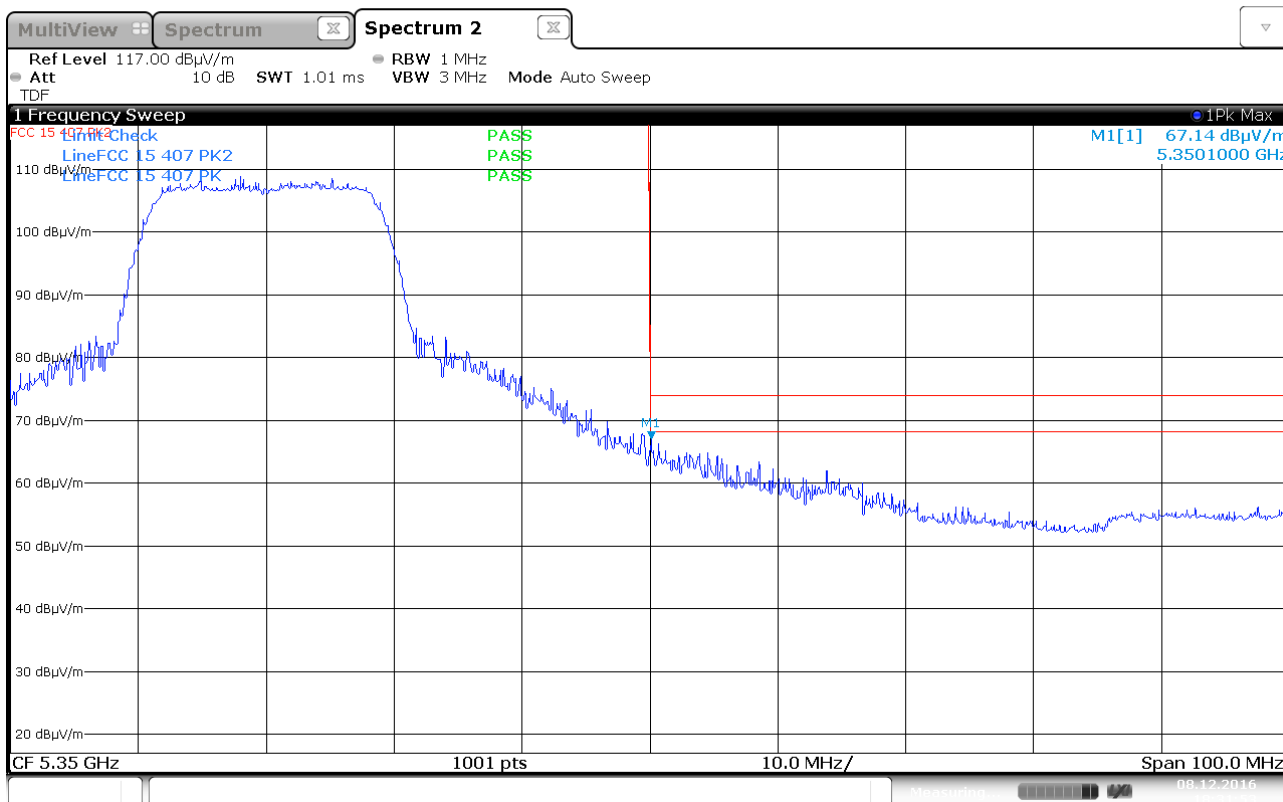
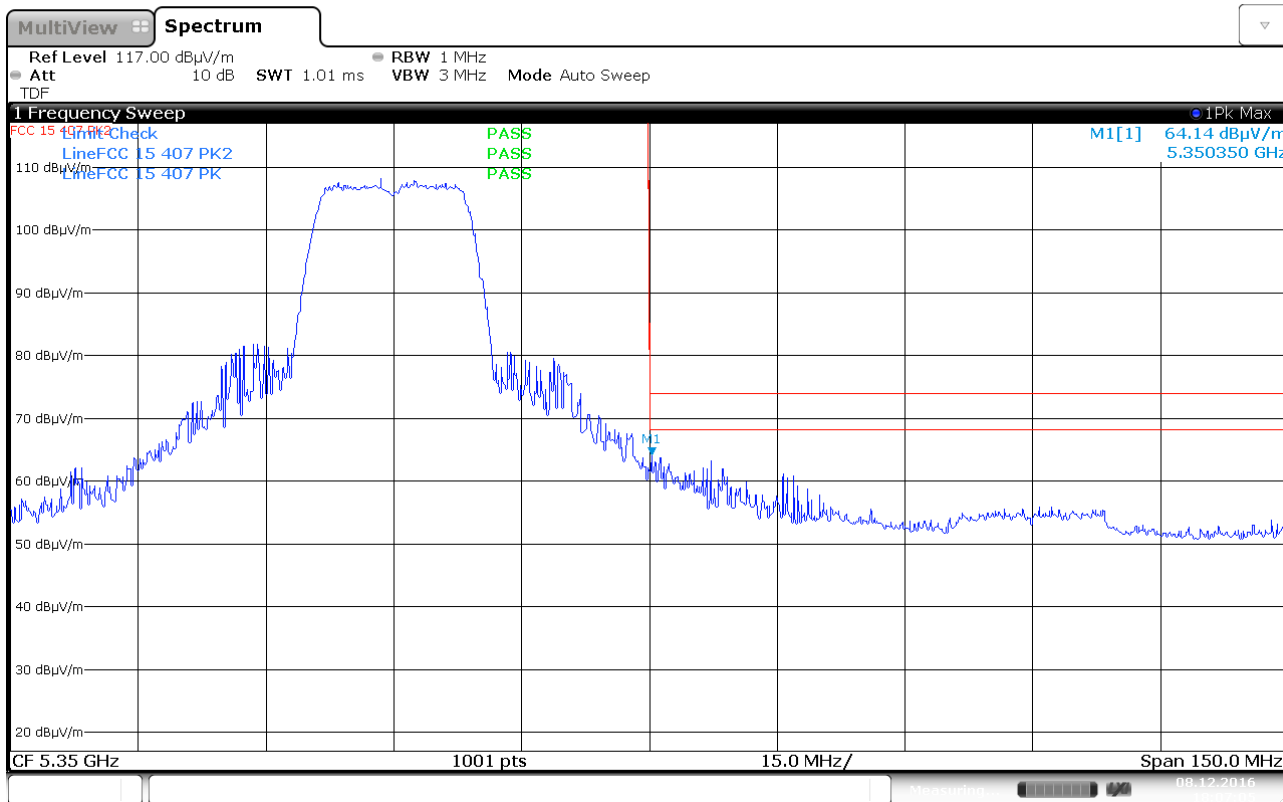


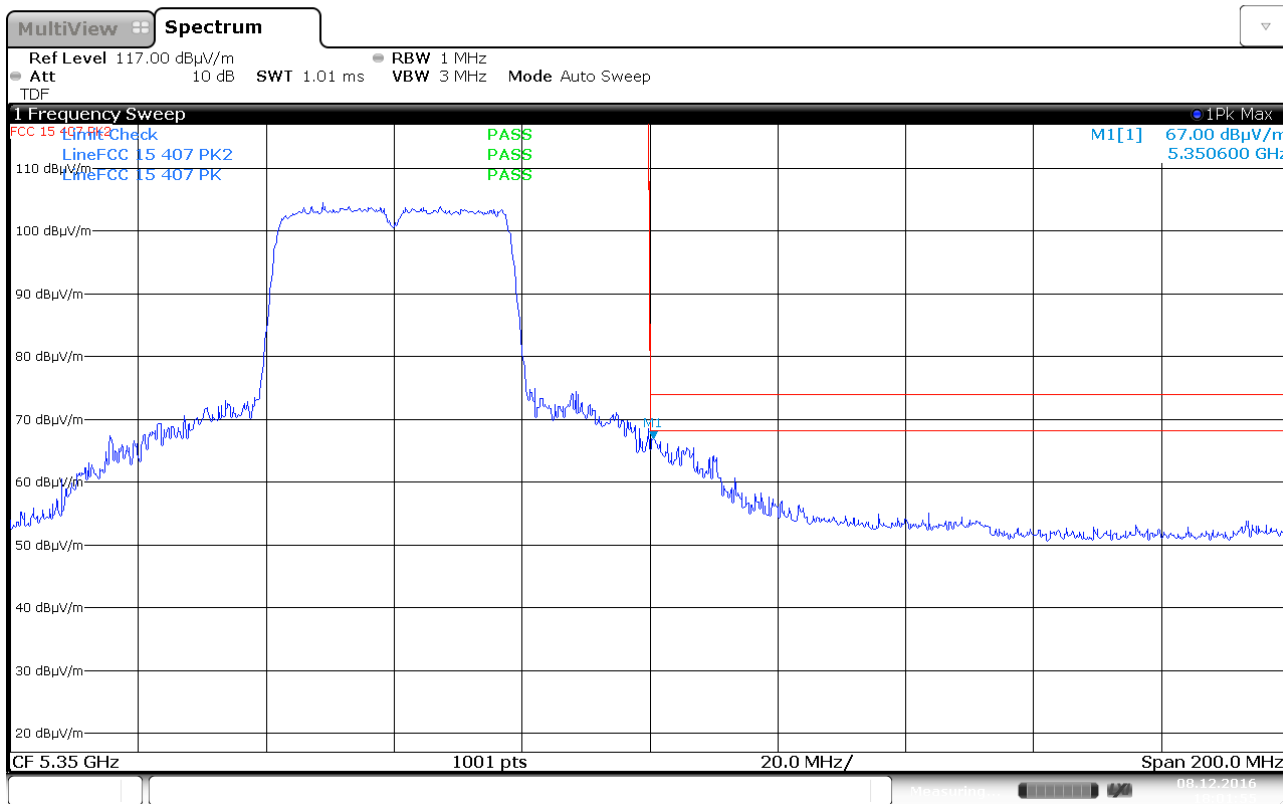
Unwanted Emissions, Band Edge, 5350MHz, ch64, 802.11a 6M, ant 0



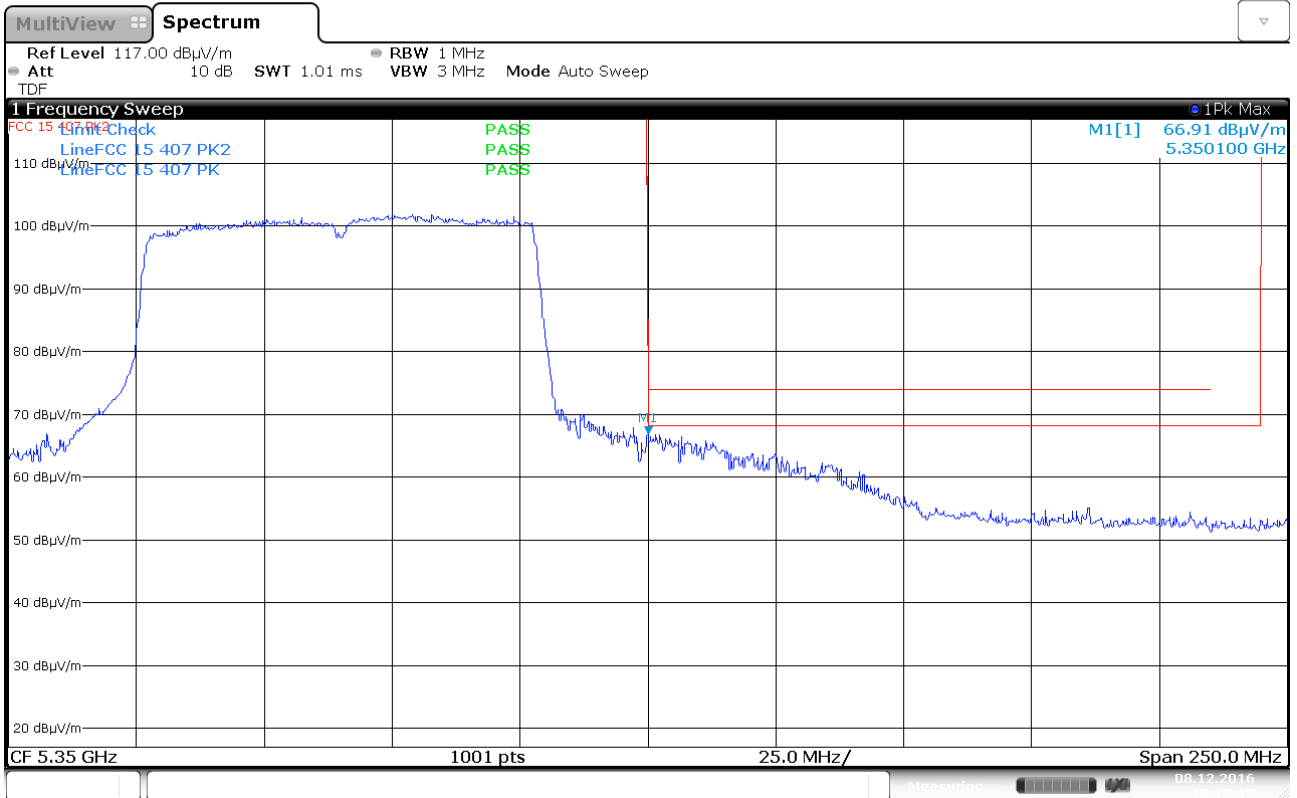
Unwanted Emissions, Band Edge, 5350MHz, ch64, 802.11a 6M, ant 1



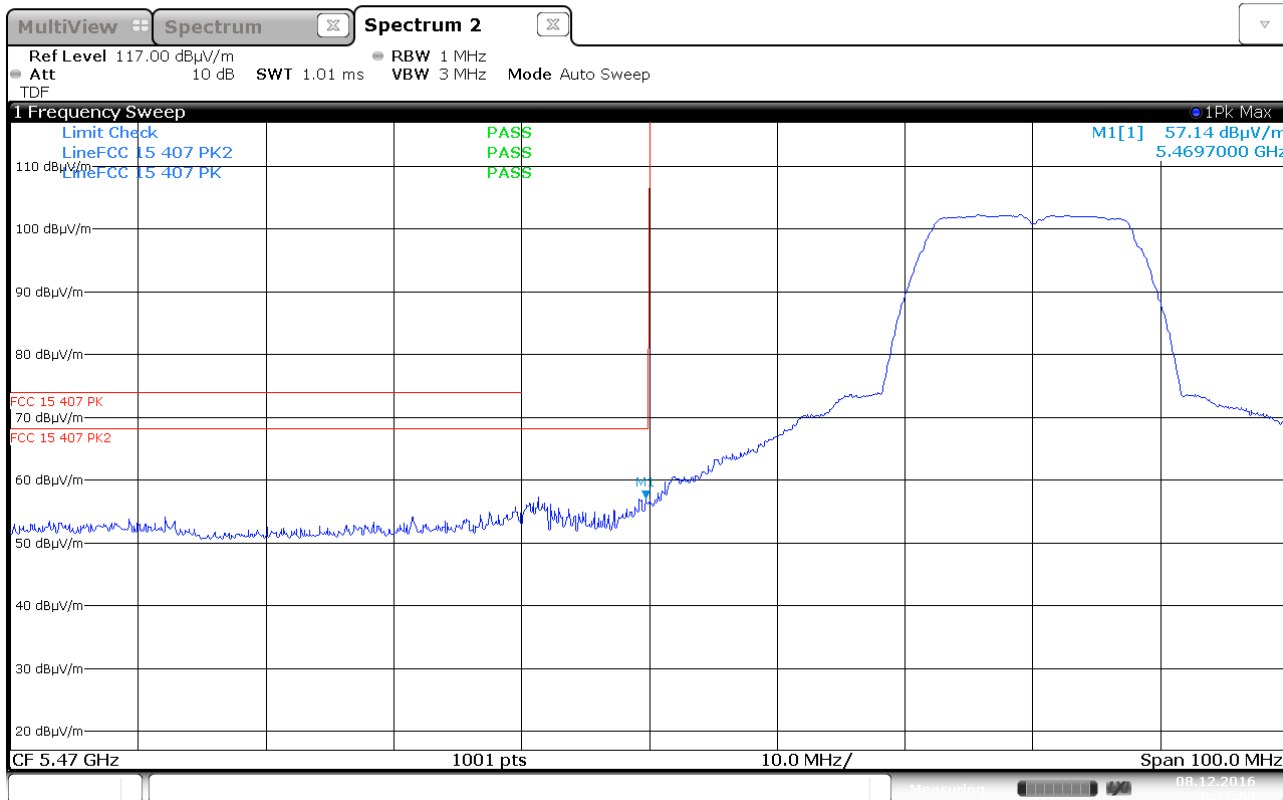
Unwanted Emissions, Band Edge, 5350MHz, ch64, 802.11n MCS0 HT20, MIMO



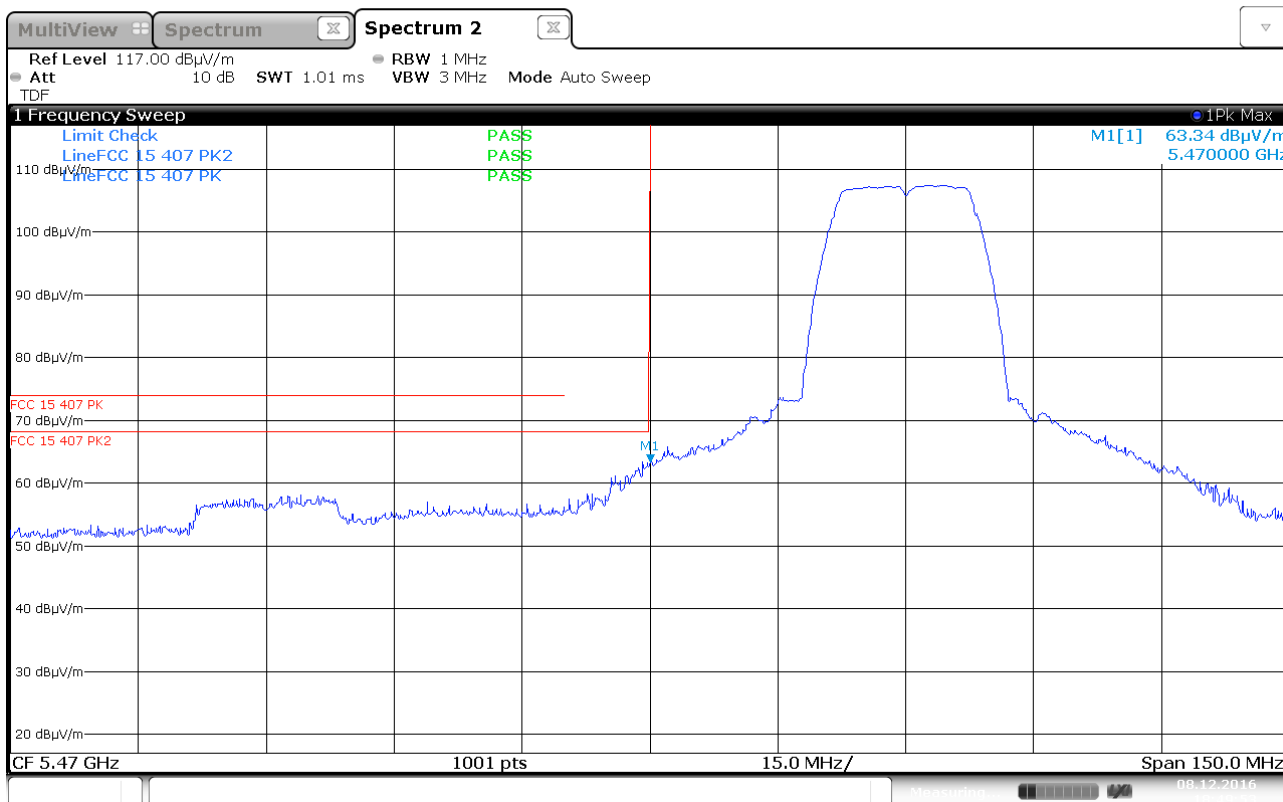
Unwanted Emissions, Band Edge, 5350MHz, ch62, 802.11n MCS0 HT40, MIMO



