

## Test Report

|                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                 |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| <b>Product</b>                                                                                                                                                                                                                                                                                                                                                                                                             | WiFi Cordless Phone with DECT and NFC                                                                                                                                                                                                                                                                                                                                                           |  |
| <b>Name and address of the applicant</b>                                                                                                                                                                                                                                                                                                                                                                                   | Ascom (Sweden) AB<br>Grimbodalen 2, Gothenburg<br>SWEDEN                                                                                                                                                                                                                                                                                                                                        |  |
| <b>Name and address of the manufacturer</b>                                                                                                                                                                                                                                                                                                                                                                                | Same as above                                                                                                                                                                                                                                                                                                                                                                                   |  |
| <b>Model</b>                                                                                                                                                                                                                                                                                                                                                                                                               | SH1-ABBA<br>SH1-ABBB                                                                                                                                                                                                                                                                                                                                                                            |  |
| <b>Rating</b>                                                                                                                                                                                                                                                                                                                                                                                                              | 3.8V DC (Secondary Battery)                                                                                                                                                                                                                                                                                                                                                                     |  |
| <b>Trademark</b>                                                                                                                                                                                                                                                                                                                                                                                                           | ASCOM                                                                                                                                                                                                                                                                                                                                                                                           |  |
| <b>Serial number</b>                                                                                                                                                                                                                                                                                                                                                                                                       | T2610621YR<br>T2610621YP                                                                                                                                                                                                                                                                                                                                                                        |  |
| <b>Additional information</b>                                                                                                                                                                                                                                                                                                                                                                                              | 802.11a/b/g/n, DECT 6.0, NFC                                                                                                                                                                                                                                                                                                                                                                    |  |
| <b>Tested according to</b>                                                                                                                                                                                                                                                                                                                                                                                                 | <b>FCC Part 15.247</b><br>Digital Transmission Systems<br><b>Industry Canada RSS-247, Issue 2</b><br>Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSs)<br>and Licence-Exempt Local Area Network (LE-LAN) Devices                                                                                                                                                            |  |
| <b>Order number</b>                                                                                                                                                                                                                                                                                                                                                                                                        | 324798                                                                                                                                                                                                                                                                                                                                                                                          |  |
| <b>Tested in period</b>                                                                                                                                                                                                                                                                                                                                                                                                    | 2017.01.31 to 2017.02.03 and 2017.03.21 and 2017.06.02                                                                                                                                                                                                                                                                                                                                          |  |
| <b>Issue date</b>                                                                                                                                                                                                                                                                                                                                                                                                          | 2017.06.02                                                                                                                                                                                                                                                                                                                                                                                      |  |
| <b>Name and address of the testing laboratory</b>                                                                                                                                                                                                                                                                                                                                                                          |  <div style="display: inline-block; vertical-align: top; margin-left: 20px;"> FCC No: 994405<br/> IC OATS: 2040D-1<br/><br/> TEL: +47 22 96 03 30<br/> FAX: +47 22 96 05 50 </div> <div style="display: inline-block; vertical-align: top; margin-left: 20px;"> Instituttveien 6<br/> Kjeller, Norway </div> |  |
| <div style="display: flex; justify-content: space-around; align-items: flex-end;"> <div style="text-align: center;"> <br/> Prepared by [Frode Sveinsen] </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>                 | Ascom                                                       |
| <b>FCC ID :</b>               | BXZSH1B2                                                    |
| <b>Industry Canada ID :</b>   | 3724B-SH1B2                                                 |
| <b>Model/version :</b>        | SH1-ABBA<br>SH1-ABBB                                        |
| <b>Serial number :</b>        | Radiated sample: T2610621YR<br>Conducted sample: T2610621YP |
| <b>Hardware version:</b>      | SH1-903584                                                  |
| <b>Software version :</b>     | SW000639/8.0.0                                              |
| <b>Frequency Range :</b>      | 2412 – 2462 MHz                                             |
| <b>Number of Channels :</b>   | 11                                                          |
| <b>Operating Modes :</b>      | 802.11b/g/n (HT20)                                          |
| <b>Type of Modulation :</b>   | DSSS, OFDM                                                  |
| <b>Rated Output Power :</b>   | 802.11b: 76 mW<br>802.11g: 263 mW<br>802.11n: 302 mW        |
| <b>Type of Power Supply :</b> | Secondary Battery (3.8V Li-Ion)                             |
| <b>Antenna Connector :</b>    | None (Integral Antennas)                                    |
| <b>Number of Antennas :</b>   | 1                                                           |
| <b>Interfaces :</b>           | USB                                                         |

#### Description of Test Item

The EUT is a Cordless Smartphone with DECT, WLAN and NFC.

Only 20 MHz (HT20) mode is supported for either 2.4GHz or 5GHz WLAN.

## 1.2 Normal test condition

|                      |                |
|----------------------|----------------|
| Temperature:         | 21.8 – 23.5 °C |
| Relative humidity:   | 25 - 41 %      |
| Normal test voltage: | 3.8 V DC       |

The values are the limit registered during the test period.

## 1.3 Test Engineer(s)

Frode Sveinsen  
Thanh Tran

## 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 mode : MCS0

## 1.8 Comments

The tested handset is a WiFi Client Device.

## 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.

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 4 reference       | Result   |
|----------------------------------------|-------------------------------------|--------------------------------------------------|----------|
| Supply Voltage Variations              | 15.31(e)                            | 6.11 (RSS-GEN)                                   | Complies |
| Antenna Requirement                    | 15.203                              | 8.3 (RSS-GEN)                                    | Complies |
| Power Line Conducted Emission          | 15.107(a)<br>15.207(a)              | 8.8 (RSS-GEN)                                    | Complies |
| Occupied Bandwidth                     | N/A                                 | 6.6 (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>6.13 (RSS-GEN)<br>8.9 (RSS-GEN) | Complies |

### 3 TEST RESULTS

#### 3.1 Power Line Conducted Emissions

FCC Part 15.207 (a)

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

Test Results: Complies.

Measurement Data: See attached graph, (Peak detector).

Highest measured value (L1 and N):

Off Hook, Charging (120 V, 60Hz):

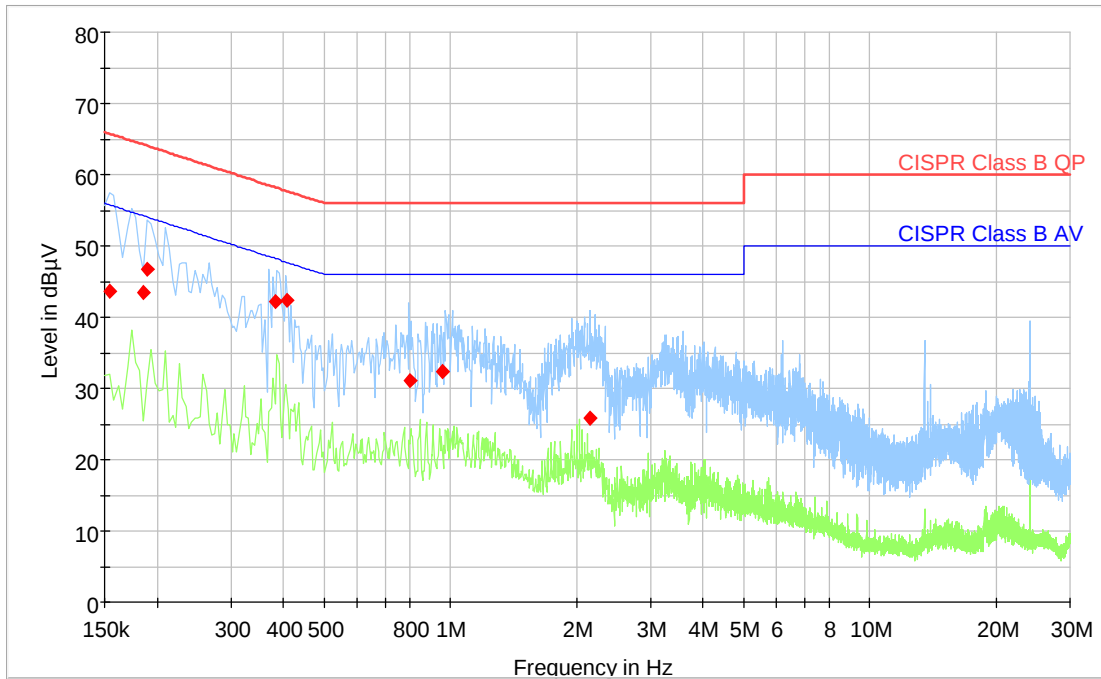
| Frequency (MHz) | QuasiPeak (dB $\mu$ V) | Average (dB $\mu$ V) | Limit (dB $\mu$ V) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Line | PE  | Corr. (dB) |
|-----------------|------------------------|----------------------|--------------------|-------------|-----------------|-----------------|------|-----|------------|
| 0.154           | 43.68                  | ---                  | 65.78              | 22.10       | 1000.0          | 9.000           | L1   | GND | 10.1       |
| 0.186           | 43.46                  | ---                  | 64.21              | 20.76       | 1000.0          | 9.000           | N    | GND | 10.1       |
| 0.190           | 46.70                  | ---                  | 64.04              | 17.33       | 1000.0          | 9.000           | N    | GND | 10.1       |
| 0.384           | 42.16                  | ---                  | 58.19              | 16.04       | 1000.0          | 9.000           | L1   | GND | 10.1       |
| 0.408           | 42.40                  | ---                  | 57.69              | 15.29       | 1000.0          | 9.000           | L1   | GND | 10.1       |
| 0.804           | 31.08                  | ---                  | 56.00              | 24.92       | 1000.0          | 9.000           | L1   | GND | 10.1       |
| 0.960           | 32.37                  | ---                  | 56.00              | 23.63       | 1000.0          | 9.000           | L1   | GND | 10.1       |
| 2.152           | 25.80                  | ---                  | 56.00              | 30.20       | 1000.0          | 9.000           | N    | GND | 10.1       |

On Hook, Charging (120 V, 60Hz):

| Frequency (MHz) | QuasiPeak (dB $\mu$ V) | Average (dB $\mu$ V) | Limit (dB $\mu$ V) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Line | PE  | Corr. (dB) |
|-----------------|------------------------|----------------------|--------------------|-------------|-----------------|-----------------|------|-----|------------|
| 0.166           | 36.27                  | ---                  | 65.16              | 28.89       | 1000.0          | 9.000           | L1   | GND | 10.1       |
| 0.384           | 45.40                  | ---                  | 58.19              | 12.79       | 1000.0          | 9.000           | L1   | GND | 10.1       |

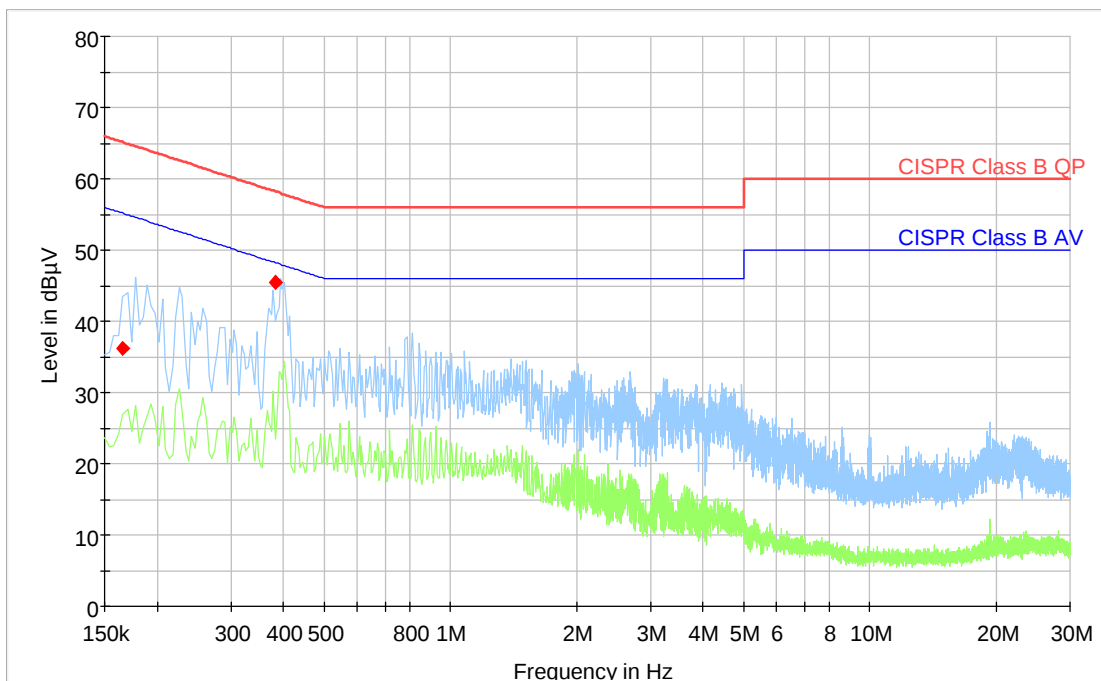
**Off Hook, Charging (120 V, 60Hz):**

Full Spectrum



**On Hook, Charging (120 V, 60Hz):**

Full Spectrum



### 3.2 Occupied Bandwidth

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

Test Results: Complies

Measurement Data: 11 RF channels in use

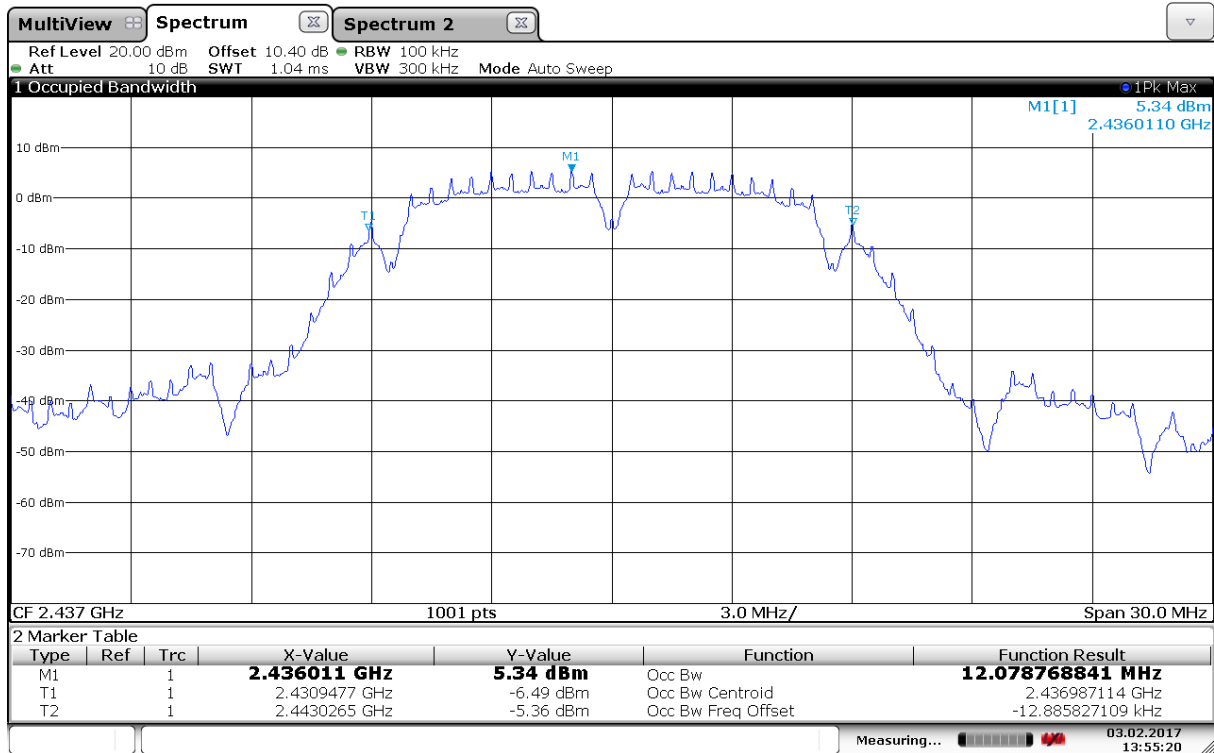
| Modulation type<br>and bitrate | Occupied Bandwidth (99%) (MHz) |
|--------------------------------|--------------------------------|
|                                | Ch06, 2437 MHz                 |
| 802.11b, 1 Mbps                | 12.1                           |
| 802.11g, 6 Mbps                | 16.6                           |
| 802.11n, MCS0                  | 17.8                           |

Occupied Bandwidth is reported for information only.

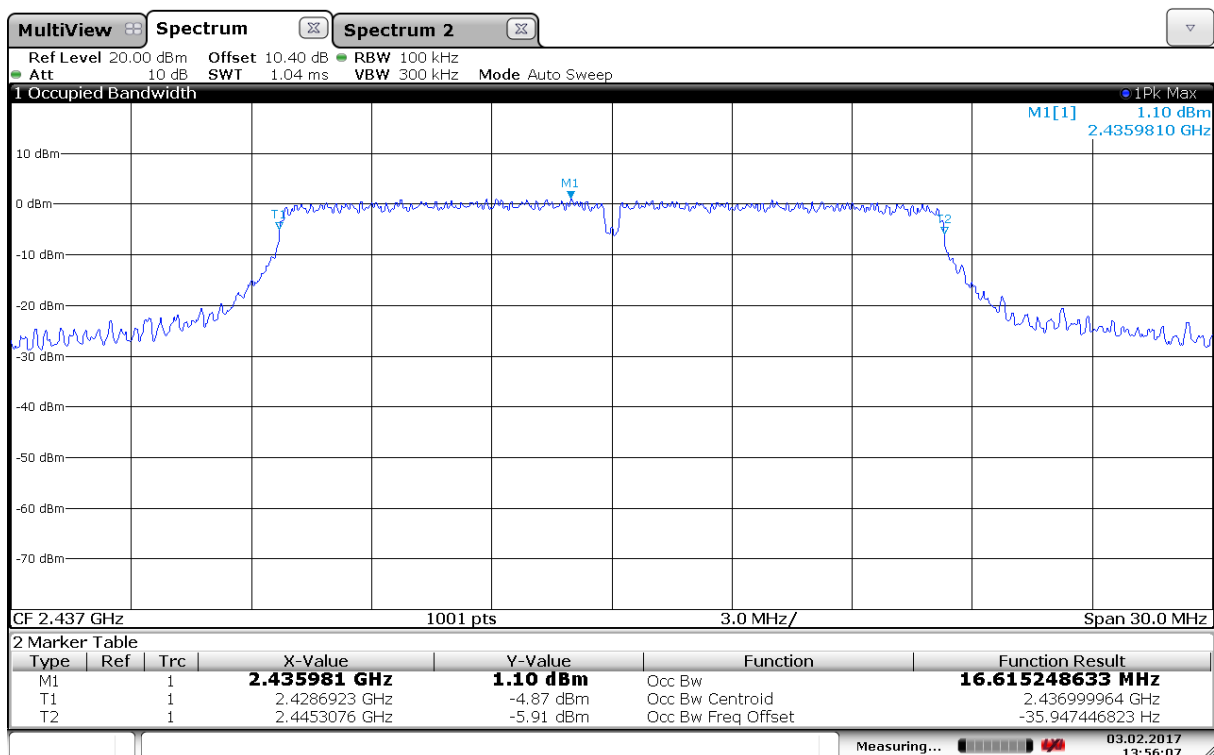
See attached graph.

**Requirements:**

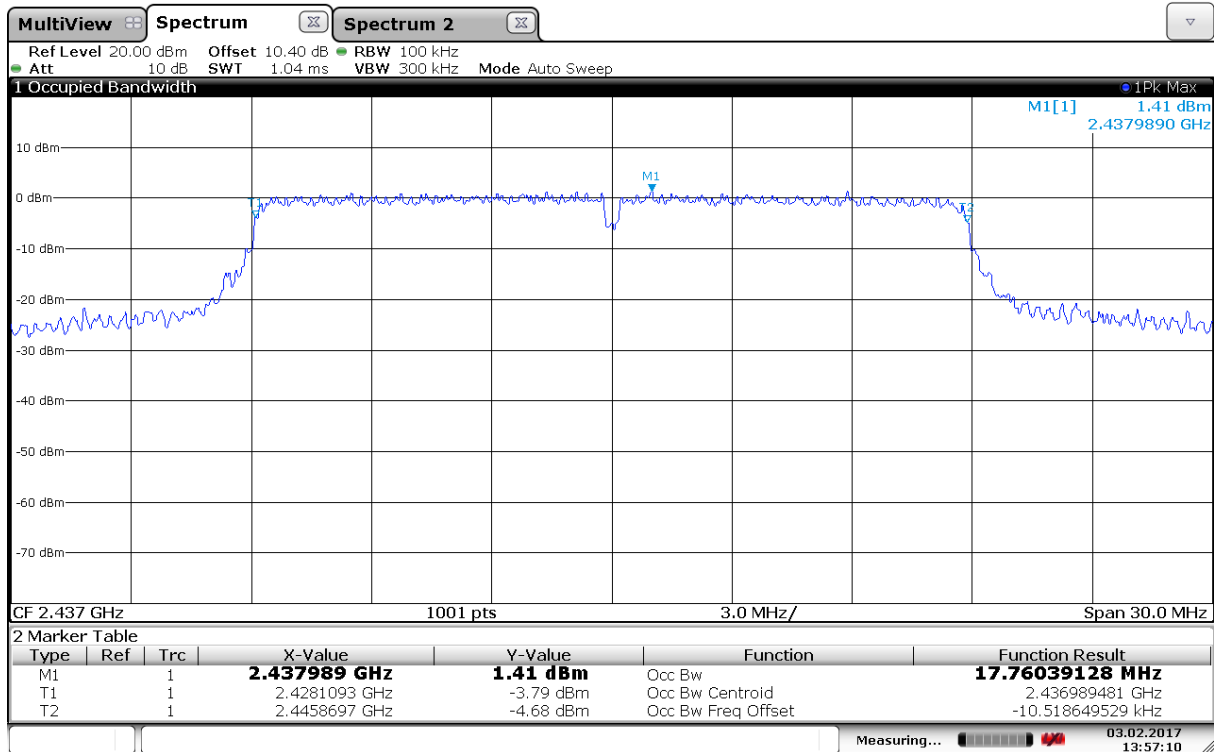
No requirements for Digital Transmission Systems.



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

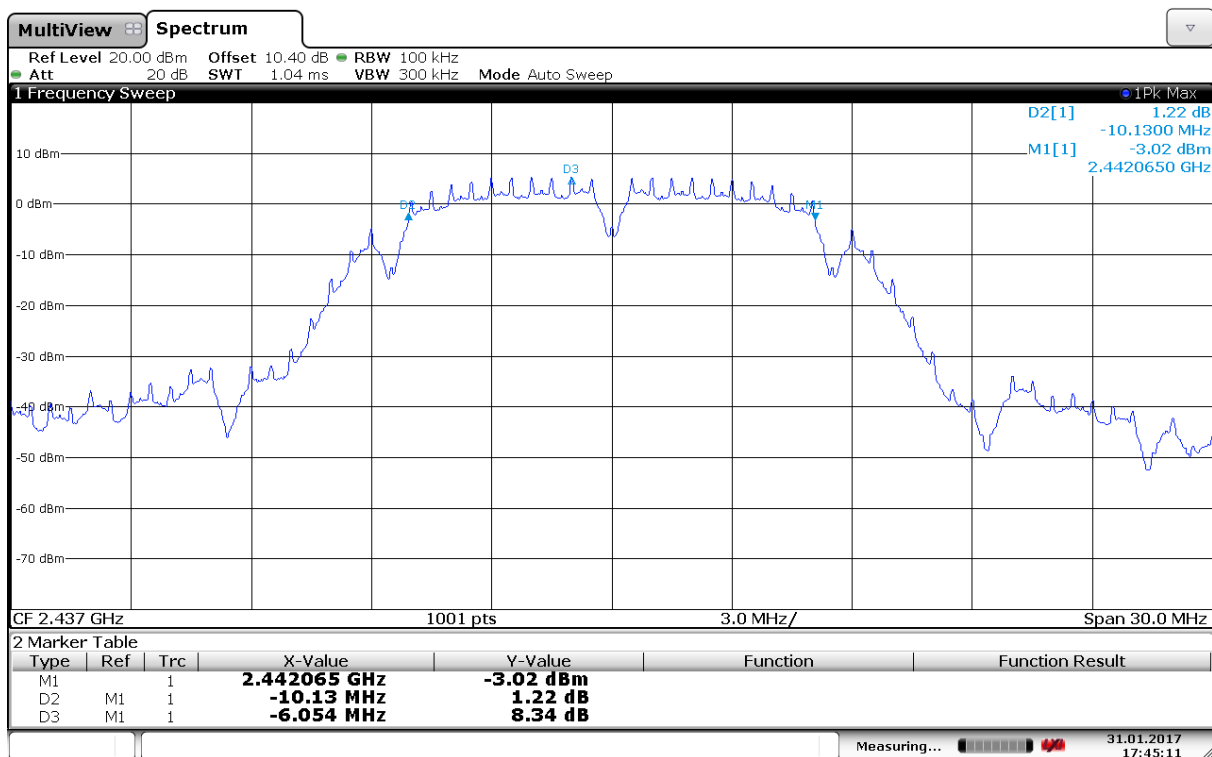
**Measurement Data:**

| Modulation type and bitrate | Measured 6 dB Bandwidth (MHz) |
|-----------------------------|-------------------------------|
|                             | Ch06, 2437 MHz                |
| 802.11b, 1 Mbps             | 10.1                          |
| 802.11g, 6 Mbps             | 16.6                          |
| 802.11n, MCS0               | 17.8                          |

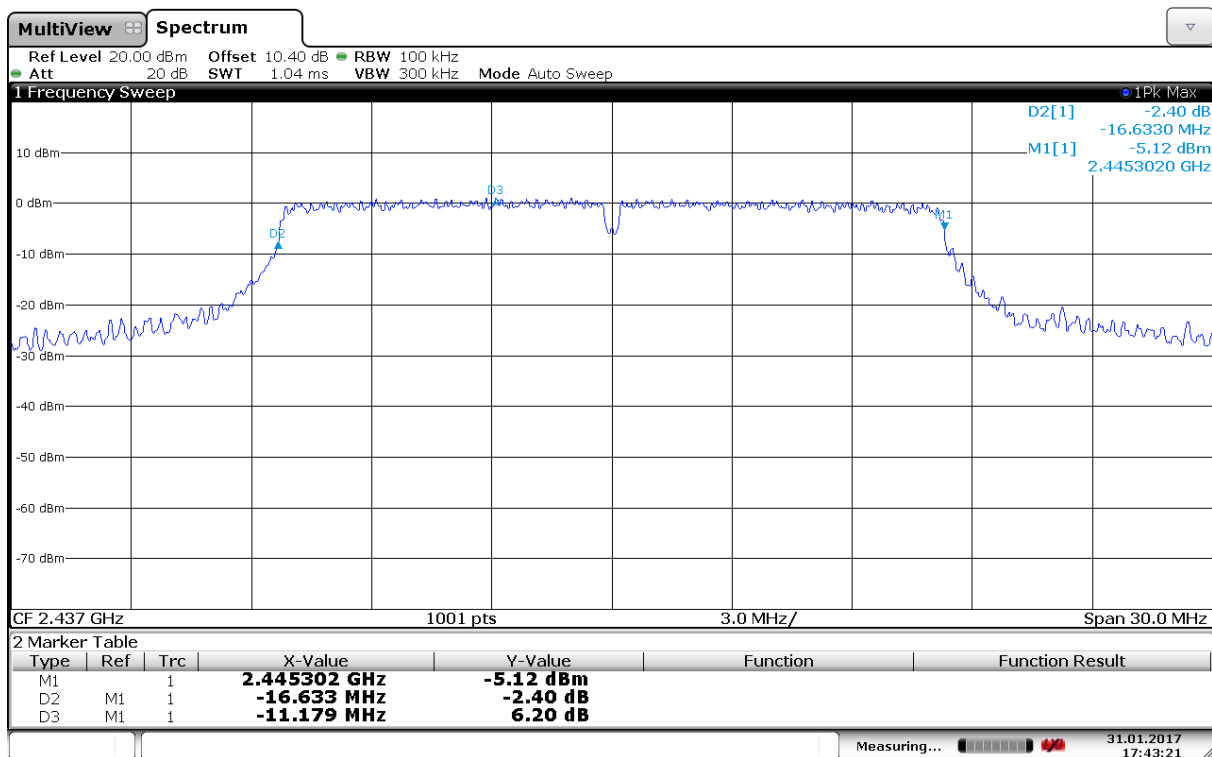
Power supply variation within 85 % to 115% of nominal value has no influence on measured value.

**Requirements:**

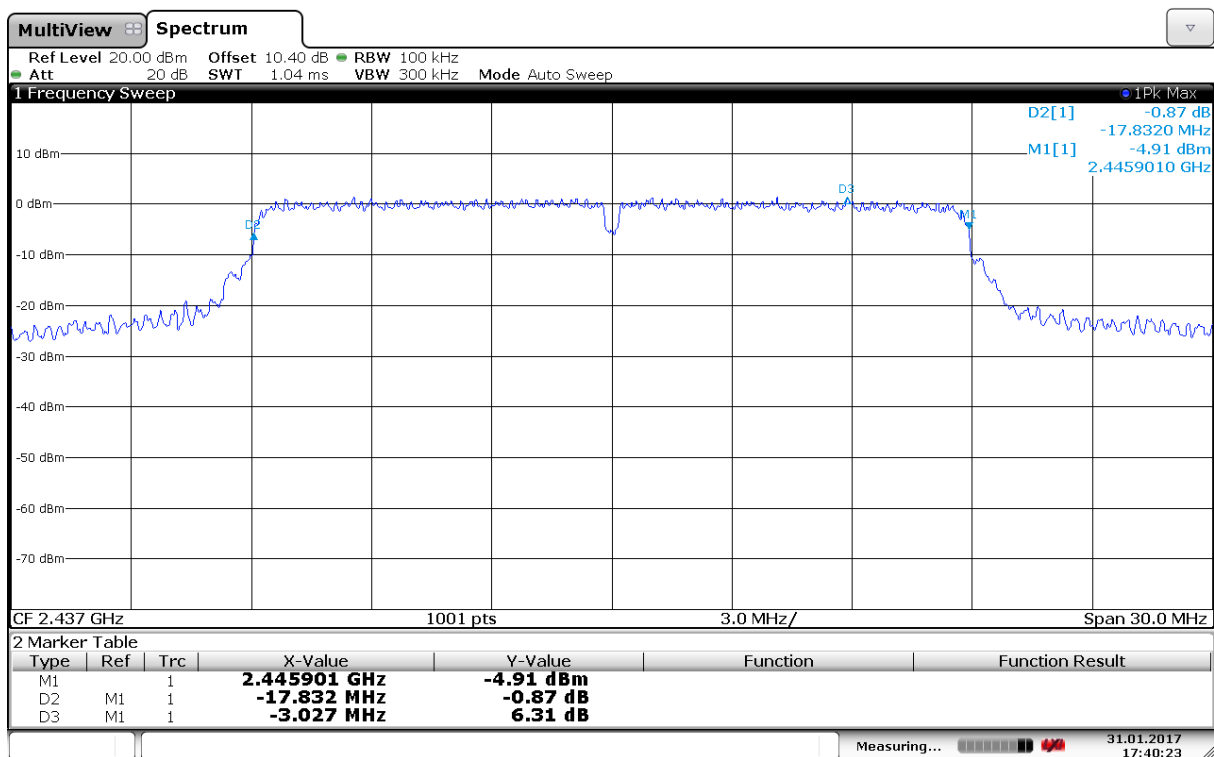
For Digital Transmission Systems in the 2400-2483.5 MHz band the minimum 6 dB bandwidth shall be at least 500 KHz.



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



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



6 dB Bandwidth, 2437 MHz, 802.11n, MCS0

### 3.4 Peak Output Power

FCC Part 15.247 (b)

Test Results: Complies

Measurement Data:

| Carrier Frequency | Maximum Conducted Output Power, Peak (dBm) |                 |               |
|-------------------|--------------------------------------------|-----------------|---------------|
|                   | 802.11b, 1 Mbps                            | 802.11g, 6 Mbps | 802.11n, MCS0 |
| 2412 MHz          | 12.8                                       | 18.3            | 18.6          |
| 2417 MHz          | 18.8                                       | 24.2            | 24.8          |
| 2437 MHz          | 17.7                                       | 23.3            | 23.7          |
| 2457 MHz          | 17.8                                       | 23.0            | 23.2          |
| 2462 MHz          | 11.6                                       | 16.7            | 17.4          |
| Carrier Frequency | Maximum Radiated Power, EIRP (dBm)         |                 |               |
|                   | 802.11b, 1 Mbps                            | 802.11g, 6 Mbps | 802.11n, MCS0 |
| 2437 MHz          | 17.5                                       | 22.6            | 23.1          |
| Carrier Frequency | Maximum Antenna Gain (dBi)                 |                 |               |
|                   | 802.11b, 1 Mbps                            | 802.11g, 6 Mbps | 802.11n, MCS0 |
| 2437 MHz          | -0.2                                       | -0.7            | -0.6          |

Peak Output Power is measured with Peak Detector and RBW=1MHz, using the Band Power function in the Spectrum Analyzer.

Antenna gain =  $10 \cdot \log(\text{EIRP} / \text{Conducted power})$  dBi

EIRP is calculated from measured field strength using the method described in KDB 412172 D01.

RMS Output Power is measured with an Average Power Sensor.

EUT was transmitting with duty cycle = 100% for all power measurements.

See attached plots.

| Carrier Frequency | Conducted Output Power, RMS (dBm) |                 |               |
|-------------------|-----------------------------------|-----------------|---------------|
|                   | 802.11b, 1 Mbps                   | 802.11g, 6 Mbps | 802.11n, MCS0 |
| 2412 MHz          | 16.4                              | 15.8            | 15.8          |
| 2437 MHz          | 16.1                              | 15.5            | 15.5          |
| 2462 MHz          | 16.0                              | 15.5            | 15.5          |

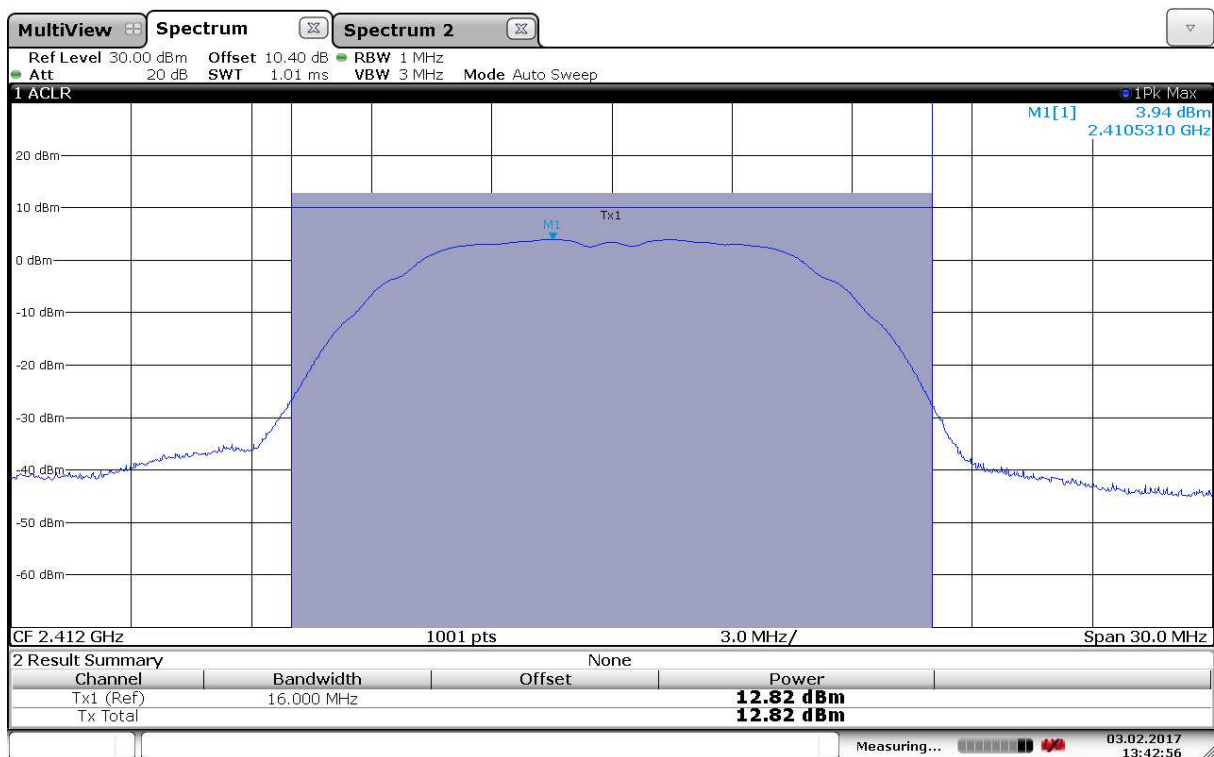
RMS values above was measured on a sample transmitting at full power on channels 1 and 11, and are reported for comparison with SAR report.

