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EMC TEST REPORT

Report ID
REP066025

Project ID
PRJ0066902

Applicant:
Nanoptix Inc.

Product:
Spill-Proof Printer

Model:
100769 / 950023

Model variant(s):
103665/950005

Specification:

- EN 55035:2017/A11:2020
- CISPR 35:2016

Date of issue: November 15, 2024

Daniel Hynes, Senior EMC Specialist
Tested by

Dhara Patel, EMC/RF Specialist
Tested by


Signature

David Duchesne, EMC/RF Lab Manager
Reviewed by


Signature

Lab and test locations

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Test site registration number:	– CA2040 (Ottawa) – CA2041 (Montreal) – CA0101 (Cambridge)		
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 55035:2017/A11:2020	Electromagnetic compatibility of multimedia equipment Immunity requirements
CISPR 35:2016	Electromagnetic compatibility of multimedia equipment Immunity requirements

1.2 Exclusions

None

1.3 Statement of compliance

In the configuration tested, the EUT was found compliant.

Unless noted in section 1.2, all 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*

Report ID.	Date of issue	Details of changes made to test report
275244-2TRFEMC	January 13, 2015	Original report issued
REP066025	November 15, 2024	New report issued to latest versions of standard including new delta testing

Section 2 Engineering considerations

2.1 Modifications incorporated in the EUT for compliance

The following modifications were performed by client in order to comply with radiated emissions requirements (Internal part numbers in parenthesis.):

Removed:

1. **R313, R314, R315**: 0R, 0402 (240008-0000R)
2. **C310B:** 100uF, 35V (230011-1008R)

Added:

3. **C465**: 0.1uF, 0603 (230001-1005R)
4. **C457, C458, C459, C802**: 0.1uF, 0402 (230015-1005R)
5. **C462, C463, C464**: 10uF, 1206 (230013-1007R)
6. **C700, C750, C800, C851**: 10uF, 0805 (230010-1007R)
7. **Z300**: 5V TVS, SP0505BAHTG (242012-5000R)
8. **L300, L301, L302**: Ferrite beads BLM15AG102SN1D (237002-1003R)
9. **C310A**: 220uF, 35V (100579-2023R)

There were no wire mods. The components added already had a footprint on the PCB so they will be added to the released BOM for this printer's main board.

These modifications were present during all testing.

2.2 Technical judgment

The new report has been updated to align with the latest versions of the standard. Data from the original assessment was utilized, and any delta test results included.

2.3 Model variant declaration

As declared by the applicant, the EUT model 100769/950023 (Spill-Proof printer) has been chosen to be representative for all other models in the model family. The model family, and the description of the variations, are as follows:

Model variant 103665/950005: Details: Same main board and the same print mechanism as the Spill-Proof printer. This printer has its main board enclosed into a metal shell and is assumed to be better shielded than the Spill-Proof printer. The PayCheck Slim printer is designed to fit inside a cabinet.

2.4 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

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Section 3 Test conditions

3.1 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 4 Information provided by the applicant

4.1 Disclaimer

This section contains information provided by the applicant and has been utilized to support the test plan. Inaccurate information provided by the applicant can affect the validity of the results contained within this test report. Nemko accepts no responsibility for the information contained within this section and the impact it may have on the test plan and resulting measurements.

4.2 Applicant/Manufacturer

Applicant name	Nanoptix Inc.
Applicant address	699 Champlain Street, Dieppe, NB, E1A 1P6, Canada
Manufacturer name	Same as applicant
Manufacturer address	Same as applicant

4.3 EUT information

Product	Spill-Proof Printer	
Model	100769 / 950023	
Serial number	SP00001 [2015 assessment]	1041308 [2024 assessment]
Part number	100769 / 950023	
Power requirements	100-240 V_{AC}, 50/60 Hz	
Description/theory of operation	Thermal printer. To insert the paper, open the top cover. Pass the paper between the top cover and the base and pull it up to the front. Close the cover. Power the printer. This printer is used to print receipts. It can receive print jobs from either USB full speed or RS-232.	
Operational frequencies	192 MHz internal to the processor 96 MHz between the processor and the memory chips.	
Software details	Firmware version SPL-5.68A [2015 assessment]	Firmware version SPL-5.73A [2024 assessment]

4.4 EUT setup details

4.4.1 EUT Exercise and monitoring [2015 assessment]

Methods used to exercise the EUT and all relevant ports:

- The EUT was configured to operate continuously printing once every 5 seconds. Verification of the printer quality as well as continued printing was used to assess any impact caused by immunity testing.

Configuration details:

- 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.
- 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.

4.4.2 EUT Exercise and monitoring [2024 assessment]

Methods used to exercise the EUT and all relevant ports:

- The EUT was configured to operate continuously printing once every 10 seconds. Verification of the printer quality as well as continued printing was used to assess any impact caused by immunity testing.

Configuration details:

- 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.
- 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.

