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Wireless test report – 461772-11TRFWL

Type of assessment:
Transmitters co-location

Applicant:
Tierra S.p.A.
Via Lombardore, 223 - 10040 Leinì (TO), Italy

Product:
Telematic device for asset management with LTE/GPS module and Wi-Fi&BT module

Model: **AM35XT** Model variant: **CM100**

FCC ID: **2A6VC-AM35** IC: **28545-AM35**

Specifications:

- FCC 47 CFR Part 22 Subpart H (partial testing)
- FCC 47 CFR Part 24 Subpart E (partial testing)
- FCC 47 CFR Part 15 Subpart C, §15.247 (partial testing)
- FCC 47 CFR Part 22, Subpart H (partial testing)
- FCC 47 CFR Part 24, Subpart E (partial testing)
- FCC 47 CFR Part 27, Subpart C (partial testing)
- RSS-247, Issue 2, Feb 2017, Section 5 (partial testing)
- R SS-130 Issue 2, February 2019 (partial testing)
- RSS-132 Issue 3, January 2013 (partial testing)
- RSS-133 Issue 6, A1 January 18, 2018 (partial testing)
- RSS-139 Issue 3, July 16, 2015 (partial testing)

Date of issue: April 27, 2022

D. Guarnone — Tested by — Signature

P. Barbieri — Reviewed by — Signature

Test location(s)

Company name	Nemko Spa
Address	Via del Carroccio, 4
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 (10 m semi anechoic chamber) ISED: 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 contain in this report are within Nemko Spa ISO/IEC 17025 accreditation.

Copyright notification

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Section 1. Report summary

1.1 Applicant and manufacturer

Company name	Tierra Spa
Address	Via Lombardore 223 10040 Leinì TO Italy

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 5725-5850 MHz
FCC 47 CFR Part 22, Subpart H	Public Mobile Services
FCC 47 CFR Part 24, Subpart E	Broadband Personal Communications Services (PCS)
FCC 47 CFR Part 27, Subpart C	Miscellaneous wireless communications services
RSS-247, Issue 2, Feb 2017, Section 5	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
RSS-130 Issue 2, February 2019	Equipment Operating in the Frequency Bands 617-652 MHz, 663-698 MHz, 698-756 MHz and 777-787 MHz
RSS-132 Issue 3, January 2013	Cellular Telephone Systems Operating in the Bands 824-849 MHz and 869-894 MHz
RSS-133 Issue 6, A1 Jan. 18, 2018	2 GHz Personal Communications Services
RSS-139 Issue 3, July 16, 2015	Advanced Wireless Services (AWS) equipment operating in the bands 1710-1780 MHz and 2110-2180 MHz

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 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
461772-11TRFWL	April 27, 2022	Original report issued

Section 2. Summary of test results

2.1 FCC Part 15 Subpart C, general requirements test results

Part	Test description	Verdict
§15.247(d)	Spurious emissions	Pass
§22.917(a)	Emission limitations for cellular equipment	Pass
§24.238(a)	Field strength of spurious radiation	Pass
§27.53	Radiated spurious emissions	Pass

2.2 ISED test results

Part	Test description	Verdict
RSS-247, 5.5	Transmitter Unwanted Emissions	Pass
RSS-130, 4.7	Transmitter Unwanted Emissions	Pass
RSS-132, 5.5	Transmitter Unwanted Emissions	Pass
RSS-133, 6.5	Transmitter Unwanted Emissions	Pass
RSS-139, 6.6	Radiated spurious emissions	Pass

Section 3. Equipment under test (EUT) details

3.1 Sample information

Receipt date	March 07 2022
Nemko sample ID number	46177200001

3.2 EUT information

Product name	Telematic device for vehicle tracking purpose
Model	AM35XT
Serial number	1600-37000010

3.3 Technical information

Frequency band	WIFI: 2400–2483.5 MHz LTE BAND 2 (1800 MHz) LTE BAND 4 (1700 MHz) LTE BAND 12 (700 MHz) WCDMA BAND 2 (1800 MHz) WCDMA BAND 4 (1700 MHz) WCDMA BAND 5 (800 MHz)
EUT power requirements	12/24 Vdc
Antenna information	The EUT uses an integral antenna

3.4 EUT setup diagram

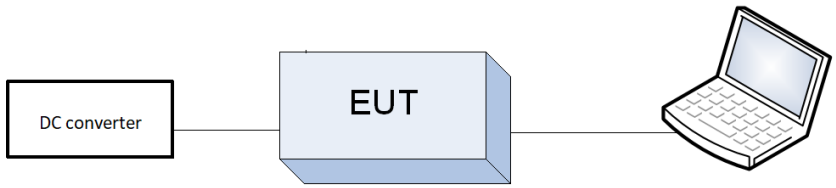

Figure 3.4-1: Setup diagram

3.5 Product description and theory of operation

The EUT is a Telematic device for vehicle tracking purpose, supplied by the vehicle battery. It's provided with a WIFI radio module Quectel EC21 for data exchange.

3.6 EUT exercise details

To set the EUT in continuous transmission the AT commands, program Docklighr and RF Connect (provided by the applicant) have been used.:

AT+QRFTEST=”WCDMA BAND2”,9400,”ON”,80,1

AT+QRFTEST=”WCDMA BAND4”,1412,”ON”,80,1

AT+QRFTEST=”WCDMA BAND5”,4182,”ON”,80,1

AT+QRFTEST=”LTE BAND2”,18899,”ON”,80,1

AT+QRFTEST=”LTE BAND4”,20175,”ON”,80,1

AT+QRFTEST=”LTE BAND12”,23095,”ON”,80,1

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 uses a Quectel EC21-A radio module and Quectel FC20 Wifi (2.4 GHz) + BT 4.2

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

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.

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	12/2020	12/2022
Thermo-hygrometer data loggers	Testo	175-H2	38203337/703	12/2020	12/2022
Barometer	Castle	GPB 3300	072015	03/2022	03/2023

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

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)

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	08/2021	08/2022
EMI receiver (2 Hz ÷ 44 GHz)	Rohde & Schwarz	ESW44	101620	08/2021	08/2022
Spectrum Analyzer (2 Hz ÷ 43 GHz)	Rohde & Schwarz	FSW43	101767	01/2022	01/2023
Trilog Antenna (30 MHz ÷ 7 GHz)	Schwarzbeck	VULB 9162	9162-025	07/2021	07/2024
Bilog antenna (1 ÷ 18 GHz)	Schwarzbeck	STLP 9148	9148-123	07/2021	07/2024
Horn Antenna (4 ÷ 40 GHz)	RFSpin	DRH40	061106A40	04/2020	04/2023
Preamplifier (1 ÷ 18 GHz)	Schwarzbeck	BBV 9718C	00121	2022-03	2023-03
Preamplifier (18 ÷ 40 GHz)	Sage	STB-1834034030-KFKF-L1	18490-01	04/2021	04/2022
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	09/2019	09/2023
Shielded room	Siemens	10m control room	1947	NCR	NCR

Notes: NCR – no calibration required, VOU – verify on use

Section 8. Testing data

8.1 FCC 15.209 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.

FCC §15.247:

(d) 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 §22.917:

(a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log (P) dB.

FCC §24.238:

(a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

FCC §27.53:

AWS emission limits

(1) General protection levels. Except as otherwise specified below, for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, 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 log10 (P) dB.

RSS-130, Clause 4.7:

The unwanted emissions in any 100 kHz bandwidth on any frequency outside the low frequency edge and the high frequency edge of each frequency block range(s), shall be attenuated below the transmitter power, P (dBW), by at least 43 + 10 log10 p (watts), dB. However, in the 100 kHz band immediately outside of the equipment's frequency block range, a resolution bandwidth of 30 kHz may be employed.

RSS-132, Clause 5.5:
In the first 1.0 MHz band immediately outside and adjacent to each of the sub-bands specified in Section 5.1, the power of emissions per any 1% of the occupied bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10p (watts).
(ii) After the first 1.0 MHz immediately outside and adjacent to each of the sub-bands, the power of emissions in any 100 kHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10 p (watts). If the measurement is performed using 1% of the occupied bandwidth, power integration over 100 kHz is required.

RSS-133, Clause 6.5:
(ii) After the first 1.0 MHz, the emission power in any 1 MHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at
least 43 + 10 log10p(watts). If the measurement is performed using 1% of the emission bandwidth, power integration over 1.0 MHz is required.
RSS-139, Clause 6.6:
In the first 1.0 MHz bands immediately outside and adjacent to the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power per any 1% of the emission bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least 43 + 10 log10 P (watts) dB.
After the first 1.0 MHz outside the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power in any 1 MHz bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least 43 + 10 log10 P (watts) dB.
RSS-247:
5.5 In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 5.4(d), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.
6.2 All emissions outside the allocated band shall not exceed -27 dBm/MHz e.i.r.p.

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			

8.1.2 Test summary

Test start date	April 27 2022
Test engineer	D. Guarnone

8.1.3 Observations, settings and special notes

The spectrum was searched from 30 MHz to 25.0 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 for frequency rand below 18 GHz, and 1 m for frequency range above 18 GHz. 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 analyzer 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

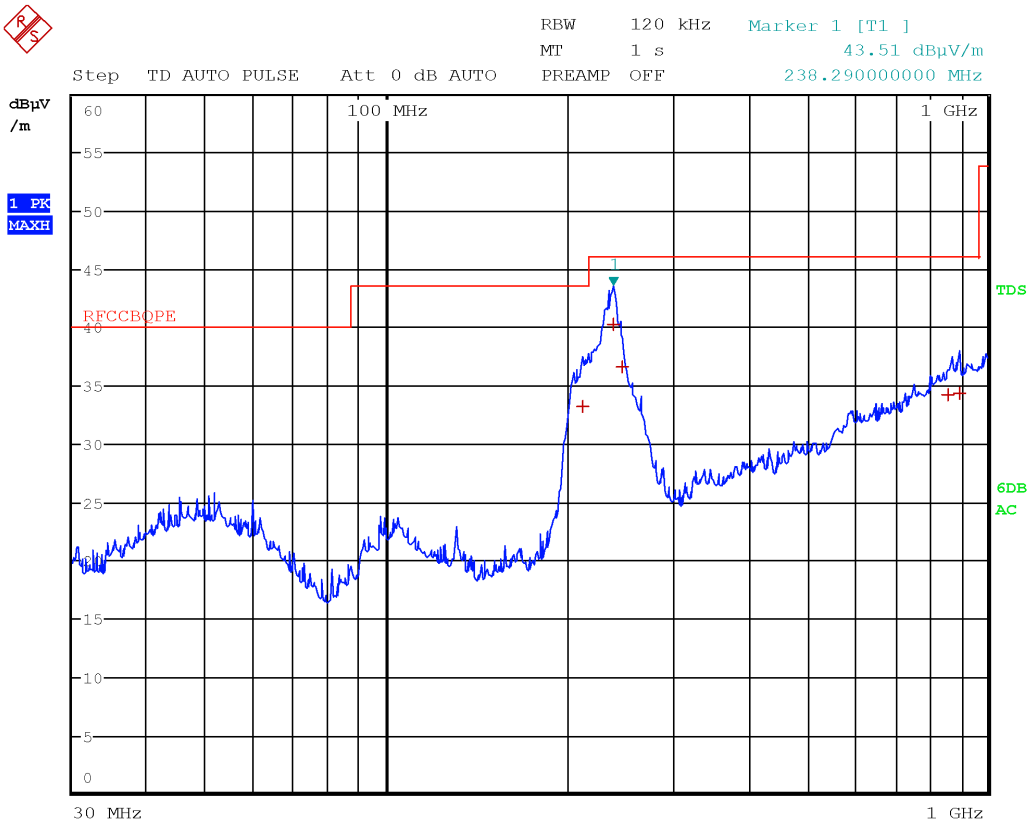

Figure 8.1-1: Radiated spurious emissions with LTE B2 at mid channel and WIFI at mid channel – antenna in horizontal polarization

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
238.2900	40.3	46.0	-5.7	QP
246.0600	36.7	46.0	-9.3	QP
211.7400	33.3	43.5	-10.2	QP
899.3700	34.5	46.0	-11.5	QP
859.0800	34.2	46.0	-11.8	QP
831.8800	22.1	46.0	-23.9	QP
918.5200	23.0	46.0	-23.0	QP

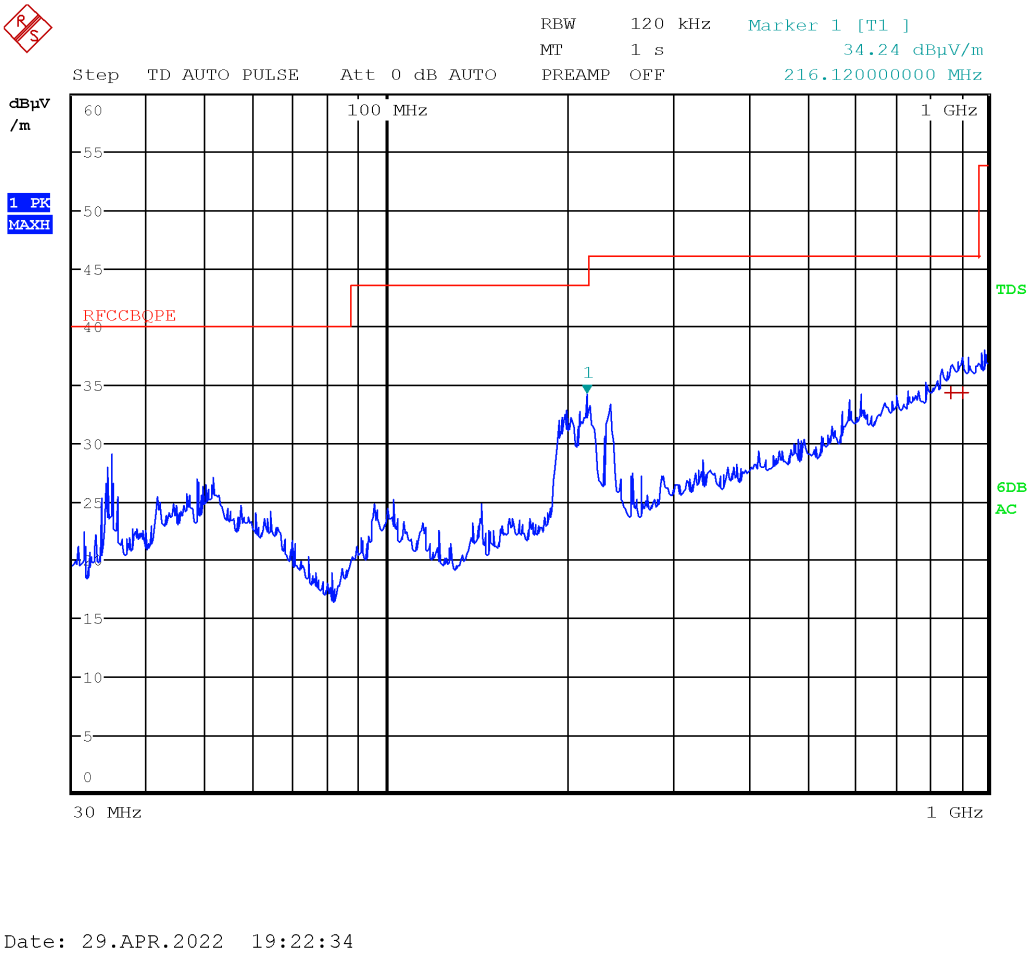

Figure 8.1-2: Radiated spurious emissions with LTE B2 at mid channel and WIFI at mid channel – antenna in vertical polarization

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
908.5200	34.4	46.0	-11.6	QP
868.5900	34.4	46.0	-11.6	QP

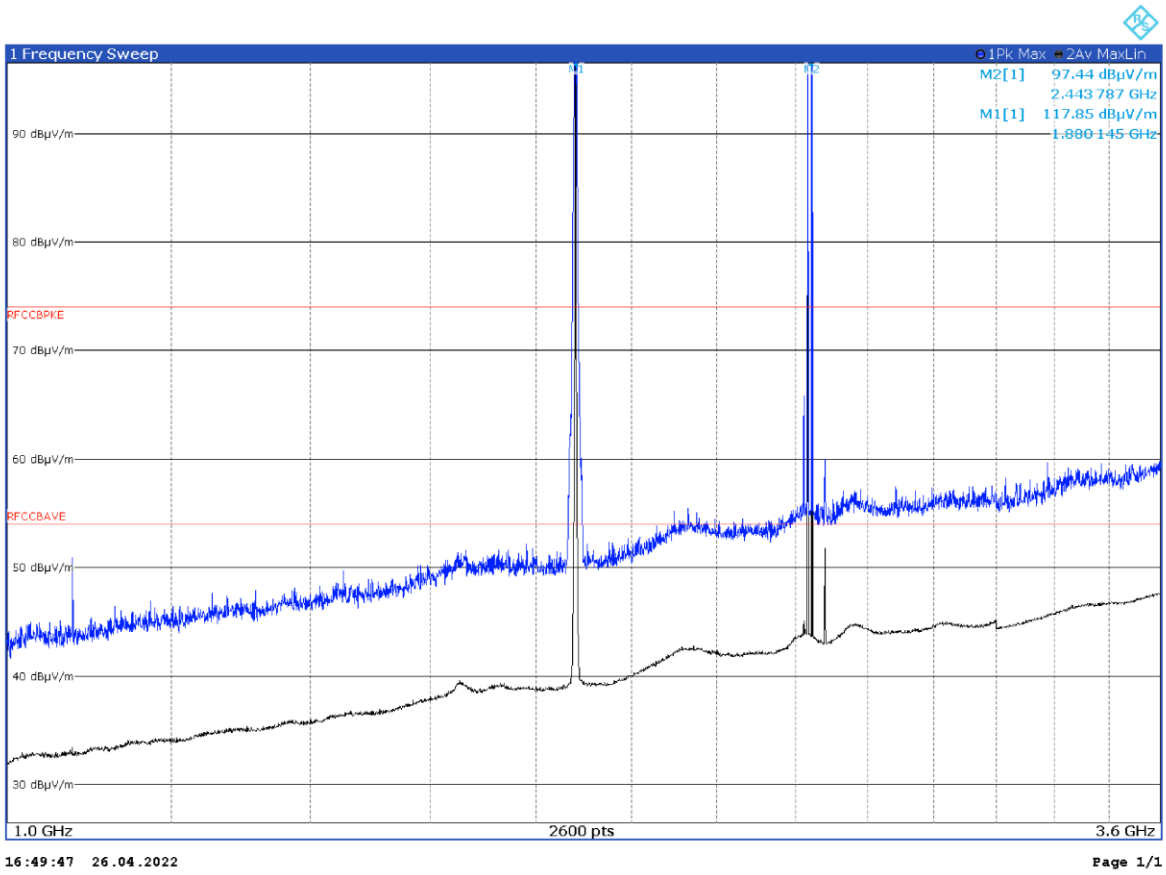

Figure 8.1-3: Radiated spurious emissions with LTE B2 at mid channel and WIFI at mid channel – antenna in horizontal polarization

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
--	--	--	--	--
Notes: Field strength includes correction factor of antenna, cable loss, amplifier, and attenuators where applicable.				

Limit exceeded by carriers

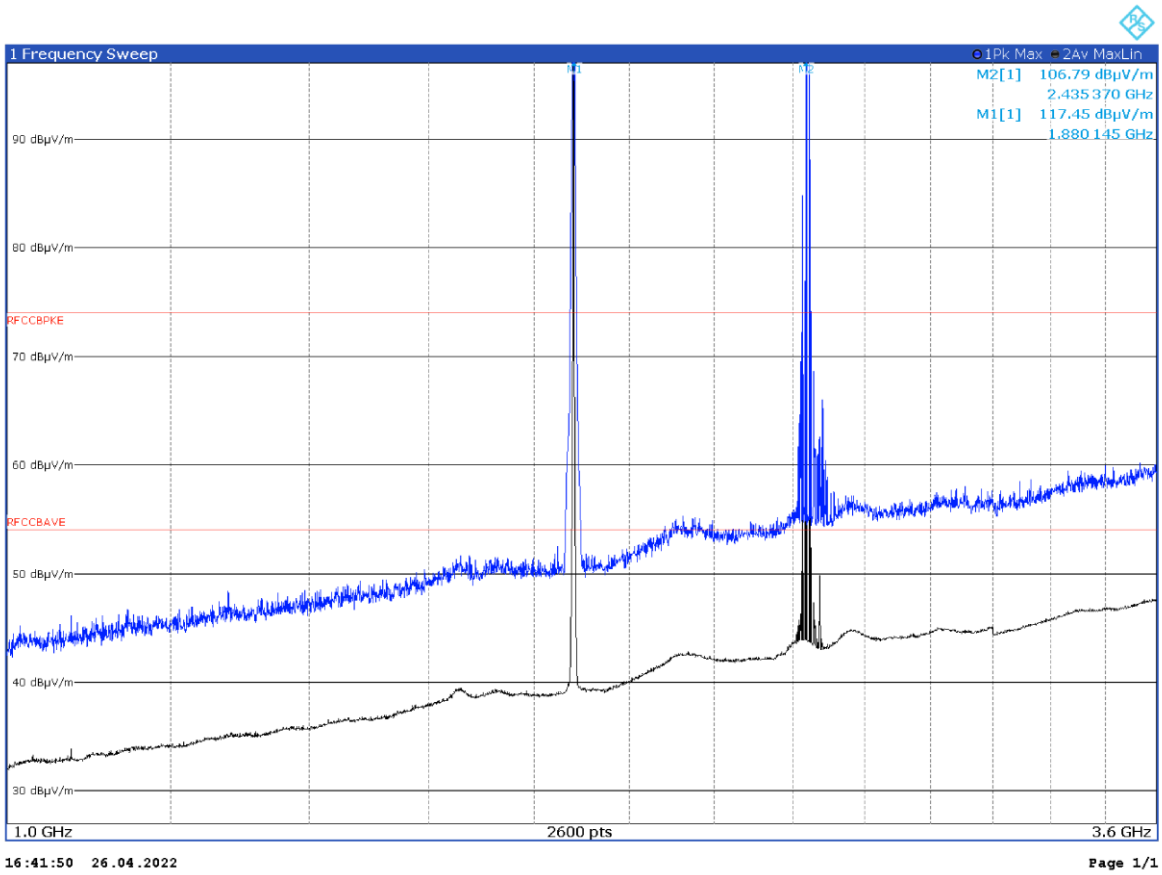

Figure 8.1-4: Radiated spurious emissions with LTE B2 at mid channel and WIFI at mid channel – antenna in vertical polarization

