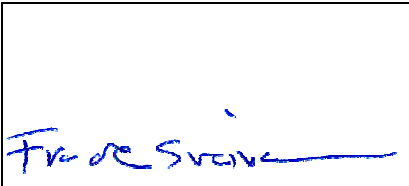


Test Report

Product	Module with WLAN and Bluetooth
Name and address of the applicant	Cisco Systems, Inc. 170 West Tasman Drive San Jose, CA 95134, USA
Name and address of the manufacturer	Cisco Systems, Inc. 170 West Tasman Drive San Jose, CA 95134, USA
Model	P3310
Rating	Mains (100-240V 50/60 Hz)
Trademark	Cisco
Serial number	/
Additional information	Bluetooth, WLAN 2x2 802.11a/b/g/n/ac
Tested according to	FCC Part 15.247 Digital Transmission Systems Industry Canada RSS-247, Issue 2 Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
Order number	349542
Tested in period	2018.05.04 to 2018.06.08
Issue date	2018.07.10
Name and address of the testing laboratory	 Instituttveien 6 Kjeller, Norway SITE NUMBER: FCC: NO0001 IC: 2040D-1   An accredited technical test executed under the Norwegian accreditation scheme
 Prepared by [Frode Sveinsen]  Approved by [Jan G Eriksen]	
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1 INFORMATION

1.1 Test Item

Name	CISCO
Model/version	P3310
FCC ID	LDKNVTX221737
Industry Canada ID	2461N-NVTX21737
Serial number	/
Hardware identity and/or version	/
Software identity and/or version	/
Frequency Range	2412 – 2472 MHz
Number of Channels	13
Operating Modes	802.11b 802.11g 802.11n (HT20) (HT40 mode is disabled)
Type of Modulation	Digital (DSSS, OFDM)
Rated Output Power	802.11b: 0.060 W (Conducted) 802.11g: 0.045 W (Conducted) 802.11n: 0.051 W (Conducted)
Antenna Connector	Patch Antennas connected to radio module by U-FL connector
Number of Antennas	2
Antenna Diversity Supported	Yes
Smart Antennas System	MIMO
Power Supply	Mains (Integral Power Supply)

Description of Test Item

The EUT is a certified radio module with WiFi and Bluetooth transceivers, this test report contains data for new antennas.

1.2 Normal test condition

Temperature:	20 – 24 °C
Relative humidity:	20 - 50 %
Normal test voltage:	120 V AC

The values are the limit registered during the test period.

1.3 Test Engineer(s)

Frode Sveinsen

1.4 Description of modification for Modification Filing

Not applicable.

1.5 Family List Rational

Not Applicable.

1.6 Antenna Requirement

Is the antenna detachable?

☒ Yes ☐ No

If detachable, is the antenna connector non-standard?

☒ Yes ☐ No

Type of antenna connector: U-FL connector

Ref. FCC §15.203

1.7 Worst-Case Configuration and Mode

Radiated Emissions and Power Line Conducted Emissions were performed with the EUT set to transmit at the channel with the highest output power as worst-case scenario. HT40 mode has been disabled in this EUT.

The worst case data rates were:

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

1.8 On Time and Duty Cycle Factors

Mode	On Time Burst (ms)	Period (msec)	Duty Cycle (linear)	Duty Cycle Correction (dB)
802.11b	8.580	8.685	0.987	0.00
802.11g	1.425	1.527	0.933	0.30
802.11n HT20 CDD	1.332	1.437	0.926	0.33

The results above are from UL report no. 15U21878-E3V2

1.9 Power Levels

Channel	802.11b	802.11g	802.11n (HT20)
1	16.5	13.5	12.5
2	16.5	15.5	12.5
3	16.5	15.5	12.5
4	16.5	15.5	12.5
5	16.5	15.5	12.5
6	16.5	15.5	12.5
7	16.5	15.5	12.5
8	16.5	15.5	12.5
9	16.5	15.5	12.5
10	16.5	13.5	12.5
11	16.5	11.5	10.5
12	13.5	7.5	7.5
13	9.0	4.0	4.0

All Power Levels are the same as those used by Nvidia during module certification.

1.10 Antenna Gain

The antennas are two patch antennas that are connected to the radio module by cable and U-FL connectors. The values below are the antenna gain values provided by the applicant:

Frequency (MHz)	Max Gain Ant #1 (dBi)	Max Gain Ant #2 (dBi)
2400	2.34	4.95
2410	2.40	5.32
2420	3.70	5.74
2440	4.25	6.02
2450	4.33	5.98
2460	4.44	5.41
2470	4.89	5.52
2480	5.61	5.69

1.11 Comments

This report covers only limited radiated tests to show compliance with the new antenna in this EUT. All other radio tests for 2.4 GHz WLAN are covered by UL reports no. 11526345-E3V2.

All tests were performed with the antennas placed on the non-conducting support table with the radio module P3310 mounted in a TTC6-13 Digital Video Codec.

2 TEST REPORT SUMMARY

2.1 General

All measurements are traceable to national standards.

The tests were performed for demonstrating compliance with FCC CFR 47 Part 15, paragraph 15.247 and Industry Canada RSS-247 Issue 2.

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

Radiated tests were performed in a semi-anechoic chamber at measuring distances of 3m and 10m.

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

☐ New Submission

☒ Production Unit

☒ Class II Permissive Change

☐ Pre-production Unit

DTS Equipment Code

☐ Family Listing



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

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

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2.2 Test Summary

Name of test	FCC Part 15 reference	RSS-247 Issue 2, RSS-GEN Issue 5 reference	Result
Supply Voltage Variations	15.31(e)	N/A	N/A ¹
Antenna Requirement	15.203	6.8 (RSS-GEN)	N/A ¹
AC Power Line Conducted Emission	15.107(a) 15.207(a)	8.8 (RSS-GEN)	N/A ¹
Occupied Bandwidth	N/A	6.7 (RSS-GEN)	N/A ¹
Minimum 6 dB Bandwidth	15.247(a)(2)	5.2 (1) (RSS-247)	N/A ¹
Peak Power Output	15.247(b)	5.4 (RSS-247)	N/A ¹
Power Spectral Density	15.247(d)	5.2 (2) (RSS-247)	N/A ¹
Spurious Emissions (Antenna Conducted)	15.247(c)	5.5 (RSS-247)	N/A ¹
Spurious Emissions (Radiated)	15.247(c) 15.109(a) 15.209(a)	5.5 (RSS-247) 6.13 (RSS-GEN) 8.9 (RSS-GEN)	Complies

¹ Not Applicable for Class II Permissive Change application

3 TEST RESULTS

3.1 Band Edge Emissions (Radiated)

Para. No.: 15.247 (c)

ISED RSS-247 Issue 2, RSS-GEN Issue 5

Test Results: Complies

Measurement Data:

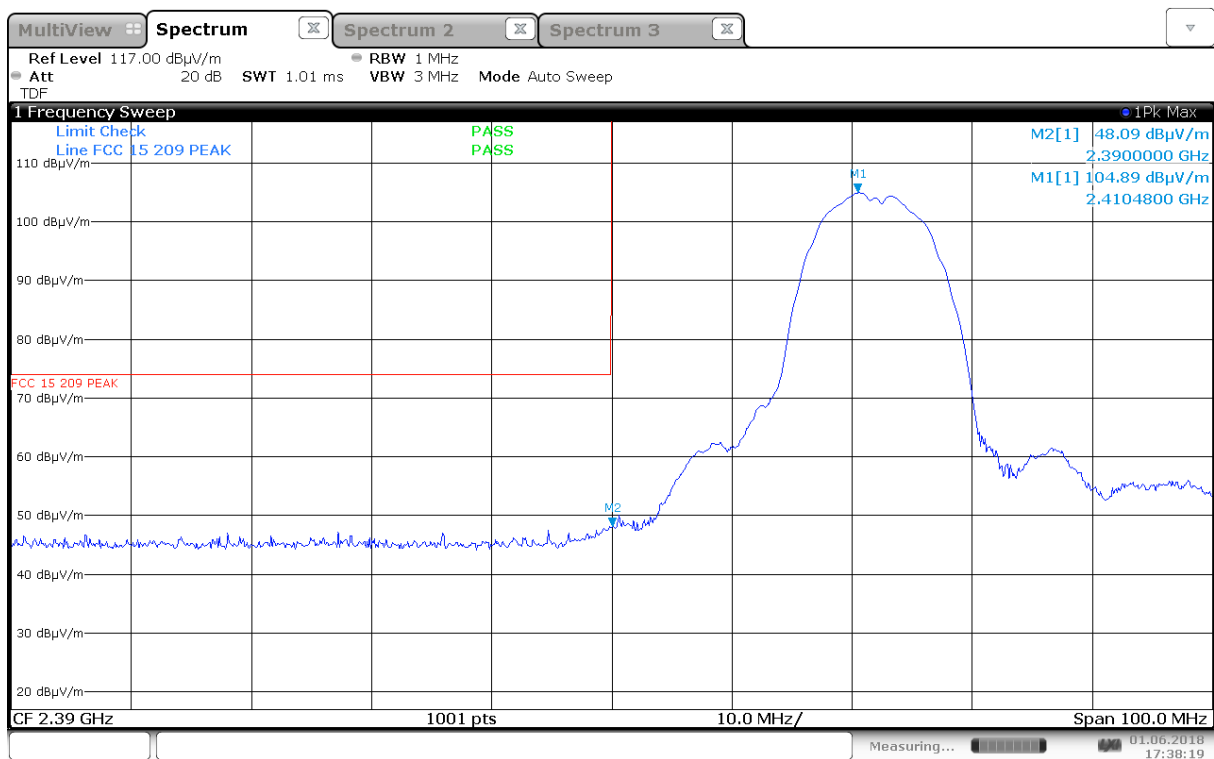
Band Edge Emissions						
Carrier Modulation	Carrier Freq (MHz)	Measured Freq (MHz)	Measured value Peak (dBμV/m @3m)	Measured value AV (dBμV/m @3m)	Limit PK/AV (dBμV/m)	Verdict
802.11b	2412	2390	48.2	38.4	74/54	Complies
802.11g	2412	2390	59.0	43.1	74/54	Complies
802.11n	2412	2390	61.1	44.3	74/54	Complies
802.11g	2417	2390	53.9	41.4	74/54	Complies
802.11g	2452	2483.5	54.8	41.8	74/54	Complies
802.11g	2457	2483.5	56.5	41.3	74/54	Complies
802.11n	2457	2483.5	62.0	41.2	74/54	Complies
802.11b	2462	2483.5	52.5	42.7	74/54	Complies
802.11g	2462	2483.5	56.6	40.0	74/54	Complies
802.11n	2462	2483.5	64.8	40.0	74/54	Complies
802.11b	2467	2483.5	55.9	42.2	74/54	Complies
802.11g	2467	2483.5	48.5	37.0	74/54	Complies
802.11n	2467	2483.5	65.4	38.3	74/54	Complies
802.11b	2472	2483.5	51.4	39.3	74/54	Complies
802.11g	2472	2483.5	47.0	37.4	74/54	Complies
802.11n	2472	2483.5	46.9	35.6	74/54	Complies

Values above are the maximum values for each modulation type.

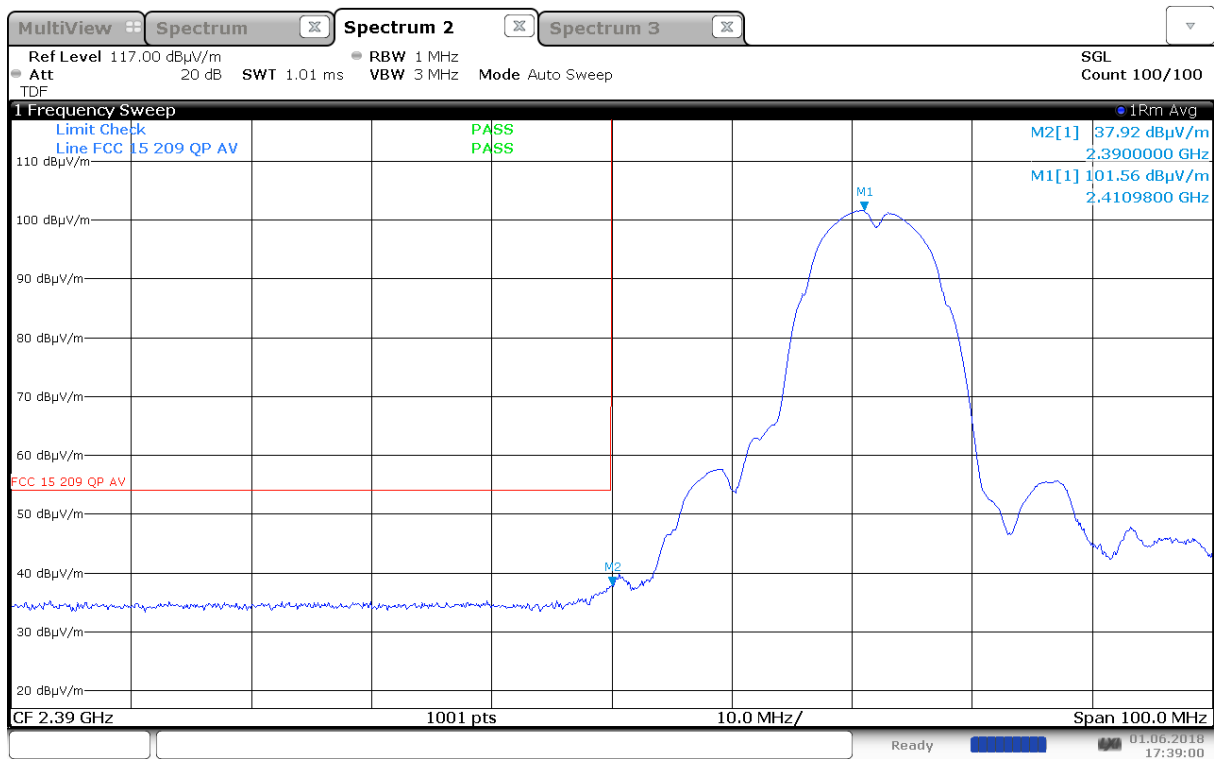
Average detector values were measured with RMS Detector and Trace Averaging.

Average detector values have been corrected for duty cycle.

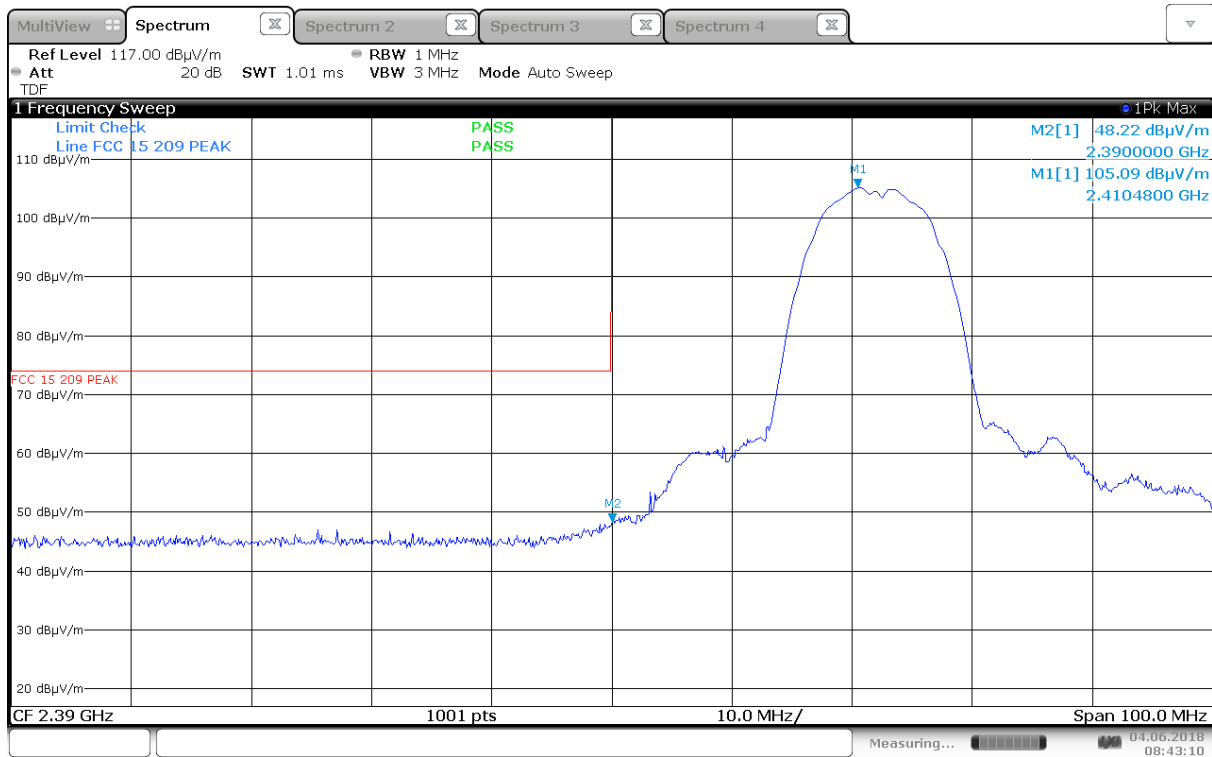
See attached plots



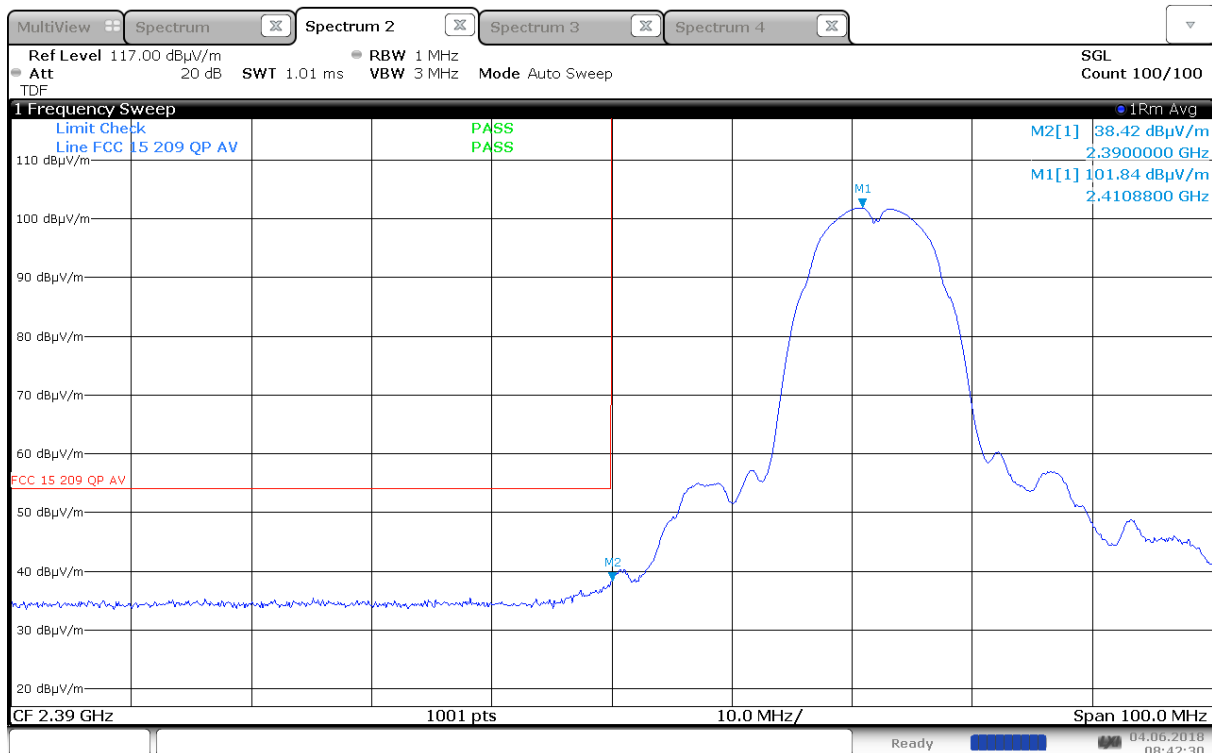
Lower Band Edge, Peak, 2412 MHz, 802.11b, 1Mb, (Max: Ant 0, HP)



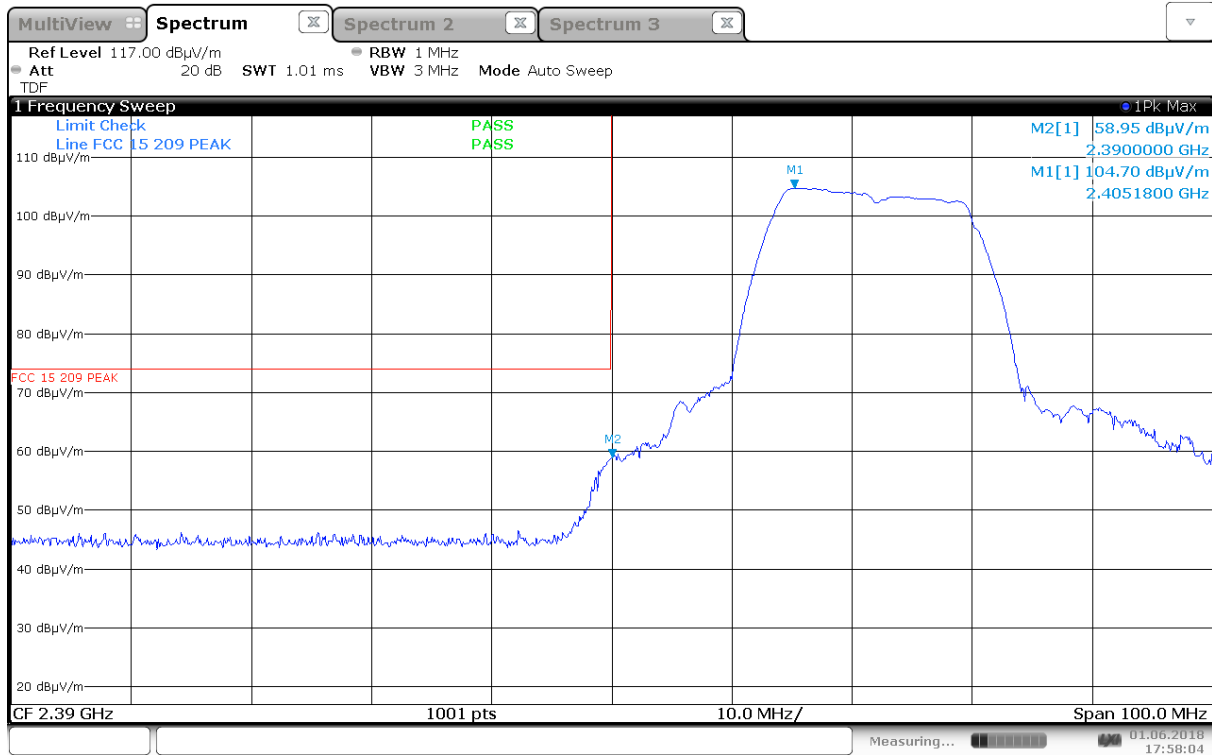
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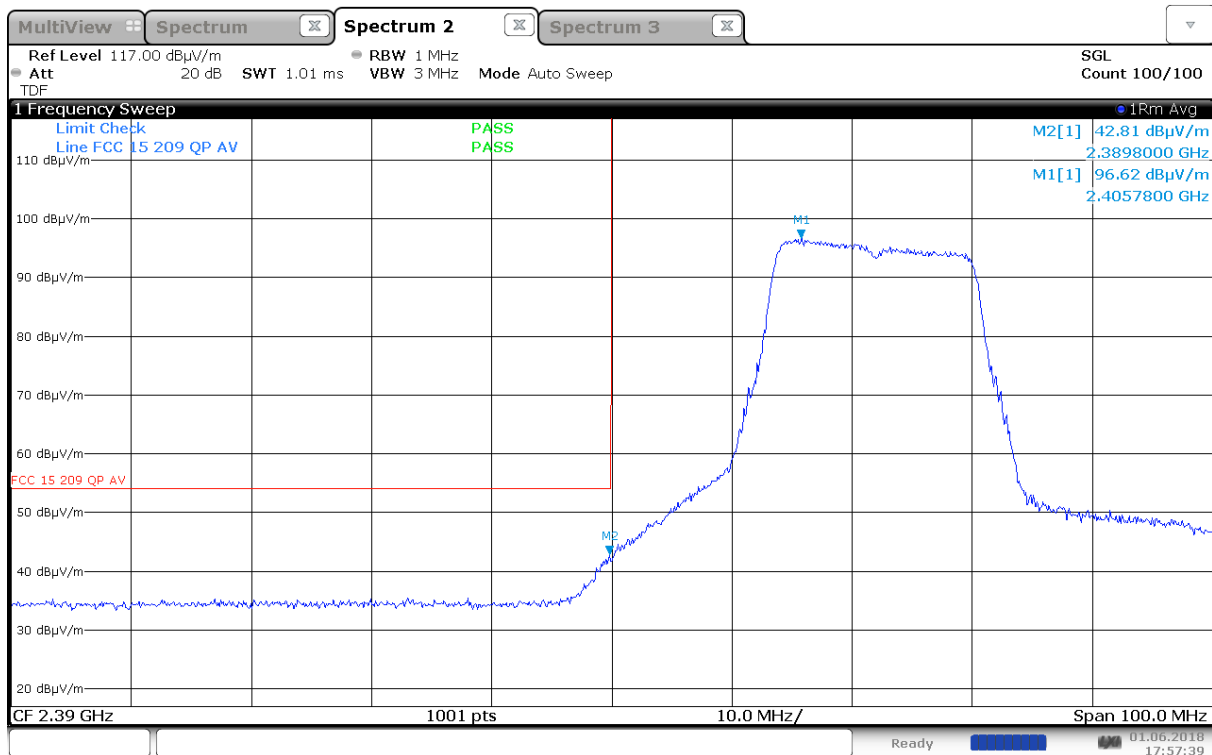
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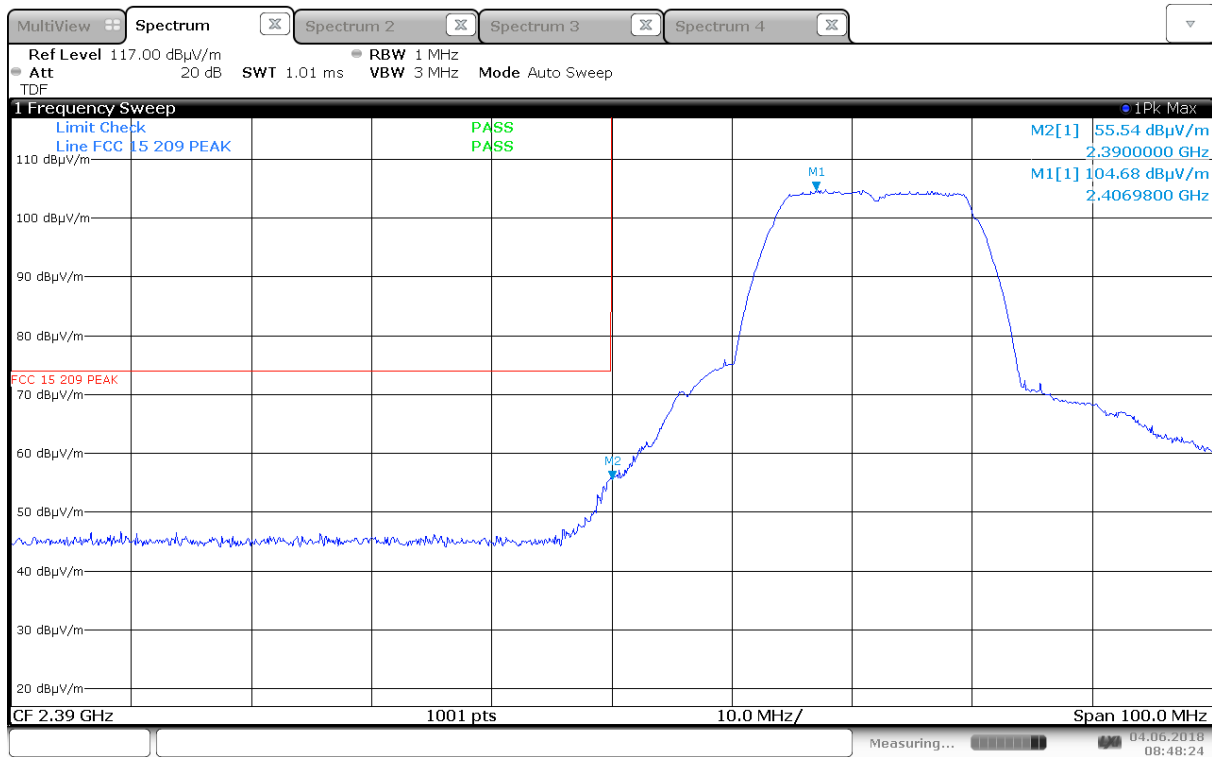
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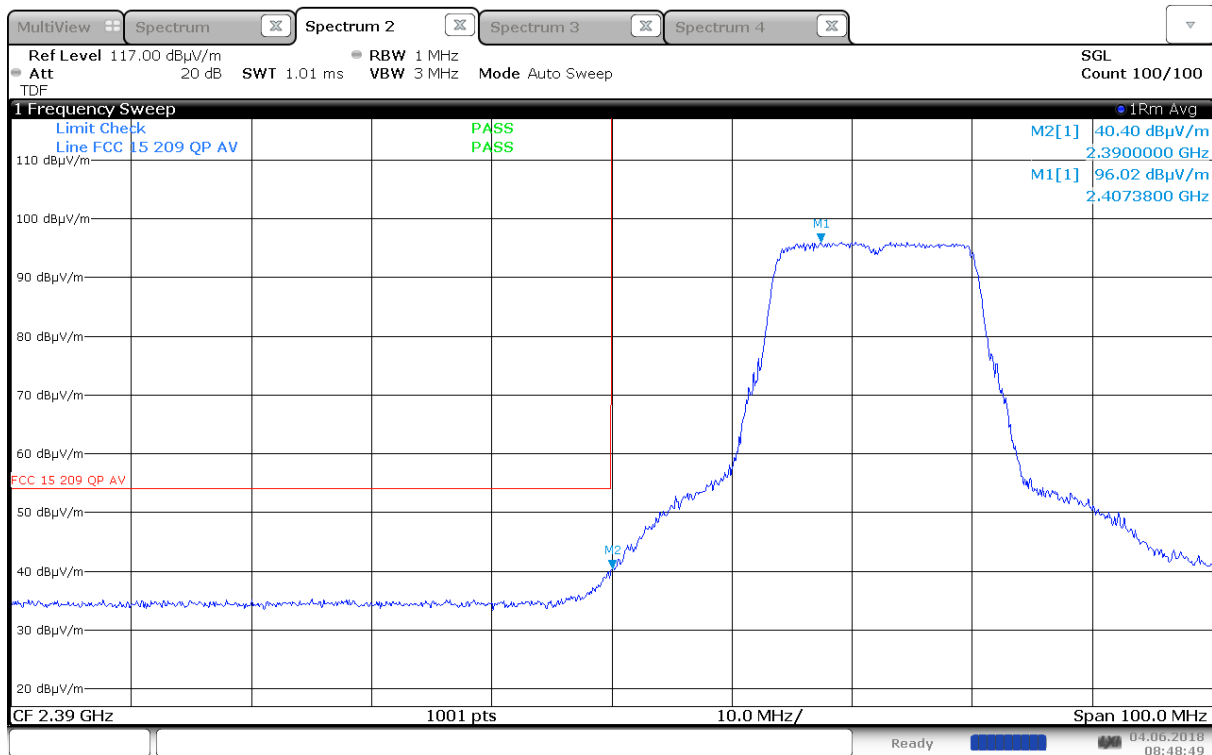
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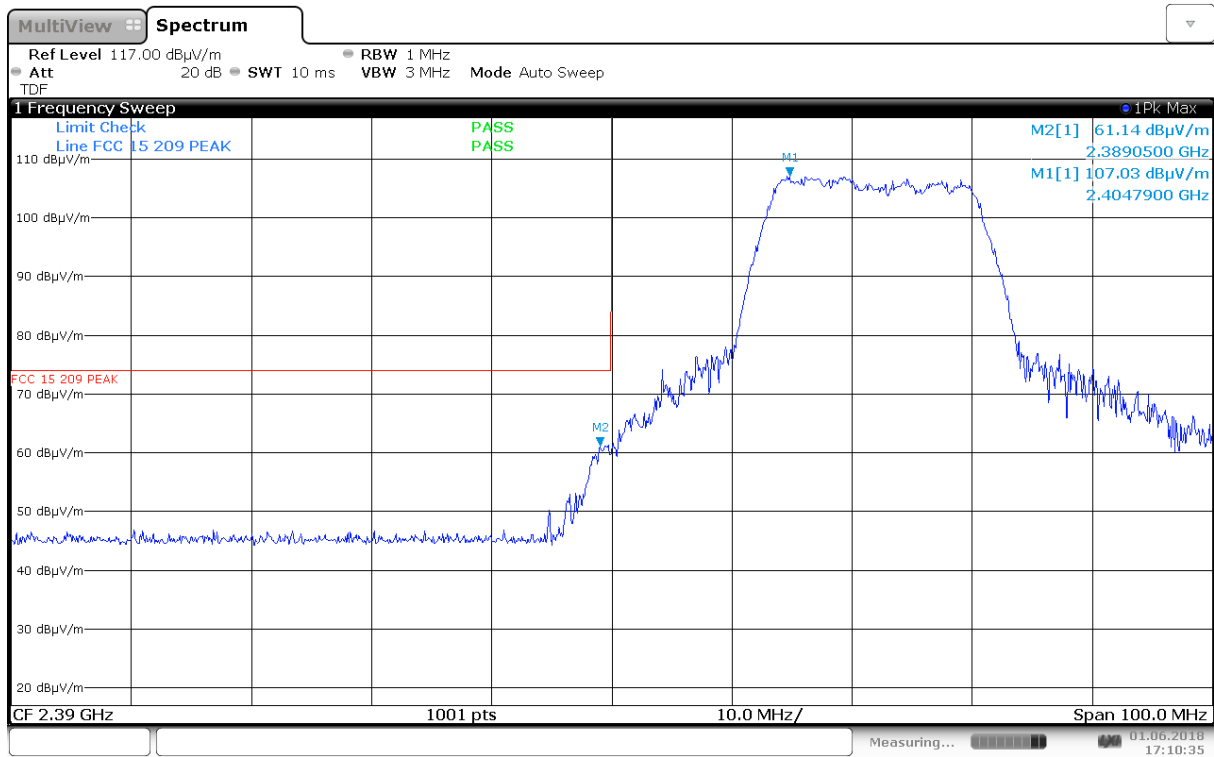
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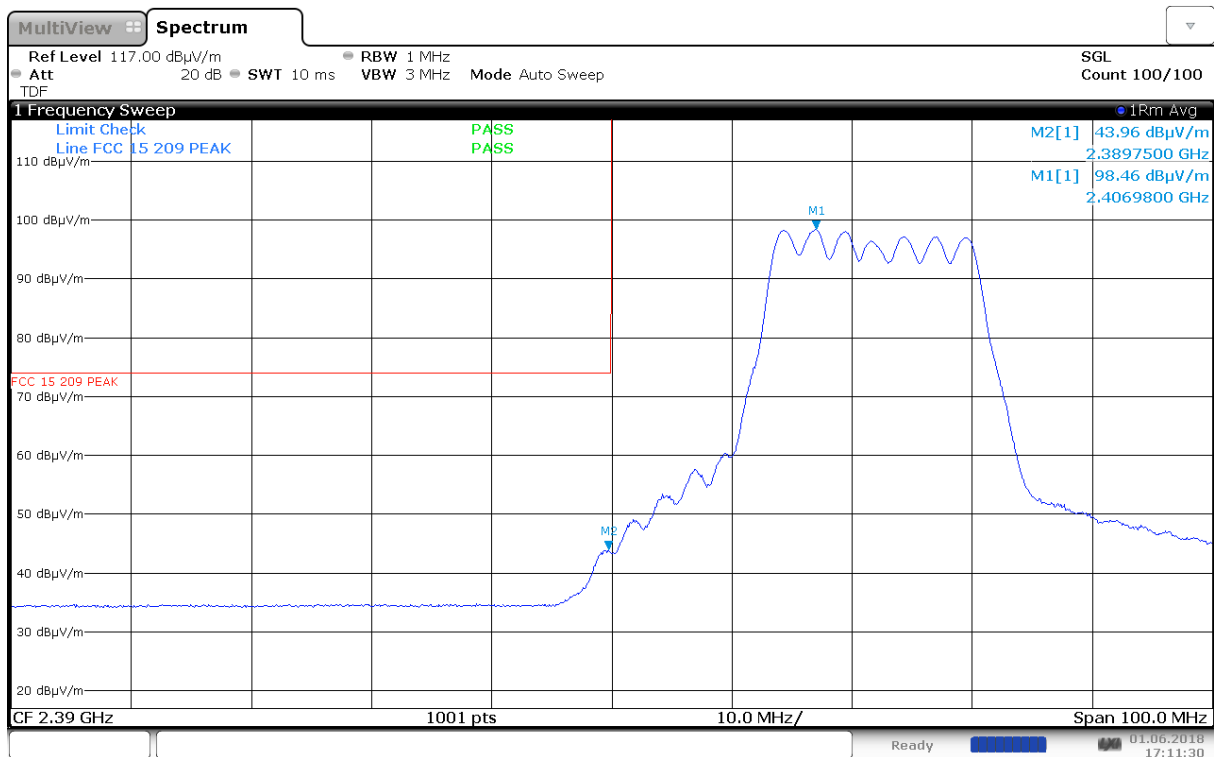
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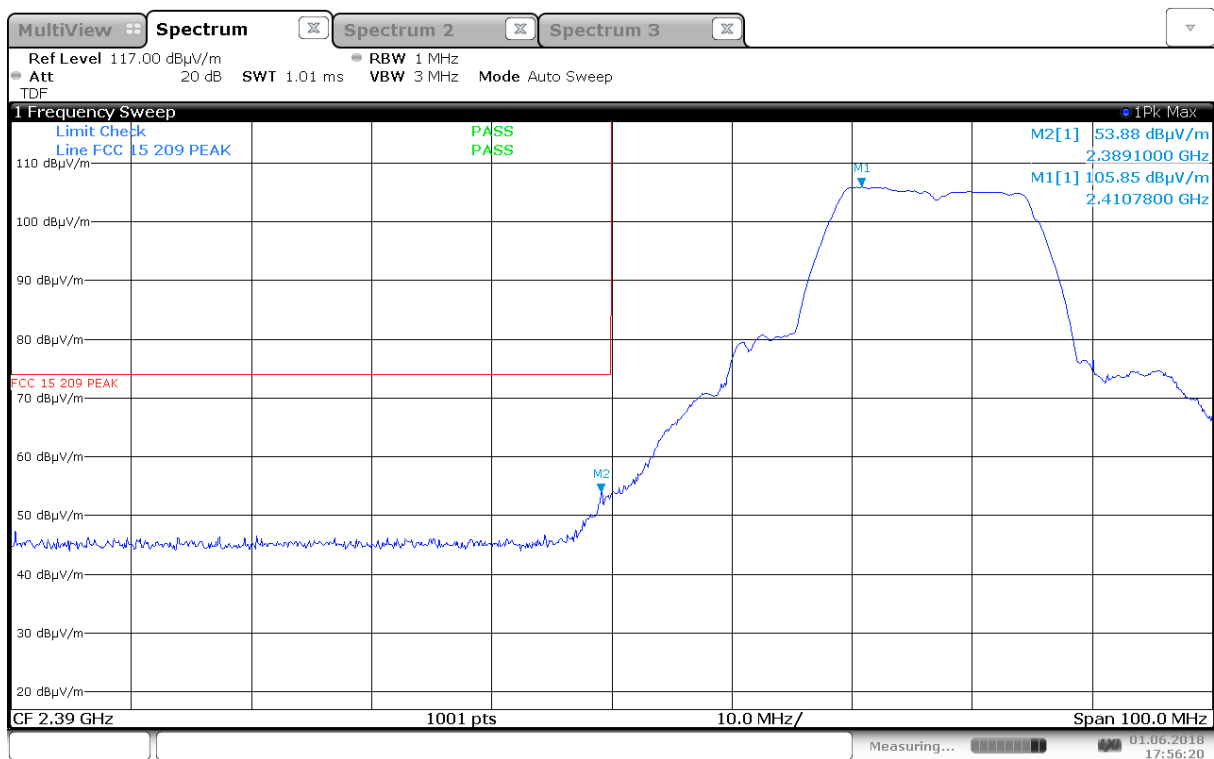
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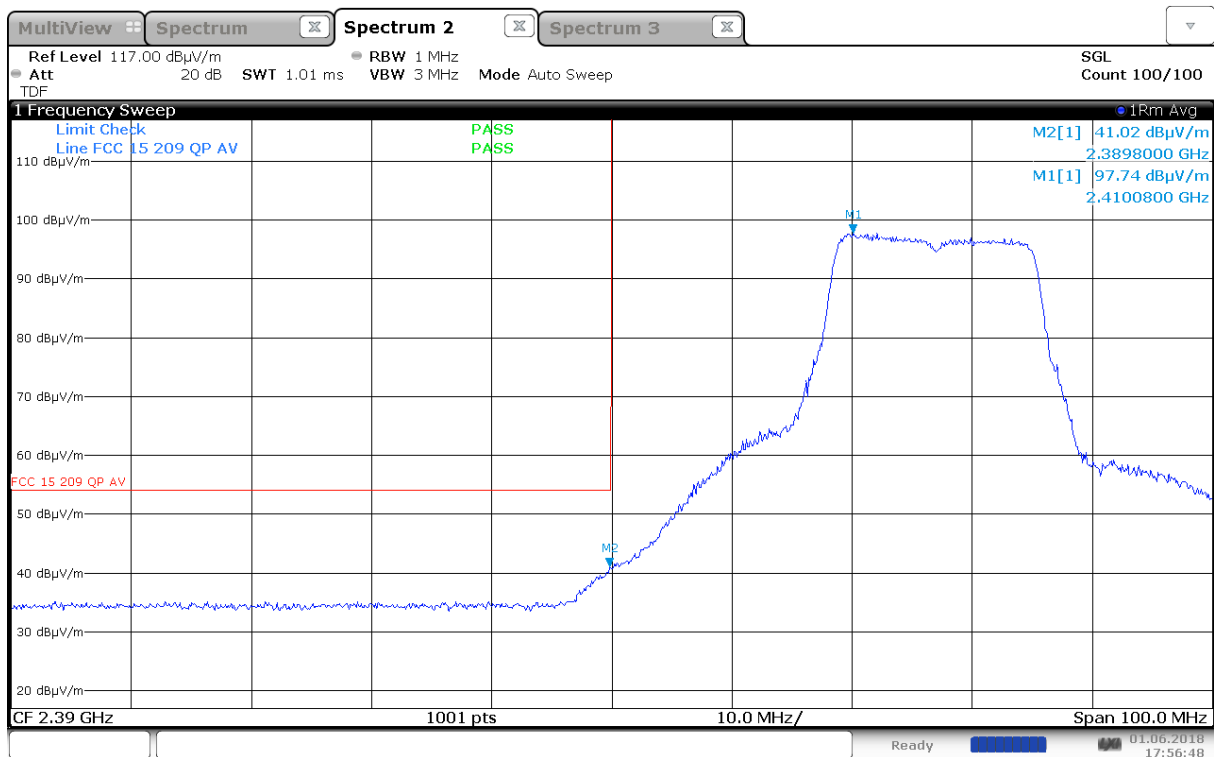
Lower Band Edge, Peak, 2412 MHz, 802.11n, MCS0, MIMO (Max: HP)



