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Test report

317747-1TRFEMC

Date of issue: November 22, 2016

Applicant:

Nanoptix Inc.

Product:

PayCheck NextGen

Model:

950050

Product variant:

PayCheck Desktop II

Model variant:

950051

Specification:

EN 55024: 2010

Information technology equipment
Immunity characteristics
Limits and methods of measurement

Lab and test locations

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Limits of responsibility

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

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Section 1 Report summary

1.1 Test specifications

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

1.2 Exclusions

None

1.3 Statement of compliance

In the configuration tested, the EUT was found compliant.

Testing was performed against all relevant requirements of the test standard. 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 #	Details of changes made to test report
TRF	Original report issued

Notes: None

Section 2 Summary of test results

2.1 Test results

Table 2.1-1: *Immunity, enclosure results*

Environmental phenomenon	Test specification	Units	Performance criteria	Basic standard	Verdict
Power-frequency magnetic field [1]	50 1	Hz A/m_{RMS}	A[2]	EN 61000-4-8	Not applicable
Radio-frequency electromagnetic field amplitude modulated [3]	80–1000 3 80	MHz V/m_{RMS} (unmodulated) % AM (1 kHz)	A	EN 61000-4-3	Pass
Electrostatic discharge (ESD)	4 (Contact discharge) 8 (Air discharge)	kV (charge voltage) kV (charge voltage)	B	EN 61000-4-2	Pass

Notes:
[1] Applicable only to EUT containing devices susceptible to magnetic fields, such as CRT monitors, Hall elements, electrodynamic microphones, magnetic field sensors, etc.
[2] See Annex B (EN 55024: 2010) as appropriate.
[3] The frequency range is scanned as specified. However, when specified in Annex A (EN 55024: 2010), an additional comprehensive functional test shall be carried out at a limited number of frequencies. The selected frequencies are: 80, 120, 160, 230, 434, 460, 600, 863 and 900 MHz (±1 %).

Table 2.1-2: *Immunity, signal ports and telecommunication ports*

Environmental phenomenon	Test specification	Units	Performance criteria	Basic standard	Verdict
Radio-frequency continuous conducted [1 and 3]	0.15–80 3 80	MHz V_{RMS} (unmodulated) % AM (1 kHz)	A	EN 61000-4-6	Pass
Surge (line to ground) [2, 4, 5, and 7]	1 or 4 10/700	kV (peak) Tr/Th µs	C	EN 61000-4-5	Not applicable
Fast transients [3, 5, and 6]	0.5 5/50 5	kV (peak) Tr/Th ns kHz (repetition rate)	B	EN 61000-4-4	Pass

Notes:
[1] The frequency range is scanned as specified. However, when specified in Annex A (EN 55024: 2010), an additional comprehensive functional test shall be carried out at a limited number of frequencies. The selected frequencies for conducted tests are: 0.2, 1, 7.1, 13.56, 21, 27.12 and 40.68 MHz (±1 %).
[2] Applicable only to ports which according to the manufacturer's specification may connect directly to outdoor cables.
[3] Applicable only to cables which according to the manufacturer's specification supports communication on cable lengths greater than 3 m.
[4] For ports where primary protection is intended, surges are applied at voltages up to 4 kV with the primary protectors fitted. Otherwise the 1 kV test level is applied without primary protection in place.
[5] Test applied to all lines simultaneously to earth (ground).
[6] For xDSL equipment, the repetition frequency for EFT testing shall be 100 kHz (See EN 55024: 2010 Annex H).
[7] Where the coupling network for the 10/700 µs waveform affects the functioning of high speed data ports, the test shall be carried out using a 1,2/50 (8/20) µs waveform and appropriate coupling network.

2.1 Test results, continued

Table 2.1-3: *Immunity, input DC power port (excluding equipment marketed with an a.c/d.c, power converter)*

Environmental phenomenon	Test specification	Units	Performance criteria	Basic standard	Verdict
Radio-frequency continuous conducted [1]	0.15–80 3 80	MHz V_{RMS} (unmodulated) % AM (1 kHz)	A	EN 61000-4-6	Not applicable
Surge (line to ground) [2]	1.2/50 (8/20) 0.5	Tr/Th µs kV (peak)	B	EN 61000-4-5	Not applicable
Fast transients	0.5 5/50 5	kV (peak) Tr/Th ns kHz (repetition rate)	B	EN 61000-4-4	Not applicable

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

Table 2.1-4: *Immunity, input AC power ports (including equipment marketed with a separate a.c./d.c power converter)*