Monitoring details:

- The current counts observed in the printer status application were recorded alongside the total number of printed receipts

4.4.3 EUT test configuration

Table 4.4-1: *EUT sub-assemblies*

Description	Brand name	Model/Part number	Serial number
Spill-Proof Printer [2015 assessment]	Nanoptix	950023/100769	SP00001
Spill-Proof Printer [2024 assessment]	Nanoptix	950023/100769	1041308

Table 4.4-2: *EUT interface ports*

Description	Qty.
Power Input	1
USB	1
Serial	1

Table 4.4-3: *Support equipment*

Description	Brand name	Serial number, Part number, Model, Revision level
Laptop Computer	Dell	Latitude D820
ITE Power Supply	Nanoptix	GT-21126-6024 / GS-1110

Table 4.4-4: *Inter-connection cables*

Cable description	From	To	Length (m)
2 Conductor DC Power Cable	EUT	AC/DC Power Adapter	2
DB9 to DB9 Null Cable (Female to Female)	EUT	Laptop Computer	7
Mini-B to Standard USB Cable	EUT	Laptop Computer	6

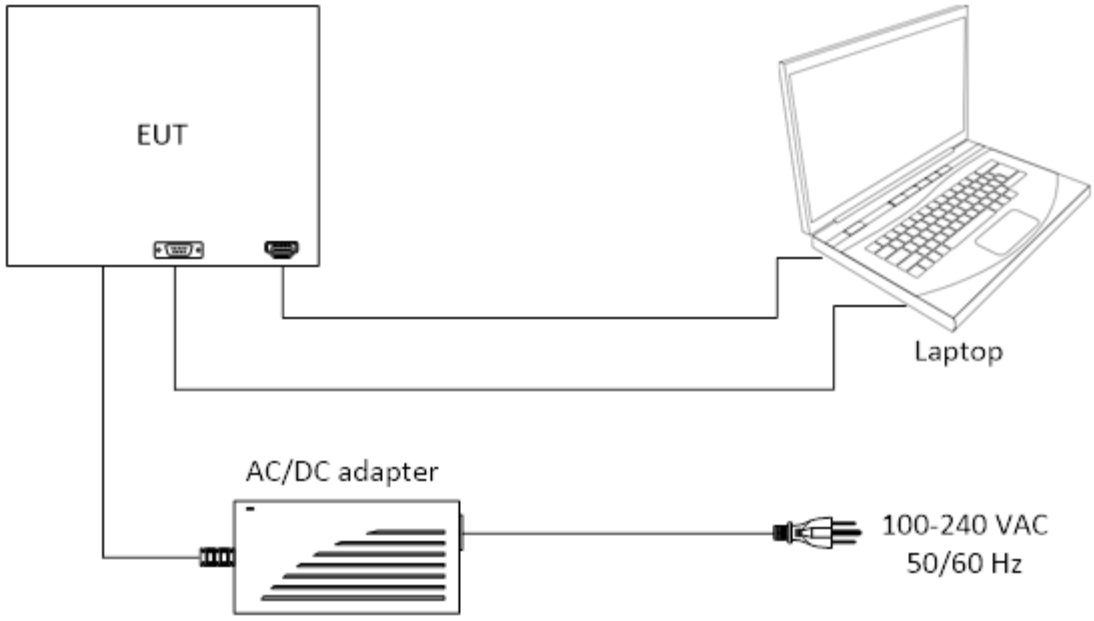

Figure 4.4-1: *Block diagram*

Section 5 Summary of test results

5.1 Testing period

2015 assessment

Test start date	December 19, 2014	Test end date	January 8, 2015

2024 assessment

Test start date	October 10, 2024	Test end date	October 10, 2024

5.2 Sample information

2015 assessment

Receipt date	December 5, 2014	Nemko sample ID number	Item # 11

2024 assessment

Receipt date	October 10, 2024	Nemko sample ID number	PRJ00669020001

5.3 Test results

Table 5.3-1: *Result summary*

Test description	Verdict
Enclosure ports	
Power frequency magnetic field	Not applicable[1]
Continuous RF electromagnetic field disturbances, swept test	Pass
Continuous RF electromagnetic field disturbances, spot test	Pass
ESD	Pass
Analogue/digital data ports	
Continuous induced RF disturbances	Pass
Broadband impulse noise disturbances, repetitive	Not applicable[2]
Broadband impulse noise disturbances, isolated	Not applicable[2]
Surges	Not applicable[3]
Electrical fast transients/burst	Pass
DC network power ports	
Continuous induced RF disturbances	Not applicable[4]
Surges	Not applicable[4]
Electrical fast transients/burst	Not applicable[4]
AC mains power ports	
Continuous induced RF disturbances	Pass
Voltage dips	Pass
Voltage interruptions	Pass
Surges	Pass
Electrical fast transients/burst	Pass

Notes:
[1] EUT does not contain devices intrinsically susceptible to magnetic fields, such as CRT monitors, Hall effect elements, electro-dynamic microphones, magnetic field sensors or audio frequency transformers.
[2] EUT does not contain CPE xDSL ports.
[3] EUT does not contain ports which may connect directly to outdoor cables.
[4] EUT does not contain DC power ports.

