

# Wireless test report – 407189-2TRFWL

Applicant:

Eurotech Spa

Via Fratelli Solari, 3/A – 33020 Amaro (UD) – Italy

Product name:

PCIE 802.11a/b/g/n 2.4GHz/5GHz + USB BT 4.0 card

Model:

SYS-04240-23

FCC ID:

UKM-SYS04240

Specifications:

◆ FCC 47 CFR Part 15 Subpart C, §15.209

Radiated emission limits; general requirements.

Date of issue: November 12, 2020

Tested by

(name, function and signature) P. Barbieri

(project handler) Signature:



Reviewed by

(name, function and signature) D. Guarnone

(verifier) Signature:



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*The test report merely corresponds to the tested sample.*

*The phase of sampling / collection of equipment under test is carried out by the customer.*

#### Test location(s)

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|              |  |
|--------------|--|
| Company name | Nemko Spa                                |
| Address      | Via del Carroccio, 4                     |
| City         | Biassono                                 |
| Province     | MB                                       |
| Postal code  | 20853                                    |
| Country      | Italy                                    |
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| Facsimile    | +39 039 220 12 21                        |
| Website      | www.nemko.com                            |
| Site number  | FCC: 682159 (10 m semi anechoic chamber) |

#### Limits of responsibility

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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

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### 1.1 Applicant and manufacturer

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

### 1.2 Test specifications

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

### 1.3 Test methods

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|                   |  |
|-------------------|--|
| ANSI C63.10 v2013 | American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices |
|-------------------|--|

### 1.4 Statement of compliance

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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

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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

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| Revision #    | Date of issue     | Details of changes made to test report |
|---------------|-------------------|--|
| 407189-2TRFWL | November 12, 2020 | Original report issued                 |



## Section 2. Summary of test results

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### 2.1 FCC Part 15 Subpart C, general requirements test results

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

## Section 3. Equipment under test (EUT) details

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### 3.1 Sample information

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|                        |                  |
|------------------------|------------------|
| Receipt date           | October 22, 2020 |
| Nemko sample ID number | 4071890010       |

### 3.2 EUT information

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|               |  |
|---------------|--|
| Product name  | PCIE 802.11a/b/g/n 2.4GHz/5GHz + USB BT 4.0 card |
| Model         | SYS-04240-23                                     |
| Model variant | --   |
| Serial number | A119GKA0020                                      |

### 3.3 Technical information

---

| Frequency band                          | WIFI:2400–2483.5 MHz band<br>WCDMA and LTE North America Bands   |                       |  |              |              |       |              |            |           |              |         |                   |                  |         |                       |
|---|--|-----------------------|--|--------------|--------------|-------|--------------|------------|-----------|--------------|---------|-------------------|------------------|---------|-----------------------|
| Type of modulation                      | 802.11b/g/n<br>WCDMA and LTE standard modulation   |                       |  |              |              |       |              |            |           |              |         |                   |                  |         |                       |
| Emission classification (F1D, G1D, D1D) | F1D, W7D   |                       |  |              |              |       |              |            |           |              |         |                   |                  |         |                       |
| Transmitter spurious, dB $\mu$ V/m @3 m | 43.4   |                       |  |              |              |       |              |            |           |              |         |                   |                  |         |                       |
| EUT power requirements                  | 24 V <sub>DC</sub>   |                       |  |              |              |       |              |            |           |              |         |                   |                  |         |                       |
| Antenna information                     | <p>The EUT uses a unique antenna coupling/ non-detachable antenna to the intentional radiator.<br/>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>WIFI antenna</td> <td>2J-ANTENNA</td> <td>2J630 2MP</td> </tr> <tr> <td>GNSS antenna</td> <td>TAOGLAS</td> <td>GSA.8827.A.101111</td> </tr> <tr> <td>Cellular antenna</td> <td>TAOGLAS</td> <td>AA.107.301111-1508816</td> </tr> </tbody> </table> |                       |  | Product Type | Manufacturer | Model | WIFI antenna | 2J-ANTENNA | 2J630 2MP | GNSS antenna | TAOGLAS | GSA.8827.A.101111 | Cellular antenna | TAOGLAS | AA.107.301111-1508816 |
| Product Type                            | Manufacturer   | Model                 |  |              |              |       |              |            |           |              |         |                   |                  |         |                       |
| WIFI antenna                            | 2J-ANTENNA   | 2J630 2MP             |  |              |              |       |              |            |           |              |         |                   |                  |         |                       |
| GNSS antenna                            | TAOGLAS  | GSA.8827.A.101111     |  |              |              |       |              |            |           |              |         |                   |                  |         |                       |
| Cellular antenna                        | TAOGLAS  | AA.107.301111-1508816 |  |              |              |       |              |            |           |              |         |                   |                  |         |                       |

### 3.4 EUT setup diagram

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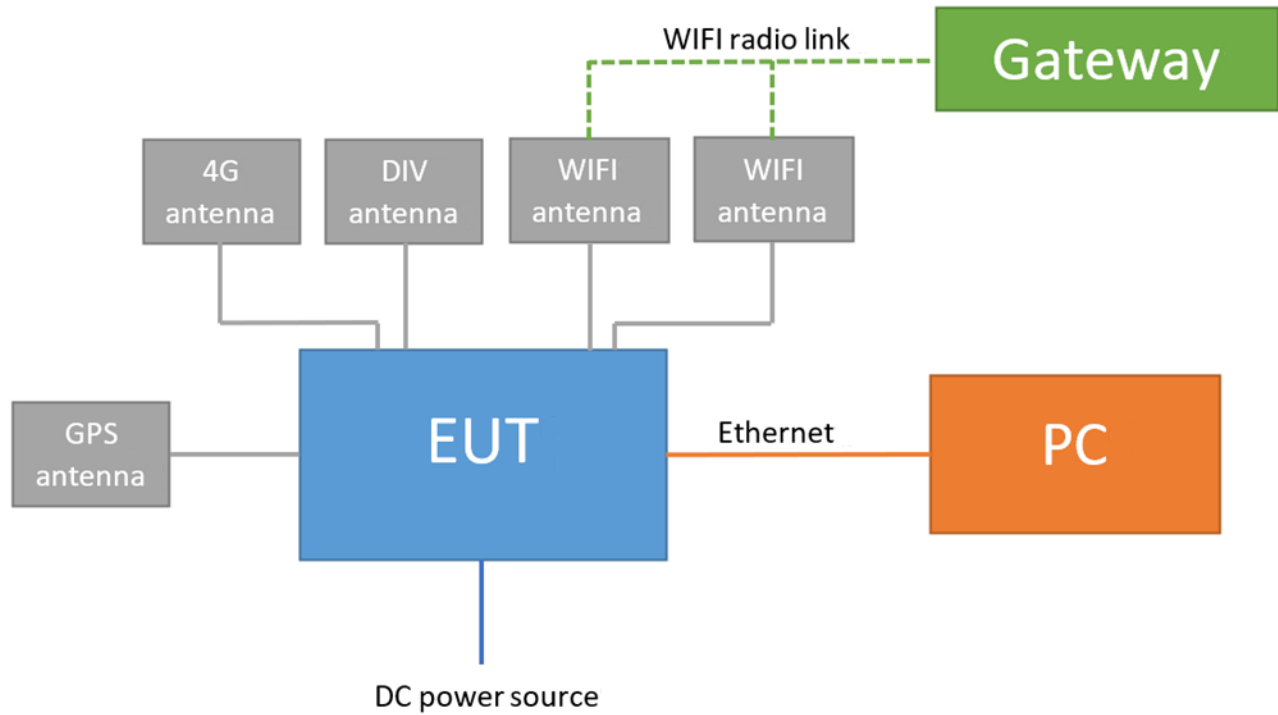


Figure 3.4-1: Setup diagram

### 3.5 Product description and theory of operation

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The EUT is intended to be used as Railway Automotive Logger Unit. It is provided with the following separately approved radio module:

- Telit model LE910C1-NF

### 3.6 EUT sub assemblies

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**Table 3.6-1:** EUT sub assemblies

| Description                    | Brand name | Model/Part number     | Serial number |
|--------------------------------|------------|-----------------------|---------------|
| Railway Automotive Logger Unit | Eurotech   | SYS-04240-23          | A119GKA0020   |
| WIFI antenna                   | 2J-ANTENNA | 2J630 2MP             | None          |
| GNSS antenna                   | TAOGLAS    | GSA.8827.A.1011111    | None          |
| Cellular antenna               | TAOGLAS    | AA.107.301111-1508816 | None          |

### 3.7 EUT exercise details

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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: Linux 4.1.46-fslc+gf134d1b armv7l

The following script has been used to force the EUT in WIFI TX mode:

```
Test_Results      : Mon Aug 17 10:52:57 UTC 2020
Current_cpu_usage: 13%
Ethernet1_eth0    : OK [197/197/0], Ping 172.16.0.2
Wireless_wlan0    : OK [183/182/1], Ping 192.168.10.10
GPS_receiver      : OK [41/41/0],
disk: mmcblk1p1   : OK [185/185/0]
```

For the 3G/4G radio module a Radio communication tester Rohde & Schwarz model CMW 290 S/N 101712 has been used.



## Section 4. Engineering considerations

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### 4.1 Modifications incorporated in the EUT

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There were no modifications performed to the EUT during this assessment.

### 4.2 Technical judgment

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The EUT has three WIFI 2.4 GHz standard; IEEE 802.11g 6 Mb/s standard and IEEE 802.11b 1 Mb/s standard are chosen to be the representative worst-case. The radio module LE910C1-NF use the standard 3G and 4G. 3G standard is chosen to be the representative worst-case.

### 4.3 Deviations from laboratory tests procedures

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No deviations were made from laboratory procedures.

## Section 5. Test conditions

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### 5.1 Atmospheric conditions

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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 | 01/2019  | 01/2021   |
| Thermo-hygrometer data loggers | Testo        | 175-H2    | 38203337/703 | 01/2019  | 01/2021   |
| Barometer                      | Castle       | GPB 3300  | 072015       | 12/2019  | 12/2020   |

### 5.2 Power supply range

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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<br>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)                     |       |

| 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. Testing data

### 7.1 FCC 15.209 Radiated emission limits; general requirements

#### 7.1.1 Definitions and limits

(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.

**Table 7.1-1: FCC §15.209 – Radiated emission limits**

| Frequency,<br>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 7.1-2: 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       |                     |               |             |

### 7.1.2 Test summary

Start date November 10, 2020

### 7.1.3 Observations, settings and special notes

The spectrum was searched from 30 MHz to the 10<sup>th</sup> harmonic.  
 EUT was set to transmit continuously. Radiated measurements were performed at a distance of 3 m.

Spectrum analyzer settings for radiated measurements below 1 GHz pre-scan

|                       |          |
|-----------------------|----------|
| Resolution bandwidth: | 100 kHz  |
| Video bandwidth:      | 300 kHz  |
| Detector mode:        | Peak     |
| Trace mode:           | Max Hold |

Spectrum analyzer settings for peak radiated measurements above 1 GHz pre-scan

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

Spectrum analyzer settings for average radiated measurements above 1 GHz pre-scan

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

### 7.1.4 Test equipment list

**Table 7.1-3: Equipment list**

| Equipment                       | Manufacturer    | Model no.                 | Asset no. | Cal cycle | Next cal. |
|---------------------------------|-----------------|---------------------------|-----------|-----------|-----------|
| EMI receiver (20 Hz ÷ 8 GHz)    | Rohde & Schwarz | ESU8                      | 100202    | 08/2020   | 08/2021   |
| EMI receiver (20 Hz ÷ 8 GHz)    | Rohde & Schwarz | ESW44                     | 101620    | 09/2020   | 09/2021   |
| Spectrum Analyzer               | Rohde & Schwarz | FSW43                     | 101767    | 07/2020   | 07/2021   |
| Trilog Antenna (30 MHz ÷ 7 GHz) | Schwarzbeck     | VULB 9162                 | 9162-025  | 07/2018   | 07/2021   |
| Bilog antenna (1 ÷ 18 GHz)      | Schwarzbeck     | STLP 9148                 | 9148-123  | 07/2018   | 07/2021   |
| Preamplifier (1 ÷ 18 GHz)       | Schwarzbeck     | BBV 9718                  | 9718-137  | 07/2020   | 07/2021   |
| Horn antenna (3 ÷ 40 GHz)       | RFSpin          | DRH40                     | 061106A40 | 04/2020   | 04/2023   |
| Preamplifier (18 ÷ 40 GHz)      | Sage            | STB-1834034030-KFKF-L1    | 18490-01  | 03/2020   | 03/2021   |
| 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   | 09/2021   |
| Shielded room                   | Siemens         | 10m control room          | 1947      | NCR       | NCR       |

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

7.1.5 Test data

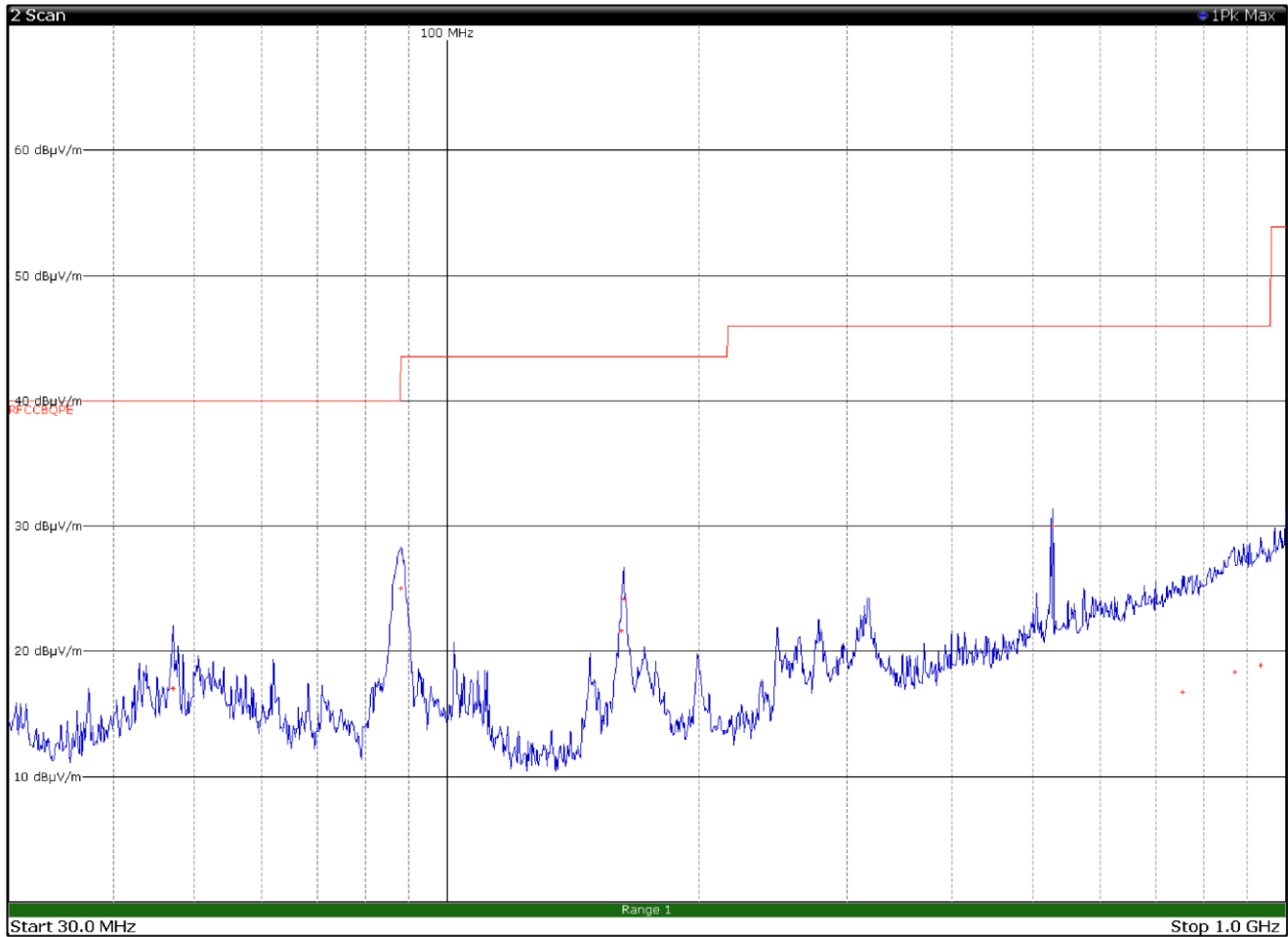


Figure 7.1-1: Radiated spurious emissions with WCDMA at 1880 MHz and WIFI at 2437 MHz – antenna in horizontal polarization

| Frequency (MHz) | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Detector |
|-----------------|----------------|----------------|-------------|----------|
| 47.1000         | 17.1           | 40.0           | -22.9       | QP       |
| 88.0500         | 25.0           | 43.5           | -18.5       | QP       |
| 161.4600        | 21.7           | 43.5           | -21.8       | QP       |
| 162.4500        | 24.2           | 43.5           | -19.3       | QP       |
| 528.0000        | 30.1           | 46.0           | -15.9       | QP       |
| 753.4200        | 16.8           | 46.0           | -29.2       | QP       |
| 868.2600        | 18.4           | 46.0           | -27.6       | QP       |
| 934.2000        | 18.9           | 46.0           | -27.1       | QP       |

