

3.6 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.

3.7 Radiated Emissions, below 1GHz

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

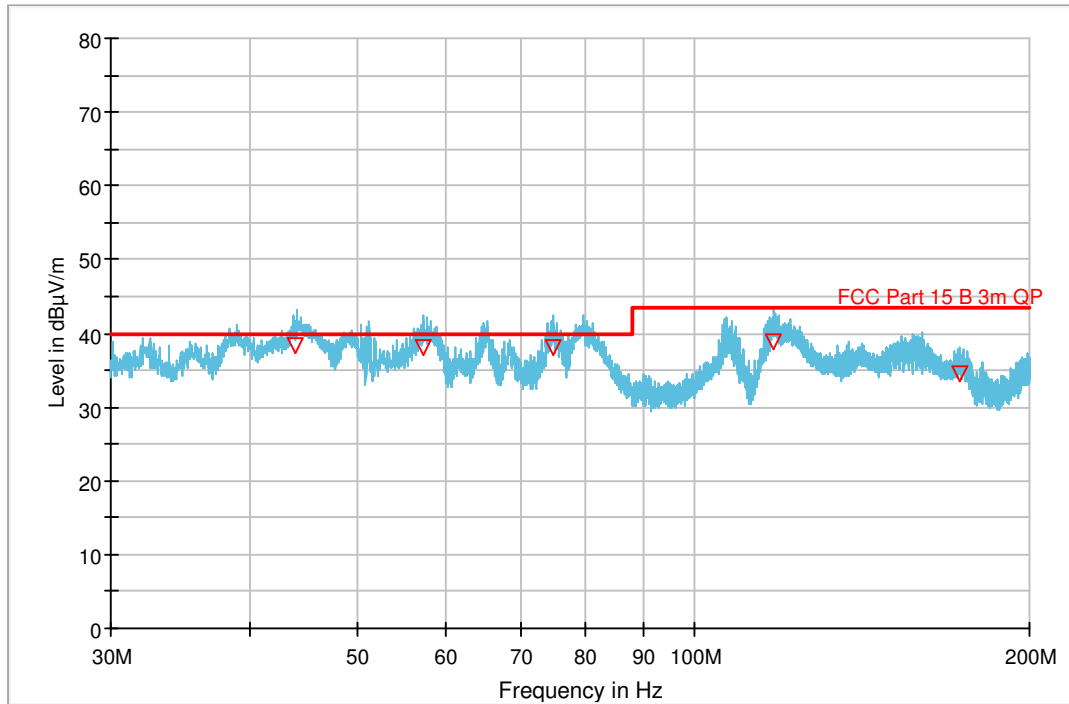
Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
43.831	38.40	40.00	1.60	1000.0	120.000	110.0	V	208	-27.1
57.103	37.98	40.00	2.02	1000.0	120.000	100.0	V	216	-28.7
74.853	38.14	40.00	1.86	1000.0	120.000	110.0	V	182	-28.3
118.001	38.83	43.50	4.67	1000.0	120.000	100.0	V	147	-26.0
173.248	34.44	43.50	9.06	1000.0	120.000	113.0	H	242	-23.2
270.336	39.27	46.00	6.73	1000.0	120.000	100.0	H	318	-23.5
285.840	34.31	46.00	11.69	1000.0	120.000	100.0	H	230	-22.9

See attached plots.

Requirements/Limit

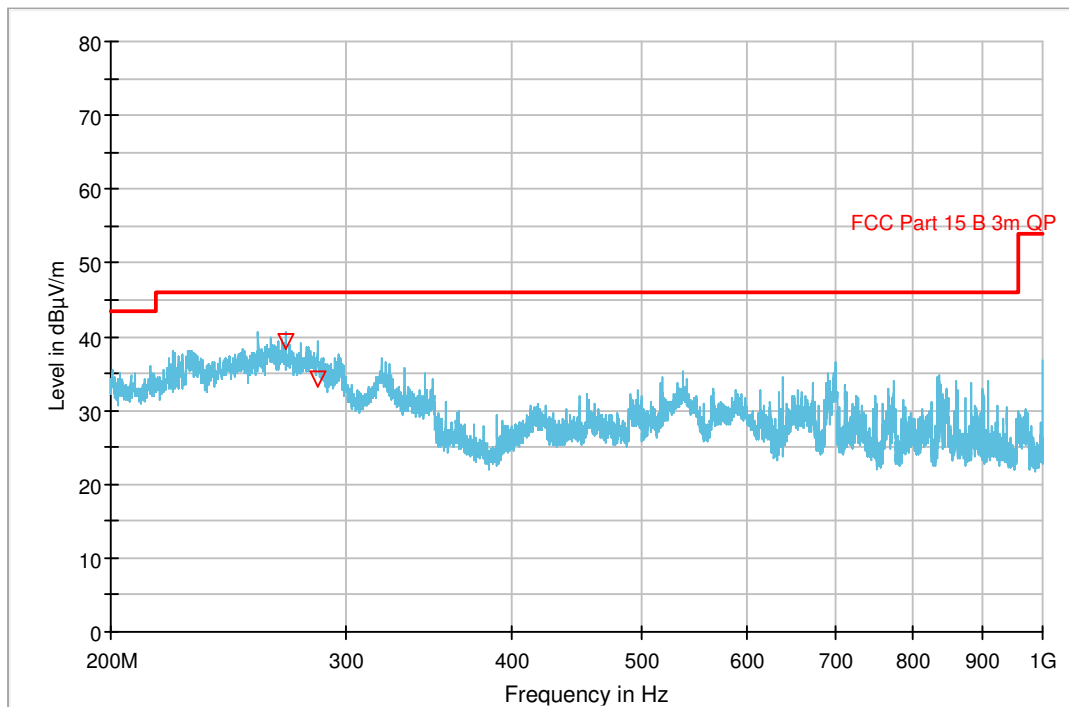
FCC	Part 15.209 @ frequencies defined in §15.205	
ISED	RSS-GEN Issue 4, clause 8.9 @ frequencies defined in clause 8.10	
	Radiated emission limit @3 meters	
Frequency (MHz)	Quasi Peak (μV/m)	Quasi Peak (dBμV/m)
30 – 88	100	40.0
88 – 216	150	43.5
216 – 960	200	46.0
Above 960	500	54.0

Full Spectrum



Radiated Emissions, 30 -200MHz

Full Spectrum



Radiated Emissions, 200 -1000MHz

3.8 Radiated Emissions, above 1GHz

FCC 15.205, 15.209

ISED RSS-GEN, Issue 4, Clause 8.9

Test Results: Complies

Measurement Data:

Radiated Emissions, 1-40 GHz

Measuring distance: 3m (1 – 8.5 GHz)
1m (8 – 25 GHz)

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

Band Edge Emissions, Restricted Bands, 5150MHz						
Carrier Modulation	Ch. No.	Carrier Freq MHz	Measured value AV dBµV/m @3m	Measured value Peak dBµV/m @3m	Limit (dBµV/m)	Verdict
802.11a, Ant 0	36	5180	47.2	65.7	54/74	Complies
802.11a, Ant 1	36	5180	43.6	57.3	54/74	Complies
802.11n, HT20, MIMO	36	5180	42.0	63.4	54/74	Complies
802.11n, HT40, MIMO	38	5190	47.0	66.8	54/74	Complies
802.11n, HT80, MIMO	42	5210	47.5	66.6	54/74	Complies

Band Edge Emissions, Restricted Bands, 5350MHz						
Carrier Modulation	Ch. No.	Carrier Freq MHz	Measured value AV dBµV/m @3m	Measured value Peak dBµV/m @3m	Limit (dBµV/m)	Verdict
802.11a, Ant 0	64	5320	46.8	63.9	54/74	Complies
802.11a, Ant 1	64	5320	43.5	59.3	54/74	Complies
802.11n, HT20, MIMO	64	5320	43.3	67.5	54/74	Complies
802.11n, HT40, MIMO	62	5310	46.7	66.7	54/74	Complies
802.11n, HT80, MIMO	58	5290	46.3	65.6	54/74	Complies

Band Edge Emissions, Restricted Bands, 5460MHz						
Carrier Modulation	Ch. No.	Carrier Freq MHz	Measured value AV dBµV/m @3m	Measured value Peak dBµV/m @3m	Limit (dBµV/m)	Verdict
802.11a, Ant 0	100	5500	44.9	< 65.5	54/74	Complies
802.11a, Ant 1	100	5500	42.2	< 61.8	54/74	Complies
802.11n, HT20, MIMO	100	5500	42.1	< 67.4	54/74	Complies
802.11n, HT40, MIMO	102	5510	41.7	< 64.3	54/74	Complies
802.11n, HT80, MIMO	106	5530	42.3	< 63.8	54/74	Complies

Radiated Emissions in Restricted Bands						
Carrier Modulation	Carrier Freq MHz	Measured Freq MHz	Measured value Peak dBµV/m @3m	Measured value AV dBµV/m @3m	Limit (dBµV/m)	Verdict
Any*	Any	2777	57.0	36.1	74/54	Complies
Any*	Any	4160	57.7	37.2	74/54	Complies
802.11n, HT20, MIMO	5300	15900	63.8	51.9	74/54	Complies

* Not an emission from the radio

Average Detector values for emissions from the radio are corrected for Duty Cycle as measured in UL report no. 15U21878-E4V2. Calculated Duty Cycle Factor $(-20 \times \log(DC))$ is added to the measured values.

Emissions at 2777MHz and 4160MHz are not from the radio and are therefore not corrected for duty cycle.

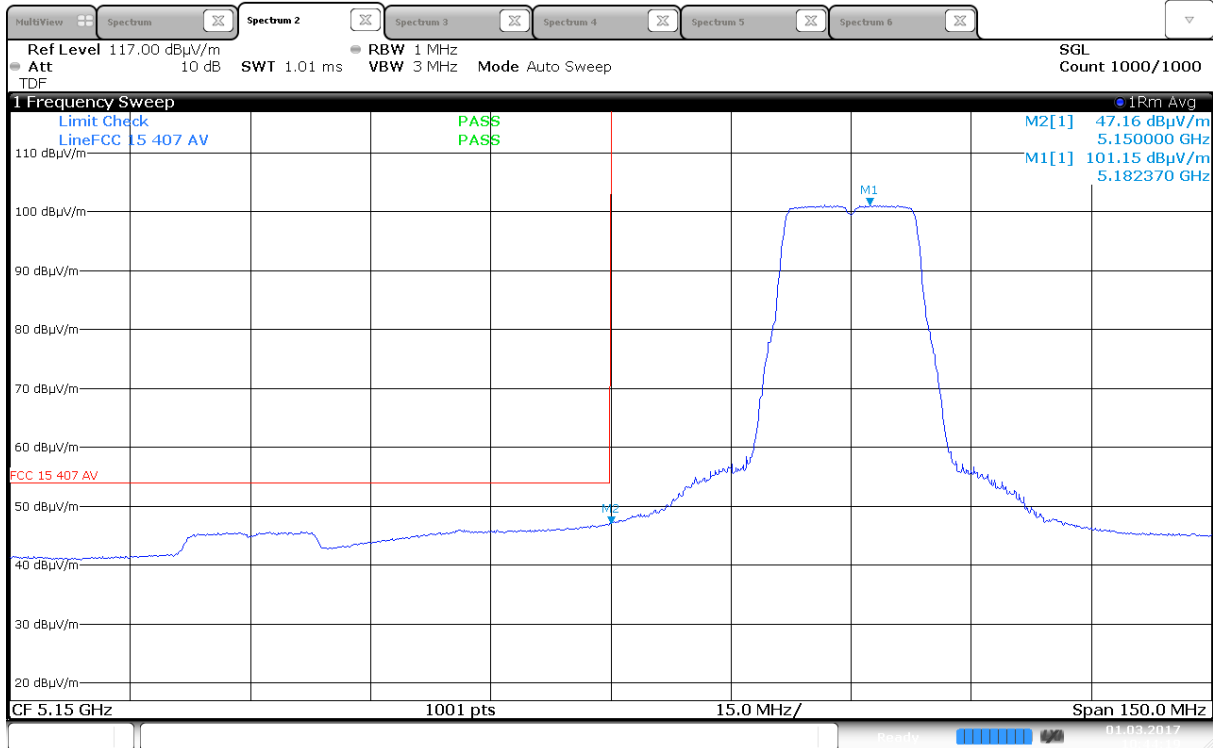
Only harmonics that fall in the restricted bands (ref. §15.205) have been checked.

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

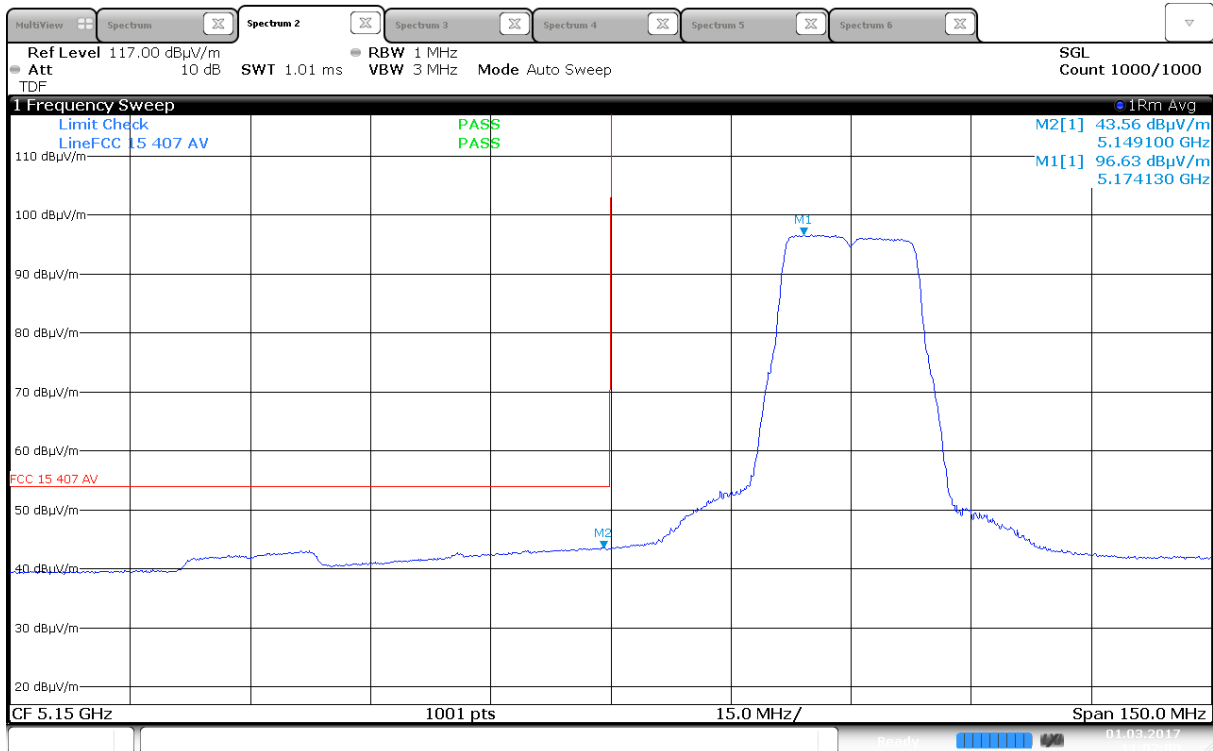
See attached plots.

Limits

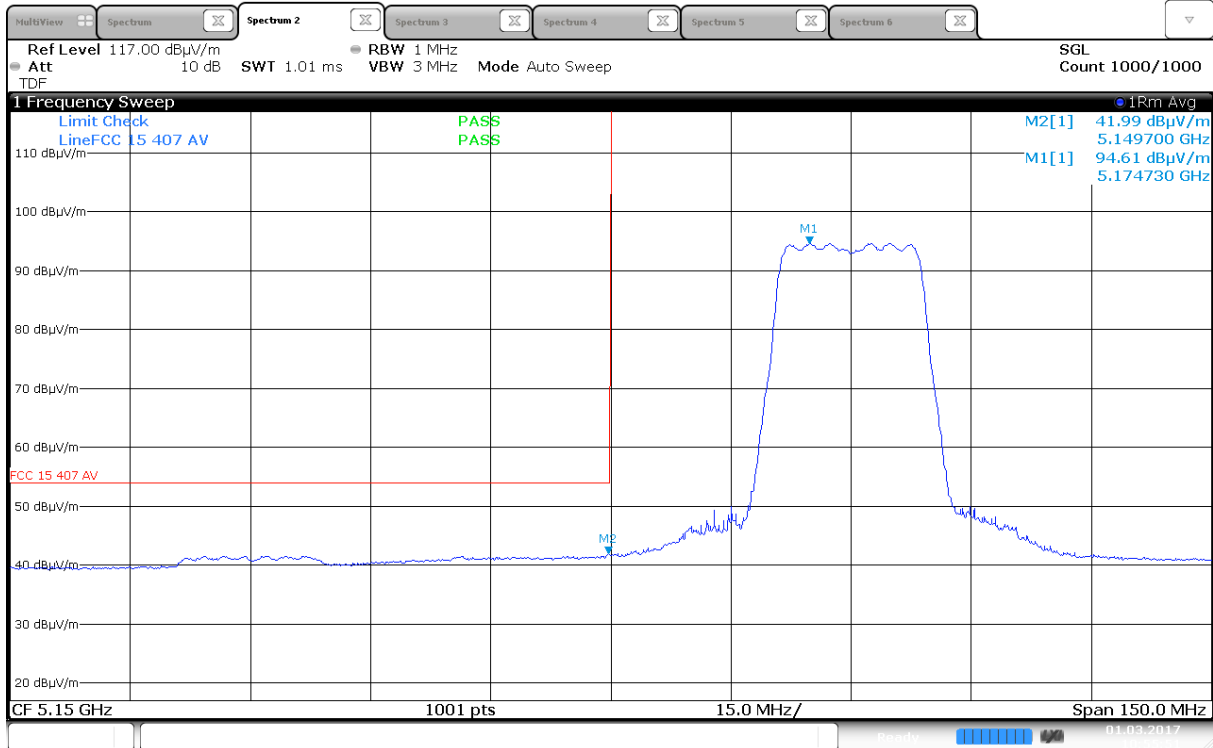
FCC	Part 15.209 @ frequencies defined in §15.205	
ISED	RSS-GEN Issue 4, Clause 8.9 @ frequencies defined in clause 8.10	
	Radiated emission limit @3 meters	
Frequency (MHz)	AV (dBμV/m)	Peak (dBμV/m)
Above 1 GHz	54.0	74.0



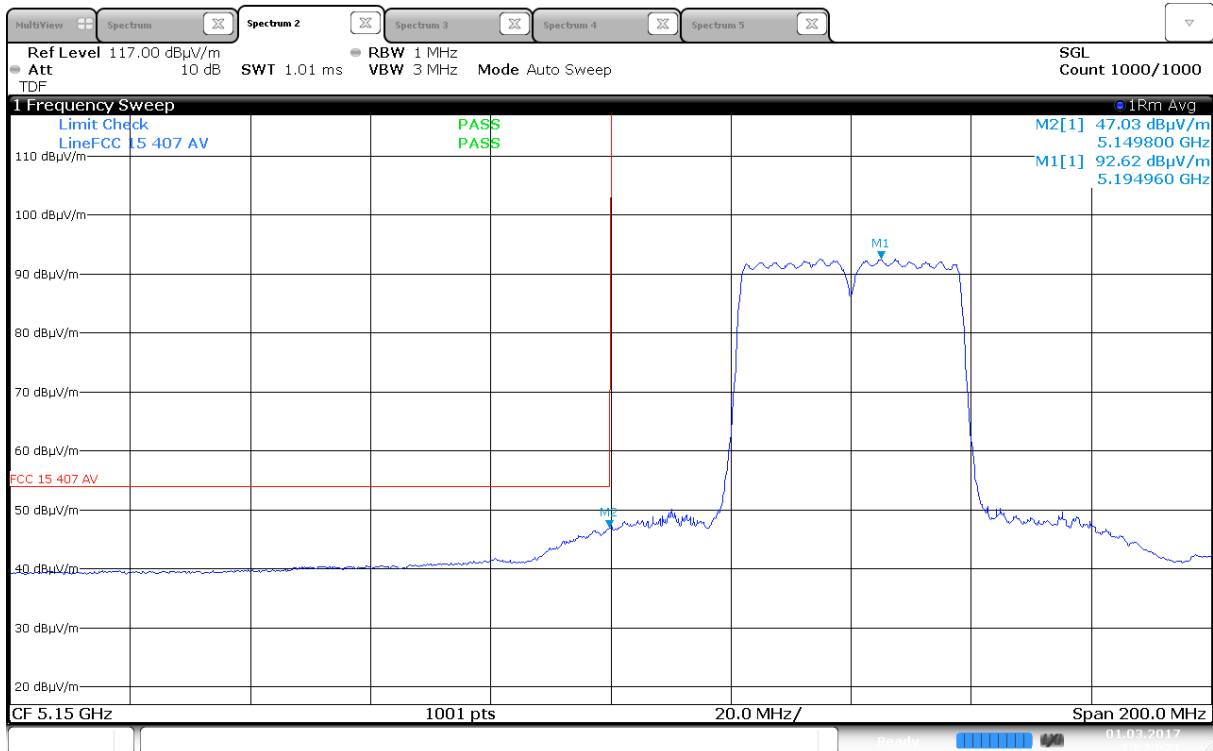
Band Edge RMS, < 5150MHz, 5180MHz, 802.11a 6Mb, Ant 0



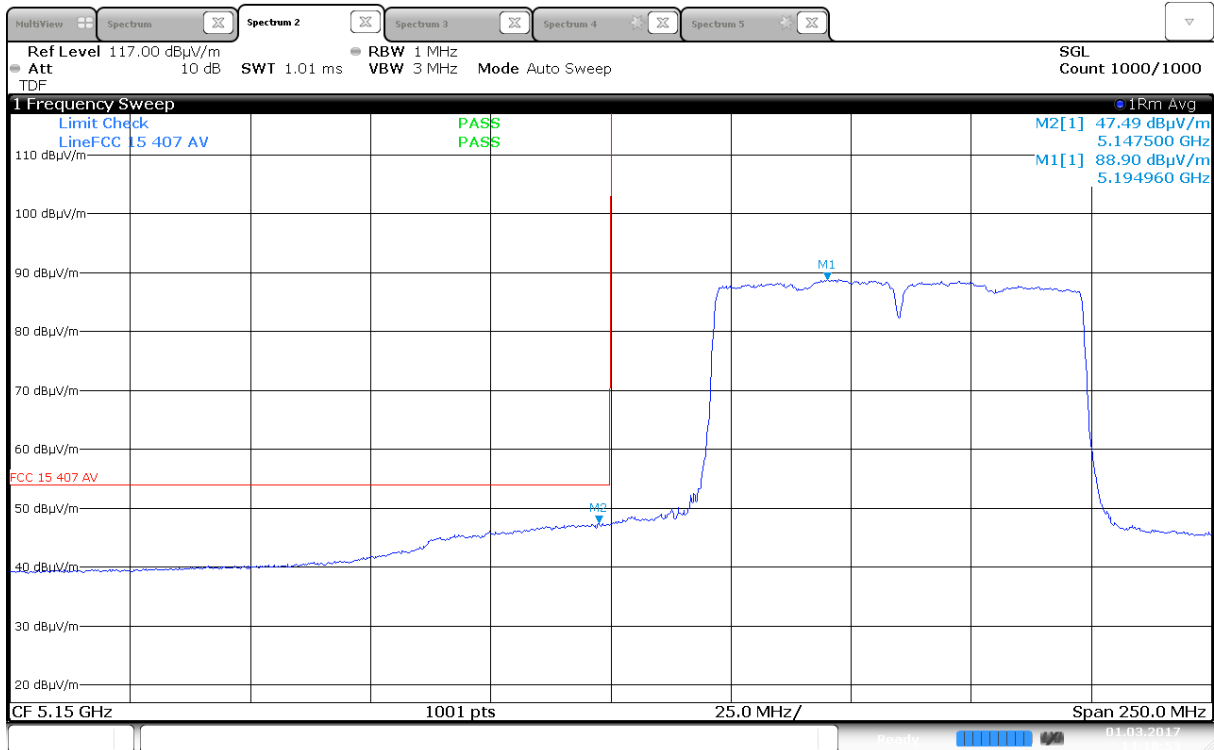
Band Edge RMS, < 5150MHz, 5180MHz, 802.11a 6Mb, Ant 1