#### Requirements:

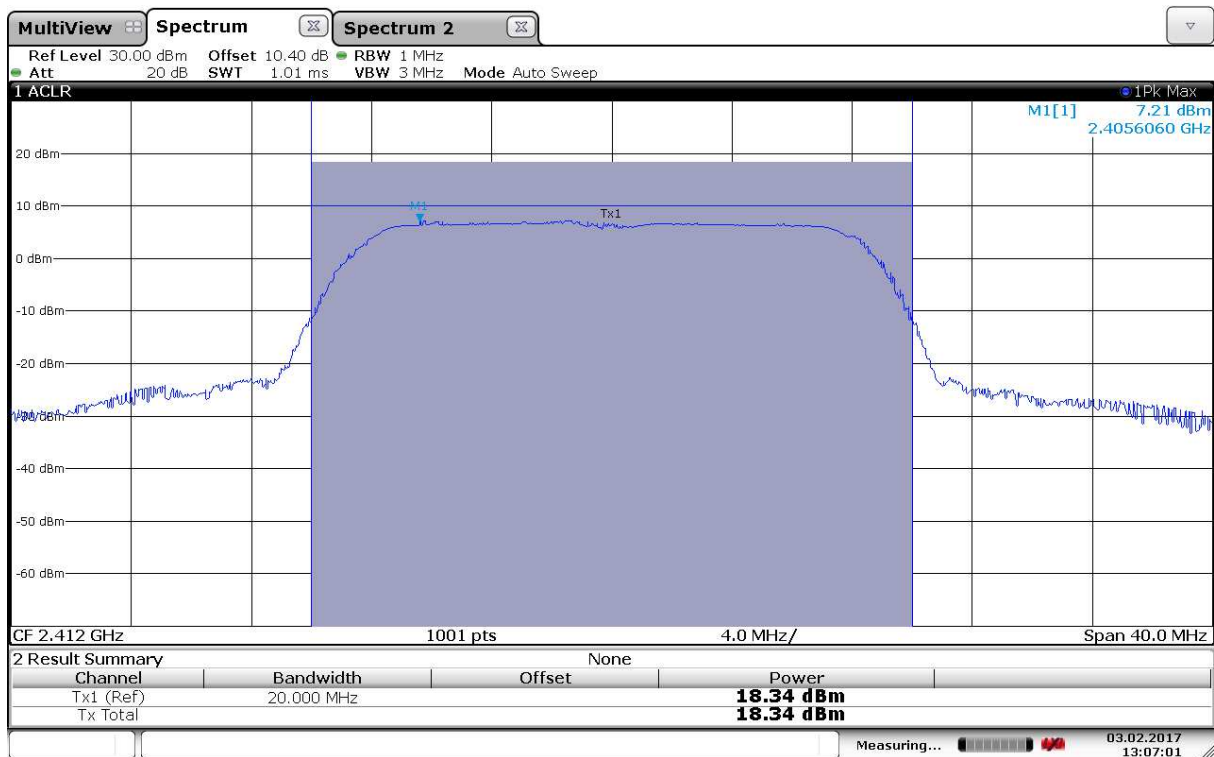
The maximum peak output power shall not exceed the following limits:

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

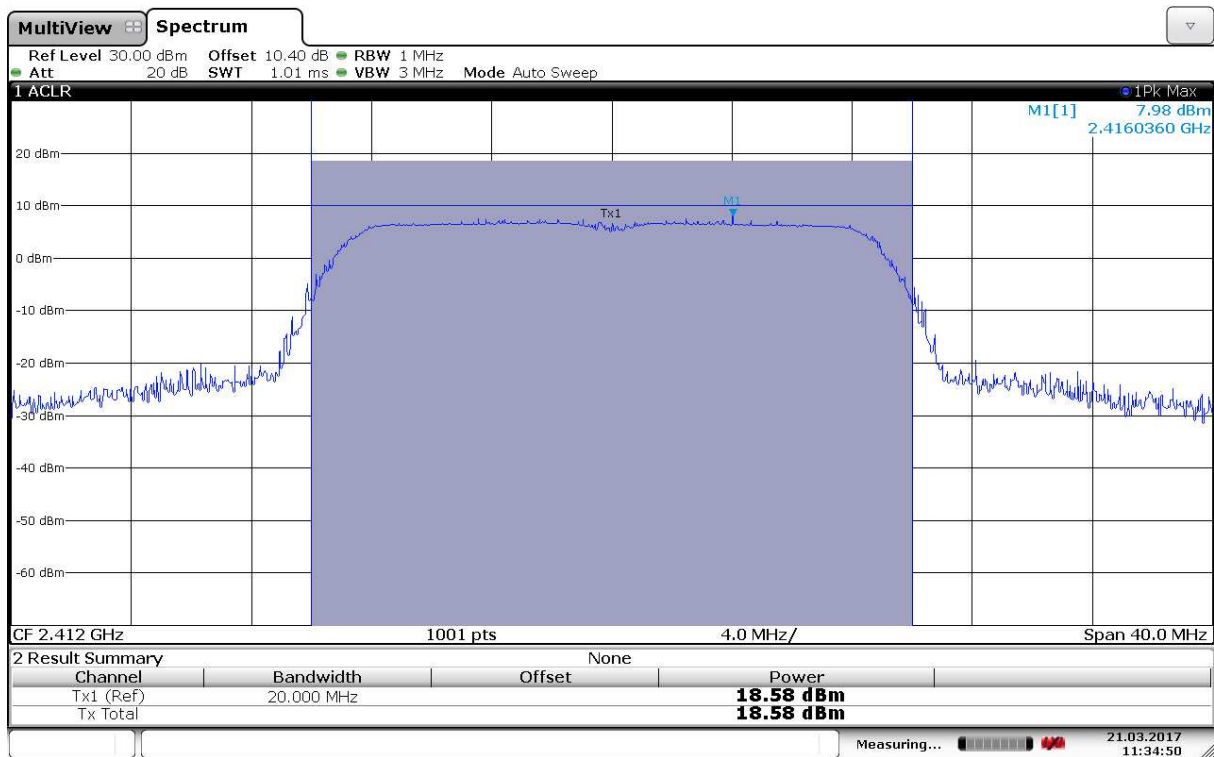
If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power from the intentional radiator shall be reduced below the stated value above by the amount in dB that the directional gain of the antenna exceeds 6 dBi.



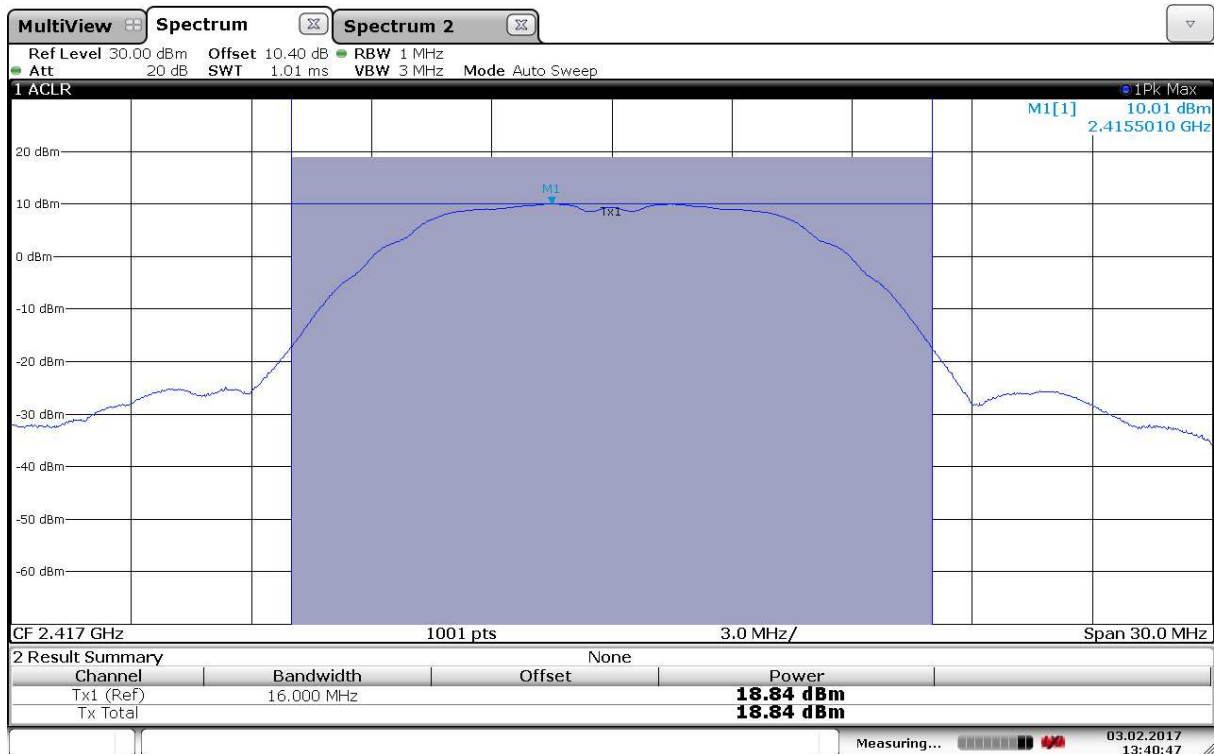
Conducted Output Power, 2412 MHz, 802.11b, 1Mbps



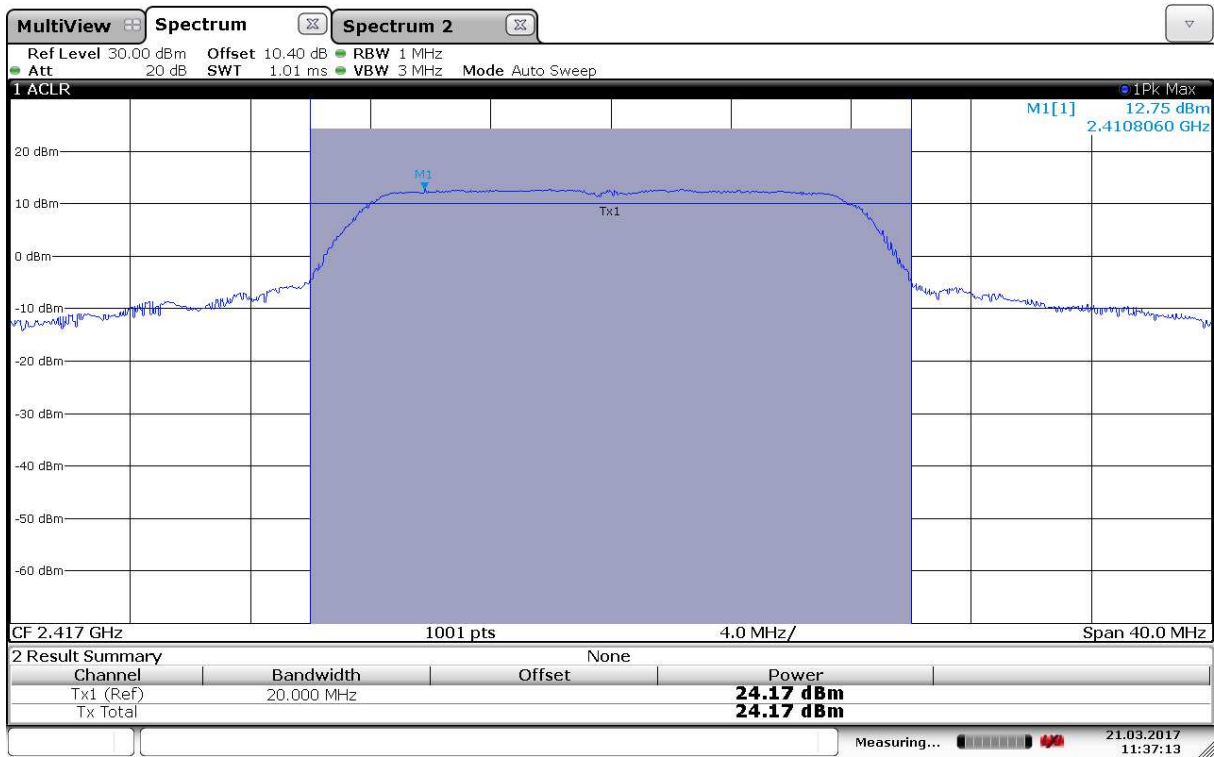
Conducted Output Power, 2412 MHz, 802.11g, 6Mbps



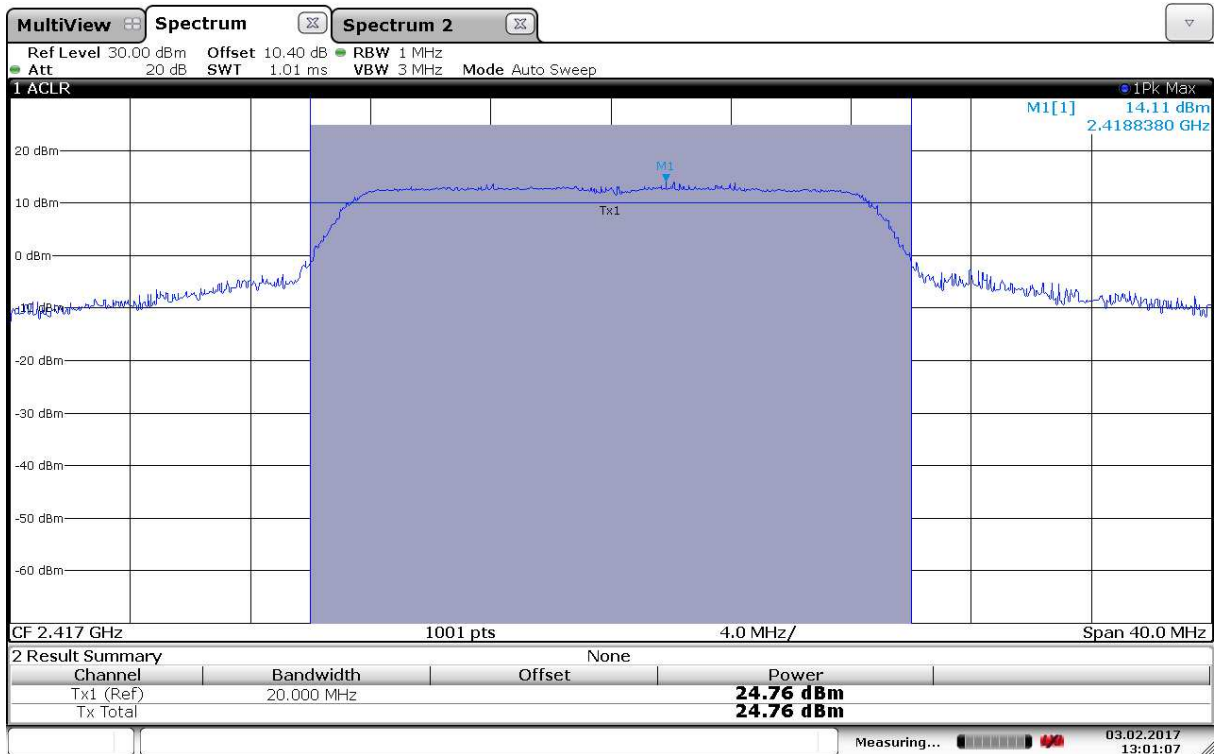
Conducted Output Power, 2412 MHz, 802.11n, MCS0



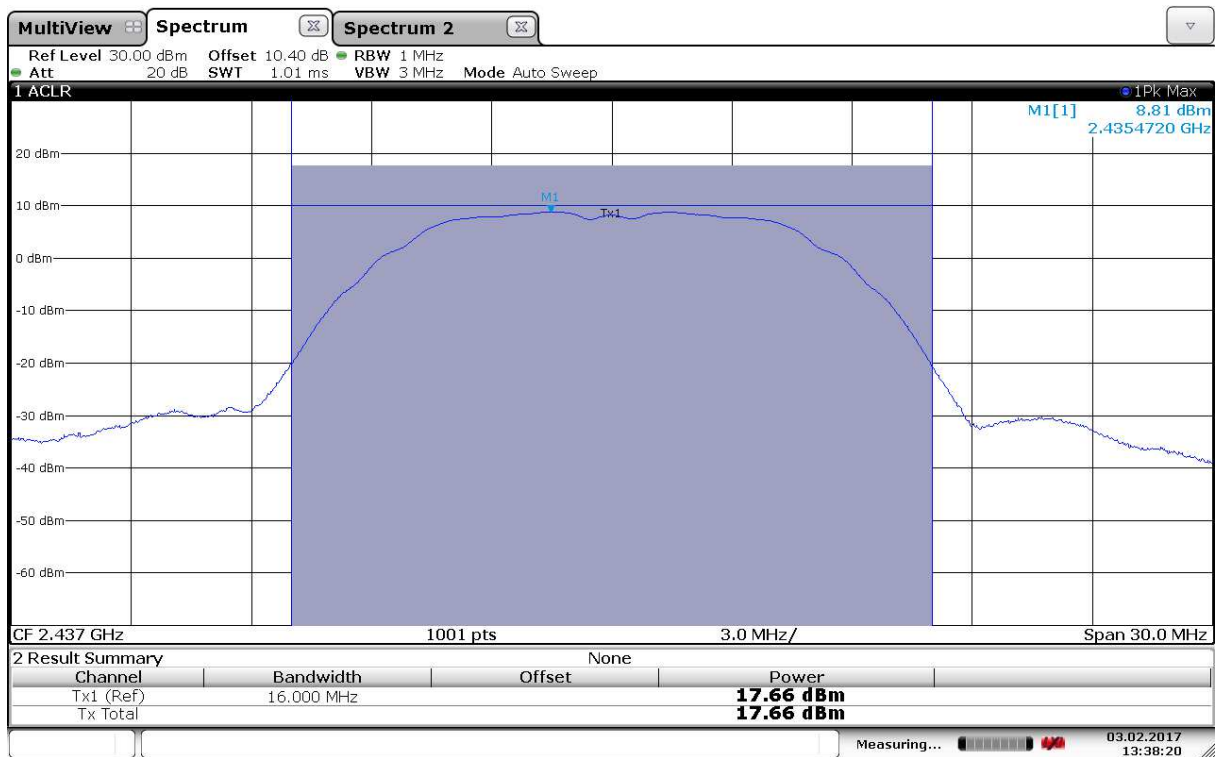
Conducted Output Power, 2417 MHz, 802.11b, 1Mbps



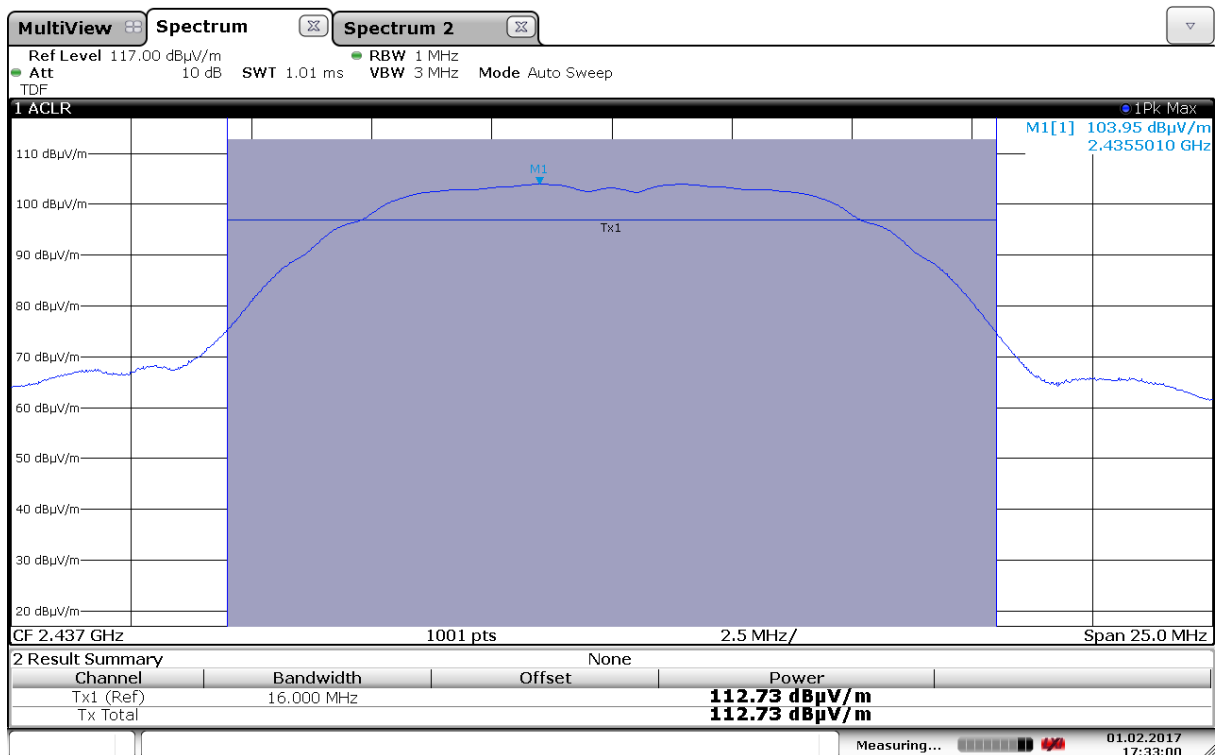
Conducted Output Power, 2417 MHz, 802.11g, 6Mbps



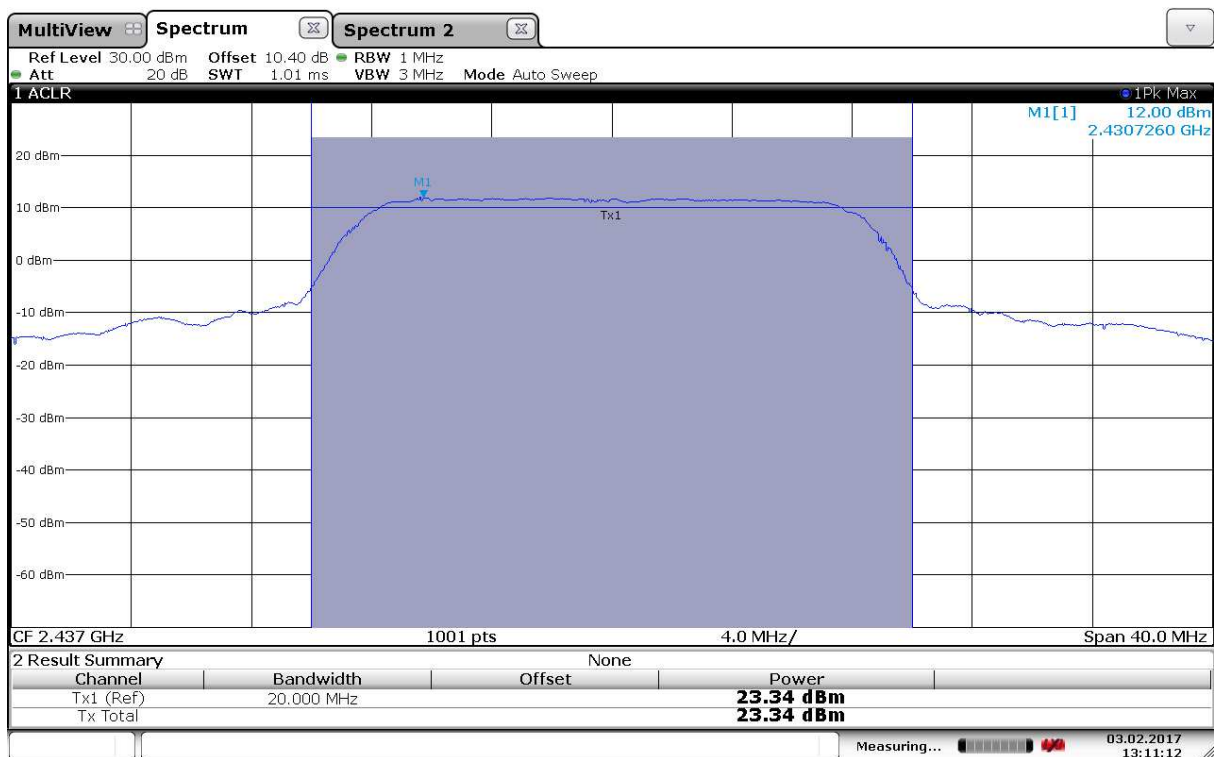
Conducted Output Power, 2417 MHz, 802.11n, MCS0



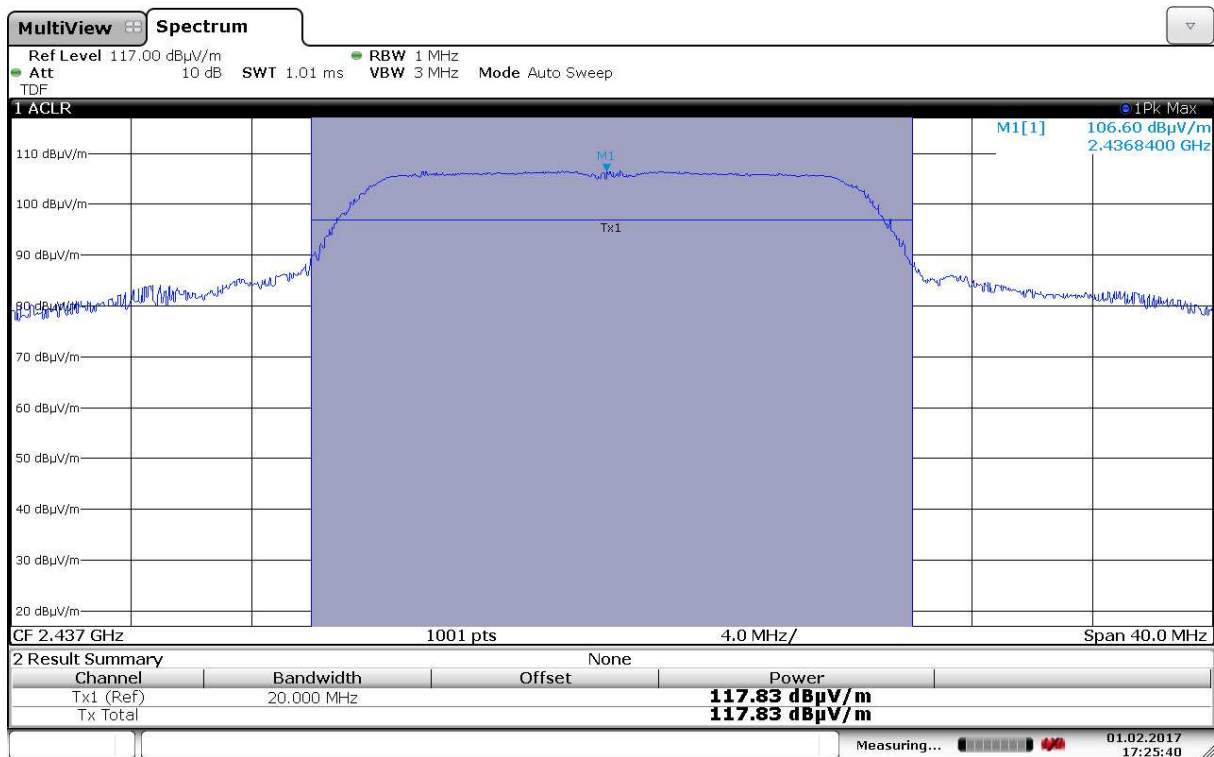
Conducted Output Power, 2437 MHz, 802.11b, 11Mbps



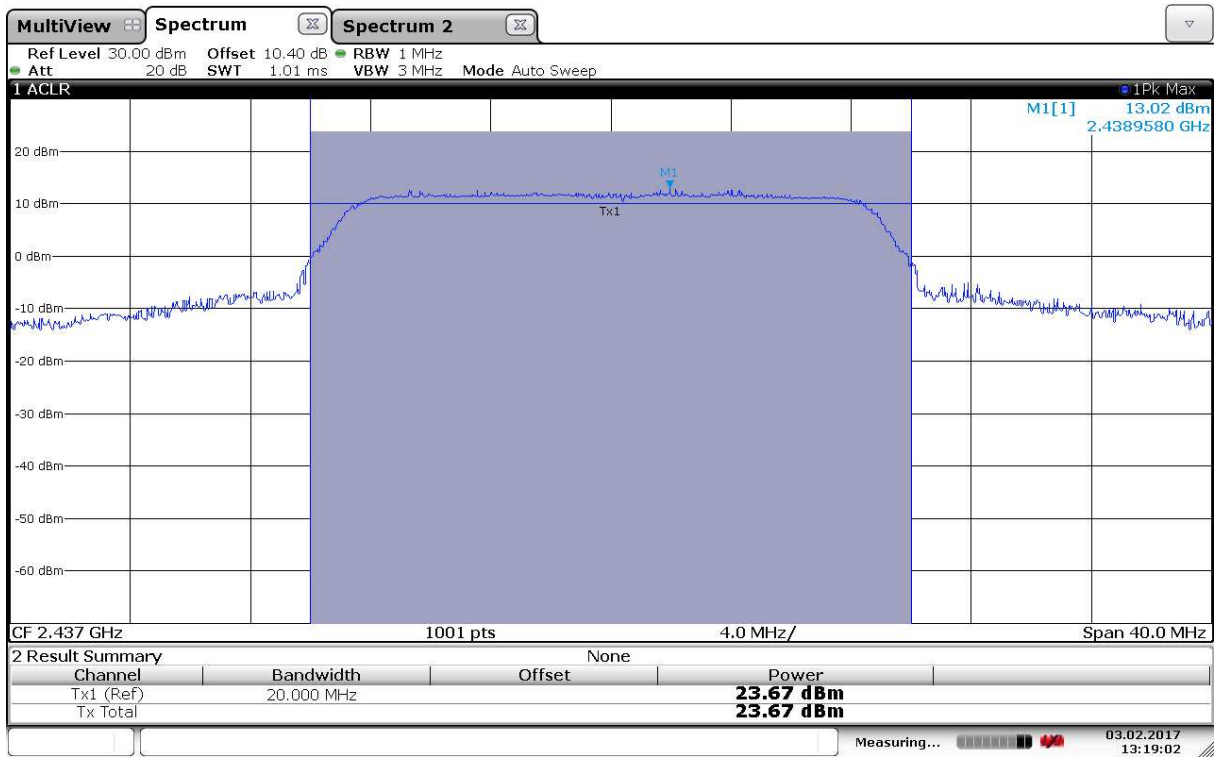
Radiated Output Power, 2437 MHz, 802.11b, 11Mbps (Max: EUT V, HP)



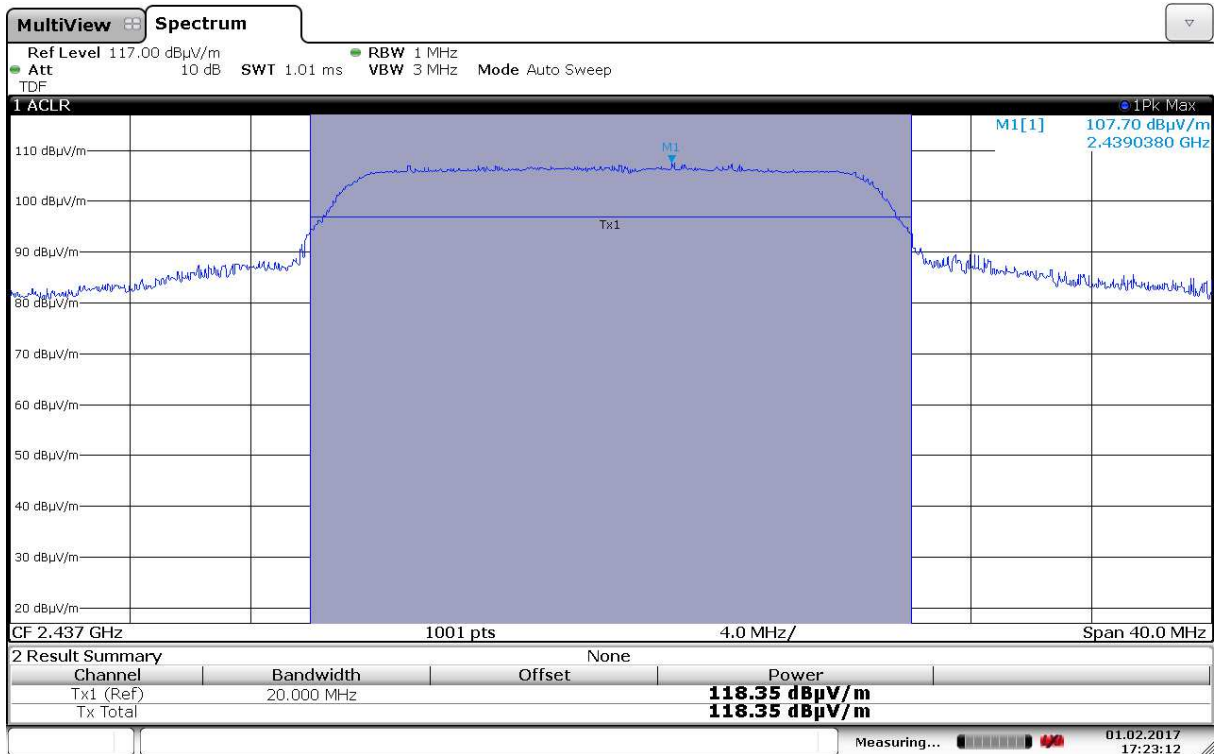
Conducted Output Power, 2437 MHz, 802.11g, 6Mbps



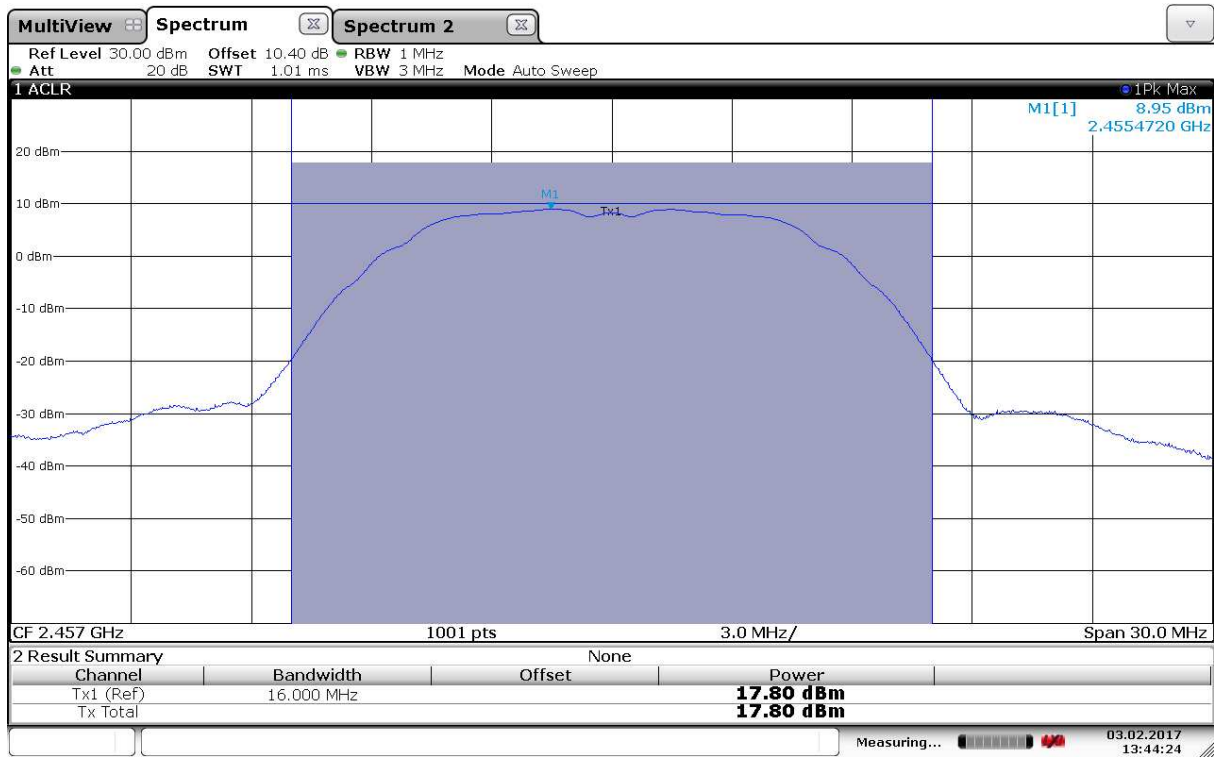
Radiated Output Power, 2437 MHz, 802.11g, 6Mbps (Max: EUT V, HP)