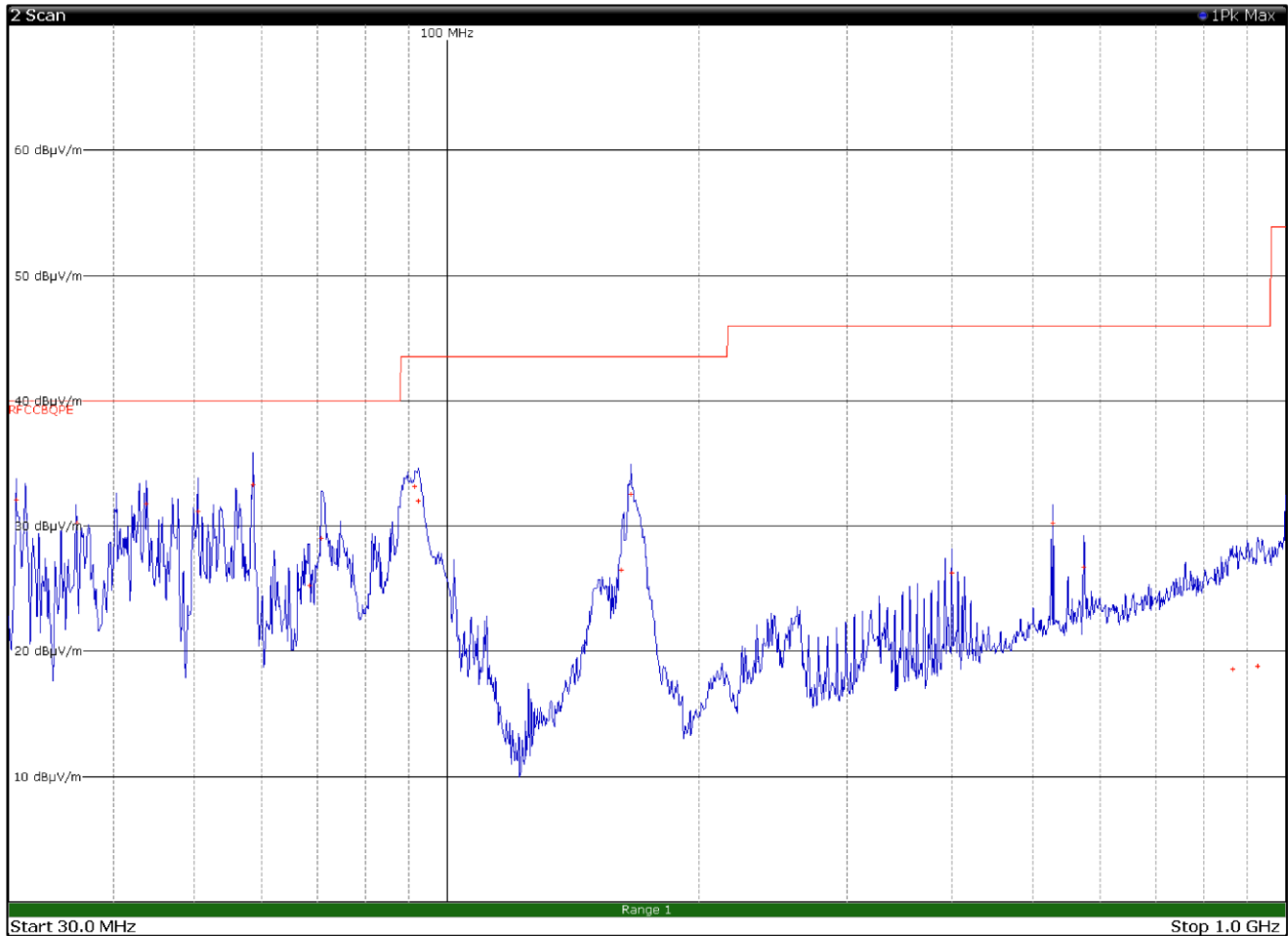


Figure 7.1-2: Radiated spurious emissions with WCDMA at 1880 MHz and WIFI at 2437 MHz – antenna in vertical polarization

| Frequency (MHz) | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Detector |
|-----------------|----------------|----------------|-------------|----------|
| 30.6300         | 32.1           | 40.0           | -7.9        | QP       |
| 36.1500         | 30.3           | 40.0           | -9.7        | QP       |
| 43.8000         | 31.8           | 40.0           | -8.2        | QP       |
| 50.4300         | 31.2           | 40.0           | -8.8        | QP       |
| 58.7100         | 33.3           | 40.0           | -6.7        | QP       |
| 68.4900         | 25.3           | 40.0           | -14.7       | QP       |
| 70.8000         | 29.0           | 40.0           | -11.0       | QP       |
| 91.5300         | 33.2           | 43.5           | -10.3       | QP       |
| 92.4000         | 32.0           | 43.5           | -11.5       | QP       |
| 161.4000        | 26.5           | 43.5           | -17.0       | QP       |
| 165.5700        | 32.6           | 43.5           | -10.9       | QP       |
| 399.6000        | 26.3           | 46.0           | -19.7       | QP       |
| 528.0000        | 30.3           | 46.0           | -15.7       | QP       |



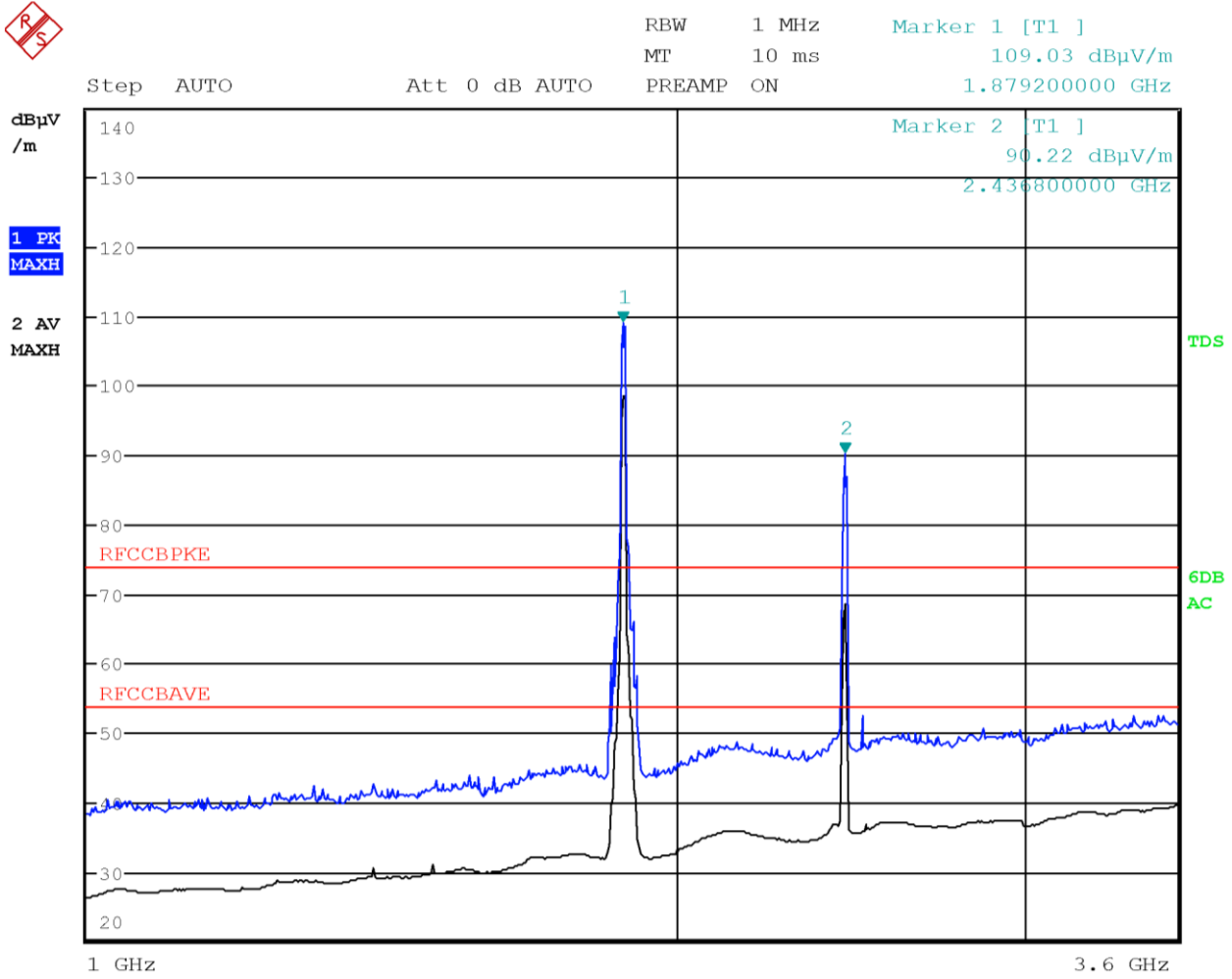


Figure 7.1-3: Radiated spurious emissions with WCDMA at 1880 MHz and WIFI at 2437 MHz – antenna in horizontal polarization

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

| Frequency (MHz) | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Detector |
|-----------------|----------------|----------------|-------------|----------|
| 1150.4000       | 27.6           | 54.0           | -26.4       | Av       |
| 1250.0000       | 28.7           | 54.0           | -25.3       | Av       |
| 1500.0000       | 30.9           | 54.0           | -23.1       | Av       |
| 1765.6000       | 32.5           | 54.0           | -21.5       | Av       |
| 2148.4000       | 35.8           | 54.0           | -18.2       | Av       |
| 3122.4000       | 37.6           | 54.0           | -16.4       | Av       |
| 3600.0000       | 39.5           | 54.0           | -14.5       | Av       |

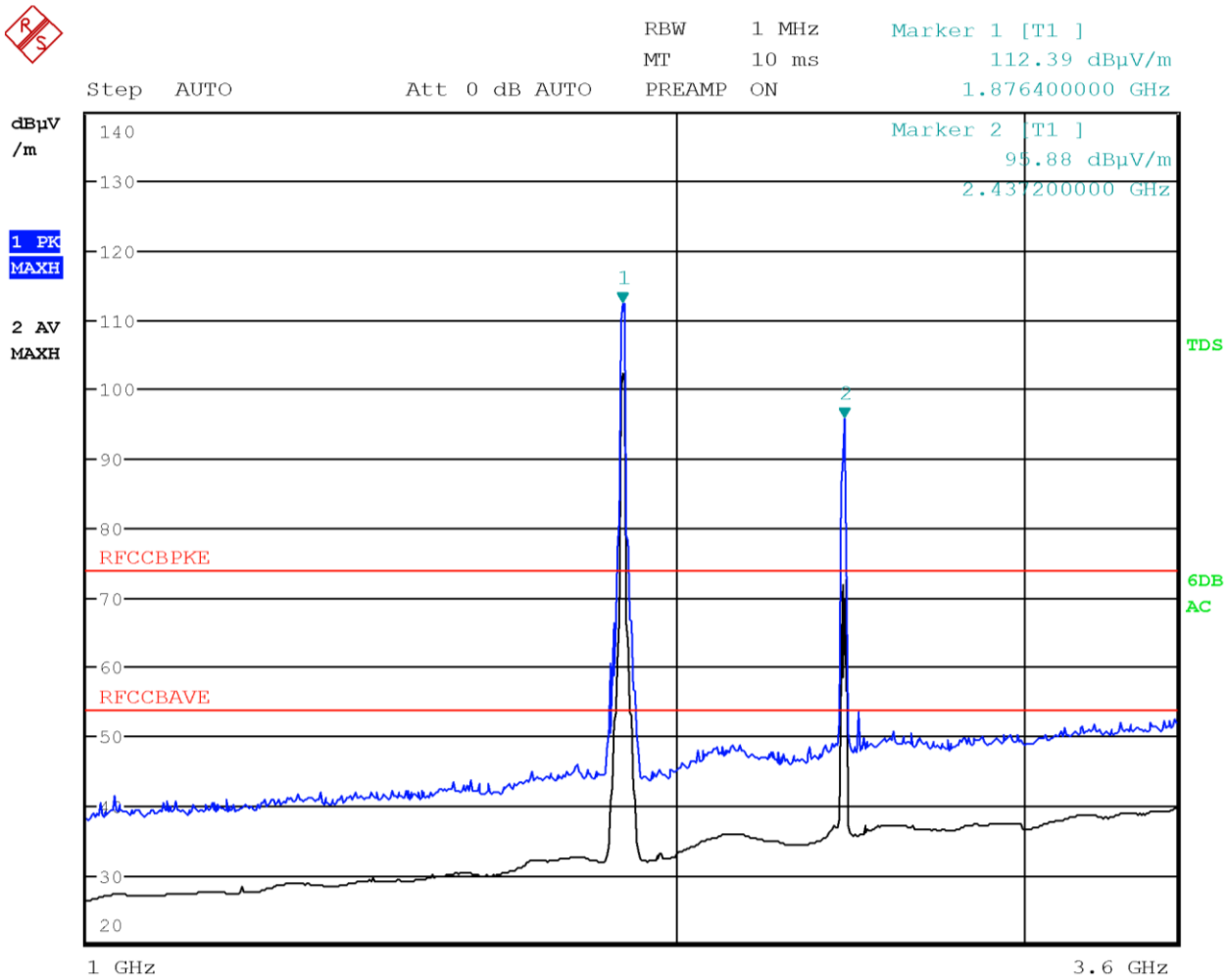


Figure 7.1-4: Radiated spurious emissions with WCDMA at 1880 MHz and WIFI at 2437 MHz – antenna in vertical polarization

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

| Frequency (MHz) | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Detector |
|-----------------|----------------|----------------|-------------|----------|
| 1151.6000       | 27.6           | 54.0           | -26.4       | Av       |
| 1272.0000       | 28.7           | 54.0           | -25.3       | Av       |
| 1500.0000       | 30.1           | 54.0           | -23.9       | Av       |
| 1766.8000       | 32.5           | 54.0           | -21.5       | Av       |
| 2150.0000       | 35.9           | 54.0           | -18.1       | Av       |
| 3114.0000       | 37.7           | 54.0           | -16.3       | Av       |
| 3597.2000       | 39.5           | 54.0           | -14.5       | Av       |