Environmental phenomenon	Test specification	Units	Performance criteria	Basic standard	Verdict
Radio-frequency continuous conducted [1]	0.15–80 3 80	MHz V_{RMS} (unmodulated) % AM (1 kHz)	A	EN 61000-4-6	Pass
Voltage dip [2]	100 0.5 30 25	% reduction period % reduction periods	B C	EN 61000-4-11	Pass Pass
Voltage interruptions [2]	100 250	% reduction periods	C	EN 61000-4-11	Pass
Surge [3]	1.2/50 (8/20) 1 (line to line) 2 (line to ground)	Tr/Th µs kV (peak) kV (peak)	B	EN 61000-4-5	Pass
Fast transients	1 5/50 5	kV (peak) Tr/Th ns kHz (repetition rate)	B	EN 61000-4-4	Pass

Notes: [1] The frequency range is scanned as specified. However, when specified in Annex A (EN 55024: 2010), an additional comprehensive functional test shall be carried out at a limited number of frequencies. The selected frequencies for conducted test are: 0.2, 1, 7.1, 13.56, 21, 27.12 and 40.68 MHz (±1 %).
[2] Changes to occur at 0 degree crossover point of the voltage waveform.
[3] When the manufacturer specifies protection measures and it is impractical to simulate these measures during the tests, then the applied test levels shall be reduced to 0.5 kV (line to line) and 1 kV (line to earth (ground)).

Section 3 Equipment under test (EUT) details

3.1 Applicant/Manufacturer

Company name	Nanoptix Inc.
Address	699 Champlain St., Dieppe, New Brunswick, Canada, E1A 7P1

3.2 Sample information

Receipt date	September 23, 2016
Nemko sample ID number	133-002513

3.3 EUT information

Product name (s)	PayCheck NextGen
Model (s)	950050
Serial number	NG00286
Product name variant	PayCheck Desktop II
Model Variant	950051
Power requirements	24 V_{DC} @ 2.4 Amps (Via 100-240 V_{AC} power supply)
Description/theory of operation	The EUT is a thermal ticket printer. This printer is used in casino game terminal to print tickets used to cash out credits from the game. It can receive print jobs from either USB full speed or RS-232.
Operational frequencies	1GHz internal processor, 400MHz for memory access
Software details	Firmware version is 1.14B

3.4 EUT exercise and monitoring details

The printer was printing a “standard” ticket. Every 6 seconds.

3.5 EUT setup details

Table 3.5-1: *EUT interface ports*

Description	Qty.
RS232 – printer connector	1

Table 3.5-2: *Support equipment*

Description	Brand name	Model/Part number	Serial number	Rev.
Power supply	FSP Group INC	FSP060-RTAAN2	-	-

Table 3.5-3: *Inter-connection cables*

Cable description	From	To	Length (m)
RS232	Host	Network	5

Figure 3.5-1: *Setup diagram*

Section 4 Engineering considerations

4.1 Modifications incorporated in the EUT

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

4.2 Technical judgment

The PayCheck Desktop II, model number 950051 was tested as a representative sample for both models. Customer has stated the EUT uses different plastic enclosure and EUT uses the same firmware. The EUT Is electrically identical.

4.3 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

Section 5 Test conditions

5.1 Atmospheric conditions

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

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

5.2 Power supply range

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

Section 6 Measurement uncertainty

6.1 Uncertainty of measurement

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

Section 7 Terms and definitions

7.1 Performance terms and definitions

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

7.2 General definitions

7.2.1 EN 61000-4-2 (Electrostatic discharge)

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

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

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

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

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

7.2 General definitions, continued

7.2.4 EN 61000-4-5 (Surge)

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

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

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

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

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

Section 8 Testing data

8.1 Radio-frequency electromagnetic field amplitude modulated

8.1.1 References

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

8.1.2 Test summary

Verdict	Pass		
Test date	October 14, 2016	Temperature	23 °C
Test engineer	Kevin Rose	Air pressure	1005 mbar
Test location	Ottawa	Relative humidity	47 %

8.1.3 Notes

Additional spot frequencies requested by client.

8.1.4 Setup details

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

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
3 m EMI test chamber	TDK	SAC-3	FA002047	1 year	Dec. 01/16
Bilog antenna (20–3000 MHz)	Sunol	JB3	FA002108	1 year	Apr. 28/17
E-Field probe (0.003–18 GHz)	AR	FP7018	FA002186	1 year	Sept. 14/17
Directional coupler (80–1000 MHz)	AR	DC6180A	FA002090	1 year	April 26/17
Amplifier (80–1000 MHz, 250 W)	AR	250W1000A	FA002038	—	NCR
Power meter	Rhode & Schwarz	NRP	FA002070	1 year	Mar. 01/17
Power sensor	Rhode & Schwarz	NRP-Z91	FA002107	1 year	Mar. 01/17
Amplifier (2–8 GHz, 250 W)	IFI	T82-250	FA002374	—	NCR
Horn antenna (1–18 GHz)	EMCO	3115	FA000825	1 year	Apr. 26/17
Signal generator	Rhode & Schwarz	SMB100A	FA002174	1 year	Apr. 22/17

