

Test report

336298-1TRFWL

Date of issue: October 12, 2017

Applicant:

Blue Line Innovations Inc.

Product:

Wireless Meter Sensor (433 MHz)

Model:

BLI-18100

FCC ID:

SUE-BLI-18100-06

IC Registration number:

5614A-BLI18100

Specifications:

- ◆ **FCC 47 CFR Part 15 Subpart C, §15.240**
Operation in the band 433.5–434.5 MHz
- ◆ **RSS-210, Issue 9, August 2016, Annex D**
Radio Frequency Identification (RFID) Devices in the Band 433.5–434.5 MHz

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: CA2040; IC: 2040A-4 (3 m semi anechoic chamber)

Tested by	Kevin Rose, Wireless/EMC Specialist
Reviewed by	Andrey Adelberg, Senior Wireless/EMC Specialist
Date	October 12, 2017
Signature of reviewer	

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

Nemko Canada Inc. authorizes the applicant to reproduce this report provided it is reproduced in its entirety and for use by the company's employees only. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties.

Nemko Canada Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

© Nemko Canada Inc.

Table of contents

Table of contents	3
Section 1. Report summary	4
1.1 Applicant	4
1.2 Manufacturer	4
1.3 Test specifications	4
1.4 Test methods	4
1.5 Statement of compliance	4
1.6 Exclusions	4
1.7 Test report revision history	4
Section 2. Summary of test results	5
2.1 FCC Part 15 Subpart C test results	5
2.2 IC RSS-GEN, Issue 4 test results	5
2.3 IC RSS-210, Issue 9 test results	5
Section 3. Equipment under test (EUT) details	6
3.1 Sample information	6
3.2 EUT information	6
3.3 Technical information	6
3.4 Product description and theory of operation	6
3.5 EUT exercise details	6
3.6 EUT setup diagram	7
Section 4. Engineering considerations	8
4.1 Modifications incorporated in the EUT	8
4.2 Technical judgment	8
4.3 Deviations from laboratory tests procedures	8
Section 5. Test conditions	9
5.1 Atmospheric conditions	9
5.2 Power supply range	9
Section 6. Measurement uncertainty	10
6.1 Uncertainty of measurement	10
Section 7. Test equipment	11
7.1 Test equipment list	11
Section 8. Testing data	12
8.1 FCC 15.240(b) and RSS-210 D(a) Conditions for intentional radiators to comply with periodic operation	12
8.2 FCC 15.240(b) and RSS-210 D(b) The field strength of any emissions radiated within the specified frequency band	14
8.3 FCC 15.240(c) and RSS-210 D(c) Field strength of emissions	18
Section 9. Block diagrams of test set-ups	21
9.1 Radiated emissions set-up for frequencies below 1 GHz	21
9.2 Radiated emissions set-up for frequencies above 1 GHz	22

Section 1. Report summary

1.1 Applicant

Company name	Blue Line Innovations Inc.
Address	510 Topsail Rd., St. John's, Newfoundland & Labrador, A1E 2C2 Canada

1.2 Manufacturer

Company name	Blue Line Innovations Inc.
Address	510 Topsail Rd., St. John's, Newfoundland & Labrador, A1E 2C2 Canada

1.3 Test specifications

FCC 47 CFR Part 15, Subpart C, Clause 15.240	Operation in the band 433.5–434.5 MHz
RSS-210, Issue 9, August 2016, Annex D	Radio Frequency Identification (RFID) Devices in the Band 433.5–434.5 MHz

1.4 Test methods

ANSI C63.10 v 2013	American National Standard for Procedures for Compliance Testing of Unsilenced Wireless Devices
--------------------	---

1.5 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.

