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Test report

291142-1R1TRFWL

Date of issue: October 5, 2015

Applicant:

8010072 CANADA Inc. (Sécurité & Protection International)

Product:

RFID Tag

Model:

RFT-1

FCC ID: 2AD3N-RFT1

IC Registration number: 12699A-RFT1

Specifications:

- FCC 47 CFR Part 15 Subpart C, §15.249
  Operation in the 902–928 MHz, 2400–2483.5 MHz, 5725–5850 MHz and 24.0–24.25 GHz
- RSS-210, Issue 8, December 2010, Annex 2.9
  Devices operating in 902–928, 2400–2483.5 and 5725–5875 MHz frequency bands for any application

Test location

Company name	Nemko Canada Inc.
Address	303 River Road
City	Ottawa
Province	Ontario
Postal code	K1V 1H2
Country	Canada
Telephone	+1 613 737 9680
Facsimile	+1 613 737 9691
Toll free	+1 800 563 6336
Website	www.nemko.com
Site number	FCC: 176392; IC: 2040A-4 (3 m semi anechoic chamber)

Tested by	David Duchesne, Senior EMC/Wireless Specialist
Reviewed by	Andrey Adelberg, Senior Wireless/EMC Specialist
Review date	October 5, 2015
Reviewer signature	

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.

Copyright notification

Table of contents

Section 1. Report summary

1.1 Applicant and manufacturer

Company name	8010072 CANADA Inc. (Sécurité & Protection International)
Address	140-440 boul. Armand-Frappier
City	Laval
Province/State	QC
Postal/Zip code	H7V 4B4
Country	Canada

1.2 Test specifications

FCC 47 CFR Part 15, Subpart C, Clause 15.249	Operation in the 902–928 MHz, 2400–2483.5 MHz, 5725–5850 MHz and 24.0–24.25 GHz
RSS-210, Issue 8 Annex 2.9	Devices operating in 902–928, 2400–2483.5 and 5725–5875 MHz frequency bands for any application

1.3 Test methods

ANSI C63.10 v2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

1.4 Statement of compliance

In the configuration tested, the EUT was found compliant.

Testing was completed 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.

1.5 Exclusions

None

1.6 Test report revision history

Revision #	Details of changes made to test report
TRF	Original report issued
R1	Correction to average calculations.

Notes: None

Section 2. Summary of test results

2.1 FCC Part 15 Subpart C, general requirements test results

Part	Test description	Verdict
§15.207(a)	Conducted limits	Not applicable
§15.31(e)	Variation of power source	Pass[1]
§15.203	Antenna requirement	Pass[2]
§15.215(c)	20 dB bandwidth	Pass

Notes: [1] Testing was carried out with fully charged or fresh battery
[2] The antenna is located within the enclosure of EUT and not user accessible.

2.2 FCC Part 15 Subpart C, intentional radiators test results

Part	Test description	Verdict
§15.249(a)	Radiated emissions not in restricted bands	Pass
§15.249(b)	Fixed Point-to-Point operation in the 24.0–24.25 GHz band	Not applicable
§15.249(d)	Spurious emissions (except harmonics)	Pass

Notes: None

2.3 IC RSS-GEN, Issue 4, test results

Part	Test description	Verdict
6.6	Occupied bandwidth	Pass
7.1.2	Receiver radiated emission limits	Not applicable
7.1.3	Receiver conducted emission limits	Not applicable
8.8	Power Line Conducted Emissions Limits for Licence-Exempt Radio Apparatus	Not applicable

Notes: [1] According to sections 5.2 and 5.3 of RSS-Gen, Issue 4 the EUT does not have a stand-alone receiver neither scanner receiver, therefore exempt from receiver requirements.

2.4 IC RSS-210, Issue 8, test results

Part	Test description	Verdict
§A2.9(a)	Radiated emissions not in restricted bands	Pass
§A2.9(b)	Spurious emissions (except harmonics)	Pass

Notes: None

Section 3. Equipment under test (EUT) details

3.1 Sample information

Receipt date	July 20, 2015
Nemko sample ID number	133001326

3.2 EUT information

Product name	RFID Tag
Model	RFT-1
Serial number	None

3.3 Technical information

Frequency band	2400–2483.5 MHz
Operating frequency	2410 MHz (Channel 10) and 2457 MHz (Channel 57)
Field strength of fundamental, Units @ 3 m	99.10 dBµV/m (peak) and 79.10 dBµV/m (average)
Channel bandwidth (99%)	1.97 MHz
Type of modulation	GFSK
Emission classification (F1D, G1D, D1D)	F1D
Transmitter spurious, Units @ 3 m	63.10 dBµV/m (peak) at 4820.0 MHz @ 3 m
Power requirements	3 V_{DC} Battery (CR2450/G1AN)
Antenna information	The EUT uses a unique antenna coupling/ non-detachable antenna to the intentional radiator.

3.4 Product description and theory of operation

Each tag has a unique 32bit ID, written in flash memory during manufacture. The tag typically sends its ID every 2 seconds, as a beacon to indicate its presence to the nearby antennas (aka readers). The beacon rate is programmable by the end-user between 0.1 and 10 seconds. The operational range is about 10 to 20 meters. Along with the ID, an application-specific byte is included in the RF message. Including preamble, msg type, tag ID, custom byte and checksum, each message is 8 byes long, which gives a total air transmission time of 62.5us (@1,024,000 MBPS). The tag's RF emitting power can be at 0, -6, -12 or -18dBm. For air transportation safety or to preserve the battery life during long shelving periods, the tag can be put in hibernation mode, where all circuitry will be shut down (including RF section). Once in this state, only the programmer can wake it up using a special patented technique. The tag uses a 3V, 620mAh lithium coin battery, and lasts about 10 years. The operating temperature range is between -40C and +85C. The tag is bidirectional, and may use both RF channels 0 and 10 (see next section below for details).

