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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:	

Nemko Canada Inc., a testing laboratory, is accredited by the Standards Council of Canada. The tests included in this report are within the scope of this accreditation

Test location(s)

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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.

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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

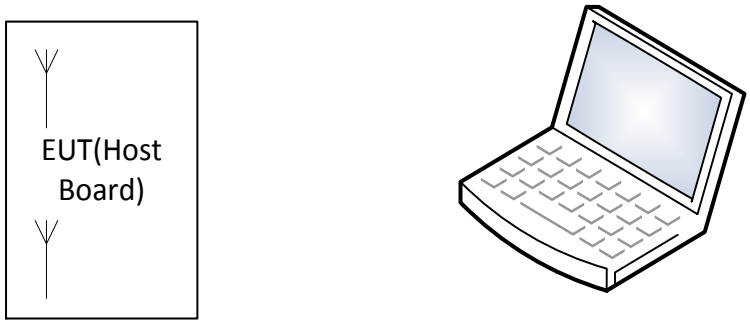


Figure 3.6-1: *Setup diagram*

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 ±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

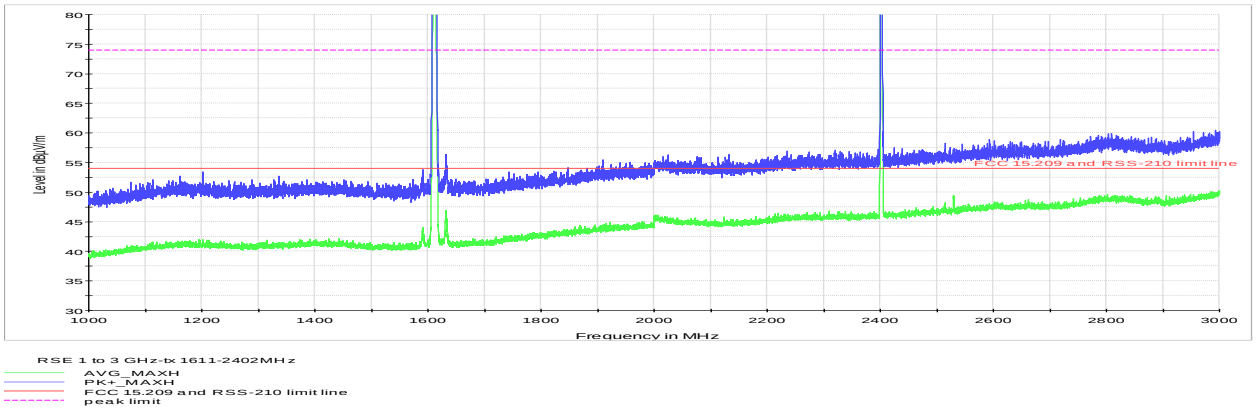


Figure 8.1-1: *Radiated spurious emissions, STX2 tx at 1611 MHz, BLE tx at 2402 MHz*