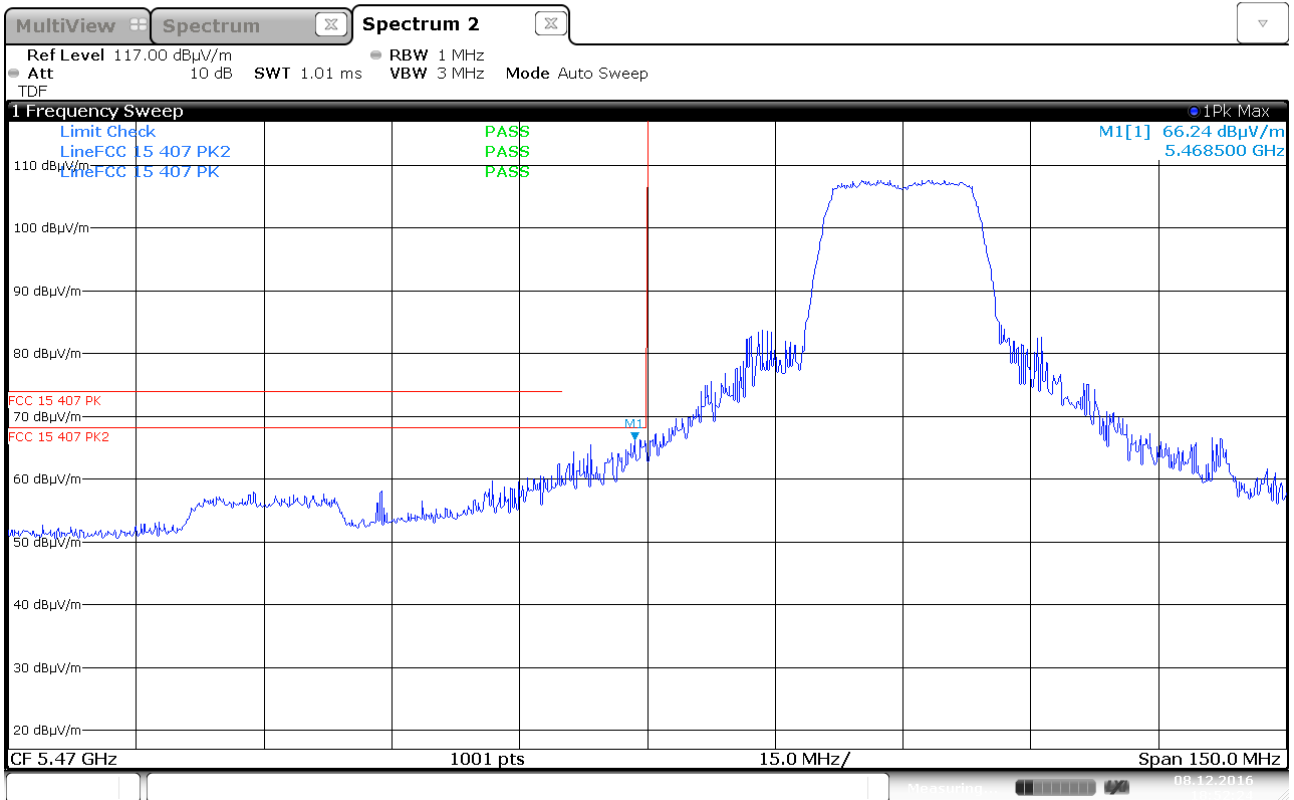
Unwanted Emissions, Band Edge, 5350MHz, ch58, 802.11n MCS0 HT80, MIMO



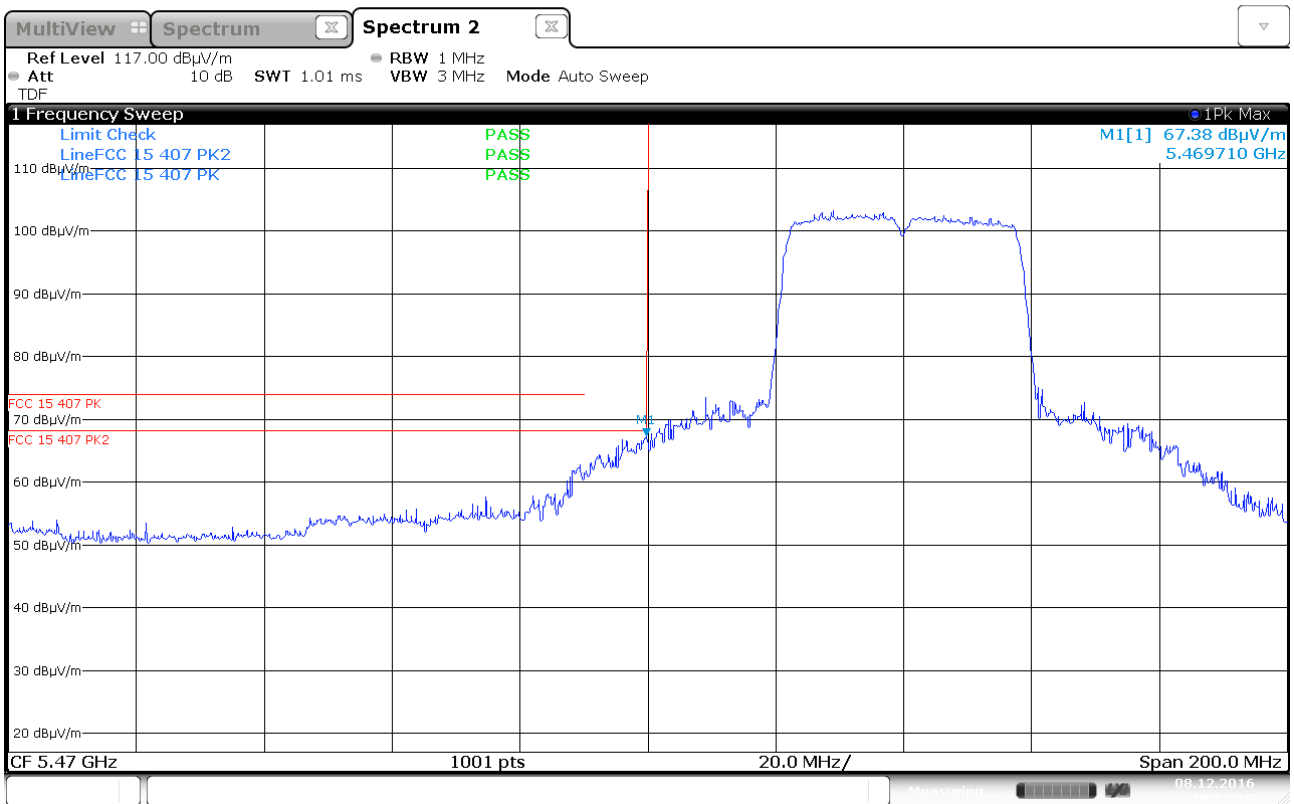
Unwanted Emissions, Band Edge, 5470MHz, ch100, 802.11a 6M, ant 0



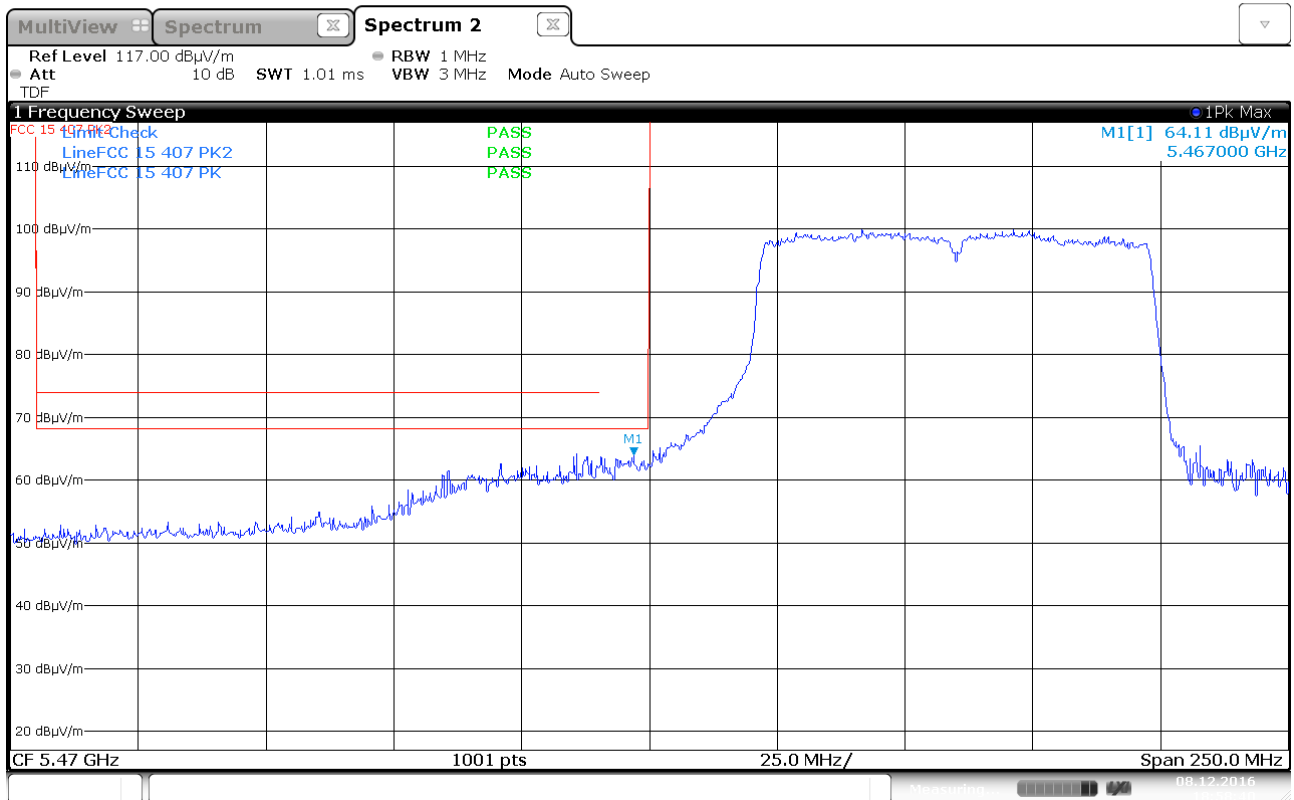
Unwanted Emissions, Band Edge, 5470MHz, ch100, 802.11a 6M, ant 1



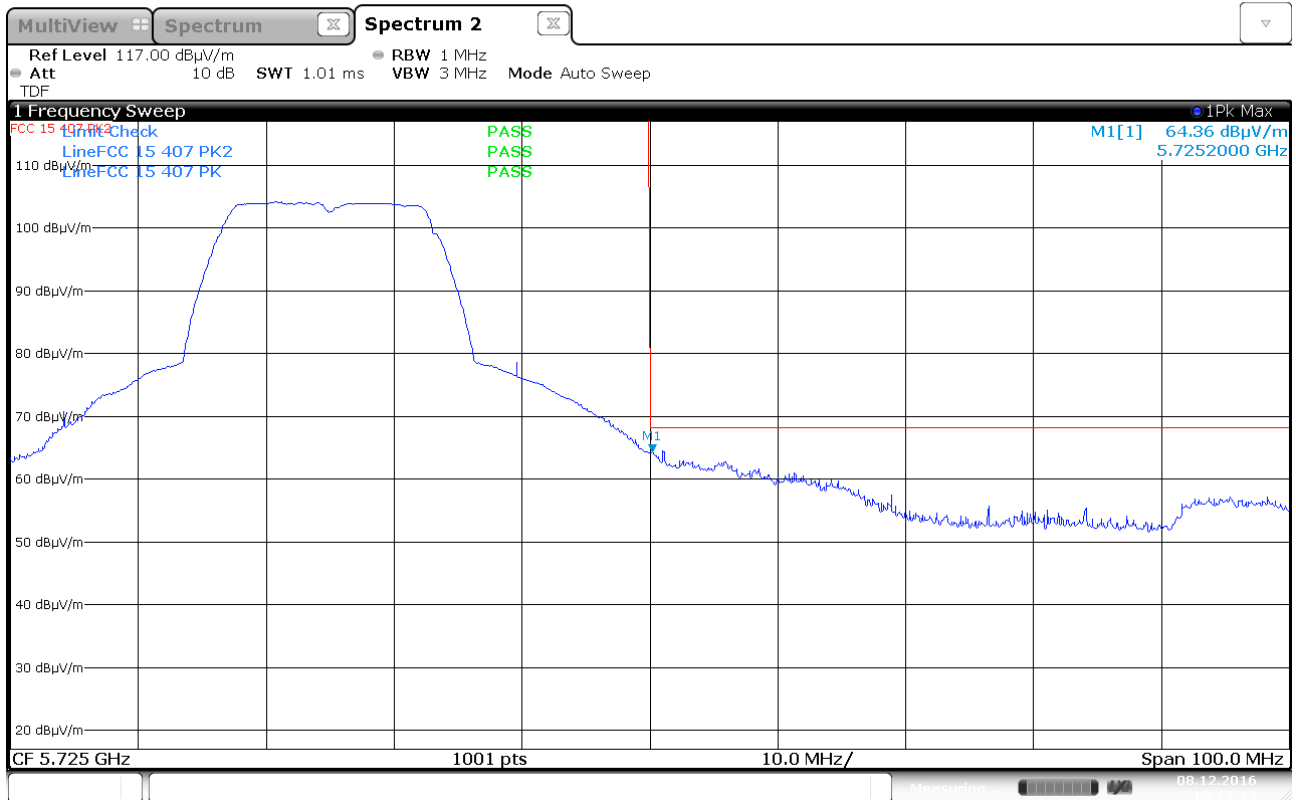
Unwanted Emissions, Band Edge, 5470MHz, ch100, 802.11n MCS0 HT20, MIMO



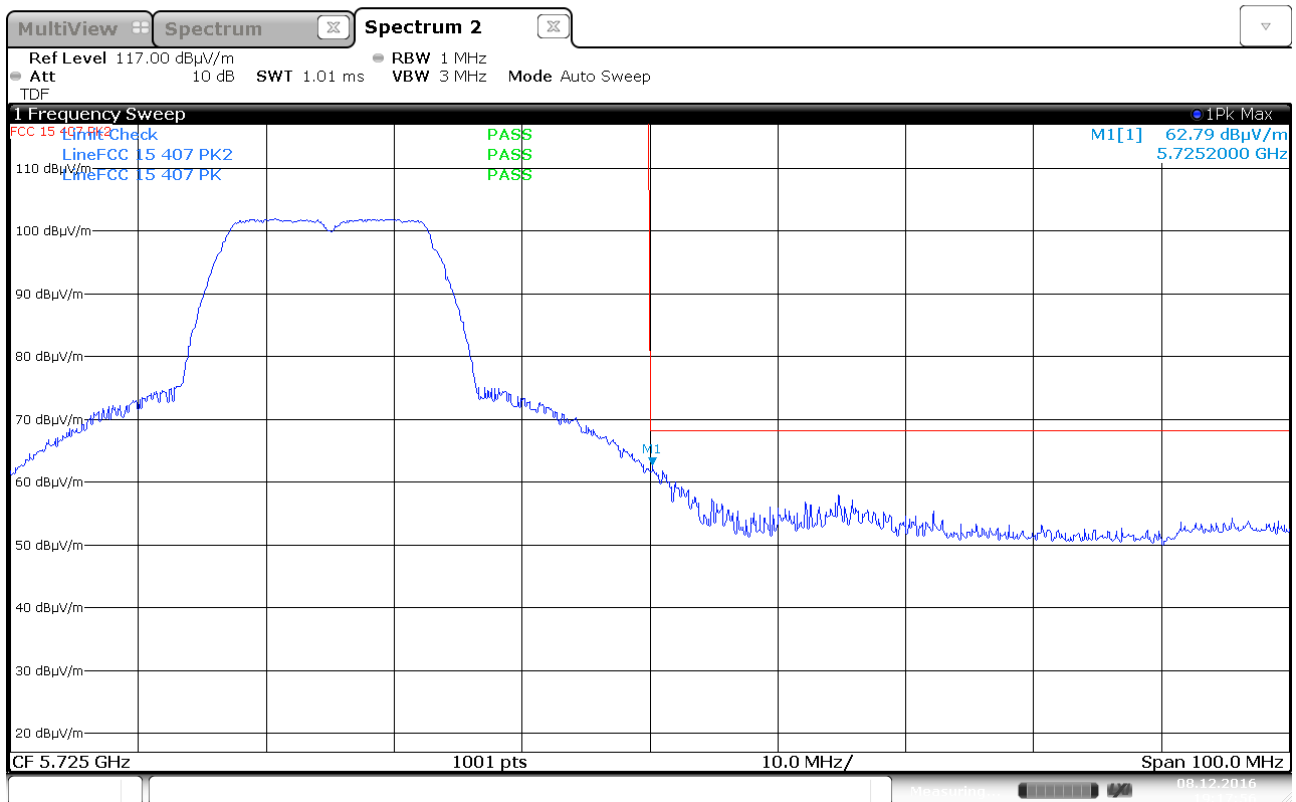
Unwanted Emissions, Band Edge, 5470MHz, ch102, 802.11n MCS0 HT40, MIMO



