

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.
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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 contain 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
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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 ISSED 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 ISSED 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 dBμV/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 dBμV/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

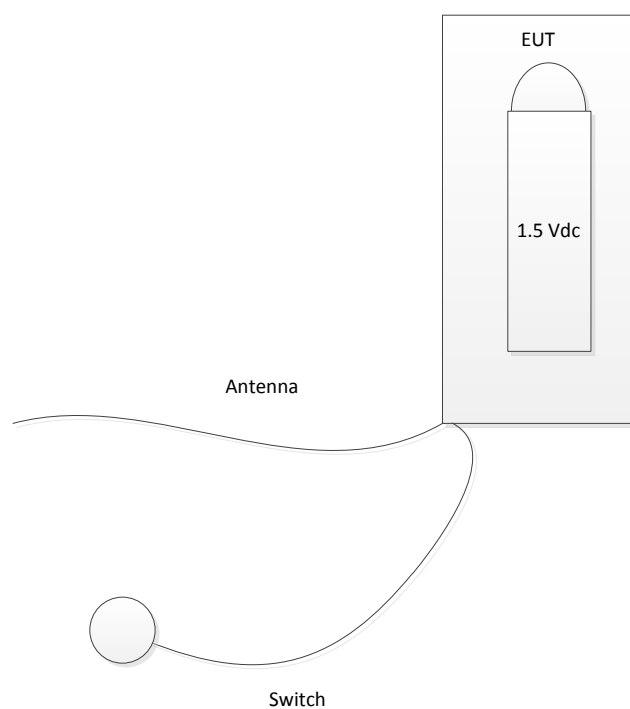


Figure 3.6-1: Setup diagram

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:

- 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.
- 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.
- 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.
- 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		Field strength of spurious emissions	
	($\mu\text{V/m}$)	(dB $\mu\text{V/m}$)	($\mu\text{V/m}$)	(dB $\mu\text{V/m}$)
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 ($\mu\text{V/m}$) = $(22.73 \times F) - 2454.55$

For 260–470 MHz: Field Strength ($\mu\text{V/m}$) = $(16.67 \times F) - 2833.33$

Table 8.1-2: 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 8.1-3: 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:

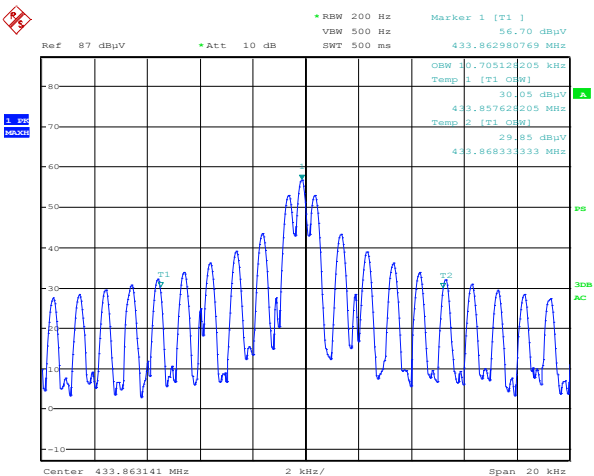
Resolution bandwidth	100 kHz
Video bandwidth	300 kHz
Detector mode	Peak
Trace mode	Max Hold