3.5 EUT exercise details

The EUT was setup in a continuous transmit state

3.6 EUT setup diagram

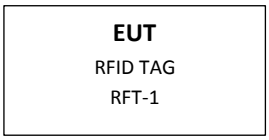


Figure 3.6-1: *Setup diagram*

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

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	860–1060 mbar

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

Measurement uncertainty budgets for the tests are detailed below. Measurement uncertainty calculations assume a coverage factor of K = 2 with 95% certainty.

Test name	Measurement uncertainty, dB
All antenna port measurements	0.55
Radiated spurious emissions	3.78

Section 7. Test equipment

7.1 Test equipment list

Table 7.1-1: *Equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
3 m EMI test chamber	TDK	SAC-3	FA002047	1 year	Feb. 25/16
Receiver/spectrum analyzer	Rohde & Schwarz	ESU 26	FA002043	1 year	Jan. 07/16
Bilog antenna (20–3000 MHz)	Sunol	JB3	FA002108	1 year	Apr. 12/16
Horn antenna (1–18 GHz)	EMCO	3115	FA000825	1 year	Apr. 01/16
Horn antenna (18–26.5 GHz)	Electro-metrics	SH-50/60-1	FA000479	—	VOU
Pre-amplifier (1–18 GHz)	JCA	JCA118-503	FA002091	1 year	May 05/16
Pre-amplifier (18–26 GHz)	Narda	BBS-1826N612	FA001550	—	VOU
50 Ω coax cable	C.C.A.	None	FA002555	1 year	May 05/16
50 Ω coax cable	Huber + Suhner	None	FA002074	1 year	May 05/16

Notes: VOU - verify on use

Section 8. Testing data

8.1 FCC 15.215(c) and RSS-Gen 6.6 Occupied (Emission) bandwidth

8.1.1 Definitions and limits

FCC
Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80 % of the permitted band in order to minimize the possibility of out-of-band operation.

IC
When the occupied bandwidth limit is not stated in the applicable RSS or reference measurement method, the transmitted signal bandwidth shall be reported as the 99% emission bandwidth, as calculated or measured.

8.1.2 Test summary

Verdict	Pass		
Test date	July 21, 2015	Temperature	21 °C
Test engineer	David Duchesne	Air pressure	994 mbar
Test location	Ottawa	Relative humidity	50 %

8.1.3 Observations, settings and special notes

Spectrum analyser settings:

Resolution bandwidth	30 kHz
Video bandwidth	≥3 × RBW
Frequency span	3 MHz
Detector mode	Peak
Trace mode	Max Hold