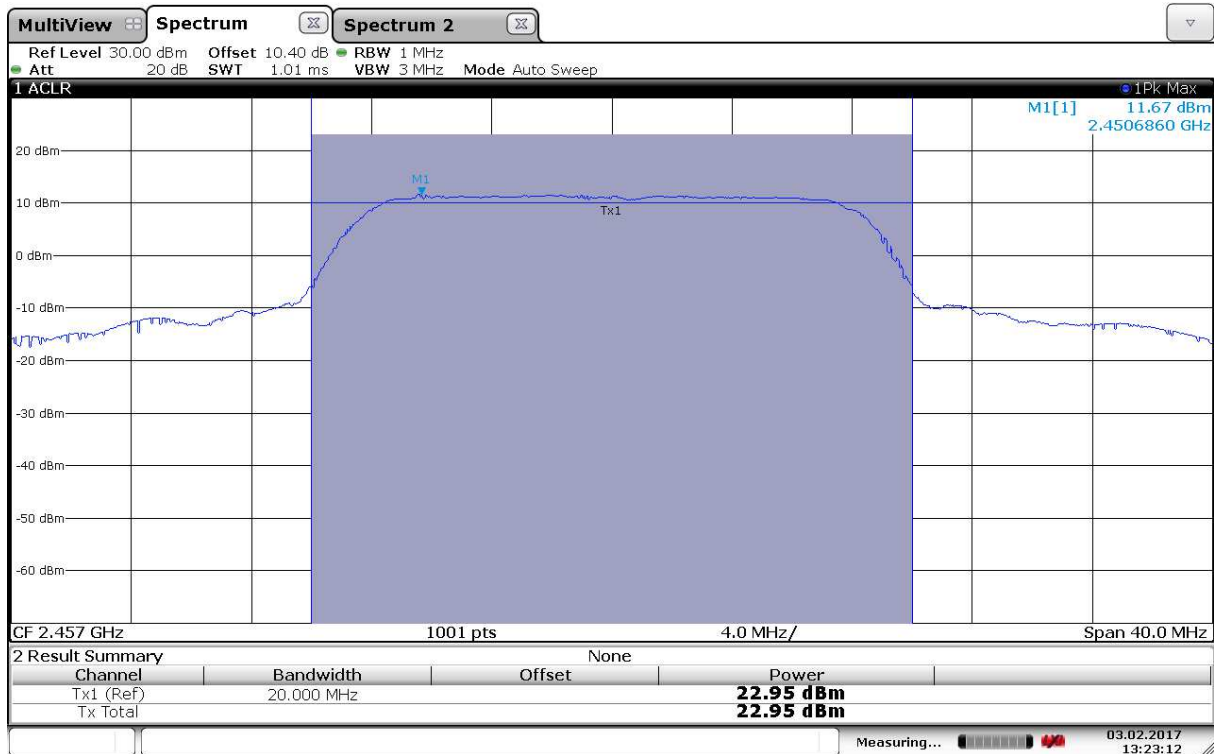
Conducted Output Power, 2437 MHz, 802.11n, MCS0



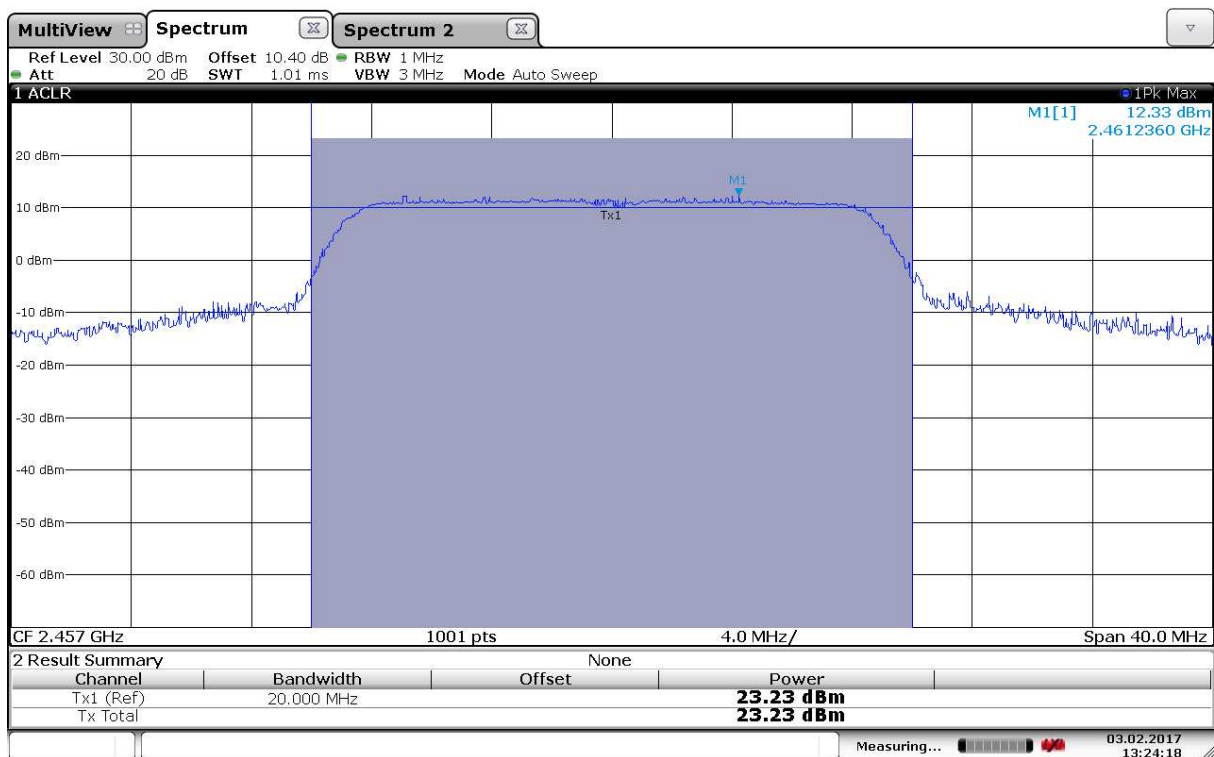
Radiated Output Power, 2437 MHz, 802.11n, MCS0 (Max: EUT V, HP)



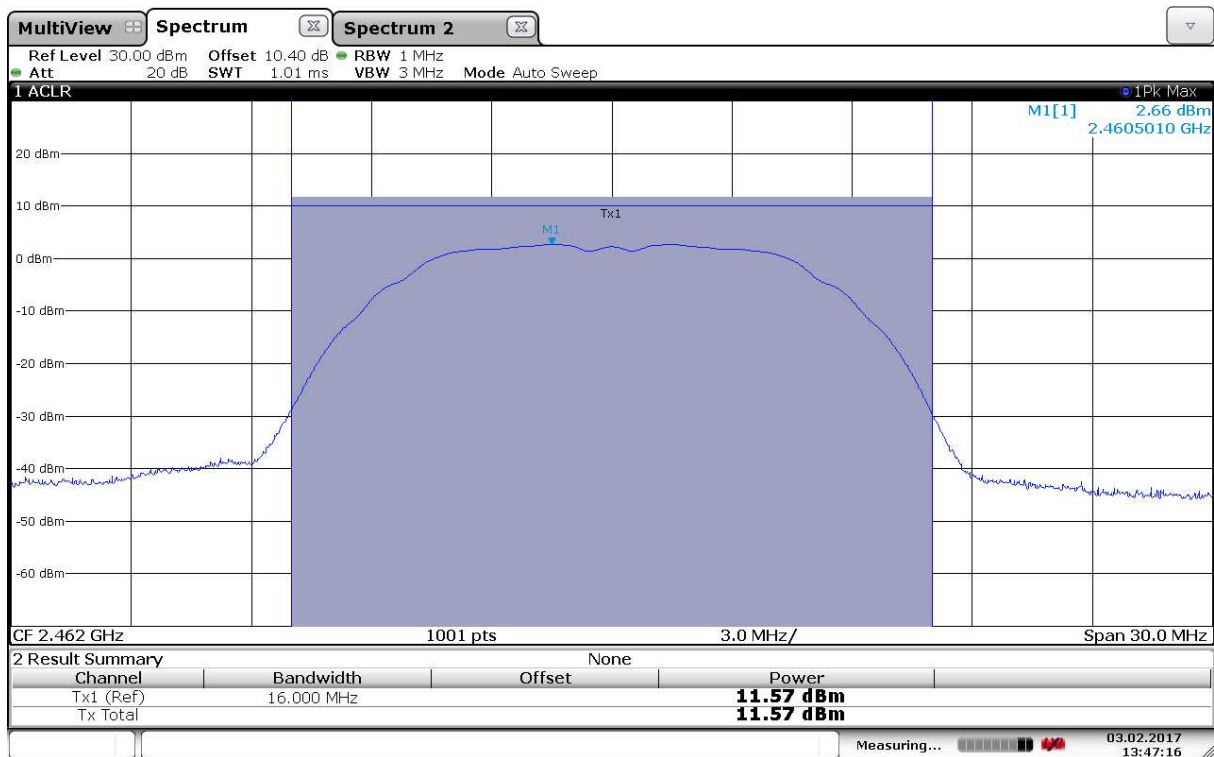
Conducted Output Power, 2457 MHz, 802.11b, 11Mbps



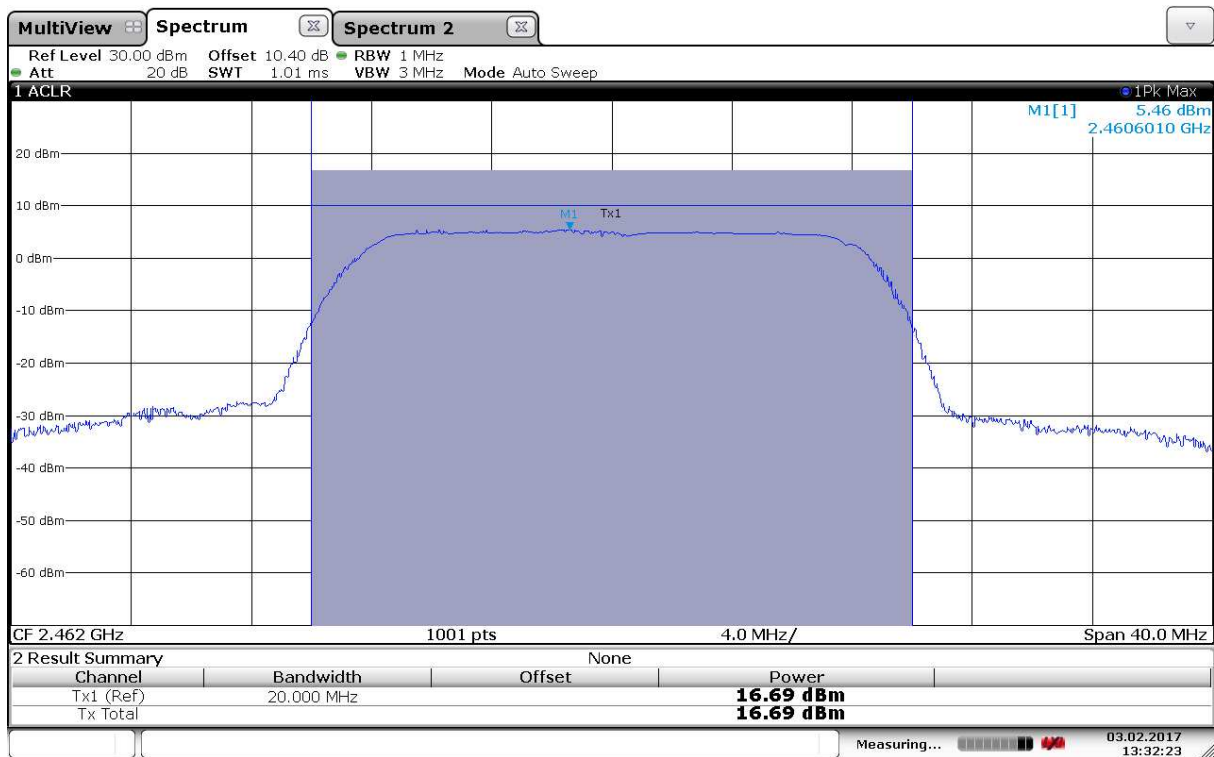
Conducted Output Power, 2457 MHz, 802.11g, 6Mbps



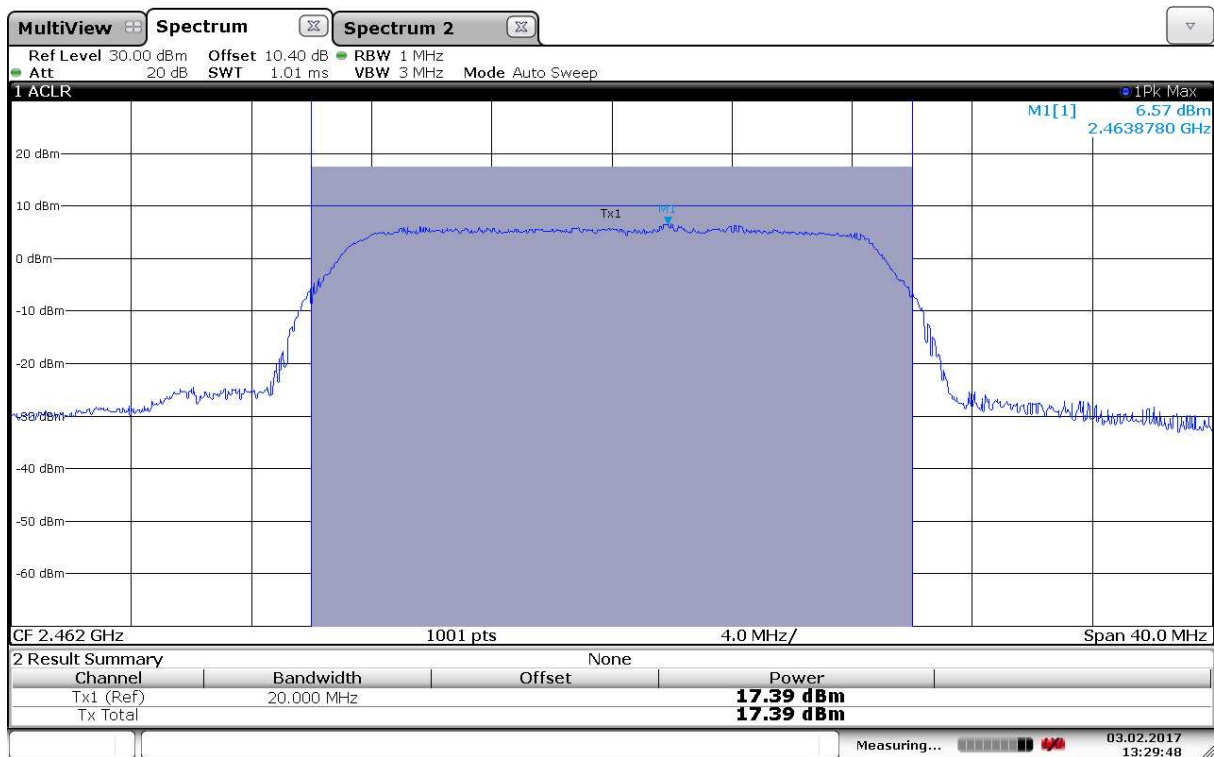
Conducted Output Power, 2457 MHz, 802.11n, MCS0



Conducted Output Power, 2462 MHz, 802.11b, 11Mbps



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)

Test Results: Complies

Measurement Data:

| Carrier Frequency | Highest Value (dBc) | Margin (dB) | Verdict |
|-------------------|---------------------|-------------|---------|
| 2412 MHz          | > 35                | > 15        | Pass    |
| 2437 MHz          | > 50                | > 30        | Pass    |
| 2462 MHz          | > 35                | > 15        | Pass    |

Measured with Peak Detector

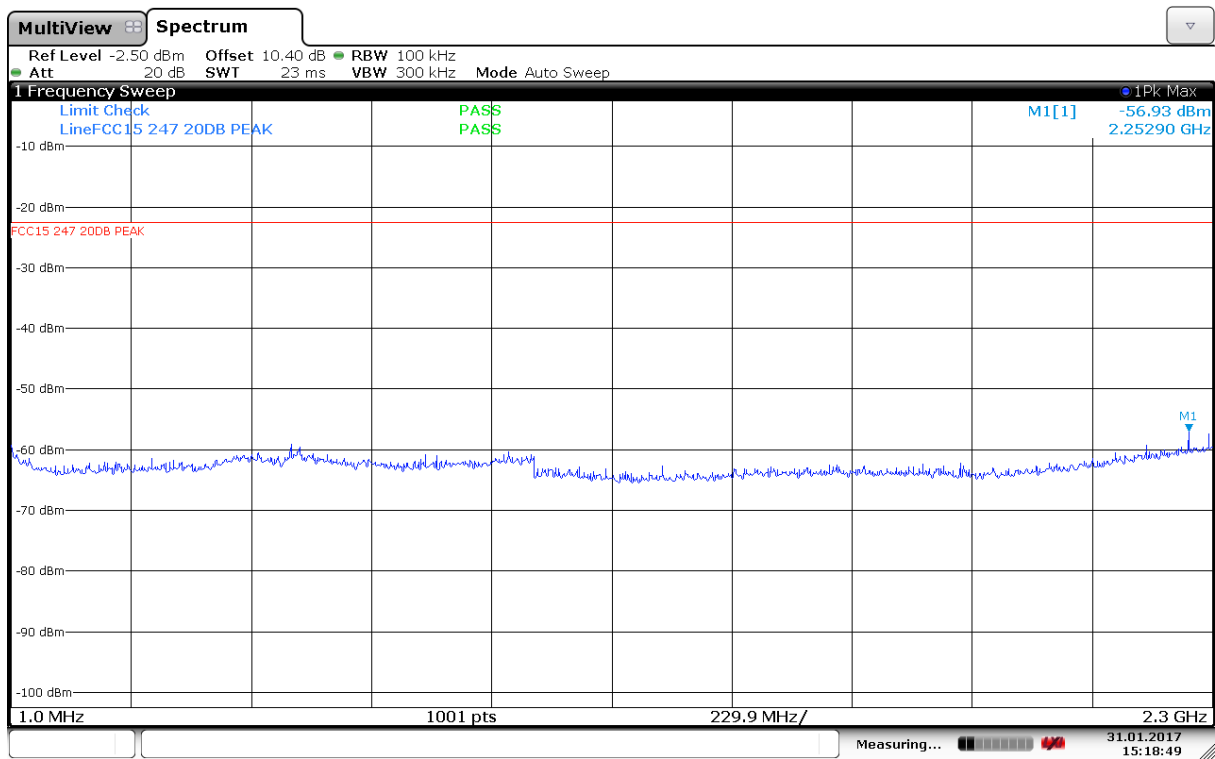
RF conducted power to 25 GHz: see attached plots.

#### Limit

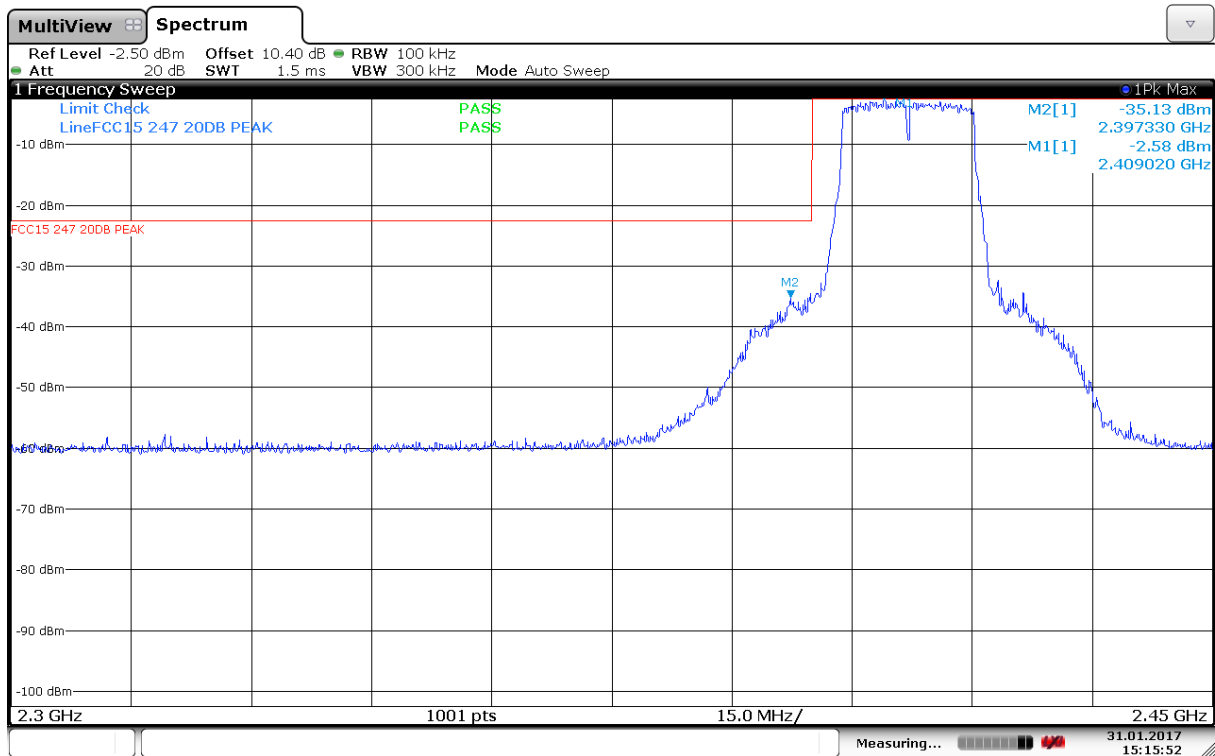
| Peak measurement                    | RMS averaging                       |
|-------------------------------------|-------------------------------------|
| 20 dBc or more in 100 kHz bandwidth | 30 dBc or more in 100 kHz bandwidth |

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

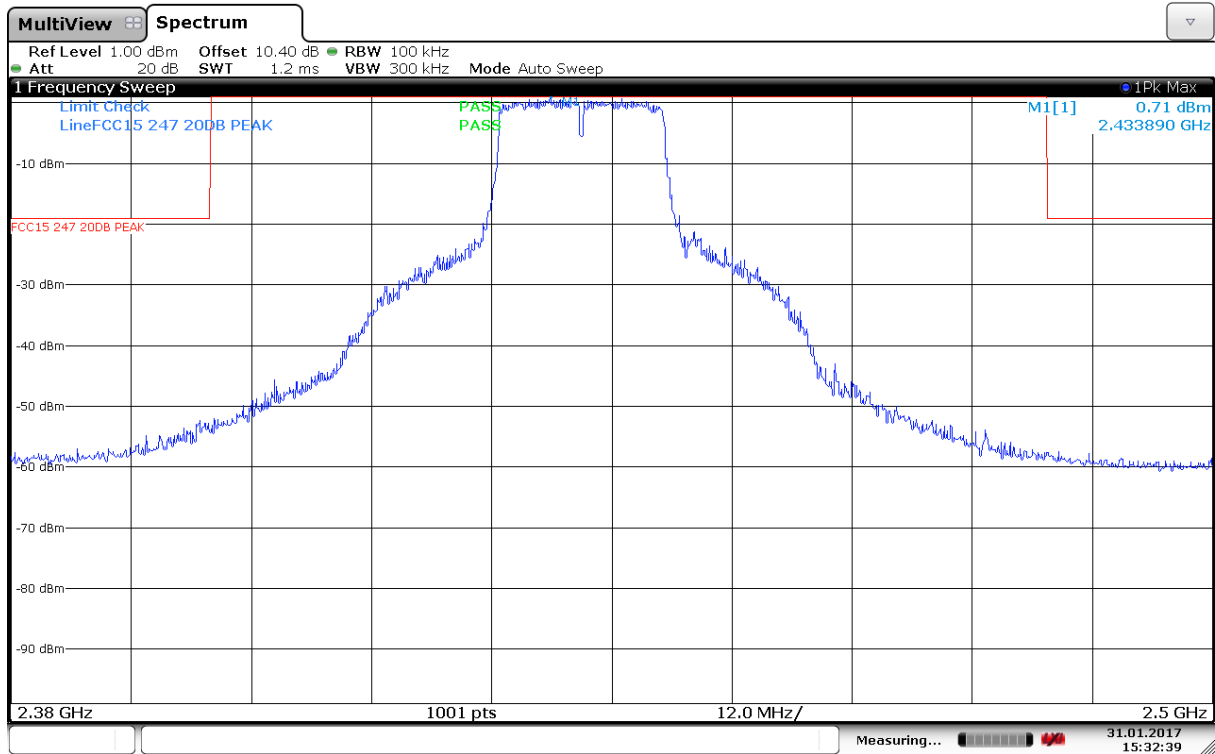
Attenuation below the general limits specified in part 15.209(a) is not required.



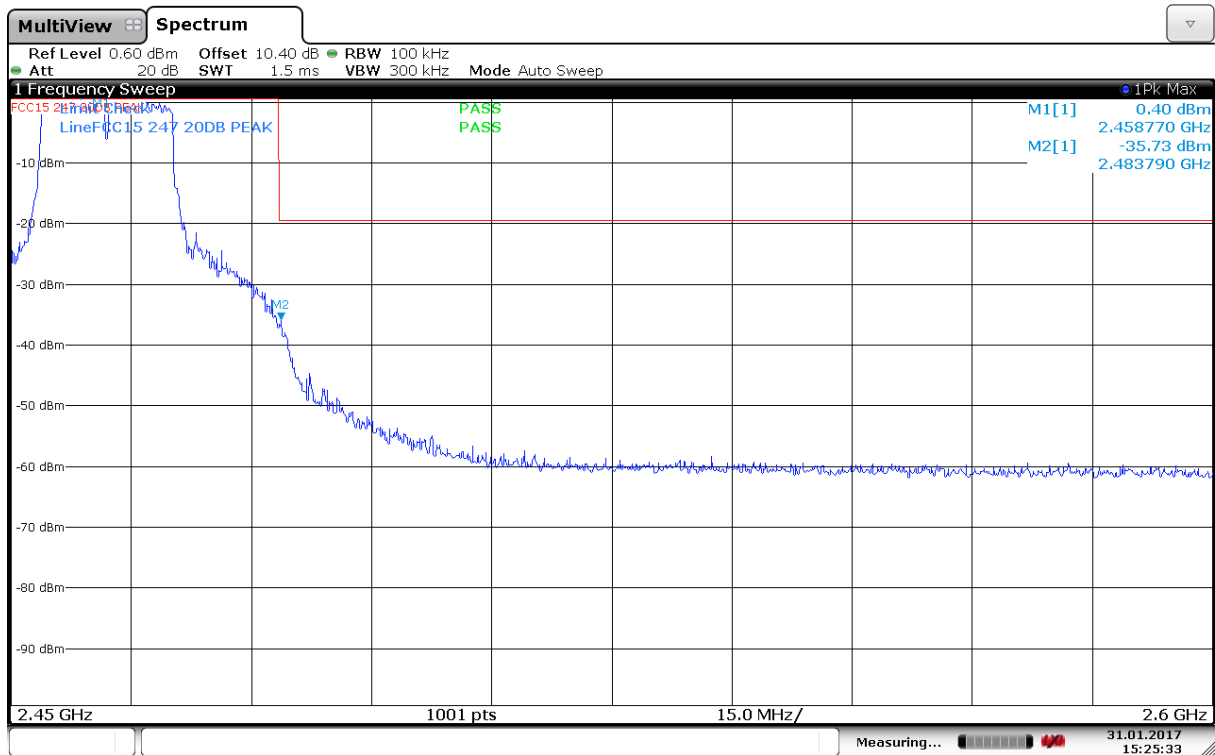
Conducted Emissions, 1 -2300MHz, ch01, 802.11g 6M



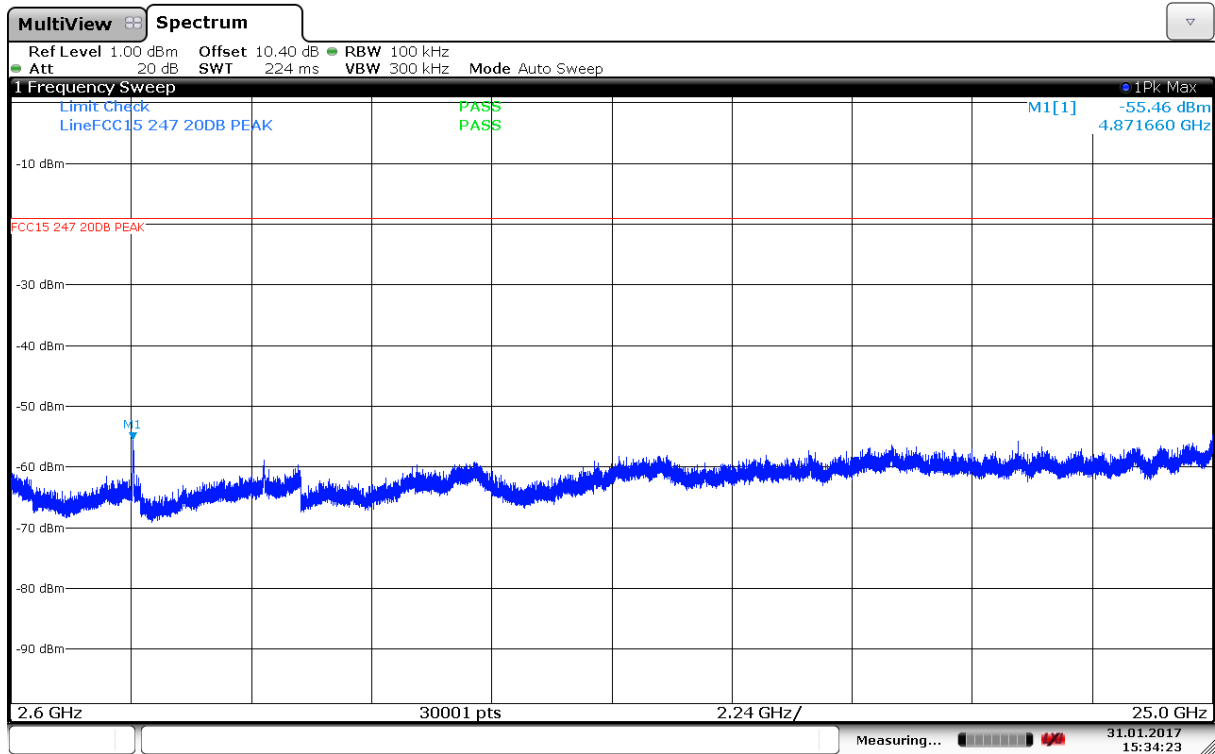
Conducted Emissions, 2300 -2450MHz, ch01, 802.11g 6M



Conducted Emissions, 2380 -2500MHz, ch06, 802.11g 6M



Conducted Emissions, 2450 -2600MHz, ch11, 802.11g 6M



Conducted Emissions, 2600 -25000MHz, ch6, 802.11g 6M

### 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 4, 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> |
| <b>0.495-0.505</b>                  |                    | 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> | <b>2.4835-2.5</b>                    |                   |
| 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                            |                   |
| <b>149.9-150.05</b>                 |                    | 36.43-36.5                           |                   |
| 156.52475-156.52525                 |                    | Above 38.6                           |                   |
| 156.7-156.9                         |                    |                                      |                   |
| <b>162.0125-167.17</b>              |                    |                                      |                   |
| <b>167.72-173.2</b>                 |                    |                                      |                   |
| 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:

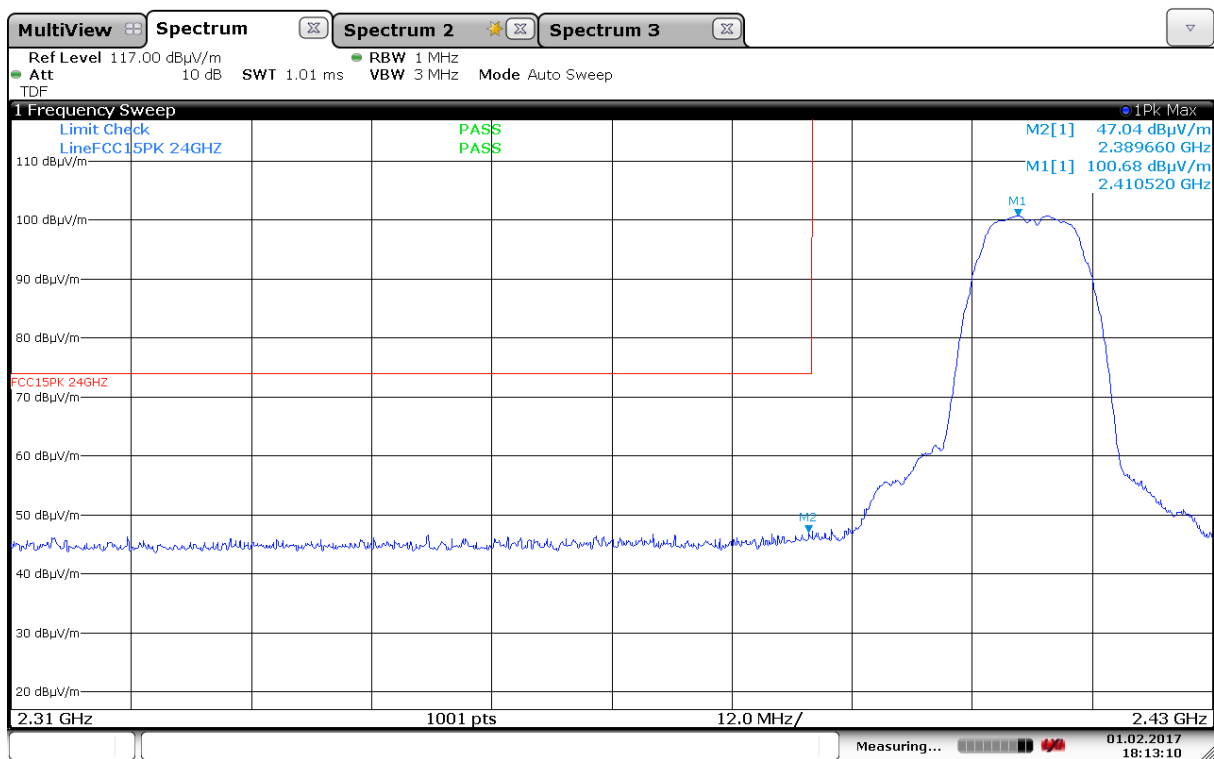
| Modulation and Bitrate | Measured field strength (dBμV/m) |            | Limit | Margin |      |
|------------------------|----------------------------------|------------|-------|--------|------|
|                        | 2390 MHz                         | 2483.5 MHz | dB    | dB     |      |
| 802.11b, 11 Mbps       | 47.0                             | 47.3       | 74    | 27.0   | 26.7 |
| 802.11g, 6 Mbps        | 68.3                             | 63.9       | 74    | 5.7    | 10.1 |
| 802.11n, MCS0          | 73.0                             | 71.8       | 74    | 1.0    | 2.2  |

Average Detector:

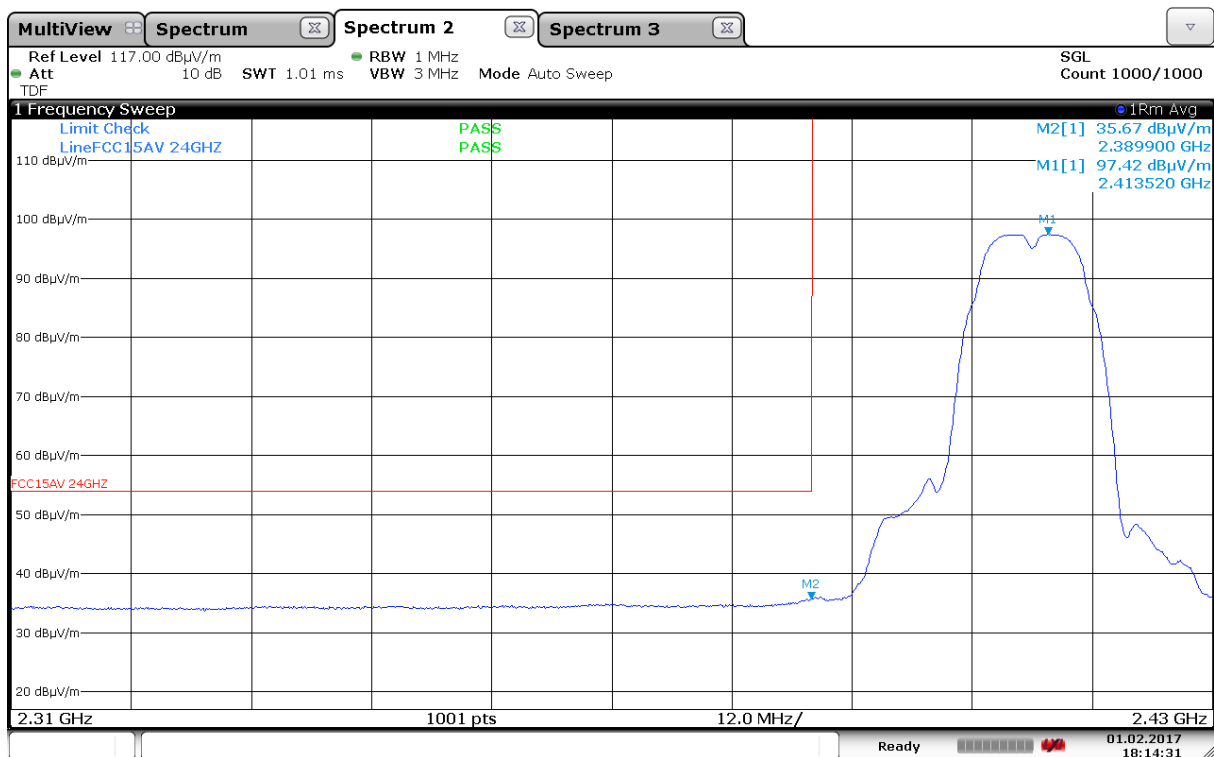
| Modulation and Bitrate | Measured field strength (dBμV/m) |            | Limit | Margin |      |
|------------------------|----------------------------------|------------|-------|--------|------|
|                        | 2390 MHz                         | 2483.5 MHz | dB    | dB     |      |
| 802.11b, 11 Mbps       | 35.7                             | 36.5       | 54    | 18.3   | 17.5 |
| 802.11g, 6 Mbps        | 49.7                             | 44.5       | 54    | 4.3    | 9.5  |
| 802.11n, MCS0          | 53.1                             | 46.5       | 54    | 0.9    | 7.5  |

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

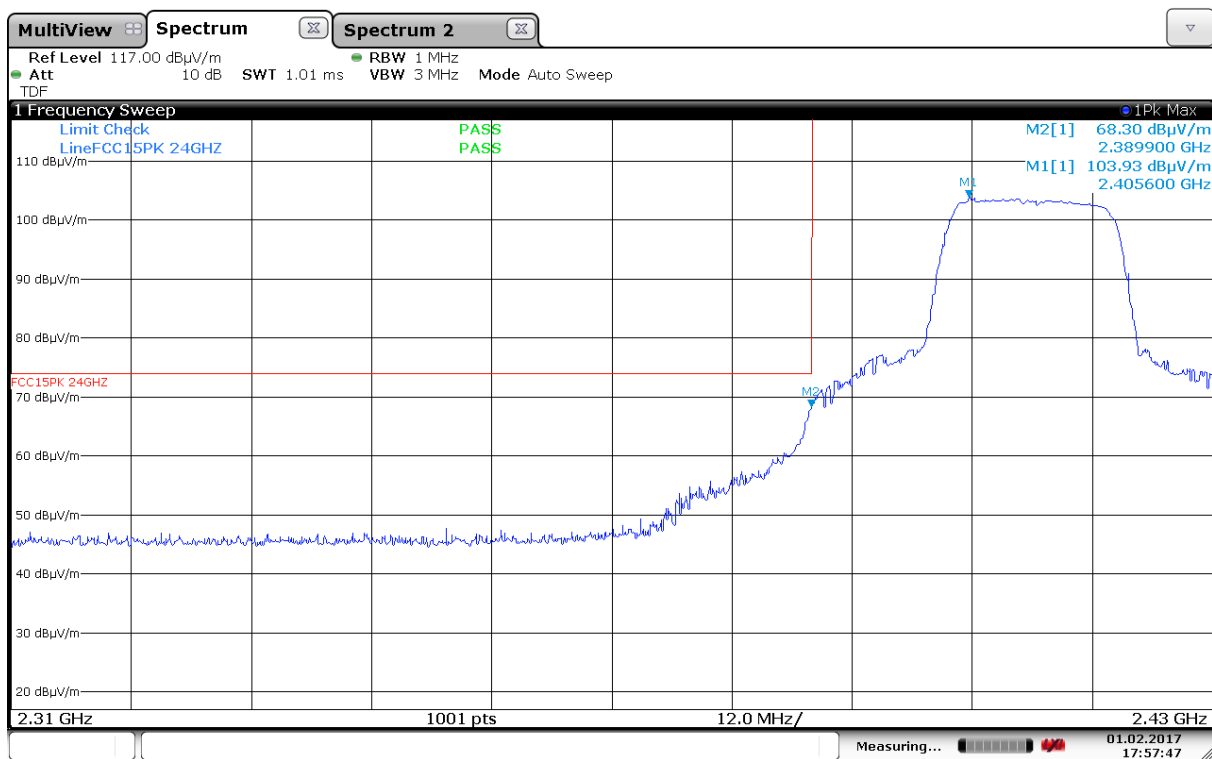
See attached plots.



