

Wireless test report – 338225-1TRFWL

Applicant:

Derive Systems Inc.

Product name:

VQ

Model:

Derive 40500

FCC ID:

2ANJJ-40500

Specifications:

Colocation testing.

◆ **FCC 47 CFR Part 15 Subpart C, §15.247**

Operation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz

◆ **FCC 47 CFR Part 27**

Miscellaneous Wireless Communications Services

Date of issue: **December 6, 2017**

Test engineer(s): **Andrey Adelberg, Senior Wireless/EMC Specialist**

Signature:



Reviewed by: **Kevin Rose, 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.

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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 Statement of compliance	4
1.4 Exclusions	4
1.5 Test report revision history	4
Section 2. Summary of test results	5
2.1 Test results summary	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 EUT exercise details	6
3.5 EUT setup diagram	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 15.247(d) and 27.53 Spurious (out-of-band) unwanted emissions	12
Section 9. Block diagrams and photos of test set-ups	33
9.1 Radiated emissions set-up diagram for frequencies below 1 GHz	33
9.2 Radiated emissions set-up diagram for frequencies above 1 GHz	34
9.3 Radiated emissions set-up photo for frequencies below 1 GHz	35
9.4 Radiated emissions set-up diagram for frequencies above 1 GHz	36

Section 1. Report summary

1.1 Applicant and manufacturer

Company name	Derive Systems Inc.
Address	4150 Church St Suite 1024
City	Sanford
Province/State	FL
Postal/Zip code	32771
Country	USA

1.2 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
FCC 47 CFR Part 27	Miscellaneous Wireless Communications Services

1.3 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 1.4 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.

1.4 Exclusions

Only limited subset of testing (simultaneous radiated spurious emission) was performed to assess Wi-Fi and LTE colocation.

1.5 Test report revision history

Revision #	Date of issue	Details of changes made to test report
TRF	December 6, 2017	Original report issued

Section 2. Summary of test results

2.1 Test results summary

Part	Test description	Verdict
§15.247(d)	Spurious emissions	Pass
§27(e) and (h)	Spurious emissions	Pass

Note: for transmitter colocation test purposes only limited subset of testing was performed.

Section 3. Equipment under test (EUT) details

3.1 Sample information

Receipt date	November 16, 2017
Nemko sample ID number	2

3.2 EUT information

Product name	VQ
Model	Derive 40500
Model variant	N/A
Serial number	FCC1

3.3 Technical information

Frequency band (Wi-Fi)	2400–2483.5 MHz
Frequency band (LTE Band 4)	1710–1755 MHz
Frequency band (LTE Band 13)	777–787 MHz
Type of modulation (Wi-Fi)	802.11b/g/n
Type of modulation (LTE)	QPSK/16-QAM

3.4 EUT exercise details

For colocation testing purposes limited subset of testing was performed.

Simultaneous operation of Wi-Fi and LTE transmitter was assessed in the following configurations:

1. Wi-Fi on low channel + LTE Band 4 at low channel
2. Wi-Fi on low channel + LTE Band 4 at high channel
3. Wi-Fi on low channel + LTE Band 13 at mid channel
4. Wi-Fi on mid channel + LTE Band 4 at low channel
5. Wi-Fi on mid channel + LTE Band 4 at high channel
6. Wi-Fi on mid channel + LTE Band 13 at mid channel
7. Wi-Fi on high channel + LTE Band 4 at low channel
8. Wi-Fi on high channel + LTE Band 4 at high channel
9. Wi-Fi on high channel + LTE Band 13 at mid channel

3.5 EUT setup diagram

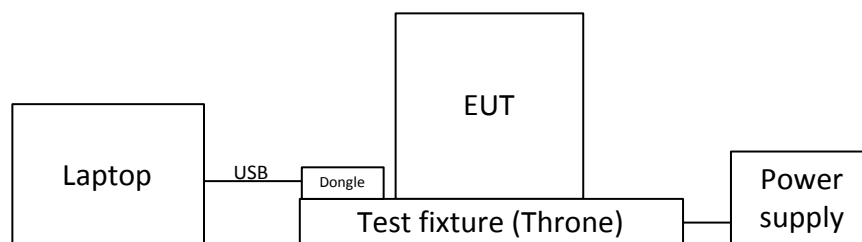


Figure 3.5-1: Setup diagram

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

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	FA002047	1 year	Dec. 1/17
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
Preamp (1–18 GHz)	ETS-Lindgren	124334	FA002873	1 year	Nov. 3/18
Bilog antenna (20–3000 MHz)	Sunol	JB3	FA002108	1 year	June 27/18
Horn antenna (1–18 GHz)	EMCO	3115	FA000825	1 year	June 21/18

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

Section 8. Testing data

8.1 FCC 15.247(d) and 27.53 Spurious (out-of-band) unwanted emissions

8.1.1 Definitions and limits

FCC 15.247:

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)).

FCC 27.53:

(e)(3) On any frequency outside the 775–776 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least $43 + 10 \log(P)$ dB;

(h) AWS emission limits—(1) General protection levels. For operations in the 1710–1755 MHz band, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10}(P)$ dB.

Table 8.1-1: FCC §15.209 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: 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			

8.1.1 Test date

Start date [Click here to enter a date.](#)

8.1.2 Observations, settings and special notes

The spectrum was searched from 30 MHz to the 10th harmonic.

EUT was set to transmit with 100 % duty cycle.

Radiated measurements were performed at a distance of 3 m.

EIRP limit for LTE (-13 dBm) was converted to the field strength equivalent measured at the distance of 3 m for convenience of presenting on the same plot with the Wi-Fi limits.

To speed up the scan times, average measurement was performed with much higher video band width settings than required, providing stringent measurements results still complying with the limits.

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

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

Resolution bandwidth:	1 MHz
Video bandwidth:	100 kHz
Detector mode:	Peak
Trace mode:	Max Hold

8.1.4 Test data

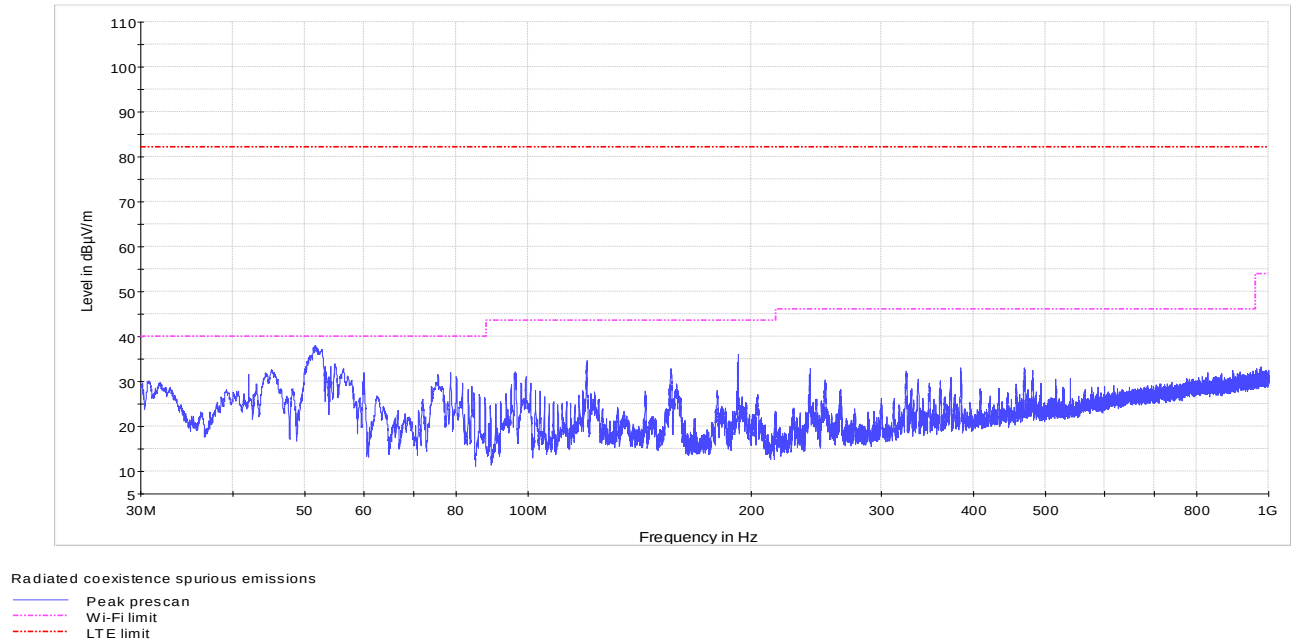


Figure 8.1-1: Radiated emissions within 30–1000 MHz, Wi-Fi low channel, LTE B4 low channel

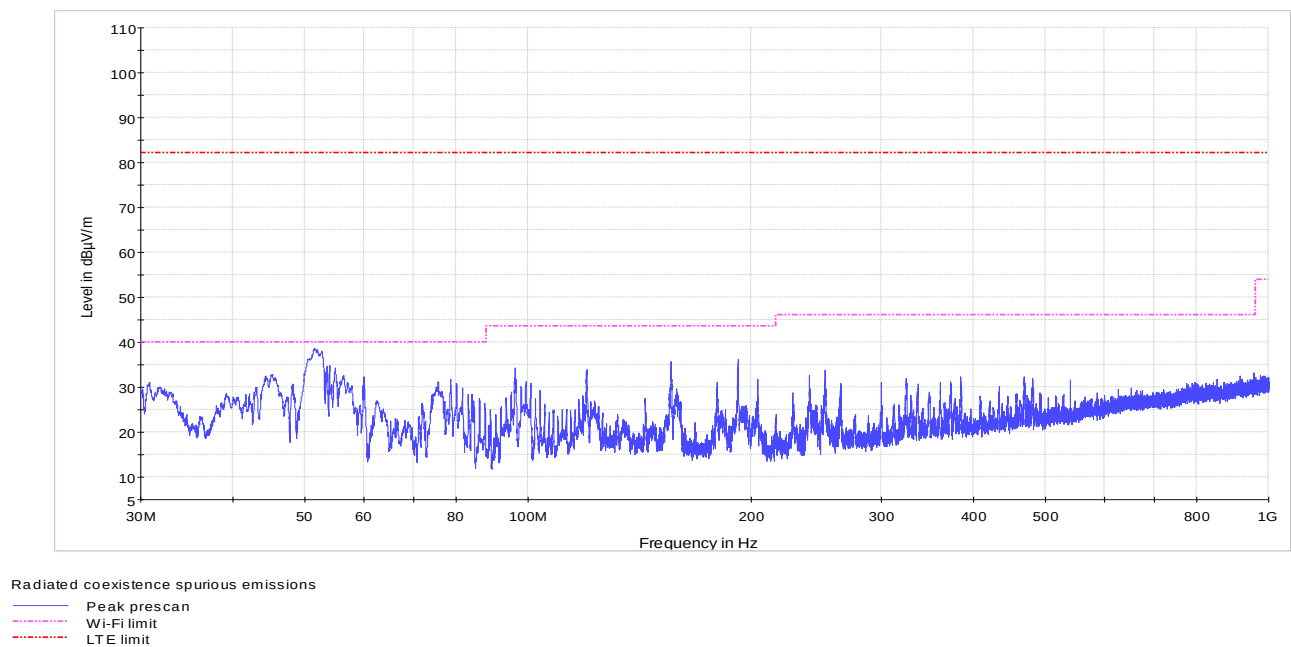
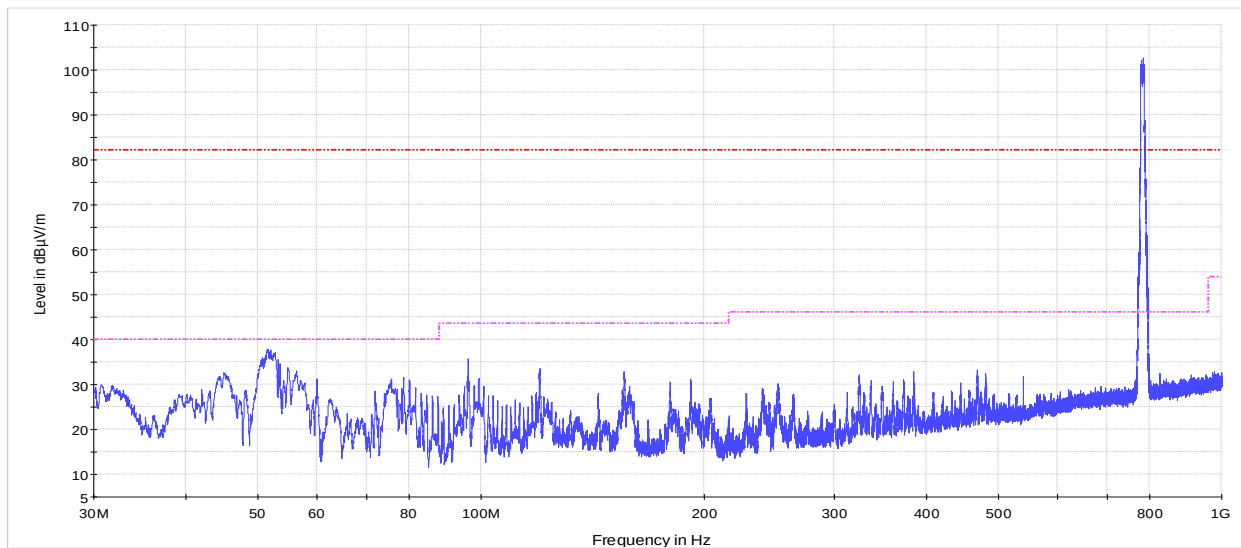


