

RADIO TEST REPORT

Project ID

PRJ0024813

Report ID

REP010190

Type of assessment:

Transmitters co-location

Applicant:

Smartwave Technologies

Product:

Bell IQ Total Solutions

Model:

Pulse Rat IQ Total

Model variant(s):

Pulse Mouse IQ Total, 24/7 IQ Total

Contains FCC ID:

2ASYW-B01004

Contains IC Registration number:

IC: 24934-B01004

Specifications:

- ◆ FCC 47 CFR Part 15 Subpart C, §15.247
- ◆ RSS-247, Issue 2, Feb 2017, Section 5
- ◆ KDB 996369 D04 Module Integration Guide v02

Date of issue: **May 11, 2023**

Ketav Jani, EMC/RF Specialist

Tested by



Signature

Fahar Abdul Sukkoor, EMC/RF Specialist

Reviewed by



Signature

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Test site identifier	Organization FCC: ISED:	Ottawa/Almonte CA2040 2040A-4	Montreal CA2041 2040G-5	Cambridge CA0101 24676
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.

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Table of Contents

Table of Contents	3
Section 1 Report summary.....	4
1.1 Test specifications	4
1.2 Test methods.....	4
1.3 Exclusions	4
1.4 Statement of compliance.....	4
1.5 Test report revision history.....	4
Section 2 Engineering considerations	5
2.1 Modifications incorporated in the EUT for compliance	5
2.2 Technical judgment	5
2.3 Model variant declaration	5
2.4 Deviations from laboratory tests procedures	5
Section 3 Test conditions	6
3.1 Atmospheric conditions.....	6
3.2 Power supply range	6
Section 4 Measurement uncertainty	7
4.1 Uncertainty of measurement	7
Section 5 Information provided by the applicant.....	8
5.1 Disclaimer	8
5.2 Applicant/Manufacture	8
5.3 EUT information, LoRa.....	8
5.4 EUT information, BLE	8
5.5 Radio technical information.....	9
5.6 EUT setup details	9
Section 6 Summary of test results	10
6.1 Testing location	10
6.2 Testing period.....	10
6.3 Sample information	10
6.4 FCC Part 15, Test results	10
6.5 ISED RSS-Gen/ ISED RSS-247, Test results.....	10
Section 7 Test equipment.....	11
7.1 Test equipment list	11
Section 8 Testing data.....	12
8.1 Spurious (out-of-band) unwanted emissions.....	12

Section 1 Report summary

1.1 Test specifications

FCC 47 CFR Part 15, Subpart C, Clause 15.247	Operation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–585 MHz
RSS-247, Issue 2, Feb 2017, Section 5	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
KDB 996369 D04 Module Integration Guide v02	Modular transmitter integration guide Guidance for host product manufacturers

1.2 Test methods

558074 D01 15.247 Meas Guidance v05r02 (April 2, 2019)	Guidance for compliance measurements on digital transmission system, frequency hopping spread spectrum system, and hybrid system devices operating under section 15.247 of the FCC rules.
ANSI C63.10 v2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
RSS-102, Issue 5, March 19, 2015	Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)

1.3 Exclusions

The evaluation was done to ensure there are no additional radiated spurious emissions generated due to simultaneous-transmission operations compared to single transmitter operations testing, and to ensure compliance with the applicable FCC/ISED rules for the transmitters operating individually and simultaneously. This includes compliance for the summation of all emissions from all outputs occupying the same or overlapping frequency ranges, as defined by the applicable rules. All other requirements are excluded from the scope of this report. Both the BLE and the LoRa radio were assessed simultaneously.

1.4 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 1.3 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.

1.5 Test report revision history

Table 1.5-1: Test report revision history

Revision #	Date of issue	Details of changes made to test report
REP010190	May 11, 2023	Original report issued

Section 2 Engineering considerations

2.1 Modifications incorporated in the EUT for compliance

There were no modifications performed to the EUT during this assessment.