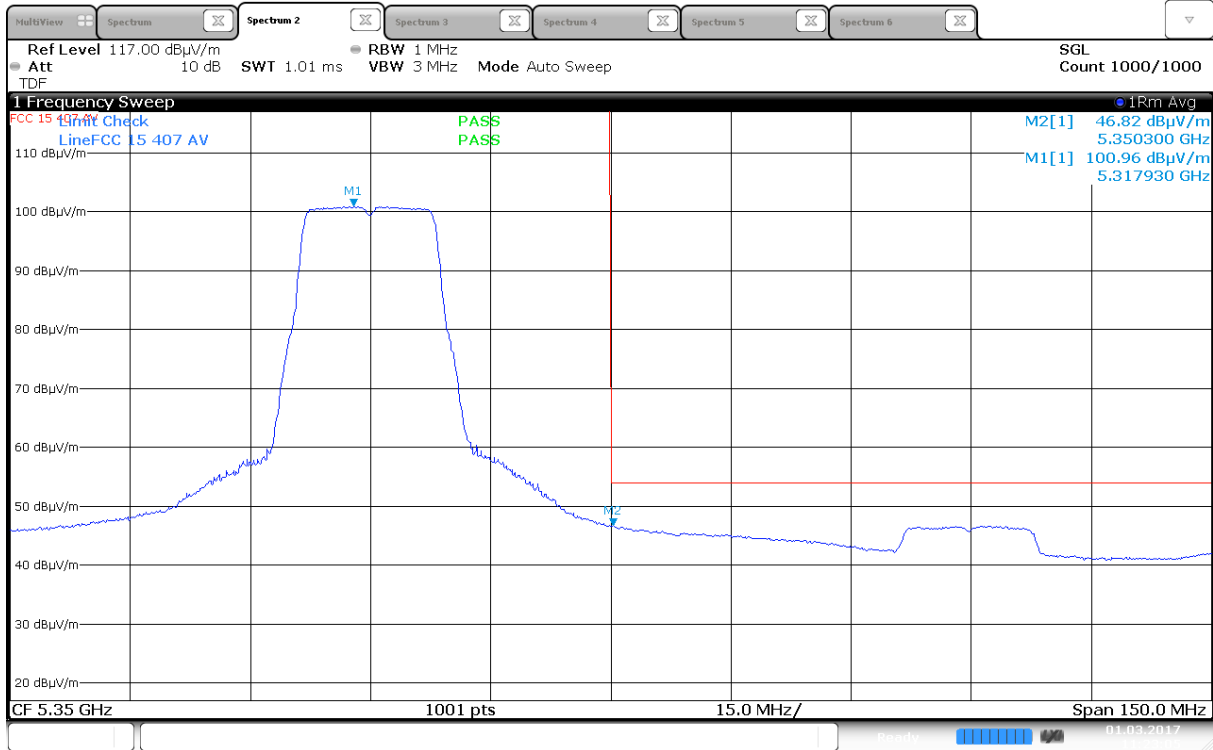
Band Edge RMS, < 5150MHz, 5180MHz, 802.11n HT20, MIMO



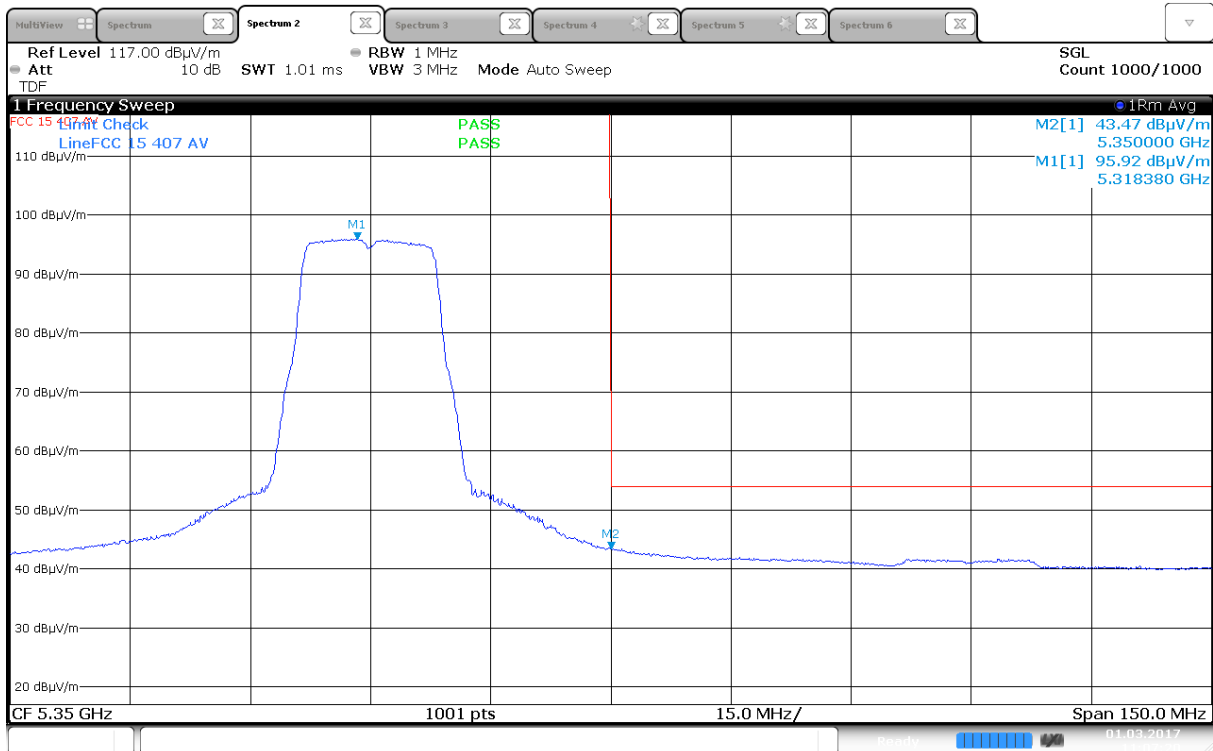
Band Edge RMS, < 5150MHz, 5190MHz, 802.11n HT40, MIMO



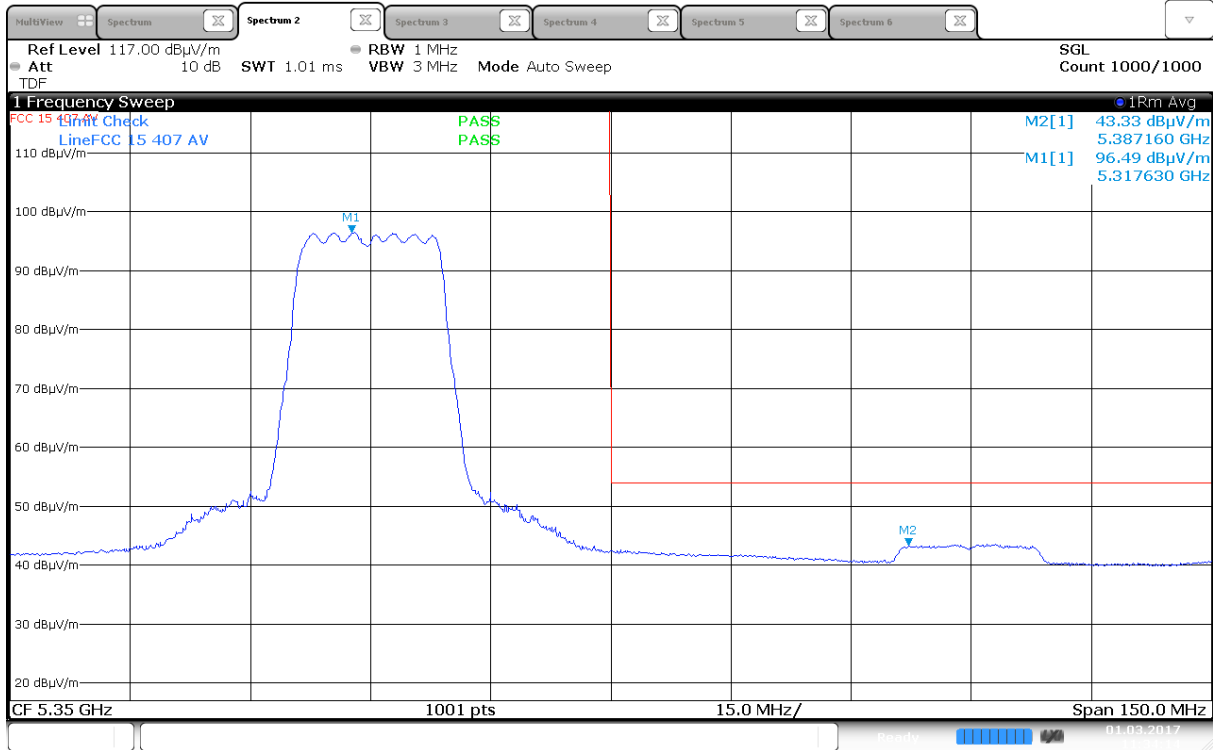
Band Edge RMS, < 5150MHz, 5210MHz, 802.11n HT80, MIMO



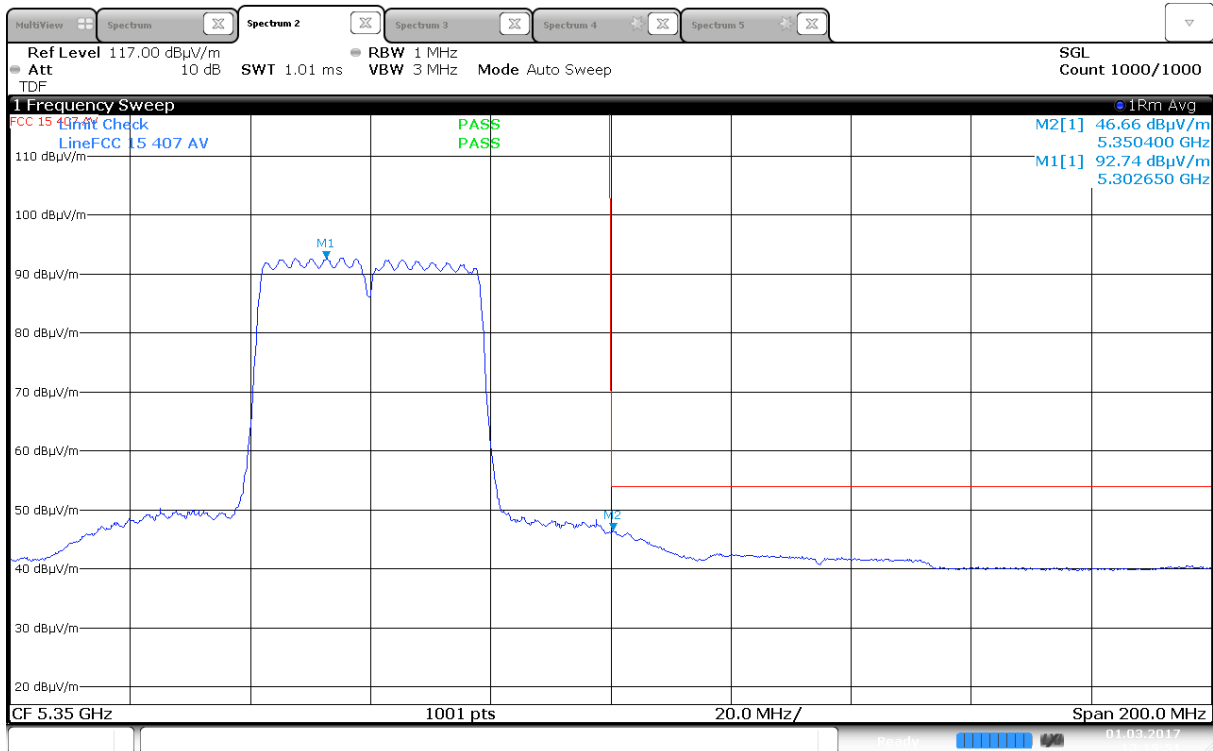
Band Edge RMS, > 5350MHz, 5320MHz, 802.11a 6Mb, Ant 0



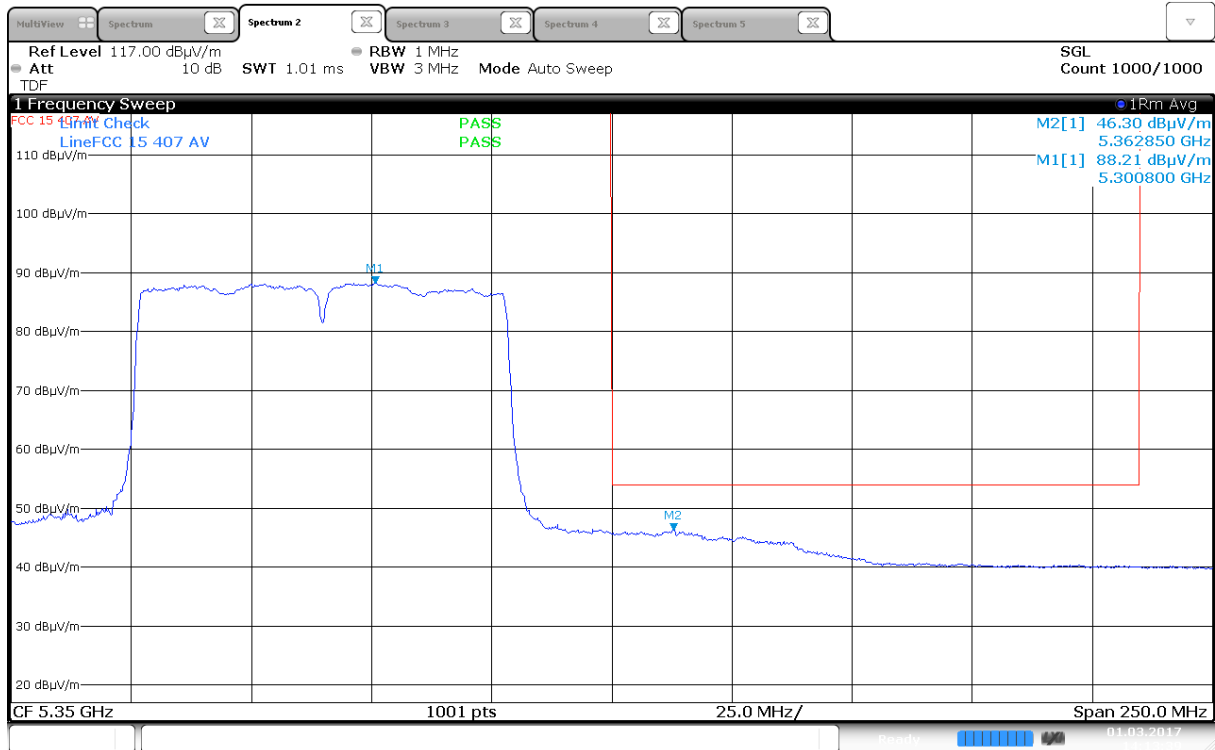
Band Edge RMS, > 5350MHz, 5320MHz, 802.11a 6Mb, Ant 1



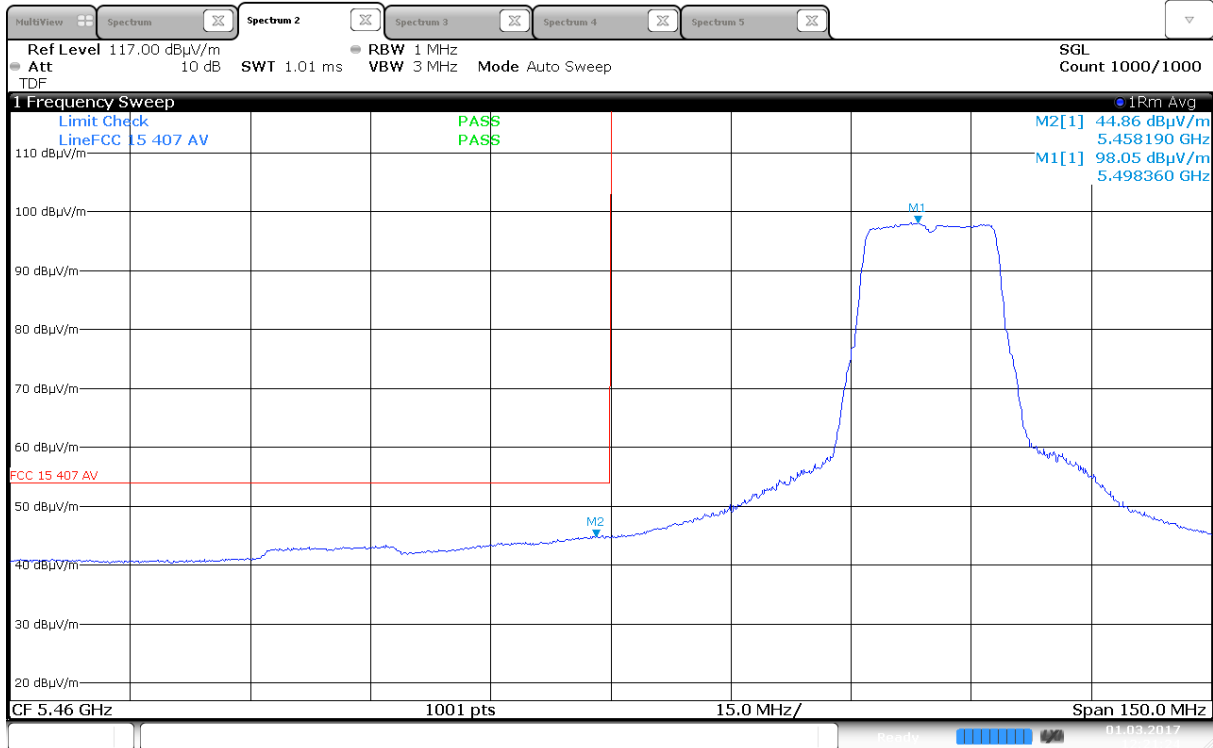
Band Edge RMS, > 5350MHz, 5320MHz, 802.11n HT20, MIMO



Band Edge RMS, > 5350MHz, 5310MHz, 802.11n HT40, MIMO

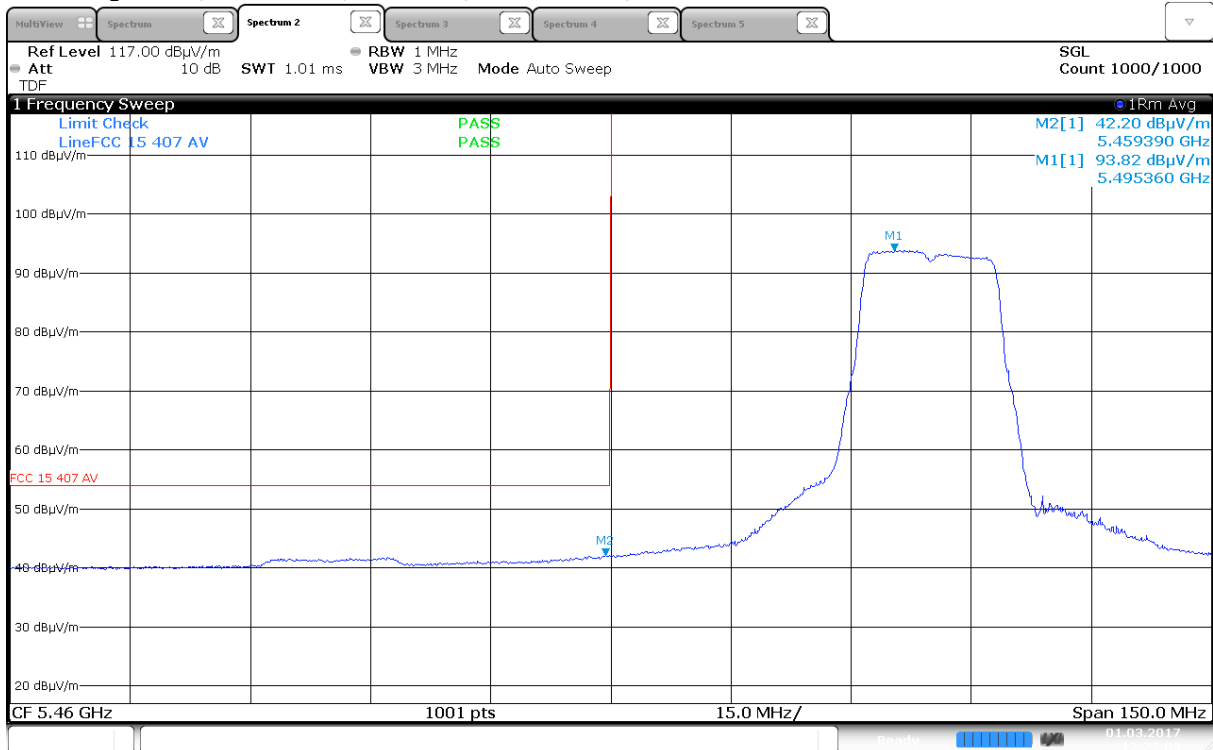


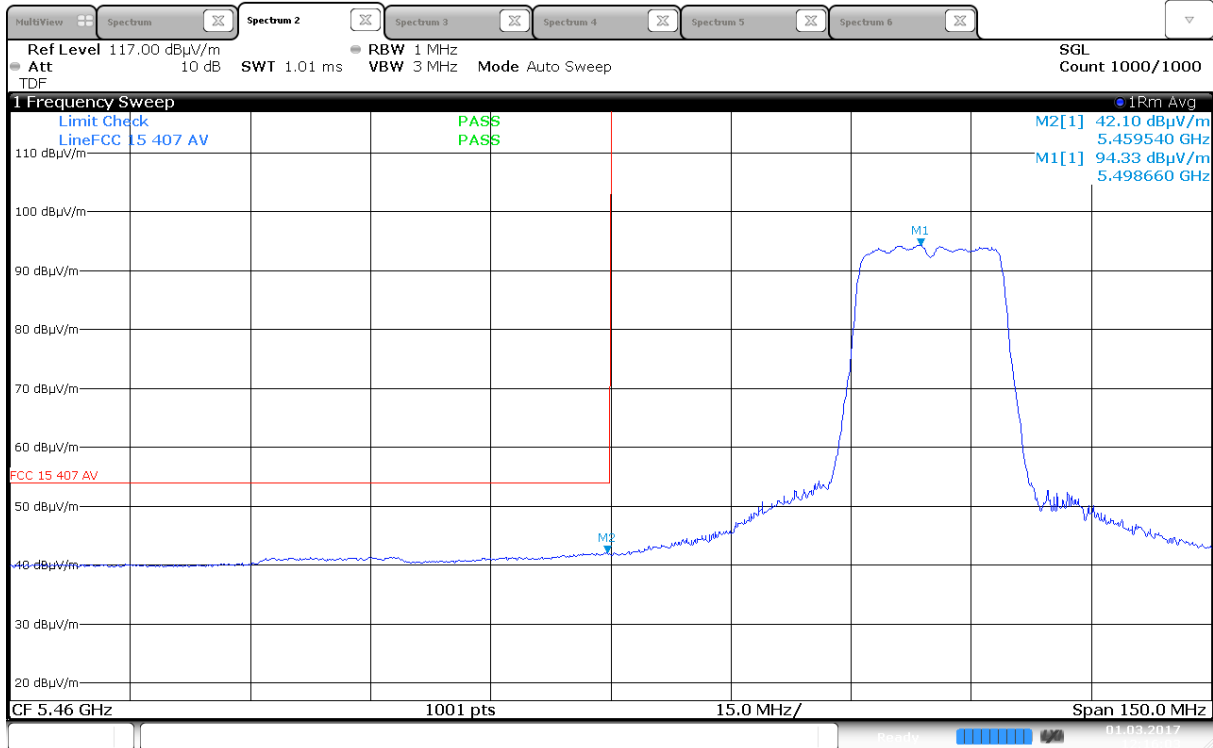
Band Edge RMS, > 5350MHz, 5290MHz, 802.11n HT80, MIMO