1.6 Exclusions

None

1.7 Test report revision history

Revision #	Details of changes made to test report
TRF	Original report issued

Section 2. Summary of test results

2.1 FCC Part 15 Subpart C test results

Part	Test description	Verdict
§15.207(a)	Conducted limits	Not applicable
§15.31(e) ¹	Variation of power source	Pass ¹
§15.203 ²	Antenna requirement	Pass ²
§15.240(a) ³	Operation under the provisions of this section	Not applicable
§15.240(b)	The field strength of any emissions radiated within the specified frequency band	Pass
§15.240(b)	Periodic operation requirements and silent period.	Pass
§15.240(c)	The field strength of emissions radiated on any frequency outside of the specified band	Pass

Notes: ¹ A fully charged battery was used for testing

² The Antennas are located within the enclosure of EUT and not user accessible.

³ The EUT is only a one way transmitter.

2.2 IC RSS-GEN, Issue 4 test results

Part	Test description	Verdict
7.1.2	Receiver radiated emission limits	Pass
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.

2.3 IC RSS-210, Issue 9 test results

Annex	Test description	Verdict
D(a)	Types of momentary signals	Pass
D(c)	The field strength of any emissions radiated	Pass
D(b)	Field strength of emissions	Pass

Notes: None

Section 3. Equipment under test (EUT) details

3.1 Sample information

Receipt date	July 26, 2017
Nemko sample ID number	1

3.2 EUT information

Product name	Wireless Meter Sensor (433 MHz)
Model	BLI-18100
Serial number	NA

3.3 Technical information

Applicant IC company number	5614A
IC UPN number	BLI18100
All used IC test site(s) Reg. number	2040A-4
RSS number and Issue number	RSS-210 Annex D, Issue 9, August 2016
Frequency band	433.5–434.5
Frequency Min (MHz)	433.865
Frequency Max (MHz)	433.865
RF power Min (W)	NA
RF power Max (W)	NA
Field strength, Units @ distance	93.3 dB μ V/m @ 3 m
Measured BW (kHz) (99 %)	10.70
Calculated BW (kHz), as per TRC-43	N/A
Type of modulation	OOK
Emission classification (F1D, G1D, D1D)	F1D
Transmitter spurious, Units @ distance	3904.786 MHz 38.95 dB μ V/m @ 3 m
Power requirements	1.5 Vdc alkaline battery
Antenna information	The EUT uses a unique antenna coupling/ non-detachable antenna to the intentional radiator.

3.4 Product description and theory of operation

Electricity meter sensor: The BLI-18100 attaches to electricity meters to collect consumption information and transmit it to a cloud-based monitoring application.

3.5 EUT exercise details

The EUT was set to transmit continuously

3.6 EUT setup diagram

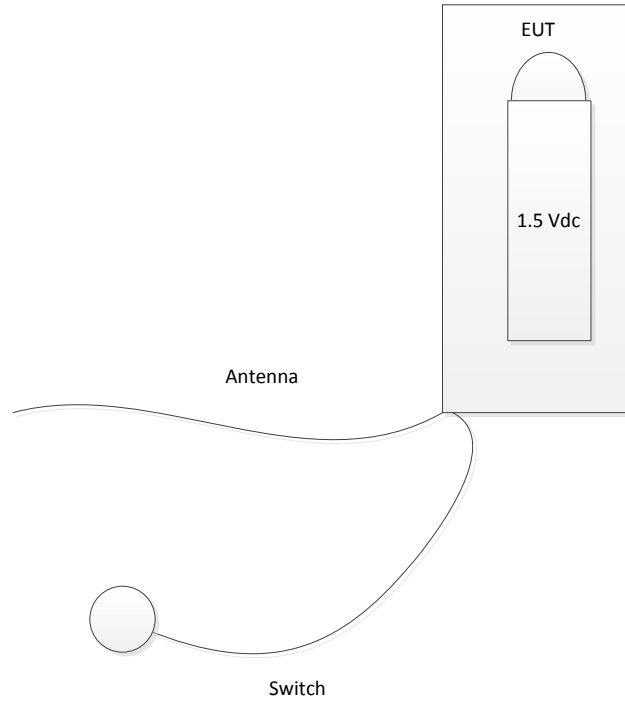


Figure 3.6-1: Setup diagram

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 $\pm 5\%$, for which the equipment was designed.



