

Test Report

Product	WLAN Handset with Bluetooth		
Name and address of the applicant	Ascom (Sweden) AB Grimbodalen 2 SE-417 49 Gothenburg, Sweden		
Name and address of the manufacturer	Ascom (Sweden) AB Grimbodalen 2 SE-417 49 Gothenburg, Sweden		
Model	WH2		
Rating	3.7V _{DC} (Li-Ion battery)		
Trademark	ASCOM		
Serial number	/		
Additional information	WiFi, 802.11a/b/g/n, Bluetooth, Bluetooth Low Energy		
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		
Order number	362353		
Tested in period	2019-01-15 to 2019-04-10		
Issue date	2019-06-12		
Name and address of the testing laboratory	<div style="display: flex; justify-content: space-between; align-items: flex-start;"> <div style="text-align: center;">  Instituttveien 6 Kjeller, Norway </div> <div style="text-align: center;"> CAB Number: FCC: NO0001 ISED: NO0470 </div> <div style="text-align: center;">   </div> </div> <p style="text-align: center; color: red; font-weight: bold;">An accredited technical test executed under the Norwegian accreditation scheme</p>		
<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  Prepared by [Frode Sveinsen] </div> <div style="text-align: center;">  Approved by [G.Suhanthakumar] </div> </div>			
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1 INFORMATION

1.1 Test Item

Name	Ascom
FCC ID	BXZWH2
ISED ID	3724B-WH2
Model/version	WH2
Serial number	/
Hardware identity and/or version	PB
Software identity and/or version	1.0.4_Nemko
Frequency Range	2412 – 2462 MHz
Number of Channels	11
Channel Separation	5 MHz
Operating Modes	802.11b/g/n (HT20)
Type of Modulation	802.11b: DSSS 802.11g: OFDM
User Frequency Adjustment	None
Conducted Output Power	802.11b: 72 mW 802.11g: 246 mW 802.11n: 151 mW
Power Supply	Secondary Battery (3.7V Li-Ion)
Antenna Connector	None
Number of Antennas	1
Diversity or Smart Antennas	No

Description of Test Item

The tested device is a WiFi Handset with 2.4GHz and 5GHz WLAN, and Bluetooth Basic Rate and Bluetooth Low Energy.

All radio transmitters in the handset, including 2.4GHz WLAN are supplied by an already certified radio module.

Description	Brand	Model	Regulatory Information
WiFi and BT Radio Module	Murata	SP-HY1MW	FCC ID: VPYLBEE5HY1MW IC: 772C-LBEE5HY1MW

1.2 Normal test condition

Temperature:	20 - 24 °C
Relative humidity:	20 - 50 %
Normal test voltage:	3.7 V _{DC} (Nominal Voltage)

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: N/A

Ref. FCC §15.203

1.7 Worst-Case Configuration, Mode and Duty Cycle

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.

All measurements were performed with bitrate and duty cycle reported below.

Modulation	Worst Case Bitrate	Duty Cycle
802.11b	1 Mb	100 %
802.11g	6 Mb	98.71 %
802.11n	MCS0	98.92 %

1.8 EUT Operating Modes

Description of operating modes	Continuous TX, 2.4 GHz 20MHz Mode
Additional information	<p>A computer was connected by USB to the supplied charger/cradle and the EUT was then placed in the cradle. USB to Serial drivers were installed on the computer to connect to the EUT.</p> <p>The proprietary Ascom Test Interface Application (TIA) was then used to program the EUT to transmit continuously on a selected carrier, modulation and bit-rate and with programmed or default power level. The EUT was removed from the cradle when performing the tests.</p>

1.9 Power Levels

Carrier No	Power Level		
	802.11b	802.11g	802.11n
1	Default	48	Default
2	Default	48	Default
3 to 10	Default	Default	Default
11	Default	48	Default

1.10 Comments

All tested parameters are passed.

2 TEST REPORT SUMMARY

2.1 General

All measurements are traceable to national standards.

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

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

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

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

☒ New Submission

☒ Production Unit

☐ Class II Permissive Change

☐ Pre-production Unit

DTS Equipment Code

☐ Family Listing



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

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

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2.2 Test Summary

Name of test	FCC Part 15 reference	RSS-247 Issue 2, RSS-GEN Issue 5 reference	Result
Supply Voltage Variations	15.31(e)	6.11 (RSS-GEN)	Complies
Antenna Requirement	15.203	6.8 (RSS-GEN)	Complies
Power Line Conducted Emission	15.107(a) 15.207(a)	7.2 / 8.8 (RSS-GEN)	N/A ¹
Occupied Bandwidth (99% BW)	N/A	6.7 (RSS-GEN)	Complies
DTS 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) 7.3 (RSS-GEN) 8.9 (RSS-GEN)	Complies

¹ The EUT is battery powered and the battery is charged in an external charger

Revision history

Version	Date	Comment	Sign
1.0	2019-04-26	First edition	FS

3 TEST RESULTS

3.1 Occupied Bandwidth (99% BW)

ISED Canada RSS-GEN Issue 5, Clause 6.7

Measurement procedure: ANSI C63.10-2013 Clause 6.9.2

Test Results: Complies

Measurement Data:

Number of RF channels in use: 11

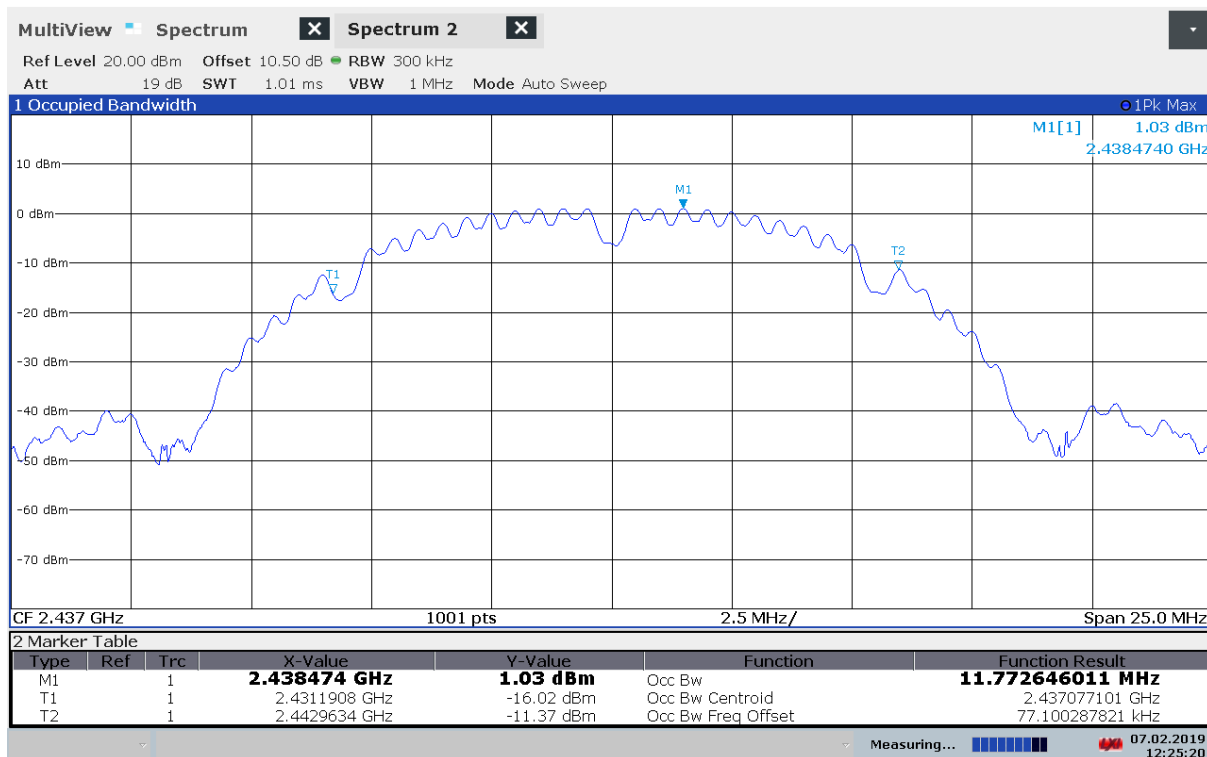
Modulation type and bitrate	Occupied Bandwidth (99% BW)
802.11b, 1 Mbps	11.8 MHz
802.11g, 6 Mbps	17.0 MHz
802.11n, MCS0	18.1 MHz

Occupied Bandwidth is reported for information only.

See attached plots

Requirements:

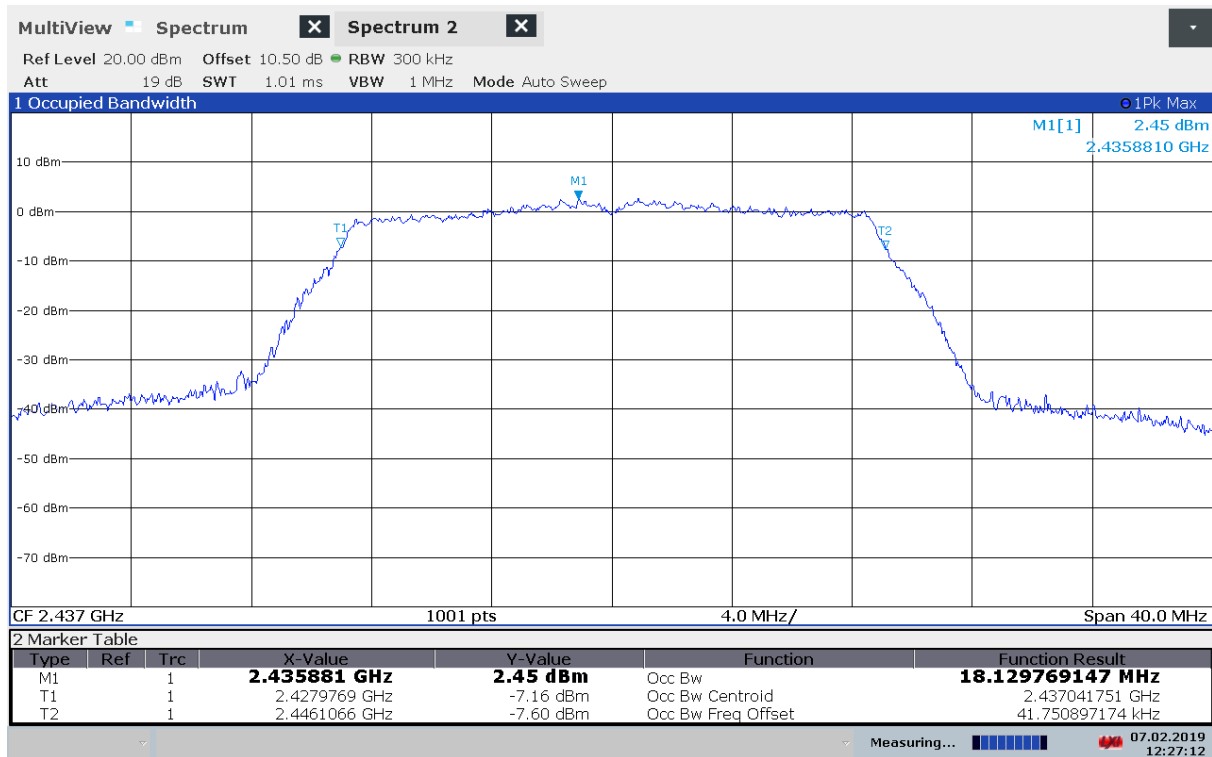
No requirements for Digital Transmission Systems.



Occupied Bandwidth, 2412 MHz, 802.11b, 1Mbps



Occupied Bandwidth, 2437 MHz, 802.11g, 6Mbps



Occupied Bandwidth, 2437 MHz, 802.11n, MCS0

3.2 DTS Bandwidth

FCC Part 15.247 (a)(2)

ISED Canada RSS-247 Issue 2, Clause 5.2 (1)

Measurement procedure: ANSI C63.10-2013 Clause 11.8

Test Results: Complies

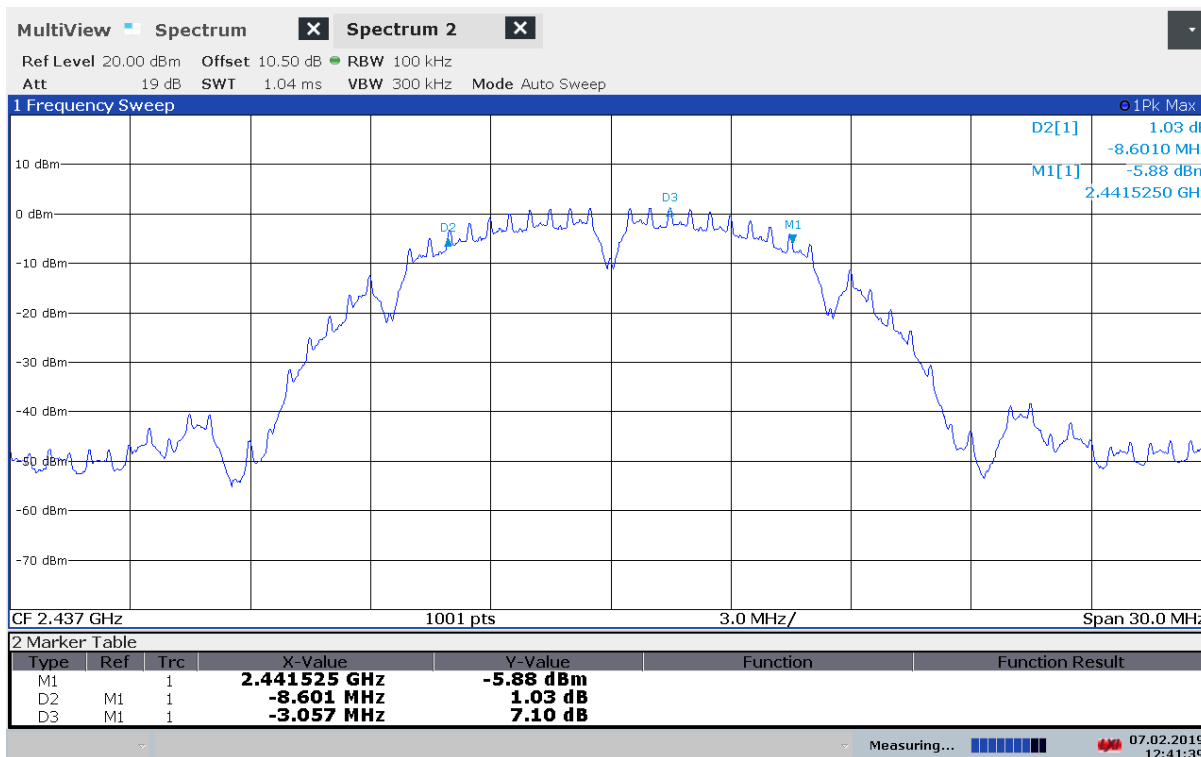
Measurement Data:

Modulation type and bitrate	Measured DTS Bandwidth
	Ch 06, 2437 MHz
802.11b, 1 Mbps	8.6 MHz
802.11g, 6 Mbps	16.3 MHz
802.11n, MCS0	17.6 MHz

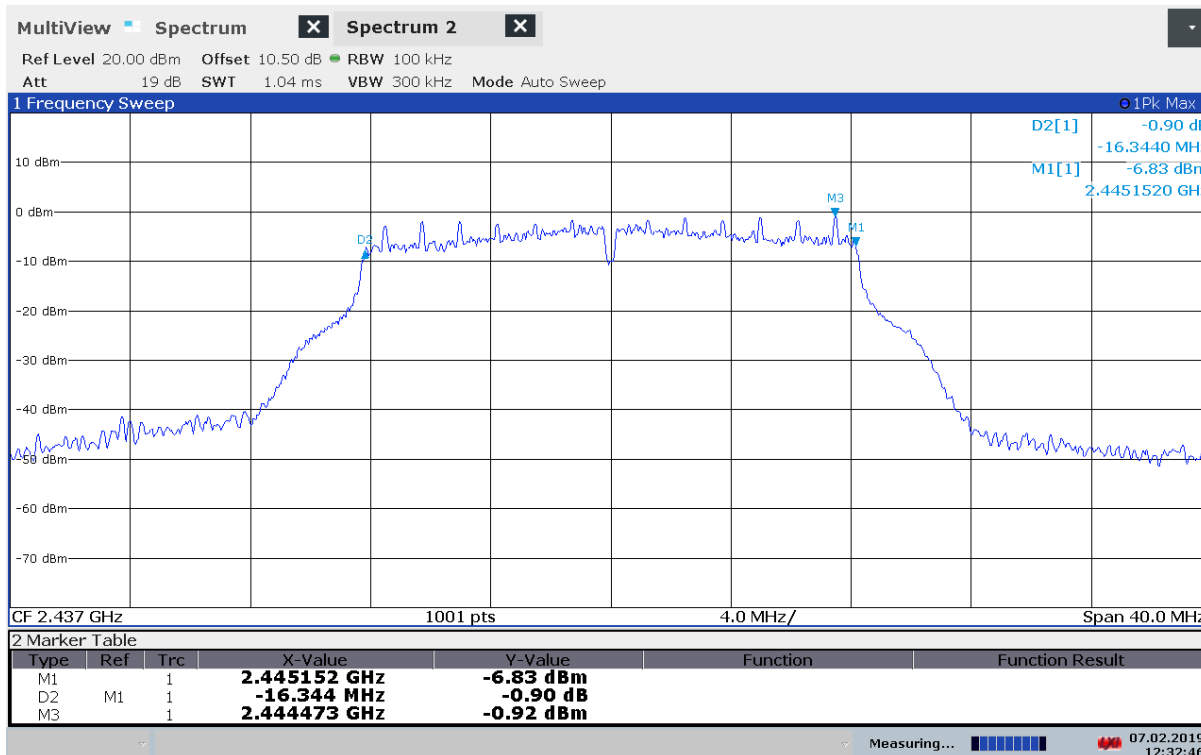
Power supply variation within 85 % to 115% of nominal value has no influence on measured value.

Requirements:

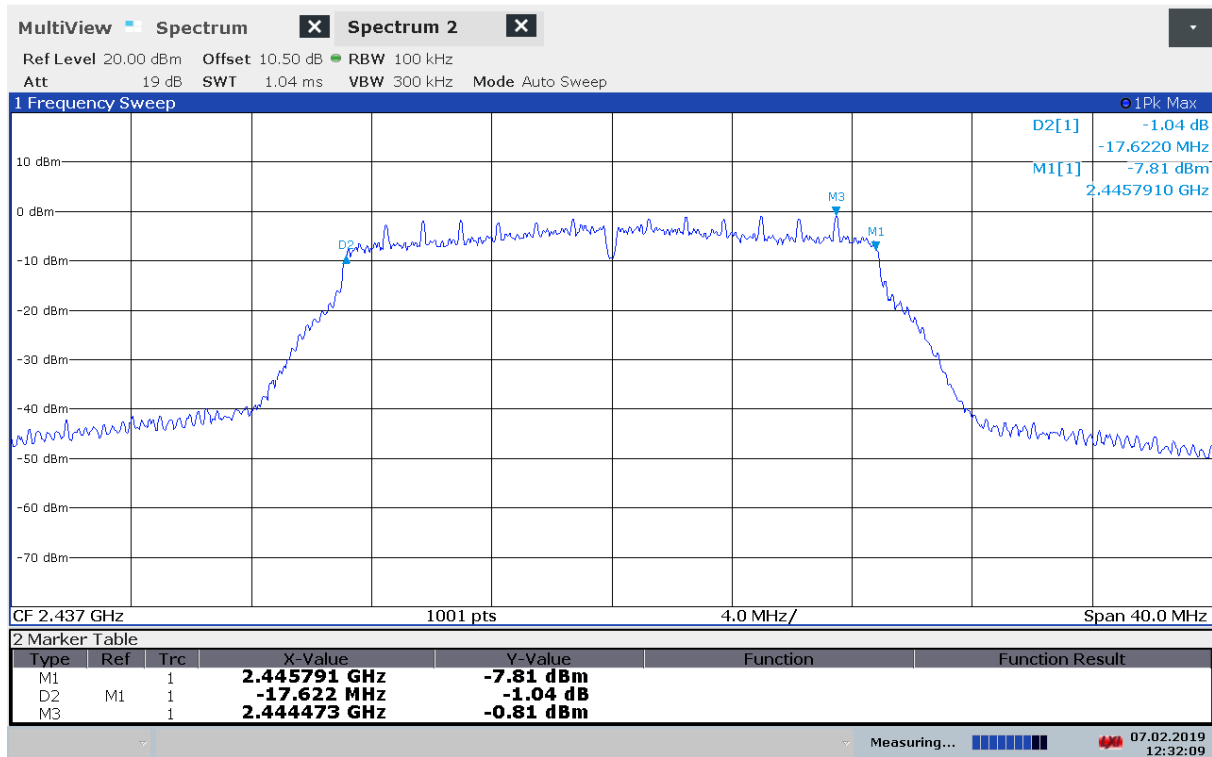
For Digital Transmission Systems in the 2400-2483.5 MHz band the minimum 6 dB bandwidth (DTS BW) shall be at least 500 KHz.



DTS Bandwidth, 2437 MHz, 802.11b, 1Mbps



DTS Bandwidth, 2437 MHz, 802.11g, 6Mbps



DTS Bandwidth, 2437 MHz, 802.11n, MCS0

3.3 Peak Power Output

FCC Part 15.247 (b)

ISED Canada RSS-247 Issue 2, Clause 5.4

Measurement procedure: ANSI C63.10-2013 Clause 11.9.1.2

Test Results: Complies

Measurement Data:

Peak Power Levels						
Carrier Frequency	Maximum Conducted Output Power, dBm			Maximum Conducted Output Power, mW		
	802.11b 1Mbps	802.11g 6Mbps	802.11n MCS0	802.11b 1Mbps	802.11g 6Mbps	802.11n MCS0
2412 MHz	19.5	20.7	22.7	89.1	117.5	186.2
2417 MHz	/	20.7	/	/	117.5	/
2422 MHz	/	24.7	/	/	295.1	/
2437 MHz	19.1	24.8	22.4	81.3	302.0	173.8
2457 MHz	/	24.8	/	/	302.0	/
2462 MHz	19.4	20.9	22.5	87.1	123.0	177.8

Peak Power Levels				
		2412 MHz	2437 MHz	2462 MHz
802.11b 1Mbps	Radiated Power (dBm)	22.4	22.3	20.7
	Conducted Power (dBm)	19.5	19.1	19.4
	Antenna Gain (dBi)	2.9	3.2	1.3
802.11g 6Mbps	Radiated Power (dBm)	24.0	27.5	22.9
	Conducted Power (dBm)	20.7	24.8	20.9
	Antenna Gain (dBi)	3.3	2.7	2.0
802.11n MCS0	Radiated Power (dBm)	25.5	25.2	23.8
	Conducted Power (dBm)	22.7	22.4	22.5
	Antenna Gain (dBi)	2.8	2.8	1.3

The Integrated Band Power Method was used to measure Output Power

Radiated Power was calculated from measured Field Strength using the method described in FCC KDB 412172 D01.

Cable loss 0.9 dB have been added to the conducted values above.

See attached plots

Requirements:

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

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

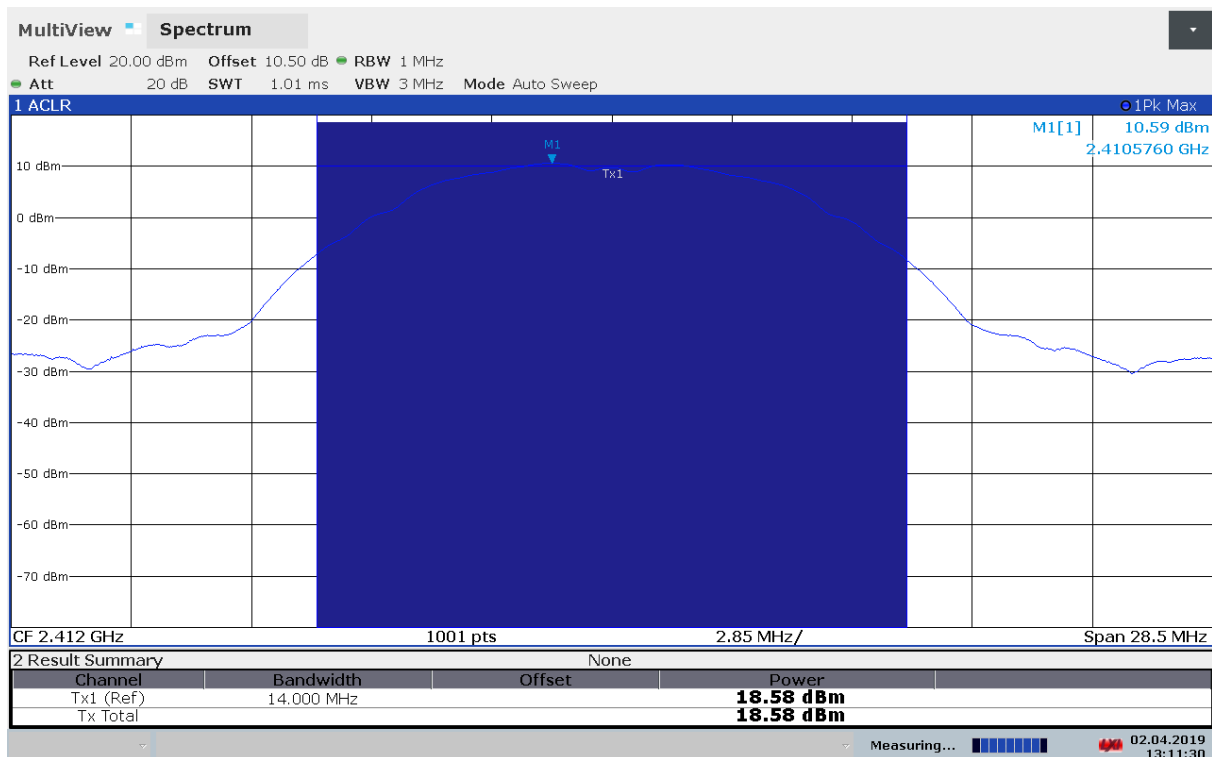
If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power from the intentional radiator shall be reduced below the stated value above by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Average Conducted Power						
Carrier Frequency	802.11b 1Mb		802.11g 6Mb		802.11n MCS0	
	dBm	mW	dBm	mW	dBm	mW
2412	16.6	45.2	12.7	18.4	14.1	25.9
2417	/	/	12.3	17.0	/	/
2437	16.4	43.9	16.3	42.7	14.0	25.3
2457	/	/	16.6	45.4	/	/
2462	16.7	46.7	12.7	18.5	14.3	27.0

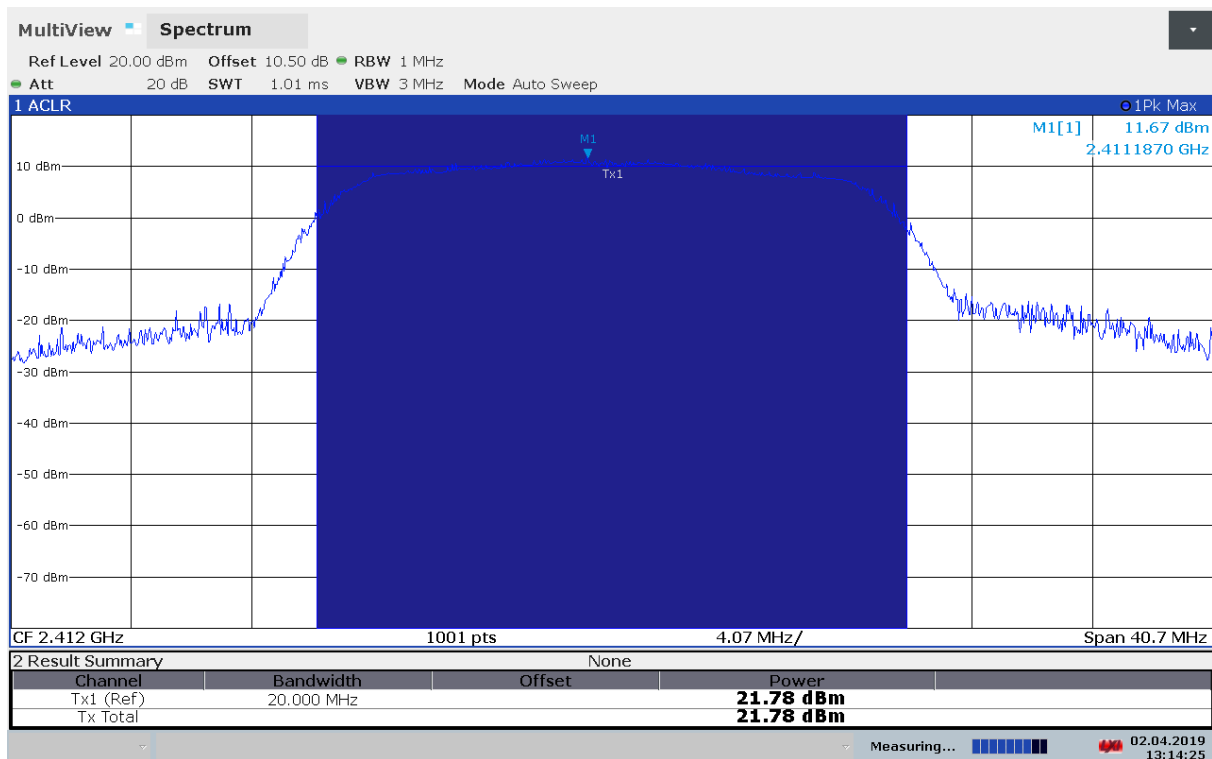
Average values are measured with an Average Power Meter.

Values are reported for consistency with the SAR report.

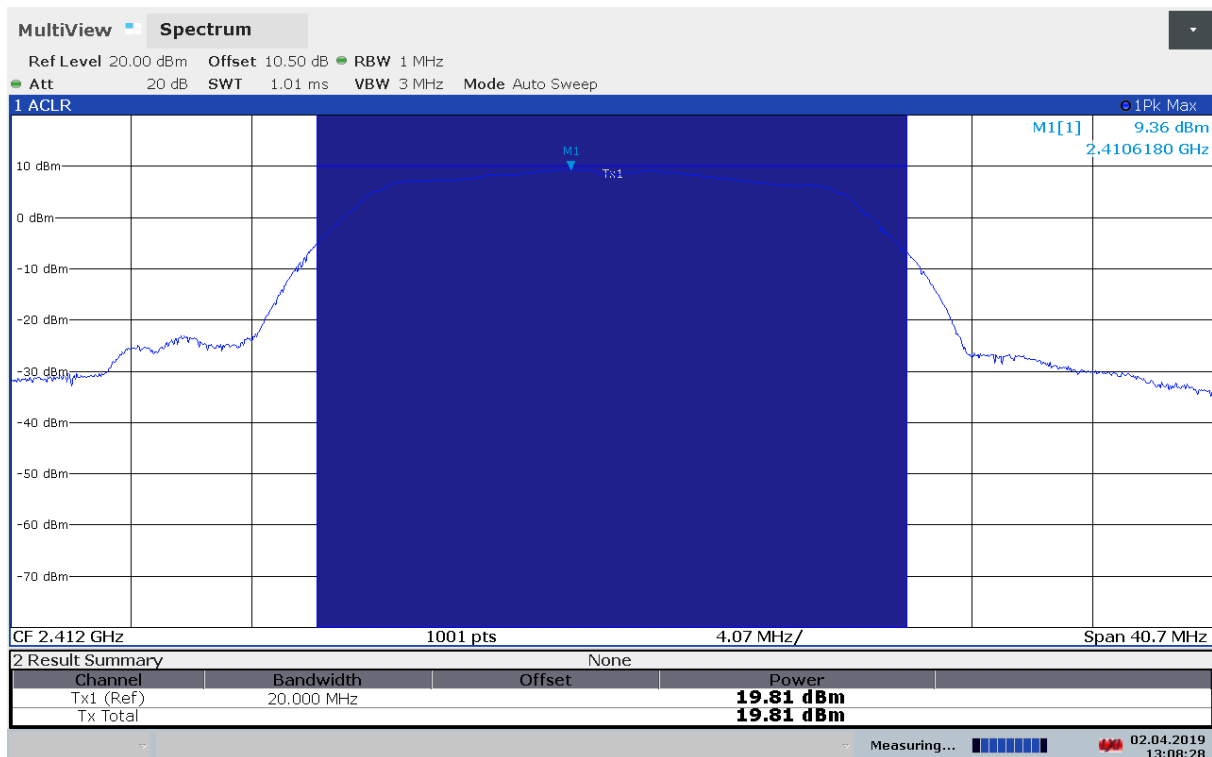
Cable loss 0.9 dB are included in the values.



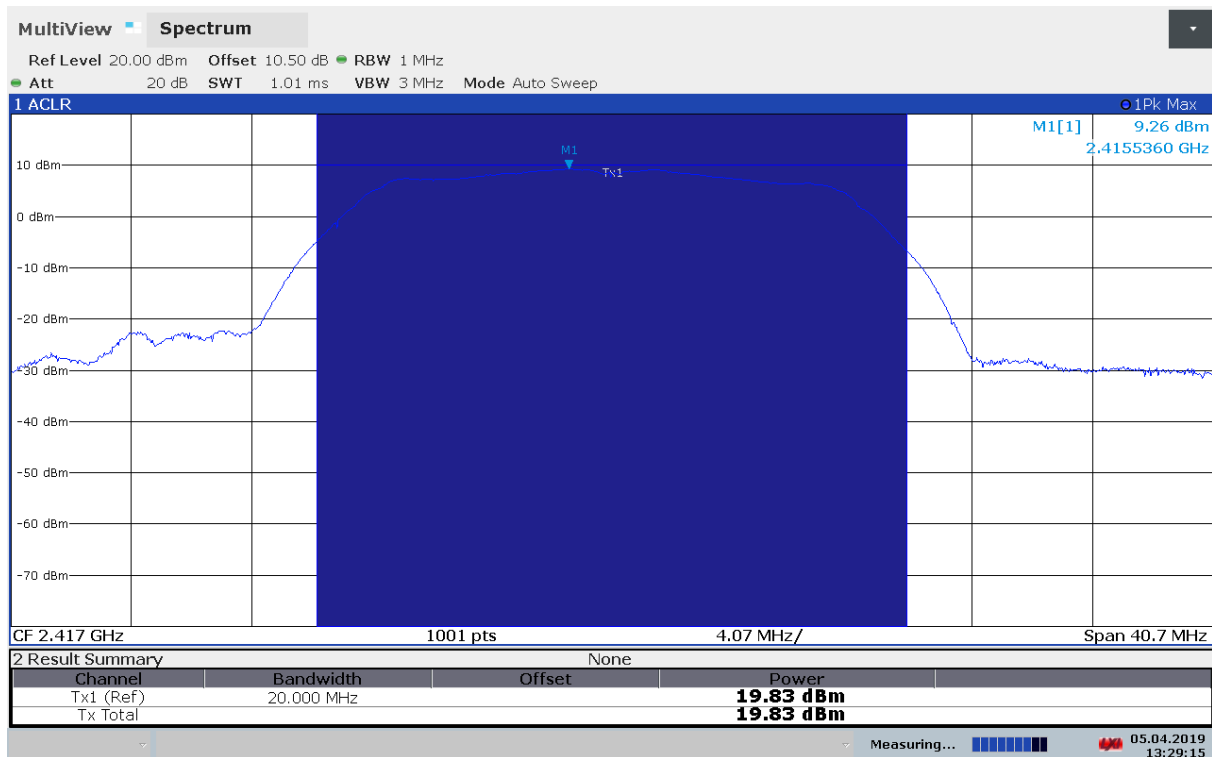
Conducted Output Power, 2412 MHz, 802.11b, 1Mbps



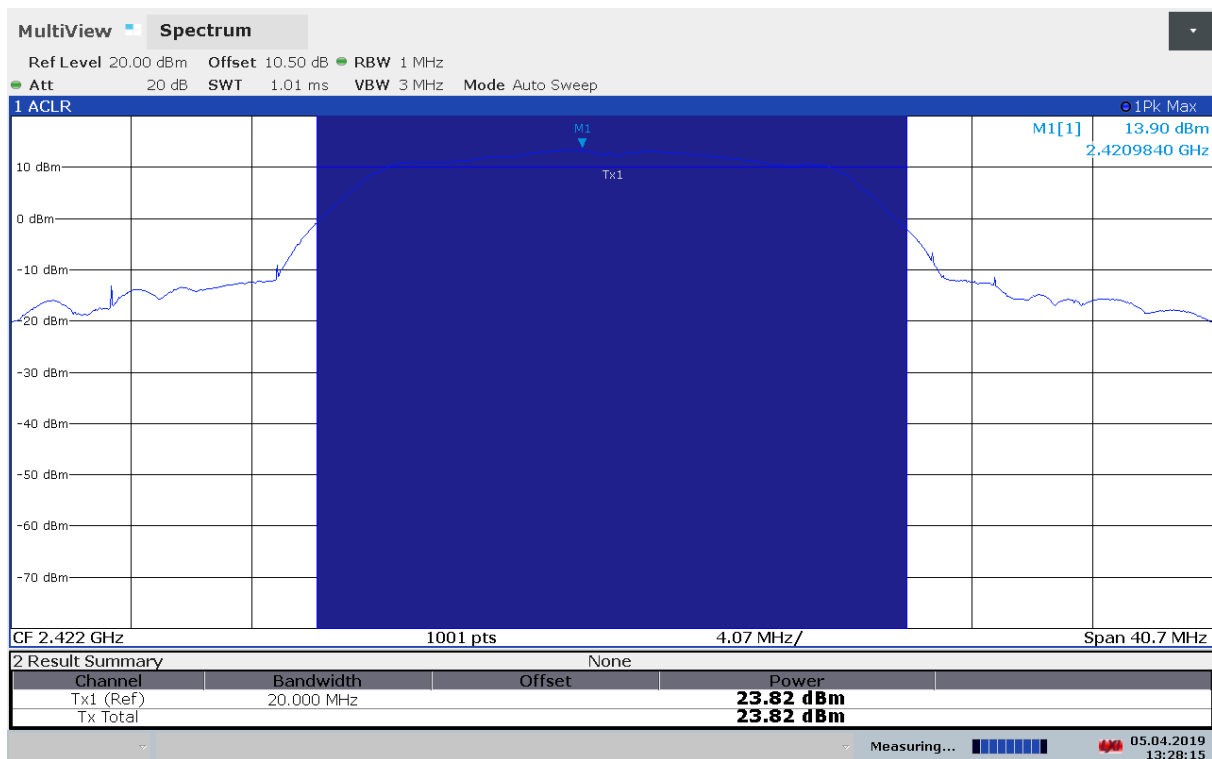
Conducted Output Power, 2412 MHz, 802.11n, MCS0



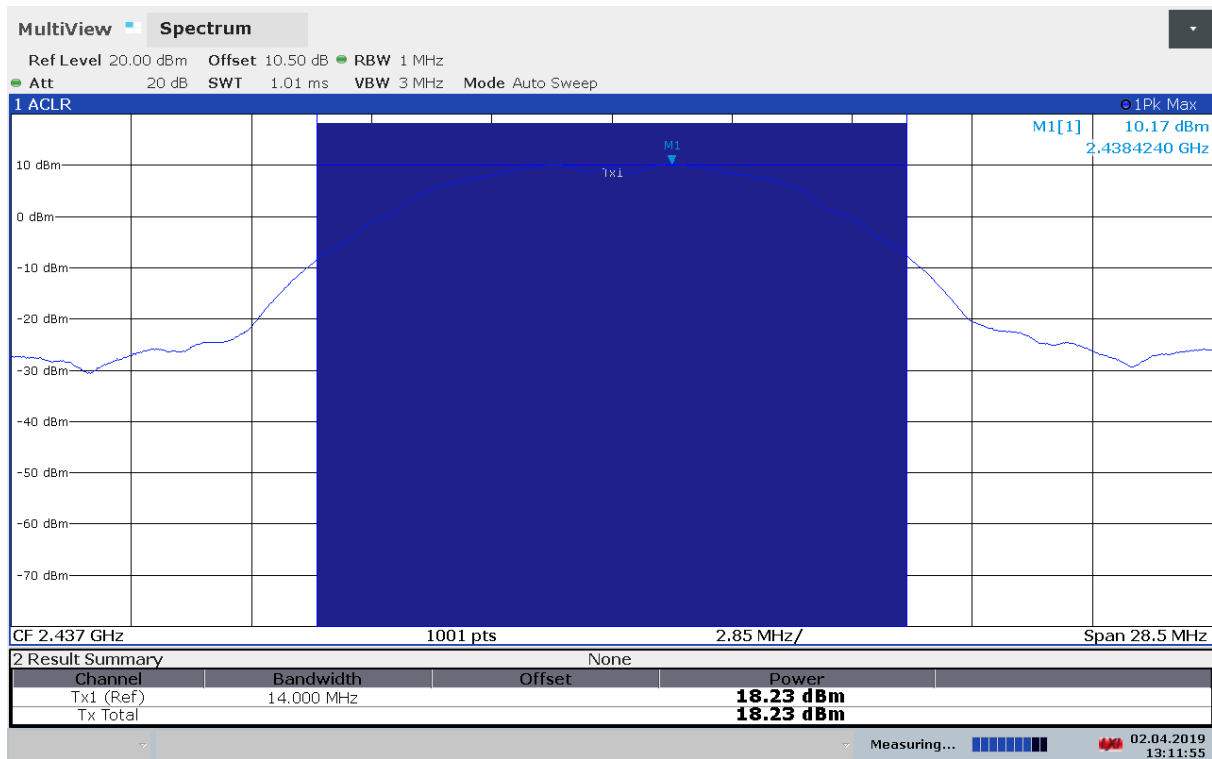
Conducted Output Power, 2412 MHz, 802.11g, 6Mbps



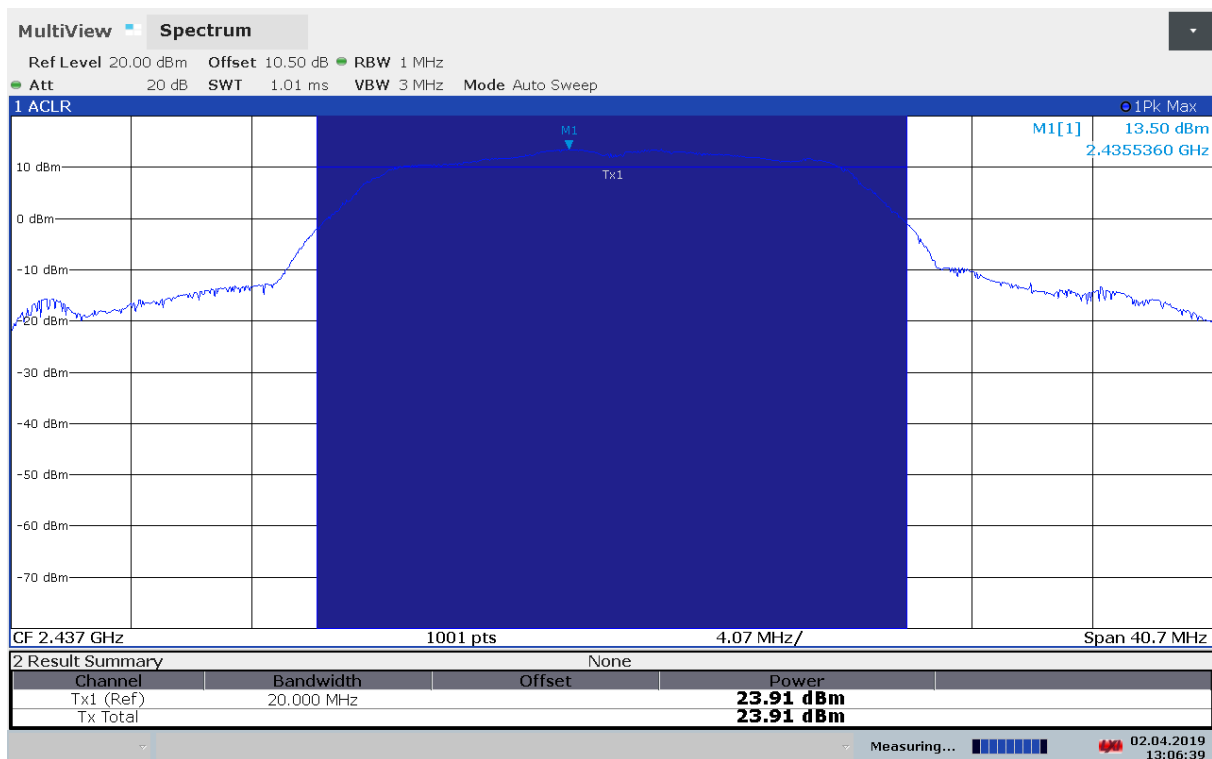
Conducted Output Power, 2417 MHz, 802.11g, 6Mbps