8.1.4 Test data

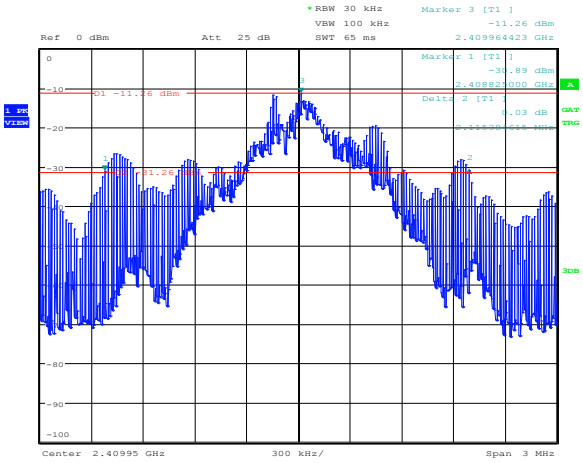


Figure 8.1-1: *20 dB bandwidth (Channel 10)*

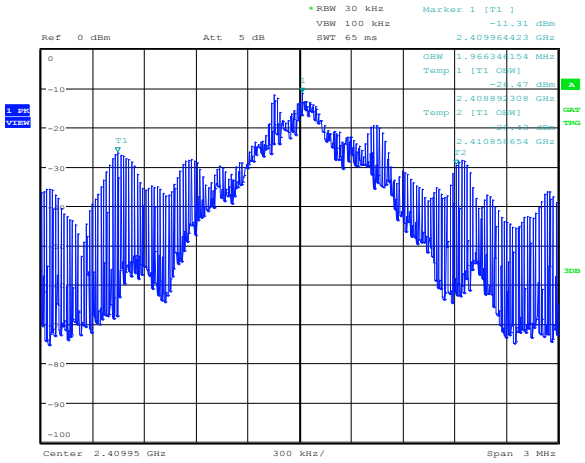


Figure 8.1-2: *99% occupied bandwidth (Channel 10)*

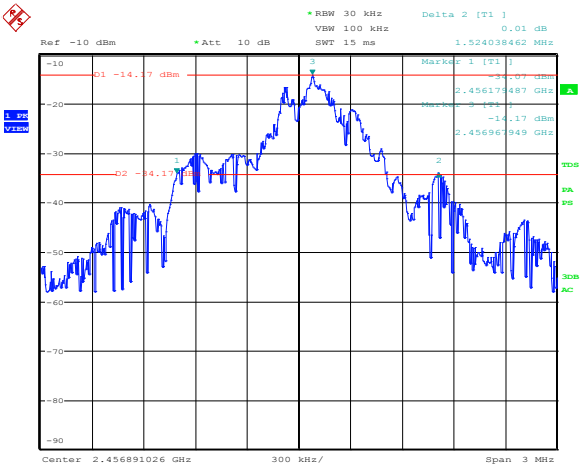


Figure 8.1-3: *20 dB bandwidth (Channel 57)*

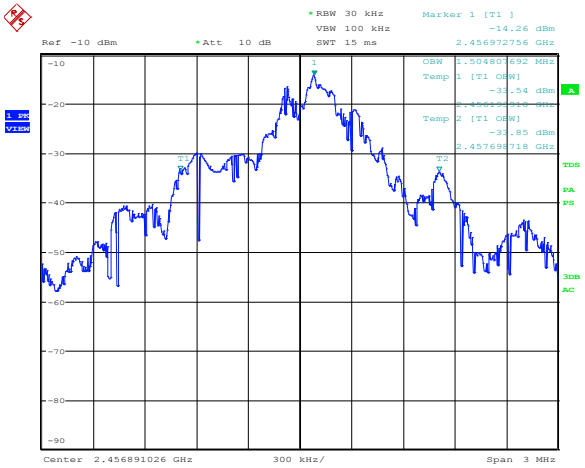


Figure 8.1-4: *99% occupied bandwidth (Channel 57)*

Table 8.1-1: *Bandwidth measurement results*

Frequency, MHz	20 dB bandwidth, MHz	99% occupied bandwidth, MHz
2410 (Channel 10)	2.12	1.97
2457 (Channel 57)	1.52	1.50

Notes: None

8.2 FCC 15.249(a) RSS 210 A2.9(a) Field strength of emissions not in restricted bands

8.2.1 Definitions and limits

In addition to the provisions of §15.205 and RSS-Gen the field strength of emissions from intentional radiators operated under this section shall not exceed the following table.

Table 8.2-1: *Field strength limits*

Fundamental frequency (MHz)	Field strength of fundamental (mV/m)	Field strength of fundamental (dBµV/m)	Field strength of spurious emissions (µV/m)	Field strength of spurious emissions (dBµV/m)
902–928	50	94	500	54
2400–2483.5	50	94	500	54
5725–5875	50	94	500	54
24.0–24.25	250	108	2500	68

Notes: None

(e) As shown in §15.35(b), for frequencies above 1000 MHz, the field strength limits in paragraphs (a) and (b) of this section are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For point-to-point operation under paragraph (b) of this section, the peak field strength shall not exceed 2500 millivolts/meter (128 dBµV/m) at 3 meters along the antenna azimuth.

8.2.2 Test summary

Verdict	Pass		
Test date	July 21, 2015	Temperature	21 °C
Test engineer	David Duchesne	Air pressure	994 mbar
Test location	Ottawa	Relative humidity	50 %

8.2.3 Observations, settings and special notes

- The spectrum was searched from 30 MHz to the 10th harmonic.
- Radiated measurements were performed at a distance of 3 m.
- Spectrum analyzer settings for peak radiated measurements:

Spectrum analyser settings:

Resolution bandwidth:	1 MHz
Video bandwidth:	3 MHz
Detector mode:	Peak
Trace mode:	Max Hold

8.2.4 Test data

Duty cycle correction factor (DCCF) was calculated as follows:
DCCF (dB) = 20 × Log_{10} ($Tx_{100\,ms}$ / 100 ms)

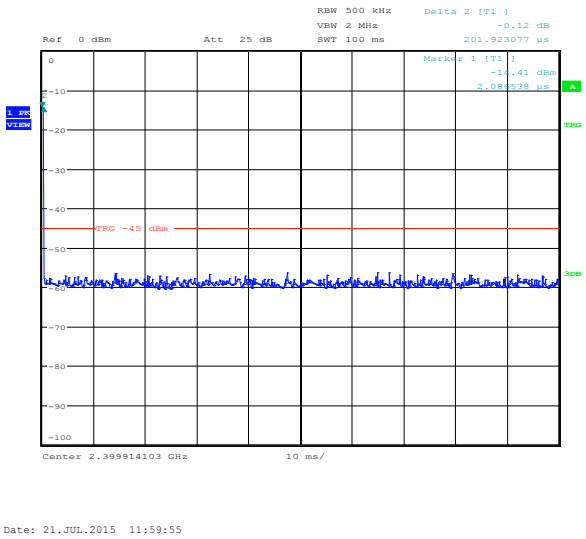


Figure 8.2-1: *100 ms transmission time frame*

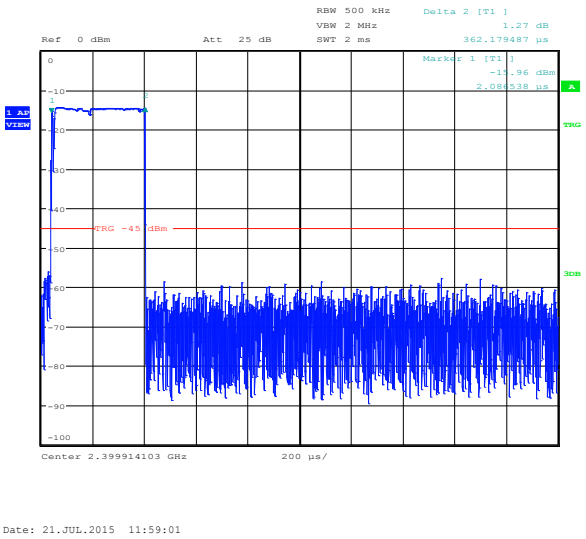


Figure 8.2-2: *Pulse with*

DCCF (dB) = 20 × Log_{10} ($Tx_{100\,ms}$ / 100 ms) = 20 × Log_{10} (0.362 / 100) = −48.8 dB. **(Maximum DCCF is limited to -20 dB)**