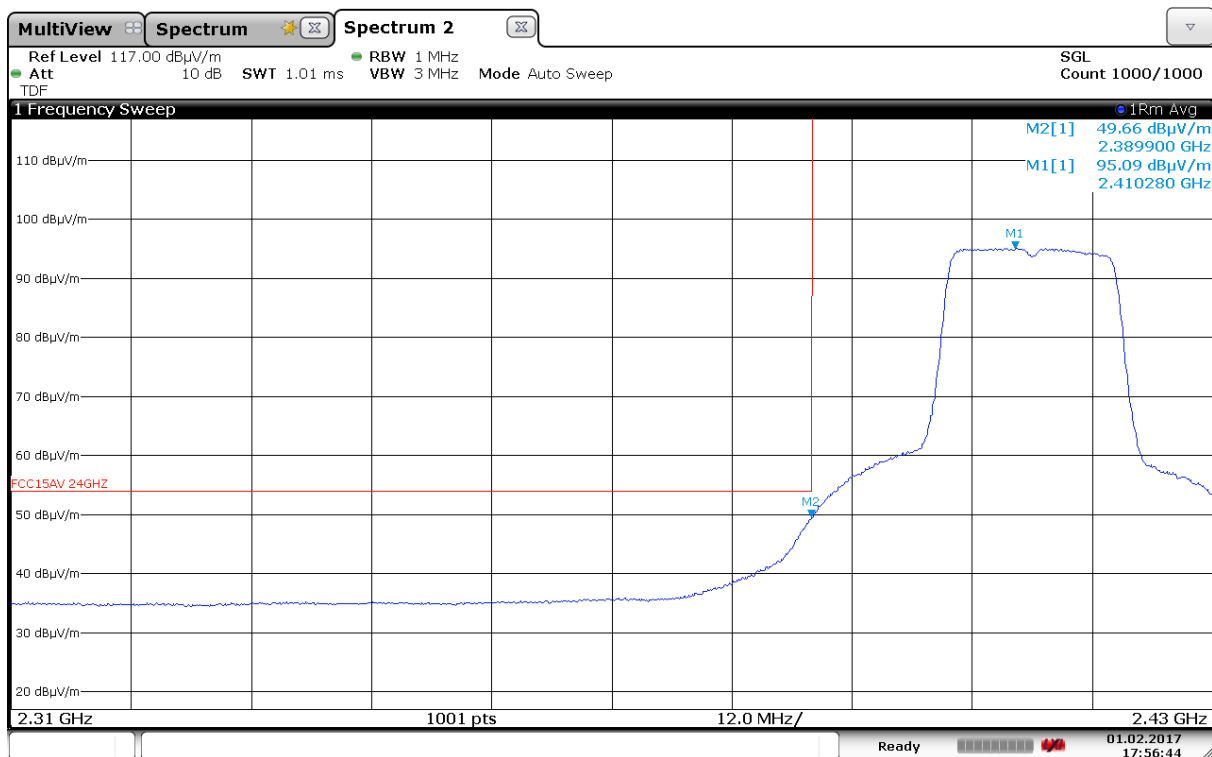
Band Edge, Lower, Peak, 2412 MHz, 802.11b, 11Mbps



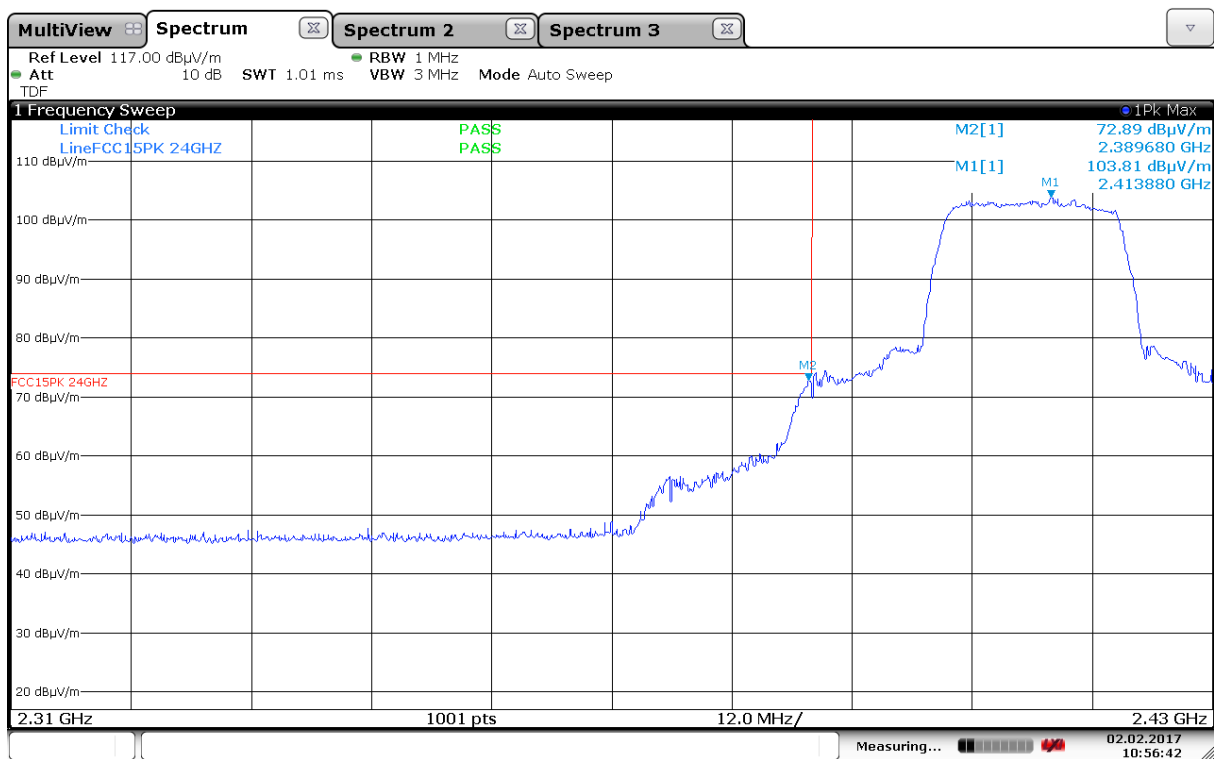
Band Edge, Lower, Average, 2412 MHz, 802.11b, 11Mbps



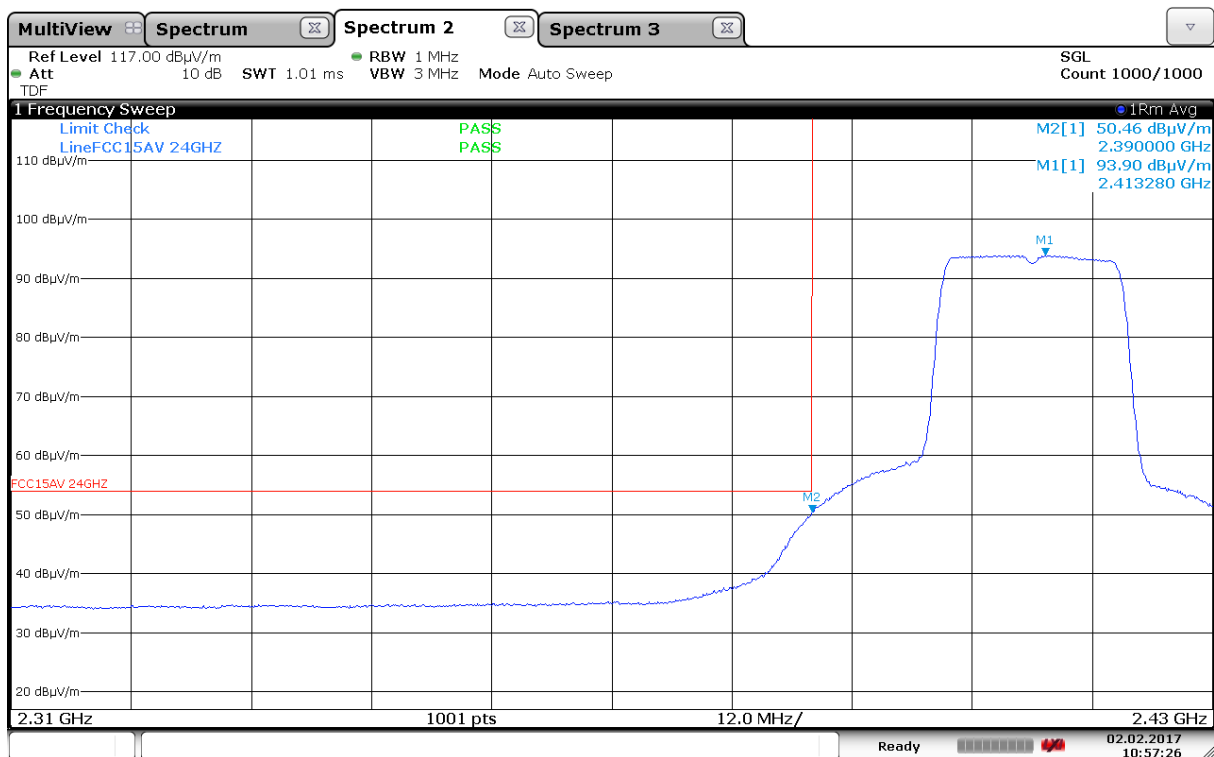
**Band Edge, Lower, Peak, 2412 MHz, 802.11g, 6Mbps**



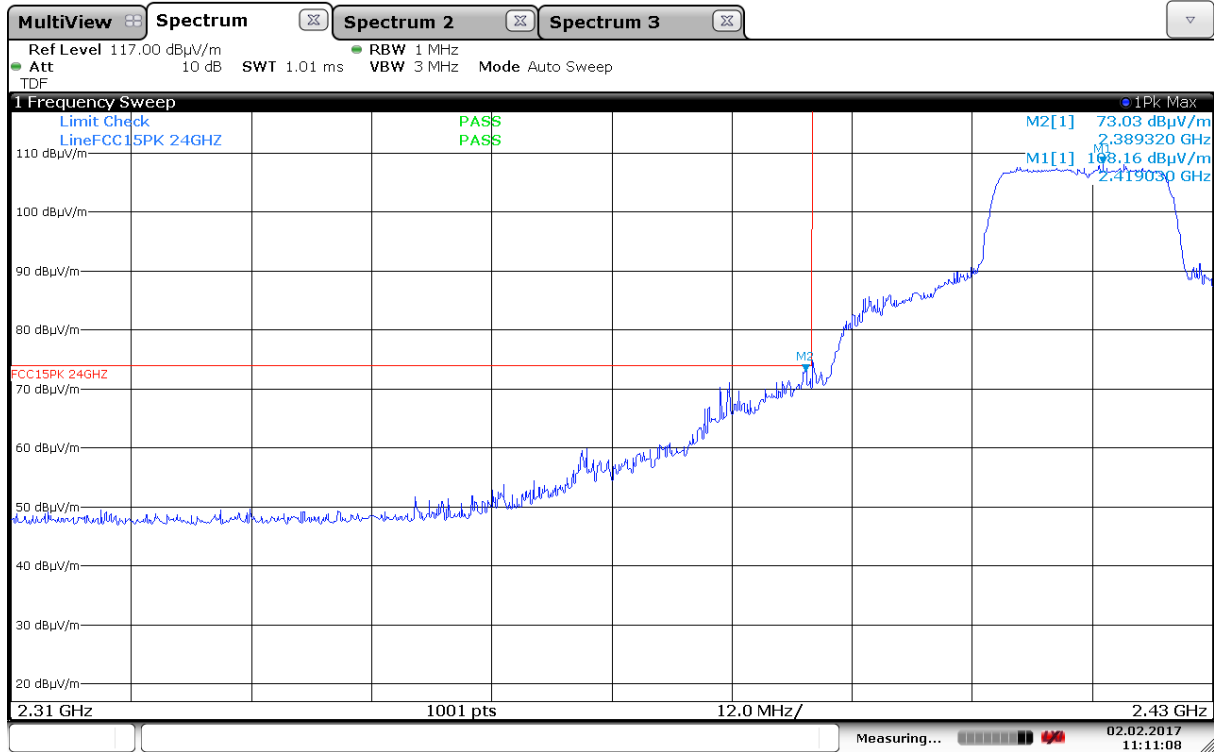
**Band Edge, Lower, Average, 2412 MHz, 802.11g, 6Mbps**



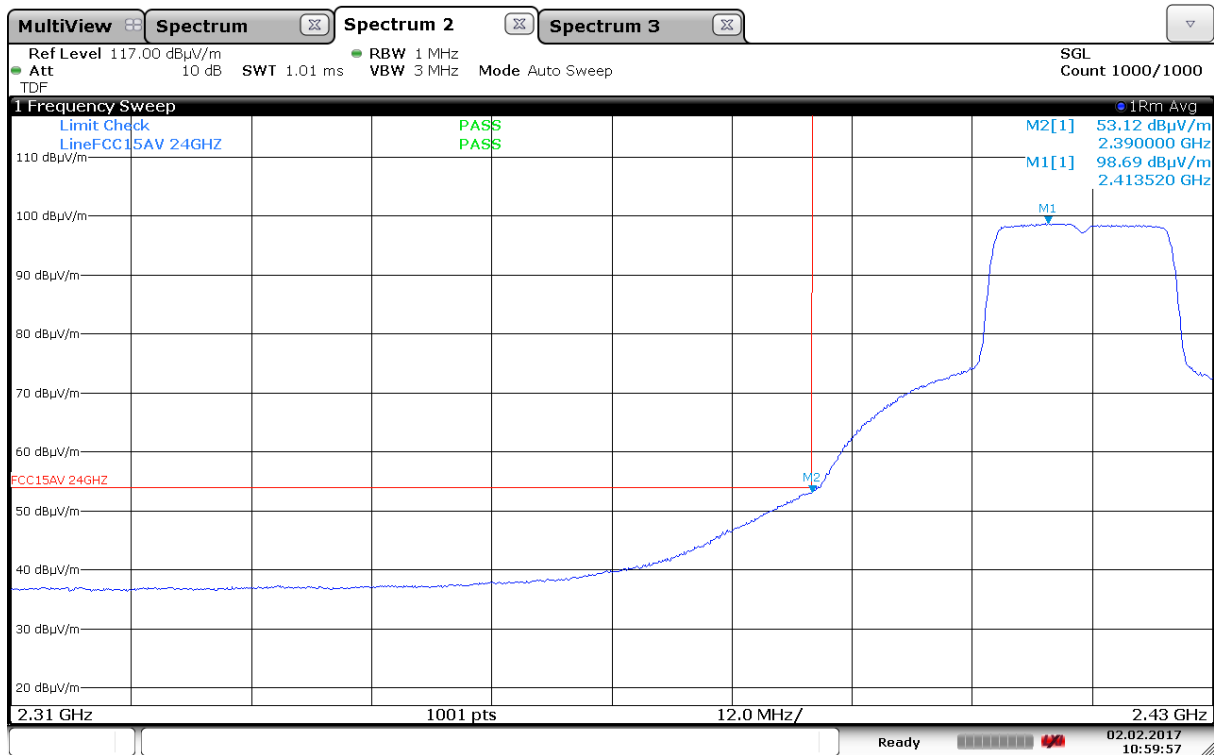
Band Edge, Lower, Peak, 2412 MHz, 802.11n, MCS0



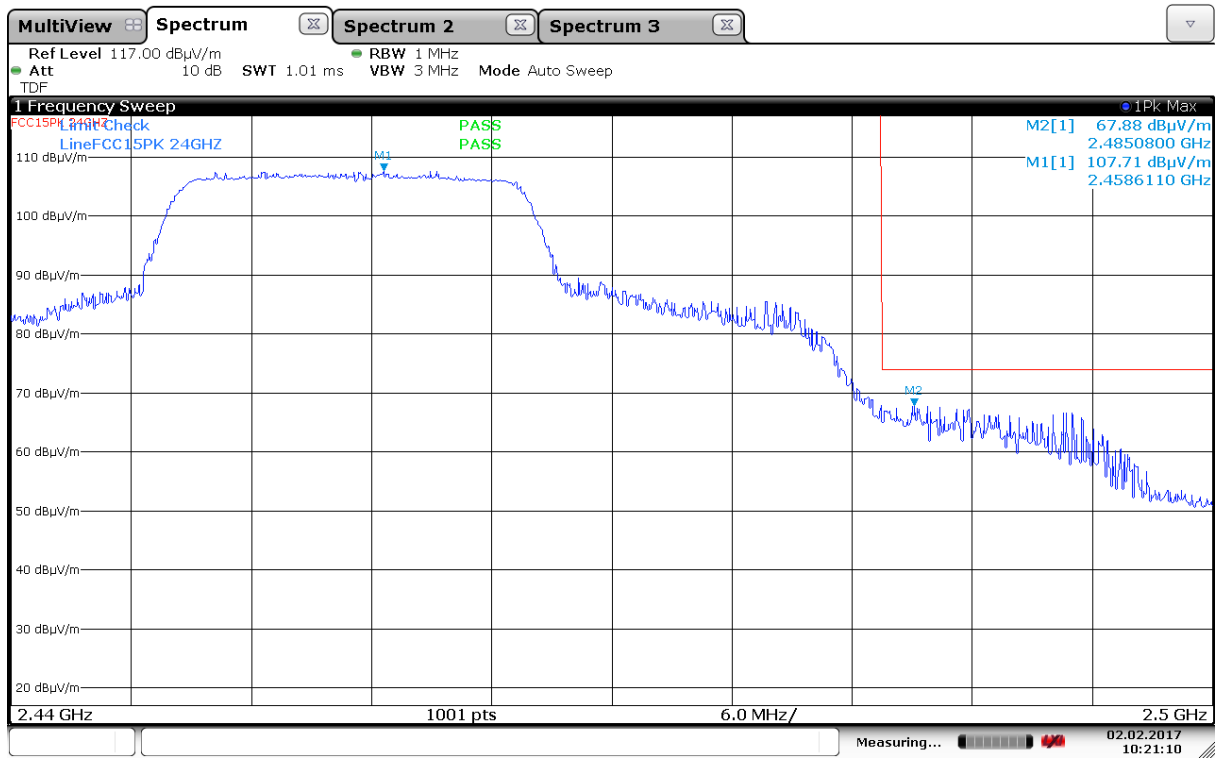
Band Edge, Lower, Average, 2412 MHz, 802.11n, MCS0



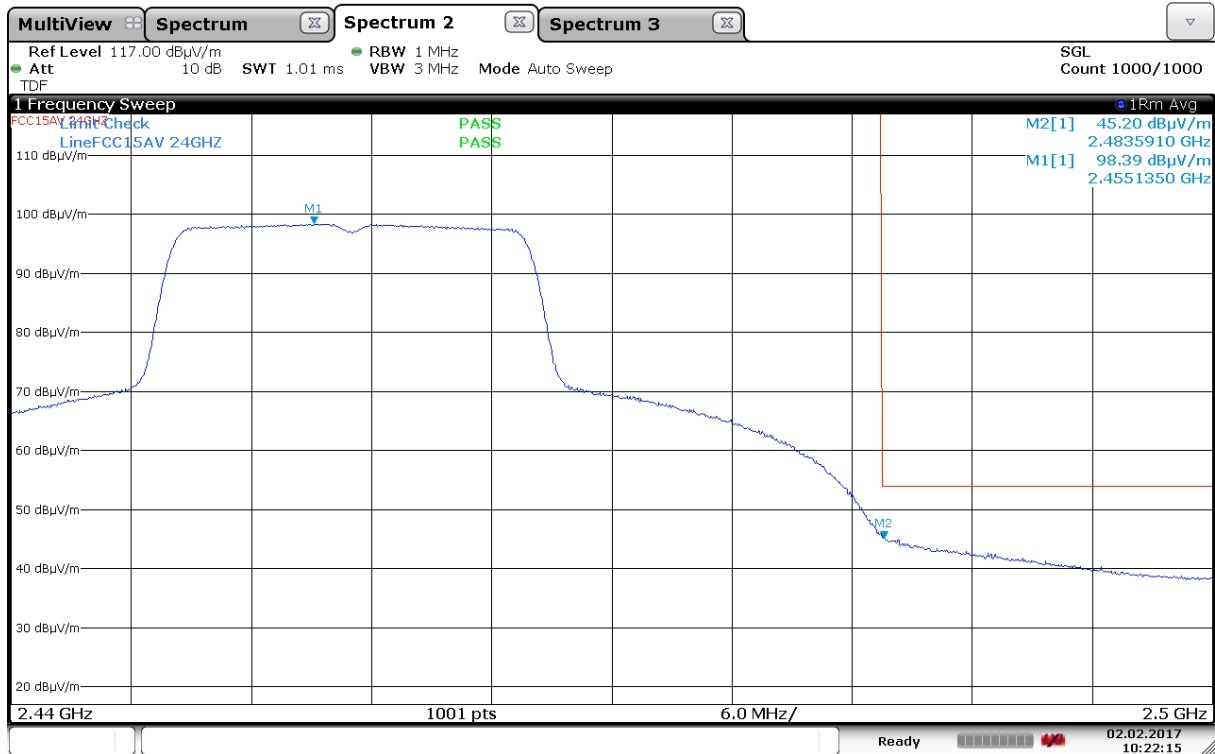
Band Edge, Lower, Peak, 2417 MHz, 802.11n, MCS0



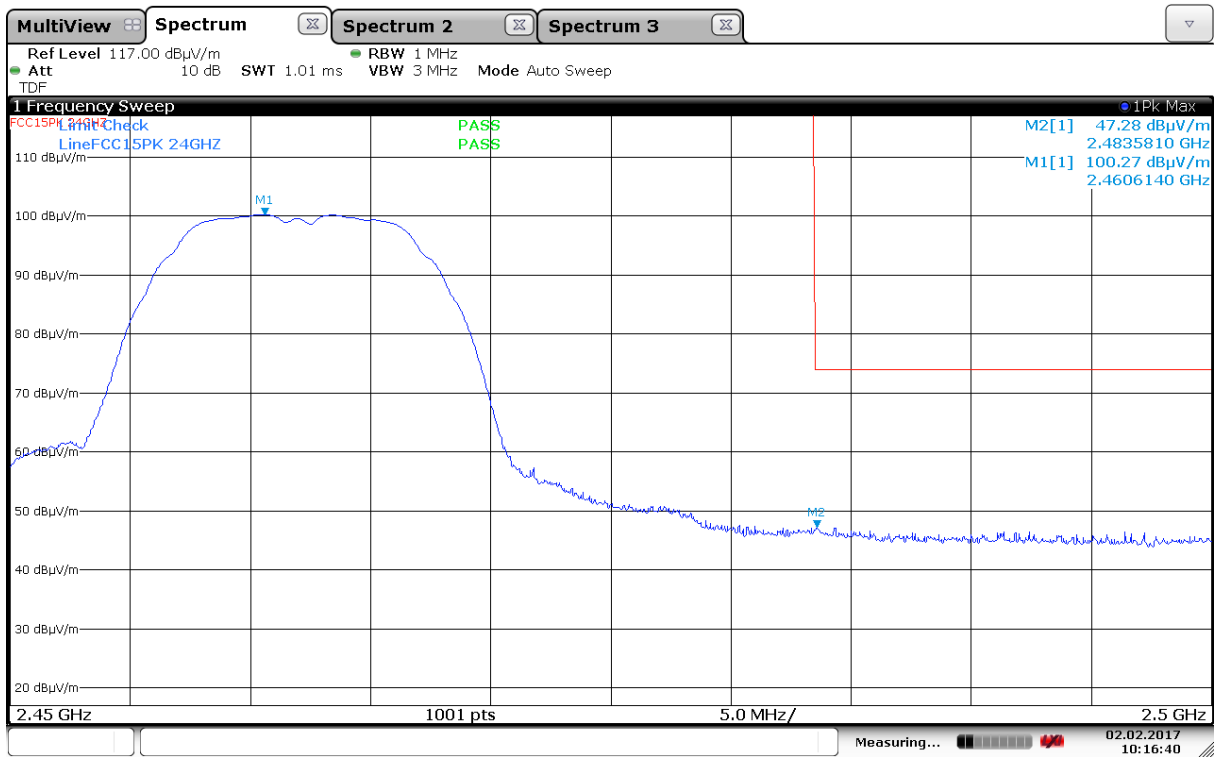
Band Edge, Lower, Average, 2417 MHz, 802.11n, MCS0



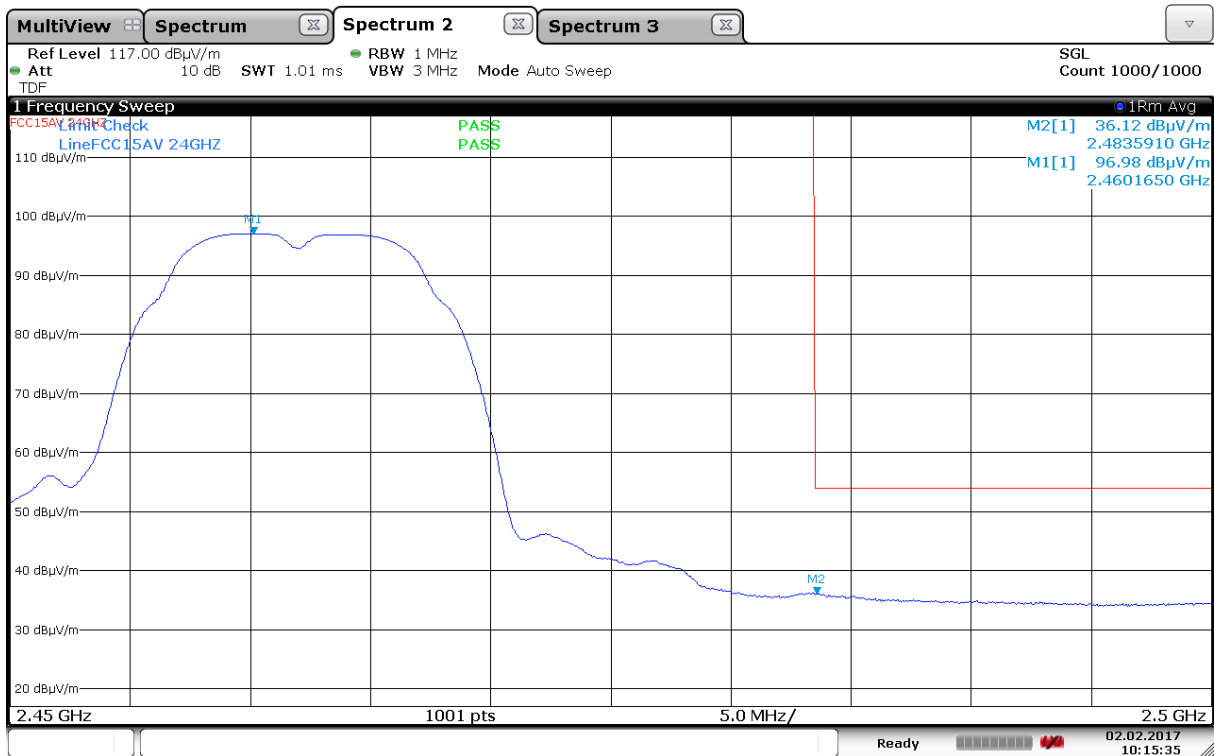
Band Edge, Upper, Peak, 2457 MHz, 802.11n, MCS0



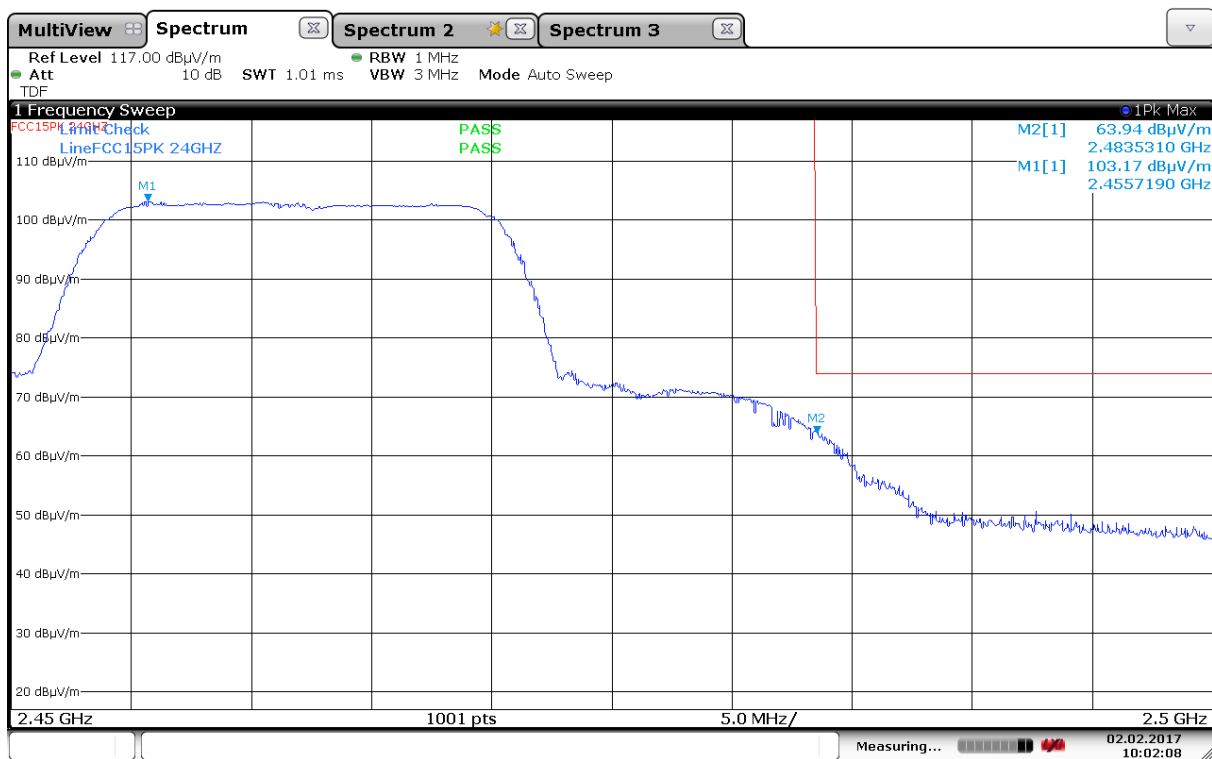
Band Edge, Upper, Average, 2457 MHz, 802.11n, MCS0



