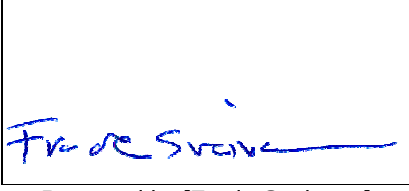
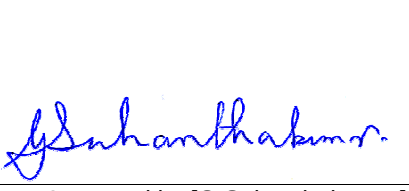


Test Report

Product	Digital Video Encoder/Decoder with WLAN and BT
Name and address of the applicant	Cisco Systems, Inc.
Name and address of the manufacturer	Cisco Norway AS Philip Pedersens vei 1 1366 Lysaker, Norway
Model	TTC7-25
Rating	120V AC
Trademark	Cisco
Serial number	/
Additional information	Bluetooth, 802.11a/b/g/n/ac
Tested according to	FCC Part 15.247 Digital Transmission Systems Industry Canada RSS-247, Issue 1 Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
Order number	315772
Tested in period	2016.06.23, 2016.09.09 and 2016.12.01
Issue date	2017.02.15
Name and address of the testing laboratory	 Instituttveien 6 Kjeller, Norway FCC No: 994405 IC OATS: 2040D-1 TEL: +47 22 96 03 30 FAX: +47 22 96 05 50
 Prepared by [Frode Sveinsen]  Approved by [G.Suhandhakumar]	
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1 INFORMATION

1.1 Test Item

Name :	Cisco
Model/version :	TTC7-25
FCC ID :	LDK07251456
Industry Canada ID :	2461L-07251456
Serial number :	/
Hardware identity and/or version:	Rev. B
Software identity and/or version :	S01828-1.0.0 Alpha7 ce913c0
Frequency Range :	2412 – 2462 MHz
Number of Channels :	11
Operating Modes :	802.11b 802.11g 802.11n (HT20)
Type of Modulation :	DSSS, OFDM
Rated Output Power :	0.061 Watts (Conducted)
Antenna Connector :	Internal Antennas connected to PCB with U-FL connector
Antenna Diversity Supported :	Yes
Smart Antennas System :	MIMO
Power Supply :	FSP070-AHAN2

Description of Test Item

The EUT is a digital video encoder/decoder with WiFi and Bluetooth transceivers. The WiFi and Bluetooth transceivers are contained in a module with single modular certification (FCC ID: VOB-P2180), however the antennas used in this EUT are not certified.

1.2 Normal test condition

Temperature:	22.3 – 23.7 °C
Relative humidity:	30 - 57 %
Normal test voltage:	120 V AC

The values are the limit registered during the test period.

1.3 Test Engineer(s)

Frode Sveinsen
Kristian Osvoll (Power Line Conducted Test)

1.4 Description of modification for Modification Filing

Not applicable.

1.5 Family List Rational

Not Applicable.

1.6 Antenna Requirement

Is the antenna detachable?

☒ Yes ☐ No

If detachable, is the antenna connector non-standard?

☒ Yes ☐ No

Type of antenna connector: U-FL (The antennas are internal with connector on the PCB)

Ref. FCC §15.203

1.7 Worst-Case Configuration and Mode

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

The worst case data rates were:

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

1.8 On Time and Duty Cycle Factors

Mode	On Time Burst (ms)	Period (msec)	Duty Cycle (linear)	Duty Cycle Correction: Power (dB)	Duty Cycle Correction: Voltage (dB)
802.11b	8.600	8.695	0.989	0.05	0.10
802.11g	1.425	1.536	0.928	0.33	0.65
802.11n HT20 CDD 2TX	0.692	0.793	0.872	0.59	1.18

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

1.9 Antenna Gain

The EUT has two antennas that are connected to the main PCB with a cable and connector. The values below are the antenna gain values provided by the manufacturer:

Frequency (MHz)	Max Gain Ant #0 (dBi)	Max Gain Ant #1 (dBi)
2400	2.54	2.12
2450	3.25	2.06
2500	3.28	2.18

1.10 Comments

This report covers only limited radiated tests to show compliance with the new antenna in this EUT. All other radio tests for 2.4GHz WLAN are covered by UL reports no. 15U21878-E3V2.

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 1.

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

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

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

☒ 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 1, RSS-GEN Issue 4 reference	Result
Supply Voltage Variations	15.31(e)	6.11 (RSS-GEN)	Complies ¹
Antenna Requirement	15.203	8.3 (RSS-GEN)	Complies
Power Line Conducted Emission	15.107(a) 15.207(a)	8.8 (RSS-GEN)	Complies
Occupied Bandwidth	N/A	6.6 (RSS-GEN)	Complies ¹
Minimum 6 dB Bandwidth	15.247(a)(2)	5.2 (1) (RSS-247)	Complies ¹
Peak Power Output	15.247(b)	5.4 (RSS-247)	Complies
Power Spectral Density	15.247(d)	5.2 (2) (RSS-247)	Complies ¹
Spurious Emissions (Antenna Conducted)	15.247(c)	5.5 (RSS-247)	Complies ¹
Spurious Emissions (Radiated)	15.247(c) 15.109(a) 15.209(a)	5.5 (RSS-247) 6.13 (RSS-GEN) 8.9 (RSS-GEN)	Complies

¹ Covered by UL Test Report no. 15U21878-E3V2

3 TEST RESULTS

3.1 Power Line Conducted Emissions

FCC Part 15.207 (a)

ISED RSS-GEN Issue 4, Clause 8.8

Test Performed By: Kristian Osvoll

Date of Test: 3-Nov-2016

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

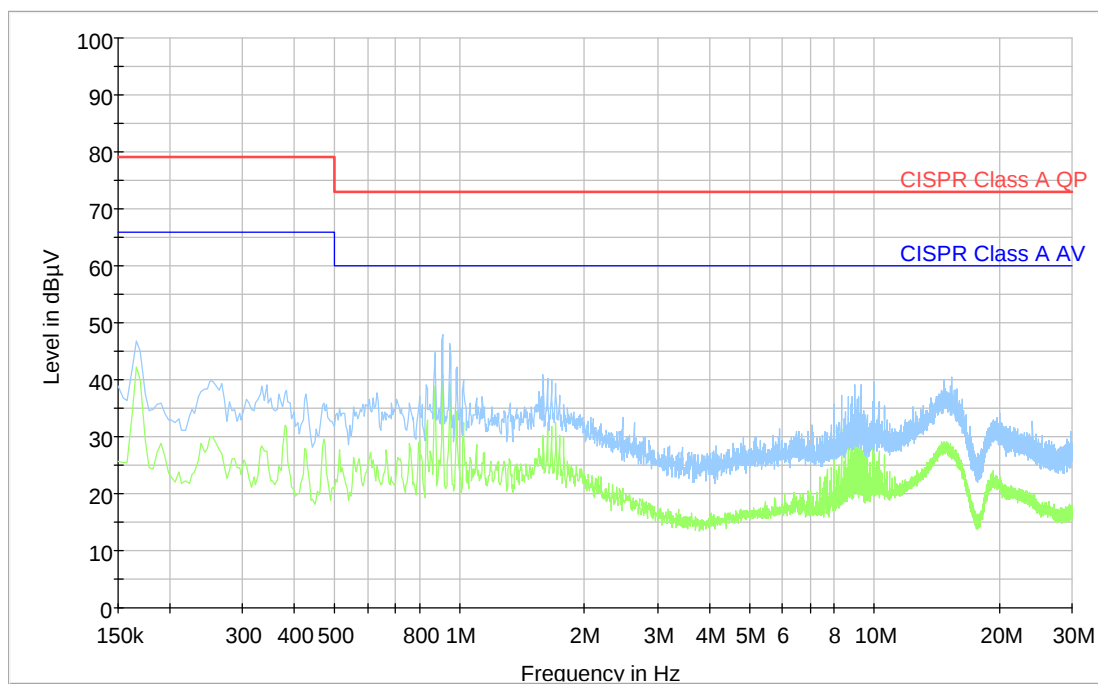
Test Results: Complies.

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

Highest measured value (L1 and N):

Frequency (MHz)	QuasiPeak (dB μ V)	Average (dB μ V)	Limit (dB μ V)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	PE	Corr. (dB)
---	---	---	---	---	---	---			---

Full Spectrum



All emissions are below the limits in FCC 15.207

3.2 Spurious Emissions (Radiated)

Para. No.: 15.247 (c)

ISED RSS-247 Issue 1, Clause

Test Results: Complies

Measurement Data:

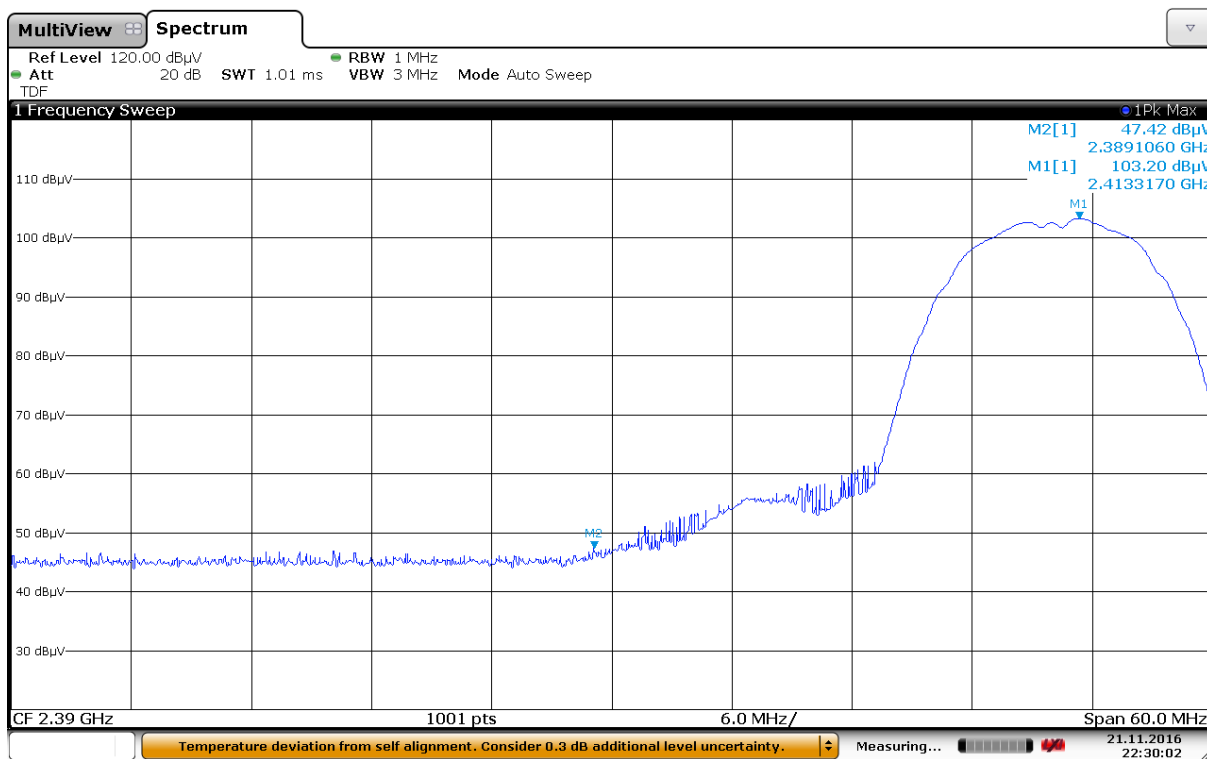
Peak Detector:

Modulation and Bitrate	Measured field strength (dB μ V/m)		Limit	Margin	
	2390 MHz	2483.5 MHz	dB	dB	
802.11b, 11 Mbps	47.4	57.4	74	26.6	16.6
802.11g, 6 Mbps	54.7	60.5	74	19.3	13.5
802.11n, MCS0	59.5	63.3	74	14.5	10.7

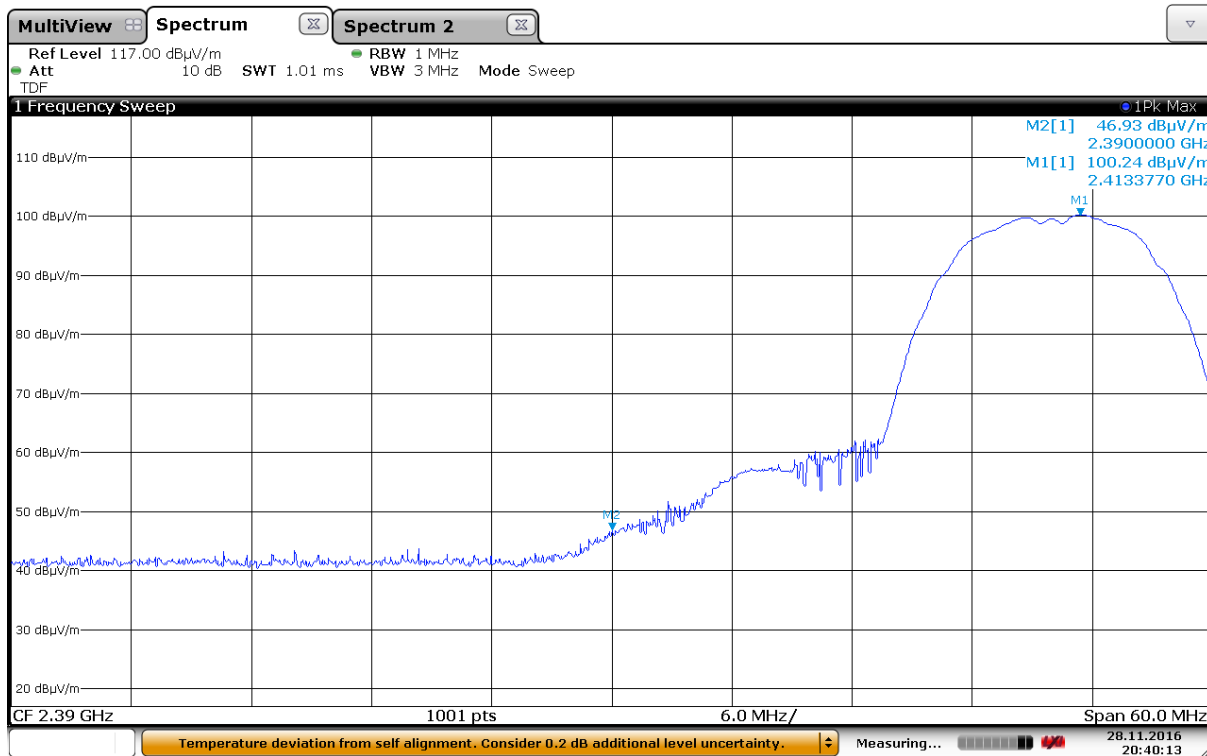
Average Detector:

Modulation and Bitrate	Measured field strength (dB μ V/m)		Limit	Margin	
	2390 MHz	2483.5 MHz	dB	dB	
802.11b, 11 Mbps	38.4	43.9	54	15.6	10.1
802.11g, 6 Mbps	35.6	42.0	54	18.4	12.0
802.11n, MCS0	36.2	42.3	54	17.8	11.7

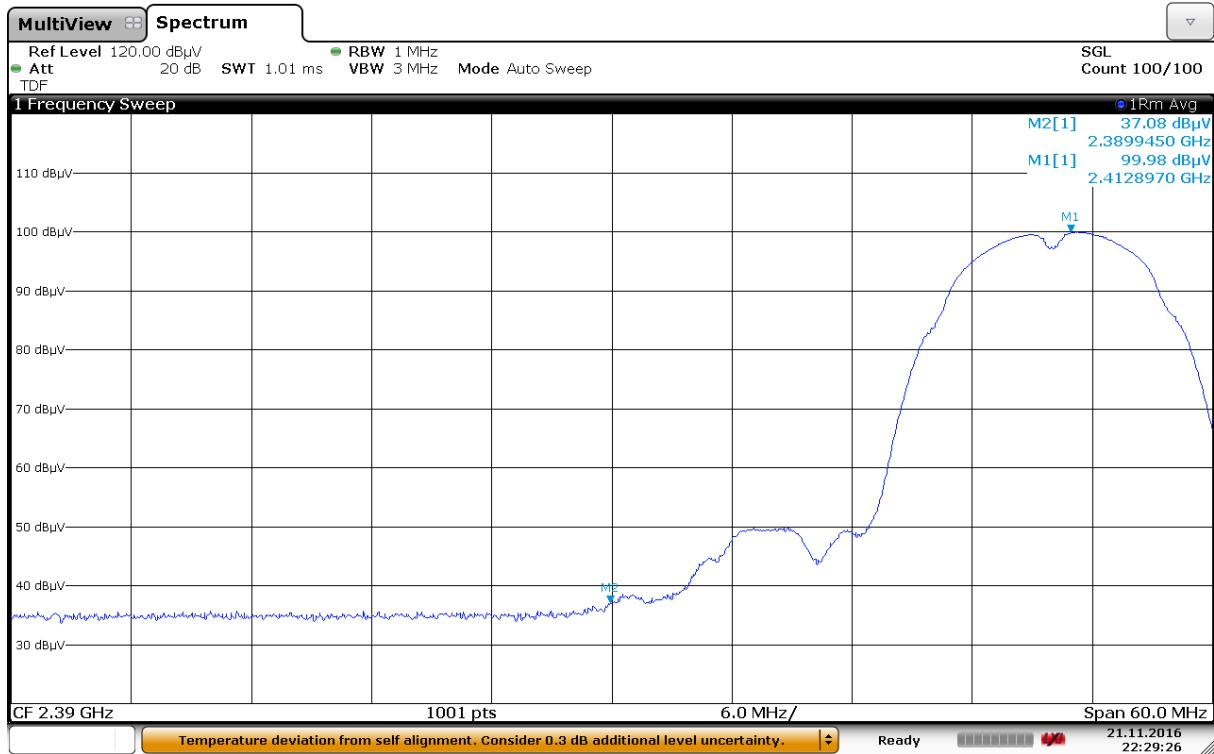
See attached plots



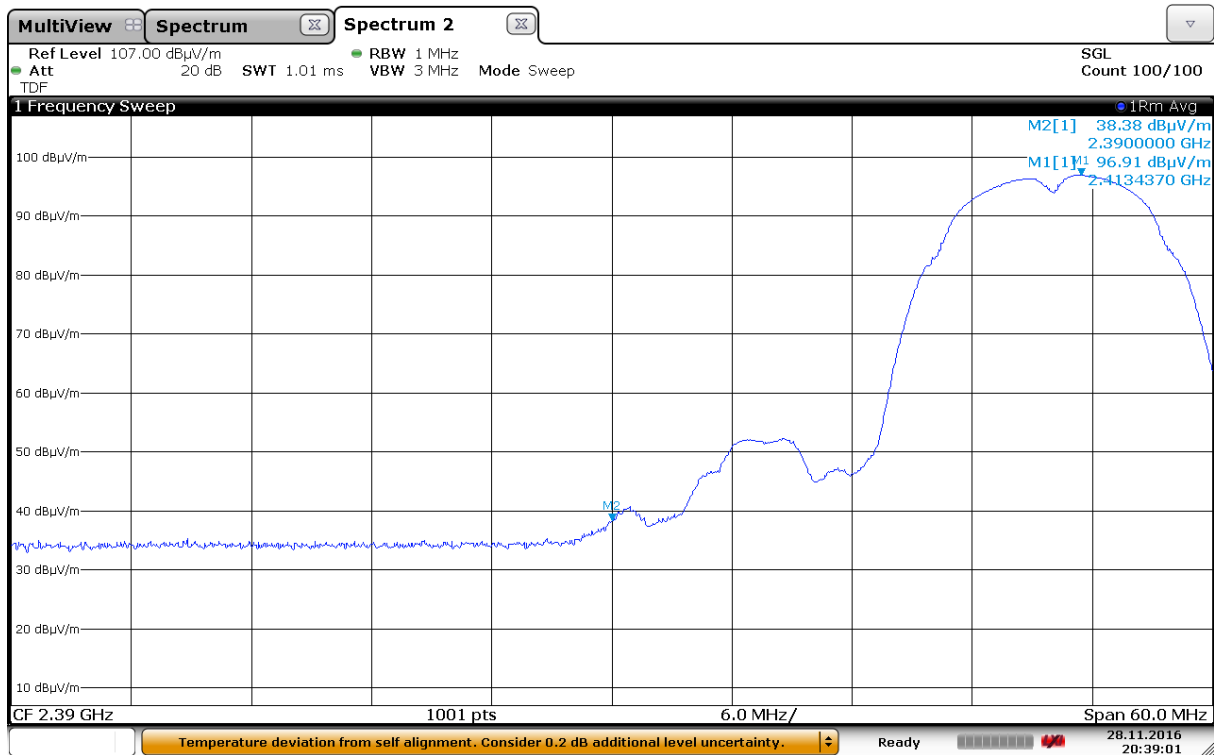
Band Edge, Lower, Peak, 2412 MHz, 802.11b, 1Mbps, Ant 0



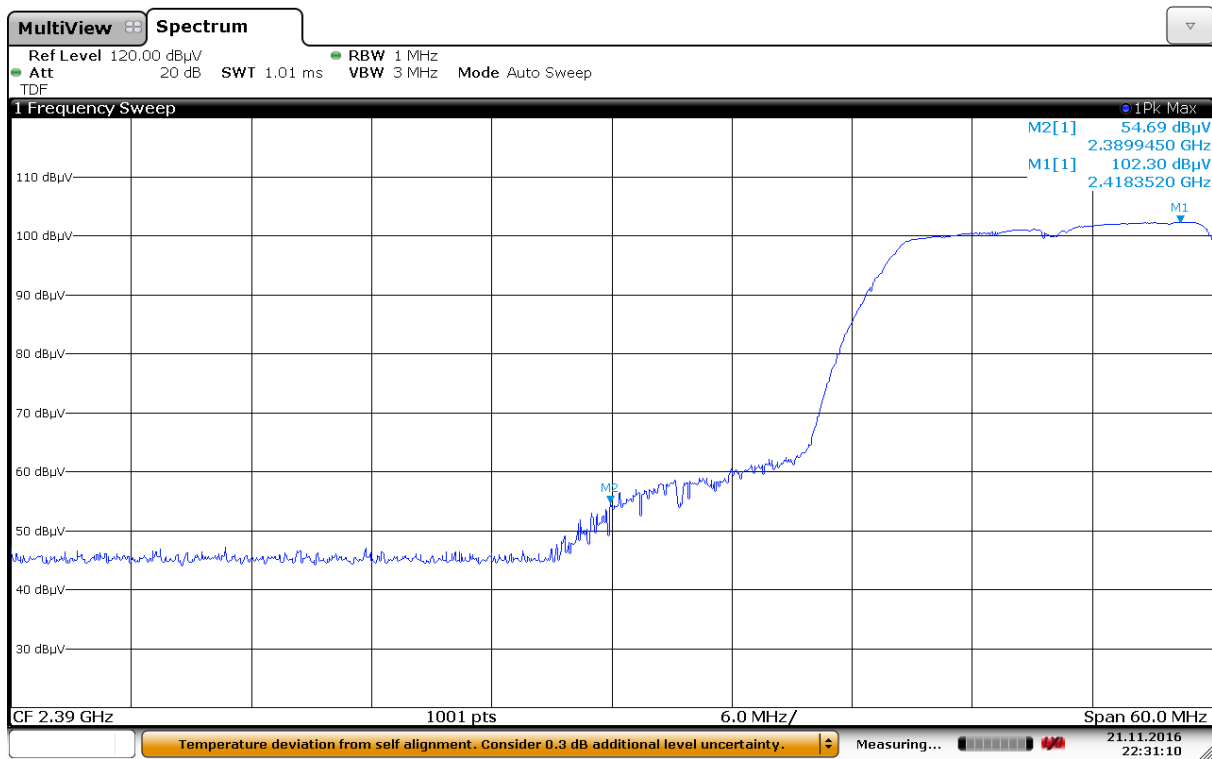
Band Edge, Lower, Peak, 2412 MHz, 802.11b, 1Mbps, Ant 1