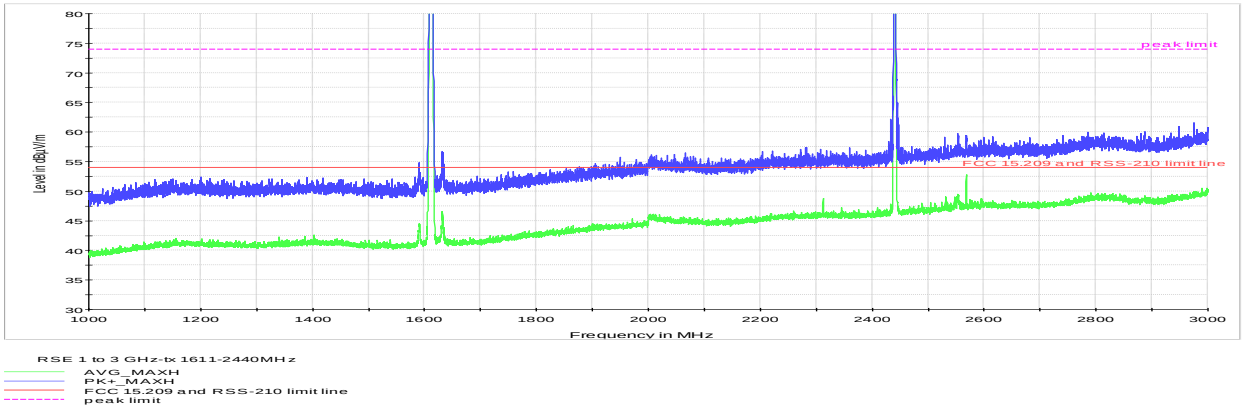


Figure 8.1-2: *Radiated spurious emissions, STX2 tx at 1611 MHz, BLE tx at 2440 MHz*

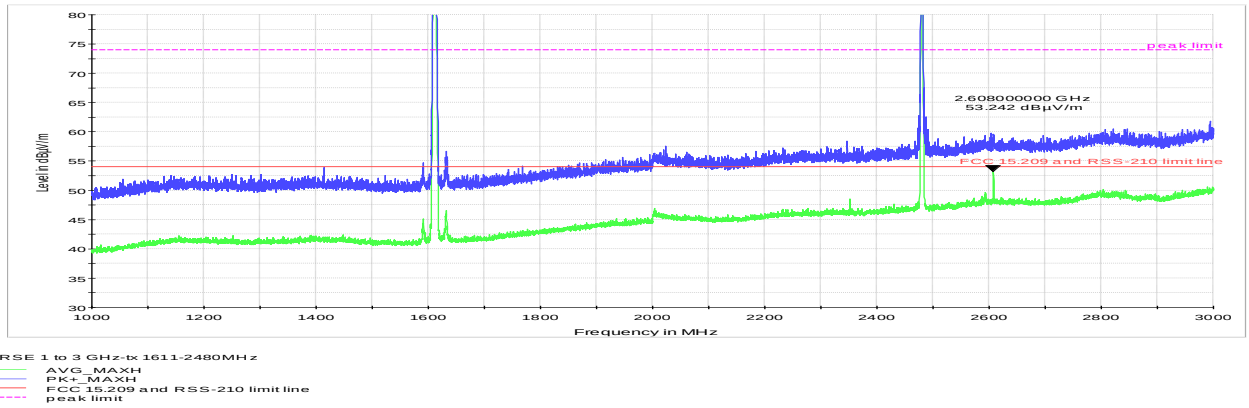


Figure 8.1-3: *Radiated spurious emissions, STX2 tx at 1611 MHz, BLE tx at 2480 MHz*