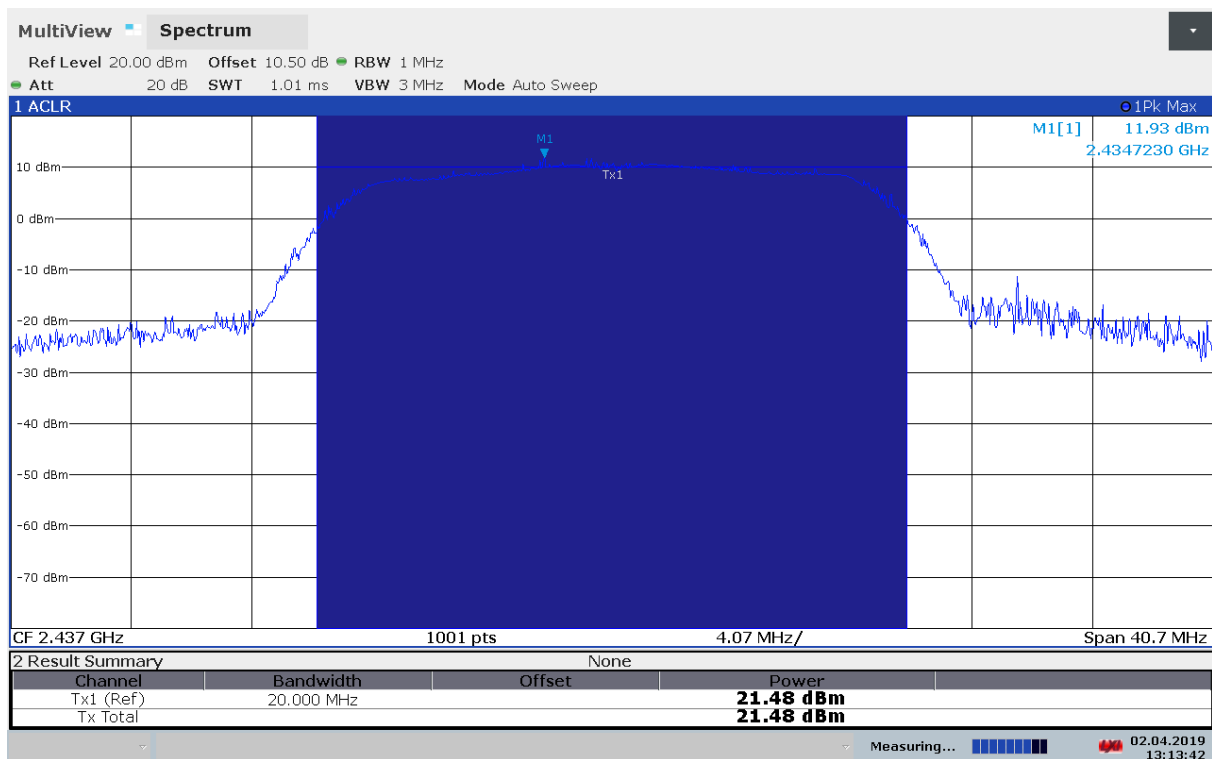
Conducted Output Power, 2422 MHz, 802.11g, 6Mbps



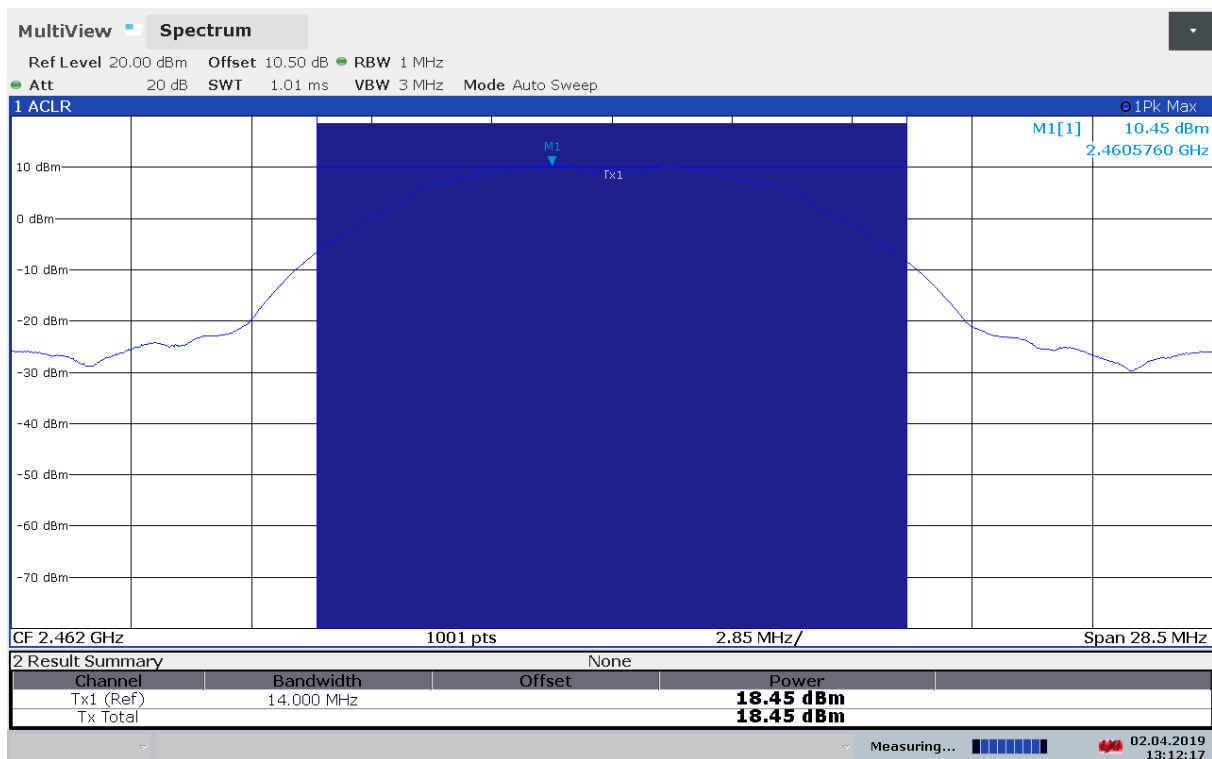
Conducted Output Power, 2437 MHz, 802.11b, 1Mbps



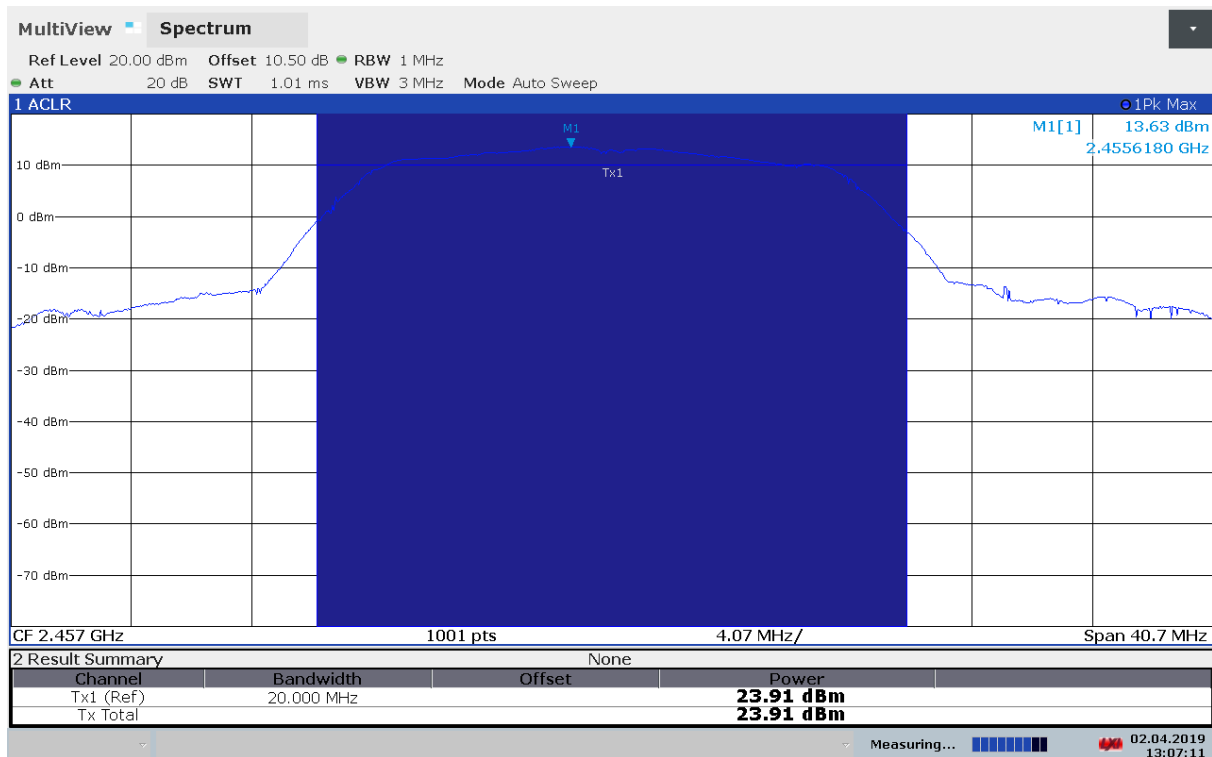
Conducted Output Power, 2437 MHz, 802.11g, 6Mbps



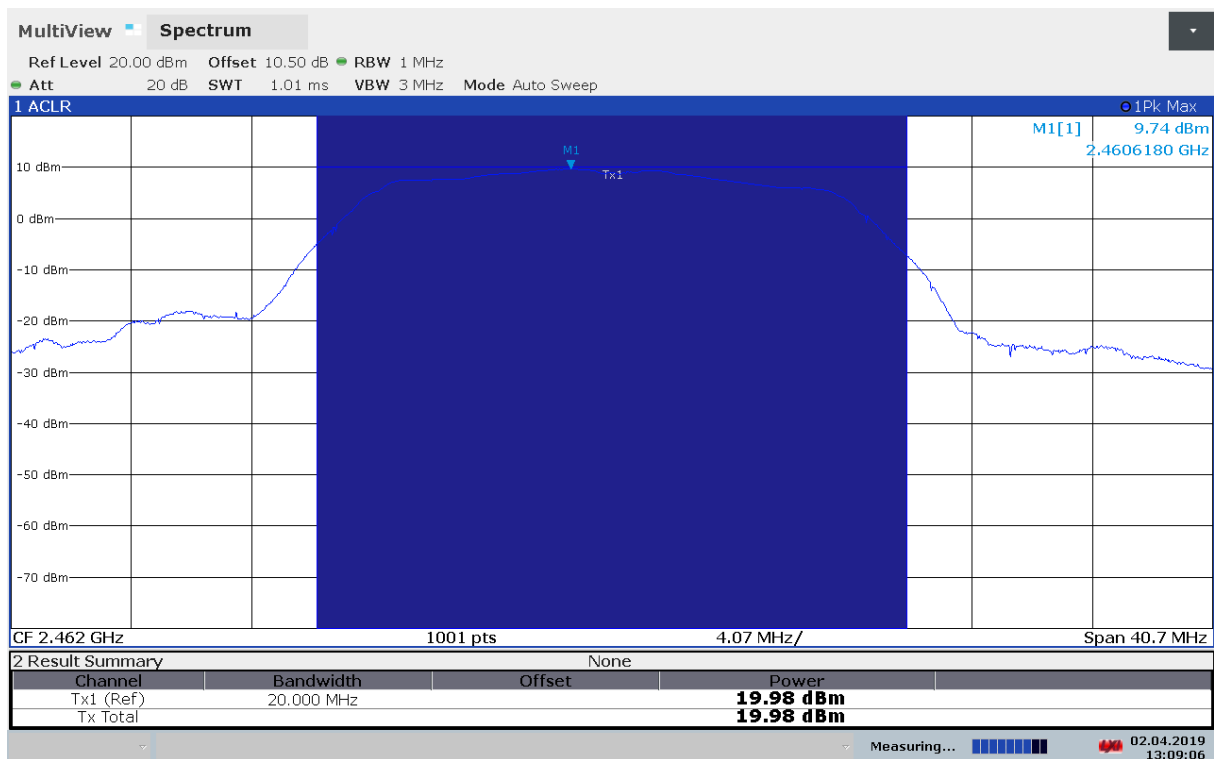
Conducted Output Power, 2437 MHz, 802.11n, MCS0



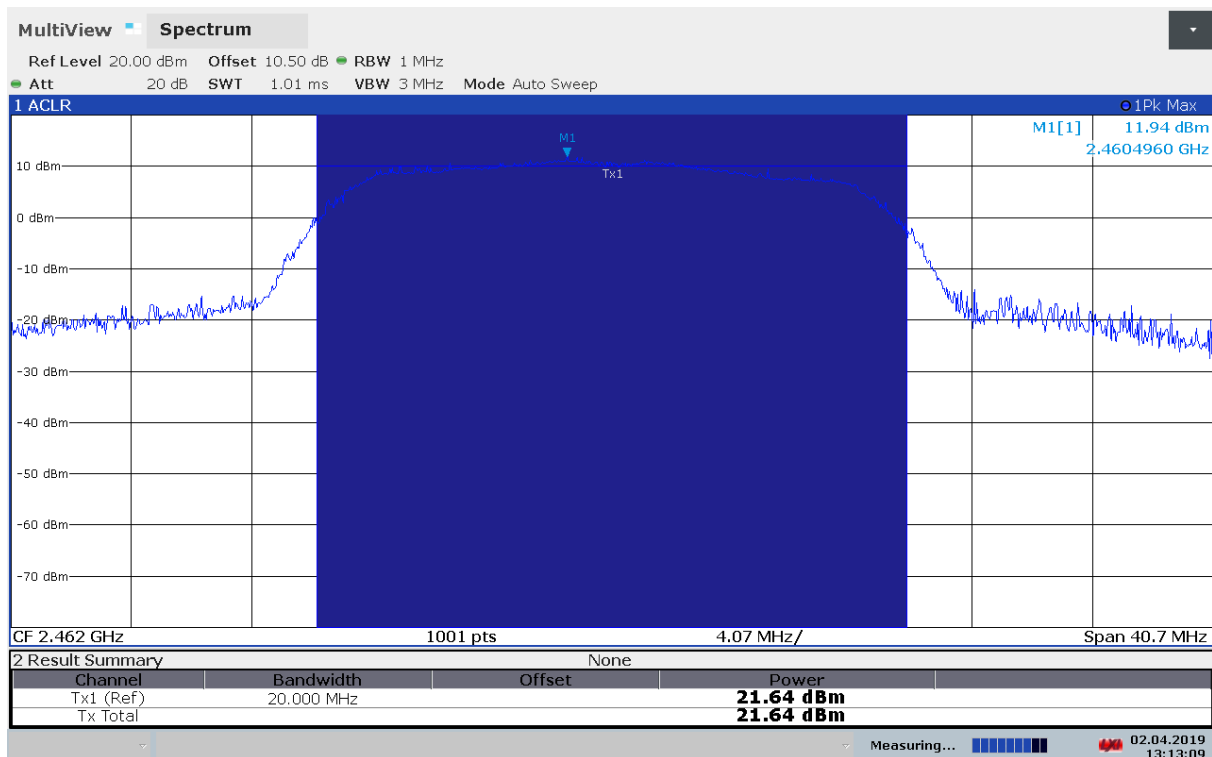
Conducted Output Power, 2462 MHz, 802.11b, 1Mbps



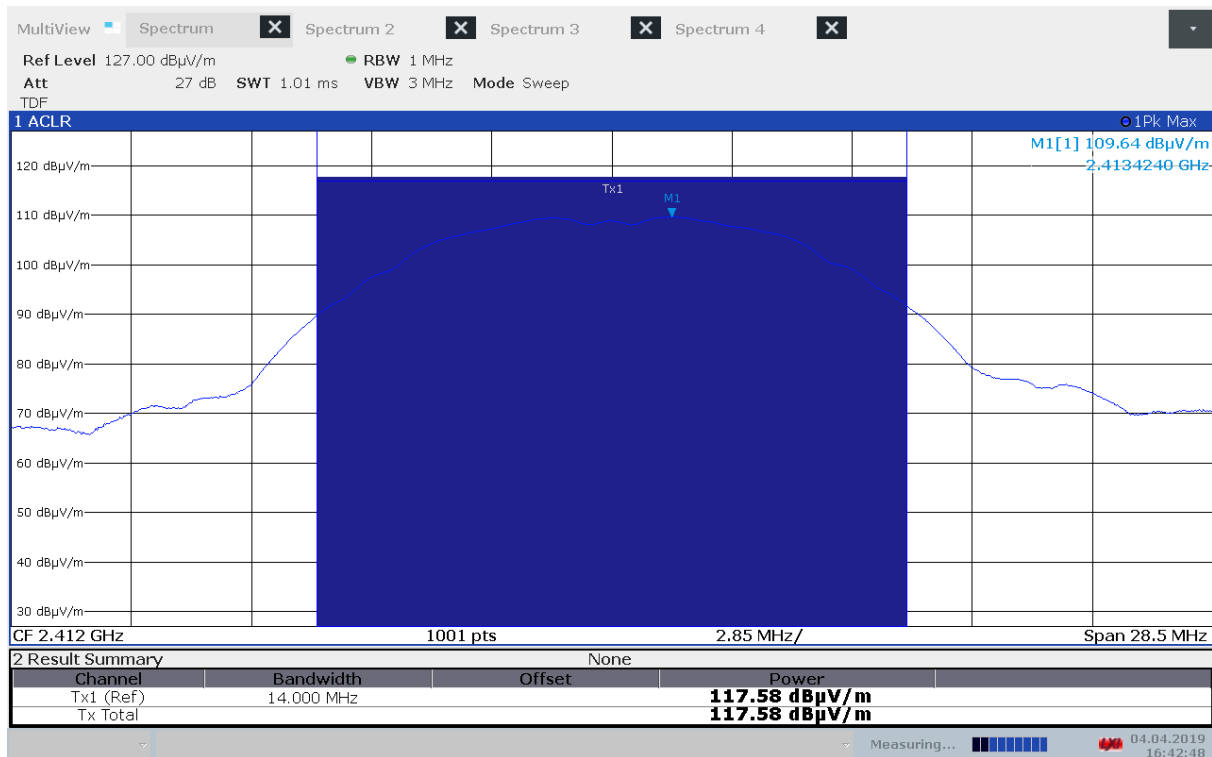
Conducted Output Power, 2457 MHz, 802.11g, 6Mbps



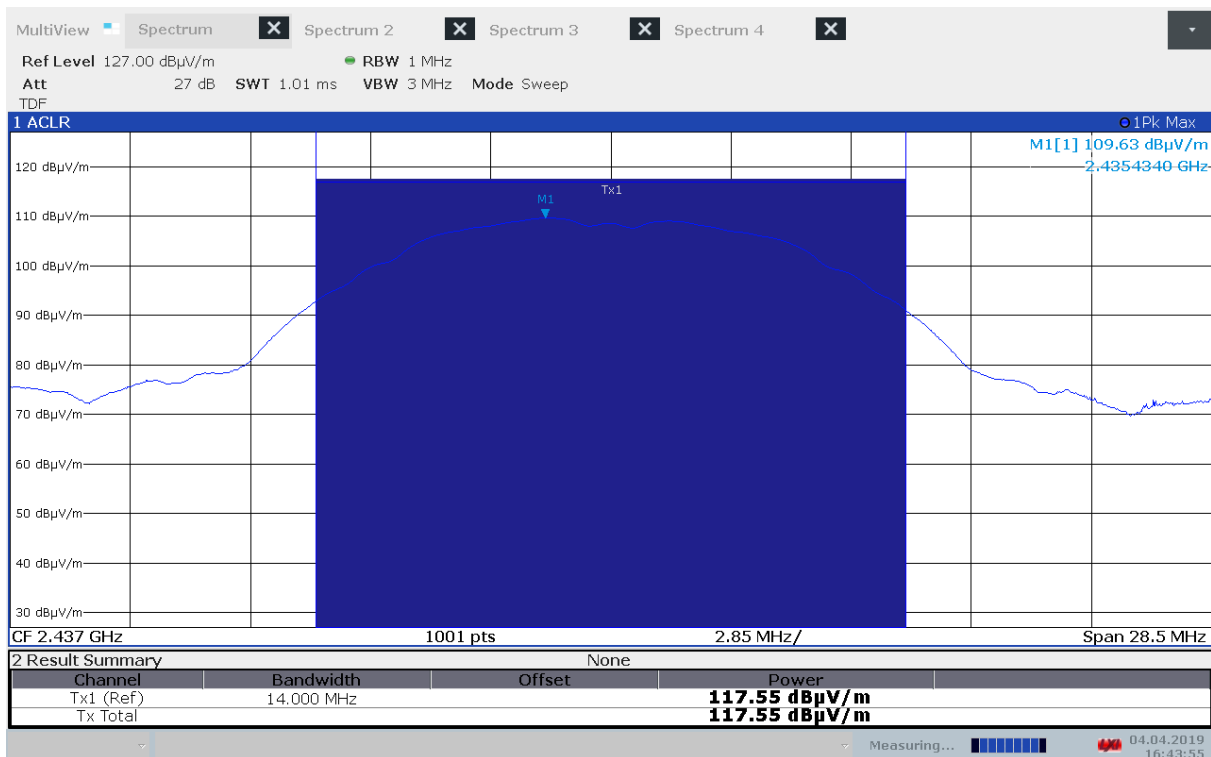
Conducted Output Power, 2462 MHz, 802.11g, 6Mbps



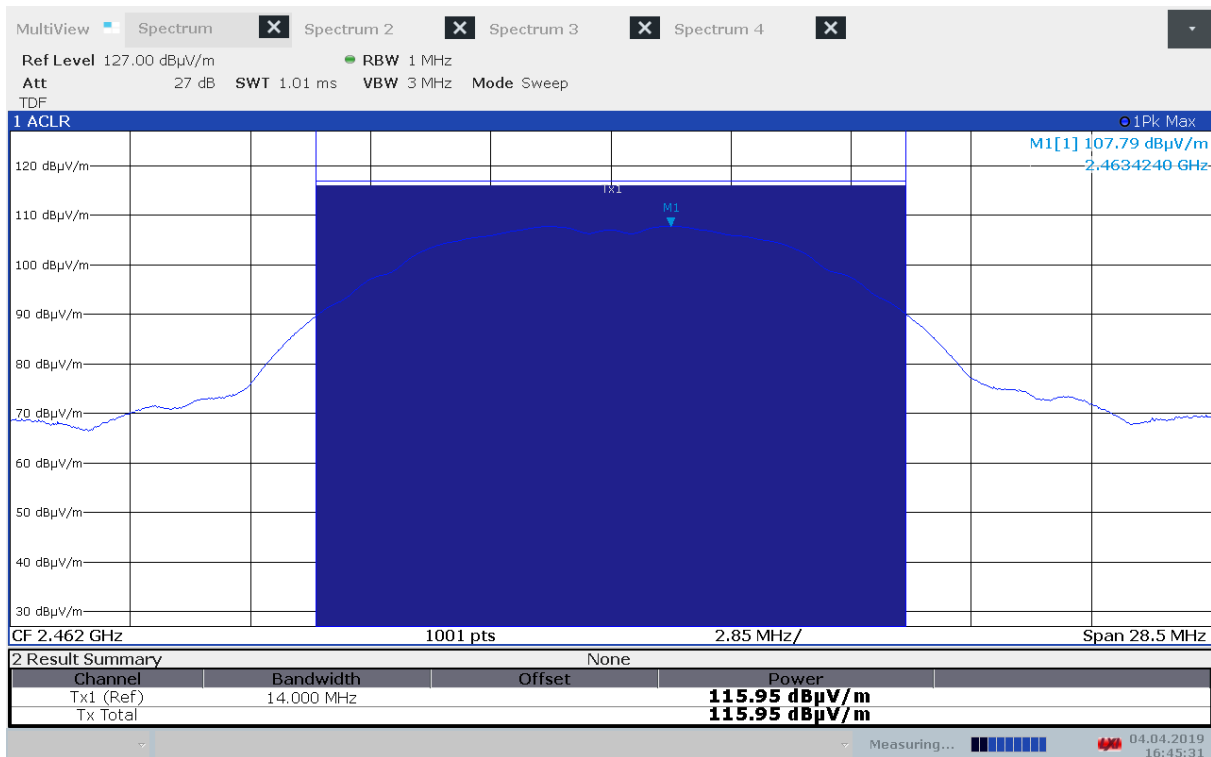
Conducted Output Power, 2462 MHz, 802.11n, MCS0



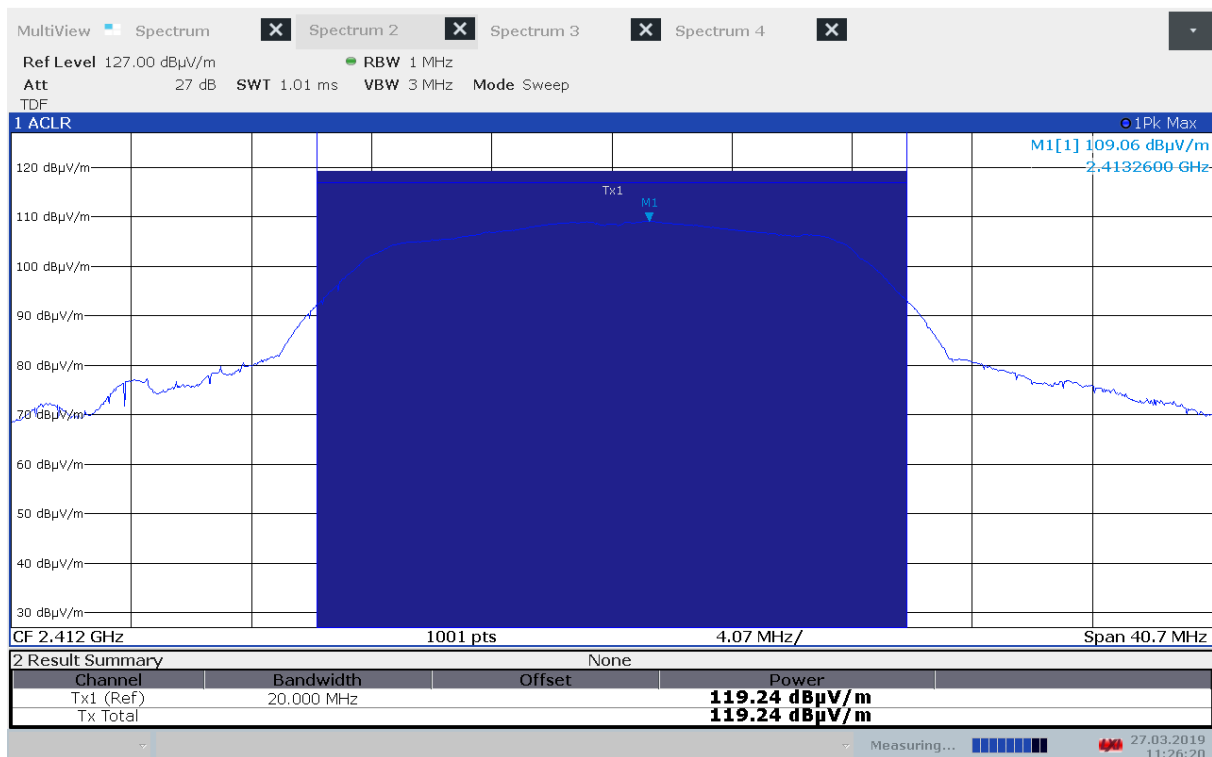
Maximum Field Strength, 2412 MHz, 802.11b, 1Mbps



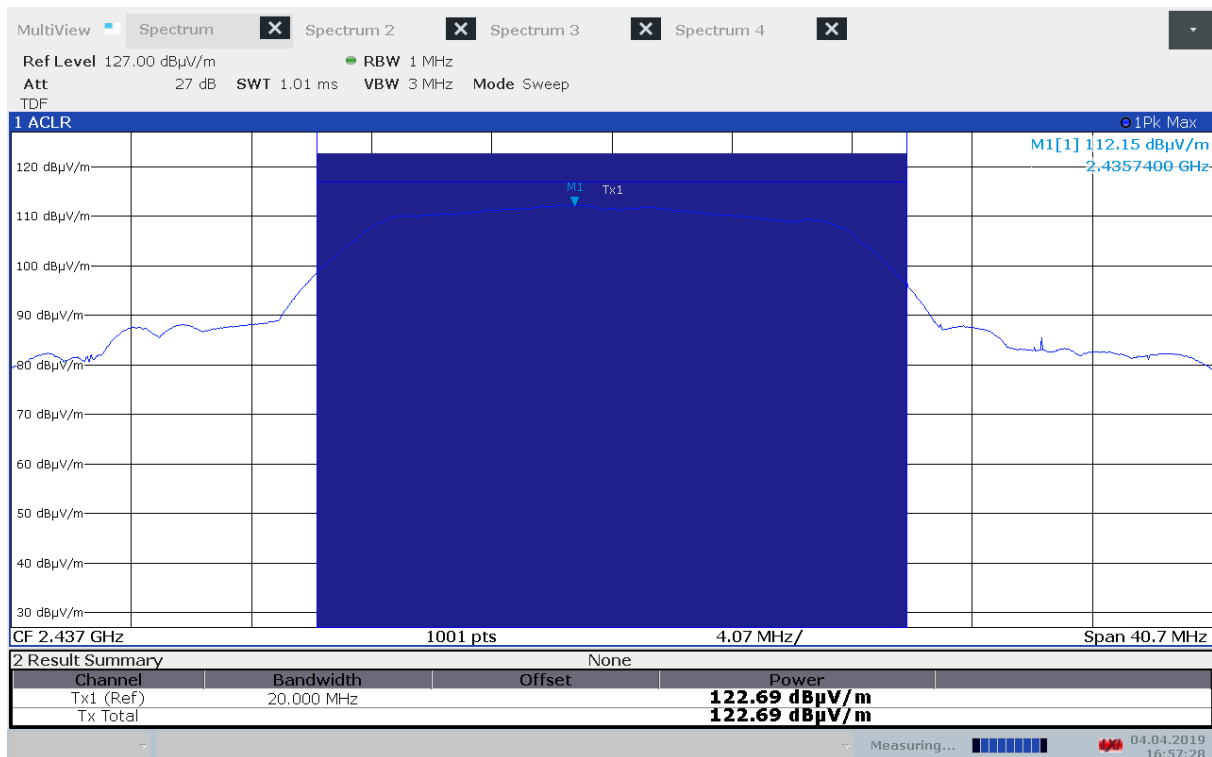
Maximum Field Strength, 2437 MHz, 802.11b, 1Mbps



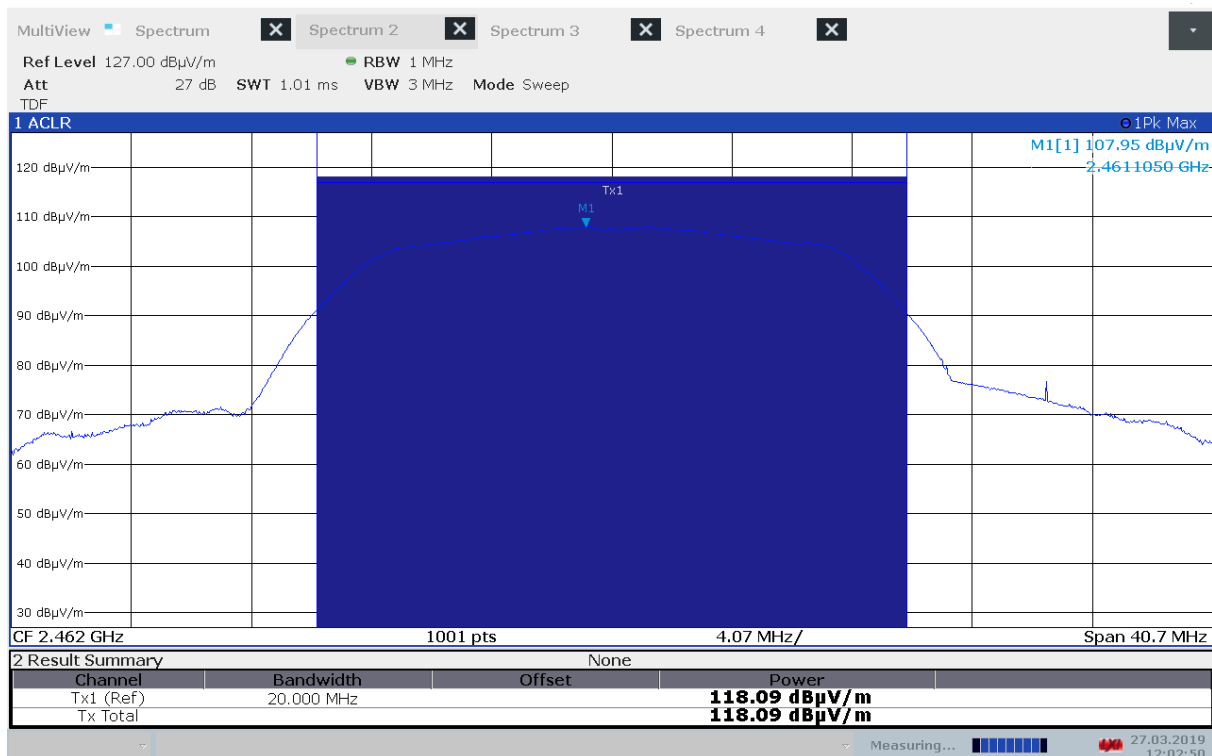
Maximum Field Strength, 2462 MHz, 802.11b, 1Mbps



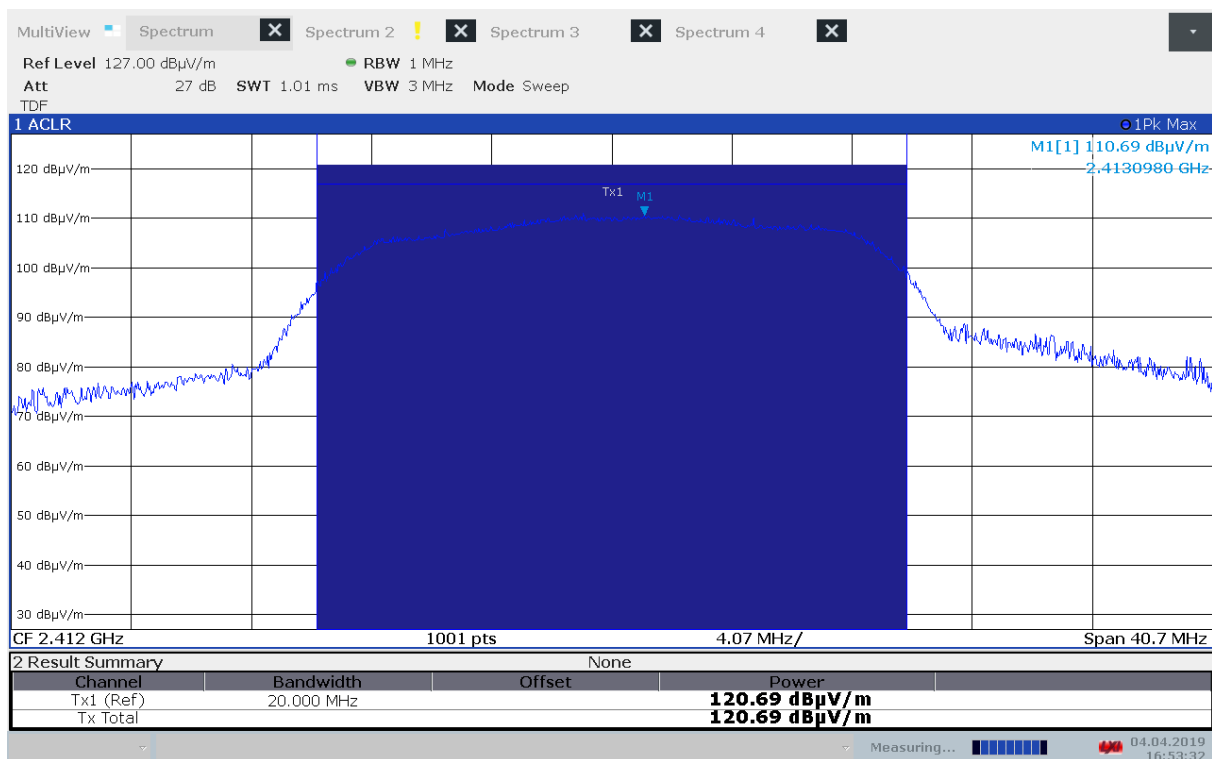
Maximum Field Strength, 2412 MHz, 802.11g, 6Mbps



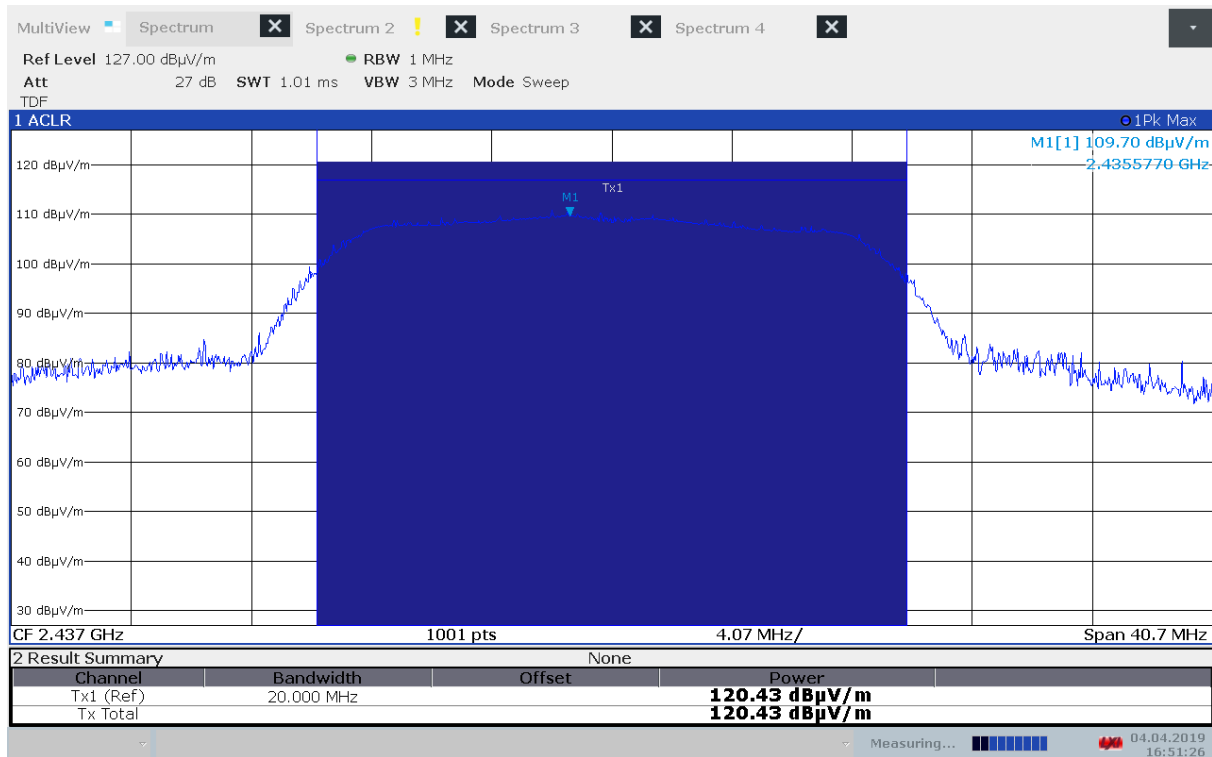
Maximum Field Strength, 2437 MHz, 802.11g, 6Mbps



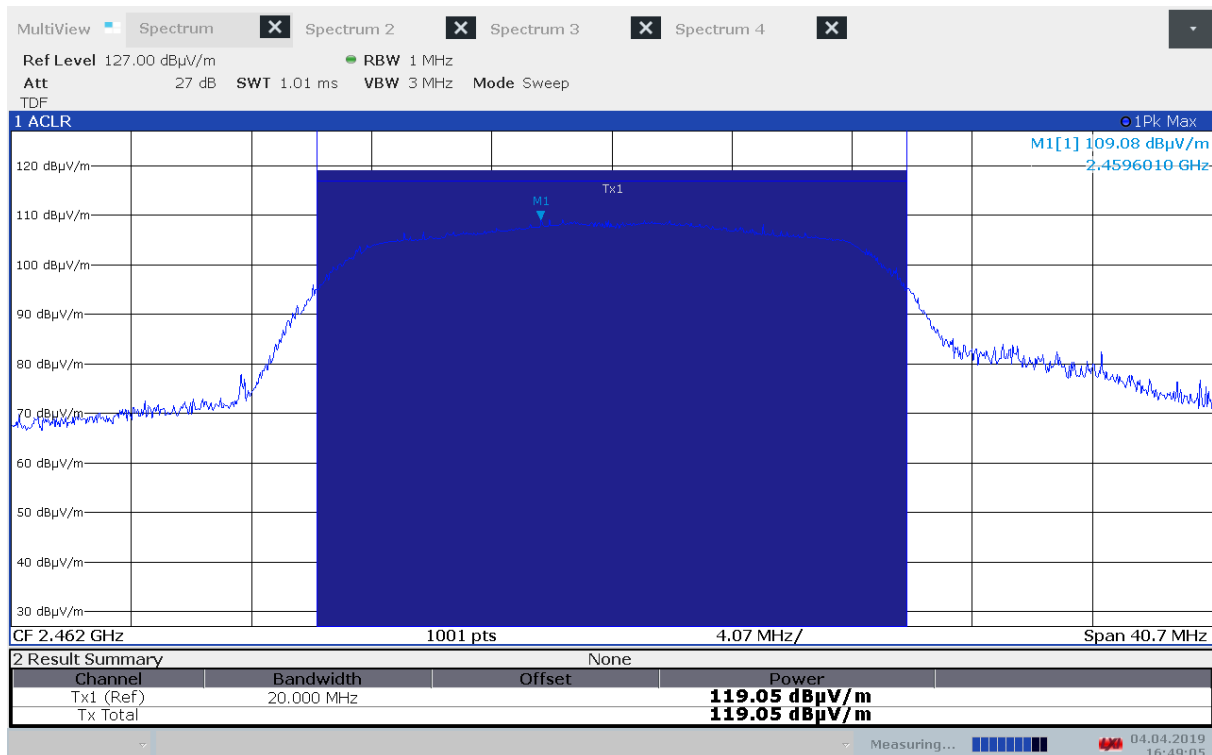
Maximum Field Strength, 2462 MHz, 802.11g, 6Mbps



Maximum Field Strength, 2412 MHz, 802.11n, MCS0



Maximum Field Strength, 2437 MHz, 802.11n, MCS0



Maximum Field Strength, 2462 MHz, 802.11n, MCS0

3.4 Conducted Emissions at Antenna Connector

FCC Part 15.247 (d)

ISED Canada RSS-247 Issue 2, Clause 5.5

Measurement procedure: ANSI C63.10-2013 Clause 11.11

Test Results: Complies

Measurement Data:

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

Measured with Peak Detector.

