

Wireless test report – 412212-10TRFWL

Applicant:

Eurotech SpA

Product name:

RG1014

Model:

REGATE 10-14

FCC ID:

UKM-RG1014

IC Registration number:

21442-RG1014

Specifications:

- ◆ **FCC 47 CFR Part 15 Subpart C, §15.209**
Radiated emission limits; general requirements.

- ◆ **RSS-GEN, Issue 5, Apr. 2018, section 8.9**
Amendment 1 March 2019
Amendment 2 February 2021
Transmitter Emission Limits

Date of issue: **June 1, 2021**

Tested by

(name, function and signature)

S: Tessa

(project handler) Signature:



Reviewed by

(name, function and signature)

P. Barbieri

(verifier) Signature:



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Doc. n. TRF001; Rev. 0; Date: 2020-11-30

Test location(s)

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City	Biassono
Province	MB
Postal code	20853
Country	Italy
Telephone	+39 039 220 12 01
Facsimile	+39 039 220 12 21
Website	www.nemko.com
Site number	FCC: 682159; IC: 9109A (10 m semi anechoic chamber)

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 Spa ISO/IEC 17025 accreditation.

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Section 1. Report summary

1.1 Applicant and manufacturer

Company name	Eurotech SpA
Address	Via Fratelli Solari 3/a – 33020 Amaro (UD) – Italy

1.2 Test specifications

FCC 47 CFR Part 15 Subpart C, §15.209	Radiated emission limits; general requirements.
RSS-GEN, Issue 5, Apr. 2018, section 8.9 Amendment 1 March 2019 Amendment 2 February 2021	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
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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 quote, 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
412212-10TRFWL	June 1, 2021	Original report issued



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 5, 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	May 13, 2021
Nemko sample ID number	4122120002

3.2 EUT information

Product name	RG1014
Model	REGATE 10-14
Model variant	--
Serial number	4122120002 (Number assigned by Nemko Spa)

3.3 Technical information

RSS number and Issue number	RSS-GEN, Issue 5, Apr. 2018, section 8.9 Amendment 1 March 2019 Amendment 2 February 2021															
Frequency band	WIFI/ BT/BLE: 2400–2483.5 MHz band WIFI: 5150–5850 MHz bands LTE North America Bands															
Type of modulation	GFSK, 802.11a/n, OFDM															
Emission classification (F1D, G1D, D1D)	F1D, W7D															
EUT power requirements	24 V _{DC} , via 120 V _{AC} adapter or battery															
Antenna information	<p>The EUT uses a unique antenna coupling. The following antennas are provided with the EUT.</p> <table border="1"> <thead> <tr> <th>Product Type</th> <th>Manufacturer</th> <th>Model</th> </tr> </thead> <tbody> <tr> <td>Wi-Fi/BT antenna</td> <td>Linx Technologies</td> <td>ANT-DB1-RAF-RPS</td> </tr> <tr> <td>GNSS antenna</td> <td>2J-ANTENNA</td> <td>2J4301MPGF</td> </tr> <tr> <td>Cellular antenna</td> <td>2J-ANTENNA</td> <td>2JW0124</td> </tr> <tr> <td>Cellular antenna</td> <td>2J-ANTENNA</td> <td>2JW0124Z</td> </tr> </tbody> </table> <p>* Two cellular antennas have the same gains, as shown in the relevant datasheets</p>	Product Type	Manufacturer	Model	Wi-Fi/BT antenna	Linx Technologies	ANT-DB1-RAF-RPS	GNSS antenna	2J-ANTENNA	2J4301MPGF	Cellular antenna	2J-ANTENNA	2JW0124	Cellular antenna	2J-ANTENNA	2JW0124Z
Product Type	Manufacturer	Model														
Wi-Fi/BT antenna	Linx Technologies	ANT-DB1-RAF-RPS														
GNSS antenna	2J-ANTENNA	2J4301MPGF														
Cellular antenna	2J-ANTENNA	2JW0124														
Cellular antenna	2J-ANTENNA	2JW0124Z														

3.4 EUT setup diagram

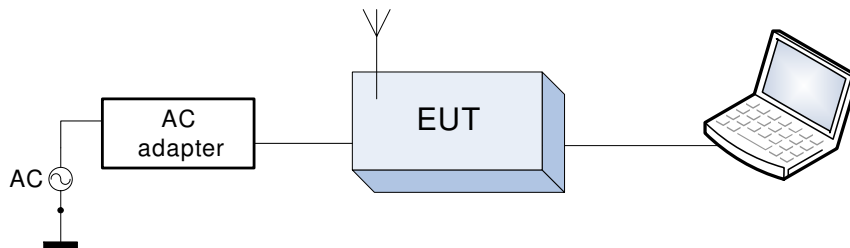


Figure 3.4-1: Setup diagram

3.5 Product description and theory of operation

The REGATE 10-14 is a Multi-service IoT Gateway that has been designed to deliver LTE and 2G/3G connectivity to industrial and lightly rugged applications. Based on the NXP i.MX 8M Mini Cortex-A53 quad core processor, with up to 4GB of RAM, up to 64GB of eMMC and a user-accessible microSD slot, the REGATE 10-14 is a low power gateway suitable for demanding use cases: it supports a 9 to 30V power supply with transient protection, Display Port video output, two protected and isolated RS-232/422/RS-485 serial ports, two noise and surge protected USB ports, six opt isolated digital and two isolated analog interfaces. The REGATE 10-14 features a wide range of connectivity capabilities: it integrates a carrier certified LTE Cat 1 cellular modem with dual SIM support, Wi-Fi, Bluetooth 4.2/BLE, and two Gigabit Ethernet ports; an optional internal GNSS provides precise geolocation capabilities. Expansion options allow adding extra features with side modules, such as the LoRa LPWAN Gateway unit, or the DAQ unit that provides analog input and more DI/O ports. The EUT is equipped with two radio module: model RG1014 for WIFI/BT and model LE910C1-NF for 3G/LTE and GNSS.

3.6 EUT sub assemblies

Table 3.6-1: EUT sub assemblies

Description	Brand name	Model/Part number	Serial number
REGATE 10-14	Eurotech	REGATE-10-14	4122120003 (Assigned by Nemko Spa)
AC adapter	Sunny	SYS1541-2424	None

Section 3: Equipment under test (EUT) details

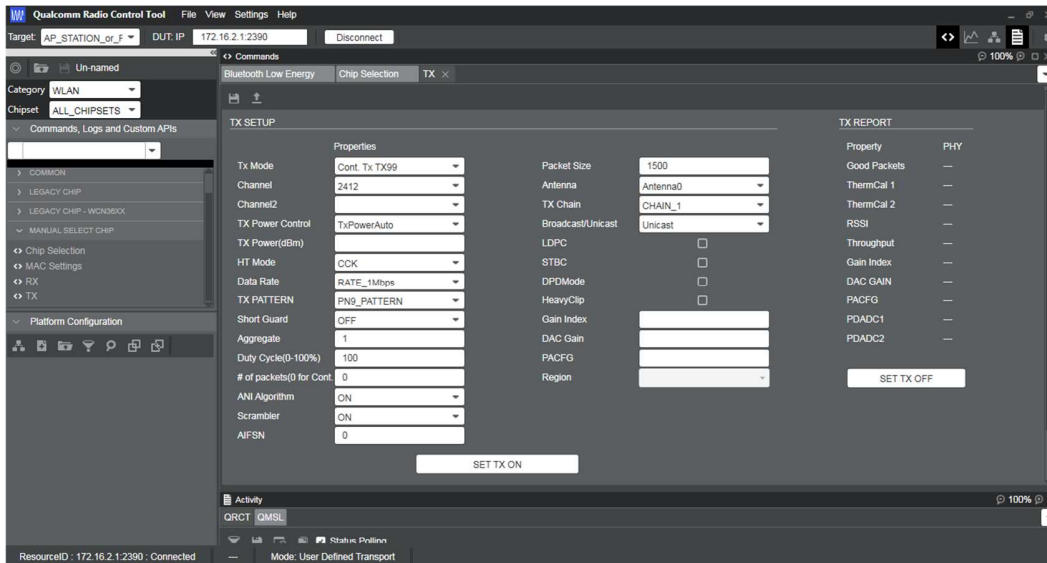
3.7 EUT exercise details

EUT was set to continuously transmit mode during tests, by test software provided by client.

The EUT runs a Linux operating system which allows for the testing to be performed using engineering test tools and scripts. Communication with the EUT is via a serial console or Ethernet connection which provides a Linux command line interface for execution of the test tools/scripts. These tools/scripts configure the radio modules to enable continuous transmission with the ability to adjust modulation, frequency and output power as required.

Linux operating system version: 4.19.35-imx_4.19.35_1.0.0+ge4452f4

For WIFI, the following software installed on the PC has been used to force the EUT in TX mode (Qualcomm Radio Control Tool version 4.0.00125):



For the 3G/4G radio module the following script with AT commands has been used to put the EUT in TX mode:

```
TEELIT 2G/3G/4G Transmission Test Mode

NOTE: ENSURE ANTENNAS ARE CONNECTED TO THE UNIT UNDER TEST BEFORE PROCEEDING

Select Mode:
 1) GSM
 2) WCDMA
 3) LTE
 4) TD-SCDMA
 Q) QUIT
Enter mode: █
```




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

The EUT has WIFI and Bluetooth in 2.4 GHz band, WIFI is chosen to be the representative worst-case. The radio module TELIT-LE910C1NF use the standard 3G and 4G. 3G standard is chosen to be the representative worst-case.

4.3 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.



Section 5. Test conditions

5.1 Atmospheric conditions

In the laboratory, the following ambient conditions are respected for each test reported below:

Temperature	18 – 33 °C
Relative humidity	25 – 70 %
Air pressure	860 – 1060 mbar

The following instruments are used to monitor the environmental conditions:

Equipment	Manufacturer	Model no.	Asset no.	Cal date	Next cal.
Thermo-hygrometer data loggers	Testo	175-H2	20012380/305	2020-12	2021-12
Thermo-hygrometer data loggers	Testo	175-H2	38203337/703	2020-12	2021-12
Barometer	Castle	GPB 3300	072015	2021-05	2022-05

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

The measurement uncertainty was calculated for each test and quantity listed in this test report, according to CISPR 16-4-2 and other specific test standard and is documented in Nemko Spa working manual WML1002.

The assessment of conformity for each test performed on the equipment is performed not taking into account the measurement uncertainty. The two following possible verdicts are stated in the report:

P (Pass) - The measured values of the equipment respect the specification limit at the points tested. The specific risk of false accept is up to 50% when the measured result is close to the limit.

F (Fail) - One or more measured values of the equipment do not respect the specification limit at the points tested. The specific risk of false reject is up to 50% when the measured result is close to the limit.

Hereafter Nemko's measurement uncertainties are reported:

EUT	Type	Test	Range	Measurement Uncertainty	Notes
Transmitter	Conducted	Frequency error	0.001 MHz ÷ 40 GHz	0.08 ppm	(1)
		Carrier power RF Output Power	0.009 MHz ÷ 30 MHz	1.1 dB	(1)
			30 MHz ÷ 18 GHz	1.5 dB	(1)
			18 MHz ÷ 40 GHz	3.0 dB	(1)
			40 MHz ÷ 140 GHz	5.0 dB	(1)
		Adjacent channel power	1 MHz ÷ 18 GHz	1.4 dB	(1)
		Conducted spurious emissions	0.009 MHz ÷ 18 GHz	3.0 dB	(1)
			18 GHz ÷ 40 GHz	4.2 dB	(1)
			40 GHz ÷ 220 GHz	6.0 dB	(1)
		Intermodulation attenuation	1 MHz ÷ 18 GHz	2.2 dB	(1)
		Attack time – frequency behaviour	1 MHz ÷ 18 GHz	2.0 ms	(1)
		Attack time – power behaviour	1 MHz ÷ 18 GHz	2.5 ms	(1)
		Release time – frequency behaviour	1 MHz ÷ 18 GHz	2.0 ms	(1)
		Release time – power behaviour	1 MHz ÷ 18 GHz	2.5 ms	(1)
		Transient behaviour of the transmitter– Transient frequency behaviour	1 MHz ÷ 18 GHz	0.2 kHz	(1)
		Transient behaviour of the transmitter – Power level slope	1 MHz ÷ 18 GHz	9%	(1)
		Frequency deviation - Maximum permissible frequency deviation	0.001 MHz ÷ 18 GHz	1.3%	(1)
		Frequency deviation - Response of the transmitter to modulation frequencies above 3 kHz	0.001 MHz ÷ 18 GHz	0.5 dB	(1)
		Dwell time	-	3%	(1)
		Hopping Frequency Separation	0.01 MHz ÷ 18 GHz	1%	(1)
	Occupied Channel Bandwidth	0.01 MHz ÷ 18 GHz	2%	(1)	
	Modulation Bandwidth	0.01 MHz ÷ 18 GHz	2%	(1)	
	Radiated	Radiated spurious emissions	0.009 MHz ÷ 26.5 GHz	6.0 dB	(1)
			26.5 GHz ÷ 66 GHz	8.0 dB	(1)
			66 GHz ÷ 220 GHz	10 dB	(1)
		Effective radiated power transmitter	10 kHz ÷ 26.5 GHz	6.0 dB	(1)
26.5 GHz ÷ 66 GHz			8.0 dB	(1)	
		66 GHz ÷ 220 GHz	10 dB	(1)	

Section 6:

Measurement uncertainty



EUT	Type	Test	Range	Measurement Uncertainty	Notes
Receiver	Radiated	Radiated spurious emissions	0.009 MHz ÷ 26.5 GHz	6.0 dB	(1)
			26.5 GHz ÷ 66 GHz	8.0 dB	(1)
			66 GHz ÷ 220 GHz	10 dB	(1)
		Sensitivity measurement	1 MHz ÷ 18 GHz	6.0 dB	(1)
	Conducted	Conducted spurious emissions	0.009 MHz ÷ 18 GHz	3.0 dB	(1)
			18 GHz ÷ 40 GHz	4.2 dB	(1)
			40 GHz ÷ 220 GHz	6.0 dB	(1)

NOTES:

(1) The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2$, which for a normal distribution corresponds to a coverage probability of approximately 95 %

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.
EMI receiver (20 Hz ÷ 8 GHz)	Rohde & Schwarz	ESU8	100202	2020-08	2021-08
EMI receiver (20 Hz ÷ 8 GHz)	Rohde & Schwarz	ESW44	101620	2020-09	2021-09
Trilog Antenna (30 MHz ÷ 7 GHz)	Schwarzbeck	VULB 9162	9162-025	2018-07	2021-07
Bilog antenna (1 ÷ 18 GHz)	Schwarzbeck	STLP 9148	9148-123	2018-07	2021-07
Preamplifier (1 ÷ 18 GHz)	Schwarzbeck	BBV 9718	9718-137	2021-04	2022-04
Horn antenna (18 ÷ 40 GHz)	RFSpin	DRH40	061106A40	2020-04	2023-04
Preamplifier (18 ÷ 40 GHz)	SAGE	STB-1834034030-KFKF-L1	18490-01	2021-04	2022-04
Controller	Maturo	FCU3.0	10041	NCR	NCR
Tilt antenna mast	Maturo	TAM4.0-E	10042	NCR	NCR
Turntable	Maturo	TT4.0-5T	2.527	NCR	NCR
Semi-anechoic chamber	Nemko	10m semi-anechoic chamber	530	2019-09	2021-09
Shielded room	Siemens	10m control room	1947	NCR	NCR
LISN three phase (9 kHz ÷ 30 MHz)	Rohde & Schwarz	ESH2-Z5	872 460/041	2020-08	2021-08
Shielded room	Siemens	Conducted emission test room	1862	NCR	NCR

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 × 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

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	
12.29–12.293	240–285	4500–5150	Above 38.6
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

Test start date	May 20, 2020
Test engineer	S. Tessa

8.1.3 Observations, settings and special notes

The spectrum was searched from 30 MHz to 40 GHz.

EUT's LTE and WIFI transmitters were set to transmit continuously, different channel setting has been investigated as per provided by client's setup, only the worst-case is presented.

Radiated measurements were performed at a distance of 3 m. No inter-modulation products emissions were detected above 18 GHz within 6 dB below the limit.

Spectrum analyzer settings for frequencies below 30 MHz:

Detector mode	Quasi-Peak
Resolution bandwidth	9 kHz
Video bandwidth	30 kHz
Trace mode	Max Hold
Measurement time	100 ms

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

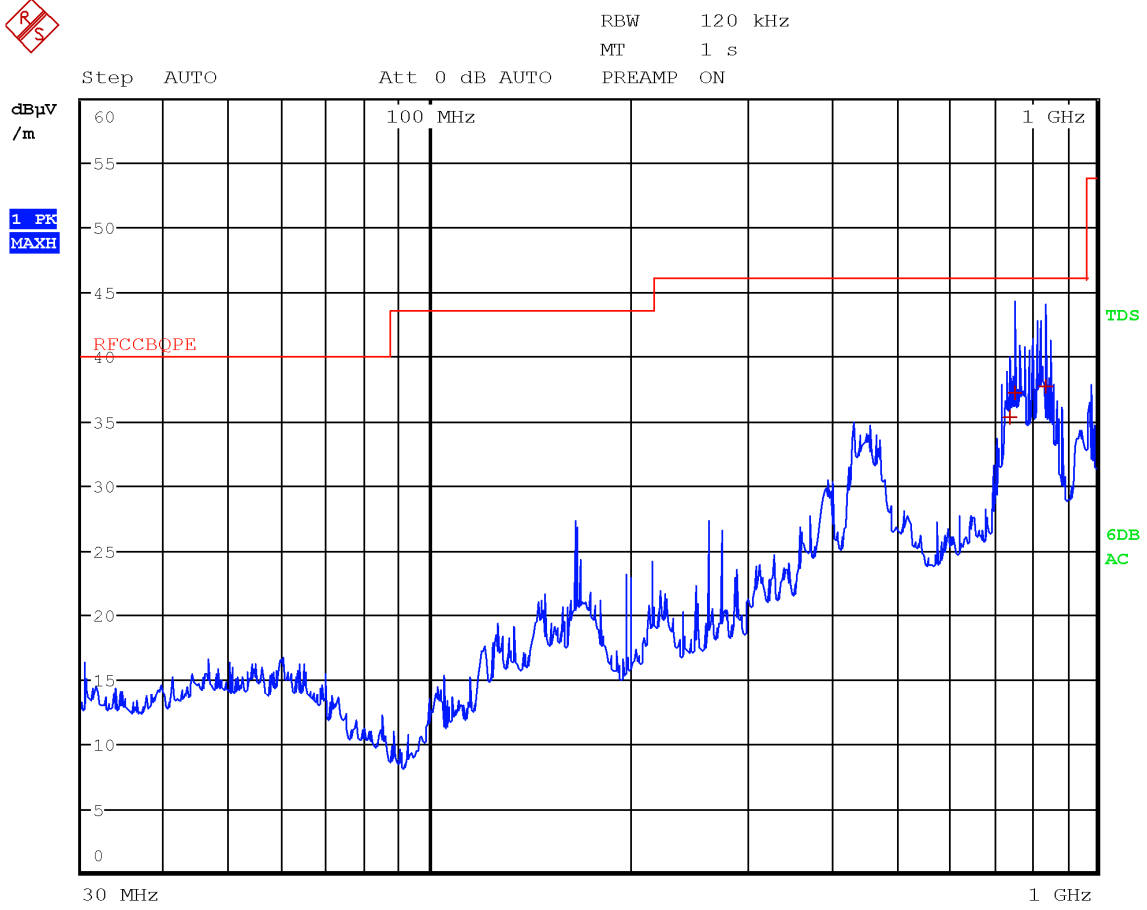


Figure 8.1-1: Radiated spurious emissions with WCDMA at 1880 MHz and WIFI at 2437 MHz – antenna in horizontal polarization

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
744.1600	35.4	46.0	-10.6	QP
756.0000	37.3	46.0	-8.7	QP
840.1200	37.7	46.0	-8.3	QP

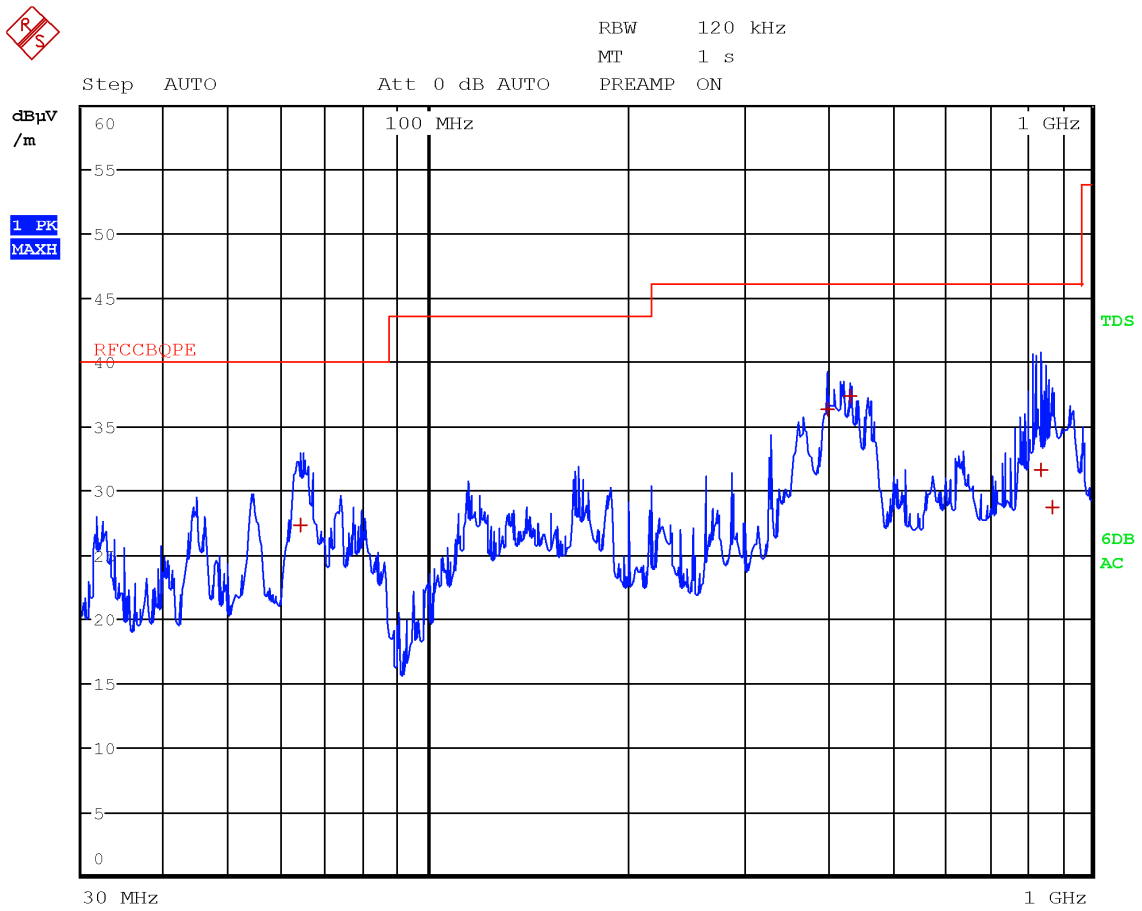


Figure 8.1-2: Radiated spurious emissions with WCDMA at 1880 MHz and WIFI at 2437 MHz – antenna in vertical polarization

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
64.1200	27.4	40.0	-12.6	QP
400.0000	36.4	46.0	-9.6	QP
432.4800	37.4	46.0	-8.6	QP
840.1200	31.6	46.0	-14.4	QP
876.1600	28.7	46.0	-17.3	QP

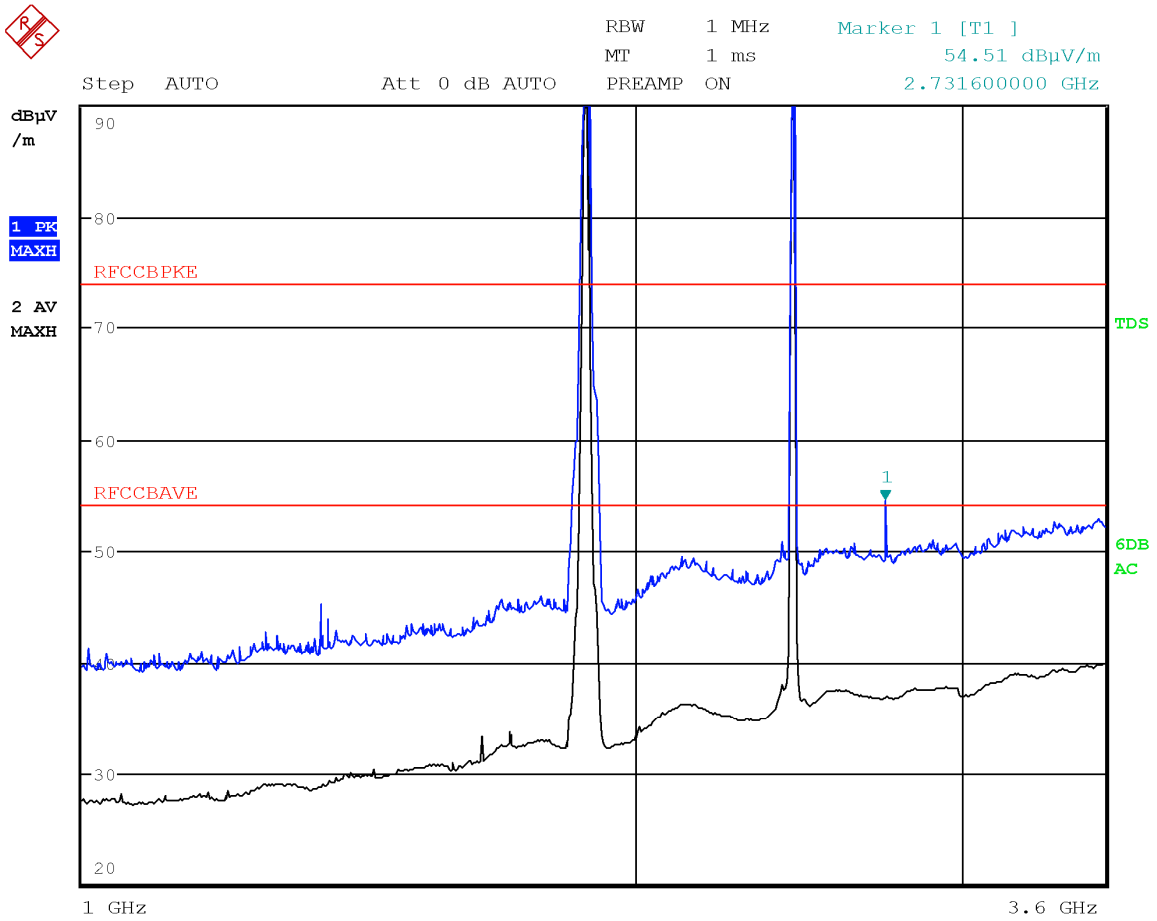


Figure 8.1-3: Radiated spurious emissions with WCDMA at 1880 MHz and WIFI at 2437 MHz – antenna in horizontal polarization

Note: Emissions above the limit were from intentional emissions. no intermodulation emissions were detected

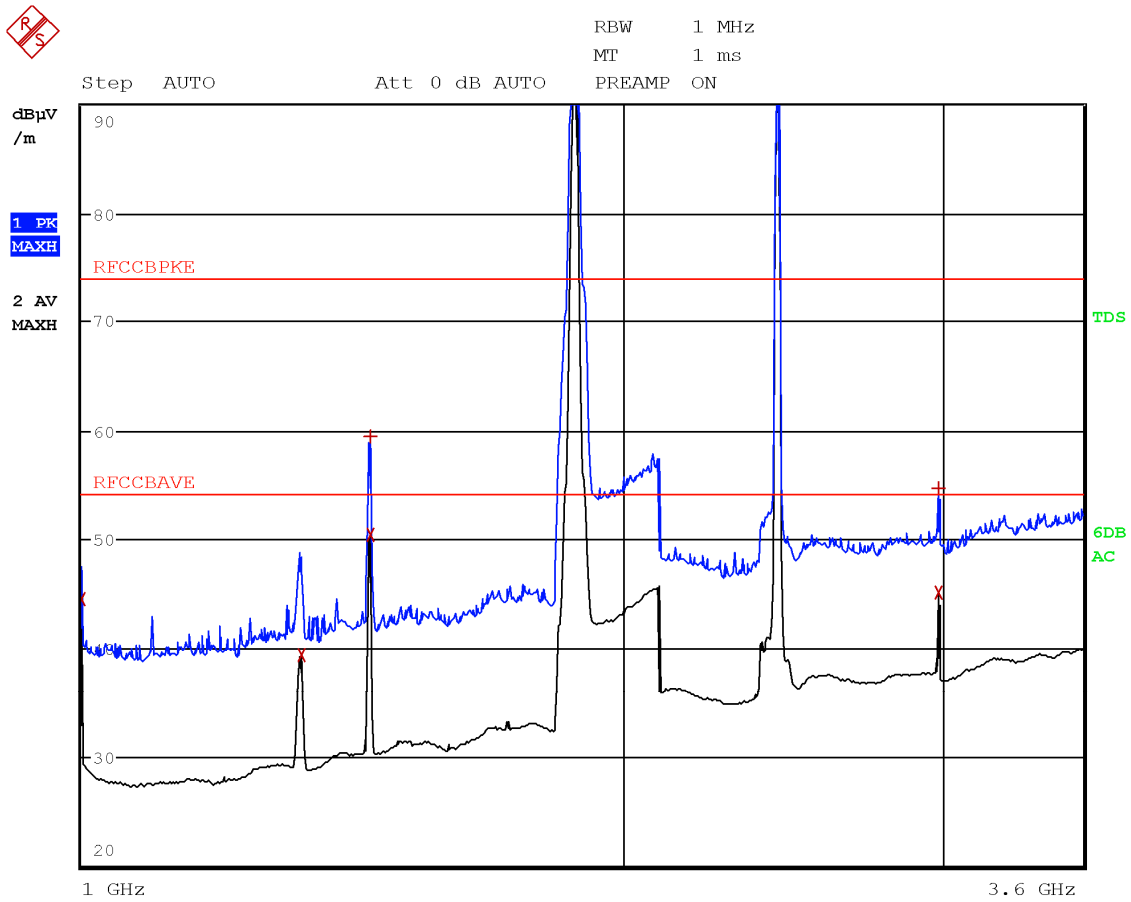


Figure 8.1-4: Radiated spurious emissions with WCDMA at 1880 MHz and WIFI at 2437 MHz – antenna in vertical polarization

Note: Emissions above the limit were from intentional emissions.