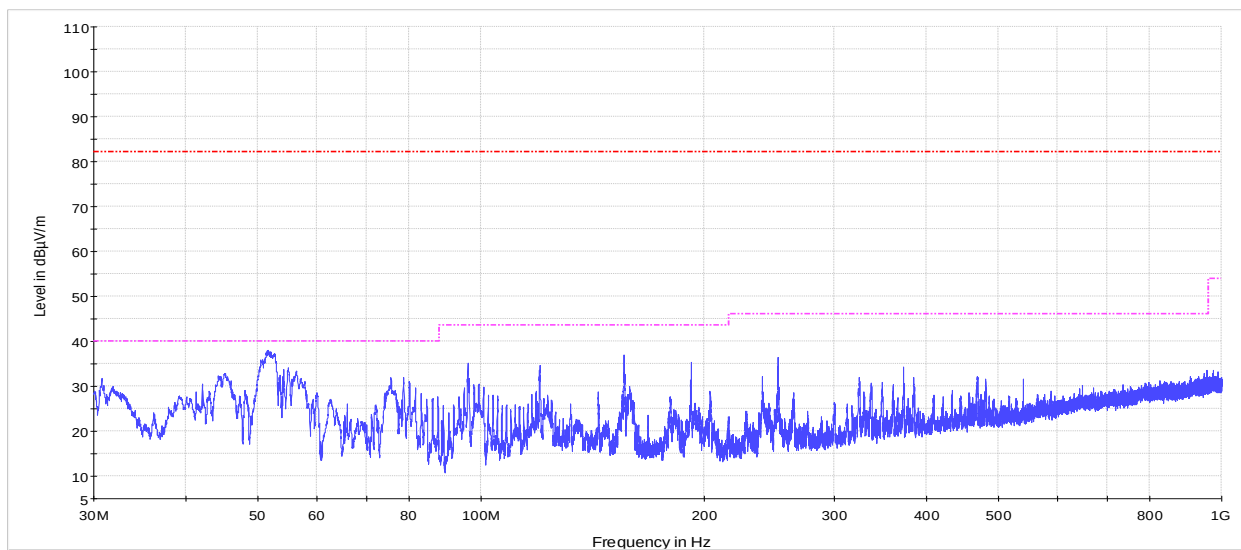
Figure 8.1-2: Radiated emissions within 30–1000 MHz, Wi-Fi low channel, LTE B4 high channel



Radiated coexistence spurious emissions

— Peak prescan
- - - Wi-Fi limit
- - - LTE limit

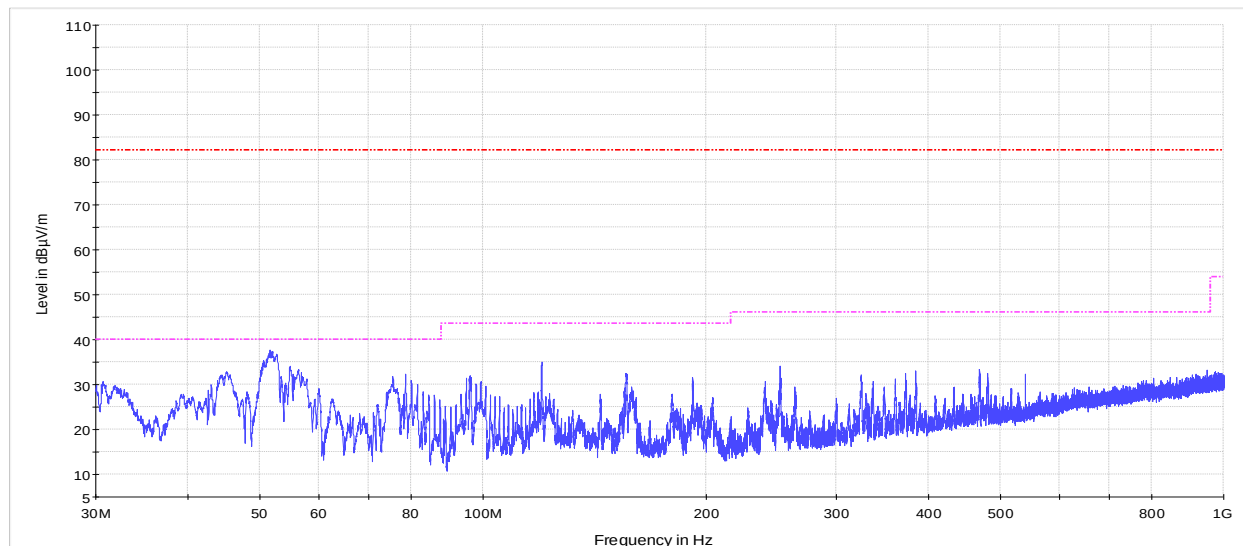
Figure 8.1-3: Radiated emissions within 30–1000 MHz, Wi-Fi low channel, LTE B13 mid channel



Radiated coexistence spurious emissions

— Peak prescan
- - - Wi-Fi limit
- - - LTE limit

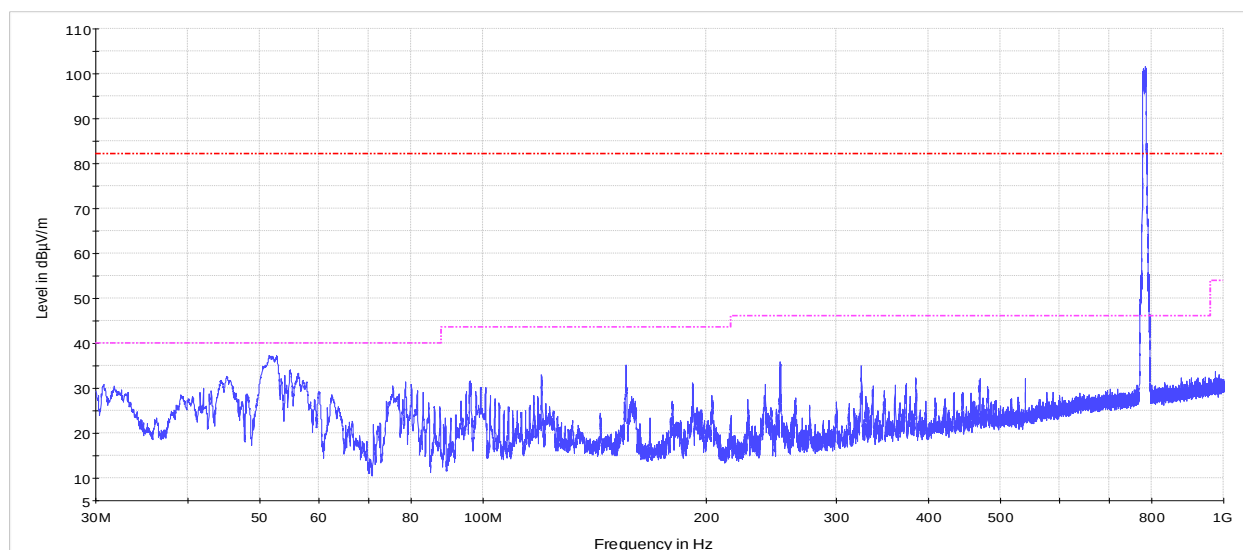
Figure 8.1-4: Radiated emissions within 30–1000 MHz, Wi-Fi mid channel, LTE B4 low channel



Radiated coexistence spurious emissions

— Peak prescan
- - - Wi-Fi limit
- - - LTE limit

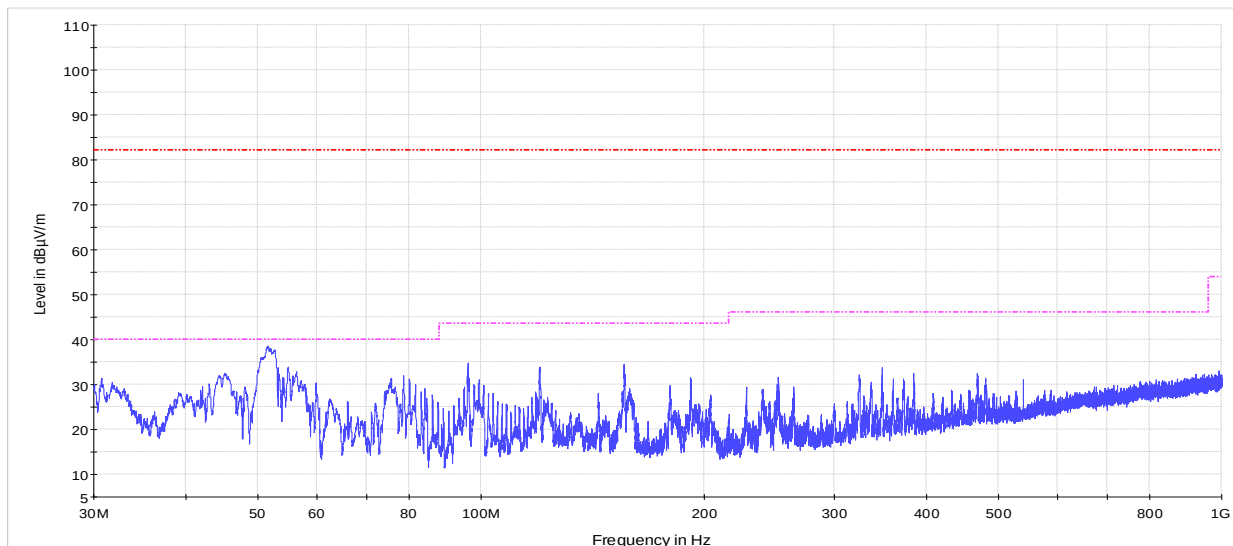
Figure 8.1-5: Radiated emissions within 30–1000 MHz, Wi-Fi mid channel, LTE B4 high channel



Radiated coexistence spurious emissions

— Peak prescan
- - - FCC Part 15.209 limit
- - - -13 dBm equiv 82.23 dBuV

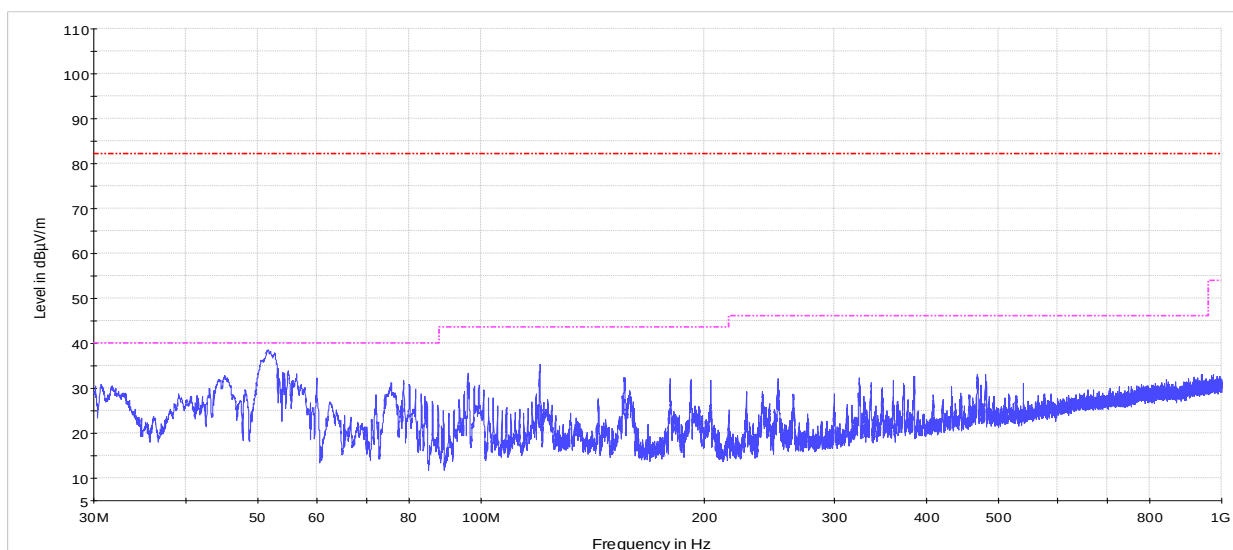
Figure 8.1-6: Radiated emissions within 30–1000 MHz, Wi-Fi mid channel, LTE B13 mid channel