All tests are performed with the EUT transmitting at maximum output power.

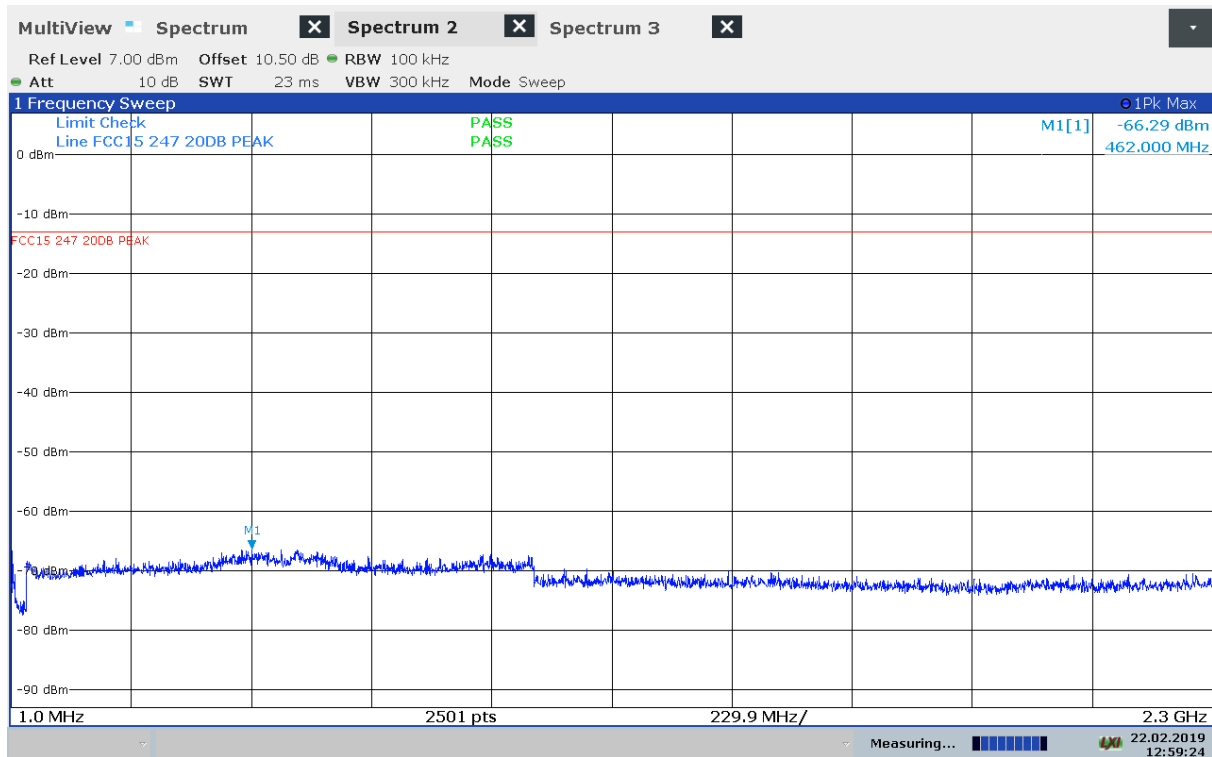
RF conducted power to 25 GHz: see attached plots.

Limit

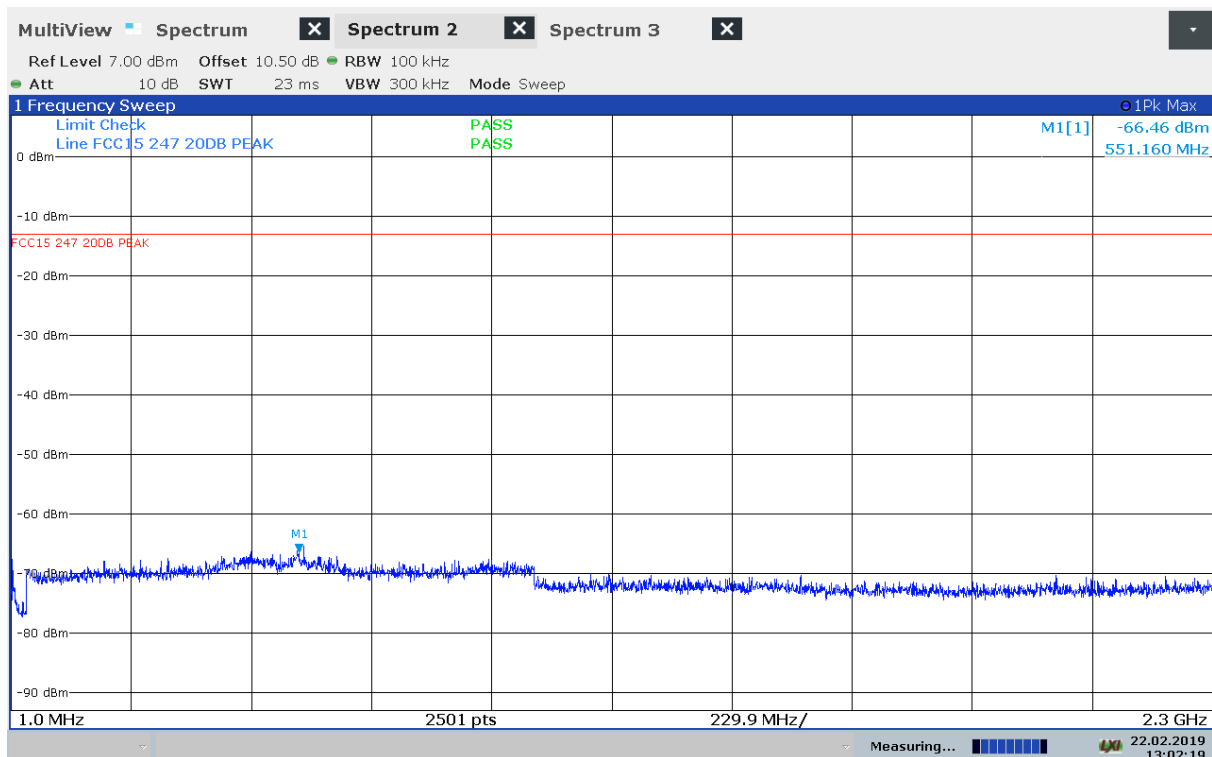
Peak measurement	RMS averaging
20 dBc or more in 100 kHz bandwidth	30 dBc or more in 100 kHz bandwidth

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

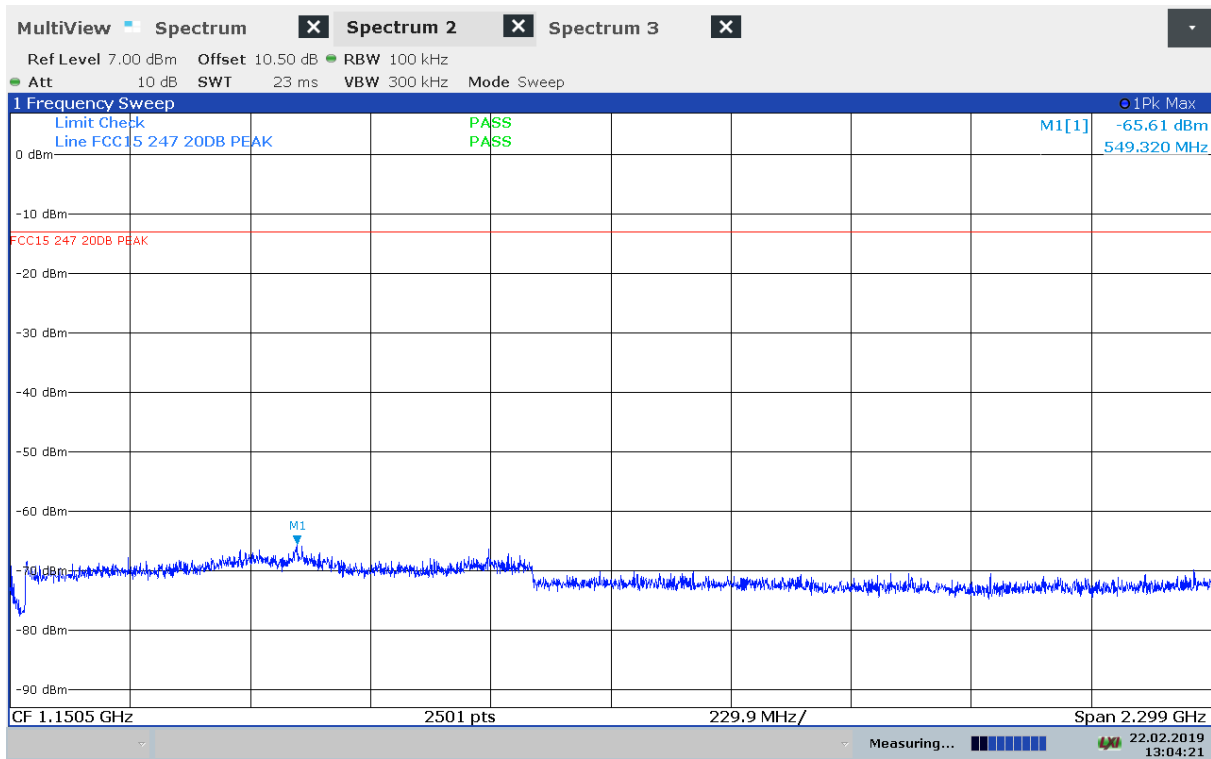
Attenuation below the general limits specified in part 15.209(a) is not required.



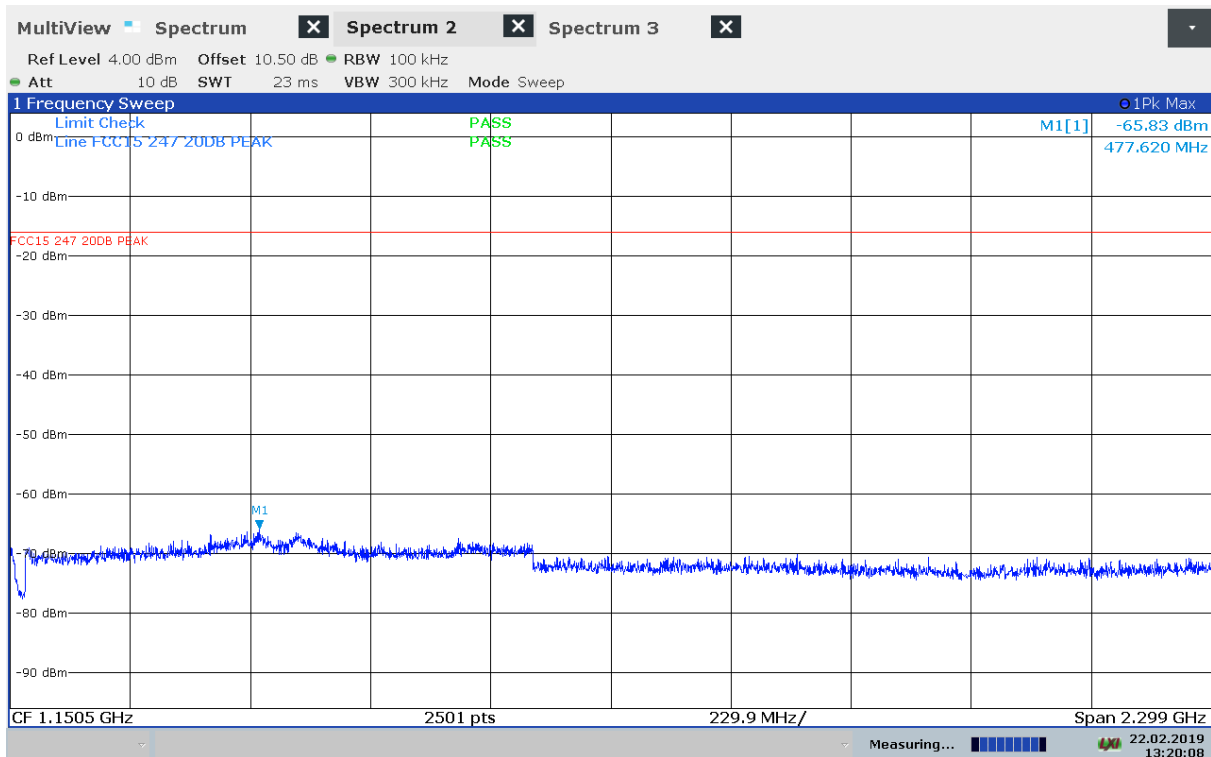
Conducted Emissions, 1 – 2300 MHz, 2412 MHz, 802.11b, 1Mbps



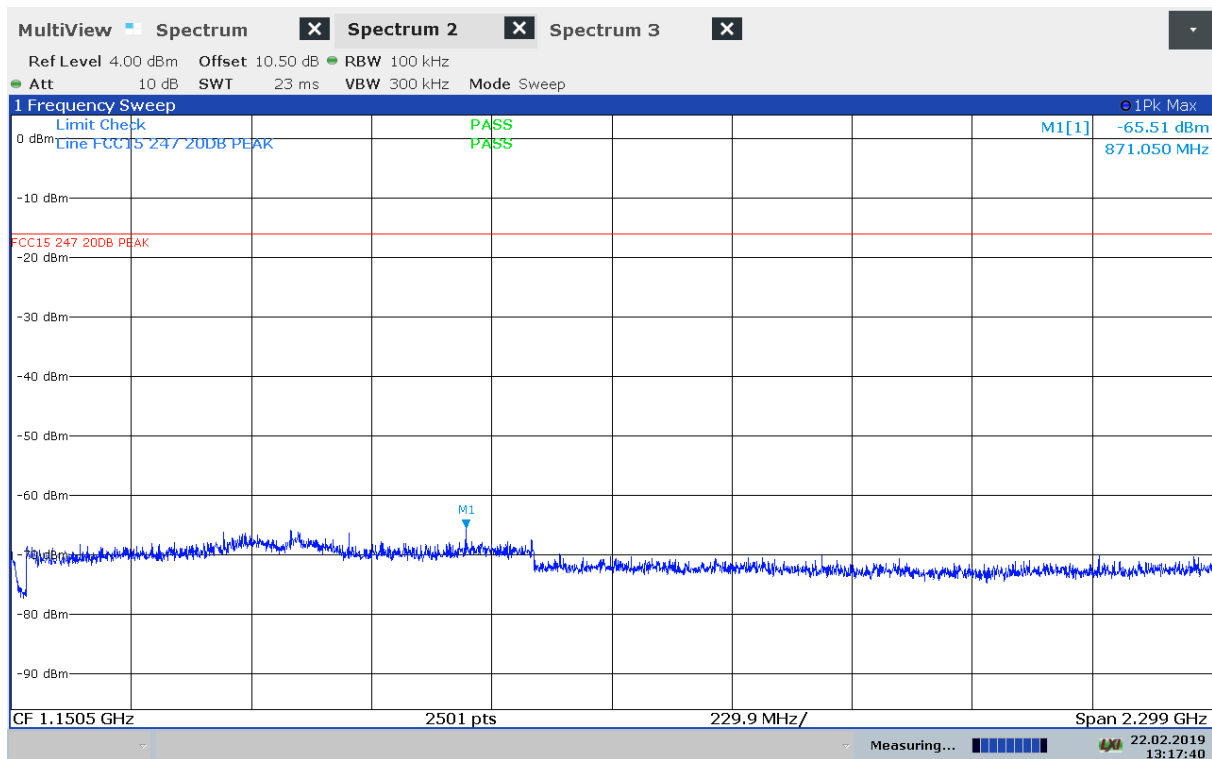
Conducted Emissions, 1 – 2300 MHz, 2437 MHz, 802.11b, 1Mbps



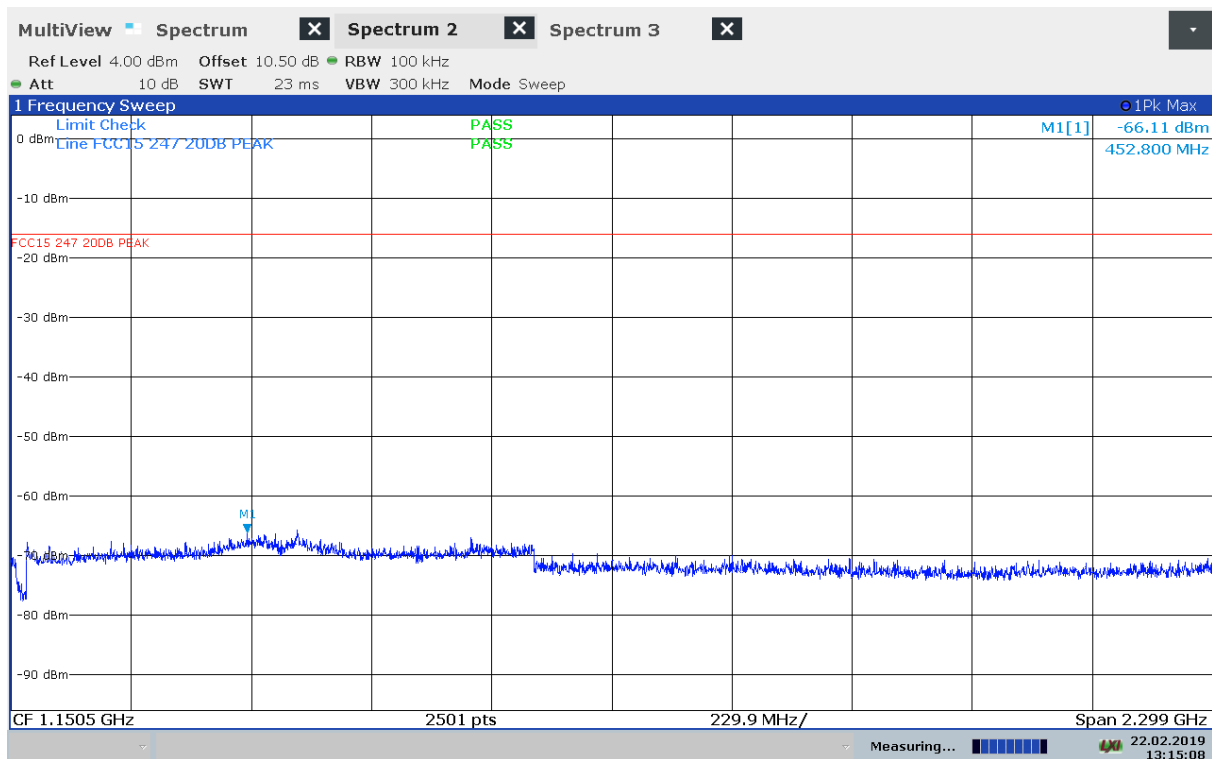
Conducted Emissions, 1 – 2300 MHz, 2462 MHz, 802.11b, 1Mbps



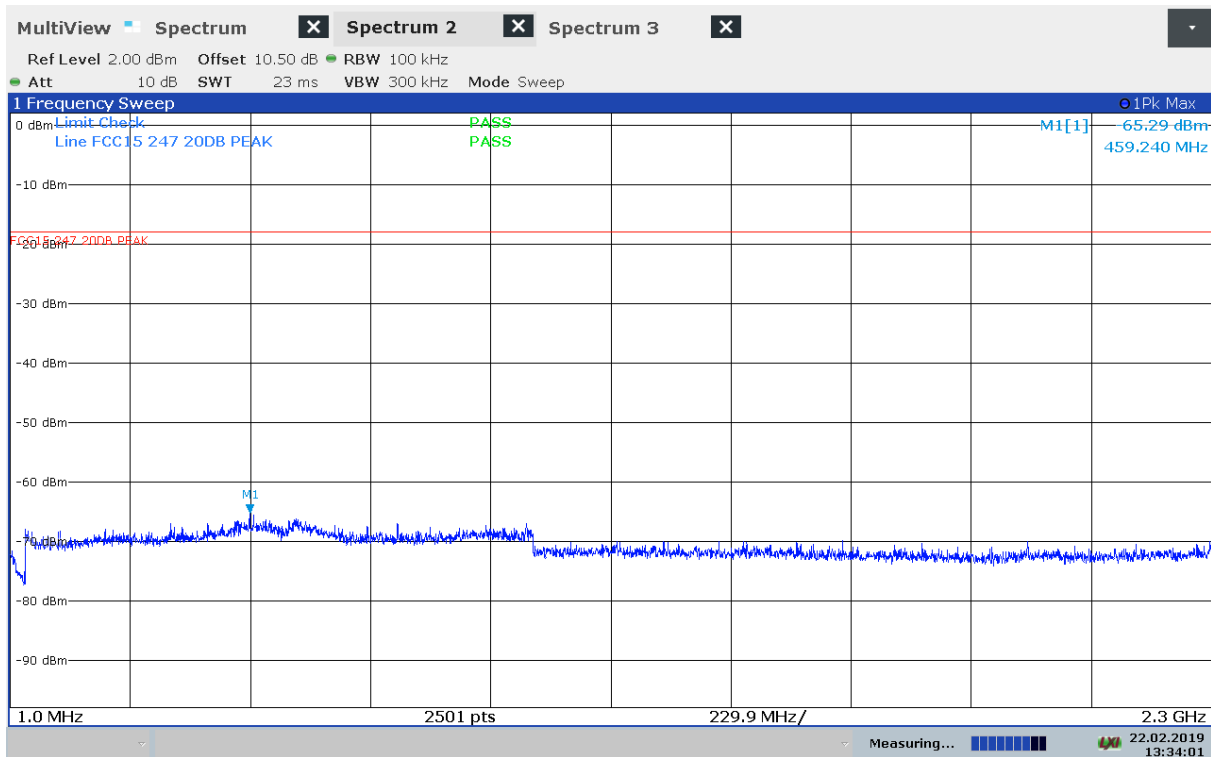
Conducted Emissions, 1 – 2300 MHz, 2412 MHz, 802.11g, 6Mbps



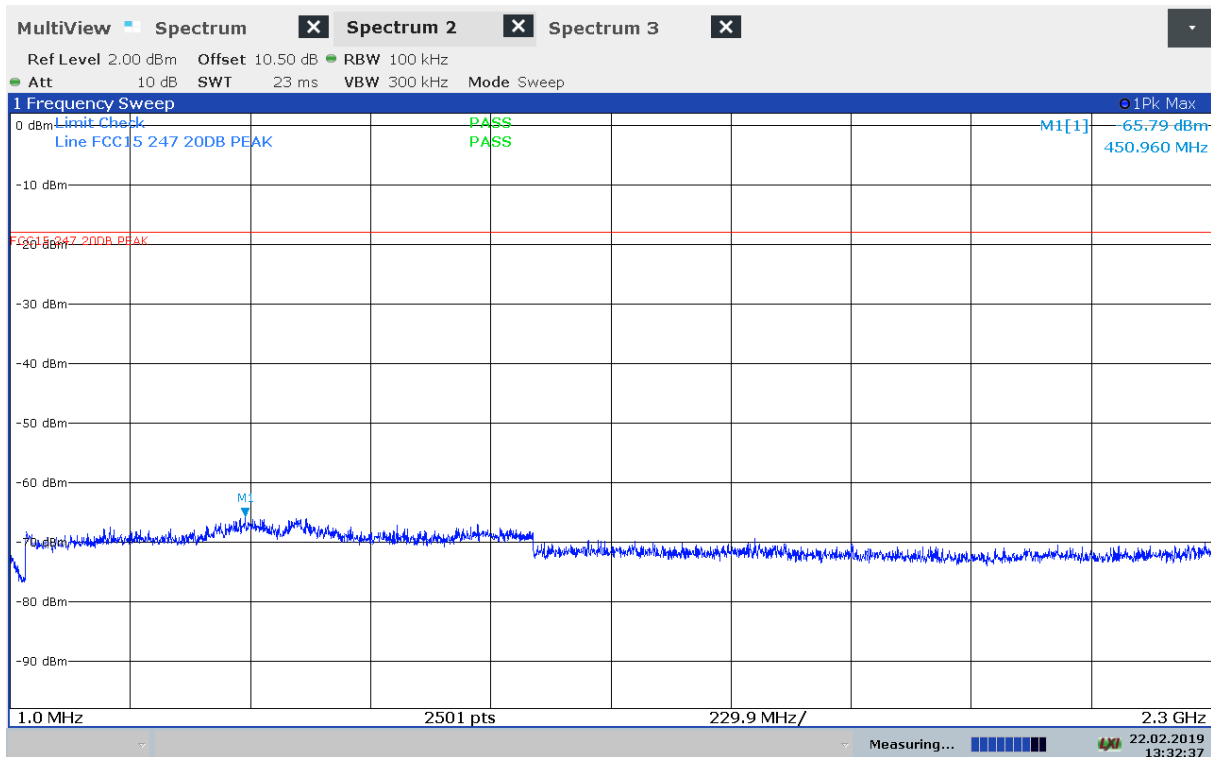
Conducted Emissions, 1 – 2300 MHz, 2437 MHz, 802.11g, 6Mbps



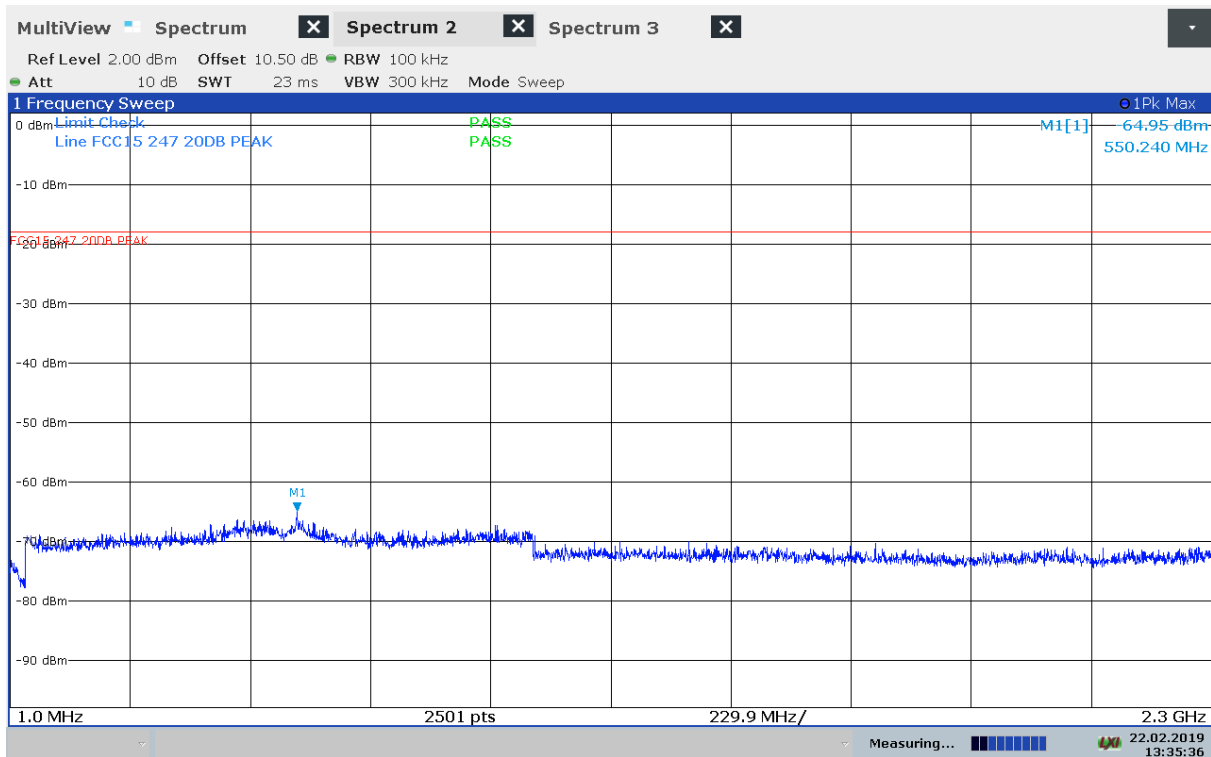
Conducted Emissions, 1 – 2300 MHz, 2462 MHz, 802.11g, 6Mbps



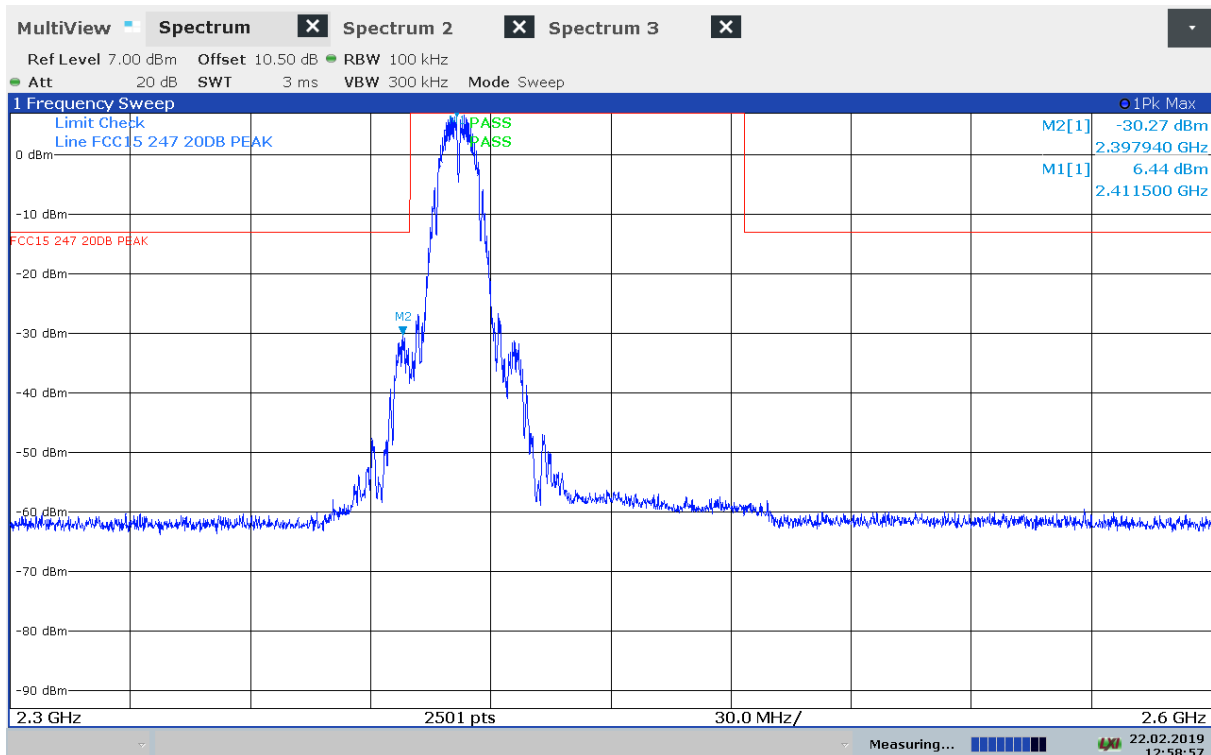
Conducted Emissions, 1 – 2300 MHz, 2412 MHz, 802.11n, MCS0



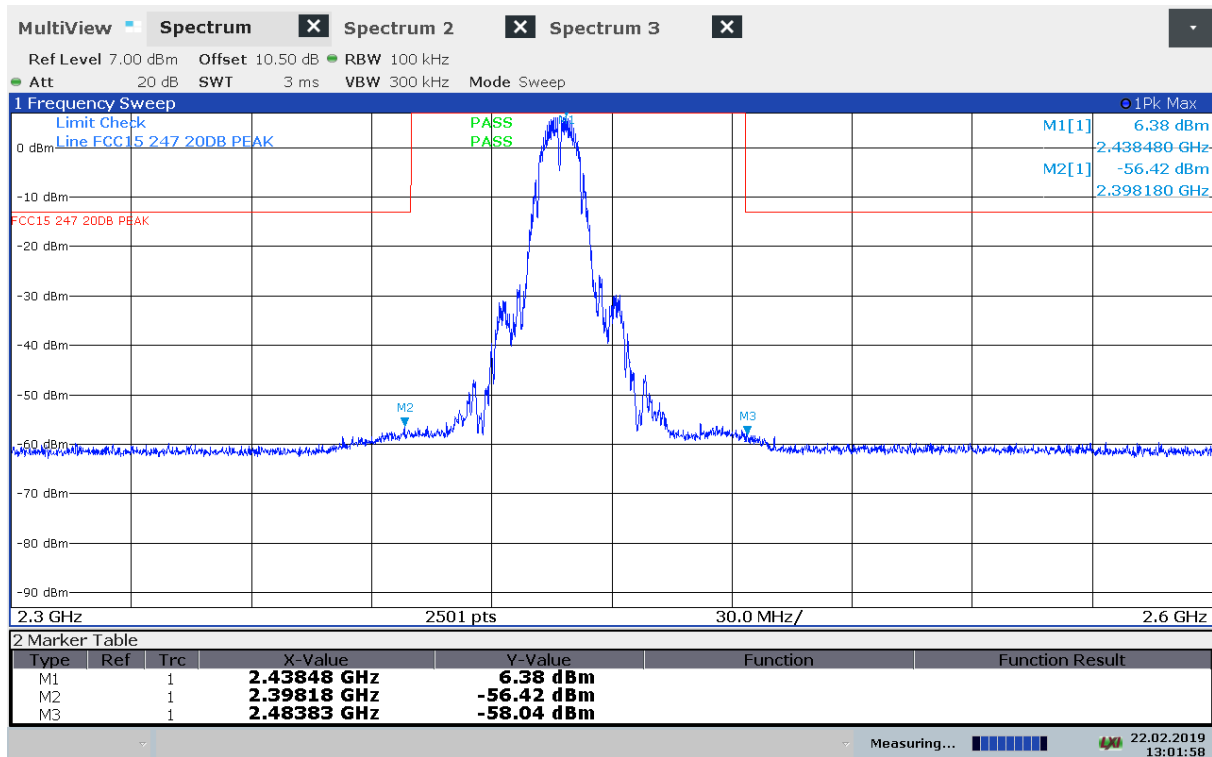
Conducted Emissions, 1 – 2300 MHz, 2437 MHz, 802.11n, MCS0



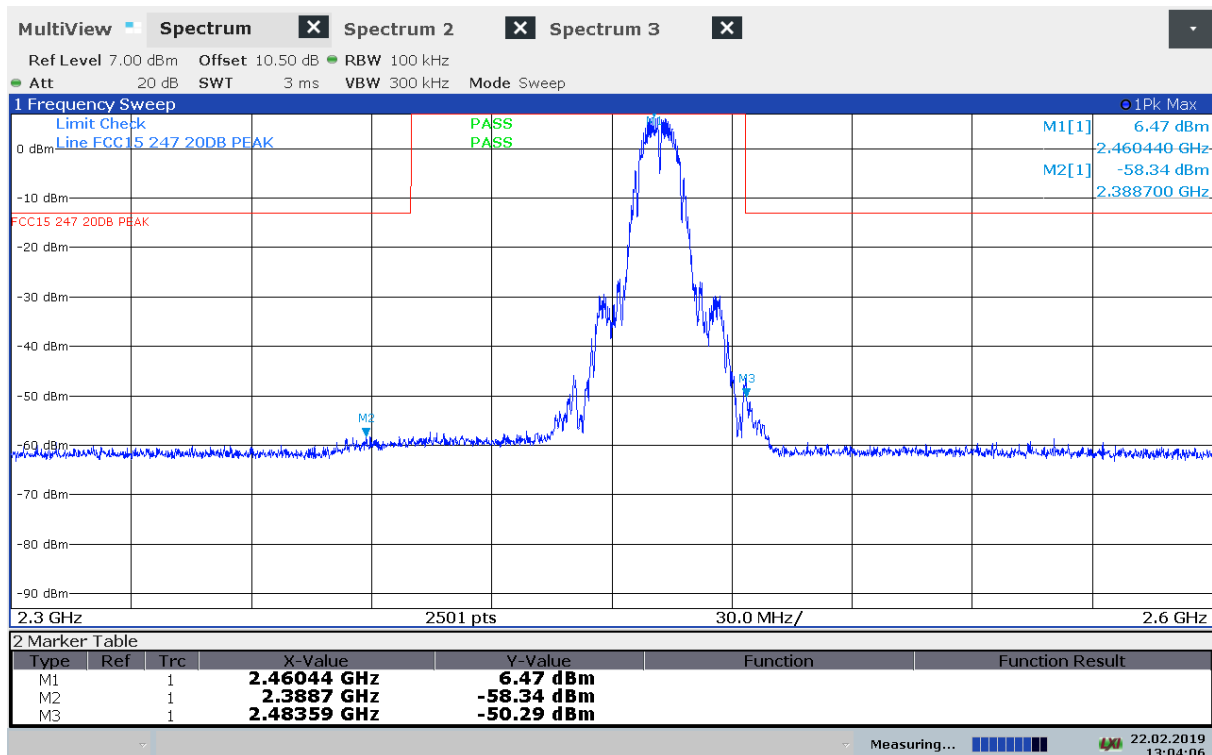
Conducted Emissions, 1 – 2300 MHz, 2462 MHz, 802.11n, MCS0



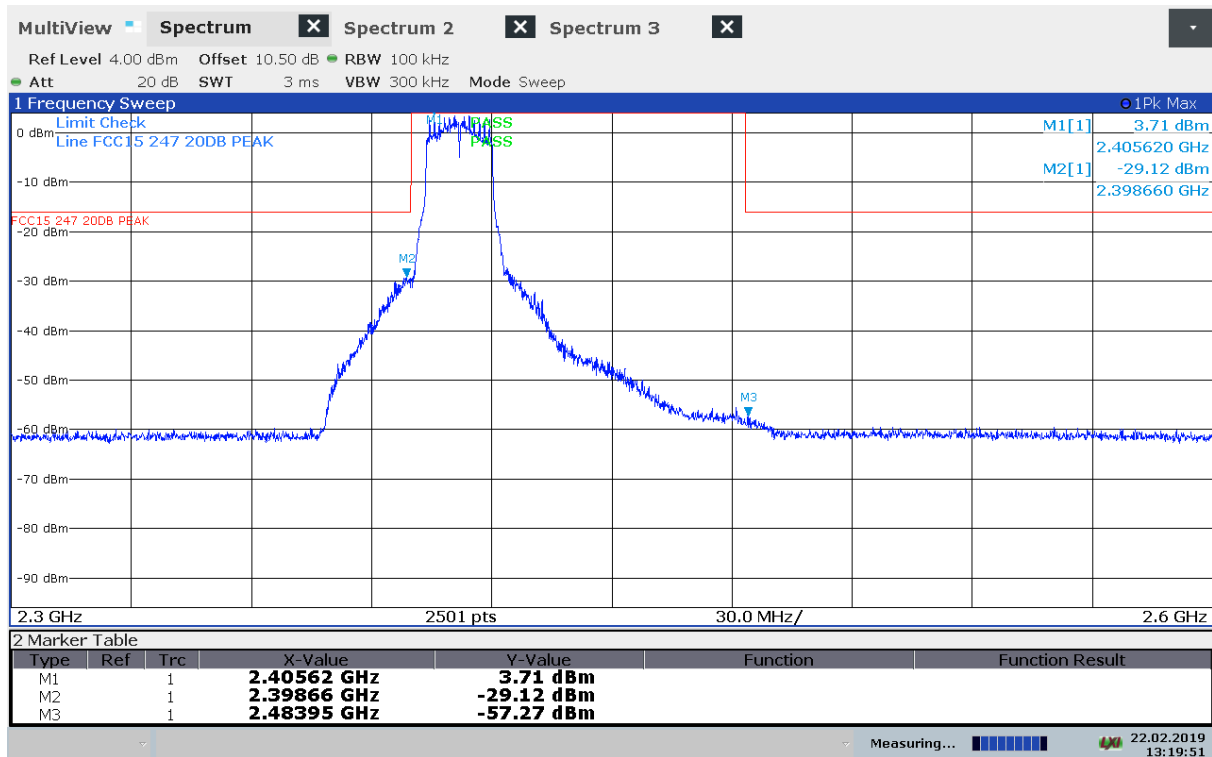
Conducted Emissions, 2300 – 2600 MHz, 2412 MHz, 802.11b, 1Mbps



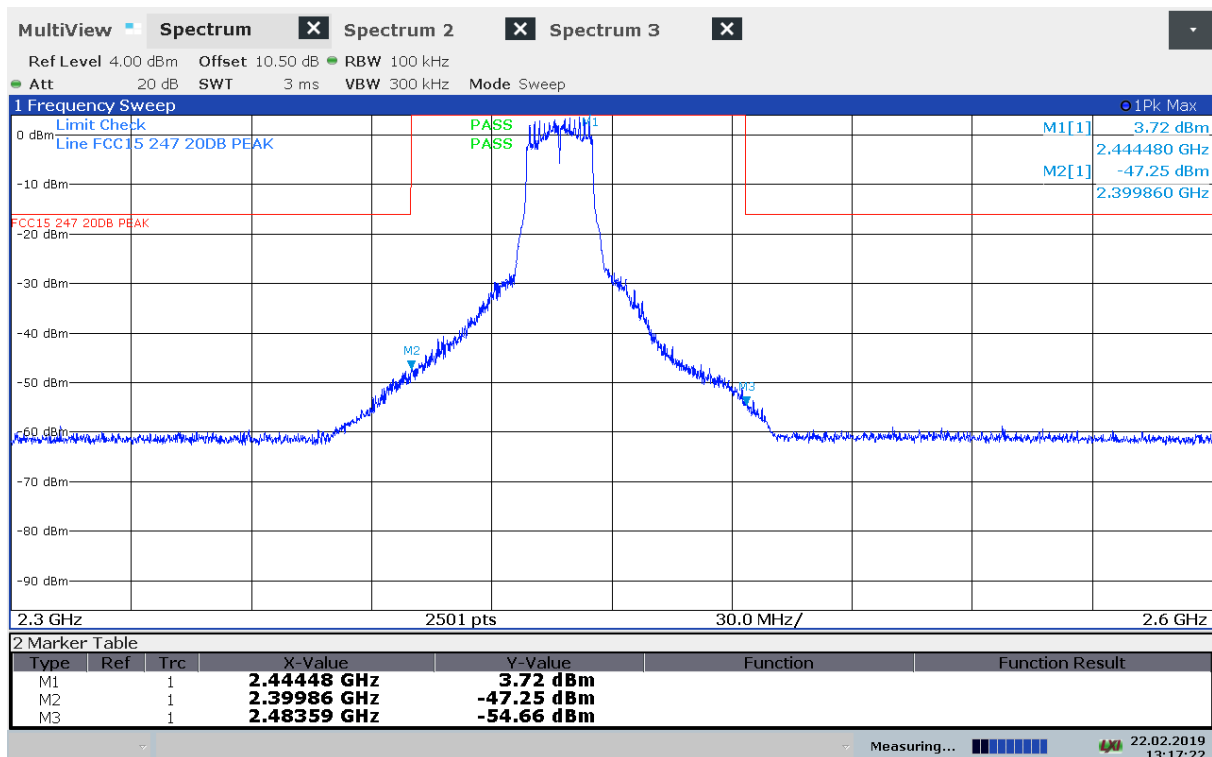
Conducted Emissions, 2300 – 2600 MHz, 2437 MHz, 802.11b, 1Mbps