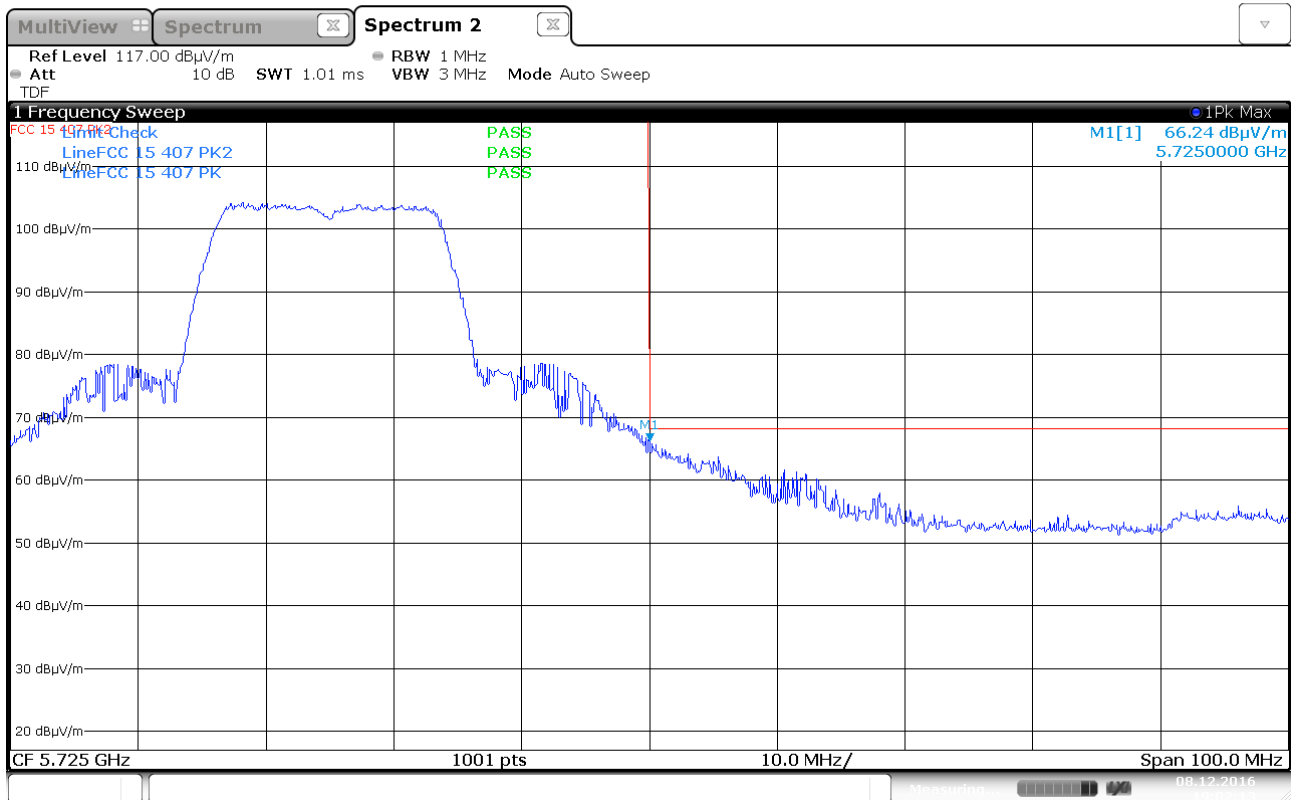
Unwanted Emissions, Band Edge, 5470MHz, ch106, 802.11n MCS0 HT80, MIMO



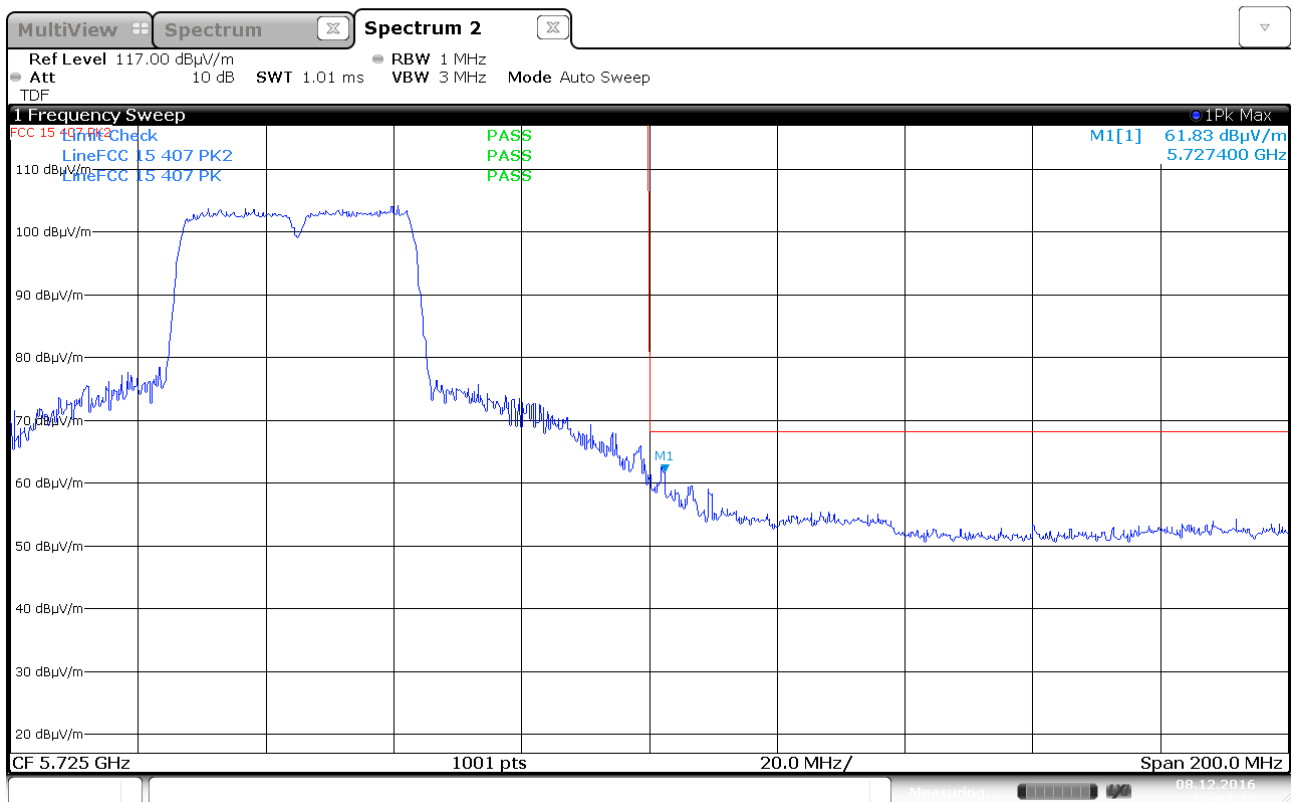
Unwanted Emissions, Band Edge, 5725MHz, ch140, 802.11a 6M, ant 0



Unwanted Emissions, Band Edge, 5725MHz, ch140, 802.11a 6M, ant 1

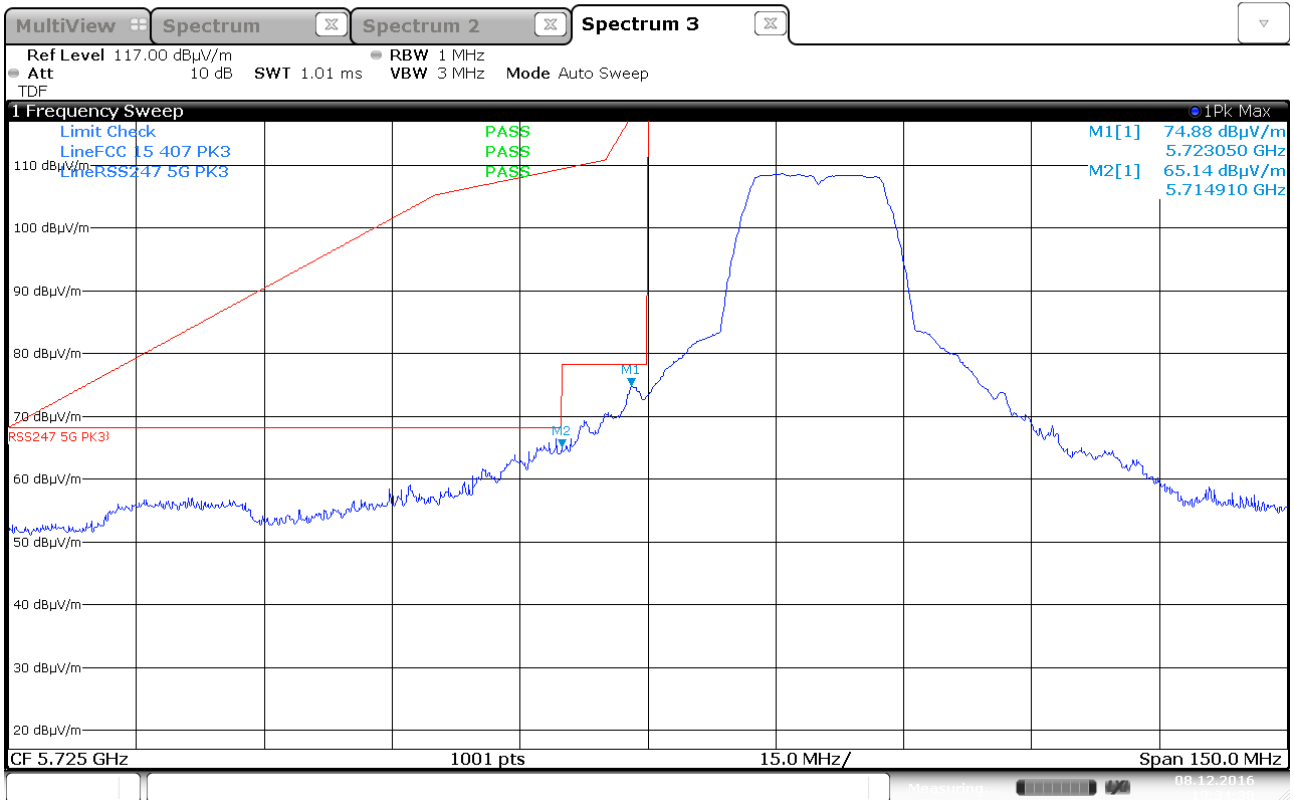


Unwanted Emissions, Band Edge, 5725MHz, ch140, 802.11n MCS0 HT20, MIMO

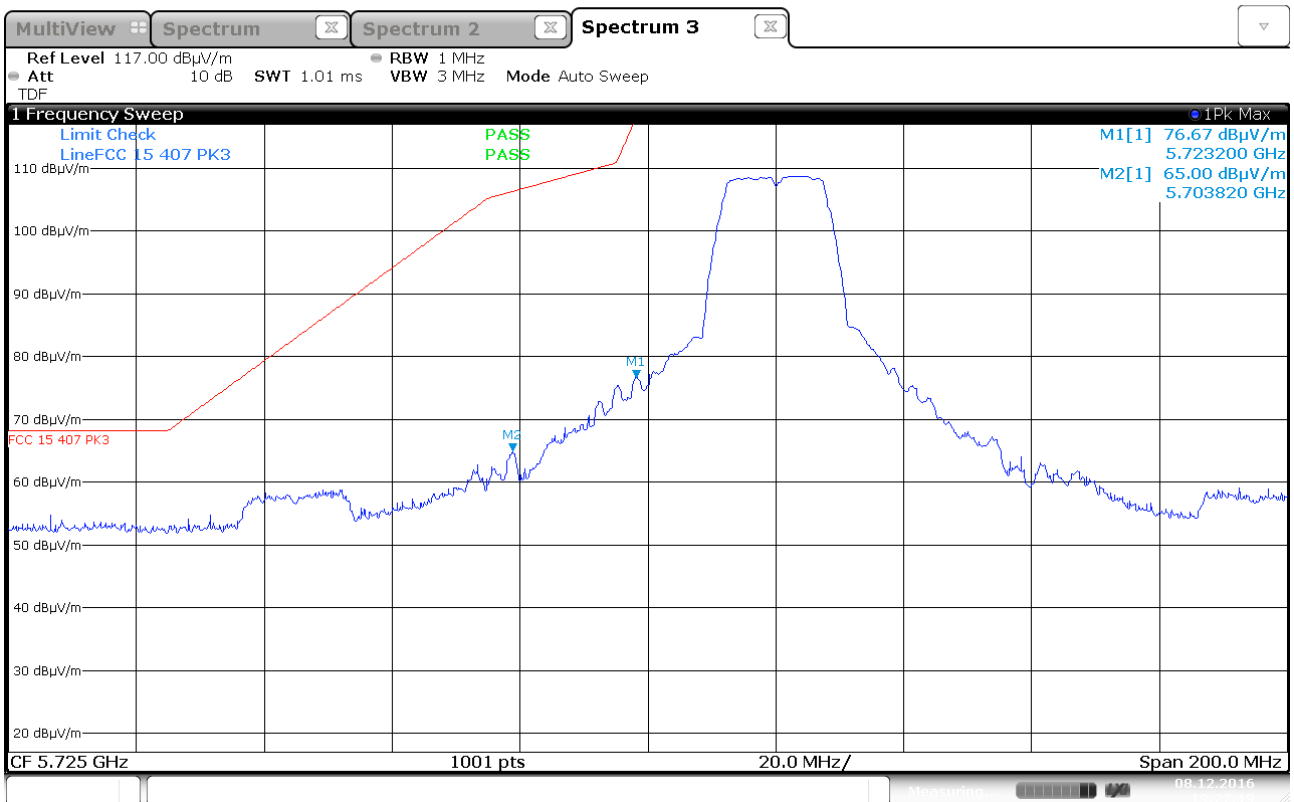


Unwanted Emissions, Band Edge, 5725MHz, ch134, 802.11n MCS0 HT40, MIMO

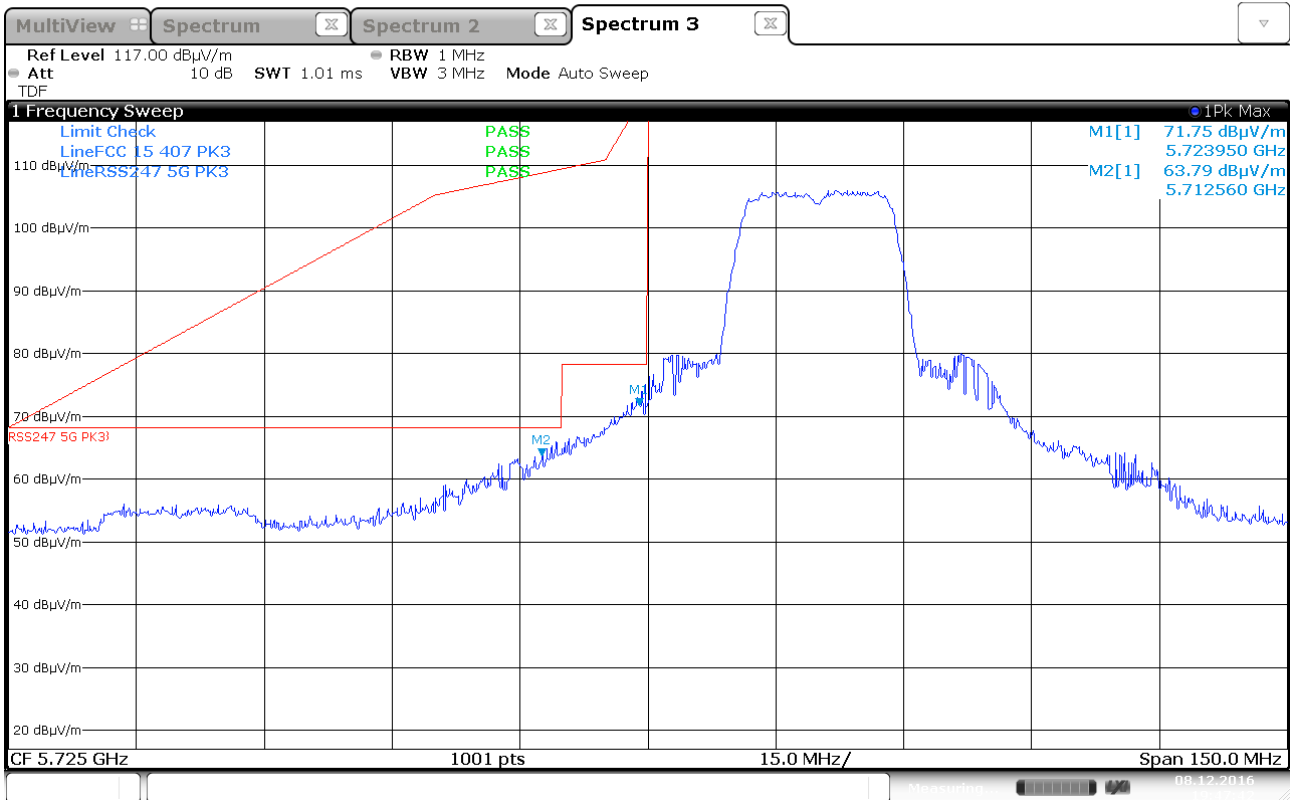




Unwanted Emissions, Band Edge, 5725MHz, ch149, 802.11a 6M, ant 0



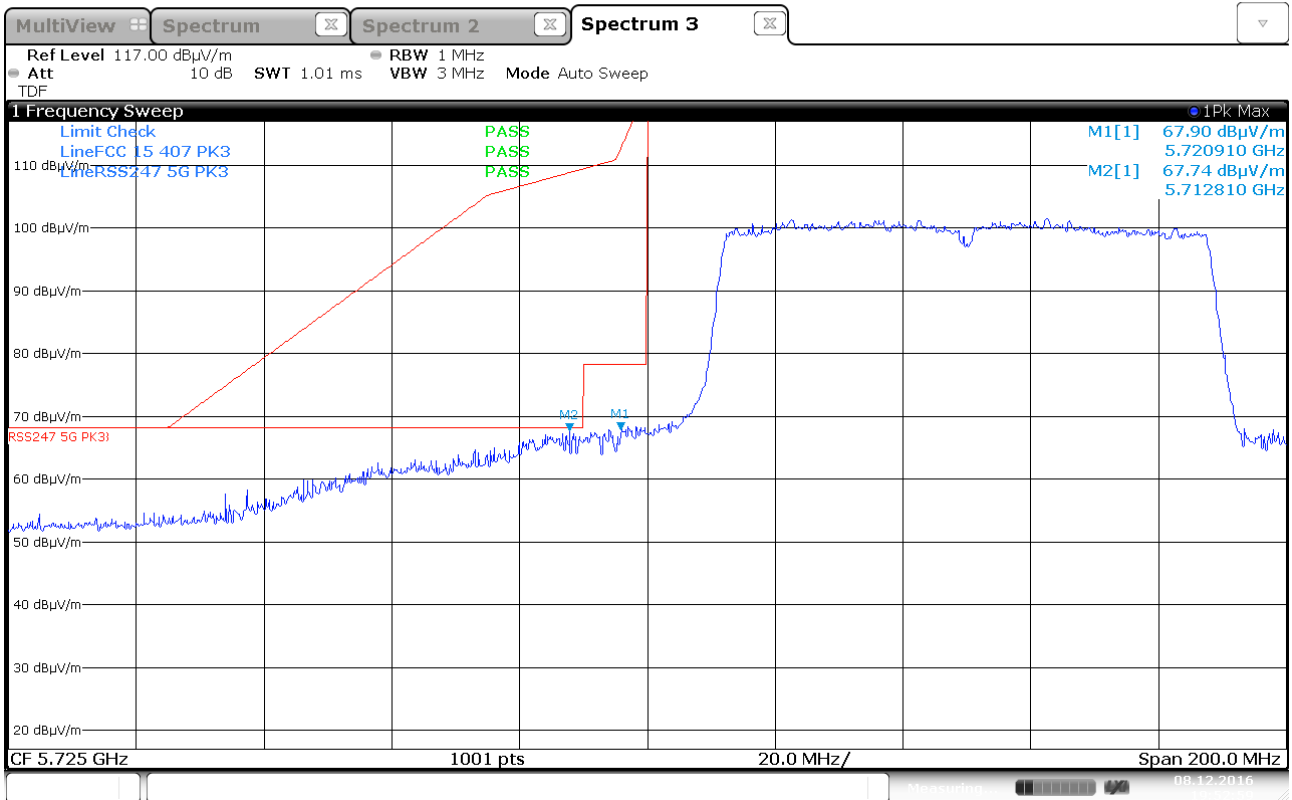
Unwanted Emissions, Band Edge, 5725MHz, ch149, 802.11a 6M, ant 1