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1000.0000	44.5	54.0	-9.5	Av
1323.6000	39.4	54.0	-14.6	Av
1447.6000	59.5	74.0	-14.5	Pk
1447.6000	50.4	54.0	-3.6	Av
2993.2000	54.7	74.0	-19.3	Pk
2994.0000	45.2	54.0	-8.8	Av

Section 8 Testing data
Test name FCC 15.209 and RSS-GEN section 8.9 Radiated emission limits; general requirements
Specification FCC Part 15 Subpart C and RSS-GEN, Issue 5

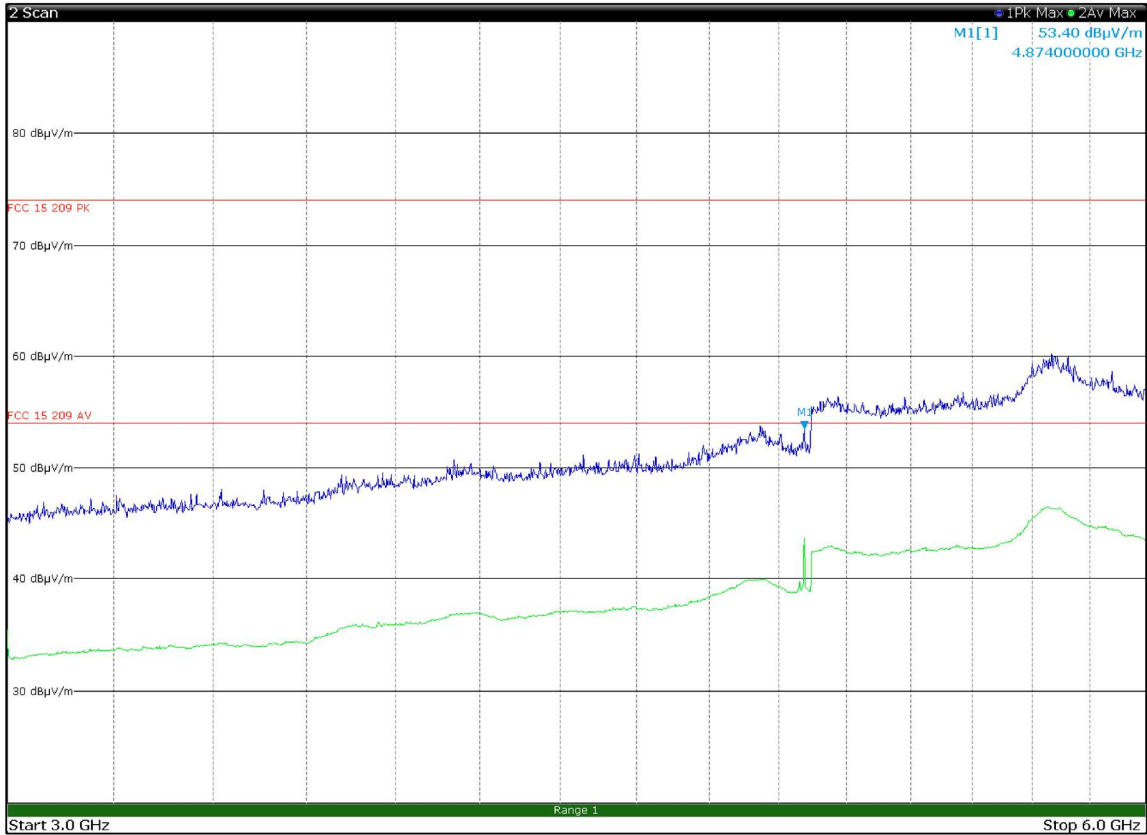


Figure 8.1-5: Radiated spurious emissions with WCDMA at 1880 MHz and WIFI at 2437 MHz – antenna in horizontal polarization

Frequency (GHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
4.8740	53.4	74.0	-20.6	Pk
4.8740	45.3	54.0	-8.7	Av

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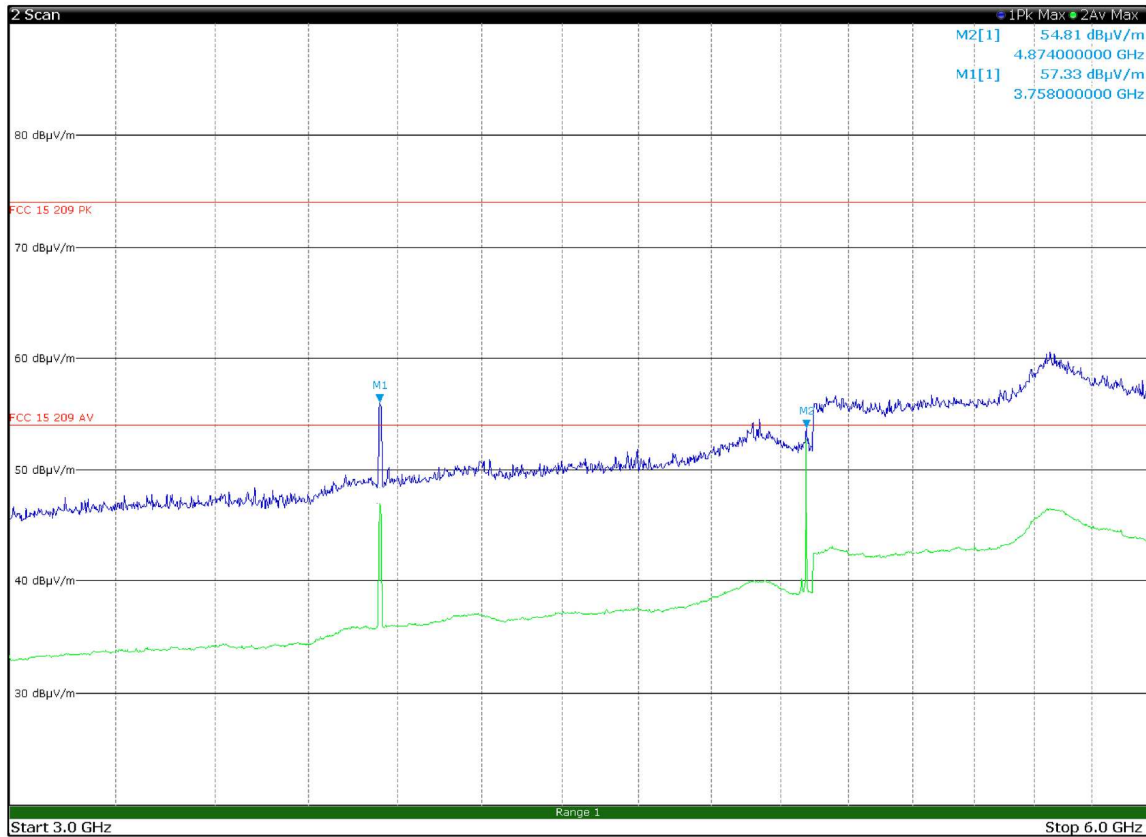


Figure 8.1-6: Radiated spurious emissions with WCDMA at 1880 MHz and WIFI at 2437 MHz – antenna in vertical polarization

Frequency (GHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
3.7580	54.8	82.2	-27.4	Pk
4.8740	53.8	74.0	-20.2	Pk
4.8740	48.5	54.0	-5.5	Av

The limit for WCDMA is -13 dBm. Limit (dBµV/m) = limit (dBm) + 95.23 = 82.2 dBµV/m

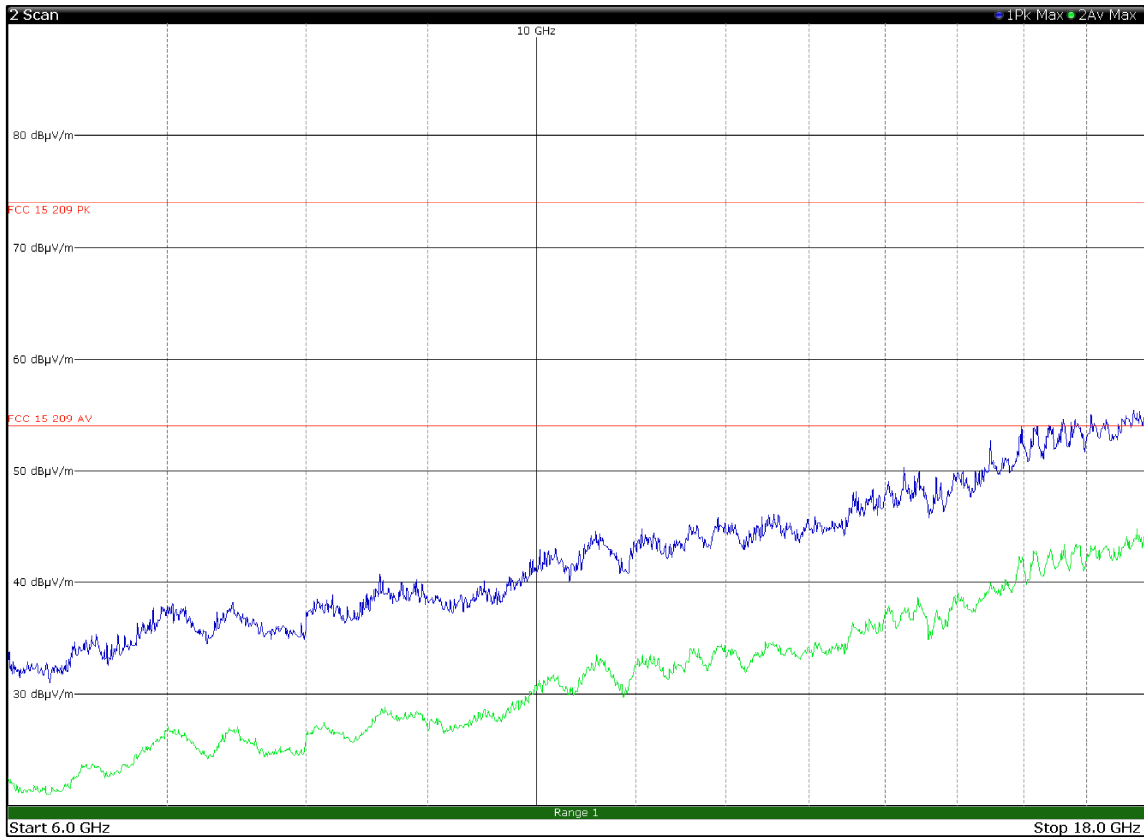


Figure 8.1-7: Radiated spurious emissions with WCDMA at 1880 MHz and WIFI at 2437 MHz – antenna in horizontal polarization

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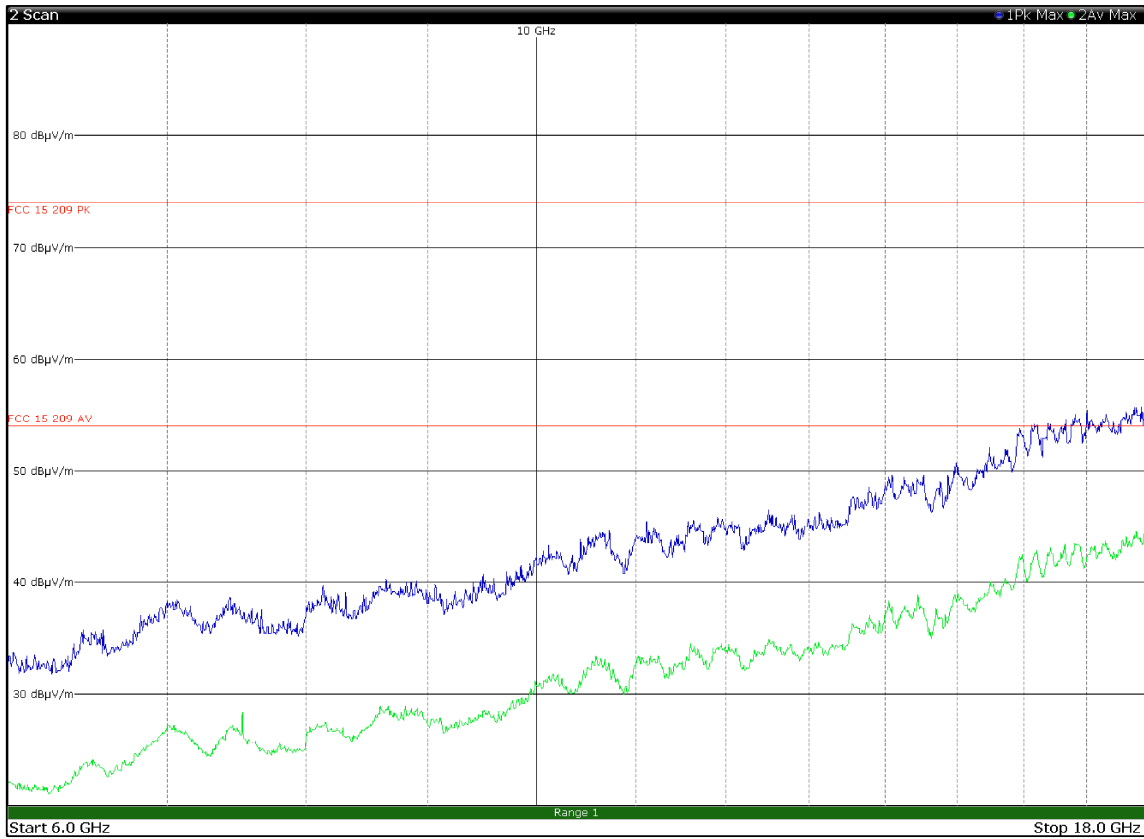


Figure 8.1-8: Radiated spurious emissions with WCDMA at 1880 MHz and WIFI at 2437 MHz – antenna in vertical polarization

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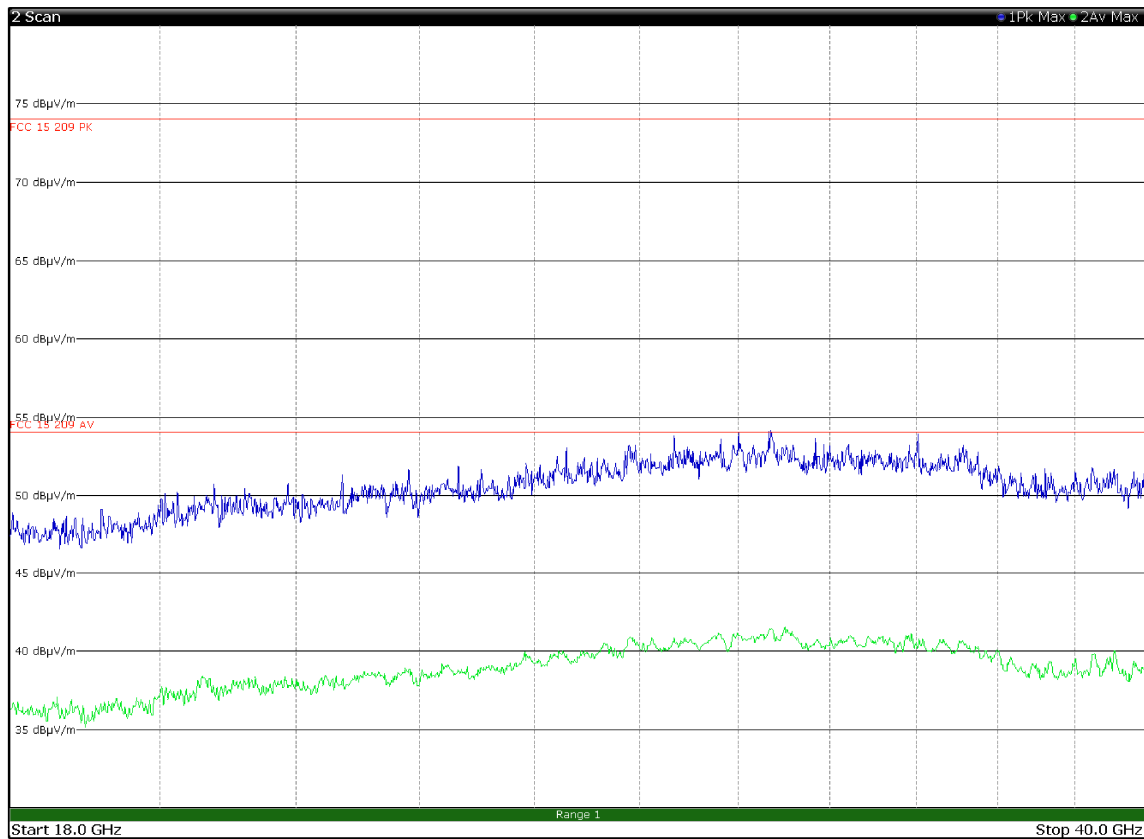


Figure 8.1-9: Radiated spurious emissions with WCDMA at 1880 MHz and WIFI at 2437 MHz – antenna in horizontal polarization

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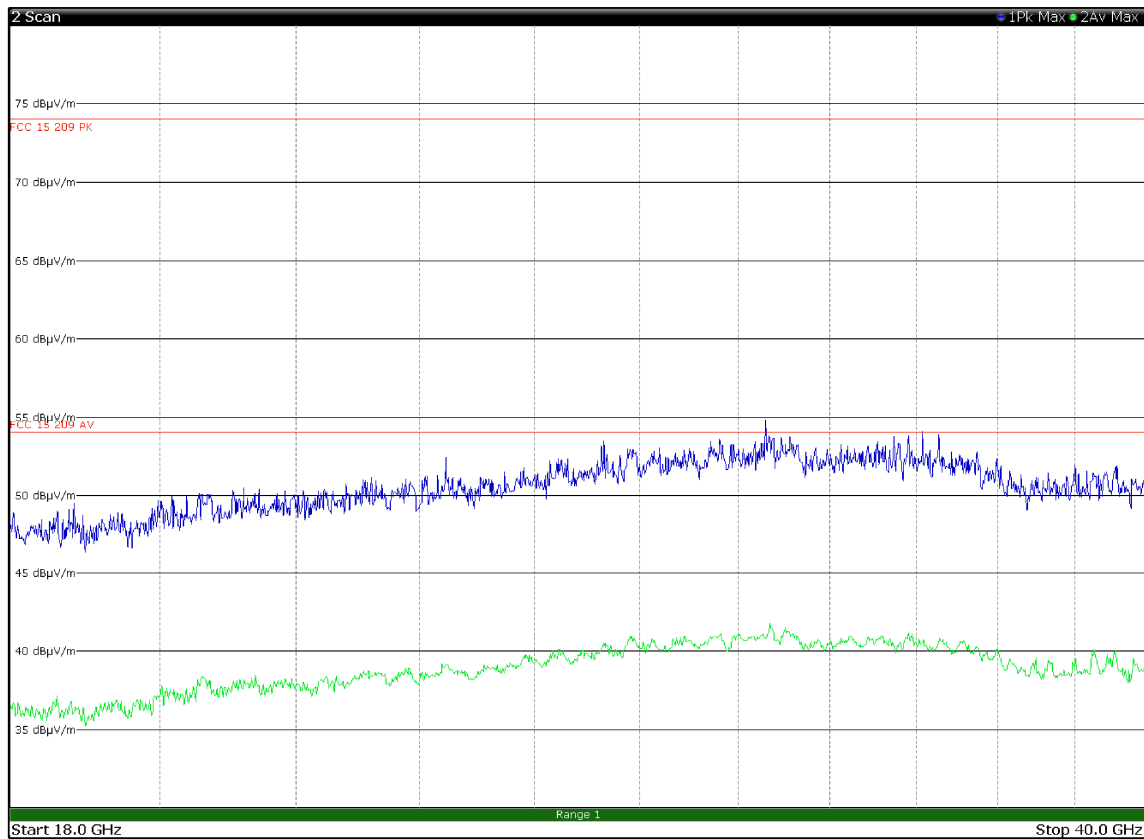


Figure 8.1-10: Radiated spurious emissions with WCDMA at 1880 MHz and WIFI at 2437 MHz – antenna in vertical polarization

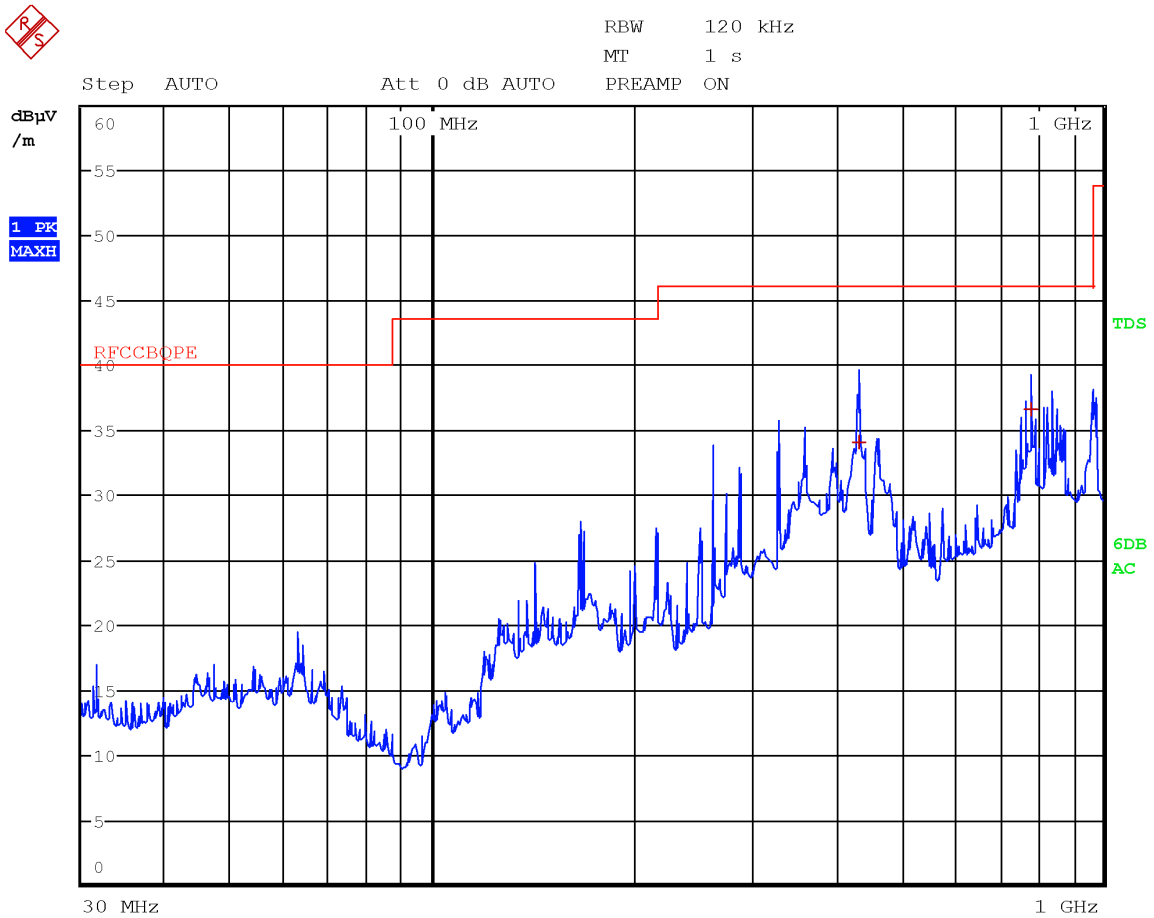


Figure 8.1-11: Radiated spurious emissions with WCDMA at 1732.6 MHz and WIFI at 2437 MHz – antenna in horizontal polarization

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
432.6800	34.1	46.0	-11.9	QP
780.1200	36.6	46.0	-9.4	QP

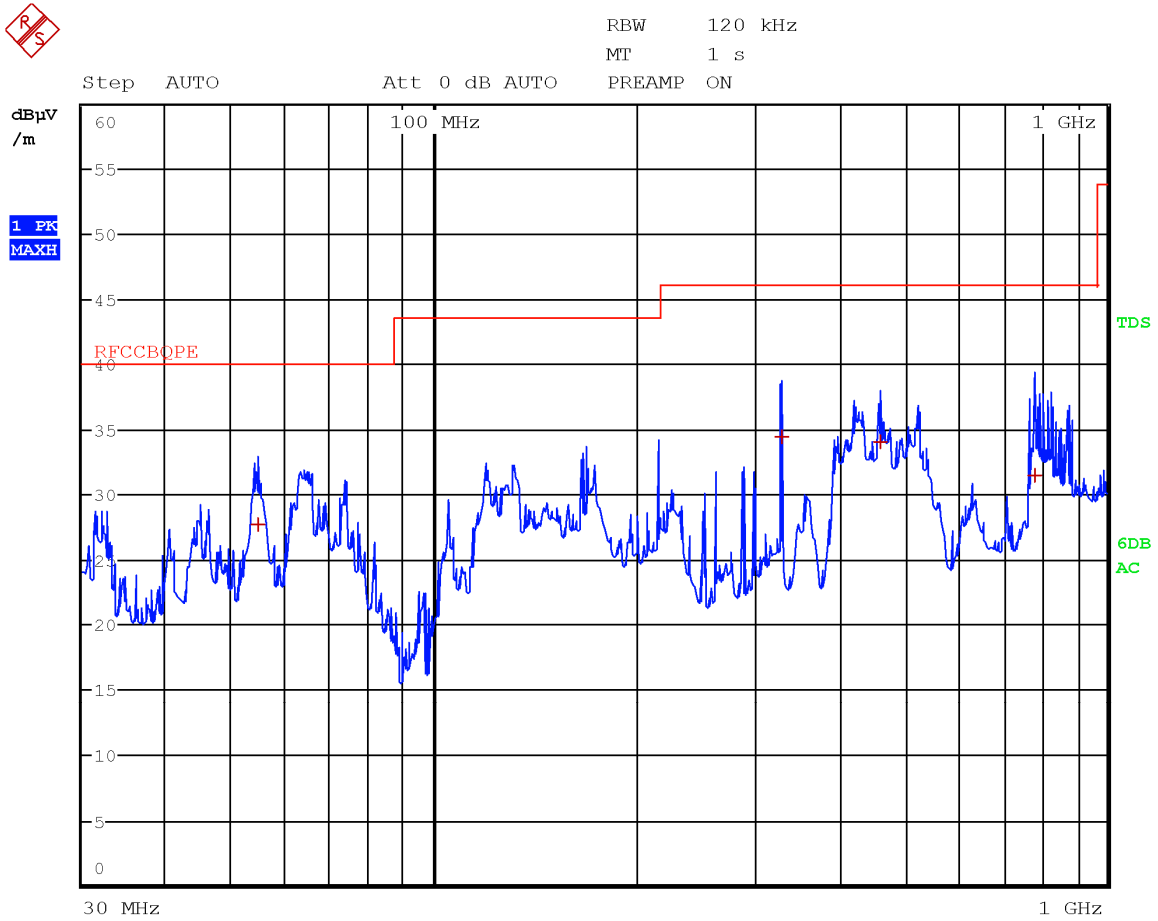


Figure 8.1-12: Radiated spurious emissions with WCDMA at 1732.6 MHz and WIFI at 2437 MHz – antenna in vertical polarization

