

Test report

336298-1TRFWL

Date of issue: February 1, 2018

Applicant:

Blue Line Innovations Inc.

Product:

Wireless Meter Sensor (433 MHz)

Model:

BLI-18100

FCC ID:

SUE-BLI-18100-06

ISED Registration number:

5614A-BLI18100

Specifications:

◆ **FCC 47 CFR Part 15 Subpart C, §15.231**

Periodic operation in the band 40.66-40.70 MHz and above 70 MHz.

◆ **RSS-210, Issue 9, August 2016, Annex A.1**

Momentarily operated devices

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 | Kevin Rose, Wireless/EMC Specialist |
| Reviewed by | David Duchesne, Senior EMC/Wireless Specialist |
| Date | February 1, 2018 |
| 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 contained in this report are within Nemko Canada's ISO/IEC 17025 accreditation.

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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 15.231 | Periodic operation in the band 40.66–40.70 MHz and above 70 MHz |
| RSS-210, Issue 9, August 2016, Annex A.1 | Momentarily operated devices |

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) | Variation of power source | Pass ¹ |
| §15.203 | Antenna requirement | Pass ² |
| §15.231(a) | Conditions for intentional radiators to comply with periodic operation | Pass |
| §15.231(b) | Field strength of emissions | Pass |
| §15.231(c) | Emission bandwidth | Pass |
| §15.231(d) | Requirements for devices operating within 40.66–40.70 MHz band | Not applicable |
| §15.231(e) | Conditions for intentional radiators to comply with periodic operation | Pass |

Notes: ¹ Performed with a full charged battery

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

2.2 ISED RSS-GEN, Issue 4 test results

| Part | Test description | Verdict |
|-------|--|----------------|
| 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.

2.3 ISED RSS-210, Issue 9 test results

| Part | Test description | Verdict |
|-------|--------------------------------|----------------|
| A.1.1 | Types of momentary signals | Not applicable |
| A.1.2 | Field strength of emissions | Not applicable |
| A.1.3 | Bandwidth of momentary signals | Pass |
| A.1.4 | Reduced Field Strengths | 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 | None |

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 A.1, Issue 9, August 2016 |
| Frequency band (MHz) | 433.865 |
| Frequency Min (MHz) | 433.865 |
| Frequency Max (MHz) | 433.865 |
| RF power Min (W) | NA |
| RF power Max (W) | NA |
| Field strength, Units @ distance | 72.51 dB μ V/m @ 3 m |
| Measured BW (kHz) (99 %) | 10.7 |
| Calculated BW (kHz), as per TRC-43 | N/A |
| Type of modulation | Pulse |
| Emission classification (F1D, G1D, D1D) | L1D |
| Transmitter spurious, Units @ distance | 33.41 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. Insulated wire, 220 mm |

3.4 Product description and theory of operation

The Blue Line Innovations "PowerCost Monitor Meter Sensor" model BLI-18100 is a device that attaches to standard residential and light-commercial type electricity meters for the purposes of collecting electricity consumption information. This information is periodically transmitted to a receiving device which then uploads the data to a cloud-based electricity monitoring application. The device employs a PIC24-based 16-bit microcontroller connected to a Semtec SX1243 transmitter.

The device is approximately 4" wide x 1.75" tall x 2" deep. It is powered by a single C-cell format battery and is designed to operate in outdoor environments.

