

Wireless test report – 342311-1R2TRFWL

Applicant:

Rigado, Inc.

Product name:

BMD-30X

Model:

BMD-300

FCC ID:

2AA9B04

IC Registration number:

12208A-04

Specifications:

◆ **FCC 47 CFR Part 15 Subpart C, §15.209**

Radiated emission limits; general requirements

◆ **RSS-GEN, Issue 4, Nov. 2014, section 8.9**

Transmitter Emission Limits for Licence-Exempt Radio Apparatus

Date of issue: **January 12, 2018**

Test engineer(s): **Yong Huang, Wireless/EMC Specialist**

Signature:



Reviewed by: **Andrey Adelberg, Senior Wireless/EMC Specialist**

Signature:

Test location(s)

| | | |
|--------------|------------------------------------|------------------------------------|
| Company name | Nemko Canada Inc. | |
| Address | 303 River Road | 292 Labrosse Avenue |
| City | Ottawa | Pointe-Claire |
| Province | Ontario | Quebec |
| Postal code | K1V 1H2 | H9R 5L8 |
| Country | Canada | Canada |
| Telephone | +1 613 737 9680 | +1 514 694 2684 |
| Facsimile | +1 613 737 9691 | +1 514 694 3528 |
| Toll free | +1 800 563 6336 | |
| Website | www.nemko.com | www.nemko.com |
| Site number | FCC: CA2040; IC: 2040A-4 (3 m SAC) | FCC: CA2041; IC: 2040G-5 (3 m SAC) |

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 and manufacturer | 4 |
| 1.2 Test specifications | 4 |
| 1.3 Test methods | 4 |
| 1.4 Statement of compliance | 4 |
| 1.5 Exclusions | 4 |
| 1.6 Test report revision history | 4 |
| Section 2. Summary of test results | 5 |
| 2.1 FCC Part 15 Subpart C, general requirements test results | 5 |
| 2.2 ISED RSS-GEN, Issue 4, 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 |
| 3.7 EUT sub assemblies | 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 15.209 and RSS-GEN section 8.9 Radiated emission limits; general requirements | 12 |
| Section 9. Block diagrams of test set-ups | 19 |
| 9.1 Radiated emissions set-up for frequencies below 1 GHz | 19 |
| 9.2 Radiated emissions set-up for frequencies above 1 GHz | 20 |

Section 1. Report summary

1.1 Applicant and manufacturer

| | |
|--------------|---|
| Company name | Rigado, Inc. |
| Address | 3950 Fairview Industrial Dr. SE, Suite 100 Salem, OR USA 97302 |

1.2 Test specifications

| | |
|--|--|
| FCC 47 CFR Part 15 Subpart C, §15.209 | Radiated emission limits; general requirements. |
| RSS-GEN, Issue 4, Nov. 2014, section 8.9 | Transmitter Emission Limits for Licence-Exempt Radio Apparatus |

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 performed against all relevant requirements of the test standard except as noted in section 1.5 below. 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

As per client's quotation, the purpose of this report is verification of transmitters colocation. Only inter-modulation products within restricted bands were assessed, other requirements were excluded from the scope of this report.

1.6 Test report revision history

| Revision # | Date of issue | Details of changes made to test report |
|------------|-------------------|---|
| TRF | December 13, 2017 | Original report issued |
| R1TRF | December 15, 2017 | Report revised with applicant information as per client's request |
| R2TRF | January 12, 2018 | Report revised as per TCB's review, emission designator updated. |



Section 2. Summary of test results

2.1 FCC Part 15 Subpart C, general requirements test results

| Part | Test description | Verdict |
|---------|---|---------|
| §15.209 | Radiated emission limits; general requirements. | Pass |

2.2 ISED RSS-GEN, Issue 4, test results

| Part | Test description | Verdict |
|------|--|---------|
| 8.9 | Transmitter Emission Limits for Licence-Exempt Radio Apparatus | Pass |

Section 3. Equipment under test (EUT) details

3.1 Sample information

| | |
|------------------------|-------------------|
| Receipt date | November 15, 2017 |
| Nemko sample ID number | Items # 3 and 4 |

3.2 EUT information

| | |
|--------------|---------|
| Product name | BMD-30X |
| Model | BMD-300 |
| Part number | BMD-300 |