Unwanted Emissions, Band Edge, 5725MHz, ch149, 802.11n MCS0 HT20, MIMO



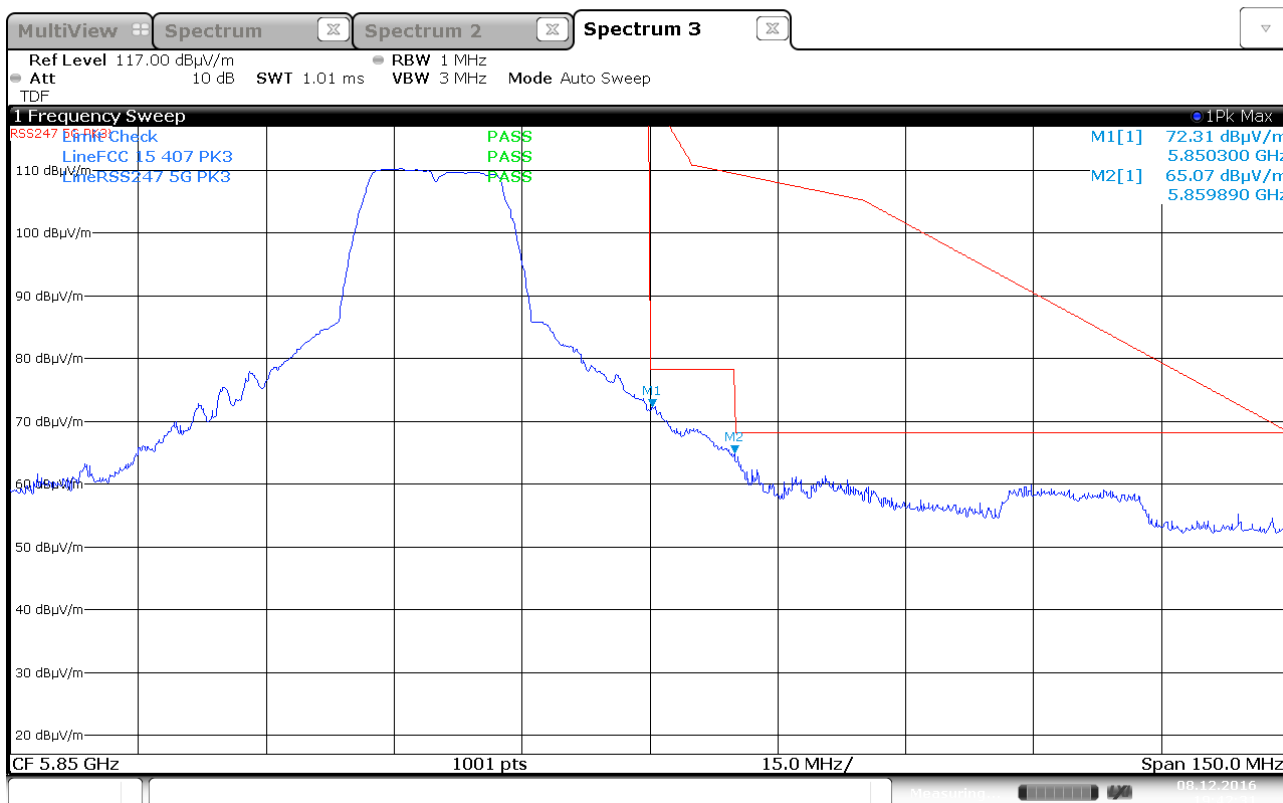
Unwanted Emissions, Band Edge, 5725MHz, ch151, 802.11n MCS0 HT40, MIMO



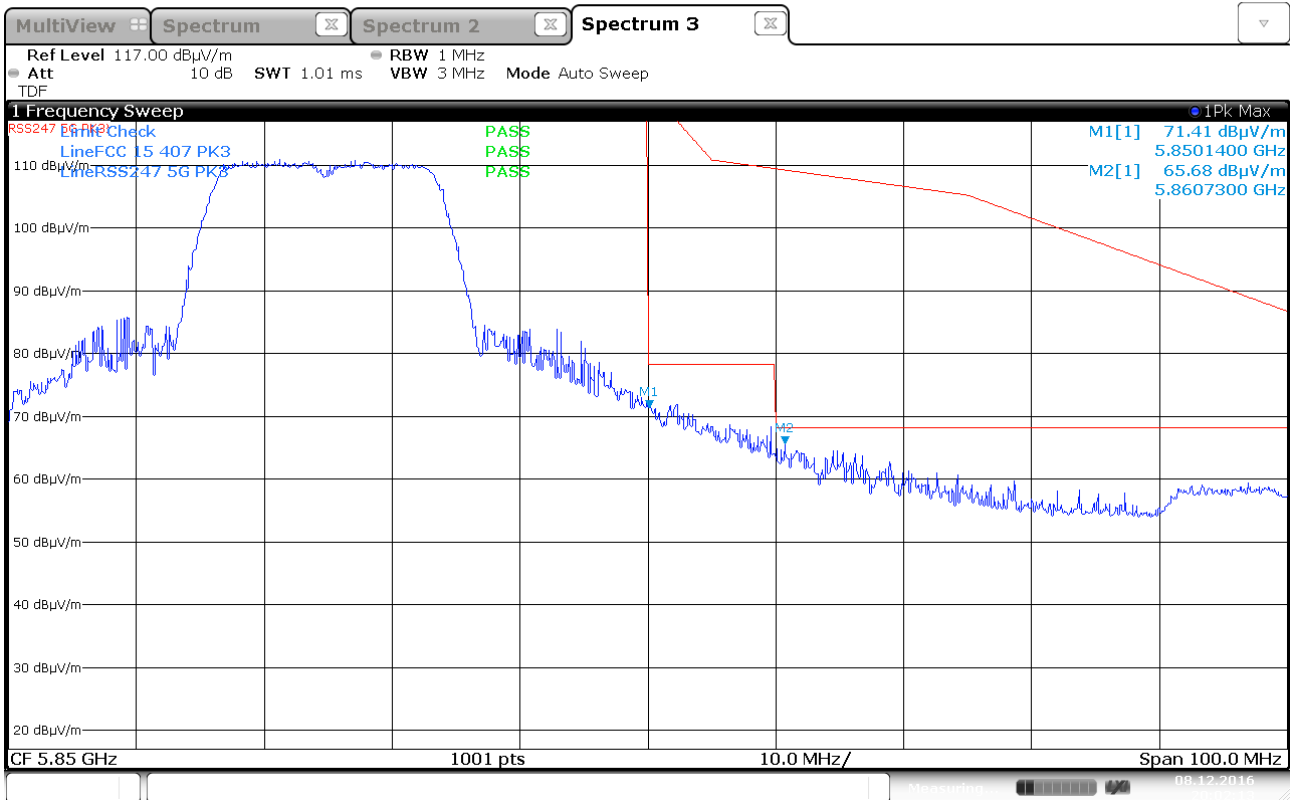
Unwanted Emissions, Band Edge, 5725MHz, ch155, 802.11n MCS0 HT80, MIMO



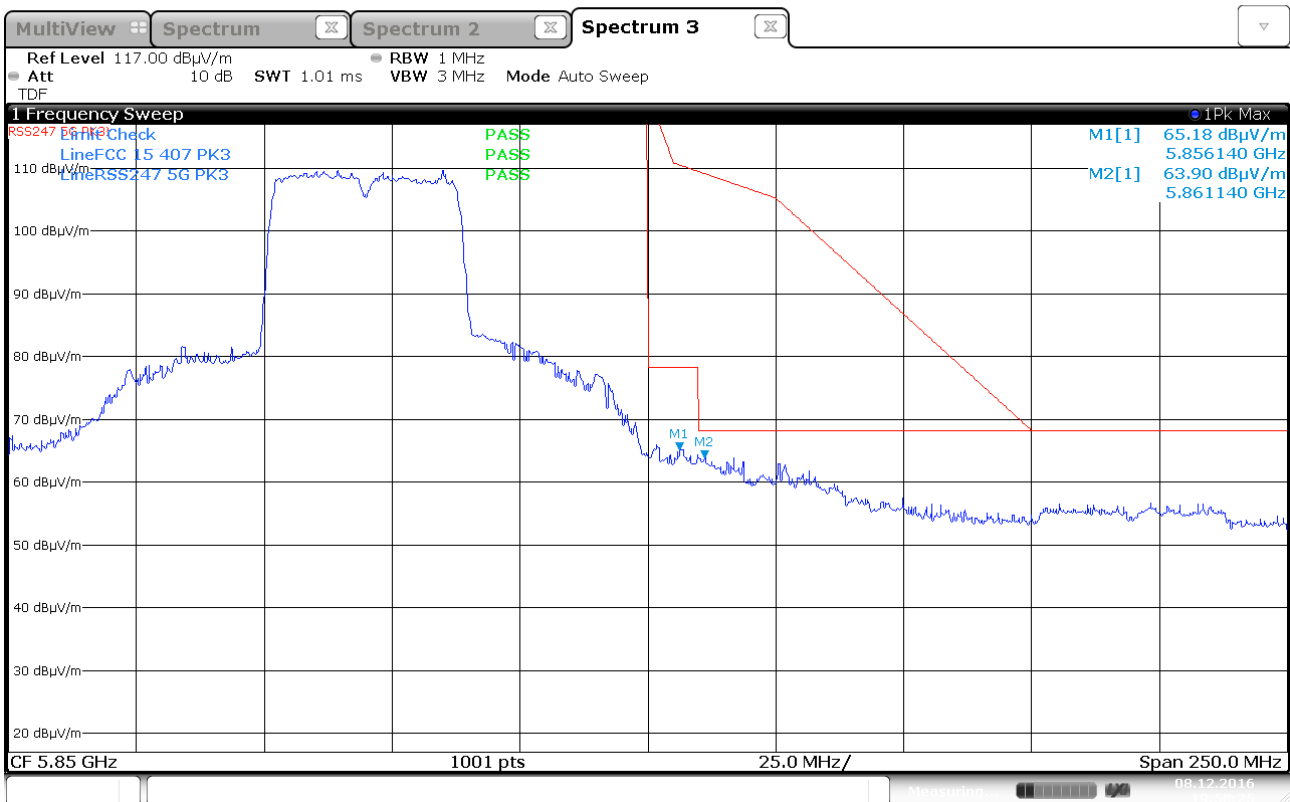
Unwanted Emissions, Band Edge, 5850MHz, ch165, 802.11a 6M, ant 0



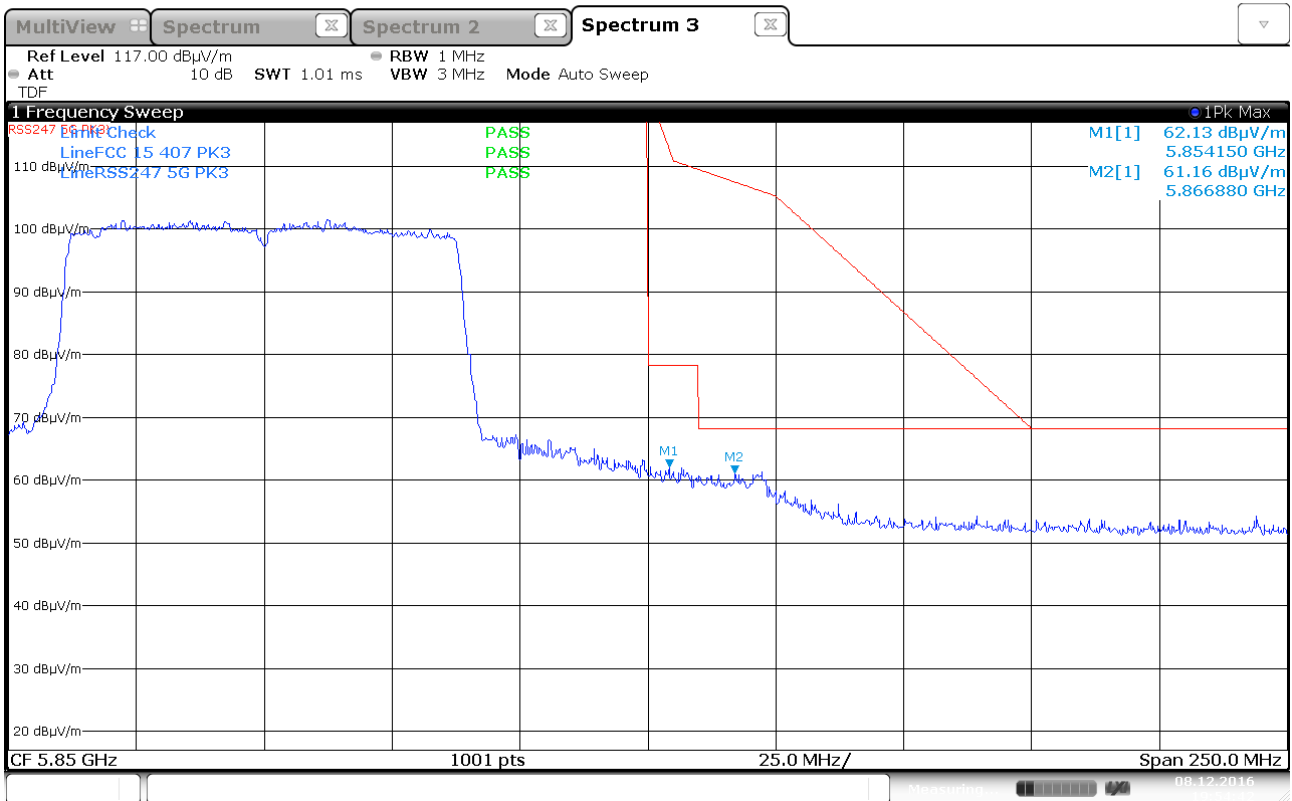
Unwanted Emissions, Band Edge, 5850MHz, ch165, 802.11a 6M, ant 1



Unwanted Emissions, Band Edge, 5850MHz, ch165, 802.11n MCS0 HT20, MIMO



Unwanted Emissions, Band Edge, 5850MHz, ch159, 802.11n MCS0 HT40, MIMO



Unwanted Emissions, Band Edge, 5850MHz, ch155, 802.11n MCS0 HT80, MIMO

### 3.6 Restricted Bands of operation

Restricted Bands of operation for FCC and ISED are defined in FCC Part 15.205 and ISED 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		<b>0.96-1.24</b> <b>1.3-1.427</b>	<b>0.96-1.427</b>
<b>0.495-0.505</b>		1.435-1.6265	
2.1735-2.1905		1.6455-1.6465	
	<b>3.020-3.026</b>	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	
	<b>5.677-5.683</b>	<b>2.4835-2.5</b>	
6.215-6.218		<b>2.69-2.9</b>	<b>2.655-2.9</b>
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		<b>3.6-4.4</b>	<b>3.5-4.4</b>
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	
<b>108-121.94</b> <b>123-138</b>	<b>108-138</b>	31.2-31.8	
<b>149.9-150.05</b>		36.43-36.5	
156.52475-156.52525		Above 38.6	
156.7-156.9			
<b>162.0125-167.17</b>			
<b>167.72-173.2</b>			
240-285			
322-335.4			
399.9-410			
608-614			

Frequencies in **Bold** text are specific for FCC or ISED, 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	Antenna Polarization	Field strength	Measuring distance	Limit FCC15.209	Margin
MHz		dB $\mu$ V/m	metres	dB $\mu$ V/m	dB
37.356	VP	34.0	3	40	5.5
51.25	VP	34.4	3	40	5.1
68.413	VP	30.9	3	40	8.6
96.202	HP	27.9	3	43.5	15.6
106.827	HP	25.3	3	43.5	18.2
148.237	HP	23.9	3	43.5	19.6
166.763	HP	28.6	3	43.5	14.9

See attached plots.