2.2 Technical judgment

None

2.3 Model variant declaration

As declared by the applicant, the EUT model Pulse Rat IQ Total has been chosen to be representative for all other models in the model family. The model family, and the description of the variations, are as follows: All models use the same PCBA (B01-004-01). The model variants are due to different plastic enclosure the PCBA is housed in. Pulse Mouse IQ Total and Pulse Rat IQ Total are essentially the same except Pulse Rat is a larger version of Pulse Mouse. Both the Pulse Mouse and the Pulse Rat can be installed as bait and/or snap trap. The 24/7 enclosure is a different type of bait station which contains the same B01-004-01 PCBA but the enclosure is constructed in a way that uses bait to attract rodents but once the rodent enters the trap they can not leave:

2.4 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

Section 3 Test conditions

3.1 Atmospheric conditions

Temperature	15 °C – 35 °C
Relative humidity	20 % – 75 %
Air pressure	86 kPa (860 mbar) – 106 kPa (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.

3.2 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 4 Measurement uncertainty

4.1 Uncertainty of measurement

UKAS Lab 34 and TIA-603-B have been used as guidance for measurement uncertainty reasonable estimations with regards to previous experience and validation of data. 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.

Table 4.1-1: Measurement uncertainty calculations

Test name	Measurement uncertainty, \pm dB
Radiated spurious emissions (30 MHz to 1 GHz)	5.7
Radiated spurious emissions (1 GHz to 6 GHz)	4.7
Radiated spurious emissions (6 GHz to 18 GHz)	5.0

Section 5 Information provided by the applicant

5.1 Disclaimer

This section contains information provided by the applicant and has been utilized to support the test plan. Inaccurate information provided by the applicant can affect the validity of the results contained within this test report. Nemko accepts no responsibility for the information contained within this section and the impact it may have on the test plan and resulting measurements.

5.2 Applicant/Manufacture

Applicant name	Smartwave Technologies
Applicant address	1 Marmac Drive, Toronto, ON, M9W 1E7, Canada
Manufacture name	Same as applicant
Manufacture address	Same as applicant

5.3 EUT information, LoRa

Product	Bell IQ Total Solutions
Model	Pulse Rat IQ Total
Model variant(s)	Pulse Mouse IQ Total, 24/7 IQ Total
Serial number	Prototype
Power requirements	Battery: 3.6 V(DC)
Product description and theory of operation	Product can be installed as bait and/or snap trap. The unit is powered on continuously and run production firmware. After manufacturing and final assembly, the unit enters a deep sleep state until installation. After installation the unit will continuously advertise trap activity over LoRa.
Software details	N/A. Product was running in a test firmware mode. Firmware Version: 154.8
Hardware version	B01-004-01

5.4 EUT information, BLE

Product	Bell IQ Total Solutions
Model	Pulse Rat IQ Total
Model variant(s)	Pulse Mouse IQ Total, 24/7 IQ Total
Serial number	Prototype
Power requirements	Battery 3.6 V _{DC}
Description/theory of operation	Product can be installed as bait and/or snap trap. The unit is powered on continuously and run production firmware. After manufacturing and final assembly, the unit enters a deep sleep state until installation. After installation the unit will continuously advertise trap activity over BLE.
Software details	N/A. Product was running in a test firmware mode. Firmware Version: 154.8
Hardware version	B01-004-01

5.5 Radio technical information

5.5.1 Technical radio information, LoRa

Operating frequency range	863-870 MHz
Type of modulation	chirp spread spectrum
Antenna information	Type: Helical antenna with connector style PCB-mount base Manufacturer: Linx Technologies Model: ANT-915-VHETH Peak gain: 0.9 dBi

5.5.2 Technical radio information, BLE

Category of Wideband Data Transmission equipment	<input type="checkbox"/> Frequency Hopping Spread Spectrum (FHSS) equipment <input checked="" type="checkbox"/> Other types of Wideband Data Transmission equipment (e.g. DSSS, OFDM, etc.).
Frequency band	2400–2483.5 MHz
Type of modulation	BLE (GFSK)
Antenna information	Type: Helical antenna with connector style PCB-mount base Manufacturer: Linx Technologies Model: ANT-915-VHETH Peak gain: 0.9 dBi

5.6 EUT setup details

5.6.1 Radio exercise details

Operating conditions	The full system (LoRa and BLE) was forced into typical application operation, all transmitters were on and transmitting. The EUT was powered on and the product was loaded with the appropriate test firmware to transmit simultaneously the specific BLE & LoRa channels.
Configuration mode	EUT was configured to transmit BLE mid channel (2440 MHz) & LoRa low channel (902.3 MHz)

