

# Test Report

|                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|
| <b>Product</b>                                                                                                                                                                                                                                                                                                                                                                                                            | Floor Standing Indoor Home Monitoring Camera with WiFi                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |  |
| <b>Name and address of the applicant</b>                                                                                                                                                                                                                                                                                                                                                                                  | Panasonic Corporation of North America<br>Two Riverfront Plaza, 9 <sup>th</sup> Floor<br>Newark, NJ 07102-5490, USA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |  |  |
| <b>Name and address of the manufacturer</b>                                                                                                                                                                                                                                                                                                                                                                               | Same as above                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |  |
| <b>Model</b>                                                                                                                                                                                                                                                                                                                                                                                                              | KX-HNC850<br>KX-HNC855C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |  |  |
| <b>Rating</b>                                                                                                                                                                                                                                                                                                                                                                                                             | Mains (120 V <sub>AC</sub> 60 Hz)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |
| <b>Trademark</b>                                                                                                                                                                                                                                                                                                                                                                                                          | Panasonic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |  |  |
| <b>Serial number</b>                                                                                                                                                                                                                                                                                                                                                                                                      | /                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |
| <b>Additional information</b>                                                                                                                                                                                                                                                                                                                                                                                             | WiFi, 802.11a/b/g/n                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |  |  |
| <b>Tested according to</b>                                                                                                                                                                                                                                                                                                                                                                                                | <b>FCC Part 15.247</b><br>Frequency Hopping Transmitters / Digital Transmission Systems<br><b>Industry Canada RSS-247, Issue 2</b><br>Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSs) and<br>Licence-Exempt Local Area Network (LE-LAN) Devices                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |  |
| <b>Order number</b>                                                                                                                                                                                                                                                                                                                                                                                                       | 367960                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |  |
| <b>Tested in period</b>                                                                                                                                                                                                                                                                                                                                                                                                   | 2018-11-26 to 2019-01-31                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |  |
| <b>Issue date</b>                                                                                                                                                                                                                                                                                                                                                                                                         | 2019-03-12                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |  |
| <b>Name and address of the testing laboratory</b>                                                                                                                                                                                                                                                                                                                                                                         | <div style="display: flex; justify-content: space-between; align-items: flex-start;"> <div style="text-align: center;"> <br/> Instituttveien 6<br/> Kjeller, Norway<br/> www.nemko.com </div> <div style="text-align: center;"> CAB Number:<br/> FCC: NO0001<br/> ISED: NO0470<br/><br/> TEL: +47 22 96 03 30<br/> FAX: +47 22 96 05 50 </div> <div style="text-align: center;"> <br/> ilac-MRA </div> <div style="text-align: center;"> <br/> NORWEGIAN<br/> ACCREDITATION<br/> TEST 033 </div> </div> <p style="text-align: center; color: red; font-weight: bold;">An accredited technical test executed under the Norwegian accreditation scheme</p> |  |  |
| <div style="display: flex; justify-content: space-around; align-items: flex-end;"> <div style="text-align: center;"> <br/> Prepared by [Frode Sveisen] </div> <div style="text-align: center;"> <br/> Approved by [G. Suhanthakumar] </div> </div> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |  |
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## 1 INFORMATION

### 1.1 Test Item

|                                         |                                                                                      |
|-----------------------------------------|--------------------------------------------------------------------------------------|
| <b>Name</b>                             | Panasonic                                                                            |
| <b>Model/version</b>                    | KX-HNC850 (US model)<br>KX-HNC855C (Canada model)                                    |
| <b>FCC ID</b>                           | ACJ96NKX-HNC850                                                                      |
| <b>ISED ID</b>                          | 216A-KXHC855                                                                         |
| <b>Serial number</b>                    | /                                                                                    |
| <b>Hardware identity and/or version</b> | N/A                                                                                  |
| <b>Software identity and/or version</b> | N/A                                                                                  |
| <b>Frequency Range</b>                  | 2412 – 2462 MHz                                                                      |
| <b>Number of Channels</b>               | 11                                                                                   |
| <b>Channel Separation</b>               | 5 MHz                                                                                |
| <b>Operating Modes</b>                  | 802.11b/g/n (HT20)                                                                   |
| <b>Type of Modulation</b>               | Digital (DSSS, OFDM)                                                                 |
| <b>User Frequency Adjustment</b>        | None                                                                                 |
| <b>Conducted Output Power</b>           | 0.092 W                                                                              |
| <b>Type of Power Supply</b>             | AC Adaptor Model PNLV252<br>(Input: 120V 60Hz 350mA, Output: 12V <sub>DC</sub> 1.0A) |
| <b>Antenna Connector</b>                | None (Integral antenna)                                                              |
| <b>Number of Antennas</b>               | 1                                                                                    |
| <b>Antenna Diversity</b>                | No                                                                                   |
| <b>Smart Antennas or MIMO</b>           | No                                                                                   |

### Description of Test Item

The tested device is an Floor Standing Indoor Home Monitoring Camera with WiFi connection.

The KX-HNC850 is identical to the KX-HNC810 (FCC ID: ACJ96NKX-HNC810) except for the voltage regulator circuitry, and the KX-HNC850 is a floor standing model that also includes a LED lamp. The Output Power in the 2.4GHz band is also reduced on the KX-HNC810.

All Antenna Conducted tests were performed on a KX-HNC810. Radiated Emissions and Power Line Conducted Emissions were tested on both models. All tests were tested with the correct Output Power for KX-HNC850.

The models KX-HNC850 and KX-HNC855C are identical.

### 1.2 Normal test condition

|                      |             |
|----------------------|-------------|
| Temperature:         | 20 - 24 °C  |
| Relative humidity:   | 20 - 50 %   |
| Normal test voltage: | 120 V 60 Hz |

The values are the limits registered during the test period.

### 1.3 Test Engineer(s)

Frode Sveinsen

### 1.4 Description of modification for Modification Filing

Not applicable.

### 1.5 Family List Rational

Not Applicable.

### 1.6 Antenna Requirement

Is the antenna detachable?

☐ Yes ☒ No

If detachable, is the antenna connector non-standard?

☐ Yes ☐ No

Type of antenna connector: N/A

Ref. FCC §15.203

### 1.7 Worst-Case Configuration and Mode

Radiated Emissions and Power Line Conducted Emissions were performed with the EUT set to transmit at the channel with the highest output power as worst-case scenario.

The worst case data rates were:

802.11b mode : 1 Mbps  
802.11g mode : 6 Mbps  
802.11n HT20 : MCS0

### 1.8 Comments

The measurements were done with the EUT powered by 120 V AC. It was checked that power variations between 85% and 115% did not have any influence on the measurements.

All ports were populated during spurious emission measurements.

## 2 TEST REPORT SUMMARY

### 2.1 General

All measurements are traceable to national standards.

The tests were conducted for demonstrating compliance with FCC CFR 47 Part 15, paragraph 15.247 and ISSED RSS-247 Issue 2 and RSS-GEN Issue 5.

Tests were performed in accordance with ANSI C63.4-2014 and ANSI C63.10-2013.

Radiated tests were performed in a semi-anechoic chamber at measuring distances of 1m and 3m.

A description of the test facility is on file with the FCC and ISSED.

☒ New Submission

☒ Production Unit

☐ Class II Permissive Change

☐ Pre-production Unit

**DTS** Equipment Code

☐ Family Listing



#### **THIS TEST REPORT APPLIES ONLY TO THE ITEM(S) AND CONFIGURATIONS TESTED.**

Deviations from, additions to, or exclusions from the test specifications are described in "Summary of Test Data".

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## 2.2 Test Summary

| Name of test                           | FCC Part 15 reference               | RSS-247 Issue 2, RSS-GEN Issue 5 reference      | Result   |
|----------------------------------------|-------------------------------------|-------------------------------------------------|----------|
| Supply Voltage Variations              | 15.31(e)                            | 6.11 (RSS-GEN)                                  | Complies |
| Antenna Requirement                    | 15.203                              | 6.8 (RSS-GEN)                                   | Complies |
| Power Line Conducted Emission          | 15.107(a)<br>15.207(a)              | 7.2 / 8.8 (RSS-GEN)                             | Complies |
| Occupied Bandwidth                     | N/A                                 | 6.7 (RSS-GEN)                                   | Complies |
| Minimum 6 dB Bandwidth                 | 15.247(a)(2)                        | 5.2 (1) (RSS-247)                               | Complies |
| Peak Power Output                      | 15.247(b)                           | 5.4 (RSS-247)                                   | Complies |
| Power Spectral Density                 | 15.247(d)                           | 5.2 (2) (RSS-247)                               | Complies |
| Spurious Emissions (Antenna Conducted) | 15.247(c)                           | 5.5 (RSS-247)                                   | Complies |
| Spurious Emissions (Radiated)          | 15.247(c)<br>15.109(a)<br>15.209(a) | 5.5 (RSS-247)<br>7.3 (RSS-GEN)<br>8.9 (RSS-GEN) | Complies |

## Revision history

| Version | Date       | Comment                   | Sign |
|---------|------------|---------------------------|------|
| 1.0     | 2019-02-12 | First edition             | FS   |
| 1.1     | 2019-02-26 | Updated with Antenna Gain | FS   |
| 1.2     | 2019-03-12 | Updated after TCB review  | FS   |
|         |            |                           |      |

### 3 TEST RESULTS

#### 3.1 Power Line Conducted Emissions

FCC Part 15.207

ISED RSS-GEN Issue 5, Clause 7.2 / 8.8

Measurement procedure: ANSI C63.4-2014 using 50  $\mu$ H/50 ohms LISN

Test Results: Complies

Measurement Data: See attached plots

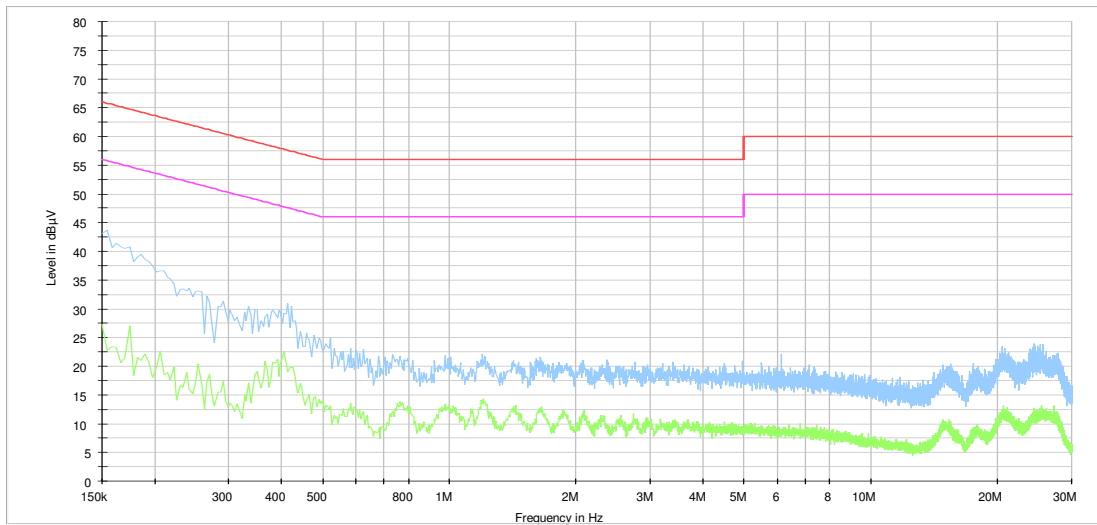
Highest measured value (L1 and N):

110V 60Hz, Camera in Standby: None found

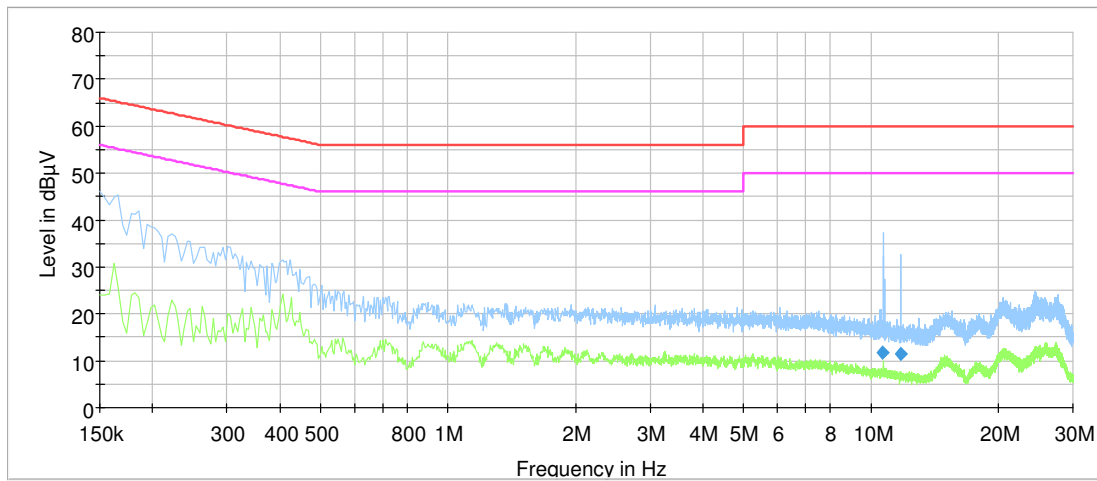
110V 60Hz, Camera Active:

| Frequency<br>(MHz) | QuasiPeak<br>(dB $\mu$ V) | Average<br>(dB $\mu$ V) | Limit<br>(dB $\mu$ V) | Margin<br>(dB) | Meas. Time<br>(ms) | Bandwidth<br>(kHz) | Line | Filter |
|--------------------|---------------------------|-------------------------|-----------------------|----------------|--------------------|--------------------|------|--------|
| 10.648             | 11.82                     | ---                     | 60.00                 | 48.18          | 1000               | 9                  | N    | OFF    |
| 11.772             | 11.39                     | ---                     | 60.00                 | 48.61          | 1000               | 9                  | L1   | OFF    |

**110V 60Hz, Camera in Standby:**



**110V 60Hz, Camera Active:**



### 3.2 Occupied Bandwidth (99% BW)

FCC Part 15.247 (a)(1)(iii)

Test Results: Complies

Measurement Data:

Number of RF channels in use: 11

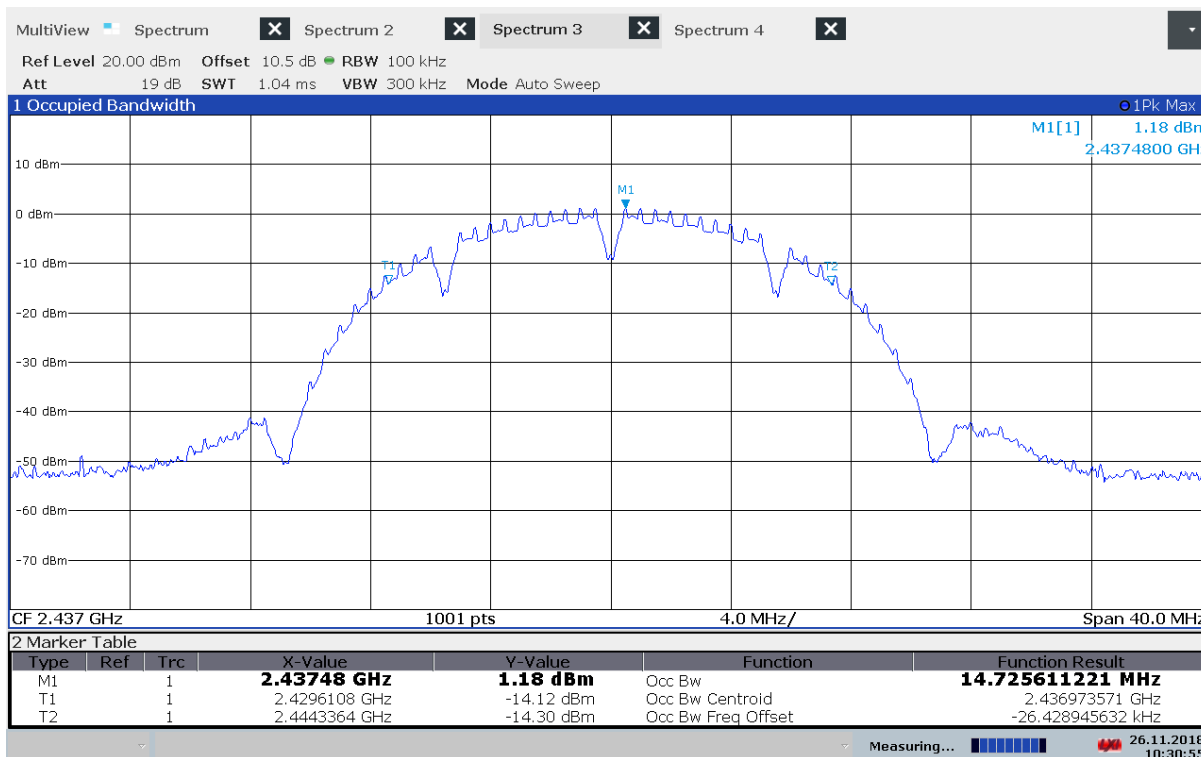
| Modulation type and bitrate | Occupied Bandwidth (99% BW) (MHz) |
|-----------------------------|-----------------------------------|
|                             | Ch 06, 2437 MHz                   |
| 802.11b, 1 Mbps             | 14.72                             |
| 802.11g, 6 Mbps             | 16.91                             |
| 802.11n, MCS0               | 17.54                             |

Occupied Bandwidth is reported for information only.

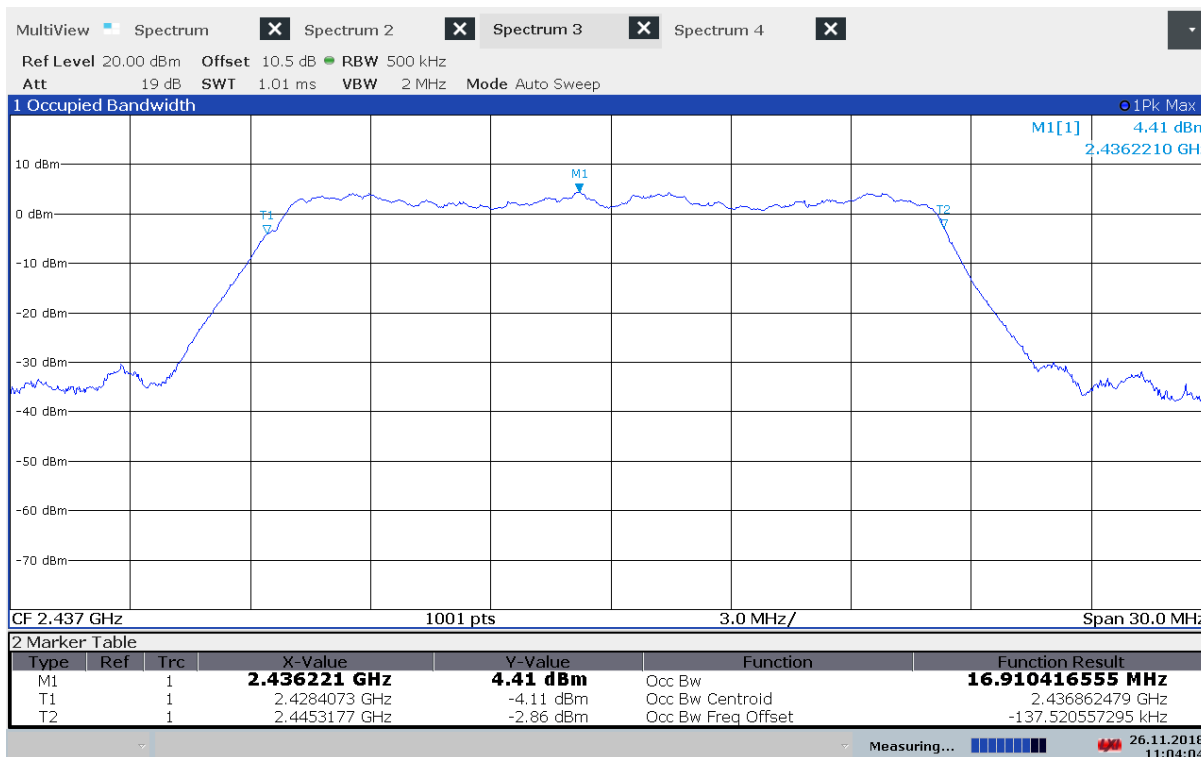
See attached plots

#### Requirements:

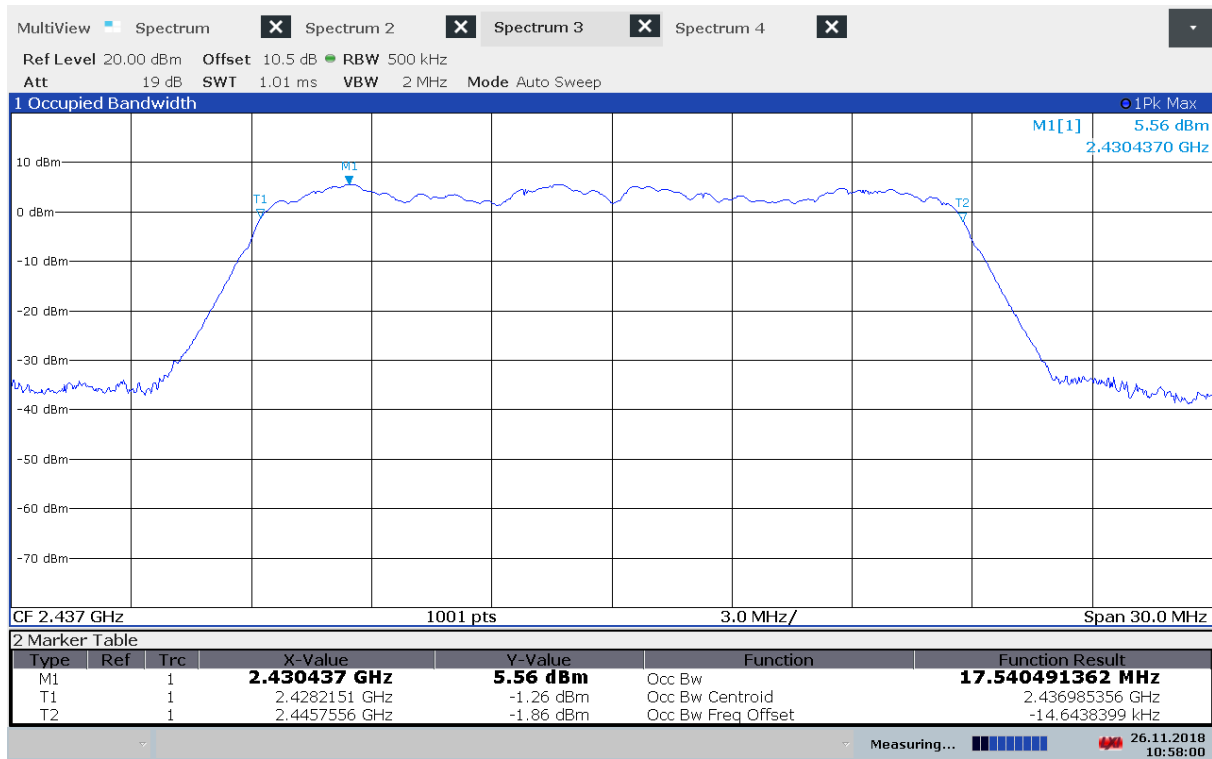
No requirements for Digital Transmission Systems.



Occupied Bandwidth, 2437 MHz, 802.11b, 1Mbps



Occupied Bandwidth, 2437 MHz, 802.11g, 6Mbps



Occupied Bandwidth, 2437 MHz, 802.11n, MCS0

### 3.3 Minimum 6 dB Bandwidth

FCC Part 15.247 (a)(2)

**Test Results: Complies**

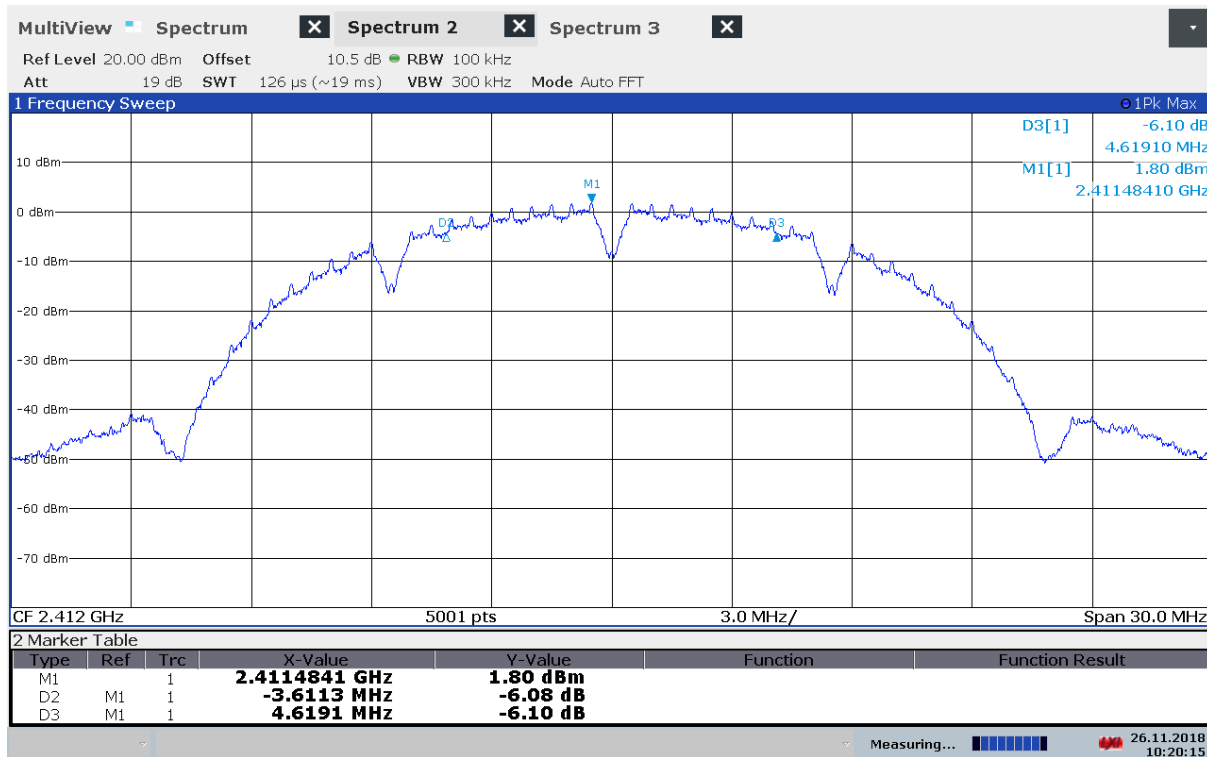
**Measurement Data:**

| Modulation type<br>and bitrate | Measured 6 dB Bandwidth |                 |                 |
|--------------------------------|-------------------------|-----------------|-----------------|
|                                | Ch 01, 2412 MHz         | Ch 06, 2437 MHz | Ch 11, 2462 MHz |
| 802.11b, 1 Mbps                | 8.23 MHz                | 8.38 MHz        | 8.33 MHz        |
| 802.11g, 6 Mbps                | 16.46 MHz               | 16.47 MHz       | 16.47 MHz       |
| 802.11n, MCS0                  | 17.38 MHz               | 17.39 MHz       | 17.27 MHz       |

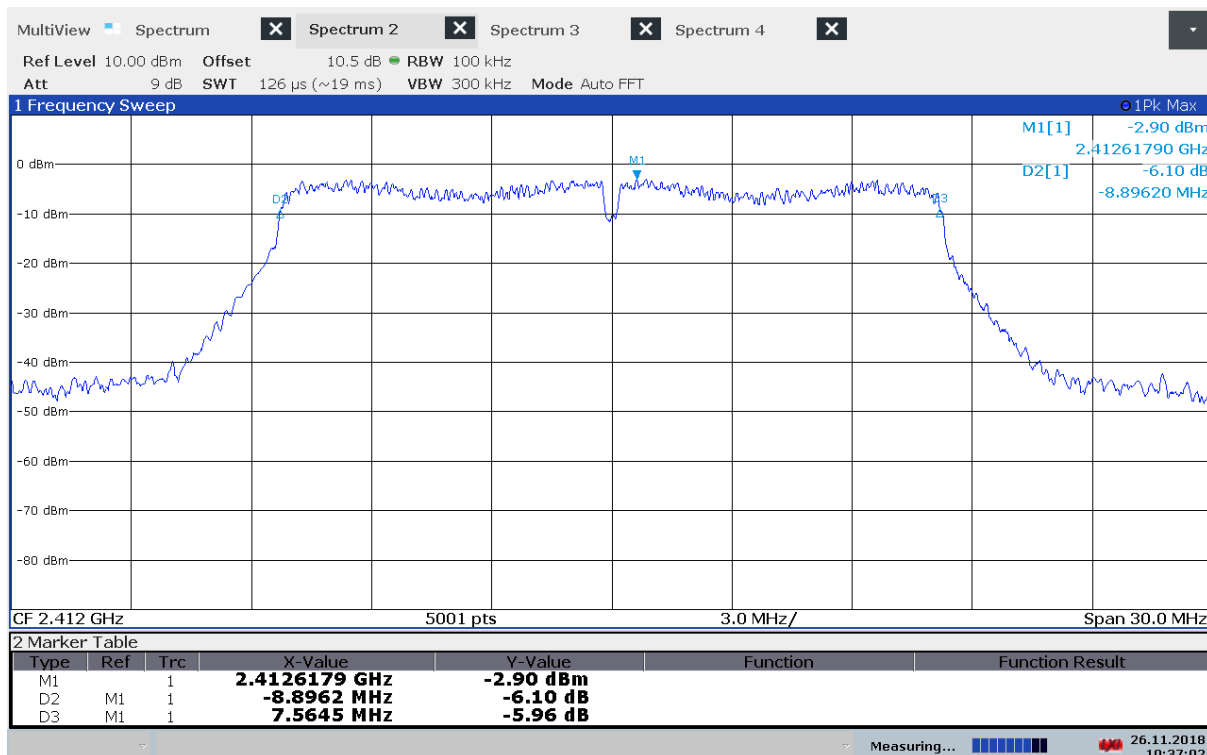
Power supply variation within 85 % to 115% of nominal value has no influence on measured value.

**Requirements:**

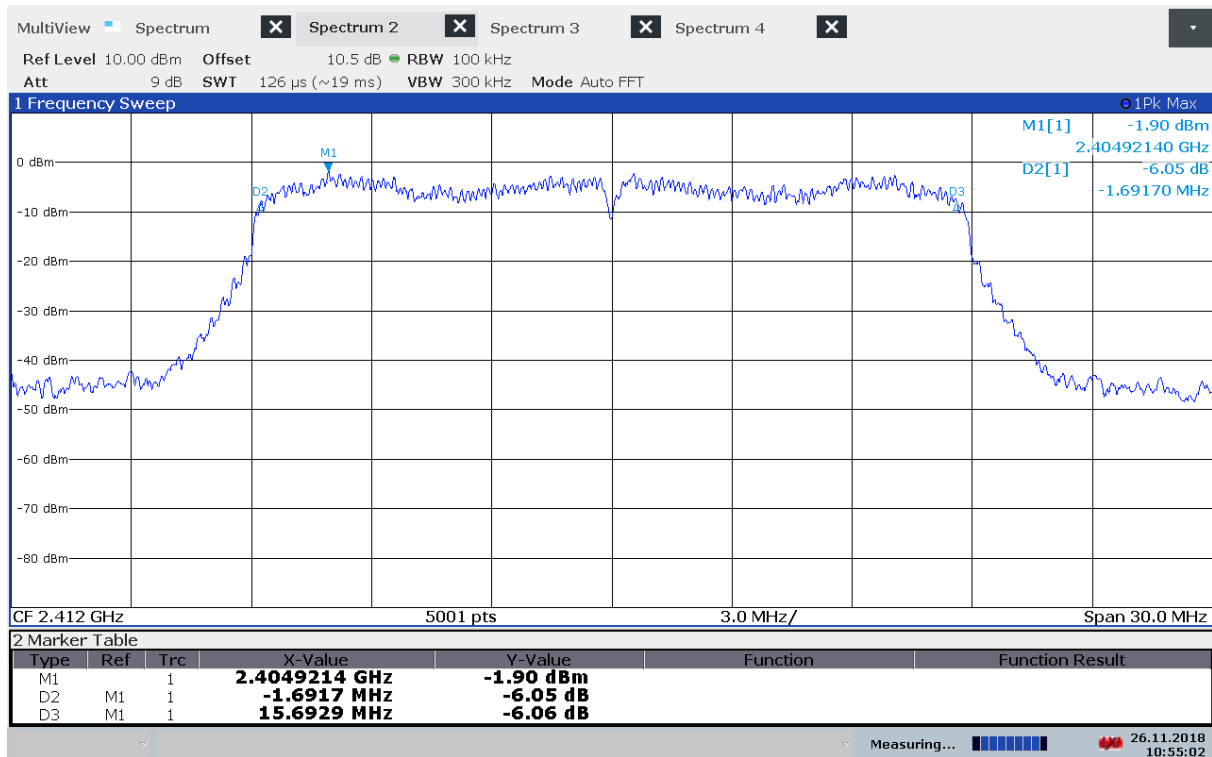
For Digital Transmission Systems in the 2400-2483.5 MHz band the minimum 6 dB bandwidth shall be at least 500 KHz.



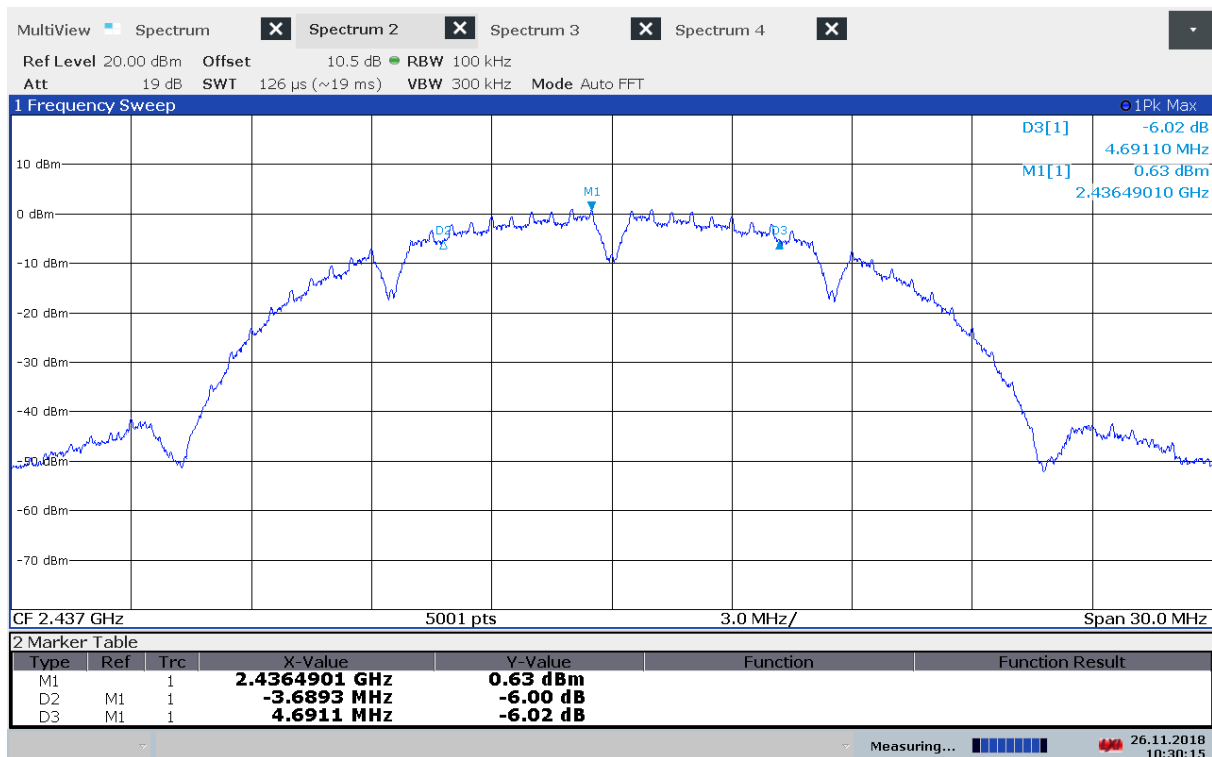
6 dB Bandwidth, 2412 MHz, 802.11b, 1Mbps



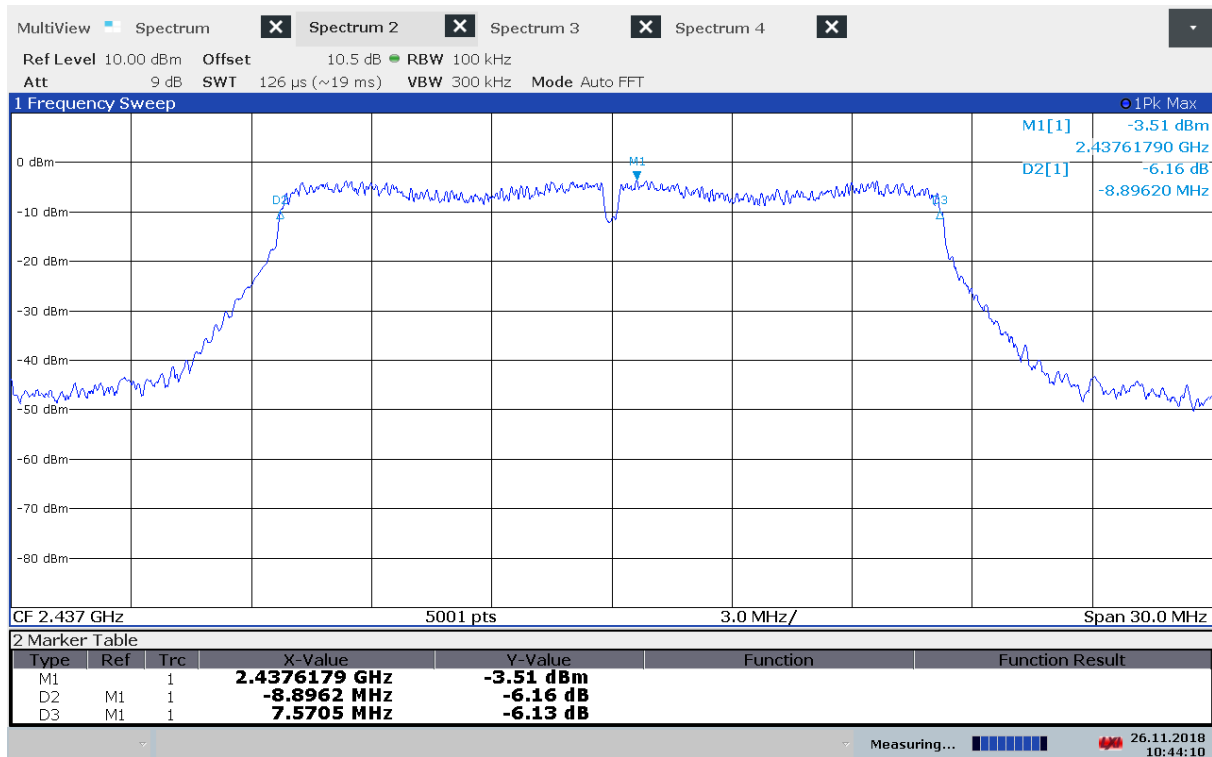
6 dB Bandwidth, 2412 MHz, 802.11g, 6Mbps



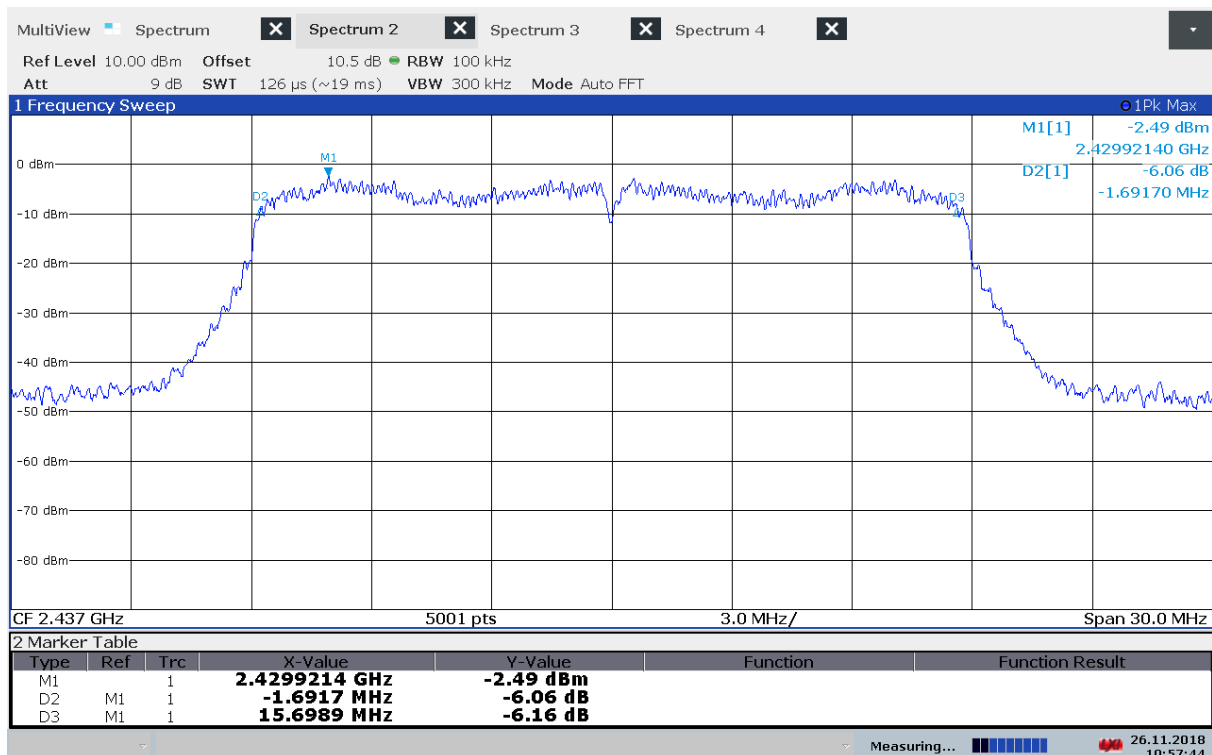
6 dB Bandwidth, 2412 MHz, 802.11n, MCS0



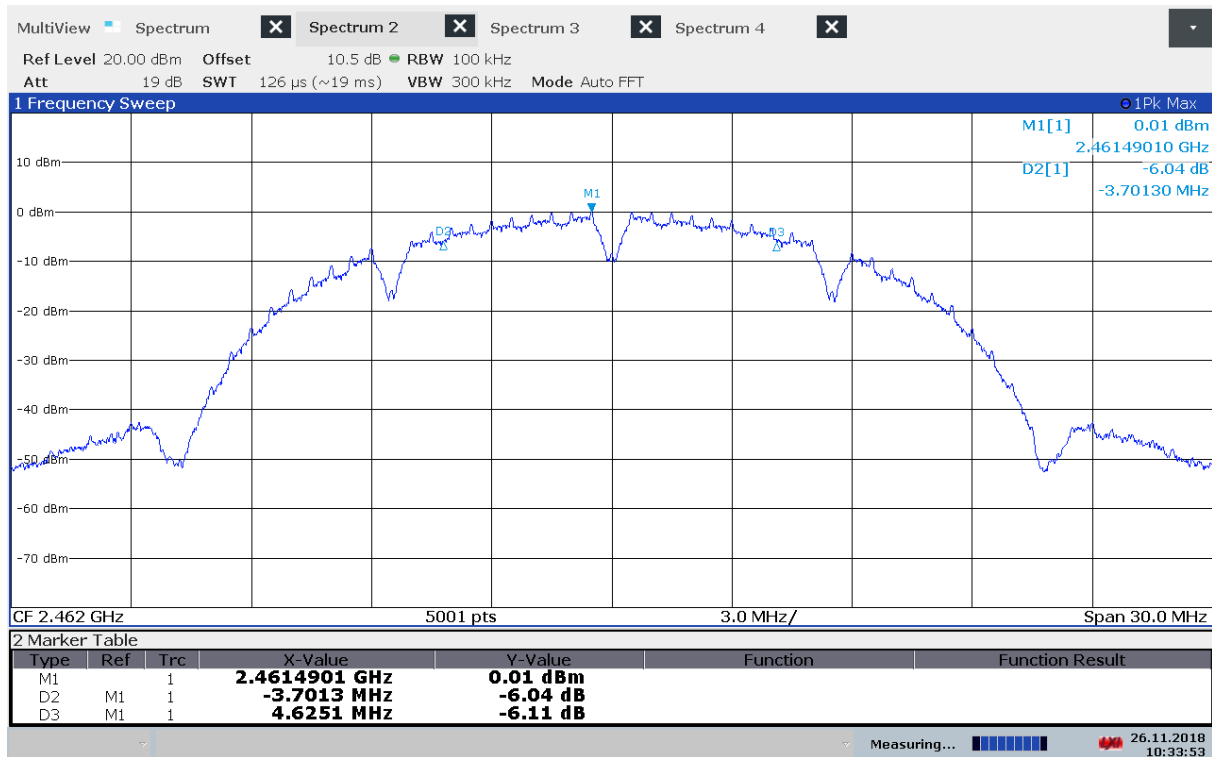
6 dB Bandwidth, 2437 MHz, 802.11b, 1Mbps