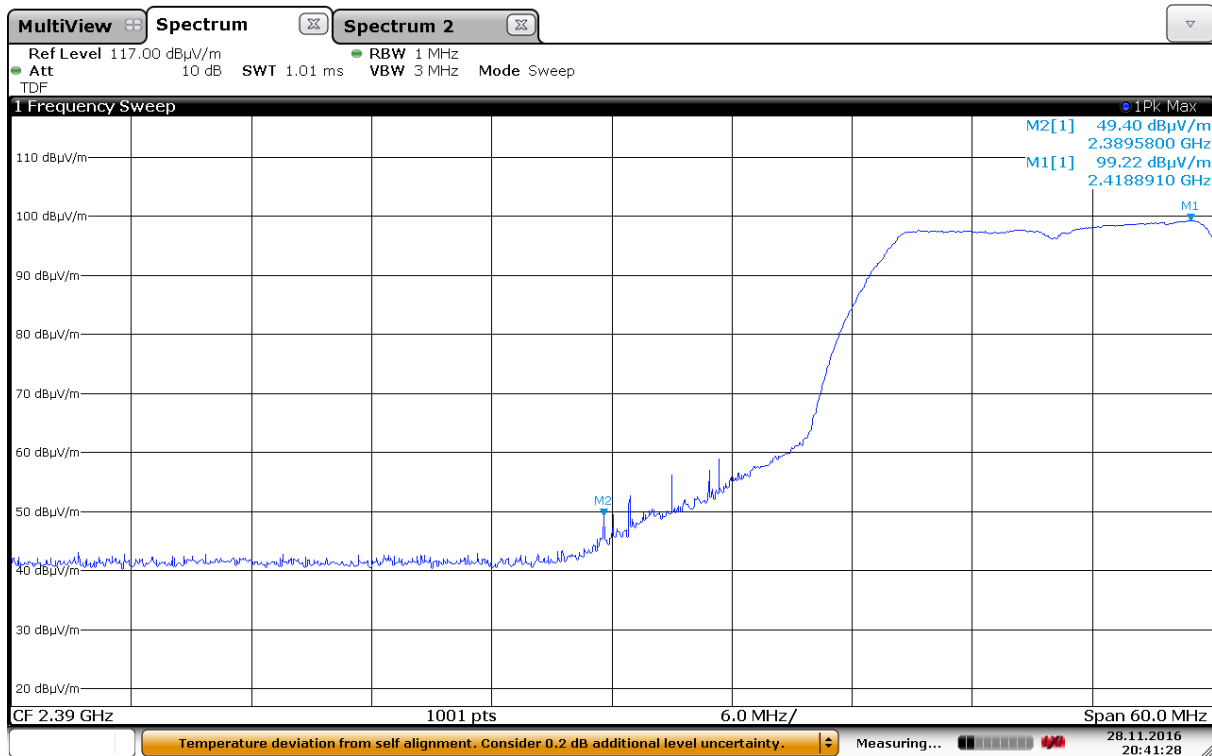
Band Edge, Lower, Average, 2412 MHz, 802.11b, 1Mbps, Ant 0



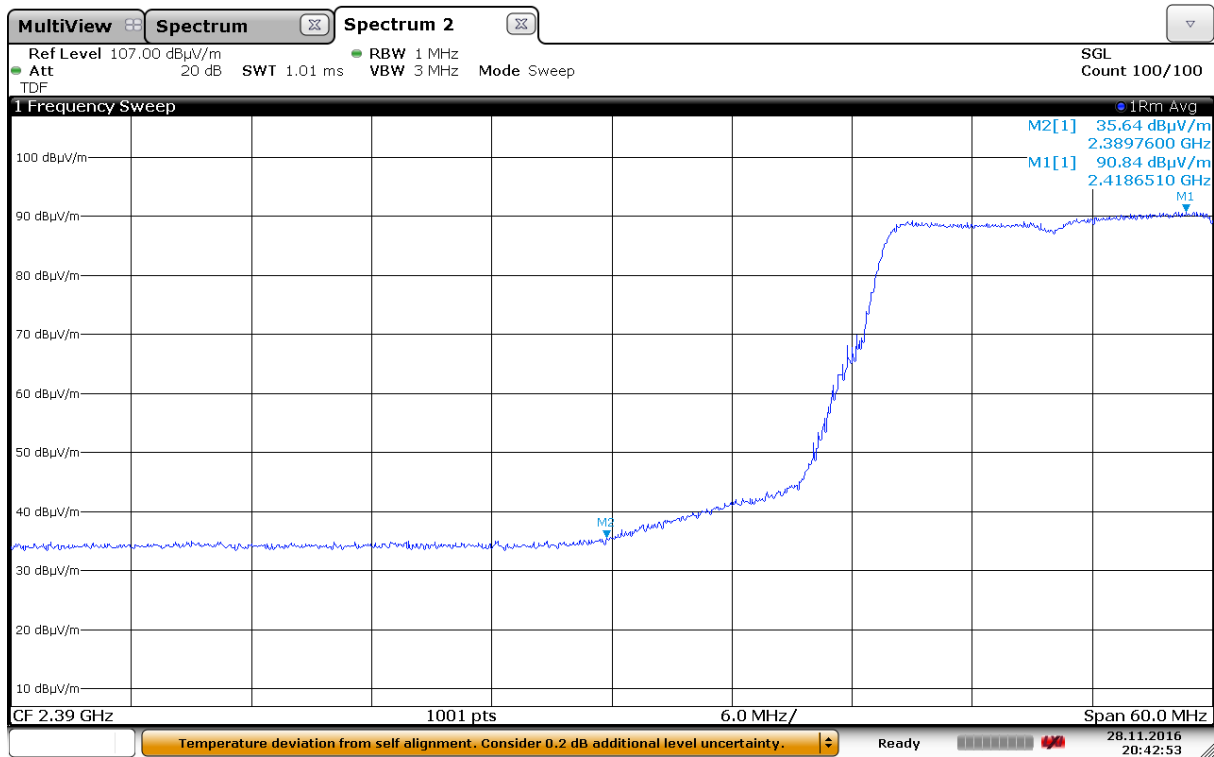
Band Edge, Lower, Average, 2412 MHz, 802.11b, 1Mbps, Ant 1



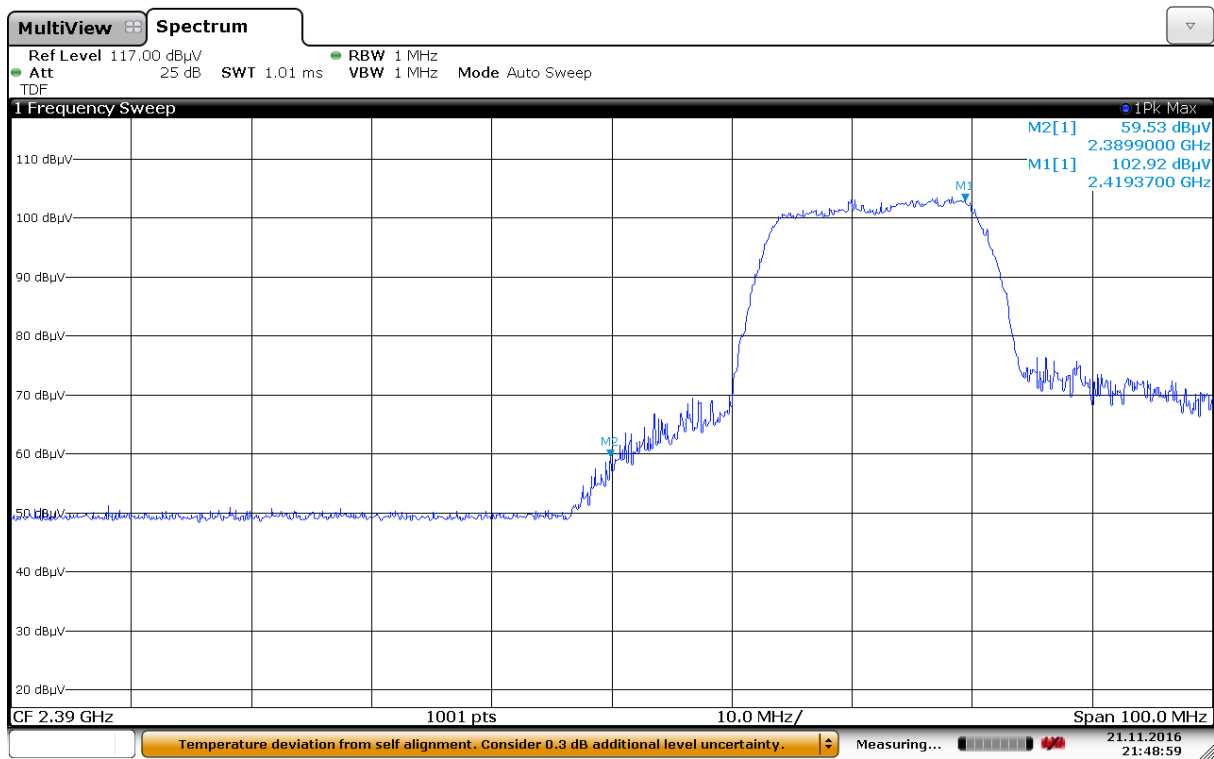
Band Edge, Lower, Peak, 2412 MHz, 802.11g, 6Mbps, Ant 0



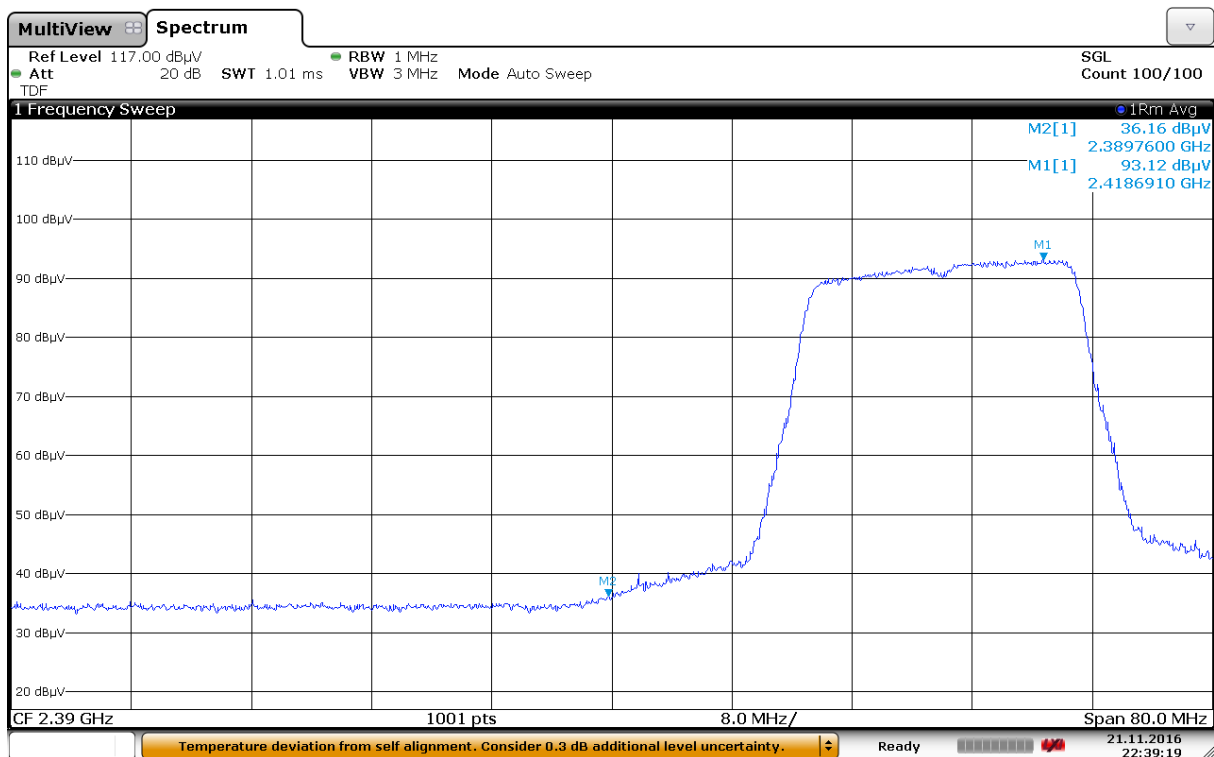
Band Edge, Lower, Peak, 2412 MHz, 802.11g, 6Mbps, Ant 1



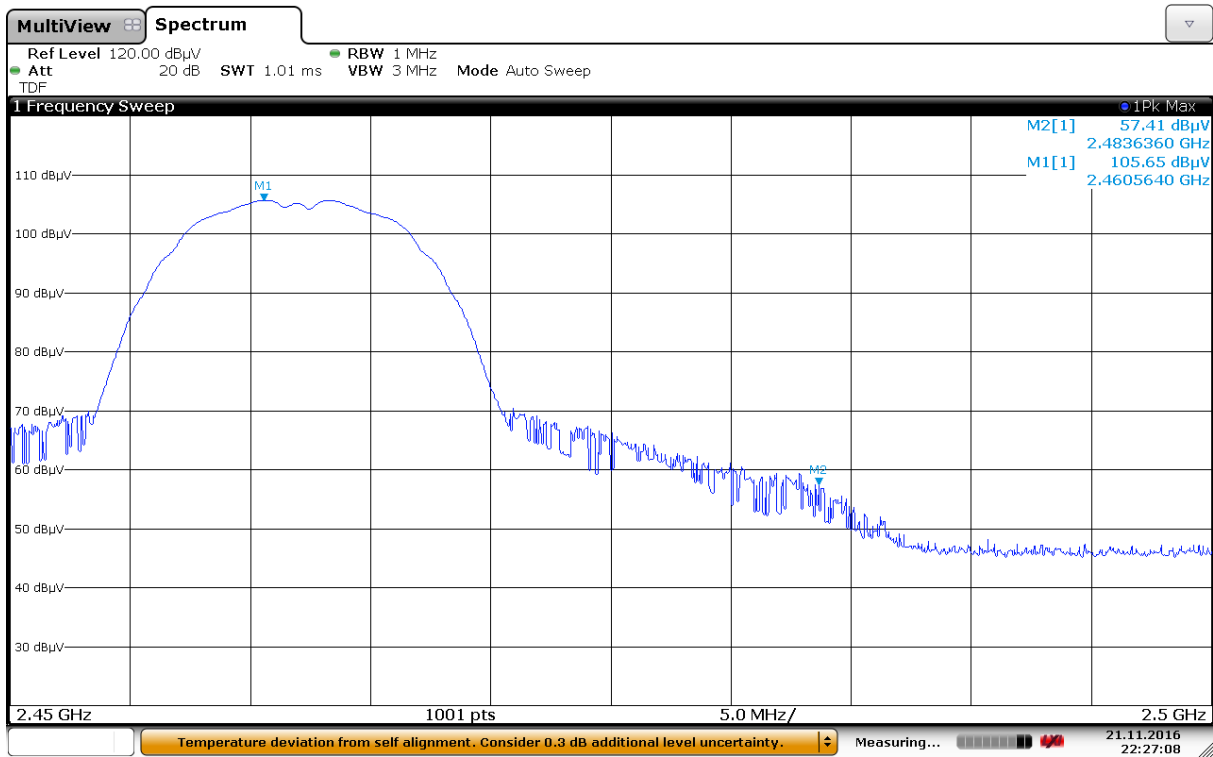
Band Edge, Lower, Average, 2412 MHz, 802.11g, 6Mbps, Ant 1



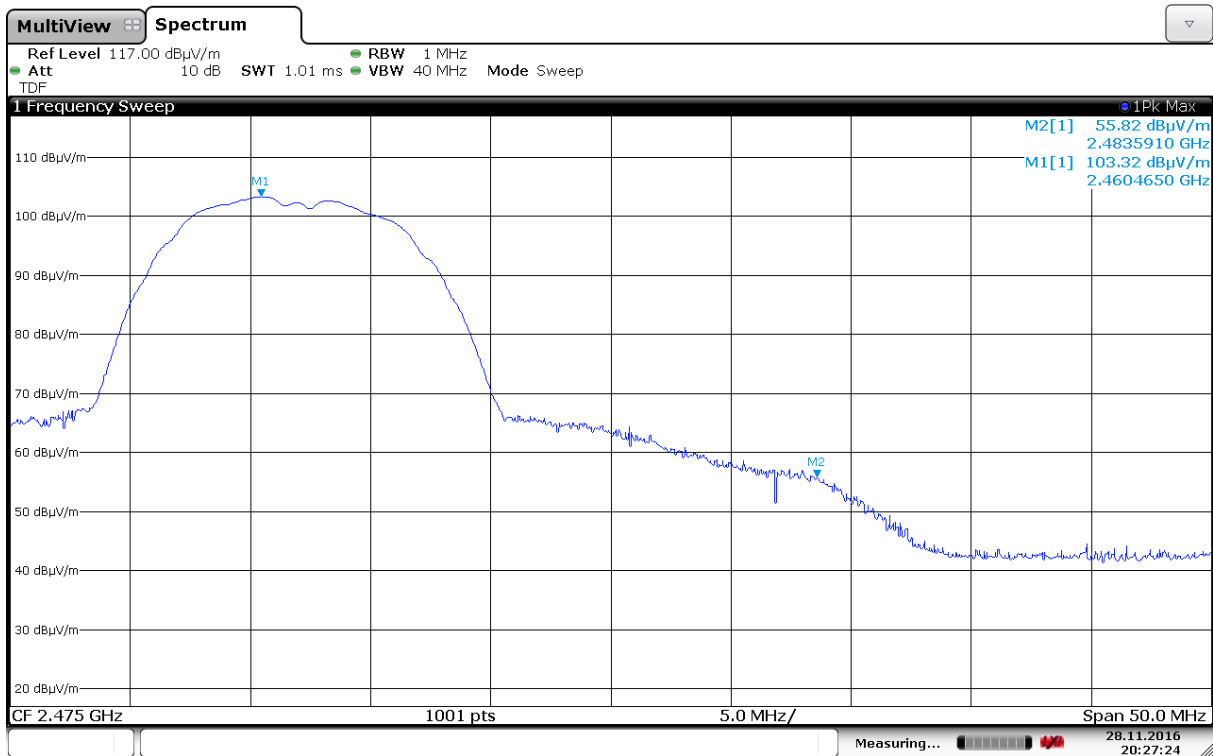
Band Edge, Lower, Peak, 2412 MHz, 802.11n, MCS0, MIMO



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



Band Edge, Upper, Peak, 2462 MHz, 802.11b, 1Mbps, Ant 0



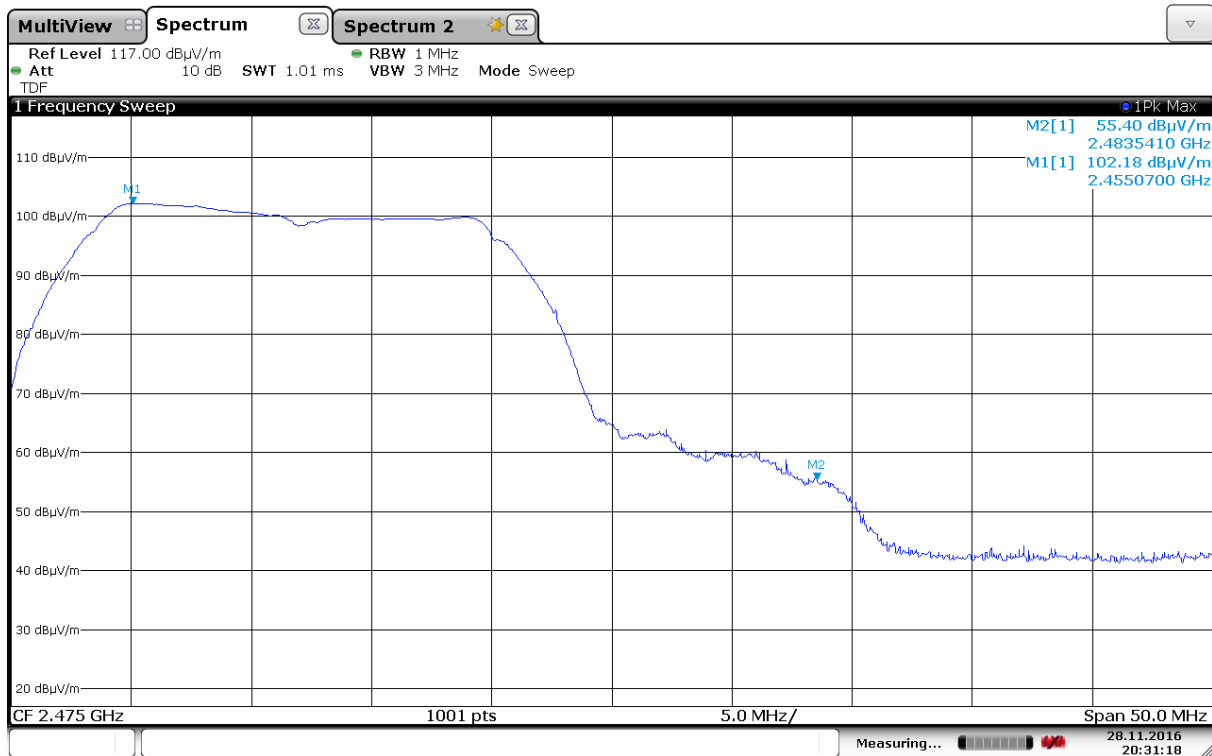
Band Edge, Upper, Peak, 2462 MHz, 802.11b, 1Mbps, Ant 1



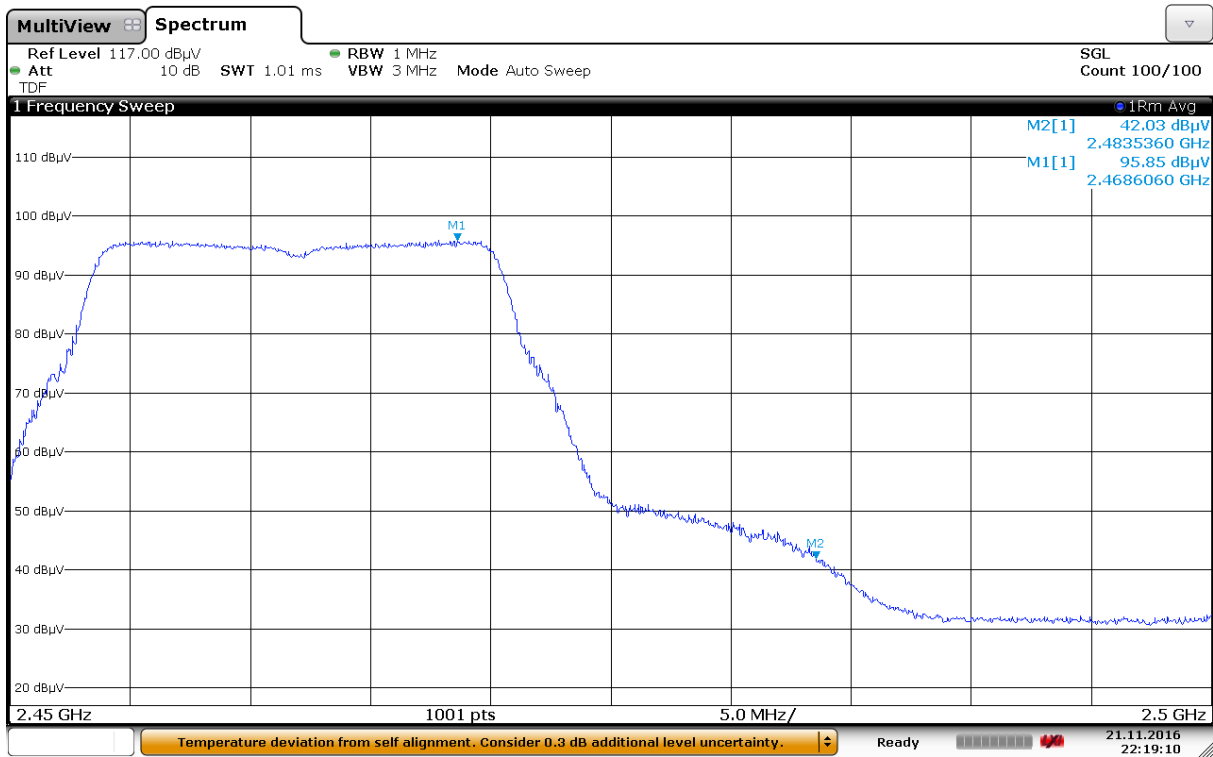
Band Edge, Upper, Average, 2462 MHz, 802.11b, 1Mbps, Ant 0



