

# Test Report

**EUT Name:** WLAN card

**Model No.:** ICS1-WLAN-ATWILC-MU-D

CFR 47 Part 15 (10-1-2016 Edition), RSS-Gen (Issue 4, November 2014) and RSS-247  
(Issue 2, February 2017)

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*Report/Reissue Date:* February 14, 2018  
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## Statement of Compliance

*Manufacturer:* Zollner Elektronik AG  
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*Name of Equipment:* WLAN card  
*Model No.* ICS1-WLAN-ATWILC-MU-D  
*Type of Equipment:* Digital Transmissions System (DTS)  
*Application of Regulations:* CFR 47 Part 15 (10-1-2016 Edition), RSS-Gen (Issue 4, November 2014) and RSS-247 (Issue 2, February 2017)

*Test Dates:* March 31, 2017 to April 20, 2017

*Guidance Documents:*

ANSI C63.10-2013 and KDB558074 D01 DTS Meas Guidance v04

*Test Methods:*

ANSI C63.10-2013

The electromagnetic compatibility test and documented data described in this report has been performed and recorded by TUV Rheinland, in accordance with the standards and procedures listed herein. As the responsible authorized agent of the test laboratory, I hereby declare that the equipment described above has been shown to be compliant with the requirements of the stated regulations and standards based on these results. If any special accessories and/or modifications were required for compliance, they are listed in the Executive Summary of this report.

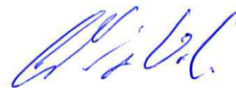
This report shall not be reproduced except in full, without the written authorization of TUV Rheinland Nederland B.V. The test results relate only to the item(s) tested.



Richard van der Meer

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Date Feb 14, 2018



Erik van der Wal

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Date Feb 14, 2018



Industry  
Canada Industrie  
Canada

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# 1 Executive Summary

## 1.1 Scope

This report is intended to document the status of conformance with the requirements of the CFR 47 Part 15 (10-1-2016 Edition), RSS-Gen (Issue 4, November 2014) and RSS-247 (Issue 2, February 2017) based on the results of testing performed on **March 31, 2017** to **April 20, 2017** on the **WLAN** card Model **ICS1-WLAN-ATWILC-MU-D** manufactured by **Brusa AG** and marketed by **Brusa AG**. This report only applies to the specific samples tested under the stated test conditions. It is the responsibility of the manufacturer to assure that additional production units of this model are manufactured with identical or EMI equivalent electrical and mechanical components. This report is further intended to document changes and modifications to the EUT throughout its life cycle.

## 1.2 Purpose

Testing was performed to evaluate the performance of the EUT in accordance with the applicable requirements, procedures, and criteria defined in the application of regulations and application of standards listed in this report.

## 1.3 Summary of Test Results

**Table 1:** Summary of Test Results

Test	Test Method ANSI C63.10-2013	Test Parameters (Measured)	Result
Spurious Emission in Transmitted Mode	CFR47 15.209, CFR47 15.247 (d) RSS-GEN Sect.8.9, RSS-247 Sect. 5.5	< 46 dB $\mu$ V/m	<b>Complied</b>
Restricted Bands of Operation	CFR47 15.205, RSS GEN Sect.8.10	< -21.2 dBm (Pk) / < -41.2 dBm (Av)	<b>Complied</b>
AC Power line Conducted Emission	CFR47 15.207, RSS-GEN Sect.8.8	--	Not Applicable
DTS Bandwidth & Occupied Bandwidth	CFR47 15.247 (a2), RSS-GEN Sect.6.6	>500 kHz	<b>Complied</b>
Maximum Output Power	CFR47 15.247 (b), RSS-247 Sect. 5.4.4, 6.2.4.1	dBm (802.11b) dBm (802.11g) dBm (HT 20)	<b>Complied</b>
Peak Power Spectral Density	CFR47 15.247 (e), RSS-247 Sect. 5.2.2	< 8 dBm/3kHz	<b>Complied</b>
Out of Band Emission	CFR47 15.247 (d), RSS-247 Sect.5.5	> 20 dBc	<b>Complied</b>

Note: This test report covers 2400 MHz to 2483.5 MHz band.

## 1.4 Special Accessories

No special accessories were necessary in order to achieve compliance.

## 1.5 Equipment Modifications

None

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## 2 Laboratory Information

### 2.1 Accreditations & Endorsements

#### 2.1.1 US Federal Communications Commission



TUV Rheinland Nederland B.V. at Eiberkamp 10, 9351VT Leek, Netherlands recognized by the commission for performing testing services for the general public on a fee basis. These laboratory test facilities have been fully described in reports submitted to and accepted by the FCC (786213). The laboratory scope of accreditation includes: Title 47 CFR Parts 15 and 18. The accreditation is updated every 3 years.

#### 2.1.2 RvA

TUV Rheinland Nederland B.V. is accredited by the Dutch Accreditation Council RvA. The laboratory has been assessed and accredited in accordance with ISO/IEC 17025:2005 with registration number: L 484. The scope of laboratory accreditation includes emission immunity testing. The accreditation is updated annually.

#### 2.1.3 Canada – Industry Canada



TUV Rheinland Nederland B.V. at Eiberkamp 10, 9351VT Leek, Netherlands is accredited by Industry Canada for performing testing services for the general public on a fee basis. This laboratory test facilities have been fully described in reports submitted to and accepted by Industry Canada (File Number 2932G-2). This reference number is the indication to the Industry Canada Certification Officers that the site meets the requirements of RSS 212, Issue 1 (Provisional). The accreditation is updated every 3 years.

## 2.2 Test Facilities

All of the test facilities are located at Eiberkamp 10, 9351VT Leek, Netherlands.

### 2.2.1 Emission Test Facility

The Semi-Anechoic chamber and AC Power Line Conducted measurement facility used to collect the radiated and conducted data has been constructed in accordance with ANSI C63.7:1992. The site has been measured in accordance with and verified to comply with the theoretical normalized site attenuation requirements of ANSI C63.4-2014, at a test distance of 3 meters. The site is listed with the FCC. The 3 meter semi-anechoic chamber used to collect the radiated data has been verified to comply with the theoretical normalized site attenuation requirements of ANSI C63.4-2014, at a test distance of 3 meter. A report detailing this site can be obtained from TUV Rheinland Nederland B.V.

Normal test conditions:

Temperature (\*) : +15°C to +35°C  
Relative humidity(\*) : 20 % to 75 %  
Supply voltage : 3.4 Vdc.

*When it was impracticable to carry out the tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests are stated separately.*



### 2.3 Measurement Uncertainty

Measurement Type	Frequency	Uncertainty
Antenna Port Conducted Emission	< 6GHz	2.5 dB
	> 6GHz	2.7 to 4.2 dB
Radiated Emission		
	30MHz - 1GHz	5.22 dB
	> 1GHz	5.22 dB

The expanded uncertainty at a level of 95% confidence is obtained by multiplying the combined standard uncertainty by a coverage factor of 2. Compliance criteria are not based on measurement uncertainty.

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## 3 Product Information

### 3.1 Product Description

The Model **ICS1-WLAN-ATWILC-MU-D**, Brand **WLAN card**, is a WLAN transceiver used to transmit data within a WLAN network.

The 802.11 channel allocation consists of channels numbered 11 to 26, starting at 2.405 GHz and ending at 2.480 GHz. Bandwidth is 20 MHz per channel.

All radiated testing was performed using the normal sample with integrated antenna, the conducted tests were performed on a specially prepared sample with SMA connector.

### 3.2 Equipment Configuration

A description of the equipment configuration is given in the Test Plan Section. The EUT was tested as called for in the test standard and was configured and operated in a manner consistent with its intended use. The EUT was connected to rated power and allowed to reach intended operating conditions. The placement of the EUT system components was guided by the test standard and selected to represent typical installation conditions.

In the case of an EUT that can operate in more than one configuration, preliminary testing was performed to determine the configuration that produced maximum radiation.

The final configuration was selected to produce the worst case radiation for emissions testing.

### 3.3 Operating Mode

A description of the operation mode is given in the Test Plan Section. In the case of an EUT that can operate in more than one state, preliminary testing was performed to determine the operating mode that produced maximum radiation.

The final operating mode was selected to produce the worst case radiation for emissions testing.

### 3.4 Unique Antenna Connector

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of CFR47 Parts 15.211, 15.213, 15.217, 15.219, or 15.221.

## 4 Emissions

Testing was performed in accordance with CFR 47 Part 15, RSS-Gen, RSS-247 and ANSI C63.10-2013. These test methods are listed under the laboratory's Scope of Accreditation. This test measures the levels emanating from the EUT, thus evaluating the potential for the EUT to cause radio frequency interference to other electronic devices. Procedures described in section 8 of the standard were used.

### 4.1 Conducted Output Power Requirements

*The maximum output power requirement is the maximum equivalent isotropic radiated power delivering at the transmitting antenna under specified conditions of measurements in the presence of modulation.*

FCC 15.247(b)(3): For systems using digital modulation in the 2400-2483.5 MHz band, the maximum peak output power is 1W (+30dBm).

RSS-247 section 5.4(4): the e.i.r.p. shall not exceed 4 W (+36 dBm).

#### 4.1.1 Test Method

The ANSI C63.10-2013 Section 11.9.1.2 conducted method was used to measure the channel power output. The preliminary investigation was performed at different data rate/ chain to determine the highest power output for each mode. The worst case findings were conducted on 3 channels in each operating range per CFR47 Part 15.247(b3) and RSS 247 Sect. 5.4.4; 2400 MHz to 2483.5 MHz. The worst case mode results are indicated below. The final measurement takes into account the loss generated by all the involved cables.

Test setup: as per section 6.4

#### 4.1.2 Results

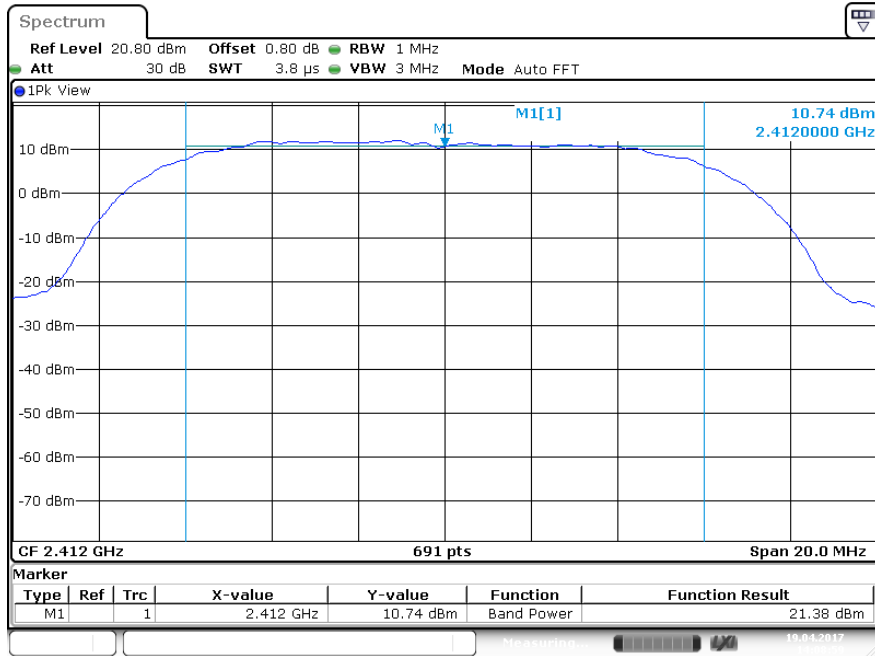
As originally tested, the EUT was found to be compliant to the requirements of the test standard(s). Plots for all the measurements stated above were taken, to reduce complexity and bulkiness of the report Highlighted Plots (worst case) are placed in the report.

**Table 2: RF Output Power at the Antenna Port – Test Results**

<b>802.11b</b>			
<b>Operating Channel (MHz)</b>	<b>Limit [dBm]</b>	<b>Max Power [dBm]</b>	<b>Margin [dB]</b>
2412.00	30.00	21.36	-8.64
2437.00	30.00	20.99	-9.01
2462.00	30.00	20.37	-9.63
<i>Note: 1. The highest output power was observed at 802.11b mode, 11 Mbps</i>			
<b>802.11g</b>			
<b>Operating Channel (MHz)</b>	<b>Limit [dBm]</b>	<b>Max Power [dBm]</b>	<b>Margin [dB]</b>
2412.00	30.00	22.29	-7.71
2437.00	30.00	21.94	-8.06
2462.00	30.00	21.61	-8.39
<i>Note: 1. The highest output power was observed at 802.11g mode, 54Mbps</i>			

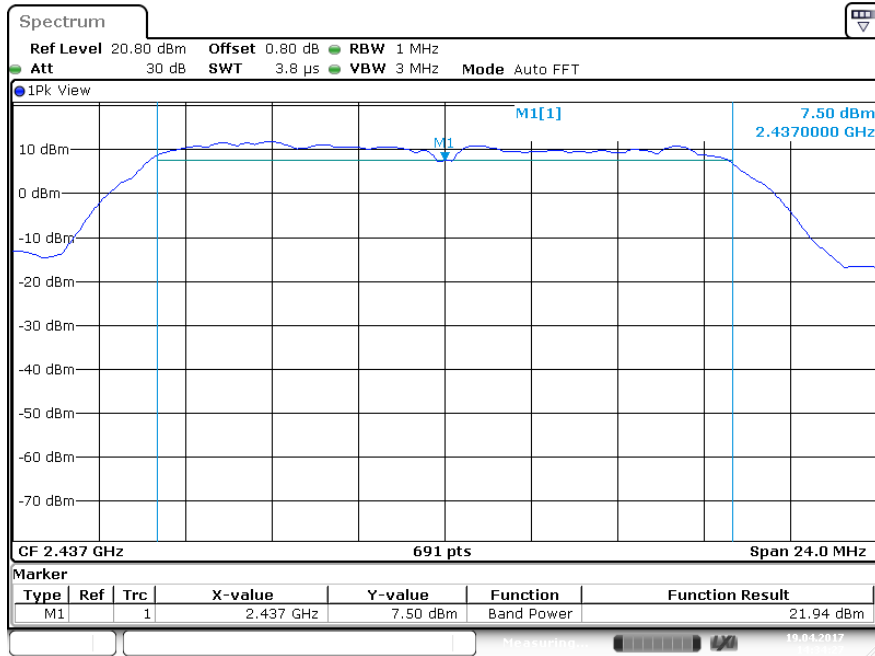
**Table 3: RF Output Power at the Antenna Port – Test Results**

<b>802.11n</b>			
<b>Operating Channel (MHz)</b>	<b>Limit [dBm]</b>	<b>Max Power [dBm]</b>	<b>Margin [dB]</b>
2412.00	30.00	21.69	-8.31
2437.00	30.00	21.63	-8.37
2462.00	30.00	21.55	-8.45
<i>Note: 1. The highest output power was observed at HT20 MCS7</i>			



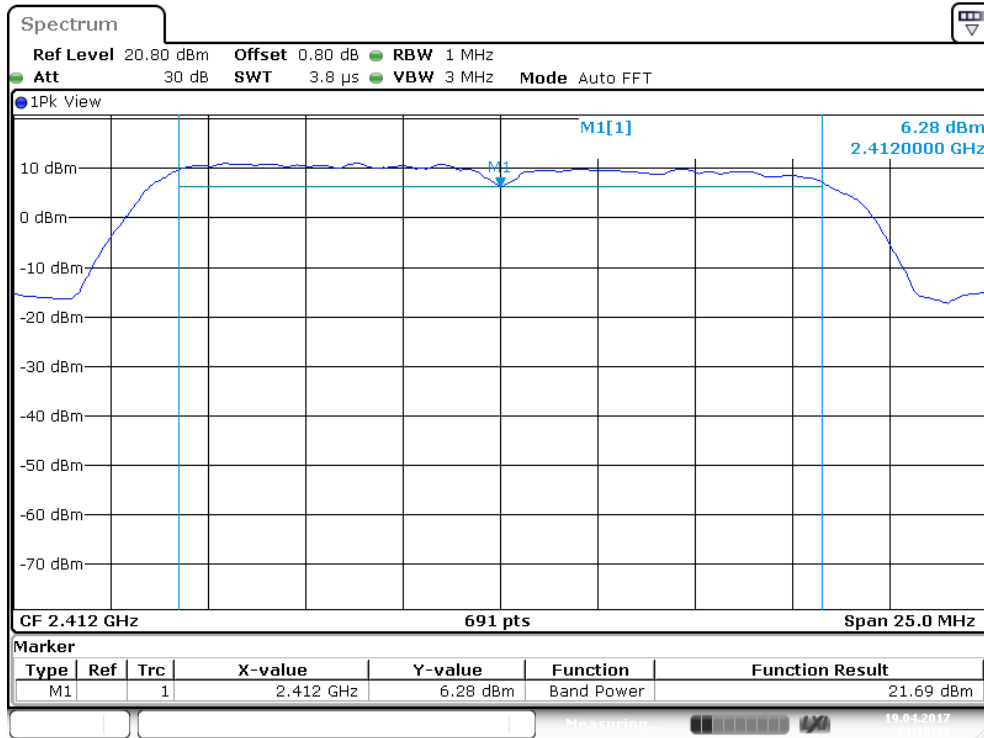
Date: 19 APR 2017 14:08:59

**Figure 1:** Maximum Transmitted Power, 2412 MHz at 11b 1Mbps



Date: 19 APR 2017 14:34:28

**Figure 2:** Maximum Transmitted Power, 2437 MHz at 11g 54Mbps



Date: 19 APR 2017 14:18:37

**Figure 3:** Maximum Transmitted Power, 2412 MHz at HT20 MCS7

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## 4.2 Occupied Bandwidth

*The occupied bandwidth is measured at an amplitude level reduced from the reference level by a specified ratio. The reference level is the level of the highest amplitude signal observed from the transmitter at the fundamental frequency.*

FCC 15.247(a)(2) and RSS-247 Section 5.2(1)

For systems using digital modulation in the 2400-2483.5MHz band, the 6dB bandwidth shall be at least 500kHz.

*The 99% bandwidth is the bandwidth in which 99% of the transmitted power occupied.*

### 4.2.1 Test Method

The conducted method was used to measure the occupied bandwidth according to ANSI C63.10-2013 Section 11.8.1. The measurement was performed with modulation per CFR47 15.247(a) (2) and RSS Gen Sect. 6.6 .

A spectrum analyzer was connected to the antenna port of the EUT. The spectrum analyzer resolution bandwidth was set to 100kHz, video bandwidth to 300kHz and the span wide enough to capture the modulated carrier.

For 99% Bandwidth:

RSS-Gen.

The transmitter shall be operated at its maximum carrier power measured under normal test conditions. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used given that a peak or peak hold may produce a wider bandwidth than actual.

A spectrum analyzer was connected to the antenna port of the EUT. The spectrum analyzer resolution bandwidth was set to 1% of the selected span, Video bandwidth was set to 3 times the resolution bandwidth. The span was set to capture the whole modulation process. The Spectrum analyzers automated function for 99% BW was used.

Test Setup: As per section as per section 6.4

### 4.2.2 Results

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s). Plots for all the measurements stated above were taken, to reduce complexity and bulkiness of the report Highlighted Plots are placed in the report.

**Table 4: Occupied Bandwidth – Test Results**

<b>802.11b</b>		
<b>Frequency (MHz)</b>	<b>6dB Bandwidth (MHz)</b>	<b>99% Bandwidth (MHz)</b>
2412	11.939	13.965
2437	<b>12.156</b>	<b>13.965</b>
2462	12.011	13.965
<b>Note: -</b>		
<b>802.11g</b>		
<b>Frequency (MHz)</b>	<b>6dB Bandwidth (MHz)</b>	<b>99% Bandwidth (MHz)</b>
2412	16.136	16.498
2437	<b>16.281</b>	<b>16.498</b>
2462	16.208	16.498
<b>Note:-</b>		

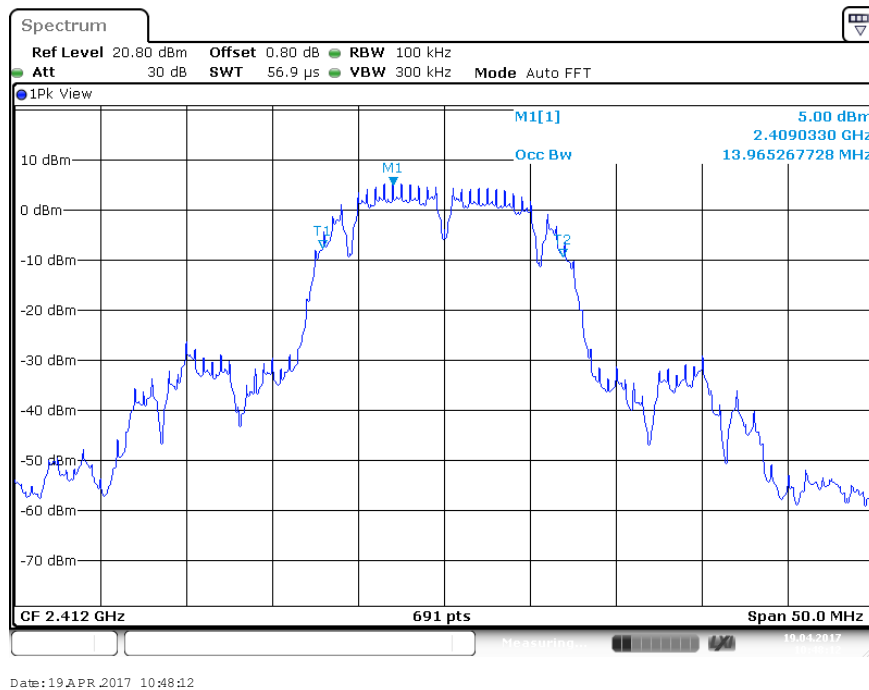
**Table 5: Occupied Bandwidth – Test Results**

<b>802.11n</b>		
<b>Frequency (MHz)</b>	<b>6dB Bandwidth (MHz)</b>	<b>99% Bandwidth (MHz)</b>
2412	17.439	17.728
2437	<b>17.728</b>	<b>17.728</b>
2462	17.728	17.728
<b>Note: -</b>		

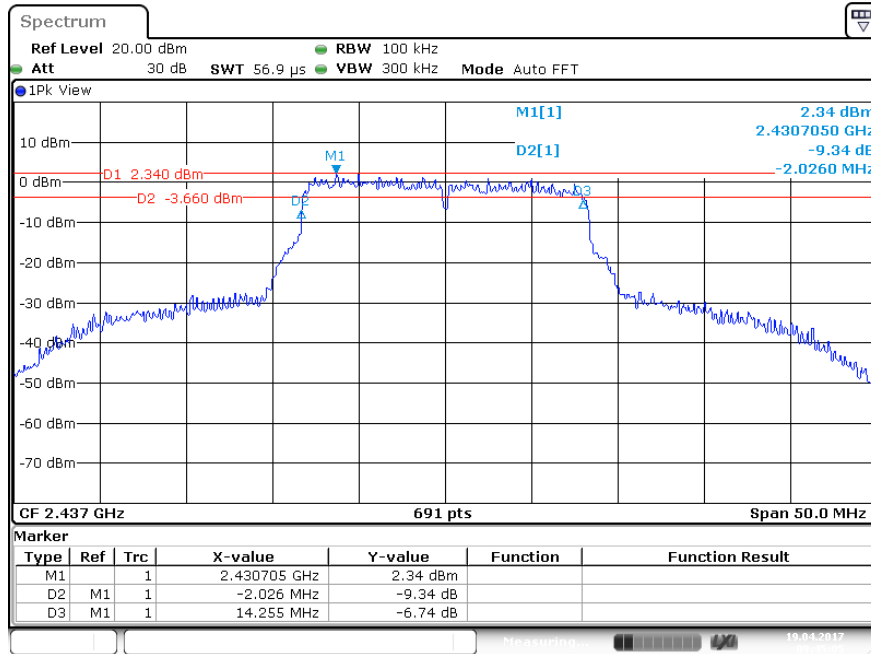




**Figure 4:** 6dB Bandwidth, 2437 MHz at 802.11b 1Mbps

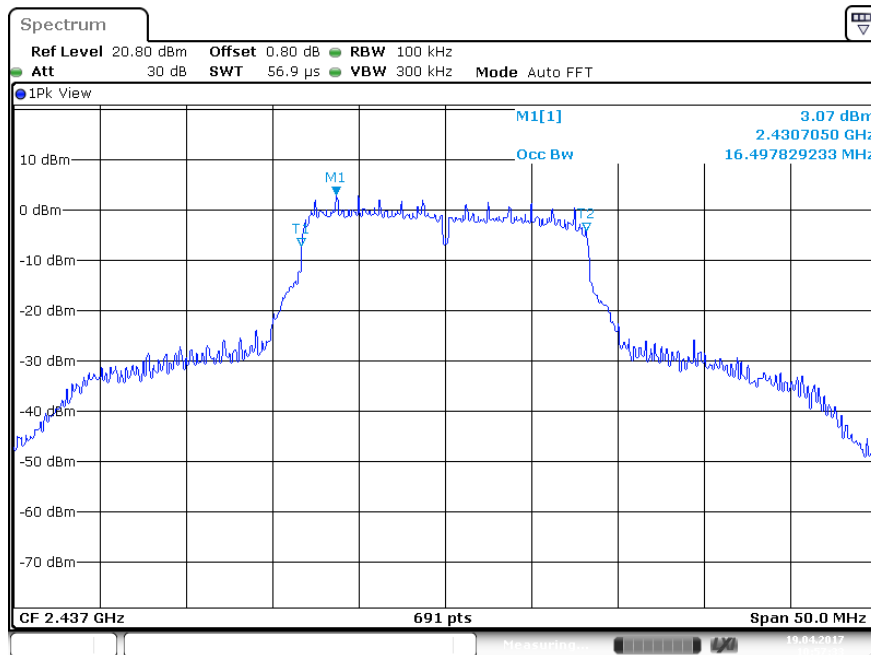


**Figure 5:** 99% Occupied Bandwidth, 2412 MHz at 802.11b 1Mbps



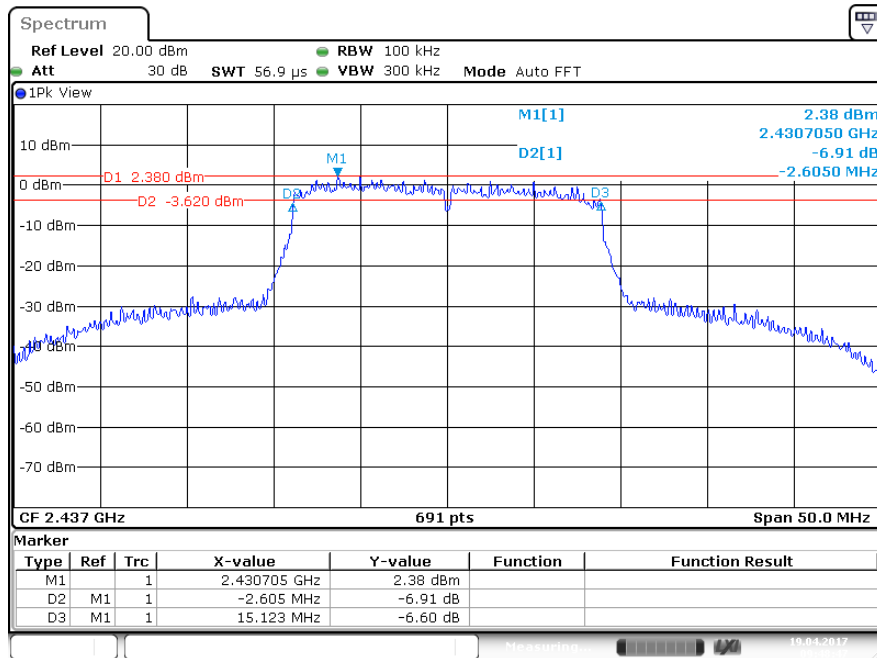
Date: 19 APR 2017 09:45:05

**Figure 6:** 6dB Bandwidth, 2437 MHz at 802.11g 54Mbps



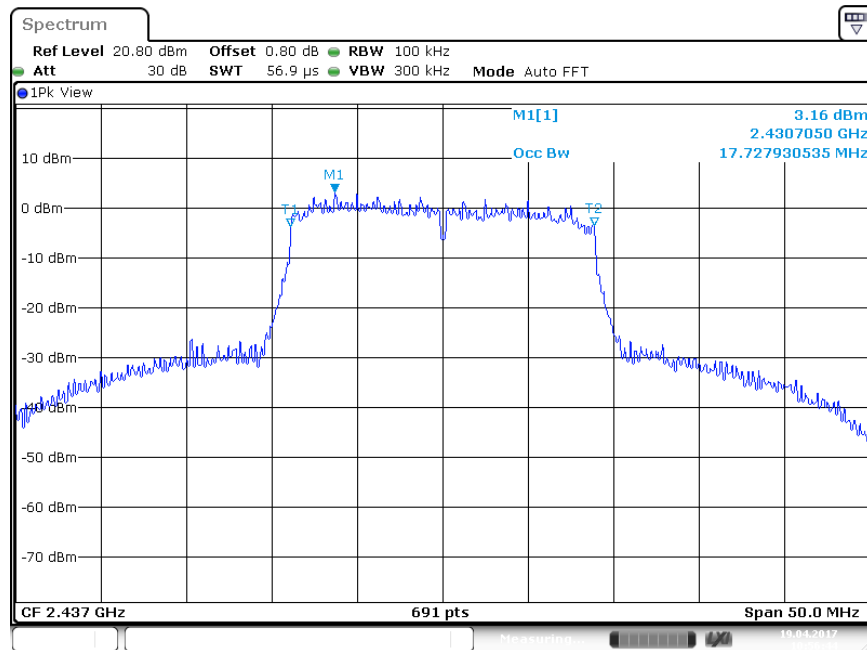
Date: 19 APR 2017 10:57:34

**Figure 7:** 99% Occupied Bandwidth, 2437 MHz at 802.11g 6Mbps



Date: 19 APR 2017 09:48:47

**Figure 8: 6dB Bandwidth, 2437 MHz at HT20 MCS7**



Date: 19 APR 2017 10:56:45

**Figure 9: 99% Occupied Bandwidth, 2437 MHz at HT20 MCS7**

### 4.3 Peak Power Spectral Density

According to the CFR47 Part 15.247 (e) and RSS 247 Sect.5.2.2, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

#### 4.3.1 Test Method

The conducted method was used to measure the channel power output per ANSI C63.10-2013 Section 11.10.3. The measurement was performed with modulation per CFR47 Part 15.247 (e) and RSS-247 Sect.5.2.2.

Test Setup: as per section 6.4.

#### 4.3.2 Results

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s). Plots for all the measurements stated above were taken, to reduce complexity and bulkiness of the report Highlighted Plots are placed in the report.

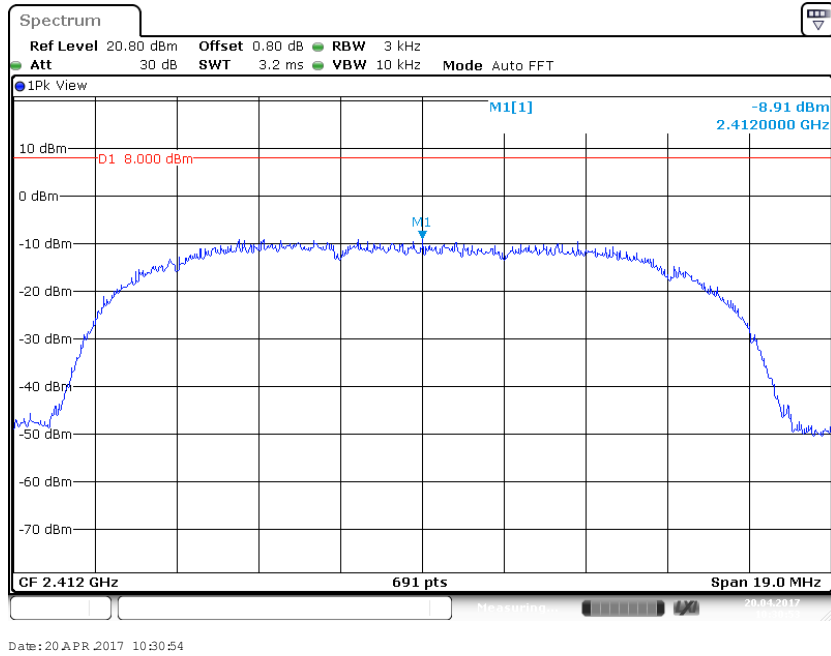
<b>Test Conditions:</b> Conducted Measurement, Normal Temperature	
<b>Power Setting:</b> See test plan	
<b>Ambient Temp.:</b> 22° C	<b>Relative Humidity:</b> 35%

**Table 6: Peak Power Spectral Density – Test Results**

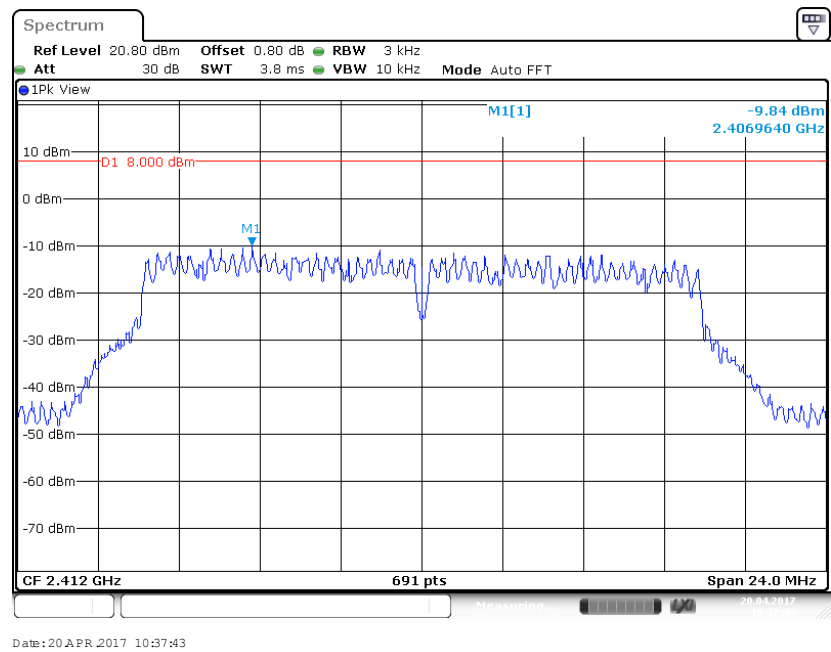
<b>802.11b</b>			
Frequency (MHz)	Max PPSD [dBm]	Limit [dBm]	Margin [dB]
2412	-7.30	8.00	-15.30
2437	-7.43	8.00	-15.43
2462	-8.32	8.00	-16.32
<b>Note:</b> 1. The highest peak output power was observed at <b>11b 1Mbps</b> .			
<b>802.11g</b>			
Frequency (MHz)	Max PPSD [dBm]	Limit [dBm]	Margin [dB]
2412	-9.84	8.00	-17.84
2437	-10.28	8.00	-18.28
2462	-10.81	8.00	-18.81
<b>Note:</b> 1. The highest peak output power was observed at <b>11g 54Mbps</b> .			

**Table 7: Peak Power Spectral Density – Test Results Continues**

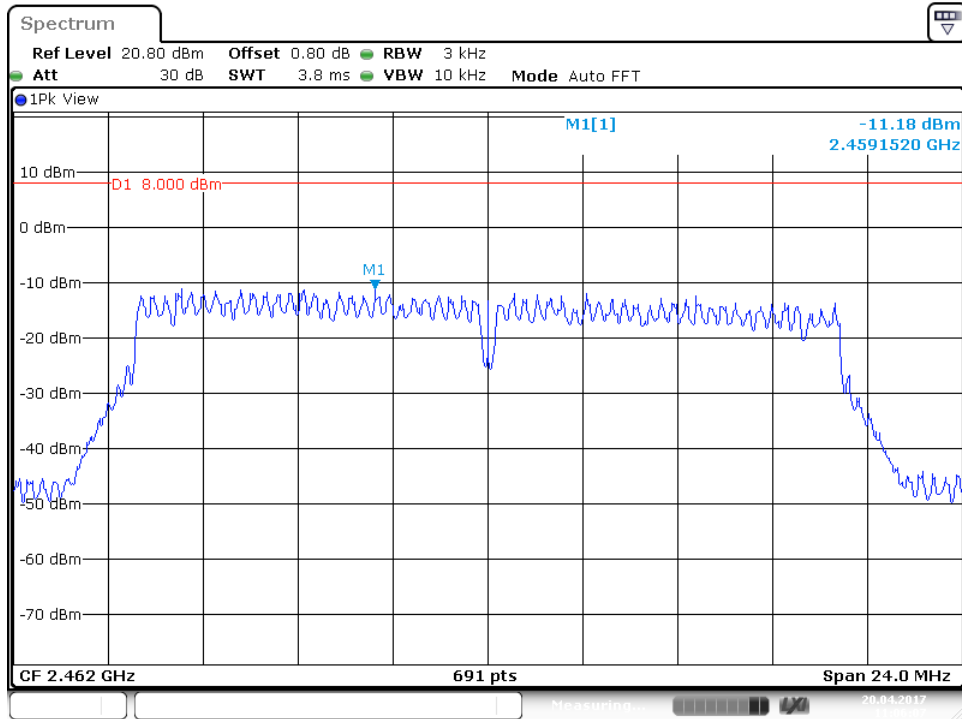
<b>802.11n</b>			
Frequency (MHz)	Max PPSD [dBm]	Limit [dBm]	Margin [dB]
2412	-10.74	8.00	-18.74
2437	-10.84	8.00	-18.84
2462	-11.19	8.00	-19.19
<b>Note:</b> 1. The highest peak output power was observed at <b>HT20 MCS0</b> .			



**Figure 10:** Power Spectral Density, 2412 MHz at 802.11b 11Mbps



**Figure 11:** Power Spectral Density, 2412 MHz at 802.11g 54Mbps



Date: 20 APR 2017 11:06:08

**Figure 12:** Power Spectral Density, 2412 MHz at HT20 MCS0

## 4.4 Out of Band Emissions

*Transmitter spurious emissions are emissions outside the frequency range of the equipment when the equipment is in transmitting mode; per requirement of CFR47 15.205, 15.209, 15.247(d), RSS-247 Sect. 5.5. In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.*

### 4.4.1 Test Method

The conducted method was used to measure the Out of band emissions. The measurement was performed with modulation. The marker-delta method, as described in ANSI C63.10 Section 11.13 was used. Measurements were performed using a spectrum analyzer with a suitable span to encompass the peak of the fundamental and using the following settings: RBW = 100kHz, VBW = 300kHz. Test Setup: as per section 6.4

The highest emission amplitudes relative to the appropriate limit were measured and recorded in this report.

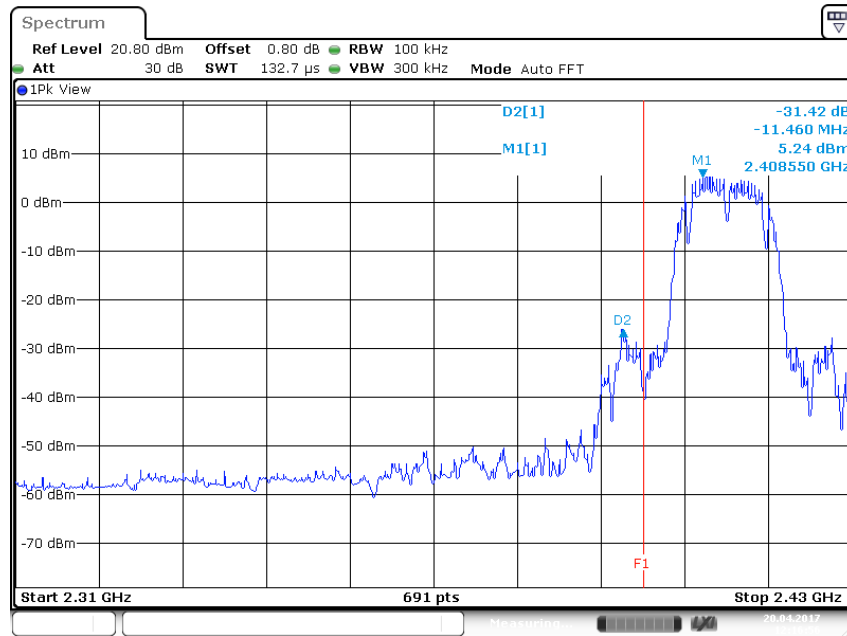
### 4.4.2 Results

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s). The line F1 in the plots refer to the bandedge frequency..

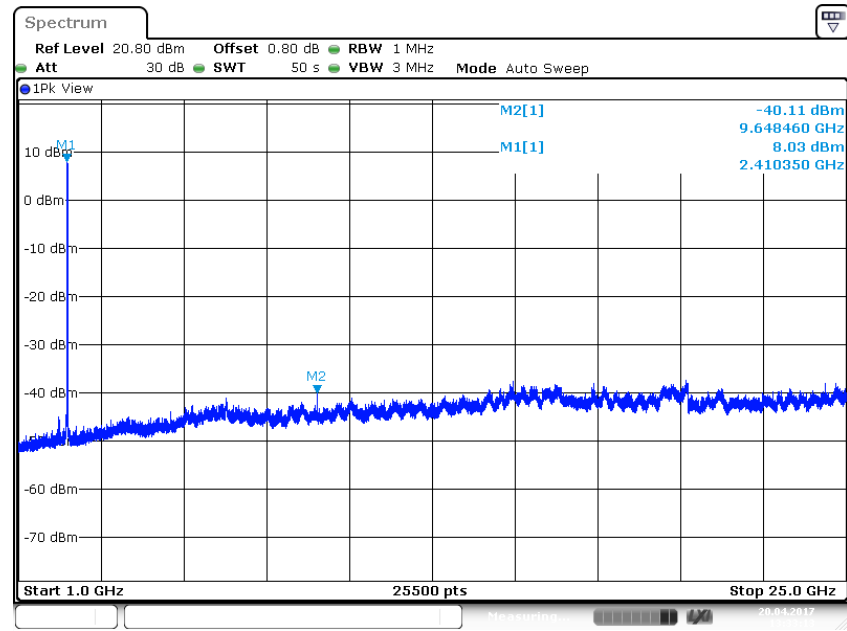
**Table 8:** Emissions at the Band-Edge – Test Results

<b>Test Conditions:</b> Conducted Measurement, Normal Temperature					
<b>Power Setting:</b> See test plan					
<b>Ambient Temp.:</b> 22° C			<b>Relative Humidity:</b> 35%		
<b>Restricted Frequency Band Emissions</b>					
Frequency (MHz)	Mode	Measured (dBc)	Limit (dBc)	Plots	Verdict
2400	11b-1Mbps	31.4	>20	Fig. 13, 14	Pass
2483.5	11b-1Mbps	60.6	>20	Fig. 15, 16	Pass
2400	11g-6Mbps	29.4	>20	Fig. 17, 18	Pass
2483.5	11g-6Mbps	42.8	>20	Fig. 19, 20	Pass
2400	HT20-MCS0	32.9	>20	Fig. 21, 22	Pass
2483.5	HT20-MCS0	45.3	>20	Fig. 23, 24	Pass
<b>Note:</b> 1. The worst case of each data rate is recorded.					