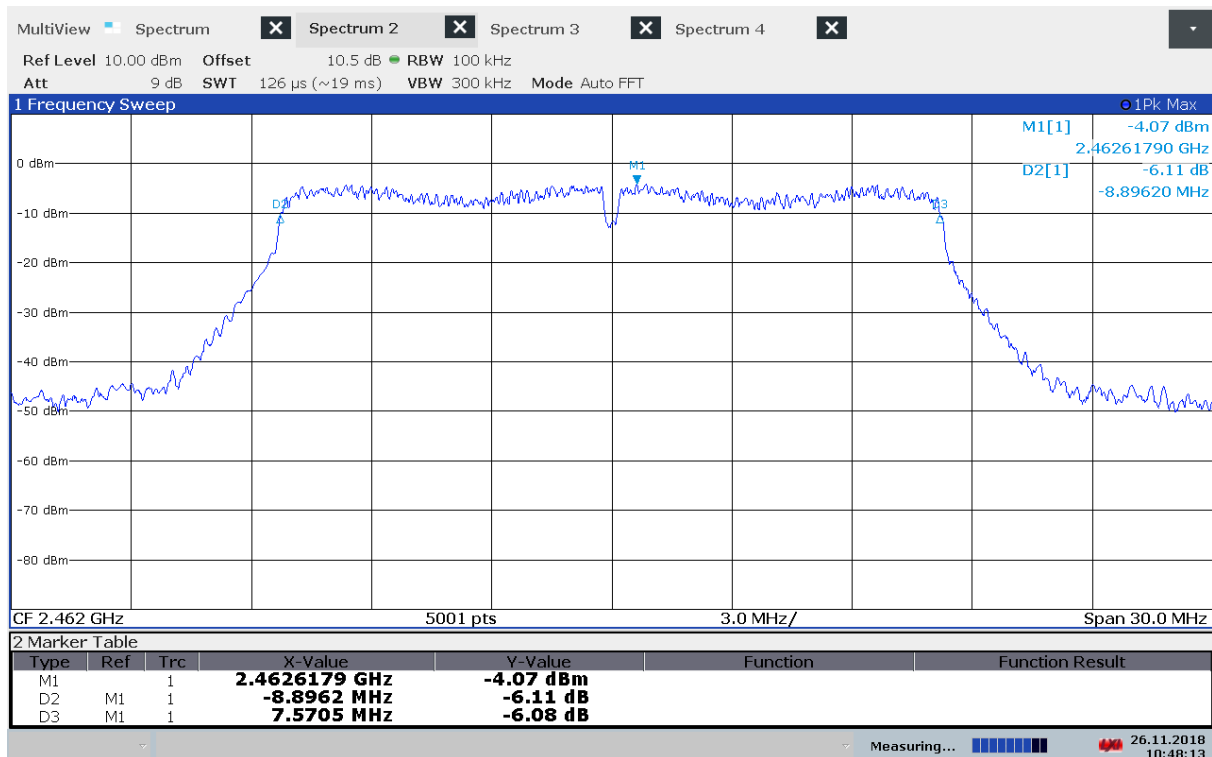
6 dB Bandwidth, 2437 MHz, 802.11g, 6Mbps



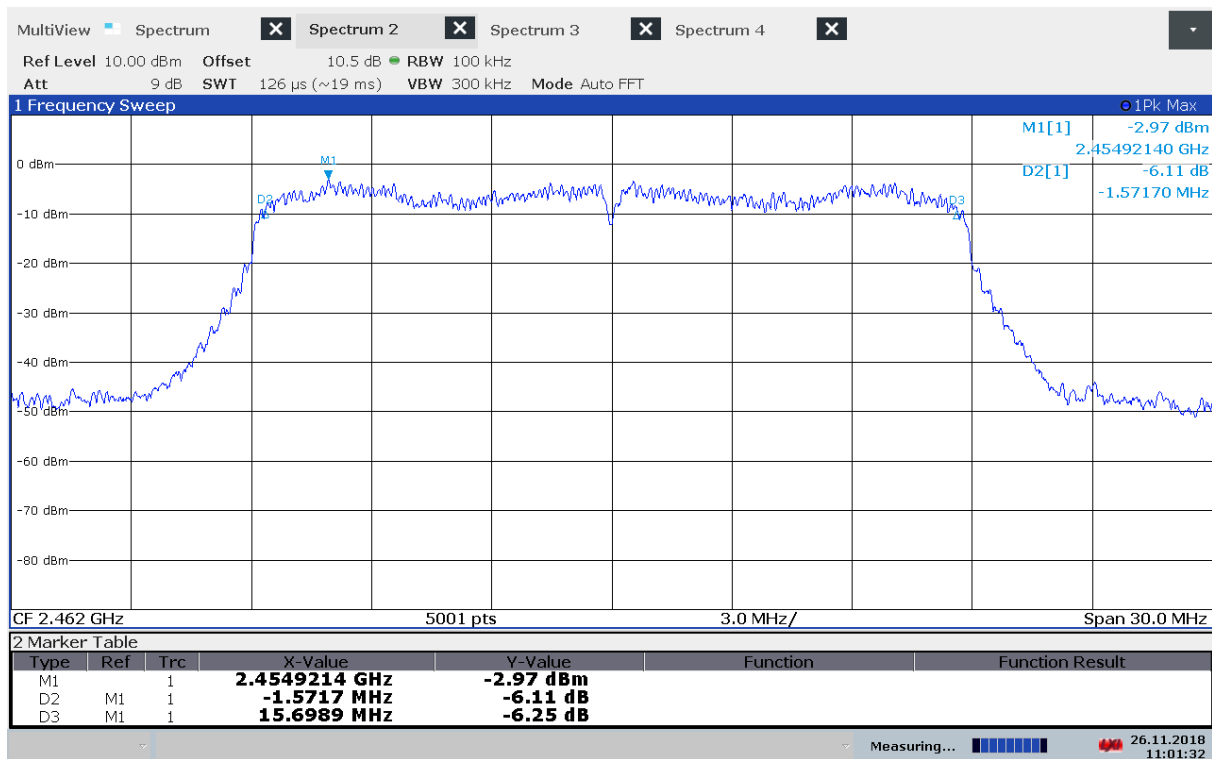
6 dB Bandwidth, 2437 MHz, 802.11n, MCS0



6 dB Bandwidth, 2462 MHz, 802.11b, 1Mbps



6 dB Bandwidth, 2462 MHz, 802.11g, 6Mbps



6 dB Bandwidth, 2462 MHz, 802.11n, MCS0

### 3.4 Peak Power Output

FCC Part 15.247 (b)

RSS-247 Issue 2, Clause 5.4

Test Results: Complies

#### Measurement Data:

| Carrier Frequency | Maximum Conducted Output Power (mW) |                |              | Declared Antenna Gain (dBi) | Verdict  |
|-------------------|-------------------------------------|----------------|--------------|-----------------------------|----------|
|                   | 802.11b 1 Mbps                      | 802.11g 6 Mbps | 802.11n MCS0 |                             |          |
| 2412 MHz          | 33.2                                | 78.2           | 92.0         | -2.0                        | Complies |
| 2437 MHz          | 28.8                                | 70.5           | 83.2         | -2.0                        | Complies |
| 2462 MHz          | 26.0                                | 64.1           | 72.6         | -2.0                        | Complies |

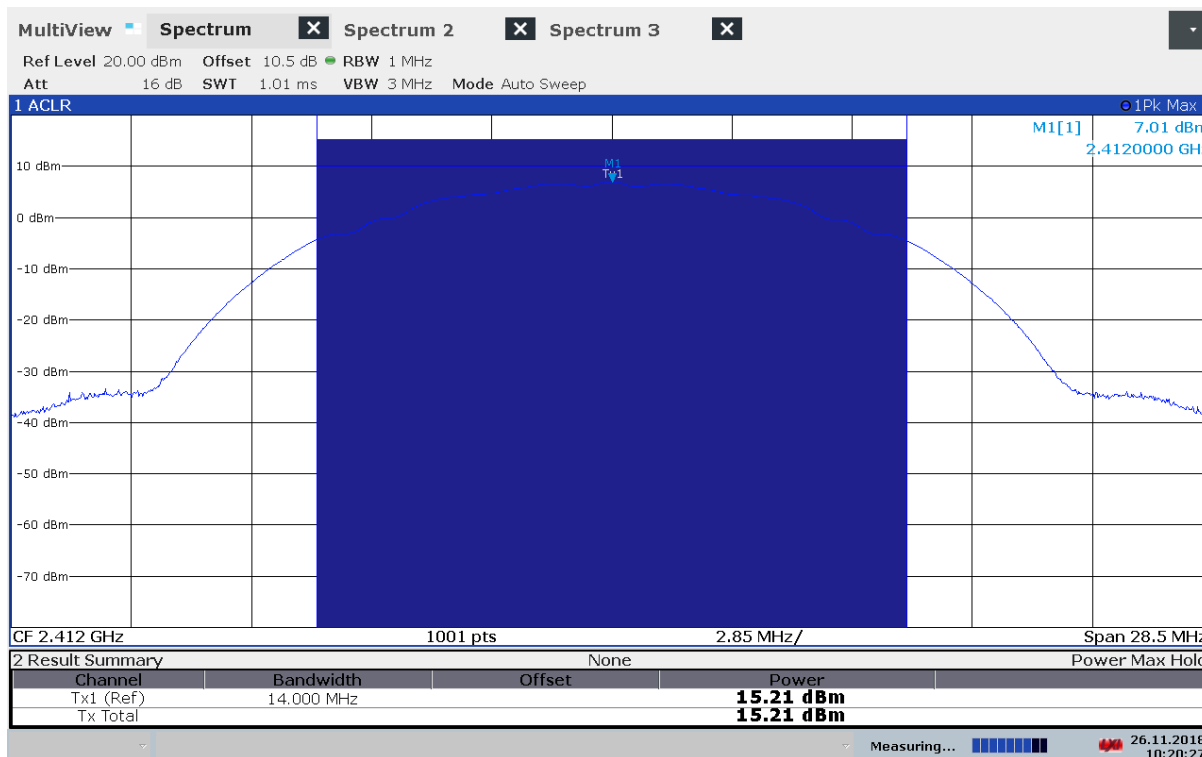
See attached plots

#### Requirements:

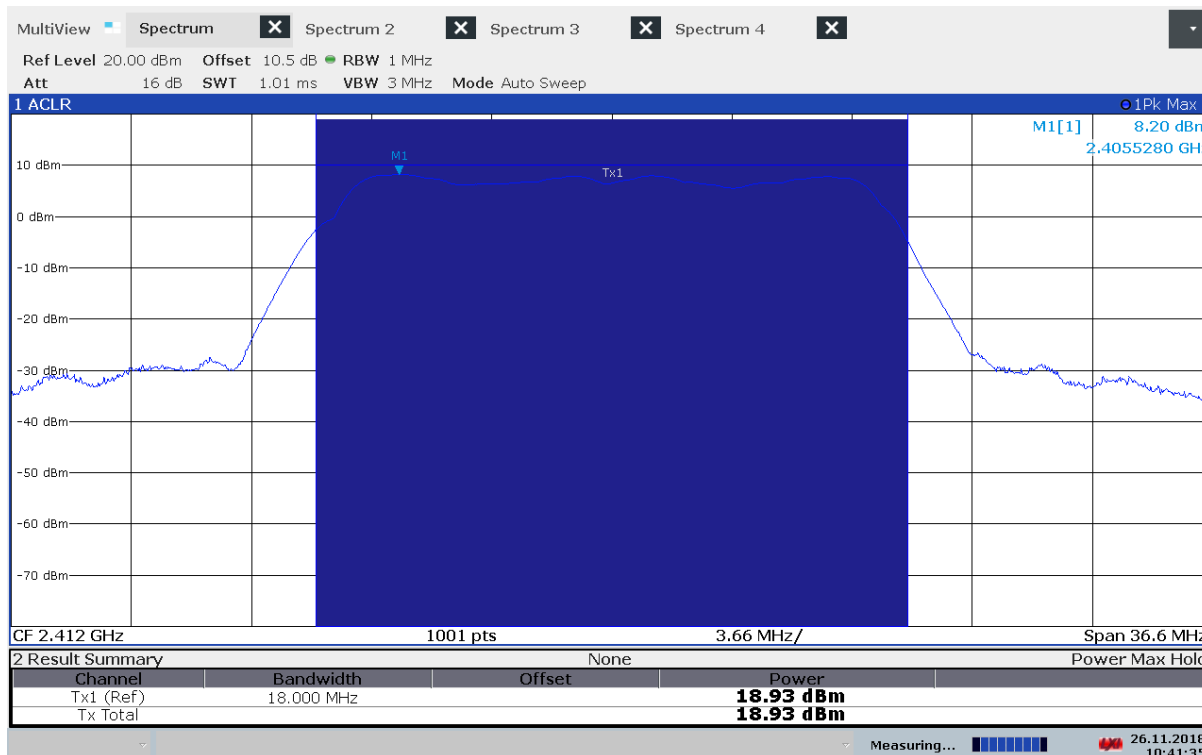
The maximum peak output power shall not exceed the following limits:

For Digital Transmission Systems in the 2400 - 2483.5 MHz band: 1 Watt

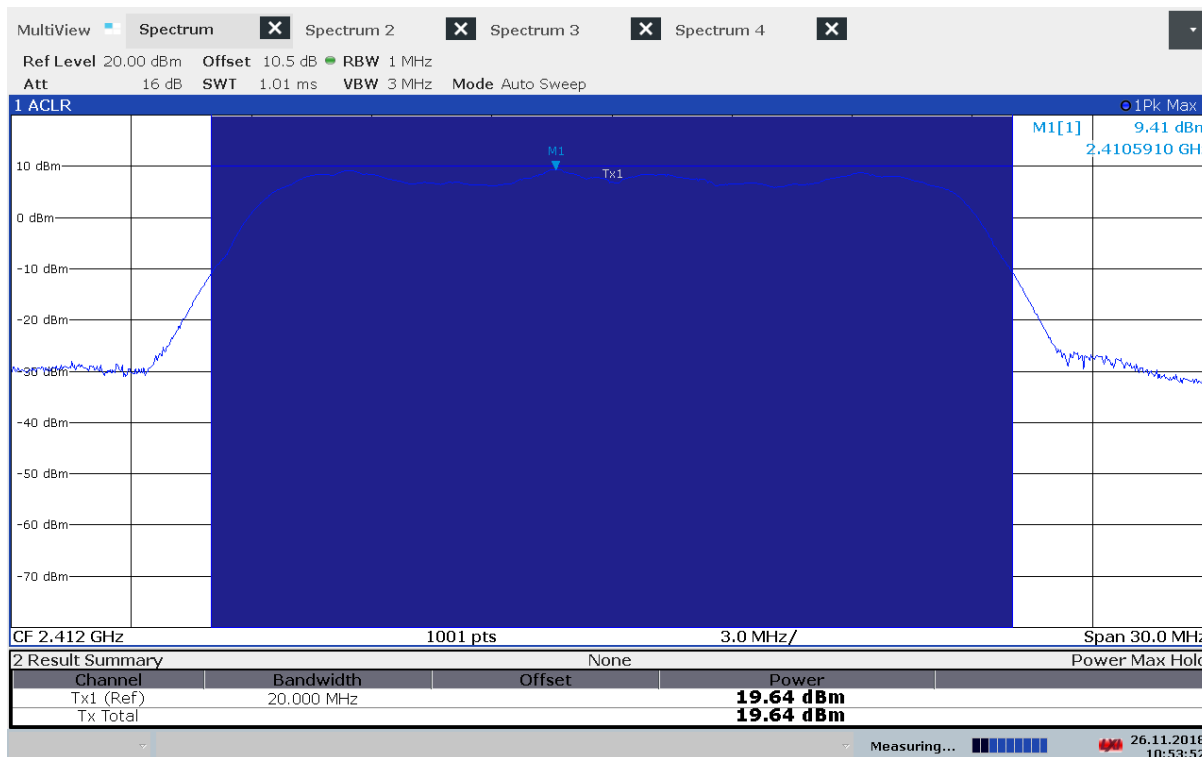
If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power from the intentional radiator shall be reduced below the stated value above by the amount in dB that the directional gain of the antenna exceeds 6 dBi.



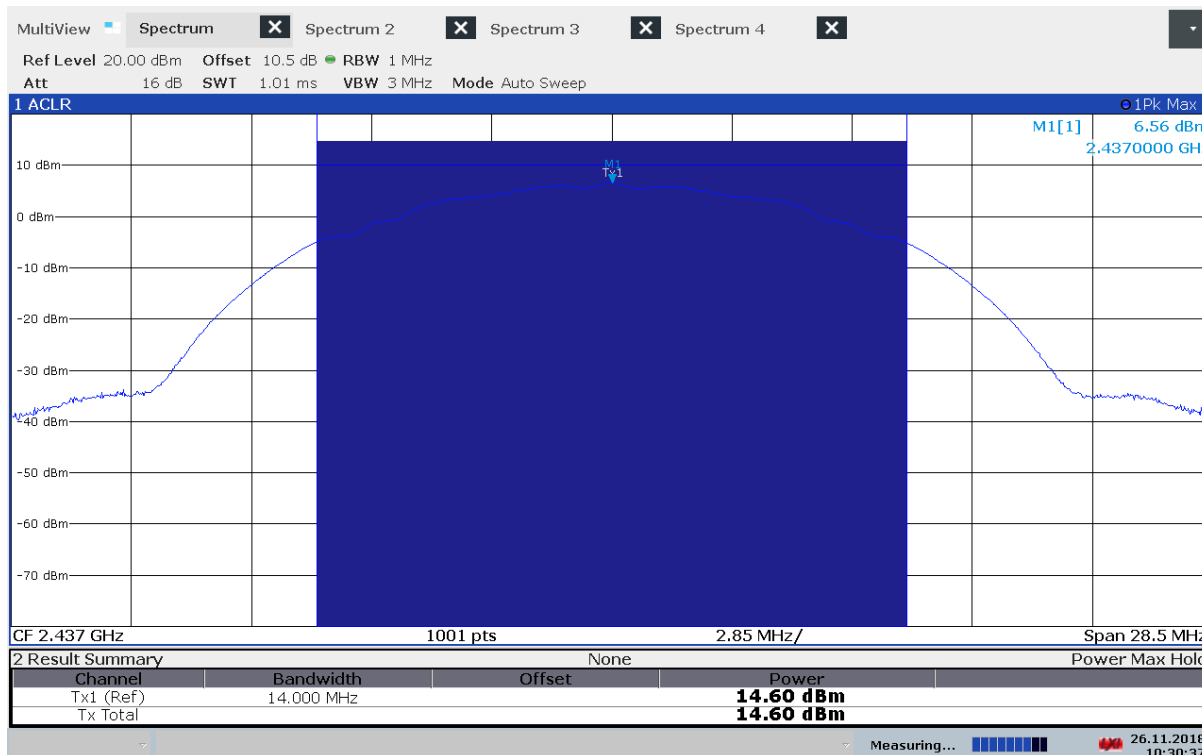
Conducted Output Power, 2412 MHz, 802.11b, 1Mbps



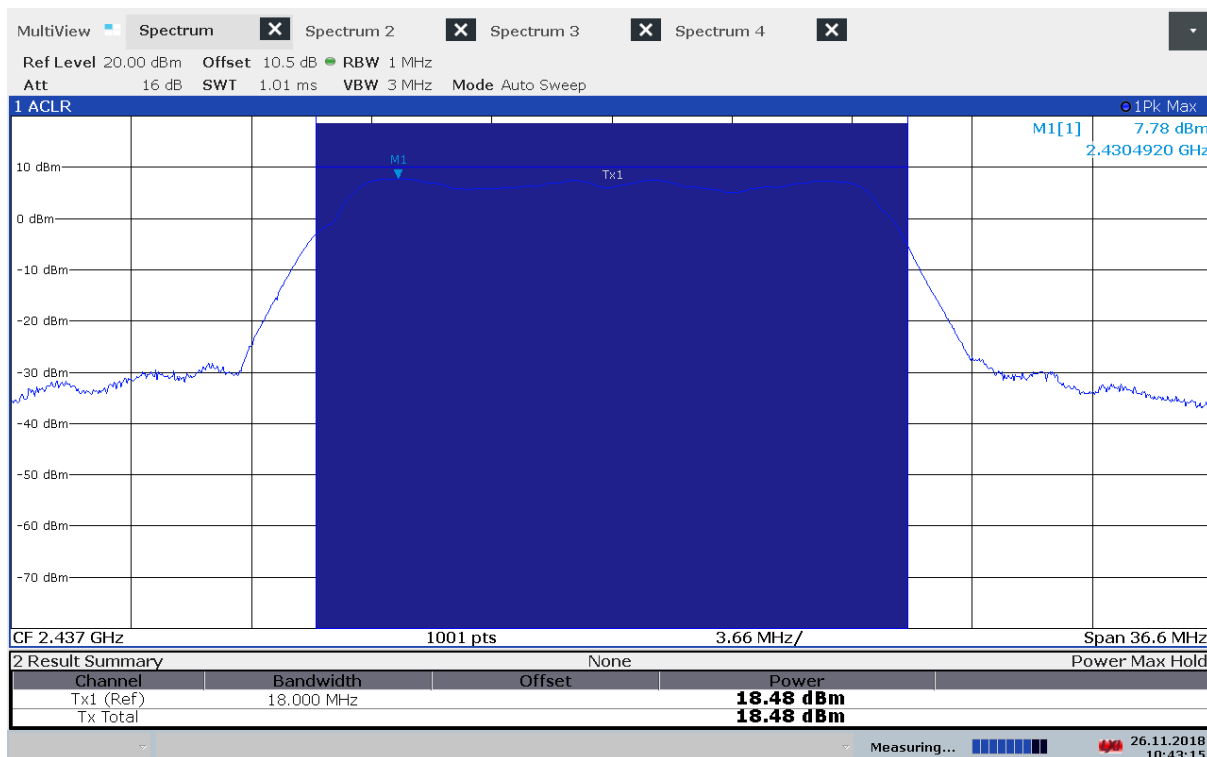
Conducted Output Power, 2412 MHz, 802.11g, 6Mbps



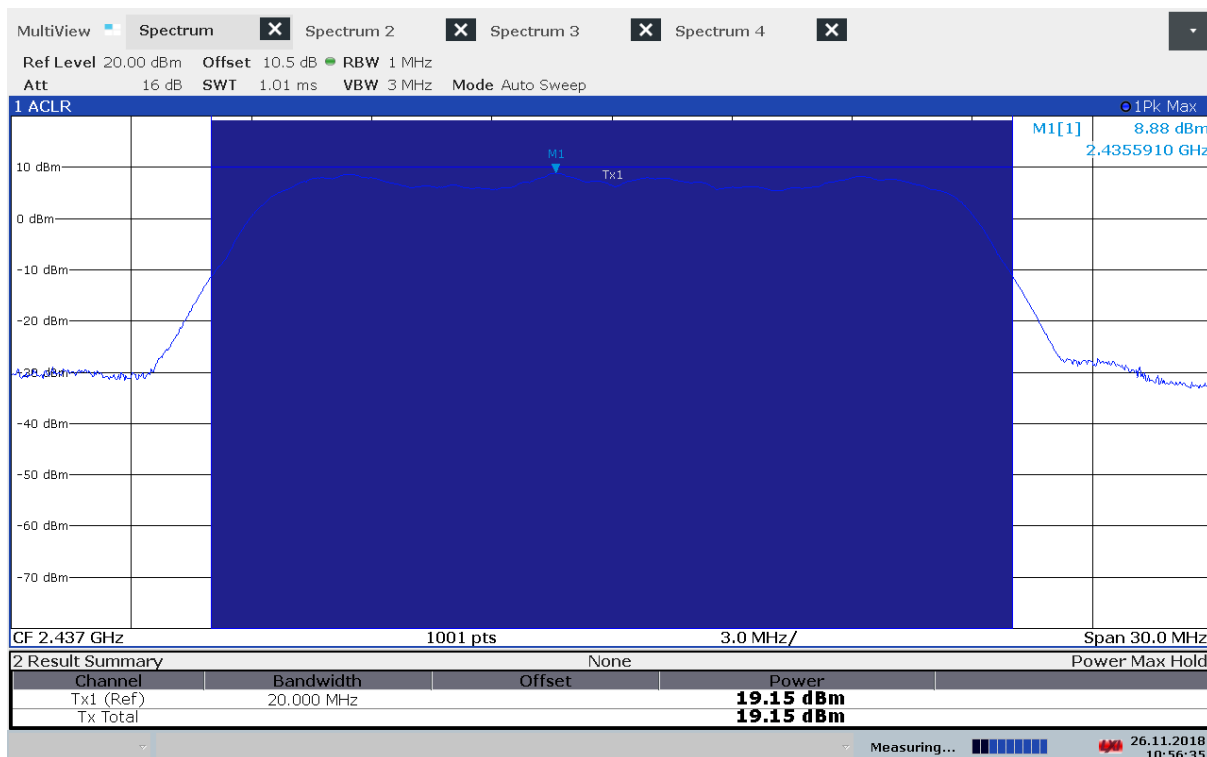
Conducted Output Power, 2412 MHz, 802.11n, MCS0



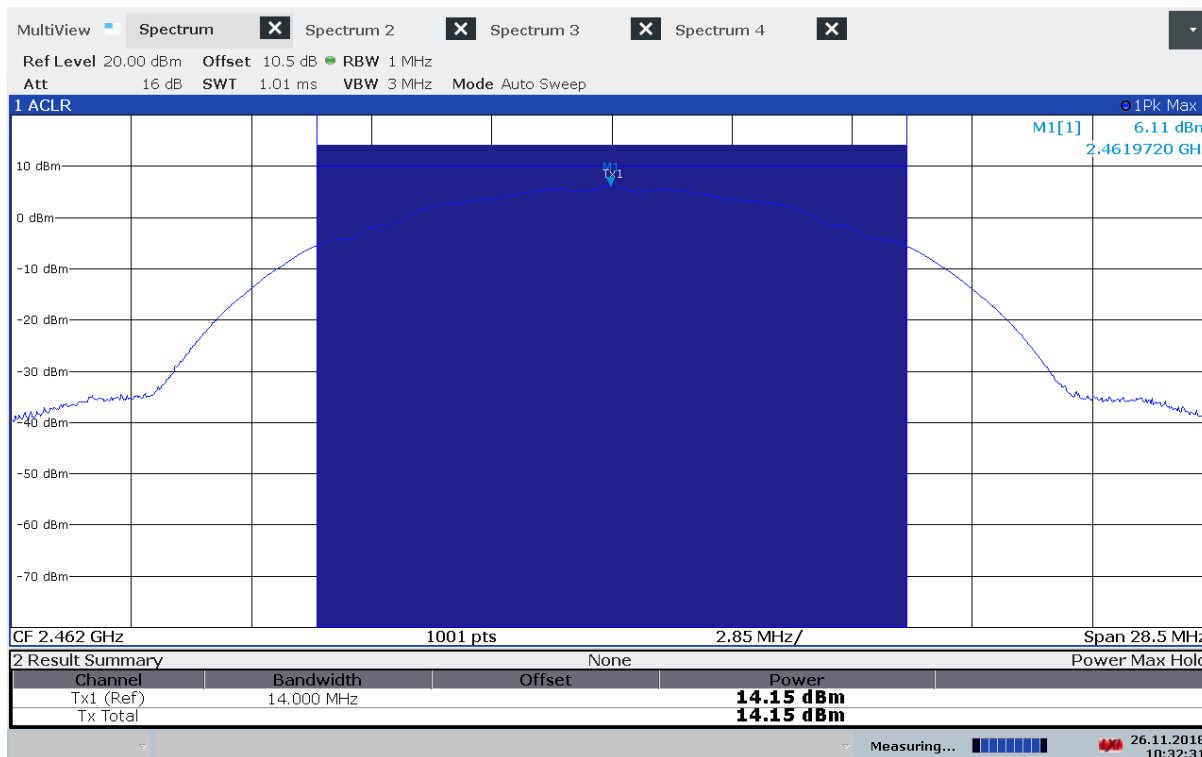
Conducted Output Power, 2437 MHz, 802.11b, 1Mbps



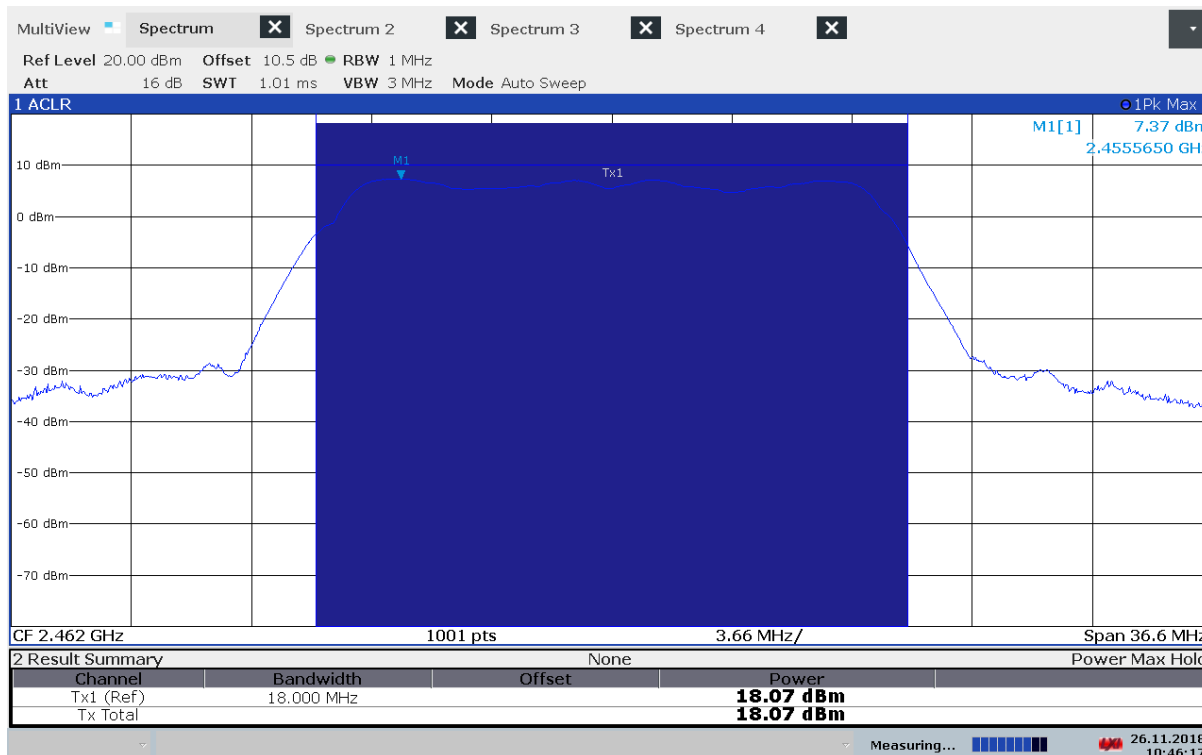
Conducted Output Power, 2437 MHz, 802.11g, 6Mbps



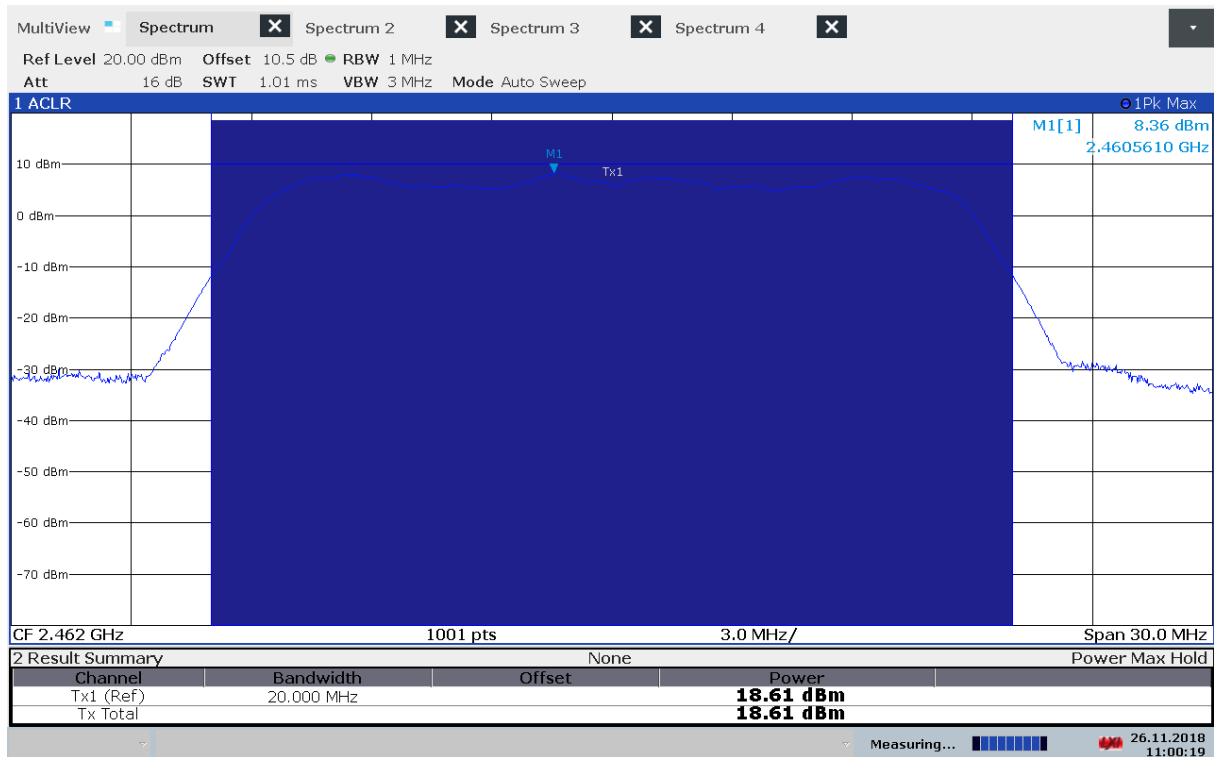
Conducted Output Power, 2437 MHz, 802.11n, MCS0



Conducted Output Power, 2462 MHz, 802.11b, 1Mbps



Conducted Output Power, 2462 MHz, 802.11g, 6Mbps



Conducted Output Power, 2462 MHz, 802.11n, MCS0

### 3.5 Conducted Emissions at Antenna Connector

FCC Part 15.247 (d)

| Carrier Frequency | Highest Value (dBc) | Margin (dB) | Verdict |
|-------------------|---------------------|-------------|---------|
| 2412 MHz          | > 30                | > 10        | Pass    |
| 2437 MHz          | > 30                | > 10        | Pass    |
| 2462 MHz          | > 30                | > 10        | Pass    |

Measured with Peak Detector

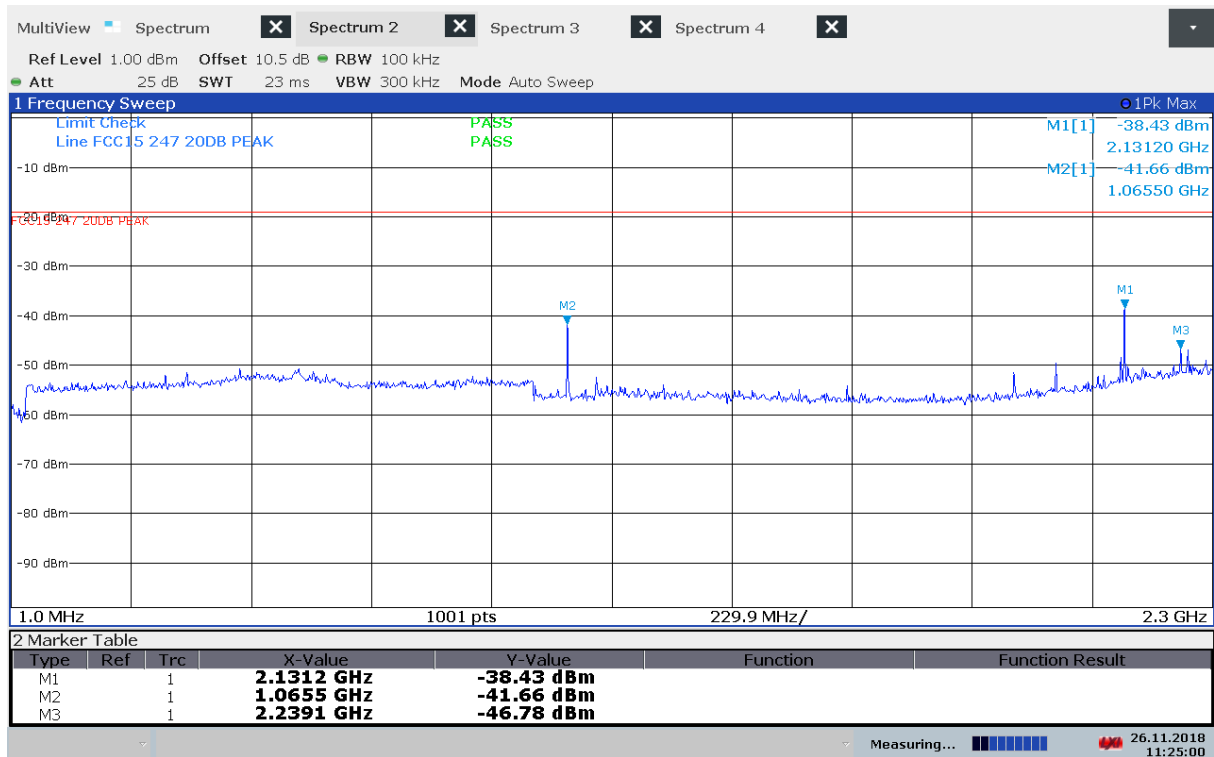
**RF conducted power** to 25 GHz: see attached plots.

#### Limit

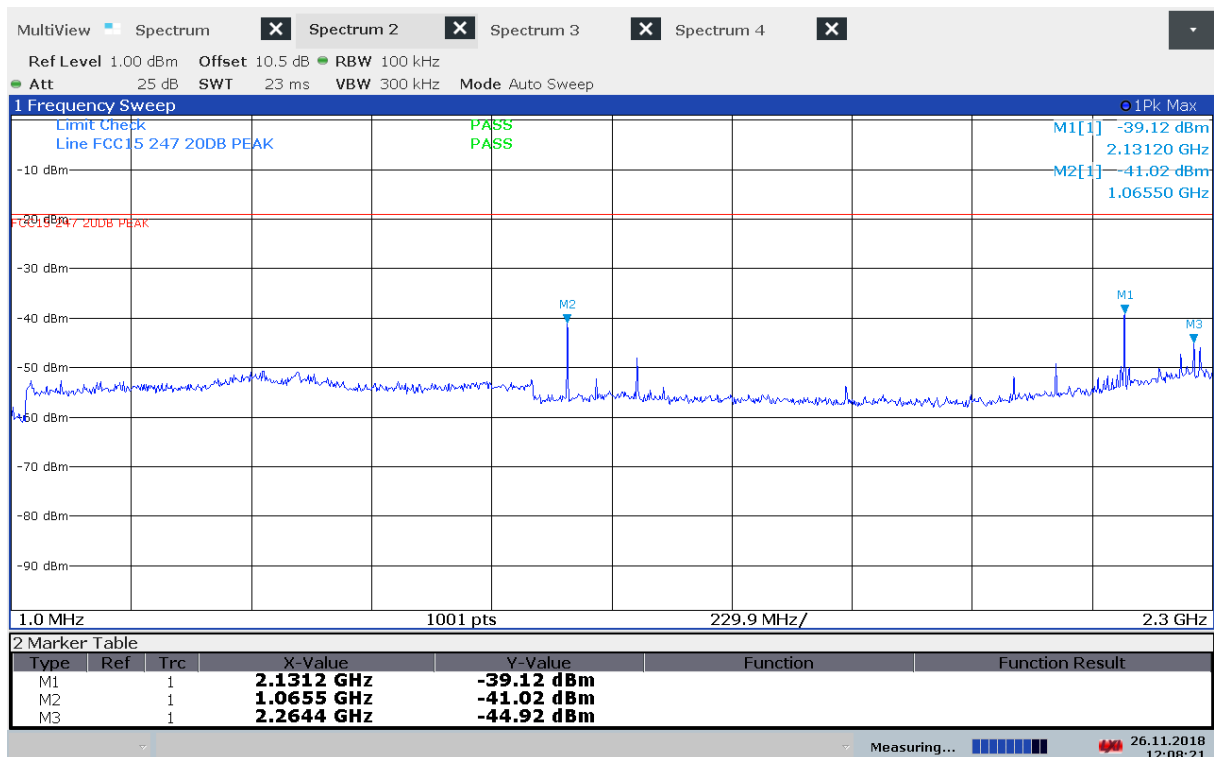
| Peak measurement                    | RMS averaging                       |
|-------------------------------------|-------------------------------------|
| 20 dBc or more in 100 kHz bandwidth | 30 dBc or more in 100 kHz bandwidth |

Detector type shall be the same as used for measuring Output Power.

