)
- ICES-003: Section 6.2

Table 8.1-1: *Requirements as per EN 55032 / CISPR 32 / AS/NZS CISPR 32 for radiated emissions for Class B*

Facility	Frequency range [MHz]	Measurement		limits
		Distance [m]	Detector type/ bandwidth	[dBµV/m]
OATS/SAC	30–230	10	Quasi Peak/120 kHz	30
	230–1000			37
OATS/SAC	30–230	3	Quasi Peak/120 kHz	40
	230–1000			47
FAR	30–230	10	Quasi Peak/120 kHz	32 to 25
	230–1000			32
FAR	30–230	3	Quasi Peak/120 kHz	42 to 35
	230–1000			42
FSOATS	1000–3000	3	CAverage/1 MHz	50
	3000–6000			54
FSOATS	1000–3000	3	Peak/1 MHz	70
	3000–6000			74

Notes:
- OATS – Open Area Test Site, SAC – Semi Anechoic Chamber, FSOATS – Free Space Open Area Test Site
- Where there is a step in the relevant limit, the lower value was applied at the transition frequency.

Table 8.1-2: *Requirements as per FCC Part 15 Subpart B and ICES-003 for radiated emissions for Class B*

Frequency range [MHz]	Measurement		limits
	Distance [m]	Detector type/ bandwidth	[dBµV/m]
30–88	10	Quasi Peak/120 kHz	29.6
88–216			33.1
216–960			35.6
960–1000			43.6
30–88	3	Quasi Peak/120 kHz	40.0
88–216			43.5
216–960			46.0
960–1000			54.0
>1000	10	Linear average/1 MHz	43.6
		Peak/1 MHz	63.6
>1000	3	Linear average/1 MHz	54.0
		Peak/1 MHz	74.0

Notes: Where there is a step in the relevant limit, the lower value was applied at the transition frequency.

8.1.2 Test summary

Verdict	Pass		
Test date	March 2, 5 & 6, 2018	Temperature	24.4 °C
Test engineer	Daniel Hynes	Air pressure	998.9 mbar
Test location	Montreal	Relative humidity	34.5 %

8.1.3 Notes

- Where tabular data has not been provided, no emissions were observed within 10 dB of the specified limit when measured with the appropriate detector.
- Where less than 6 measurements per detector has been provided, fewer than 6 emissions were observed within 10 dB of the specified limit when measured with the appropriate detector.
- The highest operating frequency of the EUT as provided by the client was 192 MHz. The spectrum was scanned to 2 GHz according to the EUT highest operating frequency.

Table 8.1-3: *Frequency range for EN 55032, AS/NZS CISPR 32 and CISPR 32*

Highest internal frequency [F_X]	Highest measured frequency
$F_X \leq 108$ MHz	1 GHz
108 MHz < $F_X \leq 500$ MHz	2 GHz
500 MHz < $F_X \leq 1$ GHz	5 GHz
$F_X > 1$ GHz	$5 \times F_X$ up to a maximum of 6 GHz

Notes: Highest internal frequency [F_X] – highest fundamental frequency generated or used within the EUT or highest frequency at which it operates. This includes frequencies which are solely used within an integrated circuit.
For FM and TV broadcast receivers F_X is determined from the highest frequency generated or used excluding the local oscillator and tuned frequencies.

Table 8.1-4: *Frequency range for FCC Part 15 Subpart B and ICES-003 Issue 6*

Highest internal frequency [F_X]	Highest measured frequency
$F_X \leq 108$ MHz	1 GHz
108 MHz < $F_X \leq 500$ MHz	2 GHz
500 MHz < $F_X \leq 1$ GHz	5 GHz
$F_X > 1$ GHz	$5 \times F_X$ up to a maximum of 40 GHz

Notes: Highest internal frequency [F_X] – highest fundamental frequency generated or used within the EUT or highest frequency at which it operates. This includes frequencies which are solely used within an integrated circuit.
For FM and TV broadcast receivers F_X is determined from the highest frequency generated or used excluding the local oscillator and tuned frequencies.

8.1.4 Setup details

Port under test	Enclosure Port
EUT power input during test	230 V_{AC}, 50 Hz
EUT setup configuration	Table top
Test facility	Semi anechoic chamber
Measuring distance	3 m
Antenna height variation	1–4 m
Turn table position	0–360°
Measurement details	A preview measurement was generated with receiver in continuous scan or sweep mode while the EUT was rotated and antenna adjusted to maximize radiated emission. Emissions detected within 10 dB or above the limit were re-measured with the appropriate detector against the correlating limit and recorded as the final measurement.

Receiver/spectrum analyzer settings for frequencies below 1 GHz:

Resolution bandwidth	120 kHz
Video bandwidth	300 kHz
Detector mode	Peak (Preview measurement), Quasi-peak (Final measurement)
Trace mode	Max Hold
Measurement time	100 ms (Peak preview measurement), 100 ms (Quasi-peak final measurement)

Receiver/spectrum analyzer settings for frequencies above 1 GHz:

Resolution bandwidth	1 MHz
Video bandwidth	3 MHz
Detector mode	Peak (Preview measurement) Peak and CAverage (Final measurement)
Trace mode	Max Hold
Measurement time	100 ms (Peak preview measurement), 100 ms (Peak and CAverage final measurement)

Table 8.1-5: *Radiated emissions equipment list*

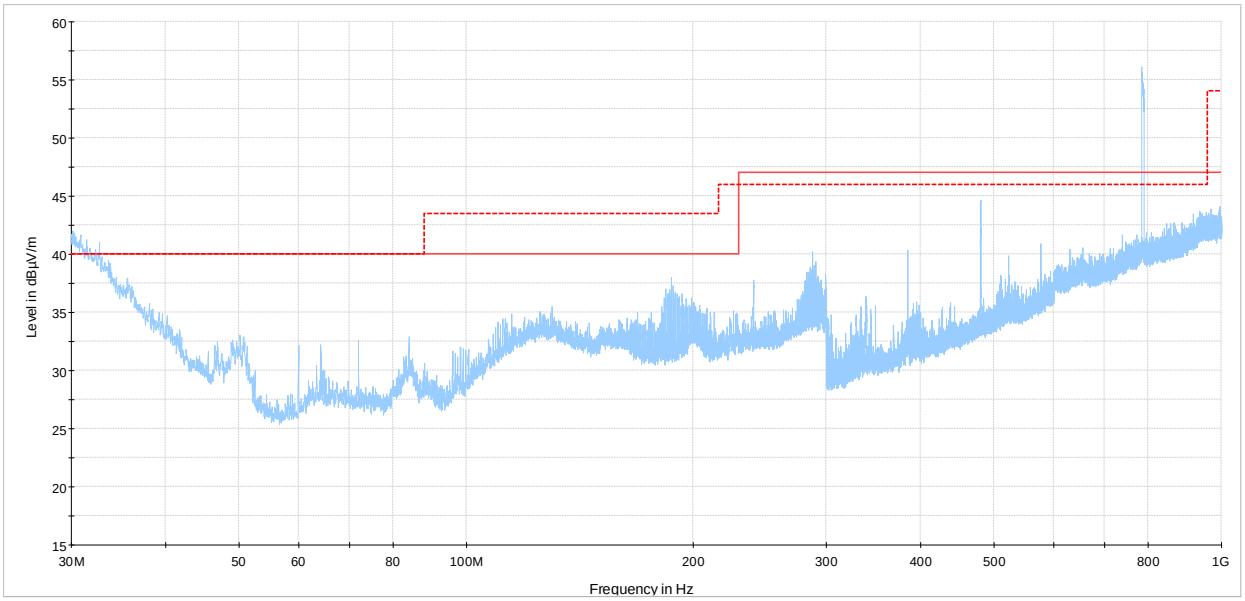
Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
3 m EMI test chamber	TDK	SAC-3	FA002532	2 year	June 5/19
Flush mount turntable	Sunol	FM2022	FA002550	—	NCR
Controller	Sunol	SC104V	FA002551	—	NCR
Antenna mast	Sunol	TLT2	FA002552	—	NCR
3 Phase AC Power Source	apc AC Power	45 kVA	FA002677	—	VOU
Power Meter	HIOKI	PW3337	FA002727	1 year	July 25/18
Receiver/spectrum analyzer	Rohde & Schwarz	ESU 40	FA002071	1 year	Sept. 18/18
Bilog antenna (20–2000 MHz)	Sunol	JB1	FA002517	1 year	Dec. 6/18
Horn antenna (1–18 GHz)	EMCO	3115	FA001451	1 year	April 5/18
Pre-amplifier (0.5–18 GHz)	COM-POWER	PAM-118A	FA002561	1 year	Sept. 21/18

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

Table 8.1-6: *Radiated emissions test software details*

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

8.1.5 Test data



NEX-349802 - March 5, 2018 - HSVL Advanced

Preview Result 1-PK+
CISPR 32 Limit - Class B, Quasi-Peak, 3 m
FCC Part 15 and ICES-003 Limit - Class B (Quasi-Peak and Average), 3 m

The spectral plot is a summation of a vertical and horizontal scan. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators.

Figure 8.1-1: *Radiated emissions spectral plot (30 to 1000 MHz) – HSVL Advanced*

8.1.5 Test data, continued

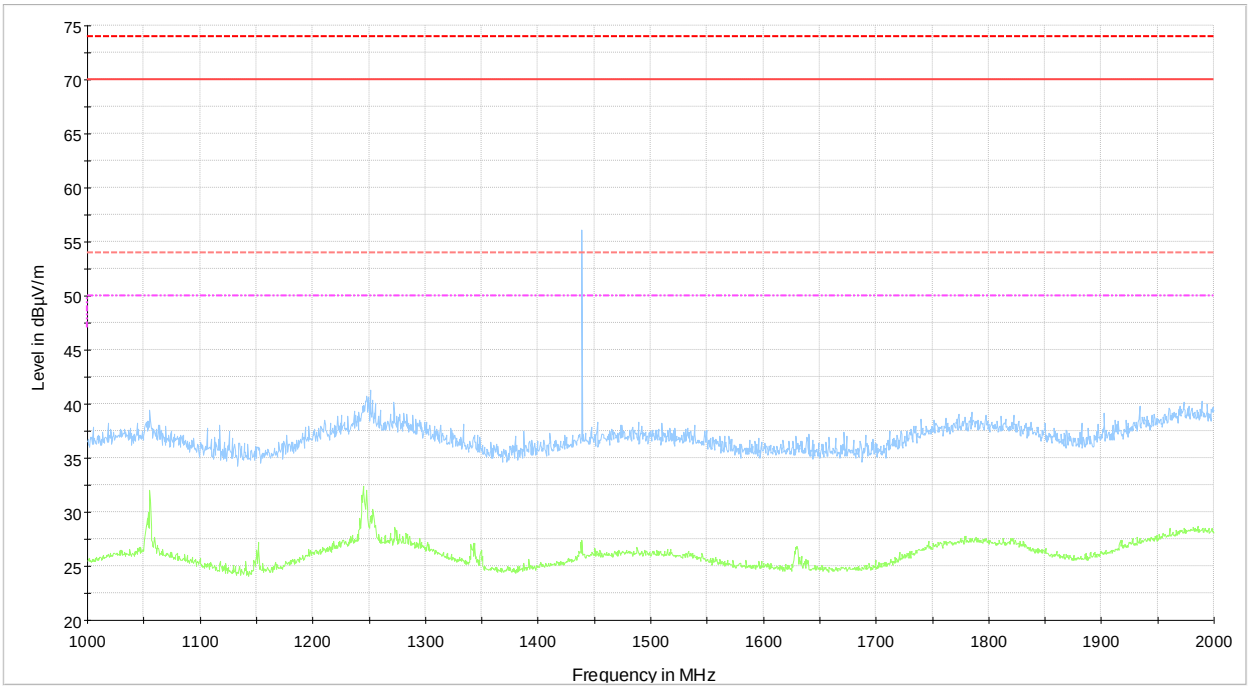
Table 8.1-7: *Radiated emissions (Quasi-Peak) results – HSVL Advanced*

Frequency (MHz)	Quasi-Peak field strength[1] (dBµV/m)	3 m Quasi-Peak limit [3] (dBµV/m)	Margin (dB)	Measurement time (ms)	Bandwidth (kHz)	Antenna height (cm)	Pol. (V/H)	Turn table position (°)	Correction factor[2] (dB)
CISPR 32, EN 55032 and AS/NZS CISPR 32									
480.00	44.2	47.0	2.8	100	120	132	V	233	20.4
575.97	39.4	47.0	7.6	100	120	167	H	292	22.0
187.68	31.8	40.0	8.2	100	120	187	H	279	13.1
384.00	37.1	47.0	9.9	100	120	103	H	254	18.1
72.00	29.1	40.0	10.9	100	120	123	V	331	9.6
168.66	28.5	40.0	11.5	100	120	223	H	97	13.5
186.90	28.1	40.0	11.9	100	120	168	H	293	13.1
287.43	34.1	47.0	12.9	100	120	112	H	41	16.0
83.97	26.5	40.0	13.5	100	120	138	V	92	8.8
50.19	25.6	40.0	14.4	100	120	147	V	76	9.9
338.46	31.3	47.0	15.7	100	120	100	H	95	17.0
60.00	23.6	40.0	16.4	100	120	150	V	210	8.2
33.63	23.3	40.0	16.7	100	120	219	V	-1	20.3
30.15	22.8	40.0	17.2	100	120	373	H	24	23.2
30.87	21.8	40.0	18.2	100	120	150	V	47	22.7
225.93	21.7	40.0	18.3	100	120	110	V	344	13.7
32.31	20.7	40.0	19.3	100	120	257	H	292	21.7
64.20	20.6	40.0	19.4	100	120	102	V	32	9.0
31.44	20.5	40.0	19.5	100	120	280	H	172	22.3
32.91	20.5	40.0	19.5	100	120	260	V	279	21.2
183.75	20.4	40.0	19.6	100	120	269	H	231	13.0
995.88	27.2	47.0	19.8	100	120	215	V	337	27.4
FCC and ICES-003									
480.00	44.2	46.0	1.8	100	120	132	V	233	20.4
575.97	39.4	46.0	6.6	100	120	167	H	292	22.0
384.00	37.1	46.0	8.9	100	120	103	H	254	18.1
72.00	29.1	40.0	10.9	100	120	123	V	331	9.6
187.68	31.8	43.5	11.7	100	120	187	H	279	13.1
287.43	34.1	46.0	11.9	100	120	112	H	41	16.0
83.97	26.5	40.0	13.5	100	120	138	V	92	8.8
50.19	25.6	40.0	14.4	100	120	147	V	76	9.9
338.46	31.3	46.0	14.7	100	120	100	H	95	17.0
168.66	28.5	43.5	15.0	100	120	223	H	97	13.5
186.90	28.1	43.5	15.4	100	120	168	H	293	13.1
60.00	23.6	40.0	16.4	100	120	150	V	210	8.2
33.63	23.3	40.0	16.7	100	120	219	V	-1	20.3
30.15	22.8	40.0	17.2	100	120	373	H	24	23.2
30.87	21.8	40.0	18.2	100	120	150	V	47	22.7
32.31	20.7	40.0	19.3	100	120	257	H	292	21.7
64.20	20.6	40.0	19.4	100	120	102	V	32	9.0
31.44	20.5	40.0	19.5	100	120	280	H	172	22.3
32.91	20.5	40.0	19.5	100	120	260	V	279	21.2

Notes: [1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factor = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions have been recorded.

Sample calculation: 39.4 dBµV/m (field strength) = 17.4 dBµV (receiver reading) + 22.0 dB (Correction factor)

8.1.5 Test data, continued



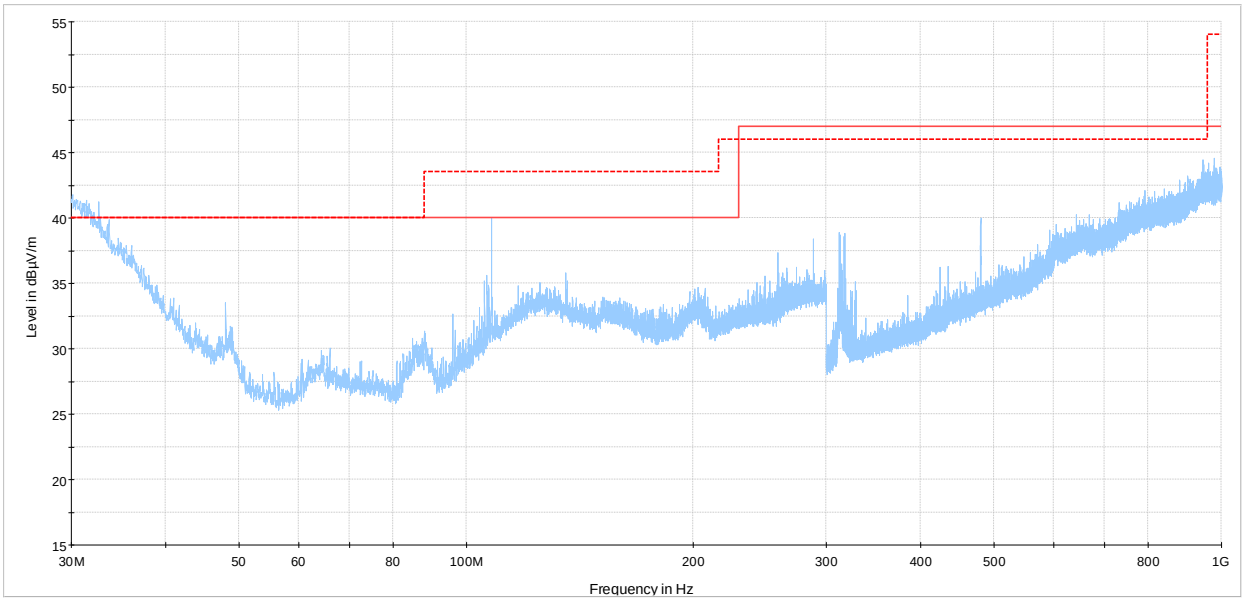
NEX-349802 - March 6, 2018 - HSVL Advanced

- Preview Result 2-AVG
- Preview Result 1-PK+
- CISPR 32 Limit - Class B, Peak, 3 m
- CISPR 32 Limit - Class B, Average, 3 m
- FCC Part 15 and ICES-003 Limit - Class B (Peak) above 1 GHz, 3 m
- FCC Part 15 and ICES-003 Limit - Class B (Quasi-Peak and Average), 3 m

The spectral plot is a summation of a vertical and horizontal scan. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators.

Figure 8.1-2: *Radiated emissions spectral plot (1 to 2 GHz) – HSVL Advanced*

8.1.5 Test data, continued



NEX-349802 - March 5, 2018 - HSVL Plus
Preview Result 1-PK+
CISPR 32 Limit - Class B, Quasi-Peak, 3 m
FCC Part 15 and ICES-003 Limit - Class B (Quasi-Peak and Average), 3 m

The spectral plot is a summation of a vertical and horizontal scan. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators.

Figure 8.1-3: *Radiated emissions spectral plot (30 to 1000 MHz) – HSVL Plus*

8.1.5 Test data, continued

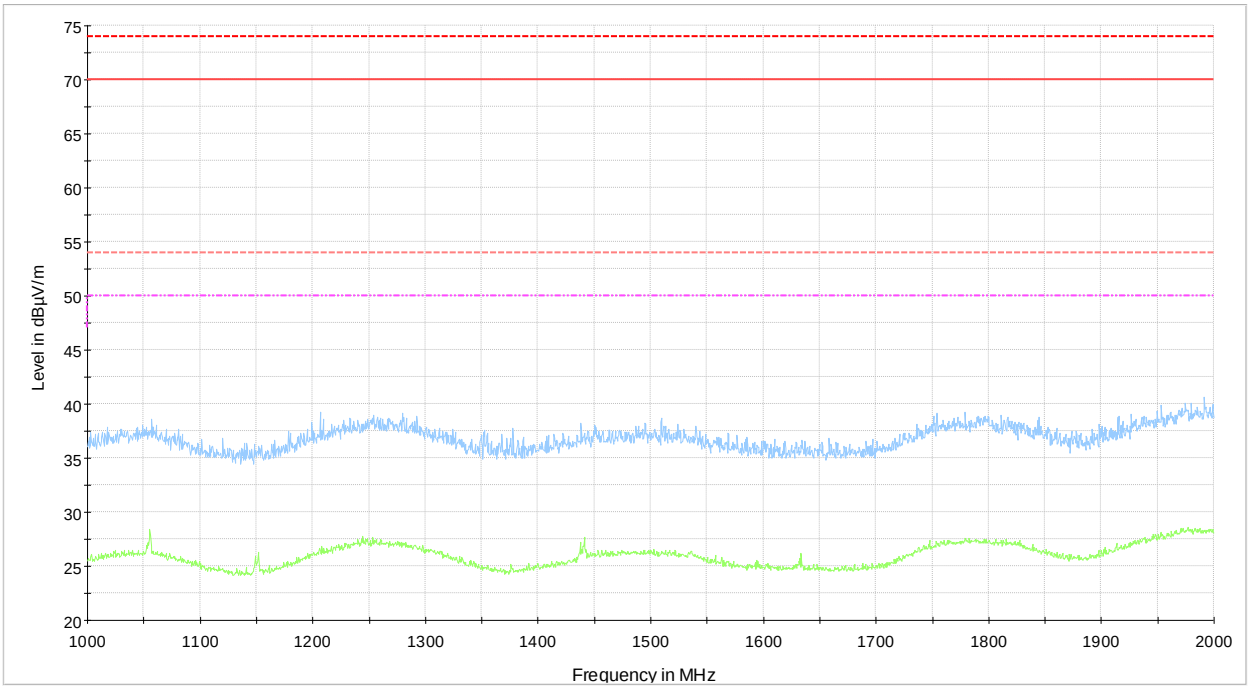
Table 8.1-8: *Radiated emissions (Quasi-Peak) results – HSVL Plus*

Frequency (MHz)	Quasi-Peak field strength[1] (dBµV/m)	3 m Quasi-Peak limit [3] (dBµV/m)	Margin (dB)	Measurement time (ms)	Bandwidth (kHz)	Antenna height (cm)	Pol. (V/H)	Turn table position (°)	Correction factor[2] (dB)
CISPR 32, EN 55032 and AS/NZS CISPR 32									
108.00	33.9	40.0	6.1	100	120	136	V	179	13.5
106.44	32.1	40.0	7.9	100	120	107	V	186	13.2
30.48	30.6	40.0	9.4	100	120	369	H	149	23.0
480.00	36.4	47.0	10.6	100	120	100	V	226	20.4
312.69	33.1	47.0	13.9	100	120	170	V	108	16.3
96.00	25.6	40.0	14.4	100	120	132	V	213	10.2
30.84	25.5	40.0	14.5	100	120	324	H	4	22.7
36.06	25.0	40.0	15.0	100	120	150	V	41	18.7
288.00	31.8	47.0	15.2	100	120	122	V	224	16.0
32.13	24.2	40.0	15.8	100	120	233	H	72	21.7
135.51	24.0	40.0	16.0	100	120	256	V	344	15.5
84.96	23.9	40.0	16.1	100	120	129	V	282	8.8
31.41	23.1	40.0	16.9	100	120	116	H	276	22.3
30.12	22.5	40.0	17.5	100	120	365	V	274	23.2
33.48	22.0	40.0	18.0	100	120	396	H	314	20.5
31.68	22.0	40.0	18.0	100	120	293	V	137	22.1
202.68	21.9	40.0	18.1	100	120	120	V	6	14.2
32.61	21.1	40.0	18.9	100	120	373	V	102	21.4
32.79	20.9	40.0	19.1	100	120	361	V	349	21.3
33.66	20.8	40.0	19.2	100	120	397	H	350	20.3
151.74	20.4	40.0	19.6	100	120	323	V	347	14.4
FCC and ICES-003									
30.48	30.6	40.0	9.4	100	120	369	H	149	23.0
108.00	33.9	43.5	9.6	100	120	136	V	179	13.5
480.00	36.4	46.0	9.6	100	120	100	V	226	20.4
106.44	32.1	43.5	11.4	100	120	107	V	186	13.2
312.69	33.1	46.0	12.9	100	120	170	V	108	16.3
288.00	31.8	46.0	14.2	100	120	122	V	224	16.0
30.84	25.5	40.0	14.5	100	120	324	H	4	22.7
36.06	25.0	40.0	15.0	100	120	150	V	41	18.7
32.13	24.2	40.0	15.8	100	120	233	H	72	21.7
84.96	23.9	40.0	16.1	100	120	129	V	282	8.8
31.41	23.1	40.0	16.9	100	120	116	H	276	22.3
30.12	22.5	40.0	17.5	100	120	365	V	274	23.2
96.00	25.6	43.5	17.9	100	120	132	V	213	10.2
33.48	22.0	40.0	18.0	100	120	396	H	314	20.5
31.68	22.0	40.0	18.0	100	120	293	V	137	22.1
32.61	21.1	40.0	18.9	100	120	373	V	102	21.4
944.13	26.9	46.0	19.1	100	120	127	H	30	27.2
32.79	20.9	40.0	19.1	100	120	361	V	349	21.3
33.66	20.8	40.0	19.2	100	120	397	H	350	20.3
135.51	24.0	43.5	19.5	100	120	256	V	344	15.5

Notes:
[1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factor = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions have been recorded.

Sample calculation: 39.4 dBµV/m (field strength) = 17.4 dBµV (receiver reading) + 22.0 dB (Correction factor)

8.1.5 Test data, continued



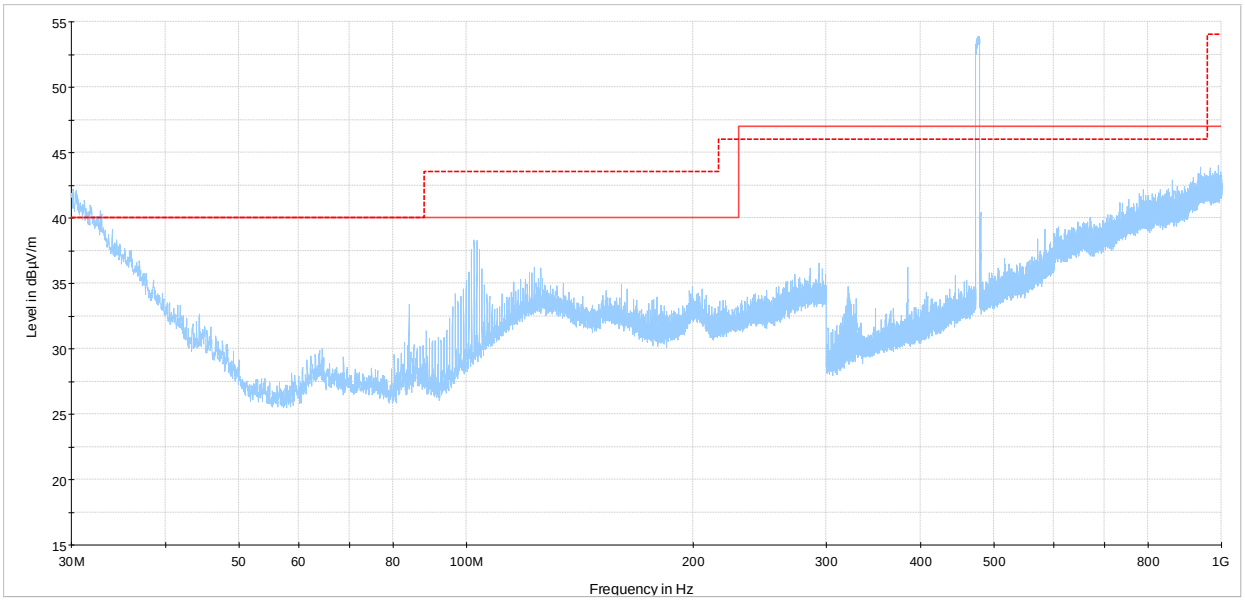
NEX-349802 - March 6, 2018 - HSVL Plus

- Preview Result 2-AVG
- Preview Result 1-PK+
- CISPR 32 Limit - Class B, Peak, 3 m
- CISPR 32 Limit - Class B, Average, 3 m
- FCC Part 15 and ICES-003 Limit - Class B (Peak) above 1 GHz, 3 m
- FCC Part 15 and ICES-003 Limit - Class B (Quasi-Peak and Average), 3 m

The spectral plot is a summation of a vertical and horizontal scan. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators.

Figure 8.1-4: *Radiated emissions spectral plot (1 to 2 GHz) – HSVL Plus*

8.1.5 Test data, continued



NEX-349802 - March 5, 2018 - HSVL Plus L

Preview Result 1-PK+
CISPR 32 Limit - Class B, Quasi-Peak, 3 m
FCC Part 15 and ICES-003 Limit - Class B (Quasi-Peak and Average), 3 m

The spectral plot is a summation of a vertical and horizontal scan. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators.