Table 8.2-2: *Radiated field strength of fundamental measurement results*

Frequency, MHz	Peak Field strength, dBµV/m		Margin, dB	Average Field strength, dBµV/m		Margin, dB
	Measured	Limit		Calculated	Limit	
Channel 10						
2410.00	95.20	114.00	18.80	75.20	94.00	18.80
Channel 57						
2457.0000	99.10	114.00	14.90	79.10	94.00	14.90

Notes: Field strength includes correction factor of antenna, cable loss, amplifier, and attenuators where applicable.
Calculated Average results were calculated as follows: Peak Field strength + DCCF

Table 8.2-3: *Radiated field strength of harmonics measurement results*

Frequency, MHz	Peak Field strength, dBµV/m		Margin, dB	Average Field strength, dBµV/m		Margin, dB
	Measured	Limit		Calculated	Limit	
Channel 10						
4820.00	63.10	74.00	10.90	43.10	54.00	10.90
Channel 57						
4914.00	62.70	74.00	11.30	42.70	54.00	11.3

Notes: Field strength includes correction factor of antenna, cable loss, amplifier, and attenuators where applicable.
Calculated Average results were calculated as follows: Peak Field strength + DCCF

8.2.5 Setup photos

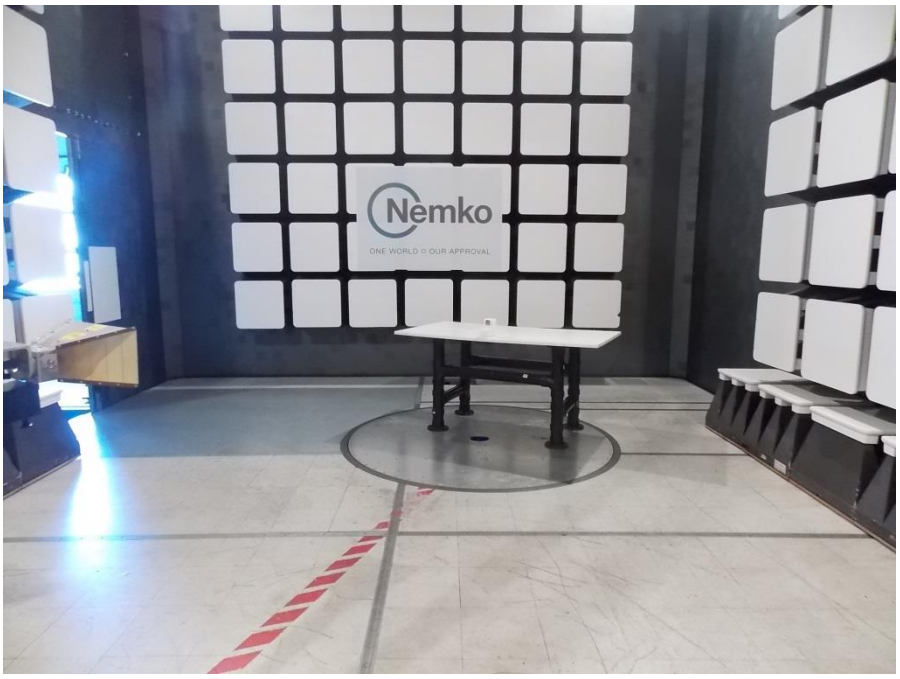


Figure 8.2-3: *Radiated field strength setup photo*

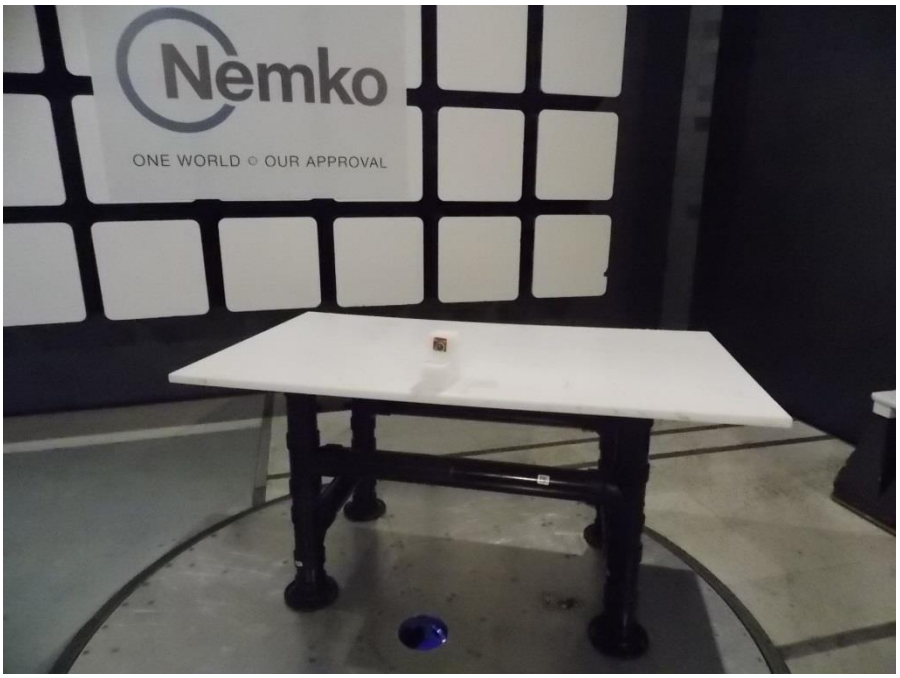


Figure 8.2-4: *Radiated field strength setup photo*

8.3 FCC 15.249(d) RSS 210 A2.9(b) Spurious emissions (except for harmonics)

8.3.1 Definitions and limits

FCC:
Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

IC:
Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general field strength limits listed in RSS-Gen, whichever is less stringent.

Table 8.3-1: *FCC §15.209 and RSS-Gen – Radiated emission limits*

Frequency, MHz	Field strength of emissions		Measurement distance, m
	µV/m	dBµV/m	
0.009–0.490	2400/F	$67.6 - 20 \times \log_{10}(F)$	300
0.490–1.705	24000/F	$87.6 - 20 \times \log_{10}(F)$	30
1.705–30.0	30	29.5	30
30–88	100	40.0	3
88–216	150	43.5	3
216–960	200	46.0	3
above 960	500	54.0	3

Notes: In the emission table above, the tighter limit applies at the band edges.
For frequencies above 1 GHz the limit on peak RF emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test