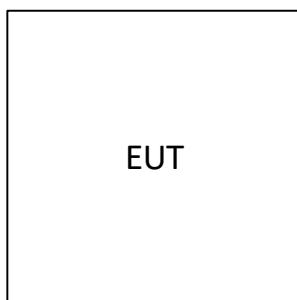


Figure 5.6-1: Radiated testing block diagram

Section 6 Summary of test results

6.1 Testing location

Test location (s)	Cambridge

6.2 Testing period

Test start date	April 14, 2023	Test end date	April 14, 2023

6.3 Sample information

Receipt date	November 16, 2022	Nemko sample ID number(s)	1

6.4 FCC Part 15, Test results

Table 6.4-1: FCC requirements results

Part	Test description	Verdict
§15.207(a)	Conducted limits	Not applicable
§15.247(d)	Spurious emissions	Pass

Notes: EUT is a battery-operated device, the testing was performed using fresh batteries.

6.5 ISED RSS-Gen/ ISED RSS-247, Test results

Table 6.5-1: RSS-Gen/ ISED RSS-247 requirements results

Part	Test description	Verdict
ISED RSS-Gen, 7.3	Receiver radiated emission limits ¹	Not applicable
ISED RSS-Gen, 8.8	AC powerline conducted emissions limits	Not applicable
ISED RSS-247, 5.5	Unwanted emissions	Pass

Notes: ¹According to sections 5.2 and 5.3 of RSS-Gen, Issue 5 the EUT does not have a stand-alone receiver neither scanner receiver, therefore exempt from receiver requirements.

EUT is a battery-operated device, the testing was performed using fresh batteries.

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.
Receiver/spectrum analyzer	Rohde & Schwarz	ESR26	FA002969	1 year	February 10, 2024
Spectrum analyzer	Rohde & Schwarz	FSW43	FA002971	1 year	December 31, 2023
3 m EMI test chamber	TDK	SAC-3	FA003012	1 year	January 30, 2024
Flush mount turntable	SUNAR	FM2022	FA003006	—	NCR
Controller	SUNAR	SC110V	FA002976	—	NCR
Antenna mast	SUNAR	TLT2	FA003007	—	NCR
Bilog antenna (30–2000 MHz)	SUNAR	JB1	FA003010	1 year	June 21, 2023
Horn antenna (1–18 GHz)	ETS-Lindgren	3117	FA002911	1 year	May 11, 2023
Preamp (1–18 GHz)	ETS-Lindgren	124334	FA002956	1 year	March 27, 2024
50 Ω coax cable	Huber + Suhner	None	FA003046	1 year	January 18, 2024
50 Ω coax cable	Huber + Suhner	None	FA003047	1 year	January 18, 2024
50 Ω coax cable	Huber + Suhner	None	FA003402	1 year	January 18, 2024
50 Ω coax cable	Huber + Suhner	None	FA003402	1 year	January 18, 2024

Notes: NCR - no calibration required

Section 8 Testing data

8.1 Spurious (out-of-band) unwanted emissions

8.1.1 References, definitions and limits

FCC §15.247:

(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

RSS-247, Clause 5.5:

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 5.4(d), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

RSS-Gen:

8.9 Except where otherwise indicated in the applicable RSS, radiated emissions shall comply with the field strength limits shown in table below.

8.10 Restricted frequency bands are designated primarily for safety-of-life services (distress calling and certain aeronautical activities), certain satellite downlinks, radio astronomy and some government uses. The following conditions related to the restricted frequency bands apply:

- a The transmit frequency, including fundamental components of modulation, of licence-exempt radio apparatus shall not fall within the restricted frequency bands.
- b Unwanted emissions that fall into restricted frequency bands listed in table 7 shall comply with the limits specified in table below.
- c Unwanted emissions that do not fall within the restricted frequency bands shall comply either with the limits specified in the applicable RSS or with those specified in table below.

Table 8.1-1: FCC §15.209 and RSS-Gen – Radiated emission limits

Field strength of emissions			
Frequency, MHz	µV/m	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.