Figure 8.1-5: *Radiated emissions spectral plot (30 to 1000 MHz) – HSVL Plus L*

8.1.5 Test data, continued

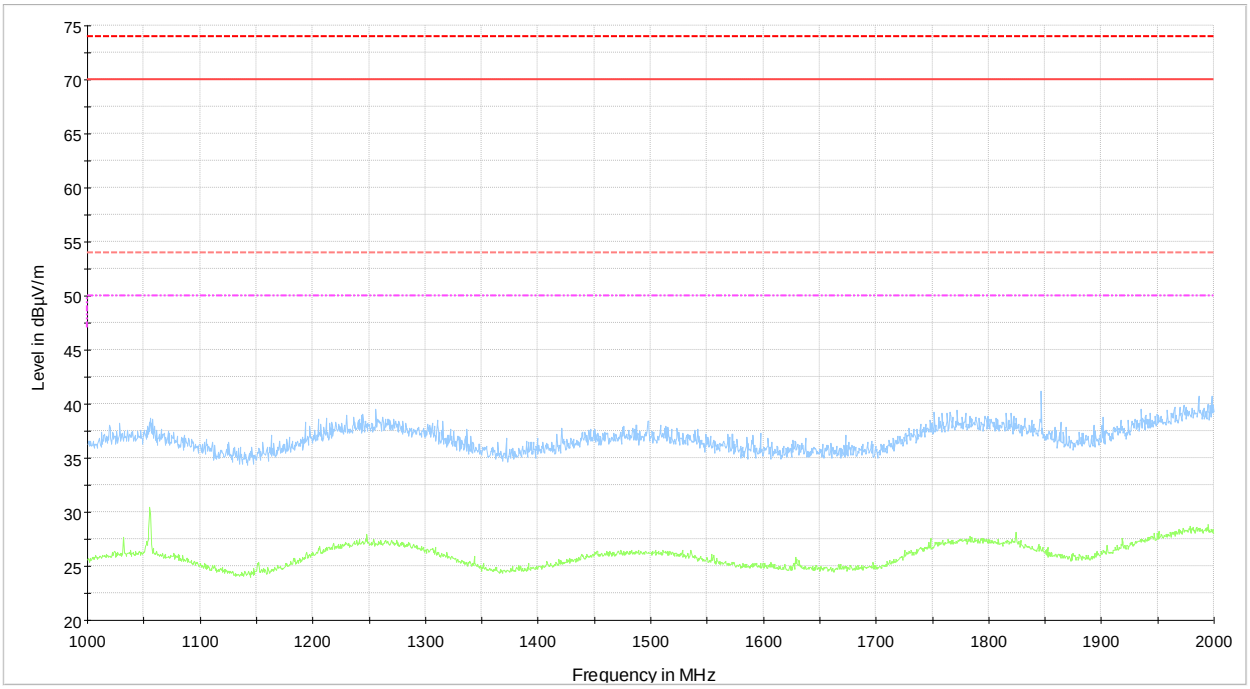
Table 8.1-9: *Radiated emissions (Quasi-Peak) results – HSVL Plus L*

Frequency (MHz)	Quasi-Peak field strength[1] (dBµV/m)	3 m Quasi-Peak limit [3] (dBµV/m)	Margin (dB)	Measurement time (ms)	Bandwidth (kHz)	Antenna height (cm)	Pol. (V/H)	Turn table position (°)	Correction factor[2] (dB)
CISPR 32, EN 55032 and AS/NZS CISPR 32									
100.80	35.0	40.0	5.0	100	120	113	V	231	11.6
101.64	35.0	40.0	5.0	100	120	106	V	212	11.8
102.45	34.6	40.0	5.4	100	120	144	V	229	12.1
103.29	34.1	40.0	5.9	100	120	102	V	191	12.3
104.10	33.3	40.0	6.7	100	120	109	V	169	12.6
99.99	32.6	40.0	7.4	100	120	108	V	239	11.2
104.91	32.5	40.0	7.5	100	120	110	V	268	12.6
99.18	31.9	40.0	8.1	100	120	102	V	206	11.0
480.00	38.7	47.0	8.3	100	120	106	V	177	20.4
122.94	31.5	40.0	8.5	100	120	111	V	268	15.8
96.72	29.7	40.0	10.3	100	120	117	V	246	10.5
125.43	25.5	40.0	14.5	100	120	100	V	304	16.0
384.00	31.8	47.0	15.2	100	120	216	H	160	18.1
199.17	24.6	40.0	15.4	100	120	108	V	235	14.4
30.45	24.0	40.0	16.0	100	120	191	V	302	23.0
30.18	23.3	40.0	16.7	100	120	215	V	82	23.2
160.62	22.3	40.0	17.7	100	120	211	V	31	14.1
31.23	21.1	40.0	18.9	100	120	387	V	212	22.4
32.76	20.7	40.0	19.3	100	120	153	V	276	21.3
32.91	20.4	40.0	19.6	100	120	392	V	228	21.2
990.51	27.1	47.0	19.9	100	120	158	H	336	27.3
FCC and ICES-003									
480.00	38.7	46.0	7.3	100	120	106	V	177	20.4
100.80	35.0	43.5	8.5	100	120	113	V	231	11.6
101.64	35.0	43.5	8.5	100	120	106	V	212	11.8
102.45	34.6	43.5	8.9	100	120	144	V	229	12.1
103.29	34.1	43.5	9.4	100	120	102	V	191	12.3
104.10	33.3	43.5	10.2	100	120	109	V	169	12.6
99.99	32.6	43.5	10.9	100	120	108	V	239	11.2
104.91	32.5	43.5	11.0	100	120	110	V	268	12.6
99.18	31.9	43.5	11.6	100	120	102	V	206	11.0
122.94	31.5	43.5	12.0	100	120	111	V	268	15.8
96.72	29.7	43.5	13.8	100	120	117	V	246	10.5
384.00	31.8	46.0	14.2	100	120	216	H	160	18.1
30.45	24.0	40.0	16.0	100	120	191	V	302	23.0
30.18	23.3	40.0	16.7	100	120	215	V	82	23.2
125.43	25.5	43.5	18.0	100	120	100	V	304	16.0
31.23	21.1	40.0	18.9	100	120	387	V	212	22.4
199.17	24.6	43.5	18.9	100	120	108	V	235	14.4
32.76	20.7	40.0	19.3	100	120	153	V	276	21.3
32.91	20.4	40.0	19.6	100	120	392	V	228	21.2

Notes: [1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factor = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions have been recorded.

Sample calculation: 39.4 dBµV/m (field strength) = 17.4 dBµV (receiver reading) + 22.0 dB (Correction factor)

8.1.5 Test data, continued



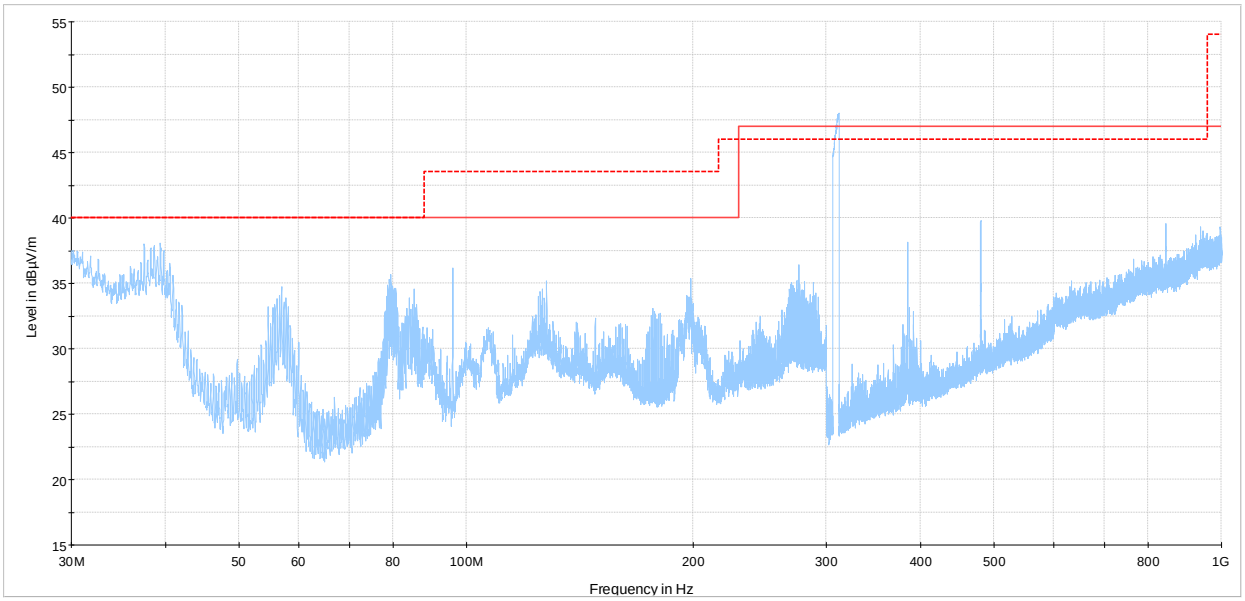
NEX-349802 - March 6, 2018 - HSVL Plus L

- Preview Result 2-AVG
- Preview Result 1-PK+
- CISPR 32 Limit - Class B, Peak, 3 m
- CISPR 32 Limit - Class B, Average, 3 m
- FCC Part 15 and ICES-003 Limit - Class B (Peak) above 1 GHz, 3 m
- FCC Part 15 and ICES-003 Limit - Class B (Quasi-Peak and Average), 3 m

The spectral plot is a summation of a vertical and horizontal scan. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators.

Figure 8.1-6: *Radiated emissions spectral plot (1 to 2 GHz) – HSVL Plus L*

8.1.5 Test data, continued



NEX-349802 - March 2, 2018 - HSVL Plus FS
Preview Result 1-PK+
CISPR 32 Limit - Class B, Quasi-Peak, 3 m
FCC Part 15 and ICES-003 Limit - Class B (Quasi-Peak and Average), 3 m

The spectral plot is a summation of a vertical and horizontal scan. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators.

Figure 8.1-7: *Radiated emissions spectral plot (30 to 1000 MHz) – HSVL Plus FS*

8.1.5 Test data, continued

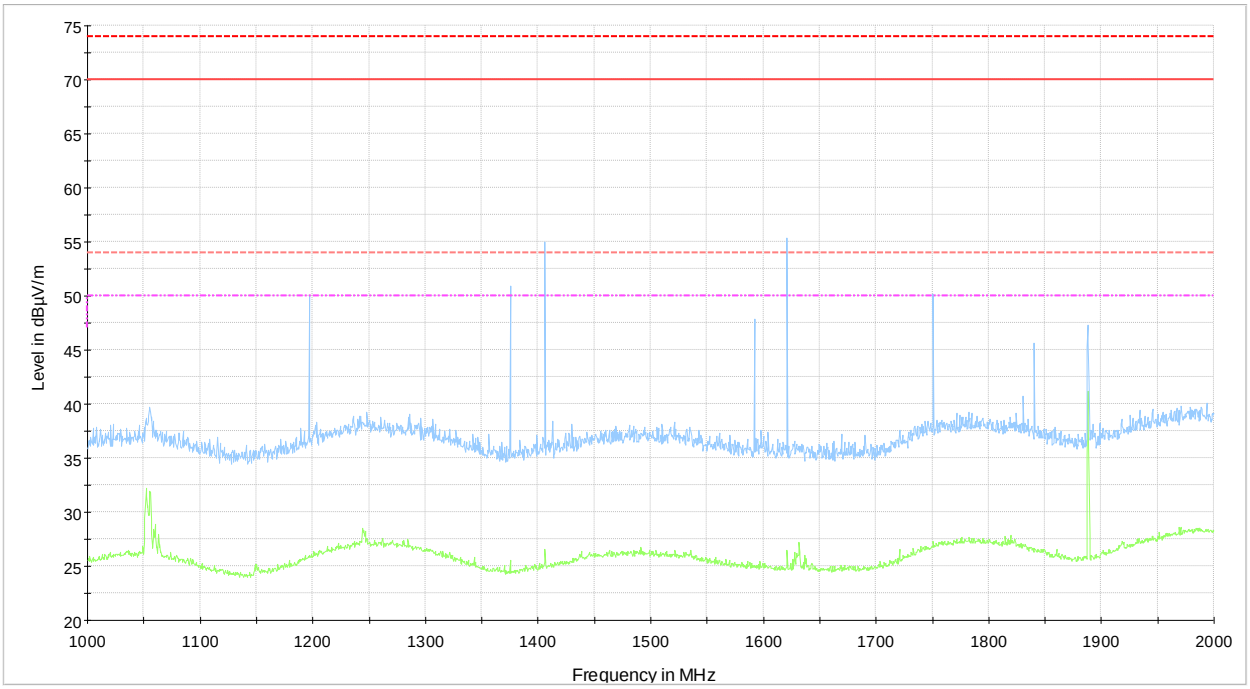
Table 8.1-10: *Radiated emissions (Quasi-Peak) results – HSVL Plus FS*

Frequency (MHz)	Quasi-Peak field strength[1] (dBµV/m)	3 m Quasi-Peak limit [3] (dBµV/m)	Margin (dB)	Measurement time (ms)	Bandwidth (kHz)	Antenna height (cm)	Pol. (V/H)	Turn table position (°)	Correction factor[2] (dB)
CISPR 32, EN 55032 and AS/NZS CISPR 32									
384.00	37.7	47.0	9.3	100	120	206	H	300	18.1
96.00	30.6	40.0	9.4	100	120	104	V	306	10.2
480.00	37.3	47.0	9.7	100	120	103	V	221	20.4
178.14	28.9	40.0	11.1	100	120	117	V	6	12.9
38.61	28.5	40.0	11.5	100	120	104	V	228	16.2
176.55	28.1	40.0	11.9	100	120	145	V	11	13.0
177.33	27.9	40.0	12.1	100	120	105	V	30	13.0
37.47	27.4	40.0	12.6	100	120	112	V	250	17.1
39.36	27.1	40.0	12.9	100	120	129	V	80	15.6
39.78	27.0	40.0	13.0	100	120	127	V	30	15.3
38.25	26.4	40.0	13.6	100	120	128	V	56	16.4
175.77	26.1	40.0	13.9	100	120	136	V	30	13.0
85.26	25.8	40.0	14.2	100	120	114	V	8	8.8
31.02	25.6	40.0	14.4	100	120	102	V	-1	22.6
79.50	25.3	40.0	14.7	100	120	150	V	270	9.1
32.55	24.8	40.0	15.2	100	120	125	V	321	21.5
127.80	24.2	40.0	15.8	100	120	142	V	318	15.9
30.18	24.1	40.0	15.9	100	120	188	V	91	23.2
31.80	23.9	40.0	16.1	100	120	150	V	20	22.0
180.51	23.5	40.0	16.5	100	120	135	V	22	12.9
122.31	23.4	40.0	16.6	100	120	102	V	308	15.8
56.94	22.9	40.0	17.1	100	120	104	V	186	8.2
198.21	21.9	40.0	18.1	100	120	120	V	185	14.3
78.42	21.5	40.0	18.5	100	120	140	V	272	9.2
FCC and ICES-003									
384.00	37.7	46.0	8.3	100	120	206	H	300	18.1
480.00	37.3	46.0	8.7	100	120	103	V	221	20.4
38.61	28.5	40.0	11.5	100	120	104	V	228	16.2
37.47	27.4	40.0	12.6	100	120	112	V	250	17.1
39.36	27.1	40.0	12.9	100	120	129	V	80	15.6
96.00	30.6	43.5	12.9	100	120	104	V	306	10.2
39.78	27.0	40.0	13.0	100	120	127	V	30	15.3
38.25	26.4	40.0	13.6	100	120	128	V	56	16.4
85.26	25.8	40.0	14.2	100	120	114	V	8	8.8
31.02	25.6	40.0	14.4	100	120	102	V	-1	22.6
178.14	28.9	43.5	14.6	100	120	117	V	6	12.9
79.50	25.3	40.0	14.7	100	120	150	V	270	9.1
32.55	24.8	40.0	15.2	100	120	125	V	321	21.5
176.55	28.1	43.5	15.4	100	120	145	V	11	13.0
177.33	27.9	43.5	15.6	100	120	105	V	30	13.0
30.18	24.1	40.0	15.9	100	120	188	V	91	23.2
31.80	23.9	40.0	16.1	100	120	150	V	20	22.0
56.94	22.9	40.0	17.1	100	120	104	V	186	8.2
175.77	26.1	43.5	17.4	100	120	136	V	30	13.0
78.42	21.5	40.0	18.5	100	120	140	V	272	9.2

Notes:
[1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factor = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions have been recorded.

Sample calculation: 39.4 dBµV/m (field strength) = 17.4 dBµV (receiver reading) + 22.0 dB (Correction factor)

8.1.5 Test data, continued



NEX-349802 - March 6, 2018 - HSVL Plus FS

- Preview Result 2-AVG
- Preview Result 1-PK+
- CISPR 32 Limit - Class B, Peak, 3 m
- CISPR 32 Limit - Class B, Average, 3 m
- FCC Part 15 and ICES-003 Limit - Class B (Peak) above 1 GHz, 3 m
- FCC Part 15 and ICES-003 Limit - Class B (Quasi-Peak and Average), 3 m

The spectral plot is a summation of a vertical and horizontal scan. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators.