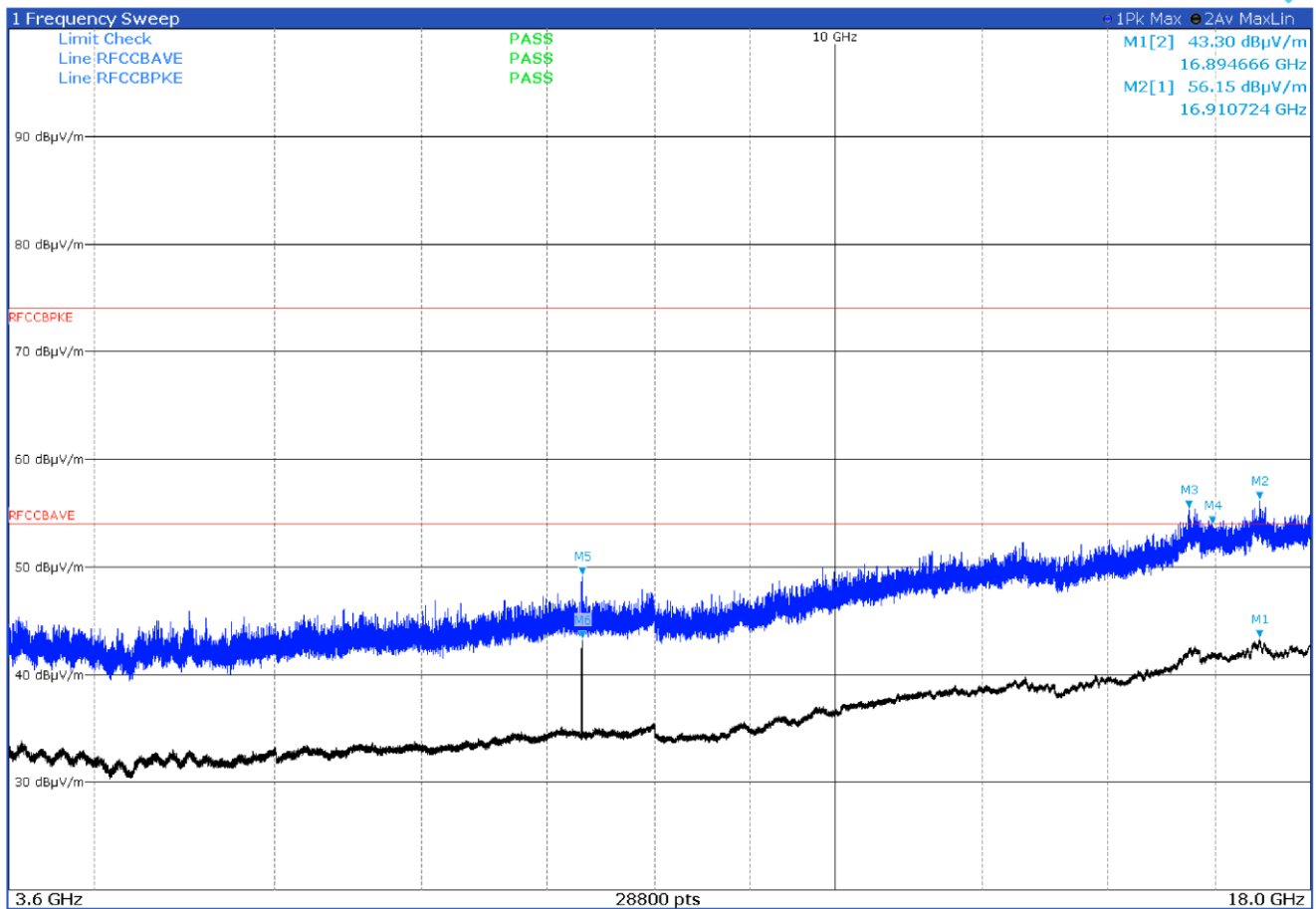


Figure 7.1-5: Radiated spurious emissions with WCDMA at 1880 MHz and WIFI at 2437 MHz – antenna in horizontal polarization

| Frequency (GHz) | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Detector |
|-----------------|----------------|----------------|-------------|----------|
| 16.8946         | 43.3           | 54             | -10.7       | Av       |
| 16.9107         | 56.1           | 74             | -17.9       | Pk       |
| 15.4954         | 55.4           | 74             | -18.6       | Pk       |
| 15.9514         | 53.9           | 74             | -20.1       | Pk       |
| 7.3108          | 49.1           | 74             | -24.9       | Pk       |
| 7.3107          | 43.2           | 54             | -10.8       | Av       |

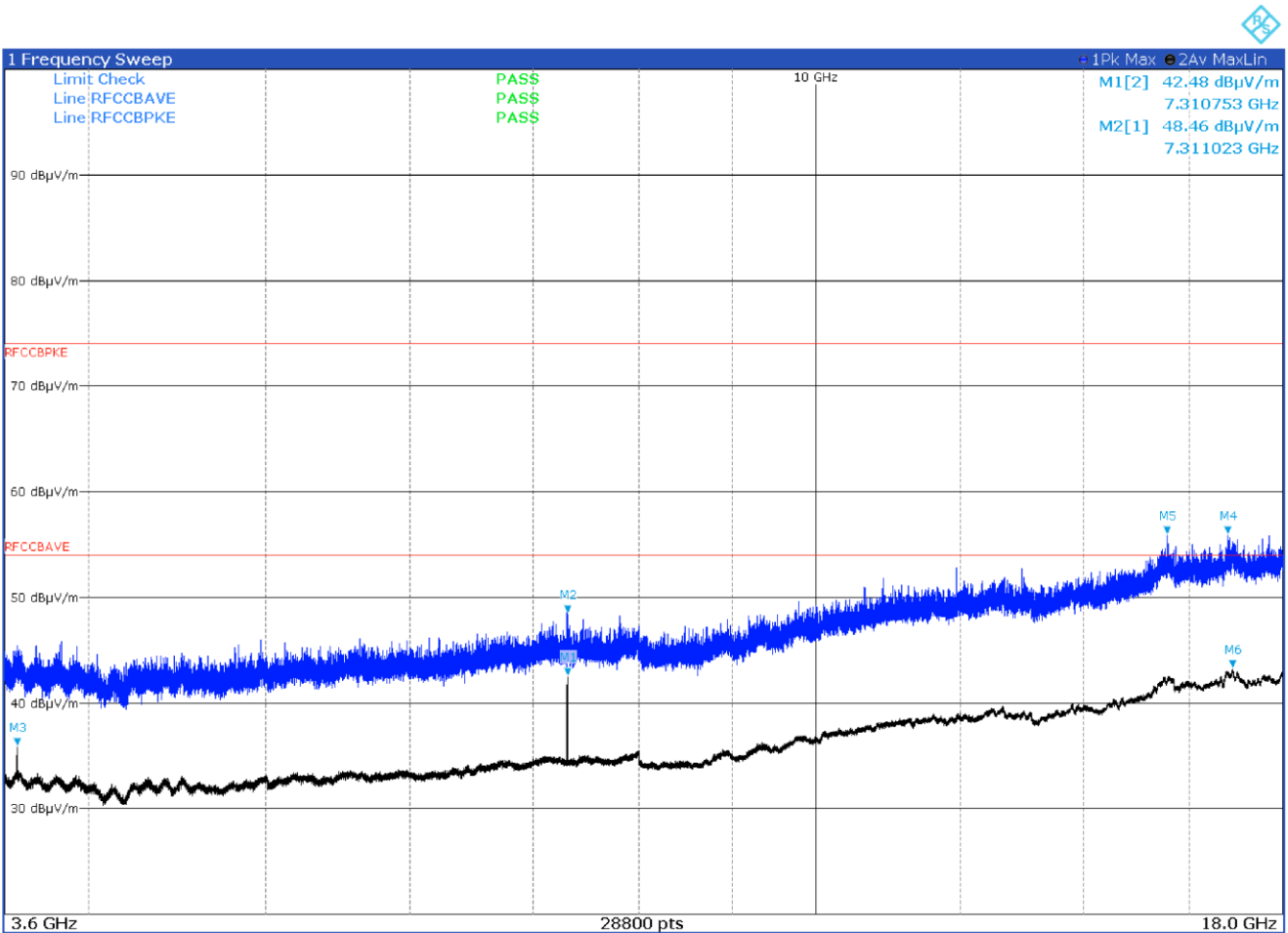


Figure 7.1-6: Radiated spurious emissions with WCDMA at 1880 MHz and WIFI at 2437 MHz – antenna in vertical polarization

| Frequency (GHz) | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Detector |
|-----------------|----------------|----------------|-------------|----------|
| 16.8946         | 43.3           | 54             | -10.7       | Av       |
| 15.5578         | 55.9           | 74             | -18.1       | Pk       |
| 16.7986         | 55.9           | 74             | -18.1       | Pk       |
| 3.6551          | 35.9           | 54             | -18.1       | Av       |
| 7.3108          | 48.5           | 74             | -25.5       | Pk       |
| 7.3107          | 42.5           | 54             | -11.5       | Av       |

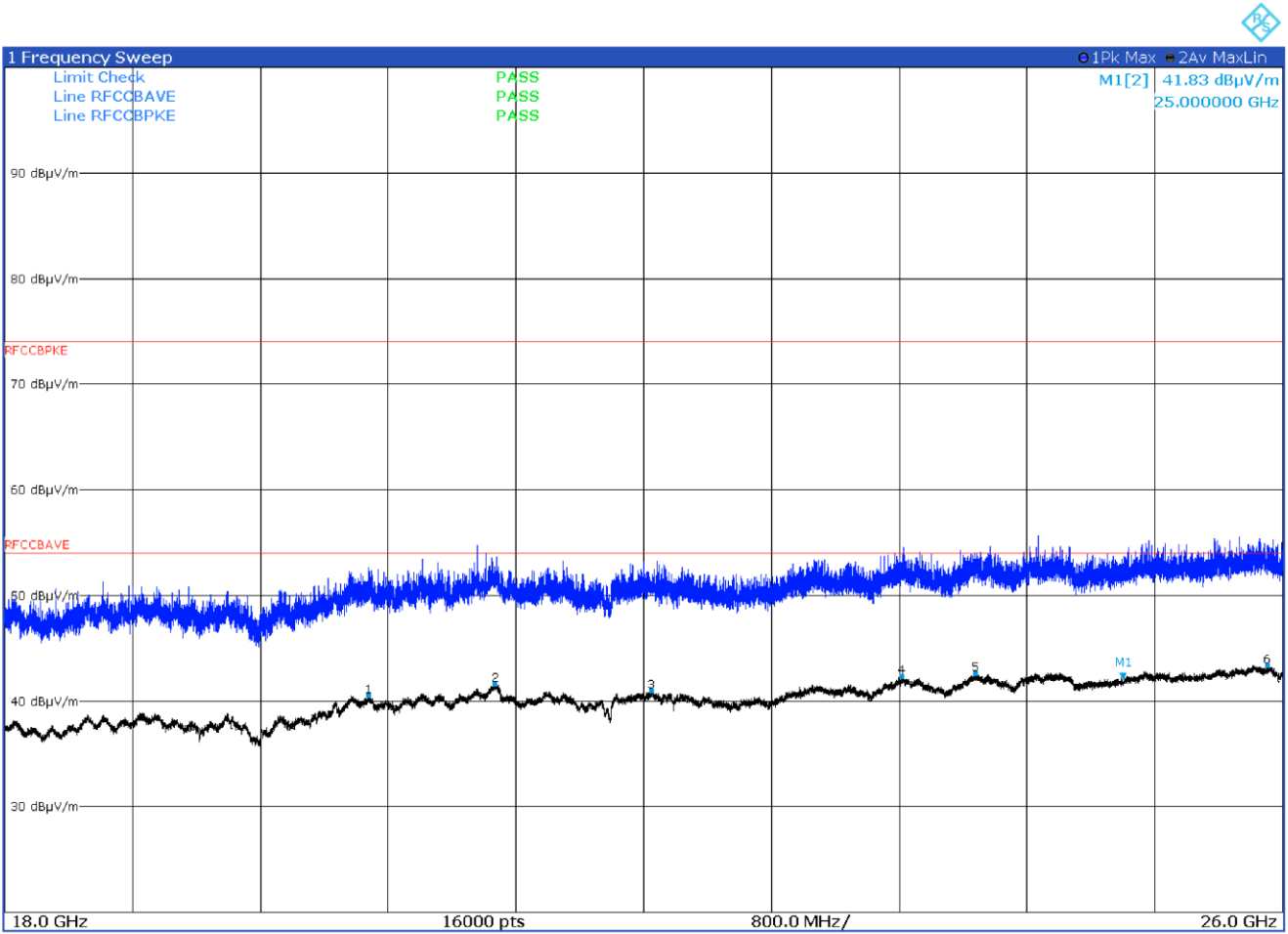


Figure 7.1-7: Radiated spurious emissions with WCDMA at 1880 MHz and WIFI at 2437 MHz – antenna in horizontal polarization

| Frequency (GHz) | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Detector |
|-----------------|----------------|----------------|-------------|----------|
| 20.2752         | 40.5           | 54             | -13.5       | Av       |
| 21.0682         | 41.6           | 54             | -12.4       | Av       |
| 22.0462         | 41.0           | 54             | -13.0       | Av       |
| 23.6137         | 42.4           | 54             | -11.6       | Av       |
| 24.0782         | 42.6           | 54             | -11.4       | Av       |
| 25.9022         | 43.4           | 54             | -10.6       | Av       |

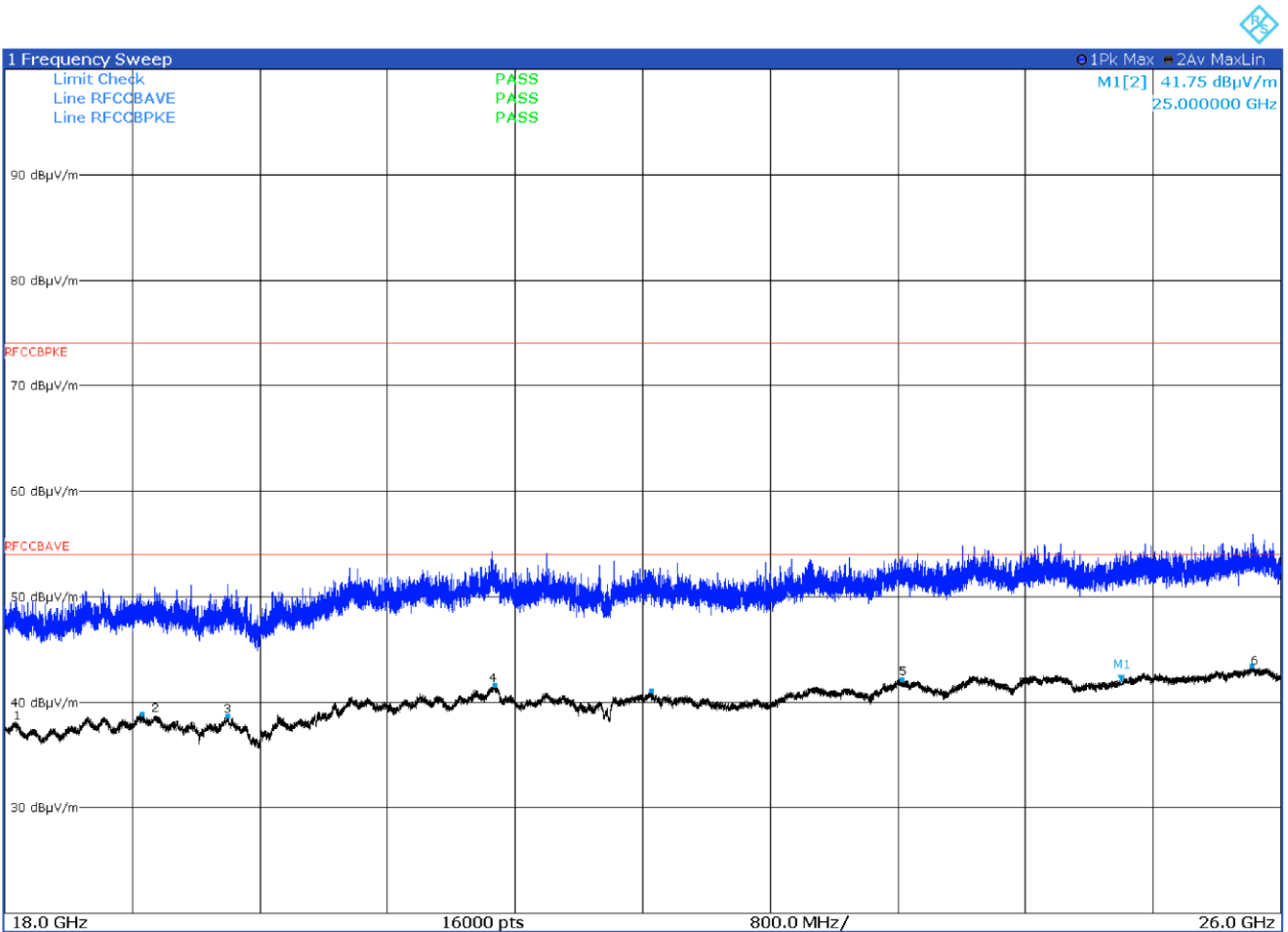


Figure 7.1-8: Radiated spurious emissions with WCDMA at 1880 MHz and WIFI at 2437 MHz – antenna in vertical polarization

| Frequency (GHz) | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Detector |
|-----------------|----------------|----------------|-------------|----------|
| 18.8632         | 38.9           | 54             | -15.1       | Av       |
| 19.3972         | 38.7           | 54             | -15.3       | Av       |
| 21.0712         | 41.7           | 54             | -12.3       | Av       |
| 22.0557         | 41.1           | 54             | -12.9       | Av       |
| 23.6277         | 42.1           | 54             | -11.9       | Av       |
| 25.8187         | 43.4           | 54             | -10.6       | Av       |