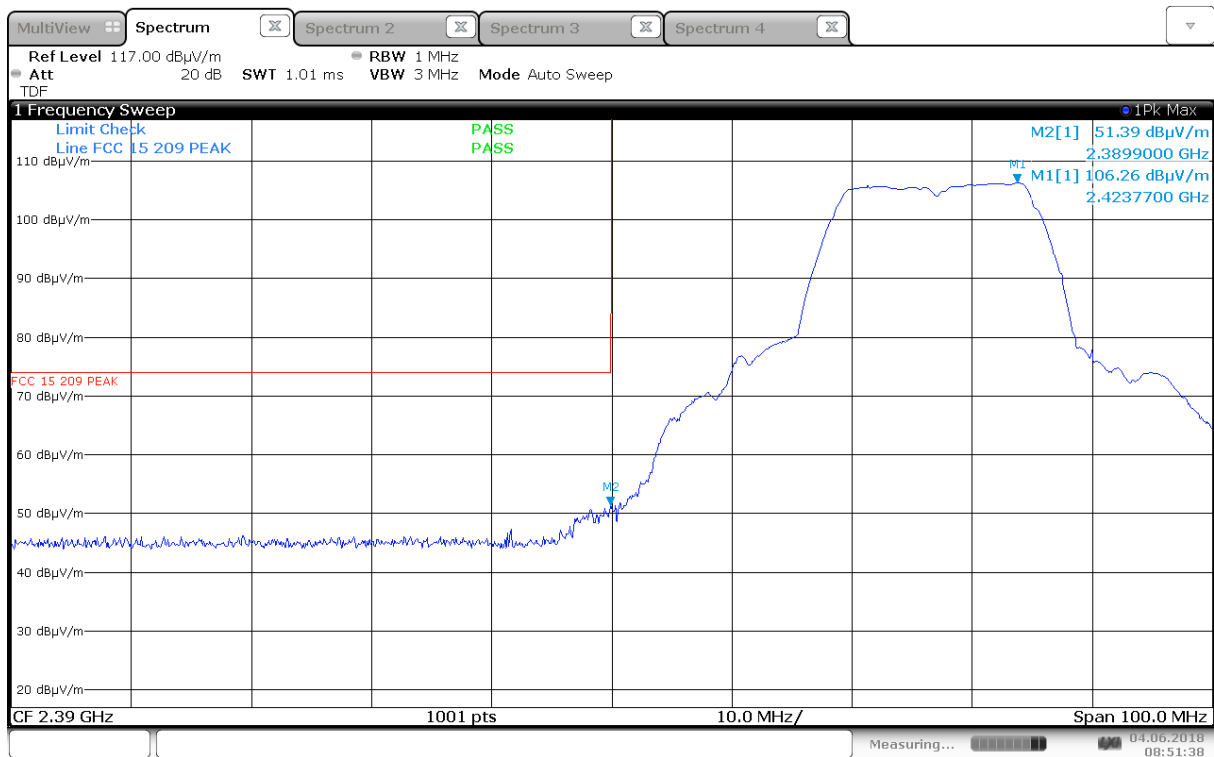
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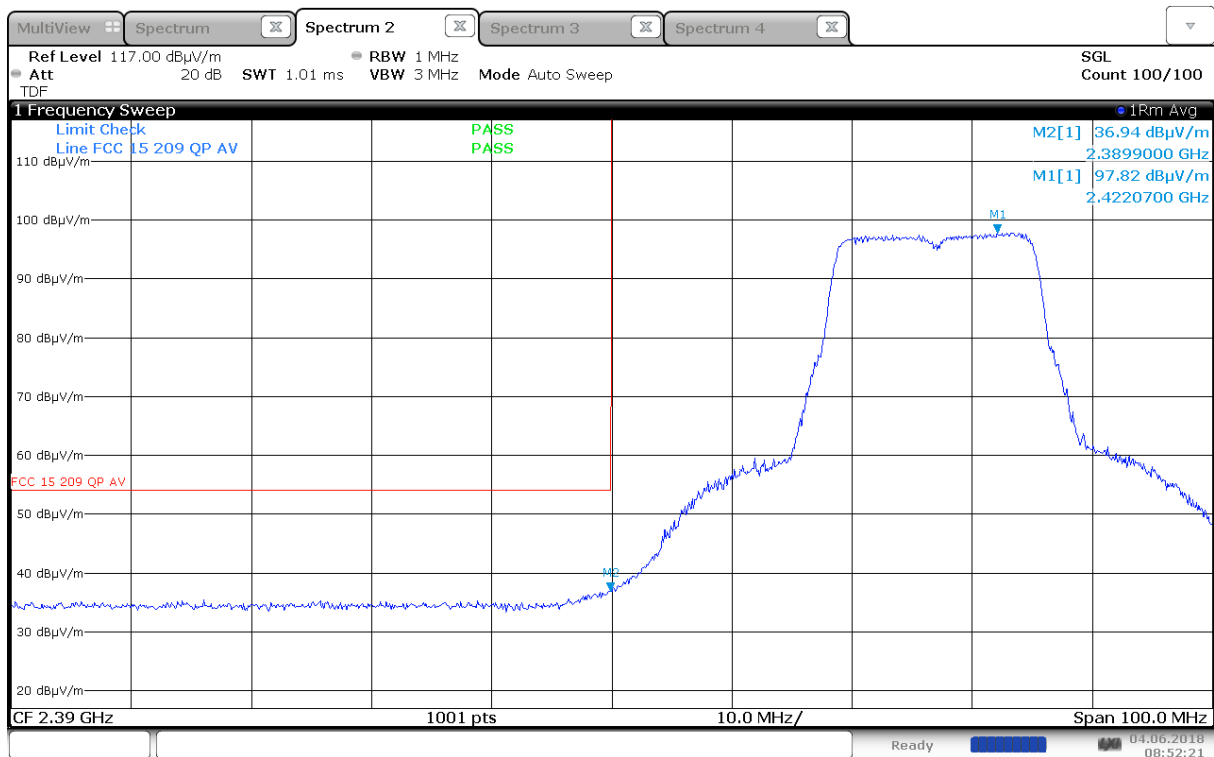
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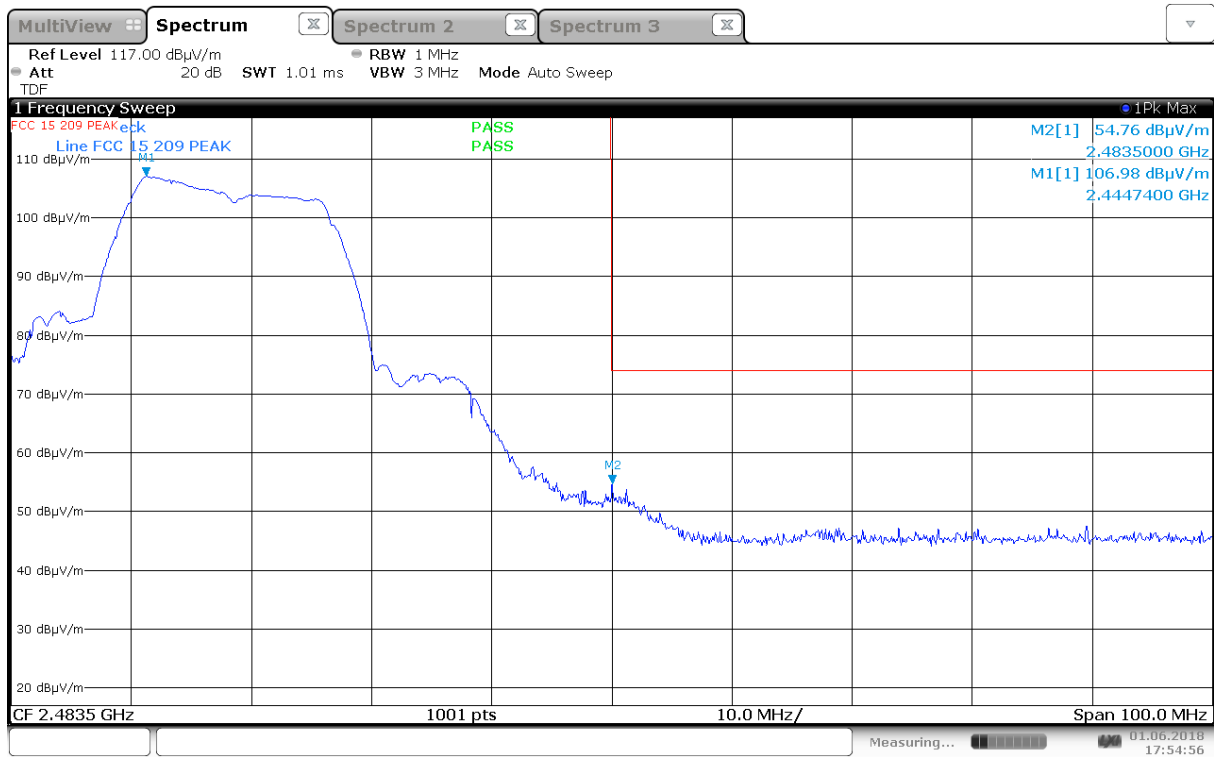
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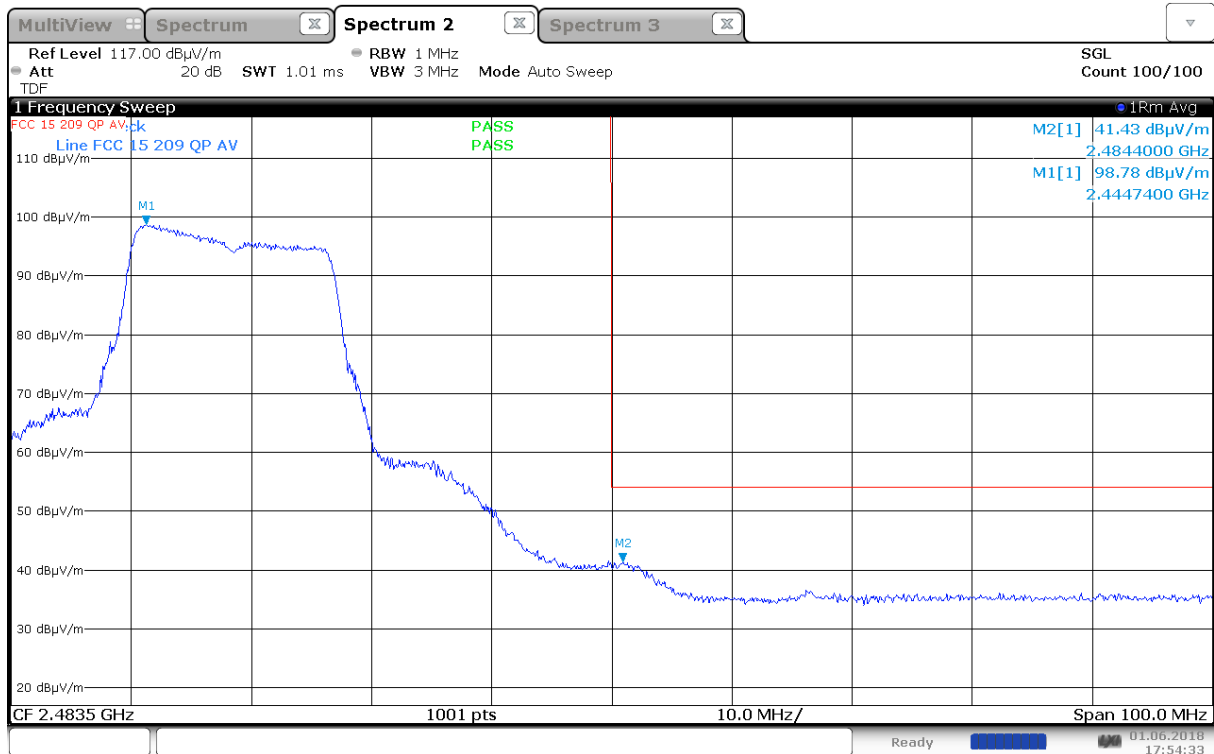
Lower Band Edge, Peak, 2417 MHz, 802.11g, 6Mb, (Max: Ant 1, HP)