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

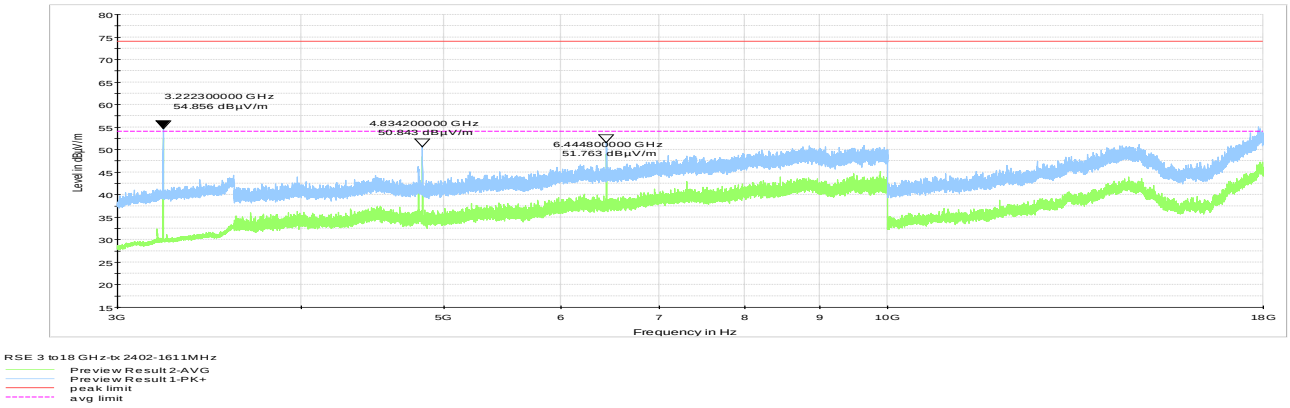


Figure 8.1-4: *Radiated spurious emissions, STX2 tx at 1611 MHz, BLE tx at 2402 MHz*

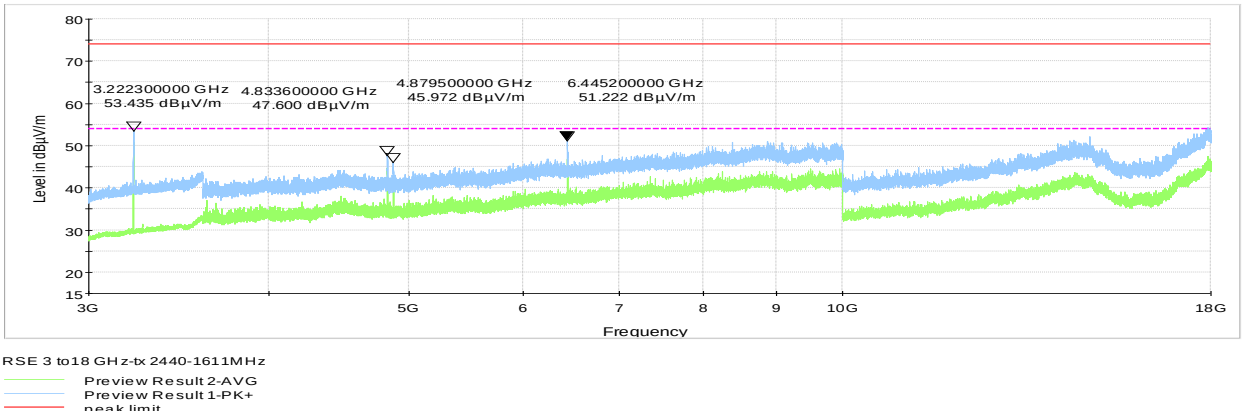


Figure 8.1-5: *Radiated spurious emissions, STX2 tx at 1611 MHz, BLE tx at 2440 MHz*