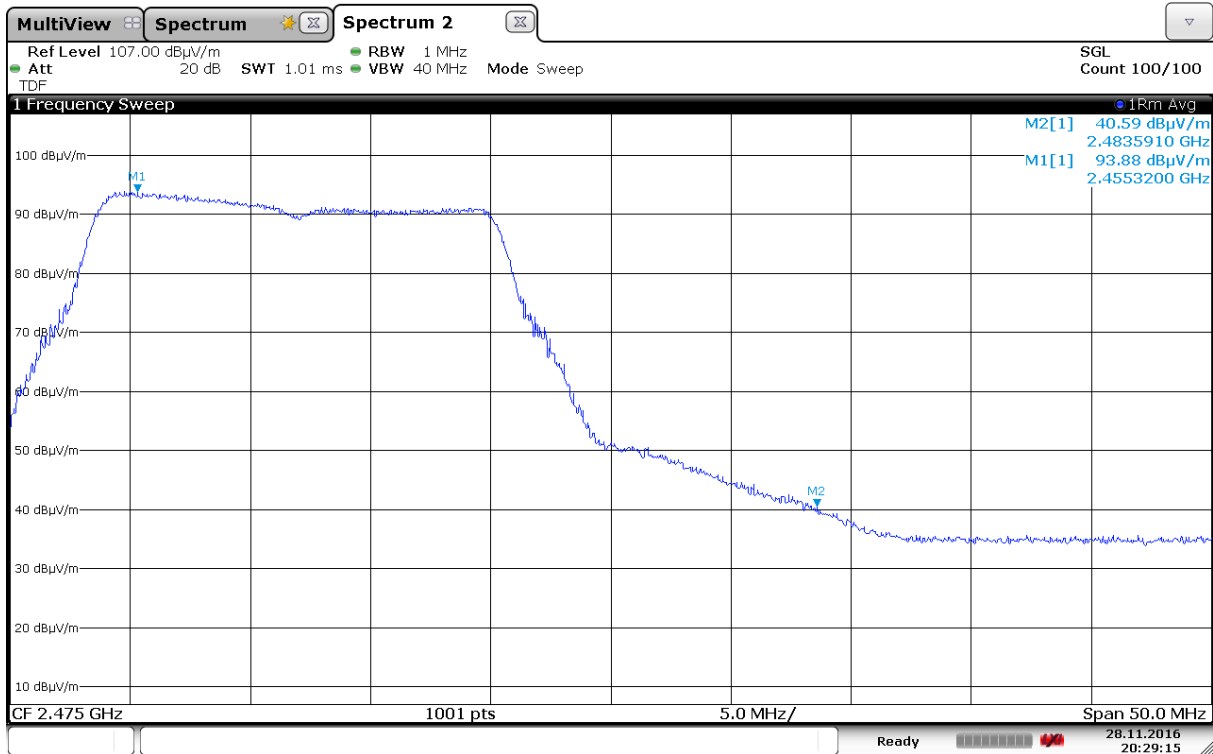
Band Edge, Upper, Peak, 2462 MHz, 802.11g, 6Mbps, Ant 0



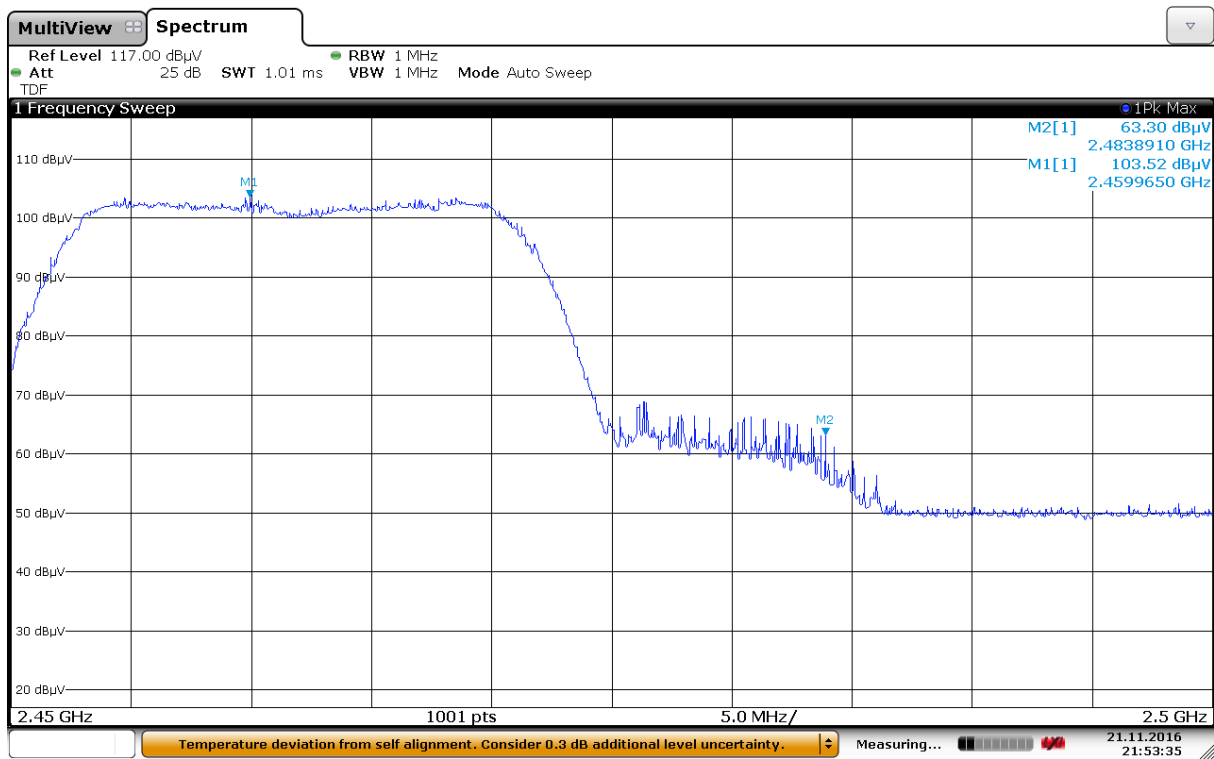
Band Edge, Upper, Peak, 2462 MHz, 802.11g, 6Mbps, Ant 1



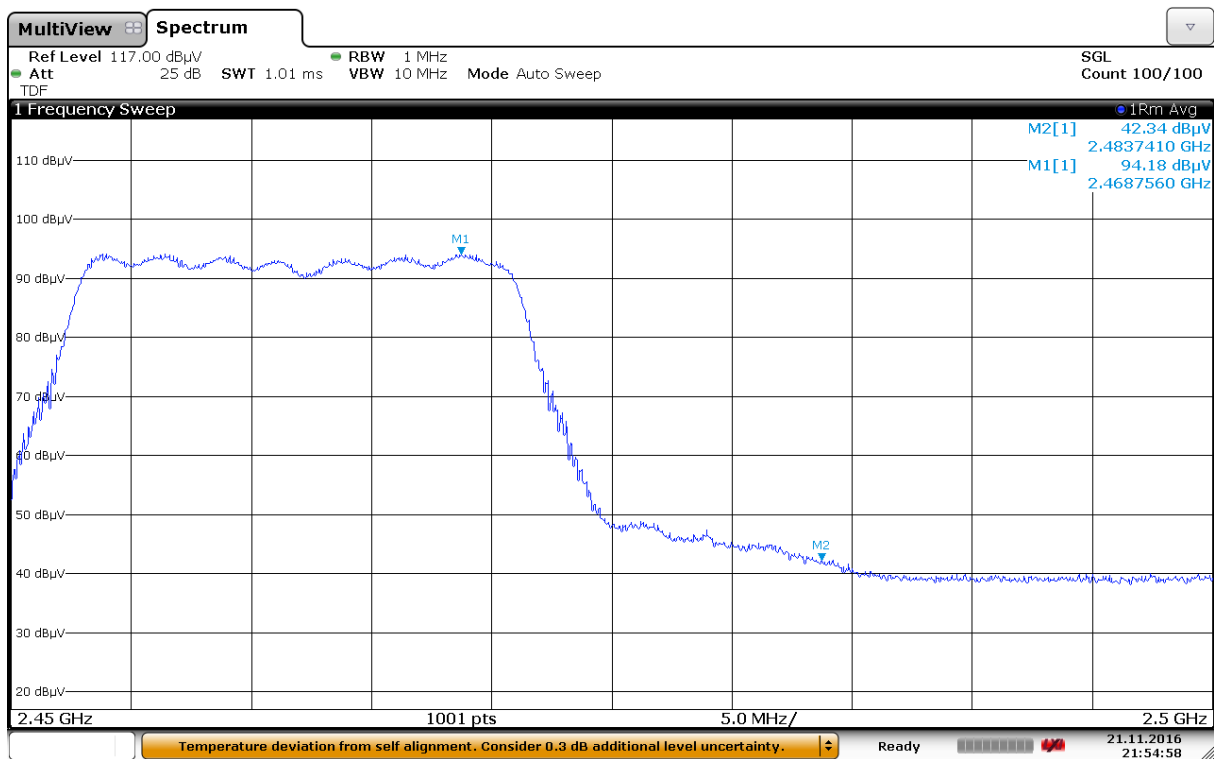
Band Edge, Upper, Average, 2462 MHz, 802.11g, 6Mbps, Ant 0



Band Edge, Upper, Average, 2462 MHz, 802.11g, 6Mbps, Ant 1



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



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

3.3 Radiated Emissions, 30 – 1000 MHz.

FCC 15.205, 15.209

ISED RSS-GEN, Issue 4, Clause 8.9

Test Results: Complies

Measurement Data:

Radiated emission 30 – 1000 MHz.

Detector: Quasi-Peak

Measuring distance 3m

Tested with all connections active

Frequency	Antenna Polarization	Field strength	Measuring distance	Limit FCC15.209	Margin
MHz		dBμV/m	metres	dBμV/m	dB
30.34	VP	32.0	3	40	8.0
49.229	VP	34.3	3	40	5.7
61.731	HP	25.4	3	40	14.6
62.818	VP	33.0	3	40	7.0
75.592	HP	25.1	3	40	14.9
103.86	HP	32.8	3	43.5	10.7
408.153	VP	30.7	3	46	15.3
424.78	VP	29.3	3	46	16.7
445.24	VP/HP	24.9	3	46	21.1
482.33	VP	30.1	3	46	15.9
552.0	HP	28.9	3	46	17.1
556.0	VP	34.7	3	46	11.3
594.245	VP	30.9	3	46	15.1
603.197	VP	35.3	3	46	10.7
999.68	VP	17.8	3	54	36.2

See attached plots.

Requirements/Limit

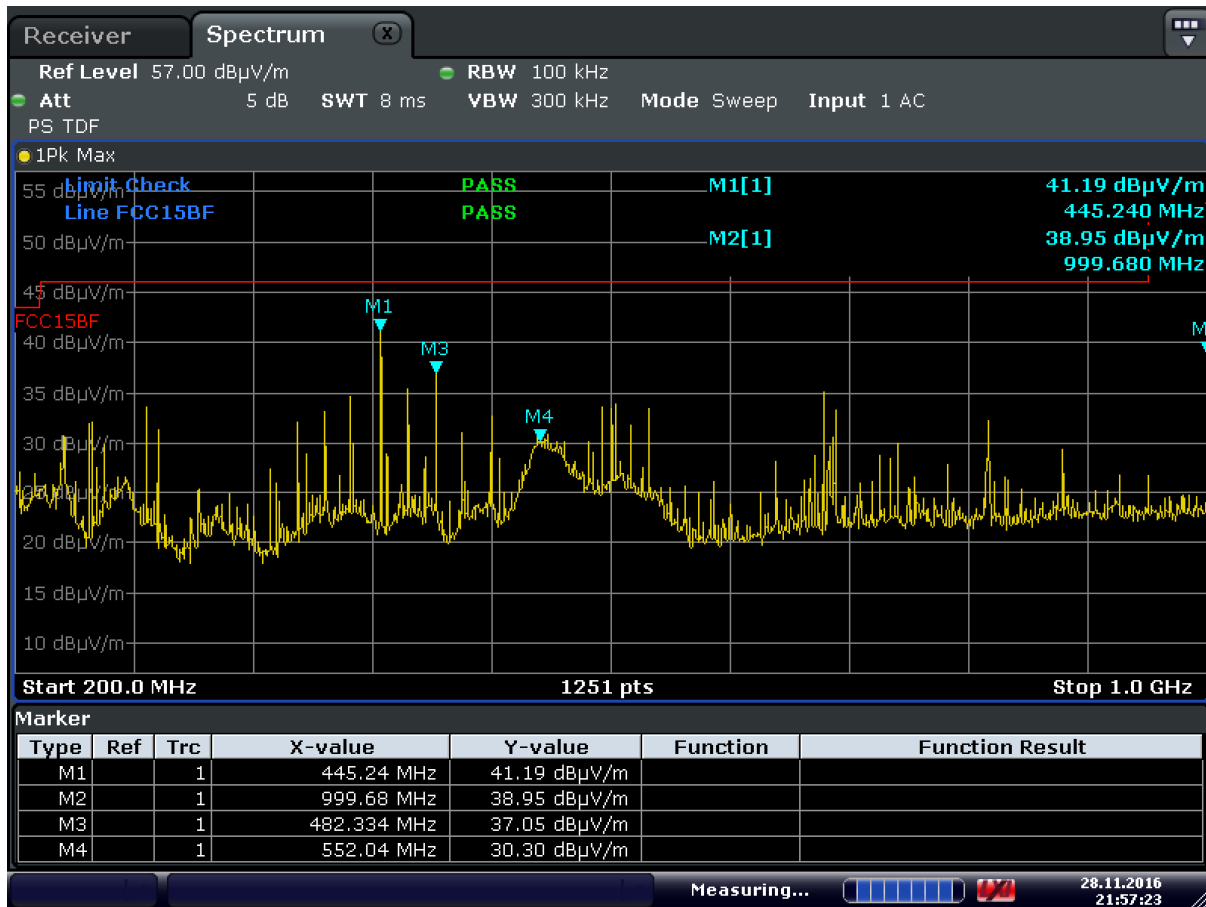
FCC	Part 15.209 @ frequencies defined in §15.205	
ISED	RSS-GEN Issue 4, Clause 8.9 @ frequencies defined in 8.10	
	Radiated emission limit @3 meters	
Frequency (MHz)	Quasi Peak (μV/m)	Quasi Peak (dBμV/m)
30 – 88	100	40.0
88 – 216	150	43.5
216 – 960	200	46.0
Above 960	500	54.0



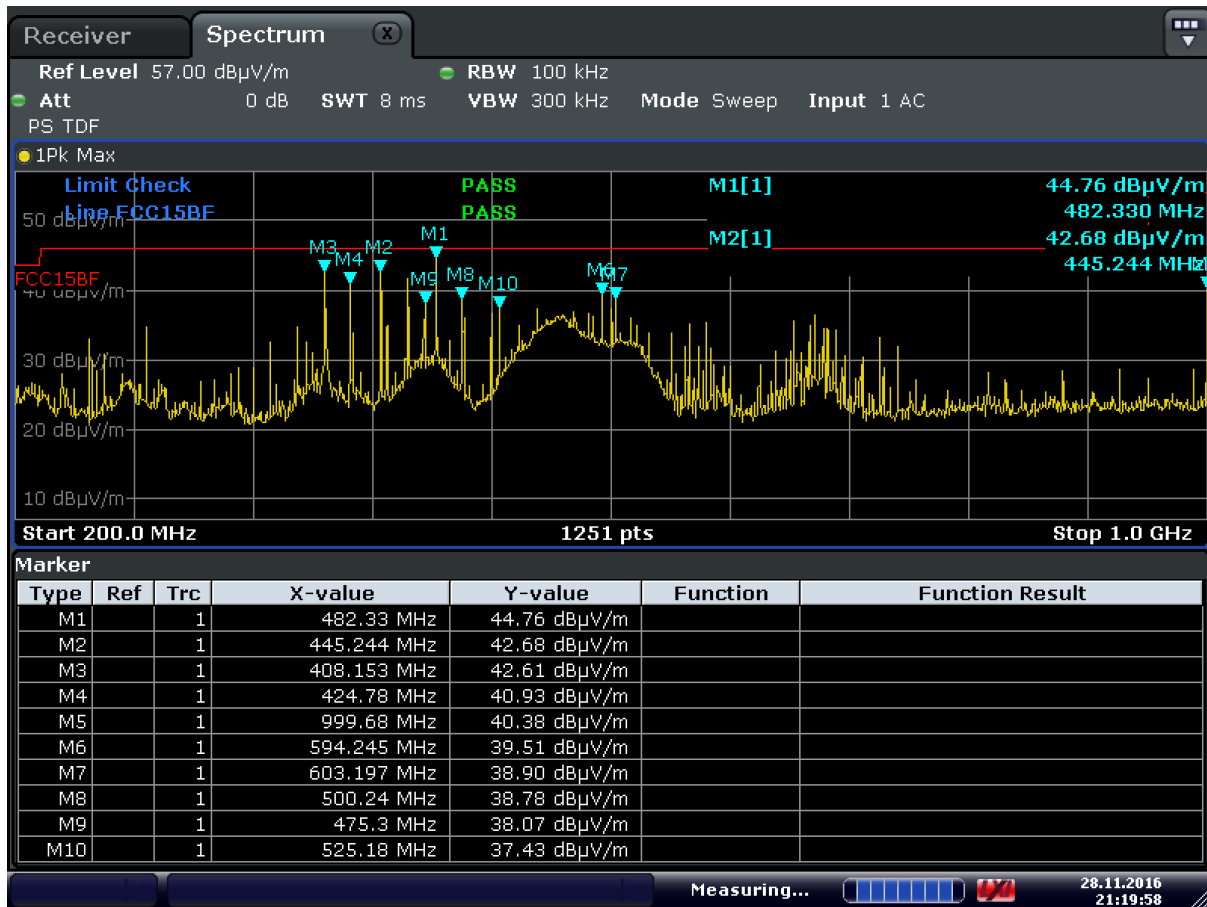
Radiated Emissions, 30 -200MHz, HP



Radiated Emissions, 30 -200MHz, VP



Radiated Emissions, 200 -1000MHz, HP



Radiated Emissions, 200 -1000MHz, VP

3.4 Radiated Emissions, 1-25 GHz

Measuring distance: 3m (1 – 8.5 GHz)
1m (8.0 – 25 GHz)

Peak Detector:

Frequency	RF channel	Dist. corr. factor	Field strength, Peak Detector, 3m	Duty cycle corr. factor	Limit	Margin
MHz	L,M,H	dB	dB μ V/m	dB	dB μ V/m	dB
4874	M	0	51.6	0	74	22.4
All freqs	L,M,H	/	<54	0	74	>20

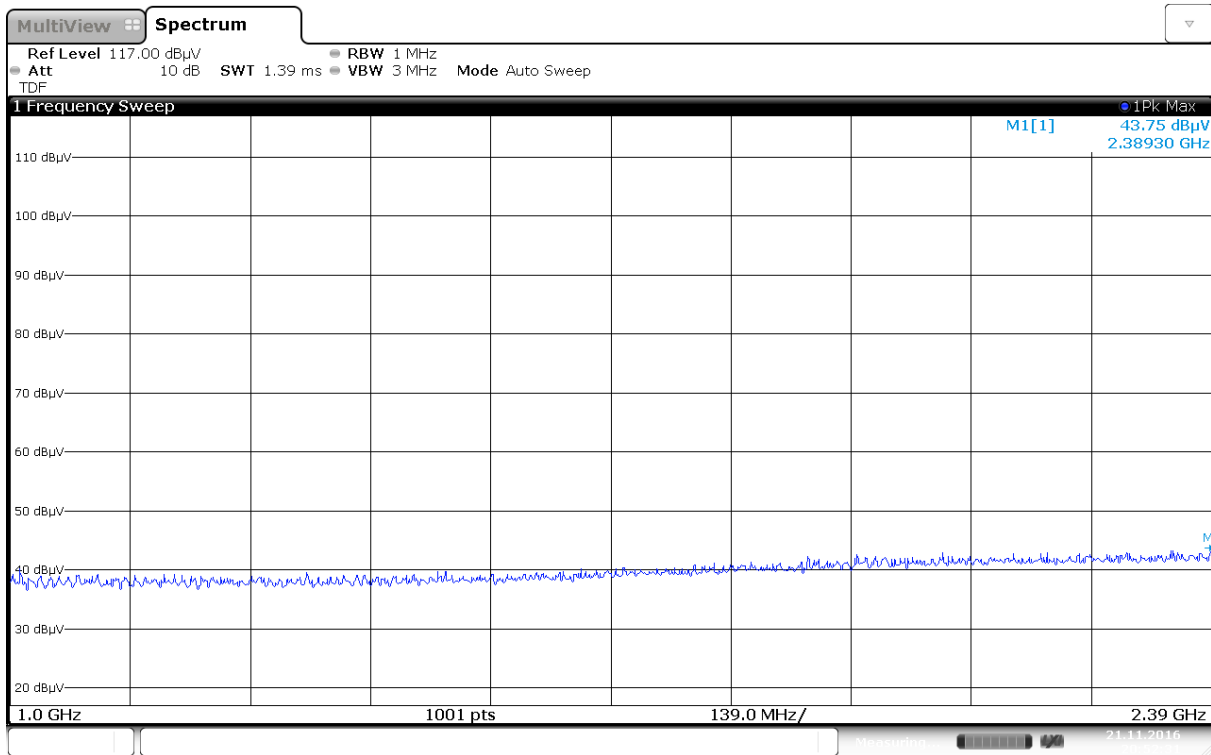
Average Detector:

Frequency	RF channel	Dist. corr. factor	Field strength, Peak Detector, 3m	Duty cycle corr. factor	Limit	Margin
MHz	L,M,H	dB	dB μ V/m	dB	dB μ V/m	dB
4874	M	0	46.7	0	54	7.3
All freqs	L,M,H	/	None detected	0	54	>20

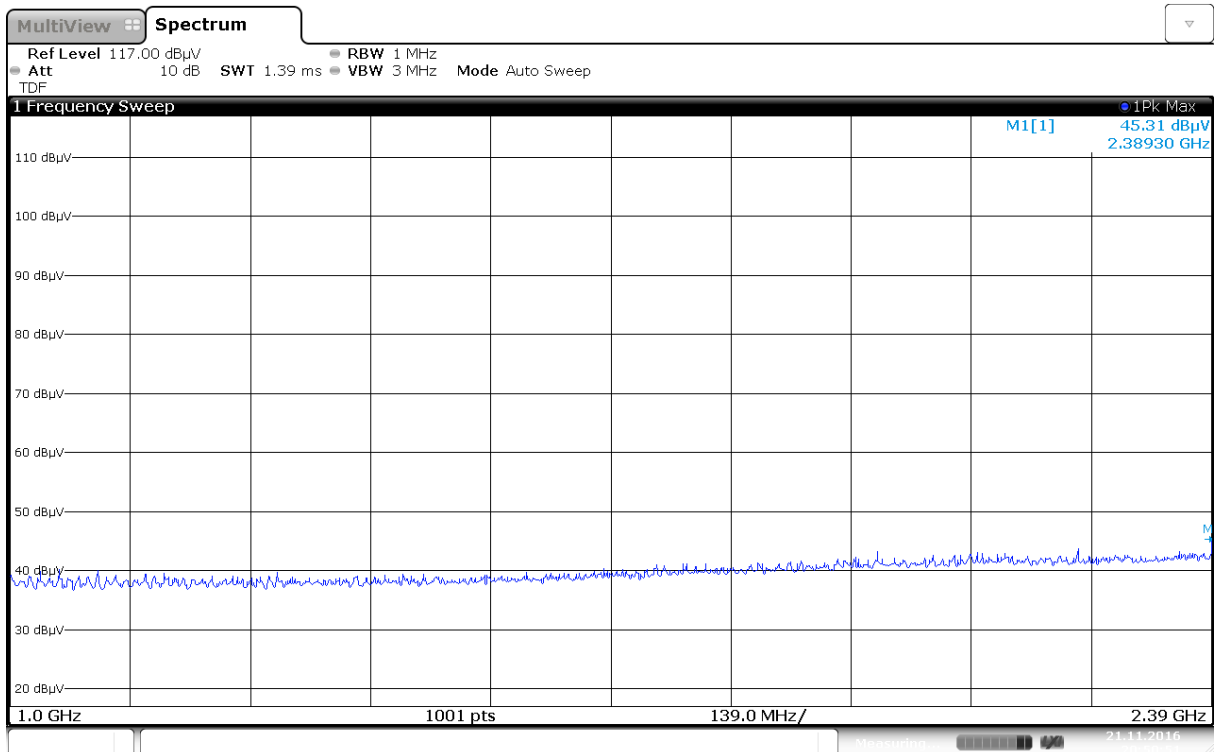
Antenna factor, amplifier gain and cable loss are included in spectrum analyzer "Transducer factor".
See plots.