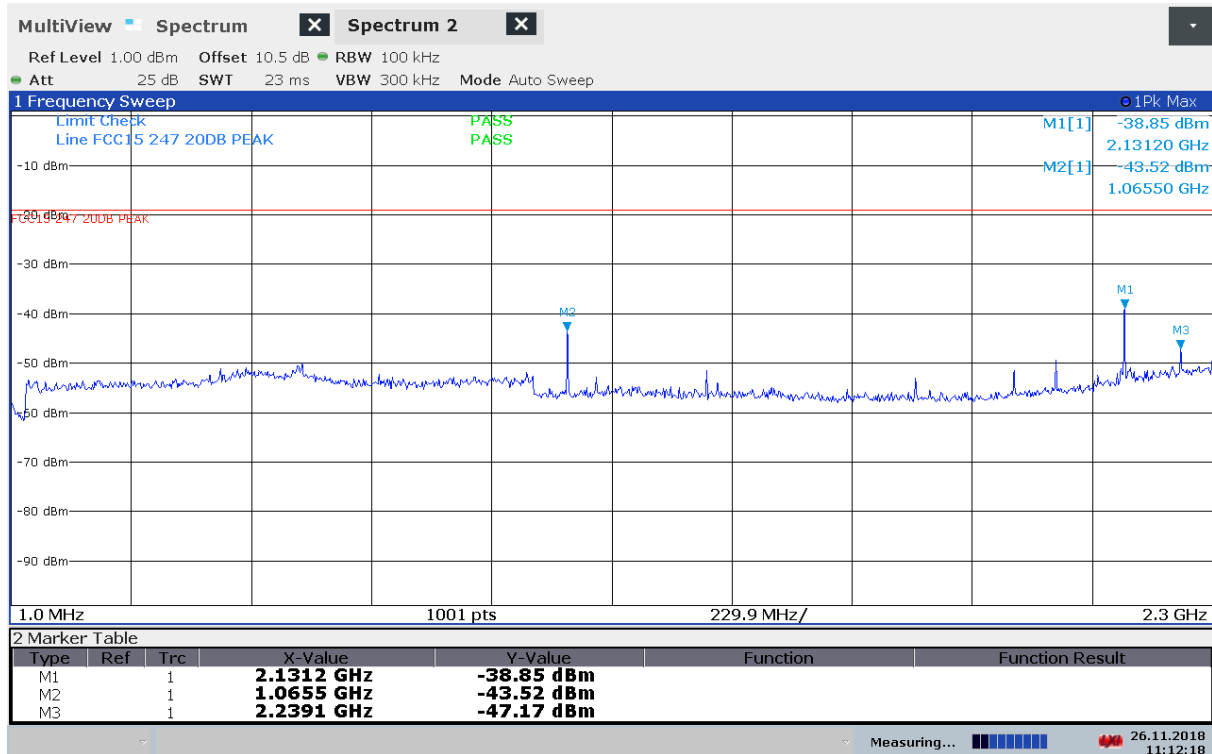
Attenuation below the general limits specified in part 15.209(a) is not required.



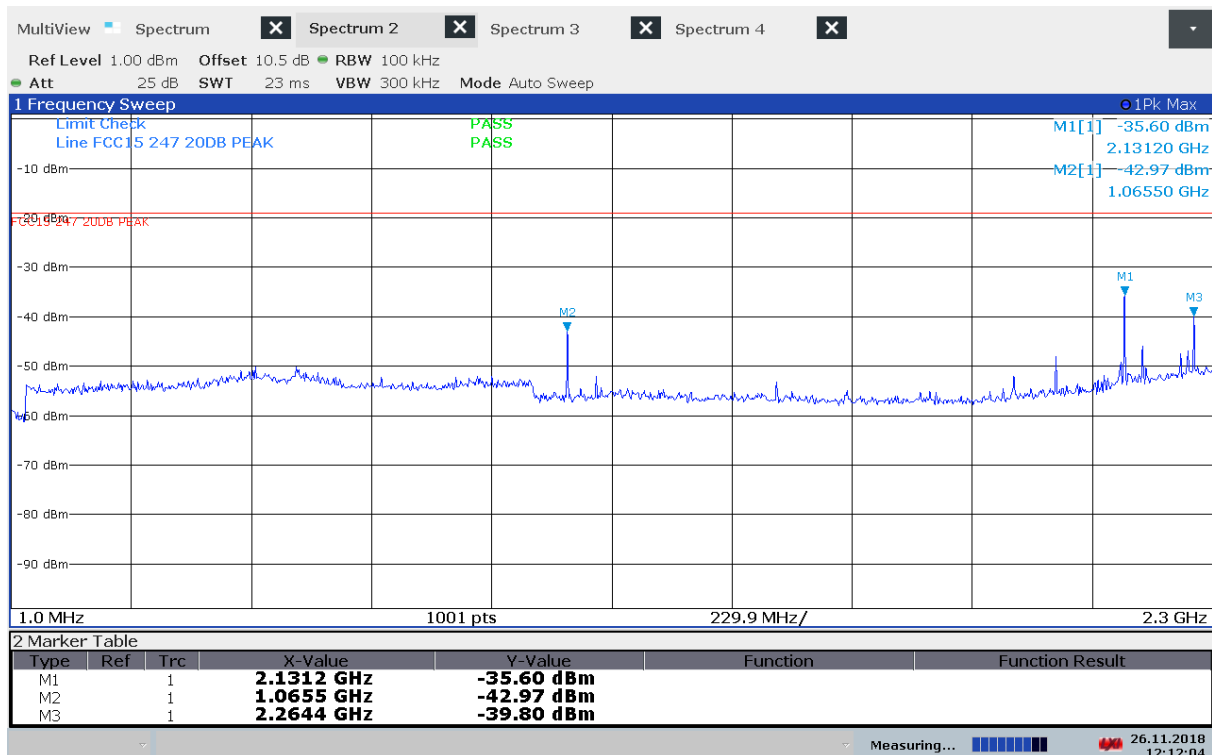
**Conducted Emissions, 1 – 2300 MHz, 2412 MHz, 802.11b, 1Mbps**



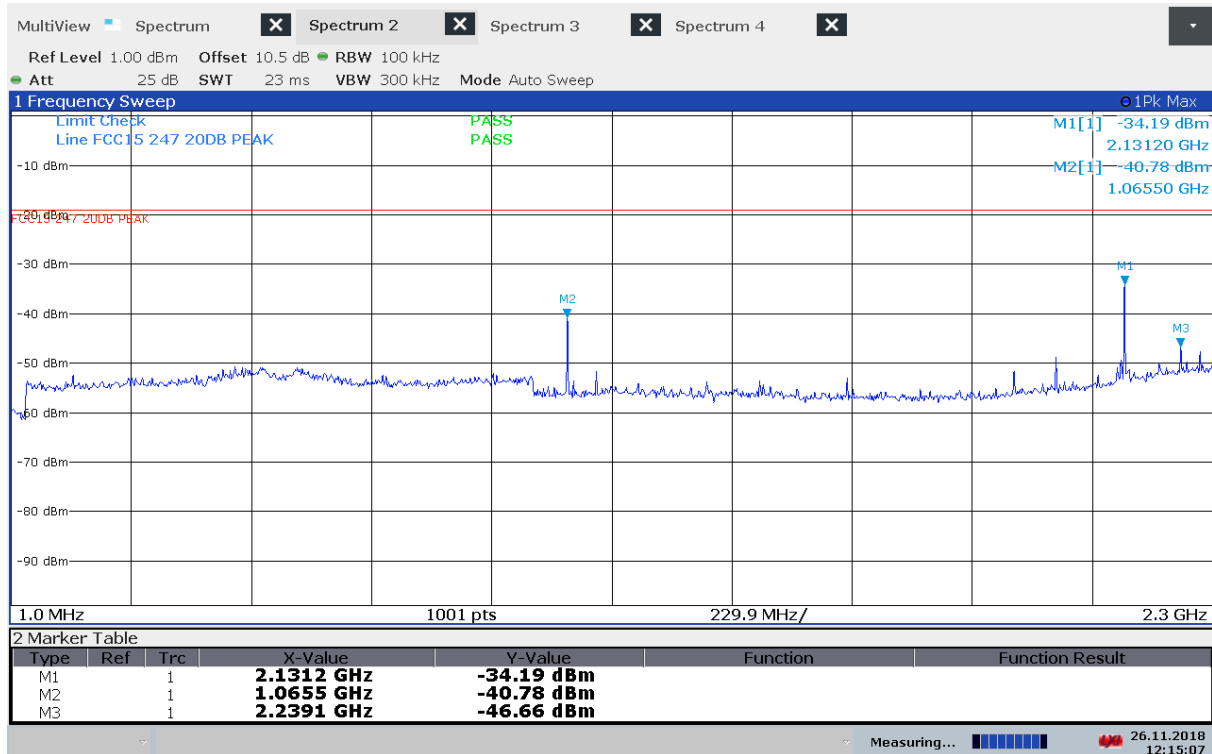
**Conducted Emissions, 1 – 2300 MHz, 2437 MHz, 802.11b, 1Mbps**



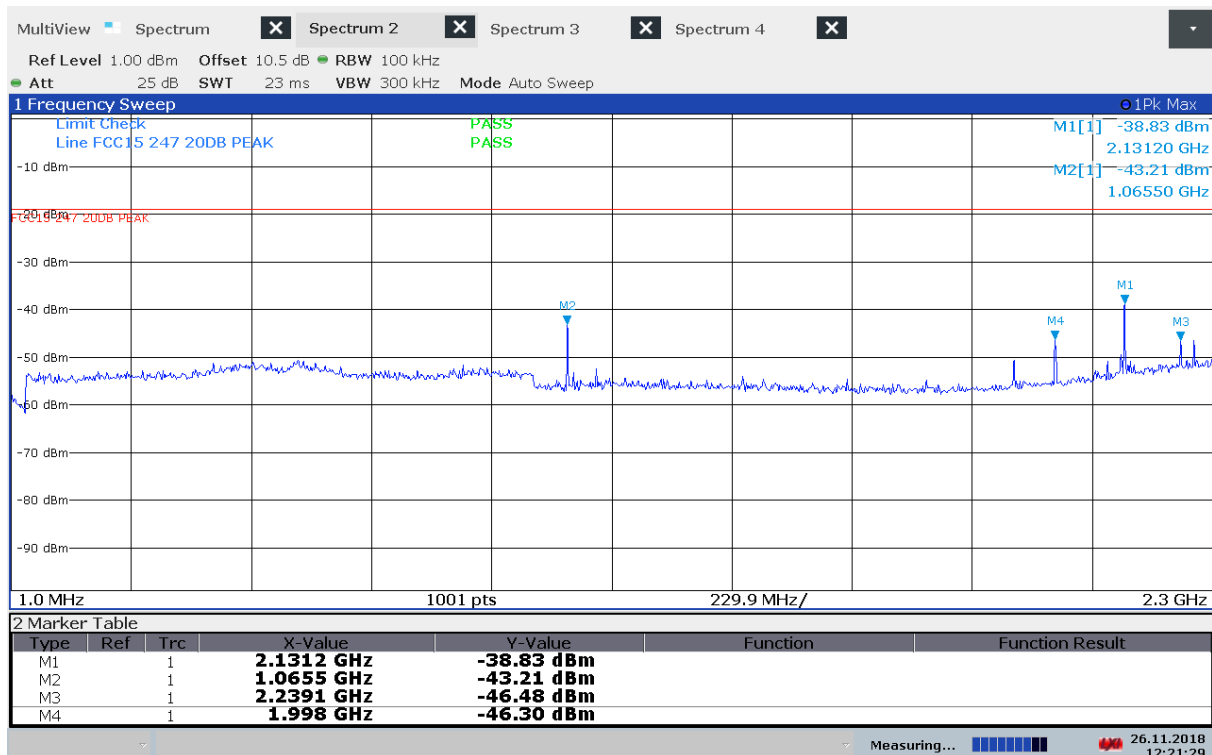
### Conducted Emissions, 1 – 2300 MHz, 2462 MHz, 802.11b, 1Mbps



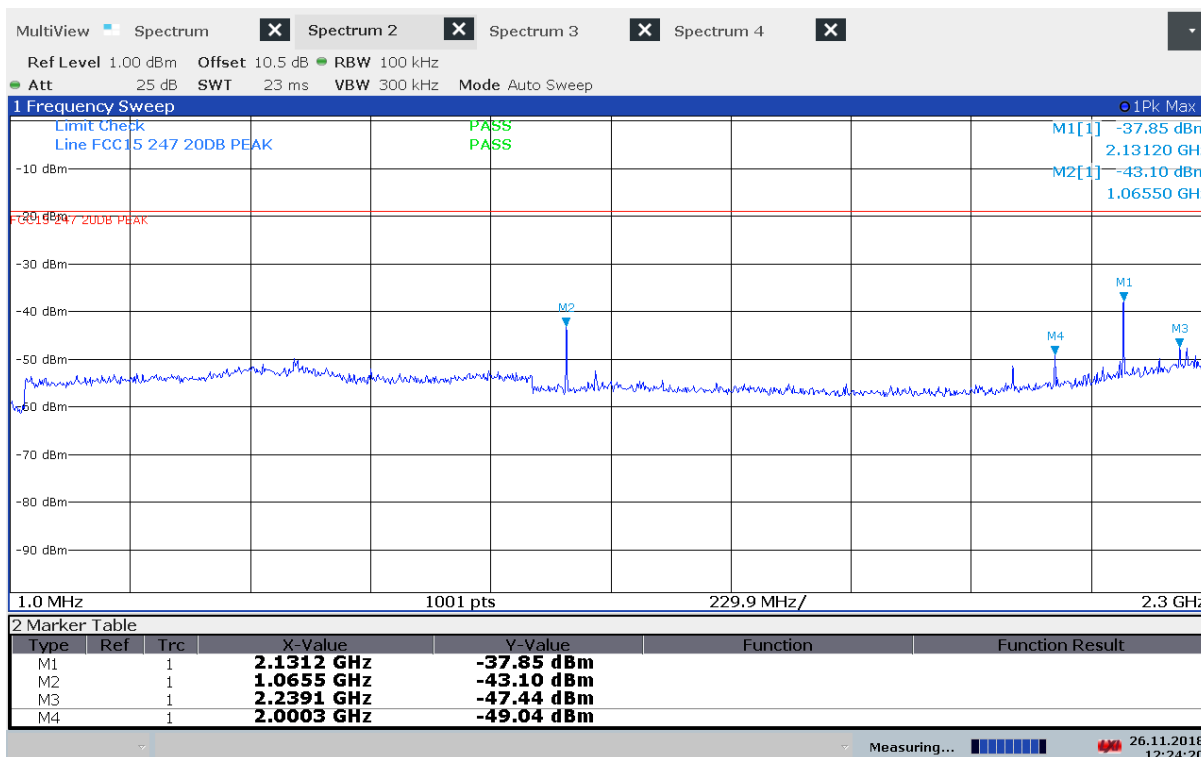
### Conducted Emissions, 1 – 2300 MHz, 2412 MHz, 802.11g, 6Mbps



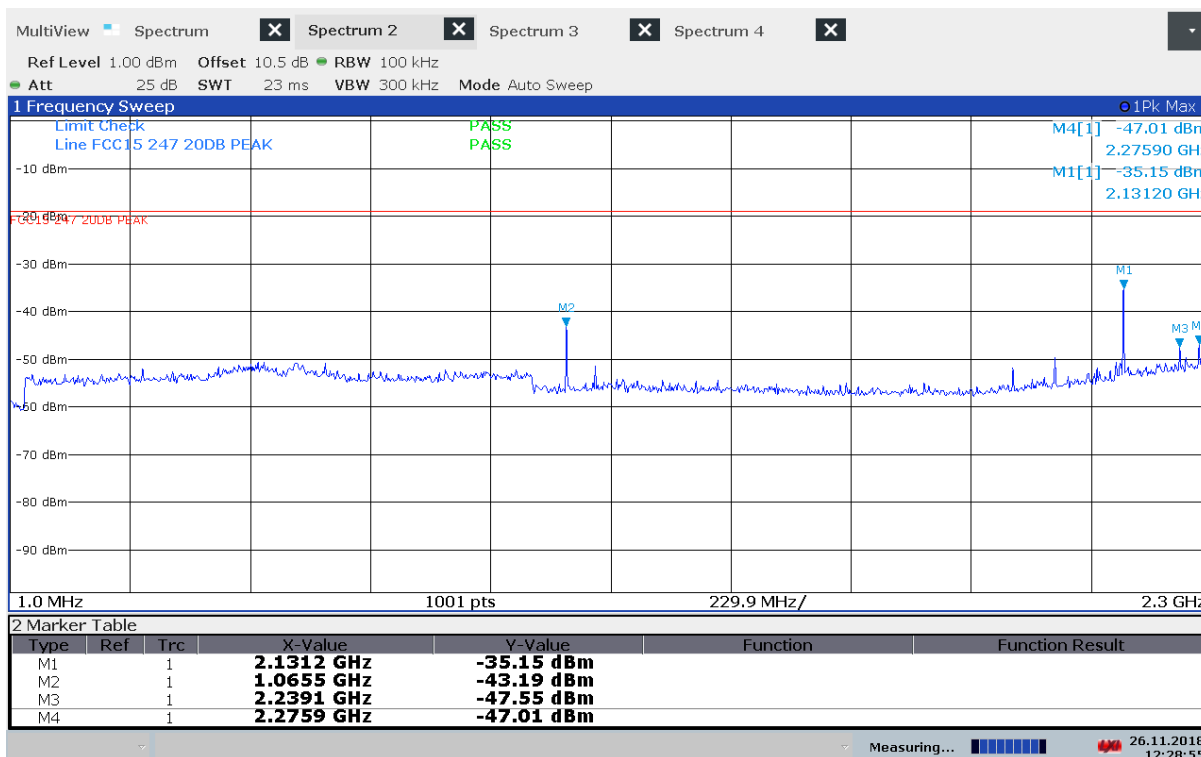
#### Conducted Emissions, 1 – 2300 MHz, 2437 MHz, 802.11g, 6Mbps



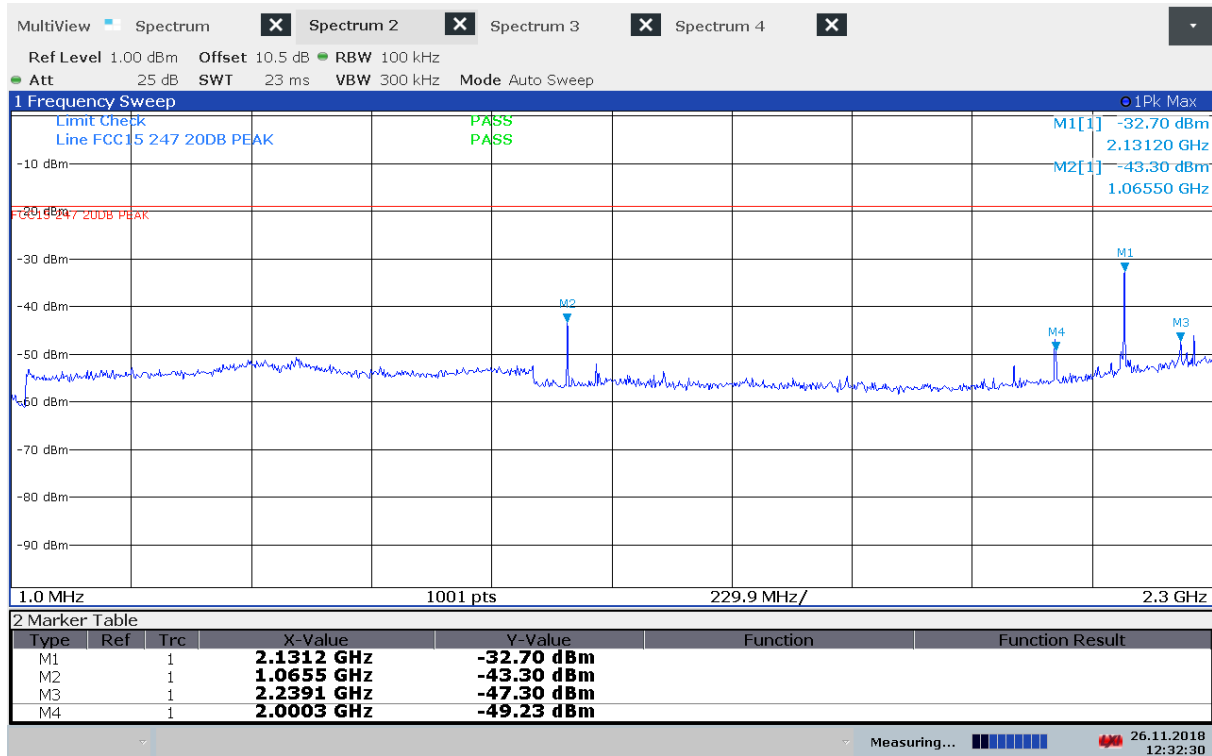
#### Conducted Emissions, 1 – 2300 MHz, 2462 MHz, 802.11g, 6Mbps



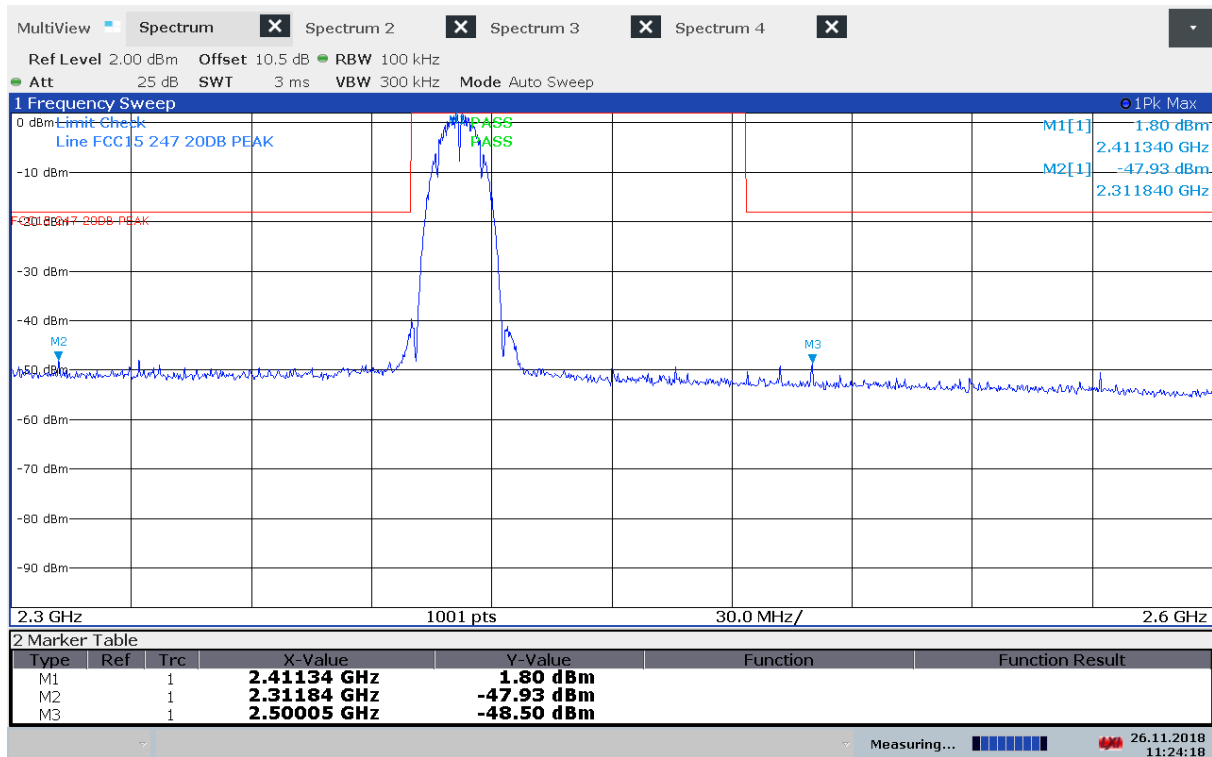
### Conducted Emissions, 1 – 2300 MHz, 2412 MHz, 802.11n, MCS0



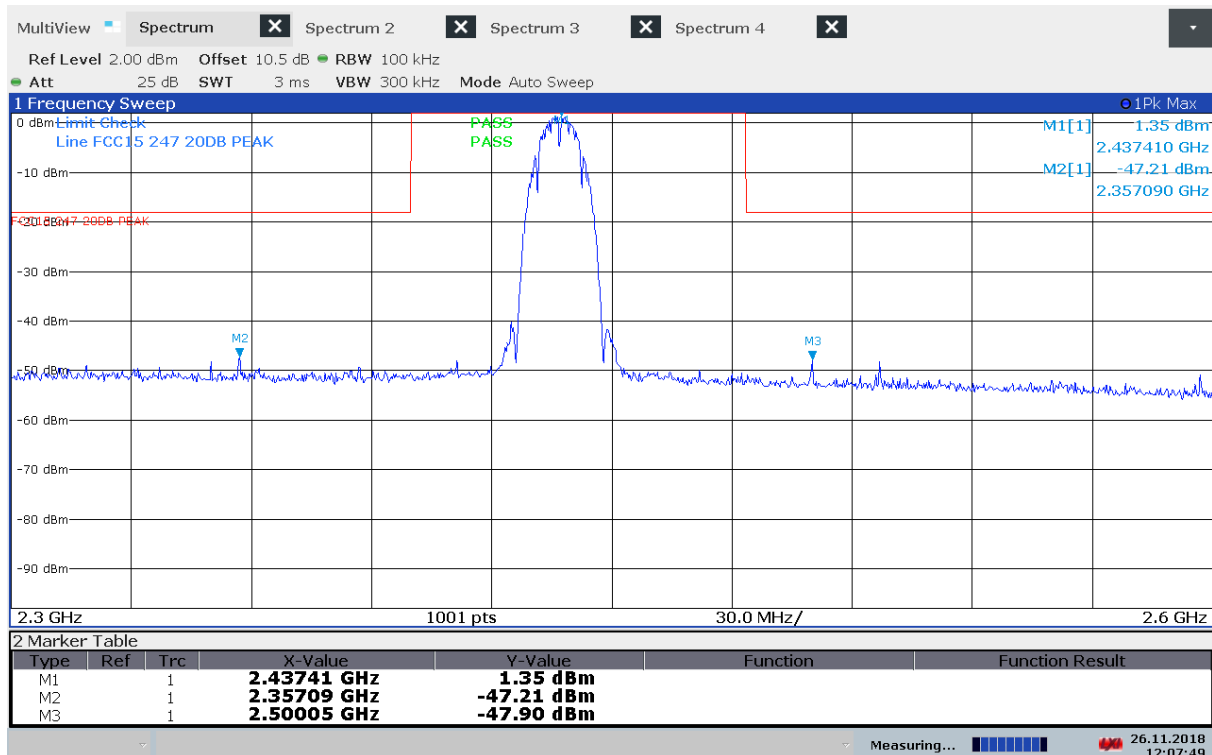
### Conducted Emissions, 1 – 2300 MHz, 2437 MHz, 802.11n, MCS0



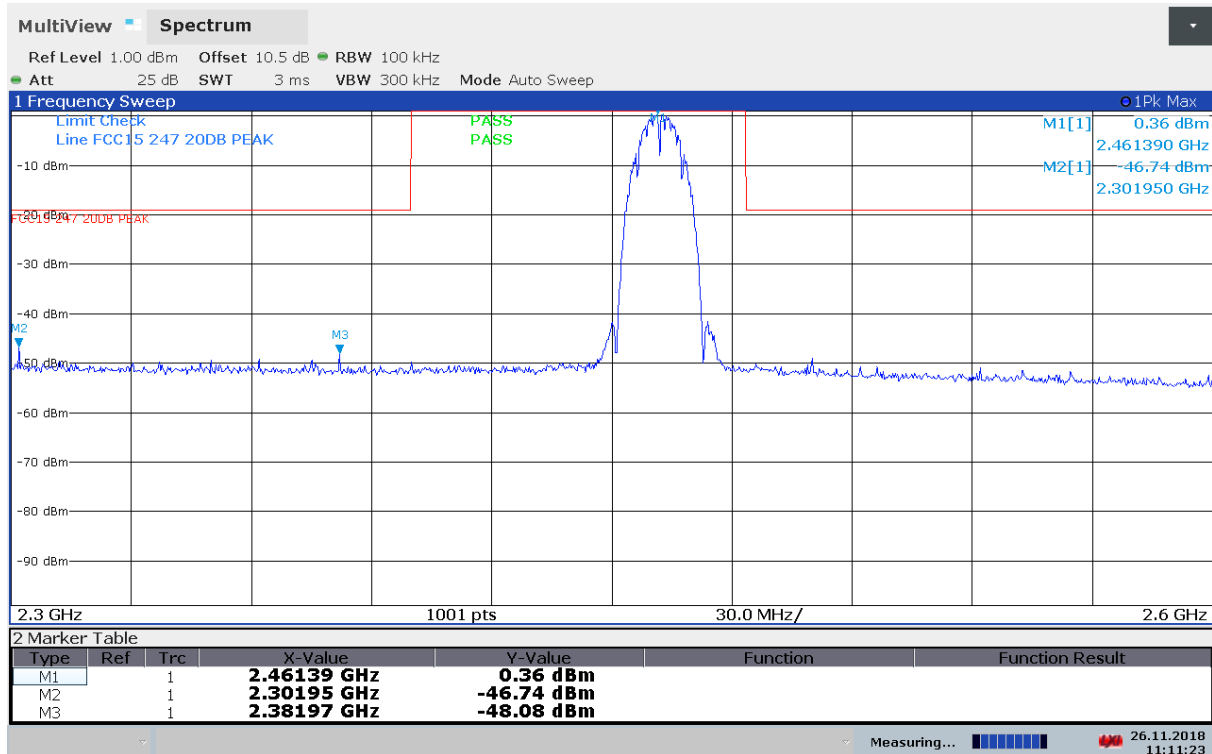
**Conducted Emissions, 1 – 2300 MHz, 2462 MHz, 802.11n, MCS0**



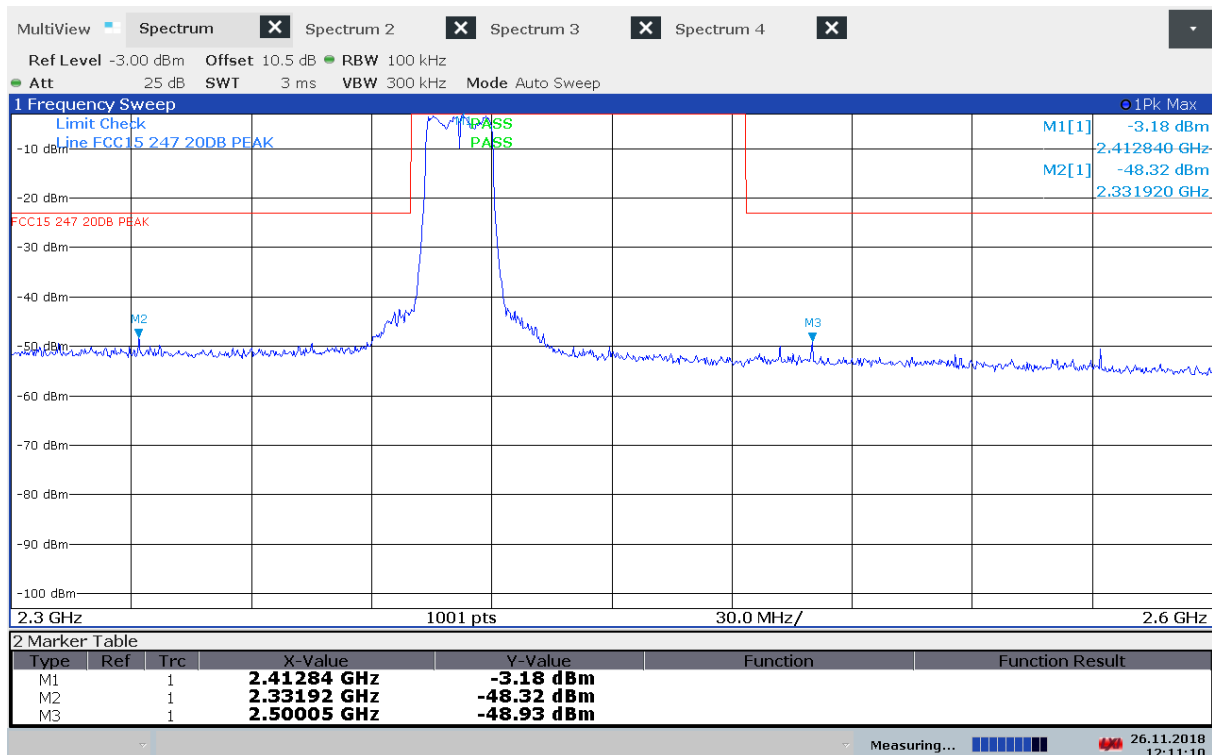
Conducted Emissions, 2300 – 2600 MHz, 2412 MHz, 802.11b, 1Mbps



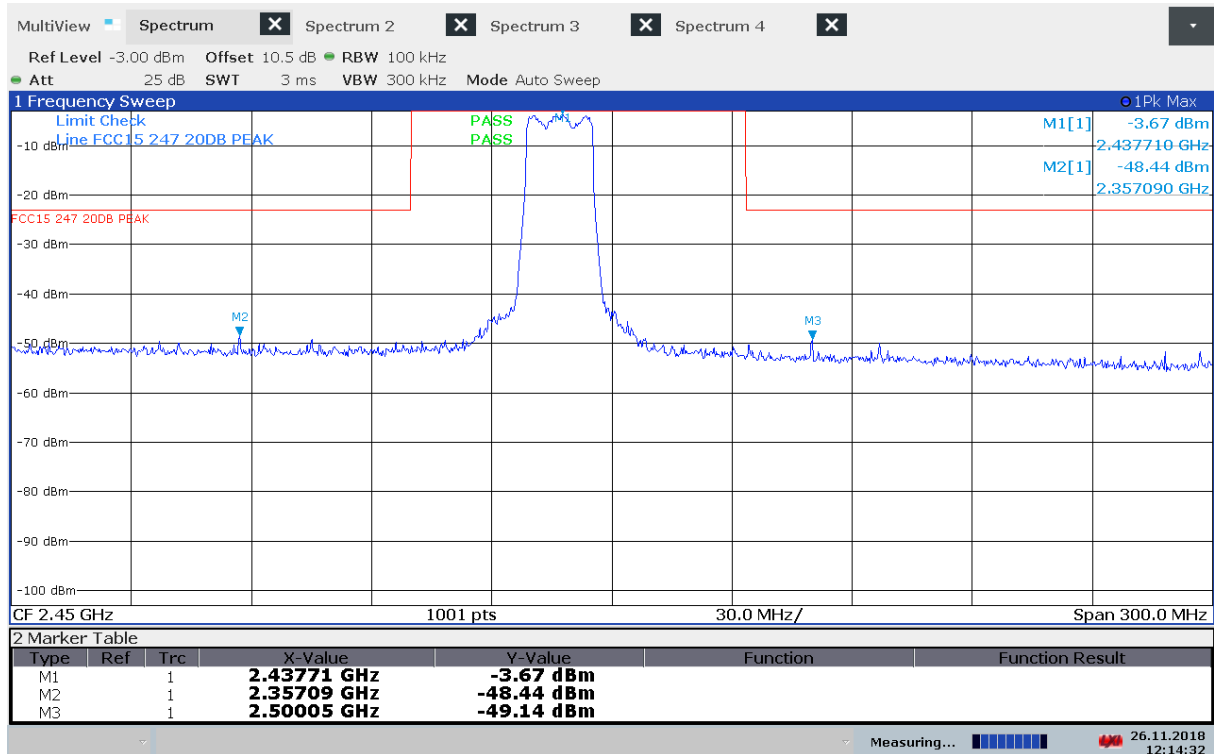
Conducted Emissions, 2300 – 2600 MHz, 2437 MHz, 802.11b, 1Mbps



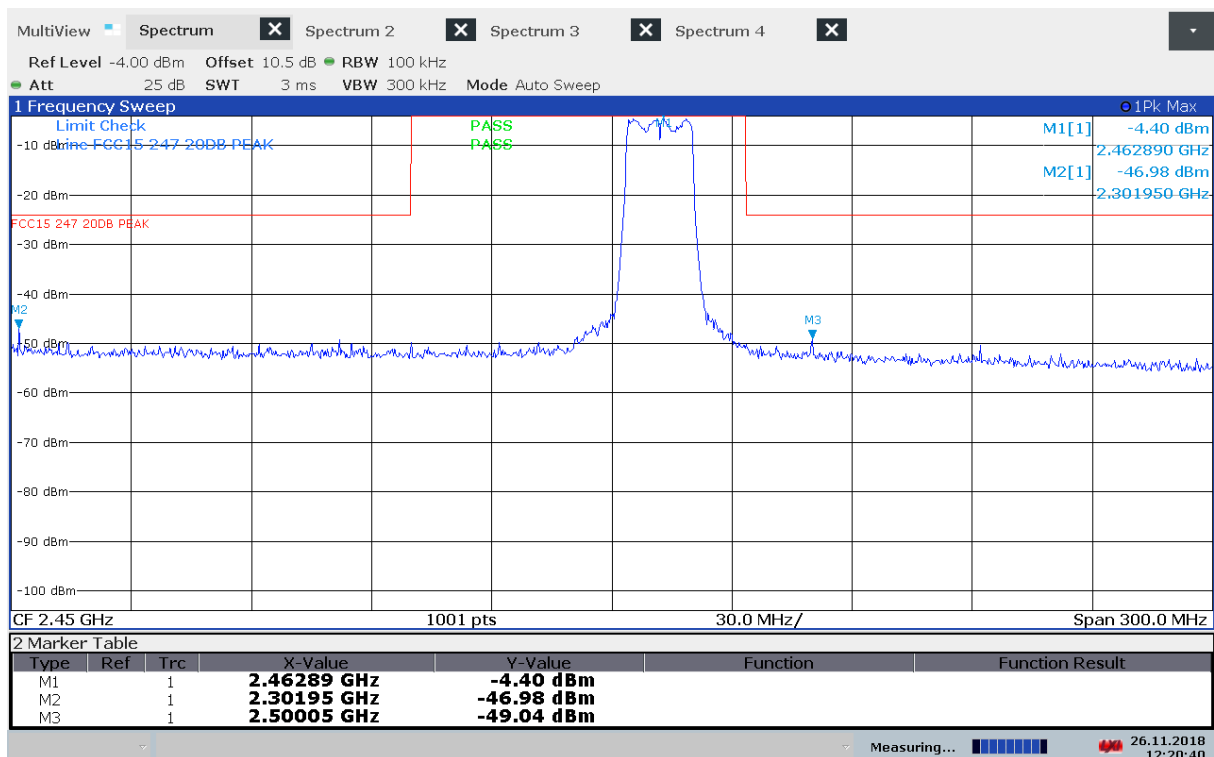
Conducted Emissions, 2300 – 2600 MHz, 2462 MHz, 802.11b, 1Mbps



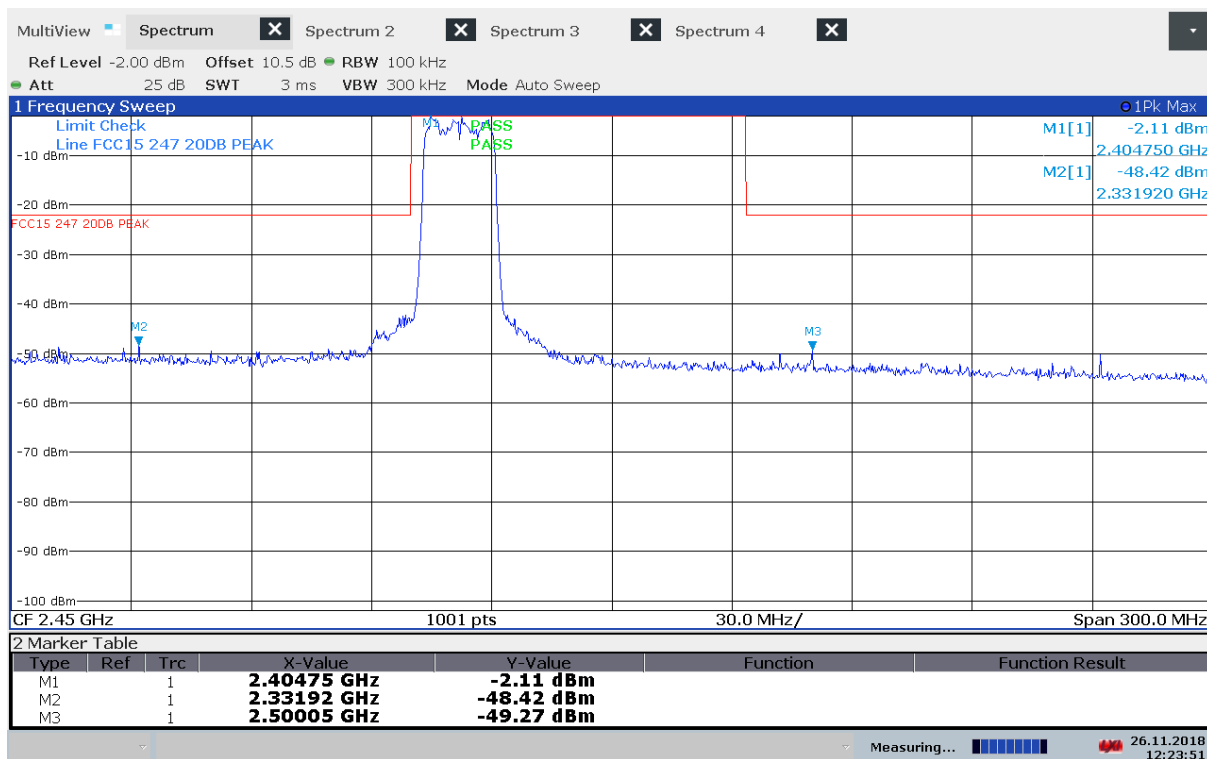
Conducted Emissions, 2300 – 2600 MHz, 2412 MHz, 802.11g, 6Mbps



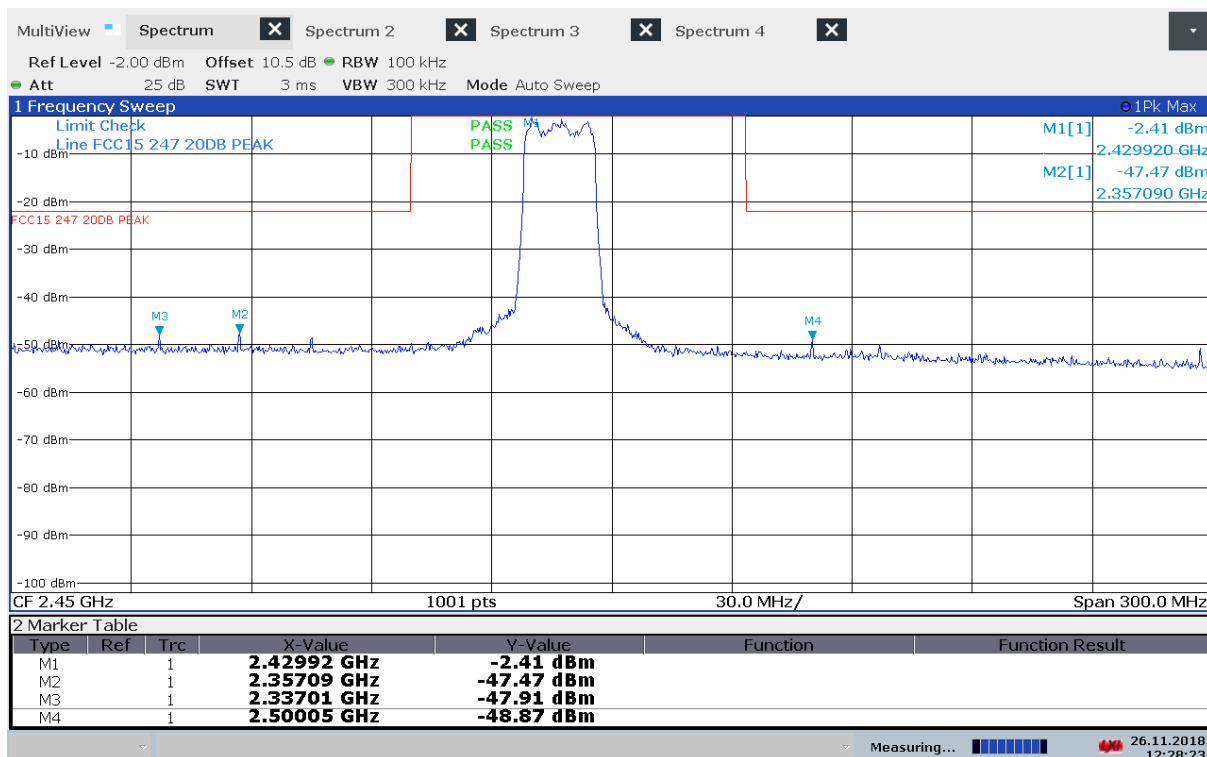
### Conducted Emissions, 2300 – 2600 MHz, 2437 MHz, 802.11g, 6Mbps