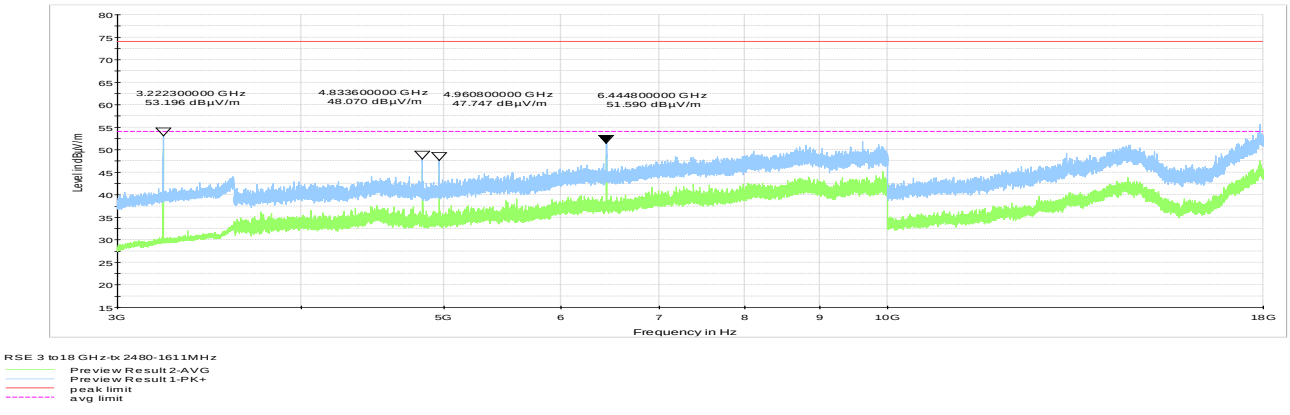


Figure 8.1-6: *Radiated spurious emissions, STX2 tx at 1611 MHz, BLE tx at 2480 MHz*

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

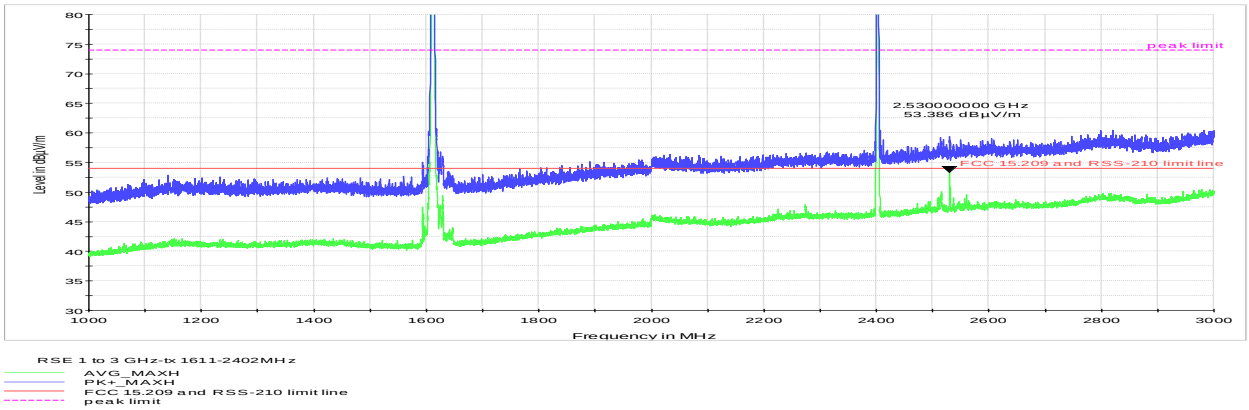


Figure 8.1-7: *Radiated spurious emissions, STX3 tx at 1611 MHz, BLE tx at 2402 MHz*

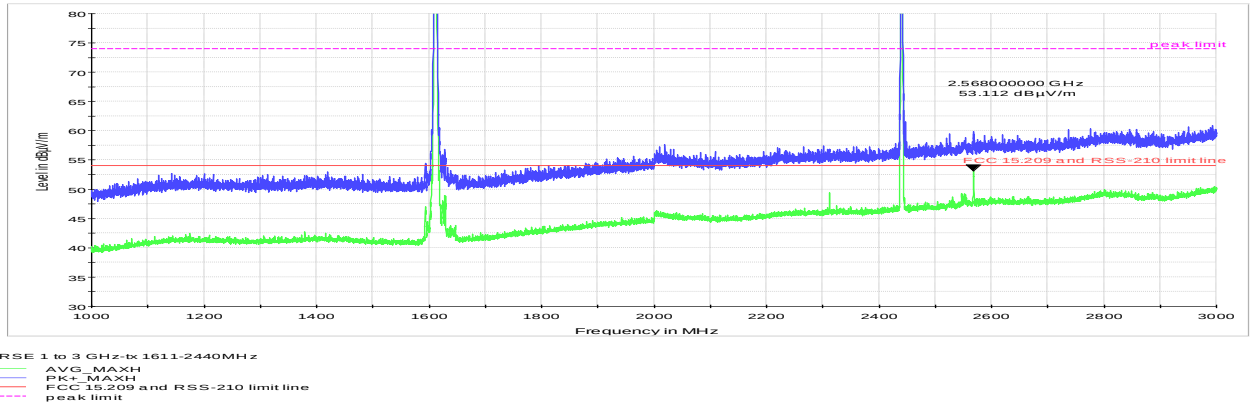


Figure 8.1-8: *Radiated spurious emissions, STX3 tx at 1611 MHz, BLE tx at 2440 MHz*