Requirements/Limit

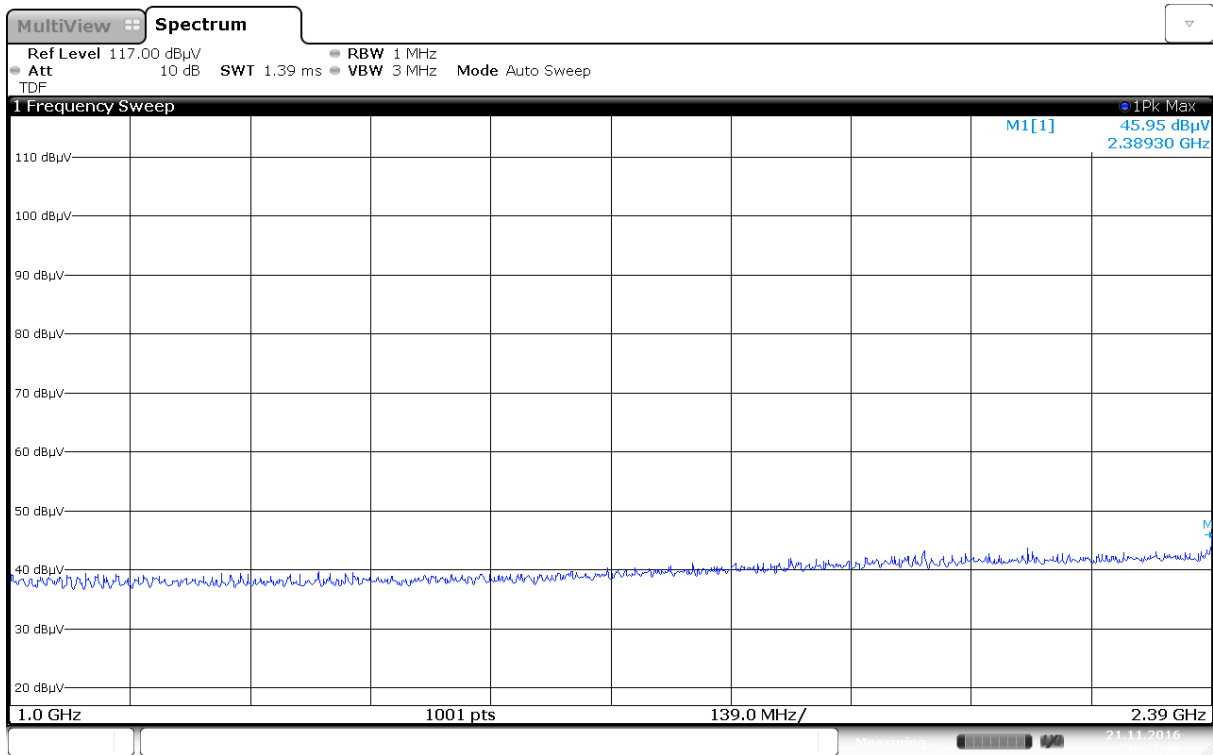
FCC	Part 15.209 @ frequencies defined in §15.205	
ISED		
	Radiated emission limit @3 meters	
Frequency (MHz)	AV (dB μ V/m)	Peak (dB μ V/m)
Above 1 GHz	54.0	74.0



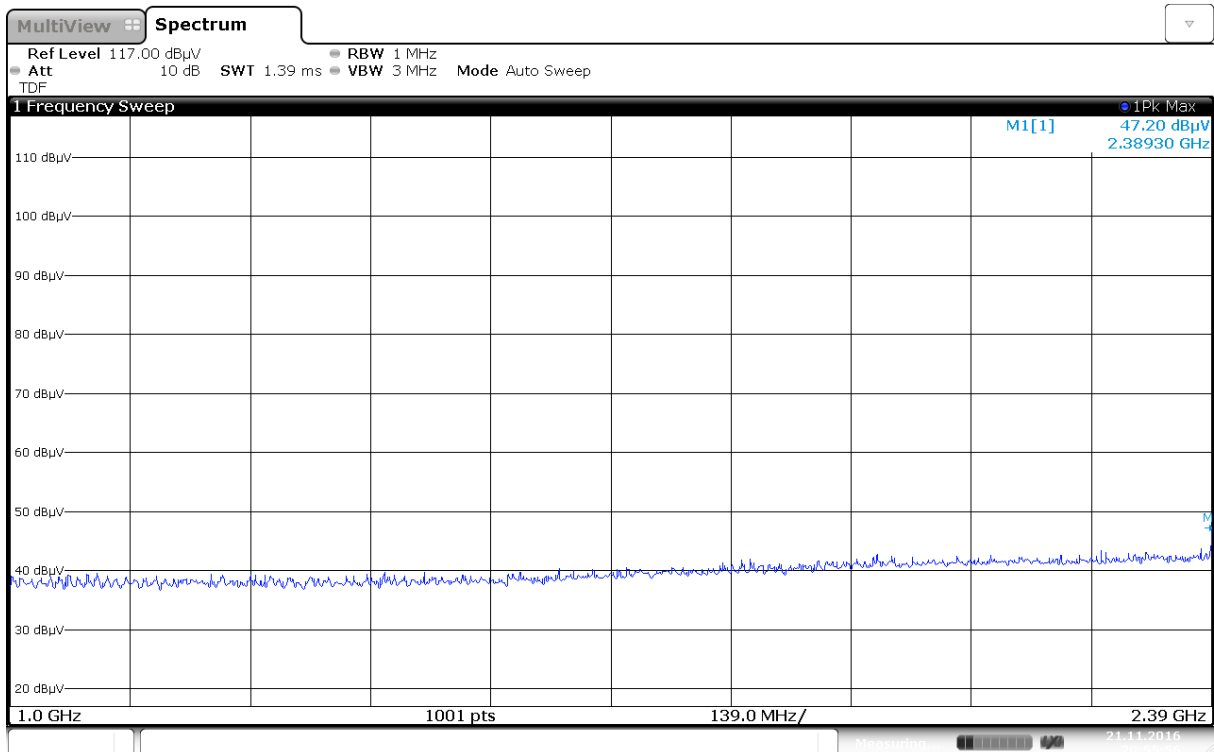
Radiated Emissions, 1000 -2390 MHz, 2412MHz, HP, 802.11b, 1Mb, Ant0



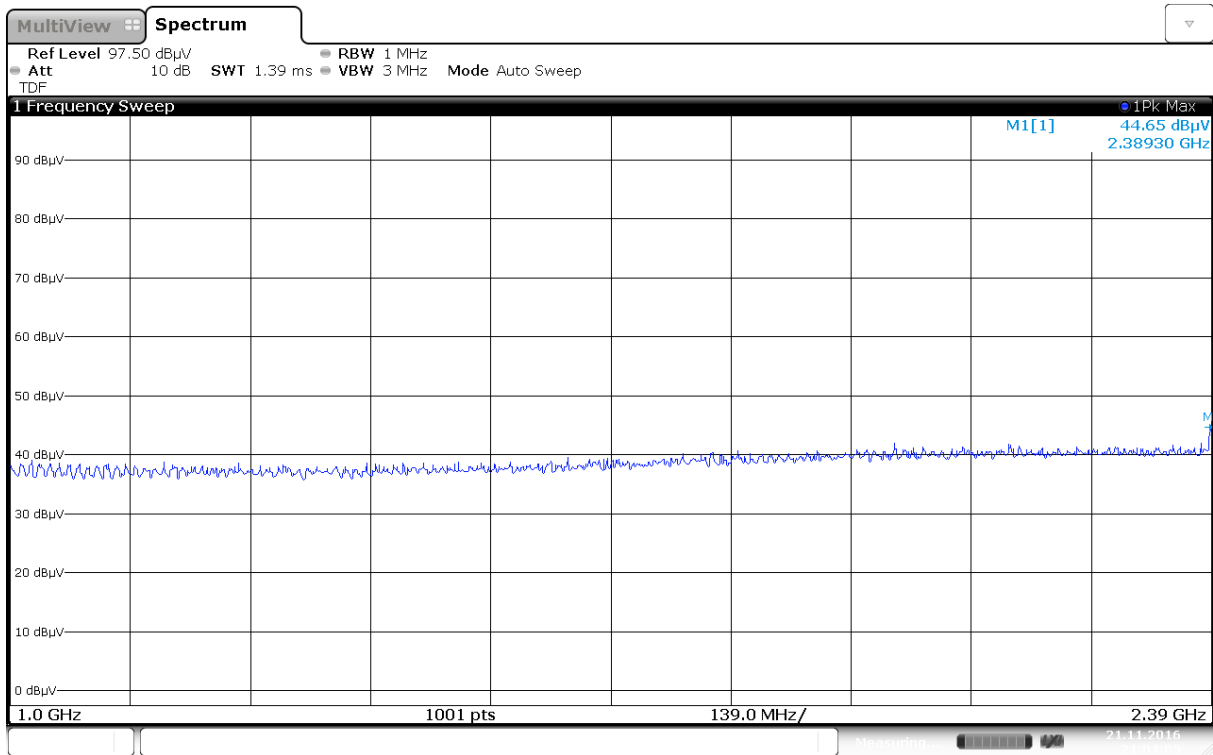
Radiated Emissions, 1000 -2390 MHz, 2412MHz, VP, 802.11b, 1Mb, Ant0



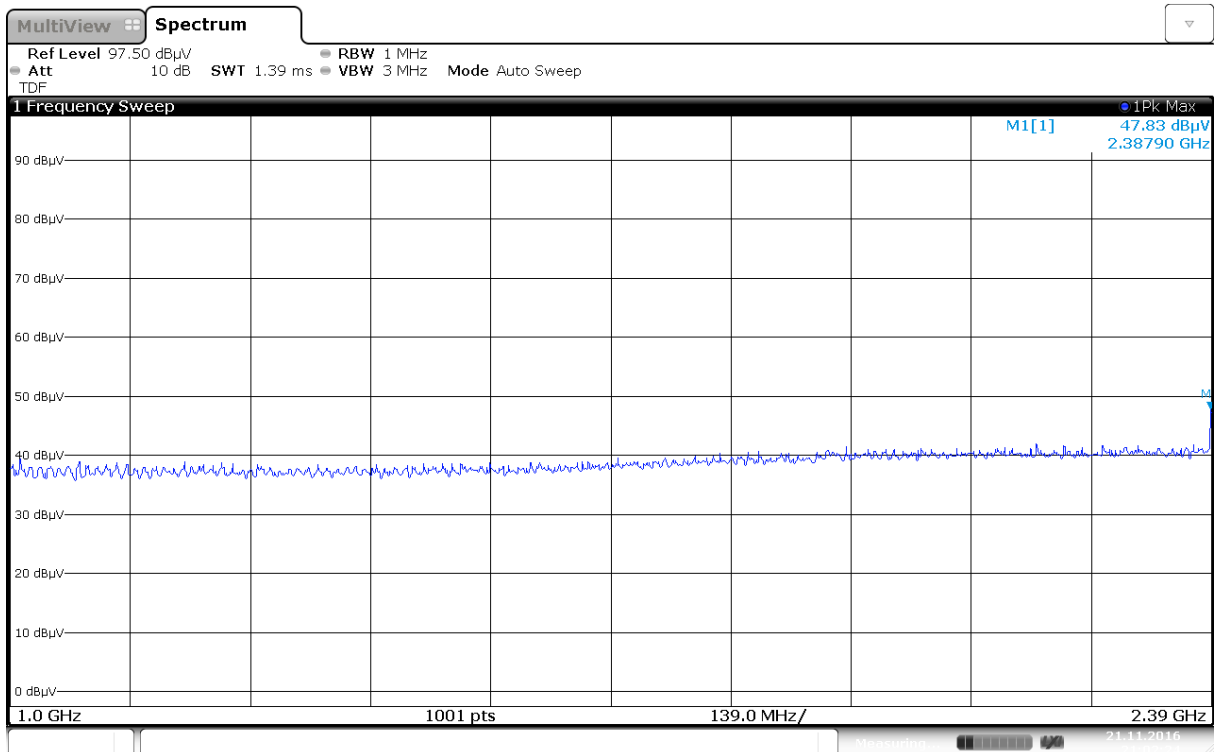
Radiated Emissions, 1000 -2390 MHz, 2412MHz, HP, 802.11b, 1Mb, Ant1



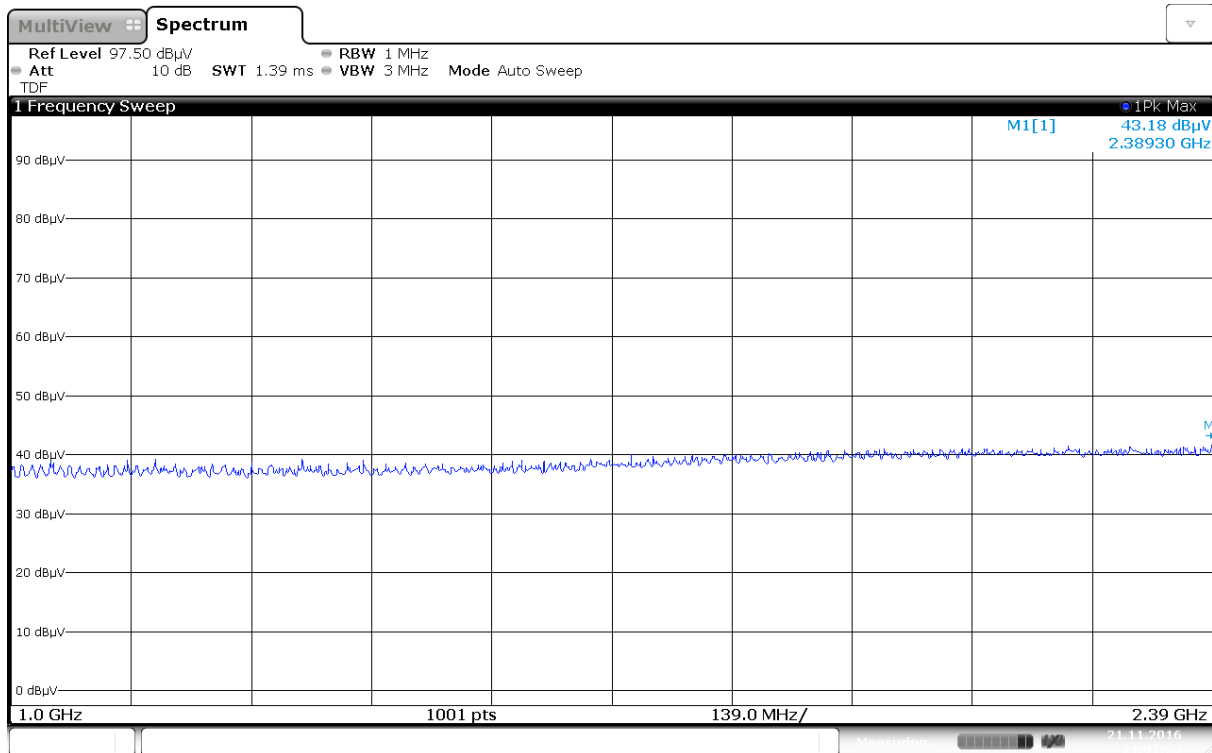
Radiated Emissions, 1000 -2390 MHz, 2412MHz, VP, 802.11b, 1Mb, Ant1



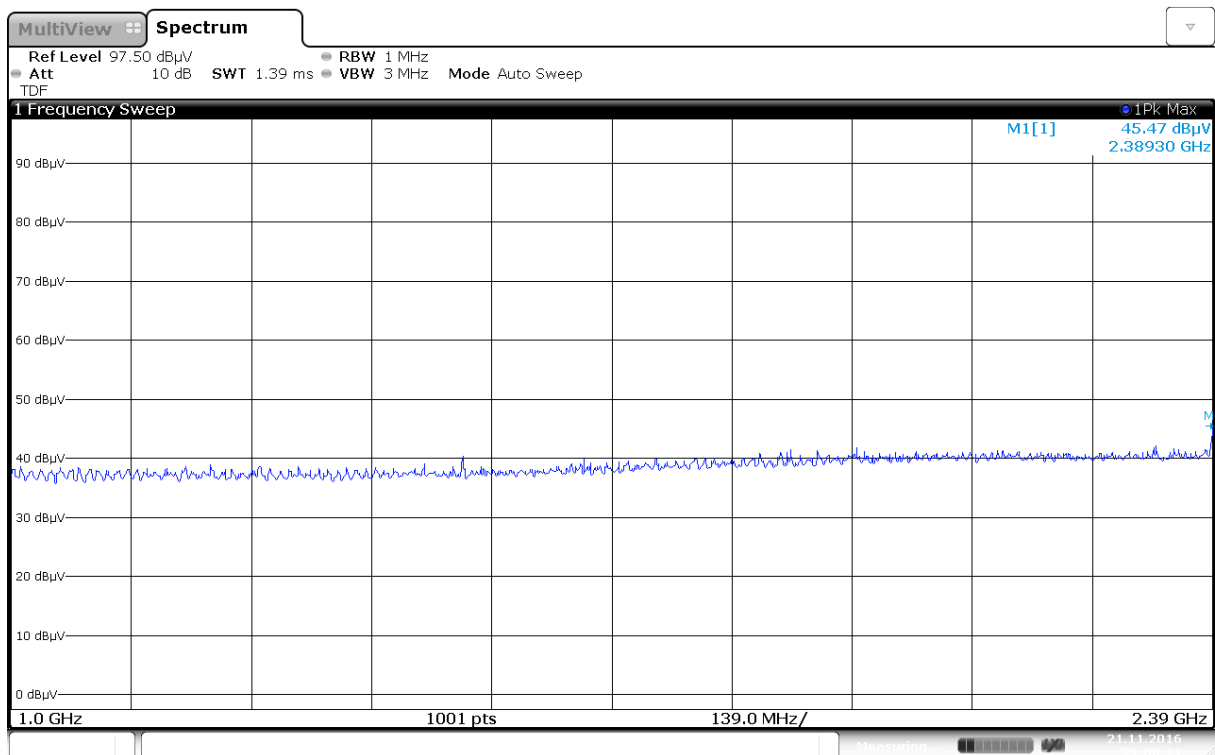
Radiated Emissions, 1000 -2390 MHz, 2412MHz, HP, 802.11g, 6Mb, Ant0



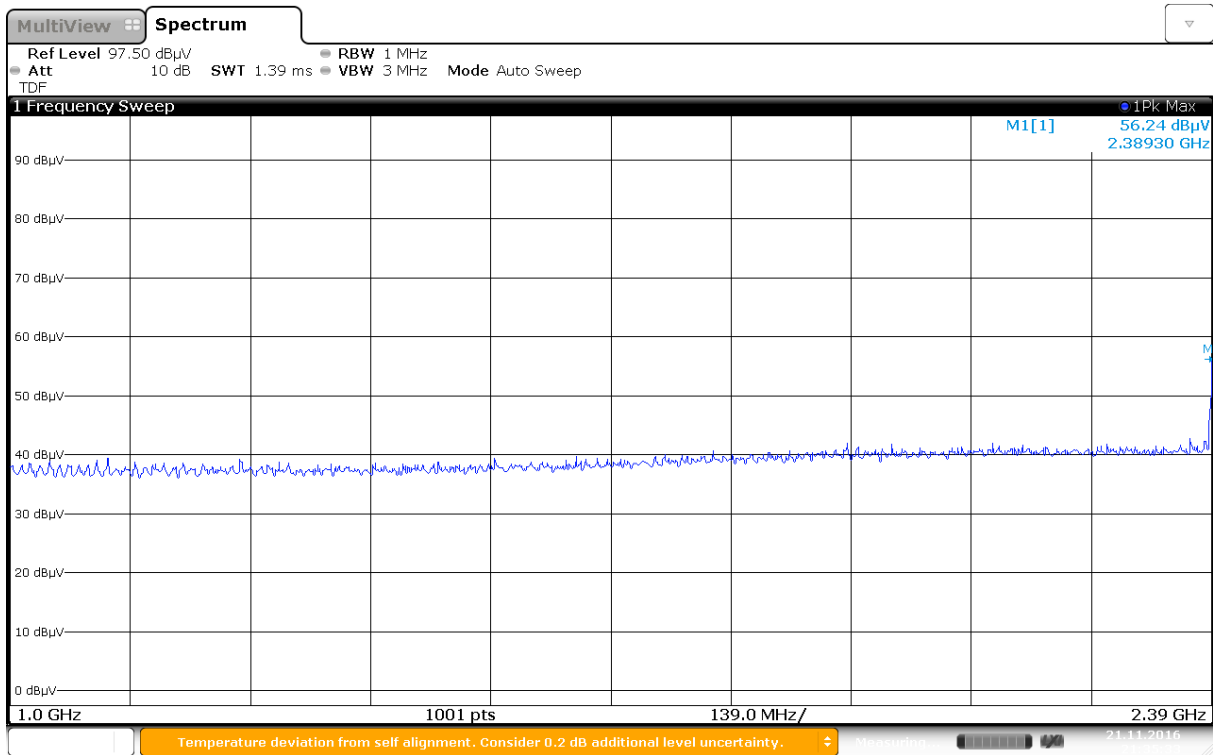
Radiated Emissions, 1000 -2390 MHz, 2412MHz, VP, 802.11g, 6Mb, Ant0



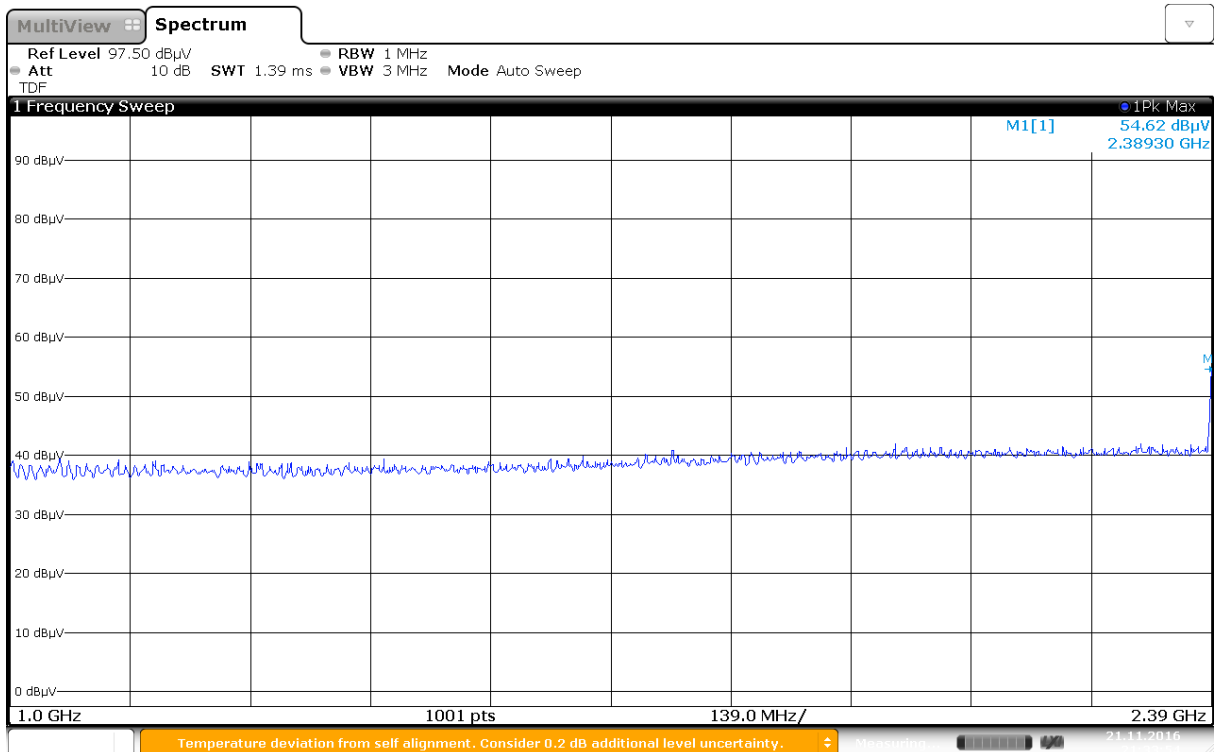
Radiated Emissions, 1000 -2390 MHz, 2412MHz, HP, 802.11g, 6Mb, Ant1