#### Requirements/Limit

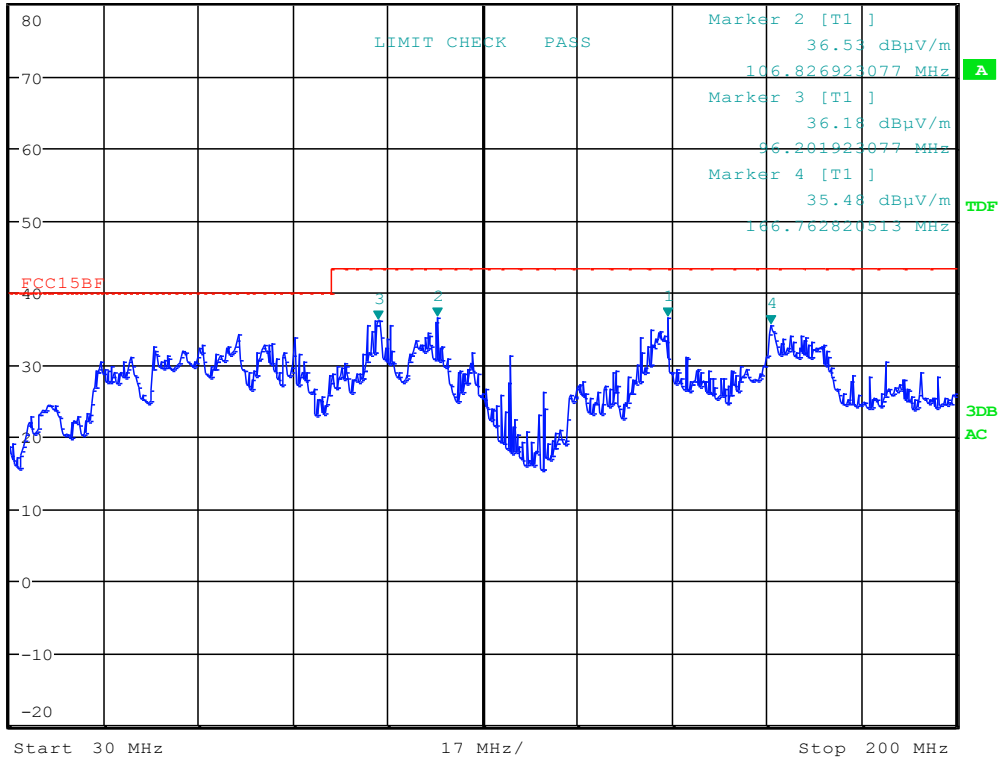
<b>FCC</b>	Part 15.209 @ frequencies defined in §15.205	
<b>ISED</b>	RSS-GEN Issue 4, Clause 8.9 @ frequencies defined in 8.10	
	<b>Radiated emission limit @3 meters</b>	
<b>Frequency (MHz)</b>	<b>Quasi Peak (<math>\mu</math>V/m)</b>	<b>Quasi Peak (dB<math>\mu</math>V/m)</b>
<b>30 – 88</b>	100	40.0
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





<b>MARKER 1</b>	*RBW 100 kHz	Marker 1 [T1 ]
148.2371795 MHz	VBW 300 kHz	36.55 dBuV/m
Ref 80 dBuV/m	*Att 10 dB	SWT 20 ms
		148.237179487 MHz

1 PK  
MAXH



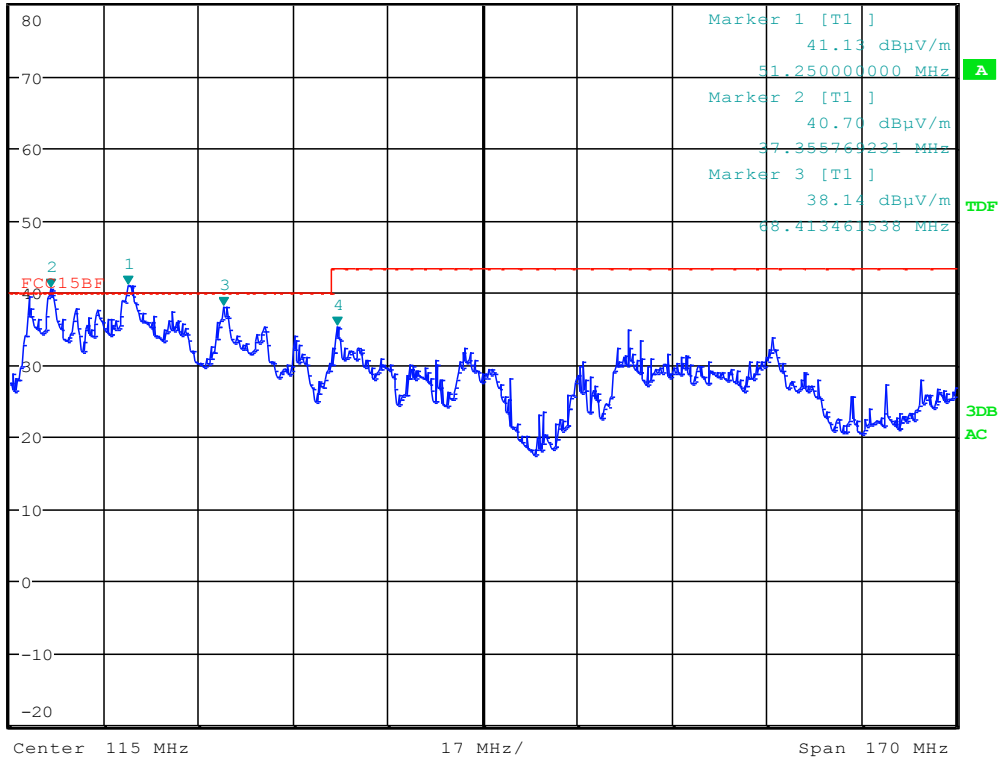
Date: 9.SEP.2016 14:52:07

**Radiated Emissions, 30 -200MHz, HP**



**MARKER 4**  
 88.84615385 MHz  
 Ref 80 dBV/m \*Att 10 dB \*RBW 100 kHz VBW 300 kHz SWT 20 ms  
 Marker 4 [T1 ] 35.30 dBV/m 88.846153846 MHz

1 PK  
 MAXH



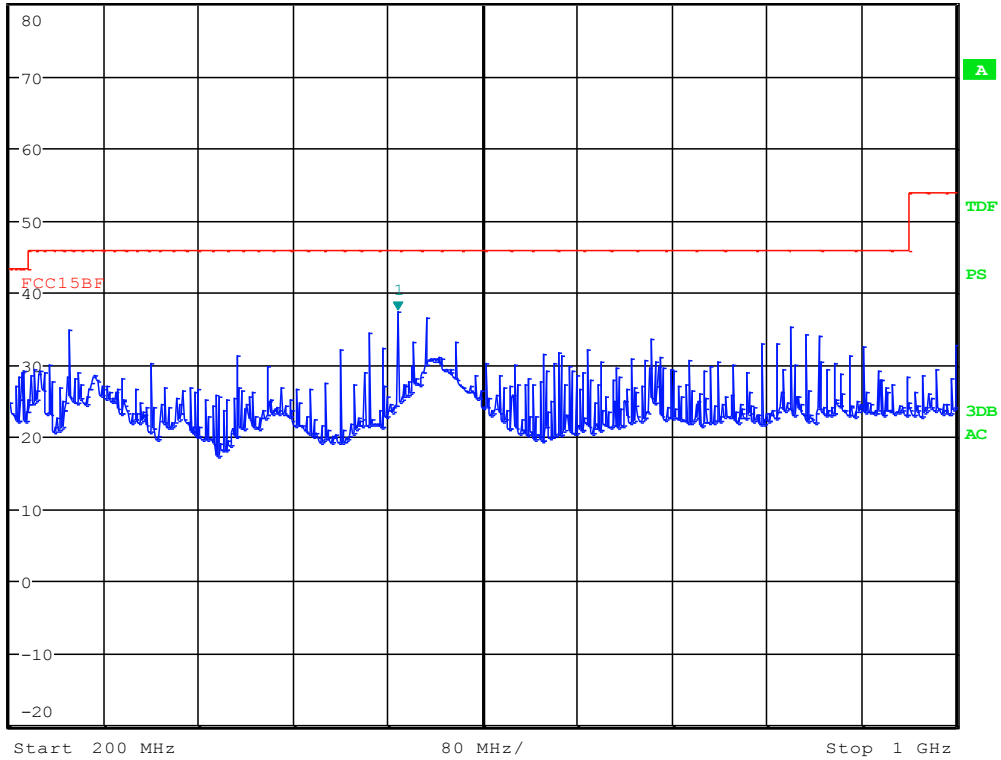
Date: 9.SEP.2016 14:34:49

**Radiated Emissions, 30 -200MHz, VP**



**MARKER 1**  
 528.2051282 MHz  
 Ref 80 dB $\mu$ V/m \*Att 10 dB \*RBW 100 kHz Marker 1 [T1 ]  
 VBW 300 kHz 37.55 dB $\mu$ V/m  
 SWT 80 ms 528.205128205 MHz

1 PK  
MAXH



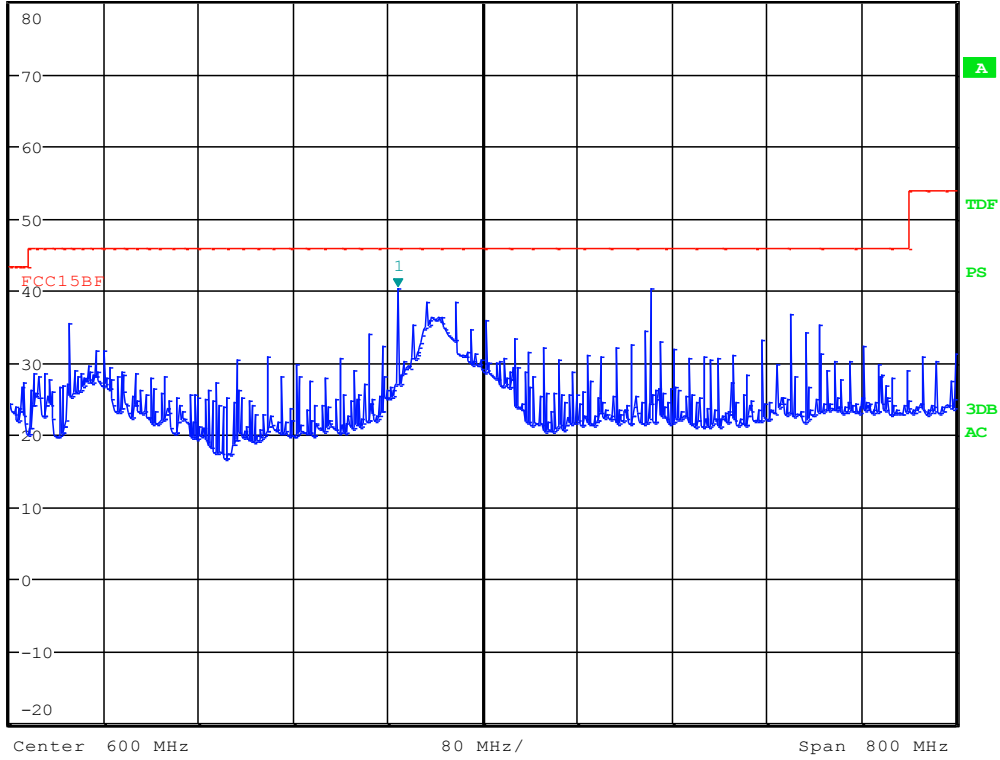
Date: 9.SEP.2016 14:25:20

**Radiated Emissions, 200 -1000MHz, HP**



<b>MARKER 1</b>	*RBW 100 kHz	Marker 1 [T1 ]
528.2051282 MHz	VBW 300 kHz	40.34 dBµV/m
Ref 80 dBµV/m	*Att 10 dB	SWT 80 ms
		528.205128205 MHz

1 PK  
MAXH



Date: 9.SEP.2016 14:21:40

**Radiated Emissions, 200 -1000MHz, VP**

### 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: 1.0 - 8.5 GHz: 3m  
 8.0 - 25.0 GHz: 1m

Band Edge Emissions, Restricted Bands, 5150MHz						
Carrier Modulation	Ch. No.	Carrier Freq MHz	Measured value AV dB $\mu$ V/m @3m	Measured value Peak dB $\mu$ V/m @3m	Limit (dB $\mu$ V/m)	Verdict
802.11a, Ant 0	36	5180	44.7	61.9	54/74	Complies
802.11a, Ant 1	36	5180	50.8	65.5	54/74	Complies
802.11n, HT20, MIMO	36	5180	43.8	61.8	54/74	Complies
802.11n, HT40, MIMO	38	5190	52.7	67.2	54/74	Complies
802.11n, HT80, MIMO	42	5210	52.5	65.1	54/74	Complies

Band Edge Emissions, Restricted Bands, 5350MHz						
Carrier Modulation	Ch. No.	Carrier Freq MHz	Measured value AV dB $\mu$ V/m @3m	Measured value Peak dB $\mu$ V/m @3m	Limit (dB $\mu$ V/m)	Verdict
802.11a, Ant 0	64	5320	45.8	58.2	54/74	Complies
802.11a, Ant 1	64	5320	44.1	67.1	54/74	Complies
802.11n, HT20, MIMO	64	5320	46.2	64.1	54/74	Complies
802.11n, HT40, MIMO	62	5310	51.0	67.0	54/74	Complies
802.11n, HT80, MIMO	58	5290	52.5	66.9	54/74	Complies

Band Edge Emissions, Restricted Bands, 5460MHz						
Carrier Modulation	Ch. No.	Carrier Freq MHz	Measured value AV dB $\mu$ V/m @3m	Measured value Peak dB $\mu$ V/m @3m	Limit (dB $\mu$ V/m)	Verdict
802.11a, Ant 0	100	5500	43.1	<57.1	54/74	Complies
802.11a, Ant 1	100	5500	48.2	<63.3	54/74	Complies
802.11n, HT20, MIMO	100	5500	47.6	<66.2	54/74	Complies
802.11n, HT40, MIMO	102	5510	45.7	<67.4	54/74	Complies
802.11n, HT80, MIMO	106	5530	51.5	<64.1	54/74	Complies

Radiated Emissions, Restricted Bands						
Carrier Modulation	Carrier Freq MHz	Measured Freq GHz	Measured value AV dBµV/m @3m	Measured value Peak dBµV/m @3m	Limit (dBµV/m)	Verdict
802.11a, Ant 0	5260	15960	<44	<60	54/74	Complies
802.11a, Ant 1	5260	15960	51.6	65.8	54/74	Complies
802.11n, HT20, MIMO	5260	15960	51.7	65.3	54/74	Complies
802.11n, HT40, MIMO	5270	15810	48.7	61.8	54/74	Complies
802.11n, HT80, MIMO	5290	15870	41.9	54.1	54/74	Complies

Average Detector values are corrected for Duty Cycle as measured in UL report no. 15U21878-E4V2. Calculated Duty Cycle Factor (-20xlog(DC)) is added to the measured values.

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

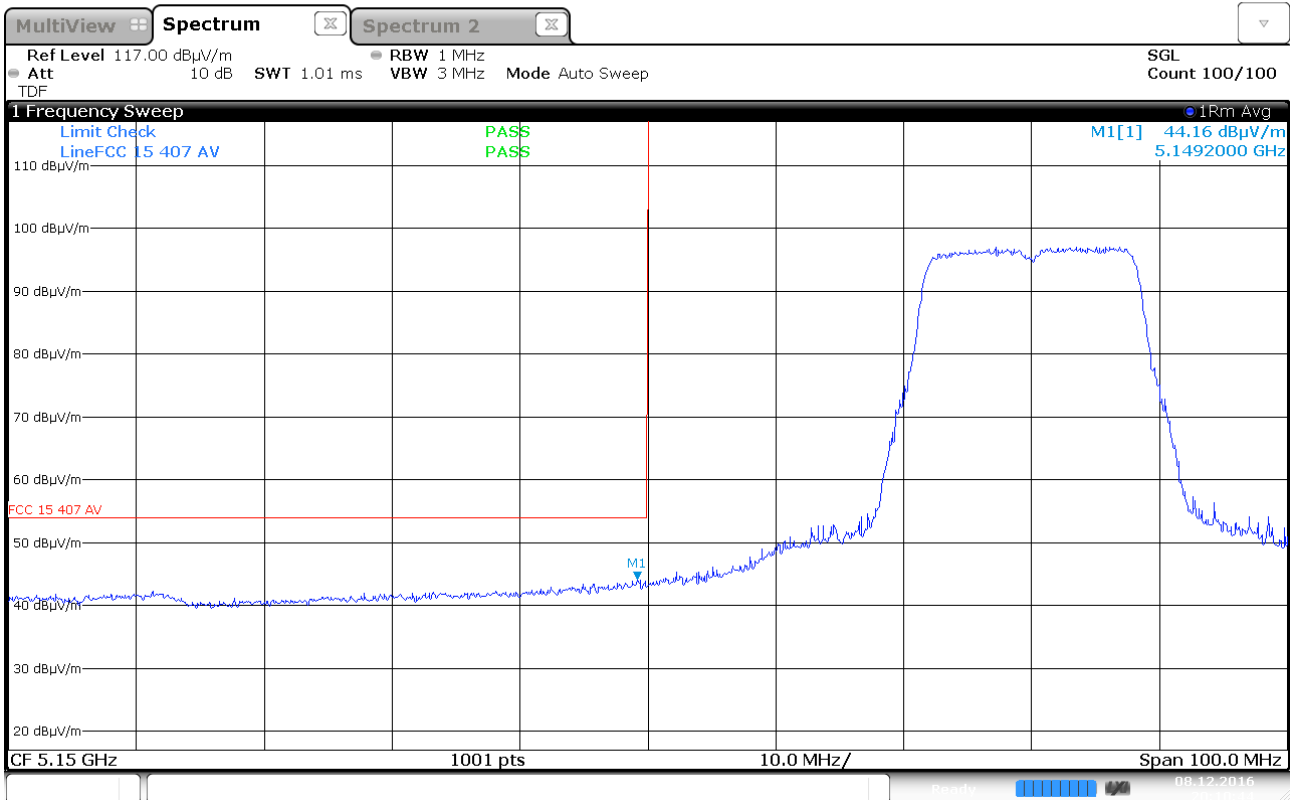
Antenna factor, amplifier gain and cable loss are included in Spectrum Analyzer "Transducer factor".

Distance correction factor are included in the plots.

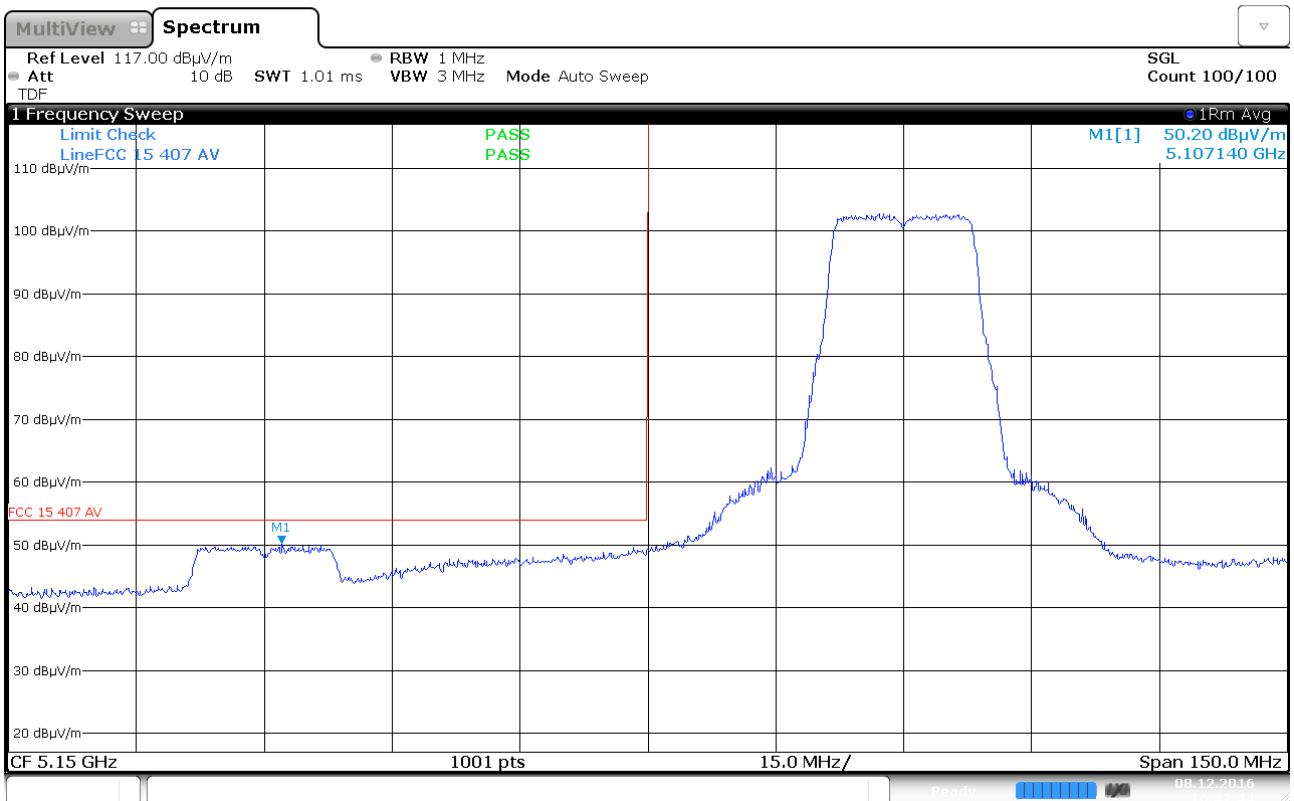
See attached plots.