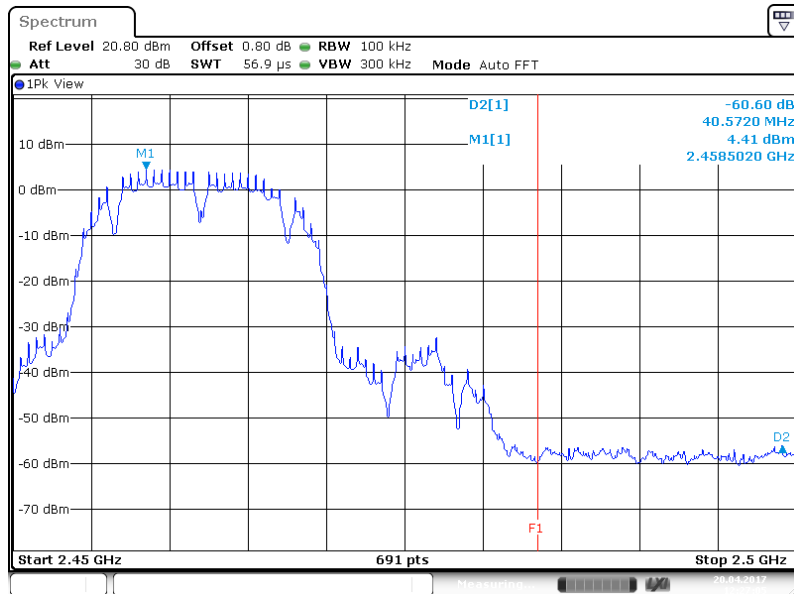




**Figure 13:** Measured Bandedge for 802.11b-1Mbps at 2412 MHz

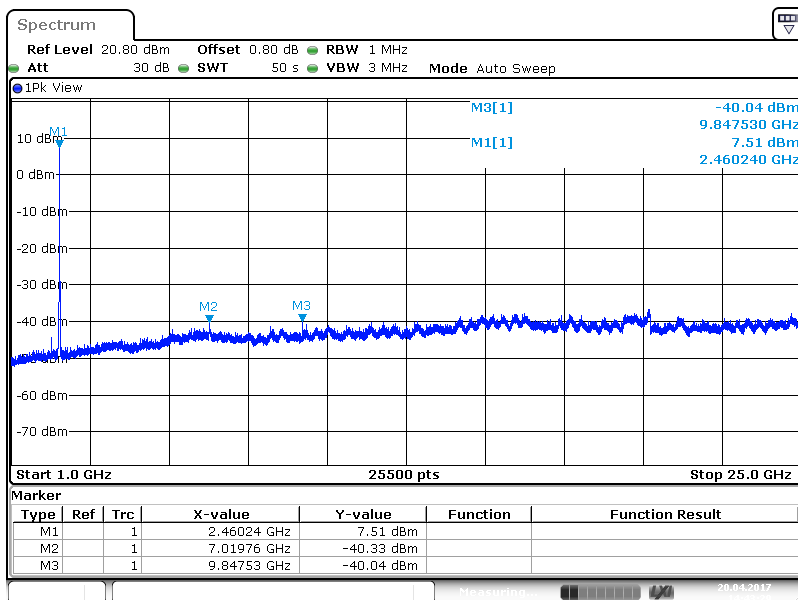


**Figure 14:** Out of Band Emissions for 802.11b-1Mbps at 2412 MHz



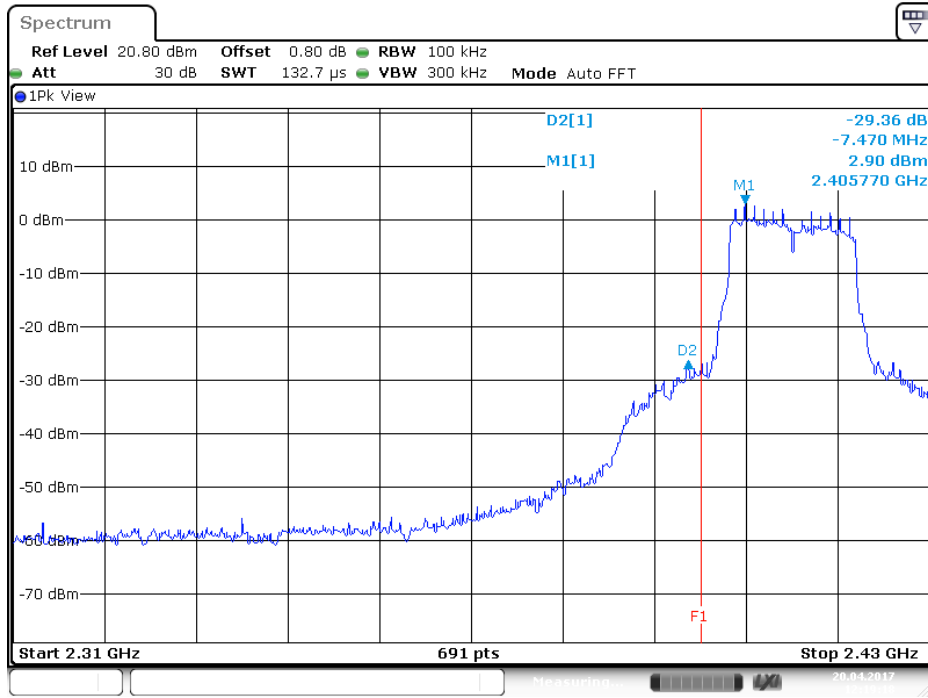
Date: 20 APR 2017 12:27:04

Figure 15: Measured Bandedge for 802.11b-1Mbps at 2462 MHz

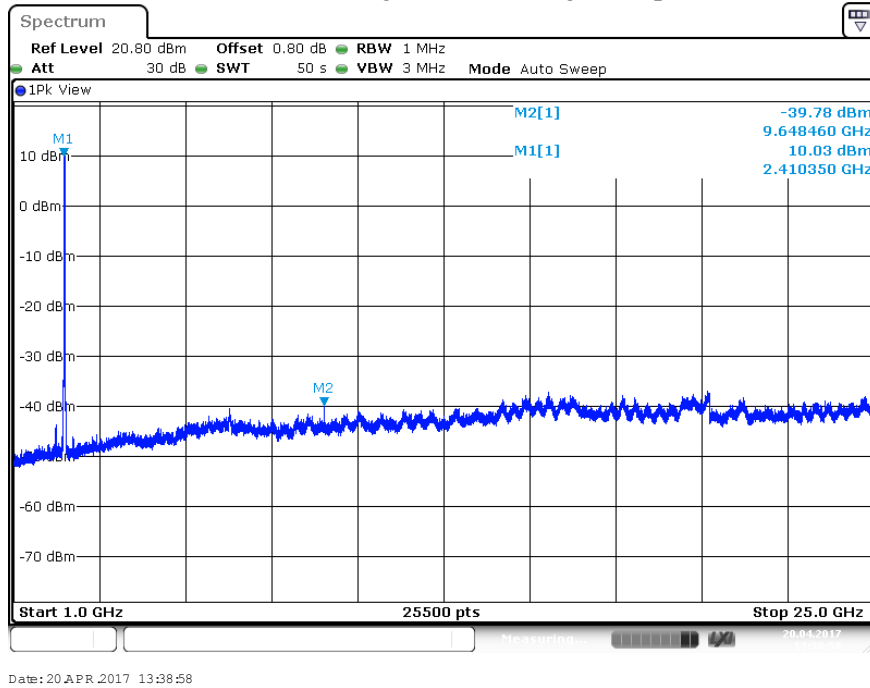


Date: 20 APR 2017 14:43:29

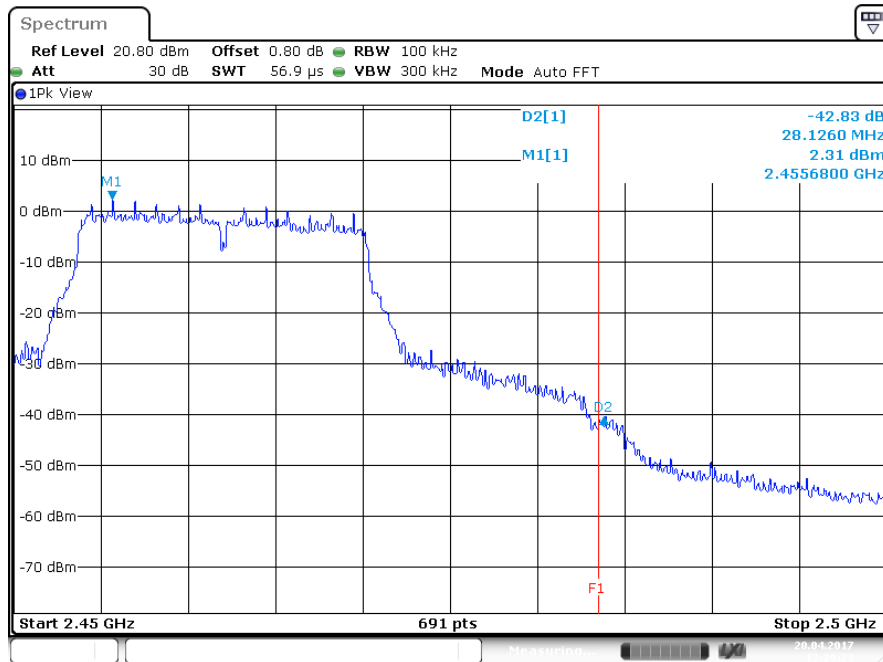
Figure 16: Out of Band Emissions for 802.11b-1Mbps at 2462 MHz



**Figure 17:** Measured Bandedge for 802.11g-6Mbps at 2412 MHz

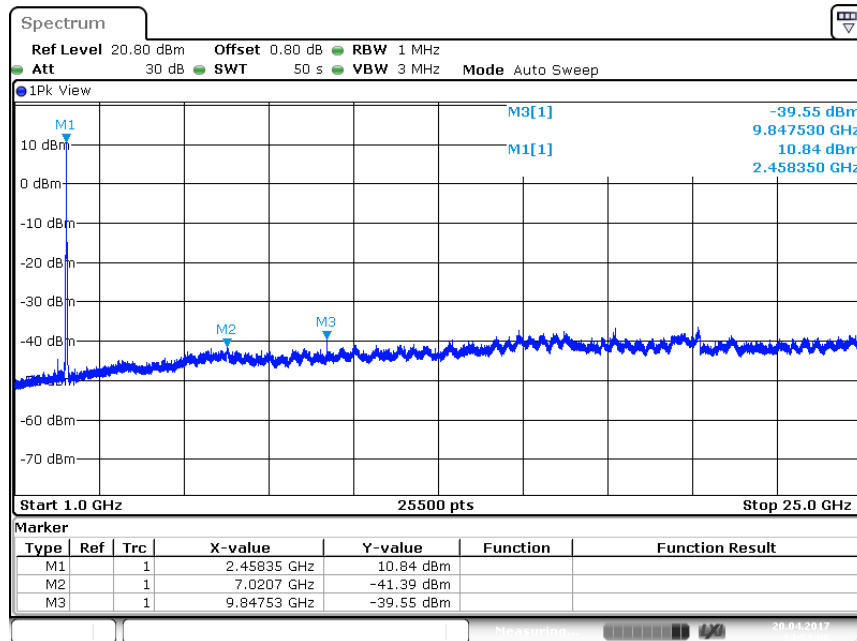


**Figure 18:** Out of Band Emissions for 802.11g-6Mbps at 2412 MHz



Date: 20 APR 2017 12:29:24

**Figure 19:** Measured Bandedge for 802.11g-6Mbps at 2462 MHz



Date: 20 APR 2017 14:51:06

**Figure 20:** Out of Band Emissions for 802.11g-6Mbps at 2462 MHz

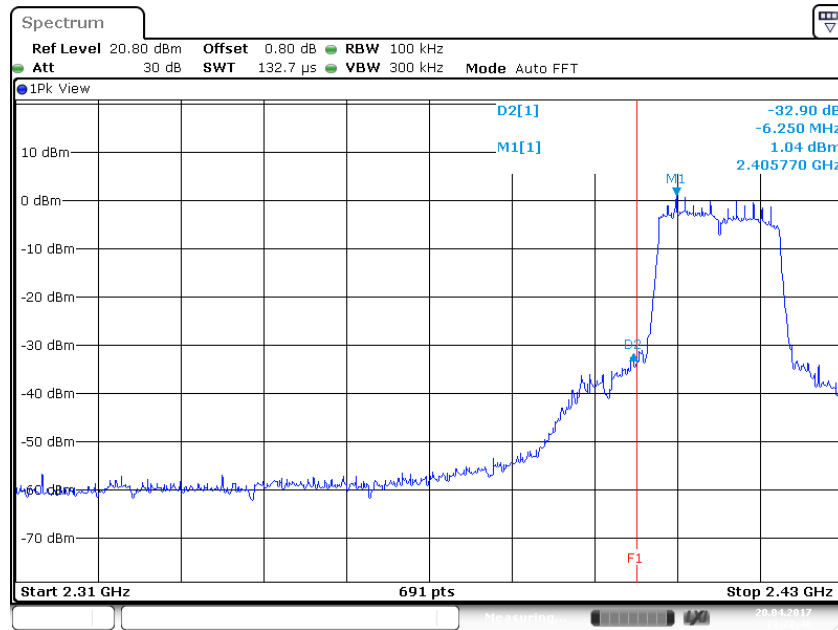


Figure 21: Measured Bandedge for HT20-MCS0 at 2412 MHz

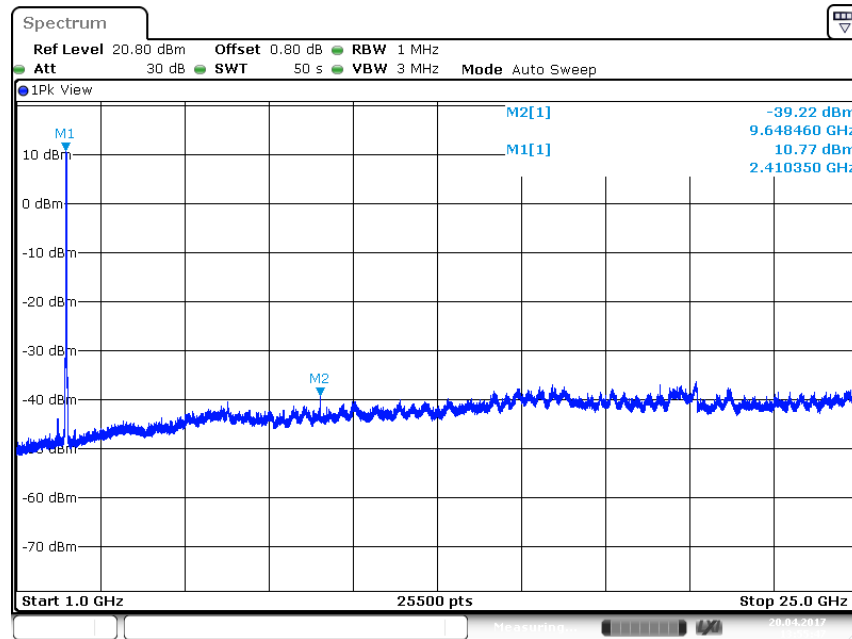
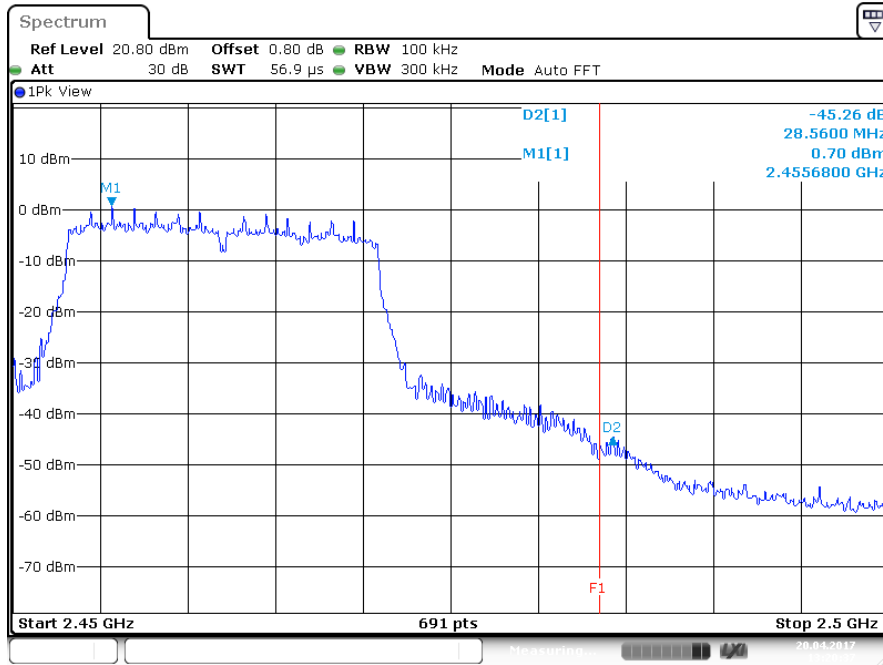
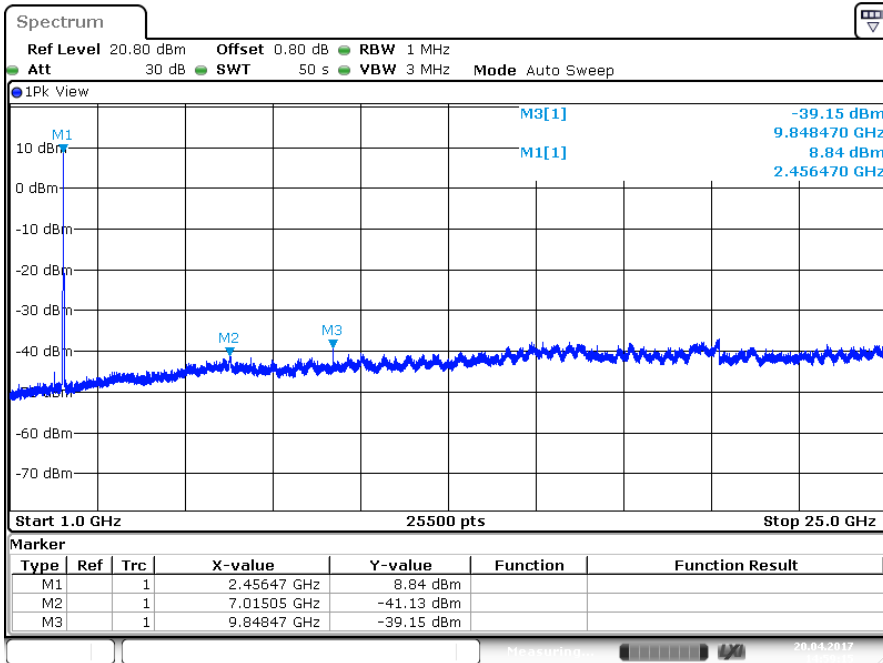


Figure 22: Out of Band Emissions for HT20-MCS0 at 2412 MHz



Date: 20 APR 2017 13:20:37

**Figure 23: Measured Bandedge for HT20-MCS0 at 2462 MHz**



Date: 20 APR 2017 14:59:15

**Figure 24: Out of Band Emissions for HT20-MCS0 at 2462 MHz**

## **4.5 Transmit Spurious Emissions**

*Transmitter spurious emissions are emissions outside the frequency range of the equipment when the equipment is in transmit mode; per requirement of CFR47 15.205, 15.209, 15.247(d), RSS-247 Sect.5.5.*

### **4.5.1 Test Methodology**

#### **4.5.1.1 Preliminary Test**

For each frequency the turntable was rotated 360° while peak emission data was recorded and plotted over the frequency range of interest in horizontal and vertical antenna polarization's.

Preliminary emission profile testing was performed inside the anechoic chamber. The EUT was placed on a non-conductive table 80cm (<1 GHz) and 150cm (>1 GHz) above the floor. The EUT was positioned as shown in the setup photographs. The receiving antenna was placed at a distance of 3m. The spectrum was examined from 30MHz to the 10th harmonic of the highest fundamental transmitter frequency (25GHz).

Pres-scans were performed to determine the worst case data rate.

#### **4.5.1.2 Final Test**

For each frequency measured, the peak emission was maximized by manipulating the receiving antenna from 1 to 4 meters above the ground plane and placing it at the position that produced the maximum signal strength reading. The turntable was then rotated through 360° while observing the peak signal and placing the EUT at the position that produced maximum radiation. The six highest emissions relative to the limit were measured unless such emissions were more than 20 dB below the limit. If less than six emissions are within 20 dB of the limit, then the noise level of the receiver is measured at frequencies where emissions are expected. Multiples of all oscillator and microprocessor frequencies were also checked. The levels are expressed in dBm which are derived from  $\text{dBm} = E(\text{dB}\mu\text{V}/\text{m}) - 95.2\text{dB}$ . Where Peak (Pk) values were at least 6 dB under the Average (Av) limits, Av value was not tested. Where Average values were tested, Average values were measured using a 10Hz Video Bandwidth.

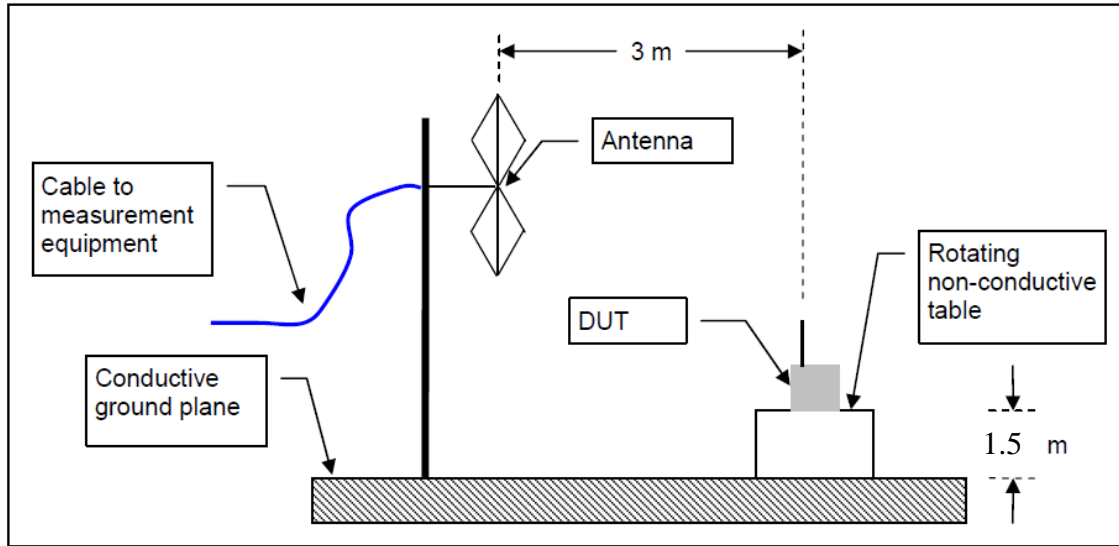
Final testing was performed on an NSA compliant test site. The EUT was placed on a non-conductive table 80cm (<1 GHz) and 150cm (>1 GHz) above the ground plane. The placement of EUT and cables were the same as for preliminary testing and is shown in the setup photographs.

Final results are: 802.11b (covered 802.11g and HT20 for 20 MHz channel BW).

#### **4.5.1.3 Deviations**

None.

**Test Setup:**



**4.5.2 Transmitter Spurious Emission Limit**

The spurious emissions of the transmitter shall not exceed the values in CFR47 Part 15.205, 15.209 and RSS-Gen Table 4.

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F (kHz)	300
0.490-1.705	24000/F (kHz)	30
1.705-30.0	30	30
30-88	100 **	3
88-216	150 **	3
216-960	200 **	3
Above 960	500	3

All harmonics and spurious emission which are outside of the restricted band shall be 20dB below the in-band emission.

**4.5.3 Test Results**

The final measurement data was taken under the worst case operating modes, configurations, and/or cable positions. It also reflects the results including any modifications and/or special accessories listed in Sections 1.4 and test plan.

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).



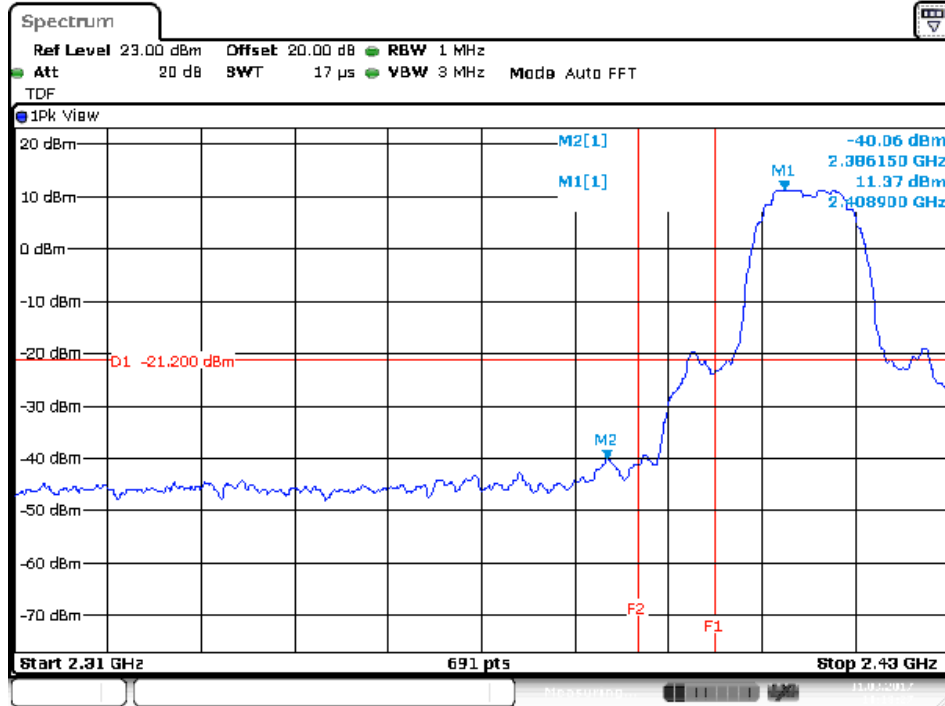
**Table 9: Transmit Spurious Emission at Band-Edge Requirements**

<b>Band-Edge Results, External antenna</b>						
Frequency (MHz)	Level (dBm)	Pol. (H/V)	Limit (dBm)	Margin (dB)	Detector	Note
2386.15	-40.1	V	-21.2	-18.9	Pk	PLOT 25: 11b-1Mbps-2412MHz EUT Z
2386.24	-51.7	V	-41.2	-10.5	Ave	PLOT 26: 11b-1Mbps-2412MHz EUT Z
2486.215	-42.4	V	-21.2	-21.2	Pk	PLOT 27: 11b-11Mbps-2462MHz EUT Z
2483.512	-56.2	V	-41.2	-15.1	Ave	PLOT 28: 11b-11Mbps-2462MHz EUT Z
2389.10	-23.0	V	-21.2	-1.8	Pk	PLOT 29: 11g54Mbps-2412MHz EUT V
2389.99	-44.5	V	-41.2	-3.3	Ave	PLOT 30 11g54Mbps-2412MHz EUT V
2483.538	-23.2	V	-21.2	-2.0	Pk	PLOT 31: 11g-54Mbps-2462MHz EUT Z
2483.512	-45.7	V	-41.2	-4.5	Ave	PLOT 32: 11g-54Mbps-2462MHz EUT Z
2389.45	-27.5	V	-21.2	-6.3	Pk	PLOT 33: HT20MCS0-2412MHz EUT V
2389.45	-45.0	V	-41.2	-3.8	Ave	PLOT 34: not available
2484.117	-22.0	V	-21.2	-0.8	Pk	PLOT 35: HT20MCS0-2462MHz EUT Z
2483.512	-41.9	V	-41.2	-0.7	Ave	PLOT 36: HT20MCS0-2462MHz EUT Z

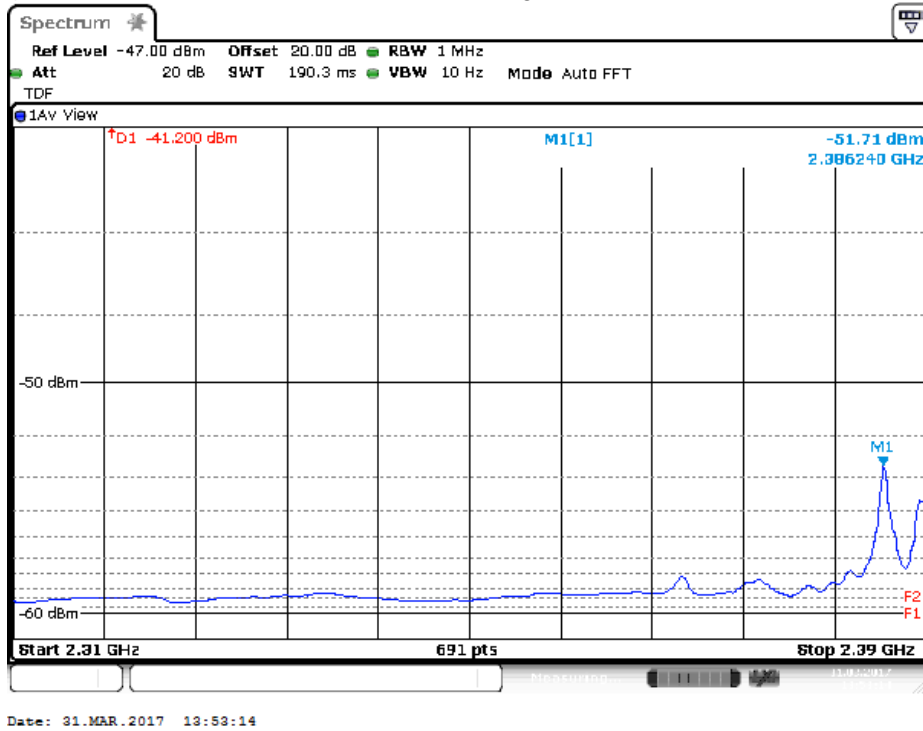
**Note:** 1. The emissions were measured at the adjacent restricted band of the fundamental signal.  
 2. All the band-edge measurements met the restricted band requirements of CFR47 15.205.  
 3. Plots: F1 line refers to band edge frequency, F2 line refers to restricted band

<b>Band-Edge Results, Internal antenna</b>						
Frequency (MHz)	Level (dBm)	Pol. (H/V)	Limit (dBm)	Margin (dB)	Det.	Note
2385.80	-50.9	V	-21.2	-29.7	Pk	PLOT 37: 11b-1Mbps-2412MHz EUT V
2385.80	-50.9	V	-41.2	-9.7	Ave	PLOT 38: 11b-1Mbps-2412MHz EUT V see plot 37 Pk already within Ave limits
2483.589	-51.2	V	-21.2	-30.0	Pk	PLOT 39: 11b-1Mbps-2462MHz EUT V
2483.589	-51.2	V	-41.2	-10.0	Ave	PLOT 40: 11b-1Mbps-2462MHz EUT V see plot 39 Pk already within Ave limits
2389.45	-31.9	V	-21.2	-10.7	Pk	PLOT 41: 11g6Mbps-2412MHz EUT V
2389.45	-47.0	V	-41.2	-5.8	Ave	PLOT 42 11g54Mbps-2412MHz EUT V
2483.61	-28.9	V	-21.2	-7.7	Pk	PLOT 43: 11g-54Mbps-2462MHz EUT V
2483.76	-50.6	V	-41.2	-9.4	Ave	PLOT 44: 11g-54Mbps-2462MHz EUT V
2389.28	-24.8	V	-21.2	-3.6	Pk	PLOT 45: HT20MCS7-2412MHz EUT V
2389.28	-53.1	V	-41.2	-11.9	Ave	PLOT 46: HT20MCS7-2412MHz EUT V
2483.61	-27.6	V	-21.2	-6.4	Pk	PLOT 47: HT20MCS0-2462MHz EUT V
2483.76	-52.2	V	-41.2	-11.0	Ave	PLOT 48: HT20MCS0-2462MHz EUT V
<b>Note:</b> 1. The emissions were measured at the adjacent restricted band of the fundamental signal. 2. All the band-edge measurements met the restricted band requirements of CFR47 15.205. 3. Plots: F1 line refers to band edge frequency, F2 line refers to restricted band						

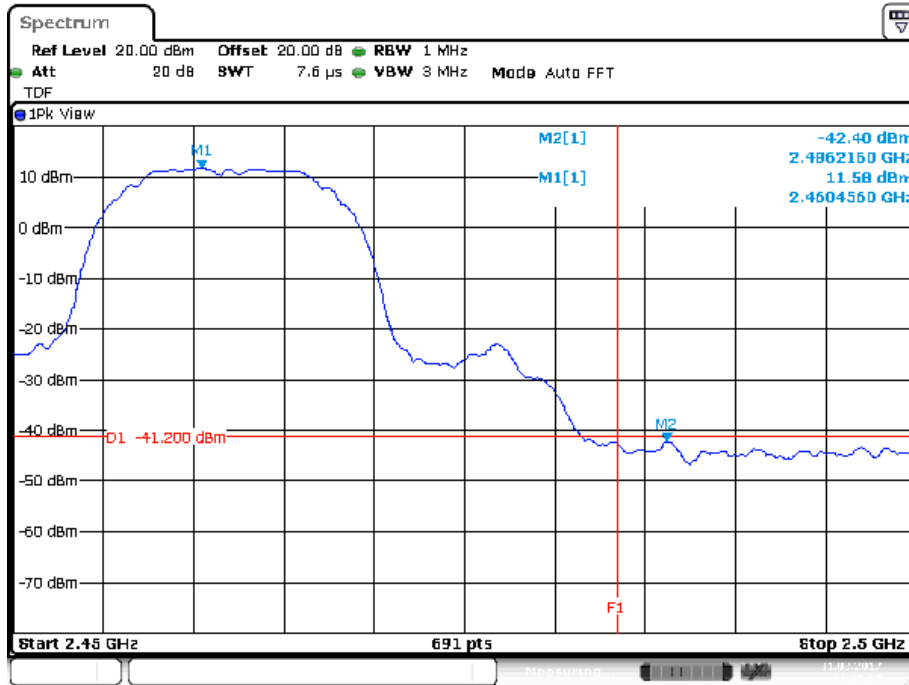
*External antenna*



**Figure 25:** Radiated Emission at 2390 MHz Edge for 2412 MHz-802.11b – Vert. (Pk)

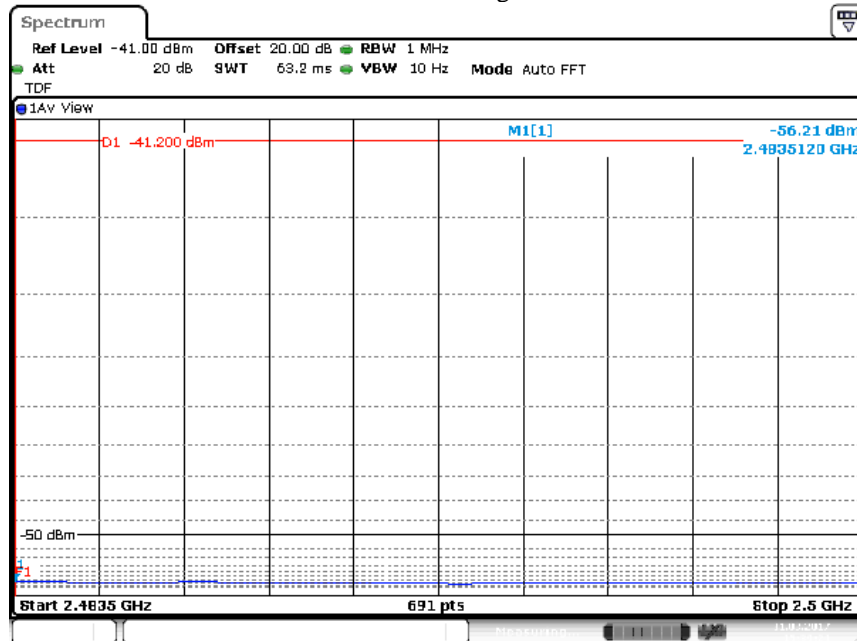


**Figure 26:** Radiated Emission at 2390 MHz Edge for 2412 MHz-802.11b – Vert. (Ave)



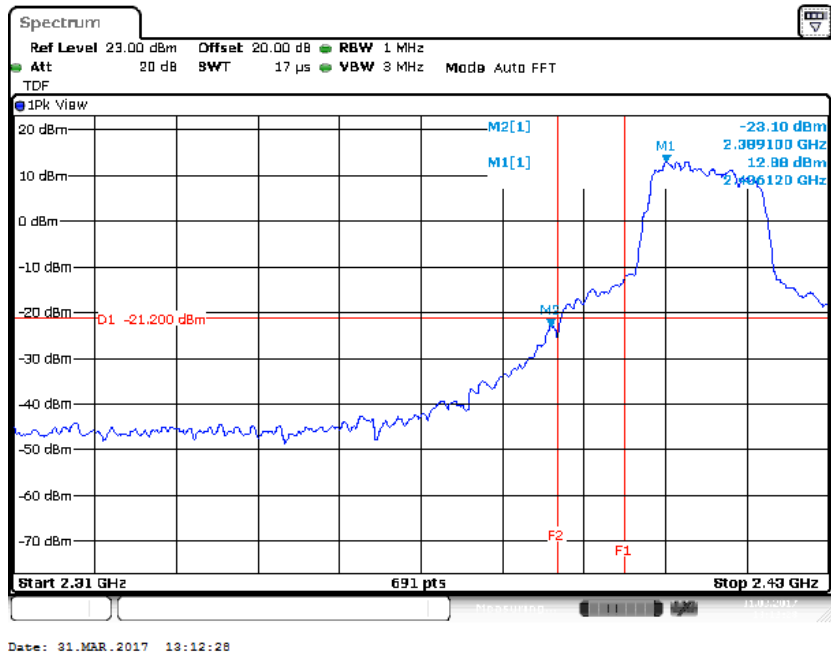
Date: 31.MAR.2017 14:25:07

**Figure 27:** Radiated Emission at 2483.5 MHz Edge for 2462 MHz-802.11b – Vert. (Pk)

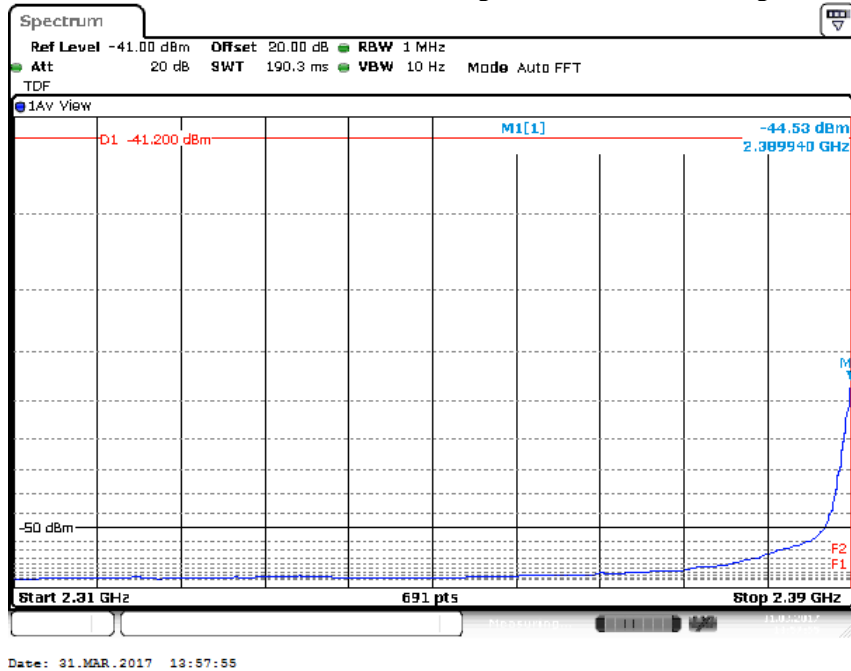


Date: 31.MAR.2017 15:39:21

**Figure 28:** Radiated Emission at 2483.5 MHz Edge for 2462 MHz-802.11b – Vert. (Ave)



**Figure 29:** Radiated Emission at 2390 MHz Edge for 2412 MHz-802.11g – Vert. (Pk)

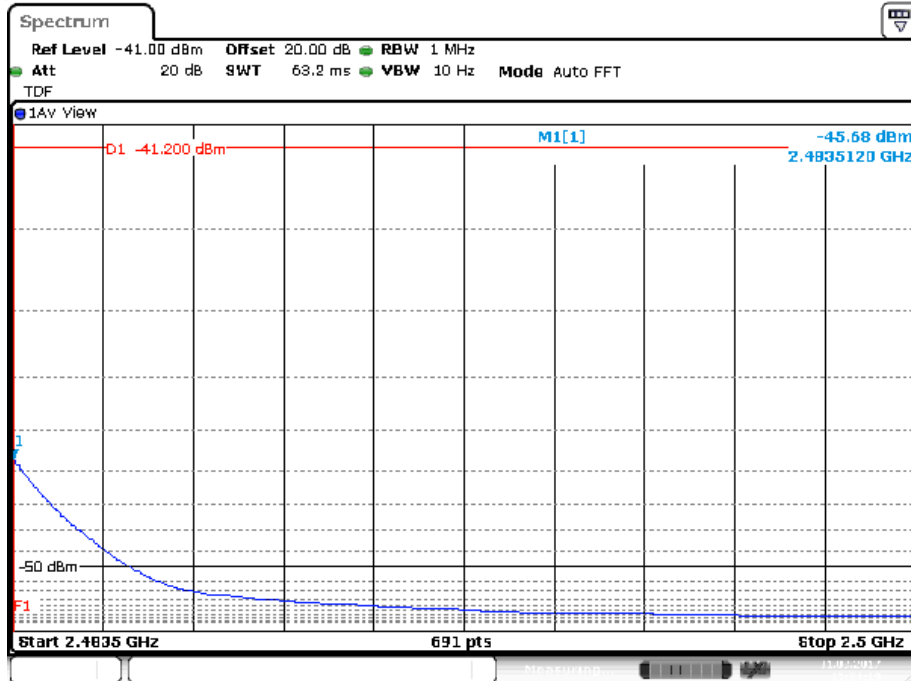


**Figure 30:** Radiated Emission at 2390 MHz Edge for 2412 MHz-802.11g – Vert. (Ave)



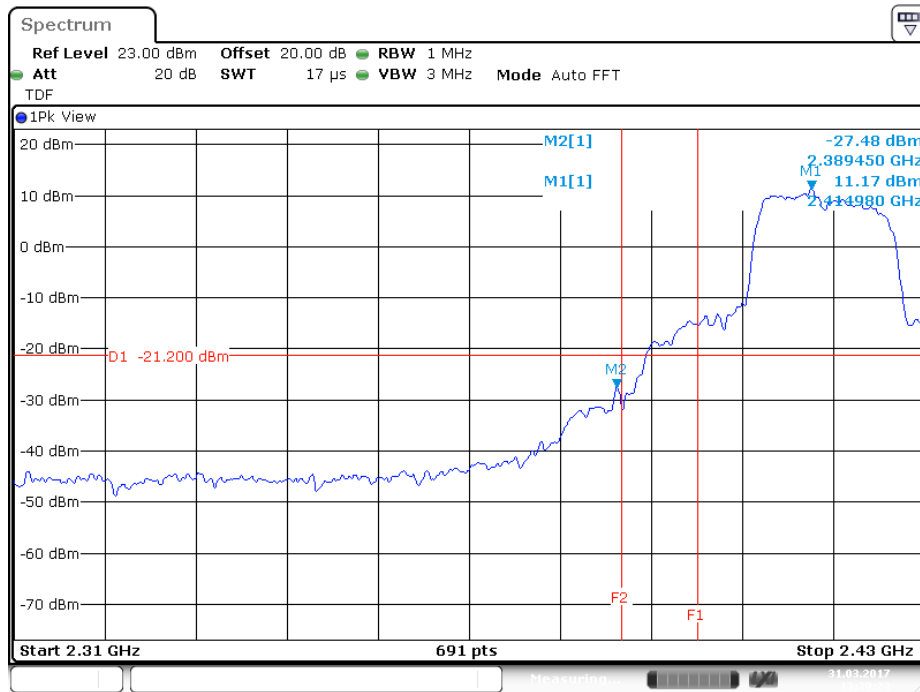
Date: 31.MAR.2017 14:54:21

**Figure 31:** Radiated Emission at 2483.5 MHz Edge for 2462 MHz-802.11g – Vert. (Pk)



Date: 31.MAR.2017 15:34:19

**Figure 32:** Radiated Emission at 2483.5 MHz Edge for 2462 MHz-802.11g – Vert. (Ave)



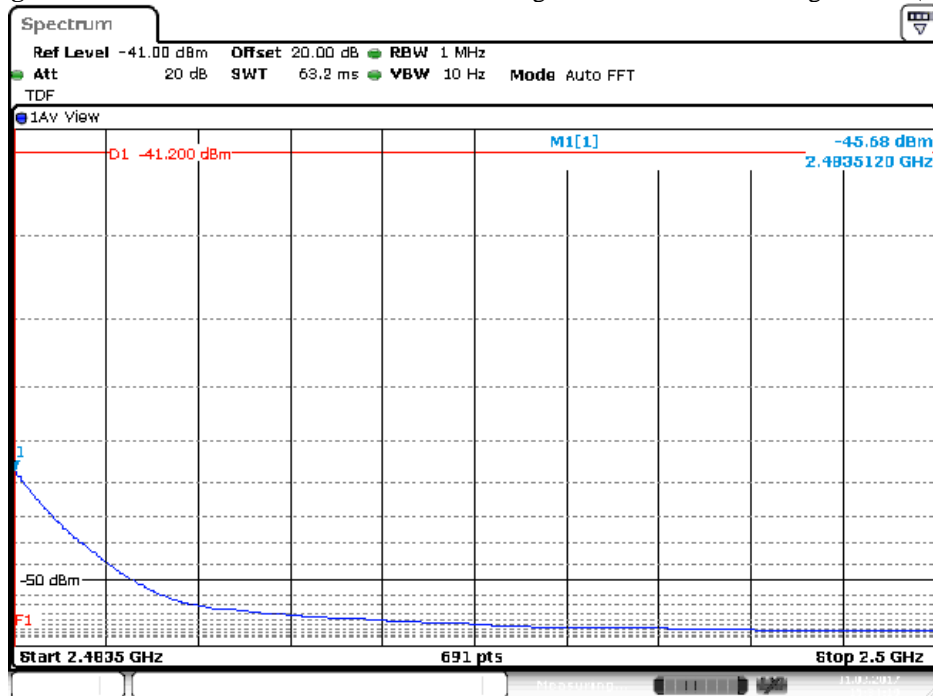
**Figure 33:** Radiated Emission at 2390 MHz Edge for 2412 MHz-802.11n – Vert. (Pk)