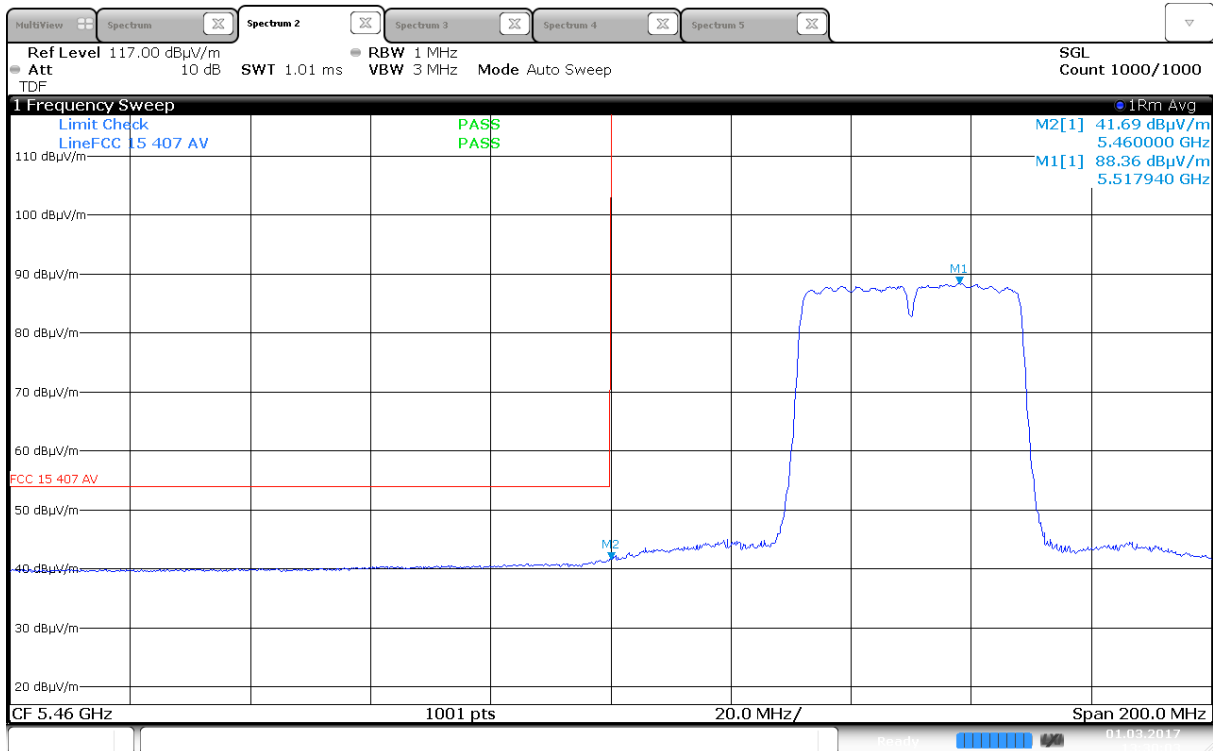
Band Edge RMS, < 5460MHz, 5500MHz, 802.11a 6Mb, Ant 0

Band Edge RMS, < 5460MHz, 5500MHz, 802.11a 6Mb, Ant 1

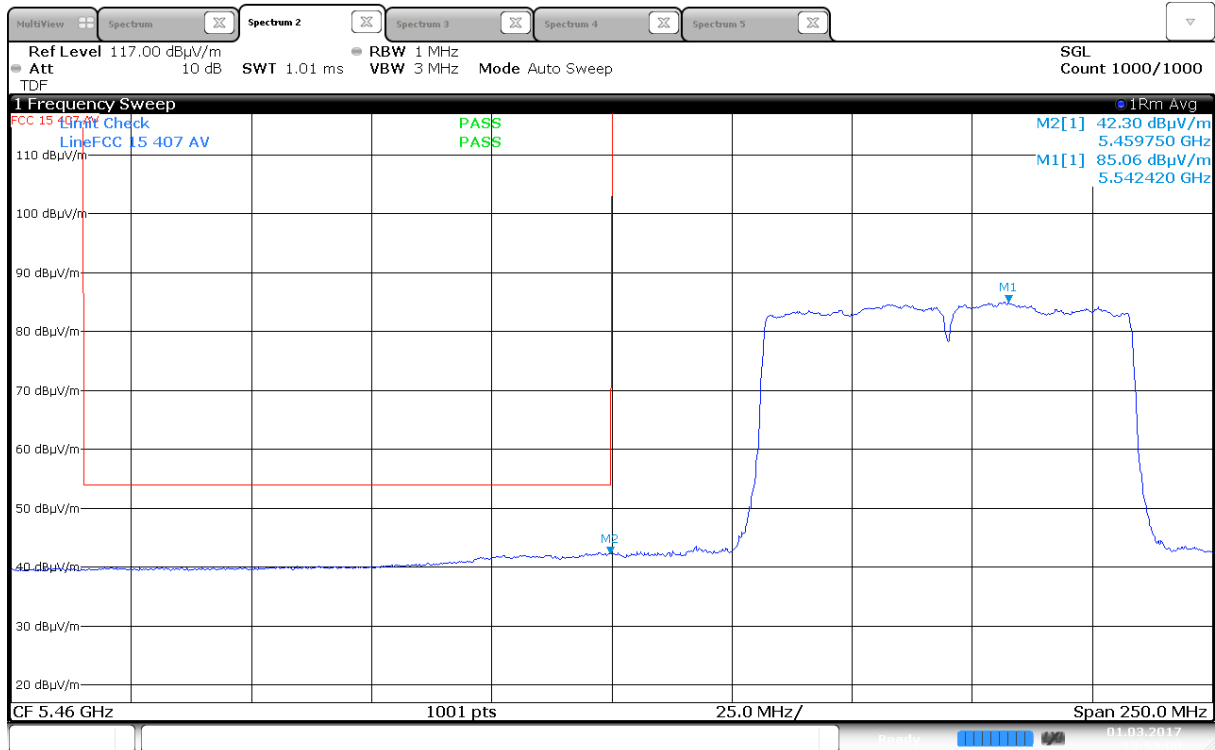




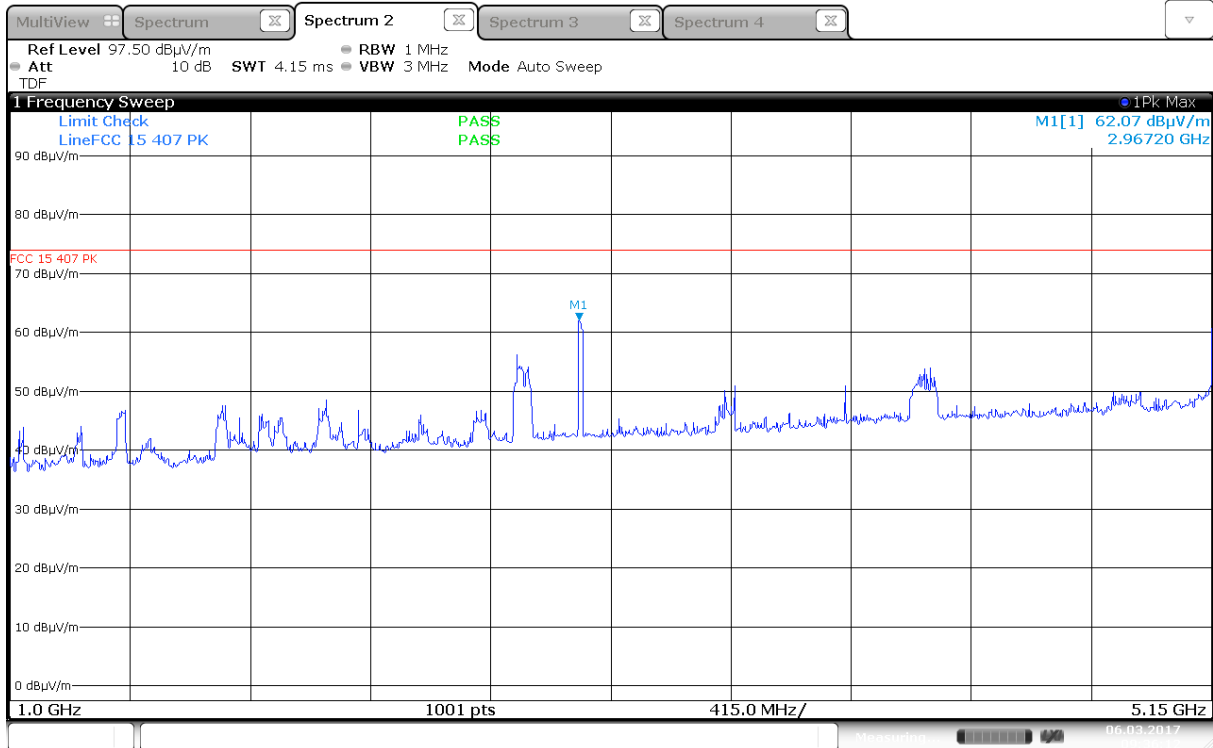
Band Edge RMS, < 5460MHz, 5500MHz, 802.11n HT20, MIMO



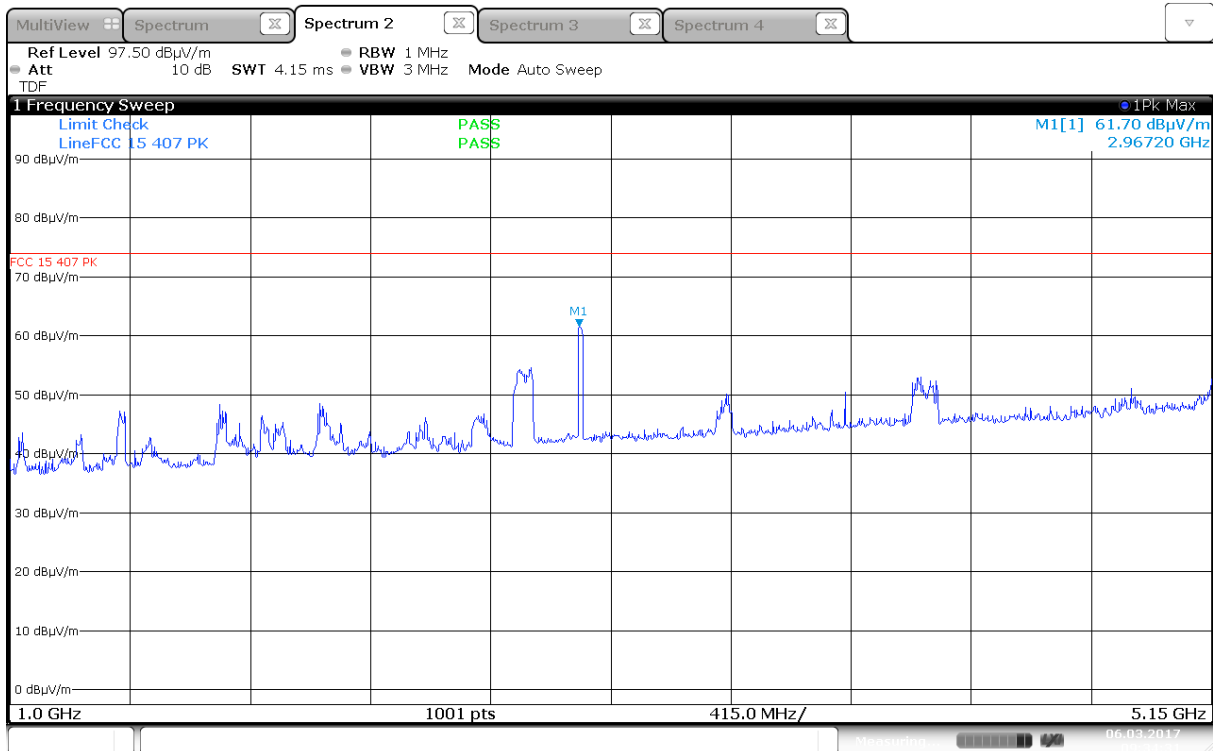
Band Edge RMS, < 5460MHz, 5510MHz, 802.11n HT40, MIMO



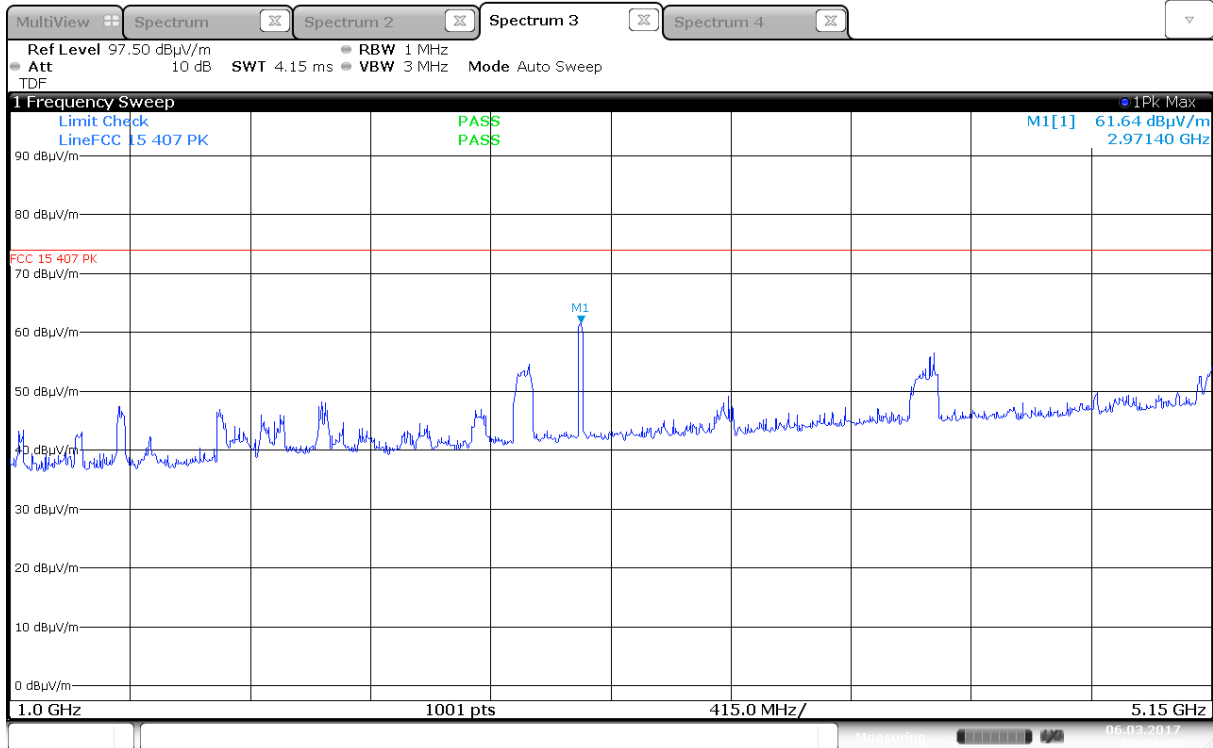
Band Edge RMS, < 5460MHz, 5530MHz, 802.11n HT80, MIMO



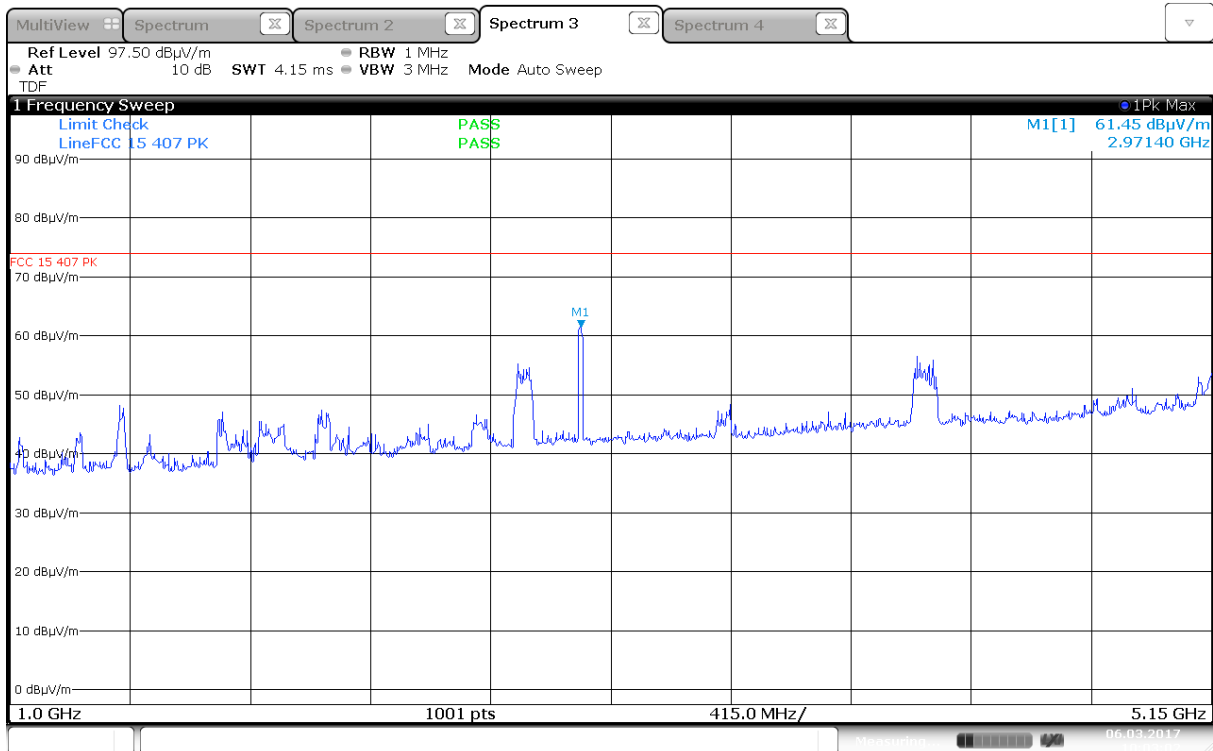
Radiated Emissions, 1.0 – 5.15 GHz, 5180 MHz, 802.11a 6M, Ant 0, HP



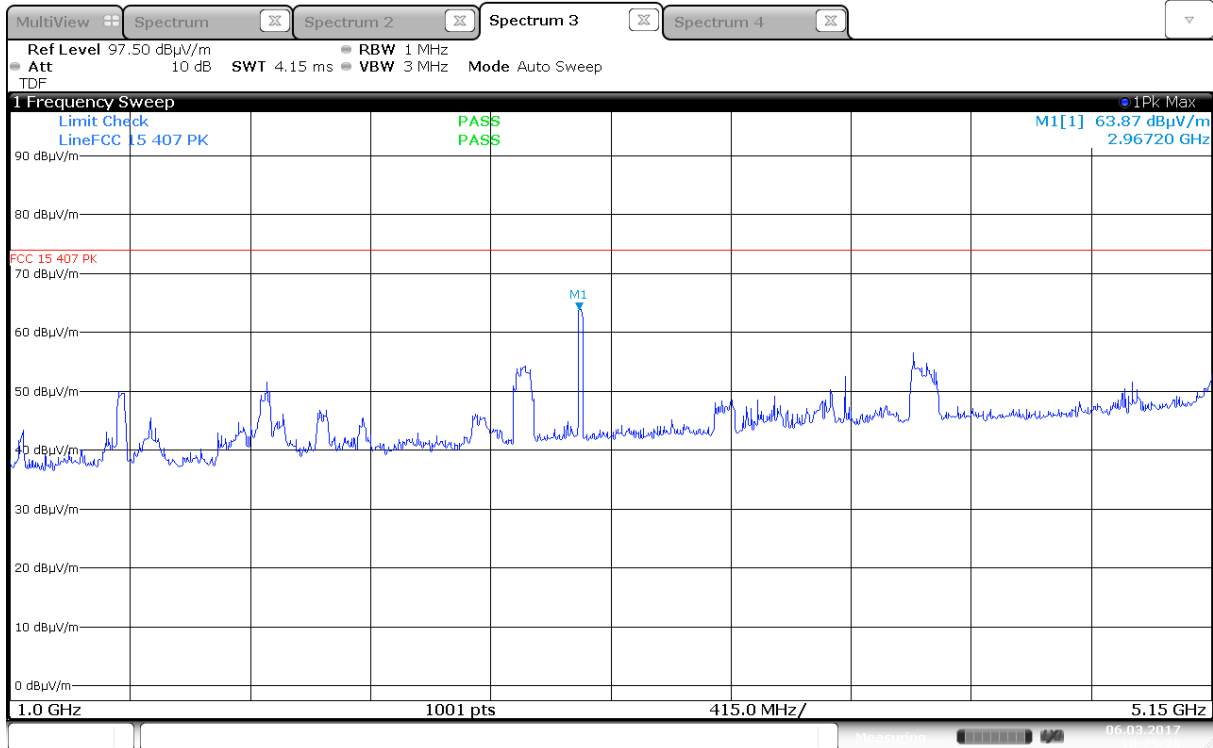
Radiated Emissions, 1.0 – 5.15 GHz, 5180 MHz, 802.11a 6M, Ant 0, VP