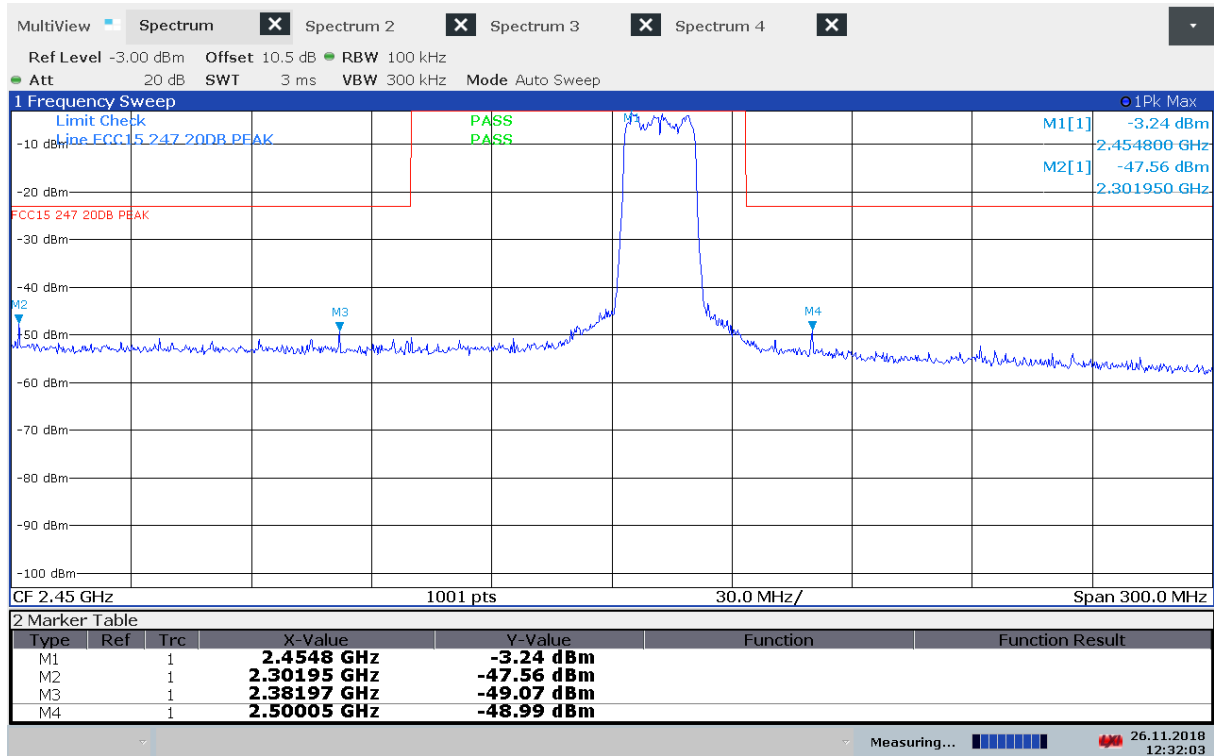
### Conducted Emissions, 2300 – 2600 MHz, 2462 MHz, 802.11g, 6Mbps



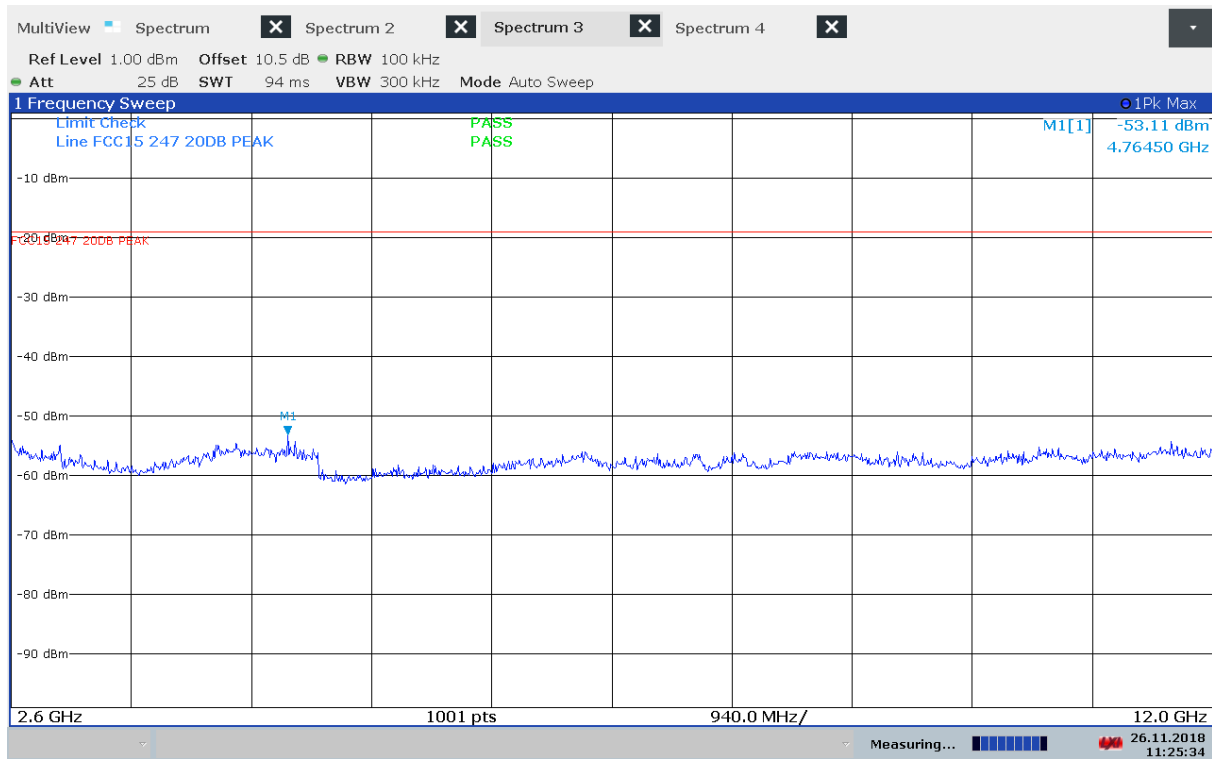
#### Conducted Emissions, 2300 – 2600 MHz, 2412 MHz, 802.11n, MCS0



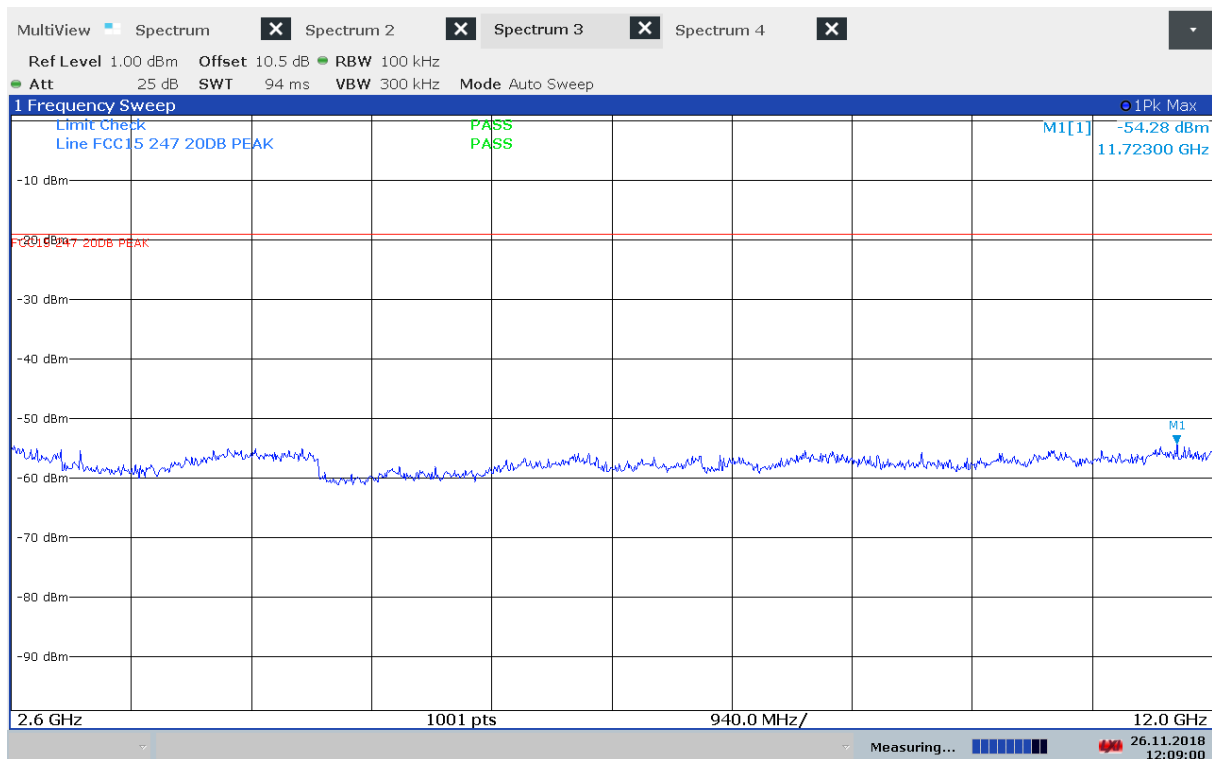
#### Conducted Emissions, 2300 – 2600 MHz, 2437 MHz, 802.11n, MCS0



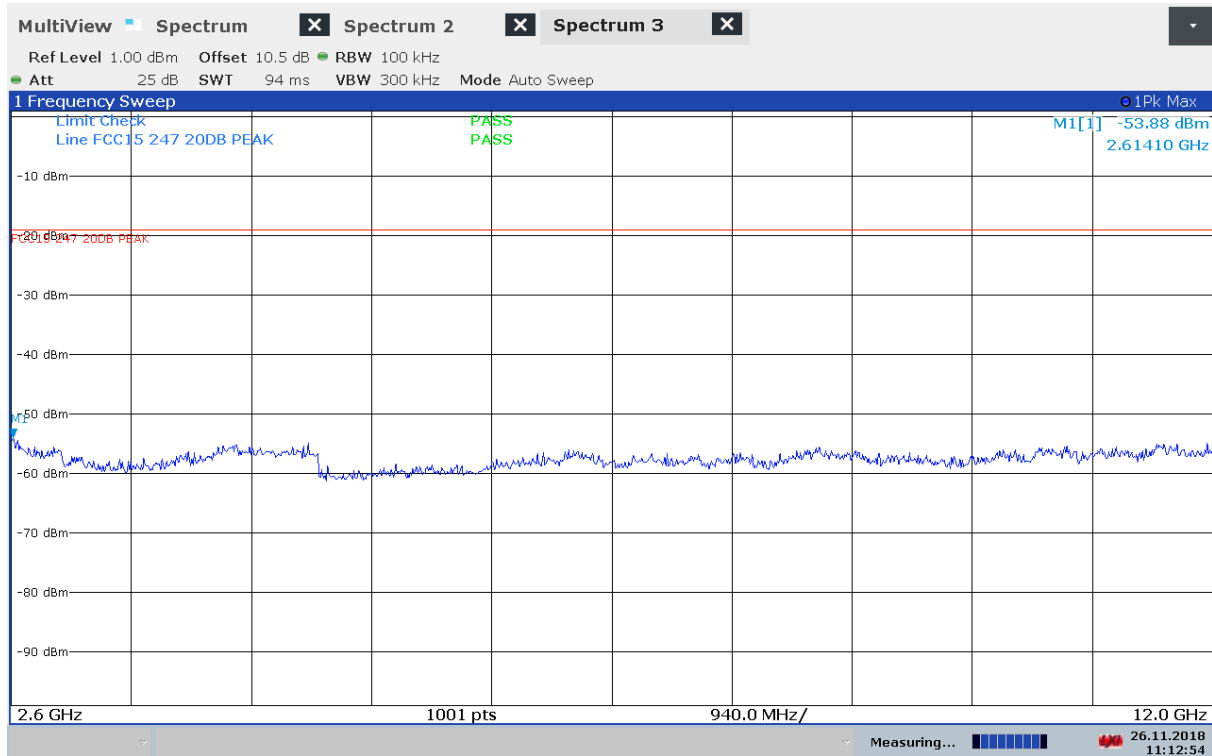
Conducted Emissions, 2300 – 2600 MHz, 2462 MHz, 802.11n, MCS0



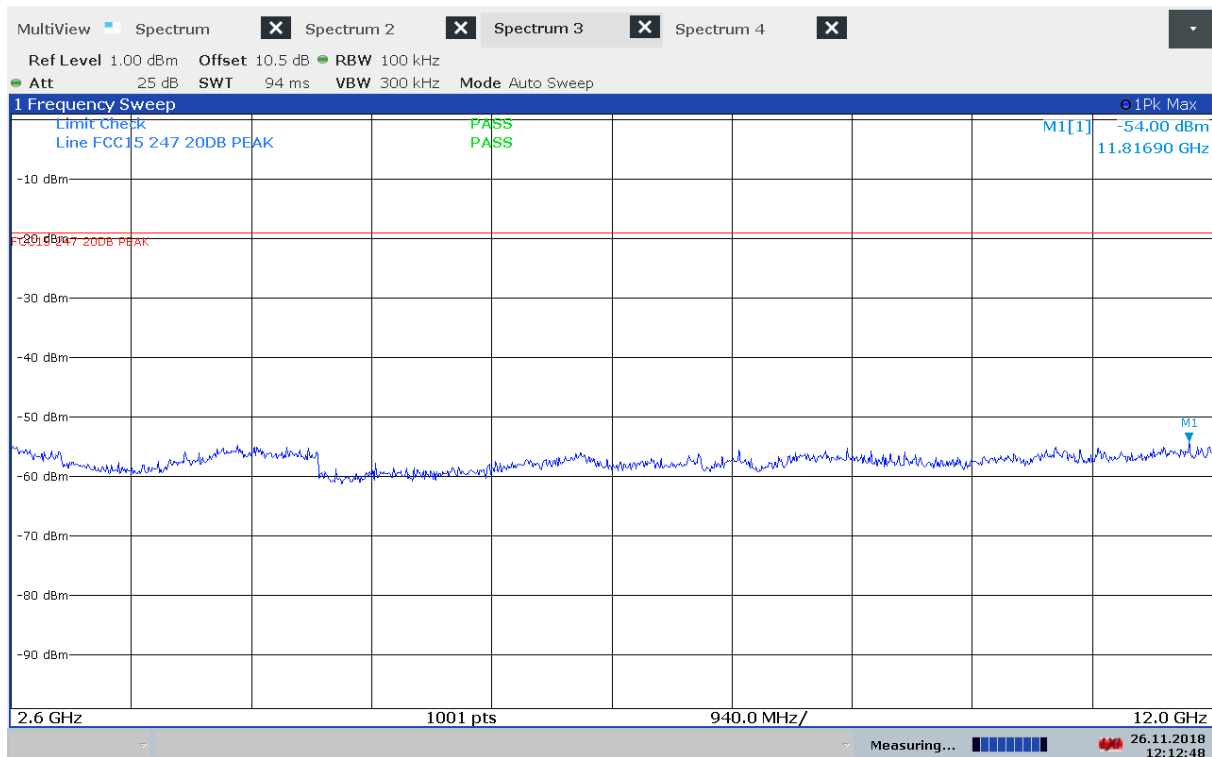
Conducted Emissions, 2600 – 12000 MHz, 2412 MHz, 802.11b, 1Mbps



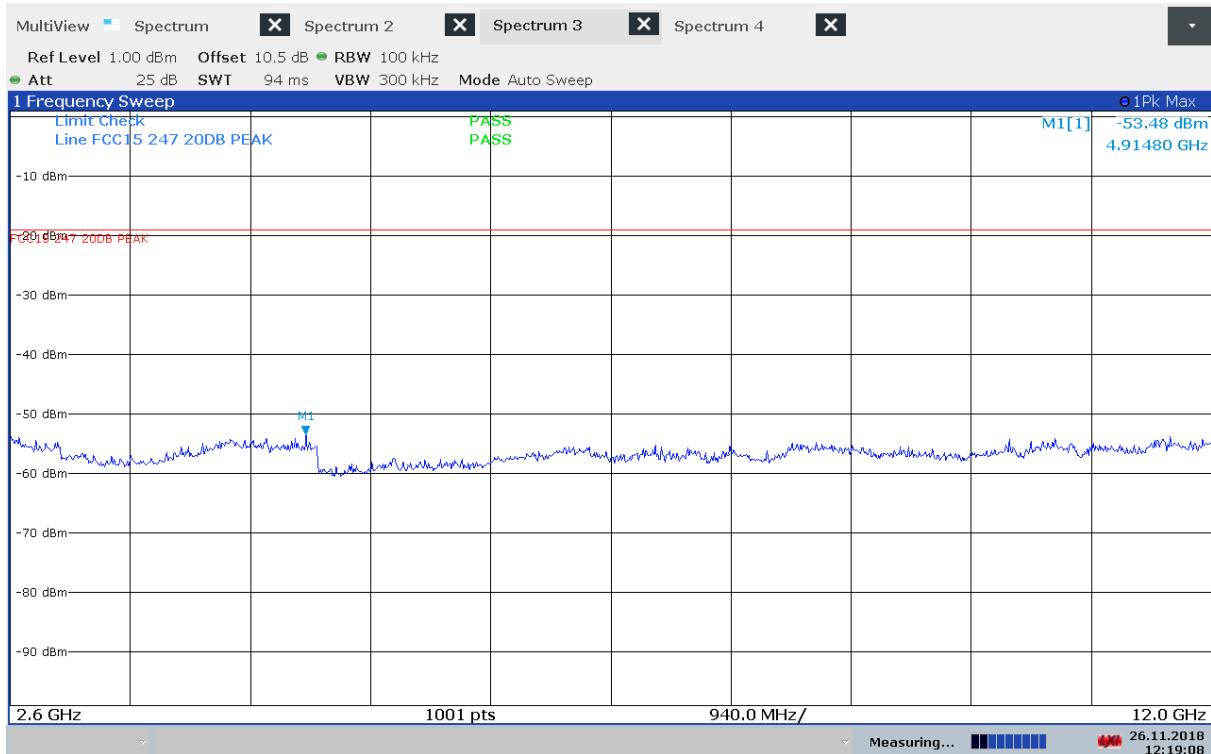
Conducted Emissions, 2600 – 12000 MHz, 2437 MHz, 802.11b, 1Mbps



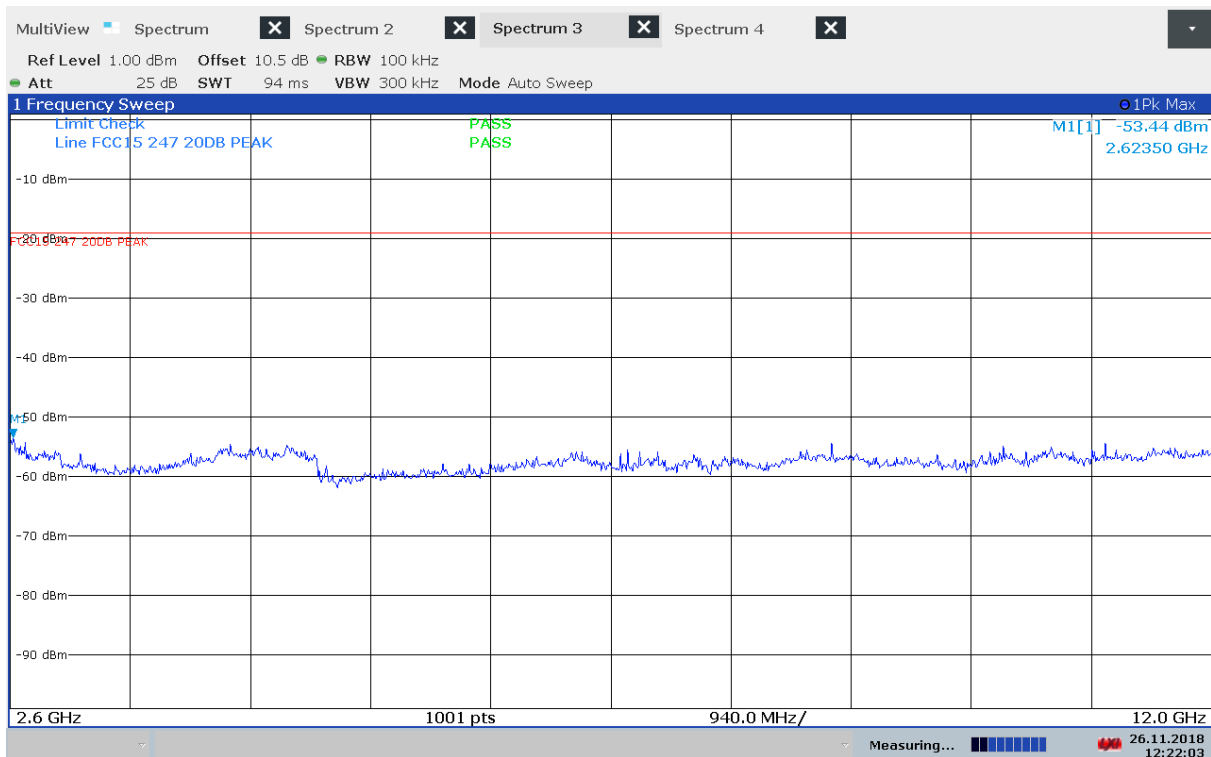
Conducted Emissions, 2600 – 12000 MHz, 2462 MHz, 802.11b, 1Mbps



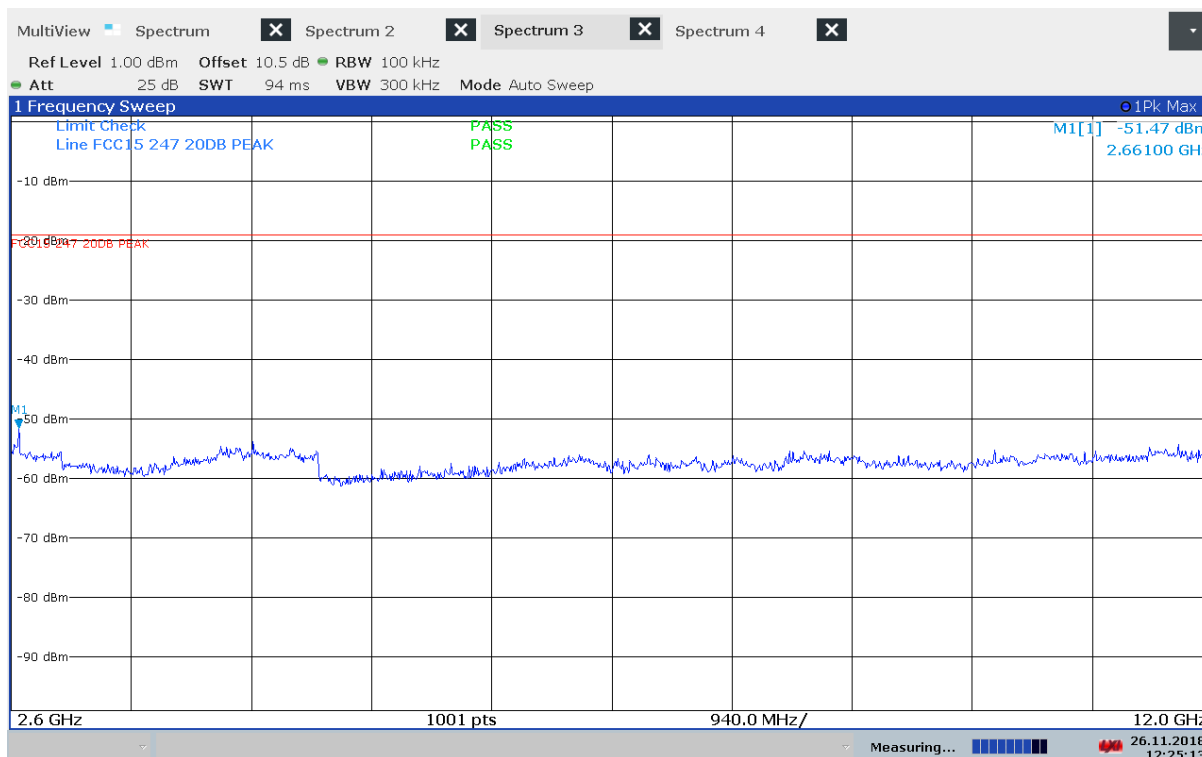
Conducted Emissions, 2600 – 12000 MHz, 2412 MHz, 802.11g, 6Mbps



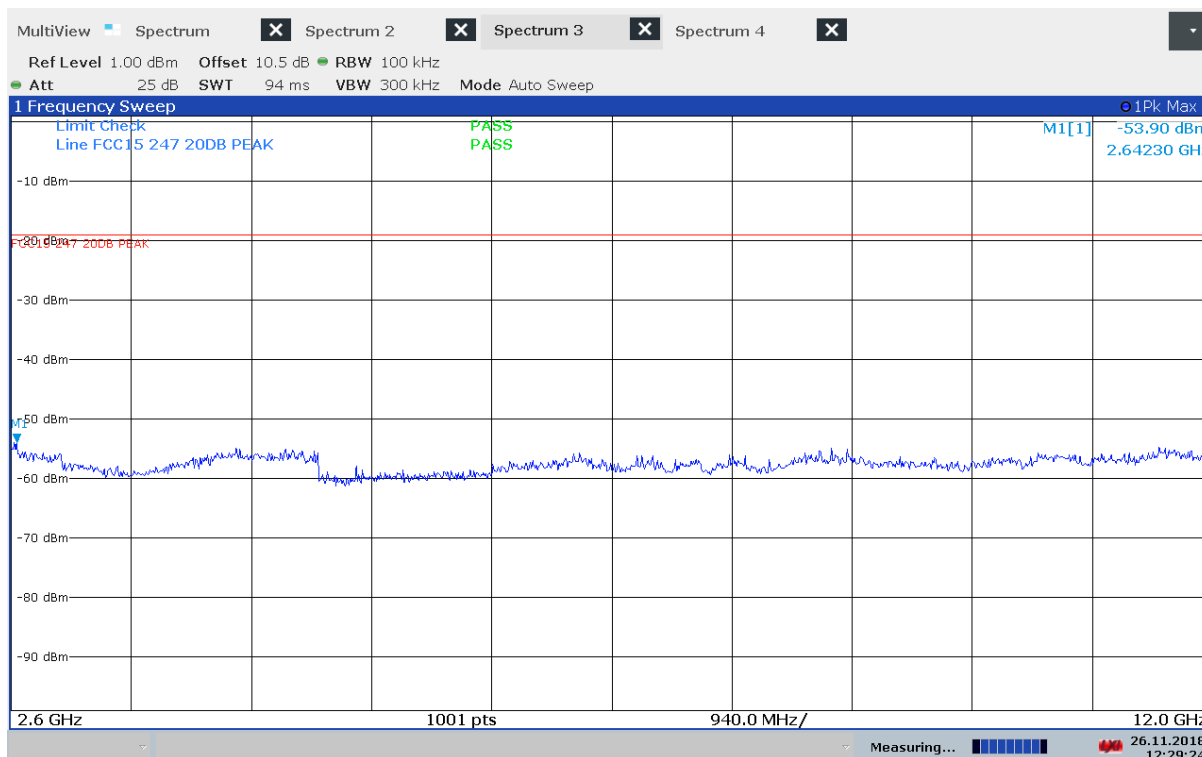
Conducted Emissions, 2600 – 12000 MHz, 2437 MHz, 802.11g, 6Mbps



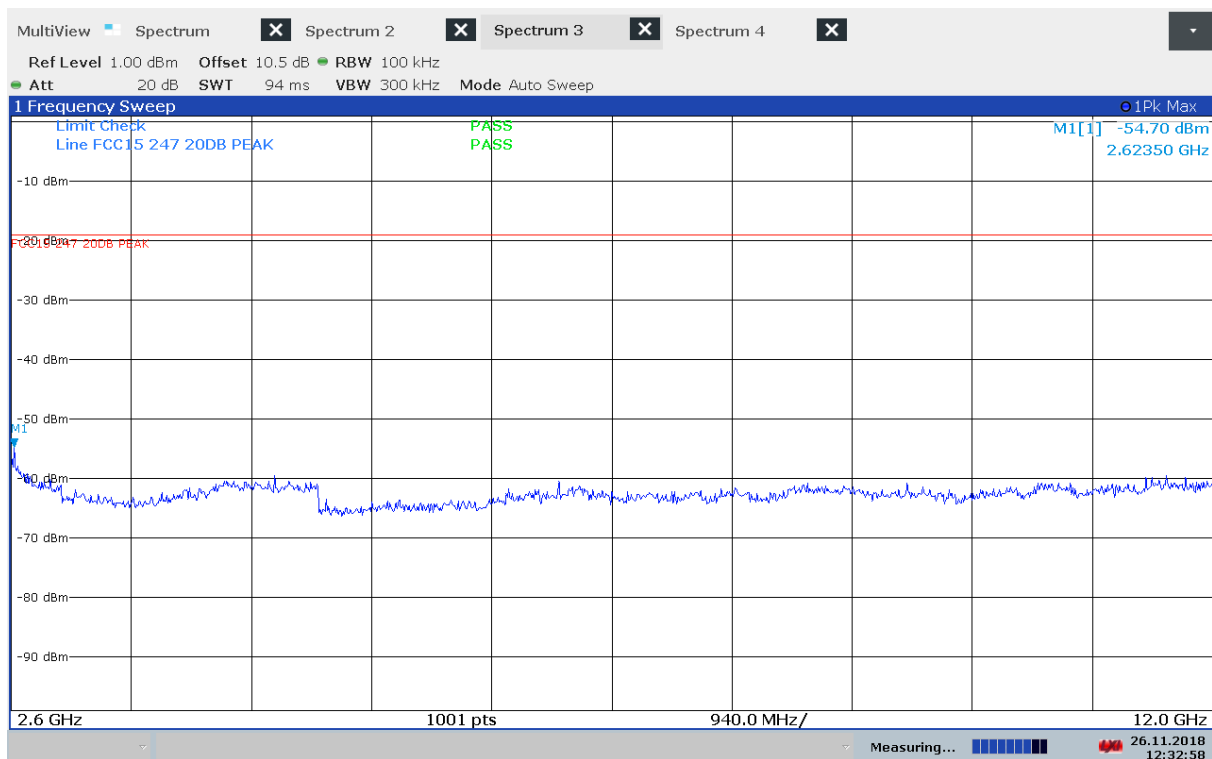
Conducted Emissions, 2600 – 12000 MHz, 2462 MHz, 802.11g, 6Mbps



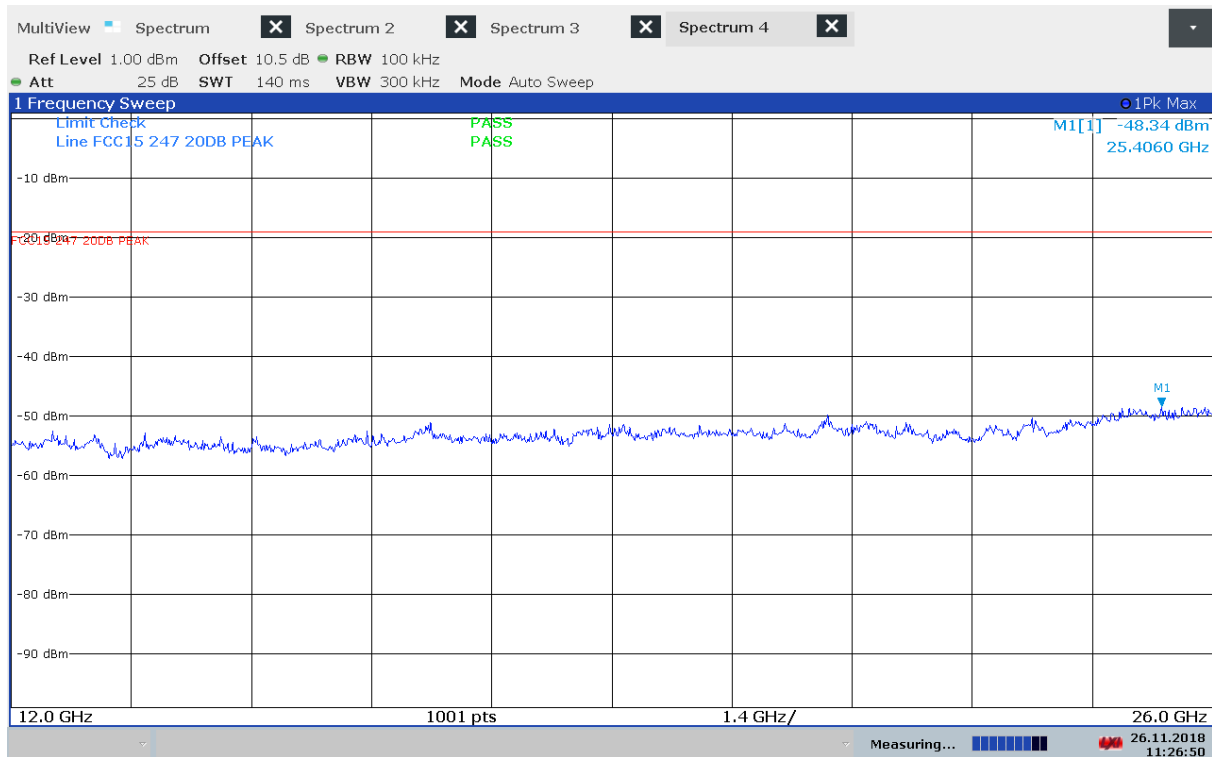
Conducted Emissions, 2600 – 12000 MHz, 2412 MHz, 802.11n, MCS0



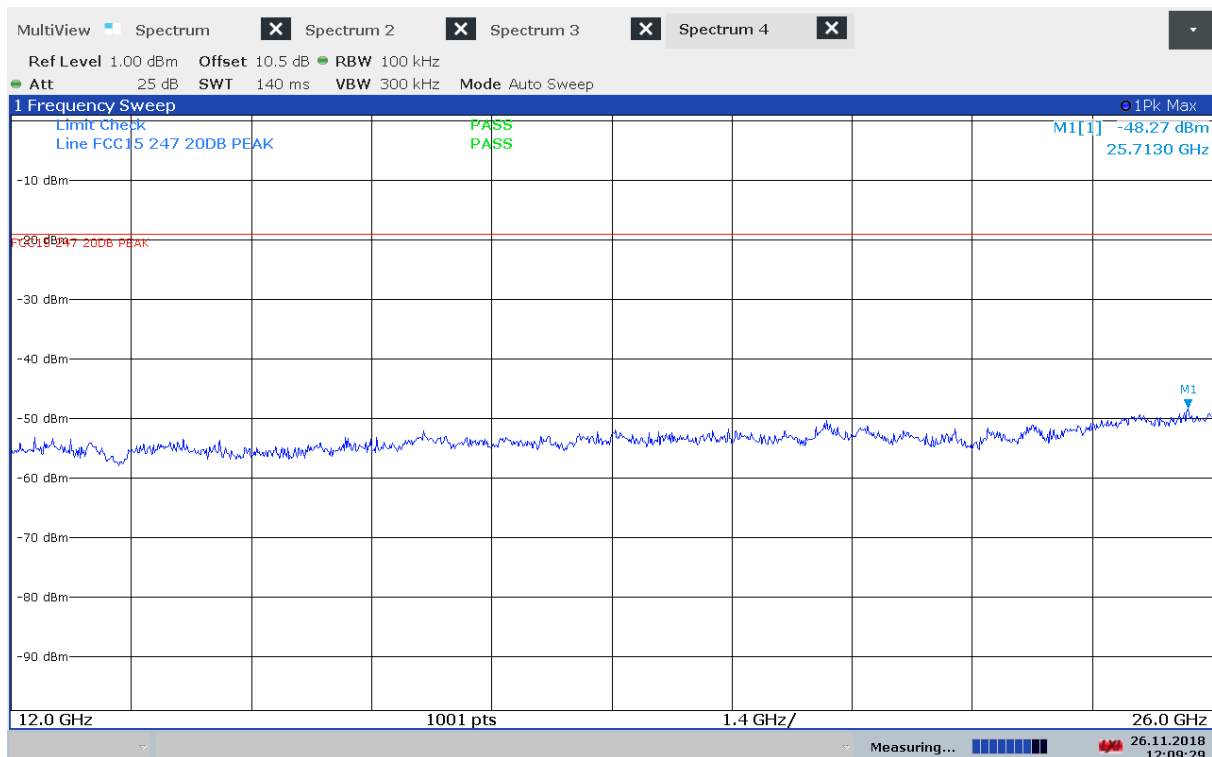
Conducted Emissions, 2600 – 12000 MHz, 2437 MHz, 802.11n, MCS0



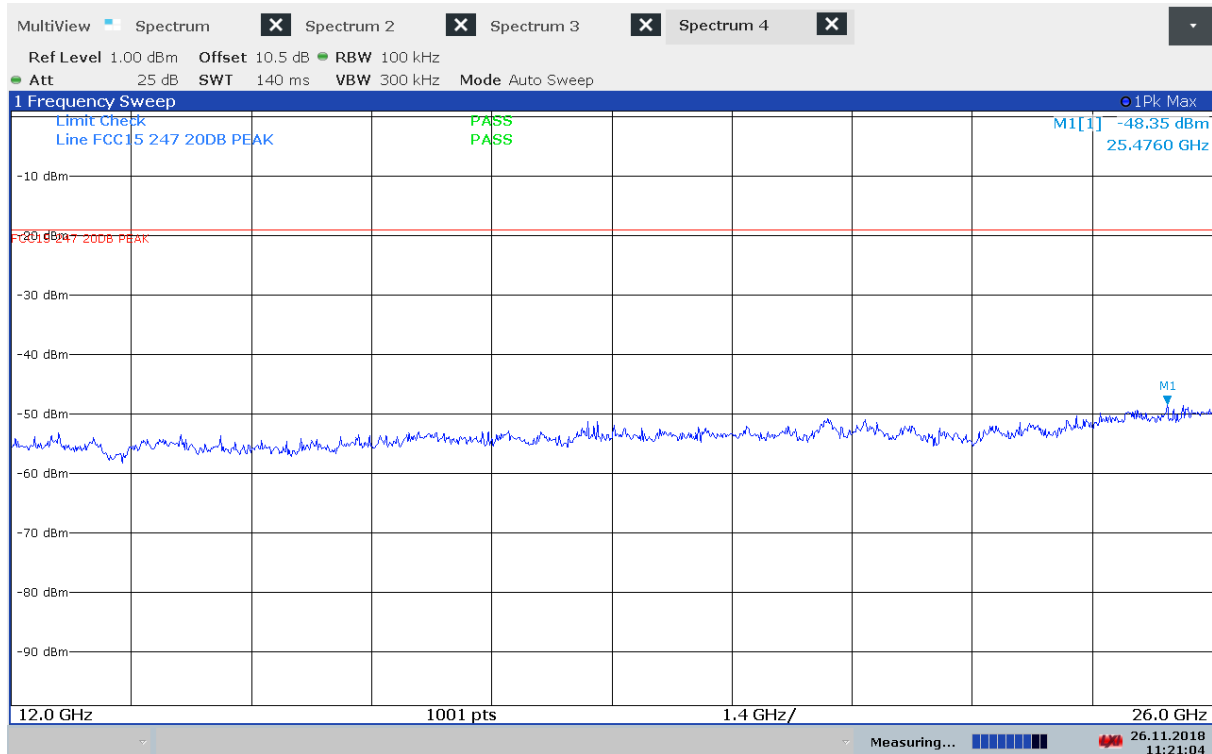
Conducted Emissions, 2600 – 12000 MHz, 2462 MHz, 802.11n, MCS0



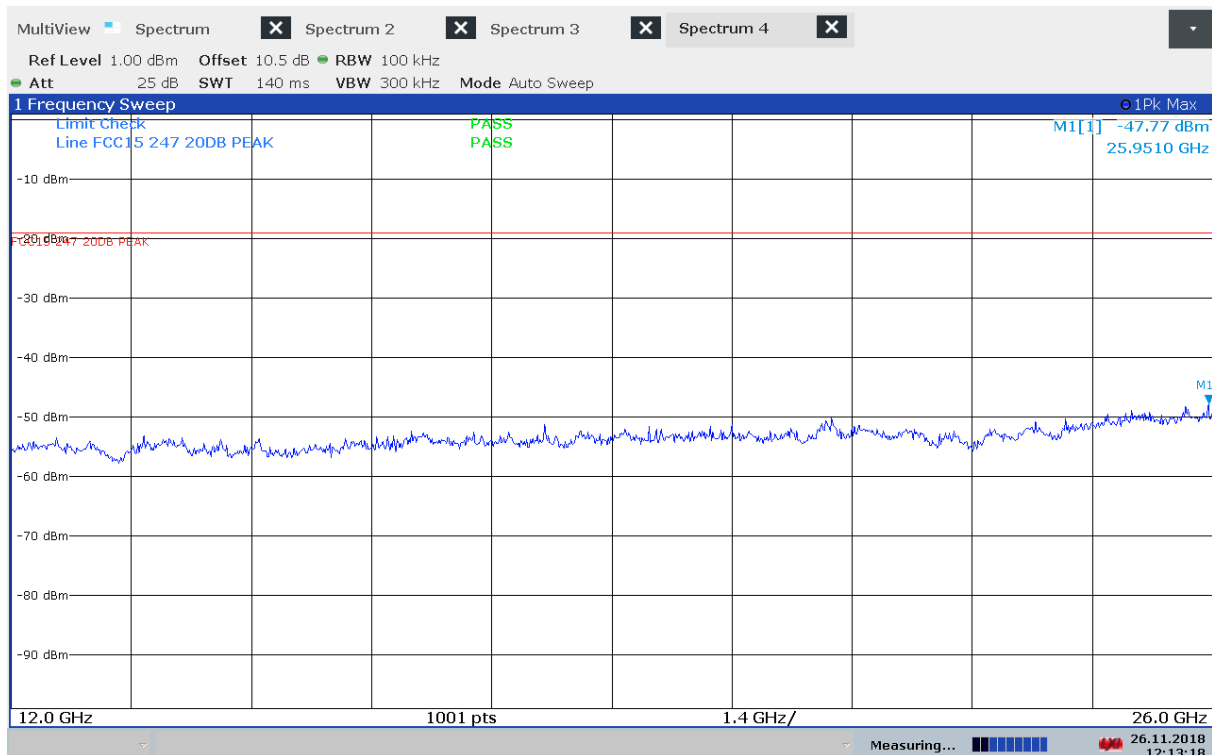
Conducted Emissions, 12000 – 26000 MHz, 2412 MHz, 802.11b, 1Mbps