**Figure 34:** Intentionally left blank



Date: 31.MAR.2017 14:54:21

**Figure 35:** Radiated Emission at 2483.5 MHz Edge for 2462 MHz-802.11g – Vert. (Pk)

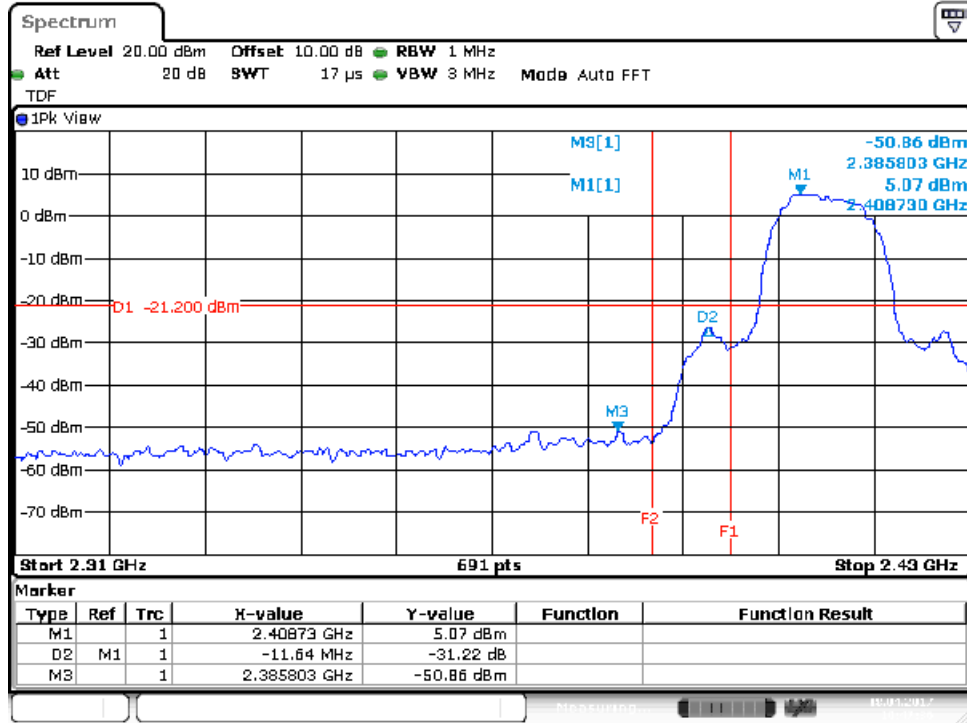


Date: 31.MAR.2017 15:34:19

**Figure 36:** Radiated Emission at 2483.5 MHz Edge for 2462 MHz-802.11n – Vert (Ave)



*Internal Antenna*



Date: 18.APR.2017 10:47:36

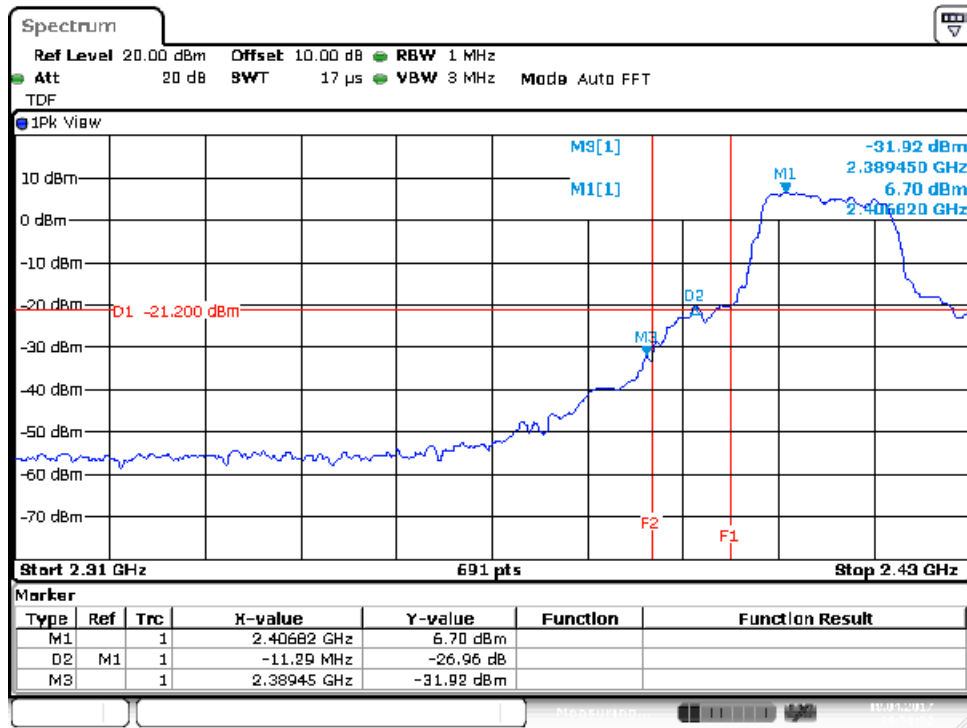
**Figure 37:** Radiated Emission at 2390 MHz Edge for 2412 MHz-802.11b- Vert. (Pk)

**Figure 38:** intentionally left blank



**Figure 39:** Radiated Emission at 2483.5 MHz Edge for 2462 MHz-802.11b- Vert. (Pk)

**Figure 40:** intentionally left blank



Date: 18.APR.2017 10:56:52

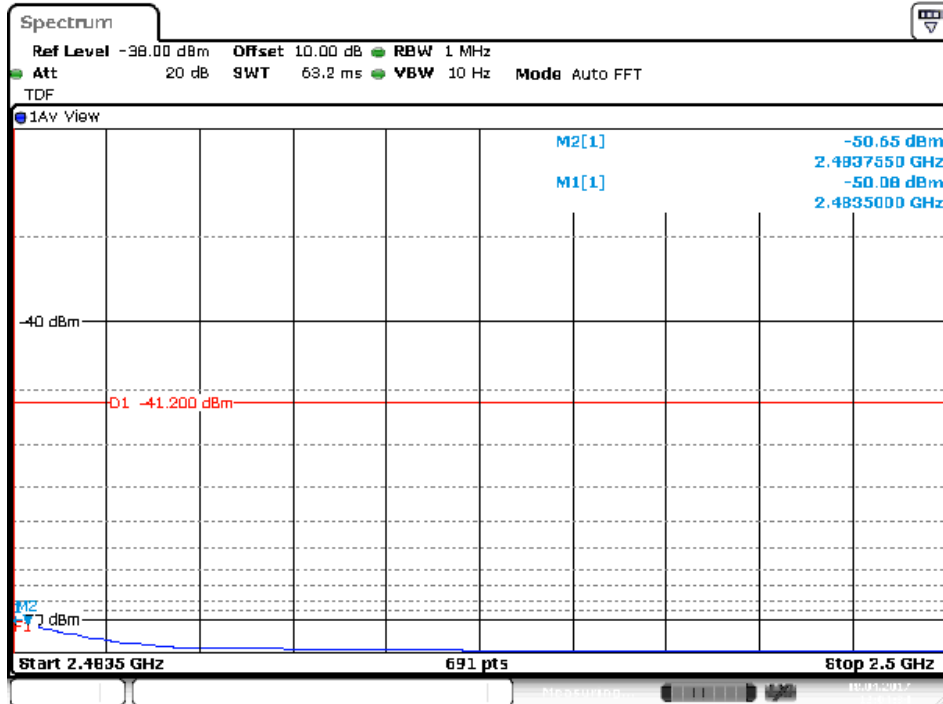
**Figure 41:** Radiated Emission at 2390 MHz Edge for 2412 MHz-802.11g- Vert. (Pk)

**Figure 42:** intentionally left blank



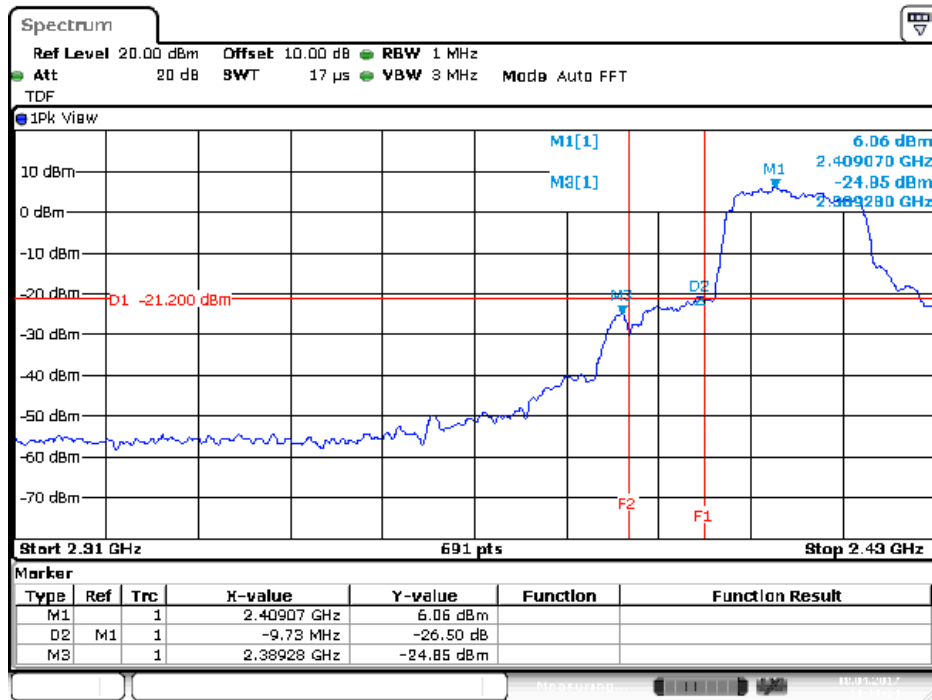
Date: 18.APR.2017 11:50:01

**Figure 43:** Radiated Emission at 2483.5 MHz Edge for 2462 MHz-802.11g- Vert (Pk)



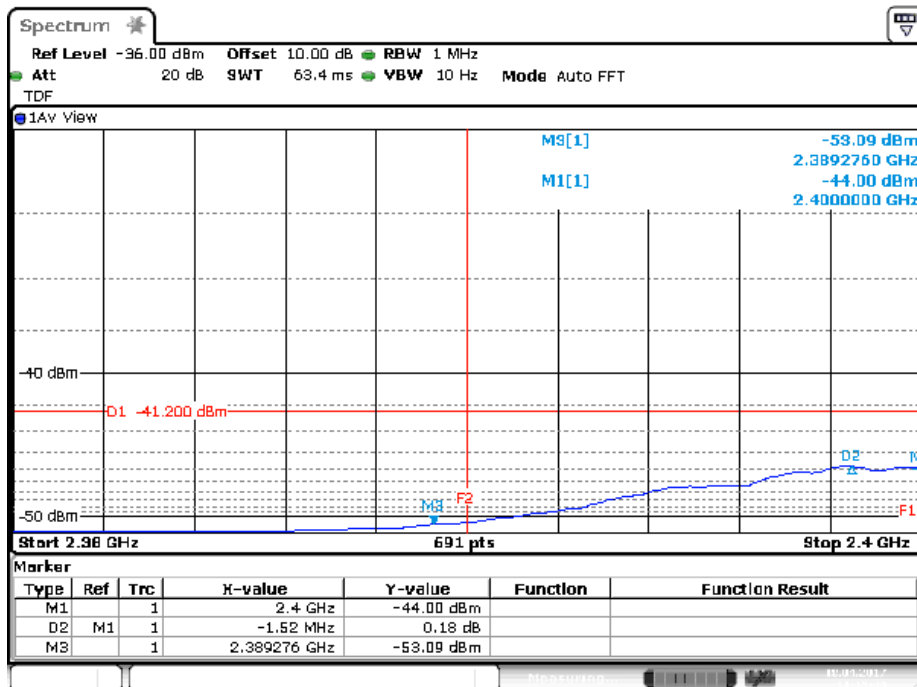
Date: 18.APR.2017 12:04:35

**Figure 44:** Radiated Emission at 2483.5 MHz Edge for 2462 MHz-802.11g- Vert. (Ave)



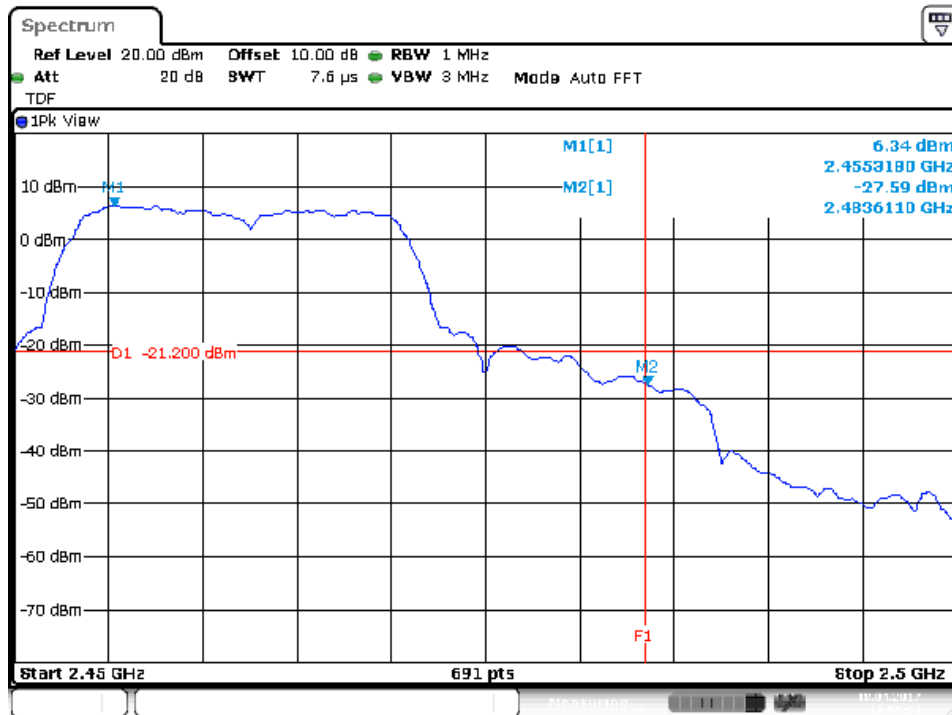
Date: 18.APR.2017 11:11:24

**Figure 45:** Radiated Emission at 2390 MHz Edge for 2412 MHz-802.11n- Vert. (Pk)



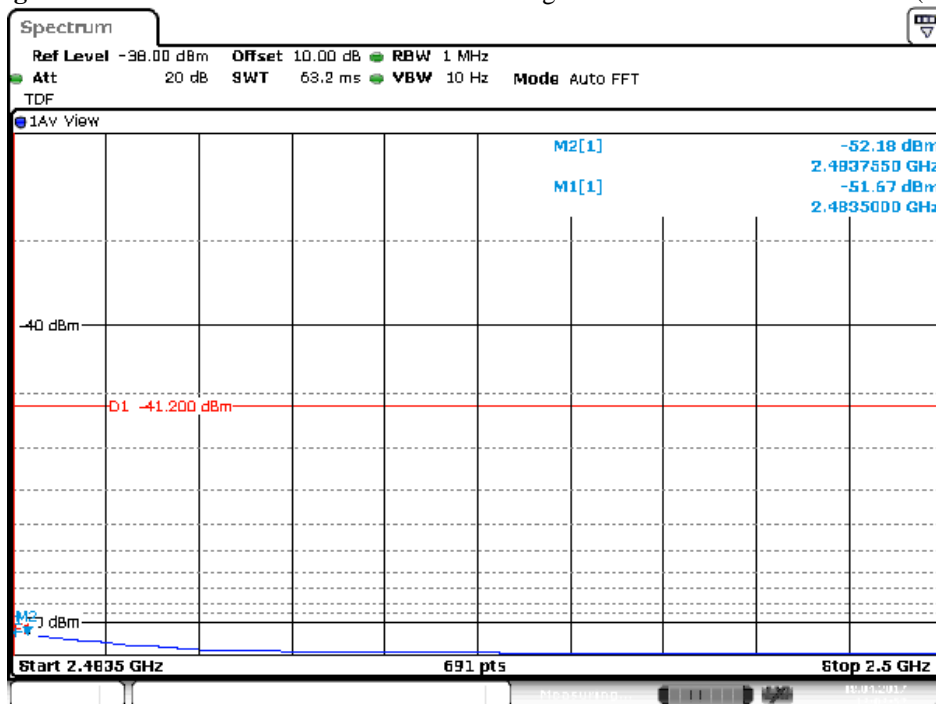
Date: 18.APR.2017 11:15:49

**Figure 46:** Radiated Emission at 2390 MHz Edge for 2412 MHz-802.11n- Vert. (Ave)



Date: 18.APR.2017 11:55:51

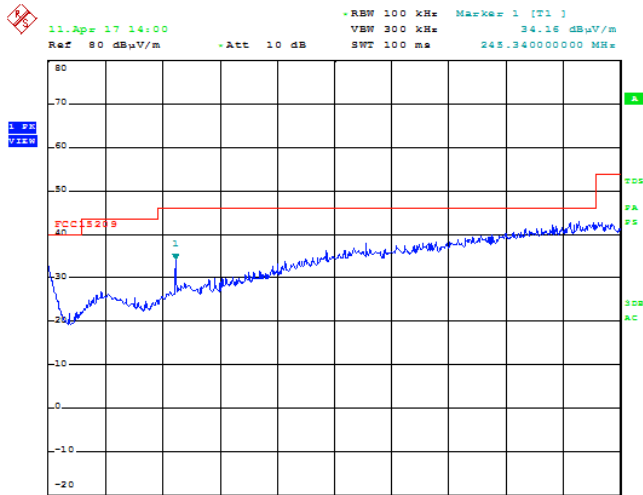
**Figure 47:** Radiated Emission at 2483.5 MHz Edge for 2462 MHz-802.11n-Horz. (Pk)



Date: 18.APR.2017 12:02:52

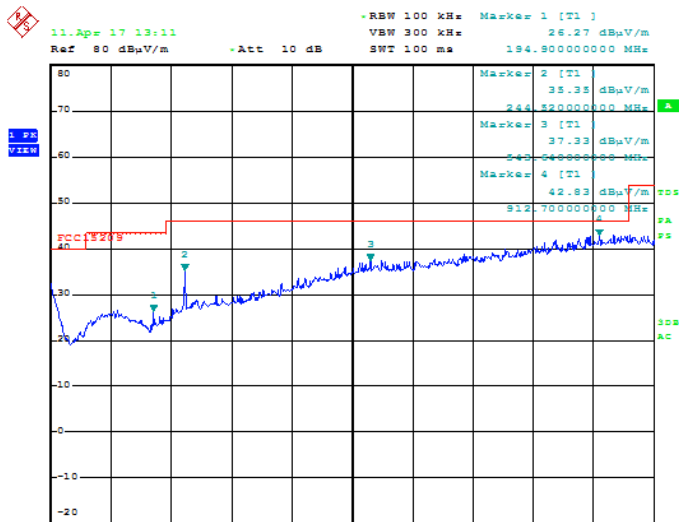
**Figure 48:** Radiated Emission at 2483.5 MHz Edge for 2462 MHz-802.11n-Vert. (Ave)

Radiated Emissions				Tracking # 17030802.fcc 01_Rev02			
<b>EUT</b>	With Internal antenna / External antenna						
<b>EUT Config.</b>	See table						
<b>Standard</b>	CFR47 Part 15 Subpart C, RSS-247, RSS-GEN			<b>RBW / VBW</b>	120 kHz/ 300 kHz		
<b>Dist/Ant Used</b>	3m			<b>Performed by</b>	R. van der Meer		
Internal antenna 30 MHz – 1 GHz							
Frequency	EUT	EUT	Level	Detector	Polarity	Limit	Margin
MHz	Mode and frequency	Orientation H/V/N	dB $\mu$ V/m		H/V	dB $\mu$ V/m	dB
174.4	802.11b 1Mbps 2412 MHz	V	23.8	QP	V	43.5	-19.7
241.2 <sup>R</sup>	802.11g 6Mbps 2412 MHz	V	26.6	QP	V	46.0	-19.4
243.7 <sup>R</sup>	802.11g 54Mbps 2437 MHz	V	31.0	QP	V	46.0	-15.0
245.7 <sup>R</sup>	802.11n mcs7 2462 MHz	V	33.9	QP	V	46.0	-12.1
246.2 <sup>R</sup>	802.11g 54Mbps 2462 MHz	V	34.6	QP	V	46.0	-11.4
947.6 noise	all	V	35.0	QP	V	46.0	-11.0
External antenna 30 MHz – 1 GHz							
Frequency	EUT	EUT	Level	Detector	Polarity	Limit	Margin
MHz	Mode and frequency	Orientation H/V/N	dB $\mu$ V/m		H/V	dB $\mu$ V/m	dB
174.37	802.11b 11Mbps 2462 MHz	H	32.6	QP	V	43.5	-10.9
194.90	802.11g 54Mbps 2462 MHz	H	35.1	QP	V	43.5	-8.4
221.20	802.11b 1Mbps 2412 MHz	V	19.5	QP	V	46.0	-26.5
328.26	802.11b 11Mbps 2462 MHz	H	28.8	QP	V	46.0	-17.2
773.02 noise	802.11b 1Mbps 2412 MHz	H	32.4	QP	H	46.0	-13.6
832.34 noise	802.11b 11Mbps 2462 MHz	H	34.0	QP	V	46.0	-12.0
Note: 1. Above 500 MHz only noise noted. 2. Tested preliminary are 802.11b, 802.11g, HT20 (low, mid & high channel), worst case values noted. 3. To reduce complexity and bulkiness of the report Worst case Plots is placed in the report. 4. <sup>R</sup> refers to an emission in a restricted band.							



ORI  
Date: 11.APR.2017 14:00:13

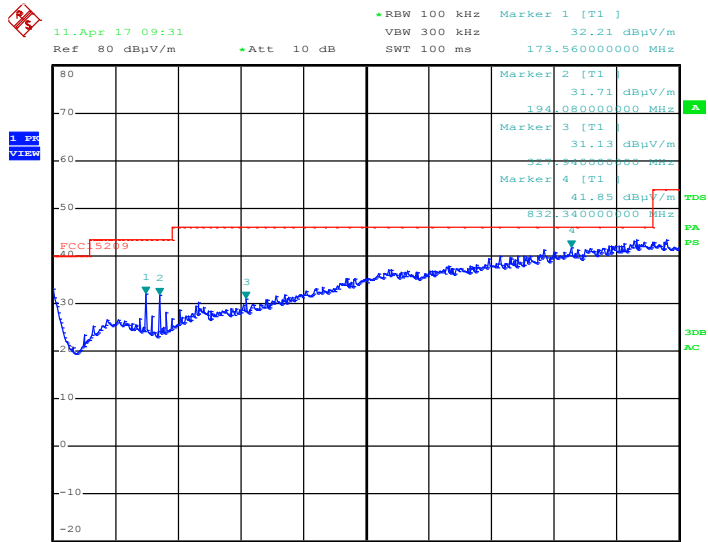
*Plot of the emissions (peak values shown) Internal antenna, EUT Vertical, Antenna Vertical-802.11n mcs7 2462MHz*



ORI  
Date: 11.APR.2017 13:11:52

*Plot of the emissions (peak values shown) Internal antenna, EUT Vertical, Antenna Vertical-802.11g 54mbps 2462MHz*

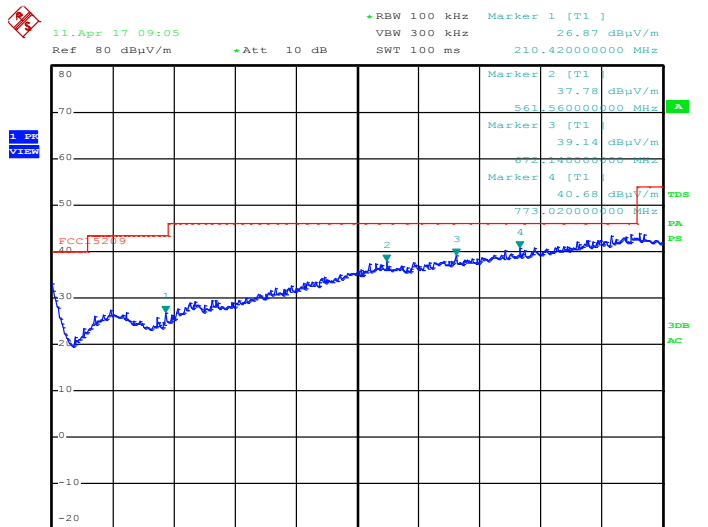




ORI

Date: 11.APR.2017 09:31:54

*Plot of the emissions (peak values shown) External antenna, EUT Horizontal, Antenna Vertical-802.11b 11Mbps 2462MHz*

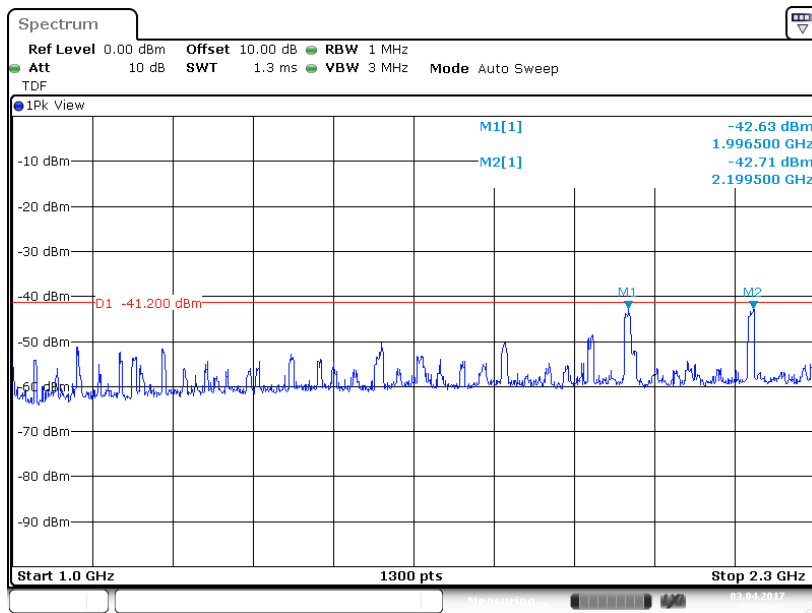


ORI

Date: 11.APR.2017 09:05:57

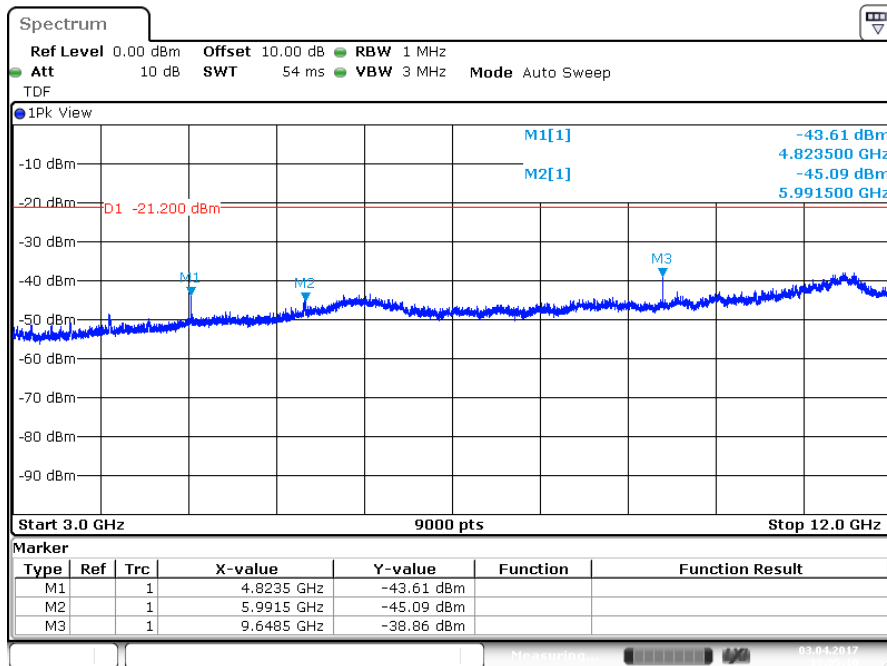
*Plot of the emissions (peak values shown) External antenna, EUT Horizontal, Antenna Vertical-802.11b 1Mbps 2412MHz*

Radiated Emissions				Tracking # 17030802.fcc 01_Rev02			
<b>EUT</b>		With External antenna		<b>Date</b>		April 03–10, 2017	
<b>EUT Config.</b>		802.11b		<b>RBW / VBW</b>		1 MHz/ 3 MHz	
<b>Standard</b>		CFR47 Part 15 Subpart C, RSS-247, RSS-GEN		<b>Performed by</b>		Richard van der Meer	
<b>Dist/Ant Used</b>		3m					
1 – 25 GHz Transmit at 2412 MHz (Low Channel)							
Frequency	EUT	EUT	Level	Detector	Polarity	Limit	Margin
MHz	Mode	Orientation	dBm		H/V	dBm	dB
1996.5	802.11b 1Mbps	Z	-42.6	Peak	V	-21.2	-21.4
2199.5	802.11b 1Mbps	Z	-42.7	Peak	V	-21.2	-21.5
3407.5	802.11b 1Mbps	Z	-38.2	Peak	V	-21.2	-16.0
3407.5	802.11b 1Mbps	Z	-66.4	Average	V	-41.2	-25.2
4824.5 <sup>H</sup>	802.11b 11Mbps	V	-42.8	Peak	V	-21.2	-21.6
4824.5 <sup>H</sup>	802.11b 11Mbps	V	<-55	Average	V	-41.2	-13.8
9648.5 <sup>H</sup>	802.11b 1Mbps	Z	-40.6	Peak	V	-21.2	-19.4
9648.5 <sup>H</sup>	802.11b 1Mbps	Z	-59.0	Average	V	-41.2	-17.8
13796.4	802.11b 11Mbps	V	-36.4	Peak	V	-21.2	-14.2
13796.4	802.11b 11Mbps	V	-51.3	Average	V	-41.2	-10.1
14600	802.11b 1Mbps	V	-38.9	Peak	V	-21.2	-17.7
14600	802.11b 1Mbps	V	-54.4	Average	V	-41.2	-13.2
17799 <sup>R</sup>	802.11b 1Mbps	V	-29.1	Peak	V	-21.2	-7.9
17799 <sup>R</sup>	802.11b 1Mbps	V	-45.7	Average	V	-41.2	-4.5
21931	802.11b 11Mbps	V	-43.3	Peak	V	-21.2 Pk/ -41.2 Ave	-22.1Pk/ -2.1 Ave
24465	802.11b 1Mbps	V	-45.5	Peak	V	-21.2 Pk/ -41.2 Ave	-24.3 Pk/ -4.3 Ave
Note: The levels are expressed in dBm which are derived from $\text{dBm} = E(\text{dB}\mu\text{V}/\text{m}) - 95.2\text{dB}$ . H refers to a harmonic of the fundamental, R refers to an emission in a restricted band See a selection of plots on the next pages.							



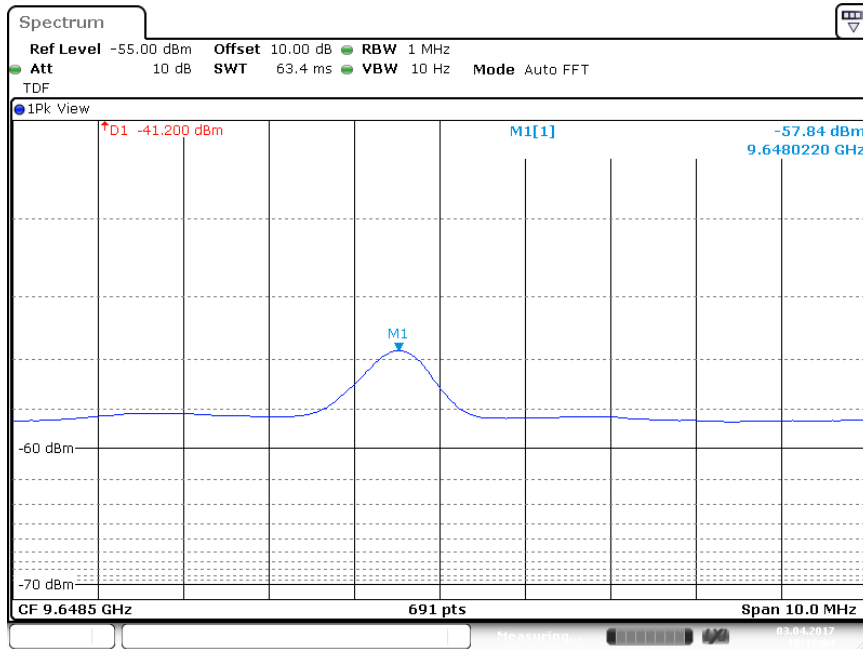
Date: 3.APR.2017 09:07:15

Plot of the emissions (peak values shown) in the range 1-2.3 GHz, 802.11b 1Mbps, EUT Z Ant V

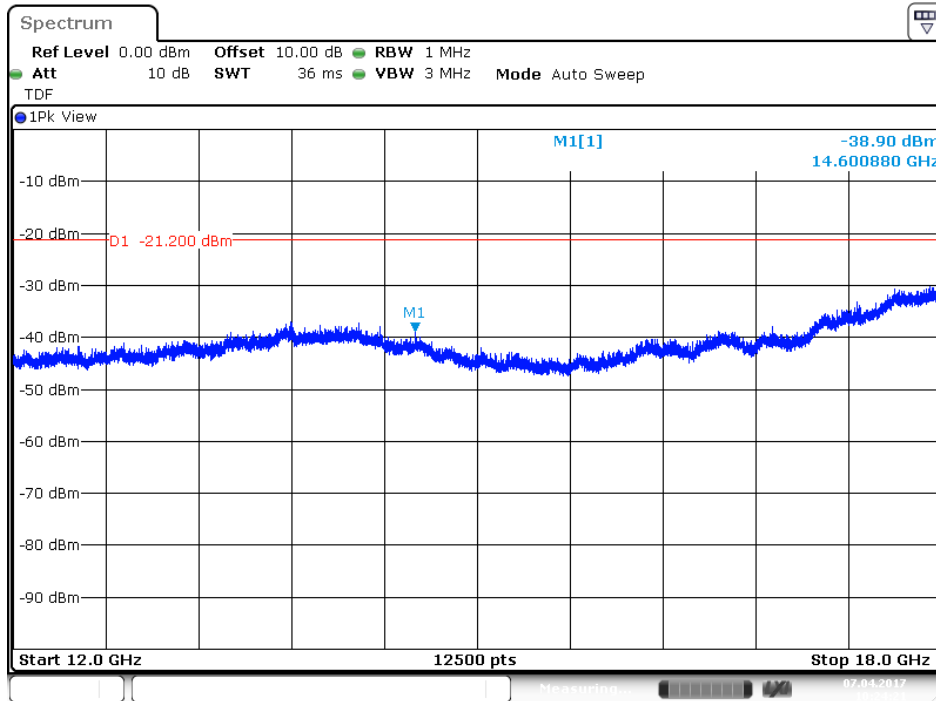


Date: 3.APR.2017 13:05:10

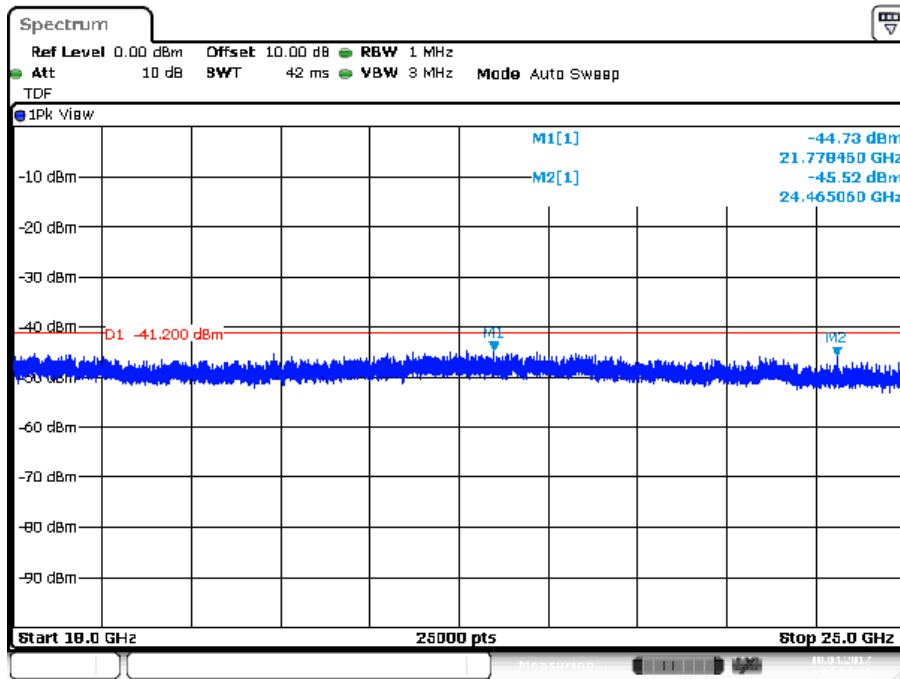
Plot of the emissions (peak values shown) in the range 3 -12 GHz, 802.11b 1Mbps, EUT Z Ant V



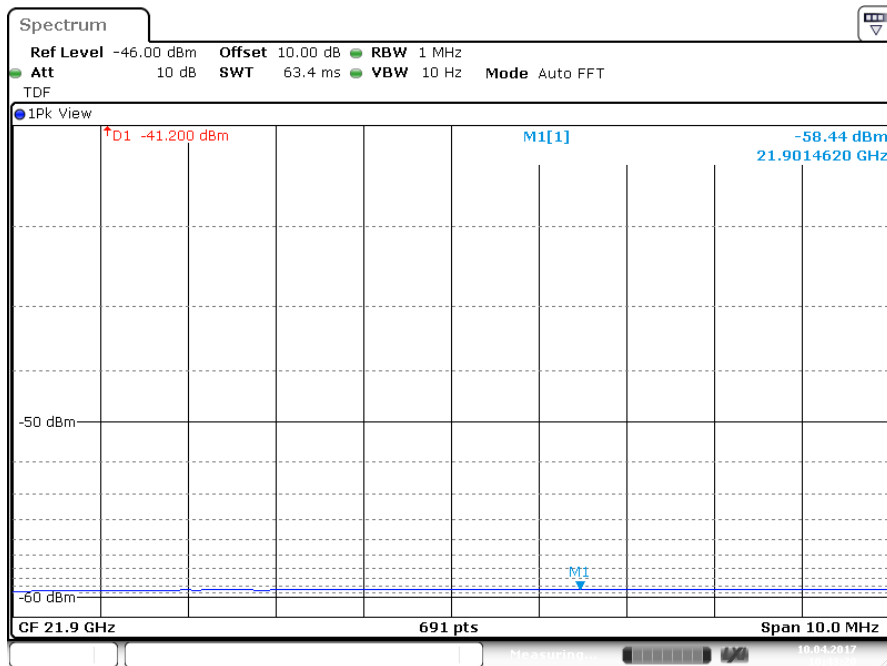
Plot of the emissions (Average value shown) in the range 3 -12 GHz, 802.11b 1Mbps, EUT Z Ant V



Plot of the emissions (peak values shown) in the range 12-18 GHz, 802.11b 1Mbps, EUT Z Ant V

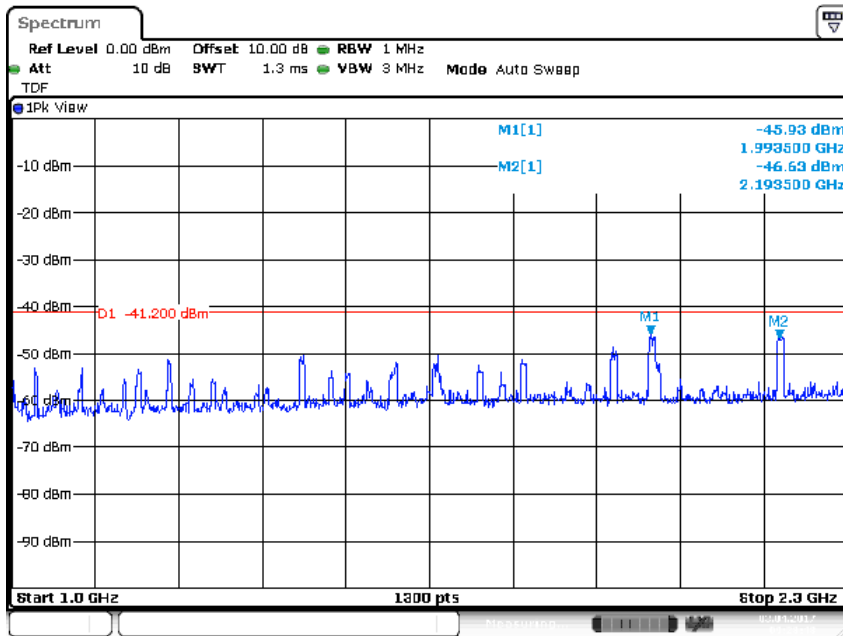


Plot of the emissions (peak values shown) in the range 18-25 GHz, 802.11b 1Mbps, EUT Z Ant V



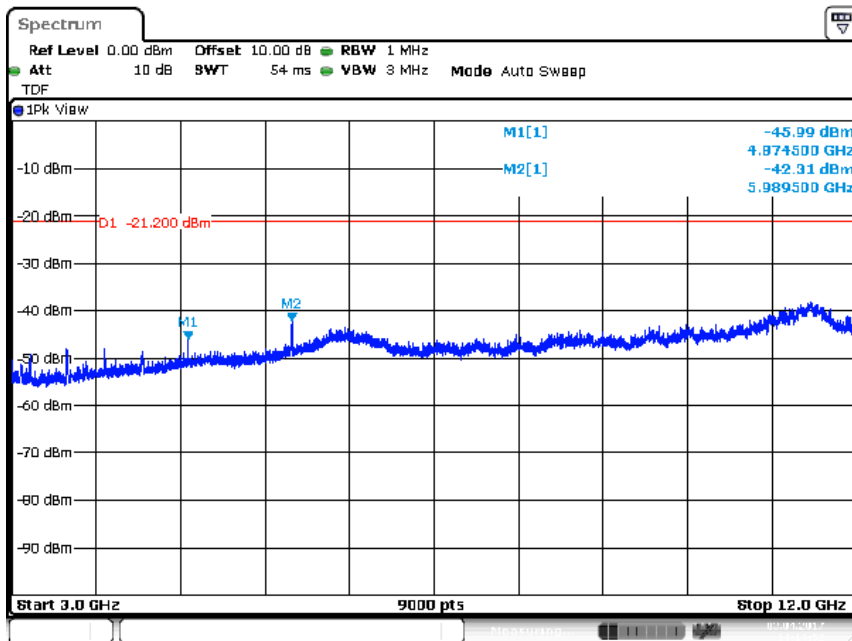
Plot of the emissions (average value shown) in the range 18-25 GHz, 802.11b 1Mbps, EUT Z Ant V

Radiated Emissions				Tracking # 17030802.fcc 01_Rev02			
<b>EUT</b>	With External antenna						
<b>EUT Config.</b>	802.11b						
<b>Standard</b>	CFR47 Part 15 Subpart C, RSS-247, RSS-GEN			<b>RBW / VBW</b>	1 MHz/ 3 MHz		
<b>Dist/Ant Used</b>	3m			<b>Performed by</b>	Richard van der Meer		
1 – 25 GHz Transmit at 2437 MHz (Mid Channel)							
Frequency MHz	EUT Mode	EUT Orientation	Level dBm	Detector	Polarity H/V	Limit dBm	Margin dB
1993.5	802.11b 11Mbps	Z	-45.9	Pk	V	-21.2 Pk/ -41.2 Ave	-24.7Pk/ -4.7 Ave
2193.5	802.11b 11Mbps	Z	-46.6	Pk	V	-21.2 Pk/ -41.2 Ave	-25.4 Pk/ -5.4 Ave
3985.5	802.11b 11Mbps	Z	-47.4	Pk	V	-21.2 Pk/ -41.2 Ave	-26.2 Pk/ -6.2 Ave
4874.5 <sup>HR</sup>	802.11b 1Mbps	Z	-46.0	Pk	V	-21.2 Pk/ -41.2 Ave	-24.8 Pk/ -4.8 Ave
5989.15	802.11b 1Mbps	Z	-42.3	Pk	V	-21.2	-21.1
5989.15	802.11b 1Mbps	Z	-61.0	Av	V	-41.2	-19.8
6223.5	802.11b 11Mbps	Z	-45.1	Pk	V	-21.2 Pk/ -41.2 Ave	-23.9Pk/ -3.9 Ave
9459.5 <sup>R</sup>	802.11b 11Mbps	H	-42.2	Pk	V	-21.2	-21.0
9459.5 <sup>R</sup>	802.11b 11Mbps	H	-59.5	Av	V	-41.2	-18.3
13741.7	802.11b 11Mbps	V	-37.2	Pk	V	-21.2	-16.0
13741.7	802.11b 11Mbps	V	-51.4	Av	V	-41.2	-10.2
Note: The levels are expressed in dBm which are derived from $\text{dBm} = E(\text{dB}\mu\text{V}/\text{m}) - 95.2\text{dB}$ . H refers to a harmonic of the fundamental, R refers to an emission in a restricted band Above 14GHz No significant emissions was observed Measured spectrum= noise floor See a selection of plots on the next pages.							