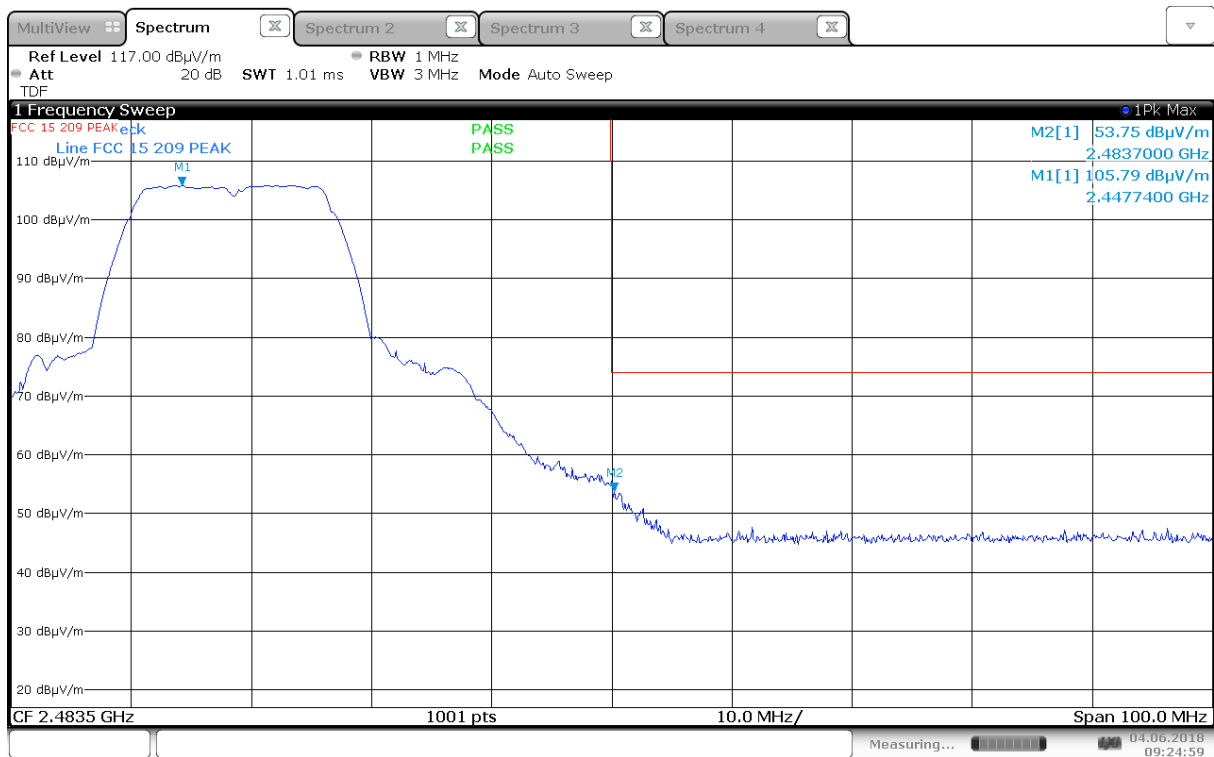
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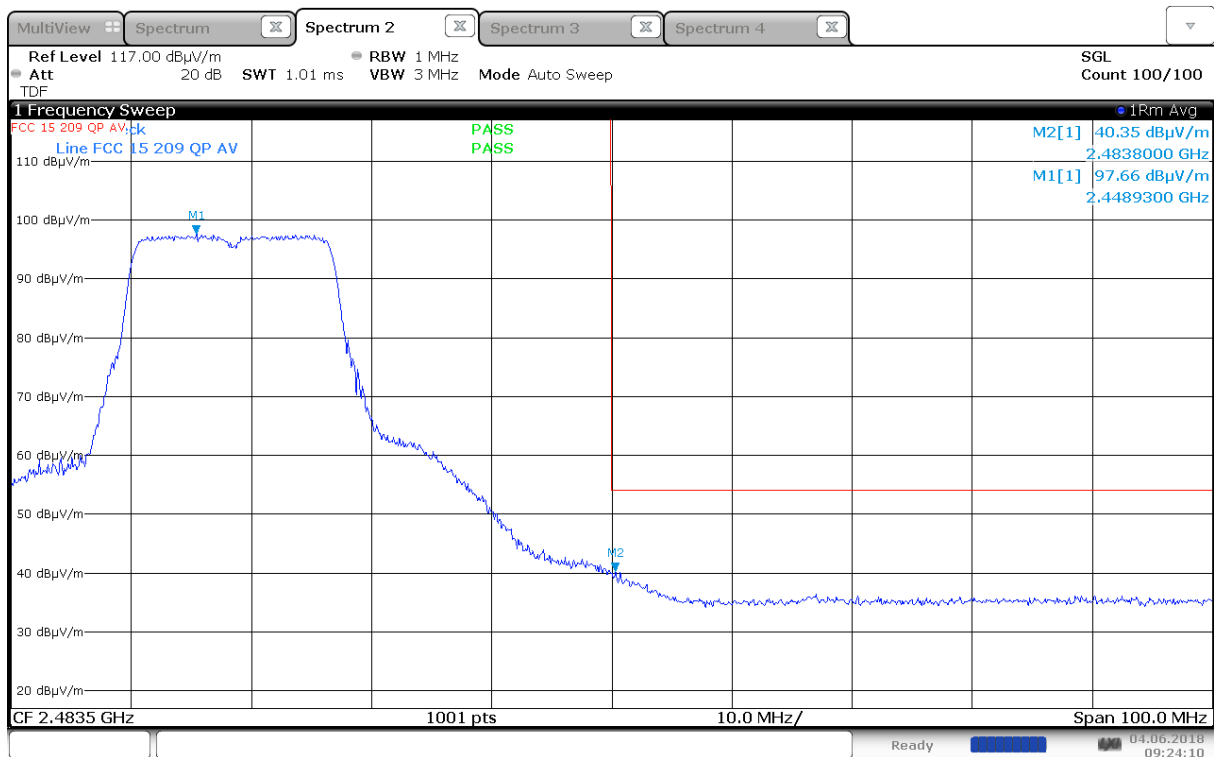
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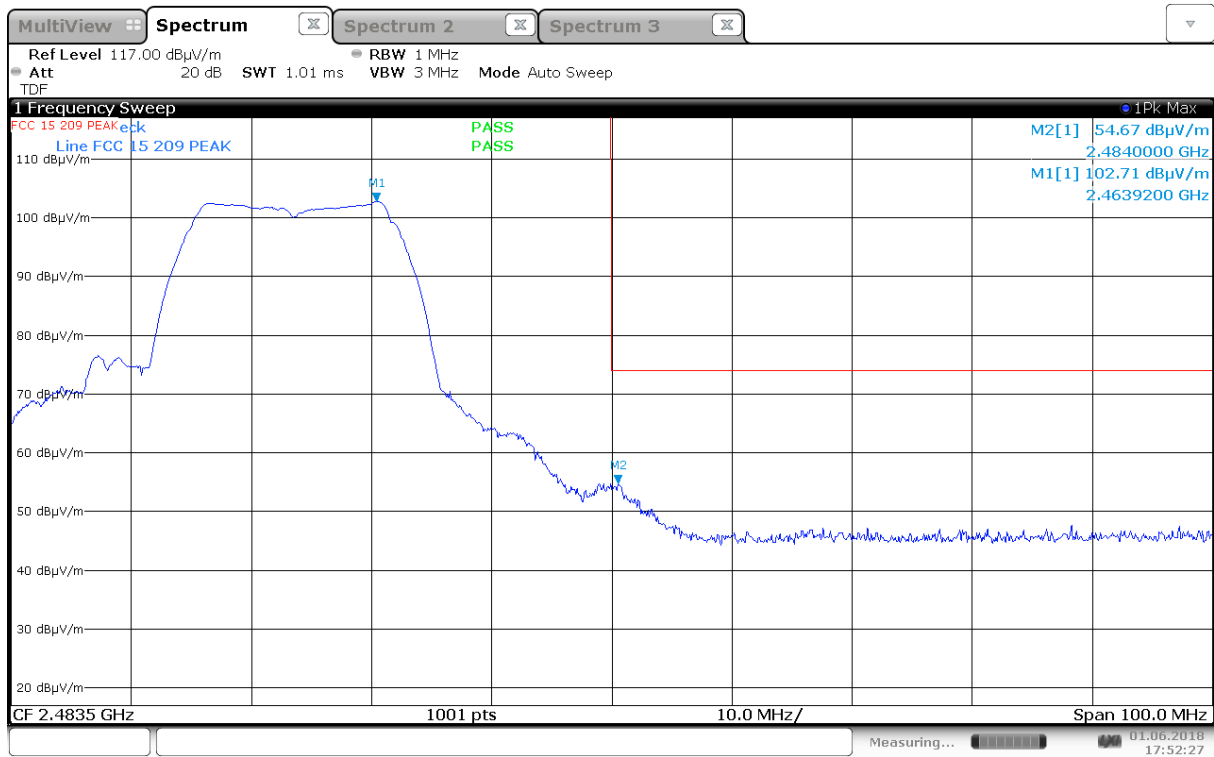
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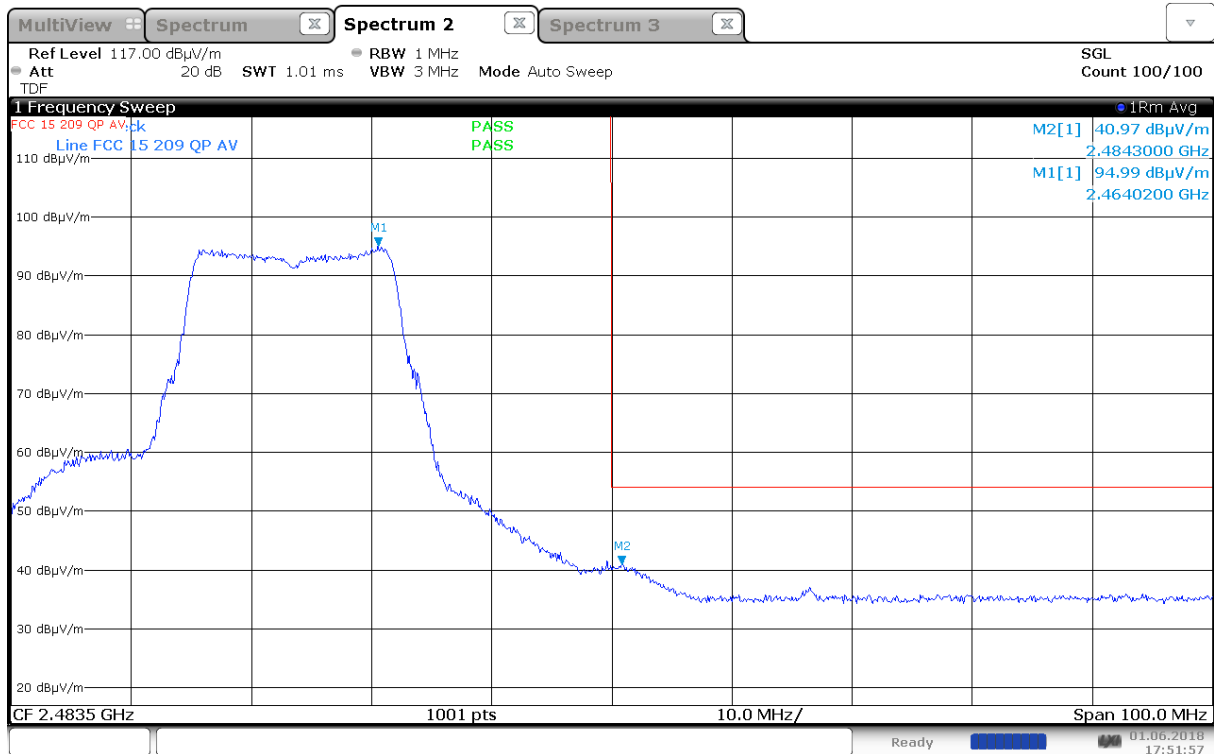
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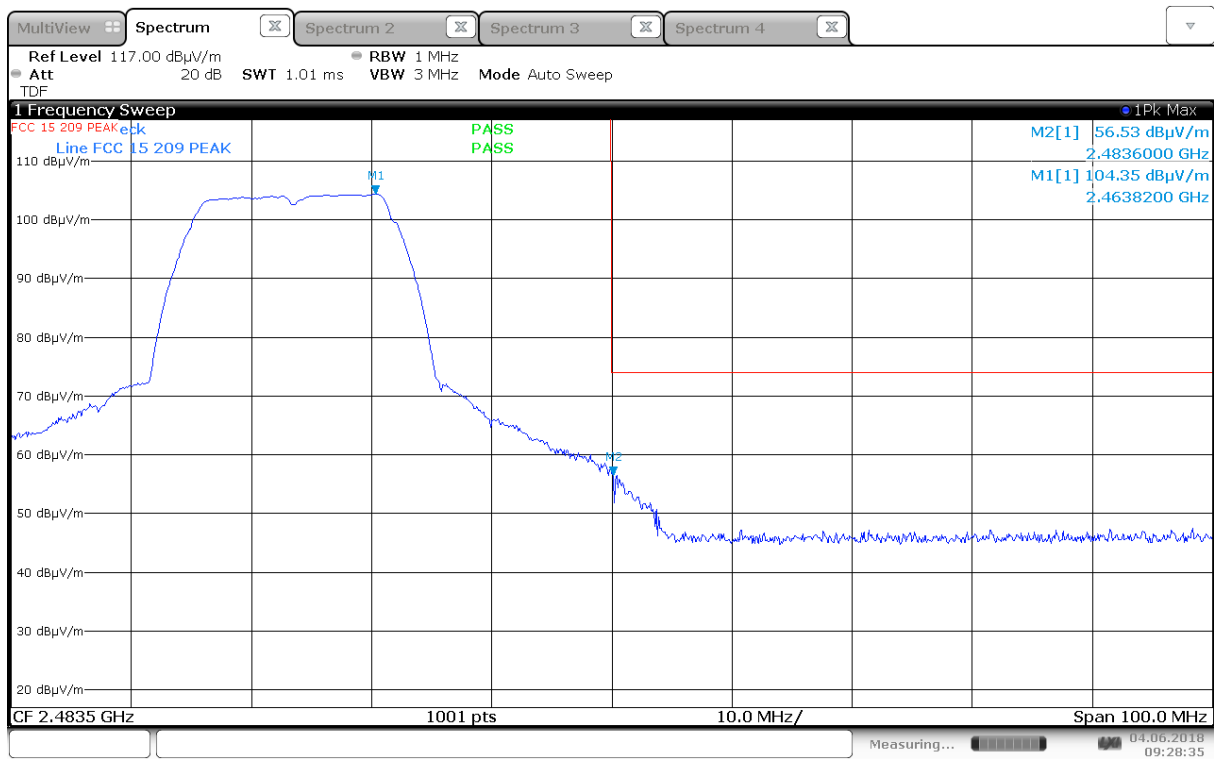
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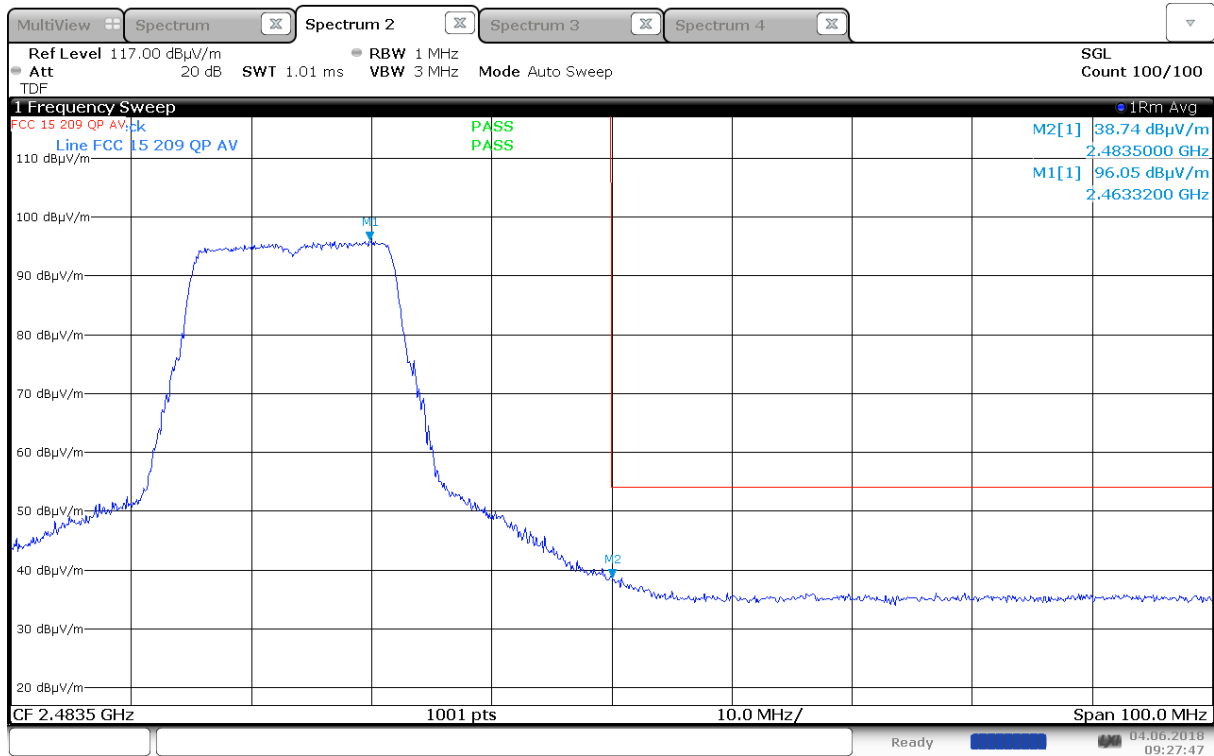
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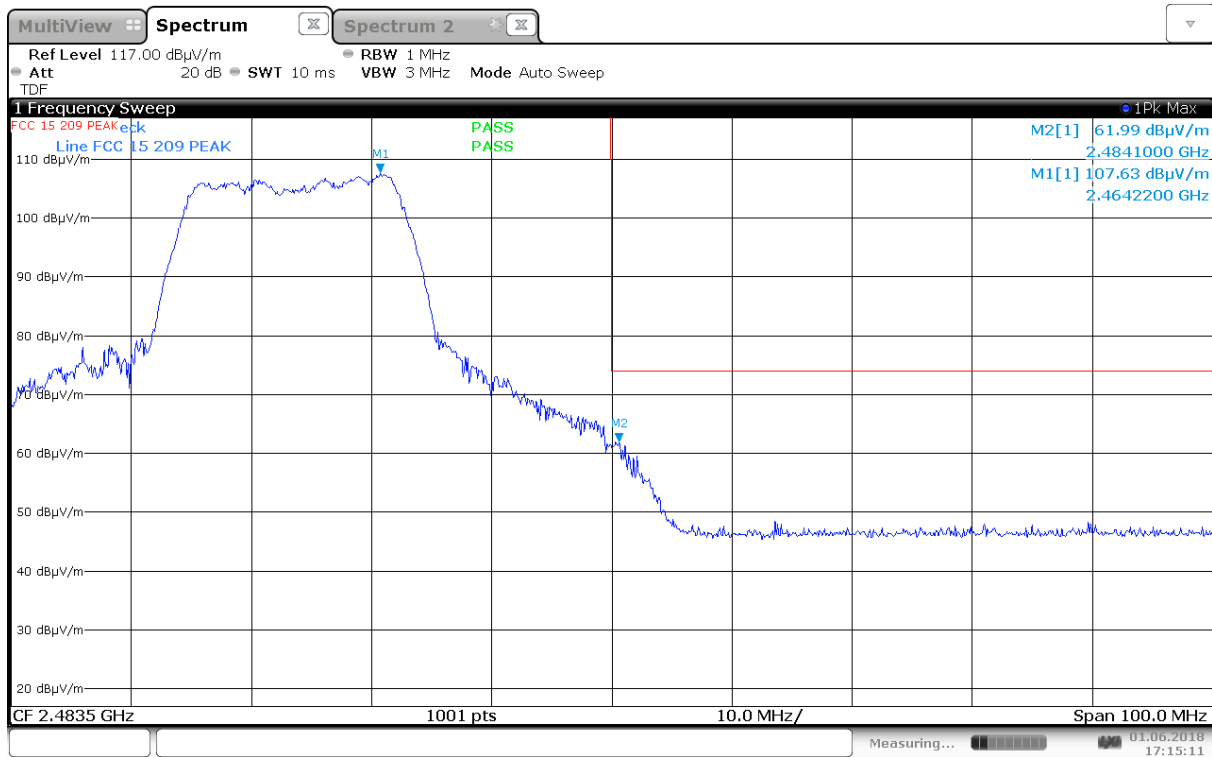
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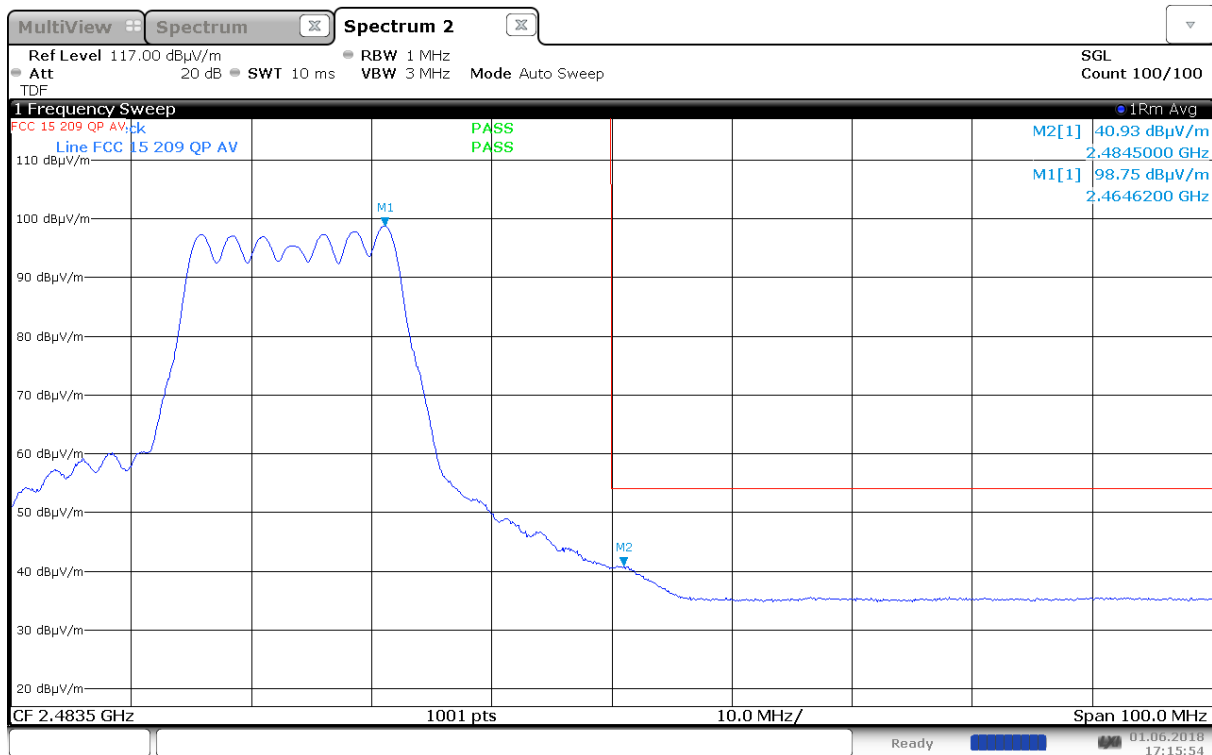
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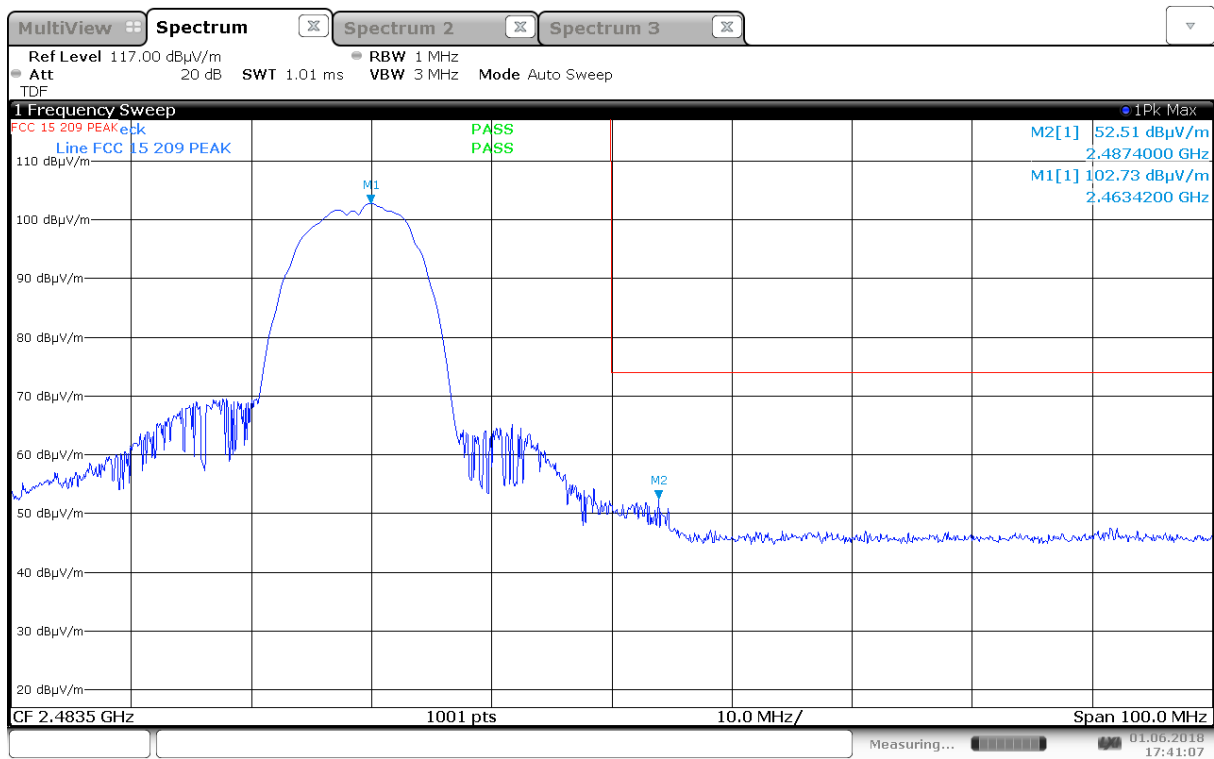
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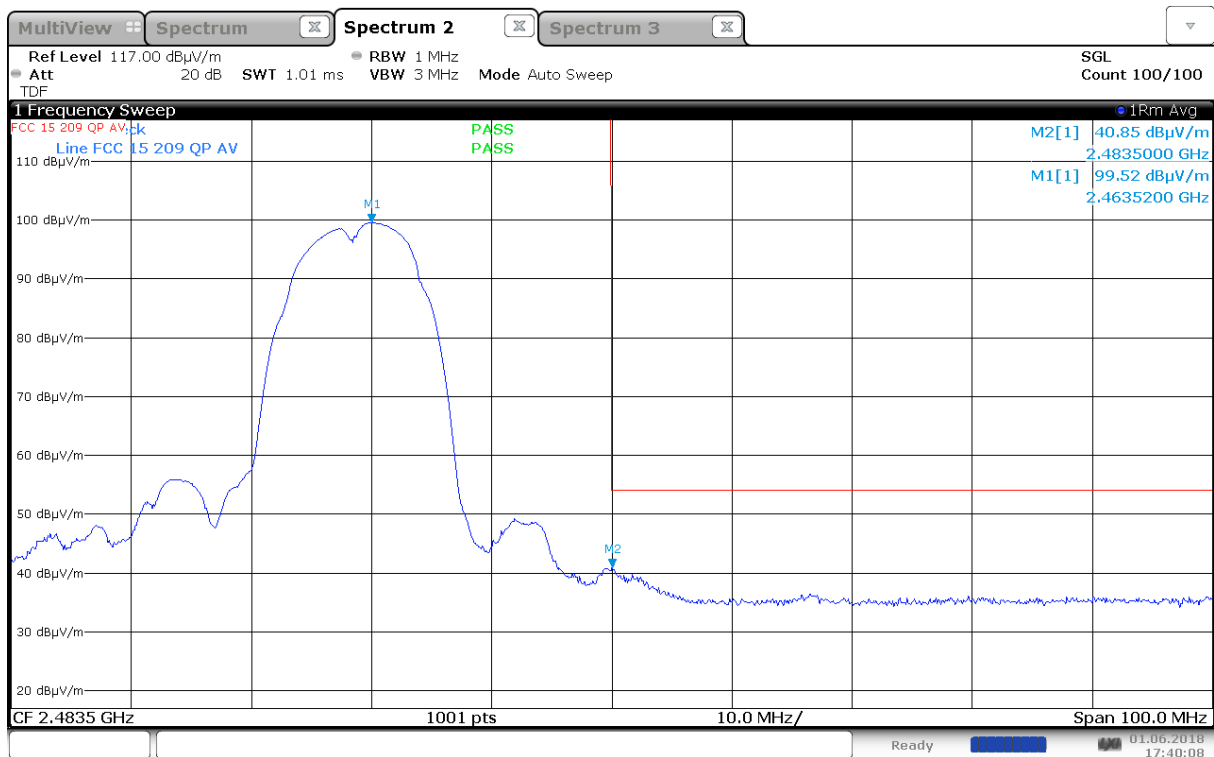
Upper Band Edge, Peak, 2457 MHz, 802.11n, MCS0, MIMO (Max: HP)



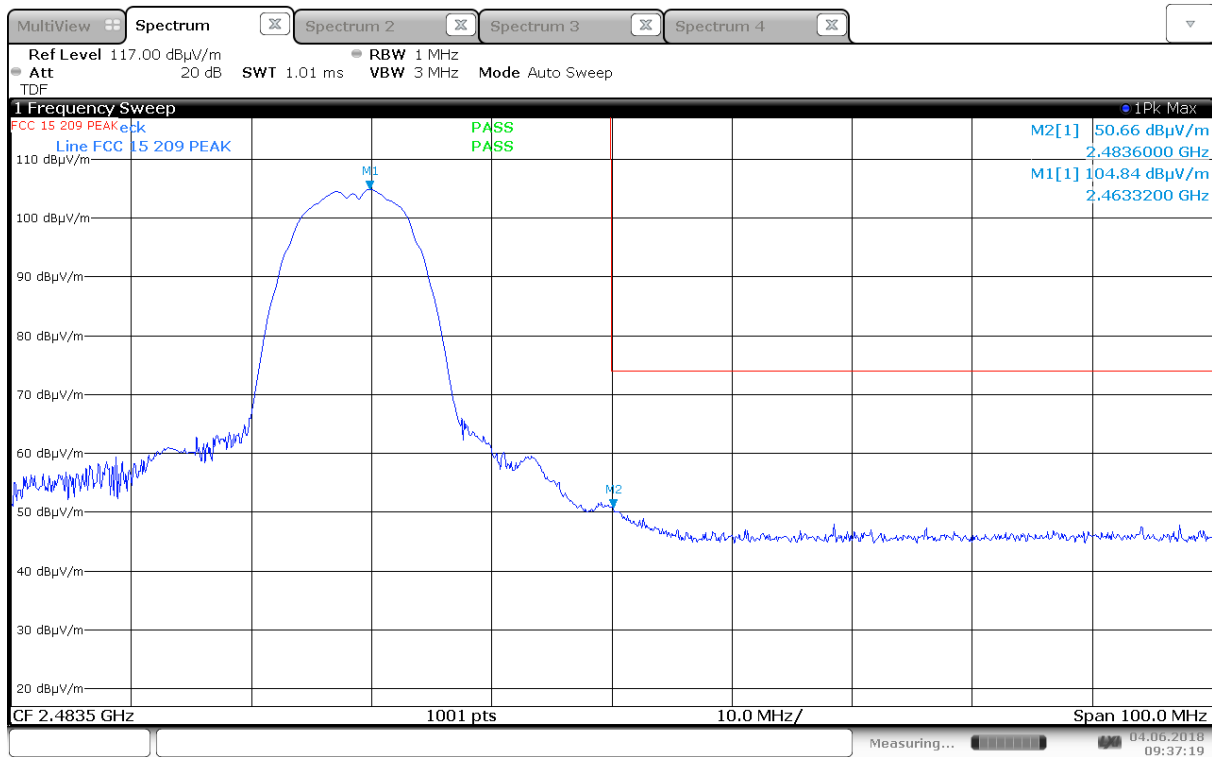
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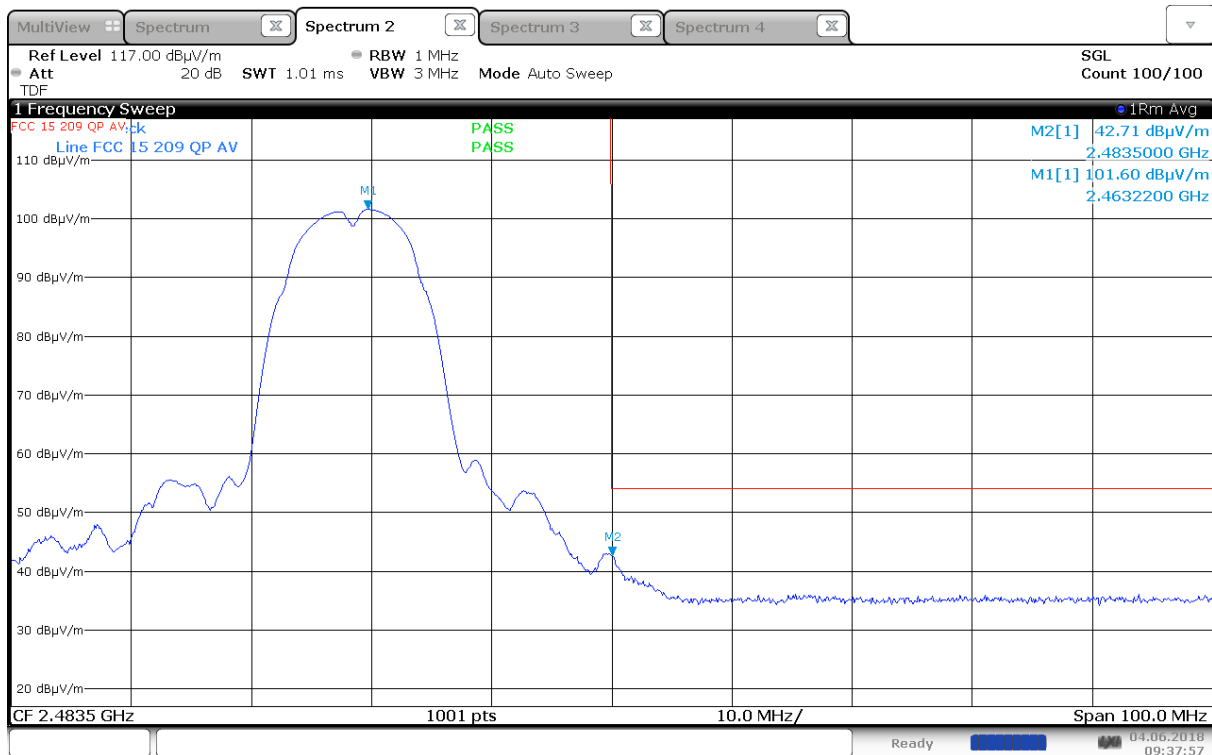
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Upper Band Edge, Average, 2462 MHz, 802.11b, 1Mb, (Max: Ant 0, HP)