3.5 EUT exercise details

The EUT was set to transmit continuously

3.6 EUT setup diagram

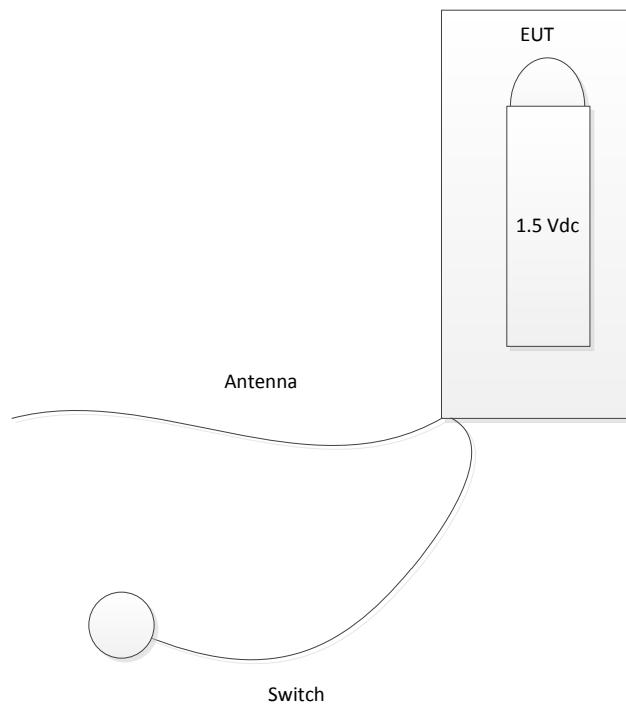


Figure 3.6-1: Setup diagram

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

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

Section 7. 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. 09/18 |
| 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 | Dec. 07/18 |
| 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, VOU - verify on use

Section 8. Testing data

8.1 FCC 15.231(e) and RSS-210 A.1.4 Field strength of emissions for periodic radiators (reduced)

8.1.1 Definitions and limits

FCC:

Intentional radiators may operate at a periodic rate exceeding that specified in paragraph (a) of this section and may be employed for any type of operation, including operation prohibited in paragraph (a) of this section, provided the intentional radiator complies with the provisions of paragraphs (b) through (d) of this section, except the field strength table in paragraph (b) of this section is replaced with the table below.

In addition, devices operated under the provisions of this paragraph shall be provided with a means for automatically limiting operation so that the duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

ISED:

- a. Devices may not meet the requirements in Section A.1.1 and may be employed for any type of operation, provided the device complies with the requirements of Section A.1.3 and the field strength corresponds with the limits specified in the table below.
- b. In addition, devices operated under the provisions of this section shall be capable of automatically limiting their operation so that the duration of each transmission is not greater than 1 second and the silent period between transmissions is at least 30 times the duration of the transmission, but not less than 10 seconds under any circumstances. However, devices that are designed for limited use for the purpose of initial programming, reprogramming or installing, and not for regular operations, may operate for up to 5 seconds, provided such devices are used only occasionally in connection with each unit being programmed or installed.
- c. The field strength limits shown in the table below are based on the average value of the measured emissions. As an alternative, compliance with the limits in this table may be based on the use of measurement instruments with an International Special Committee on Radio Interference (CISPR) quasi-peak detector.
- d. Unwanted emissions shall comply with the general field strength limits specified in RSS-Gen or 10 times below the fundamental emissions field strength limit in the table below whichever is less stringent.

Table 8.1-1: Reduced Field Strength Limits for Momentarily Operated Devices

| Fundamental frequency (MHz) | Field strength of fundamental (µV/m) | Field strength of fundamental (dBµV/m) | Field strength of spurious emissions (µV/m) | Field strength of spurious emissions (dBµV/m) |
|-----------------------------|--------------------------------------|--|---|---|
| 40.66–40.70 ¹ | 1,000 | 60 | 100 | 40 |
| 70–130 | 500 | 53.9 | 50 | 33.9 |
| 130–174 | 500 to 1,500* | 53.9 to 63.5* | 50 to 150* | 33.9 to 43.5* |
| 174–260 | 1,500 | 63.5 | 150 | 43.5 |
| 260–470 | 1,500 to 5,000* | 63.5 to 73.9* | 150 to 500* | 43.5 to 53.9* |
| Above 470 | 5,000 | 73.9 | 500 | 53.9 |

Note: ¹The levels applicable to FCC only.

* Linear interpolation with frequency F in MHz:

For 130–174 MHz: Field Strength (µV/m) = (22.73 × F) – 2454.55

For 260–470 MHz: Field Strength (µV/m) = (16.67 × F) – 2833.33

| | |
|----------------------|---|
| Section 8 | Testing data |
| Test name | FCC Clause 15.231(e) and RSS-210 A.1.4 Field strength of emissions for periodic radiators (reduced) |
| Specification | FCC Part 15 Subpart C and RSS-210, Issue 9 |



Table 8.1-2: FCC §15.209 and RSS-Gen – Radiated emission limits

| Frequency, MHz | Field strength of emissions μV/m | Field strength of emissions dBμV/m | Measurement distance, m |
|-------------------|-------------------------------------|---------------------------------------|-------------------------|
| 0.009–0.490 | 2400/F | 67.6 – 20 × log ₁₀ (F) | 300 |
| 0.490–1.705 | 24000/F | 87.6 – 20 × 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 8.1-3: 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 |