Notes: NCR - no calibration required

Table 8.1-2: *Radio-frequency electromagnetic field amplitude modulated test software details*

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

Notes: None

8.1.5 Test data

Table 8.1-3: *Swept frequency – Radio-frequency electromagnetic field amplitude modulated results*

Step size increment	1 %
Dwell time[1]	6 s
Antenna polarization	Vertical and Horizontal
Modulation	CW signal amplitude modulated (AM) with 80 % depth with a 1 kHz sine wave
EUT setup configuration	Table top
EUT position facing antenna	Front side, back side, left side and right side

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

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

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

Dwell time[1]	6 s
Antenna polarization	Vertical and Horizontal
Modulation	CW signal amplitude modulated (AM) with 80 % depth with a 1 kHz sine wave
EUT setup configuration	Table top
EUT position facing antenna	Front side, back side, left side and right side

Frequency MHz	Test level, V/m	Comments
1800	30	No degradation
2600	30	No degradation
3500	30	No degradation
5000	30	No degradation

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

8.1.6 Setup photo

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

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

8.2 Radio-frequency continuous conducted

8.2.1 References

EN 61000-4-6: 2009

8.2.2 Test summary

Verdict	Pass		
Test date	October 24, 2016	Temperature	22 °C
Test engineer	Kevin Rose	Air pressure	1004 mbar
Test location	Ottawa	Relative humidity	35 %

8.2.3 Notes

None

8.2.4 Setup details

Table 8.2-1: *Radio-frequency continuous conducted equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
Amplifier (0.01–250 MHz, 75 W)	AR	75A250A	FA001943	—	NCR
Signal generator	Rhode & Schwarz	SML-03	FA002046	1 year	Jan 01/17
6 dB attenuator	Inmet	64671	FA002215	1 year	June 30/17
Directional coupler (0.01–250 MHz)	AR	DC2600A	FA002089	1 year	June 30/17
Direct Injection 100 Ω resistor	Nemko	N/A	FA001751	1 year	May 06/17
Power meter	Rhode & Schwarz	NRP	FA002076	1 year	Jan. 21/17
Power sensor	Rhode & Schwarz	NRP-Z91	FA002075	1 year	Jan. 21/17
CDN-M3	FCC	FCC-801-M3-16A	FA002066	1 year	Aug.24/17

Notes: NCR - no calibration required

Table 8.2-2: *Radio-frequency continuous conducted test software details*

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

Notes: None

8.2.5 Test data

Table 8.2-3: *Swept frequency – Radio-frequency continuous conducted results*

Frequency range:	0.15–80 MHz
Step size increment:	1 %
Dwell time[1]:	6 s
Signal level:	3 V_{RMS}
Modulation:	CW signal amplitude modulated (AM) with 80 % depth with a 1 kHz sine wave

Ports investigated	Coupling method	50 Ω termination point	Comments
AC mains	M3	DI	No degradation
RS232	DI	M3	No degradation

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

8.2.6 Setup photo

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

8.3 Electrostatic discharge

8.3.1 References

EN 61000-4-2: 2009

8.3.2 Test summary

Verdict	Pass		
Test date	October 25, 2016	Temperature	23 °C
Test engineer	Kevin Rose	Air pressure	1006 mbar
Test location	Ottawa	Relative humidity	38 %

8.3.3 Notes

Additional test levels were assessed as per client request.

8.3.4 Setup details

Table 8.3-1: *Electrostatic discharge equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
ESD gun	TESEQ	NSG 435	FA002682	1 year	Mar. 09/17

Notes: None

8.3.5 Test data

Table 8.3-2: *Electrostatic discharge results*

EUT setup configuration:	Table top
ESD repetition rate:	1 pulse per second
Discharges:	25 contact discharges and 10 air discharges at each polarity

Contact discharge[1 and 2]	**Test voltage (±kV)**	**Comments**
Please refer to "Electrostatic discharge test location points" photos of this section	8	No degradation
Indirect discharge[1 and 2]	**Test voltage (±kV)**	**Comments**
HCP (all sides)	8	No degradation
VCP (all sides)	8	No degradation
Air discharge	**Test voltage (±kV)**	**Comments**
Please refer to "Electrostatic discharge test location points" photos of this section	2, 4, 8, 15	No degradation