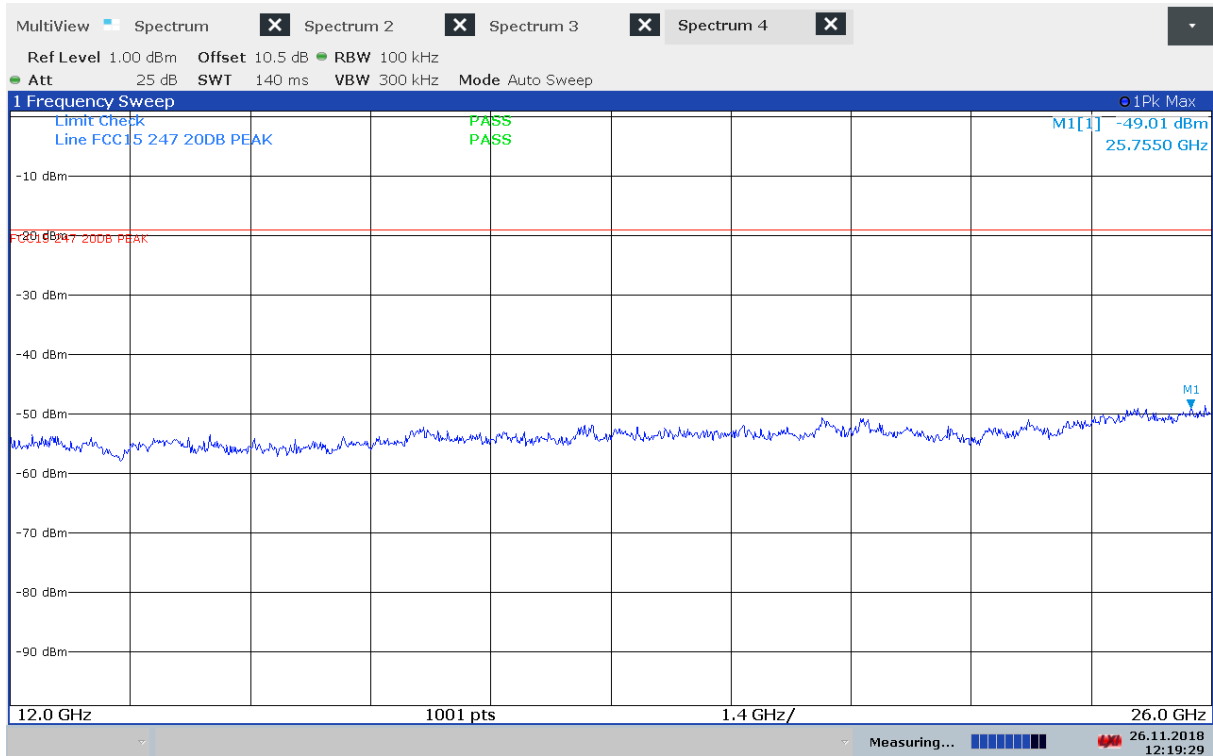
Conducted Emissions, 12000 – 26000 MHz, 2437 MHz, 802.11b, 1Mbps



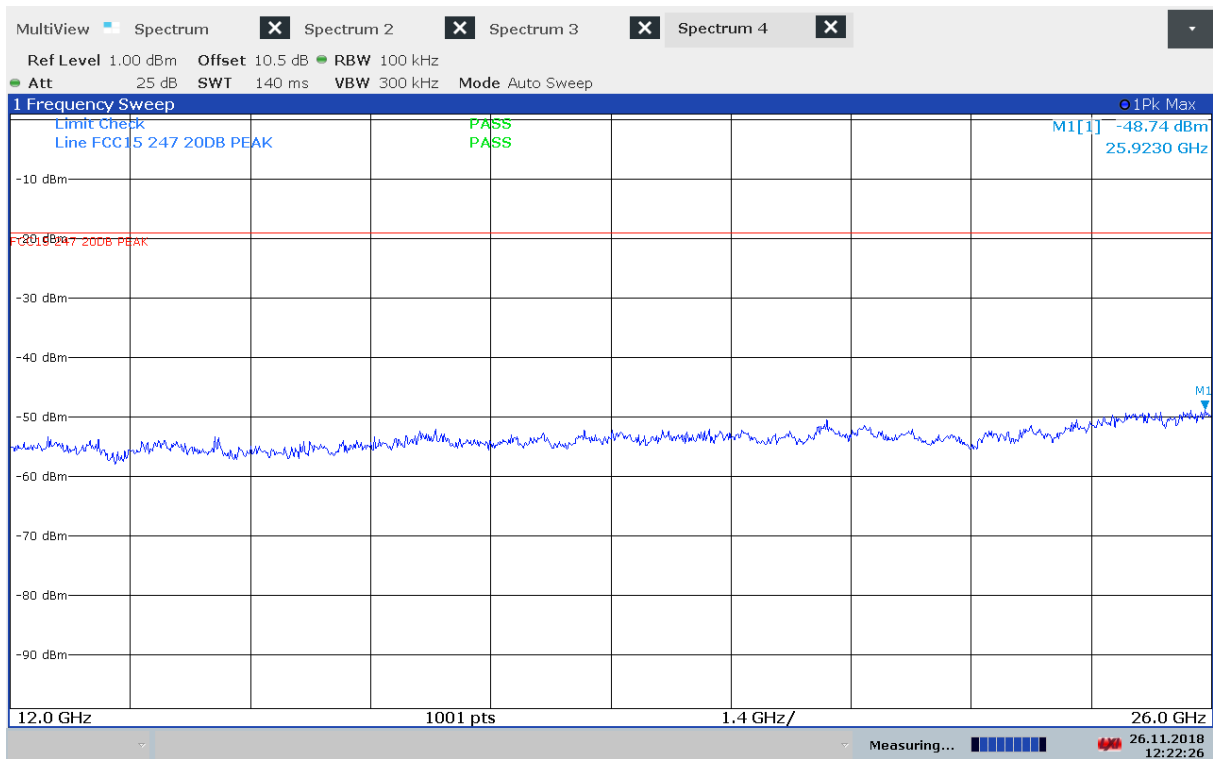
Conducted Emissions, 12000 – 26000 MHz, 2462 MHz, 802.11b, 1Mbps



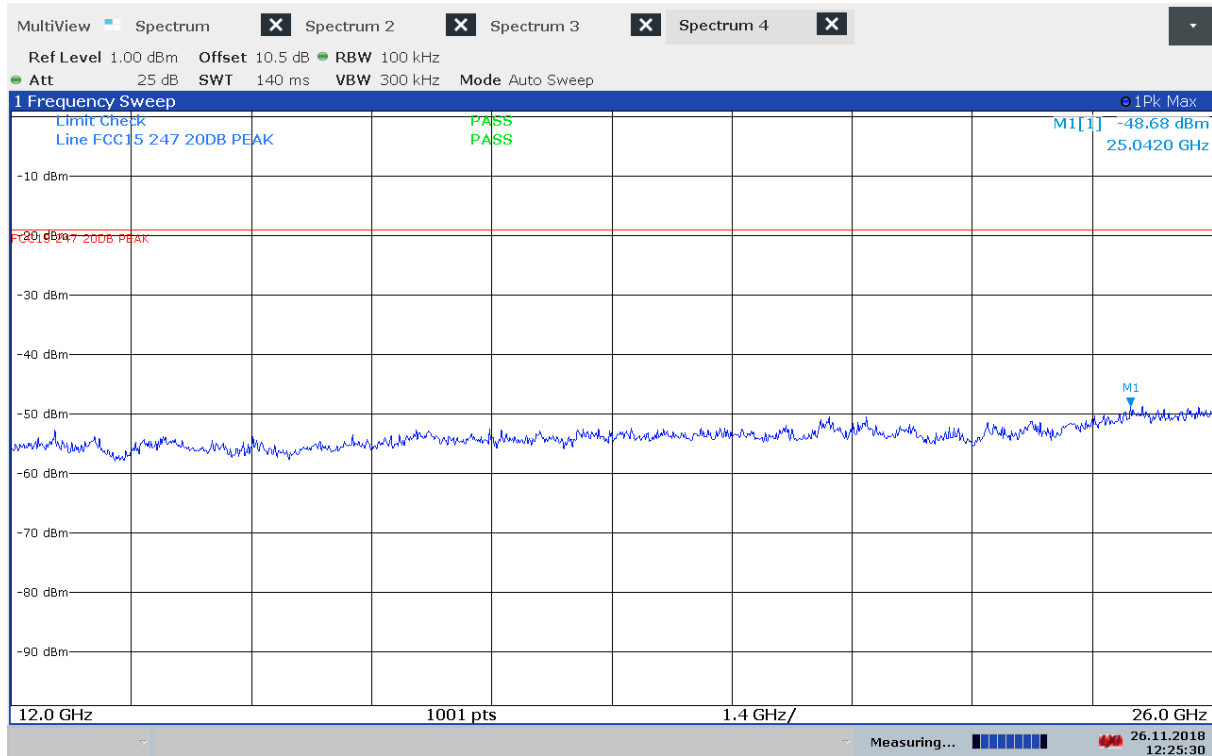
Conducted Emissions, 12000 – 26000 MHz, 2412 MHz, 802.11g, 6Mbps



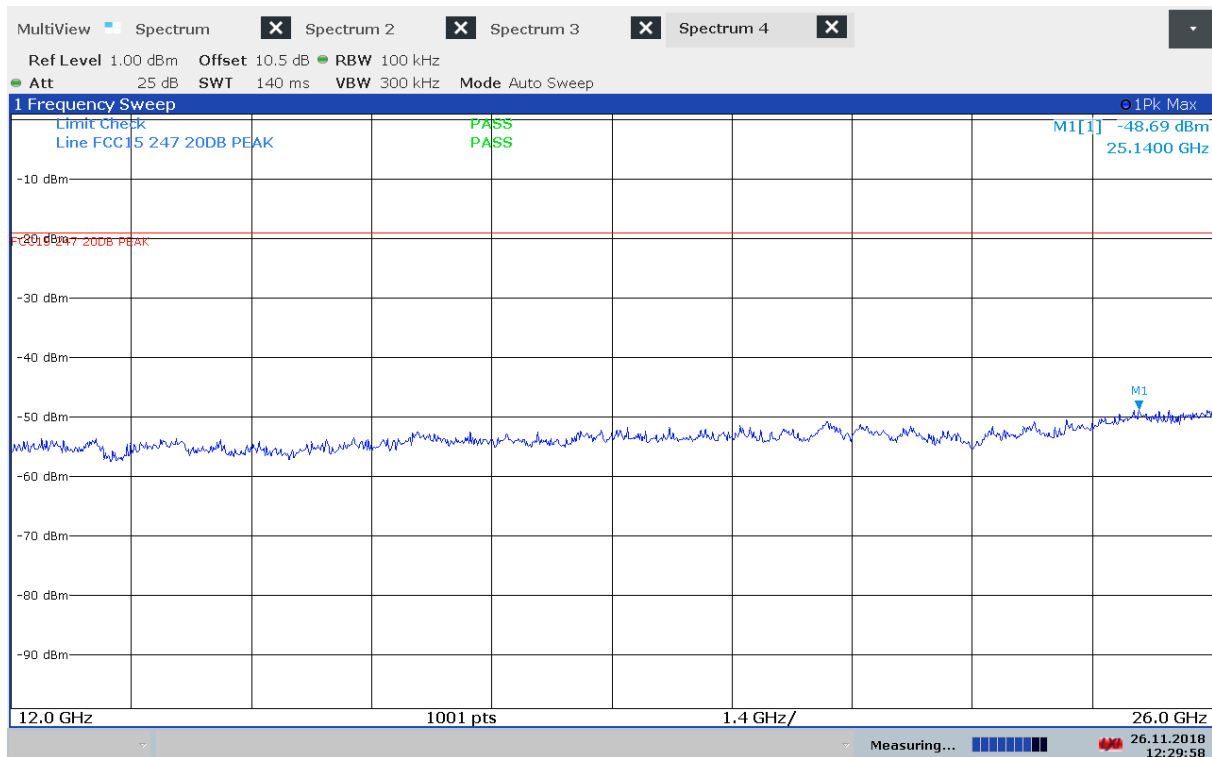
Conducted Emissions, 12000 – 26000 MHz, 2437 MHz, 802.11g, 6Mbps



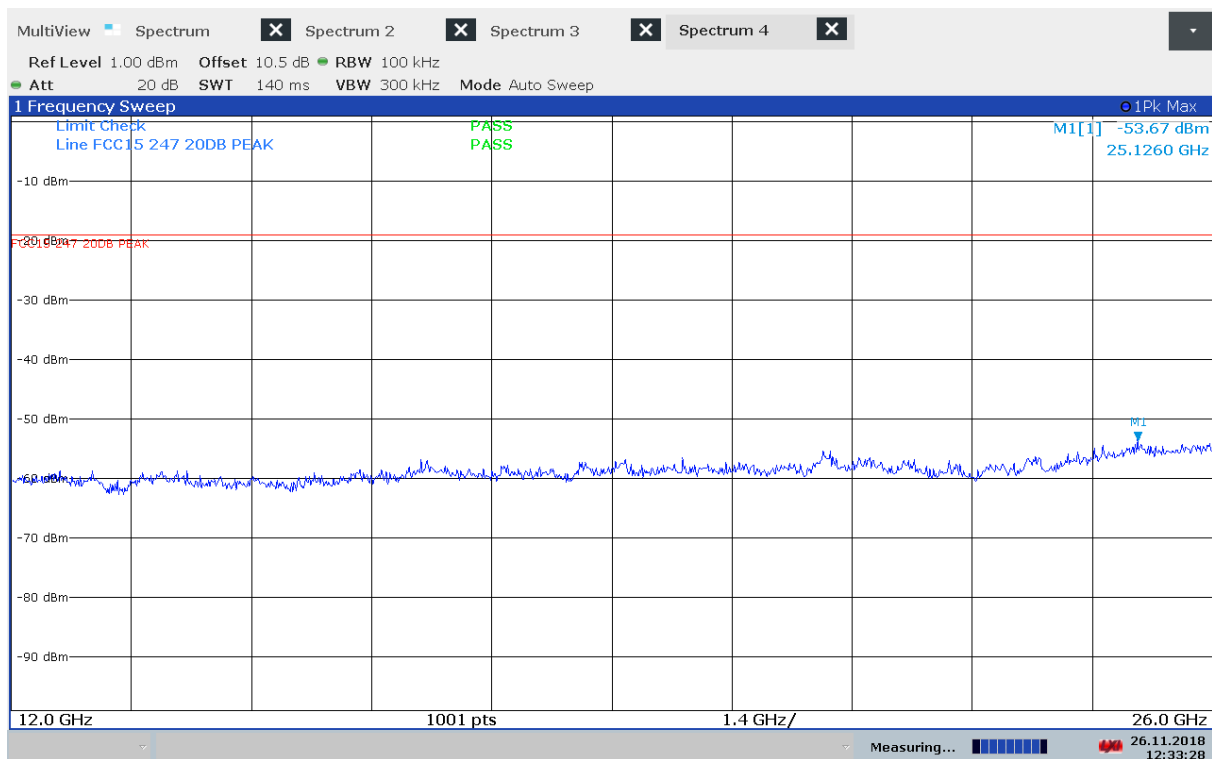
Conducted Emissions, 12000 – 26000 MHz, 2462 MHz, 802.11g, 6Mbps



Conducted Emissions, 12000 – 26000 MHz, 2412 MHz, 802.11n, MCS0



Conducted Emissions, 12000 – 26000 MHz, 2437 MHz, 802.11n, MCS0



Conducted Emissions, 12000 – 26000 MHz, 2462 MHz, 802.11n, MCS0

### 3.6 Restricted Bands of operation

Restricted Bands of operation for FCC and ISSED are defined in FCC Part 15.205 and ISSED RSS-GEN, Issue 4 clause 8.10.

Generally, no fundamentals are allowed in the restricted bands and all emissions must comply with the limits in FCC 15.209 or RSS-GEN, Issue 5, clause 8.9.

| FCC (MHz)                           | ISSED (MHz)        | FCC (GHz)                            | ISSED (GHz)       |
|-------------------------------------|--------------------|--------------------------------------|-------------------|
| 0.090-0.110                         |                    | <b>0.96-1.24</b><br><b>1.3-1.427</b> | <b>0.96-1.427</b> |
| 0.495-0.505                         |                    | 1.435-1.6265                         |                   |
| 2.1735-2.1905                       |                    | 1.6455-1.6465                        |                   |
|                                     | <b>3.020-3.026</b> | 1.660-1.710                          |                   |
| 4.125-4.128                         |                    | 1.7188-1.7222                        |                   |
| 4.17725-4.17775                     |                    | 2.2-2.3                              |                   |
| 4.20725-4.20775                     |                    | 2.31-2.39                            |                   |
|                                     | <b>5.677-5.683</b> | 2.4835-2.5                           |                   |
| 6.215-6.218                         |                    | <b>2.69-2.9</b>                      | <b>2.655-2.9</b>  |
| 6.26775-6.26825                     |                    | 3.26-3.267                           |                   |
| 6.31175-6.31225                     |                    | 3.332-3.339                          |                   |
| 8.291-8.294                         |                    | 3.3458-3.358                         |                   |
| 8.362-8.366                         |                    | <b>3.6-4.4</b>                       | <b>3.5-4.4</b>    |
| 8.37625-8.38675                     |                    | 4.5-5.15                             |                   |
| 8.41425-8.41475                     |                    | 5.35-5.46                            |                   |
| 12.29-12.293                        |                    | 7.25-7.75                            |                   |
| 12.51975-12.52025                   |                    | 8.025-8.5                            |                   |
| 12.57675-12.57725                   |                    | 9.0-9.2                              |                   |
| 13.36-13.41                         |                    | 9.3-9.5                              |                   |
| 16.42-16.423                        |                    | 10.6-12.7                            |                   |
| 16.69475-16.69525                   |                    | 13.25-13.4                           |                   |
| 16.80425-16.80475                   |                    | 14.47-14.5                           |                   |
| 25.5-25.67                          |                    | 15.35-16.2                           |                   |
| 37.5-38.25                          |                    | 17.7-21.4                            |                   |
| 73-74.6                             |                    | 22.01-23.12                          |                   |
| 74.8-75.2                           |                    | 23.6-24.0                            |                   |
| <b>108-121.94</b><br><b>123-138</b> | <b>108-138</b>     | 31.2-31.8                            |                   |
| 149.9-150.05                        |                    | 36.43-36.5                           |                   |
| 156.52475-156.52525                 |                    | Above 38.6                           |                   |
| 156.7-156.9                         |                    |                                      |                   |
| 162.0125-167.17                     |                    |                                      |                   |
| 167.72-173.2                        |                    |                                      |                   |
| 240-285                             |                    |                                      |                   |
| 322-335.4                           |                    |                                      |                   |
| 399.9-410                           |                    |                                      |                   |
| 608-614                             |                    |                                      |                   |

Frequencies in **Bold** text are specific for FCC or ISSED, all other frequencies are common.

### 3.7 Spurious Emissions (Radiated)

FCC Part 15.209

Test Results: Complies

Measurement Data:

Peak Detector:

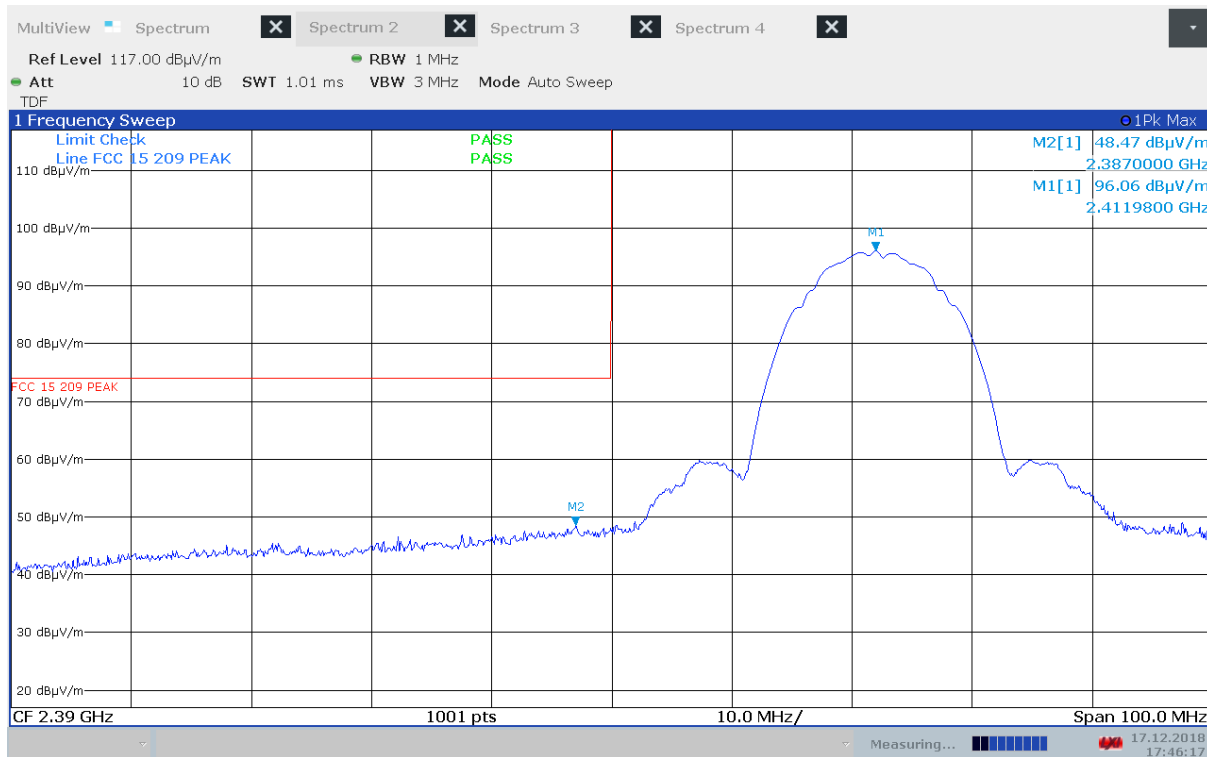
| Modulation and Bitrate | Measured field strength (dB $\mu$ V/m) |            | Limit | Margin |      |
|------------------------|----------------------------------------|------------|-------|--------|------|
|                        | 2390 MHz                               | 2483.5 MHz | dB    | dB     |      |
| 802.11b, 11 Mbps       | 48.5                                   | 46.7       | 74    | 25.5   | 27.3 |
| 802.11g, 6 Mbps        | 66.7                                   | 63.2       | 74    | 7.3    | 10.8 |
| 802.11n, MCS0          | 72.3                                   | 67.3       | 74    | 1.7    | 6.7  |

Average Detector:

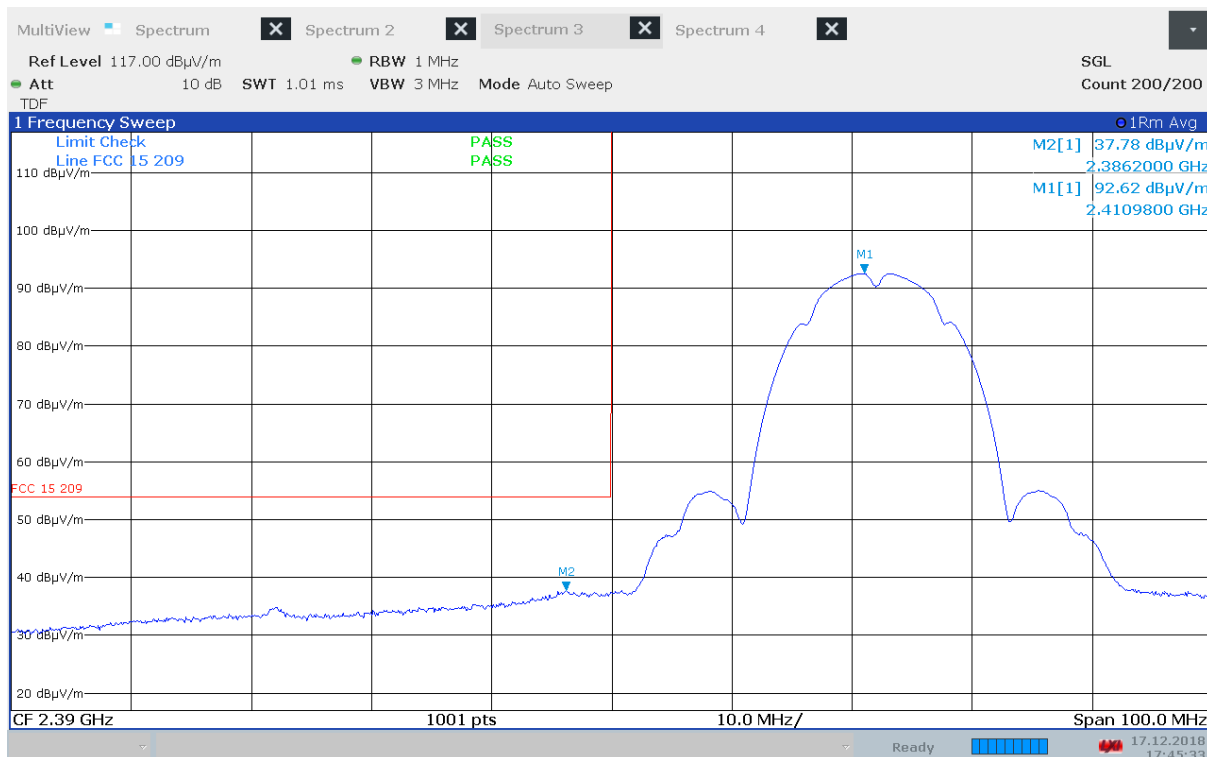
| Modulation and Bitrate | Measured field strength (dB $\mu$ V/m) |            | Limit | Margin |      |
|------------------------|----------------------------------------|------------|-------|--------|------|
|                        | 2390 MHz                               | 2483.5 MHz | dB    | dB     |      |
| 802.11b, 11 Mbps       | 37.8                                   | 36.1       | 54    | 16.2   | 17.9 |
| 802.11g, 6 Mbps        | 50.0                                   | 48.5       | 54    | 4.0    | 5.5  |
| 802.11n, MCS0          | 53.1                                   | 50.1       | 54    | 0.9    | 3.9  |

Average values are measured with RMS detector and trace averaging (Duty Cycle  $\approx$ 100%).

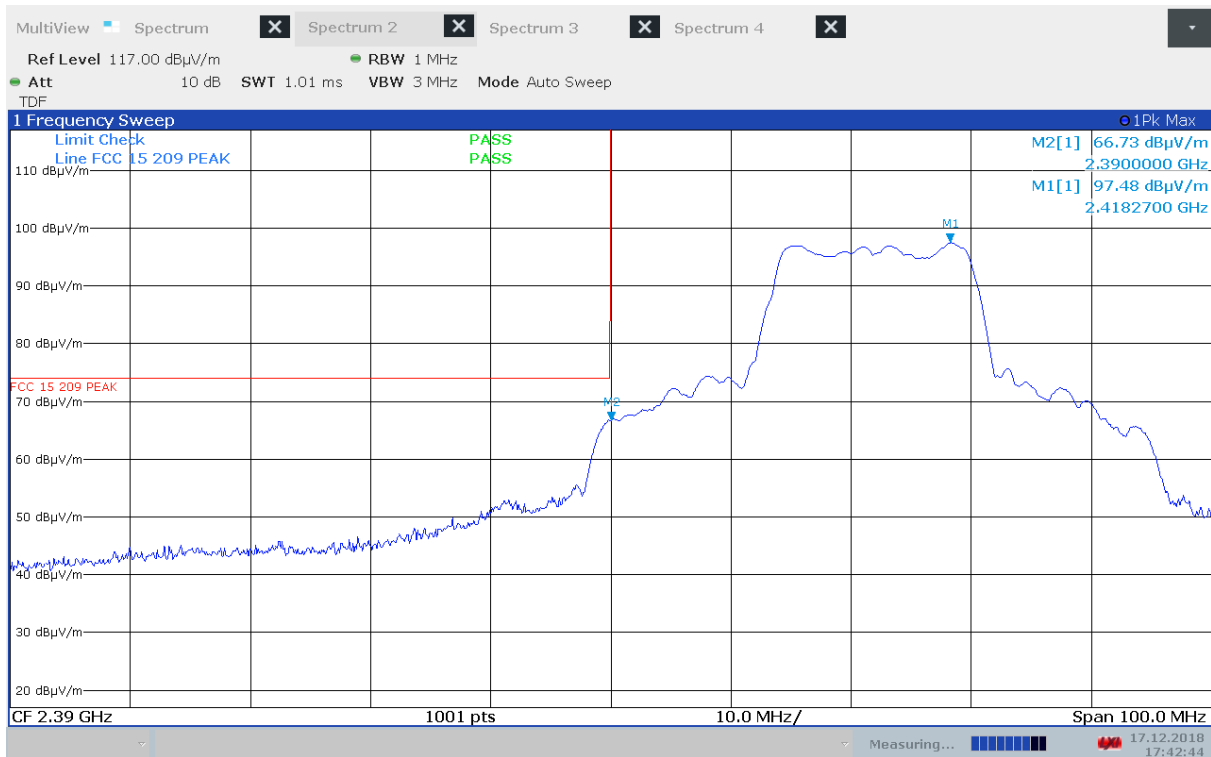
See attached plots.



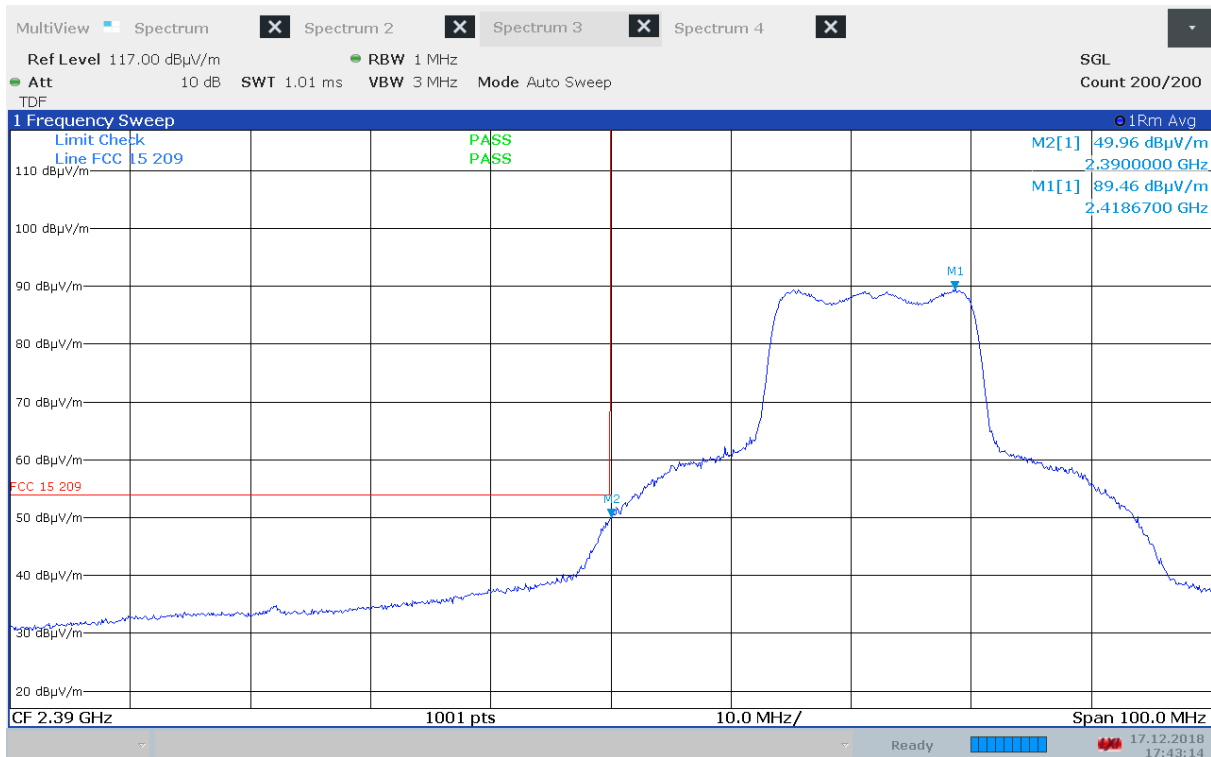
Lower Band Edge, Peak, 2412 MHz, 802.11b, 1Mbps



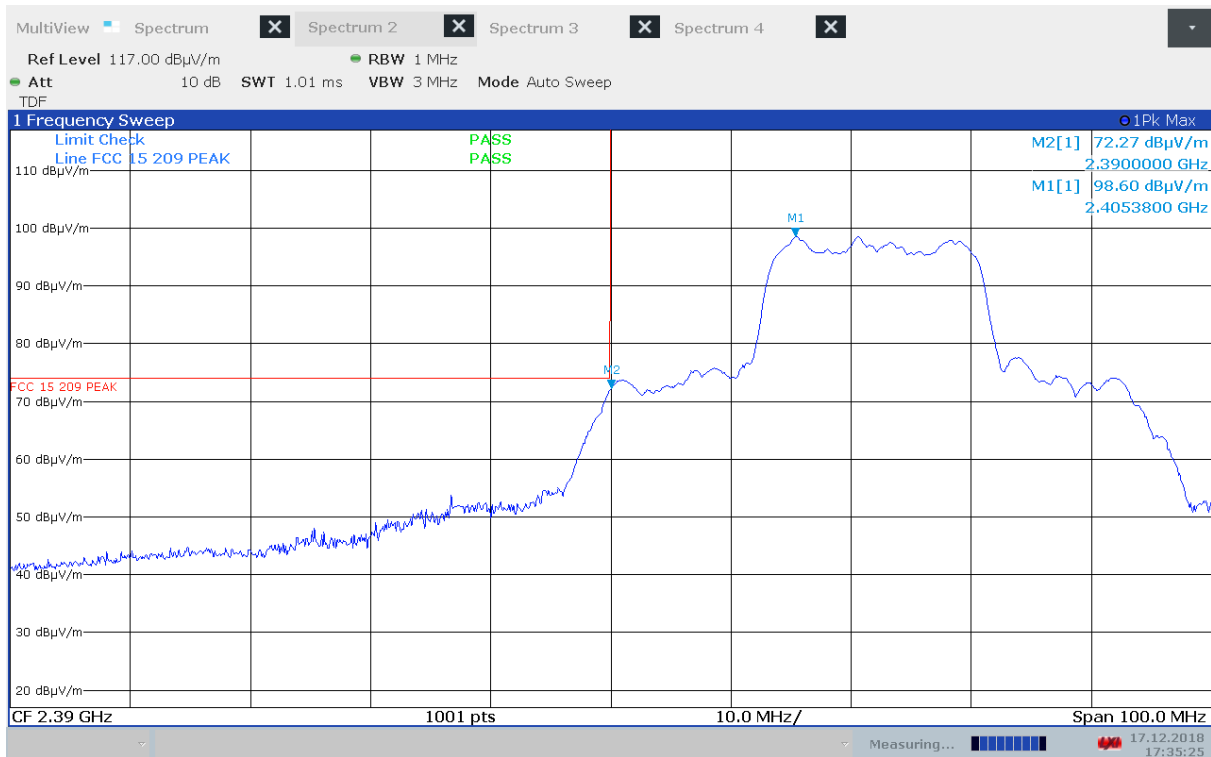
Lower Band Edge, Average, 2412 MHz, 802.11b, 1Mbps



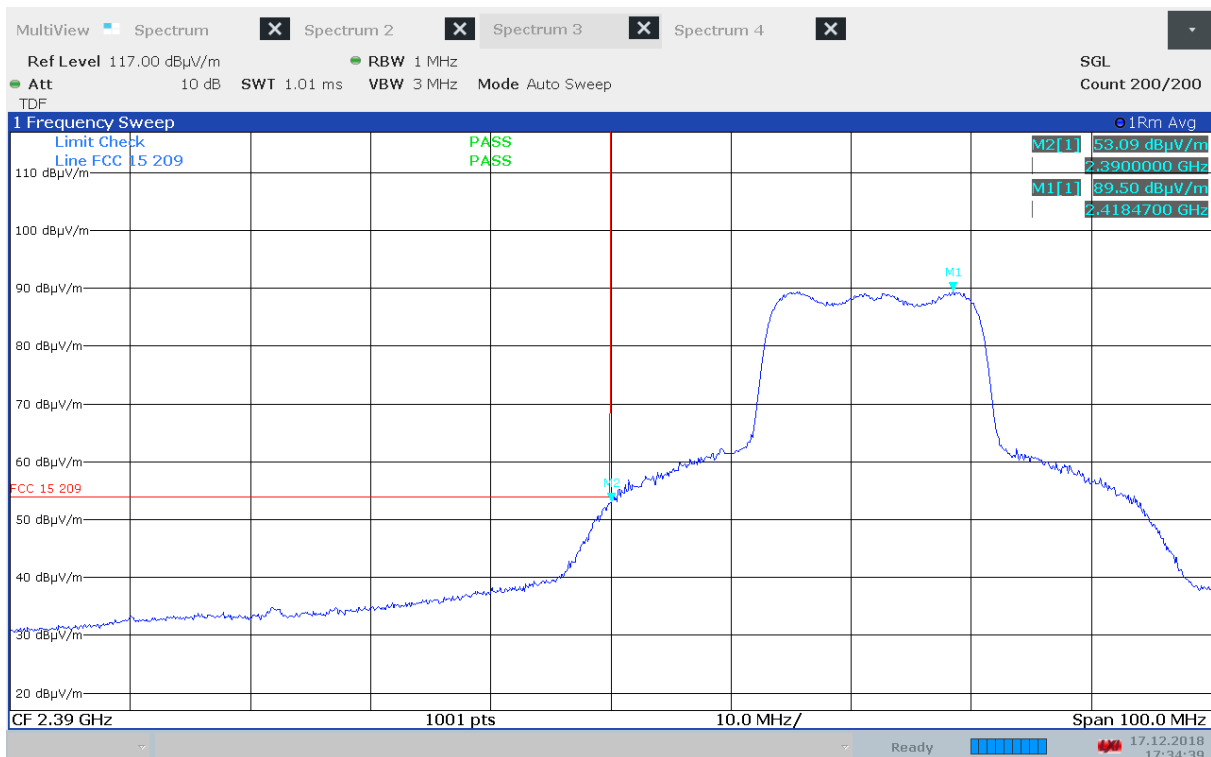
Lower Band Edge, Peak, 2412 MHz, 802.11g, 6Mbps



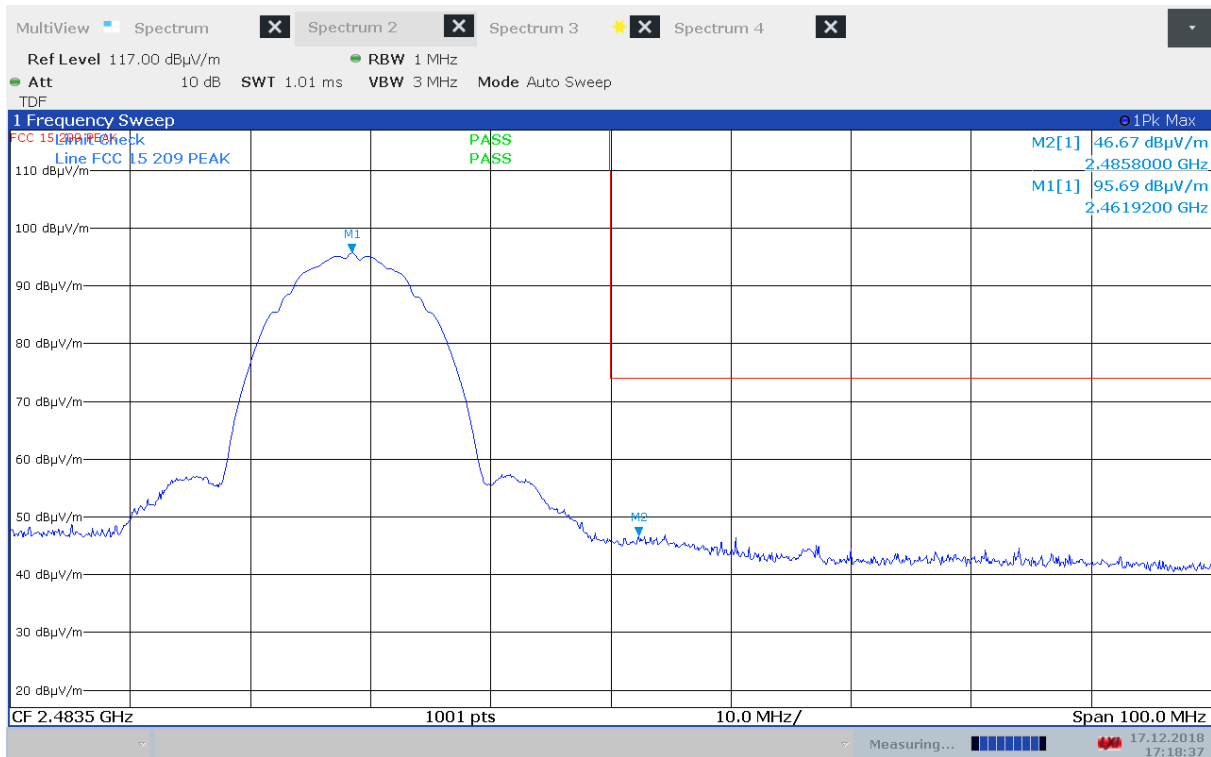
Lower Band Edge, Average, 2412 MHz, 802.11g, 6Mbps



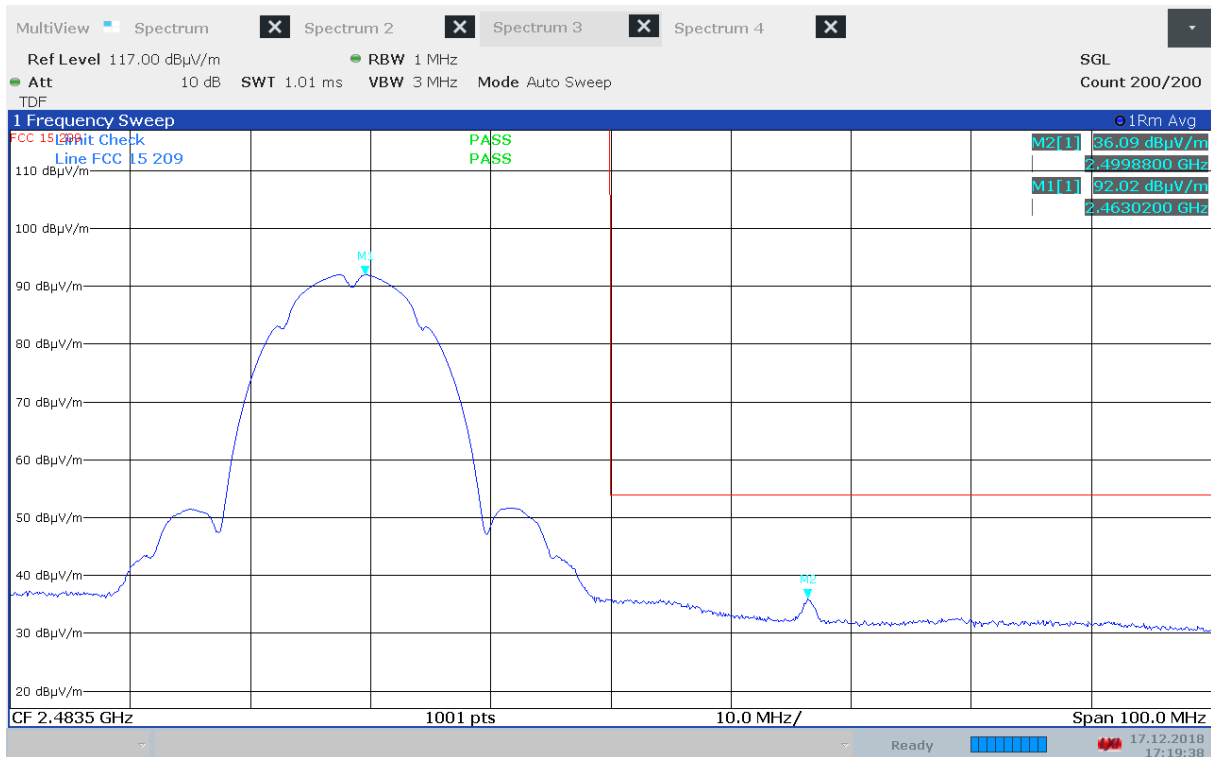
Lower Band Edge, Peak, 2412 MHz, 802.11n, MCS0



