



Report No. 400939-01

FCC TEST REPORT / IC TEST REPORT

Product	Climatix WLAN Stick		
Name and address of the applicant	Siemens Switzerland Ltd. Theilerstrasse 1a CH – 6300 Zug (Switzerland)		
Name and address of the manufacturer	emtrion GmbH Alter Schlachthof 45 D - 76131 Karlsruhe (Germany)		
Model	POL903.00/100		
Rating	5 Vdc via USB		
Trademark	Siemens		
Serial number	0000028; 0000039		
Additional information	WiFi, 802.11b/g/n		
Tested according to	FCC Part 15.247 Frequency Hopping Transmitters / 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		
Report number	400939-01		
Tested in period	2019-08-05 - 2019-08-21		
Issue date	2020-07-06		
Name and address of the testing laboratory	Nemko GmbH & Co. KG Reetzstraße 58 D-76327 Pfinztal Tel.: + 49 (0) 7240 – 63 - 0 Fax: + 49 (0) 7240 – 63 - 11	 Bundesnetzagentur BNetzA-CAB-17/21-17	FCC No: 973501 IC OATS: 10921A
 Prepared by [F. Hupbauer]  Approved by [Dipl.-Ing. P. Lukas]			

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1 INFORMATION

1.1 Test Item

Name :	Climatix WLAN Stick
FCC ID :	2AVJ7POL90300
Model/version :	POL903.00/100
Frequency Range :	2412 - 2462 MHz
Tunable Bands :	None
Number of Channels:	11
Operating Modes :	802.11b/g/n (HT20)
Type of Modulation :	Digital (DSSS, OFDM)
User Frequency Adjustment :	None
Output Power (radiated) :	89.4 mW
Type of Power Supply :	5 Vdc via USB
Antenna Connector :	None (PCB antenna)
Number of Antennas	1
Antenna Diversity Supported :	No
Smart Antennas or MMO	No

Description of Test Item

The EuT is an 802.11b/g/n 2.4GHz WiFi USB Stick. The EuT is supplied via USB.

1.2 Normal test conditions

Temperature: 20 - 24 °C
Relative humidity: 46 - 59 %
Normal test voltage: 5 Vdc via USB

The values are the limit registered during the test period.

1.3 Test Engineer(s)

Frederic Hupbauer

1.4 Description of modification for Modification Filing

Not applicable.

1.5 Family List Rational

Not Applicable.

1.6 Antenna Requirement

Is the antenna detachable?

☐ Yes ☒ No

If detachable, is the antenna connector non-standard?

☐ Yes ☐ No

Type of antenna connector: N/A

Ref. FCC §15.203

1.7 Worst-Case Configuration and Mode

Radiated Emissions was performed with the EUT set to transmit at the channel with the highest output power as worst-case scenario.

The worst case data rates were:

802.11b mode: 1 Mbps
802.11g mode: 6 Mbps
802.11n HT20: MCS 0

1.8 Comments

The measurement were done with the EUT powered by 5 Vdc via USB for both conducted and radiated tests. Controlled in test mode using a Texas Instruments RadioToolGUI CC3xxxRadioTool v1.0.3.11. It was checked that power variations between 85% and 115% did not have any influence on the measurements.

The radiated measurements are tested on three axes.

All ports were populated during spurious emission measurements.

2 TEST REPORT SUMMARY

2.1 General

All measurements are traceable to national standards.

The tests were conducted for the purpose of 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 shielded room ($f < 1$ GHz) and a fully-anechoic shielded room ($f > 1$ GHz) at a measuring distance of 3m.

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

Test setup photo document: 400939-01TRFFCC Annex – Test set-up photos

☒ New Submission

☒ Production Unit

☐ Class II Permissive Change

☐ Pre-production Unit

DTS Equipment Code

☐ Family Listing



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

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

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2.2 Test Summary

Name of test	FCC Part 15 reference	RSS-247 Issue 2, RSS-GEN Issue 4 reference	Result
Supply Voltage Variations	15.31(e)	6.11 (RSS-GEN)	Complies
Number of Operating Frequencies	15.31(m)	5.1 (6) (RSS-247)	N/A
Antenna Requirement	15.203	8.3 (RSS-GEN)	Complies ¹
Power Line Conducted Emission	15.107(a) 15.207(a)	8.8 (RSS-GEN)	Complies
Occupied Bandwidth / 99% OCC-BW	N/A	6.7 (RSS-GEN)	-
Minimum 6 dB Bandwidth	15.247(a)(2)	5.2 (1) (RSS-247)	Complies
Peak Power Output	15.247(b)	5.4 (RSS-247)	Complies
Power Spectral Density	15.247(d)	5.2 (2) (RSS-247)	Complies
Spurious Emissions (Antenna Conducted)	15.247(c)	5.5 (RSS-247)	Complies
Spurious Emissions (Radiated)	15.247(c) 15.109(a) 15.209(a)	5.5 (RSS-247) 6.13 (RSS-GEN) 8.9 (RSS-GEN)	Complies

¹ The tested equipment has integrated antennas only

3 TEST RESULTS

3.1 Power Line Conducted Emissions

Para. No.: 15.207 (a)/8.8

Para. No.: 8.8 RSS-Gen

Test Performed By: Frederic Hupbauer

Date of Test: 2019-08-19

Measurement procedure: ANSI C63.4-2014 using 50 μ H/50 ohms LISN.

Test Results: Complies.

Measurement Data: See attached graph.

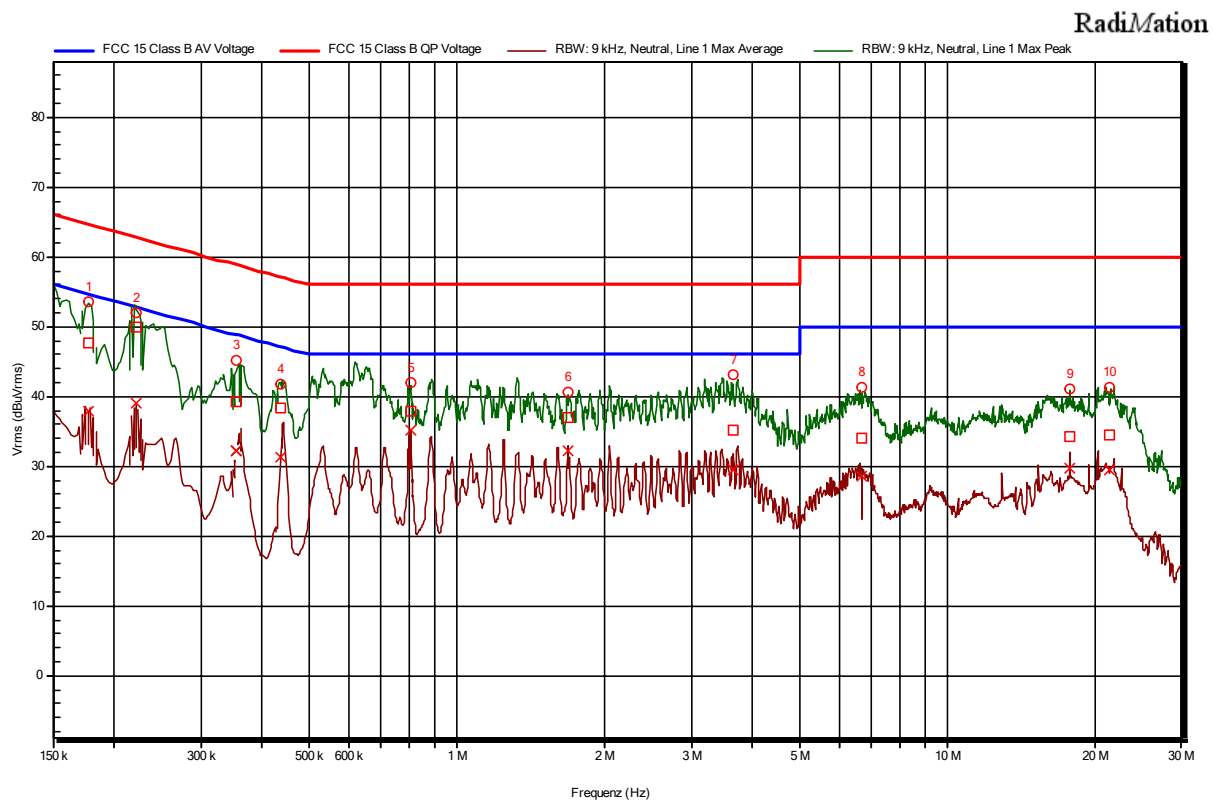
EUT supplied via USB from Laptop HP EliteBook 8470w

AC/DC adapter type: HP PPP012L-E

Input voltage to AC/DC adapter: 115V/60Hz

Highest measured value (L1 and N):

Diagram



Final measurements QP with Quasi-Peak-Detector

Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	LISN
1	0.177000 MHz	47.58 dBuVrms	64.63 dBuVrms	-17.04 dB	Neutral
2	0.222000 MHz	49.96 dBuVrms	62.74 dBuVrms	-12.78 dB	Neutral
3	0.354750 MHz	39.17 dBuVrms	58.85 dBuVrms	-19.69 dB	Neutral
4	0.438000 MHz	38.34 dBuVrms	57.10 dBuVrms	-18.76 dB	Neutral
5	0.802500 MHz	37.91 dBuVrms	56.00 dBuVrms	-18.09 dB	Line 1
6	1.684500 MHz	37.08 dBuVrms	56.00 dBuVrms	-18.92 dB	Line 1
7	3.642000 MHz	35.22 dBuVrms	56.00 dBuVrms	-20.78 dB	Neutral
8	6.659250 MHz	34.02 dBuVrms	60.00 dBuVrms	-25.98 dB	Neutral
9	17.745000 MHz	34.28 dBuVrms	60.00 dBuVrms	-25.72 dB	Line 1
10	21.336000 MHz	34.47 dBuVrms	60.00 dBuVrms	-25.53 dB	Line 1

Final measurements AV with Average-Detector

Peak Number	Frequency	Average	Average Limit	Average Difference	LISN
1	0.177000 MHz	37.90 dBuVrms	54.63 dBuVrms	-16.73 dB	Neutral
2	0.222000 MHz	39.06 dBuVrms	52.74 dBuVrms	-13.68 dB	Neutral
3	0.354750 MHz	32.24 dBuVrms	48.85 dBuVrms	-16.61 dB	Neutral
4	0.438000 MHz	31.20 dBuVrms	47.10 dBuVrms	-15.90 dB	Neutral
5	0.802500 MHz	35.28 dBuVrms	46.00 dBuVrms	-10.72 dB	Line 1
6	1.684500 MHz	32.30 dBuVrms	46.00 dBuVrms	-13.70 dB	Line 1
7	3.642000 MHz	29.48 dBuVrms	46.00 dBuVrms	-16.52 dB	Neutral
8	6.659250 MHz	28.57 dBuVrms	50.00 dBuVrms	-21.43 dB	Neutral
9	17.745000 MHz	29.68 dBuVrms	50.00 dBuVrms	-20.32 dB	Line 1
10	21.336000 MHz	29.40 dBuVrms	50.00 dBuVrms	-20.60 dB	Line 1

3.2 Occupied Bandwidth (99% BW)

Para. No.: 15.247 (a)(1)(iii)

Para. No.: 6.7 RSS-Gen

Test Performed By: Frederic Hupbauer

Date of Test: 2019-08-05

Test Results: Complies

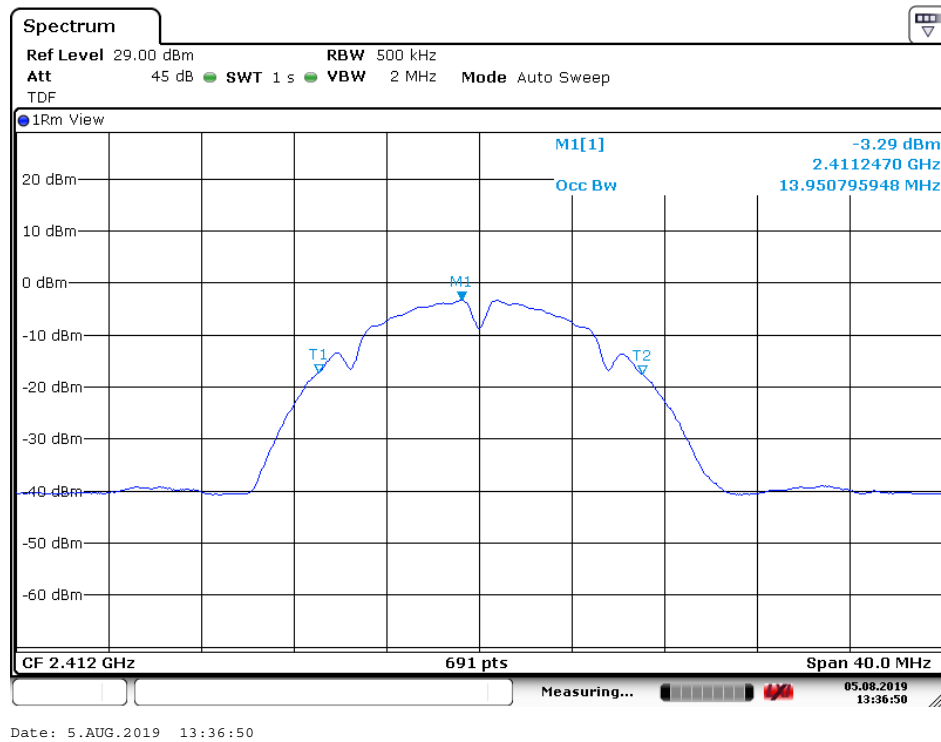
Measurement Data:

Modulation type and bitrate	Occupied Bandwidth (99% BW) (MHz)		
	Ch 01, 2412 MHz	Ch 06, 2437 MHz	Ch 11, 2462 MHz
802.11b, 1 Mbps	13.95	13.95	14.07
802.11g, 6 Mbps	16.61	16.61	16.56
802.11n, MCS 0	17.66	17.54	17.66

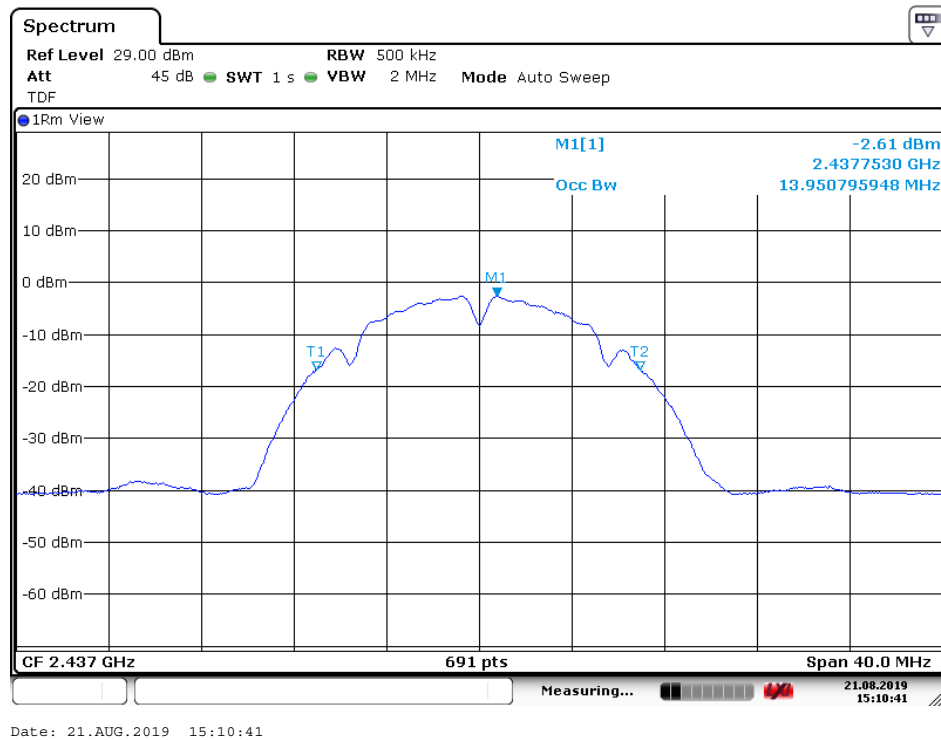
Requirements:

No requirements for Digital Transmission Systems.

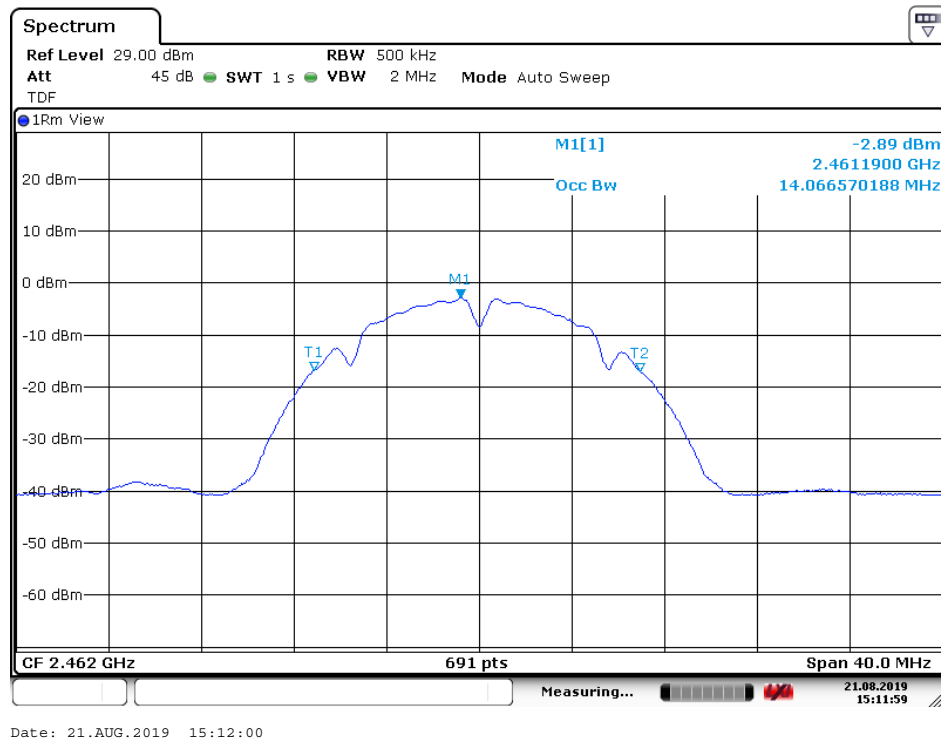
Reported for information only



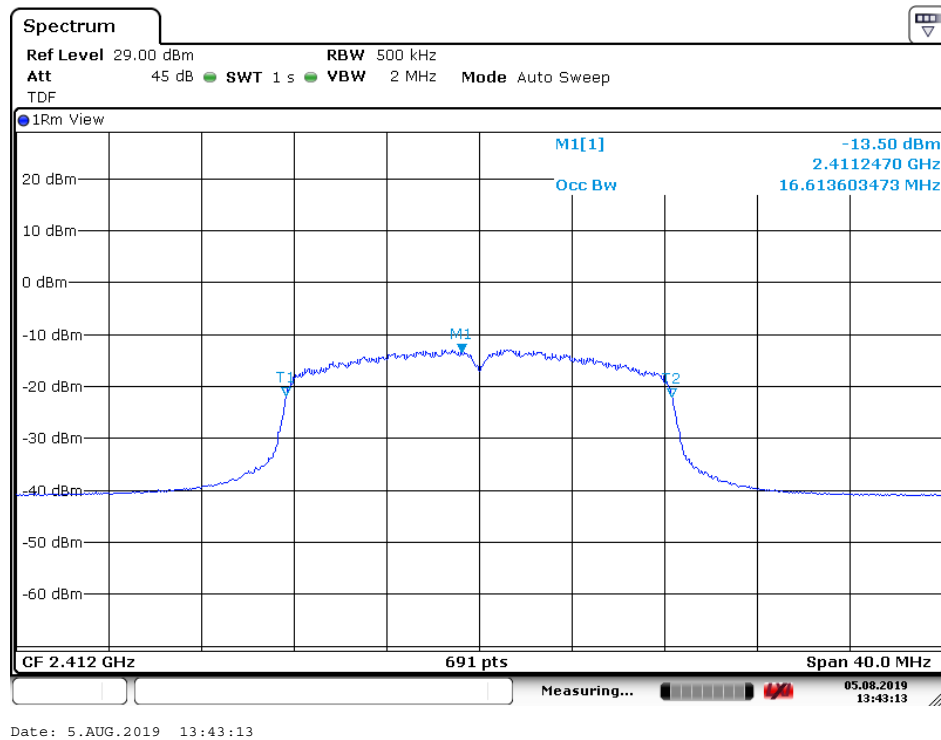
99% OCC BW, 2412 MHz, 1 Mbps



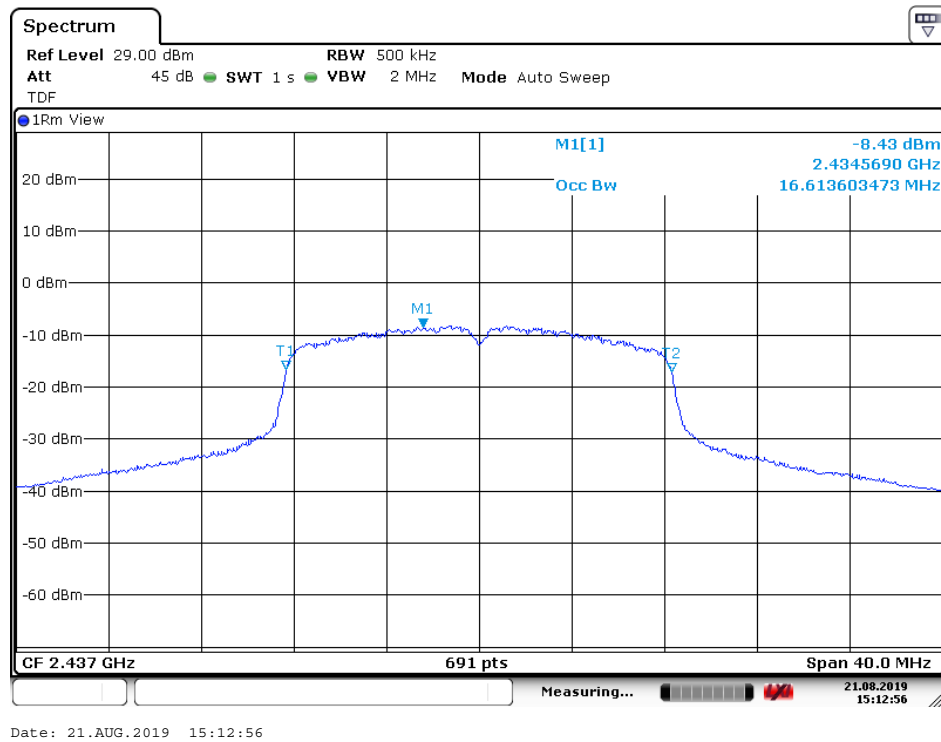
99% OCC BW, 2437 MHz, 1 Mbps



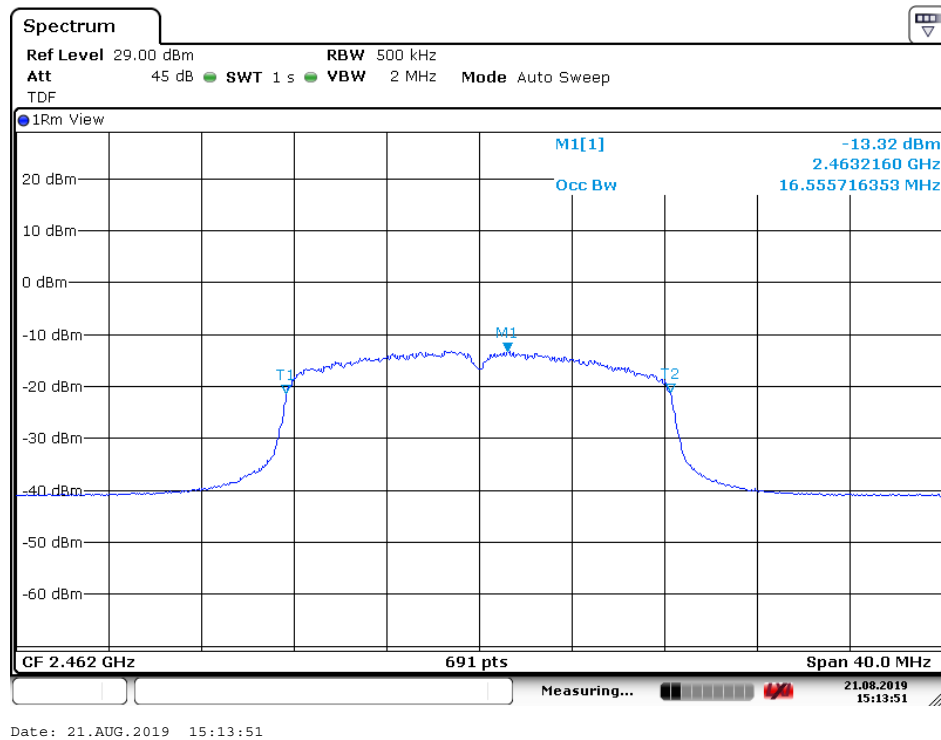
99% OCC BW, 2462 MHz, 1 Mbps



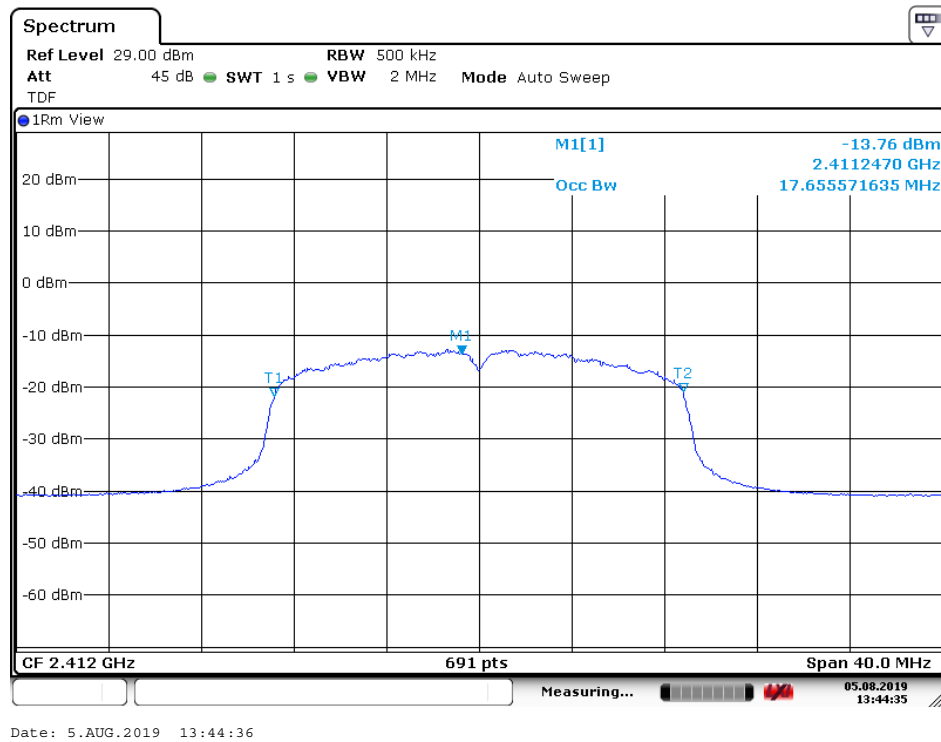
99% OCC BW, 2412 MHz, 6 Mbps



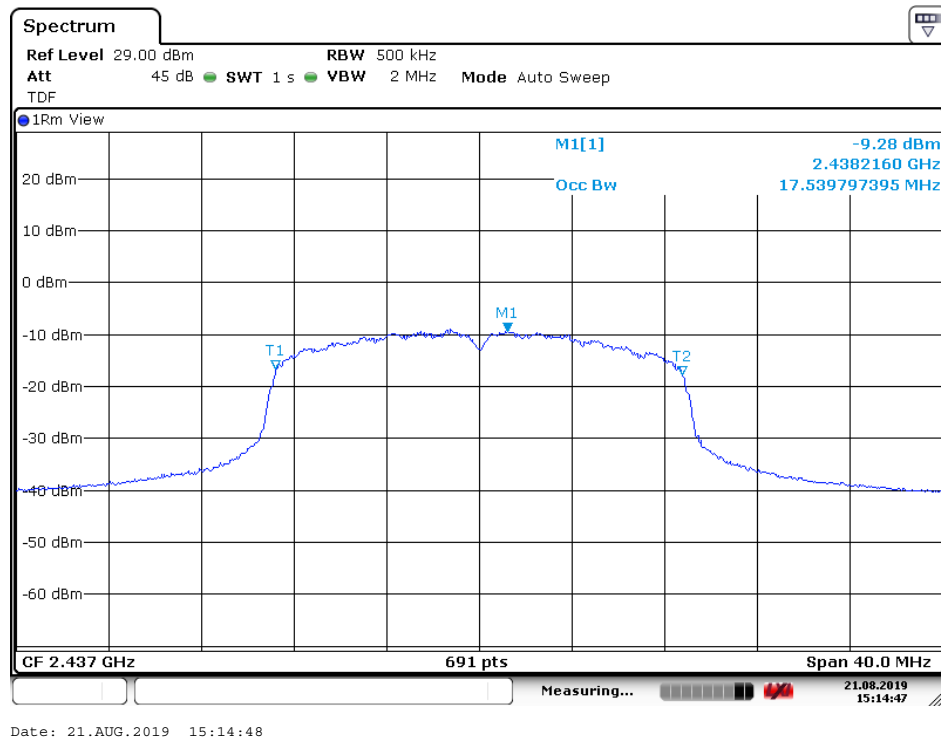
99% OCC BW, 2437 MHz, 6 Mbps



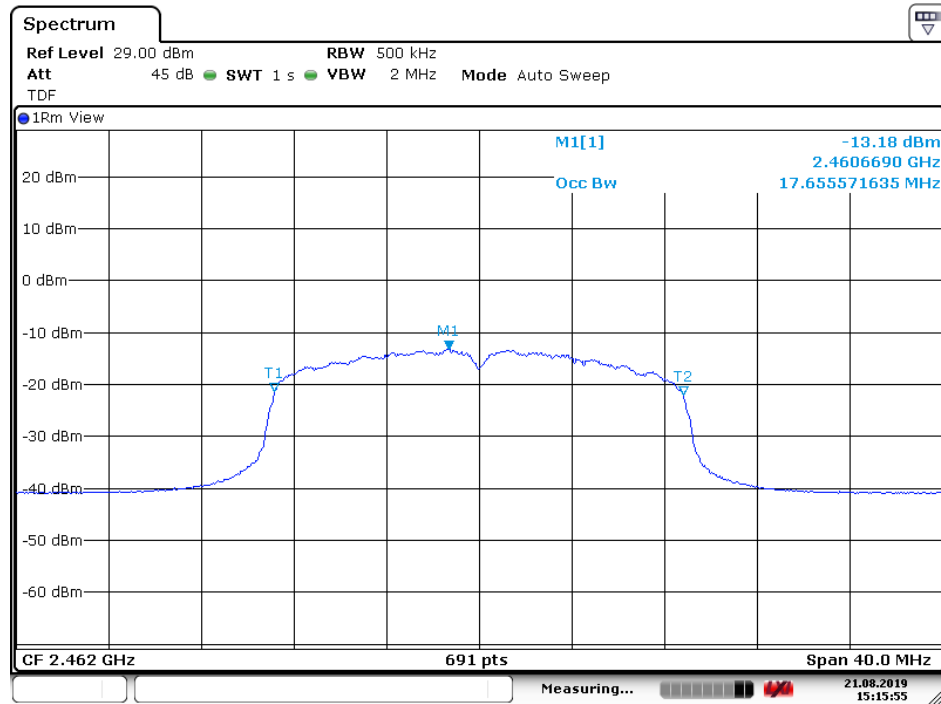
99% OCC BW, 2462 MHz, 6 Mbps



99% OCC BW, 2412 MHz, MCS 0



99% OCC BW, 2437 MHz, MCS 0



Date: 21.AUG.2019 15:15:56

99% OCC BW, 2462 MHz, MCS 0

3.4 Minimum 6 dB Bandwidth

Para. No.: 15.247 (a)(2)

Para. No.: 5.2 (1) (RSS-247)

Test Performed By: Frederic Hupbauer

Date of Test: 2019-08-12

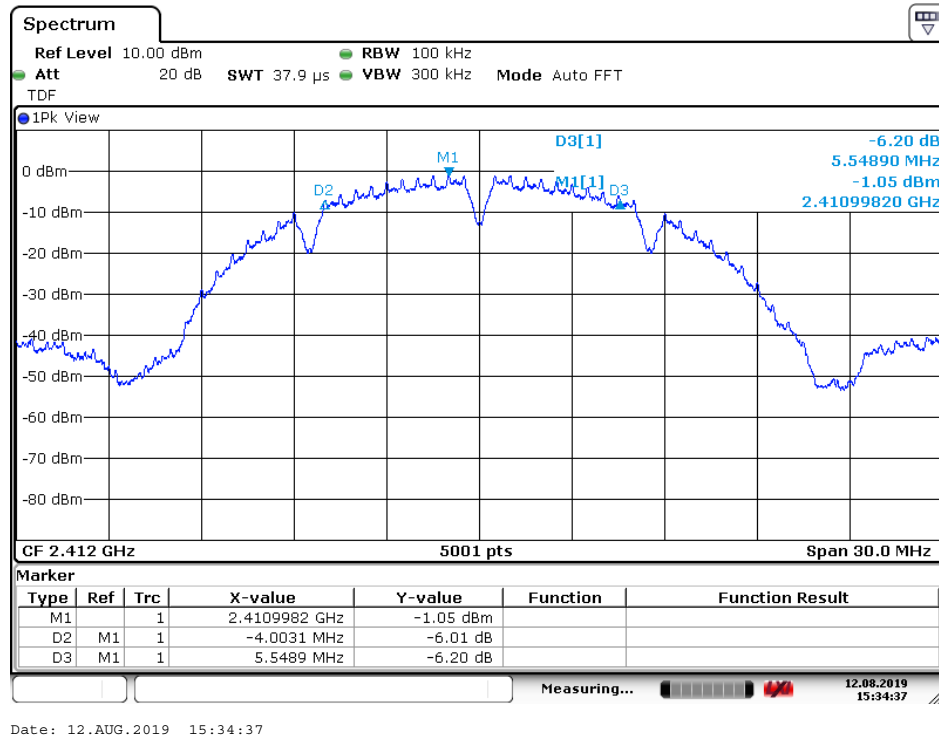
Test Results: Complies

Measurement Data:

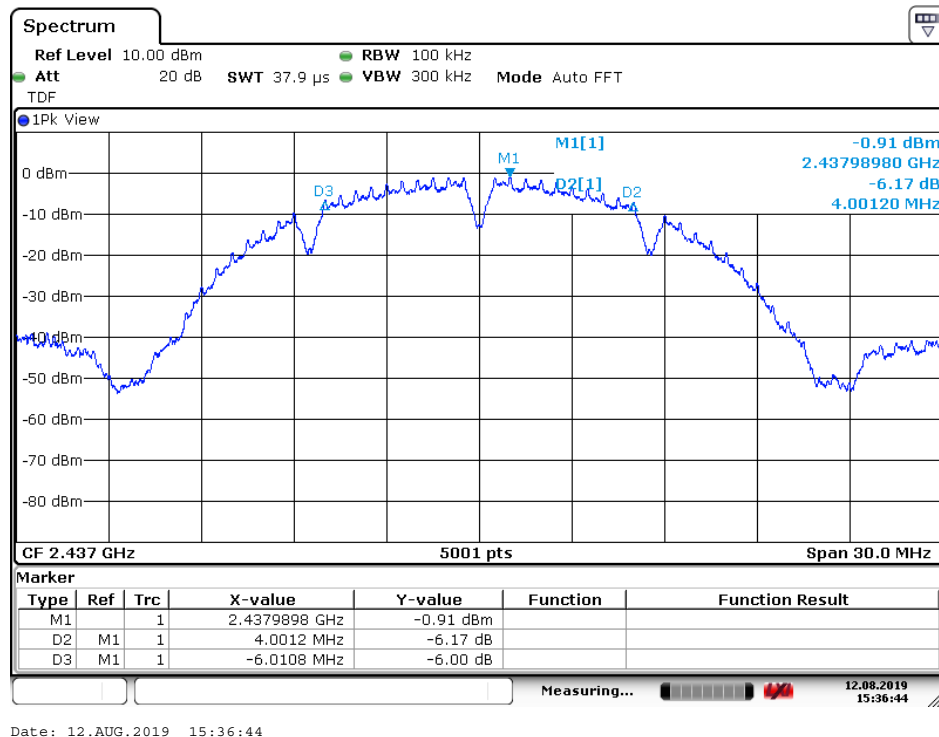
Modulation type and bitrate	Measured 6 dB Bandwidth (MHz)		
	Ch 01, 2412 MHz	Ch 06, 2437 MHz	Ch 11, 2462 MHz
802.11b, 1 Mbps	9.55	10.01	9.56
802.11g, 6 Mbps	15.1	15.1	15.1
802.11n, MCS 0	15.1	15.1	15.1

Requirements:

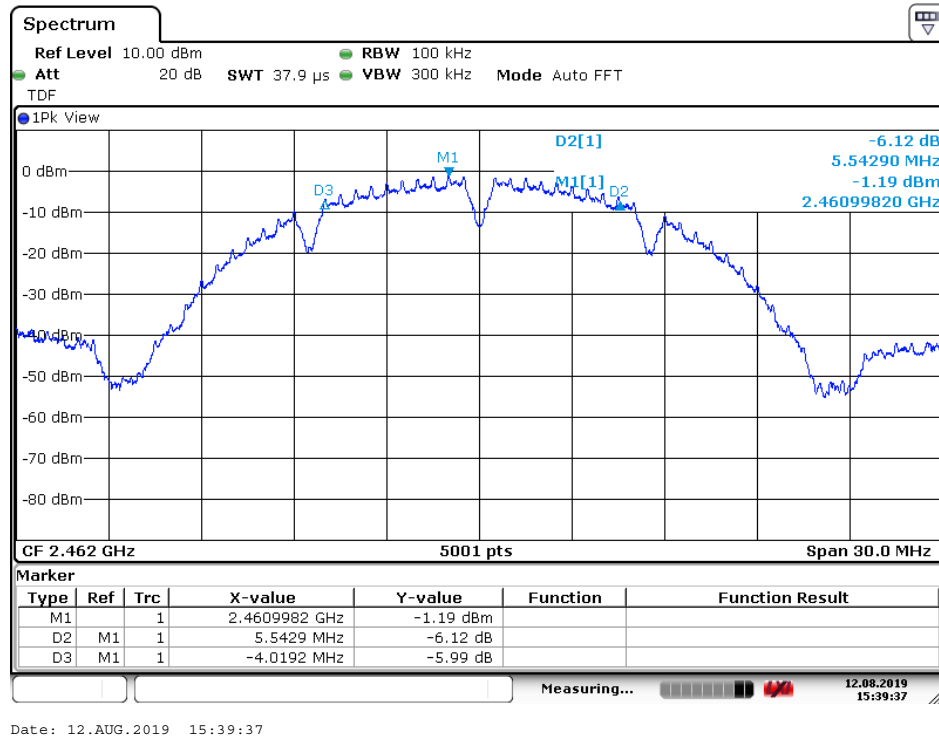
For Digital Transmission Systems in the 2400-2483.5 MHz band the minimum 6 dB bandwidth shall be at least 500 KHz.