Section 6. Measurement uncertainty

6.1 Uncertainty of measurement

The following referenced documents are used as guidance for measurement uncertainty reasonable estimations with regards to previous experience and validation of data:

1. TIA-603-B Land Mobile FM or PM Communications Equipment, Measurement and Performance Standards. Nov. 7, 2002
2. UKAS LAB 34: 2003: The Expression of Uncertainty in EMC Testing: United Kingdom Accreditation Service.
3. ETSI TR 100 028-1 v1.4.1 (2001-12): Electromagnetic Compatibility and Radio Spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part1”.
4. ETSI TR 100 028-2 v 1.4.1(2001-12): Electromagnetic Compatibility and Radio Spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part2”.

Nemko Canada, Inc. follows these test methods in order to satisfy ISO/IEC 17025 requirements for estimation of uncertainty of measurement for wireless products.

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
Conducted spurious emissions	1.13
Radiated spurious emissions	3.78
AC power line conducted emissions	3.55

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	Dec. 1/17
Flush mount turntable	Sunol	FM2022	FA002082	—	NCR
Controller	Sunol	SC104V	FA002060	—	NCR
Antenna mast	Sunol	TLT2	FA002061	—	NCR
Receiver/spectrum analyzer	Rohde & Schwarz	ESU 26	FA002043	1 year	Jan. 31/18
Bilog antenna (20–3000 MHz)	Sunol	JB3	FA002108	1 year	June 27/18
Horn with Preamp	ETS-Lindgren	3117-PA	FA002840	1 year	Nov. 11/17
50 Ω coax cable	Huber + Suhner	None	FA002074	1 year	May 12/18
50 Ω coax cable	Huber + Suhner	None	FA002830	1 year	May 12/18

Note: NCR - no calibration required

Section 8. Testing data

8.1 FCC 15.240(b) and RSS-210 D(a) Conditions for intentional radiators to comply with periodic operation

8.1.1 Definitions and limits

FCC:

(b) The field strength of any emissions radiated within the specified frequency band shall not exceed 11,000 microvolts per meter measured at a distance of 3 meters. The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The peak level of any emissions within the specified frequency band shall not exceed 55,000 microvolts per meter measured at a distance of 3 meters. Additionally, devices authorized under these provisions shall be provided with a means for automatically limiting operation so that the duration of each transmission shall not be greater than 60 seconds and be only permitted to reinitiate an interrogation in the case of a transmission error. Absent such a transmission error, the silent period between transmissions shall not be less than 10 seconds.

ISED:

(a) Devices shall be provided with a means for automatically limiting operation so that the duration of each transmission shall not be greater than 60 seconds and be permitted only to reinitiate an interrogation in the case of transmission error. Under normal circumstances (no transmission error), the silent period between transmissions shall not be less than 10 seconds

8.1.2 Test summary

Test date	July 26, 2017	Temperature	23 °C
Test engineer	Kevin Rose	Air pressure	1004 mbar
Verdict	Pass	Relative humidity	45 %

8.1.3 Observations, settings and special notes

None

Section 8

Test name

Specification

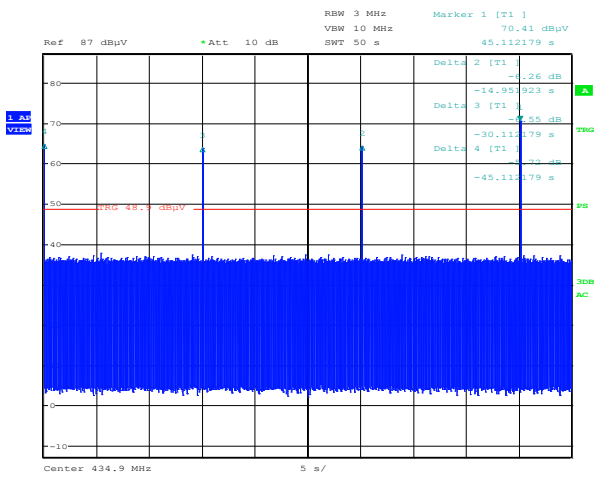
Testing data

FCC 15.240(b) and RSS-210 D(a) Conditions for intentional radiators to comply with periodic operation