Lower Band Edge, Average, 2412 MHz, 802.11n, MCS0



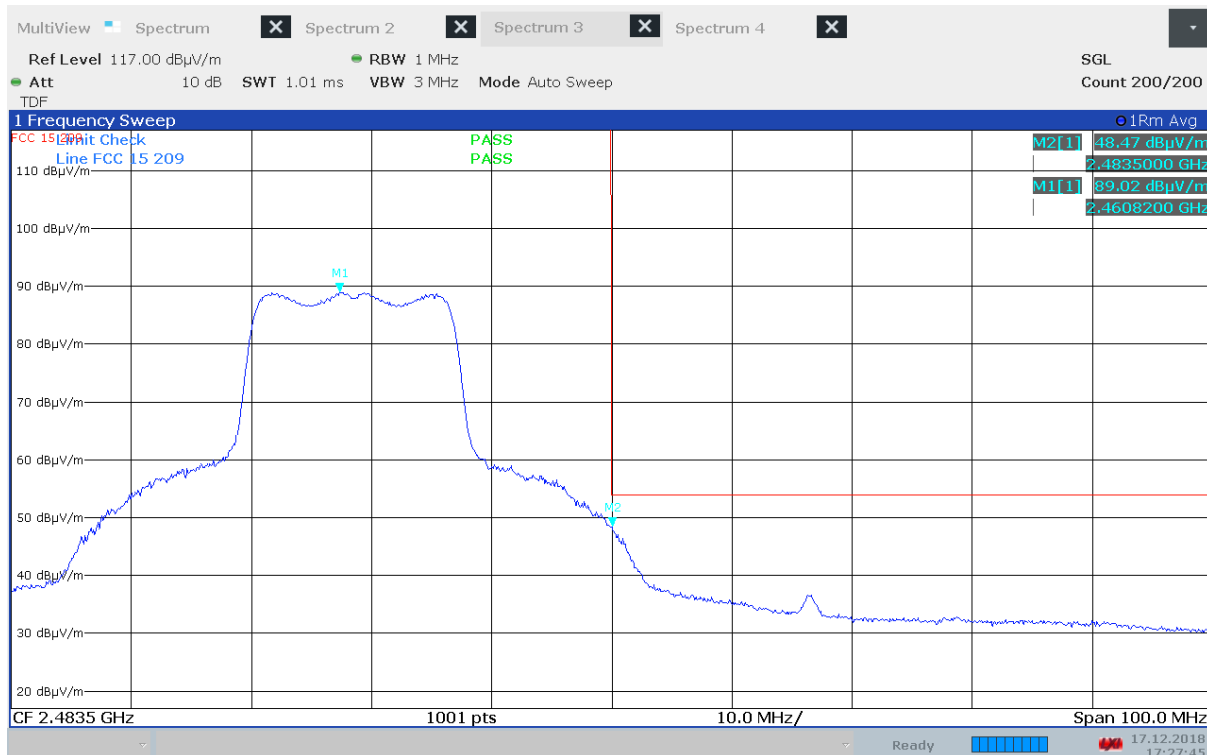
Upper Band Edge, Peak, 2462 MHz, 802.11b, 1Mbps



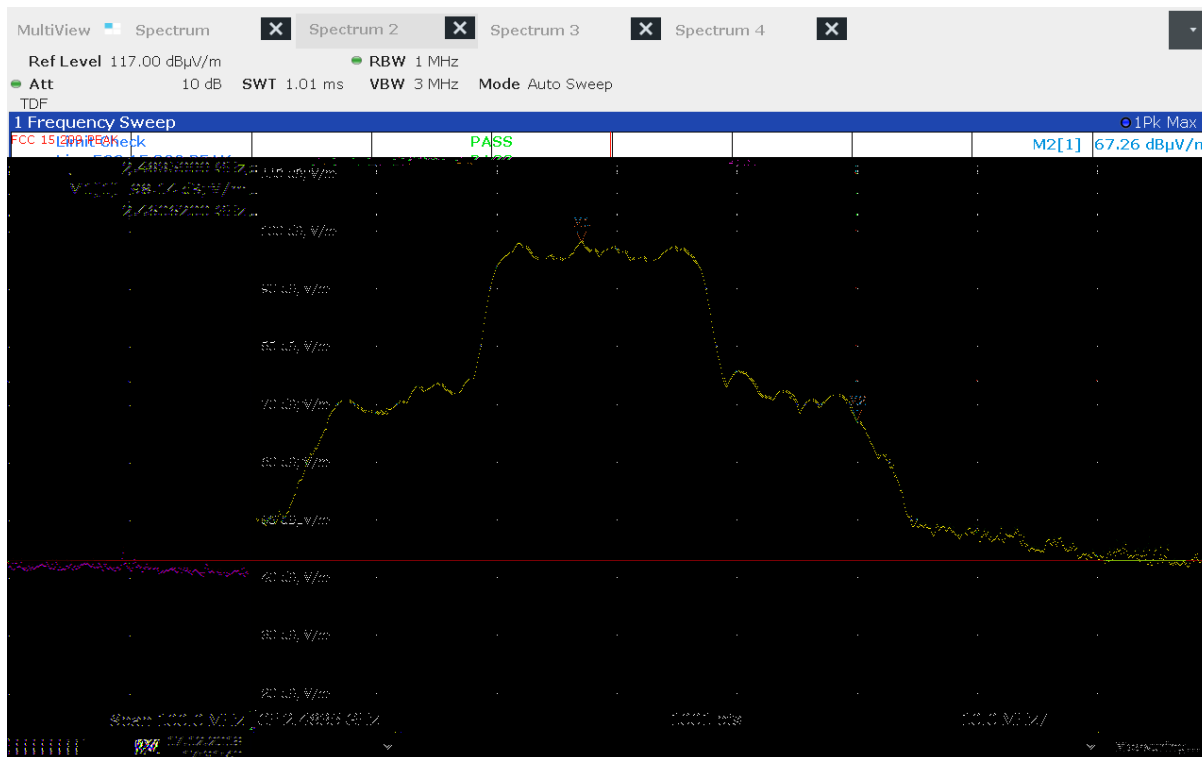
Upper Band Edge, Average, 2462 MHz, 802.11b, 1Mbps



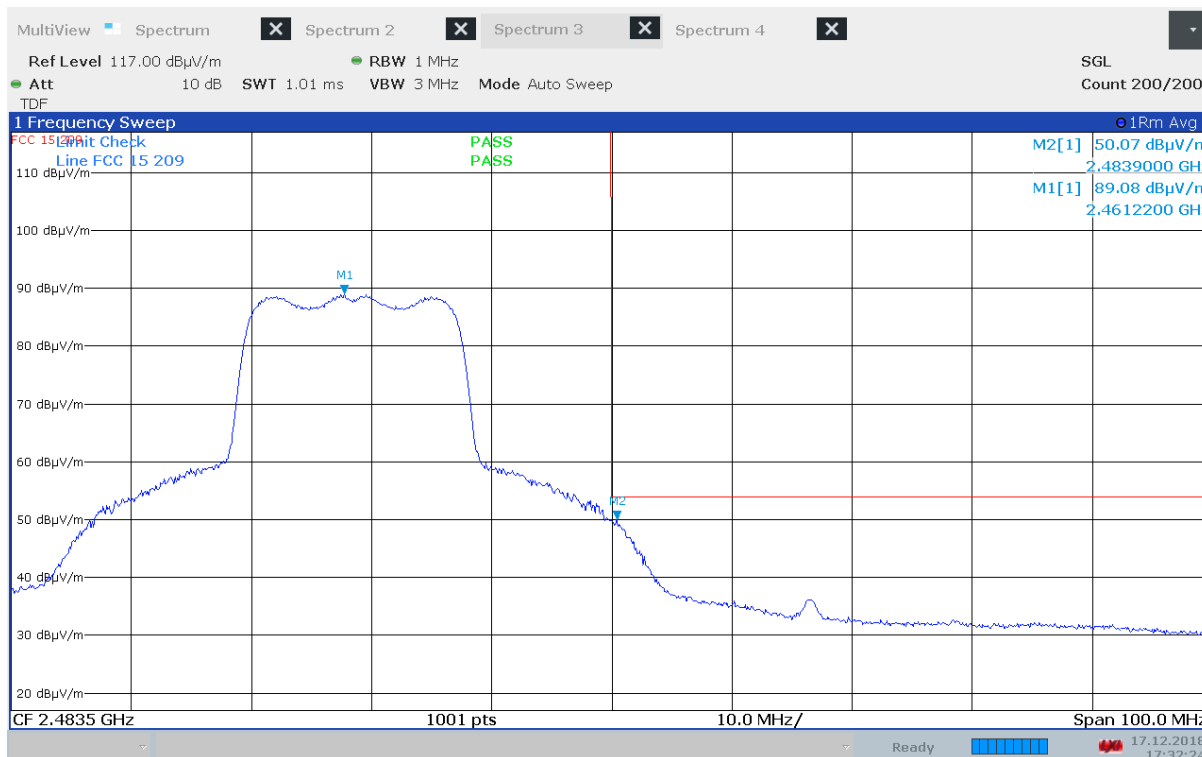
Upper Band Edge, Peak, 2462 MHz, 802.11g, 6Mbps



Upper Band Edge, Average, 2462 MHz, 802.11g, 6Mbps



Upper Band Edge, Peak, 2462 MHz, 802.11n, MCS0



Upper Band Edge, Average, 2462 MHz, 802.11n, MCS0

## Radiated emission 30 – 1000 MHz.

Detector: Peak

Measuring distance 3 m

Tested in test mode with EUT transmitting on ch01

| Frequency (MHz) | QuasiPeak (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) |
|-----------------|--------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|
| 30.249944       | 28.82              | 40.00          | 11.18       | 1000.0          | 120.000         | 111.0       | V   | 82.0          |
| 44.918650       | 19.06              | 40.00          | 20.94       | 1000.0          | 120.000         | 112.0       | V   | 52.0          |
| 48.750150       | 11.06              | 40.00          | 28.94       | 1000.0          | 120.000         | 106.0       | V   | 66.0          |
| 51.168050       | 8.22               | 40.00          | 31.78       | 1000.0          | 120.000         | 100.0       | V   | 59.0          |
| 932.736700      | 18.12              | 46.00          | 27.88       | 1000.0          | 120.000         | 152.0       | V   | 128.0         |

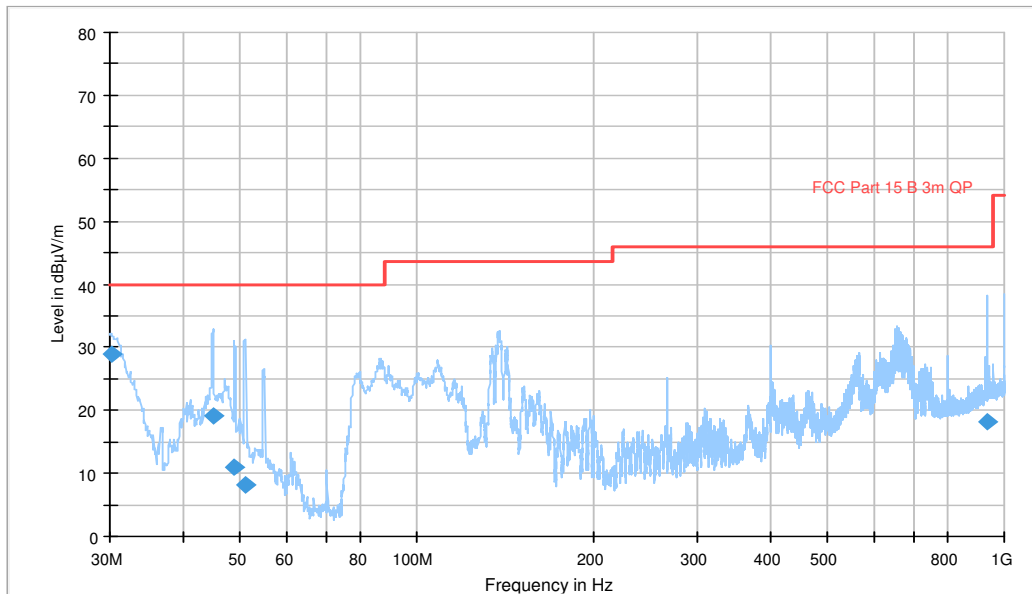
See attached plots.

## Requirements/Limit

|                 |                                                                  |                     |
|-----------------|------------------------------------------------------------------|---------------------|
| FCC             | Part 15.209 @ frequencies defined in §15.205                     |                     |
| ISED            | RSS-GEN Issue 5, clause 8.9 @ frequencies defined in clause 8.10 |                     |
|                 | Radiated emission limit @3 meters                                |                     |
| Frequency (MHz) | Quasi Peak (µV/m)                                                | Quasi Peak (dBµV/m) |
| 30 – 88         | 100                                                              | 40.0                |
| 88 – 216        | 150                                                              | 43.5                |
| 216 – 960       | 200                                                              | 46.0                |
| Above 960       | 500                                                              | 54.0                |

The limit above 1000 MHz is specified for Average Detector, when the measurement is performed with a Peak Detector a Duty-Cycle Correction Factor has to be calculated to find the corresponding Average Detector value.

Full Spectrum



**Radiated Emissions, 30 -1000 MHz, 2412 MHz, 802.11b, 1Mbps**

## Radiated Emissions, 1 - 26 GHz

Measuring distance: 3m (1 – 18 GHz)

A pre-scan was performed above 18 GHz and any found spurioues were measured @1m

### Peak Detector, RBW=1 MHz

| Carrier Frequency | Measured Frequency | Modulation | Measured Emission (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|-------------------|--------------------|------------|----------------------------|----------------|-------------|
| Any*              | 2132 MHz           | Any        | 62.7                       | 74             | 11.3        |
| Any               | Any other          | Any        | < 54                       | 74             | >20         |

\*Worst case

### Average Detector, RBW=1 MHz

| Carrier Frequency | Measured Frequency | Modulation    | Measured Emission (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|-------------------|--------------------|---------------|----------------------------|----------------|-------------|
| 2412 MHz          | 19.3 GHz           | 802.11a 6Mbps | 41.8                       | 54             | 12.2        |
|                   | Any other          | Any other     | < 44                       | 54             | >10         |
| 2437 MHz          | 19.5 GHz           | 802.11a 6Mbps | 43.0                       | 54             | 11.0        |
|                   | Any other          | Any other     | < 44                       | 54             | >10         |
| 2462 MHz          | 19.7 GHz           | 802.11a 6Mbps | 41.6                       | 54             | 12.4        |
|                   | Any other          | Any other     | < 44                       | 54             | >10         |
| Any*              | 1600 MHz           | Any           | 30.2                       | 54             | 23.8        |
| Any*              | 2132 MHz           | Any           | 47.9                       | 54             | 6.1         |

\*Same value for all modulations and carrier frequencies

Measured results are for 802.11a 6 Mbps and 802.11n MCS0, it was checked that other modulations and/or bitrates did not produce higher emissions.

A Band Reject Filter was used for measurements from 1 GHz to 4 GHz and a High Pass Filter was used from 3 GHz to 18 GHz.

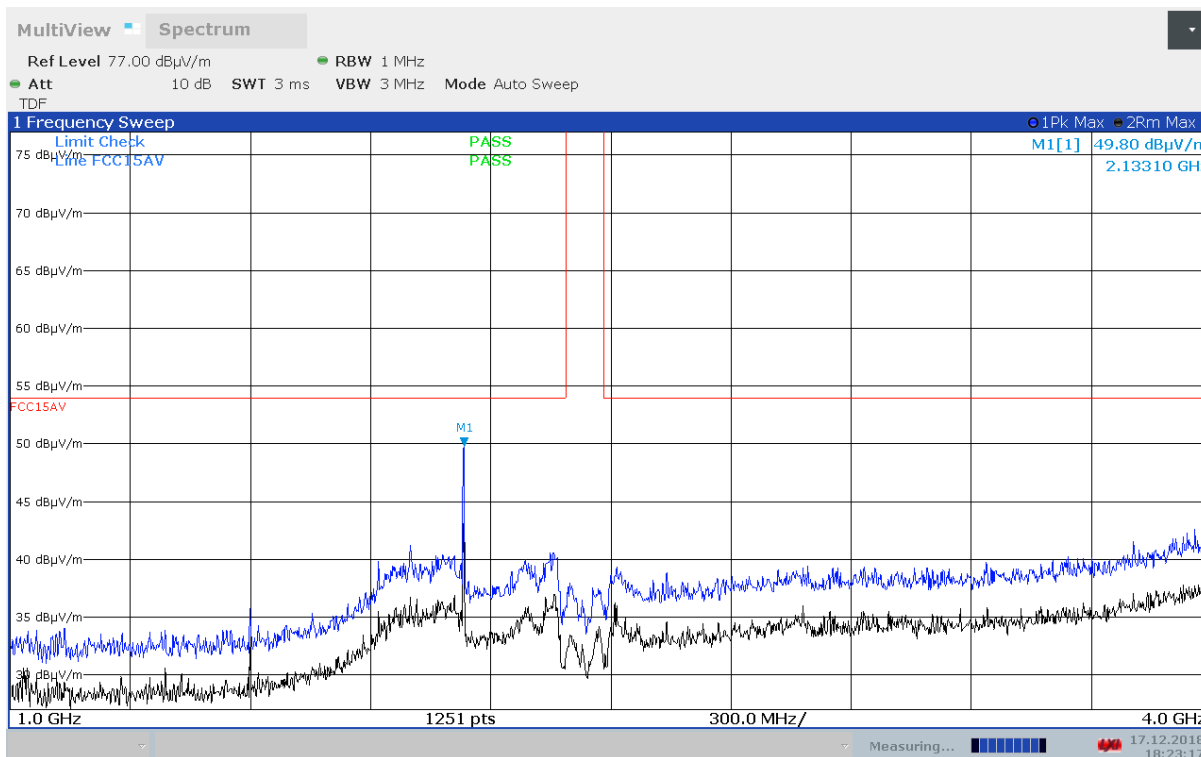
Only harmonics that fall in the restricted bands (ref. §15.205) have been measured.

Antenna factor, amplifier gain and cable loss are included in Spectrum Analyzer "Transducer factor".

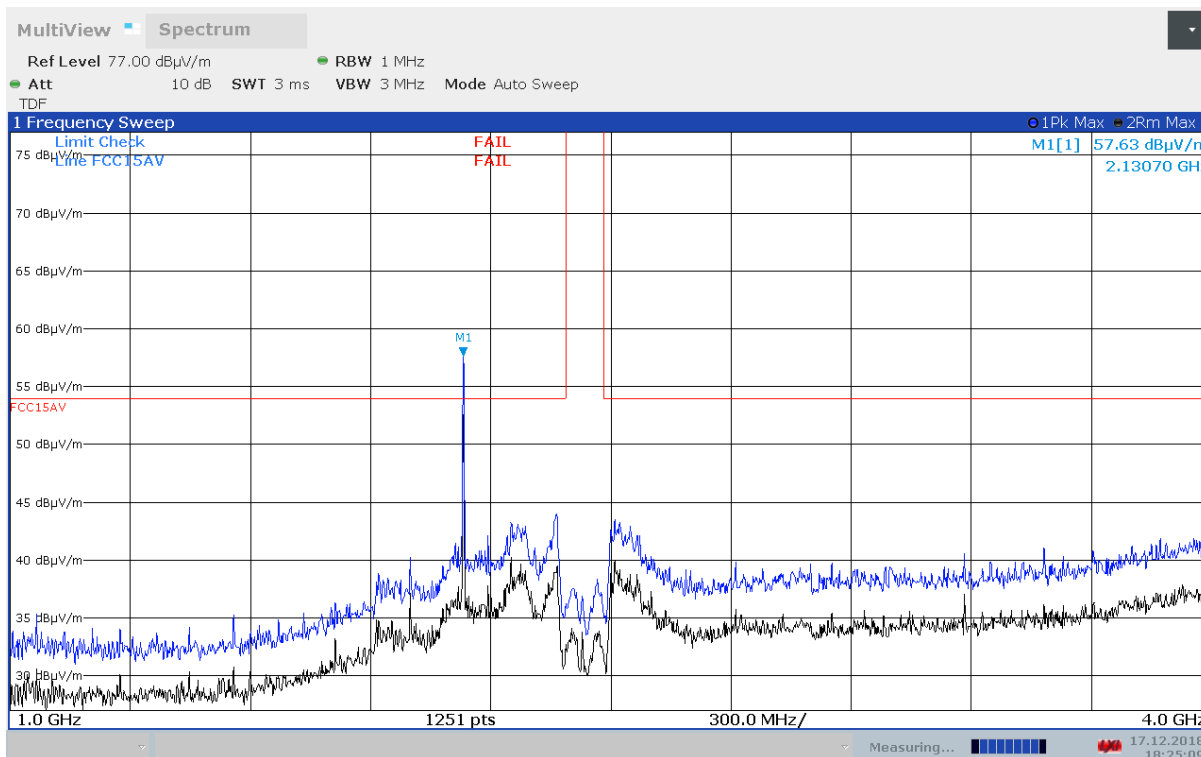
See attached plots.

### Requirements/Limit

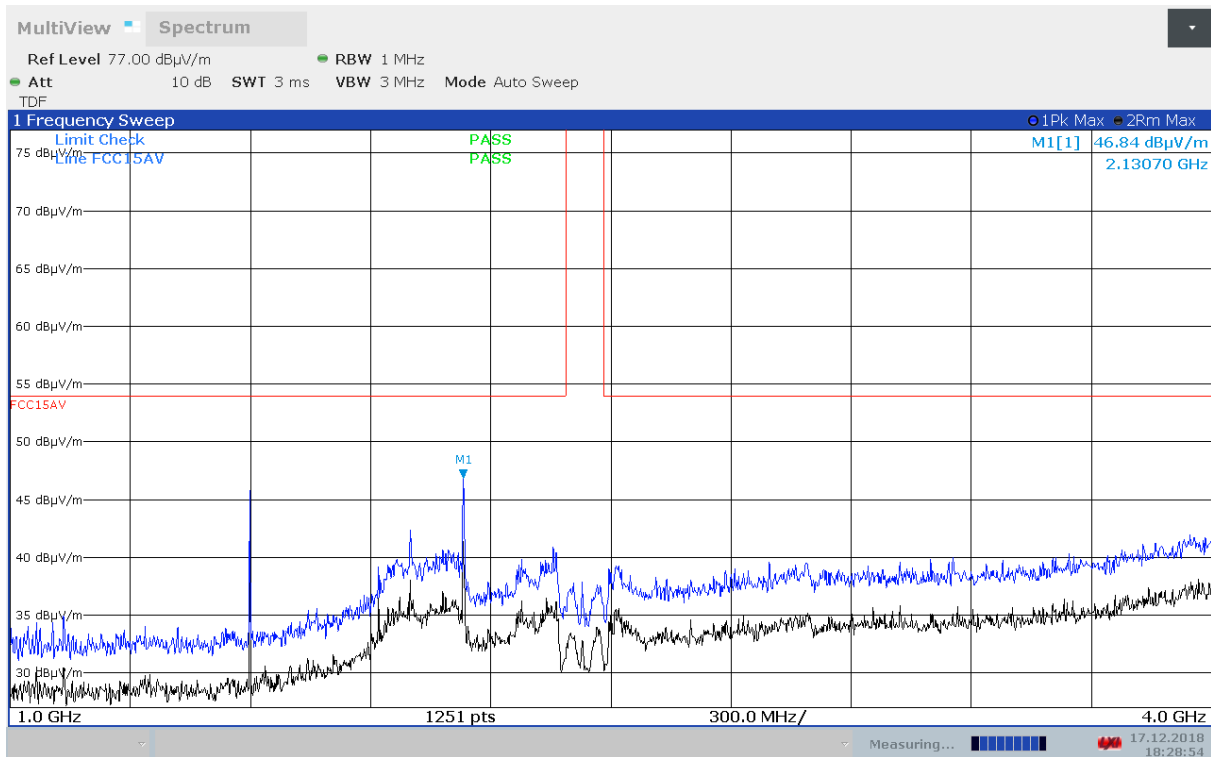
|                 |                                                                  |               |
|-----------------|------------------------------------------------------------------|---------------|
| FCC             | Part 15.209 @ frequencies defined in §15.205                     |               |
| ISED            | RSS-GEN Issue 5, clause 8.9 @ frequencies defined in clause 8.10 |               |
|                 | Radiated emission limit @3 meters                                |               |
| Frequency (MHz) | AV (dBμV/m)                                                      | Peak (dBμV/m) |
| Above 1 GHz     | 54.0                                                             | 74.0          |



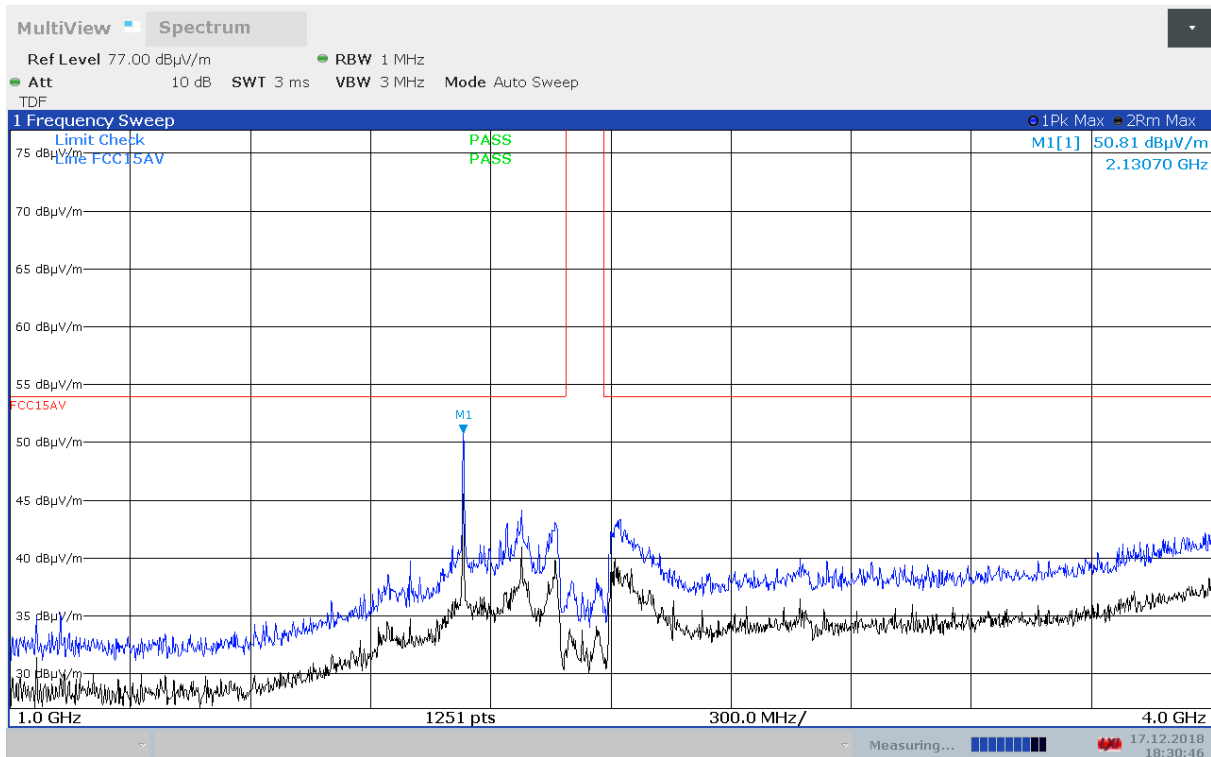
Radiated Emissions, 1000 -4000 MHz, 2412 MHz, VP, 802.11b, 1Mbps



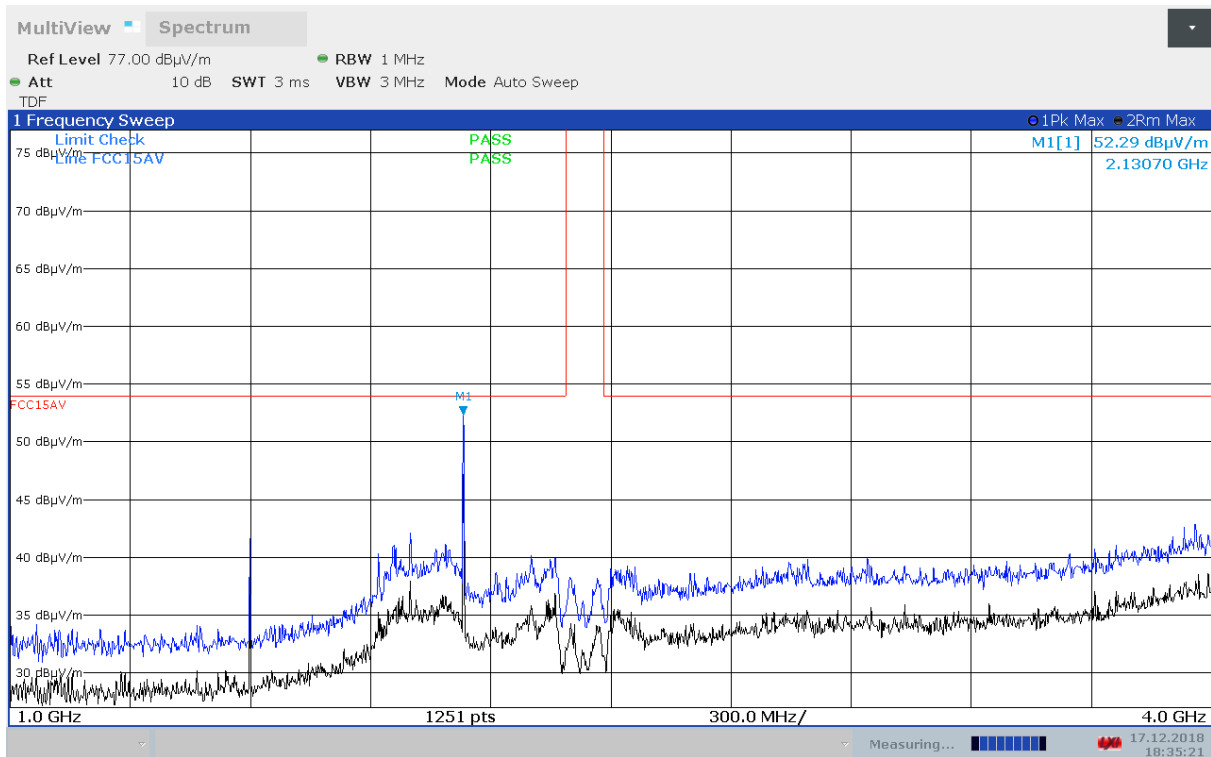
Radiated Emissions, 1000 -4000 MHz, 2412 MHz, HP, 802.11b, 1Mbps



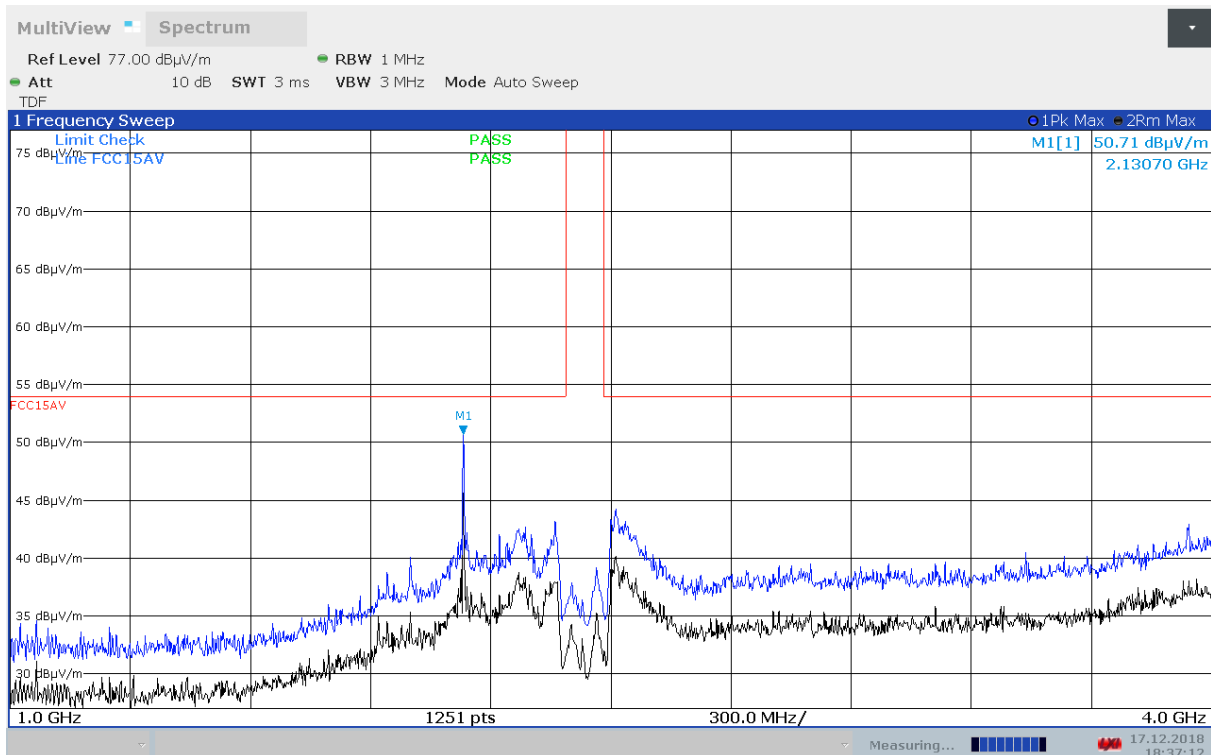
Radiated Emissions, 1000 -4000 MHz, 2437 MHz, VP, 802.11b, 1Mbps



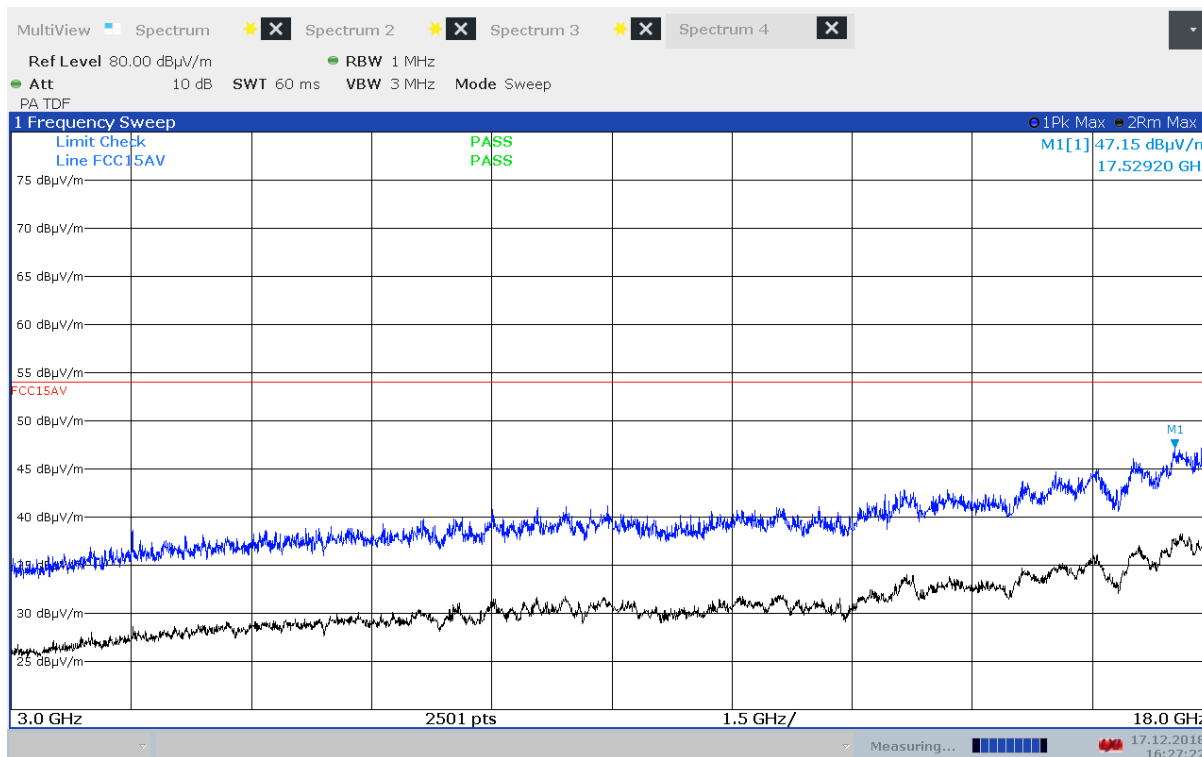
Radiated Emissions, 1000 -4000 MHz, 2437 MHz, HP, 802.11b, 1Mbps



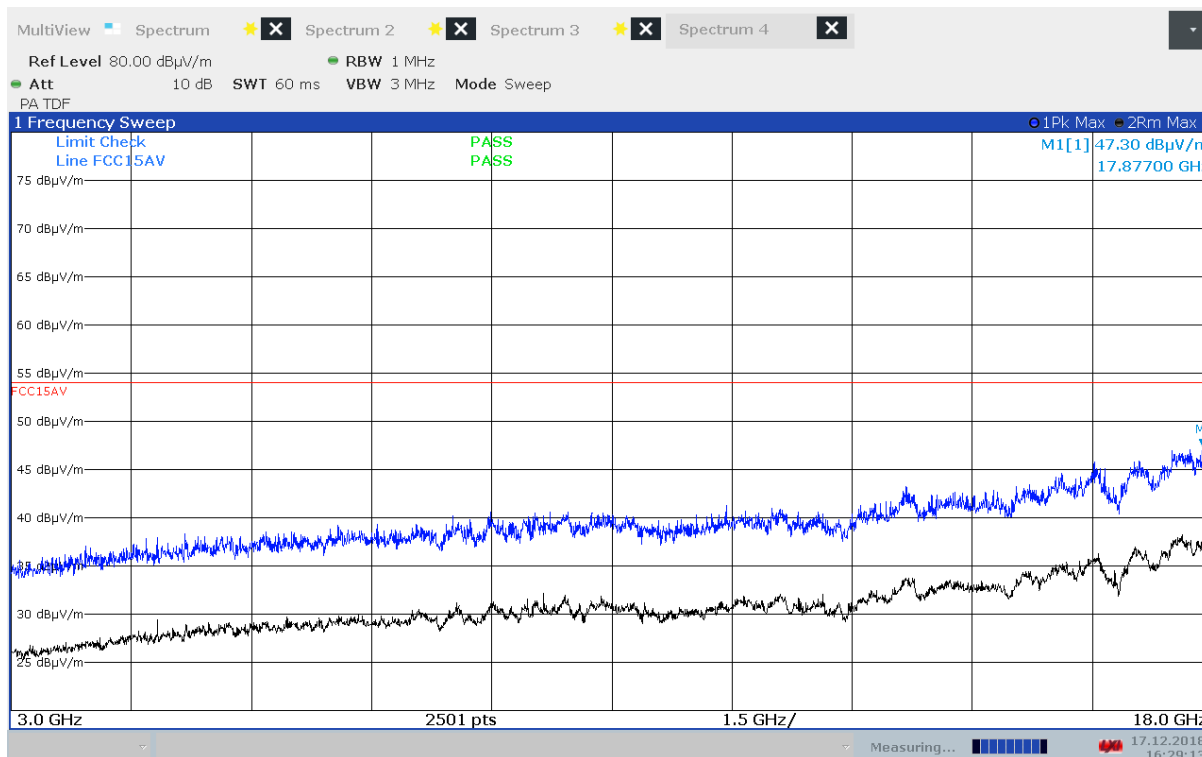
Radiated Emissions, 1000 -4000 MHz, 2462 MHz, VP, 802.11b, 1Mbps



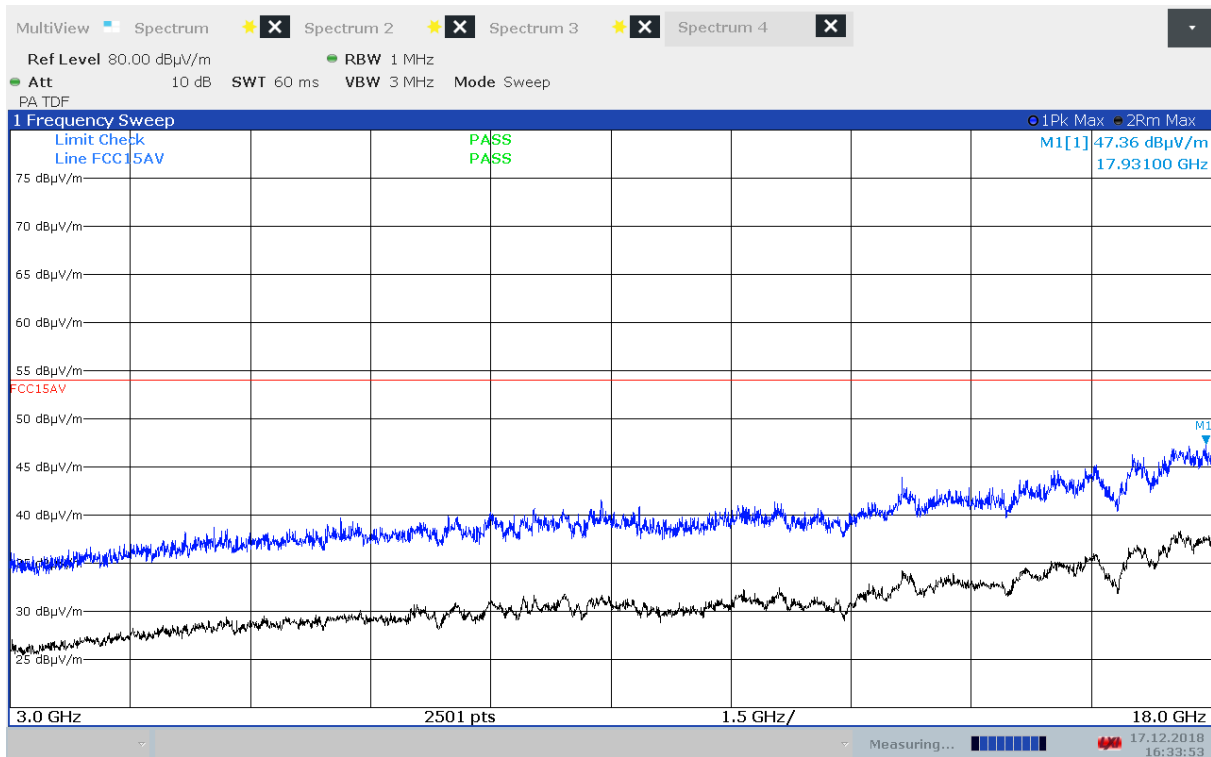
Radiated Emissions, 1000 -4000 MHz, 2462 MHz, HP, 802.11b, 1Mbps