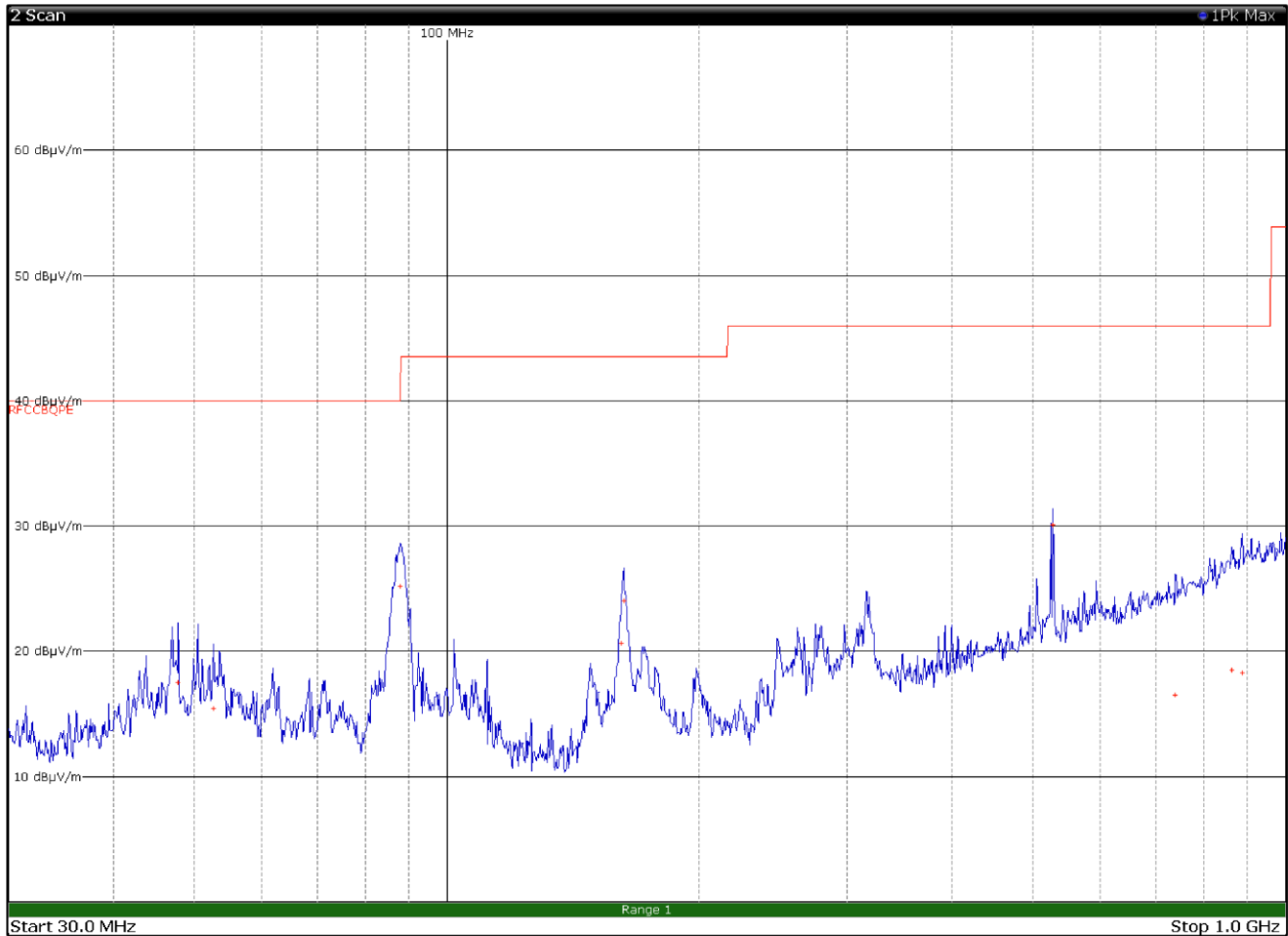


Figure 7.1-9: Radiated spurious emissions with WCDMA at 1732.6 MHz and WIFI at 2437 MHz – antenna in horizontal polarization

| Frequency (MHz) | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Detector |
|-----------------|----------------|----------------|-------------|----------|
| 47.7900         | 17.6           | 40.0           | -22.4       | QP       |
| 52.6200         | 15.5           | 40.0           | -24.5       | QP       |
| 87.8700         | 25.2           | 40.0           | -14.8       | QP       |
| 161.4600        | 20.7           | 43.5           | -22.8       | QP       |
| 162.4800        | 24.0           | 43.5           | -19.5       | QP       |
| 528.0000        | 30.1           | 46.0           | -15.9       | QP       |
| 738.9300        | 16.5           | 46.0           | -29.5       | QP       |
| 862.9200        | 18.5           | 46.0           | -27.5       | QP       |
| 887.9700        | 18.3           | 46.0           | -27.7       | QP       |

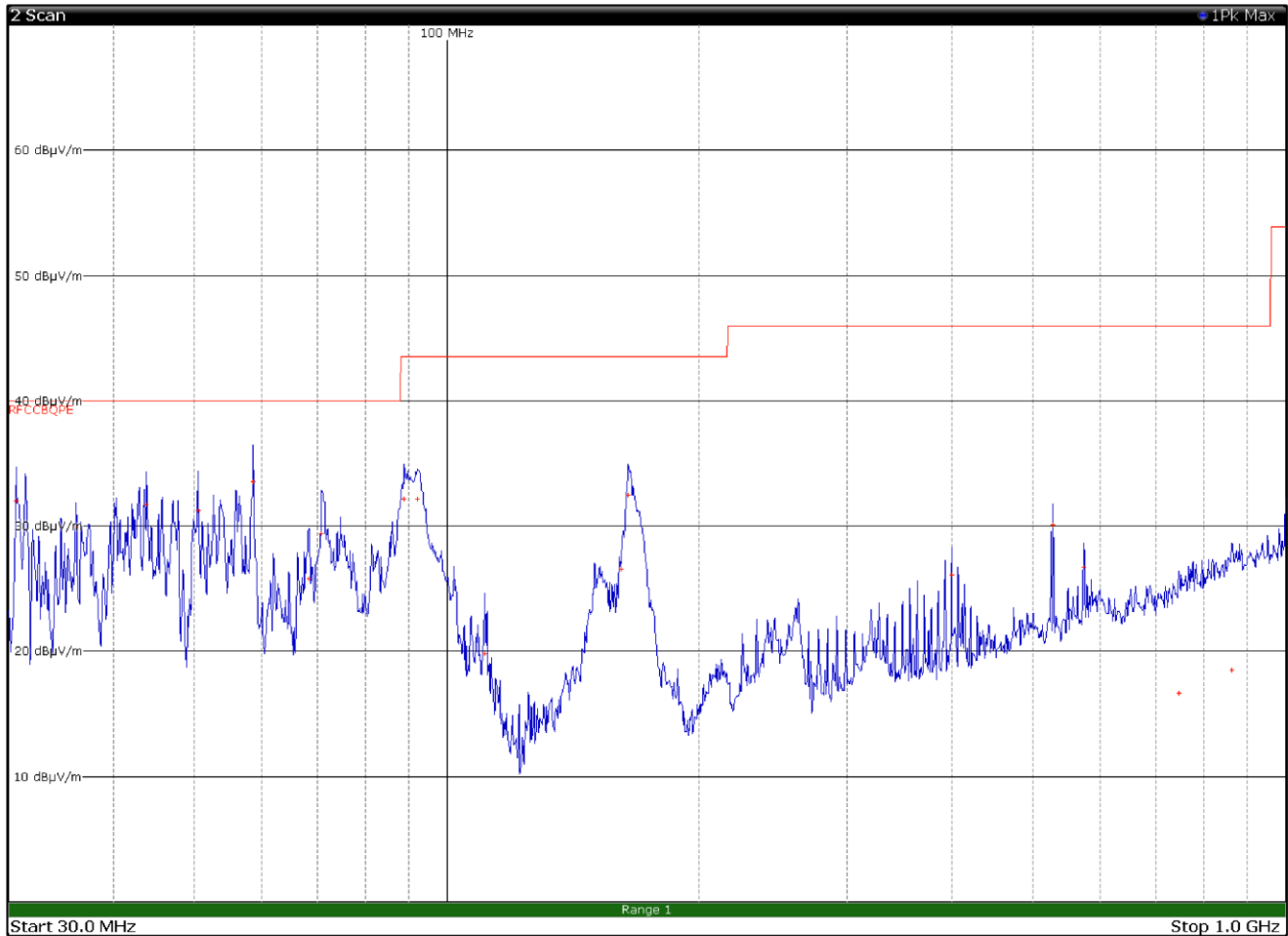


Figure 7.1-10: Radiated spurious emissions with WCDMA at 1732.6 MHz and WIFI at 2437 MHz – antenna in vertical polarization

| Frequency (MHz) | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Detector |
|-----------------|----------------|----------------|-------------|----------|
| 30.6300         | 32.0           | 40.0           | -8.0        | QP       |
| 36.1200         | 30.0           | 40.0           | -10.0       | QP       |
| 43.8000         | 31.8           | 40.0           | -8.2        | QP       |
| 50.4300         | 31.3           | 40.0           | -8.7        | QP       |
| 58.7100         | 33.6           | 40.0           | -6.4        | QP       |
| 68.4600         | 25.9           | 40.0           | -14.1       | QP       |
| 70.8300         | 29.5           | 40.0           | -10.5       | QP       |
| 88.8600         | 32.2           | 43.5           | -11.3       | QP       |
| 92.1600         | 32.2           | 43.5           | -11.3       | QP       |
| 110.7900        | 19.8           | 43.5           | -23.7       | QP       |
| 161.4300        | 26.6           | 43.5           | -16.9       | QP       |
| 164.4900        | 32.5           | 43.5           | -11.0       | QP       |
| 399.6000        | 26.2           | 46.0           | -19.8       | QP       |
| 528.0000        | 30.2           | 46.0           | -15.8       | QP       |



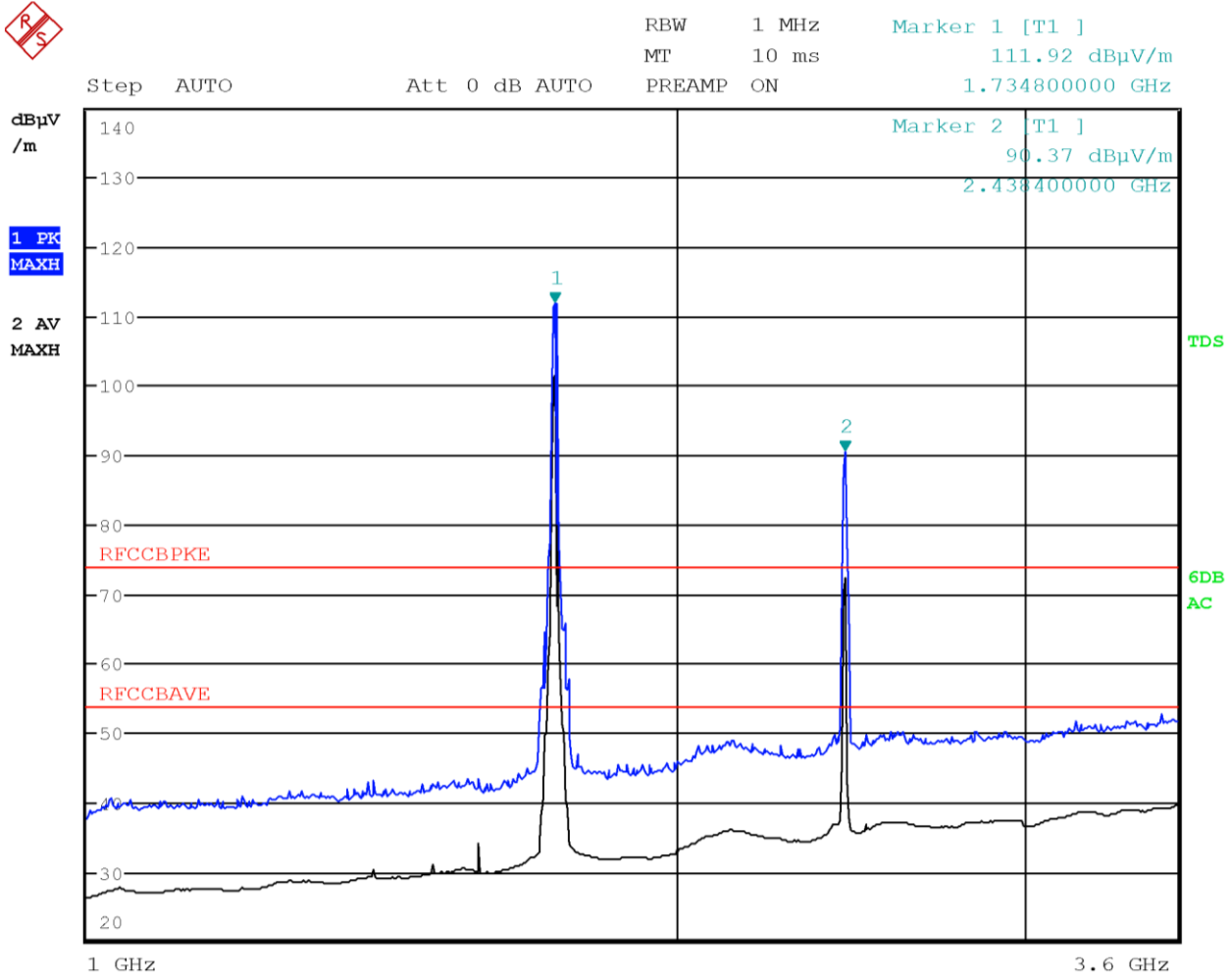


Figure 7.1-11: Radiated spurious emissions with WCDMA at 1732.6 MHz and WIFI at 2437 MHz – antenna in horizontal polarization

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

| Frequency (MHz) | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Detector |
|-----------------|----------------|----------------|-------------|----------|
| 1040.0000       | 27.7           | 54.0           | -26.3       | Av       |
| 1374.8000       | 29.0           | 54.0           | -25.0       | Av       |
| 1584.0000       | 34.1           | 54.0           | -19.9       | Av       |
| 2130.0000       | 36.0           | 54.0           | -18.0       | Av       |
| 2927.2000       | 37.3           | 54.0           | -16.7       | Av       |
| 3599.6000       | 39.5           | 54.0           | -14.5       | Av       |