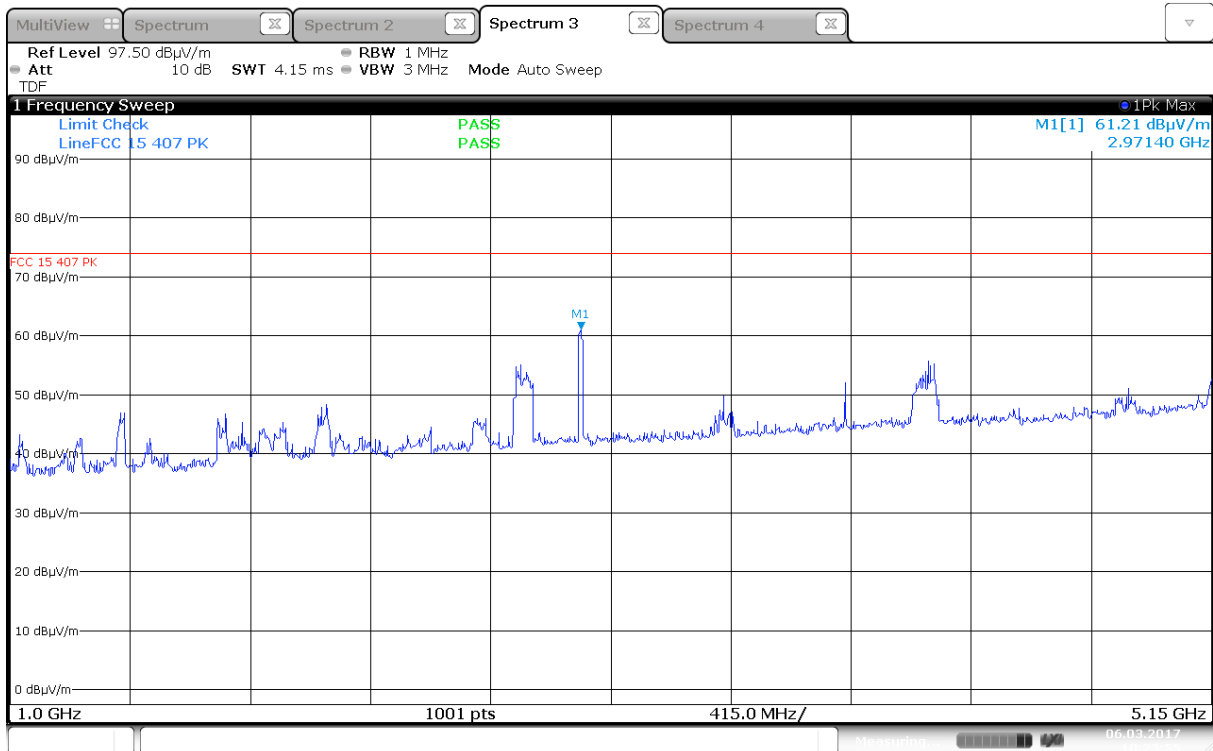
Radiated Emissions, 1.0 – 5.15 GHz, 5180 MHz, 802.11a 6M, Ant 1, HP



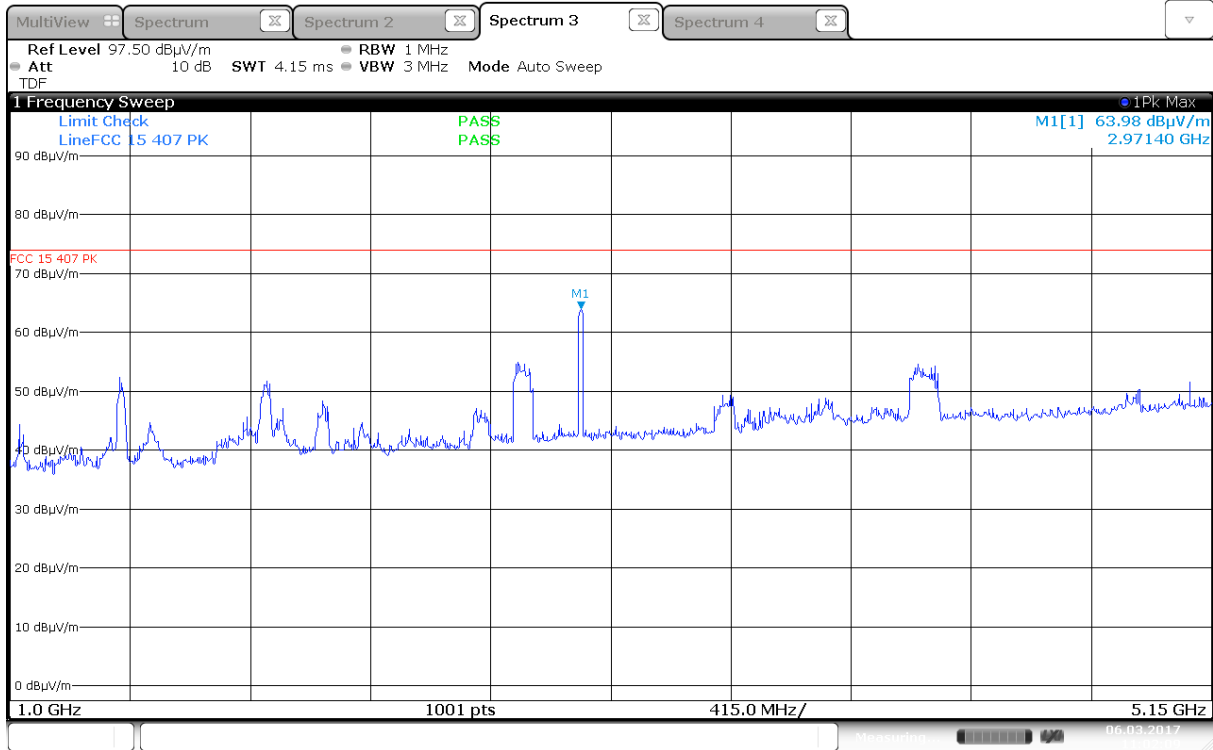
Radiated Emissions, 1.0 – 5.15 GHz, 5180 MHz, 802.11a 6M, Ant 1, VP



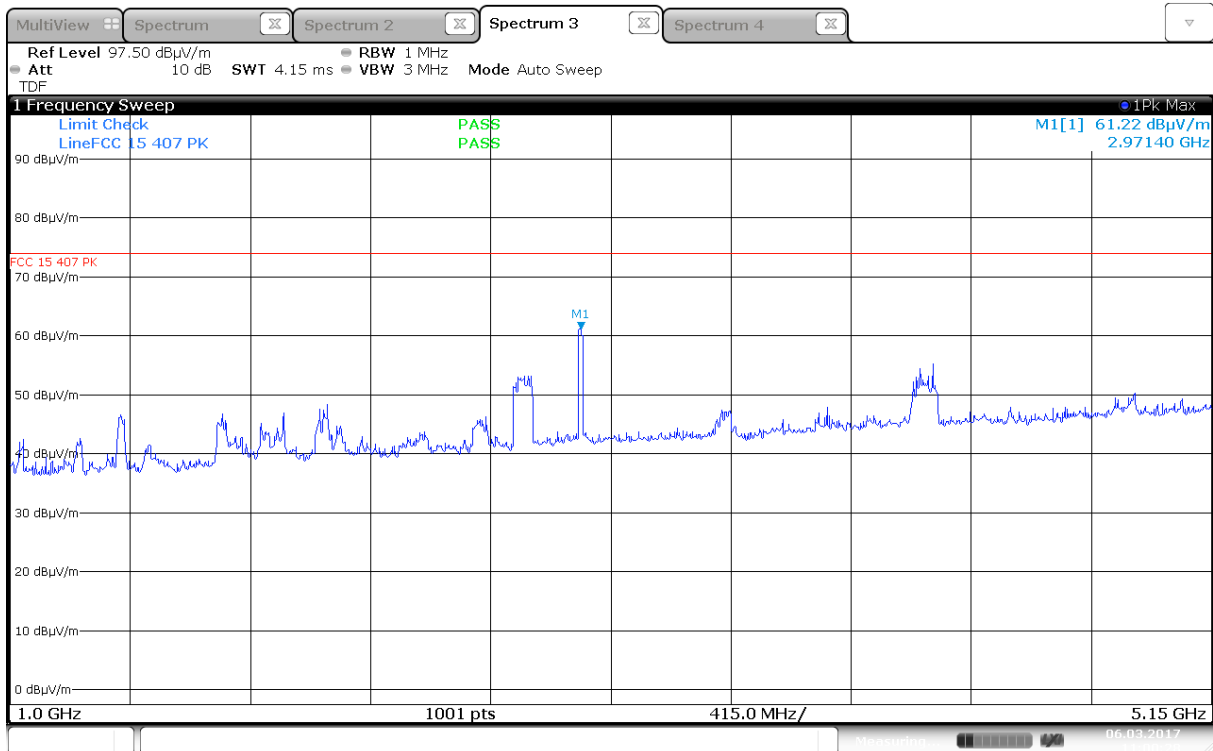
Radiated Emissions, 1.0 – 5.15 GHz, 5180 MHz, 802.11n HT20, MIMO, HP



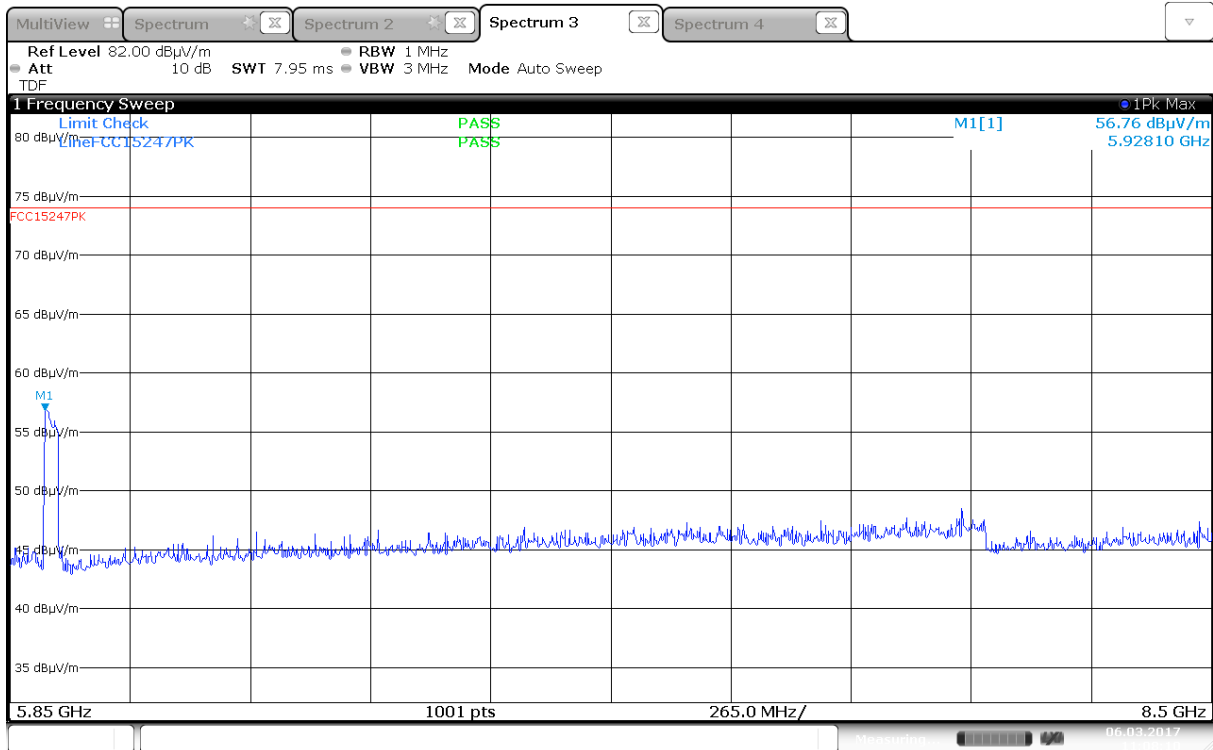
Radiated Emissions, 1.0 – 5.15 GHz, 5180 MHz, 802.11n HT20, MIMO, VP



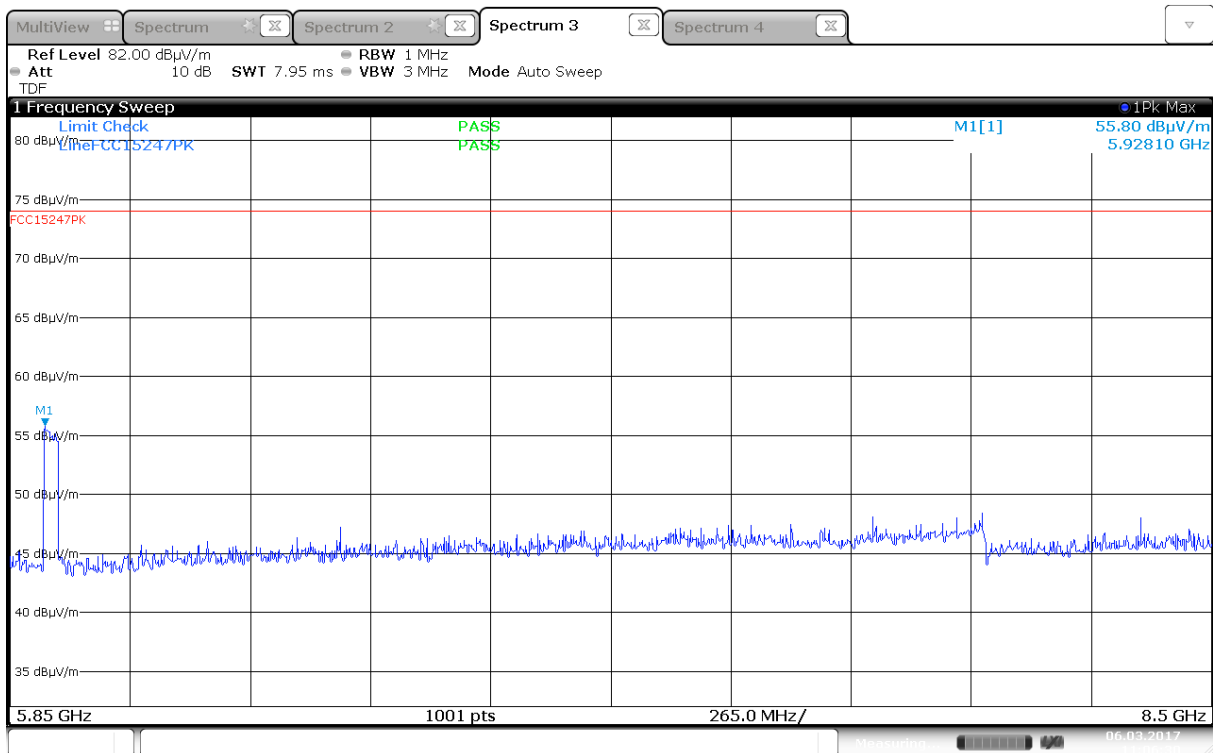
Radiated Emissions, 1.0 – 5.15 GHz, 5500 MHz, 802.11n HT20, MIMO, HP



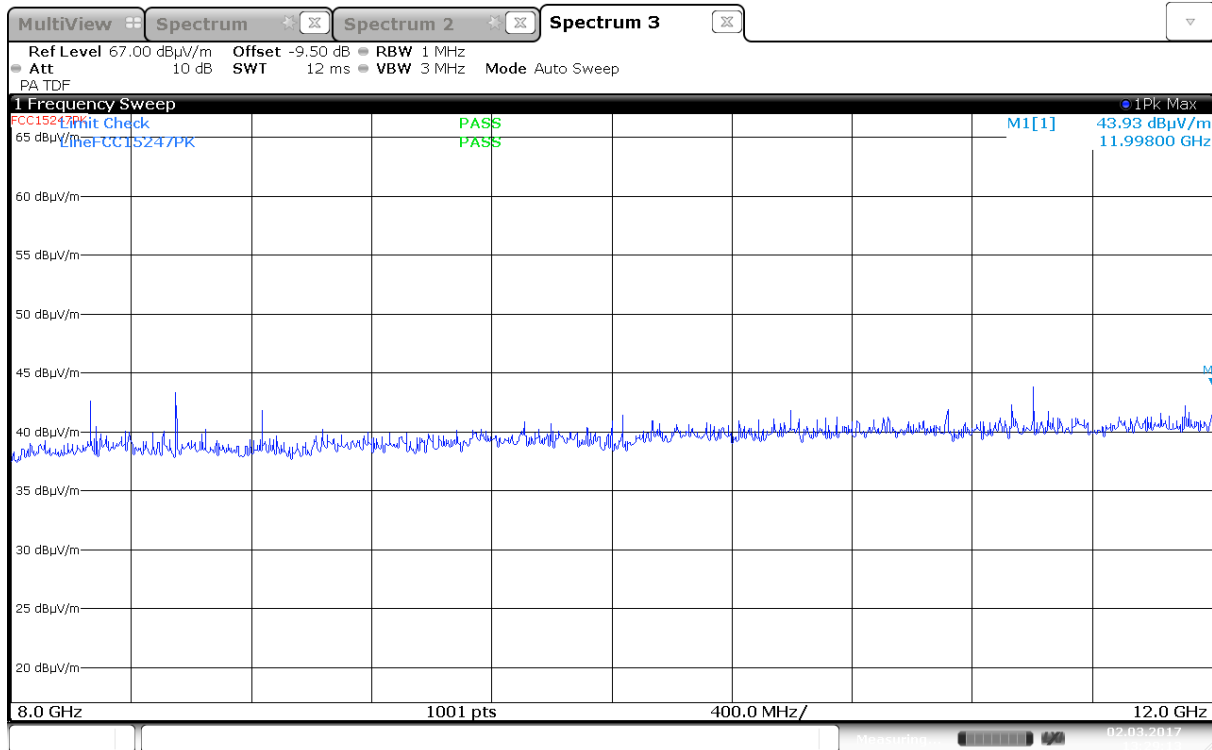
Radiated Emissions, 1.0 – 5.15 GHz, 5500 MHz, 802.11n HT20, MIMO, VP



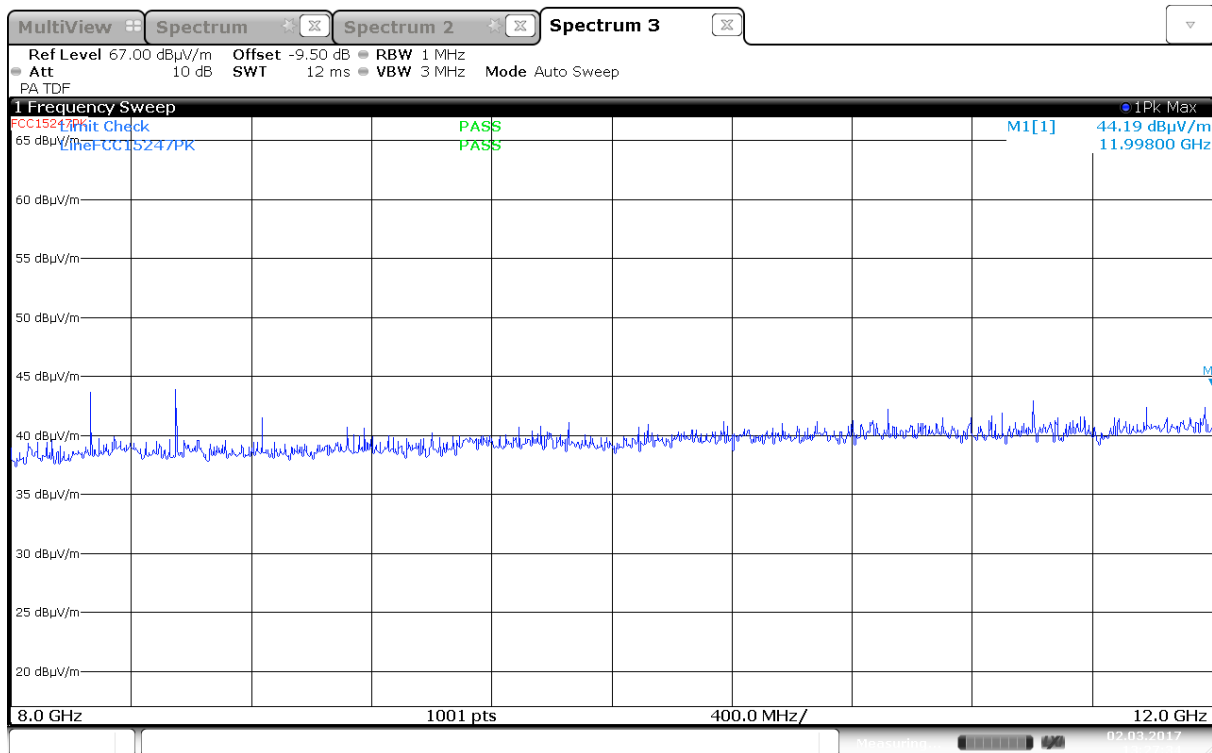
Radiated Emissions, 5.85 – 8.5 GHz, 5500 MHz, 802.11n HT20, MIMO, HP



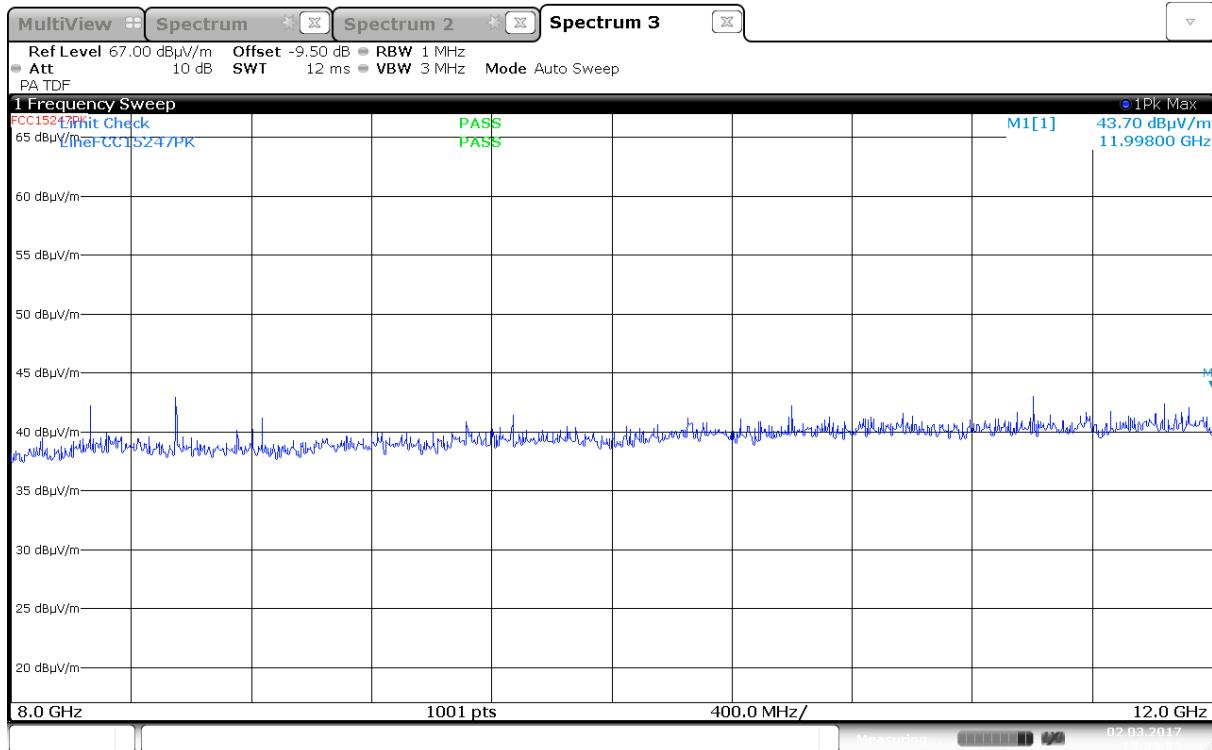
Radiated Emissions, 5.85 – 8.5 GHz, 5500 MHz, 802.11n HT20, MIMO, VP