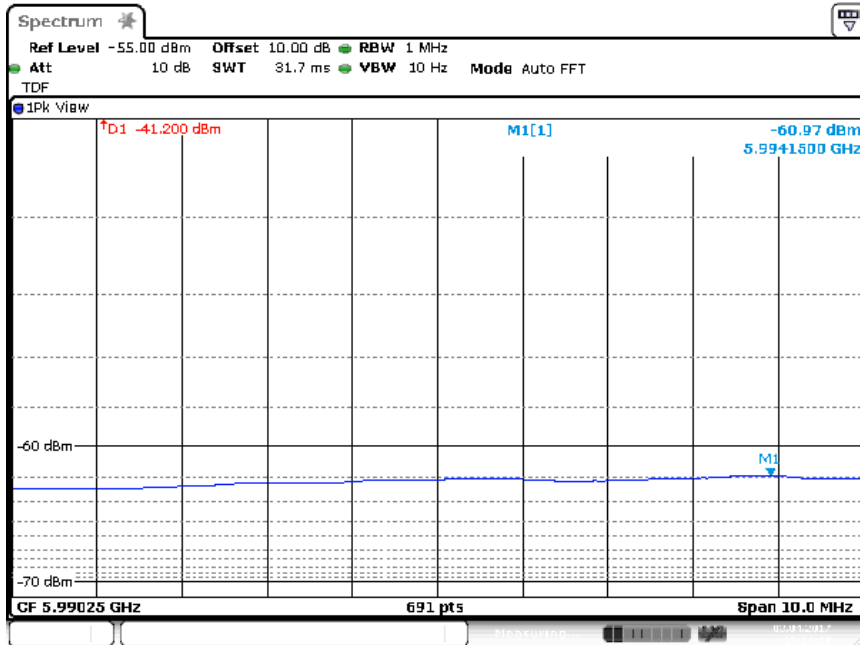
Date: 3.APR.2017 09:28:48

Plot of the emissions (peak values shown) in the range 1-2.3 GHz, 802.11b 1Mbps, EUT Z Ant V



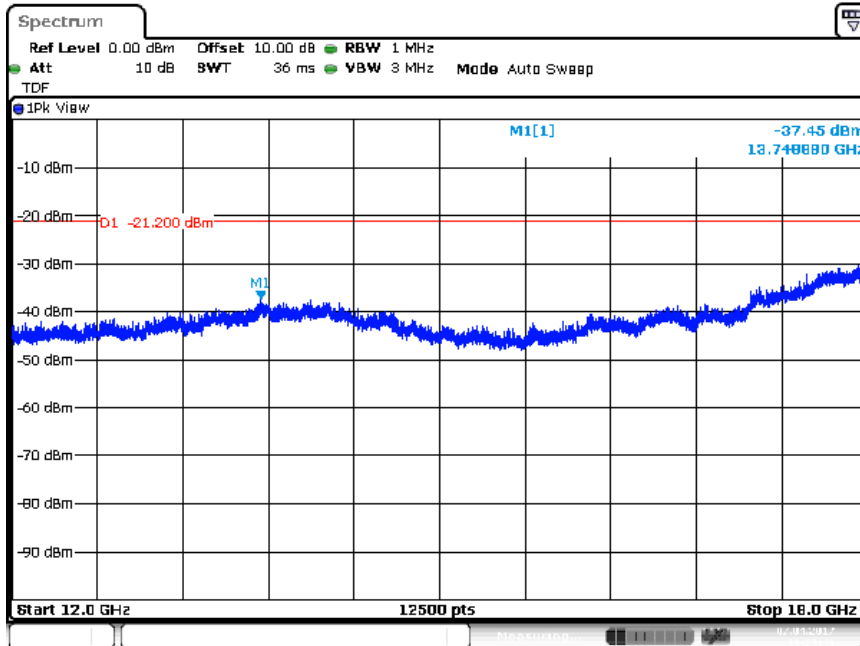
Date: 3.APR.2017 13:14:52

Plot of the emissions (peak values shown) in the range 3-12 GHz, 802.11b 1Mbps, EUT Z Ant V



Date: 3.APR.2017 15:14:23

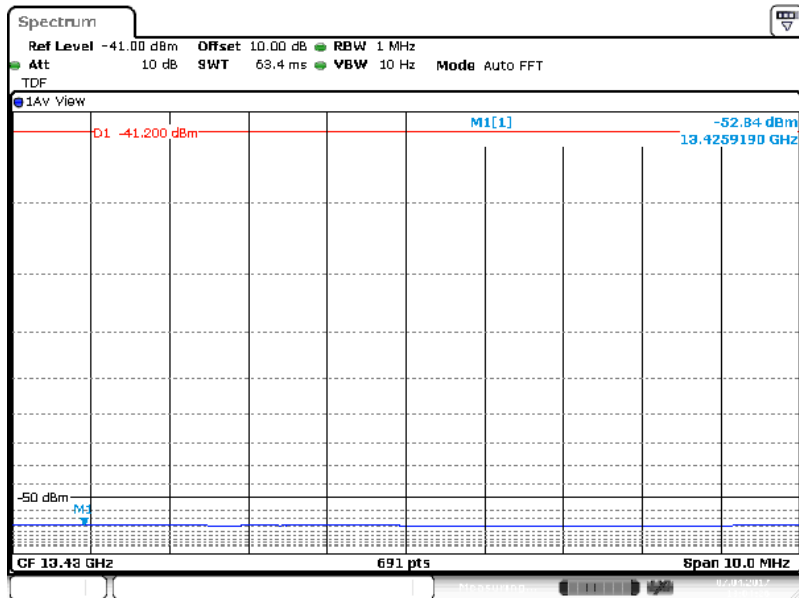
Plot of the emissions (average value shown) in the range 3-12 GHz, 802.11b 1Mbps, EUT Z Ant V (related to the previous plot).



Date: 7.APR.2017 10:29:46

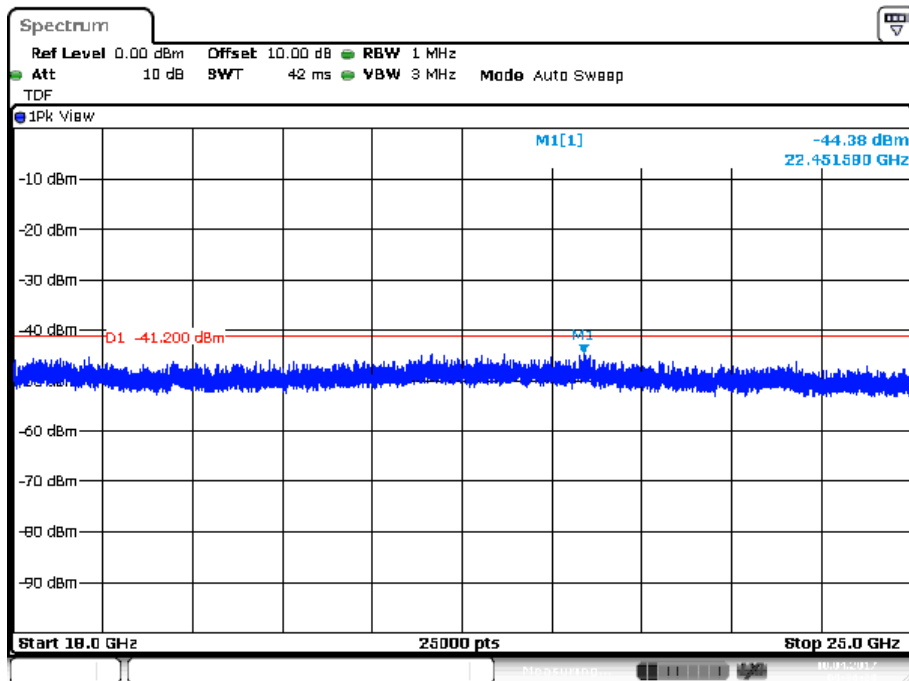
Plot of the emissions (peak values shown) in the range 12-18 GHz, 802.11b 11Mbps, EUT Z Ant V





Date: 7.APR.2017 13:04:26

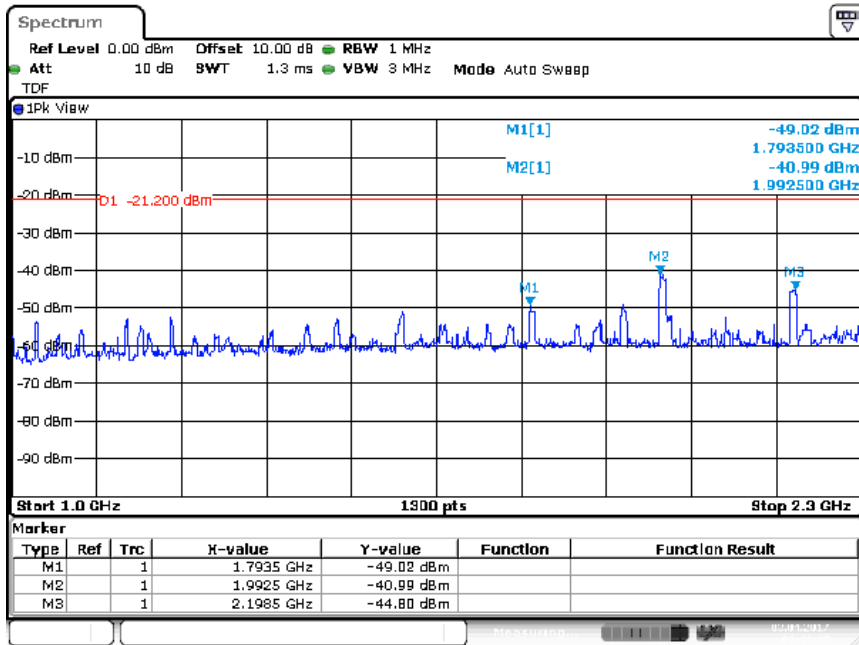
Plot of the emissions (average value shown) in the range 12-18 GHz, 802.11b 11Mbps, EUT Z Ant V (related to the previous plot).



Date: 10.APR.2017 09:36:29

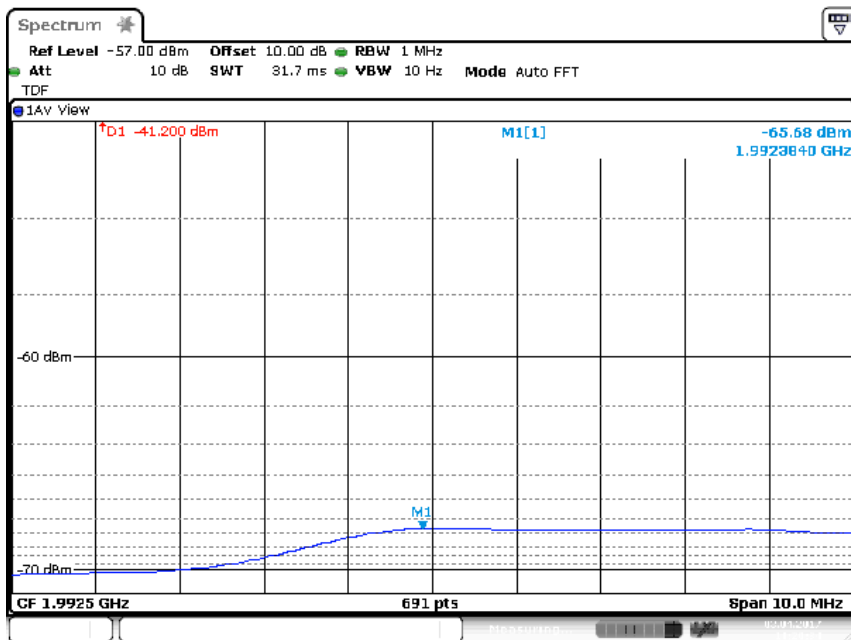
Plot of the emissions (peak values shown) in the range 18-25 GHz, 802.11b 11Mbps, EUT Z Ant V

<b>Radiated Emissions</b>				Tracking # 17030802.fcc 01_Rev02			
<b>EUT</b> With External antenna							
<b>EUT Config.</b> 802.11b							
<b>Standard</b> CFR47 Part 15 Subpart C, RSS-247, RSS-GEN				<b>RBW / VBW</b> 1 MHz/ 3 MHz			
<b>Dist/Ant Used</b> 3m				<b>Performed by</b> Richard van der Meer			
1 – 25 GHz Transmit at 2462 MHz (High Channel)							
Frequency	EUT	EUT	Level	Detector	Polarity	Limit	Margin
MHz	Mode	Orientation	dBm		H/V	dBm	dB
1793.5	802.11b 11Mbps	V	-49.0	Pk	V	-21.2 Pk/ -41.2 Ave	-27.8Pk/ -7.8Ave
1992.5	802.11b 11Mbps	V	-41.0	Pk	V	-21.2	-19.8
1992.5	802.11b 11Mbps	V	-65.7	Ave	V	-41.2	-24.5
3181.5	802.11b 11Mbps	V	-42.0	Pk	V	-21.2	-20.8
3181.5	802.11b 11Mbps	V	-66.6	Ave	V	-41.2	-25.4
5386.5 <sup>R</sup>	802.11b 11Mbps	V	-43.9	Pk	V	-21.2	-22.7
5386.5 <sup>R</sup>	802.11b 11Mbps	V	-63.1	Ave	V	-41.2	-21.9
7090.5	802.11b 11Mbps	V	-42.7	Pk	V	-21.2	-21.5
7090.5	802.11b 11Mbps	V	-60.2	Ave	V	-41.2	-19.0
9848.5 <sup>H</sup>	802.11b 11Mbps	V	-41.8	Pk	V	-21.2	-20.6
9848.5 <sup>H</sup>	802.11b 11Mbps	V	-58.2	Ave	V	-41.2	-17.0
14229.4	802.11b 11Mbps	V	-36.8	Pk	V	-21.2	-15.6
14229.4	802.11b 11Mbps	V	-51.3	Ave	V	-41.2	-10.1
21530	802.11b 11Mbps	V	-44.5	Pk	V	-21.2 Pk/ -41.2 Ave	-23.3Pk/ -3.3Ave
<p>Note: The levels are expressed in dBm which are derived from <math>\text{dBm} = E(\text{dB}\mu\text{V}/\text{m}) - 95.2\text{dB}</math>.          H refers to a harmonic of the fundamental, R refers to an emission in a restricted band          Above 15GHz No significant emissions was observed Measured spectrum= noise floor          See a selection of plots on the next pages.</p>							



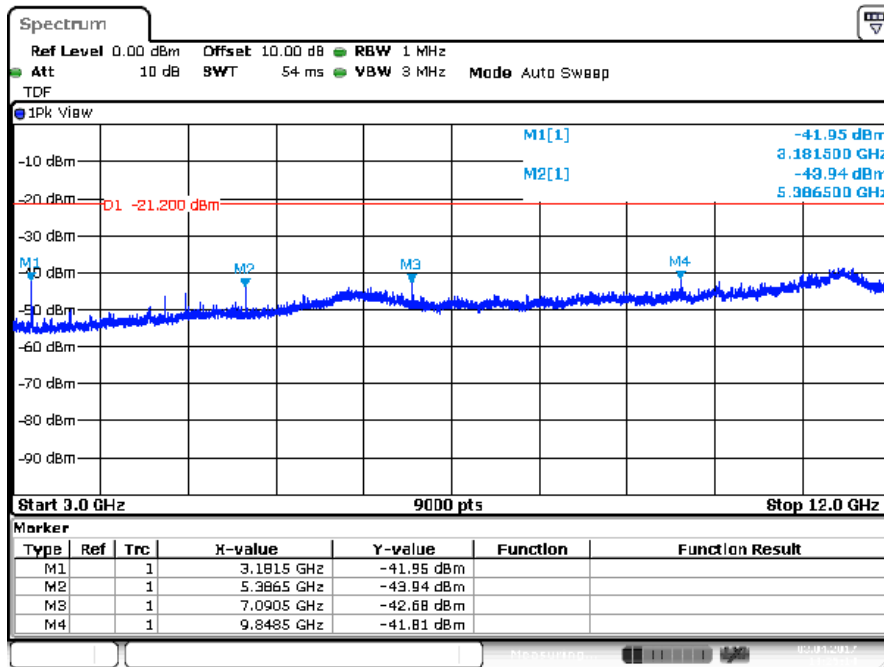
Date: 3.APR. 2017 09:44:48

Plot of the emissions (peak values shown) in the range 1-2.3 GHz, 802.11b 11Mbps, EUT V Ant V



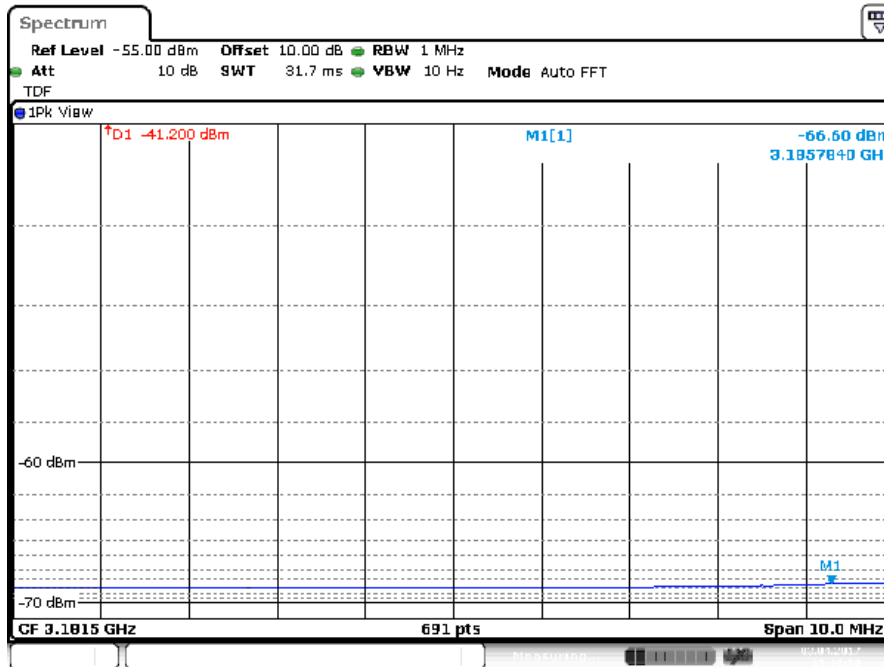
Date: 3.APR. 2017 11:20:34

Plot of the emissions (average value shown) in the range 1-2.3 GHz, 802.11b 11Mbps, EUT V Ant V (related to the previous plot).



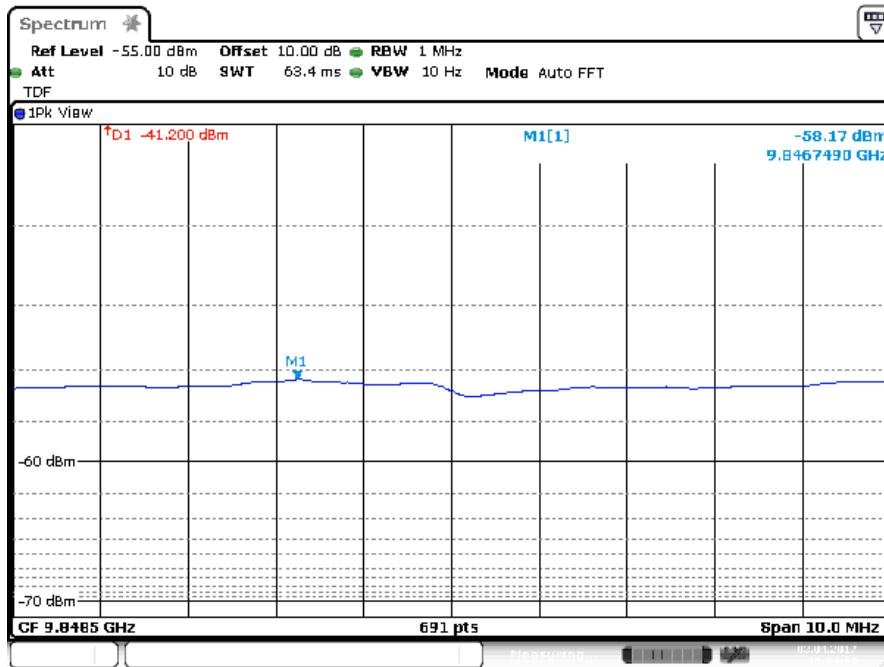
Date: 3.APR.2017 13:25:14

Plot of the emissions (peak values shown) in the range 3-12 GHz, 802.11b 11Mbps, EUT V Ant V



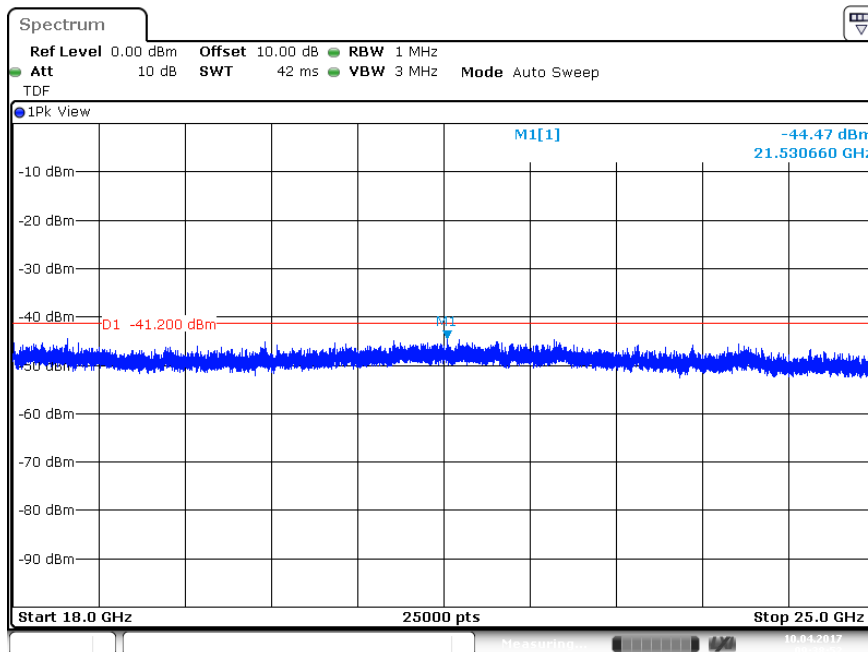
Date: 3.APR.2017 15:18:59

Plot of the emissions (average value shown) in the range 3-12 GHz, 802.11b 11Mbps, EUT V Ant V (related to the previous plot).



Date: 3.APR.2017 15:23:56

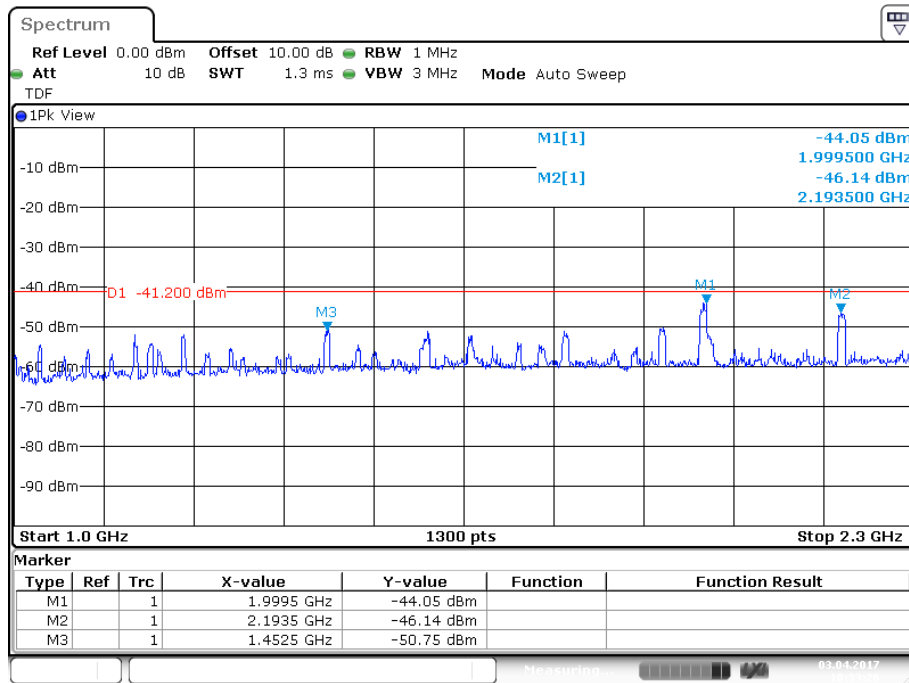
Plot of the emissions (average value shown) in the range 3-12 GHz, 802.11b 11Mbps, EUT V Ant V (related to the previous plot).



Date: 10.APR.2017 09:38:52

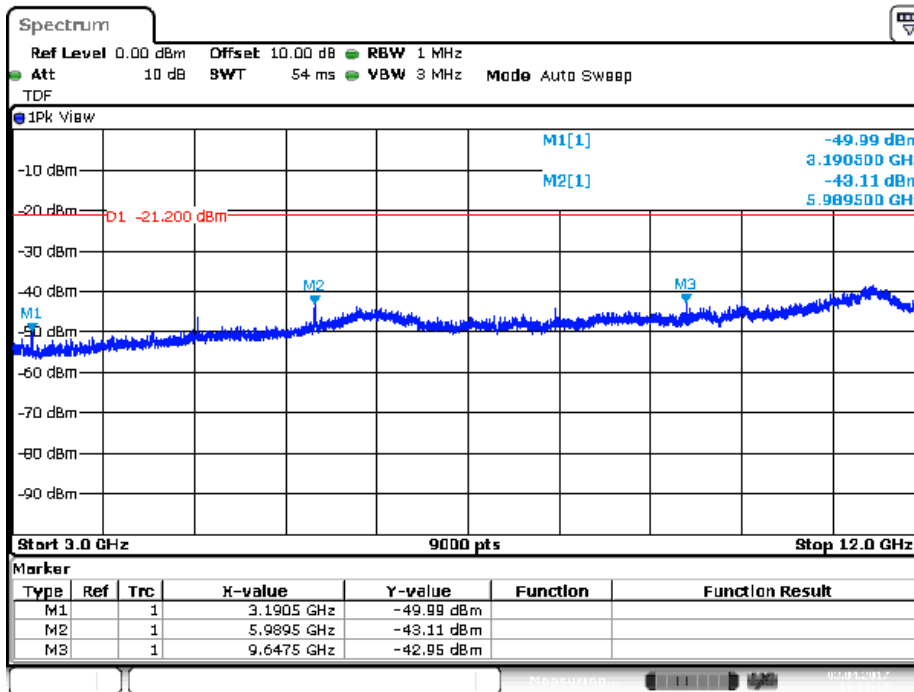
Plot of the emissions (peak values shown) in the range 18-25 GHz, 802.11b 11Mbps, EUT V Ant V

Radiated Emissions				Tracking # 17030802.fcc 01_Rev02			
<b>EUT</b>		With External antenna		<b>Date</b>		April 03–10, 2017	
<b>EUT Config.</b>		802.11g		<b>RBW / VBW</b>		1 MHz/ 3 MHz	
<b>Standard</b>		CFR47 Part 15 Subpart C, RSS-247, RSS-GEN		<b>Performed by</b>		Richard van der Meer	
<b>Dist/Ant Used</b>		3m					
1 – 25 GHz Transmit at 2412 MHz (Low Channel)							
Frequency	EUT	EUT	Level	Detector	Polarity	Limit	Margin
MHz	Mode	Orientation	dBm		H/V	dBm	dB
1999.5	802.11g 54Mbps	V	-44.0	Peak	V	-21.2 Pk/ -41.2 Ave	-22.8Pk/ -2.8 Ave
2193.5	802.11g 54Mbps	V	-45.2	Peak	V	-21.2 Pk/ -41.2 Ave	-23.0Pk/ -3.0 Ave
3190.5	802.11g 54Mbps	V	-50.0	Peak	V	-21.2 Pk/ -41.2 Ave	-28.8Pk/ -8.8 Ave
5989.5	802.11g 54Mbps	V	-43.1	Peak	V	-21.2 Pk/ -41.2 Ave	-21.9Pk/ -1.9 Ave
9647.5 <sup>H</sup>	802.11g 54Mbps	V	-43.0	Peak	V	-21.2	-21.8
9647.5 <sup>H</sup>	802.11g 54Mbps	V	-55.0	Average	V	-41.2	-13.8
14120.4	802.11g 6Mbps	V	-36.8	Peak	V	-21.2	-14.6
14120.4	802.11g 6Mbps	V	-51.8	Average	V	-41.2	-10.6
16650.0	802.11g 6Mbps	V	-37.8	Peak	V	-21.2	-16.6
16650.0	802.11g 6Mbps	V	-52.5	Average	V	-41.2	-11.3
21938.34	802.11g 54Mbps	Z	-43.6	Peak	V	-21.2	-22.4
21938.34	802.11g 54Mbps	Z	<-55	Peak	V	-41.2	-13.8
Note: The levels are expressed in dBm which are derived from $\text{dBm} = E(\text{dB}\mu\text{V}/\text{m}) - 95.2\text{dB}$ . H refers to a harmonic of the fundamental, R refers to an emission in a restricted band See a selection of plots on the next pages.							



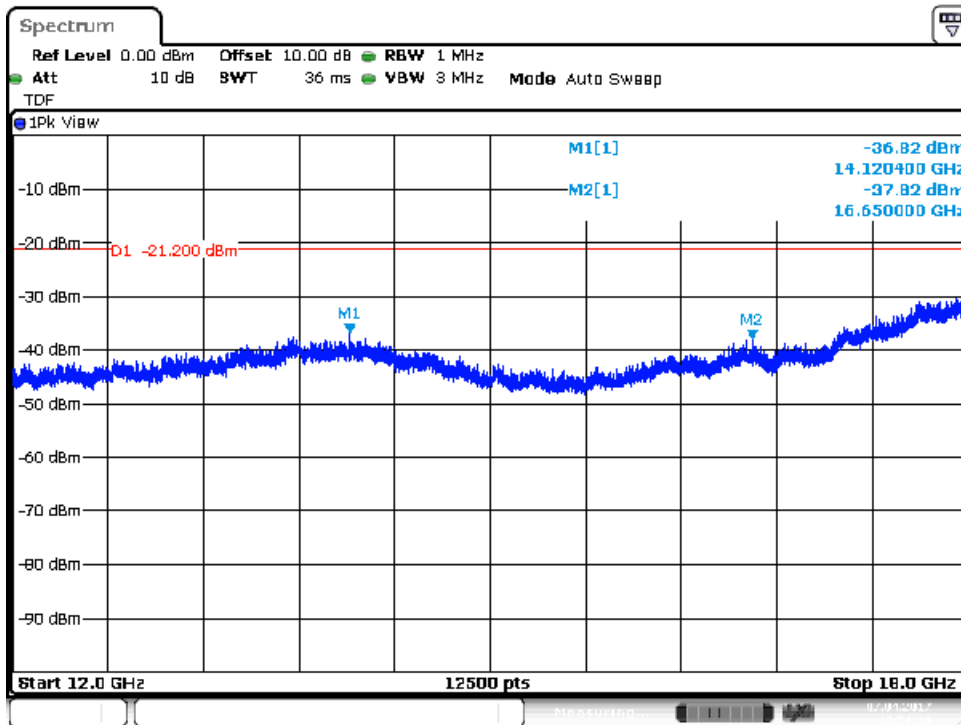
Date: 3.APR.2017 10:33:27

Plot of the emissions (peak values shown) in the range 1-2.3 GHz, 802.11g 54Mbps, EUT V Ant V



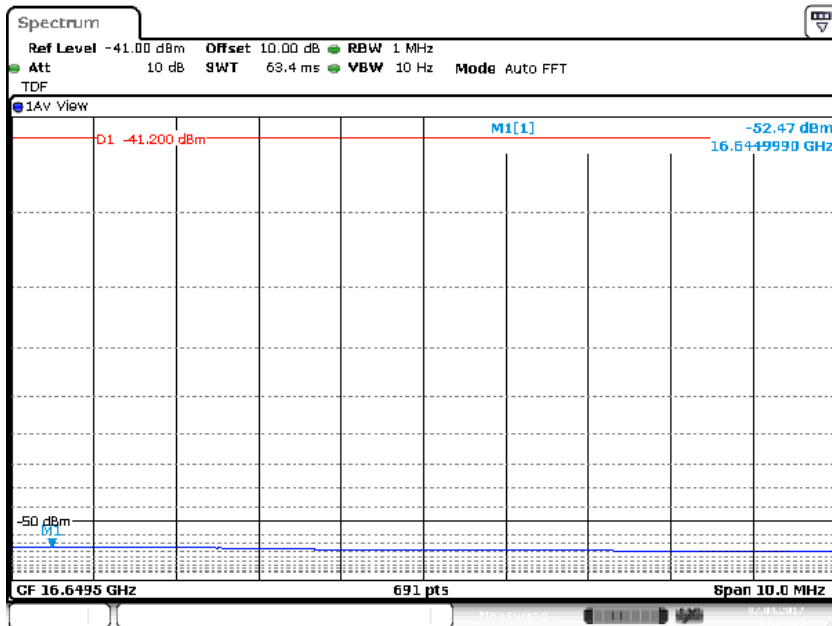
Date: 3.APR.2017 13:34:17

Plot of the emissions (peak values shown) in the range 3 -12 GHz, 802.11g 54Mbps, EUT V Ant V



Date: 7.APR.2017 10:51:26

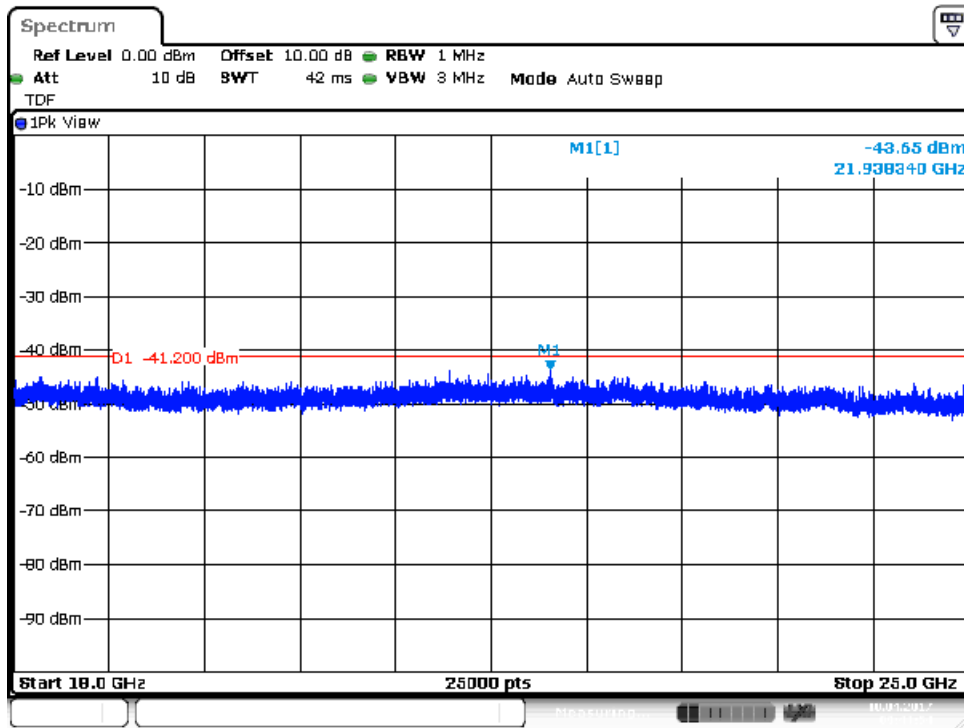
Plot of the emissions (peak values shown) in the range 12 -18 GHz, 802.11g 6Mbps, EUT V Ant V



Date: 7.APR.2017 13:18:24

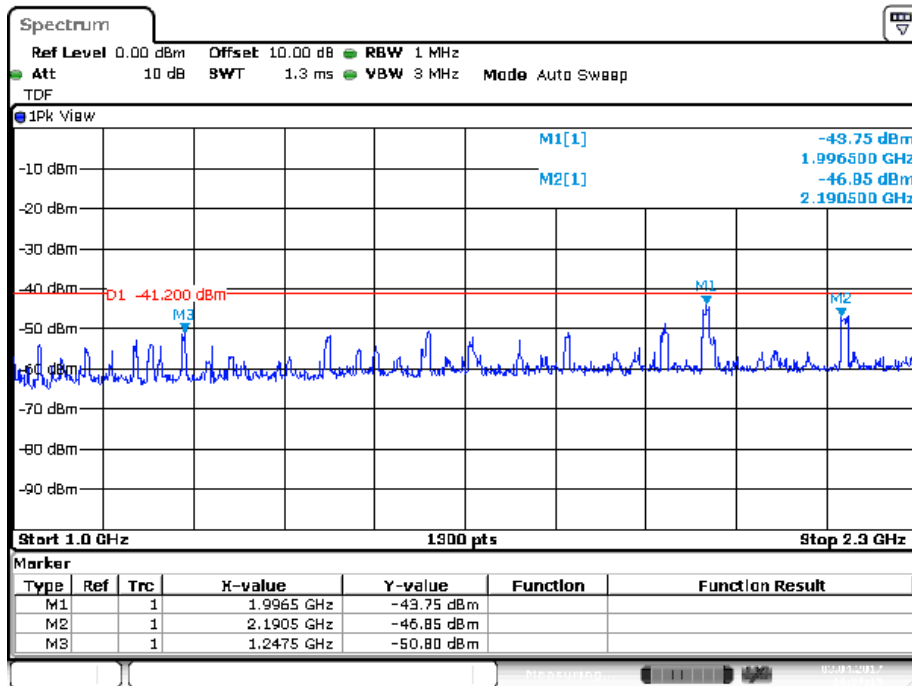
Plot of the emissions (average value shown) in the range 3-12 GHz, 802.11g 6Mbps, EUT V Ant V (related to the previous plot).





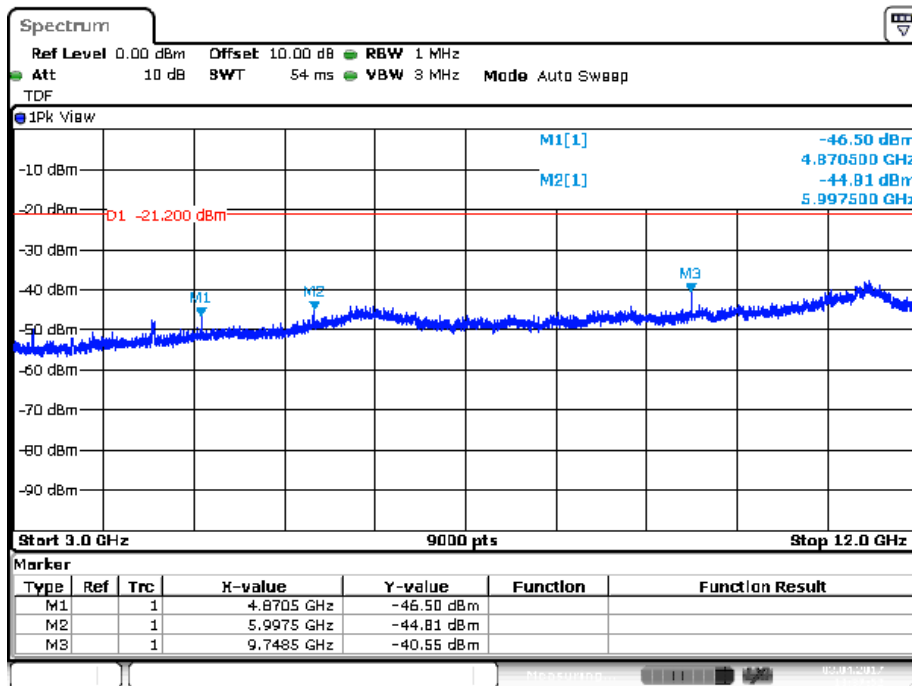
Plot of the emissions (Peak value shown) in the range 18 -25 GHz, 802.11g 54Mbps, EUT Z Ant V

Radiated Emissions				Tracking # 17030802.fcc 01_Rev02					
EUT				With External antenna					
EUT Config.				802.11g		Date		April 03–10, 2017	
Standard				CFR47 Part 15 Subpart C, RSS-247, RSS-GEN		RBW / VBW		1 MHz/ 3 MHz	
Dist/Ant Used				3m		Performed by		Richard van der Meer	
1 – 25 GHz Transmit at 2437 MHz (Mid Channel)									
Frequency	EUT	EUT	Level	Detector	Polarity	Limit	Margin		
MHz	Mode	Orientation	dBm		H/V	dBm	dB		
1996.5	802.11g 54Mbps	Z	-43.7	Peak	V	-21.2 Pk/ -41.2 Ave	-22.5Pk/ -2.5 Ave		
2190.5	802.11g 54Mbps	Z	-46.8	Peak	V	-21.2 Pk/ -41.2 Ave	-25.6Pk/ -5.6 Ave		
4870.5 <sup>H</sup> <sup>R</sup>	802.11g 6Mbps	Z	-46.5	Peak	V	-21.2 Pk/ -41.2 Ave	-24.3Pk/ -4.3 Ave		
5997.5	802.11g 6Mbps	Z	-44.8	Peak	V	-21.2 Pk/ -41.2 Ave	-23.6Pk/ -3.6 Ave		
9748.5 <sup>H</sup>	802.11g 6Mbps	Z	-40.5	Peak	V	-21.2	-19.3		
9748.5 <sup>H</sup>	802.11g 6Mbps	Z	-58.7	Average	V	-41.2	-17.5		
13859.76	802.11g 6Mbps	V	-36.2	Peak	V	-21.2	-15.0		
13859.76	802.11g 6Mbps	V	-51.5	Average	V	-41.2	-10.3		
21853.0	802.11g 54Mbps	V	-44.4	Peak	V	-21.2 Pk/ -41.2 Ave	-23.2Pk/ -3.2 Ave		
<p>Note: The levels are expressed in dBm which are derived from <math>\text{dBm} = E(\text{dB}\mu\text{V}/\text{m}) - 95.2\text{dB}</math>.          H refers to a harmonic of the fundamental, R refers to an emission in a restricted band          See a selection of plots on the next pages.</p>									



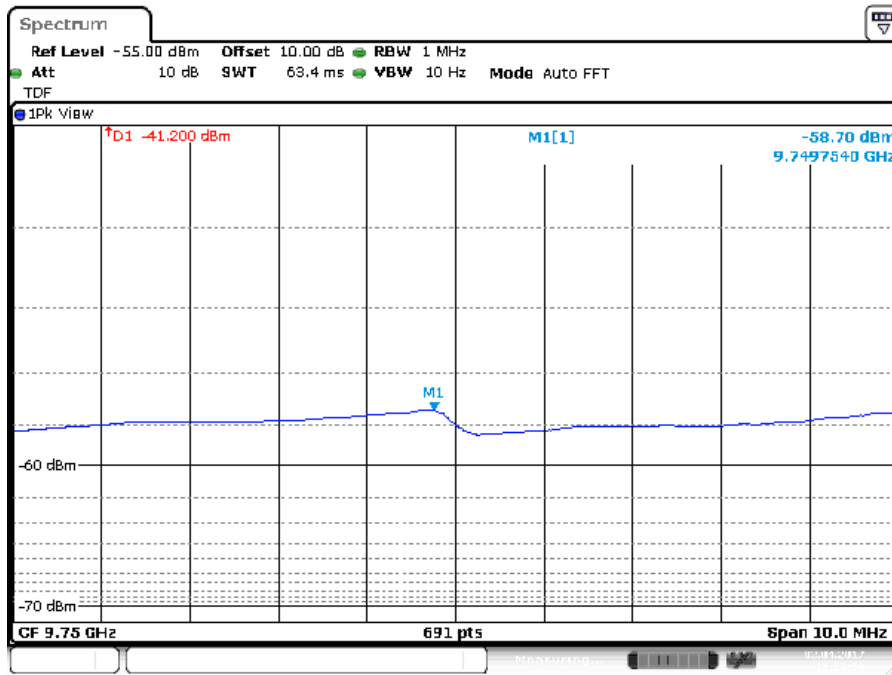
Date: 3.APR.2017 10:37:15

Plot of the emissions (peak values shown) in the range 1-2.3 GHz, 802.11g 54Mbps, EUT Z Ant V



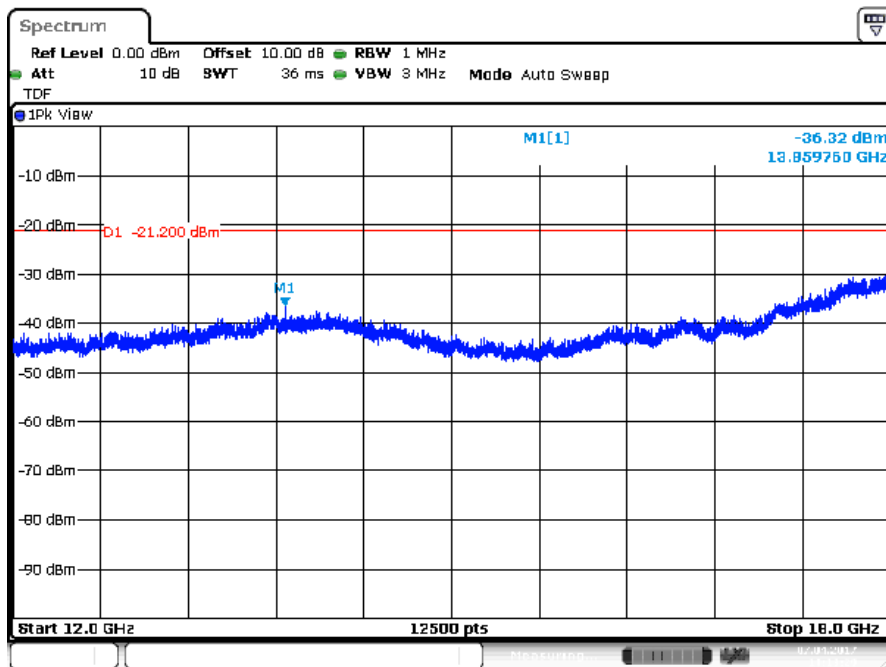
Date: 3.APR.2017 13:37:52

Plot of the emissions (peak values shown) in the range 3 -12 GHz, 802.11g 6Mbps, EUT Z Ant V



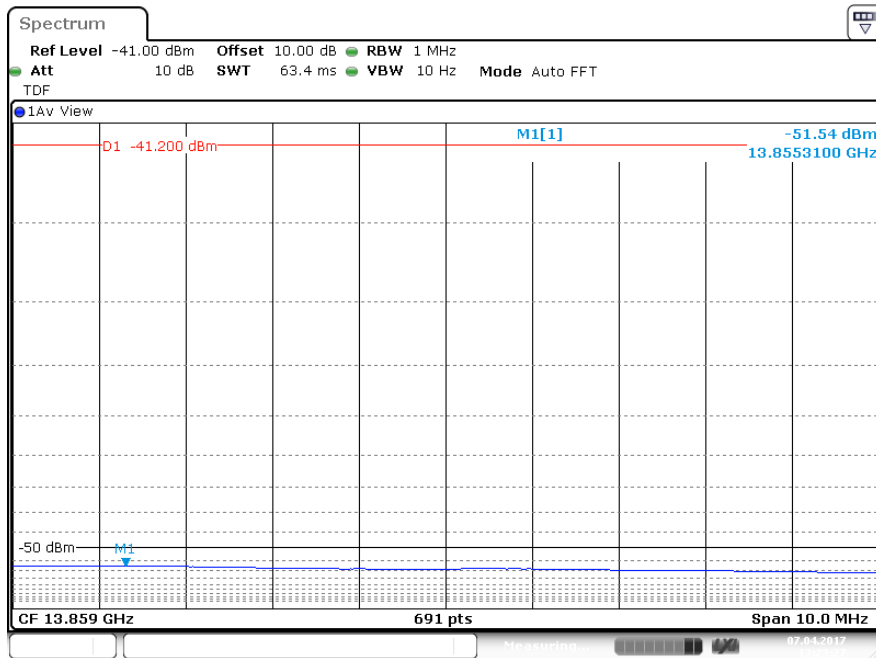
Date: 3.APR.2017 15:28:56

Plot of the emissions (Average value shown) in the range 3 -12 GHz, 802.11g 6Mbps, EUT Z Ant V related to previous plot.