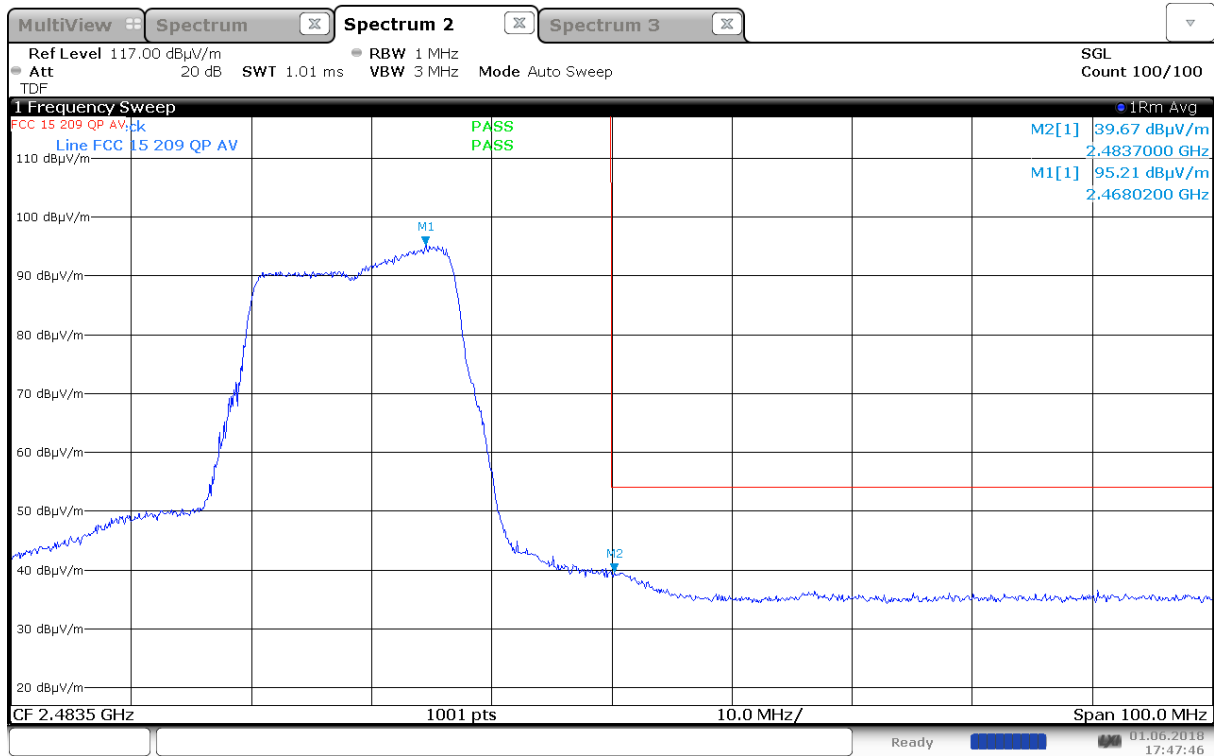
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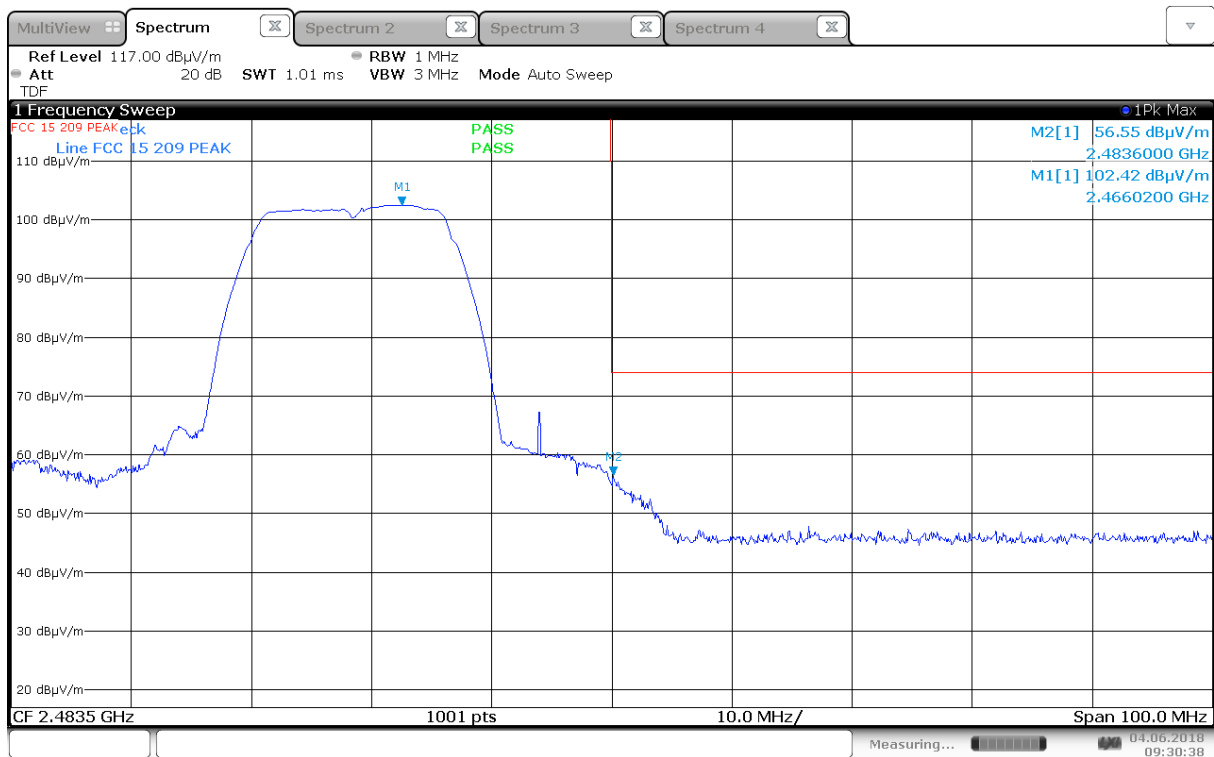
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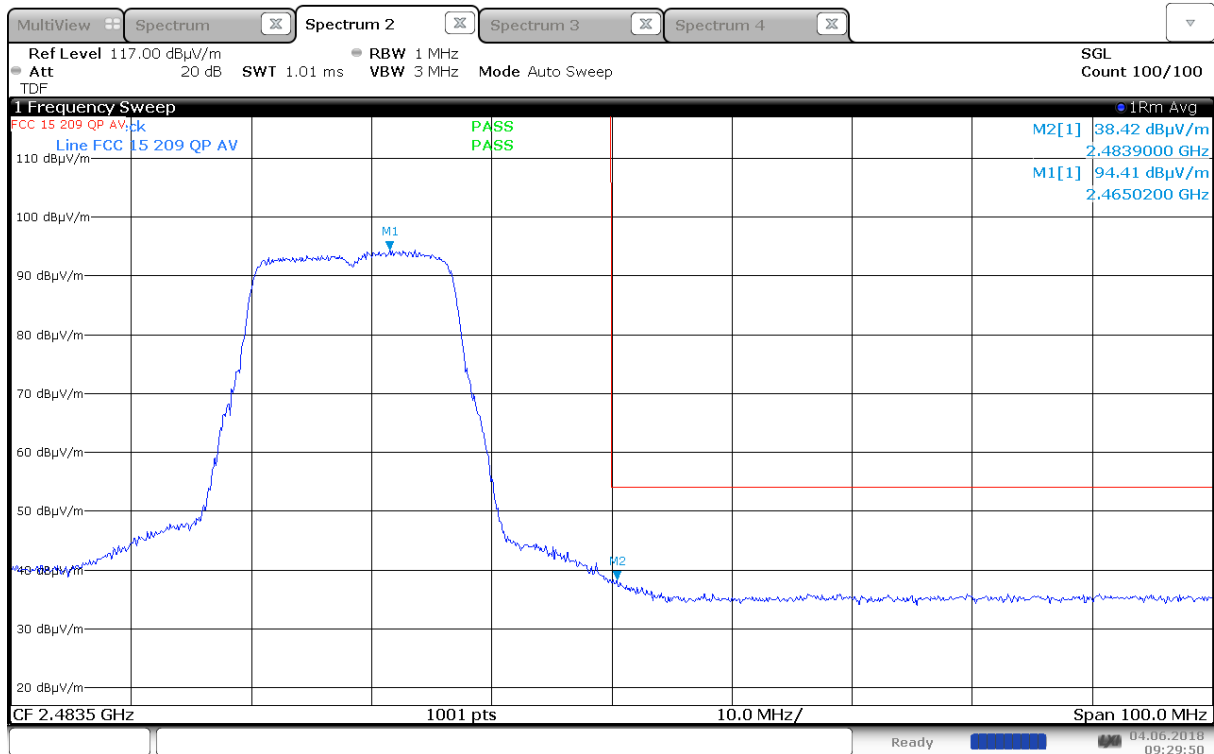
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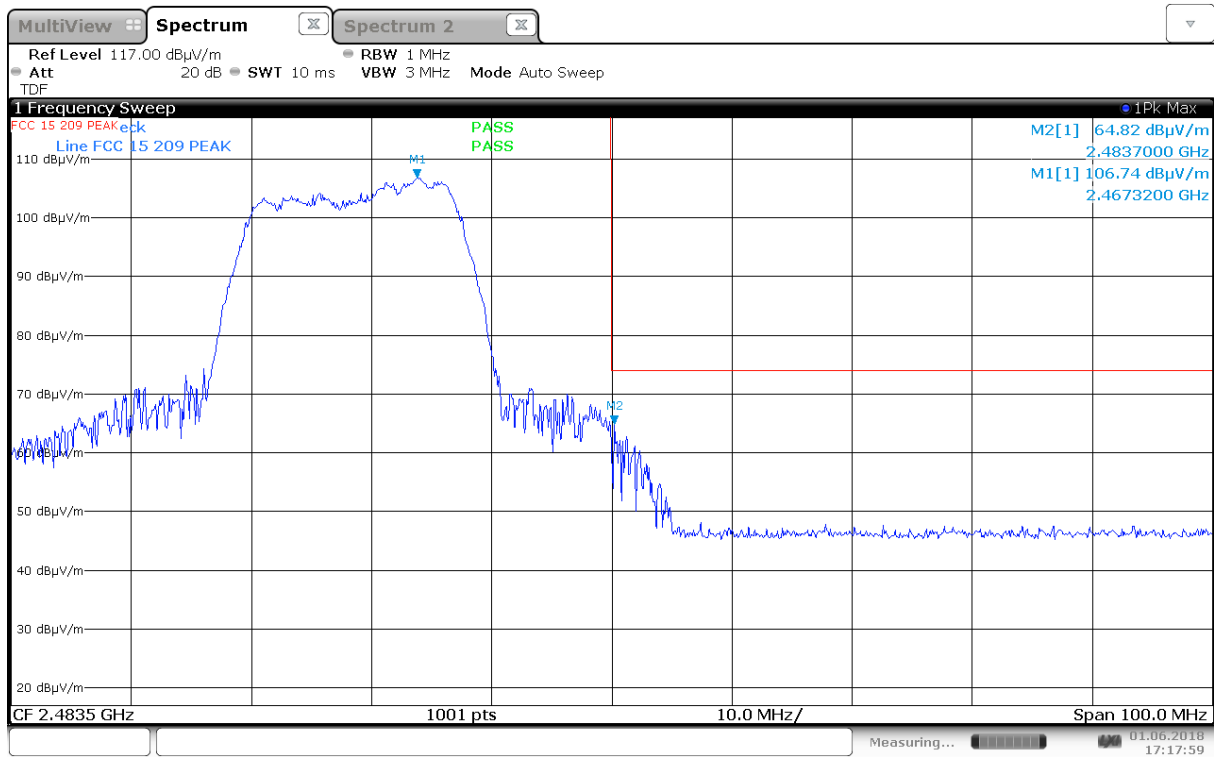
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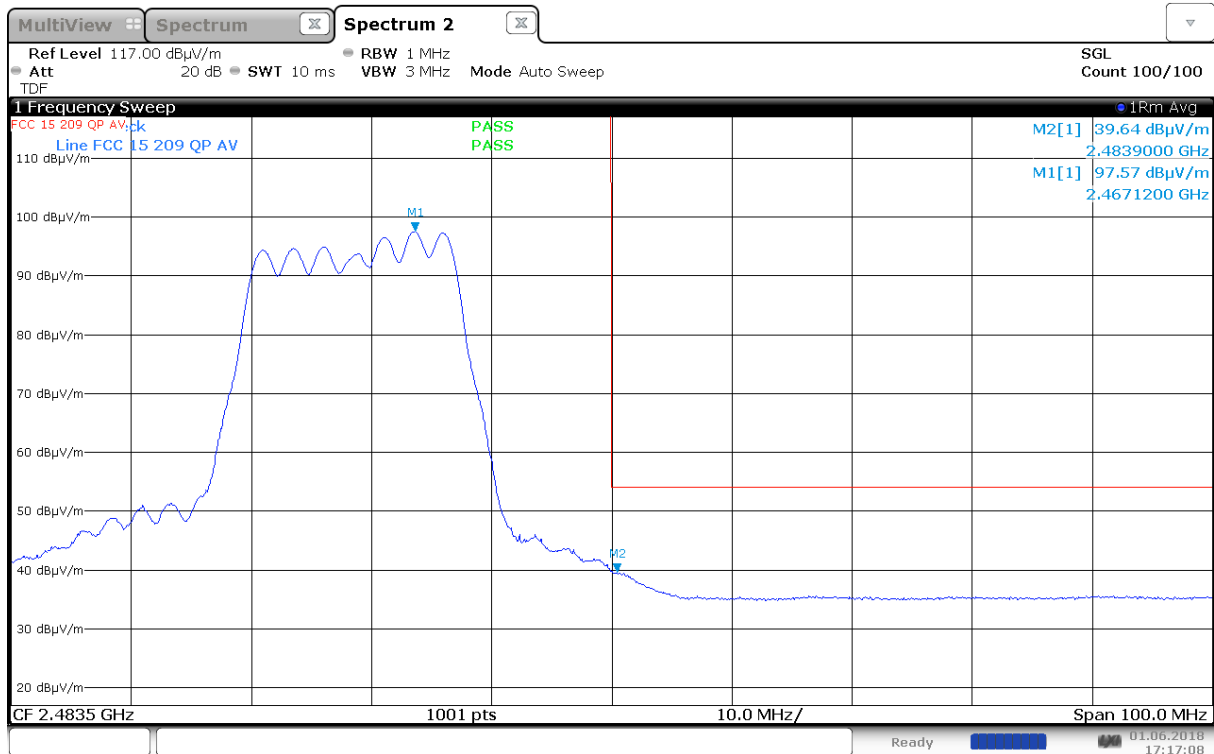
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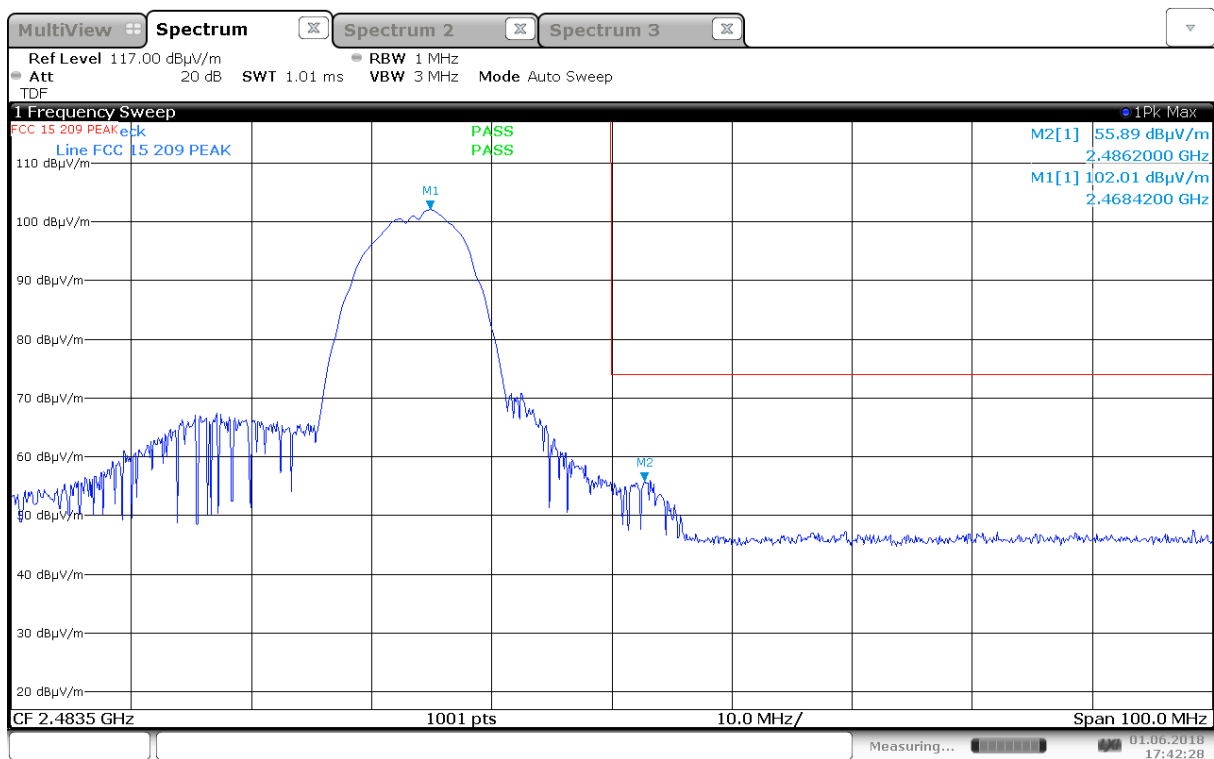
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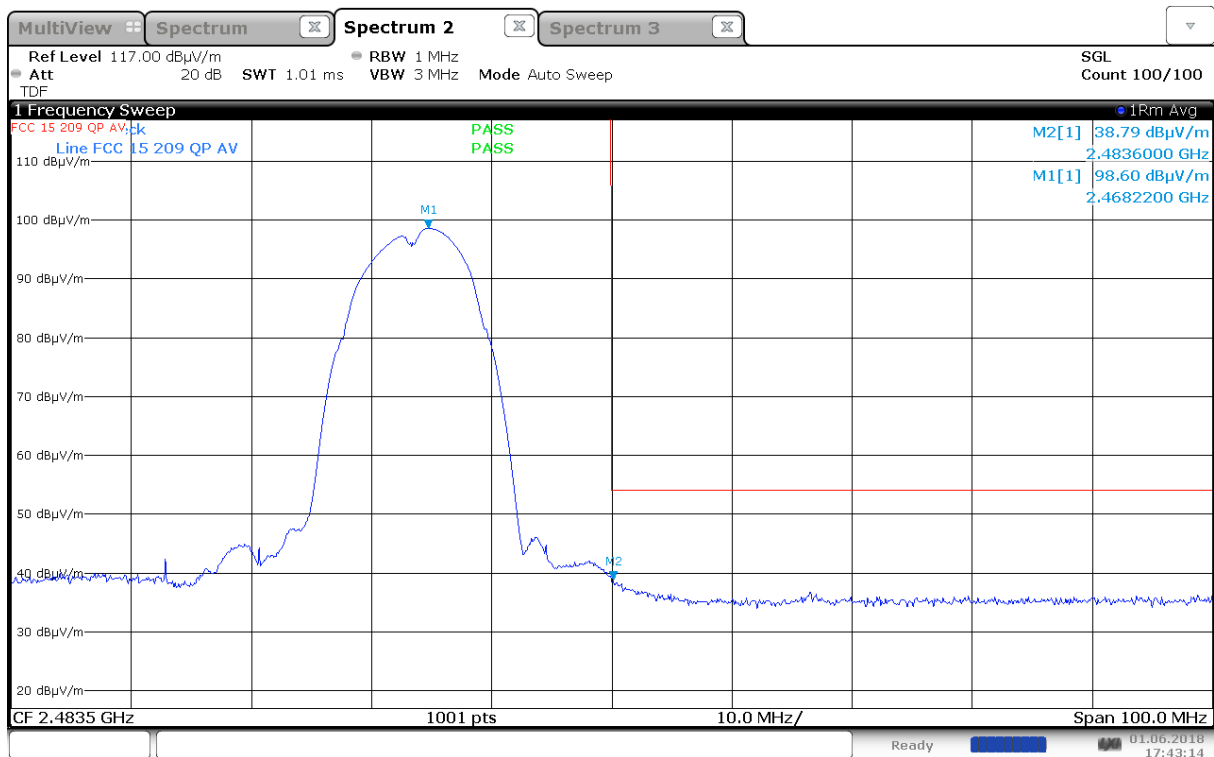
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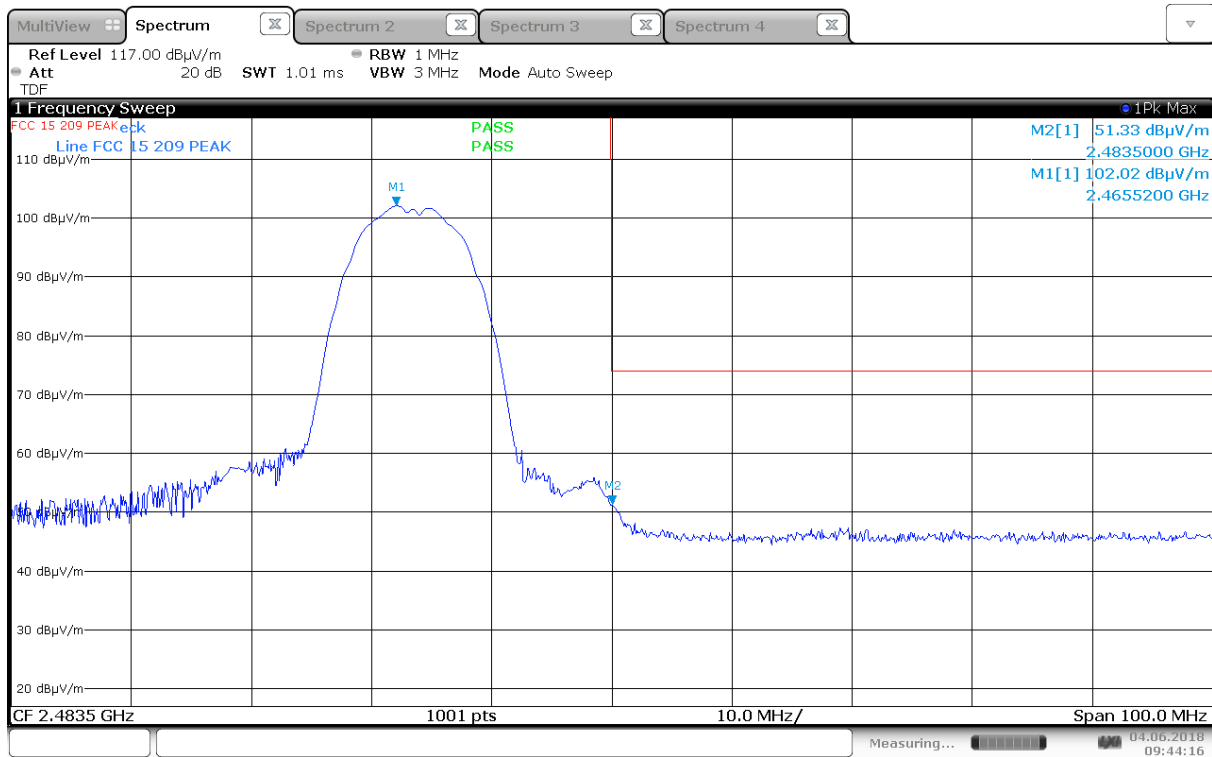
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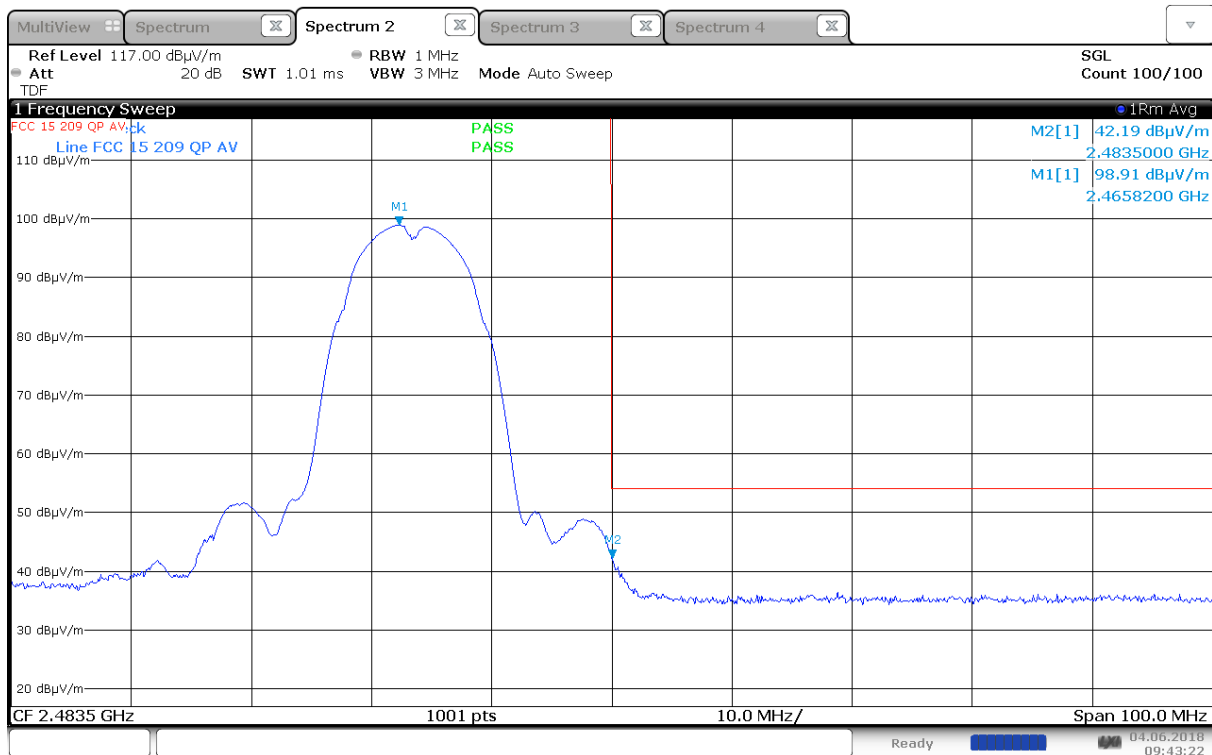
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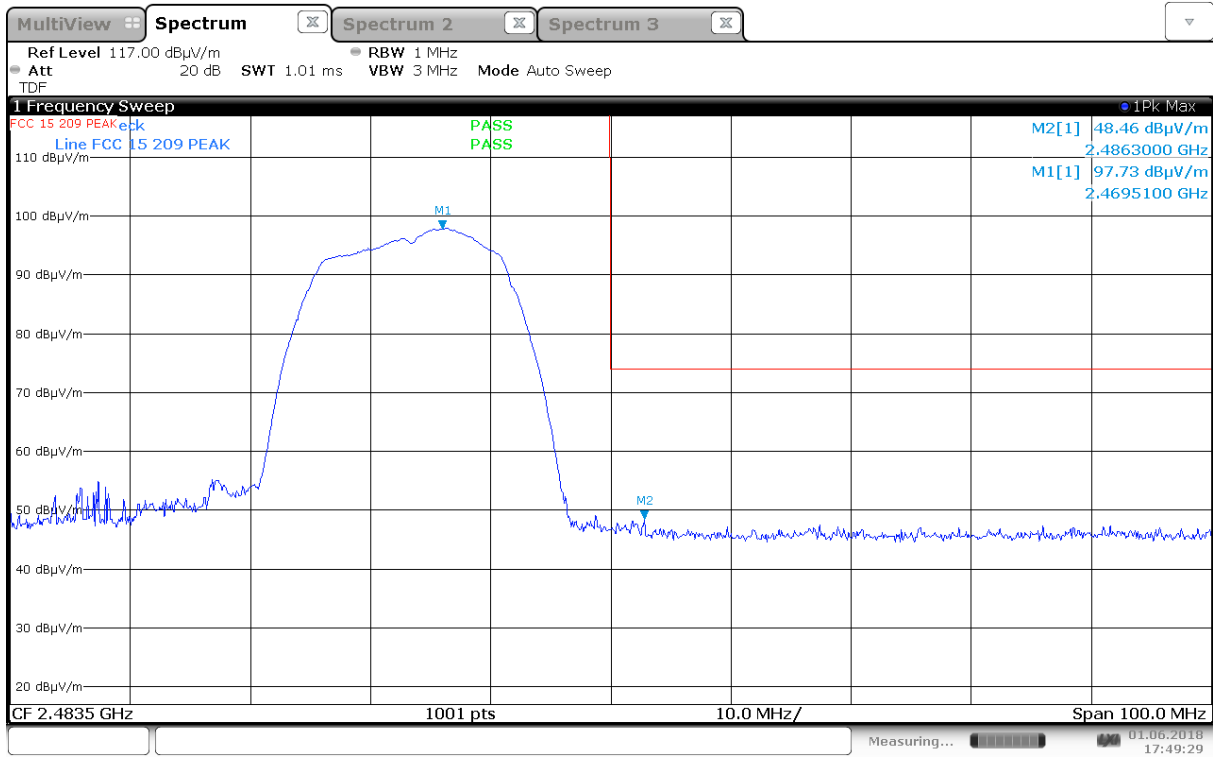
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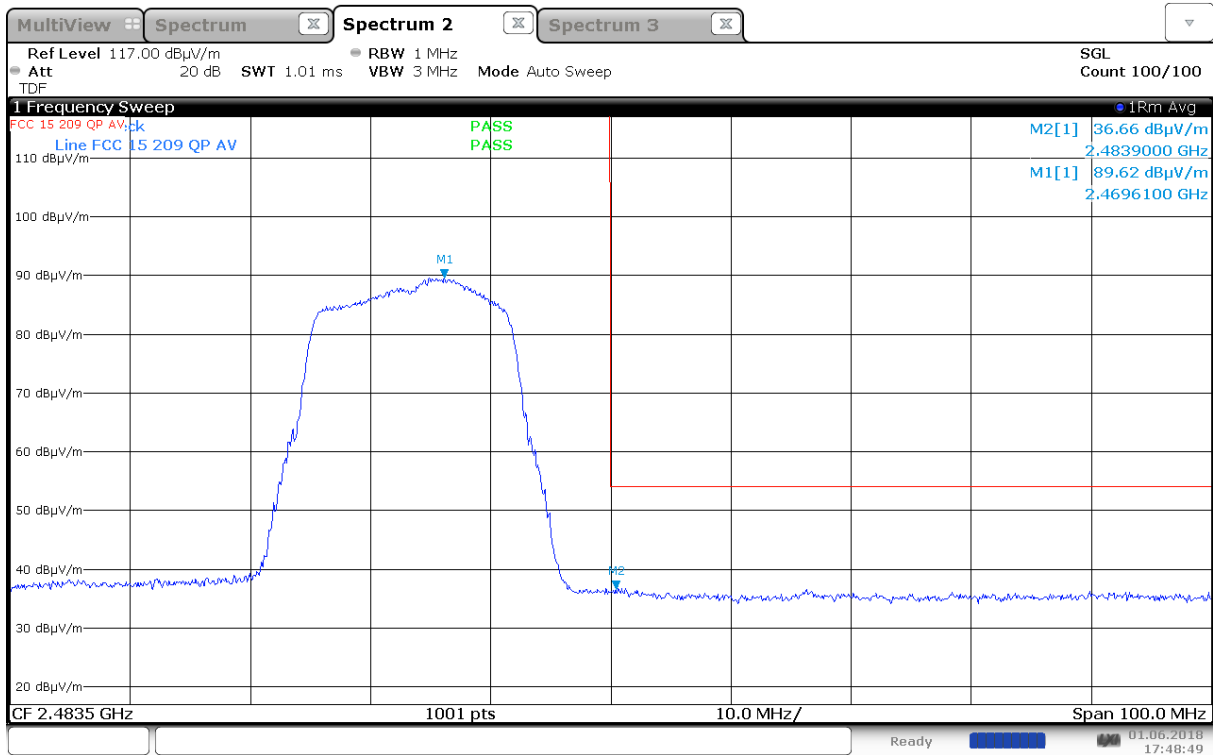
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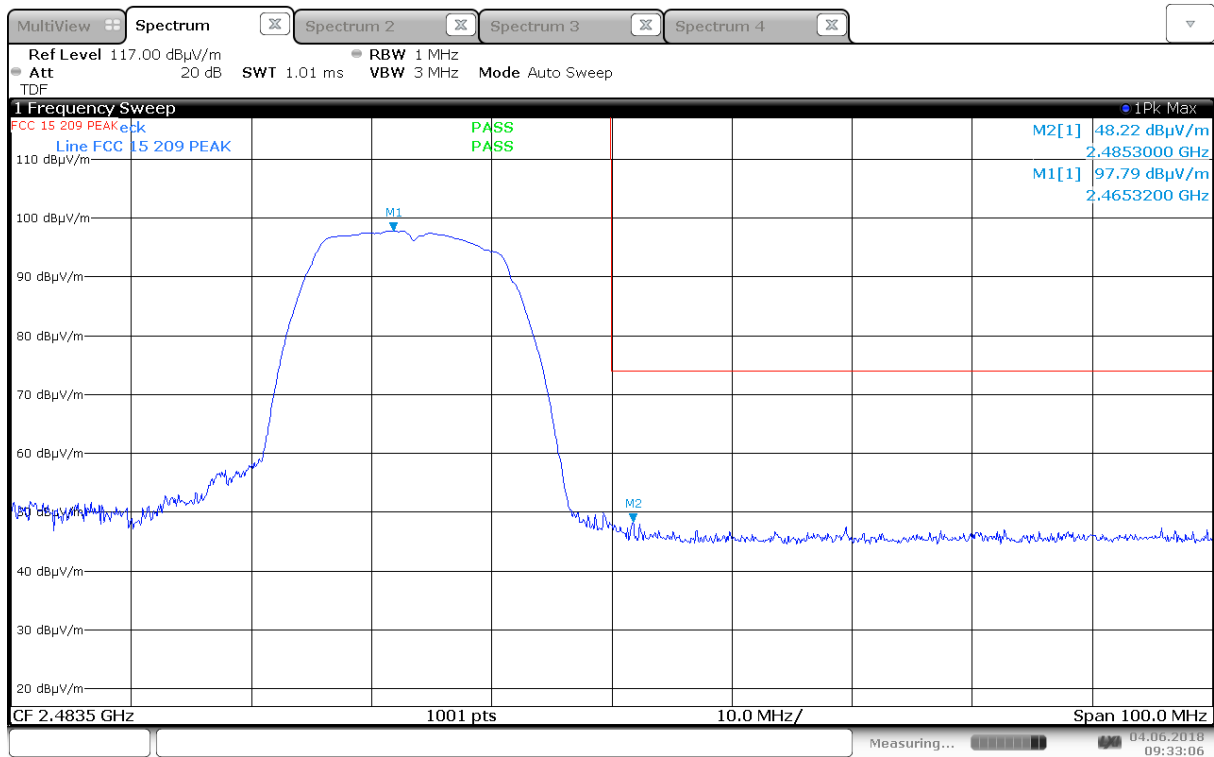
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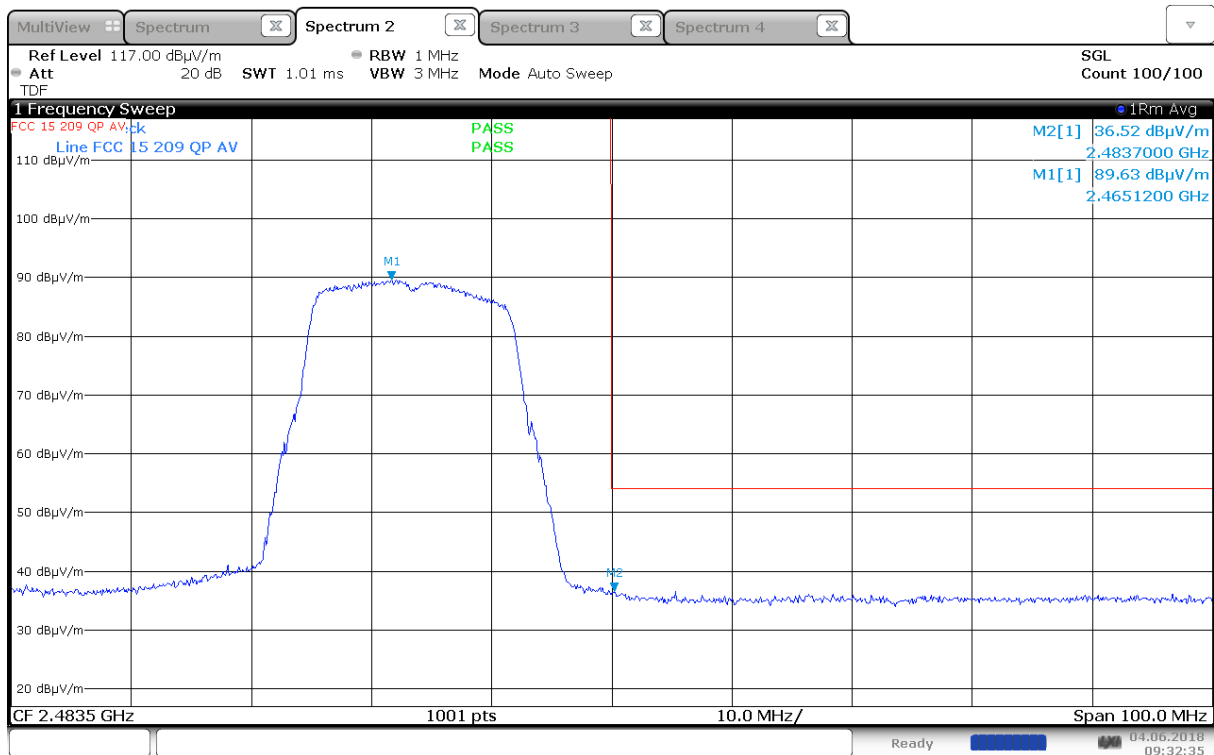
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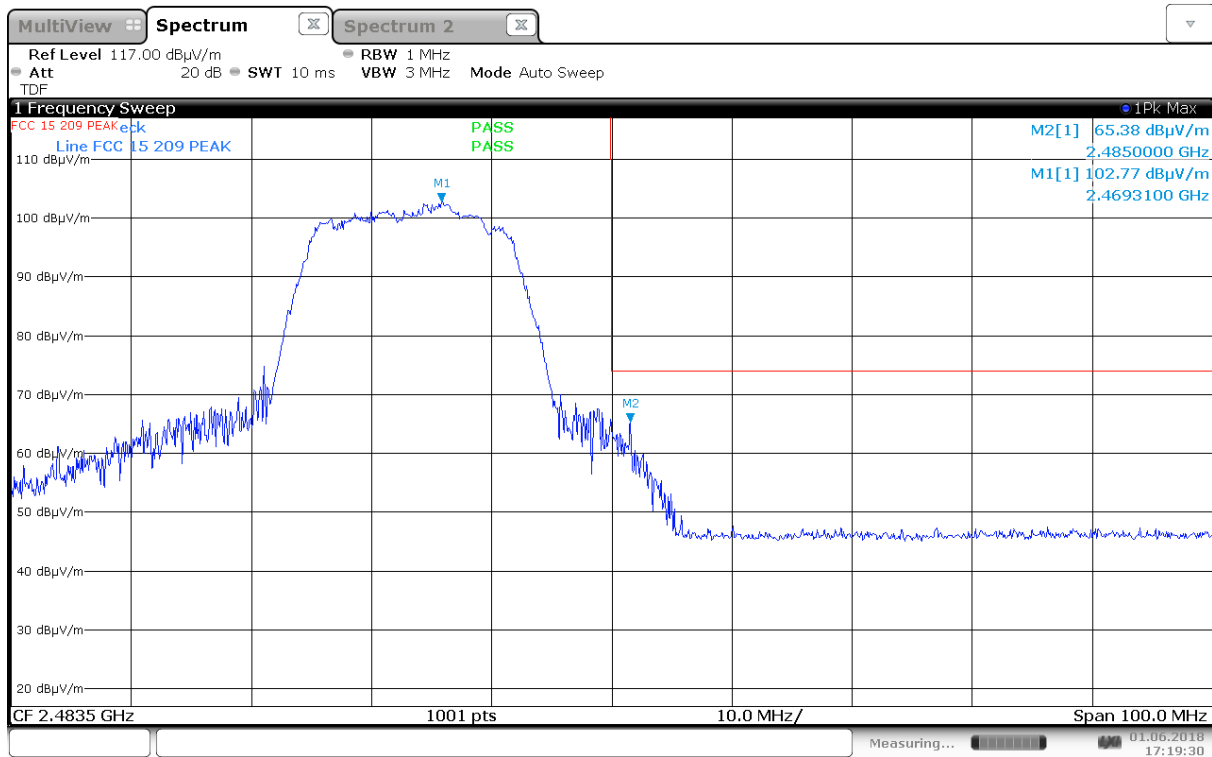
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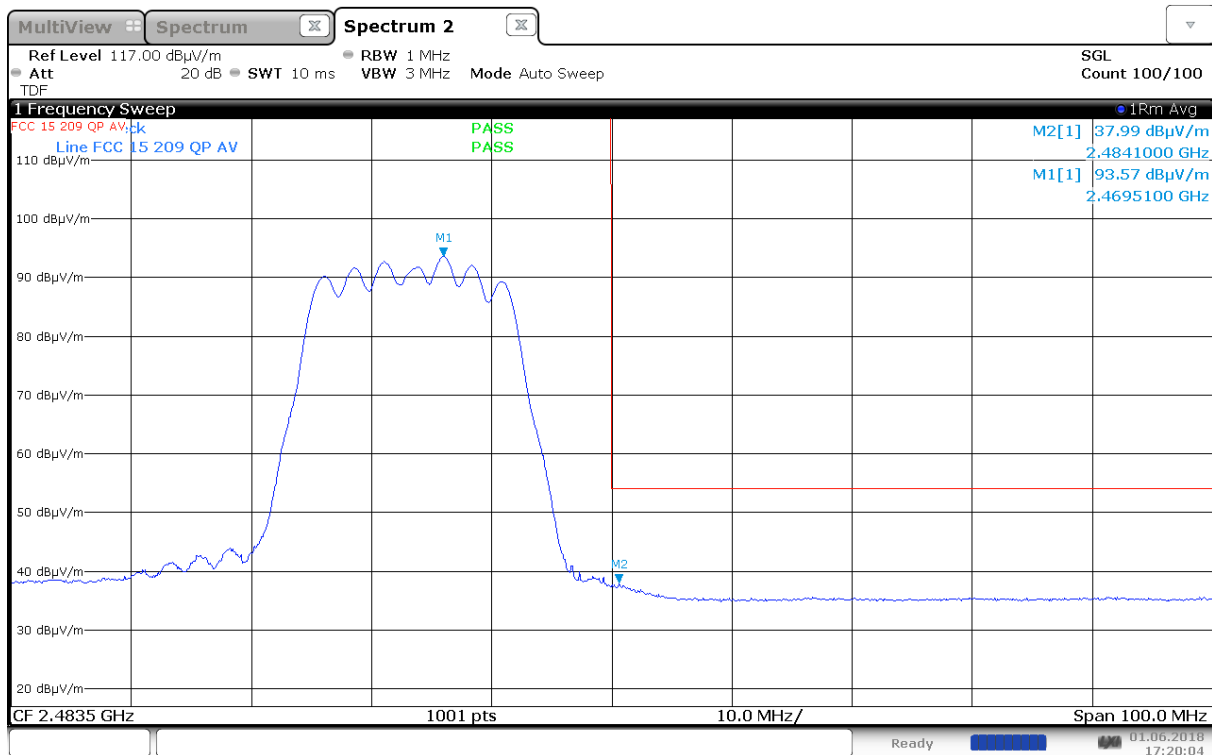
Upper Band Edge, Peak, 2467 MHz, 802.11g, 6Mb, (Max: Ant 1, HP)