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1674.4000	44.3	54.0	-9.7	Av
1674.8000	53.6	74.0	-20.4	Pk
2512.0000	52.3	74.0	-21.7	Pk
2512.0000	41.7	54.0	-12.3	Av

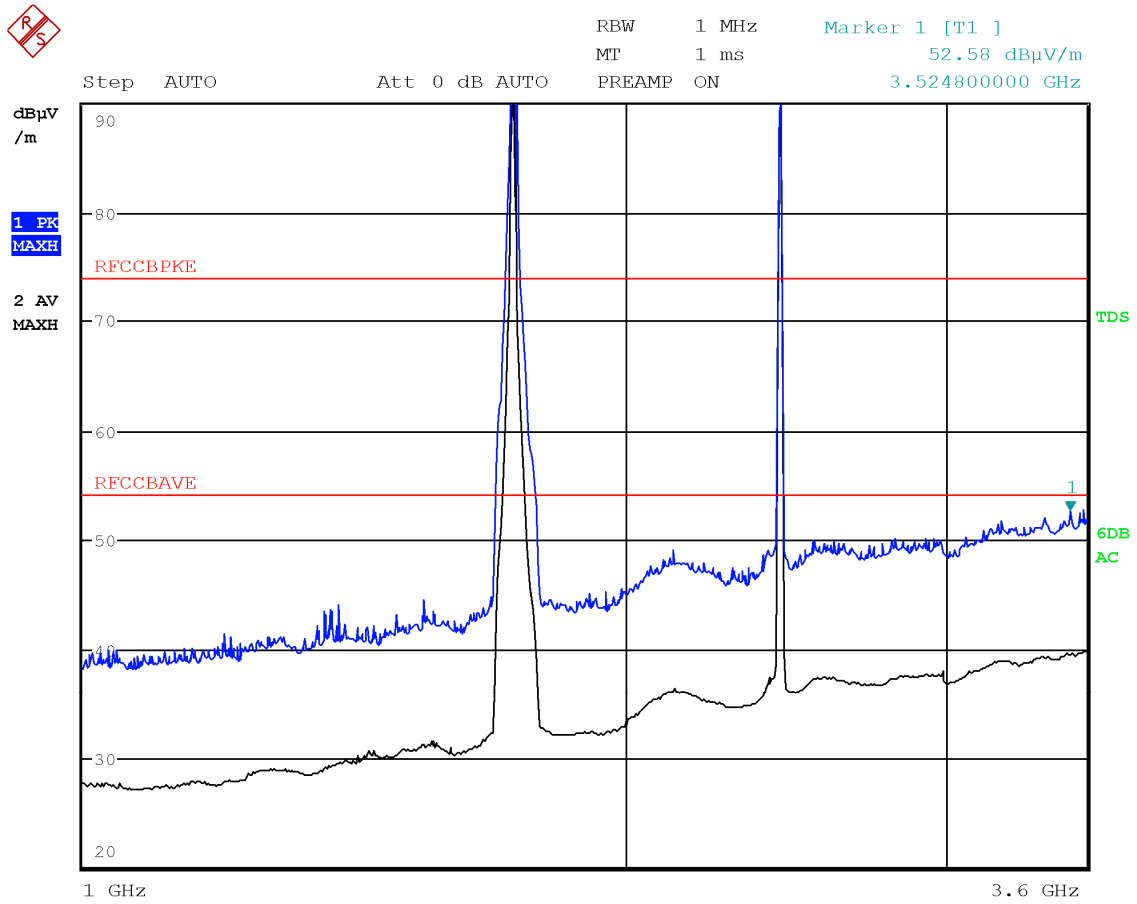


Figure 8.1-13: Radiated spurious emissions with WCDMA at 1732.6 MHz and WIFI at 2437 MHz – antenna in horizontal polarization

Note: Emissions above the limit were from intentional emissions. no intermodulation emissions were detected

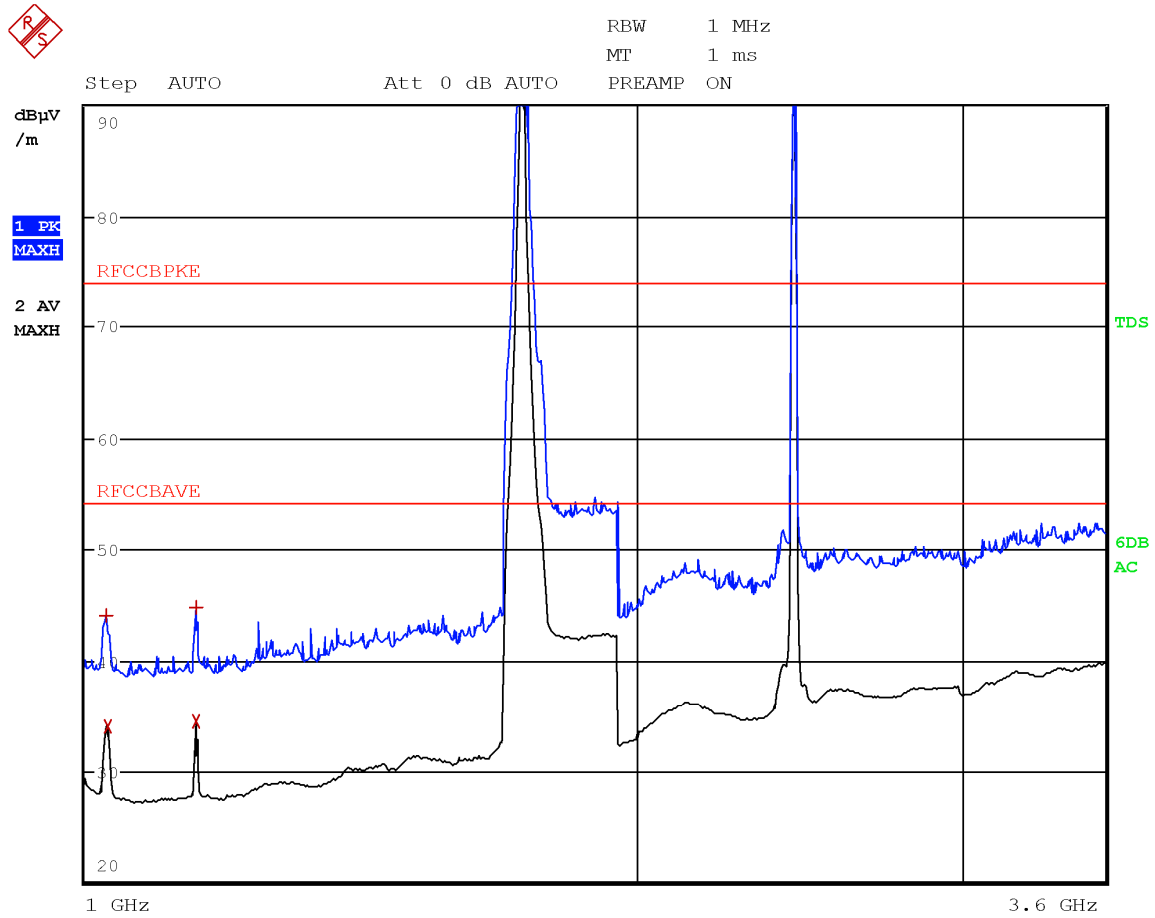


Figure 8.1-14: Radiated spurious emissions with WCDMA at 1732.6 MHz and WIFI at 2437 MHz – antenna in vertical polarization

Note: Emissions above the limit were from intentional emissions. no intermodulation emissions were detected

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1026.8000	44.1	74.0	-29.9	Pk
1028.0000	34.1	54.0	-19.9	Av
1148.8000	34.5	54.0	-19.5	Av
1148.8000	44.8	74.0	-29.2	Pk

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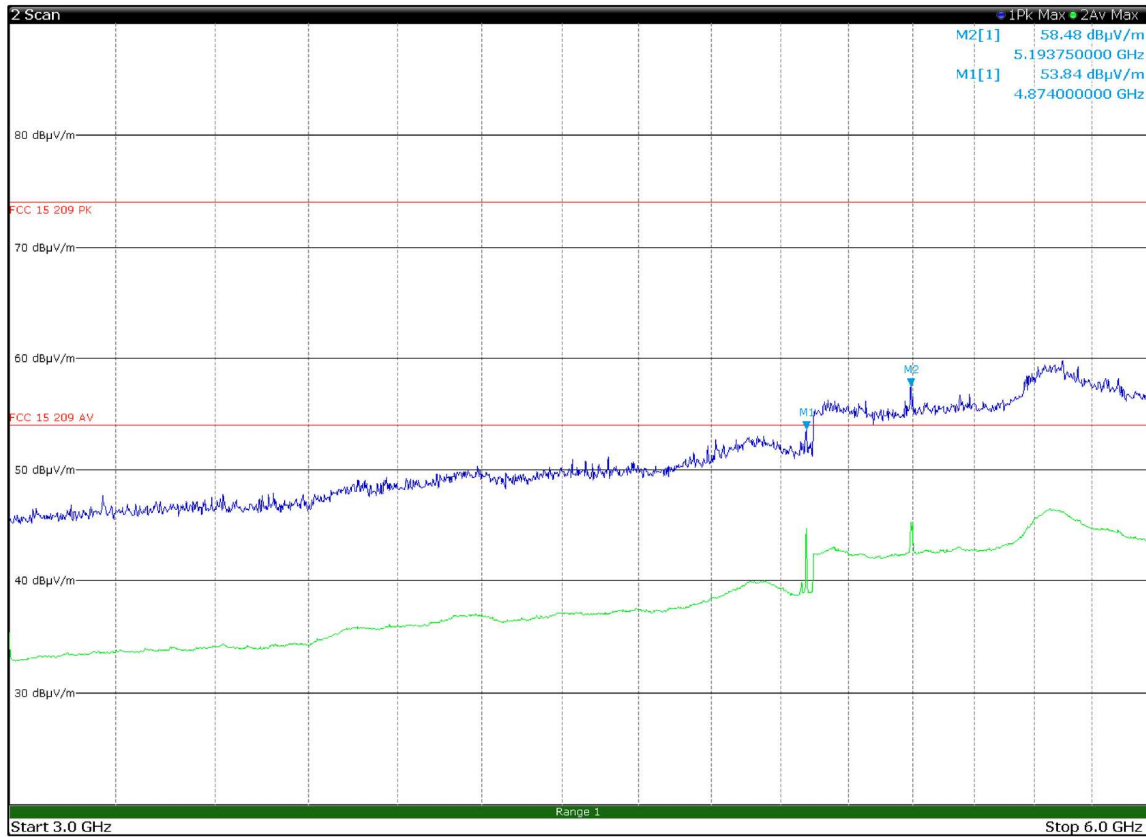


Figure 8.1-15: Radiated spurious emissions with WCDMA at 1732.6 MHz and WIFI at 2437 MHz – antenna in horizontal polarization

Frequency (GHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
4.8740	53.9	74.0	-20.1	Pk
4.8740	47.3	54.0	-6.7	Av
5.1937	58.5	82.2	-23.7	Av

The limit for WCDMA is -13 dBm. Limit (dBµV/m) = limit (dBm) + 95.23 = 82.2 dBµV/m

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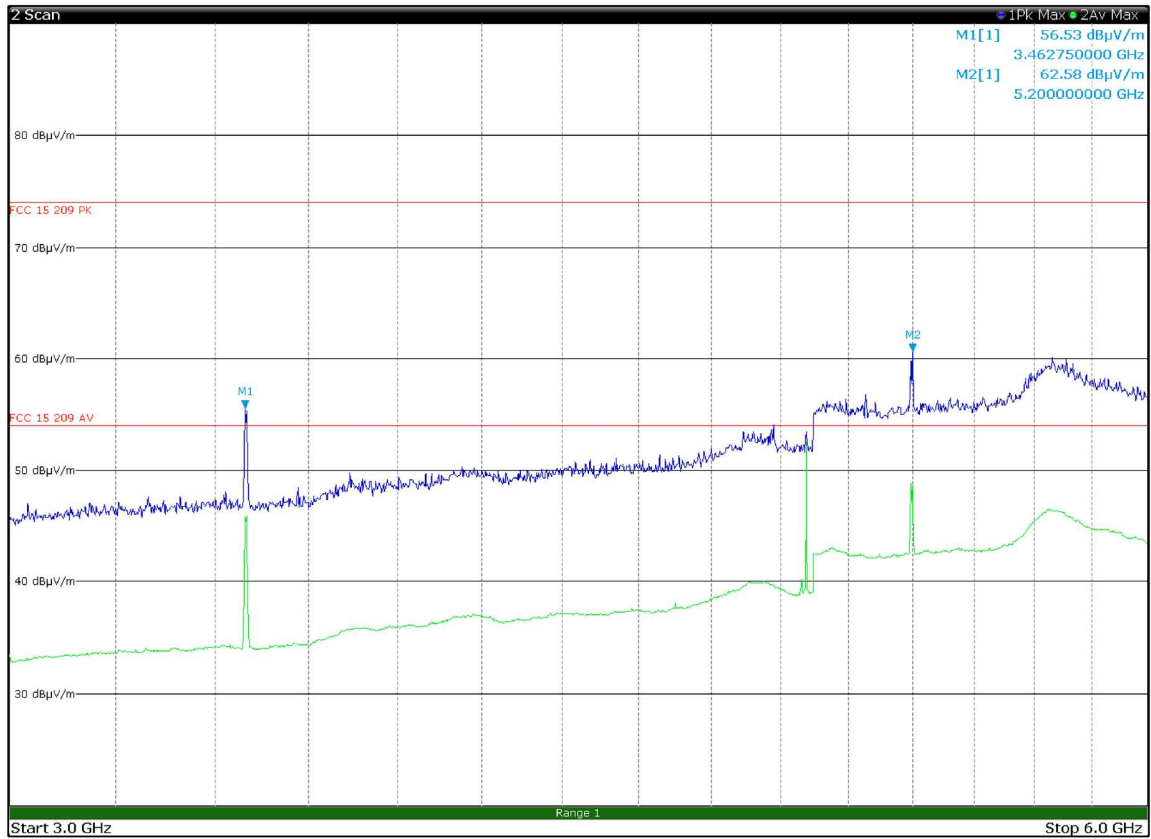


Figure 8.1-16: Radiated spurious emissions with WCDMA at 1732.6 MHz and WIFI at 2437 MHz – antenna in vertical polarization

Frequency (GHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
3.4627	56.6	82.2	-25.6	Pk
4.8740	54.2	74.0	-19.8	Pk
4.8740	50.5	54.0	-3.5	Av
5.1937	62.6	82.2	-19.6	Av

The limit for WCDMA is -13 dBm. Limit (dBµV/m) = limit (dBm) + 95.23 = 82.2 dBµV/m

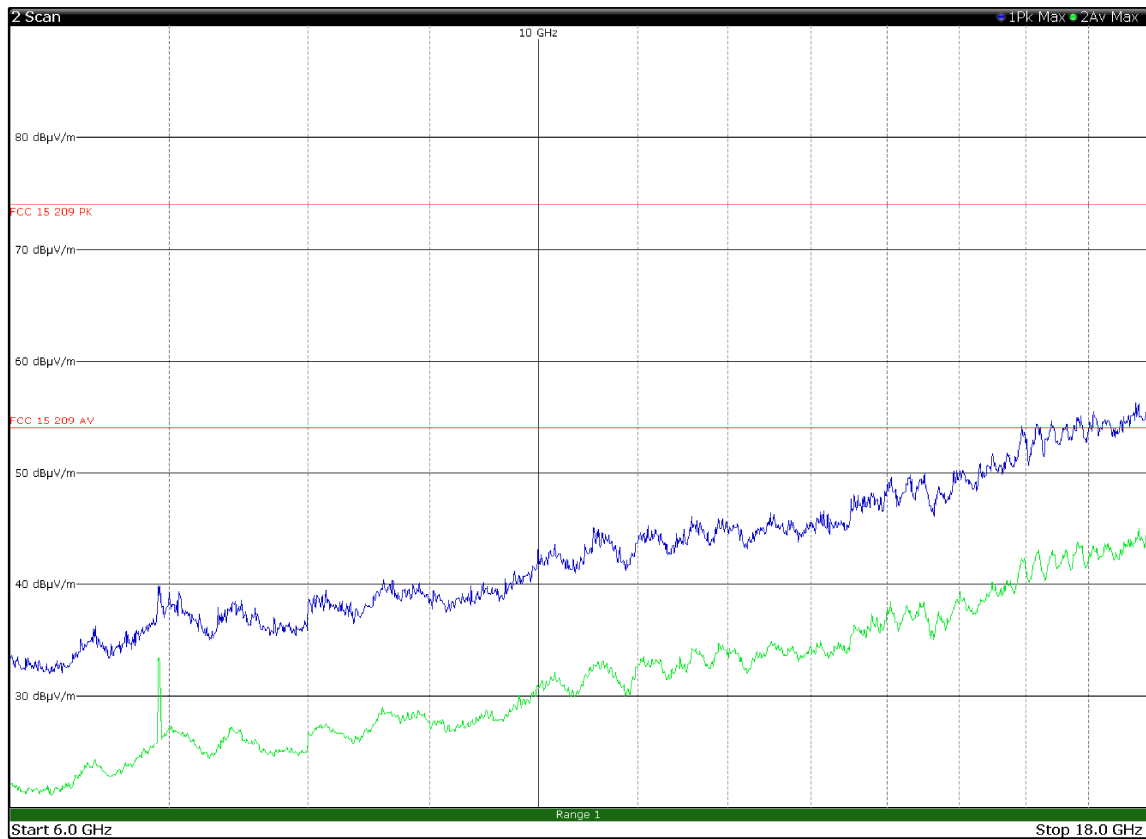


Figure 8.1-17: Radiated spurious emissions with WCDMA at 1732.6 MHz and WIFI at 2437 MHz – antenna in horizontal polarization

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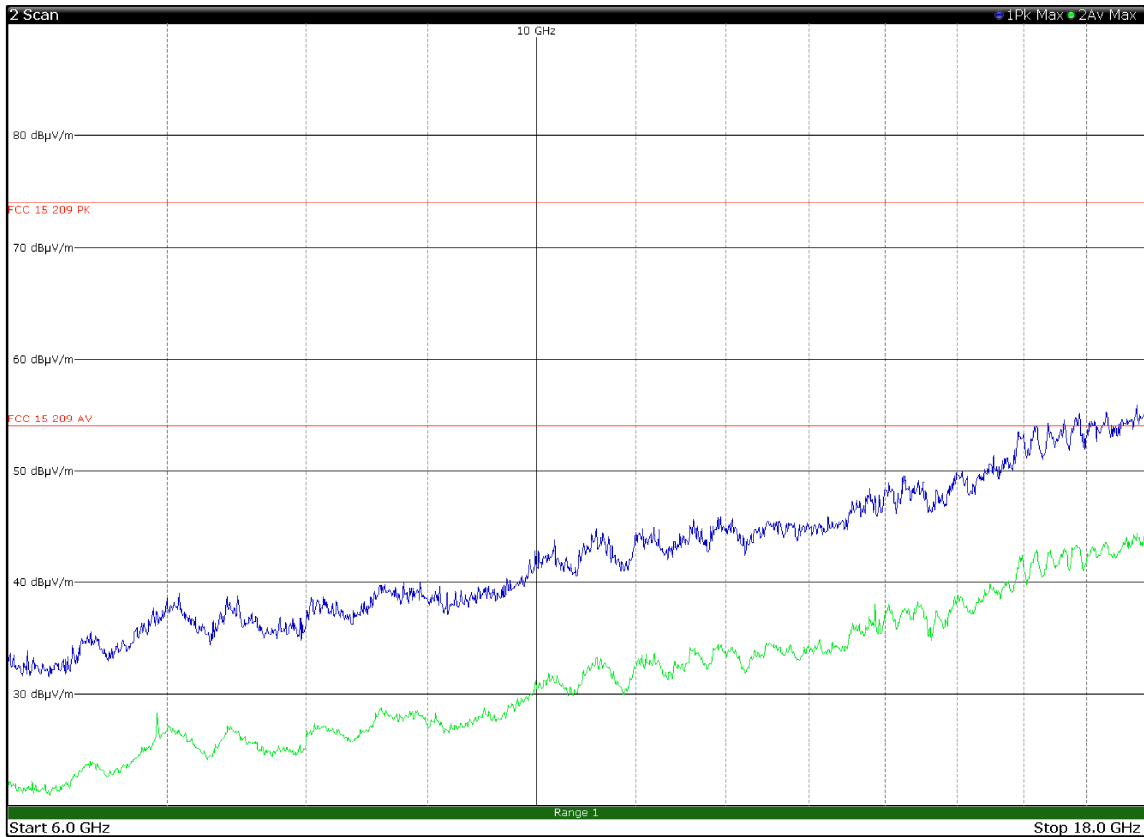


Figure 8.1-18: Radiated spurious emissions with WCDMA at 1732.6 MHz and WIFI at 2437 MHz – antenna in vertical polarization

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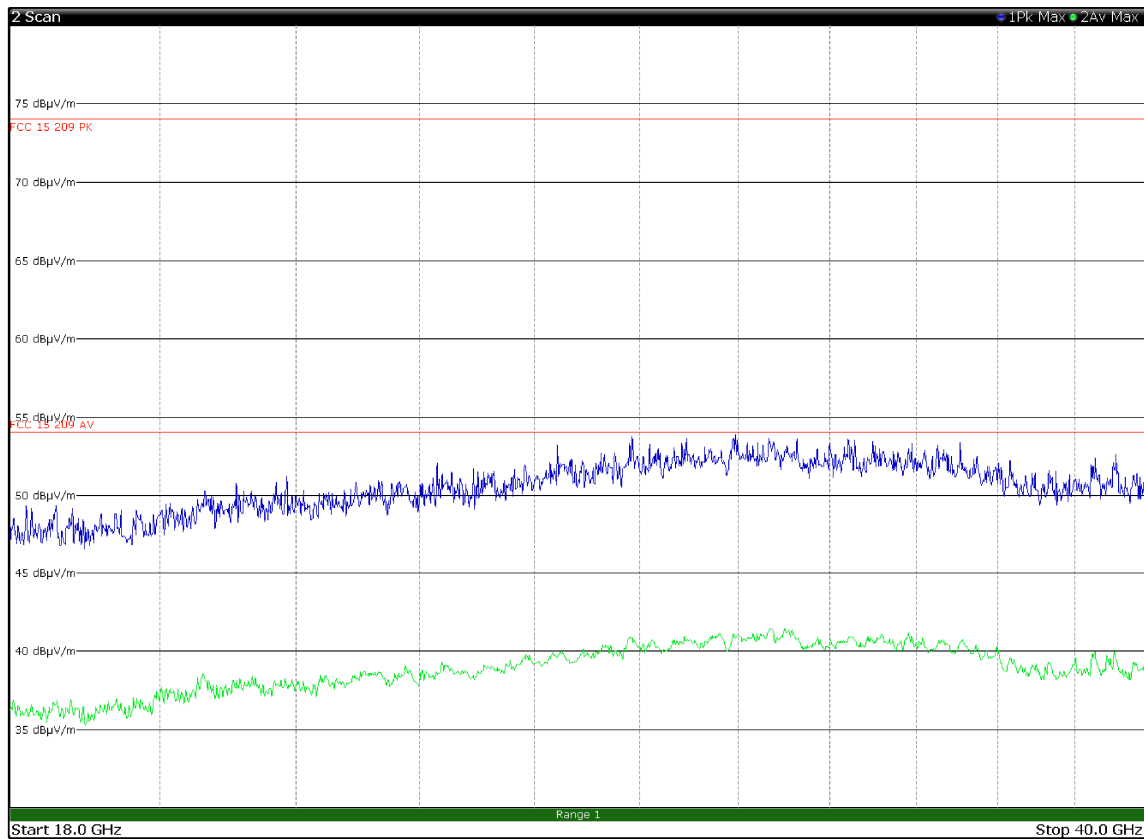


Figure 8.1-19: Radiated spurious emissions with WCDMA at 1732.6 MHz and WIFI at 2437 MHz – antenna in horizontal polarization

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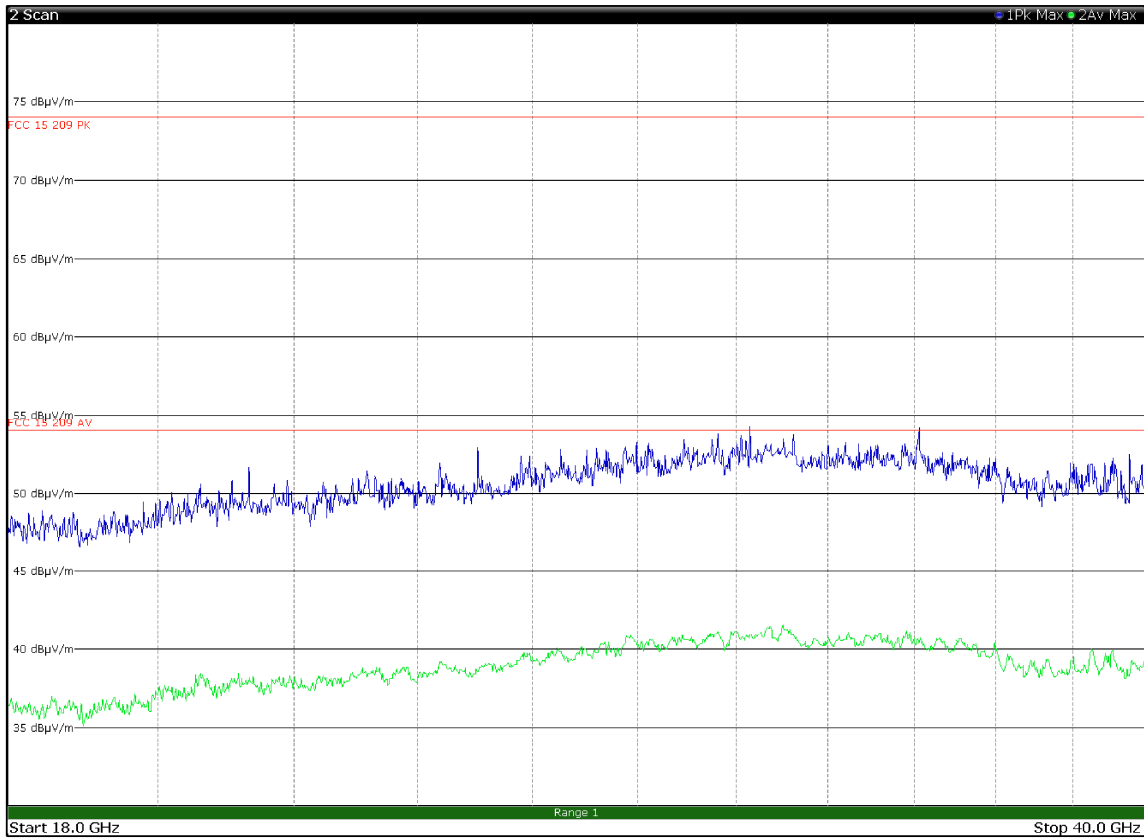


Figure 8.1-20: Radiated spurious emissions with WCDMA at 1732.6 MHz and WIFI at 2437 MHz – antenna in vertical polarization