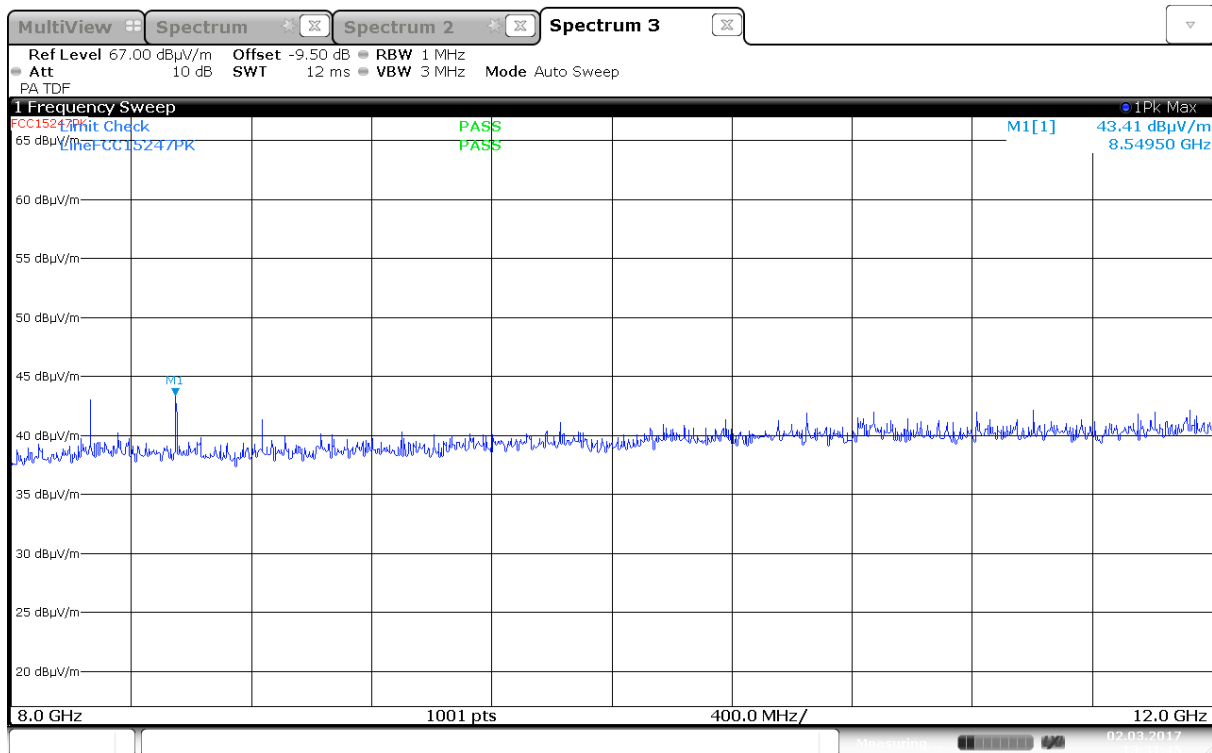
Radiated Emissions, 8.0 – 12.0 GHz, 5700 MHz, 802.11a 6M, Ant 0, HP, @1m



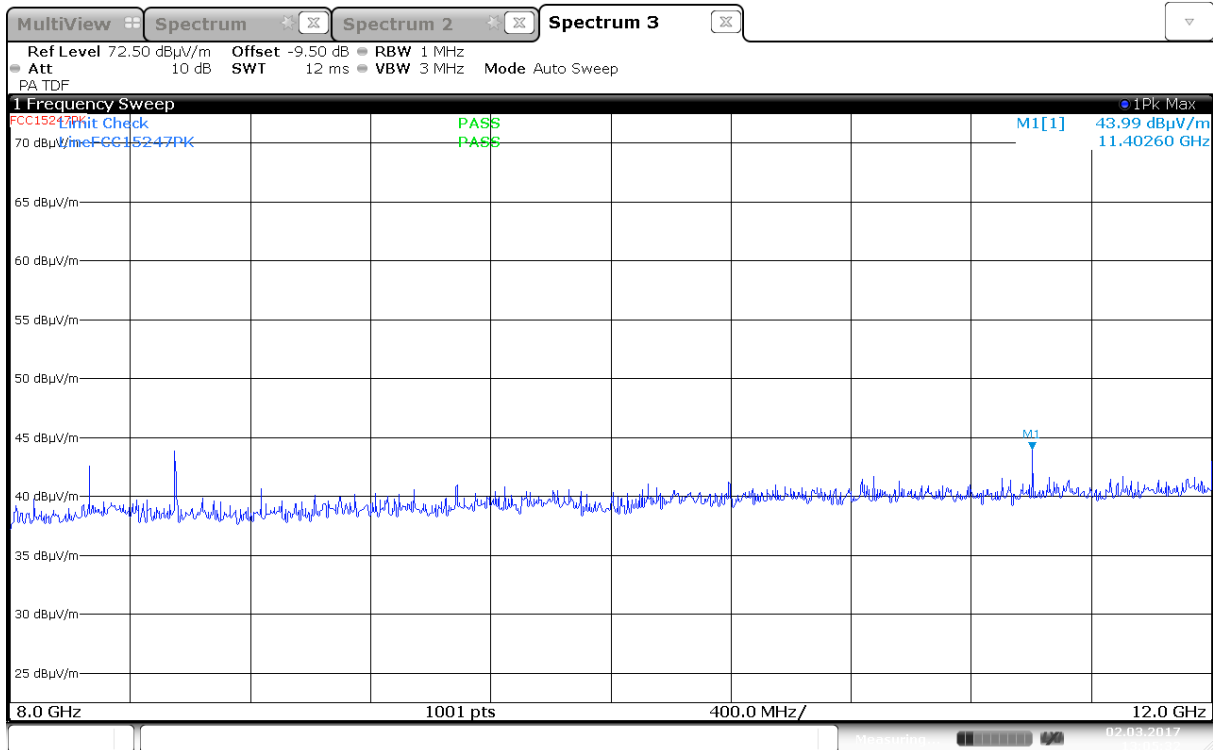
Radiated Emissions, 8.0 – 12.0 GHz, 5700 MHz, 802.11a 6M, Ant 0, VP, @1m



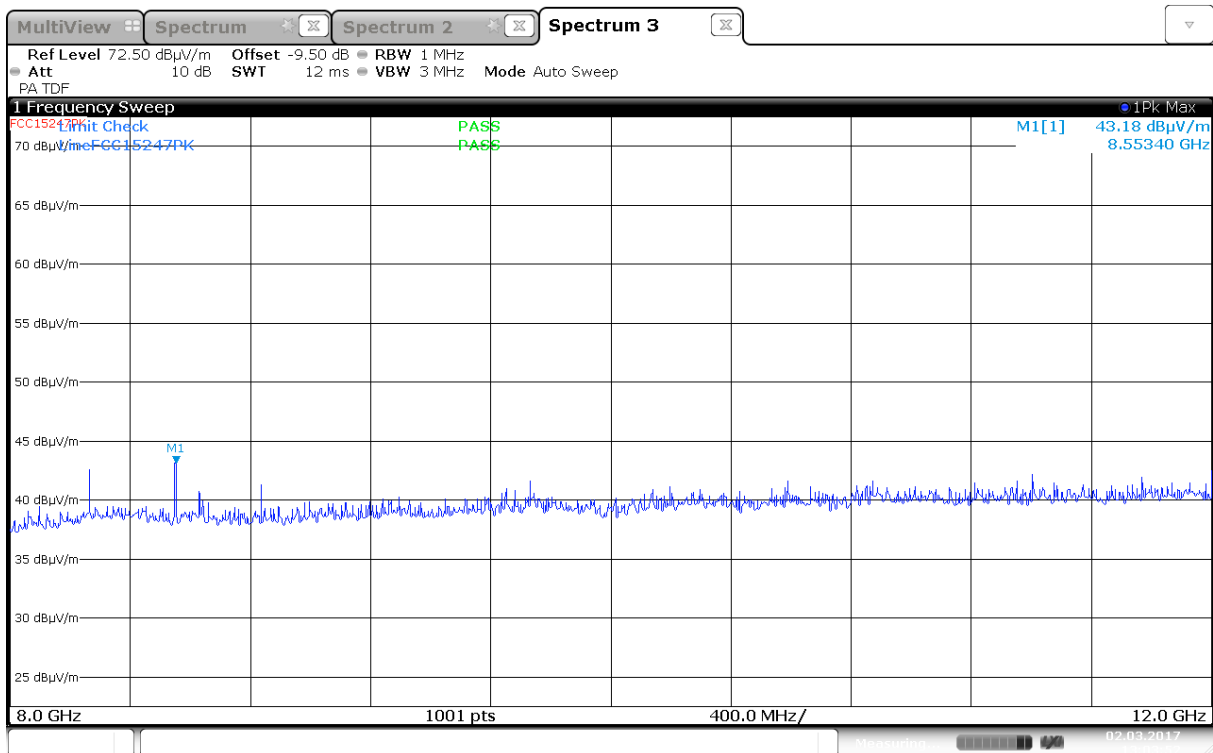
Radiated Emissions, 8.0 – 12.0 GHz, 5700 MHz, 802.11a 6M, Ant 1, HP, @1m



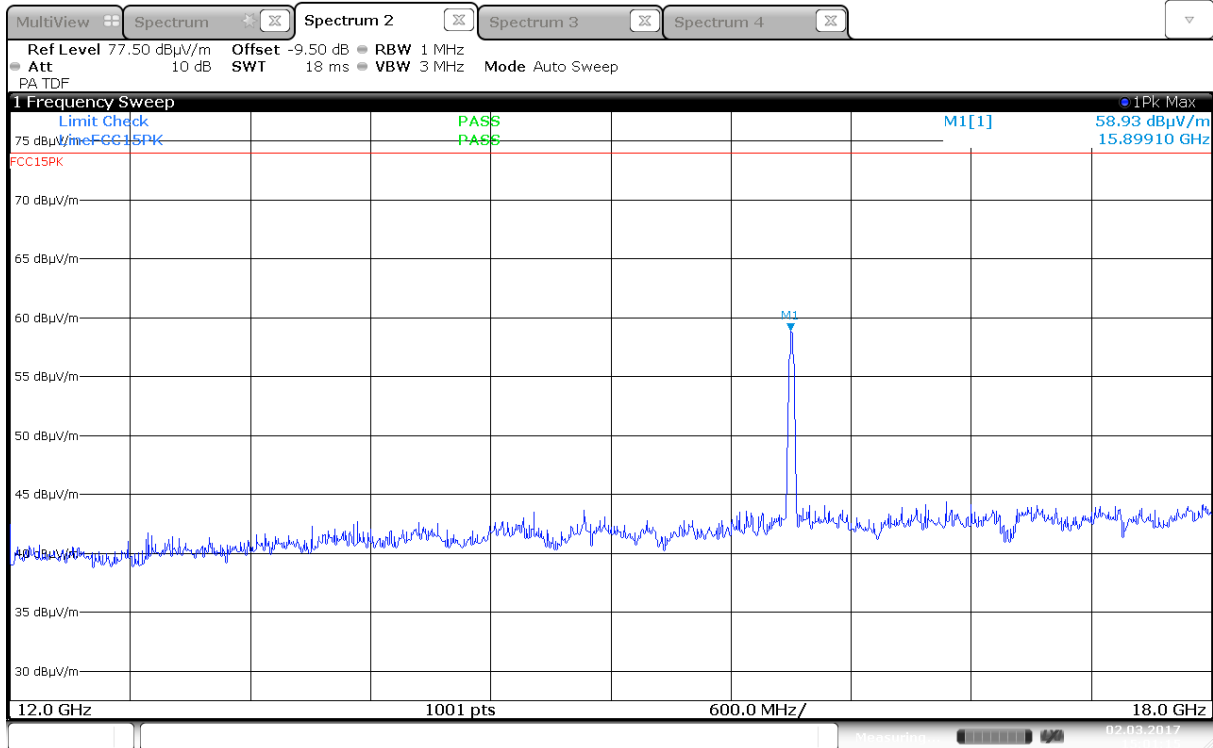
Radiated Emissions, 8.0 – 12.0 GHz, 5700 MHz, 802.11a 6M, Ant 1, VP, @1m



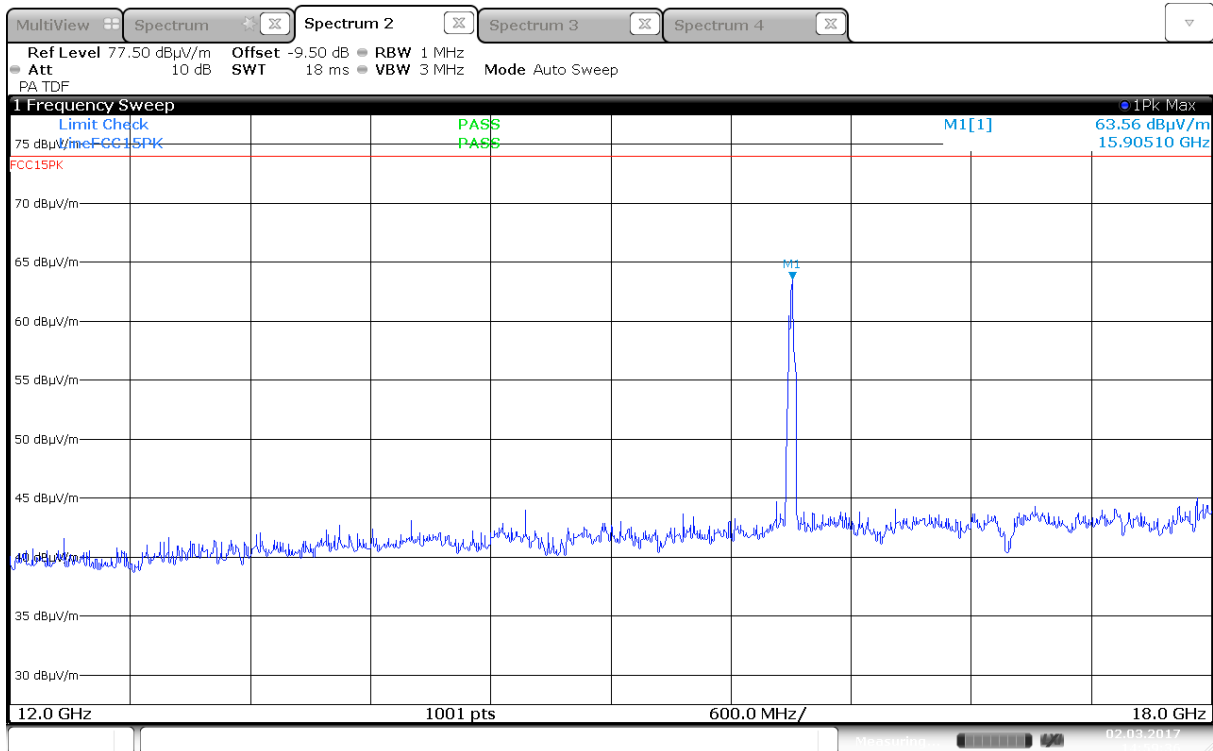
Radiated Emissions, 8.0 – 12.0 GHz, 5700 MHz, 802.11n HT20, MIMO, HP, @1m



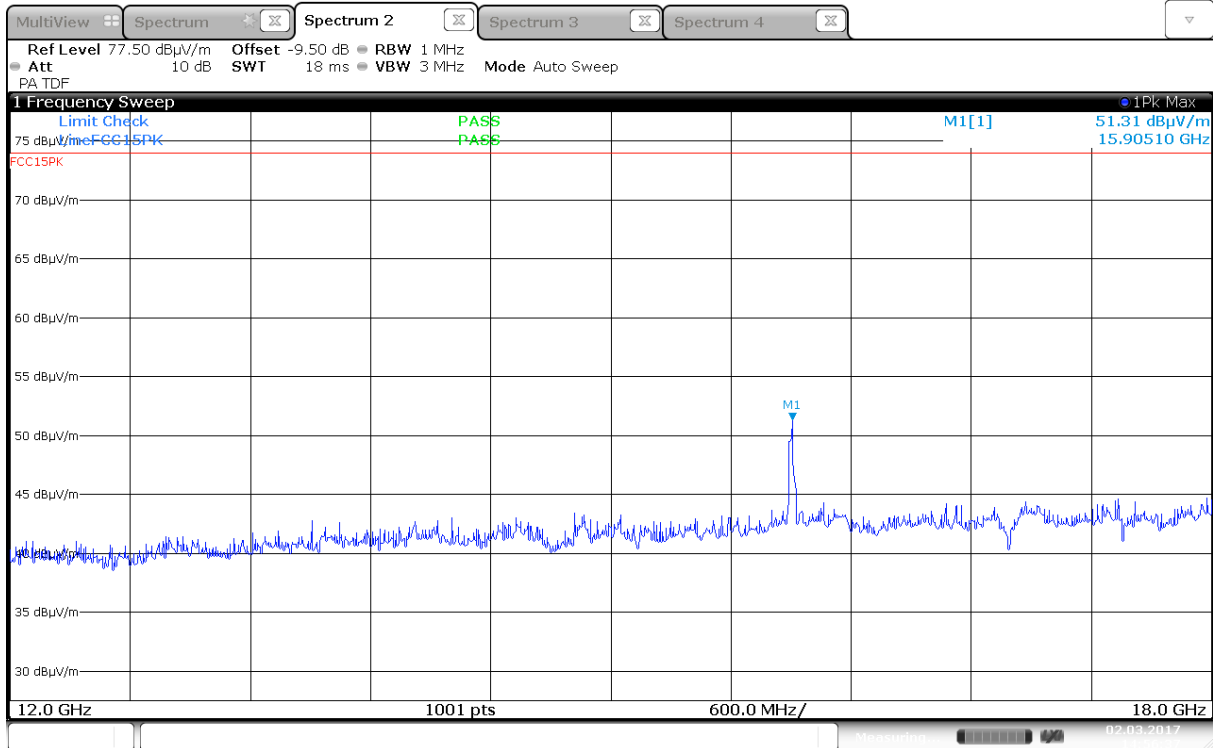
Radiated Emissions, 8.0 – 12.0 GHz, 5700 MHz, 802.11n HT20, MIMO, VP, @1m



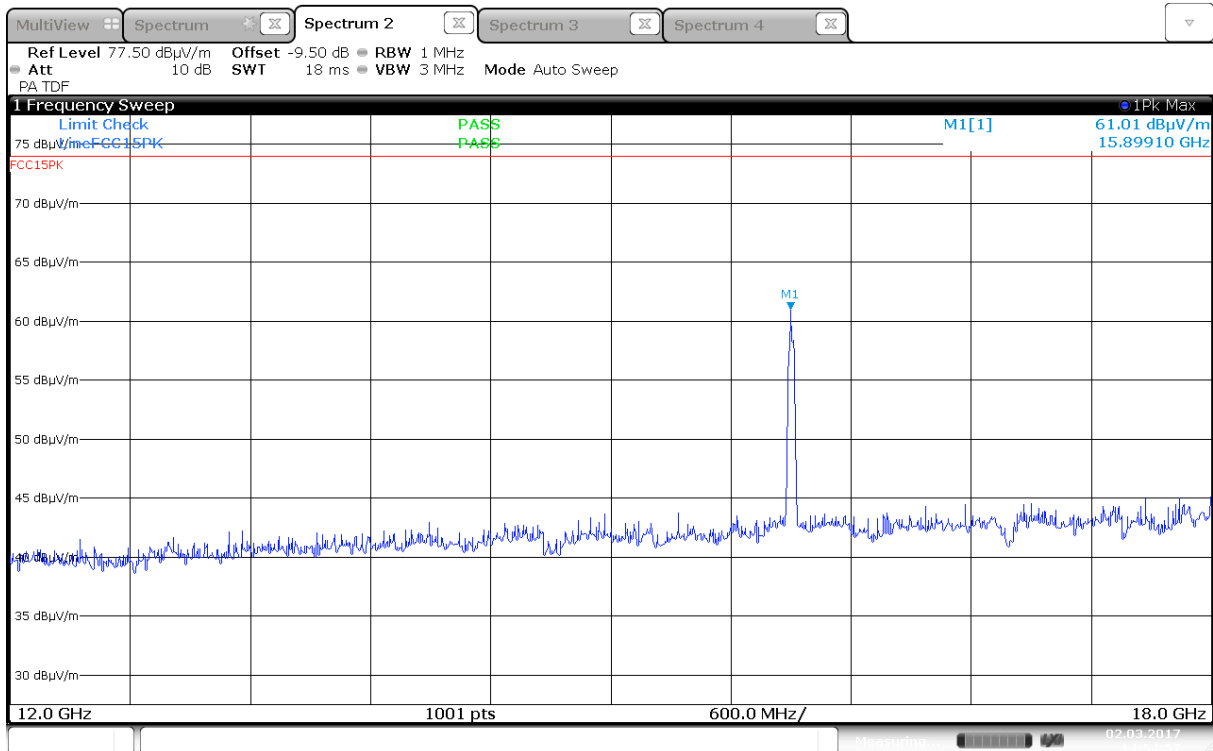
Radiated Emissions, 12.0 – 18.0 GHz, 5300 MHz, 802.11a 6M, Ant 0, HP, @1m