Table 8.3-2: *IC restricted frequency bands*

MHz	MHz	MHz	GHz
0.090–0.110	12.51975–12.52025	399.9–410	5.35–5.46
2.1735–2.1905	12.57675–12.57725	608–614	7.25–7.75
3.020–3.026	13.36–13.41	960–1427	8.025–8.5
4.125–4.128	16.42–16.423	1435–1626.5	9.0–9.2
4.17725–4.17775	16.69475–16.69525	1645.5–1646.5	9.3–9.5
4.20725–4.20775	16.80425–16.80475	1660–1710	10.6–12.7
5.677-5.683	25.5–25.67	1718.8–1722.2	13.25–13.4
6.215–6.218	37.5–38.25	2200–2300	14.47–14.5
6.26775–6.26825	73–74.6	2310–2390	15.35–16.2
6.31175–6.31225	74.8–75.2	2655–2900	17.7–21.4
8.291–8.294	108–138	3260–3267	22.01–23.12
8.362–8.366	156.52475–156.52525	3332–3339	23.6–24.0
8.37625–8.38675	156.7–156.9	3345.8–3358	31.2–31.8
8.41425–8.41475	240–285	3500–4400	36.43–36.5
12.29–12.293	322–335.4	4500–5150	Above 38.6

Notes: Certain frequency bands listed in table above and above 38.6 GHz are designated for low-power licence-exempt applications. These frequency bands and the requirements that apply to the devices are set out in this Standard

Table 8.3-3: *FCC restricted frequency bands*

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2690–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	Above 38.6
13.36–13.41			

Notes: None

8.3.2 Test summary

Verdict	Pass		
Test date	July 23, 2015	Temperature	22.3 °C
Test engineer	David Duchesne	Air pressure	999 mbar
Test location	Ottawa	Relative humidity	57.7 %

8.3.3 Observations, settings and special notes

- The spectrum was searched from 30 MHz to the 10th harmonic.
- Radiated measurements were performed at a distance of 3 m.
- The EUT was tested at both Channel 10 and Channel 57.
- The spectral plots are summation of a vertical and horizontal scan. The spectral scans have been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators.

Spectrum analyser settings for radiated measurements within restricted bands below 1 GHz:

Resolution bandwidth:	100 kHz
Video bandwidth:	300 kHz
Detector mode:	Peak
Trace mode:	Max Hold

Spectrum analyser settings for peak radiated measurements within restricted bands above 1 GHz:

Resolution bandwidth:	1 MHz
Video bandwidth:	3 MHz
Detector mode:	Peak
Trace mode:	Max Hold