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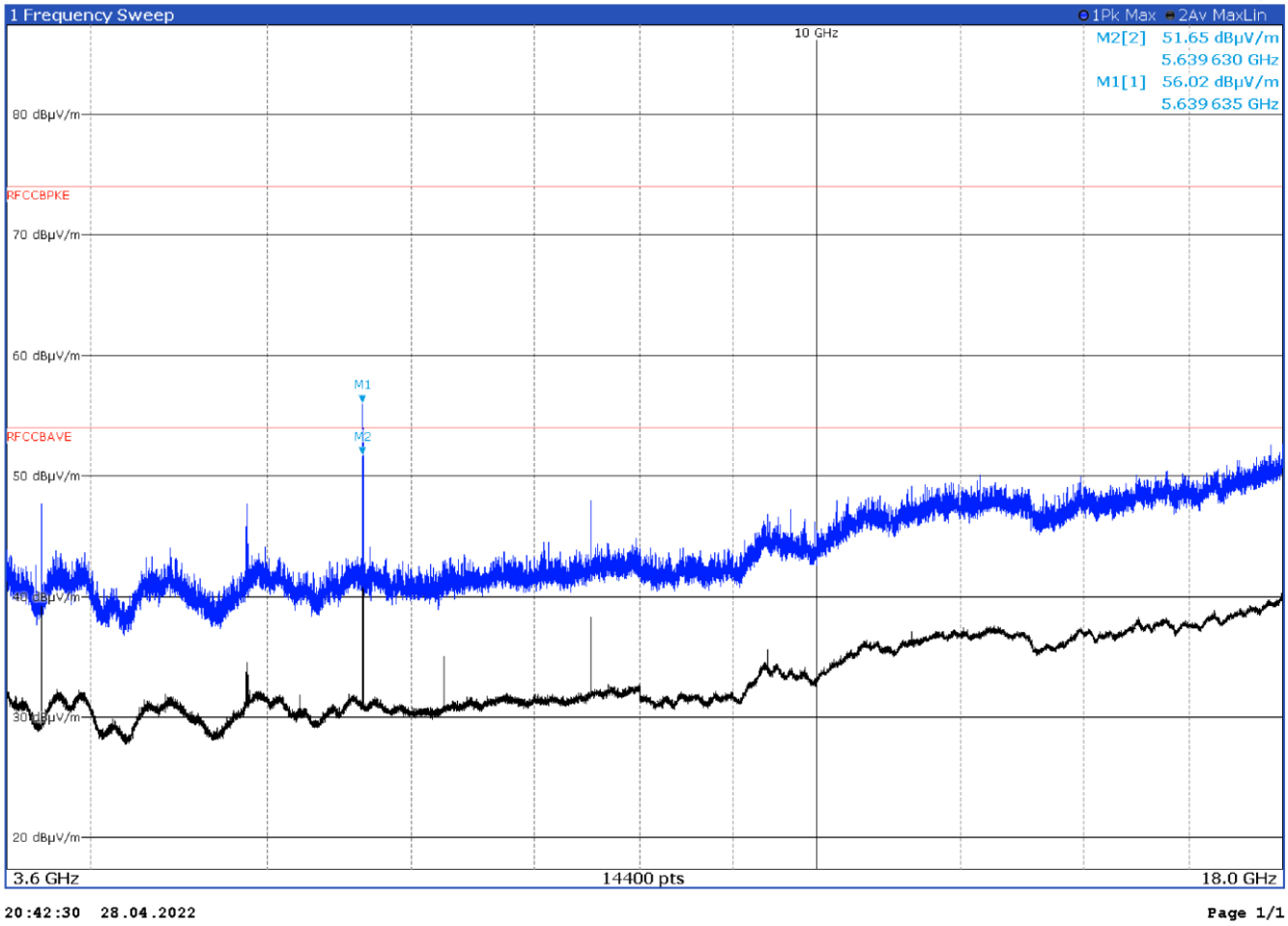
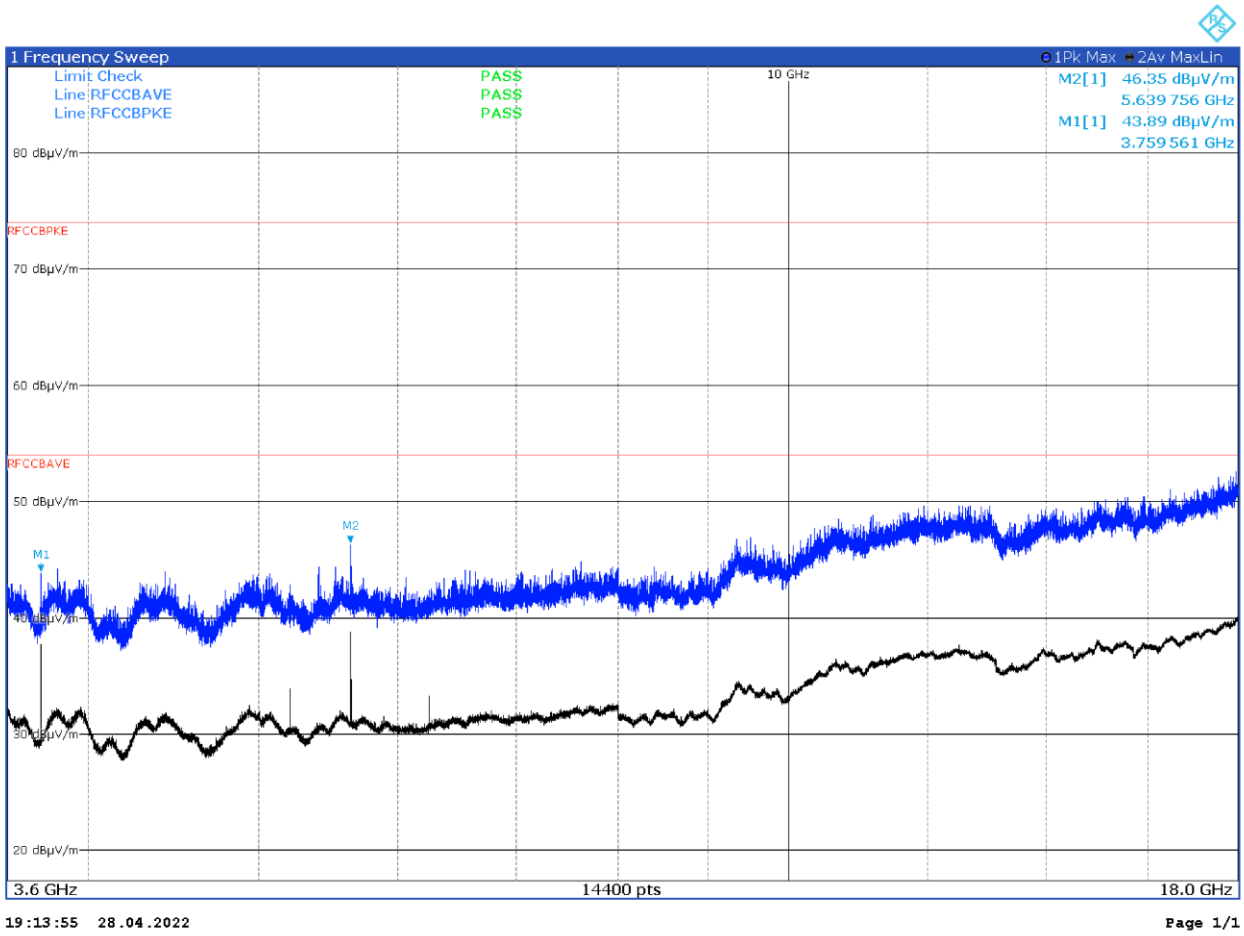
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
--	--	--	--	Av
Notes: Field strength includes correction factor of antenna, cable loss, amplifier, and attenuators where applicable.				

Limit exceeded by carriers



Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
5639.75	56.0	82.2	-26.2	Pk

Figure 8.1-5: Radiated spurious emissions with LTE B2 at mid channel and WIFI at mid channel – antenna in horizontal polarization



Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
5639.7	46.5	82.2	-0.2	Pk

The limit for LTE is -13 dBm. Limit (dBµV/m) = limit (dBm) + 95.23 = 82.2 dBµV/m: limits for restricted band also fulfilled

Figure 8.1-6: Radiated spurious emissions with LTE B2 at mid channel and WiFi at mid channel – antenna in vertical polarization

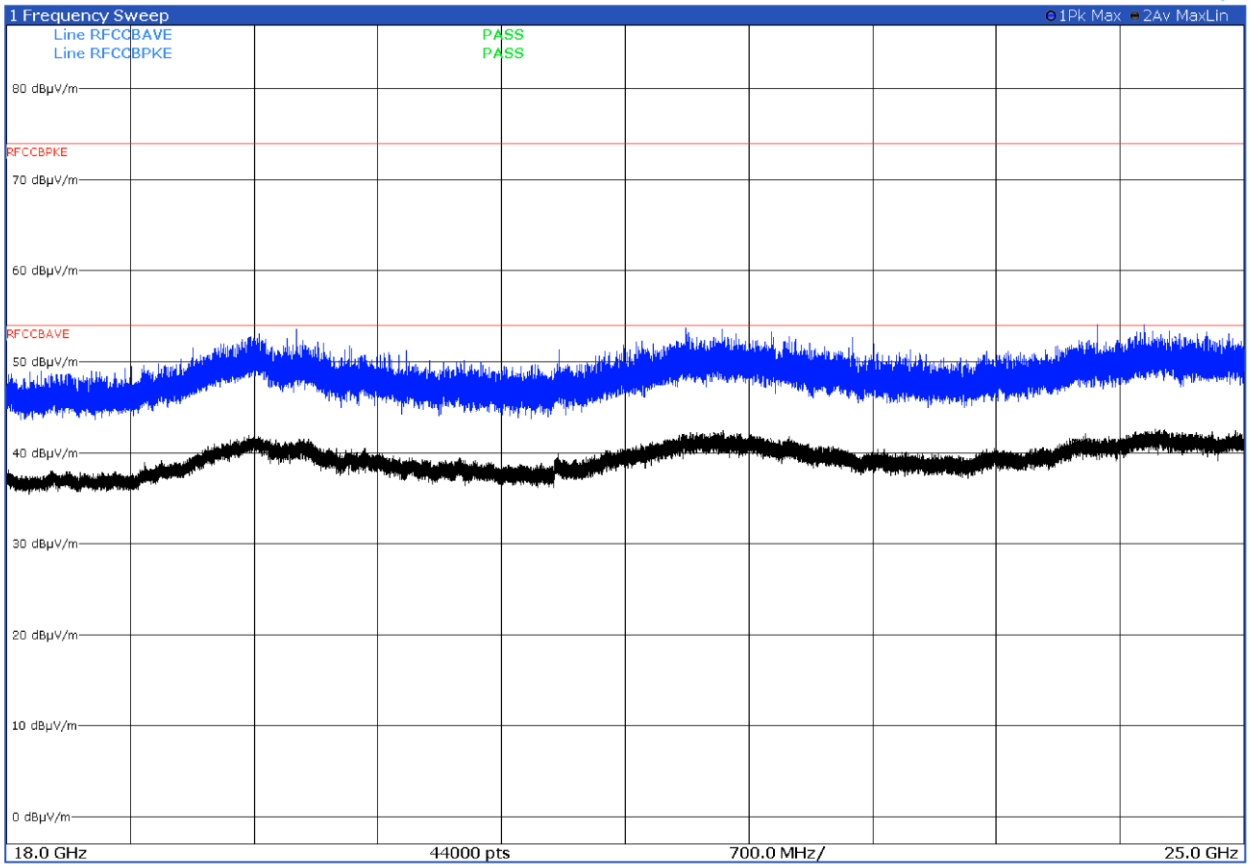


Figure 8.1-7: Radiated spurious emissions with LTE B2 at mid channel and BLE at mid channel – antenna in horizontal polarization

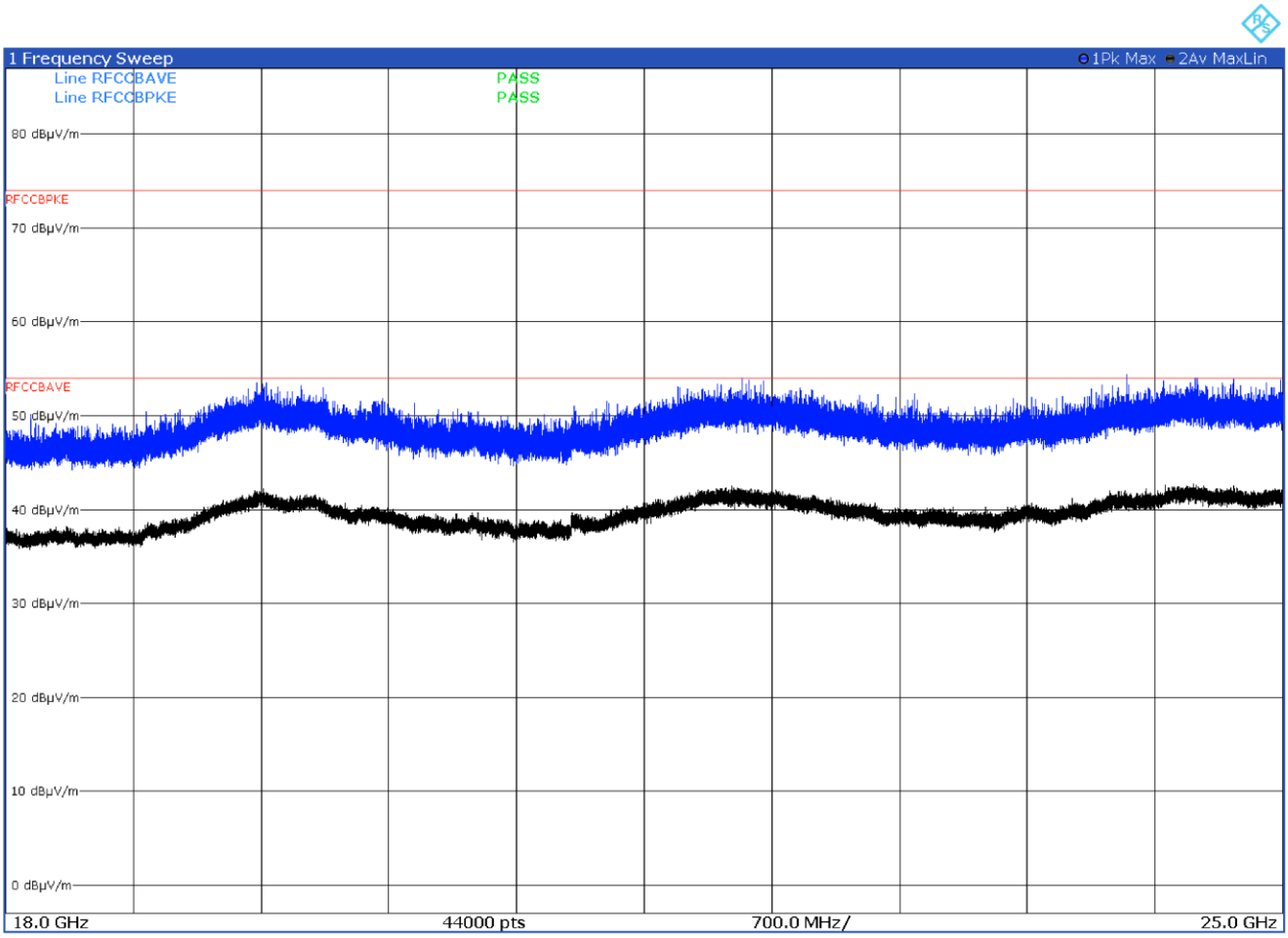


Figure 8.1-8: Radiated spurious emissions with LTE B2 at mid channel and BLE at mid channel – antenna in vertical polarization

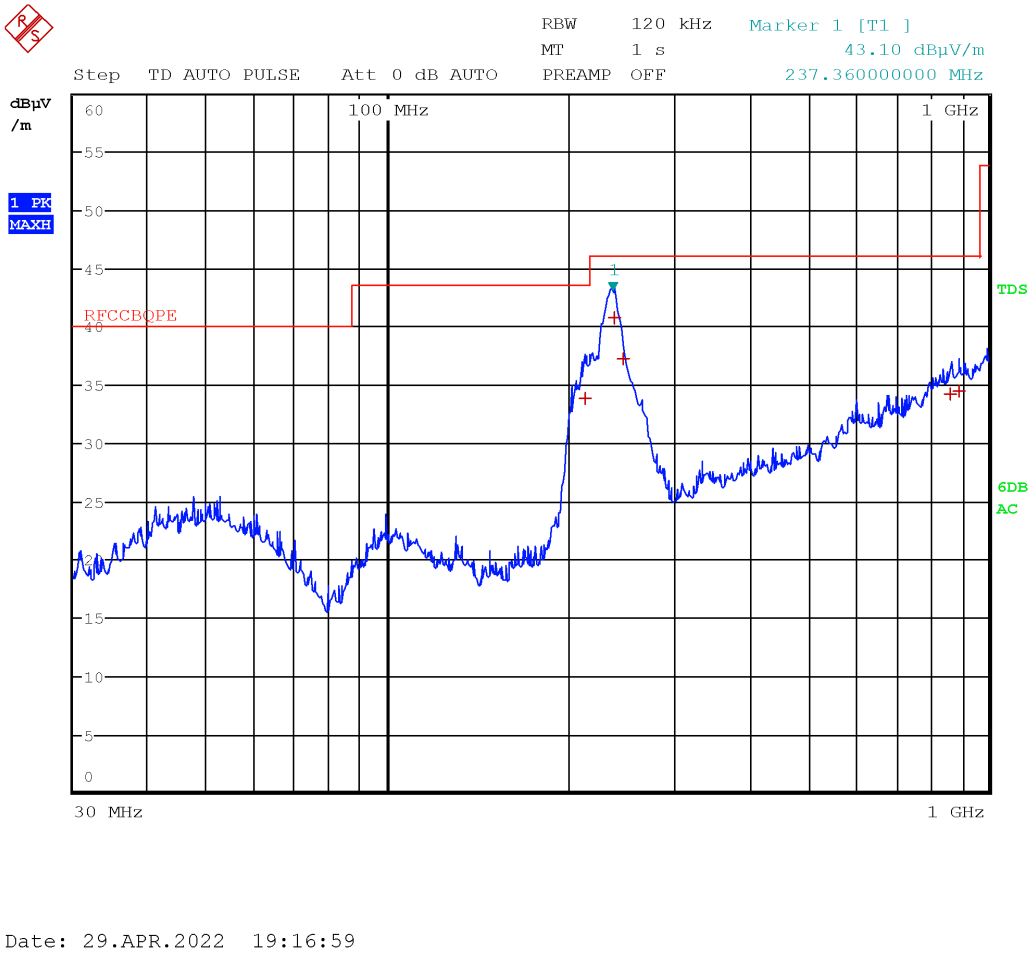


Figure 8.1-9: Radiated spurious emissions with LTE B4 at mid channel and WIFI at mid channel – antenna in horizontal polarization

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
238.7400	40.8	46.0	-5.2	QP
246.5700	37.3	46.0	-8.7	QP
213.7200	33.8	43.5	-9.7	QP
892.9800	34.5	46.0	-11.5	QP
867.6600	34.3	46.0	-11.7	QP

No intermodulation emissions were detected, limit exceeded by carrier

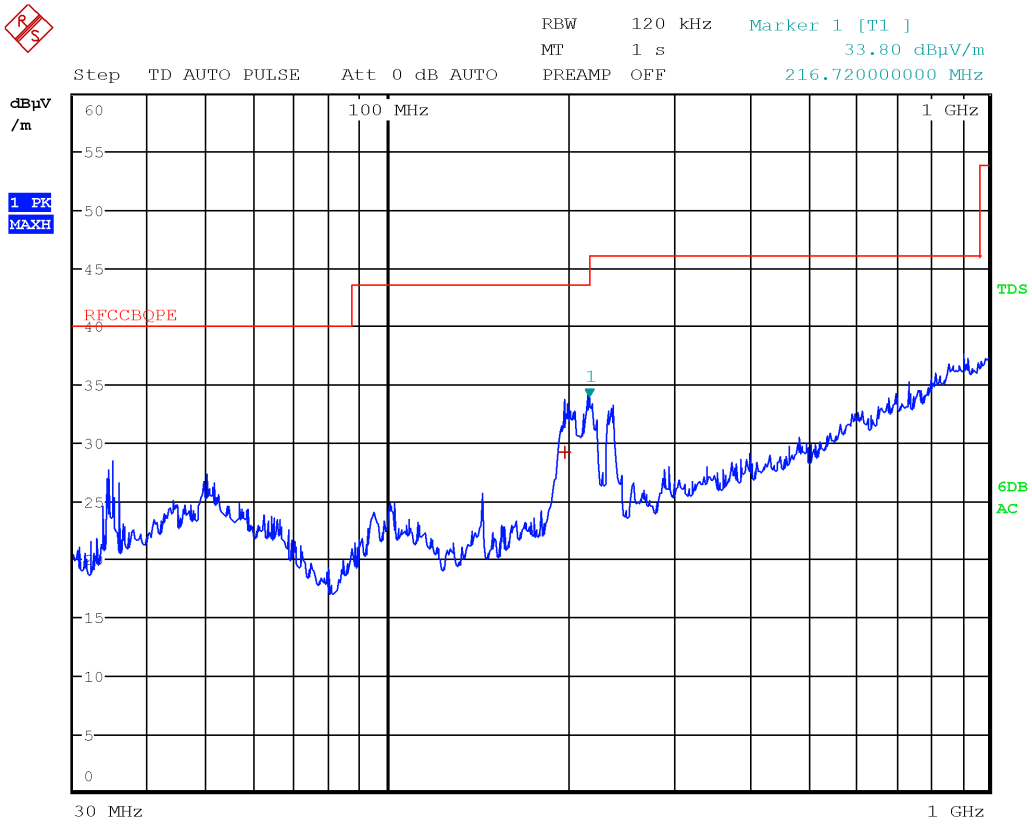


Figure 8.1-10: Radiated spurious emissions with LTE B4 at mid channel and WIFI at mid channel – antenna in vertical polarization

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
197.4900	29.2	43.5	-14.3	QP

No intermodulation emissions were detected, limit exceeded by carrier

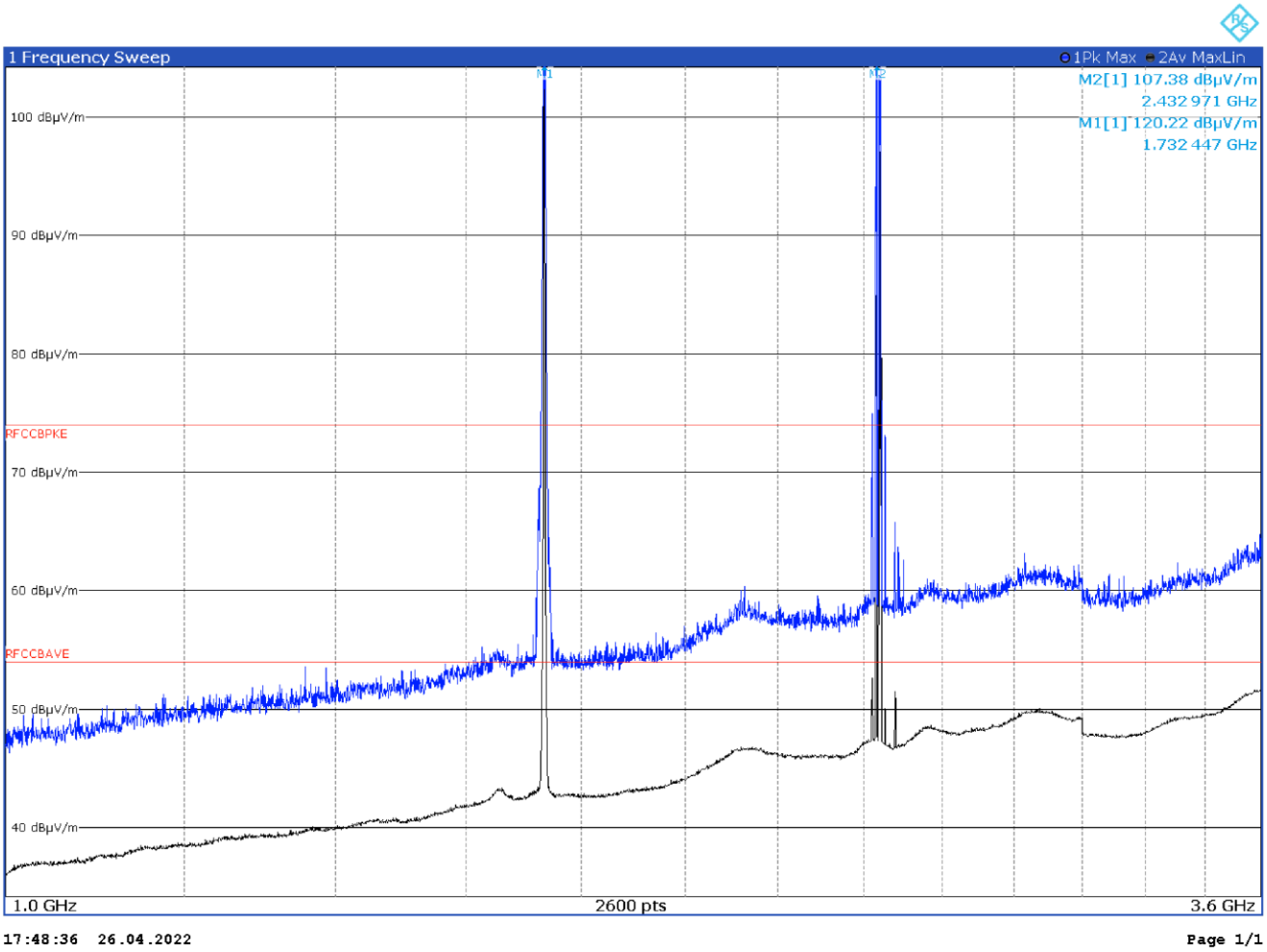


Figure 8.1-11: Radiated spurious emissions with LTE B4 at mid channel and WIFI at mid channel – antenna in horizontal polarization

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
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Limit exceeded by carrier

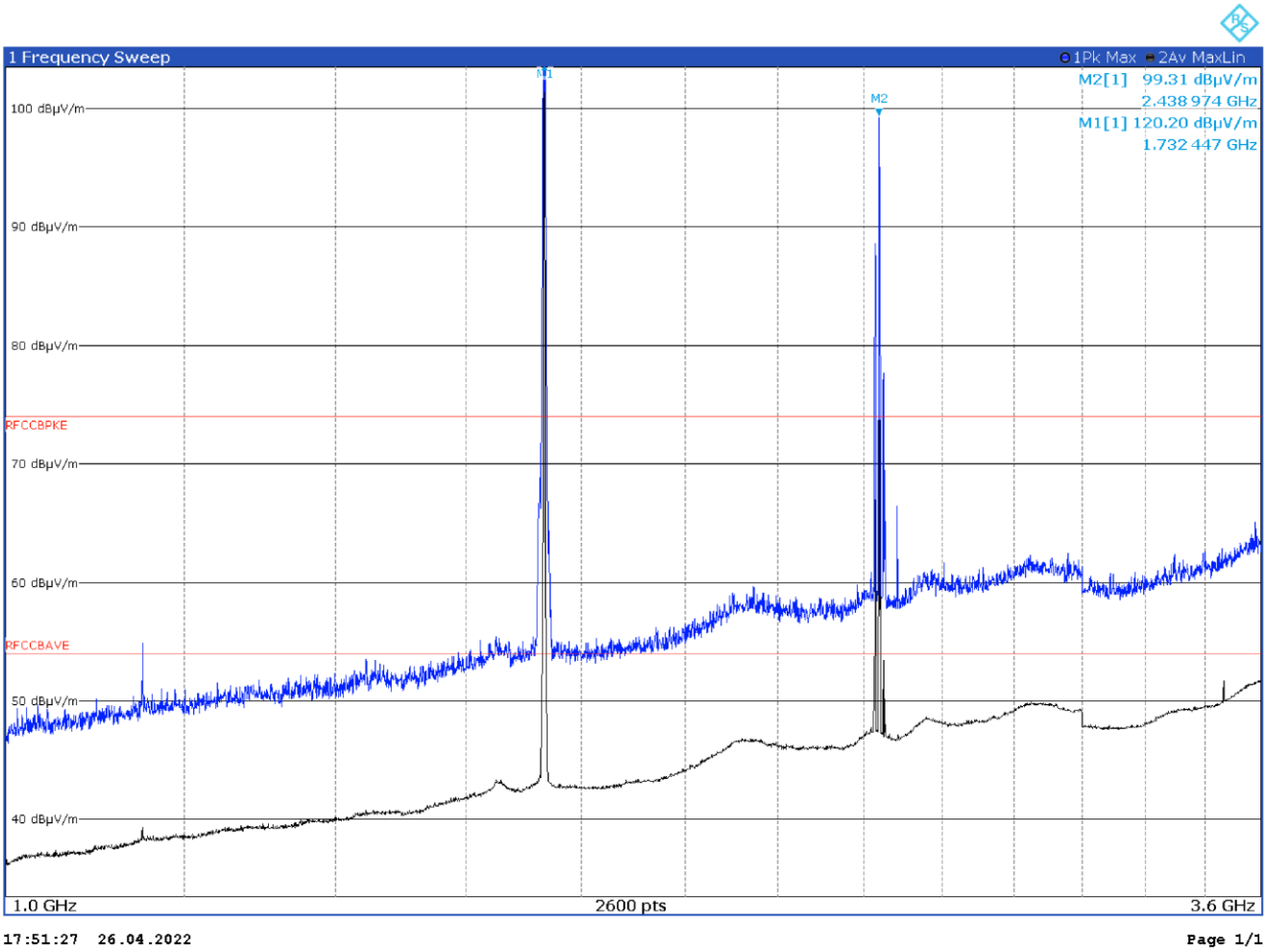

Figure 8.1-12: Radiated spurious emissions with LTE B4 at mid channel and WIFI at mid channel – antenna in vertical polarization