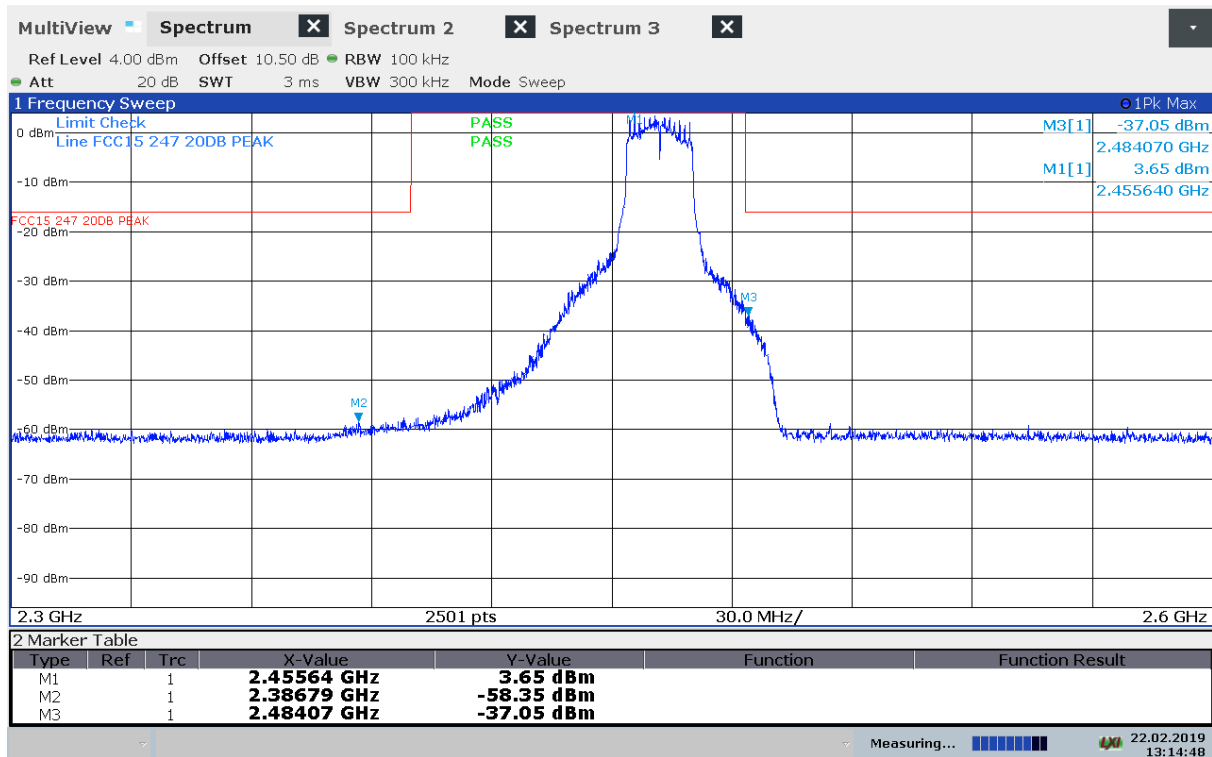
Conducted Emissions, 2300 – 2600 MHz, 2462 MHz, 802.11b, 1Mbps



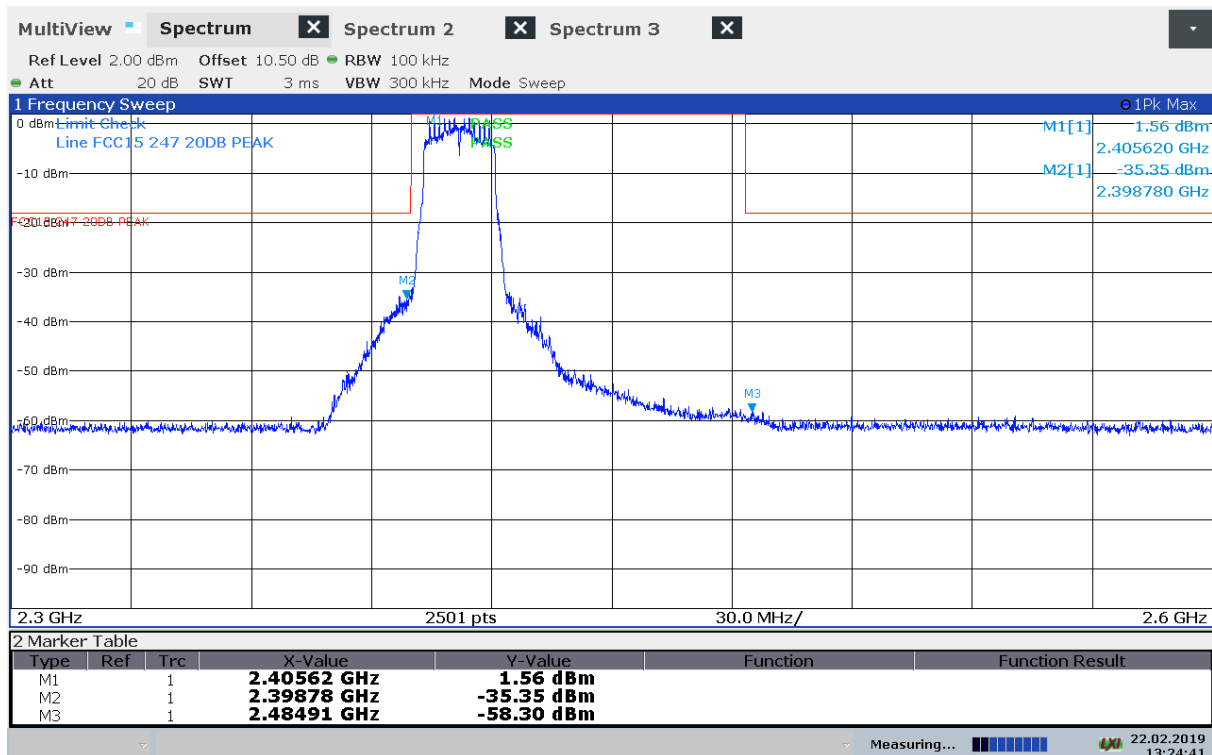
Conducted Emissions, 2300 – 2600 MHz, 2412 MHz, 802.11g, 6Mbps



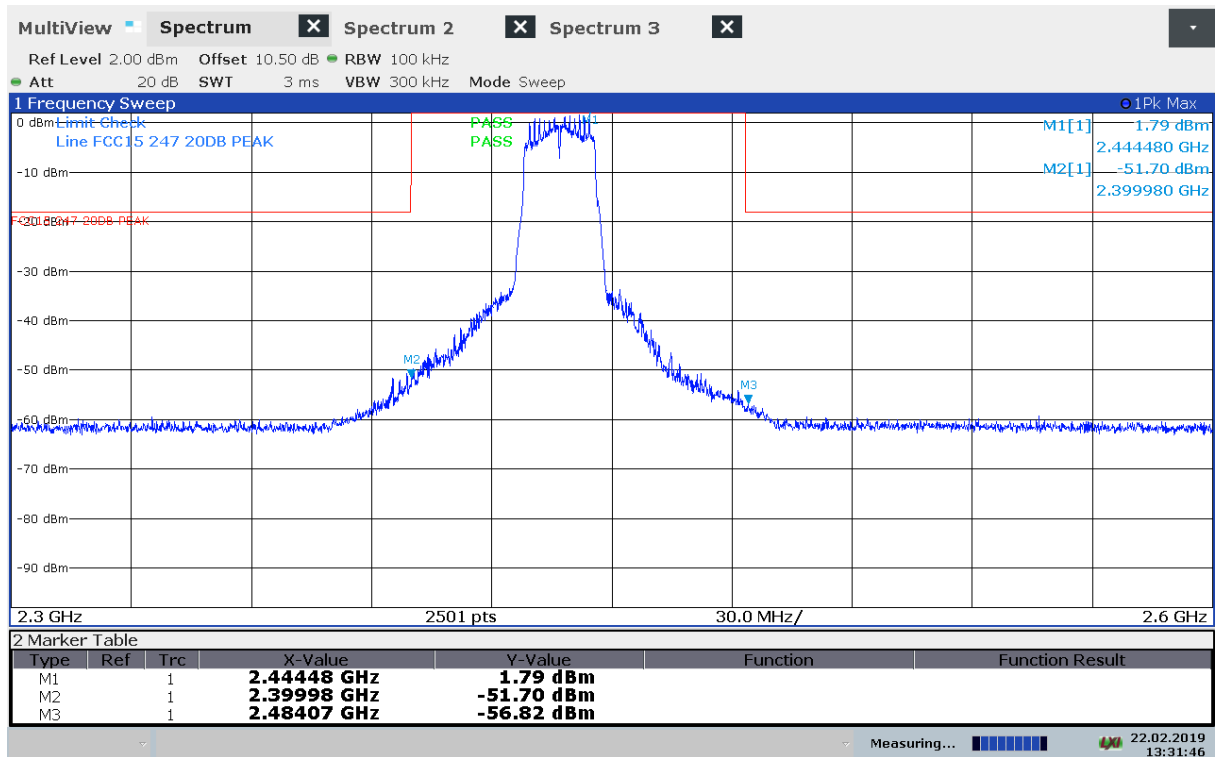
Conducted Emissions, 2300 – 2600 MHz, 2437 MHz, 802.11g, 6Mbps



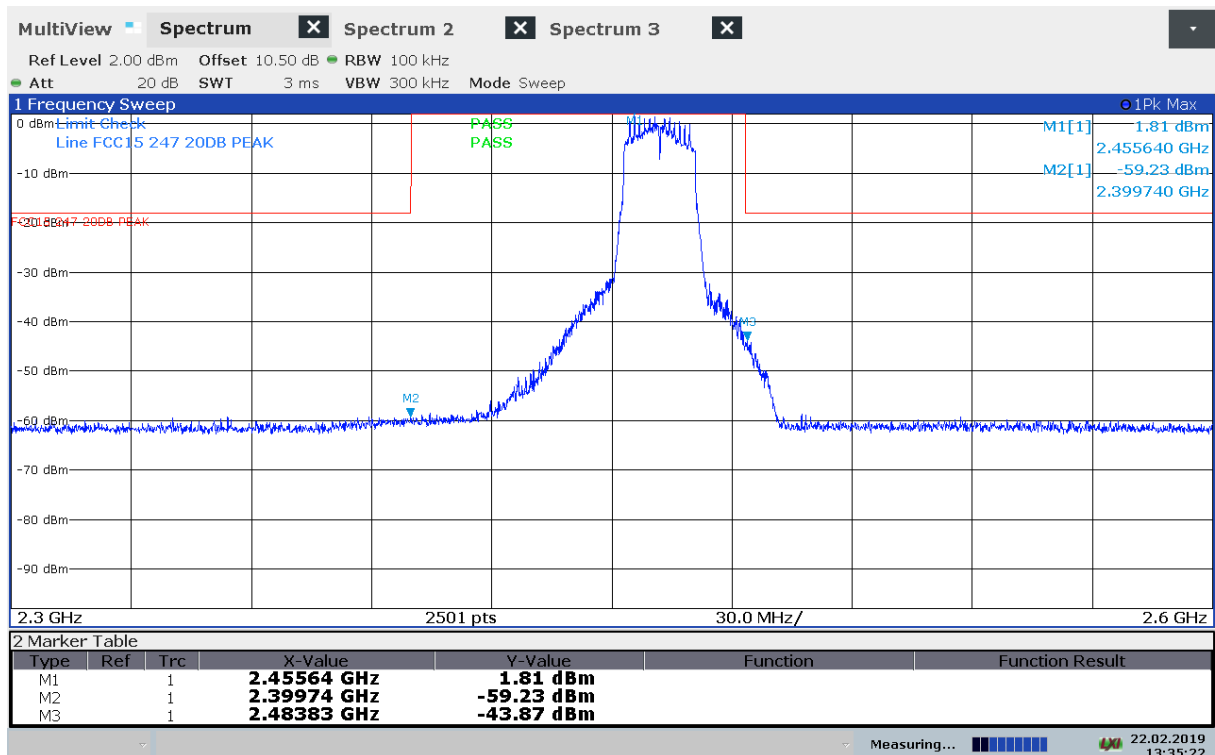
Conducted Emissions, 2300 – 2600 MHz, 2462 MHz, 802.11g, 6Mbps



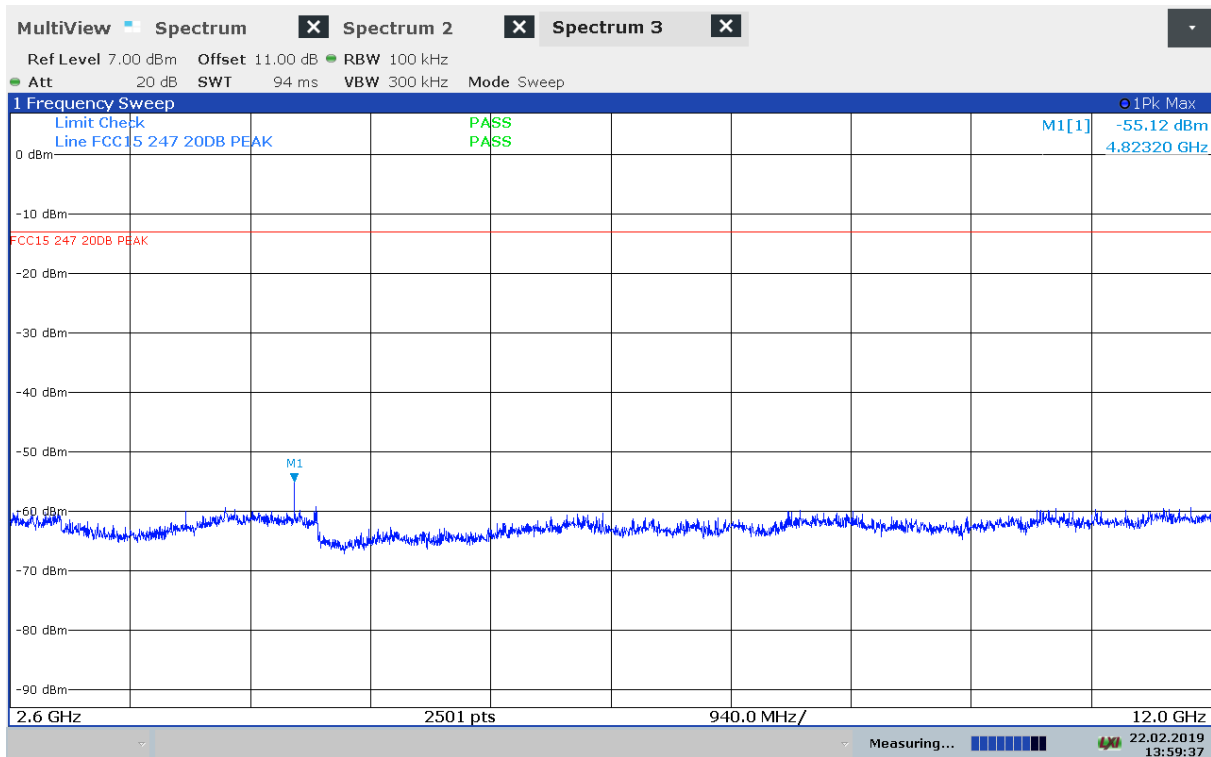
Conducted Emissions, 2300 – 2600 MHz, 2412 MHz, 802.11n, MCS0



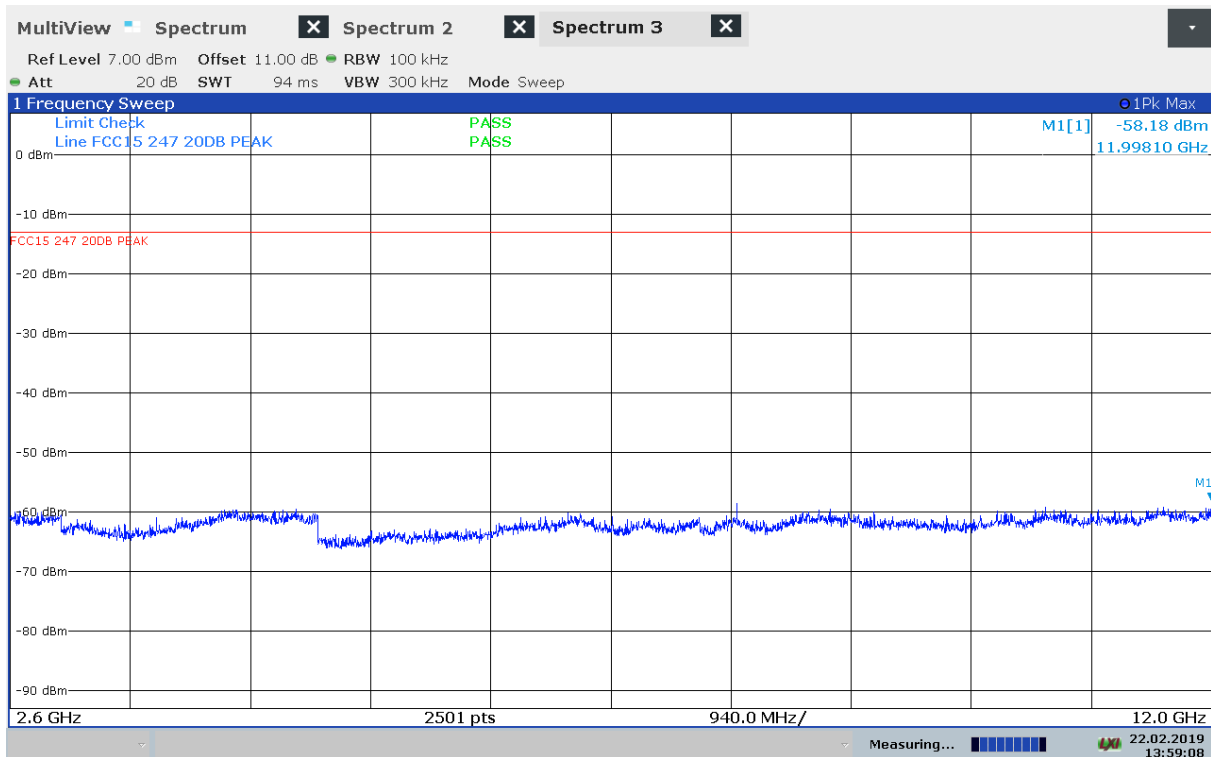
Conducted Emissions, 2300 – 2600 MHz, 2437 MHz, 802.11n, MCS0



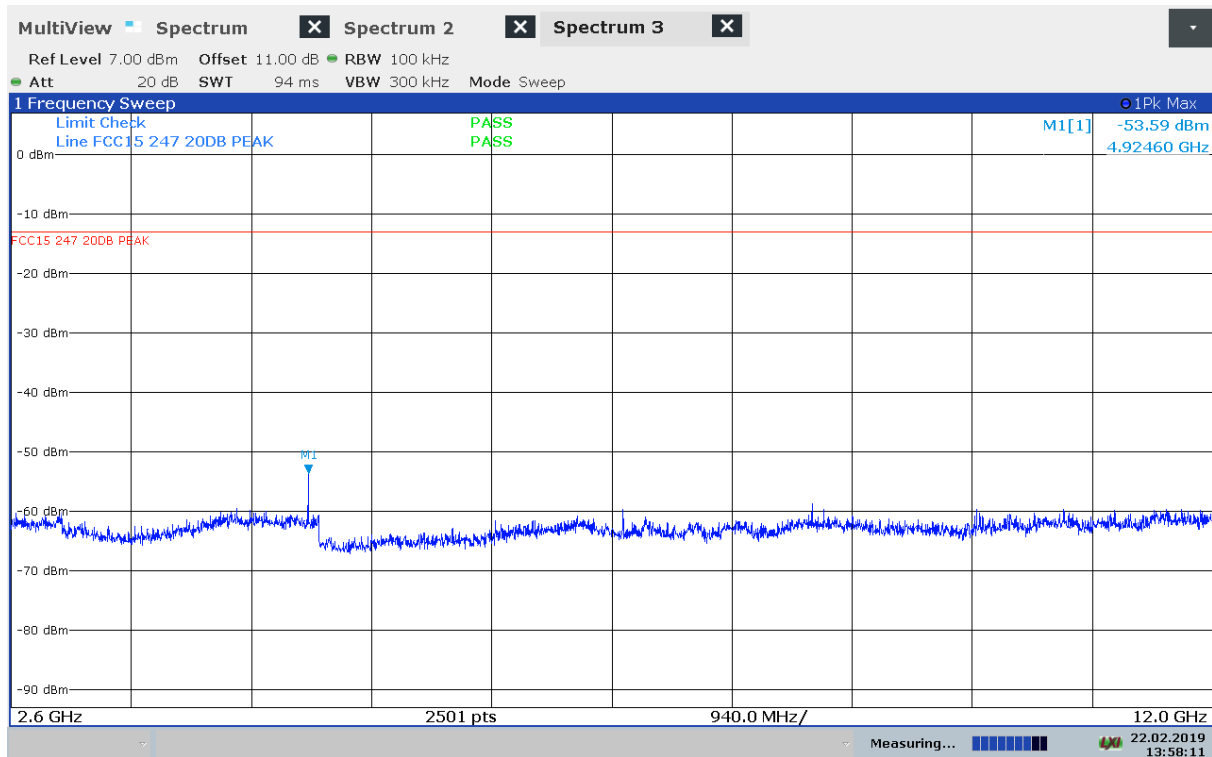
Conducted Emissions, 2300 – 2600 MHz, 2462 MHz, 802.11n, MCS0



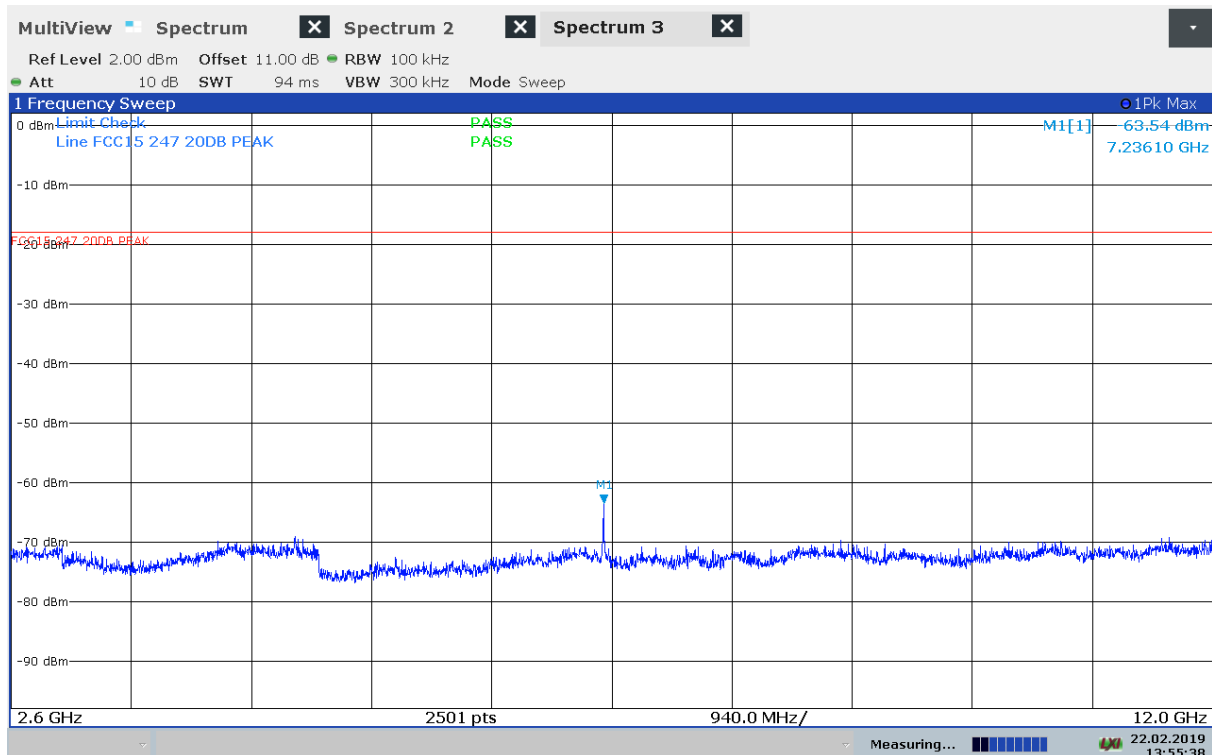
Conducted Emissions, 2600 – 12000 MHz, 2412 MHz, 802.11b, 1Mbps



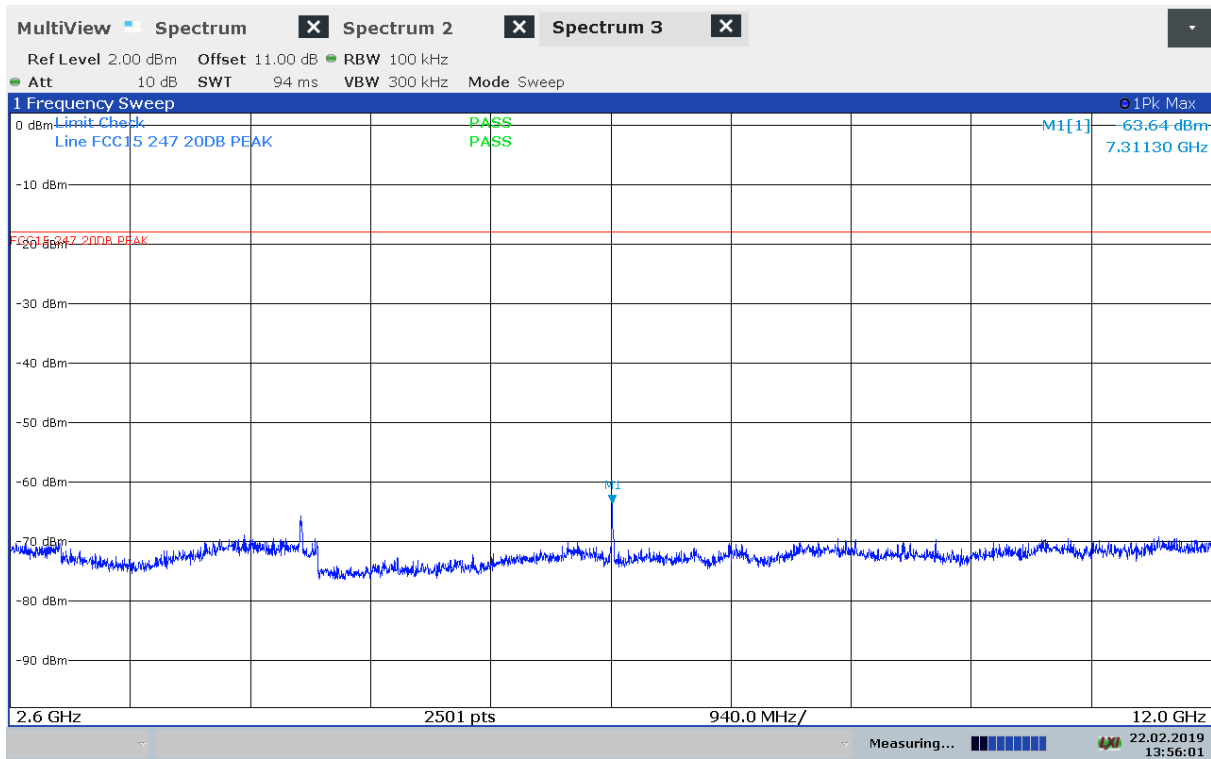
Conducted Emissions, 2600 – 12000 MHz, 2437 MHz, 802.11b, 1Mbps



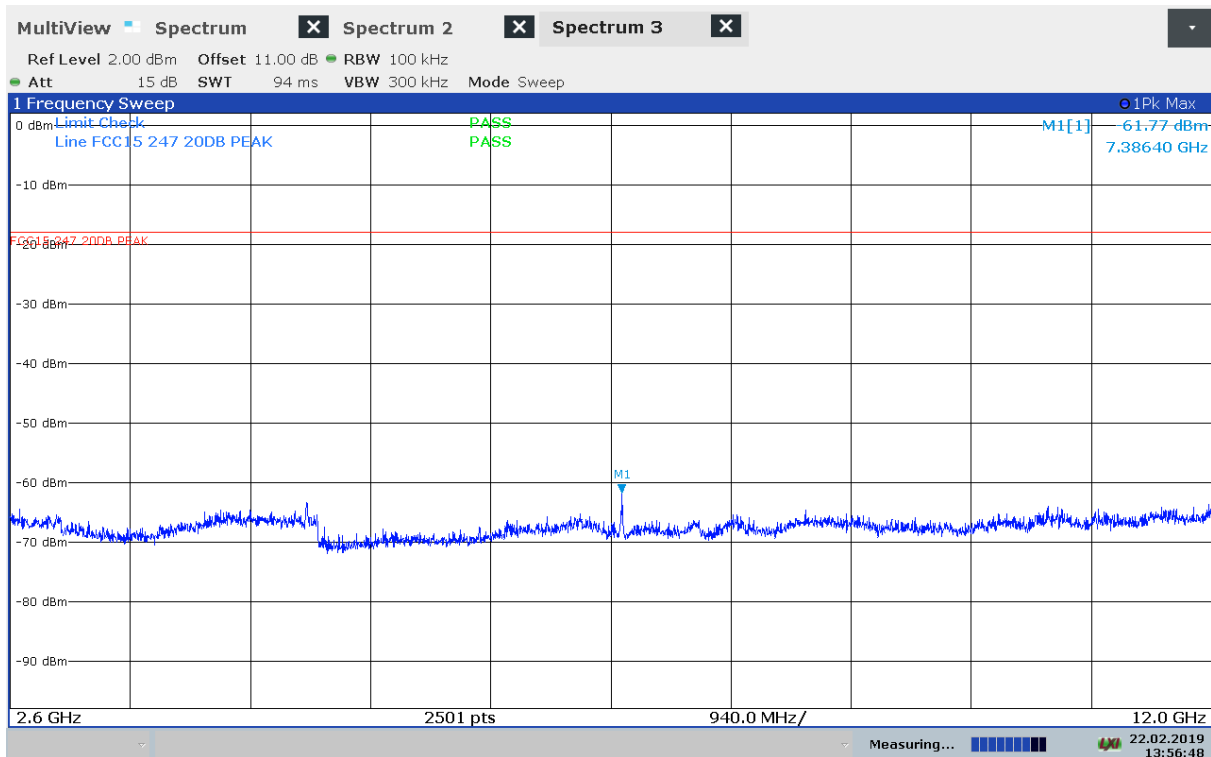
Conducted Emissions, 2600 – 12000 MHz, 2462 MHz, 802.11b, 1Mbps



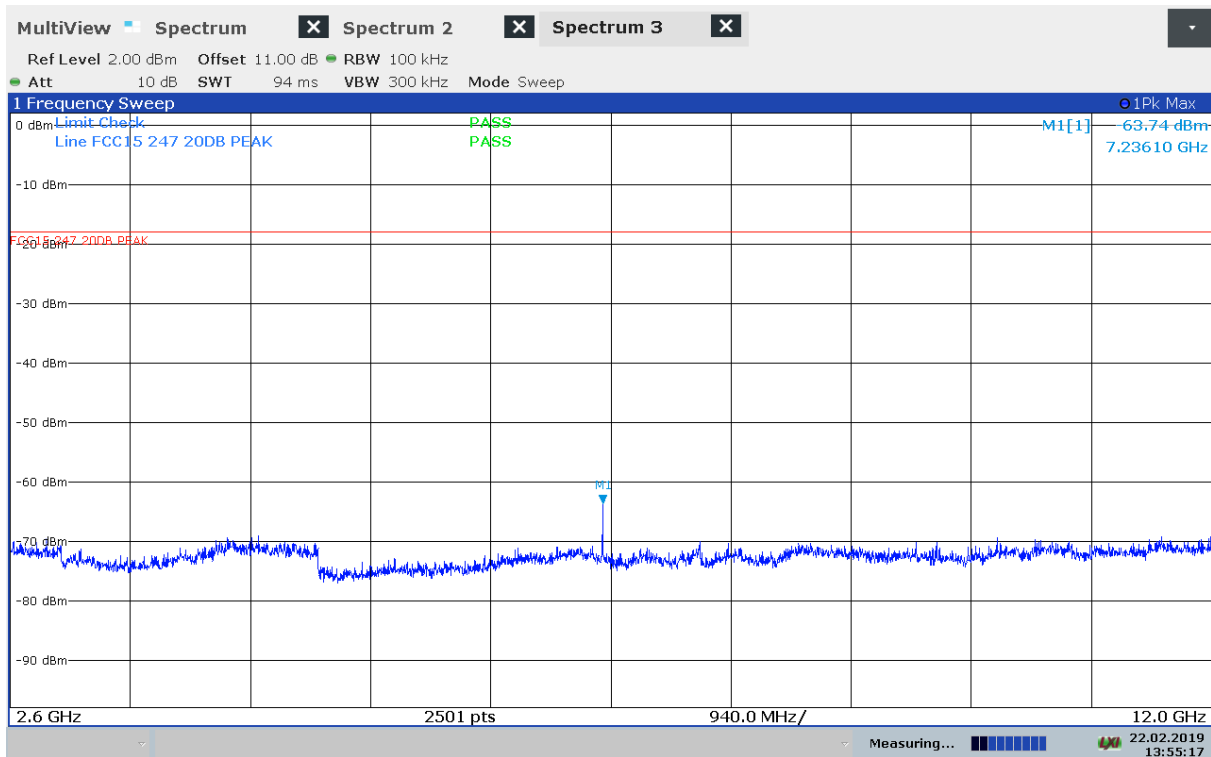
Conducted Emissions, 2600 – 12000 MHz, 2412 MHz, 802.11g, 6Mbps



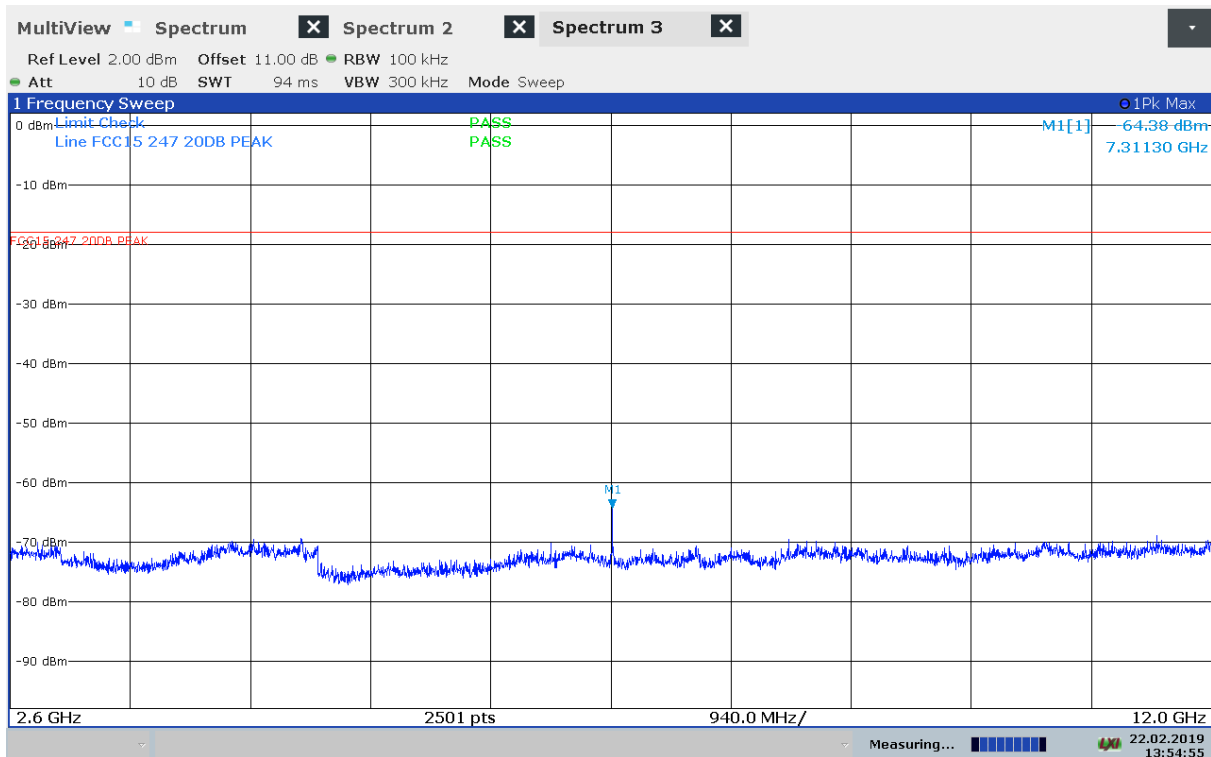
Conducted Emissions, 2600 – 12000 MHz, 2437 MHz, 802.11g, 6Mbps



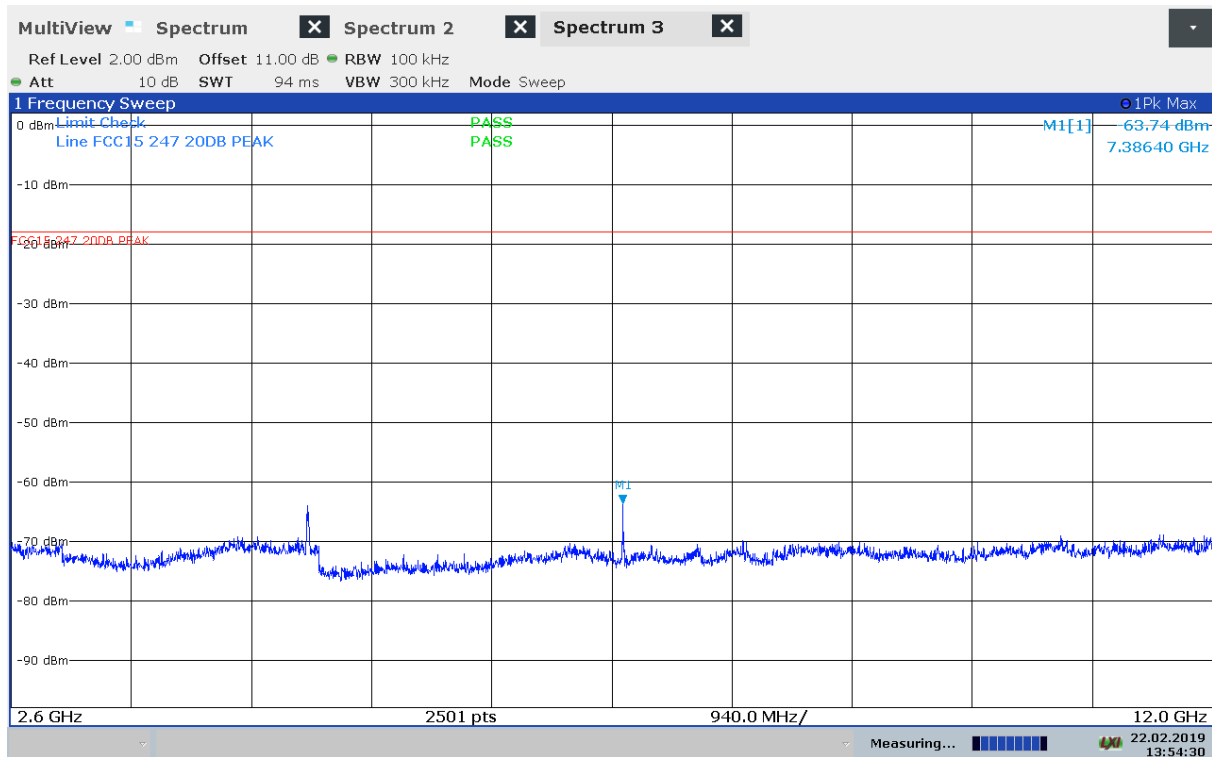
Conducted Emissions, 2600 – 12000 MHz, 2462 MHz, 802.11g, 6Mbps



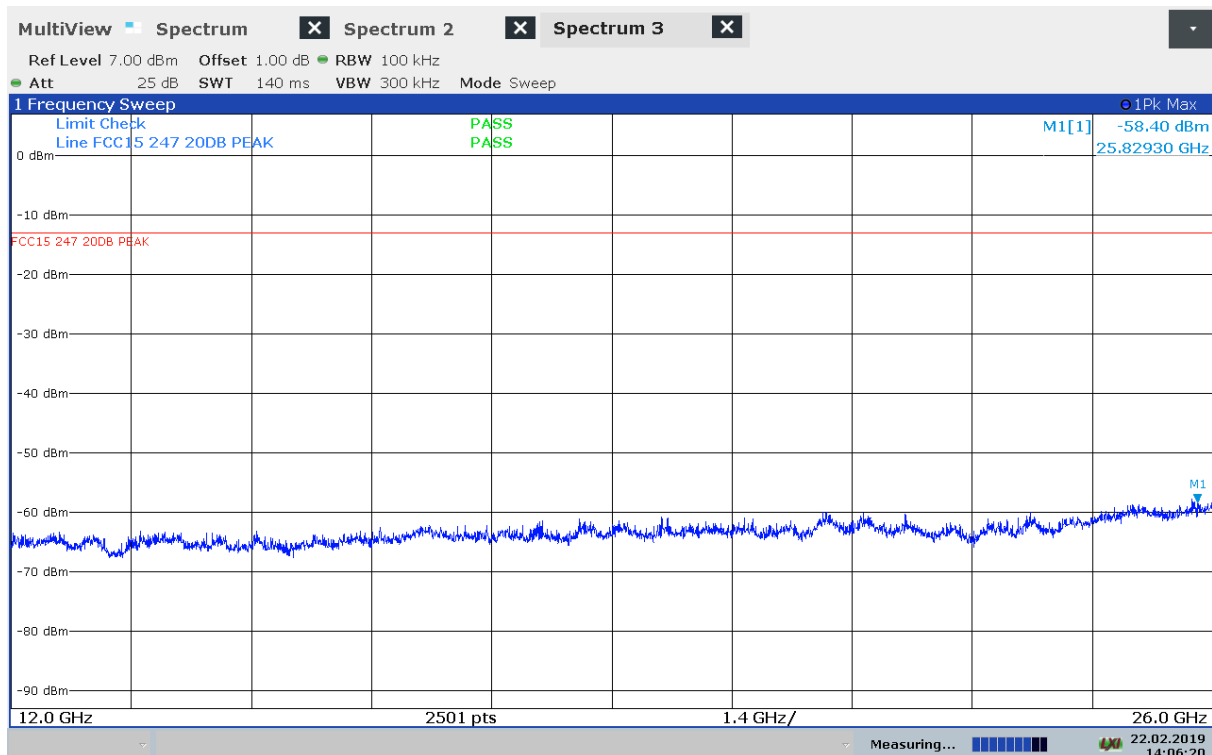
Conducted Emissions, 2600 – 12000 MHz, 2412 MHz, 802.11n, MCS0



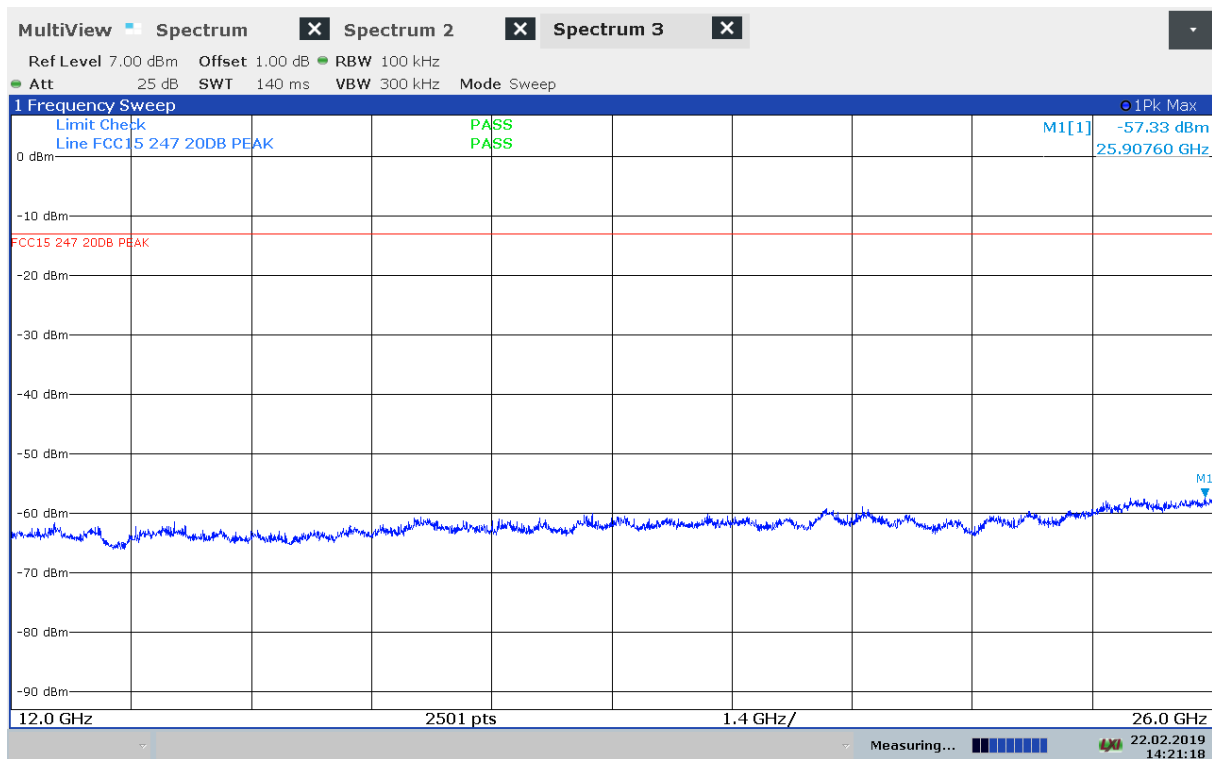
Conducted Emissions, 2600 – 12000 MHz, 2437 MHz, 802.11n, MCS0