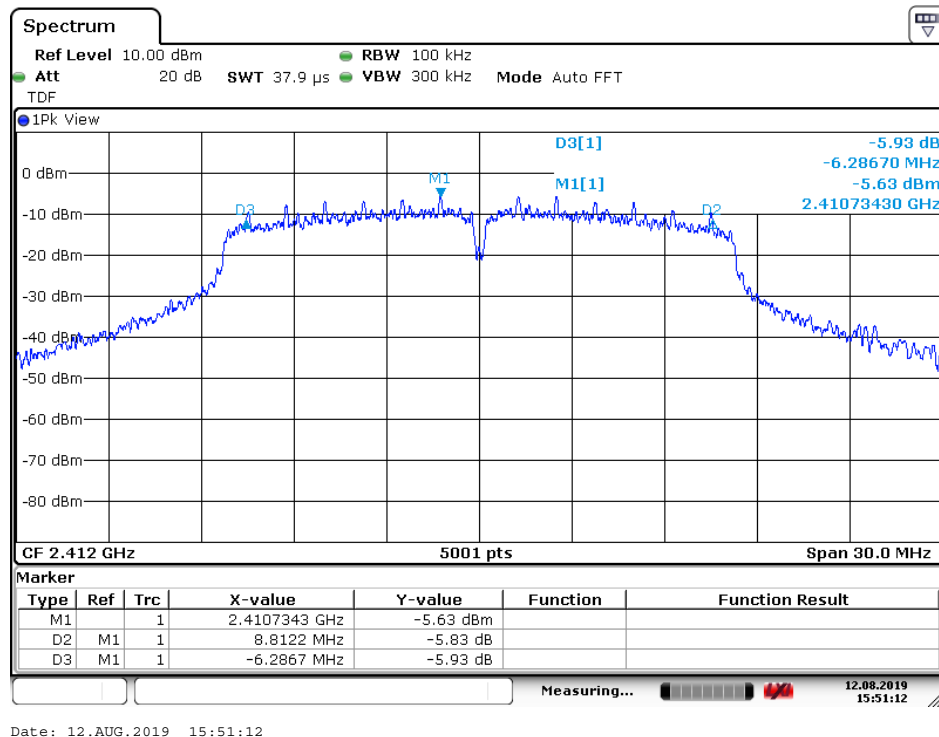
6 dB Bandwidth, 2412 MHz, 1 Mbps



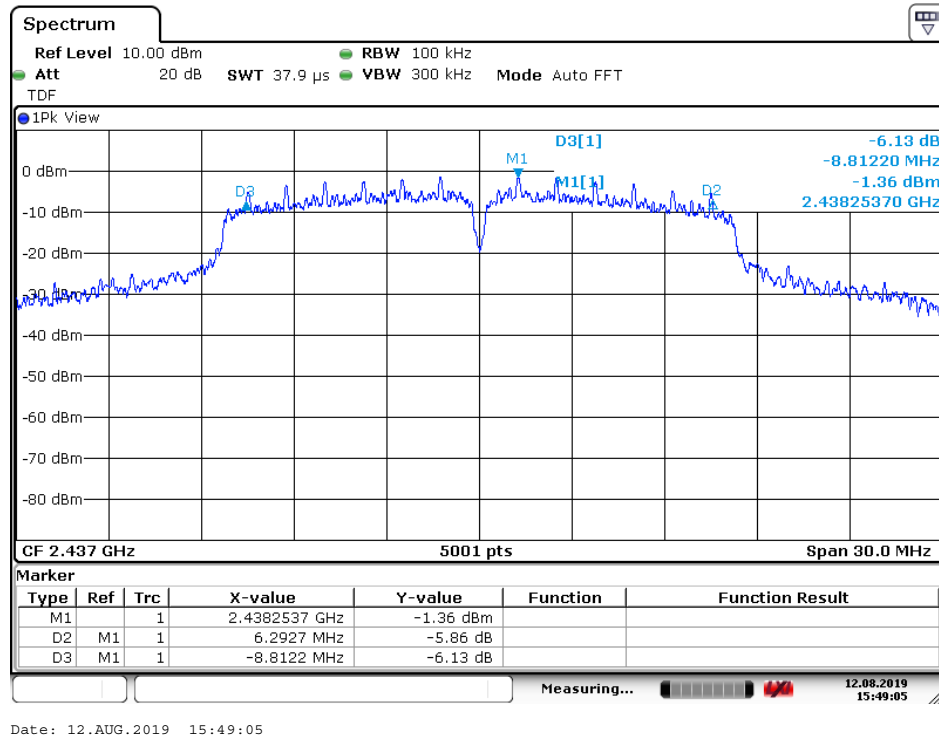
6 dB Bandwidth, 2437 MHz, 1 Mbps



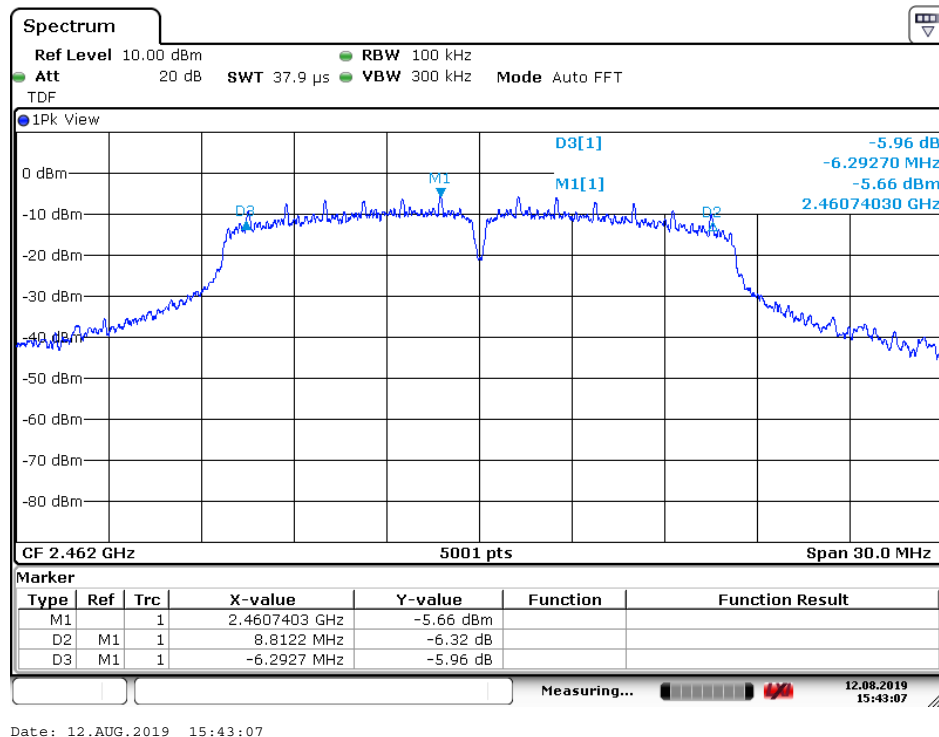
6 dB Bandwidth, 2462 MHz, 1 Mbps



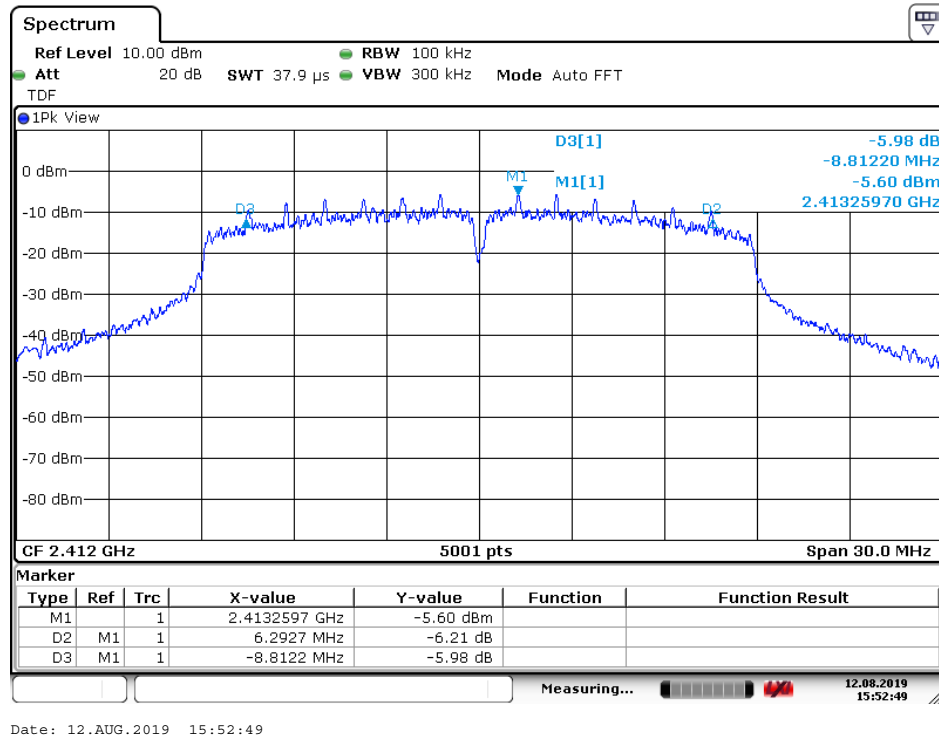
6 dB Bandwidth, 2412 MHz, 6 Mbps



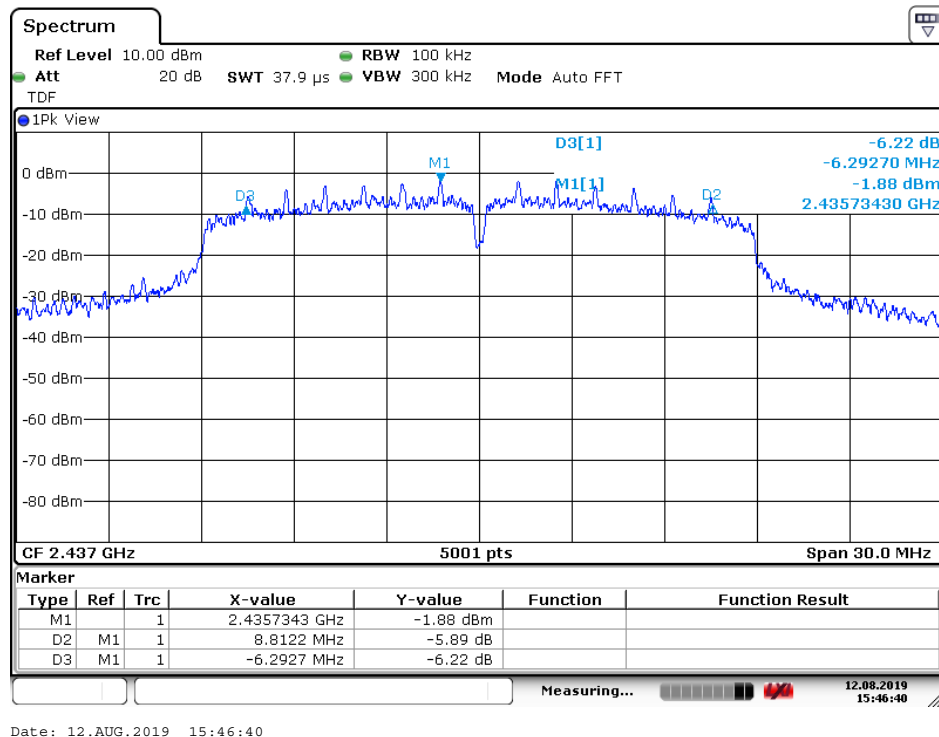
6 dB Bandwidth, 2437 MHz, 6 Mbps



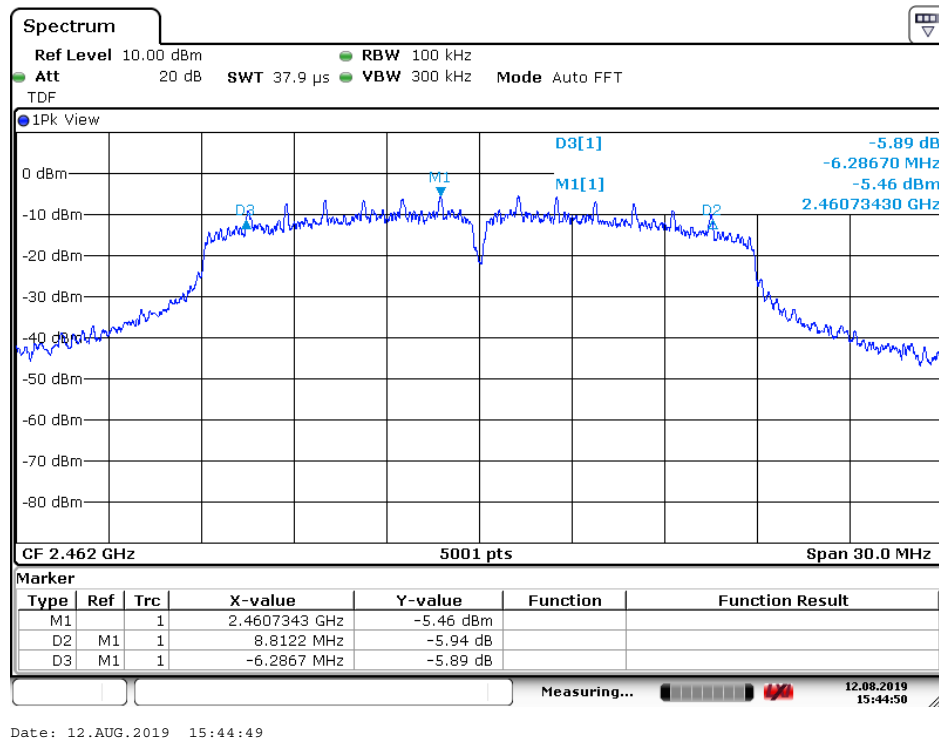
6 dB Bandwidth, 2462 MHz, 6 Mbps



6 dB Bandwidth, 2412 MHz, MCS 0



6 dB Bandwidth, 2437 MHz, MCS 0



6 dB Bandwidth, 2462 MHz, MCS 0

3.5 Peak Power Output

Para. No.: 15.247 (b)

Para. No.: 5.4 (RSS-247)

Test Performed By: Frederic Hupbauer	Date of Test: 2019-08-08, 2019-08-12
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Test Results: Complies

Measurement Data:

Modulation type and bitrate	802.11b, 1 Mbps		
Carrier Frequency	2412 MHz	2437 MHz	2462 MHz
Measured Maximum Field strength (dBμV/m) – VP	109.67	111.98	113.53
Calc. Radiated Power (dBm)	14.44	16.75	18.3
Calc. Radiated Power (mW)	27.8	47.33	67.63
Measured Conducted Power (dBm)	11.27	11.51	11.69
Calculated Conducted Power (mW)	13.4	14.16	14.76
Calculated Antenna Gain (dBi)	1.0	3.1	4.5

Modulation type and bitrate	802.11g, 6 Mbps		
Carrier Frequency	2412 MHz	2437 MHz	2462 MHz
Measured Maximum Field strength (dBμV/m) – HP	113.04	114.39	114.12
Calc. Radiated Power (dBm)	17.81	19.16	18.89
Calc. Radiated Power (mW)	60.41	82.44	77.47
Measured Conducted Power (dBm)	13.15	13.45	12.33
Calculated Conducted Power (mW)	20.65	22.13	17.1
Calculated Antenna Gain (dBi)	2.5	3.6	4.4

Modulation type and bitrate	802.11n, MCS 0		
Carrier Frequency	2412 MHz	2437 MHz	2462 MHz
Measured Maximum Field strength (dBμV/m) – HP	113.53	114.48	114.74
Calc. Radiated Power (dBm)	18.3	19.25	19.51
Calc. Radiated Power (mW)	67.63	84.16	89.36
Measured Conducted Power (dBm)	13.18	13.34	12.15
Calculated Conducted Power (mW)	20.8	21.58	16.41
Calculated Antenna Gain (dBi)	3.0	3.8	5.2

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

EIRP is calculated from measured field strength by the formulas in KDB 412172 D01 Determining ERP and EIRP v01.

The maximum field strength is obtained in XY plane and Vertical polarization.a

Only the highest power output for each modulation type and bitrate was documented in the report.

See attached graph.

Detachable antenna?

☐ Yes

☒ No

If detachable, is the antenna connector non-standard?

☐ Yes

☐ No

Type of antenna connector: N/A

Requirements:

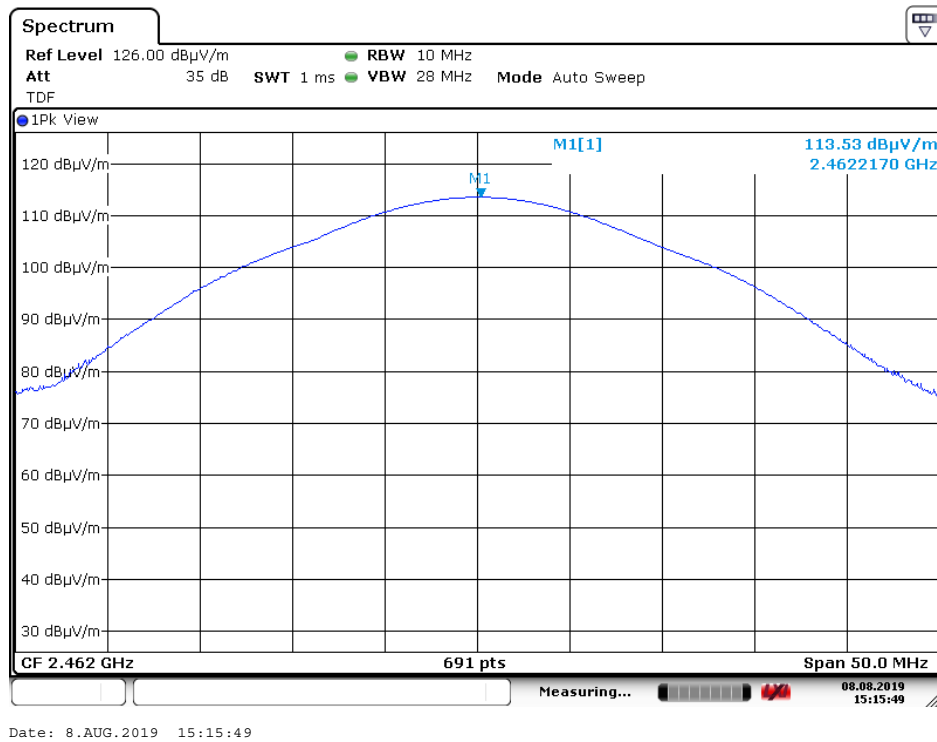
The maximum peak output power shall not exceed the following limits:

For frequency hopping systems employing at least 75 hopping channels: 1 Watt

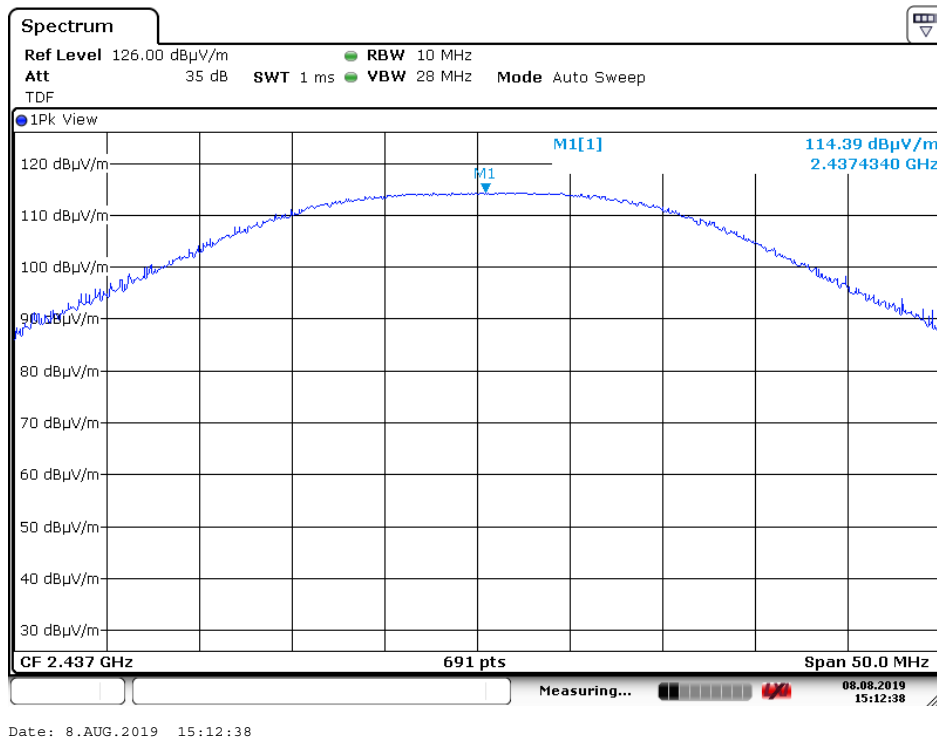
For all other frequency hopping systems in the 2400 - 2483.5 MHz band: 0.125 Watts

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

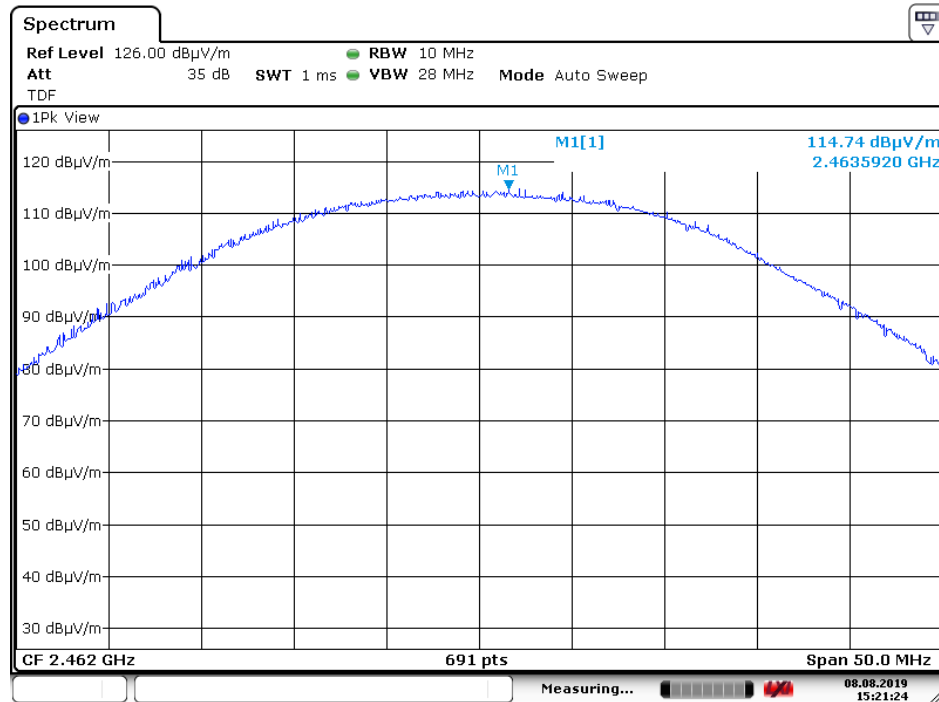
If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power from the intentional radiator shall be reduced below the stated value above by the amount in dB that the directional gain of the antenna exceeds 6 dBi.



Radiated field strength, VP, 2462 MHz, 1 Mbps

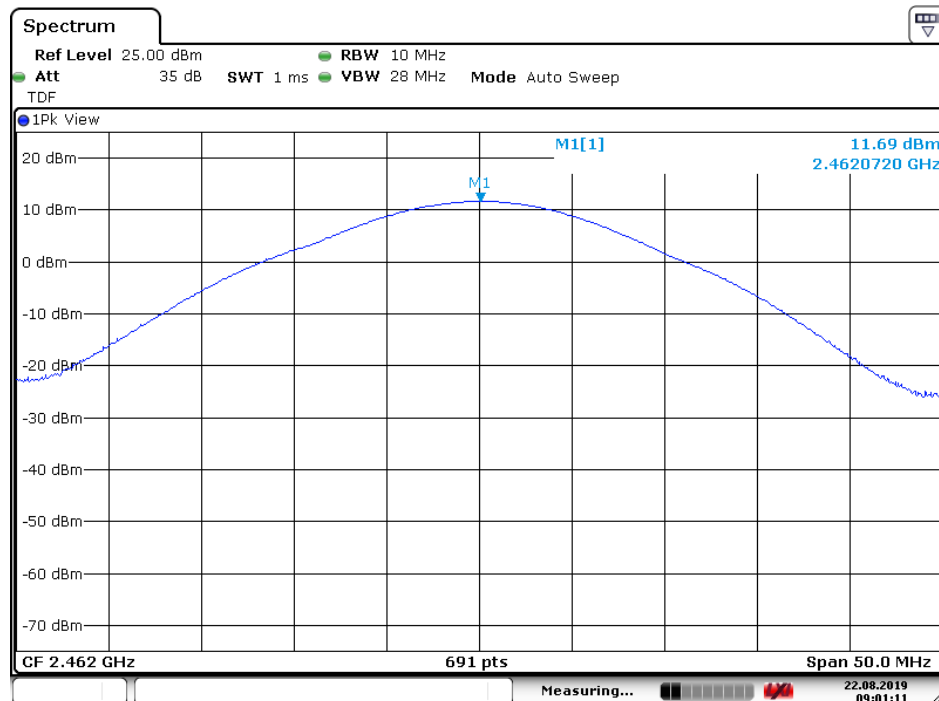


Radiated field strength, VP, 2437 MHz, 6 Mbps



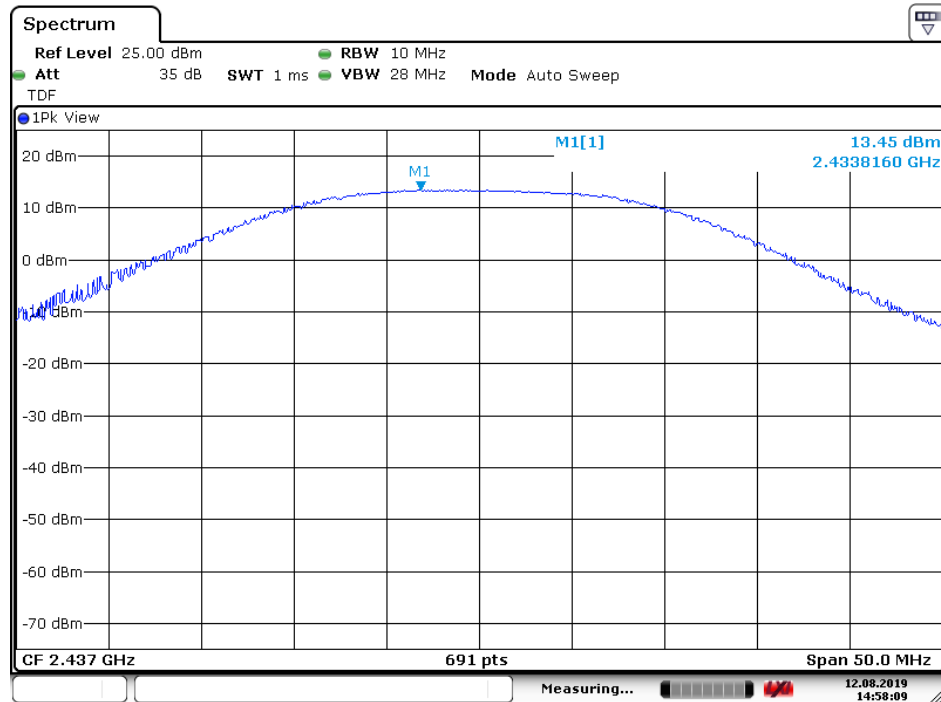
Date: 8.AUG.2019 15:21:25

Radiated field strength, VP, 2462 MHz, MCS 0



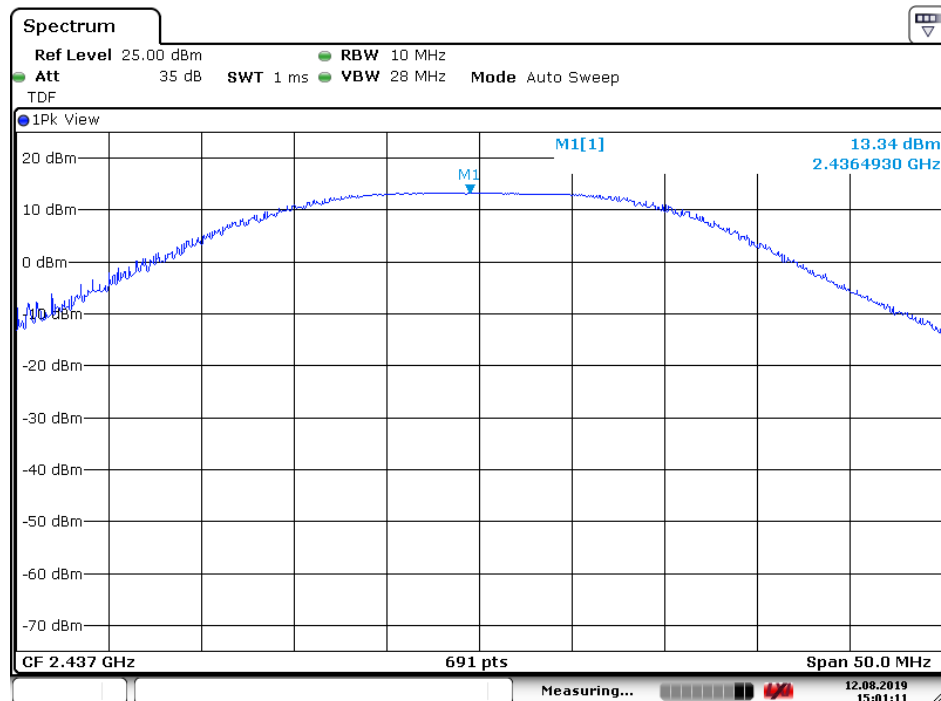
Date: 22.AUG.2019 09:01:11

Conducted power – 2462MHz, 1 Mbps



Date: 12.AUG.2019 14:58:09

Conducted power – 2437MHz, 6 Mbps



Date: 12.AUG.2019 15:01:11

Conducted power – 2437MHz, MCS 0

3.6 Conducted Emissions at Antenna Connector

Para. No.: 15.247 (d)

Para. No.: 5.5 (RSS-247)

Test Performed By: Frederic Hupbauer

Date of Test: 2019-08-12

Test Results: Complies

RF conducted power to 25 GHz see attached plots.

Maximum RF level outside operating band:

RF ch 2412MHz: 39.32 dBc, margin: 9.32 dB

RF ch 2437MHz: 48.69 dBc, margin >10 dB

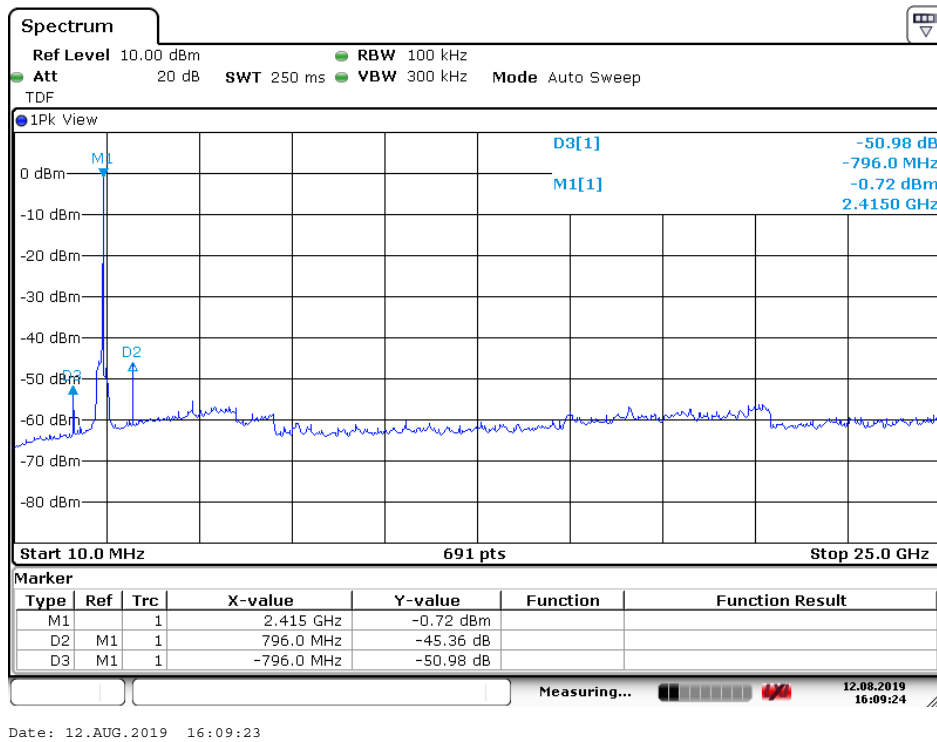
RF ch 2462MHz: 46.66 dBc, margin >10 dB

Limit

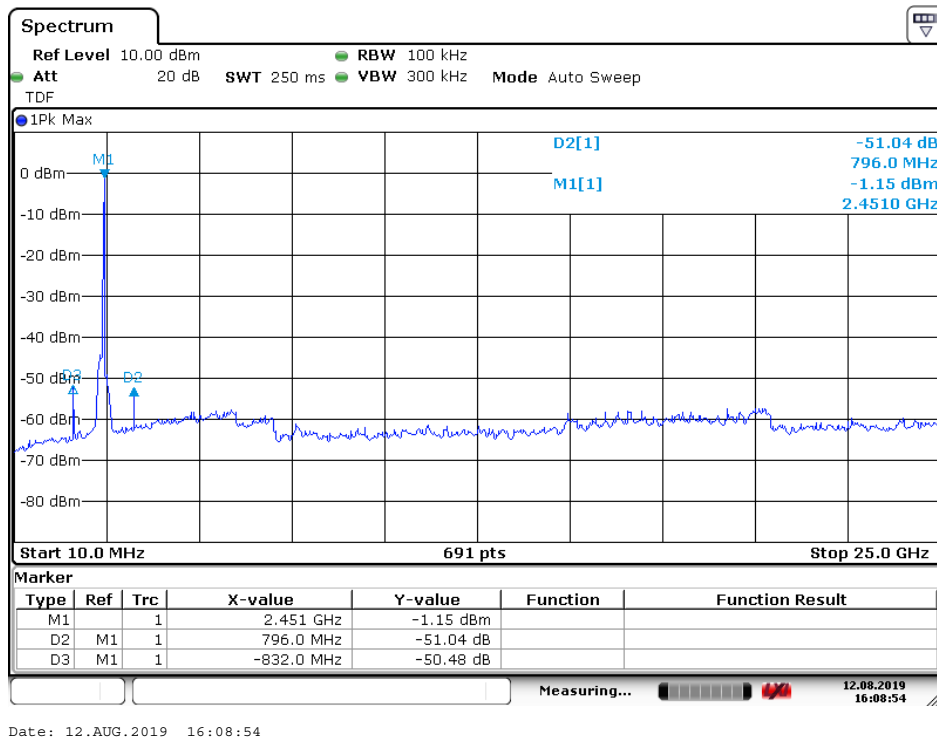
Peak measurement	RMS averaging
20 dBc or more in 100 kHz bandwidth	30 dBc or more in 100 kHz bandwidth

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

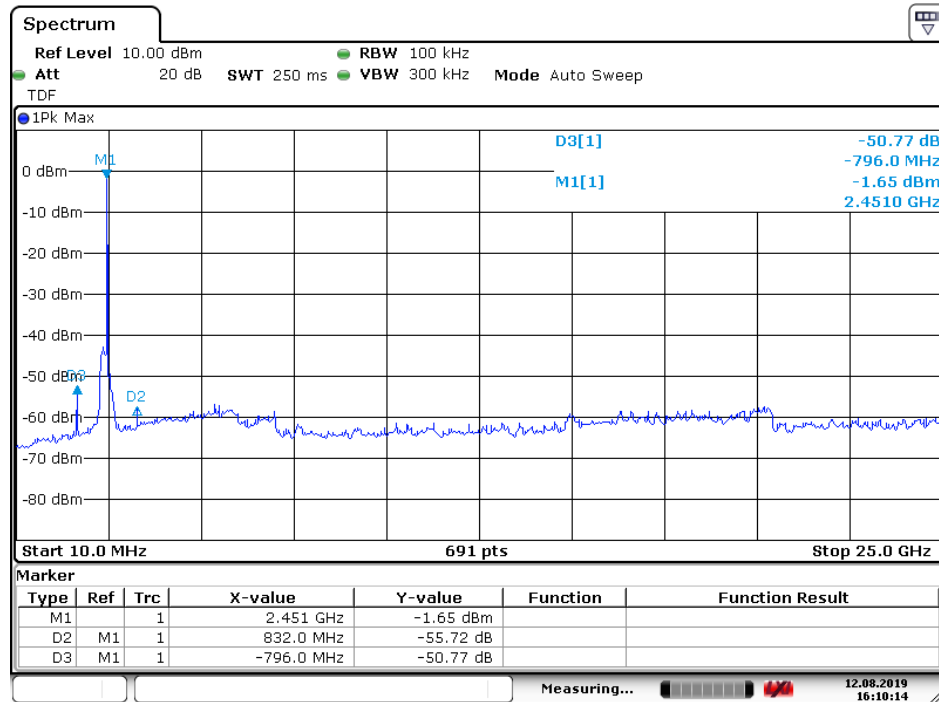
Attenuation below the general limits specified in part 15.209(a) is not required.



Conducted emissions 10MHz – 25GHz - 2412MHz, 1 Mbps

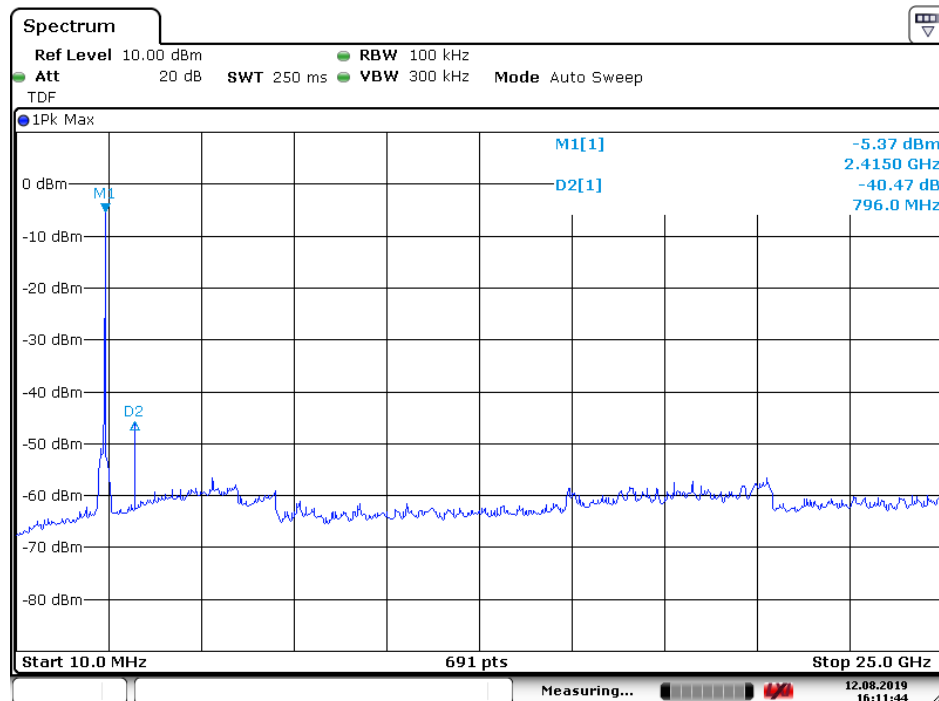


Conducted emissions 10MHz – 25GHz - 2437MHz, 1 Mbps



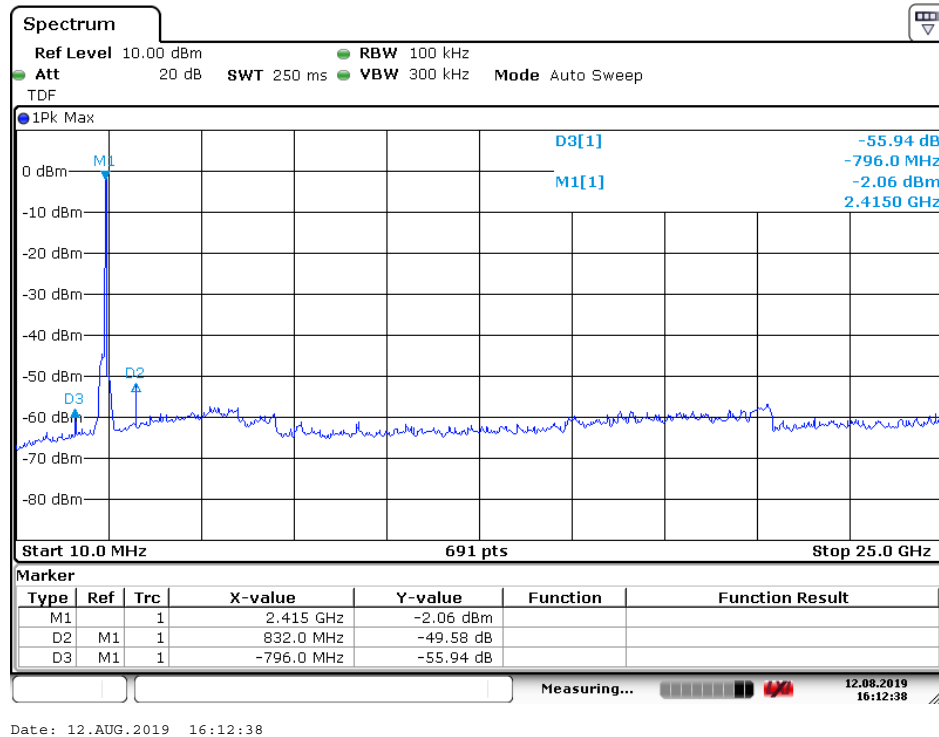
Date: 12.AUG.2019 16:10:14

Conducted emissions 10MHz – 25GHz - 2462MHz, 1 Mbps

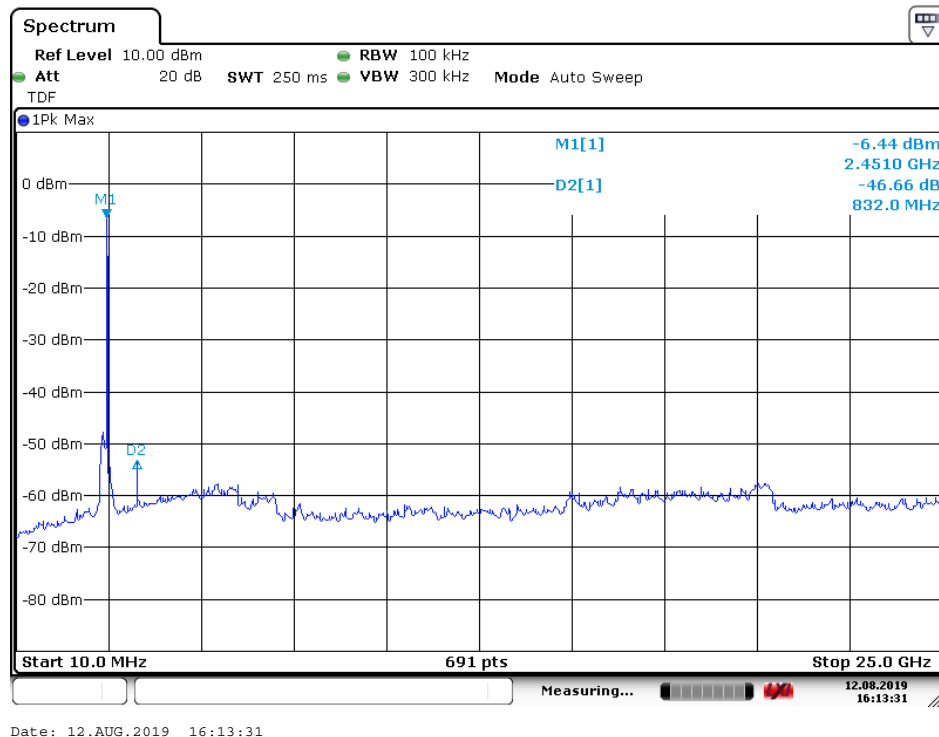


Date: 12.AUG.2019 16:11:44

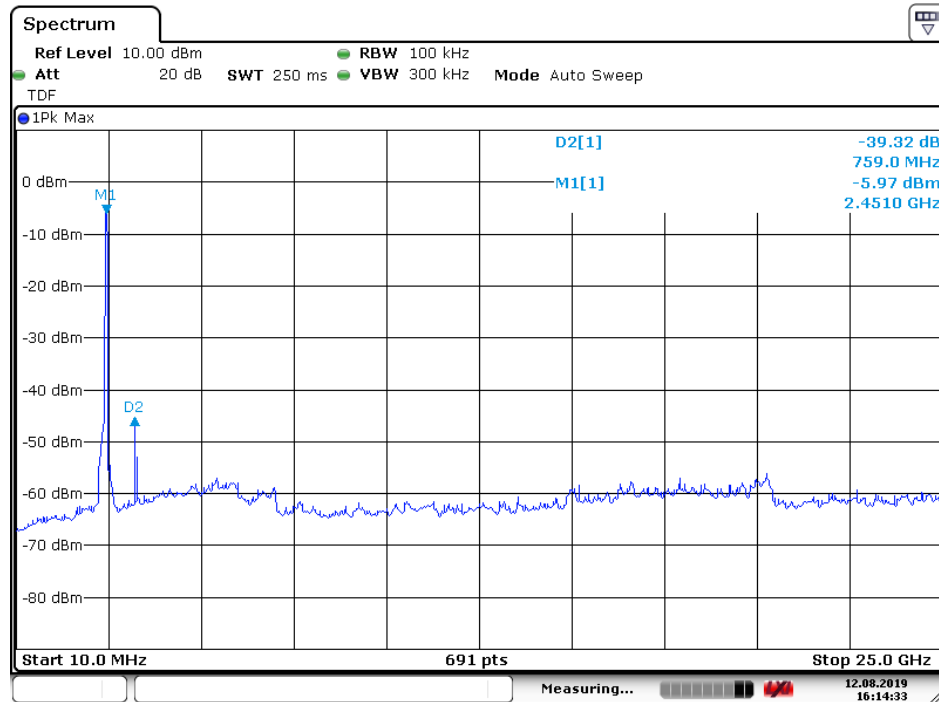
Conducted emissions 10MHz – 25GHz - 2412MHz, 6 Mbps