Section 6 Terms and definitions

6.1 Performance terms and definitions

General performance criteria, Reference Clause 8.1 of EN 55035:2017/A11:2020 and CISPR 35:2016	General performance criteria are defined in 8.2, 8.3 and 8.4. These criteria shall be used during the testing of primary functions where no relevant annex is applicable. When assessing the impact of a disturbance on a function, the assessment should take into consideration the function's performance prior to the application of the disturbance and only identify as failures those changes in performance that are a result of the disturbance.
Performance criterion A, Reference Clause 8.2 of EN 55035:2017/A11:2020 and CISPR 35:2016	The equipment shall continue to operate as intended without operator intervention. No degradation of performance, loss of function or change of operating state is allowed below a performance level specified by the manufacturer when the equipment 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 equipment if used as intended.
Performance criterion B, Reference Clause 8.3 of EN 55035:2017/A11:2020 and CISPR 35:2016	During the application of the disturbance, degradation of performance is allowed. However, no unintended change of actual operating state or stored data is allowed to persist after the test. After the test, the equipment shall continue to operate as intended without operator intervention; no degradation of performance or loss of function is allowed, below a performance level specified by the manufacturer, when the equipment 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), or recovery time, 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 equipment if used as intended.
Performance criterion C, Reference Clause 8.4 of EN 55035:2017/A11:2020 and CISPR 35:2016	Loss of function is allowed, provided the function is self-recoverable, or can be restored by the operation of the controls by the user in accordance with the manufacturer's instructions. A reboot or re-start operation is allowed. Information stored in non-volatile memory, or protected by a battery backup, shall not be lost.

6.2 General definitions

6.2.1 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.

6.2.2 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.

6.2.3 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.

General definitions, continued

6.2.4 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.

6.2.5 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.

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

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

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

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

Section 7 Testing data

7.1 ESD

7.1.1 References and limits

- EN 55035:2017/A11:2020
- CISPR 35:2016
- EN 61000-4-2:2009
- IEC 61000-4-2:2008

Table 7.1-1: *ESD specification*

Test specification	Performance criterion
±4 (Contact discharge), ±8 (Air discharge)	B

Notes: Electrostatic discharges shall be applied only to points and surfaces of the EUT which are expected to be touched during normal operation, including user access operations specified in the user manual, for example cleaning or adding consumables when the EUT is powered. The application of discharges to the contacts of open connectors is not required.

7.1.2 Test summary

Verdict	Pass		
Test date	January 9, 2015	Temperature	24 °C
Tested by	Daniel Hynes	Air pressure	1000 mbar
Test location	Montreal	Relative humidity	35.6 %

7.1.3 Notes

Elevated test levels performed in accordance with customer request.

7.1.4 Setup details

Table 7.1-2: *ESD equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
ESD gun	Keytek	MZ-15/EC	FA001983	1 year	March 6/15

Notes: None

Table 7.1-3: *Measurement uncertainty*

Measurement uncertainty (MU) considerations
Measurement uncertainty requirements for EN/IEC 61000-4-2 are currently under consideration, and no applicable requirements have been established at this time. The test equipment is calibrated to meet the tolerance requirements of EN/IEC 61000-4-2, with calibration uncertainty taken into account. (Tolerances are not reduced by MU)

7.1.5 Test data

Table 7.1-4: *ESD results*

EUT setup configuration	Table top
EUT power input during test	100-240 V_{AC}, 50/60 Hz
ESD repetition rate	1 pulse every 5 seconds
Discharges	25 contact discharges and 10 air discharges at each polarity

Contact discharge	**Test voltage (±kV)**	**Comments**
Screw on bottom of EYR	4	No degradation
Rear Plate for interface connections	4	No degradation
Shield of DB9 connector	4	No degradation
Shield of USB connector	4	No degradation
Indirect discharge[1 and 2]	**Test voltage (±kV)**	**Comments**
HCP (all sides)	4	No degradation
VCP (all sides)	4	No degradation
Air discharge	**Test voltage (±kV)**	**Comments**
Power connector	2, 4, 8	No degradation
USB connector	2, 4, 8	No degradation
DB9 connector	2, 4, 8	No degradation
Paper roll cover	2, 4, 8	No degradation
Paper holder area	2, 4, 8	No degradation
Print button	2, 4, 8	No degradation
All sides of EUT	2, 4, 8	No degradation

Notes:
[1]For contact discharge, the requirement to apply ESD discharges at lower levels, as defined in Clause 5 of 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.

7.1.6 Setup photos

Figure 7.1-1: *ESD setup photo*

Figure 7.1-2: *ESD setup photo*

7.2 Continuous RF electromagnetic field disturbances

7.2.1 References and limits

- EN 55035:2017/A11:2020
- CISPR 35:2016
- EN/IEC 61000-4-3:2006 + A1:2008 + A2:2010

Table 7.2-1: *Continuous RF electromagnetic field disturbances, specification*

Test specification	Performance criterion
Swept test	
80–1000 MHz, 3 V/m (unmodulated), 80 % AM (1 kHz)	A
Spot test	
1800, 2600, 3500, 5000 MHz, 3 V/m (unmodulated), 80 % AM (1 kHz)	A

Notes: None

7.2.2 Test summary

2015 assessment

Verdict	Pass		
Test date	January 6, 2015	Temperature	24.3 °C
Tested by	Daniel Hynes	Air pressure	1016 mbar
Test location	Montreal	Relative humidity	37.5 %

2024 assessment

Verdict	Pass		
Test date	October 10, 2024	Temperature	22.5 °C
Tested by	Dhara Patel	Air pressure	1001 mbar
Test location	Ottawa	Relative humidity	67.6 %