8.3.4 Test data

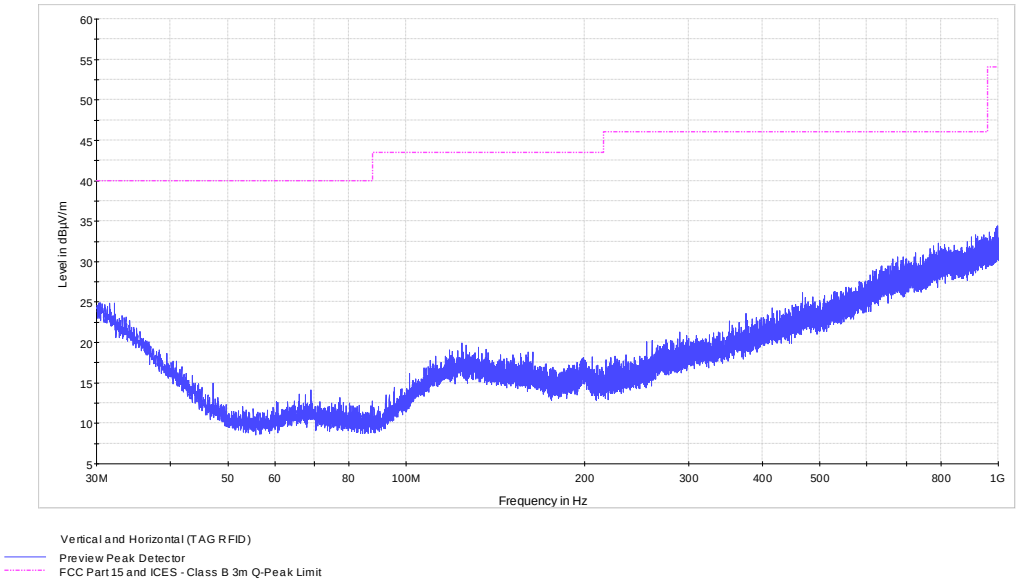


Figure 8.3-1: *Spurious emissions below 1 GHz (Channel 10)*

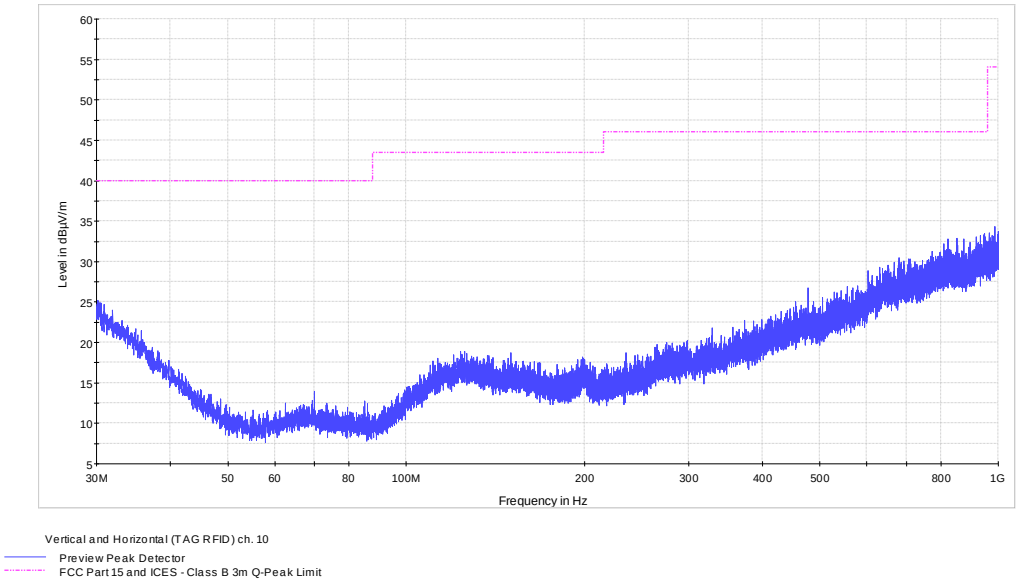
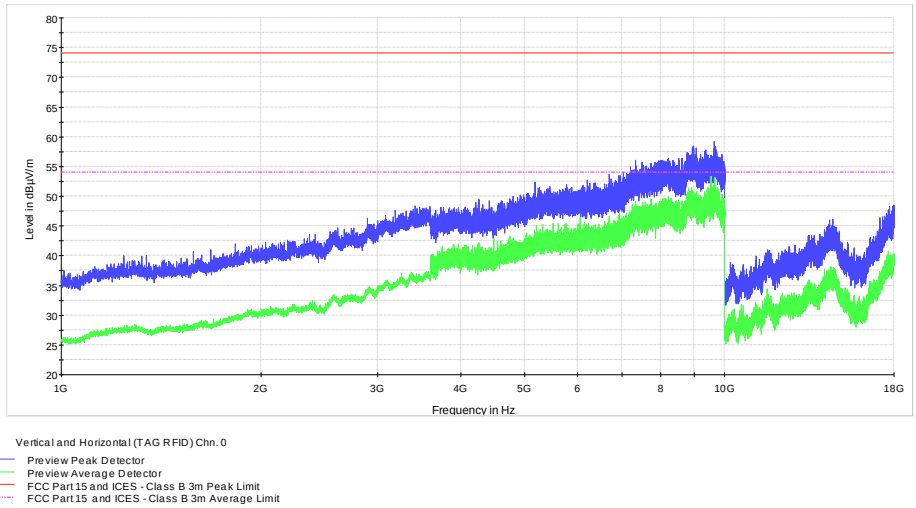


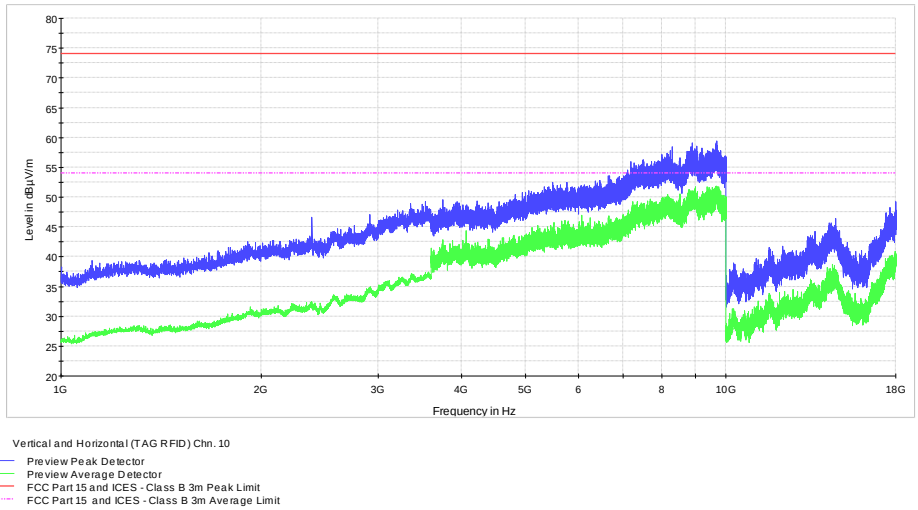
Figure 8.3-2: *Spurious emissions below 1 GHz (Channel 57)*

8.3.4 Test data, continued



Special note: A 2.4 to 2.483 GHZ notch filter was utilized to reduce the Fundamental.