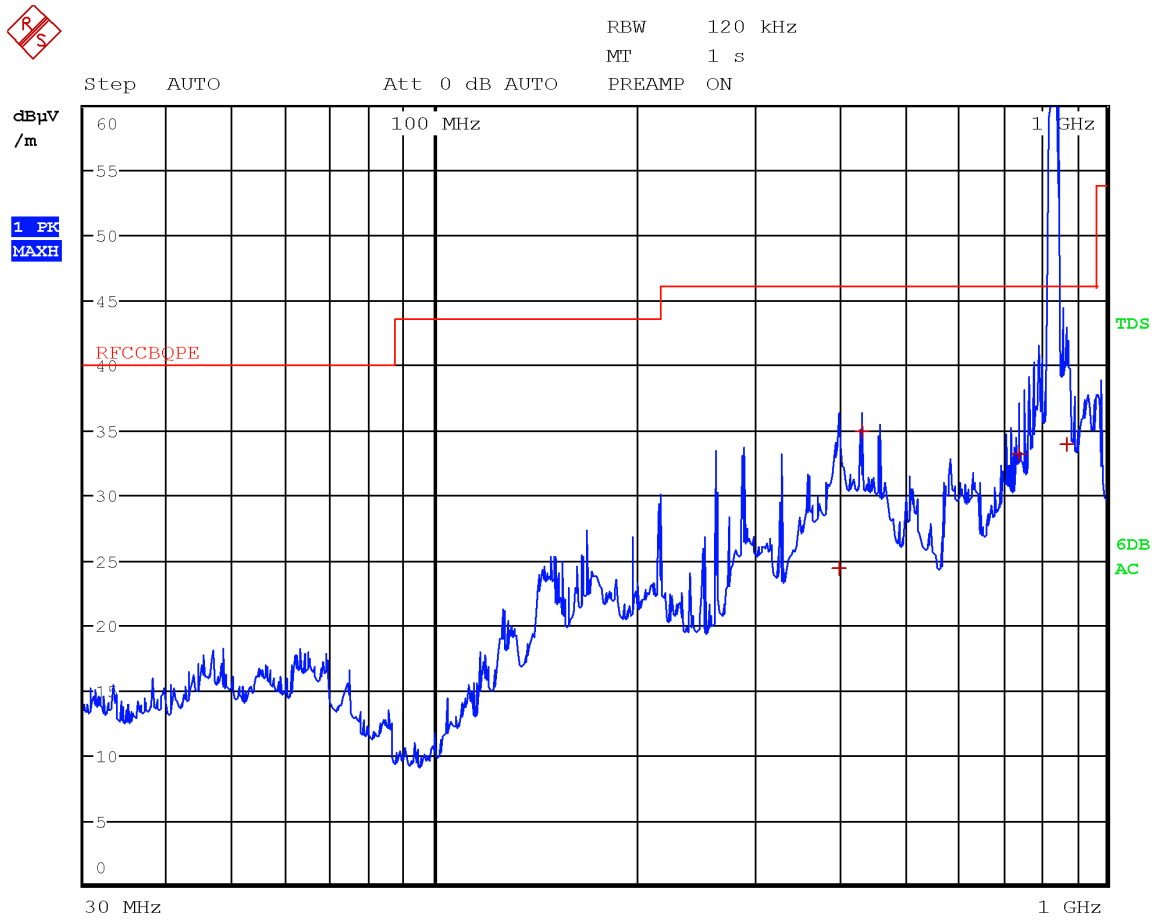


Figure 8.1-21: Radiated spurious emissions with WCDMA at 832.6 MHz and WIFI at 2437 MHz – antenna in horizontal polarization

Note: Emissions above the limit were from intentional emissions. no intermodulation emissions were detected

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
400.0400	24.4	46.0	-21.6	QP
432.6800	35.0	46.0	-11.0	QP
744.0400	33.2	46.0	-12.8	QP
876.0400	34.0	46.0	-12.0	QP

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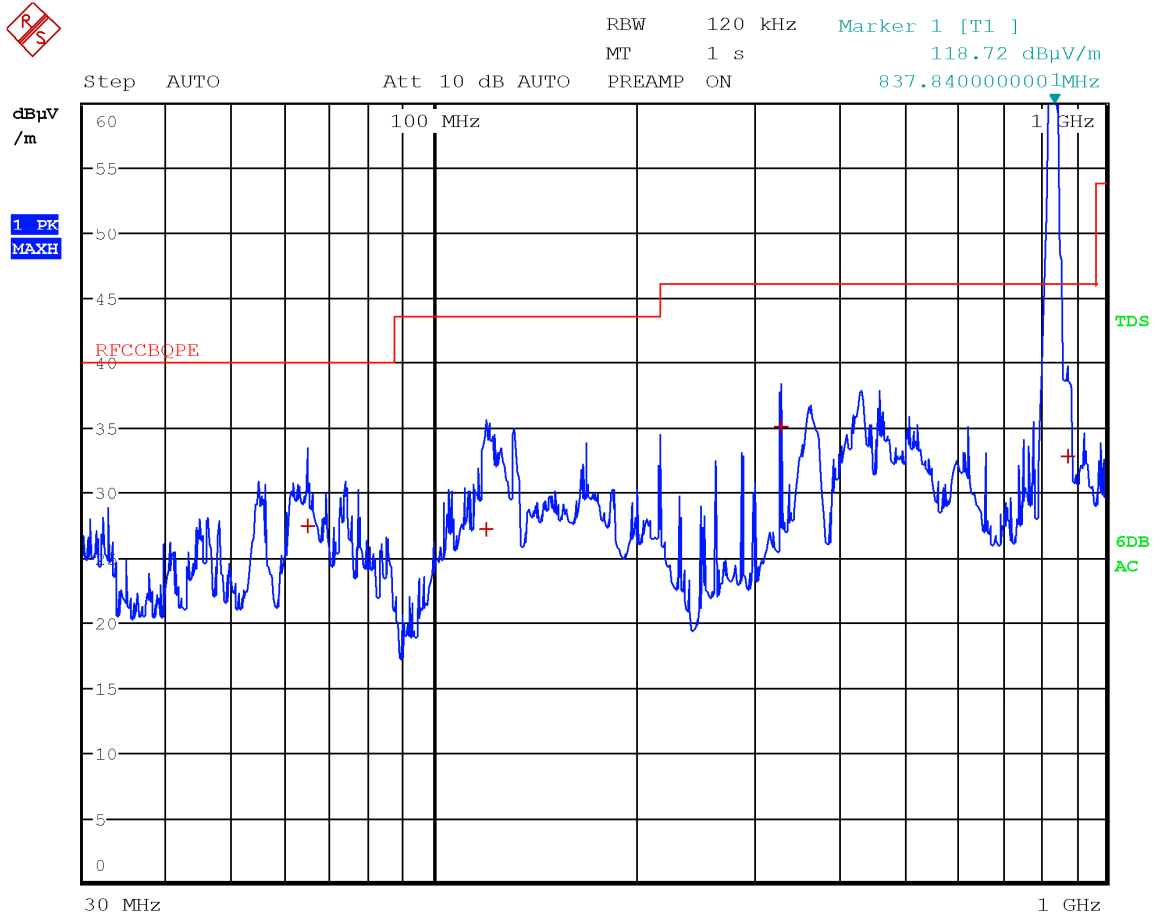


Figure 8.1-22: Radiated spurious emissions with WCDMA at 832.6 MHz and WIFI at 2437 MHz – antenna in vertical polarization

Note: Emissions above the limit were from intentional emissions. no intermodulation emissions were detected

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
64.9200	27.5	40.0	-12.5	QP
119.5600	27.3	43.5	-16.2	QP
328.4000	35.2	46.0	-10.8	QP
881.0800	32.9	46.0	-13.1	QP

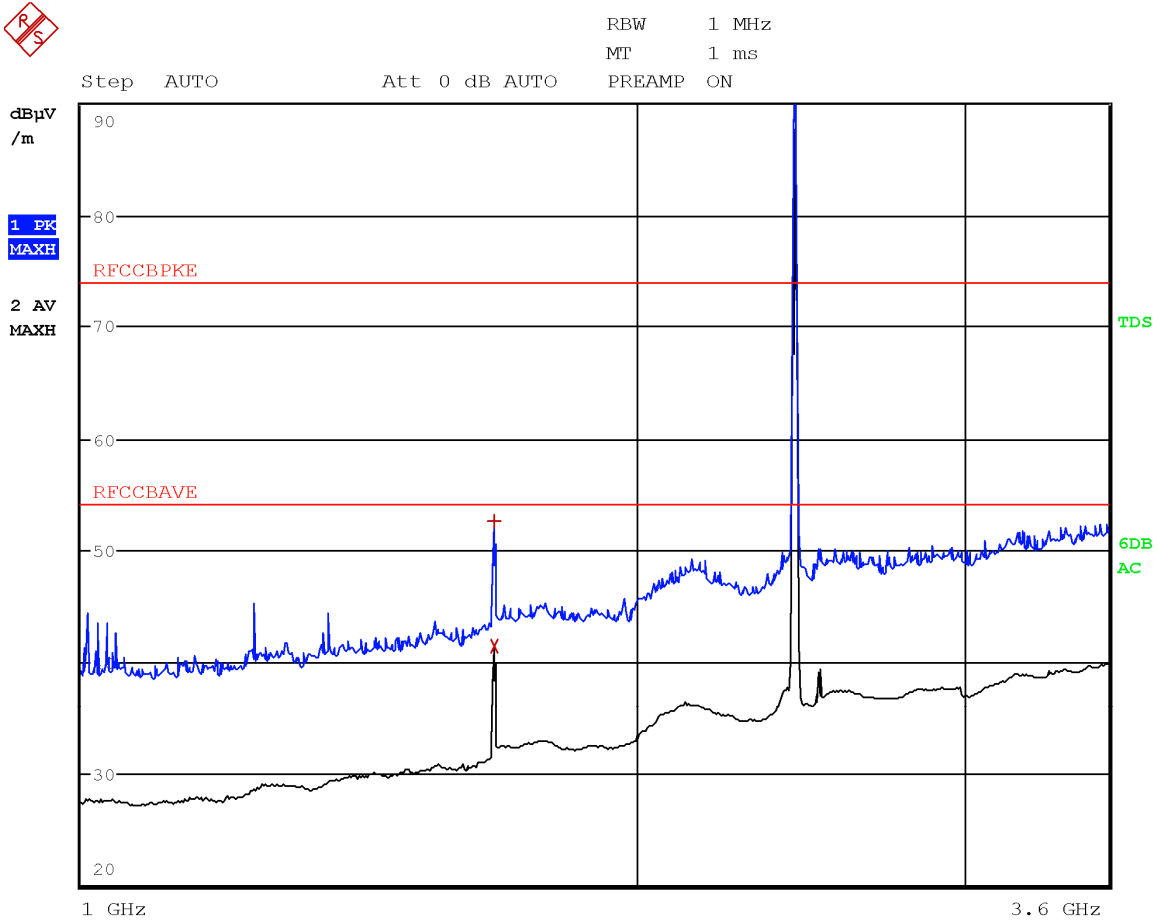


Figure 8.1-23: Radiated spurious emissions with WCDMA at 832.6 MHz and WIFI at 2437 MHz – antenna in horizontal polarization

Note: Emissions above the limit were from intentional emissions. no intermodulation emissions were detected

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1674.8000	52.6	82.2	-29.6	Pk

The limit for LTE is -13 dBm. Limit (dBµV/m) = limit (dBm) + 95.23 = 82.2 dBµV/m

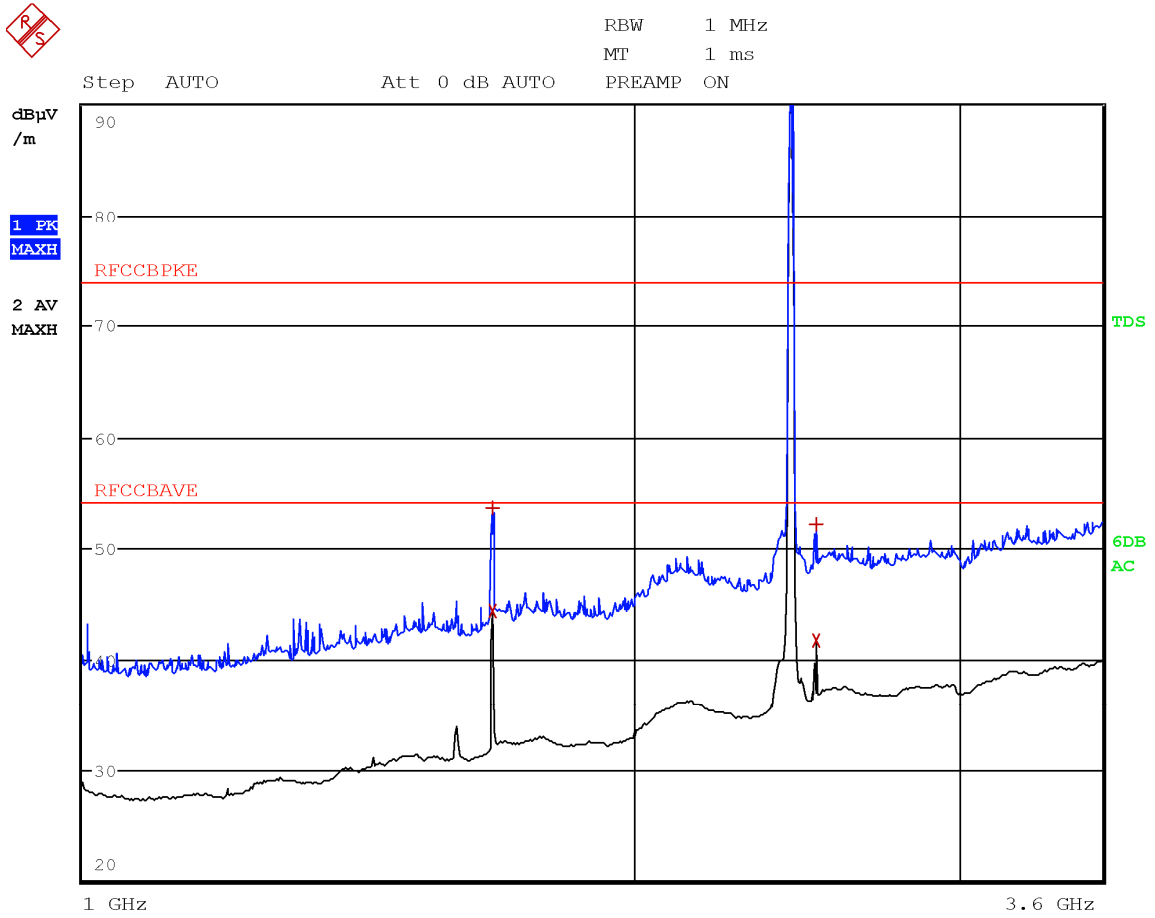


Figure 8.1-24: Radiated spurious emissions with WCDMA at 832.6 MHz and WIFI at 2437 MHz – antenna in vertical polarization

Note: Emissions above the limit were from intentional emissions.

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1674.8000	53.6	82.2	-28.6	PK
2512.0000	52.3	74.0	-21.7	PK
2512.0000	41.7	54.0	-12.3	Av

The limit for LTE is -13 dBm. Limit (dBµV/m) = limit (dBm) + 95.23 = 82.2 dBµV/m

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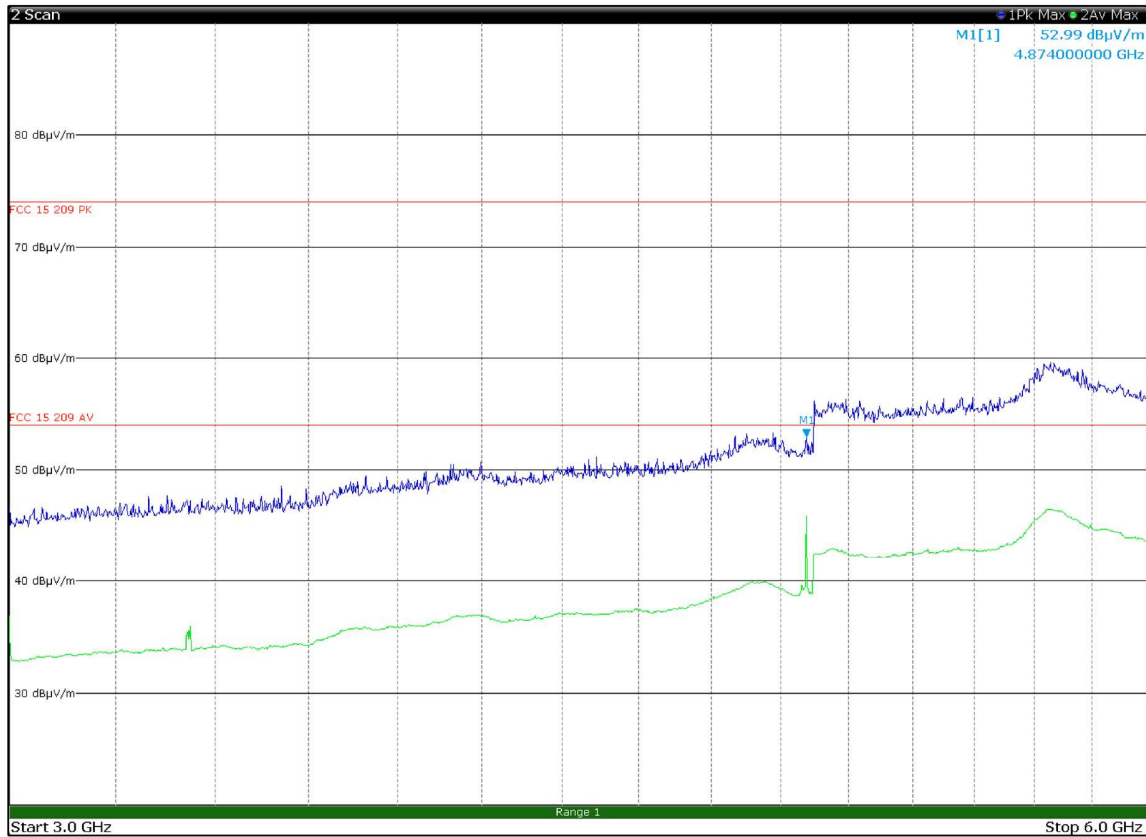


Figure 8.1-25: Radiated spurious emissions with WCDMA at 832.6 MHz and WIFI at 2437 MHz – antenna in horizontal polarization

Frequency (GHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
4.8740	53.0	74.0	-21.0	Pk
4.8740	48.8	54.0	-5.2	Av

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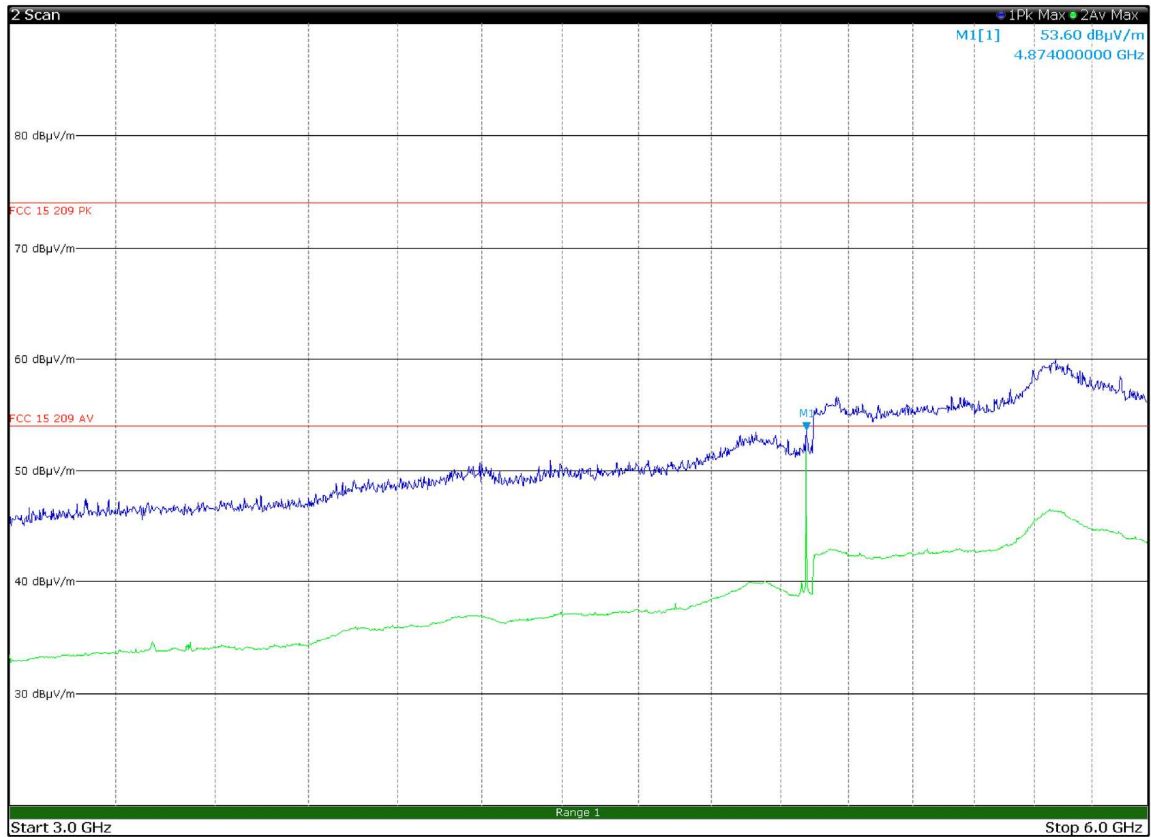


Figure 8.1-26: Radiated spurious emissions with WCDMA at 832.6 MHz and WIFI at 2437 MHz – antenna in vertical polarization

Frequency (GHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
4.8740	53.6	74.0	-20.4	Pk
4.8740	51.3	54.0	-2.7	Av

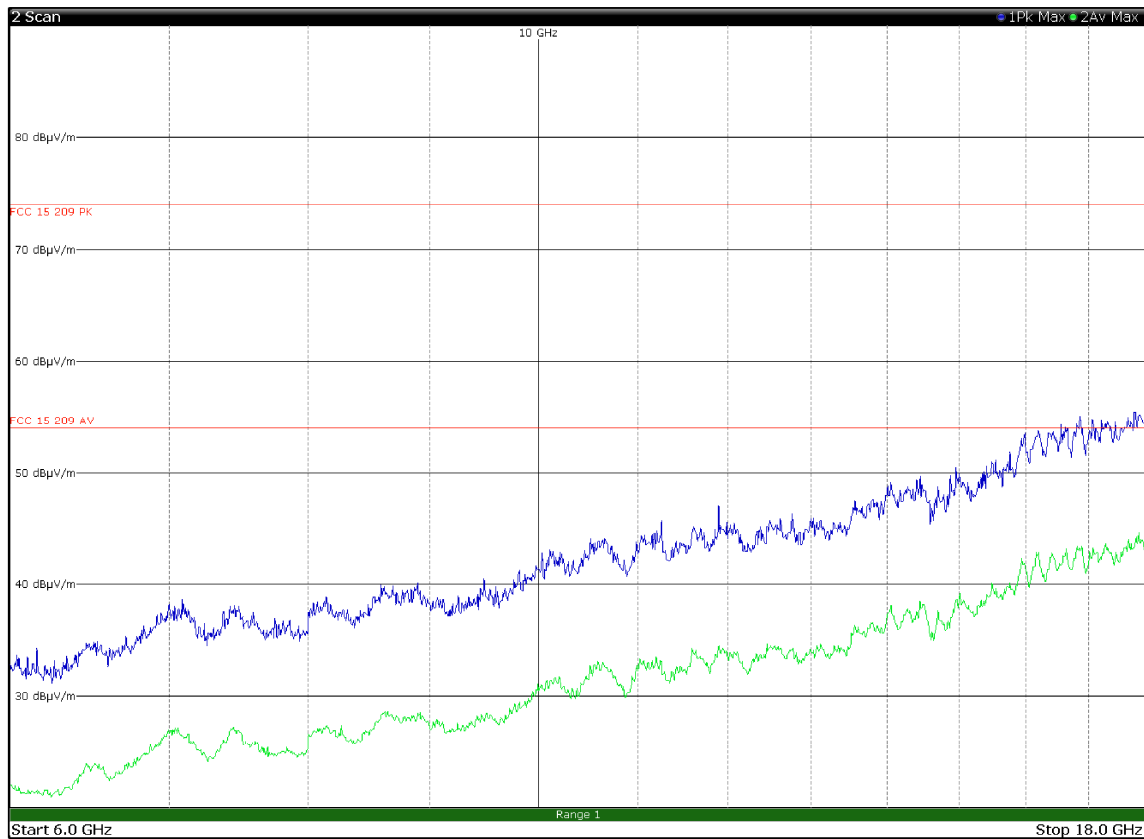


Figure 8.1-27: Radiated spurious emissions with WCDMA at 832.6 MHz and WIFI at 2437 MHz – antenna in horizontal polarization

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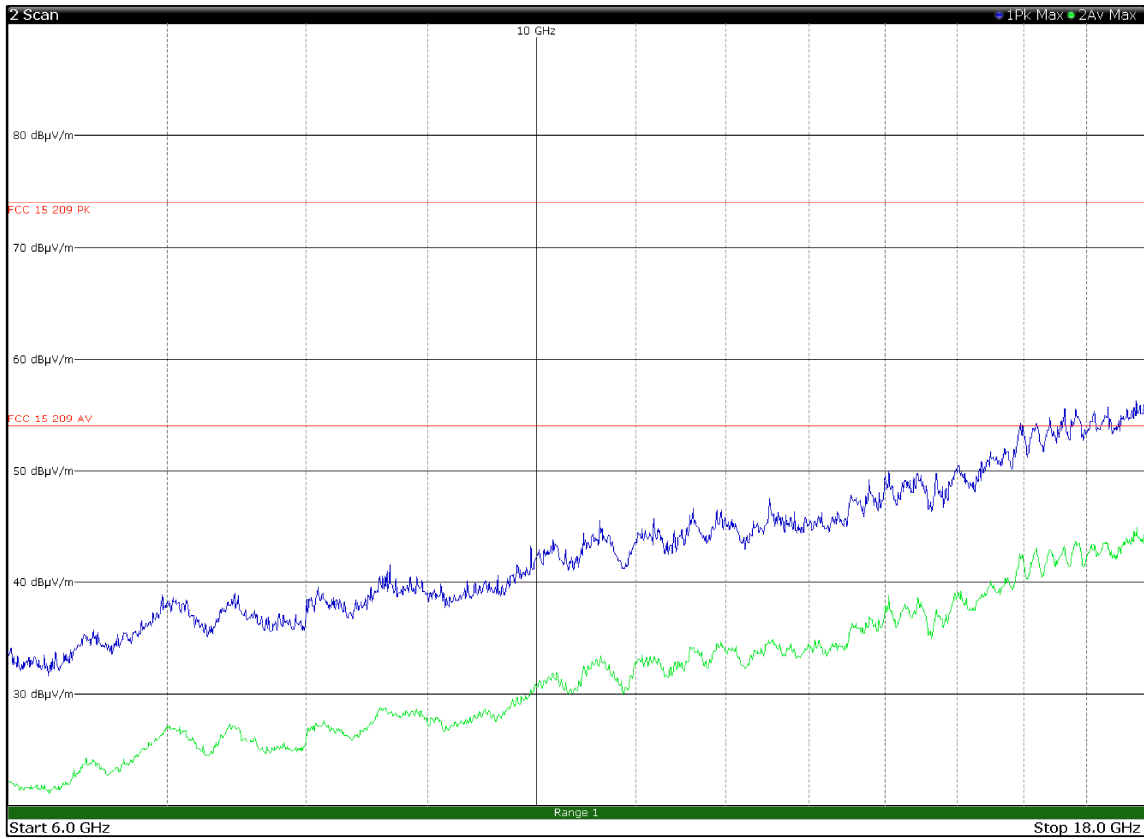


Figure 8.1-28: Radiated spurious emissions with WCDMA at 832.6 MHz and WIFI at 2437 MHz – antenna in vertical polarization