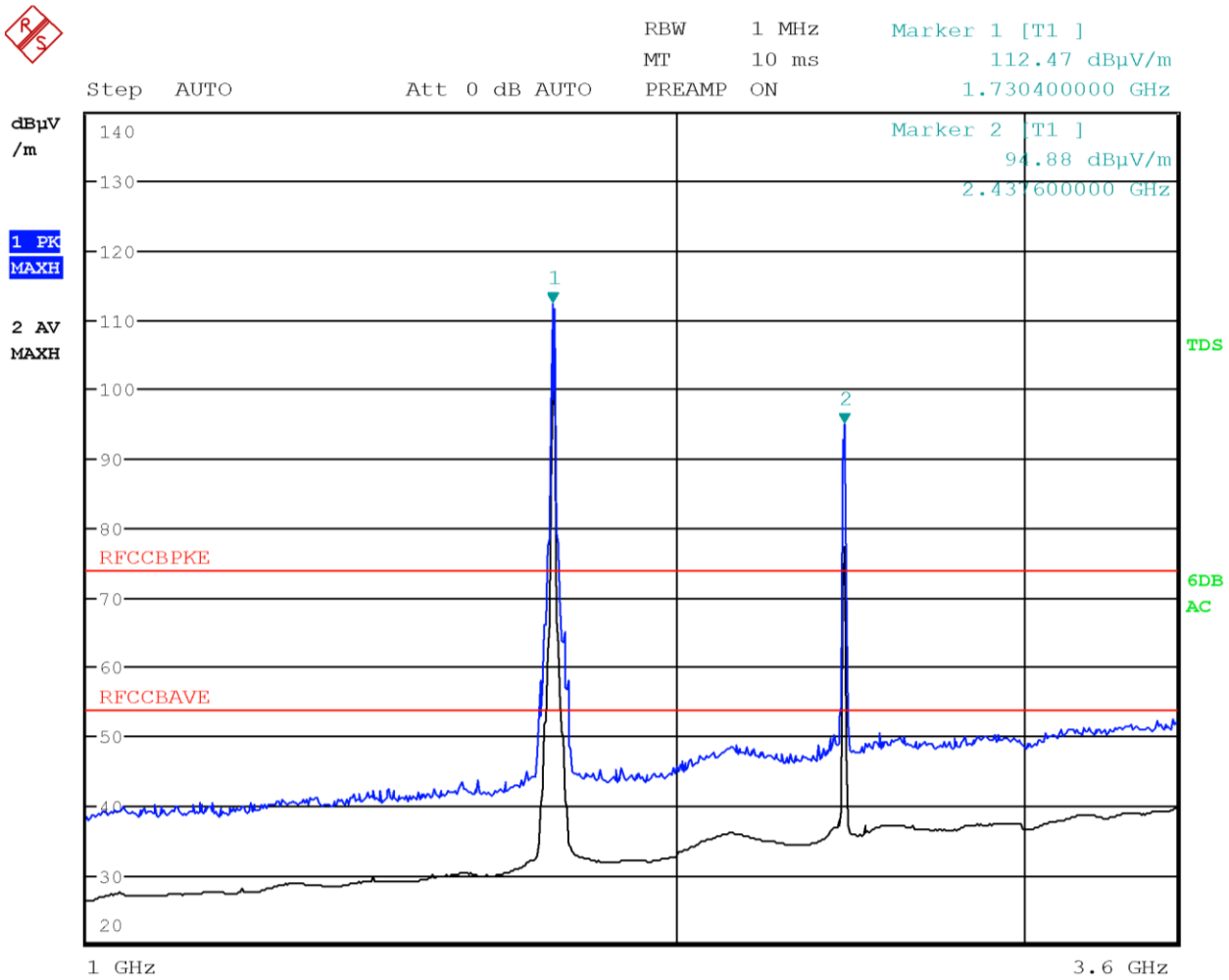


Figure 7.1-12: Radiated spurious emissions with WCDMA at 1732.6 MHz and WIFI at 2437 MHz – antenna in vertical polarization

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 |
|-----------------|----------------|----------------|-------------|----------|
| 1159.2000       | 27.5           | 54.0           | -26.5       | Av       |
| 1376.0000       | 28.9           | 54.0           | -25.1       | Av       |
| 1562.8000       | 30.2           | 54.0           | -23.8       | Av       |
| 2134.0000       | 36.1           | 54.0           | -17.9       | Av       |
| 2957.2000       | 37.4           | 54.0           | -16.6       | Av       |
| 3596.8000       | 39.5           | 54.0           | -14.5       | Av       |

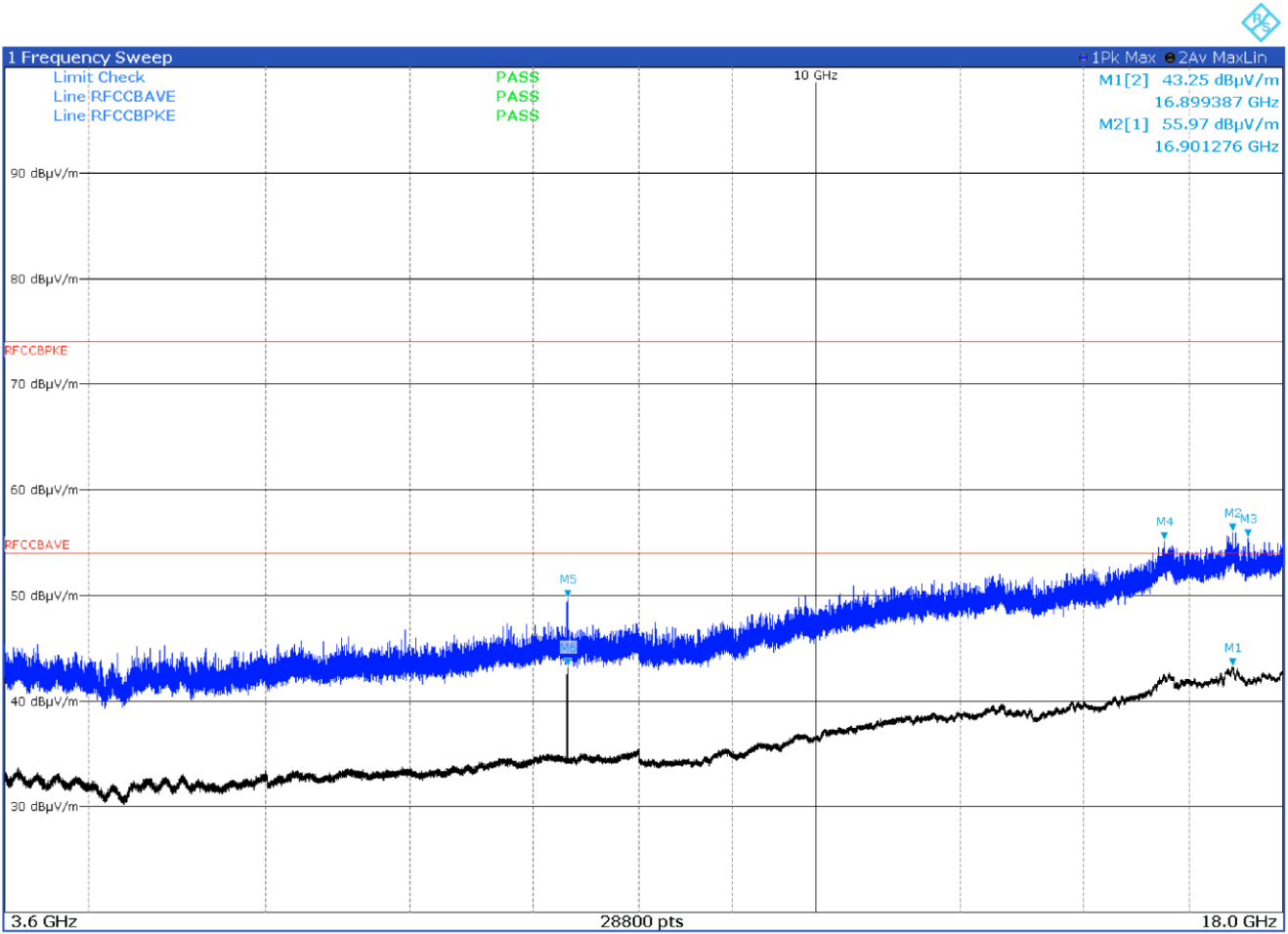


Figure 7.1-13: Radiated spurious emissions with WCDMA at 1732.6 MHz and WIFI at 2437 MHz – antenna in horizontal polarization

| Frequency (GHz) | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Detector |
|-----------------|----------------|----------------|-------------|----------|
| 16.8993         | 43.2           | 54             | -10.8       | Av       |
| 16.9012         | 55.9           | 74             | -18.1       | Pk       |
| 15.2370         | 55.5           | 74             | -18.5       | Pk       |
| 15.5084         | 55.2           | 74             | -18.8       | Pk       |
| 7.3108          | 49.8           | 74             | -24.2       | Pk       |
| 7.3108          | 43.3           | 54             | -10.7       | Av       |

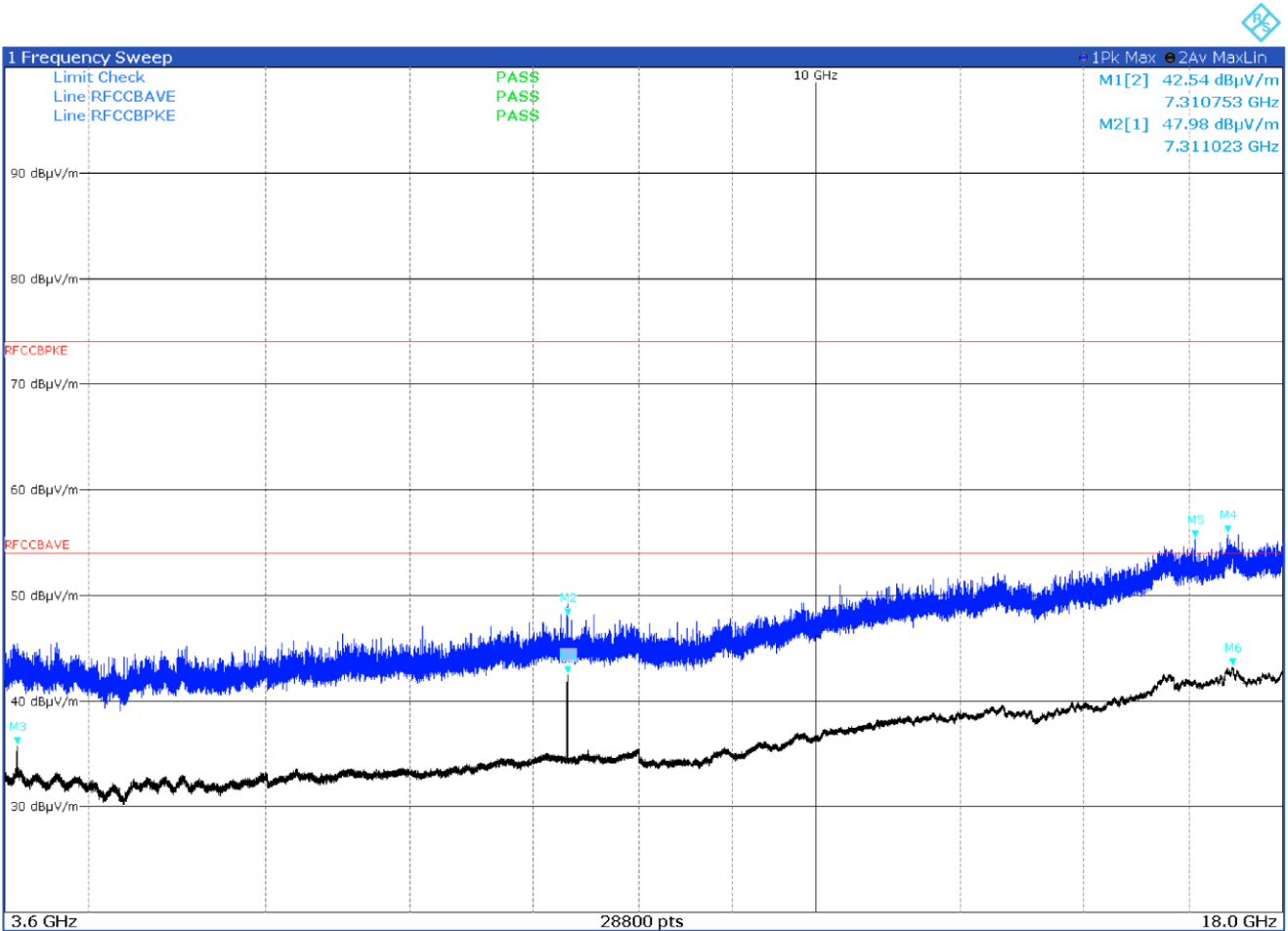


Figure 7.1-14: Radiated spurious emissions with WCDMA at 1732.6 MHz and WIFI at 2437 MHz – antenna in vertical polarization

| Frequency (GHz) | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Detector |
|-----------------|----------------|----------------|-------------|----------|
| 7.3107          | 42.6           | 54             | -11.4       | Av       |
| 7.3110          | 48.0           | 74             | -26.0       | Pk       |
| 3.6552          | 35.8           | 54             | -18.2       | Av       |
| 16.8005         | 55.8           | 74             | -18.2       | Pk       |
| 16.1180         | 55.4           | 74             | -18.6       | Pk       |
| 16.8927         | 43.3           | 54             | -10.7       | Av       |

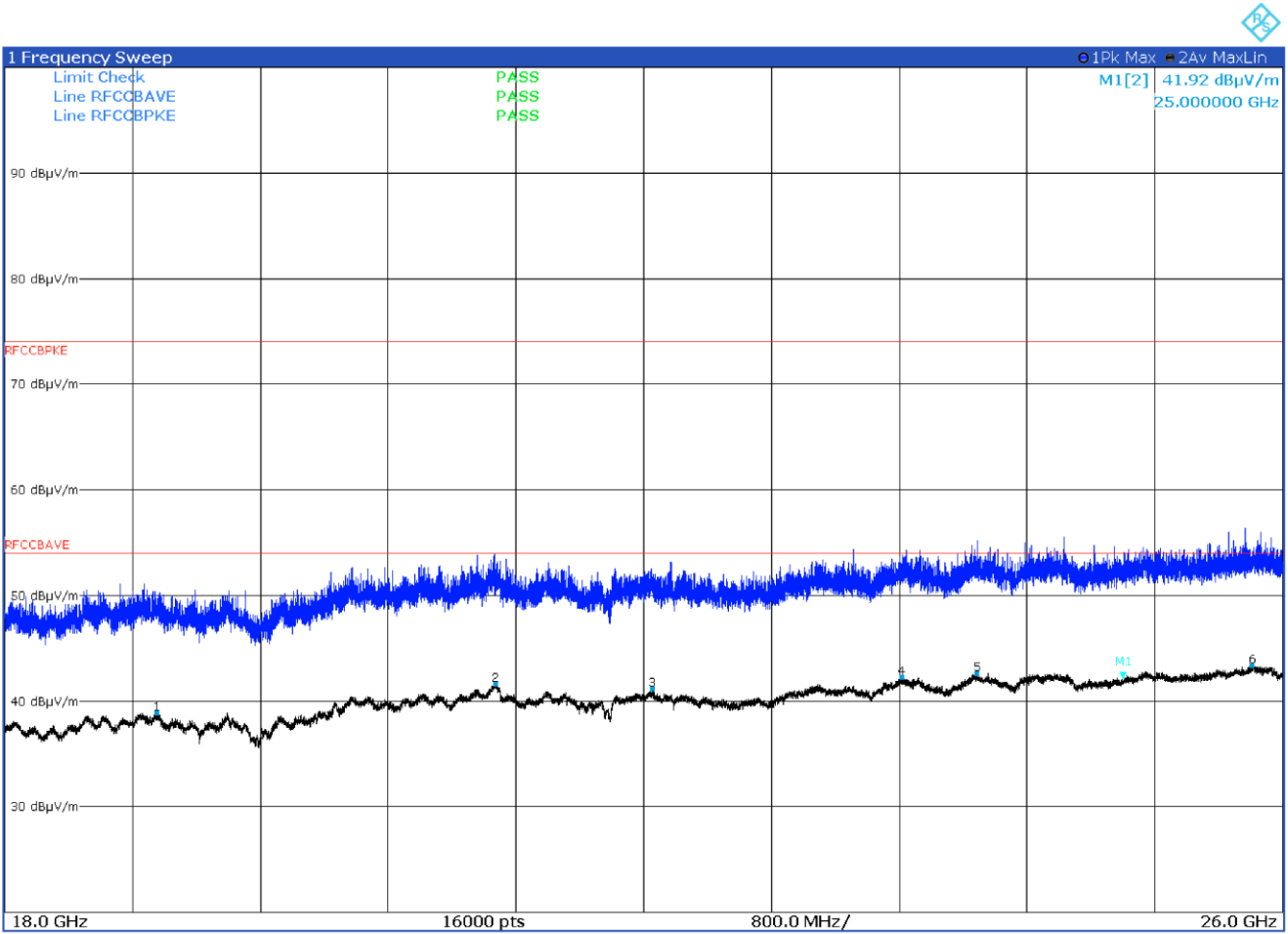


Figure 7.1-15: Radiated spurious emissions with WCDMA at 1732.6 MHz and WIFI at 2437 MHz – antenna in horizontal polarization

| Frequency (GHz) | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Detector |
|-----------------|----------------|----------------|-------------|----------|
| 18.9542         | 38.9           | 54             | -15.1       | Av       |
| 21.0712         | 41.7           | 54             | -12.3       | Av       |
| 22.0532         | 41.1           | 54             | -12.9       | Av       |
| 23.6157         | 42.3           | 54             | -11.7       | Av       |
| 24.0857         | 42.6           | 54             | -11.4       | Av       |
| 25.8077         | 43.4           | 54             | -10.6       | Av       |