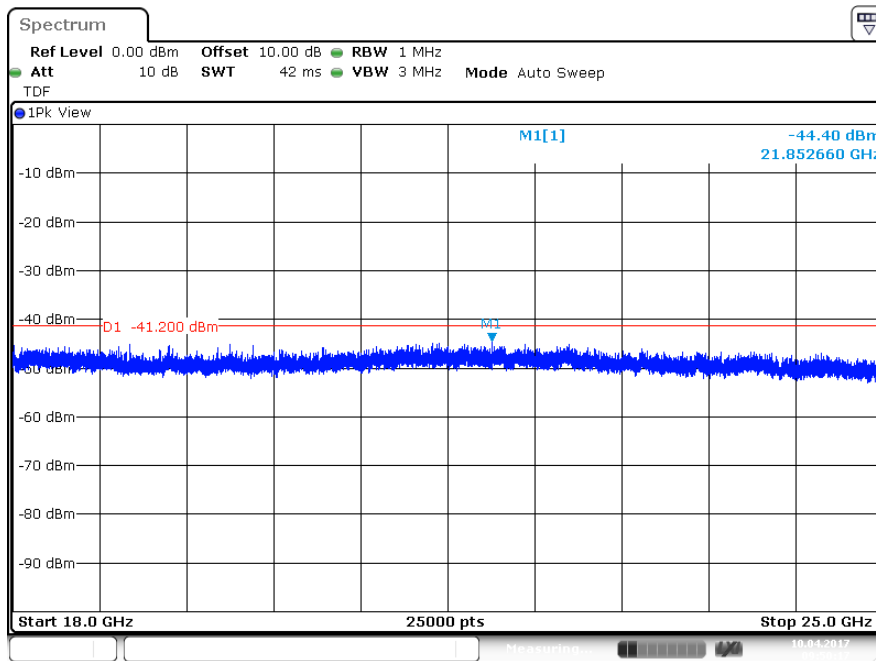


Date: 7.APR.2017 11:13:29

Plot of the emissions (peak values shown) in the range 12 -18 GHz, 802.11g 6Mbps, EUT V Ant V

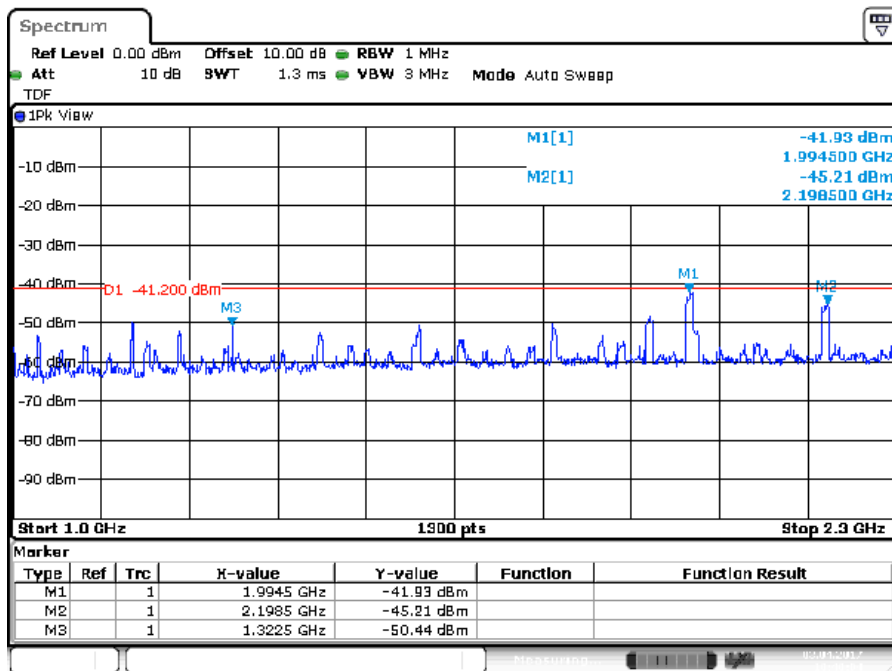


Plot of the emissions (Average value shown) in the range 12 -18 GHz, 802.11g 6Mbps, EUT Z Ant V related to previous plot.



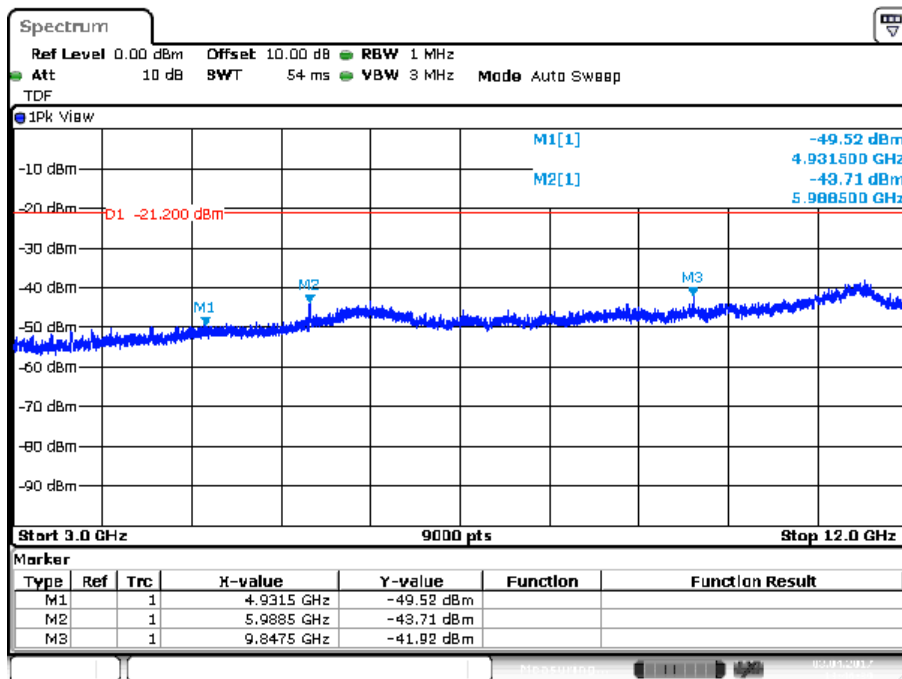
Plot of the emissions (peak values shown) in the range 18 -25 GHz, 802.11g 54Mbps, EUT V Ant V

<b>Radiated Emissions</b>				Tracking # 17030802.fcc 01_Rev02			
<b>EUT</b> With External antenna							
<b>EUT Config.</b> 802.11g				<b>Date</b> April 03–07, 2017			
<b>Standard</b> CFR47 Part 15 Subpart C, RSS-247, RSS-GEN				<b>RBW / VBW</b> 1 MHz/ 3 MHz			
<b>Dist/Ant Used</b> 3m				<b>Performed by</b> Richard van der Meer			
1 – 25 GHz Transmit at 2462 MHz (High Channel)							
Frequency MHz	EUT Mode	EUT Orientation	Level dBm	Detector	Polarity H/V	Limit dBm	Margin dB
1994.5	802.11g 54Mbps	Z	-41.9	Peak	V	-21.2	-20.7
1994.5	802.11g 54Mbps	Z	<-55	Average	V	-41.2	-13.8
2198.5	802.11g 54Mbps	Z	-45.2	Peak	V	-21.2	-23.0
5988.5	802.11g 54Mbps	Z	-43.7	Peak	V	-21.2	-22.5
9847.5 <sup>H</sup>	802.11g 54Mbps	Z	-41.9	Peak	V	-21.2	-20.7
9847.5 <sup>H</sup>	802.11g 54Mbps	Z	-58.2	Average	V	-41.2	-17.0
13752.2	802.11g 54Mbps	Z	-37.7	Peak	V	-21.2	-16.5
13752.2	802.11g 54Mbps	Z	-51.3	Average	V	-41.2	-10.1
17746 <sup>R</sup>	802.11g 6Mbps	Z	-29.9	Peak	V	-21.2	-8.7
17746 <sup>R</sup>	802.11g 6Mbps	Z	-45.5	Average	V	-41.2	-4.3
<p>Note: The levels are expressed in dBm which are derived from <math>\text{dBm} = E(\text{dB}\mu\text{V}/\text{m}) - 95.2\text{dB}</math>.          H refers to a harmonic of the fundamental, R refers to an emission in a restricted band          Above 13 GHz no significant emissions was observed Measured spectrum=noise floor.          See a selection of plots on the next pages.</p>							



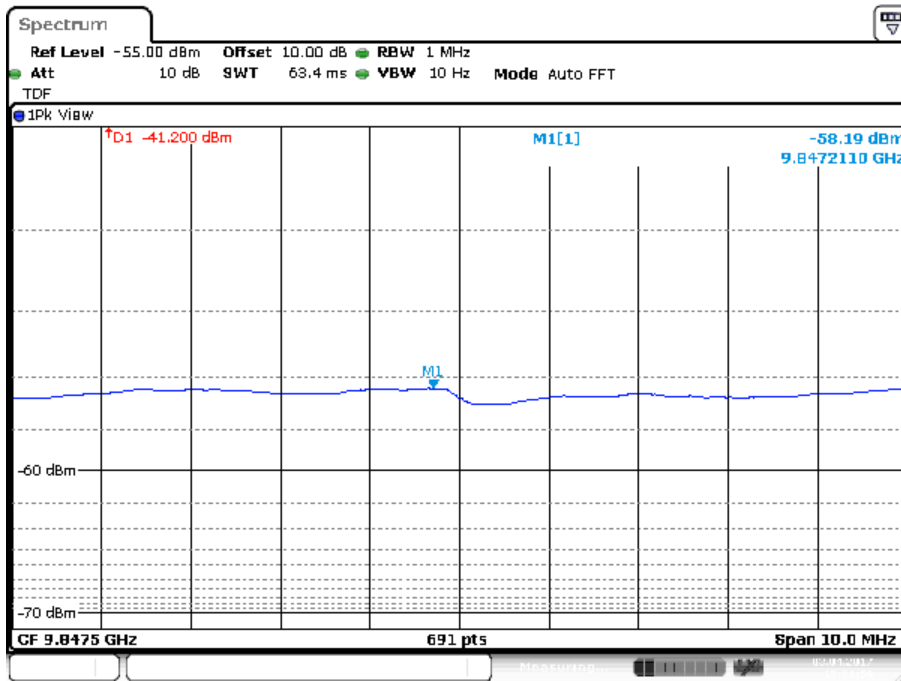
Date: 3.APR.2017 10:40:04

Plot of the emissions (peak values shown) in the range 1-2.3 GHz, 802.11g 54Mbps, EUT Z Ant V



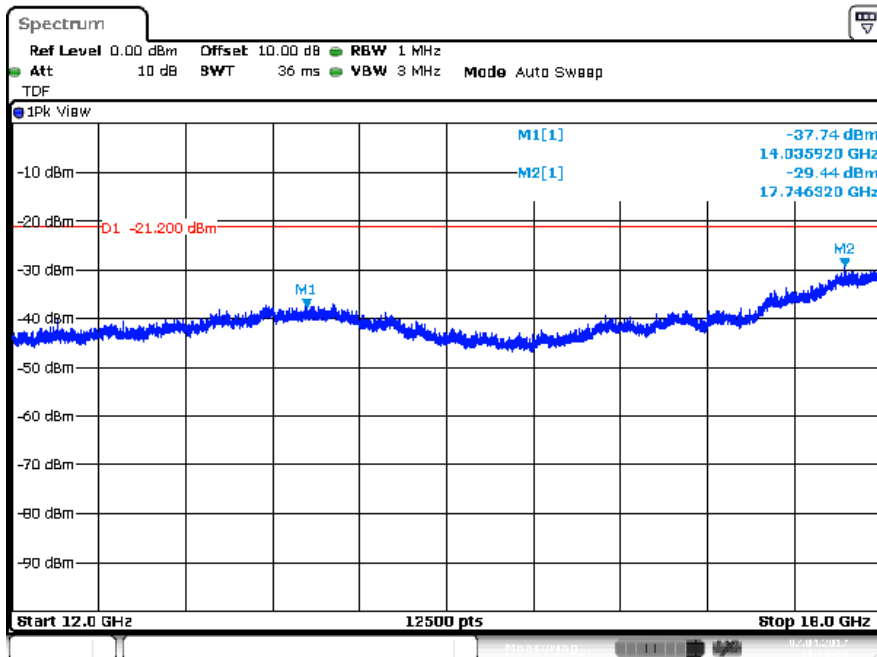
Date: 3.APR.2017 13:46:39

Plot of the emissions (peak values shown) in the range 3 -12 GHz, 802.11g 54Mbps, EUT Z Ant V



Date: 3.APR.2017 15:33:56

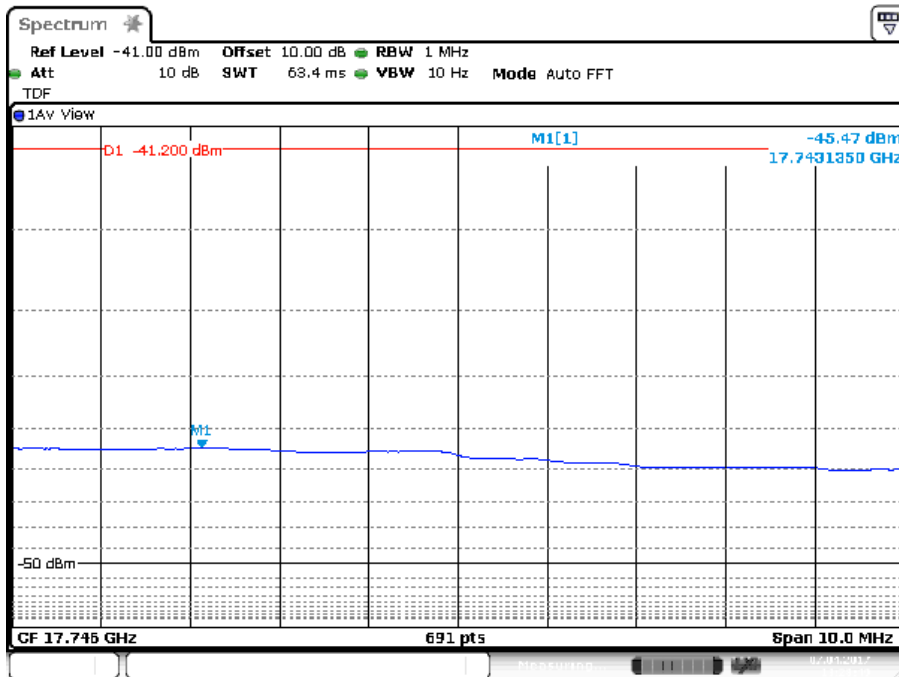
Plot of the emissions (Average value shown) in the range 3 -12 GHz, 802.11g 54Mbps, EUT Z Ant V related to previous plot.



Date: 7.APR.2017 11:18:09

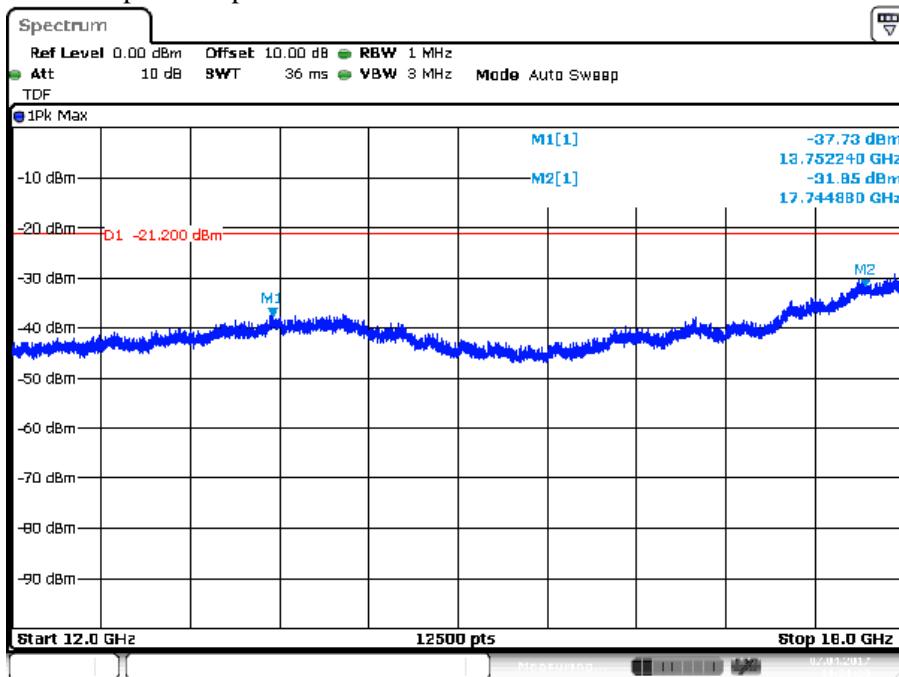
Plot of the emissions (peak values shown) in the range 12 -18 GHz, 802.11g 6Mbps, EUT Z Ant V





Date: 7.APR.2017 13:28:49

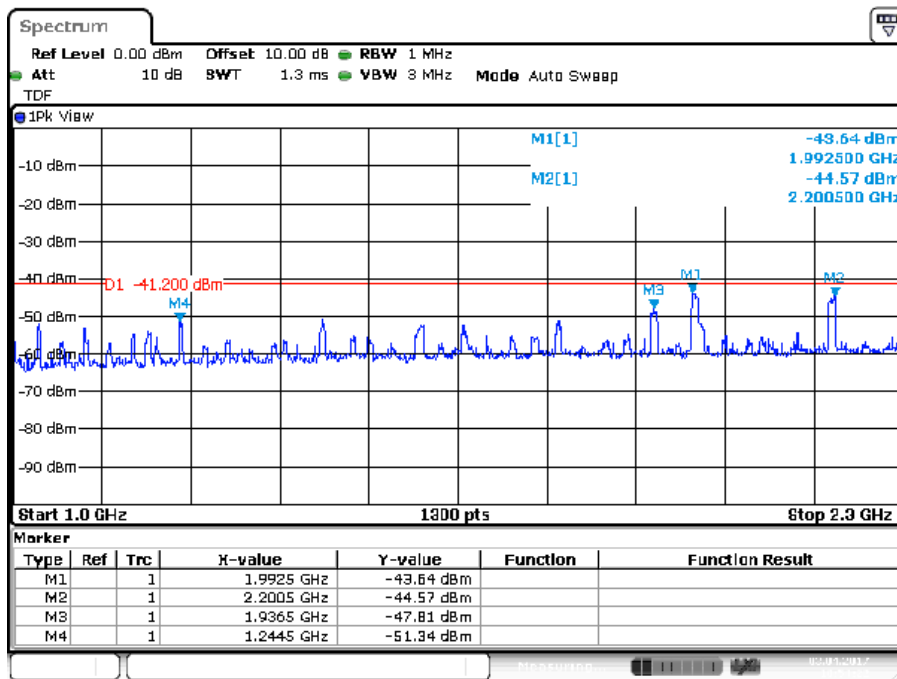
Plot of the emissions (Average value shown) in the range 12 -18 GHz, 802.11g 6Mbps, EUT Z Ant V related to previous plot.



Date: 7.APR.2017 11:21:30

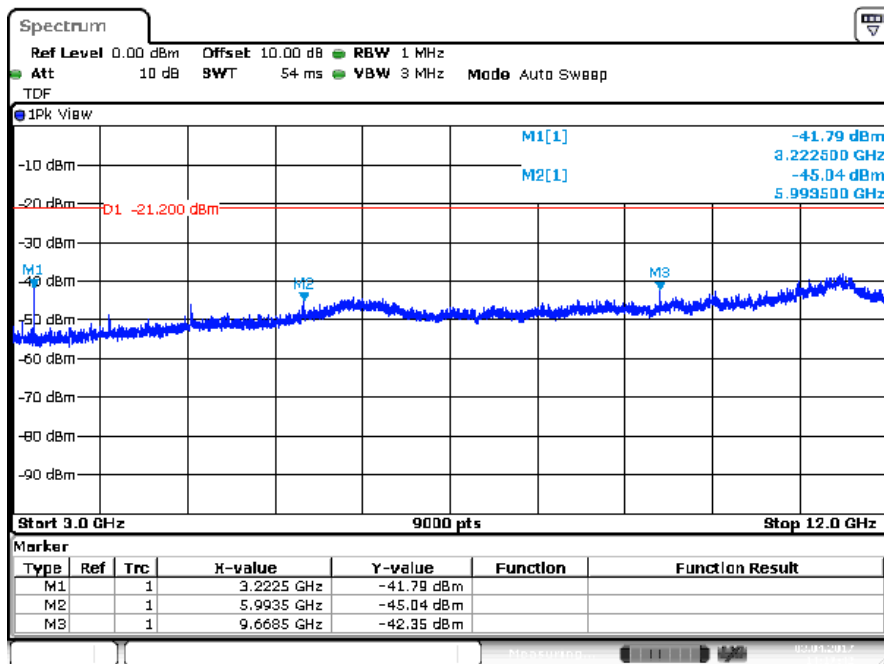
Plot of the emissions (peak values shown) in the range 12 -18 GHz, 802.11g 54Mbps, EUT Z Ant V, noise only

Radiated Emissions				Tracking # 17030802.fcc 01_Rev02			
<b>EUT</b>		With External antenna		<b>Date</b>		April 03–07, 2017	
<b>EUT Config.</b>		802.11n		<b>RBW / VBW</b>		1 MHz/ 3 MHz	
<b>Standard</b>		CFR47 Part 15 Subpart C, RSS-247, RSS-GEN		<b>Performed by</b>		Richard van der Meer	
<b>Dist/Ant Used</b>		3m					
1 – 25 GHz Transmit at 2412 MHz (Low Channel)							
Frequency	EUT	EUT	Level	Detector	Polarity	Limit	Margin
MHz	Mode	Orientation	dBm		H/V	dBm	dB
1992.5	802.11n mcs7	Z	-43.6	Peak	V	-21.2 Pk/ -41.2 Ave	-22.4Pk/ -2.4 Ave
2200.5	802.11n mcs7	Z	-44.6	Peak	V	-21.2 Pk/ -41.2 Ave	-23.4Pk/ -3.4 Ave
3222.5	802.11n mcs7	V	-41.8	Peak	V	-21.2	-20.6
3222.5	802.11n mcs7	V	-67.4	Average	V	-41.2	-26.2
5993.5	802.11n mcs7	V	-45.0	Peak	V	-21.2	-23.8
5993.5	802.11n mcs7	V	<-55	Average	V	-41.2	-13.8
9668.5 <sup>H</sup>	802.11n mcs7	V	-42.4	Peak	V	-21.2	-21.2
9668.5 <sup>H</sup>	802.11n mcs7	V	-56.1	Average	V	-41.2	-14.9
14227	802.11n mcs0	V	-36.6	Peak	V	-21.2	-15.4
14227	802.11n mcs0	V	-51.5	Average	V	-41.2	-10.3
17831 <sup>R</sup>	802.11n mcs0	V	-29.4	Peak	V	-21.2	-8.2
17831 <sup>R</sup>	802.11n mcs0	V	-46.2	Average	V	-41.2	-5.0
Note: The levels are expressed in dBm which are derived from $\text{dBm} = E(\text{dB}\mu\text{V}/\text{m}) - 95.2\text{dB}$ . H refers to a harmonic of the fundamental, R refers to an emission in a restricted band Above 14 GHz no significant emissions was observed Measured spectrum=noise floor. a selection of plots are provided on the next pages							



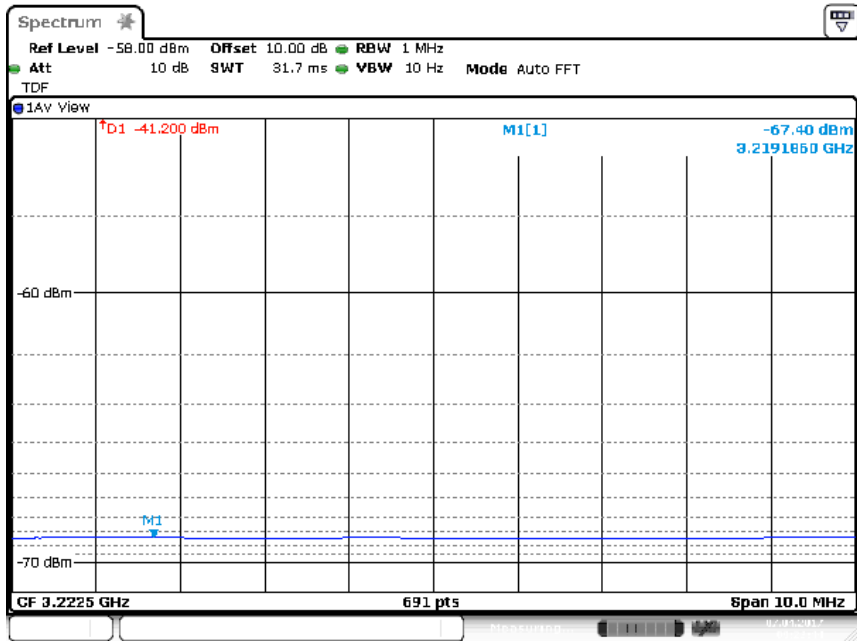
Date: 3.APR.2017 10:54:23

Plot of the emissions (peak values shown) in the range 1-2.3 GHz, 802.11n mcs7 , EUT Z Ant V

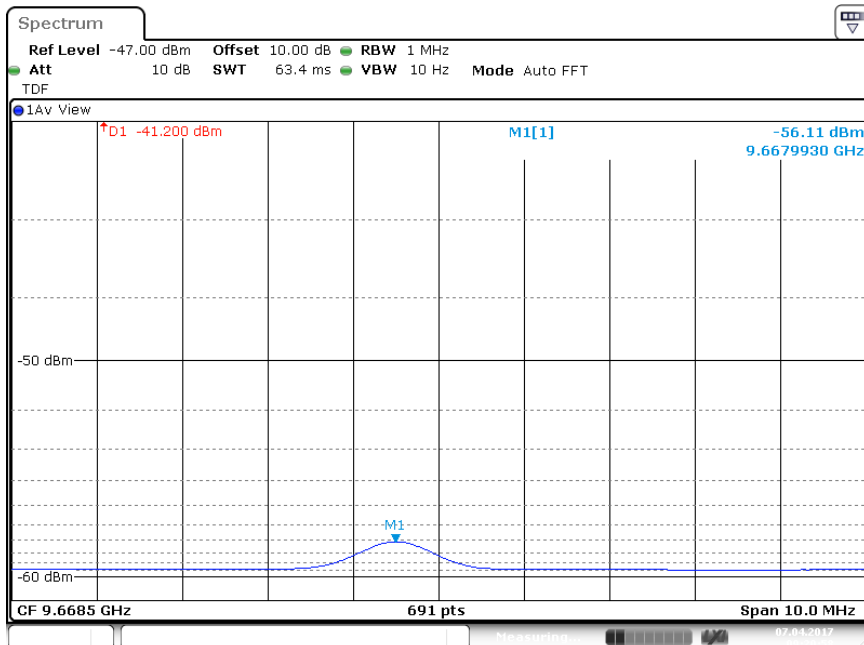


Date: 3.APR.2017 14:17:42

Plot of the emissions (peak values shown) in the range 3 -12 GHz, 802.11n mcs7 , EUT Z Ant V

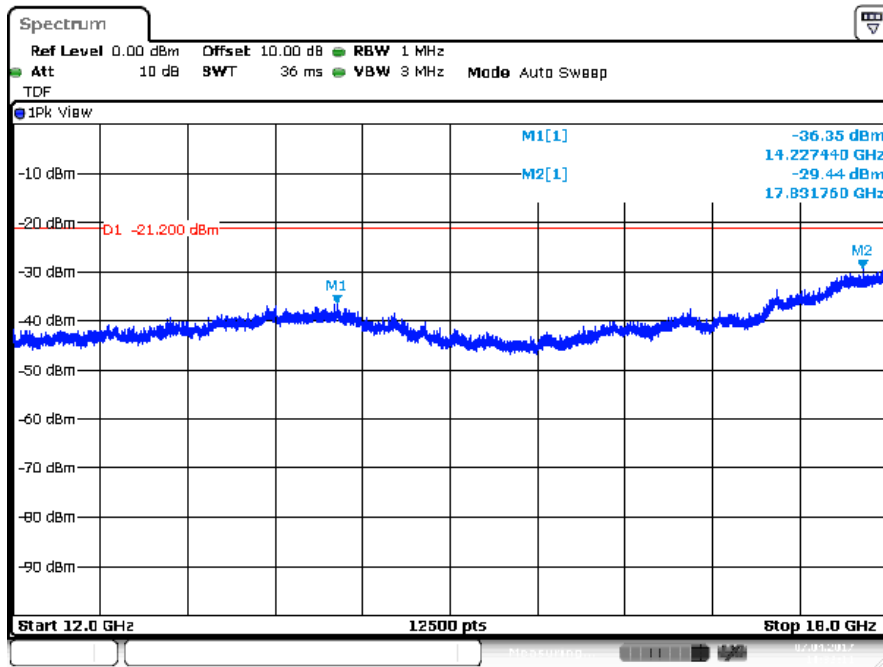


Date: 7.APR.2017 09:22:45



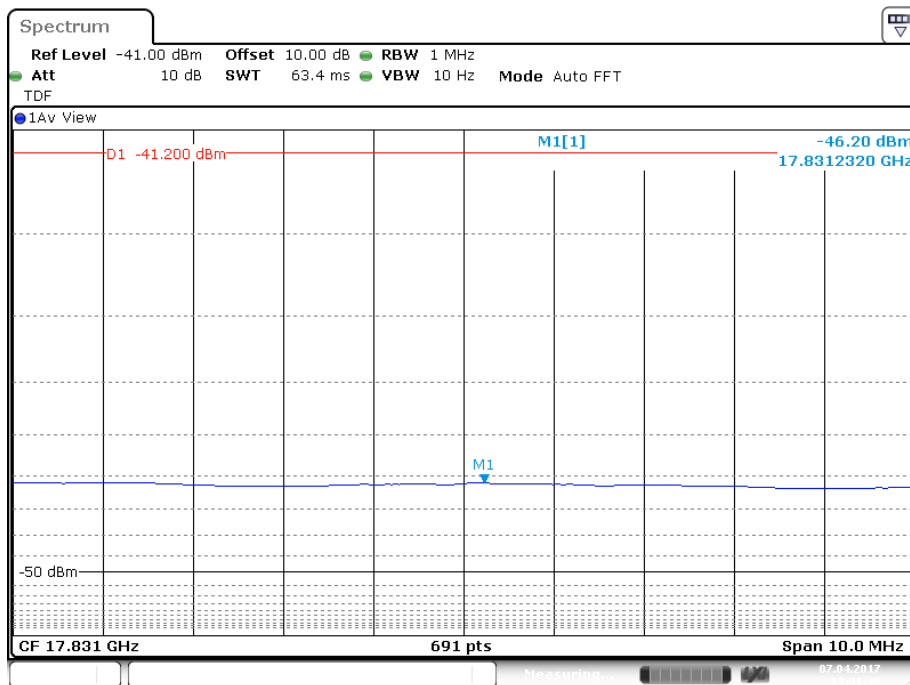
Date: 7.APR.2017 09:20:59

Plots of the emissions (average value shown) in the range 3-12 GHz, 802.11b 1Mbps, EUT Z Ant V (related to the previous plot).



Date: 7.APR.2017 11:32:10

Plot of the emissions (peak values shown) in the range 12 -18 GHz, 802.11n mcs0 , EUT V Ant V



Date: 7.APR.2017 13:41:46

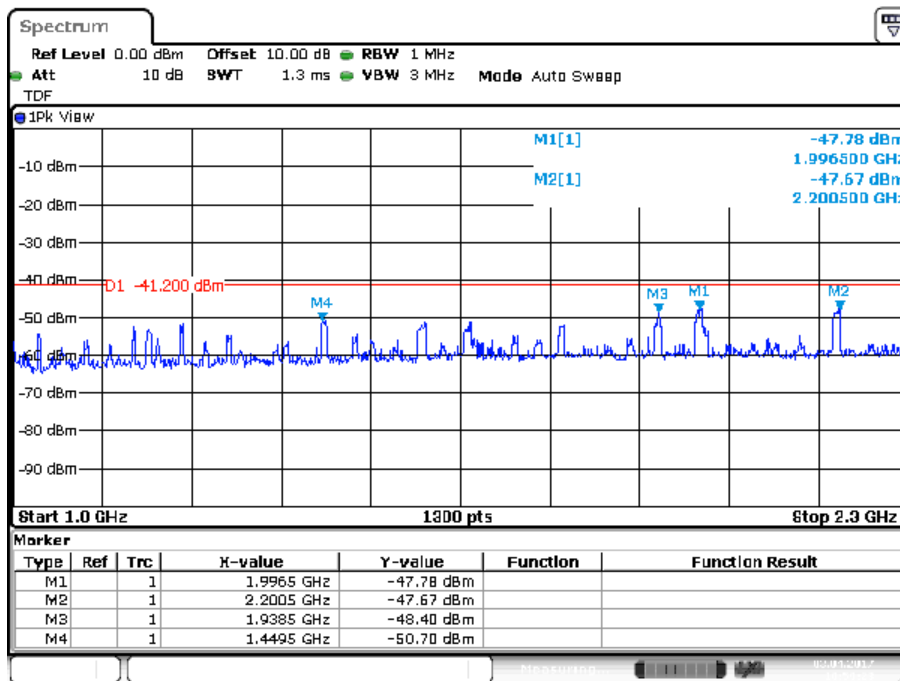
Plots of the emissions (average value shown) in the range 12-18 GHz, 802.11n mcs0, EUT V Ant V (related to the previous plot).

<b>Radiated Emissions</b>		Tracking # 17030802.fcc 01_Rev02	
<b>EUT</b>	With External antenna	<b>Date</b>	April 03–10, 2017
<b>EUT Config.</b>	802.11n	<b>RBW / VBW</b>	1 MHz/ 3 MHz
<b>Standard</b>	CFR47 Part 15 Subpart C, RSS-247, RSS-GEN	<b>Performed by</b>	Richard van der Meer
<b>Dist/Ant Used</b>	3m		

1 – 25 GHz Transmit at 2437 MHz (Mid Channel)

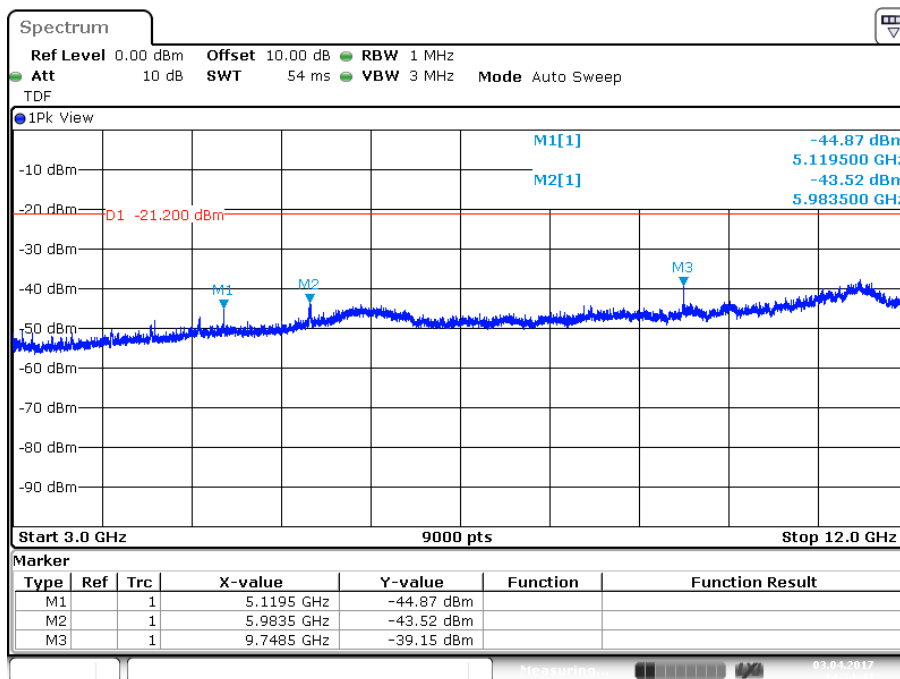
Frequency MHz	EUT Mode	EUT Orientation	Level dBm	Detector	Polarity H/V	Limit dBm	Margin dB
1938.5	802.11n mcs7	Z	-48.4	Peak	V	-21.2 Pk/ -41.2 Ave	-27.2 Pk/ -7.2 Ave
1996.5	802.11n mcs7	Z	-47.8	Peak	V	-21.2 Pk/ -41.2 Ave	-26.6 Pk/ -6.6 Ave
2200.5 <sup>R</sup>	802.11n mcs7	Z	-47.7	Peak	V	-21.2 Pk/ -41.2 Ave	-26.5 Pk/ -6.5 Ave
5119.5 <sup>R</sup>	802.11n mcs0	V	-44.9 Pk <-55 Ave	Peak	V	-21.2 Pk/ -41.2 Ave	-23.7 Pk/ -13.8 Ave
5982.5	802.11n mcs0	V	-43.5 Pk <-55 Ave	Peak	V	-21.2 Pk/ -41.2 Ave	-22.3 Pk/ -13.8 Ave
9748.5 <sup>H</sup>	802.11n mcs0	V	-39.1	Peak	V	-21.2	-17.9
9748.5 <sup>H</sup>	802.11n mcs0	V	-56.2	Average	V	-41.2	-15.0
14588.4	802.11n mcs0	V	-38.9	Peak	V	-21.2	-17.7
14588.4	802.11n mcs0	V	-53.5	Average	V	-41.2	-12.3
17910 <sup>R</sup>	802.11n mcs0	V	-29.9	Peak	V	-21.2	-8.7
17910 <sup>R</sup>	802.11n mcs0	V	-45.7	Average	V	-41.2	-4.5
22153 <sup>R</sup>	802.11n mcs0	V	-43.7	Peak	V	-21.2	-22.5
22153 <sup>R</sup>	802.11n mcs0	V	-59.0	Average	V	-41.2	-17.8

Note: The levels are expressed in dBm which are derived from  $\text{dBm} = E(\text{dB}\mu\text{V}/\text{m}) - 95.2\text{dB}$ .  
 H refers to a harmonic of the fundamental, R refers to an emission in a restricted band  
 Above 15 GHz no significant emissions was observed Measured spectrum=noise floor.  
 a selection of plots are provided on the next pages.