7.2.3 Notes

None

7.2.4 Setup details

Table 7.2-2: *Continuous RF electromagnetic field disturbances, equipment list [2015 assessment]*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
3 m EMI test chamber	TDK	SAC-3	FA002532	1 year	Sept. 16/15
Bilog antenna (20–2000 MHz)	Sunol	JB1	FA002517	1 year	Aug. 29/15
Starprobe (0.1–6000 MHz)	AR	FL7006	FA002054	1 year	June 5/15
Laser probe interface	AR	FI7000	FA002054	—	NCR
Directional coupler (80–1000 MHz)	AR	DC6180	FA001659	1 year	July 9/15
Power meter	Rhode & Schwarz	NRP	FA002485	1 year	June 5/15
Power sensor	Rhode & Schwarz	NRP-Z91	FA002488	1 year	June 5/15
Signal generator	Rhode & Schwarz	SMB100A	FA002174	1 year	Mar. 06/15
Amplifier (80–1000 MHz, 250 W)	AR	250W1000A	FA002088	—	NCR

Notes: NCR - no calibration required

Table 7.2-3: *Continuous RF electromagnetic field disturbances, equipment list [2024 assessment]*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
3 m EMI test chamber	TDK	SAC-3	FA002047	1 year	January 18, 2025
Horn antenna (1–18 GHz)	EMCO	3115	FA000825	1 year	May 16, 2025
Starprobe (2 MHz–40 GHz)	AR	FL7040	FA002592	1 year	April 23, 2025
Laser probe interface (monitor)	AR	FL7000	FA002593	—	NCR
Power meter	Rohde & Schwarz	NRP	FA002485	1 year	May 16, 2025
Power sensor	Rohde & Schwarz	NRP-Z91	FA002488	1 year	May 24, 2025
Amplifier (1-6 GHz, 100 W)	Ametek	CBA-6G-100D	FA003390	—	NCR
50 Ω coax cable	Carlisle	WHU18-1818-072	FA002391	1 year	October 18, 2025
50 Ω coax cable	Huber+Suhner	104B11NX2/11000	FA003441	1 year	October 18, 2025

Notes: NCR - no calibration required

All equipment related to the contribution of measurement has been included in this list. Such items include, but are not limited to, cables, attenuators, directional couplers, and pre-amps.

Table 7.2-4: *Measurement uncertainty*

Measurement uncertainty (MU) considerations
Measurement uncertainty requirements for EN/IEC 61000-4-3 are currently under consideration, and no applicable requirements have been established at this time. The test equipment is calibrated to meet the tolerance requirements of EN/IEC 61000-4-3, with calibration uncertainty taken into account. (Tolerances are not reduced by MU)

Table 7.2-5: *Continuous RF electromagnetic field disturbances, software details [2015 assessment]*

Manufacturer of Software	Details
Rhode & Schwarz	EMC32, Software for EMC Measurements, Version 8.53.0

Table 7.2-6: *Continuous RF electromagnetic field disturbances, software details [2024 assessment]*

Manufacturer of Software	Details
Rhode & Schwarz	EMC32, Software for EMC Measurements, Version 11.20.00

7.2.5 Test data

Table 7.2-7: *Swept frequency – Continuous RF electromagnetic field disturbances, results [2015 assessment]*

Step size increment	1 %[1]
Dwell time	5 s[2]
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
Transmit antenna	3 meters from EUT, 1.5 meters above GRP
EUT power input during test	100-240 V_{AC}, 50/60 Hz
EUT position facing antenna	Front side, back side, left side and right side

Frequency range, MHz		Test level, V/m[1]	Comments
80	1000	3	No degradation

Notes: [1]Recognizing that a 1% step size is preferred, the frequency range can be swept incrementally with a step size not exceeding 4% of the previous frequency with a test level of twice the value of the specified test level in order to reduce the testing time for equipment requiring testing in multiple configurations and/or long cycle times.
[2]The dwell time at each frequency shall not be less than the time necessary for the EUT to be exercised and to be able to respond. However, the dwell time shall not exceed 5 seconds at each of the frequencies during the scan. The time to exercise the EUT is not interpreted as a total time of a program or a cycle but related to the reaction time in case of failure of the EUT.

Table 7.2-8: *Spot frequencies – Continuous RF electromagnetic field disturbances, results [2024 assessment]*

Dwell time	30 s[1]
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
Transmit antenna	3 meters from EUT, 1.5 meters above GRP
EUT power input during test	100-240 V_{AC}, 50/60 Hz
EUT position facing antenna	Front side, back side, left side and right side

Frequency, MHz	Test level, V/m	Comments
1800	3	No degradation
2600	3	No degradation
3500	3	No degradation
5000	3	No degradation