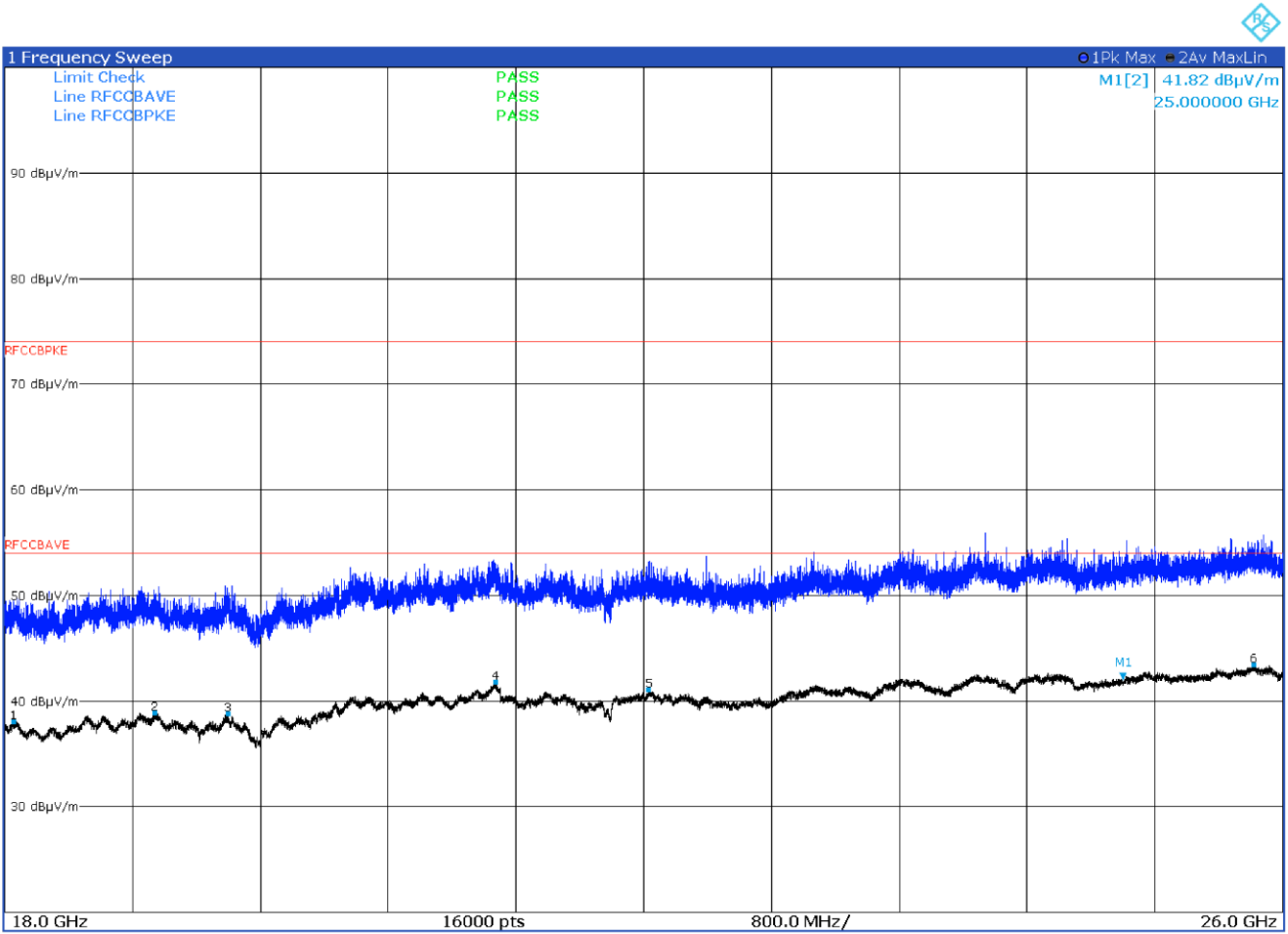


Figure 7.1-16: Radiated spurious emissions with WCDMA at 1732.6 MHz and WIFI at 2437 MHz – antenna in vertical polarization

| Frequency (GHz) | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Detector |
|-----------------|----------------|----------------|-------------|----------|
| 18.0532         | 38.1           | 54             | -15.9       | Av       |
| 18.9382         | 38.9           | 54             | -15.1       | Av       |
| 19.3957         | 38.8           | 54             | -15.2       | Av       |
| 21.0727         | 41.8           | 54             | -12.2       | Av       |
| 22.0317         | 41.1           | 54             | -12.9       | Av       |
| 25.8167         | 43.4           | 54             | -10.6       | Av       |

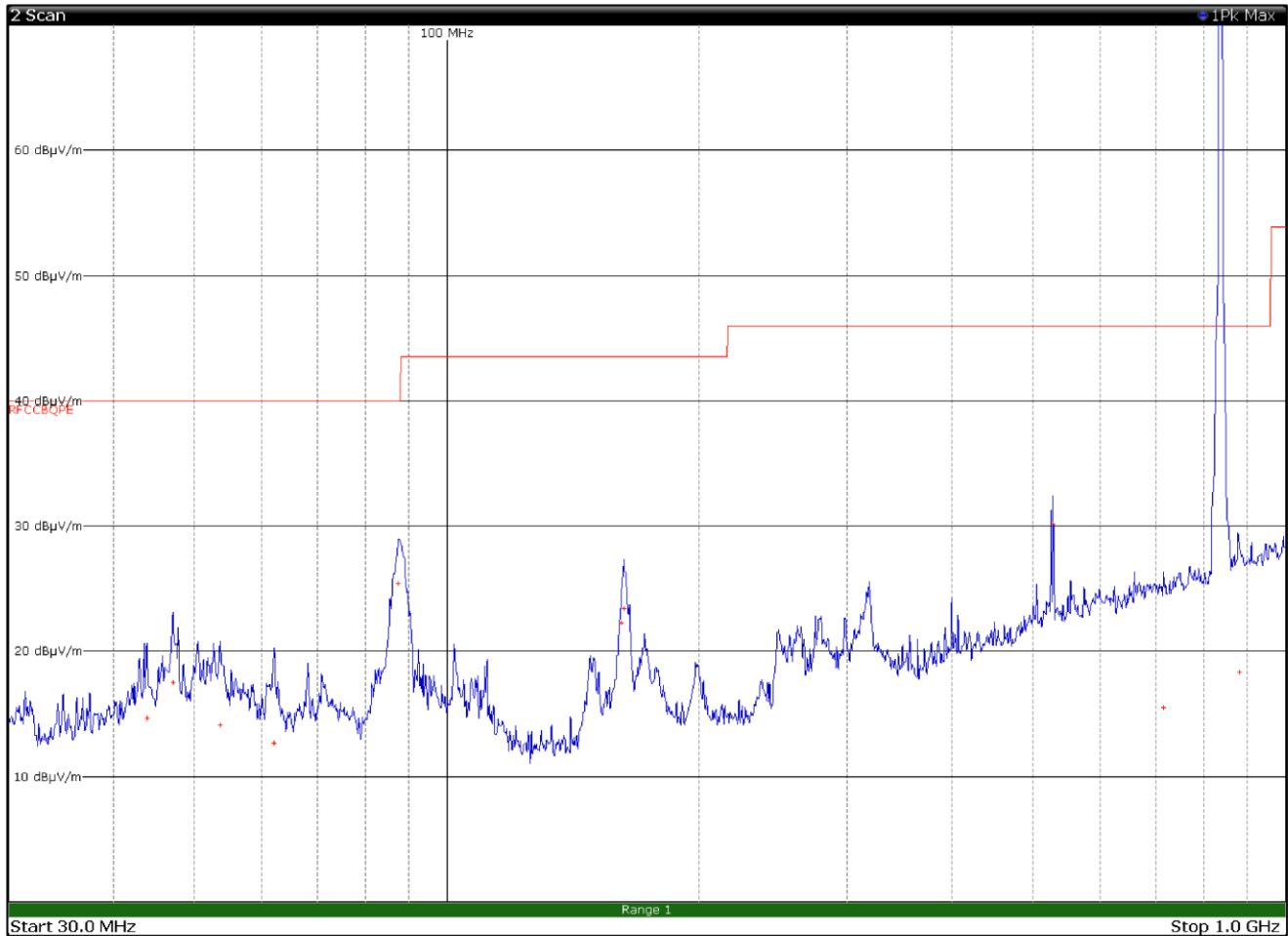


Figure 7.1-17: Radiated spurious emissions with WCDMA at 832.6 MHz and WIFI at 2437 MHz – antenna in horizontal polarization

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 |
|-----------------|----------------|----------------|-------------|----------|
| 43.8300         | 14.7           | 40.0           | -25.3       | QP       |
| 47.0700         | 17.6           | 40.0           | -22.4       | QP       |
| 53.5800         | 14.2           | 40.0           | -25.8       | QP       |
| 62.2500         | 12.7           | 40.0           | -27.3       | QP       |
| 87.4500         | 25.4           | 40.0           | -14.6       | QP       |
| 161.4000        | 22.3           | 43.5           | -21.2       | QP       |
| 162.5400        | 23.5           | 43.5           | -20.0       | QP       |
| 528.0000        | 30.2           | 46.0           | -15.8       | QP       |
| 715.1700        | 15.5           | 46.0           | -30.5       | QP       |
| 857.6400        | 18.4           | 46.0           | -27.6       | QP       |

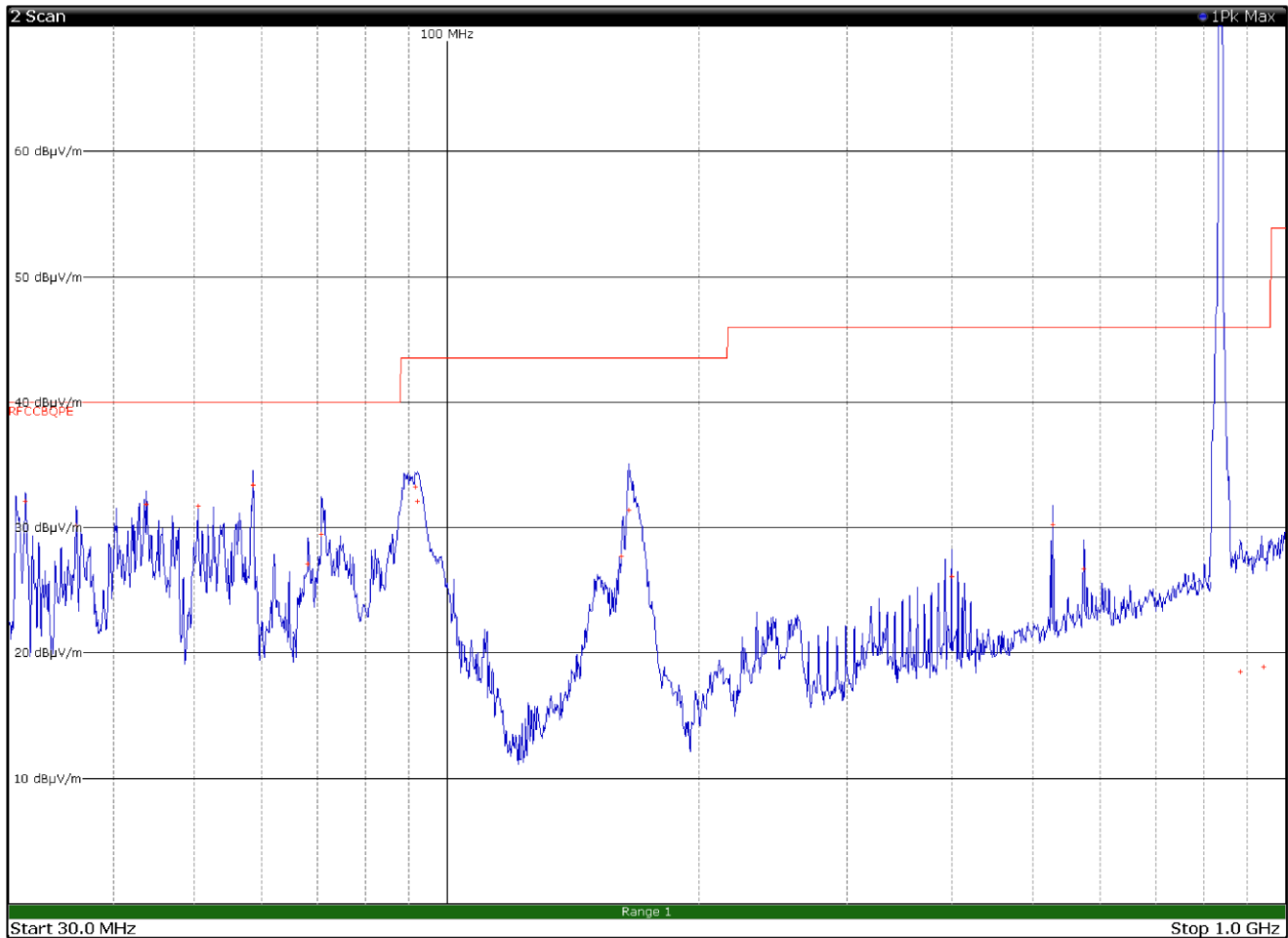


Figure 7.1-18: Radiated spurious emissions with WCDMA at 832.6 MHz and WIFI at 2437 MHz – antenna in vertical polarization

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 |
|-----------------|----------------|----------------|-------------|----------|
| 31.4100         | 32.1           | 40.0           | -7.9        | QP       |
| 36.1200         | 30.2           | 40.0           | -9.8        | QP       |
| 43.8000         | 31.9           | 40.0           | -8.1        | QP       |
| 50.4300         | 31.7           | 40.0           | -8.3        | QP       |
| 58.7100         | 33.4           | 40.0           | -6.6        | QP       |
| 68.2500         | 27.1           | 40.0           | -12.9       | QP       |
| 70.8300         | 29.5           | 40.0           | -10.5       | QP       |
| 91.5600         | 33.3           | 43.5           | -10.2       | QP       |
| 92.1900         | 32.1           | 43.5           | -11.4       | QP       |
| 161.4300        | 27.7           | 43.5           | -15.8       | QP       |
| 164.5500        | 31.4           | 43.5           | -12.1       | QP       |
| 399.6000        | 26.2           | 46.0           | -19.8       | QP       |
| 528.0000        | 30.3           | 46.0           | -15.7       | QP       |