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

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

8.3.5 Test data, continued

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

Red points = contact discharge
Green points = air discharge

8.3.5 Test data, continued

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

Red points = contact discharge
Green points = air discharge

8.3.6 Setup photo

Figure 8.3-3: *Electrostatic discharge setup photo*

8.4 Surge

8.4.1 References

EN 61000-4-5: 2006

8.4.2 Test summary

Verdict	Pass		
Test date	October 24, 2016	Temperature	24 °C
Test engineer	Kevin Rose	Air pressure	1003 mbar
Test location	Ottawa	Relative humidity	40 %

8.4.3 Notes

None

8.4.4 Setup details

Table 8.4-1: *Surge equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
Surge/EFT generator/Ringwave	TESEQ	NSG 3060	FA002177	1 year	Sep. 16/17
Surge/EFT coupler/Decoupler	TESEQ	NSG 3063	FA002177	1 year	Sep. 16/17

Table 8.4-2: *Surge test software details*

Manufacturer of Software	Details
Teseq	NSG300, Version 1.3.2

Notes: None

8.4.5 Test data

Table 8.4-3: *Surge at AC power ports results*

Open circuit voltage (T_1 / T_2):	1.2/50 µs (T_1 = front time, T_2= time to half value)
Short circuit curent (T_1 / T_2):	8/20 µs (T_1 = front time, T_2= time to half value)
Surge pulse interval:	30 s
Number of pulses:	5 positive and 5 negative

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

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

8.4.6 Setup photo

Figure 8.4-1: *Surge setup photo*

8.5 Fast transients

8.5.1 References

EN 61000-4-4: 2004 + A1: 2010

Special Note: A more relevant publication of EN 61000-4-4 has been applied for this assessment.

8.5.2 Test summary

Verdict	Pass		
Test date	October 24, 2016	Temperature	24 °C
Test engineer	Kevin Rose	Air pressure	1003 mbar
Test location	Ottawa	Relative humidity	40 %

8.5.3 Notes

None

8.5.4 Setup details

Table 8.5-1: *Fast transients equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
Surge/EFT generator/Ringwave	TESEQ	NSG 3060	FA002177	1 year	Sep. 16/17
Surge/EFT coupler/Decoupler	TESEQ	NSG 3063	FA002177	1 year	Sep. 16/17
Burst / EFT Coupling – Decoupling Network	TESEQ	CDN 163	FA002181	—	NCR

Notes: NCR - no calibration required

Table 8.5-2: *Fast transients test software details*

Manufacturer of Software	Details
Teseq	NSG300, Version 1.3.2

Notes: None

8.5.5 Test data

Table 8.5-3: *Fast transients results*

Wave shape (Tr / Td):	5/50 ns (Tr = rise time, Td= duration time)
Repetition frequency[4]:	5 kHz
Burst duration:	15 ms
Burst period:	300 ms
Test duration:	60 s

Test port	Test voltage (±kV)	Comments
AC input[1]	0.5, 1	No degradation
Signal port[3]	0.5	No degradation

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

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

8.5.6 Setup photos

Figure 8.5-1: *Fast transients setup photo*

8.6 Voltage dips and voltage interruptions

8.6.1 References

EN 61000-4-11: 2004

8.6.2 Test summary

Verdict	Pass		
Test date	October 24, 2016	Temperature	24 °C
Test engineer	Kevin Rose	Air pressure	1003 mbar
Test location	Ottawa	Relative humidity	40 %

8.6.3 Notes

None

8.6.4 Setup details

Table 8.6-1: *Voltage dips and voltage interruptions equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
Single Phase 5kVA, Harmonics, Flicker and Dips system	TESEQ	Profline 2105-208: (NSG1007-5, CCN1000-1, NSG2200-1)	FA002824	1 year	May 26/17

Table 8.6-2: *Voltage dips and voltage interruptions test software details*

Manufacturer of Software	Details
TESEQ	WIN2110SII, PN CIC924, Version 2.2.0.6, Feb 25, 2010

Notes: None

8.6.5 Test data

Table 8.6-3: *Voltage dips results*

Variation/dip repetition:	Sequence of three dips/interruptions with an interval of 10 seconds between each test		
Test port	**Voltage reduction (%)**	**Periods**	**Comments**
AC Mains	100	0.5	No degradation
	30	25	No degradation

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

Table 8.6-4: *Voltage interruptions results*

Variation/dip repetition:	Sequence of three dips/interruptions with an interval of 10 seconds between each test		
Test port	**Voltage reduction (%)**	**Periods**	**Comments**
AC Mains	100	250	EUT power cycled

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

8.6.6 Setup photo

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

Section 9 EUT photos

9.1 External photos

Figure 9.1-1: *Front view photo*

Figure 9.1-2: *Rear view photo*

Figure 9.1-3: *Side view photo*