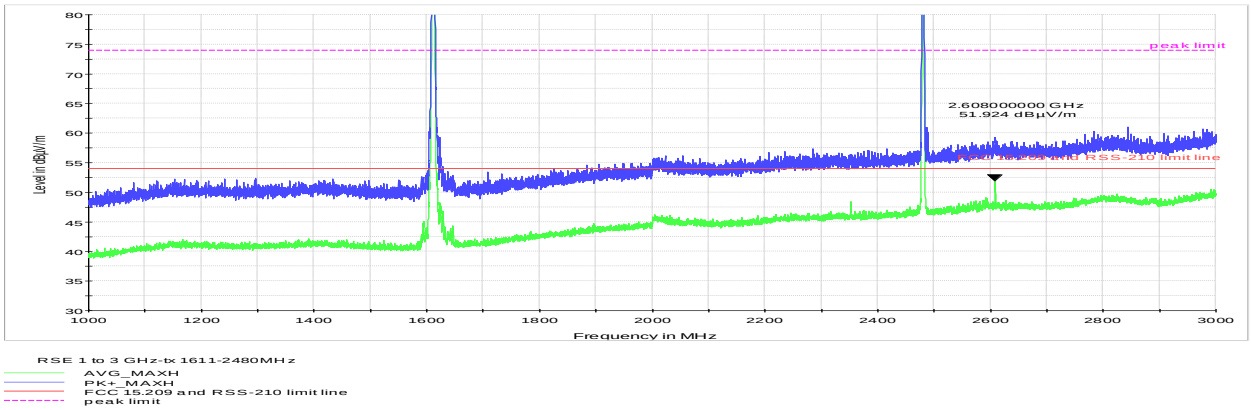


Figure 8.1-9: *Radiated spurious emissions, STX3 tx at 1611 MHz, BLE tx at 2480 MHz*

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

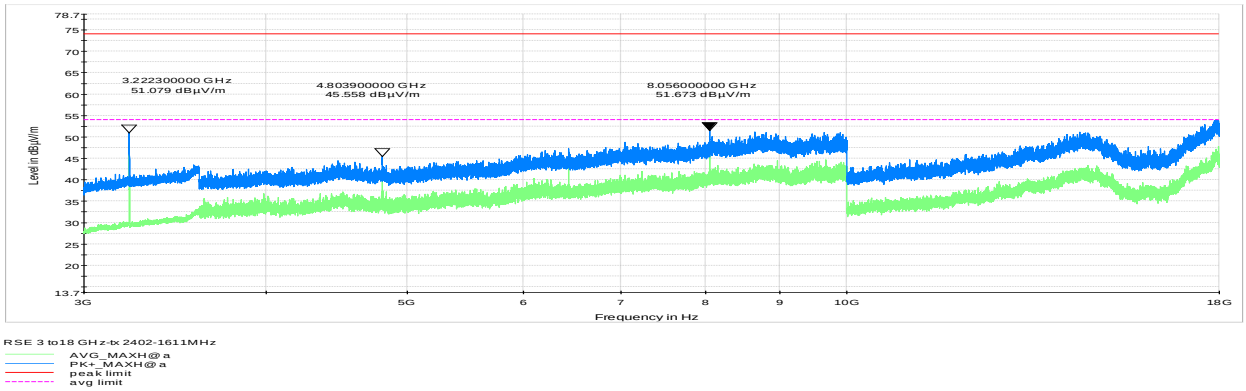


Figure 8.1-10: *Radiated spurious emissions, STX3 tx at 1611 MHz, BLE tx at 2402 MHz*