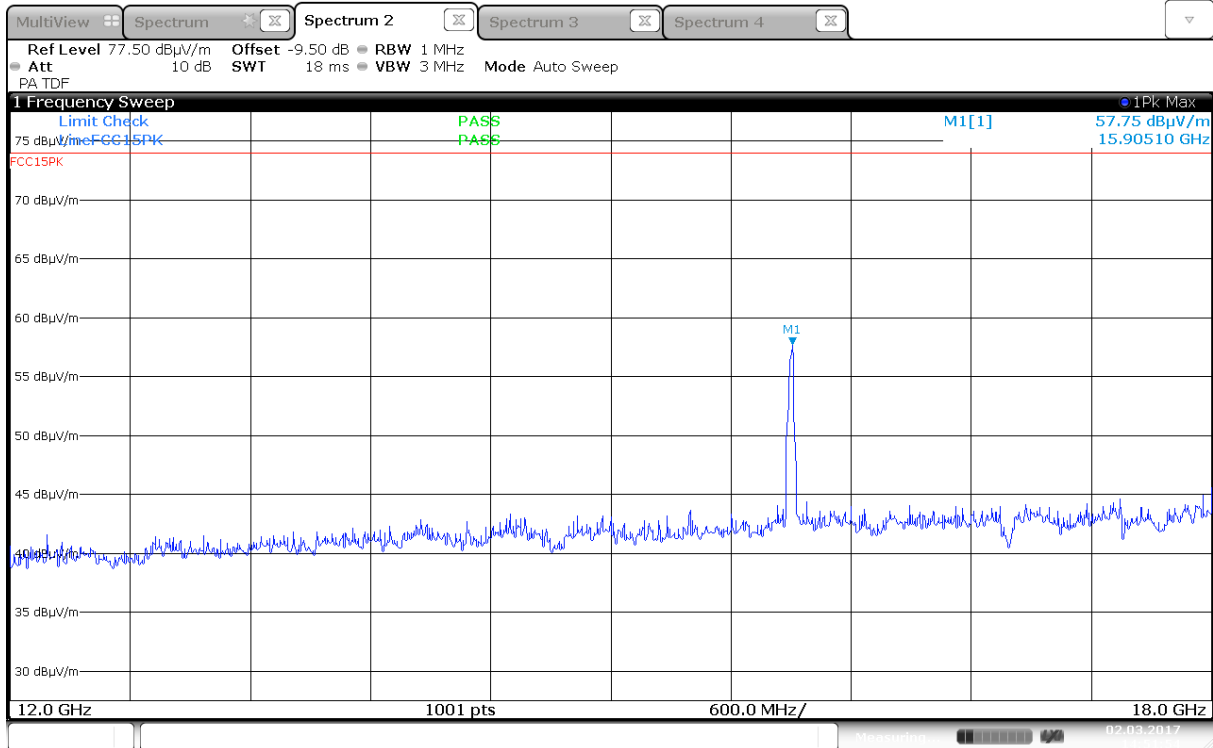
Radiated Emissions, 12.0 – 18.0 GHz, 5300 MHz, 802.11a 6M, Ant 0, VP, @1m



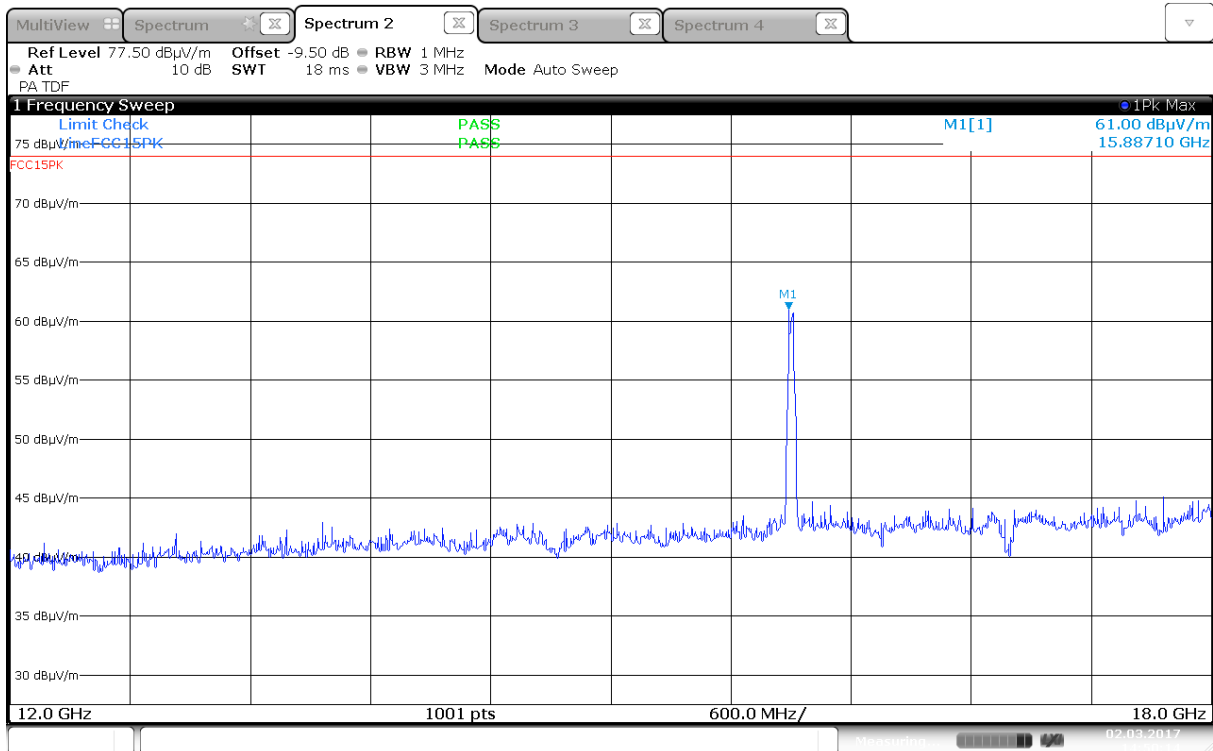
Radiated Emissions, 12.0 – 18.0 GHz, 5300 MHz, 802.11a 6M, Ant 1, HP, @1m



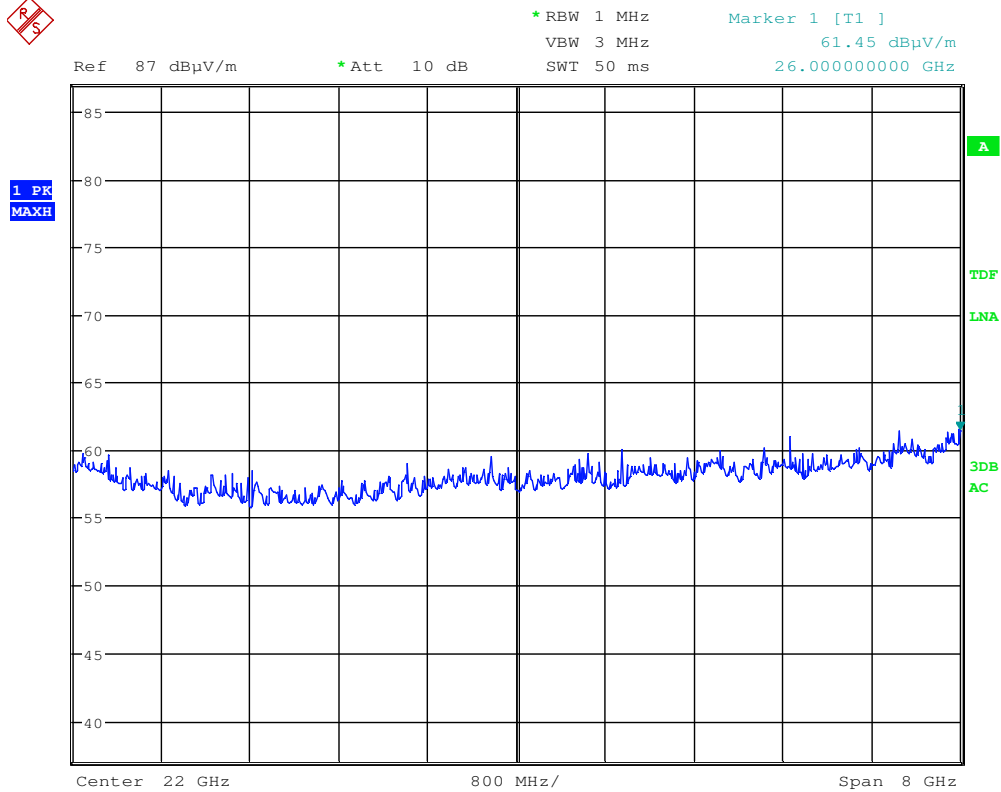
Radiated Emissions, 12.0 – 18.0 GHz, 5300 MHz, 802.11a 6M, Ant 1, VP, @1m



Radiated Emissions, 12.0 – 18.0 GHz, 5300 MHz, 802.11n MCS0, MIMO, HP, @1m

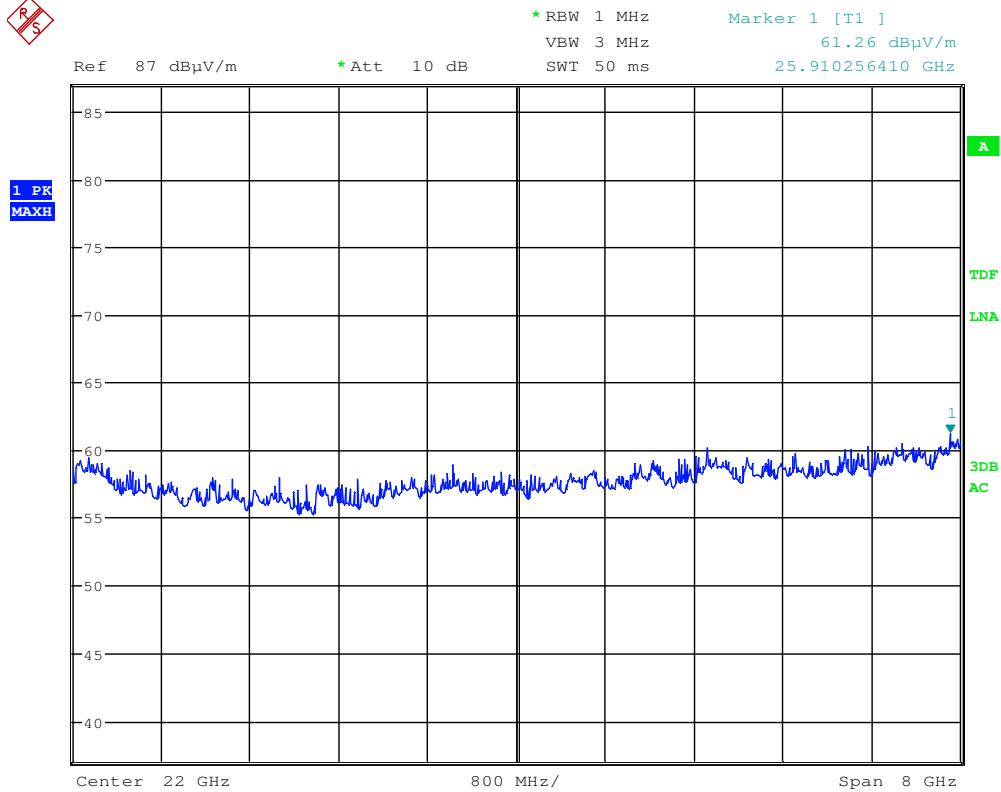


Radiated Emissions, 12.0 – 18.0 GHz, 5300 MHz, 802.11n MCS0, MIMO, VP, @1m



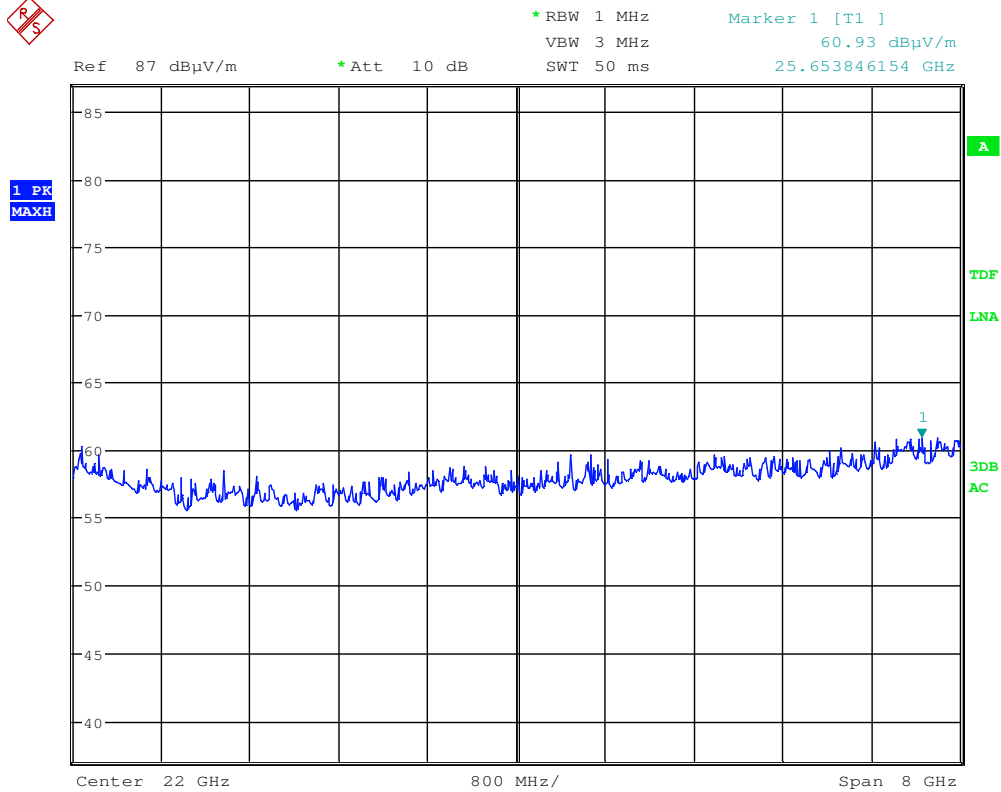
Date: 2.MAR.2017 15:31:24

Pre-scan, 18.0 – 25.0 GHz, 5300 MHz, 802.11a 6M, Ant 0, @approx 10cm



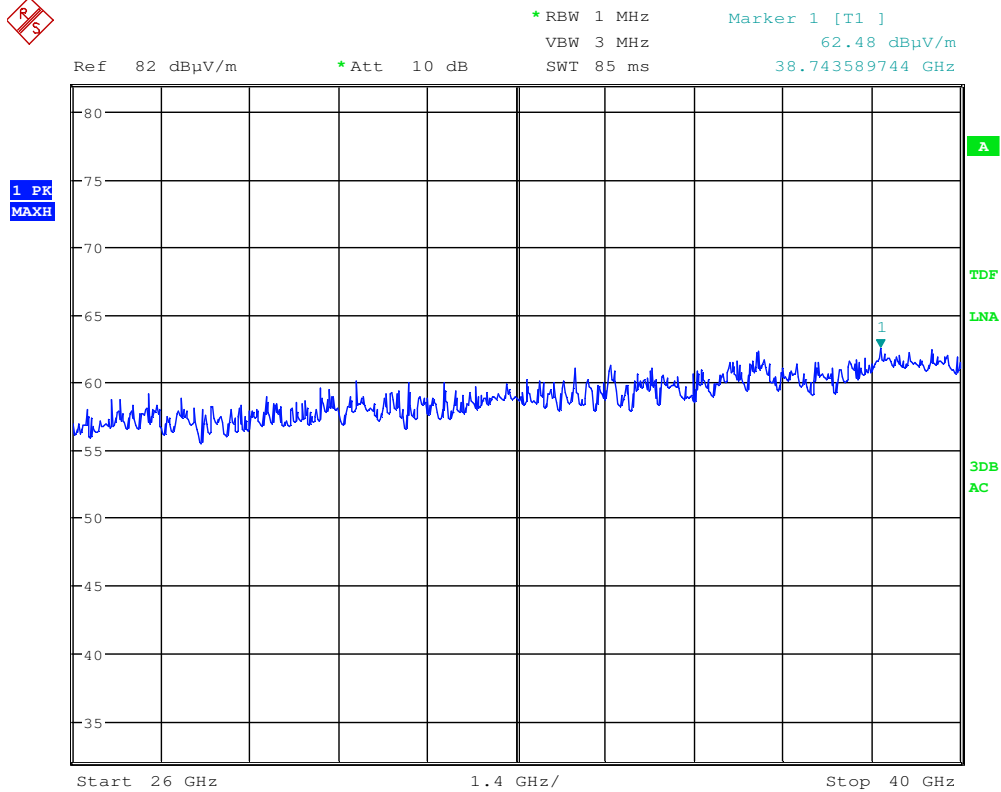
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Pre-scan, 18.0 – 25.0 GHz, 5300 MHz, 802.11a 6M, Ant 1, @approx 10cm



