EMC TEST REPORT – 369969-2TRFEMC

Applicant:

TR Controls Inc

Product name:

Access Management Keypad

Model:

K1

Specifications:

- FCC 47 CFR Part 15, Subpart B – Verification
- ICES-003 Issue 6 January 2016

Date of issue: May 8, 2019

Test engineer(s):	Kevin Rose, Wireless/EMC Specialist	Signature:	
Reviewed by:	Andrey Adelberg, Senior Wireless/EMC Specialist	Signature:	Andrey Adelberg

Lab and test locations

Company name	Nemko Canada Inc.			
Facilities	Ottawa site: 303 River Road Ottawa, Ontario Canada K1V 1H2 Tel: +1 613 737 9680 Fax: +1 613 737 9691	Montréal site: 292 Labrosse Avenue Pointe-Claire, Québec Canada H9R 5L8 Tel: +1 514 694 2684 Fax: +1 514 694 3528	**Cambridge site:** **1-130 Saltsman Drive** **Cambridge, Ontario** **Canada** **N3E 0B2** **Tel: +1 519 650 4811**	Almonte site: 1500 Peter Robinson Road West Carleton, Ontario Canada K0A 1L0 Tel: +1 613 256-9117 Fax: +1 613 256-8848
Test site registration	**Organization**	**Recognition numbers and location**		
	FCC/ISED	CA2040 (Ottawa/Almonte); 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

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

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	May 8, 2019	Original report issued

Section 2 Summary of test results

2.1 Testing period

Test start date	April 8, 2019
Test end date	April 9, 2019

2.2 North America test results

Table 2.2-1: *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]	Not applicable [2]
ICES-003 Issue 6	6.1	AC Power Line Conducted Emissions Limits[1]	Not applicable [2]
ICES-003 Issue 6	6.2	Radiated Emissions Limits[1]	Pass

Notes: [1] Product classification B
[2] The EUT is DC powered

Section 3 Equipment under test (EUT) details

3.1 Applicant

Company name	TR Controls Inc
Address	955 Green Valley Road London Ontario N6N1E4 Canada

3.2 Manufacturer

Company name	Microart Services Inc
Address	190 Duffield Drive Markham Ontario L6G1B5 Canada

3.3 Sample information

Receipt date	April 3, 2019
Nemko sample ID number	#5

3.4 EUT information

Product name	Access Control Keypad
Model	K1
Serial number	None
Part number	None
Power requirements	12–60 V_{DC}
Description/theory of operation	The K1 is an access control device with NFC/RFID (13.56 MHz) and PIN keypad entry options. The device will be transmitting constant modulated signal at 13.56 MHz The modulation used is specific to the ISO14443A protocol which is 106 kbit/s data rate and 100% ASK.
Operational frequencies	13.56 MHz, Highest clock frequency: 27.12 MHz
Software details	Test firmware version 1.0.08

3.5 EUT setup details

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

- The EUT is powered with 12 V DC source and unit transmits signals at frequency 13.56 MHz
- When connections are made, observe the LED's on the keypad
- Yellow LED will initially light up to indicate the keypad is connected
- The EUT is tested for keypress and NFC functionality

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:

- Once EUT is powered ON, it starts transmitting and is monitored through a receiver antenna

3.5 EUT setup details, continued

Table 3.5-1: *EUT interface ports*

Description	Qty.
DC mains port	1

Table 3.5-2: *Support equipment*

Description	Brand name	Model, Part number, Serial number, Revision level
Power Supply source	GW Instek	GPR-306000

Table 3.5-3: *Inter-connection cables*

Cable description	From	To	Length (m)
DC mains power cable	EUT	Power Supply	<1

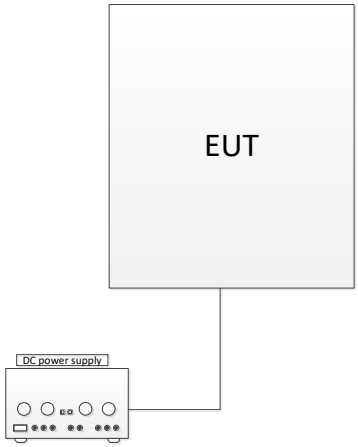

Figure 3.5-1: *block diagram*

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 16-4-2 Specification for radio disturbance and immunity measuring apparatus and methods – Part 4-2: Uncertainties, statistics and limit modelling – Measurement instrumentation uncertainty. The expression of Uncertainty in EMC Testing. Measurement uncertainty calculations assume a coverage factor of K=2 with 95% certainty.

Table 6.1-1: *Measurement uncertainty calculations*

Measurement		U_{cispr} dB	U_{lab} dB			
			Ottawa	Montreal	Cambridge	Almonte
Conducted disturbance at AC mains and other port power using a V-AMN	(9 kHz to 150 kHz)	3.8	2.9	2.8	2.8	N/A
	(150 kHz to 30 MHz)	3.4	2.3	2.2	2.2	N/A
Conducted disturbance at telecommunication port using AAN	(150 kHz to 30 MHz)	5.0	4.3	4.3	4.3	N/A
Conducted disturbance at telecommunication port using CVP	(150 kHz to 30 MHz)	3.9	2.9	2.8	2.8	N/A
Conducted disturbance at telecommunication port using CP	(150 kHz to 30 MHz)	2.9	1.4	1.1	1.1	N/A
Conducted disturbance at telecommunication port using CP and CVP	(150 kHz to 30 MHz)	4.0	3.1	3.0	3.0	N/A
Disturbance power	(30 MHz to 300 MHz)	4.0	3.7	3.7	3.7	N/A
Radiated disturbance (electric field strength at an OATS or in a SAC)	(30 MHz to 1 GHz)	6.3	5.7	5.5	5.5	5.5
Radiated disturbance (electric field strength in a FAR)	(1 GHz to 6 GHz)	5.2	4.8	5.1	4.8	N/A
Radiated disturbance (electric field strength in a FAR)	(6 GHz to 18 GHz)	5.5	5.1	5.0	4.7	N/A