3.3 Technical information

| | |
|---|---|
| Applicant IC company number | 12208A |
| IC UPN number | 04 |
| All used IC test site(s) Reg. number | 2040G-5 |
| RSS number and Issue number | RSS-GEN, Issue 4, Nov. 2014, section 8.9 |
| Operating frequency band | 2.4 GHz (BLE), 1.6 GHz (Globalstar Satellite) |
| Operating frequency | BLE: 2402–2480 MHz, Satellite: 1611.25–1618.75 MHz |
| Modulation type | BLE: GFSK, Satellite: BPSK |
| Emission classification (F1D, G1D, D1D) | F1D |
| Power requirements | 3.6 V DC to module, powered by battery |
| Antenna information | The EUT uses a unique antenna coupling/ non-detachable antenna to the intentional radiator. Satellite antenna: PA251615025SALF Gain: 3 dBi, BLE: Internal to the Rigado module BMD-300 (FCC approved), GPS: Taoglass GP.1575.18.2.A.02 |

3.4 Product description and theory of operation

Rigado BMD-300 BLE module allowing simultaneous transmission with Globalstar STX2 and STX3 transmitters

3.5 EUT exercise details

The EUT was set up as per client's instruction. Both the BLE and Satellite transmitters were set to continuous transmit mode during the tests.

3.6 EUT setup diagram

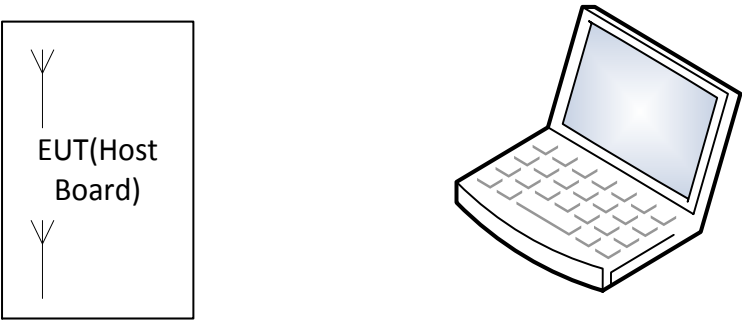


Figure 3.6-1: Setup diagram

3.7 EUT sub assemblies

Table 3.7-1: EUT sub assemblies

| Description | Brand name | Model, Part number, Serial number, Revision level |
|--|------------|---|
| Host board with the Rigado BMD-300 + Globalstar STX3 | Carmanah | MN: BMD-300, PN: BMD-300, SN: 0-2315089, |
| Host board with the Rigado BMD-300 + Globalstar STX2 | Carmanah | MN: BMD-300, PN: BMD-300, SN: 0-000782350 |

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

As provided by client, EUT with host board of STX2 and STX3 modules have been tested.

- BMD-300 + STX2
- BMD-300 + STX3

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

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.

| 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 | FA002532 | 2 year | June 5/19 |
| Flush mount turntable | Sunol | FM2022 | FA002550 | — | NCR |
| Controller | Sunol | SC104V | FA002551 | — | NCR |
| Antenna mast | Sunol | TLT2 | FA002552 | — | NCR |
| Power source | California Instruments | 5001ix | FA001770 | 1 year | Feb. 1/18 |
| Receiver/spectrum analyzer | Rohde & Schwarz | ESU 40 | FA002071 | 1 year | Sept. 18/18 |
| Biconical antenna (30–300 MHz) | Sunol | BC2 | FA002078 | 1 year | May 8/18 |
| Log periodic antenna (200–5000 MHz) | Sunol | LP5 | FA002077 | 1 year | May 8/18 |
| Horn antenna (1–18 GHz) | EMCO | 3115 | FA001451 | 1 year | April 5/18 |
| Pre-amplifier (0.5–18 GHz) | COM-POWER | PAM-118A | FA002561 | 1 year | Sept. 21/18 |
| 2.4 GHz band Notch Filter | Microwave Circuits | N0324413 | FA002693 | — | VOU |
| 50 Ω coax cable | C.C.A. | None | FA002603 | — | VOU |
| 50 Ω coax cable | C.C.A. | None | FA002605 | — | VOU |
| 50 Ω coax cable | C.C.A. | None | FA002831 | — | VOU |

Note: NCR - no calibration required, VOU - verify on use

Section 8. Testing data

8.1 FCC 15.209 and RSS-GEN section 8.9 Radiated emission limits; general requirements

8.1.1 Definitions and limits

FCC:
(f) In accordance with §15.33(a), in some cases the emissions from an intentional radiator must be measured to beyond the tenth harmonic of the highest fundamental frequency designed to be emitted by the intentional radiator because of the incorporation of a digital device. If measurements above the tenth harmonic are so required, the radiated emissions above the tenth harmonic shall comply with the general radiated emission limits applicable to the incorporated digital device, as shown in §15.109 and as based on the frequency of the emission being measured, or, except for emissions contained in the restricted frequency bands shown in §15.205, the limit on spurious emissions specified for the intentional radiator, whichever is the higher limit. Emissions which must be measured above the tenth harmonic of the highest fundamental frequency designed to be emitted by the intentional radiator and which fall within the restricted bands shall comply with the general radiated emission limits in §15.109 that are applicable to the incorporated digital device.