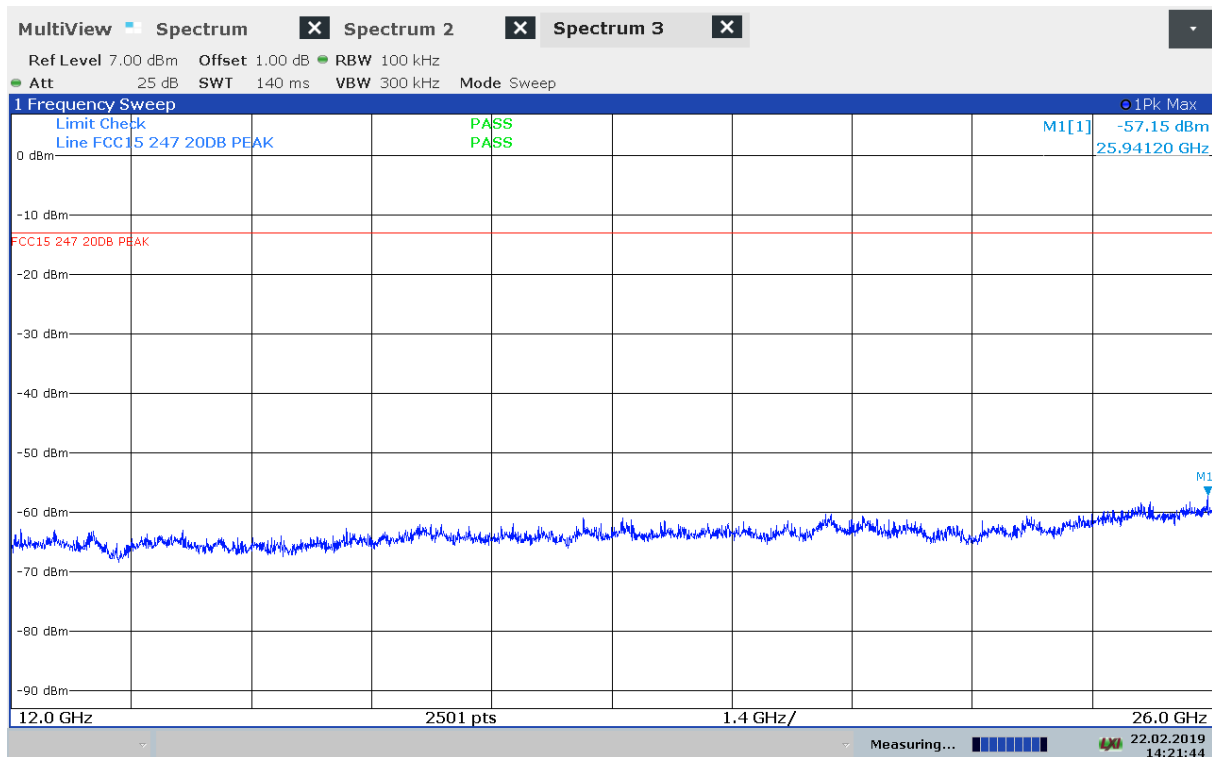
Conducted Emissions, 2600 – 12000 MHz, 2462 MHz, 802.11n, MCS0



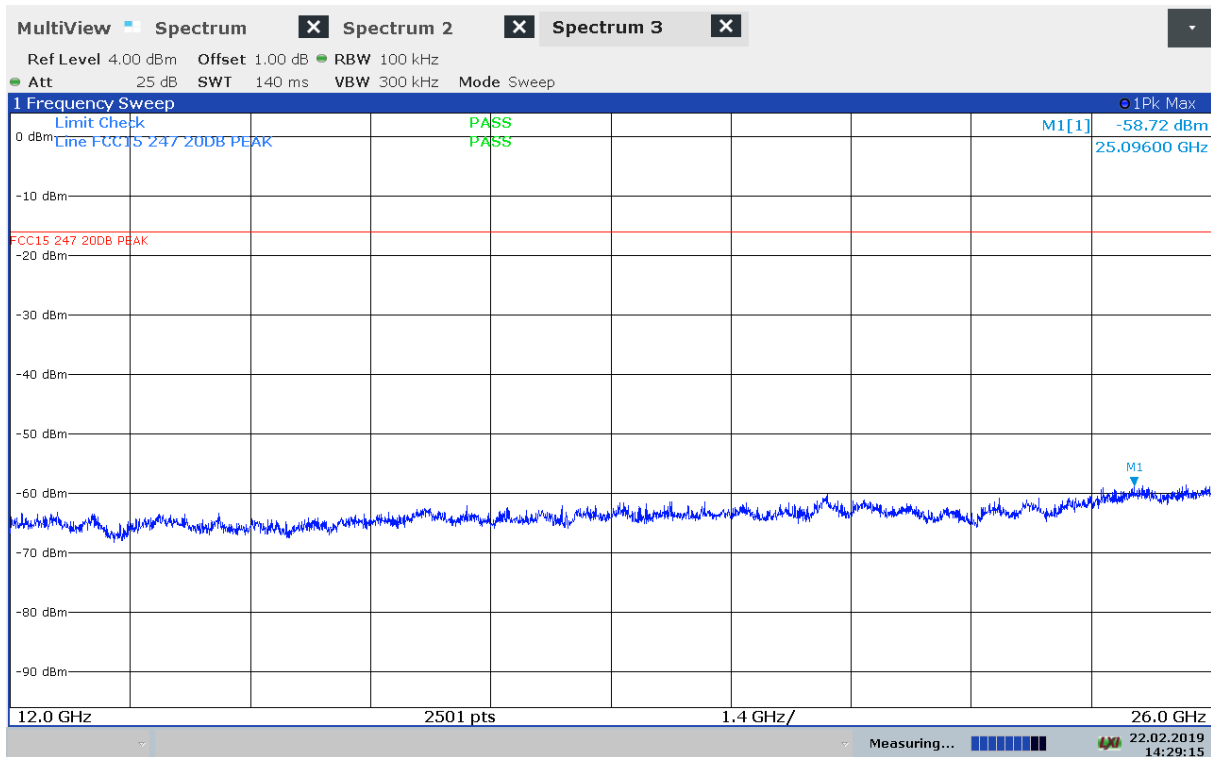
Conducted Emissions, 12000 – 26000 MHz, 2412 MHz, 802.11b, 1Mbps



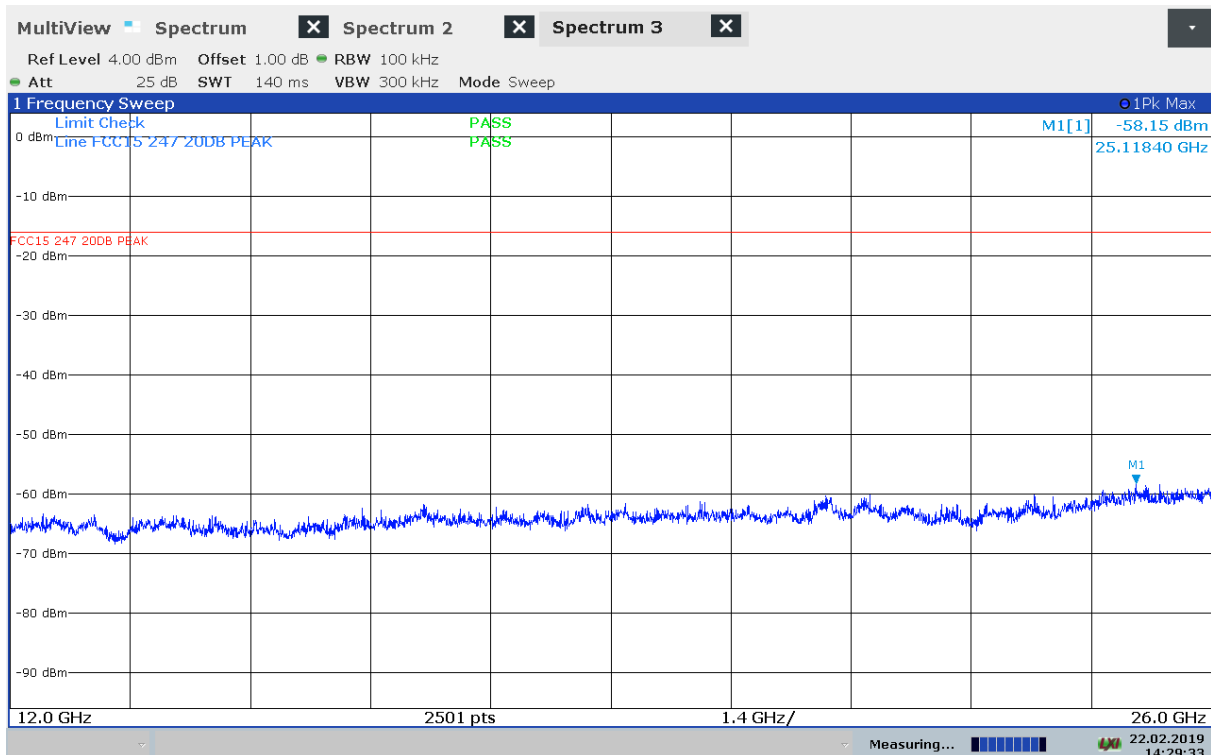
Conducted Emissions, 12000 – 26000 MHz, 2437 MHz, 802.11b, 1Mbps



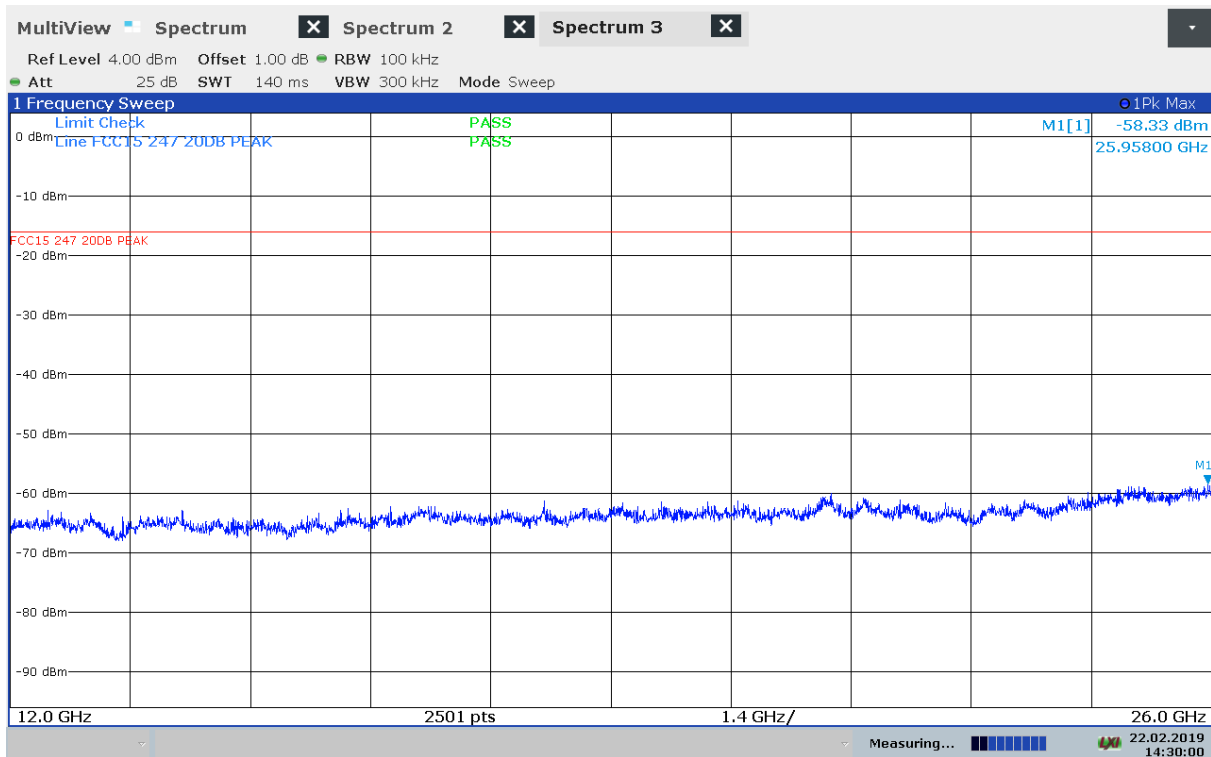
Conducted Emissions, 12000 – 26000 MHz, 2462 MHz, 802.11b, 1Mbps



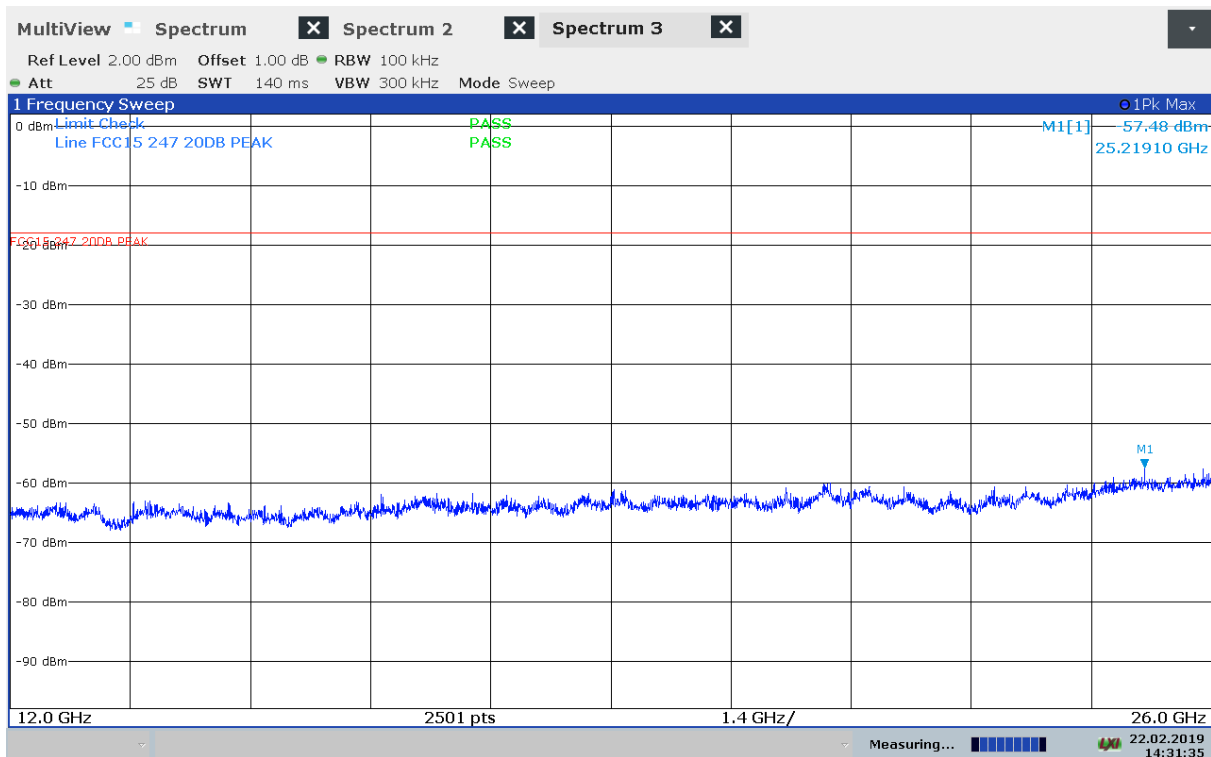
Conducted Emissions, 12000 – 26000 MHz, 2412 MHz, 802.11g, 6Mbps



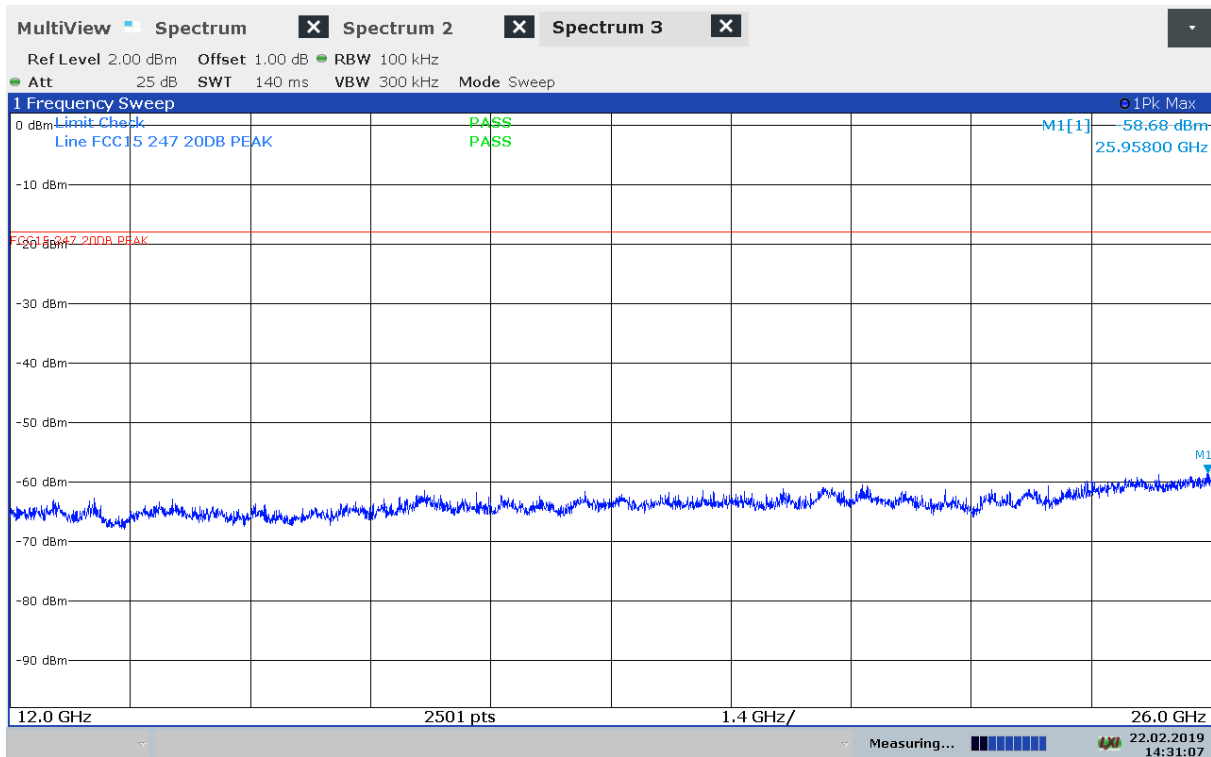
Conducted Emissions, 12000 – 26000 MHz, 2437 MHz, 802.11g, 6Mbps



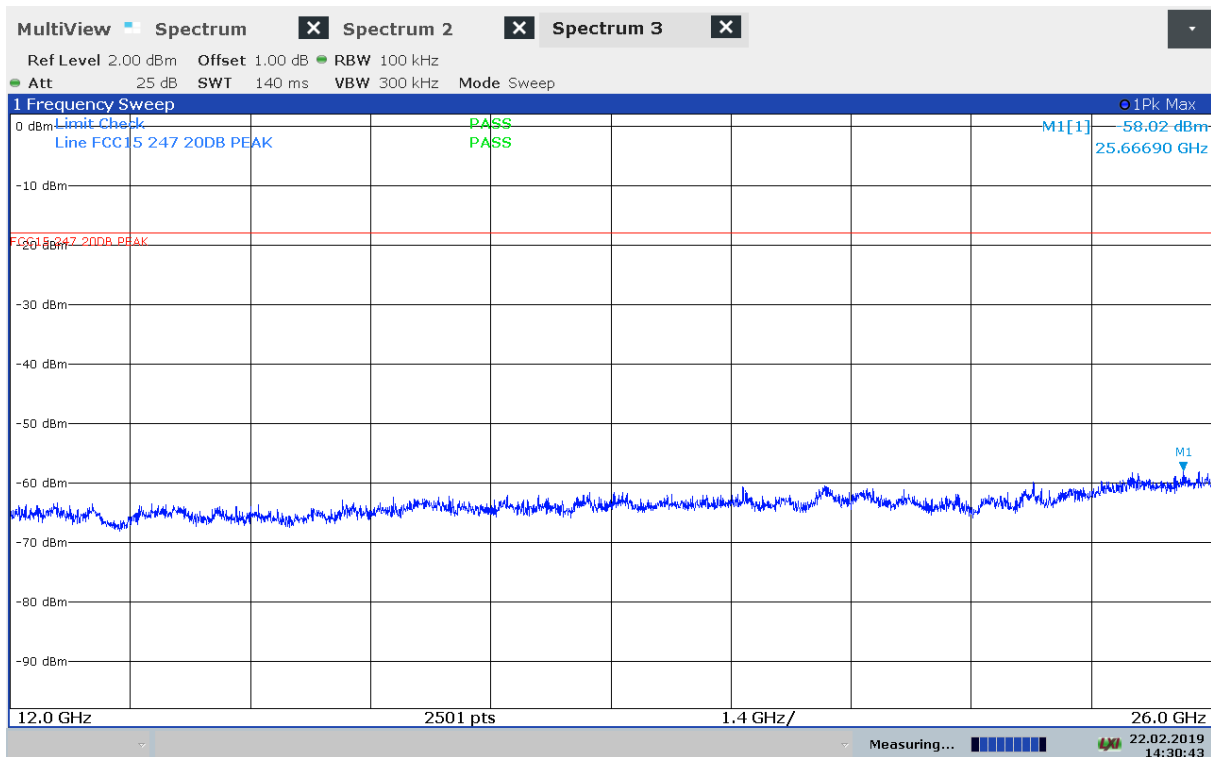
Conducted Emissions, 12000 – 26000 MHz, 2462 MHz, 802.11g, 6Mbps



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



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



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

3.5 Restricted Bands of operation

Restricted Bands of operation for FCC and ISSED are defined in FCC Part 15.205 and ISSED RSS-GEN, Issue 5 clause 8.10.

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

FCC (MHz)	ISSED (MHz)	FCC (GHz)	ISSED (GHz)
0.090-0.110		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.

3.6 Radiated Emissions, Band Edge

FCC Part 15.209 (a)

ISED Canada RSS-GEN Issue 5, Clause 7.3 / 8.9

Measurement procedure: ANSI C63.10-2013 Clause 11.12

Test Results: Complies

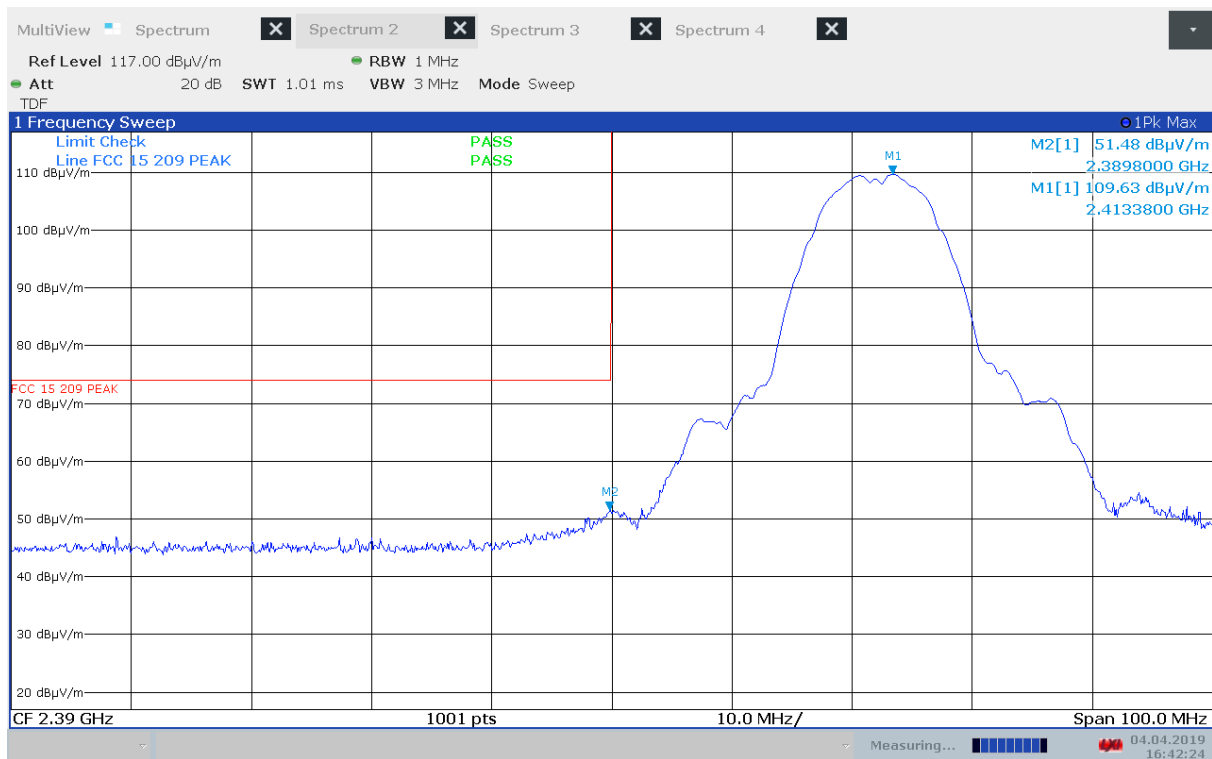
Measurement Data:

Peak Detector					
Modulation and Bitrate	Measured field strength (dB μ V/m)		Limit	Margin	
	2390 MHz	2483.5 MHz	dB	dB	
802.11b, 11 Mbps	51.5	53.3	74	22.5	20.7
802.11g, 6 Mbps	66.3	63.3	74	7.7	10.7
802.11n, MCS0	70.7	70.7	74	3.3	3.3

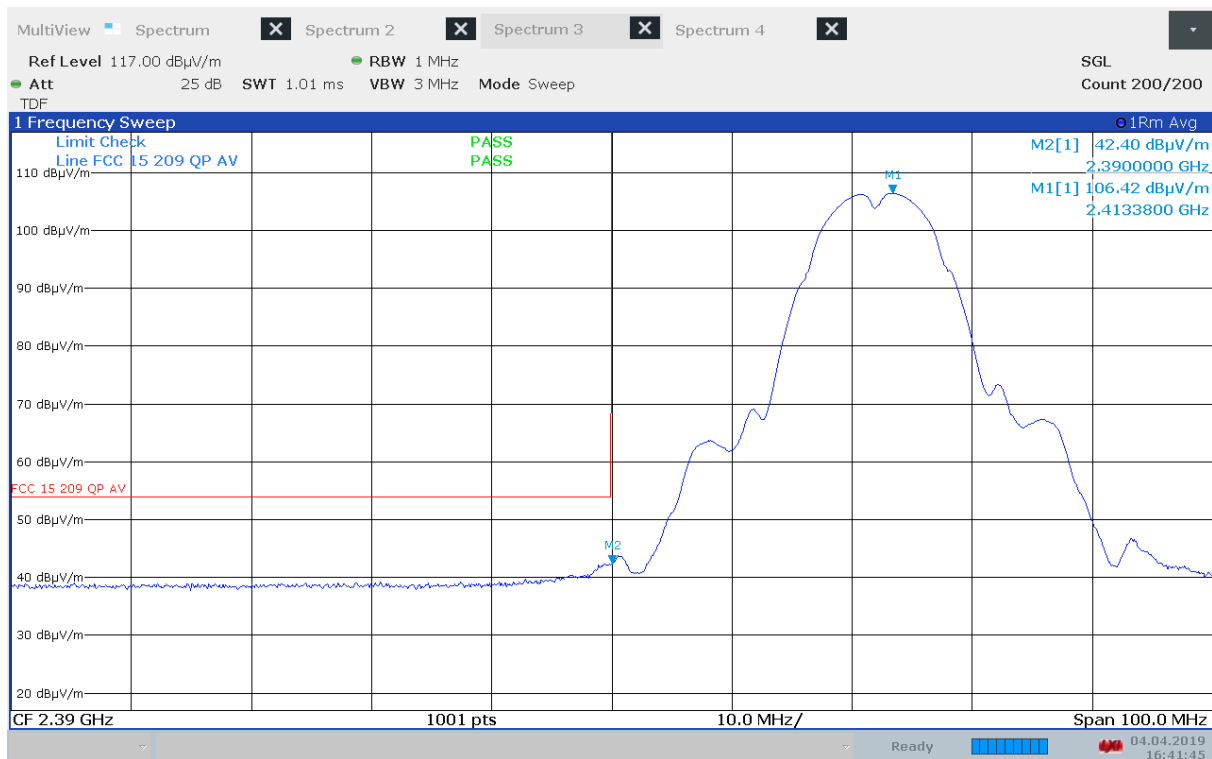
Average Detector					
Modulation and Bitrate	Measured field strength (dB μ V/m)		Limit	Margin	
	2390 MHz	2483.5 MHz	dB	dB	
802.11b, 11 Mbps	42.4	45.1	54	11.6	8.9
802.11g, 6 Mbps	46.5	49.7	54	7.5	4.3
802.11n, MCS0	52.5	51.5	54	1.5	2.5

Average values were measured using trace averaging as described in ANSI C63.10-2013 clause 11.12.2.5.1 (Duty Cycle \approx 100%).

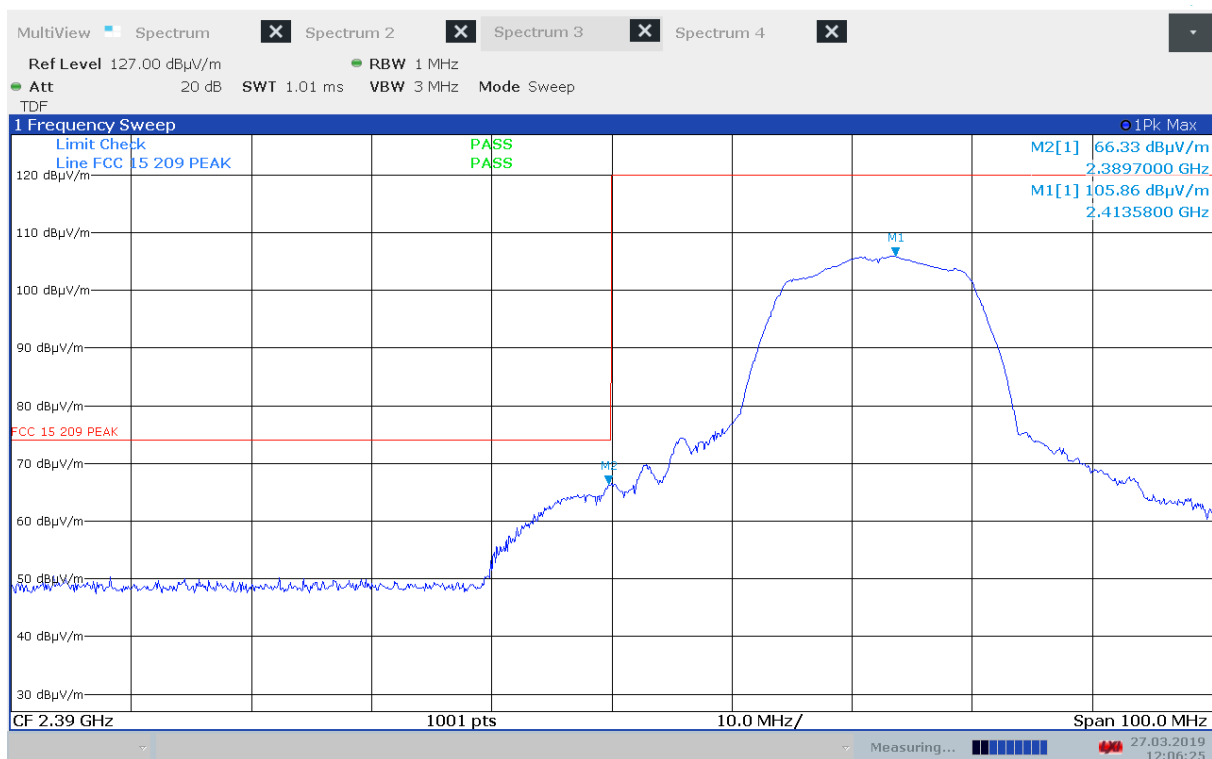
See attached plots.



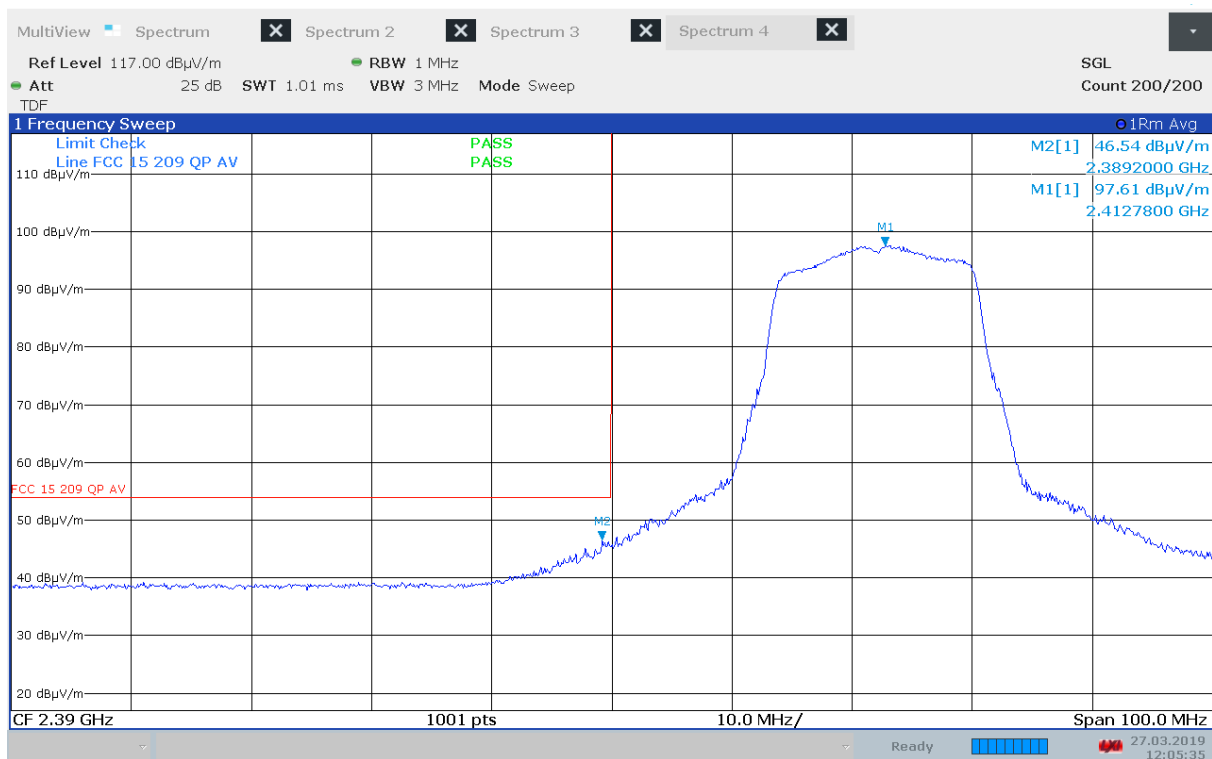
Lower Band Edge, Peak, 2412 MHz, 802.11b, 1Mbps



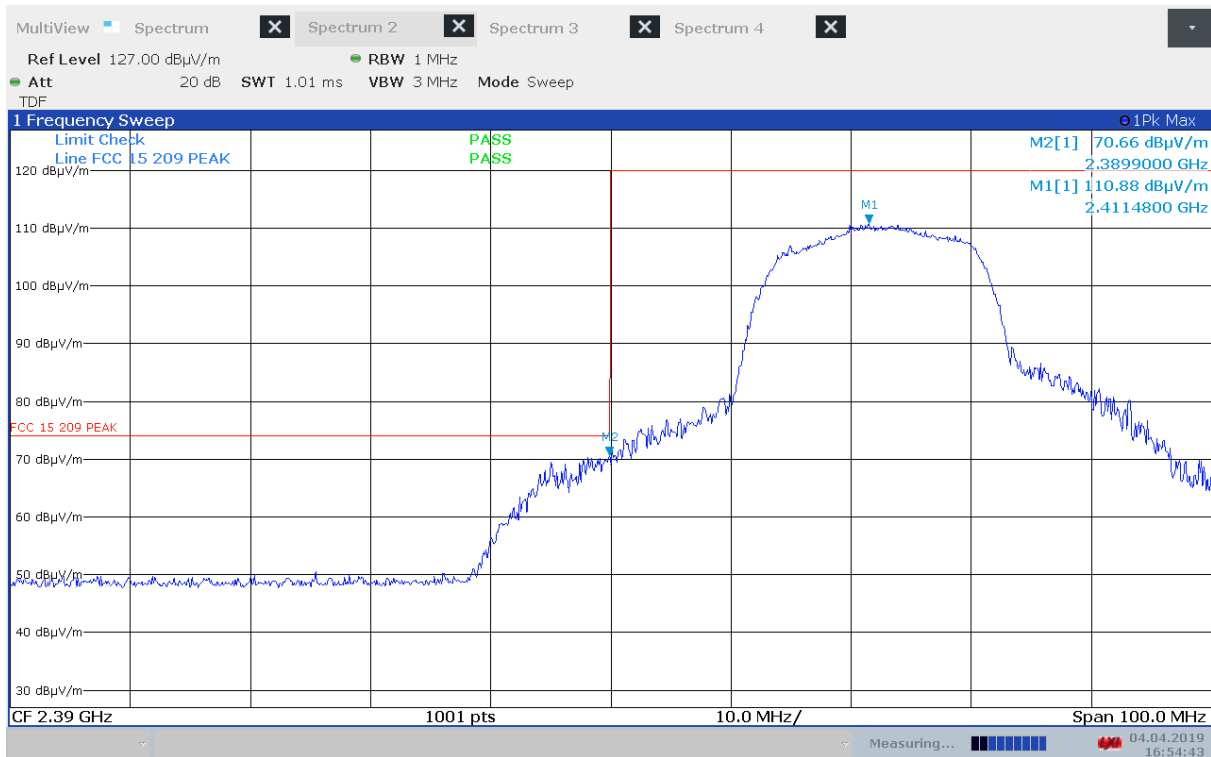
Lower Band Edge, Average, 2412 MHz, 802.11b, 1Mbps



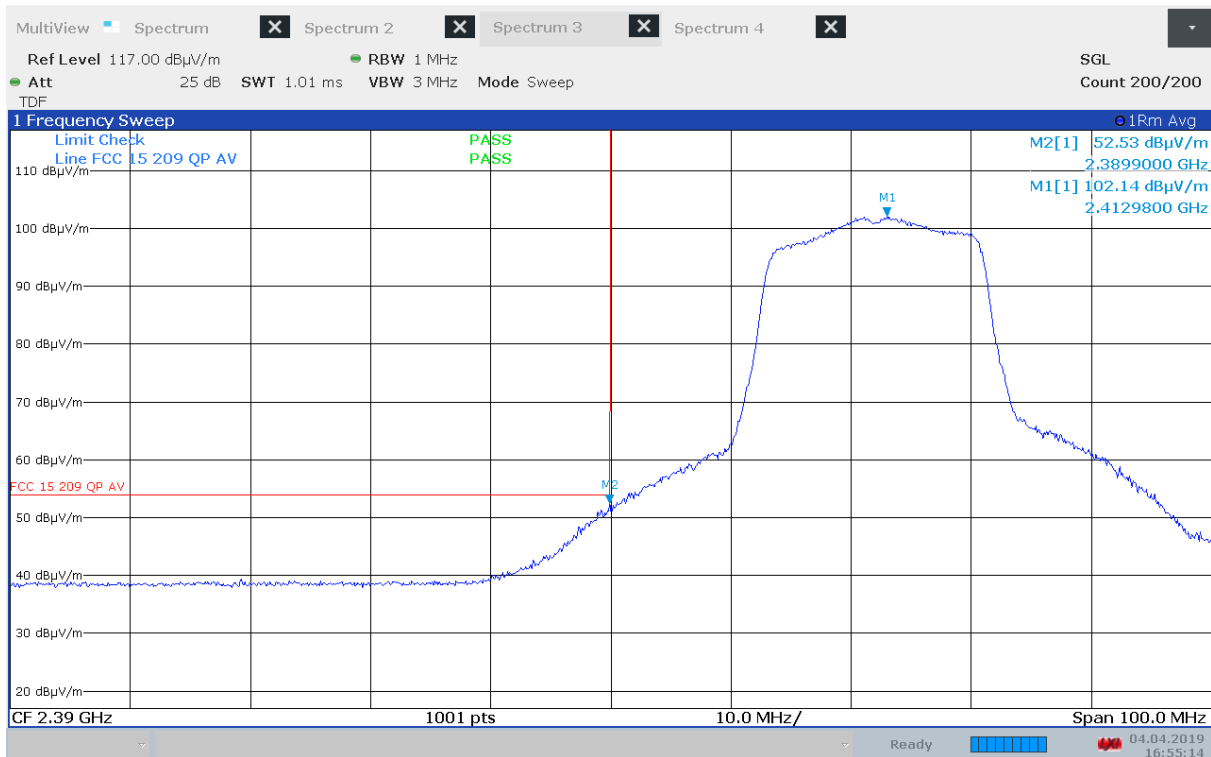
Lower Band Edge, Peak, 2412 MHz, 802.11g, 6Mbps



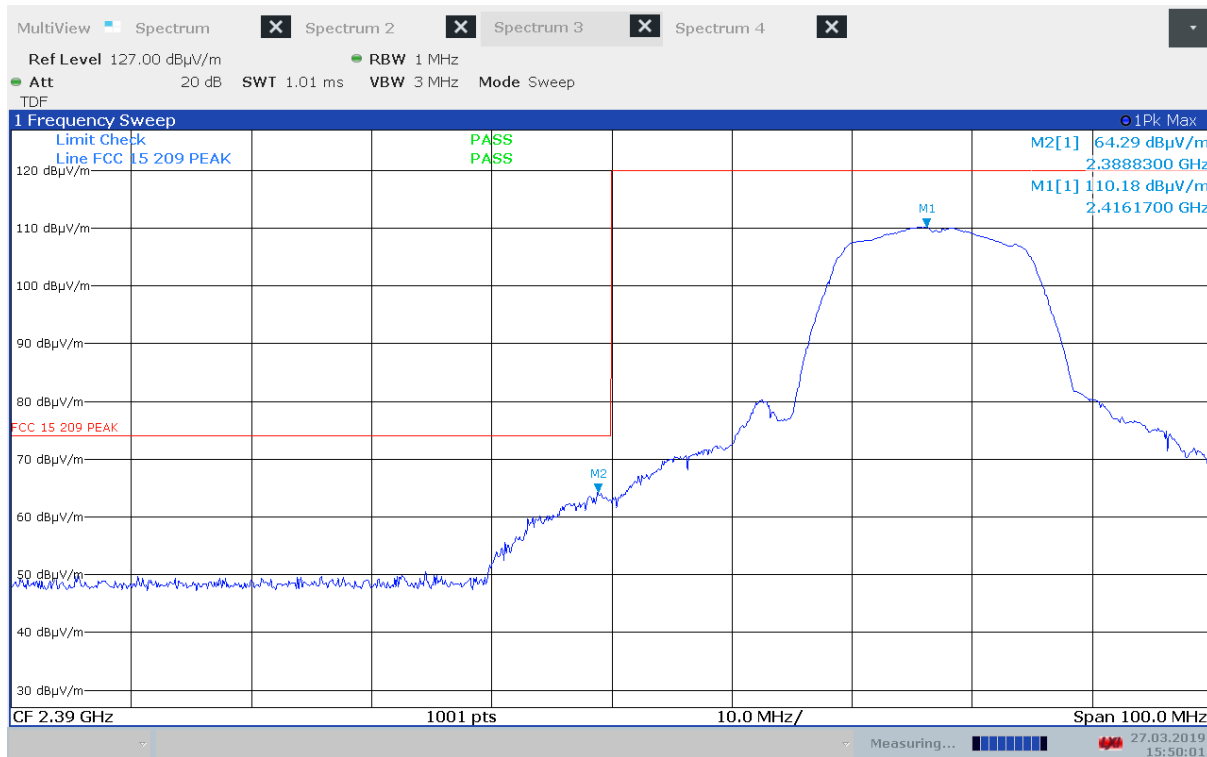
Lower Band Edge, Average, 2412 MHz, 802.11g, 6Mbps