Notes: Compliance assessment:

If U_{lab} is less than or equal to U_{cispr} then:

- compliance is deemed to occur is no measured disturbance level exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit

If U_{lab} is greater than U_{cispr} then:

- compliance is deemed to occur is no measured disturbance level, increased by (U_{lab} - U_{cispr}), exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level, increased by (U_{lab} - U_{cispr}), exceeds the disturbance limit

Section 7 Terms and definitions

7.1 Product classifications definitions

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

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.

7.1.2 ICES-003 – Equipment classification

Class B ITE	limits of radio noise for ITE for residential operation

7.2 General definitions

7.2.1 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.

7.2.2 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.

Section 8 Testing data

8.1 Radiated emissions

8.1.1 References and limits

- 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 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	29.5
88–216			33.1
216–960			35.6
960–1000			43.5
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	April 8, 2019	Temperature	27 °C
Test engineer	Kevin Rose	Air pressure	985 mbar
Test location	Cambridge	Relative humidity	24 %

8.1.3 Notes

- The spectral plots within this section are a summation of a vertical and horizontal scans. The spectral scans have been corrected with the associated applicable transducer factors.
- 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 spectrum was scanned to 1GHz according to the EUT highest digital operating frequency.

Table 8.1-2: *Maximum frequency test range based on highest digital operating frequency*

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	12 V_{DC}
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:

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)

Table 8.1-3: *Radiated emissions equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
Receiver/spectrum analyzer	Rohde & Schwarz	ESR 26	FA002969	1 year	Jun-01/2019
3m EMI Test chamber	TDK	SAC-3	FA003012	1 year	Aug-22/2019
Flush mount table	SUNAR	FM2022	FA003006	–	NCR
Controller	SUNAR	SC110V	FA002976	–	NCR
Antenna mast	SUNAR	TLT2	FA003007	–	NCR
Bilog Antenna(20-2000 MHz)	SUNAR	JB1	FA003009	1year	Sep-06/2019

Notes: NCR - no calibration required

Table 8.1-4: *Radiated emissions test software details*

Manufacturer of Software	Details
Rohde & Schwarz	EMC 32, software for EMC Measurements, Version 10.40.10

8.1.5 Test data

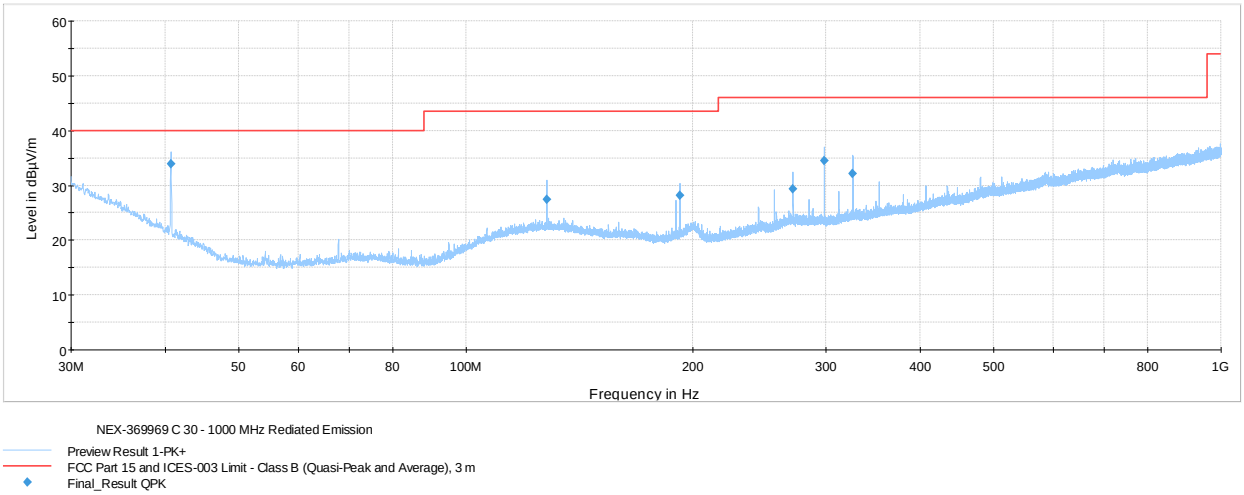

Figure 8.1-1: *Radiated emissions spectral plot (30 to 1000 MHz)*

Table 8.1-5: *Radiated emissions (Quasi-Peak) results*

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)
40.68	33.9	40.0	6.1	100	120	108.0	V	289	13.8
128.01	27.4	43.5	16.1	100	120	108.0	V	86	14.3
192.00	28.1	43.5	15.4	100	120	100.0	V	154	12.0
271.20	29.3	46.0	16.7	100	120	100.0	V	345	13.8
298.32	34.4	46.0	11.6	100	120	108.0	V	324	14.0
325.44	32.2	46.0	13.8	100	120	108.0	V	329	14.7

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 has been recorded.

Sample calculation: 33.9 dBµV/m (field strength) = 20.1 dBµV (receiver reading) + 13.8dB (Correction factor)

End of the test report