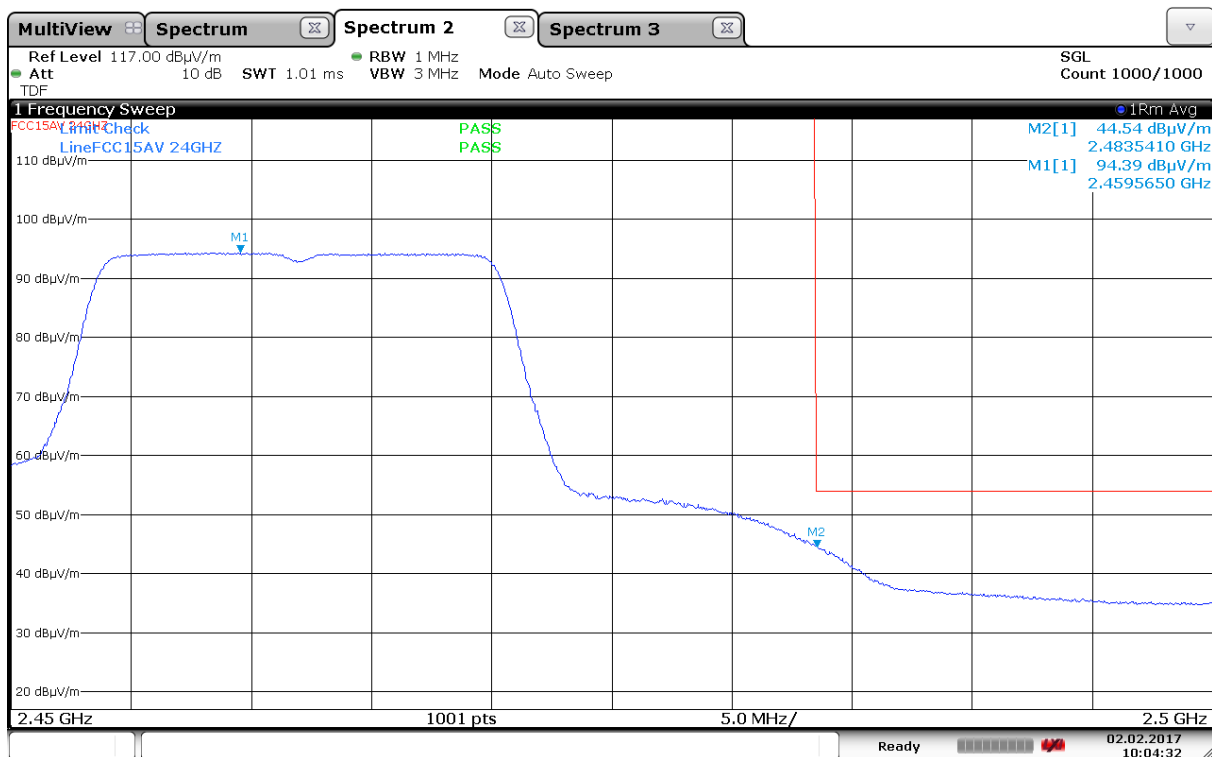
Band Edge, Upper, Peak, 2462 MHz, 802.11b, 11Mbps



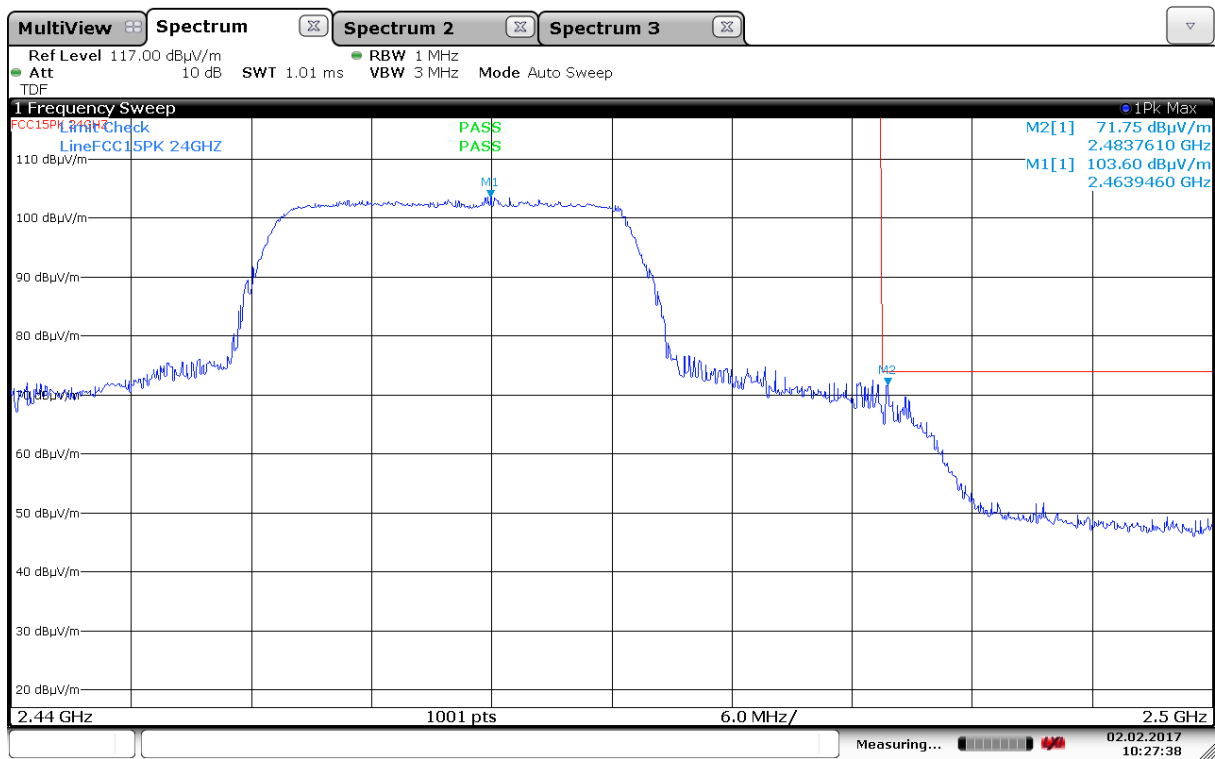
Band Edge, Upper, Average, 2462 MHz, 802.11b, 11Mbps



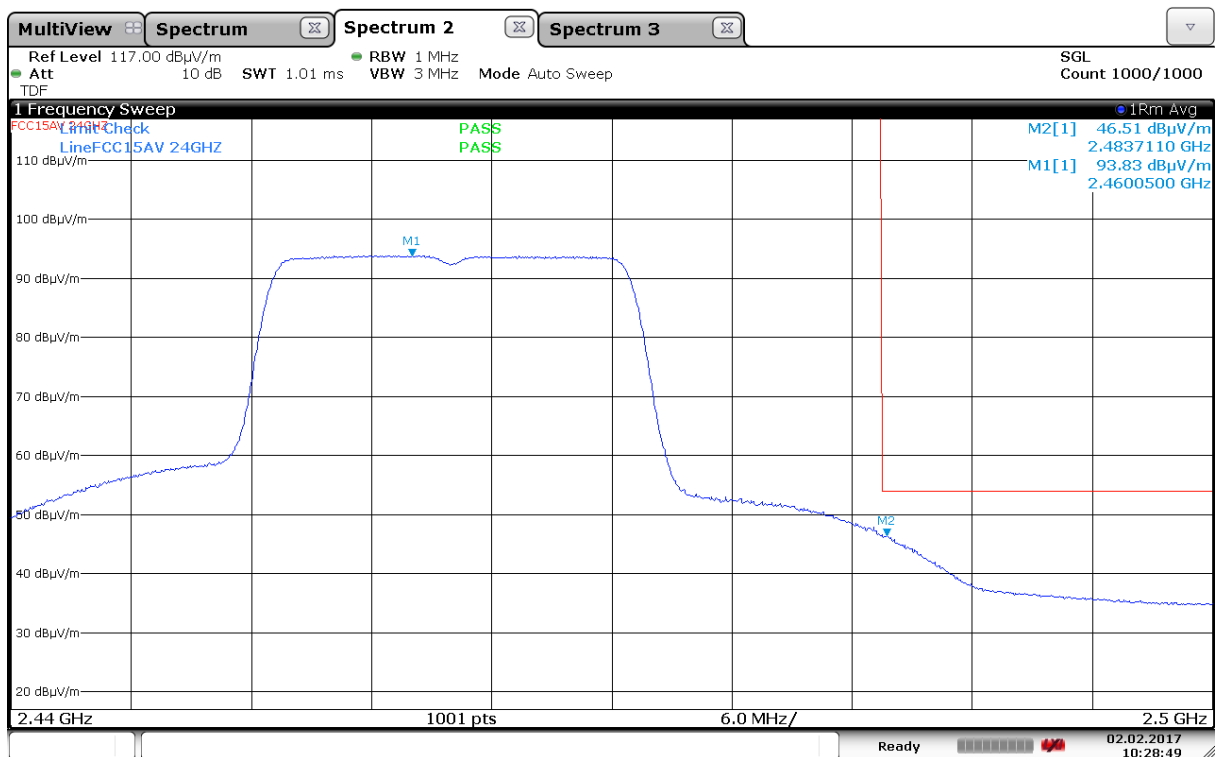
Band Edge, Upper, Peak, 2462 MHz, 802.11g, 6Mbps



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



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



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

### 3.8 Radiated Emissions, below 1GHz

FCC 15.205, 15.209

ISED RSS-GEN, Issue 4, Clause 8.9

Test Results: Complies

#### Radiated emission 30 – 1000 MHz

Detector: Quasi-Peak

Measuring distance 3m.

Tested in test mode with EUT transmitting on ch06.

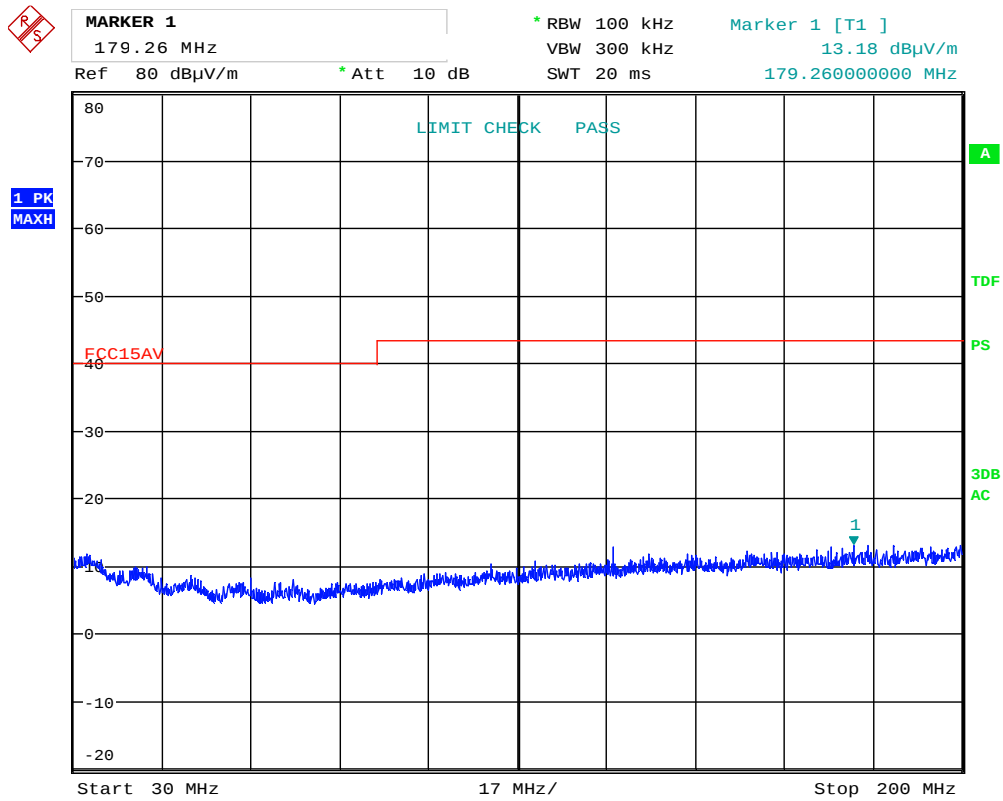
#### Measured values:

| Frequency | RF channel | Field Strength<br>QP | Limit  | Margin |
|-----------|------------|----------------------|--------|--------|
| MHz       | L,M,H      | dBμV/m @3m           | dBμV/m | dB     |
| 30-88     | M          | < 15 (Peak)          | 40     | >25    |
| 88-216    | M          | < 14.5 (Peak)        | 43.5   | >29    |
| 216-960   | M          | < 25 (Peak)          | 46     | >21    |
| 960-1000  | M          | < 26 (Peak)          | 54     | >28    |

See attached plots.

#### Requirements/Limit

|                 |                                                                  |                     |
|-----------------|------------------------------------------------------------------|---------------------|
| FCC             | Part 15.209 @ frequencies defined in §15.205                     |                     |
| ISED            | RSS-GEN Issue 4, 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                |



Date: 9.FEB.2017 09:50:06

### Radiated Emissions, 30 -200MHz, HP



**MARKER 1**

196.668 MHz

\* RBW 100 kHz

Marker 1 [T1]

VBW 300 kHz

14.05 dBμV/m

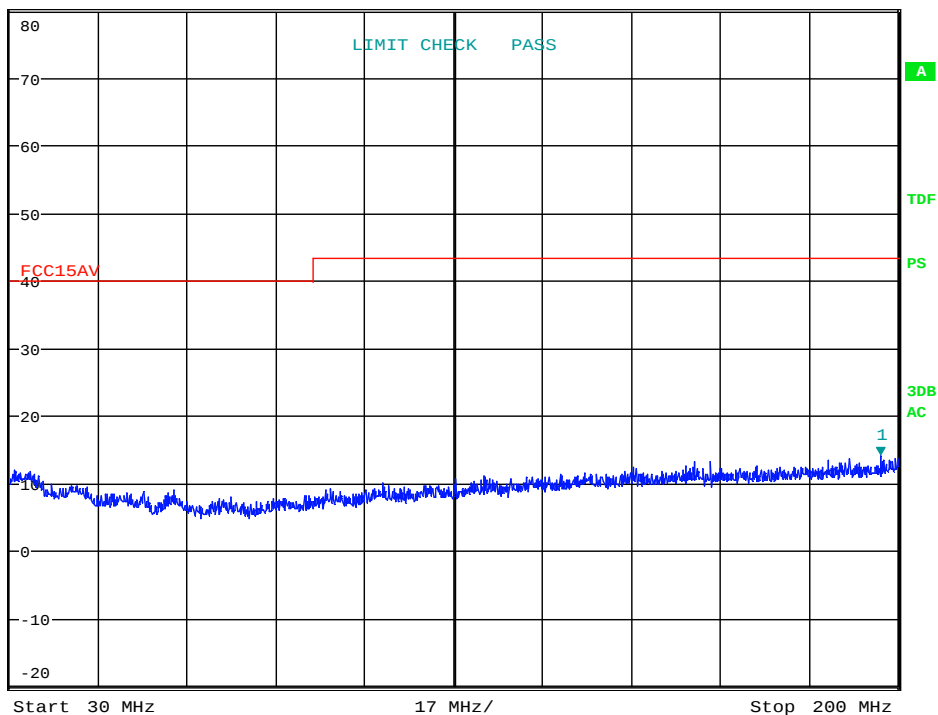
SWT 20 ms

196.668000000 MHz

Ref 80 dBμV/m

\* Att 10 dB

1 PK  
MAXH



Date: 9.FEB.2017 09:46:13

**Radiated Emissions, 30 -200MHz, VP**



MARKER 1

981.76 MHz

\* RBW 100 kHz

Marker 1 [T1]

VBW 300 kHz

25.19 dBμV/m

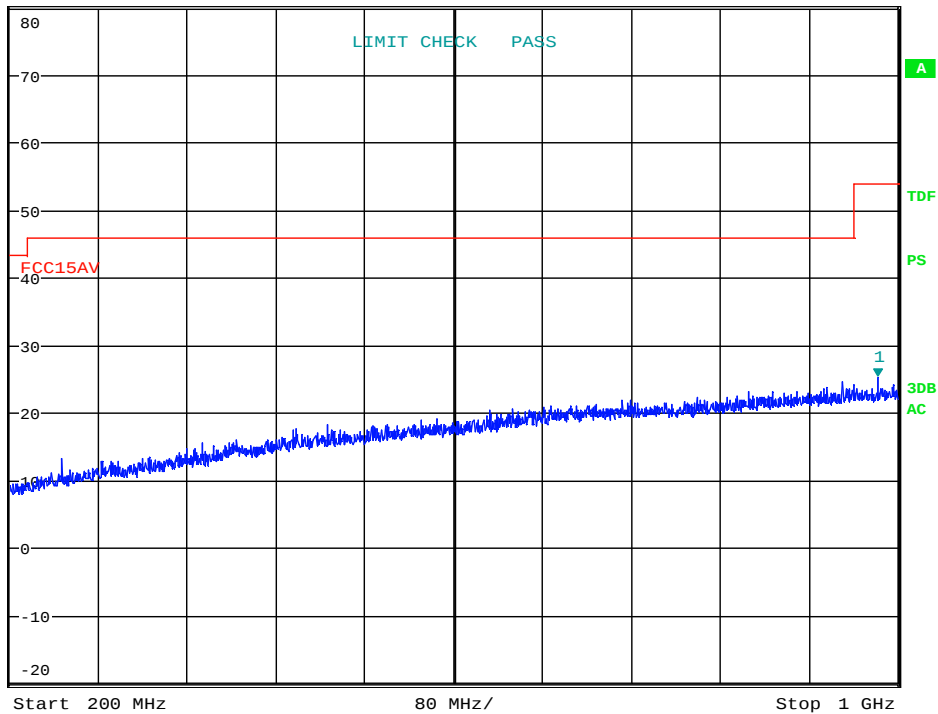
SWT 80 ms

981.760000000 MHz

Ref 80 dBμV/m

\* Att 10 dB

1 PK  
MAXH



Date: 9.FEB.2017 09:59:12

**Radiated Emissions, 200 -1000MHz, HP**



MARKER 1

972.16 MHz

\* RBW 100 kHz

Marker 1 [T1]

VBW 300 kHz

24.58 dBμV/m

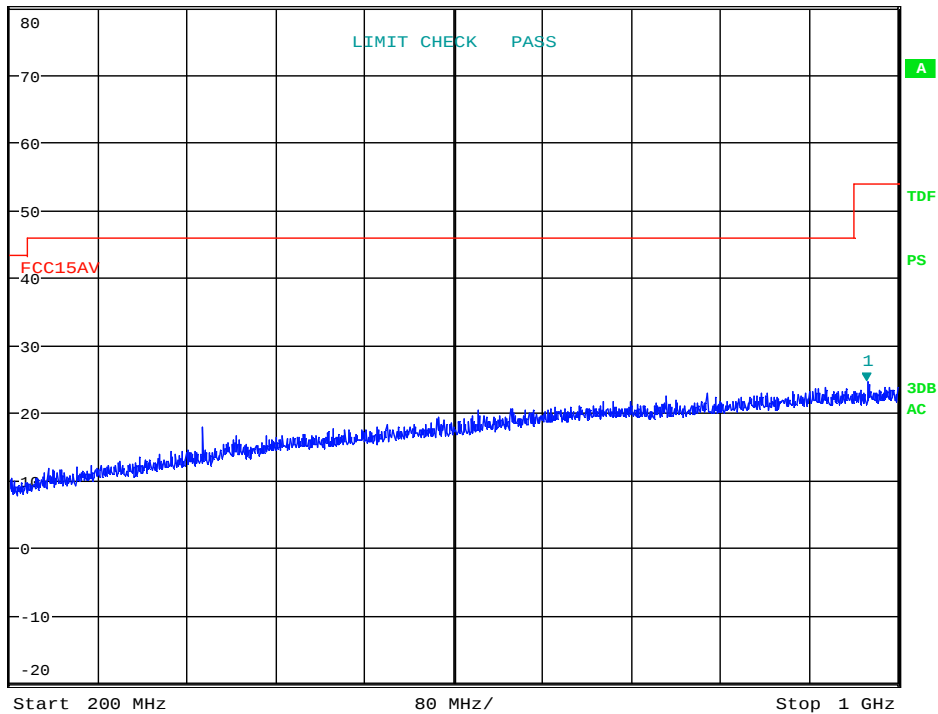
SWT 80 ms

972.160000000 MHz

Ref 80 dBμV/m

\* Att 10 dB

1 PK  
MAXH



Date: 9.FEB.2017 09:55:44

### Radiated Emissions, 200 -1000MHz, VP

### 3.9 Radiated Emissions, above 1GHz

FCC 15.205, 15.209

ISED RSS-GEN, Issue 4, Clause 8.9

Test Results: Complies

Measurement Data:

#### Radiated Emissions, 1-25 GHz

Measuring distance: 3m (1 – 8.5 GHz)  
1m (8.0 – 18 GHz)

A pre-scan was performed above 18 GHz and no spurious emissions were detected.

#### Measured values:

| Frequency   | RF channel | Field Strength<br>Peak | Field Strength<br>AV | Limit        | Margin dB |      |
|-------------|------------|------------------------|----------------------|--------------|-----------|------|
| GHz         | L,M,H      | dB $\mu$ V/m @3m       | dB $\mu$ V/m @3m     | dB $\mu$ V/m | Peak      | AV   |
| 4874        | M          | 49.6                   | 49.6                 | 74/54        | 24.4      | >4.4 |
| Other freqs | L,M,H      | None detected          | None detected        | 74/54        | >20       | >20  |

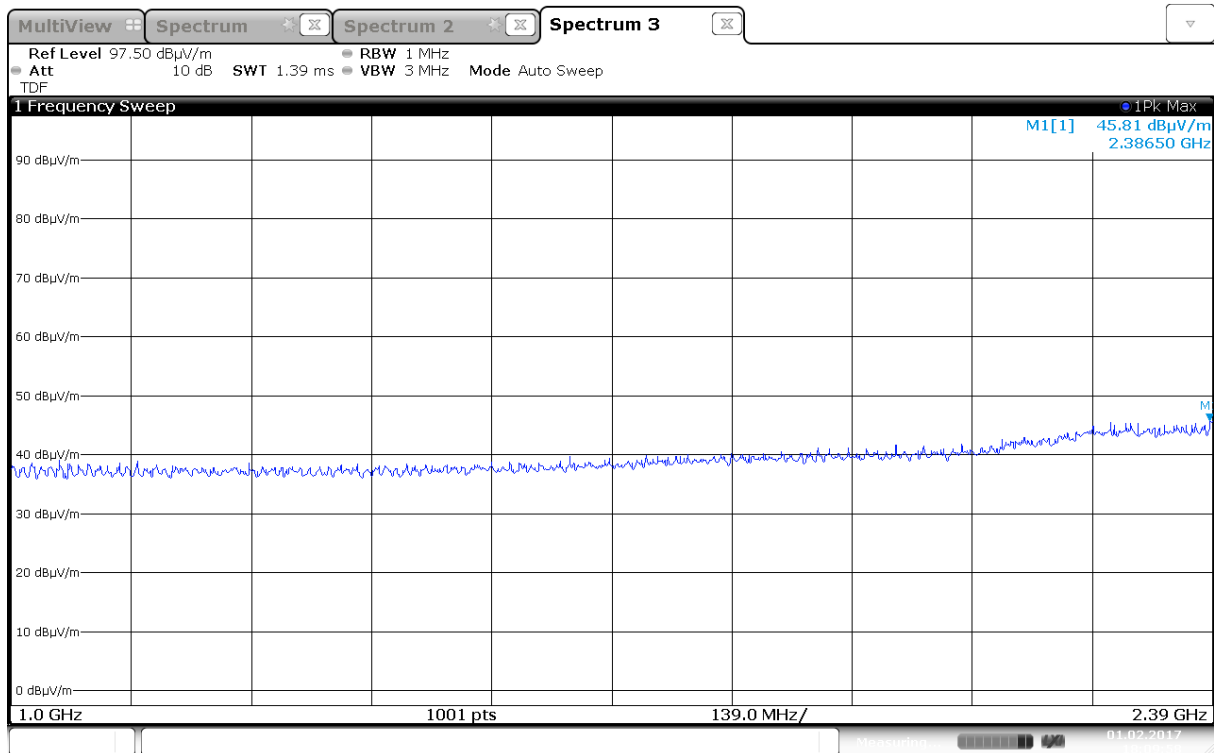
All emissions are below the Average Limit even when measured with Peak Detector.

Antenna factor, amplifier gain and cable loss are included in spectrum analyzer "Transducer factor".

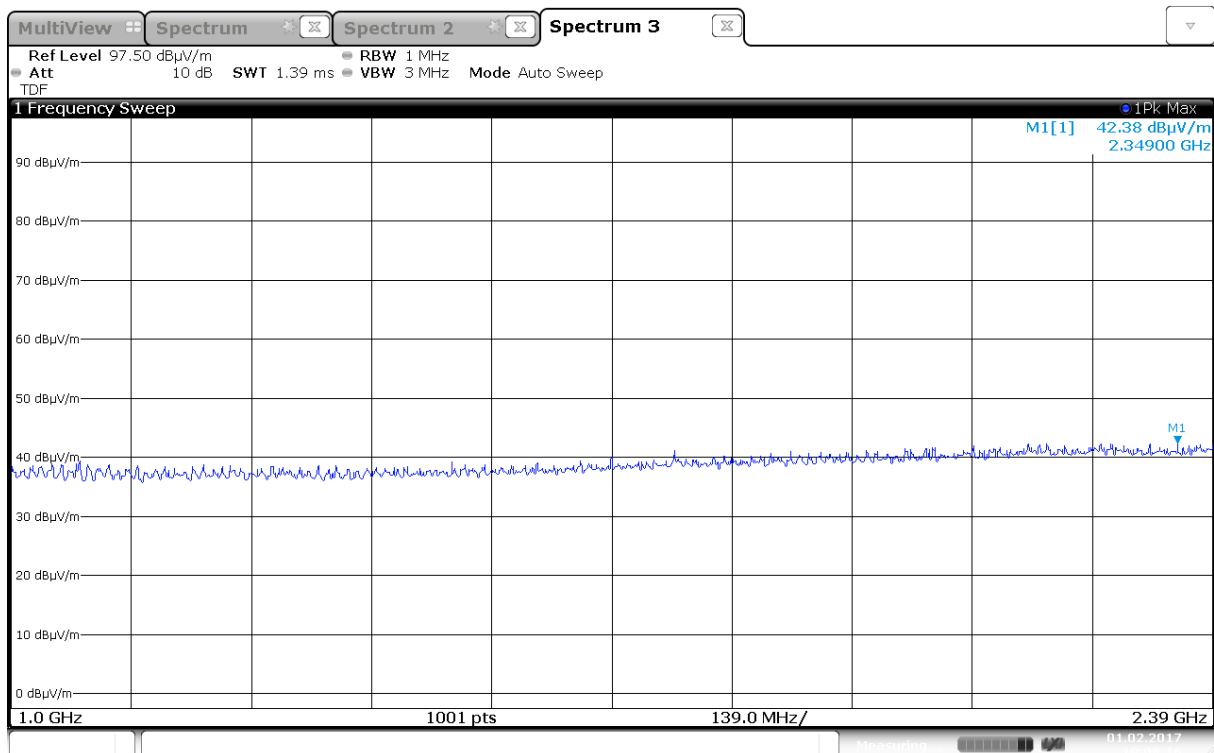
See plots.

#### Requirements/Limit

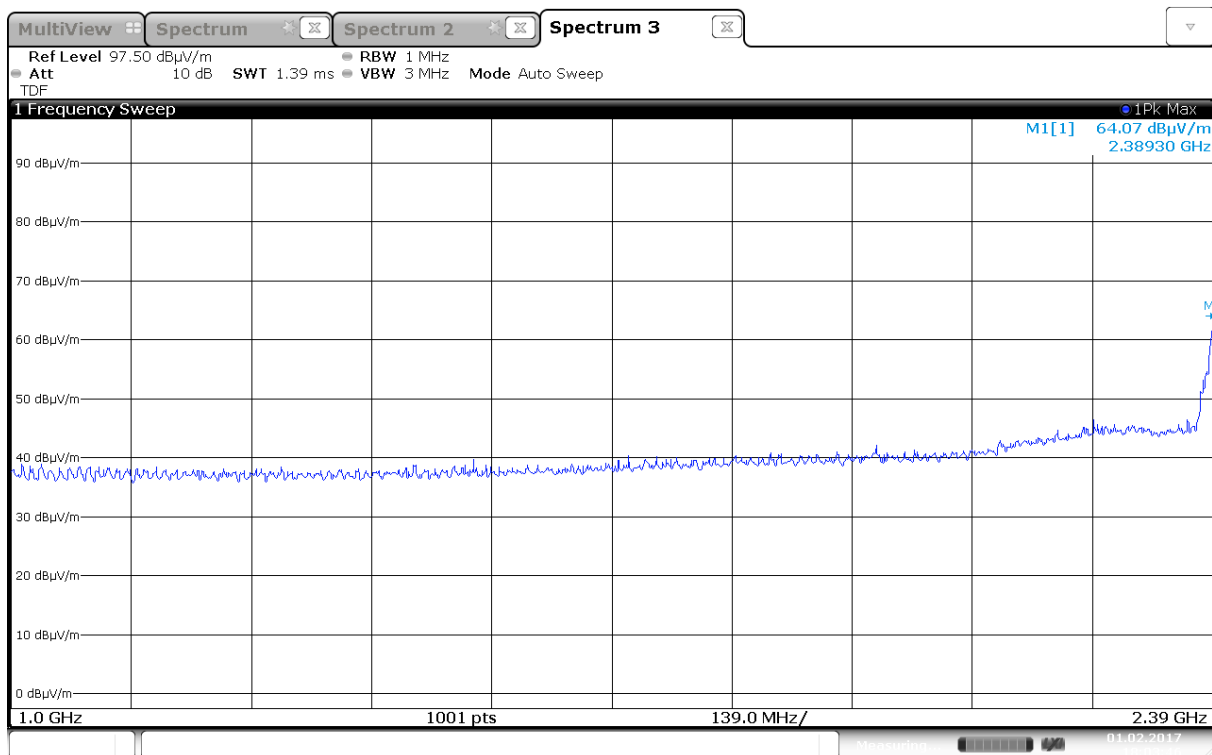
|                 |                                                                  |                     |
|-----------------|------------------------------------------------------------------|---------------------|
| FCC             | Part 15.209 @ frequencies defined in §15.205                     |                     |
| ISED            | RSS-GEN Issue 4, clause 8.9 @ frequencies defined in clause 8.10 |                     |
|                 | Radiated emission limit @3 meters                                |                     |
| Frequency (MHz) | AV (dB $\mu$ V/m)                                                | Peak (dB $\mu$ V/m) |
| Above 1 GHz     | 54.0                                                             | 74.0                |



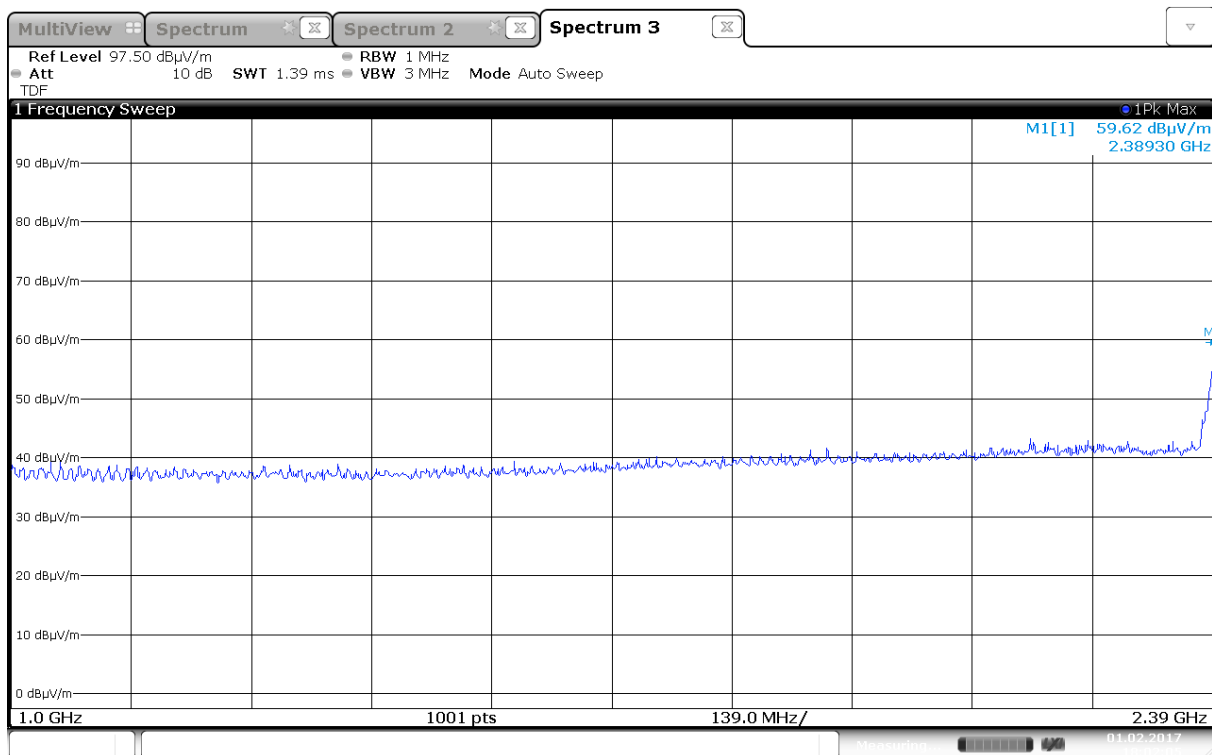
Radiated Emissions, 1000 -2390 MHz, HP, 802.11b, 1Mbps



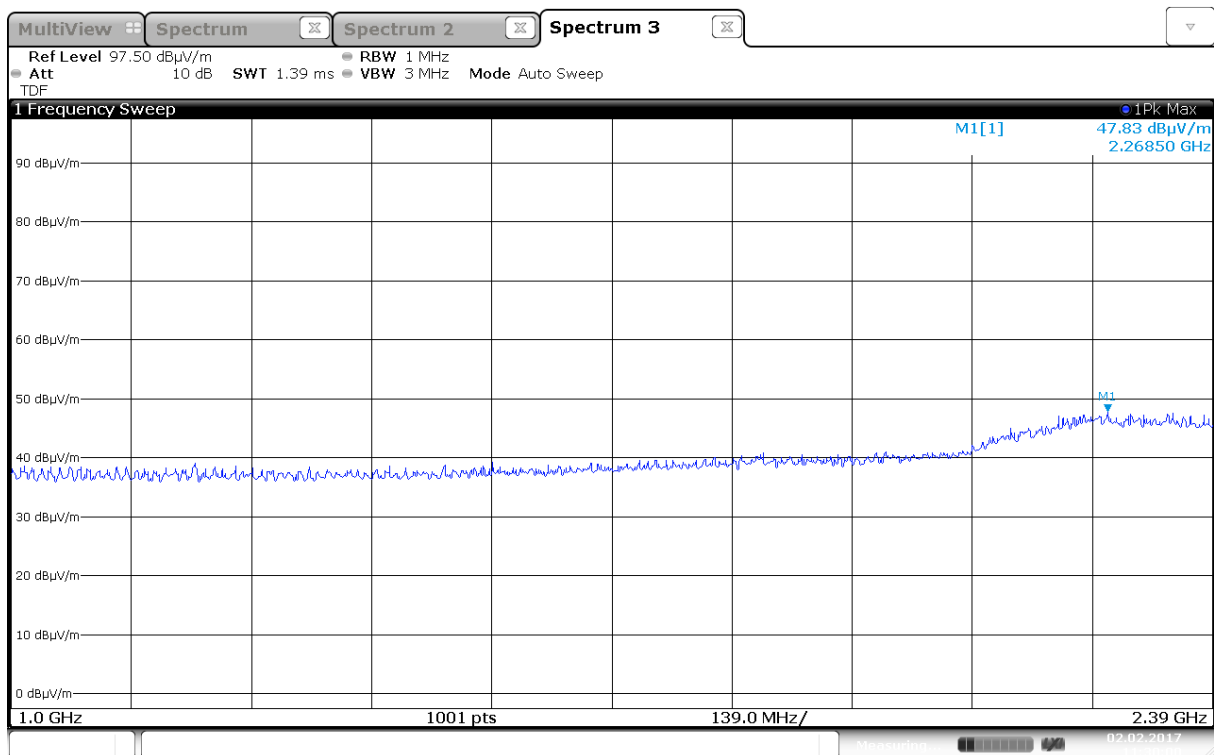
Radiated Emissions, 1000 -2390 MHz, VP, 802.11b, 1Mbps