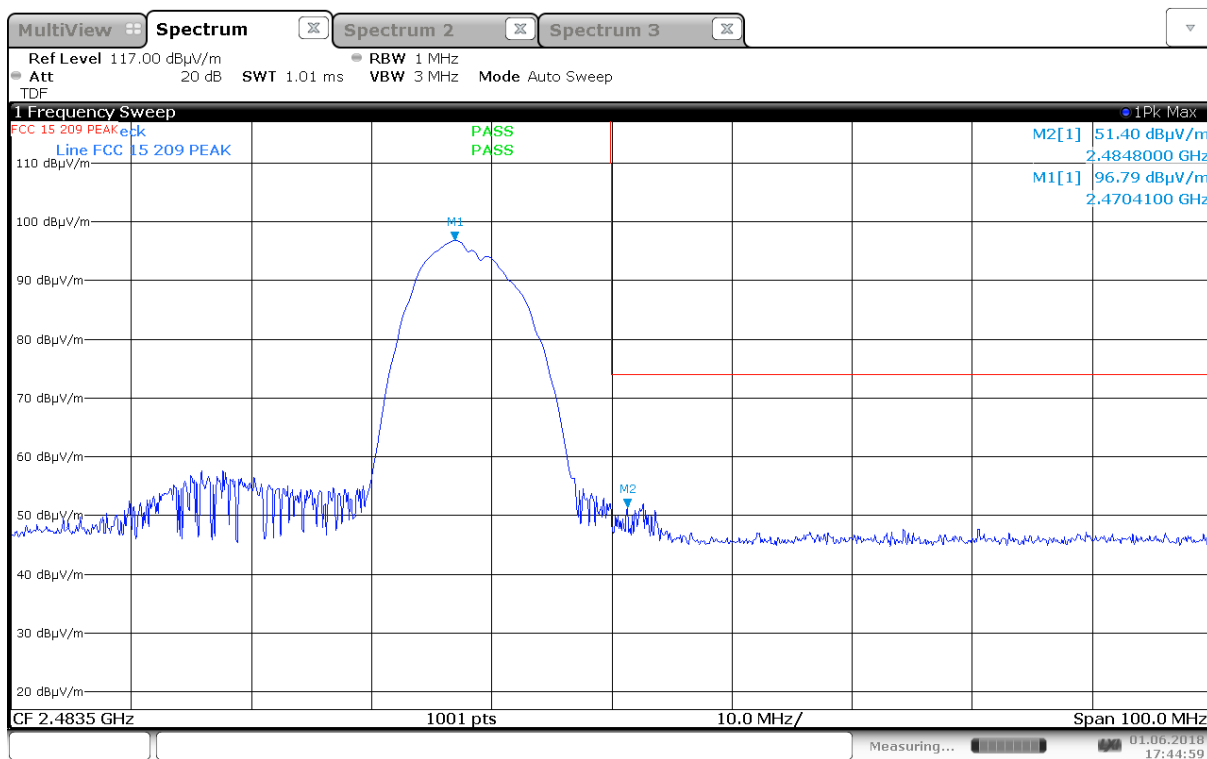
Upper Band Edge, Average, 2467 MHz, 802.11g, 6Mb, (Max: Ant 1, HP)



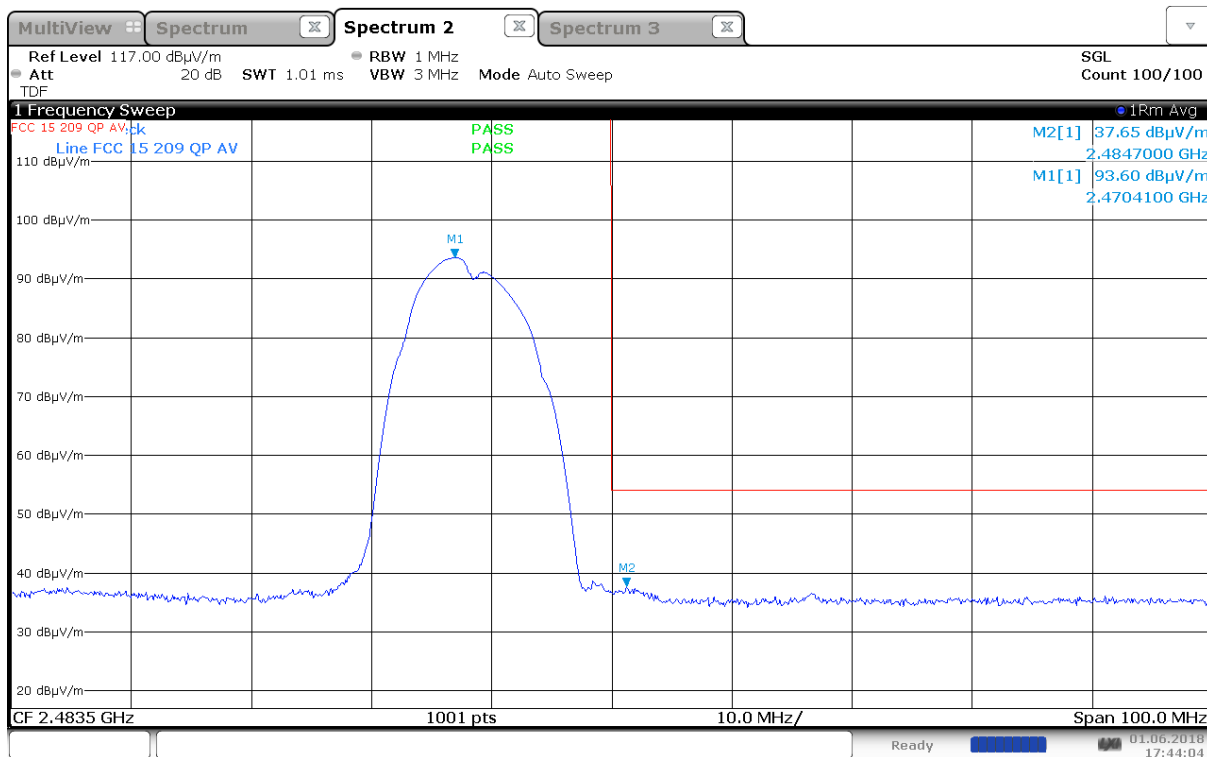
Upper Band Edge, Peak, 2467 MHz, 802.11n, MCS0, MIMO (Max: HP)



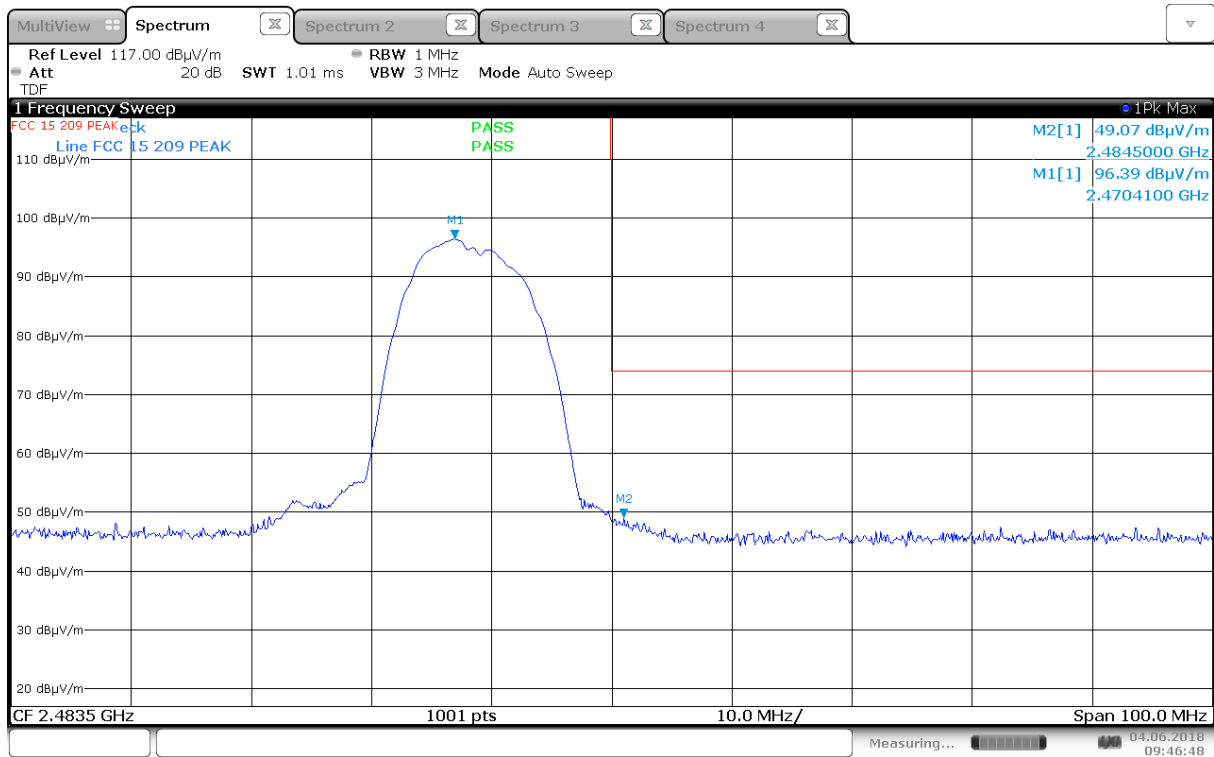
Upper Band Edge, Average, 2467 MHz, 802.11n, MCS0, MIMO (Max: HP)



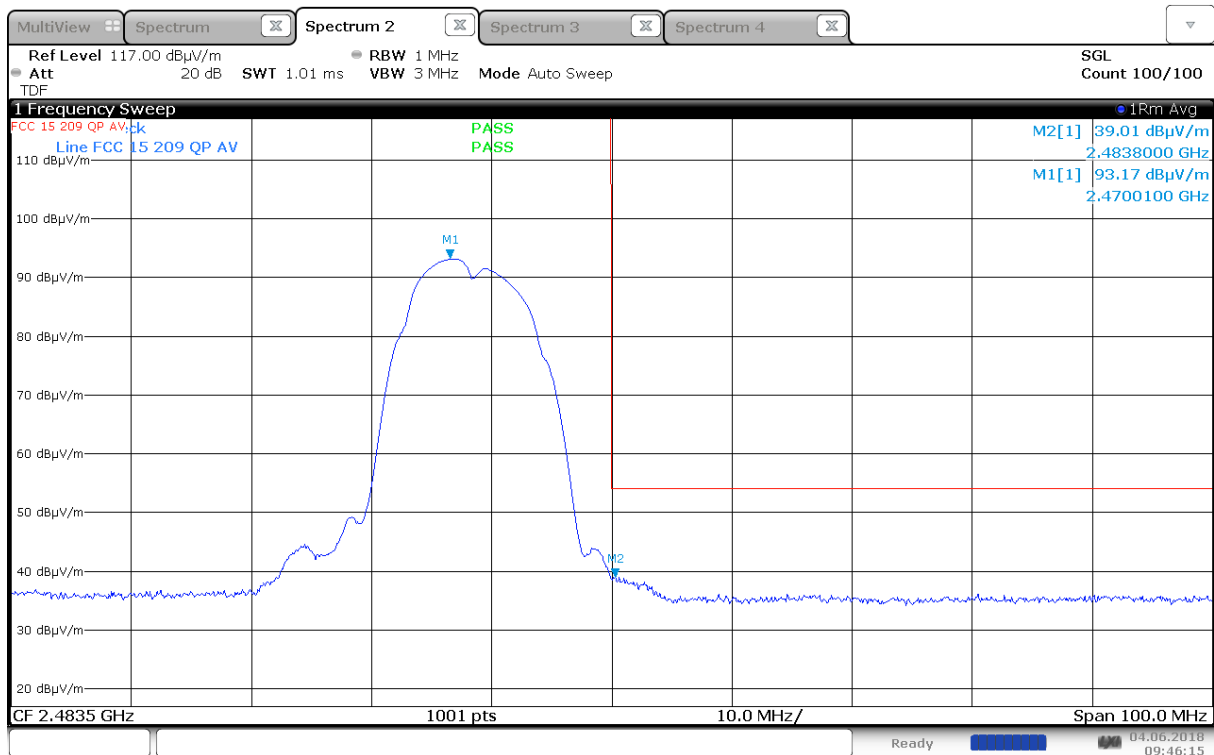
Upper Band Edge, Peak, 2472 MHz, 802.11b, 1Mb, (Max: Ant 0, HP)



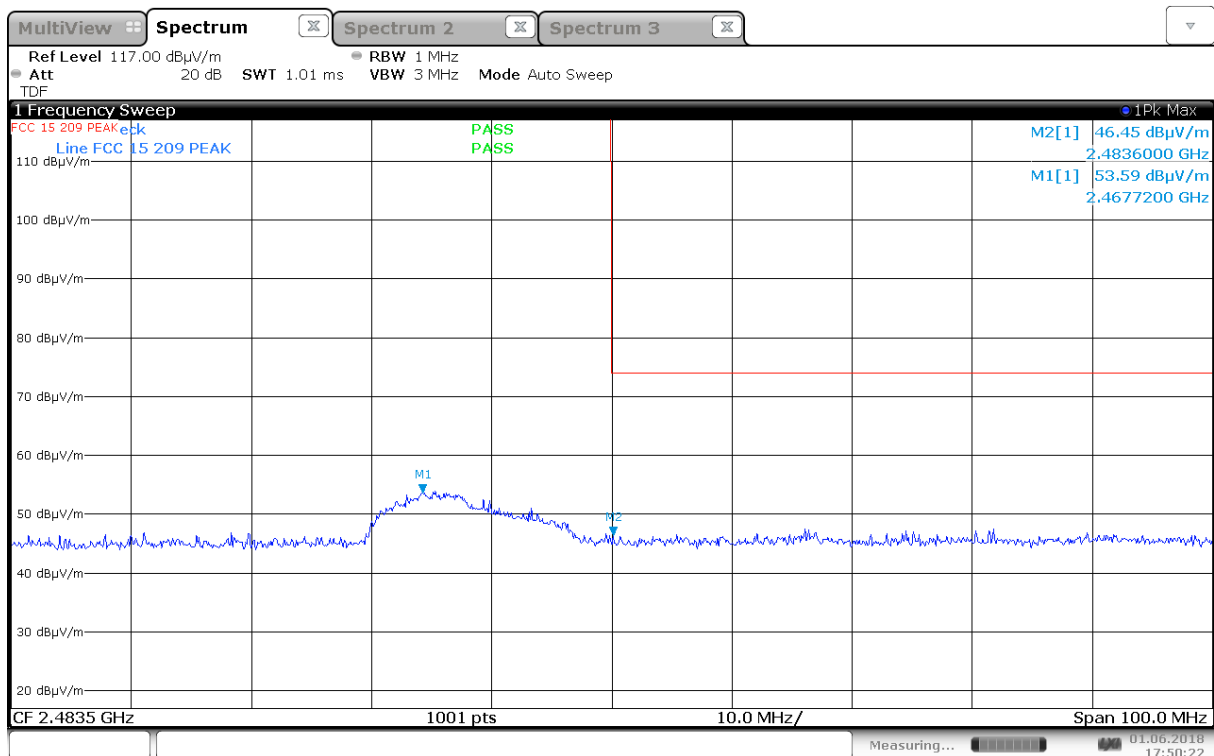
Upper Band Edge, Average, 2472 MHz, 802.11b, 1Mb, (Max: Ant 0, HP)



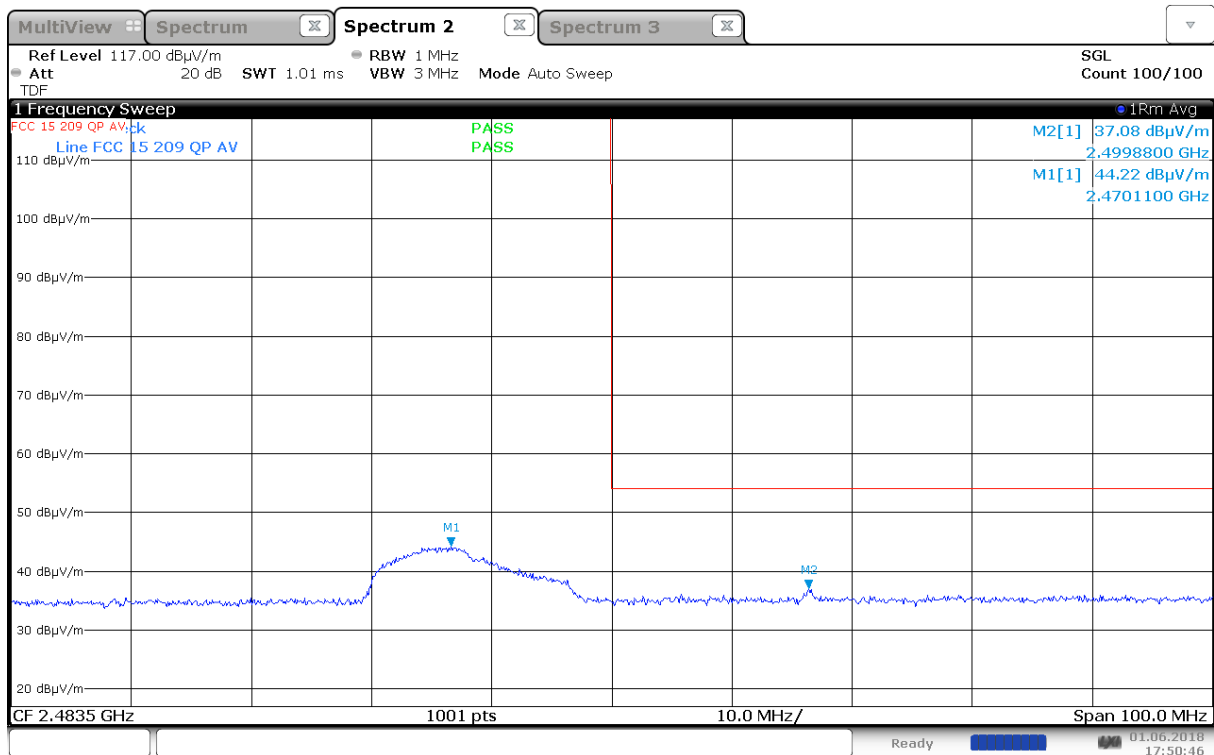
Upper Band Edge, Peak, 2472 MHz, 802.11b, 1Mb, (Max: Ant 1, HP)



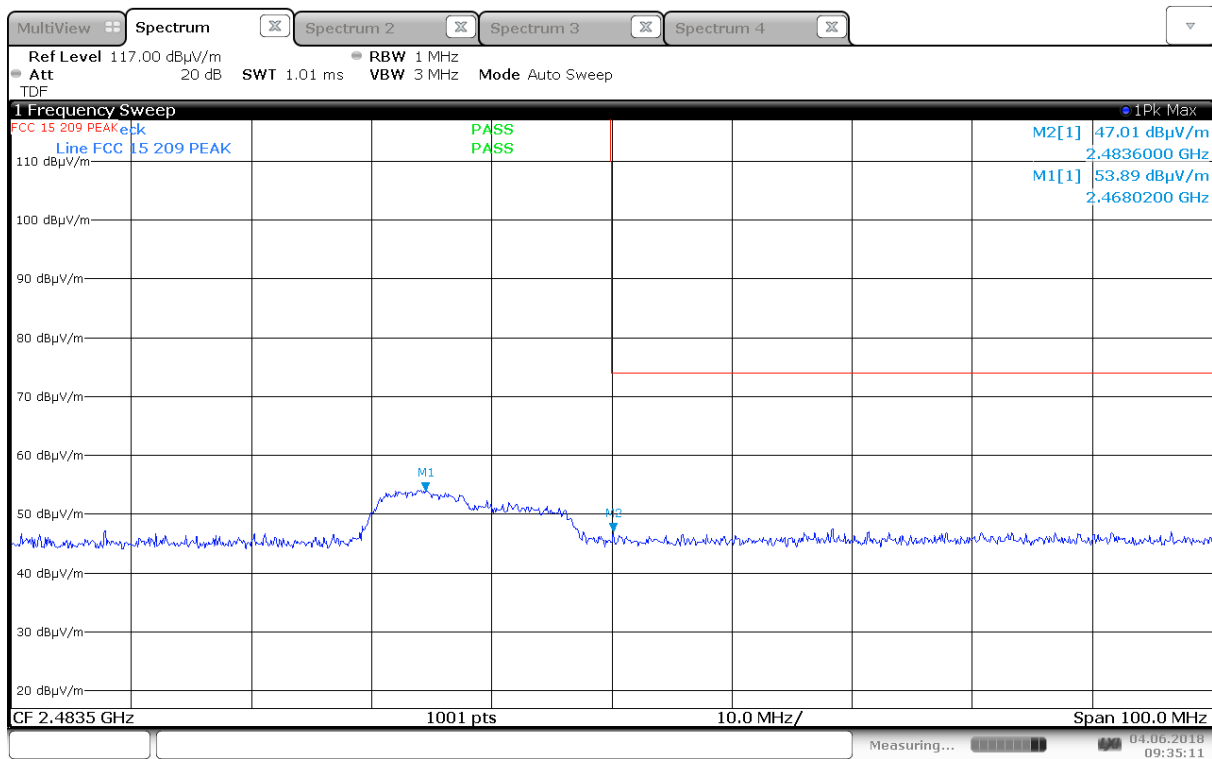
Upper Band Edge, Average, 2472 MHz, 802.11b, 1Mb, (Max: Ant 1, HP)



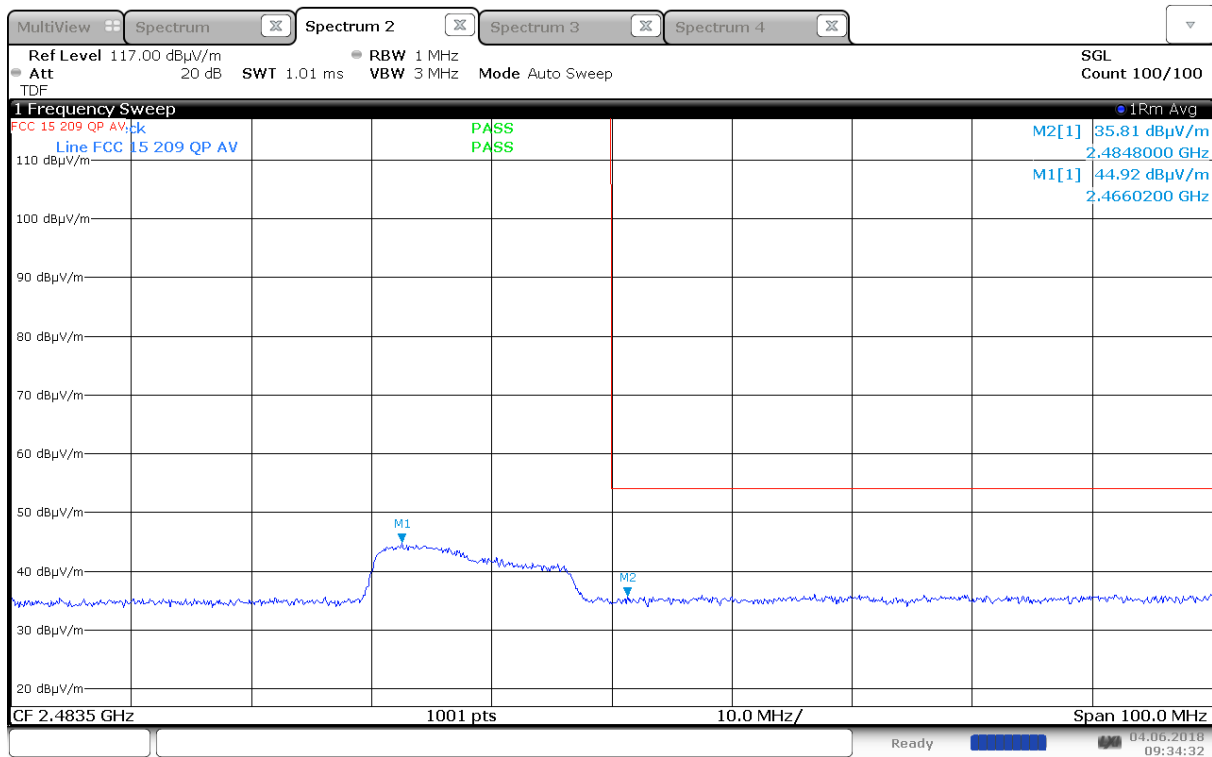
Upper Band Edge, Peak, 2472 MHz, 802.11g, 6Mb, (Max: Ant 0, HP)