ISED:
Except when the requirements applicable to a given device state otherwise, emissions from licence - exempt transmitters shall comply with the field strength limits shown in Table below. Additionally, the level of any transmitter emission shall not exceed the level of the transmitter's fundamental emission.

Table 8.1-1: 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 8.1-2: 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 Table 8.1-2 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 8.1-3: 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

| | | | |
|---------------|--|-------------------|-----------|
| Test date | November 24, 2017 to November 30, 2017 | Temperature | 25 °C |
| Test engineer | Yong Huang | Air pressure | 1004 mbar |
| Verdict | Pass | Relative humidity | 35 % |

8.1.3 Observations, settings and special notes

Radiated measurements were performed at a distance of 3 m.
The spectrum was searched from 30 MHz to 25 GHz. No emissions related to colocation was detected below 1 GHz or above 18 GHz.
EUT was set to transmit continuously during tests.

Spectrum analyser settings for radiated measurements within restricted bands 30 MHz to 1 GHz:

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

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

| | |
|-----------------------|----------|
| Resolution bandwidth: | 1 MHz |
| Video bandwidth: | 10 Hz |
| Detector mode: | Peak |
| Trace mode: | Max Hold |

8.1.4 Test data

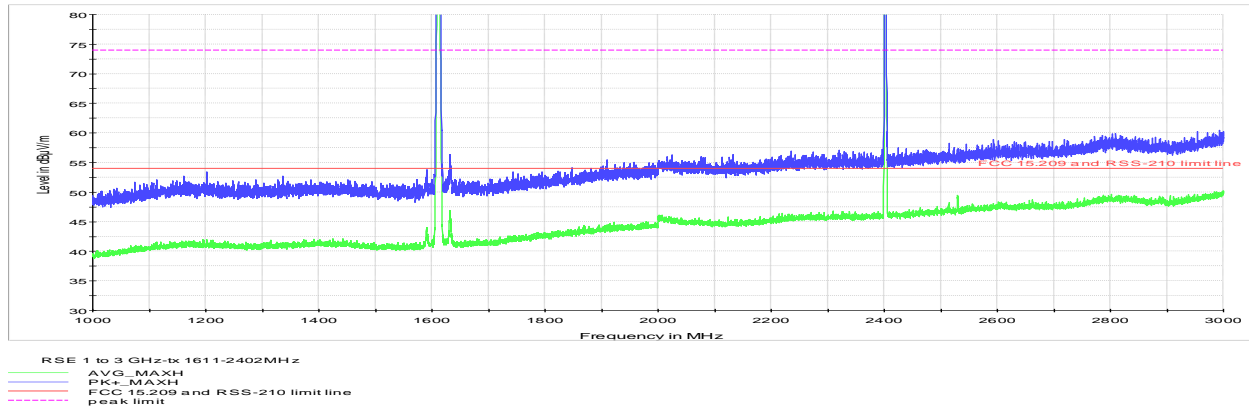


Figure 8.1-1: Radiated spurious emissions, STX2 tx at 1611 MHz, BLE tx at 2402 MHz

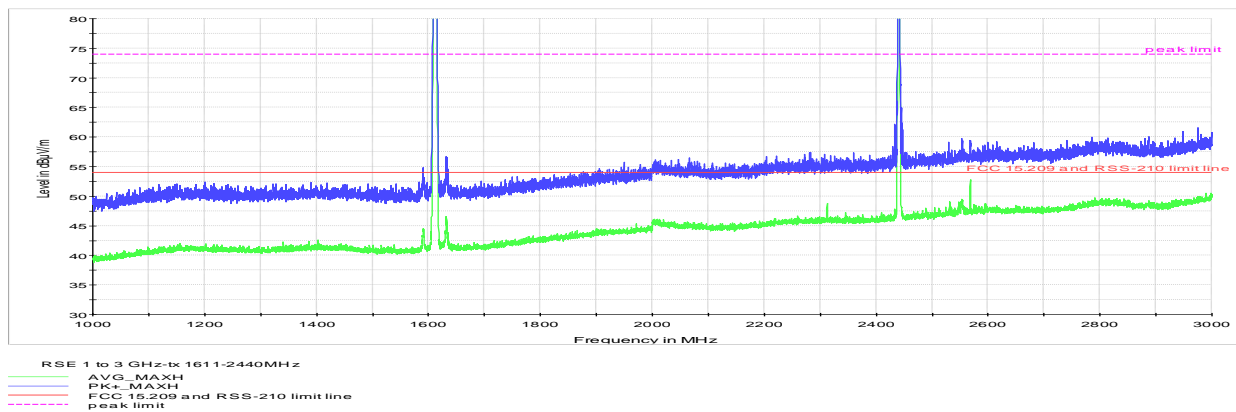


Figure 8.1-2: Radiated spurious emissions, STX2 tx at 1611 MHz, BLE tx at 2440 MHz