Figure 8.3-3: *Spurious emissions within 1–18 GHz (Channel 10)*



Special note: A 2.4 to 2.483 GHZ notch filter was utilized to reduce the Fundamental.

Figure 8.3-4: *Spurious emissions within 1–18 GHz (Channel 57)*

8.3.4 Test data, continued

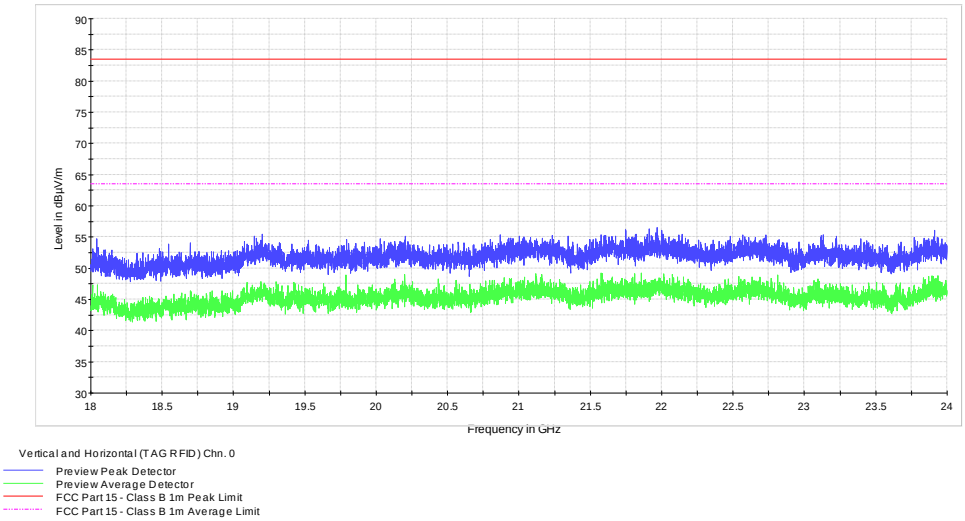


Figure 8.3-5: *Spurious emissions above 18 GHz (Channel 10)*

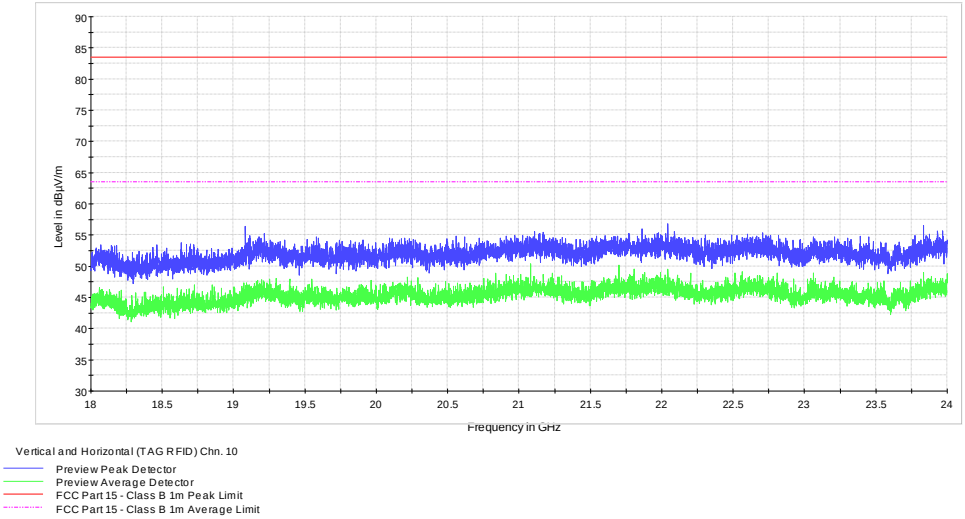


Figure 8.3-6: *Spurious emissions above 18 GHz (Channel 57)*

8.3.4 Test data, continued

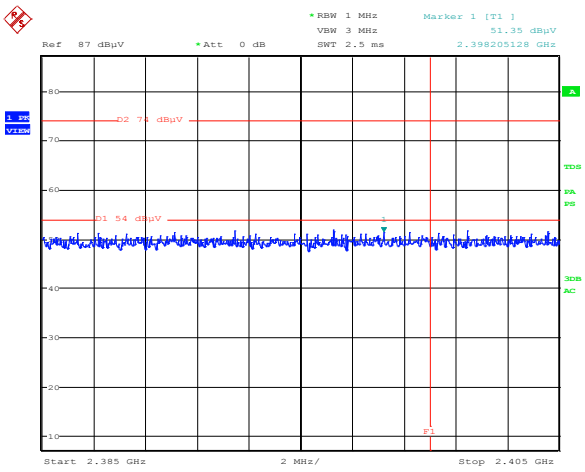


Figure 8.3-7: *Lower band edge emission at 2400 MHz (Tx set to Channel 10) F1= 2400 MHz*