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 8.1-4: 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 | | | |

| | |
|----------------------|---|
| Section 8 | Testing data |
| Test name | FCC Clause 15.231(e) and RSS-210 A.1.4 Field strength of emissions for periodic radiators (reduced) |
| Specification | FCC Part 15 Subpart C and RSS-210, Issue 9 |



8.1.2 Test summary

| | | | |
|---------------|------------------|-------------------|-----------|
| Test date | January 23, 2018 | Temperature | 22 °C |
| Test engineer | Kevin Rose | Air pressure | 1006 mbar |
| Verdict | Pass | Relative humidity | 30 % |

8.1.3 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 |

Section 8**Test name**

Testing data

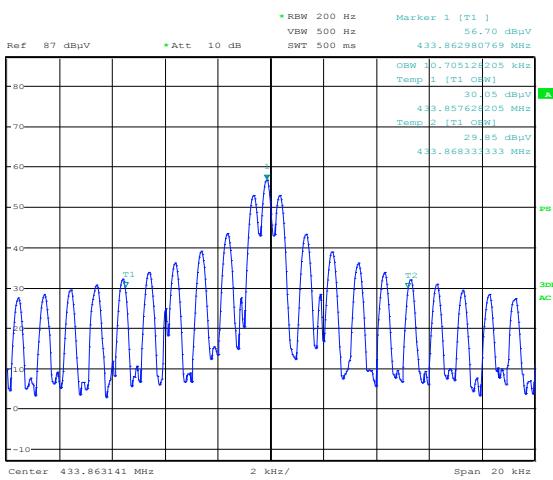
FCC Clause 15.231(e) and RSS-210 A.1.4 Field strength of emissions for periodic radiators (reduced)

Specification

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

**8.1.4 Test data**

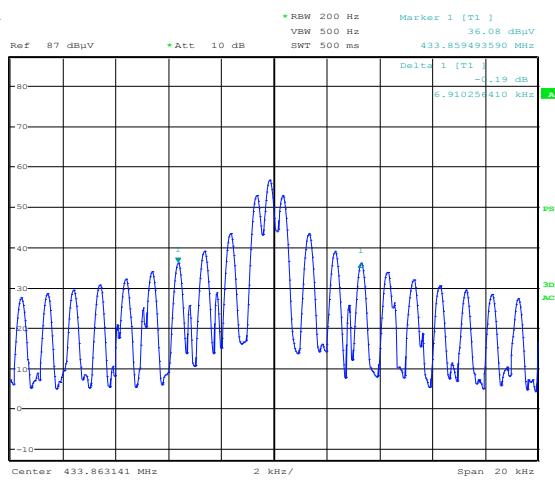
Pulses



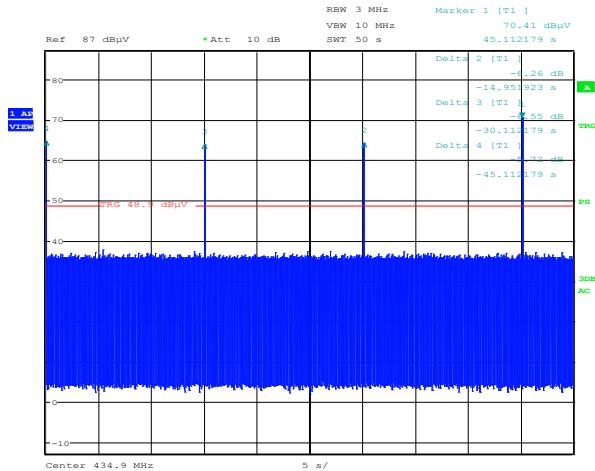
Date: 26.JUL.2017 23:10:52

Figure 8.1-1: 99% bandwidth

Note RSS 210 A1.3 10.7 MHz is > 0.25 % of 433.865 MHz



Date: 26.JUL.2017 23:11:45

Figure 8.1-2: 20dB bandwidth

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

Figure 8.1-3: 14.95 sec between transmission.