Radiated coexistence spurious emissions

— Peak prescan
- - - Wi-Fi limit
- - - LTE limit

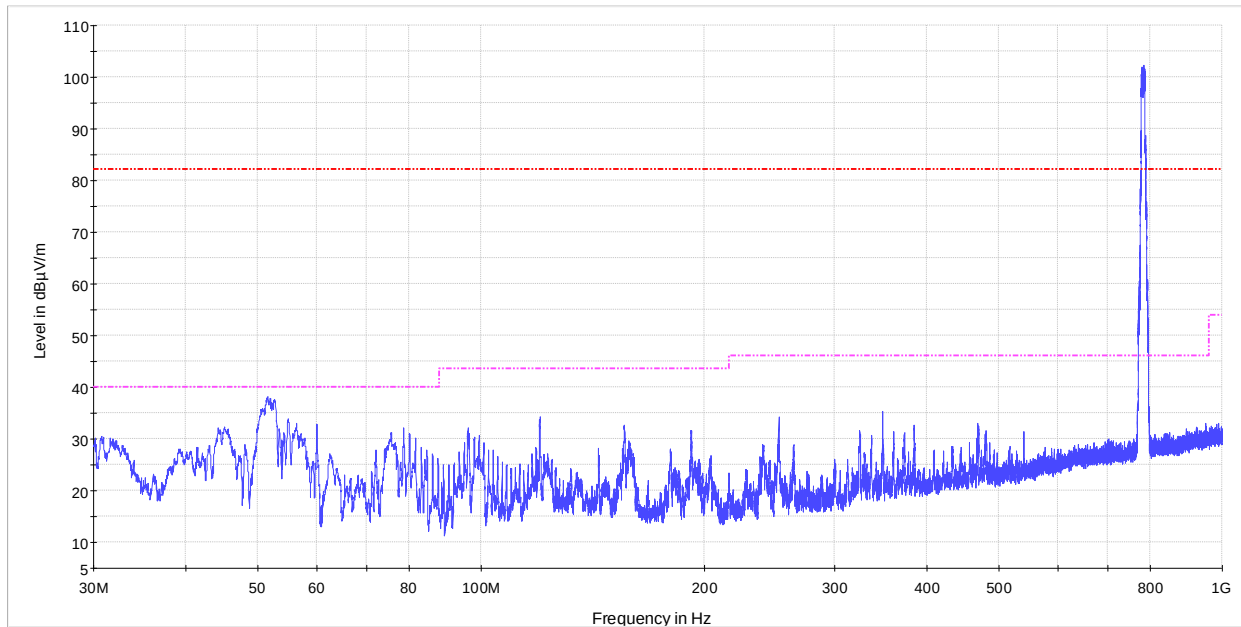
Figure 8.1-7: Radiated emissions within 30–1000 MHz, Wi-Fi high channel, LTE B4 low channel



Radiated coexistence spurious emissions

— Peak prescan
- - - Wi-Fi limit
- - - LTE limit

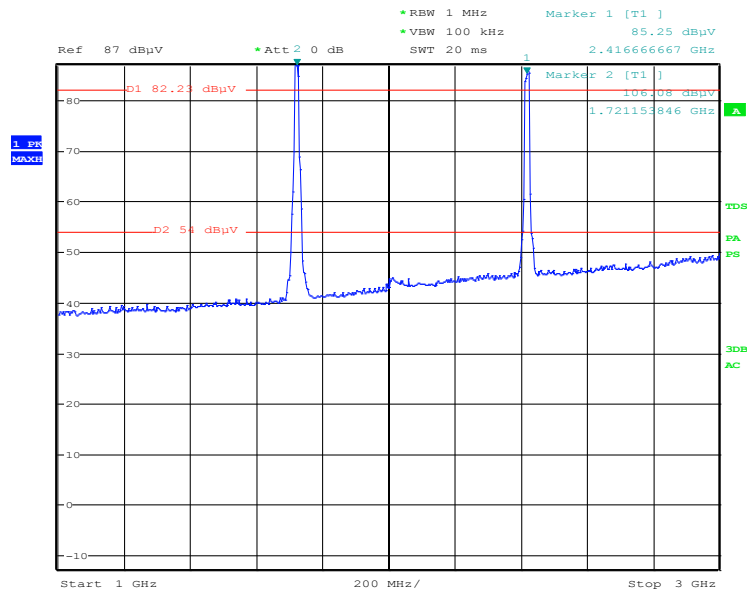
Figure 8.1-8: Radiated emissions within 30–1000 MHz, Wi-Fi high channel, LTE B5 high channel



Radiated coexistence spurious emissions

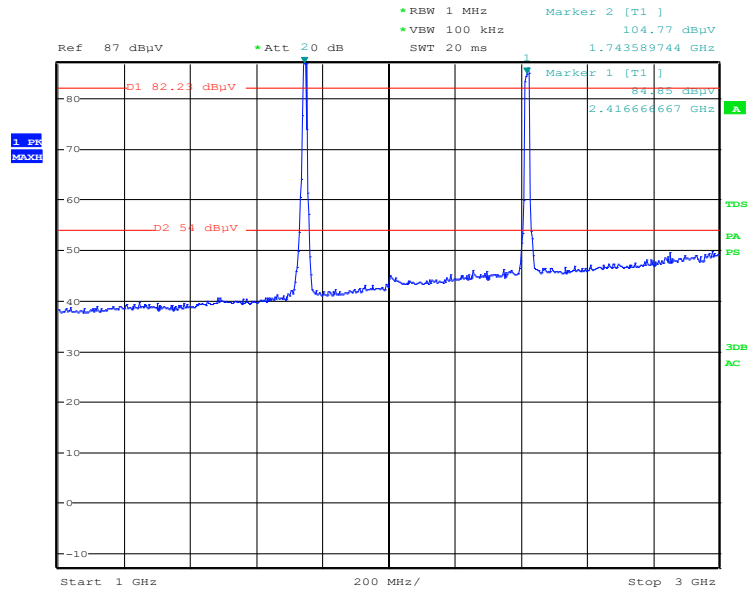
- Peak prescan
- Wi-Fi limit
- LTE limit

Figure 8.1-9: Radiated emissions within 30–1000 MHz, Wi-Fi high channel, LTE B13 mid channel



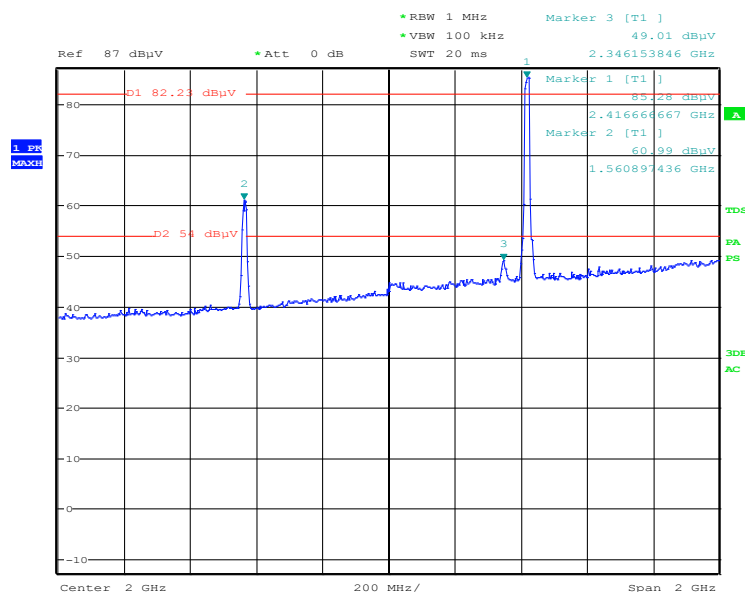
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Figure 8.1-10: Radiated emissions within 1–3 GHz, Wi-Fi low channel, LTE B4 low channel



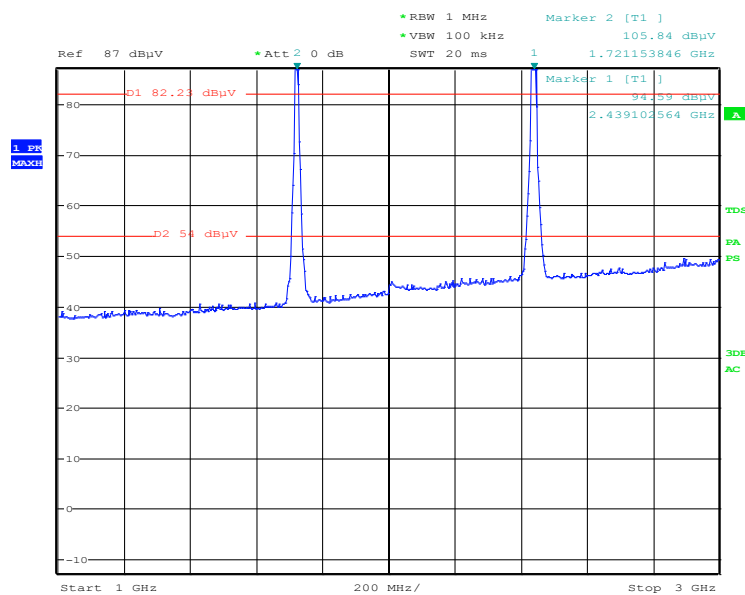
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Figure 8.1-11: Radiated emissions within 1–3 GHz, Wi-Fi low channel, LTE B4 high channel



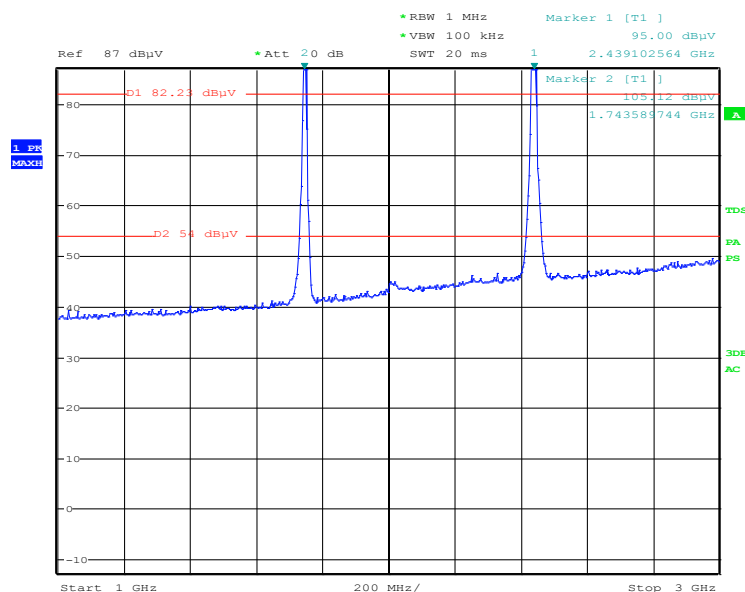
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Figure 8.1-12: Radiated emissions within 1–3 GHz, Wi-Fi low channel, LTE B13 mid channel