FCC Part 15 Subpart C and RSS-210, Issue 9

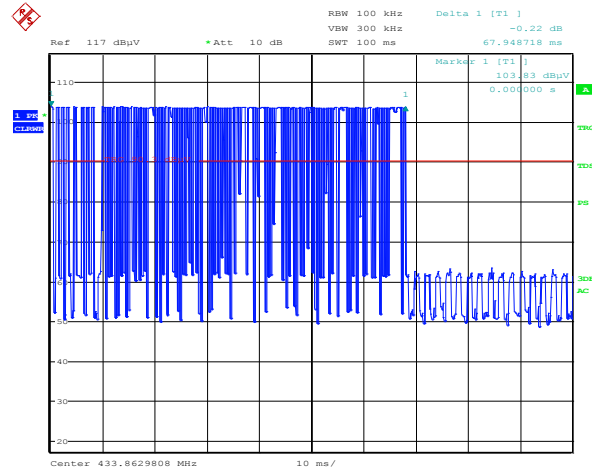


8.1.4 Test data



Date: 27.JUL.2017 02:00:07

Figure 8.1-1: Transmission on time interval 14.95 sec



Date: 26.JUL.2017 23:24:54

Figure 8.1-2: Transmission on time 67.95 ms

Table 8.1-1: Transmission length results

Transmission length, sec	Limit, sec	Margin, sec
0.06745	60	59.93255

Table 8.1-2: Transmission interval results

Transmission interval, sec	Minimum limit, sec	Margin, sec
14.95	10	4.95

Section 8 Testing data
 Test name FCC 15.240(b) and RSS-210 D(b) The field strength of any emissions radiated within the specified frequency band
 Specification FCC Part 15 Subpart C and RSS-210, Issue 9



8.2 FCC 15.240(b) and RSS-210 D(b) The field strength of any emissions radiated within the specified frequency band

8.2.1 Definitions and limits

FCC:

(b) The field strength of any emissions radiated within the specified frequency band shall not exceed 11,000 microvolts per meter measured at a distance of 3 meters. The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The peak level of any emissions within the specified frequency band shall not exceed 55,000 microvolts per meter measured at a distance of 3 meters. Additionally, devices authorized under these provisions shall be provided with a means for automatically limiting operation so that the duration of each transmission shall not be greater than 60 seconds and be only permitted to reinitiate an interrogation in the case of a transmission error. Absent such a transmission error, the silent period between transmissions shall not be less than 10 seconds.

ISED:

(b) The field strength of any emissions radiated within the band 433.5-434.5 MHz shall not exceed 11,000 $\mu\text{V}/\text{m}$ measured at 3 m with an average detector. The peak level of any emission within this specified frequency band shall not exceed 55,000 $\mu\text{V}/\text{m}$ measured at 3 m

(c) The field strength of emissions on any frequencies outside this specified band shall not exceed the general field strength limits specified in RSS-Gen.

Table 8.2-1: Peak field strength in-band limit

Fundamental frequency (MHz)	Field strength of Peak fundamental	
	($\mu\text{V}/\text{m}$)	(dB $\mu\text{V}/\text{m}$)
433.5-434.5	55000	94.8

Table 8.2-2: Average field strength in-band limit

Fundamental frequency (MHz)	Field strength of Average fundamental	
	($\mu\text{V}/\text{m}$)	(dB $\mu\text{V}/\text{m}$)
433.5-434.5	11000	80.8

Section 8 Testing data
Test name FCC 15.240(b) and RSS-210 D(b) The field strength of any emissions radiated within the specified frequency band
Specification FCC Part 15 Subpart C and RSS-210, Issue 9



8.2.2 Test summary

Test date	July 26, 2017	Temperature	23 °C
Test engineer	Kevin Rose	Air pressure	1005 mbar
Verdict	Ottawa	Relative humidity	37 %

8.2.3 Observations, settings and special notes

Radiated measurements were performed at a distance of 3 m.
Average radiated emissions were obtained by subtracting duty cycle / correction factor from the peak measurement results.