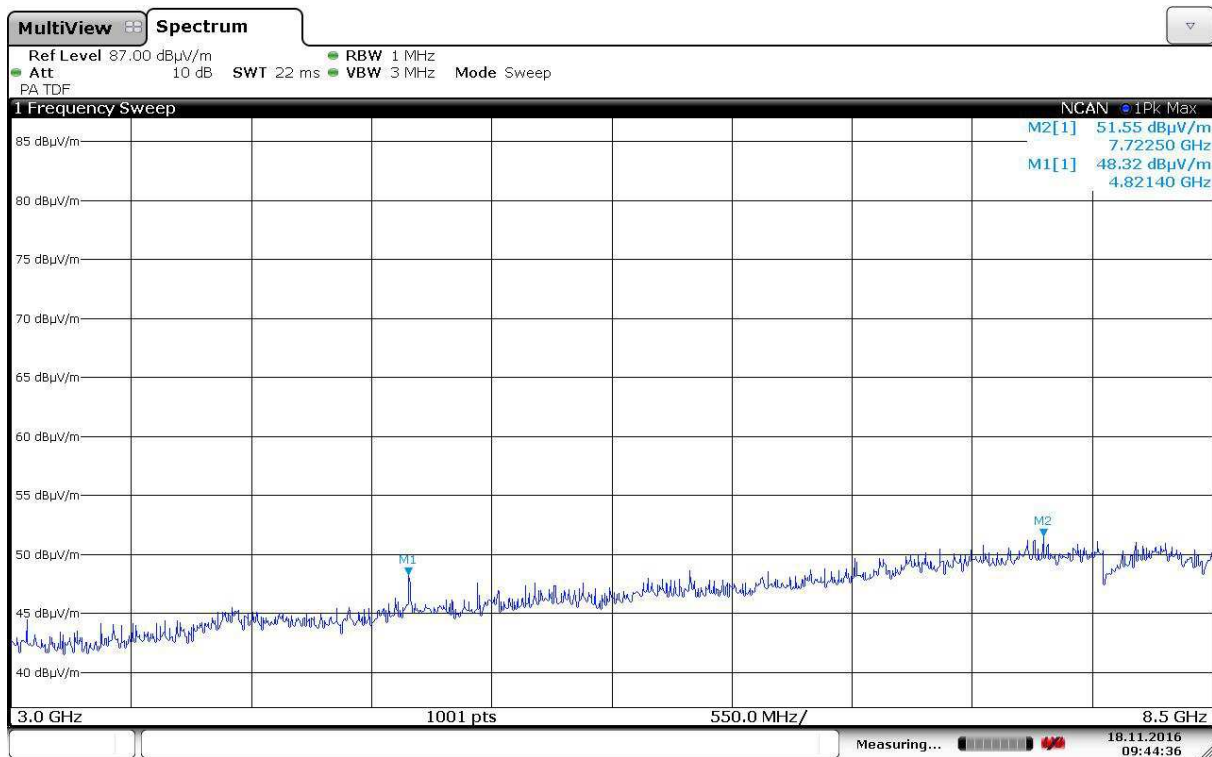
Radiated Emissions, 1000 -2390 MHz, 2412MHz, VP, 802.11g, 6Mb, Ant1



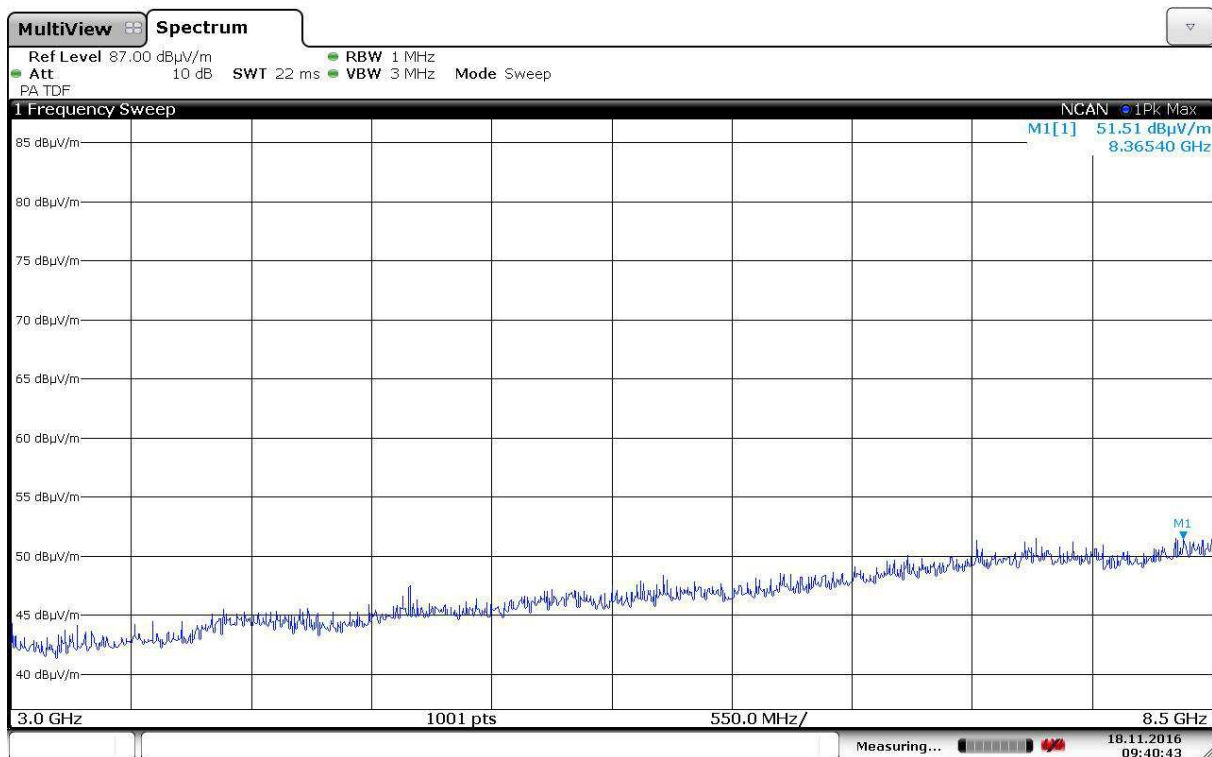
Radiated Emissions, 1000 -2390 MHz, 2412MHz, HP, 802.11n, MCS0, MIMO



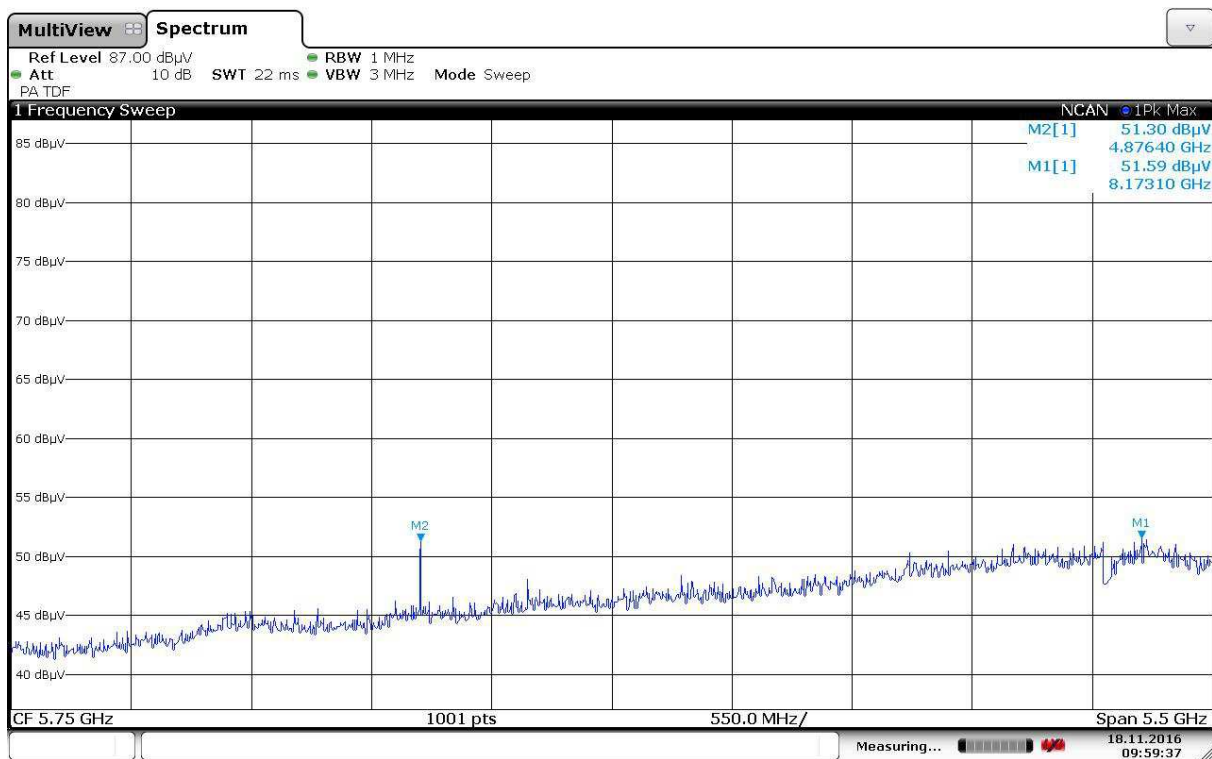
Radiated Emissions, 1000 -2390 MHz, 2412MHz, VP, 802.11n, MCS0, MIMO



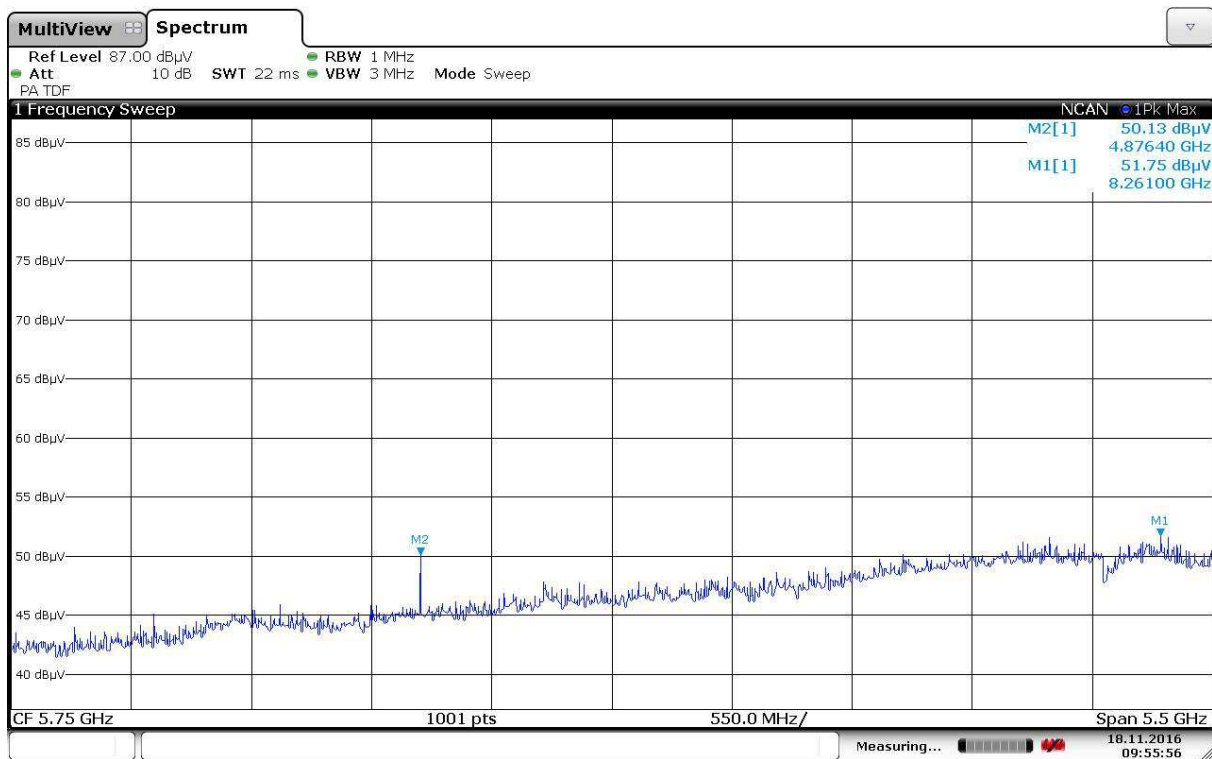
Radiated Emissions, 3000 -8500 MHz, 2412MHz, HP, 802.11b, 6Mbps, Ant0



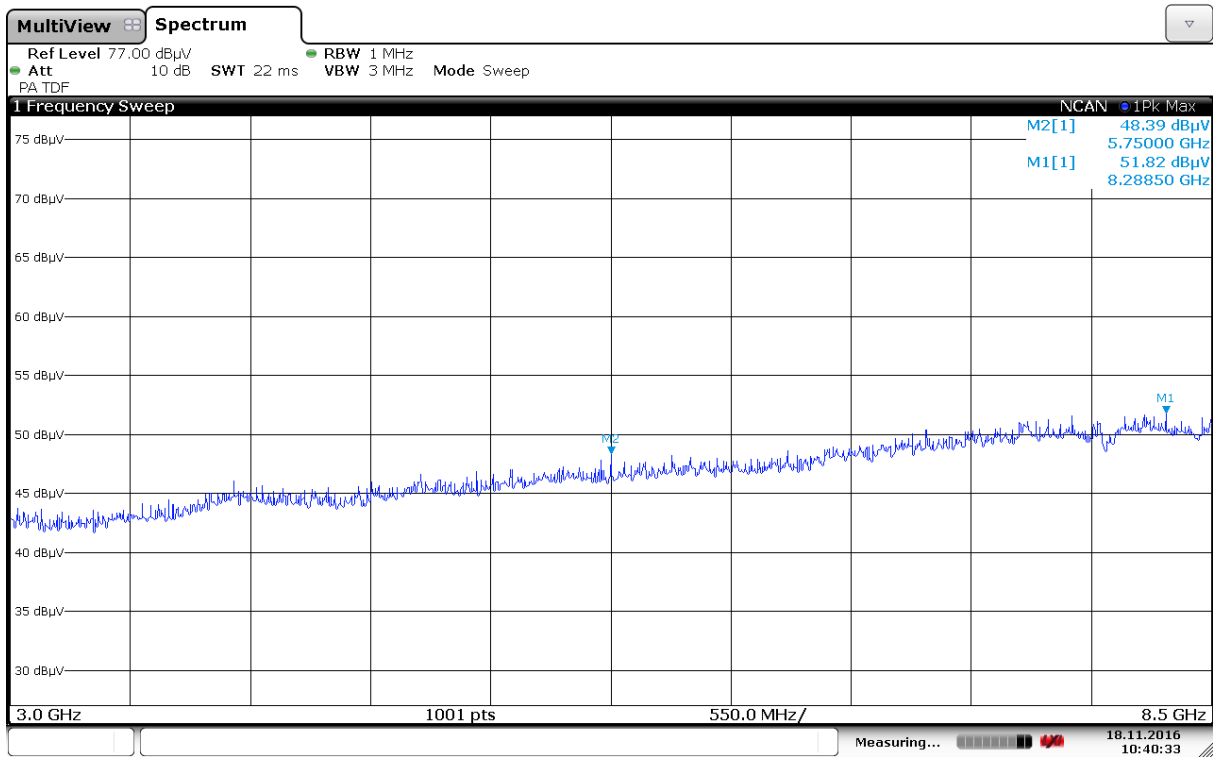
Radiated Emissions, 3000 -8500 MHz, 2412MHz, VP, 802.11b, 6Mbps, Ant0



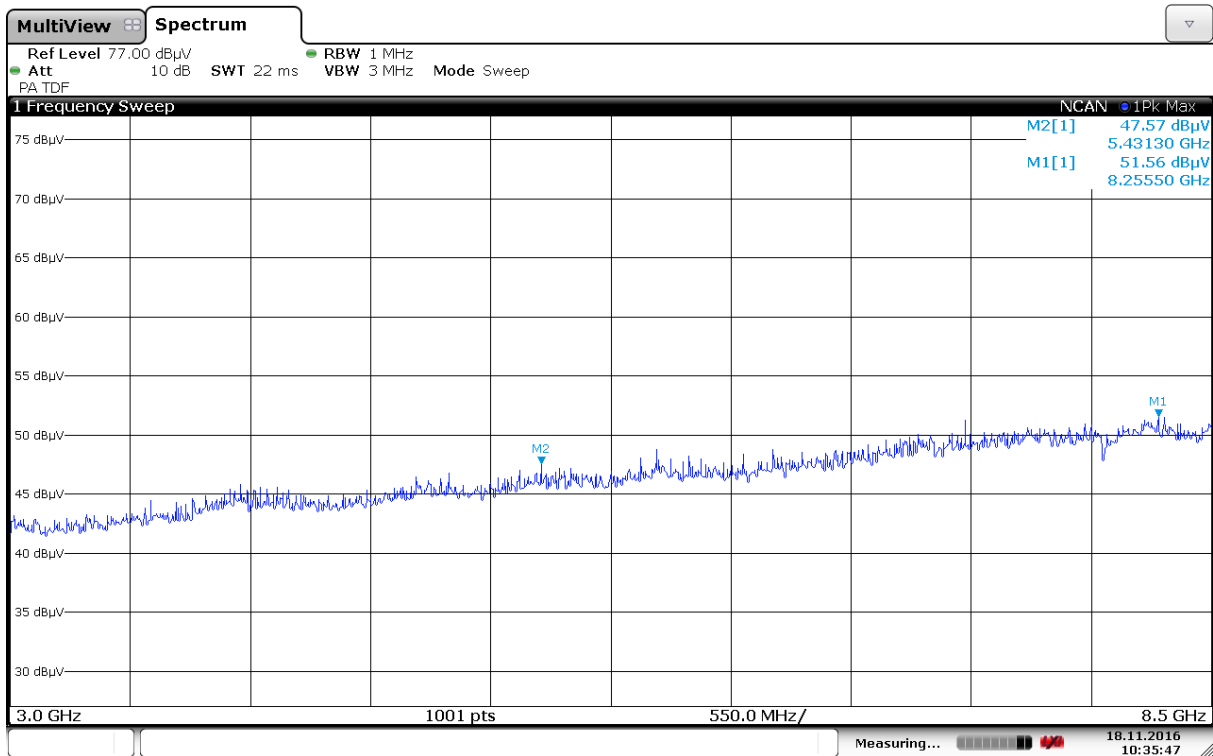
Radiated Emissions, 3000 -8500 MHz, 2442MHz, HP, 802.11b, 6Mbps, Ant1



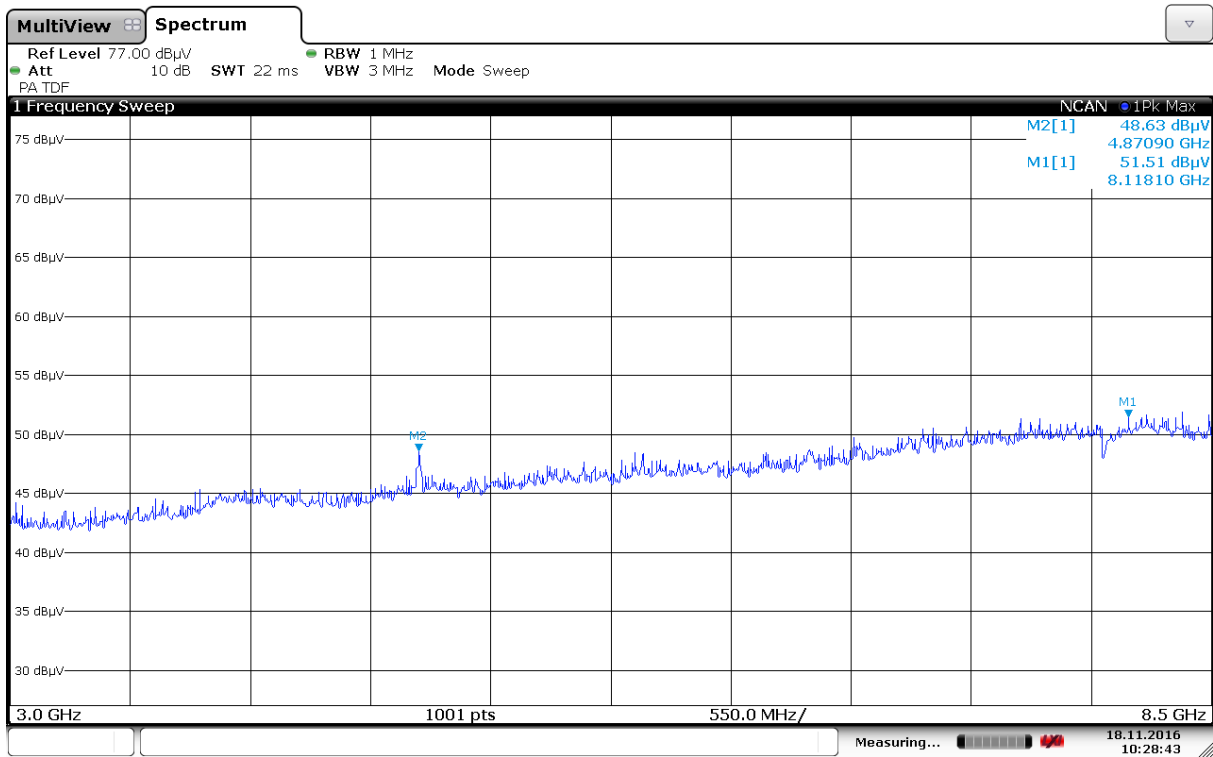
Radiated Emissions, 3000 -8500 MHz, 2442MHz, VP, 802.11b, 6Mbps, Ant1



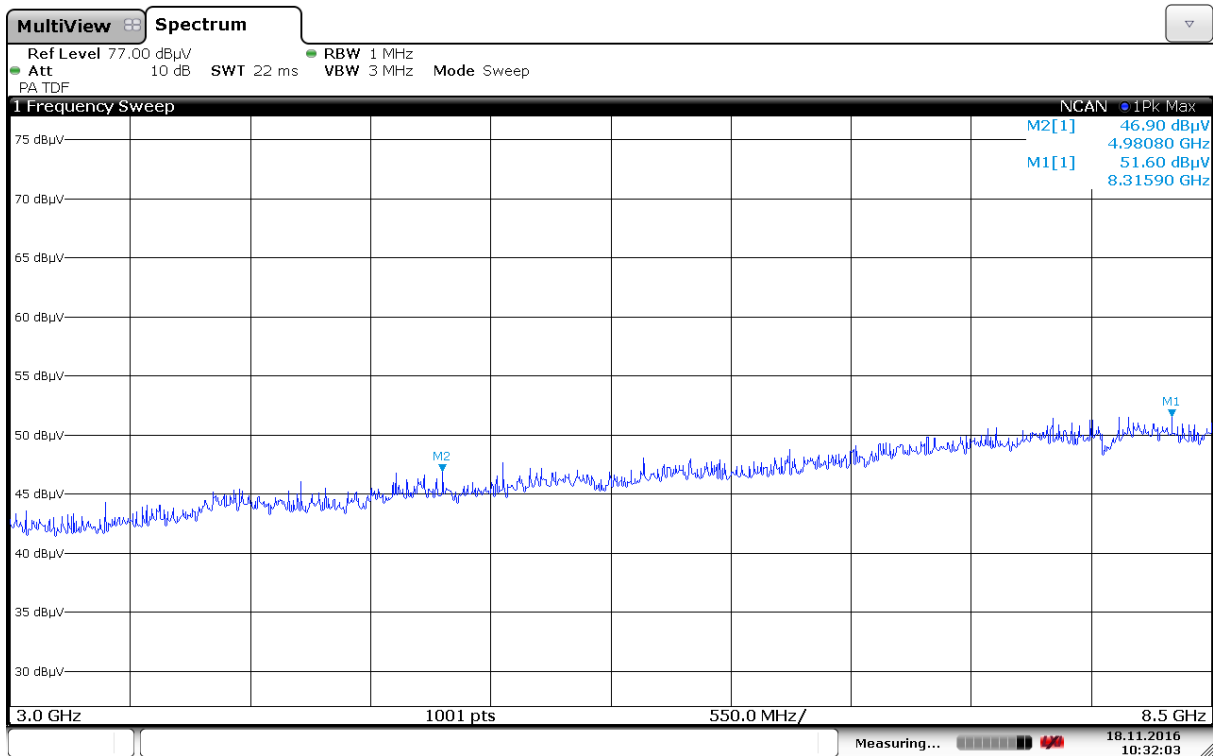
Radiated Emissions, 3000 -8500 MHz, 2442MHz, HP, 802.11g, 6Mbps, Ant0