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
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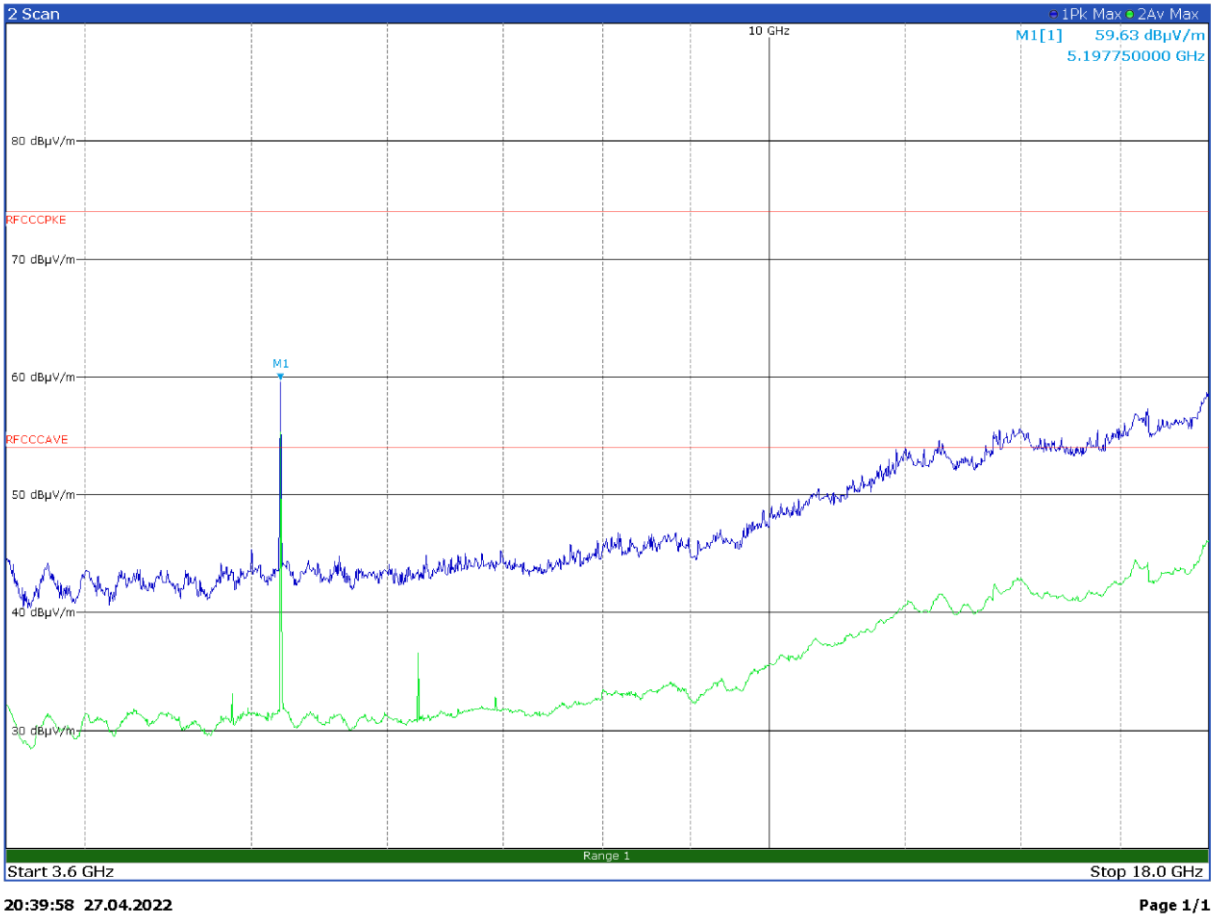
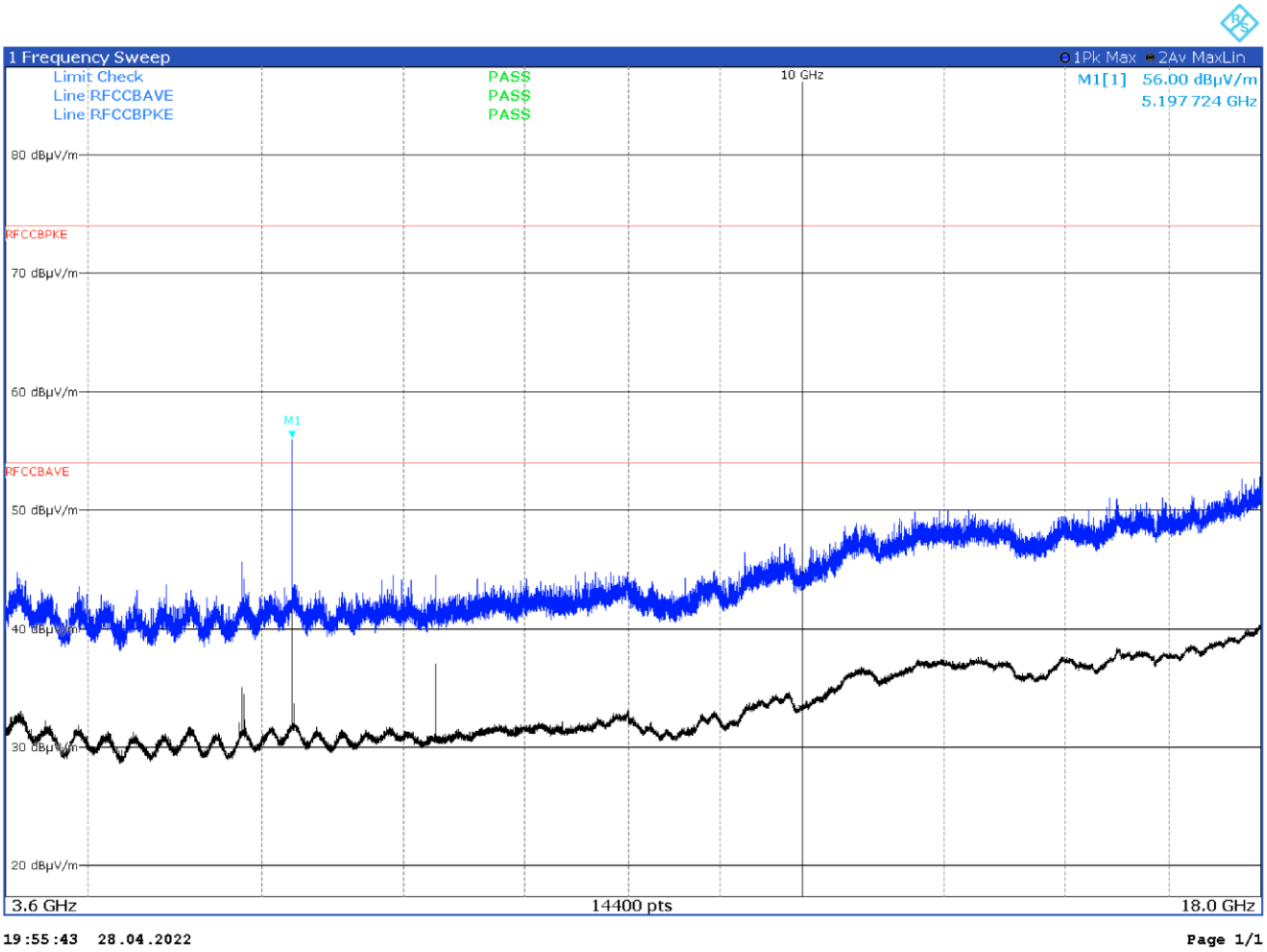
Limit exceeded by carrier



Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
5197.75	59.6	82.2	-22.6	Pk

Figure 8.1-13: Radiated spurious emissions with LTE B4 at mid channel and WIFI at mid channel – antenna in horizontal polarization



+

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
5197.7500	56.0	82.2	-26.2	Pk

Figure 8.1-14: Radiated spurious emissions with LTE B4 at mid channel and WIFI at mid channel – antenna in vertical polarization

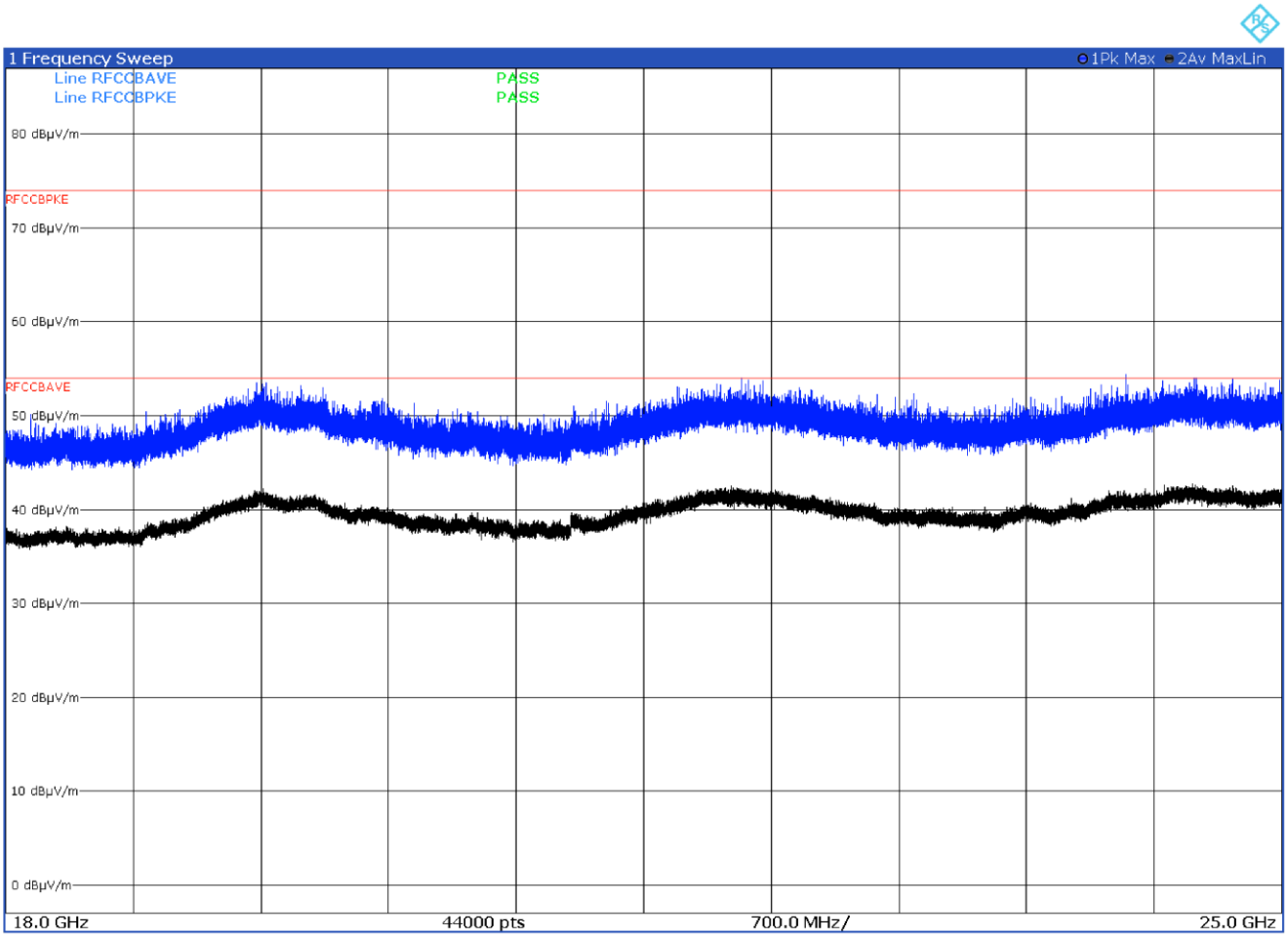


Figure 8.1-15: Radiated spurious emissions with LTE B4 at mid channel and WIFI at mid channel – antenna in horizontal polarization

Peak level under the average limit – no additional measures need. No intermodulation emissions were detected

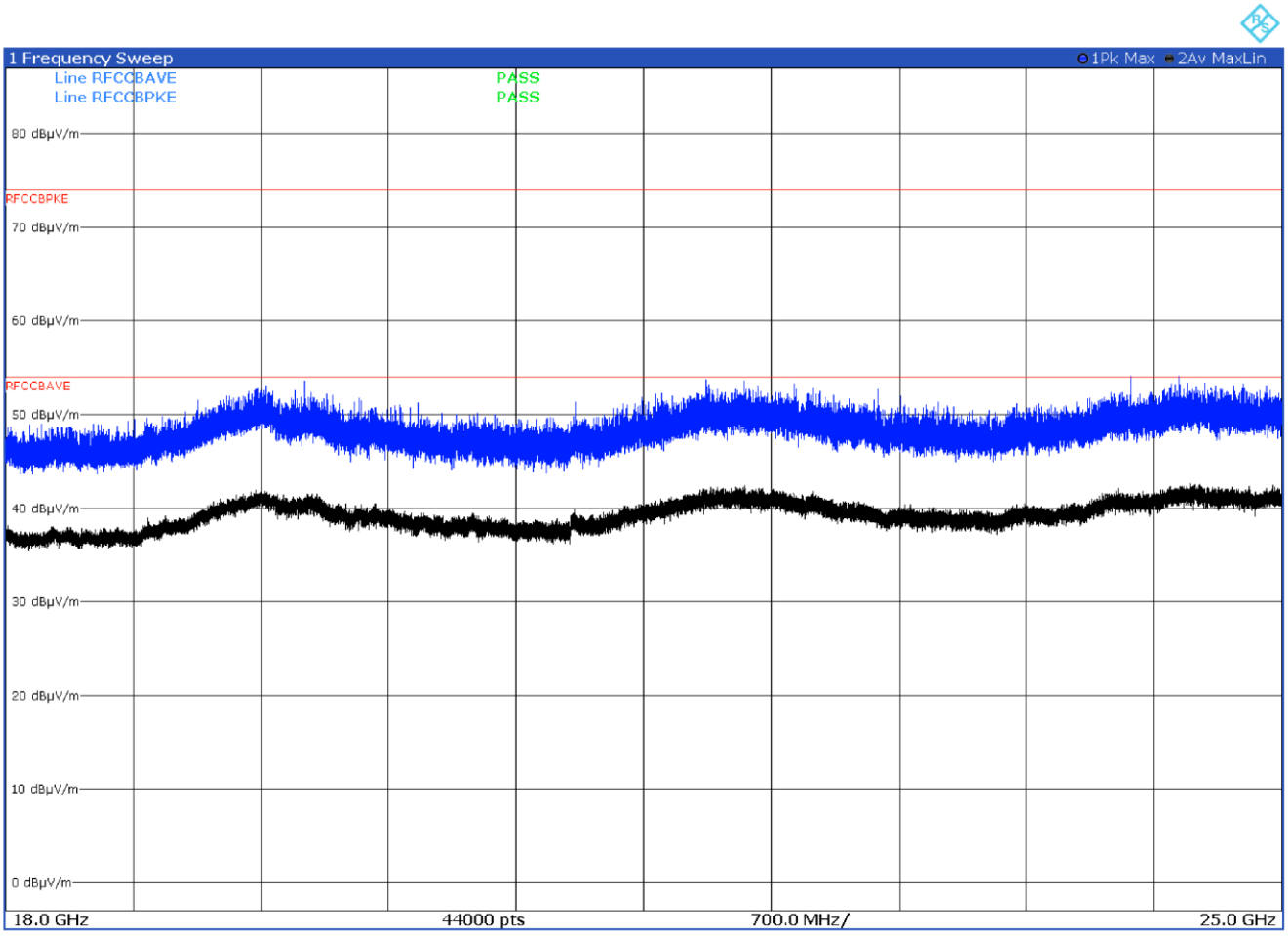
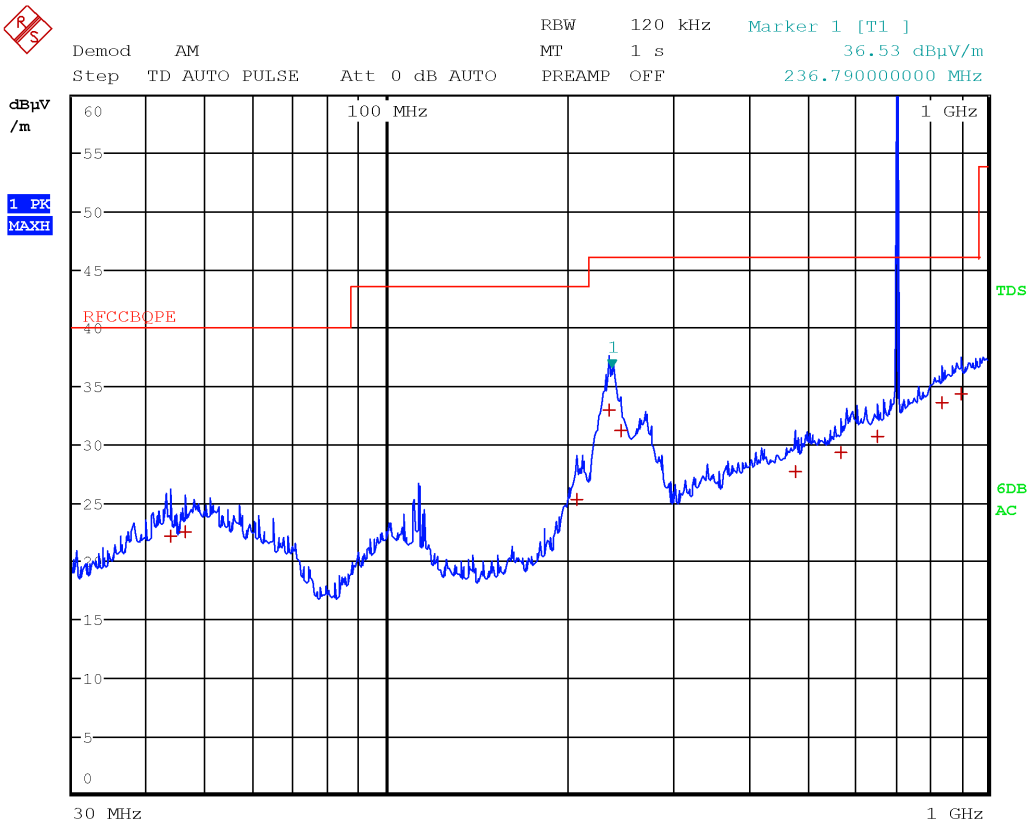


Figure 8.1-16: Radiated spurious emissions with LTE B4 at mid channel and WIFI at mid channel – antenna in vertical polarization

Peak level under the average limit – no additional measures need. No intermodulation emissions were detected



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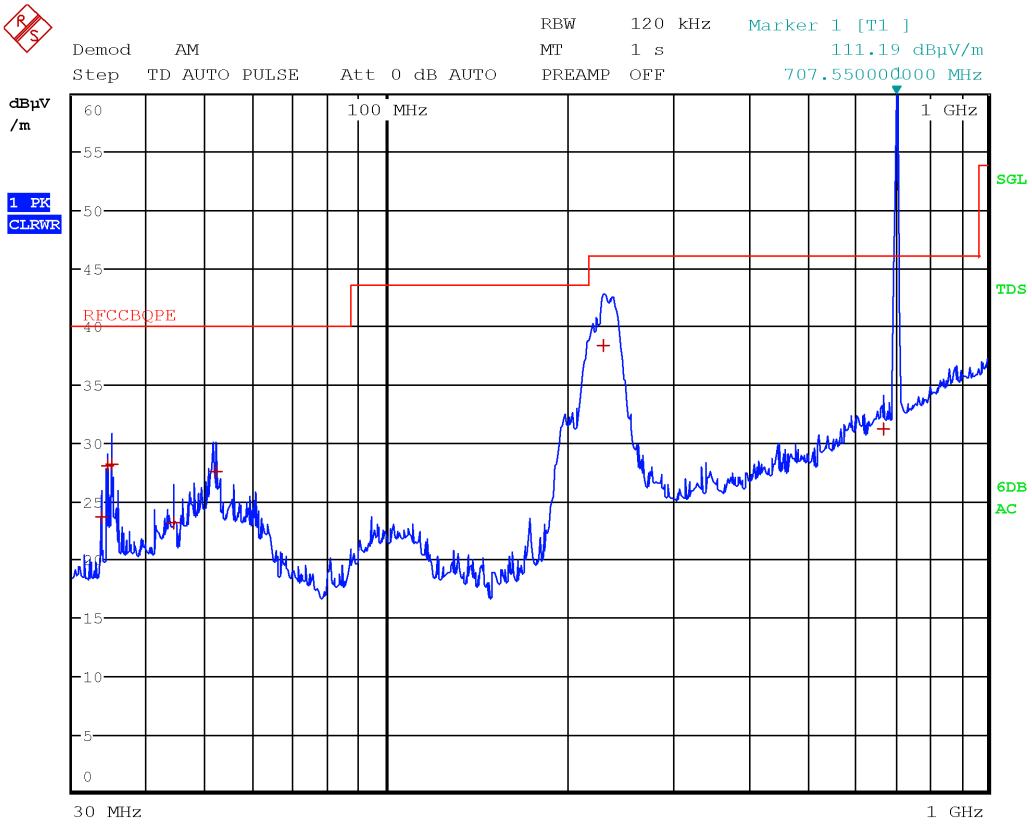
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
43.6500	22.2	40.0	-17.8	QP
46.2900	22.5	40.0	-17.5	QP
207.0000	25.4	43.5	-18.1	QP
234.6600	33.0	46.0	-13.0	QP
246.0300	31.2	46.0	-14.8	QP
478.0800	27.7	46.0	-18.3	QP
569.7300	29.4	46.0	-16.6	QP
654.3000	30.8	46.0	-15.2	QP
707.5200	95.8	46.0	49.8	QP
838.0800	33.7	46.0	-12.3	QP

Figure 8.1-17: Radiated spurious emissions with LTE B12 at mid channel and WIFI at mid channel – antenna in horizontal polarization



Date: 29.APR.2022 18:10:42

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
33.5100	23.6	40.0	-16.4	QP
34.2300	28.1	40.0	-11.9	QP
34.9200	28.2	40.0	-11.8	QP
44.2200	23.2	40.0	-16.8	QP
52.1100	27.6	40.0	-12.4	QP
229.6200	38.5	46.0	-7.5	QP
671.3700	31.2	46.0	-14.8	QP
707.5500	86.4	46.0	40.4	QP

Figure 8.1-18: Radiated spurious emissions with LTE B12 at mid channel and WIFI at mid channel – antenna in vertical polarization