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

7.2.6 Setup photos

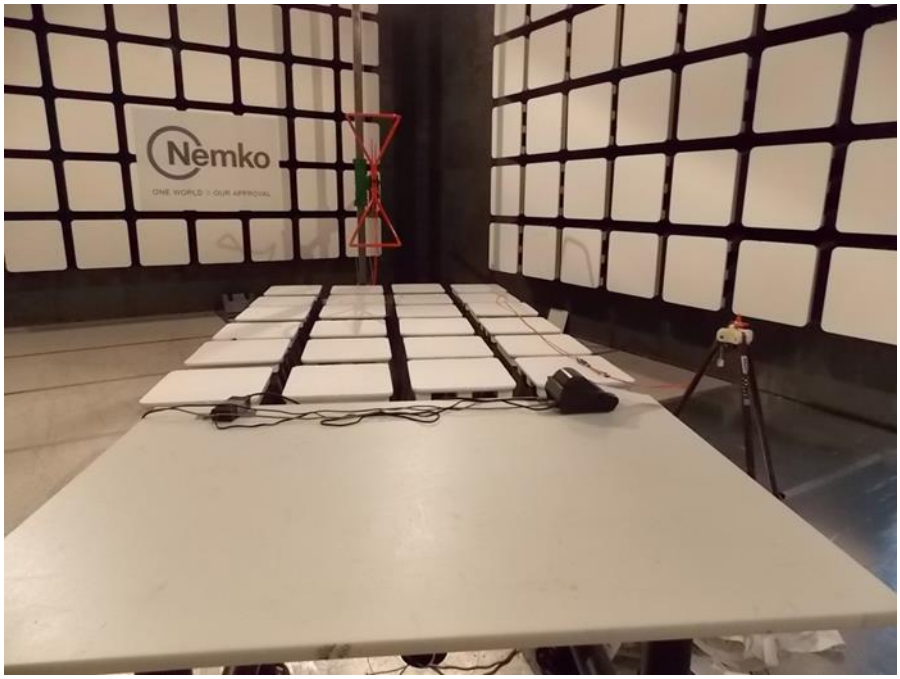

Figure 7.2-1: *Continuous RF electromagnetic field disturbances, setup photo (swept test)*

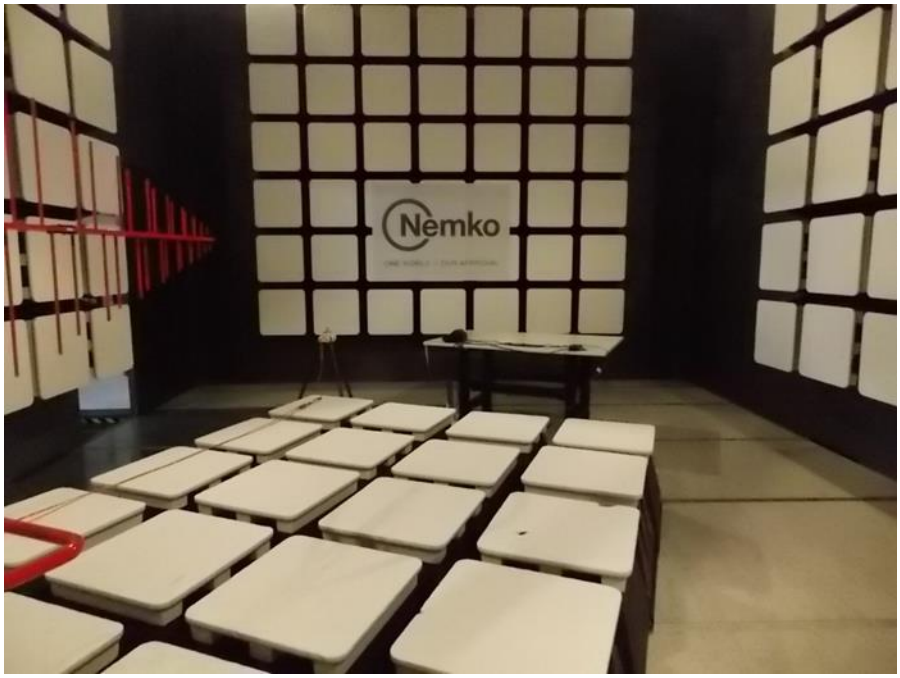

Figure 7.2-2: *Continuous RF electromagnetic field disturbances, setup photo (swept test)*