Conducted emissions 10MHz – 25GHz - 2437MHz, 6 Mbps

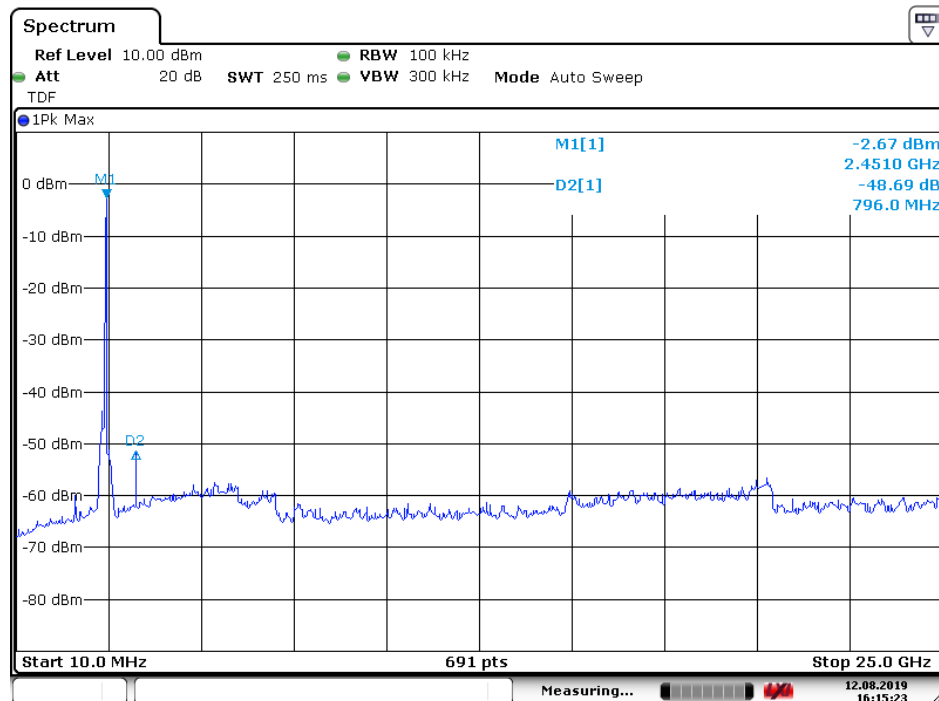


Conducted emissions 10MHz – 25GHz - 2462MHz, 6 Mbps



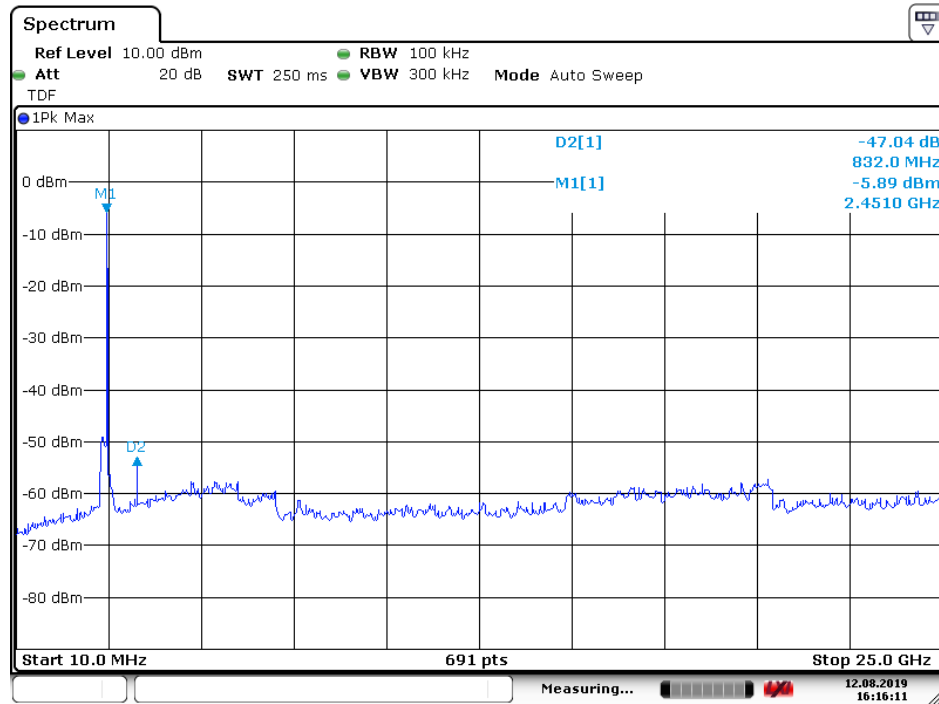
Date: 12.AUG.2019 16:14:33

Conducted emissions 10MHz – 25GHz - 2412MHz, MCS 0



Date: 12.AUG.2019 16:15:23

Conducted emissions 10MHz – 25GHz - 2437MHz, MCS 0



Date: 12.AUG.2019 16:16:11

Conducted emissions 10MHz – 25GHz - 2462MHz, MCS 0

3.7 Restricted Bands of operation

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

Generally, no fundamentals are allowed in the restricted bands and all emissions must comply with the limits in FCC 15.209 or RSS-GEN, Issue 4, clause 8.9.

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

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

3.8 Spurious Emissions (Radiated)

Para. No.: 15.247 (c)

Para. No.: 5.5 (RSS-247)

Test Performed By: Frederic Hupbauer

Date of Test: 2019-08-08, 2019-08-09

Test Results: Complies

Band-edge, @3m

Peak detector:

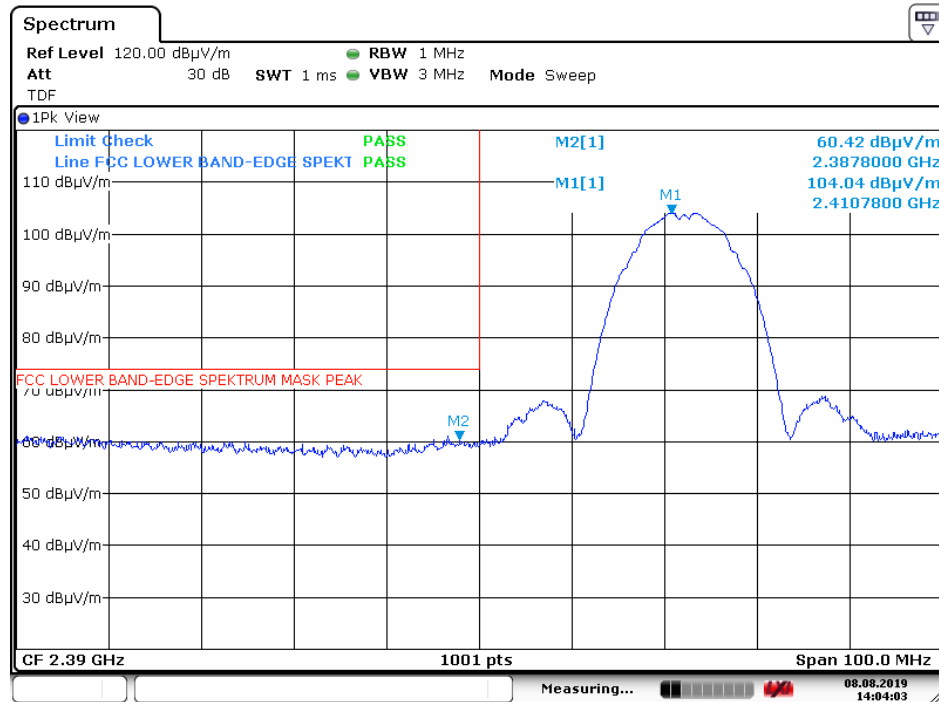
Modulation type and bitrate	Measured field strength (dBμV/m)		Limit (dB)	Margin (dB)	
	2390 MHz	2483,5 MHz		-	
802.11b, 1 Mbps	60.4	61.8	74	13.6	12.2
802.11g, 6 Mbps	64.0	62.5	74	10.0	11.5
802.11n, MCS 0	65.4	65.4	74	8.6	8.6

Average detector:

Modulation type and bitrate	Measured field strength (dBμV/m)		Limit (dB)	Margin (dB)	
	2390 MHz	2483,5 MHz		-	
802.11b, 1 Mbps	39.9	44.0	54	14.1	10.0
802.11g, 6 Mbps	39.2	43.1	54	14.8	10.9
802.11n, MCS 0	38.8	44.1	54	15.2	9.9

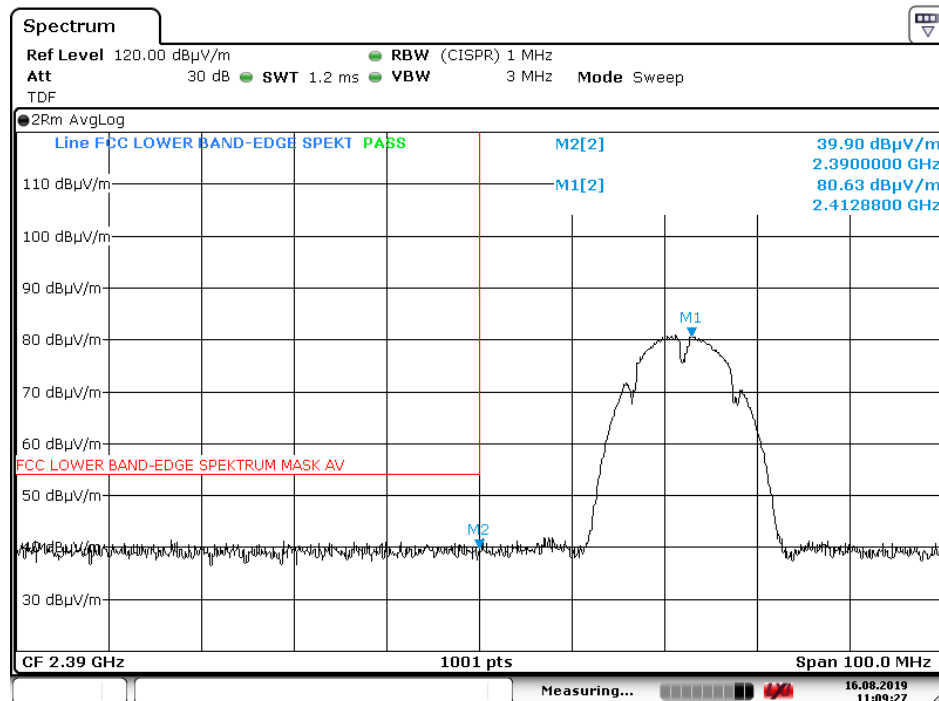
Average values are measured with RMS detector and trace averaging (Duty Cycle ≈ 100%).

See attached plots.



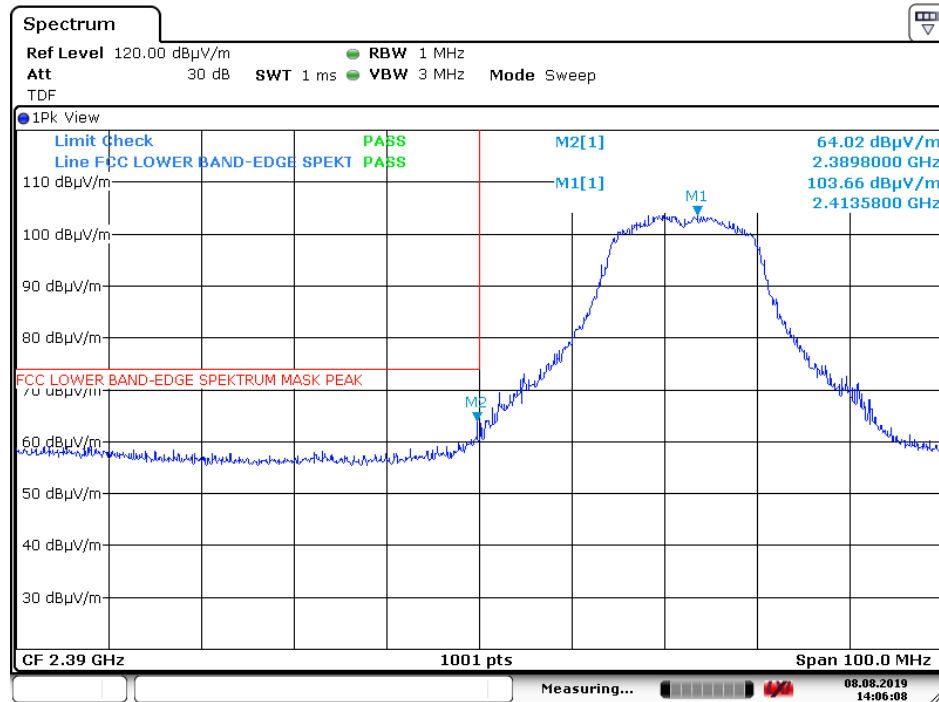
Date: 8.AUG.2019 14:04:03

Lower Band Edge, Peak, 2412MHz, 1 Mbps



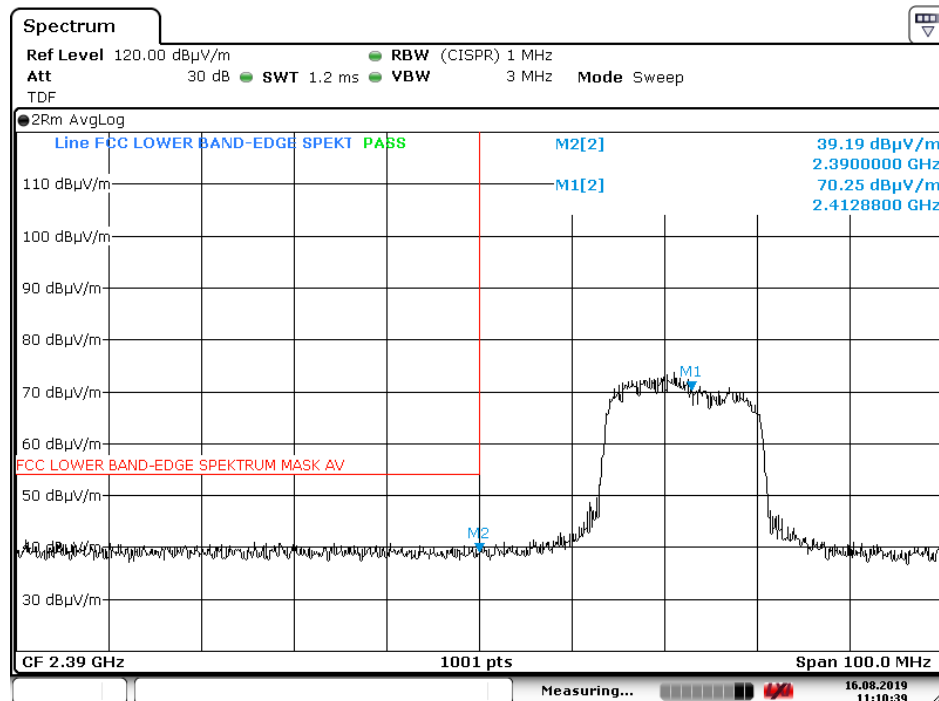
Date: 16.AUG.2019 11:09:28

Lower Band Edge, Average, 2412MHz, 1 Mbps



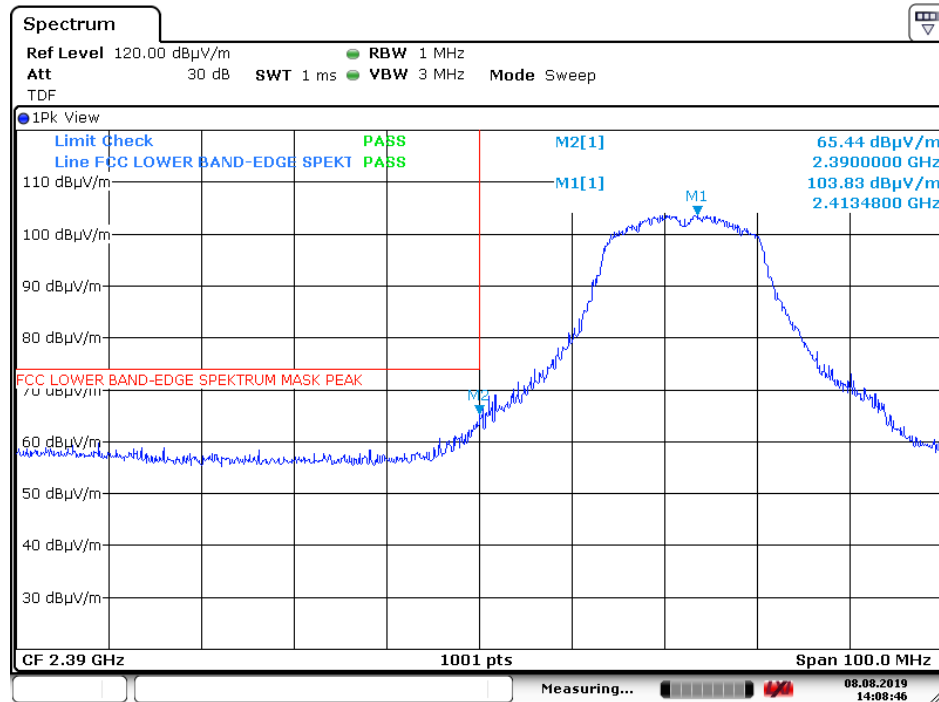
Date: 8.AUG.2019 14:06:09

Lower Band Edge, Peak, 2412MHz, 6 Mbps



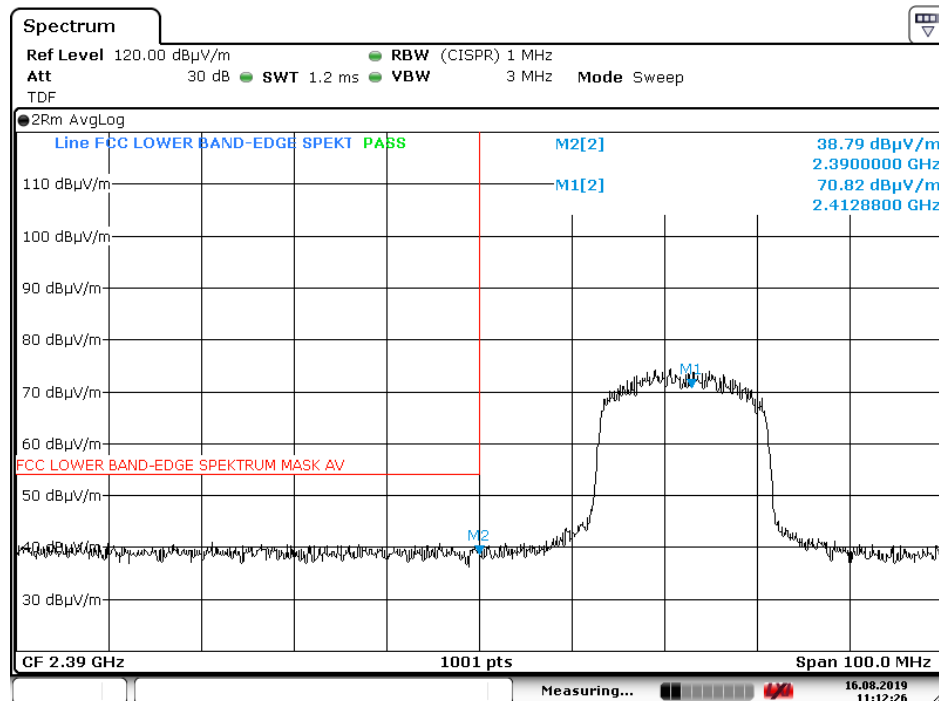
Date: 16.AUG.2019 11:10:40

Lower Band Edge, Average, 2412MHz, 6 Mbps



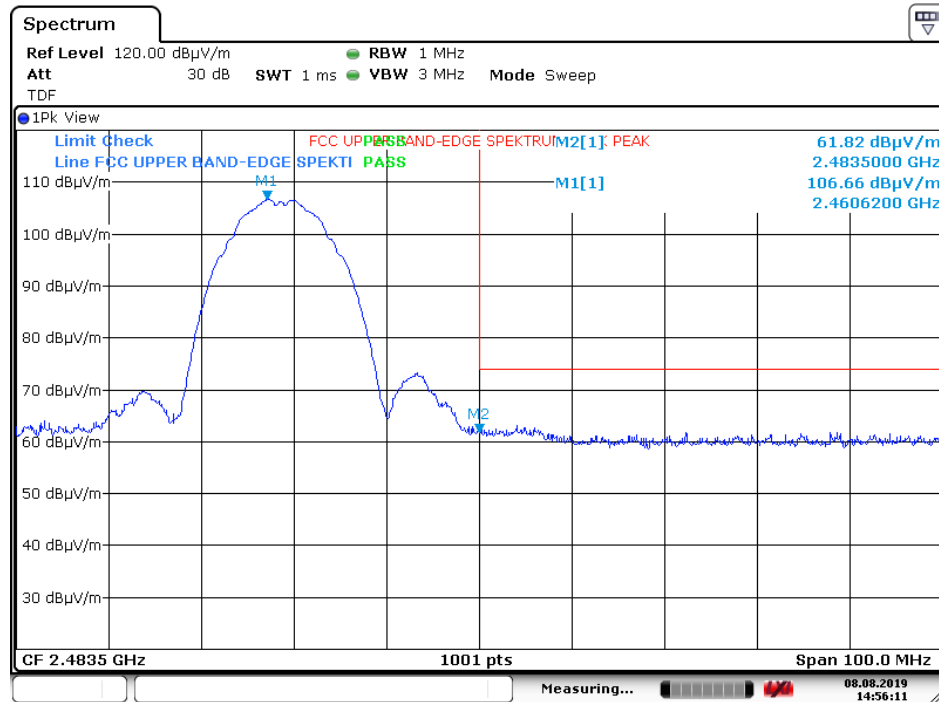
Date: 8.AUG.2019 14:08:47

Lower Band Edge, Peak, 2412MHz, MCS 0



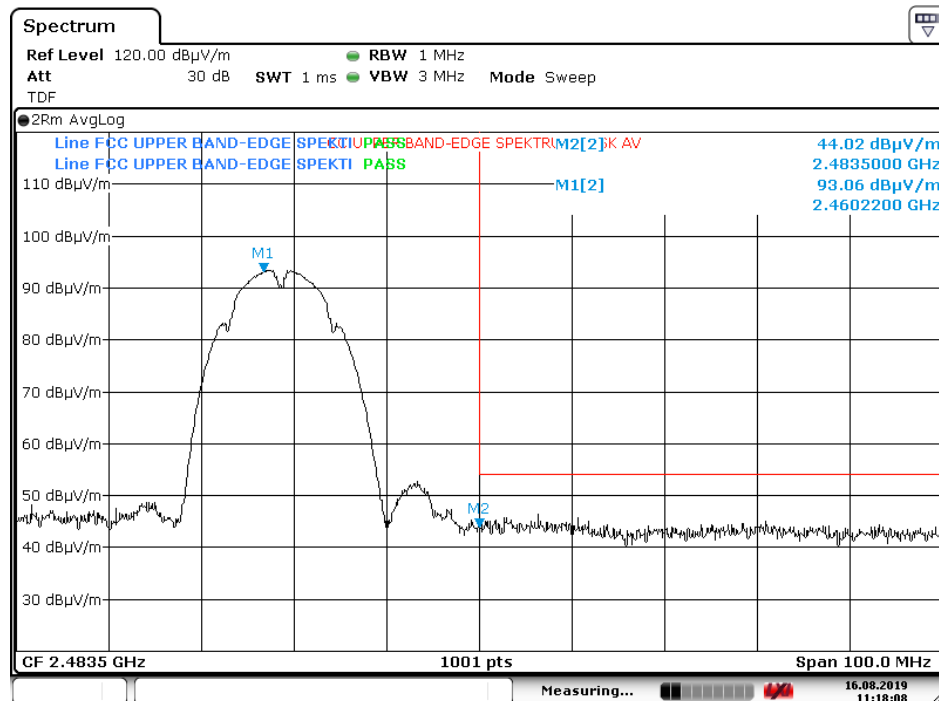
Date: 16.AUG.2019 11:12:27

Lower Band Edge, Average, 2412MHz, MCS 0



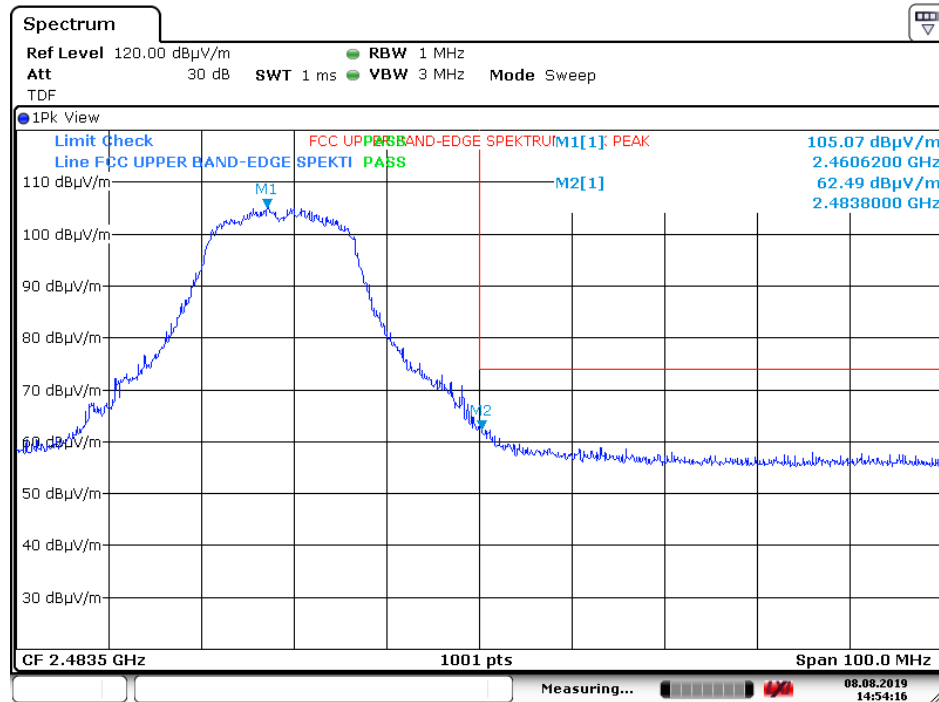
Date: 8.AUG.2019 14:56:12

Upper Band Edge, Peak, 2462MHz, 1 Mbps



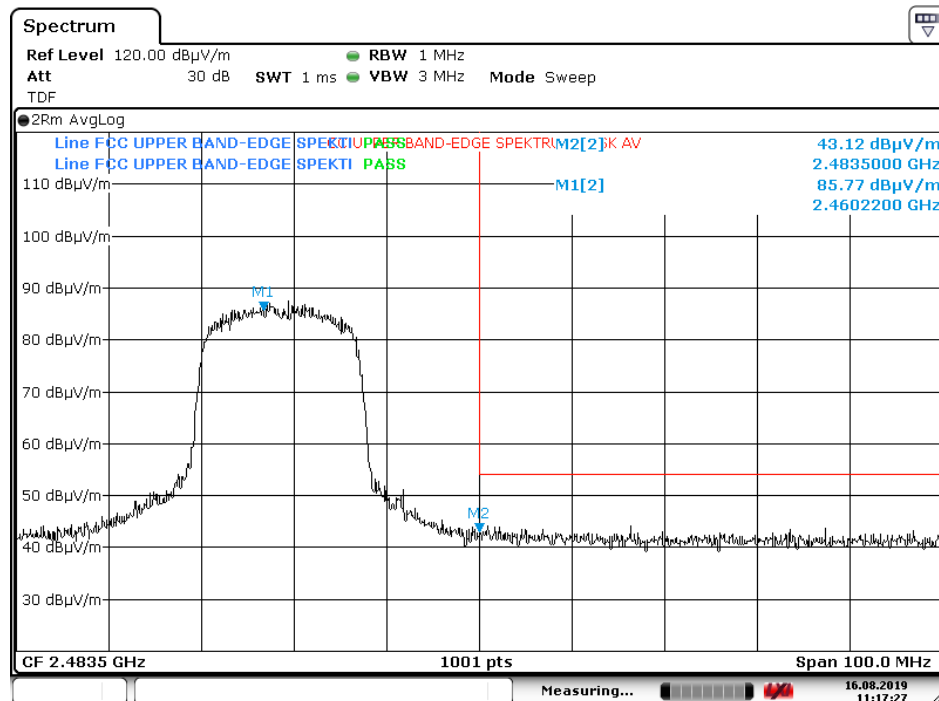
Date: 16.AUG.2019 11:18:08

Upper Band Edge, Average, 2462MHz, 1 Mbps



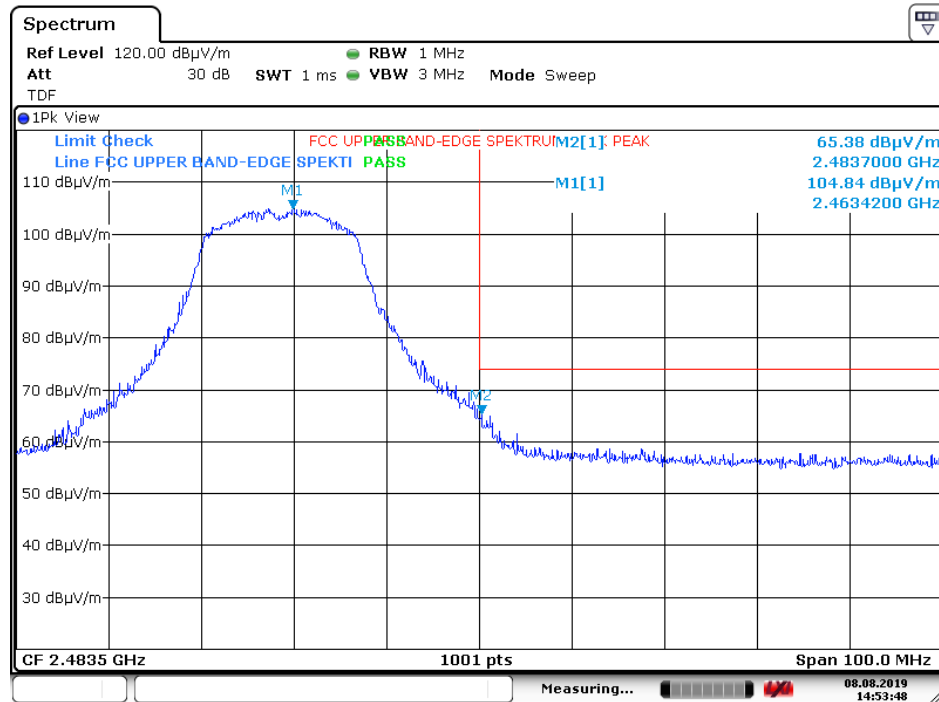
Date: 8.AUG.2019 14:54:16

Upper Band Edge, Peak, 2462MHz, 6 Mbps



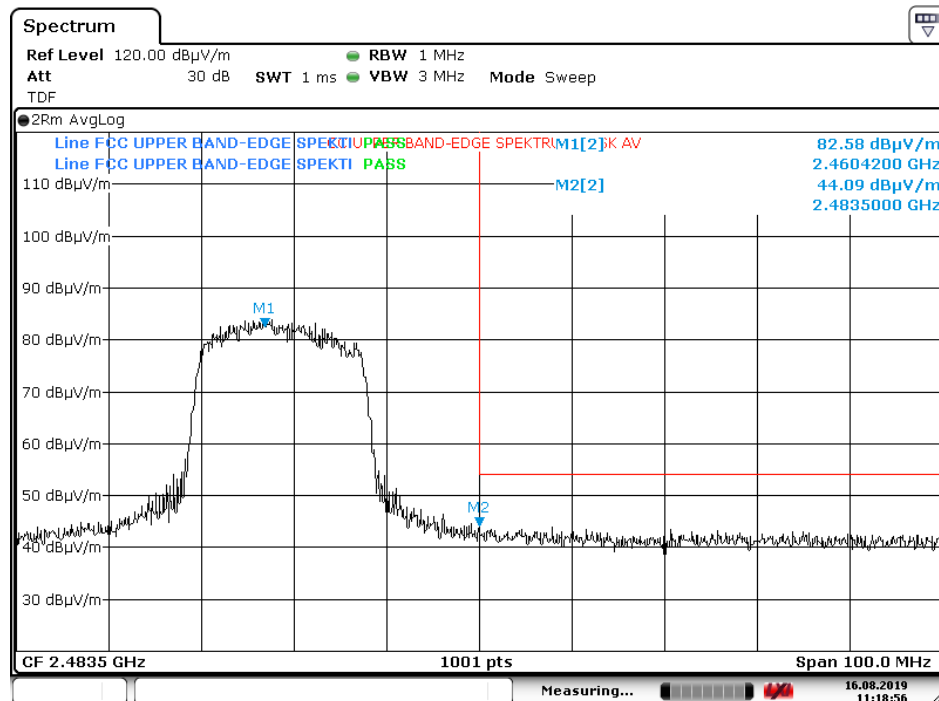
Date: 16.AUG.2019 11:17:28

Upper Band Edge, Average, 2462MHz, 6 Mbps



Date: 8.AUG.2019 14:53:49

Upper Band Edge, Peak, 2462MHz, MCS 0



Date: 16.AUG.2019 11:18:57

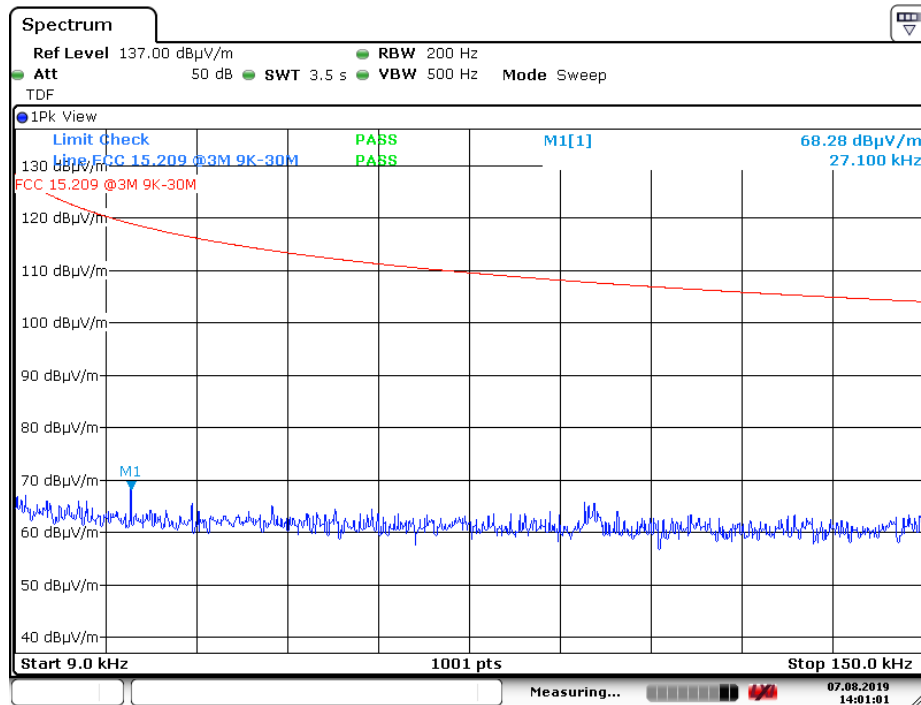
Upper Band Edge, Average, 2462MHz, MCS 0

Radiated emissions 10 kHz-30 MHz.

Measuring distance 3 m, measured with Peak detector.

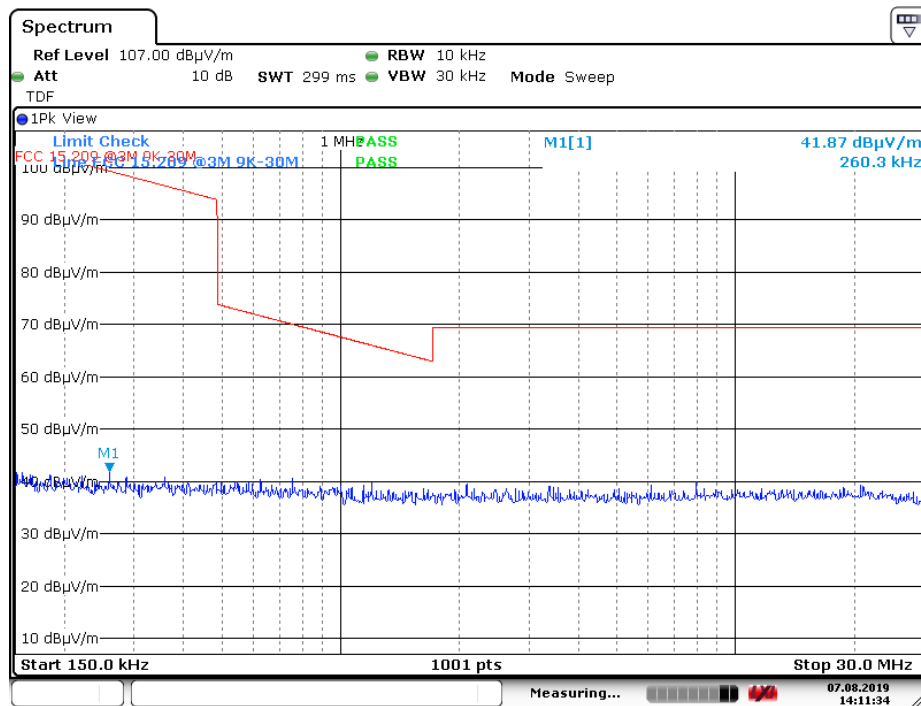
No component detected, see attached graph.

Limit is converted to 3 m using 40 dB/decade according to 15.31 (f) (2).



Date: 7.AUG.2019 14:01:02

Radiated Emissions, 9 kHz – 150 kHz @3m



Date: 7.AUG.2019 14:11:34

Radiated Emissions, 150 kHz - 30MHz @3m

Radiated emission 30 – 1000 MHz.

Detector: Peak

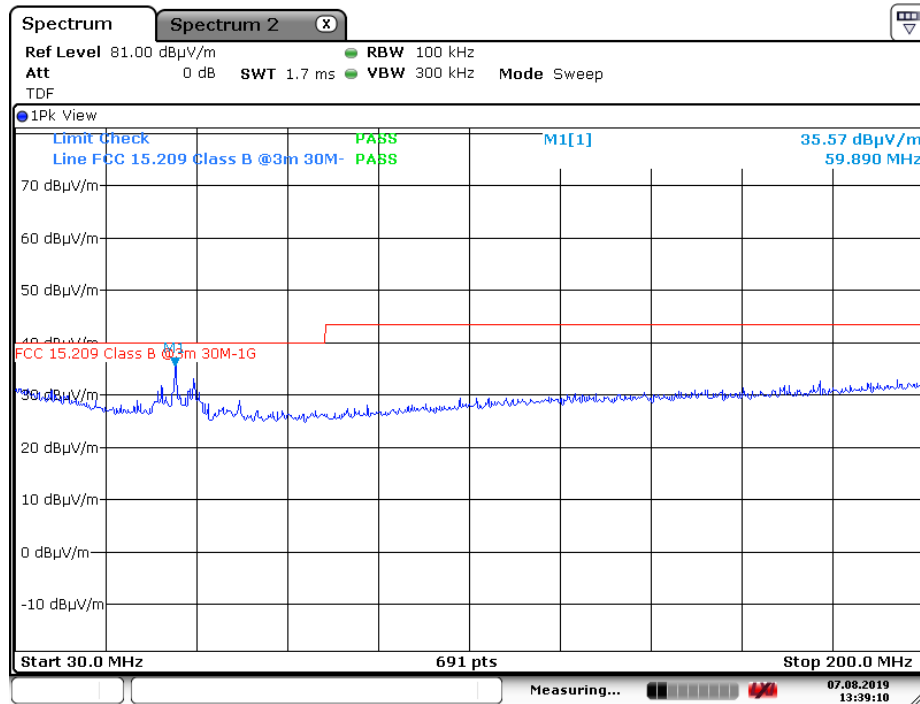
Measuring distance 3 m.

Measured Frequency (MHz)	Carrier Frequency (MHz)	Modulation	Measured Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
30 - 88	2412	6 Mbps	35.57	40.0	4.43
88 - 216	2412	6 Mbps	33.19	43.5	10.31
216 - 960	2412	6 Mbps	44.55	46.0	1.45
960 - 1000	2412	6 Mbps	44.82	54.0	9.18

See attached graphs.