Figure 8.1-8: *Radiated emissions spectral plot (1 to 2 GHz) – HSVL Plus FS*

8.1.6 Setup photos

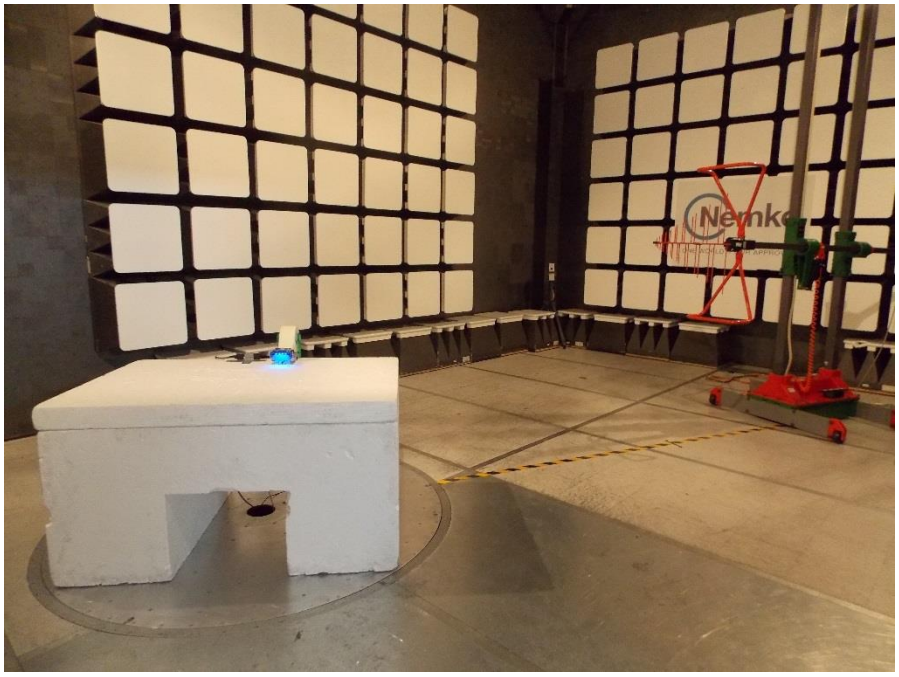


Figure 8.1-9: *Radiated emissions setup photo – below 1 GHz – HSVL Advanced*

Figure 8.1-10: *Radiated emissions setup photo – below 1 GHz – HSVL Advanced*

8.1.6 Setup photos, continued

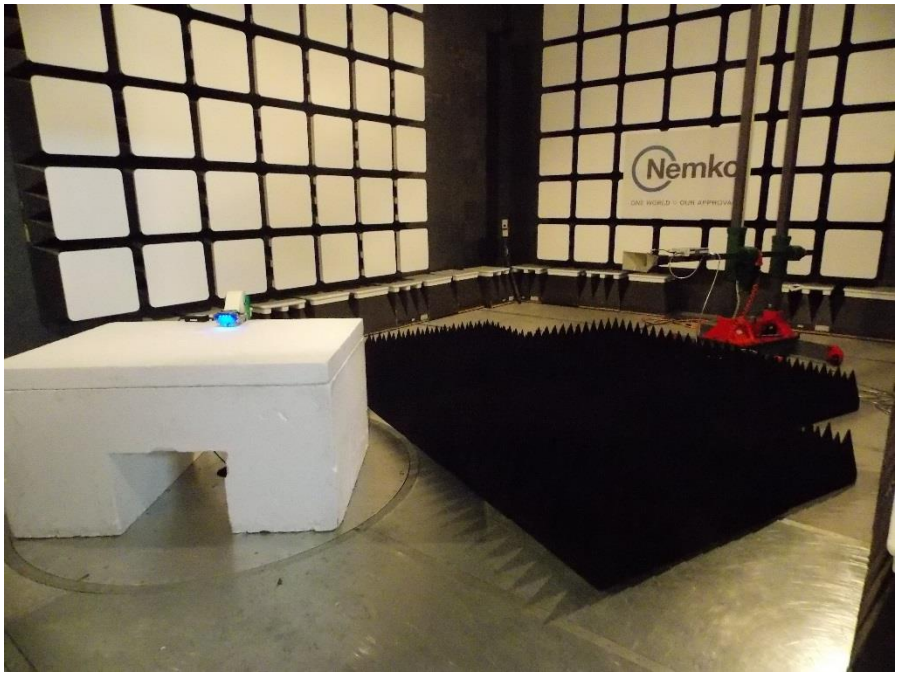


Figure 8.1-11: *Radiated emissions setup photo – above 1 GHz – HSVL Advanced*

Figure 8.1-12: *Radiated emissions setup photo – above 1 GHz – HSVL Advanced*

8.1.6 Setup photos, continued

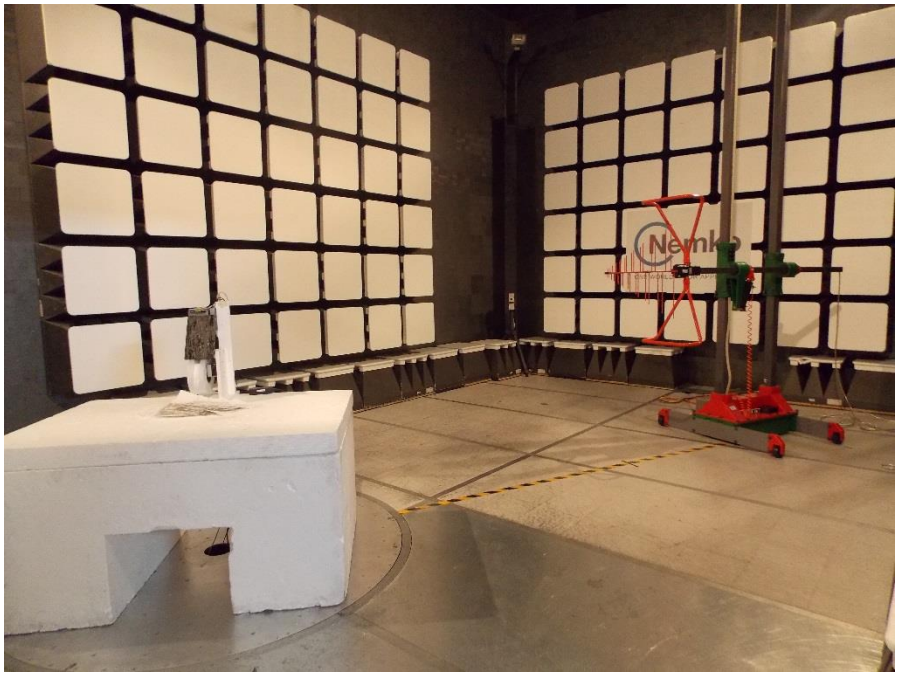


Figure 8.1-13: *Radiated emissions setup photo – below 1 GHz – HSVL Plus*

Figure 8.1-14: *Radiated emissions setup photo – below 1 GHz – HSVL Plus*

8.1.6 Setup photos, continued

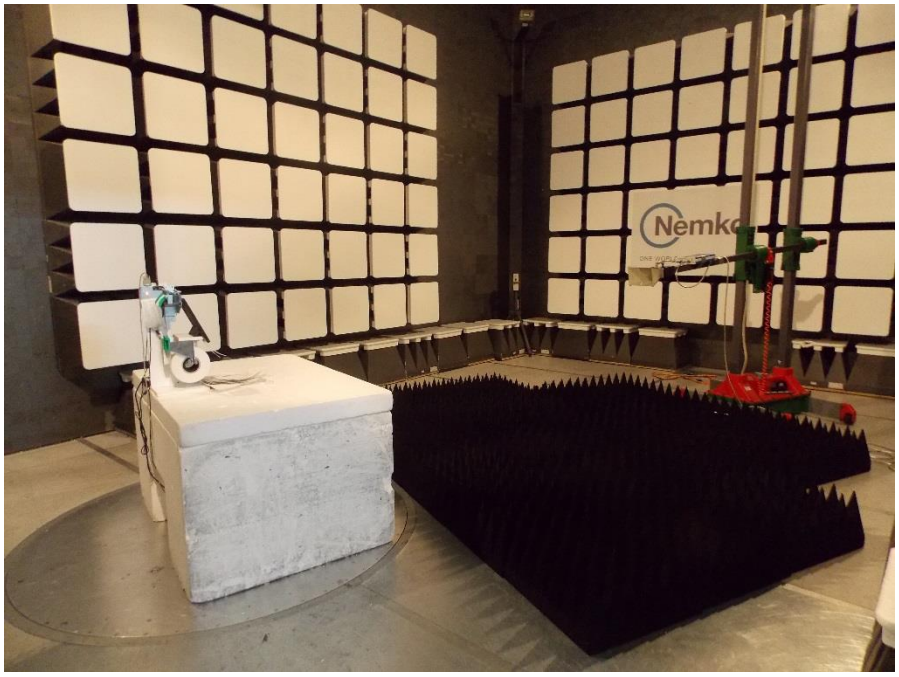


Figure 8.1-15: *Radiated emissions setup photo – above 1 GHz – HSVL Plus*

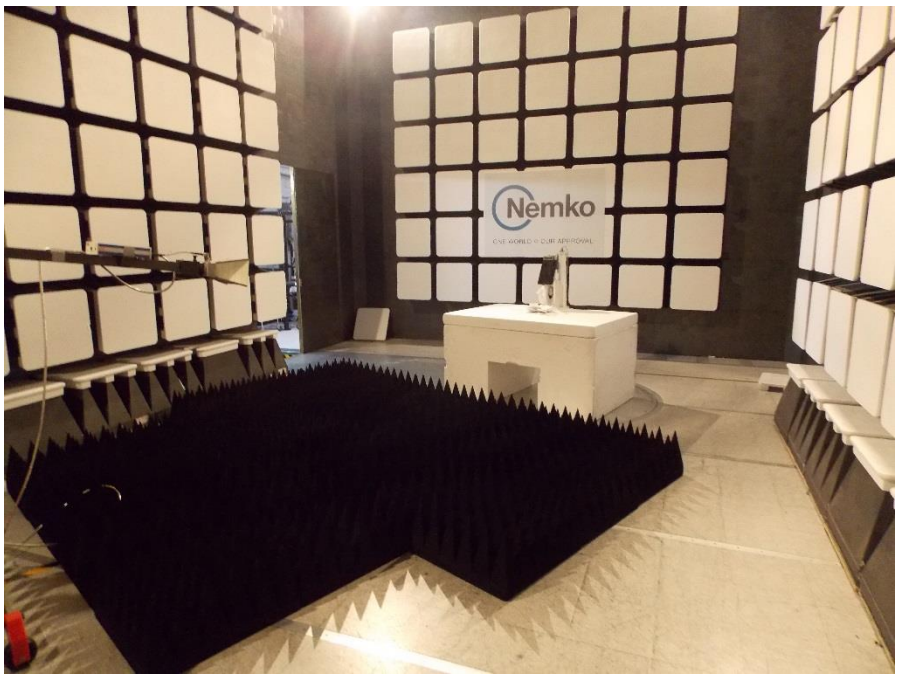


Figure 8.1-16: *Radiated emissions setup photo – above 1 GHz – HSVL Plus*

8.1.6 Setup photos, continued

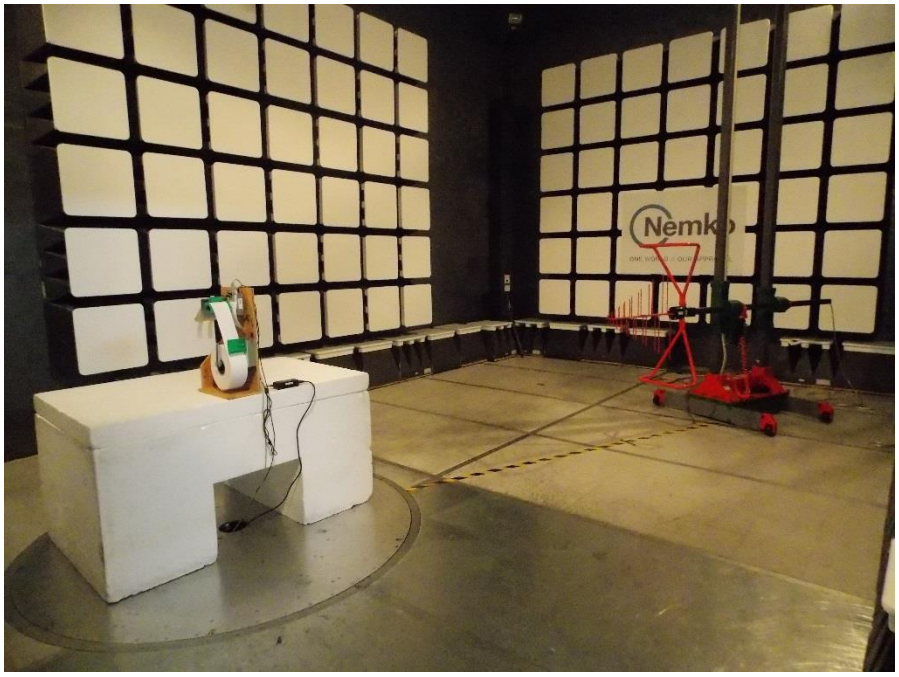


Figure 8.1-17: *Radiated emissions setup photo – below 1 GHz – HSVL Plus L*

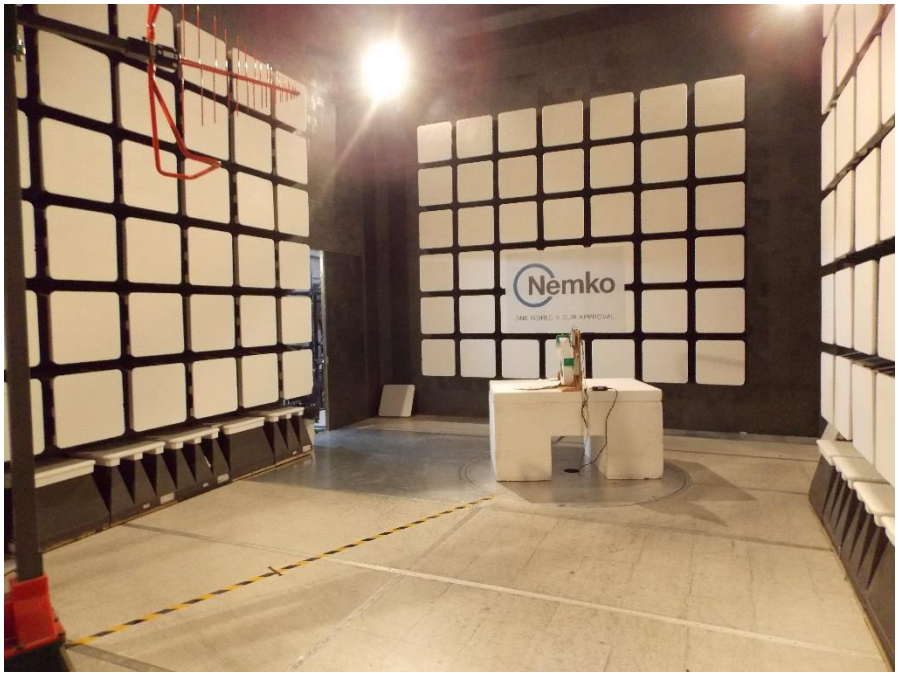


Figure 8.1-18: *Radiated emissions setup photo – below 1 GHz – HSVL Plus L*

8.1.6 Setup photos, continued

Figure 8.1-19: *Radiated emissions setup photo – above 1 GHz – HSVL Plus L*

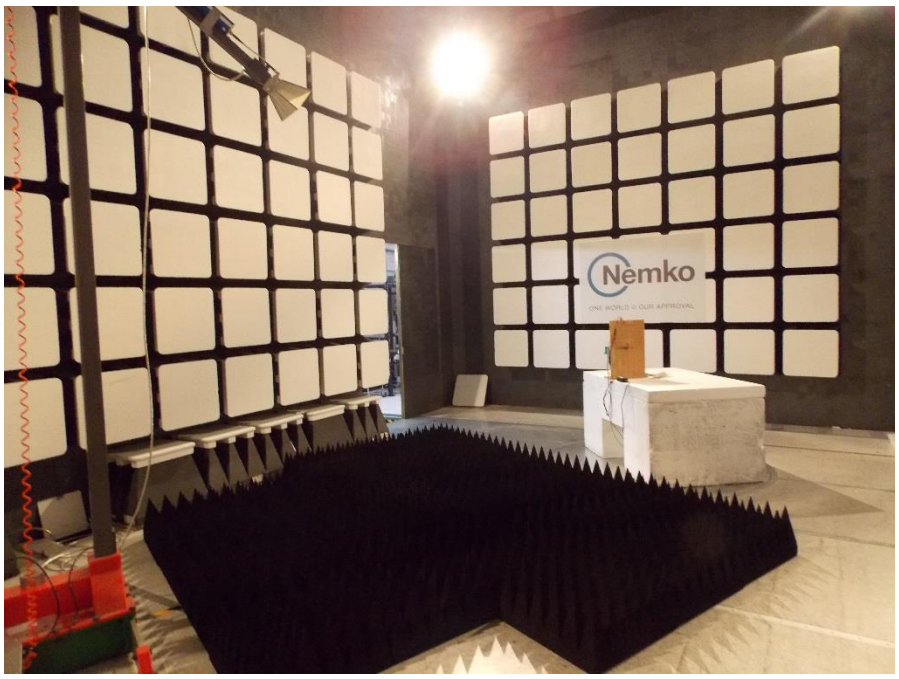


Figure 8.1-20: *Radiated emissions setup photo – above 1 GHz – HSVL Plus L*

8.1.6 Setup photos, continued

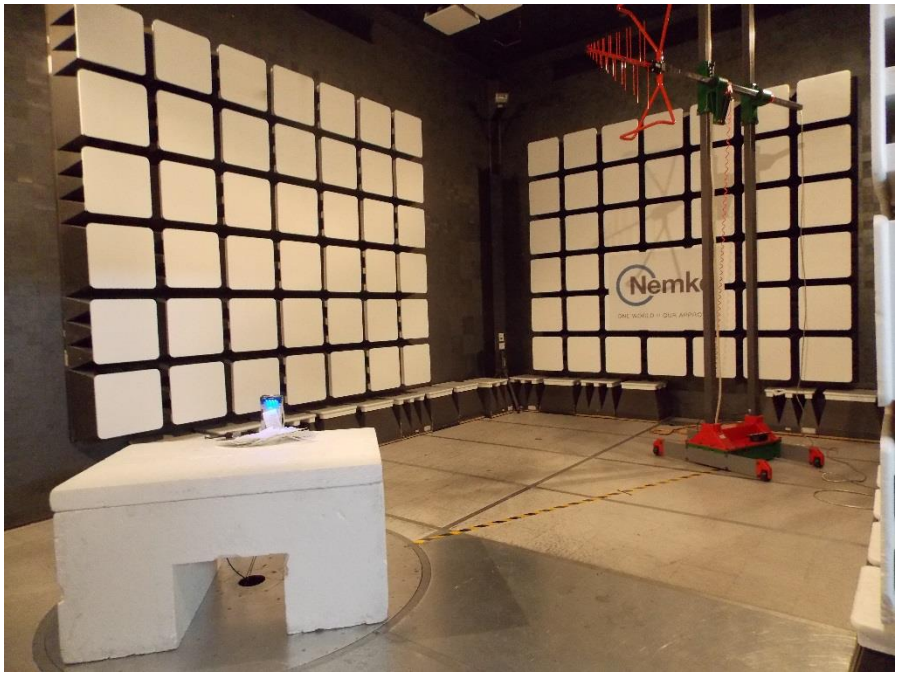


Figure 8.1-21: *Radiated emissions setup photo – below 1 GHz – HSVL Plus FS*

Figure 8.1-22: *Radiated emissions setup photo – below 1 GHz – HSVL Plus FS*

8.1.6 Setup photos, continued

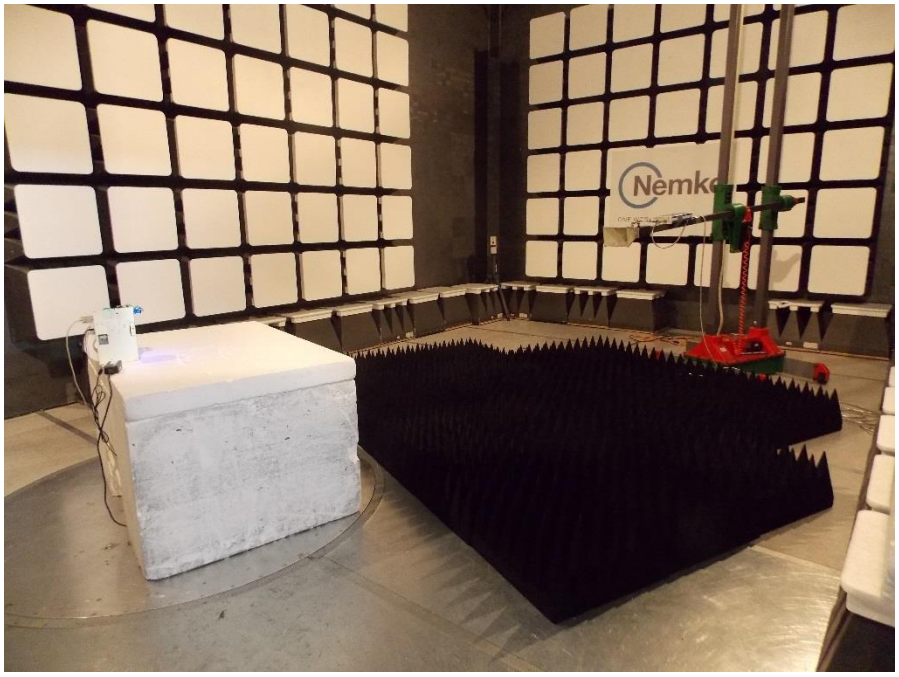


Figure 8.1-23: *Radiated emissions setup photo – above 1 GHz – HSVL Plus FS*

Figure 8.1-24: *Radiated emissions setup photo – above 1 GHz – HSVL Plus FS*

8.2 Conducted emissions – from AC mains power ports

8.2.1 References and limits

- CISPR 32:2015: Section A.3
- AS/NZS CISPR 32:2015: Section A.3
- EN 55032:2012/AC:2013: Section A.3
- FCC 47 CFR Part 15, Subpart B: Clause §15.107 (Test method ANSI C63.4:2014)
- ICES-003: Section 6.1

Table 8.2-1: *Requirements for conducted emissions from the AC mains power ports for Class B*

Frequency range [MHz]	Measurement		Limits
	Coupling device	Detector type/ bandwidth	[dBµV]
0.15–0.5			66–56
0.5–5	AMN	Quasi Peak/9 kHz	56
5–30			60
0.15–0.5			56–46
0.5–5	AMN	CAverage/9 kHz	46
5–30			50

Notes: The lower limit shall apply at the transition frequency.

8.2.2 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 %

8.2.3 Notes

- Where tabular data has not been provided, no emissions were observed within 10 dB of the specified limit when measured with the appropriate detector.
- Where less than 6 measurements per detector has been provided, fewer than 6 emissions were observed within 10 dB of the specified limit when measured with the appropriate detector.
- Equipment with a DC power port powered by a dedicated AC/DC power converter is considered to be AC mains powered equipment and was tested with a power converter. Where the power converter was provided by the manufacturer, the provided converter was used.

8.2.4 Setup details

Port under test – Coupling device	AC Mains Input of PSU – Artificial Mains Network (AMN)
EUT power input during test	120 V_{AC}, 60 Hz; 230 V_{AC}, 50 Hz
EUT setup configuration	Table top
Measurement details	A preview measurement was generated with the receiver in continuous scan mode. Emissions detected within 10 dB or above the limit were re-measured with the appropriate detector against the correlating limit and recorded as the final measurement.

Receiver settings:

Resolution bandwidth	9 kHz
Video bandwidth	30 kHz
Detector mode	Peak and Average (Preview measurement), Quasi-peak and CAverage (Final measurement)
Trace mode	Max Hold
Measurement time	– 100 ms (Peak and Average preview measurement) – 100 ms (Quasi-peak final measurement) – 160 ms (CAverage final measurement)

Table 8.2-2: *Conducted emissions – from AC mains power ports equipment list*

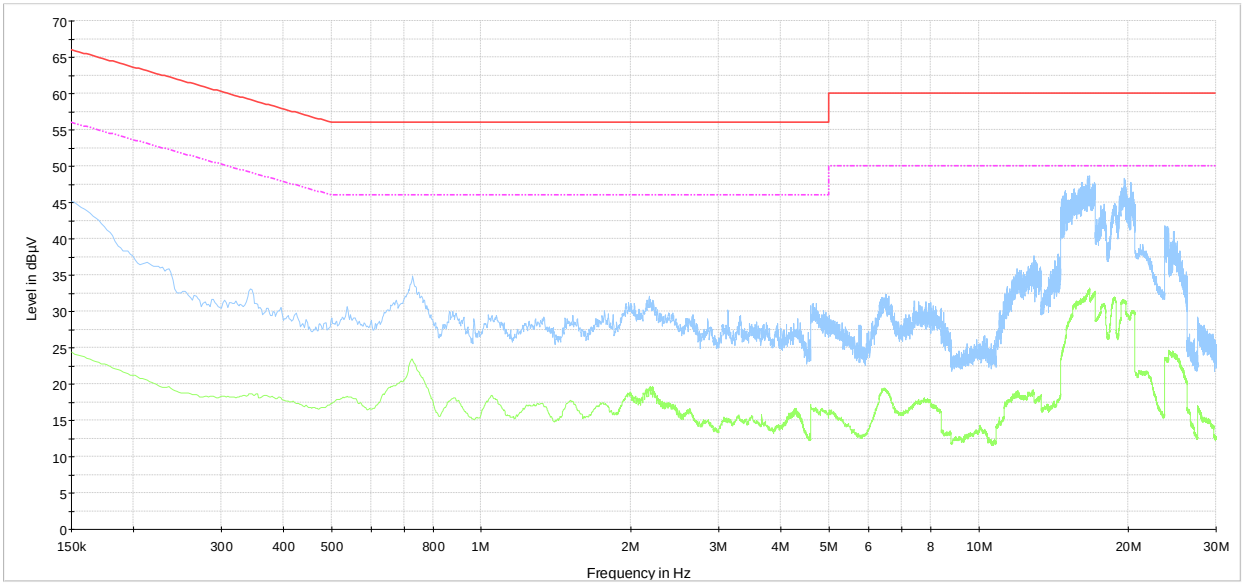
Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
Receiver/spectrum analyzer	Rohde & Schwarz	ESU 40	FA002071	1 year	Sept. 18/18
3 Phase AC Power Source	apc AC Power	45 kVA	FA002677	—	VOU
Power Meter	HIOKI	PW3337	FA002727	1 year	July 25/18
LISN	Rohde & Schwarz	ENV216	FA002514	1 year	Dec. 15/18

Notes: VOU - verify on use

Table 8.2-3: *Conducted emissions – from AC mains power ports test software details*

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

8.2.5 Test data

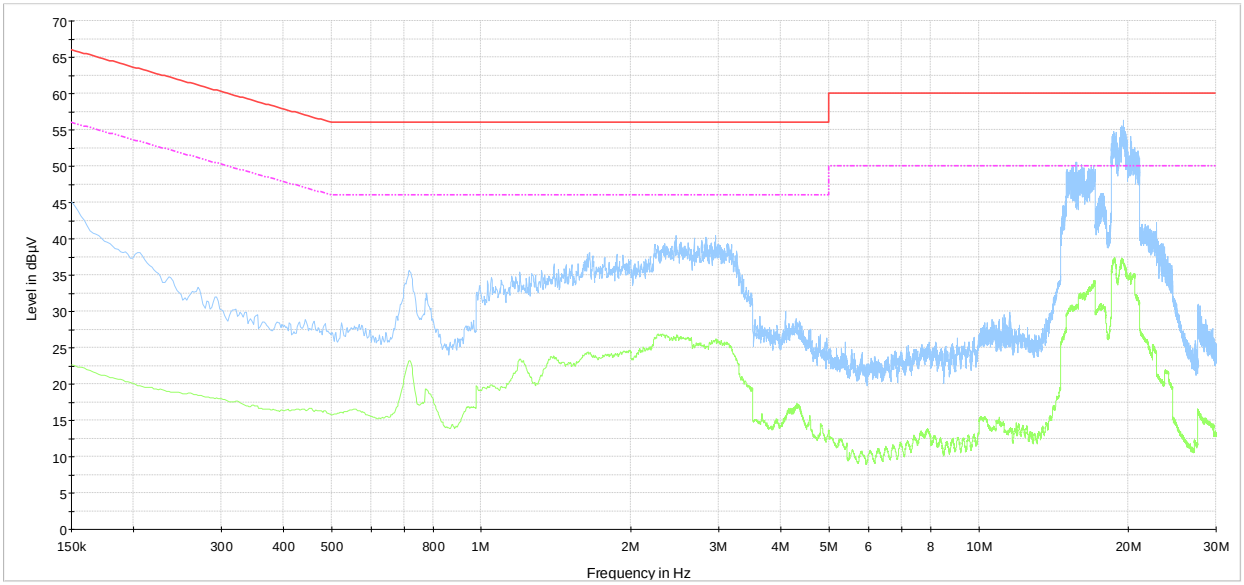


NEX-349802 - March 14, 2018 - AC Mains - HSVL Advanced - 120 VAC, 60 Hz - Phase
Preview Result 2-AVG
Preview Result 1-PK+
CISPR 32 Limit - Class B, Mains (Quasi-Peak)
CISPR 32 Limit - Class B, Mains (Average)

The spectral plot has been corrected with transducer factors. (i.e. cable loss, LISN factors, and attenuators)

Figure 8.2-1: *Conducted emissions – from AC mains power ports spectral plot on phase line – HSVL Advanced*

8.2.5 Test data, continued



The spectral plot has been corrected with transducer factors. (i.e. cable loss, LISN factors, and attenuators)

Figure 8.2-2: *Conducted emissions – from AC mains power ports spectral plot on neutral line – HSVL Advanced*

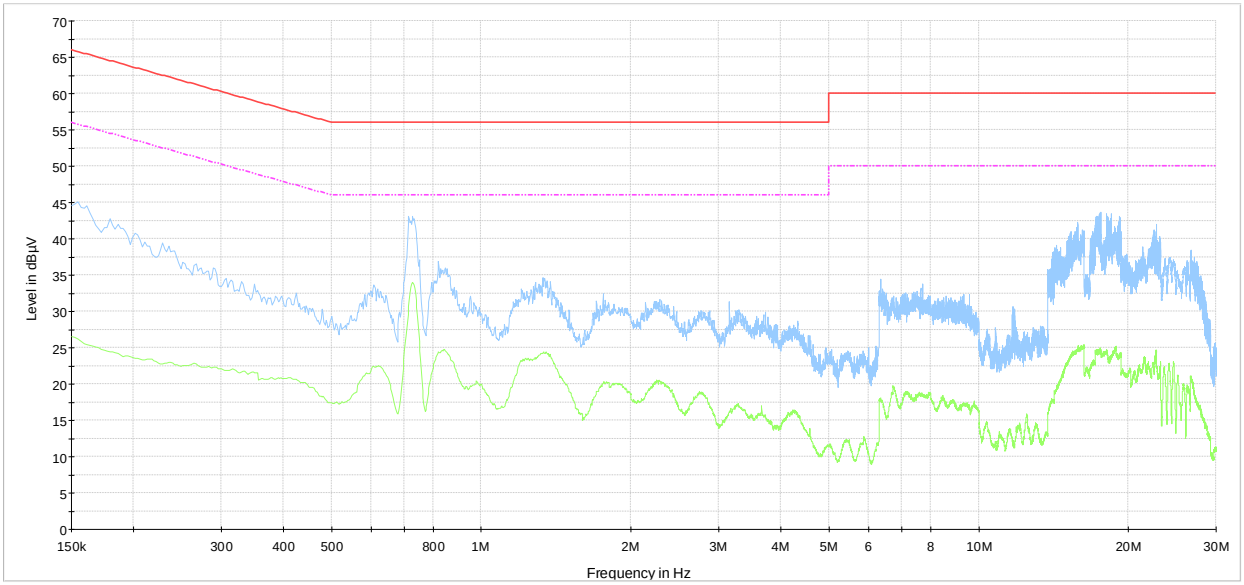
Table 8.2-4: *Conducted emissions – from AC mains power ports (Quasi-Peak) results – HSVL Advanced*

Frequency (MHz)	Quasi-Peak result[1] and [3] (dBµV)	Quasi-Peak limit (dBµV)	Margin (dB)	Measurement time (ms)	Bandwidth (kHz)	Conductor	Filter	Correction factor[2] (dB)
19.33300	45.8	60.0	14.2	100	9	N	ON	11.1
18.61300	45.5	60.0	14.5	100	9	N	ON	11.2
18.65575	45.3	60.0	14.7	100	9	N	ON	11.2
19.60750	45.1	60.0	14.9	100	9	N	ON	11.1
19.79200	44.4	60.0	15.6	100	9	N	ON	11.1
19.28575	44.0	60.0	16.0	100	9	N	ON	11.2

Notes:
[1] Result (dBµV) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factor (dB) = LISN factor IL (dB) + cable loss (dB) + attenuator (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions have been recorded.

Sample calculation: 45.8 dBµV (result) = 34.7 dBµV (receiver reading) + 11.1 dB (Correction factor)

8.2.5 Test data, continued



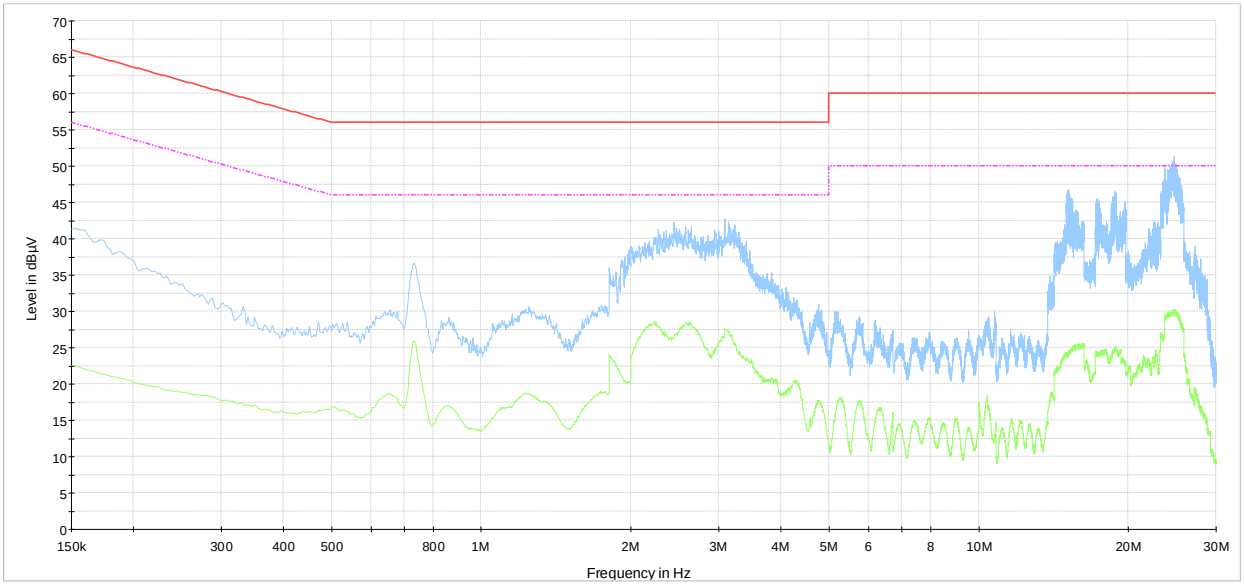
NEX-349802 - March 14, 2018 - AC Mains - HSVL Advanced - 230 VAC, 50 Hz - Phase

Preview Result 2-AVG
Preview Result 1-PK+
CISPR 32 Limit - Class B, Mains (Quasi-Peak)
CISPR 32 Limit - Class B, Mains (Average)

The spectral plot has been corrected with transducer factors. (i.e. cable loss, LISN factors, and attenuators)

Figure 8.2-3: *Conducted emissions – from AC mains power ports spectral plot on phase line – HSVL Advanced*

8.2.5 Test data, continued



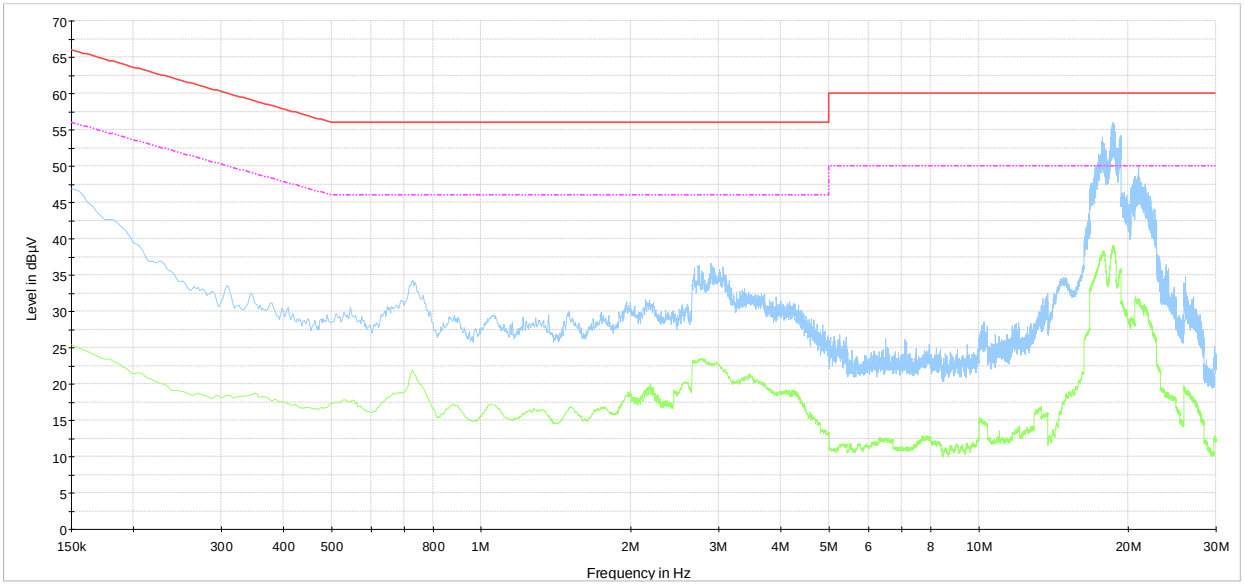
NEX-349802 - March 14, 2018 - AC Mains - HSVL Advanced - 230 VAC, 50 Hz - Neutral

Preview Result 2-AVG
Preview Result 1-PK+
CISPR 32 Limit - Class B, Mains (Quasi-Peak)
CISPR 32 Limit - Class B, Mains (Average)

The spectral plot has been corrected with transducer factors. (i.e. cable loss, LISN factors, and attenuators)

Figure 8.2-4: *Conducted emissions – from AC mains power ports spectral plot on neutral line – HSVL Advanced*

8.2.5 Test data, continued



The spectral plot has been corrected with transducer factors. (i.e. cable loss, LISN factors, and attenuators)

Figure 8.2-5: *Conducted emissions – from AC mains power ports spectral plot on phase line – HSVL Plus*

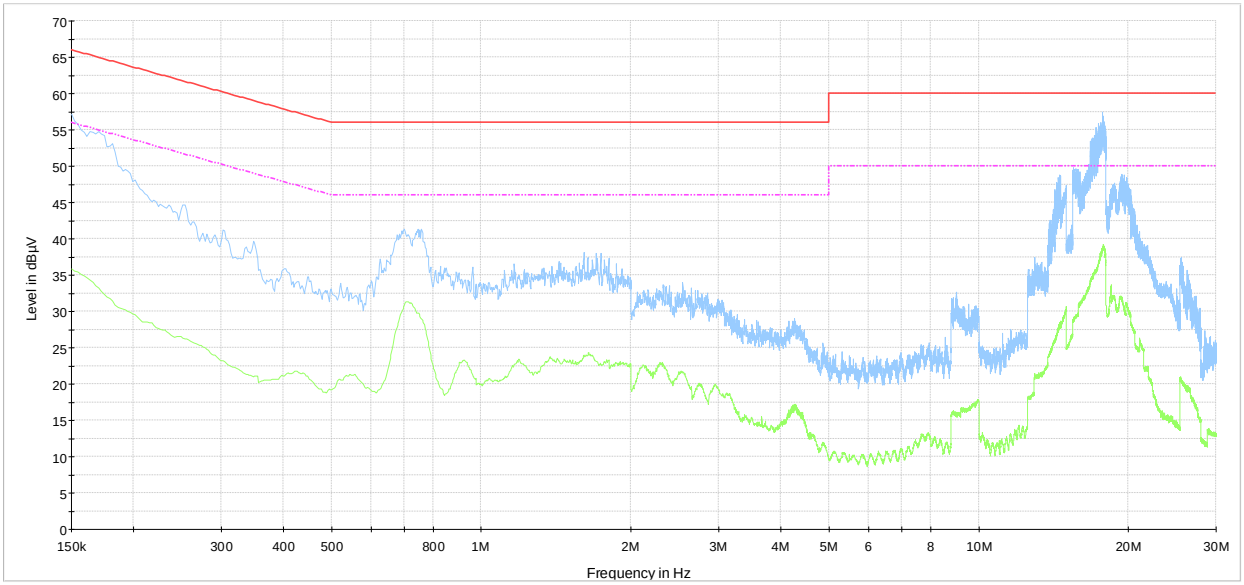
Table 8.2-5: *Conducted emissions – from AC mains power ports (Quasi-Peak) results – HSVL Plus*

Frequency (MHz)	Quasi-Peak result[1] and [3] (dBµV)	Quasi-Peak limit (dBµV)	Margin (dB)	Measurement time (ms)	Bandwidth (kHz)	Conductor	Filter	Correction factor[2] (dB)
18.57250	46.9	60.0	13.1	100	9	L1	ON	11.1
18.75025	46.3	60.0	13.7	100	9	L1	ON	11.2
17.74900	46.3	60.0	13.7	100	9	L1	ON	11.1
17.67700	46.0	60.0	14.0	100	9	L1	ON	11.1
18.43975	44.3	60.0	15.7	100	9	L1	ON	11.1
18.80650	44.0	60.0	16.0	100	9	L1	ON	11.2

Notes:
[1] Result (dBµV) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factor (dB) = LISN factor IL (dB) + cable loss (dB) + attenuator (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions have been recorded.