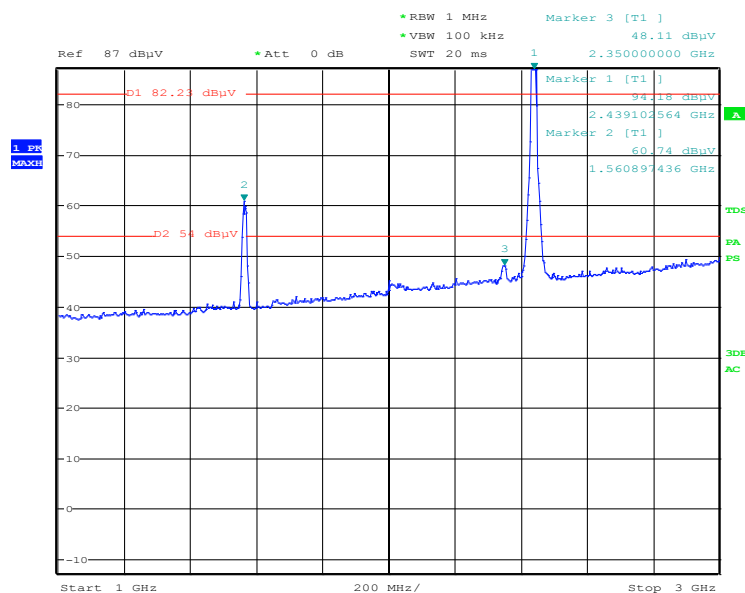
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Figure 8.1-13: Radiated emissions within 1–3 GHz, Wi-Fi mid channel, LTE B4 low channel



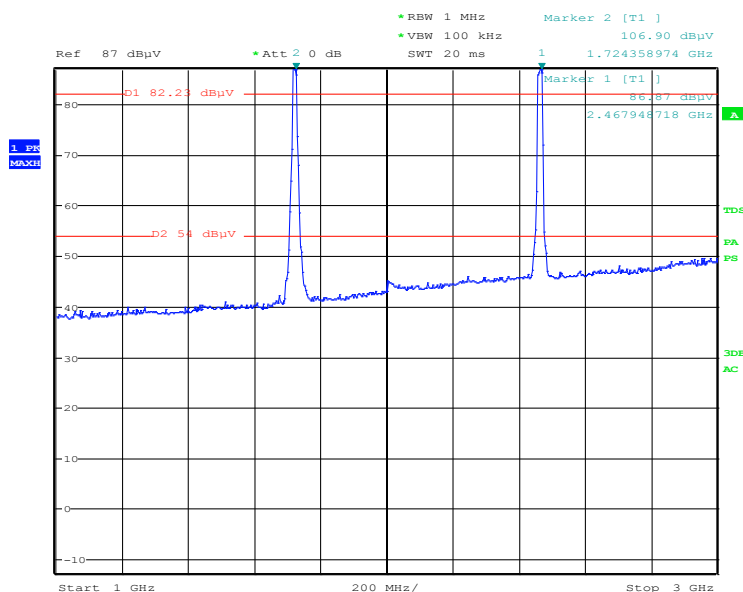
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Figure 8.1-14: Radiated emissions within 1–3 GHz, Wi-Fi mid channel, LTE B4 high channel



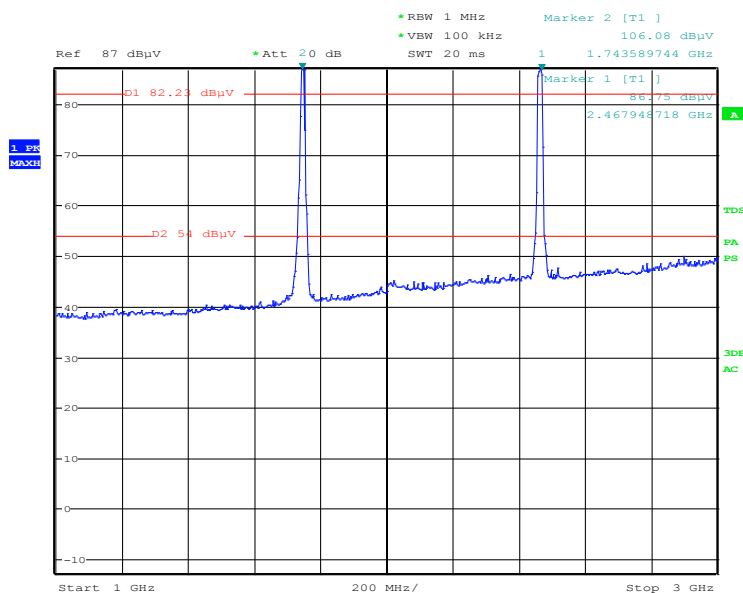
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Figure 8.1-15: Radiated emissions within 1–3 GHz, Wi-Fi mid channel, LTE B13 mid channel



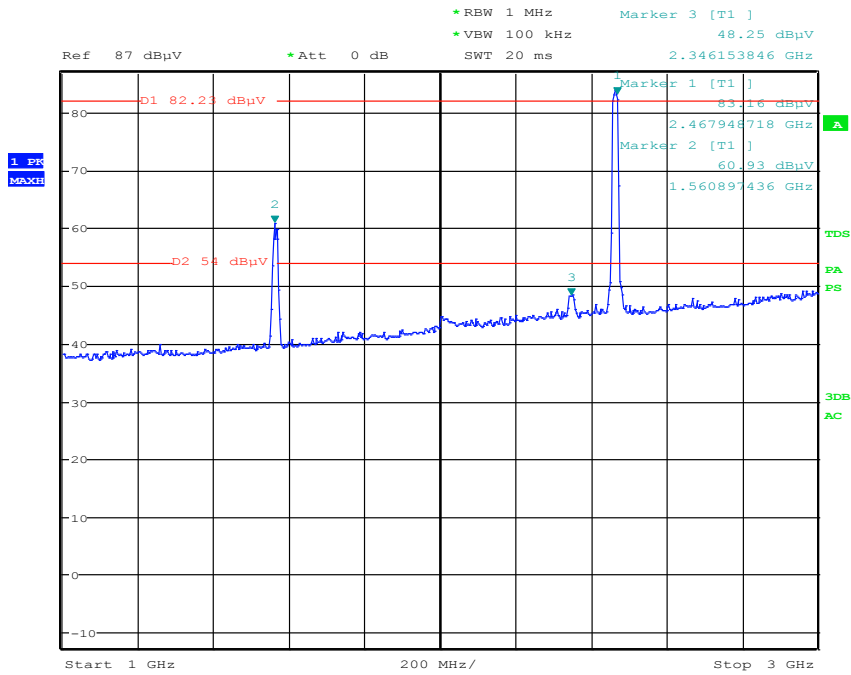
Date: 30.NOV.2017 12:50:28

Figure 8.1-16: Radiated emissions within 1-3 GHz, Wi-Fi high channel, LTE B4 low channel



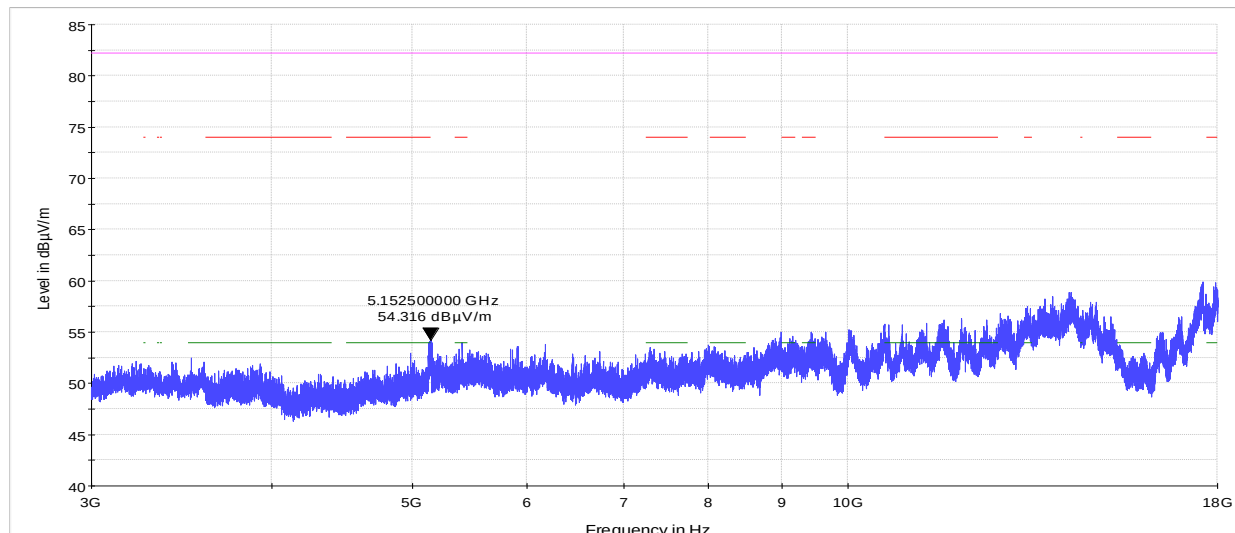
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Figure 8.1-17: Radiated emissions within 1-3 GHz, Wi-Fi high channel, LTE B4 high channel



Date: 30.NOV.2017 12:56:43

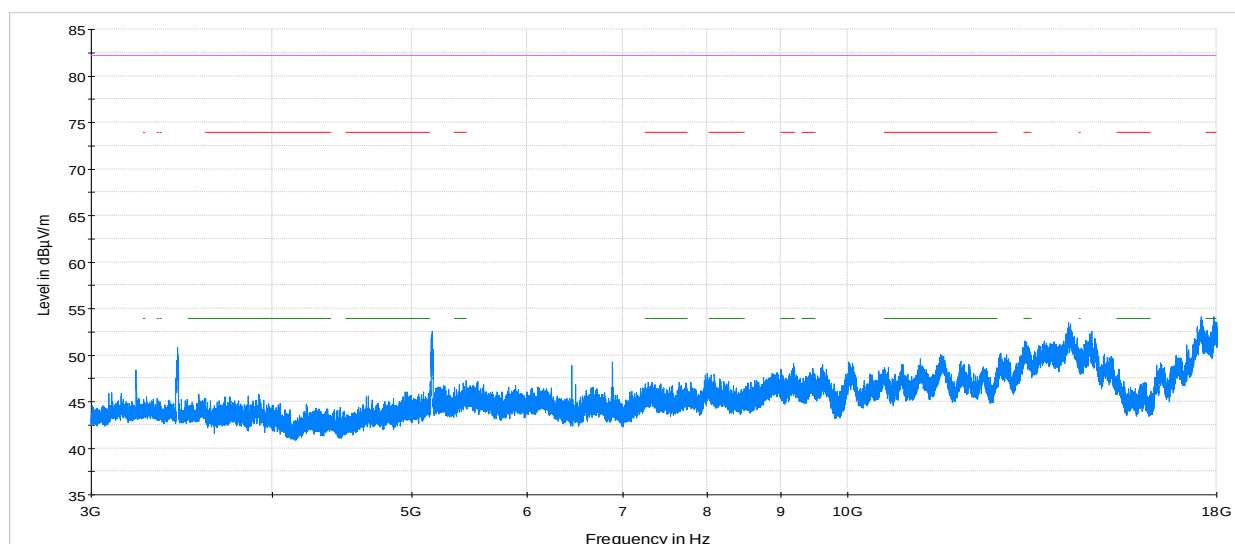
Figure 8.1-18: Radiated emissions within 1–3 GHz, Wi-Fi high channel, LTE B13 mid channel



Radiated coexistence spurious emissions

- LTE limit line
- Peak prescan
- Wi-Fi average limit line
- Wi-Fi peak limit line

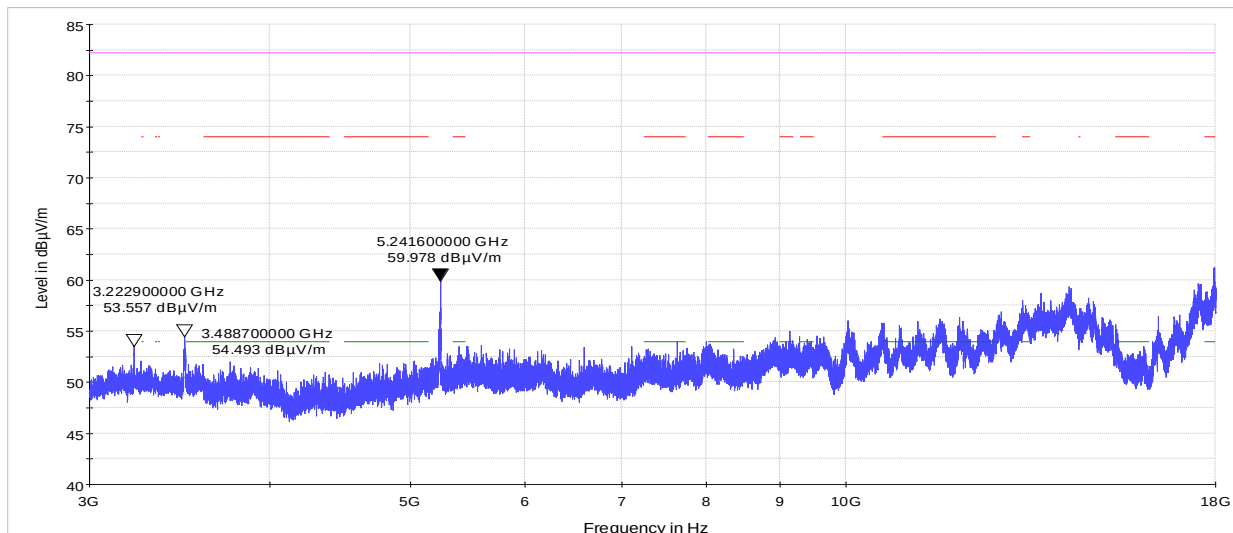
Figure 8.1-19: Radiated emissions within 3–18 GHz, Wi-Fi low channel, LTE B5 low channel, peak measurement