### Limits

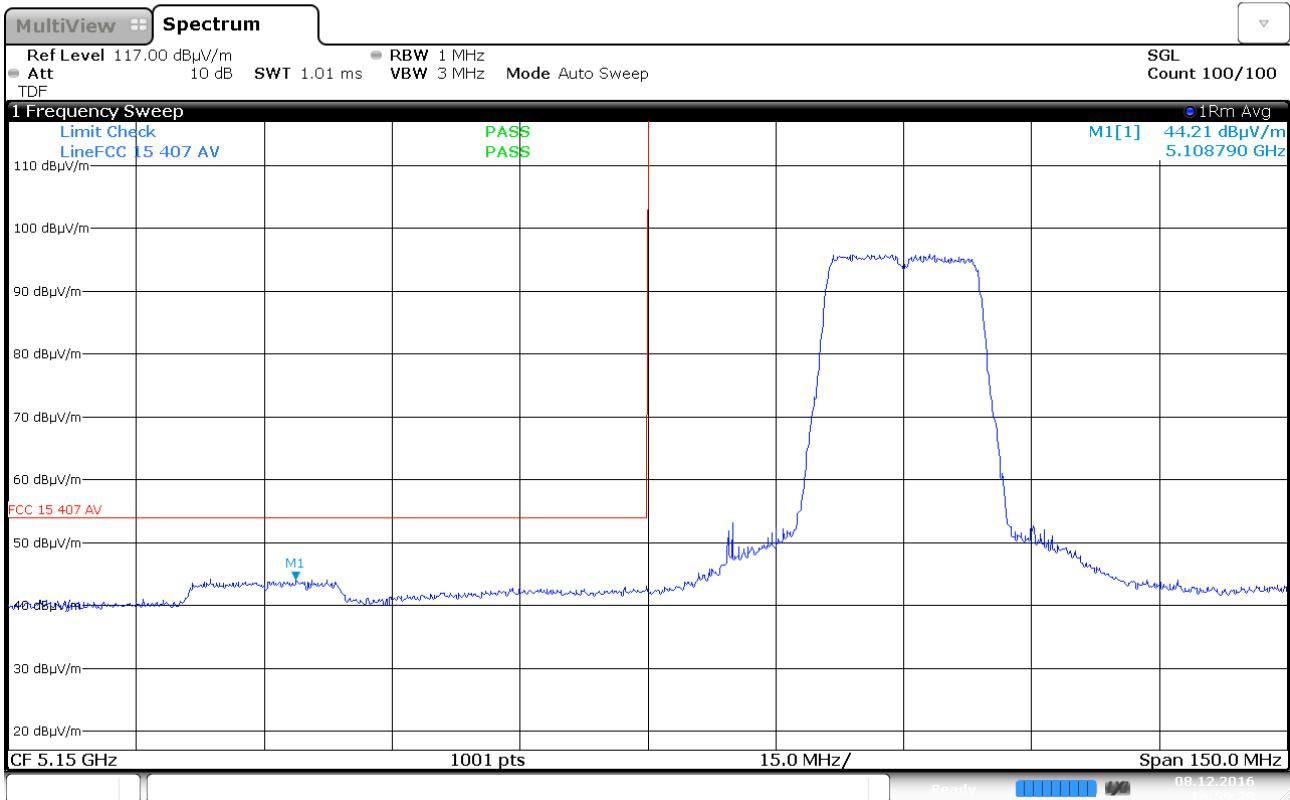
<b>FCC</b>	Part 15.209 @ frequencies defined in §15.205	
<b>ISED</b>	RSS-GEN Issue 4, Clause 8.9 @ frequencies defined in clause 8.10	
	<b>Radiated emission limit @3 meters</b>	
<b>Frequency (MHz)</b>	<b>AV (dBµV/m)</b>	<b>Peak (dBµV/m)</b>
<b>Above 1 GHz</b>	54.0	74.0



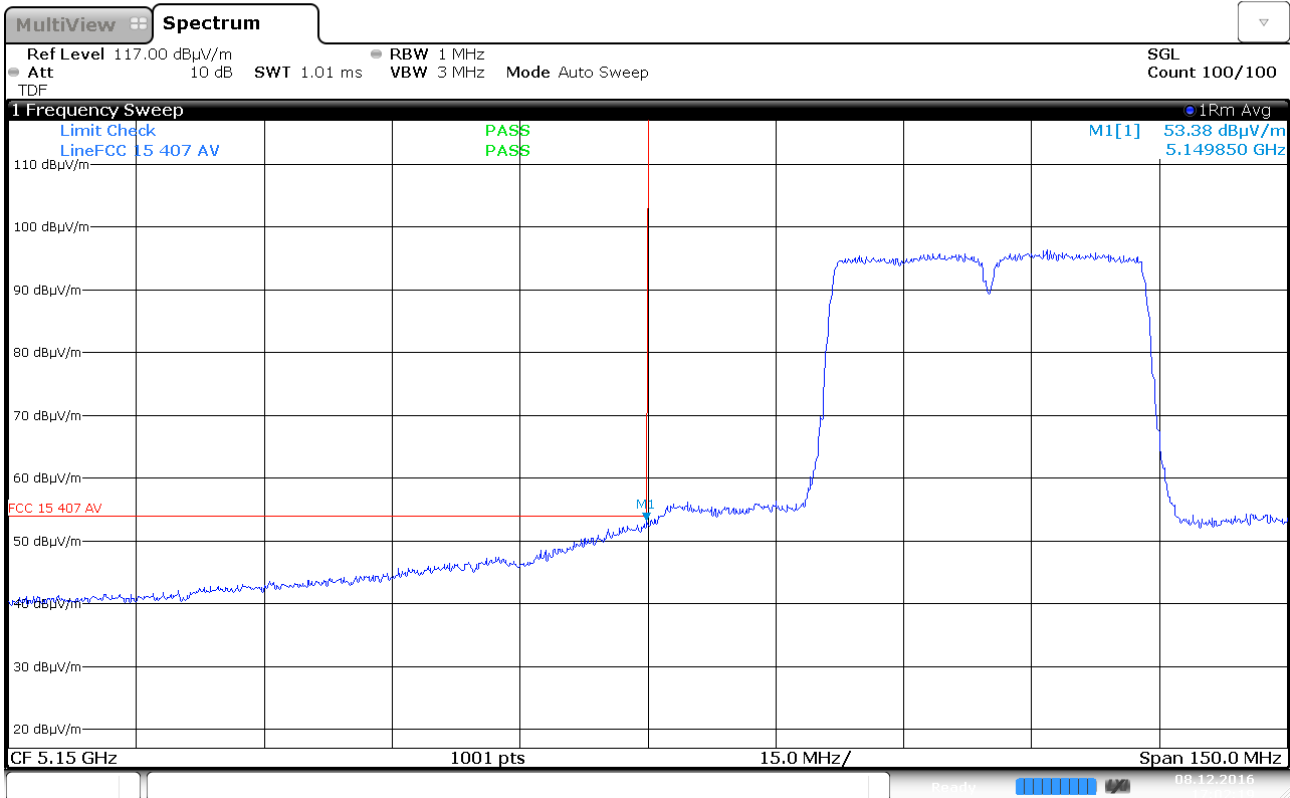
Band Edge RMS, < 5150MHz, 5180MHz, 802.11a 6Mb, Ant 0