References, definitions and limits, continued

Table 8.1-2: ISED restricted frequency bands

MHz	MHz	MHz	GHz
0.090–0.110	12.57675–12.57725	399.9–410	7.25–7.75
0.495–0.505	13.36–13.41	608–614	8.025–8.5
2.1735–2.1905	16.42–16.423	960–1427	9.0–9.2
3.020–3.026	16.69475–16.69525	1435–1626.5	9.3–9.5
4.125–4.128	16.80425–16.80475	1645.5–1646.5	10.6–12.7
4.17725–4.17775	25.5–25.67	1660–1710	13.25–13.4
4.20725–4.20775	37.5–38.25	1718.8–1722.2	14.47–14.5
5.677–5.683	73–74.6	2200–2300	15.35–16.2
6.215–6.218	74.8–75.2	2310–2390	17.7–21.4
6.26775–6.26825	108–138	2483.5–2500	22.01–23.12
6.31175–6.31225	149.9–150.05	2655–2900	23.6–24.0
8.291–8.294	156.52475–156.52525	3260–3267	31.2–31.8
8.362–8.366	156.7–156.9	3332–3339	36.43–36.5
8.37625–8.38675	162.0125–167.17	3345.8–3358	
8.41425–8.41475	167.72–173.2	3500–4400	Above 38.6
12.29–12.293	240–285	4500–5150	
12.51975–12.52025	322–335.4	5350–5460	

Note: Certain frequency bands listed in Table 8.1-2 and above 38.6 GHz are designated for licence-exempt applications. These frequency bands and the requirements that apply to related devices are set out in the 200 and 300 series of RSSs.

Table 8.1-3: 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			

8.1.2 Test summary

Verdict	Pass		
Tested by	Ketav Jani	Test date	April 14, 2023

8.1.3 Observations, settings and special notes

- Only radiated spurious emissions within restricted bands were evaluated.
- As part of the current assessment, the test range of 9 kHz to 10th harmonic has been fully considered and compared to the actual frequencies utilized within the EUT. Since the EUT contains a transmitter in the GHz range, the EUT has been deemed compliant without formal testing in the 9 kHz to 30 MHz test range, therefore formal test results (tabular data and/or plots) are not provided within this test report.
- No intermods were observed between 18-26 GHz frequency range, therefore formal test results for that band are not provided within this test report.
- EUT was set to transmit with 100 % duty cycle.
- Radiated measurements were performed at a distance of 3 m.
- DTS emissions in restricted frequency bands test was performed as per KDB 558074, section 8.6 with reference to ANSI C63.10 subclause 11.12.

Spectrum analyser settings (Measurements within restricted bands)

Resolution bandwidth:	Measurements below 1 GHz: 100 kHz Peak or 120 kHz Q-Peak, Measurements above 1 GHz: 1 MHz
Video bandwidth:	Measurements below 1 GHz: 300 kHz, Measurements above 1 GHz: 3 MHz
Detector mode:	Peak or Q-Peak
Trace mode:	Max Hold

8.1.4 Test data

Table 8.1-4: Radiated field strength measurement results

Frequency, MHz	Peak Field strength, dB μ V/m		Margin, dB	Average Field strength, dB μ V/m		Margin, dB
	Measured	Limit		Measured	Limit	
4880.50	57.6	74.0	16.4	44.7	54.0	9.3
5414.50	53.7	74.0	20.3	43.9	54.0	10.1
7320.40	59.3	74.0	14.7	46.7	54.0	7.3
9022.80	62.7	74.0	11.3	52.9	54.0	1.1
12200.80	57.7	74.0	16.3	42.4	54.0	11.6
17879.20	54.7	74.0	19.3	41.5	54.0	12.5
17948.00	54.2	74.0	19.8	41.7	54.0	12.3