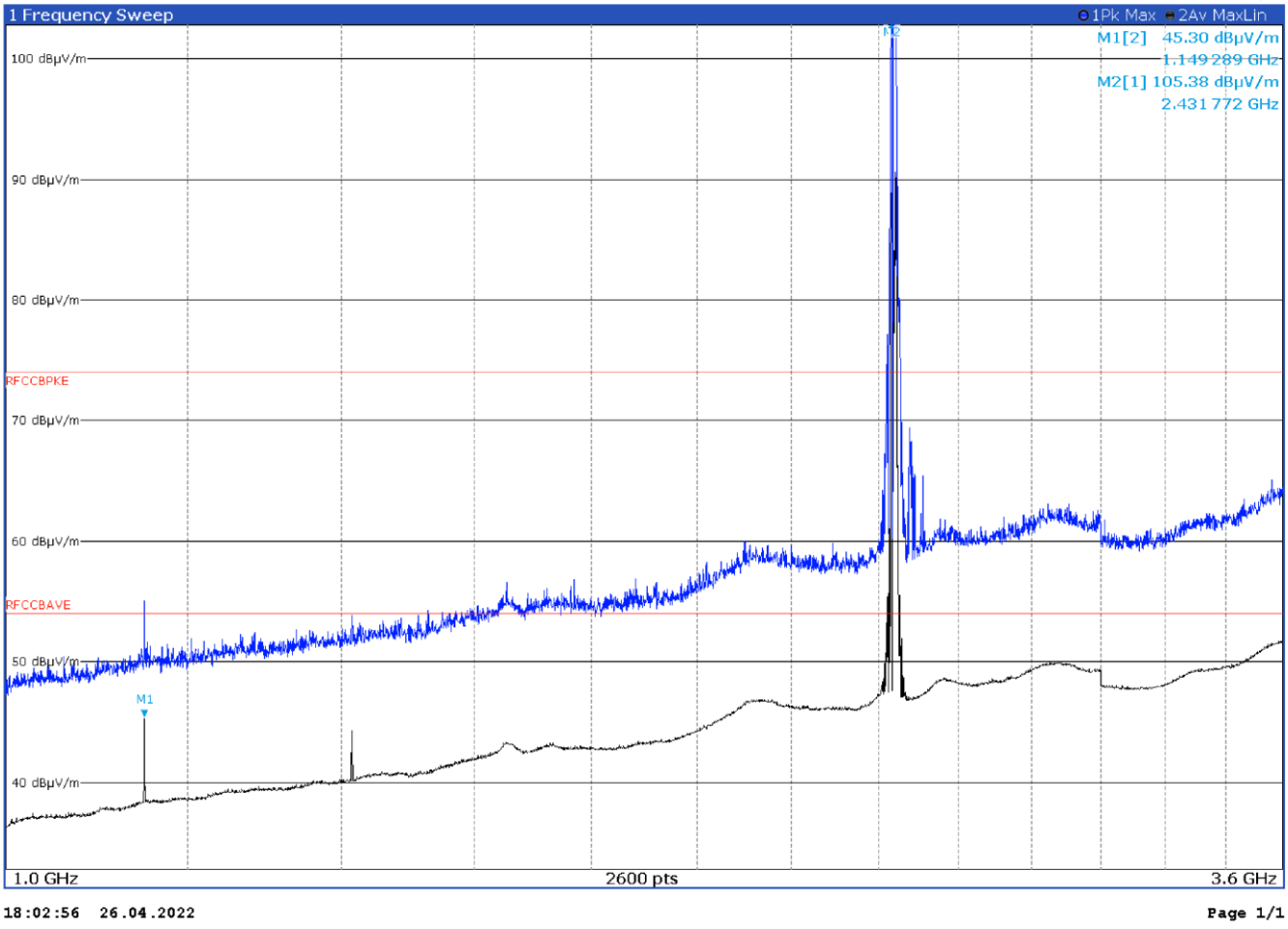


Figure 8.1-19: Radiated spurious emissions with LTE B12 at mid channel and WIFI at mid channel – antenna in horizontal polarization

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
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Limit exceeded by carrier

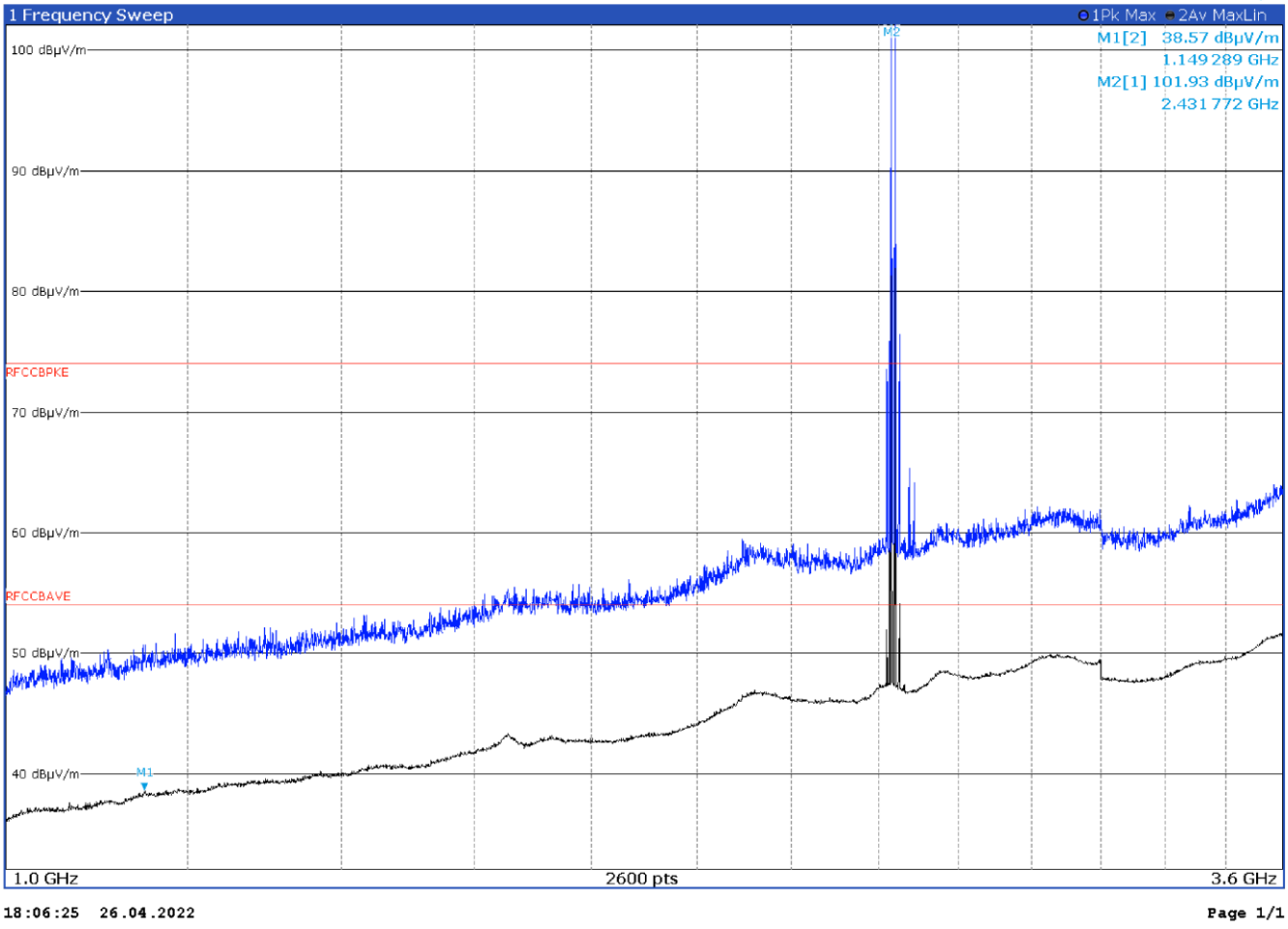

Figure 8.1-20: Radiated spurious emissions with LTE B12 at mid channel and WIFI at mid channel – antenna in vertical polarization

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
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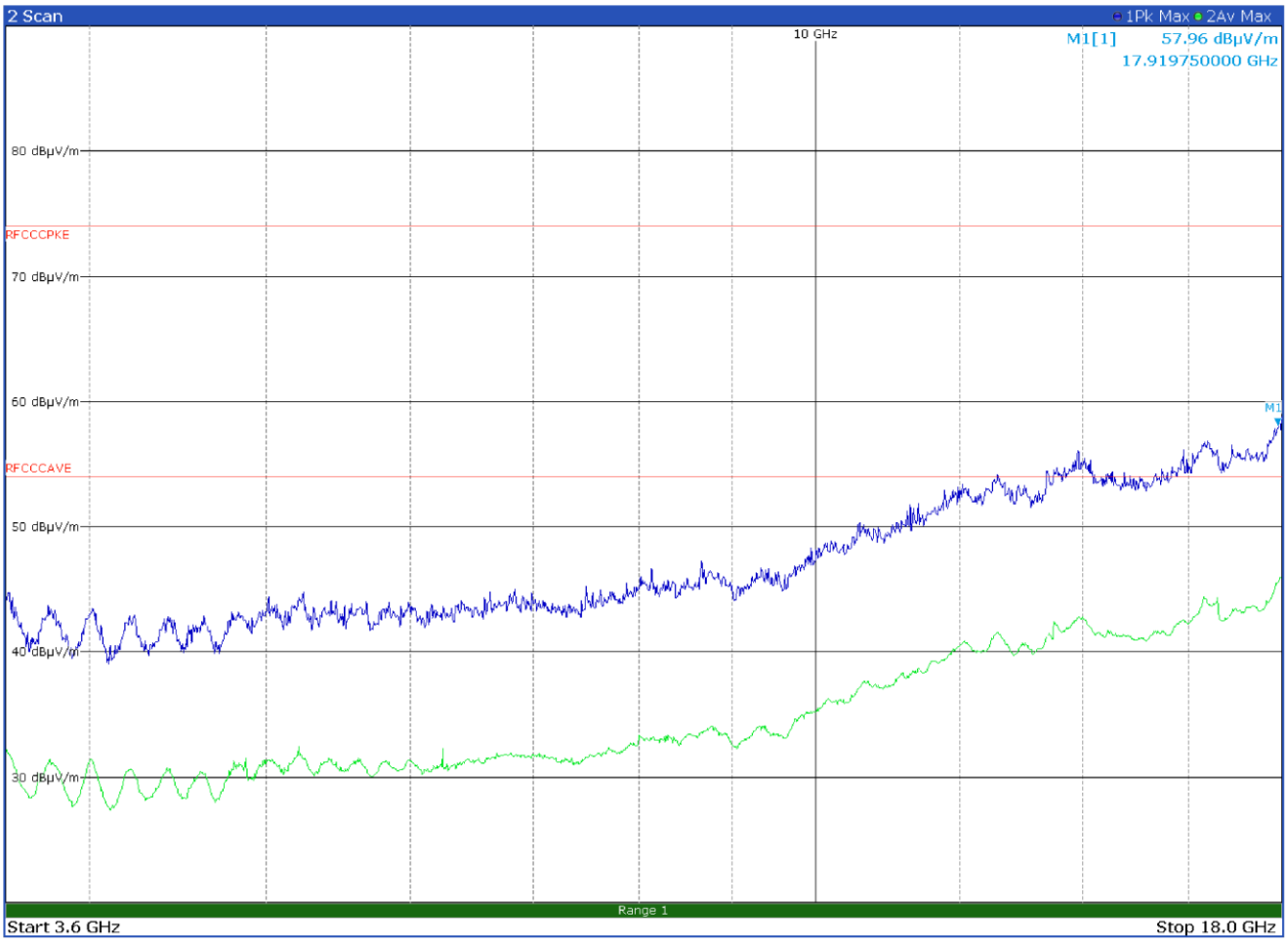
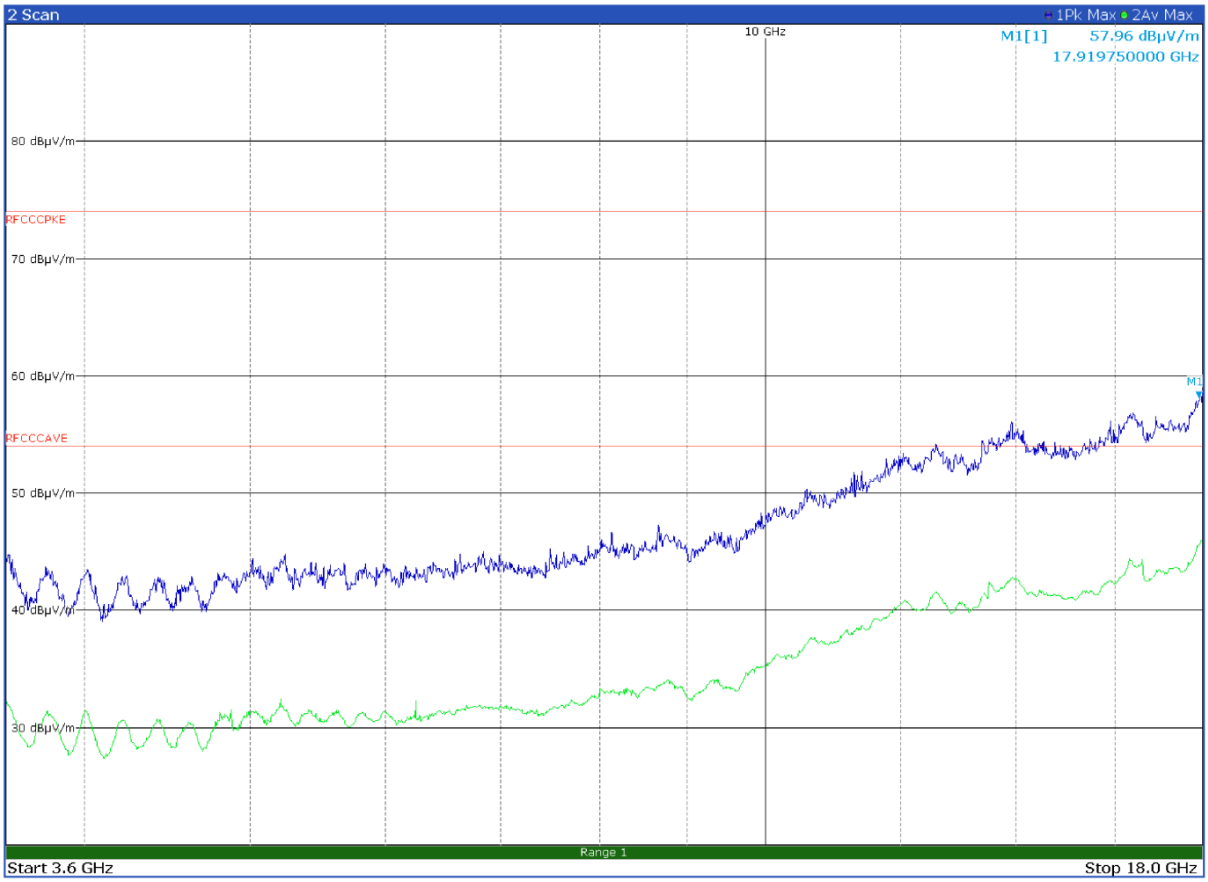
Limit exceeded by carrier



Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
--	--	--	--	Av

The limit for LTE is -13 dBm. Limit (dBµV/m) = limit (dBm) + 95.23 = 82.2 dBµV/m:: limits for restricted band also fulfilled

Figure 8.1-21: Radiated spurious emissions with LTE B12 at mid channel and WIFI at mid channel – antenna in horizontal polarization



Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
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Figure 8.1-22: Radiated spurious emissions with LTE B12 at mid channel and WIFI at mid channel – antenna in vertical polarization

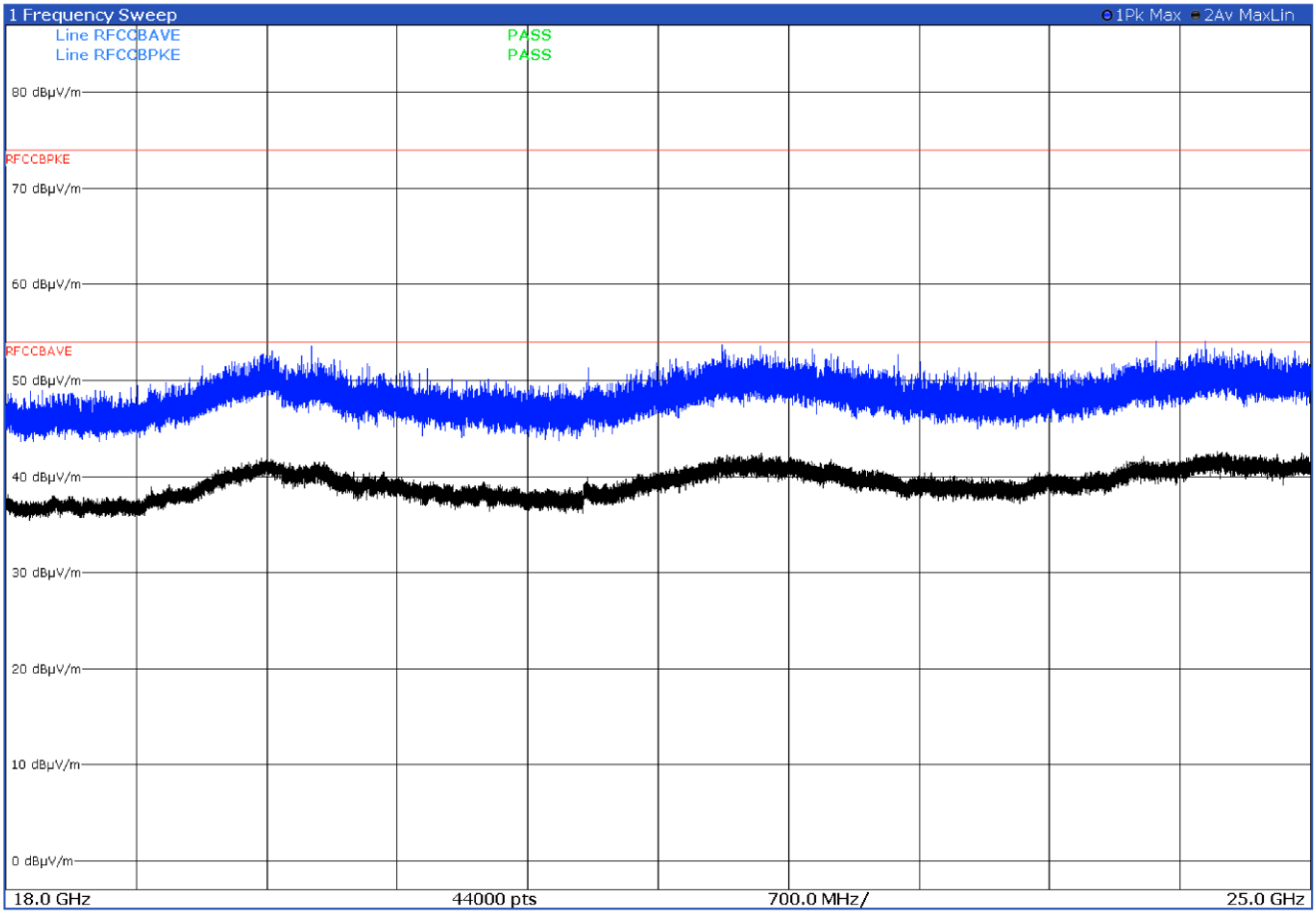


Figure 8.1-23: Radiated spurious emissions with LTE B12 at mid channel and WIFI at mid channel – antenna in vertical polarization

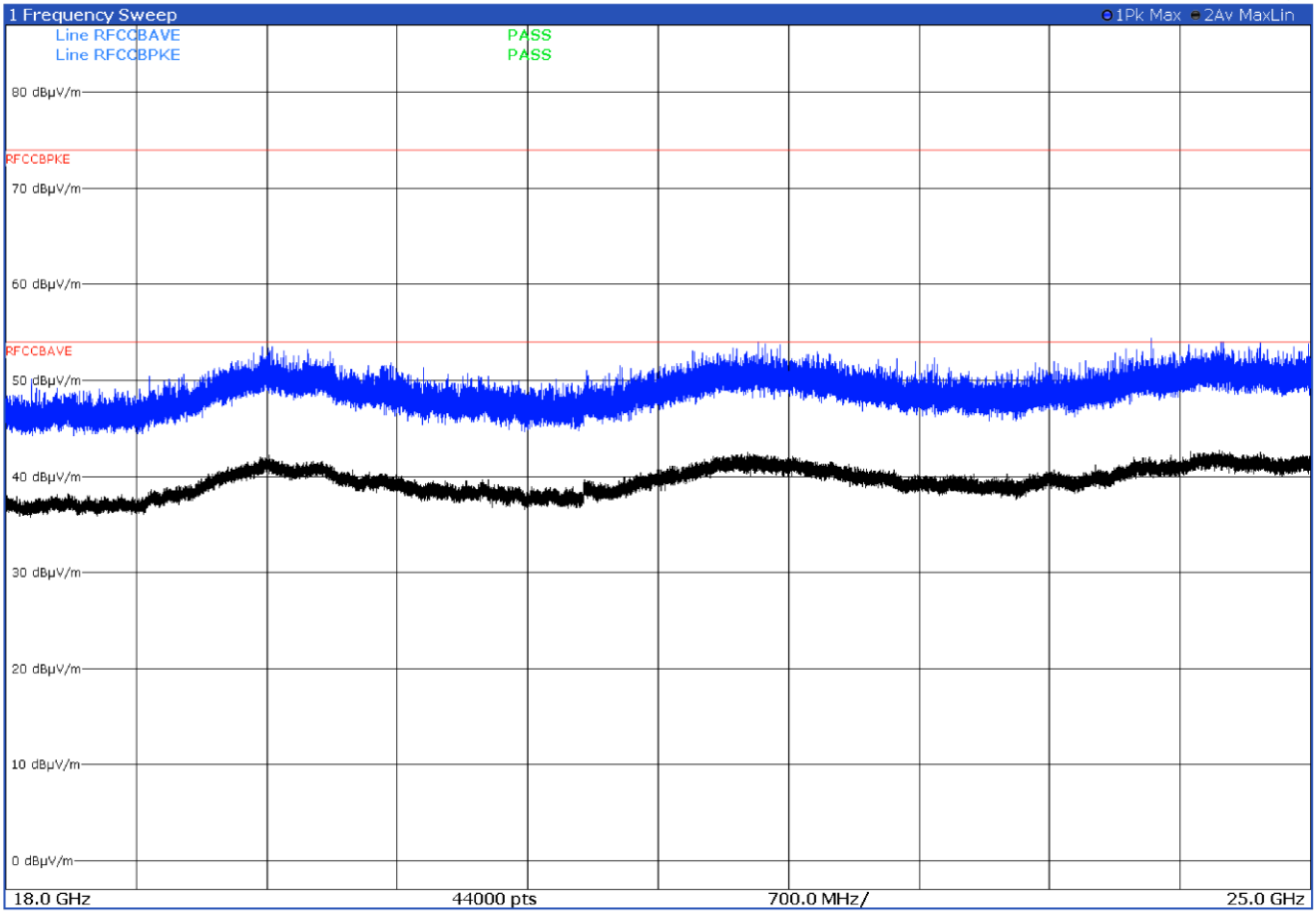
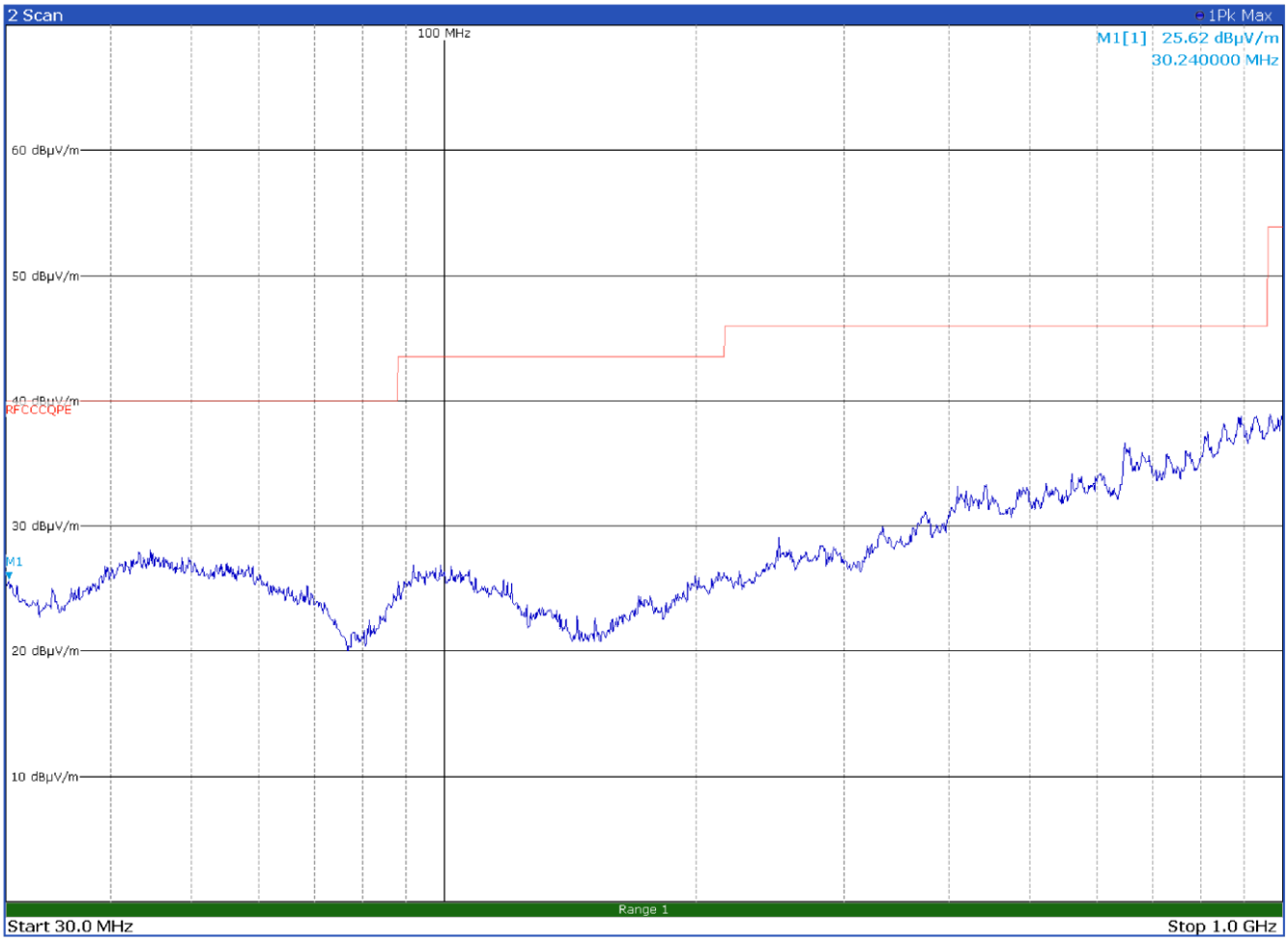


Figure 8.1-24: Radiated spurious emissions with LTE B12 at mid channel and WIFI at mid channel – antenna in horizontal polarization