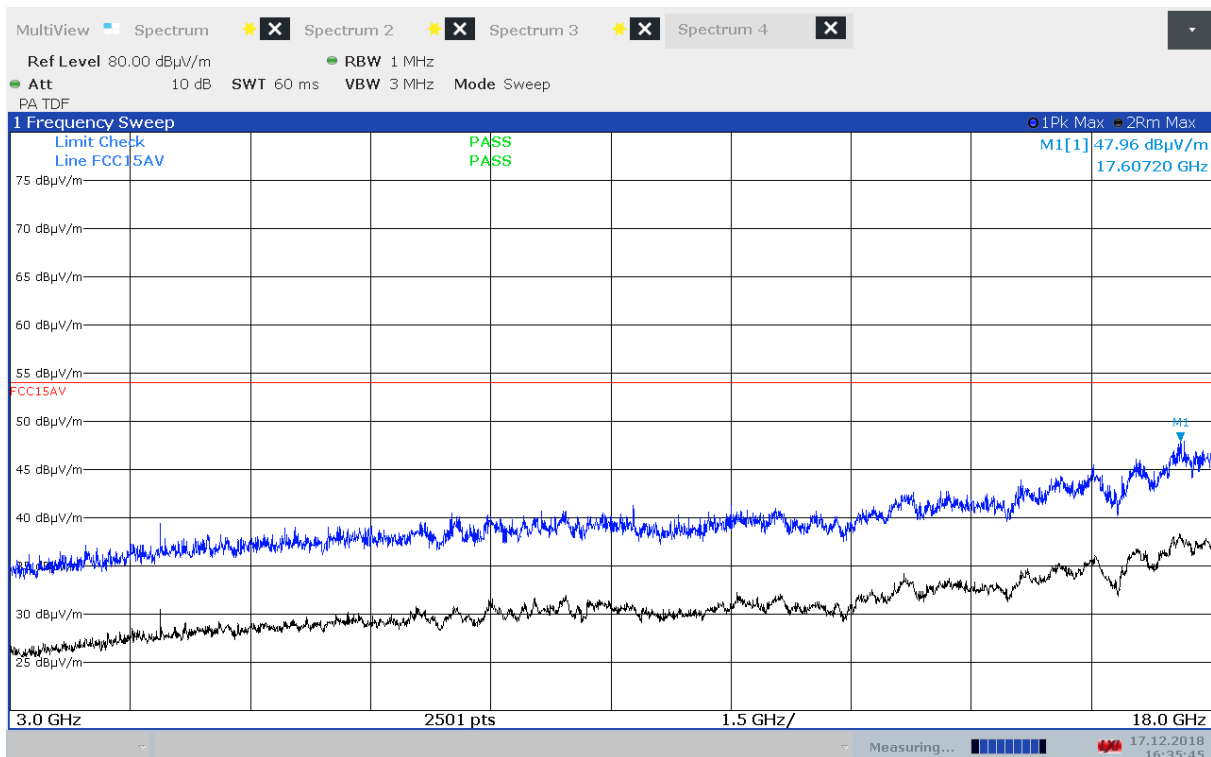
Radiated Emissions, 3000 -18000 MHz, 2412 MHz, VP, 802.11b, 1Mbps



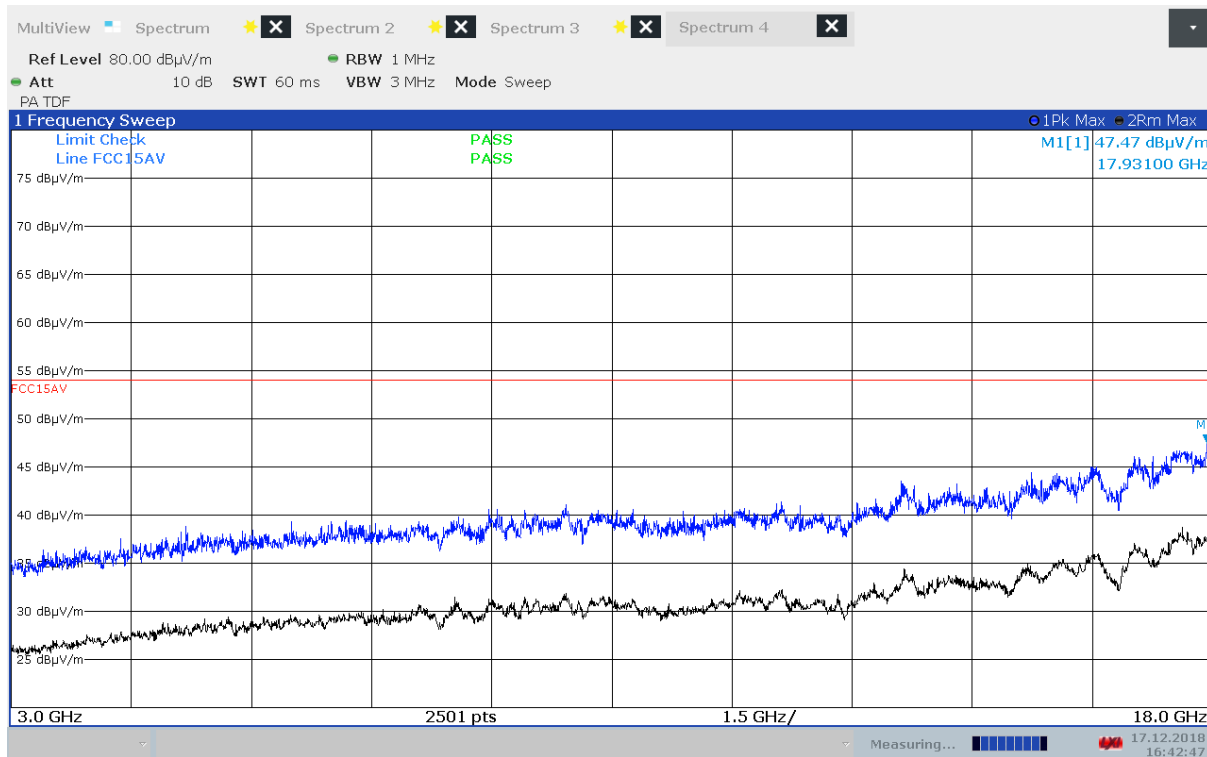
Radiated Emissions, 3000 -18000 MHz, 2412 MHz, HP, 802.11b, 1Mbps



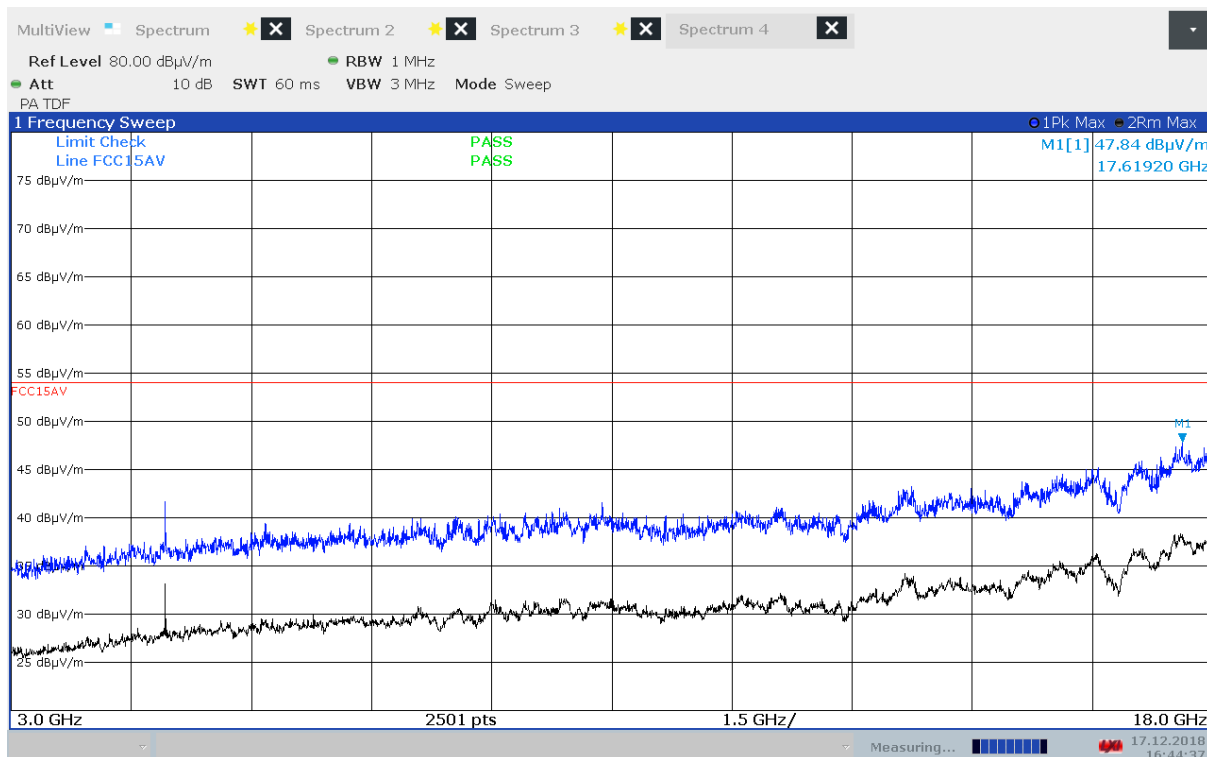
Radiated Emissions, 3000 -18000 MHz, 2437 MHz, VP, 802.11b, 1Mbps



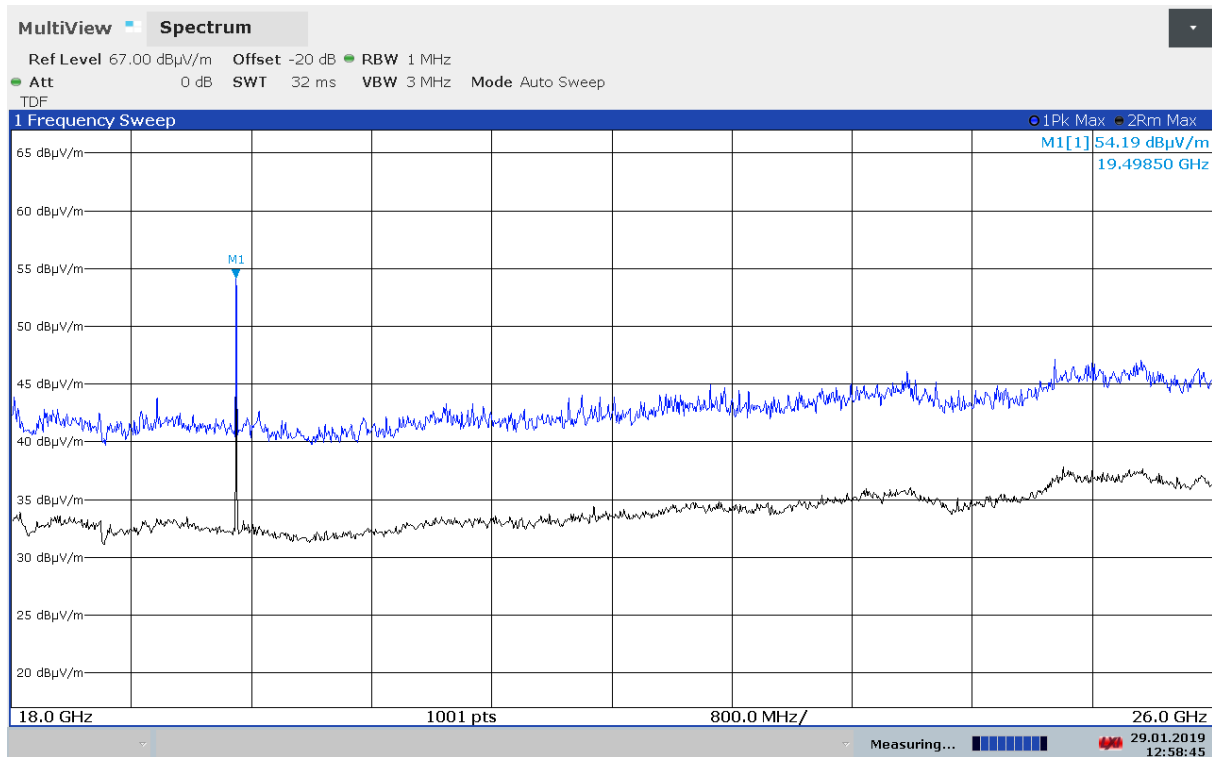
Radiated Emissions, 3000 -18000 MHz, 2437 MHz, HP, 802.11b, 1Mbps



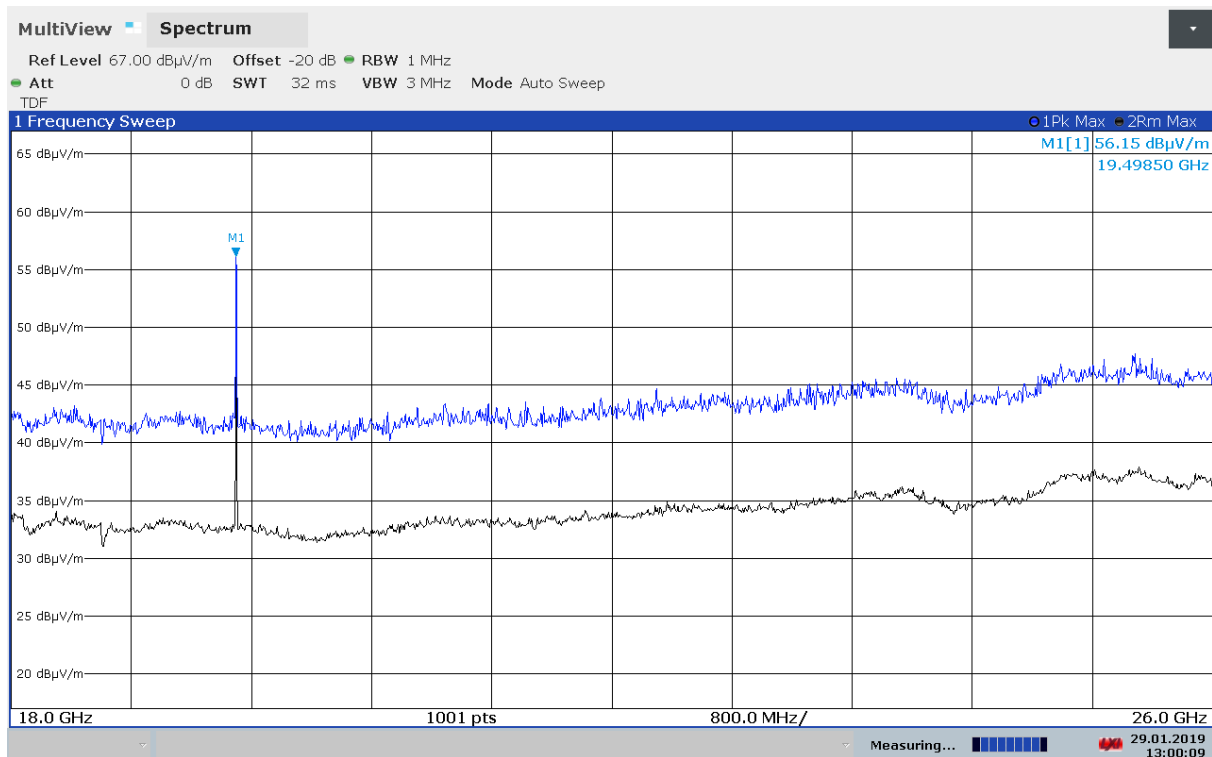
Radiated Emissions, 3000 -18000 MHz, 2462 MHz, VP, 802.11b, 1Mbps



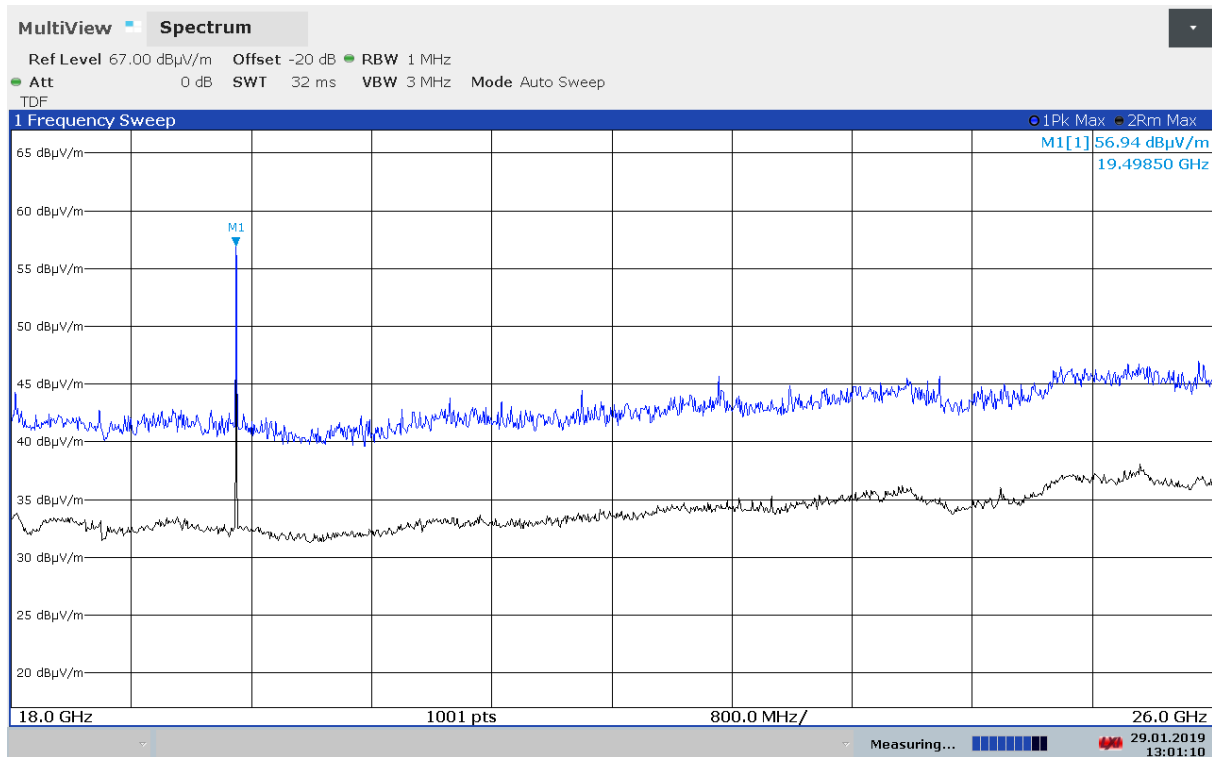
Radiated Emissions, 3000 -18000 MHz, 2462 MHz, HP, 802.11b, 1Mbps



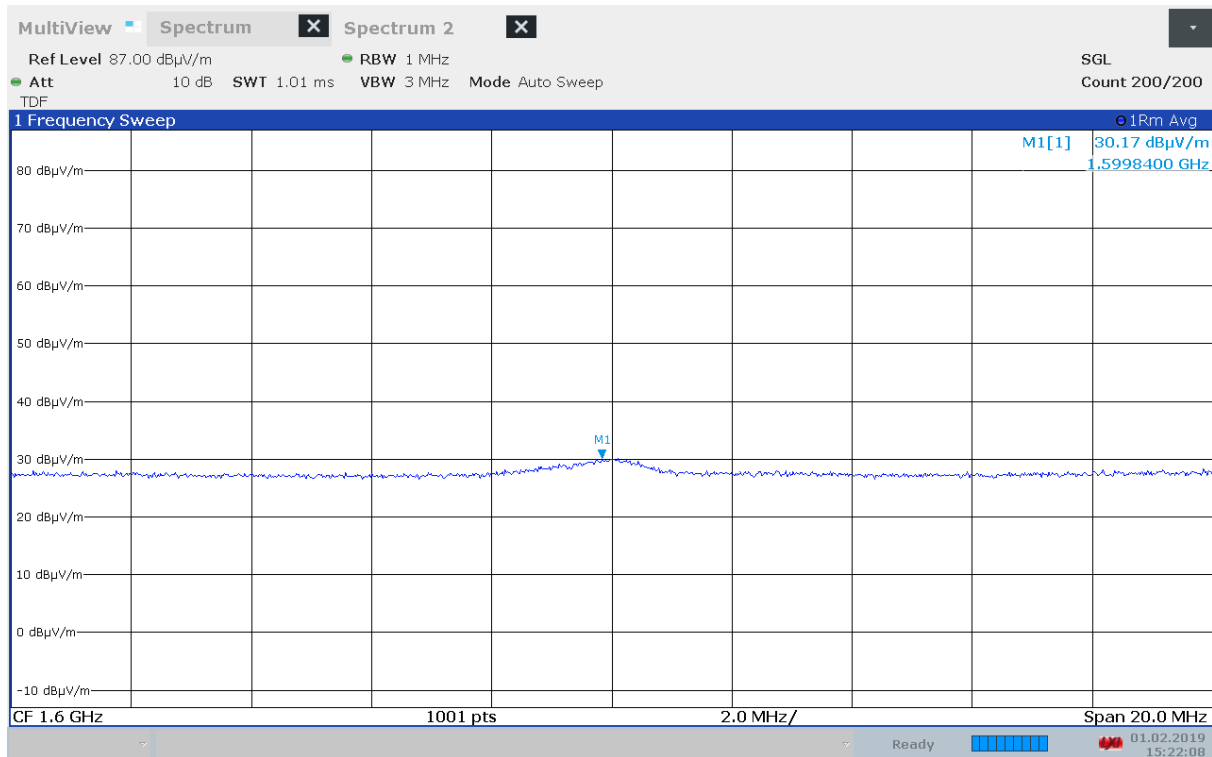
Pre-scan, 18000 -25000 MHz, 802.11b, 1Mbps



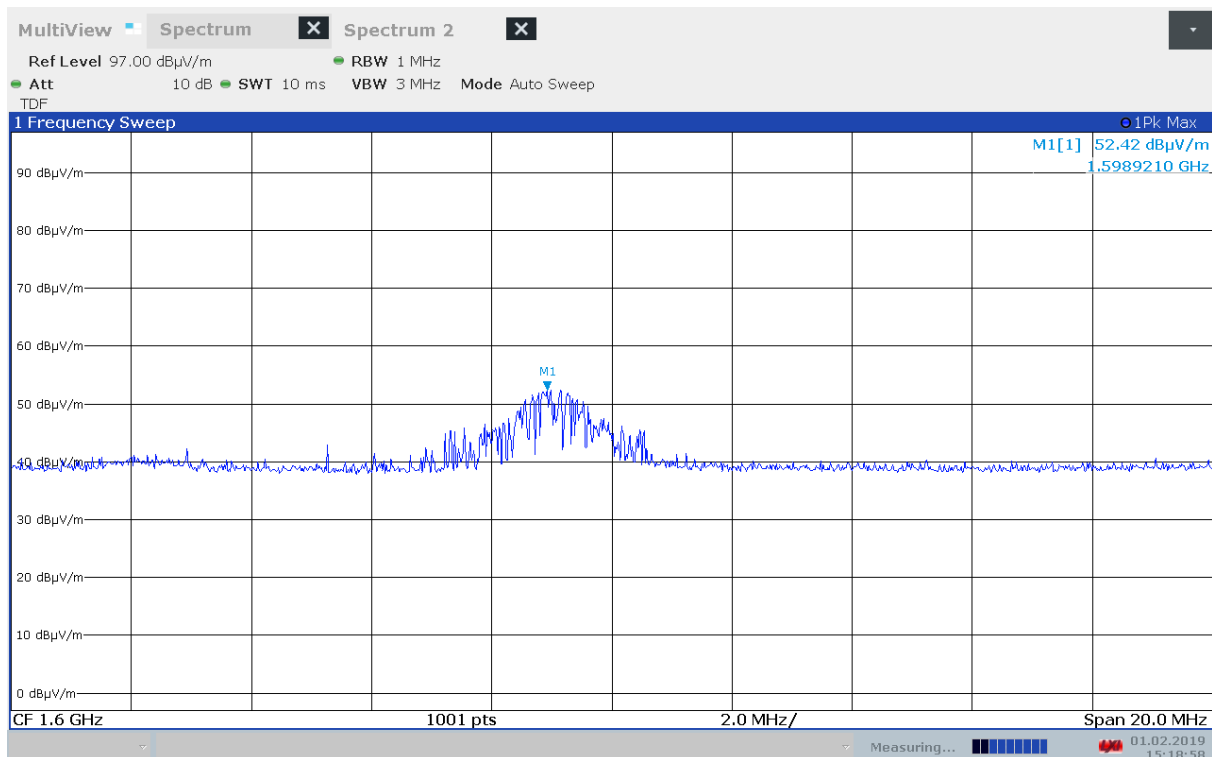
Pre-scan, 18000 -25000 MHz, 802.11g, 6Mbps



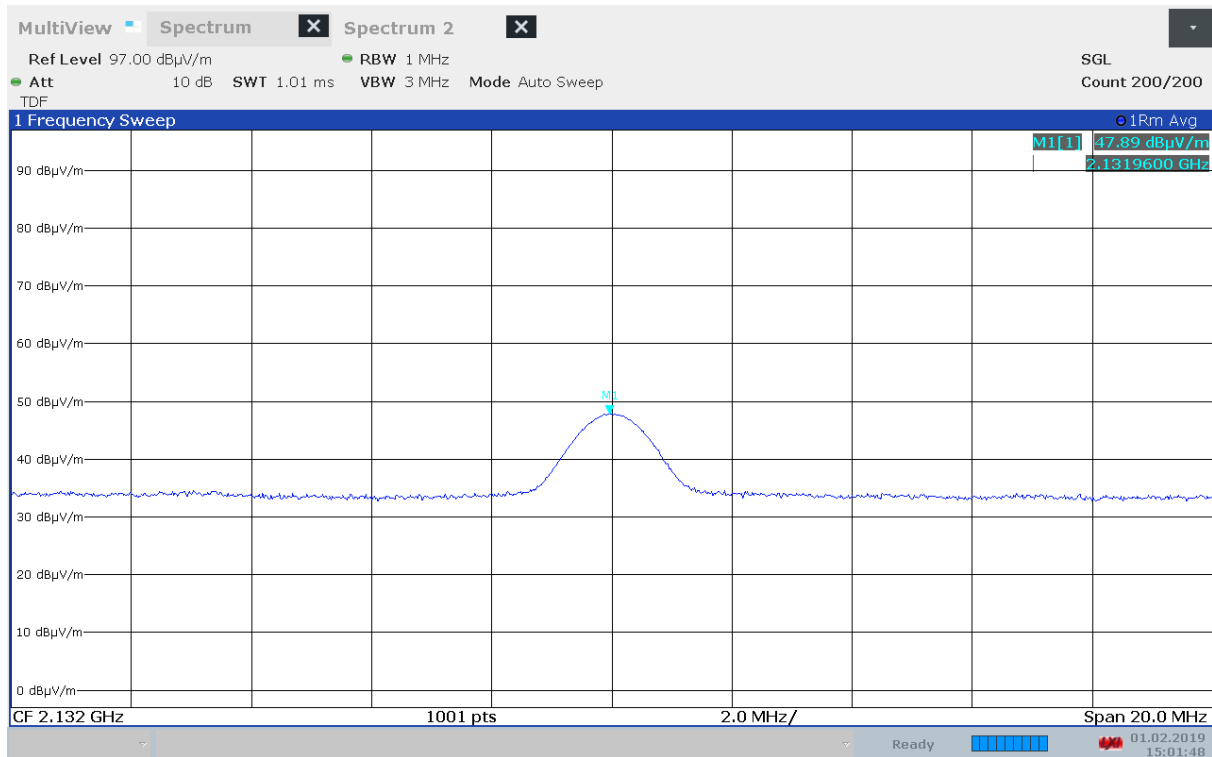
Pre-scan, 18000 -25000 MHz, 802.11n, MCS0



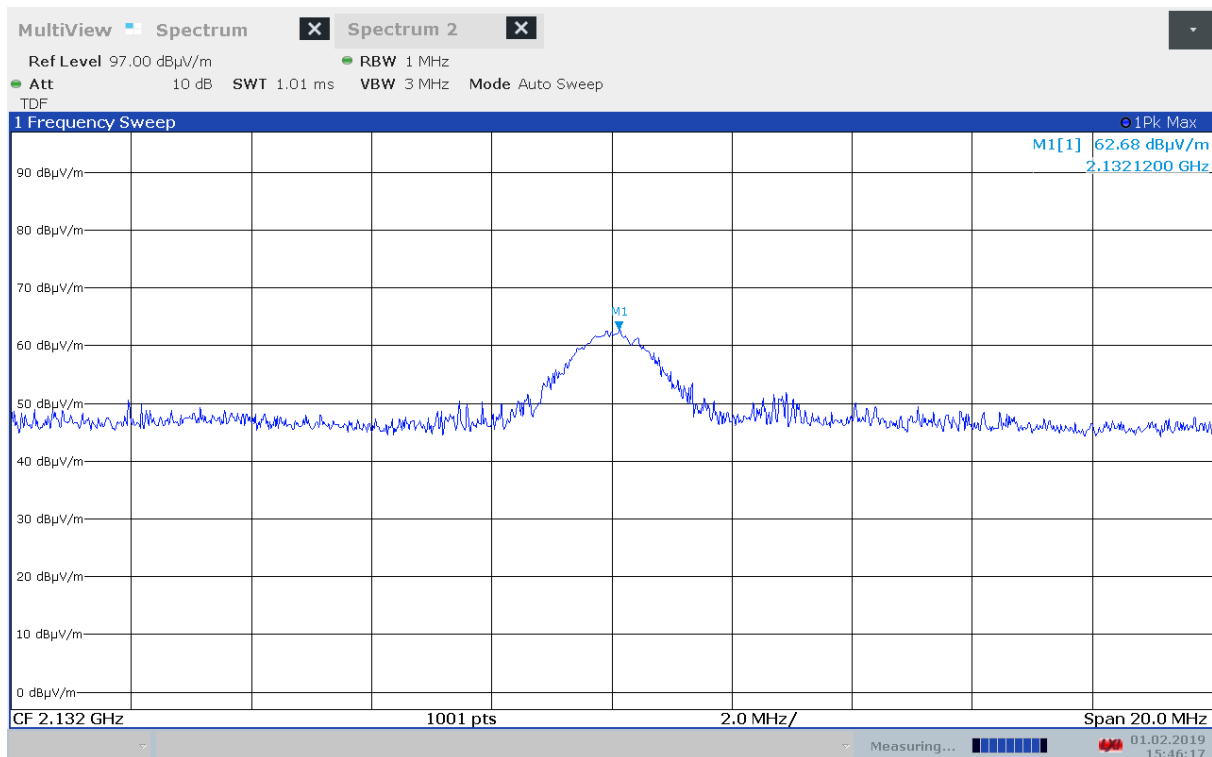
Radiated Emissions, 1600 MHz, 2412 MHz, 802.11g, 6Mbps (Max: VP), Average



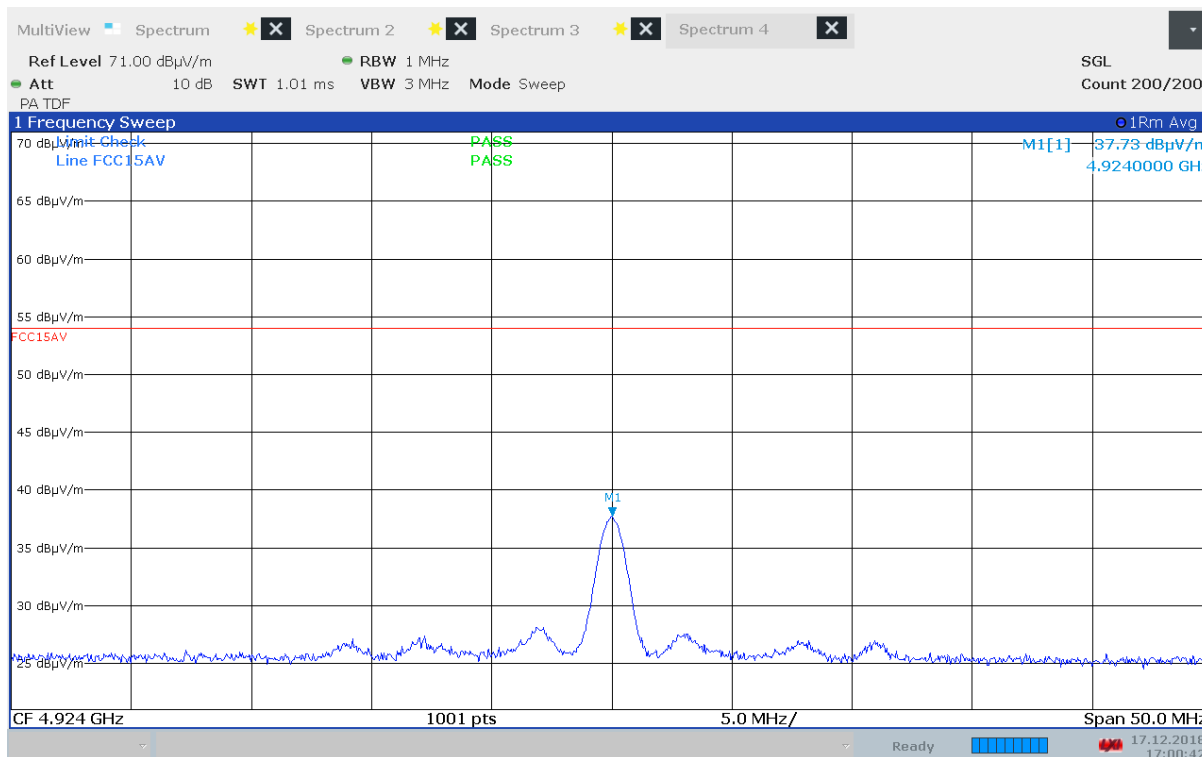
Radiated Emissions, 1600 MHz, 2412 MHz, 802.11g, 6Mbps (Max: VP), Peak



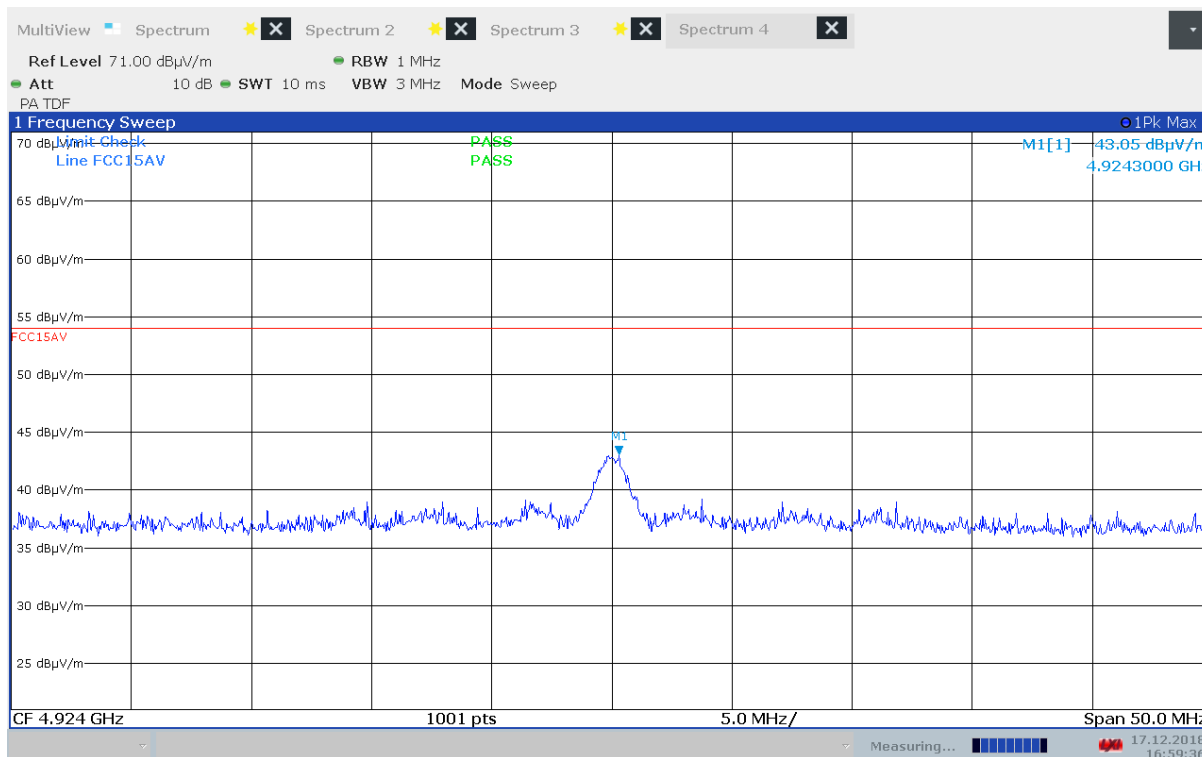
Radiated Emissions, 2132 MHz, 2412 MHz, 802.11g, 6Mbps (Max: HP), Average



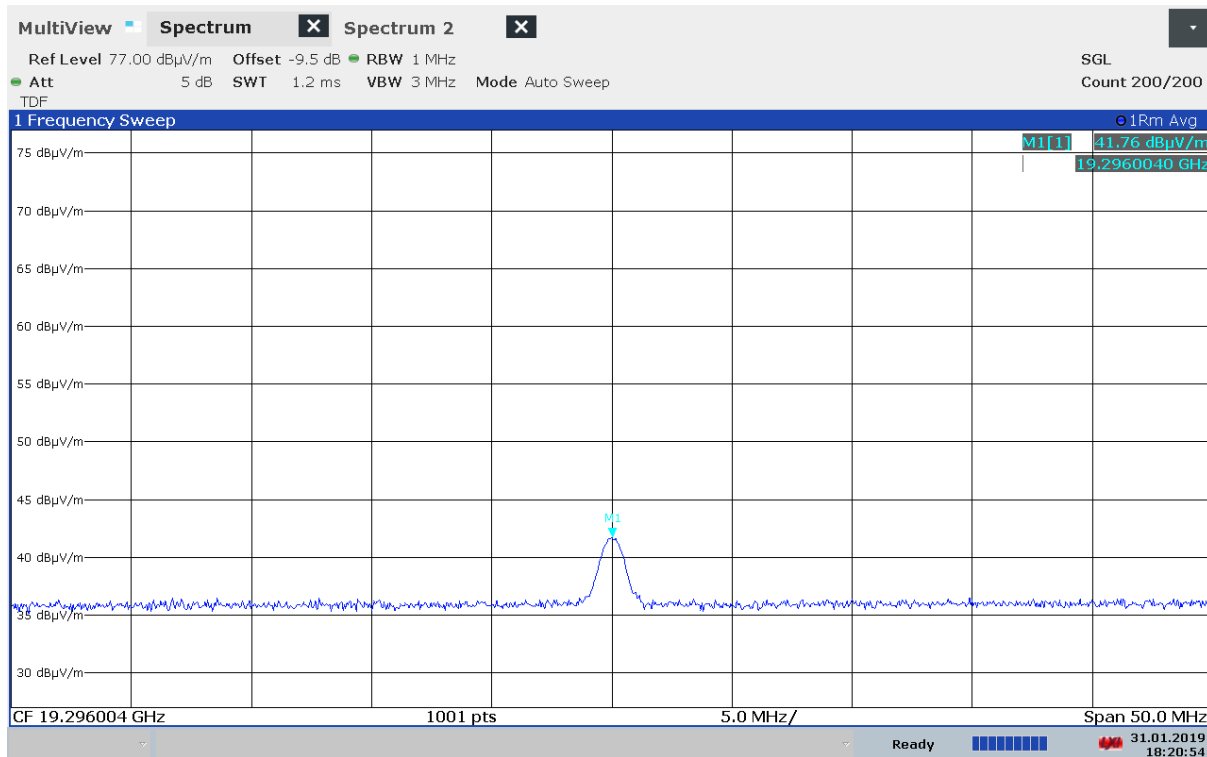
Radiated Emissions, 2132 MHz, 2412 MHz, 802.11g, 6Mbps (Max: HP), Peak



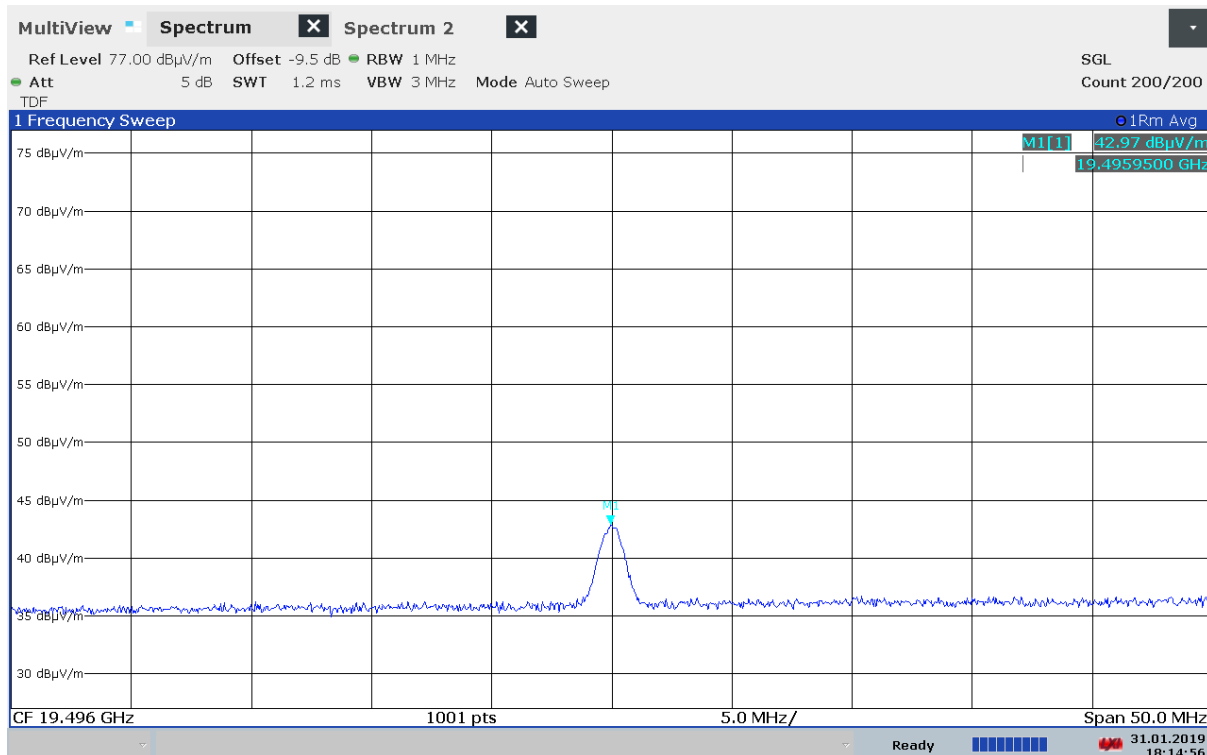
Radiated Emissions, 4924 MHz, 2462 MHz, 802.11b, 1Mbps (Max: HP), Average