Sample calculation: 45.8 dBµV (result) = 34.7 dBµV (receiver reading) + 11.1 dB (Correction factor)

8.2.5 Test data, continued



The spectral plot has been corrected with transducer factors. (i.e. cable loss, LISN factors, and attenuators)

Figure 8.2-6: *Conducted emissions – from AC mains power ports spectral plot on neutral line – HSVL Plus*

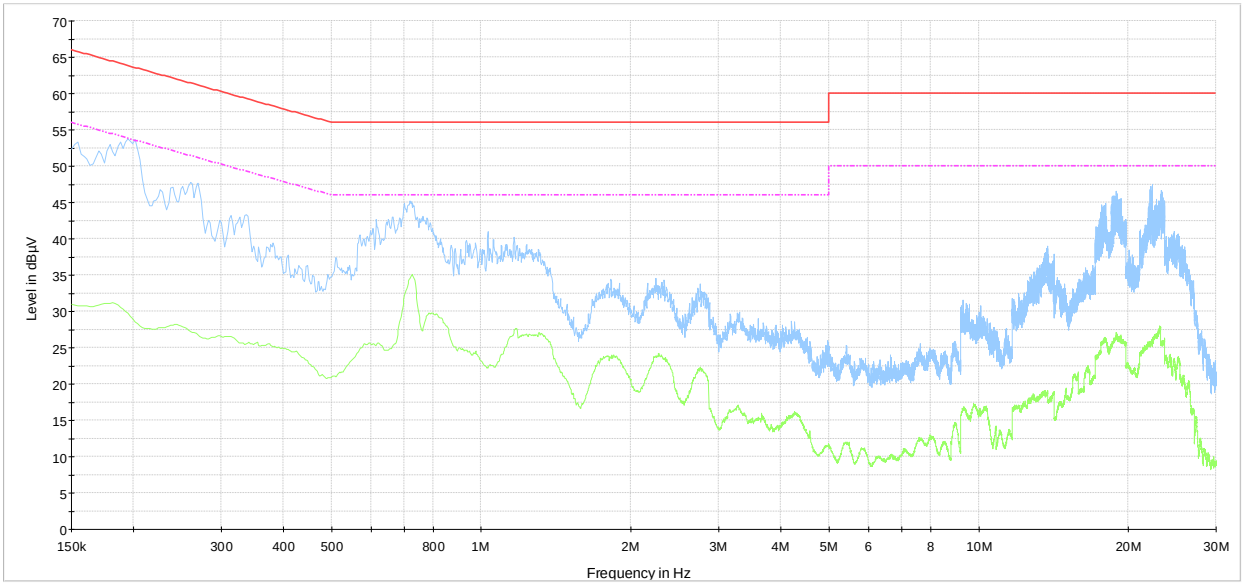
Table 8.2-6: *Conducted emissions – from AC mains power ports (Quasi-Peak) results – HSVL Plus*

Frequency (MHz)	Quasi-Peak result[1] and [3] (dBµV)	Quasi-Peak limit (dBµV)	Margin (dB)	Measurement time (ms)	Bandwidth (kHz)	Conductor	Filter	Correction factor[2] (dB)
17.91100	47.4	60.0	12.6	100	9	N	ON	11.1
17.78950	47.2	60.0	12.8	100	9	N	ON	11.1
17.57350	45.7	60.0	14.3	100	9	N	ON	11.1
17.85025	43.4	60.0	16.6	100	9	N	ON	11.1
17.39125	43.3	60.0	16.7	100	9	N	ON	11.0
17.45200	42.9	60.0	17.1	100	9	N	ON	11.0

Notes:
[1] Result (dBµV) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factor (dB) = LISN factor IL (dB) + cable loss (dB) + attenuator (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions have been recorded.

Sample calculation: 45.8 dBµV (result) = 34.7 dBµV (receiver reading) + 11.1 dB (Correction factor)

8.2.5 Test data, continued

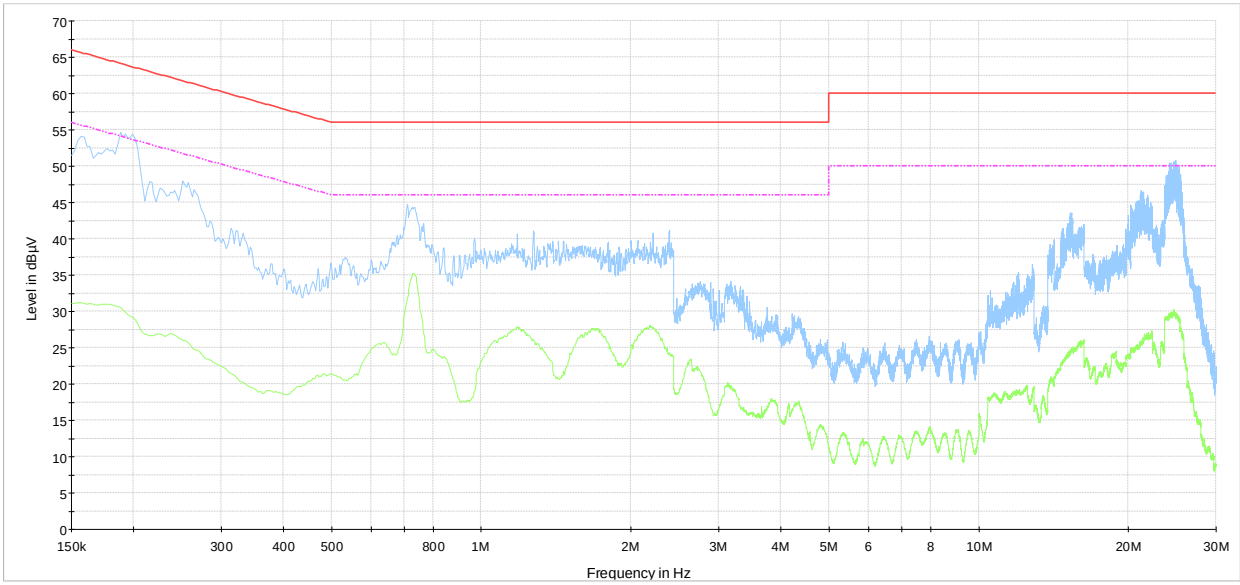


NEX-349802 - March 14, 2018 - AC Mains - HSVL Plus - 230 VAC, 50 Hz - Phase
Preview Result 2-AVG
Preview Result 1-PK+
CISPR 32 Limit - Class B, Mains (Quasi-Peak)
CISPR 32 Limit - Class B, Mains (Average)

The spectral plot has been corrected with transducer factors. (i.e. cable loss, LISN factors, and attenuators)

Figure 8.2-7: *Conducted emissions – from AC mains power ports spectral plot on phase line – HSVL Plus*

8.2.5 Test data, continued

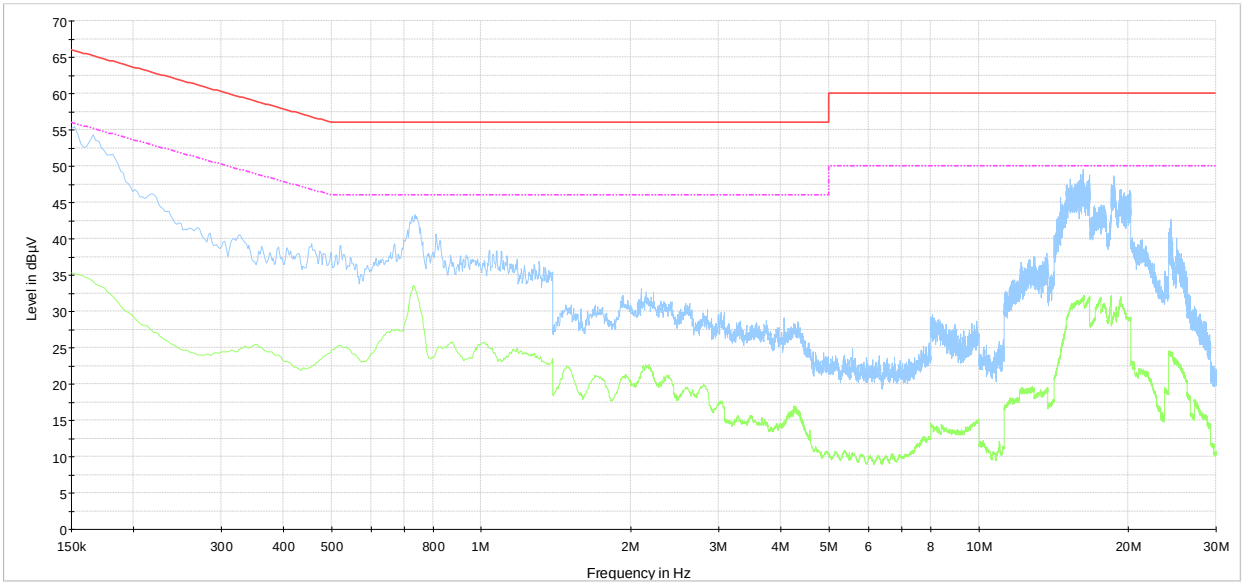


NEX-349802 - March 14, 2018 - AC Mains - HSVL Plus - 230 VAC, 50 Hz - Neutral
Preview Result 2-AVG
Preview Result 1-PK+
CISPR 32 Limit - Class B, Mains (Quasi-Peak)
CISPR 32 Limit - Class B, Mains (Average)

The spectral plot has been corrected with transducer factors. (i.e. cable loss, LISN factors, and attenuators)

Figure 8.2-8: *Conducted emissions – from AC mains power ports spectral plot on neutral line – HSVL Plus*

8.2.5 Test data, continued

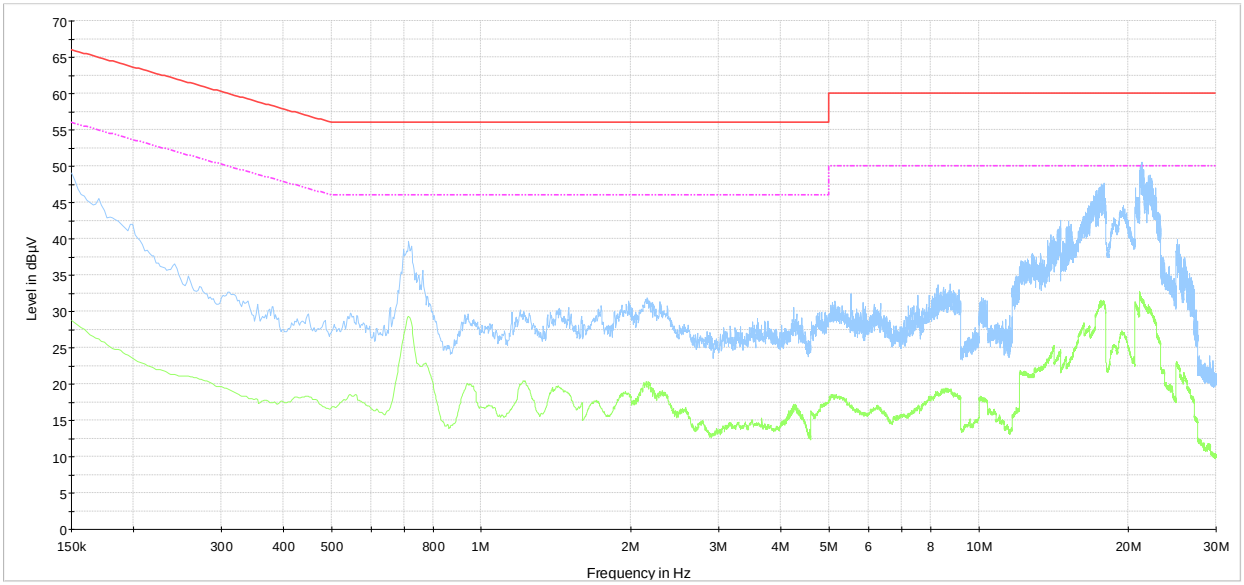


NEX-349802 - March 14, 2018 - AC Mains - HSVL Plus L - 120 VAC, 60 Hz - Phase
Preview Result 2-AVG
Preview Result 1-PK+
CISPR 32 Limit - Class B, Mains (Quasi-Peak)
CISPR 32 Limit - Class B, Mains (Average)

The spectral plot has been corrected with transducer factors. (i.e. cable loss, LISN factors, and attenuators)

Figure 8.2-9: *Conducted emissions – from AC mains power ports spectral plot on phase line – HSVL Plus L*

8.2.5 Test data, continued



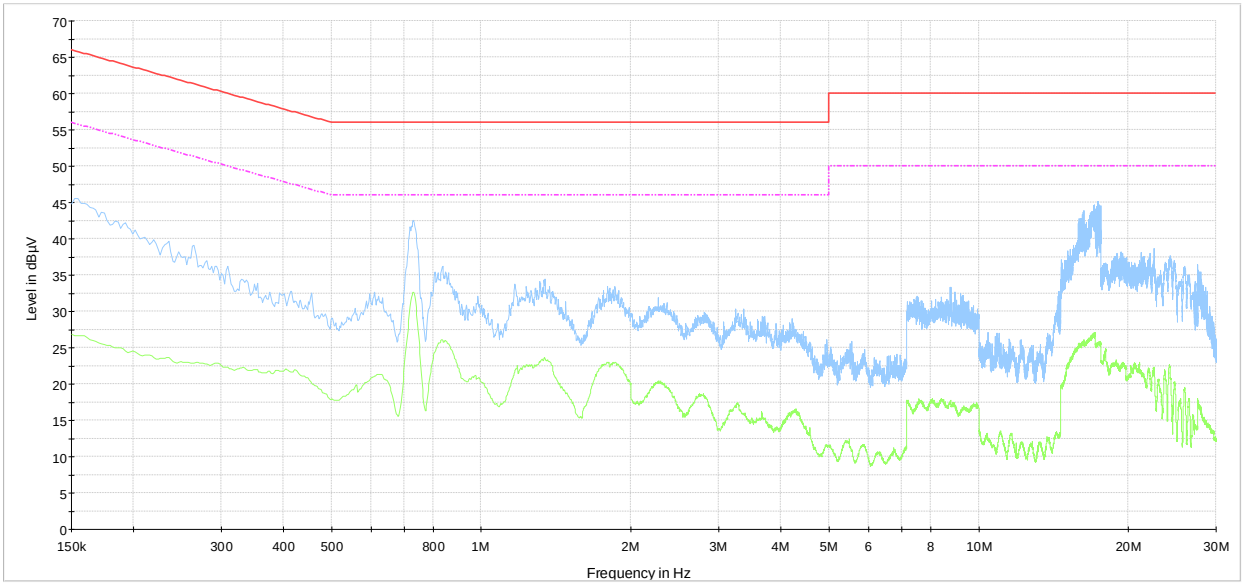
NEX-349802 - March 14, 2018 - AC Mains - HSVL Plus L - 120 VAC, 60 Hz - Neutral

Preview Result 2-AVG
Preview Result 1-PK+
CISPR 32 Limit - Class B, Mains (Quasi-Peak)
CISPR 32 Limit - Class B, Mains (Average)

The spectral plot has been corrected with transducer factors. (i.e. cable loss, LISN factors, and attenuators)

Figure 8.2-10: *Conducted emissions – from AC mains power ports spectral plot on neutral line – HSVL Plus L*

8.2.5 Test data, continued



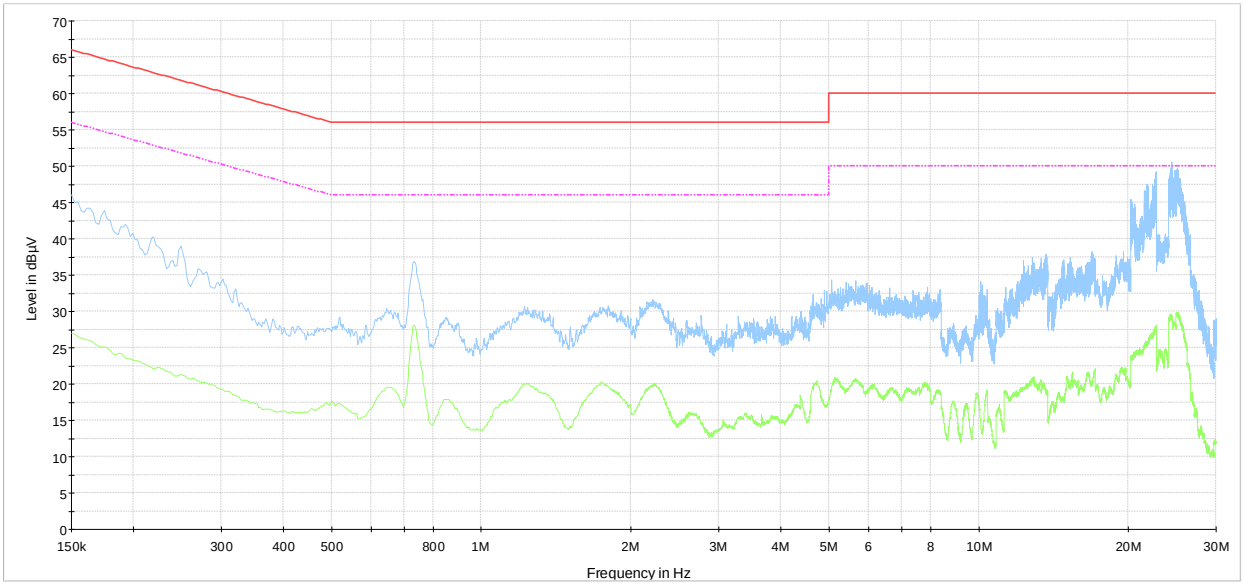
NEX-349802 - March 14, 2018 - AC Mains - HSVL Plus L - 230 VAC, 50 Hz - Phase

- Preview Result 2-AVG
- Preview Result 1-PK+
- CISPR 32 Limit - Class B, Mains (Quasi-Peak)
- CISPR 32 Limit - Class B, Mains (Average)

The spectral plot has been corrected with transducer factors. (i.e. cable loss, LISN factors, and attenuators)

Figure 8.2-11: *Conducted emissions – from AC mains power ports spectral plot on phase line – HSVL Plus L*

8.2.5 Test data, continued



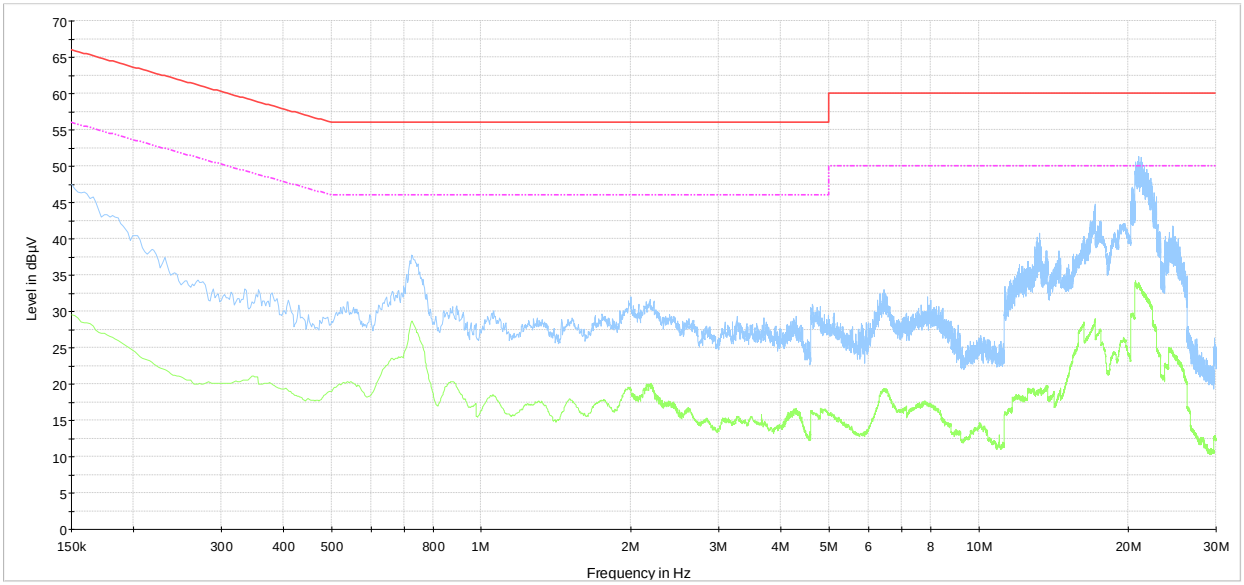
NEX-349802 - March 14, 2018 - AC Mains - HSVL Plus L - 230 VAC, 50 Hz - Neutral

Preview Result 2-AVG
Preview Result 1-PK+
CISPR 32 Limit - Class B, Mains (Quasi-Peak)
CISPR 32 Limit - Class B, Mains (Average)

The spectral plot has been corrected with transducer factors. (i.e. cable loss, LISN factors, and attenuators)

Figure 8.2-12: *Conducted emissions – from AC mains power ports spectral plot on neutral line – HSVL Plus L*

8.2.5 Test data, continued



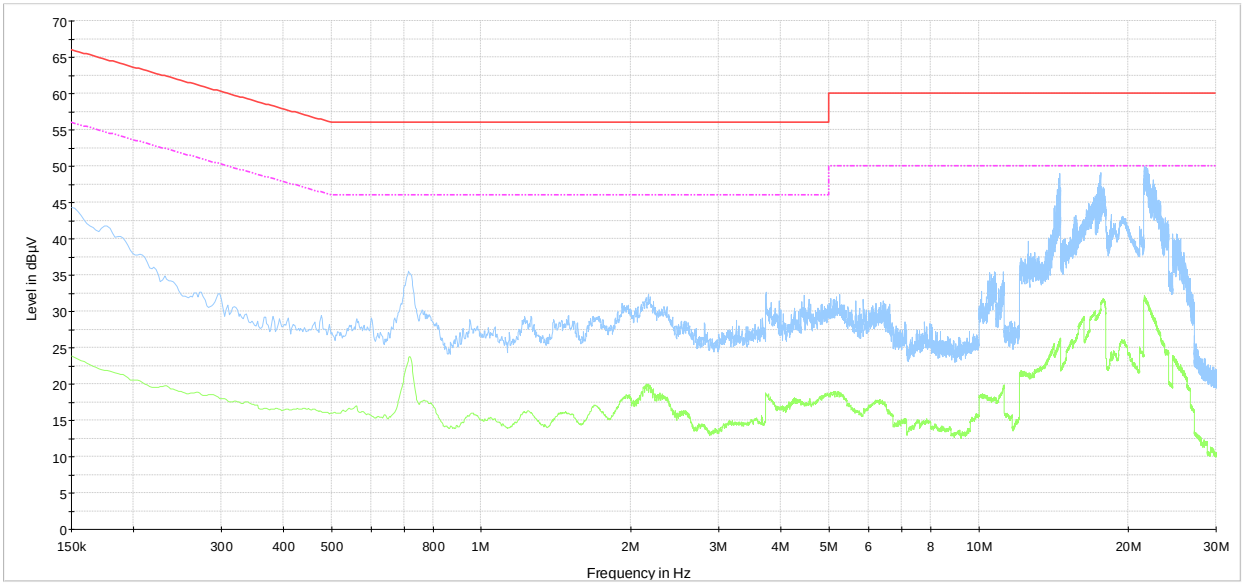
NEX-349802 - March 14, 2018 - AC Mains - HSVL Plus FS - 120 VAC, 60 Hz - Phase

Preview Result 2-AVG
Preview Result 1-PK+
CISPR 32 Limit - Class B, Mains (Quasi-Peak)
CISPR 32 Limit - Class B, Mains (Average)

The spectral plot has been corrected with transducer factors. (i.e. cable loss, LISN factors, and attenuators)

Figure 8.2-13: *Conducted emissions – from AC mains power ports spectral plot on phase line – HSVL Plus FS*

8.2.5 Test data, continued

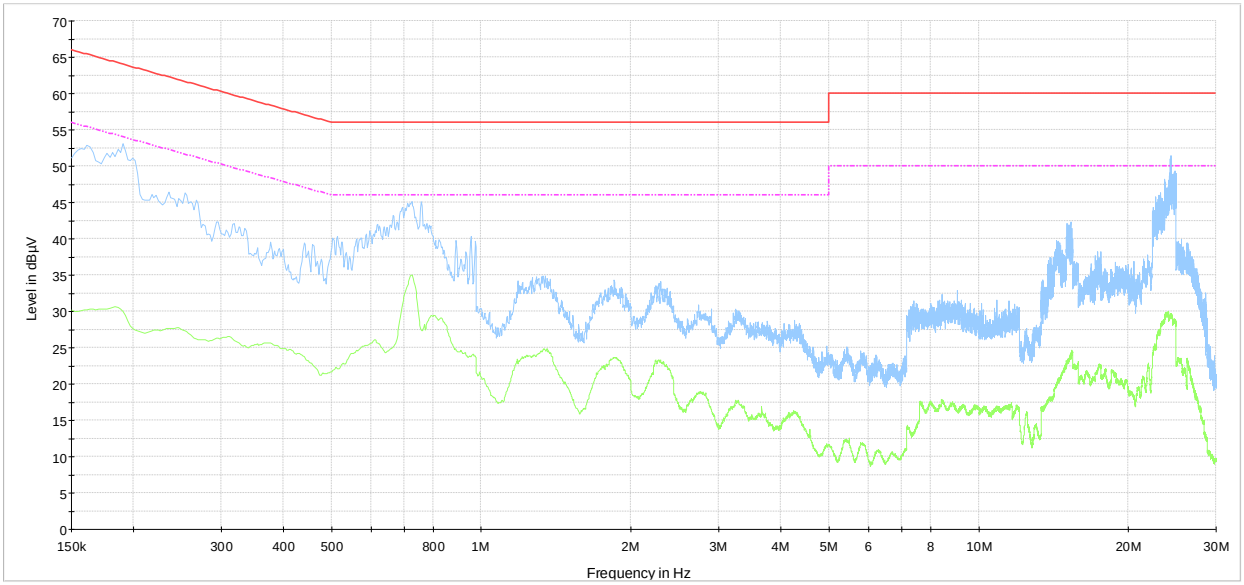


NEX-349802 - March 14, 2018 - AC Mains - HSVL Plus FS - 120 VAC, 60 Hz - Neutral
Preview Result 2-AVG
Preview Result 1-PK+
CISPR 32 Limit - Class B, Mains (Quasi-Peak)
CISPR 32 Limit - Class B, Mains (Average)

The spectral plot has been corrected with transducer factors. (i.e. cable loss, LISN factors, and attenuators)

Figure 8.2-14: *Conducted emissions – from AC mains power ports spectral plot on neutral line – HSVL Plus FS*

8.2.5 Test data, continued



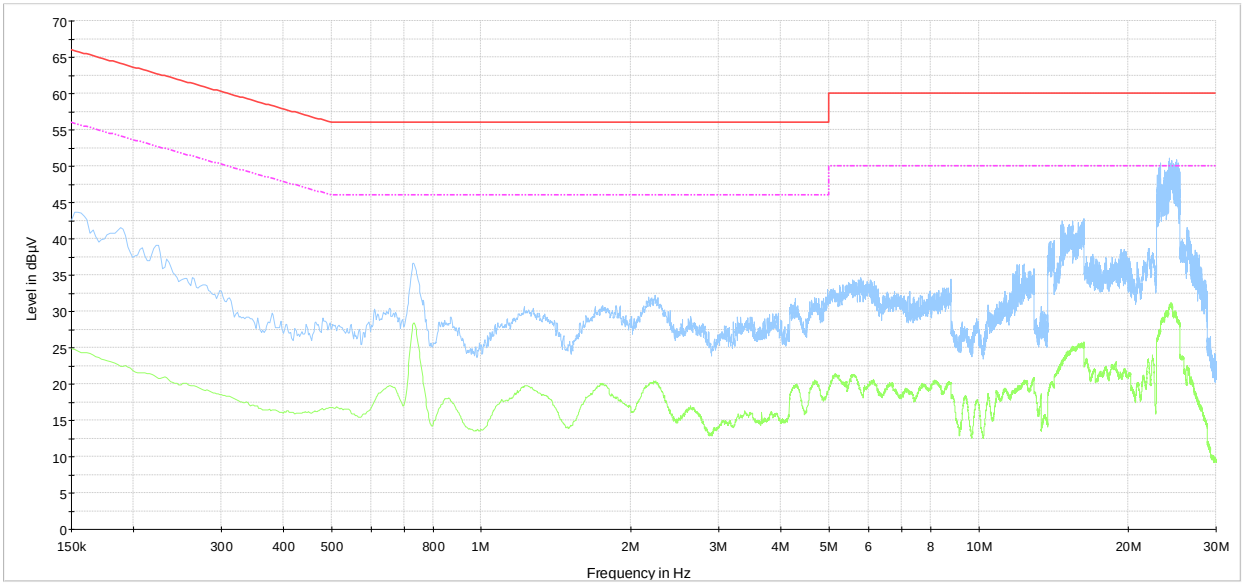
NEX-349802 - March 14, 2018 - AC Mains - HSVL Plus FS - 230 VAC, 50 Hz - Phase

- Preview Result 2-AVG
- Preview Result 1-PK+
- CISPR 32 Limit - Class B, Mains (Quasi-Peak)
- CISPR 32 Limit - Class B, Mains (Average)

The spectral plot has been corrected with transducer factors. (i.e. cable loss, LISN factors, and attenuators)

Figure 8.2-15: *Conducted emissions – from AC mains power ports spectral plot on phase line – HSVL Plus FS*

8.2.5 Test data, continued



NEX-349802 - March 14, 2018 - AC Mains - HSVL Plus FS - 230 VAC, 50 Hz - Neutral

Preview Result 2-AVG
Preview Result 1-PK+
CISPR 32 Limit - Class B, Mains (Quasi-Peak)
CISPR 32 Limit - Class B, Mains (Average)