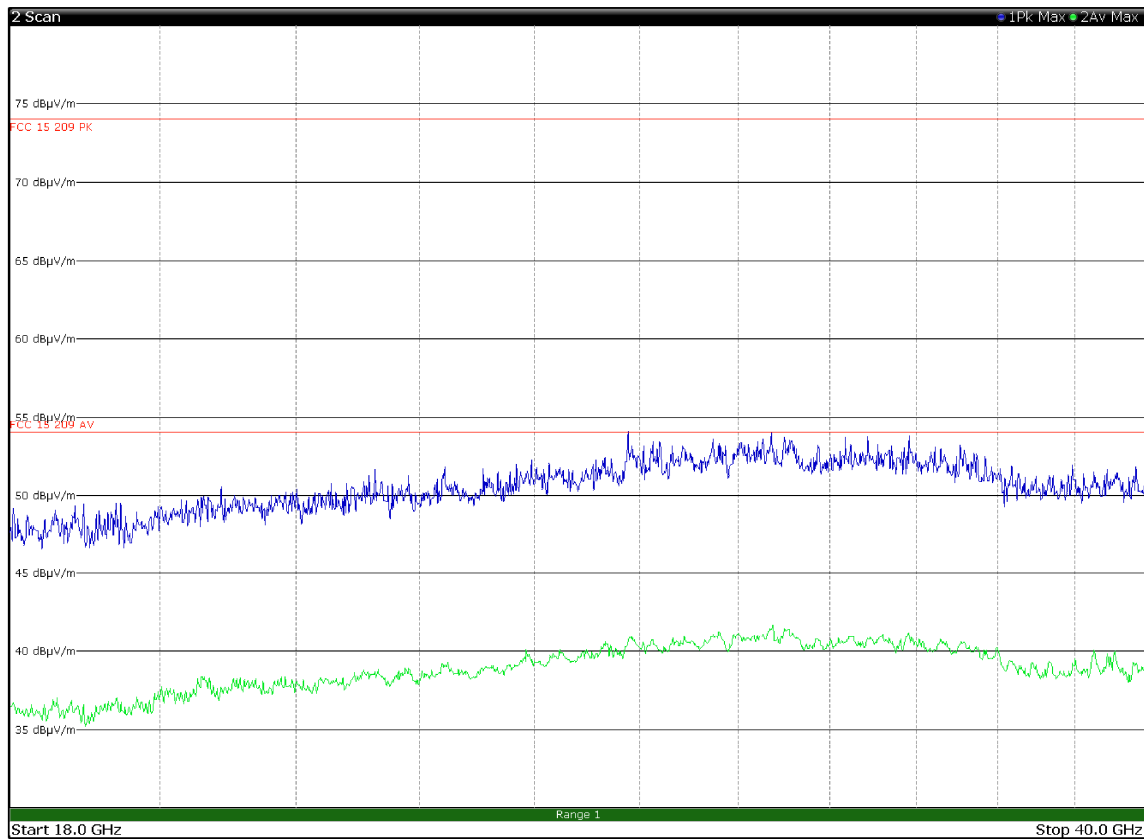


Figure 8.1-29: Radiated spurious emissions with WCDMA at 832.6 MHz and WIFI at 2437 MHz – antenna in horizontal polarization

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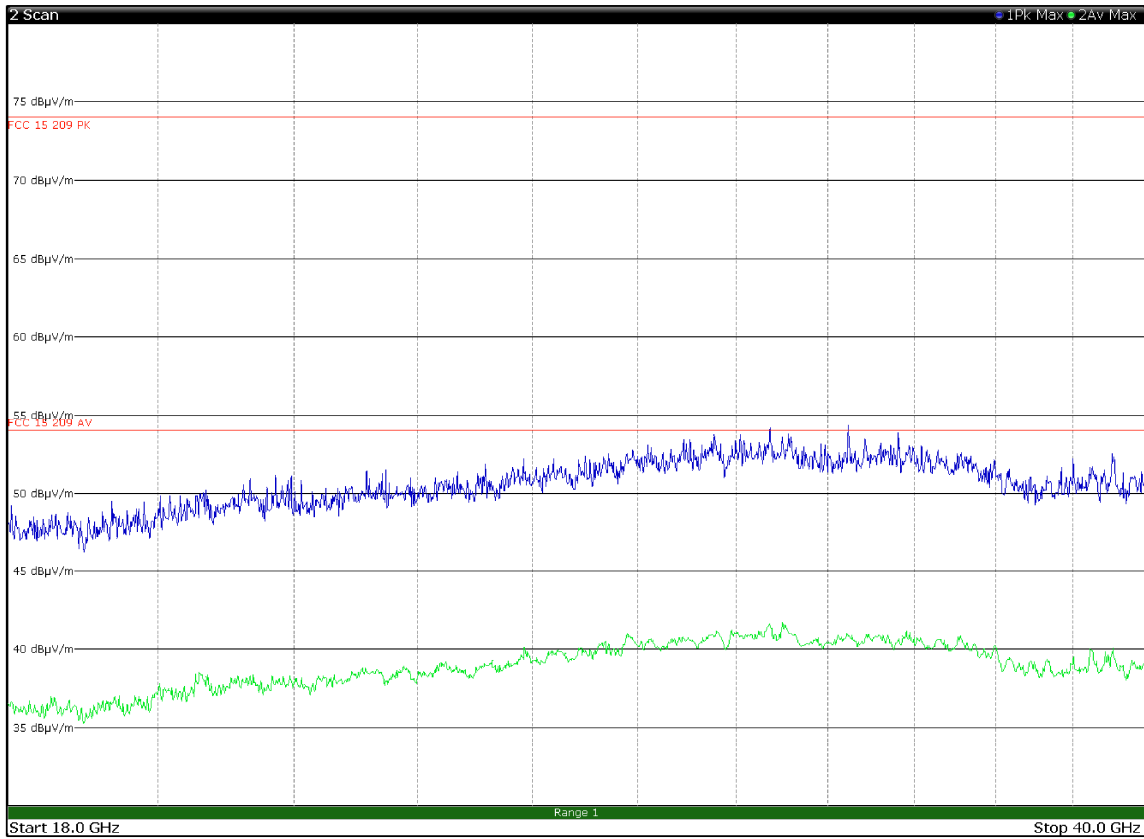


Figure 8.1-30: Radiated spurious emissions with WCDMA at 832.6 MHz and WIFI at 2437 MHz – antenna in vertical polarization

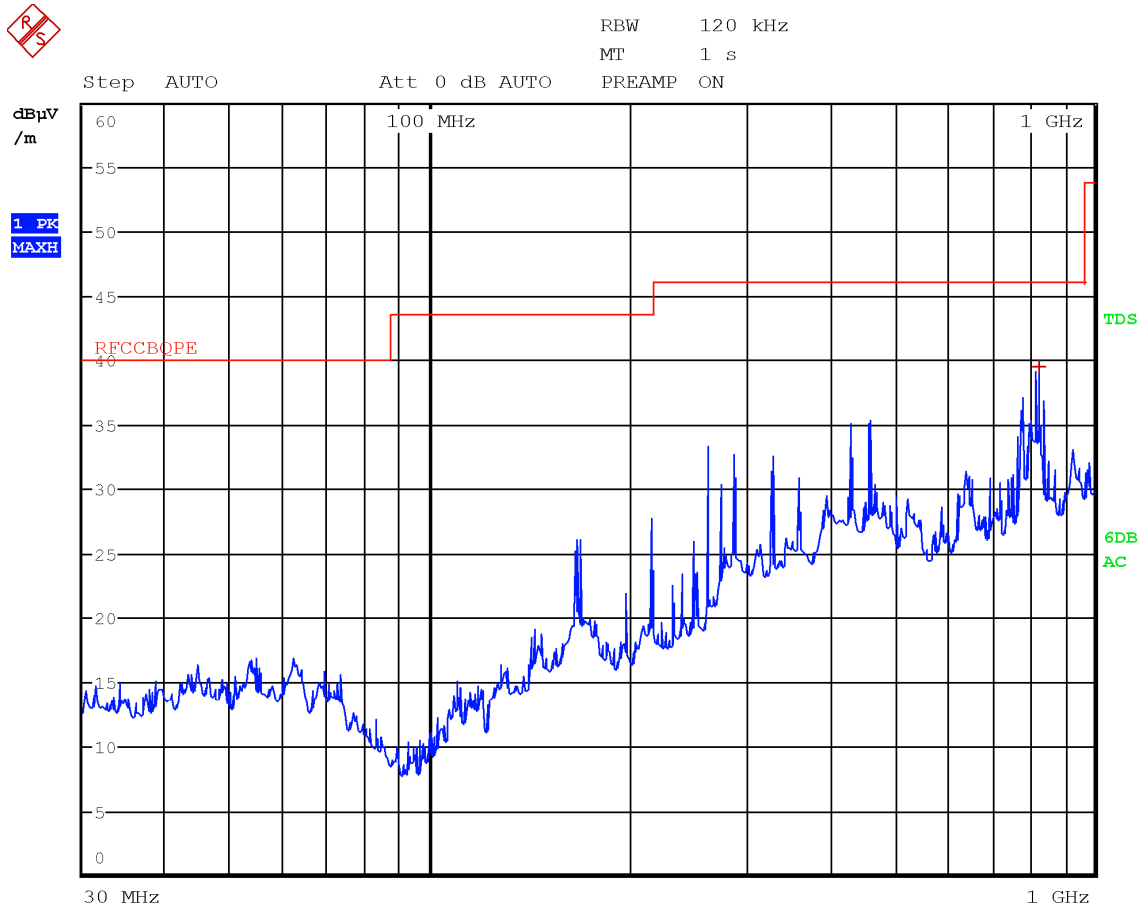


Figure 8.1-31: Radiated spurious emissions with WCDMA at 1880 MHz and WIFI at 5200 MHz – antenna in horizontal polarization

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
828.1600	39.6	46.0	-6.4	QP

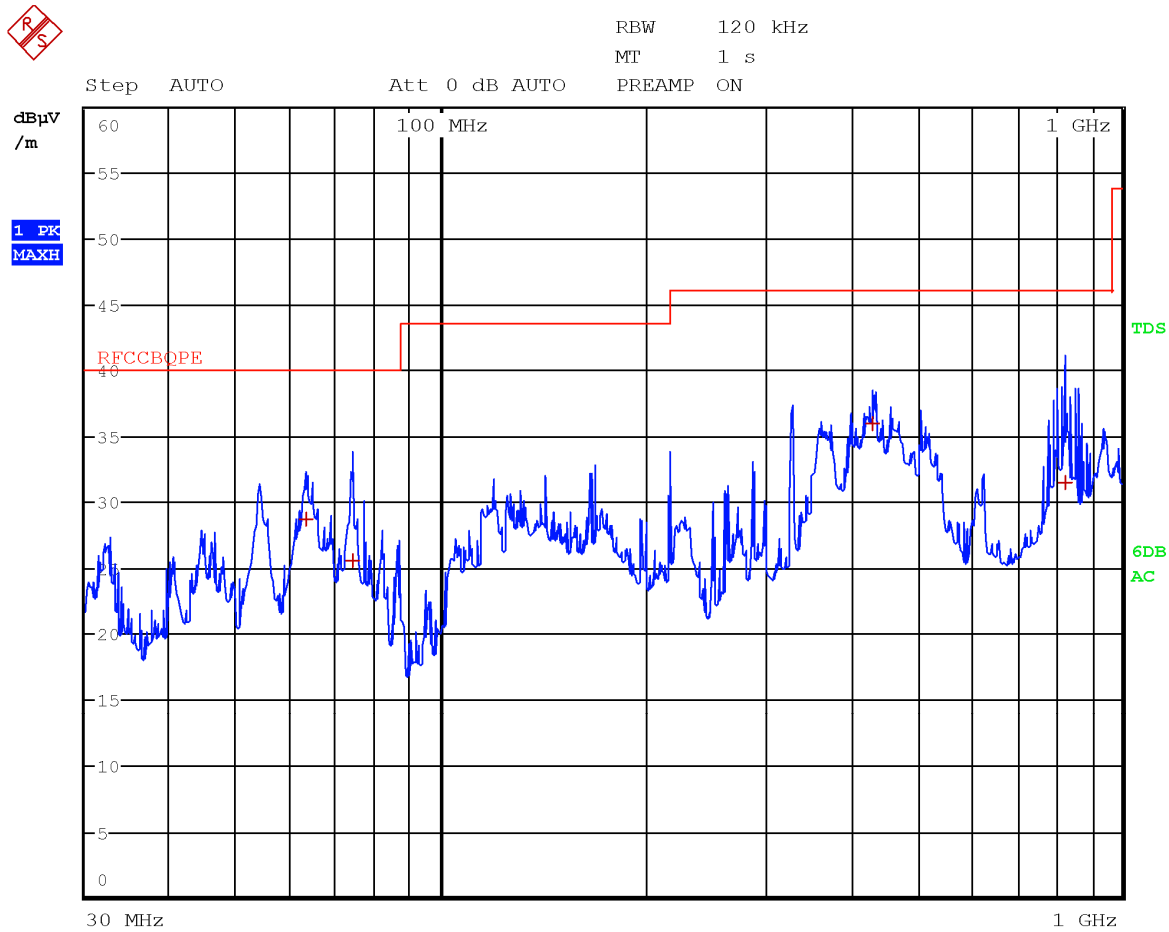


Figure 8.1-32: Radiated spurious emissions with WCDMA at 1880 MHz and WIFI at 5200 MHz – antenna in vertical polarization

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
63.4000	28.7	40.0	-11.3	QP
73.9200	25.6	40.0	-14.4	QP
431.4400	36.0	46.0	-10.0	QP
828.0800	31.5	46.0	-14.5	QP

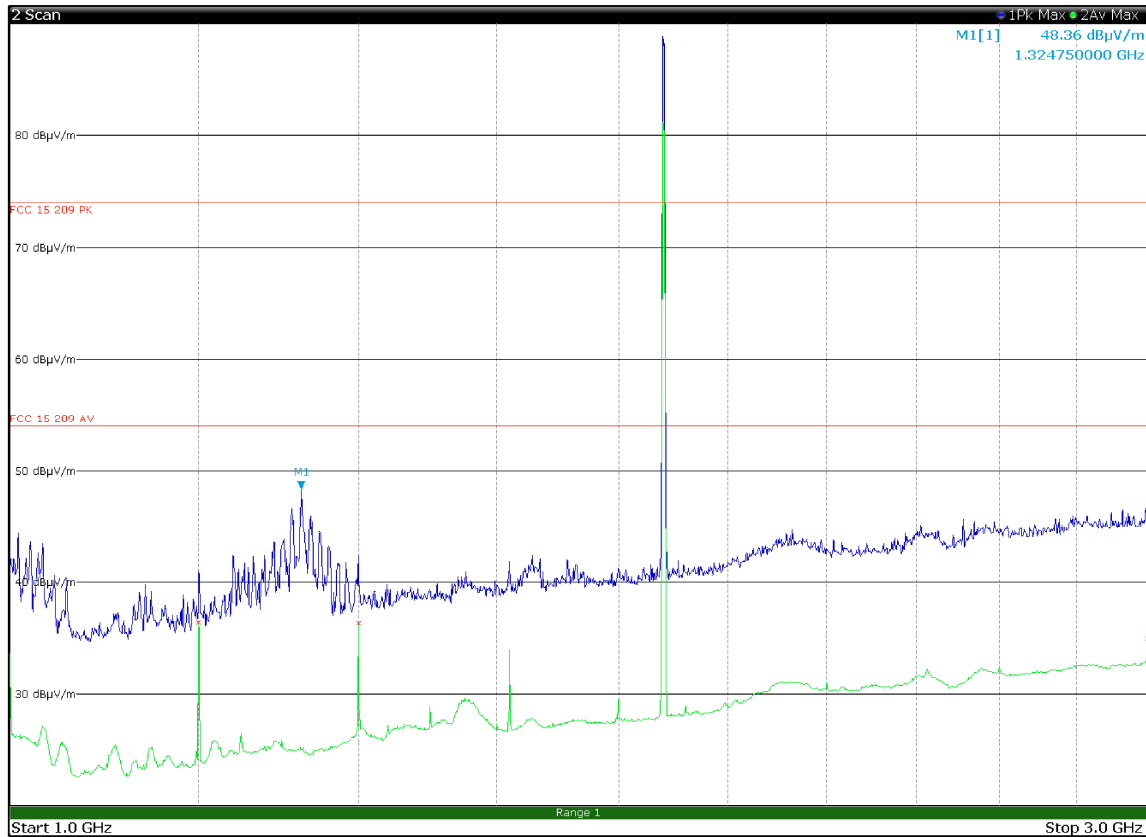


Figure 8.1-33: Radiated spurious emissions with WCDMA at 1880 MHz and WIFI at 5200 MHz – antenna in horizontal polarization

Note: Emissions above the limit were from intentional emissions. no intermodulation emissions were detected

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1200.0000	36.6	54.0	-17.6	Av
1400.0000	36.2	54.0	-17.6	Av

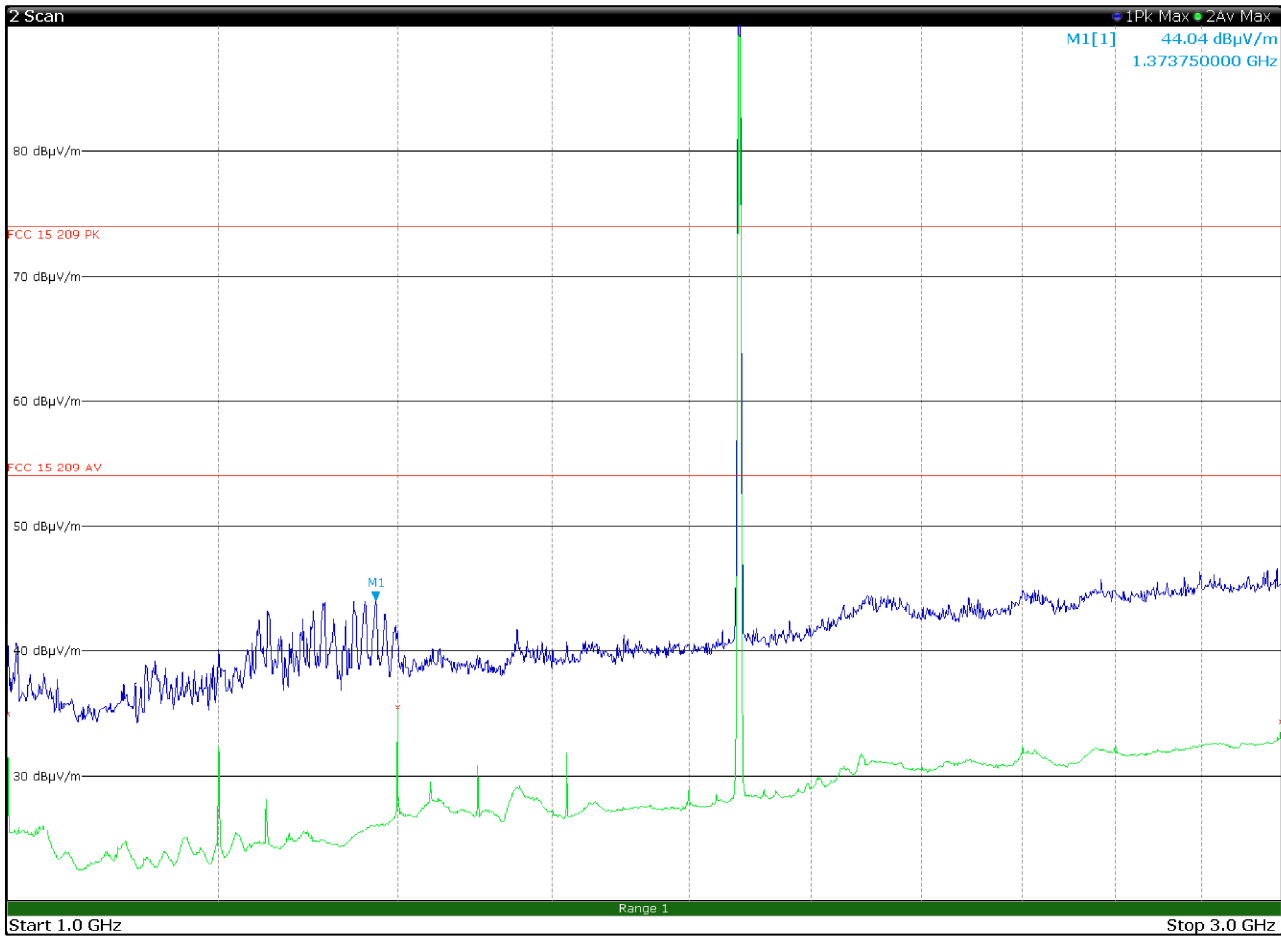


Figure 8.1-34: Radiated spurious emissions with WCDMA at 1880 MHz and WIFI at 5200 MHz – antenna in vertical polarization

Note: Emissions above the limit were from intentional emissions. no intermodulation emissions were detected

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1000.0000	35.0	54.0	-19.0	Av
1400.0000	35.5	54.0	-18.5	Av
3000.0000	34.3	54.0	-19.7	Av

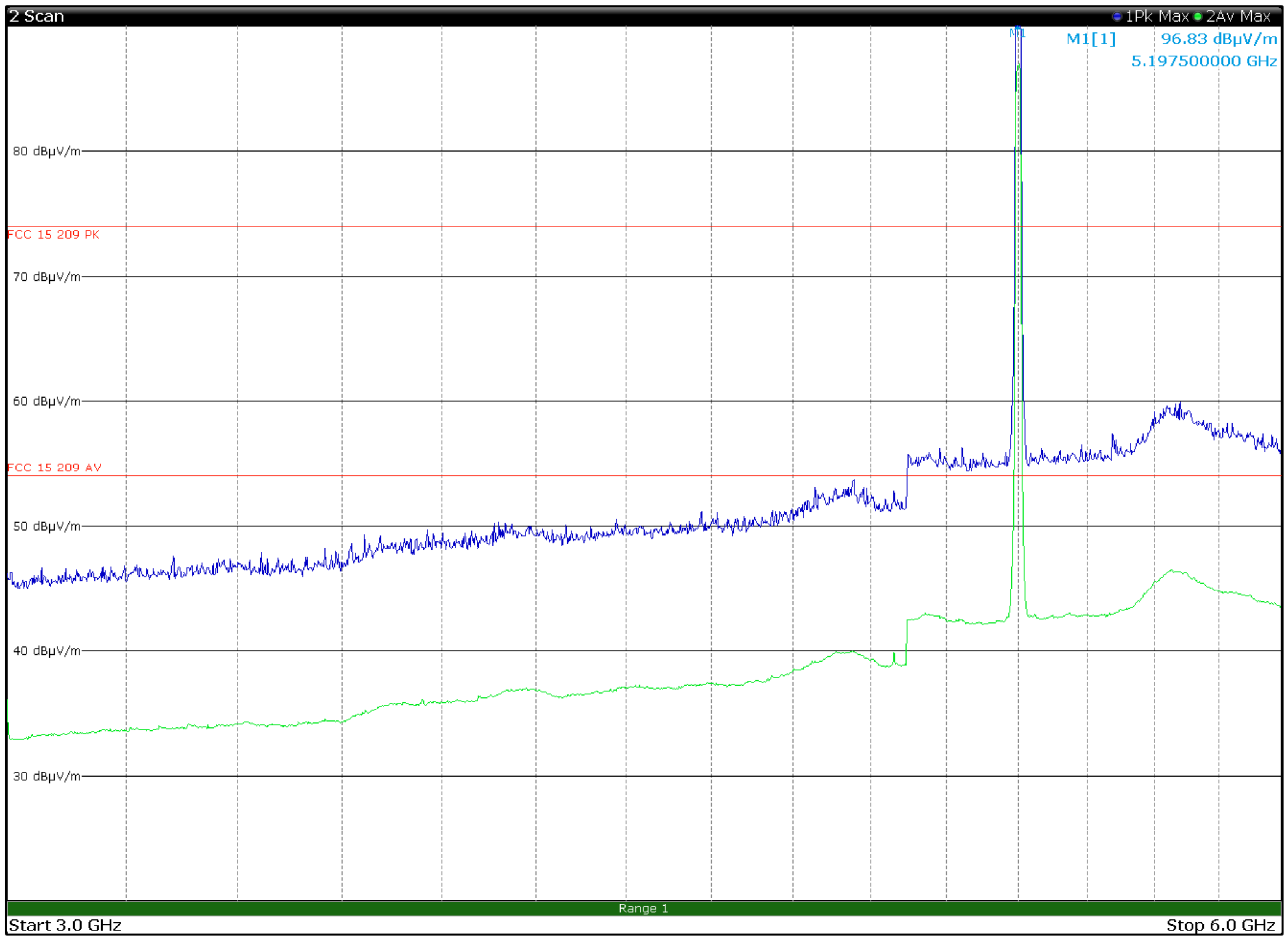


Figure 8.1-35: Radiated spurious emissions with WCDMA at 1880 MHz and WIFI at 5200 MHz – antenna in horizontal polarization

Note: Emissions above the limit were from intentional emissions. no intermodulation emissions were detected

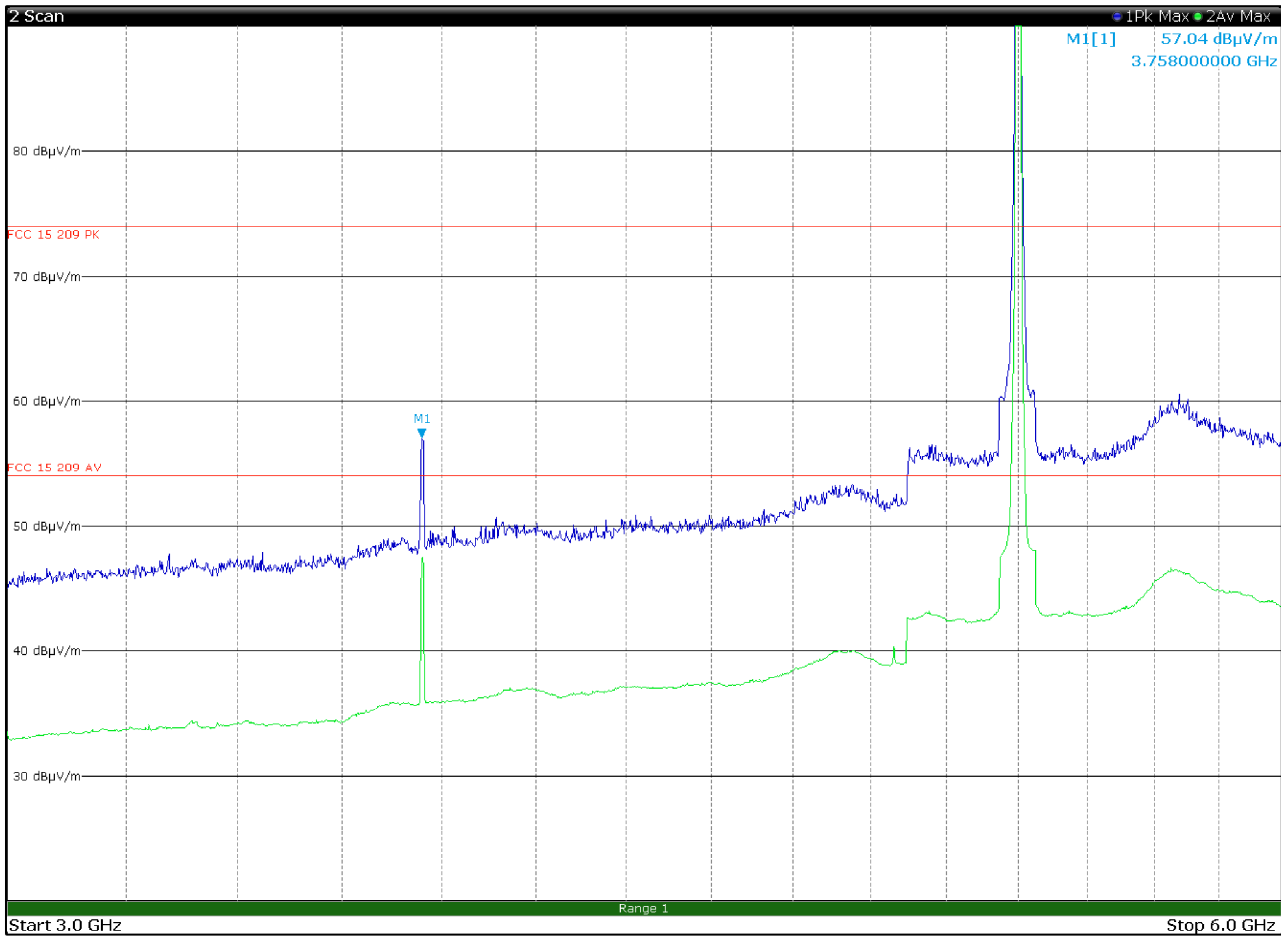


Figure 8.1-36: Radiated spurious emissions with WCDMA at 1880 MHz and WIFI at 5200 MHz – antenna in vertical polarization