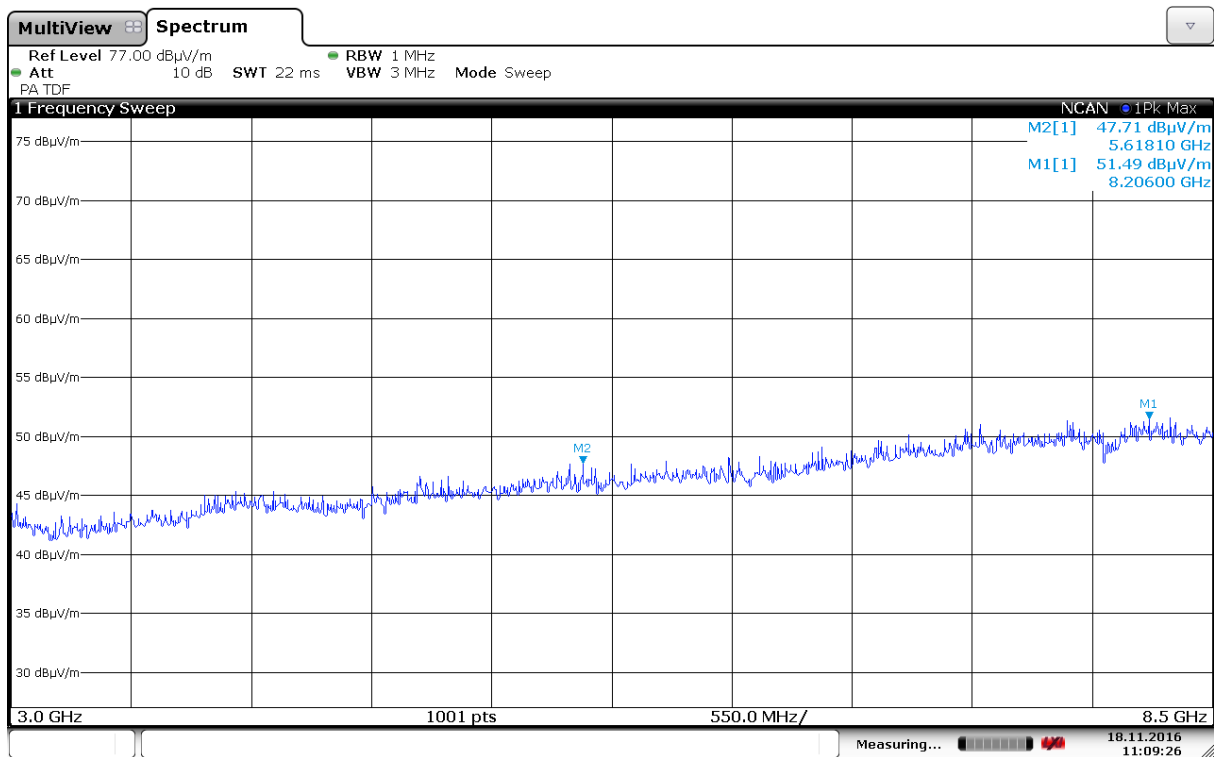
Radiated Emissions, 3000 -8500 MHz, 2442MHz, VP, 802.11g, 6Mbps, Ant0



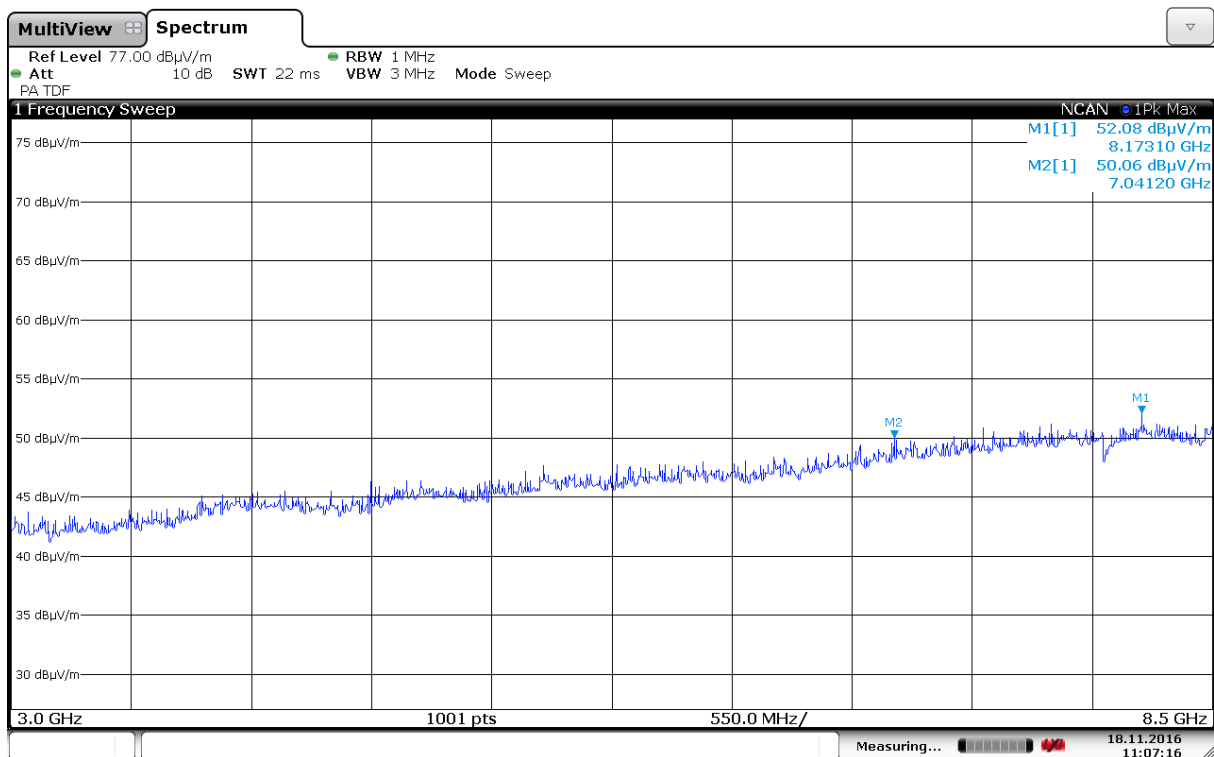
Radiated Emissions, 3000 -8500 MHz, 2442MHz, HP, 802.11g, 6Mbps, Ant1



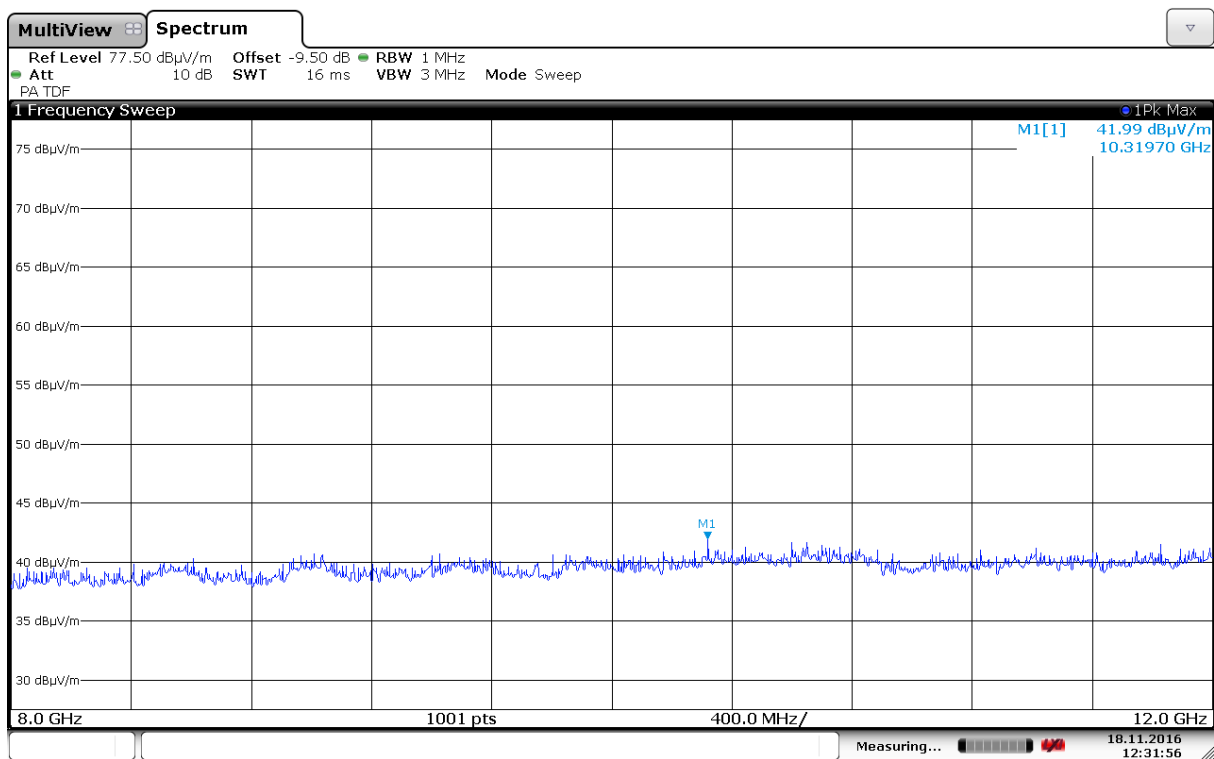
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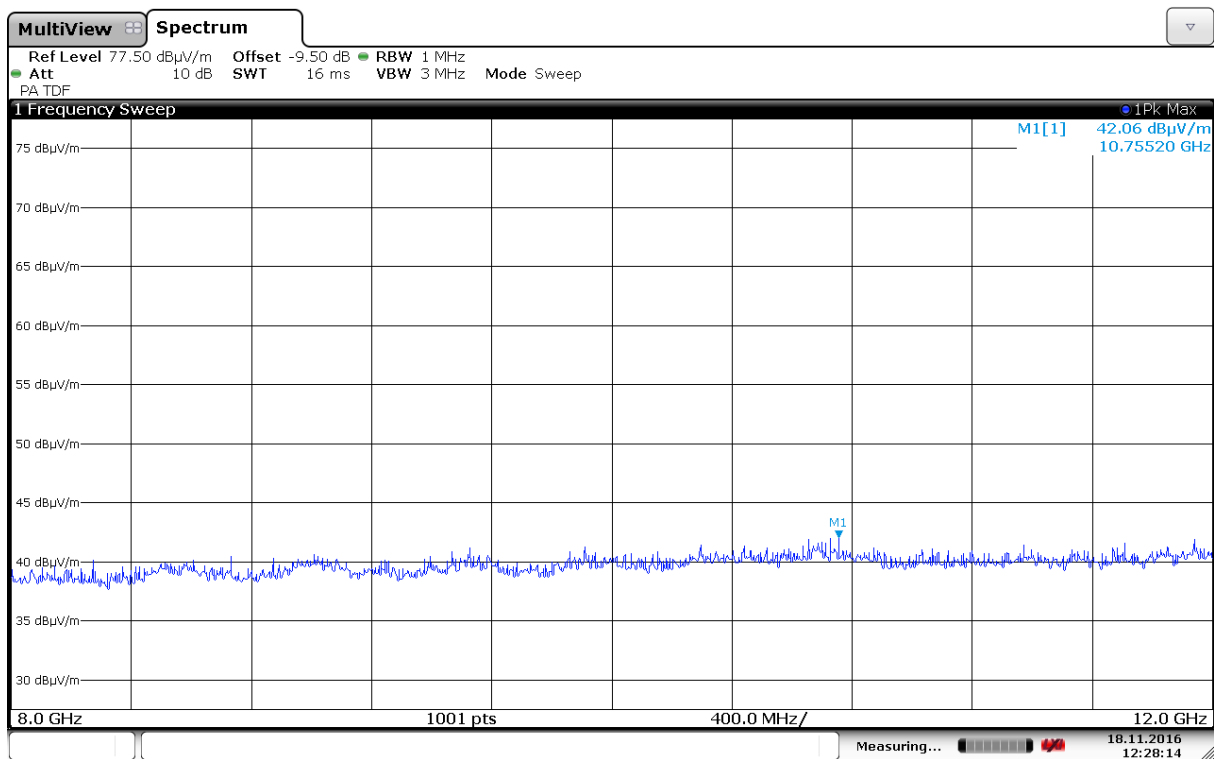
Radiated Emissions, 3000 -8500 MHz, 2442MHz, HP, 802.11n, MCS0, MIMO



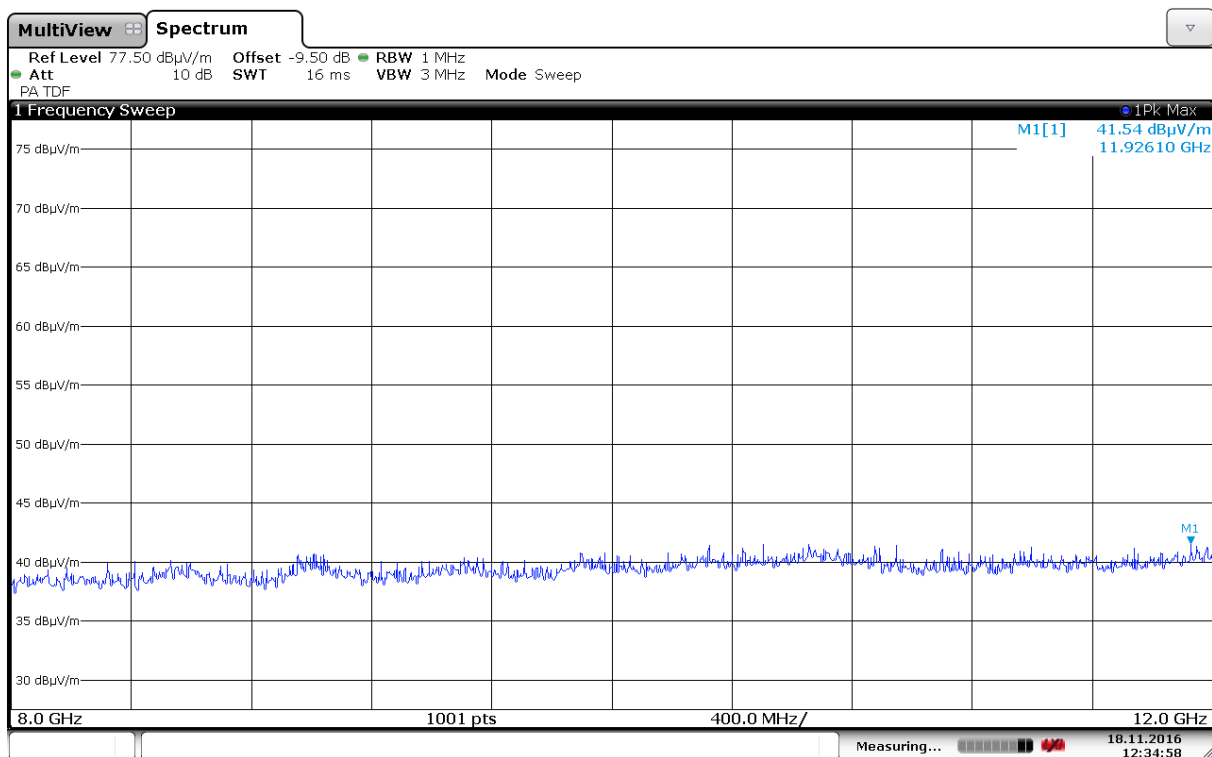
Radiated Emissions, 3000 -8500 MHz, 2442MHz, VP, 802.11n, MCS0, MIMO



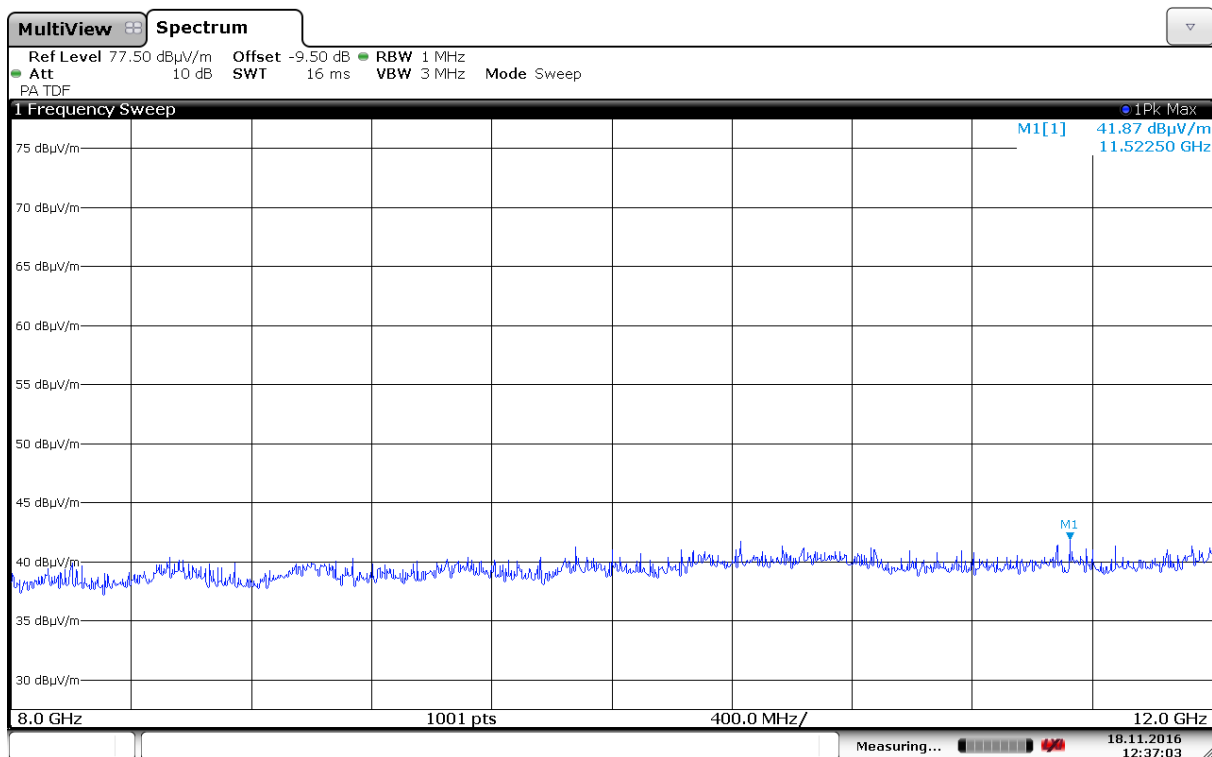
Radiated Emissions, 8000 -12000 MHz, 2437MHz, HP, 802.11b, 6Mbps, Ant0



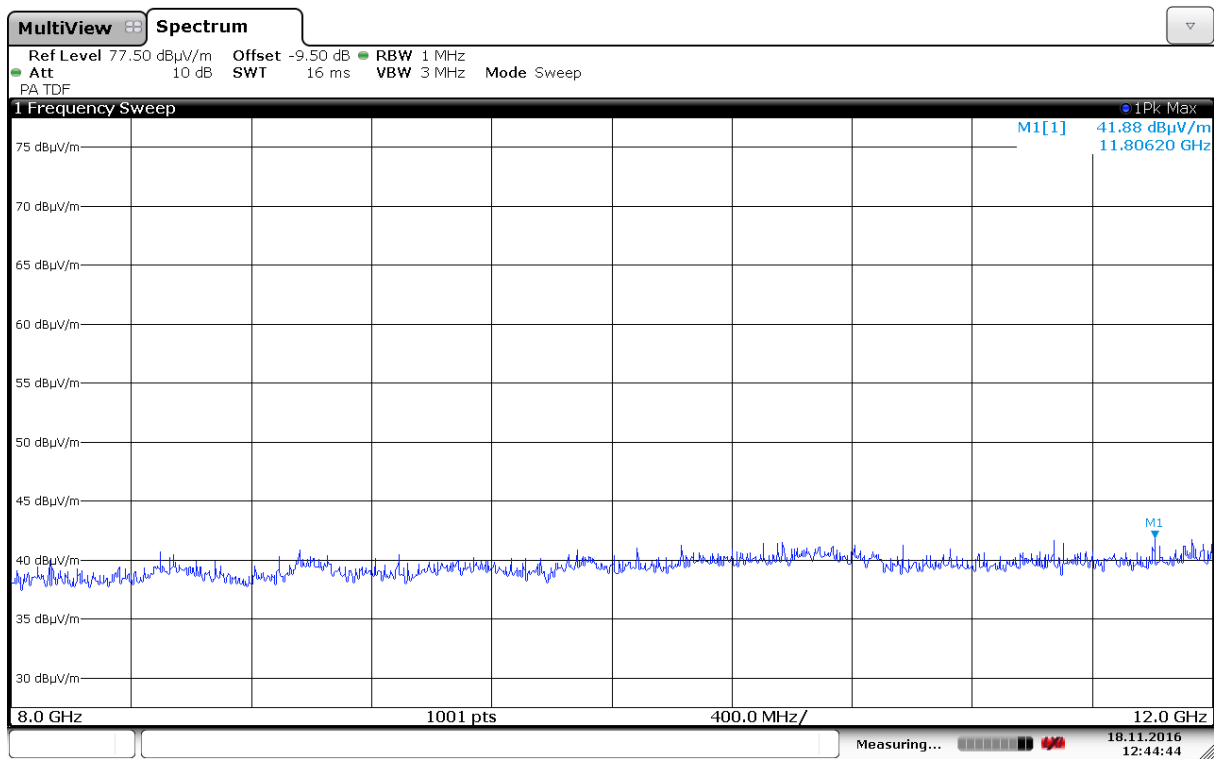
Radiated Emissions, 8000 -12000 MHz, 2437MHz, VP, 802.11b, 6Mbps, Ant0



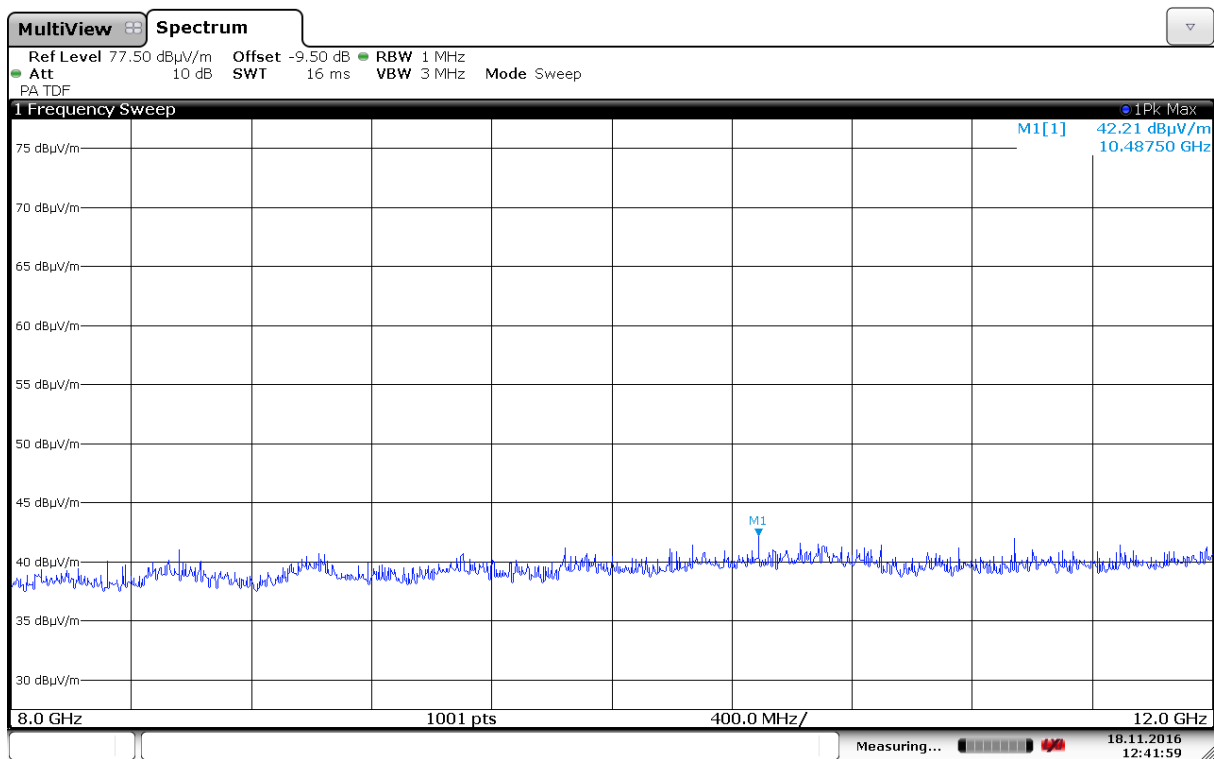
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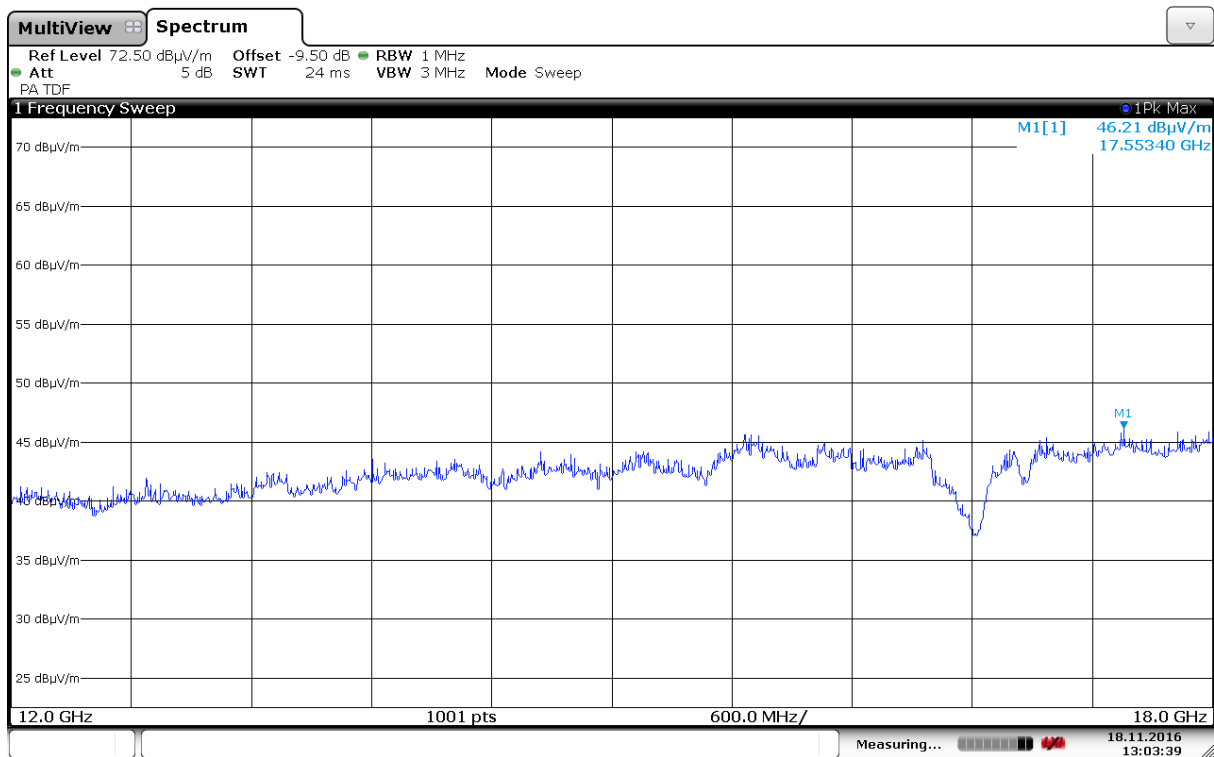
Radiated Emissions, 8000 -12000 MHz, 2437MHz, VP, 802.11b, 6Mbps, Ant1