The spectral plot has been corrected with transducer factors. (i.e. cable loss, LISN factors, and attenuators)

Figure 8.2-16: *Conducted emissions – from AC mains power ports spectral plot on neutral line – HSVL Plus FS*

8.2.6 Setup photos

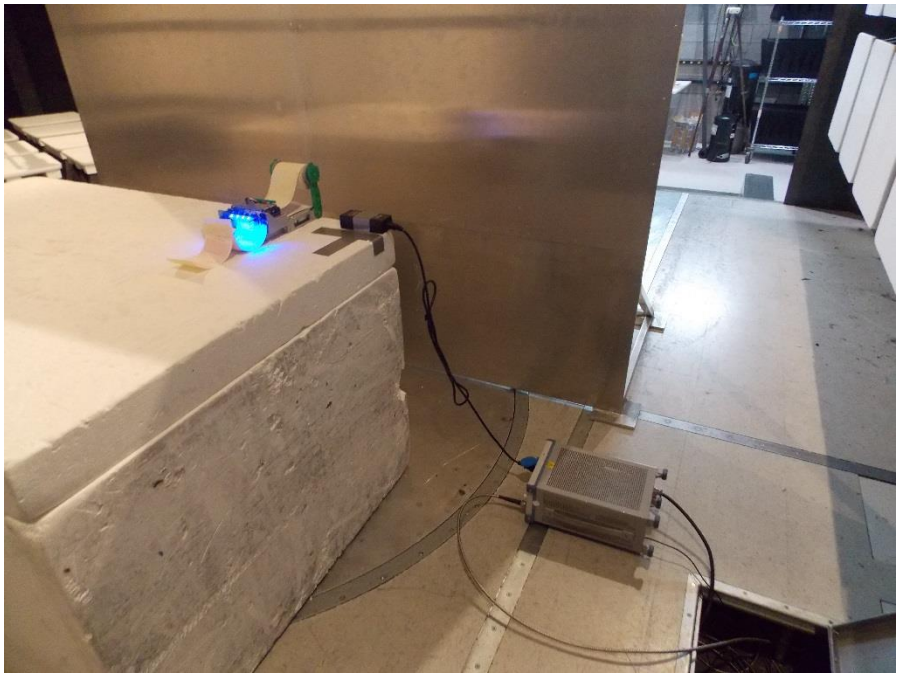


Figure 8.2-17: *Conducted emissions – from AC mains power ports setup photo – HSVL Advanced*

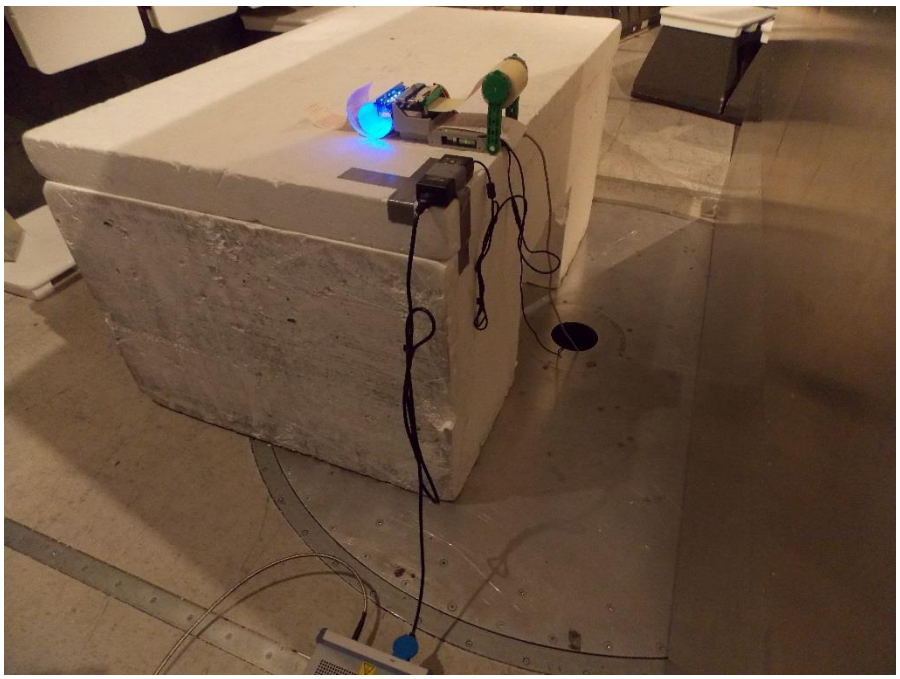


Figure 8.2-18: *Conducted emissions – from AC mains power ports setup photo – HSVL Advanced*

8.2.6 Setup photos, continued

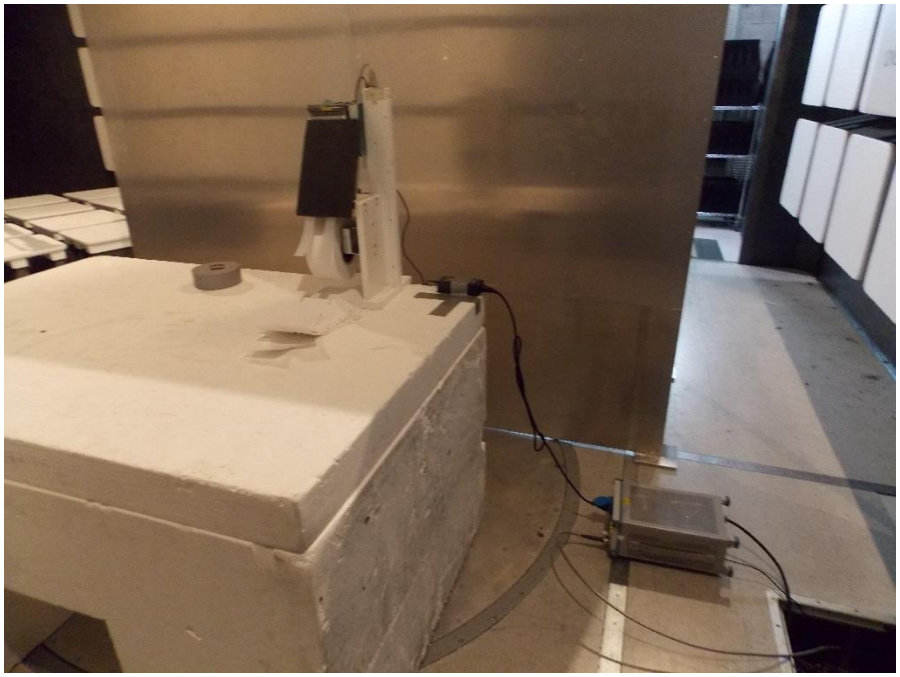


Figure 8.2-19: *Conducted emissions – from AC mains power ports setup photo – HSVL Plus*

Figure 8.2-20: *Conducted emissions – from AC mains power ports setup photo – HSVL Plus*

8.2.6 Setup photos, continued

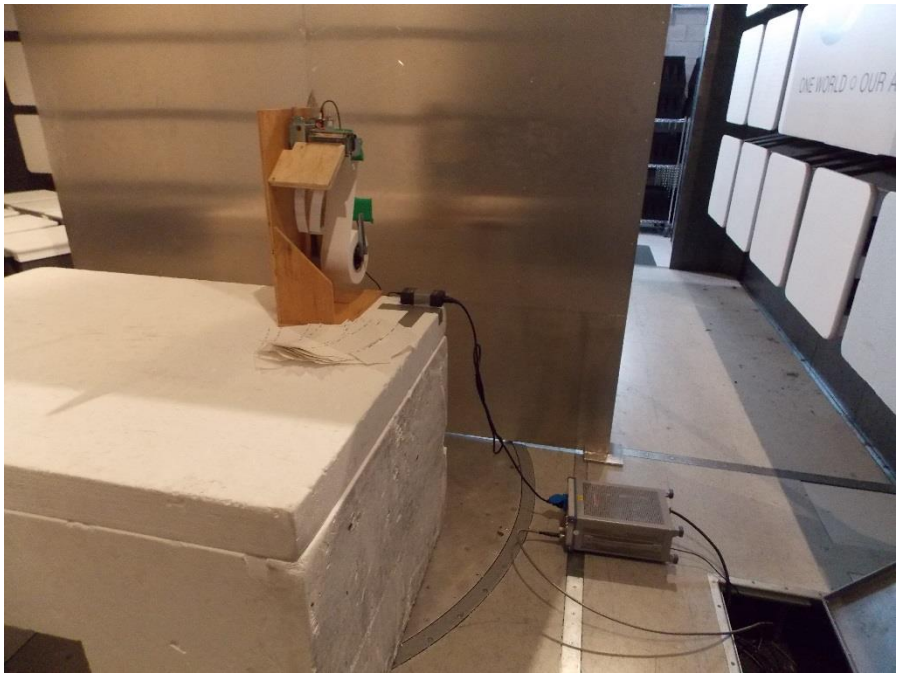


Figure 8.2-21: *Conducted emissions – from AC mains power ports setup photo – HSVL Plus L*

Figure 8.2-22: *Conducted emissions – from AC mains power ports setup photo – HSVL Plus L*

8.2.6 Setup photos, continued

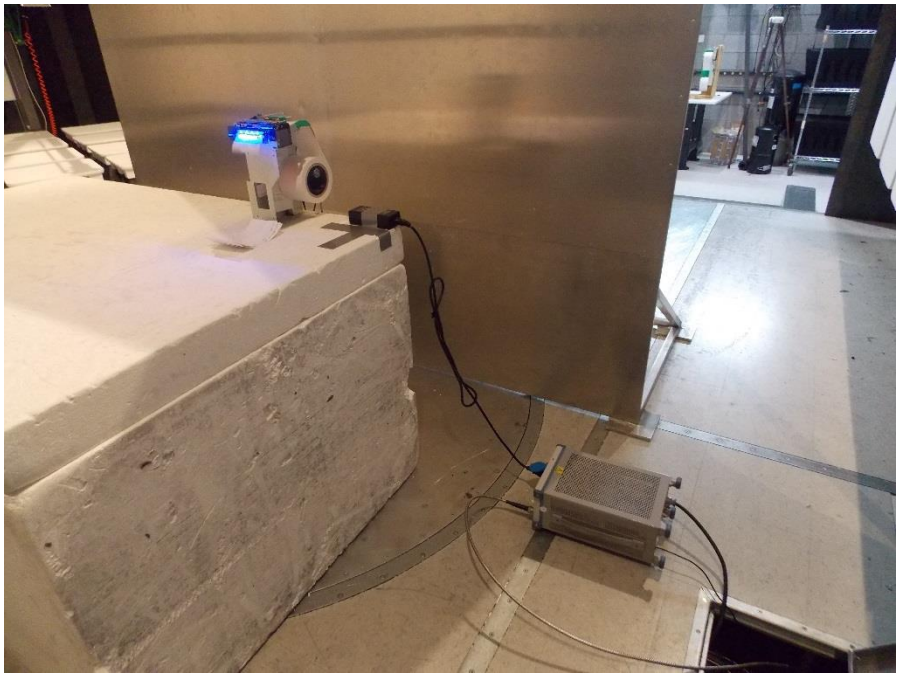


Figure 8.2-23: *Conducted emissions – from AC mains power ports setup photo – HSVL Plus FS*

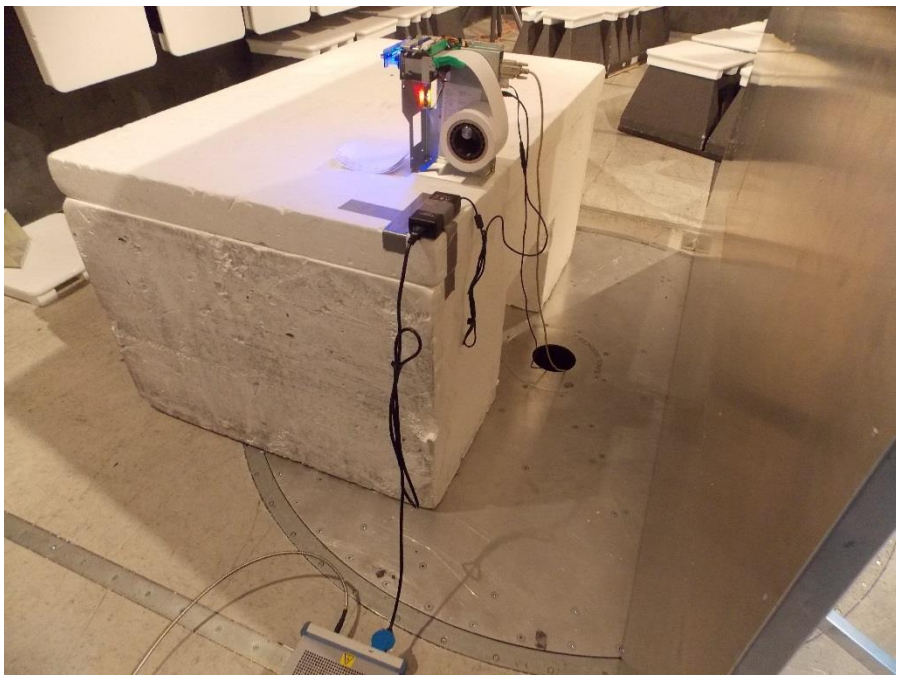


Figure 8.2-24: *Conducted emissions – from AC mains power ports setup photo – HSVL Plus FS*

8.3 Harmonic current emissions

8.3.1 References and limits

EN 61000-3-2:2014

Table 8.3-1: *Limits for Class A equipment*

Harmonic order (*n*)	Maximum permissible harmonic current (A)
Odd harmonics	
3	2.30
5	1.14
7	0.77
9	0.40
11	0.33
13	0.21
$15 \le n \le 39$	$0.15 \times 15/n$
Even harmonics	
2	1.08
4	0.43
6	0.30
$8 \le n \le 40$	$0.23 \times 8/n$

8.3.2 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 %

8.3.3 Notes

None

8.3.4 Setup details

Port under test	AC Mains Input of PSU
Measurement time	10 minutes
EUT power input during test	230 V_{AC}, 50 Hz

Table 8.3-2: *Harmonic current emissions 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 8.3-3: *Harmonic current emissions test software details*

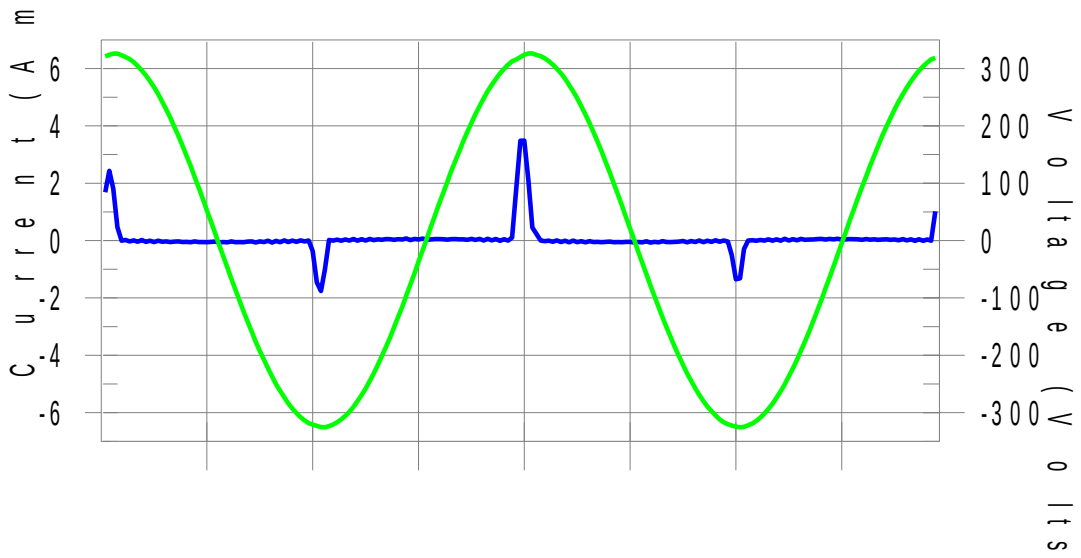
Manufacturer of Software	Details
TESEQ	WIN2100V4, Version 4.14.0

8.3.5 Test data

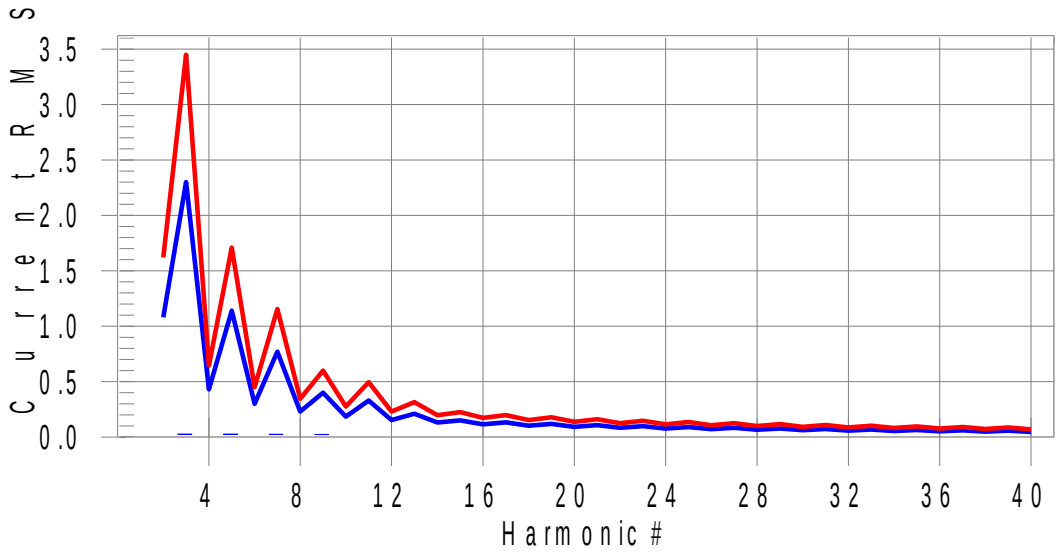
Measurement data – HSVL Advanced

Harmonics – Class-A per Ed. 4.0 (2014)(Run time) incl. inter-harmonics

Current & voltage waveforms



Harmonics and Class A limit line European Limits



Worst harmonics H17-20.9% of 150% limit, H21-14.5% of 100% limit

8.3.5 Test data, continued

Measurement data – HSVL Advanced, continued

Current Test Result Summary (Run time)

THC (A): 0.077 I-THD (%): 92.3 POHC (A): 0.033 POHC Limit (A): 0.251

Highest parameter values during test:

V_RMS (Volts):	230.03	Frequency(Hz):	50.00
I_Peak (Amps):	3.685	I_RMS (Amps):	0.489
I_Fund (Amps):	0.084	Crest Factor:	31.752
Power (Watts):	15.2	Power Factor:	0.358

Harm#	Harms(avg)	100%Limit	%of Limit	Harms(max)	150%Limit	%of Limit	Status
2	0.005	1.080	0.5	0.016	1.620	1.0	Pass
3	0.026	2.300	1.1	0.068	3.450	2.0	Pass
4	0.006	0.430	1.4	0.021	0.645	3.3	Pass
5	0.025	1.140	2.2	0.066	1.710	3.8	Pass
6	0.006	0.300	2.0	0.021	0.450	4.7	Pass
7	0.025	0.770	3.2	0.063	1.155	5.4	Pass
8	0.006	0.230	2.6	0.021	0.345	6.1	Pass
9	0.024	0.400	5.9	0.059	0.600	9.9	Pass
10	0.006	0.184	3.1	0.021	0.276	7.5	Pass
11	0.023	0.330	6.9	0.056	0.495	11.2	Pass
12	0.006	0.153	3.7	0.020	0.230	8.8	Pass
13	0.021	0.210	10.2	0.051	0.315	16.2	Pass
14	0.005	0.131	4.1	0.019	0.197	9.9	Pass
15	0.020	0.150	13.3	0.046	0.225	20.6	Pass
16	0.005	0.115	4.5	0.018	0.173	10.7	Pass
17	0.019	0.132	14.0	0.041	0.198	20.9	Pass
18	0.005	0.102	N/A	0.017	0.153	N/A	Pass
19	0.017	0.118	14.4	0.036	0.178	20.5	Pass
20	0.004	0.092	N/A	0.016	0.138	N/A	Pass
21	0.016	0.107	14.5	0.031	0.161	19.6	Pass
22	0.004	0.084	N/A	0.014	0.125	N/A	Pass
23	0.014	0.098	14.3	0.027	0.147	18.3	Pass
24	0.004	0.077	N/A	0.012	0.115	N/A	Pass
25	0.013	0.090	14.0	0.023	0.135	17.0	Pass
26	0.003	0.071	N/A	0.010	0.107	N/A	Pass
27	0.011	0.083	13.5	0.020	0.125	15.7	Pass
28	0.003	0.066	N/A	0.009	0.099	N/A	Pass
29	0.010	0.078	12.8	0.016	0.116	14.2	Pass
30	0.002	0.061	N/A	0.007	0.092	N/A	Pass
31	0.009	0.073	12.1	0.014	0.109	12.6	Pass
32	0.002	0.058	N/A	0.005	0.086	N/A	Pass
33	0.008	0.068	11.3	0.011	0.102	11.1	Pass
34	0.002	0.054	N/A	0.004	0.081	N/A	Pass
35	0.007	0.064	10.6	0.009	0.096	9.8	Pass
36	0.001	0.051	N/A	0.003	0.077	N/A	Pass
37	0.006	0.061	10.0	0.008	0.091	8.8	Pass
38	0.001	0.048	N/A	0.003	0.073	N/A	Pass
39	0.006	0.058	9.5	0.007	0.087	8.2	Pass
40	0.001	0.046	N/A	0.002	0.069	N/A	Pass

8.3.5 Test data, continued

Measurement data – HSVL Advanced, continued

Voltage Source Verification Data (Run time)

Highest parameter values during test:

Voltage (Vrms):	230.03	Frequency(Hz):	50.00
I_Peak (Amps):	3.685	I_RMS (Amps):	0.489
I_Fund (Amps):	0.084	Crest Factor:	31.752
Power (Watts):	15.2	Power Factor:	0.358

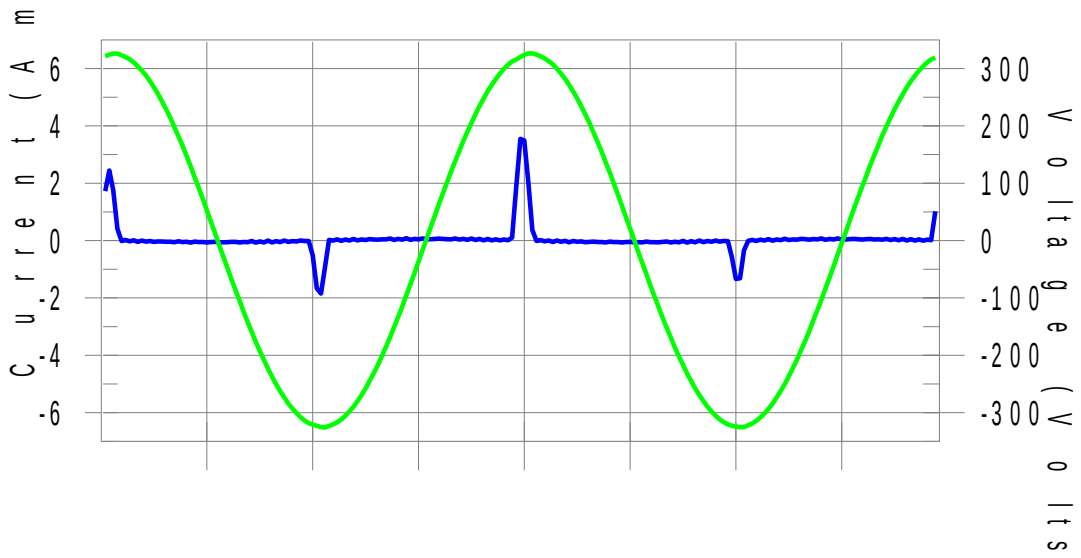
Harm#	Harmonics V-rms	Limit V-rms	% of Limit	Status
2	0.020	0.460	4.38	OK
3	0.387	2.070	18.67	OK
4	0.036	0.460	7.78	OK
5	0.040	0.920	4.33	OK
6	0.029	0.460	6.21	OK
7	0.055	0.690	7.97	OK
8	0.028	0.460	6.03	OK
9	0.044	0.460	9.46	OK
10	0.021	0.460	4.58	OK
11	0.050	0.230	21.95	OK
12	0.021	0.230	9.15	OK
13	0.048	0.230	20.84	OK
14	0.018	0.230	7.68	OK
15	0.044	0.230	19.06	OK
16	0.017	0.230	7.25	OK
17	0.042	0.230	18.22	OK
18	0.018	0.230	8.01	OK
19	0.043	0.230	18.50	OK
20	0.018	0.230	7.84	OK
21	0.040	0.230	17.37	OK
22	0.017	0.230	7.35	OK
23	0.037	0.230	16.20	OK
24	0.013	0.230	5.86	OK
25	0.035	0.230	15.02	OK
26	0.013	0.230	5.68	OK
27	0.032	0.230	13.95	OK
28	0.013	0.230	5.55	OK
29	0.027	0.230	11.88	OK
30	0.011	0.230	4.86	OK
31	0.022	0.230	9.57	OK
32	0.011	0.230	4.78	OK
33	0.020	0.230	8.65	OK
34	0.014	0.230	5.87	OK
35	0.024	0.230	10.50	OK
36	0.015	0.230	6.64	OK
37	0.020	0.230	8.74	OK
38	0.011	0.230	4.68	OK
39	0.018	0.230	7.66	OK
40	0.011	0.230	4.81	OK

8.3.5 Test data, continued

Measurement data – HSVL Plus

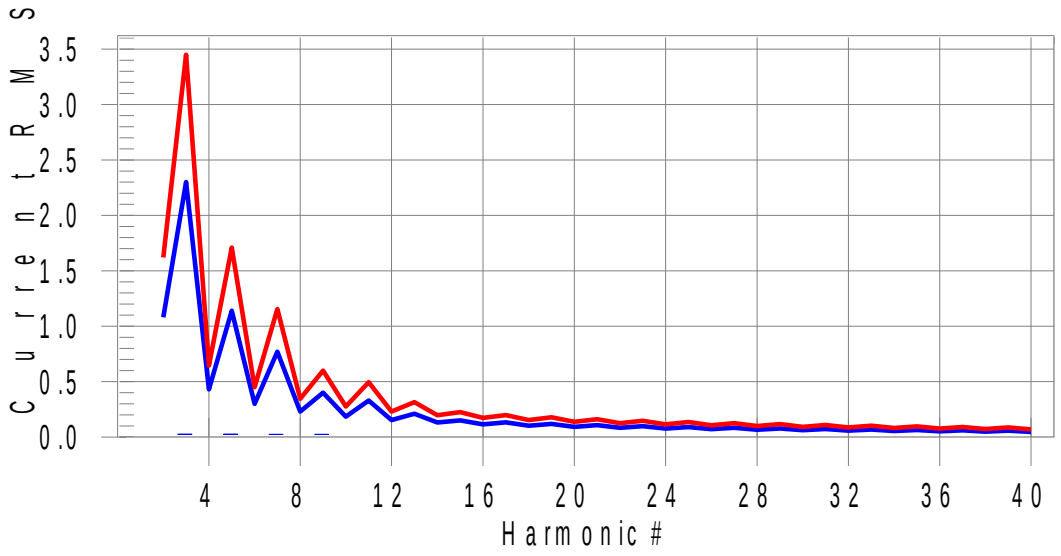
Harmonics – Class-A per Ed. 4.0 (2014)(Run time) incl. inter-harmonics

Current & voltage waveforms



Harmonics and Class A limit line

European Limits



Worst harmonics H17-21.5% of 150% limit, H21-14.5% of 100% limit

8.3.5 Test data, continued

Measurement data – HSVL Plus, continued

Current Test Result Summary (Run time)

THC (A): 0.077 I-THD (%): 91.3 POHC (A): 0.033 POHC Limit (A): 0.251

Highest parameter values during test:

V_RMS (Volts):	230.02	Frequency(Hz):	50.00
I_Peak (Amps):	3.787	I_RMS (Amps):	0.500
I_Fund (Amps):	0.085	Crest Factor:	39.895
Power (Watts):	15.5	Power Factor:	0.360