Section 8**Test name****Testing data**

FCC Clause 15.231(e) and RSS-210 A.1.4 Field strength of emissions for periodic radiators (reduced)

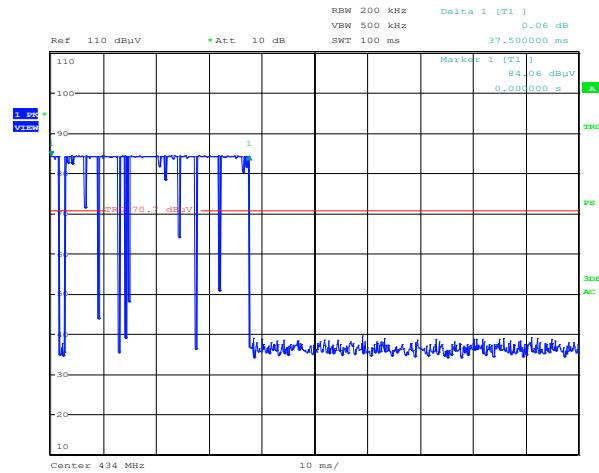
Specification

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

**Duty cycle/average factor calculations**

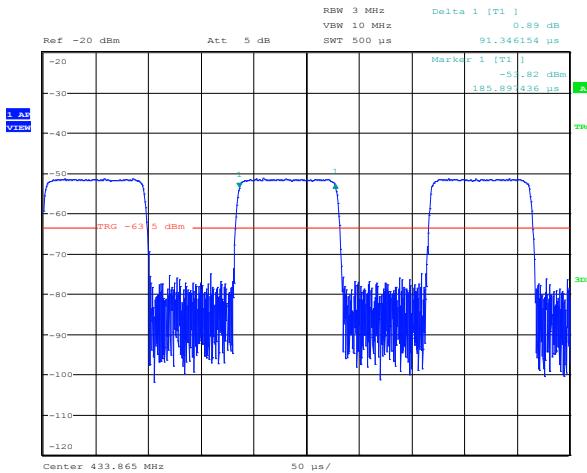
§15.35(c) When the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed; the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed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

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



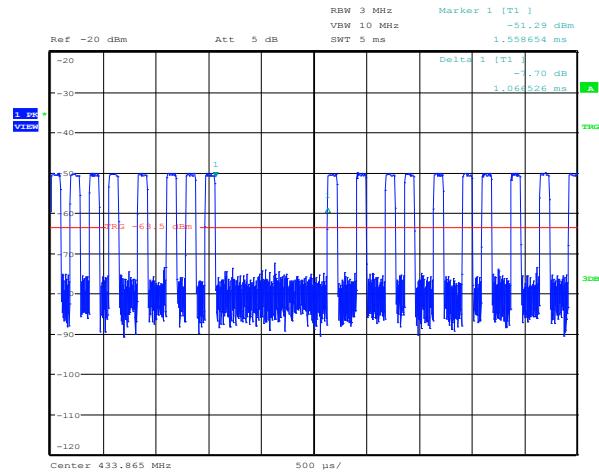
Date: 24.JAN.2018 02:03:01

Figure 8.1-4: Transmission within 100 ms



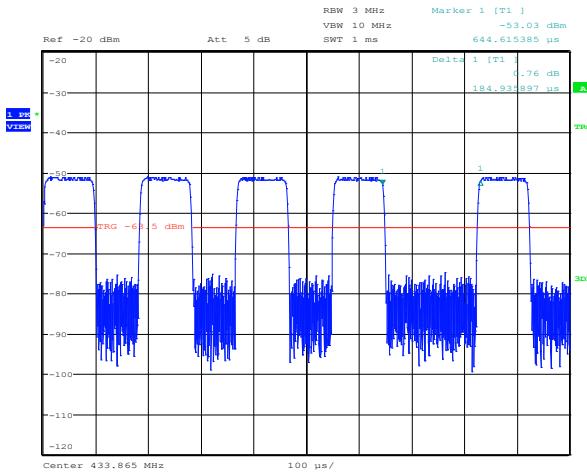
Date: 31.JAN.2018 18:52:21

Figure 8.1-5: Transmission single pulse



Date: 31.JAN.2018 18:56:16

Figure 8.1-6: Transmission sync off 1000 us



Date: 31.JAN.2018 18:59:11

Figure 8.1-7: Transmission payload off 184 us

Section 8 Testing data
Test name FCC Clause 15.231(e) and RSS-210 A.1.4 Field strength of emissions for periodic radiators (reduced)
Specification FCC Part 15 Subpart C and RSS-210, Issue 9