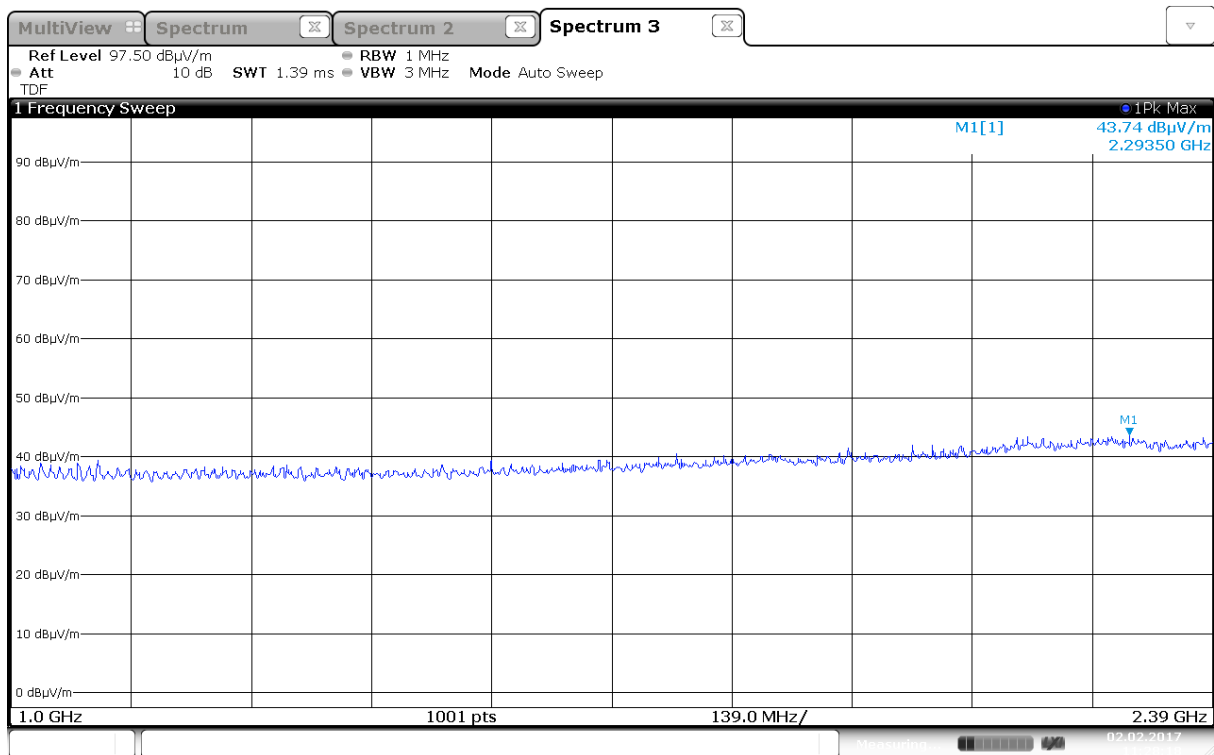
Radiated Emissions, 1000 -2390 MHz, HP, 802.11g, 6Mbps



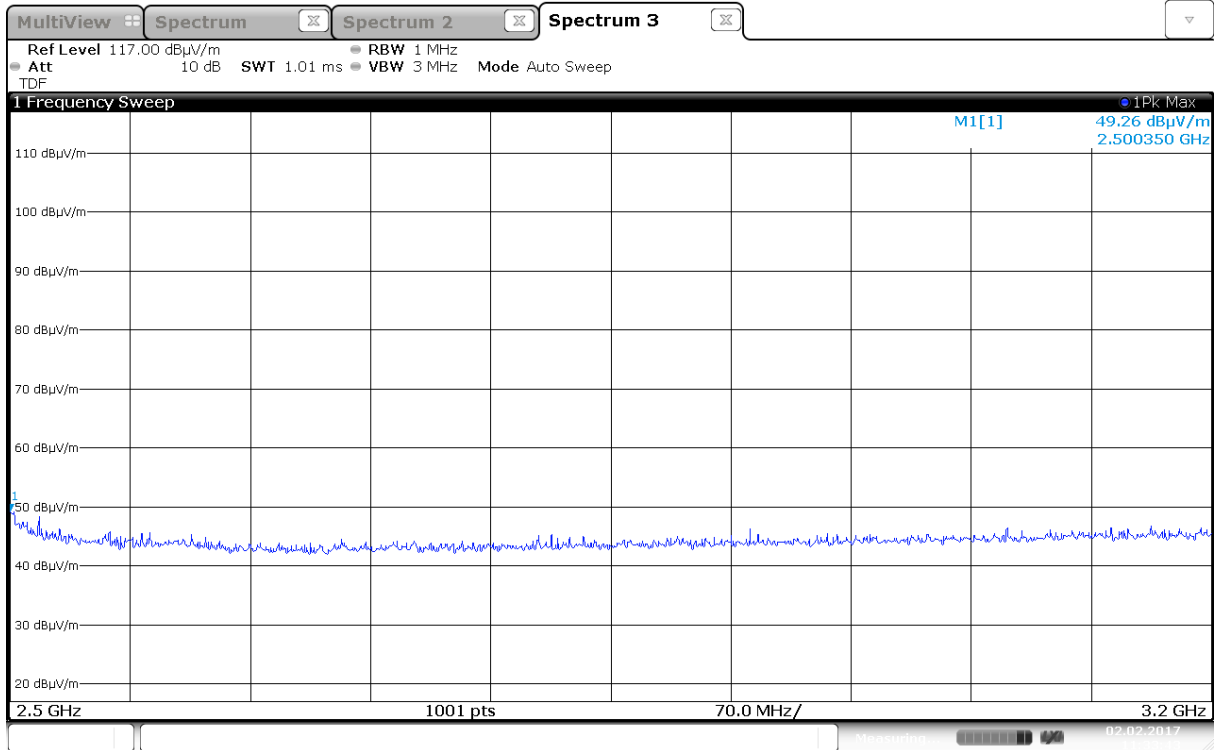
Radiated Emissions, 1000 -2390 MHz, VP, 802.11g, 6Mbps



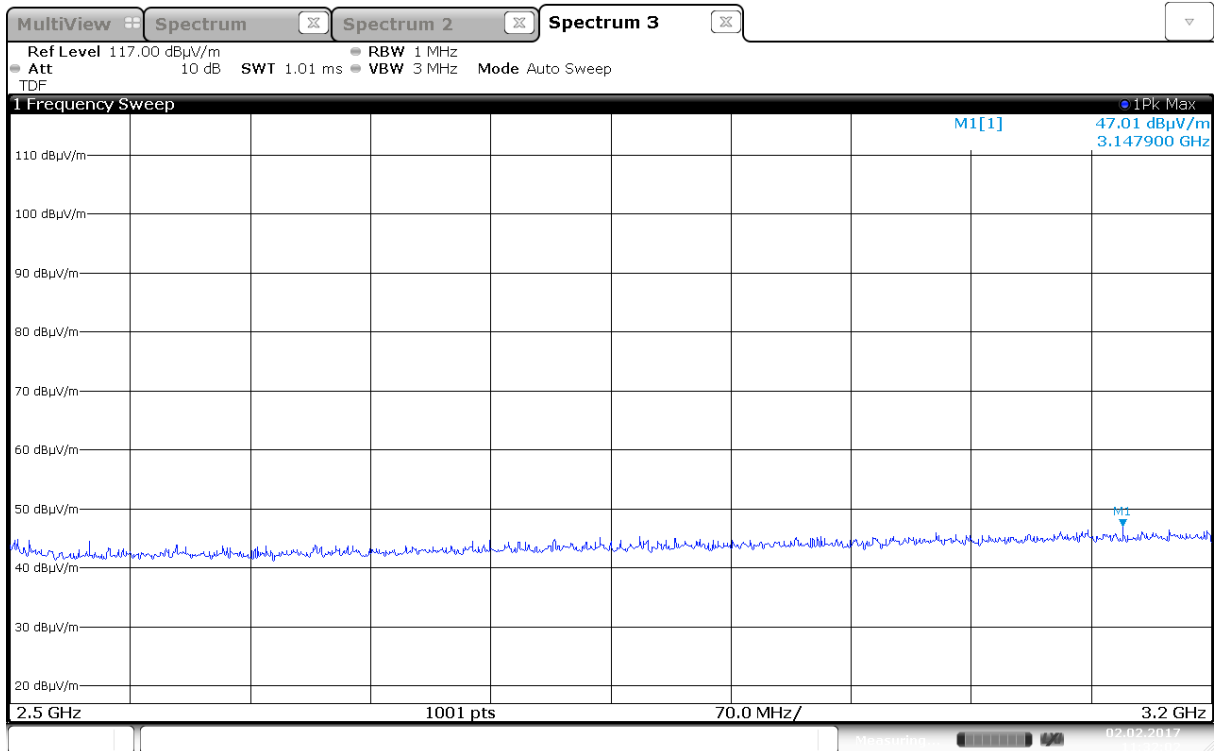
Radiated Emissions, 1000 -2390 MHz, HP, 802.11n, MCS0



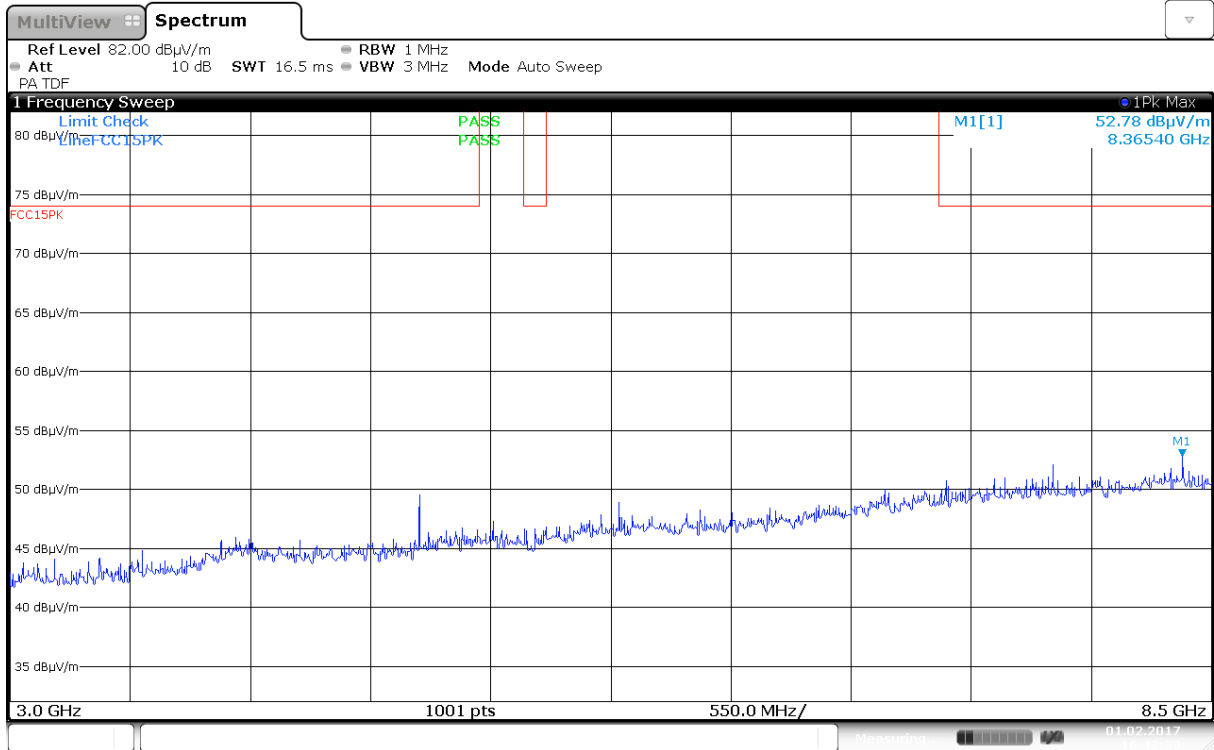
Radiated Emissions, 1000 -2390 MHz, VP, 802.11n, MCS0



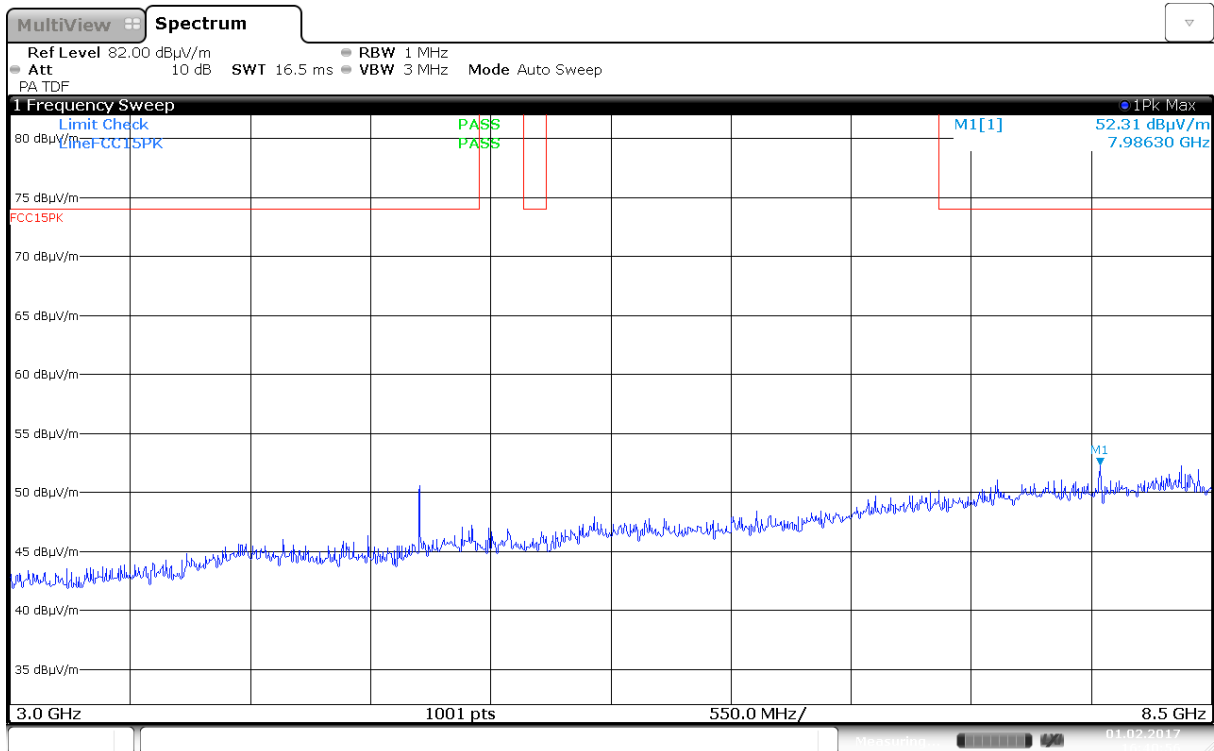
**Radiated Emissions, 2500 -3200 MHz, HP, 802.11n, MCS0**



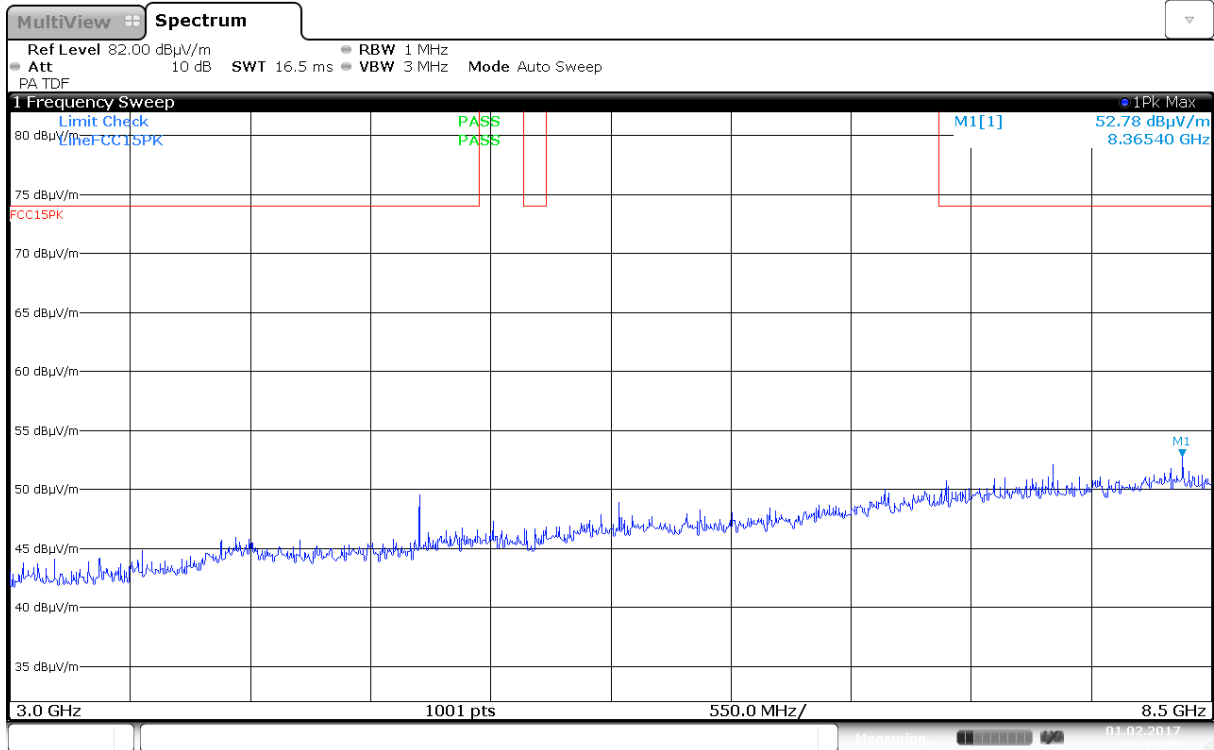
**Radiated Emissions, 2500 -3200 MHz, VP, 802.11n, MCS0**



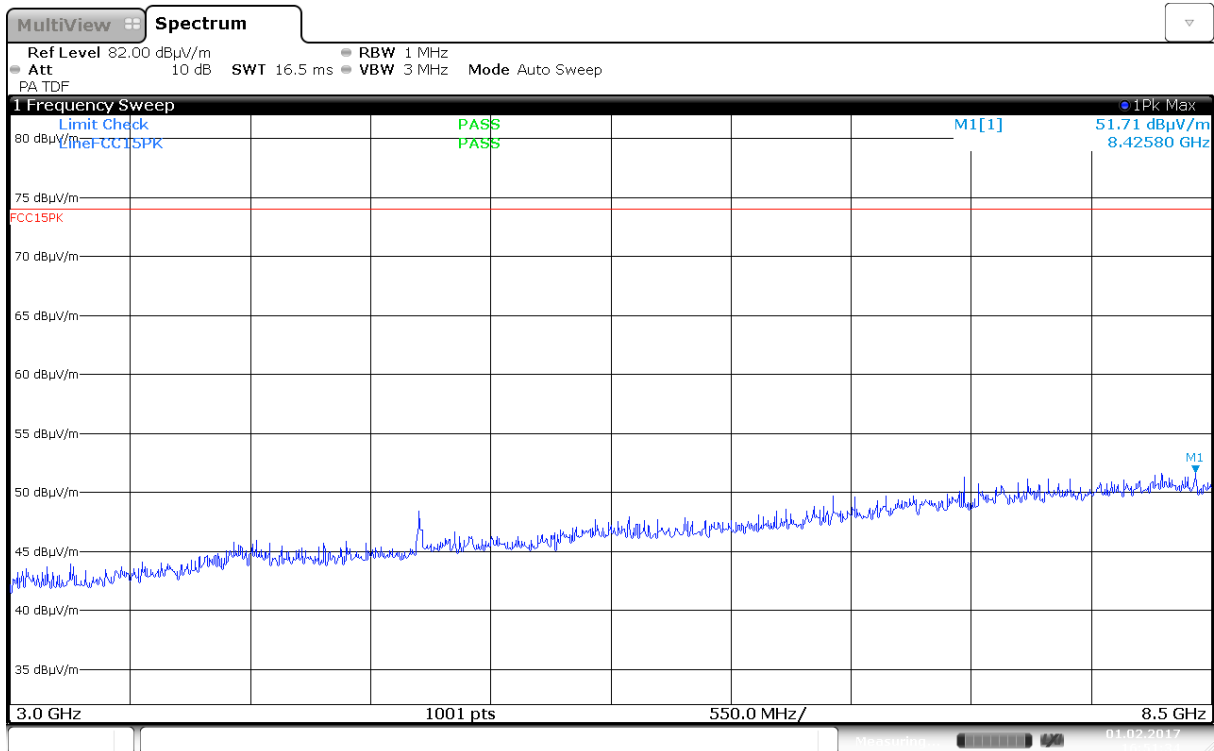
Radiated Emissions, 3000 -8500 MHz, HP, 802.11b, 1Mbps



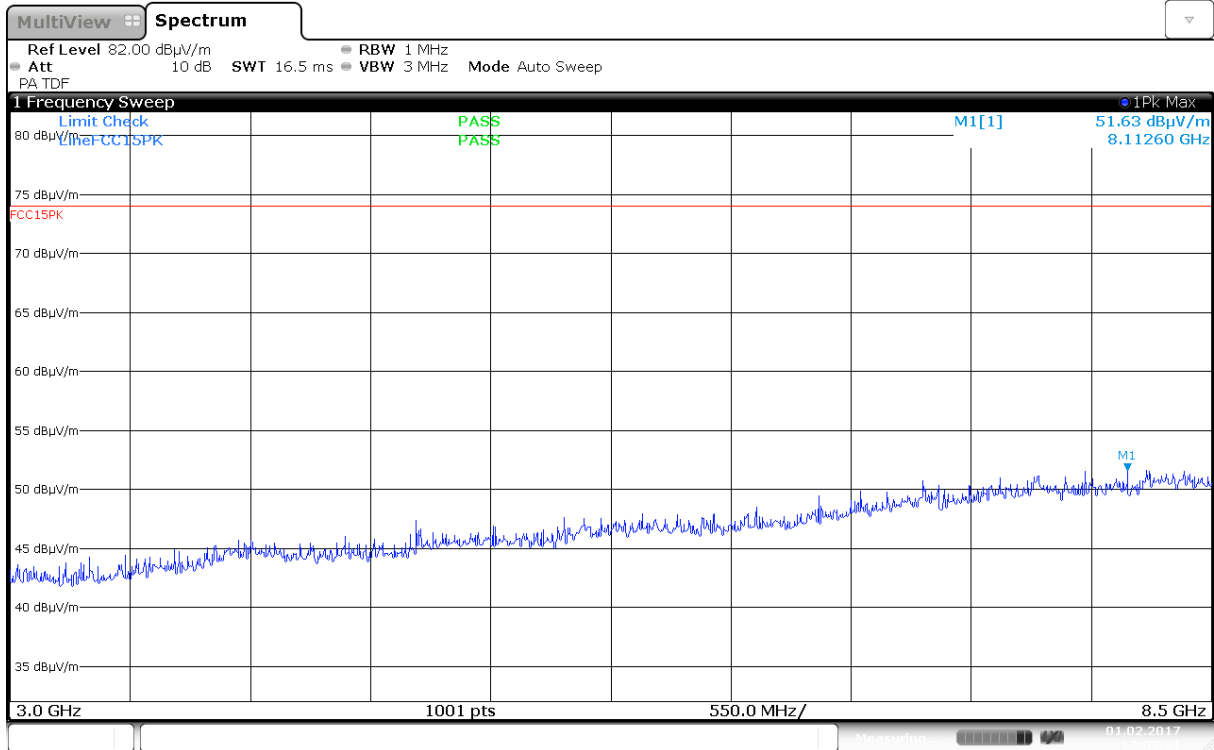
Radiated Emissions, 3000 -8500 MHz, VP, 802.11b, 1Mbps



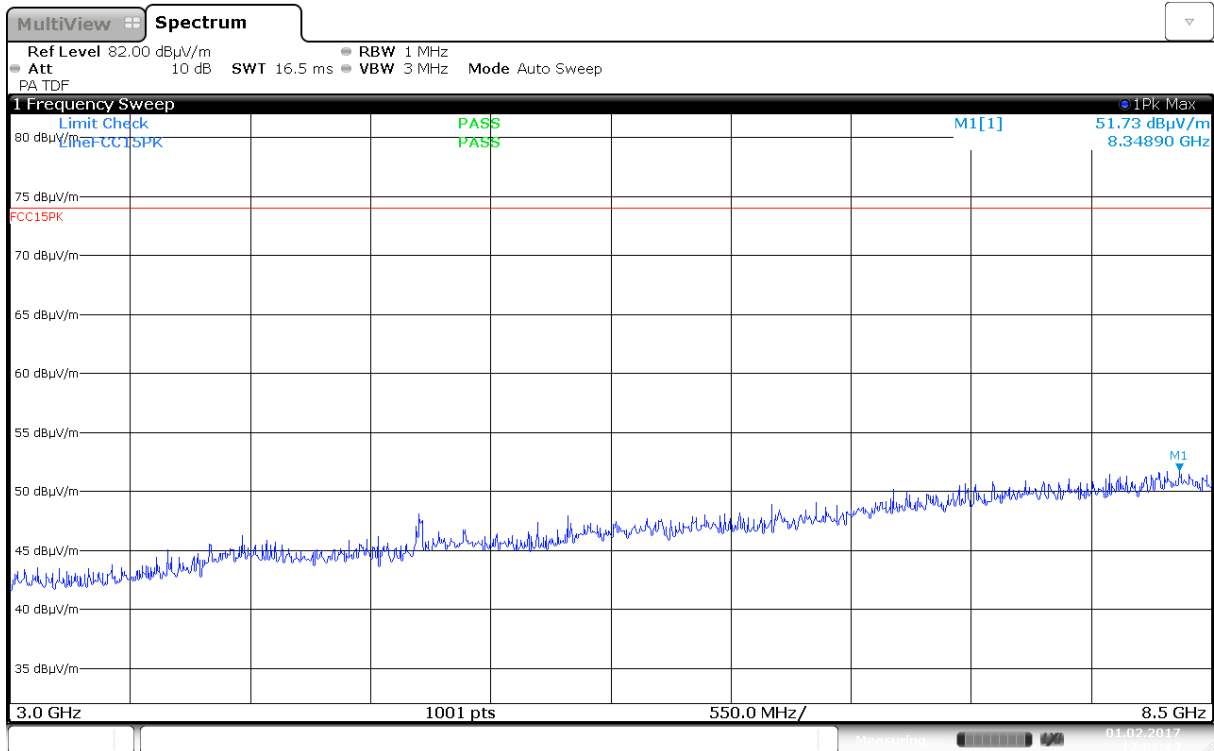
Radiated Emissions, 3000 -8500 MHz, HP, 802.11g, 6Mbps



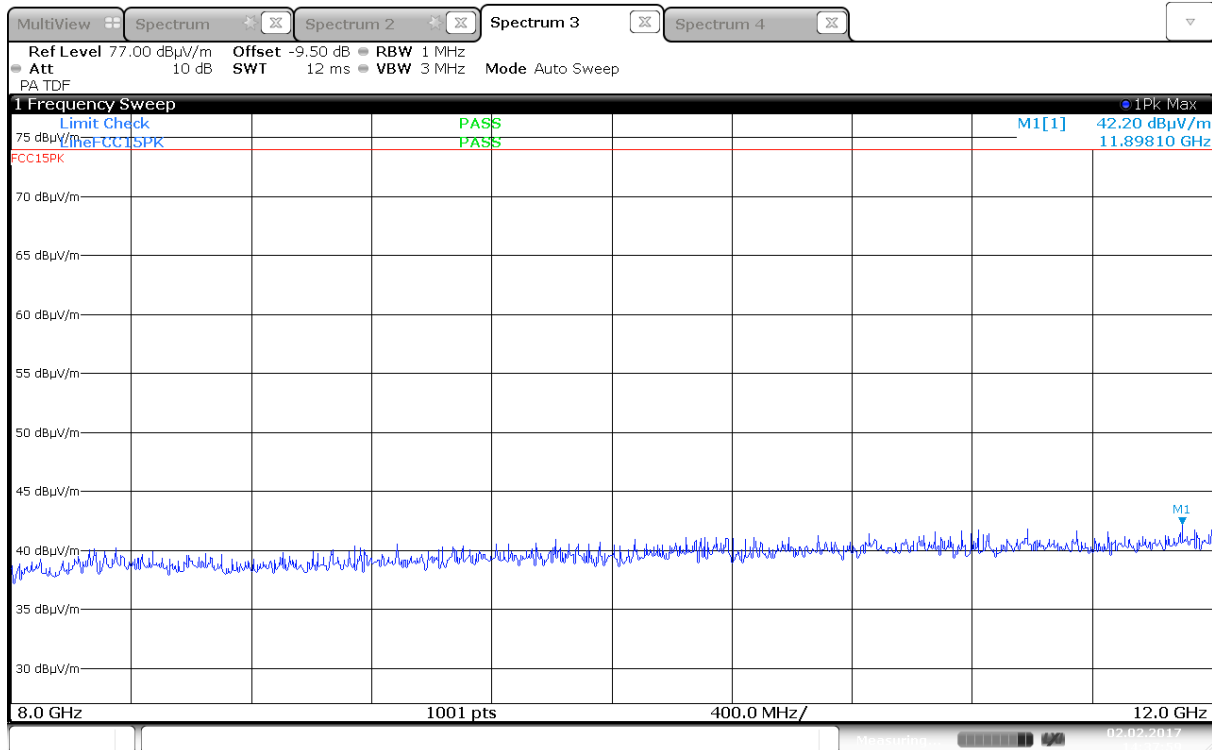
Radiated Emissions, 3000 -8500 MHz, VP, 802.11g, 6Mbps



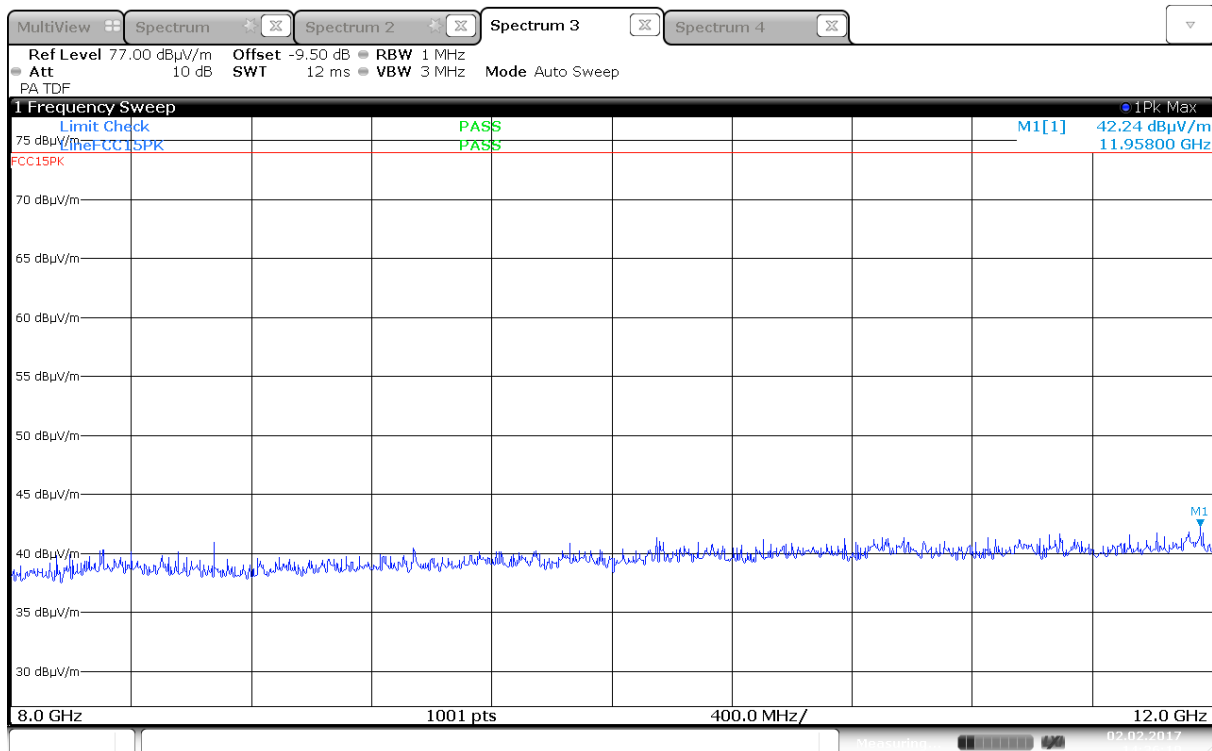
Radiated Emissions, 3000 -8500 MHz, HP, 802.11n, MCS0



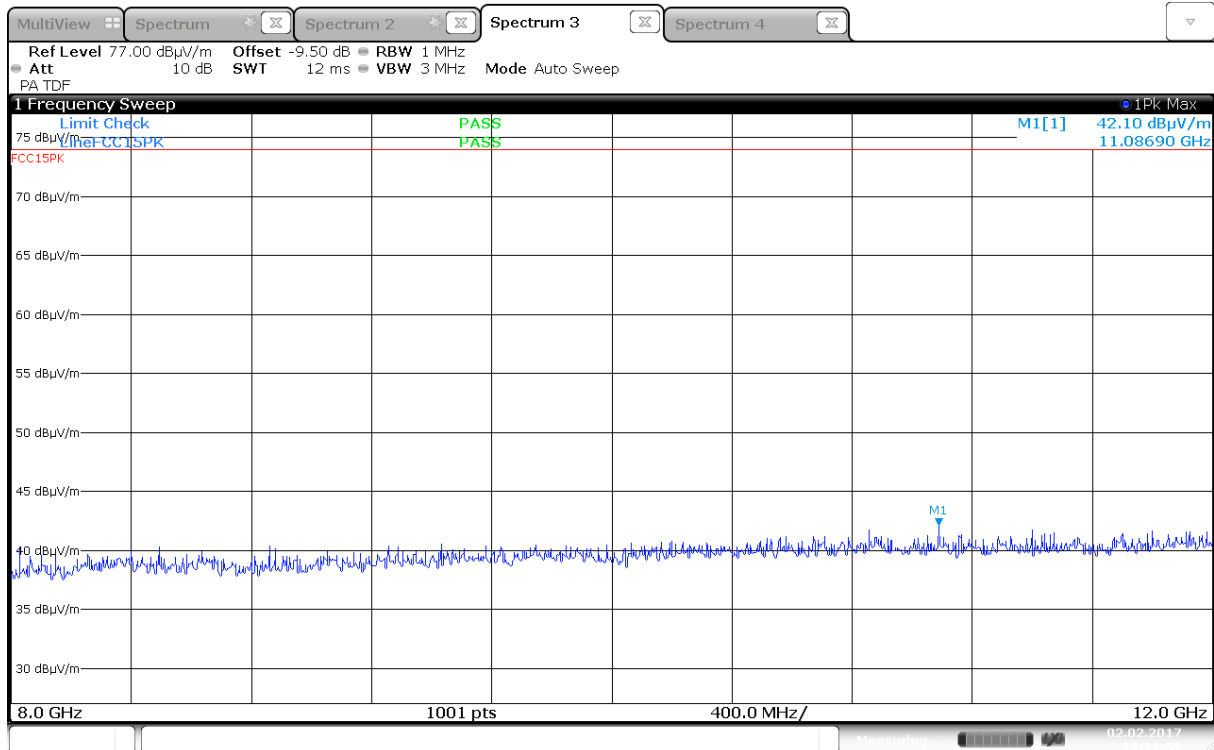
Radiated Emissions, 3000 -8500 MHz, VP, 802.11n, MCS0



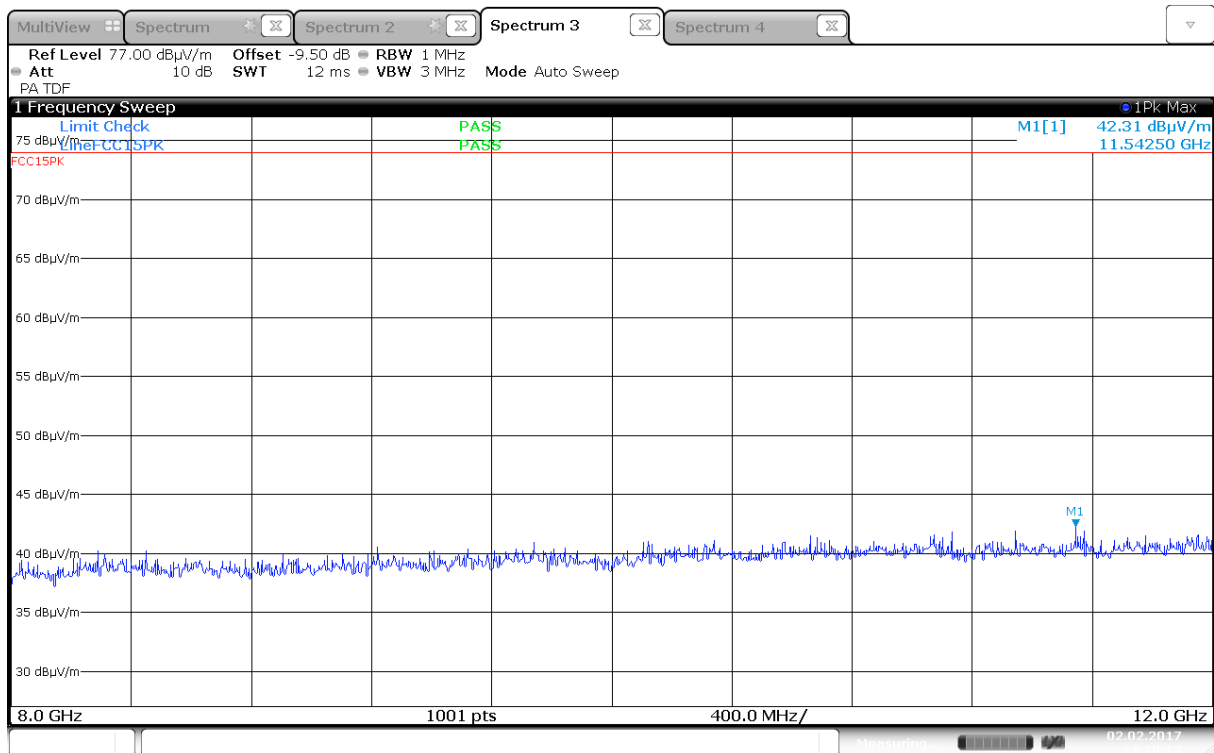
Radiated Emissions, 8000 -12000 MHz, HP, 802.11b, 1Mbps