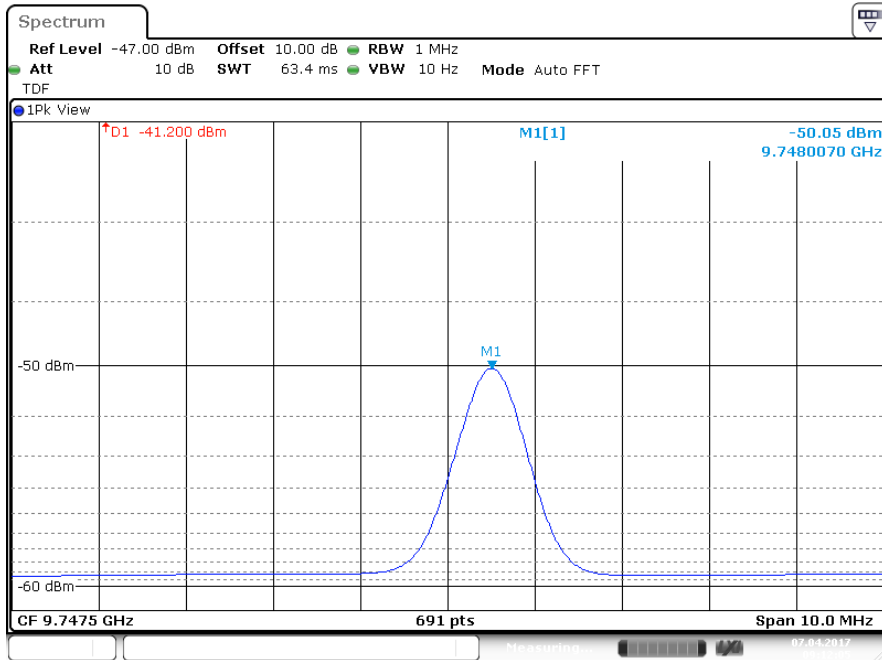
Date: 3.APR.2017 10:59:22

Plot of the emissions (peak values shown) in the range 1-2.3 GHz, 802.11n mcs7 , EUT Z Ant V



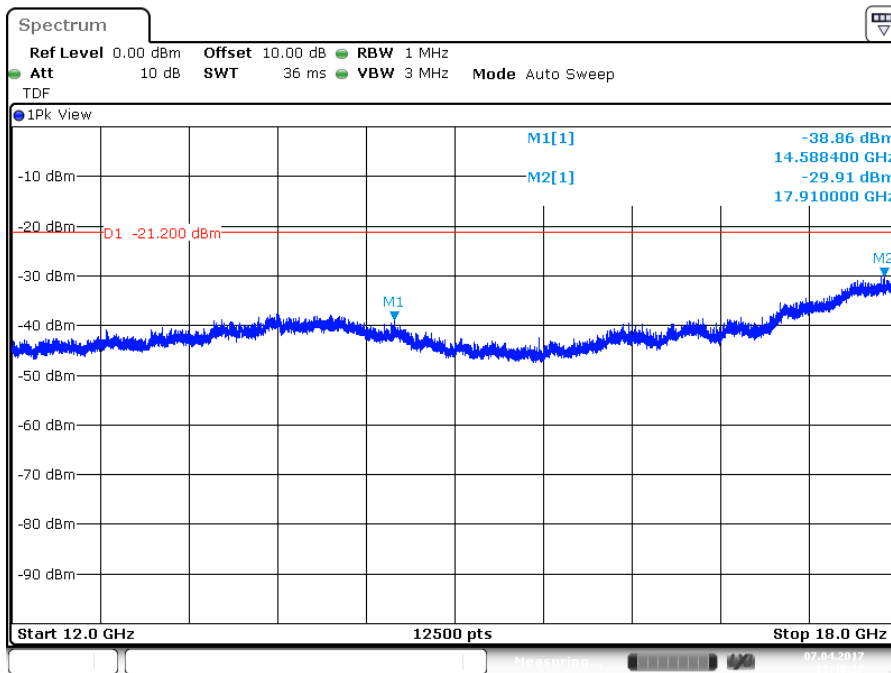
Date: 3.APR.2017 14:34:44

Plot of the emissions (peak values shown) in the range 3 -12 GHz, 802.11n mcs0 , EUT V Ant V



Date: 7.APR.2017 09:12:05

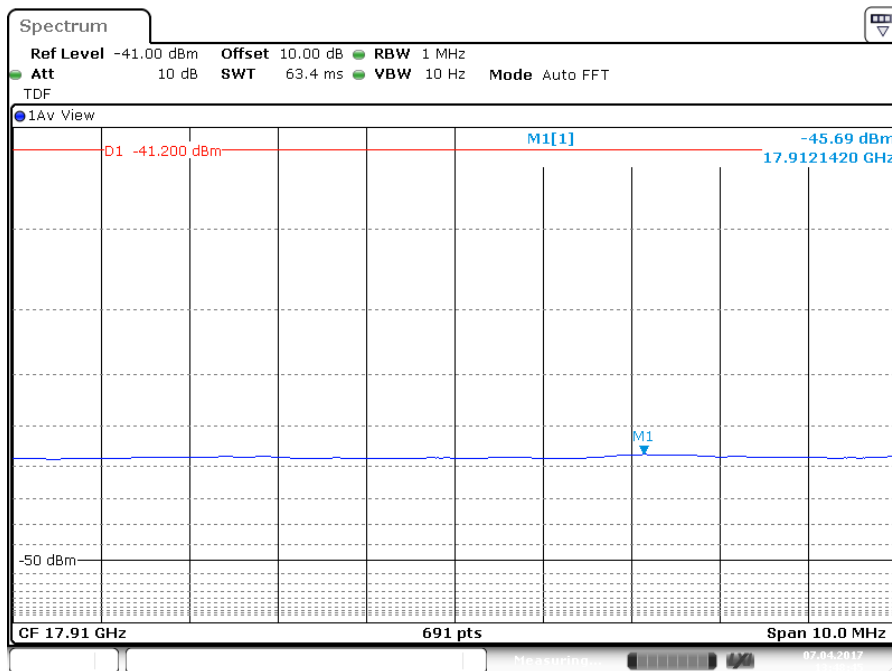
Plots of the emissions (average value shown) in the range 3-12 GHz, 802.11n mcs0, EUT V Ant V (related to the previous plot).



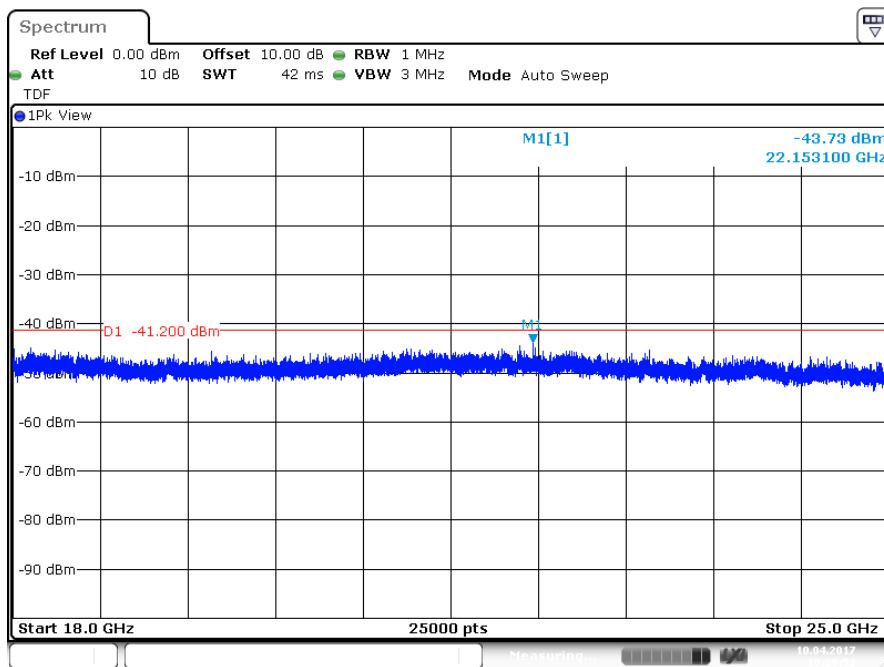
Date: 7.APR.2017 11:40:27

Plot of the emissions (peak values shown) in the range 12 -18 GHz, 802.11n mcs0, EUT V Ant V



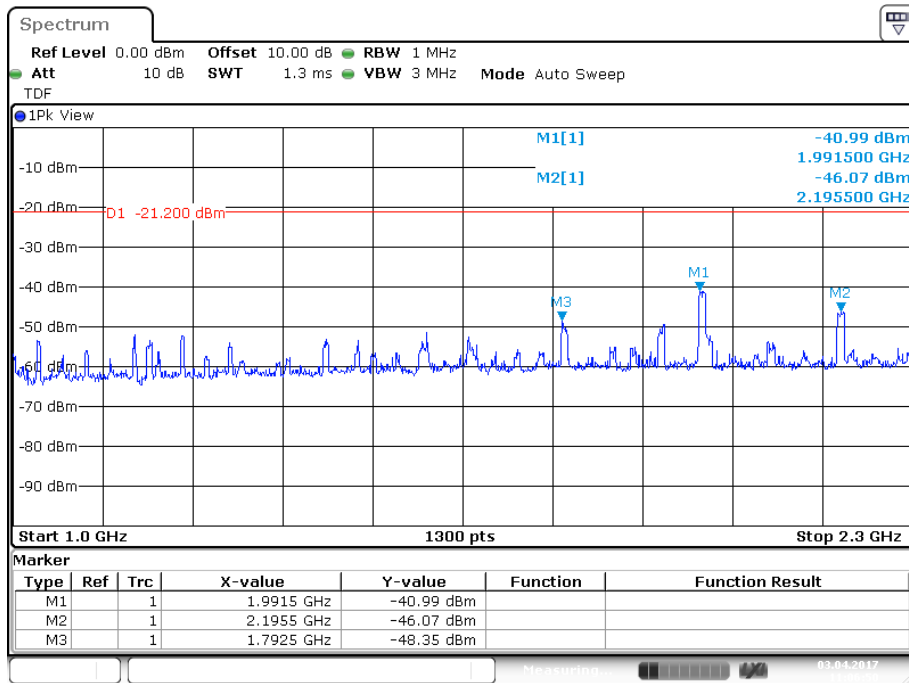


Plots of the emissions (average value shown) in the range 12-18 GHz, 802.11n mcs0, EUT V Ant V (related to the previous plot).

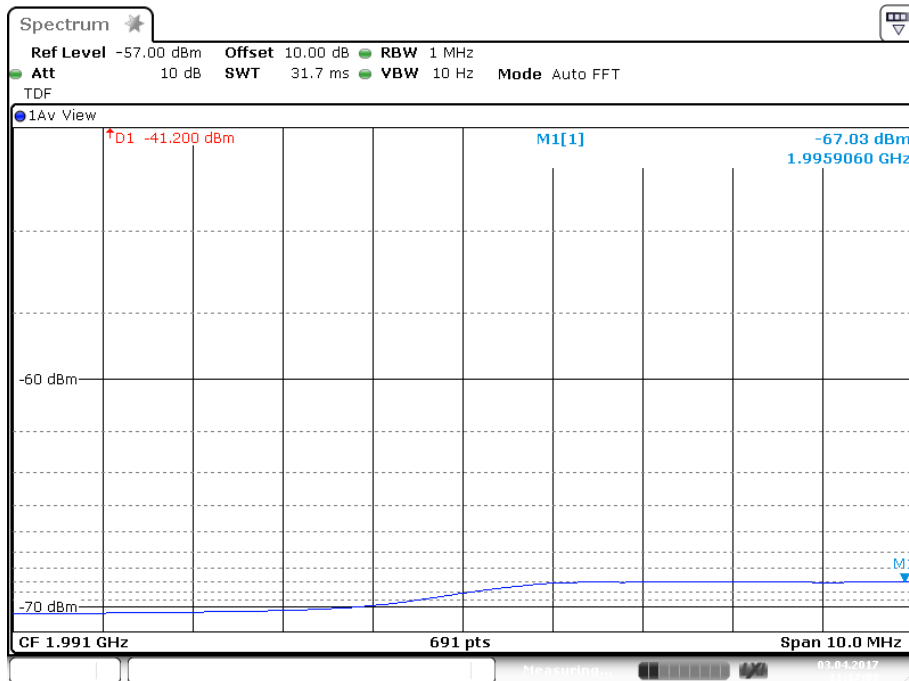


Plot of the emissions (peak values shown) in the range 18 -25 GHz, 802.11n mcs0, EUT V Ant V

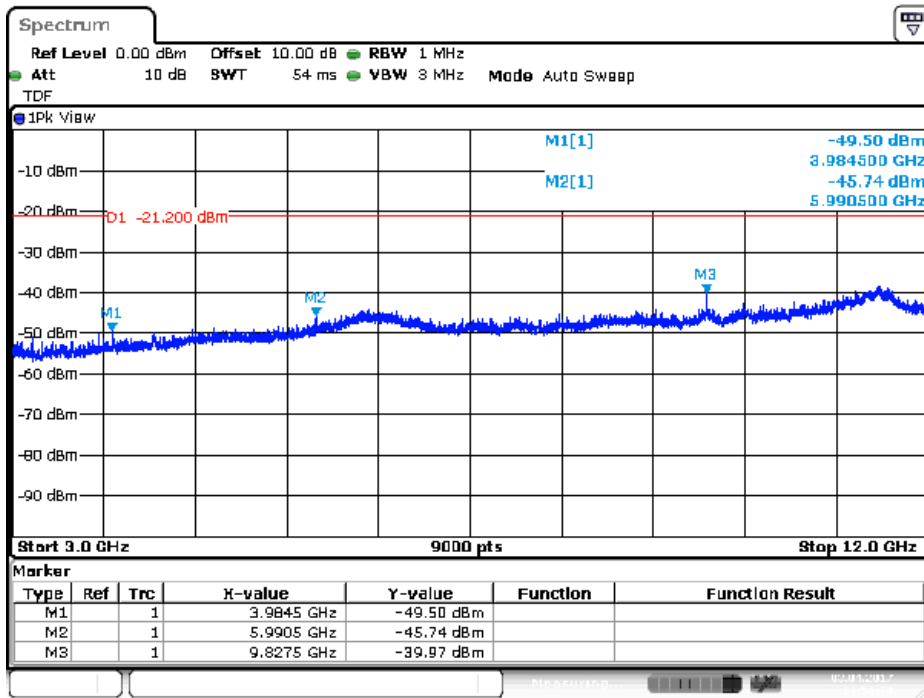
Radiated Emissions				Tracking # 17030802.fcc 01_Rev02			
<b>EUT</b>		With External antenna		<b>Date</b>		April 03–10, 2017	
<b>EUT Config.</b>		802.11n		<b>RBW / VBW</b>		1 MHz/ 3 MHz	
<b>Standard</b>		CFR47 Part 15 Subpart C, RSS-247, RSS-GEN		<b>Performed by</b>		Richard van der Meer	
<b>Dist/Ant Used</b>		3m					
1 – 25 GHz Transmit at 2462 MHz (High Channel)							
Frequency	EUT	EUT	Level	Detector	Polarity	Limit	Margin
MHz	Mode	Orientation	dBm		H/V	dBm	dB
1792.5	802.11n mcs0	Z	-48.3	Peak	V	-21.2 Pk/ -41.2 Ave	-27.1Pk/ -7.1 Ave
1991.5	802.11n mcs0	Z	-41.0	Peak	V	-21.2	-19.8
1991.5	802.11n mcs0	Z	-67.0	Average	V	-41.2	-25.8
2195.5	802.11n mcs0	Z	-46.1	Peak	V	-21.2 Pk/ -41.2 Ave	-24.9Pk/ -4.9 Ave
3984.5 <sup>R</sup>	802.11n mcs0	V	-49.5	Peak	V	-21.2 Pk/ -41.2 Ave	-28.3Pk/ -8.3 Ave
5990.5	802.11n mcs0	V	-45.7	Peak	V	-21.2 Pk/ -41.2 Ave	-24.5Pk/ -4.5 Ave
9827.5 <sup>H</sup>	802.11n mcs0	V	-40.0	Peak	V	-21.2	-18.8
9827.5 <sup>H</sup>	802.11n mcs0	V	-50.2	Average	V	-41.2	-9.0
14239	802.11n mcs0	V	-37.4	Peak	V	-21.2	-16.2
14239	802.11n mcs0	V	-51.3	Average	V	-41.2	-10.1
15674 <sup>R</sup>	802.11n mcs0	V	-41.7	Peak	V	-21.2	-20.5
15674 <sup>R</sup>	802.11n mcs0	V	-56.4	Average	V	-41.2	-25.2
18332 <sup>R</sup>	802.11n mcs0	V	-44.4	Peak	V	-21.2	-23.2
18332 <sup>R</sup>	802.11n mcs0	V	-59.3	Average	V	-41.2	-18.1
<p>Note: The levels are expressed in dBm which are derived from <math>\text{dBm} = E(\text{dB}\mu\text{V}/\text{m}) - 95.2\text{dB}</math>.            H refers to a harmonic of the fundamental, R refers to an emission in a restricted band            Above 15 GHz no significant emissions was observed Measured spectrum=noise floor.            a selection of plots are provided on the next pages.</p>							



Plot of the emissions (peak values shown) in the range 1-2.3 GHz, 802.11n mcs0 , EUT Z Ant V

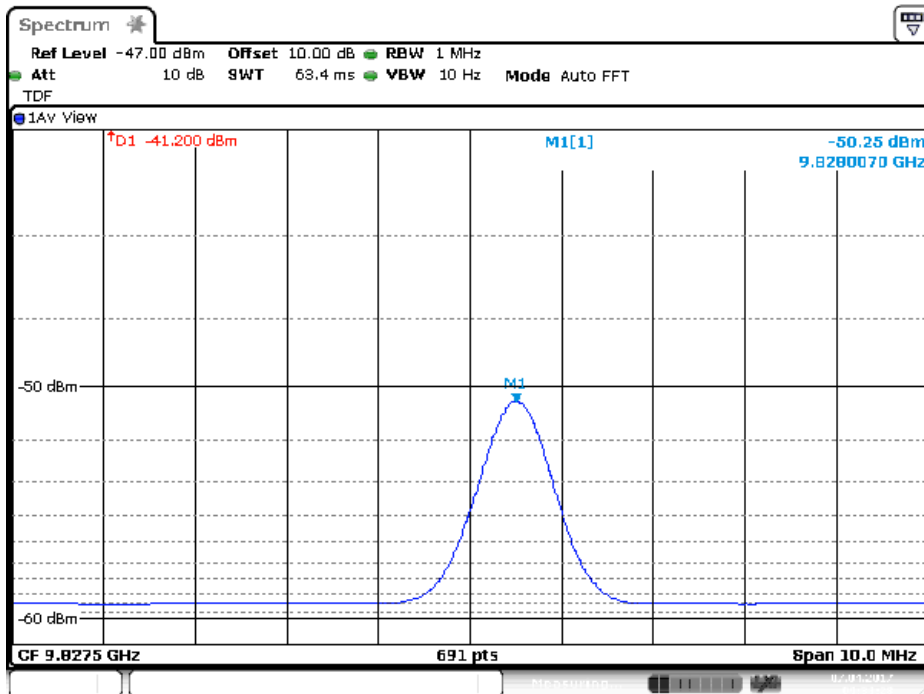


Plots of the emissions (average value shown) in the range 1-2.3 GHz, 802.11n mcs0, EUT Z Ant V (related to the previous plot).



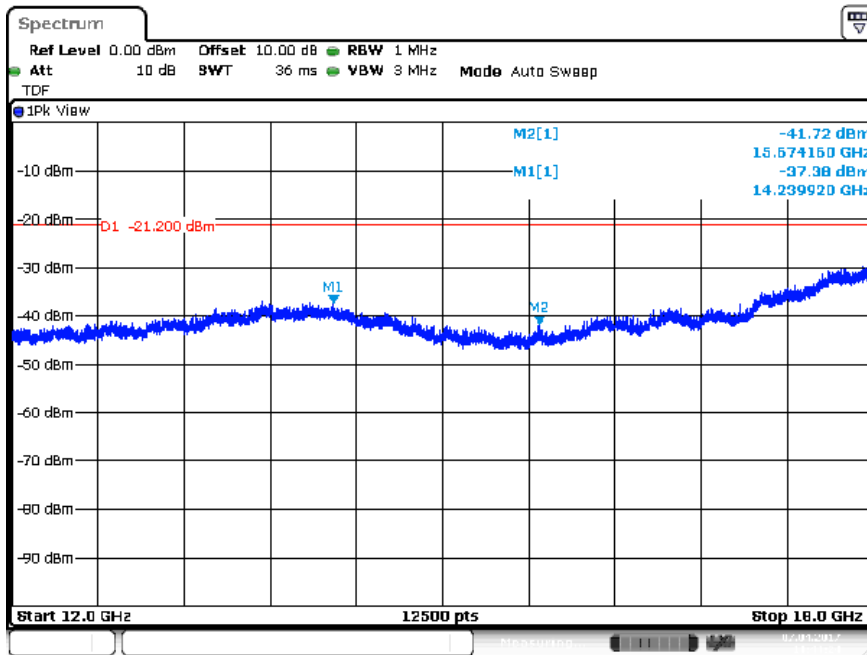
Date: 3.APR.2017 14:56:38

Plot of the emissions (peak values shown) in the range 3 -12 GHz, 802.11n mcs0 , EUT V Ant V



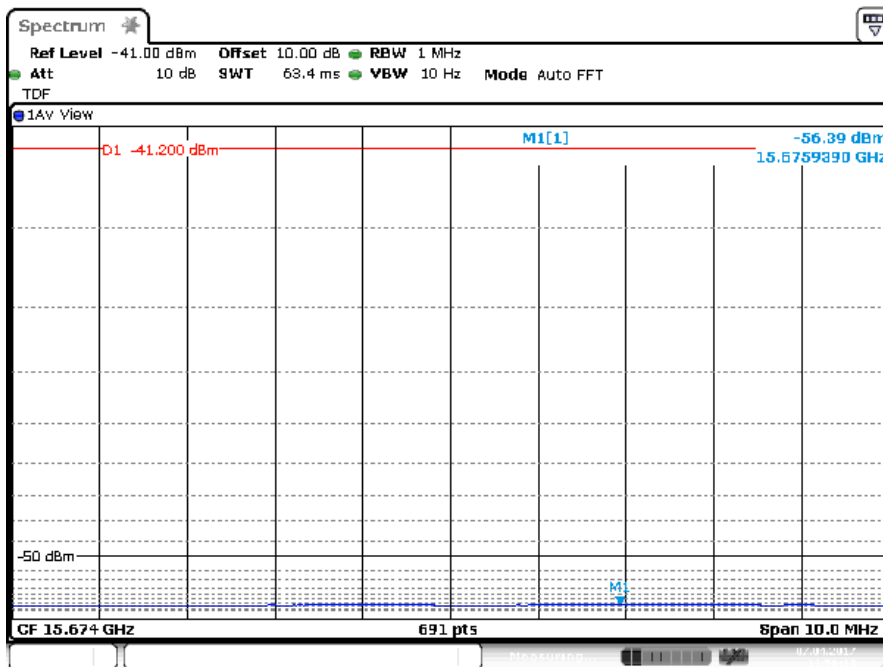
Date: 7.APR.2017 09:33:29

Plots of the emissions (average value shown) in the range 3-12 GHz, 802.11n mcs0, EUT V Ant V (related to the previous plot).



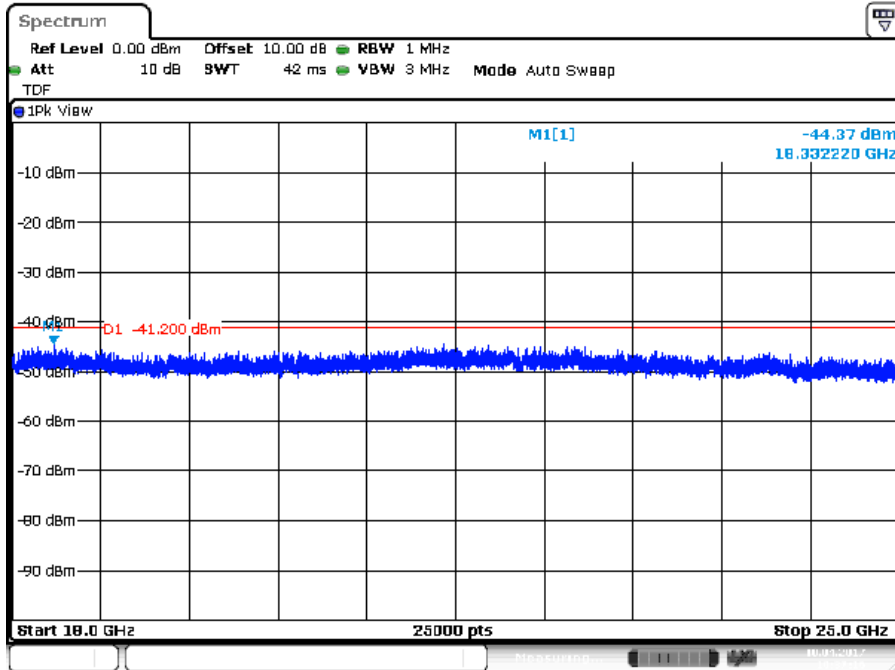
Date: 7.APR.2017 11:44:24

Plot of the emissions (peak values shown) in the range 12 -18 GHz, 802.11n mcs0 , EUT V Ant V



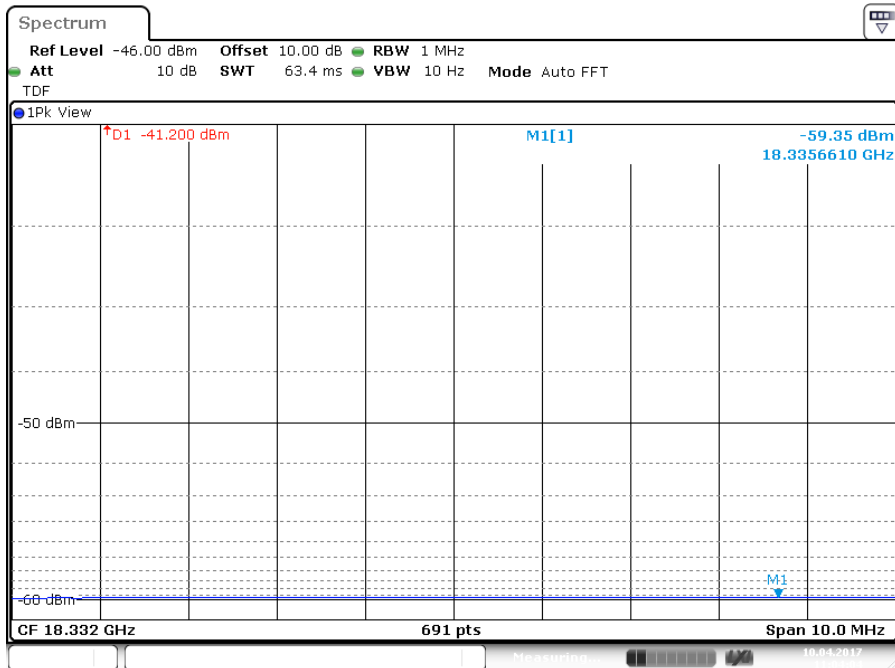
Date: 7.APR.2017 13:56:13

Plots of the emissions (average value shown) in the range 12-18 GHz, 802.11n mcs0, EUT V Ant V (related to the previous plot).



Date: 10.APR.2017 10:37:16

Plot of the emissions (peak values shown) in the range 18 -25 GHz, 802.11n mcs0 , EUT V Ant V

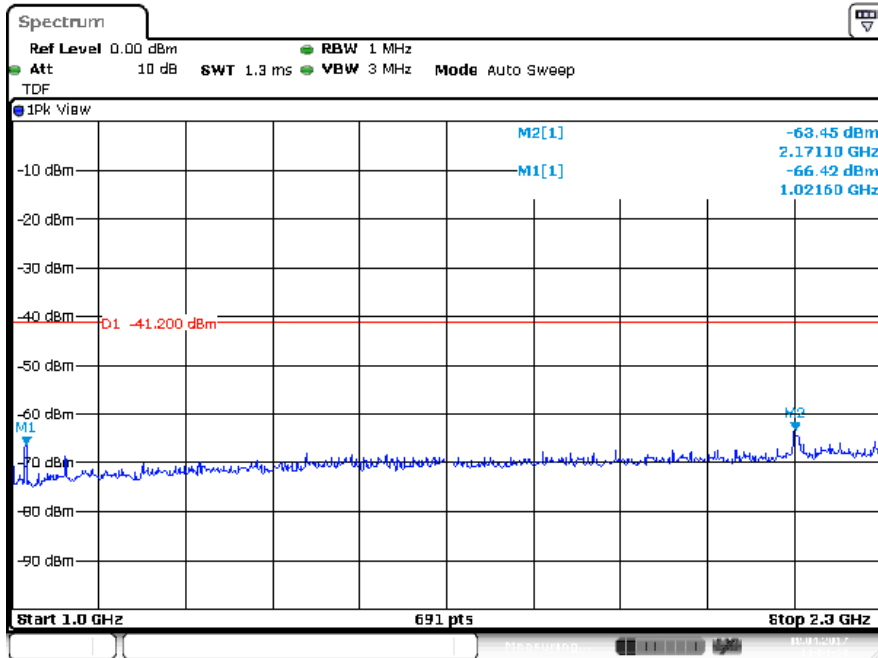


Date: 10.APR.2017 11:04:04

Plots of the emissions (average value shown) in the range 18-25 GHz, 802.11n mcs0, EUT V Ant V (related to the previous plot).

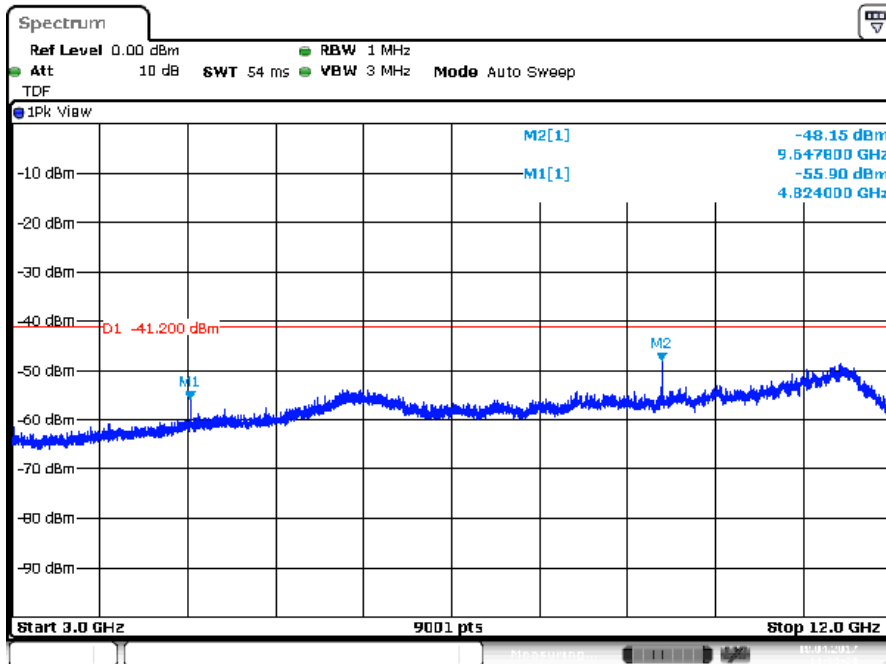
**INTERNAL ANT**

<b>Radiated Emissions</b>				Tracking # 17030802.fcc 01_Rev02			
<b>EUT</b> With Internal antenna							
<b>EUT Config.</b> 802.11b				<b>Date</b> April 18, 2017			
<b>Standard</b> CFR47 Part 15 Subpart C, RSS-247, RSS-GEN				<b>RBW / VBW</b> 1 MHz/ 3 MHz			
<b>Dist/Ant Used</b> 3m				<b>Performed by</b> Richard van der Meer			
1 – 25 GHz Transmit at 2412 MHz (Low Channel)							
Frequency MHz	EUT Mode	EUT Orientation	Level dBm	Detector	Polarity H/V	Limit dBm	Margin dB
4824.0 <sup>H R</sup>	802.11b 1Mbps	H	-55.9	Peak	V	-21.2 Pk/ -41.2 Ave	-34.7Pk/ -4.7Ave
9647.8 <sup>H</sup>	802.11b 1Mbps	H	-48.1	Peak	V	-21.2 Pk/ -41.2 Ave	-26.9Pk/ -6.9 Ave
13761.2	802.11b 1Mbps	V	-46.9	Peak	H	-21.2 Pk/ -41.2 Ave	-25.7Pk/ -5.7 Ave
16858.7	802.11b 1Mbps	V	-46.6	Peak	V	-21.2 Pk/ -41.2 Ave	-25.4Pk/ -5.4 Ave
<p>Note: The levels are expressed in dBm which are derived from <math>\text{dBm} = E(\text{dB}\mu\text{V}/\text{m}) - 95.2\text{dB}</math>.          H refers to a harmonic of a fundamental frequency, R refers to an emission in a restricted band          See a selection of plots on the next pages.</p>							



Date: 18.APR.2017 13:04:23

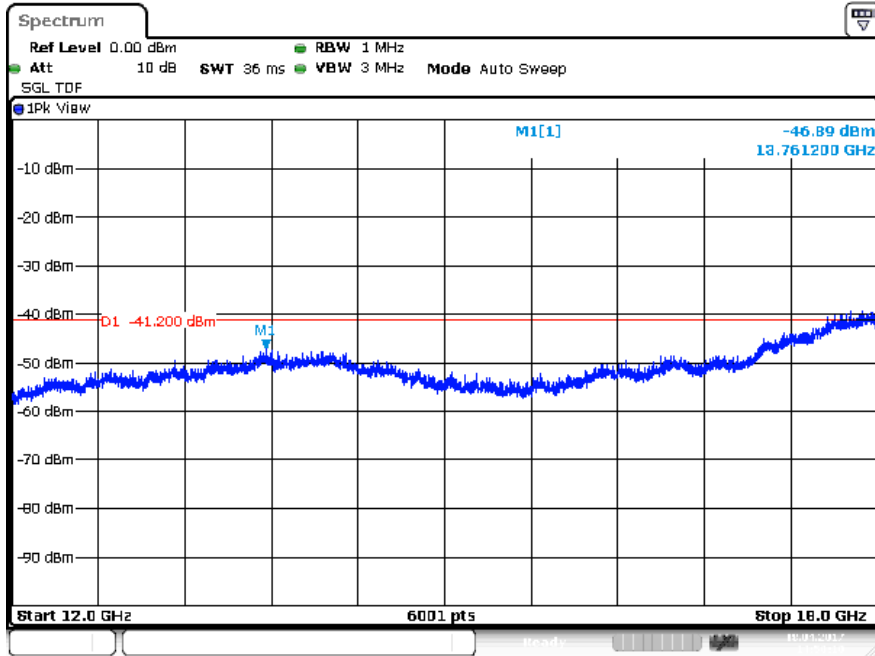
Plot of the emissions (peak values shown) in the range 1-2.3 GHz, 802.11b 1Mbps, EUT V Ant H



Date: 18.APR.2017 13:39:28

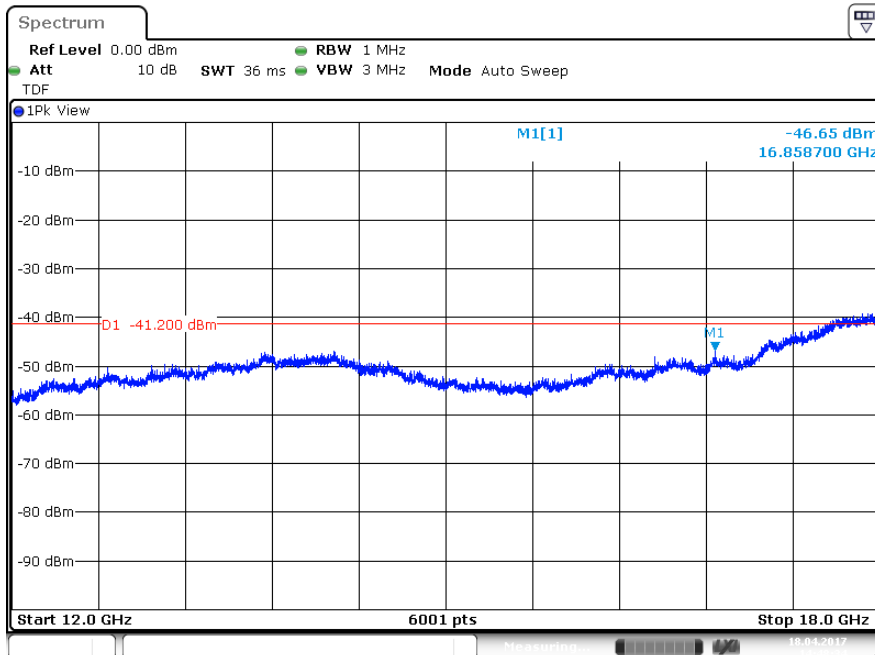
Plot of the emissions (peak values shown) in the range 3 -12 GHz, 802.11b 1Mbps, EUT H Ant V





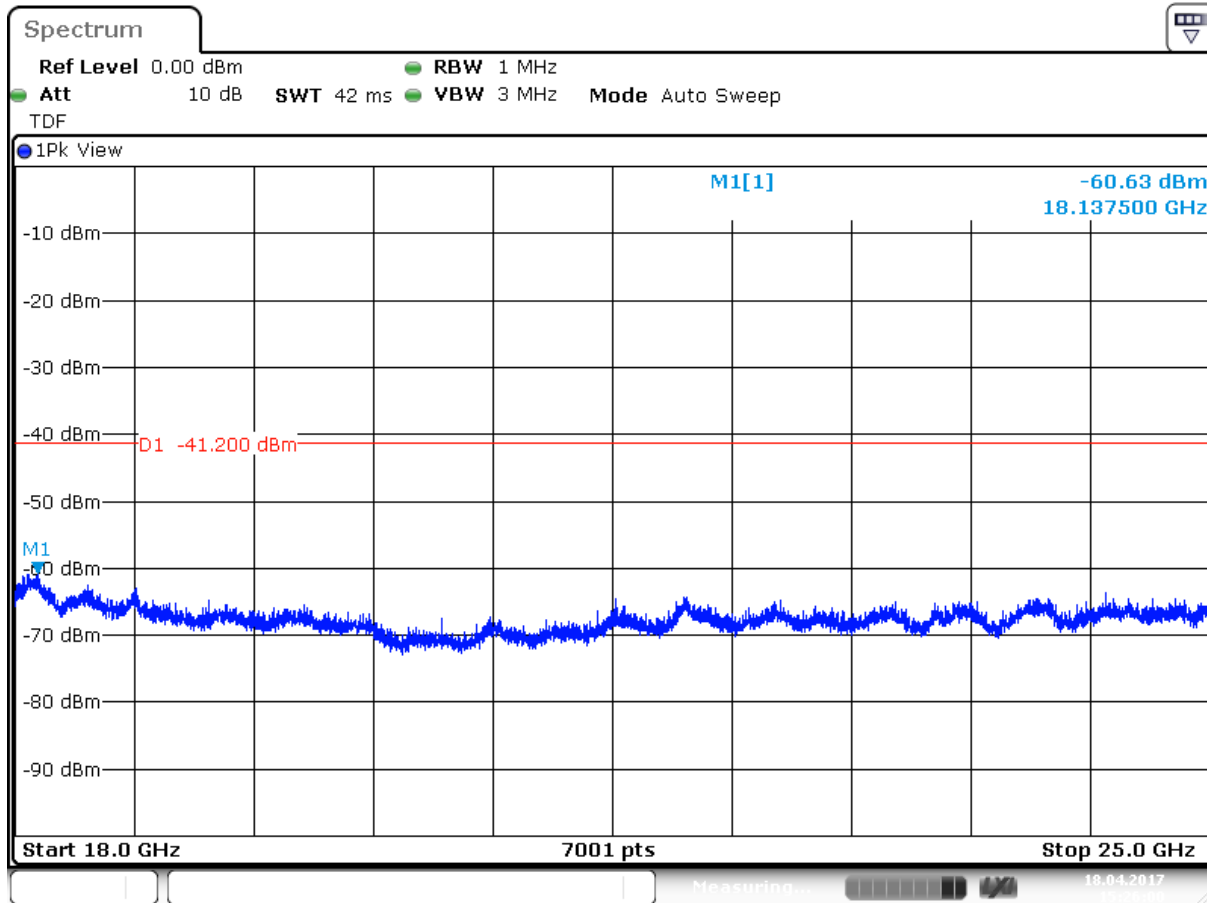
Date: 18.APR.2017 14:50:09

Plot of the emissions (peak value shown) in the range 12-18 GHz, 802.11b 1Mbps, EUT V Ant H



Date: 18.APR.2017 14:48:35

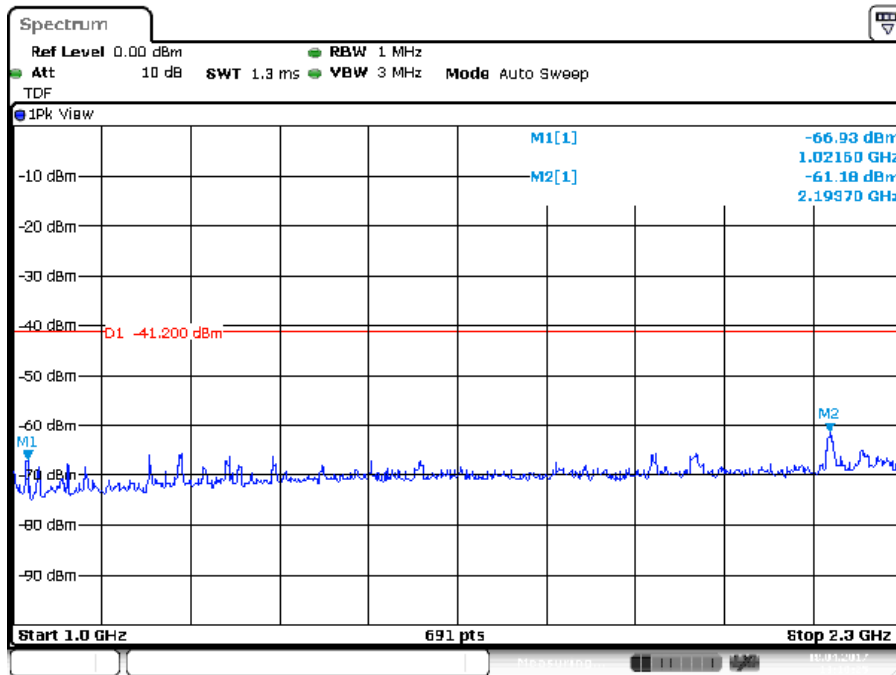
Plot of the emissions (peak values shown) in the range 12-18 GHz, 802.11b 1Mbps, EUT V Ant V



Date: 18.APR.2017 15:26:00

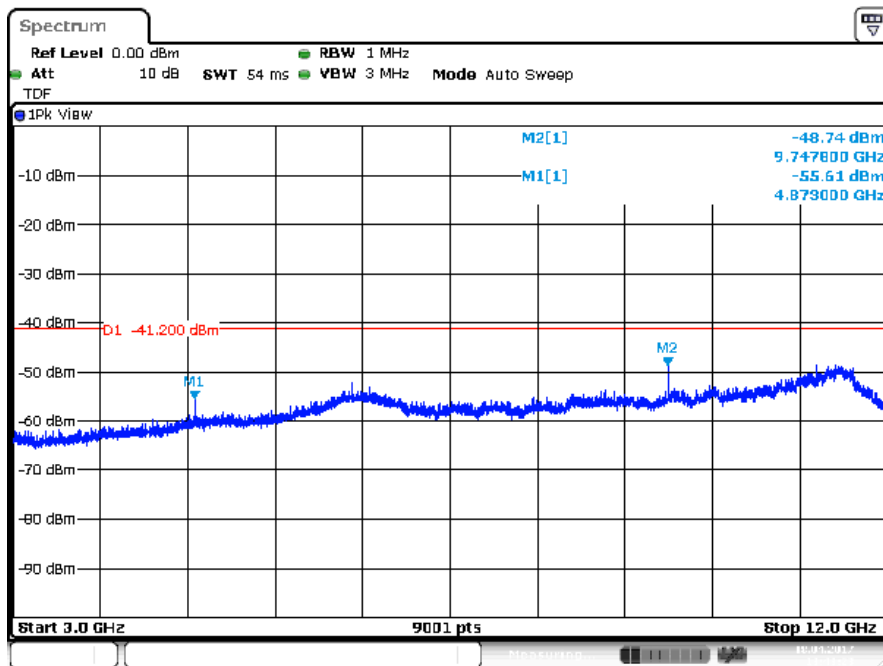
Plot of the emissions (peak values shown) in the range 18-25 GHz, 802.11b 1Mbps, EUT V Ant V – only noise (applicable for all modes)

<b>Radiated Emissions</b>		Tracking # 17030802.fcc 01_Rev02					
<b>EUT</b>	With Internal antenna						
<b>EUT Config.</b>	802.11b	<b>Date:</b>		April 18, 2017			
<b>Standard</b>	CFR47 Part 15 Subpart C, RSS-247, RSS-GEN	<b>RBW / VBW</b>		1 MHz/ 3 MHz			
<b>Dist/Ant Used</b>	3m	<b>Performed by</b>		Richard van der Meer			
1 – 25 GHz Transmit at 2437 MHz (Mid Channel)							
Frequency	EUT	EUT	Level	Detector	Polarity	Limit	Margin
MHz	Mode	Orientation	dBm		H/V	dBm	dB
4873.0 <sup>H R</sup>	802.11b 1Mbps	H	-55.6	Pk	V	-21.2 Pk/ -41.2 Ave	-34.4 Pk/ -14.4 Ave
9747.8 <sup>H</sup>	802.11b 1Mbps	H	-48.7	Pk	V	-21.2 Pk/ -41.2 Ave	-27.5 Pk/ -7.5 Ave
14083.2	802.11b 1Mbps	V	-46.5	Pk	V	-21.2 Pk/ -41.2 Ave	-25.3 Pk/ -5.3 Ave
<p>Note: The levels are expressed in dBm which are derived from <math>\text{dBm} = E(\text{dB}\mu\text{V}/\text{m}) - 95.2\text{dB}</math>.          H refers to a harmonic of the fundamental, R refers to an emission in a restricted band          Above 12GHz No significant emissions was observed Measured spectrum= noise floor          See a selection of plots on the next pages.</p>							