Note: Emissions above the limit were from intentional emissions. no intermodulation emissions were detected

Frequency (GHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
3.7580	57.1	82.2	-25.1	Pk

The limit for WCDMA is -13 dBm. Limit (dBµV/m) = limit (dBm) + 95.23 = 82.2 dBµV/m

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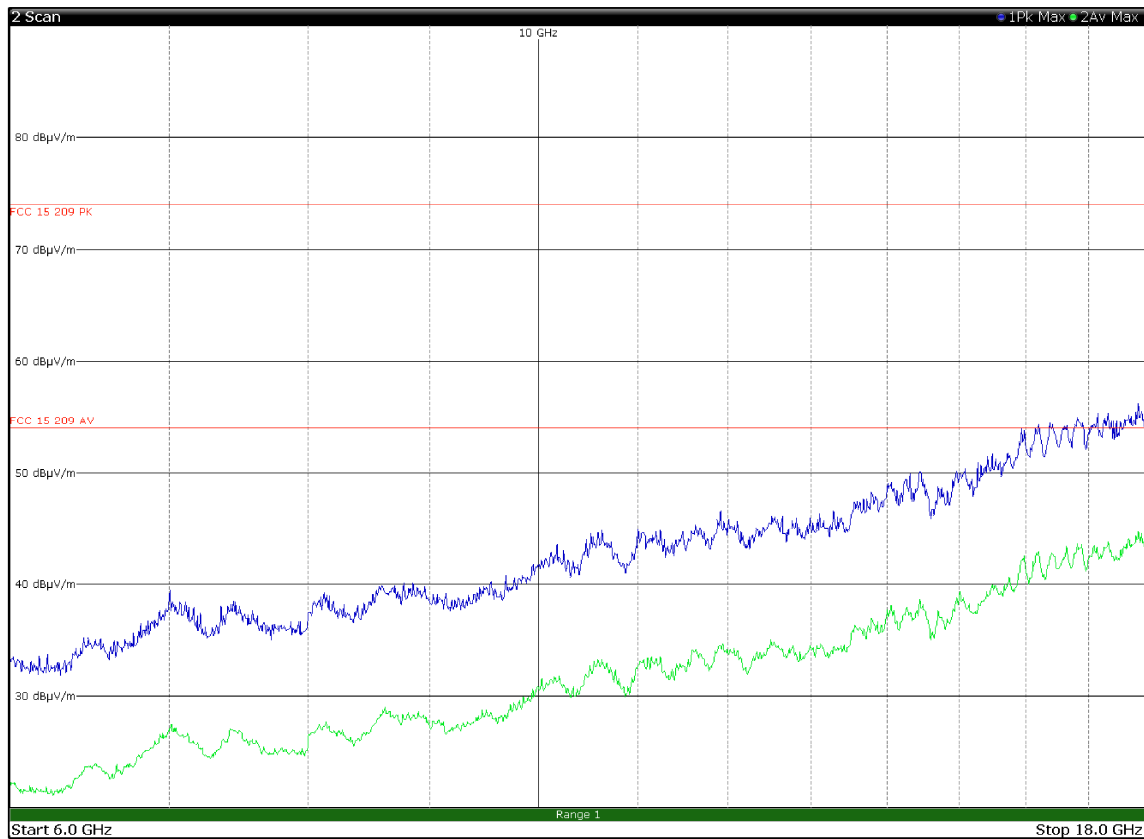


Figure 8.1-37: Radiated spurious emissions with WCDMA at 1880 MHz and WIFI at 5200 MHz – antenna in horizontal polarization

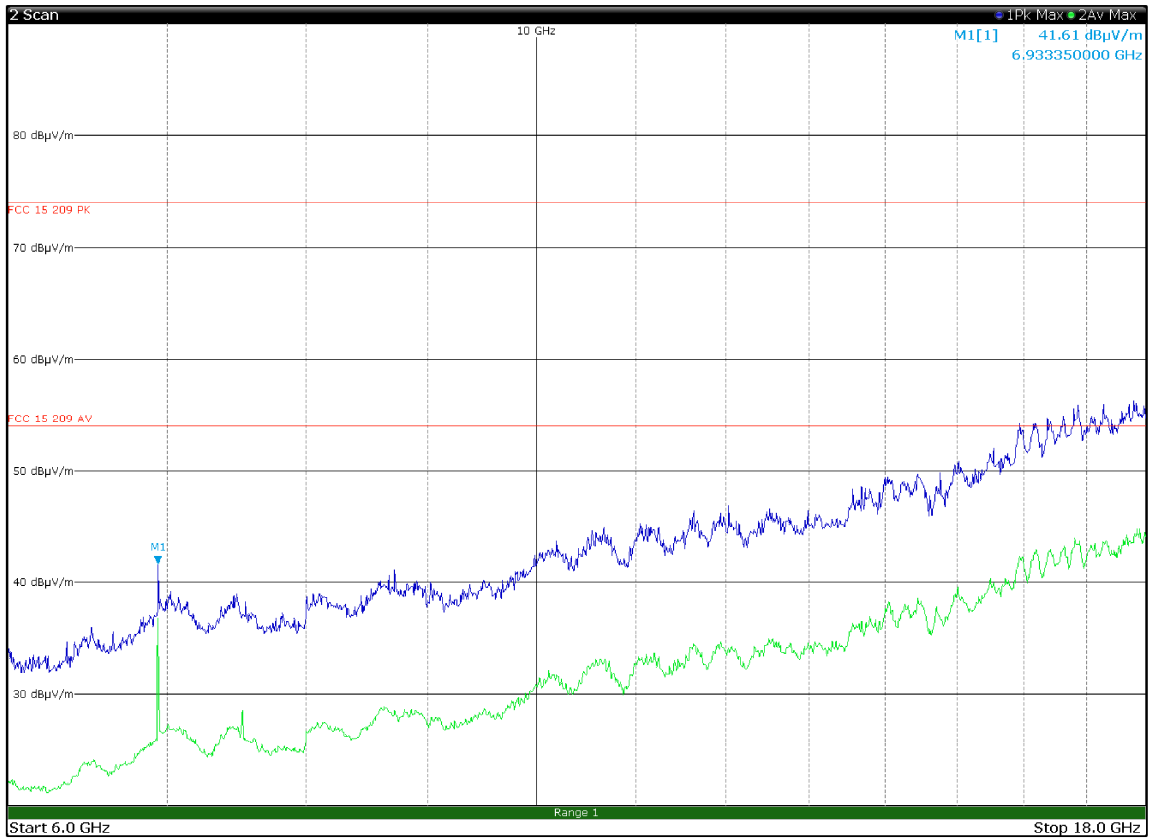


Figure 8.1-38: Radiated spurious emissions with WCDMA at 1880 MHz and WIFI at 5200 MHz – antenna in vertical polarization

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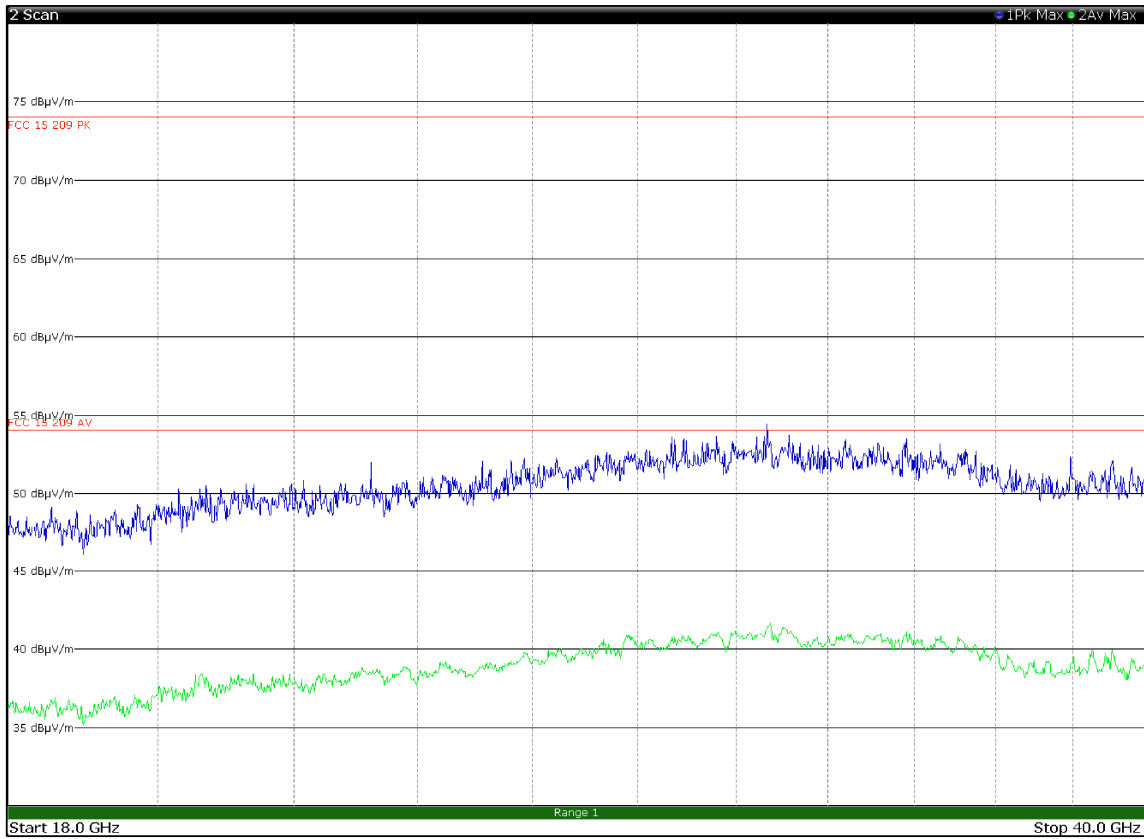


Figure 8.1-39: Radiated spurious emissions with WCDMA at 1880 MHz and WIFI at 5200 MHz – antenna in horizontal polarization

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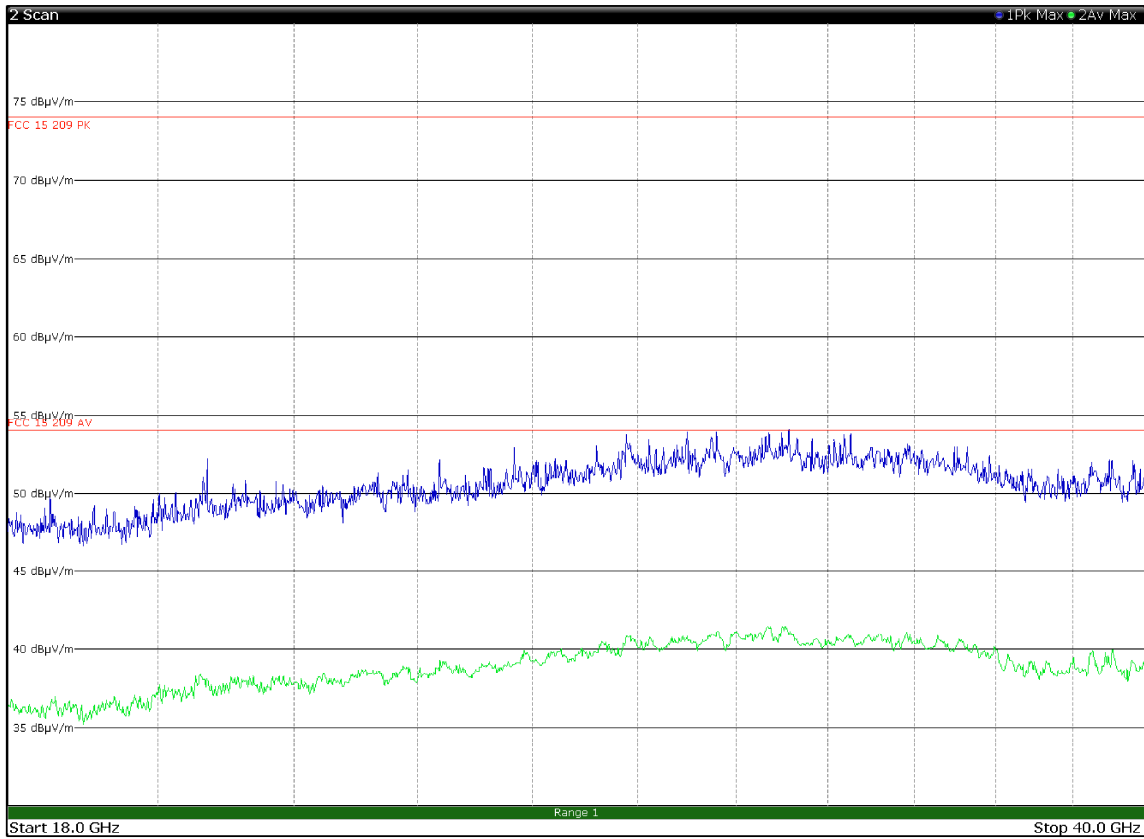


Figure 8.1-40: Radiated spurious emissions with WCDMA at 1880 MHz and WIFI at 5200 MHz – antenna in vertical polarization

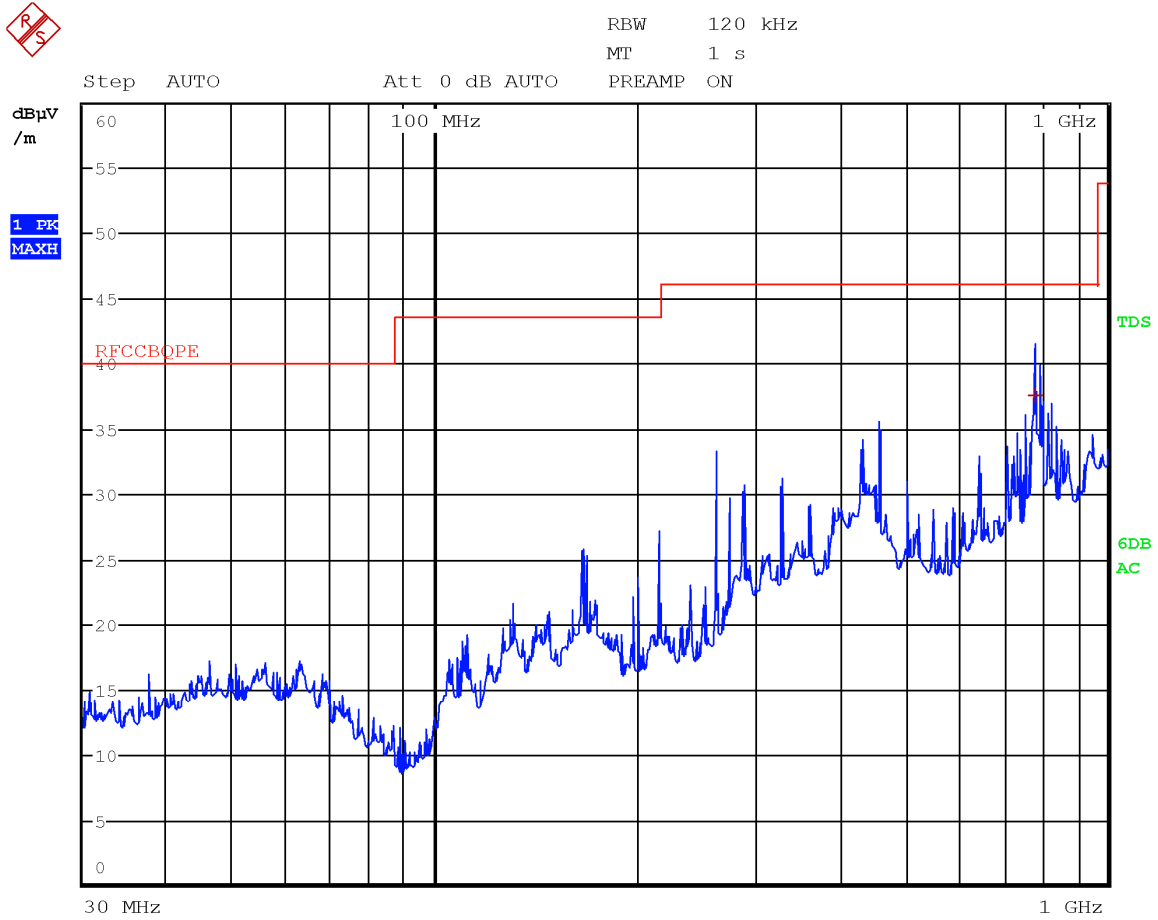


Figure 8.1-41: Radiated spurious emissions with WCDMA at 1732.6 MHz and WIFI at 5200 MHz – antenna in horizontal polarization

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
780.2000	37.7	46.0	-8.3	QP

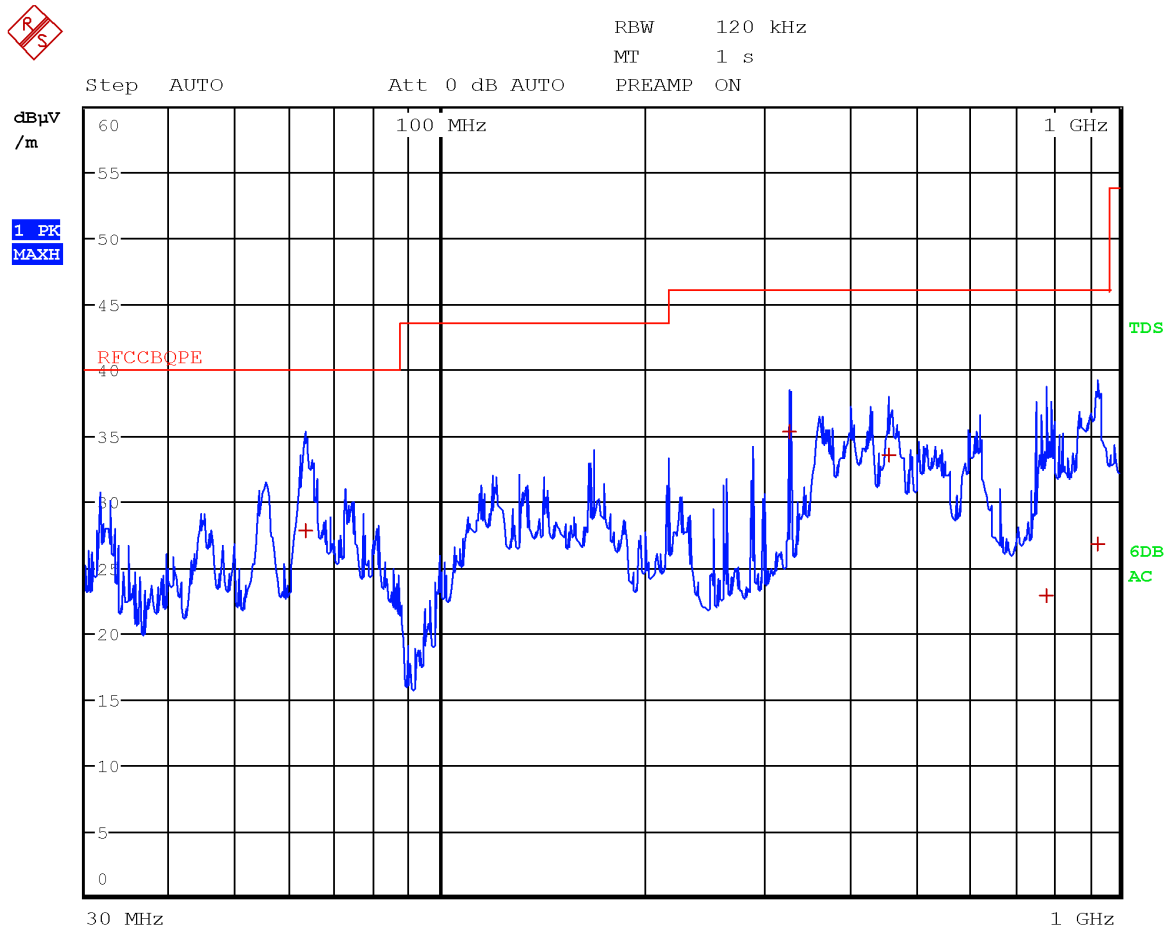


Figure 8.1-42: Radiated spurious emissions with WCDMA at 1732.6 MHz and WIFI at 5200 MHz – antenna in vertical polarization

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
63.3200	27.8	40.0	-12.2	QP
326.4000	35.4	46.0	-10.6	QP
456.6800	33.6	46.0	-12.4	QP
779.9200	22.9	46.0	-23.1	QP
928.6000	26.8	46.0	-19.2	QP

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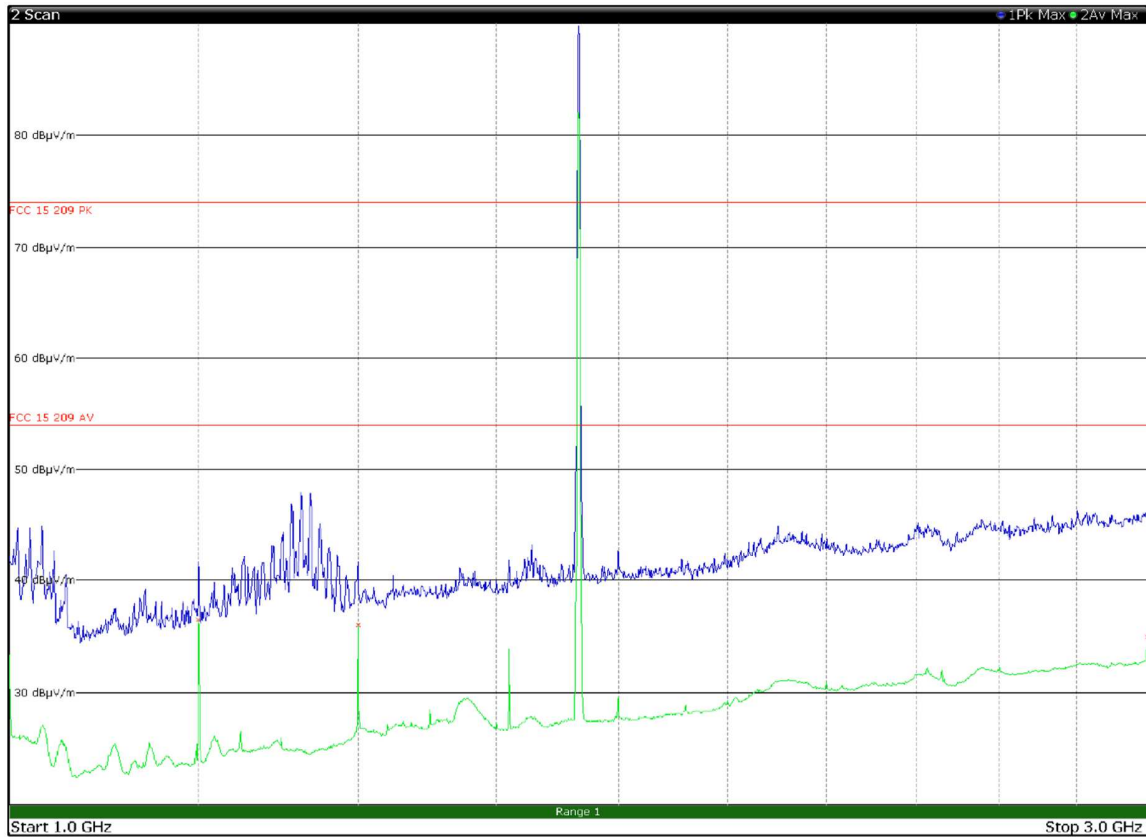


Figure 8.1-43: Radiated spurious emissions with WCDMA at 1732.6 MHz and WIFI at 5200 MHz – antenna in horizontal polarization

Note: Emissions above the limit were from intentional emissions. no intermodulation emissions were detected

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1200.0000	37.8	54.0	-16.2	Av
1400.0000	35.7	54.0	-18.3	Av

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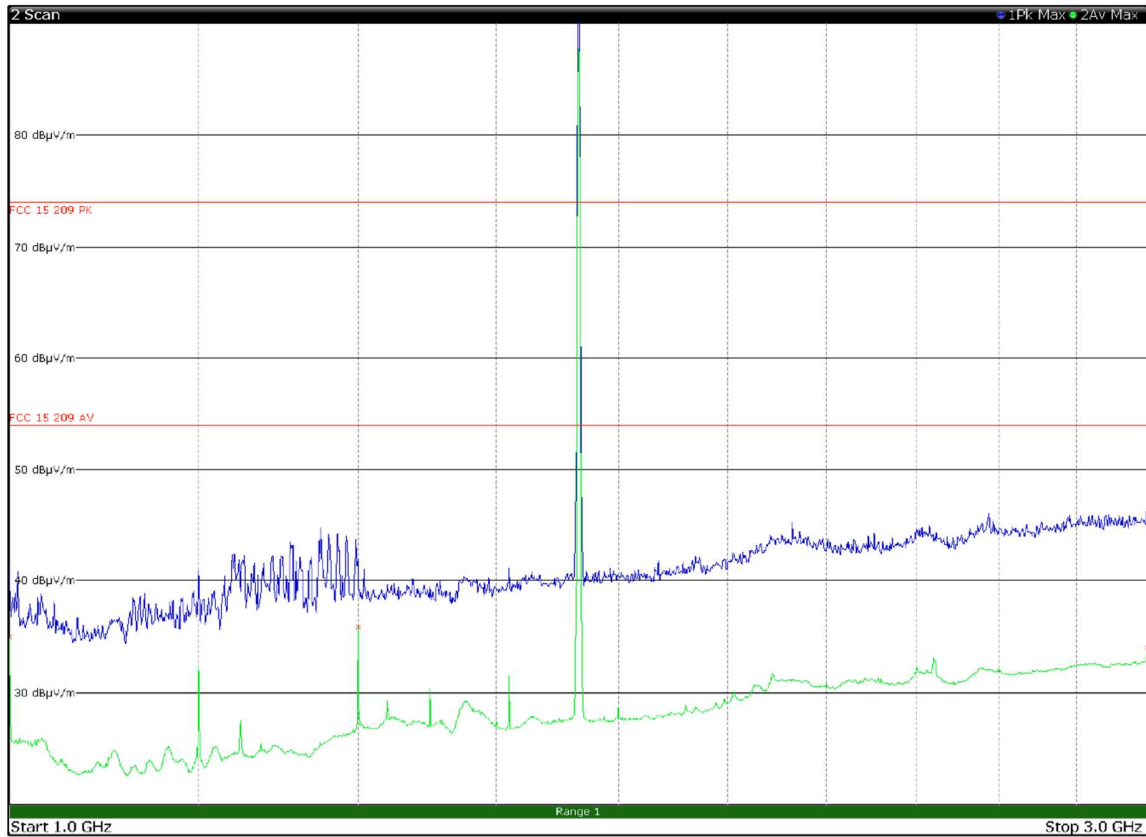


Figure 8.1-44: Radiated spurious emissions with WCDMA at 1732.6 MHz and WIFI at 5200 MHz – antenna in vertical polarization

Note: Emissions above the limit were from intentional emissions. no intermodulation emissions were detected

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1000.0000	35.9	54.0	-18.1	Av
1400.0000	36.3	54.0	-17.7	Av