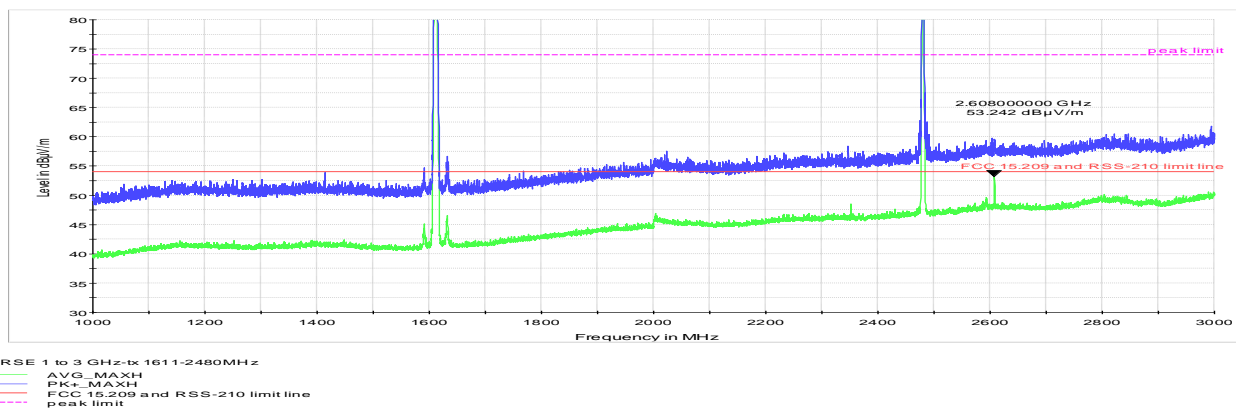


Figure 8.1-3: Radiated spurious emissions, STX2 tx at 1611 MHz, BLE tx at 2480 MHz

Note: marker on emissions in above plots were not related to inter-modulation products of the transmitter's colocation.

8.1.4 Test data, continued

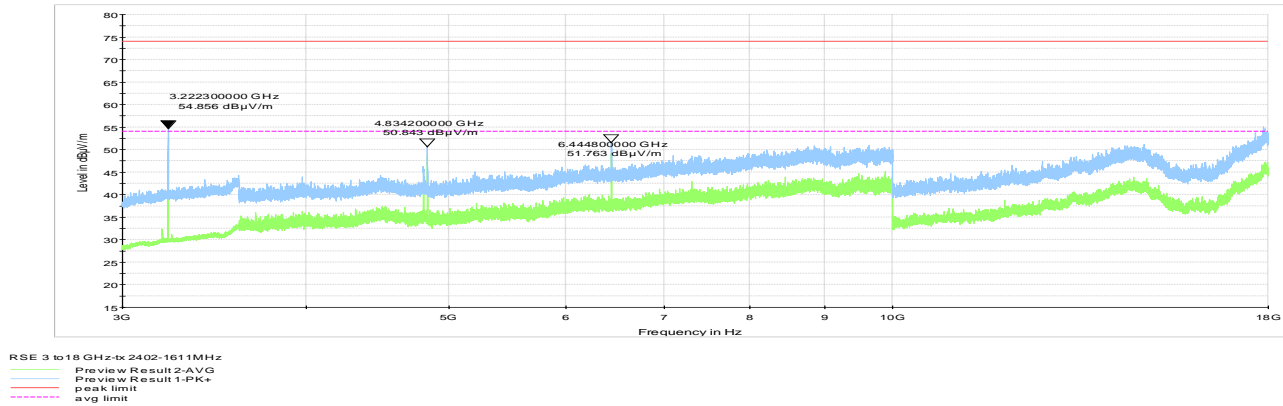


Figure 8.1-4: Radiated spurious emissions, STX2 tx at 1611 MHz, BLE tx at 2402 MHz