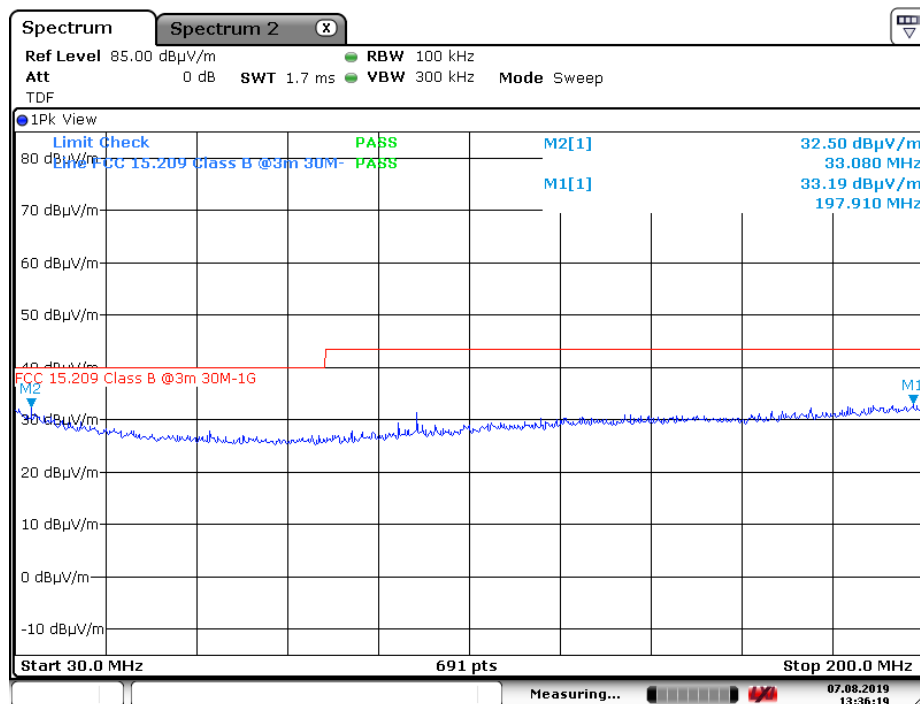
Requirements/Limit

FCC	Part 15.209 @ frequencies defined in §15.205	
ISED	RSS-GEN Issue 4, Clause 8.9 @ frequencies defined in clause 8.10	
	Radiated emission limit @3 meters	
Frequency (MHz)	Quasi Peak (µV/m)	Quasi Peak (dBµV/m)
30 – 88	100	40.0
88 – 216	150	43.5
216 – 960	200	46.0
Above 960	500	54.0



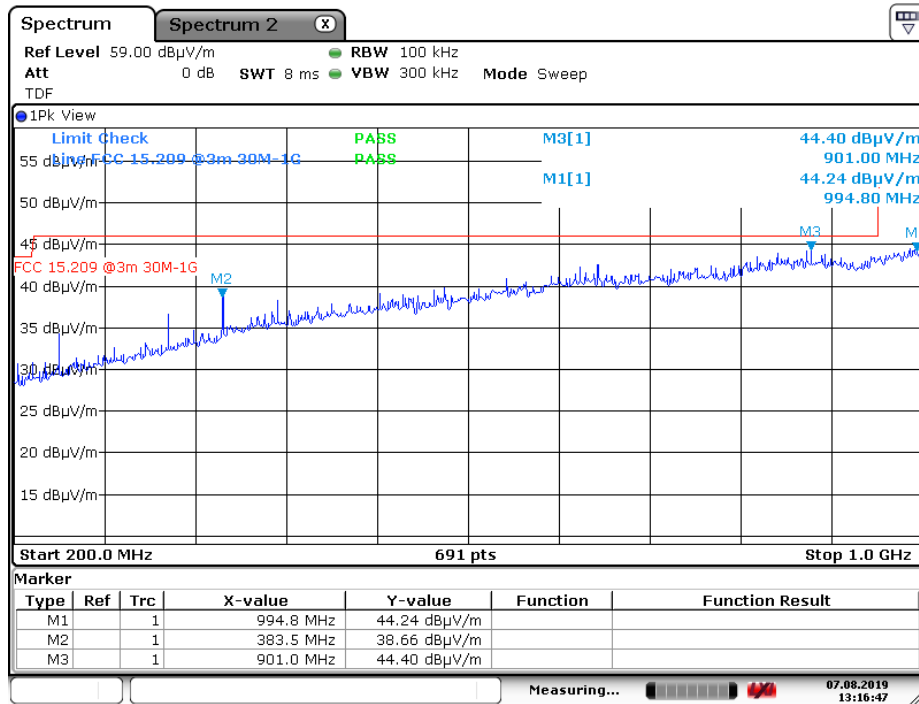
Date: 7.AUG.2019 13:39:11

Radiated Emissions, 30 – 200 MHz, VP, @3m, PK scan



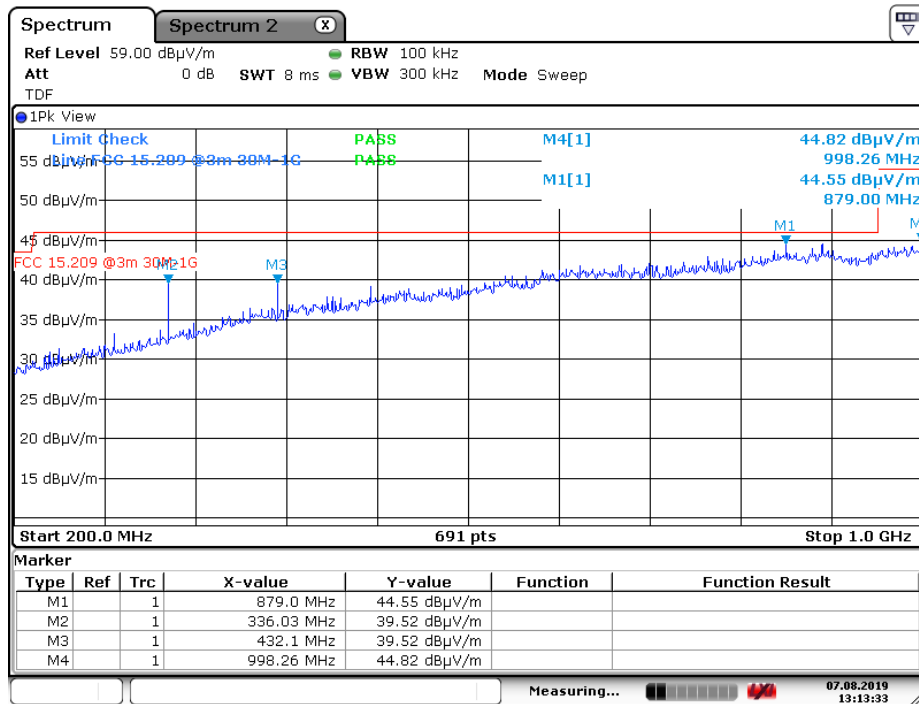
Date: 7.AUG.2019 13:36:20

Radiated Emissions, 30 – 200 MHz, HP, @3m, PK scan



Date: 7.AUG.2019 13:16:47

Radiated Emissions, 200 - 1000 MHz, VP, @3m, PK scan



Date: 7.AUG.2019 13:13:34

Radiated Emissions, 200 - 1000MHz, HP, @3m, PK scan

Radiated Emissions, 1-25 GHz

Measuring distance: 3m (1 – 25 GHz)

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

Peak Detector:

Measured Frequency (GHz)	Carrier Frequency (MHz)	Modulation	Measured Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
6.43	2412	1 Mbps	59.18	74	14.82
6.50	2437	1 Mbps	59.19	74	14.81
6.57	2462	1 Mbps	57.07	74	16.93
6.43	2412	6 Mbps	58.21	74	15.79
4.06	2437	6 Mbps	57.12	74	16.88
6.50	2437	6 Mbps	61.05	74	12.95
6.57	2462	6 Mbps	56.47	74	17.53
6.43	2412	MCS 0	58.63	74	15.37
6.50	2437	MCS 0	60.85	74	13.15
6.57	2462	MCS 0	56.25	74	17.75
Other freqs.	-	-	<54	74	>20

Average Detector:

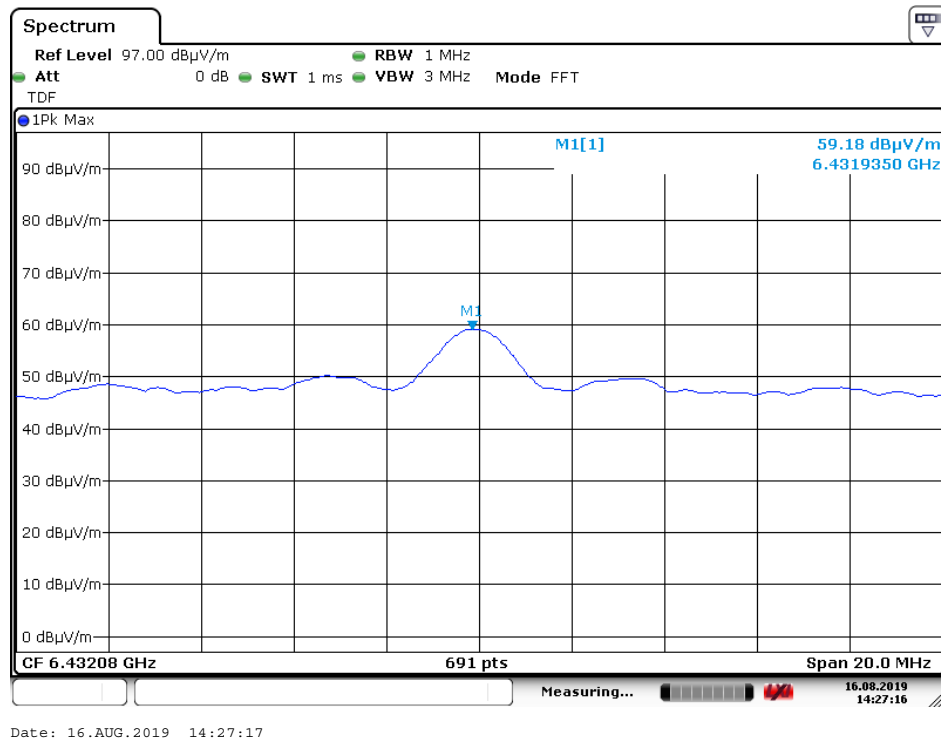
Measured Frequency (GHz)	Carrier Frequency (MHz)	Modulation	Measured Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
6.43	2412	1 Mbps	52.80	54	1.2
6.50	2437	1 Mbps	52.85	54	1.15
6.57	2462	1 Mbps	52.90	54	1.1
6.43	2412	6 Mbps	53.07	54	0.93
4.06	2437	6 Mbps	44.40	54	9.6
6.50	2437	6 Mbps	53.07	54	0.93
6.57	2462	6 Mbps	49.94	54	4.06
6.43	2412	MCS 0	52.30	54	1.7
6.50	2437	MCS 0	52.92	54	1.08
6.57	2462	MCS 0	50.38	54	3.62
Other freqs.	-	-	<53	54	>1

Tested according to KDB 558074 D01 DTS Meas Guidance v03r05, Section 12.2.5.2

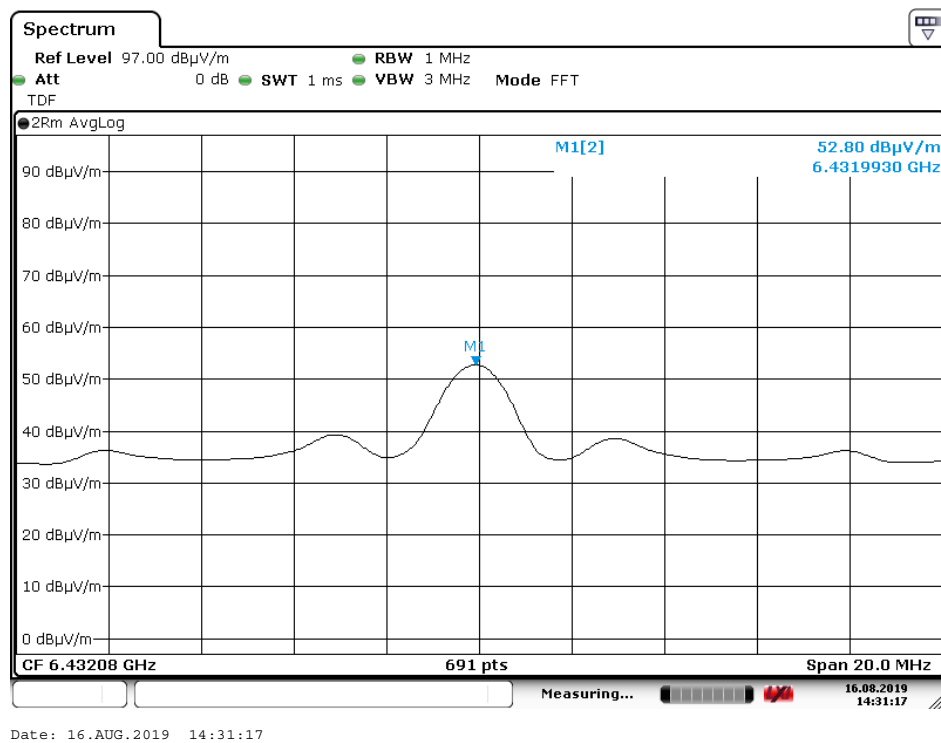
Antenna factor, amplifier gain and cable loss are included in spectrum analyzer "Transducer factor".

See plots.

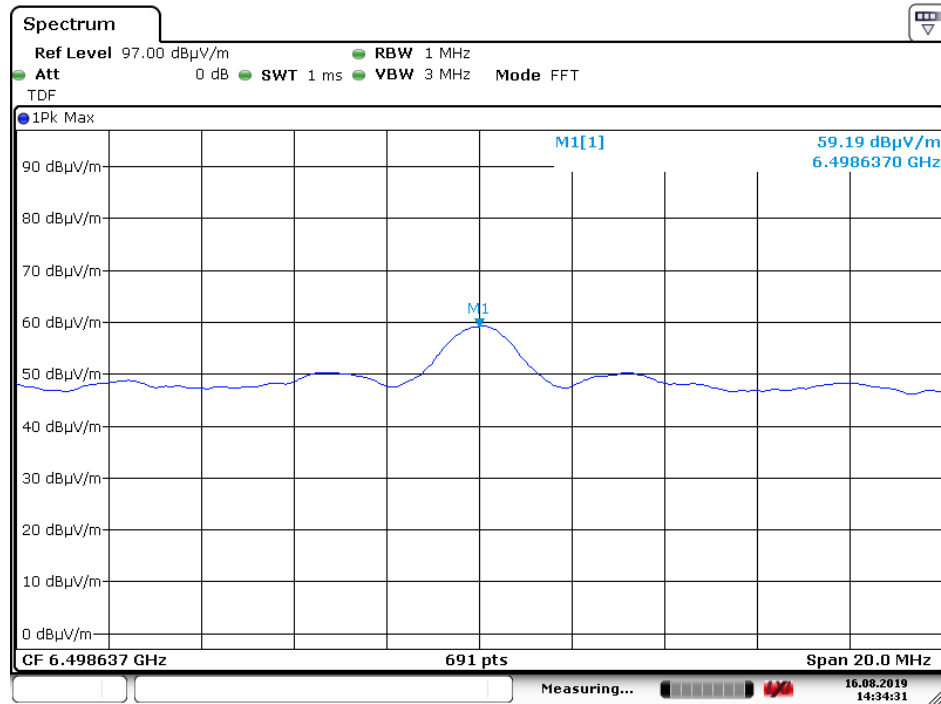
No harmonics detected in the frequency range 18 – 25 GHz