Setup photos, continued

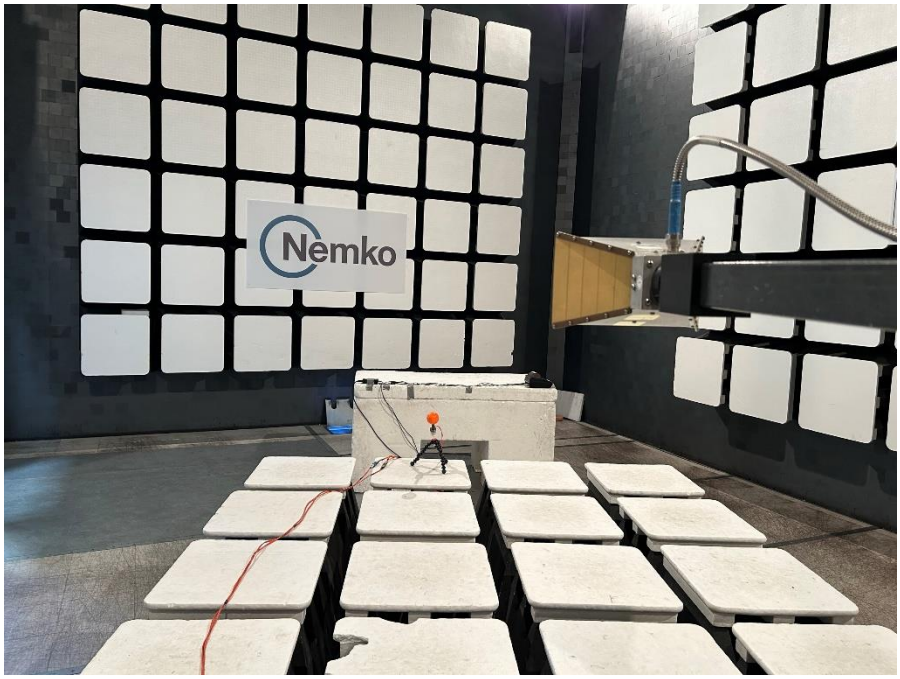

Figure 7.2-3: *Continuous RF electromagnetic field disturbances, setup photo (spot test) [2024 assessment]*

Figure 7.2-4: *Continuous RF electromagnetic field disturbances, setup photo (spot test) [2024 assessment]*

7.3 Electrical fast transients/burst

7.3.1 References and limits

- EN 55035:2017/A11:2020
- CISPR 35:2016
- EN/IEC 61000-4-4:2012

Table 7.3-1: *Electrical fast transients/burst specification*

Test specification	Performance criterion
Analogue/digital data ports [1 and 2]	
±0.5 kV (peak), 5/50 Tr/Th ns, 5 kHz (repetition rate)	B
AC mains power ports	
±1 kV (peak), 5/50 Tr/Th ns, 5 kHz (repetition rate)	B

Notes: [1] Applicable only to ports which, according to the manufacturer's specification, supports cable lengths greater than 3 m.
[2] For CPE xDSL ports repetition frequency is 100 kHz

- If the EUT contained several ports with the same particular interface, only one was tested
- Multi-conductor cables shall be tested as a single cable. Cables shall not be split or divided into groups of conductors for this test.

7.3.2 Test summary

Verdict	Pass		
Test date	January 8, 2015	Temperature	24.4 °C
Tested by	Daniel Hynes	Air pressure	1015.1 mbar
Test location	Montreal	Relative humidity	36.6 %

7.3.3 Notes

None

7.3.4 Setup details

Table 7.3-2: *Electrical fast transients/burst equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
Surge/EFT generator	TESEQ	NSG 3060	FA002495	1 year	Oct. 9/15
Surge/EFT coupler/decoupler	TESEQ	NSG 3063	FA002497	1 year	Oct. 9/15
Capacitive coupling clamp	TESEQ	CDN 3425	FA002498	1 year	NCR

Notes: NCR - no calibration required

Table 7.3-3: *Measurement uncertainty*

Measurement uncertainty (MU) considerations
Measurement uncertainty requirements for EN/IEC 61000-4-4 are currently under consideration, and no applicable requirements have been established at this time. The test equipment is calibrated to meet the tolerance requirements of EN/IEC 61000-4-4, with calibration uncertainty taken into account. (Tolerances are not reduced by MU)

Table 7.3-4: *Fast transients test software details*

Manufacturer of Software	Details
Teseq	NSG300, Version 1.2.0

7.3.5 Test data

Table 7.3-5: *Electrical fast transients/burst results*

Wave shape (Tr / Td)	5/50 ns (Tr = rise time, Td= duration time)
Burst duration	15 ms @ 5 kHz repetition frequency
Burst period	300 ms
Test duration	60 s
EUT power input during test	100-240 V_{AC}, 50/60 Hz

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

7.3.6 Setup photos

Figure 7.3-1: *Electrical fast transients/burst setup photo*

7.4 Surges

7.4.1 References and limits

- EN 55035:2017/A11:2020
- CISPR 35:2016
- EN 61000-4-5:2006
- IEC 61000-4-5:2005

Table 7.4-1: *Surges specification*

Test specification	Performance criterion
AC mains power ports	
±1 kV (line to line), 1.2/50 (8/20) Tr/Th µs ±2 kV (line to ground), 1.2/50 (8/20) Tr/Th µs	B

Notes: None

7.4.2 Test summary

Verdict	Pass		
Test date	January 8, 2015	Temperature	24.4 °C
Tested by	Daniel Hynes	Air pressure	1015.1 mbar
Test location	Montreal	Relative humidity	36.6 %

7.4.3 Notes

None

7.4.4 Setup details

Table 7.4-2: *Surges equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
Surge/EFT generator	TESEQ	NSG 3060	FA002495	1 year	Oct. 9/15
Surge/EFT coupler/decoupler	TESEQ	NSG 3063	FA002497	1 year	Oct. 9/15

Notes: None

Table 7.4-3: *Measurement uncertainty*

Measurement uncertainty (MU) considerations
Measurement uncertainty requirements for EN/IEC 61000-4-5 are currently under consideration, and no applicable requirements have been established at this time. The test equipment is calibrated to meet the tolerance requirements of EN/IEC 61000-4-5, with calibration uncertainty taken into account. (Tolerances are not reduced by MU)