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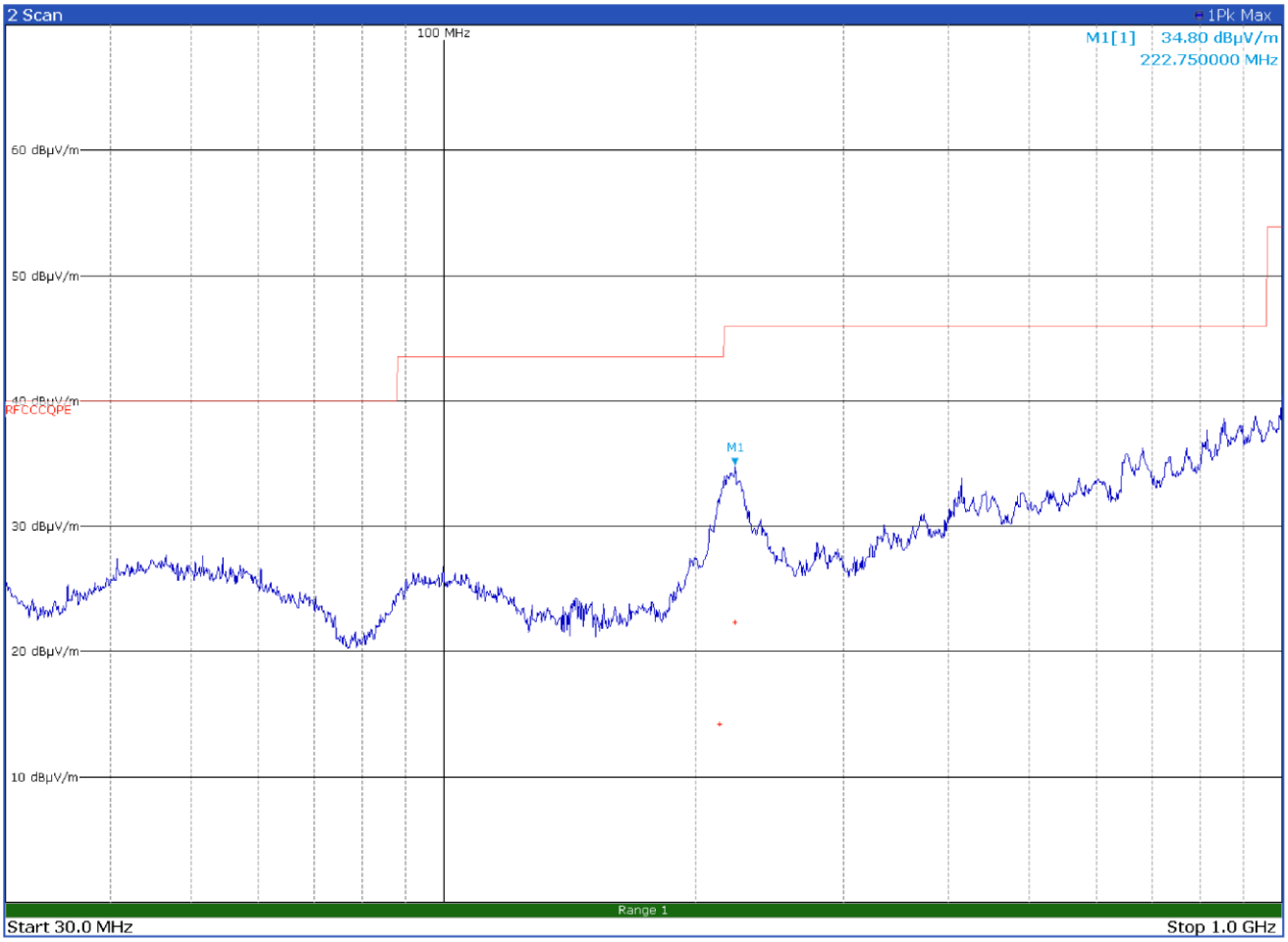
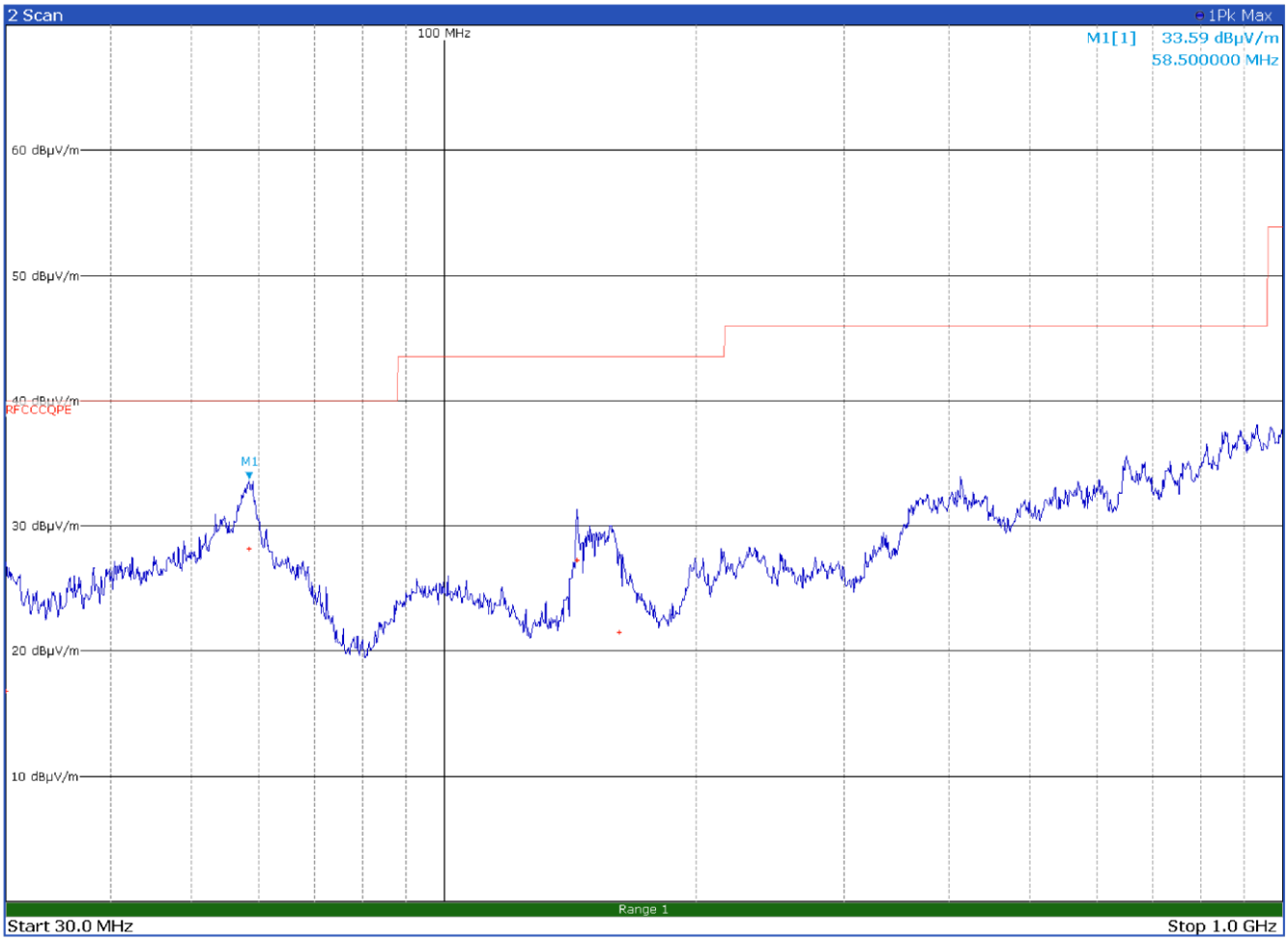
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
113.9600	24.6	43.5	-18.9	QP
125.0400	17.2	43.5	-26.3	QP
159.8400	29.1	43.5	-14.4	QP
161.8800	25.5	43.5	-18.0	QP
202.2000	21.7	43.5	-21.8	QP
234.8800	22.9	46.0	-23.1	QP
263.2400	25.3	46.0	-20.7	QP
286.2400	23.2	46.0	-22.8	QP
343.2000	17.2	46.0	-28.8	QP
387.0000	21.7	46.0	-24.3	QP



Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
213.4500	14.3	43.5	-29.2	QP
222.7500	22.4	46.0	-23.6	QP

Figure 8.1-25: Radiated spurious emissions with WCDMA B2 at mid channel and WIFI at mid channel – antenna in horizontal polarization



Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
30.0000	16.8	40.0	-23.2	QP
58.5000	28.2	40.0	-11.8	QP
143.9700	27.3	43.5	-16.2	QP
161.6700	21.5	43.5	-22.0	QP

Figure 8.1-26: Radiated spurious emissions with WCDMA B2 at mid channel and WIFI at mid channel – antenna in vertical polarization

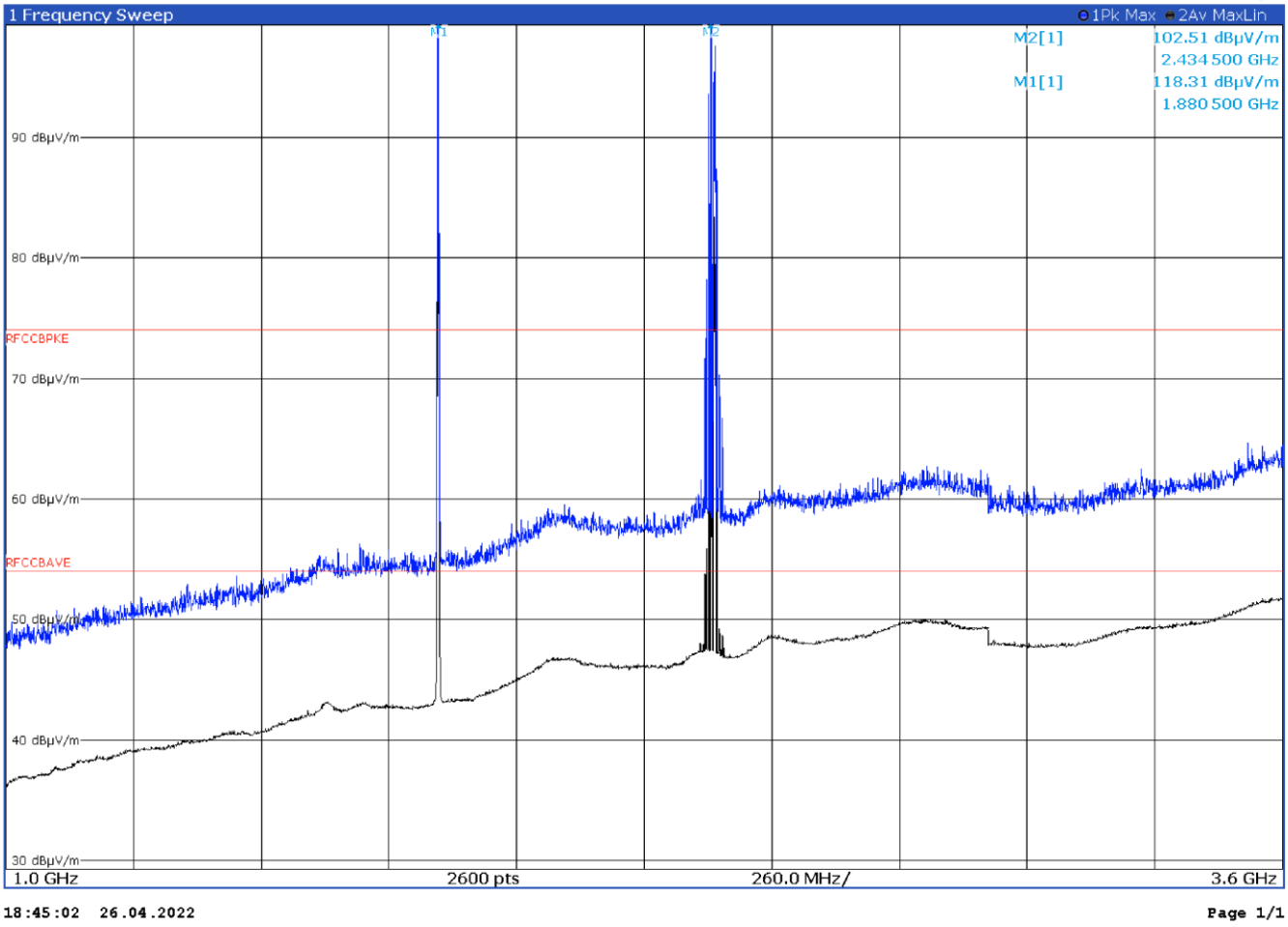


Figure 8.1-27: Radiated spurious emissions with WCDMA B2 at mid channel and WIFI at mid channel – antenna in vertical polarization

Limits exceeded by carrier

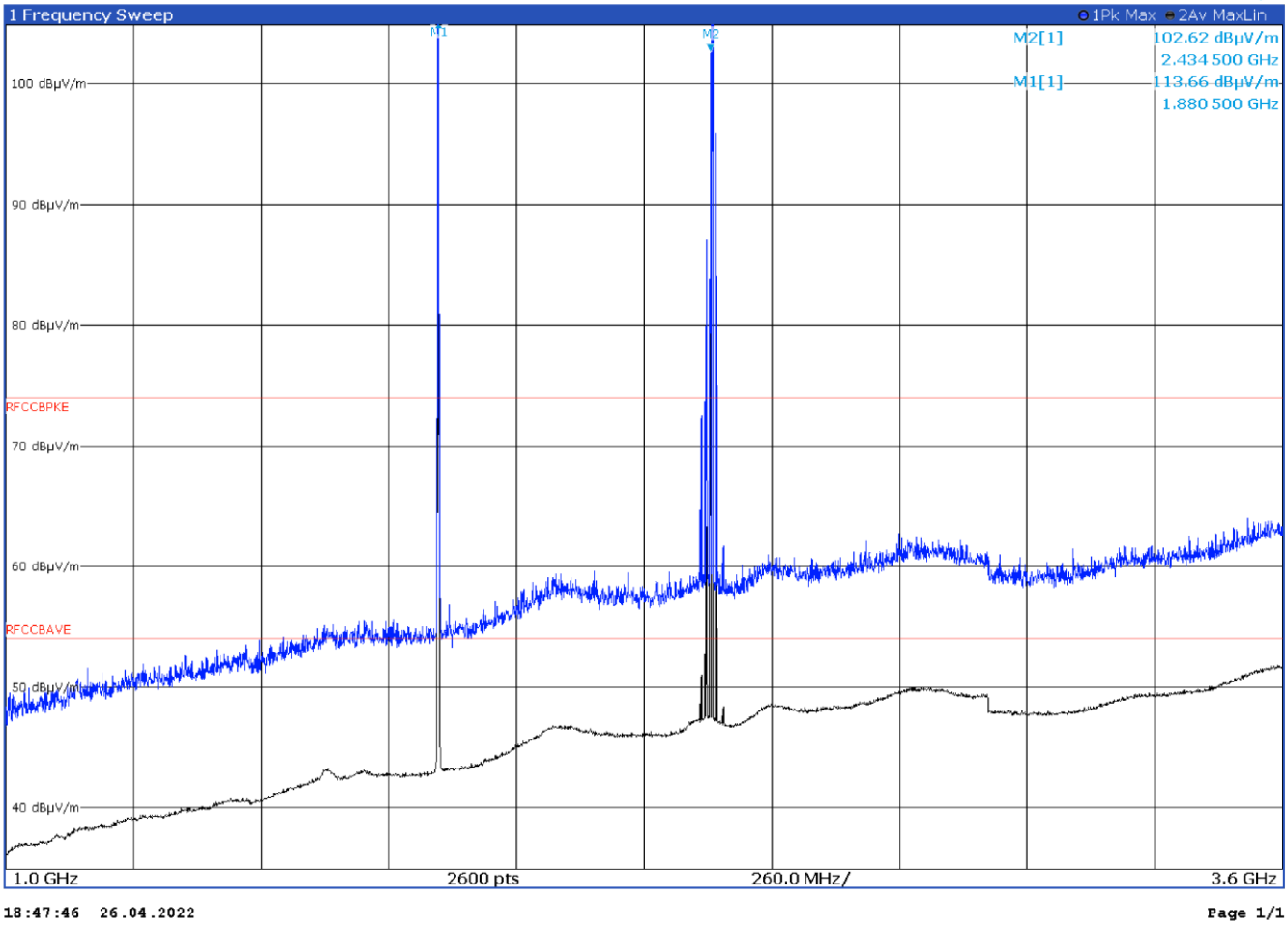
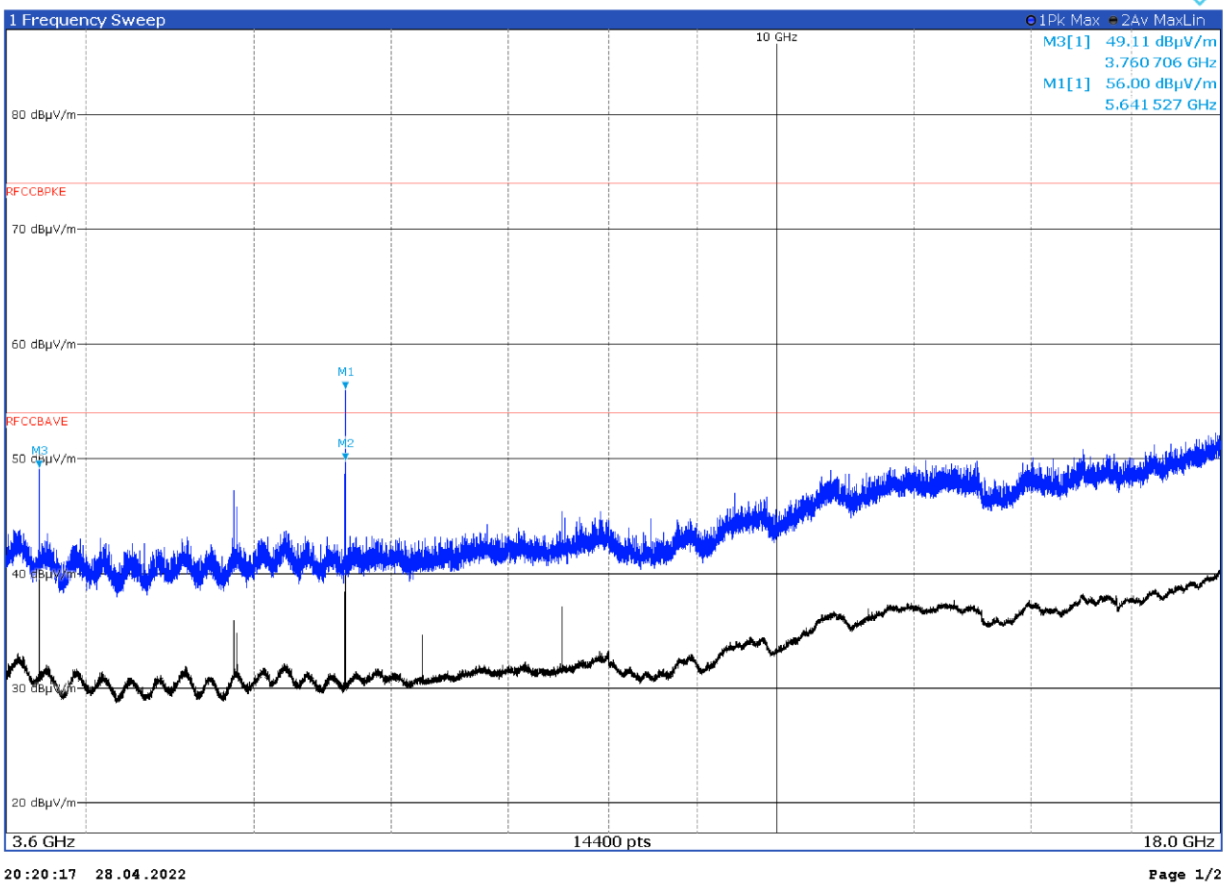


Figure 8.1-28: Radiated spurious emissions with WCDMA B2 at mid channel and WIFI at mid channel – antenna in horizontal polarization

Limits exceeded by carrier

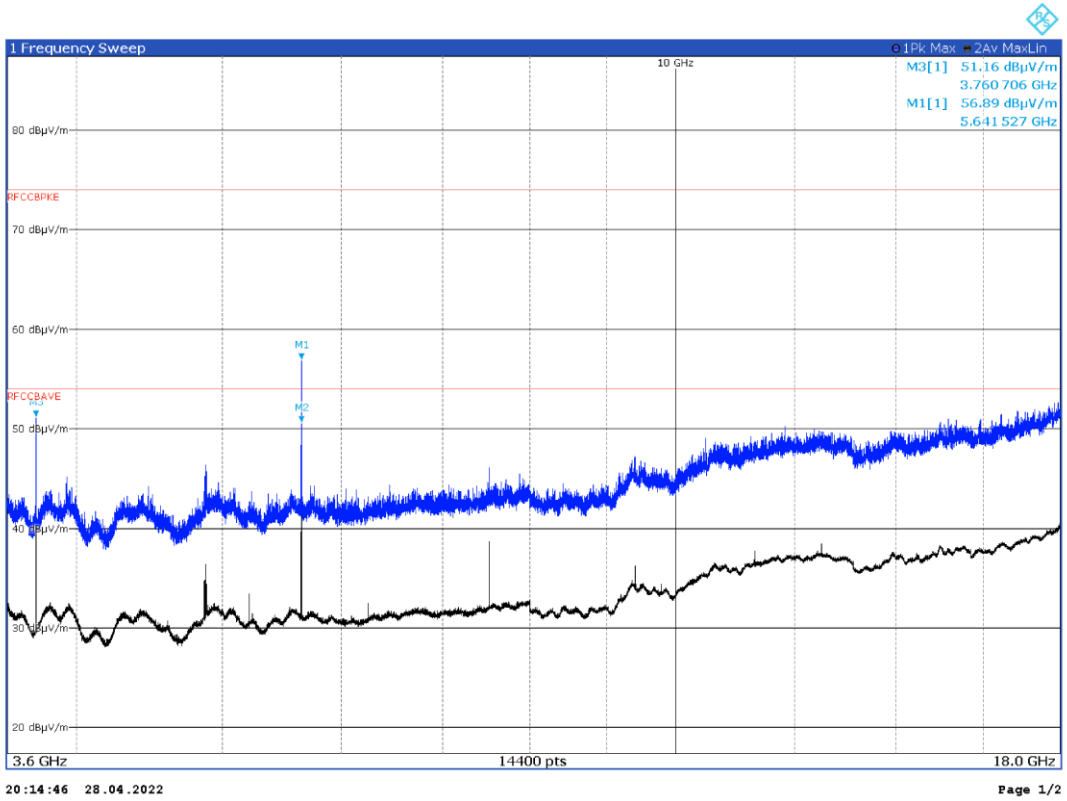


Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
3760.1	49.1	74.0	-18.9	PK
5641.5	56.0	82.2	-18.9	PK

2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**5.641 53 GHz**	**56.00 dBµV/m**		
M2		2	**5.641 GHz**	**49.74 dBµV/m**		
M3		1	**3.760 71 GHz**	**49.11 dBµV/m**		

Figure 8.1-29: Radiated spurious emissions with WCDMA B2 at mid channel and WIFI at mid channel – antenna in horizontal polarization



Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
3760.1	51.3	74.0	-18.9	PK
5641.5	56.8	82.2	-18.9	PK

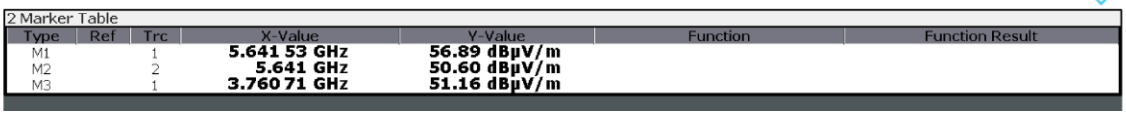


Figure 8.1-30: Radiated spurious emissions with WCDMA B2 at mid channel and WIFI at mid channel – antenna in vertical polarization