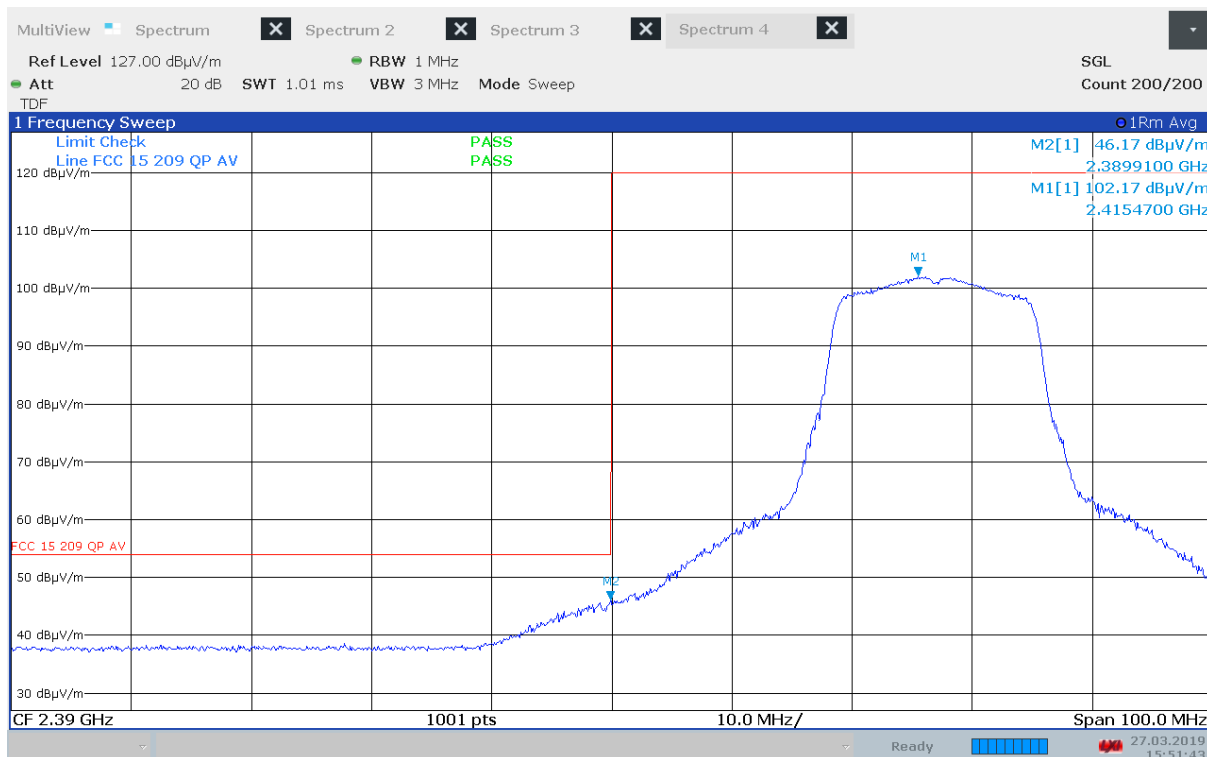
Lower Band Edge, Peak, 2412 MHz, 802.11n, MCS0



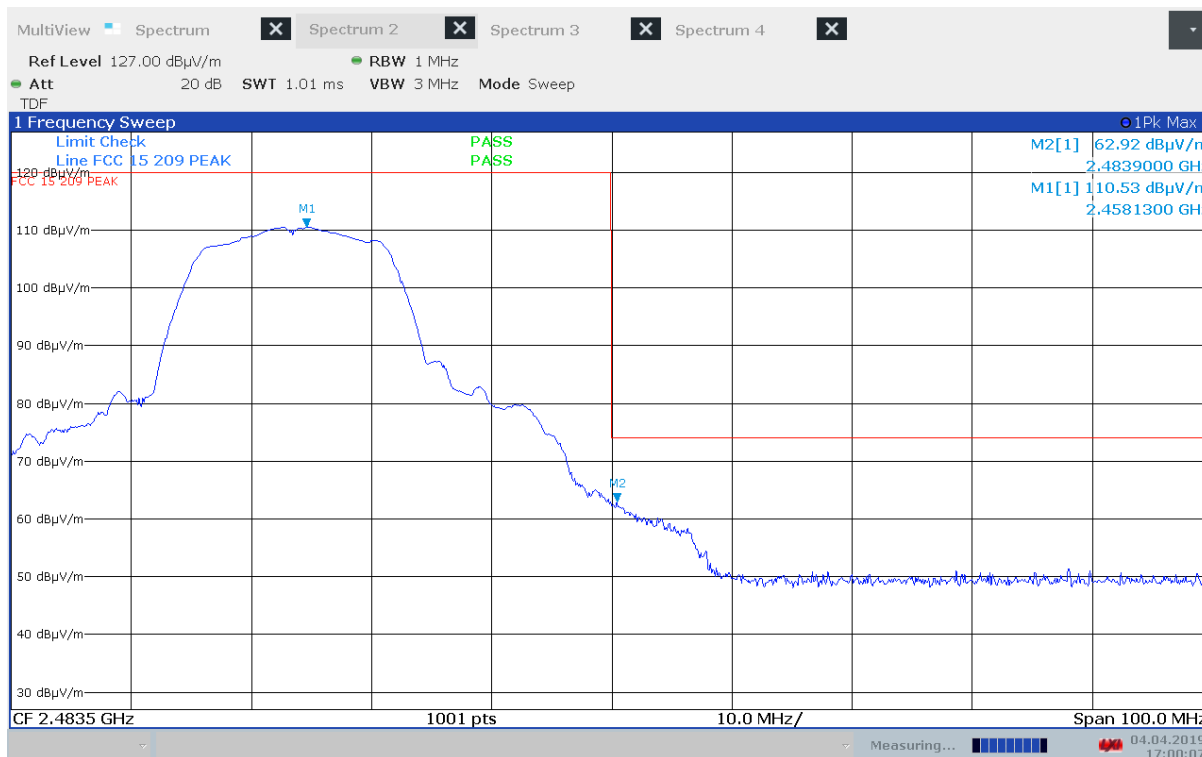
Lower Band Edge, Average, 2412 MHz, 802.11n, MCS0



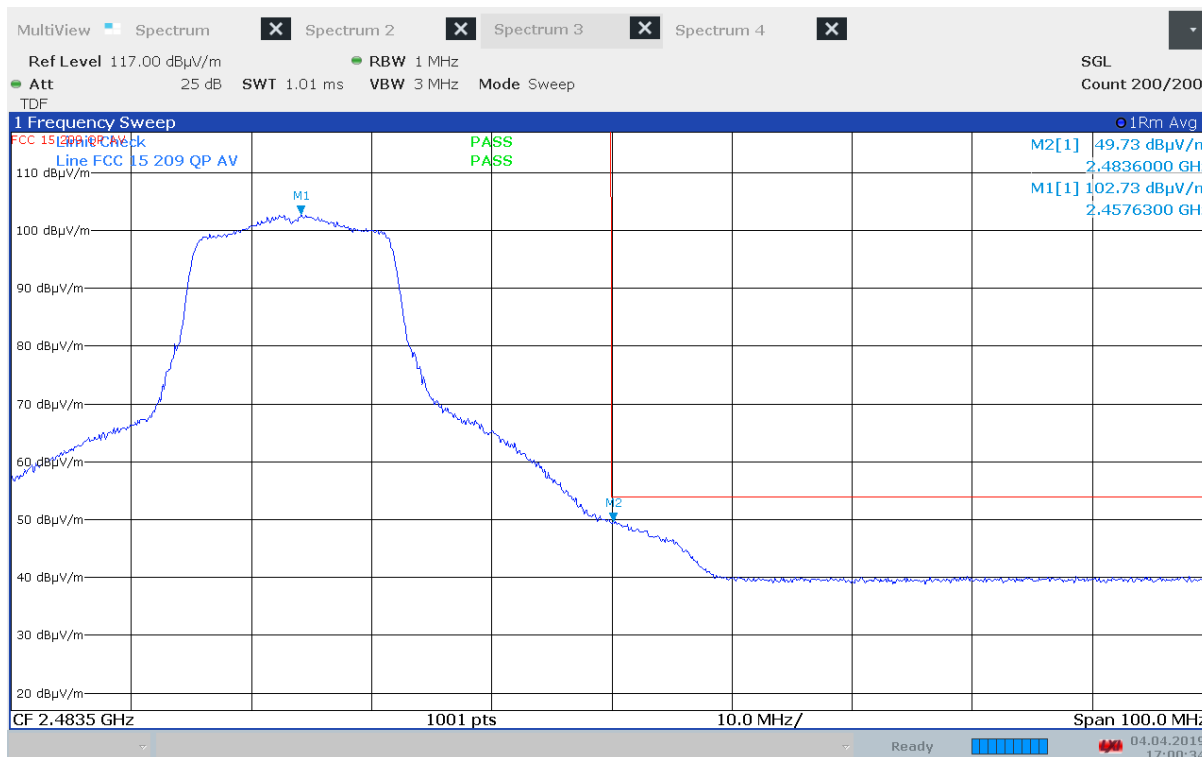
Lower Band Edge, Peak, 2417 MHz, 802.11g, 6Mbps



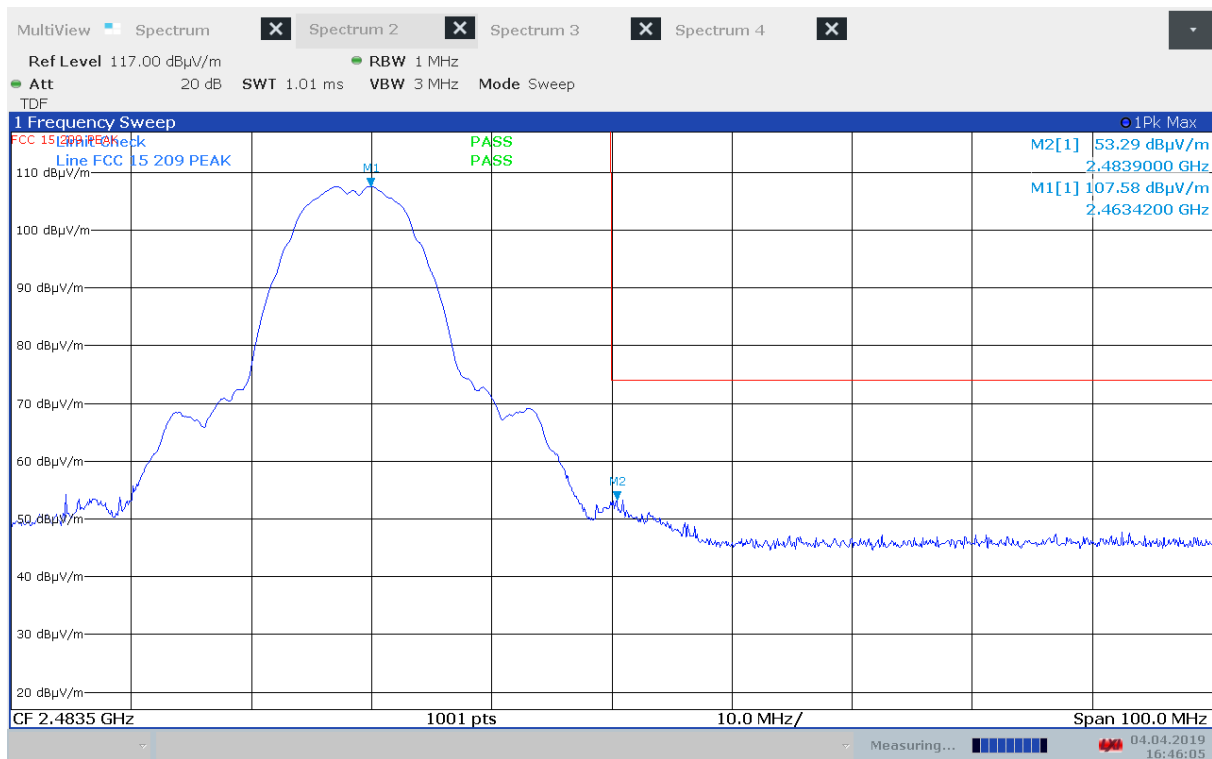
Lower Band Edge, Average, 2417 MHz, 802.11g, 6Mbps



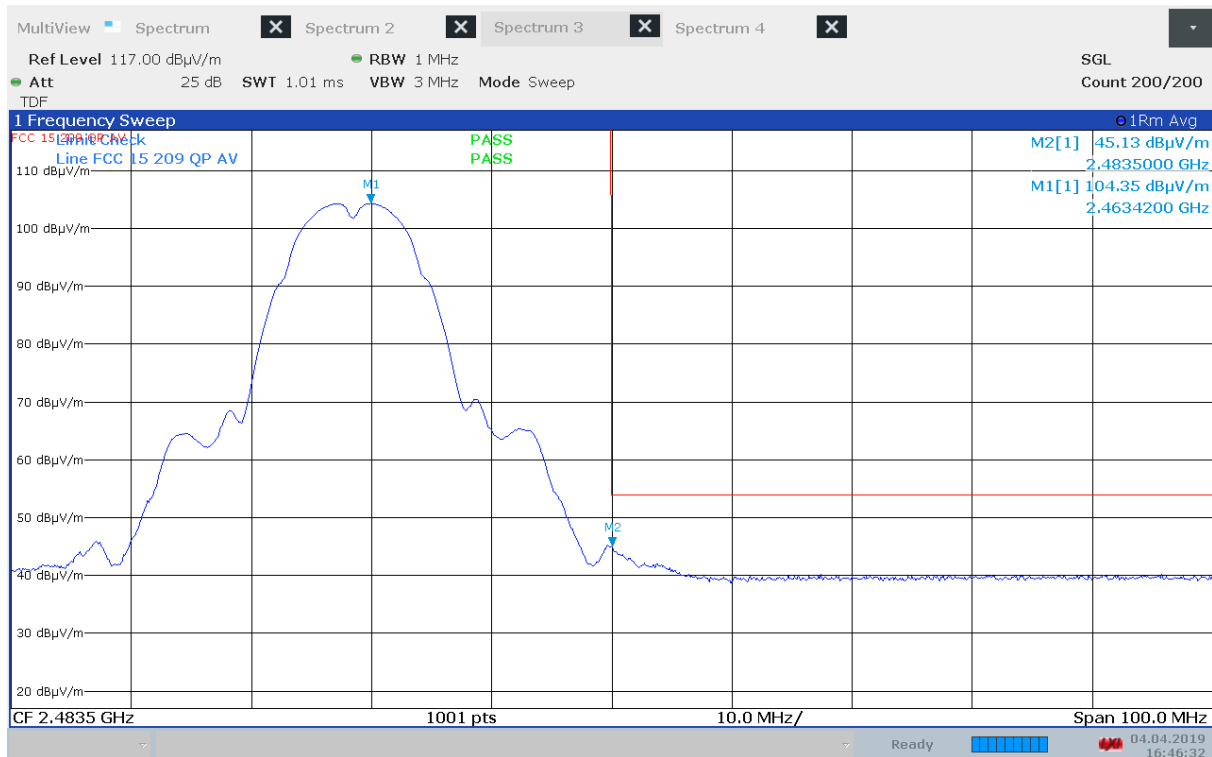
Upper Band Edge, Peak, 2457 MHz, 802.11g, 6Mbps



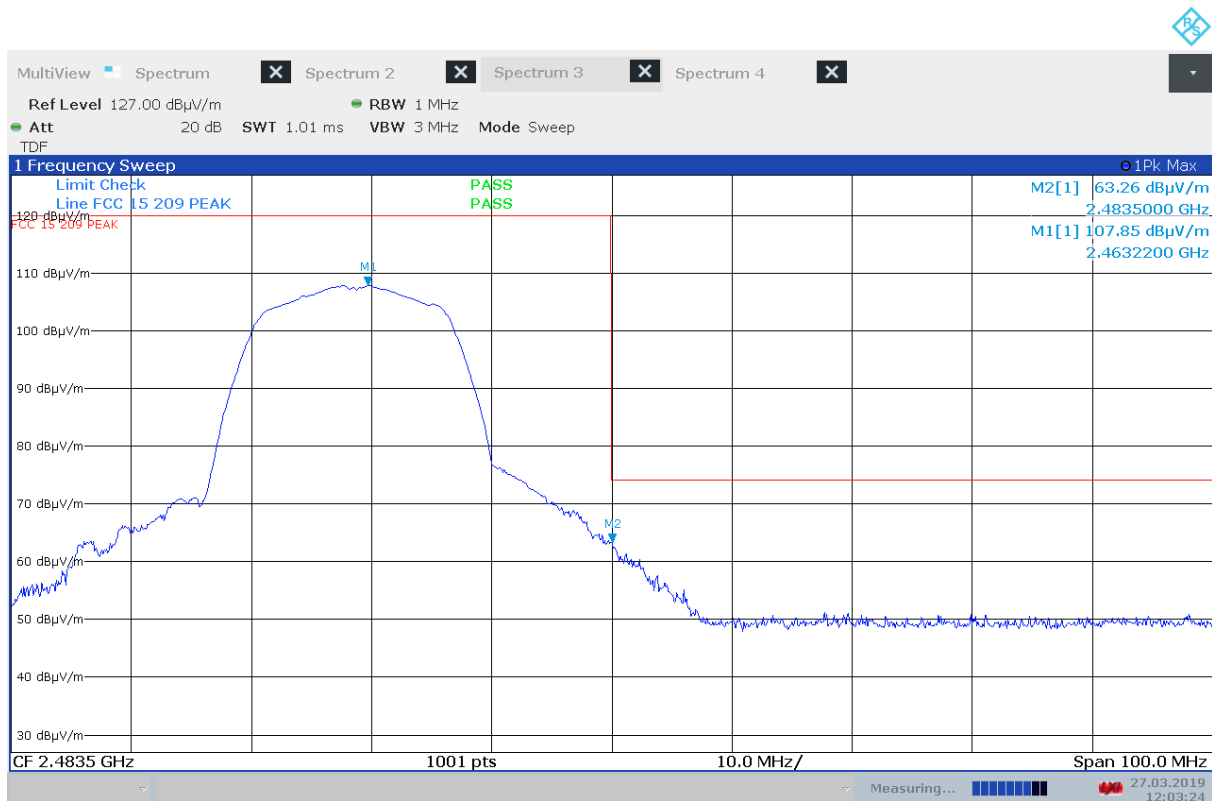
Upper Band Edge, Average, 2457 MHz, 802.11g, 6Mbps



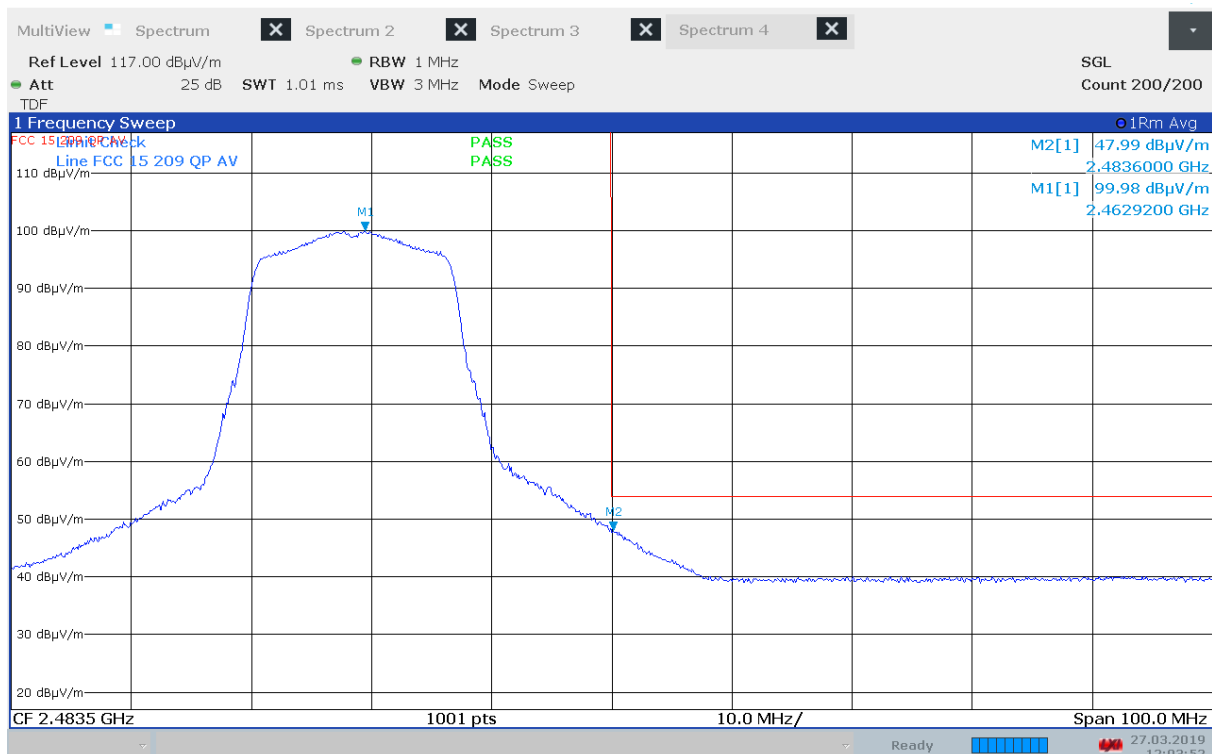
Upper Band Edge, Peak, 2462 MHz, 802.11b, 1Mbps



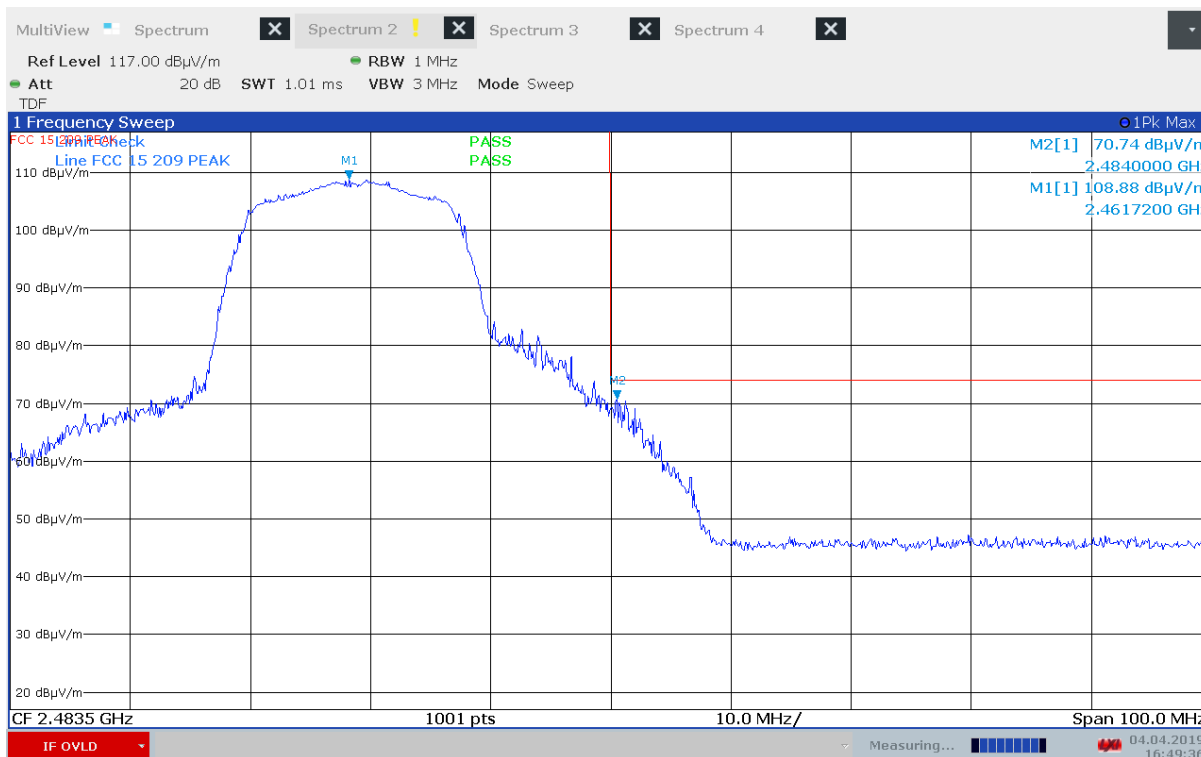
Upper Band Edge, Average, 2462 MHz, 802.11b, 1Mbps



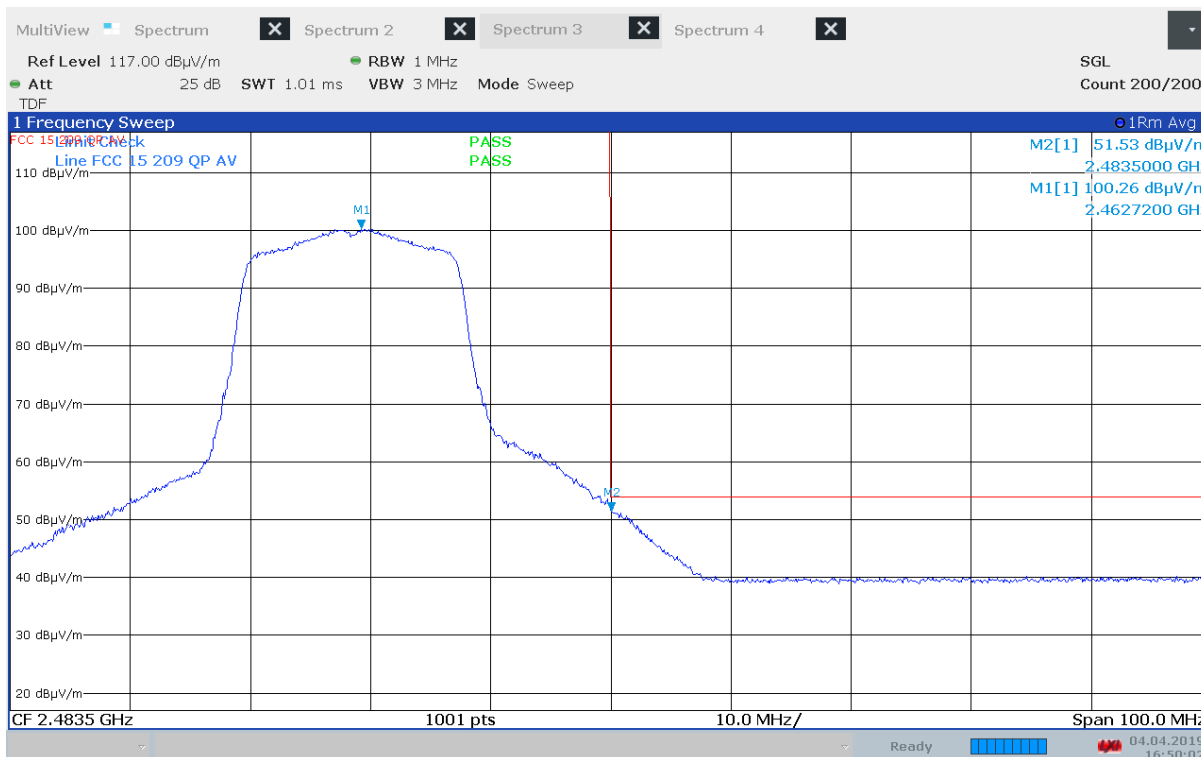
Upper Band Edge, Peak, 2462 MHz, 802.11g, 6Mbps



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



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



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

3.7 Radiated Emissions 30 – 1000 MHz

FCC Part 15.209 (a)

ISED Canada RSS-GEN Issue 5, Clause 7.3/8.9

Measurement procedure: ANSI C63.10-2013 Clause 11.12

Test Results: Complies

Measurement Data:

Detector: Peak (found frequencies were measured with Quasi-Peak Detector)

Measuring distance 3m.

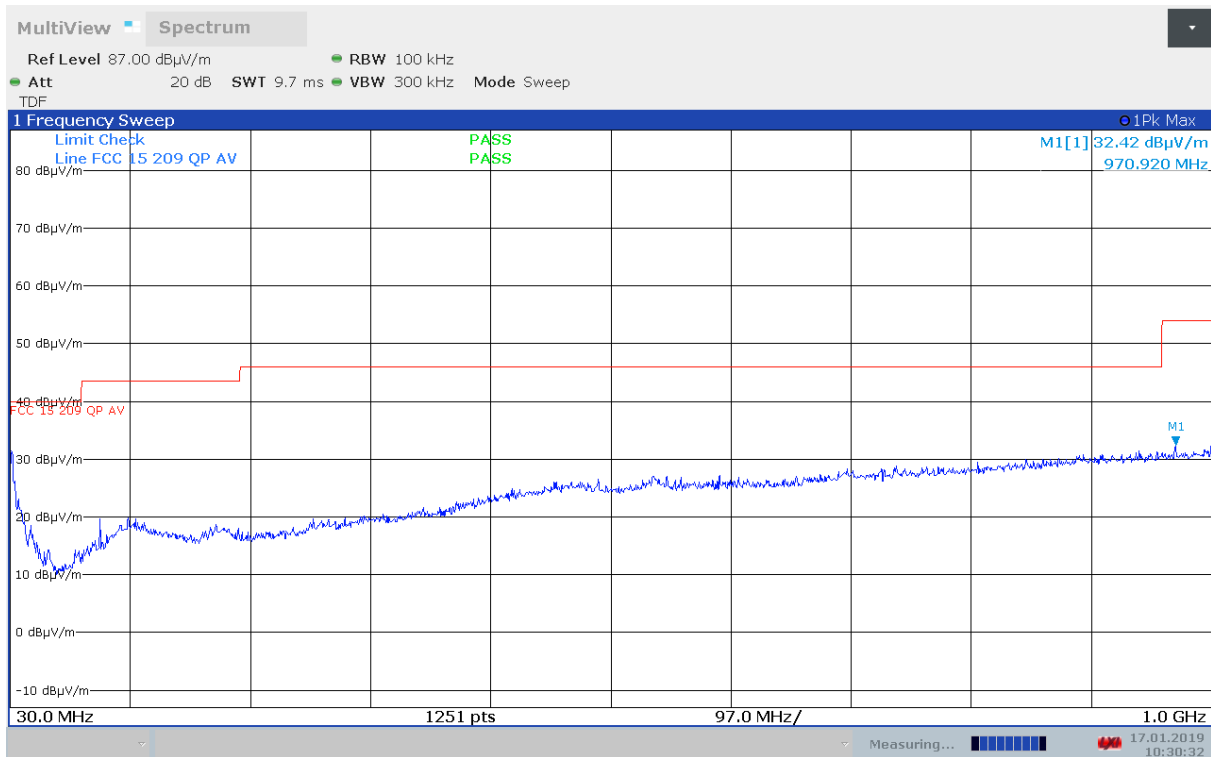
Tested in test mode with EUT transmitting on Ch06.

Measured Frequency (MHz)	Carrier Frequency (MHz)	Modulation	Measured Emission (dBμV/m)	Limit (dBμV/m)	Margin (dB)
30.000	2437	802.11g 6Mbps	38.5	40.0	1.5
30 – 88 (except as above)	2437	802.11g 6Mbps	< 33	40.0	> 7
88 – 216	2437	802.11g 6Mbps	< 23.5	43.5	> 20
216 – 960	2437	802.11g 6Mbps	< 36	46.0	> 10
960 – 1000	2437	802.11g 6Mbps	< 34	54.0	> 20

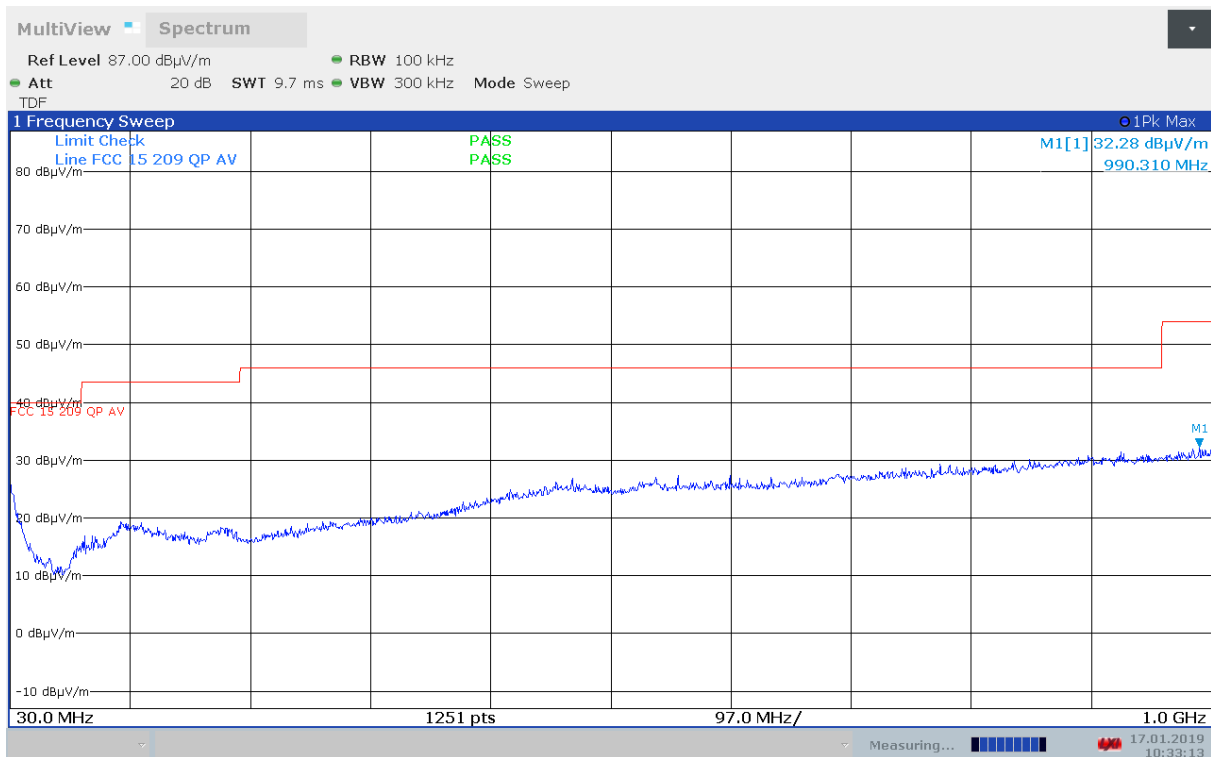
See attached plots.

Requirements/Limit

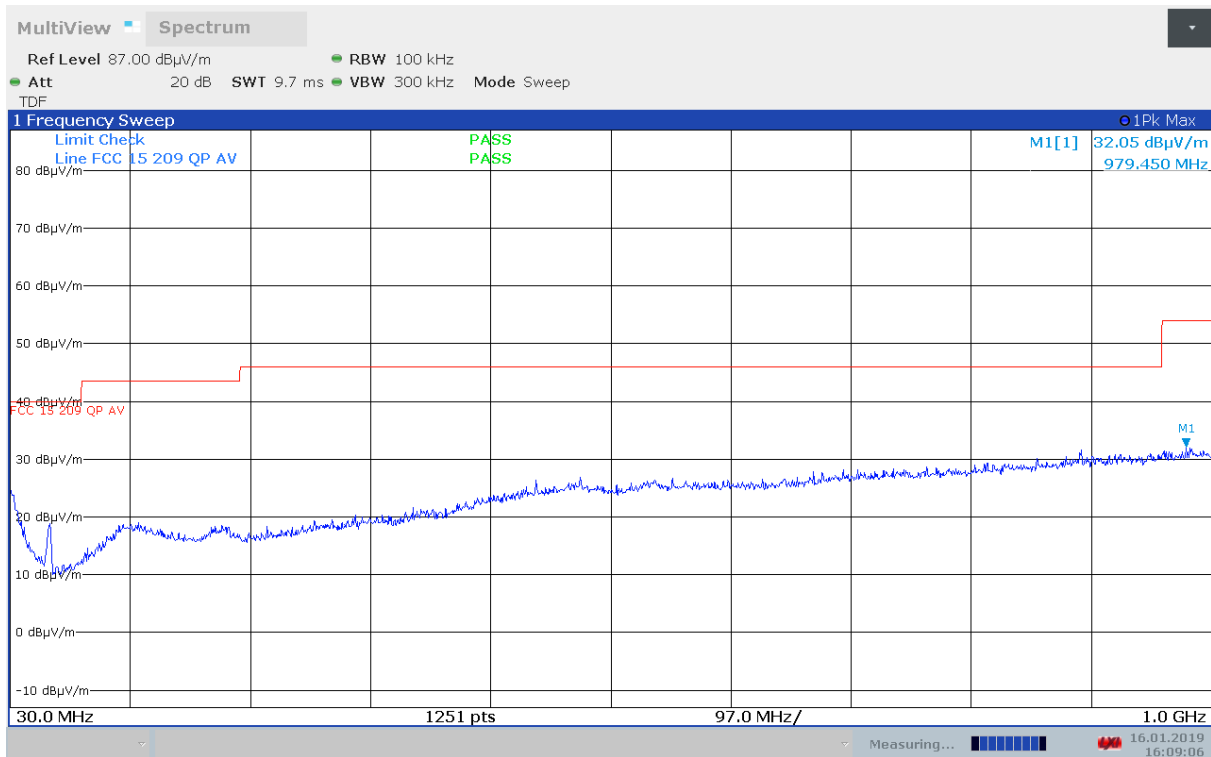
FCC	Part 15.209 @ frequencies defined in §15.205	
ISED	RSS-GEN Issue 5, Clause 8.9 @ frequencies defined in clause 8.10	
Frequency	Radiated emission limit @3 meters	
30 – 88 MHz	100 μV/m	40.0 dBμV/m
88 – 216 MHz	150 μV/m	43.5 dBμV/m
216 – 960 MHz	200 μV/m	46.0 dBμV/m
960 – 1000 MHz	500 μV/m	54.0 dBμV/m
	Limits above are with Quasi Peak Detector	



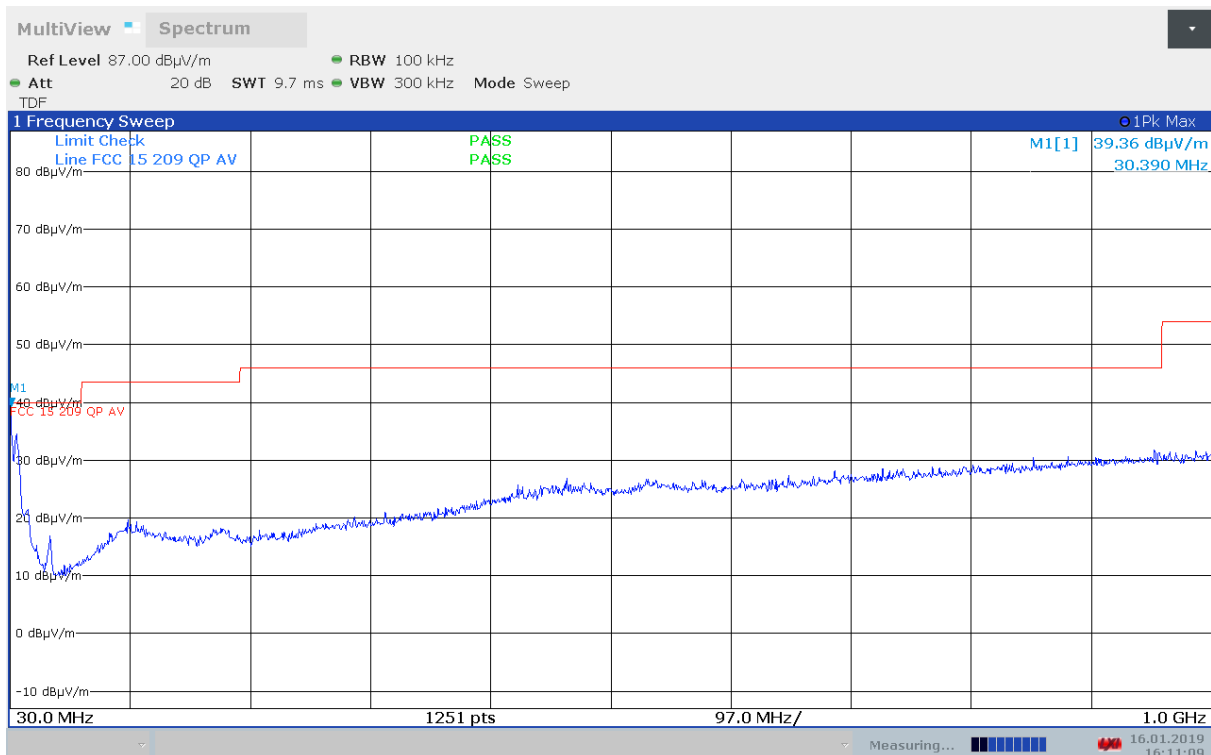
Radiated Emissions, 30 -1000 MHz, 2437 MHz, VP, 802.11b, 1Mbps



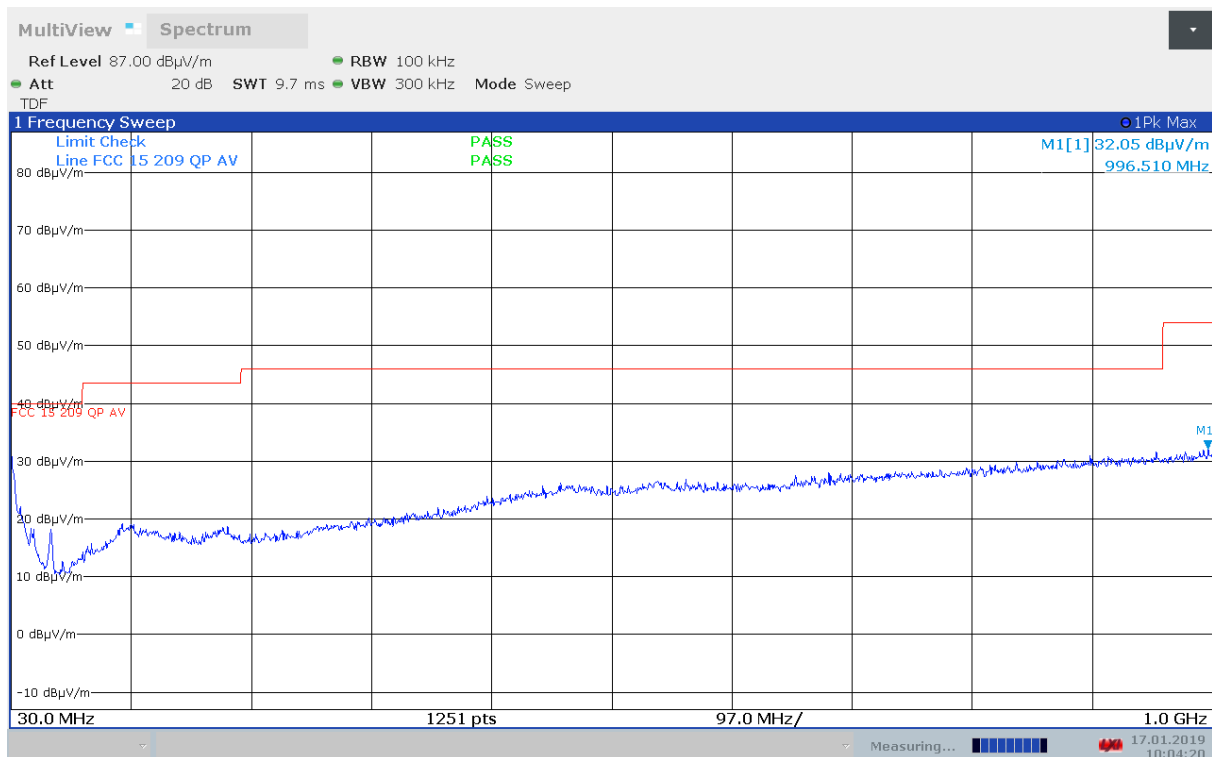
Radiated Emissions, 30 -1000 MHz, 2437 MHz, HP, 802.11b, 1Mbps