Radiated coexistence spurious emissions

- LTE limit line
- Average prescan
- Wi-Fi average limit line
- Wi-Fi peak limit line

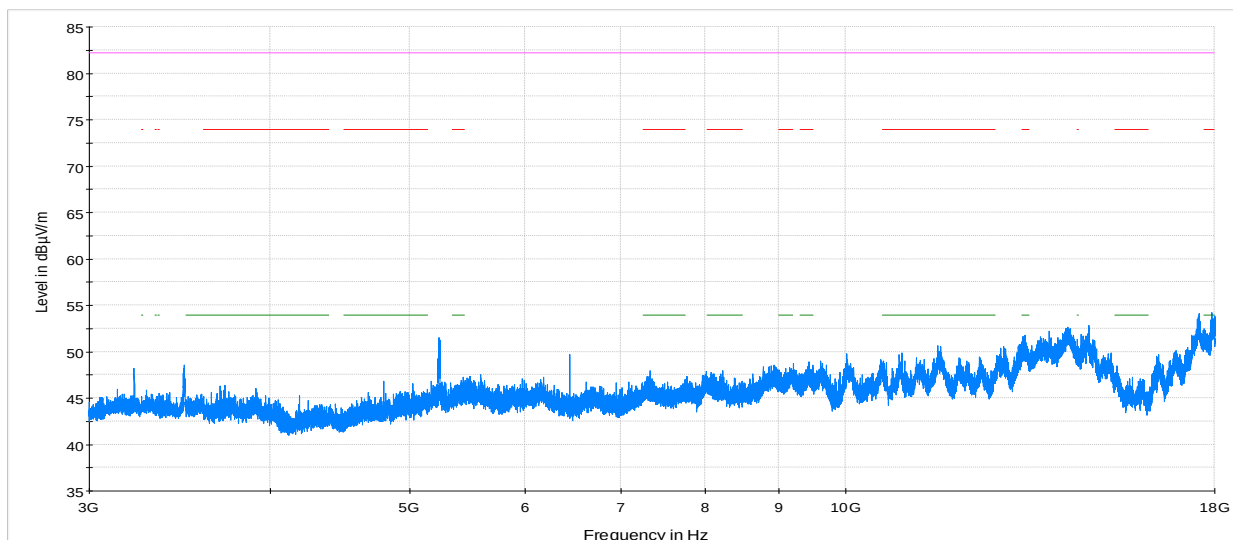
Figure 8.1-20: Radiated emissions within 3–18 GHz, Wi-Fi low channel, LTE B5 low channel, average measurement



Radiated coexistence spurious emissions

- LTE limit line
- Peak prescan
- Wi-Fi average limit line
- Wi-Fi peak limit line

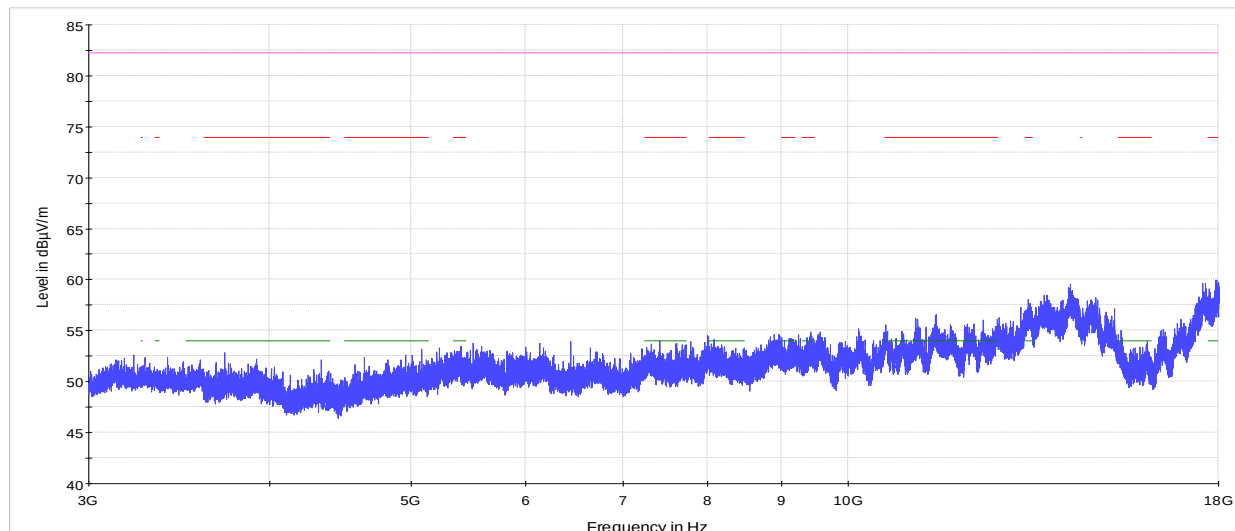
Figure 8.1-21: Radiated emissions within 3–18 GHz, Wi-Fi low channel, LTE B5 high channel, peak measurement



Radiated coexistence spurious emissions

- LTE limit line
- Average prescan
- Wi-Fi average limit line
- Wi-Fi peak limit line

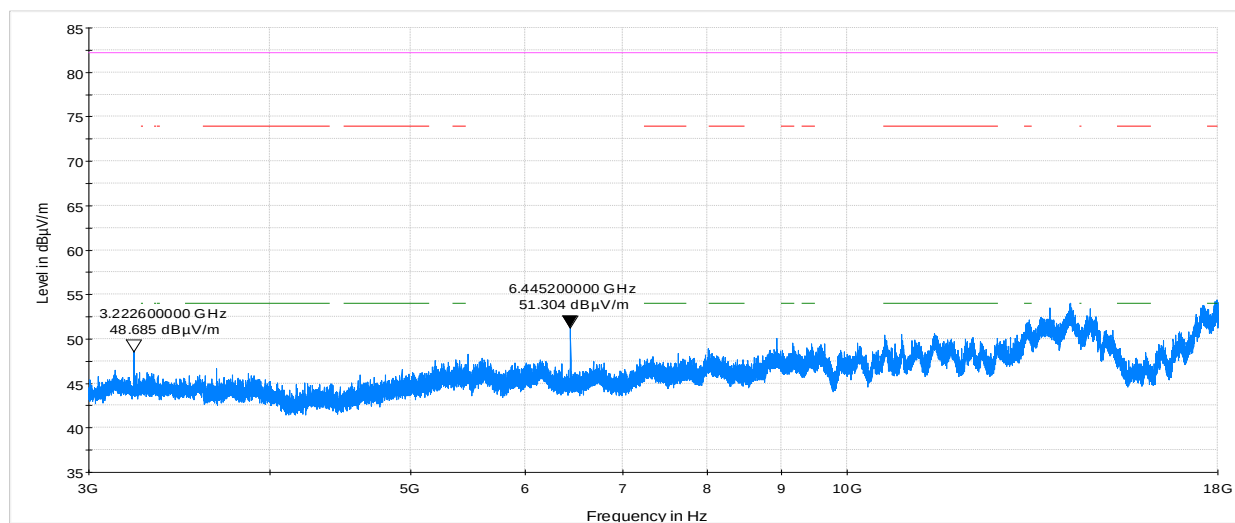
Figure 8.1-22: Radiated emissions within 3–18 GHz, Wi-Fi low channel, LTE B5 high channel, average measurement



Radiated coexistence spurious emissions

- LTE limit line
- Peak pre-scan
- Wi-Fi average limit line
- Wi-Fi peak limit line

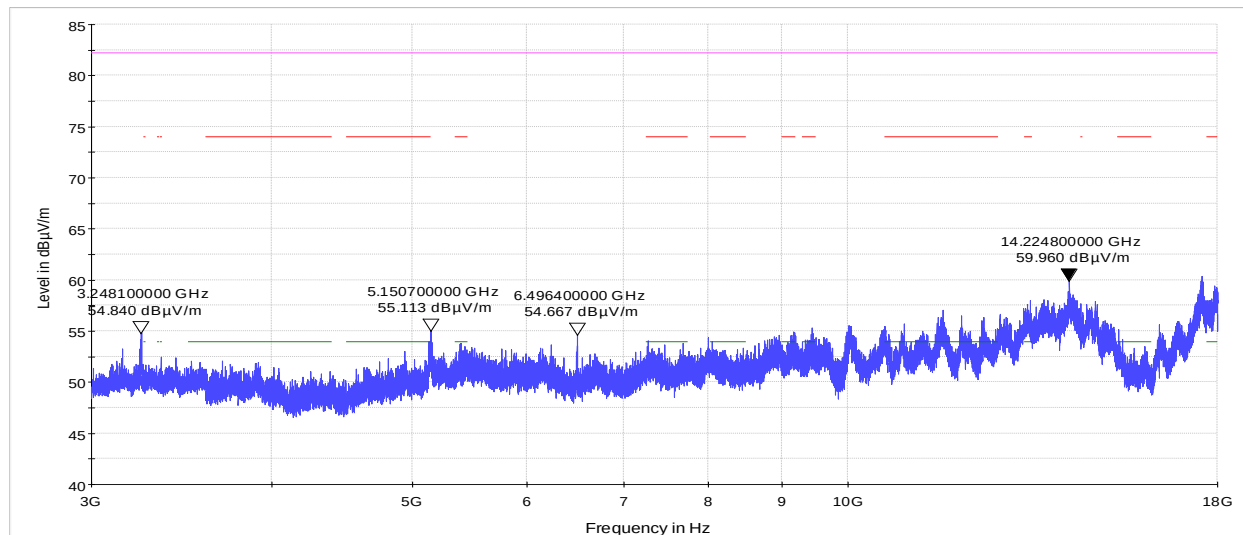
Figure 8.1-23: Radiated emissions within 3–18 GHz, Wi-Fi low channel, LTE B13 mid channel, peak measurement



Radiated coexistence spurious emissions

- Average pre-scan
- LTE limit line
- Wi-Fi average limit line
- Wi-Fi peak limit line

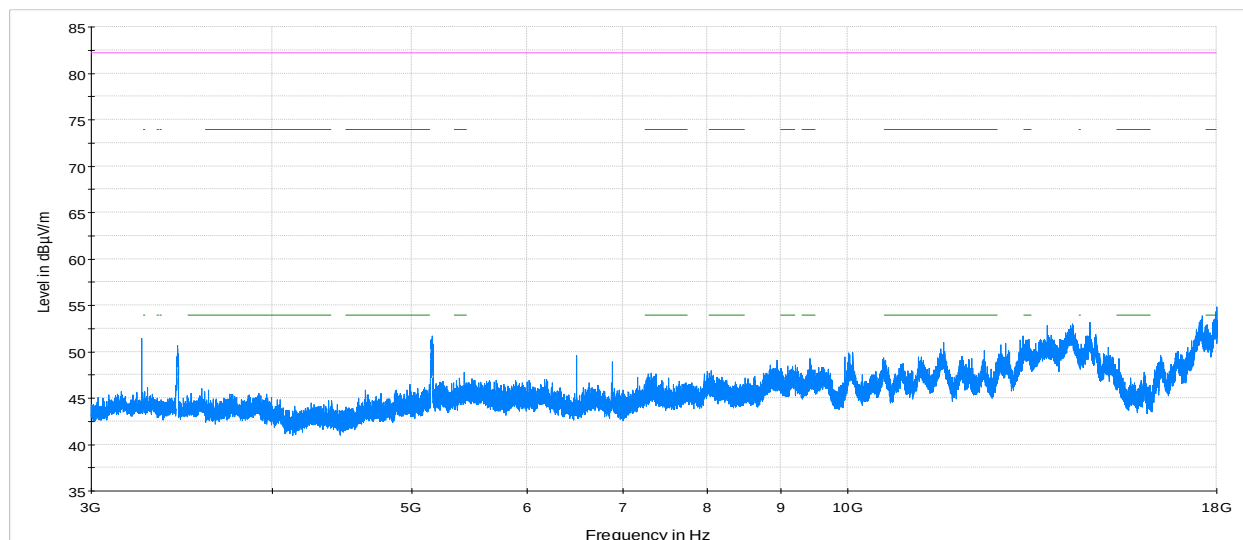
Figure 8.1-24: Radiated emissions within 3–18 GHz, Wi-Fi low channel, LTE B13 mid channel, average measurement