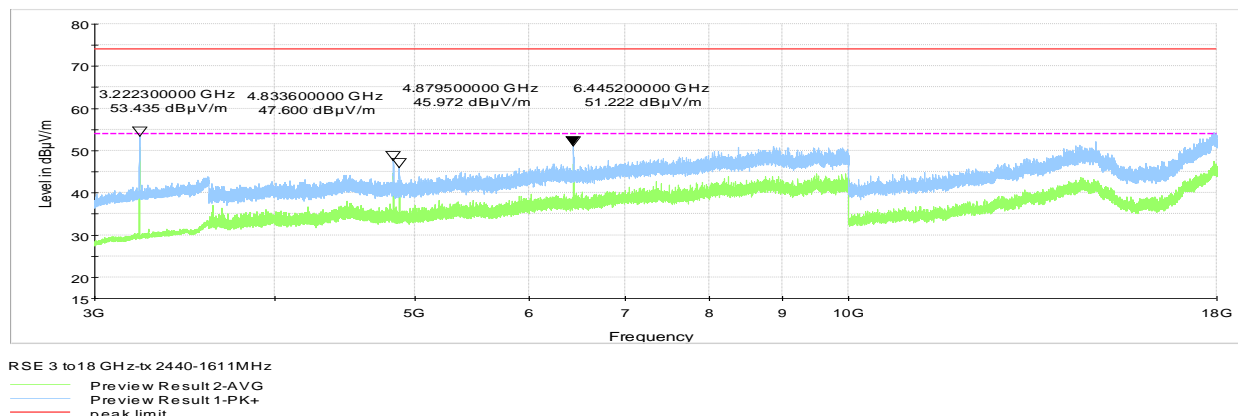


Figure 8.1-5: Radiated spurious emissions, STX2 tx at 1611 MHz, BLE tx at 2440 MHz

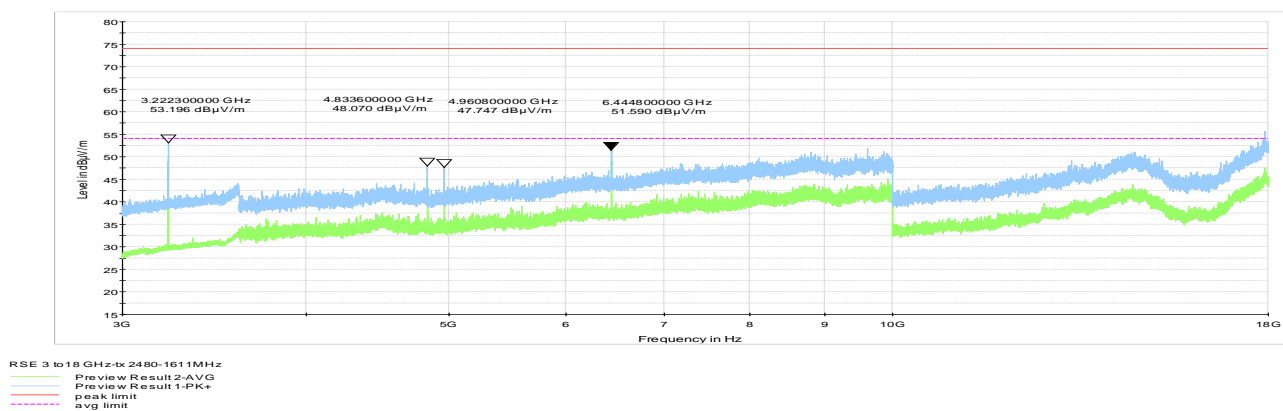


Figure 8.1-6: Radiated spurious emissions, STX2 tx at 1611 MHz, BLE tx at 2480 MHz

Note: marker on emissions in above plots were not related to inter-modulation products of the transmitter's colocation.