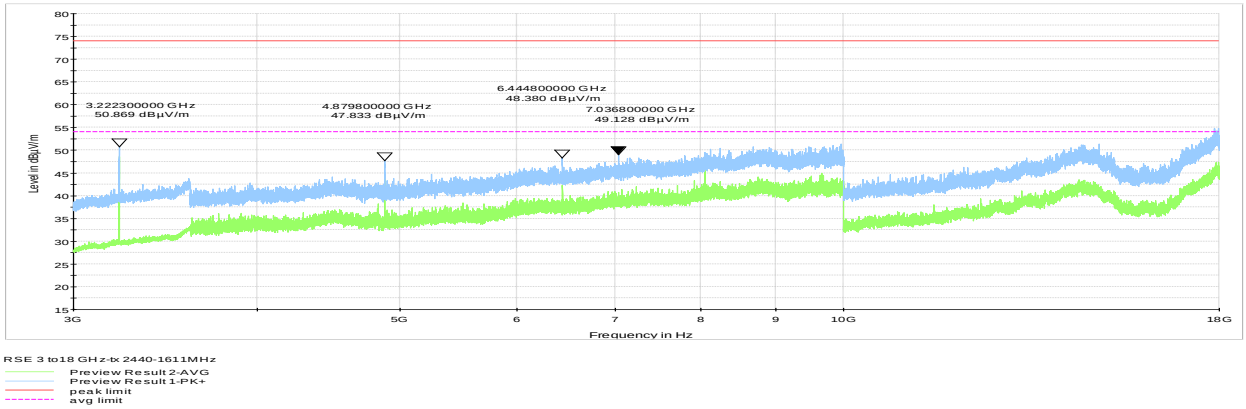


Figure 8.1-11: *Radiated spurious emissions, STX3 tx at 1611 MHz, BLE tx at 2440 MHz*