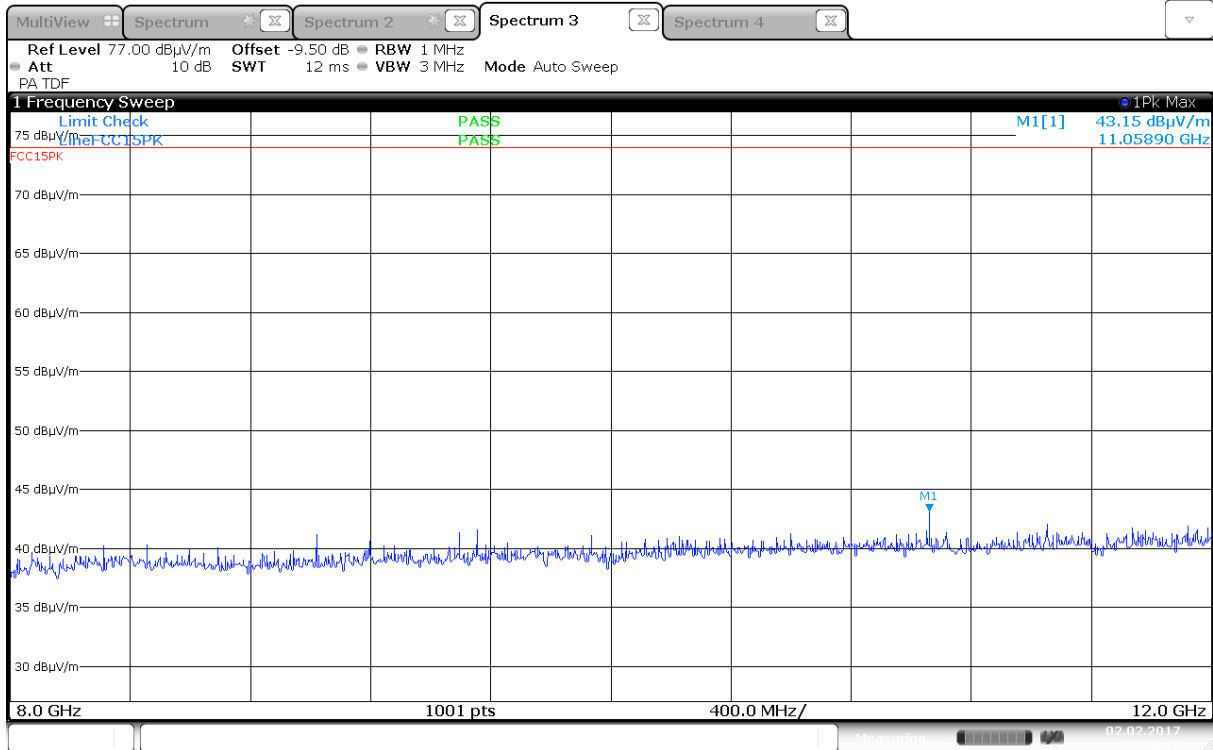
Radiated Emissions, 8000 -12000 MHz, VP, 802.11b, 1Mbps



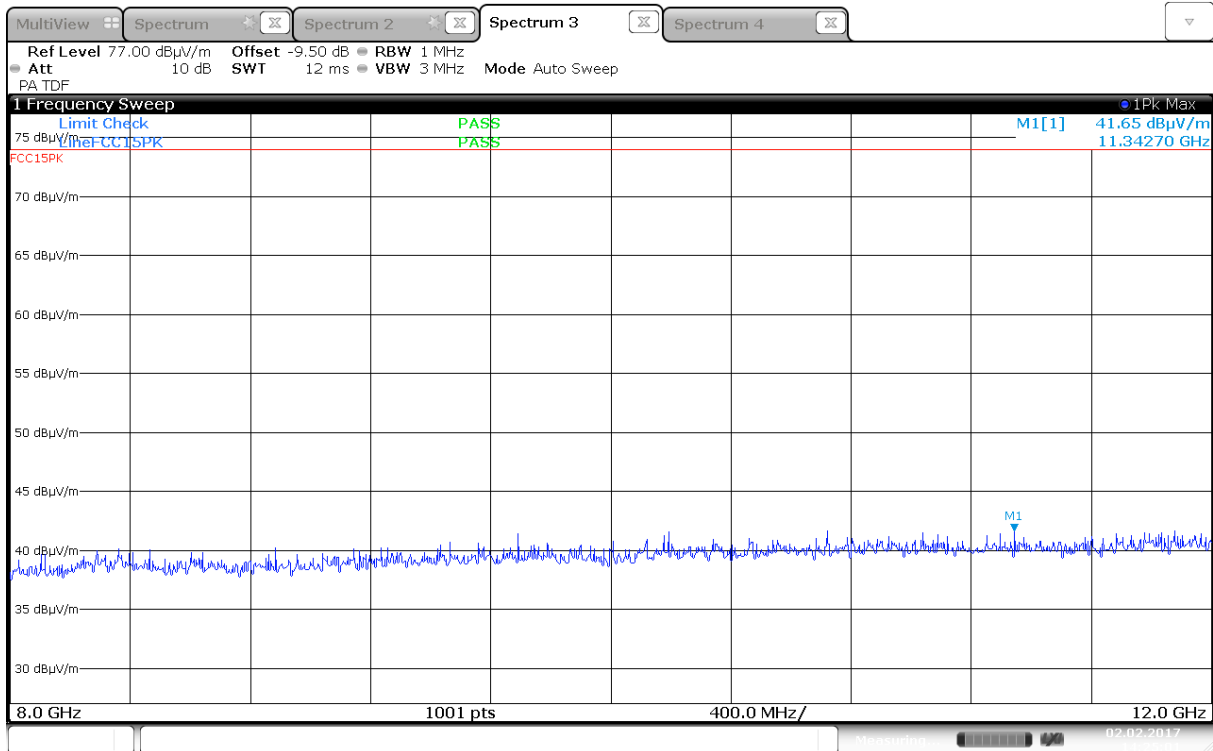
Radiated Emissions, 8000 -12000 MHz, HP, 802.11g, 6Mbps



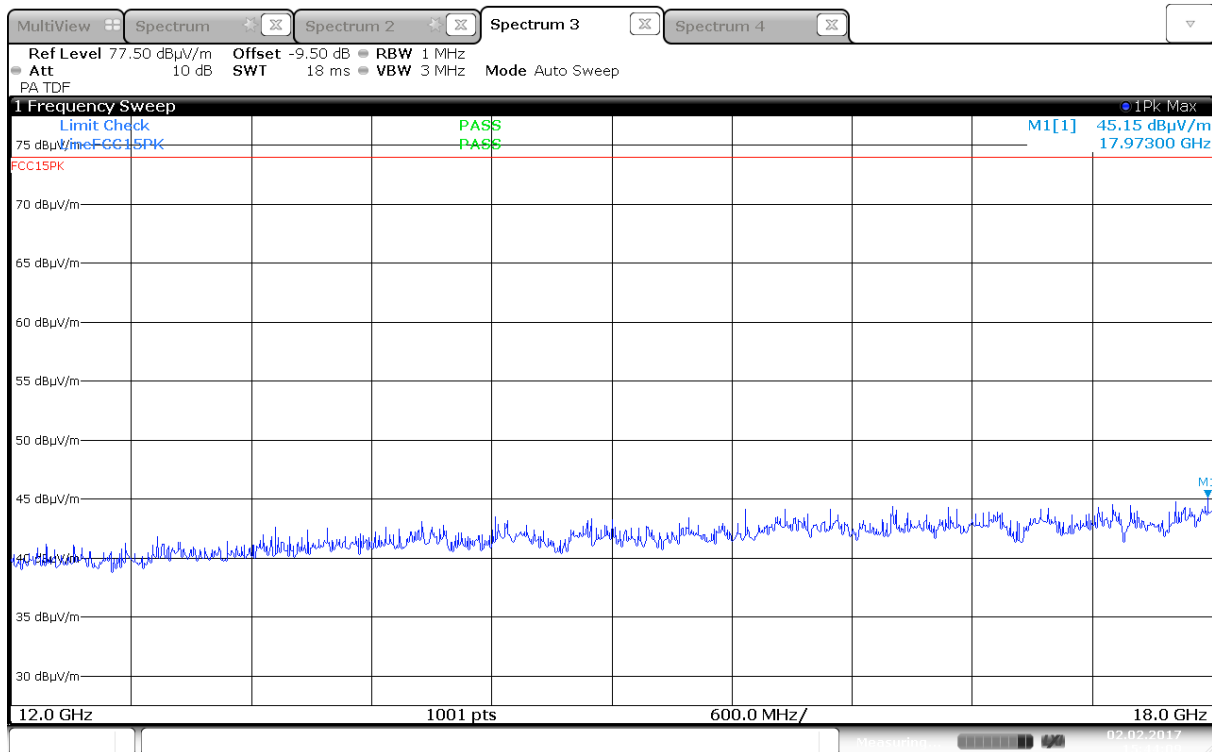
Radiated Emissions, 8000 -12000 MHz, VP, 802.11g, 6Mbps



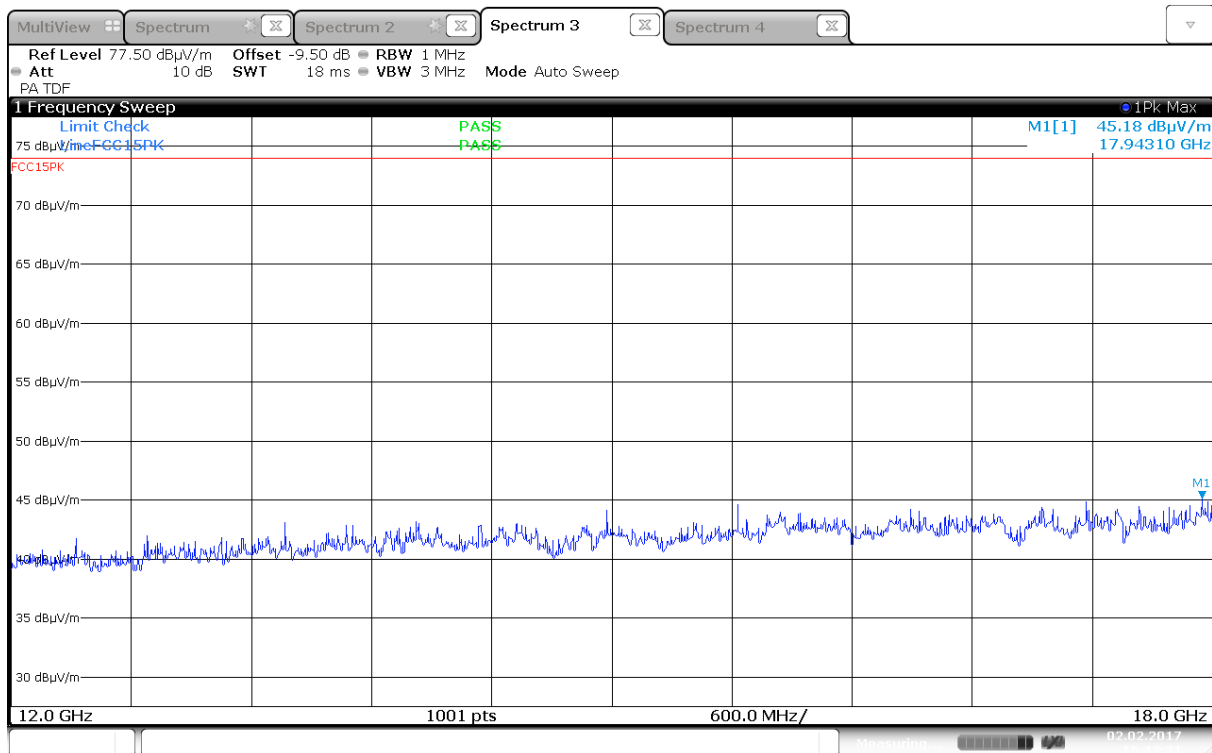
Radiated Emissions, 8000 -12000 MHz, HP, 802.11n, MCS0



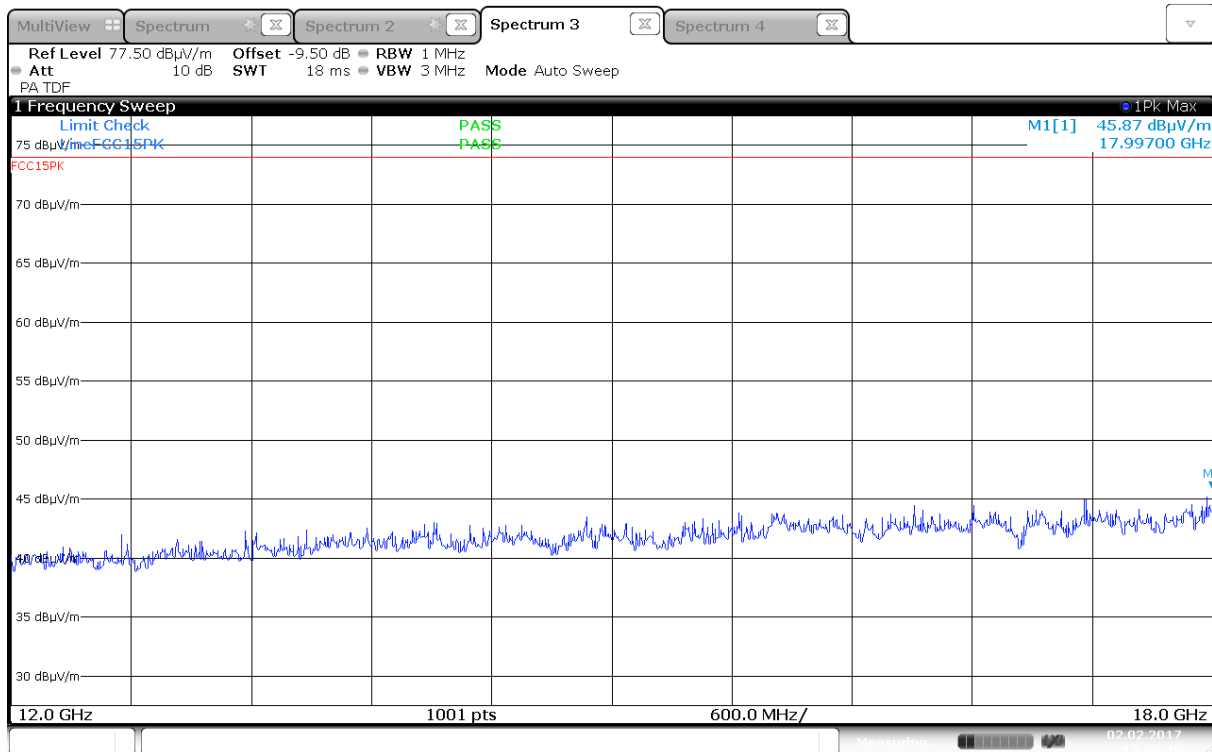
Radiated Emissions, 8000 -12000 MHz, VP, 802.11n, MCS0



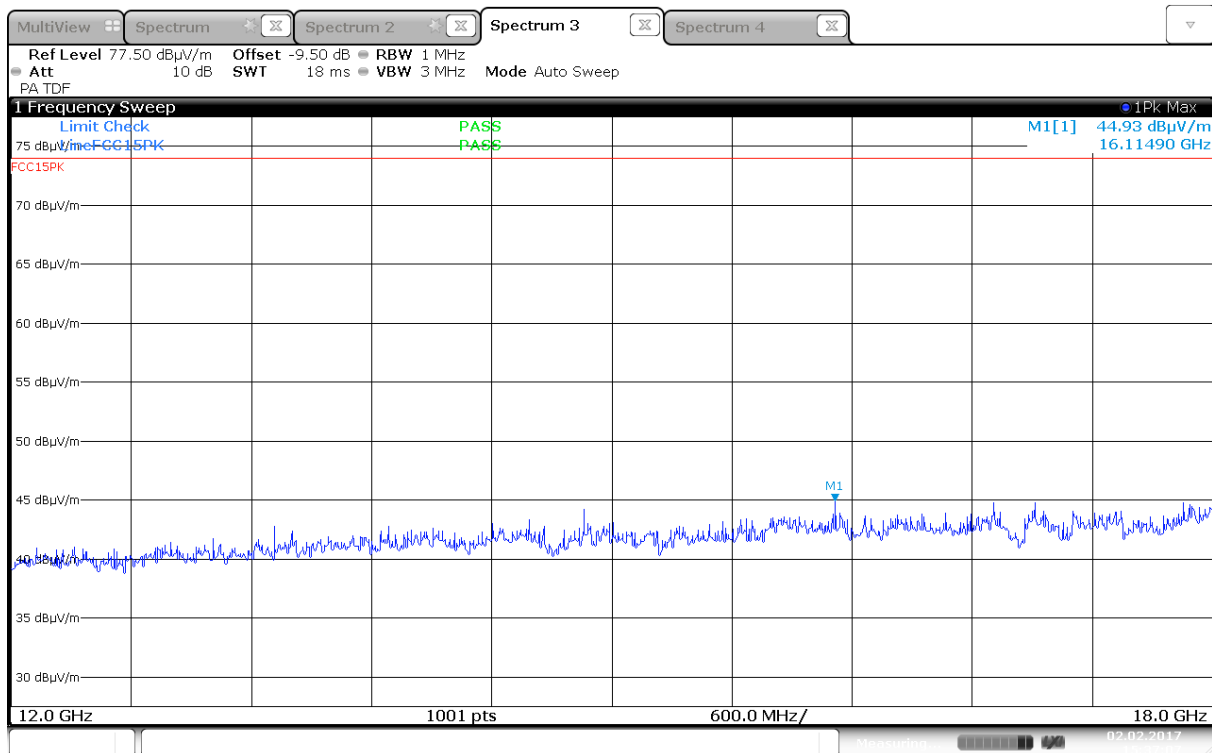
Radiated Emissions, 12000 -18000 MHz, HP, 802.11b, 1Mbps



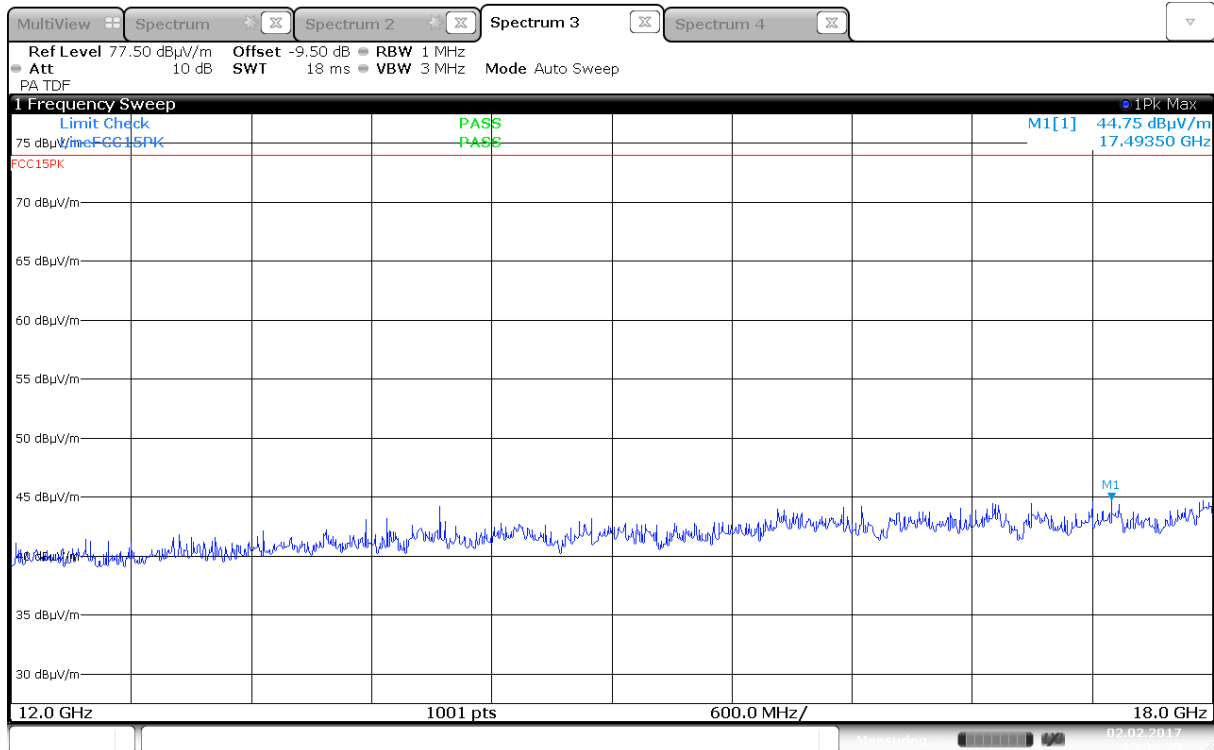
Radiated Emissions, 12000 -18000 MHz, VP, 802.11b, 1Mbps



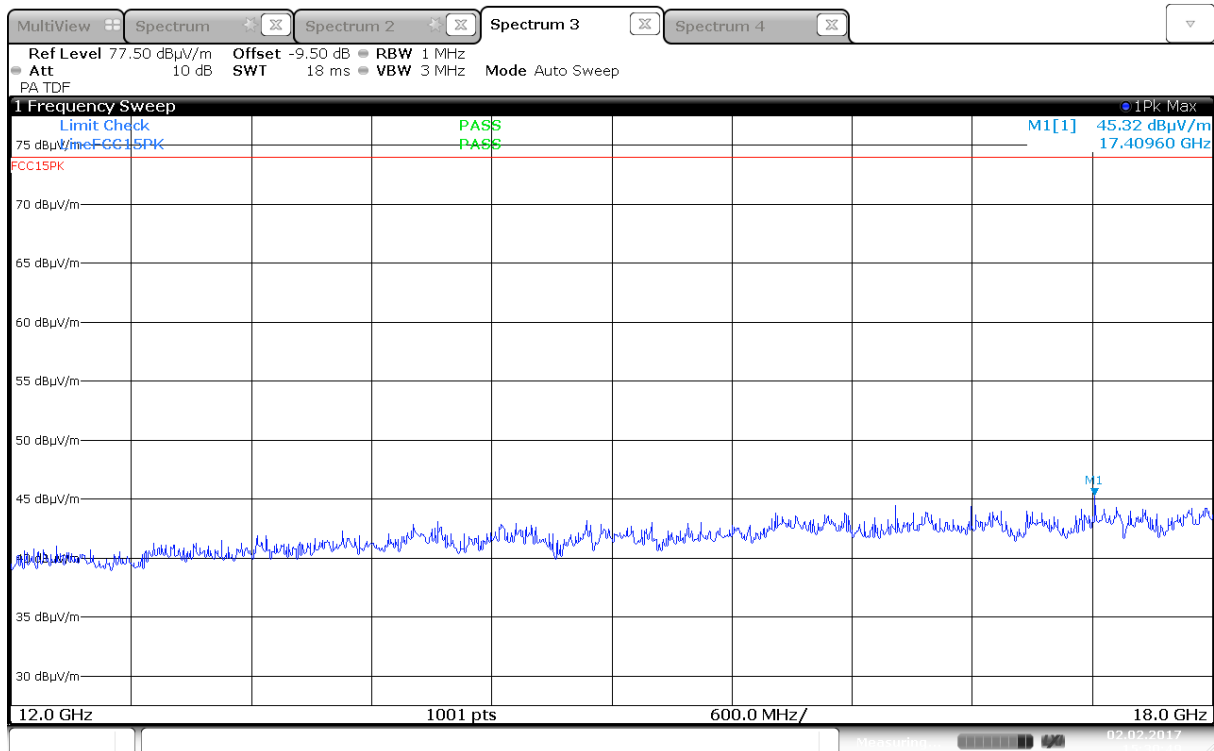
Radiated Emissions, 12000 -18000 MHz, HP, 802.11g, 6Mbps



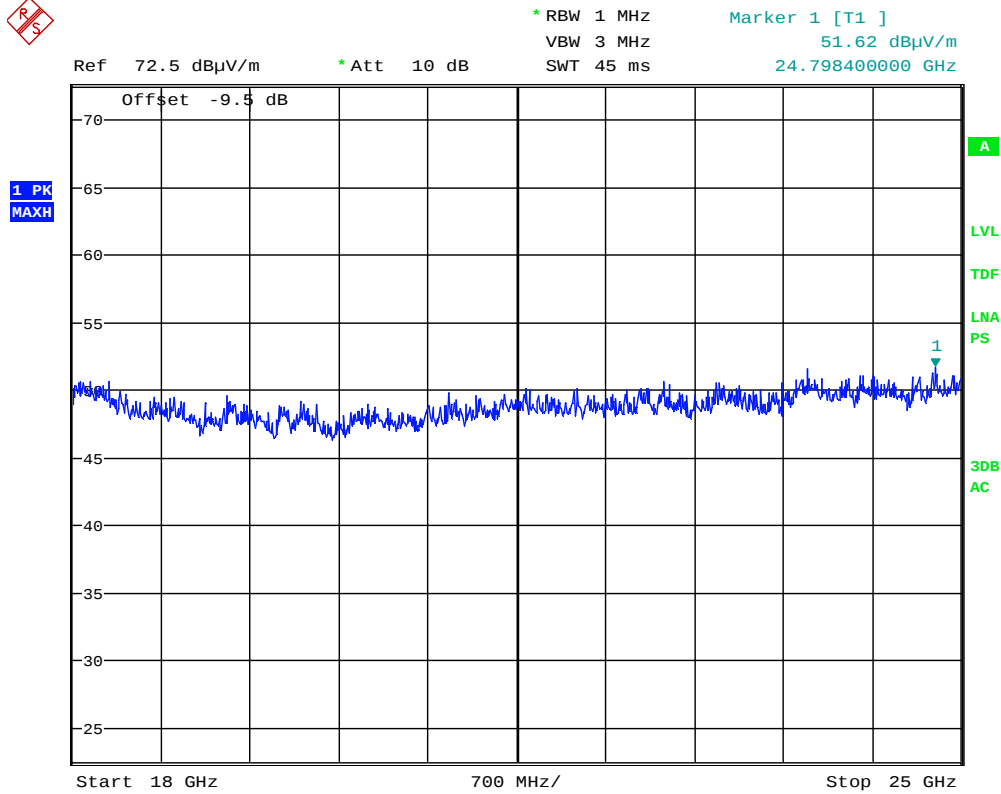
Radiated Emissions, 12000 -18000 MHz, VP, 802.11g, 6Mbps