Radiated Emissions, 6.43GHz, 2412MHz, 1 Mbps, HP, Peak

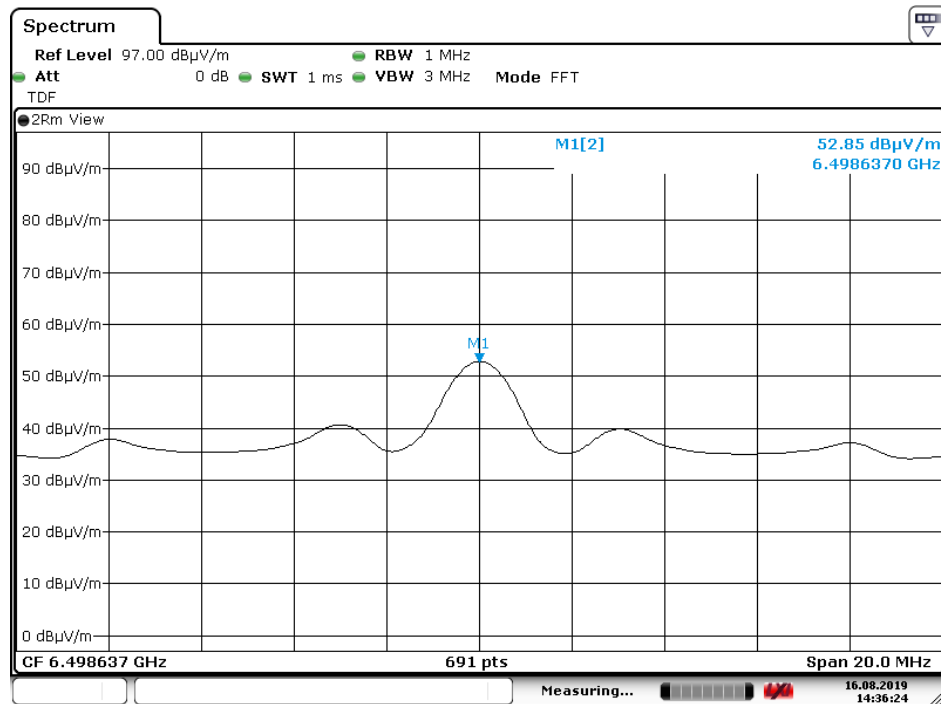


Radiated Emissions, 6.43GHz, 2412MHz, 1 Mbps, HP, Average



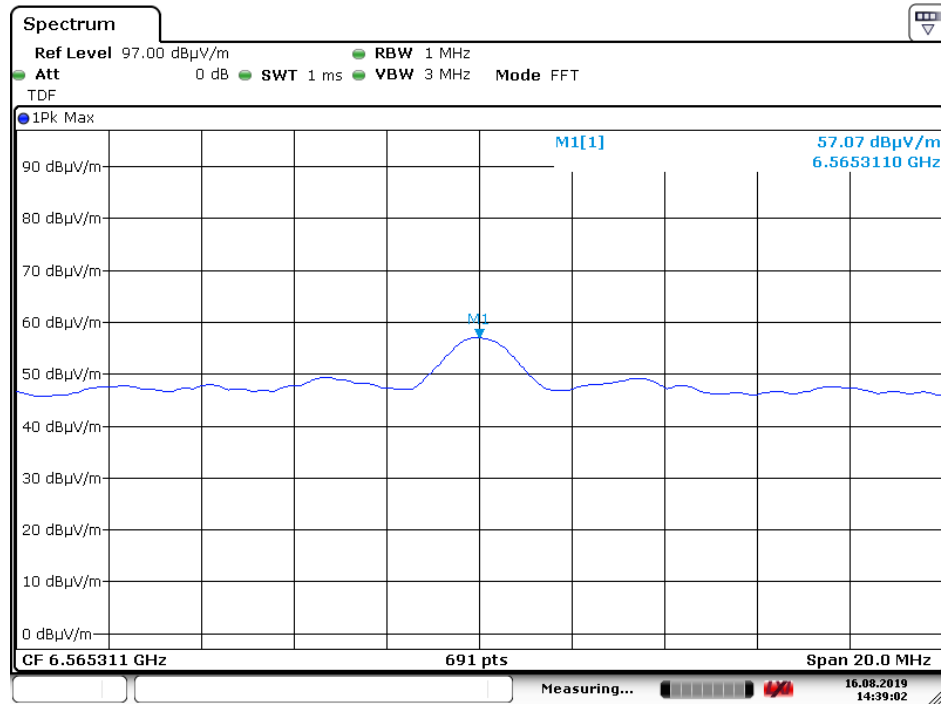
Date: 16.AUG.2019 14:34:31

Radiated Emissions, 6.5GHz, 2437MHz, 1 Mbps, HP, Peak



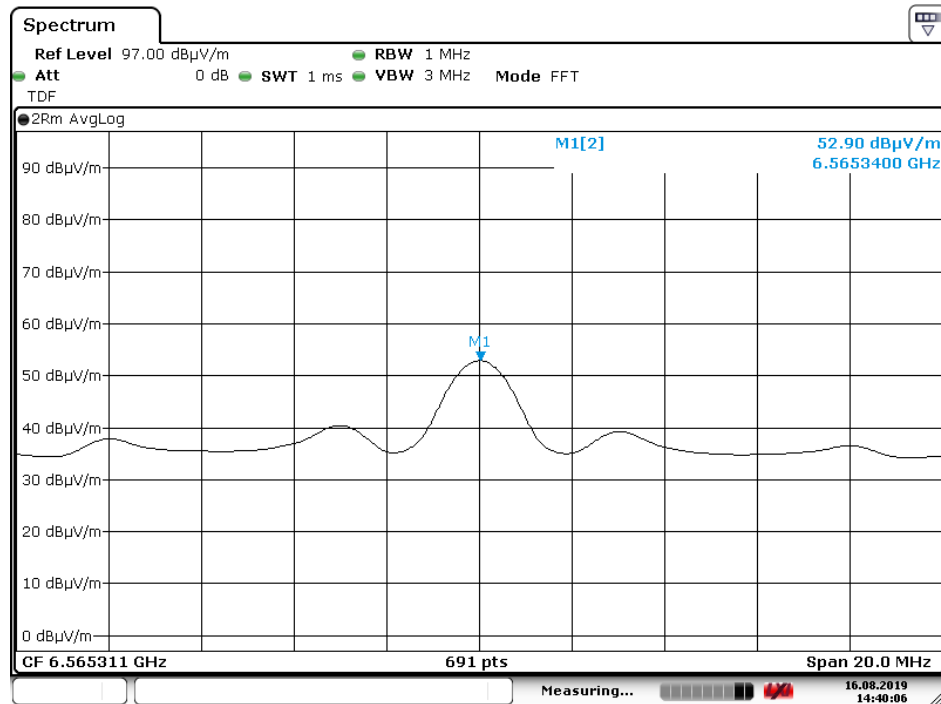
Date: 16.AUG.2019 14:36:25

Radiated Emissions, 6.5GHz, 2437MHz, 1 Mbps, HP, Average



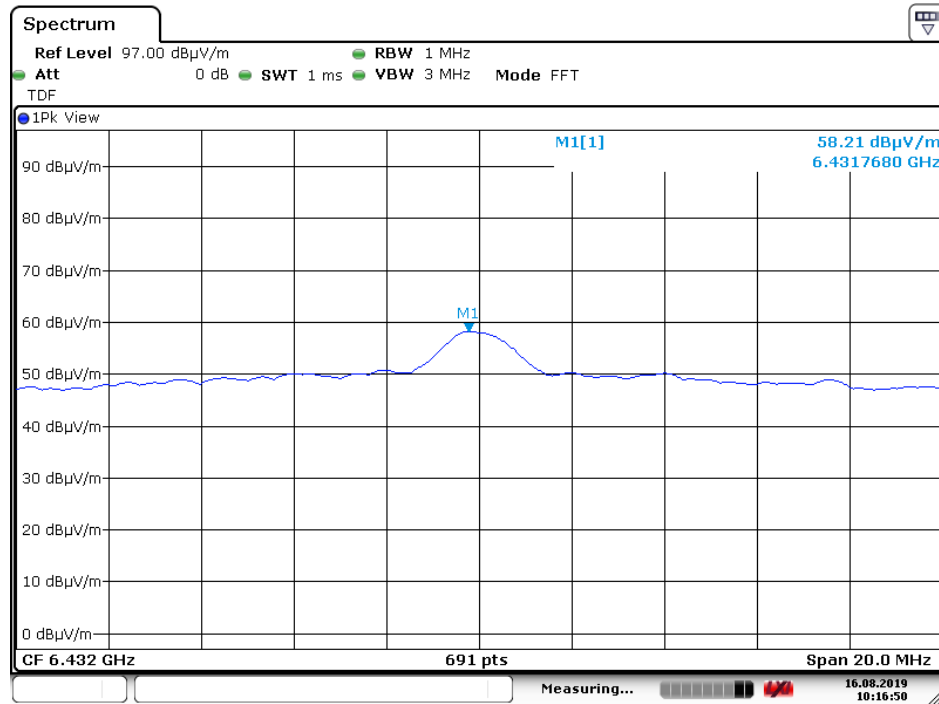
Date: 16.AUG.2019 14:39:02

Radiated Emissions, 6.57GHz, 2462MHz, 1 Mbps, HP, Peak



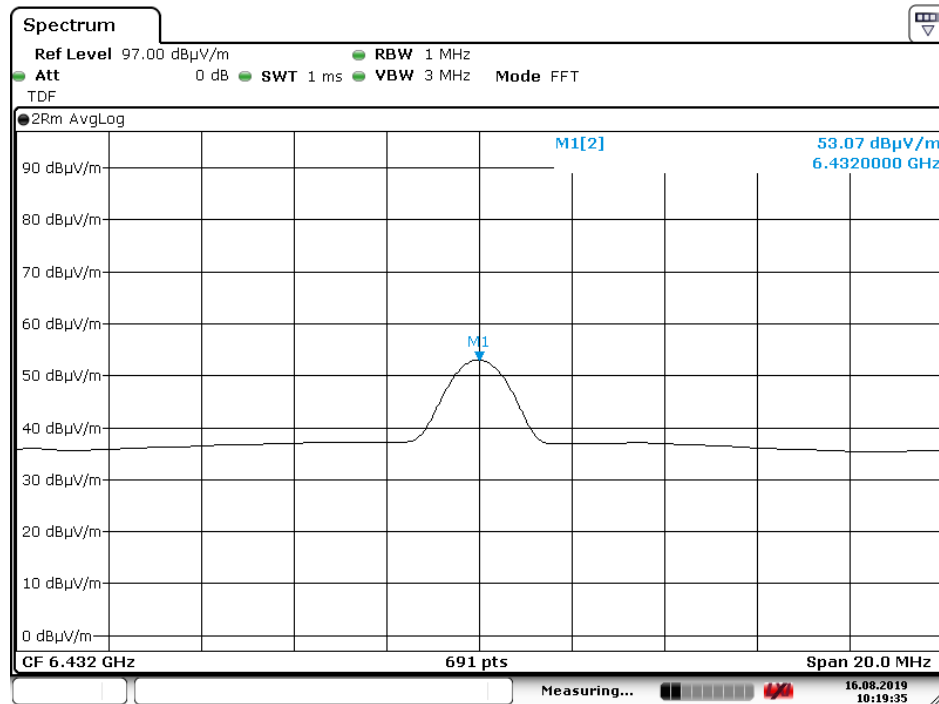
Date: 16.AUG.2019 14:40:07

Radiated Emissions, 6.57GHz, 2462MHz, 1 Mbps, HP, Average



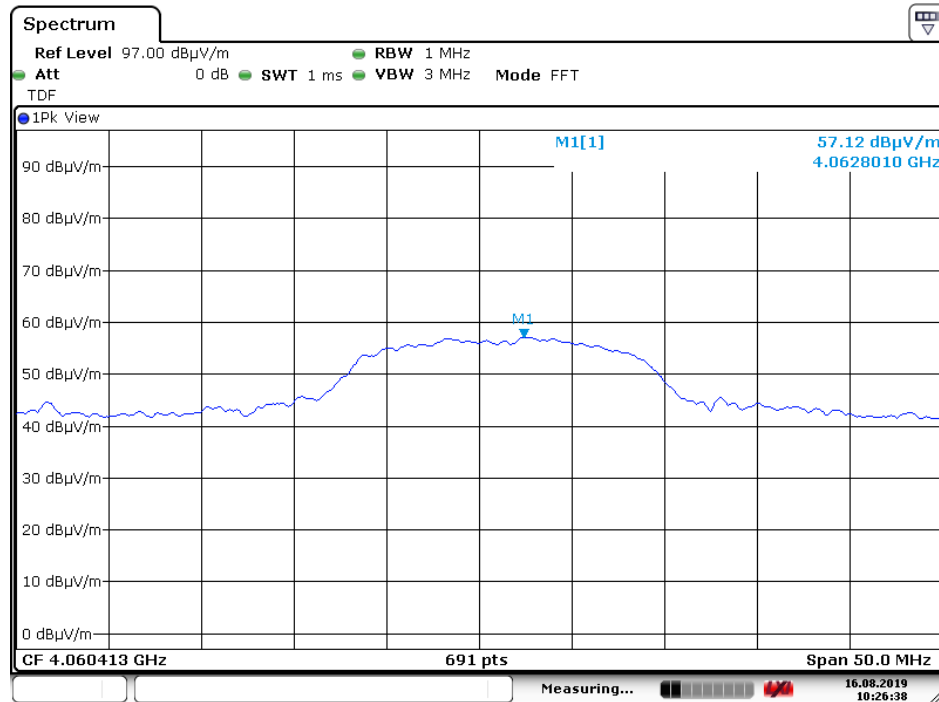
Date: 16.AUG.2019 10:16:50

Radiated Emissions, 6.43GHz, 2412MHz, 6 Mbps, HP, Peak



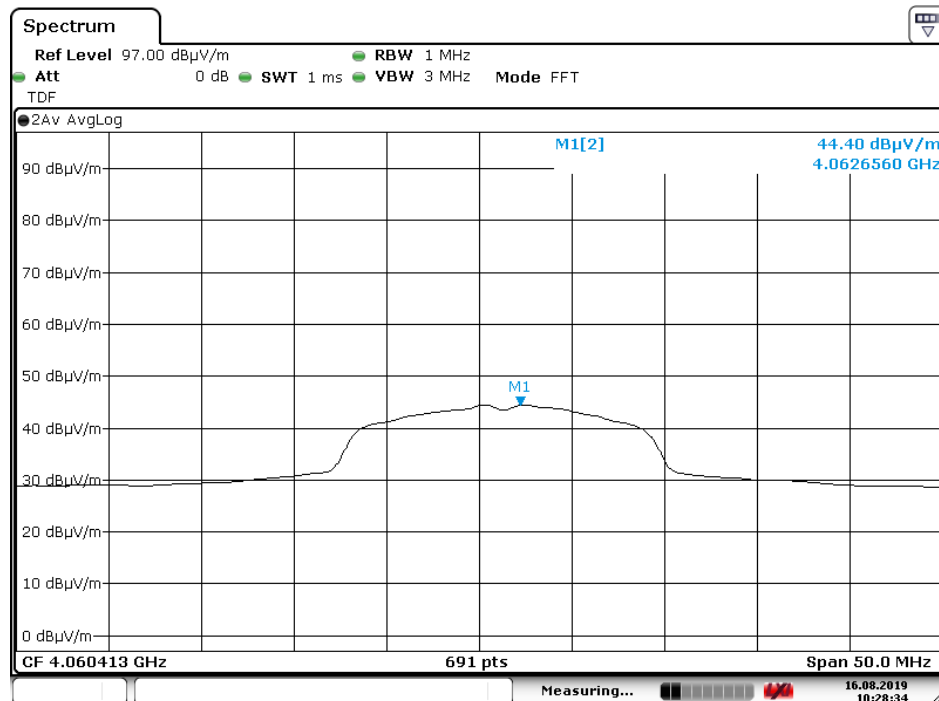
Date: 16.AUG.2019 10:19:36

Radiated Emissions, 6.43GHz, 2412MHz, 6 Mbps, HP, Average



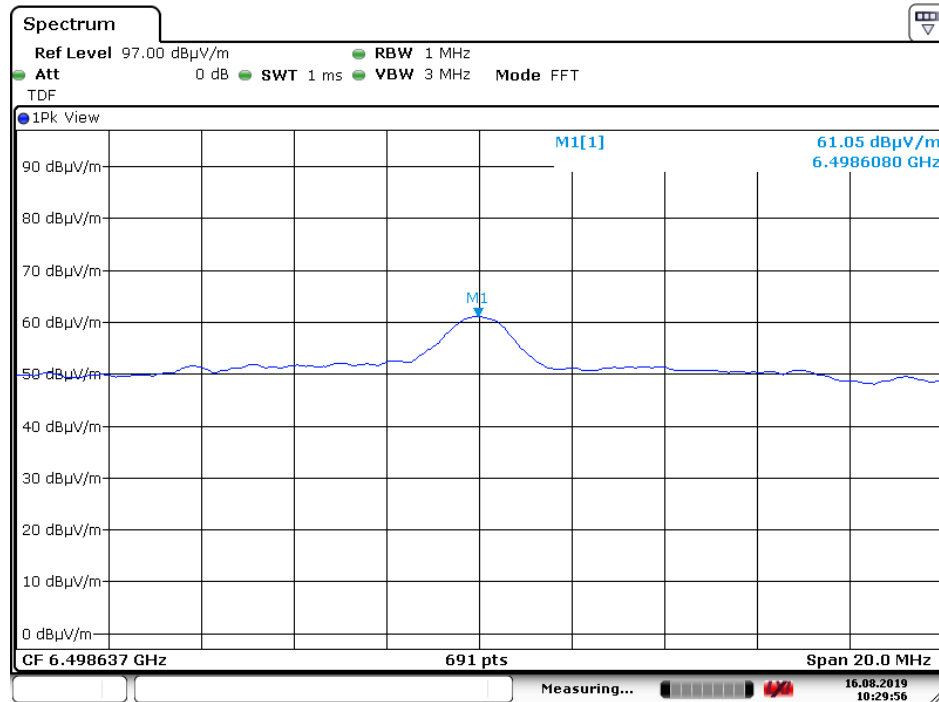
Date: 16.AUG.2019 10:26:39

Radiated Emissions, 4.06GHz, 2437MHz, 6 Mbps, HP, Peak



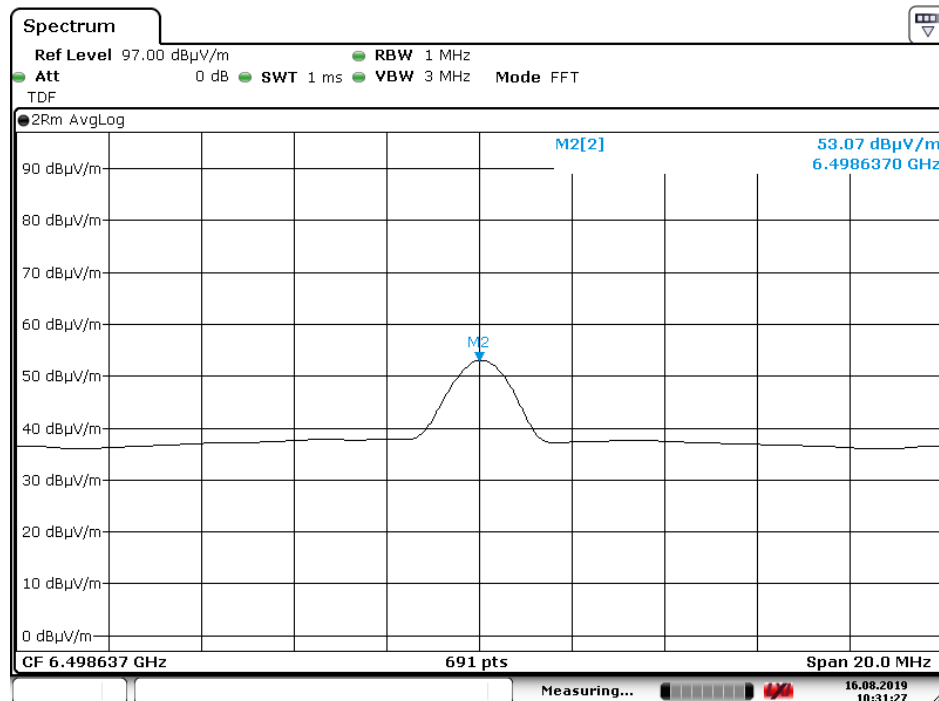
Date: 16.AUG.2019 10:28:34

Radiated Emissions, 4.06GHz, 2437MHz, 6 Mbps, HP, Average



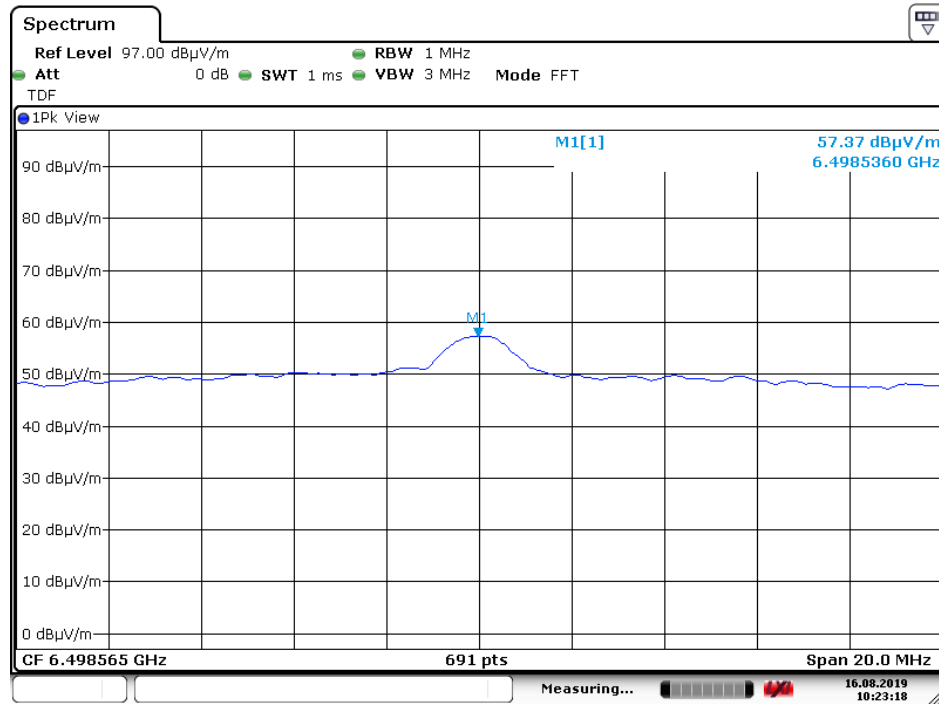
Date: 16.AUG.2019 10:29:56

Radiated Emissions, 6.5GHz, 2437MHz, 6 Mbps, HP, Peak



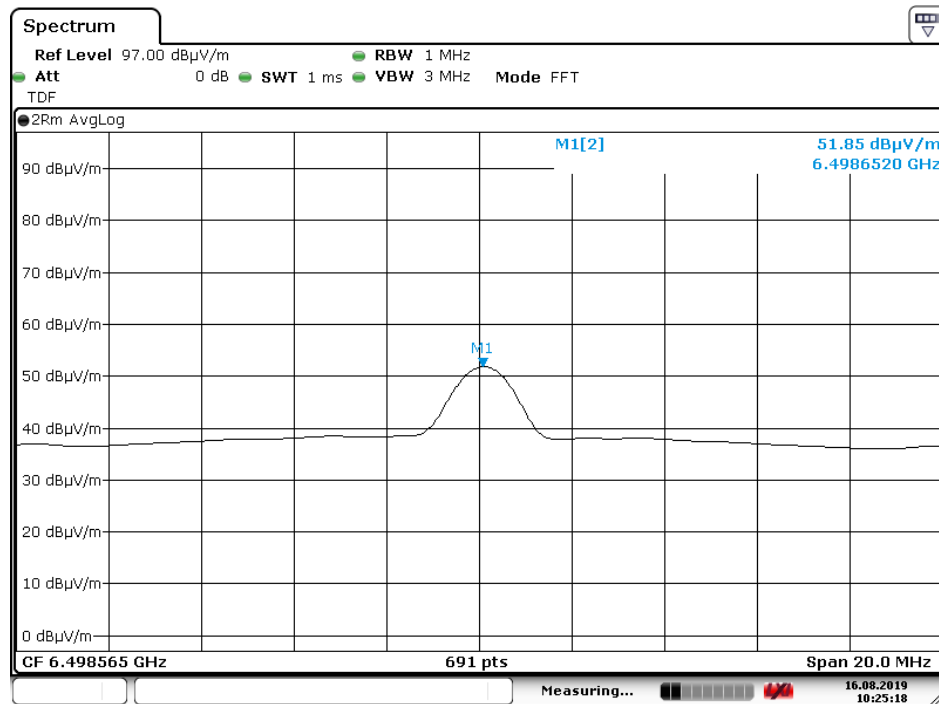
Date: 16.AUG.2019 10:31:28

Radiated Emissions, 6.5GHz, 2437MHz, 6 Mbps, HP, Peak



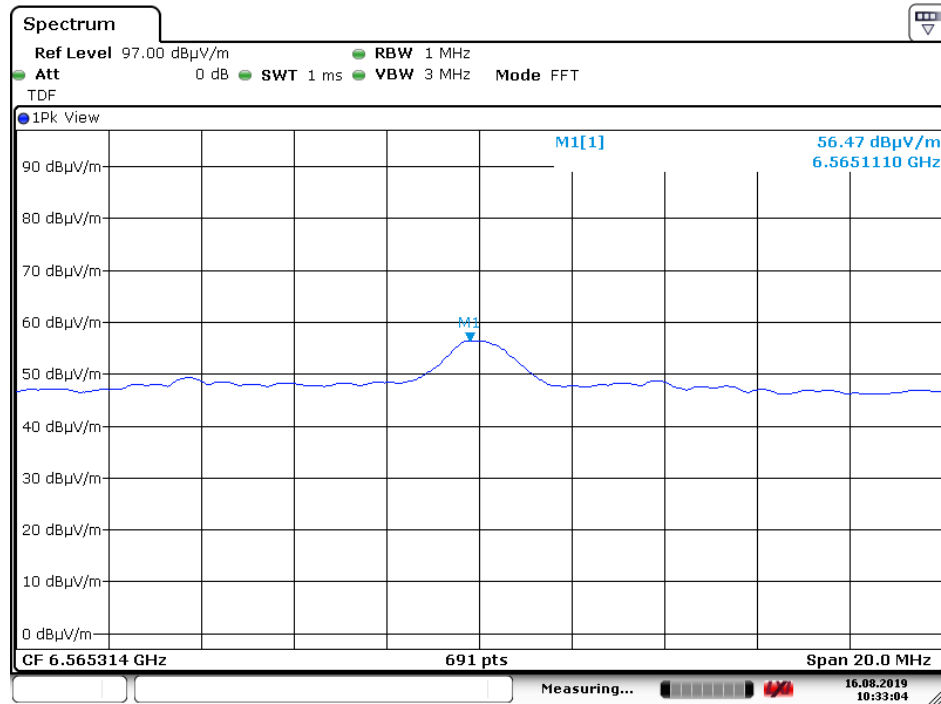
Date: 16.AUG.2019 10:23:18

Radiated Emissions, 6.5GHz, 2437MHz, 6 Mbps, VP, Peak



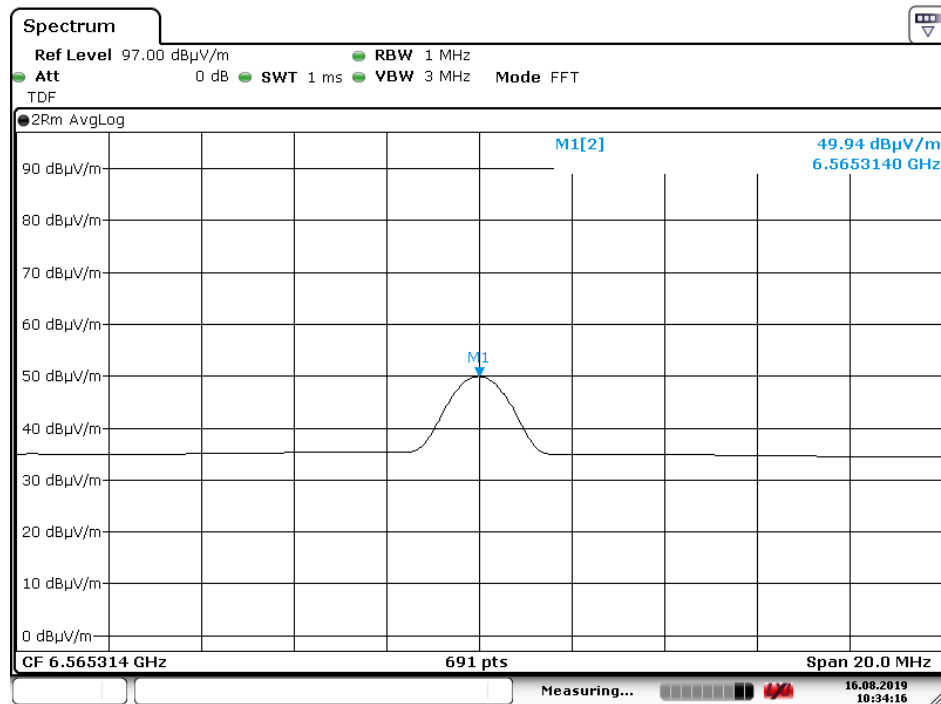
Date: 16.AUG.2019 10:25:19

Radiated Emissions, 6.5GHz, 2437MHz, 6 Mbps, VP, Average



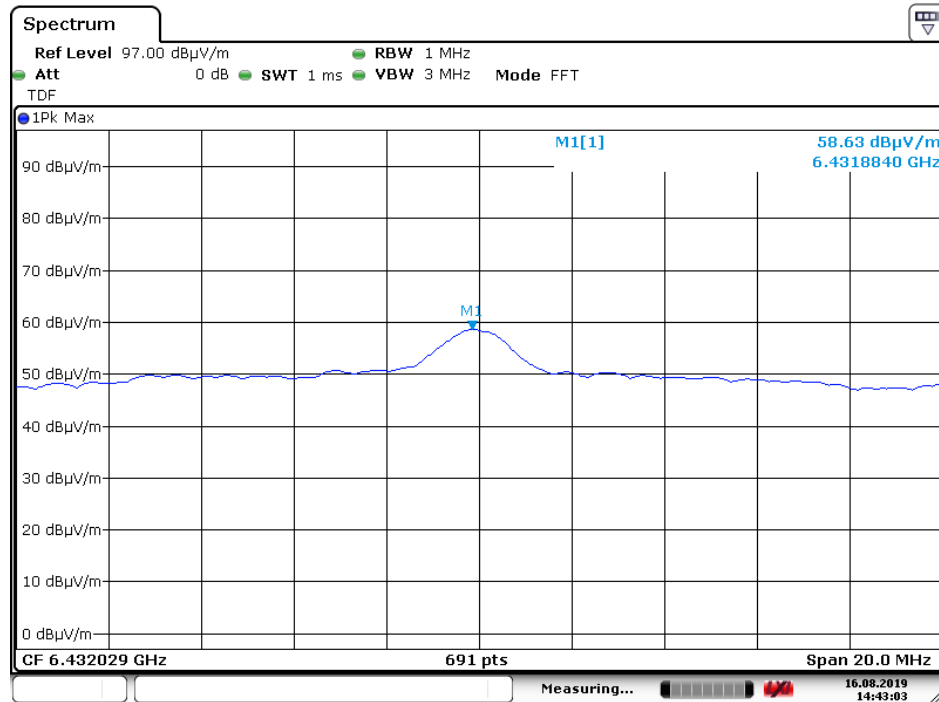
Date: 16.AUG.2019 10:33:05

Radiated Emissions, 6.57GHz, 2462MHz, 6 Mbps, HP, Peak



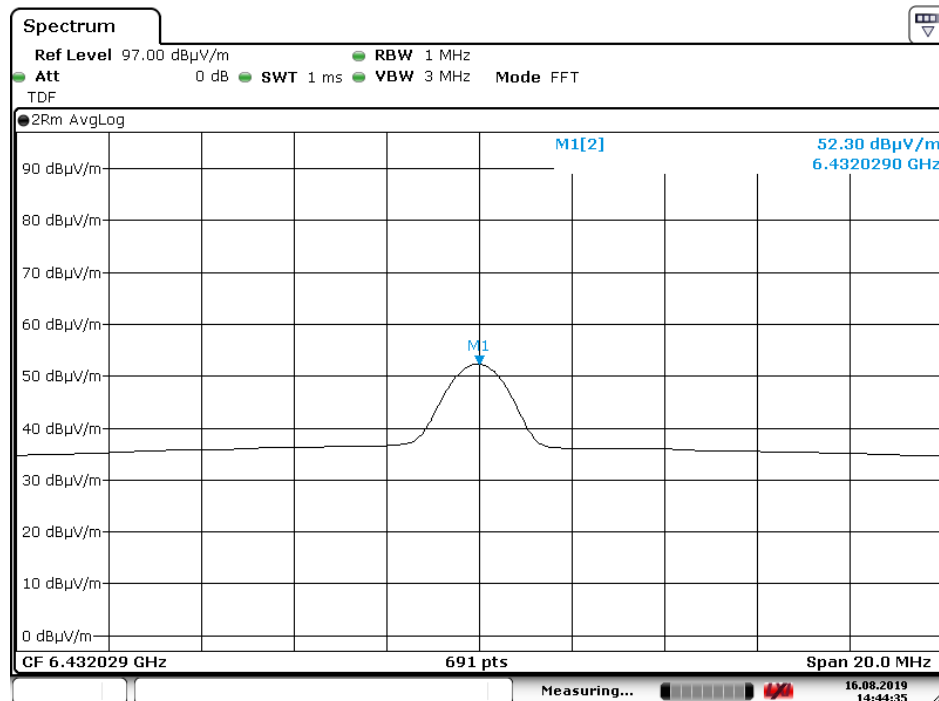
Date: 16.AUG.2019 10:34:16

Radiated Emissions, 6.57GHz, 2462MHz, 6 Mbps, HP, Average



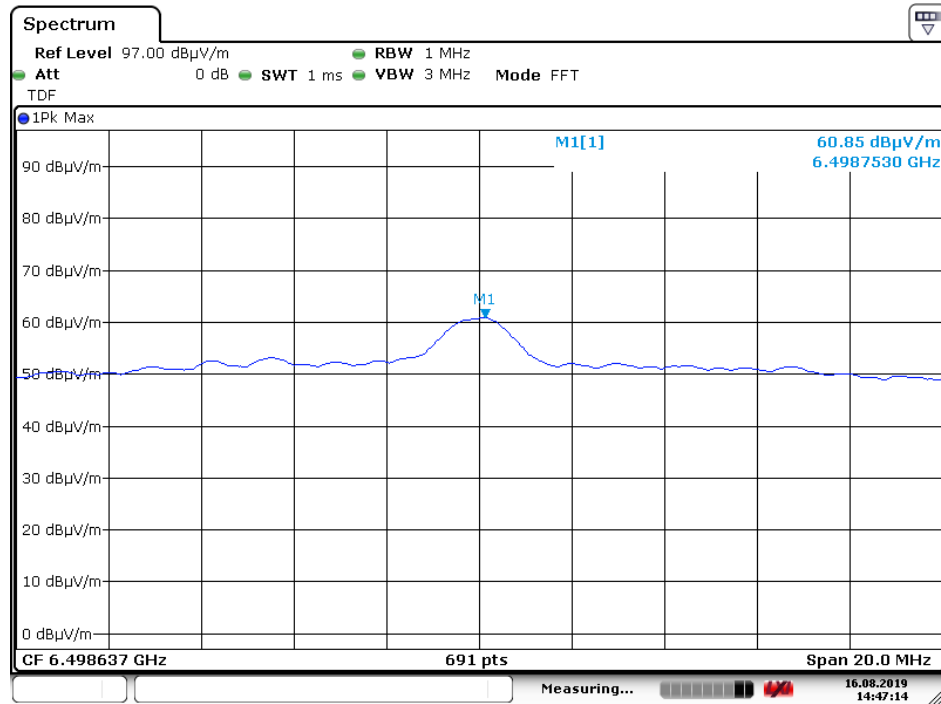
Date: 16.AUG.2019 14:43:04

Radiated Emissions, 6.43GHz, 2412MHz, MCS 0, HP, Peak



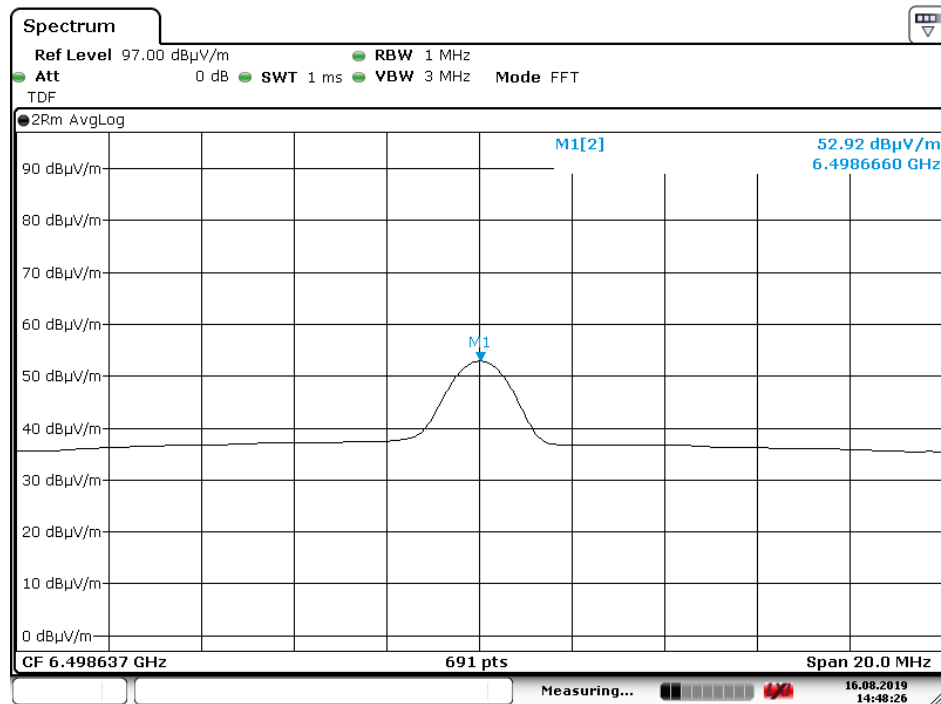
Date: 16.AUG.2019 14:44:36

Radiated Emissions, 6.43GHz, 2412MHz, MCS 0, HP, Average



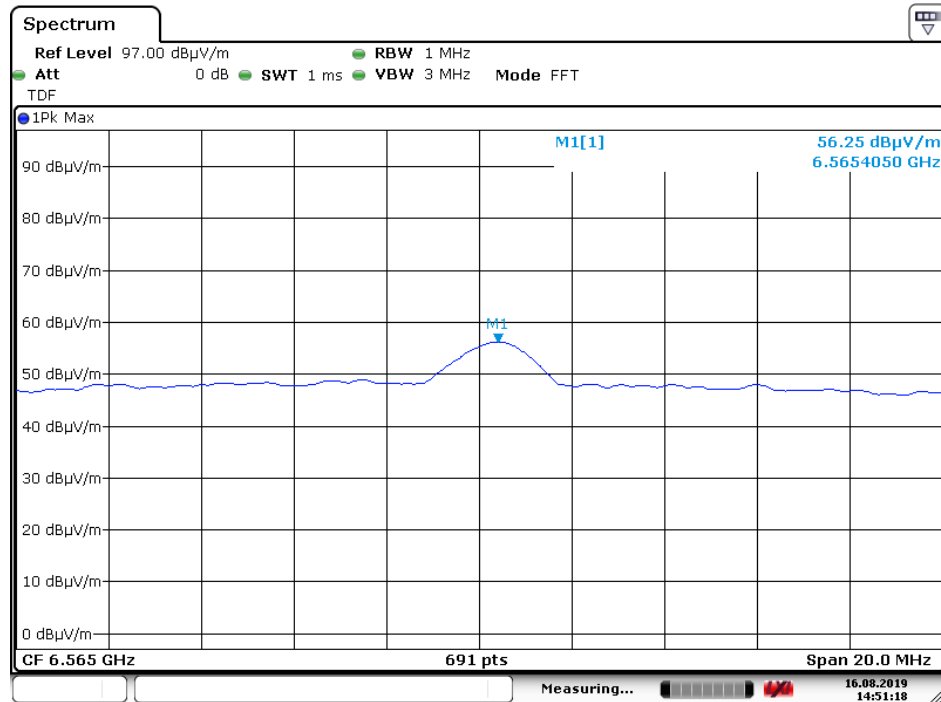
Date: 16.AUG.2019 14:47:14

Radiated Emissions, 6.5GHz, 2437MHz, MCS 0, HP, Peak



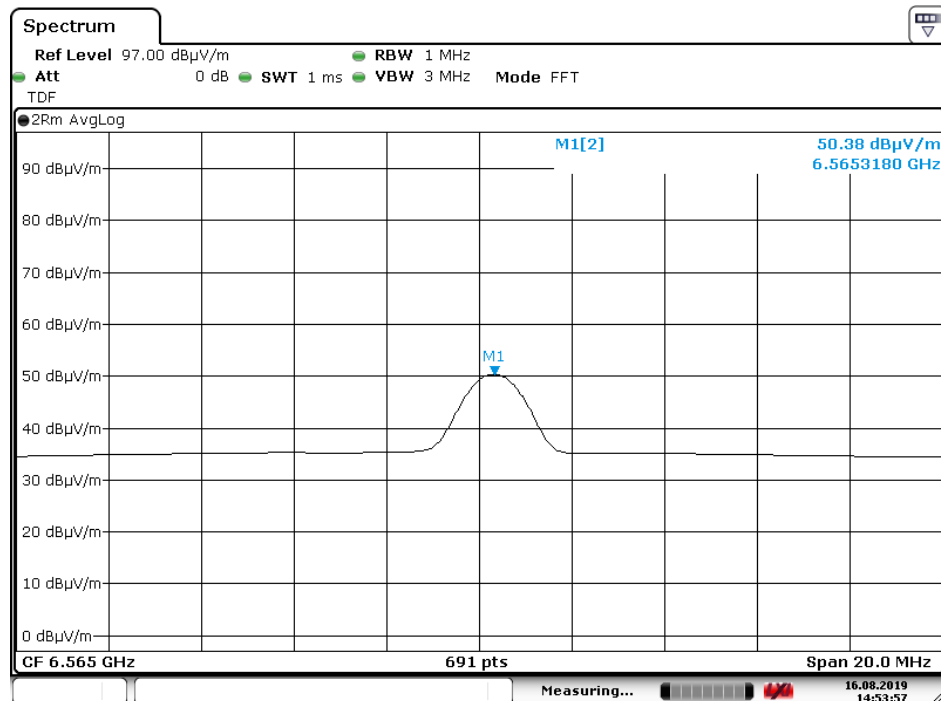
Date: 16.AUG.2019 14:48:27

Radiated Emissions, 6.5GHz, 2437MHz, MCS 0, HP, Average



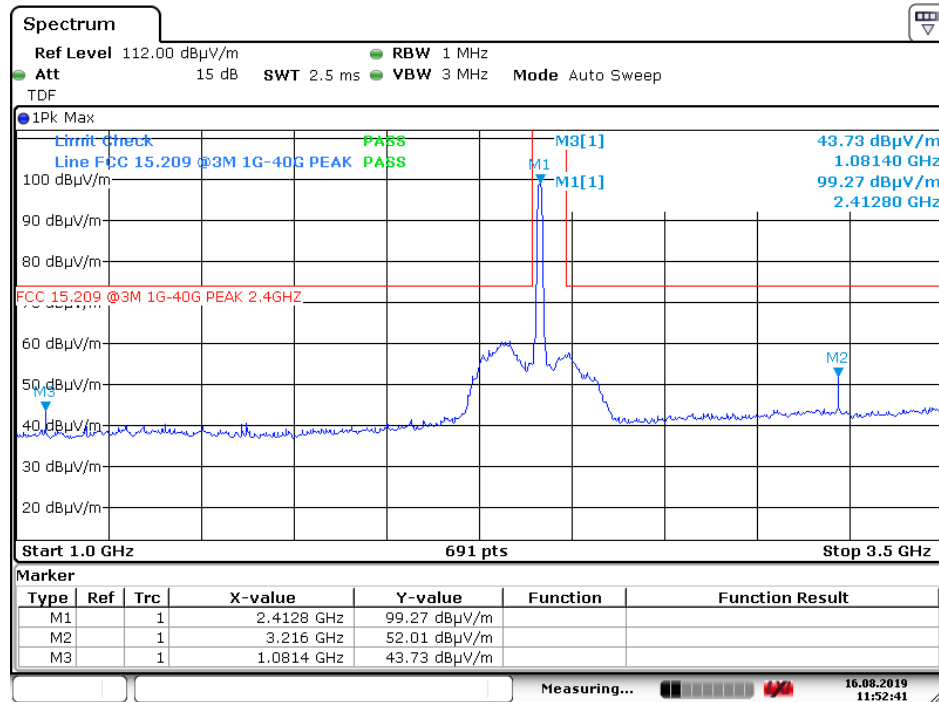
Date: 16.AUG.2019 14:51:19

Radiated Emissions, 6.57GHz, 2462MHz, MCS 0, HP, Peak



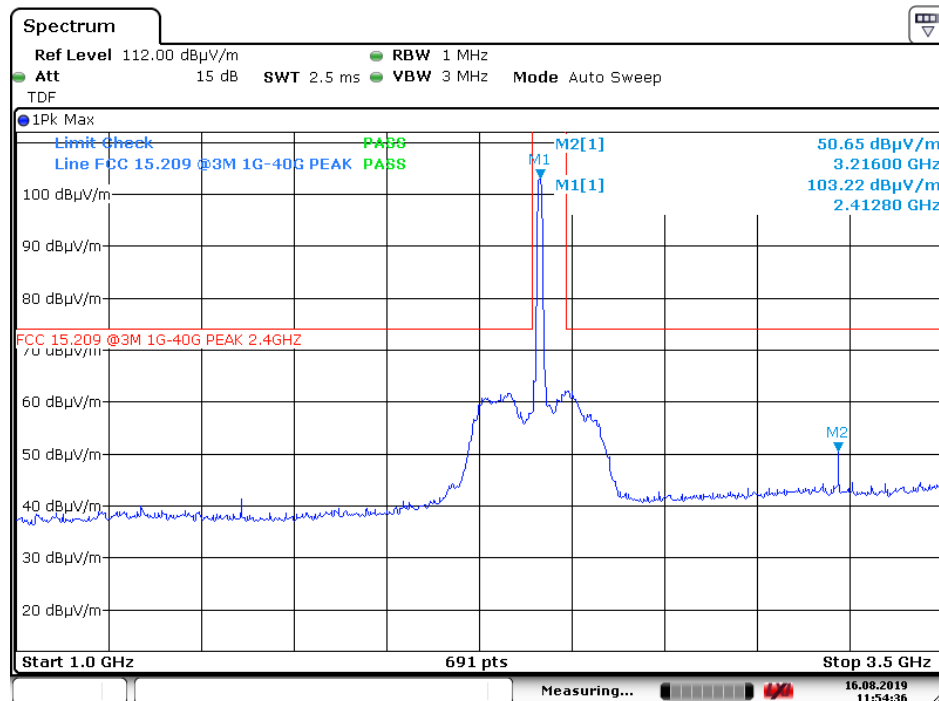
Date: 16.AUG.2019 14:53:58

Radiated Emissions, 6.57GHz, 2462MHz, MCS 0, HP, Average



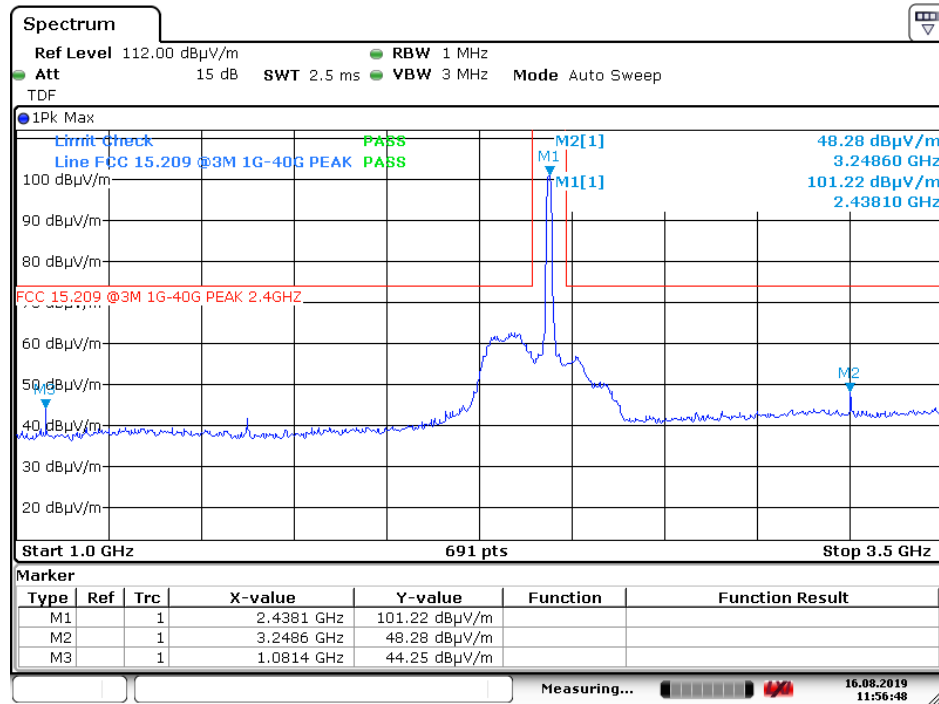
Date: 16.AUG.2019 11:52:41

Radiated Emissions, 1GHz – 3.5GHz, 2412MHz, 1 Mbps, VP



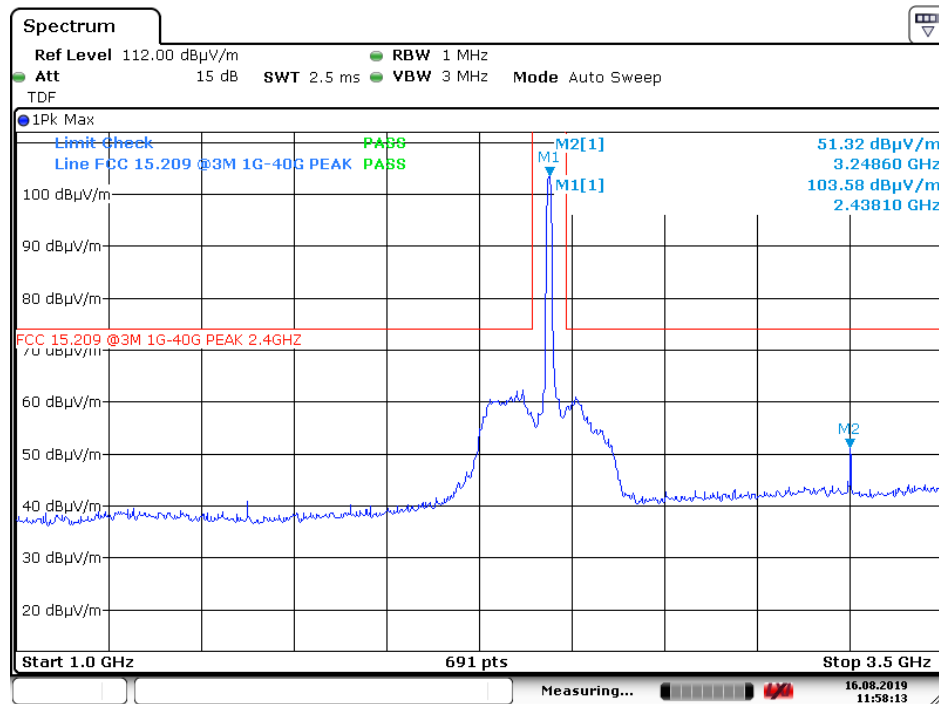
Date: 16.AUG.2019 11:54:36

Radiated Emissions, 1GHz – 3.5GHz, 2412MHz, 1 Mbps, HP



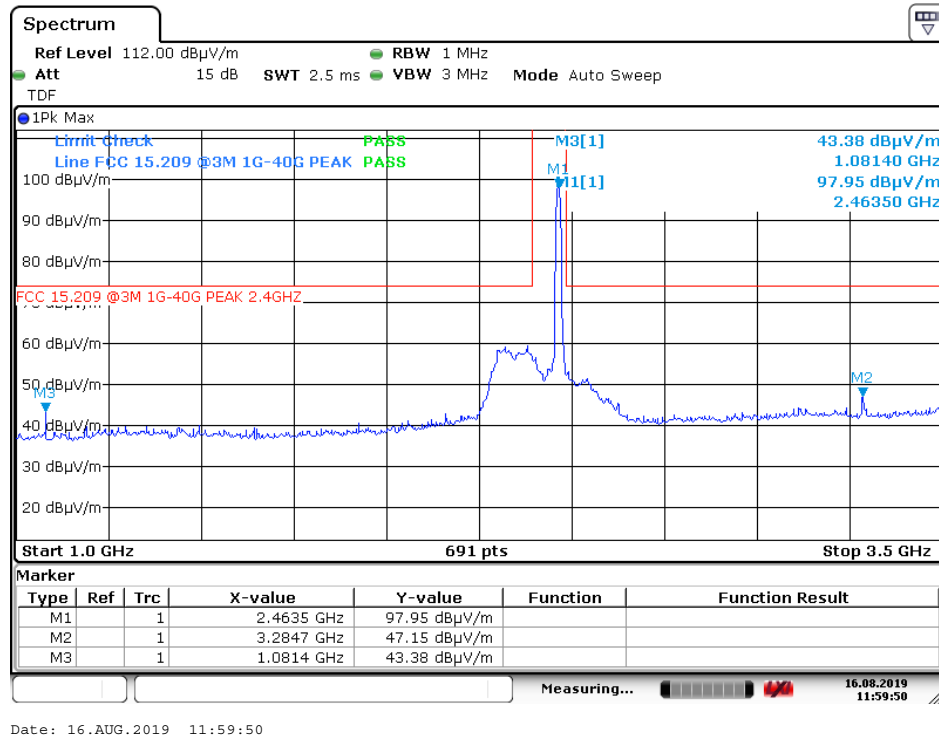
Date: 16.AUG.2019 11:56:48

Radiated Emissions, 1GHz – 3.5GHz, 2437MHz, 1 Mbps, VP

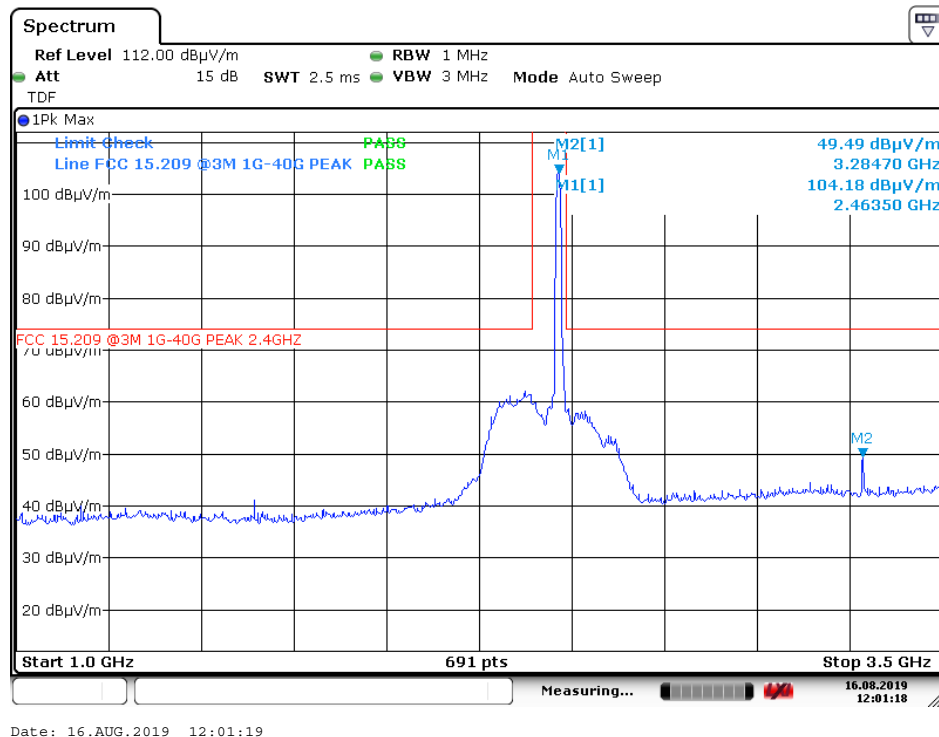


Date: 16.AUG.2019 11:58:14

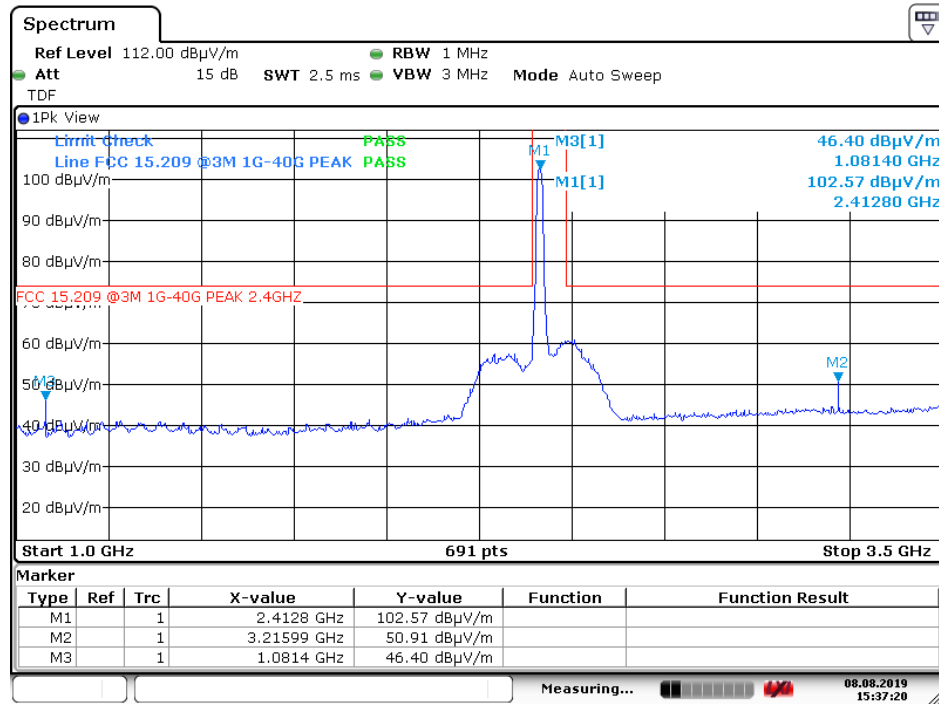
Radiated Emissions, 1GHz – 3.5GHz, 2437MHz, 1 Mbps, HP



Radiated Emissions, 1GHz – 3.5GHz, 2462MHz, 1 Mbps, VP

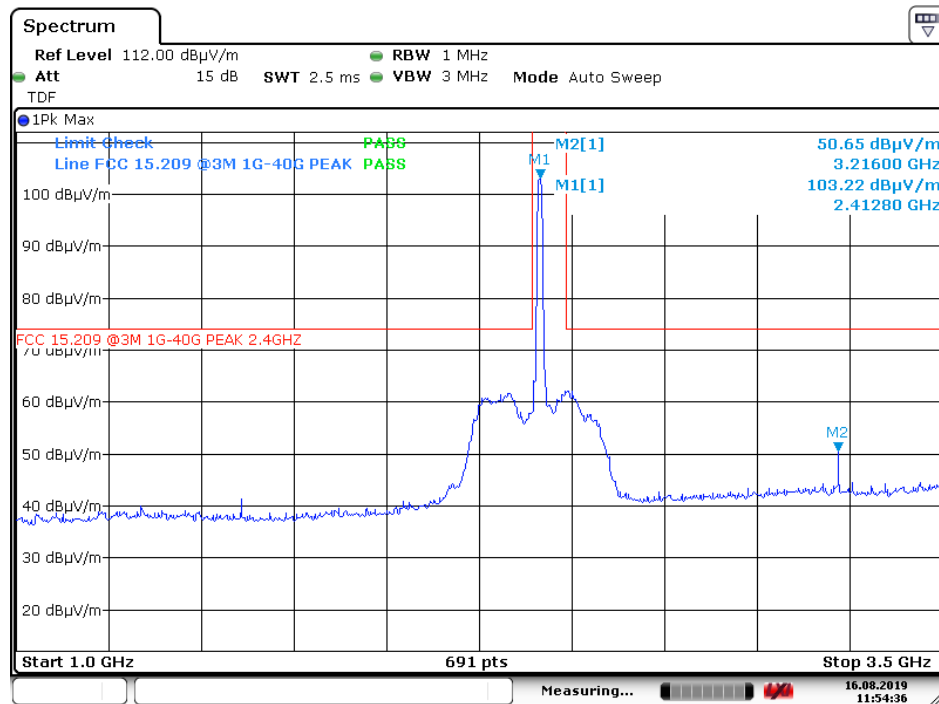


Radiated Emissions, 1GHz – 3.5GHz, 2462MHz, 1 Mbps, HP



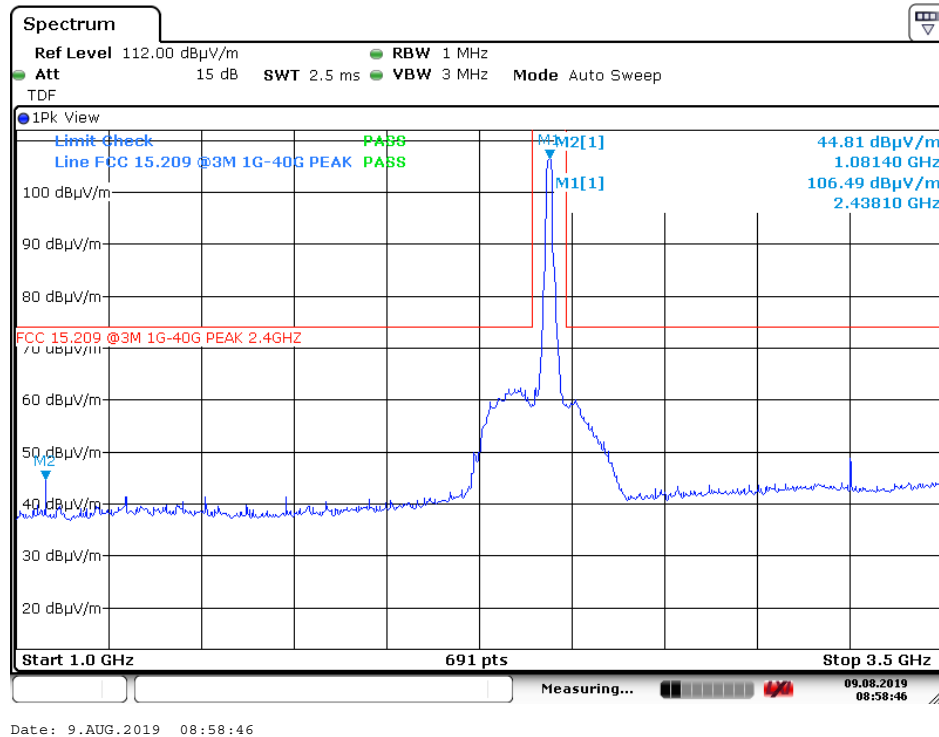
Date: 8.AUG.2019 15:37:21

Radiated Emissions, 1GHz – 3.5GHz, 2412MHz, 6 Mbps, VP

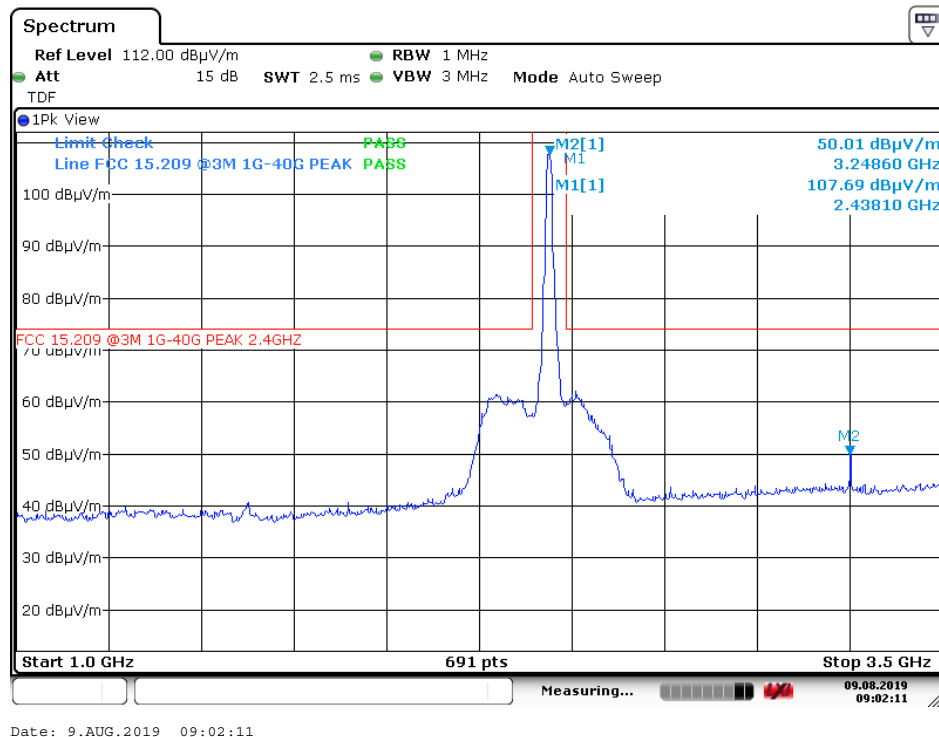


Date: 16.AUG.2019 11:54:36

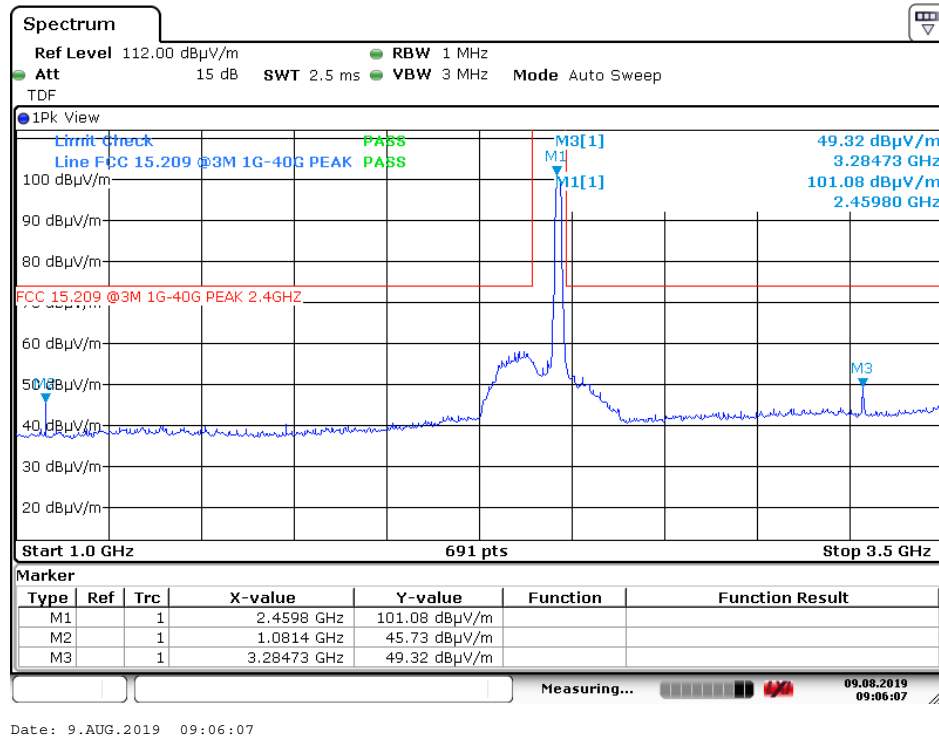
Radiated Emissions, 1GHz – 3.5GHz, 2412MHz, 6 Mbps, HP