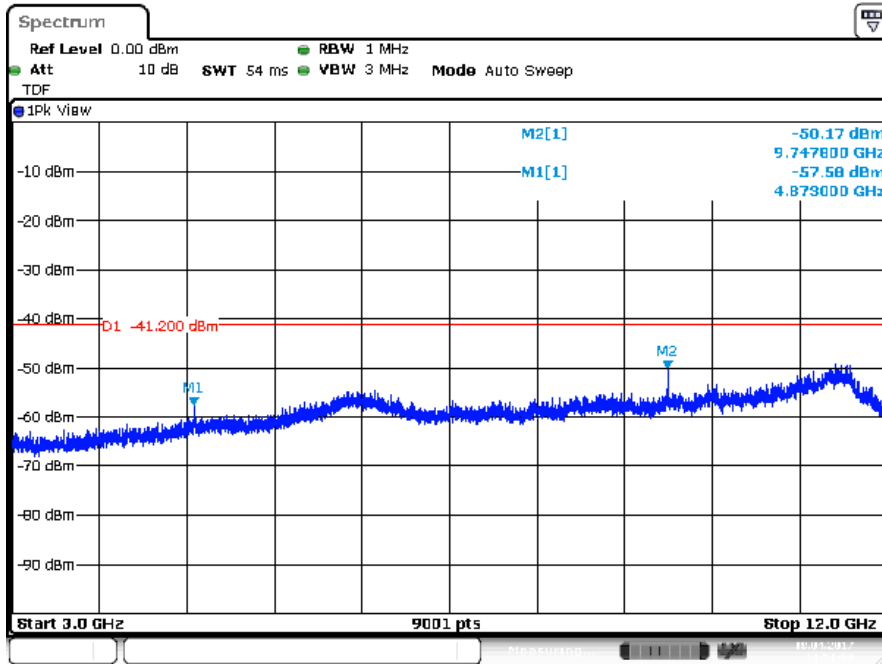
Date: 18.APR.2017 13:10:25

Plot of the emissions (peak values shown) in the range 1-2.3 GHz, 802.11b 1Mbps, EUT H Ant V



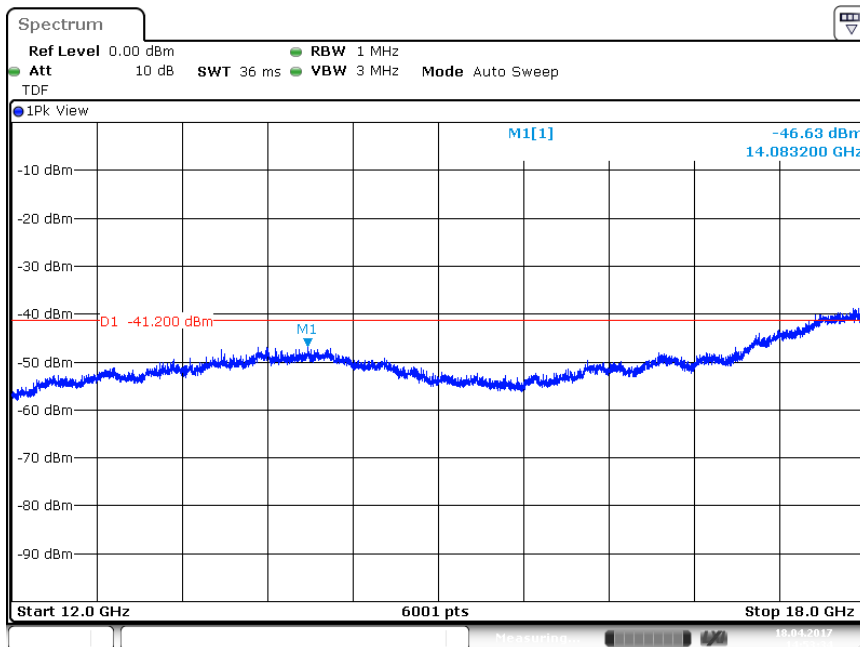
Date: 18.APR.2017 13:43:23

Plot of the emissions (peak values shown) in the range 3-12 GHz, 802.11b 1Mbps, EUT H Ant V



Date: 18.APR.2017 13:51:07

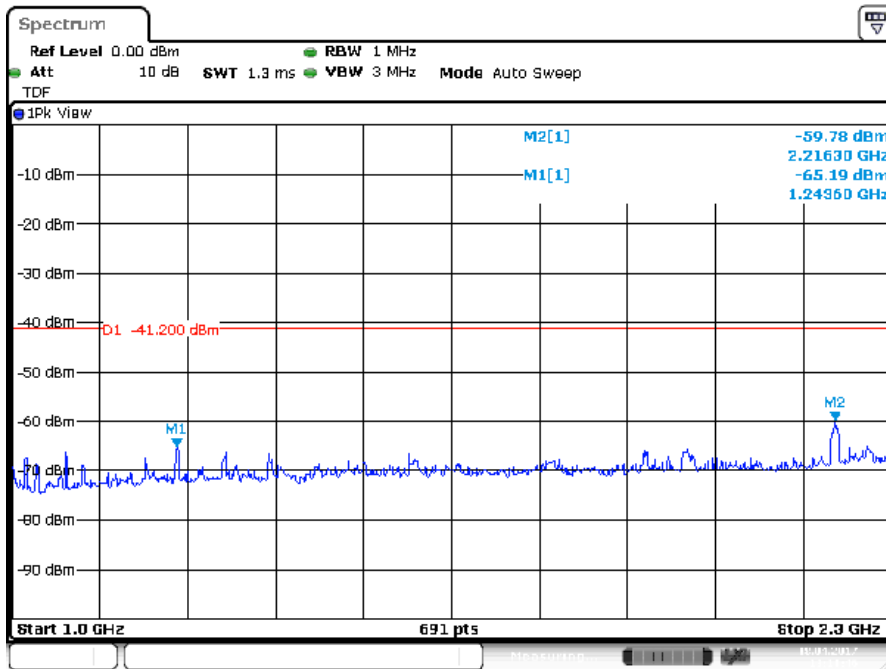
Plot of the emissions (peak value shown) in the range 3-12 GHz, 802.11b 11Mbps, EUT H Ant V



Date: 18.APR.2017 14:53:34

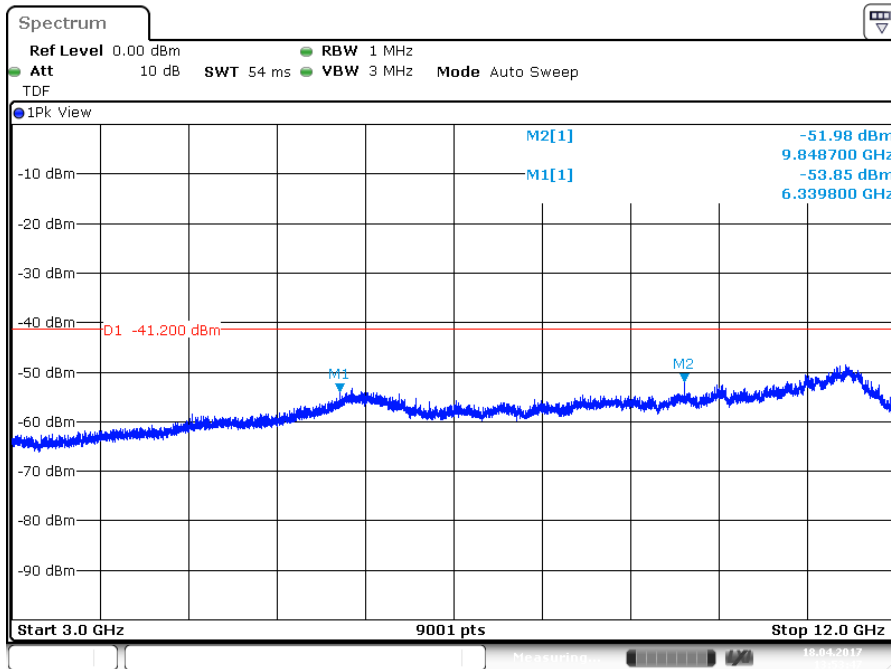
Plot of the emissions (peak values shown) in the range 12-18 GHz, 802.11b 1Mbps, EUT V Ant V

<b>Radiated Emissions</b>		Tracking # 17030802.fcc 01_Rev02					
<b>EUT</b>	With Internal antenna						
<b>EUT Config.</b>	802.11b	<b>Date</b>	April 18, 2017				
<b>Standard</b>	CFR47 Part 15 Subpart C, RSS-247, RSS-GEN	<b>RBW / VBW</b>	1 MHz/ 3 MHz				
<b>Dist/Ant Used</b>	3m	<b>Performed by</b>	Richard van der Meer				
1 – 25 GHz Transmit at 2462 MHz (High Channel)							
Frequency	EUT	EUT	Level	Detector	Polarity	Limit	Margin
MHz	Mode	Orientation	dBm		H/V	dBm	dB
6339.8	802.11b 1Mbps	H	-53.8	Pk	H	-21.2 Pk/ -41.2 Ave	-32.6 Pk/ -12.6 Ave
9848.7 <sup>H</sup>	802.11b 1Mbps	H	-52.0	Pk	V	-21.2 Pk/ -41.2 Ave	-30.8 Pk/ -10.8 Ave
14208.1	802.11b 1Mbps	V	-47.5	Pk	V	-21.2 Pk/ -41.2 Ave	-26.3 Pk/ -6.3 Ave
<p>Note: The levels are expressed in dBm which are derived from <math>\text{dBm} = E(\text{dB}\mu\text{V}/\text{m}) - 95.2\text{dB}</math>.          H refers to a harmonic of the fundamental, R refers to an emission in a restricted band          Above 12GHz No significant emissions was observed Measured spectrum= noise floor          See a selection of plots on the next pages.</p>							



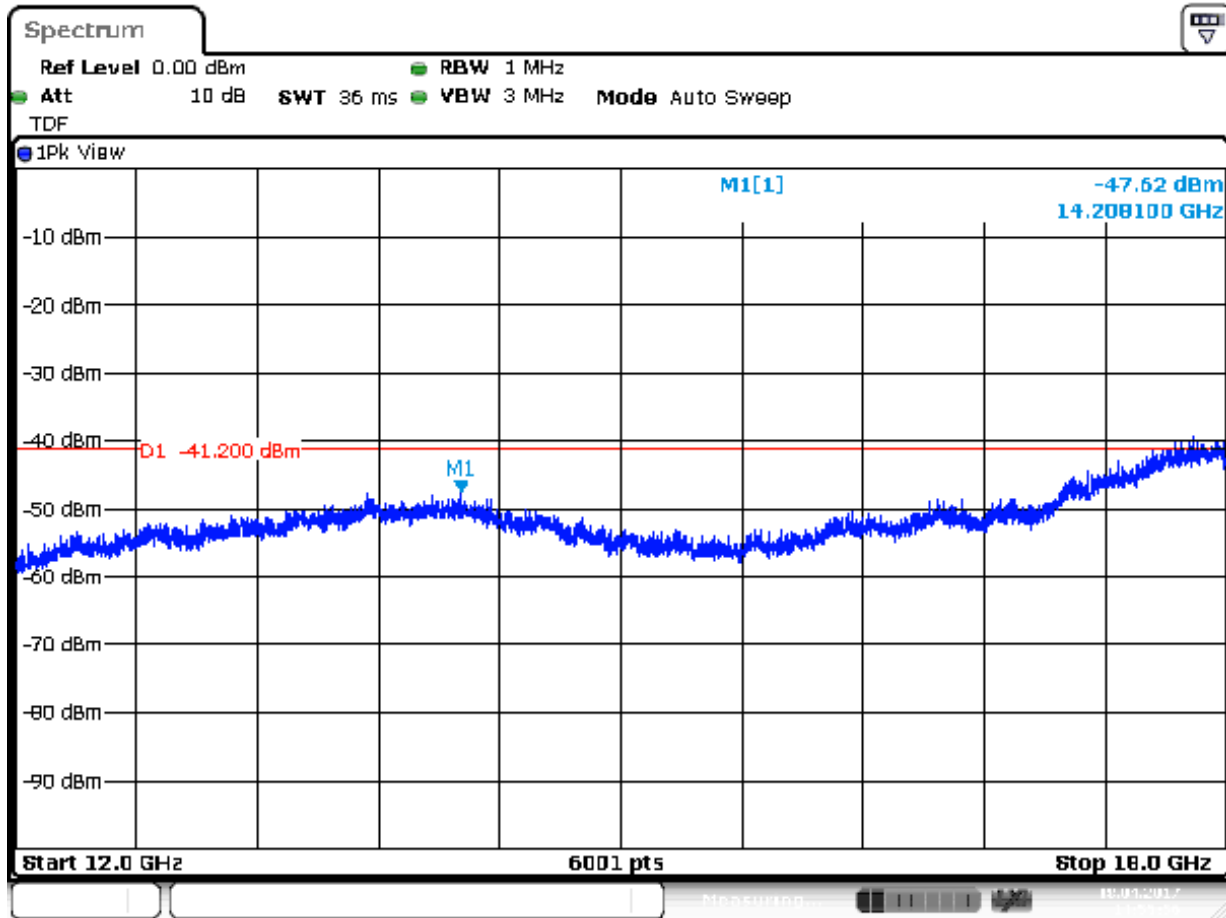
Date: 18.APR.2017 13:11:46

Plot of the emissions (peak values shown) in the range 1-2.3 GHz, 802.11b 1Mbps, EUT V Ant H



Date: 18.APR.2017 13:53:47

Plot of the emissions (peak value shown) in the range 3-12 GHz, 802.11b 1Mbps, EUT H Ant V

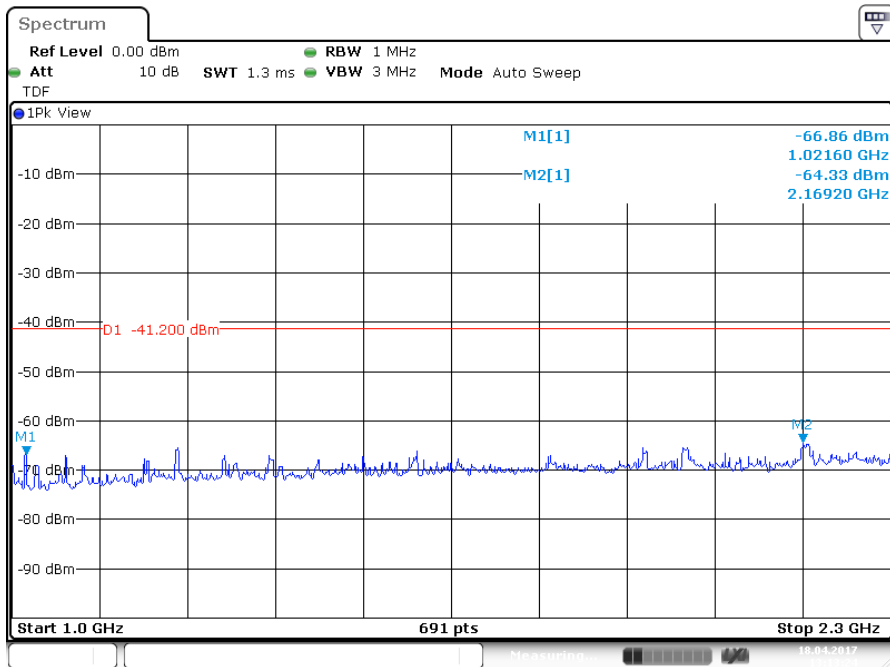


Date: 18.APR.2017 14:55:56

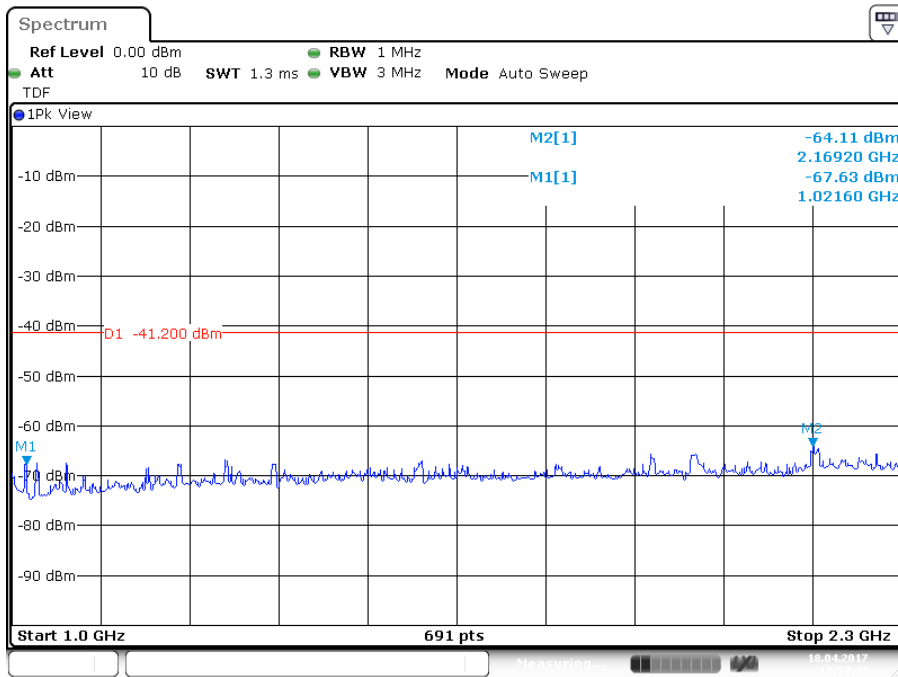
Plot of the emissions (peak values shown) in the range 12-18 GHz, 802.11b 1Mbps, EUT V Ant V



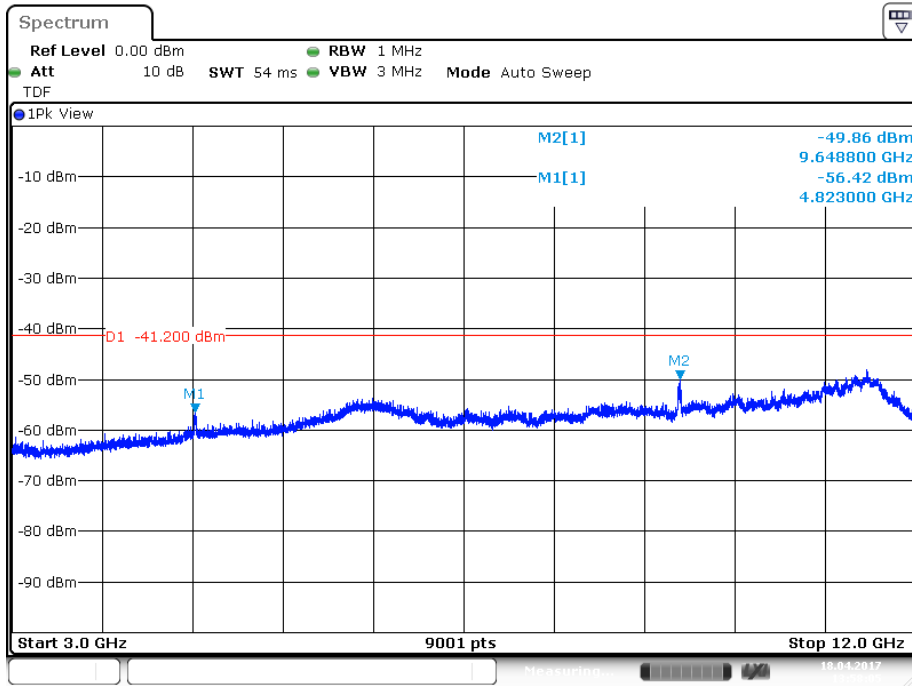
<b>Radiated Emissions</b>				Tracking # 17030802.fcc 01_Rev02			
<b>EUT</b> With Internal antenna							
<b>EUT Config.</b> 802.11g				<b>Date</b> April 18, 2017			
<b>Standard</b> CFR47 Part 15 Subpart C, RSS-247, RSS-GEN				<b>RBW / VBW</b> 1 MHz/ 3 MHz			
<b>Dist/Ant Used</b> 3m				<b>Performed by</b> Richard van der Meer			
1 – 25 GHz Transmit at 2412 MHz (Low Channel)							
Frequency	EUT	EUT	Level	Detector	Polarity	Limit	Margin
MHz	Mode	Orientation	dBm		H/V	dBm	dB
4823.0 <sup>H R</sup>	802.11g 6Mbps	H	-56.4	Peak	V	-21.2 Pk/ -41.2 Ave	-35.2 Pk/ -15.2 Ave
9648.8 <sup>H</sup>	802.11g 6Mbps	H	-49.9	Peak	V	-21.2 Pk/ -41.2 Ave	-28.7 Pk/ -8.7 Ave
14222.1	802.11g 54Mbps	V	-47.1	Peak	V	-21.2 Pk/ -41.2 Ave	-25.9 Pk/ -5.9 Ave
<p>Note: The levels are expressed in dBm which are derived from <math>\text{dBm} = E(\text{dB}\mu\text{V}/\text{m}) - 95.2\text{dB}</math>.          H refers to a harmonic of the fundamental, R refers to an emission in a restricted band          Above 10GHz No significant emissions was observed Measured spectrum= noise floor          See a selection of plots on the next pages.</p>							



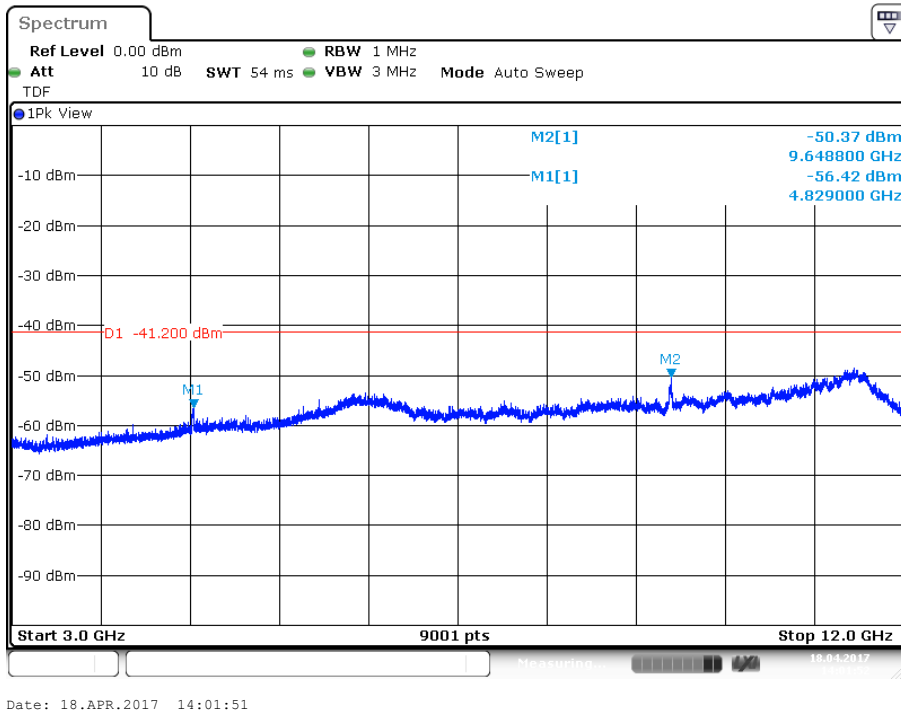
Plot of the emissions (peak values shown) in the range 1-2.3 GHz, 802.11g 6Mbps, EUT V Ant H



Plot of the emissions (peak values shown) in the range 1-2.3 GHz, 802.11g 54Mbps, EUT V Ant H

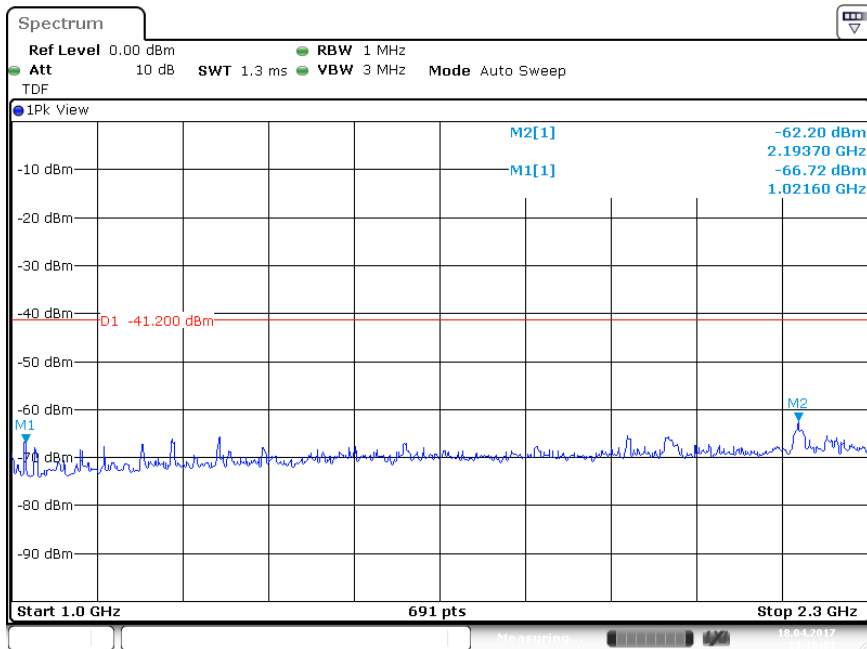


Plot of the emissions (peak values shown) in the range 3 -12 GHz, 802.11g 6Mbps, EUT H Ant V



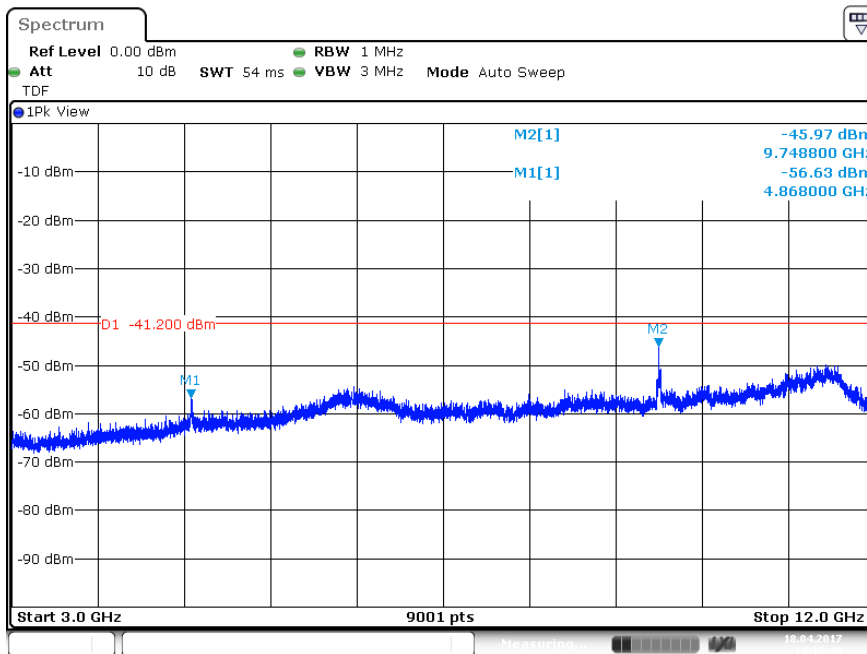
Plot of the emissions (peak values shown) in the range 3 -12 GHz, 802.11g 54Mbps, EUT H Ant V

<b>Radiated Emissions</b>		Tracking # 17030802.fcc 01_Rev02					
<b>EUT</b>	With Internal antenna						
<b>EUT Config.</b>	802.11g	<b>Date</b>	April 18, 2017				
<b>Standard</b>	CFR47 Part 15 Subpart C, RSS-247, RSS-GEN	<b>RBW / VBW</b>	1 MHz/ 3 MHz				
<b>Dist/Ant Used</b>	3m	<b>Performed by</b>	Richard van der Meer				
1 – 25 GHz Transmit at 2437 MHz (Mid Channel)							
Frequency	EUT	EUT	Level	Detector	Polarity	Limit	Margin
MHz	Mode	Orientation	dBm		H/V	dBm	dB
4868.0 <sup>H R</sup>	802.11g 54Mbps	H	-56.6	Peak	V	-21.2 Pk/ -41.2 Ave	-35.4 Pk/ -15.4 Ave
9748.8 <sup>H</sup>	802.11g 54Mbps	H	-46.0	Peak	V	-21.2 Pk/ -41.2 Ave	-24.8 Pk/ -4.8 Ave
14189.1	802.11g 54Mbps	V	-46.3	Peak	V	-21.2 Pk/ -41.2 Ave	-25.1Pk/ -5.1 Ave
<p>Note: The levels are expressed in dBm which are derived from <math>\text{dBm} = E(\text{dB}\mu\text{V}/\text{m}) - 95.2\text{dB}</math>.          H refers to a harmonic of the fundamental, R refers to an emission in a restricted band          Above 10GHz No significant emissions was observed Measured spectrum= noise floor          See a selection of plots on the next pages.</p>							



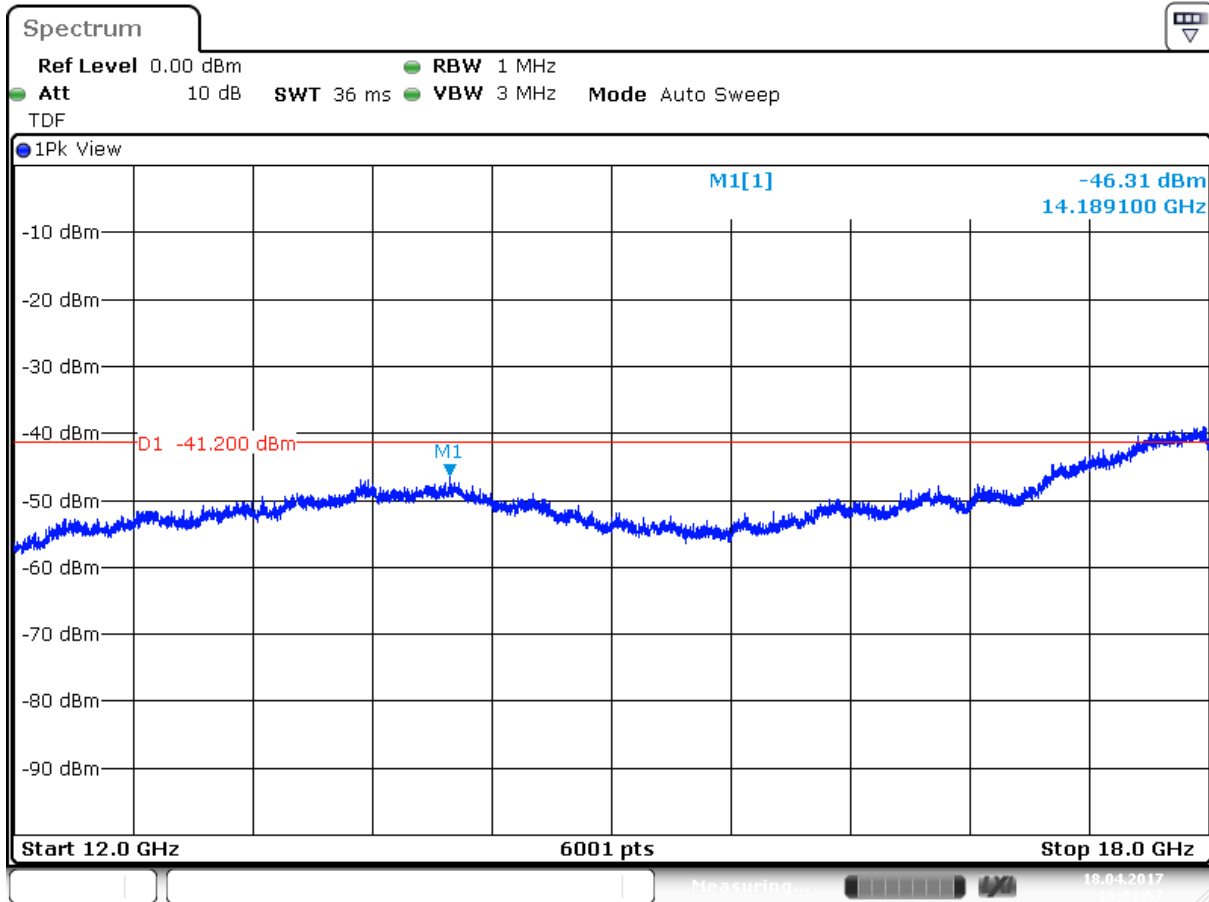
Date: 18.APR.2017 13:16:22

Plot of the emissions (peak values shown) in the range 1-2.3 GHz, 802.11g 54Mbps, EUT V Ant H



Date: 18.APR.2017 14:16:48

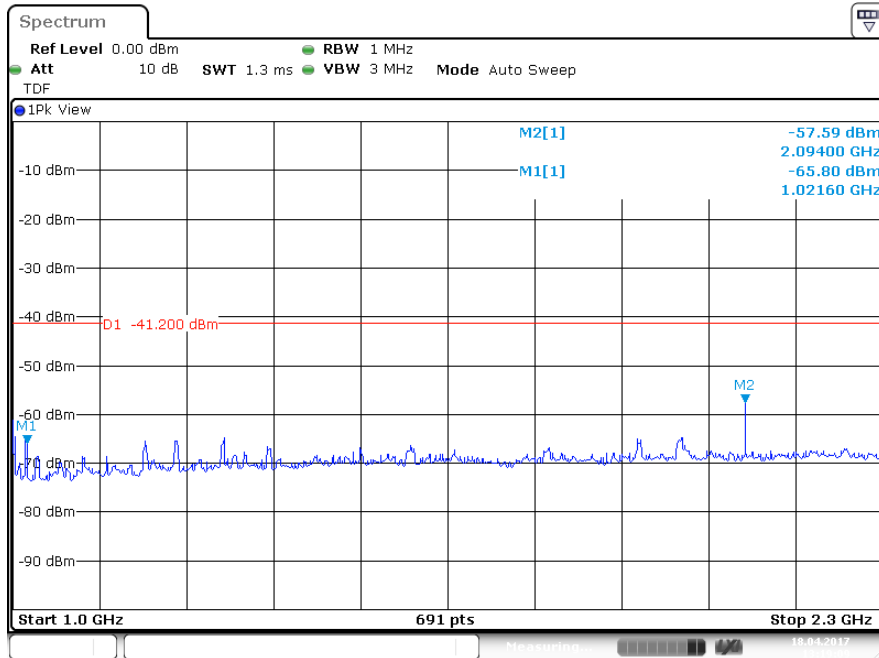
Plot of the emissions (peak values shown) in the range 3 -12 GHz, 802.11g 54Mbps, EUT H Ant V



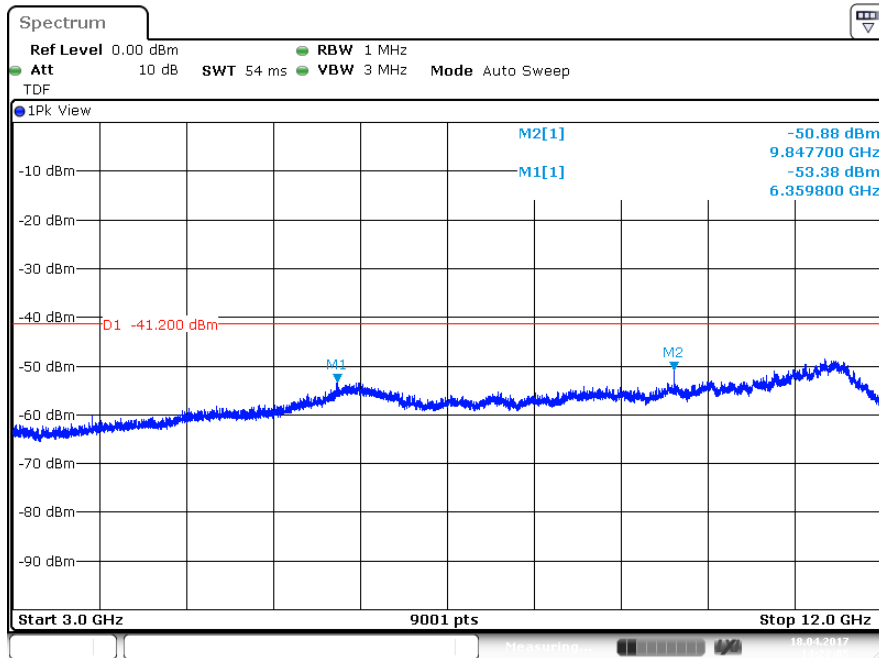
Date: 18.APR.2017 15:01:56

Plot of the emissions (peak values shown) in the range 12 -18 GHz, 802.11g 54Mbps, EUT V Ant V

<b>Radiated Emissions</b>		Tracking # 17030802.fcc 01_Rev02					
<b>EUT</b>	With Internal antenna						
<b>EUT Config.</b>	802.11g	<b>Date</b>	April 18, 2017				
<b>Standard</b>	CFR47 Part 15 Subpart C, RSS-247, RSS-GEN	<b>RBW / VBW</b>	1 MHz/ 3 MHz				
<b>Dist/Ant Used</b>	3m	<b>Performed by</b>	Richard van der Meer				
1 – 25 GHz Transmit at 2462 MHz (High Channel)							
Frequency	EUT	EUT	Level	Detector	Polarity	Limit	Margin
MHz	Mode	Orientation	dBm		H/V	dBm	dB
2094.0	802.11g 54Mbps	V	-57.6	Peak	V	-21.2 Pk/ -41.2 Ave	-36.4 Pk/ -16.4 Ave
6359.8	802.11g 54Mbps	H	-53.4	Peak	V	-21.2 Pk/ -41.2 Ave	-32.3 Pk/ -12.3 Ave
9847.7 <sup>R</sup>	802.11g 54Mbps	H	-50.9	Peak	V	-21.2 Pk/ -41.2 Ave	-29.7 Pk/ -19.7 Ave
13752.2	802.11g 54Mbps	V	-46.4	Peak	V	-21.2 Pk/ -41.2 Ave	-25.2 Pk/ -5.2 Ave
<p>Note: The levels are expressed in dBm which are derived from <math>\text{dBm} = E(\text{dB}\mu\text{V}/\text{m}) - 95.2\text{dB}</math>.          H refers to a harmonic of the fundamental, R refers to an emission in a restricted band          Above 10 GHz no significant emissions was observed Measured spectrum=noise floor.          See a selection of plots on the next pages.</p>							

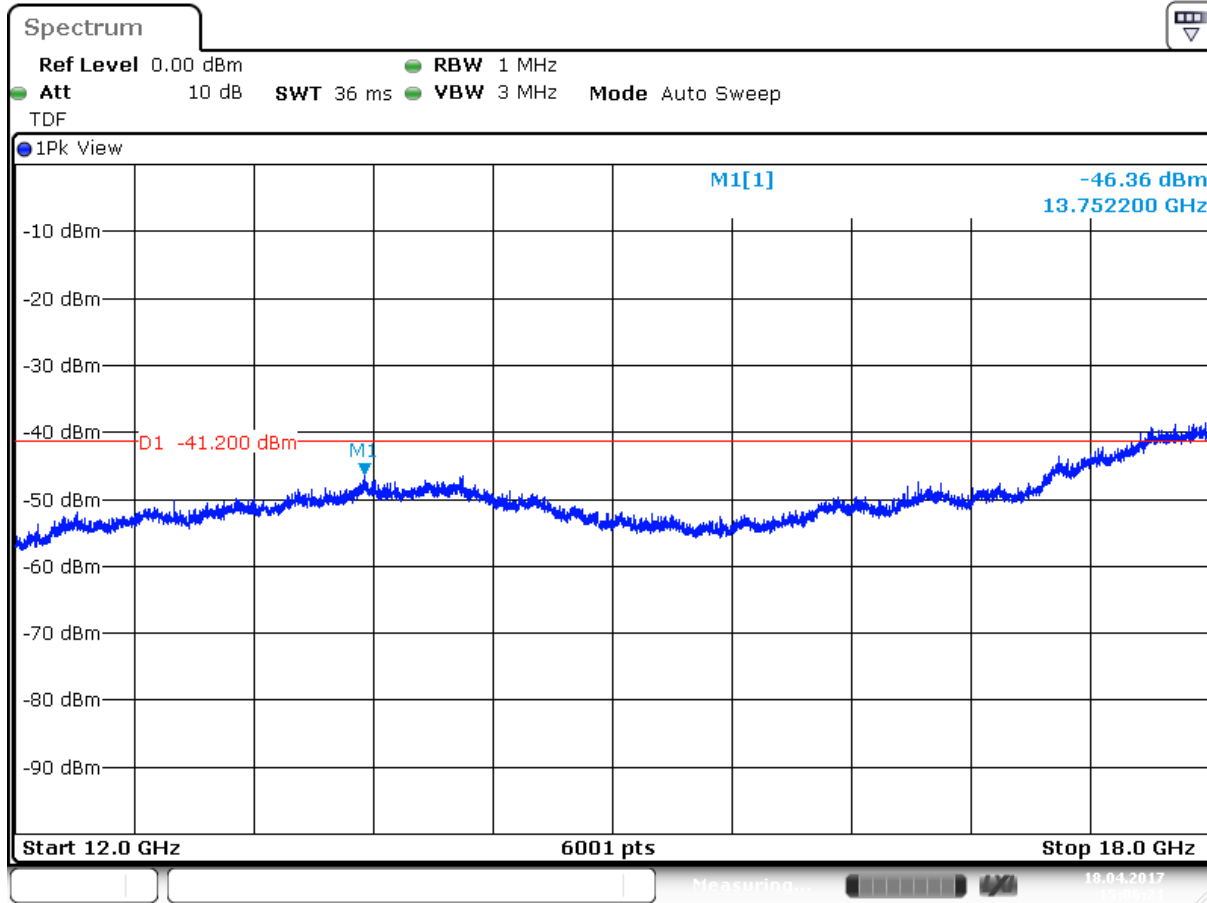


Plot of the emissions (peak values shown) in the range 1-2.3 GHz, 802.11g 54Mbps, EUT V Ant H



Plot of the emissions (peak values shown) in the range 3 -12 GHz, 802.11g 54Mbps, EUT H Ant V