8.1.4 Test data, continued

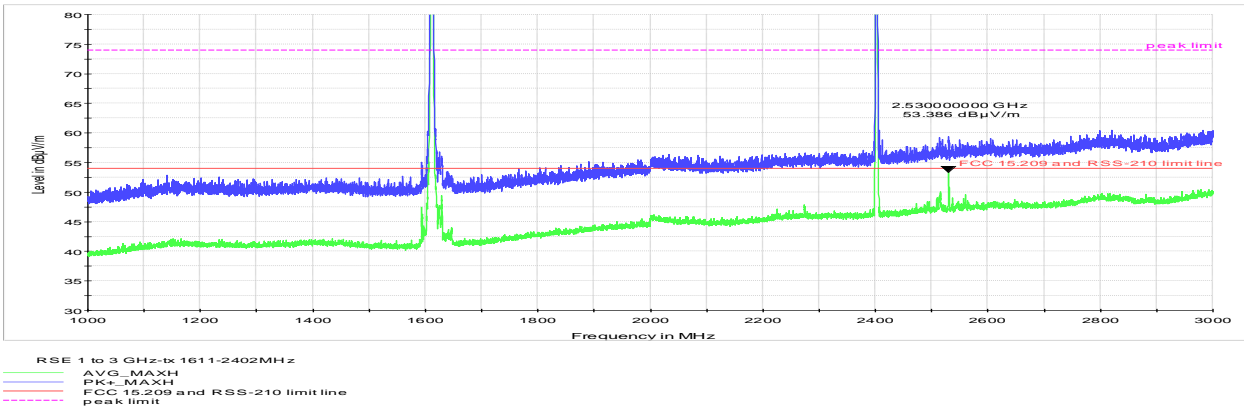


Figure 8.1-7: Radiated spurious emissions, STX3 tx at 1611 MHz, BLE tx at 2402 MHz

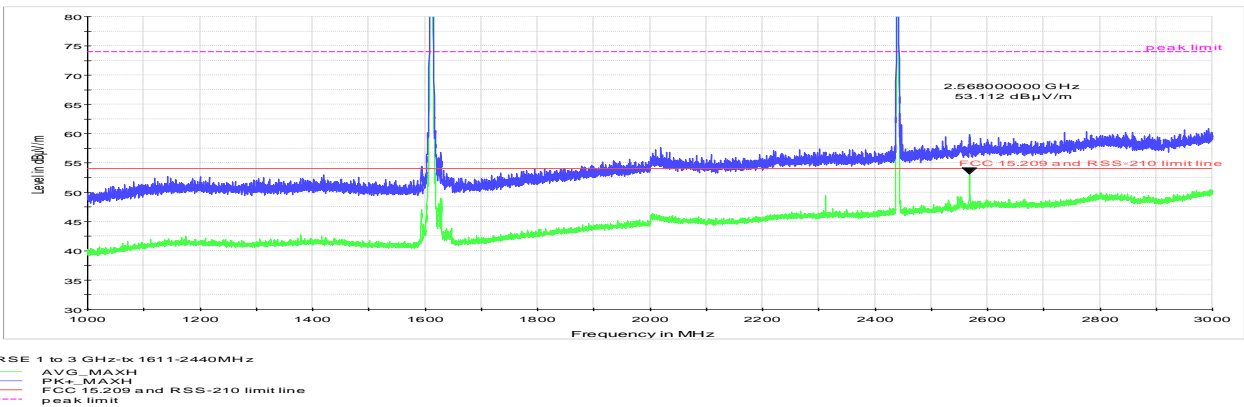


Figure 8.1-8: Radiated spurious emissions, STX3 tx at 1611 MHz, BLE tx at 2440 MHz

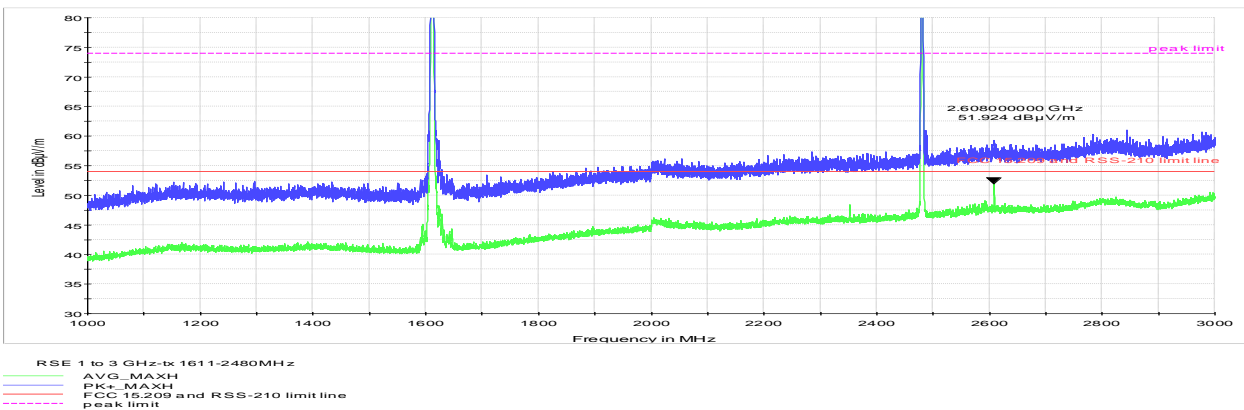


Figure 8.1-9: Radiated spurious emissions, STX3 tx at 1611 MHz, BLE tx at 2480 MHz

Note: marker on emissions in above plots were not related to inter-modulation products of the transmitter's colocation.