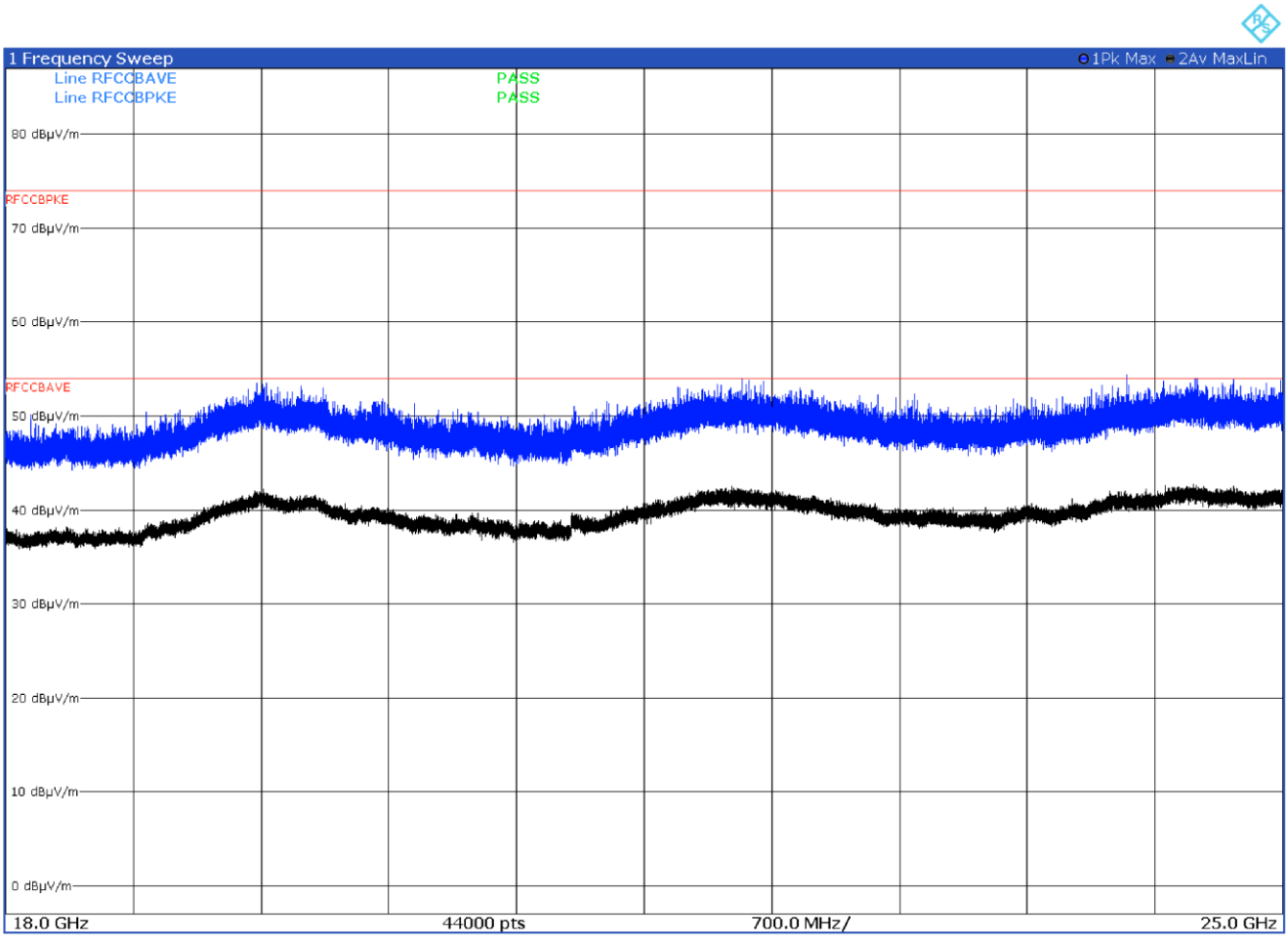


Figure 8.1-31: Radiated spurious emissions with WCDMA B2 at mid channel and WIFI at mid channel – antenna in vertical polarization

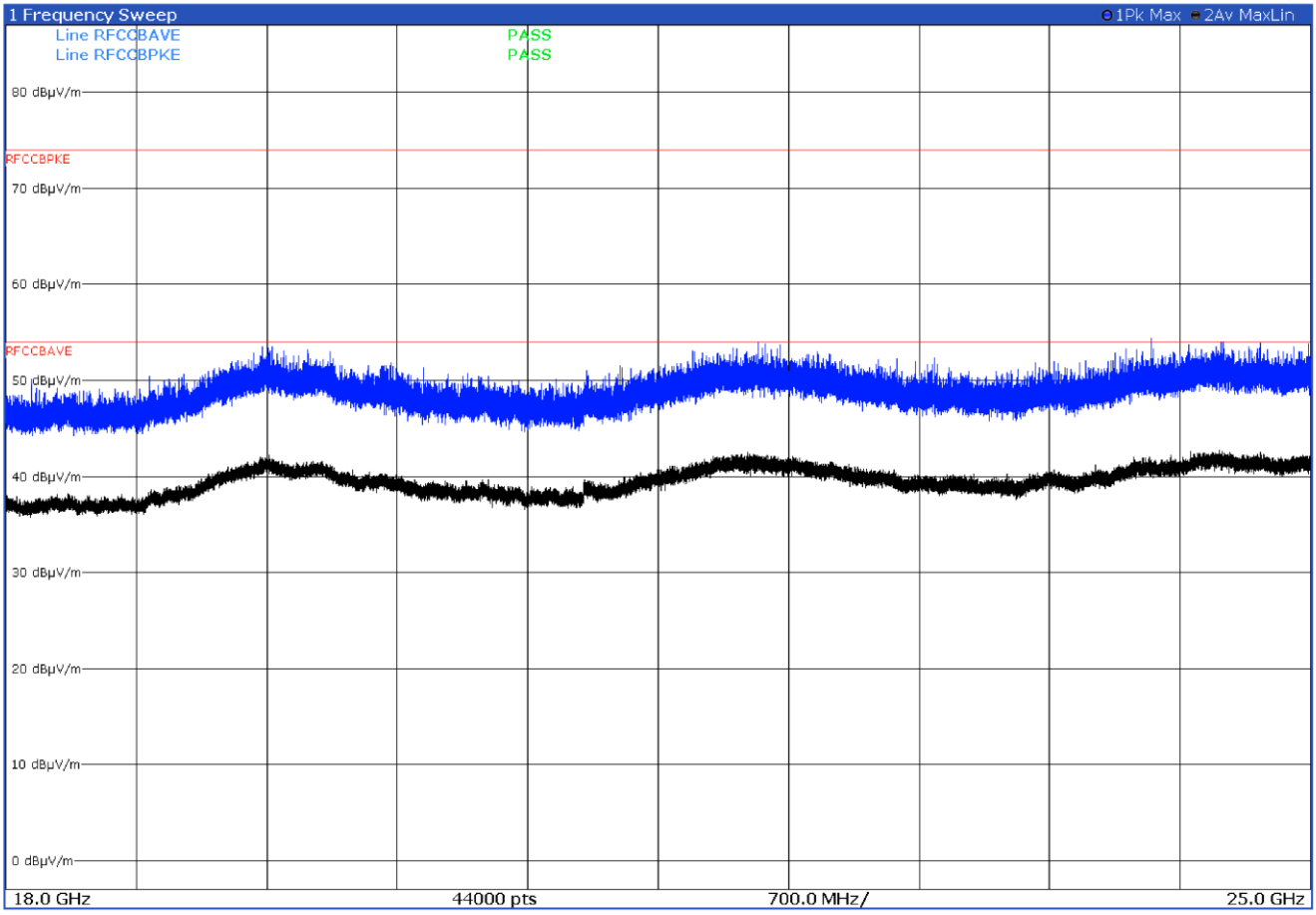
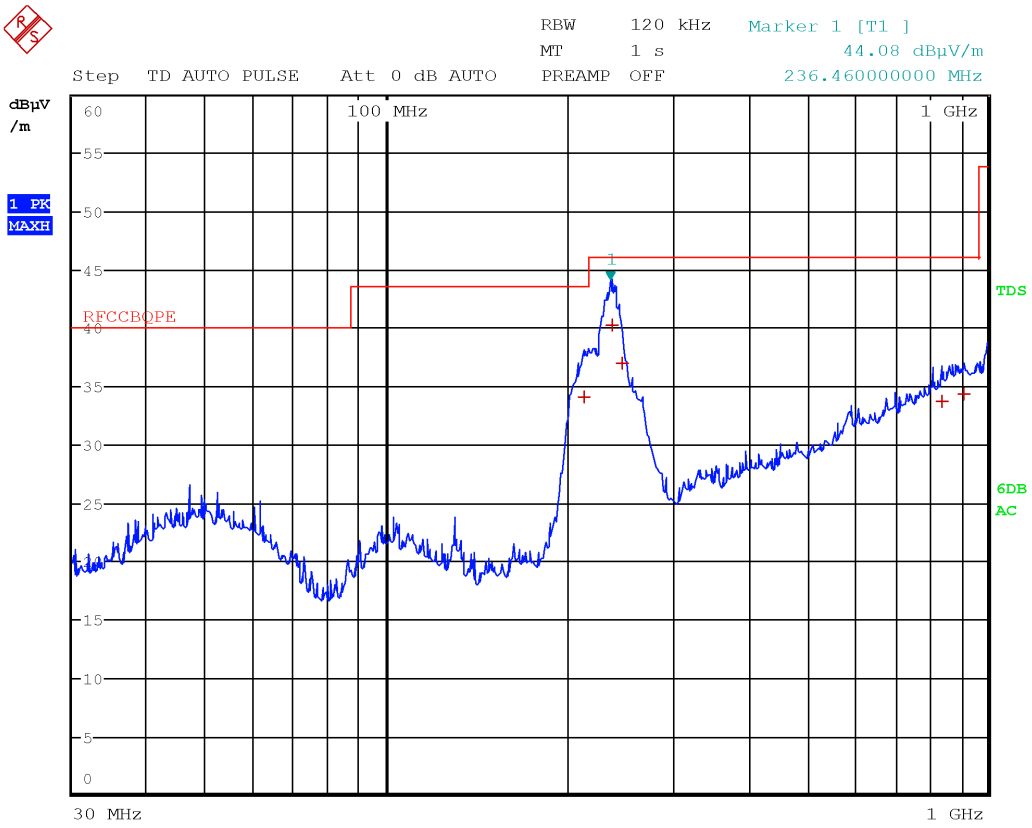


Figure 8.1-32: Radiated spurious emissions with WCDMA B2 at mid channel and WIFI at mid channel – antenna in horizontal polarization



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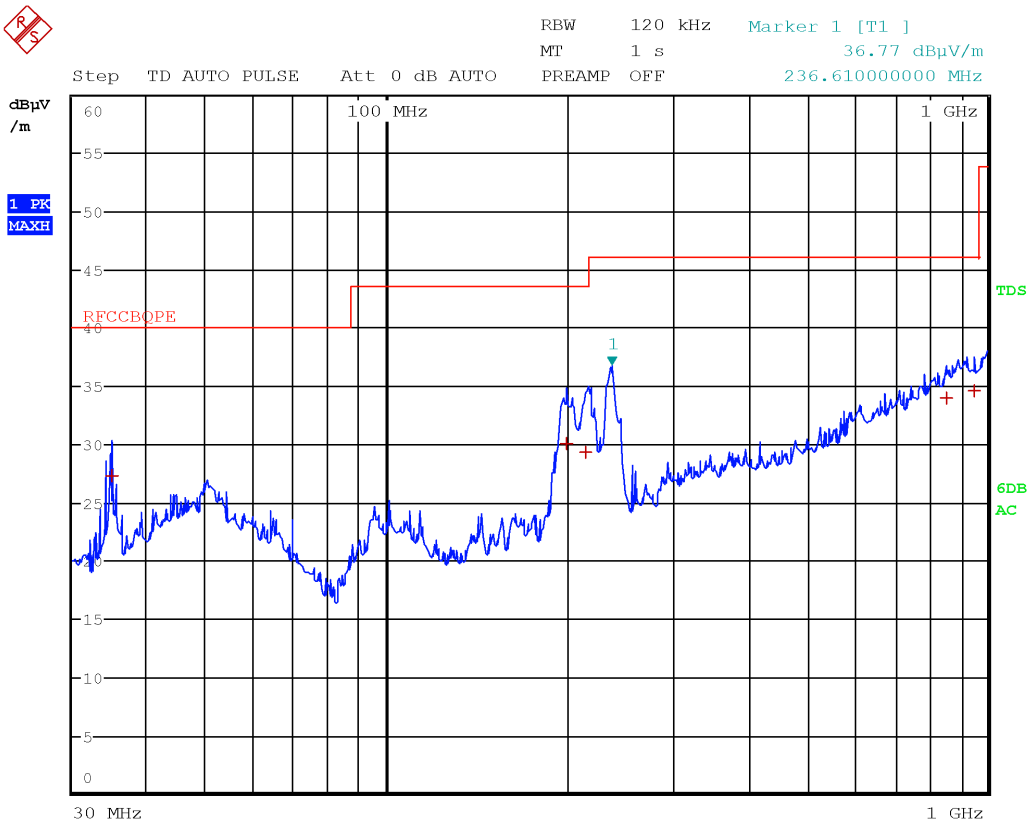
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
237.1200	40.3	46.0	-5.7	QP
246.3900	37.1	46.0	-8.9	QP
213.6300	34.2	43.5	-9.3	QP
913.5600	34.3	46.0	-11.7	QP

Figure 8.1-33: Radiated spurious emissions with WCDMA B4 at mid channel and WIFI at mid channel – antenna in horizontal polarization



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Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
34.8000	27.3	40.0	-12.7	QP
198.8100	30.1	43.5	-13.4	QP
214.5300	29.4	43.5	-14.1	QP
853.2900	34.1	46.0	-11.9	QP
951.5100	34.7	46.0	-11.3	QP

Figure 8.1-34: Radiated spurious emissions with WCDMA B4 at mid channel and WIFI at mid channel – antenna in vertical polarization

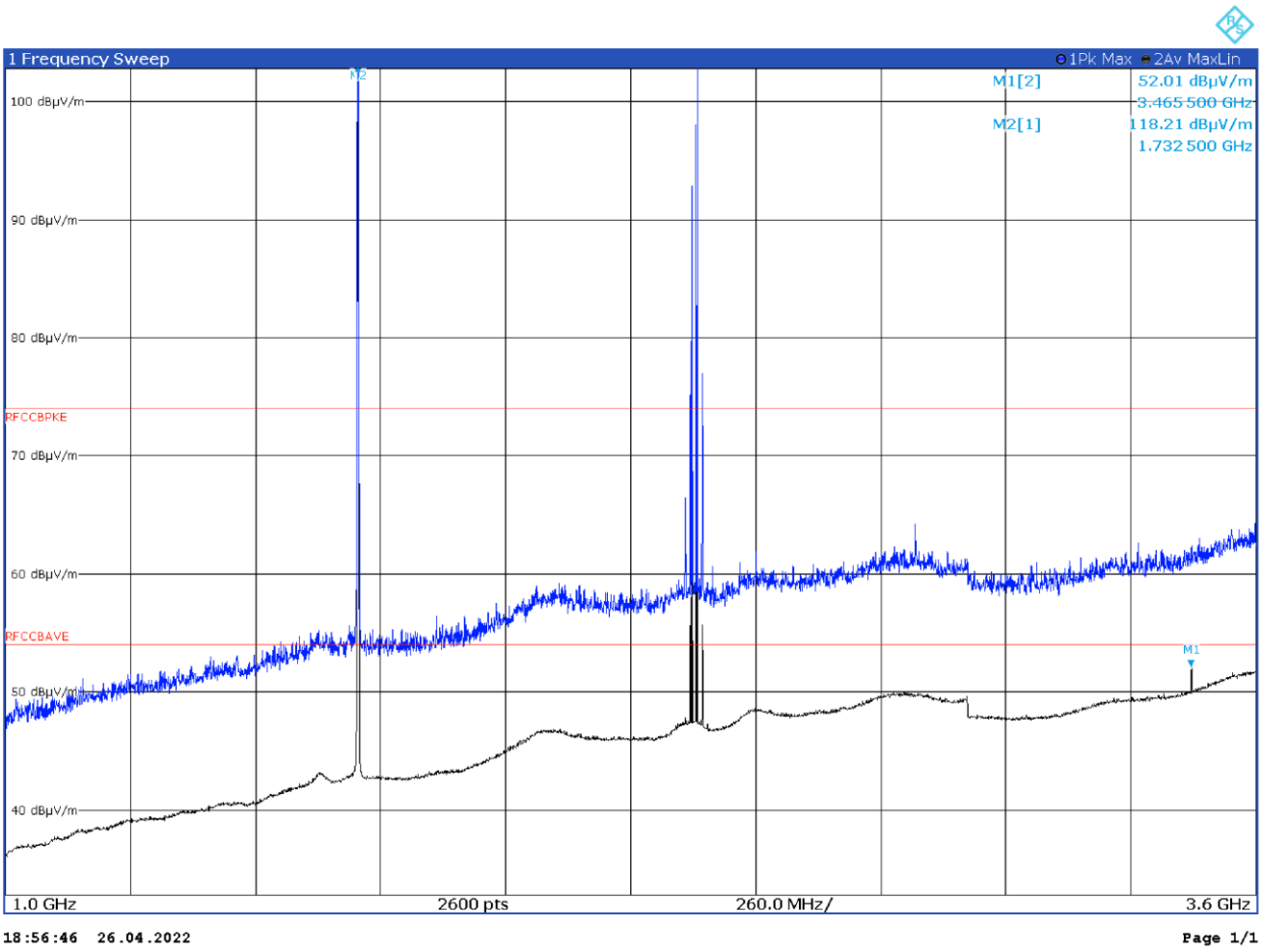


Figure 8.1-35: Radiated spurious emissions with WCDMA B4 at mid channel and WIFI at mid channel – antenna in vertical polarization

Limit exceeded by carrier

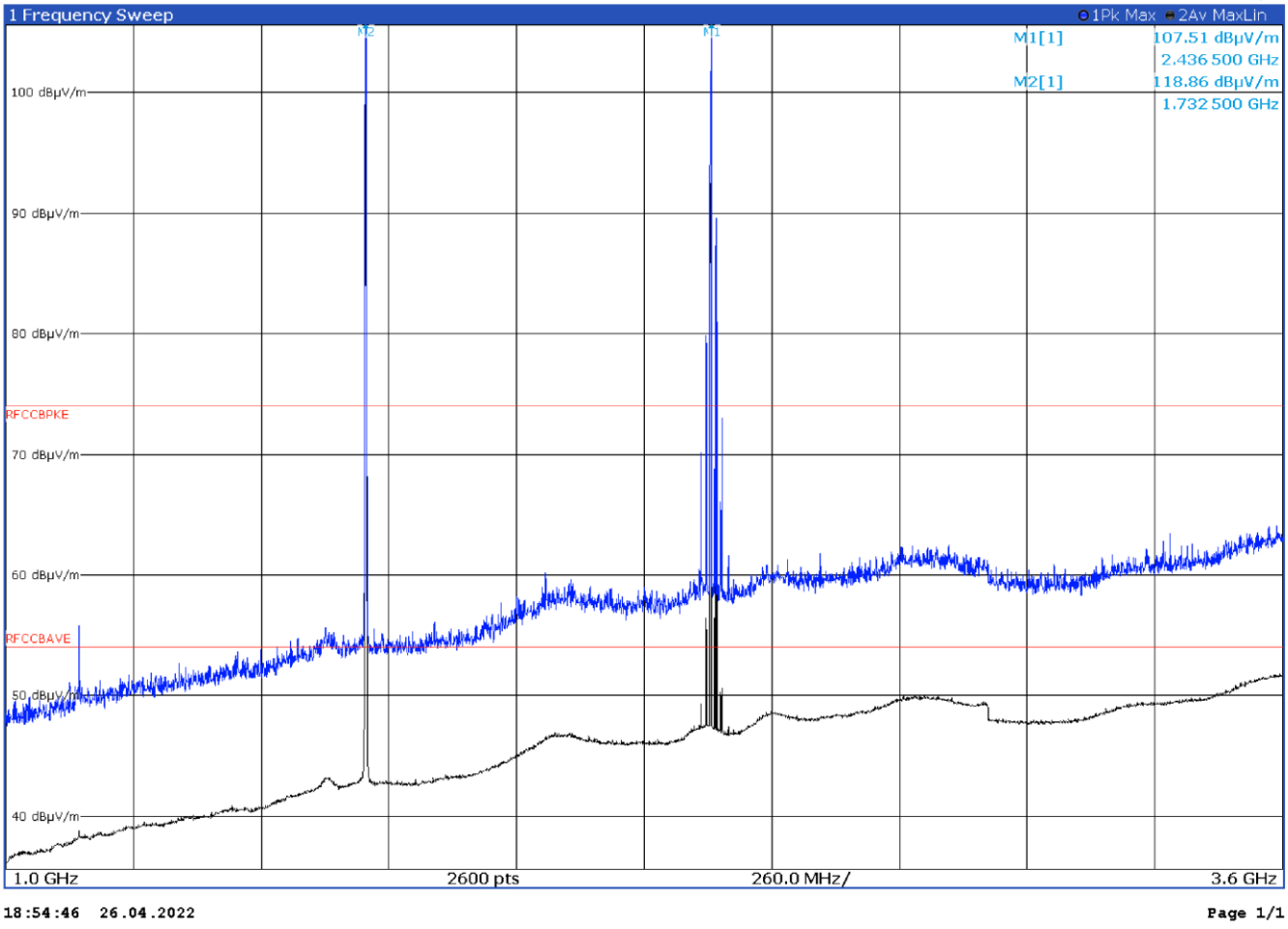


Figure 8.1-36: Radiated spurious emissions with WCDMA B4 at mid channel and WIFI at mid channel – antenna in horizontal polarization

Limit exceeded by carrier

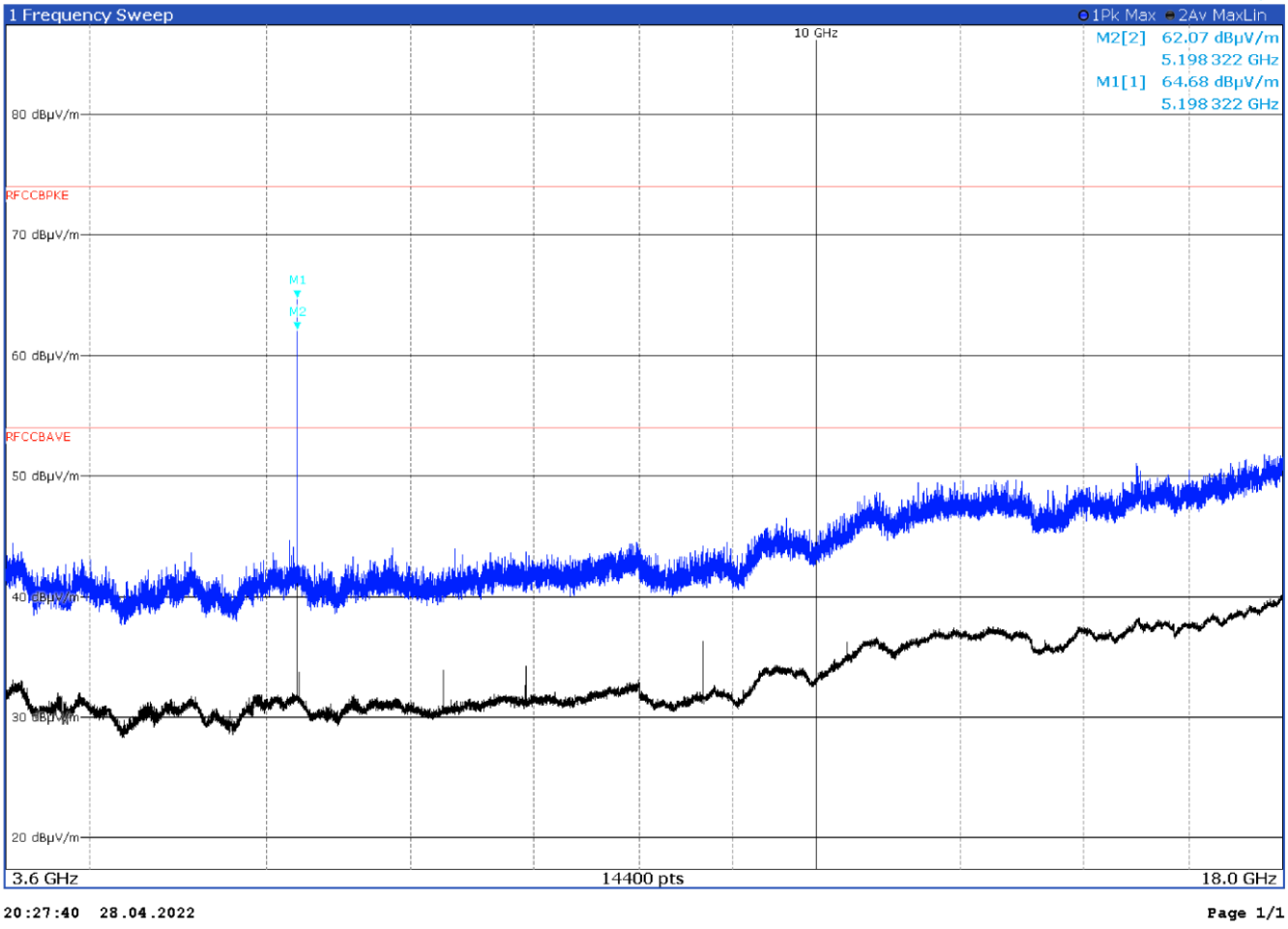
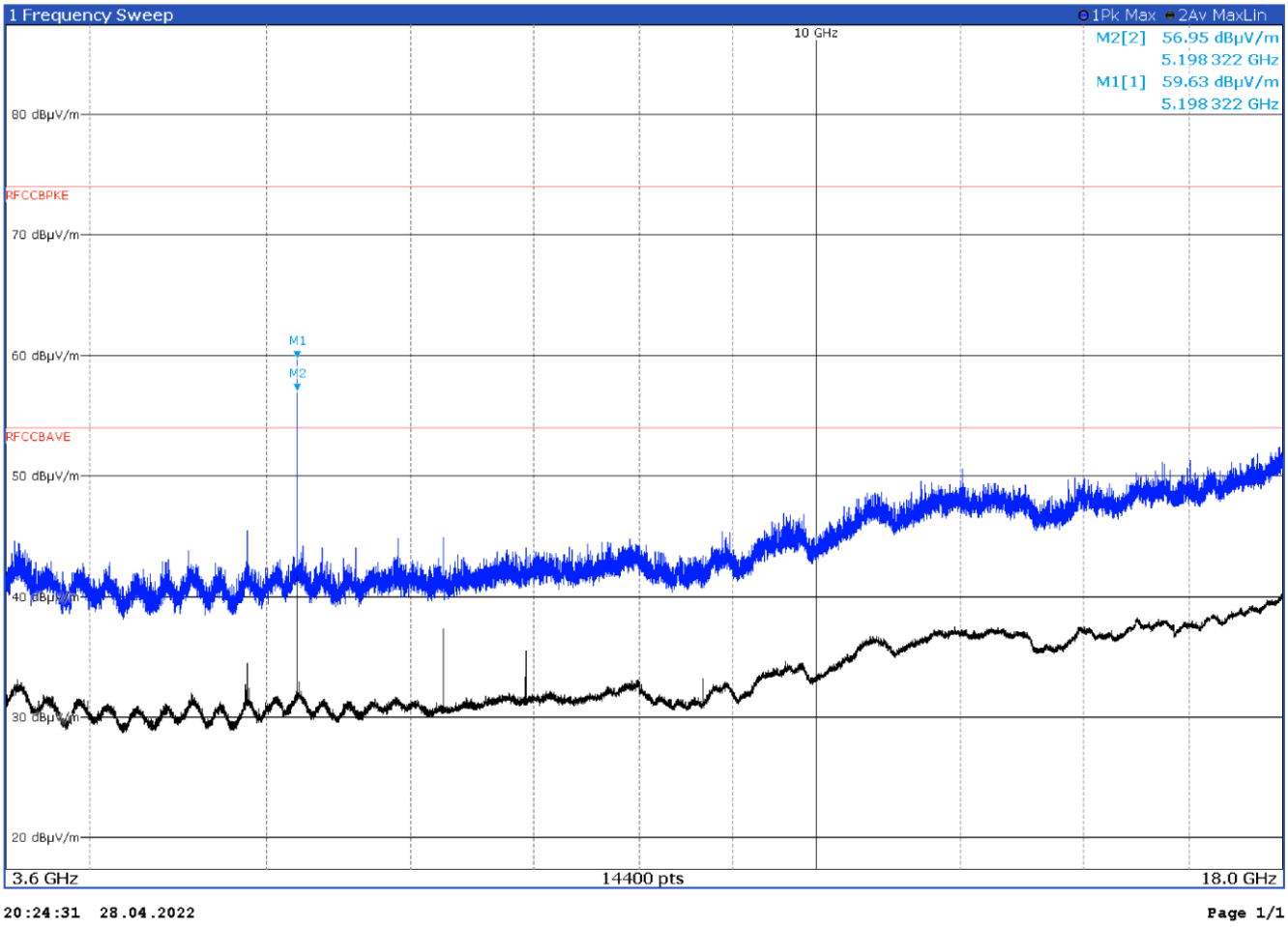