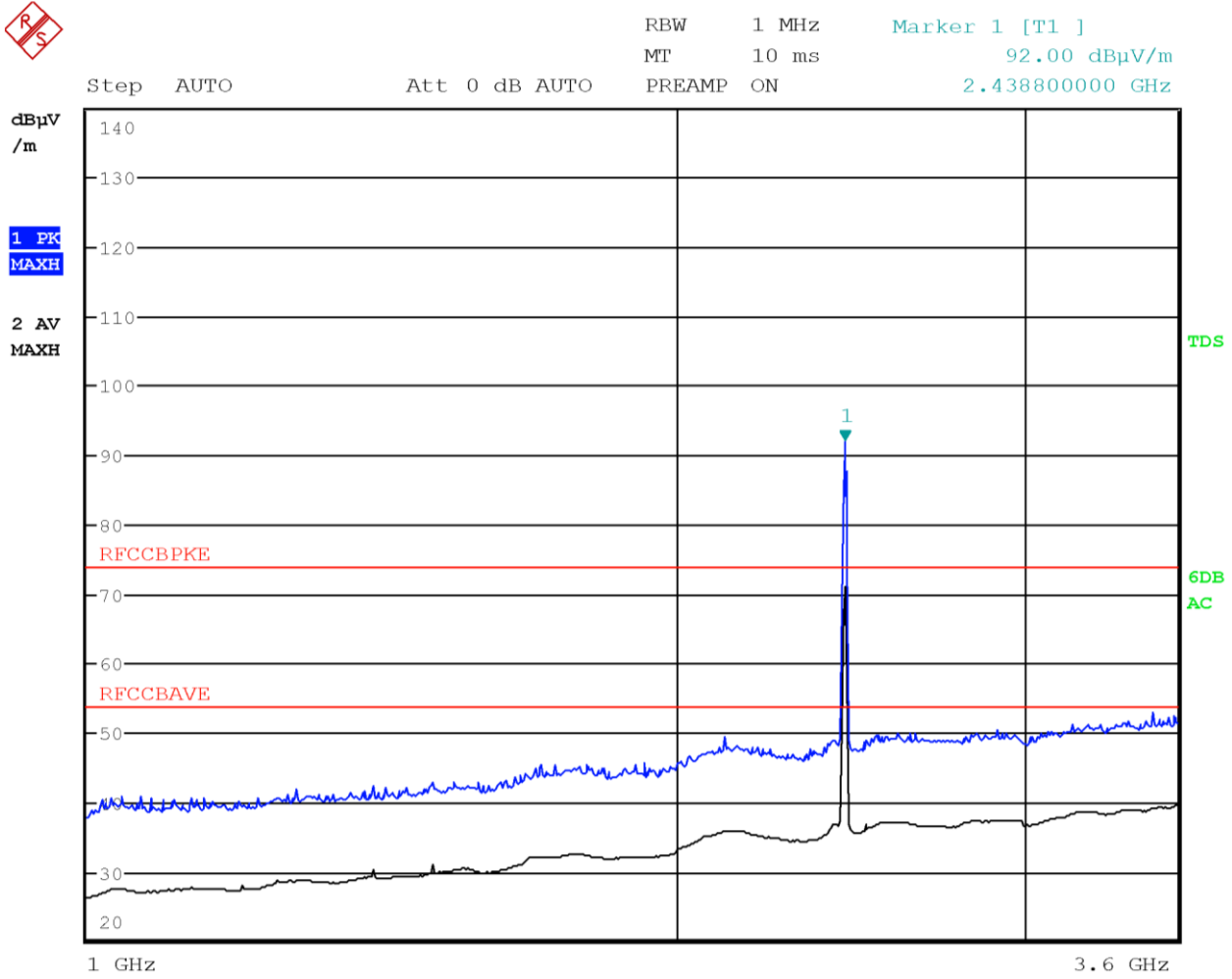


Figure 7.1-19: Radiated spurious emissions with WCDMA at 832.6 MHz and WIFI at 2437 MHz – antenna in horizontal polarization

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 |
|-----------------|----------------|----------------|-------------|----------|
| 1130.0000       | 27.7           | 54.0           | -26.3       | Av       |
| 1374.8000       | 29.0           | 54.0           | -25.0       | Av       |
| 1500.0000       | 31.0           | 54.0           | -23.0       | Av       |
| 1782.8000       | 32.6           | 54.0           | -21.4       | Av       |
| 2133.2000       | 35.9           | 54.0           | -18.1       | Av       |
| 2986.8000       | 37.4           | 54.0           | -16.6       | Av       |
| 3596.4000       | 39.6           | 54.0           | -14.4       | Av       |

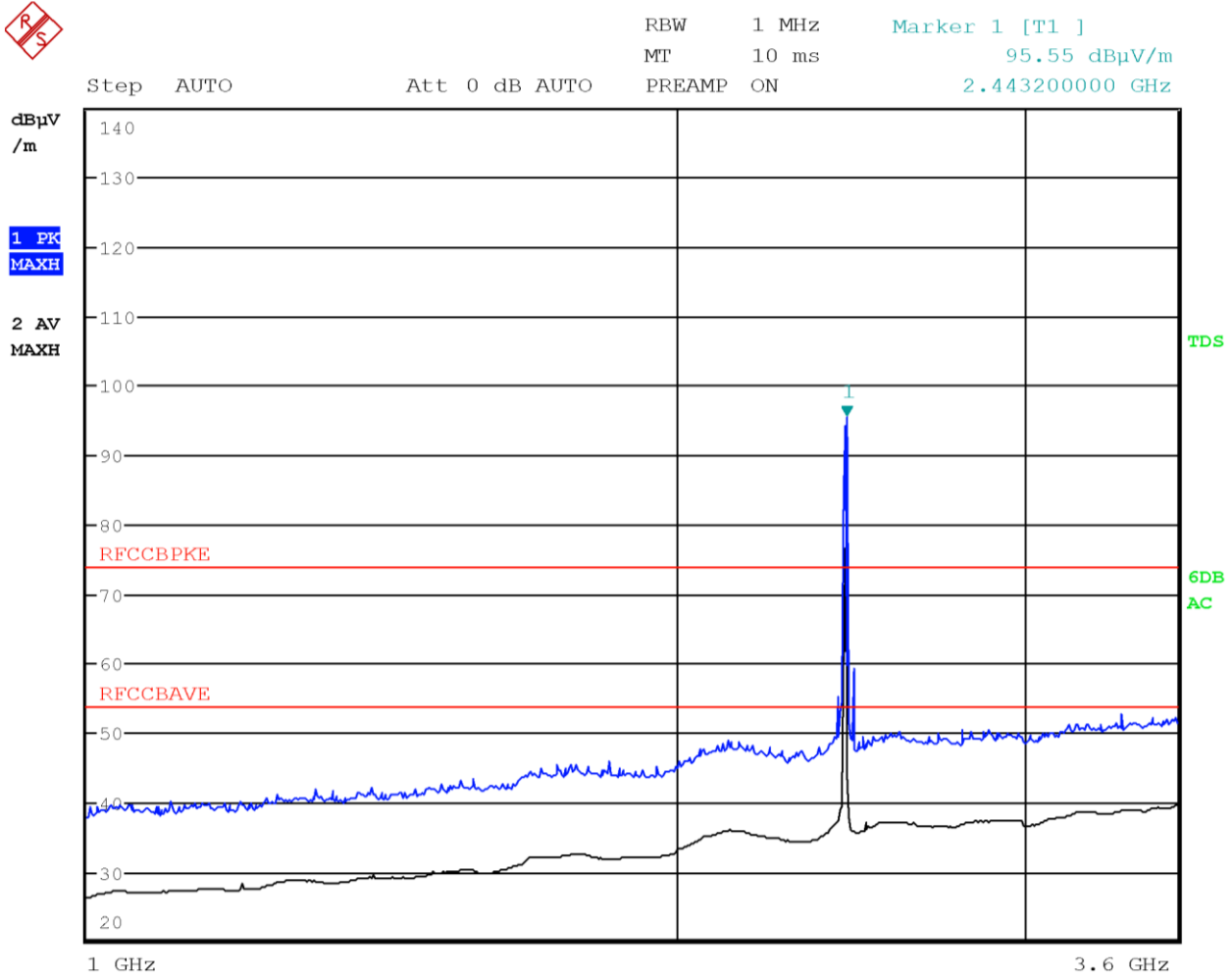


Figure 7.1-20: Radiated spurious emissions with WCDMA at 832.6 MHz and WIFI at 2437 MHz – antenna in vertical polarization

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 |
|-----------------|----------------|----------------|-------------|----------|
| 1157.6000       | 27.6           | 54.0           | -26.4       | Av       |
| 1374.8000       | 28.9           | 54.0           | -25.1       | Av       |
| 1557.2000       | 30.3           | 54.0           | -23.7       | Av       |
| 1776.0000       | 32.6           | 54.0           | -21.4       | Av       |
| 2986.4000       | 37.4           | 54.0           | -16.6       | Av       |
| 3599.6000       | 39.5           | 54.0           | -14.5       | Av       |

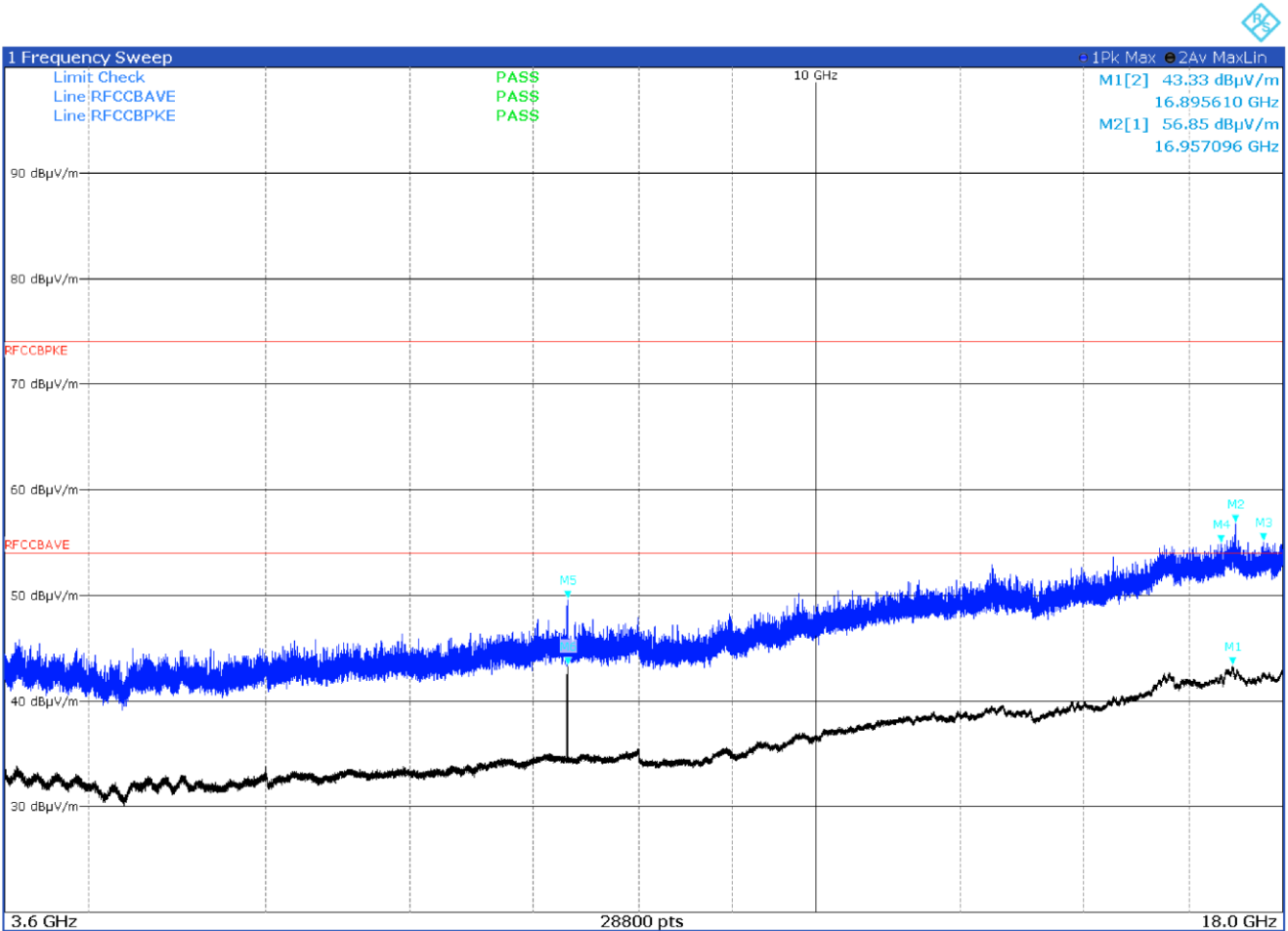


Figure 7.1-21: Radiated spurious emissions with WCDMA at 832.6 MHz and WIFI at 2437 MHz – antenna in horizontal polarization

| Frequency (GHz) | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Detector |
|-----------------|----------------|----------------|-------------|----------|
| 16.8956         | 43.4           | 54             | -10.6       | Av       |
| 16.9570         | 56.9           | 74             | -17.1       | Pk       |
| 17.5647         | 55.1           | 74             | -18.9       | Pk       |
| 16.6546         | 54.9           | 74             | -19.1       | Pk       |
| 7.3108          | 49.6           | 74             | -24.4       | Pk       |
| 7.3108          | 43.4           | 54             | -10.6       | Av       |

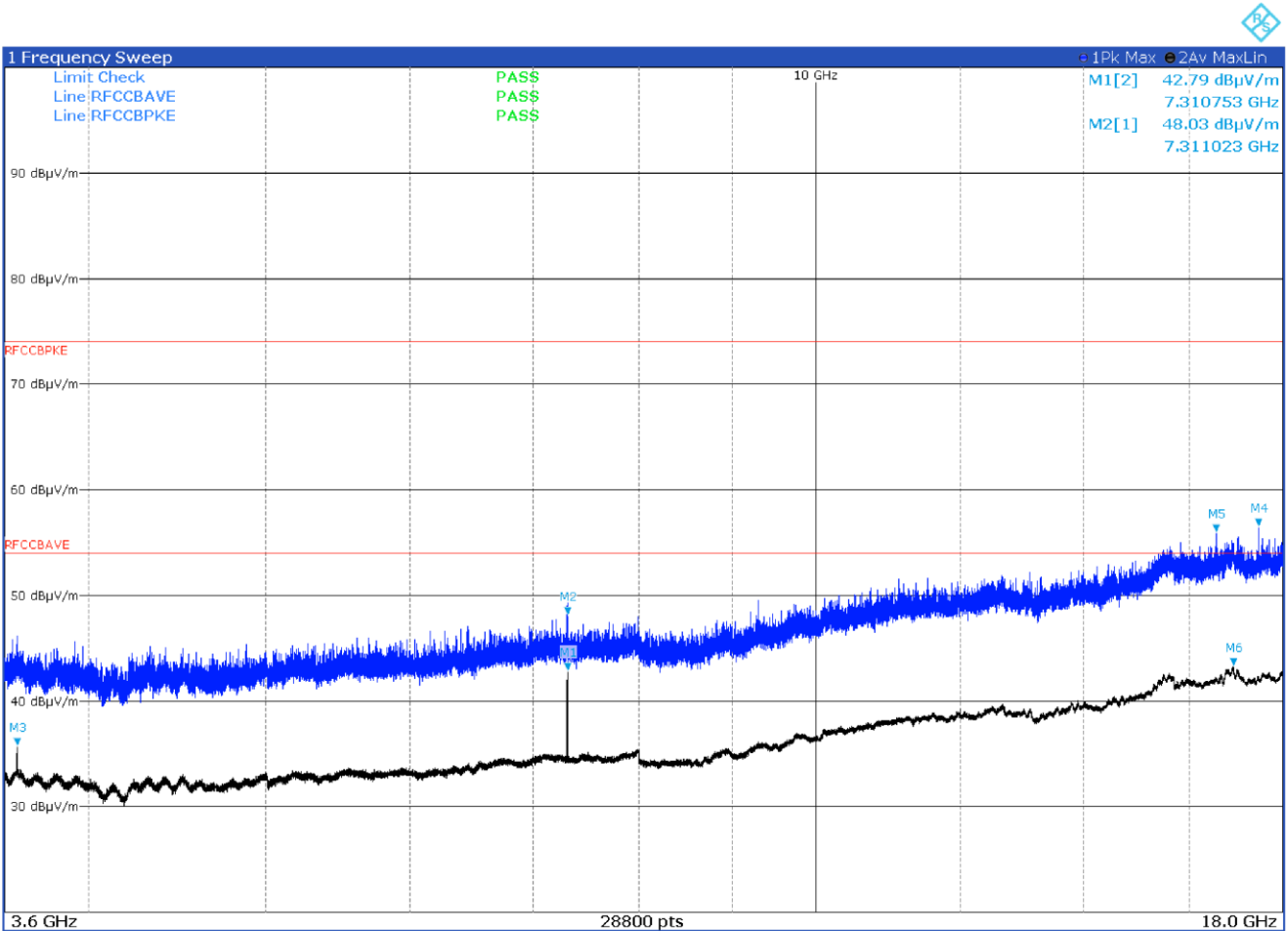


Figure 7.1-22: Radiated spurious emissions with WCDMA at 832.6 MHz and WIFI at 2437 MHz – antenna in vertical polarization

| Frequency (GHz) | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Detector |
|-----------------|----------------|----------------|-------------|----------|
| 7.3107          | 42.8           | 54             | -11.2       | Av       |
| 7.3110          | 48.1           | 74             | -25.9       | Pk       |
| 3.6552          | 35.7           | 54             | -18.3       | Av       |
| 17.4658         | 56.5           | 74             | -17.5       | Pk       |
| 16.5655         | 55.9           | 74             | -18.1       | Pk       |
| 16.9126         | 43.2           | 54             | -10.8       | Av       |