Radiated coexistence spurious emissions

- LTE limit line
- Peak prescan
- Wi-Fi average limit line
- Wi-Fi peak limit line

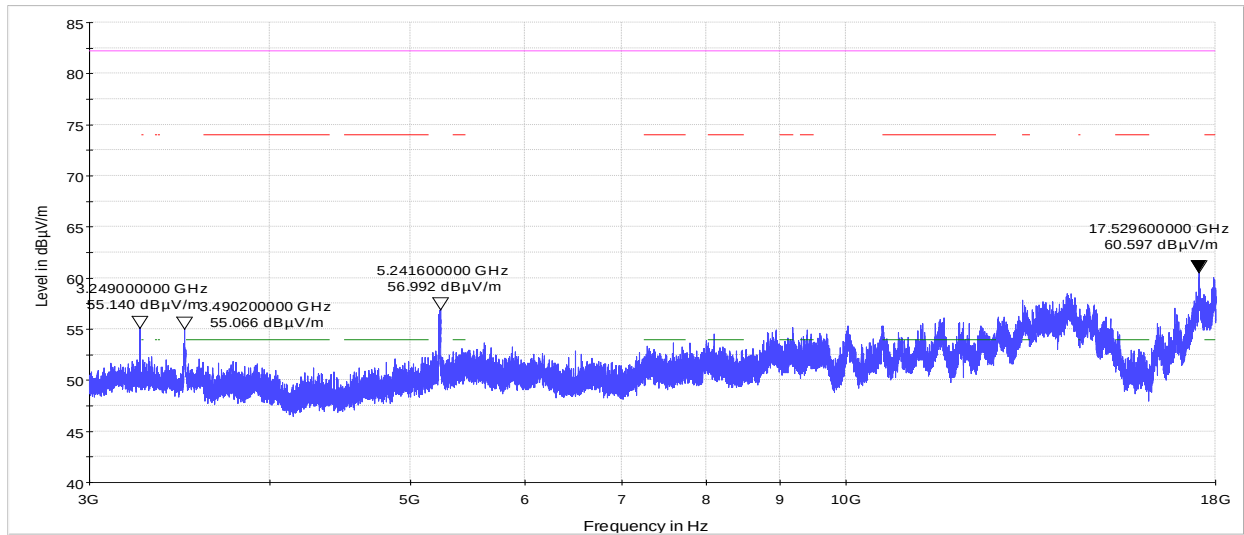
Figure 8.1-25: Radiated emissions within 3–18 GHz, Wi-Fi mid channel, LTE B5 low channel, peak measurement



Radiated coexistence spurious emissions

- LTE limit line
- Average prescan
- Wi-Fi average limit line
- Wi-Fi peak limit line

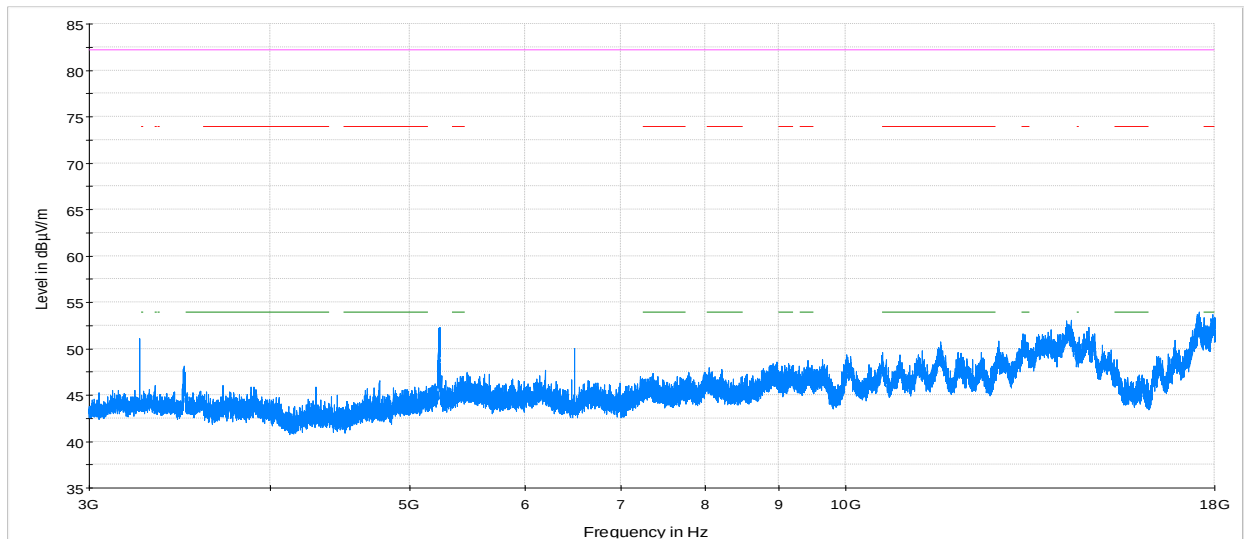
Figure 8.1-26: Radiated emissions within 3–18 GHz, Wi-Fi mid channel, LTE B5 low channel, average measurement



Radiated coexistence spurious emissions

- LTE limit line
- Peak prescan
- Wi-Fi average limit line
- Wi-Fi peak limit line

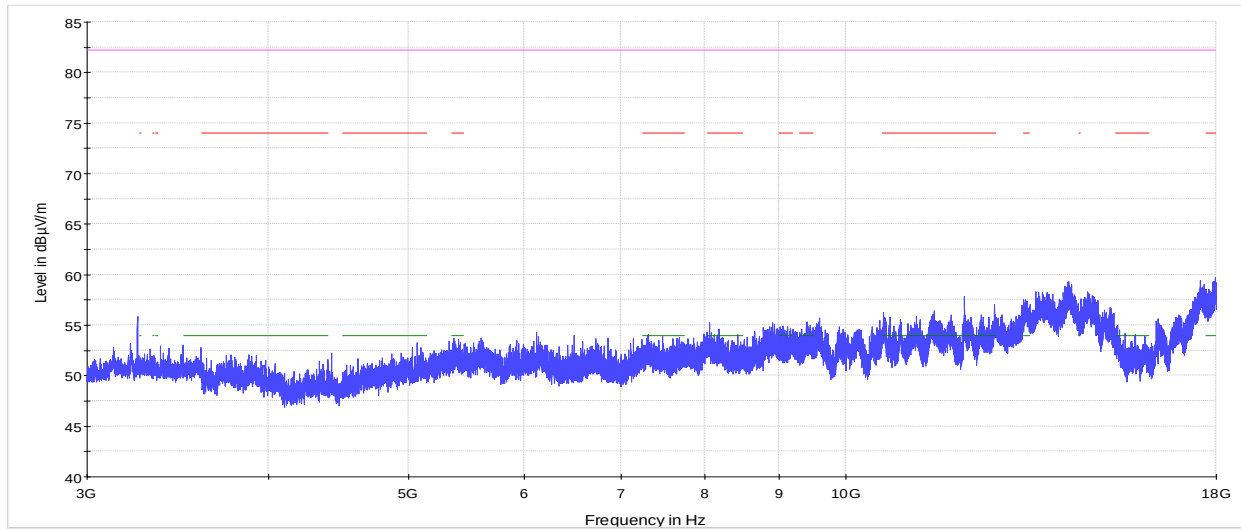
Figure 8.1-27: Radiated emissions within 3–18 GHz, Wi-Fi mid channel, LTE B5 high channel, peak measurement



Radiated coexistence spurious emissions

- LTE limit line
- Average prescan
- Wi-Fi average limit line
- Wi-Fi peak limit line

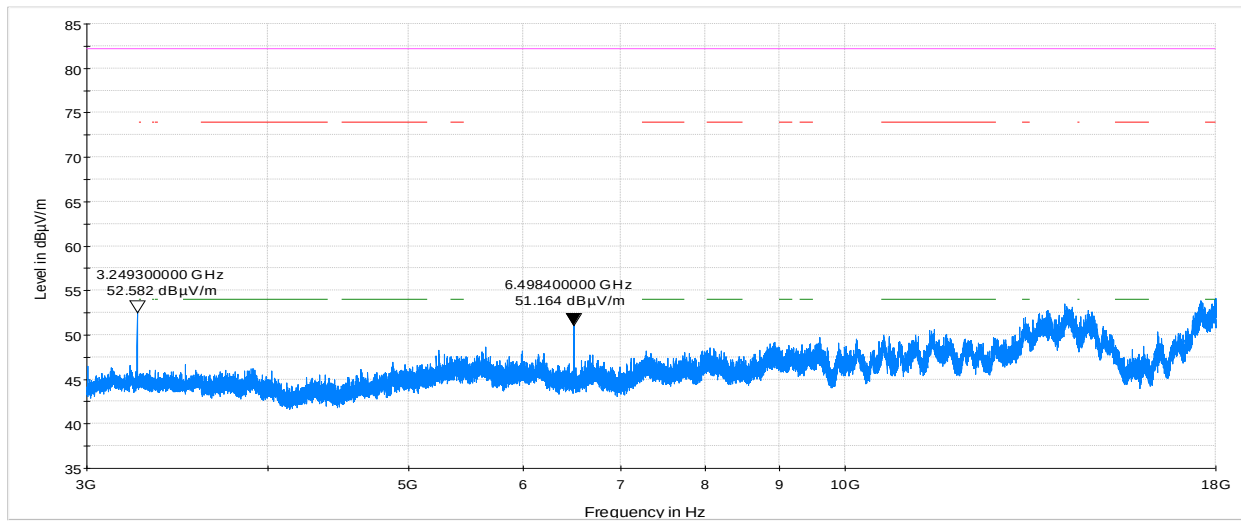
Figure 8.1-28: Radiated emissions within 3–18 GHz, Wi-Fi mid channel, LTE B5 high channel, average measurement



Radiated coexistence spurious emissions

- Peak prescan
- LTE limit line
- - - Wi-Fi Peak limit line
- - - Wi-Fi Average limit line

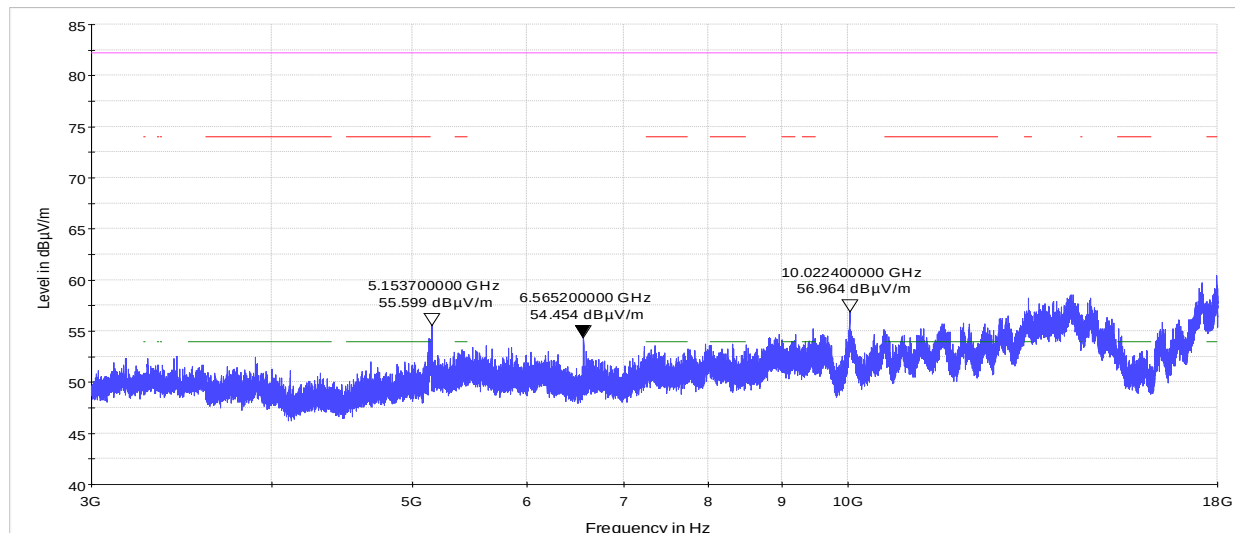
Figure 8.1-29: Radiated emissions within 3–18 GHz, Wi-Fi mid channel, LTE B13 mid channel, peak measurement