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

Section 8

Testing data

Test name

FCC 15.240(b) and RSS-210 D(b) The field strength of any emissions radiated within the specified frequency band

Specification

FCC Part 15 Subpart C and RSS-210, Issue 9

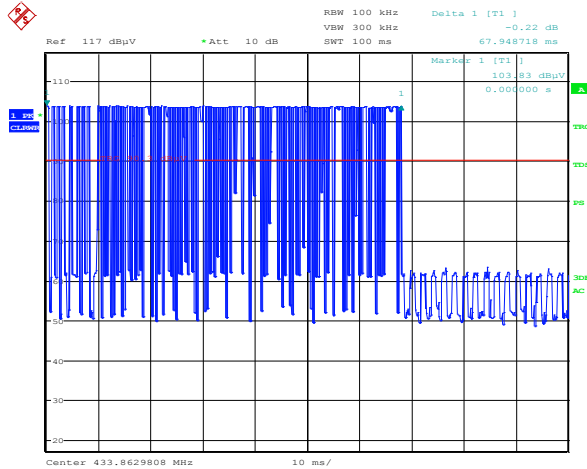


8.2.4 Test data

Duty cycle/average factor calculations

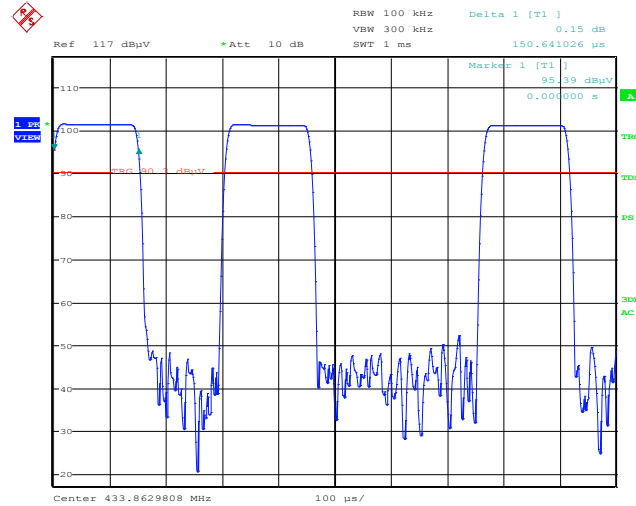
§15.35(c) When the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed; the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds.

$$\text{Duty cycle or average factor} = 20 \times \log_{10} \left(\frac{T_{x_{100ms}}}{100ms} \right)$$



Date: 26.JUL.2017 23:24:54

Figure 8.2-1: Transmission within 100 ms



Date: 26.JUL.2017 23:26:41

Figure 8.2-2: Maximum On time of transmission 150.6 μs max number of pulses 153

Max on time in 100 ms is 23.04 ms = -12.75 dB

Section 8

Testing data

Test name

FCC 15.240(b) and RSS-210 D(b) The field strength of any emissions radiated within the specified frequency band

Specification

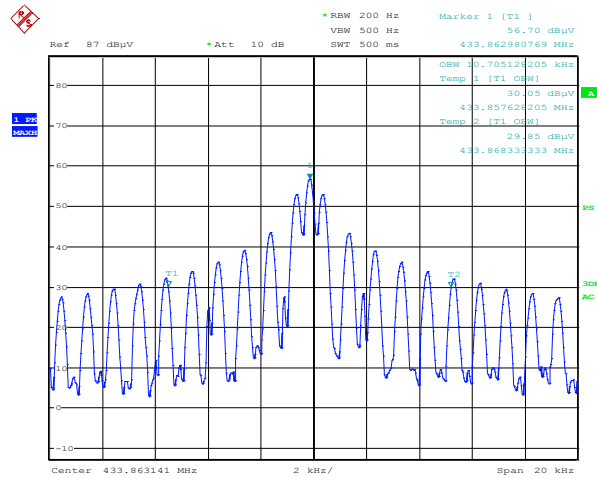
FCC Part 15 Subpart C and RSS-210, Issue 9