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

Test data, continued

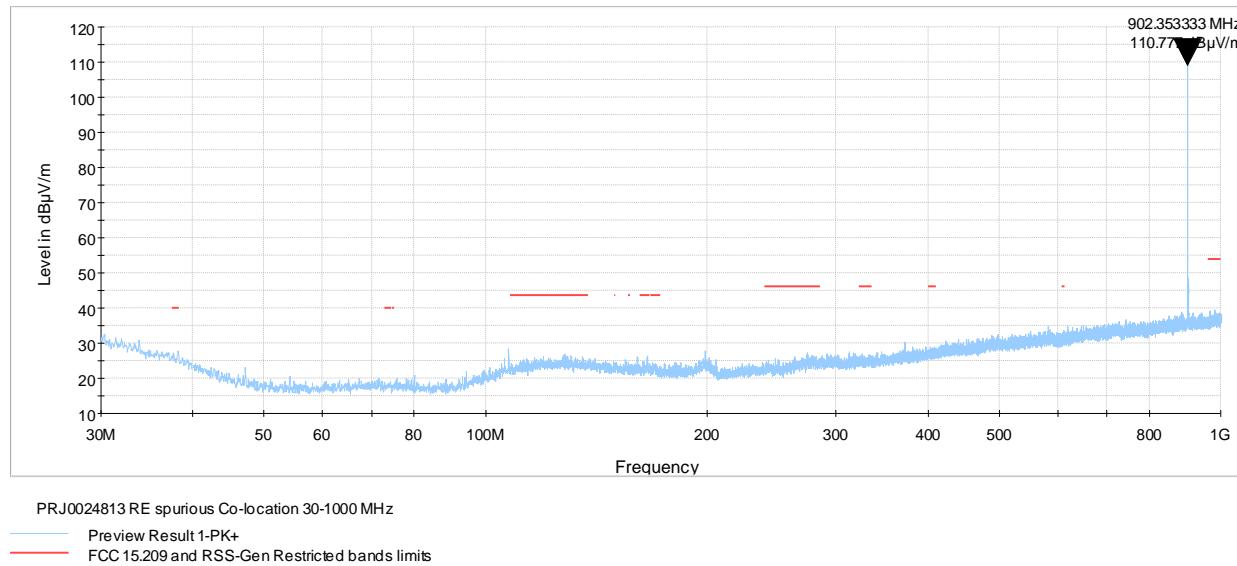


Figure 8.1-1: Radiated spurious emissions on 30-1000 MHz

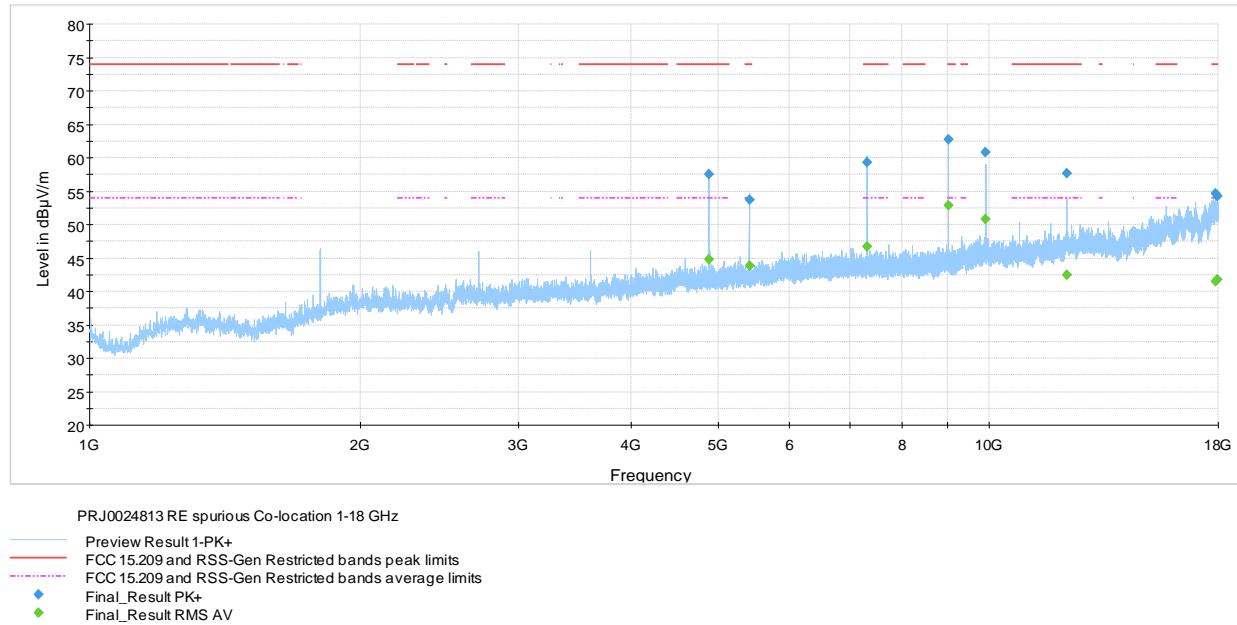


Figure 8.1-2: Radiated spurious emissions on 1-18 GHz

End of the test report