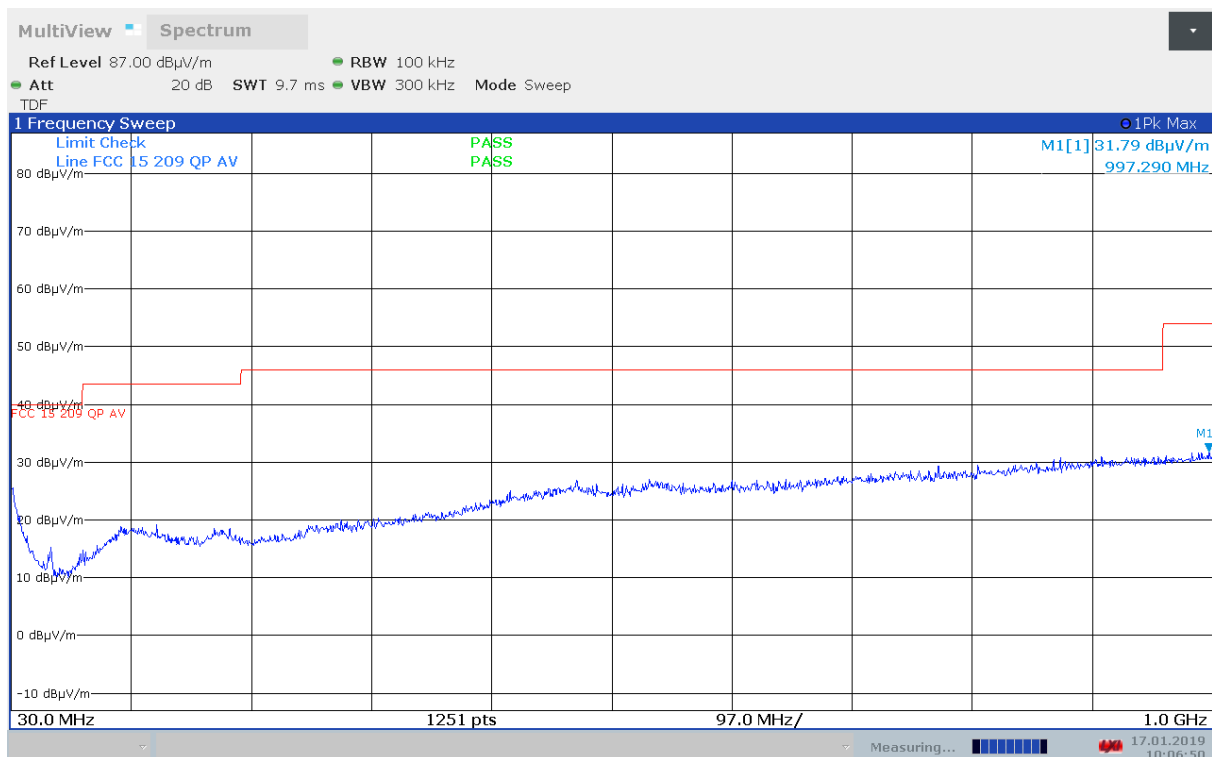
Radiated Emissions, 30 -1000 MHz, 2437 MHz, VP, 802.11g, 6Mbps



Radiated Emissions, 30 -1000 MHz, 2437 MHz, HP, 802.11g, 6Mbps



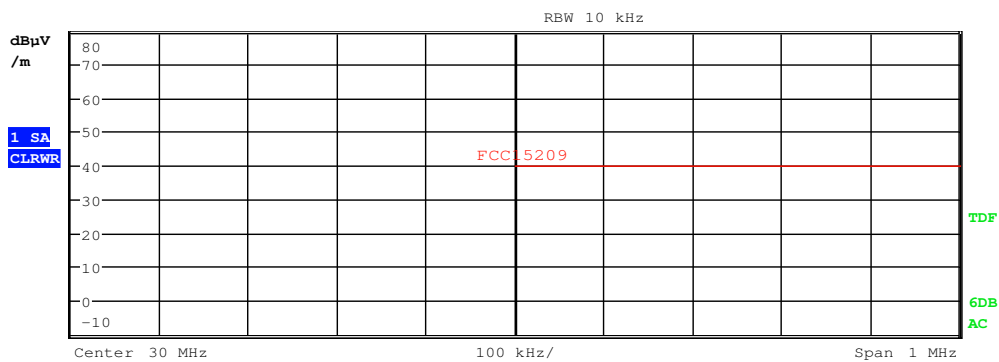
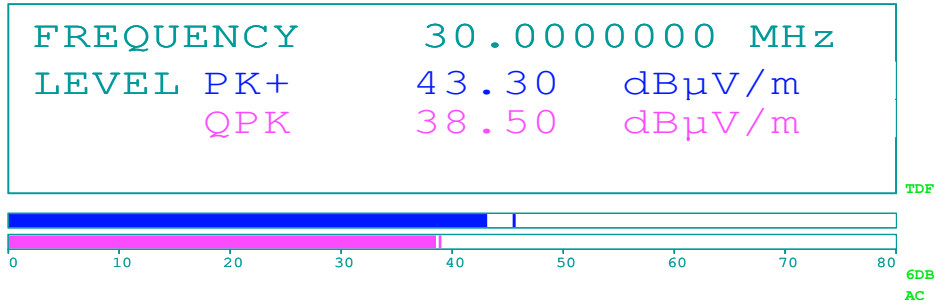
Radiated Emissions, 30 -1000 MHz, 2437 MHz, VP, 802.11n, MCS0



Radiated Emissions, 30 -1000 MHz, 2437 MHz, HP, 802.11n, MCS0



Att 20 dB AUTO RBW 120 kHz
MT 100 ms
PREAMP ON



Date: 16.JAN.2019 18:05:51

Radiated Emissions, 30 MHz, 2437 MHz, 802.11g, 6Mbps (Max: HP)

3.8 Radiated Emissions, 1 – 26 GHz

FCC Part 15.209 (a)

ISED Canada RSS-GEN Issue 5, Clause 7.3/8.9

Measurement procedure: ANSI C63.10-2013 Clause 11.12

Test Results: Complies

Measurement Data:

Measuring distance: 3m (1–18 GHz)
Pre-scan (18-26 GHz)

Bandwidths: RBW=1MHz / VBW=3MHz

Peak Detector, RBW=1 MHz

Carrier Frequency	Measured Frequency	Modulation	Measured Emission (dBμV/m)	Limit (dBμV/m)	Margin (dB)
Any	Any	Any	< 54	74	>20

Average Detector, RBW=1 MHz

Carrier Frequency	Measured Frequency	Modulation	Measured Emission (dBμV/m)	Limit (dBμV/m)	Margin (dB)
Any*	Any	Any	< 44	54	>10

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

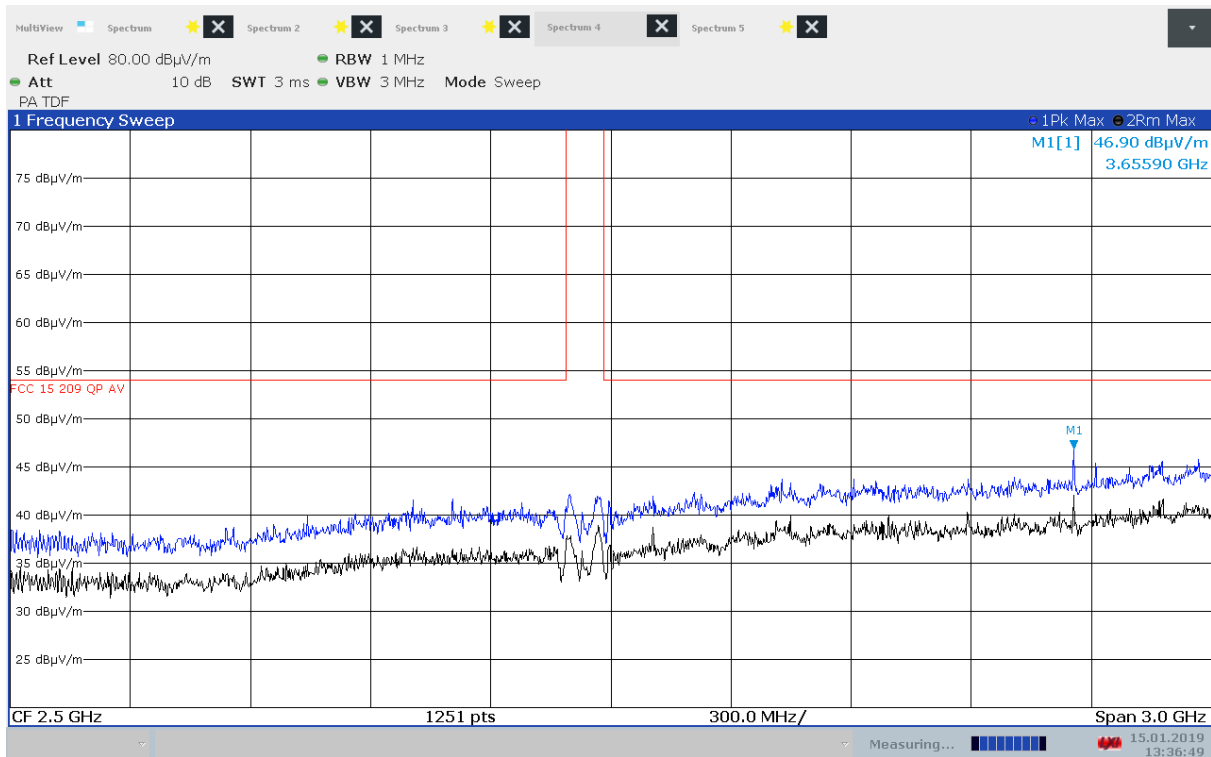
A Band Reject Filter was used for measurements from 1 GHz to 4 GHz and a High Pass Filter was used from 3 GHz to 18 GHz.

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

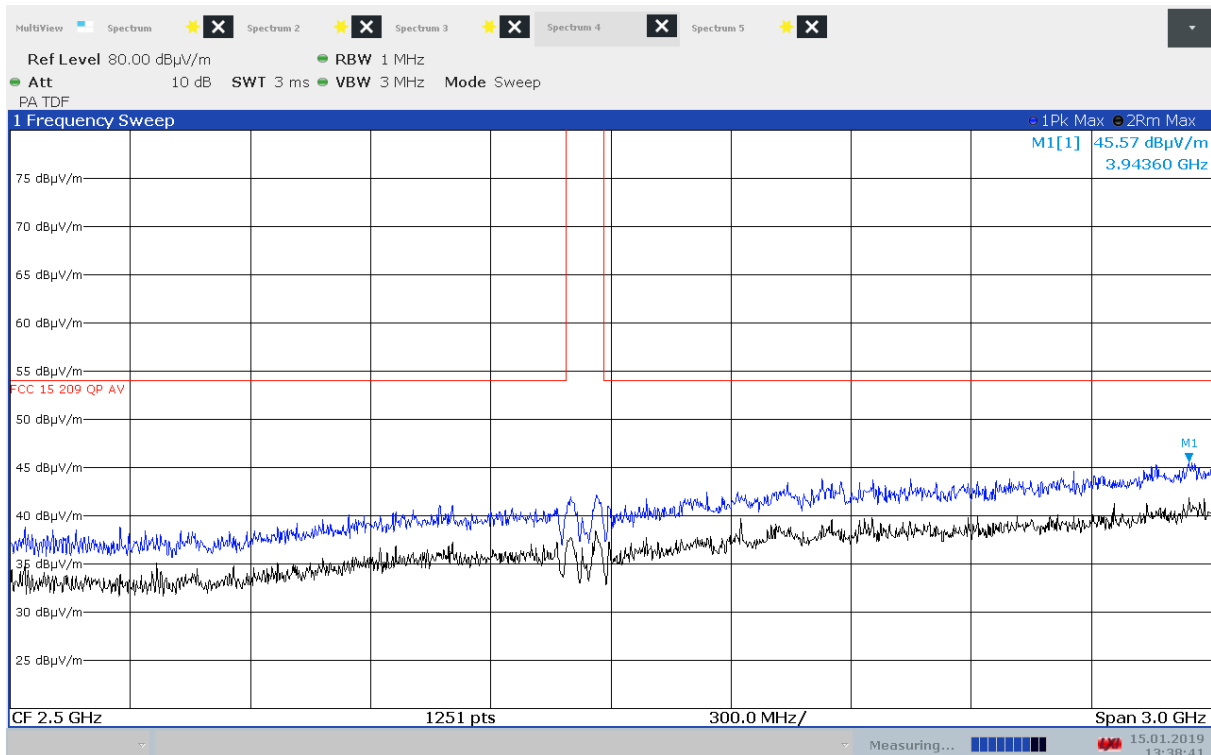
See attached plots.

Requirements/Limit

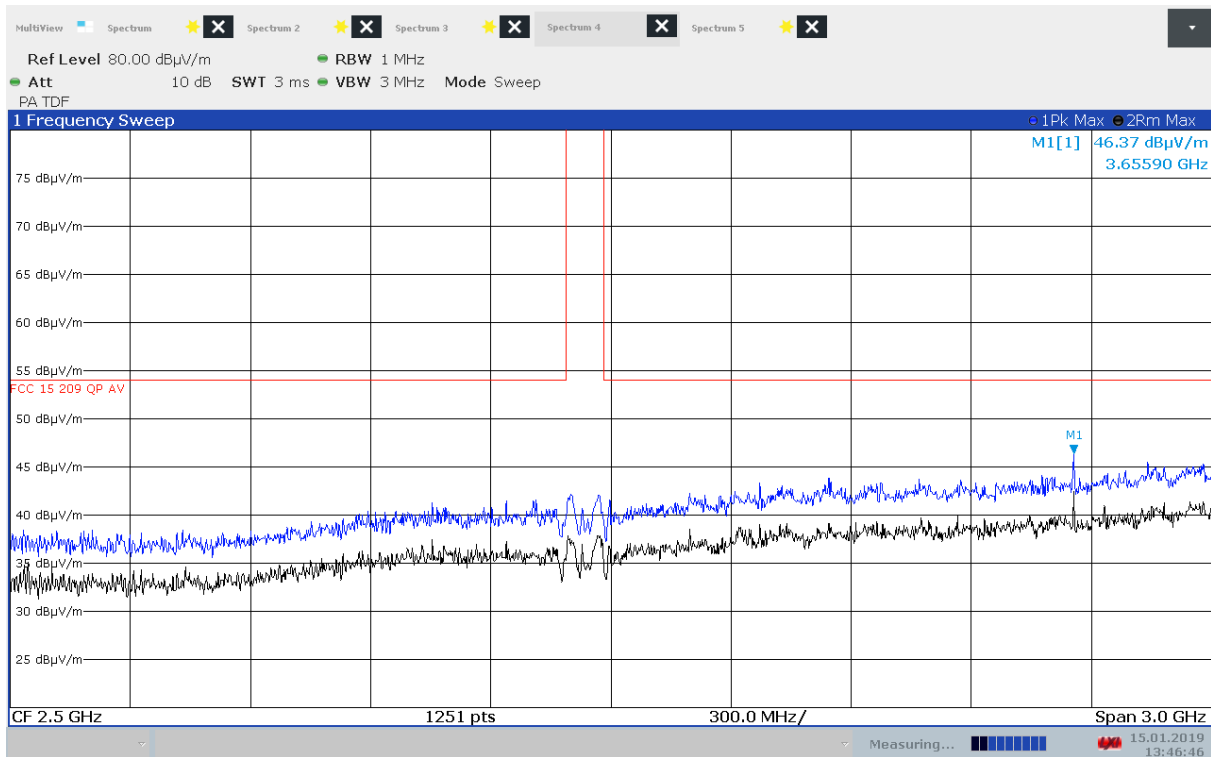
FCC	Part 15.209 @ frequencies defined in §15.205	
ISED	RSS-GEN Issue 5, clause 8.9 @ frequencies defined in clause 8.10	
	Radiated emission limit @3 meters	
Frequency	Average Detector	Peak Detector
1 – 26 GHz	54.0 dBμV/m	74.0 dBμV/m



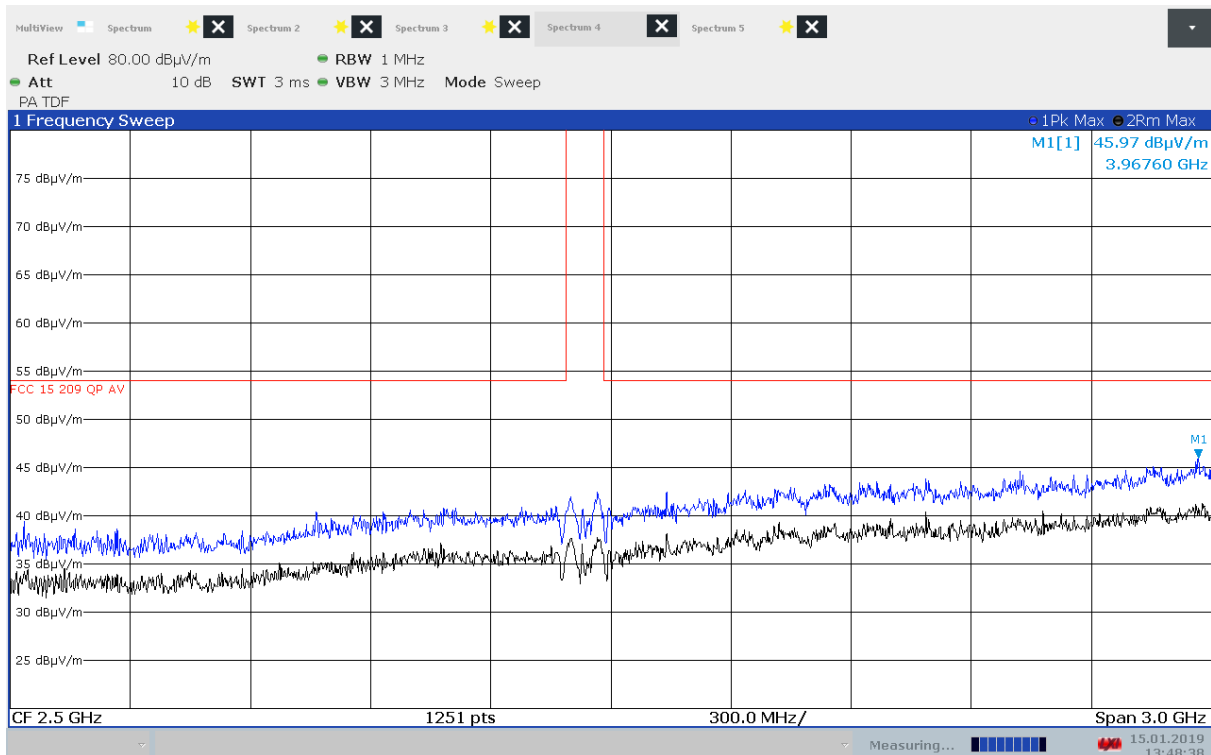
Radiated Emissions, 1000 -4000 MHz, 2437 MHz, VP, 802.11b, 1Mbps



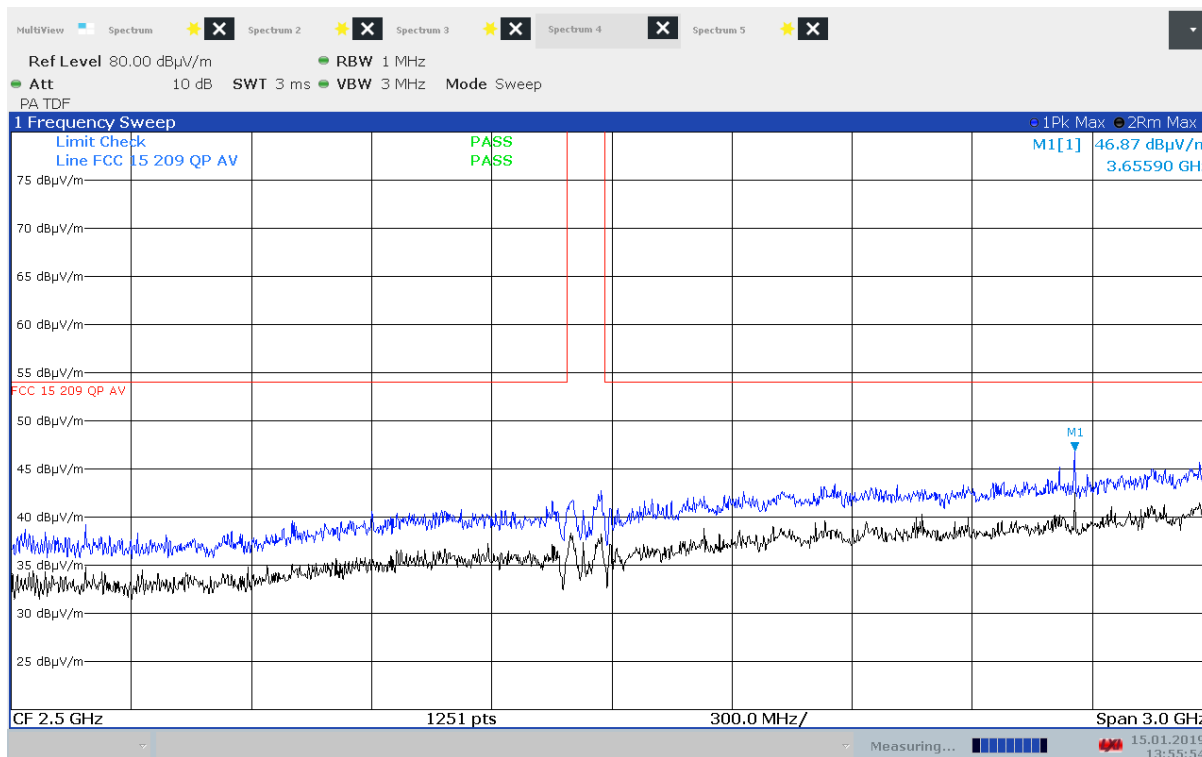
Radiated Emissions, 1000 -4000 MHz, 2437 MHz, HP, 802.11b, 1Mbps



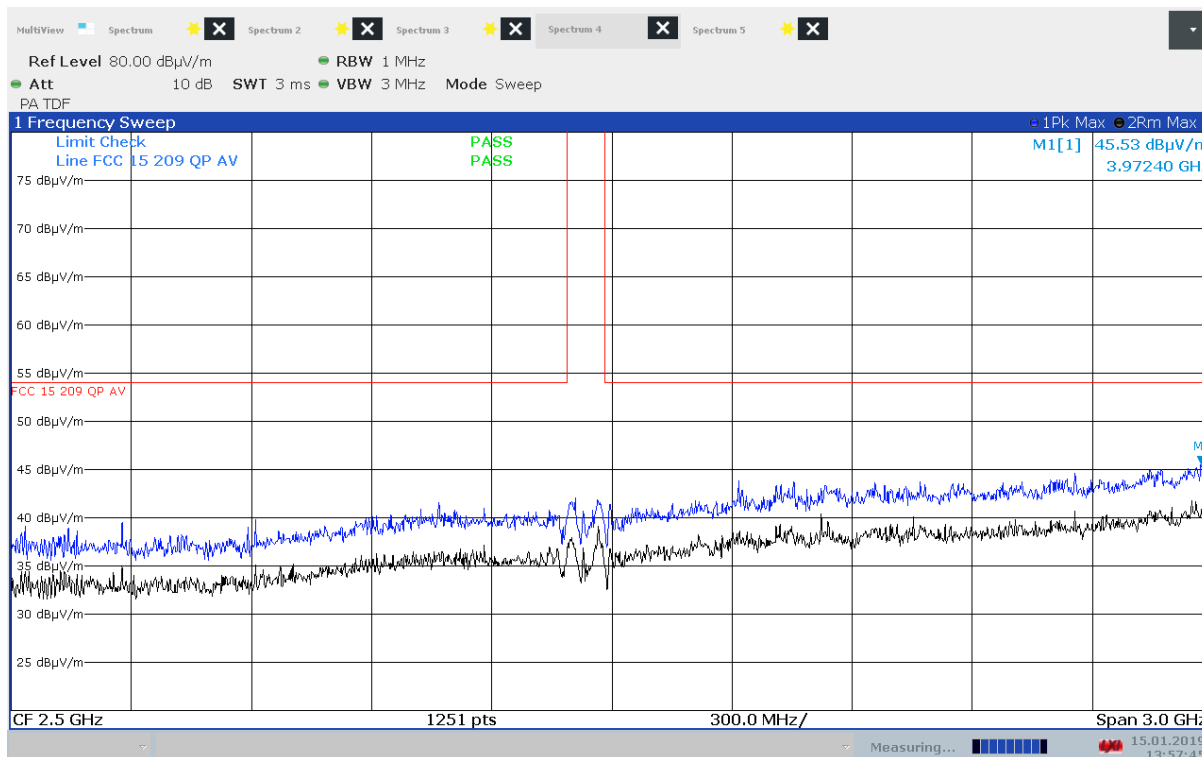
Radiated Emissions, 1000 -4000 MHz, 2437 MHz, VP, 802.11g, 6Mbps



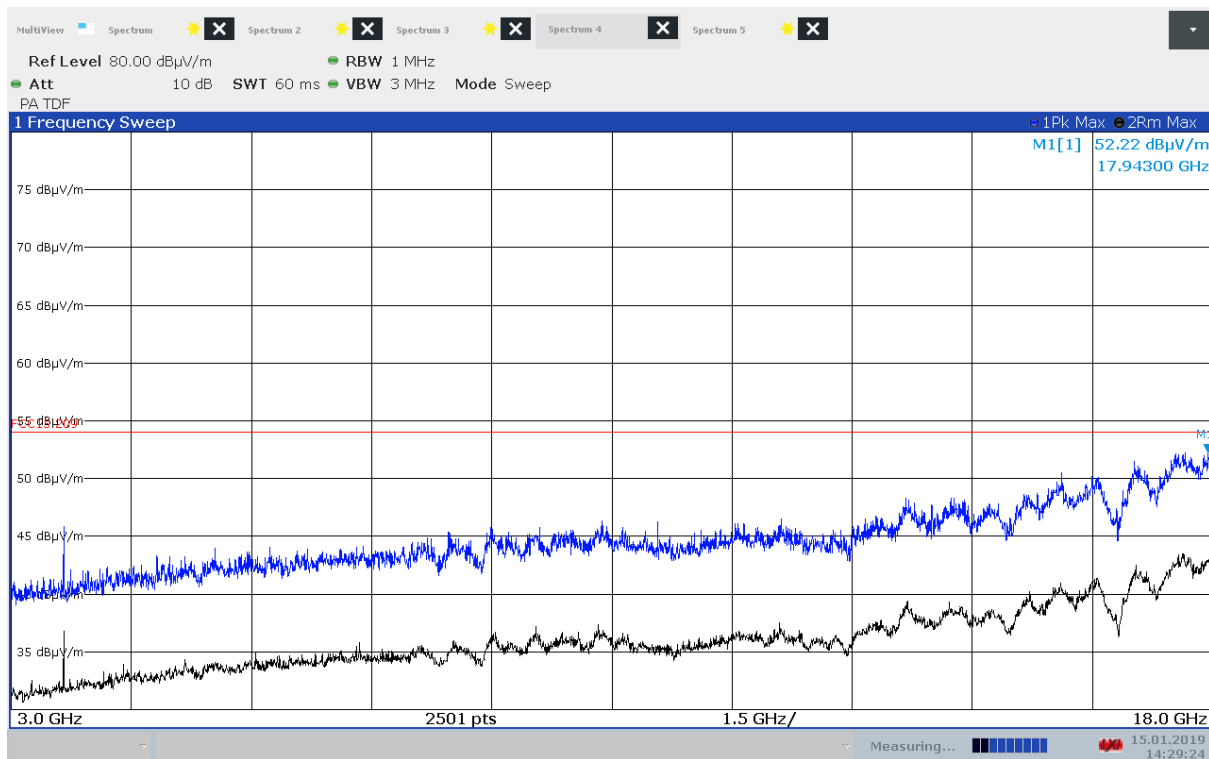
Radiated Emissions, 1000 -4000 MHz, 2437 MHz, HP, 802.11g, 6Mbps



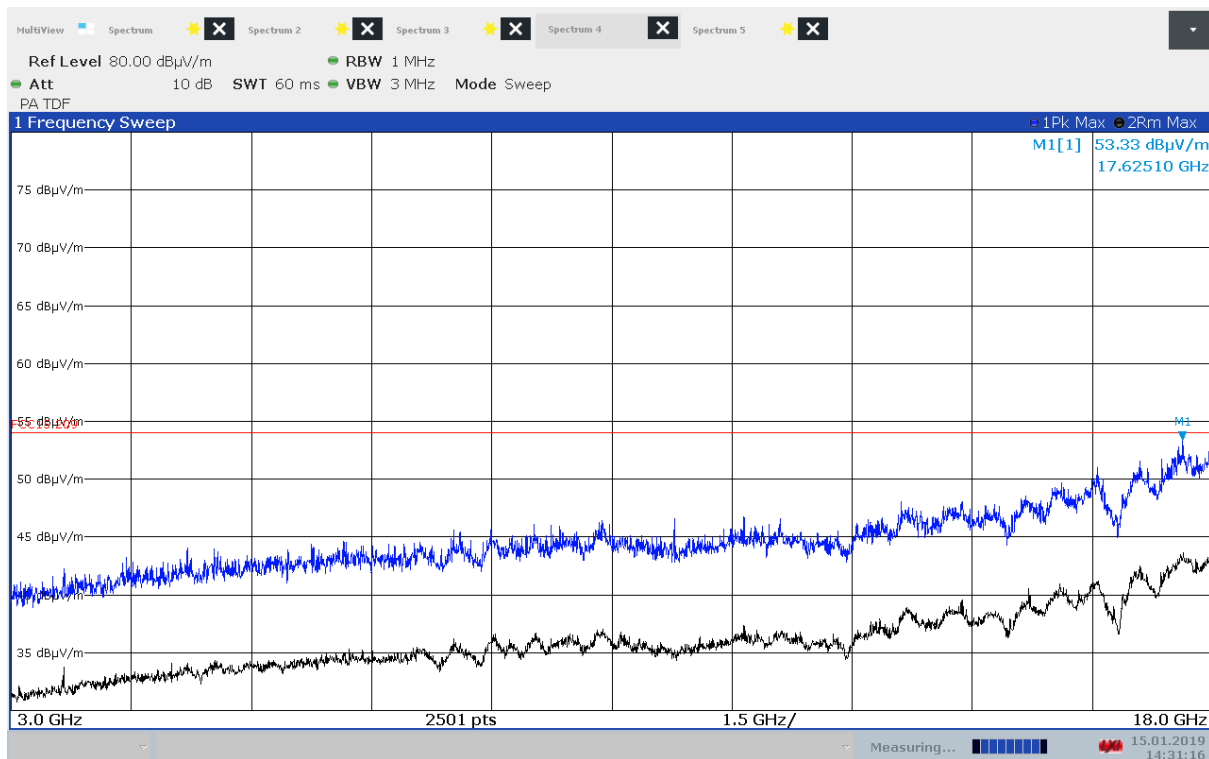
Radiated Emissions, 1000 -4000 MHz, 2437 MHz, VP, 802.11n, MCS0



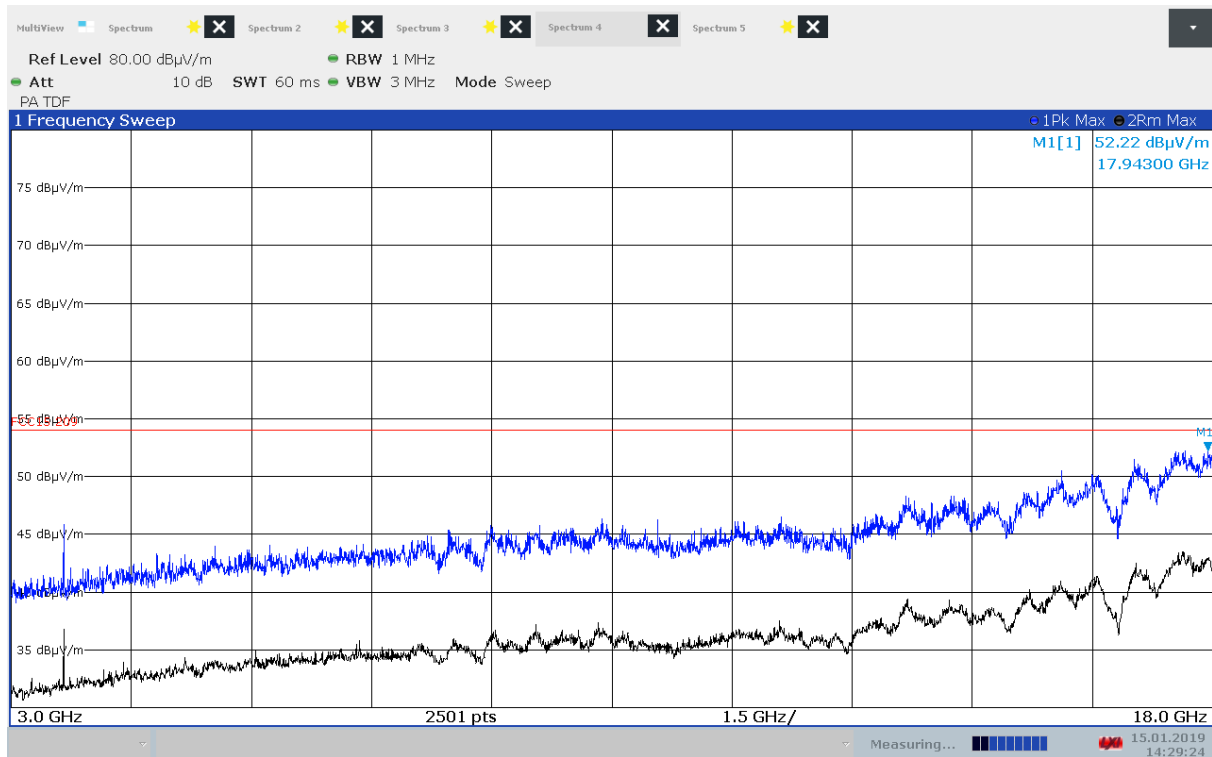
Radiated Emissions, 1000 -4000 MHz, 2437 MHz, HP, 802.11n, MCS0



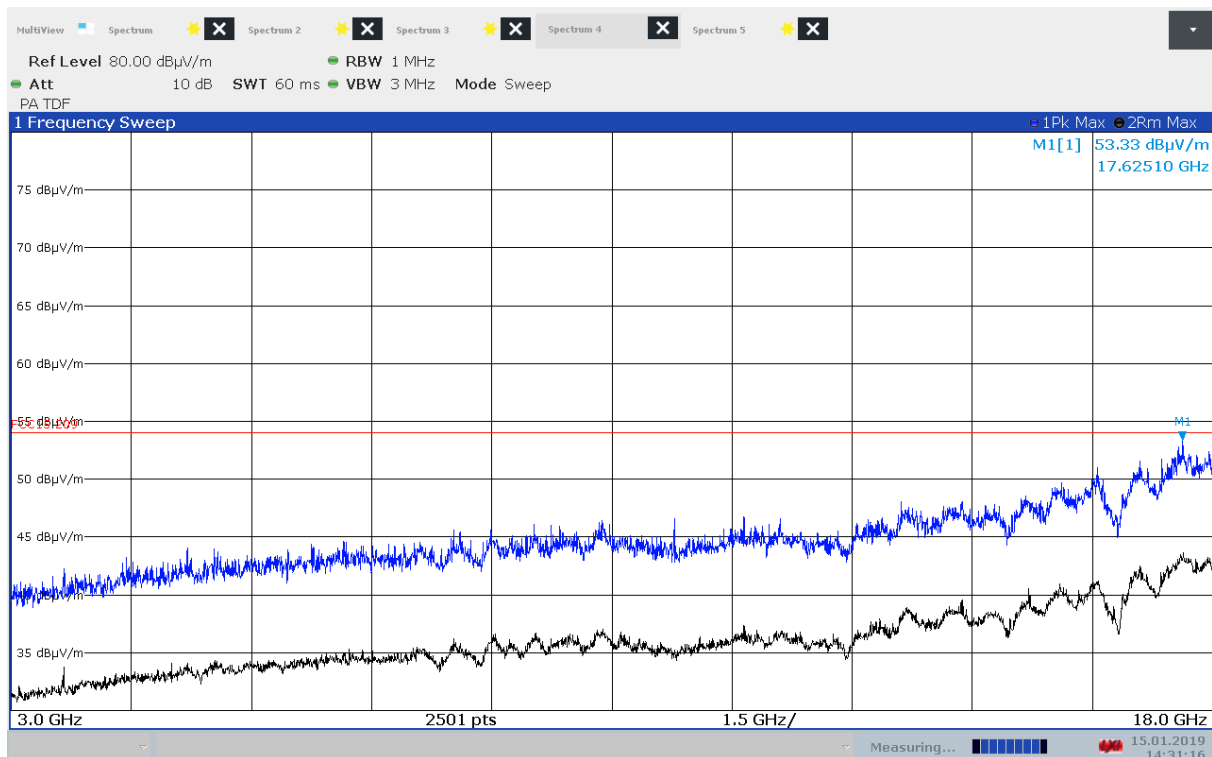
Radiated Emissions, 3000 -18000 MHz, 2437 MHz, VP, 802.11b, 1Mbps



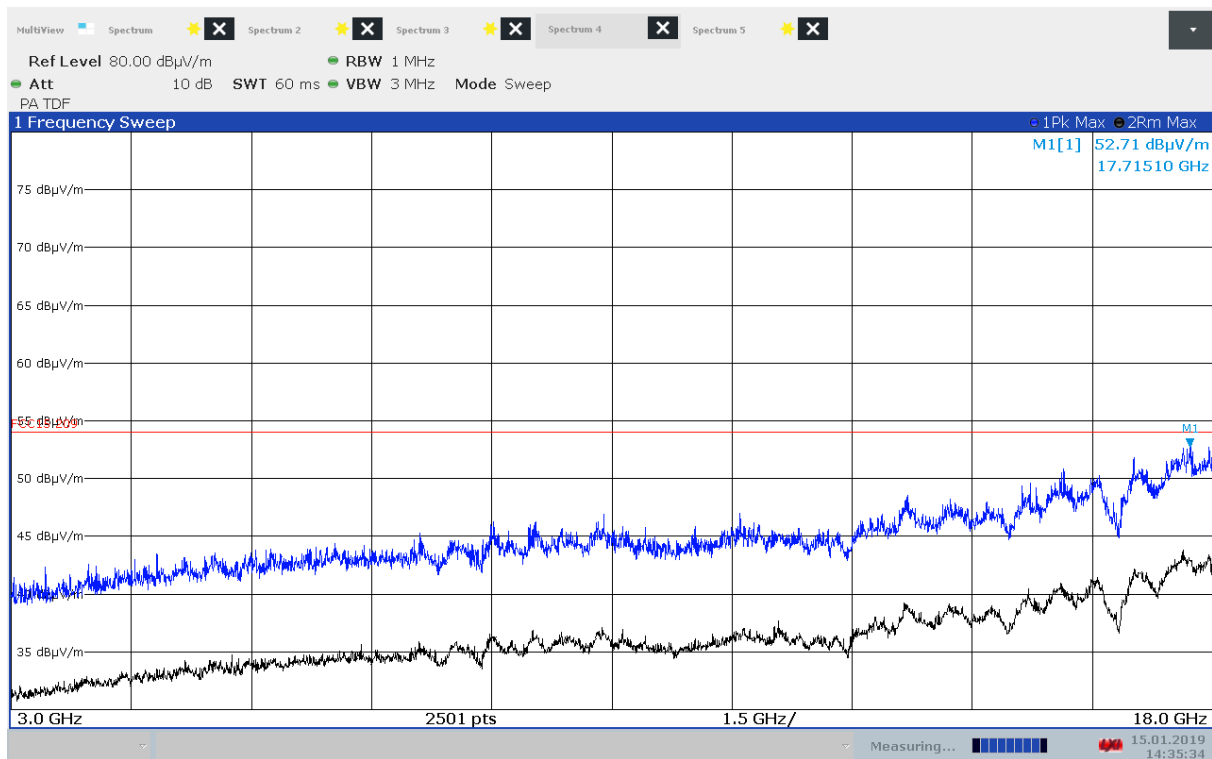
Radiated Emissions, 3000 -18000 MHz, 2437 MHz, HP, 802.11b, 1Mbps



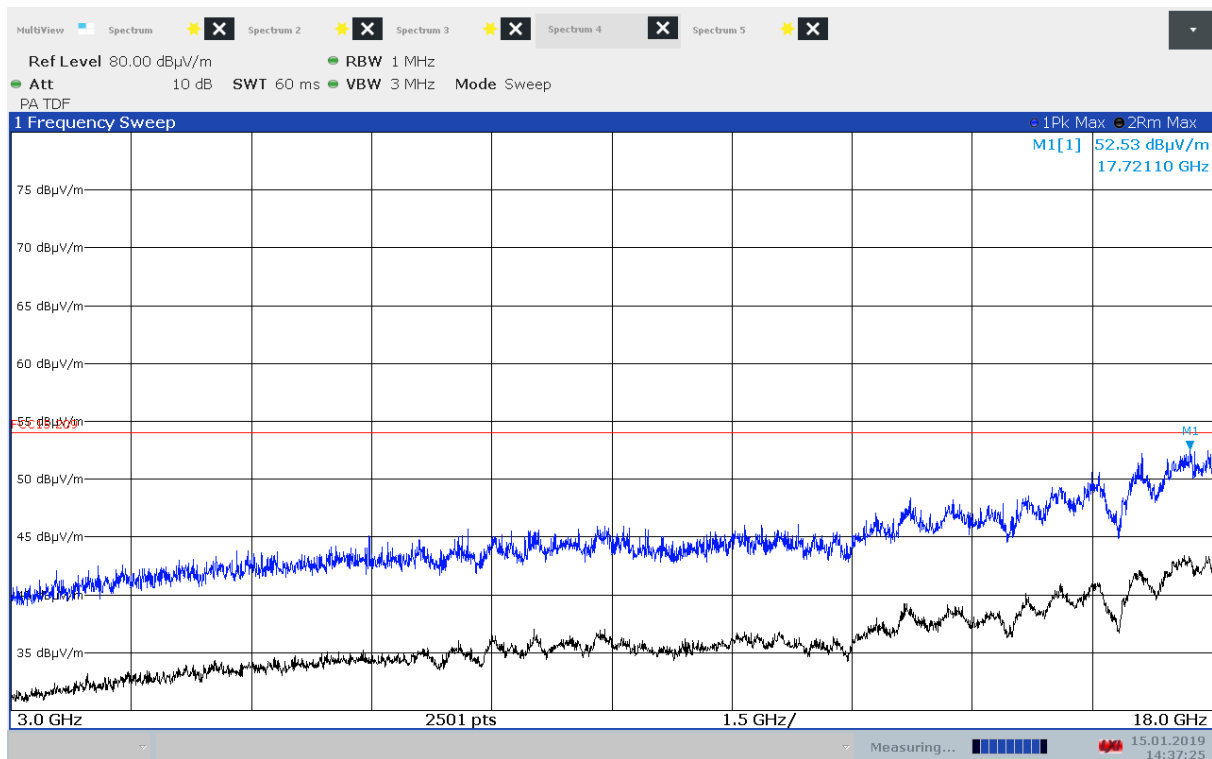
Radiated Emissions, 3000 -18000 MHz, 2437 MHz, VP, 802.11g, 6Mbps