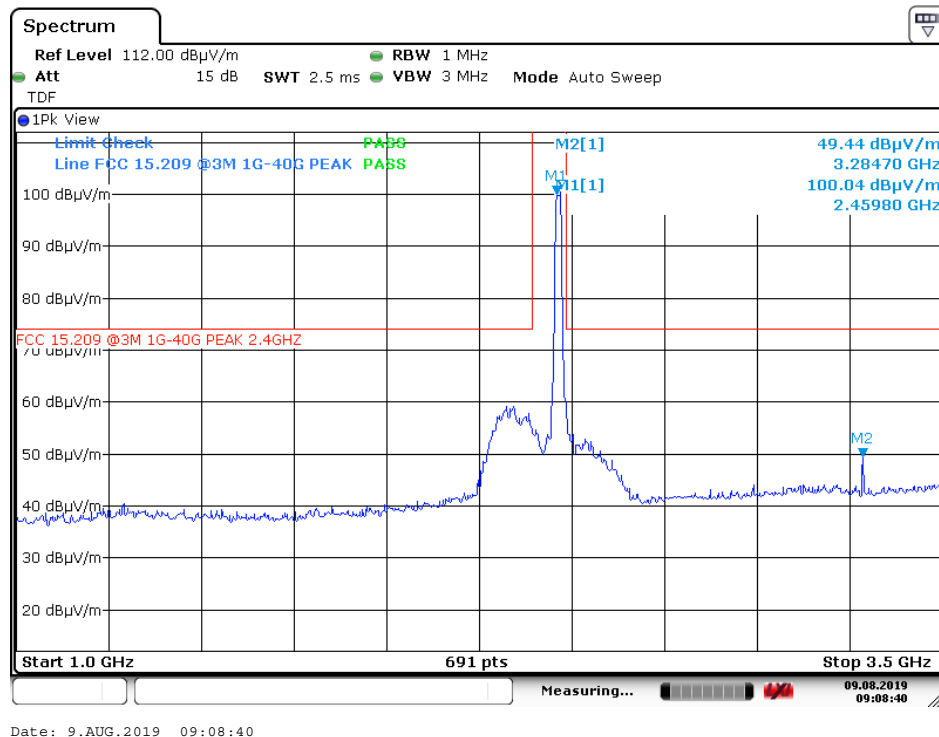
Radiated Emissions, 1GHz – 3.5GHz, 2437MHz, 6 Mbps, VP



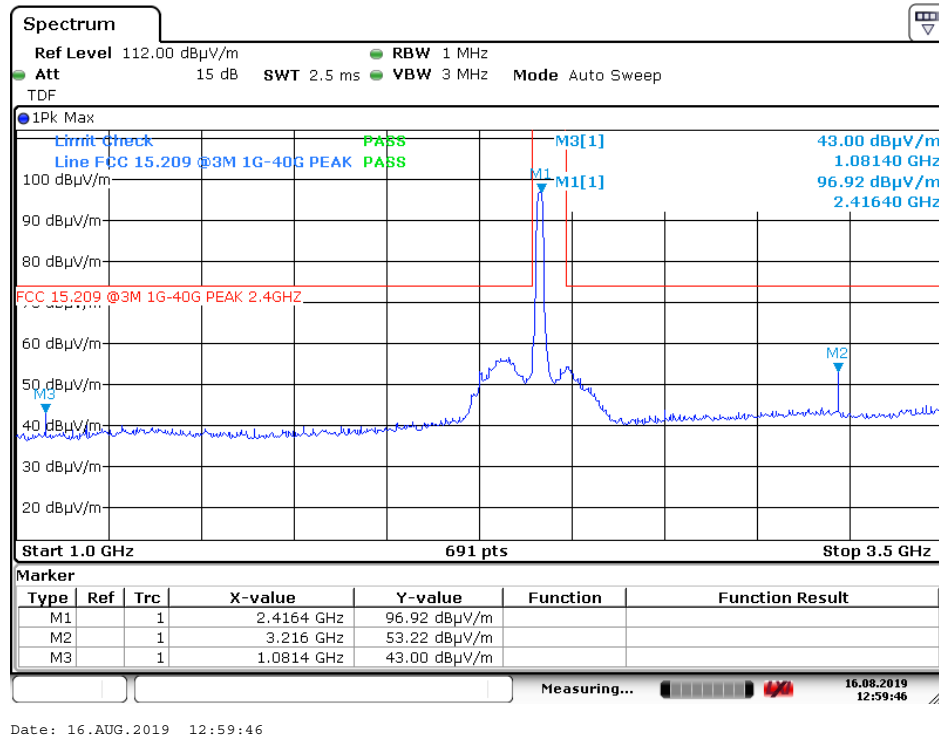
Radiated Emissions, 1GHz – 3.5GHz, 2437MHz, 6 Mbps, HP



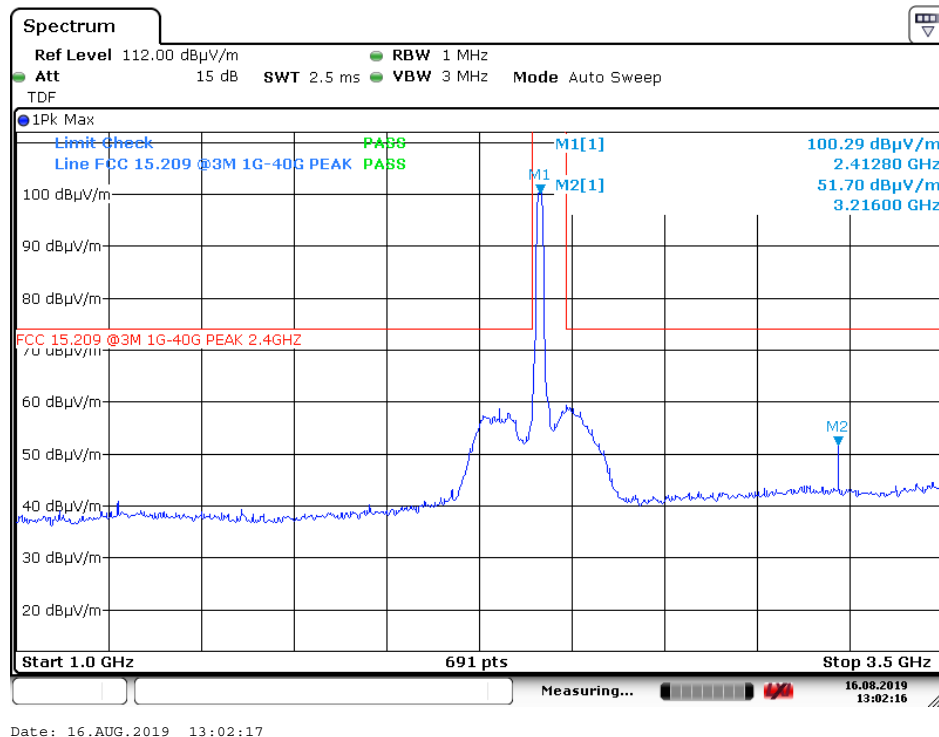
Radiated Emissions, 1GHz – 3.5GHz, 2462MHz, 6 Mbps, VP



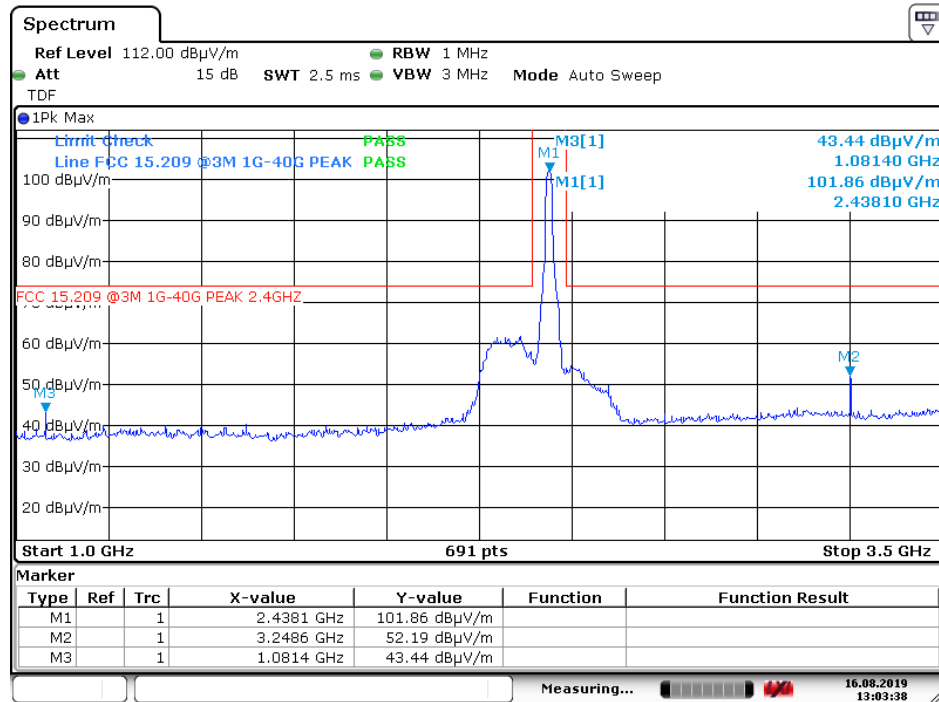
Radiated Emissions, 1GHz – 3.5GHz, 2462MHz, 6 Mbps, HP



Radiated Emissions, 1GHz – 3.5GHz, 2412MHz, MCS 0, VP

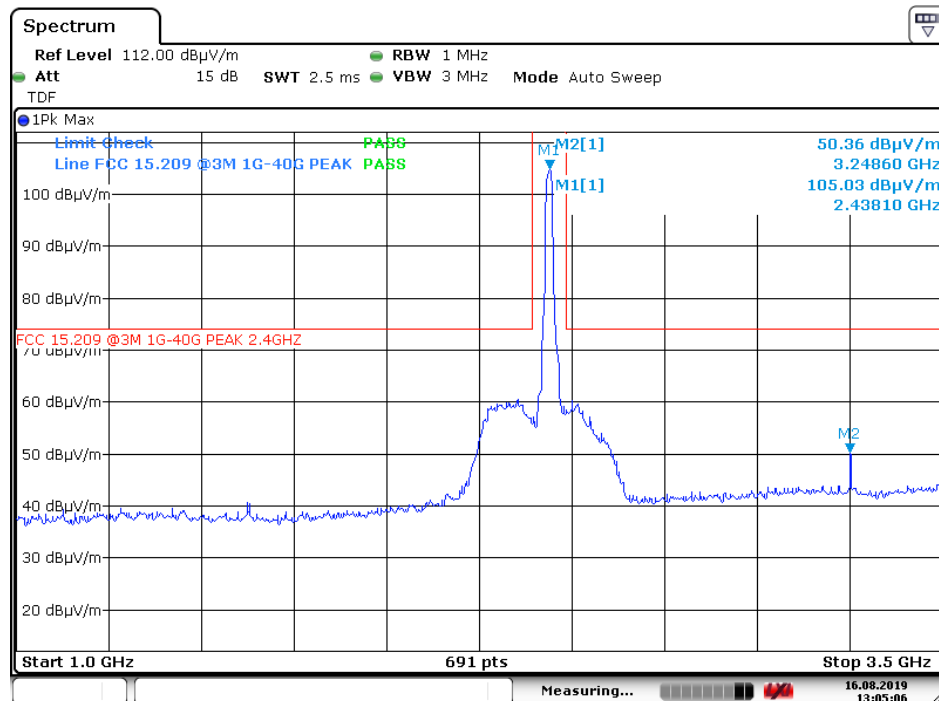


Radiated Emissions, 1GHz – 3.5GHz, 2412MHz, MCS 0, HP



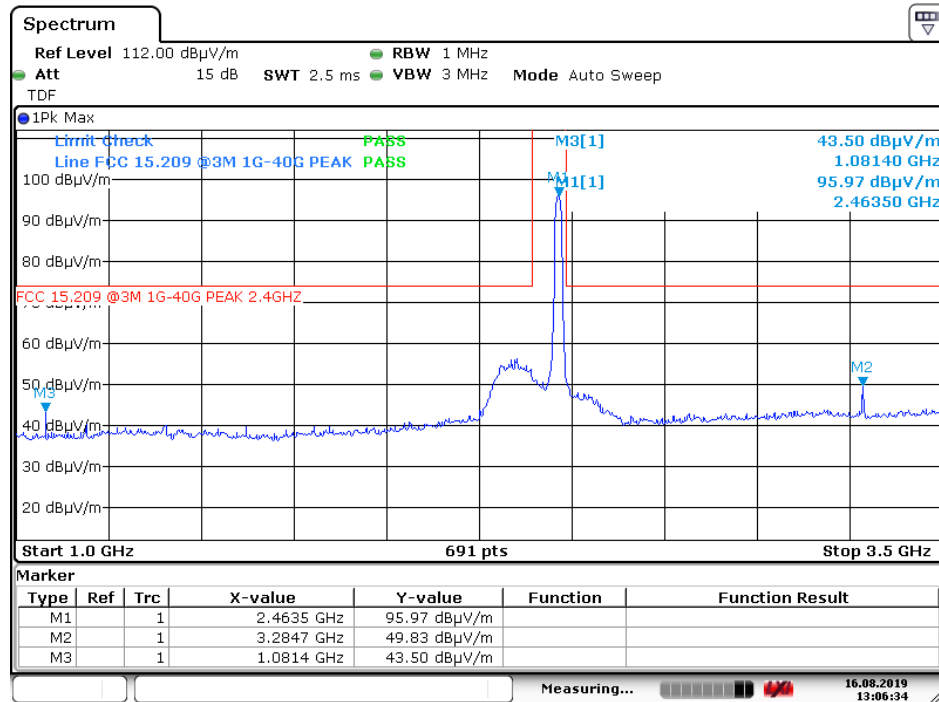
Date: 16.AUG.2019 13:03:39

Radiated Emissions, 1GHz – 3.5GHz, 2437MHz, MCS 0, VP



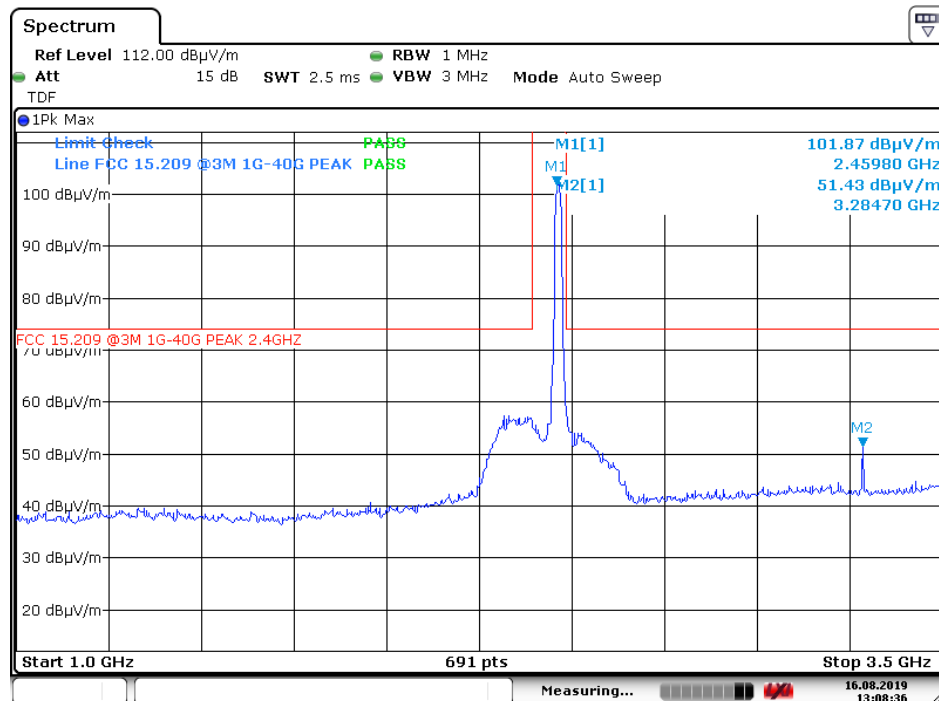
Date: 16.AUG.2019 13:05:07

Radiated Emissions, 1GHz – 3.5GHz, 2437MHz, MCS 0, HP



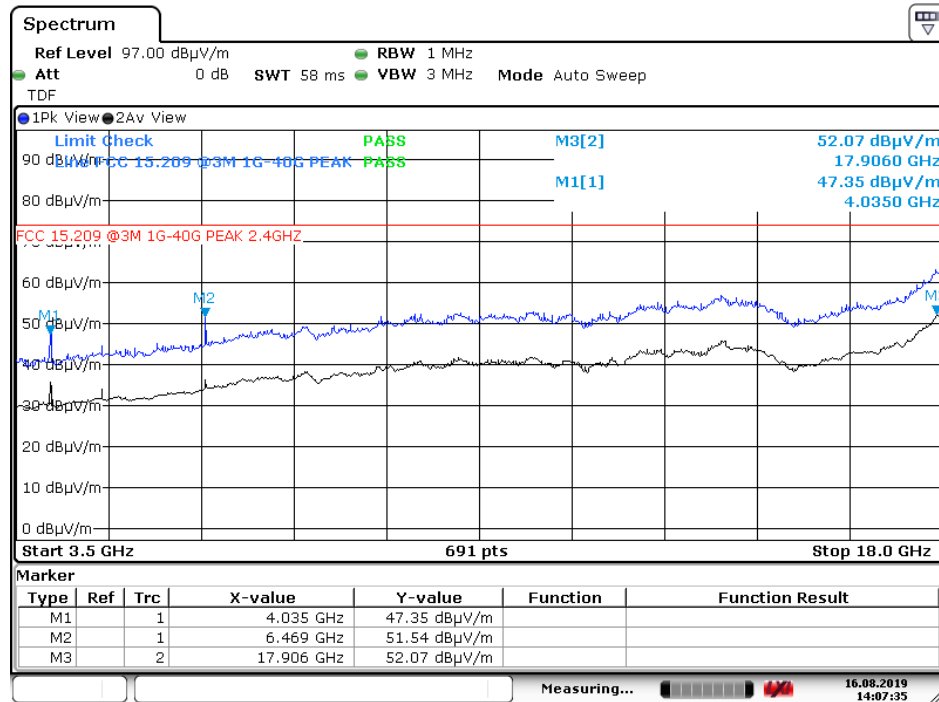
Date: 16.AUG.2019 13:06:34

Radiated Emissions, 1GHz – 3.5GHz, 2462MHz, MCS 0, VP



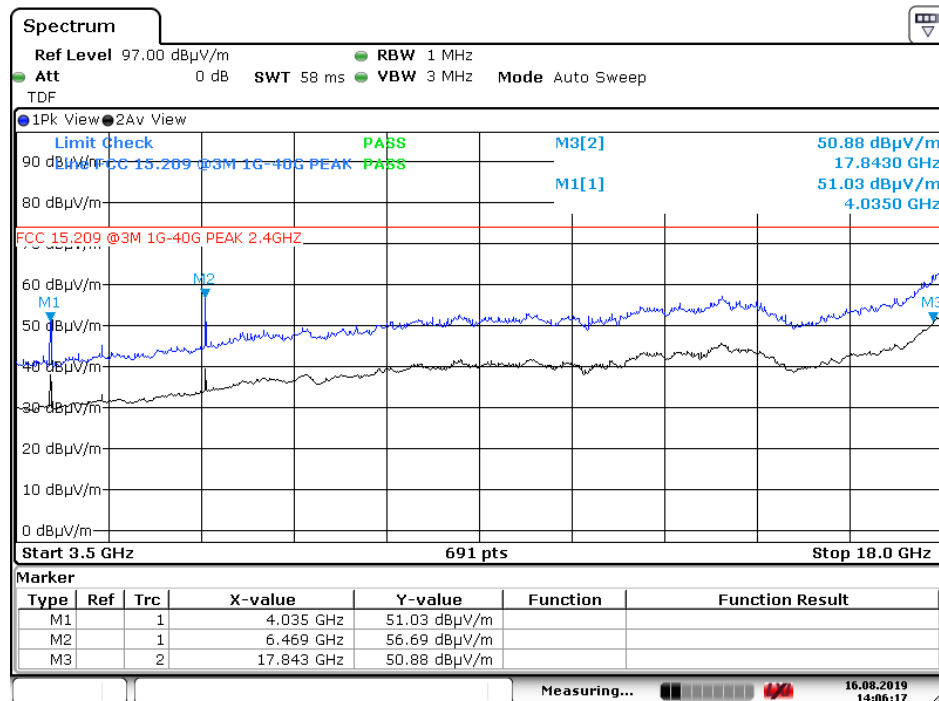
Date: 16.AUG.2019 13:08:36

Radiated Emissions, 1GHz – 3.5GHz, 2462MHz, MCS 0, HP



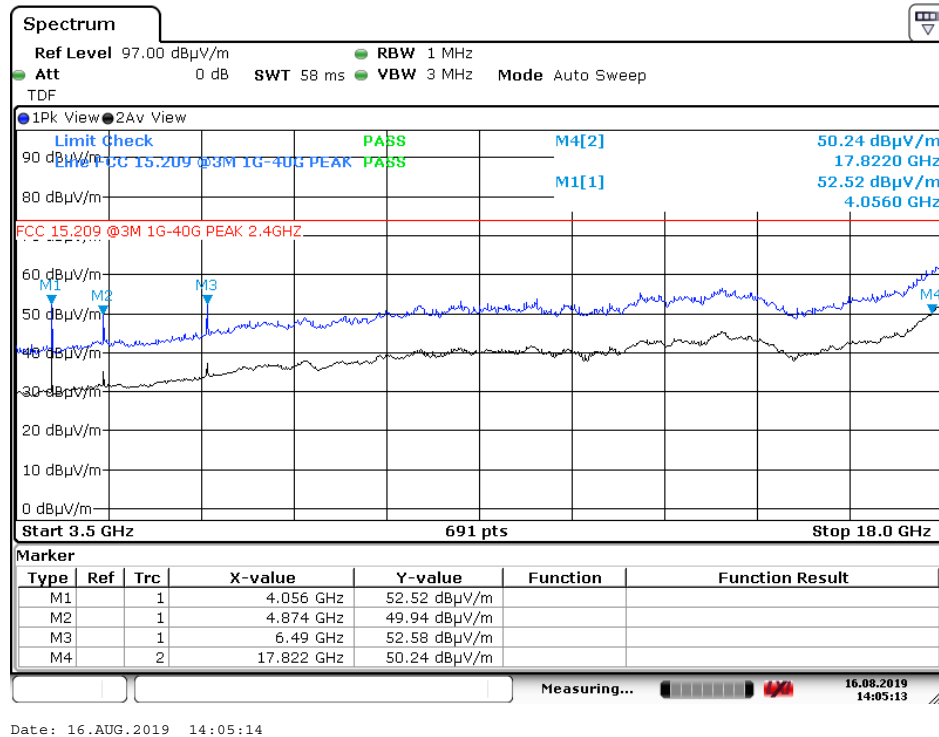
Date: 16.AUG.2019 14:07:35

Radiated Emissions, 3.5GHz – 18GHz, 2412MHz, 1 Mbps, VP

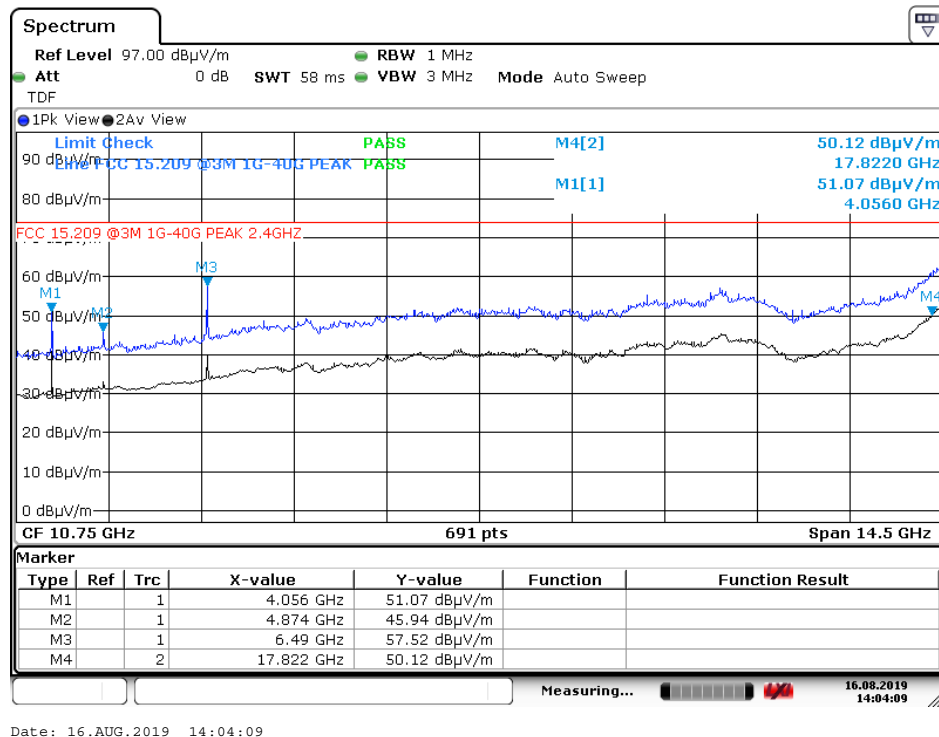


Date: 16.AUG.2019 14:06:18

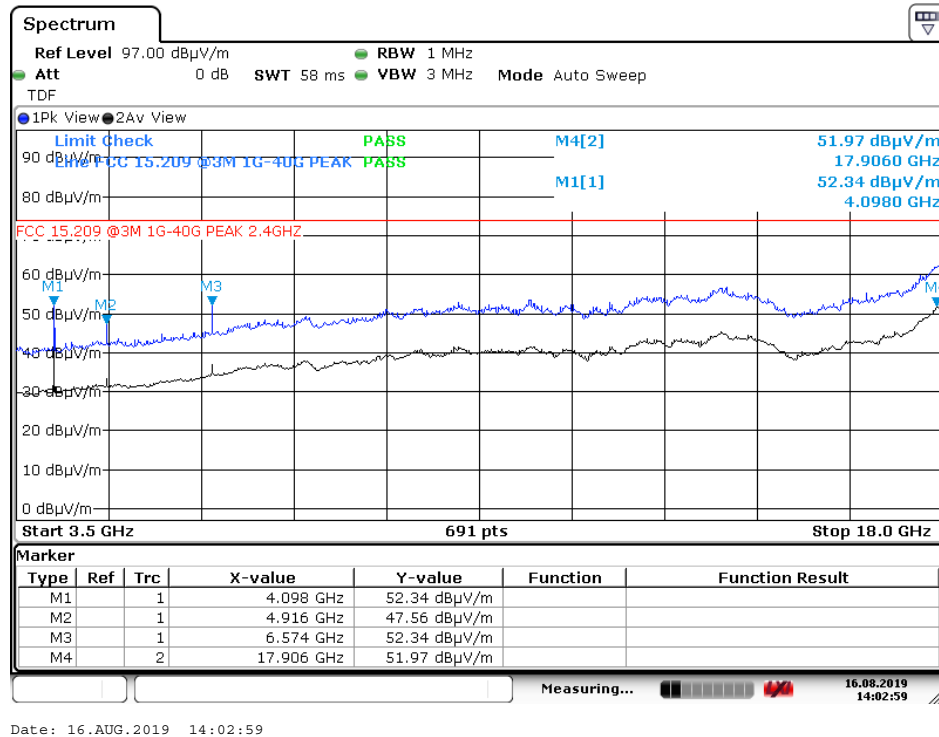
Radiated Emissions, 3.5GHz – 18GHz, 2412MHz, 1 Mbps, HP



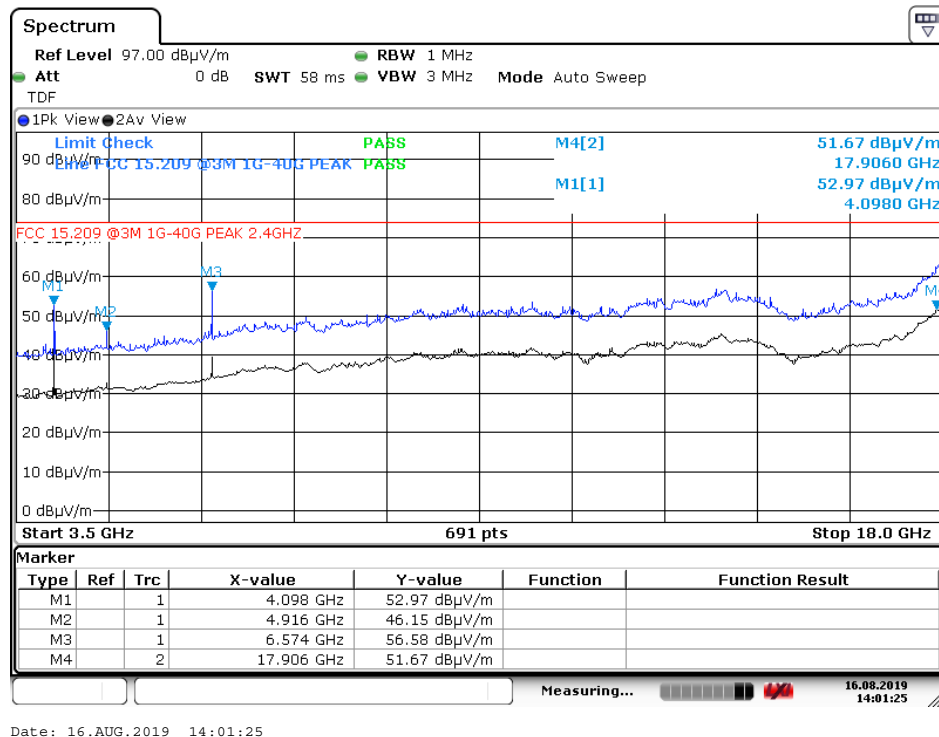
Radiated Emissions, 3.5GHz – 18GHz, 2437MHz, 1 Mbps, VP



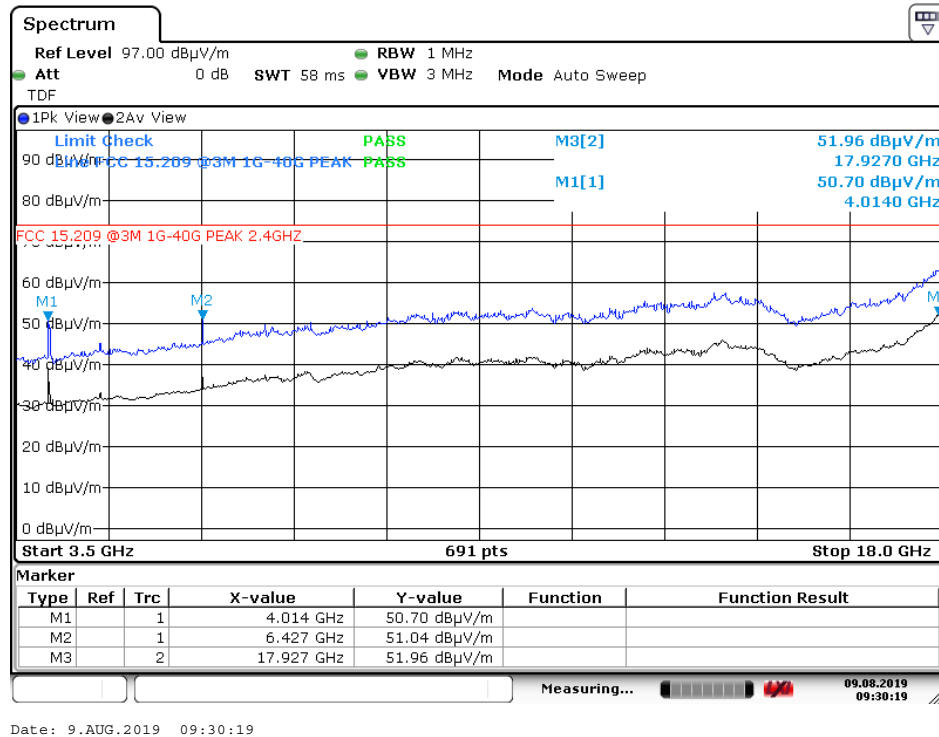
Radiated Emissions, 3.5GHz – 18GHz, 2437MHz, 1 Mbps, HP



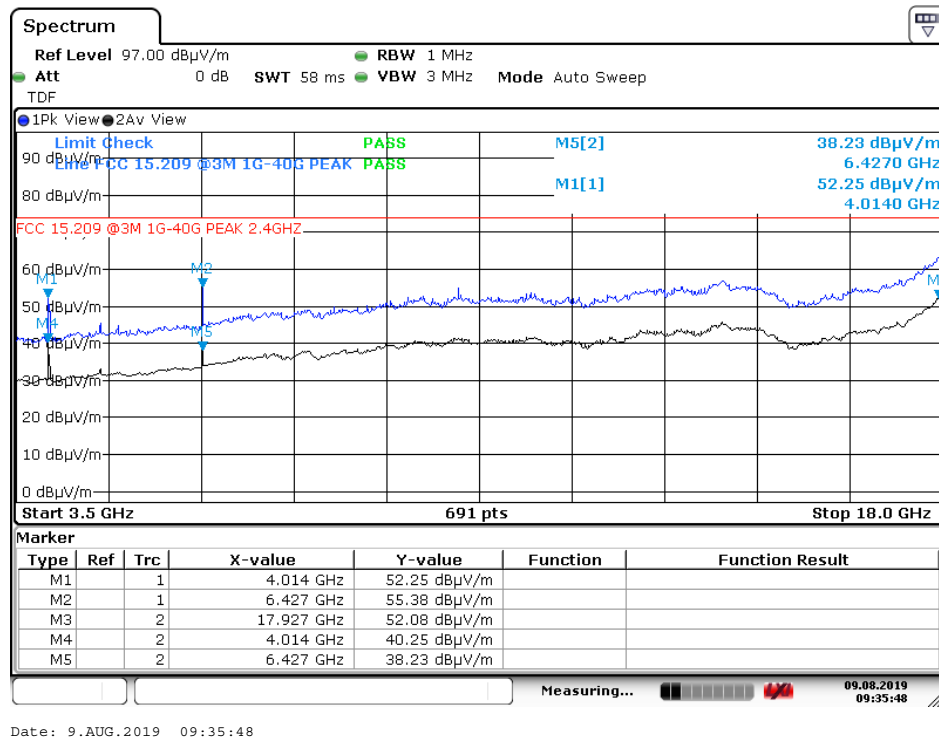
Radiated Emissions, 3.5GHz – 18GHz, 2462MHz, 1 Mbps, VP



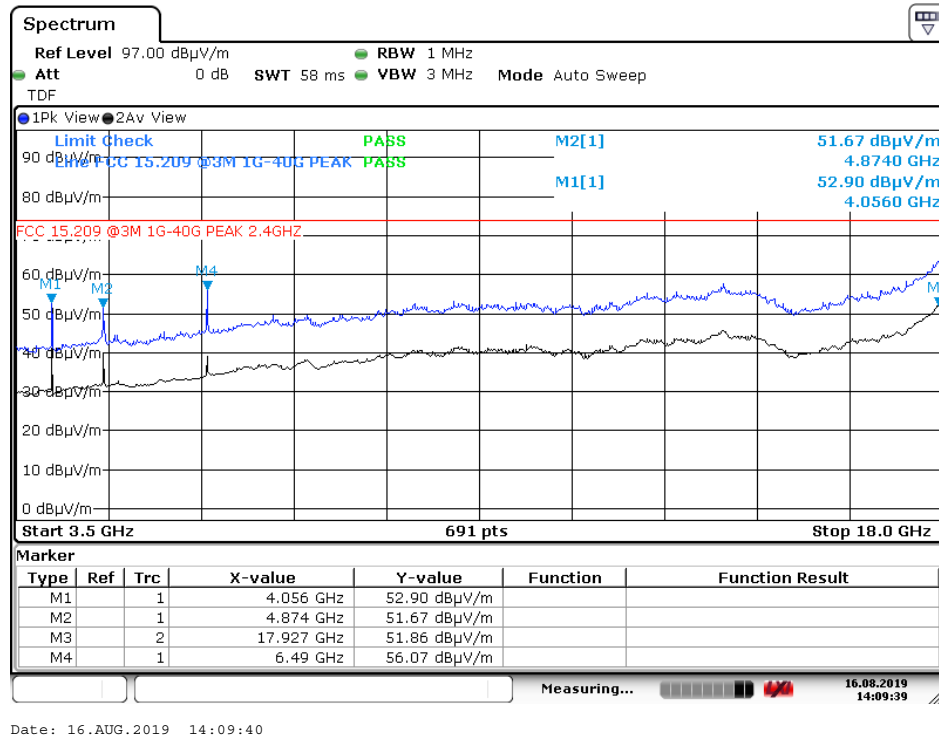
Radiated Emissions, 3.5GHz – 18GHz, 2462MHz, 1 Mbps, HP



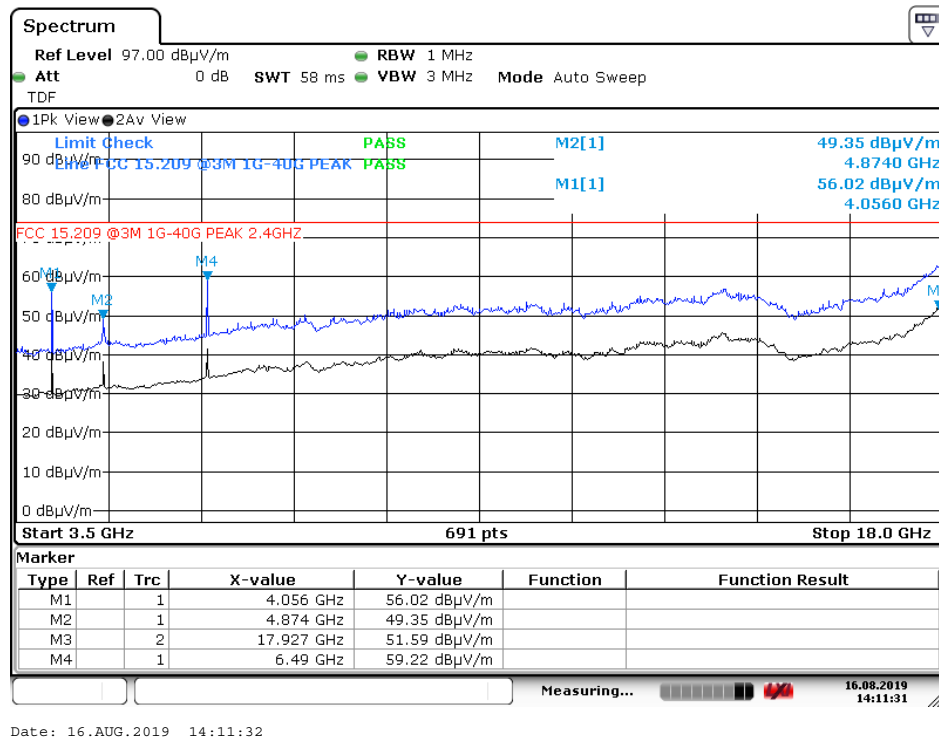
Radiated Emissions, 3.5GHz – 18GHz, 2412MHz, 6 Mbps, VP



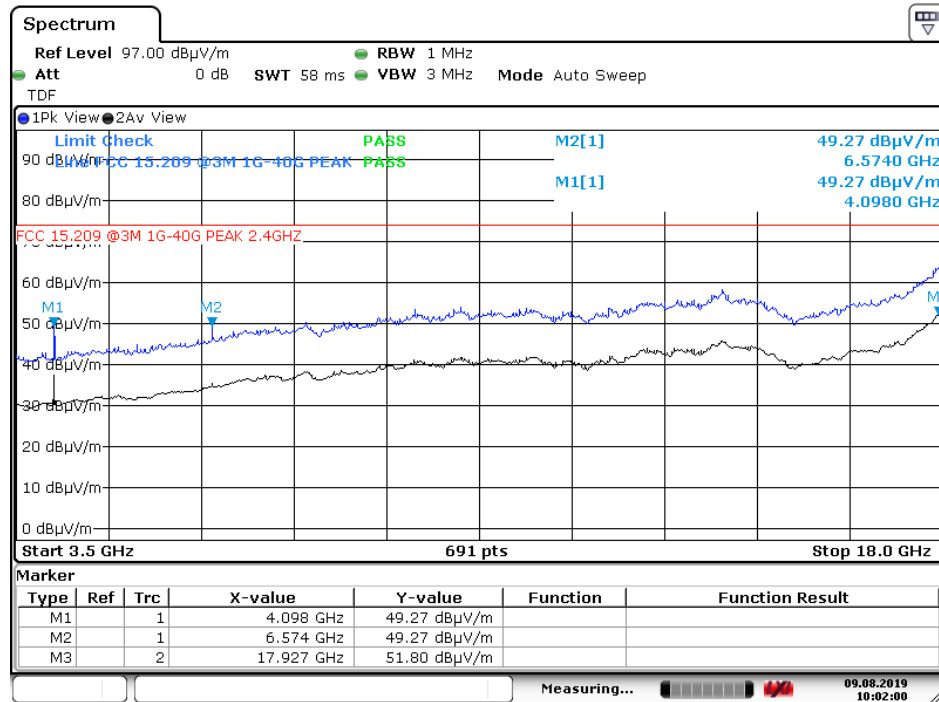
Radiated Emissions, 3.5GHz – 18GHz, 2412MHz, 6 Mbps, HP