Table 7.4-4: *Surges test software details*

Manufacturer of Software	Details
Teseq	NSG300, Version 1.2.0

7.4.5 Test data

Table 7.4-5: *Surges at AC mains power results*

Open circuit voltage (T_1 / T_2)	1.2/50 µs (T_1 = front time, T_2= time to half value)
Short circuit curent (T_1 / T_2)	8/20 µs (T_1 = front time, T_2= time to half value)
Surge pulse interval	30 s
Number of pulses	5 positive and 5 negative
EUT power input during test	100-240 V_{AC}, 50/60 Hz

Test port	Coupling	Test voltage (±kV)	Comments
AC Input	Phase to Neutral[1 and 3]	0.5, 1	No degradation
	Phase to ground[2 and 3]	0.5, 1, 2	No degradation
	Neutral to ground[2 and 3]	0.5, 1, 2	No degradation

Notes: [1]Surge applied with generator output impedance set to 2 Ω
[2]Surge applied with generator output impedance set to 12 Ω
[3]Surge applied synchronous (relation to power supply): 90 and 270°

7.4.6 Setup photos

Figure 7.4-1: *Surges setup photo*

7.5 Continuous induced RF disturbances

7.5.1 References and limits

- EN 55035:2017/A11:2020
- CISPR 35:2016
- EN 61000-4-6:2009
- IEC 61000-4-6:2008

Table 7.5-1: *Continuous induced RF disturbances specification*

Test specification	Performance criterion
Analogue/digital data ports [1]	
0.15–10 MHz, 3 V_{RMS} (unmodulated), 80 % AM (1 kHz)	
10–30 MHz, 3 to 1 V_{RMS} (unmodulated), 80 % AM (1 kHz)	A
30–80 MHz, 1 V_{RMS} (unmodulated), 80 % AM (1 kHz)	
AC mains power ports	
0.15–10 MHz, 3 V_{RMS} (unmodulated), 80 % AM (1 kHz)	
10–30 MHz, 3 to 1 V_{RMS} (unmodulated), 80 % AM (1 kHz)	A
30–80 MHz, 1 V_{RMS} (unmodulated), 80 % AM (1 kHz)	

Notes: [1] Applicable only to ports which, according to the manufacturer's specification, supports cable lengths greater than 3 m.

- If d.c. power is fed on conductors included in a signal cable, then the requirements of Signal ports and telecommunication ports only apply to this cable.
- Multi-conductor cables shall be tested as a single cable. Cables shall not be split or divided into groups of conductors for this test.

7.5.2 Test summary

Verdict	Pass		
Test date	January 9, 2015	Temperature	24 °C
Tested by	Daniel Hynes	Air pressure	1000 mbar
Test location	Montreal	Relative humidity	35.6 %

7.5.3 Notes

None

7.5.4 Setup details

Table 7.5-2: *Continuous induced RF disturbances equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
Amplifier	AR	150A220	FA001744	—	NCR
Signal generator	Rhode & Schwarz	SMC100A	FA002483	1 year	May 22/15
6 dB attenuator	Inmet	2N200W-06	FA002482	1 year	July 10/15
CDN-M3	FCC	FCC-801-M3-16	FA001776	1 year	June 5/15
CDN-M3	FCC	FCC-801-M3-16A	FA002065	1 year	July 14/15
EM injection clamp	FCC	F-2031-23MM	FA002491	1 year	June 9/15
Directional coupler (0.01–250 MHz)	AR	DC2600A	FA001856	1 year	July 9/15
Power meter	Rhode & Schwarz	NRP	FA002485	1 year	June 5/15
Power sensor	Rhode & Schwarz	NRP-Z91	FA002488	1 year	June 5/15

Notes: NCR - no calibration required

Table 7.5-3: *Measurement uncertainty*

Measurement uncertainty (MU) considerations
Measurement uncertainty requirements for EN/IEC 61000-4-6 are currently under consideration, and no applicable requirements have been established at this time. The test equipment is calibrated to meet the tolerance requirements of EN/IEC 61000-4-6, with calibration uncertainty taken into account. (Tolerances are not reduced by MU)

Table 7.5-4: *Continuous induced RF disturbances test software details*

Manufacturer of Software	Details
Rhode & Schwarz	EMC32, Software for EMC Measurements, Version 8.53.0

7.5.5 Test data

Table 7.5-5: *Continuous induced RF disturbances results*

Frequency range	0.15–80 MHz		
Signal level[1]	3 V_{RMS}		
Step size increment	1 %[1]		
Dwell time	5 s[2]		
EUT power input during test	100-240 V_{AC}, 50/60 Hz		
Modulation	CW signal amplitude modulated (AM) with 80 % depth with a 1 kHz sine wave		
Ports investigated	**Coupling method**	**50 Ω termination point**	**Comments**
AC input	CDN-M3	CDN-M3 (AM Mains on Support Laptop)	No degradation
USB port	EM Clamp	CDN-M3 (AM Mains of EUT)	No degradation
Serial port	EM Clamp	CDN-M3 (AM Mains of EUT)	No degradation

Notes: [1]Recognizing that a 1% step size is preferred, the frequency range can be swept incrementally with a step size not exceeding 4% of the previous frequency with a test level of twice the value of the specified test level in order to reduce the testing time for equipment requiring testing in multiple configurations and/or long cycle times.