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

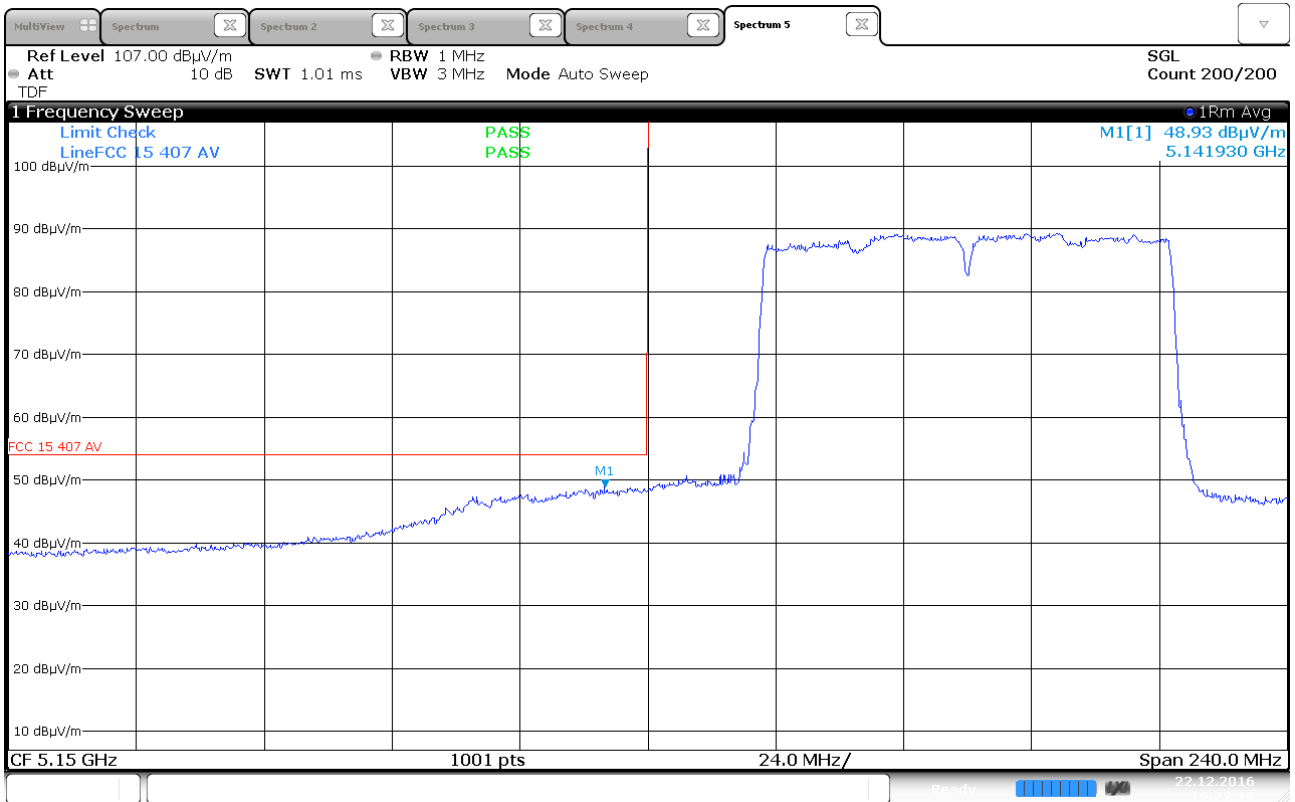


Band Edge RMS, < 5150MHz, 5180MHz, 802.11n HT20, MIMO

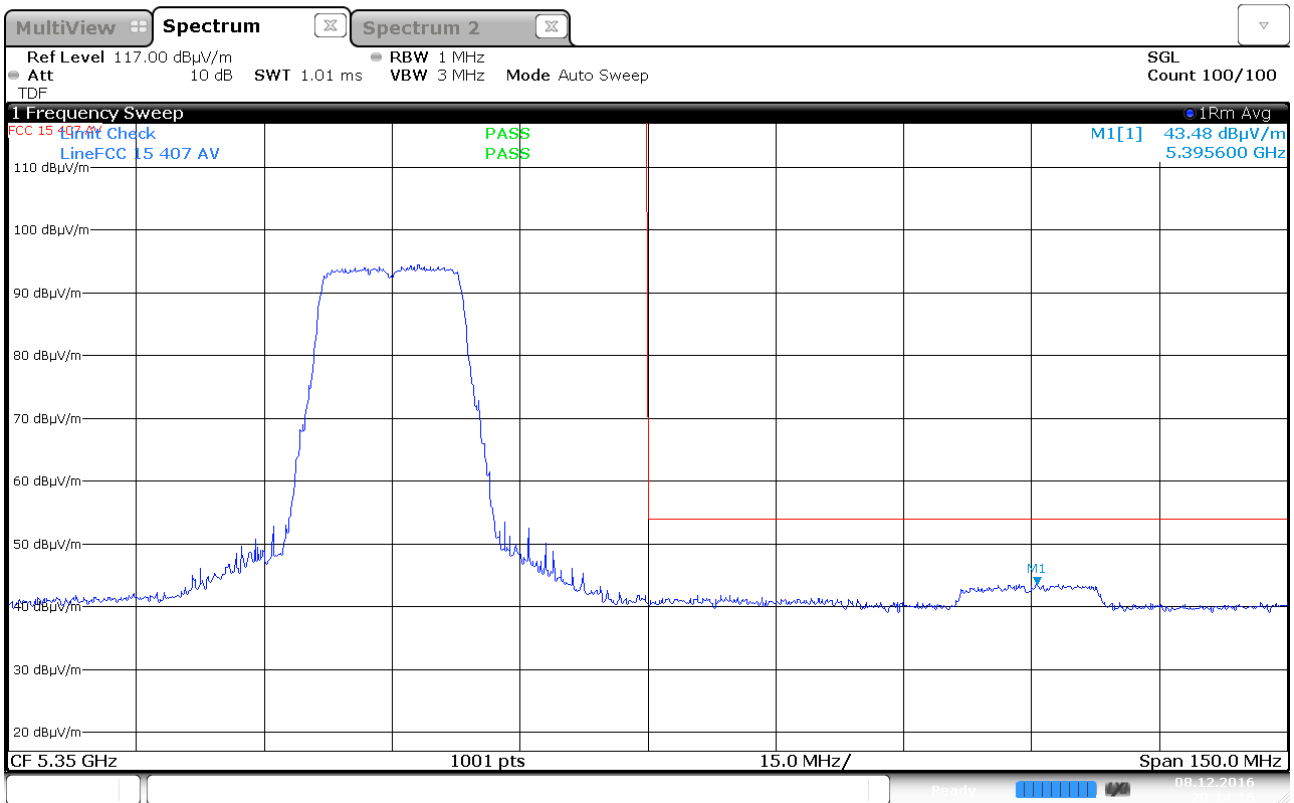


Band Edge RMS, < 5150MHz, 5190MHz, 802.11n HT40, MIMO

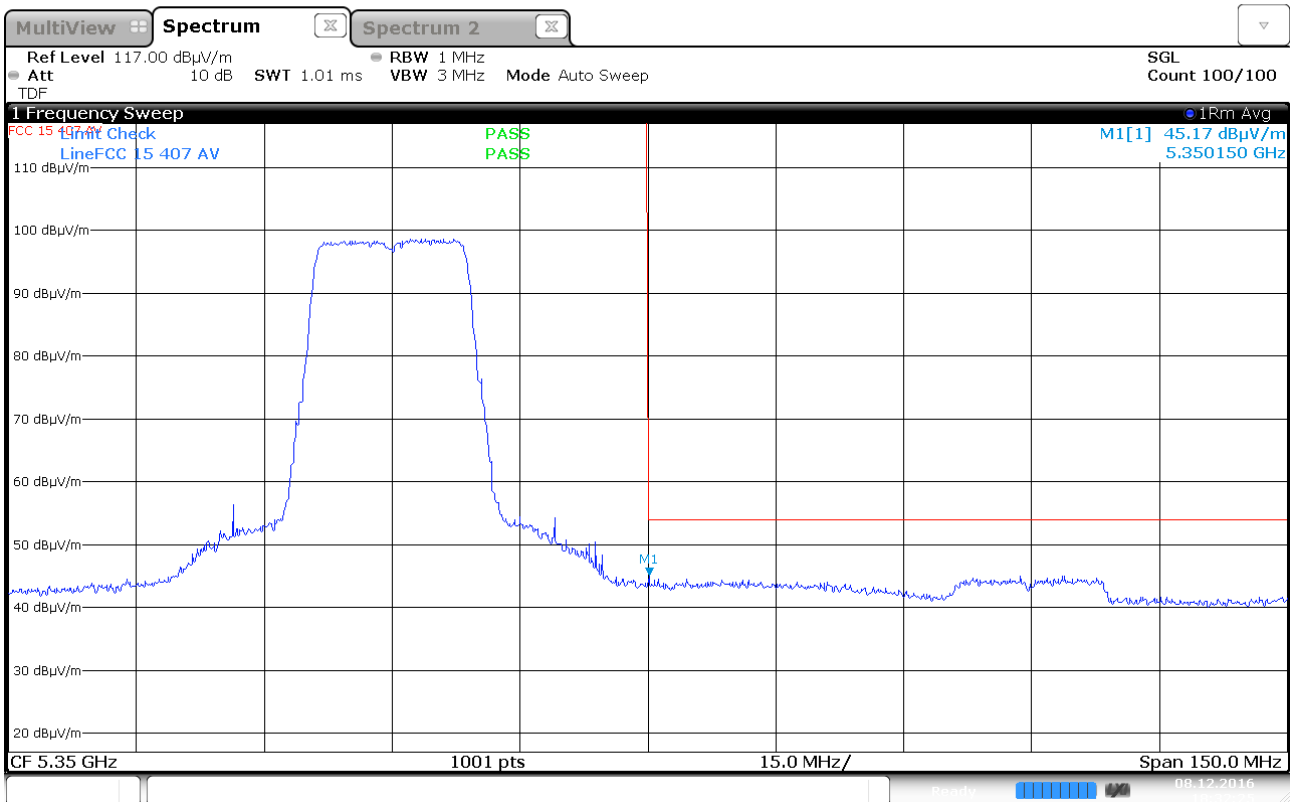




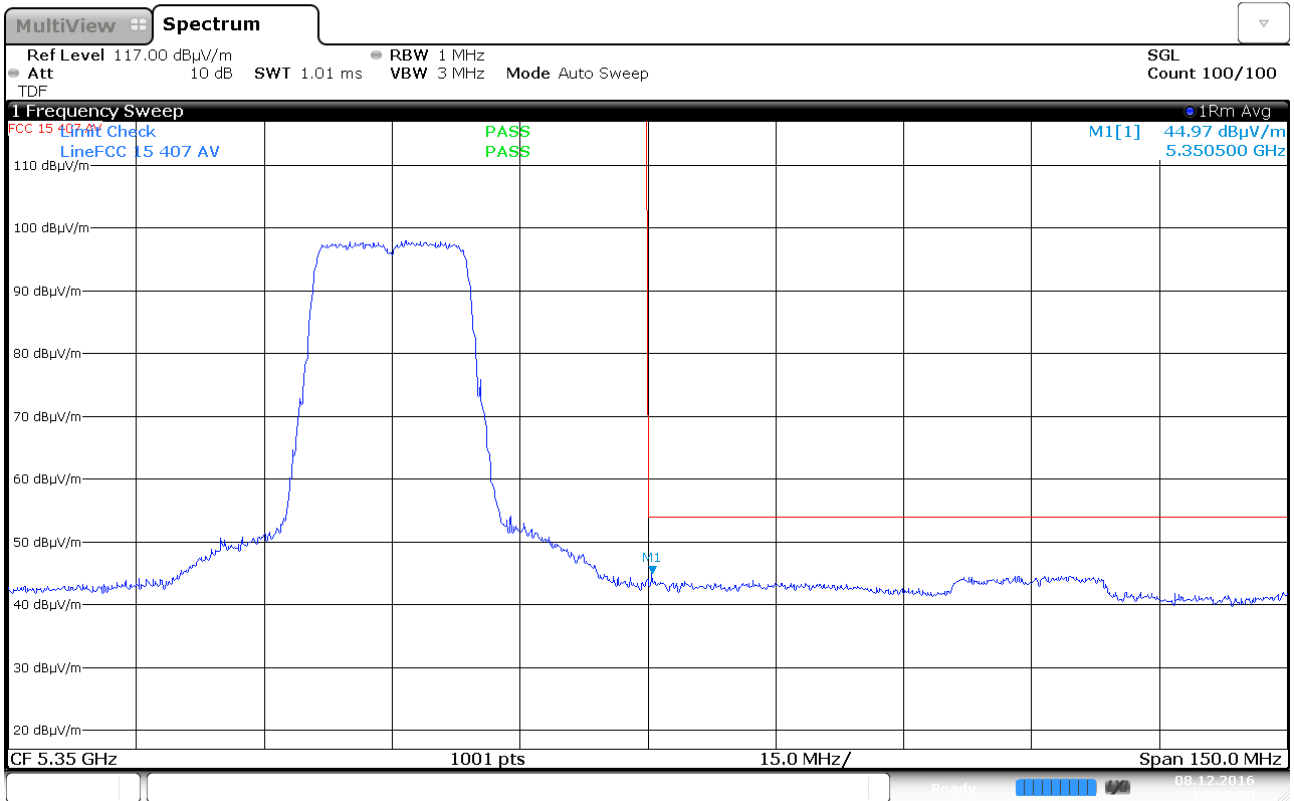
**Band Edge RMS, < 5150MHz, 5210MHz, 802.11n HT80, MIMO**



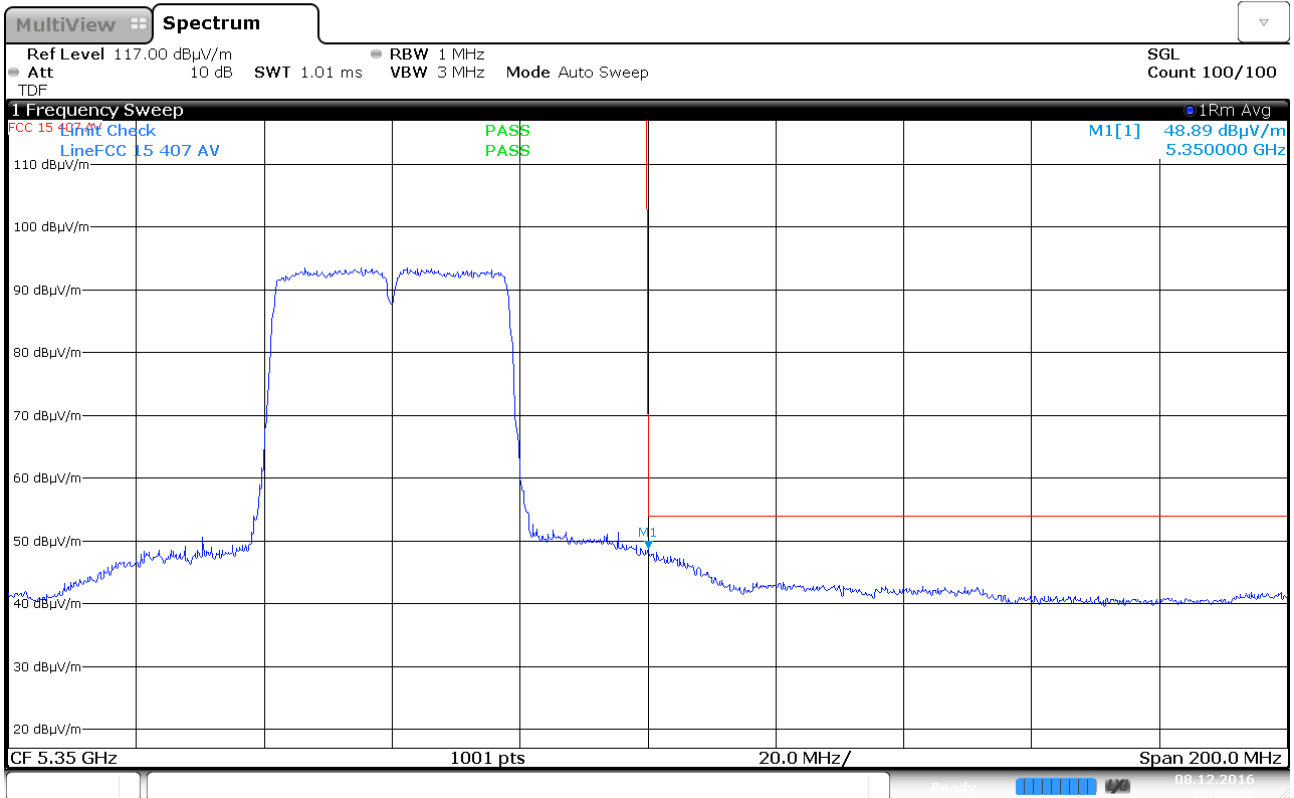
Band Edge RMS, > 5350MHz, 5320MHz, 802.11a 6Mb, Ant 0



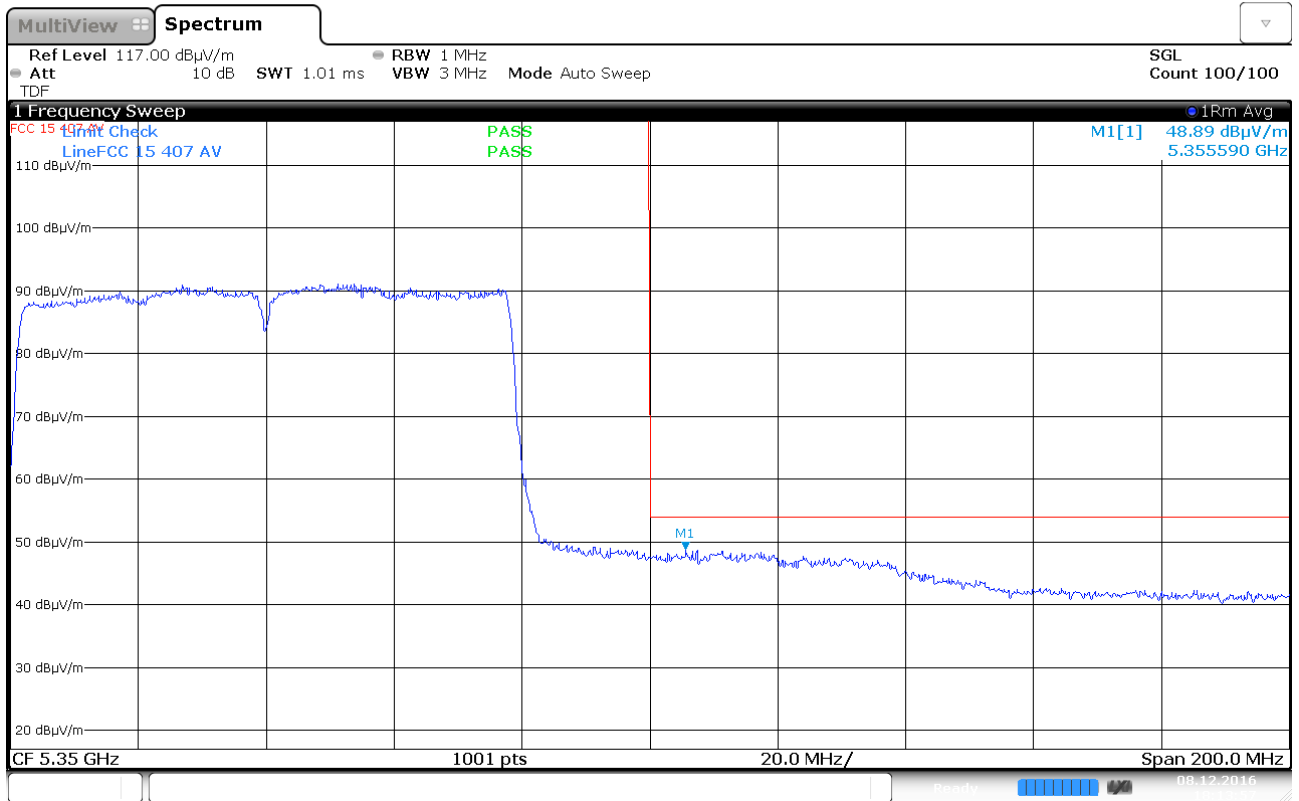
Band Edge RMS, > 5350MHz, 5320MHz, 802.11a 6Mb, Ant 1



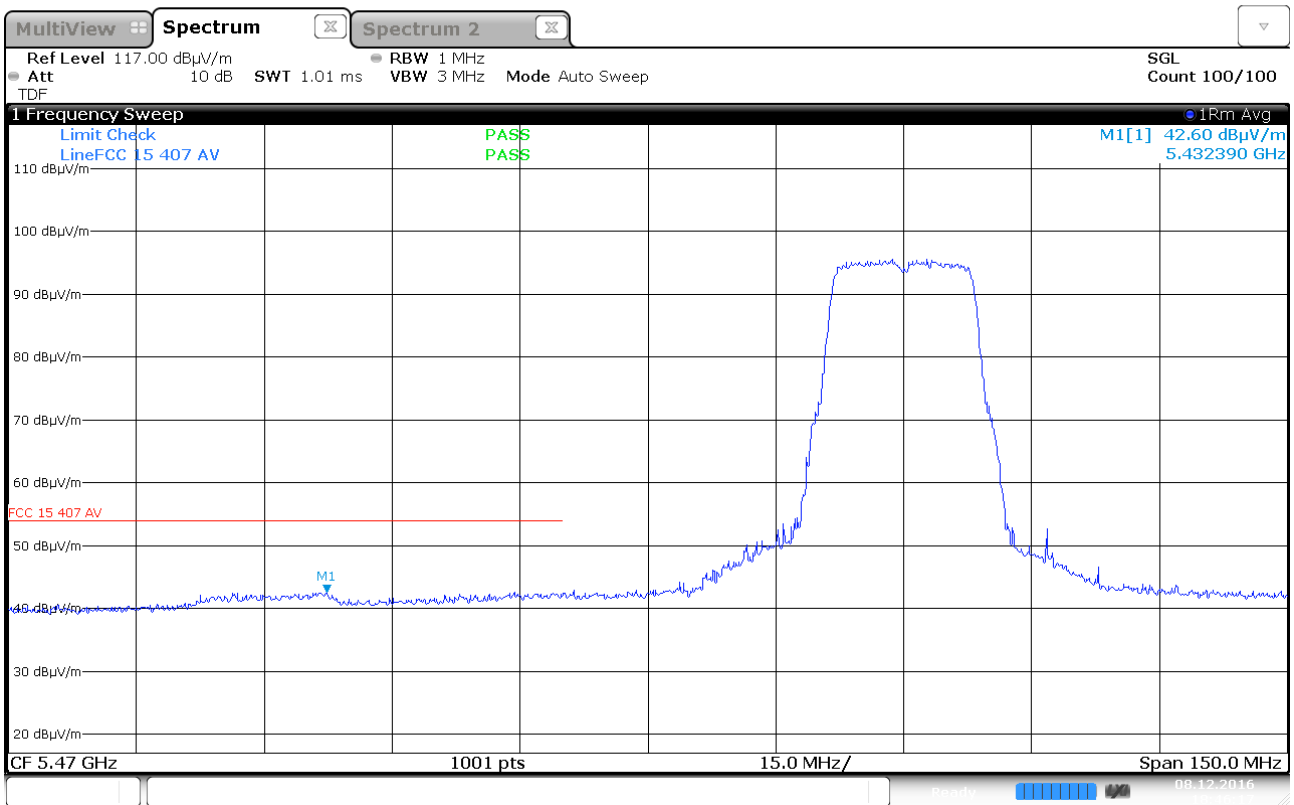
Band Edge RMS, > 5350MHz, 5320MHz, 802.11n HT20, MIMO



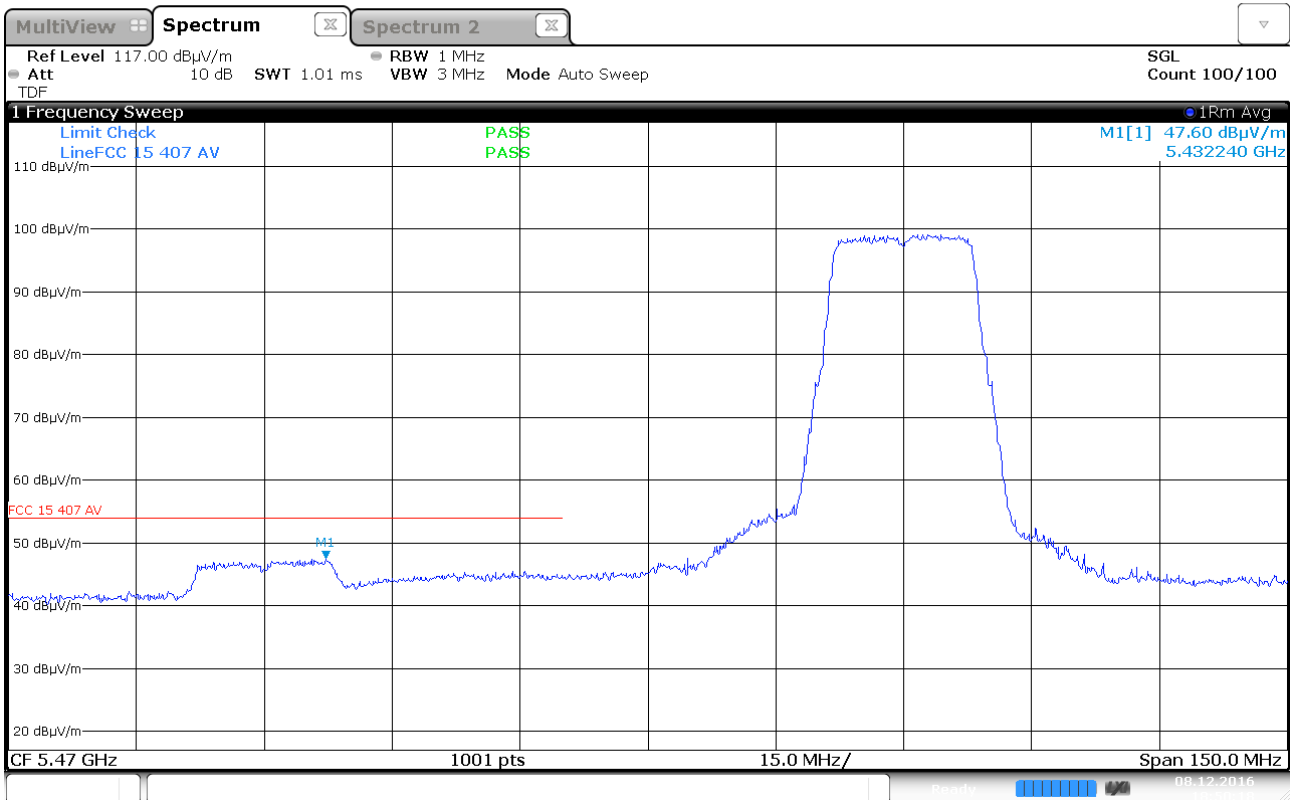
Band Edge RMS, > 5350MHz, 5310MHz, 802.11n HT40, MIMO



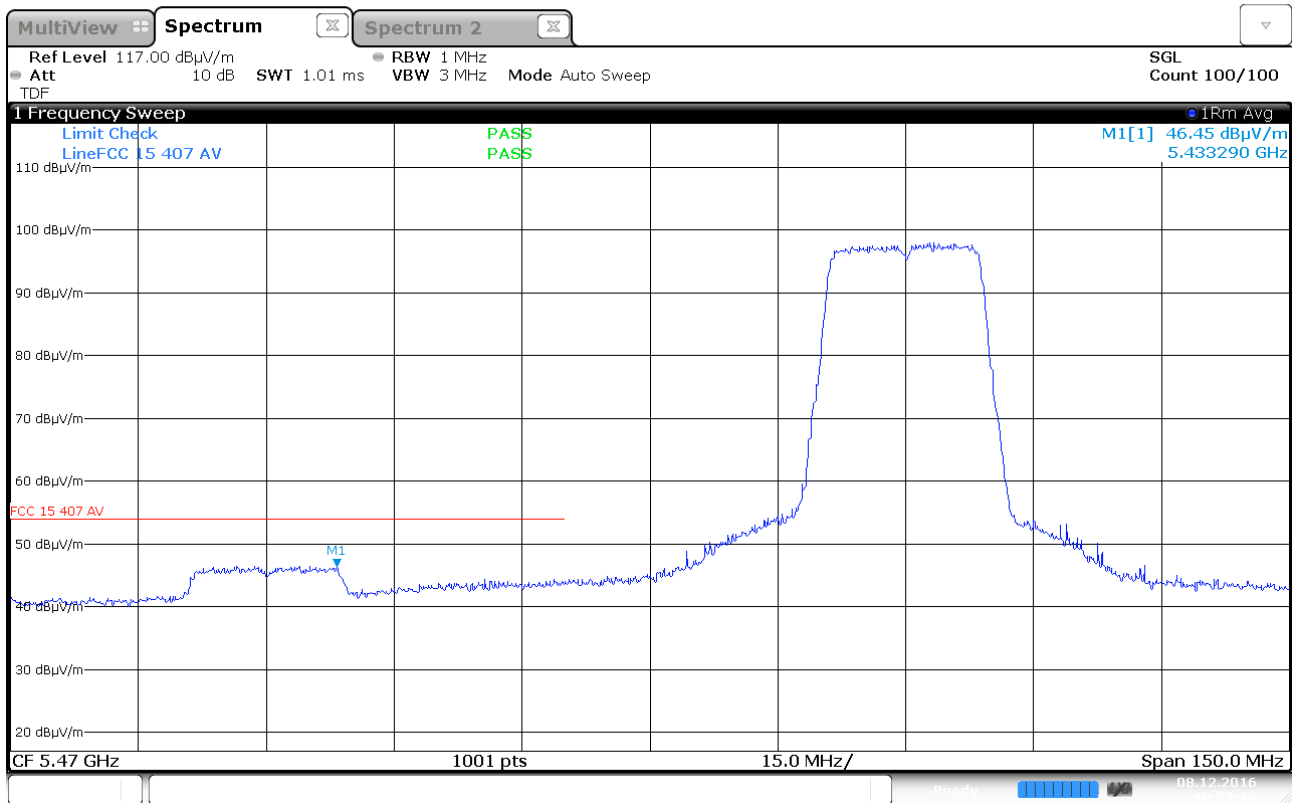
**Band Edge RMS, > 5350MHz, 5290MHz, 802.11n HT80, MIMO**