Harm#	Harms(avg)	100%Limit	%of Limit	Harms(max)	150%Limit	%of Limit	Status
2	0.005	1.080	0.5	0.016	1.620	1.0	Pass
3	0.026	2.300	1.1	0.069	3.450	2.0	Pass
4	0.006	0.430	1.4	0.021	0.645	3.2	Pass
5	0.026	1.140	2.2	0.067	1.710	3.9	Pass
6	0.006	0.300	2.0	0.021	0.450	4.7	Pass
7	0.025	0.770	3.2	0.064	1.155	5.6	Pass
8	0.006	0.230	2.5	0.021	0.345	6.0	Pass
9	0.024	0.400	6.0	0.061	0.600	10.1	Pass
10	0.006	0.184	3.1	0.021	0.276	7.5	Pass
11	0.023	0.330	6.9	0.057	0.495	11.5	Pass
12	0.006	0.153	3.7	0.020	0.230	8.8	Pass
13	0.021	0.210	10.2	0.052	0.315	16.6	Pass
14	0.005	0.131	4.1	0.020	0.197	10.0	Pass
15	0.020	0.150	13.4	0.048	0.225	21.1	Pass
16	0.005	0.115	4.4	0.019	0.173	10.8	Pass
17	0.019	0.132	14.1	0.042	0.198	21.5	Pass
18	0.005	0.102	N/A	0.017	0.153	N/A	Pass
19	0.017	0.118	14.4	0.037	0.178	21.0	Pass
20	0.004	0.092	N/A	0.016	0.138	N/A	Pass
21	0.016	0.107	14.5	0.032	0.161	20.1	Pass
22	0.004	0.084	N/A	0.014	0.125	N/A	Pass
23	0.014	0.098	14.4	0.028	0.147	18.9	Pass
24	0.004	0.077	N/A	0.012	0.115	N/A	Pass
25	0.013	0.090	14.0	0.024	0.135	17.5	Pass
26	0.003	0.071	N/A	0.010	0.107	N/A	Pass
27	0.011	0.083	13.5	0.020	0.125	16.0	Pass
28	0.003	0.066	N/A	0.008	0.099	N/A	Pass
29	0.010	0.078	12.8	0.017	0.116	14.4	Pass
30	0.002	0.061	N/A	0.007	0.092	N/A	Pass
31	0.009	0.073	12.0	0.014	0.109	12.8	Pass
32	0.002	0.058	N/A	0.005	0.086	N/A	Pass
33	0.008	0.068	11.3	0.012	0.102	11.2	Pass
34	0.002	0.054	N/A	0.004	0.081	N/A	Pass
35	0.007	0.064	10.6	0.009	0.096	9.8	Pass
36	0.001	0.051	N/A	0.003	0.077	N/A	Pass
37	0.006	0.061	10.0	0.008	0.091	8.7	Pass
38	0.001	0.048	N/A	0.003	0.073	N/A	Pass
39	0.005	0.058	9.5	0.007	0.087	8.0	Pass
40	0.001	0.046	N/A	0.002	0.069	N/A	Pass

8.3.5 Test data, continued

Measurement data – HSVL Plus, continued

Voltage Source Verification Data (Run time)

Highest parameter values during test:

Voltage (Vrms):	230.02	Frequency(Hz):	50.00
I_Peak (Amps):	3.787	I_RMS (Amps):	0.500
I_Fund (Amps):	0.085	Crest Factor:	39.895
Power (Watts):	15.5	Power Factor:	0.360

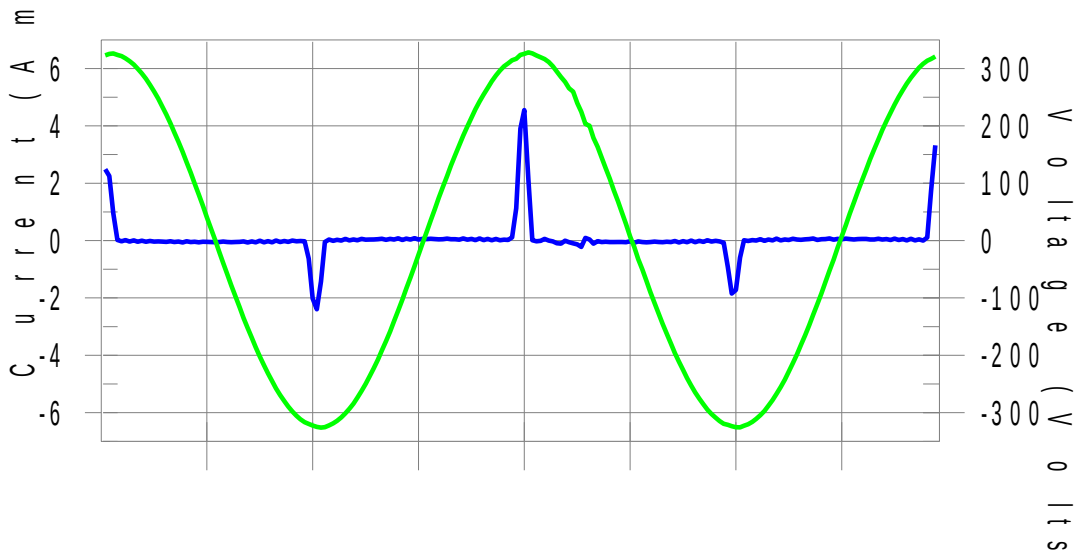
Harm#	Harmonics V-rms	Limit V-rms	% of Limit	Status
2	0.021	0.460	4.53	OK
3	0.387	2.070	18.69	OK
4	0.035	0.460	7.51	OK
5	0.039	0.920	4.21	OK
6	0.025	0.460	5.43	OK
7	0.058	0.690	8.41	OK
8	0.022	0.460	4.81	OK
9	0.044	0.460	9.65	OK
10	0.020	0.460	4.44	OK
11	0.051	0.230	22.22	OK
12	0.020	0.230	8.62	OK
13	0.046	0.230	19.89	OK
14	0.016	0.230	6.88	OK
15	0.046	0.230	19.87	OK
16	0.018	0.230	7.65	OK
17	0.045	0.230	19.38	OK
18	0.015	0.230	6.51	OK
19	0.044	0.230	19.34	OK
20	0.016	0.230	7.07	OK
21	0.041	0.230	17.74	OK
22	0.014	0.230	6.13	OK
23	0.037	0.230	15.96	OK
24	0.014	0.230	6.29	OK
25	0.035	0.230	15.30	OK
26	0.016	0.230	6.77	OK
27	0.034	0.230	14.88	OK
28	0.013	0.230	5.67	OK
29	0.028	0.230	12.01	OK
30	0.011	0.230	4.83	OK
31	0.022	0.230	9.75	OK
32	0.010	0.230	4.51	OK
33	0.022	0.230	9.58	OK
34	0.012	0.230	5.12	OK
35	0.019	0.230	8.30	OK
36	0.010	0.230	4.39	OK
37	0.019	0.230	8.42	OK
38	0.012	0.230	5.05	OK
39	0.019	0.230	8.26	OK
40	0.011	0.230	4.85	OK

8.3.5 Test data, continued

Measurement data – HSVL Plus L

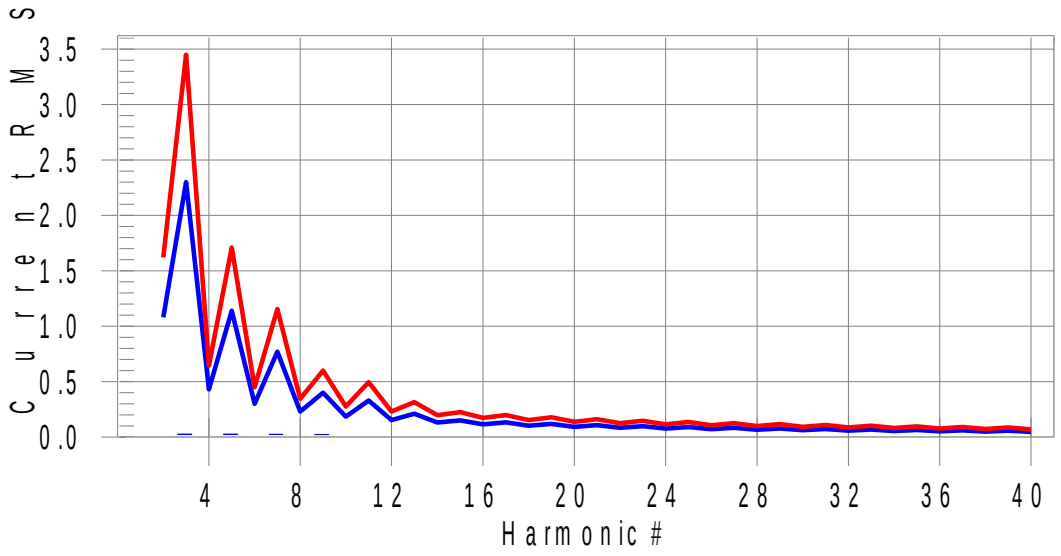
Harmonics – Class-A per Ed. 4.0 (2014)(Run time) incl. inter-harmonics

Current & voltage waveforms



Harmonics and Class A limit line

European Limits



Worst harmonics H17-21.7% of 150% limit, H21-14.4% of 100% limit

8.3.5 Test data, continued

Measurement data – HSVL Plus L, continued

Current Test Result Summary (Run time)

THC (A): 0.077 I-THD (%): 89.0 POHC (A): 0.033 POHC Limit (A): 0.251

Highest parameter values during test:

V_RMS (Volts):	230.02	Frequency(Hz):	50.00
I_Peak (Amps):	4.869	I_RMS (Amps):	0.518
I_Fund (Amps):	0.087	Crest Factor:	41.429
Power (Watts):	16.0	Power Factor:	0.361

Harm#	Harms(avg)	100%Limit	%of Limit	Harms(max)	150%Limit	%of Limit	Status
2	0.005	1.080	0.5	0.016	1.620	1.0	Pass
3	0.026	2.300	1.1	0.071	3.450	2.1	Pass
4	0.006	0.430	1.4	0.022	0.645	3.5	Pass
5	0.026	1.140	2.2	0.069	1.710	4.0	Pass
6	0.006	0.300	2.0	0.022	0.450	5.0	Pass
7	0.025	0.770	3.2	0.066	1.155	5.7	Pass
8	0.006	0.230	2.6	0.022	0.345	6.5	Pass
9	0.024	0.400	6.0	0.062	0.600	10.4	Pass
10	0.006	0.184	3.2	0.022	0.276	8.1	Pass
11	0.023	0.330	6.9	0.058	0.495	11.7	Pass
12	0.006	0.153	3.7	0.022	0.230	9.5	Pass
13	0.021	0.210	10.2	0.053	0.315	16.9	Pass
14	0.005	0.131	4.2	0.021	0.197	10.7	Pass
15	0.020	0.150	13.3	0.048	0.225	21.4	Pass
16	0.005	0.115	4.5	0.020	0.173	11.6	Pass
17	0.019	0.132	14.0	0.043	0.198	21.7	Pass
18	0.005	0.102	N/A	0.019	0.153	N/A	Pass
19	0.017	0.118	14.4	0.038	0.178	21.2	Pass
20	0.005	0.092	N/A	0.017	0.138	N/A	Pass
21	0.015	0.107	14.4	0.032	0.161	20.2	Pass
22	0.004	0.084	N/A	0.015	0.125	N/A	Pass
23	0.014	0.098	14.3	0.027	0.147	18.7	Pass
24	0.004	0.077	N/A	0.013	0.115	N/A	Pass
25	0.013	0.090	13.9	0.023	0.135	17.3	Pass
26	0.003	0.071	N/A	0.011	0.107	N/A	Pass
27	0.011	0.083	13.4	0.020	0.125	15.8	Pass
28	0.003	0.066	N/A	0.009	0.099	N/A	Pass
29	0.010	0.078	12.7	0.017	0.116	14.2	Pass
30	0.002	0.061	N/A	0.007	0.092	N/A	Pass
31	0.009	0.073	12.0	0.014	0.109	12.7	Pass
32	0.002	0.058	N/A	0.005	0.086	N/A	Pass
33	0.008	0.068	11.2	0.011	0.102	11.2	Pass
34	0.002	0.054	N/A	0.004	0.081	N/A	Pass
35	0.007	0.064	10.5	0.010	0.096	10.0	Pass
36	0.001	0.051	N/A	0.003	0.077	N/A	Pass
37	0.006	0.061	10.0	0.008	0.091	9.0	Pass
38	0.001	0.048	N/A	0.003	0.073	N/A	Pass
39	0.005	0.058	9.5	0.007	0.087	8.3	Pass
40	0.001	0.046	N/A	0.002	0.069	N/A	Pass

8.3.5 Test data, continued

Measurement data – HSVL Plus L, continued

Voltage Source Verification Data (Run time)

Highest parameter values during test:

Voltage (Vrms):	230.02	Frequency(Hz):	50.00
I_Peak (Amps):	4.869	I_RMS (Amps):	0.518
I_Fund (Amps):	0.087	Crest Factor:	41.429
Power (Watts):	16.0	Power Factor:	0.361

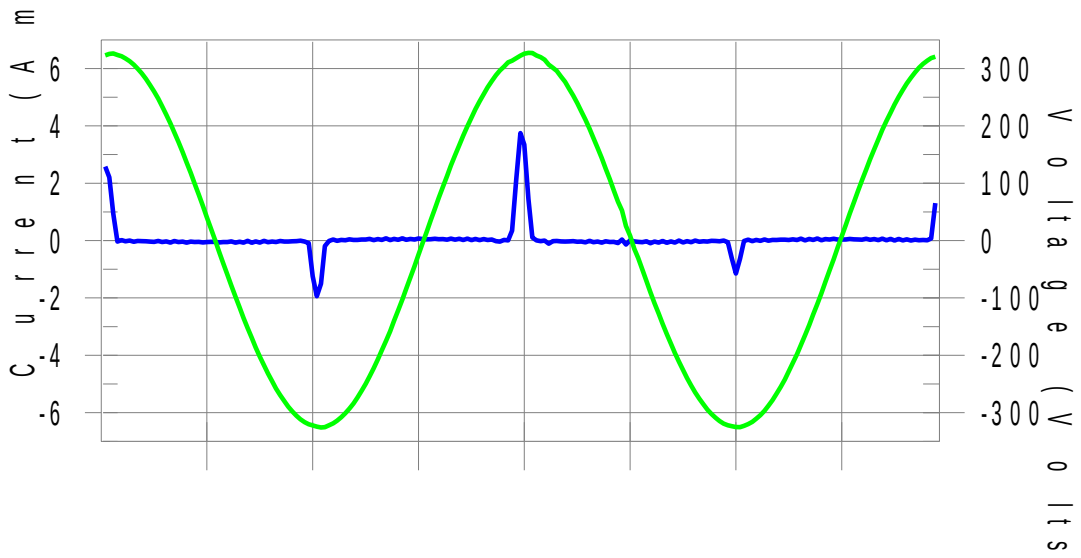
Harm#	Harmonics V-rms	Limit V-rms	% of Limit	Status
2	0.023	0.460	5.07	OK
3	0.389	2.070	18.81	OK
4	0.034	0.460	7.45	OK
5	0.038	0.920	4.09	OK
6	0.025	0.460	5.40	OK
7	0.055	0.690	7.94	OK
8	0.026	0.460	5.61	OK
9	0.046	0.460	9.99	OK
10	0.020	0.460	4.32	OK
11	0.053	0.230	23.19	OK
12	0.024	0.230	10.39	OK
13	0.049	0.230	21.44	OK
14	0.016	0.230	6.84	OK
15	0.048	0.230	20.74	OK
16	0.015	0.230	6.74	OK
17	0.044	0.230	19.17	OK
18	0.016	0.230	6.96	OK
19	0.046	0.230	20.22	OK
20	0.016	0.230	7.04	OK
21	0.043	0.230	18.82	OK
22	0.015	0.230	6.38	OK
23	0.040	0.230	17.20	OK
24	0.014	0.230	6.01	OK
25	0.032	0.230	13.75	OK
26	0.013	0.230	5.86	OK
27	0.031	0.230	13.57	OK
28	0.012	0.230	5.27	OK
29	0.026	0.230	11.25	OK
30	0.011	0.230	4.60	OK
31	0.023	0.230	10.08	OK
32	0.011	0.230	4.89	OK
33	0.023	0.230	10.08	OK
34	0.012	0.230	5.26	OK
35	0.021	0.230	8.95	OK
36	0.011	0.230	4.65	OK
37	0.016	0.230	7.10	OK
38	0.012	0.230	5.36	OK
39	0.017	0.230	7.33	OK
40	0.013	0.230	5.49	OK

8.3.5 Test data, continued

Measurement data – HSVL Plus FS

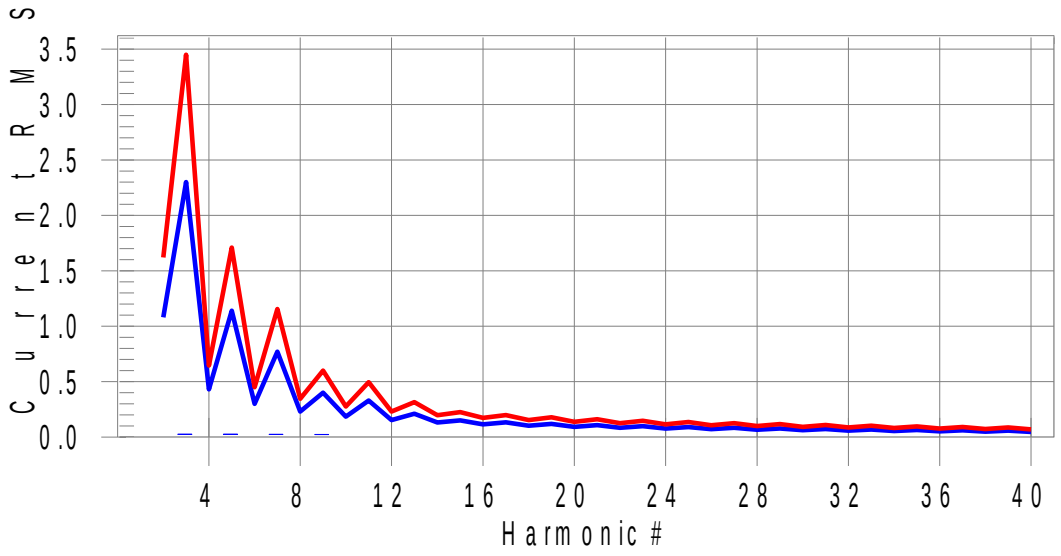
Harmonics – Class-A per Ed. 4.0 (2014)(Run time) incl. inter-harmonics

Current & voltage waveforms



Harmonics and Class A limit line

European Limits



Worst harmonics H17-21.2% of 150% limit, H21-14.5% of 100% limit

8.3.5 Test data, continued

Measurement data – HSVL Plus FS, continued

Current Test Result Summary (Run time)

THC (A): 0.077 I-THD (%): 91.2 POHC (A): 0.033 POHC Limit (A): 0.251

Highest parameter values during test:

V_RMS (Volts):	230.02	Frequency(Hz):	50.00
I_Peak (Amps):	3.915	I_RMS (Amps):	0.503
I_Fund (Amps):	0.085	Crest Factor:	38.549
Power (Watts):	15.6	Power Factor:	0.359

Harm#	Harms(avg)	100%Limit	%of Limit	Harms(max)	150%Limit	%of Limit	Status
2	0.005	1.080	0.5	0.016	1.620	1.0	Pass
3	0.026	2.300	1.1	0.069	3.450	2.0	Pass
4	0.006	0.430	1.4	0.022	0.645	3.4	Pass
5	0.026	1.140	2.2	0.067	1.710	3.9	Pass
6	0.006	0.300	2.0	0.022	0.450	4.8	Pass
7	0.025	0.770	3.2	0.064	1.155	5.6	Pass
8	0.006	0.230	2.6	0.022	0.345	6.3	Pass
9	0.024	0.400	6.0	0.061	0.600	10.1	Pass
10	0.006	0.184	3.2	0.021	0.276	7.8	Pass
11	0.023	0.330	6.9	0.057	0.495	11.4	Pass
12	0.006	0.153	3.8	0.021	0.230	9.1	Pass
13	0.021	0.210	10.2	0.052	0.315	16.5	Pass
14	0.006	0.131	4.2	0.020	0.197	10.3	Pass
15	0.020	0.150	13.4	0.047	0.225	20.9	Pass
16	0.005	0.115	4.6	0.019	0.173	11.1	Pass
17	0.019	0.132	14.1	0.042	0.198	21.2	Pass
18	0.005	0.102	N/A	0.018	0.153	N/A	Pass
19	0.017	0.118	14.4	0.037	0.178	20.8	Pass
20	0.005	0.092	N/A	0.016	0.138	N/A	Pass
21	0.016	0.107	14.5	0.032	0.161	19.8	Pass
22	0.004	0.084	N/A	0.015	0.125	N/A	Pass
23	0.014	0.098	14.3	0.027	0.147	18.5	Pass
24	0.004	0.077	N/A	0.013	0.115	N/A	Pass
25	0.013	0.090	14.0	0.023	0.135	17.1	Pass
26	0.003	0.071	N/A	0.011	0.107	N/A	Pass
27	0.011	0.083	13.5	0.020	0.125	15.7	Pass
28	0.003	0.066	N/A	0.009	0.099	N/A	Pass
29	0.010	0.078	12.8	0.016	0.116	14.2	Pass
30	0.002	0.061	N/A	0.007	0.092	N/A	Pass
31	0.009	0.073	12.1	0.014	0.109	12.6	Pass
32	0.002	0.058	N/A	0.006	0.086	N/A	Pass
33	0.008	0.068	11.3	0.012	0.102	11.3	Pass
34	0.002	0.054	N/A	0.004	0.081	N/A	Pass
35	0.007	0.064	10.6	0.010	0.096	10.1	Pass
36	0.001	0.051	N/A	0.003	0.077	N/A	Pass
37	0.006	0.061	10.0	0.008	0.091	9.0	Pass
38	0.001	0.048	N/A	0.003	0.073	N/A	Pass
39	0.006	0.058	9.5	0.007	0.087	8.1	Pass
40	0.001	0.046	N/A	0.002	0.069	N/A	Pass

8.3.5 Test data, continued

Measurement data – HSVL Plus FS, continued

Voltage Source Verification Data (Run time)

Highest parameter values during test:

Voltage (Vrms):	230.02	Frequency(Hz):	50.00
I_Peak (Amps):	3.915	I_RMS (Amps):	0.503
I_Fund (Amps):	0.085	Crest Factor:	38.549
Power (Watts):	15.6	Power Factor:	0.359

Harm#	Harmonics V-rms	Limit V-rms	% of Limit	Status
2	0.021	0.460	4.48	OK
3	0.388	2.070	18.75	OK
4	0.036	0.460	7.88	OK
5	0.039	0.920	4.24	OK
6	0.026	0.460	5.65	OK
7	0.057	0.690	8.20	OK
8	0.022	0.460	4.77	OK
9	0.046	0.460	10.01	OK
10	0.019	0.460	4.11	OK
11	0.053	0.230	22.91	OK
12	0.020	0.230	8.73	OK
13	0.047	0.230	20.23	OK
14	0.016	0.230	7.05	OK
15	0.047	0.230	20.46	OK
16	0.015	0.230	6.64	OK
17	0.044	0.230	19.10	OK
18	0.019	0.230	8.19	OK
19	0.043	0.230	18.77	OK
20	0.014	0.230	6.06	OK
21	0.041	0.230	17.67	OK
22	0.015	0.230	6.37	OK
23	0.036	0.230	15.63	OK
24	0.013	0.230	5.51	OK
25	0.033	0.230	14.25	OK
26	0.016	0.230	6.83	OK
27	0.034	0.230	14.93	OK
28	0.018	0.230	7.70	OK
29	0.031	0.230	13.31	OK
30	0.012	0.230	5.37	OK
31	0.024	0.230	10.64	OK
32	0.012	0.230	5.12	OK
33	0.022	0.230	9.53	OK
34	0.011	0.230	4.93	OK
35	0.020	0.230	8.84	OK
36	0.010	0.230	4.48	OK
37	0.017	0.230	7.59	OK
38	0.010	0.230	4.43	OK
39	0.016	0.230	7.12	OK
40	0.011	0.230	4.75	OK

8.3.6 Setup photos

Figure 8.3-1: *Harmonic current emissions setup photo – HSVL Advanced*

Figure 8.3-2: *Harmonic current emissions setup photo – HSVL Plus*

8.3.6 Setup photos, continued

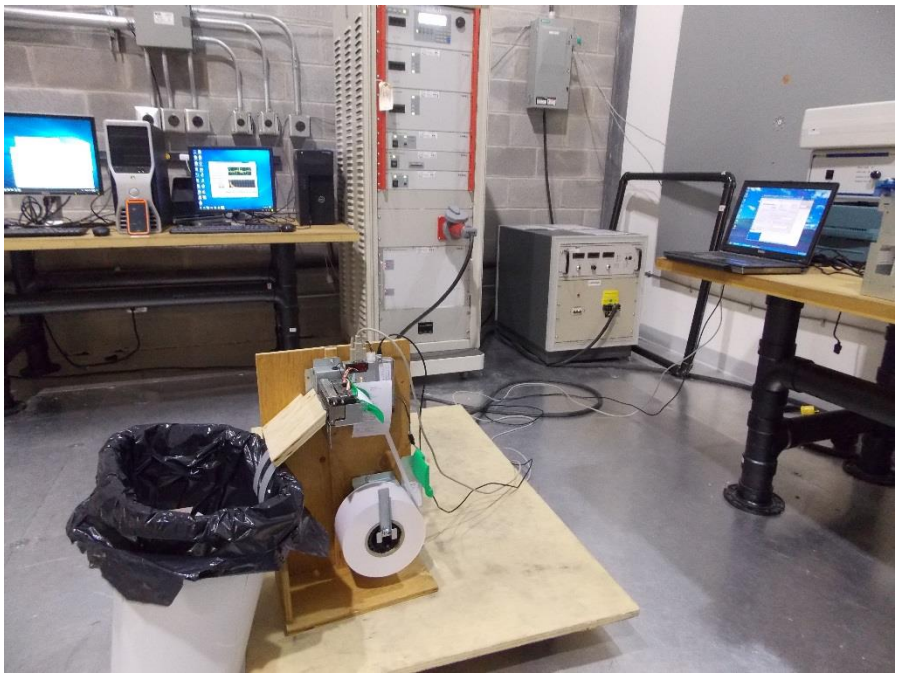


Figure 8.3-3: *Harmonic current emissions setup photo – HSVL Plus L*

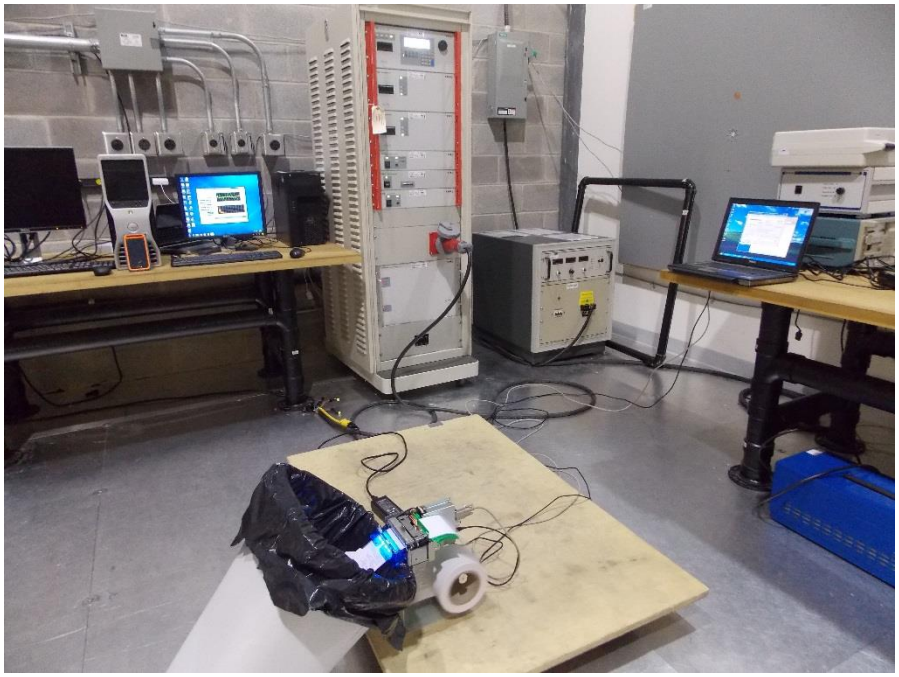


Figure 8.3-4: *Harmonic current emissions setup photo – HSVL Plus FS*

8.4 Voltage fluctuations and flicker

8.4.1 References

EN 61000-3-3:2013

8.4.2 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 %

8.4.3 Notes

None

8.4.4 Setup details

Port under test	AC Mains Input of PSU
Measurement time	10 minutes
EUT power input during test	230 V_{AC}, 50 Hz

Table 8.4-1: *Voltage fluctuations and flicker 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 8.4-2: *Voltage fluctuations and flicker test software details*

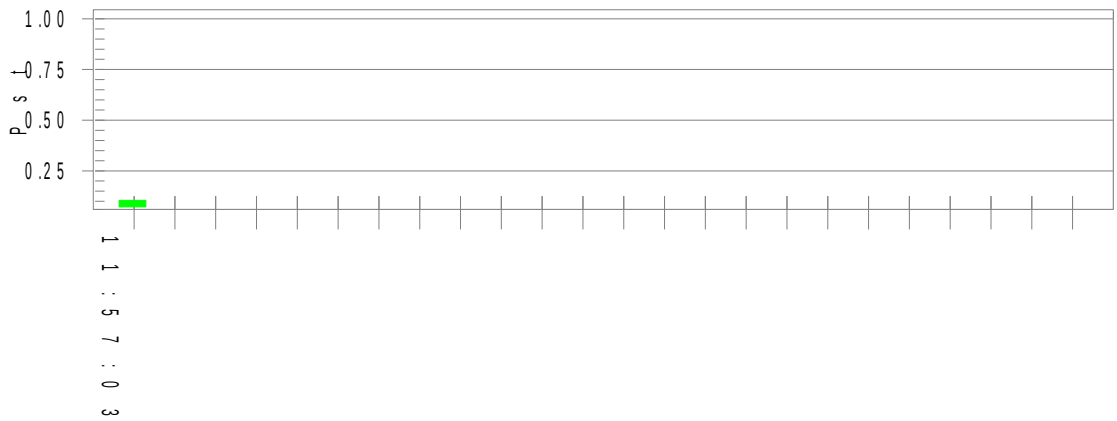
Manufacturer of Software	Details
TESEQ	WIN2100V4, Version 4.14.0