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

8.1.4 Test data

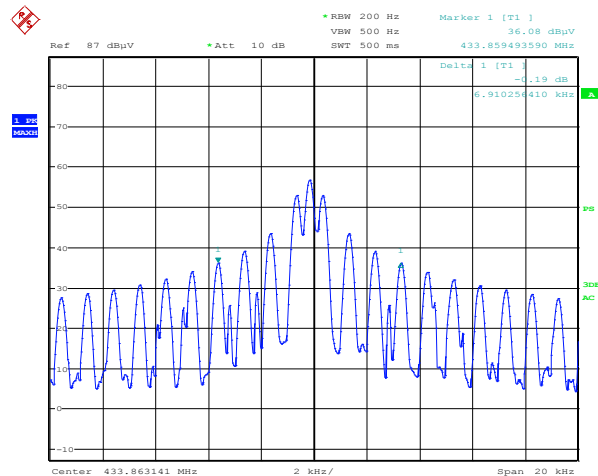
Pulses



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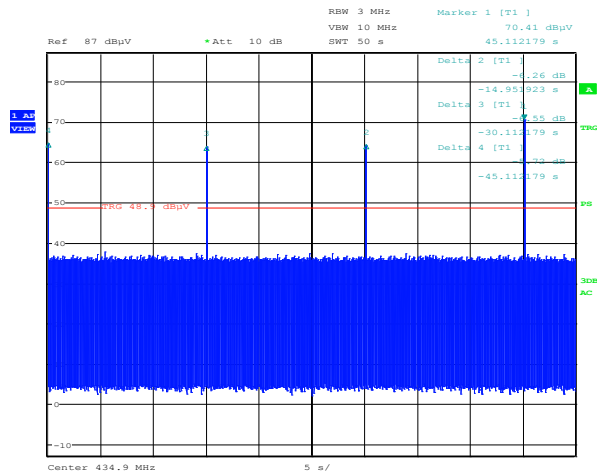
Figure 8.1-1: 99% bandwidth

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



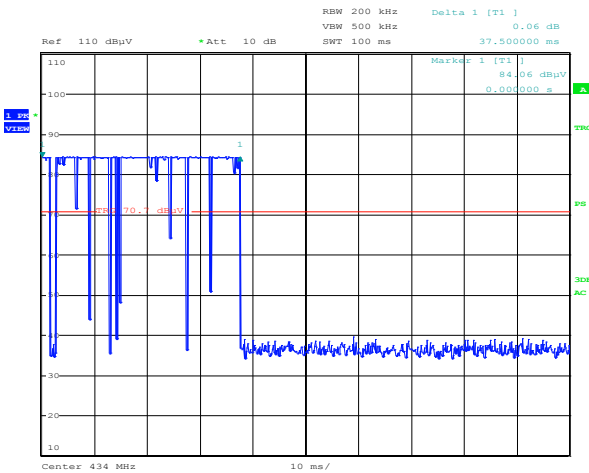
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Figure 8.1-3: 14.95 sec between transmission.

Duty cycle/average factor calculations

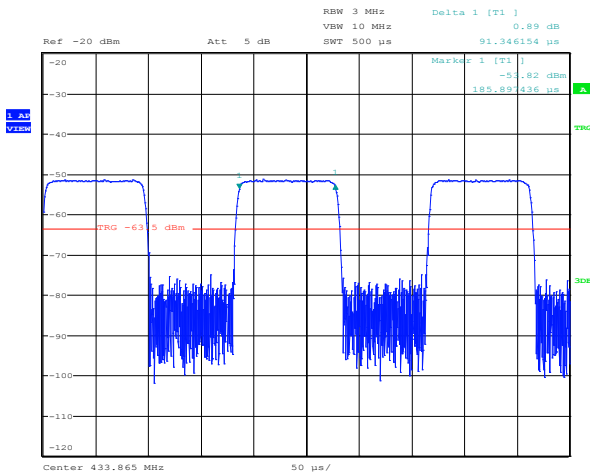
§15.35(c) When the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed; the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed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

$$\text{Duty cycle or average factor} = 20 \times \log_{10} \left(\frac{T_{x100ms}}{100ms} \right)$$