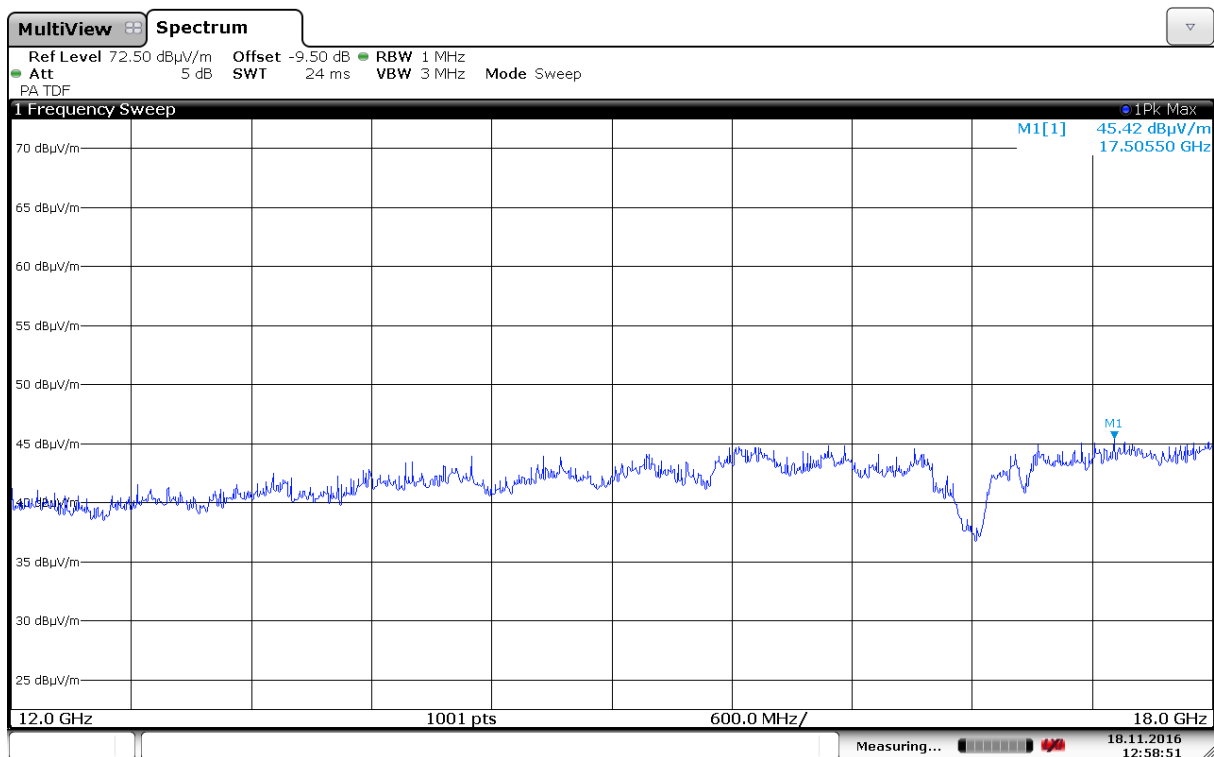
Radiated Emissions, 8000 -12000 MHz, 2437MHz, HP, 802.11n, MCS0, MIMO



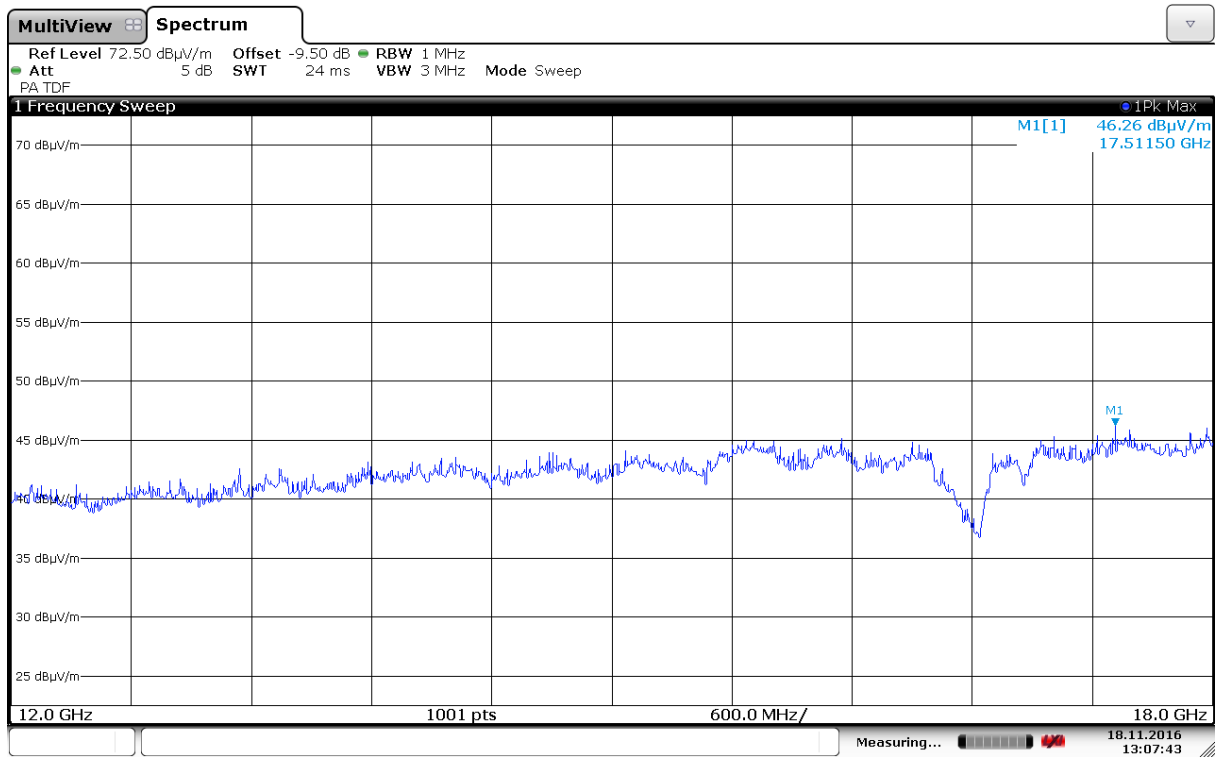
Radiated Emissions, 8000 -12000 MHz, 2437MHz, VP, 802.11n, MCS0, MIMO



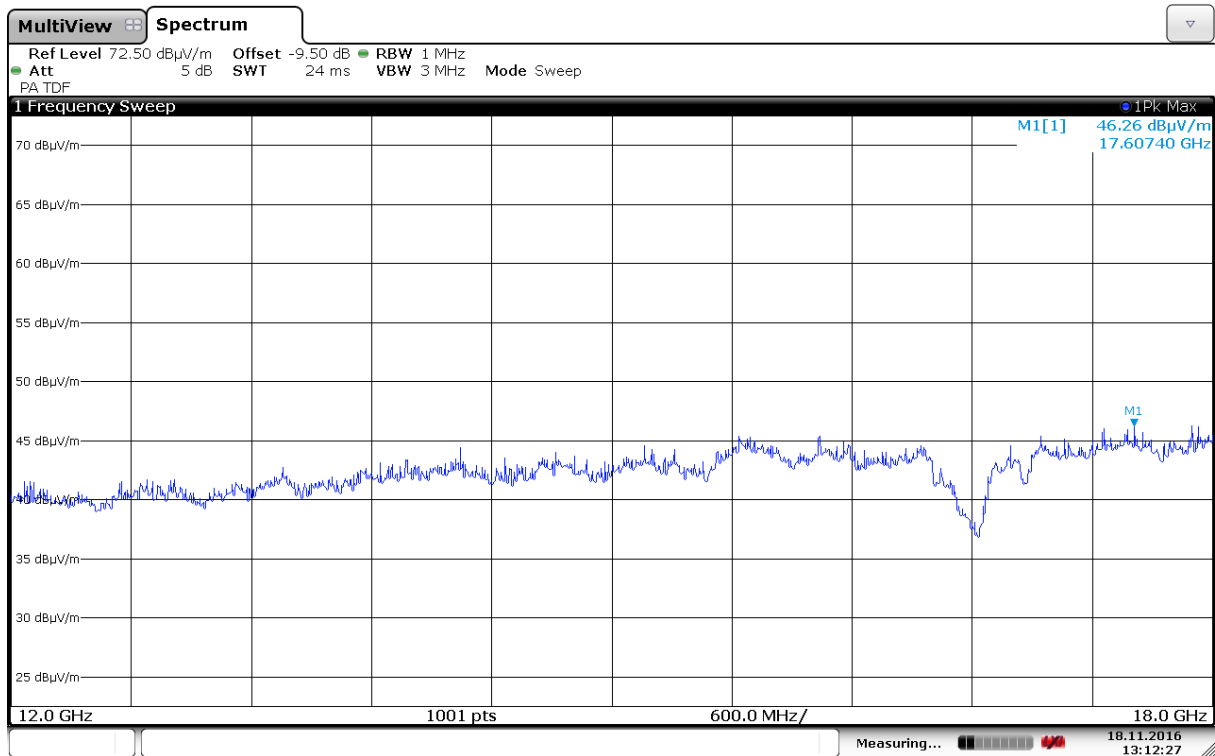
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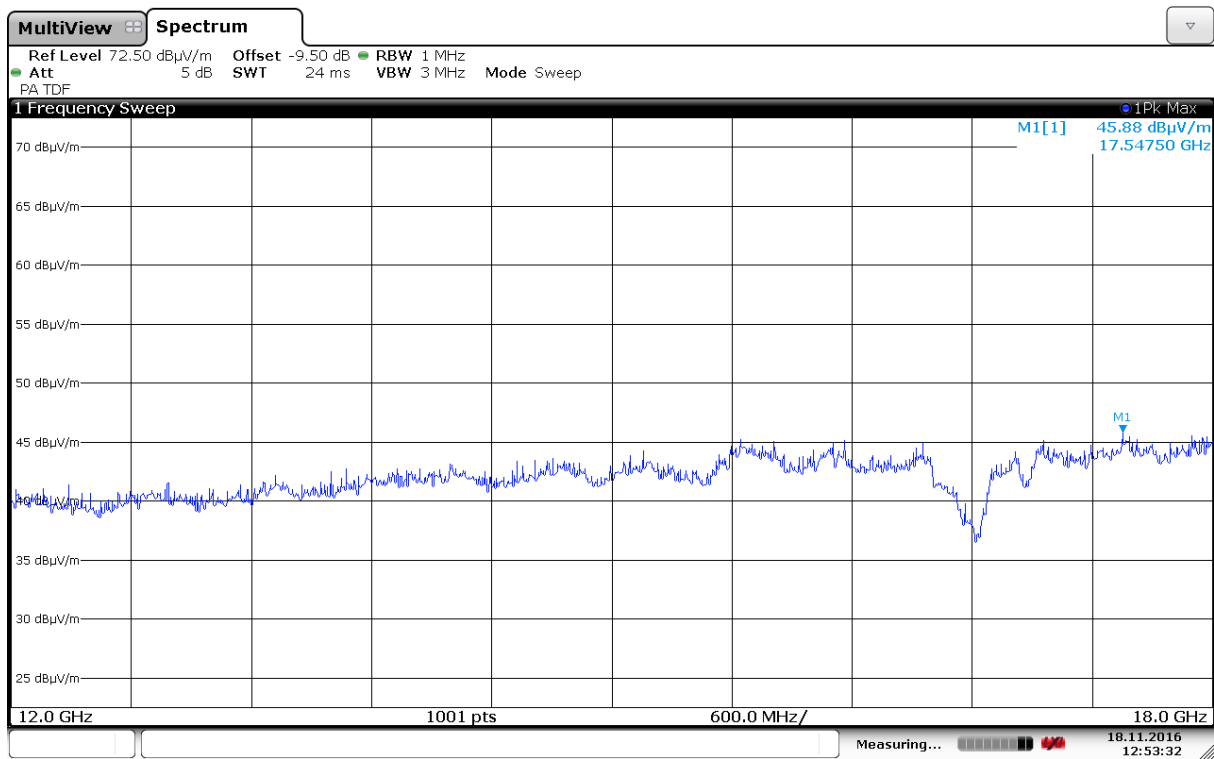
Radiated Emissions, 12000 -18000 MHz, 2437MHz, VP, 802.11b, 6Mbps, Ant0



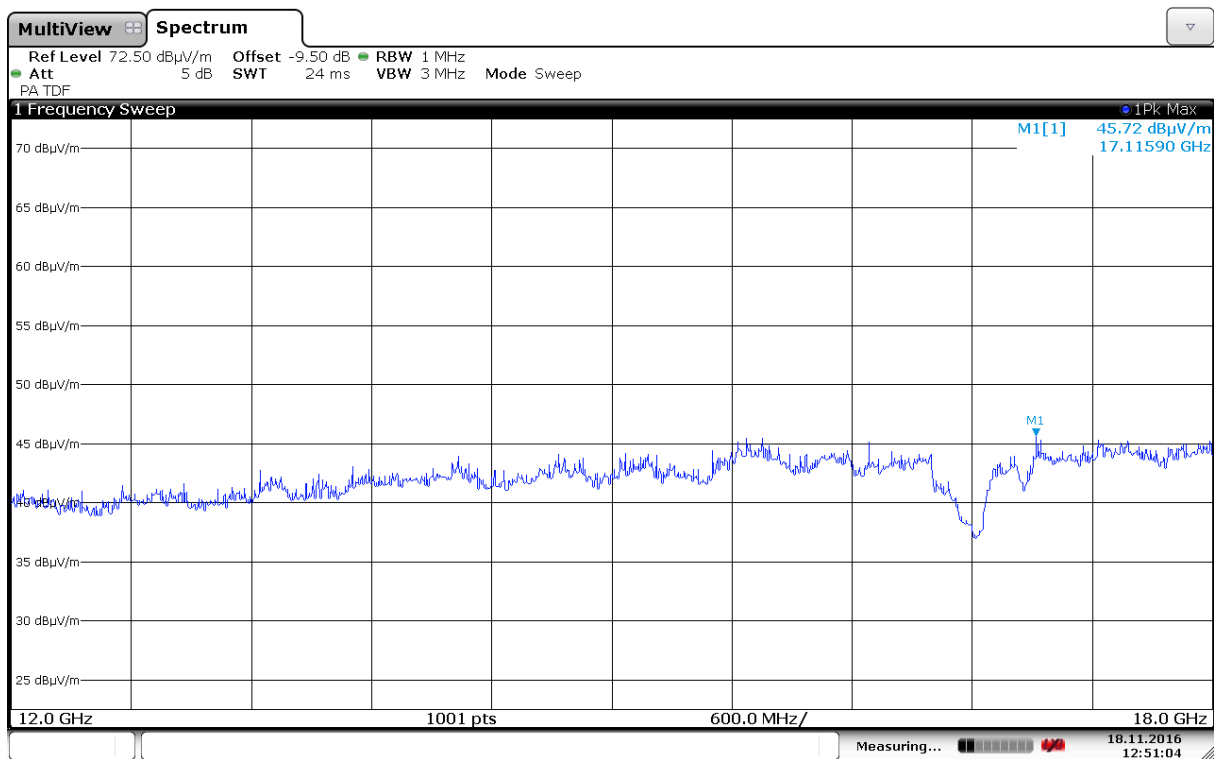
Radiated Emissions, 12000 -18000 MHz, 2437MHz, HP, 802.11b, 6Mbps, Ant1



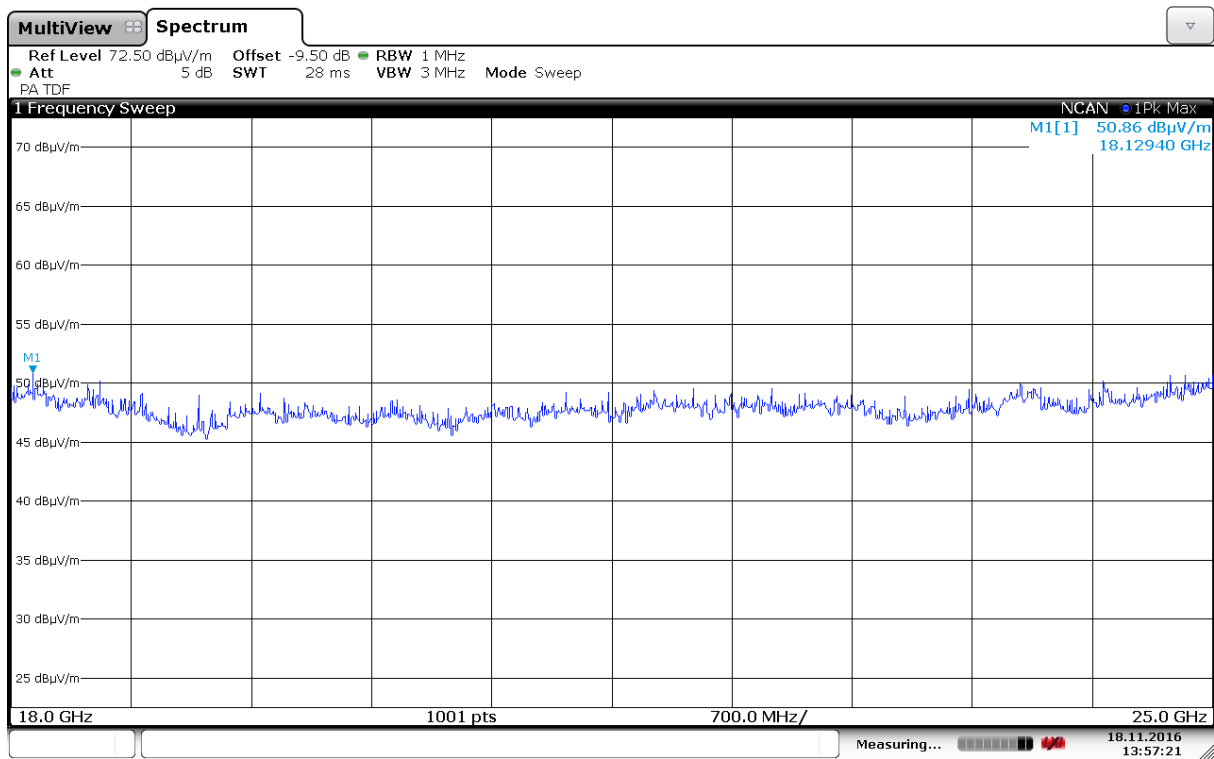
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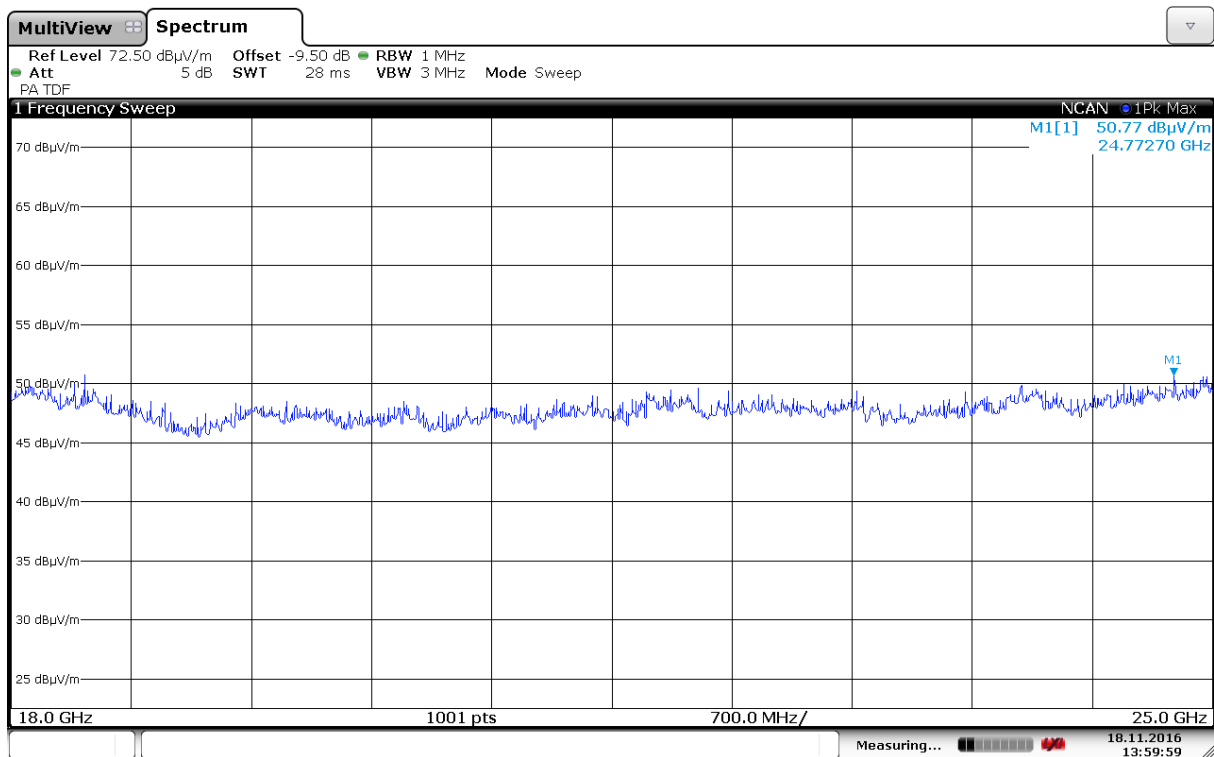
Radiated Emissions, 12000 -18000 MHz, 2437MHz, HP, 802.11n, MCS0, MIMO