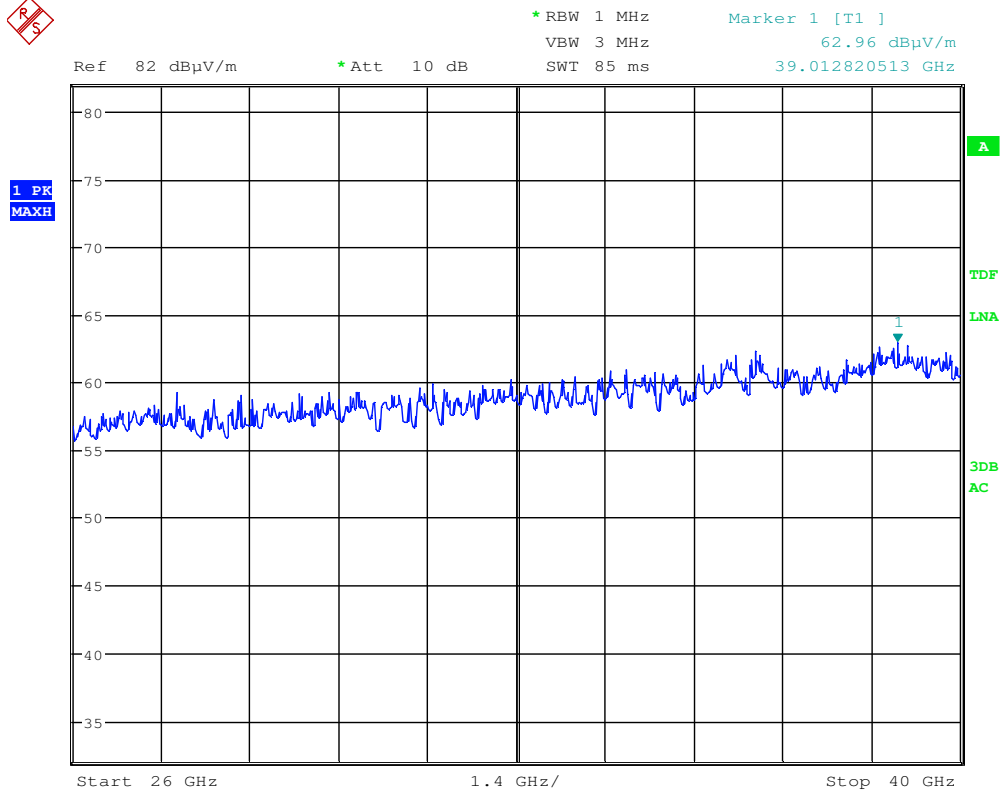
Date: 2.MAR.2017 15:35:11

Pre-scan, 18.0 – 25.0 GHz, 5300 MHz, 802.11n MCS0, MIMO, @approx 10cm



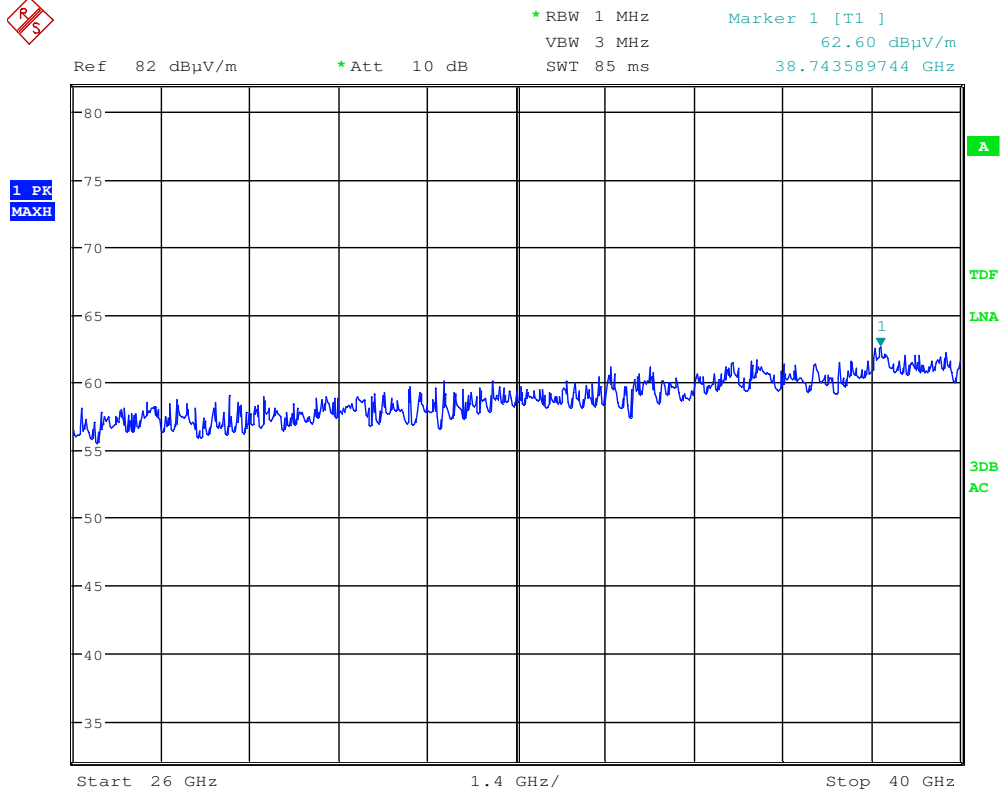
Date: 2.MAR.2017 15:54:57

Pre-scan, 26.0 – 40.0 GHz, 5300 MHz, 802.11a 6M, Ant 0, @approx 10cm



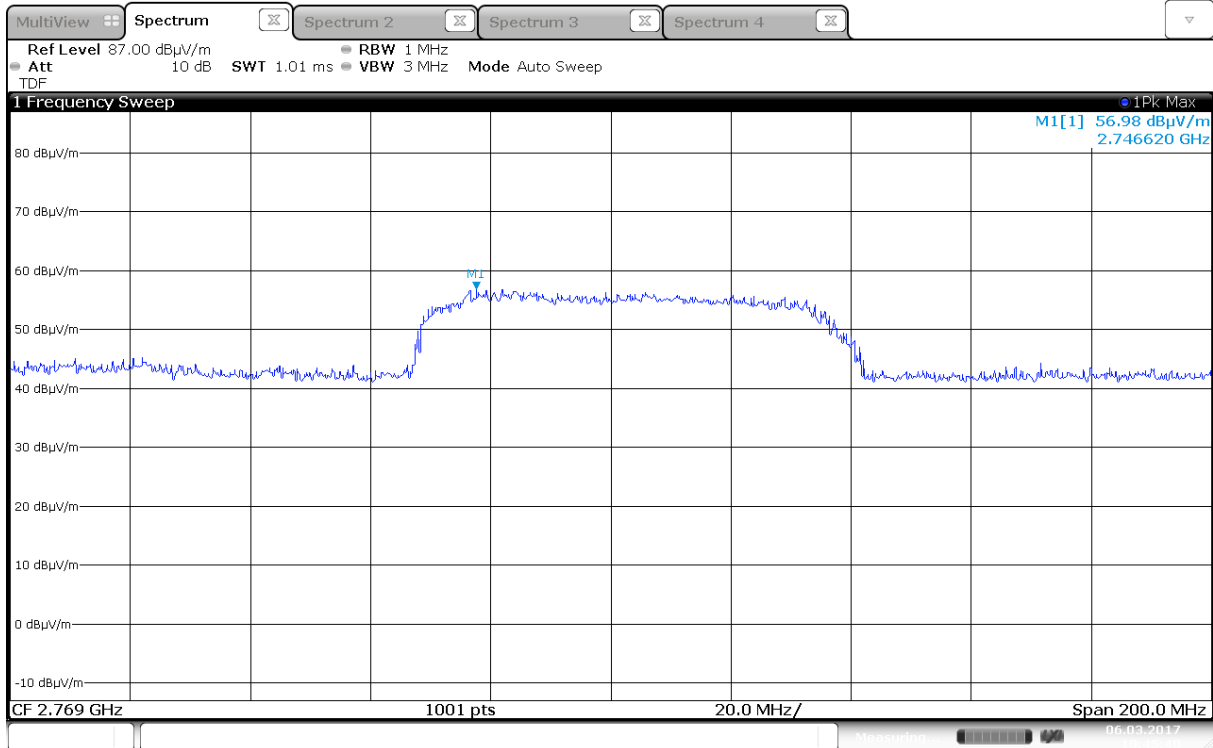
Date: 2.MAR.2017 15:56:38

Pre-scan, 26.0 – 40.0 GHz, 5300 MHz, 802.11a 6M, Ant 1, @approx 10cm

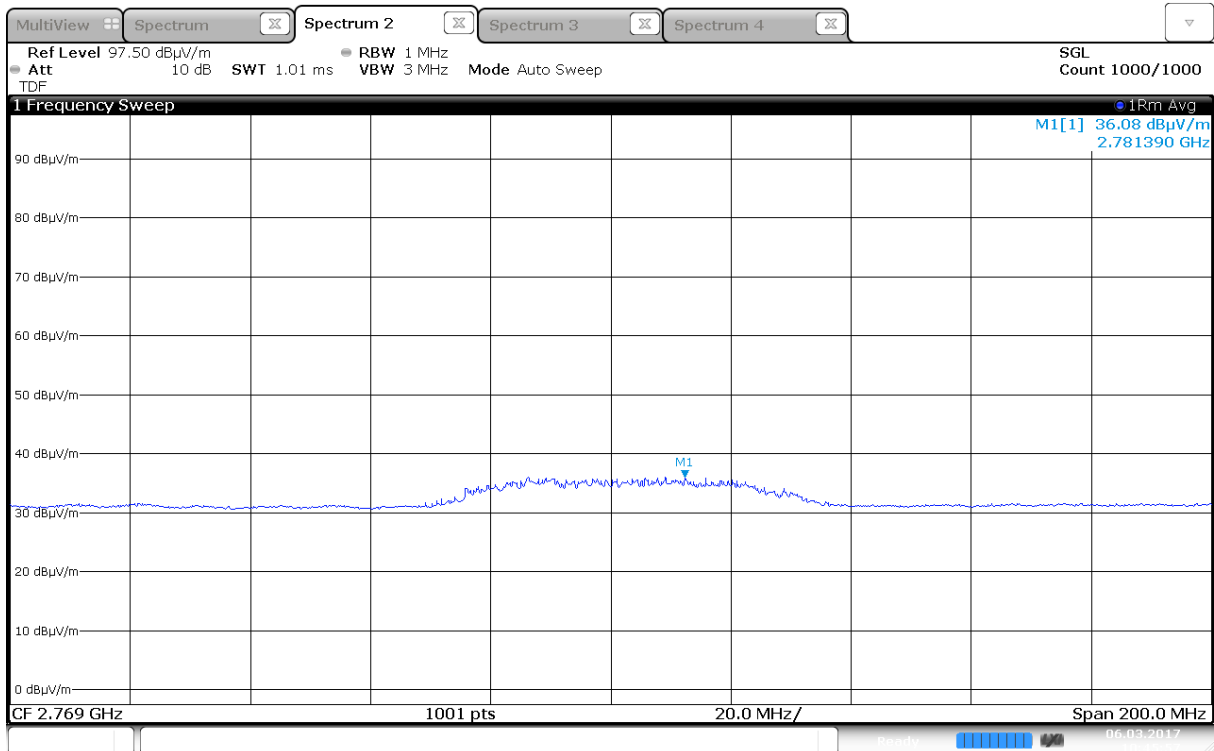


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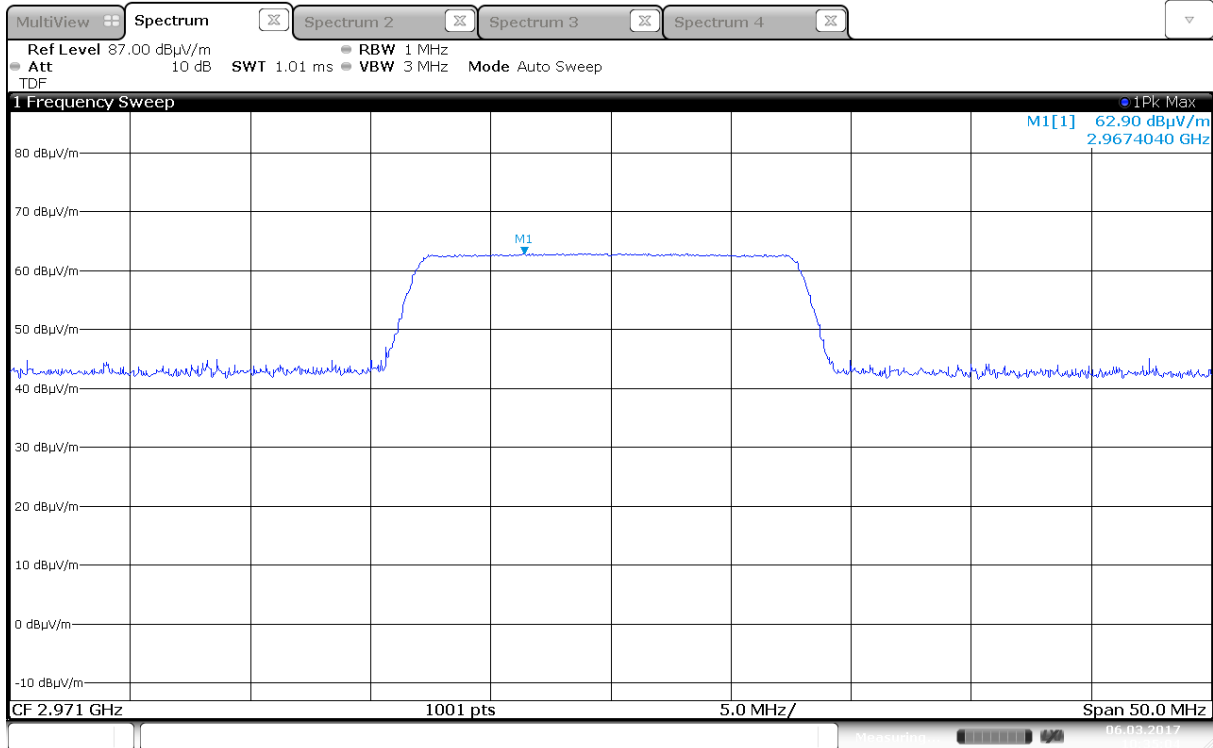
Pre-scan, 26.0 – 40.0 GHz, 5300 MHz, 802.11n MCS0, MIMO, @approx 10cm



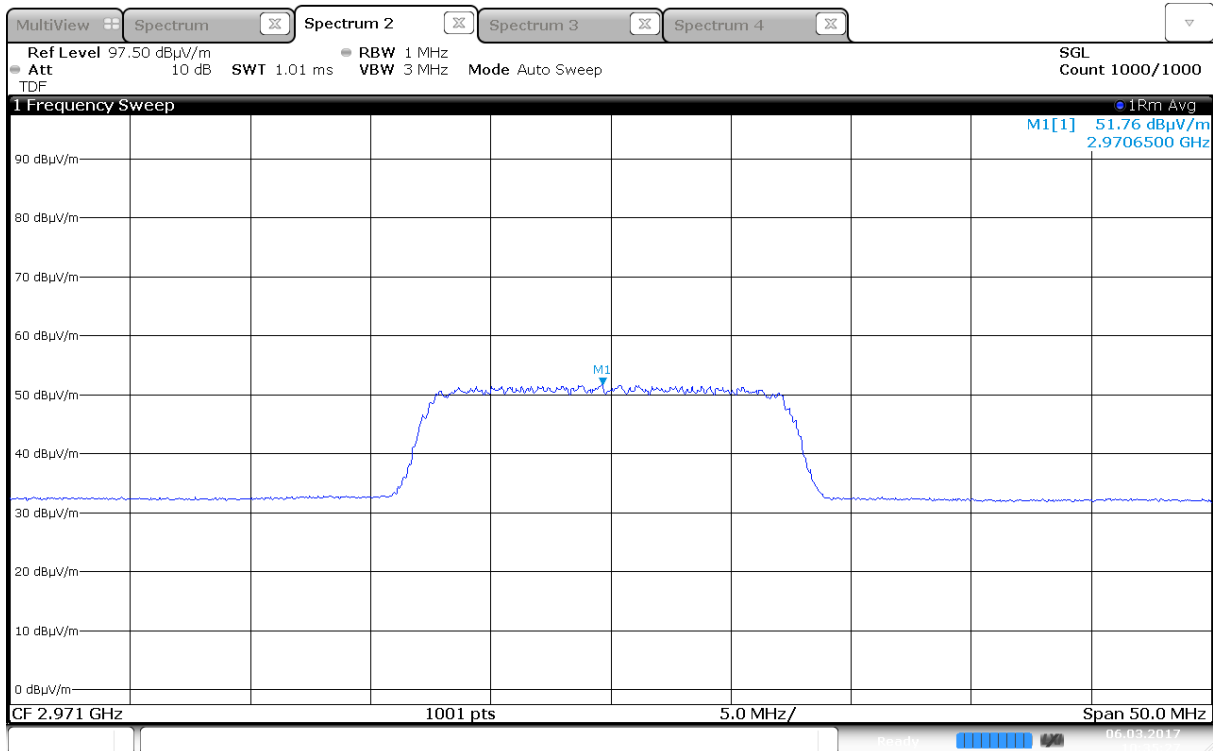
Radiated Emissions Pk, 2769 MHz, 5180 MHz, 802.11n MCS0, MIMO, (Max: HP)



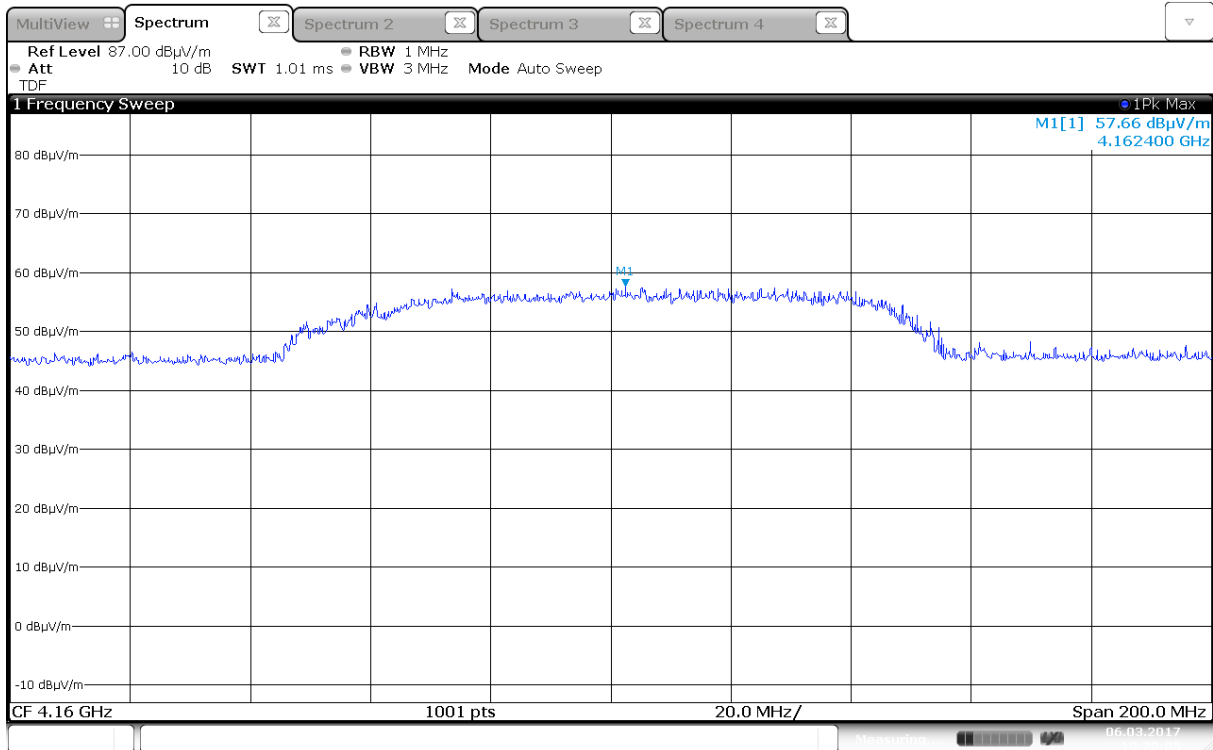
Radiated Emissions RMS, 2769 MHz, 5180 MHz, 802.11n MCS0, MIMO, (Max: HP)



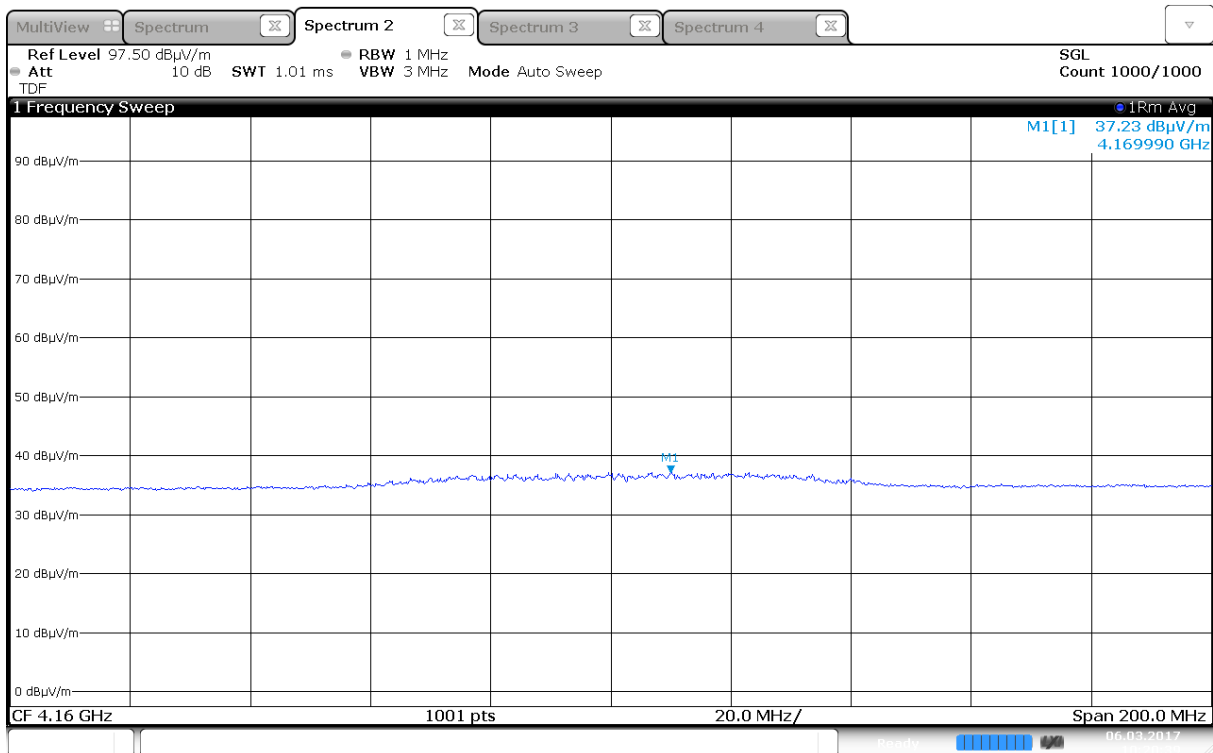
Radiated Emissions Pk, 2971 MHz, 5180 MHz, 802.11n MCS0, MIMO, (Max: HP)



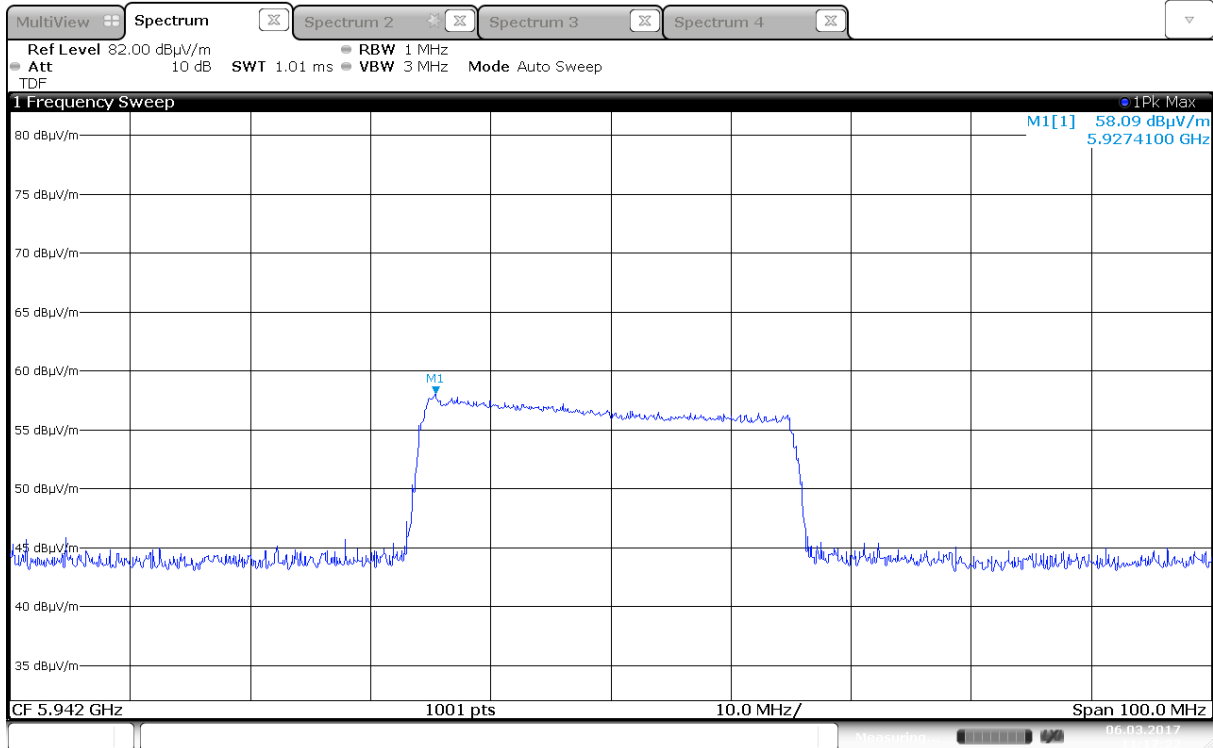
Radiated Emissions RMS, 2971 MHz, 5180 MHz, 802.11n MCS0, MIMO, (Max: HP)



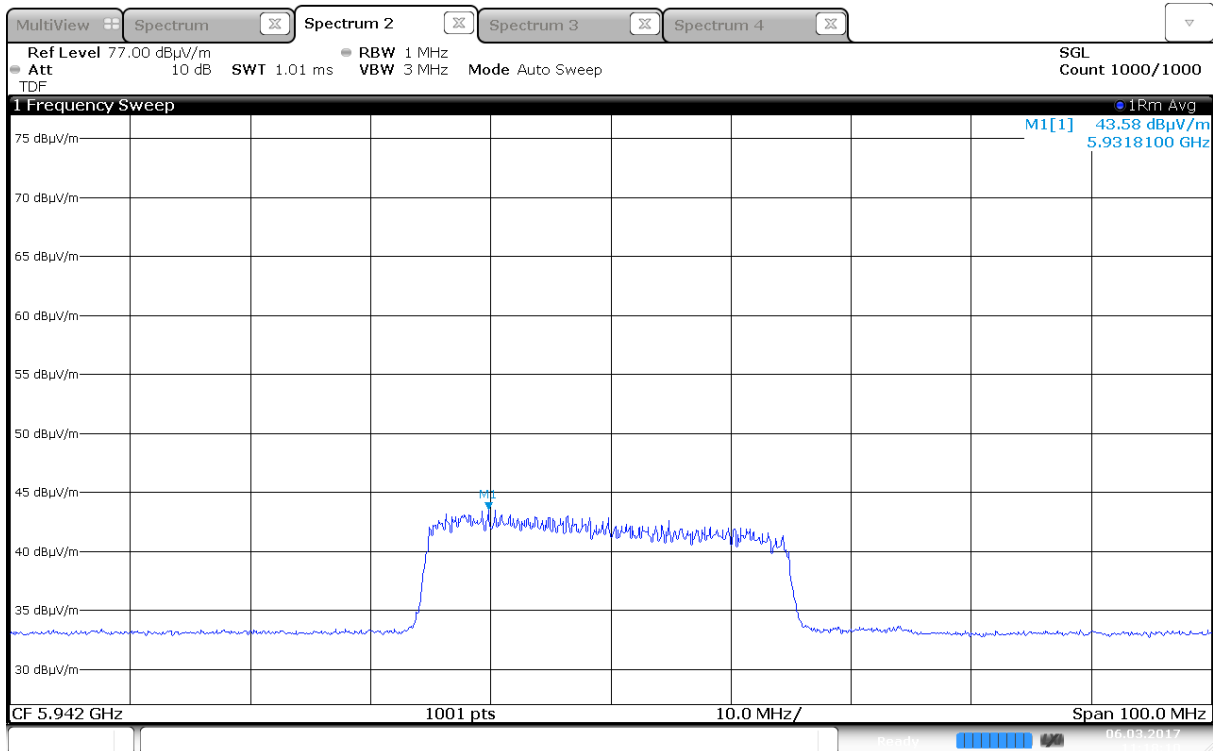
Radiated Emissions Pk, 4160 MHz, 5180 MHz, 802. 11a 6M, Ant 1, (Max: HP)