Figure 8.1-37: Radiated spurious emissions with WCDMA B4 at mid channel and WIFI at mid channel – antenna in vertical polarization

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
5198	64.7	82.2	-18.9	PK



Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
5198	59.6	82.2	-18.9	PK

Figure 8.1-38: Radiated spurious emissions with WCDMA B4 at mid channel and WIFI at mid channel – antenna in horizontal polarization

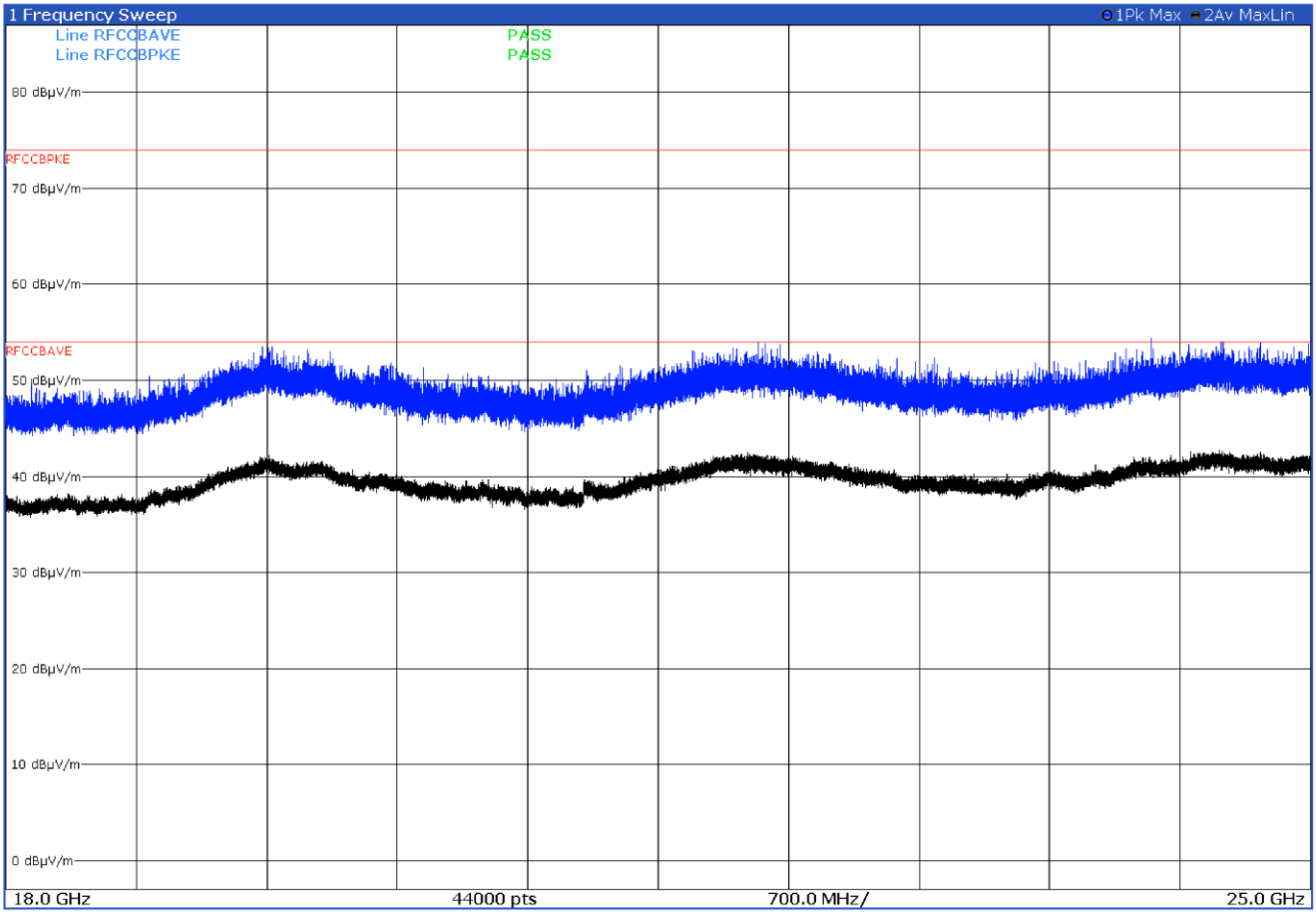


Figure 8.1-39: Radiated spurious emissions with WCDMA B4 at mid channel and WIFI at mid channel – antenna in vertical polarization

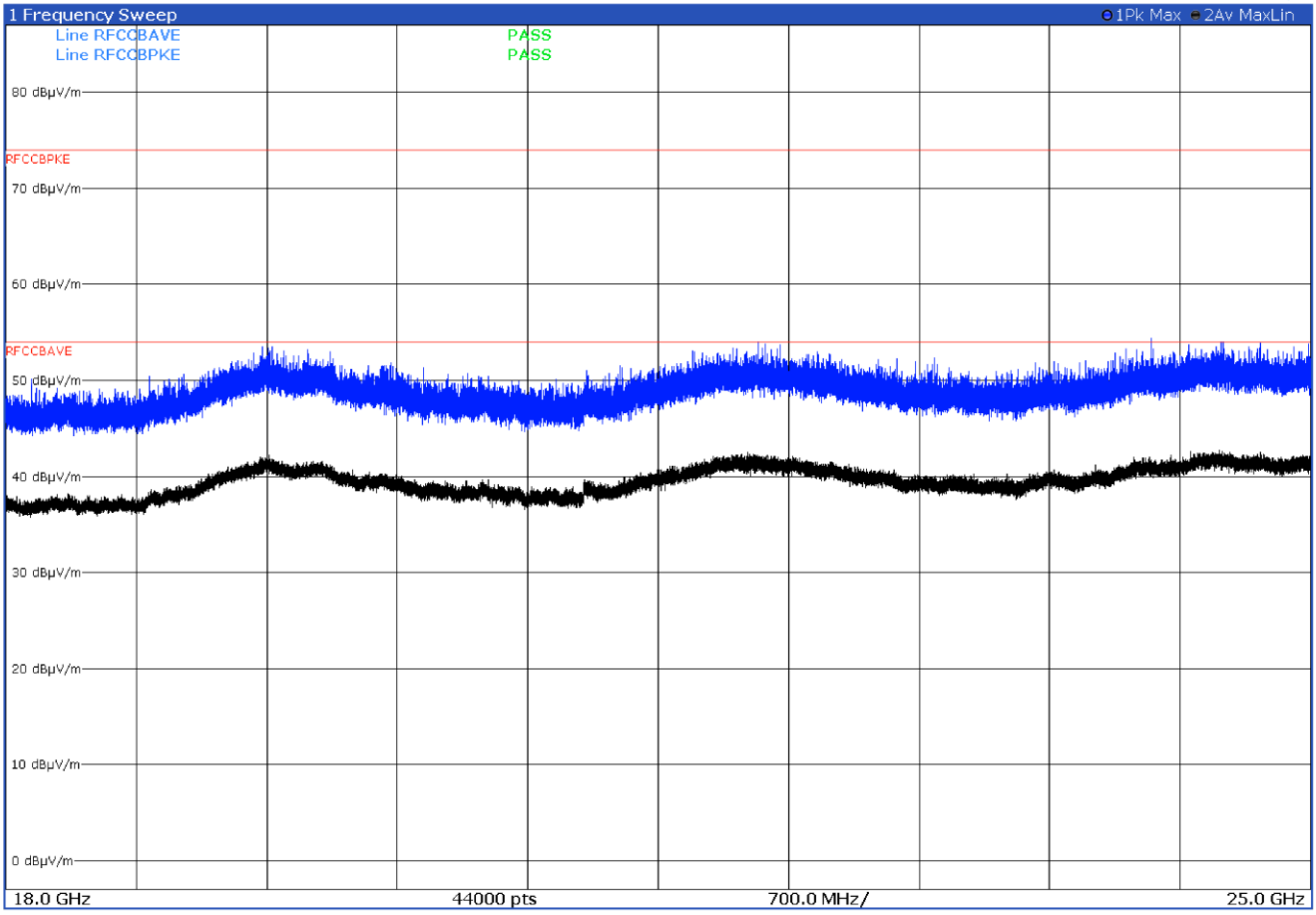
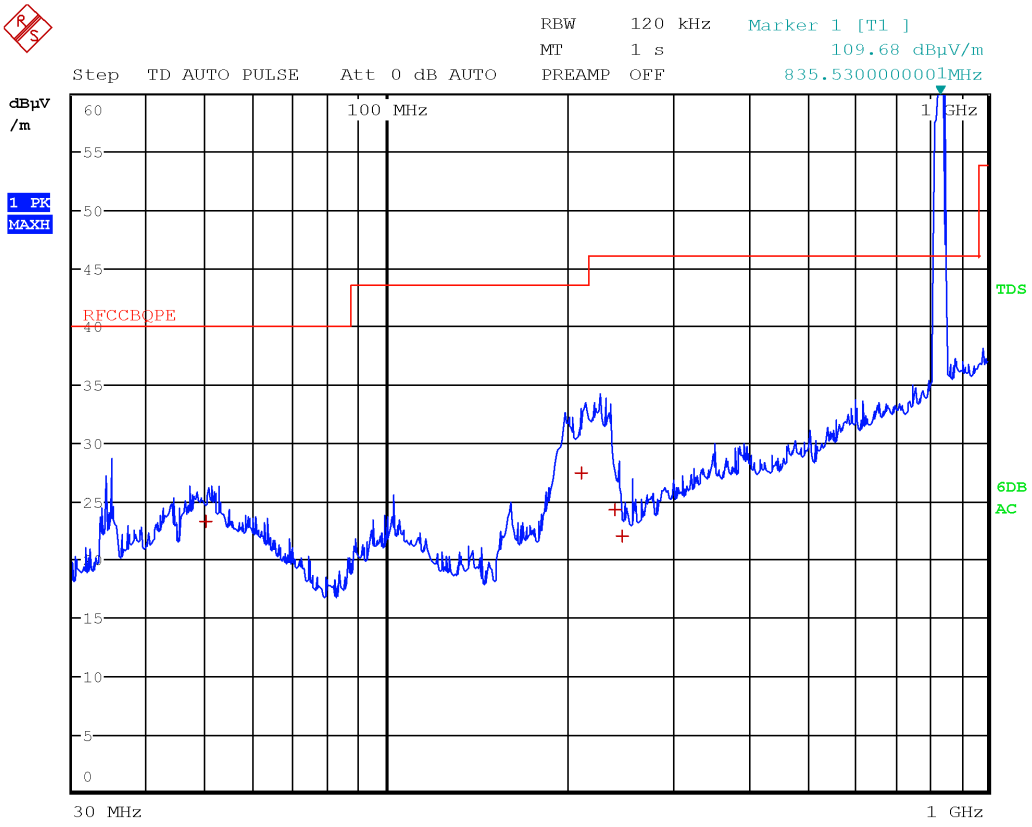


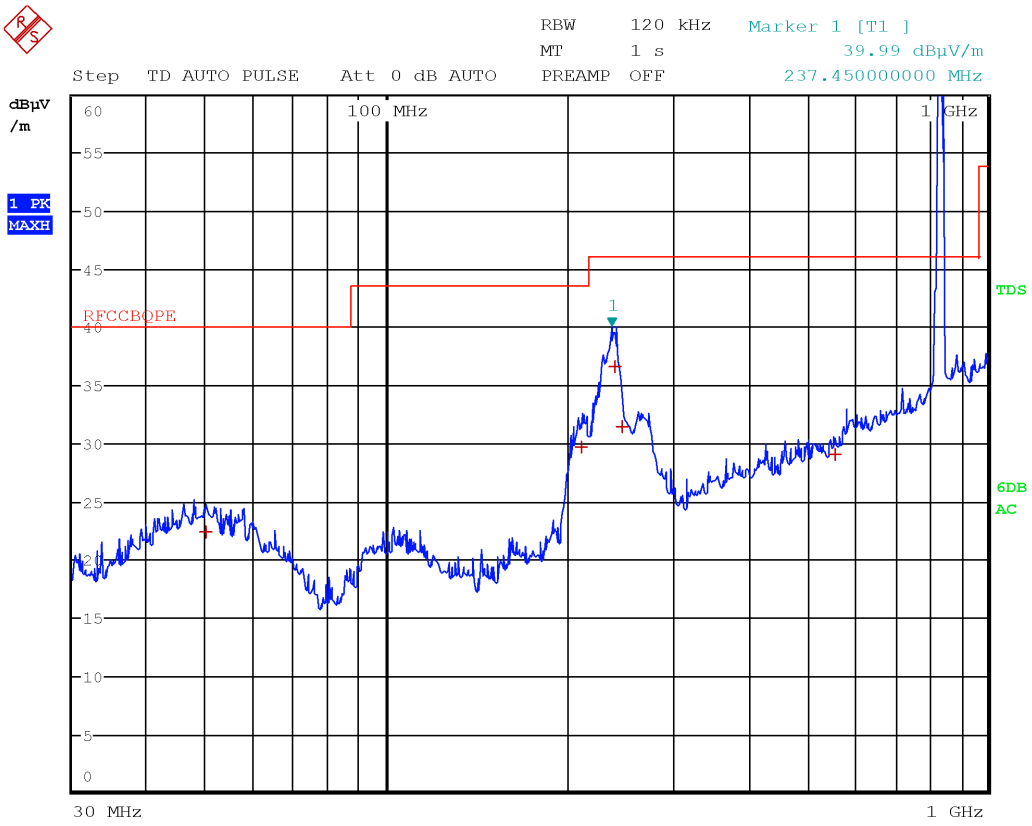
Figure 8.1-40: Radiated spurious emissions with WCDMA B4 at mid channel and WIFI at mid channel – antenna in horizontal polarization



Date: 29.APR.2022 18:54:05

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
50.0400	23.3	40.0	-16.7	QP
211.0200	27.4	43.5	-16.1	QP
239.5200	24.3	46.0	-21.7	QP
246.5400	22.1	46.0	-23.9	QP
50.0400	23.3	40.0	-16.7	QP
211.0200	27.4	43.5	-16.1	QP
239.5200	24.3	46.0	-21.7	QP
246.5400	22.1	46.0	-23.9	QP

Figure 8.1-40: Radiated spurious emissions with WCDMA B5 at mid channel and WIFI at mid channel – antenna in vertical polarization



Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
50.0400	22.5	40.0	-17.5	QP
211.0200	29.7	43.5	-13.8	QP
239.5200	36.7	46.0	-9.3	QP
246.5400	31.5	46.0	-14.5	QP
559.9200	29.2	46.0	-16.8	QP

Figure 8.1-41: Radiated spurious emissions with WCDMA B5 at mid channel and WIFI at mid channel – antenna in horizontal polarization

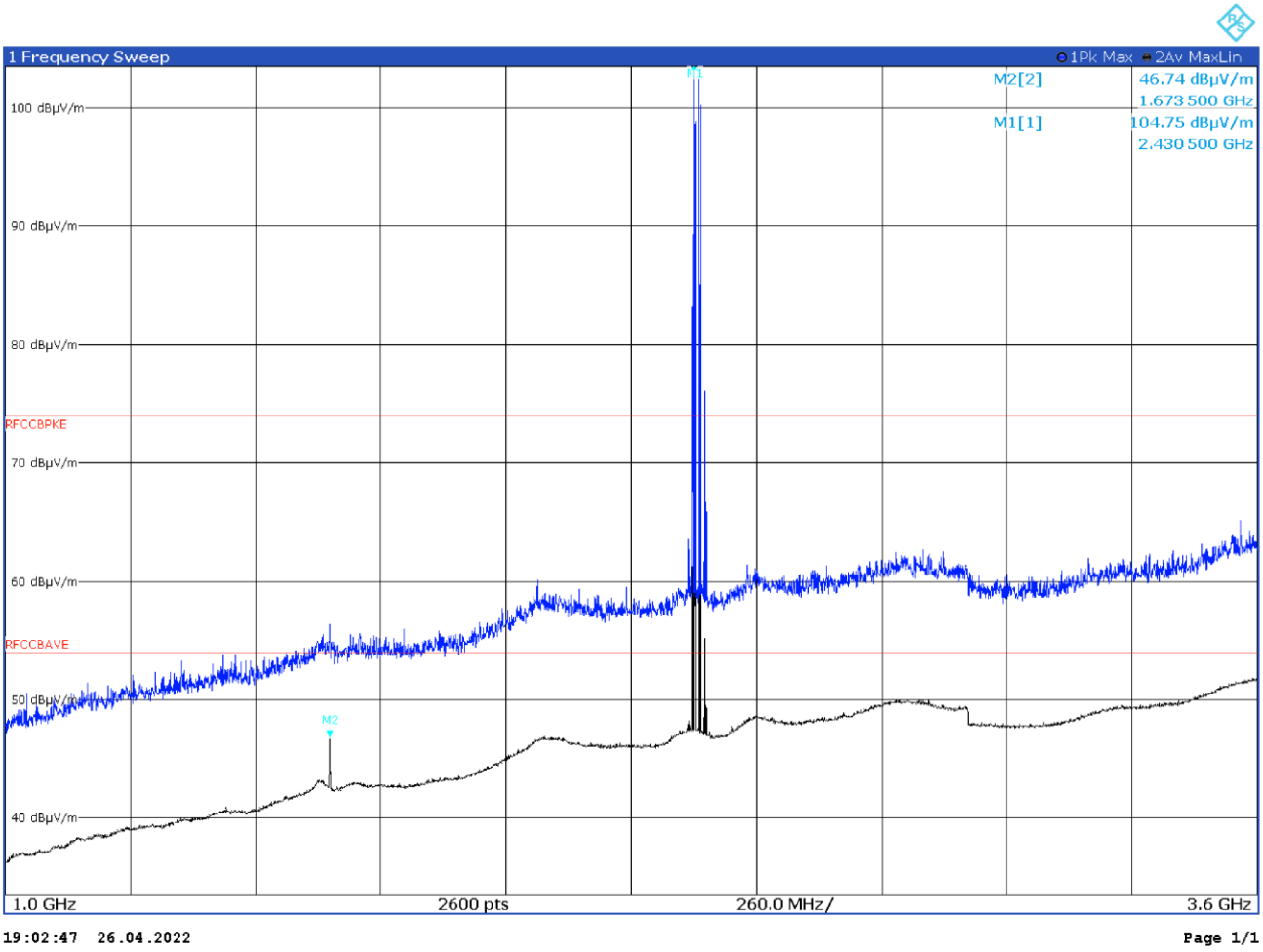


Figure 8.1-42: Radiated spurious emissions with WCDMA B5 at mid channel and WIFI at mid channel – antenna in vertical polarization

Limit exceeded by carrier

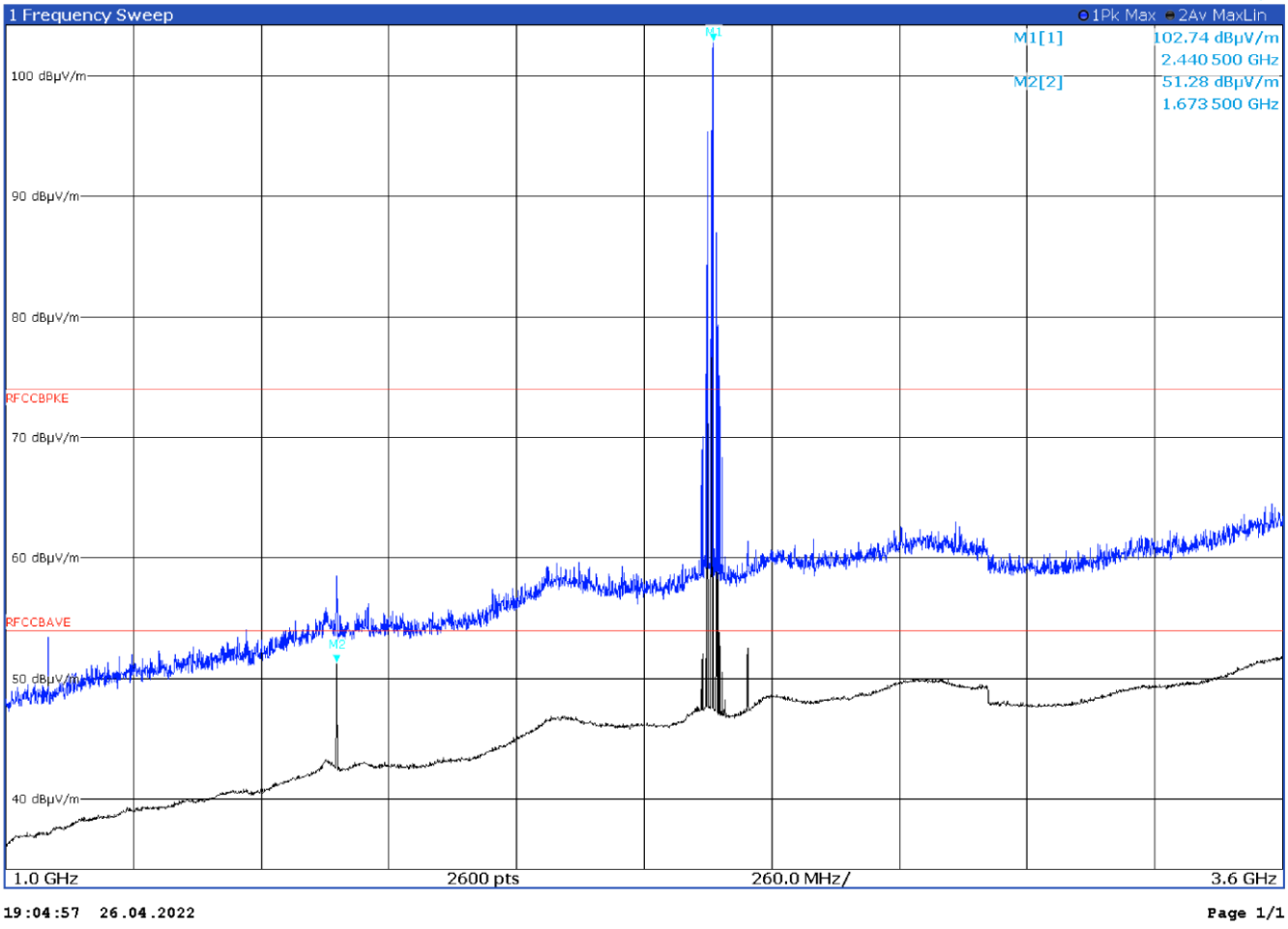


Figure 8.1-43: Radiated spurious emissions with WCDMA B5 at mid channel and WIFI at mid channel – antenna in horizontal polarization