Radiated Emissions, 3.5GHz – 18GHz, 2437MHz, 6 Mbps, VP

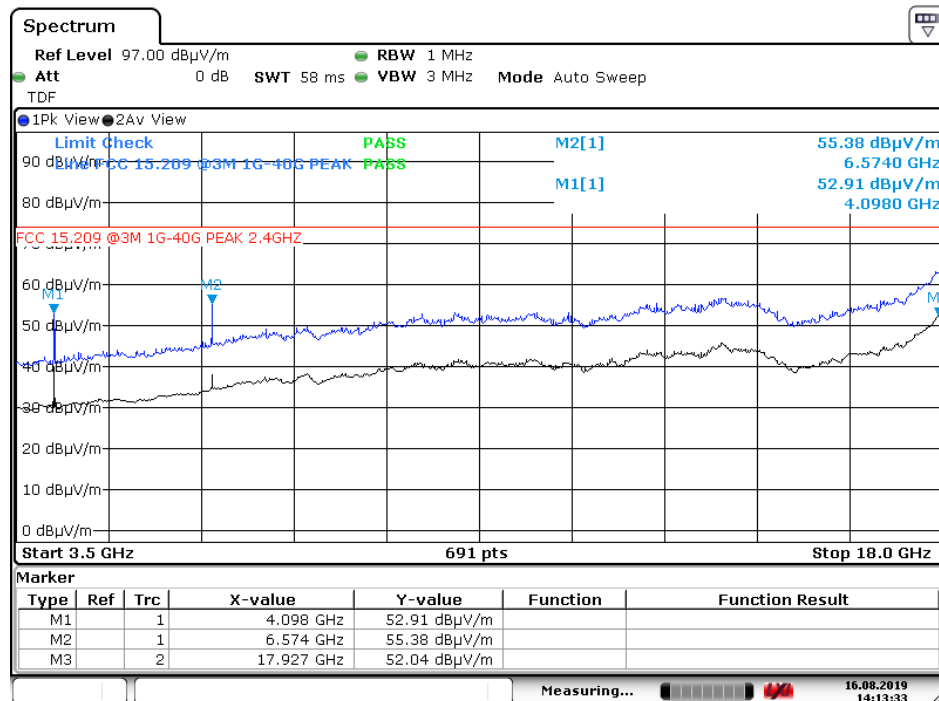


Radiated Emissions, 3.5GHz – 18GHz, 2437MHz, 6 Mbps, HP



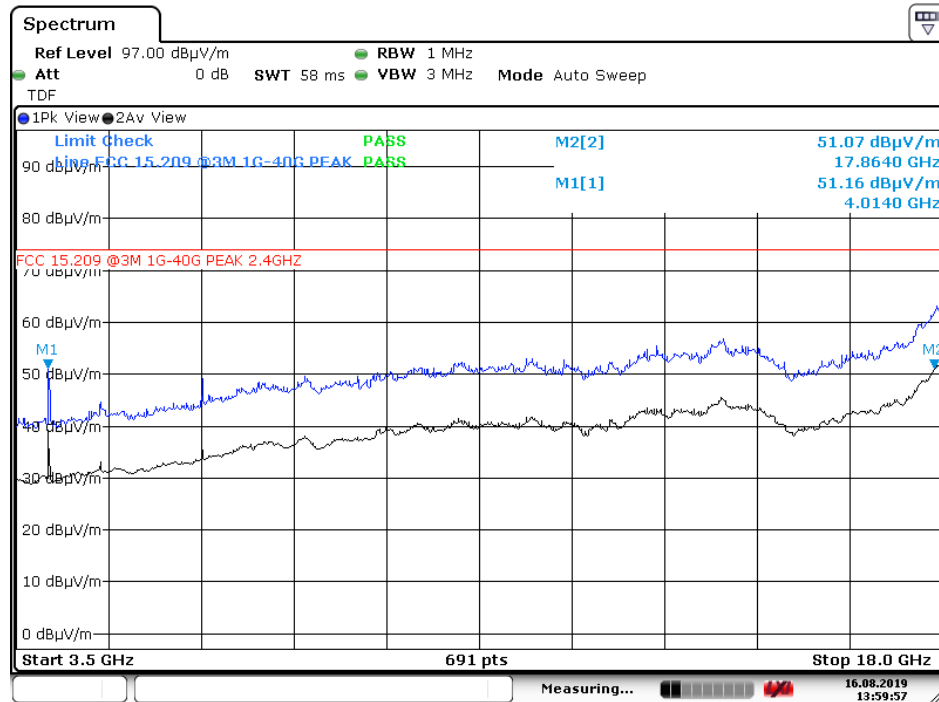
Date: 9.AUG.2019 10:02:00

Radiated Emissions, 3.5GHz – 18GHz, 2462MHz, 6 Mbps, VP



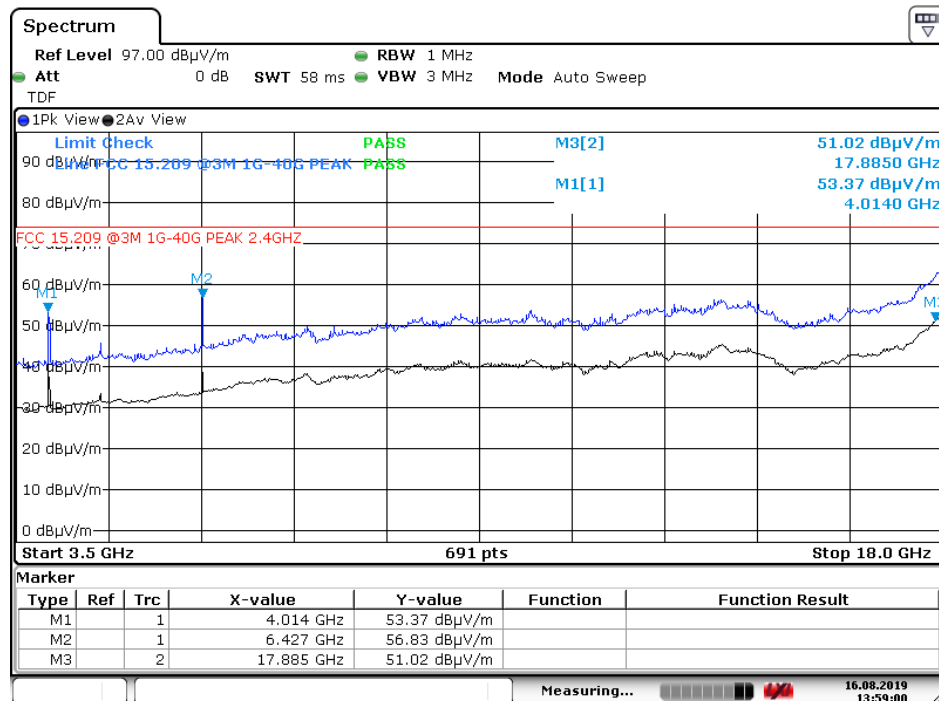
Date: 16.AUG.2019 14:13:33

Radiated Emissions, 3.5GHz – 18GHz, 2462MHz, 6 Mbps, HP



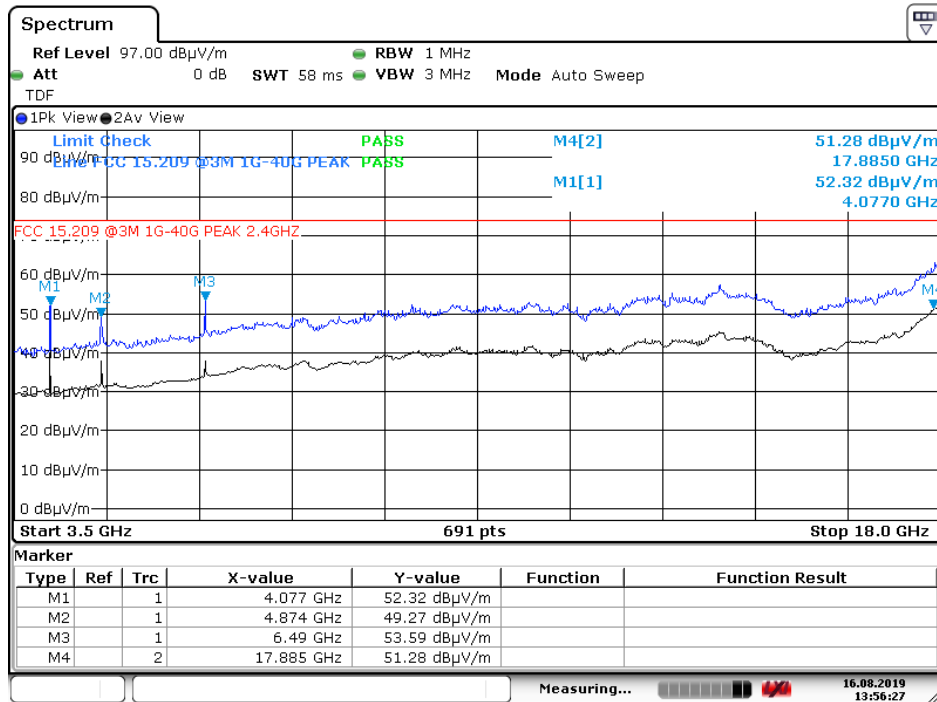
Date: 16.AUG.2019 13:59:57

Radiated Emissions, 3.5GHz – 18GHz, 2412MHz, MCS 0, VP



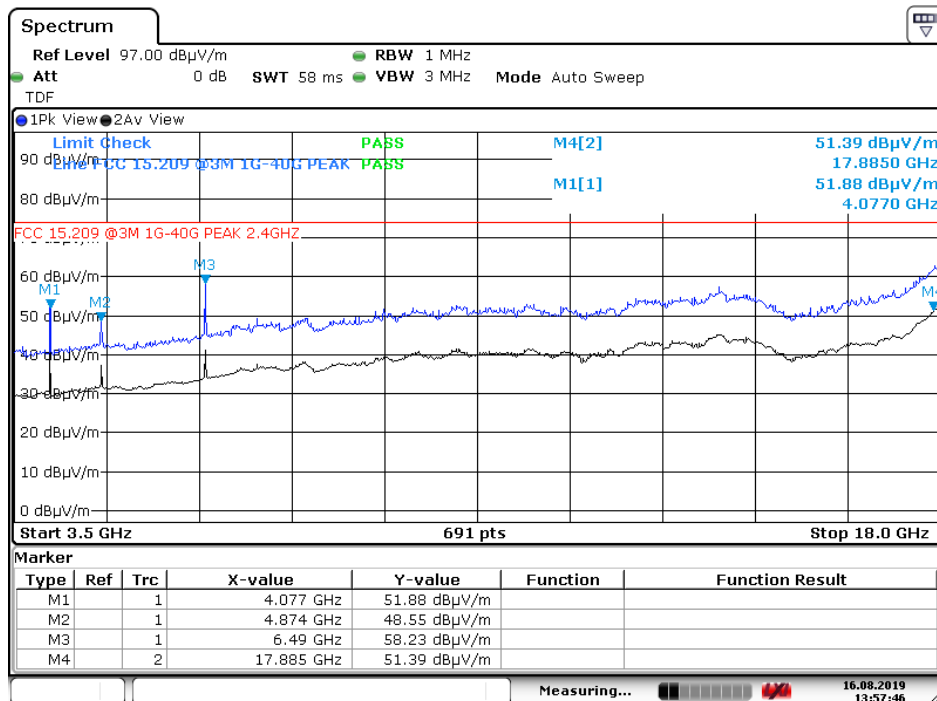
Date: 16.AUG.2019 13:59:01

Radiated Emissions, 3.5GHz – 18GHz, 2412MHz, MCS 0, HP



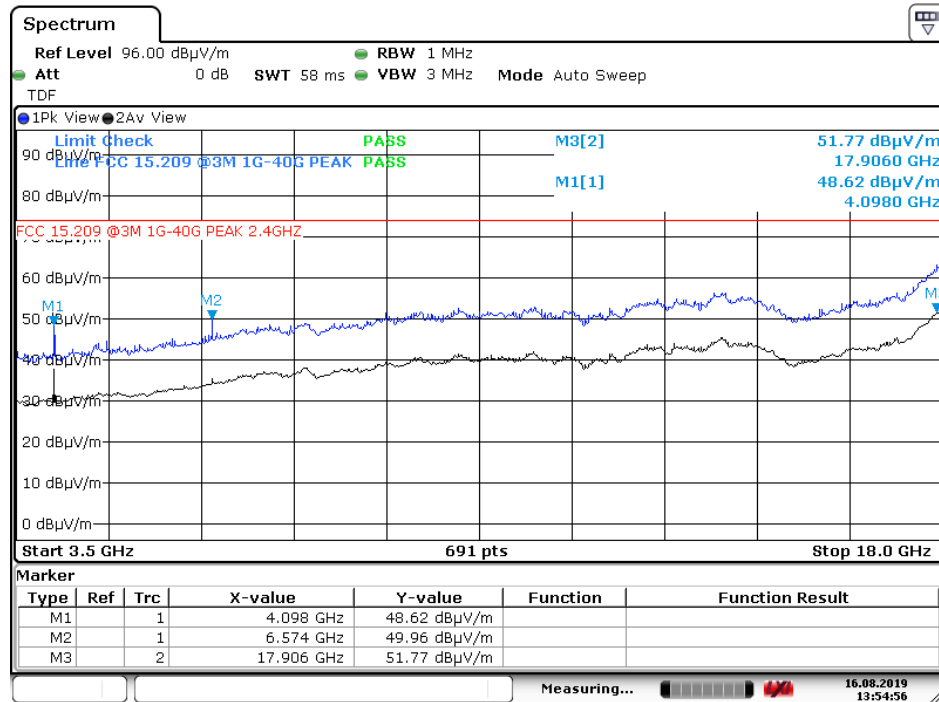
Date: 16.AUG.2019 13:56:27

Radiated Emissions, 3.5GHz – 18GHz, 2437MHz, MCS 0, VP



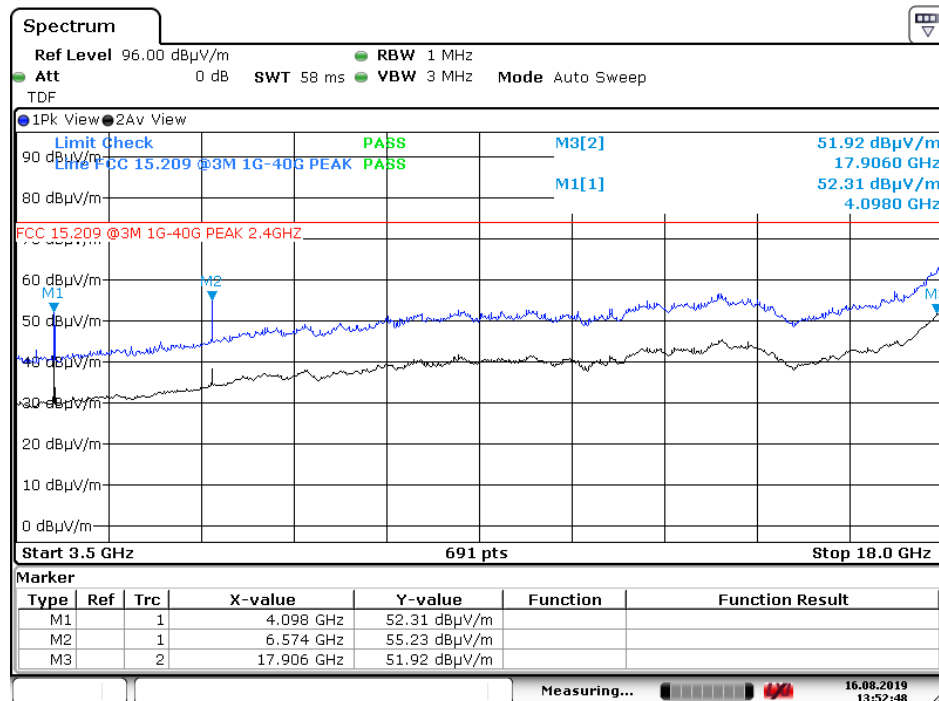
Date: 16.AUG.2019 13:57:46

Radiated Emissions, 3.5GHz – 18GHz, 2437MHz, MCS 0, HP



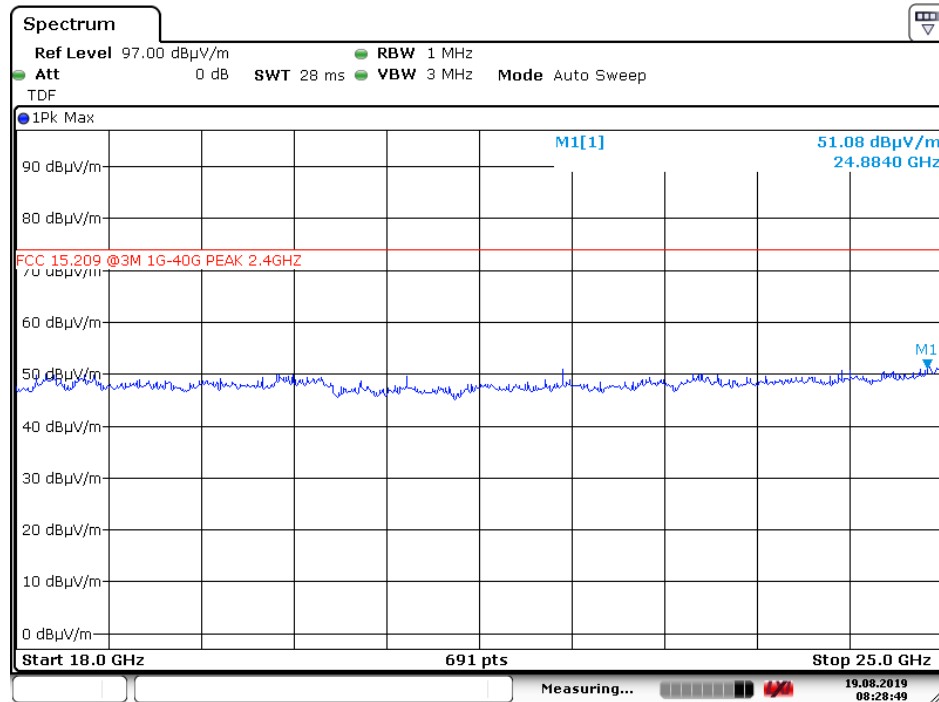
Date: 16.AUG.2019 13:54:57

Radiated Emissions, 3.5GHz – 18GHz, 2462MHz, MCS 0, VP



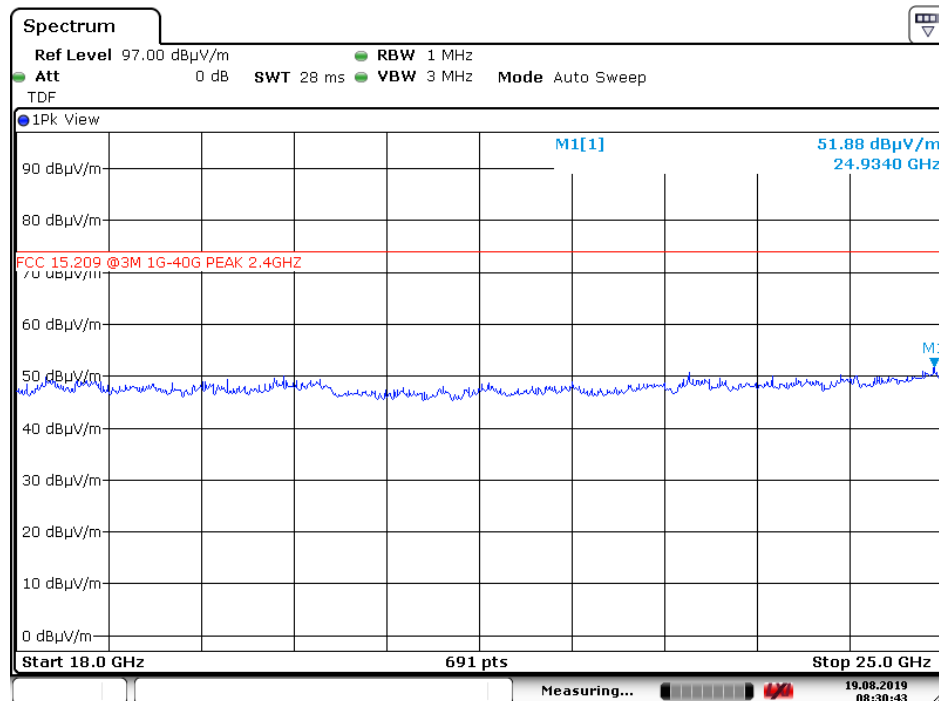
Date: 16.AUG.2019 13:52:48

Radiated Emissions, 3.5GHz – 18GHz, 2462MHz, MCS 0, HP



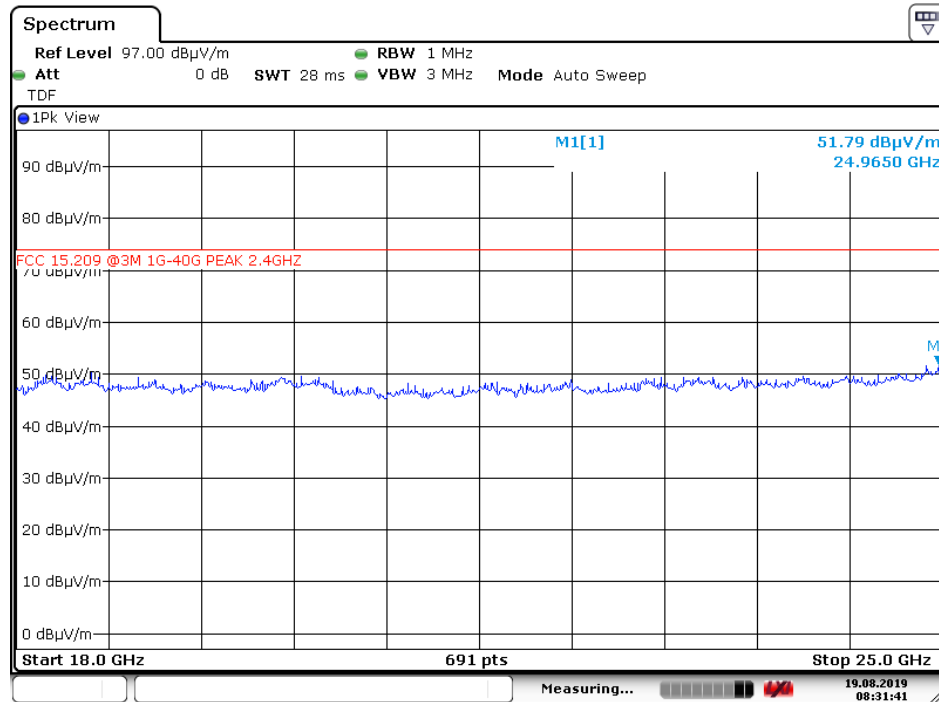
Date: 19.AUG.2019 08:28:49

Radiated Emissions, 18GHz – 25GHz, 2412MHz, 1 Mbps, VP



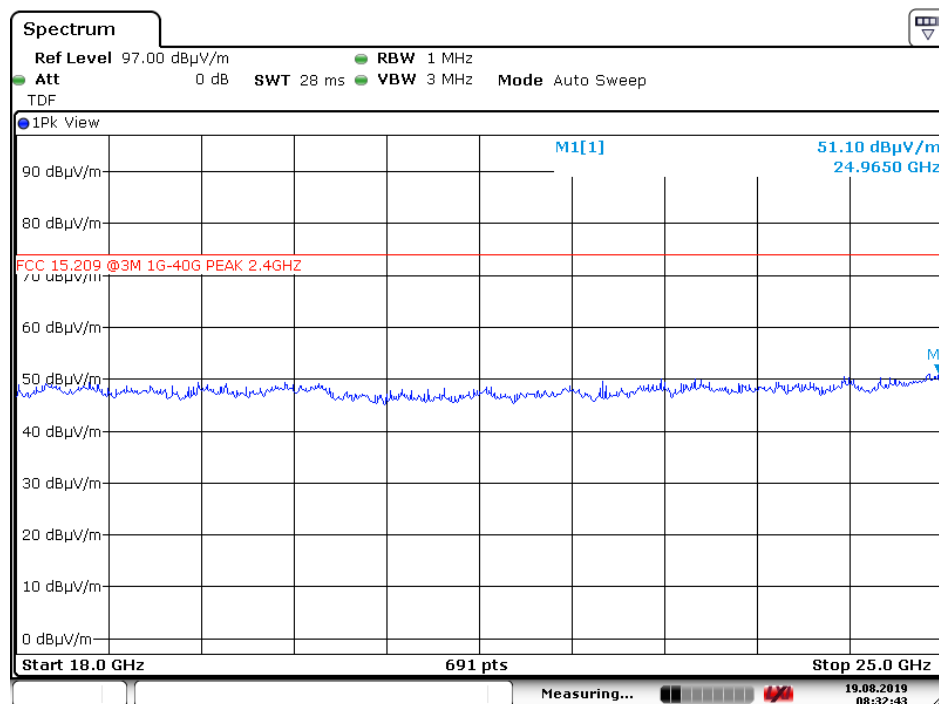
Date: 19.AUG.2019 08:30:44

Radiated Emissions, 18GHz – 25GHz, 2412MHz, 1 Mbps, HP



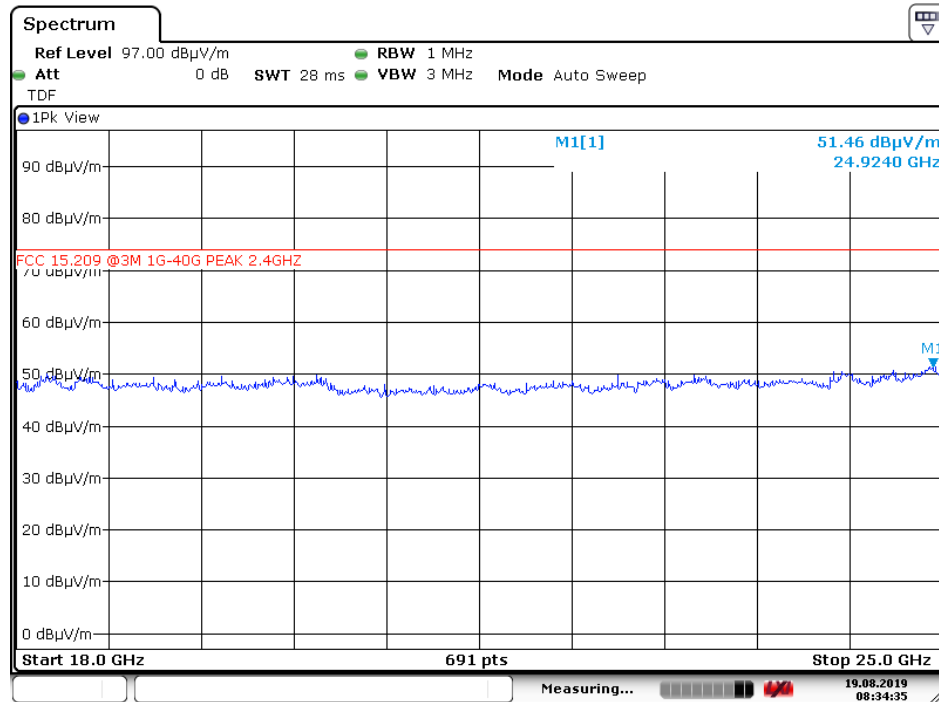
Date: 19.AUG.2019 08:31:41

Radiated Emissions, 18GHz – 25GHz, 2437MHz, 1 Mbps, VP



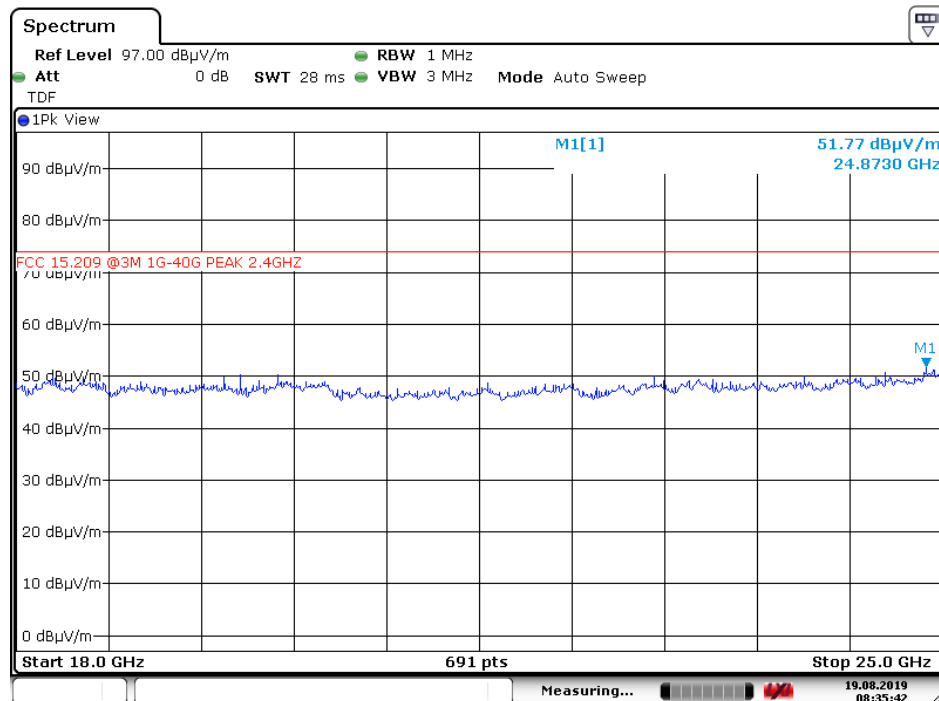
Date: 19.AUG.2019 08:32:43

Radiated Emissions, 18GHz – 25GHz, 2437MHz, 1 Mbps, HP



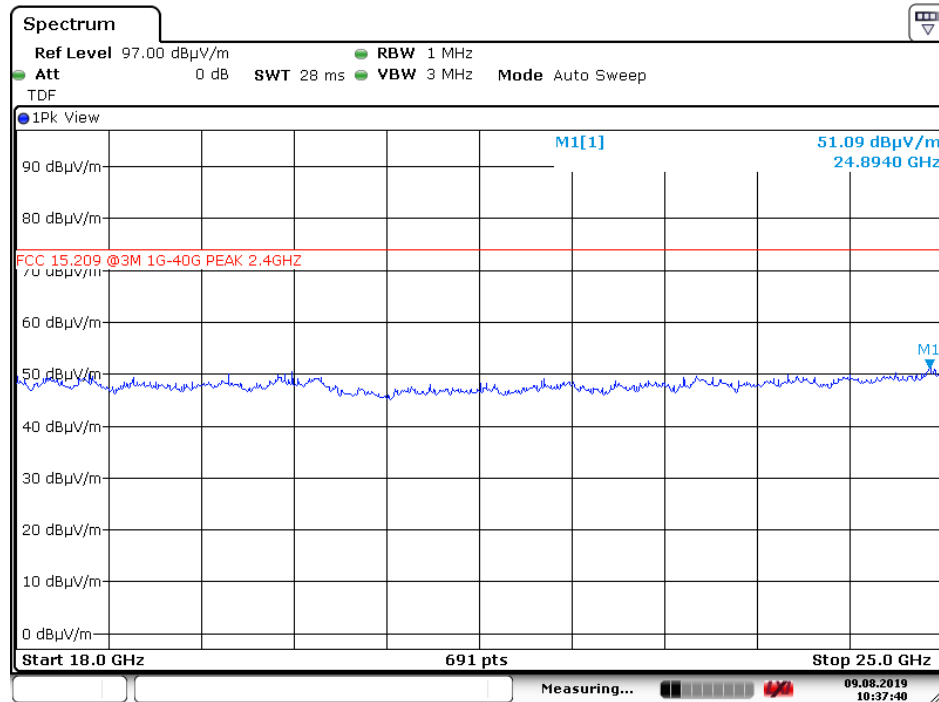
Date: 19.AUG.2019 08:34:35

Radiated Emissions, 18GHz – 25GHz, 2462MHz, 1 Mbps, VP



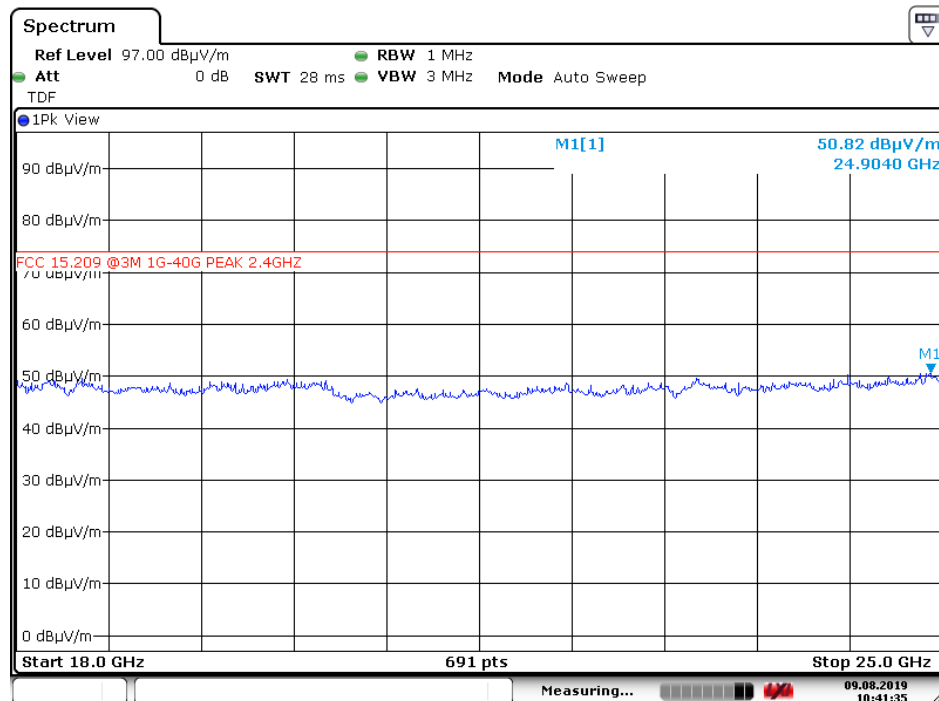
Date: 19.AUG.2019 08:35:42

Radiated Emissions, 18GHz – 25GHz, 2462MHz, 1 Mbps, HP



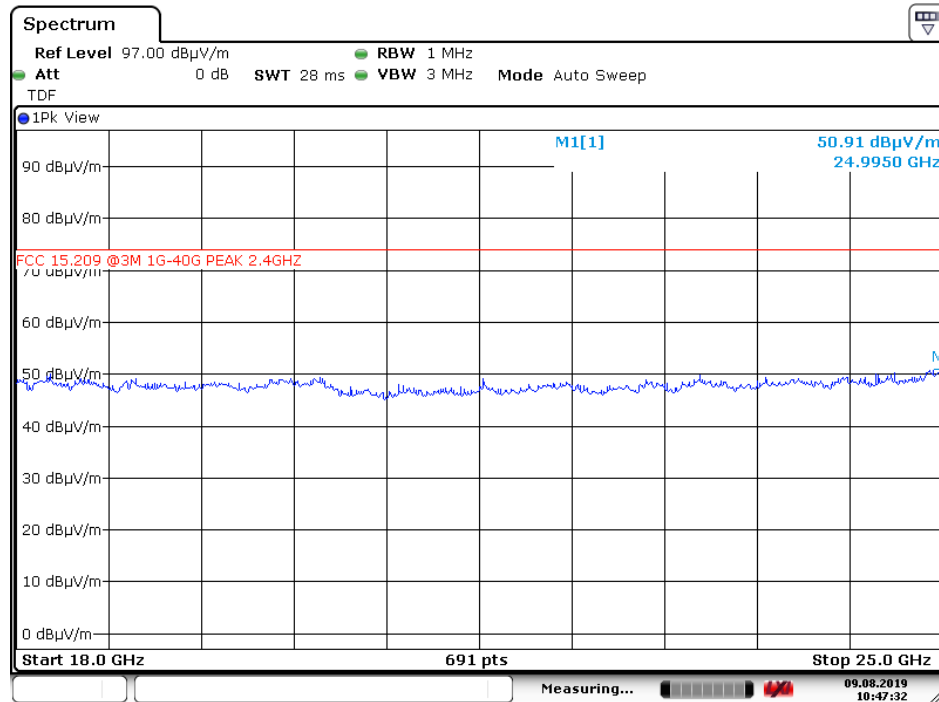
Date: 9.AUG.2019 10:37:40

Radiated Emissions, 18GHz – 25GHz, 2412MHz, 6 Mbps, VP



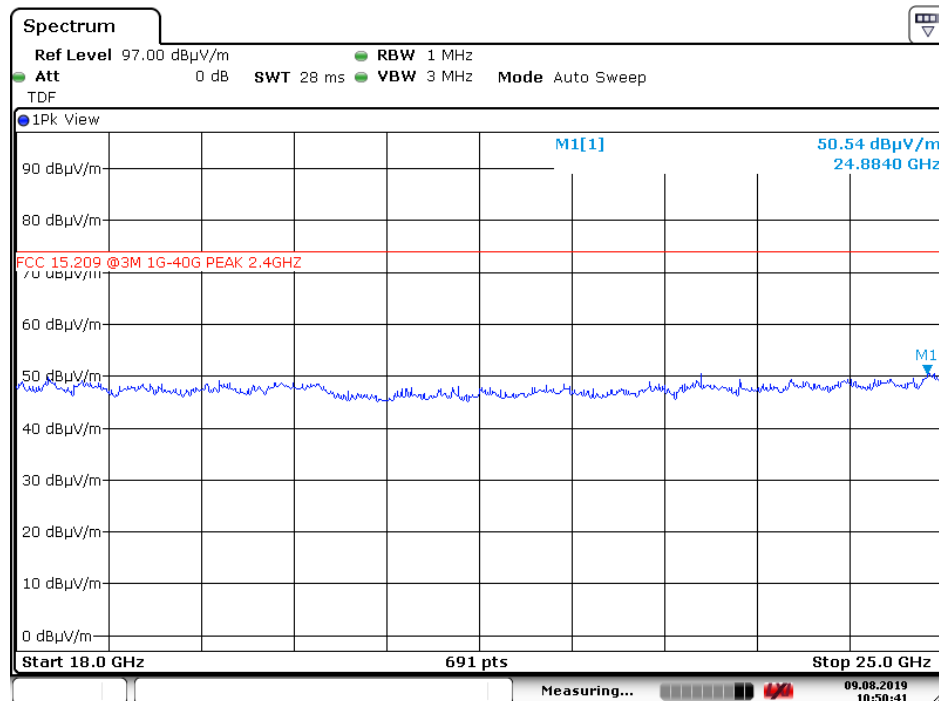
Date: 9.AUG.2019 10:41:35

Radiated Emissions, 18GHz – 25GHz, 2412MHz, 6 Mbps, HP



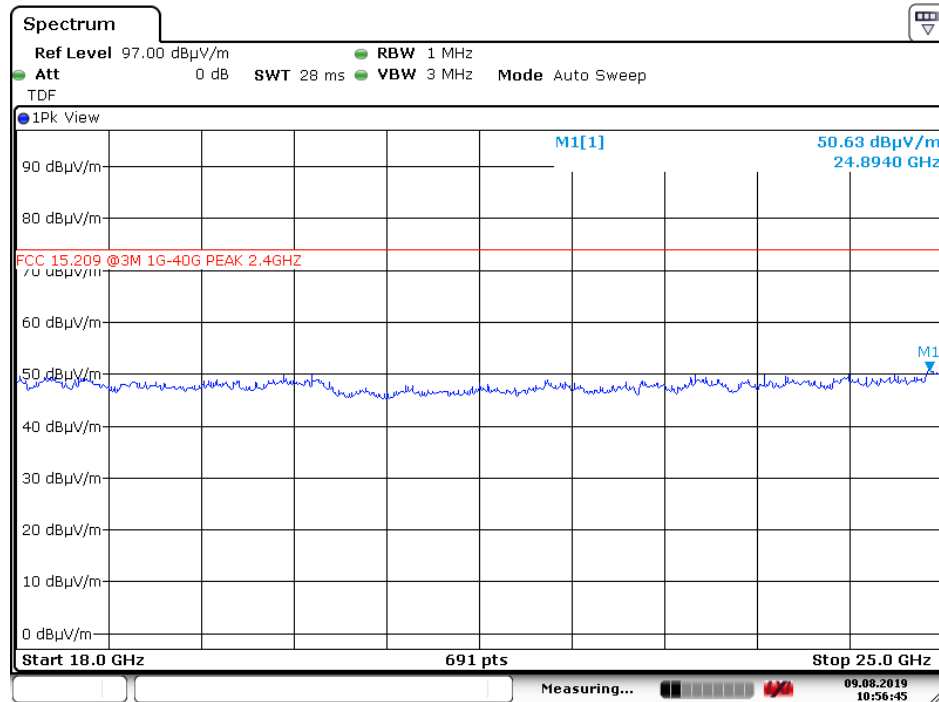
Date: 9.AUG.2019 10:47:32

Radiated Emissions, 18GHz – 25GHz, 2437MHz, 6 Mbps, VP



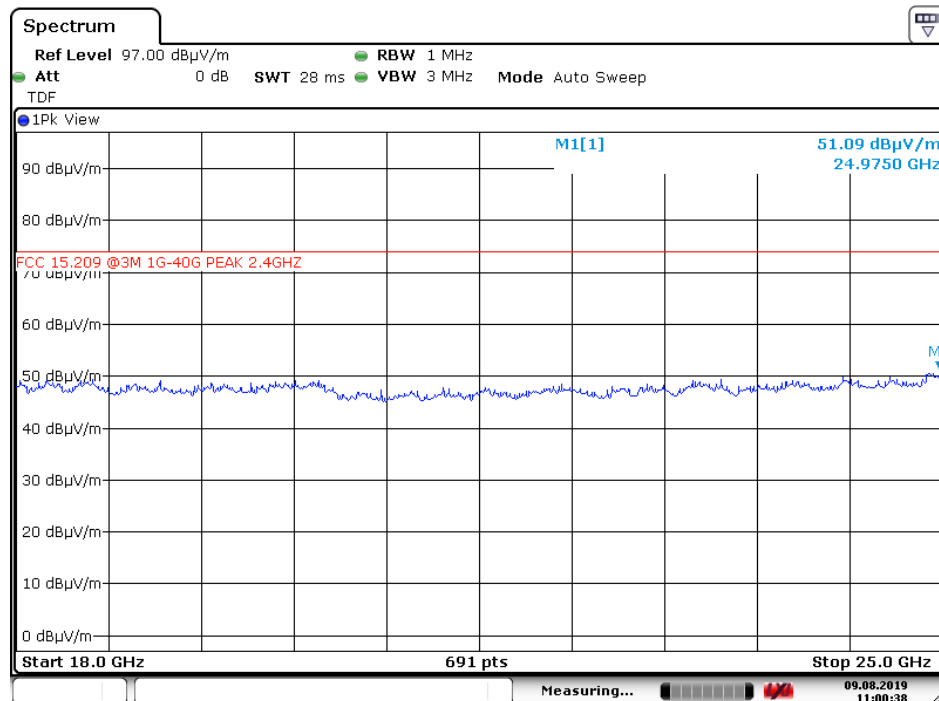
Date: 9.AUG.2019 10:50:41

Radiated Emissions, 18GHz – 25GHz, 2437MHz, 6 Mbps, HP



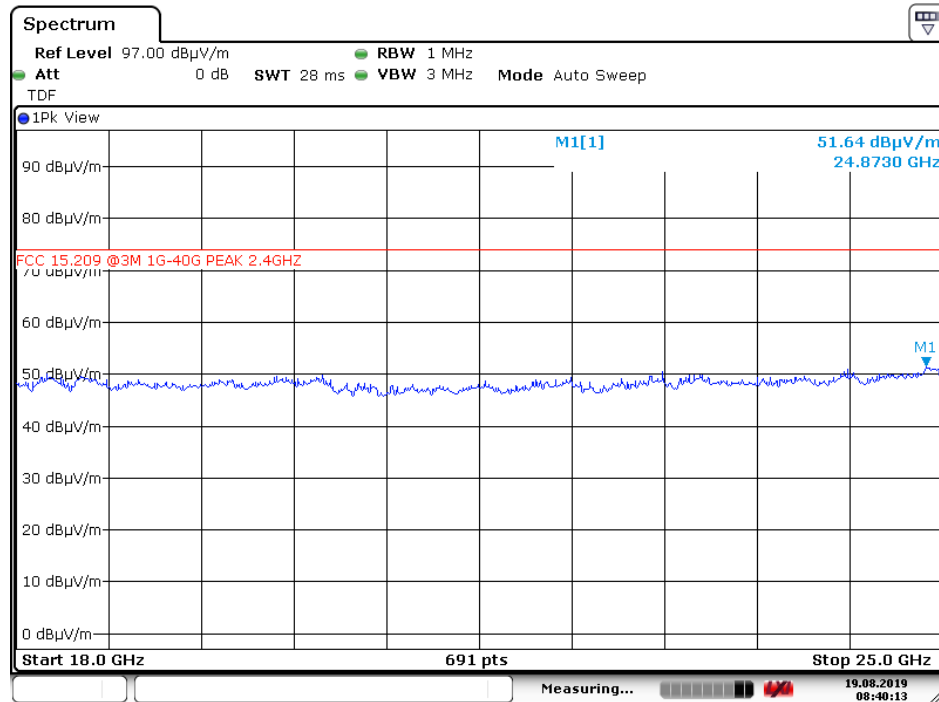
Date: 9.AUG.2019 10:56:45

Radiated Emissions, 18GHz – 25GHz, 2462MHz, 6 Mbps, VP



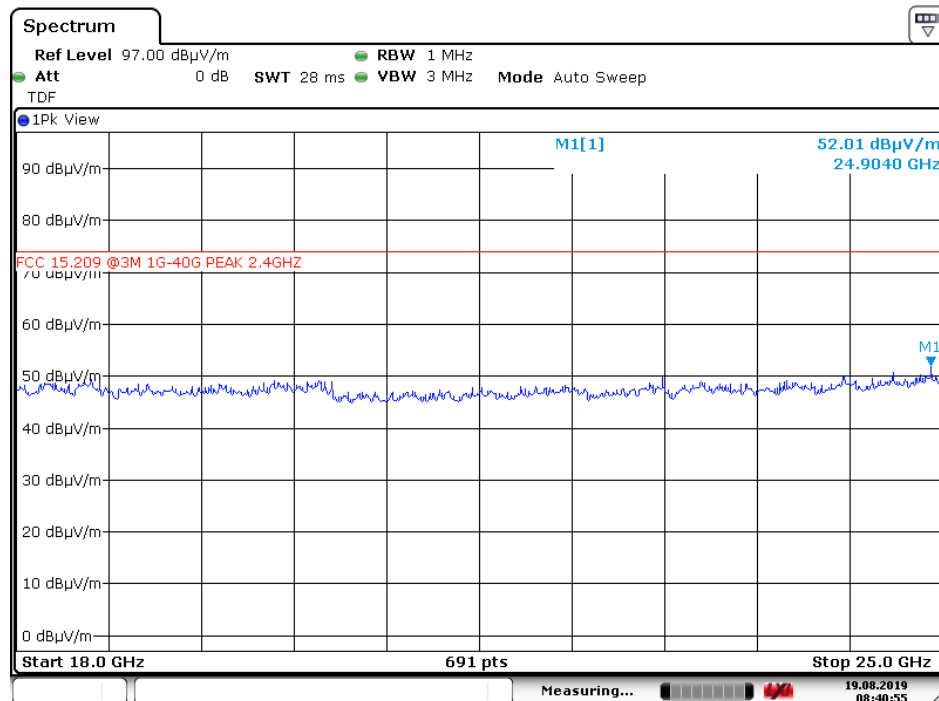
Date: 9.AUG.2019 11:00:38

Radiated Emissions, 18GHz – 25GHz, 2462MHz, 6 Mbps, HP



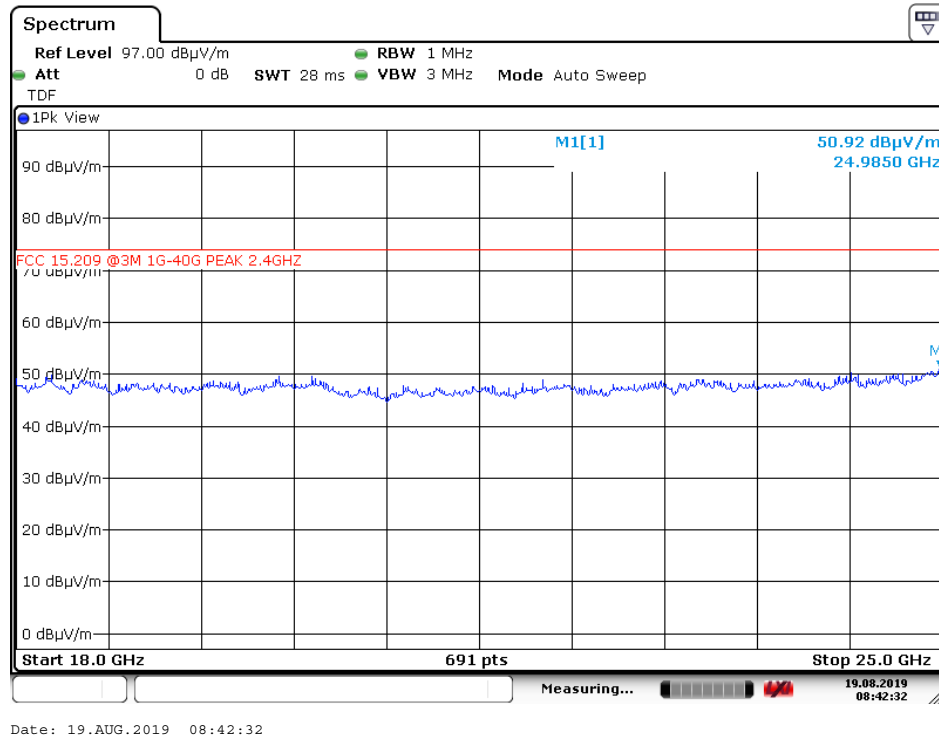
Date: 19.AUG.2019 08:40:13

Radiated Emissions, 18GHz – 25GHz, 2412MHz, MCS 0, VP

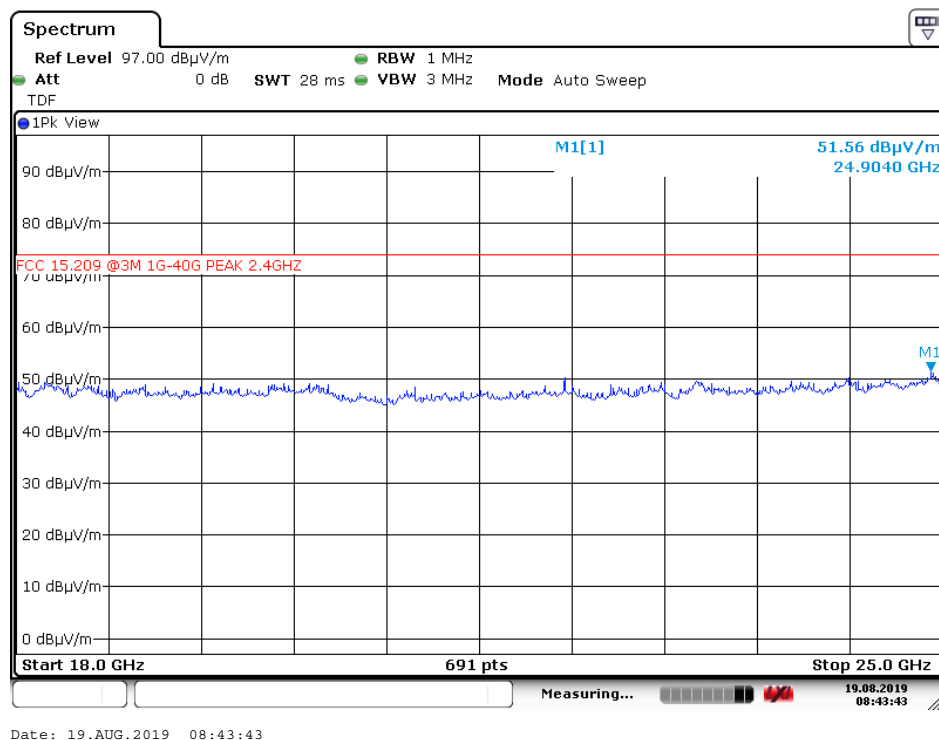


Date: 19.AUG.2019 08:40:55

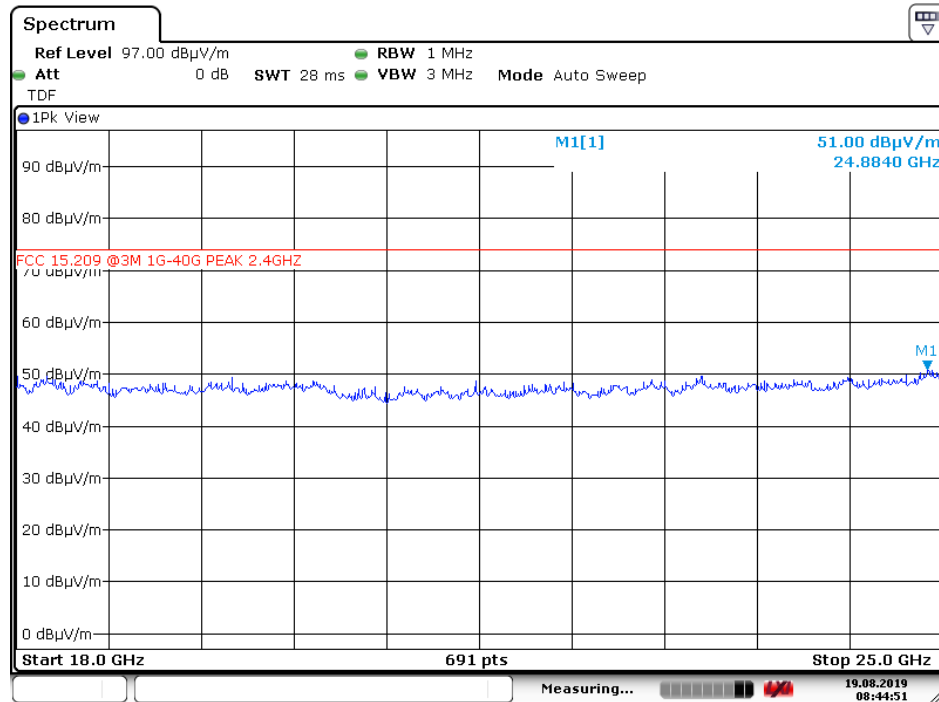
Radiated Emissions, 18GHz – 25GHz, 2412MHz, MCS 0, HP



Radiated Emissions, 18GHz – 25GHz, 2437MHz, MCS 0, VP

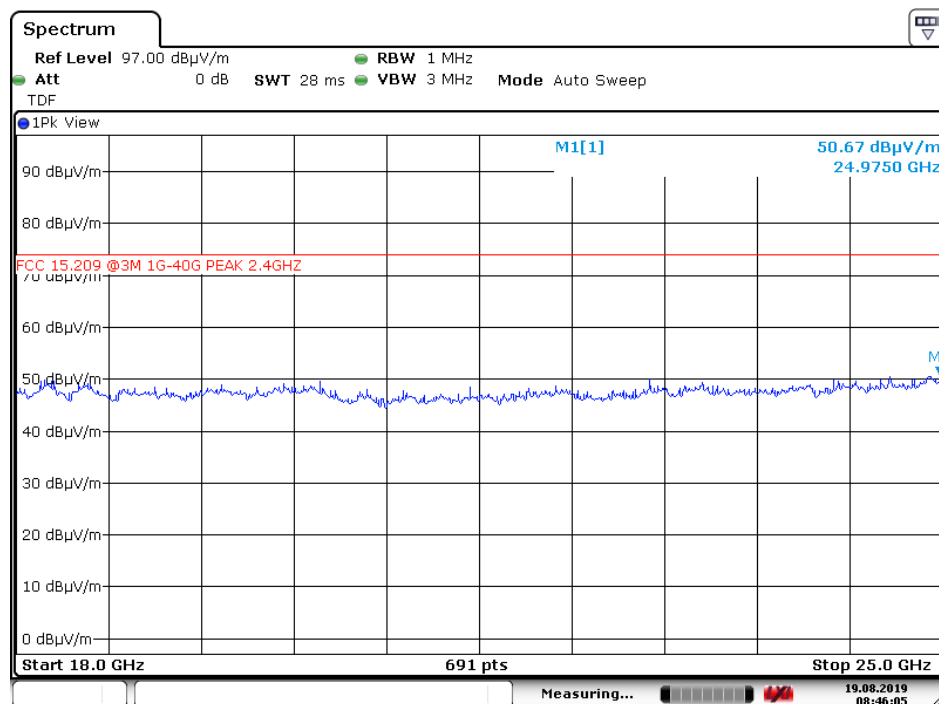


Radiated Emissions, 18GHz – 25GHz, 2437MHz, MCS 0, HP



Date: 19.AUG.2019 08:44:51

Radiated Emissions, 18GHz – 25GHz, 2462MHz, MCS 0, VP



Date: 19.AUG.2019 08:46:05

Radiated Emissions, 18GHz – 25GHz, 2462MHz, MCS 0, HP

3.9 Power Spectral Density (PSD)

Para. No.: 15.247 (d)

Para. No.: 5.2 (RSS-247)

Test Performed By: Frederic Hupbauer	Date of Test: 2019-08-13
--------------------------------------	--------------------------

Test Results: Passed

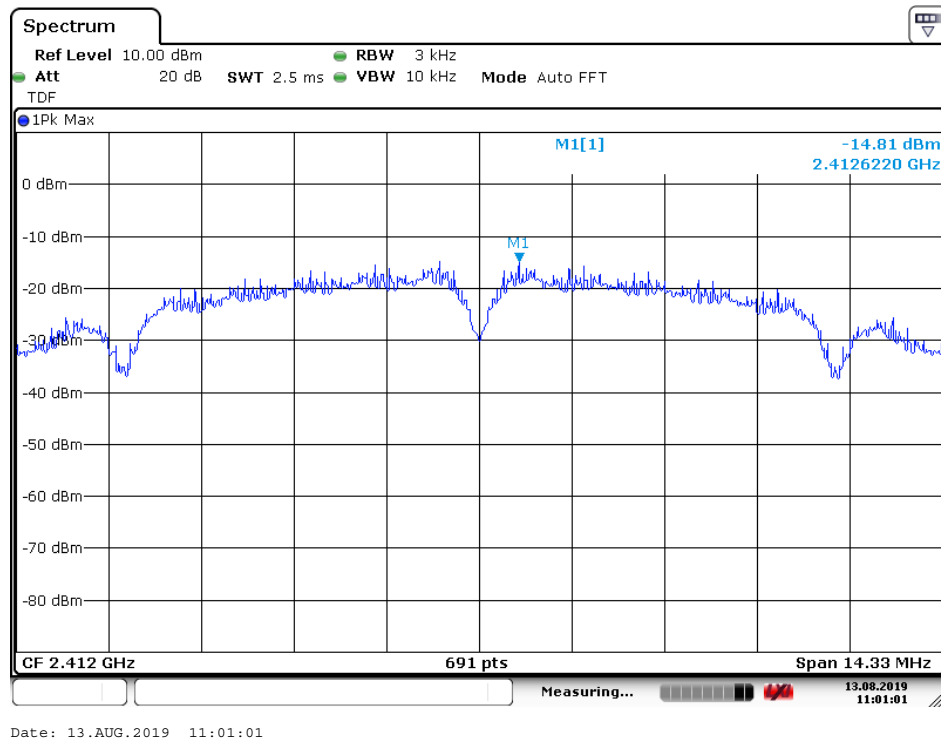
Measured and Calculated Data:

The measurement procedures PKPSD described in KDB 558074 D01 v03r05 was used.

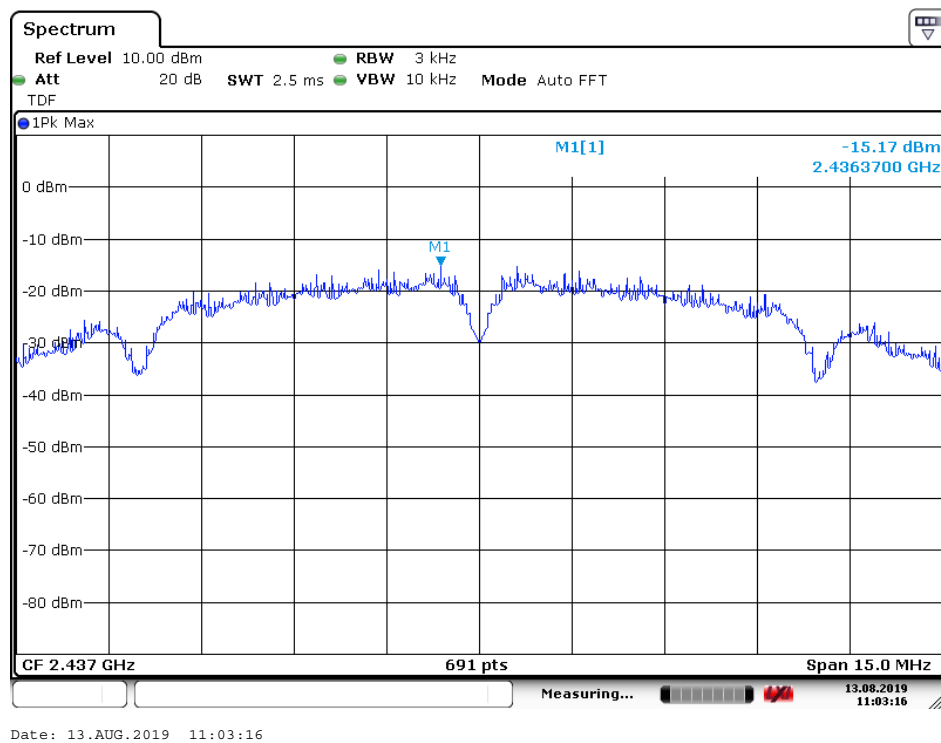
Modulation type and bitrate	Power Spectral Density (dBm)		
	Ch 01, 2412 MHz	Ch 06, 2437 MHz	Ch 11, 2462 MHz
802.11b, 1 Mbps	-14.81	-15.17	-17.24