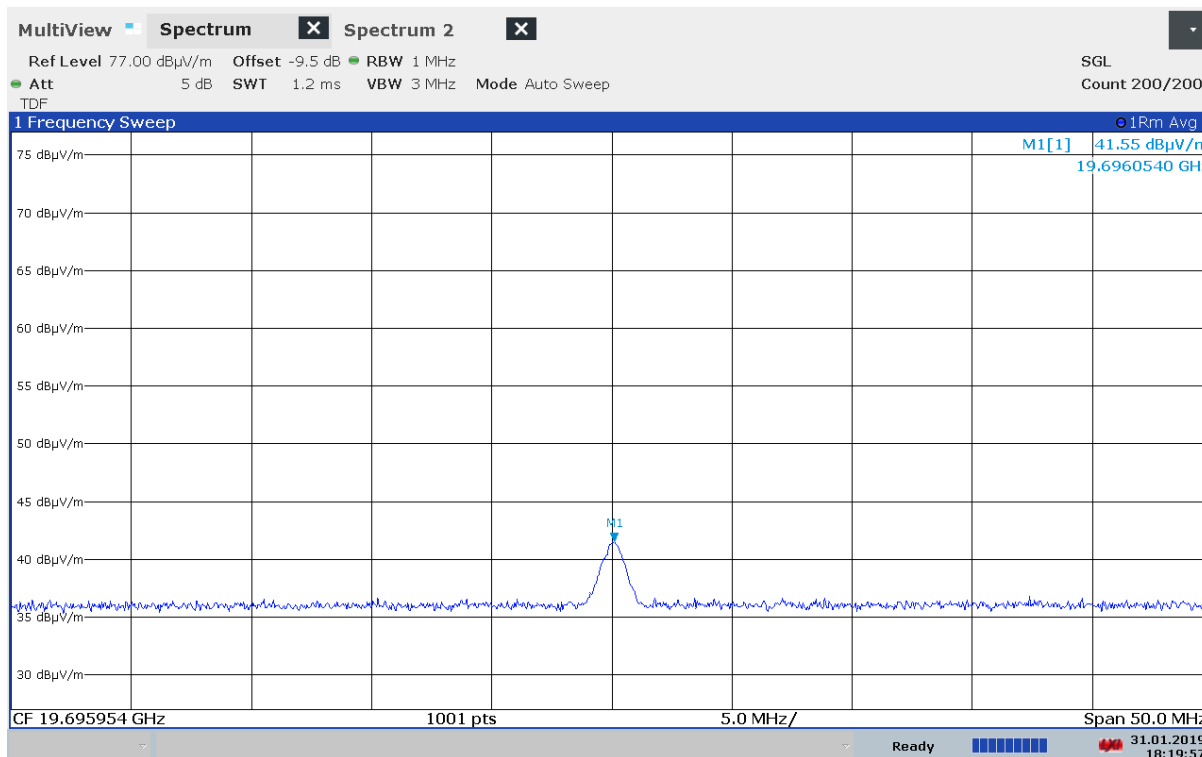
Radiated Emissions, 4924 MHz, 2462 MHz, 802.11b, 1Mbps (Max: HP), Peak



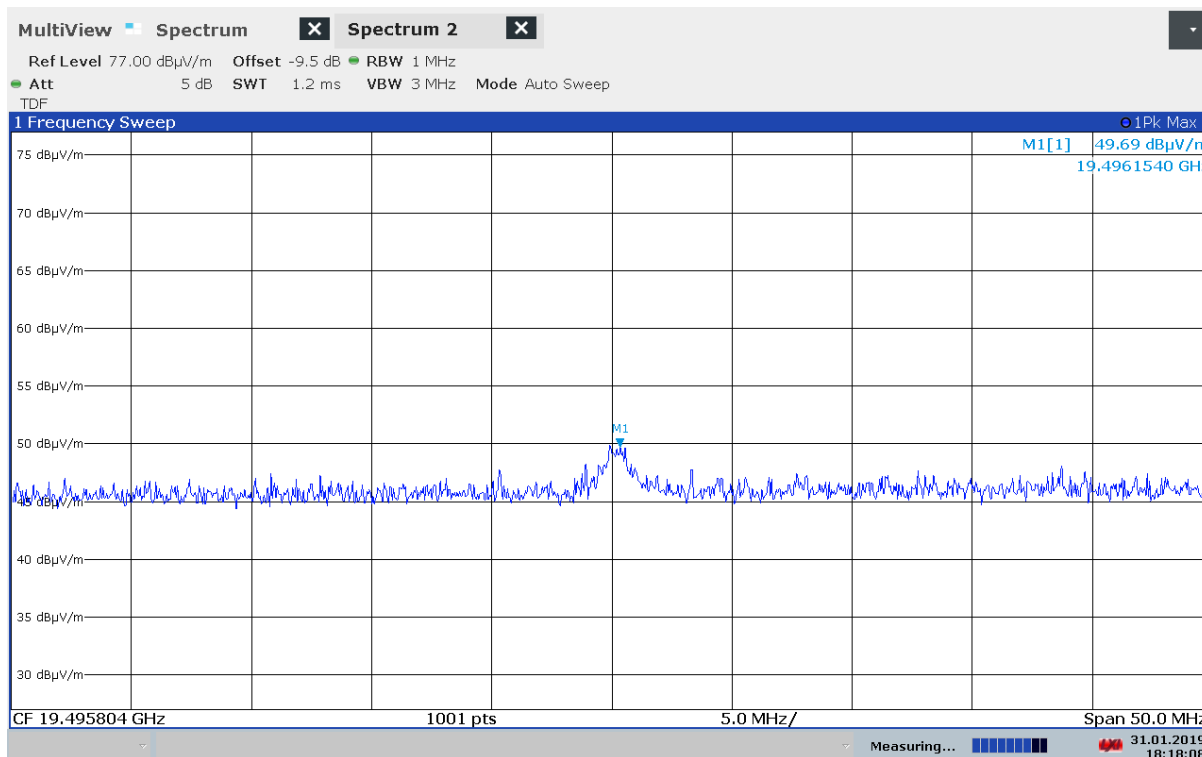
Radiated Emissions, 19.3 GHz, 2412 MHz, 802.11g, 6Mbps (Max: HP), Average, @1m



Radiated Emissions, 19.5 GHz, 2437 MHz, 802.11n, MCS0 (Max: HP), Average, @1m



Radiated Emissions, 19.7 GHz, 2462 MHz, 802.11g, 6Mbps (Max: HP), Average, @1m



Radiated Emissions, 19.5 GHz, 2437 MHz, 802.11g, 6Mbps (Max: HP), Peak, @1m

### 3.8 Power Spectral Density (PSD)

FCC part 15.247(e)

Test Results: Passed

#### Measured and Calculated Data:

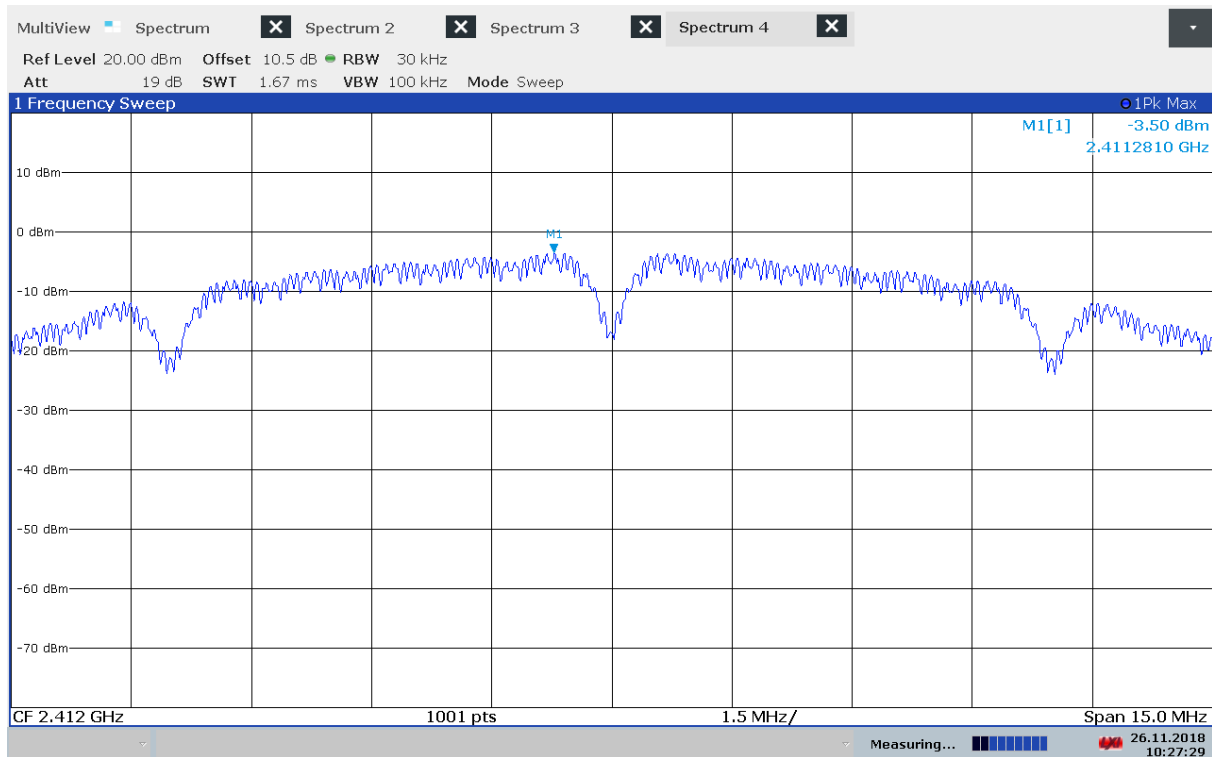
The measurement procedures PKPSD described in ANSI C63.10-2013 was used.

| Carrier Frequency<br>(MHz) | Power Spectral Density<br>(dBm) |                 |               |
|----------------------------|---------------------------------|-----------------|---------------|
|                            | 802.11b, 11 Mbps                | 802.11g, 6 Mbps | 802.11n, MCS0 |
| 2412                       | -13.5                           | -14.2           | -14.7         |
| 2437                       | -15.4                           | -16.0           | -16.4         |
| 2462                       | -15.2                           | -15.7           | -16.3         |

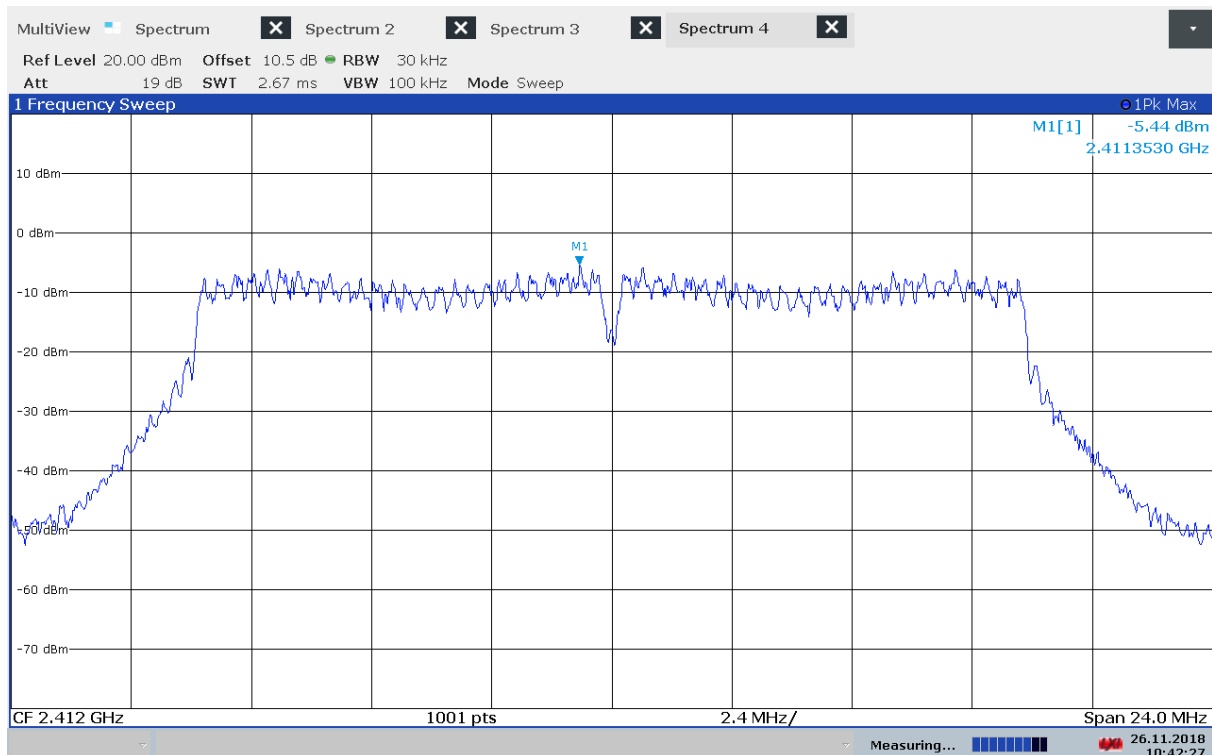
The measured values with 30 kHz RBW are corrected by a Bandwidth Correction Factor of -10 dB.

#### Requirements:

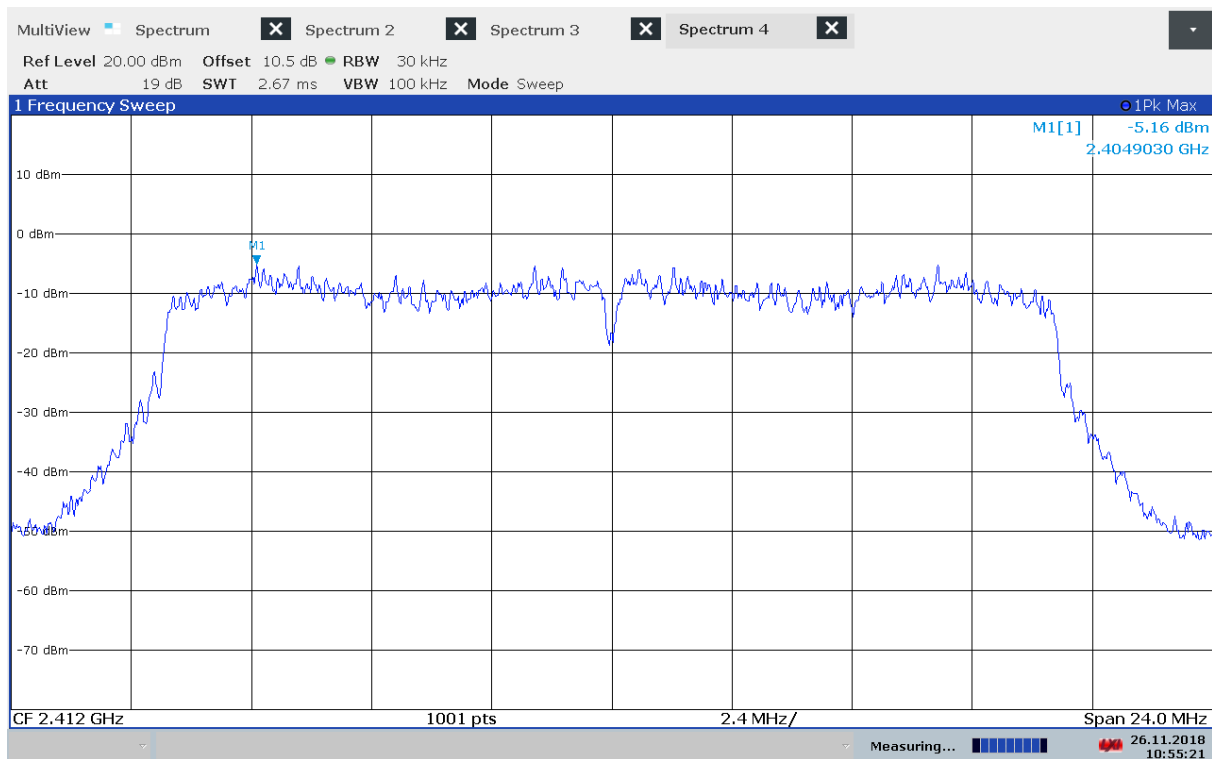
The Power Spectral Density of a Digital Transmission System shall be no greater than +8 dBm in any 3 kHz band



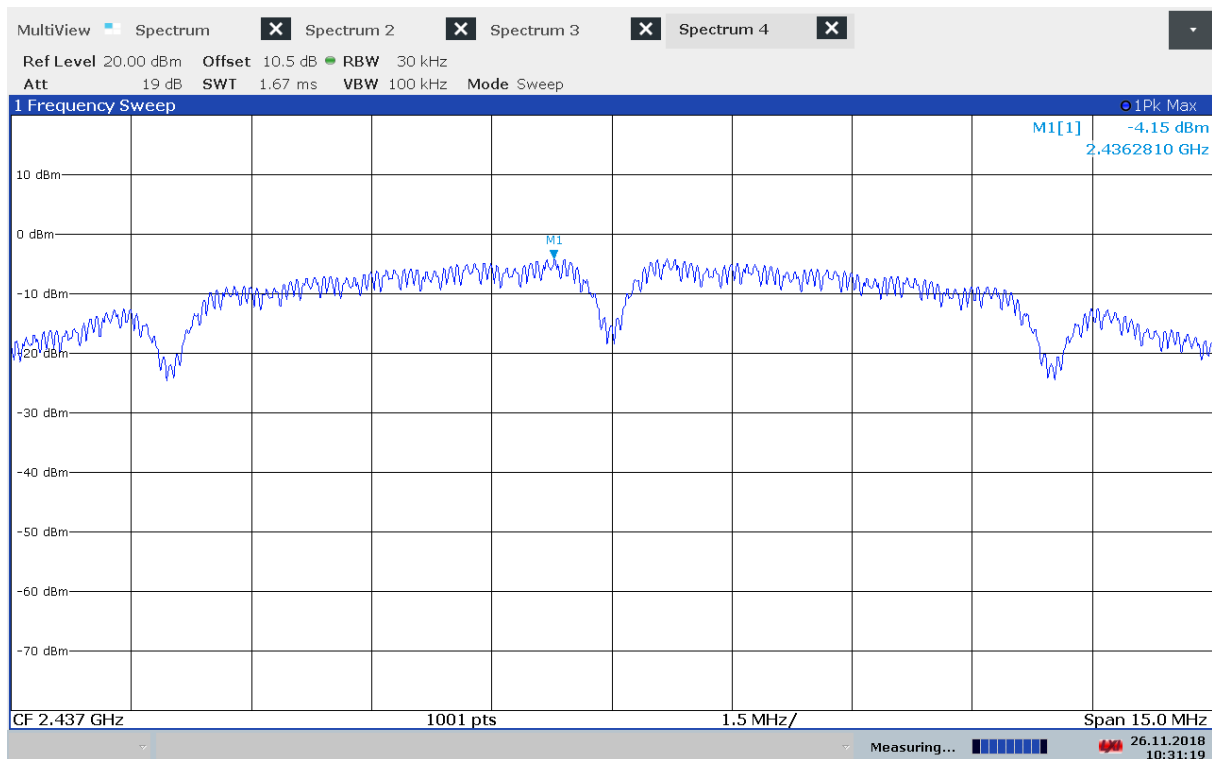
PSD, 2412 MHz, 802.11b, 1Mbps



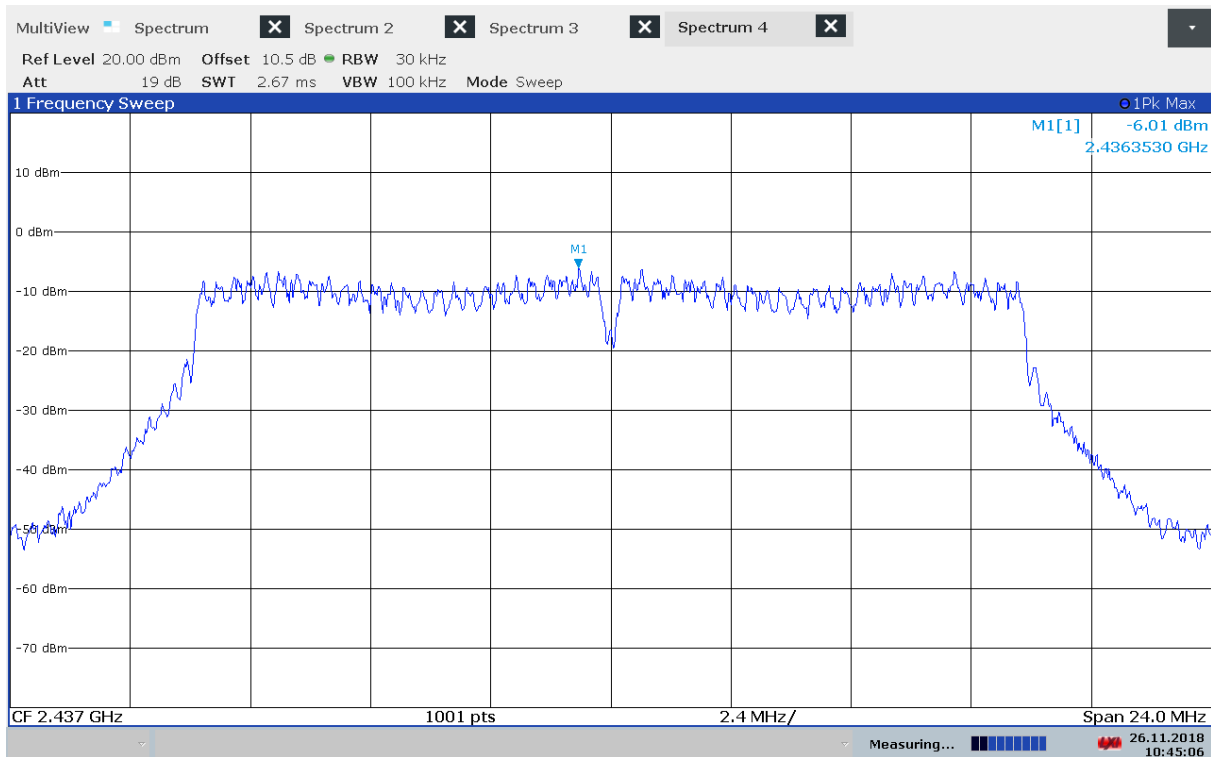
PSD, 2412 MHz, 802.11g, 6Mbps



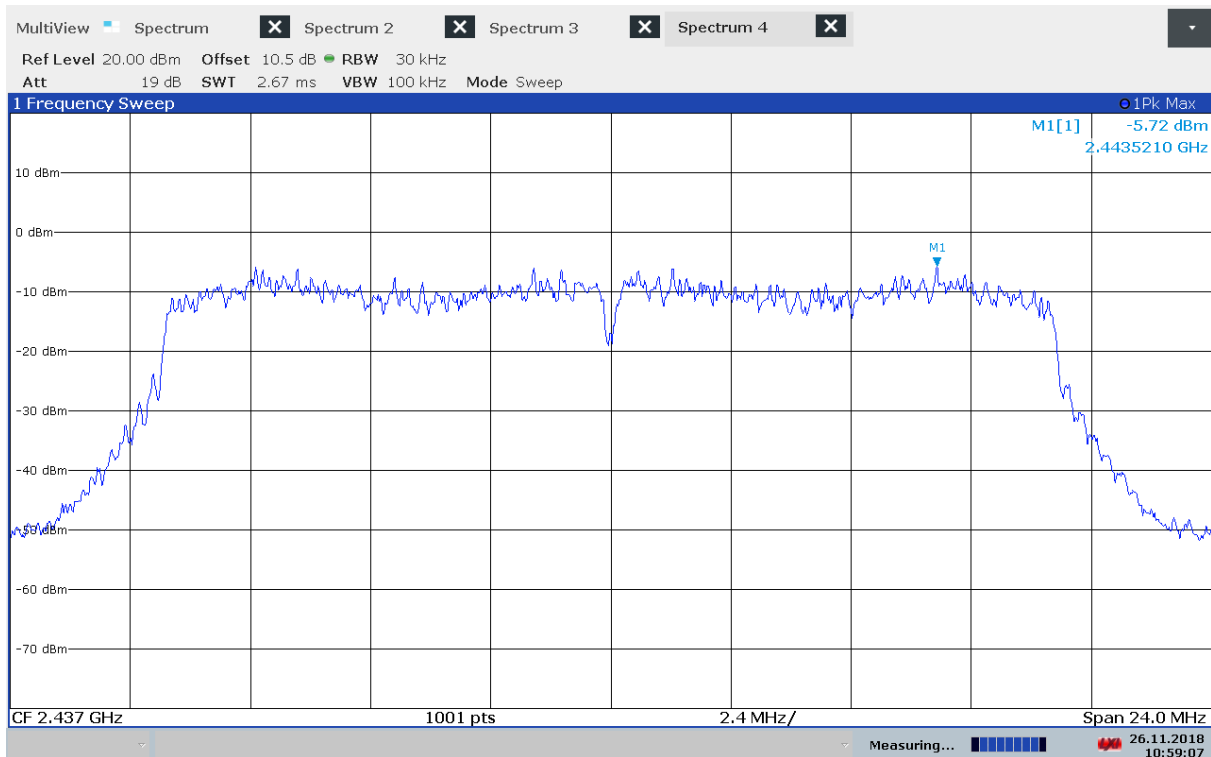
PSD, 2412 MHz, 802.11n, MCS0



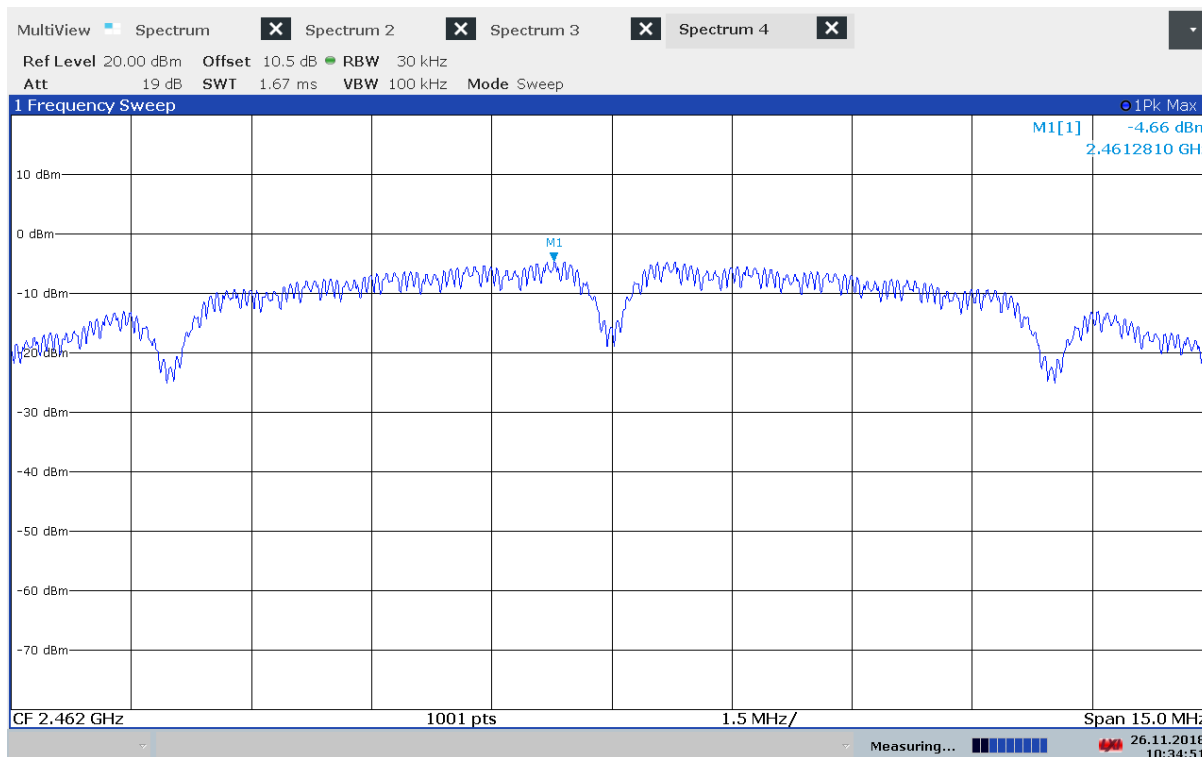
PSD, 2437 MHz, 802.11b, 1Mbps



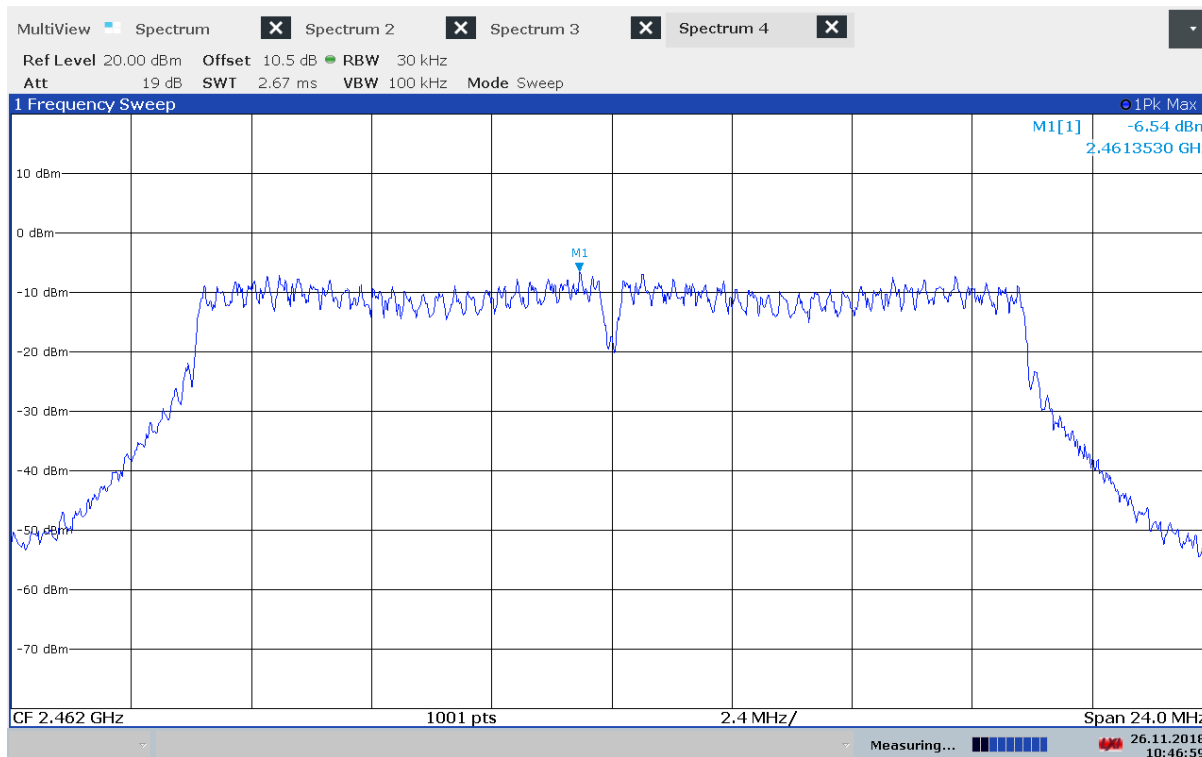
PSD, 2437 MHz, 802.11g, 6Mbps



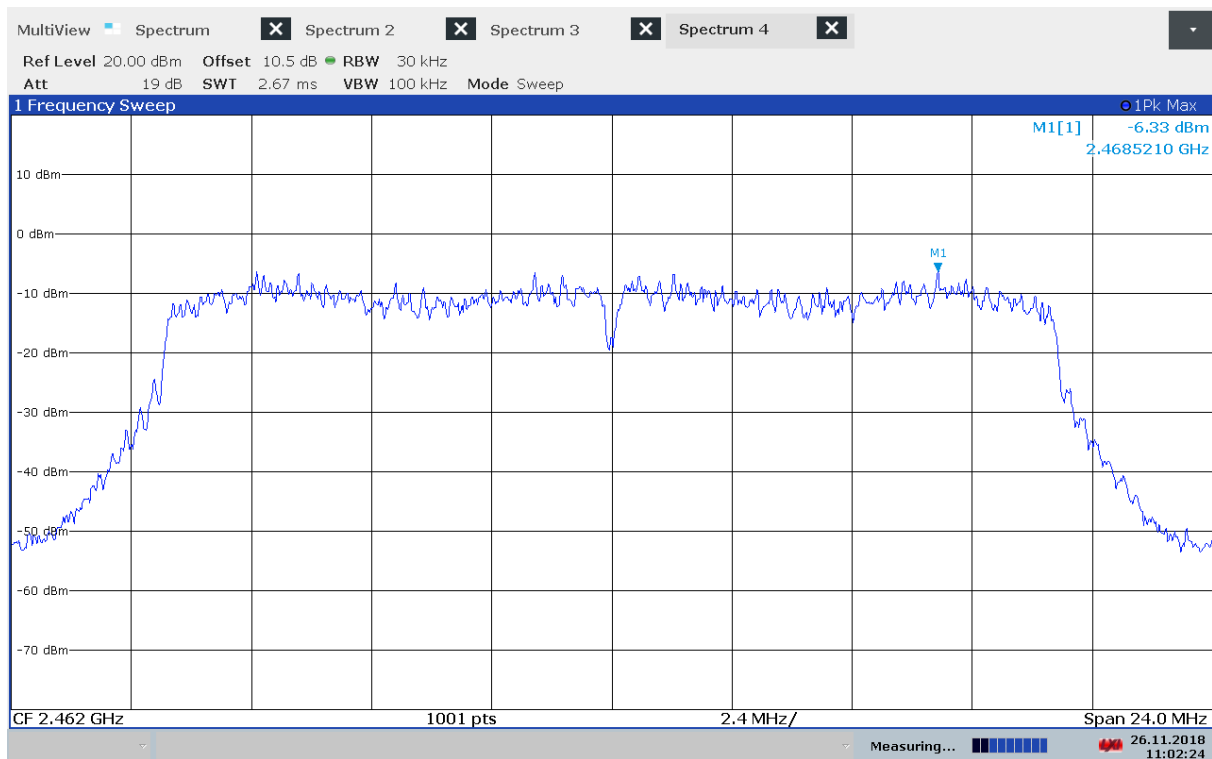
PSD, 2437 MHz, 802.11n, MCS0



PSD, 2462 MHz, 802.11b, 1Mbps



PSD, 2462 MHz, 802.11g, 6Mbps



PSD, 2462 MHz, 802.11n, MCS0

## 4 Measurement Uncertainty

| Measurement Uncertainty Values   |           |                |
|----------------------------------|-----------|----------------|
| Test Item                        |           | Uncertainty    |
| Output Power                     |           | ±0.5 dB        |
| Power Spectral Density           |           | ±0.5 dB        |
| Out of Band Emissions, Conducted | < 3.6 GHz | ±0.6 dB        |
|                                  | > 3.6 GHz | ±0.9 dB        |
| Spurious Emissions, Radiated     | < 1 GHz   | ±2.5 dB        |
|                                  | > 1 GHz   | ±2.2 dB        |
| Emission Bandwidth               |           | ±4 %           |
| Power Line Conducted Emissions   |           | +2.9 / -4.1 dB |
| Spectrum Mask Measurements       | Frequency | ±5 %           |
|                                  | Amplitude | ±1.0 dB        |
| Frequency Error                  |           | ±0.6 ppm       |
| Temperature Uncertainty          |           | ±1 °C          |

All uncertainty values are expanded standard uncertainty to give a confidence level of 95%, based on coverage factor k=2

## 5 LIST OF TEST EQUIPMENT

To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment and ancillaries are identified (numbered) by the Test Laboratory.

| No. | Model number    | Description          | Manufacturer     | Ref. no.    | Cal. date          | Cal. Due           |
|-----|-----------------|----------------------|------------------|-------------|--------------------|--------------------|
| 1   | FSW43           | Spectrum Analyzer    | Rohde & Schwarz  | LR 1690     | 2018.01<br>2019.01 | 2019.01<br>2020.01 |
| 2   | ESU40           | Measuring Receiver   | Rohde & Schwarz  | LR 1639     | 2018.03<br>2019.01 | 2019.03<br>2020.01 |
| 3   | 6810-17B        | Attenuator           | Suhner           | LR 1669     | COU                |                    |
| 4   | 6HC3000/18000   | Highpass Filter      | Trilithic        | LR 1614     | COU                |                    |
| 5   | JB3             | BiLog Antenna        | Sunol Sciences   | N-4525      | 2016.05            | 2019.05            |
| 6   | 317             | Preamplifier         | Sonoma Inst.     | LR 1687     | 2018.07            | 2019.07            |
| 7   | 8449A           | Pre-amplifier        | Hewlett Packard  | LR 1322     | 2018.07            | 2019.07            |
| 8   | 3115            | Horn Antenna         | EMCO             | LR 1330     | 2016.10            | 2019.12            |
| 9   | 3117-PA         | Horn Antenna +PreAmp | EMCO             | LR 1717     | 2017-12            | 2019-12            |
| 10  | 638             | Antenna Horn         | Narda            | LR 1480     | 2010.06            | 2020.06            |
| 11  | WRCG2400/2483.5 | Band Reject Filter   | Wainwright Inst. | LR 1530     | COU                |                    |
| 12  | Model 87 V      | Multimeter           | Fluke            | LR 1597     | 2018.02            | 2019.02            |
| 14  | 6812B           | AC Power Source      | Agilent          | LR 1515     | COU                |                    |
| 15  | ENV216          | Two Line V-Network   | Rohde & Schwarz  | LR 1665     | 2017.11            | 2019.11            |
| 16  | ESCI3           | Measuring Receiver   | Rohde & Schwarz  | N-4259      | 2017.10            | 2019.10            |
| 17  | ST18/SMA/N/36   | RF Cable             | Suhner           | LR 1627     | COU                |                    |
| 18  | SF102/1000MM    | RF Cable             | Suhner           | SN 50113/2  | COU                |                    |
| 19  | SF102/2000MM    | RF Cable             | Suhner           | SN 500100/2 | COU                |                    |

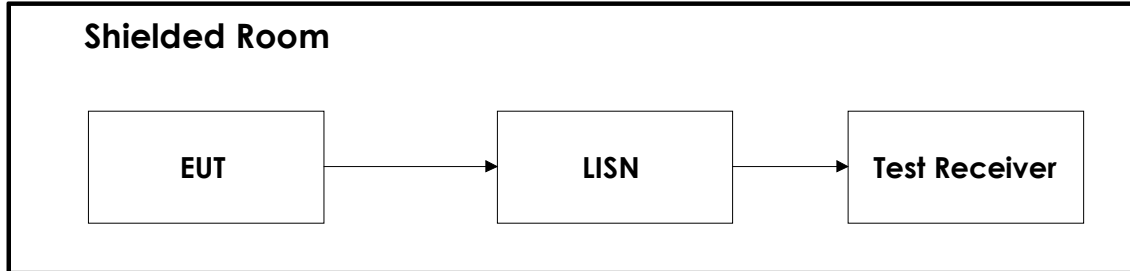
Note: COU – calibrate on use; N/A – Not Applicable

The software listed below has been used for one or more tests.

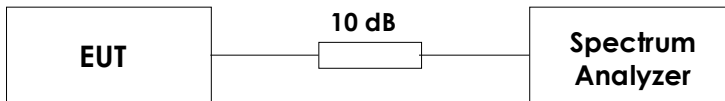
| No. | Manufacturer    | Name    | Version  | Comment                                 |
|-----|-----------------|---------|----------|-----------------------------------------|
| 1   | Rohde & Schwarz | EMC32   | 10.20.10 | Power Line Conducted test software      |
| 2   | Rohde & Schwarz | EMC32   | 10.20.10 | Radiated Emission test software         |
| 3   | Rohde & Schwarz | GPIShot | 2.7      | Screenshots from R&S Spectrum Analyzers |

## 6 BLOCK DIAGRAM

### 6.1 Power Line Conducted Emission

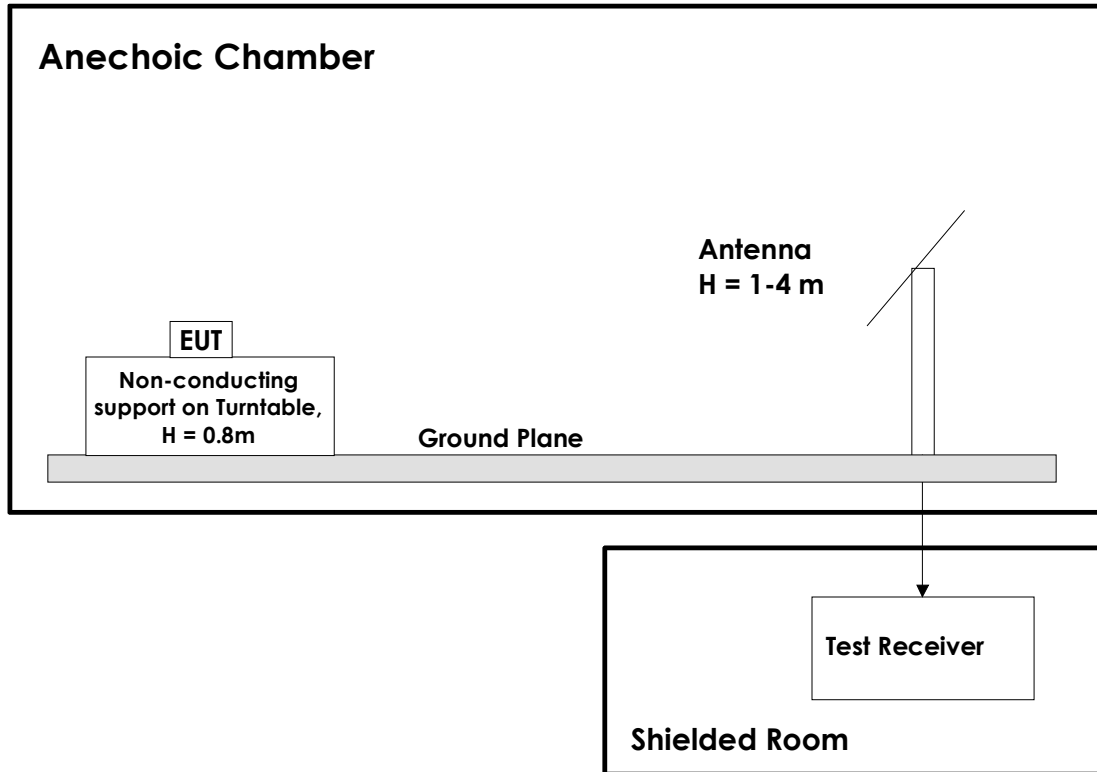


### 6.2 Conducted Tests



This test set-up is used for all Conducted tests.

### 6.3 Test Site Radiated Emission



This test setup is used for all radiated emissions tests. Measuring distance is 3m for all frequencies.

Emissions above 1 GHz are measured with a Spectrum Analyzer and Horn Antenna.

All measurements at 1GHz and above were performed with turntable height 1.5m and with the ground plane covered by absorbers.

A pre-amplifier is used for all measurements, and High-Pass filter is used for all harmonics.