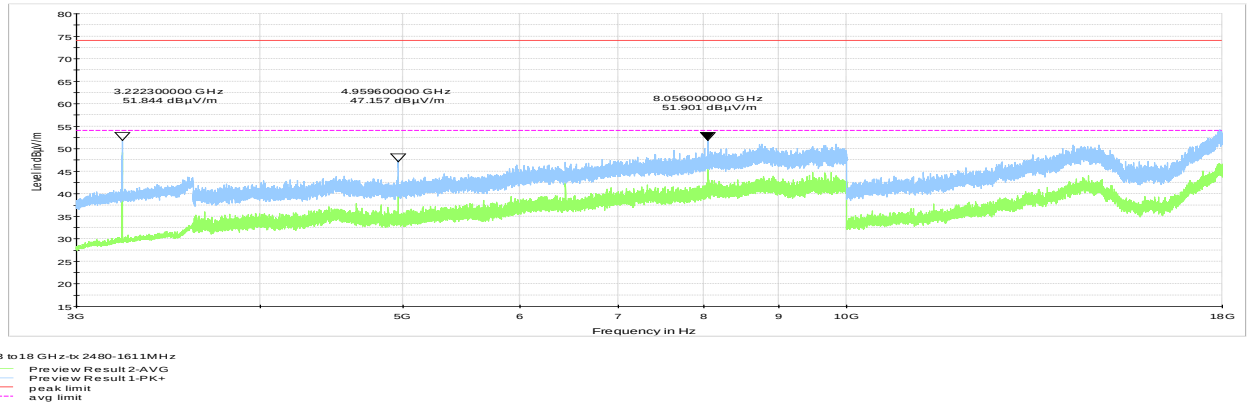
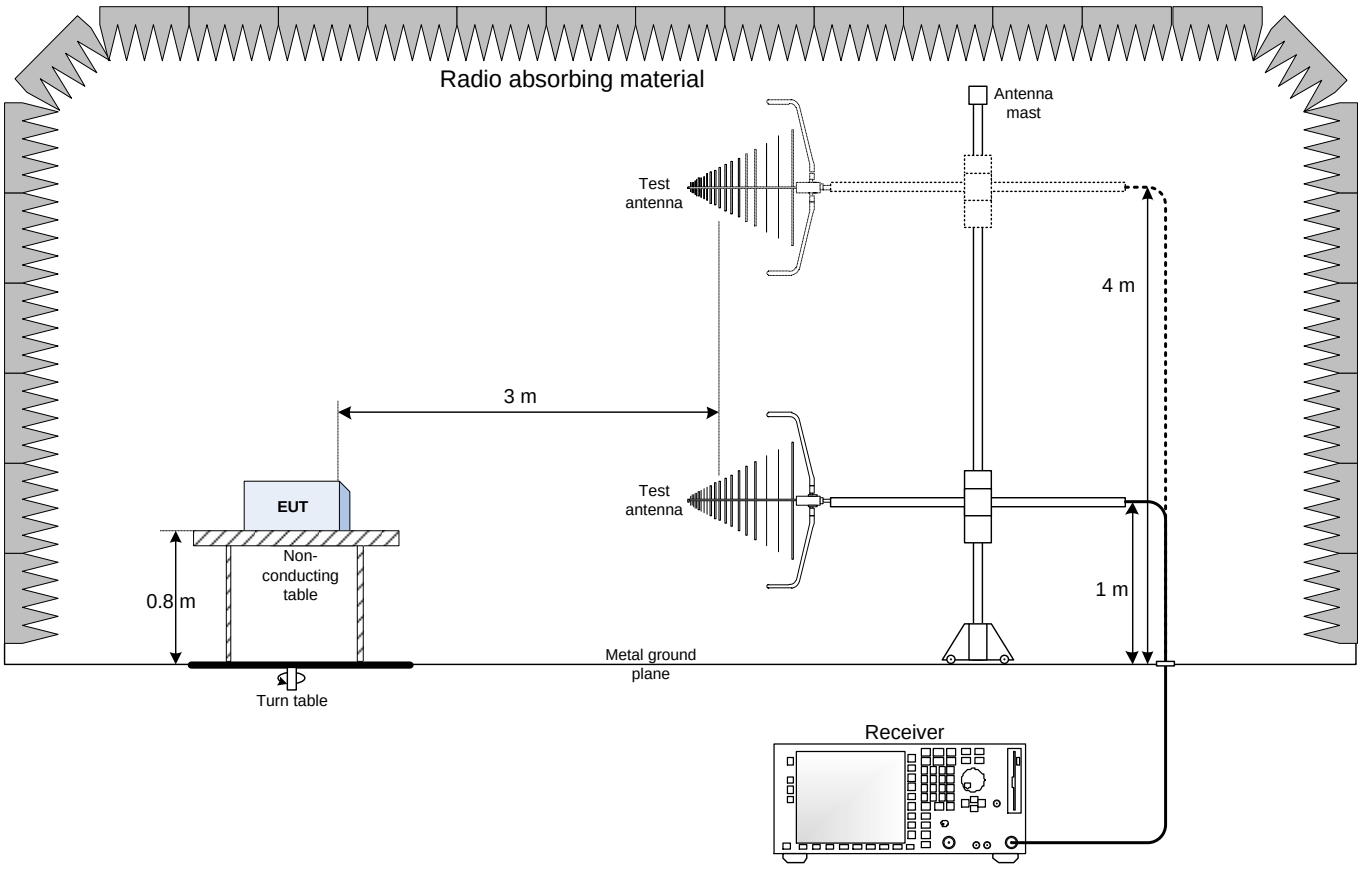
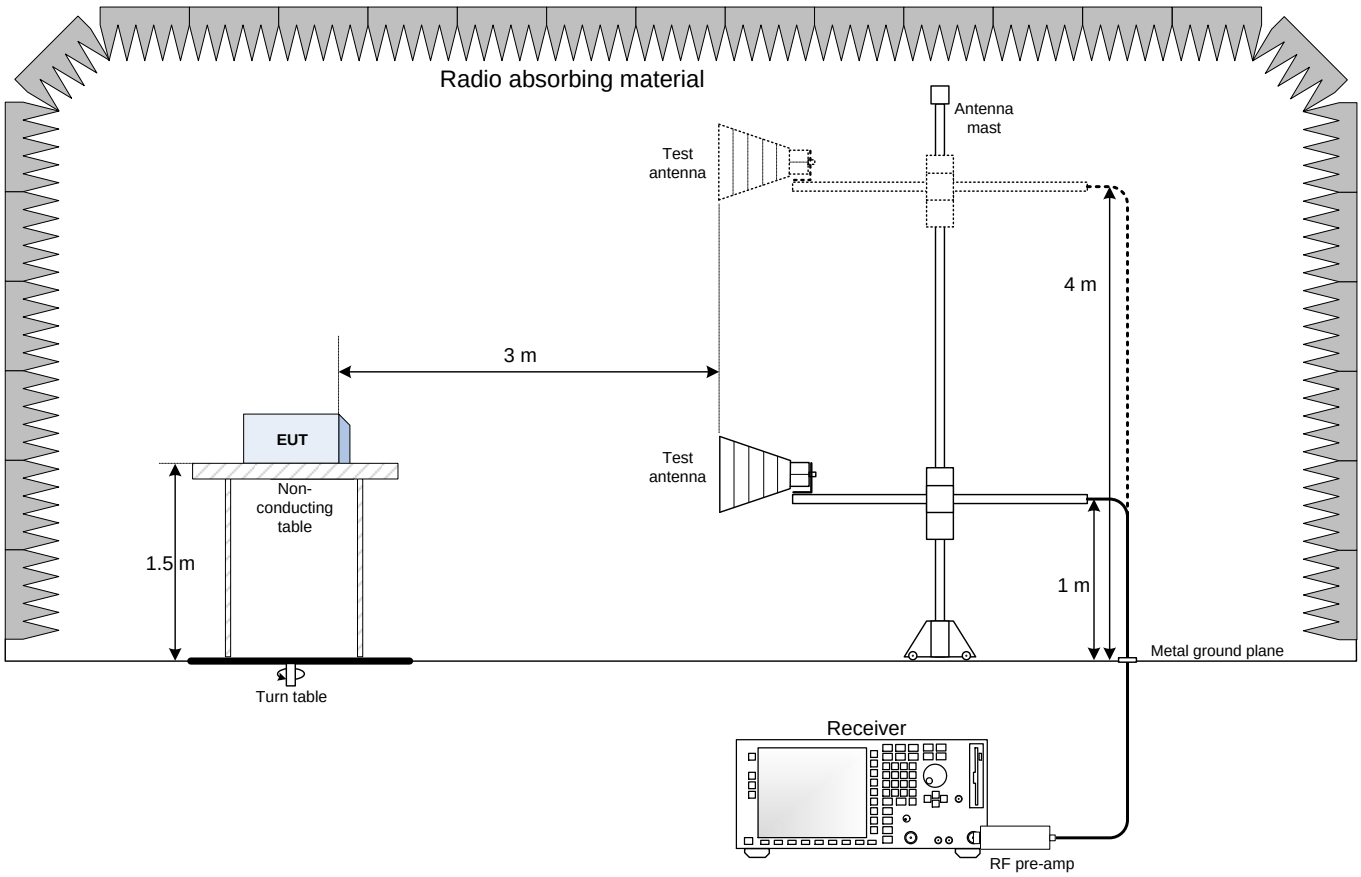


Figure 8.1-12: *Radiated spurious emissions, STX3 tx at 1611 MHz, BLE tx at 2480 MHz*

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