Radiated coexistence spurious emissions

- Average prescan
- LTE limit line
- - - Wi-Fi average limit line
- - - Wi-Fi peak limit line

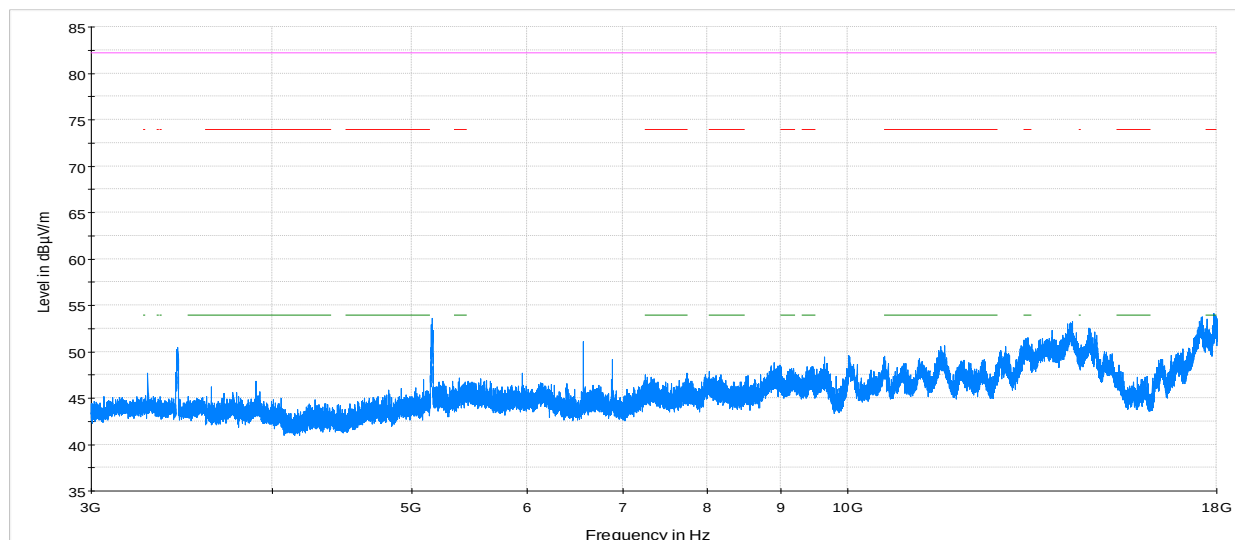
Figure 8.1-30: Radiated emissions within 3–18 GHz, Wi-Fi mid channel, LTE B13 mid channel, average measurement



Radiated coexistence spurious emissions

- LTE limit line
- Peak pre-scan
- Wi-Fi average limit line
- Wi-Fi peak limit line

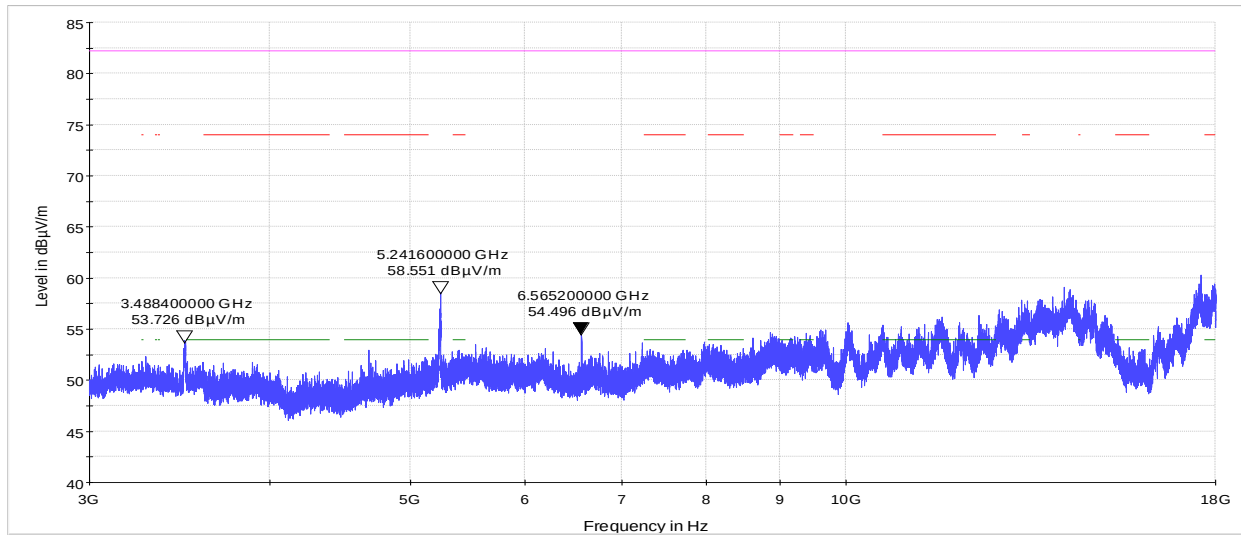
Figure 8.1-31: Radiated emissions within 3–18 GHz, Wi-Fi high channel, LTE B5 low channel, peak measurement



Radiated coexistence spurious emissions

- LTE limit line
- Average pre-scan
- Wi-Fi average limit line
- Wi-Fi peak limit line

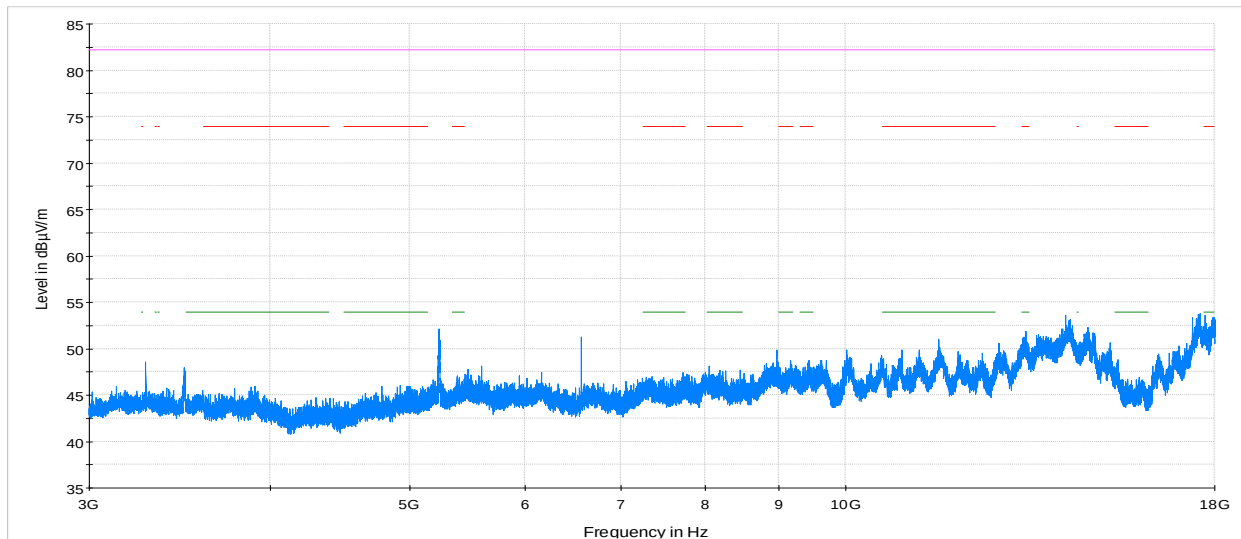
Figure 8.1-32: Radiated emissions within 3–18 GHz, Wi-Fi high channel, LTE B5 low channel, average measurement



Radiated coexistence spurious emissions

- LTE limit line
- Peak prescan
- Wi-Fi average limit line
- Wi-Fi peak limit line

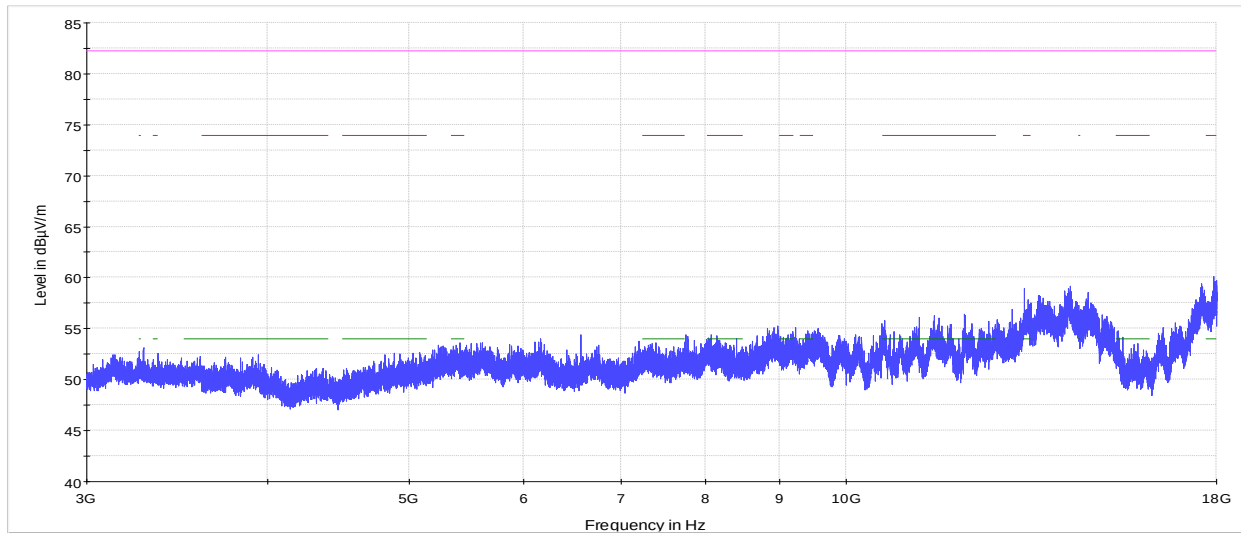
Figure 8.1-33: Radiated emissions within 3–18 GHz, Wi-Fi high channel, LTE B5 high channel, peak measurement



Radiated coexistence spurious emissions

- LTE limit line
- Average prescan
- Wi-Fi average limit line
- Wi-Fi peak limit line

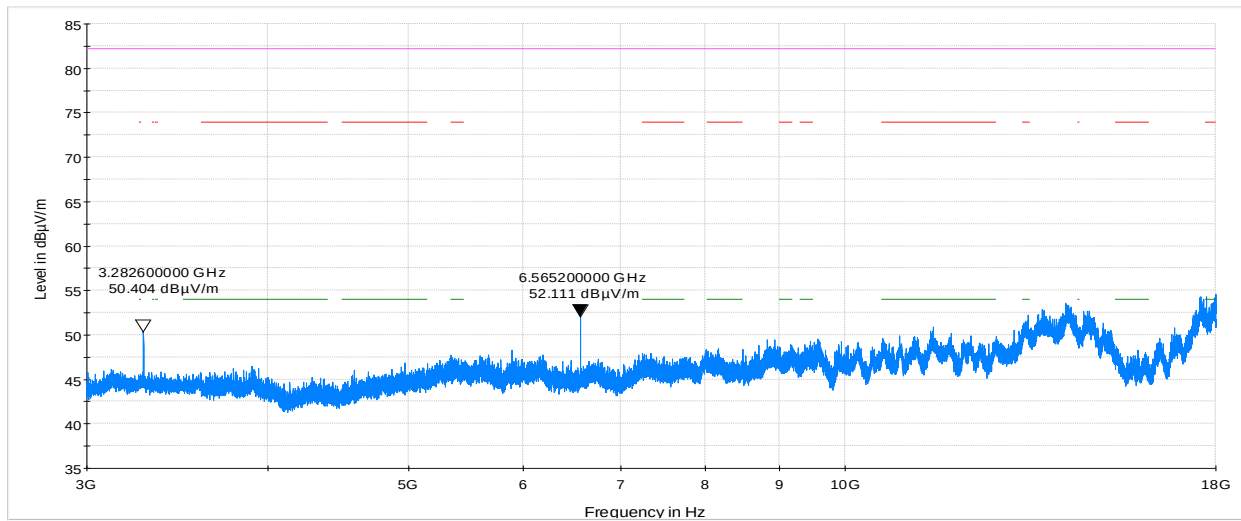
Figure 8.1-34: Radiated emissions within 3–18 GHz, Wi-Fi high channel, LTE B5 high channel, average measurement