Table 8.2-3: Radiated field strength measurement results

Frequency, MHz	Peak field strength, dBμV/m	Peak limit, dBμV/m	Margin, dB	Duty cycle factor, dB	Average field strength, dBμV/m	Average limit, dBμV/m	Margin, dB
433.865	93.3	94.8	1.5	12.75	80.55	80.8	0.25

Notes: Field strength includes correction factor of antenna, cable loss, amplifier, and attenuators where applicable.



Date: 26.JUL.2017 23:10:52

Figure 8.2-3: 99% emission bandwidth

8.3 FCC 15.240(c) and RSS-210 D(c) Field strength of emissions

8.3.1 Definitions and limits

FCC:

The field strength of emissions radiated on any frequency outside of the specified band shall not exceed the general radiated emission limits in §15.209.

ISED:

The field strength of emissions on any frequencies outside this specified band shall not exceed the general field strength limits specified in RSS-Gen

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: ISED 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

Note: Certain frequency bands listed in **Error! Reference source not found.** 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			

8.3.2 Test summary

Test date	July 26, 2017	Temperature	23 °C
Test engineer	Kevin Rose	Air pressure	1005 mbar
Verdict	Ottawa	Relative humidity	37 %

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.
 Average radiated emissions were obtained by subtracting duty cycle / correction factor from the peak measurement results.

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

Table 8.3-4: Radiated field strength measurement results below 1 GHz

Frequency, MHz	Q Peak field strength, dBµV/m	Q Peak limit, dBµV/m	Margin, dB
867.720	44.9	46	1.1

Notes: Field strength includes correction factor of antenna, cable loss, amplifier, and attenuators where applicable.

Table 8.3-5: Radiated field strength measurement results above 1 GHz

Frequency, MHz	Peak field strength, dBµV/m	Peak limit, dBµV/m	Margin, dB	Duty cycle factor, dB	Average field strength, dBµV/m	Average limit, dBµV/m	Margin, dB
2458.511	44.4	74	29.6	12.75	31.65	54	22.35
3470.886	45.5	74	28.5	12.75	32.75	54	21.25
3904.786	51.7	74	22.3	12.75	38.95	54	15.05
4338.604	45.5	74	28.5	12.75	32.75	54	21.25
4772.604	46.4	74	27.6	12.75	33.65	54	20.35

Notes: Field strength includes correction factor of antenna, cable loss, amplifier, and attenuators where applicable.