8.1.4 Test data, continued

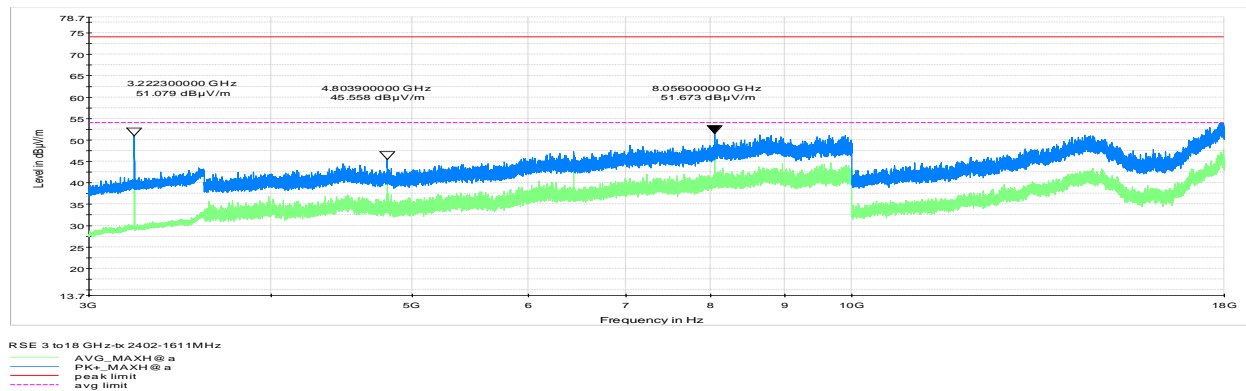


Figure 8.1-10: Radiated spurious emissions, STX3 tx at 1611 MHz, BLE tx at 2402 MHz

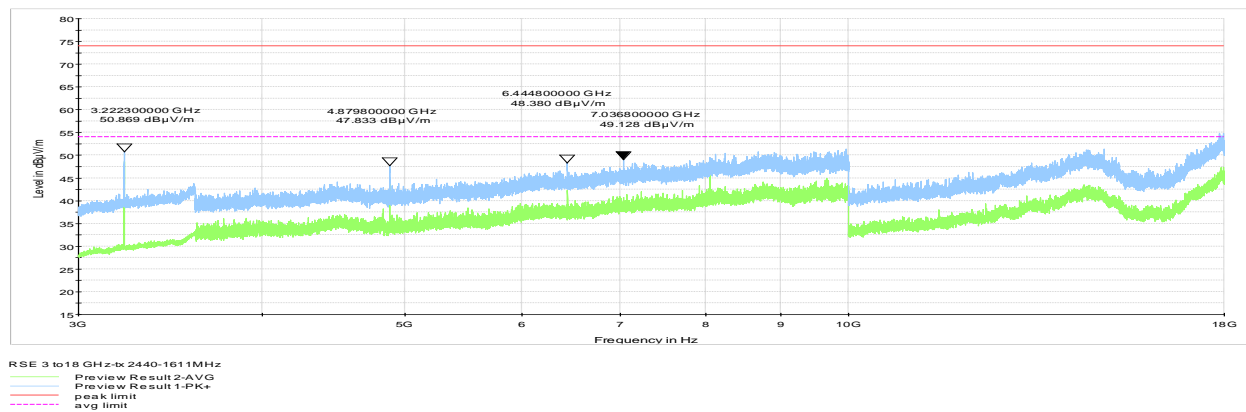


Figure 8.1-11: Radiated spurious emissions, STX3 tx at 1611 MHz, BLE tx at 2440 MHz