Table 8.1-5: Customer declared duty cycle

| Max Duration of Pulse, ms | Max on time, ms | Max off time, ms | Duty cycle factor, dB |
|----------------------------------|------------------------|-------------------------|------------------------------|
| 42.584 | 14.076 | 28.508 | -17.03 |

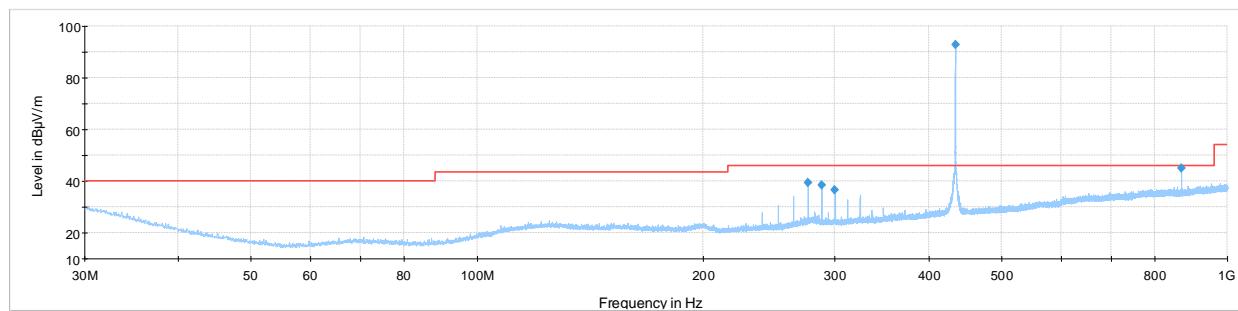
Table 8.1-6: Transmission duration

| Max Duration of Pulse, ms | 30 times Duration, sec | Time between pulses, sec | Margin, sec |
|----------------------------------|-------------------------------|---------------------------------|--------------------|
| 42.584 | 1.277 | 14.950 | 13.673 |

Table 8.1-7: Radiated field strength measurement results

| Frequency, MHz | Peak field strength, dB μ V/m | Peak limit, dB μ V/m | Margin, dB | Duty cycle factor, dB | Average field strength, dB μ V/m | Average limit, dB μ V/m | Margin, dB |
|----------------|-----------------------------------|--------------------------|------------|-----------------------|--------------------------------------|-----------------------------|------------|
| 433.87 | 89.54 | 92.9 | 3.36 | -17.03 | 72.51 | 72.9 | 0.39 |
| 867.73 | 49.93 | 72.9 | 22.97 | -17.03 | 32.90 | 52.9 | 20.00 |
| 3904.8 | 50.44 | 72.9 | 22.46 | -17.03 | 33.41 | 52.9 | 19.49 |

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



NEX- 336298 R Escan 30-1000 MHz

Preview Result 1-PK+
FCC Part 15 and ICES - Class B 3m Q-Peak Limit
Final_Result QPK