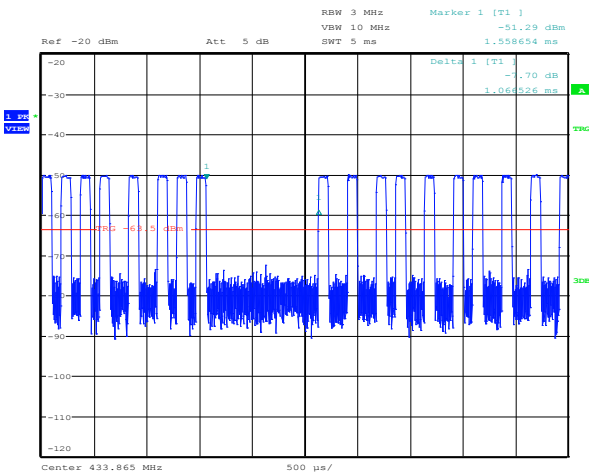
Date: 24.JAN.2018 02:03:01

Figure 8.1-4: Transmission within 100 ms



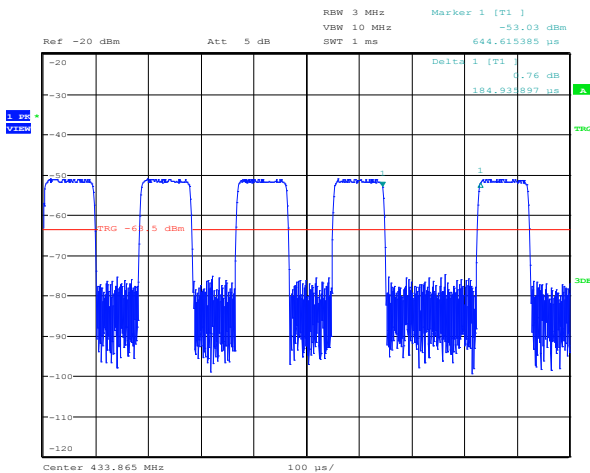
Date: 31.JAN.2018 18:52:21

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, dBμV/m	Peak limit, dBμV/m	Margin, dB	Duty cycle factor, dB	Average field strength, dBμV/m	Average limit, dBμV/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.