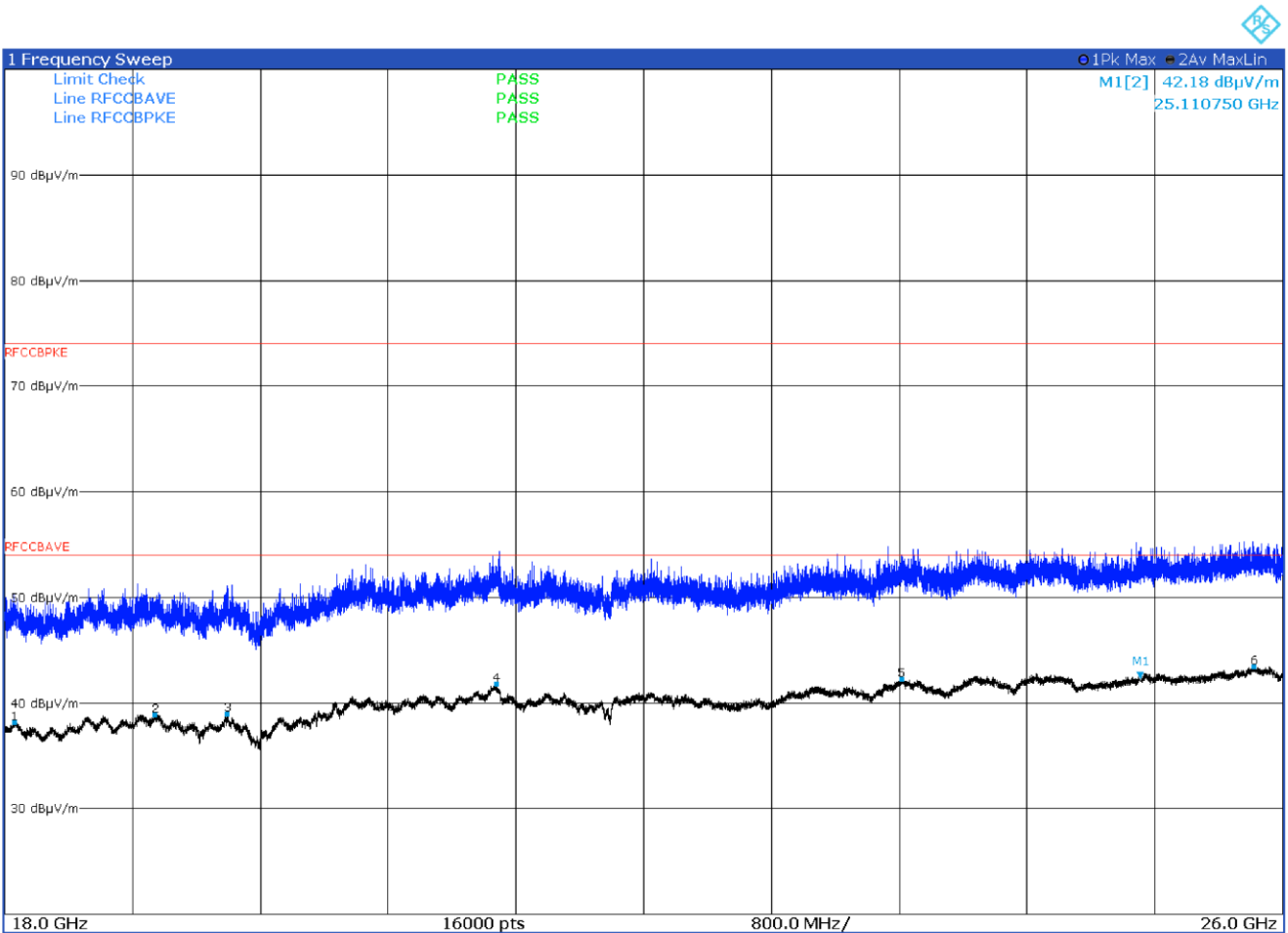


Figure 7.1-23: Radiated spurious emissions with WCDMA at 832.6 MHz and WIFI at 2437 MHz – antenna in horizontal polarization

| Frequency (GHz) | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Detector |
|-----------------|----------------|----------------|-------------|----------|
| 18.0622         | 38.2           | 54             | -15.8       | Av       |
| 18.9402         | 38.9           | 54             | -15.1       | Av       |
| 19.3922         | 39.1           | 54             | -14.9       | Av       |
| 21.0777         | 41.7           | 54             | -12.3       | Av       |
| 23.6132         | 42.2           | 54             | -11.8       | Av       |
| 25.8212         | 43.4           | 54             | -10.6       | Av       |

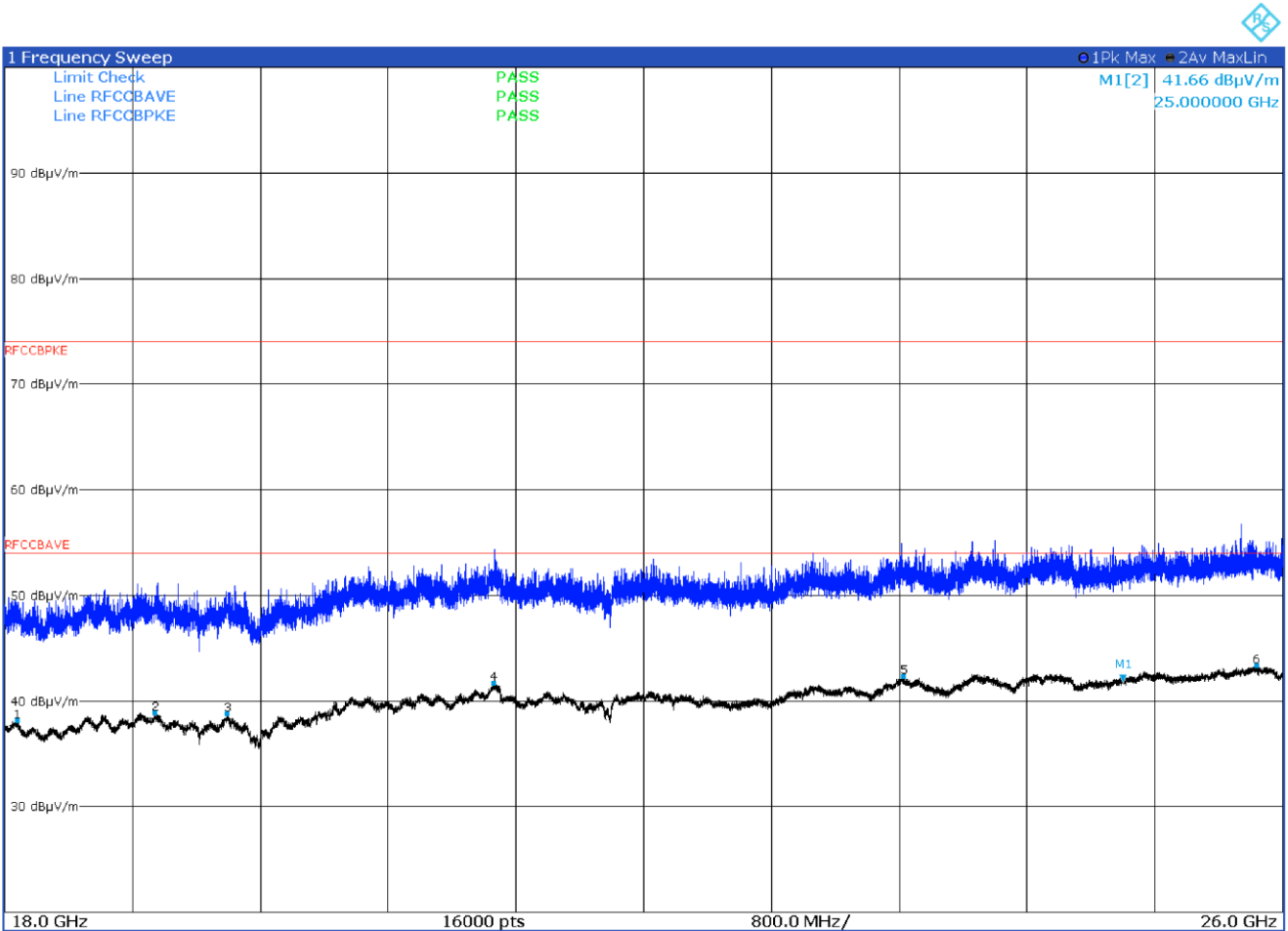
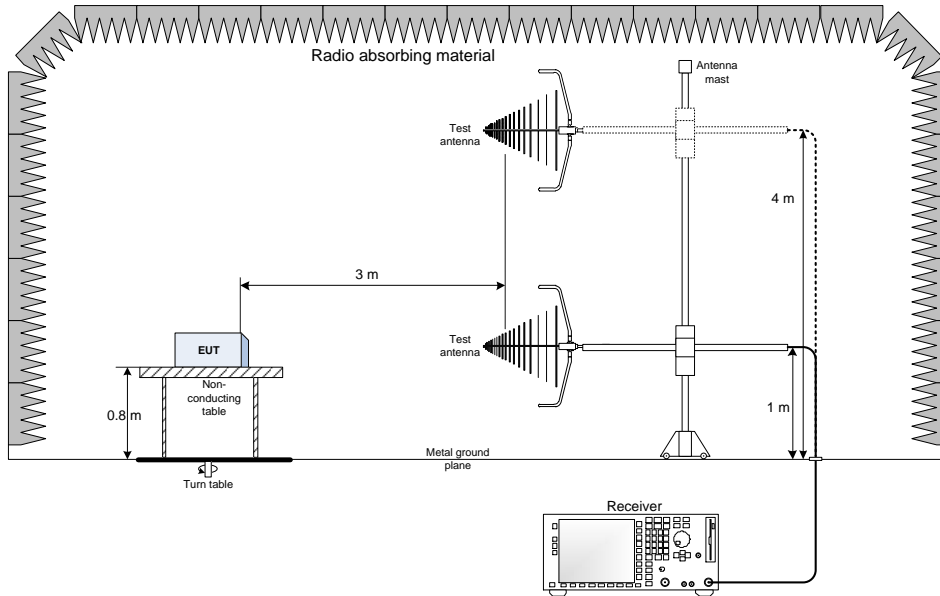


Figure 7.1-24: Radiated spurious emissions with WCDMA at 832.6 MHz and WIFI at 2437 MHz – antenna in vertical polarization

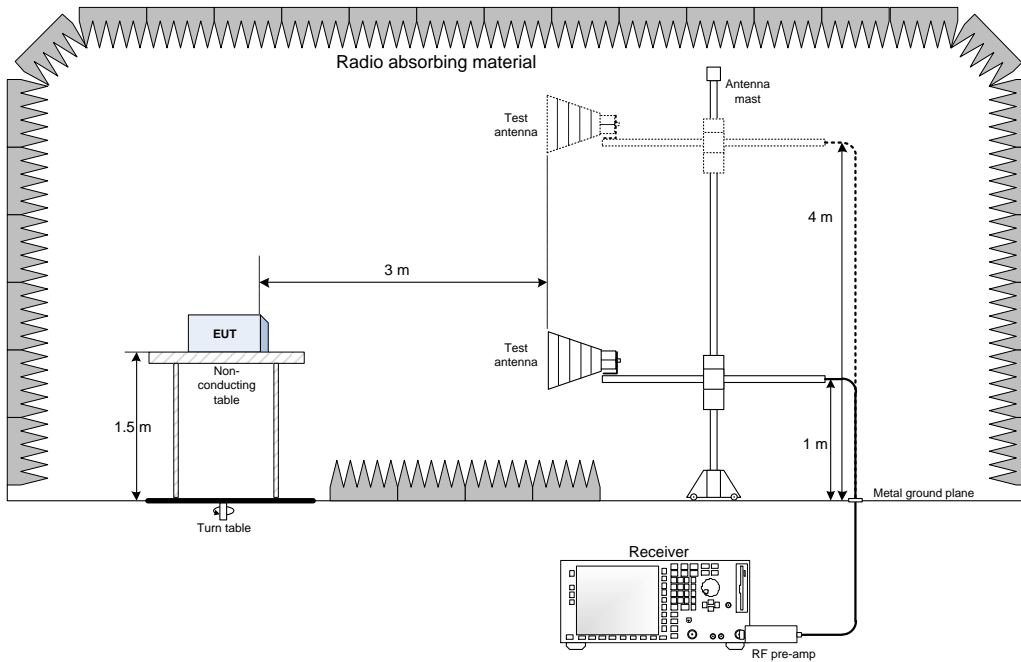
| Frequency (GHz) | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Detector |
|-----------------|----------------|----------------|-------------|----------|
| 18.0792         | 38.1           | 54             | -15.9       | Av       |
| 18.9402         | 38.9           | 54             | -15.1       | Av       |
| 19.3932         | 38.8           | 54             | -15.2       | Av       |
| 21.0622         | 41.7           | 54             | -12.3       | Av       |
| 23.6292         | 42.3           | 54             | -11.7       | Av       |
| 25.8347         | 42.3           | 54             | -11.7       | Av       |

## Section 8. Block diagrams of test set-ups

### 8.1 Radiated emissions set-up for frequencies below 1 GHz



### 8.2 Radiated emissions set-up for frequencies above 1 GHz

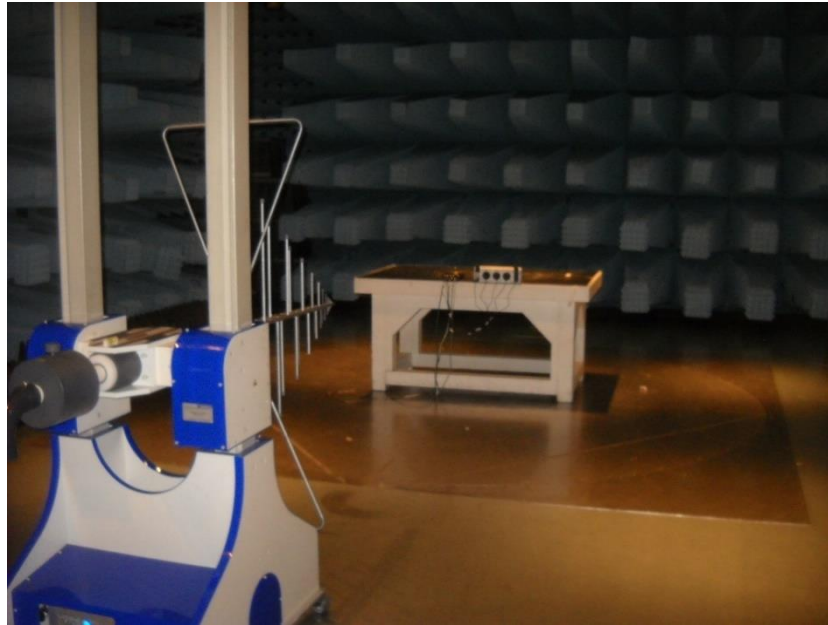


## Section 9. Photos

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### 9.1 Photos of the test set-up

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Radiated emission below 1 GHz



Radiated emission above 1 GHz



### 9.2 Photos of the EUT

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(End of report)