Figure 8.1-8: Spurious emissions below 1 GHz

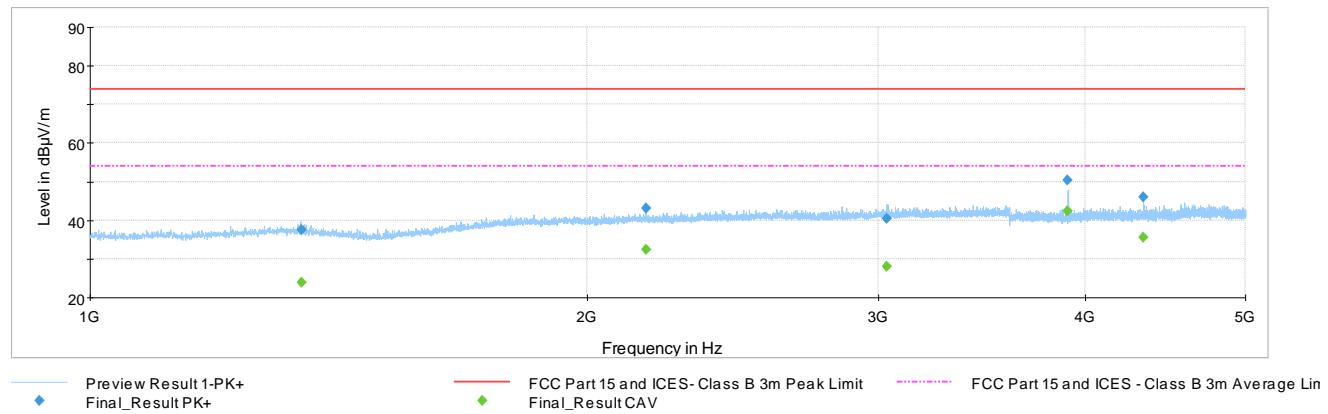
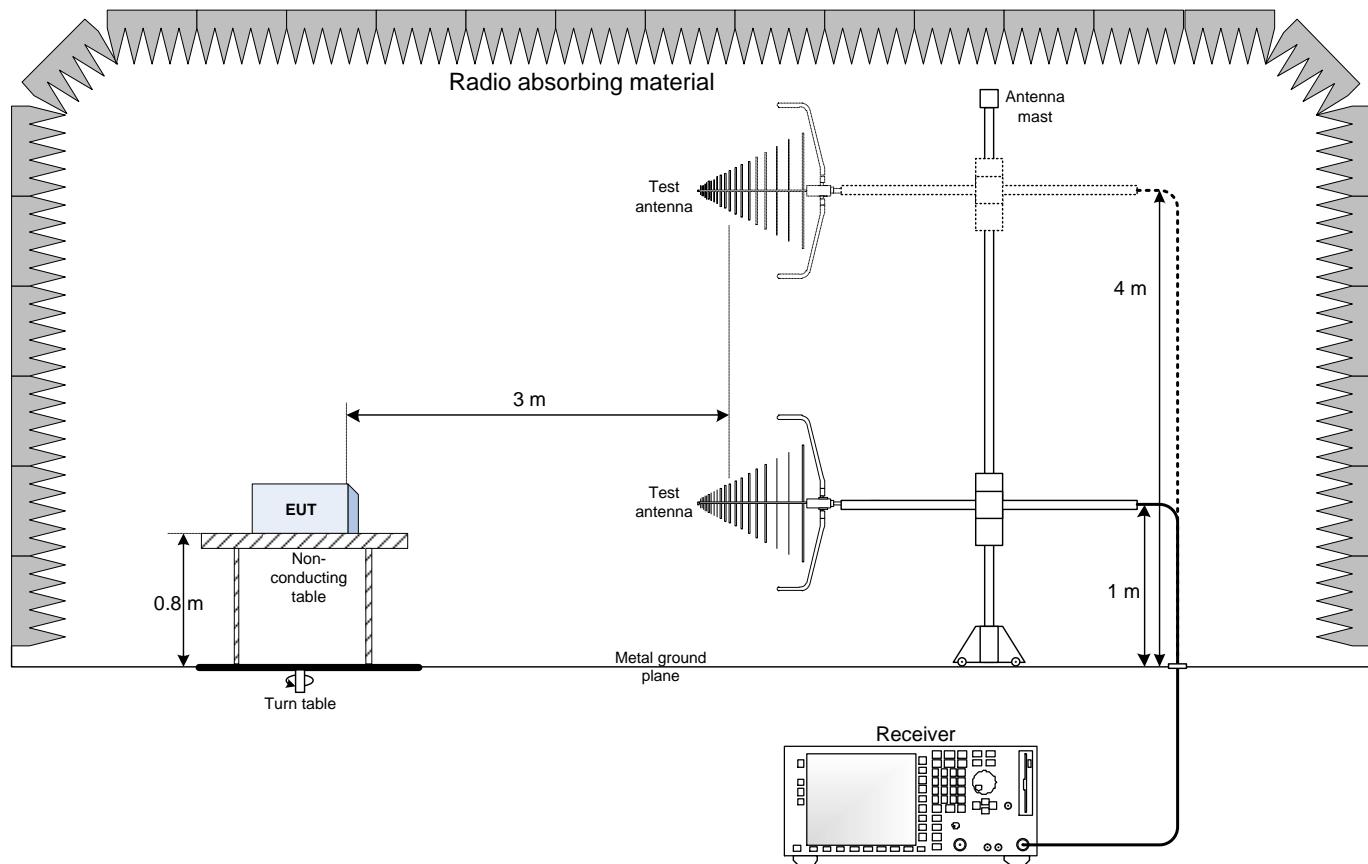


Figure 8.1-9: Spurious emissions above 1 GHz

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