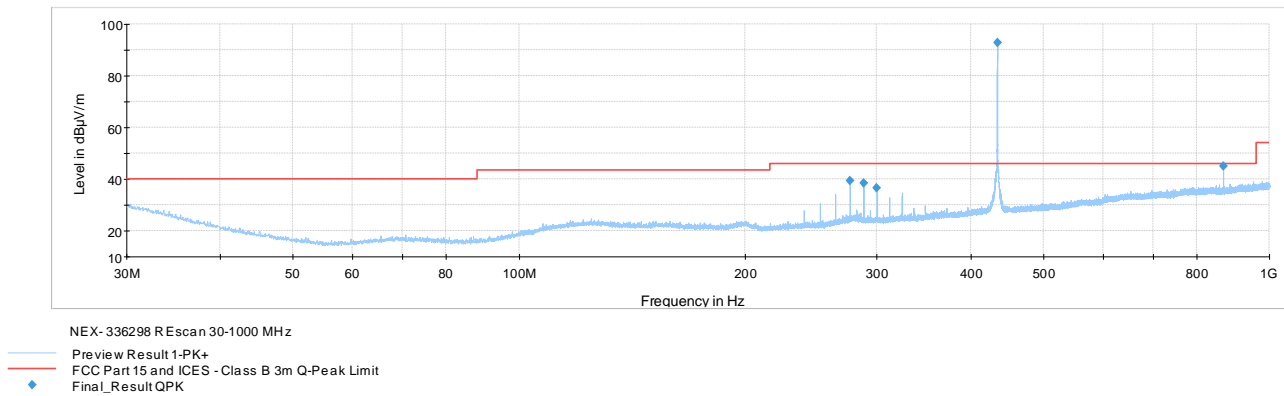


Figure 8.1-8: Spurious emissions below 1 GHz

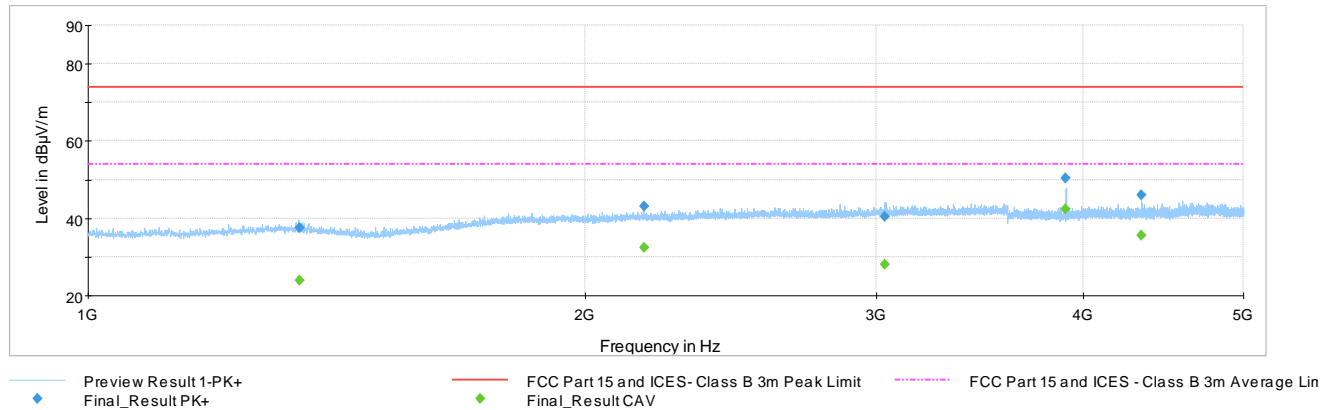
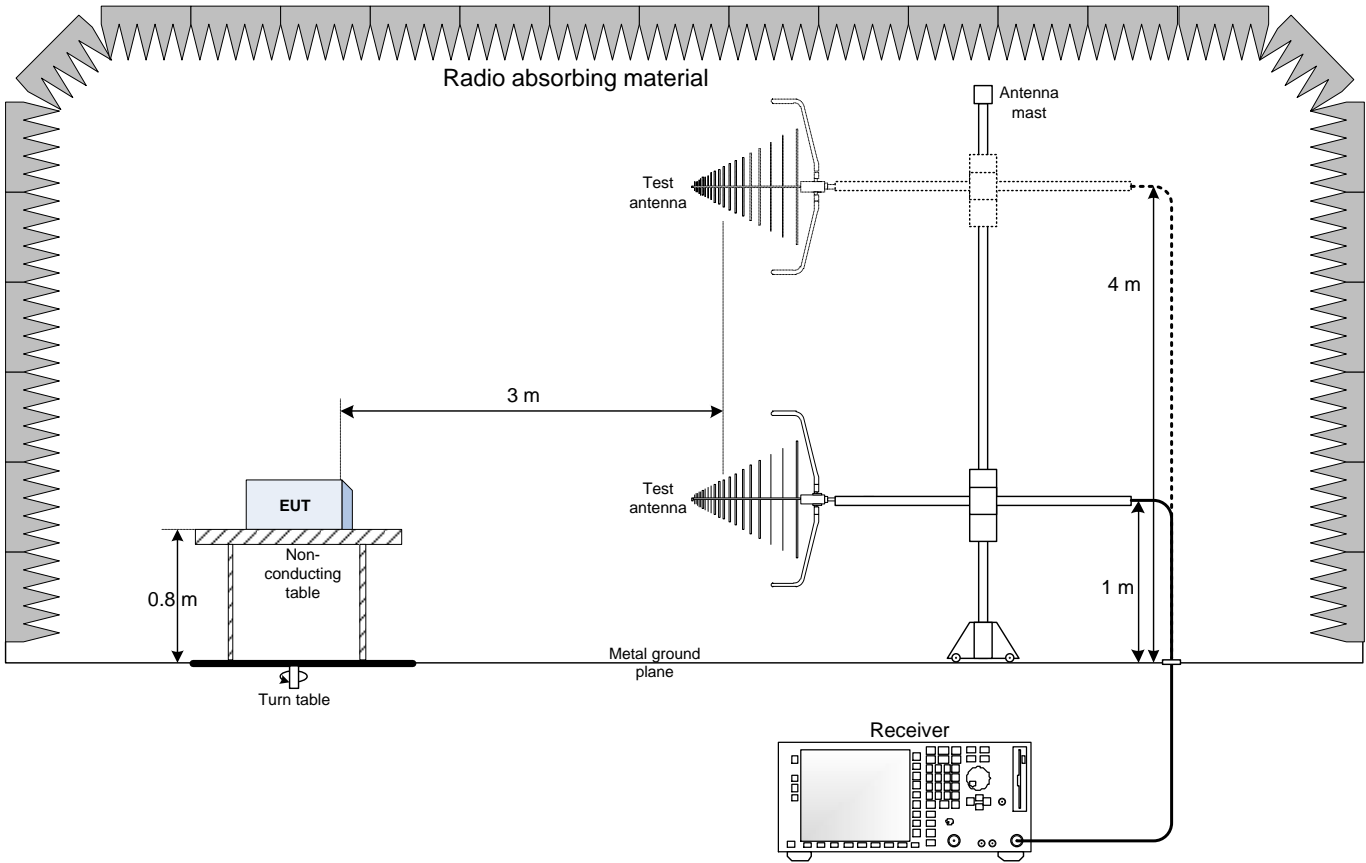


Figure 8.1-9: Spurious emissions above 1 GHz

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