Limit exceeded by carrier

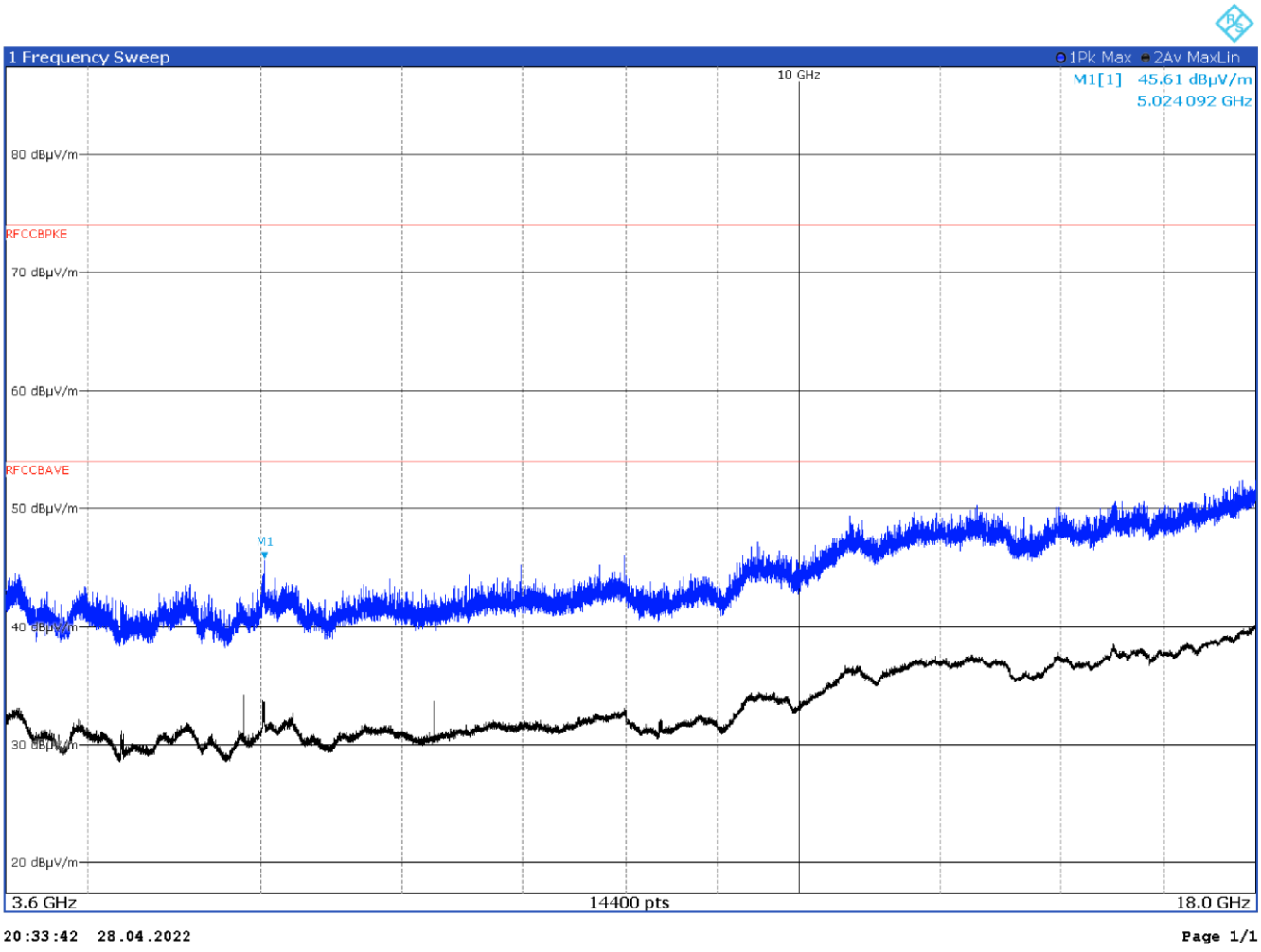


Figure 8.1-44: Radiated spurious emissions with WCDMA B5 at mid channel and WIFI at mid channel – antenna in vertical polarization

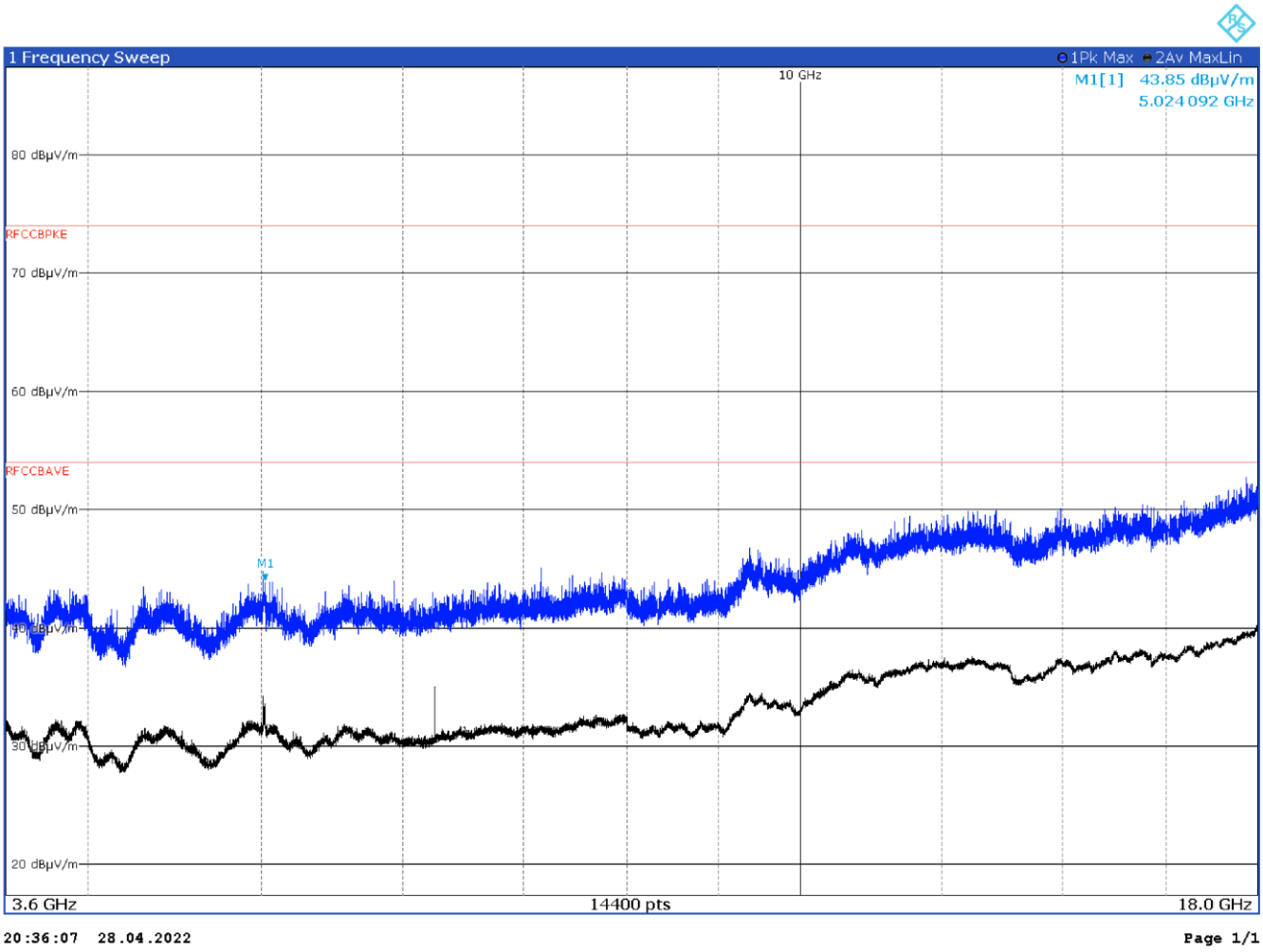


Figure 8.1-45: Radiated spurious emissions with WCDMA B5 at mid channel and WIFI at mid channel – antenna in horizontal polarization

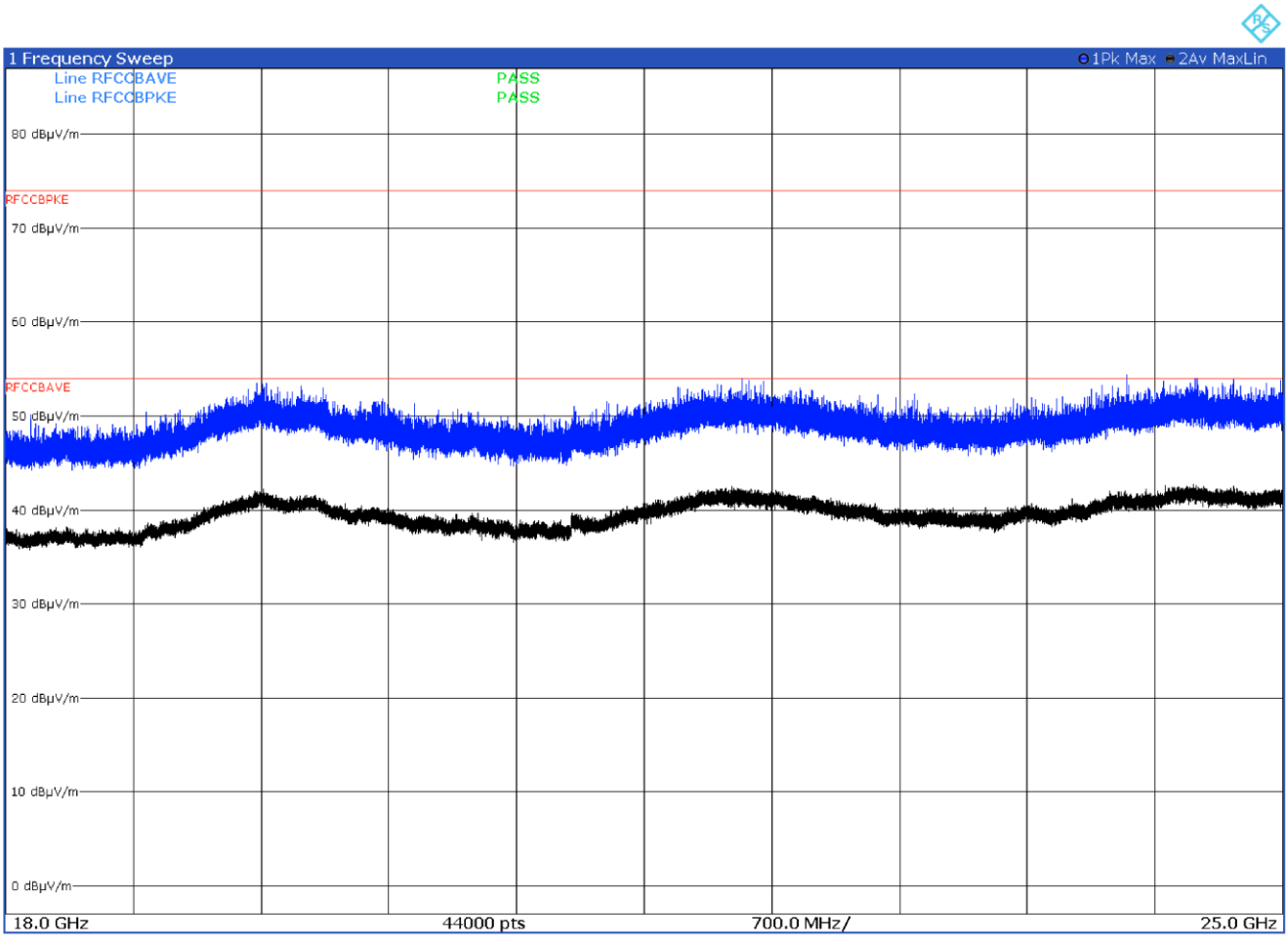


Figure 8.1-46: Radiated spurious emissions with WCDMA B5 at mid channel and WIFI at mid channel – antenna in vertical polarization

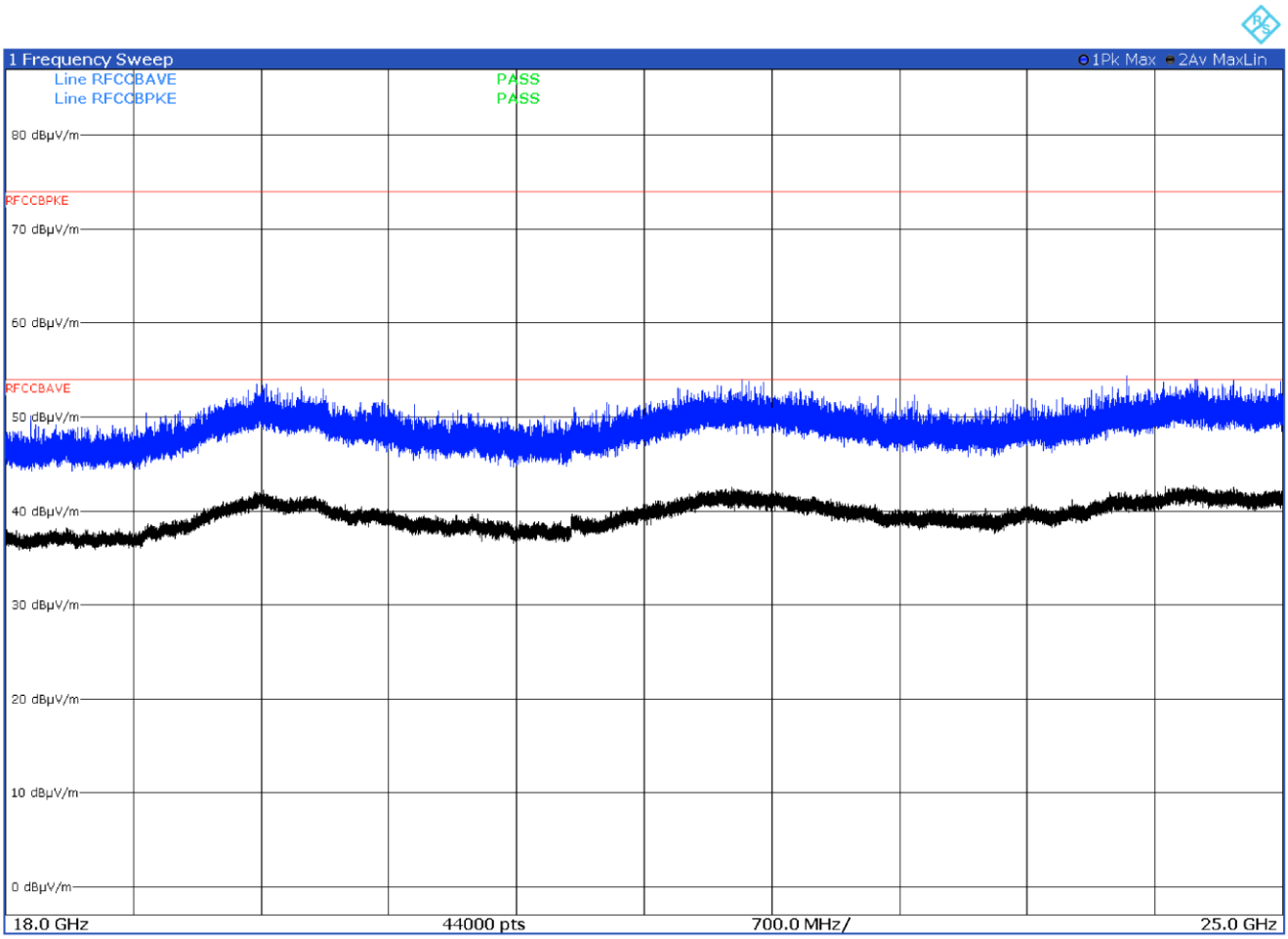
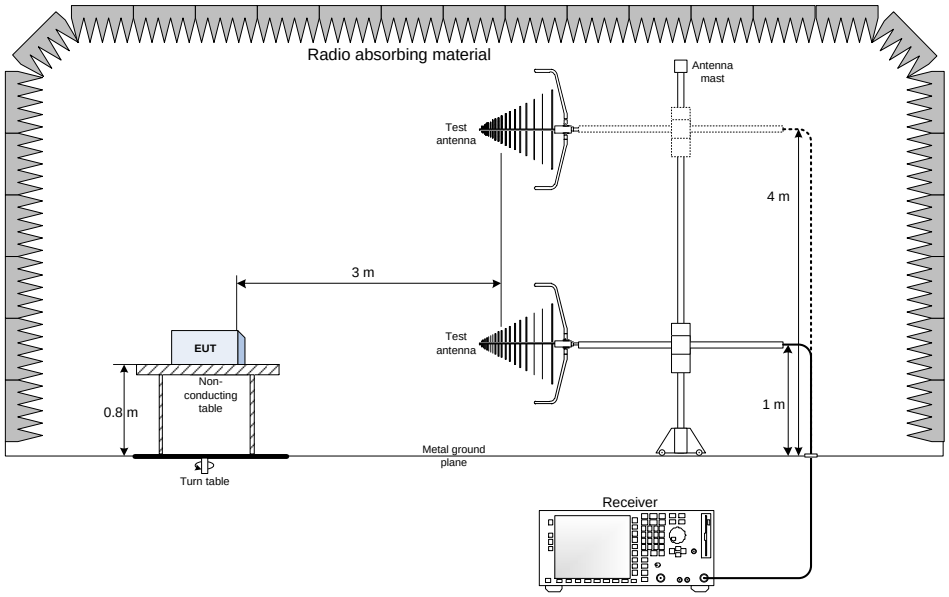


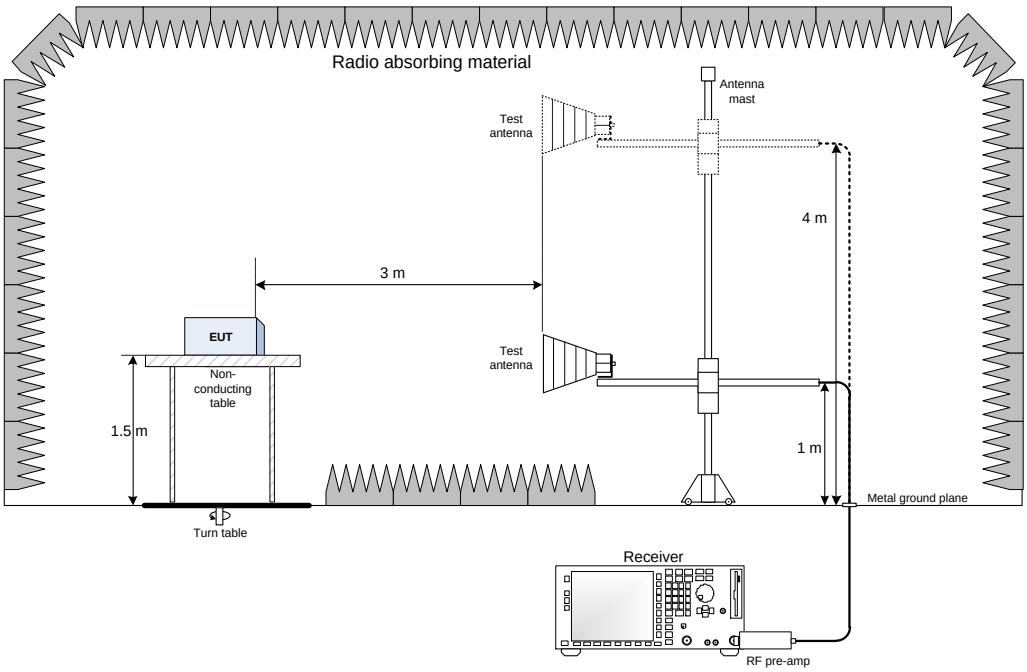
Figure 8.1-47: Radiated spurious emissions with WCDMA B5 at mid channel and WIFI at mid channel – antenna in horizontal polarization

Section 9. Block diagrams of test set-ups

9.1 Radiated emissions set-up for frequencies below 1 GHz

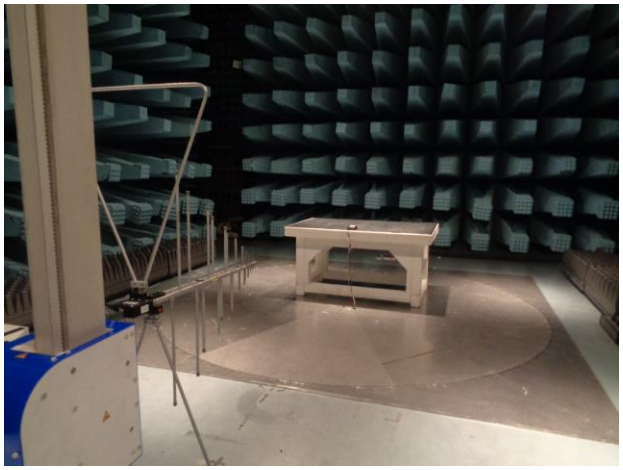


9.2 Radiated emissions set-up for frequencies above 1 GHz

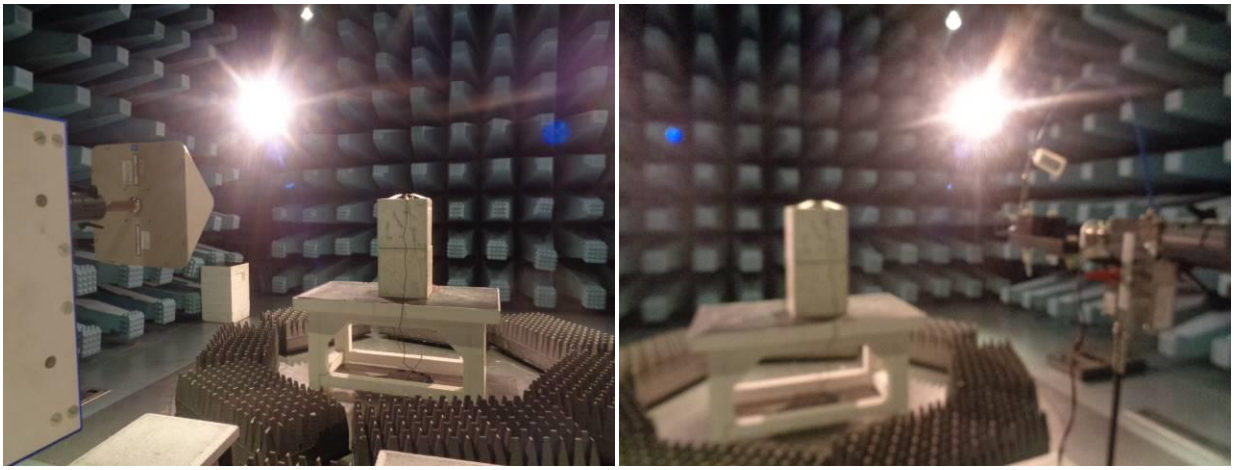


Section 10. Photos

10.1 Photos of the test set-up

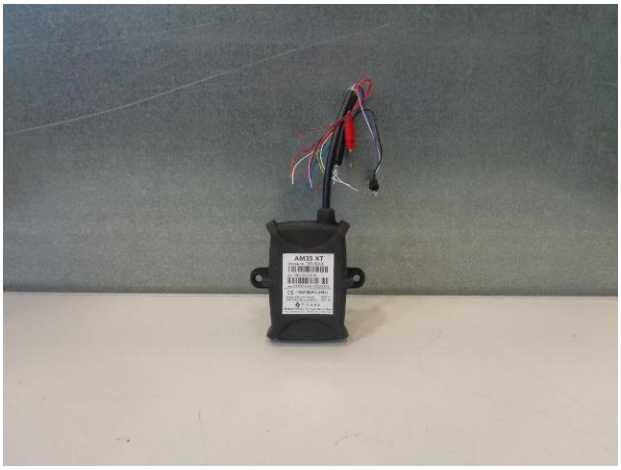


Radiated emission below 1 GHz

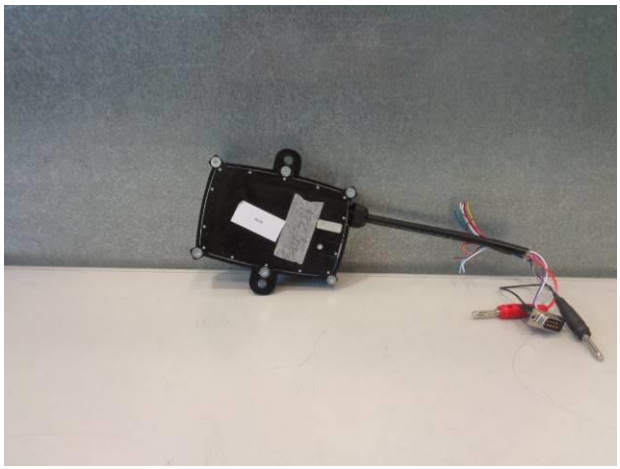


Radiated emission above 1 GHz

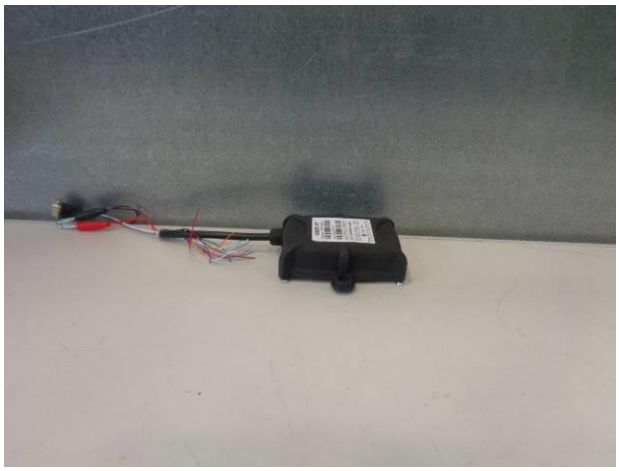
10.2 Photos of the EUT



Top view phto



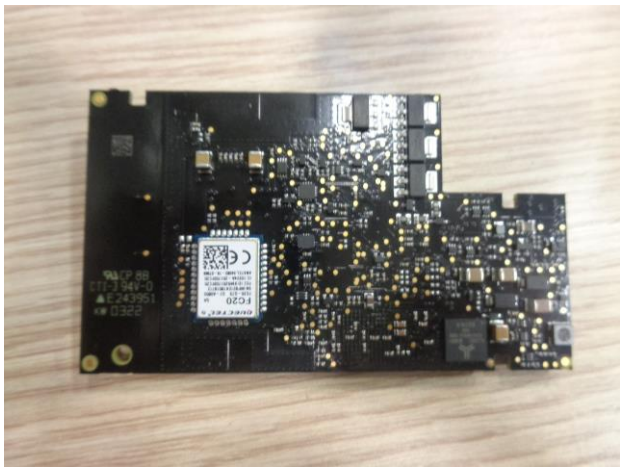
Bottom view photo



Lateral view photo

Internal view

Internal view photo



Internal view photo

(End of report)