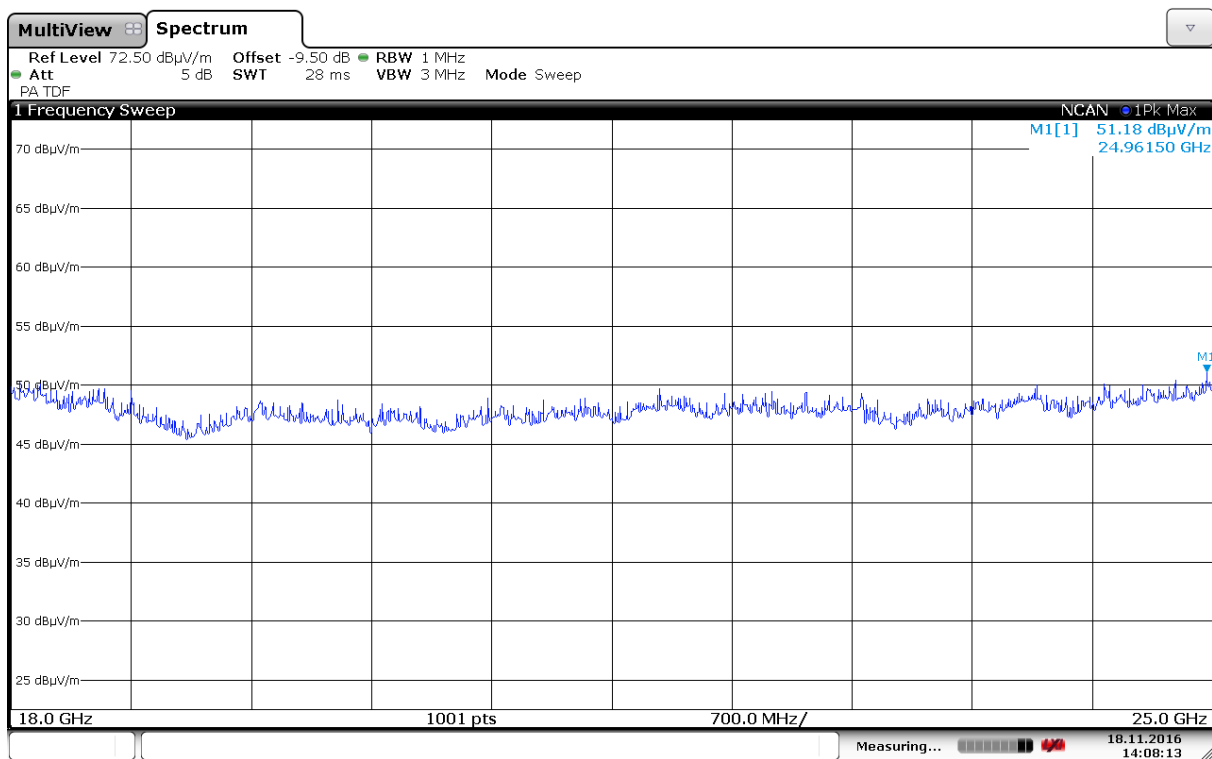
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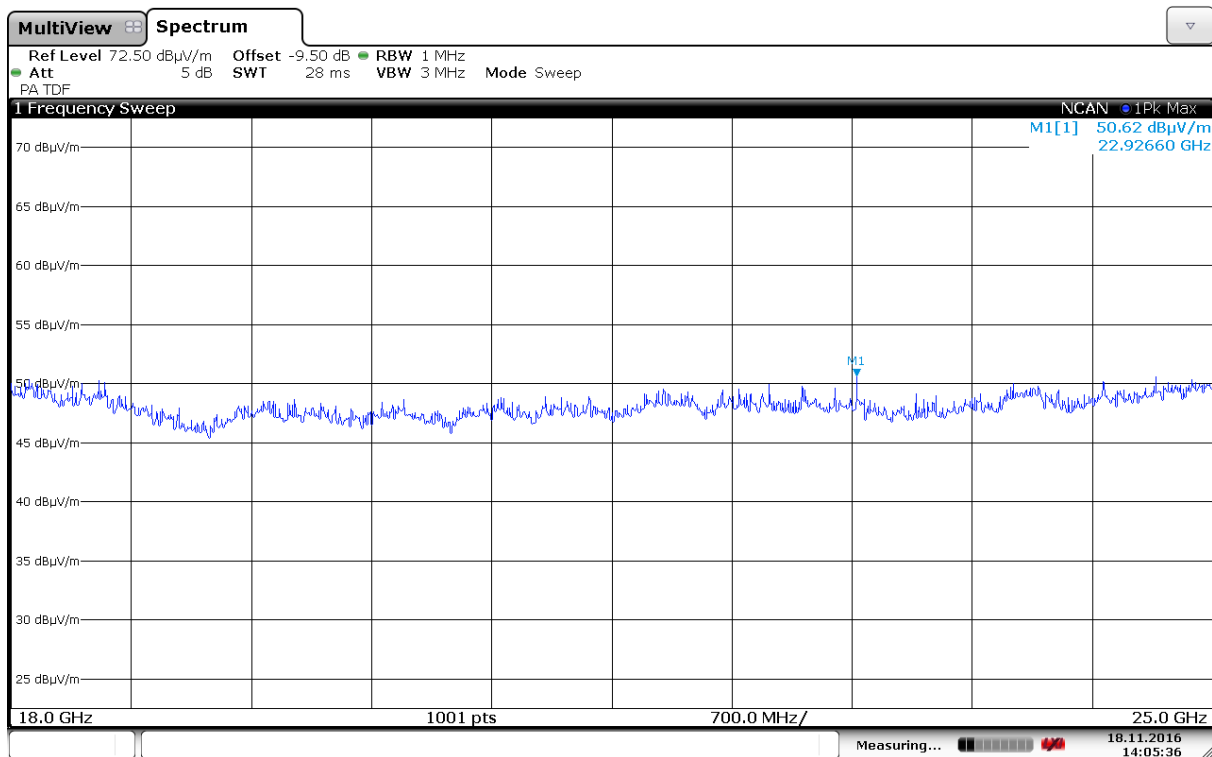
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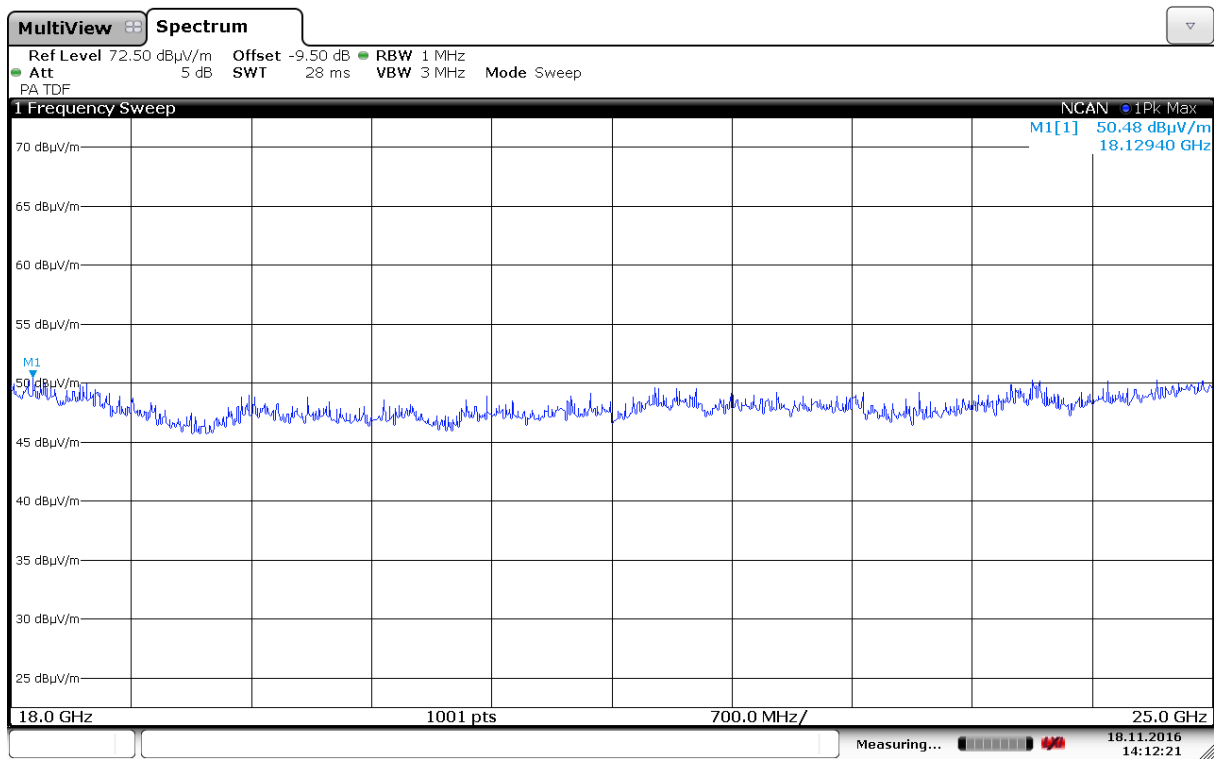
Radiated Emissions, 18000 -25000 MHz, 2437MHz, VP, 802.11b, 6Mbps, Ant0



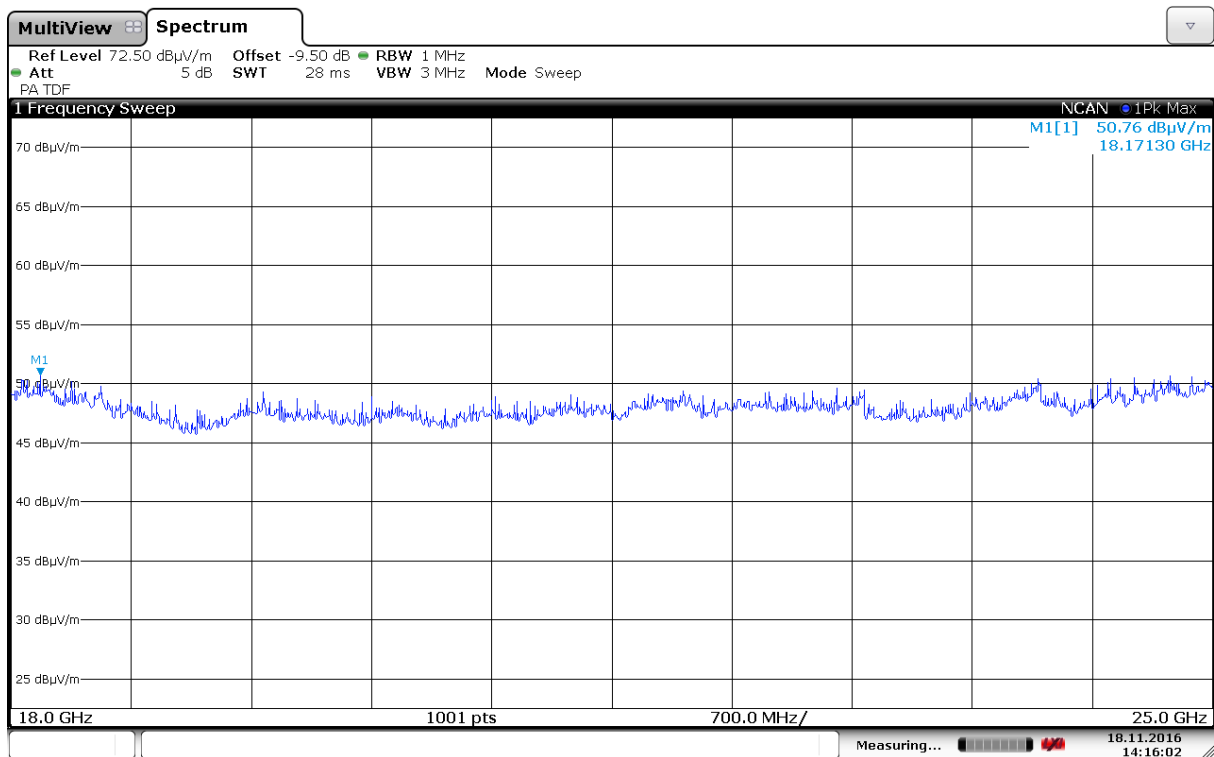
Radiated Emissions, 18000 -25000 MHz, 2437MHz, HP, 802.11b, 6Mbps, Ant1



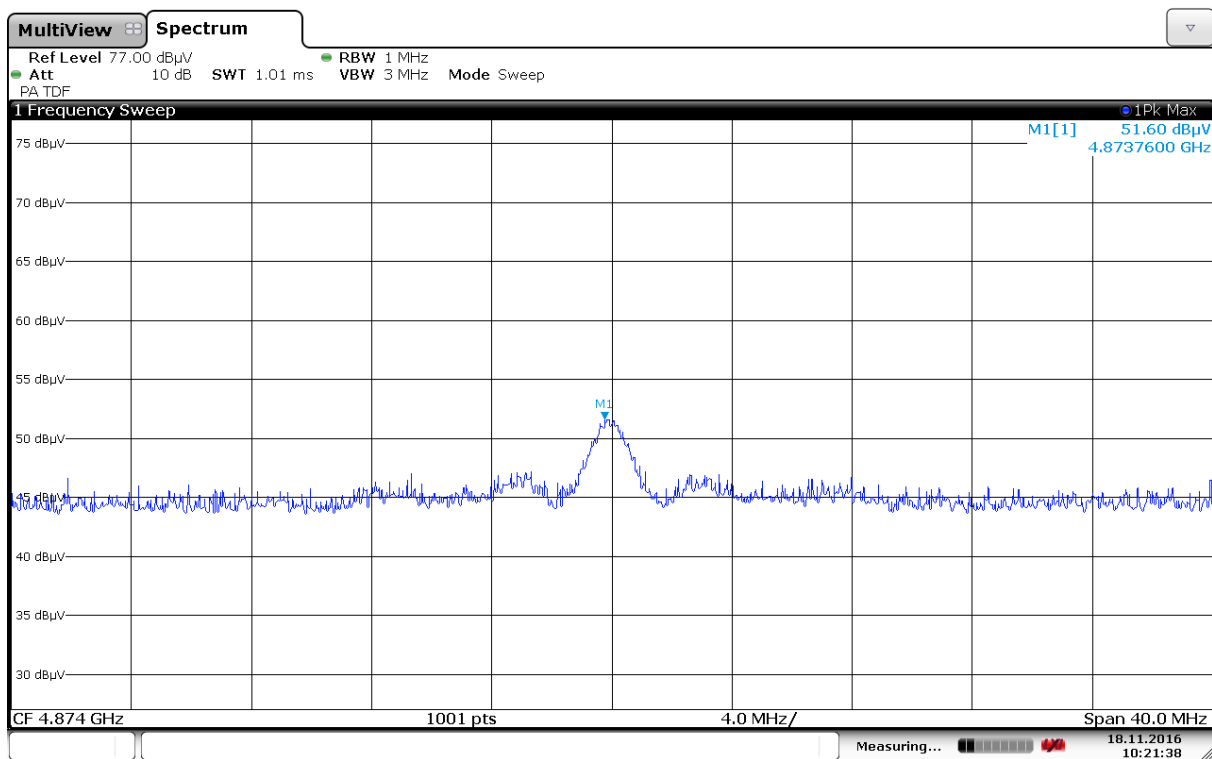
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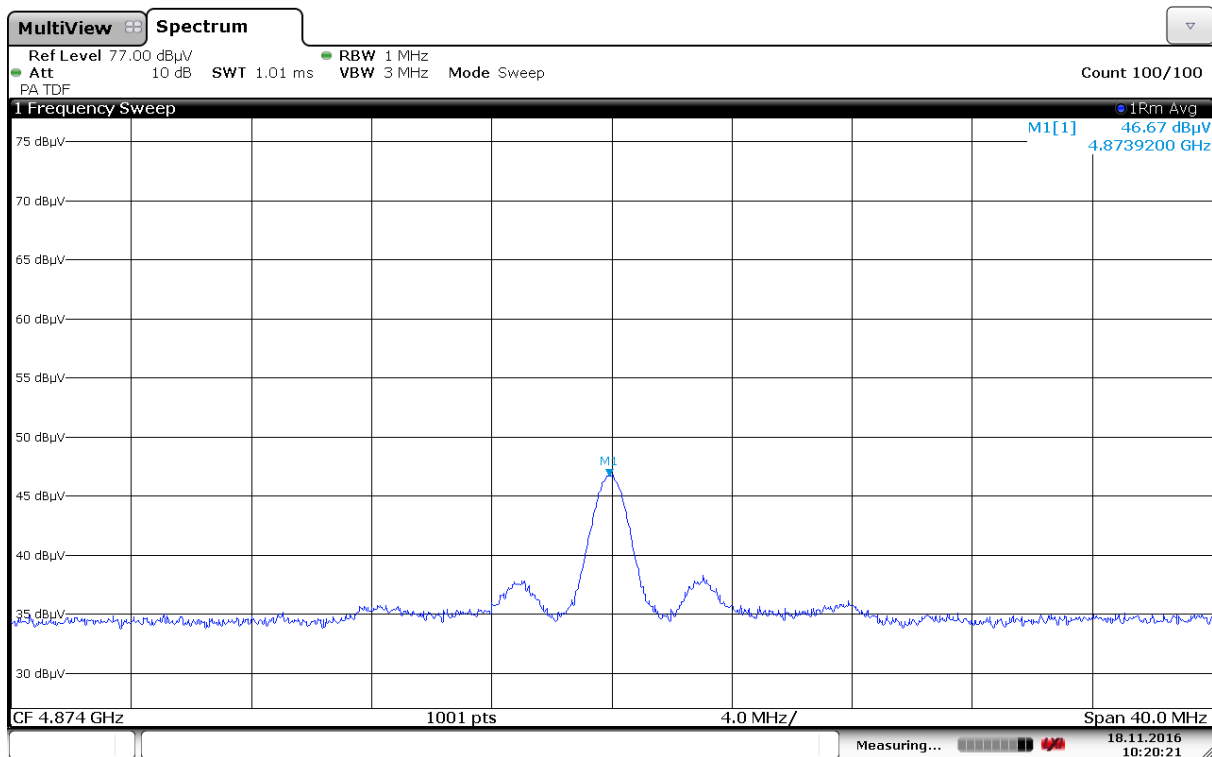
Radiated Emissions, 18000 -25000 MHz, 2437MHz, HP, 802.11n, MCS0, MIMO



Radiated Emissions, 18000 -25000 MHz, 2437MHz, VP, 802.11n, MCS0, MIMO



Radiated Emissions Pk, 4874MHz, 2437MHz, HP, 802.11b, 1Mb, Ant1



Radiated Emissions Av, 4874MHz, 2437MHz, HP, 802.11b, 1Mb, Ant1

4 Measurement Uncertainty

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

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

5 LIST OF TEST EQUIPMENT

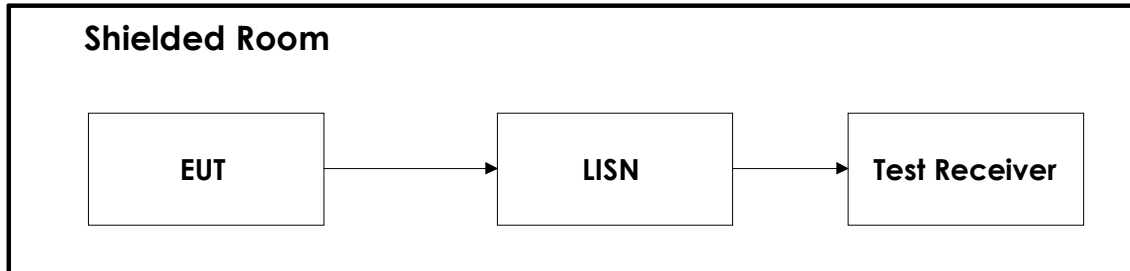
To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment and ancillaries are identified (numbered) by the Test Laboratory.

No.	Model	Description	Manufacturer	Asset no.	Cal. date	Cal. Due
1	FSW40	Spectrum Analyzer	Rohde & Schwarz	LR 1690	2016.07	2017.07
2	ESU40	Measuring Receiver	Rohde & Schwarz	LR 1639	2015.11 2016.12	2016.11 2017.12
3	ESR7	Measuring Receiver	Rohde & Schwarz	LR 1675	2015.12	2016.12
4	6HC3000/18000	Highpass Filter	Trilithic	LR 1614	Cal b4 use	
5	317	Preamplifier	Sonoma Instrument	LR 1687	2016.05	2017.05
6	8449A	Pre-amplifier	Hewlett Packard	LR 1322	2016.10	2017.10
7	6812B	AC Power Source	Agilent	LR1515	2015.12	2016.12
8	3115	Horn Antenna	EMCO	LR 1330	2016.10	2021.10
9	642	Antenna Horn	Narda	LR 220	2009.01	2019.01
10	PM7320X	Antenna Horn	Sivers Lab	LR 102	2009.01	2019.01
11	DBF-520-20	Antenna Horn	Systron Donner	LR 100	2009.01	2019.01
12	638	Antenna Horn	Narda	LR 1480	2010.06	2020.06
14	637	Antenna Horn	Narda	LR 099	2007.04	2017.04
15	HK116	Biconical Antenna	Rohde & Schwarz	LR 1260	2013.12	2018.12
16	HL223	LogPeriod Antenna	Rohde & Schwarz	LR 1261	2013.12	2018.12

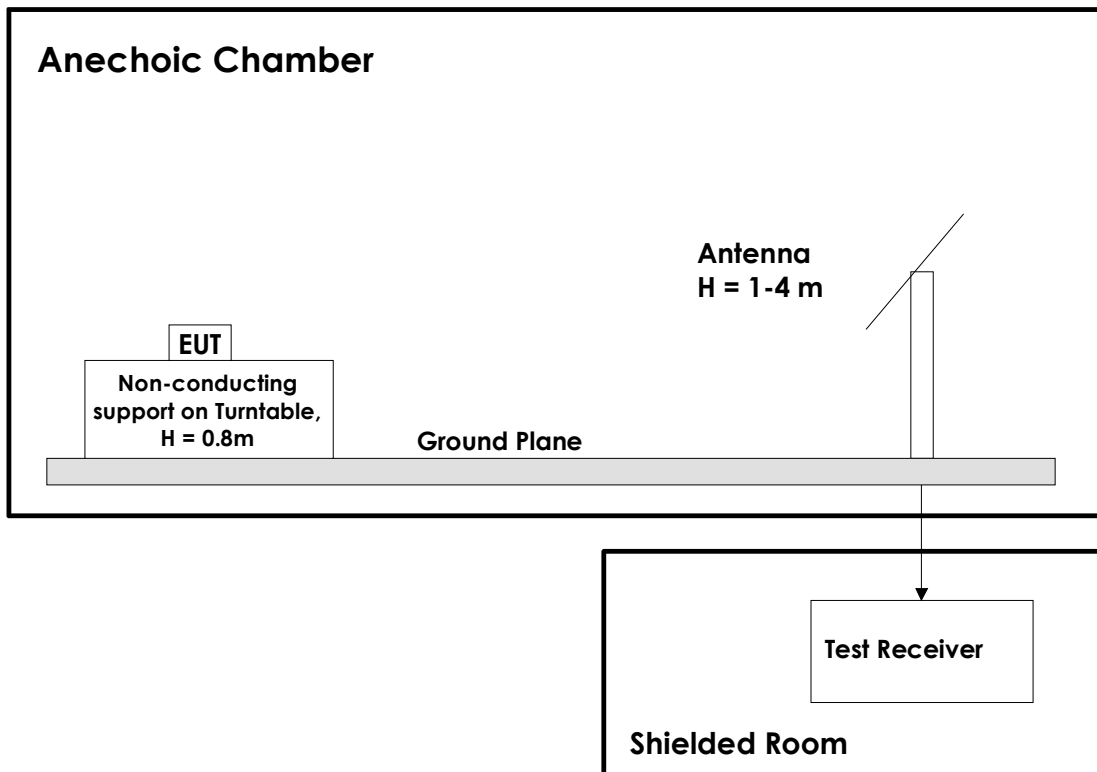
Test Software List			
Description	Manufacturer	Model	Version
EMC Software for Conducted tests	Rohde & Schwarz	EMC32	9.26.00

6 BLOCK DIAGRAM

6.1 Power Line Conducted Emission



6.2 Test Site Radiated Emission



Drawing above shows tests below 1 GHz. At 1GHz and above the turntable height is 1.5m and the ground plane between EUT and measuring antenna is covered by floor absorbers.

Revision history

Version	Date	Comment	Sign
1.0	2016.12.23	First edition	FS
1.1	2017.02.07	Corrected test setup for radiated tests	FS