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

7.5.6 Setup photos

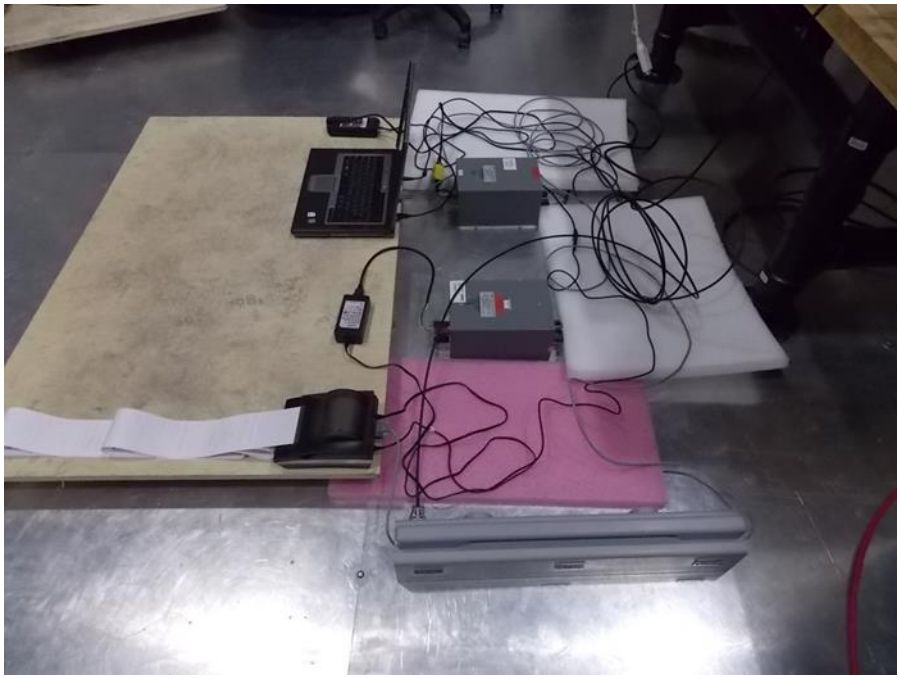

Figure 7.5-1: *Continuous induced RF disturbances setup photo*

7.6 Voltage dips and voltage interruptions

7.6.1 References and limits

- EN 55035:2017/A11:2020
- CISPR 35:2016
- EN/IEC 61000-4-11:2004

Table 7.6-1: *Voltage dips and voltage interruptions specification*

Test specification	Performance criterion
Input AC power ports (including equipment marketed with a separate a.c./d.c power converter)	
< 5 % residual voltage, 0.5 cycles (Voltage dip) 70 % residual voltage, 25 cycles (Voltage dip)	B
< 5 % residual voltage, 250 cycles (Voltage interruption)	C

Notes: Changes to occur at 0 degree crossover point of the voltage waveform. If the EUT does not demonstrate compliance when tested with 0 degree switching, the test shall be repeated with the switching occurring at both 90 degrees and 270 degrees. If the EUT satisfies these alternative requirements, then it fulfils the requirements.

7.6.2 Test summary

Verdict	Pass		
Test date	January 8, 2015	Temperature	24.4 °C
Tested by	Daniel Hynes	Air pressure	1015.1 mbar
Test location	Montreal	Relative humidity	36.6 %

7.6.3 Notes

None

7.6.4 Setup details

Table 7.6-2: *Voltage dips and voltage interruptions equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
Three phase power system	TESEQ	ProfLine 2115-400	FA002516	1 year	May 7/15

Notes: None

Table 7.6-3: *Measurement uncertainty*

Measurement uncertainty (MU) considerations
Measurement uncertainty requirements for EN/IEC 61000-4-11 are currently under consideration, and no applicable requirements have been established at this time. The test equipment is calibrated to meet the tolerance requirements of EN/IEC 61000-4-11, with calibration uncertainty taken into account. (Tolerances are not reduced by MU)

Table 7.6-4: *Voltage dips and voltage interruptions test software details*

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

7.6.5 Test data

Table 7.6-5: *Voltage dips results*

Variation/dip repetition	Sequence of three dips/interruptions with an interval of 10 seconds between each test		
Voltage change degree of the voltage waveform	0 and 180		
EUT power input during test	230 V_{AC}, 50 Hz		
Test port	**Voltage reduction (%)**	**Cycles**	**Comments**
AC Mains input of AC/DC adapter	100	0.5	No degradation
	30	25	No degradation

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

Table 7.6-6: *Voltage interruptions results*

Variation/dip repetition	Sequence of three dips/interruptions with an interval of 10 seconds between each test		
Voltage change degree of the voltage waveform	0 and 180		
EUT power input during test	230 V_{AC}, 50 Hz		
Test port	**Voltage reduction (%)**	**Cycles**	**Comments**
AC Mains input of AC/DC adapter	100	250	EUT power cycled

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

7.6.6 Setup photo

Figure 7.6-1: *Voltage dips and voltage interruptions setup photo*

Section 8 EUT photos

8.1 External photos

Figure 8.1-1: *Front view photo*

Figure 8.1-2: *Rear view photo*

External photos, continued

Figure 8.1-3: *Side view photo*

Figure 8.1-4: *Side view photo*

External photos, continued

Figure 8.1-5: *Top view photo*

Figure 8.1-6: *Bottom view photo*

External photos, continued

***Figure 8.1-7**: Paper holder view photos*

End of the test report