8.4.5 Test data

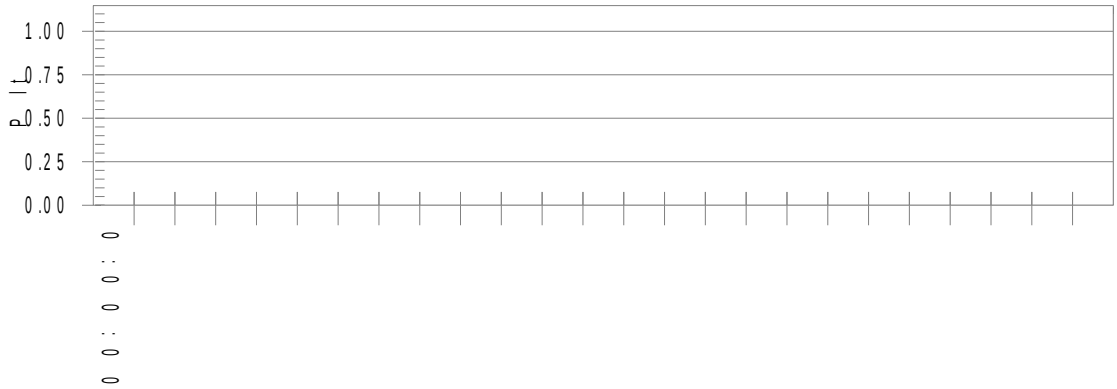
Measurement data – HSVL Advanced

Flicker Test Summary per EN/IEC61000-3-3 Ed. 3.0 (2013) (Run time)

Pst and limit line European Limits



Plt and limit line



Parameter values recorded during the test:

Vrms at the end of test (Volt):	230.00			
Highest dt (%):	-0.50	Test limit (%):	N/A	N/A
T-max (mS):	0	Test limit (mS):	500.0	Pass
Highest dc (%):	0.00	Test limit (%):	3.30	Pass
Highest dmax (%):	-0.40	Test limit (%):	4.00	Pass
Highest Pst (10 min. period):	0.105	Test limit:	1.000	Pass
Highest Plt (2 hr. period):	0.046	Test limit:	0.650	Pass

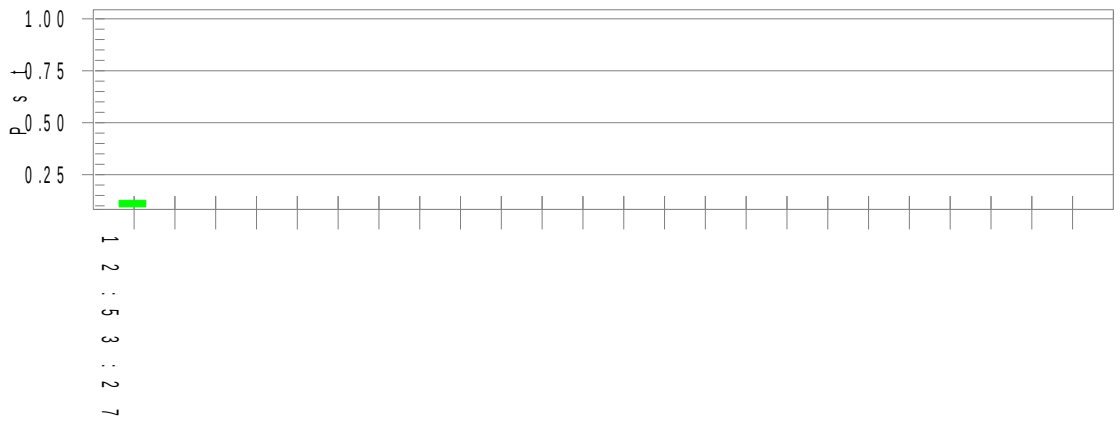
8.4.5 Test data, continued

Measurement data – HSVL Plus

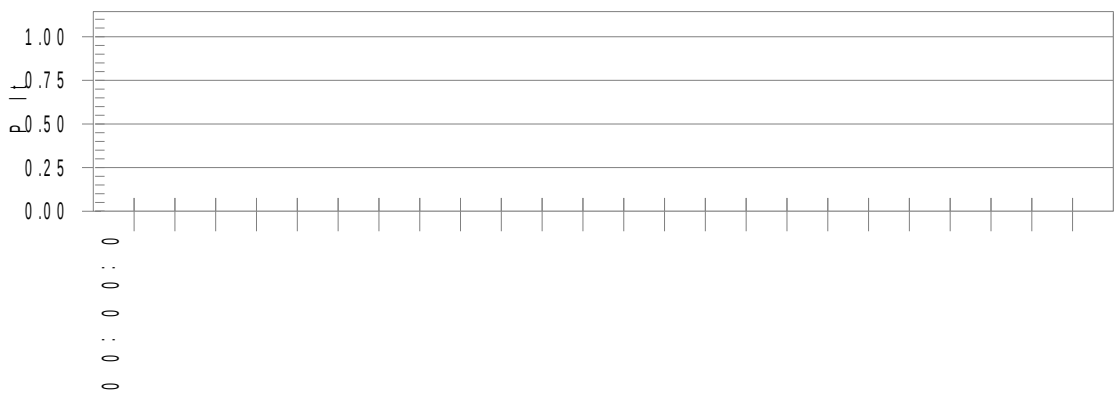
Flicker Test Summary per EN/IEC61000-3-3 Ed. 3.0 (2013) (Run time)

Pst and limit line

European Limits



Plt and limit line



Parameter values recorded during the test:

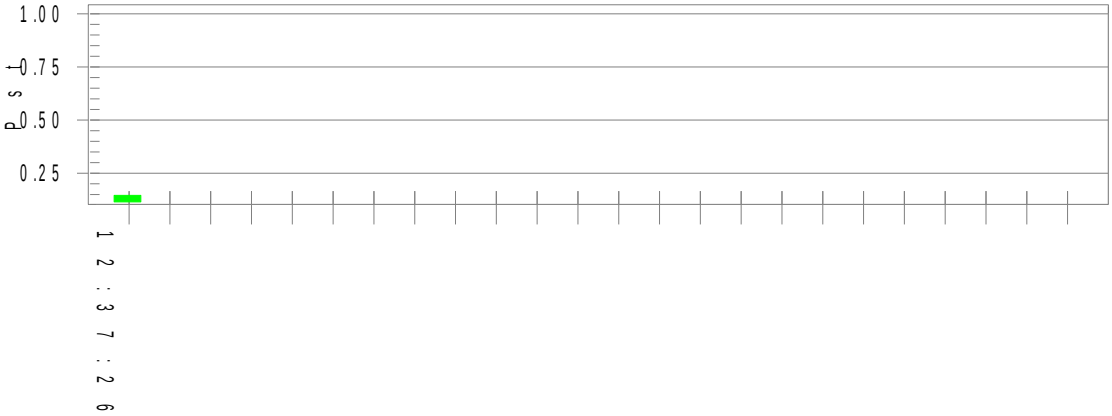
Vrms at the end of test (Volt):	229.55			
Highest dt (%):	0.72	Test limit (%):	N/A	N/A
T-max (mS):	0	Test limit (mS):	500.0	Pass
Highest dc (%):	0.00	Test limit (%):	3.30	Pass
Highest dmax (%):	0.45	Test limit (%):	4.00	Pass
Highest Pst (10 min. period):	0.127	Test limit:	1.000	Pass
Highest Plt (2 hr. period):	0.055	Test limit:	0.650	Pass

8.4.5 Test data, continued

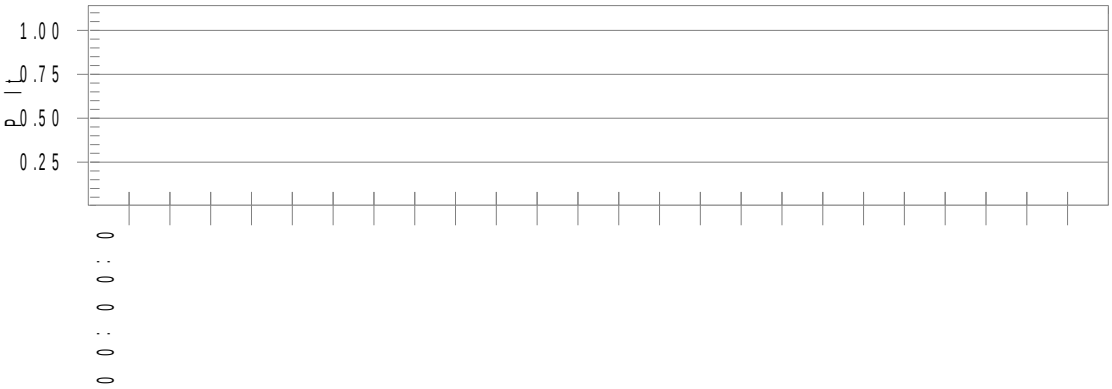
Measurement data – HSVL Plus L

Flicker Test Summary per EN/IEC61000-3-3 Ed. 3.0 (2013) (Run time)

Pst$_i$ and limit line European Limits



Plt and limit line



Parameter values recorded during the test:

Vrms at the end of test (Volt):	229.98			
Highest dt (%):	0.44	Test limit (%):	N/A	N/A
T-max (mS):	0	Test limit (mS):	500.0	Pass
Highest dc (%):	0.00	Test limit (%):	3.30	Pass
Highest dmax (%):	-0.40	Test limit (%):	4.00	Pass
Highest Pst (10 min. period):	0.146	Test limit:	1.000	Pass
Highest Plt (2 hr. period):	0.064	Test limit:	0.650	Pass

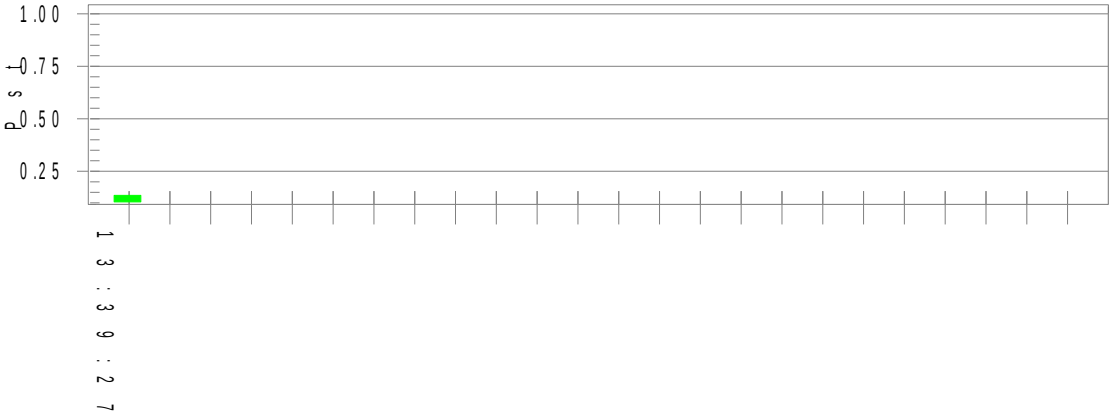
8.4.5 Test data, continued

Measurement data – HSVL Plus FS

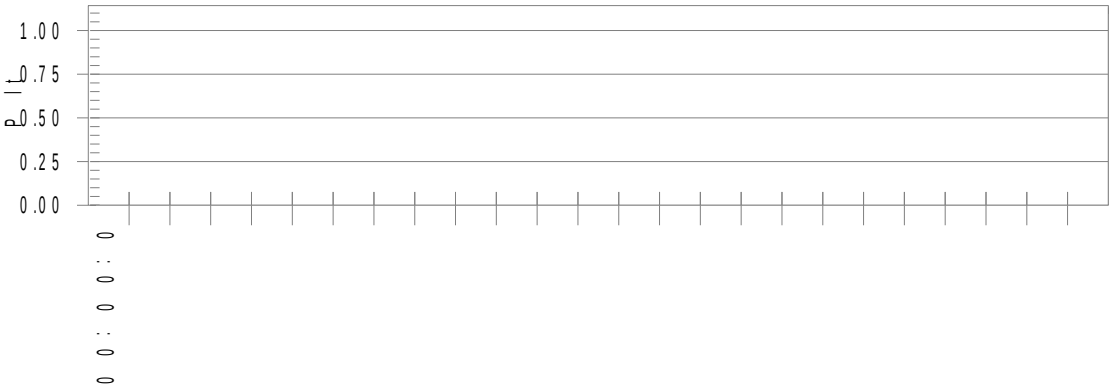
Flicker Test Summary per EN/IEC61000-3-3 Ed. 3.0 (2013) (Run time)

Pst and limit line

European Limits



Plt and limit line



Parameter values recorded during the test:

Vrms at the end of test (Volt):	229.99			
Highest dt (%):	-0.48	Test limit (%):	N/A	N/A
T-max (mS):	0	Test limit (mS):	500.0	Pass
Highest dc (%):	0.00	Test limit (%):	3.30	Pass
Highest dmax (%):	0.47	Test limit (%):	4.00	Pass
Highest Pst (10 min. period):	0.136	Test limit:	1.000	Pass
Highest Plt (2 hr. period):	0.059	Test limit:	0.650	Pass