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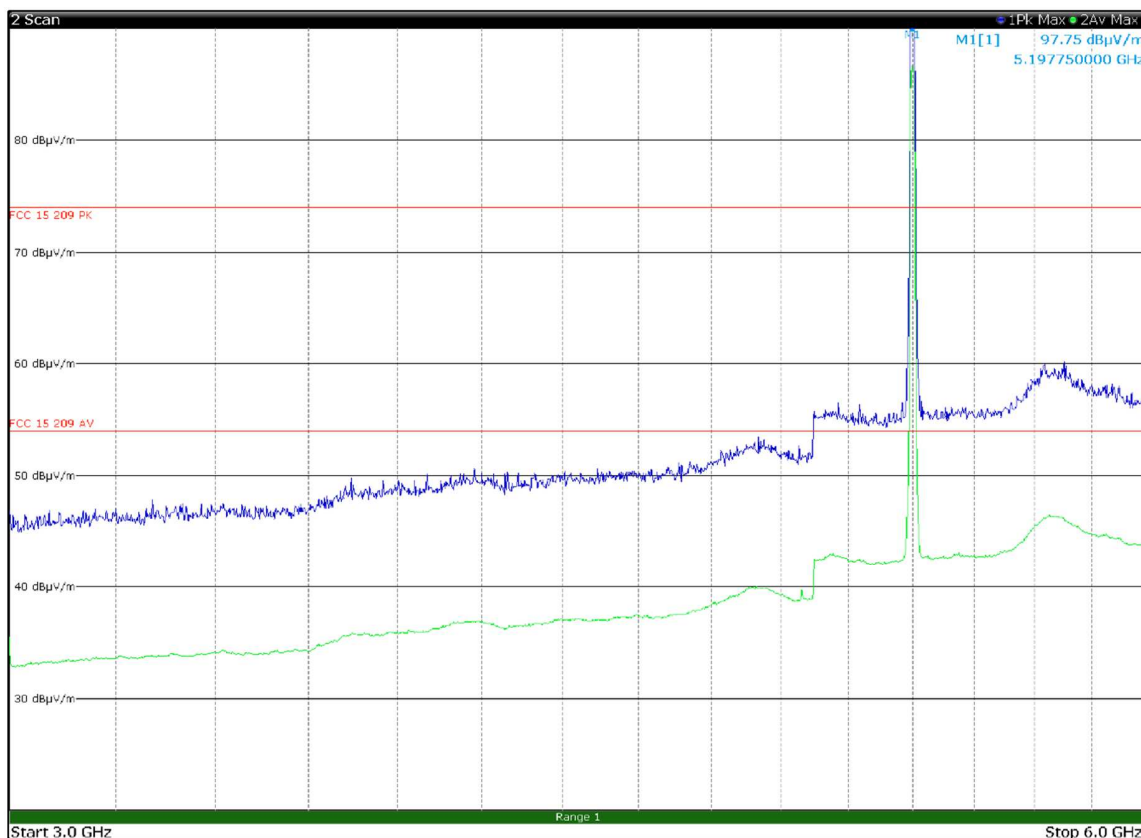


Figure 8.1-45: Radiated spurious emissions with WCDMA at 1732.6 MHz and WIFI at 5200 MHz – antenna in horizontal polarization

Note: Emissions above the limit were from intentional emissions. no intermodulation emissions were detected

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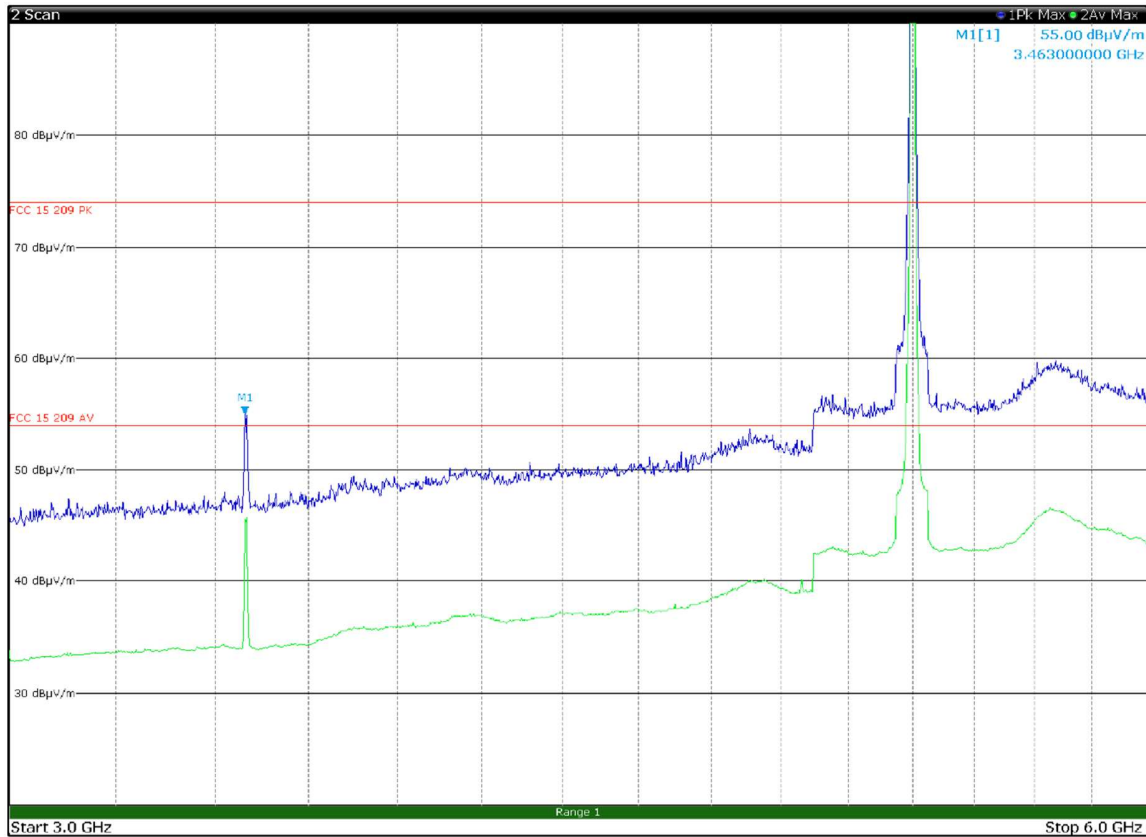


Figure 8.1-46: Radiated spurious emissions with WCDMA at 1732.6 MHz and WIFI at 5200 MHz – antenna in vertical polarization

Note: Emissions above the limit were from intentional emissions. no intermodulation emissions were detected

Frequency (GHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
3.4630	55.0	82.2	-27.2	Pk

The limit for WCDMA is -13 dBm. Limit (dBµV/m) = limit (dBm) + 95.23 = 82.2 dBµV/m

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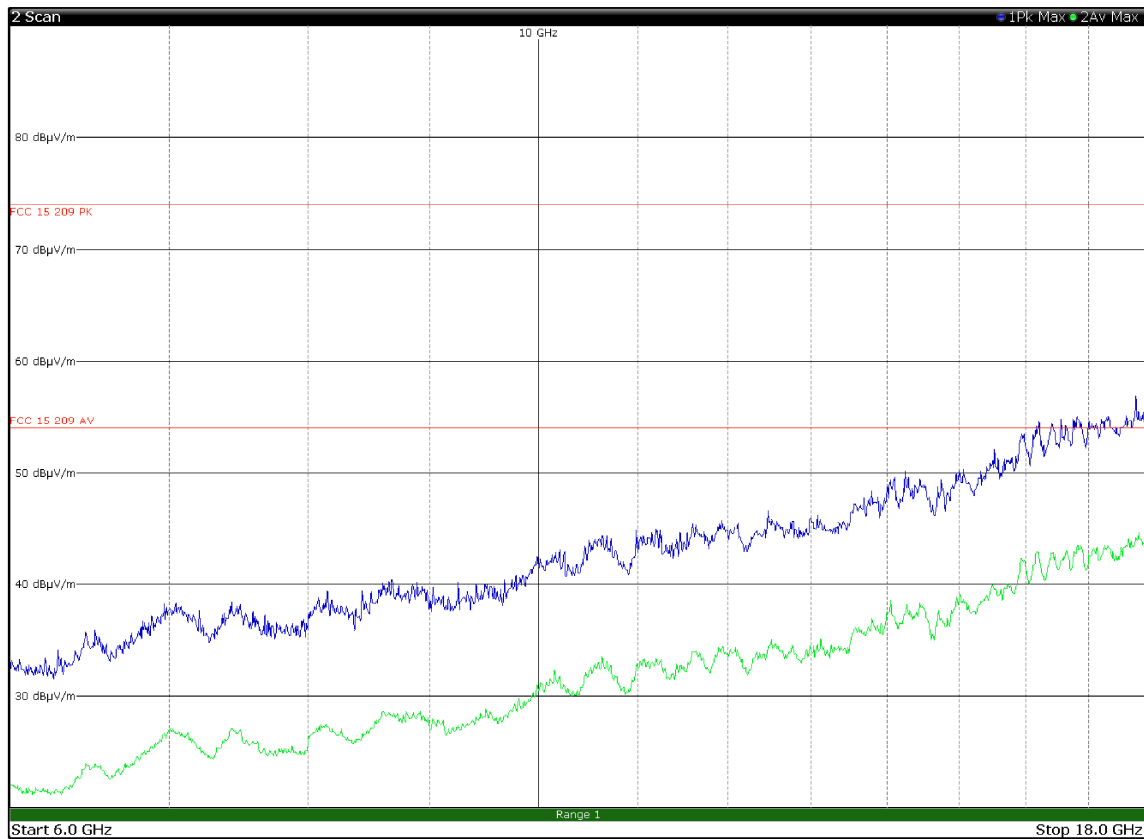


Figure 8.1-47: Radiated spurious emissions with WCDMA at 1732.6 MHz and WIFI at 5200 MHz – antenna in horizontal polarization

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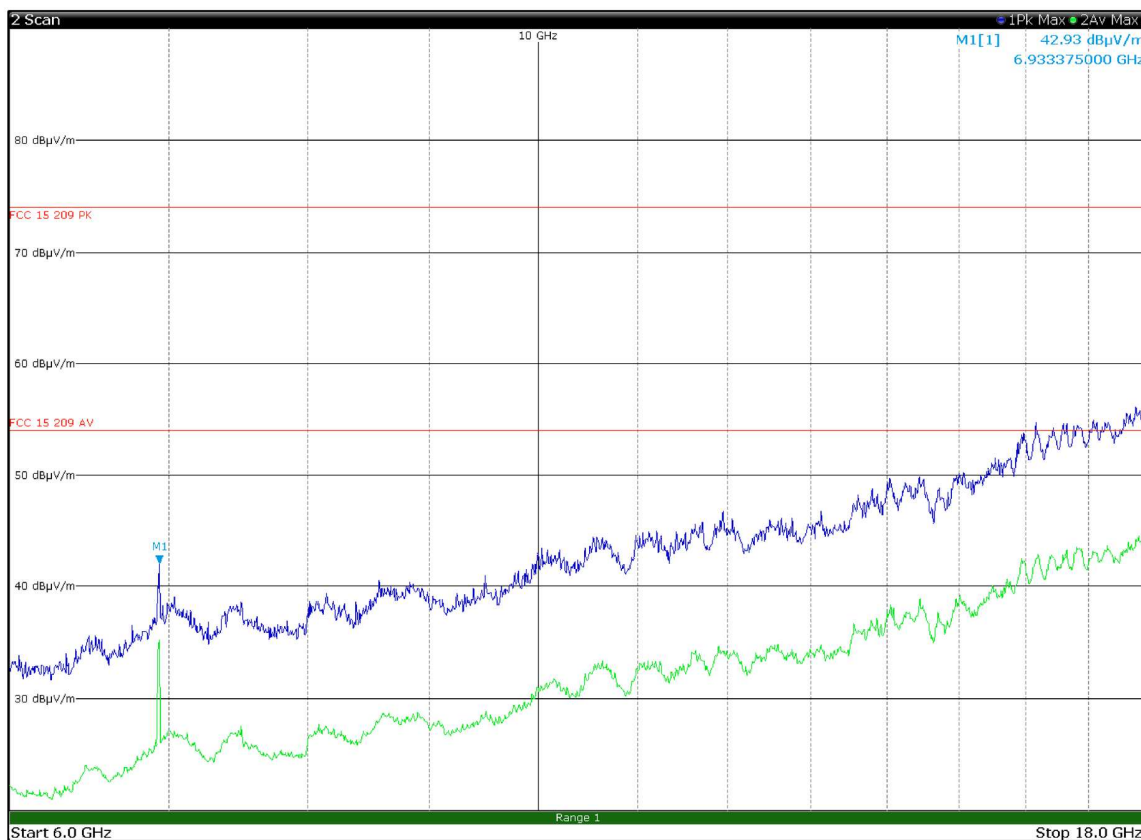


Figure 8.1-48: Radiated spurious emissions with WCDMA at 1732.6 MHz and WIFI at 5200 MHz – antenna in vertical polarization

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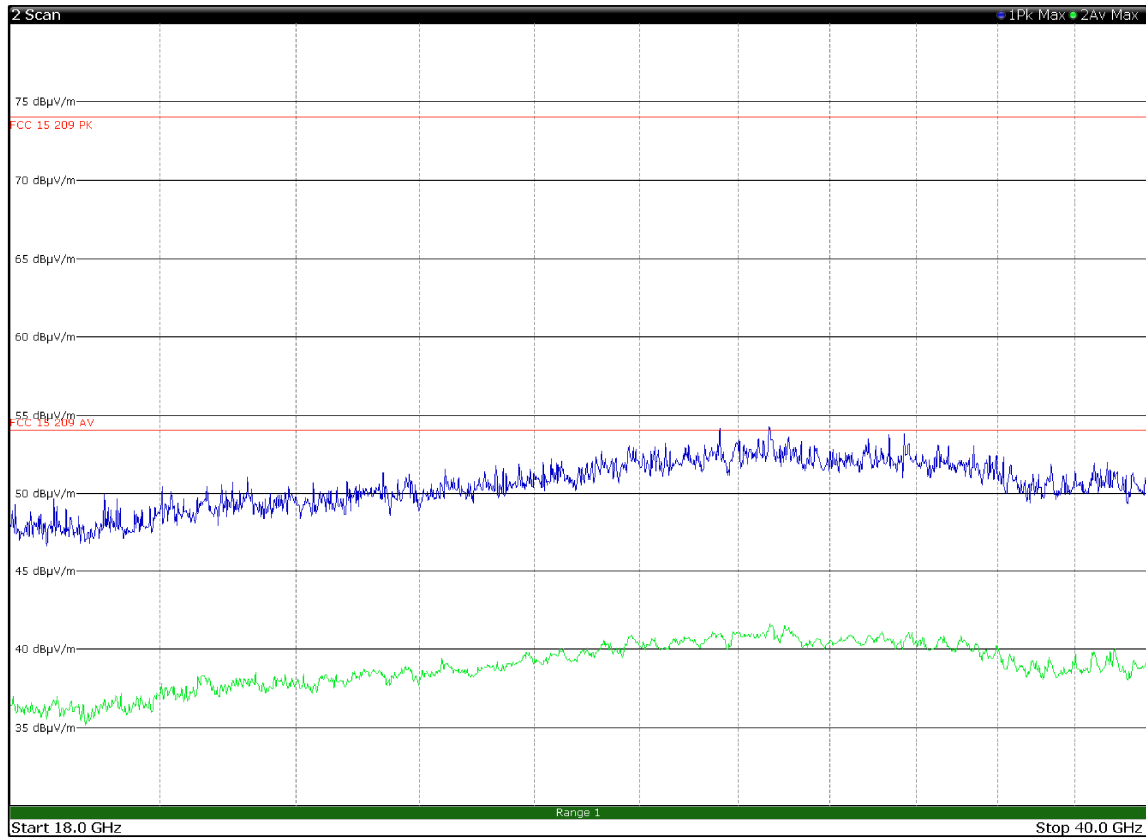


Figure 8.1-49: Radiated spurious emissions with WCDMA at 1732.6 MHz and WIFI at 5200 MHz – antenna in horizontal polarization

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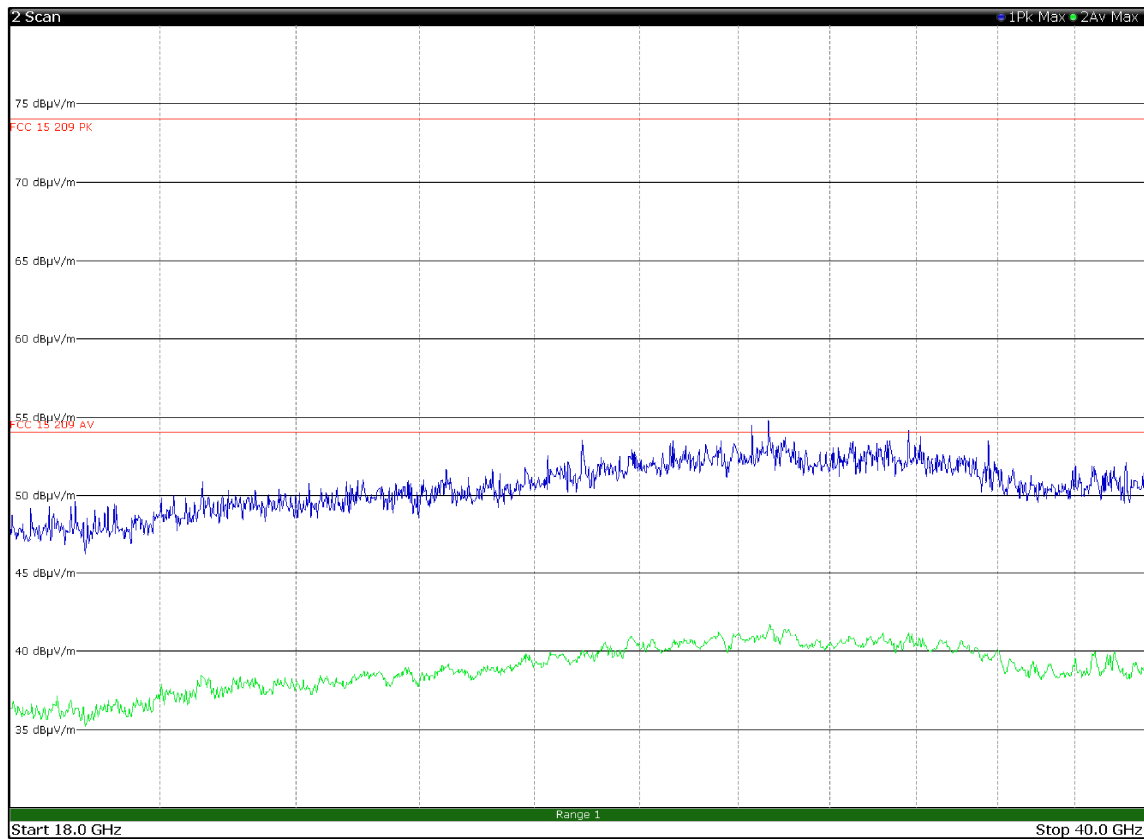


Figure 8.1-50: Radiated spurious emissions with WCDMA at 1732.6 MHz and WIFI at 5200 MHz – antenna in vertical polarization

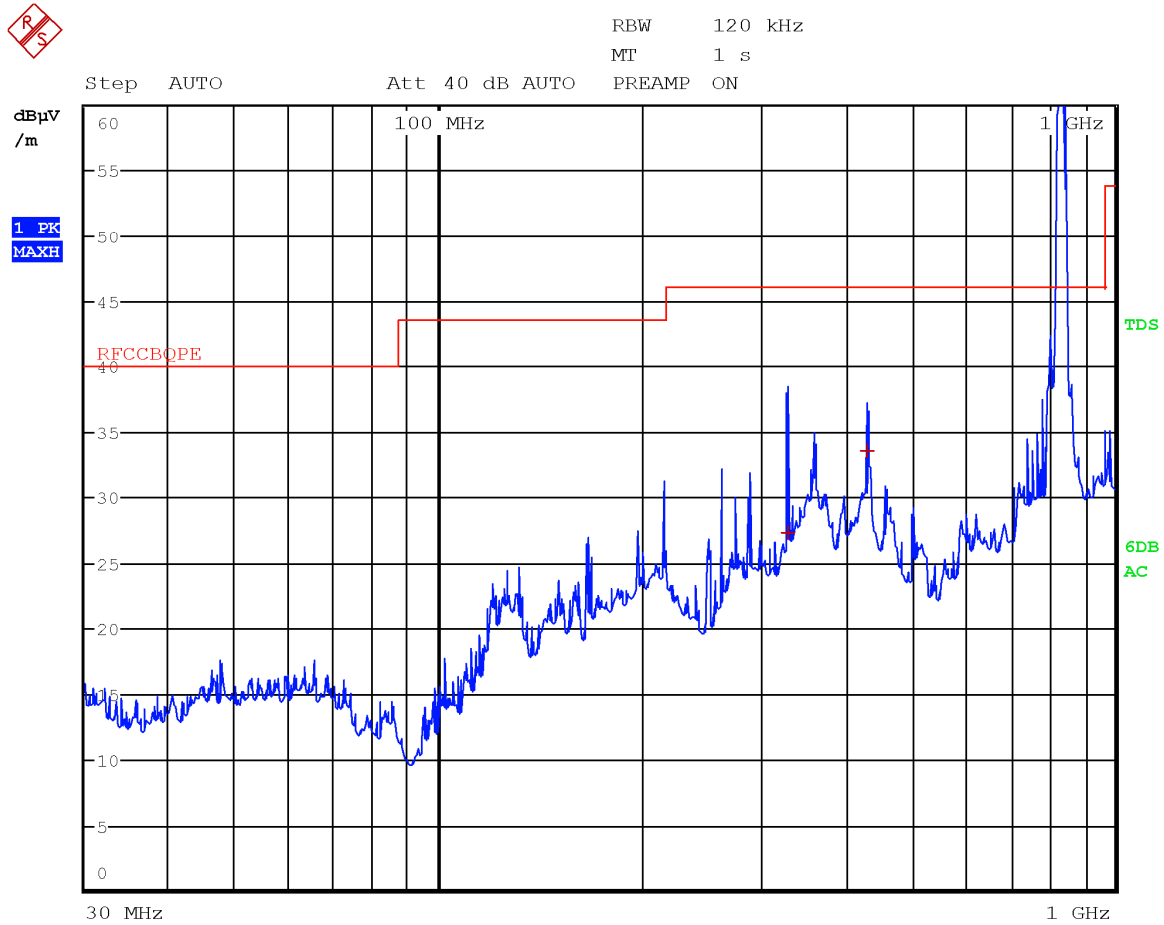


Figure 8.1-51: Radiated spurious emissions with WCDMA at 832.6 MHz and WIFI at 5200 MHz – antenna in horizontal polarization

Note: Emissions above the limit were from intentional emissions. no intermodulation emissions were detected

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
328.3200	27.4	46.0	-18.6	QP
431.0800	33.7	46.0	-12.3	QP

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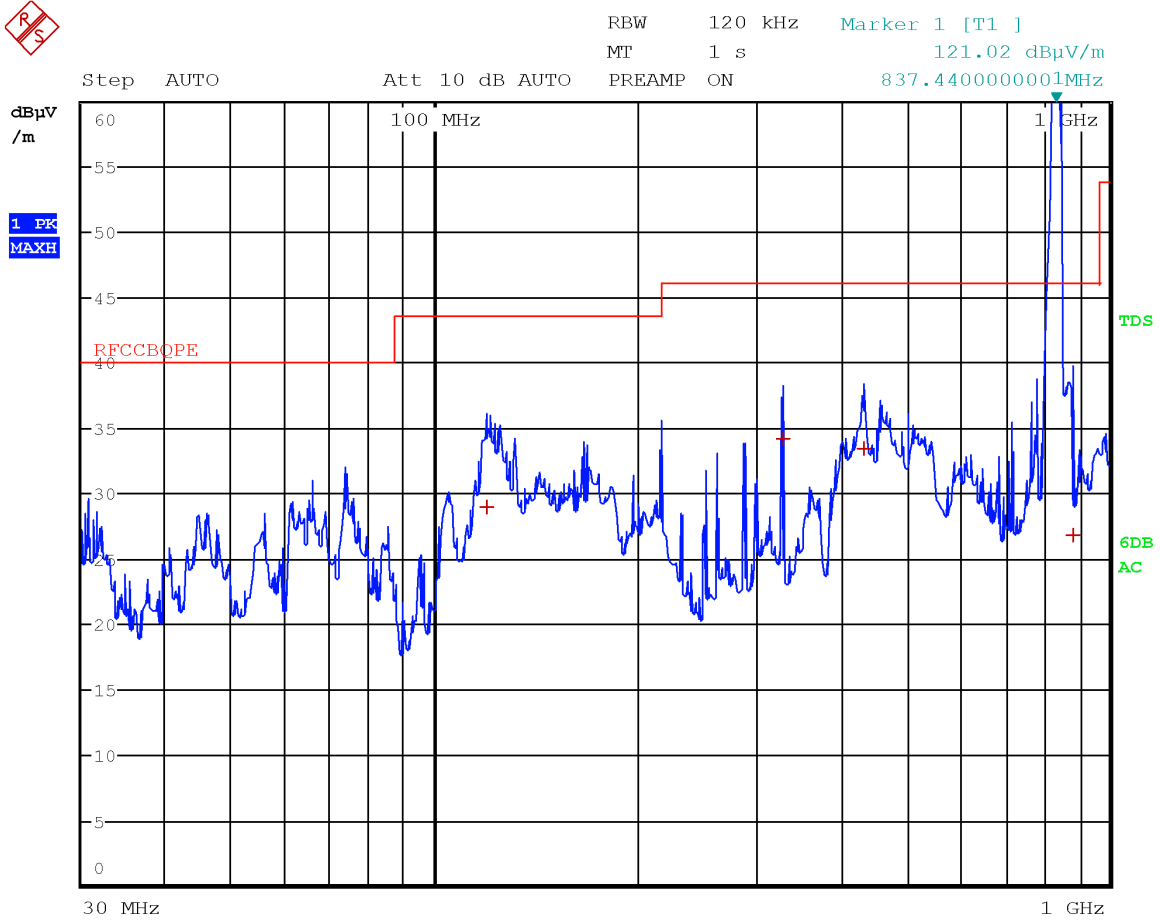


Figure 8.1-52: Radiated spurious emissions with WCDMA at 832.6 MHz and WIFI at 5200 MHz – antenna in vertical polarization

Note: Emissions above the limit were from intentional emissions. no intermodulation emissions were detected

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
119.3600	29.0	43.5	-14.5	QP
328.2000	34.2	46.0	-11.8	QP
432.6000	33.6	46.0	-12.4	QP
837.4400	118.7	46.0	72.6	QP
881.5200	26.8	46.0	-19.2	QP

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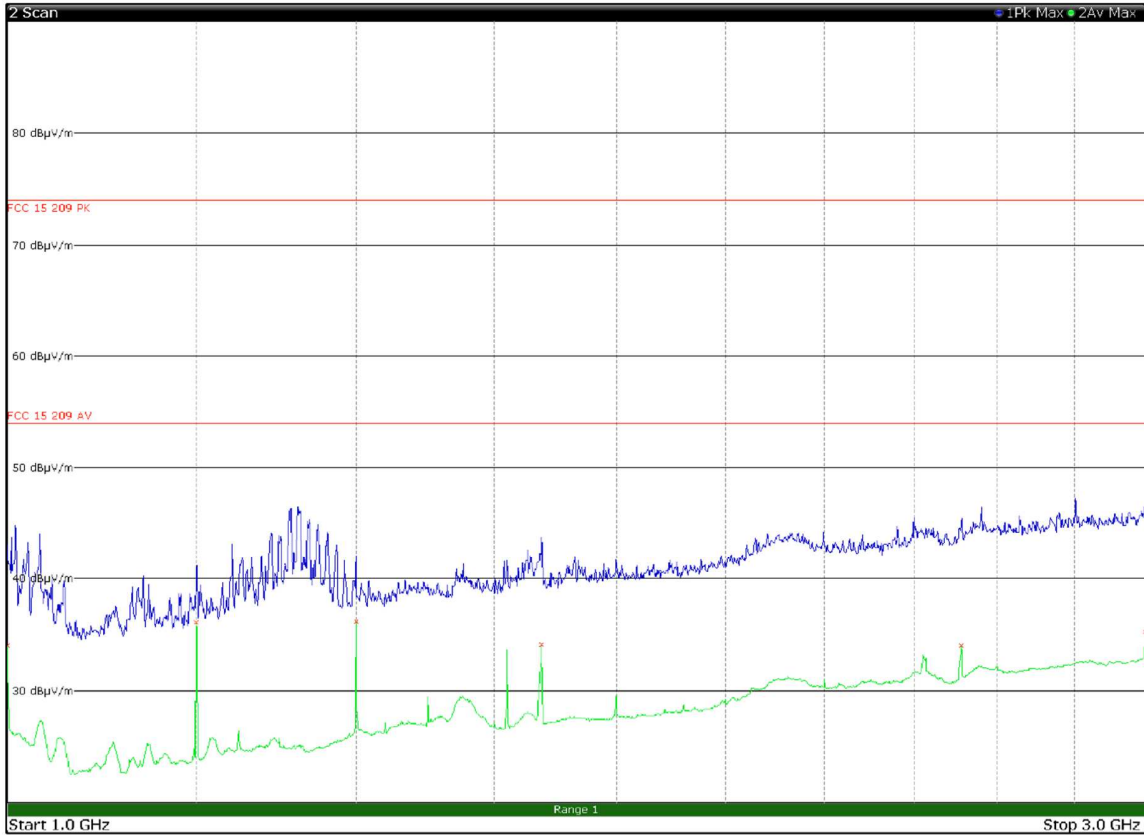