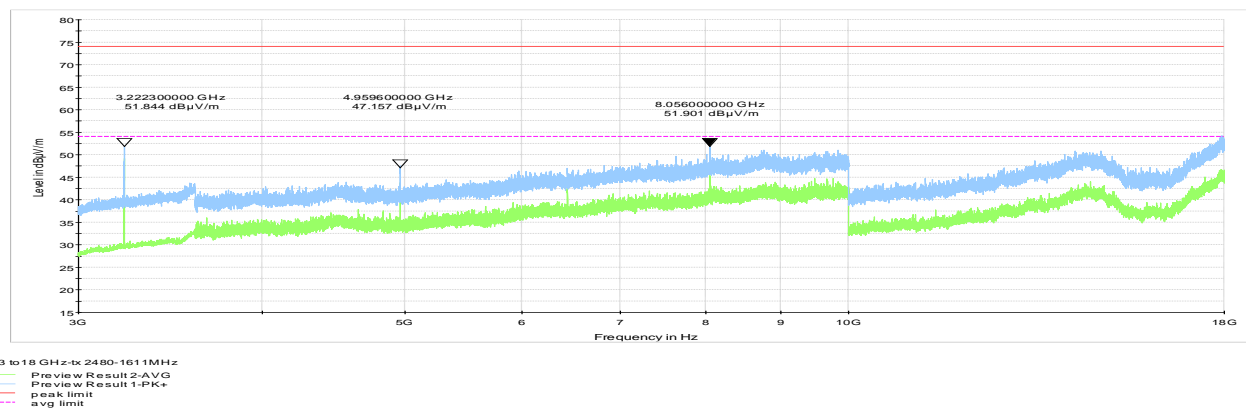
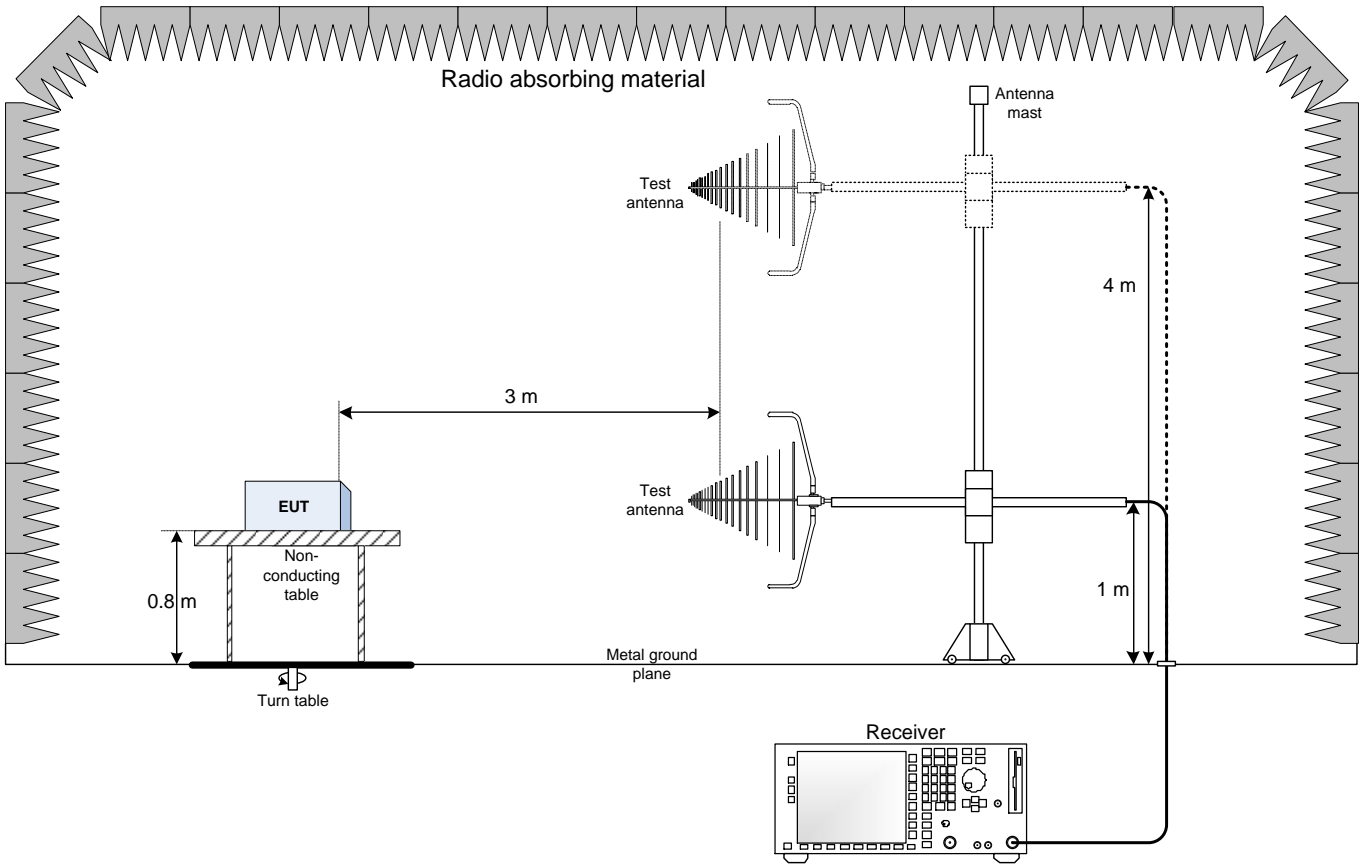


Figure 8.1-12: Radiated spurious emissions, STX3 tx at 1611 MHz, BLE tx at 2480 MHz

Note: marker on emissions in above plots were not related to inter-modulation products of the transmitter's colocation.

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