8.4.6 Setup photos

Figure 8.4-1: *Voltage fluctuations and flicker setup photo – HSVL Advanced*

Figure 8.4-2: *Voltage fluctuations and flicker setup photo – HSVL Plus*

8.4.6 Setup photos, continued

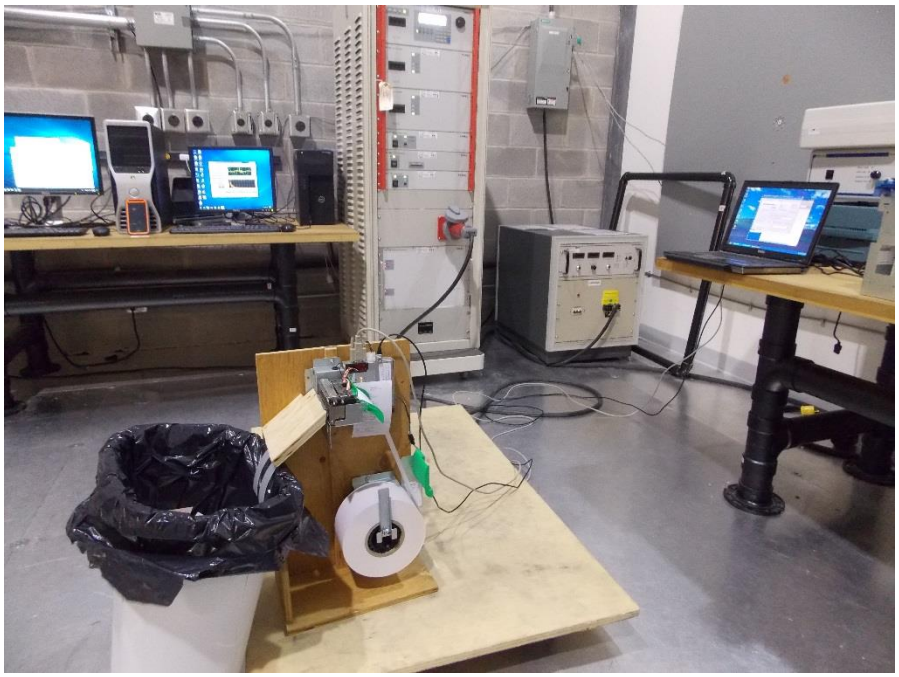


Figure 8.4-3: *Voltage fluctuations and flicker setup photo – HSVL Plus L*

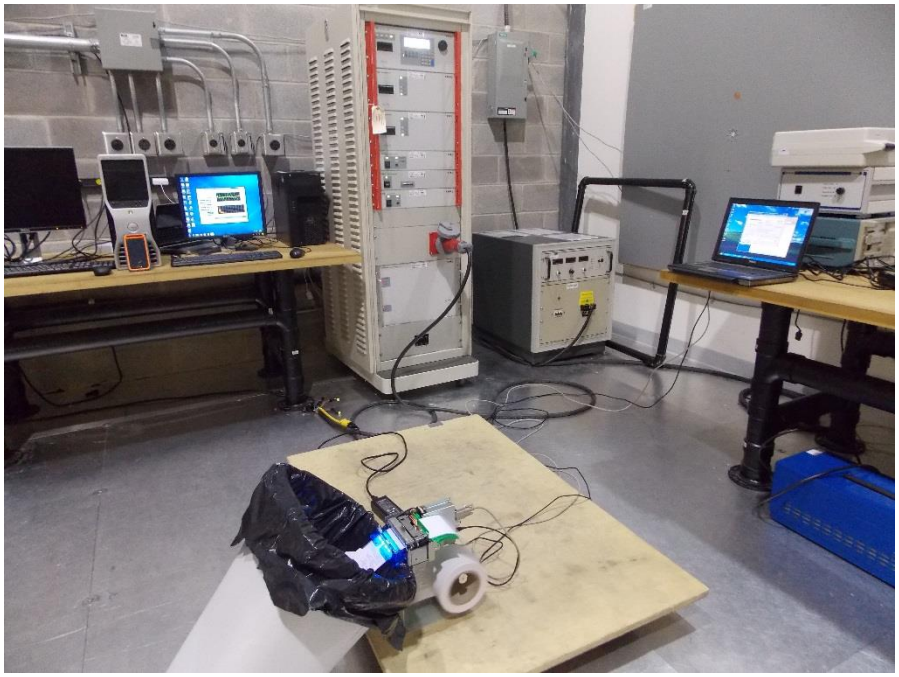


Figure 8.4-4: *Voltage fluctuations and flicker setup photo – HSVL Plus FS*

Section 9 EUT photos

9.1 External photos

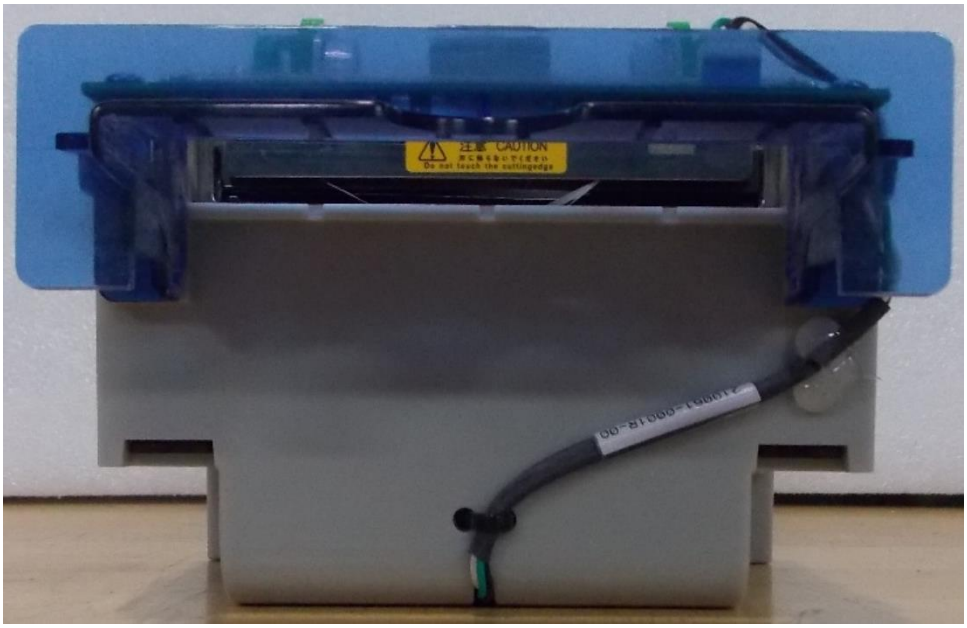


Figure 9.1-1: *Front view photo – HSVL Advanced*

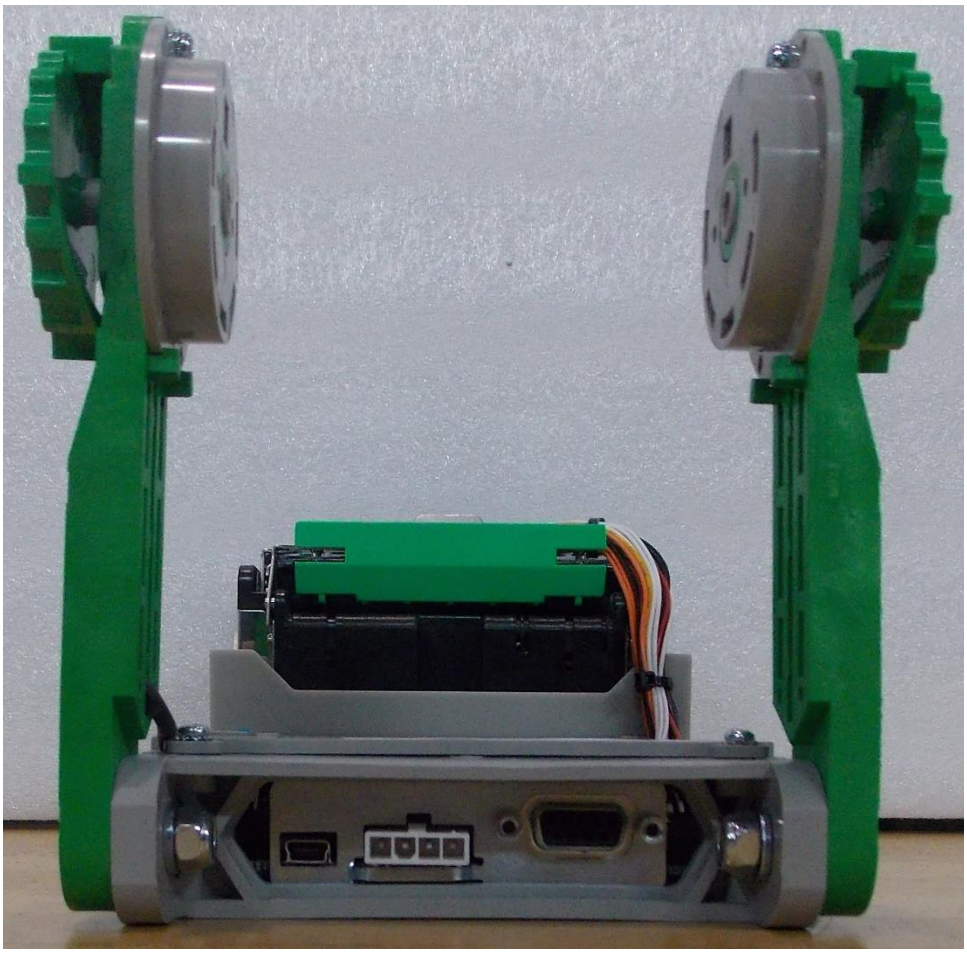


Figure 9.1-2: *Rear view photo – HSVL Advanced*

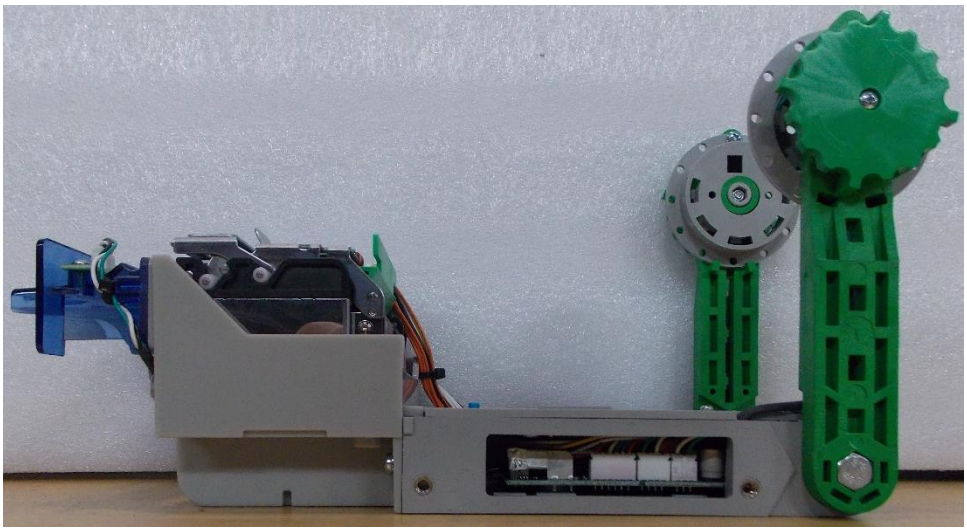


Figure 9.1-3: *Side view photo – HSVL Advanced*

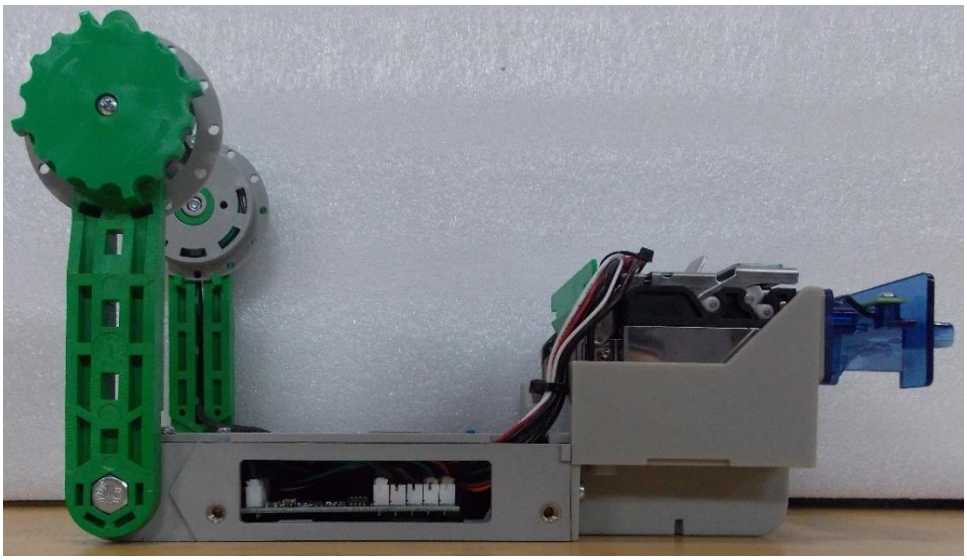


Figure 9.1-4: *Side view photo – HSVL Advanced*

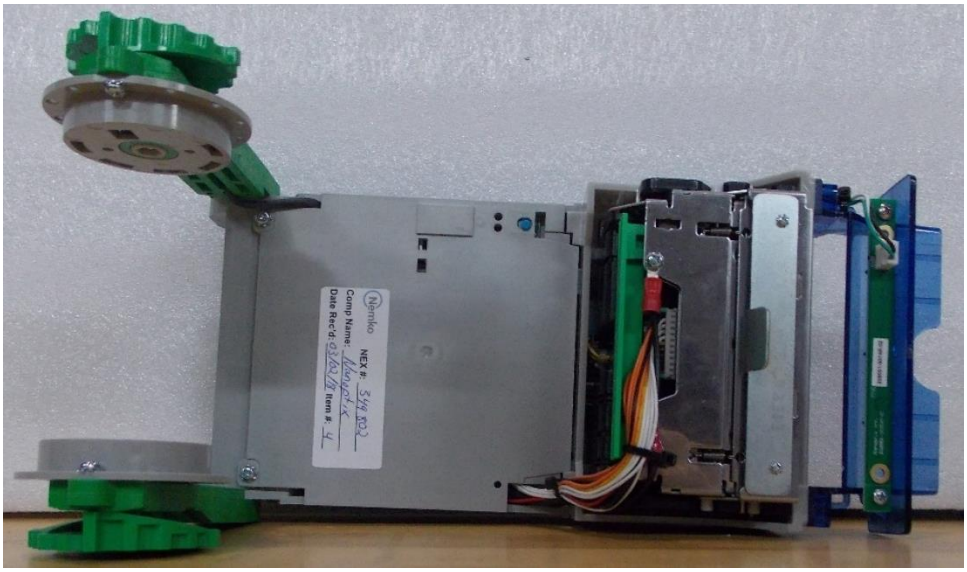


Figure 9.1-5: *Top view photo – HSVL Advanced*

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*

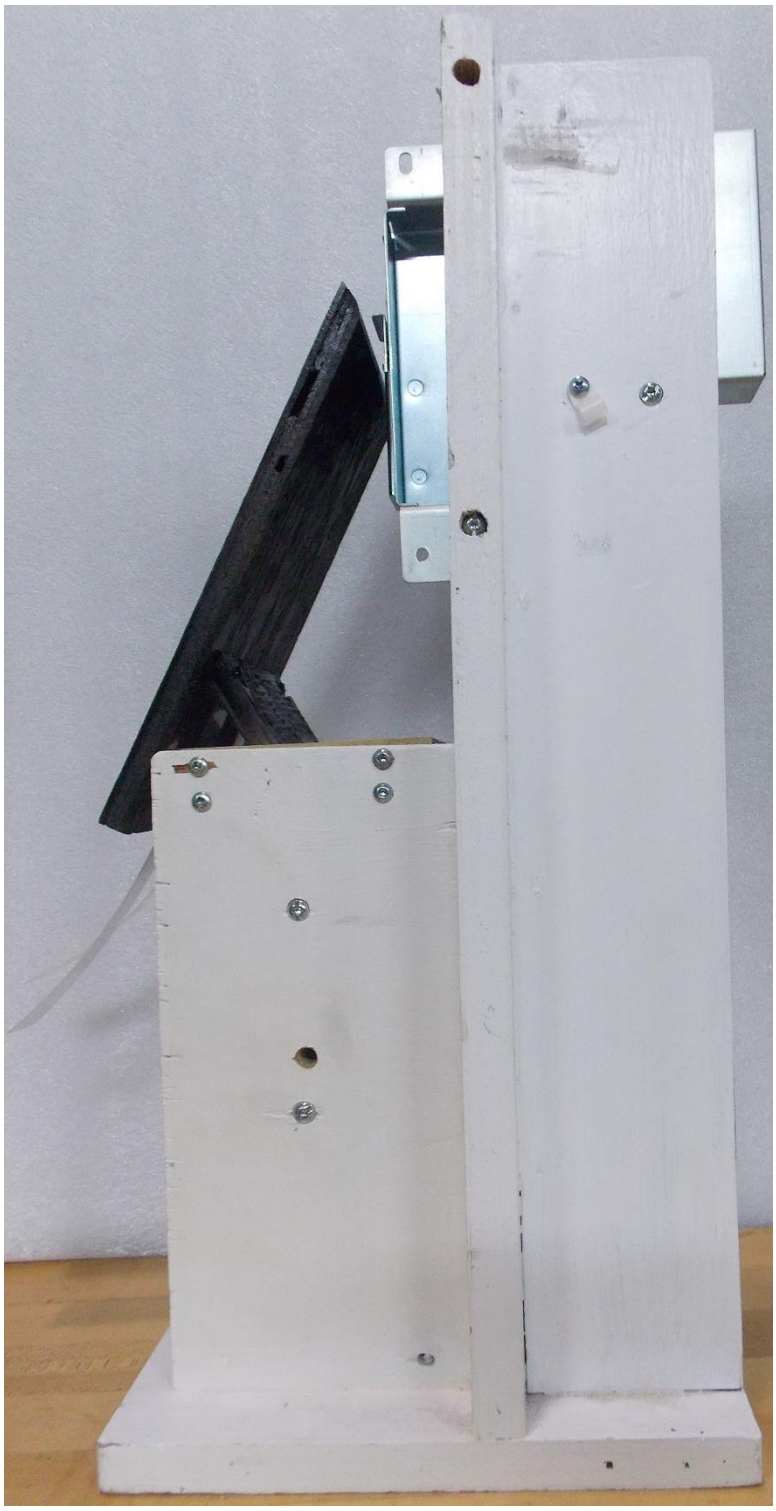


Figure 9.1-9: *Side view photo – HSVL Plus*

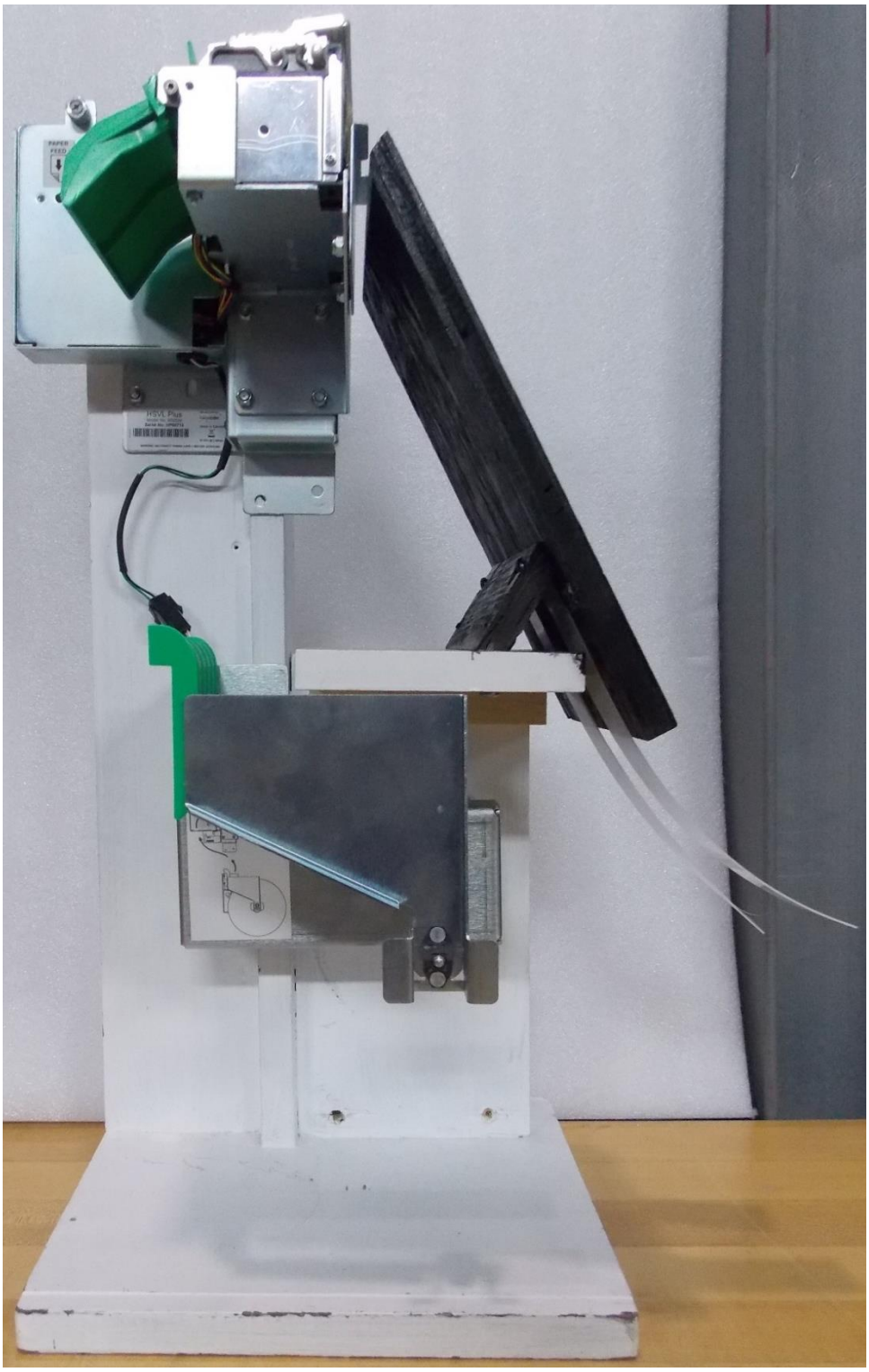


Figure 9.1-10: *Side view photo – HSVL Plus*

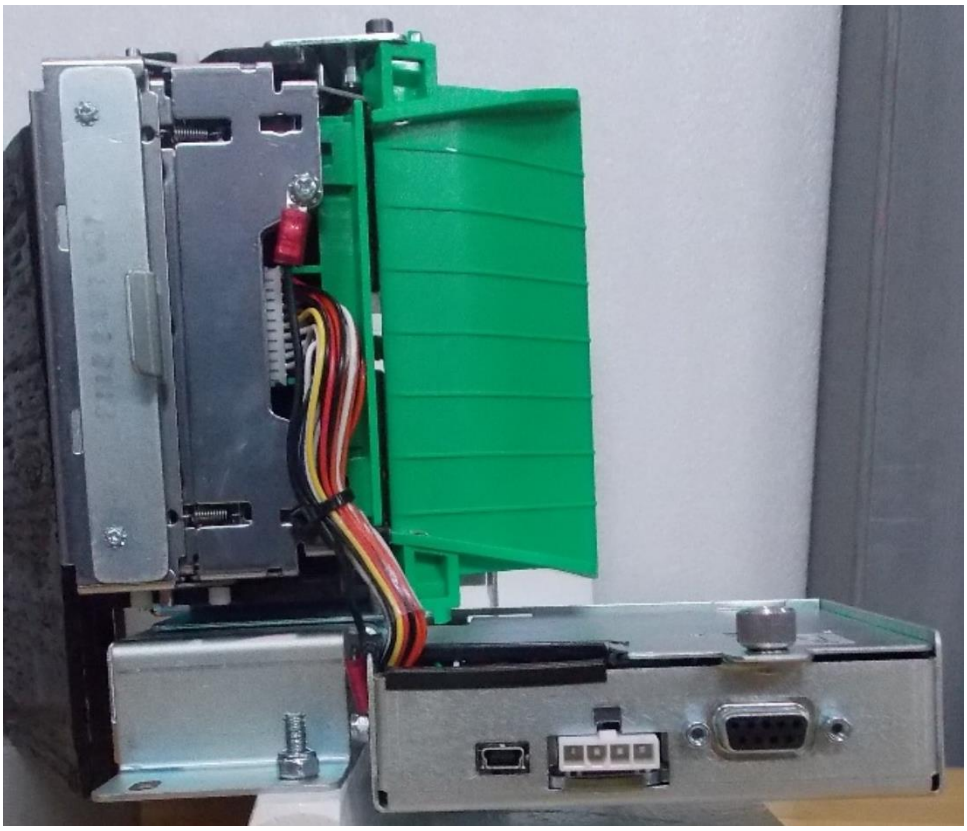


Figure 9.1-11: *Top view photo – HSVL Plus*

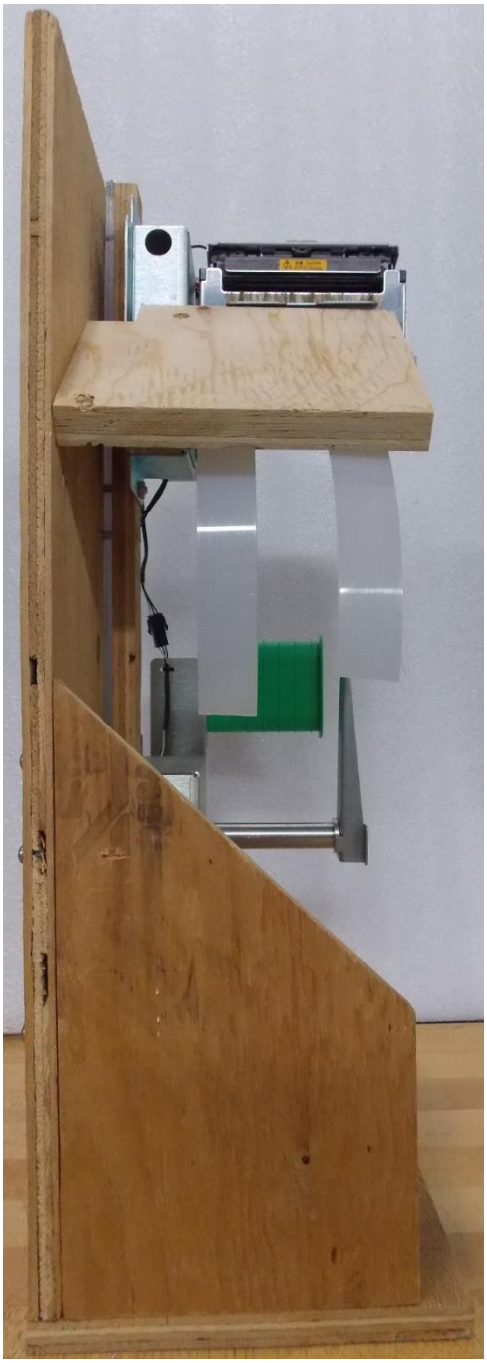


Figure 9.1-12: *Front view photo – HSVL Plus L*

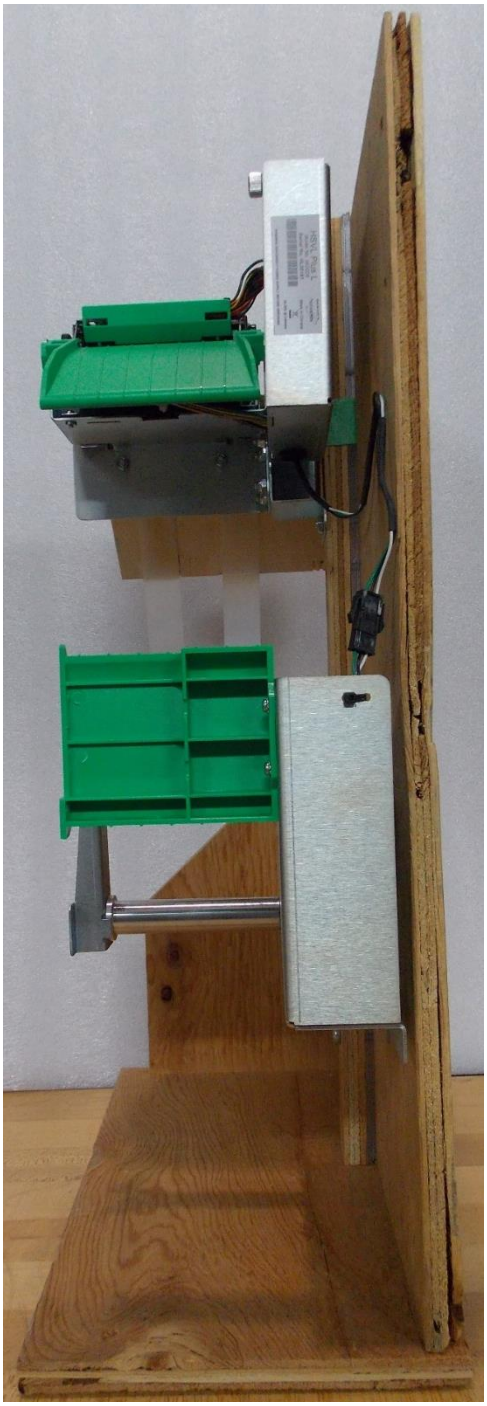


Figure 9.1-13: *Rear view photo – HSVL Plus L*

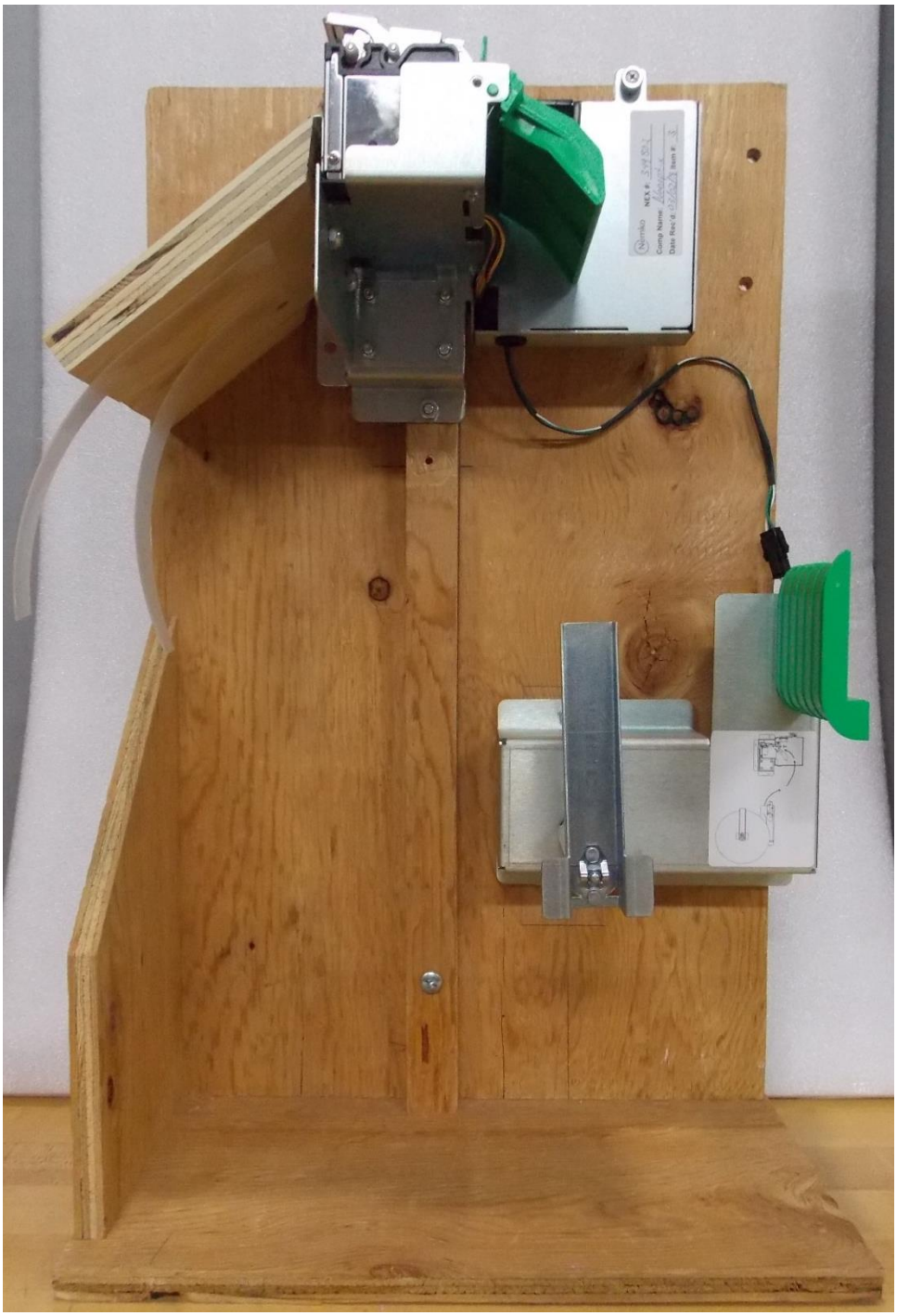


Figure 9.1-14: *Side view photo – HSVL Plus L*

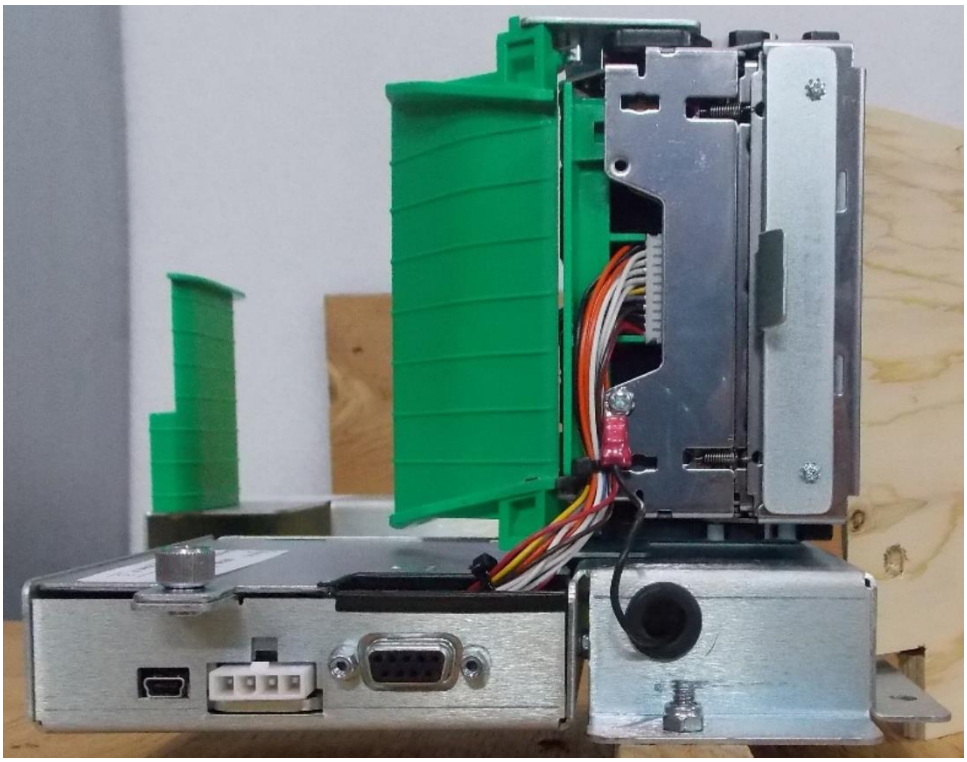


Figure 9.1-15: *Top view photo – HSVL Plus L*

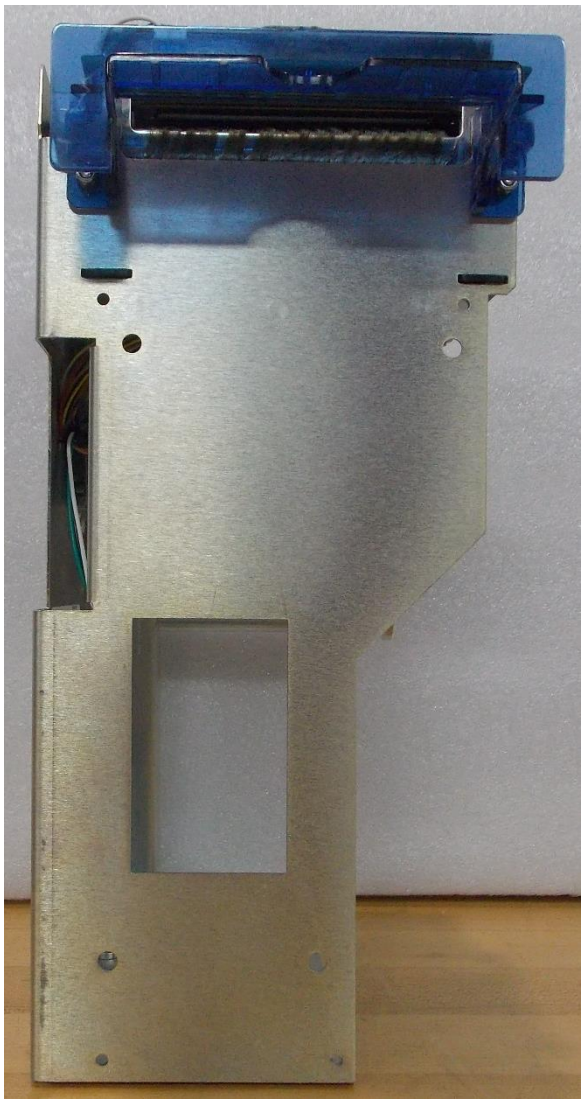


Figure 9.1-16: *Front view photo – HSVL Plus FS*

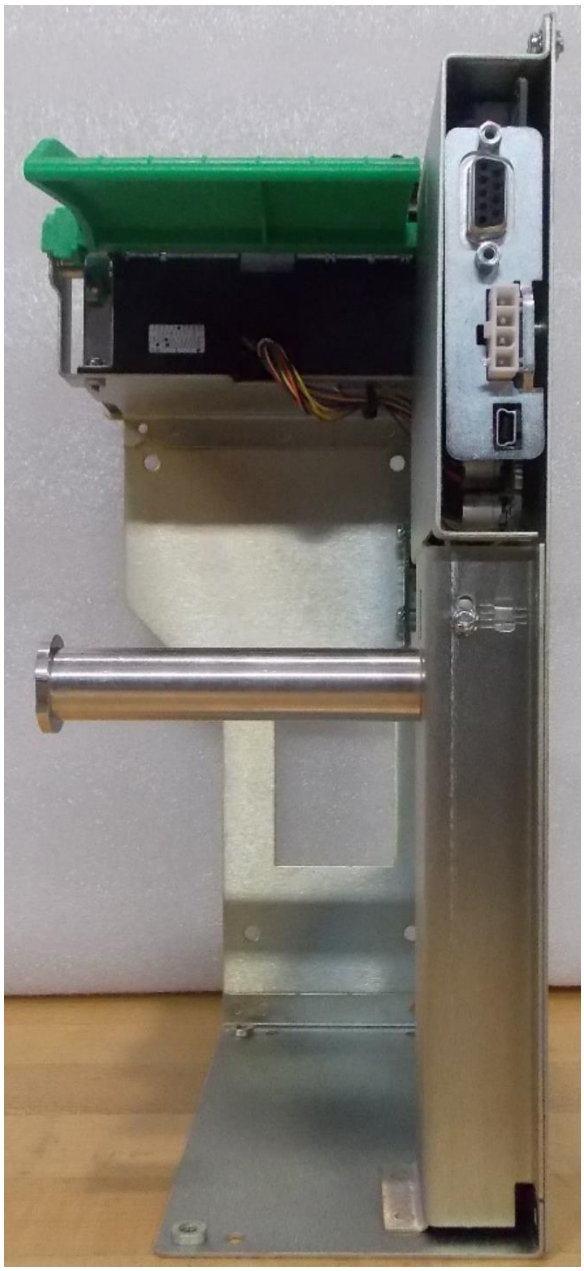


Figure 9.1-17: *Rear view photo – HSVL Plus FS*

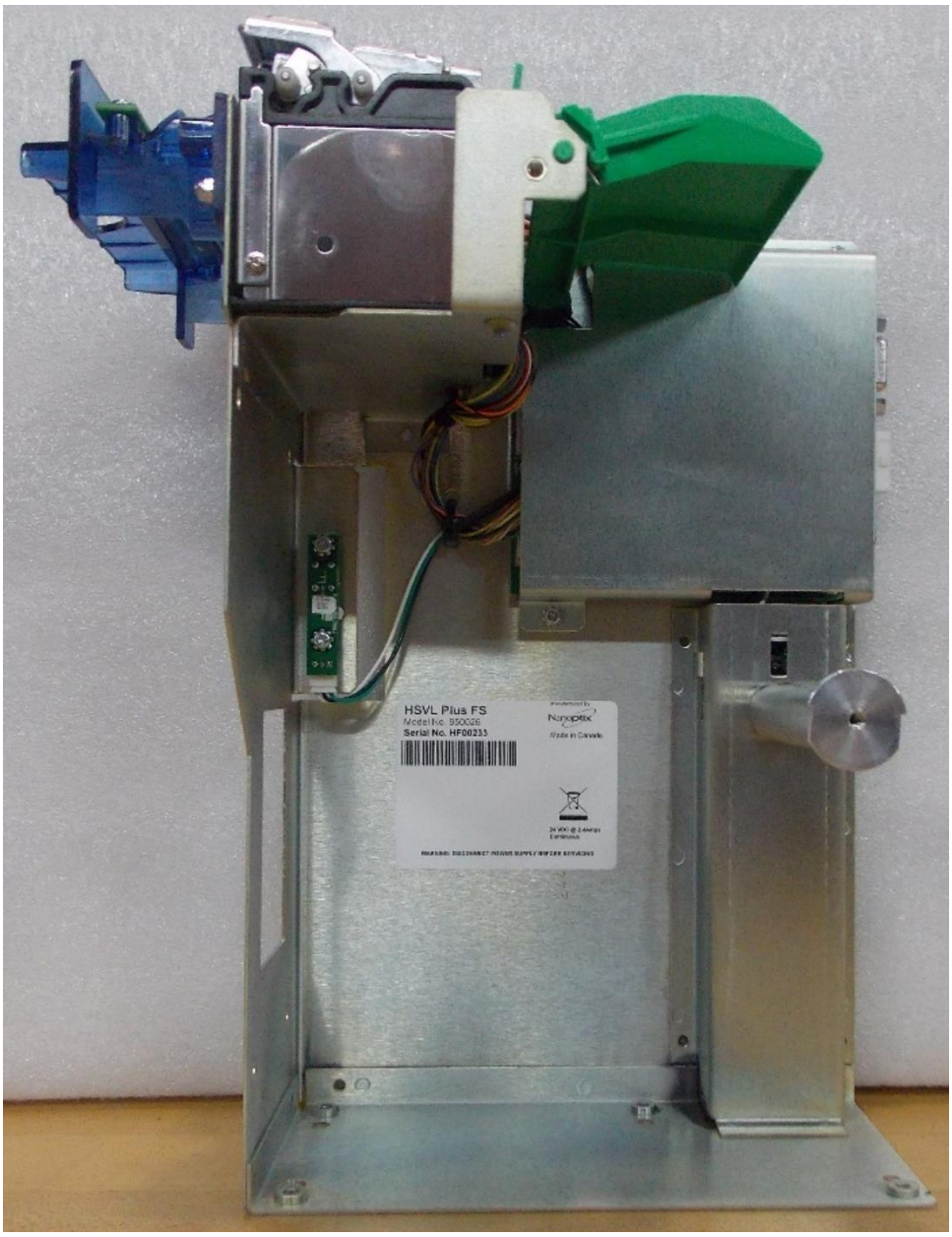


Figure 9.1-18: *Side view photo – HSVL Plus FS*

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

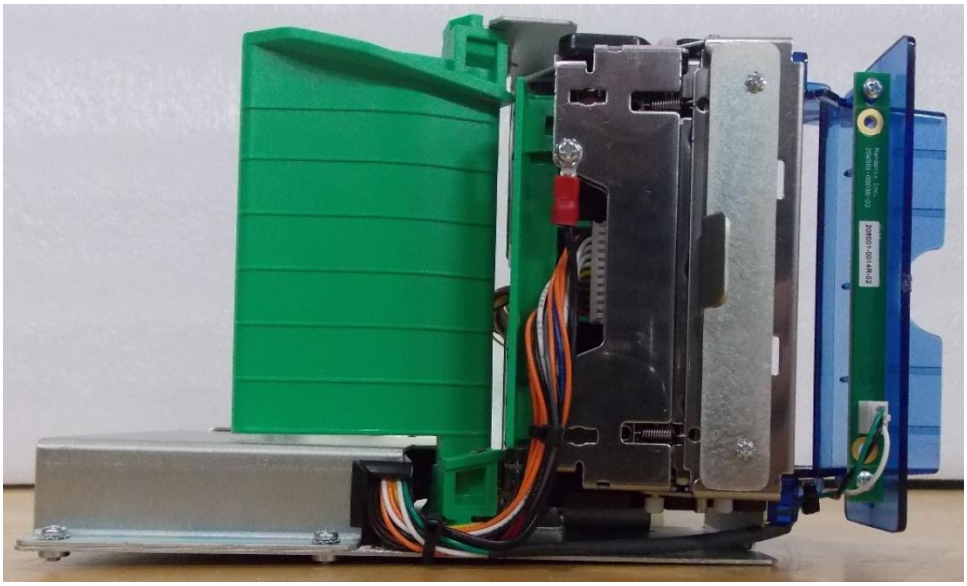


Figure 9.1-20: *Top view photo – HSVL Plus FS*

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