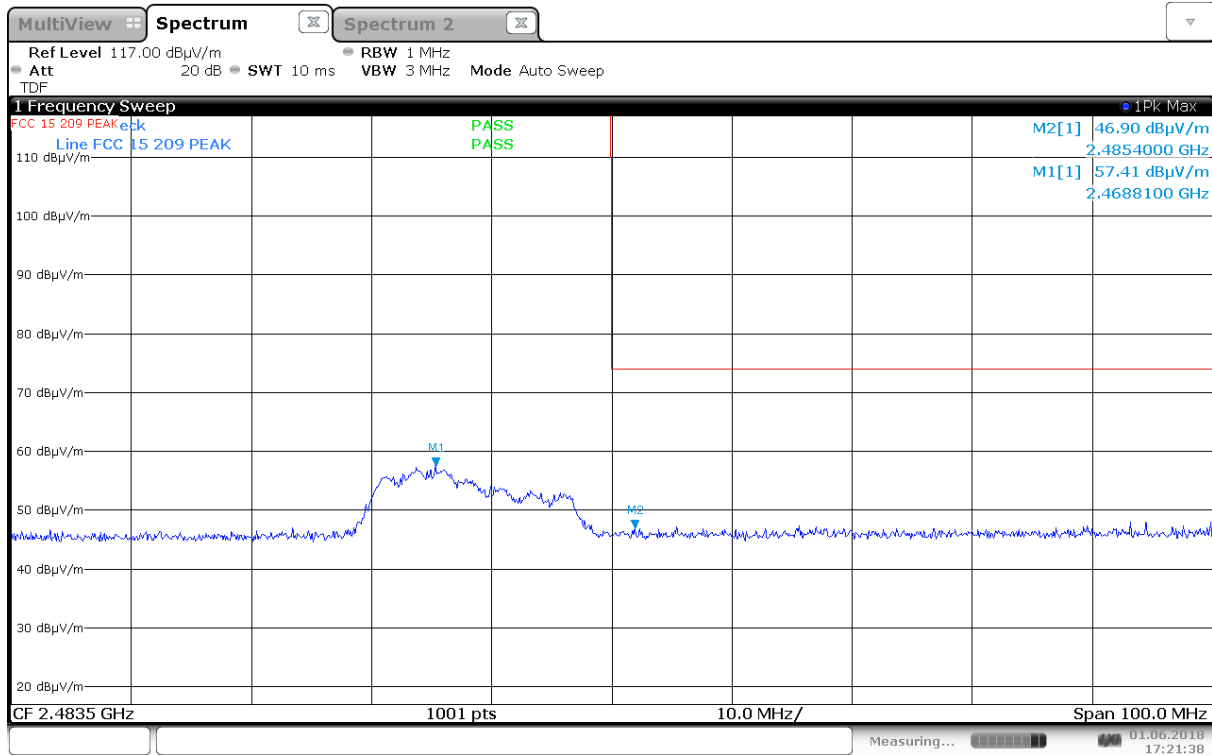
Upper Band Edge, Average, 2472 MHz, 802.11g, 6Mb, (Max: Ant 0, HP)



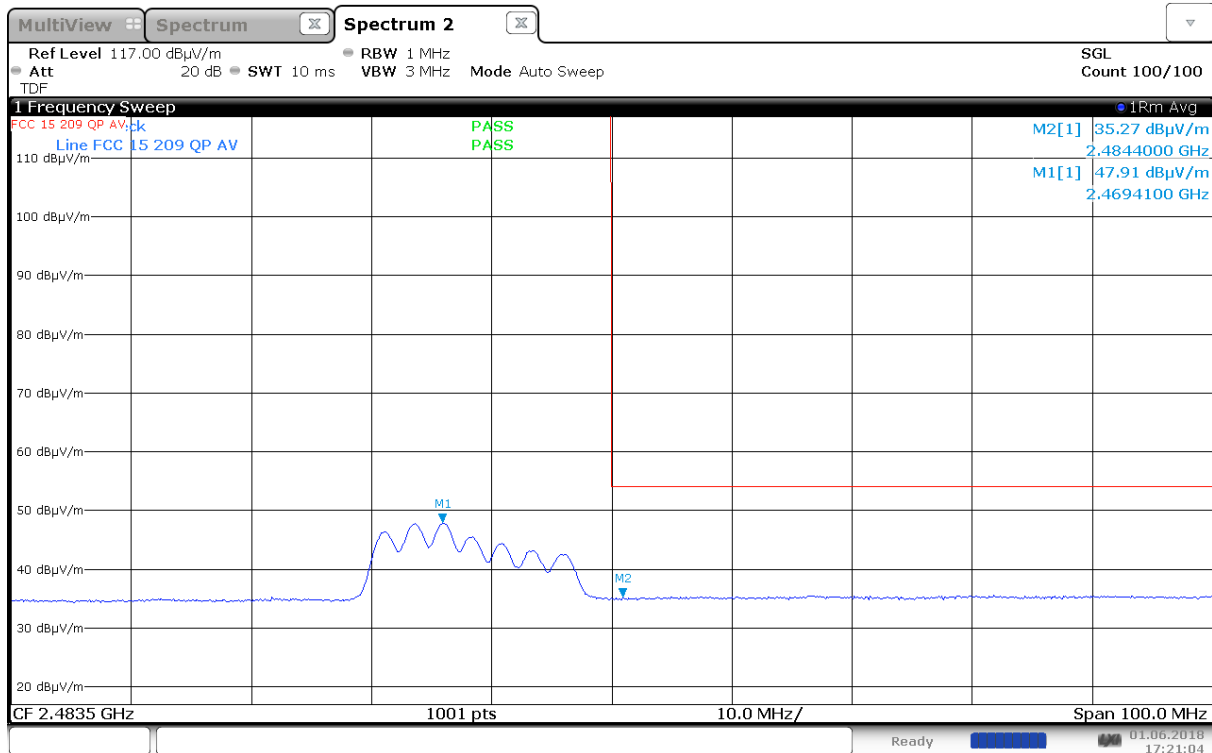
Upper Band Edge, Peak, 2472 MHz, 802.11g, 6Mb, (Max: Ant 1, HP)



Upper Band Edge, Average, 2472 MHz, 802.11g, 6Mb, (Max: Ant 1, HP)



Upper Band Edge, Peak, 2472 MHz, 802.11n, MCS0, MIMO (Max: HP)



Upper Band Edge, Average, 2472 MHz, 802.11n, MCS0, MIMO (Max: HP)

3.2 Radiated Emissions, 30 – 1000 MHz

FCC 15.205, 15.209

ISED RSS-GEN Issue 5, Clause 8.9

Test Results: Complies

Measurement Data:

Detector: Quasi-Peak

Measuring distance 3m

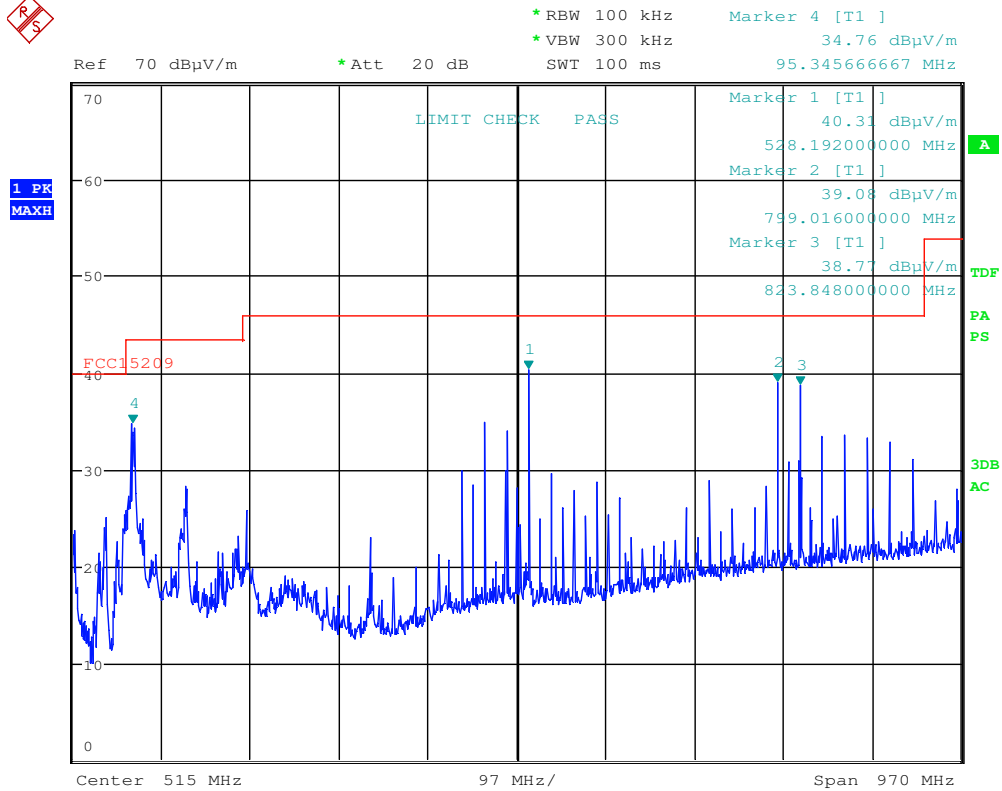
Tested with all all connections active

Radiated Emissions					
Carrier Modulation	Carrier Freq MHz	Measured Freq MHz	Measured value QP dBµV/m @3m	Limit (dBµV/m)	Verdict
Any	Any	32.500	28.0	40.0	Complies
Any	Any	454.660	40.4	46.0	Complies
Any	Any	479.233	40.8	46.0	Complies

See attached plots.

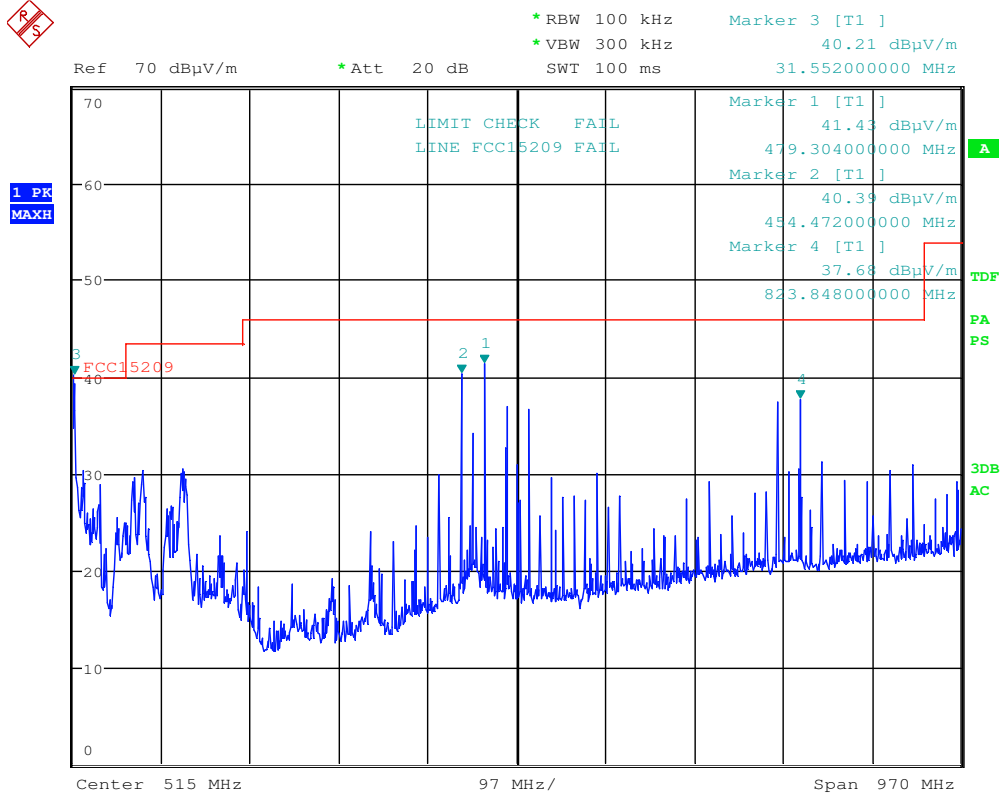
Requirements/Limit

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



Date: 4.JUN.2018 15:12:33

Radiated Emissions, 30 -1000MHz, HP, Peak Detector



Date: 4.JUN.2018 15:22:53

Radiated Emissions, 30 -1000MHz, VP, Peak Detector

3.3 Radiated Emissions, 1-25 GHz

FCC 15.205, 15.209

ISED RSS-GEN Issue 5, Clause 8.9

Test Results: Complies

Measurement Data:

Measuring distance: 3m (1 – 18 GHz)
A prescan was performed at 18 – 26 GHz

Radiated Emissions in Restricted Bands						
Carrier Modulation	Carrier Freq (MHz)	Measured Freq (MHz)	Measured value Peak (dBµV/m @3m)	Measured value AV (dBµV/m @3m)	Limit PK/AV (dBµV/m)	Verdict
Any	Any	Any	< 54	< 44	74/54	Complies

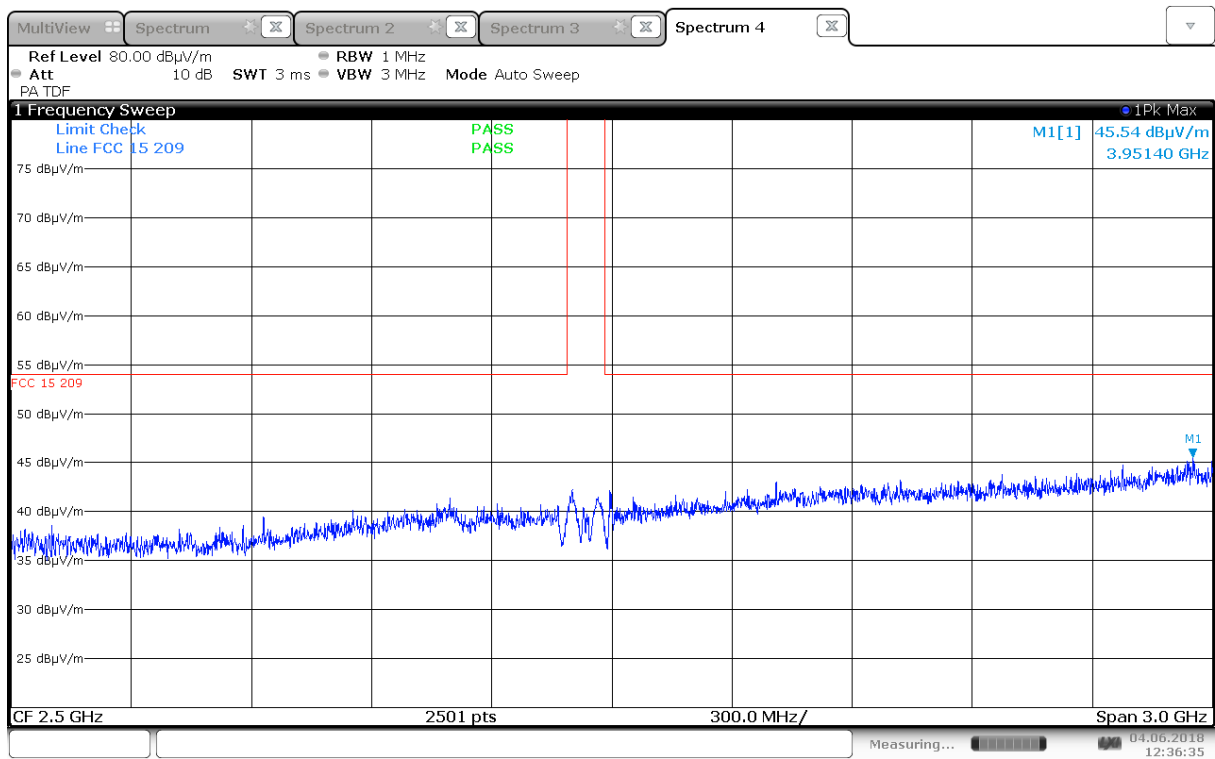
Only harmonics that fall in the restricted bands (ref. §15.205) have been checked.

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

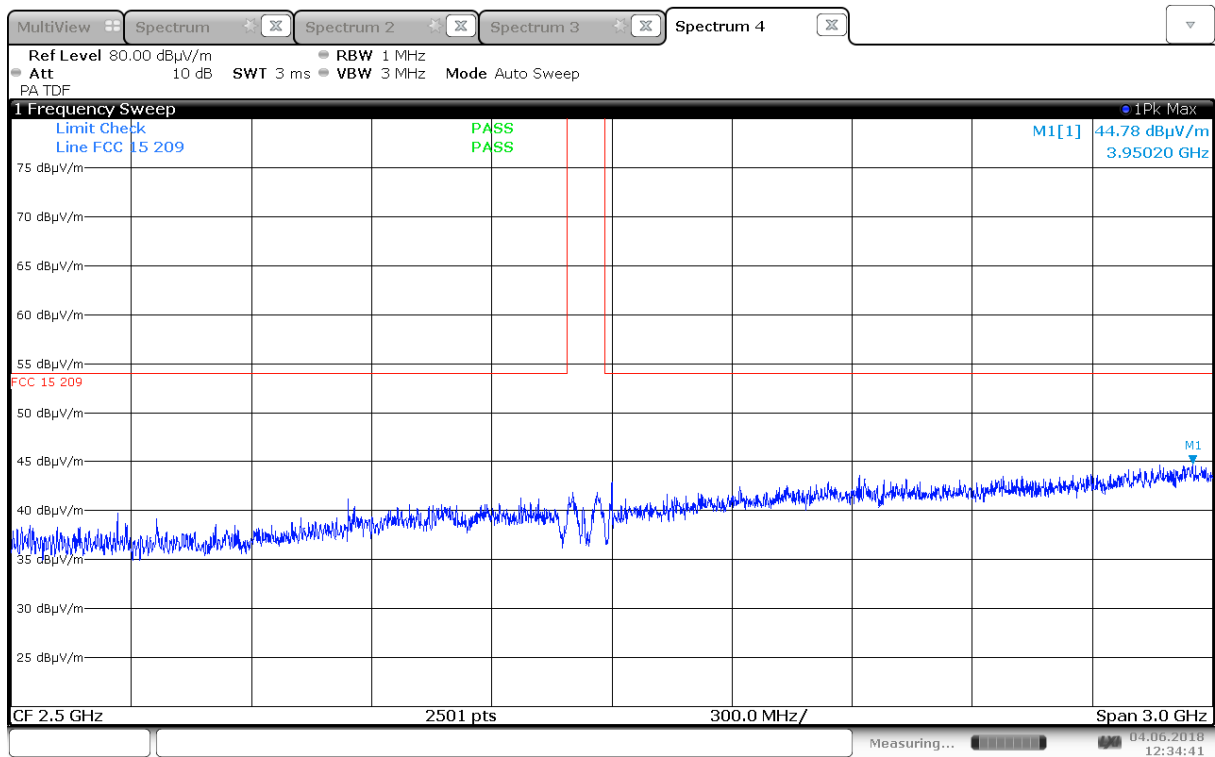
See attached plots.

Requirements/Limit

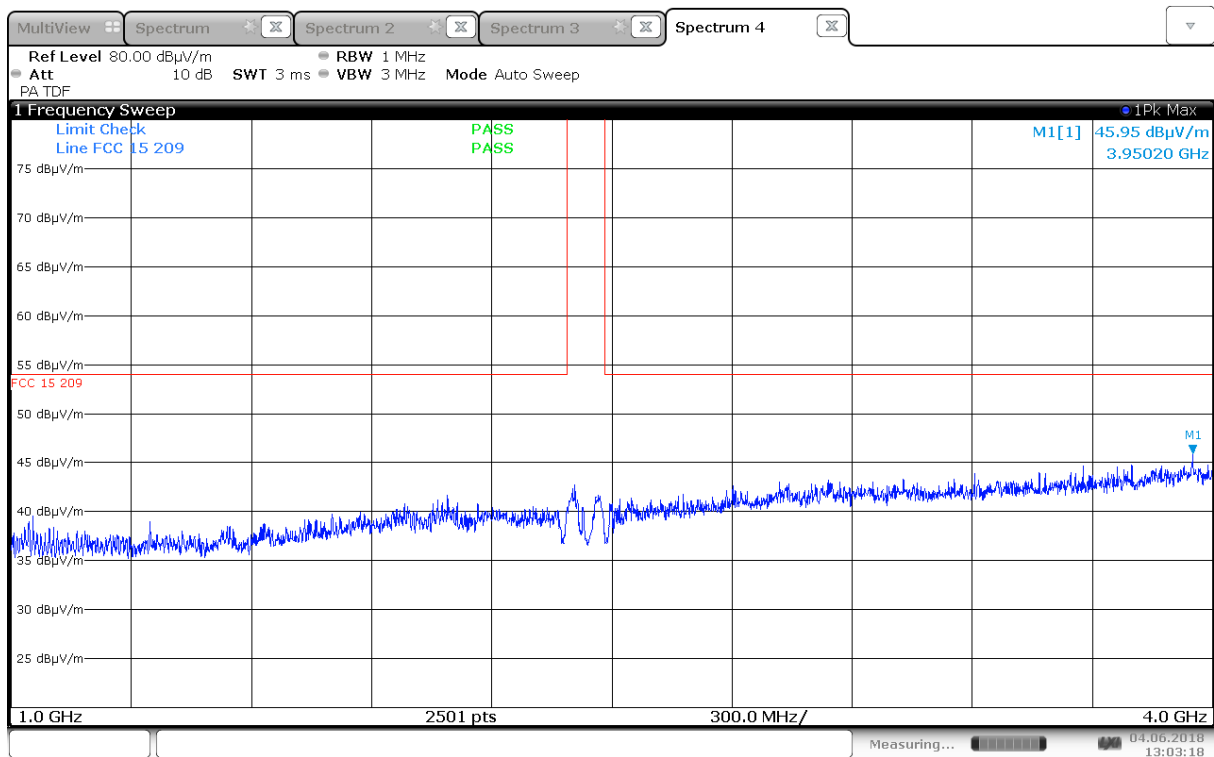
FCC	Part 15.209 @ frequencies defined in §15.205	
ISED	RSS-GEN Issue 5, clause 8.9 @ frequencies defined in clause 8.10	
	Radiated emission limit @3 meters	
Frequency (MHz)	AV (dBµV/m)	Peak (dBµV/m)
Above 1 GHz	54.0	74.0



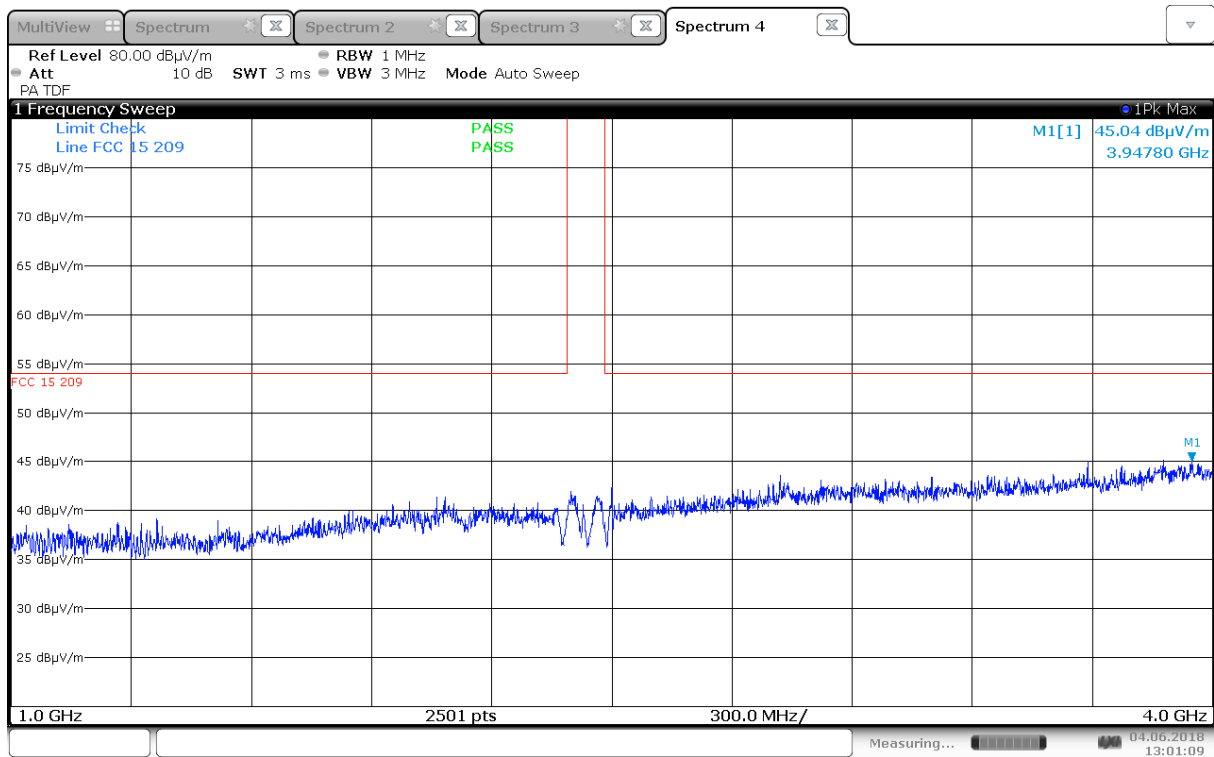
Radiated Emissions, 1000 -4000 MHz, 2412 MHz, 802.11b, 1Mb, Ant0, HP



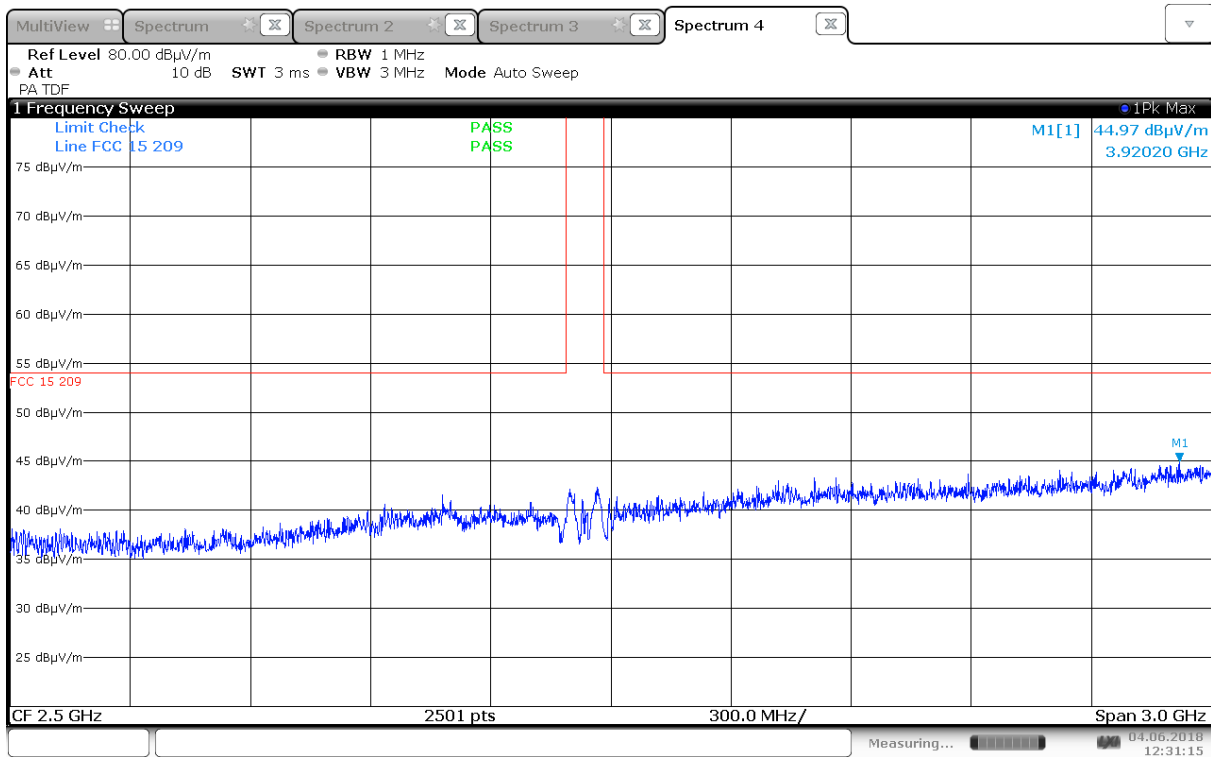
Radiated Emissions, 1000 -4000 MHz, 2412 MHz, 802.11b, 1Mb, Ant0, VP



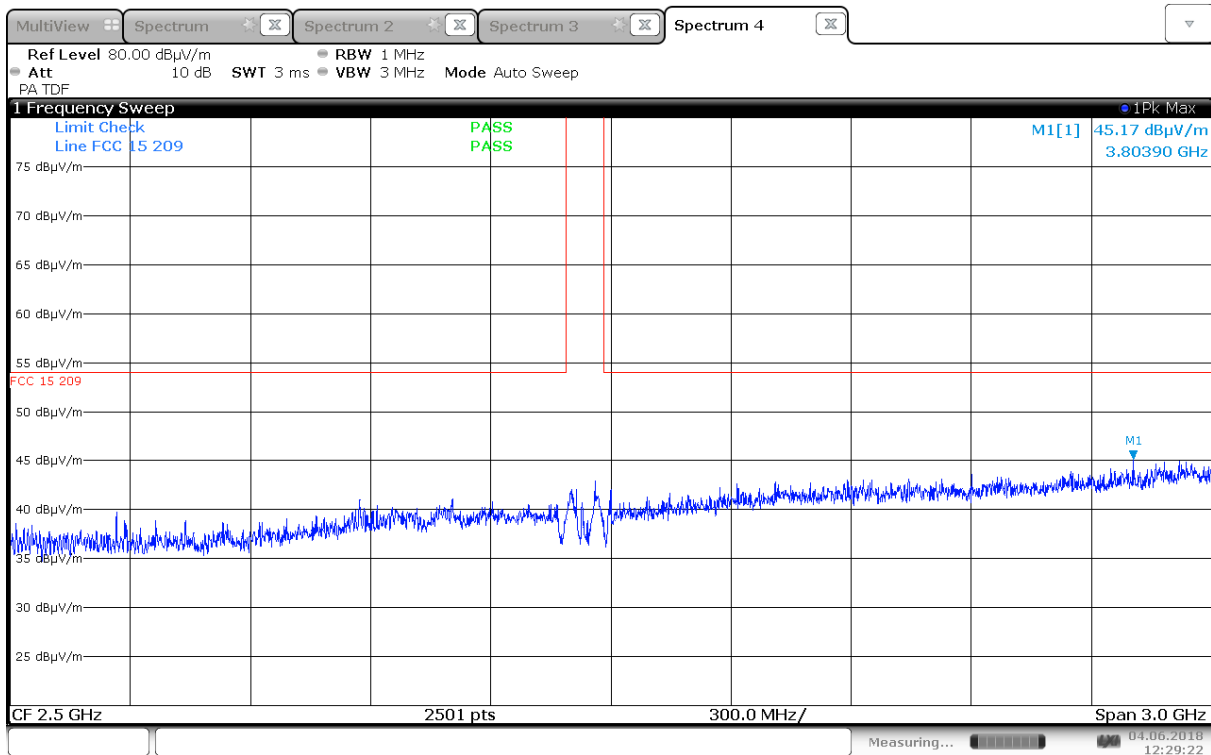
Radiated Emissions, 1000 -4000 MHz, 2412 MHz, 802.11b, 1Mb, Ant1, HP