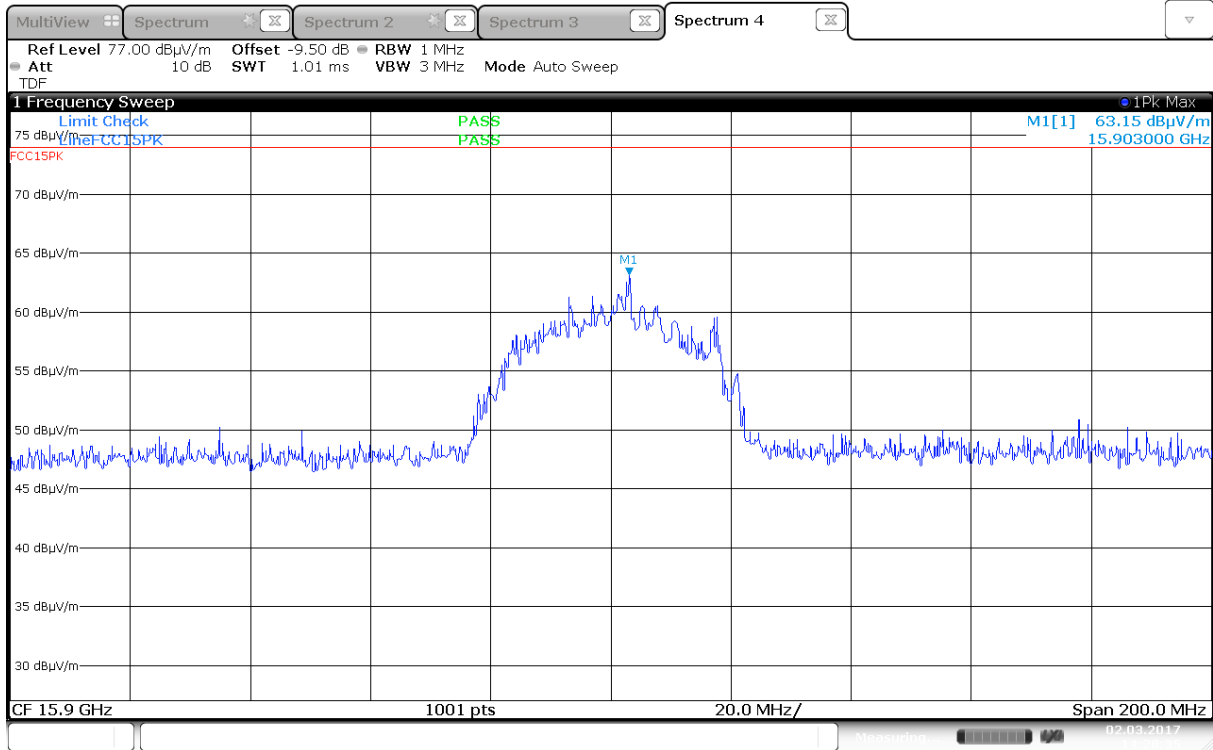
Radiated Emissions RMS, 4160 MHz, 5180 MHz, 802.11a 6M, Ant 1, (Max: HP)



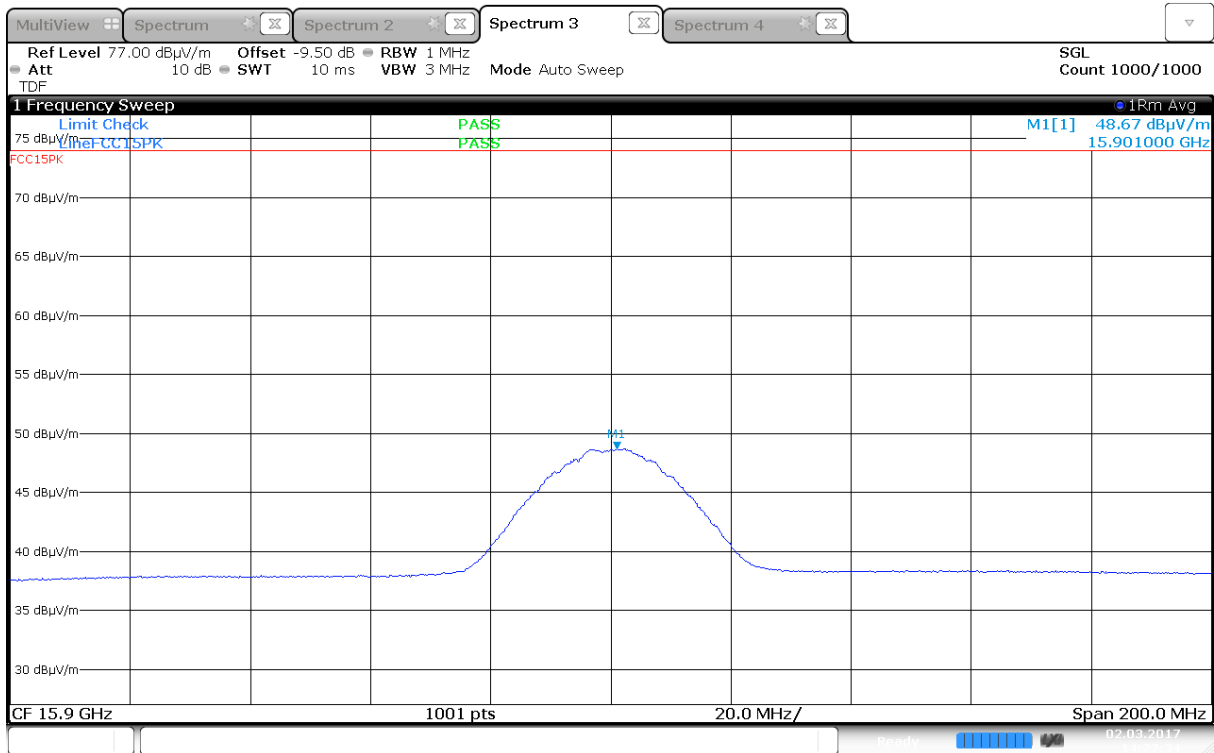
Radiated Emissions Pk, 5942 MHz, 5500 MHz, 802.11n MCS0, MIMO, (Max: HP)



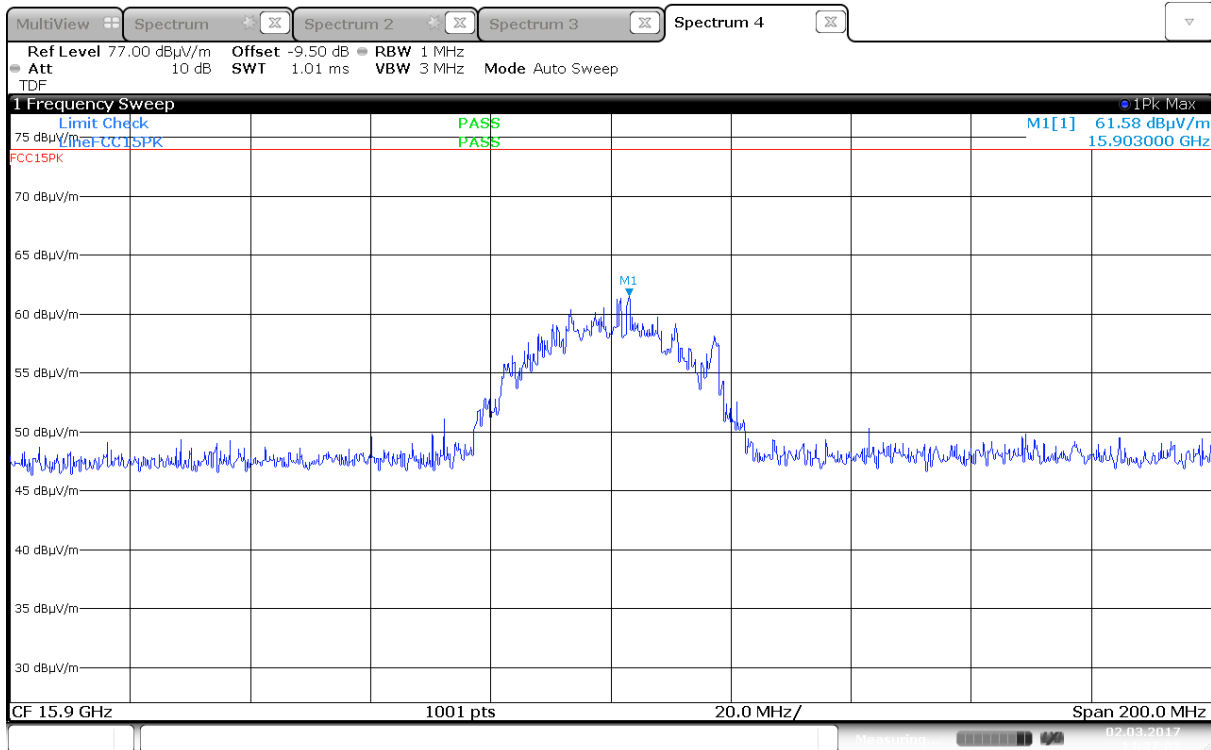
Radiated Emissions RMS, 5942 MHz, 5500 MHz, 802.11n MCS0, MIMO, (Max: HP)



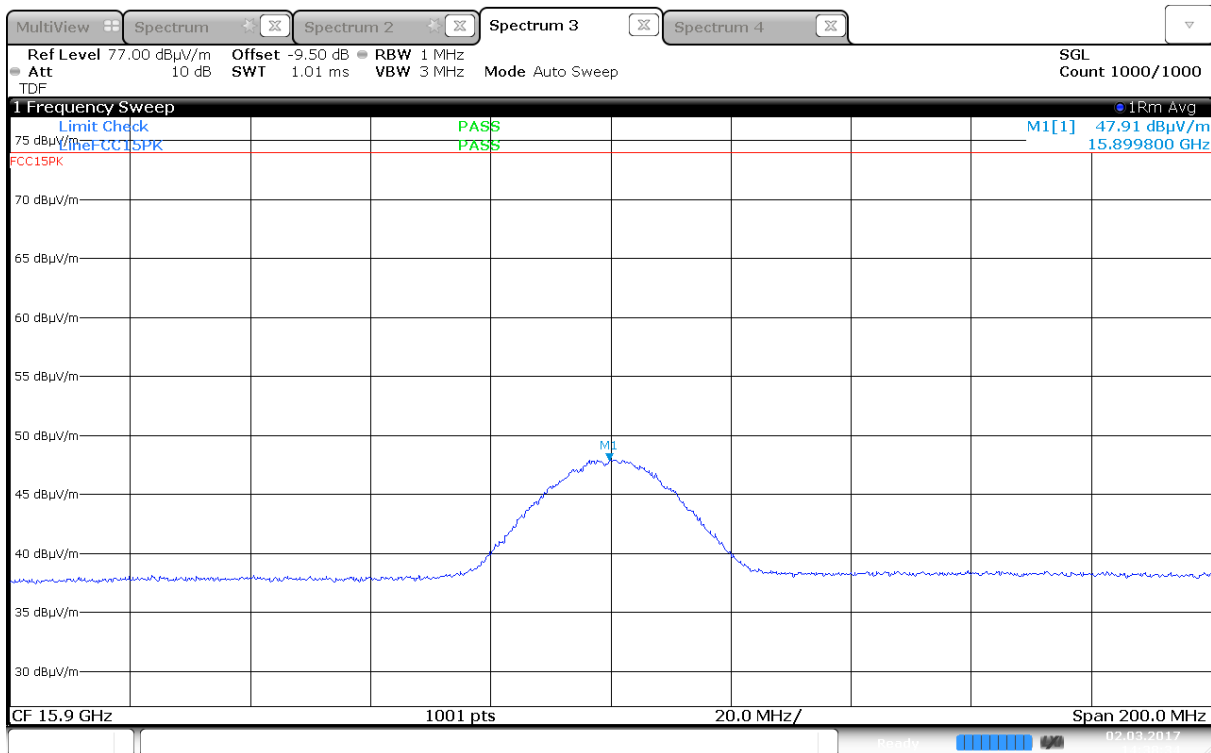
Radiated Emissions Pk, 15900 MHz, 5300 MHz, 802.11a 6M, Ant 0, (Max: VP)



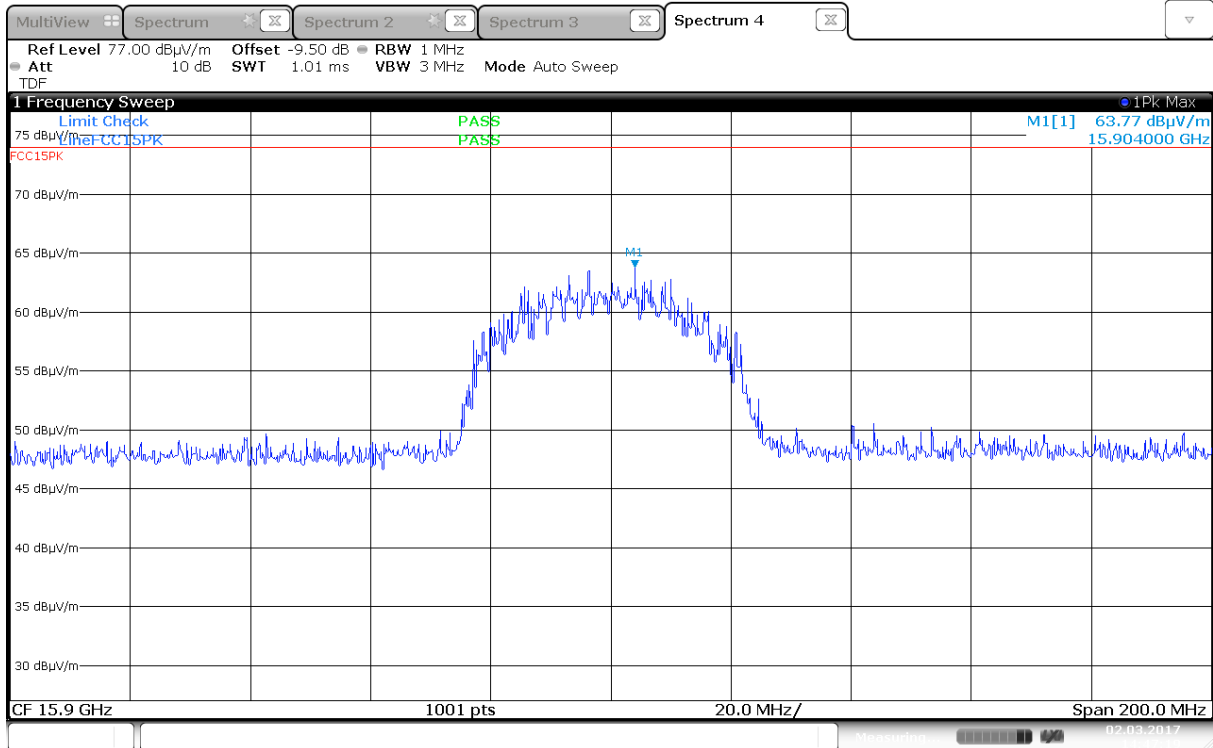
Radiated Emissions RMS, 15900 MHz, 5300 MHz, 802.11a 6M, Ant 0, (Max: VP)



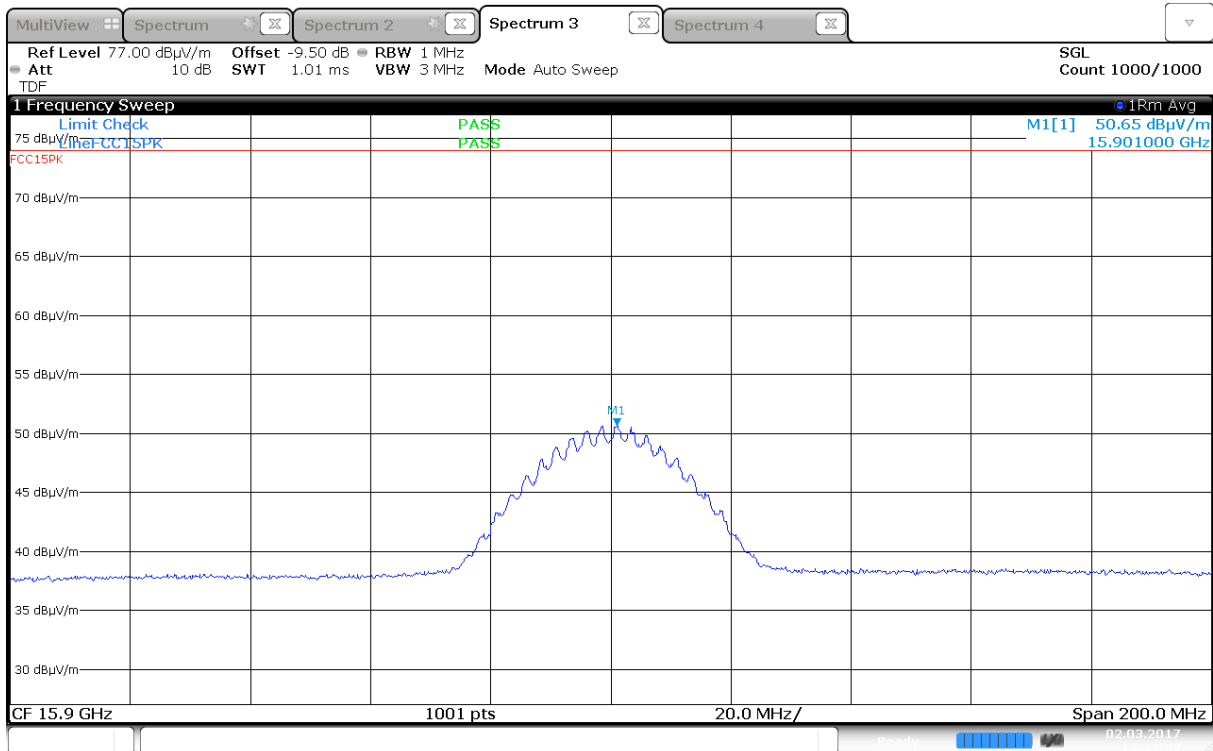
Radiated Emissions Pk, 15900 MHz, 5300 MHz, 802.11a 6M, Ant 1, (Max: VP)



Radiated Emissions RMS, 15900 MHz, 5300 MHz, 802.11a 6M, Ant 1, (Max: VP)



Radiated Emissions Pk, 15900 MHz, 5300 MHz, 802.11n MCS0, MIMO, (Max: VP)



Radiated Emissions RMS, 15900 MHz, 5300 MHz, 802.11n MCS0, MIMO, (Max: VP)

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

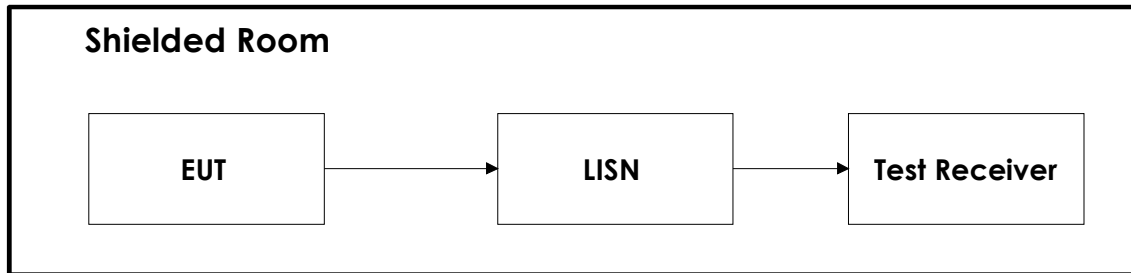
To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment and ancillaries are identified (numbered) by the Test Laboratory.

No.	Model	Description	Manufacturer	Asset no.	Cal. date	Cal. Due
1	FSW26	Spectrum Analyzer	Rohde & Schwarz	LR 1640	2017.01	2018.01
2	ESU40	Measuring Receiver	Rohde & Schwarz	LR 1639	2016.12	2017.12
3	WHKX6.5/18G-8SS	Highpass Filter	Wainwright Instruments	LR 1619	Cal b4 use	
4	317	Preamplifier	Sonoma Instrument	LR 1687	2016.05	2017.05
5	8449A	Pre-amplifier	Hewlett Packard	LR 1322	2016.10	2017.10
6	JS4-26004000	Pre-amplifier	Miteq	LR 1591	2016.07	2017.07
7	6812B	AC Power Source	Agilent	LR1515	Cal b4 use	
8	3115	Horn Antenna	EMCO	LR 1330	2016.10	2021.10
9	PM7320X	Antenna Horn	Sivers Lab	LR 102	2009.01	2019.01
10	DBF-520-20	Antenna Horn	Systron Donner	LR 100	2009.01	2019.01
11	637	Antenna Horn	Narda	LR 099	2007.04	2017.04
12	638	Antenna Horn	Narda	LR 098	2010.06	2020.06
13	HK116	Biconical Antenna	Rohde & Schwarz	LR 1260	2013.12	2018.12
14	HL223	Logperiod Antenna	Rohde & Schwarz	LR 1261	2013.12	2018.12
15	Model 87 V	Multimeter	Fluke	LR 1597	2016.10	2017.10
16	ESCI3	Measuring receiver	Rohde & Schwarz	N-4259	2015.08	2017.08
17	ESH3-Z2	Pulse Limiter	Rohde & Schwarz	LR 1074	2016.05	2017.05
18	ESH3-Z5	Two-Line V-Network	Rohde & Schwarz	N-3403	2015.07	2017.07

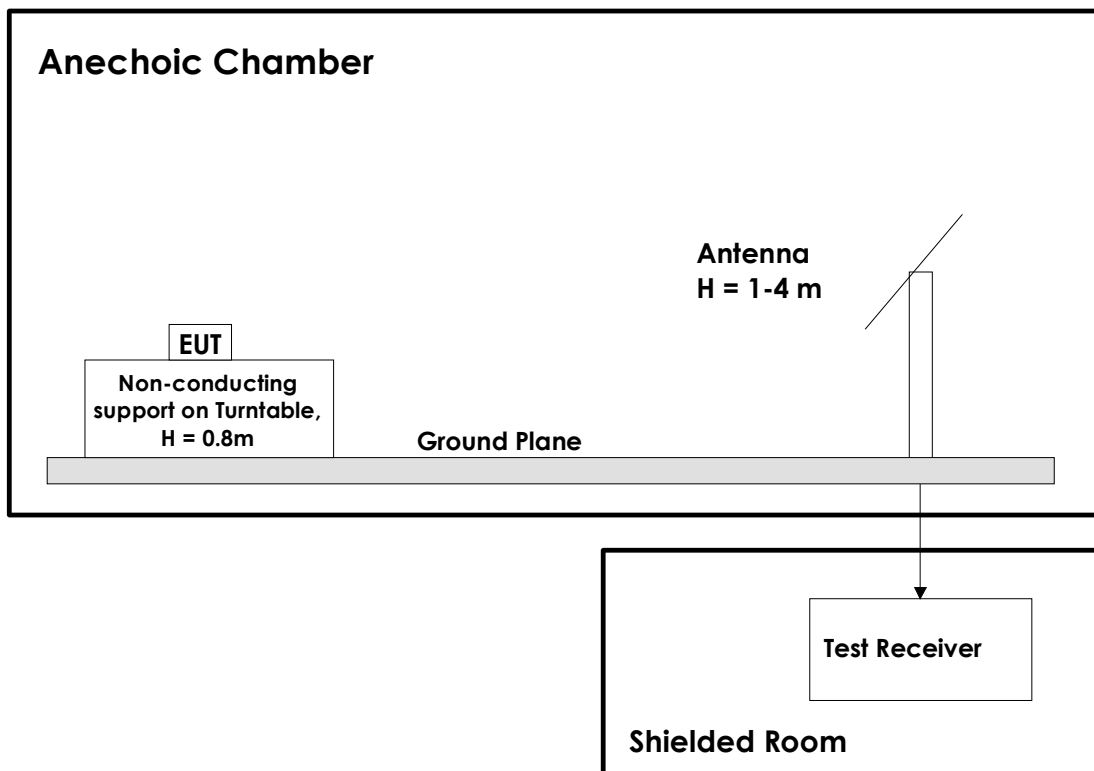
Test Software List			
Description	Manufacturer	Model	Version
EMC Software for Conducted tests	Rohde & Schwarz	EMC32	9.26.00

6 BLOCK DIAGRAM

6.1 Power Line Conducted Emission



6.2 Test Site Radiated Emission



The EUT is supplied with a stand for floor standing use, all tests were performed with the EUT mounted on this stand. No turntable was used for any of the tests.

For frequencies above 1 GHz the ground plane between the EUT and the measuring antenna was covered by absorbers.

Revision history

Version	Date	Comment	Sign
1.0	2017.04.12	First edition	FS
2.0	2017.05.22	Added comments	FS