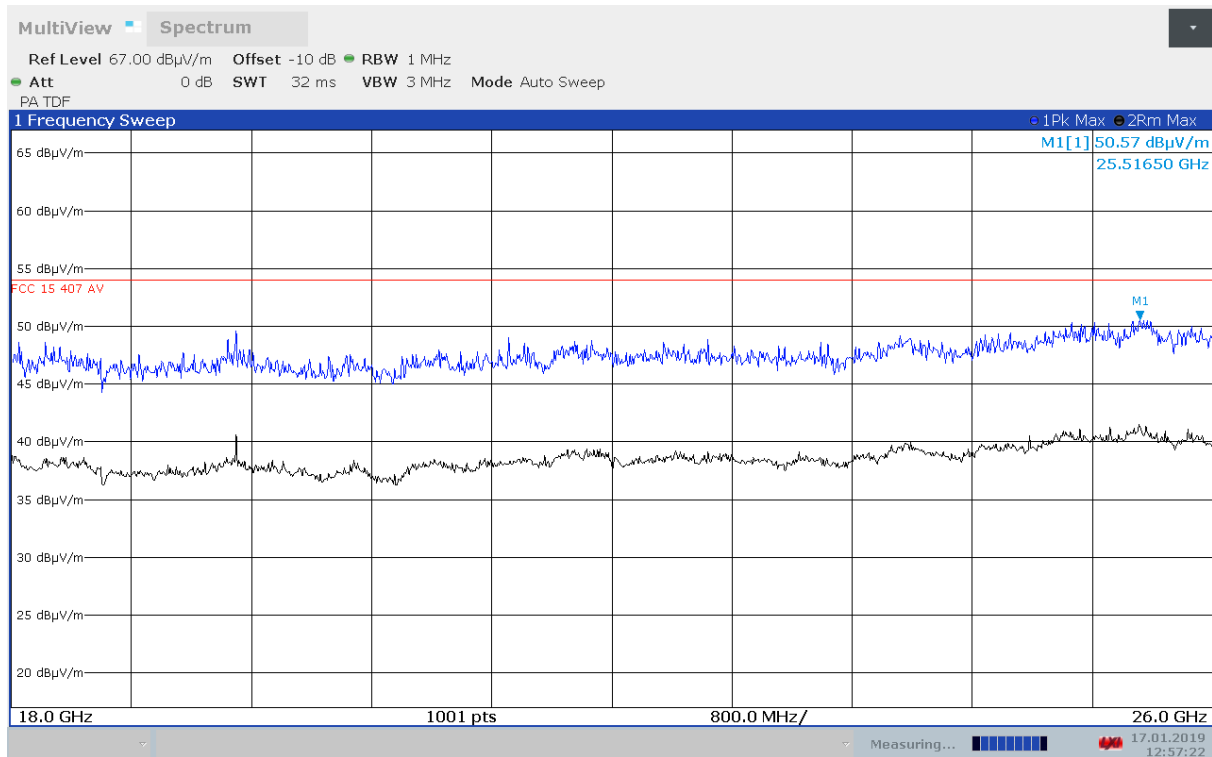
Radiated Emissions, 3000 -18000 MHz, 2437 MHz, HP, 802.11g, 6Mbps



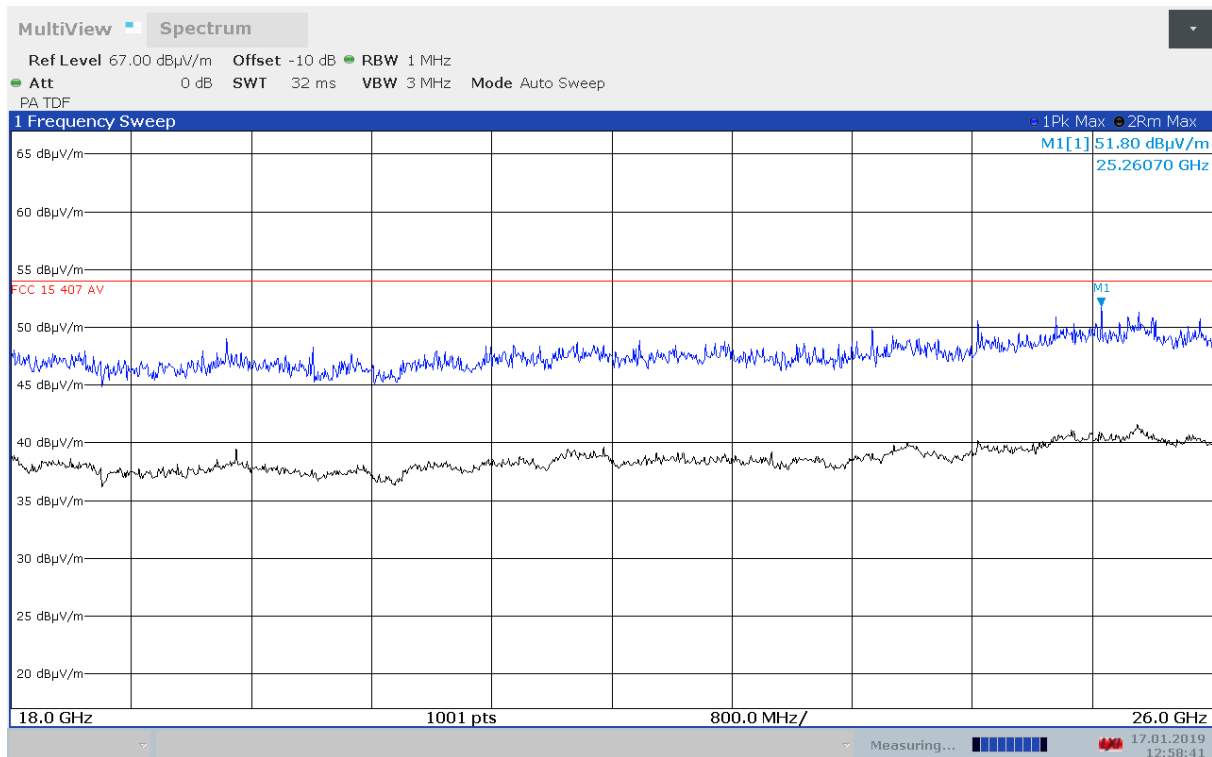
Radiated Emissions, 3000 -18000 MHz, 2437 MHz, VP, 802.11n, MCS0



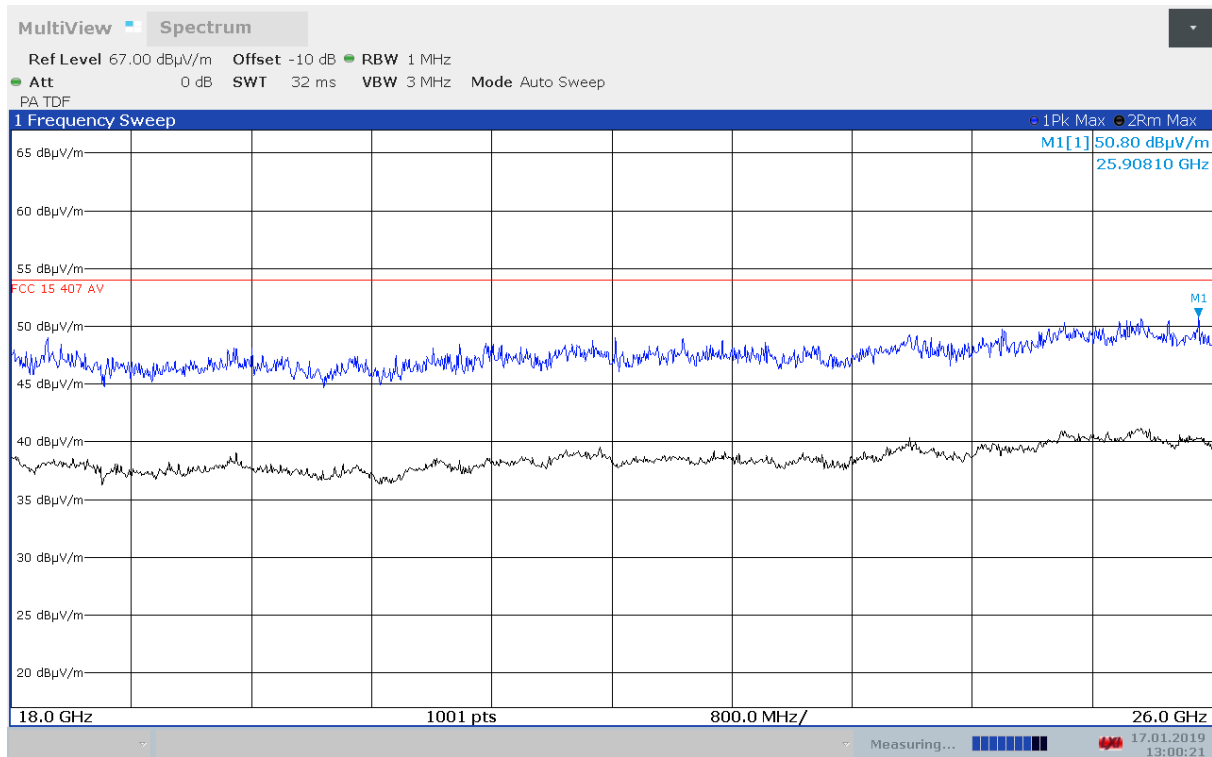
Radiated Emissions, 3000 -18000 MHz, 2437 MHz, HP, 802.11n, MCS0



Pre-scan, 18000 -26000 MHz, 802.11b, 1Mbps



Pre-scan, 18000 -26000 MHz, 802.11g, 6Mbps



Pre-scan, 18000 -26000 MHz, 802.11n, MCS0

3.9 Power Spectral Density (PSD)

FCC part 15.247(d)

ISED Canada RSS-247 Issue 2, Clause 5.2 (2)

Measurement procedure: ANSI C63.10-2013 Clause 11.10

Test Results: Complies

Measurement Data:

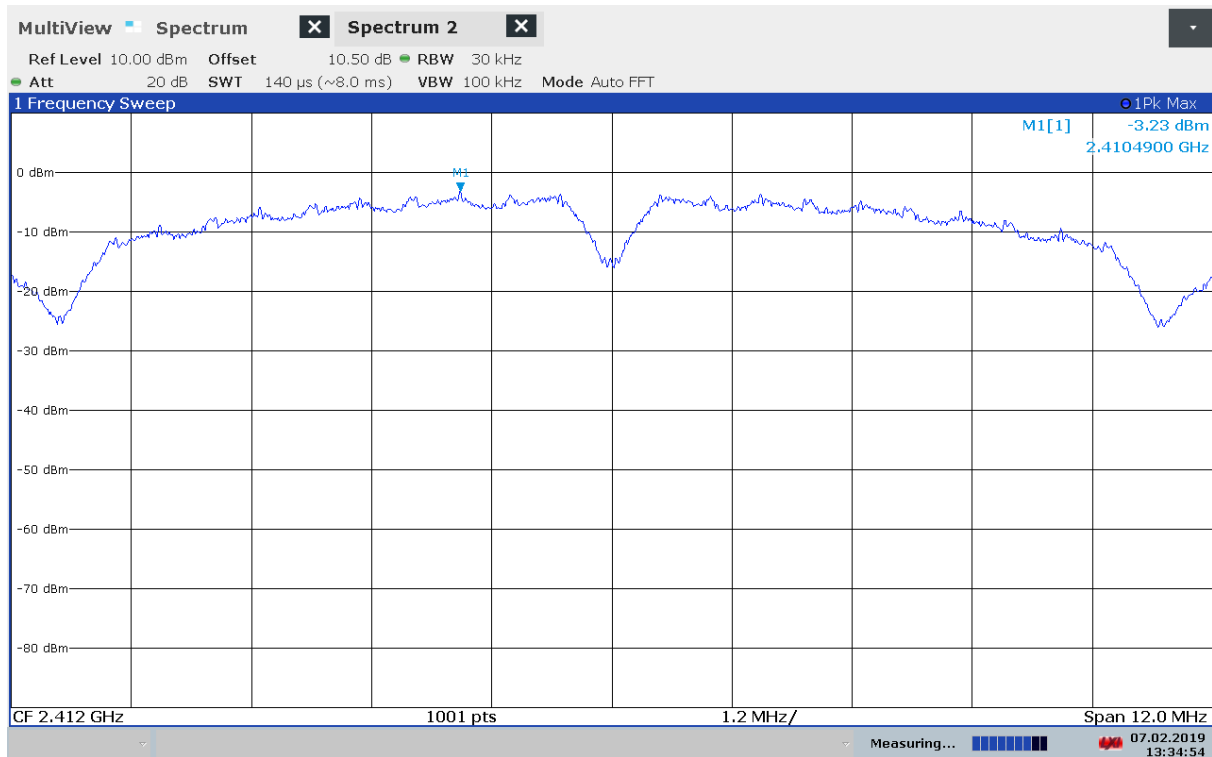
The measurement procedures PKPSD described in ANSI C63.10-2013 was used.

Carrier Frequency (MHz)	Power Spectral Density (dBm/3kHz)		
	802.11b, 11 Mbps	802.11g, 6 Mbps	802.11n, MCS0
2412	-13.2	-15.0	-14.8
2437	-13.0	-15.0	-14.7
2462	-12.9	-14.8	-14.4

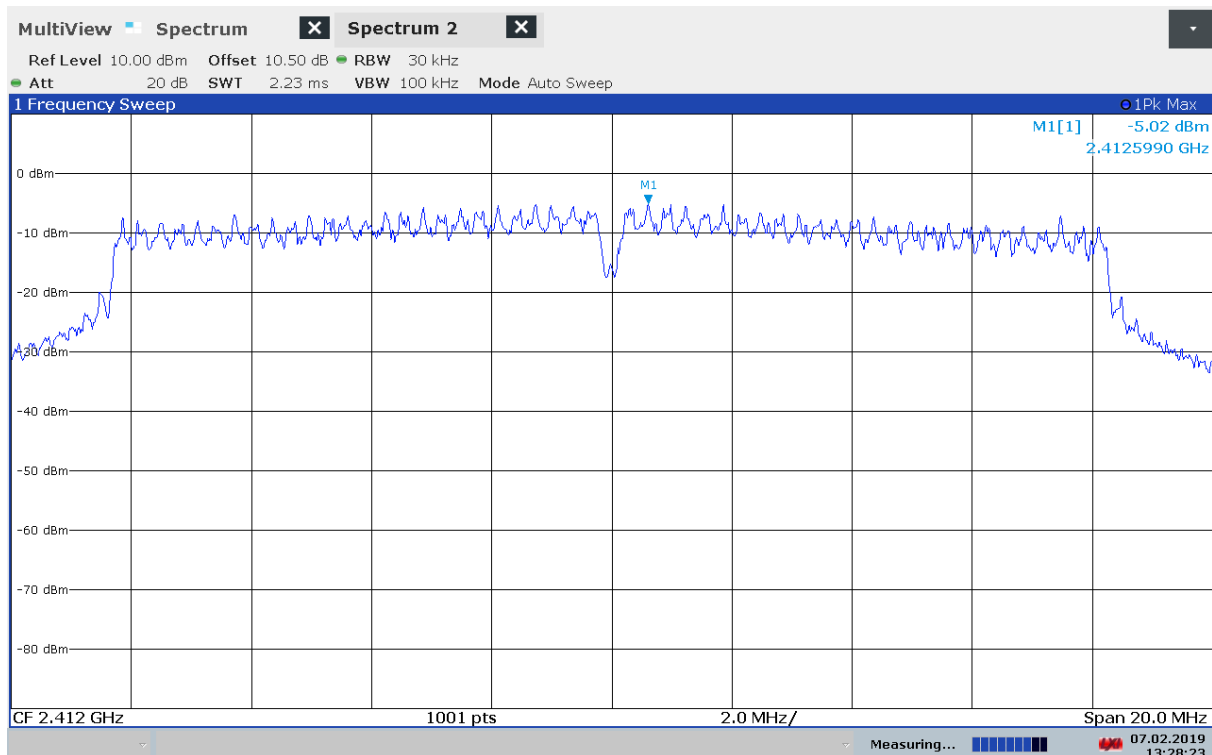
The measured values with 30 kHz RBW are corrected by a Bandwidth Correction Factor of -10 dB.

Requirements:

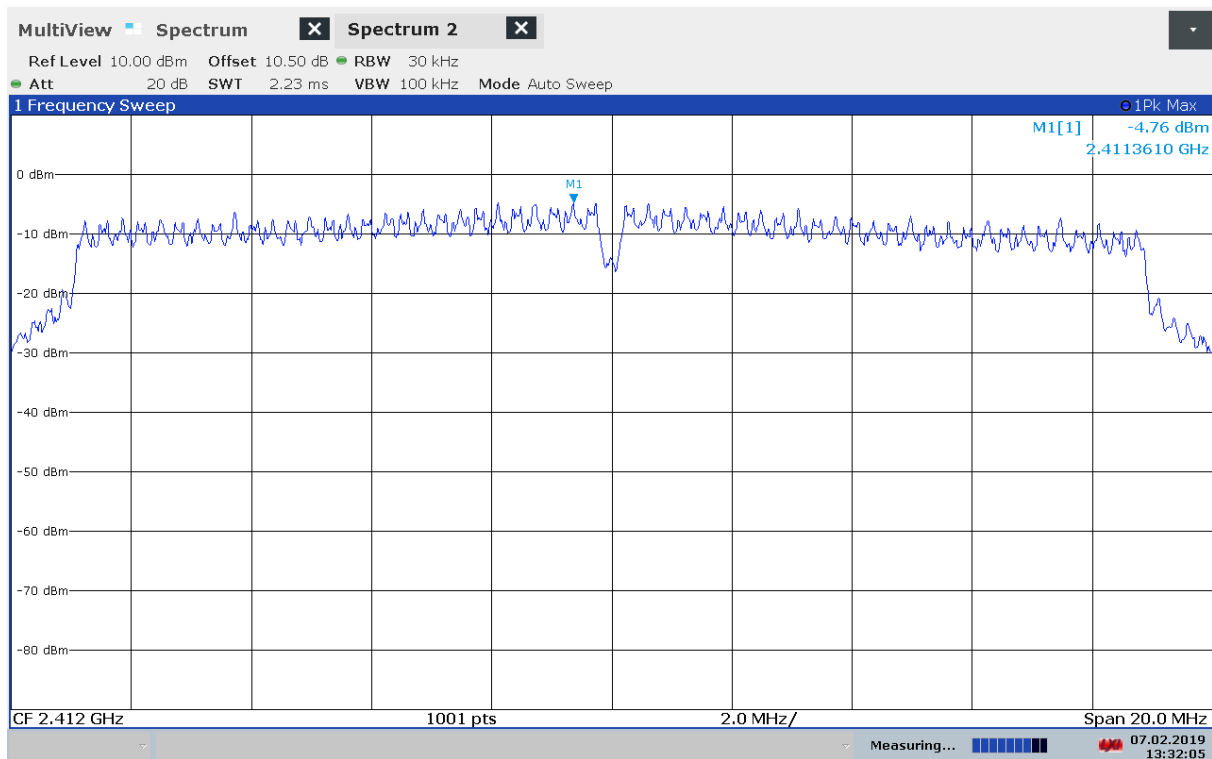
The Power Spectral Density of a Digital Transmission System shall be no greater than +8 dBm in any 3 kHz band



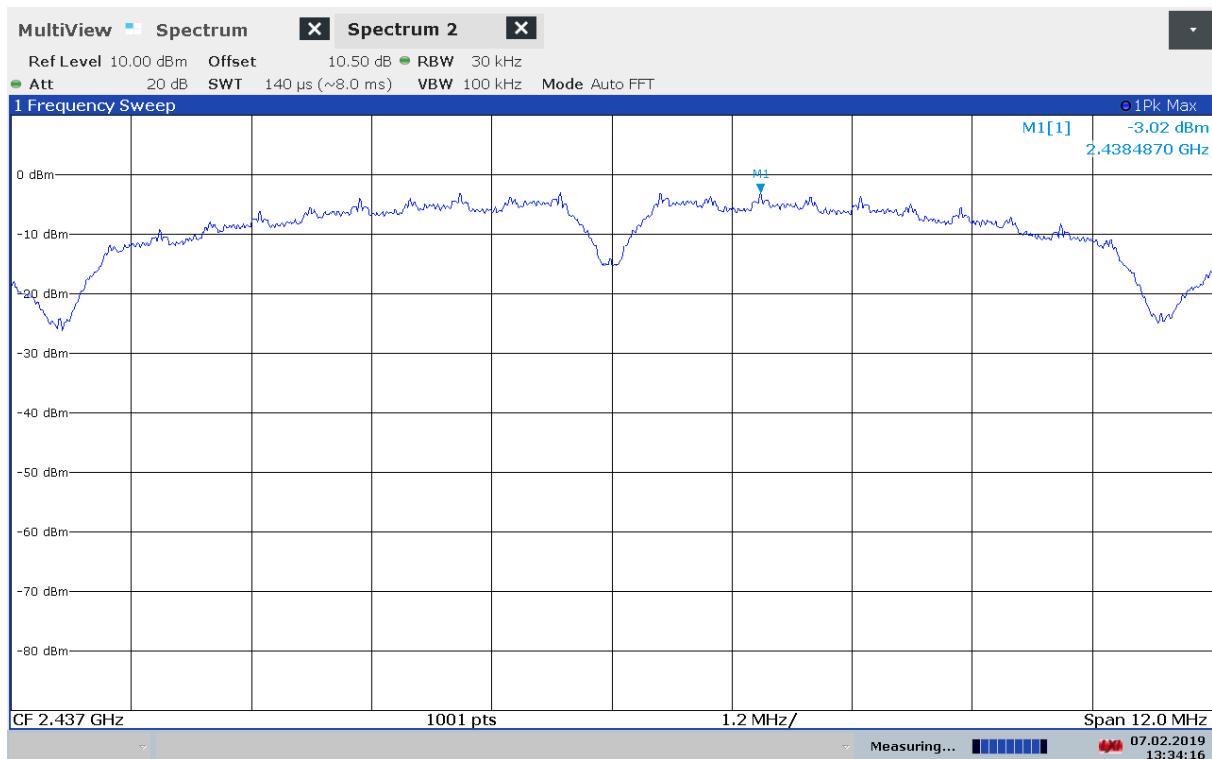
PSD, 2412 MHz, 802.11b, 1Mbps



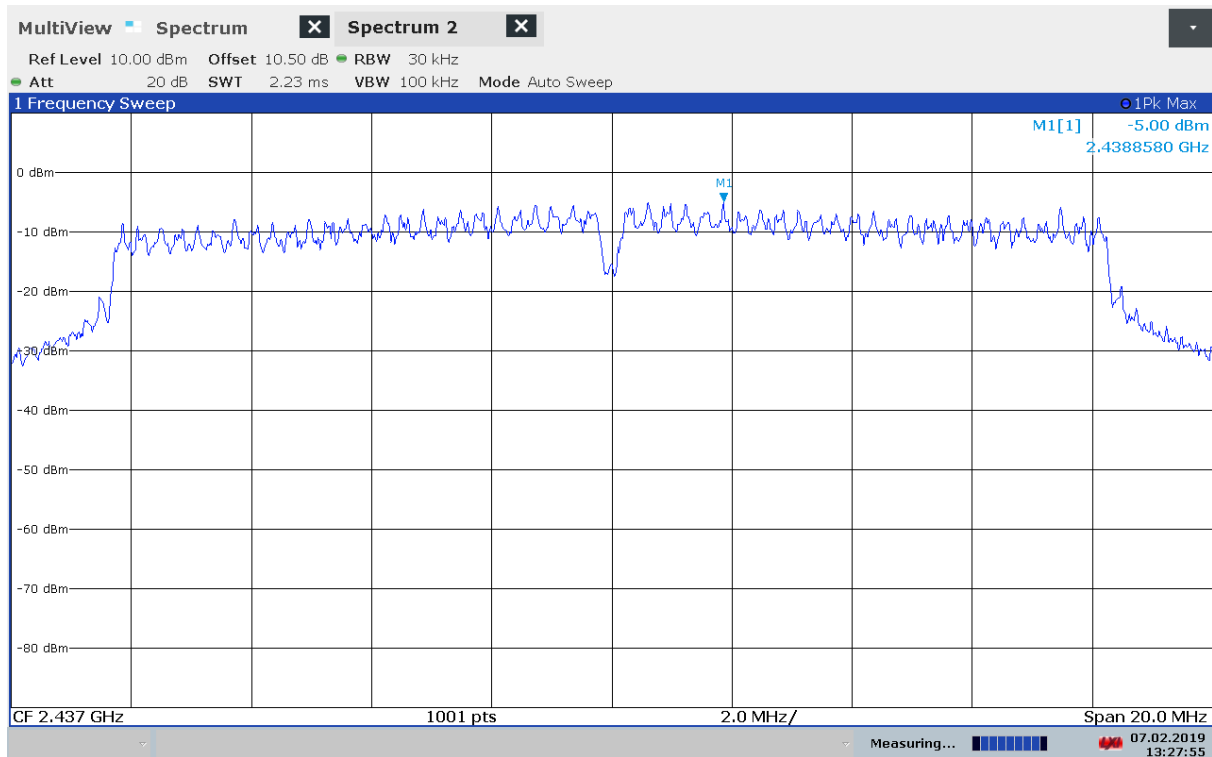
PSD, 2412 MHz, 802.11g, 6Mbps



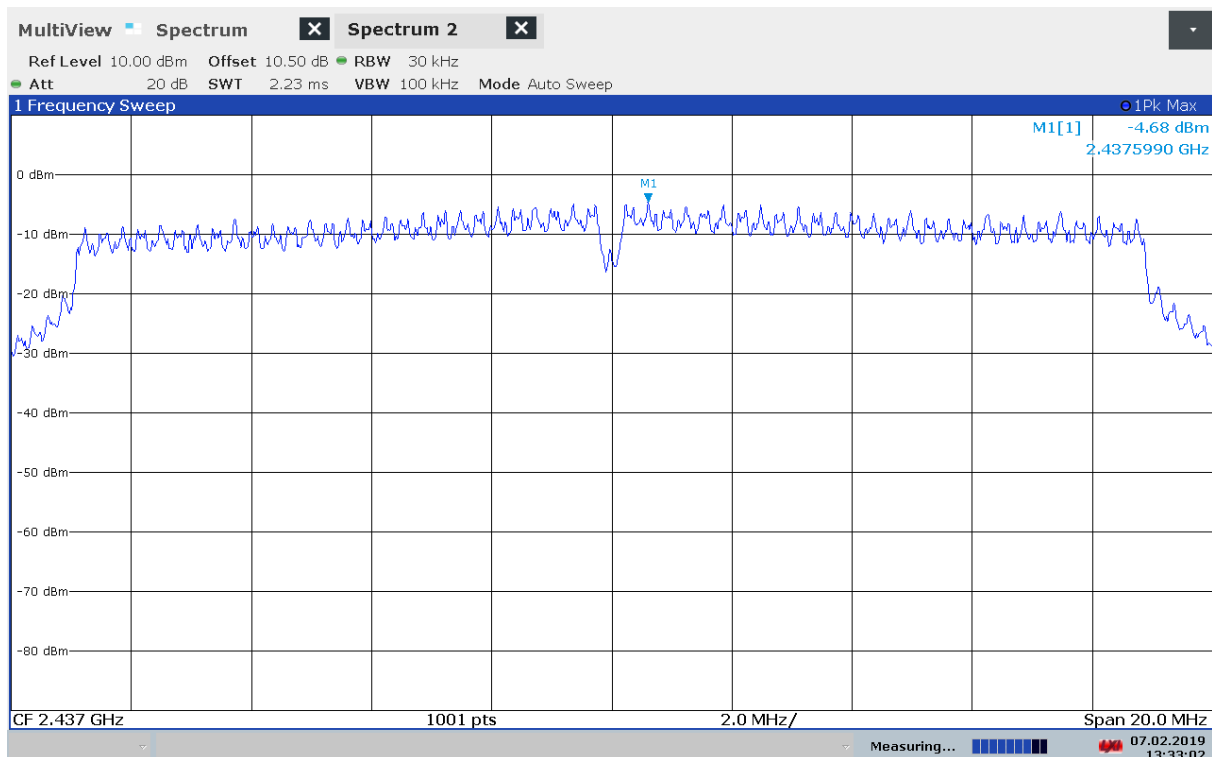
PSD, 2412 MHz, 802.11n, MCS0



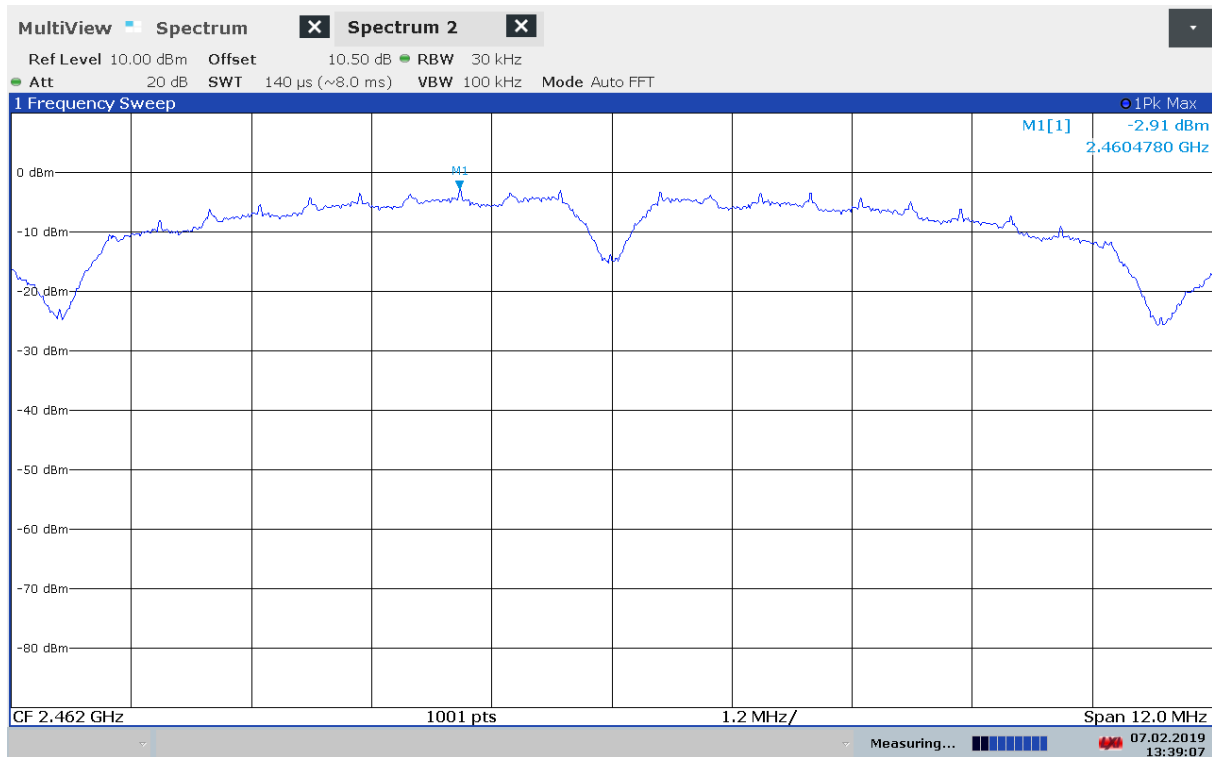
PSD, 2437 MHz, 802.11b, 1Mbps



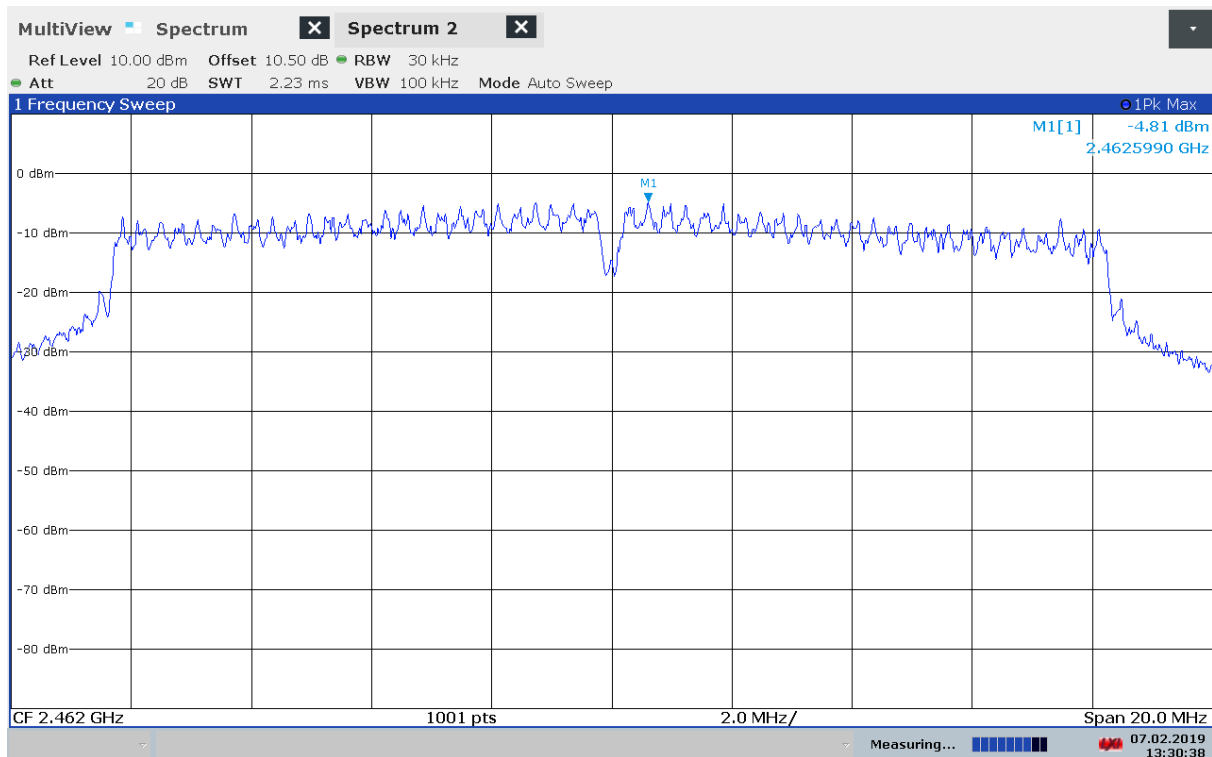
PSD, 2437 MHz, 802.11g, 6Mbps



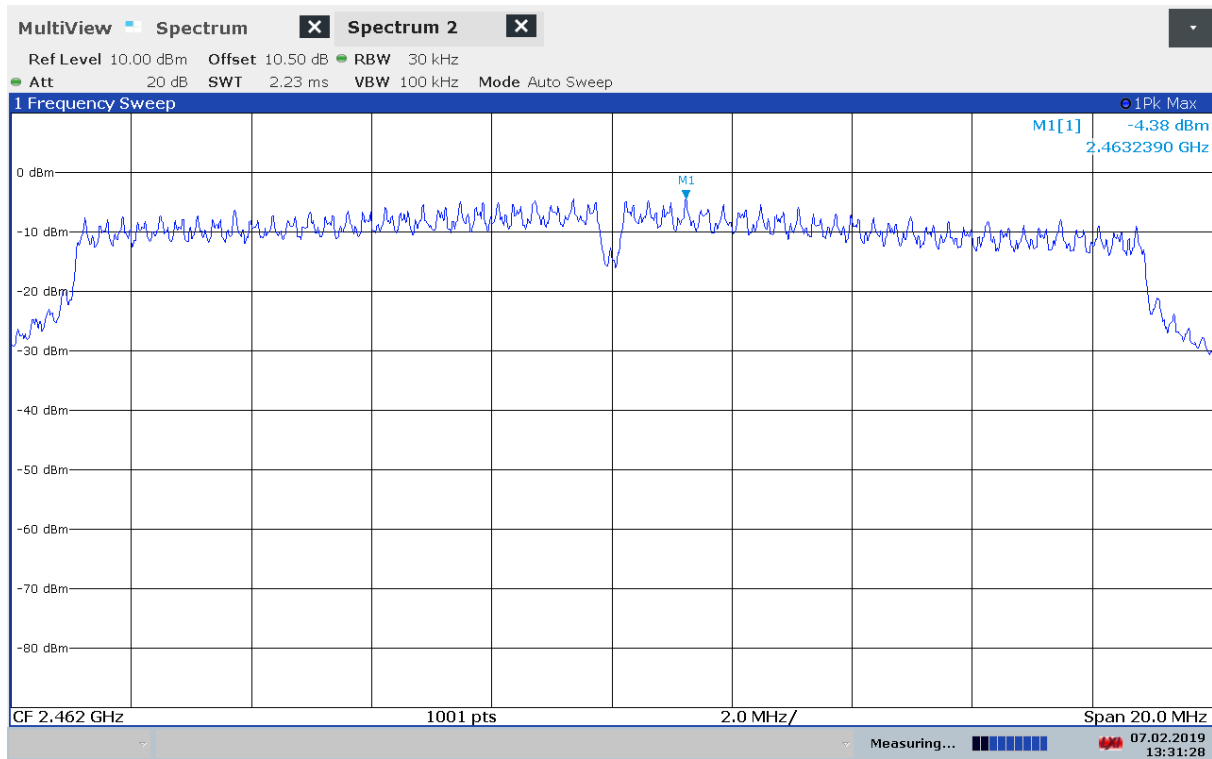
PSD, 2437 MHz, 802.11n, MCS0



PSD, 2462 MHz, 802.11b, 1Mbps



PSD, 2462 MHz, 802.11g, 6Mbps



PSD, 2462 MHz, 802.11n, MCS0

4 Measurement Uncertainty

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

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

5 LIST OF TEST EQUIPMENT

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

No.	Model number	Description	Manufacturer	Ref. no.	Cal. date	Cal. Due
1	FSW43	Spectrum Analyzer	Rohde & Schwarz	LR 1690	2018.01 2019.01	2019.01 2020.01
2	ESU40	Measuring Receiver	Rohde & Schwarz	LR 1639	2018.03 2019.01	2019.03 2020.01
3	6810-17B	Attenuator	Suhner	LR 1669	COU	
4	6HC3000/18000	Highpass Filter	Trilithic	LR 1614	COU	
5	JB3	BiLog Antenna	Sunol Sciences	N-4525	2016.05	2019.05
6	317	Preamplifier	Sonoma Inst.	LR 1687	2018.07	2019.07
7	8449A	Pre-amplifier	Hewlett Packard	LR 1322	2018.07	2019.07
8	3115	Horn Antenna	EMCO	LR 1330	2016.10	2019.12
9	3117-PA	Horn Antenna +PreAmp	EMCO	LR 1717	2017-12	2019-12
10	638	Antenna Horn	Narda	LR 1480	2010.06	2020.06
11	WRCG2400/2483.5	Band Reject Filter	Wainwright Inst.	LR 1530	COU	
12	Model 87 V	Multimeter	Fluke	LR 1597	2018.02	2020.02
14	6812B	AC Power Source	Agilent	LR 1515	COU	
15	ENV216	Two Line V-Network	Rohde & Schwarz	LR 1665	2017.11	2019.11
16	ESCI3	Measuring Receiver	Rohde & Schwarz	N-4259	2017.10	2019.10
17	ST18/SMA/N/36	RF Cable	Suhner	LR 1627	COU	
18	SF102/1000MM	RF Cable	Suhner	SN 50113/2	COU	
19	SF102/2000MM	RF Cable	Suhner	SN 500100/2	COU	

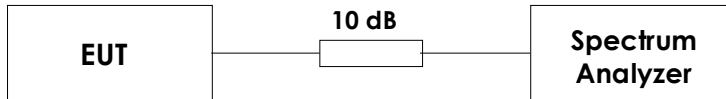
Note: COU – calibrate on use; N/A – Not Applicable

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

No.	Manufacturer	Name	Version	Comment
1	Rohde & Schwarz	EMC32	10.30.10	Power Line Conducted test software
2	Rohde & Schwarz	EMC32	10.30.10	Radiated Emission test software
3	Rohde & Schwarz	GPIShot	2.7	Screenshots from R&S Spectrum Analyzers

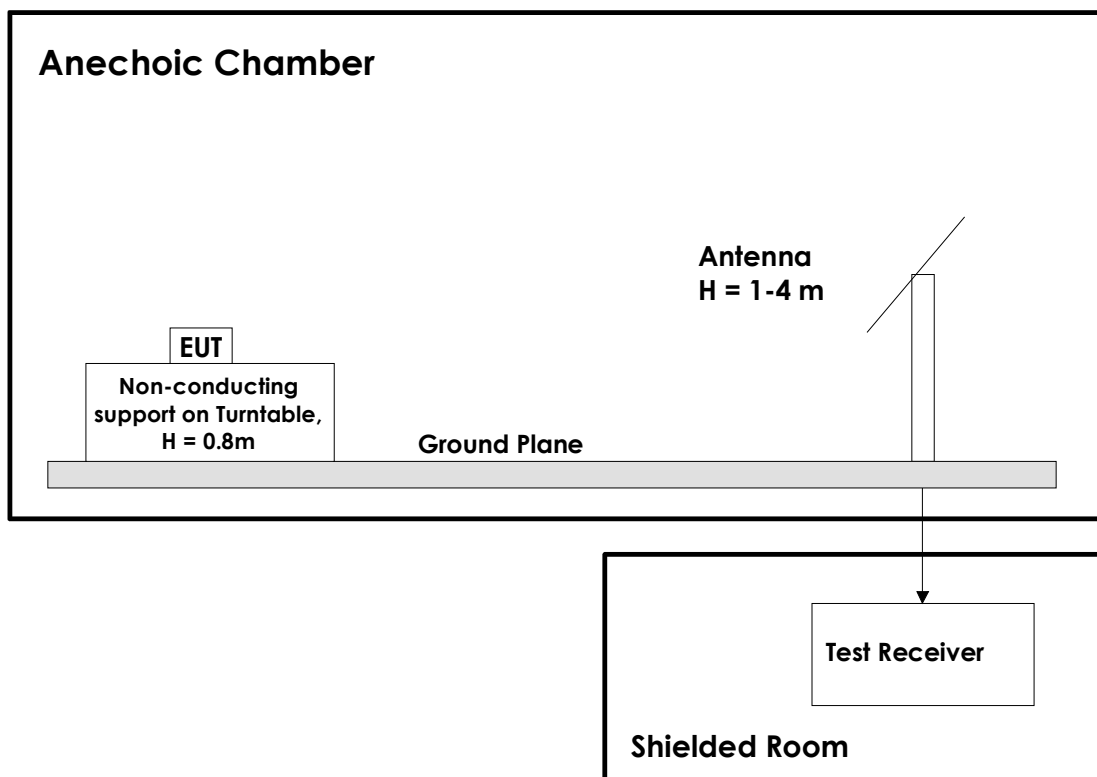
6 BLOCK DIAGRAM

6.1 Conducted Tests



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

6.2 Test Site Radiated Emission



This test setup is used for all radiated emissions tests. Measuring distance is 3m for all frequencies up to 18 GHz. Above 18 GHz measuring distance is 1m.

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

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

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

Above 18 GHz the test receiver is moved inside the anechoic chamber and located next to the antenna to minimize the cable loss.