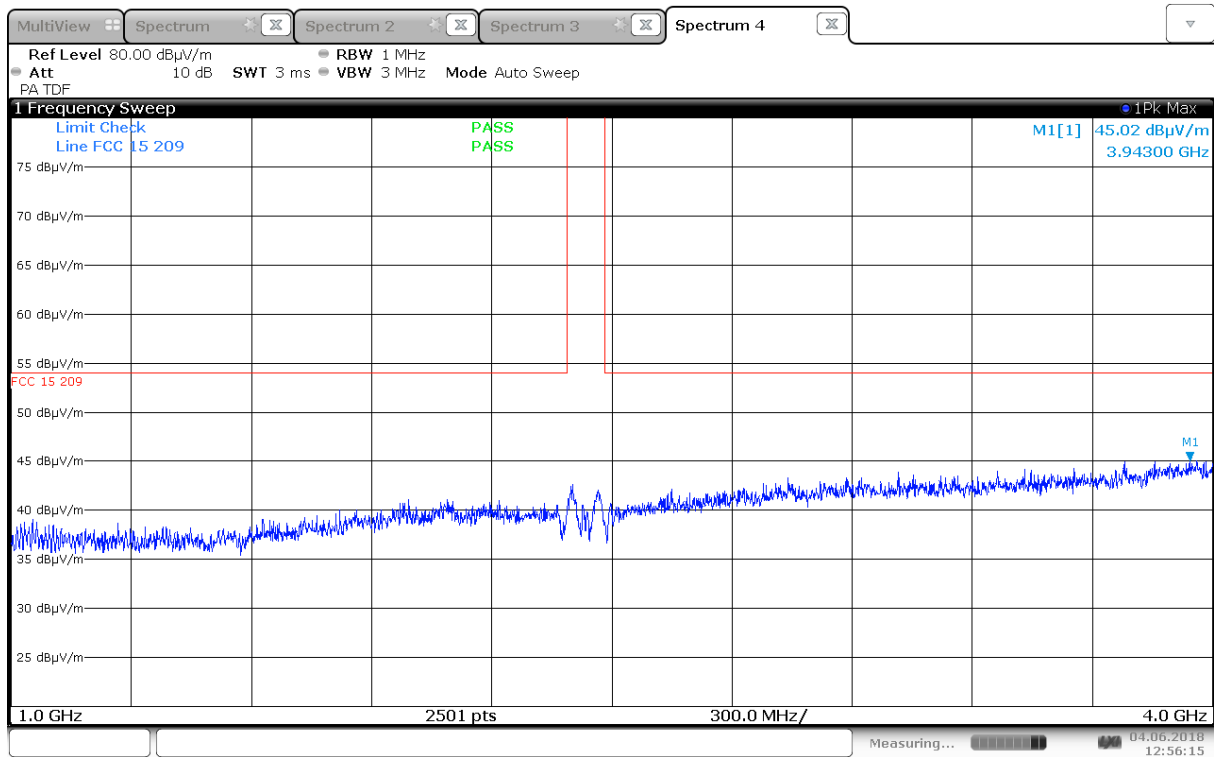
Radiated Emissions, 1000 -4000 MHz, 2412 MHz, 802.11b, 1Mb, Ant1, VP



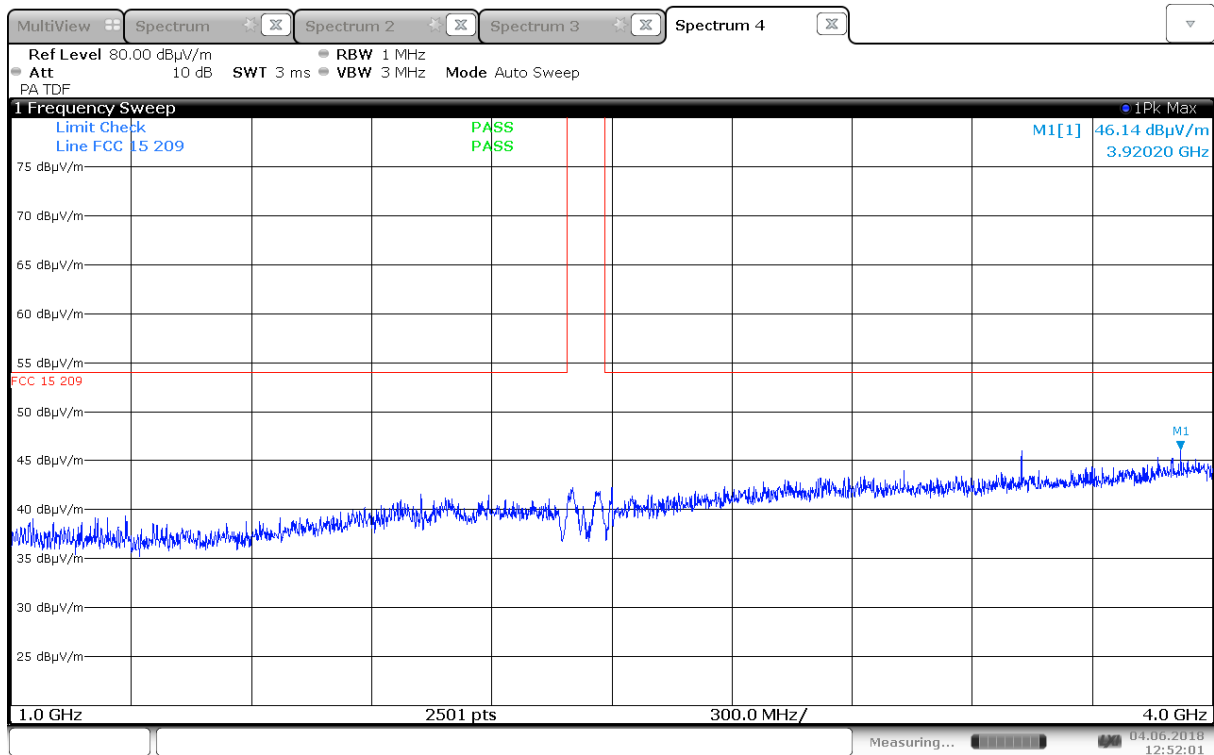
Radiated Emissions, 1000 -4000 MHz, 2437 MHz, 802.11b, 1Mb, Ant0, HP



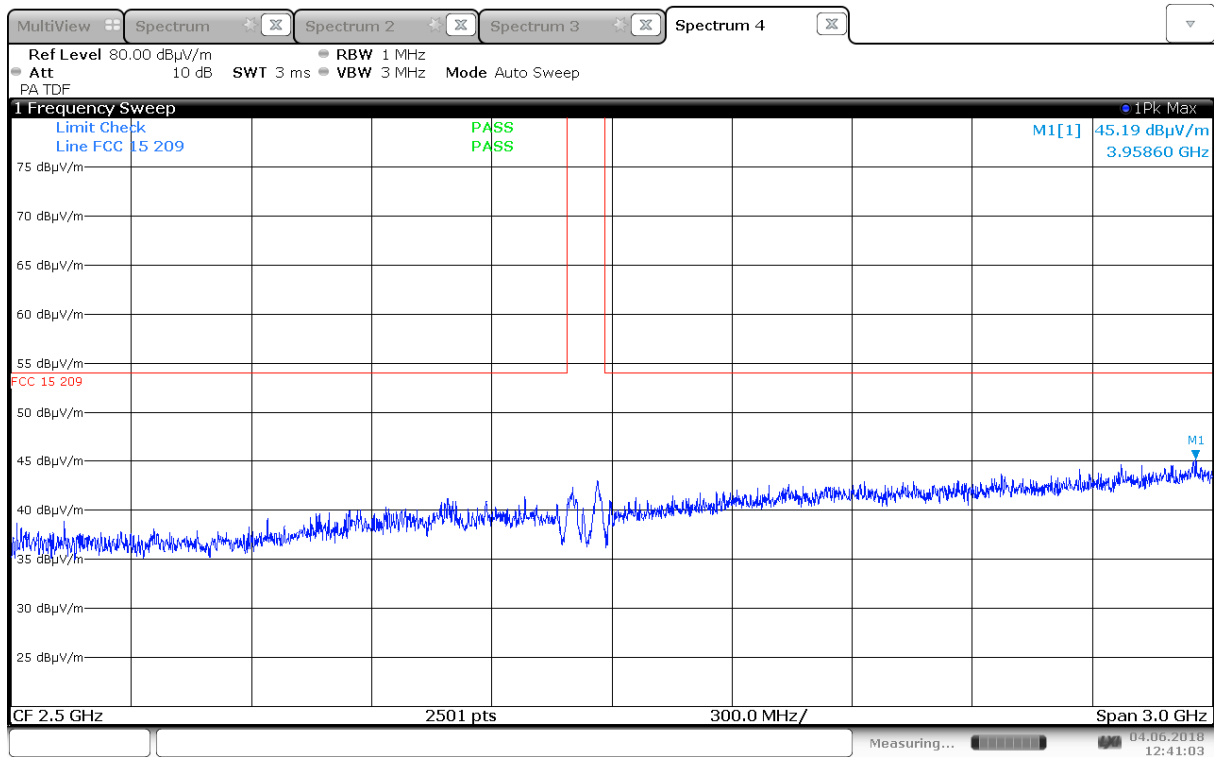
Radiated Emissions, 1000 -4000 MHz, 2437 MHz, 802.11b, 1Mb, Ant0, VP



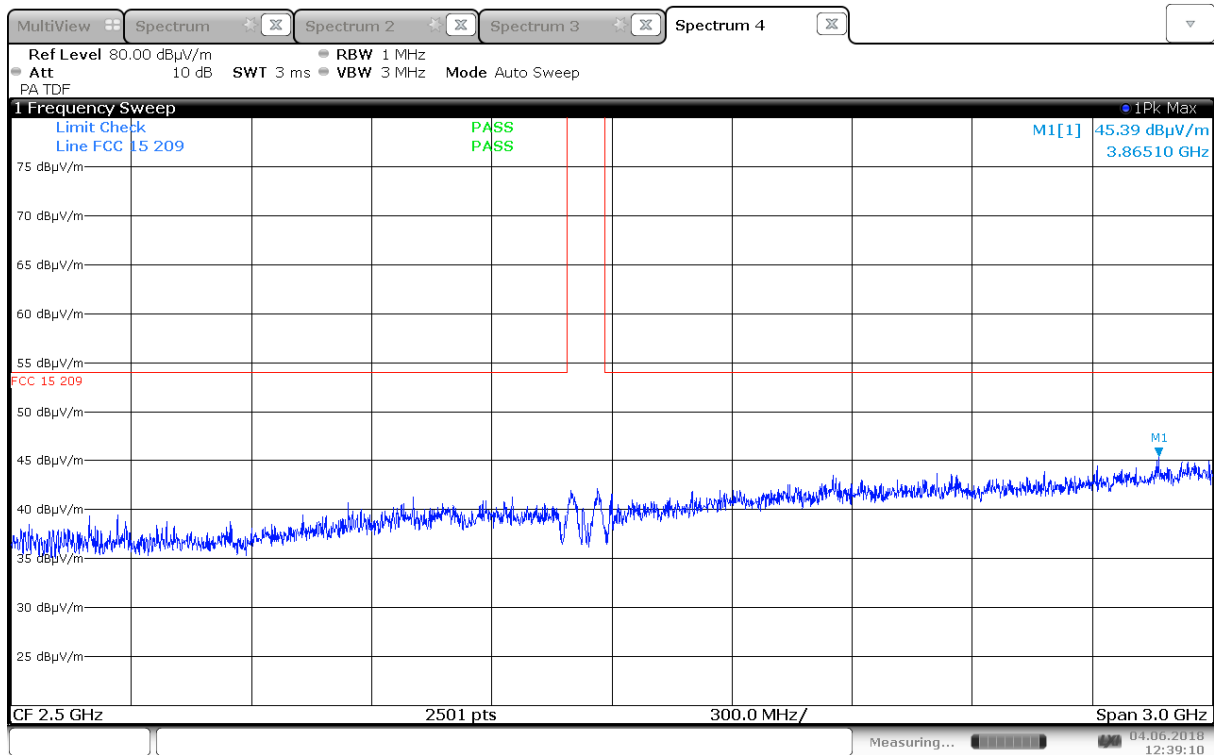
Radiated Emissions, 1000 -4000 MHz, 2437 MHz, 802.11b, 1Mb, Ant1, HP



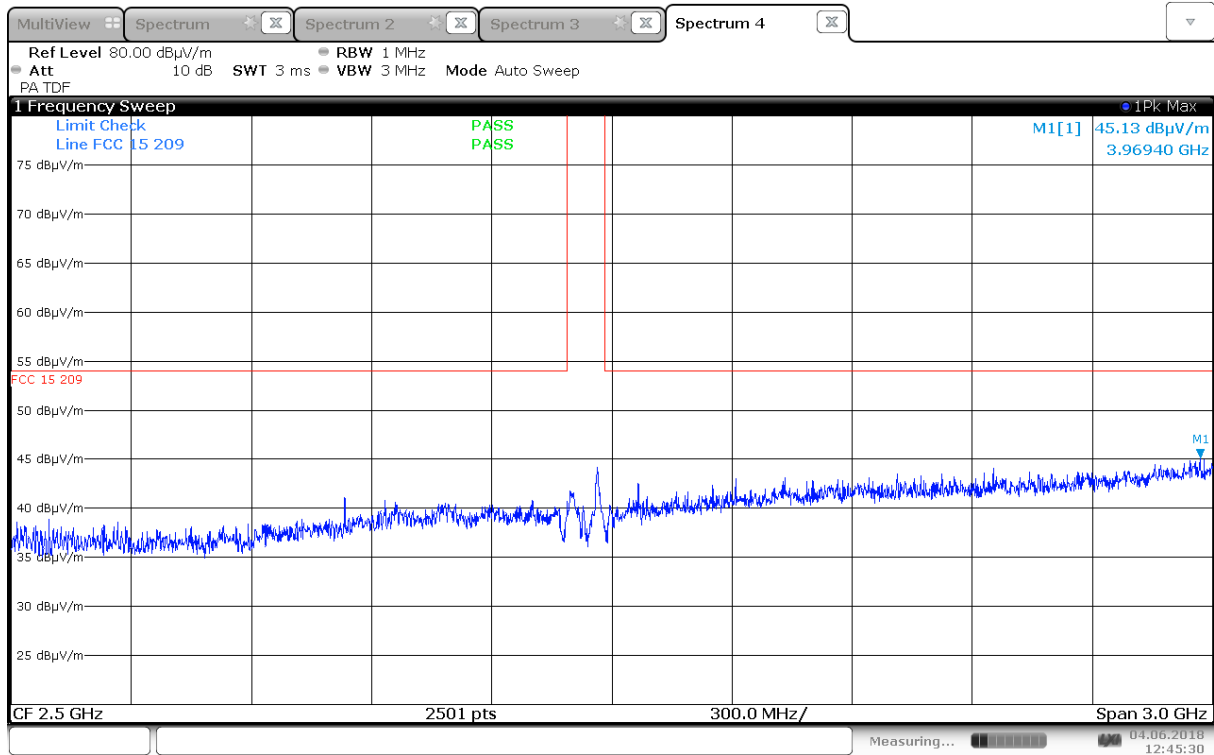
Radiated Emissions, 1000 -4000 MHz, 2437 MHz, 802.11b, 1Mb, Ant1, VP



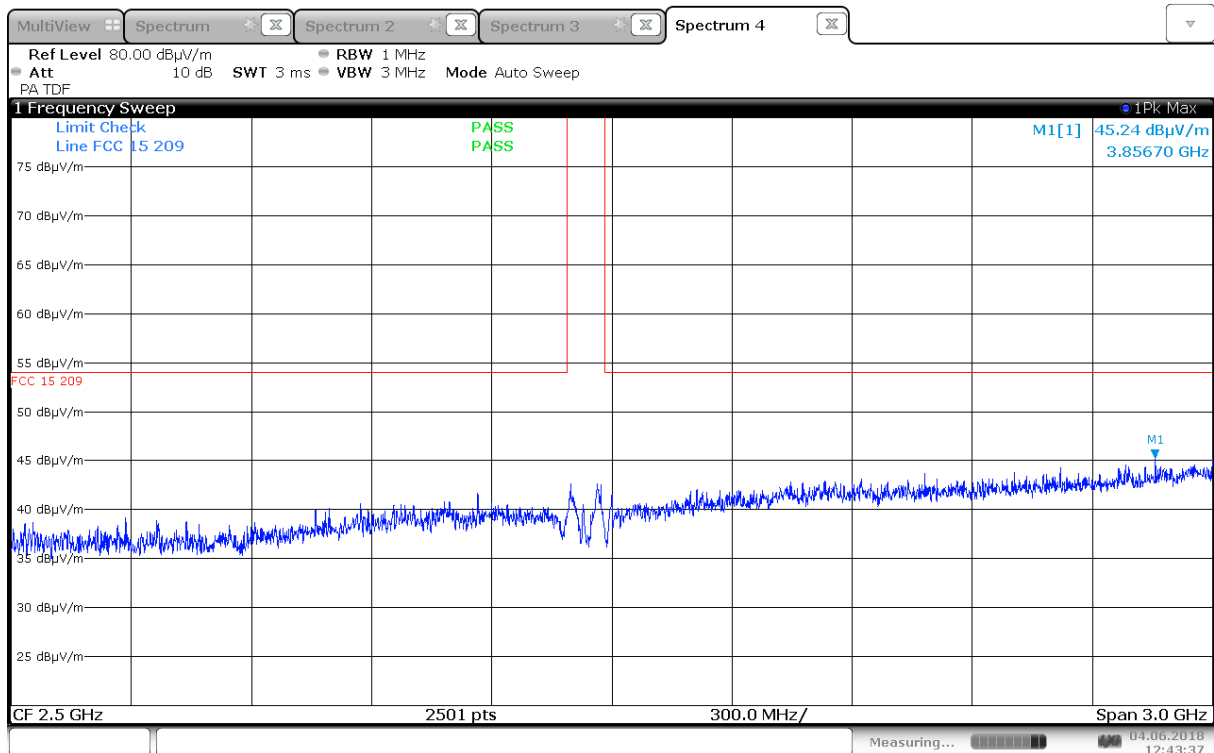
Radiated Emissions, 1000 -4000 MHz, 2462 MHz, 802.11b, 1Mb, Ant0, HP



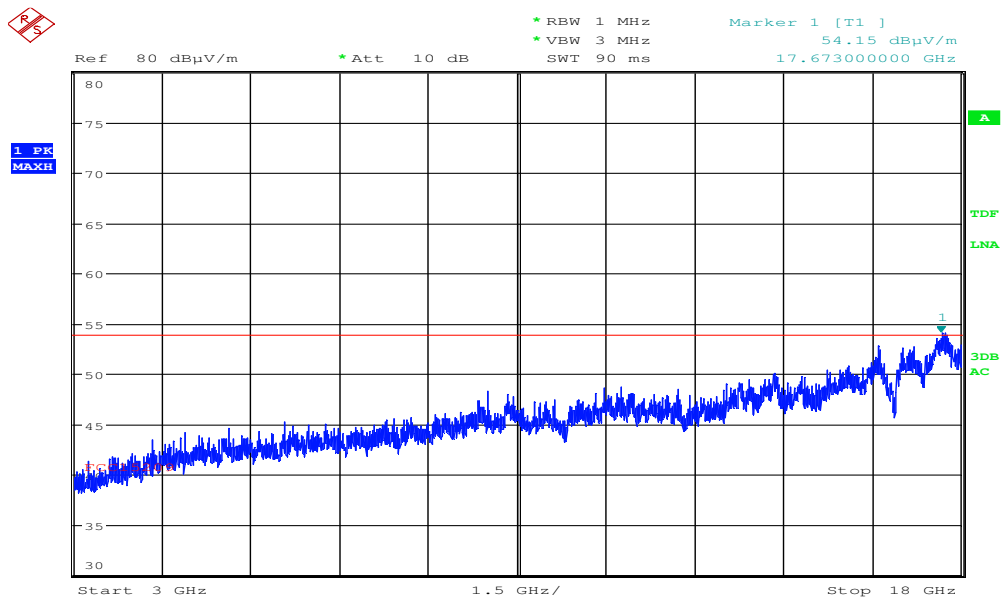
Radiated Emissions, 1000 -4000 MHz, 2462 MHz, 802.11b, 1Mb, Ant0, VP