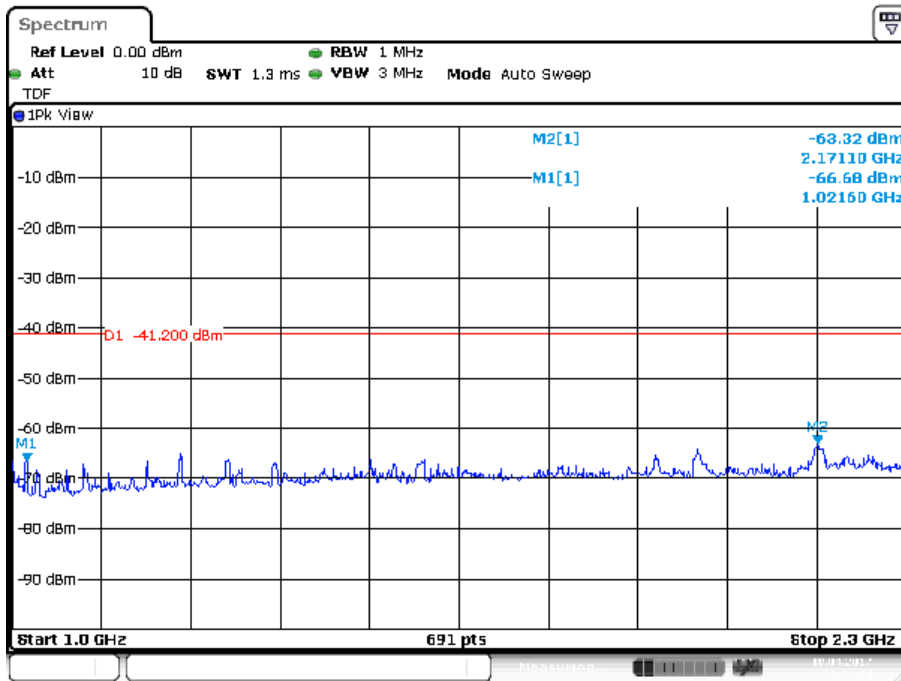




Date: 18.APR.2017 15:06:20

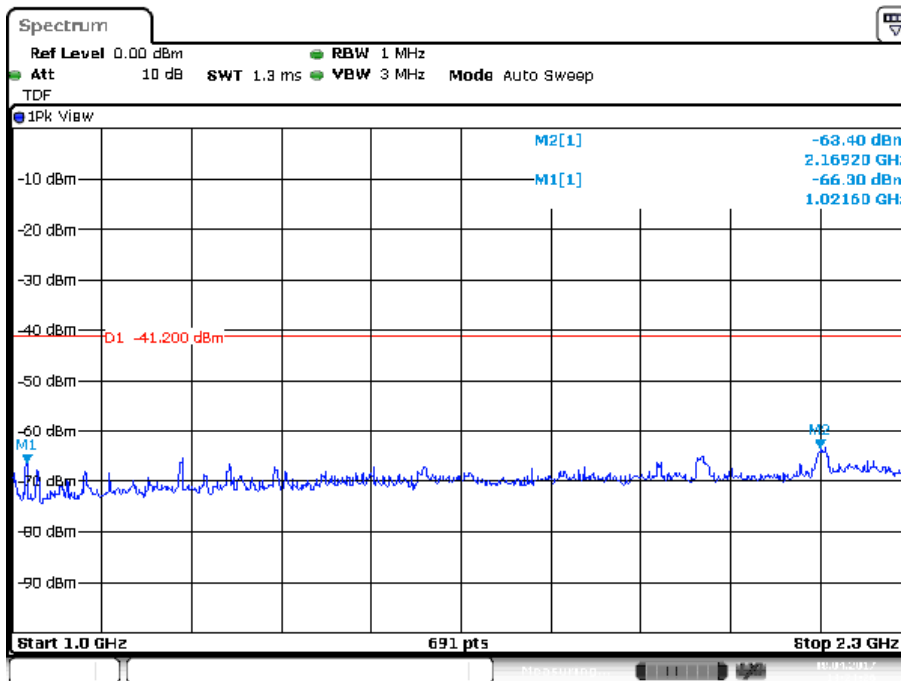
Plot of the emissions (peak values shown) in the range 12 -18 GHz, 802.11g 54Mbps, EUT V Ant V

<b>Radiated Emissions</b>		Tracking # 17030802.fcc 01_Rev02					
<b>EUT</b>	With Internal antenna						
<b>EUT Config.</b>	802.11n	<b>Date</b>		April 18, 2017			
<b>Standard</b>	CFR47 Part 15 Subpart C, RSS-247, RSS-GEN	<b>RBW / VBW</b>		1 MHz/ 3 MHz			
<b>Dist/Ant Used</b>	3m	<b>Performed by</b>		Richard van der Meer			
1 – 25 GHz Transmit at 2412 MHz (Low Channel)							
Frequency MHz	EUT Mode	EUT Orientation	Level dBm	Detector	Polarity H/V	Limit dBm	Margin dB
4822.0 <sup>H R</sup>	802.11n mcs0	H	-57.5	Peak	V	-21.2 Pk/ -41.2 Ave	-36.3 Pk/ -16.3 Ave
9647.8 <sup>H</sup>	802.11n mcs7	H	-49.8	Peak	V	-21.2 Pk/ -41.2 Ave	-28.6 Pk/ -8.6 Ave
<p>Note: The levels are expressed in dBm which are derived from <math>\text{dBm} = E(\text{dB}\mu\text{V}/\text{m}) - 95.2\text{dB}</math>.          H refers to a harmonic of the fundamental, R refers to an emission in a restricted band          Above 10 GHz no significant emissions was observed Measured spectrum=noise floor.          a selection of plots are provided on the next pages</p>							



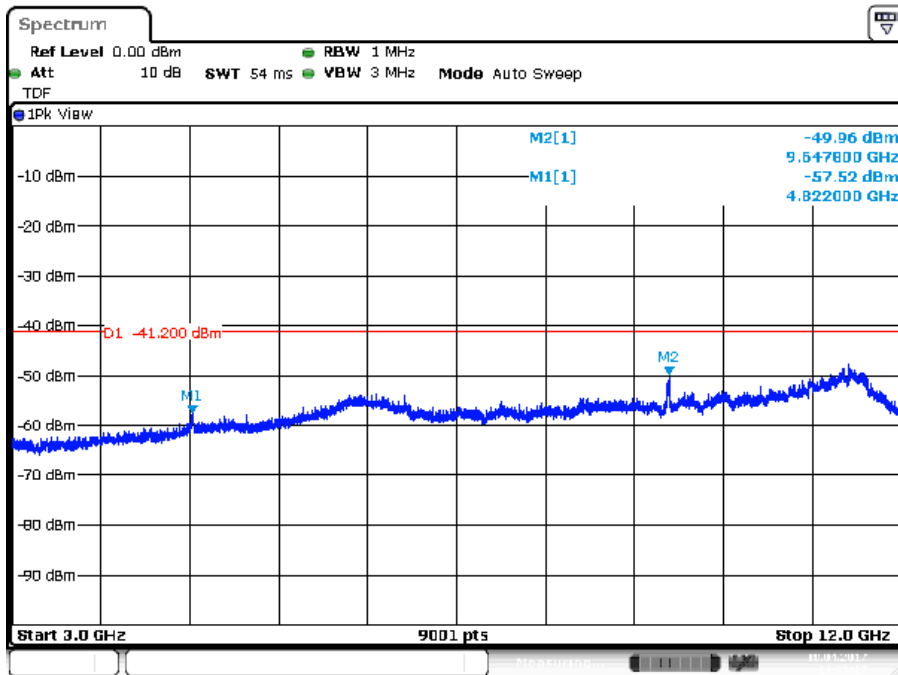
Date: 18.APR.2017 13:22:24

Plot of the emissions (peak values shown) in the range 1-2.3 GHz, 802.11n mcs0 , EUT V Ant H



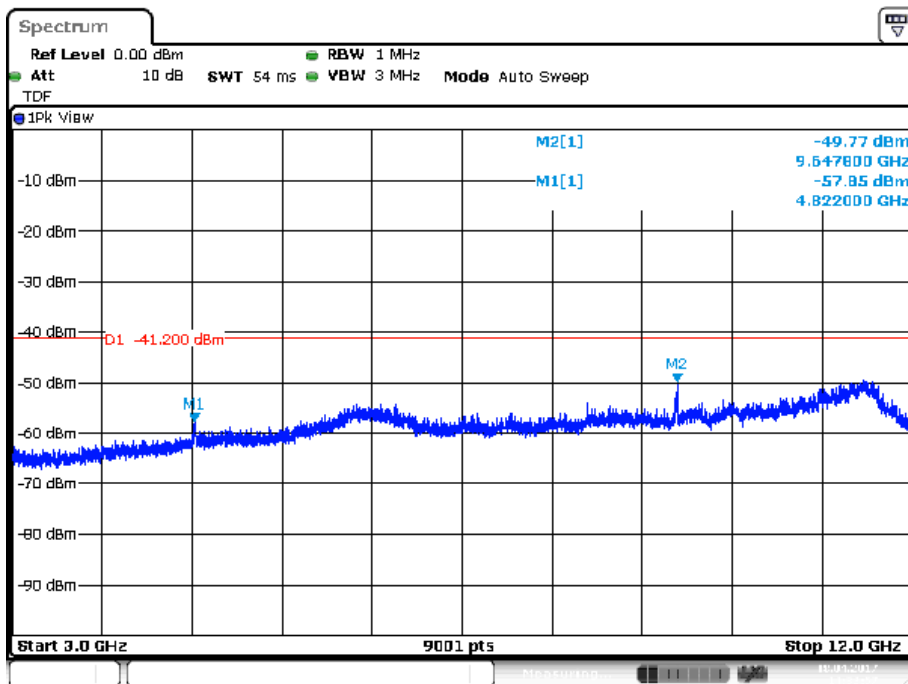
Date: 18.APR.2017 13:24:27

Plot of the emissions (peak values shown) in the range 3 -12 GHz, 802.11n mcs7 , EUT V Ant H



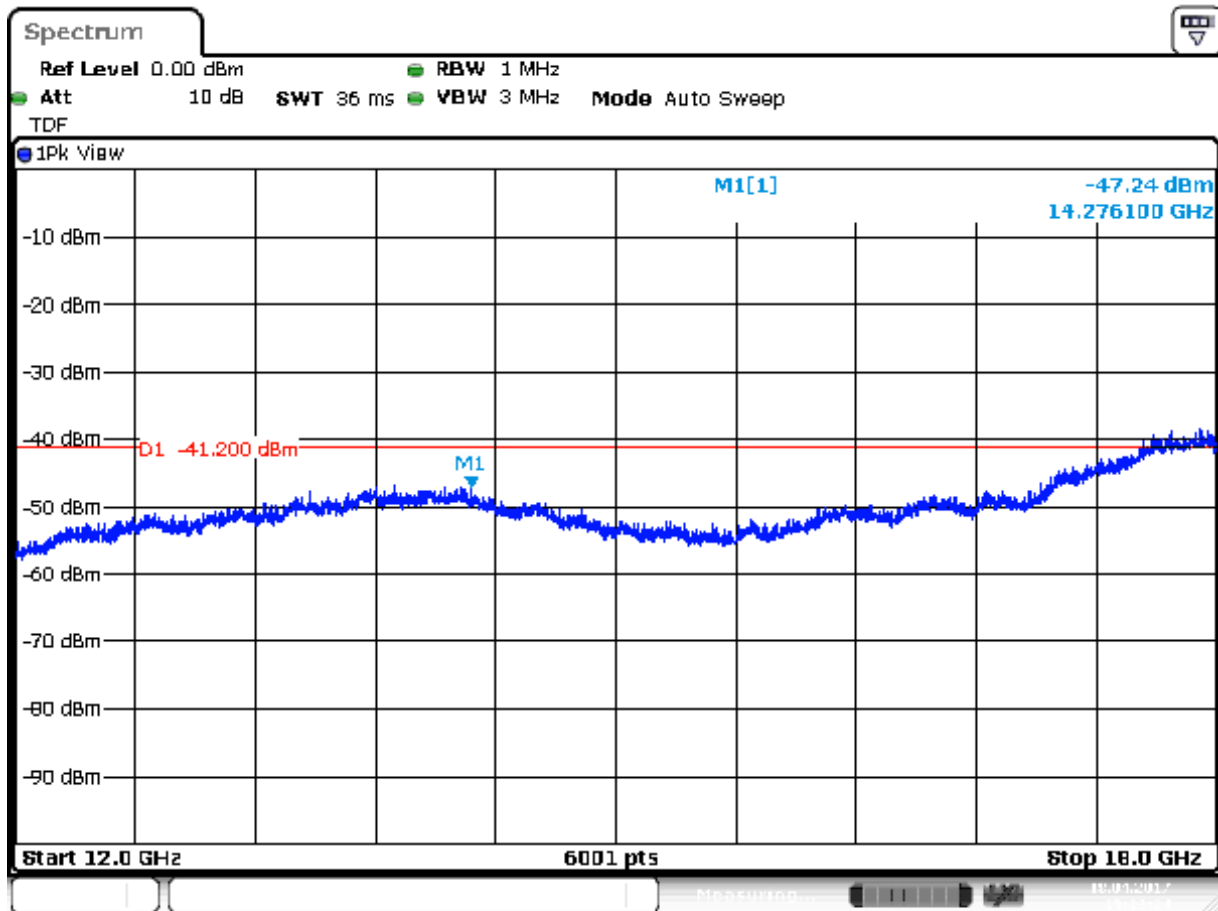
Date: 18.APR.2017 14:25:17

Plot of the emissions (peak values shown) in the range 3-12 GHz, 802.11n mcs0 , EUT H Ant V



Date: 18.APR.2017 14:32:57

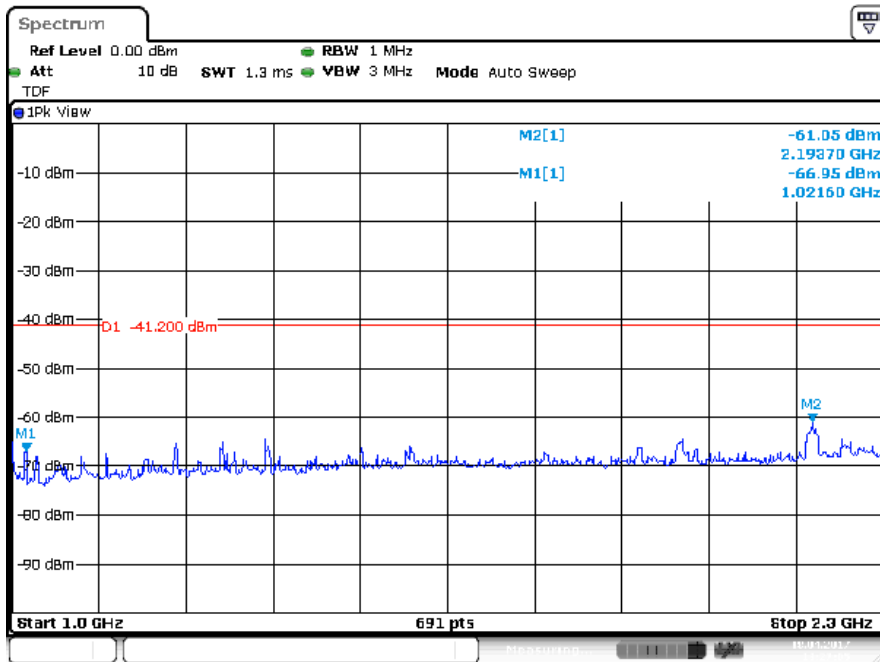
Plot of the emissions (peak values shown) in the range 3-12 GHz, 802.11n mcs0 , EUT H Ant V



Date: 18.APR.2017 15:12:24

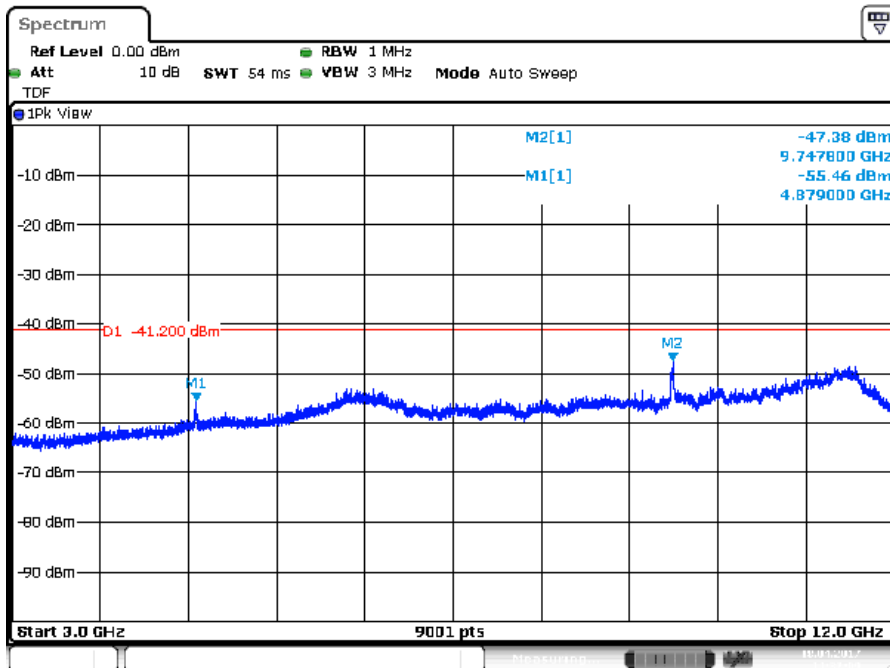
Plot of the emissions (peak values shown) in the range 12-18 GHz, 802.11n mcs0 , EUT V Ant V

<b>Radiated Emissions</b>		Tracking # 17030802.fcc 01_Rev02					
<b>EUT</b>	With Internal antenna						
<b>EUT Config.</b>	802.11n	<b>Date</b>		April 18, 2017			
<b>Standard</b>	CFR47 Part 15 Subpart C, RSS-247, RSS-GEN	<b>RBW / VBW</b>		1 MHz/ 3 MHz			
<b>Dist/Ant Used</b>	3m	<b>Performed by</b>		Richard van der Meer			
1 – 25 GHz Transmit at 2437 MHz (Mid Channel)							
Frequency MHz	EUT Mode	EUT Orientation	Level dBm	Detector	Polarity H/V	Limit dBm	Margin dB
2193.7	802.11n mcs0	V	-61.0	Peak	H	-21.2 Pk/ -41.2 Ave	-39.8 Pk/ -19.8 Ave
4879.0 <sup>H</sup> <sup>R</sup>	802.11n mcs7	H	-55.5	Peak	V	-21.2 Pk/ -41.2 Ave	-34.3 Pk/ -12.3 Ave
9747.8 <sup>H</sup>	802.11n mcs7	H	-47.4	Peak	V	-21.2 Pk/ -41.2 Ave	-26.2 Pk/ -6.2 Ave
13766.2	802.11n mcs7	V	-46.5	Peak	V	-21.2 Pk/ -41.2 Ave	-25.3 Pk/ -5.3 Ave
<p>Note: The levels are expressed in dBm which are derived from <math>\text{dBm} = E(\text{dB}\mu\text{V}/\text{m}) - 95.2\text{dB}</math>.          H refers to a harmonic of the fundamental, R refers to an emission in a restricted band          Above 15 GHz no significant emissions was observed Measured spectrum=noise floor.          a selection of plots are provided on the next pages.</p>							



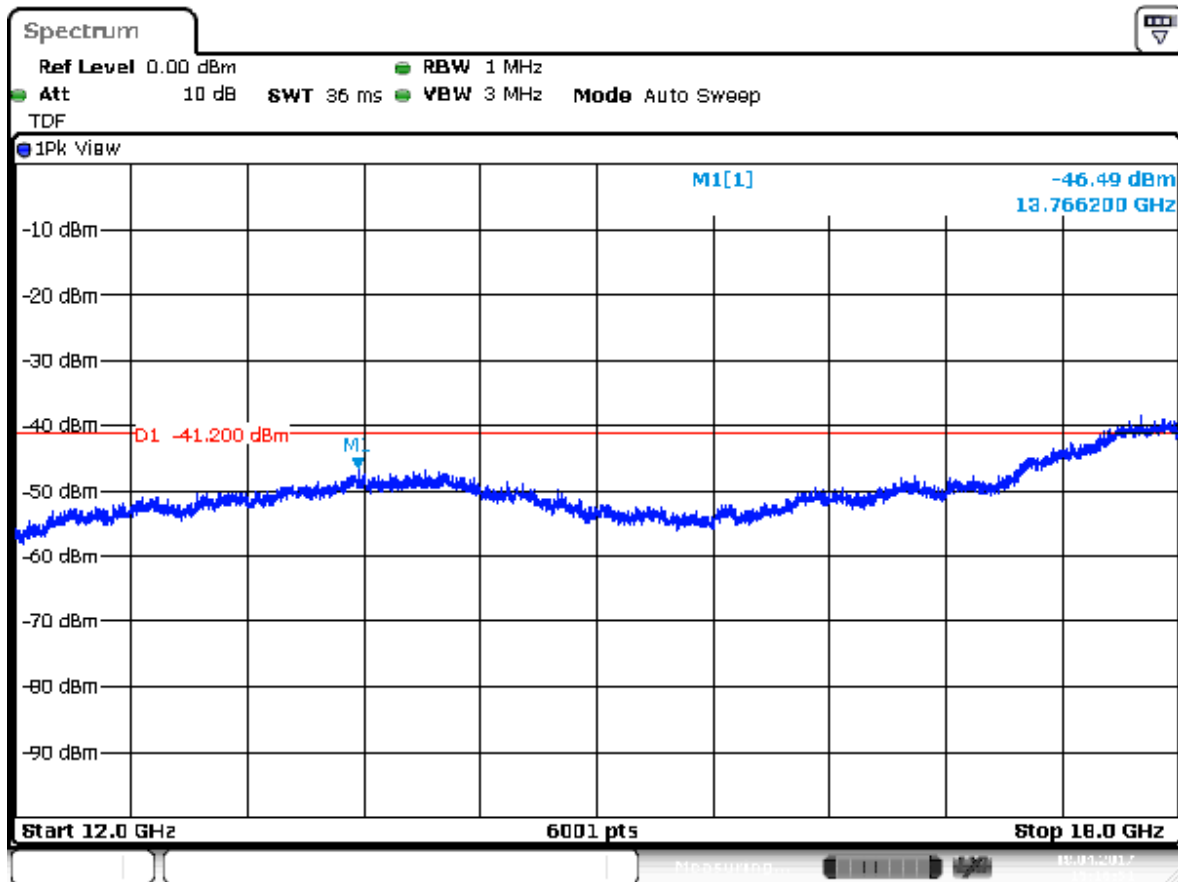
Date: 18.APR.2017 13:27:05

Plot of the emissions (peak values shown) in the range 1-2.3 GHz, 802.11n mcs0 , EUT V Ant H



Date: 18.APR.2017 14:37:09

Plot of the emissions (peak values shown) in the range 3 -12 GHz, 802.11n mcs7 , EUT H Ant V

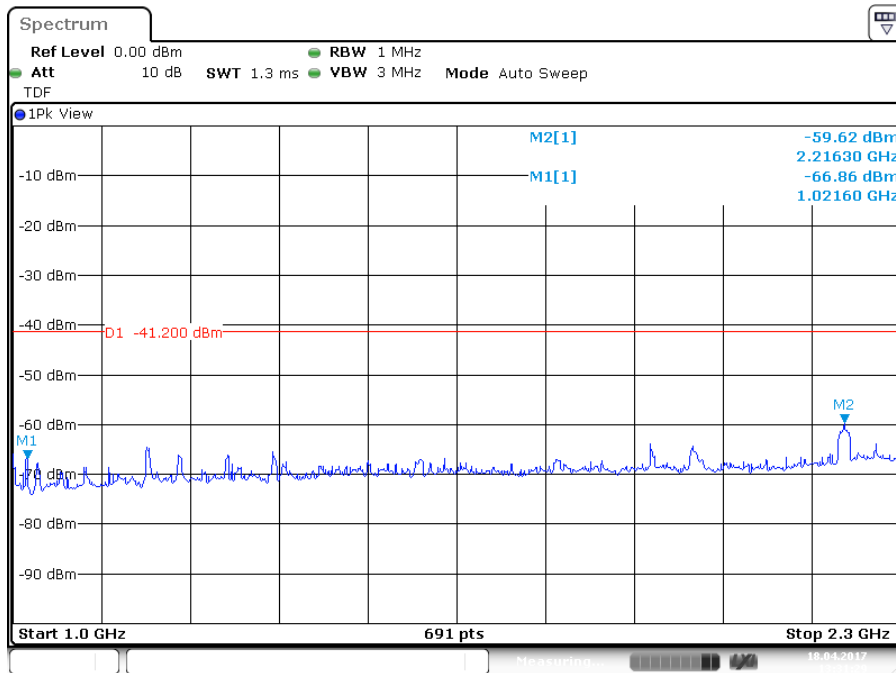


Date: 18.APR.2017 15:16:51

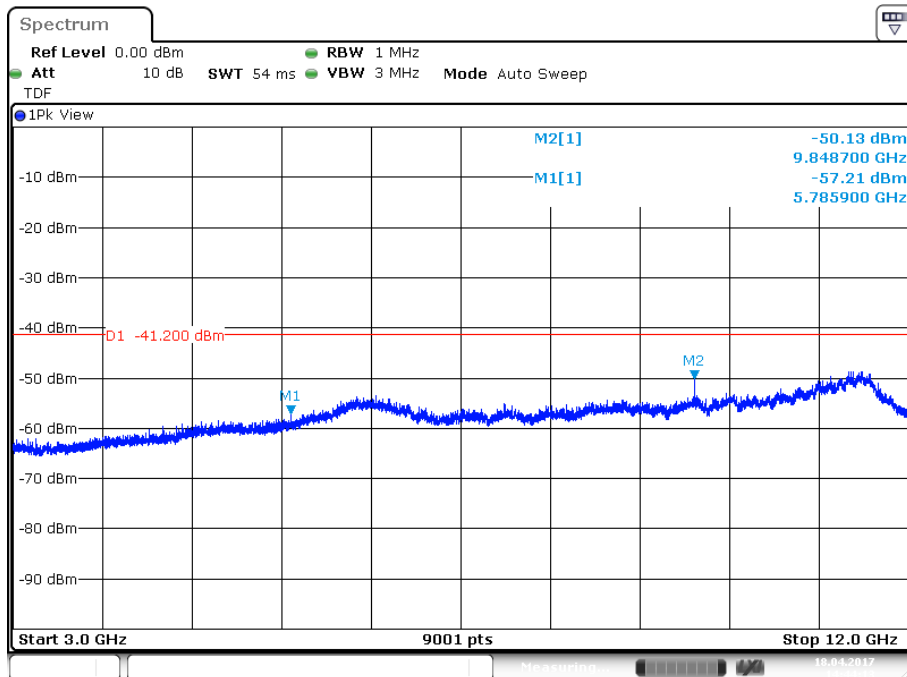
Plot of the emissions (peak values shown) in the range 12 -18 GHz, 802.11n mcs7 , EUT V Ant V



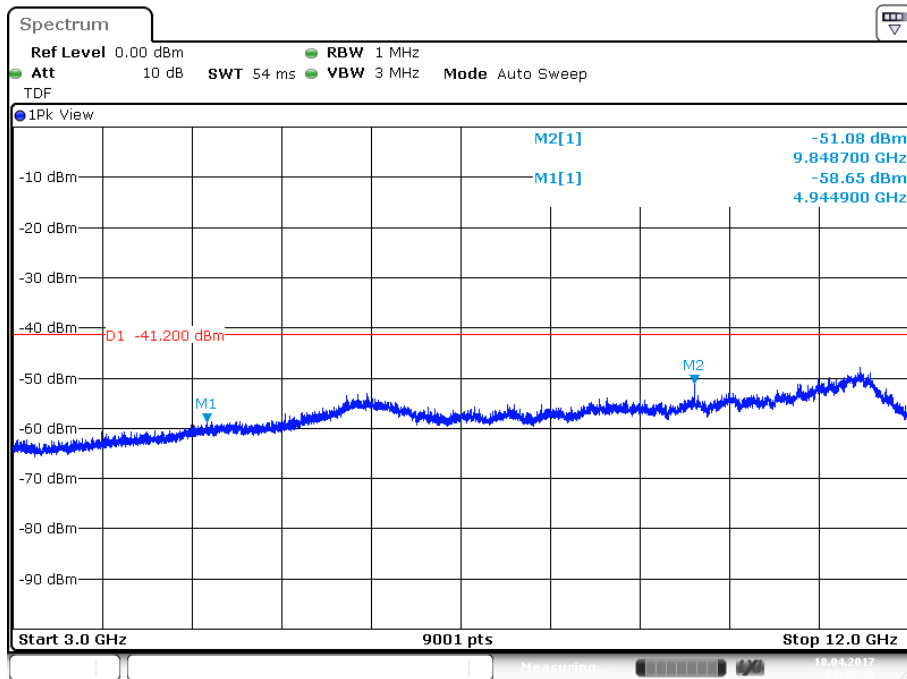
<b>Radiated Emissions</b>				Tracking # 17030802.fcc 01_Rev02			
<b>EUT</b> With Internal antenna							
<b>EUT Config.</b> 802.11n				<b>Date</b> April 18, 2017			
<b>Standard</b> CFR47 Part 15 Subpart C, RSS-247, RSS-GEN				<b>RBW / VBW</b> 1 MHz/ 3 MHz			
<b>Dist/Ant Used</b> 3m				<b>Performed by</b> Richard van der Meer			
1 – 25 GHz Transmit at 2462 MHz (High Channel)							
Frequency	EUT	EUT	Level	Detector	Polarity	Limit	Margin
MHz	Mode	Orientation	dBm		H/V	dBm	dB
2216.3 <sup>R</sup>	802.11n mcs0	V	-59.6	Peak	V	-21.2 Pk/ -41.2 Ave	-38.4 Pk/ -12.4 Ave
5785.9	802.11n mcs0	V	-57.2	Peak	V	-21.2 Pk/ -41.2 Ave	-36.0 Pk/ -6.0 Ave
9848.7 <sup>H</sup>	802.11n mcs0	V	-50.1	Peak	V	-21.2 Pk/ -41.2 Ave	-28.9 Pk/ -8.9 Ave
13800.2	802.11n mcs7	V	-46.3	Peak	V	-21.2 Pk/ -41.2 Ave	-25.1 Pk/ -5.1 Ave
<p>Note: The levels are expressed in dBm which are derived from <math>\text{dBm} = E(\text{dB}\mu\text{V}/\text{m}) - 95.2\text{dB}</math>.          H refers to a harmonic of the fundamental, R refers to an emission in a restricted band          Above 15 GHz no significant emissions was observed Measured spectrum=noise floor.          a selection of plots are provided on the next pages.</p>							



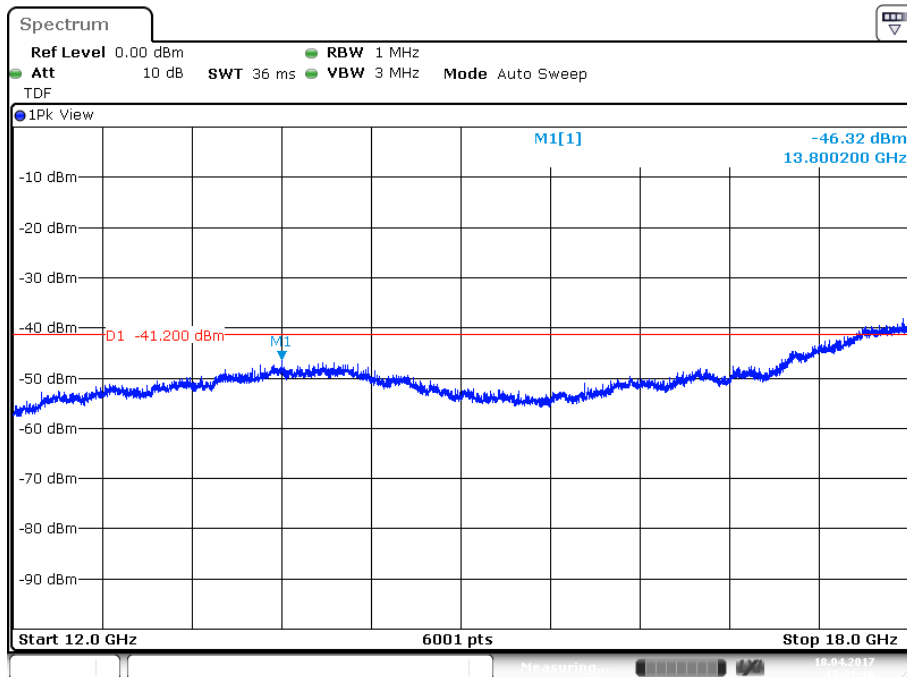
Plot of the emissions (peak values shown) in the range 1-2.3 GHz, 802.11n mcs0 , EUT V Ant H



Plots of the emissions (peak value shown) in the range 1-2.3 GHz, 802.11n mcs0, EUT V Ant V



Plot of the emissions (peak values shown) in the range 3 -12 GHz, 802.11n mcs7 , EUT H Ant V



Plot of the emissions (peak values shown) in the range 12 -18 GHz, 802.11n mcs7 , EUT V Ant V

## 5 AC Power-line Conducted Emissions

***Not Applicable***

***Not tested, module will be tested in host device when that is due for certification.***

## 6 Test Equipment List

### 6.1 Equipment List

Kind of Equipment	Manufacturer	Model Name	Inventory number	Calibration date (mm/yyyy)	Calibration due date (mm/yyyy)
<b>For Antenna Port Conducted Emissions</b>					
Temperature-Humiditymeter	Extech	SD500	A00446	04-14/2016	04-14/2017
Spectrum Analyzer	Rohde & Schwarz	FSV	A01744	07/2016	07/2017
RF Cable	Huber + Suhner	Sucoflex 102	A00344	05/2016	05/2017
<b>For Radiated Emissions</b>					
Measurement Receiver	Rohde & Schwarz	ESCI	A00314	03/2017	03/2018
RF Cable S-AR	Gigalink	APG0500	A00447	01/2017	01/2018
Controller	Maturo	SCU/088/ 8090811	A00450	N/A	N/A
Controller	EMCS	DOC202	A00257	N/A	N/A
Test facility	Comtest	FCC listed: 90828 IC: 2932G-2	A00235	07/2014	07/2017
Spectrum Analyzer	Rohde & Schwarz	FSV	A00337	06/2016	06/2017
Antenna mast	EMCS	AP-4702C	A00258	N/A	N/A
Temperature-Humiditymeter	Extech	SD500	A00444	04-30/2016	04-30/2017
Guidehorn 1-18 GHz	EMCO	3115	A00009	02/2017	02/2018
Guidehorn 18-40 GHz	EMCO	RA42-K-F-4B-C	A00012	02/2017	02/2018
Biconilog Testantenna	Teseq	CBL 6111D	A00466	06/2016	06/2017
2.4 GHz bandreject filter	BSC	XN-1783	A00065	N/A	N/A
Bandpass filter 4-10 GHz	Reactel	7AS-7G-6G- 511	A00131	N/A	N/A
Bandpass filter 10-26 GHz	Reactel	9HS- 10G/26.5G-S11	A00151	N/A	N/A
Preamplifier 0.5 - 18 GHz	Miteq	AMF-5D- 005180-28-13p	A00247	N/A	N/A
Filterbox	EMCS	RFS06S	A00255	02/2017	02/2018

Conformance of the used measurement and test equipment with the requirements of ISO/IEC 17025:2005 has been confirmed before testing. NA= Not Applicable

## 7 Test Plan

### 7.1 Introduction

This section provides a description of the Equipment Under Test (EUT), configurations, operating conditions, and performance acceptance criteria. It is an overview of information provided by the manufacturer so that the test laboratory may perform the requested testing.

### 7.2 Customer

**Table 10:** Customer Information

<b>Company Name</b>	Zollner Elektronik AG for Brusa AG
<b>Address</b>	Mannfred Zollner Strasse 1
<b>City, State, Zip</b>	D-93499 Zandt
<b>Country</b>	Germany
<b>Phone</b>	(0049) 09944-201-0
<b>Fax</b>	(0049) 09944-201-1314

**Table 11:** Technical Contact Information

<b>Name</b>	Kai Lanzl
<b>E-mail</b>	Kai_Lanzl@zollner.de
<b>Phone</b>	+ 49 99 44 201 5220
<b>Fax</b>	+ 49 99 44 201 1314

### 7.3 Equipment Under Test (EUT)

**Table 12:** EUT Specifications

EUT Specifications	
AC Input	100-240V AC, 50 – 60 Hz
Hardware Version	-
Part Number	-
802.11-radio modules	
Operating Mode	802.11b, 802.11g, 802.11n (HT20)
Transmitter Frequency Band	2.4 GHz – 2.4835 GHz
Max. Rated Power Output	See Channel Planning Table.
Power Setting @ Operating Channel	See Channel Planning Table.
Antenna Type	External and Internal
Antenna Gain	+2 dBi (external antenna ), +2dBi (internal antenna)
Modulation Type	<input type="checkbox"/> AM <input type="checkbox"/> FM <input checked="" type="checkbox"/> DSSS <input checked="" type="checkbox"/> OFDM <input type="checkbox"/> Other describe: 16QAM and 64 QAM
Data Rate	802.11b: 1 Spatial Stream: 1, 2, 5.5, 11 Mbps 802.11g: 1 Spatial Stream: 6, 9, 12, 18, 24, 36, 48, 54 Mbps 802.11n HT20: 1 Spatial Stream: 13, 26, 39, 52, 78, 104, 117, 130 /156 Mbps (LGI)
TX/RX Chain (s)	Single; no beam forming
Directional Gain Type	<input checked="" type="checkbox"/> Uncorrelated <input type="checkbox"/> Beam-Forming <input type="checkbox"/> Other describe:
Type of Equipment	<input type="checkbox"/> Table Top <input type="checkbox"/> Wall-mount <input type="checkbox"/> Floor standing cabinet <input checked="" type="checkbox"/> Other: module, type depends on host
<b>Note:</b> None.	

**Table 13: EUT Channel Power Specifications**
**Max Power for single Chain**

Channel No.	Frequency (MHz)	Digital Gain step setting					
		802.11b 1 Mbps	802.11b 11 Mbps	802.11g 6 Mbps	802.11g 54 Mbps	802.11n (HT20) MCS0	802.11n (HT20) MCS7
1	2412	-10	-10				
6	2437	-10	-10				
11	2462	-10	-10				
1	2412			-8	-8		
6	2437			-8	-8		
11	2462			-8	-8		
1	2412					-10	-10
6	2437					-8	-8
11	2462					-8	-10
<b>Note: -</b>							



**Table 14:** Interface Specifications

Interface Type	Cabled with what type of cable?	Is the cable shielded?	Maximum potential length of the cable?	Metallic (M), Coax (C), Fiber (F), or Not Applicable?
-	-	<input type="checkbox"/> No	<input type="checkbox"/> Metric: - m	<input type="checkbox"/> N/A

**Table 15:** Supported Equipment

Equipment	Manufacturer	Model	Serial	Used for
Laptop	HP	Compaq 610	(A01877)	AUX1 Setup EUT operating channel property testlab
Interface	Aardvark	I2C	-	AUX2
Power supply	Delta elektronika	E-030-3	(A00124)	AUX3
<b>Note:</b> None.				

**Table 16:** Description of Sample used for Testing

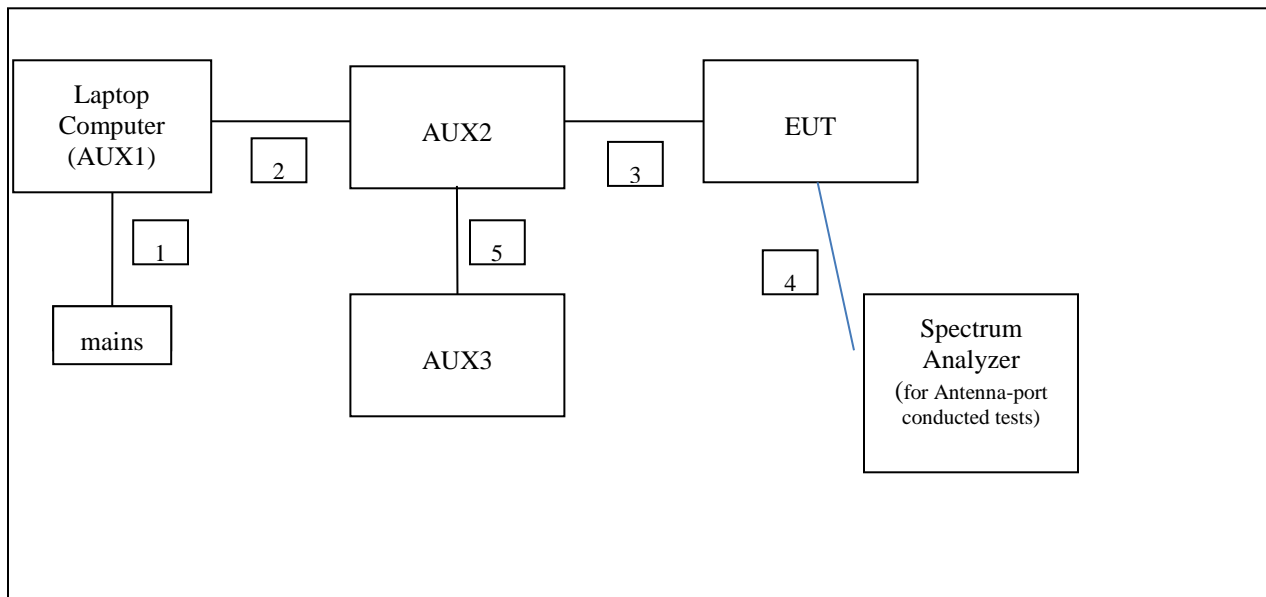
Device	Serial	RF Connection	CFR47 Part 15.247
EUT	-	External antenna and Internal antenna	Radiated Emissions
	-	External antenna and Internal antenna	Radiated Bandedge Emissions,
	-	Direct Connection	Peak Transmit Power, Peak Power Spectral Density, Occupied Bandwidth, Band-Edge, Out-of-Band Emissions
<b>Note:</b> *			

## 7.4 Physical Configuration for Testing

For programming purposes only the EUT was connected to the usb port of a laptop computer. The laptop computer was used to configure the EUT to continuously transmit at a specified output power and channel as specified in the test data. See section 7.3 table 16 for Auxiliary details.

The justification and manipulation of cables and equipment in order to simulate a worst-case behavior of the test setup has been carried out as prescribed in ANSI C63.10-2013.

Figure 49a: Test Setup Diagram – antenna port conducted tests and programming.



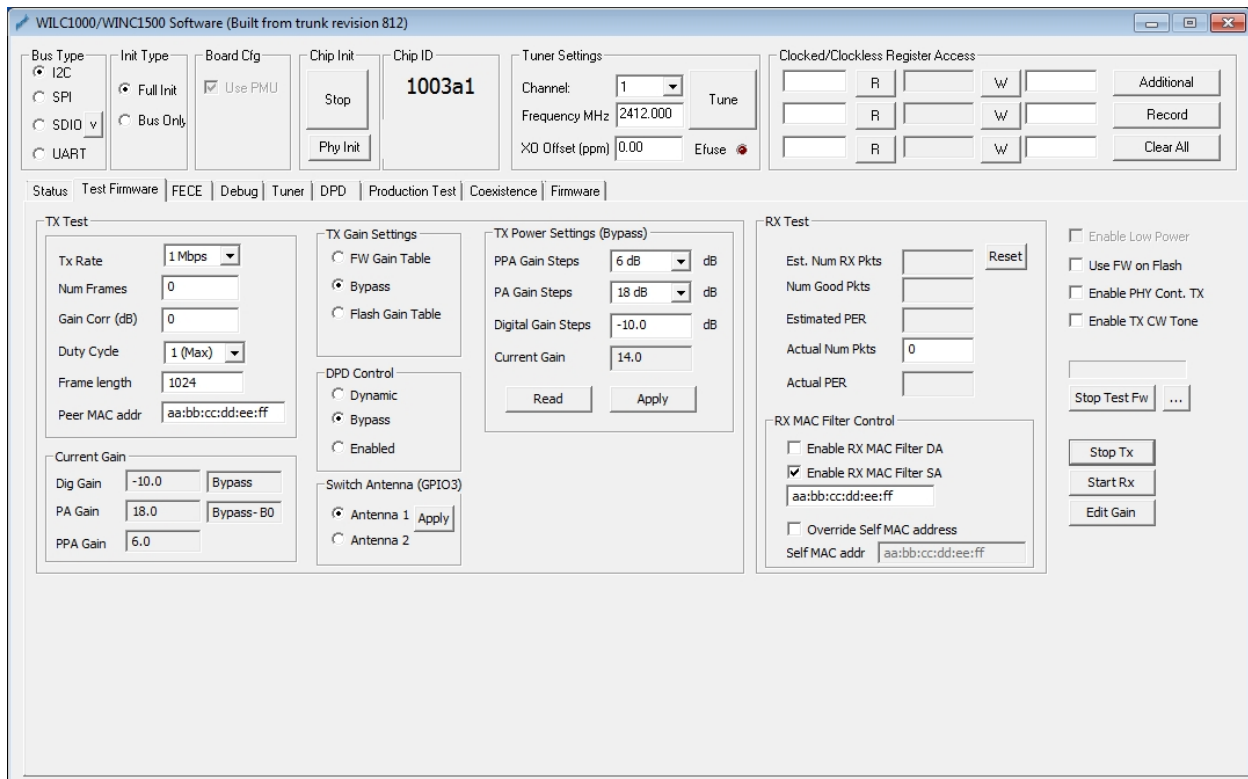
No.	Port	From	To	Remarks
1.	Mains	Mains	Laptop (AUX1)	Through a AC/DC power supply
2.	Data com.	Laptop USB	AUX2	--
3.	Data com.	AUX2	EUT	--
4.	Antenna port	EUT	Spectrum analyzer	Conducted tests
5.	DC power	AUX3	AUX2	3.4V power for interface

## 7.5 Test Software

A continuous transmit mode could be initiated by using test software as supplied by the applicant. The test software was used to define various different operational modes of the EUT for the purpose of compliance testing. The version of the test software, as supplied by the applicant and used during all tests is:

Test software : WILC1000/WINC1500

This software was running on a laptop computer (AUX1). It was used to enable the test operation modes listed in section 6.3 Table 14 as appropriate.



Screenshot of the software (and settings) as used on AUX1

**END OF REPORT**