802.11g, 6 Mbps	-19.83	-16.85	-22.85
802.11n, MCS 0	-19.43	-15.38	-21.75

Requirements:

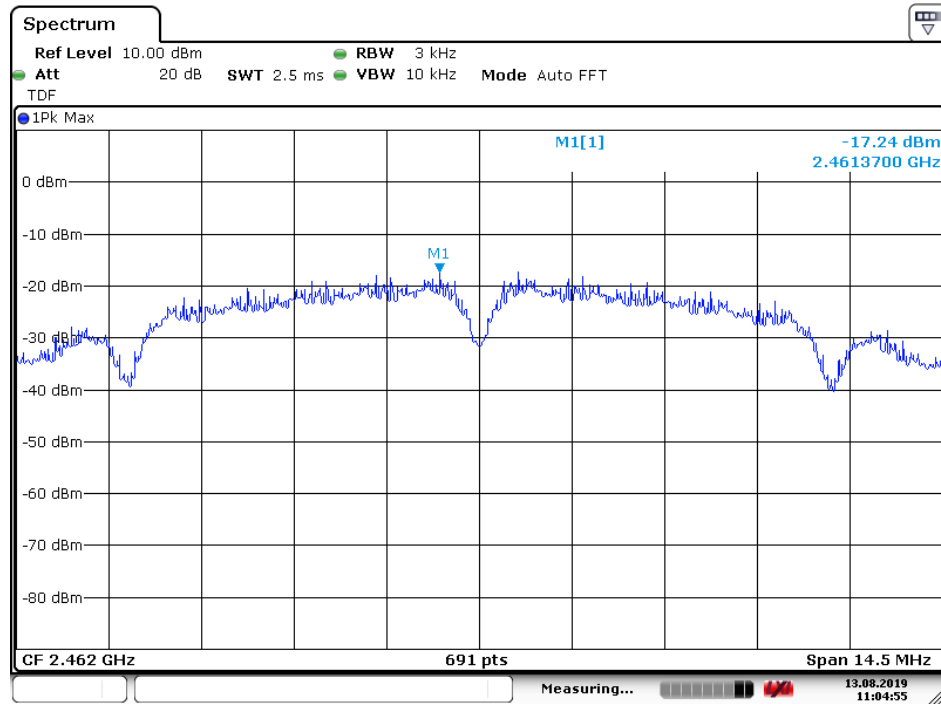
The Power Spectral Density of a Digital Transmission System shall be no greater than +8 dBm in any 3 kHz band.



PSD Measurement, 2412MHz, 1 Mbps

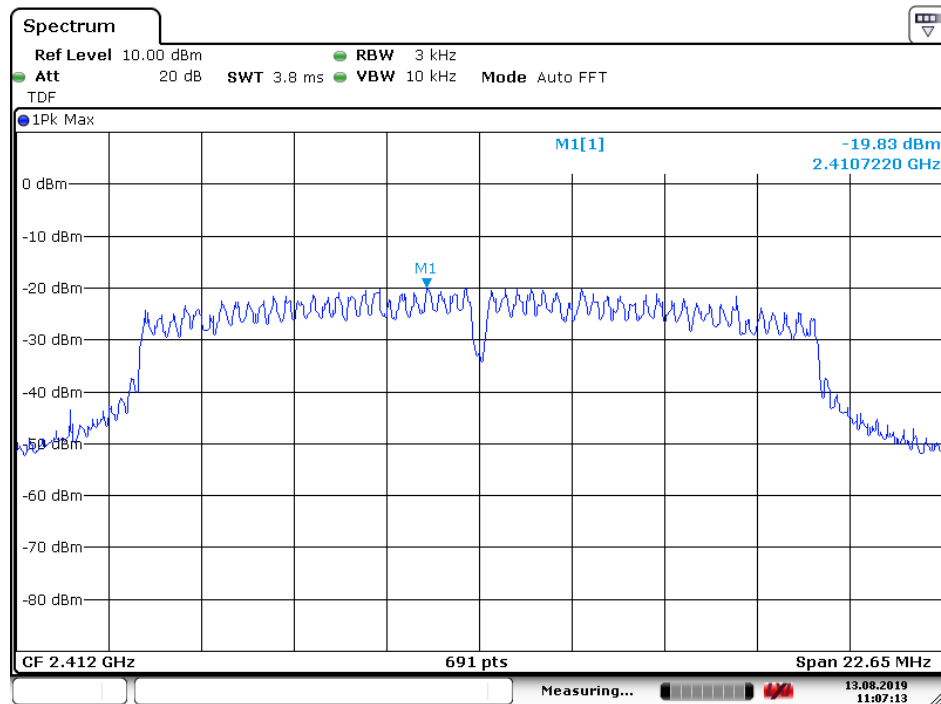


PSD Measurement, 2437MHz, 1 Mbps



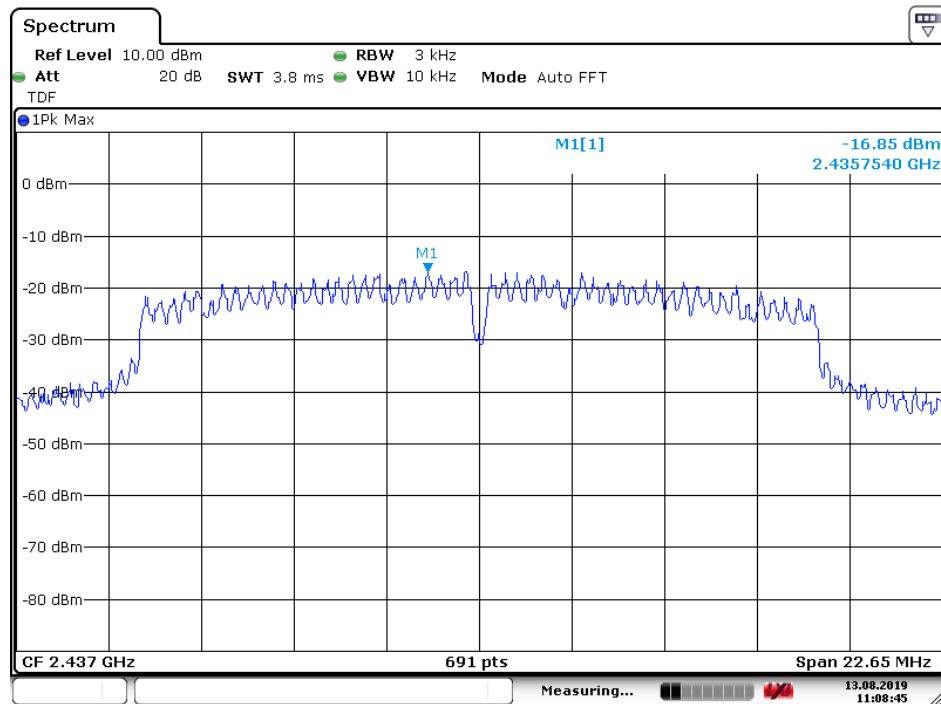
Date: 13.AUG.2019 11:04:55

PSD Measurement, 2462MHz, 1 Mbps



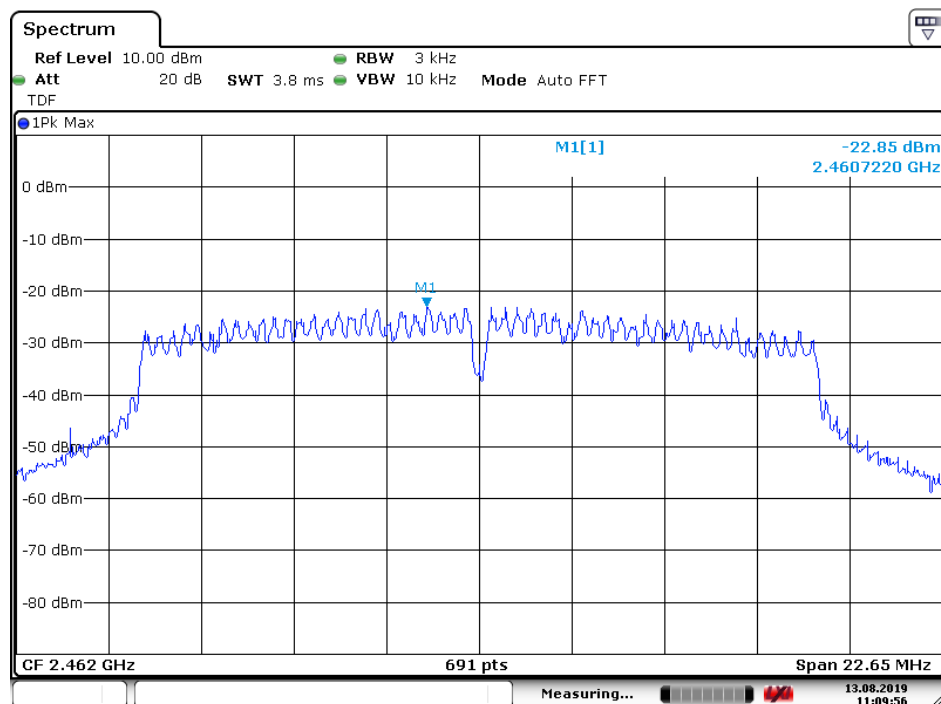
Date: 13.AUG.2019 11:07:13

PSD Measurement, 2412MHz, 6 Mbps



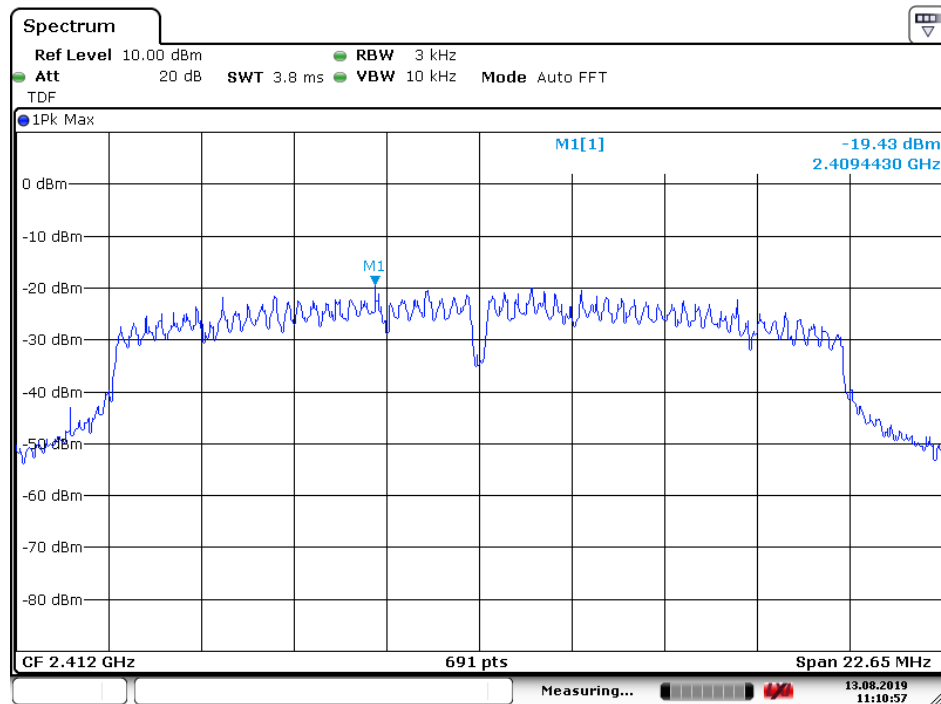
Date: 13.AUG.2019 11:08:45

PSD Measurement, 2437MHz, 6 Mbps



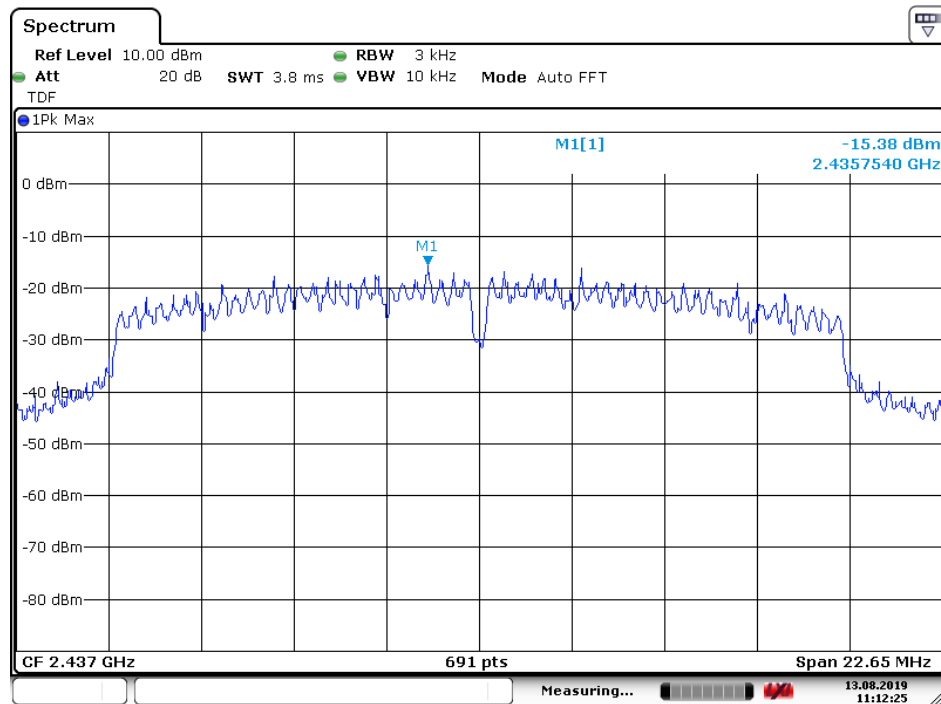
Date: 13.AUG.2019 11:09:56

PSD Measurement, 2462MHz, 6 Mbps



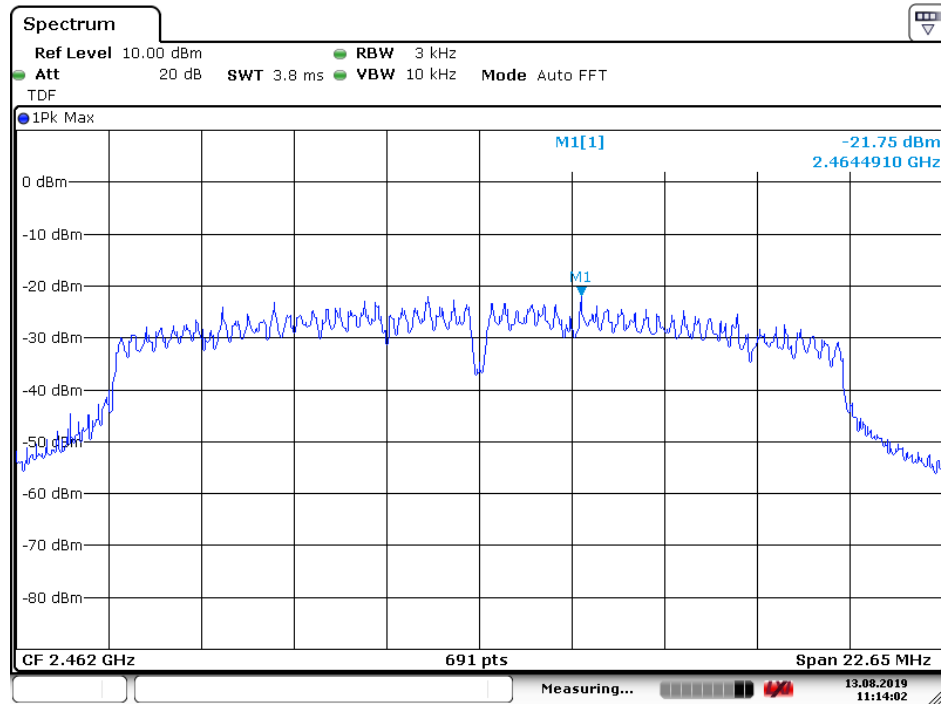
Date: 13.AUG.2019 11:10:57

PSD Measurement, 2412MHz, MCS 0



Date: 13.AUG.2019 11:12:25

PSD Measurement, 2437MHz, MCS 0



Date: 13.AUG.2019 11:14:02

PSD Measurement, 2462MHz, MCS 0

4 MEASUREMENT UNCERTAINTY

Measurement Uncertainty Values		
Test Item		Uncertainty
Output Power		±0.8 dB
Power Spectral Density		±0.8 dB
Out of Band Emissions, Conducted	< 3.6 GHz	±0.8 dB
	> 3.6 GHz	±1.2 dB
Spurious Emissions, Radiated	< 200 MHz	±4.77 dB
	200 MHz - 1 GHz	±5.02 dB
	1 GHz – 18 GHz	±4.94 dB
	> 18 GHz	±5.91 dB
Emission Bandwidth		±4 %
Power Line Conducted Emissions		±3.58 %
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

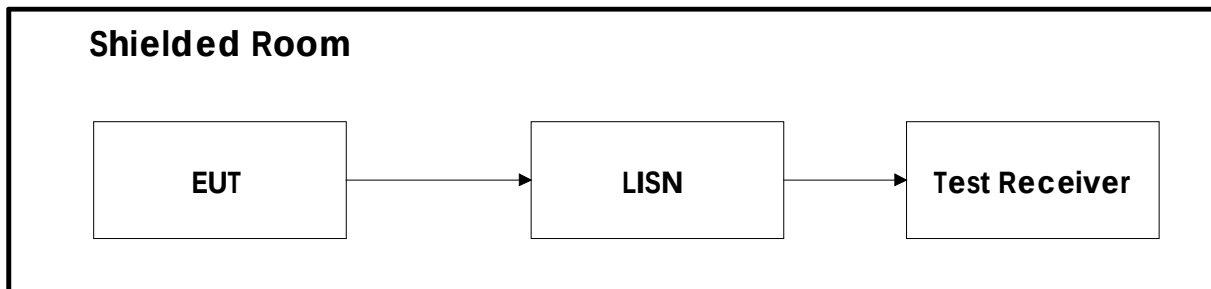
5 LIST OF TEST EQUIPMENT

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.

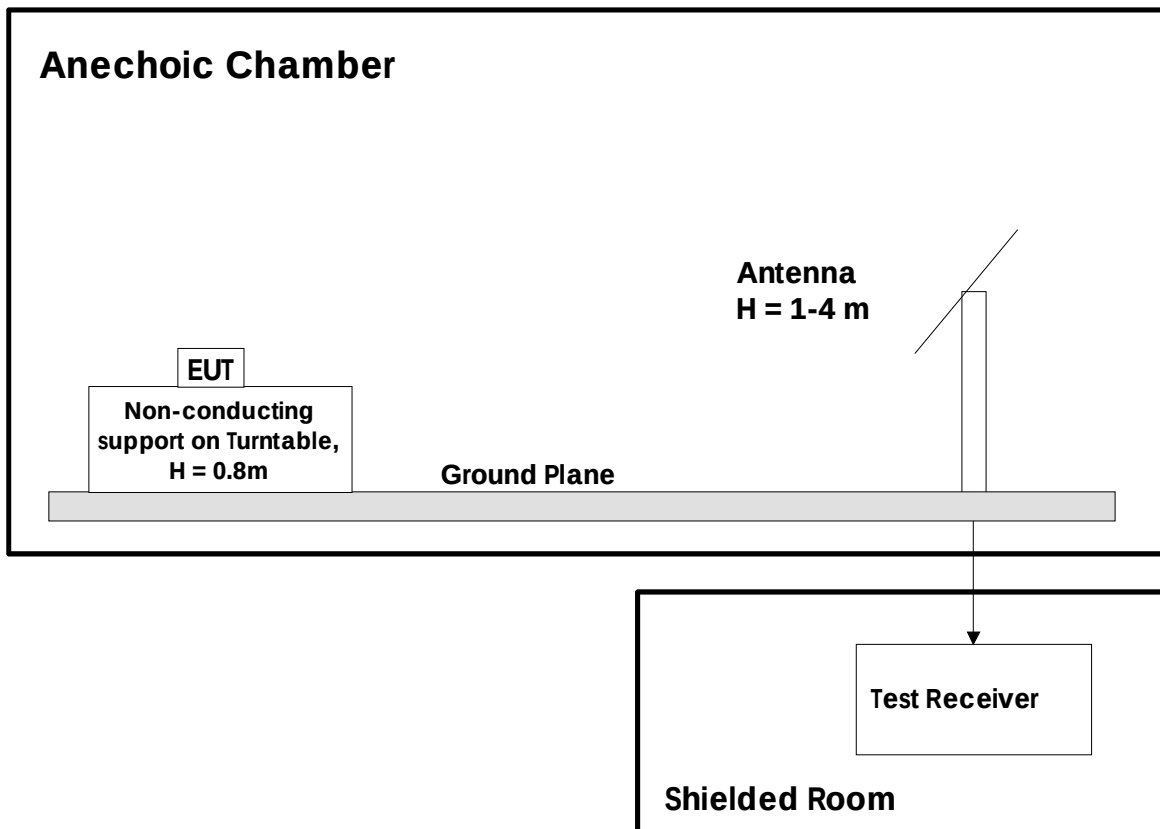
Ref No	Instrument/ ancillary	Manufacturer	Type of instrument/ ancillary	Cal. Date	Cal. Due
1-0039	Loop antenna	Rohde & Schwarz	HFH2-Z2	2018-09	2019-09
1-0040	Biconical antenna	Rohde & Schwarz	HK116	2017-07	2020-07
1-0055	LogPer antenna	Rohde & Schwarz	HL223	2017-07	2020-07
1-0250	RF signal generator	Rohde & Schwarz	SML 03, Sach-Nr. 1090.3000K13	2017-09	2020-09
1-0359	Shielded chamber	Reinhold & Mahla		--	--
1-0361	Semi anechoic chamber	Reinhold & Mahla	3m	2017-06	2020-06
1-0364	Antenna cable 2	Kabelwerk Eupen	RF/Cord CMS / RG 214-N/7	2016-09	2019-09
1-0604	EMI test receiver	Rohde & Schwarz	ESU8	2018-09	2019-09
1-0611	Signal analyzer	Rohde & Schwarz	FSV 40	2018-09	2019-09
1-0615	Pre amplifier	Schwarzbeck Mess-Elektronik	BBV-9718 Broadband Preamplifier	2018-09	2019-09
1-0619	Coaxial cable (to SAC)	Huber+Suhner	SF106/2x11N-651/2m	2016-09	2019-09
1-0620	Antenna cable 3	Huber+Suhner	SF106/2x11N-651/3m	2016-09	2019-09
1-0771	Broadband Horn antenna	Schwarzbeck Mess-Elektronik	SHF-EHF Horn, 15-40GHz	2019-03	2021-03
1-0772	Horn antenna	Schwarzbeck Mess-Elektronik	BBHA 9120D	2018-03	2021-03
1-0781	Pre amplifier	Schwarzbeck Mess-Elektronik	BBV 9721	2018-09	2019-09
1-0792	Splitter	Mini Circuits	ZFRSC.42-S+ DC-4200MHz	2016-09	2019-09
1-0795	Dual Rotary Attenuator	JFW Industries	50DR-125	2016-09	2019-09
1-0914	Splitter	Mini Circuits	ZFRSC-42-S+, DC-4200MHz	2016-09	2019-09
1-0915	Coaxial Directional Coupler	Mini Circuits	ZFDC-20-33-S+	2016-09	2019-09
1-0923	Cable 1m	---	SMA	2016-09	2019-09
1-0924	Cable 1m	---	SMA	2016-09	2019-09
1-0925	Cable 1m	---	SMA	2016-09	2019-09
1-0926	Cable 1m	Harbour Industries	SMA	2016-09	2019-09
1-0927	Cable 1m	Harbour Industries	SMA	2016-09	2019-09
1-0932	Tunable Bandreject (Notch) Filter	K&L Microwave	3TNF-500/1000-0/0	2016-09	2019-09
1-0933	Tunable Bandreject (Notch) Filter	K&L Microwave	3TNF-1000/2000-0/0	2016-09	2019-09
1-0966	RF power meter	DARE	RPR3006W	2019-01	2020-01
1-0997	Attenuator	Mini Circuits	BW-S3-2W263+	2017-10	2020-10
1-1017	High pass filter	Wainwright	WHKX10-3150-3500-18000-40SS	2018-09	2021-09

6 BLOCK DIAGRAM

6.1 Power Line Conducted Emission



6.2 Test Site Radiated Emission



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

Revision history

Version	Date	Comment	Sign
400939-01	2020-07-06	First version	FH