Radiated Emissions, 1000 -4000 MHz, 2462 MHz, 802.11b, 1Mb, Ant1, HP

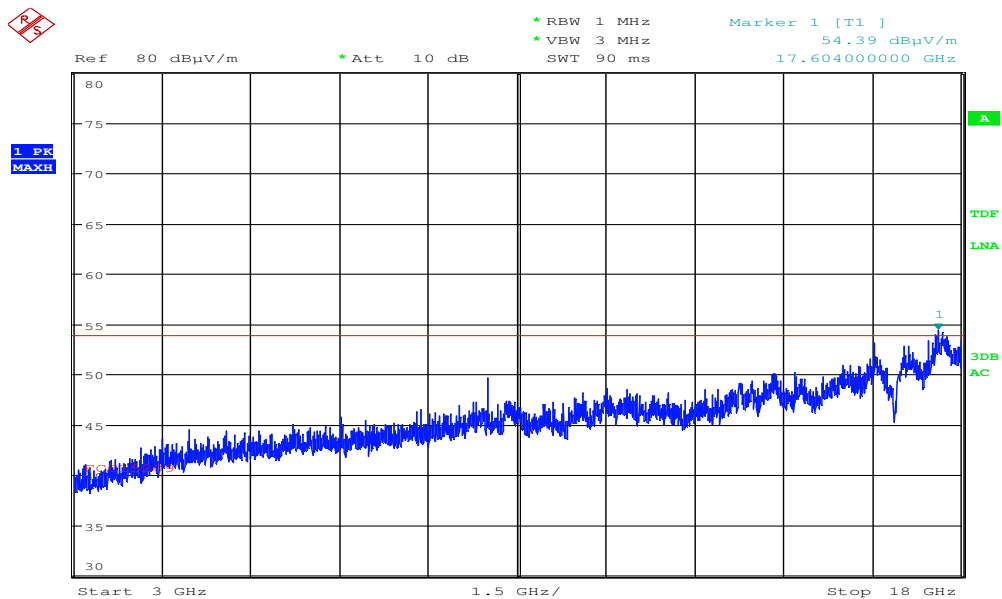


Radiated Emissions, 1000 -4000 MHz, 2462 MHz, 802.11b, 1Mb, Ant1, VP



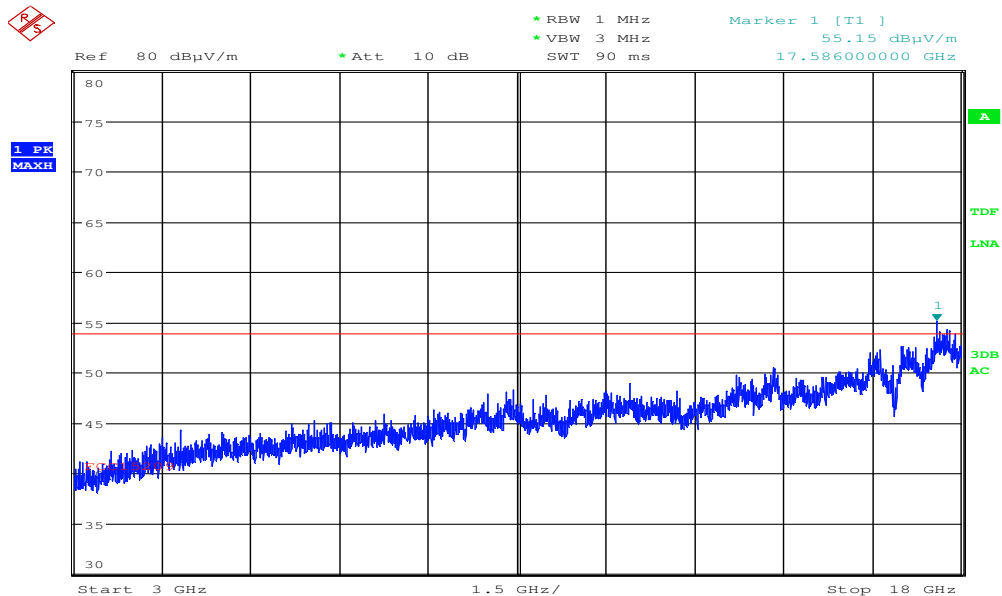
Date: 1.JUN.2018 15:41:54

Radiated Emissions, 3000 -18000 MHz, 2437 MHz, 802.11b, 1Mbps, Ant0, HP



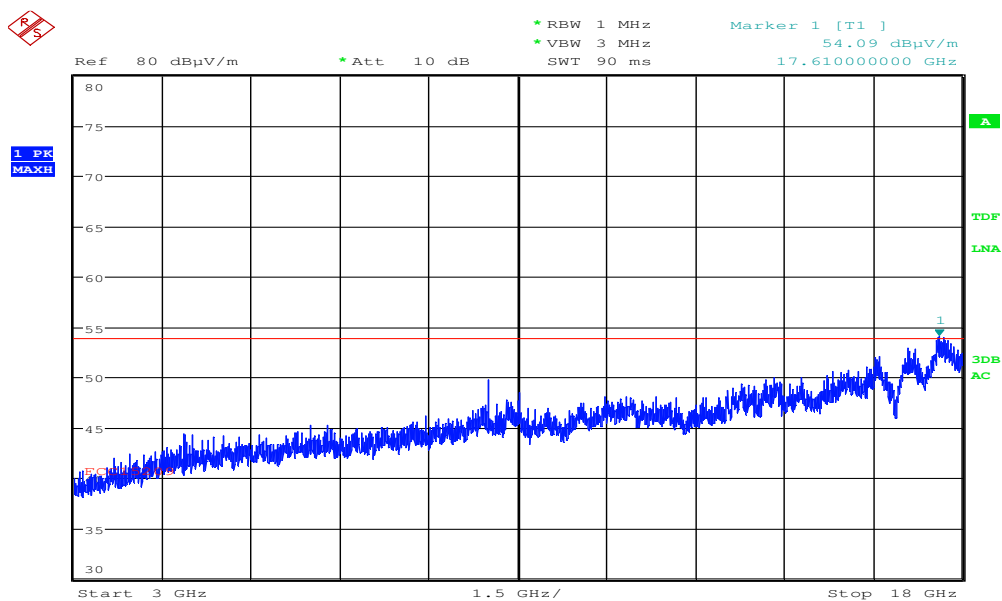
Date: 1.JUN.2018 15:39:53

Radiated Emissions, 3000 -18000 MHz, 2437 MHz, 802.11b, 1Mbps, Ant0, VP



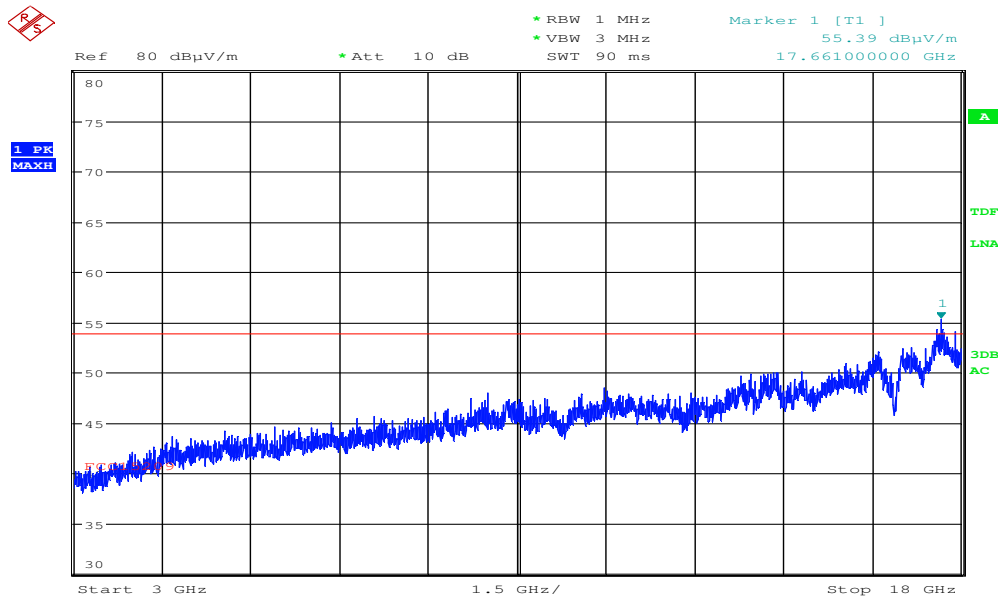
Date: 1.JUN.2018 15:36:47

Radiated Emissions, 3000 -18000 MHz, 2437 MHz, 802.11b, 1Mbps, Ant1, HP



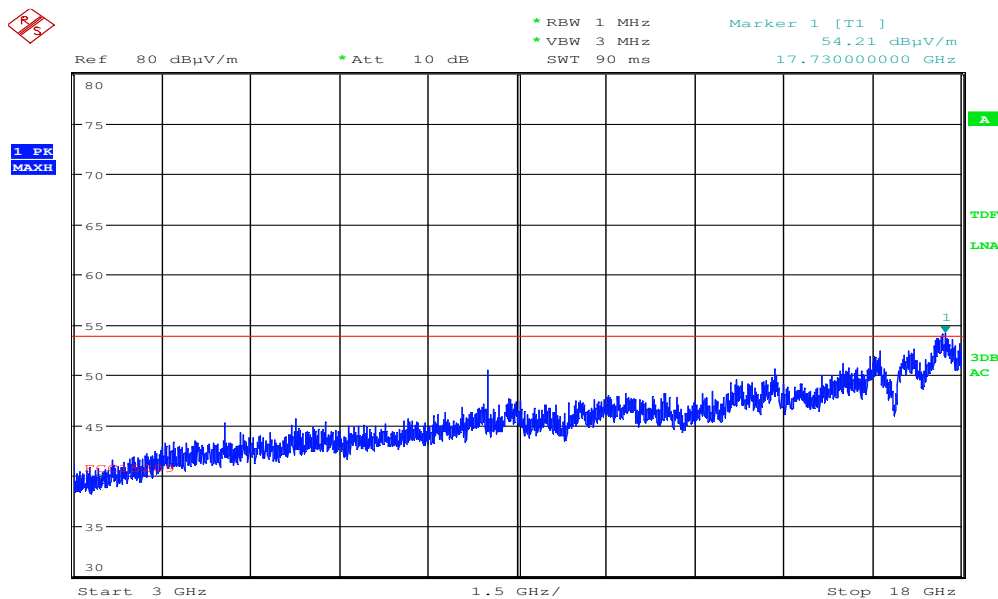
Date: 1.JUN.2018 15:34:45

Radiated Emissions, 3000 -18000 MHz, 2437 MHz, 802.11b, 1Mbps, Ant1, VP



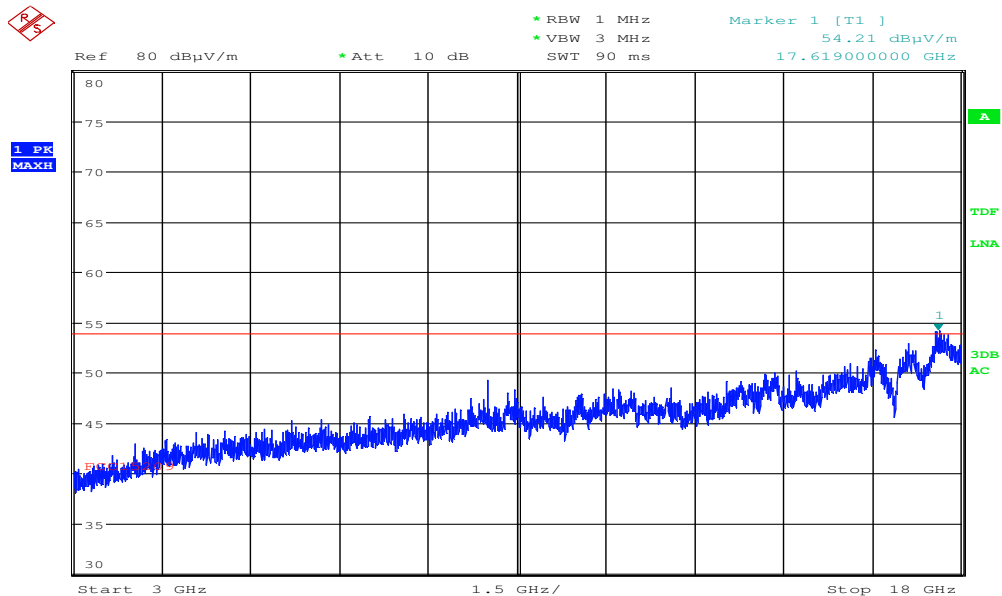
Date: 1.JUN.2018 15:48:00

Radiated Emissions, 3000 -18000 MHz, 2437 MHz, 802.11g, 6Mbps, Ant0, HP



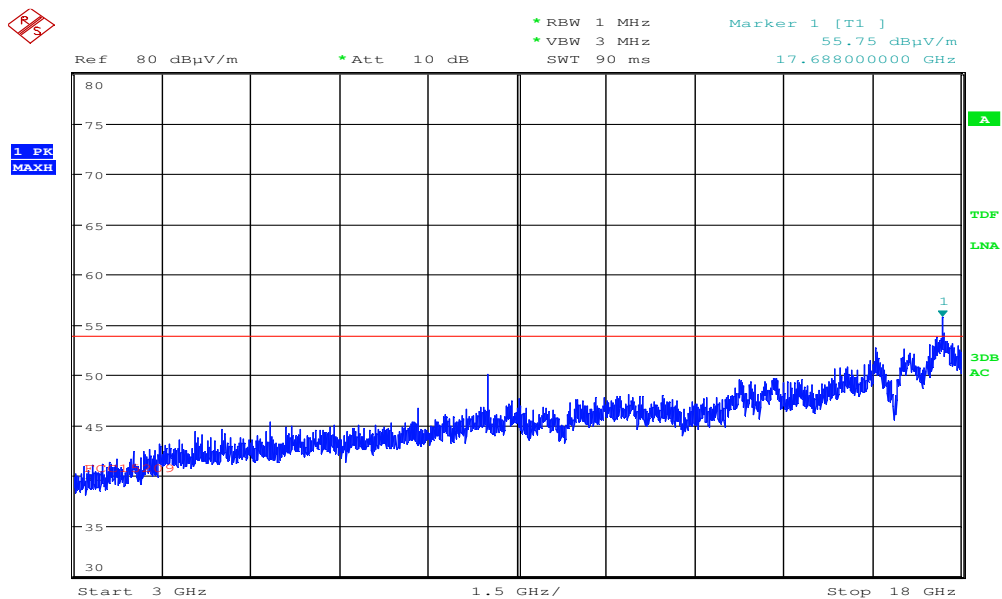
Date: 1.JUN.2018 15:45:59

Radiated Emissions, 3000 -18000 MHz, 2437 MHz, 802.11g, 6Mbps, Ant0, VP



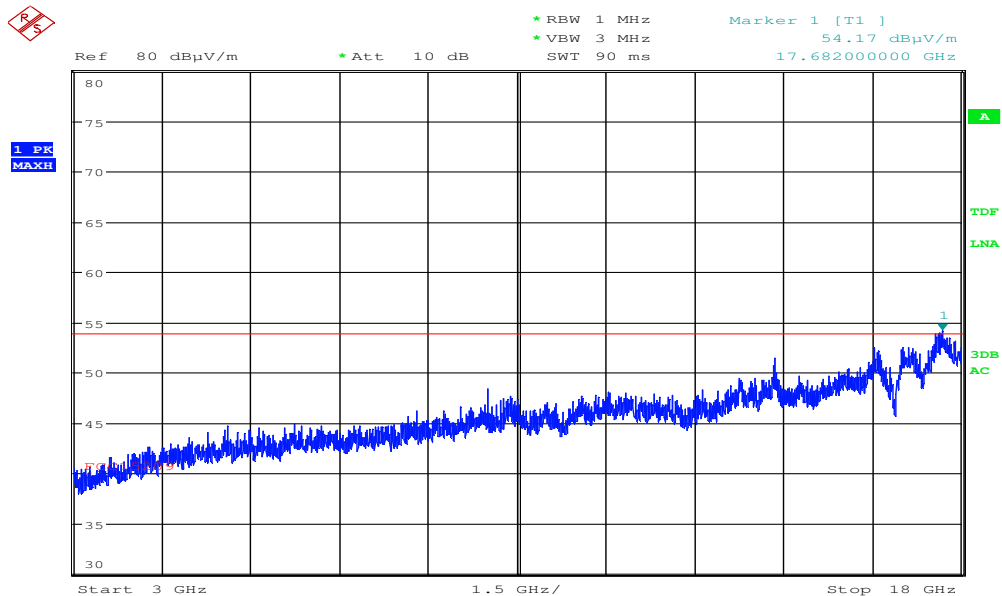
Date: 1.JUN.2018 16:11:03

Radiated Emissions, 3000 -18000 MHz, 2437 MHz, 802. 11g, 6Mbps, Ant1, HP



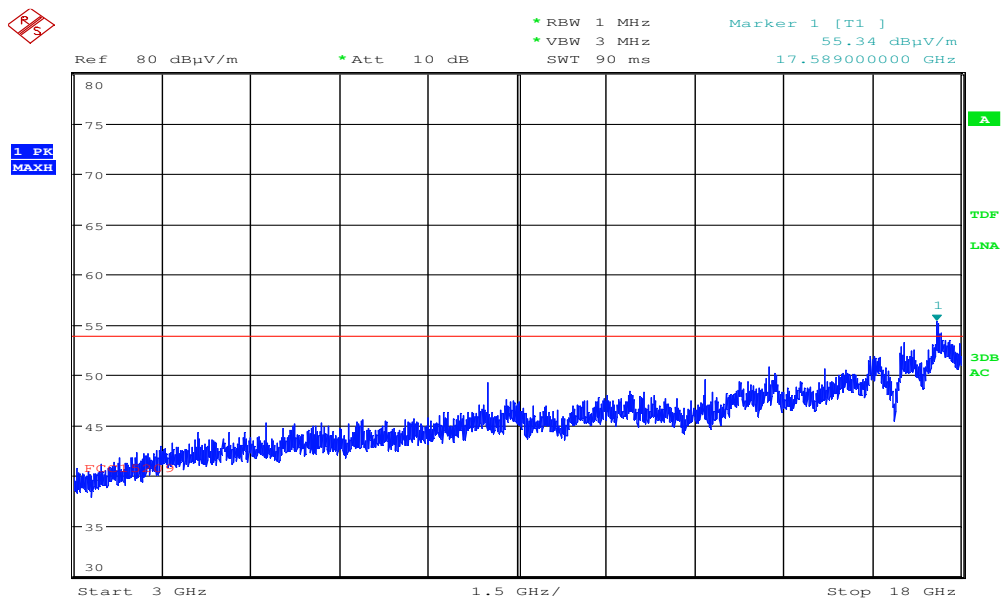
Date: 1.JUN.2018 16:09:02

Radiated Emissions, 3000 -18000 MHz, 2437 MHz, 802. 11g, 6Mbps, Ant1, VP



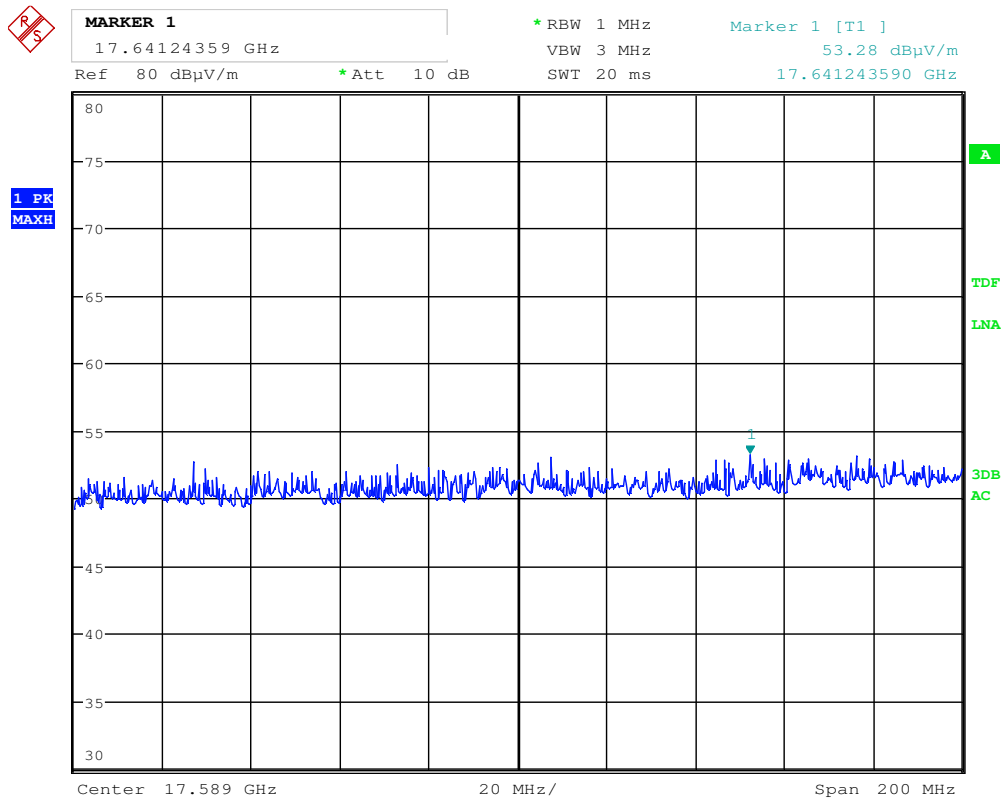
Date: 1.JUN.2018 16:22:01

Radiated Emissions, 3000 -18000 MHz, 2437 MHz, 802.11n, MCS0, MIMO, HP



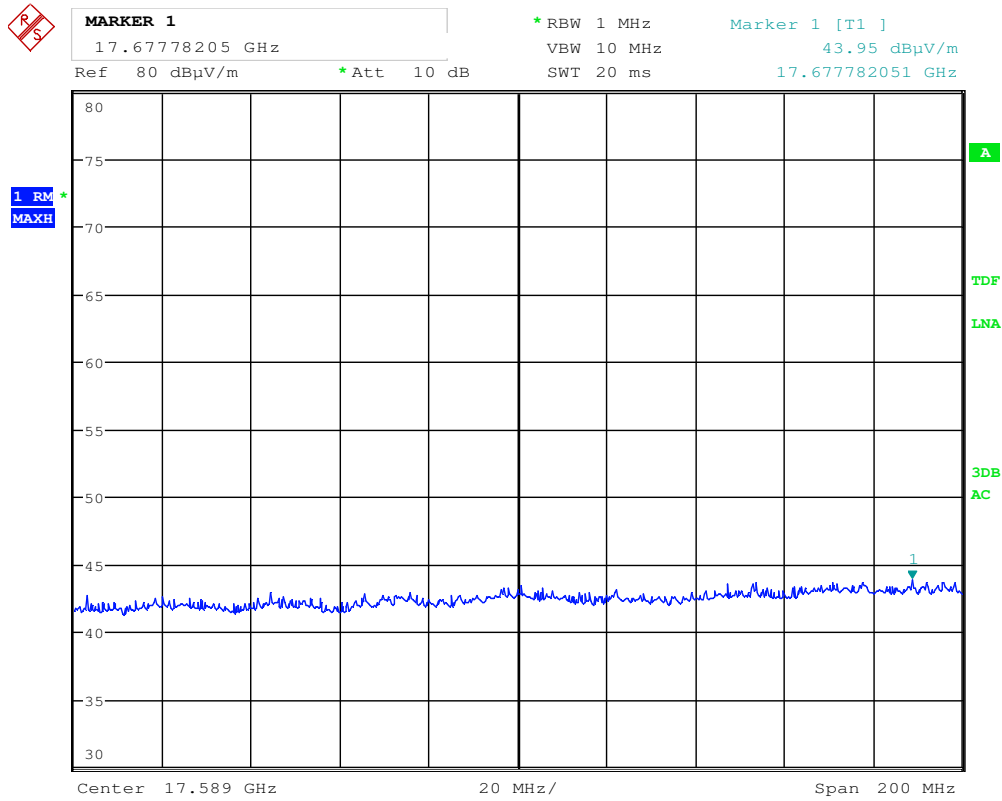
Date: 1.JUN.2018 16:20:00

Radiated Emissions, 3000 -18000 MHz, 2437 MHz, 802.11n, MCS0, MIMO, VP



Date: 1.JUN.2018 16:34:58

Radiated Emissions, 17585 MHz, 2437 MHz, 802.11n, MCS0, MIMO, VP, Peak



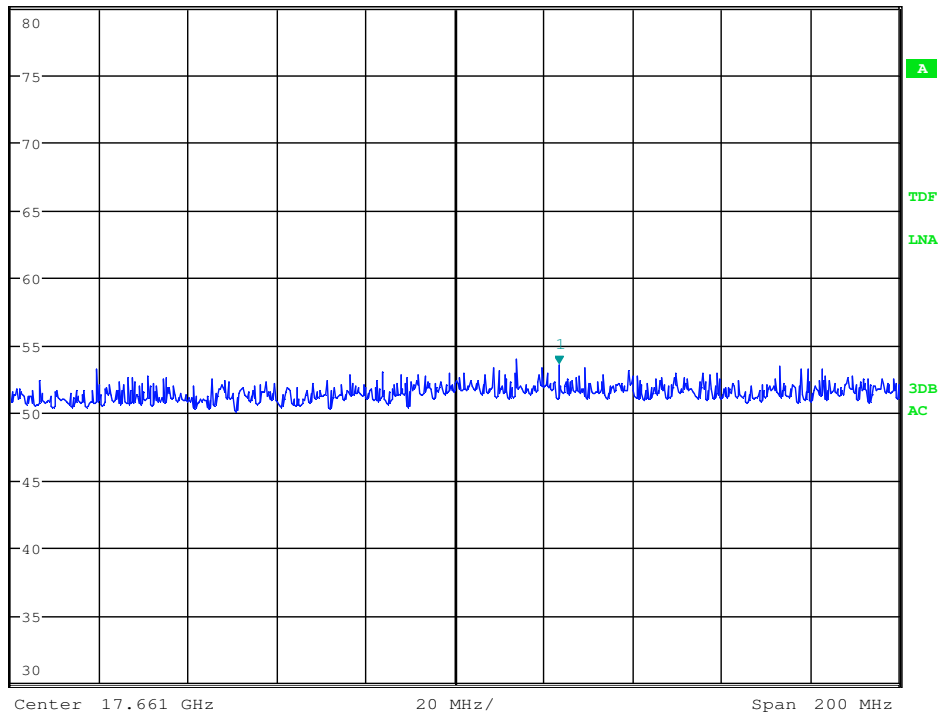
Date: 1.JUN.2018 16:35:45

Radiated Emissions, 17585 MHz, 2437 MHz, 802.11n, MCS0, MIMO, VP, Av



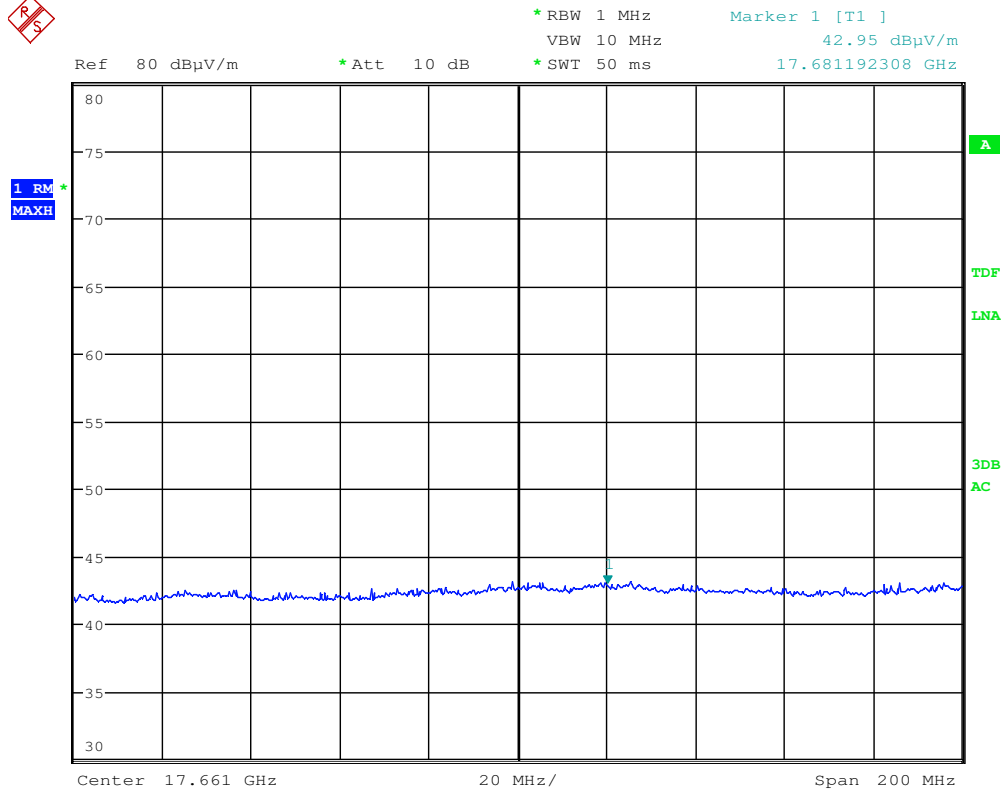
MARKER 1
17.68439744 GHz
Ref 80 dBμV/m * Att 10 dB * RBW 1 MHz Marker 1 [T1]
VBW 3 MHz 53.56 dBμV/m
* SWT 50 ms 17.684397436 GHz

1 PK
MAXH



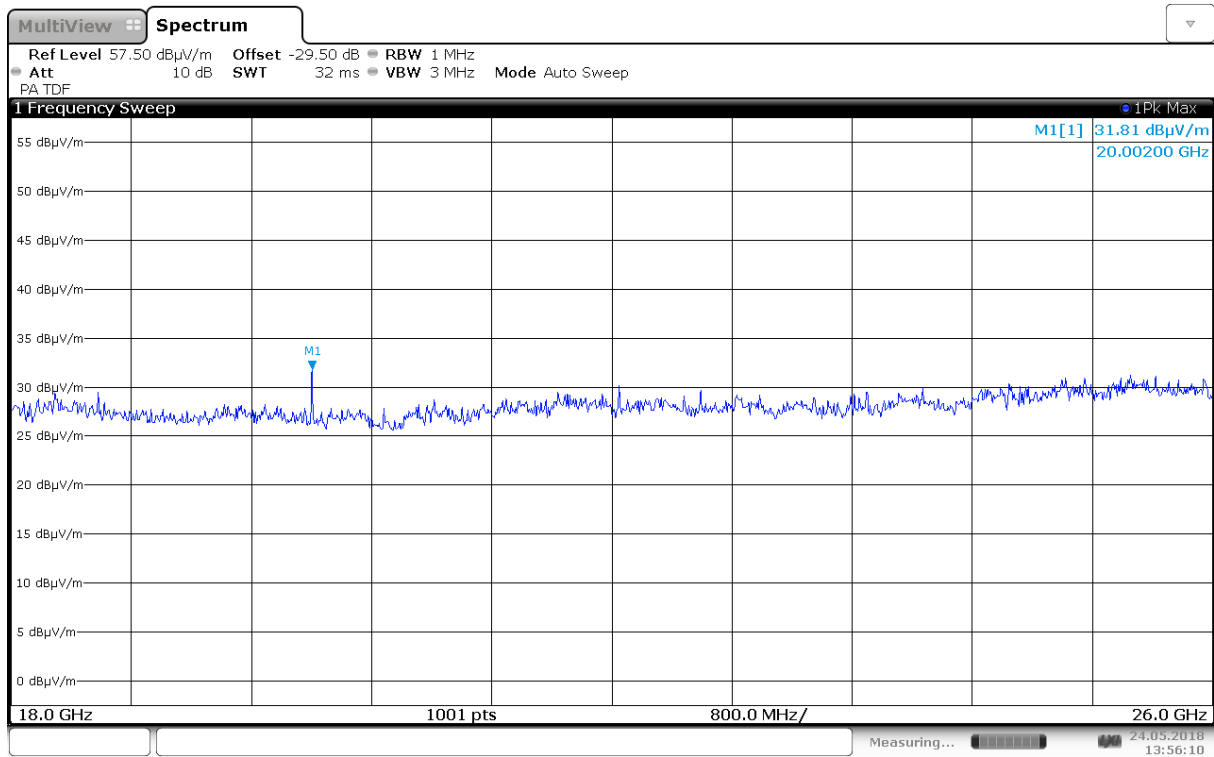
Date: 1.JUN.2018 16:05:17

Radiated Emissions, 17661 MHz, 2437 MHz, 802.11g, 6Mb, Ant0, HP, Peak

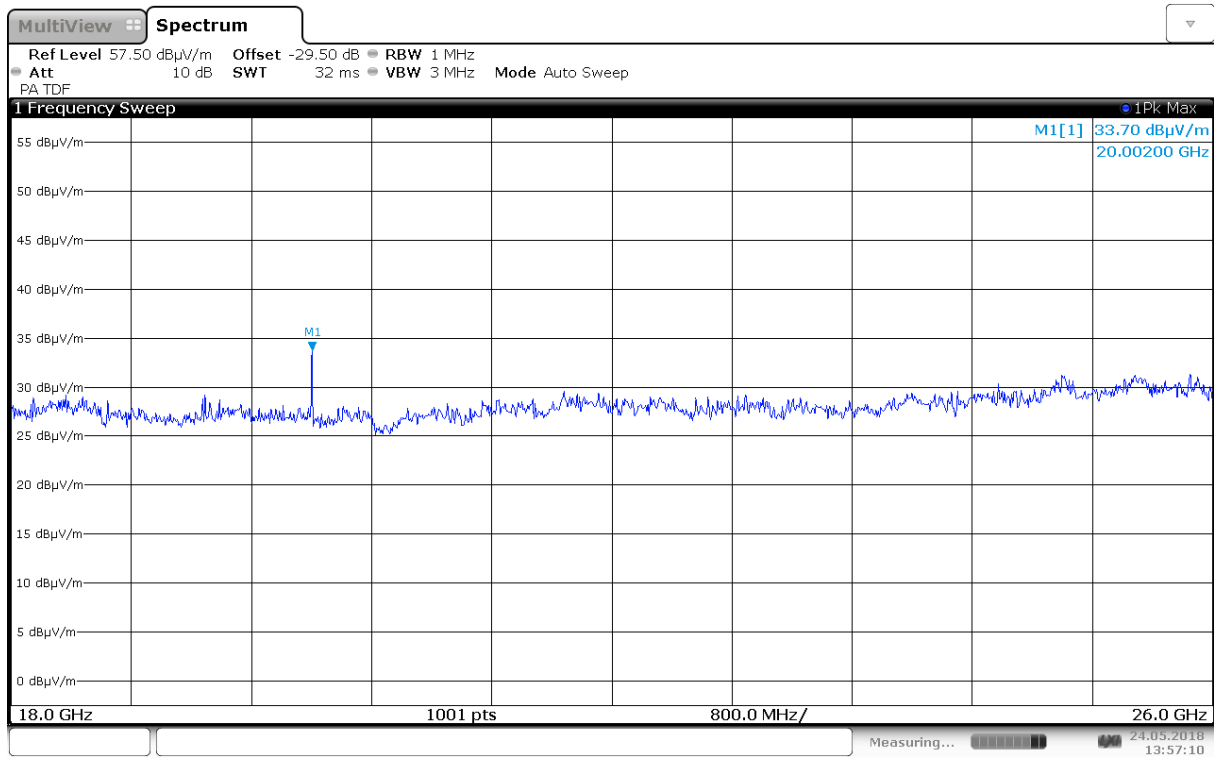


Date: 1.JUN.2018 16:04:48

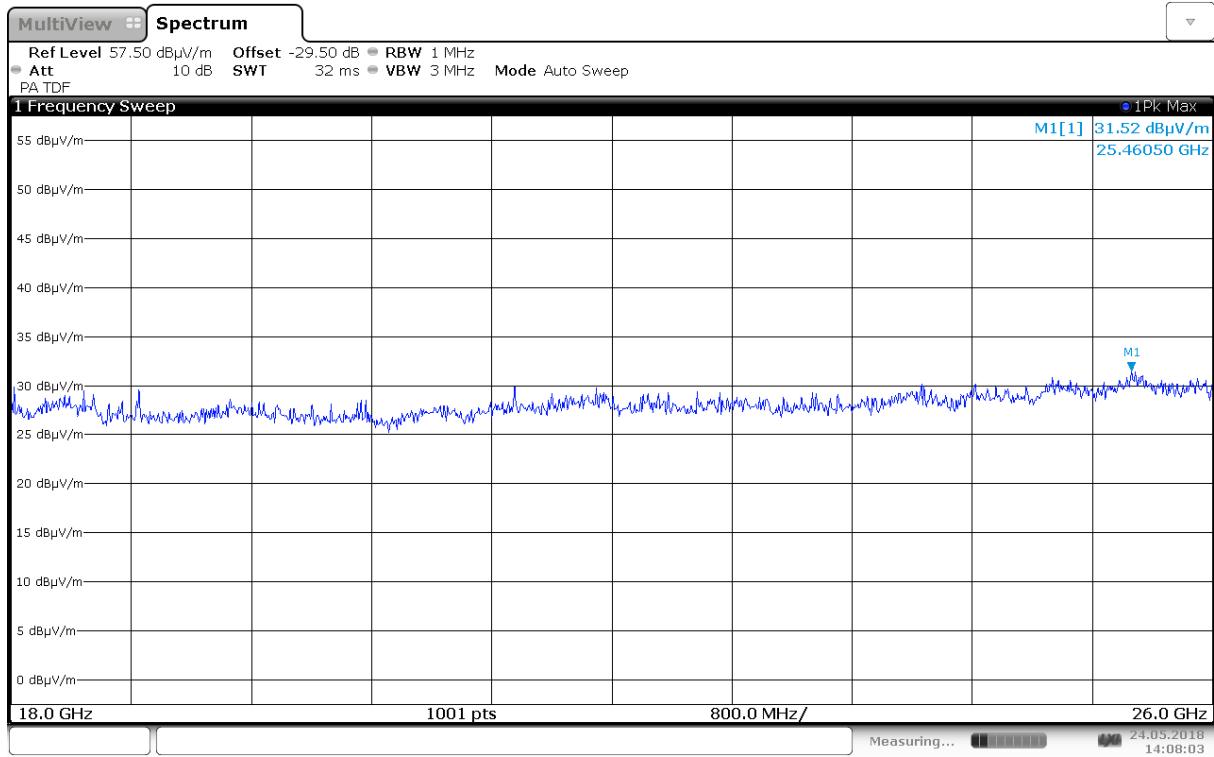
Radiated Emissions, 17661 MHz, 2437 MHz, 802.11g, 6Mb, Ant0, HP, Av



Pre-scan, 18000 -26000 MHz, 2437MHz, 802.11b, 1Mb, Ant0, @approx 10cm



Pre-scan, 18000 -26000 MHz, 2437MHz, 802.11b, 1Mb, Ant1, @ approx 10cm



Pre-scan, 18000 -26000 MHz, 2437MHz, 802.11n, MCS0, MIMO, @ approx 10cm

4 Measurement Uncertainty

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

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

5 LIST OF TEST EQUIPMENT

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

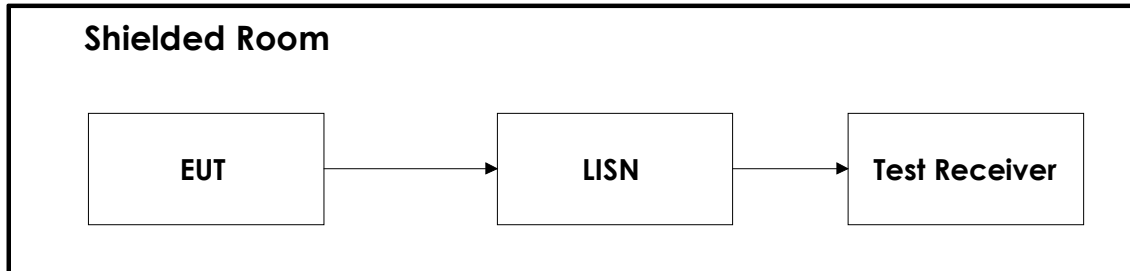
No.	Model	Description	Manufacturer	Asset no.	Cal. date	Cal. Due
1	FSW40	Spectrum Analyzer	Rohde & Schwarz	LR 1690	2018.01	2019.01
2	ESU40	Measuring Receiver	Rohde & Schwarz	LR 1639	2018.03	2019.03
3	6HC3000/18000	Highpass Filter	Trilithic	LR 1614	COU	
4	310	Preamplifier	Sonoma Instrument	LR 1686	2017.08	2018.08
5	317	Preamplifier	Sonoma Instrument	LR 1687	2017.08	2018.08
6	8449A	Pre-amplifier	Hewlett Packard	LR 1322	2017.08	2018.08
7	6812B	AC Power Source	Agilent	LR 1515	COU	
8	3115	Horn Antenna	EMCO	LR 1330	2016.10	2021.10
9	3117-PA	Horn Antenna with Preamp	EMCO	LR 1717	2017.12	2018.12
10	JB3	BiLog Antenna	Sunol	N-4525	2017.11	2020.11
11	638	Antenna Horn	Narda	LR 1480	2010.06	2020.06
12	Model 87 V	Multimeter	Fluke	N-4669	2016.10	2018.10

COU = Calibrate on use

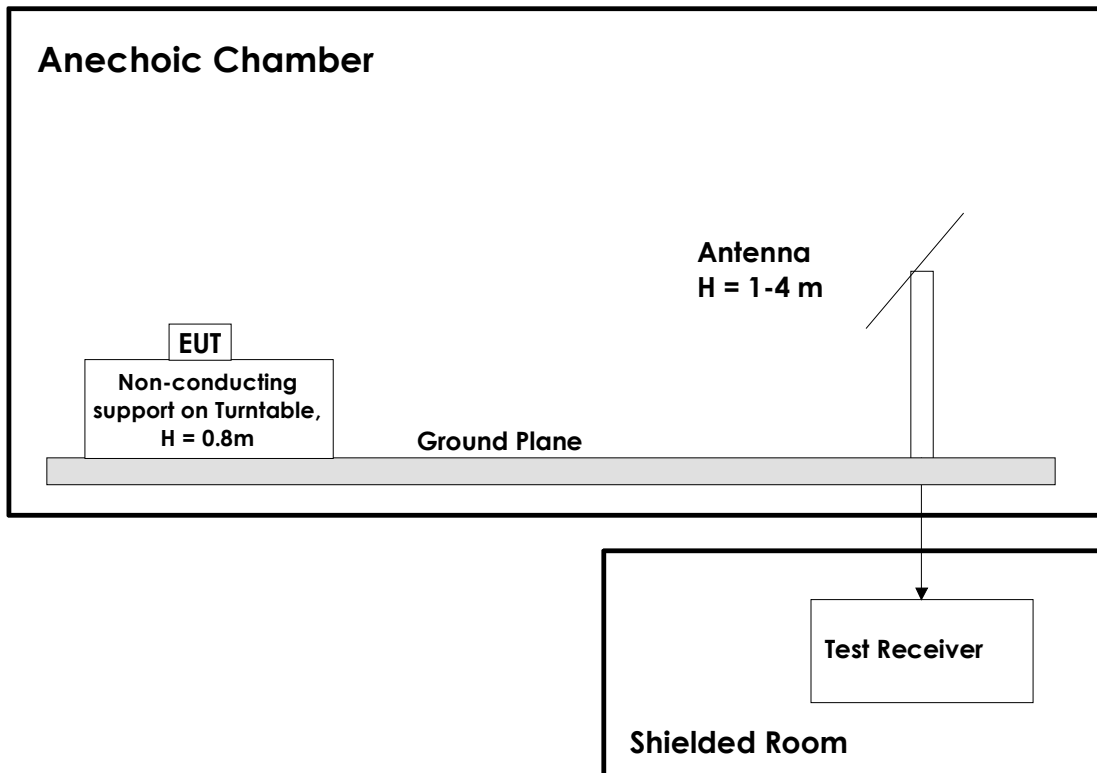
Test Software List			
Description	Manufacturer	Model	Version
EMC Software for Conducted tests	Rohde & Schwarz	EMC32	10.20.01
EMC Software for Radiated tests	Rohde & Schwarz	EMC32	10.20.01

6 BLOCK DIAGRAM

6.1 Power Line Conducted Emission



6.2 Test Site Radiated Emission



All tests below 1 GHz were performed at 3m with ground plane. The EUT was placed on the stand at 0.8m height.

Tests above 1 GHz were performed with the space between the EUT and the antenna covered by absorbers. The EUT was placed on a 1.5m high stand. Tests from 1 GHz to 18 GHz were performed @3m distance. Tests above 18 GHz were performed @1m distance.

The antenna was raised from 1 to 4m and the turntable rotated from 0 to 360 degrees to maximize any emissions found.

Revision history

Version	Date	Comment	Sign
1.0	2018.07.10	First edition	FS