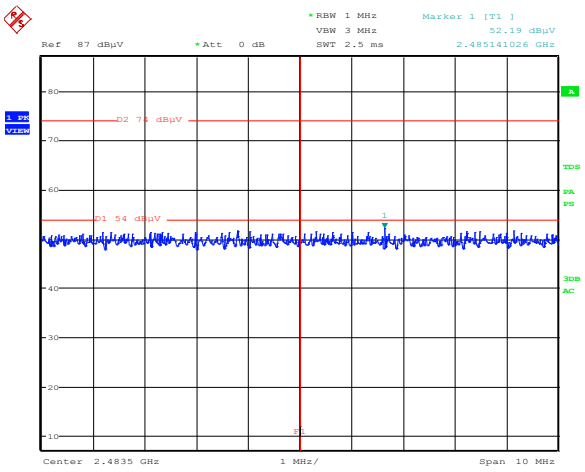


Figure 8.3-8: *Upper band edge emission at 2483.5 MHz (Tx set to Channel 57) F1 = 2483.5 MHz*

8.3.5 Setup photos

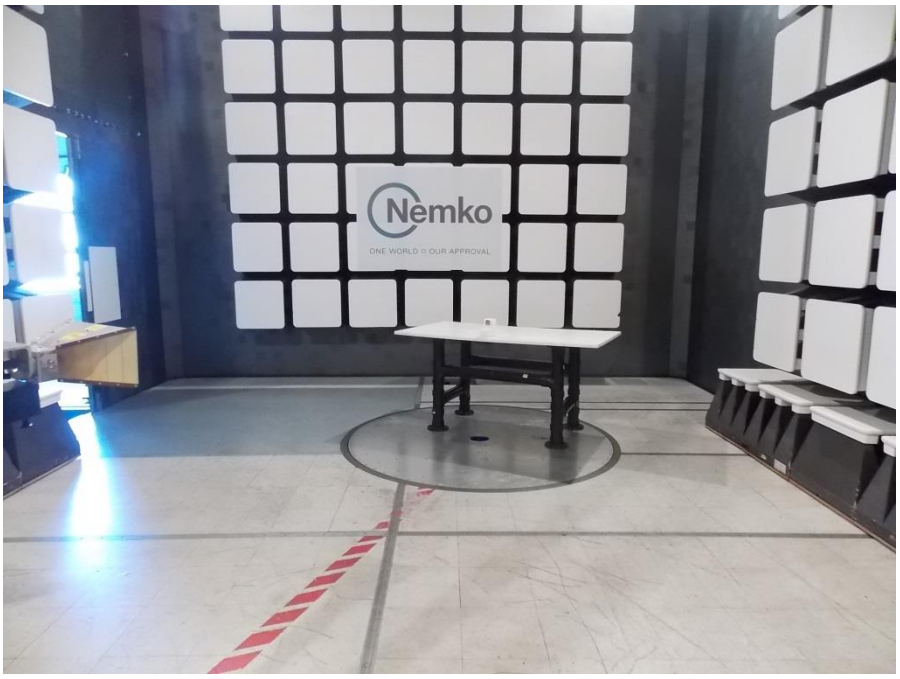


Figure 8.3-9: *Spurious emissions setup photo*

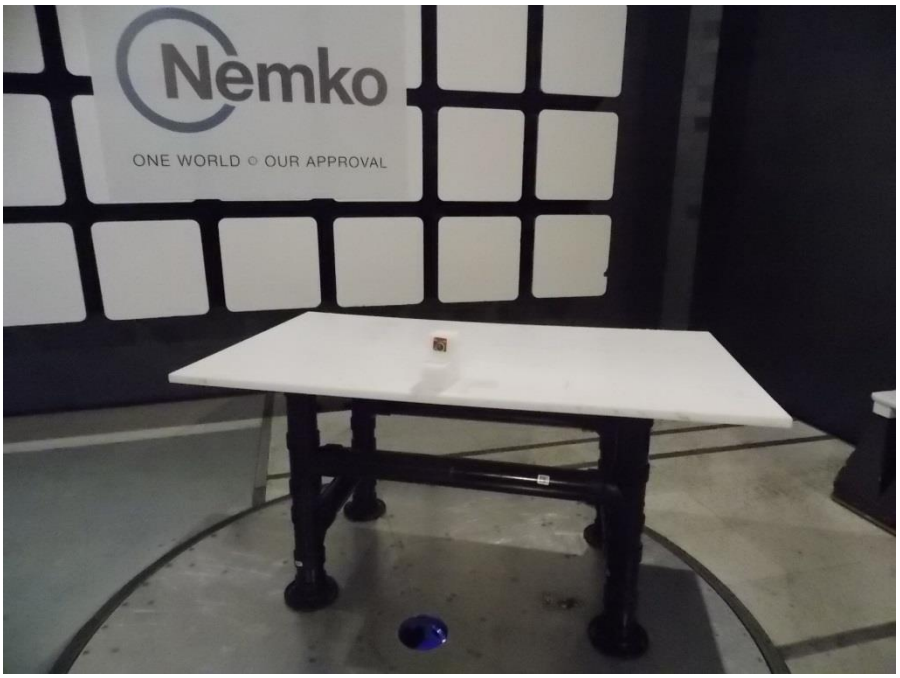


Figure 8.3-10: *Spurious emissions setup photo*

Section 9. Block diagrams of test set-ups

9.1 Radiated emissions set-up