Radiated coexistence spurious emissions

- LTE limit line
- Peak prescan
- Wi-Fi average kimit line
- Wi-Fi peak limit line

Figure 8.1-35: Radiated emissions within 3–18 GHz, Wi-Fi high channel, LTE B13 mid channel, peak measurement



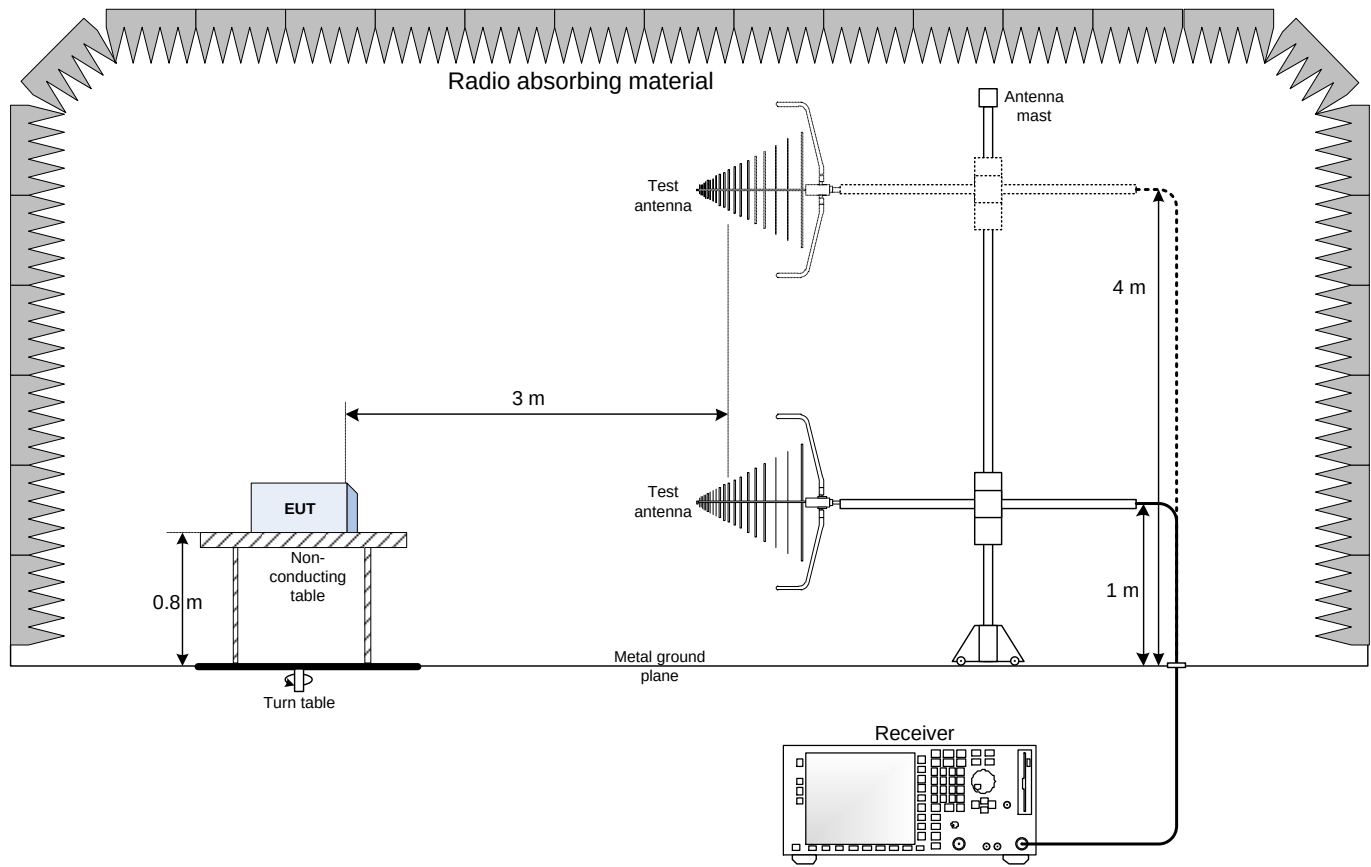
Radiated coexistence spurious emissions

- Average prescan
- LTE limit line
- Wi-Fi average limit line
- Wi-Fi peak limit line

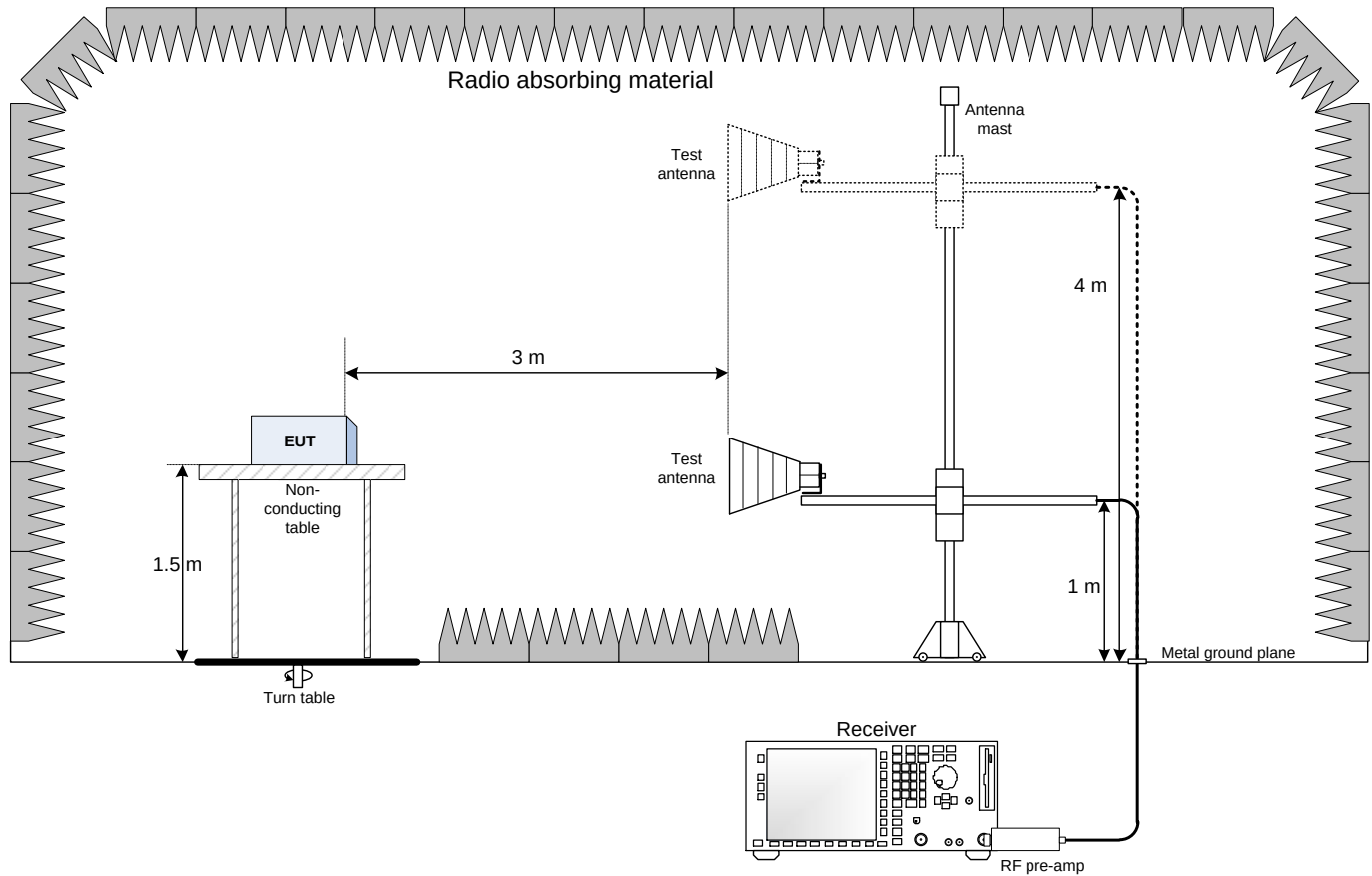
Figure 8.1-36: Radiated emissions within 3–18 GHz, Wi-Fi high channel, LTE B13 mid channel, average measurement

Section 9. Block diagrams and photos of test set-ups

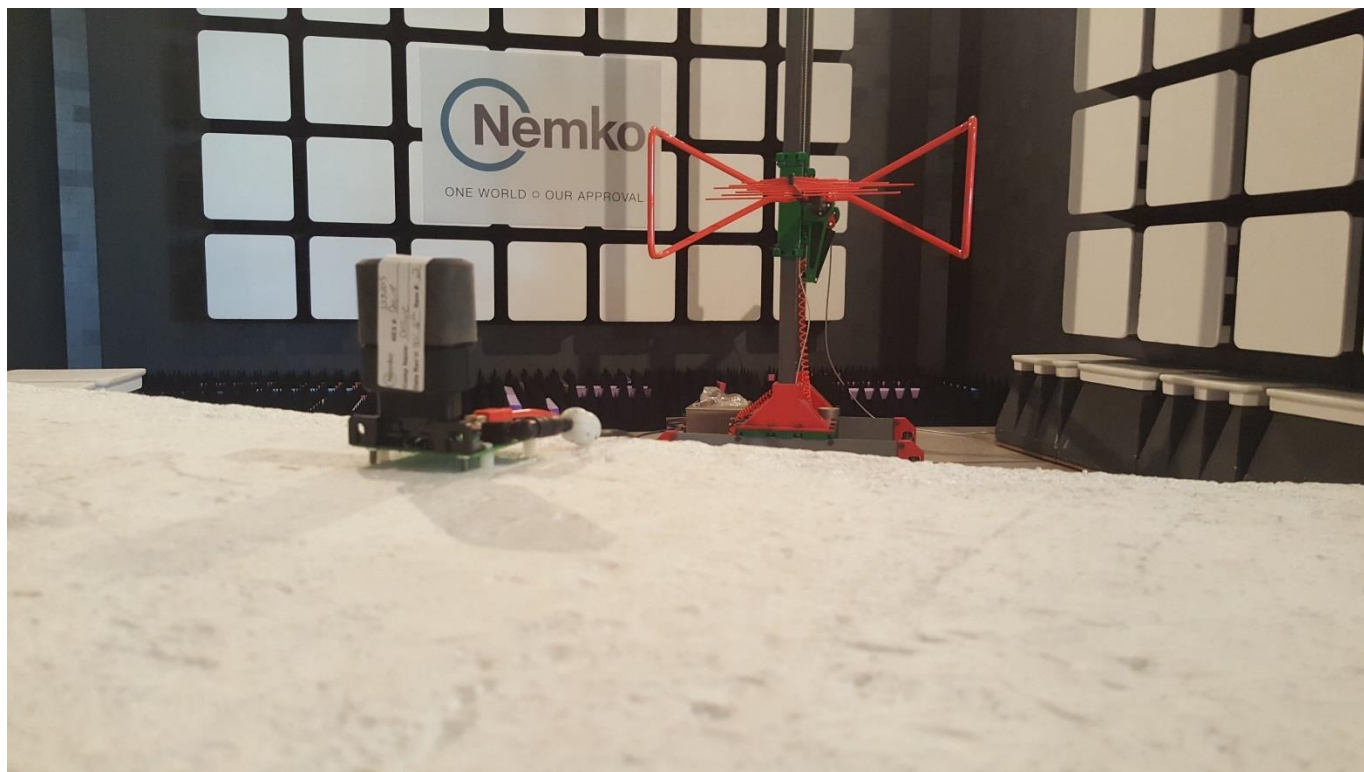
9.1 Radiated emissions set-up diagram for frequencies below 1 GHz



9.2 Radiated emissions set-up diagram for frequencies above 1 GHz



9.3 Radiated emissions set-up photo for frequencies below 1 GHz



9.4 Radiated emissions set-up diagram for frequencies above 1 GHz