Figure 8.1-53: Radiated spurious emissions with WCDMA at 832.6 MHz and WIFI at 5200 MHz – antenna in horizontal polarization

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1000.0000	35.8	54.0	-18.2	Av
1200.0000	36.9	54.0	-17.1	Av
1400.0000	36.4	54.0	-17.6	Av
1674.2500	33.8	54.0	-20.2	Av
2512.0000	33.9	54.0	-20.1	Av
3000.0000	34.3	54.0	-19.7	Av

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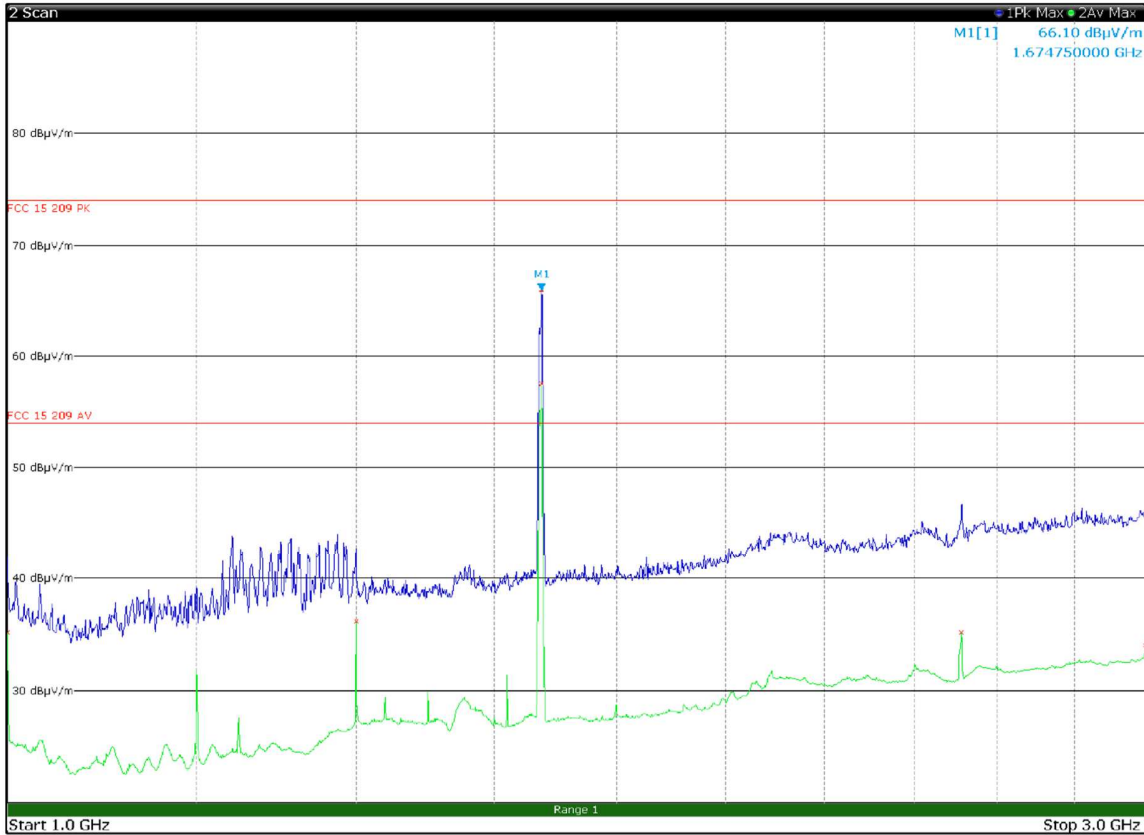


Figure 8.1-54: Radiated spurious emissions with WCDMA at 832.6 MHz and WIFI at 5200 MHz – antenna in vertical polarization

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1000.0000	34.8	54.0	-19.2	Av
1400.0000	36.9	54.0	-17.1	Av
1674.7500	66.1	82.2	-16.1	Pk
2512.0000	35.2	54.0	-18.8	Av
3000.0000	34.4	54.0	-19.6	Av

The limit for LTE is -13 dBm. Limit (dBµV/m) = limit (dBm) + 95.23 = 82.2 dBµV/m

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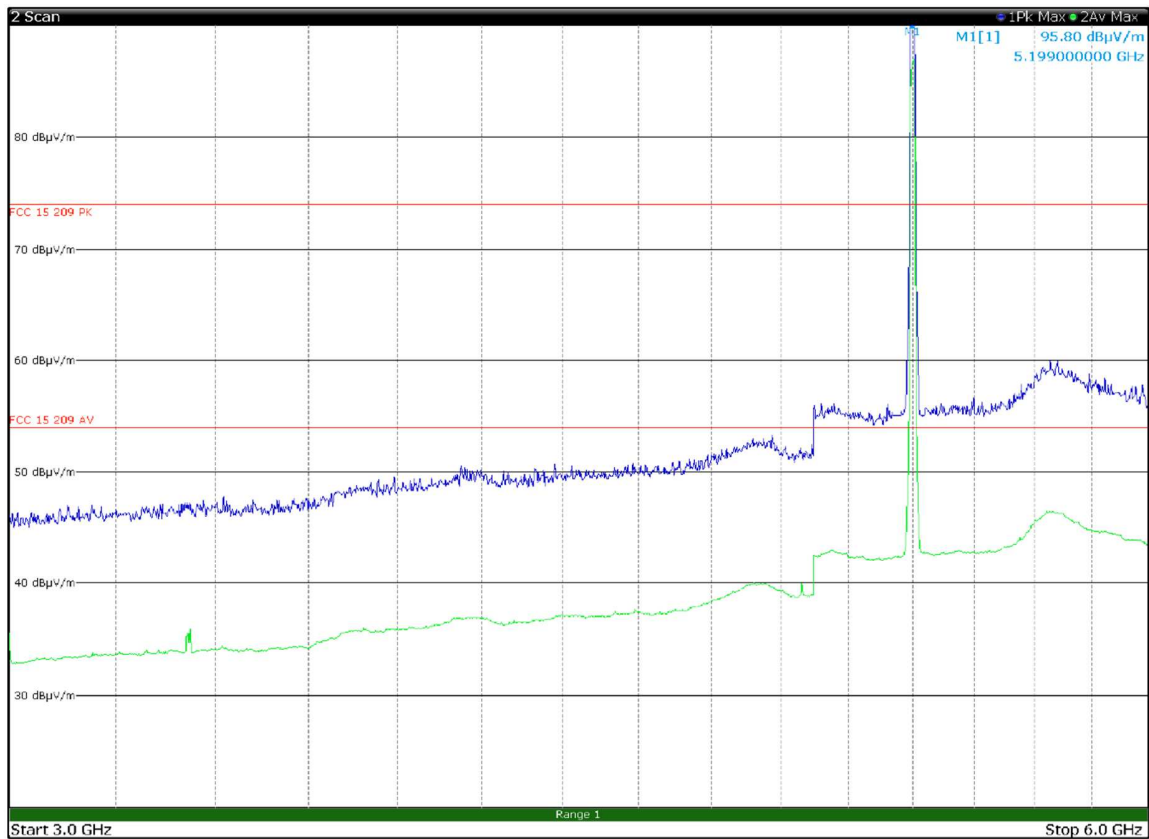


Figure 8.1-55: Radiated spurious emissions with WCDMA at 832.6 MHz and WIFI at 5200 MHz – antenna in horizontal polarization

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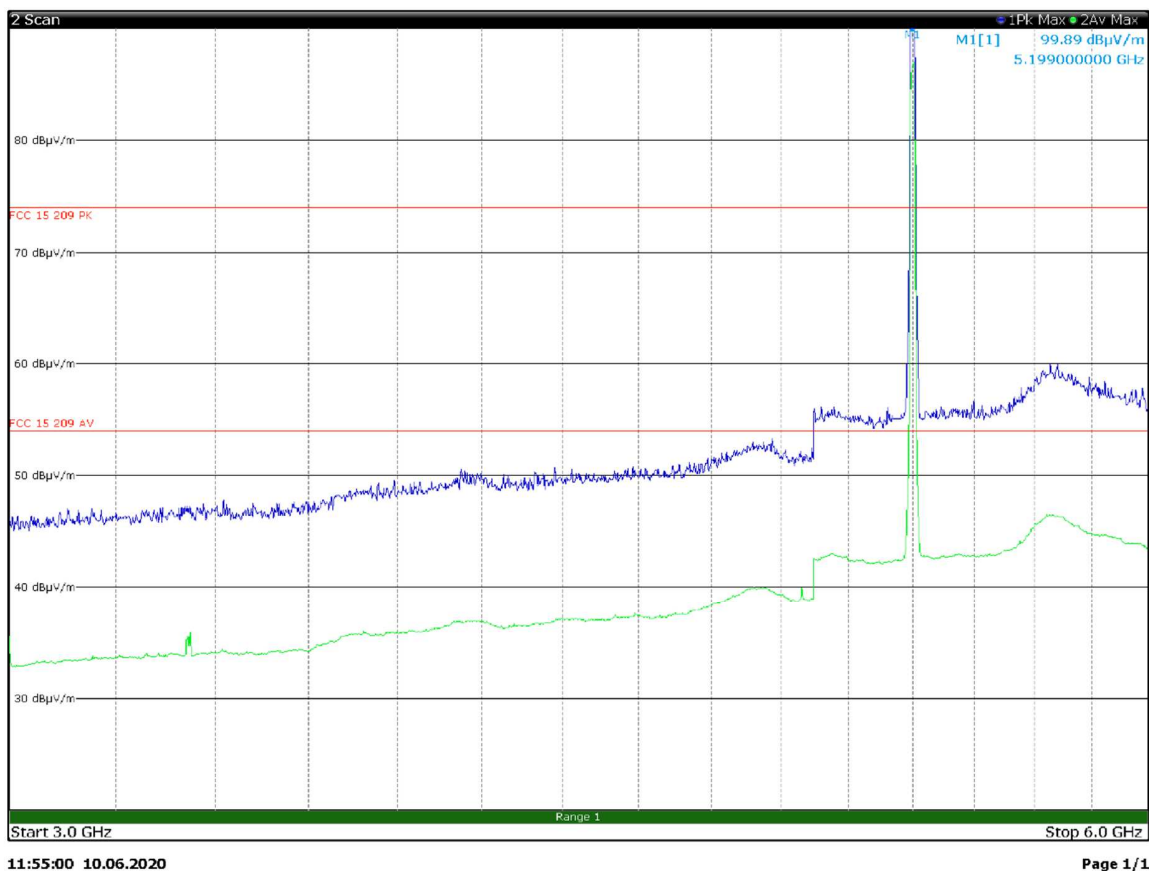


Figure 8.1-56: Radiated spurious emissions with WCDMA at 832.6 MHz and WIFI at 5200 MHz – antenna in vertical polarization

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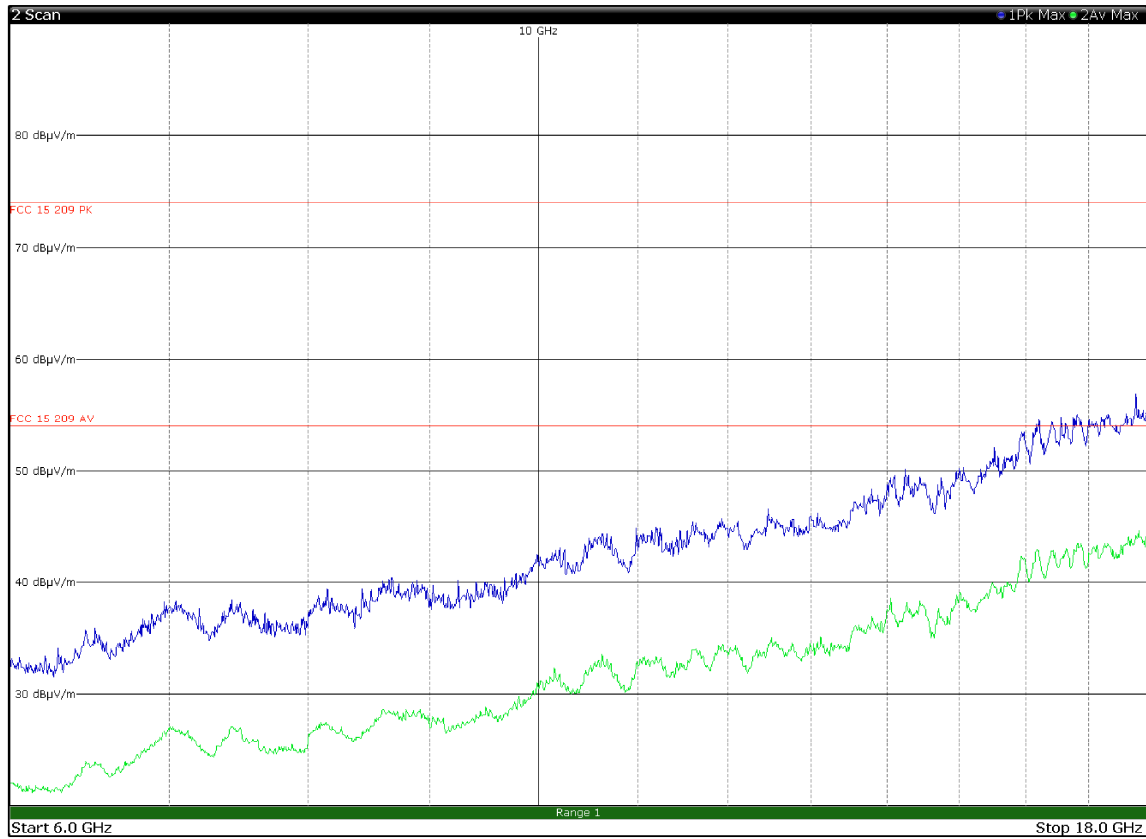


Figure 8.1-57: Radiated spurious emissions with WCDMA at 832.6 MHz and WIFI at 5200 MHz – antenna in horizontal polarization

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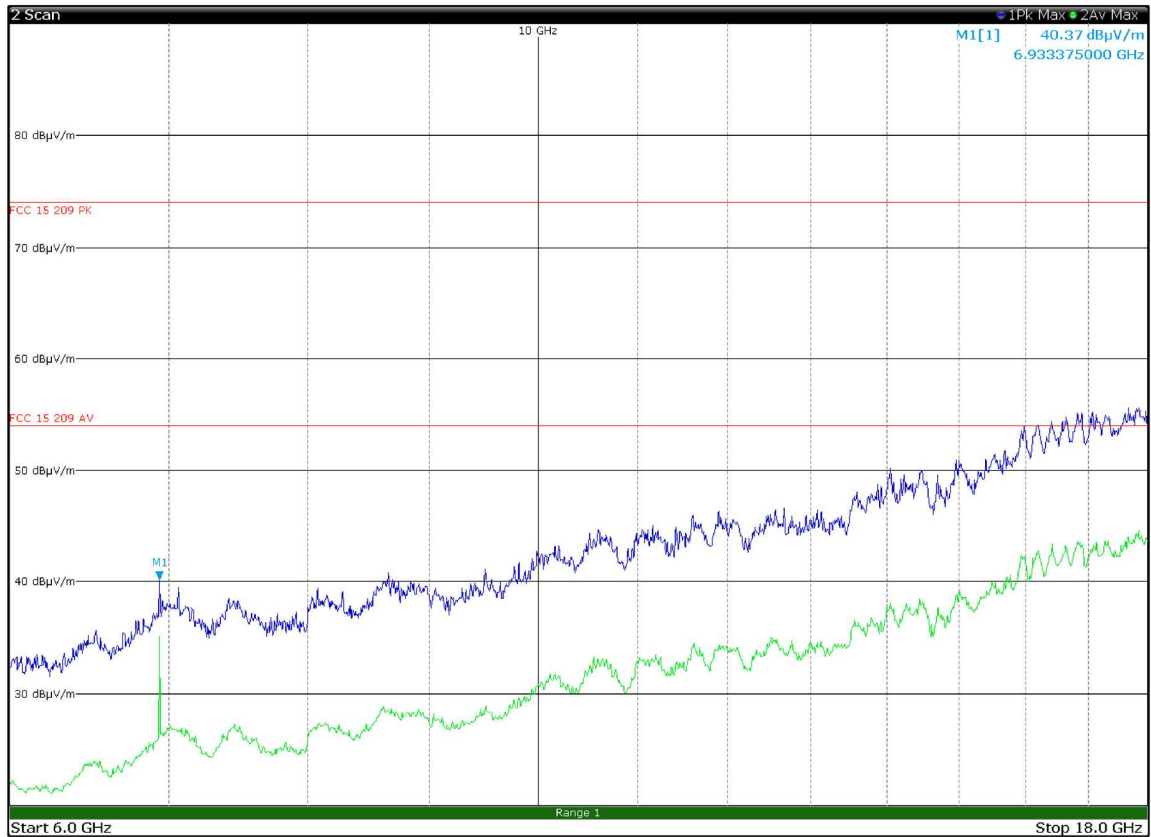


Figure 8.1-58: Radiated spurious emissions with WCDMA at 832.6 MHz and WIFI at 5200 MHz – antenna in vertical polarization

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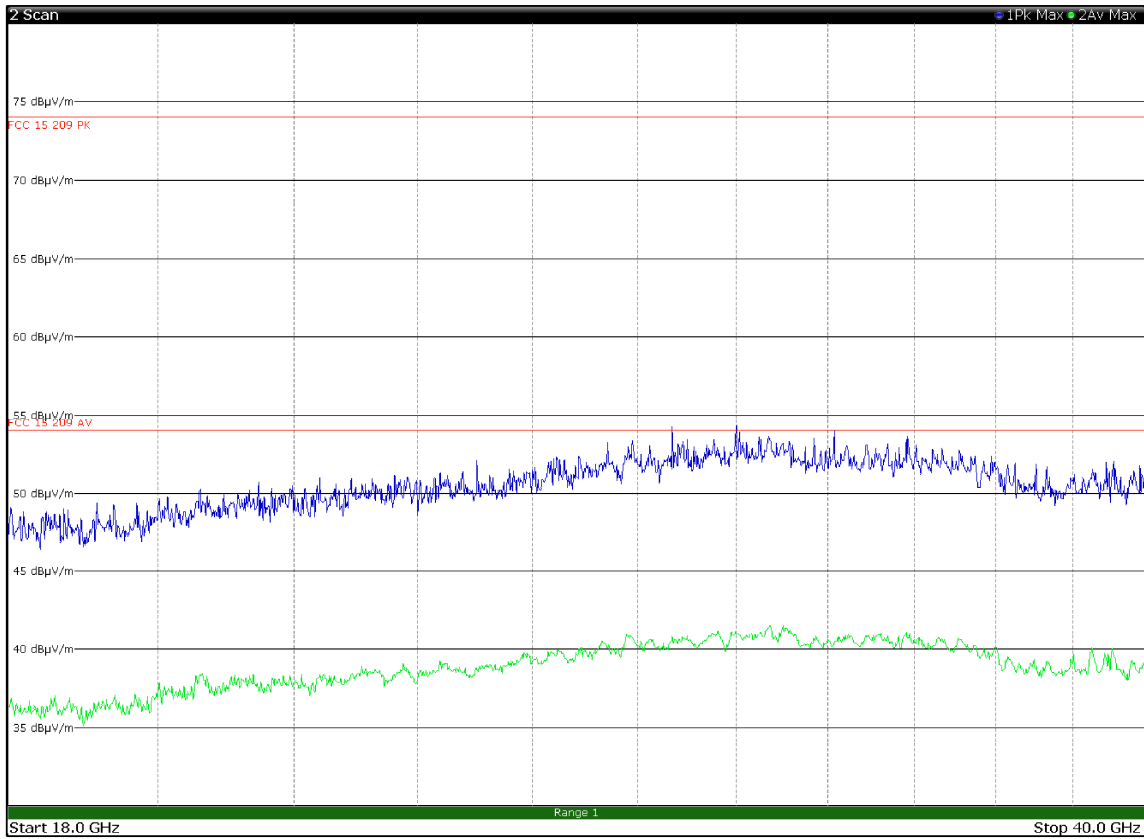


Figure 8.1-59: Radiated spurious emissions with WCDMA at 832.6 MHz and WIFI at 5200 MHz – antenna in horizontal polarization

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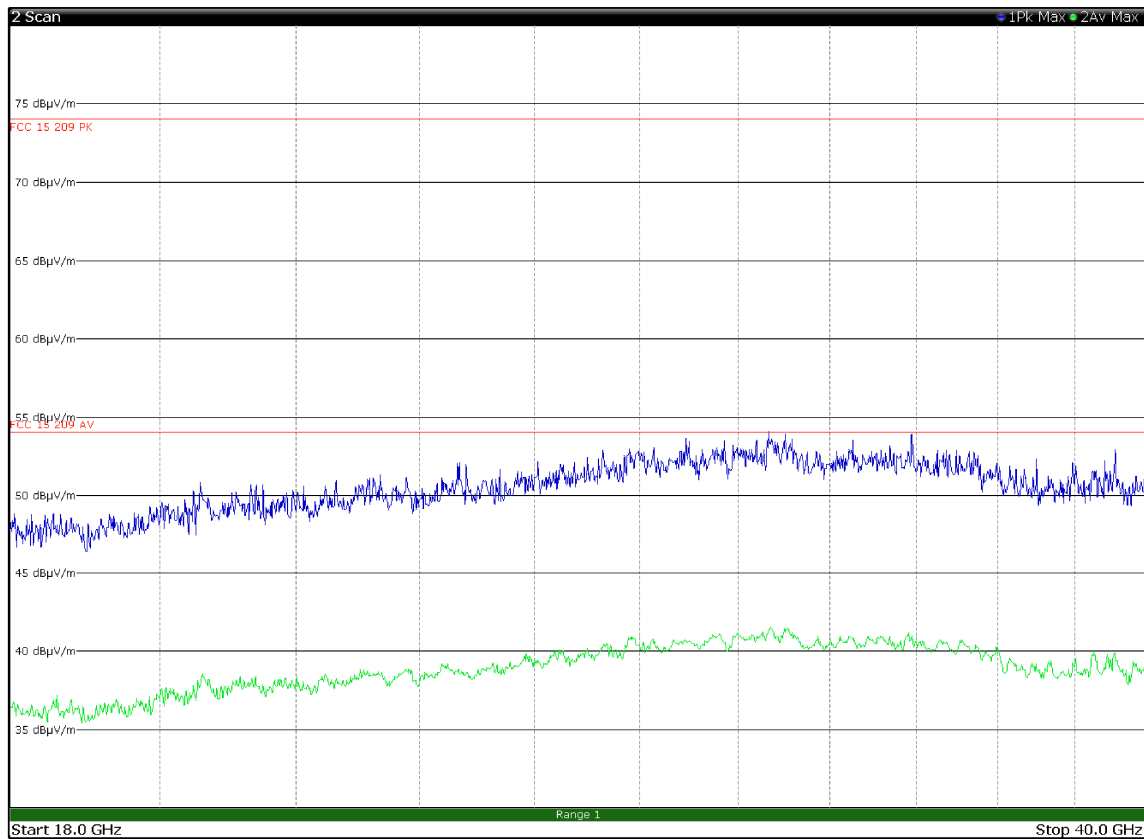
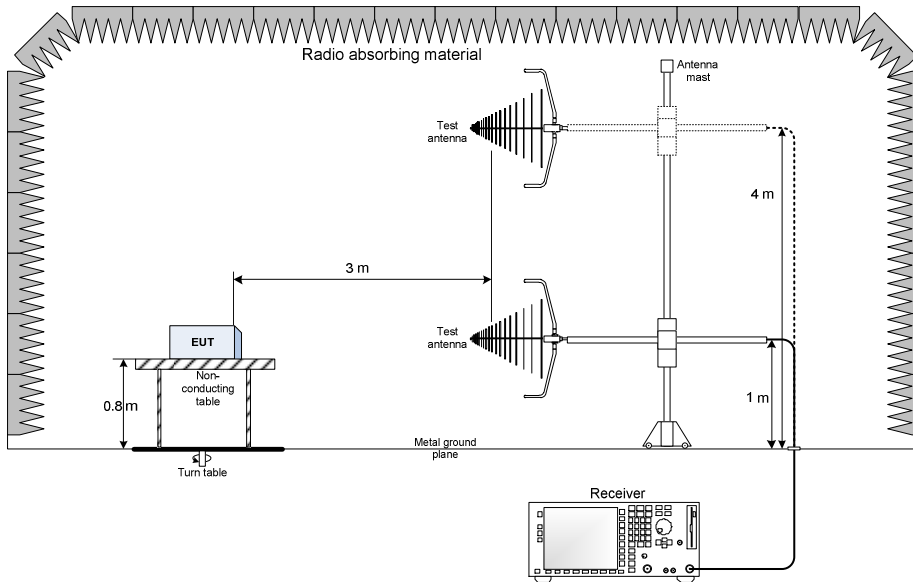


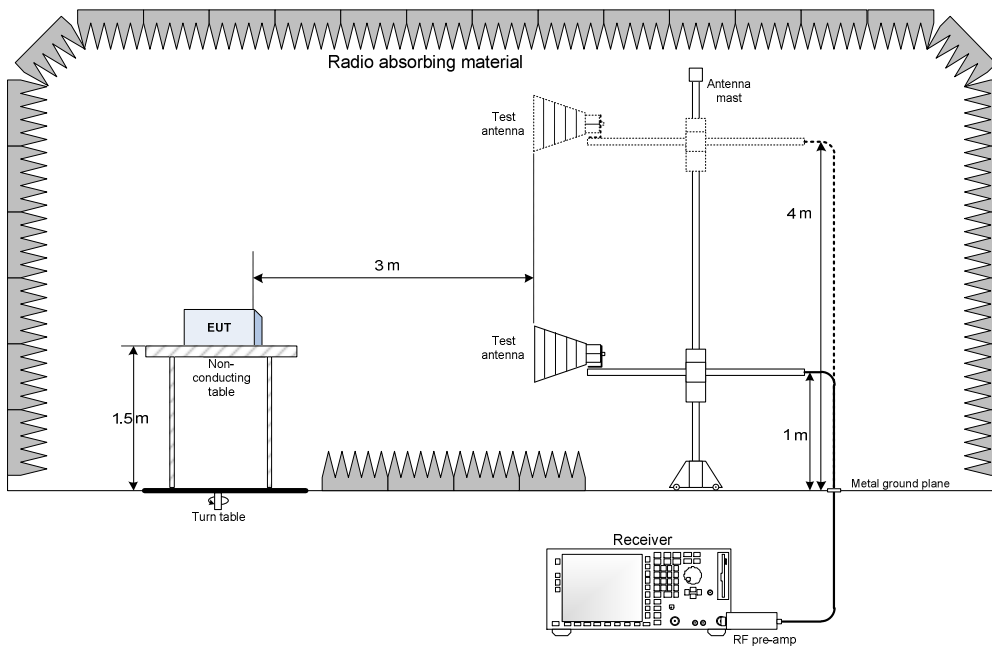
Figure 8.1-60: Radiated spurious emissions with WCDMA at 832.6 MHz and WIFI at 5200 MHz – antenna in vertical polarization

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



Section 10. Photos

10.1 Photos of the test set-up



Radiated emission below 1 GHz



Radiated emission above 1 GHz

10.2 Photos of the EUT





(End of report)