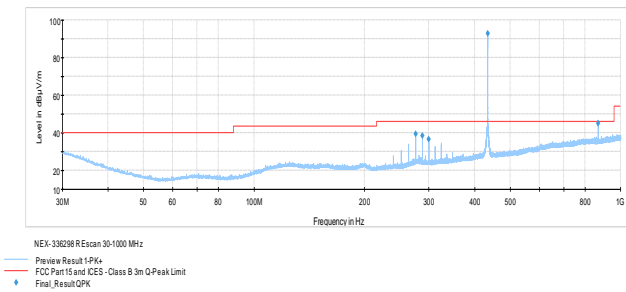


Figure 8.3-1: Spurious emissions below 1 GHz

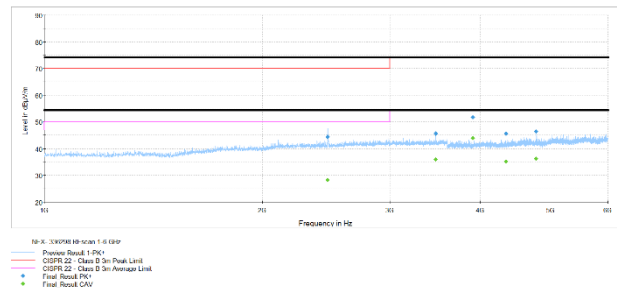
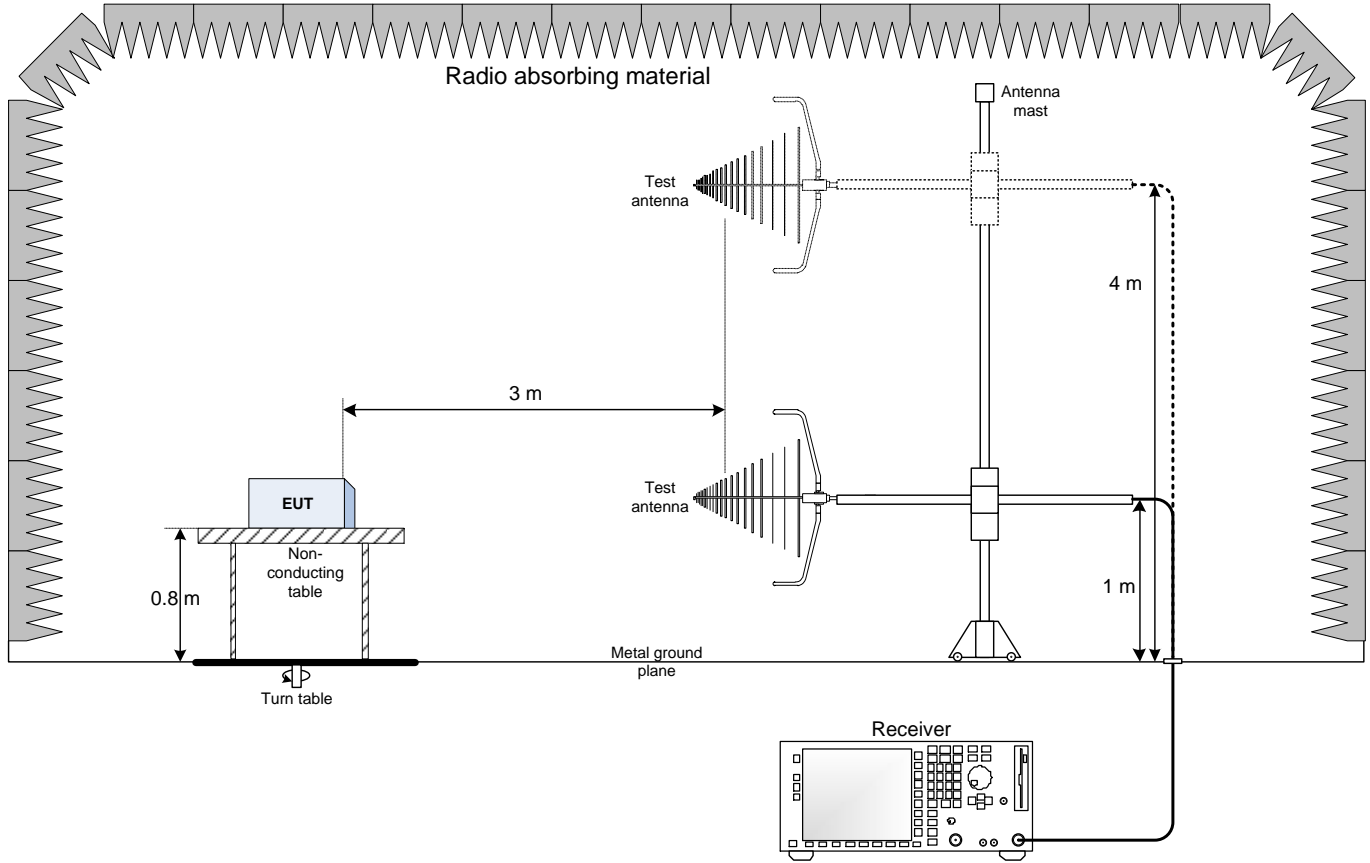


Figure 8.3-2: Spurious emissions above 1 GHz

Section 9. Block diagrams of test set-ups

9.1 Radiated emissions set-up for frequencies below 1 GHz



9.2 Radiated emissions set-up for frequencies above 1 GHz