Radiated Emissions, 12000 -18000 MHz, HP, 802.11n, MCS0

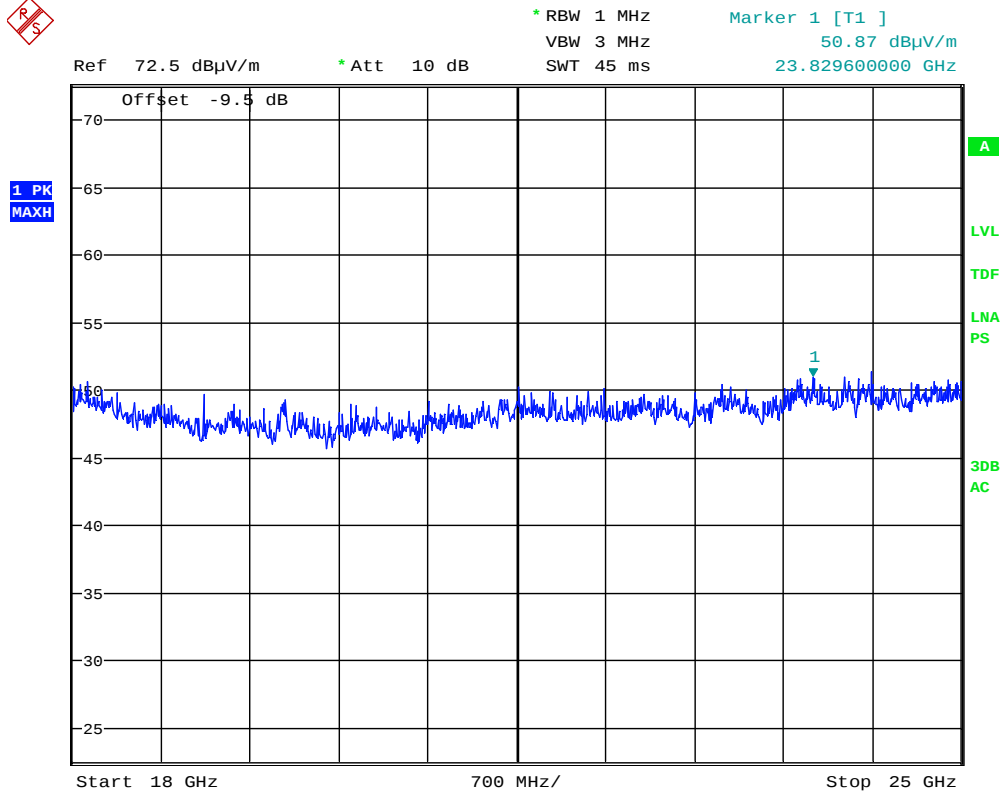


Radiated Emissions, 12000 -18000 MHz, VP, 802.11n, MCS0



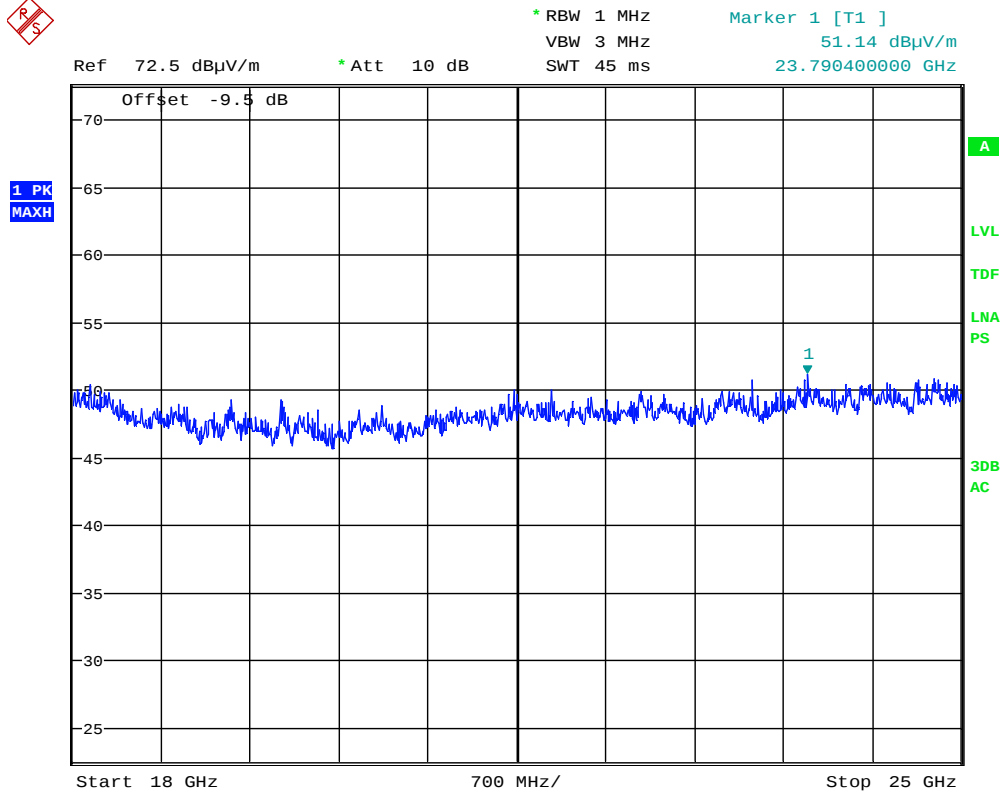
Date: 3.FEB.2017 09:53:41

**Radiated Emissions, 18000 -25000 MHz, HP, 802.11b, 1Mbps**



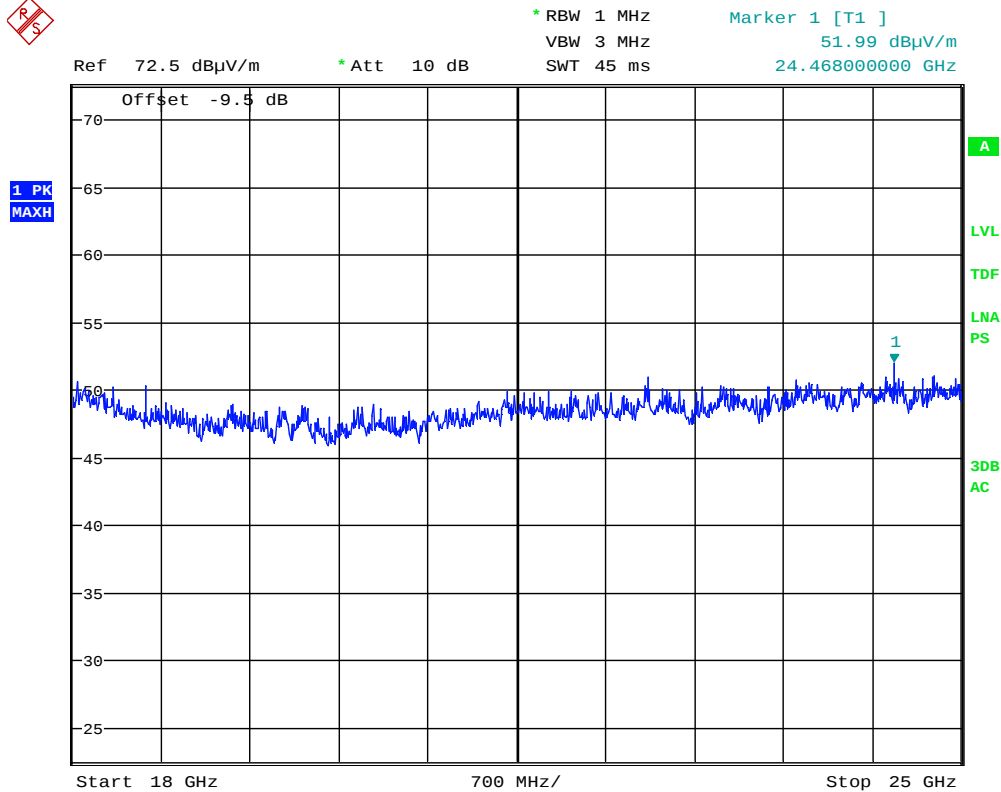
Date: 3.FEB.2017 09:46:40

**Radiated Emissions, 18000 -25000 MHz, VP, 802.11b, 1Mbps**



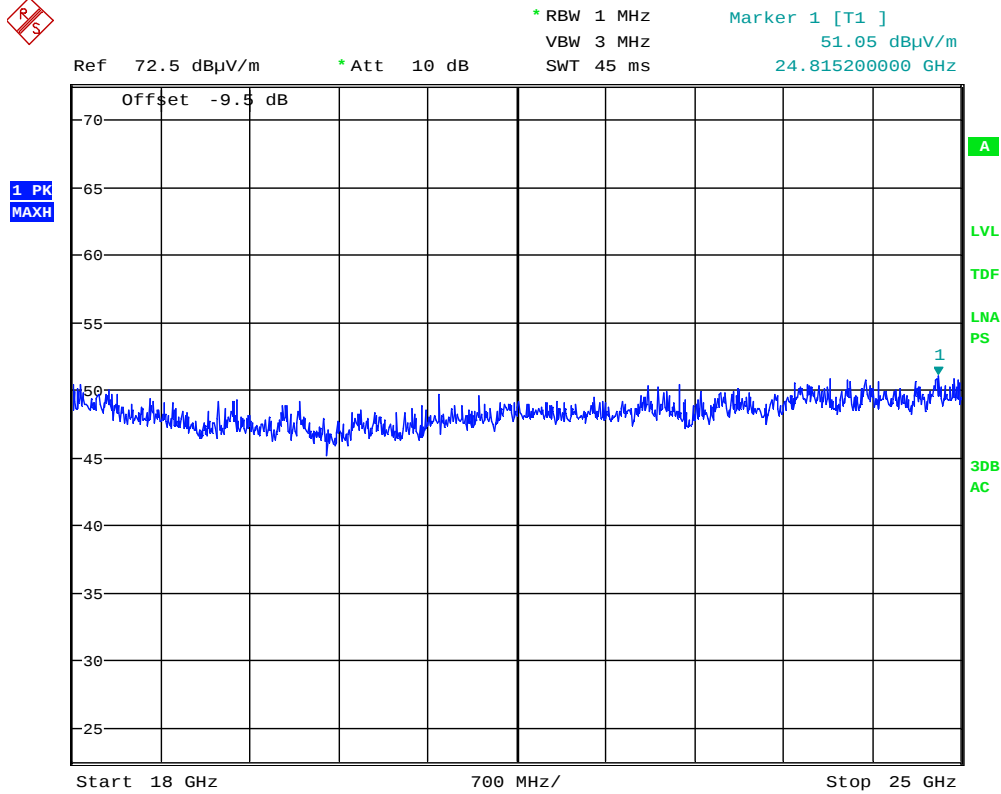
Date: 2.FEB.2017 16:22:18

**Radiated Emissions, 18000 -25000 MHz, HP, 802.11g, 6Mbps**



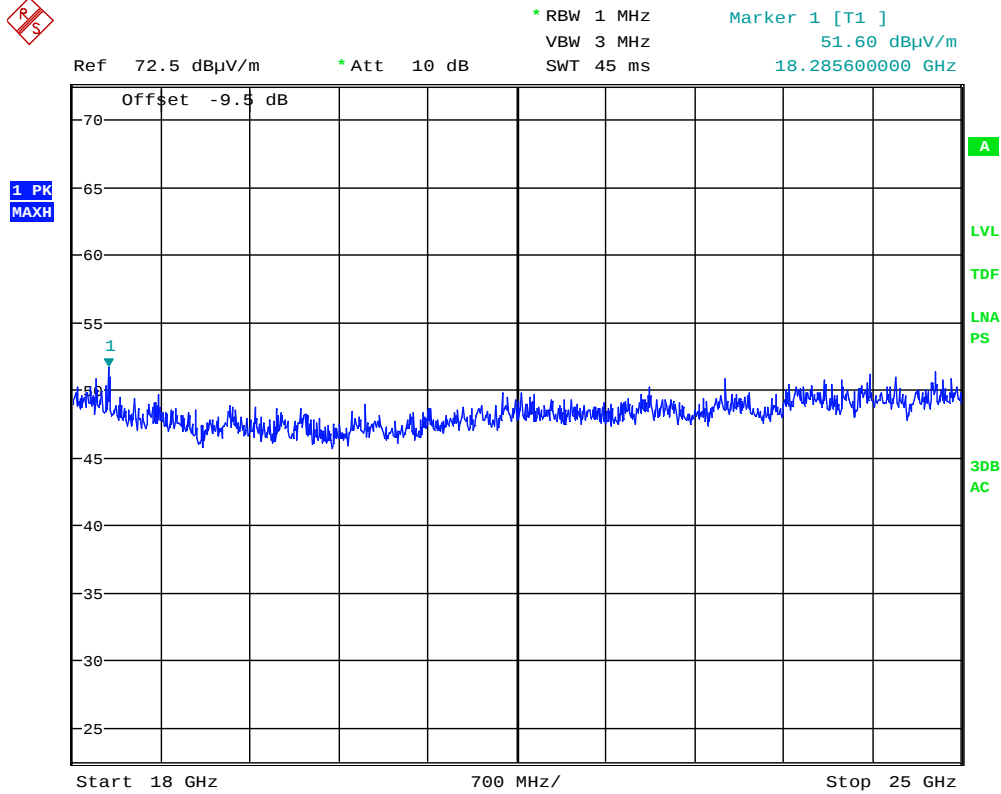
Date: 2.FEB.2017 16:19:12

**Radiated Emissions, 18000 -25000 MHz, VP, 802.11g, 6Mbps**



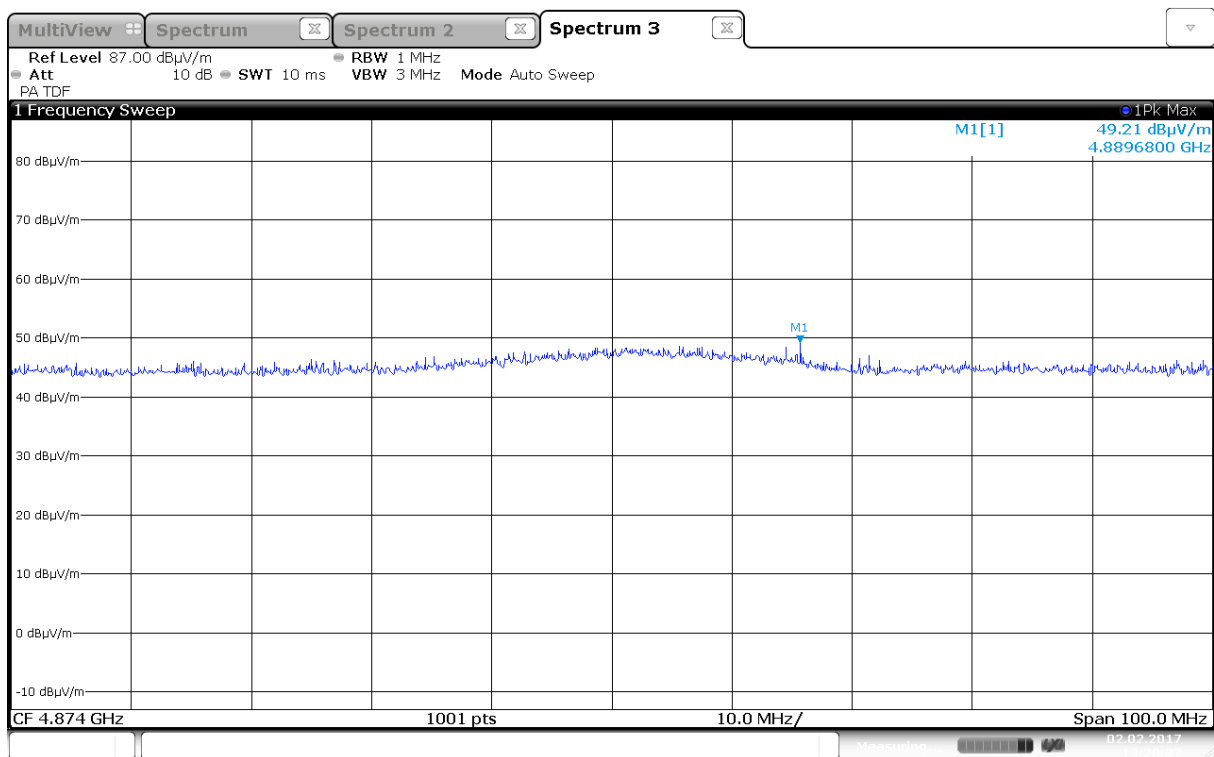
Date: 2.FEB.2017 16:25:33

**Radiated Emissions, 18000 -25000 MHz, HP, 802.11n, MCS0**

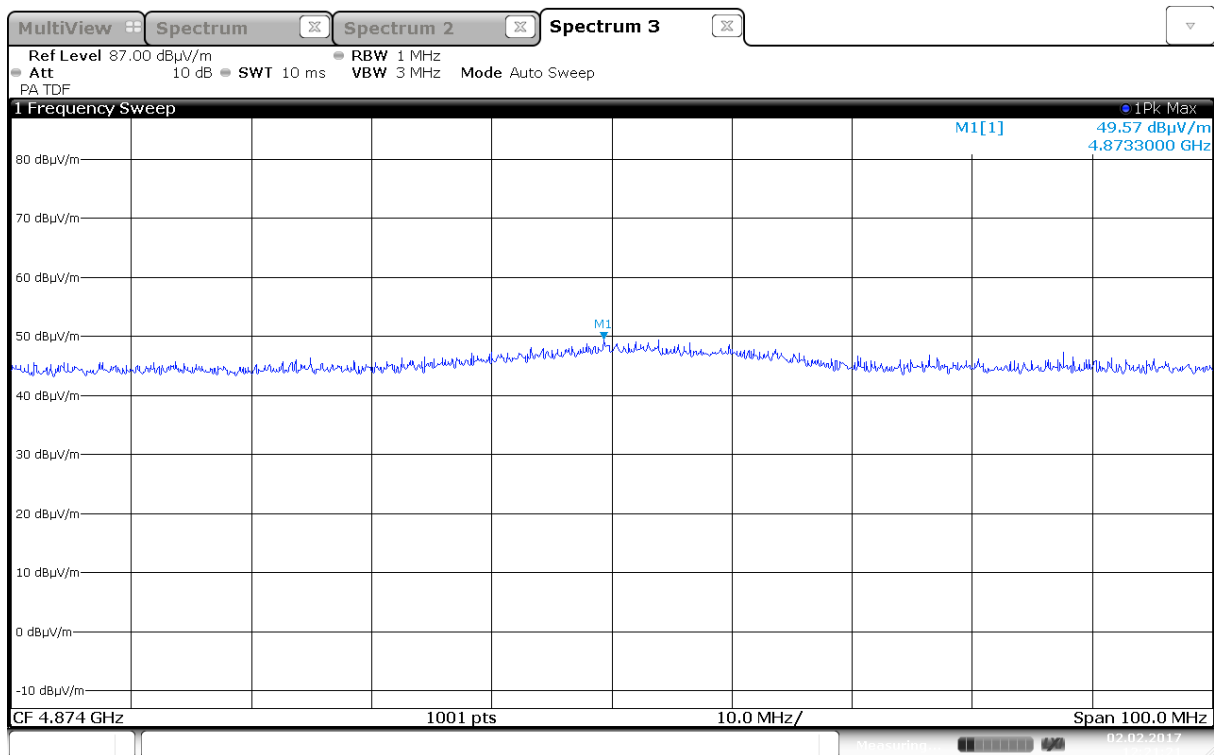


Date: 2.FEB.2017 16:27:47

**Radiated Emissions, 18000 -25000 MHz, VP, 802.11n, MCS0**



Radiated Emissions, 4874MHz, ch06, HP, 802.11n, MCS0



Radiated Emissions, 4874MHz, ch06, VP, 802.11n, MCS0

### 3.10 Power Spectral Density (PSD)

FCC part 15.247(e)

**Test Results: Complies**

**Measured and Calculated Data:**

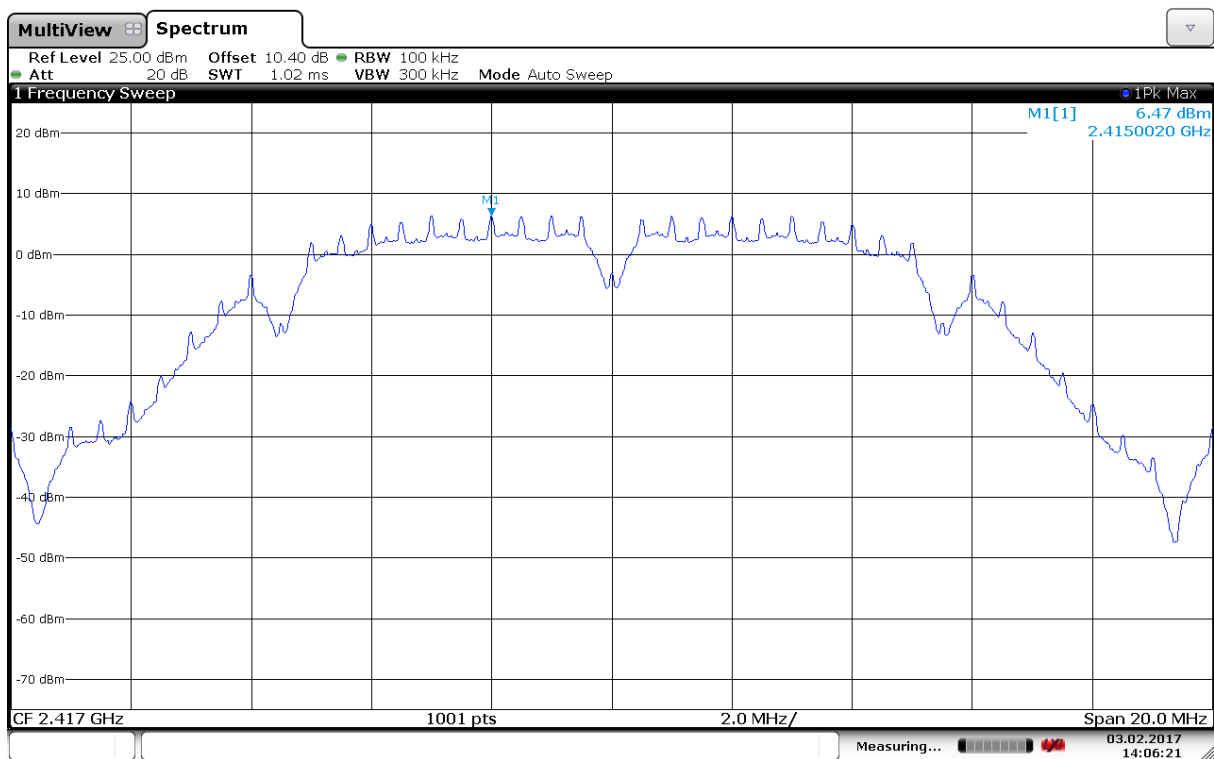
The measurement method PKPSD described in ANSI C63.10-2013 was used.

| Carrier Frequency<br>(MHz) | Power Spectral Density (dBm) |                 |               |
|----------------------------|------------------------------|-----------------|---------------|
|                            | 802.11b, 11 Mbps             | 802.11g, 6 Mbps | 802.11n, MCS0 |
| 2417                       | -8.7                         | -13.1           | -12.6         |
| 2437                       | -9.9                         | -14.1           | -13.6         |

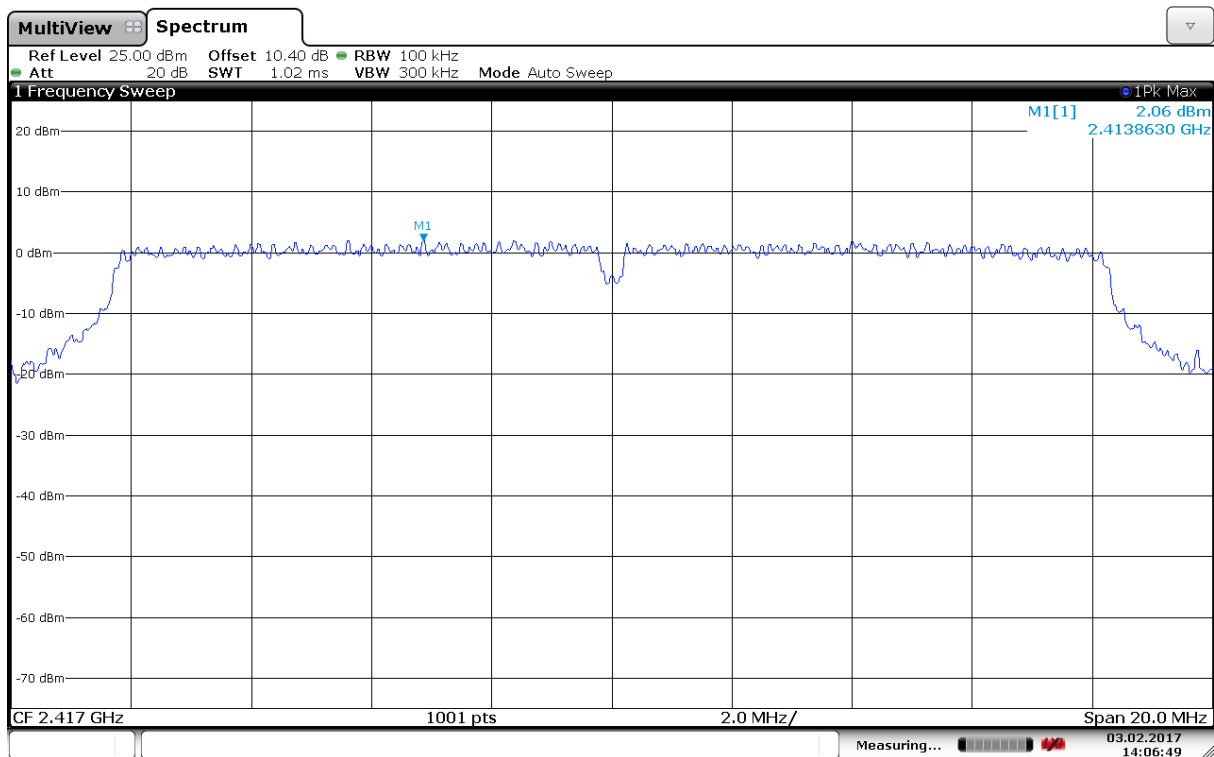
The measured values with 100kHz RBW are corrected by a Bandwidth Correction Factor of -15.2 dB.

**Requirements:**

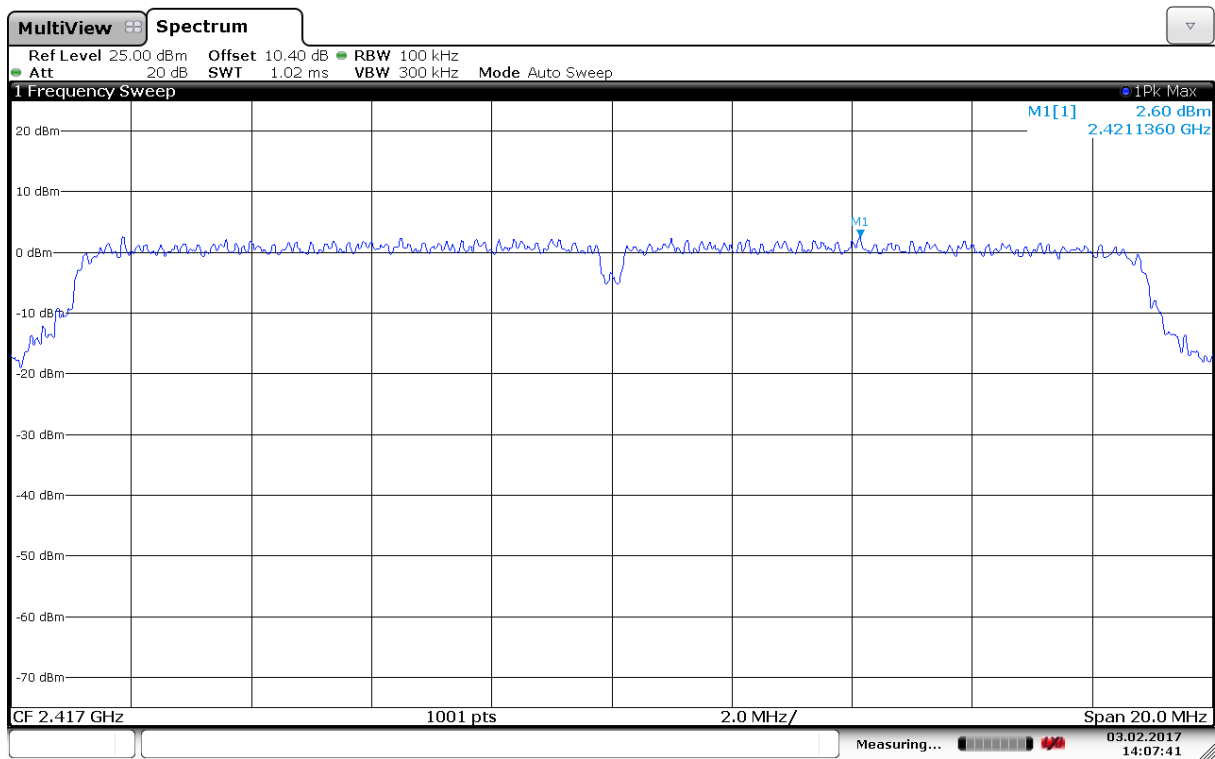
The Power Spectral Density of a Digital Transmission System shall be no greater than +8 dBm in any 3 kHz band



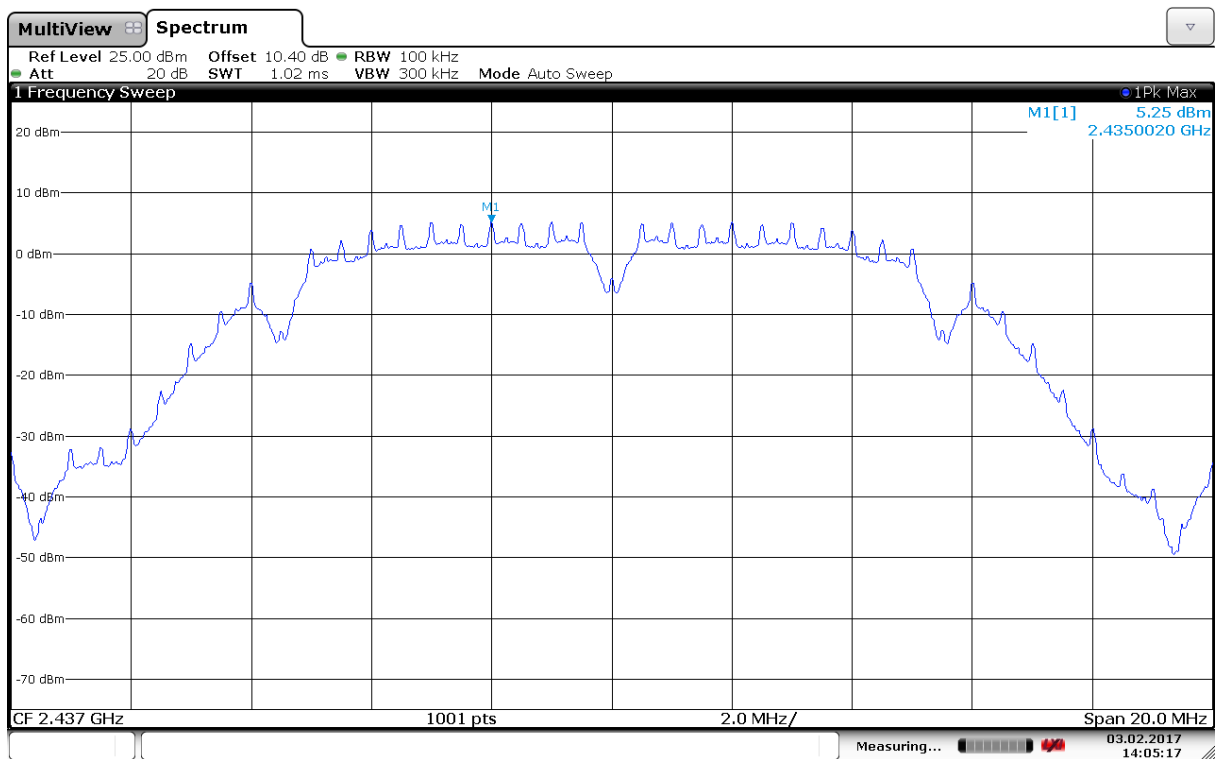
PSD, 2417 MHz, 802.11b, 11 Mbps



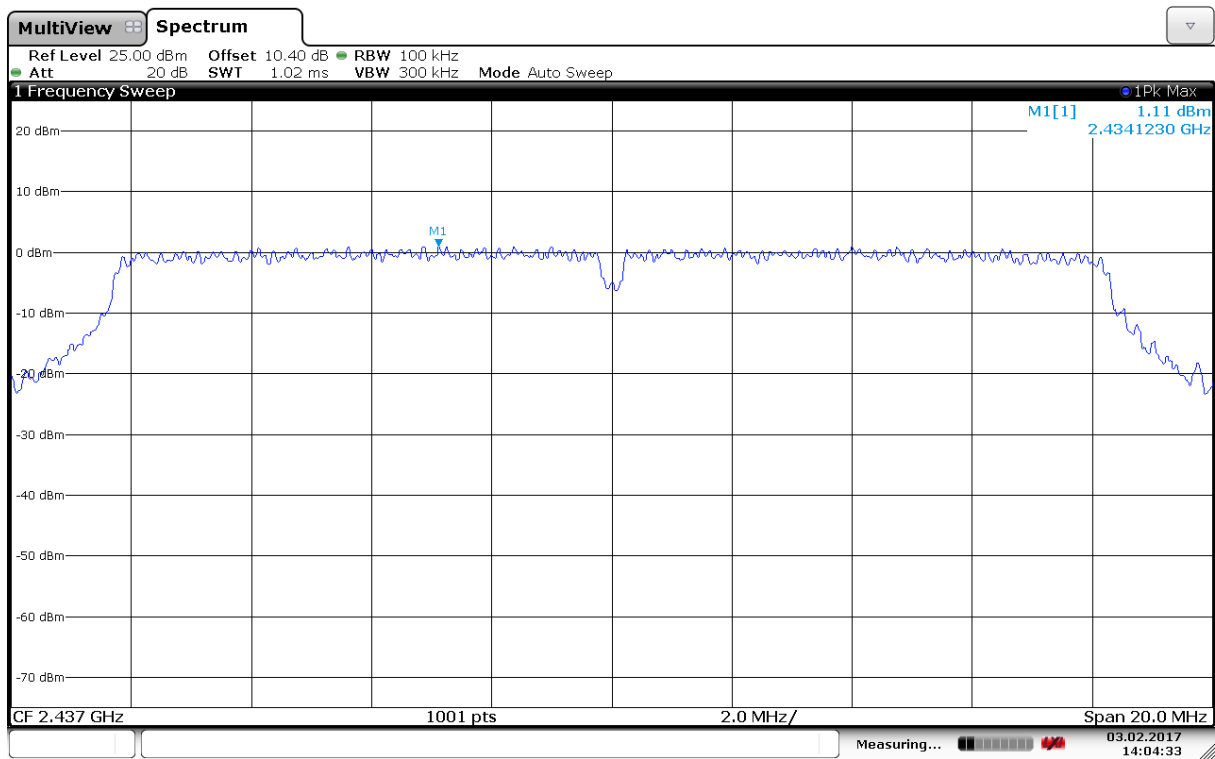
PSD, 2417 MHz, 802.11g, 6 Mbps



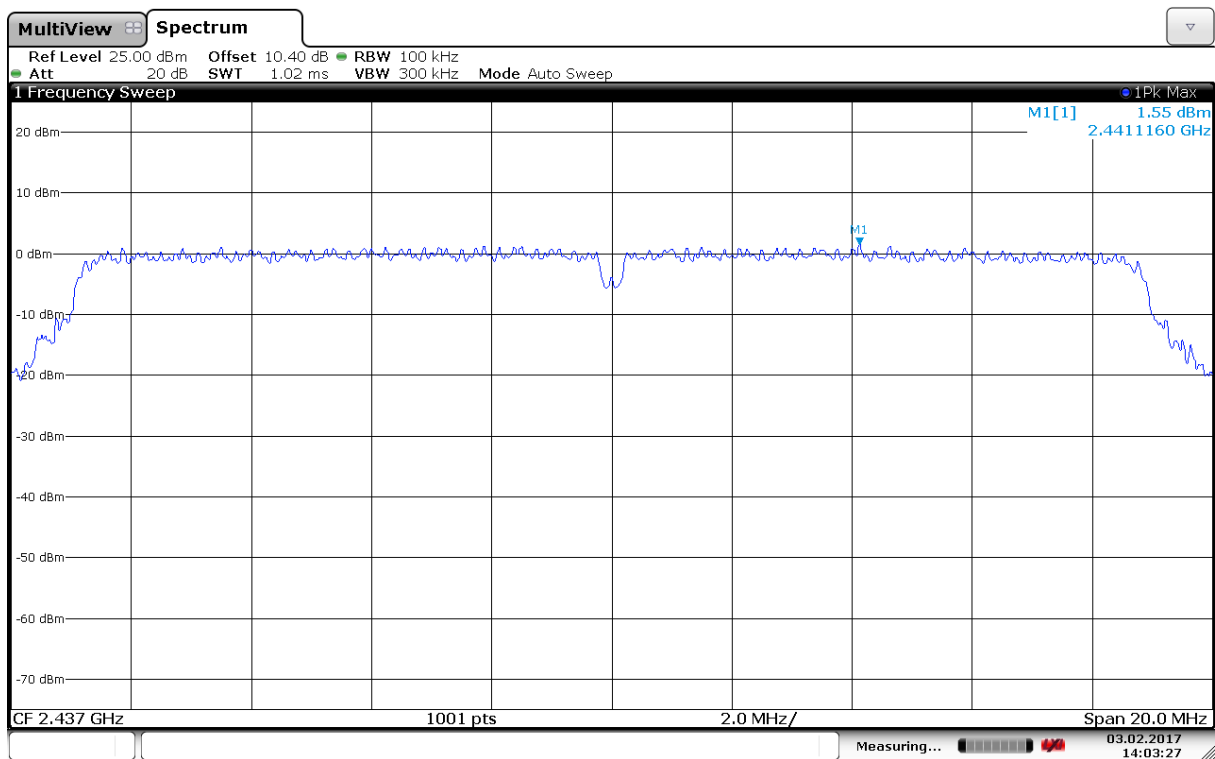
PSD, 2417 MHz, 802.11n, MCS0



PSD, 2437 MHz, 802.11b, 1 Mbps



PSD, 2437 MHz, 802.11g, 6 Mbps



PSD, 2437 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

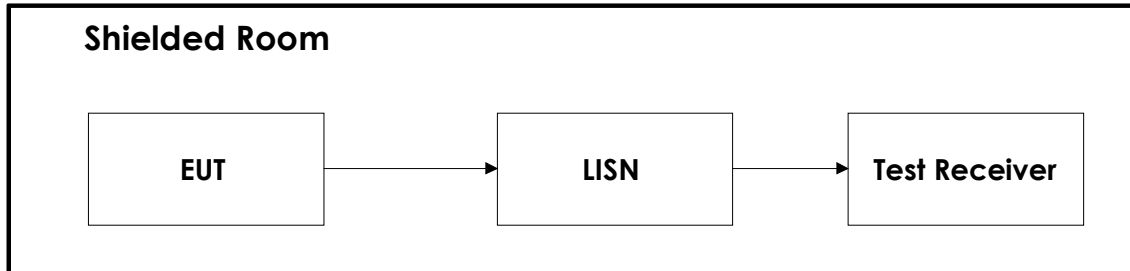
To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment and ancillaries are identified (numbered) by the Test Laboratory.

| No. | Model number  | Description              | Manufacturer      | Ref. no. | Cal. date  | Cal. Due |
|-----|---------------|--------------------------|-------------------|----------|------------|----------|
| 1   | FSW26         | Spectrum Analyzer        | Rohde & Schwarz   | LR 1640  | 2017.01    | 2018.01  |
| 2   | ESU40         | Measuring Receiver       | Rohde & Schwarz   | LR 1639  | 2016.12    | 2017.12  |
| 3   | 6810.17B      | Attenuator               | Suhner            | LR 1669  | Cal b4 use |          |
| 4   | 6HC3000/18000 | Highpass Filter          | Trilithic         | LR 1614  | Cal b4 use |          |
| 5   | NGSM 32/10    | DC Power Supply          | Rohde & Schwarz   | LR1299   | Cal b4 use |          |
| 6   | 317           | Preamplifier             | Sonoma Instrument | LR 1687  | 2016.05    | 2017.05  |
| 7   | 3115          | Horn Antenna             | EMCO              | LR 1330  | 2016.10    | 2021.10  |
| 8   | 8449A         | Pre-amplifier            | Hewlett Packard   | LR 1322  | 2016-09    | 2017-09  |
| 9   | 642           | Antenna Horn             | Narda             | LR 220   | 2009.01    | 2019.01  |
| 10  | PM7320X       | Antenna Horn             | Sivers Lab        | LR 102   | 2009.01    | 2019.01  |
| 11  | DBF-520-20    | Antenna Horn             | Systron Donner    | LR 100   | 2009.01    | 2019.01  |
| 12  | 638           | Antenna Horn             | Narda             | LR 098   | 2010.06    | 2020.06  |
| 13  | HK116         | Biconical Antenna        | Rohde & Schwarz   | LR 1260  | 2013.12    | 2018.12  |
| 14  | HL223         | LogPeriod Antenna        | Rohde & Schwarz   | LR 1261  | 2013.12    | 2018.12  |
| 15  | Model 87 V    | Multimeter               | Fluke             | LR 1597  | 2016.10    | 2017.10  |
| 16  | ESCI3         | Measuring receiver       | Rohde & Schwarz   | N-4259   | 2015.08    | 2017.08  |
| 17  | ESH3-Z2       | Pulse Limiter            | Rohde & Schwarz   | LR 1074  | 2016.05    | 2017.05  |
| 18  | ESH3-Z5       | Two-Line V-Network       | Rohde & Schwarz   | N-3403   | 2015.07    | 2017.07  |
| 19  | 6812B         | AC Power Source          | Agilent           | LR 1515  | Cal b4 use |          |
| 20  | U2000A        | USB Average Power Sensor | Agilent           | LR 1523  | 2017.02    | 2018.02  |

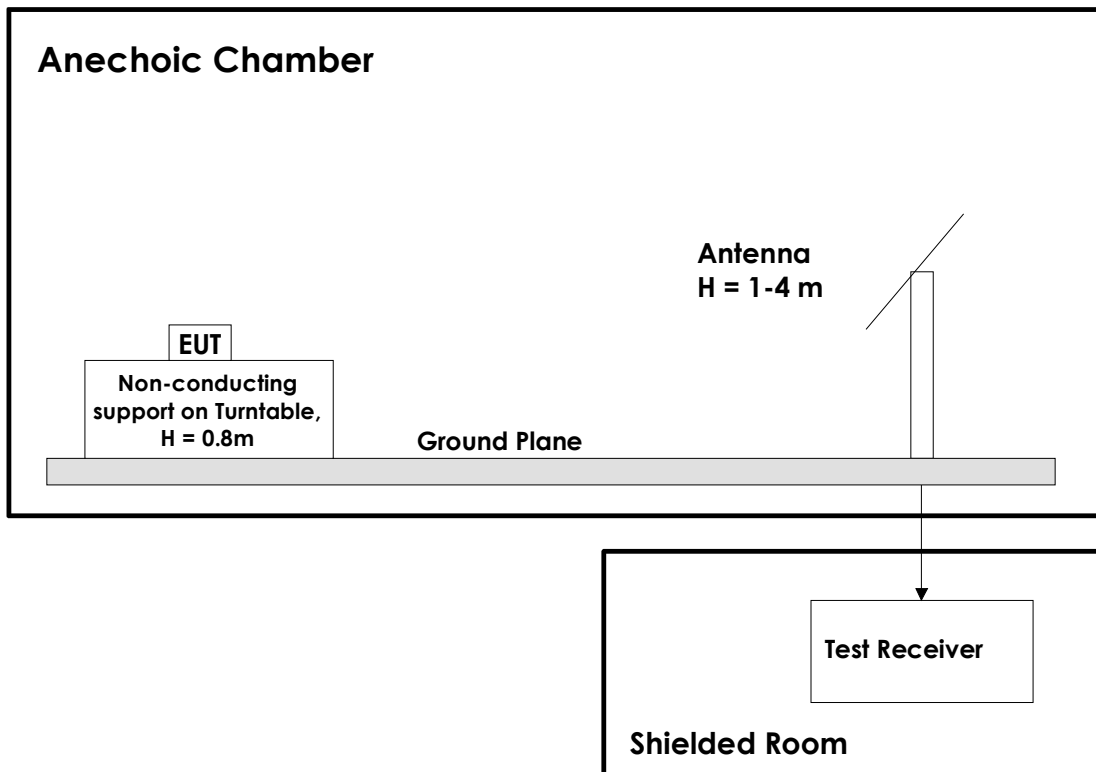
| Test Software List               |                 |       |         |
|----------------------------------|-----------------|-------|---------|
| Description                      | Manufacturer    | Model | Version |
| EMC Software for Conducted tests | Rohde & Schwarz | EMC32 | 9.26.00 |
|                                  |                 |       |         |

## 6 BLOCK DIAGRAM

### 6.1 Power Line Conducted Emission



### 6.2 Test Site Radiated Emission



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

### Revision history

| Version | Date       | Comment                       | Sign |
|---------|------------|-------------------------------|------|
| 1.0     | 2017.04.24 | First Edition                 | FS   |
| 2.0     | 2017.06.02 | Updated with RMS Power values | FS   |
|         |            |                               |      |