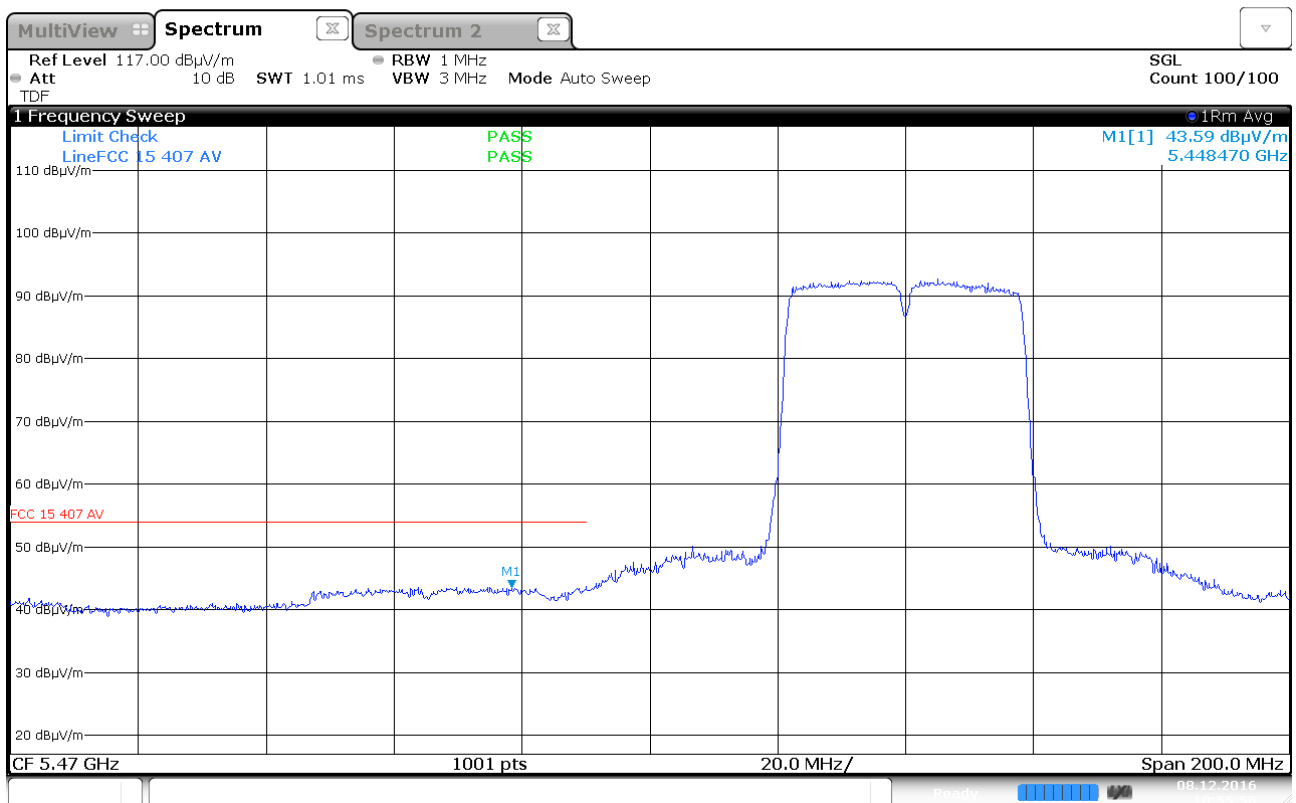
**Band Edge RMS, < 5460MHz, 5500MHz, 802.11a 6Mb, Ant 0**



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



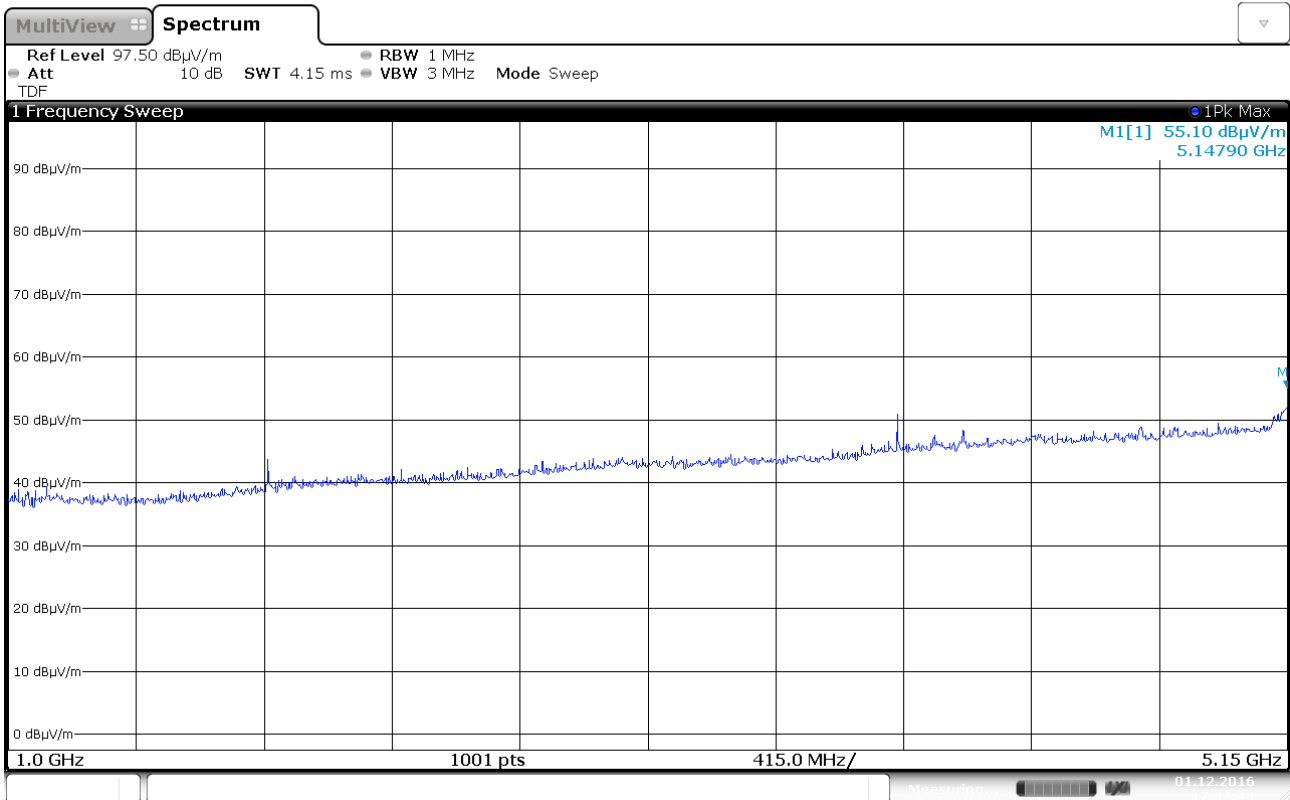
Band Edge RMS, < 5460MHz, 5500MHz, 802.11n HT20, MIMO



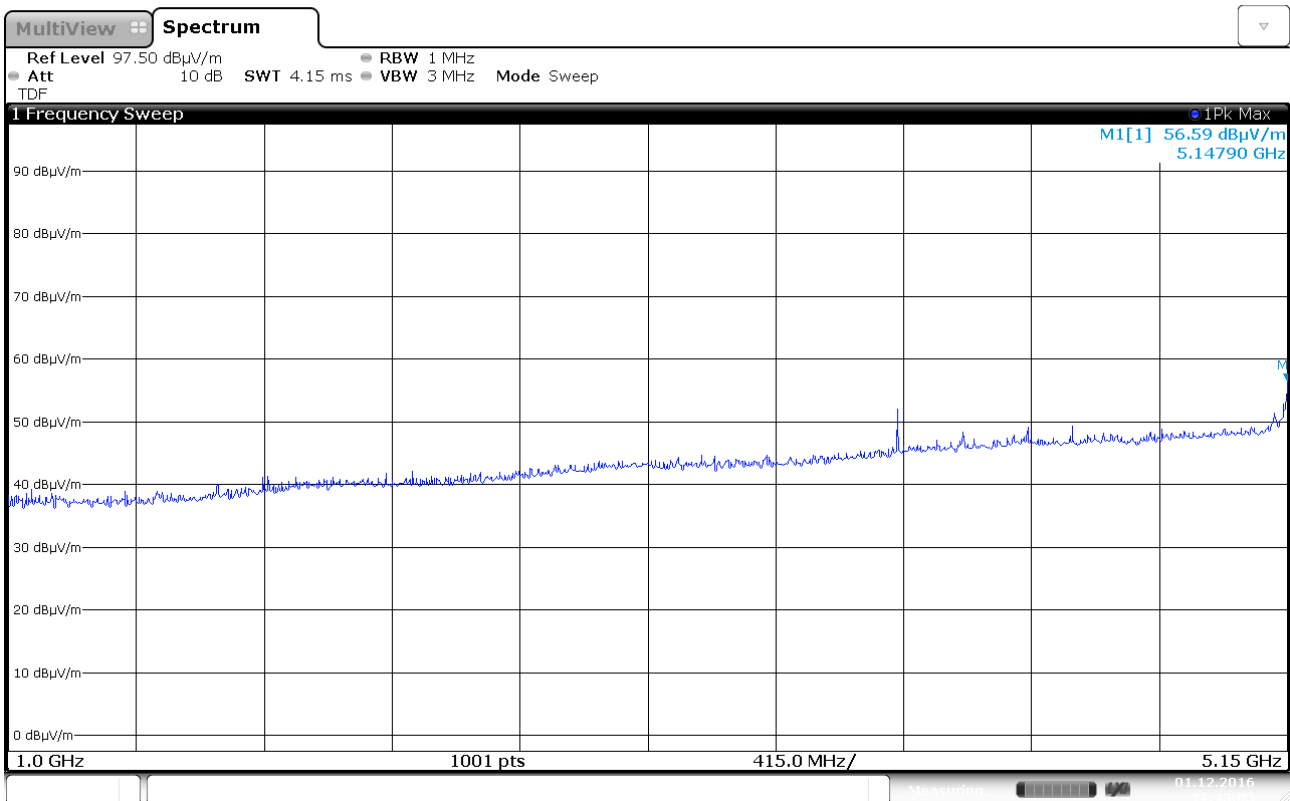
Band Edge RMS, < 5460MHz, 5510MHz, 802.11n HT40, MIMO



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

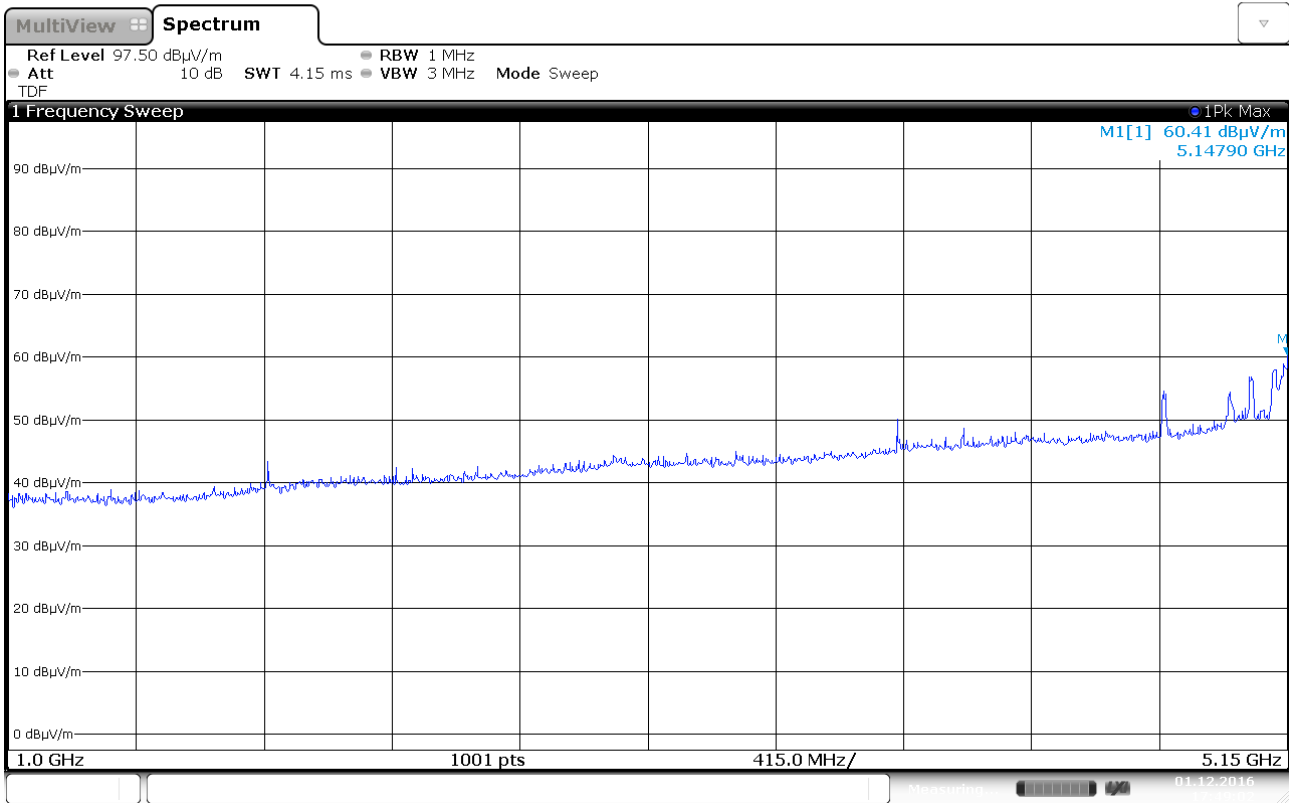


**Radiated Emissions, 1.0 – 5.15 GHz, 5180 MHz, 802.11a 6M, Ant 0, HP**

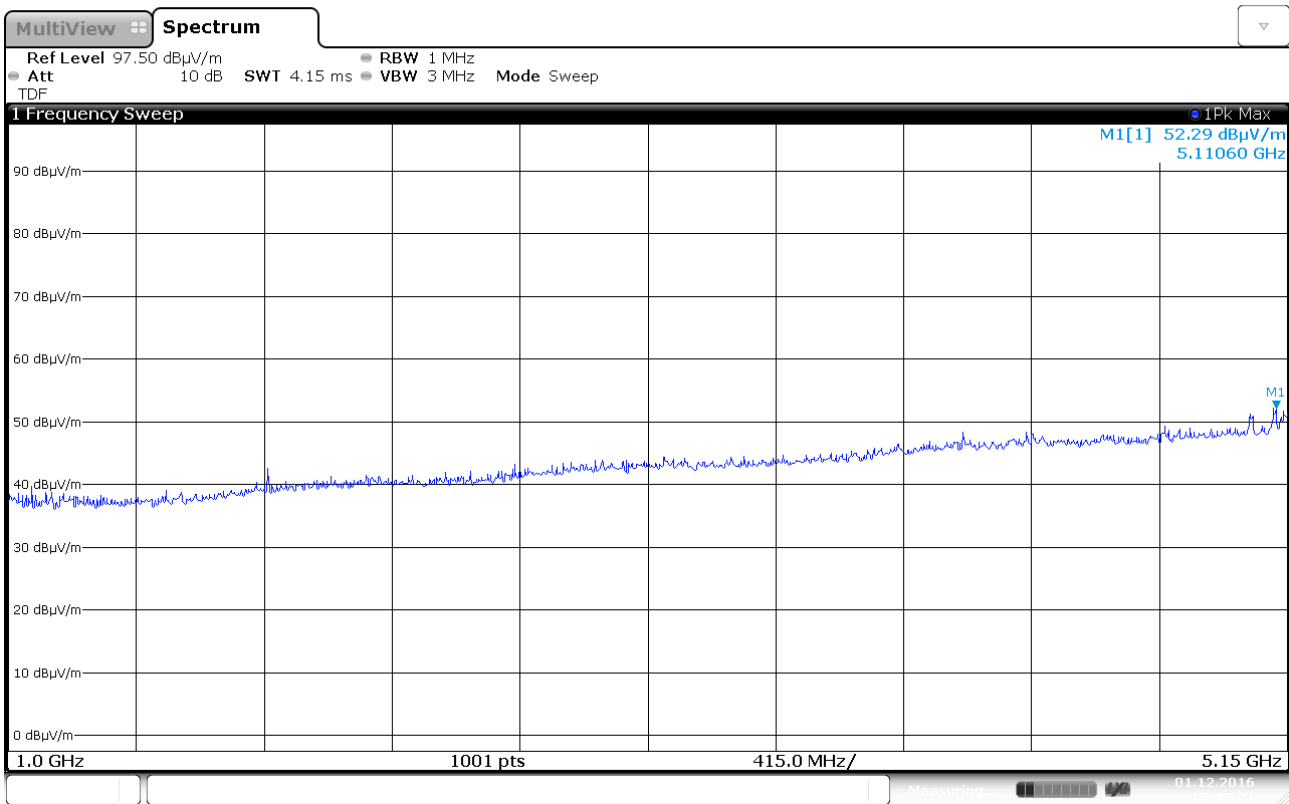


**Radiated Emissions, 1.0 – 5.15 GHz, 5180 MHz, 802.11a 6M, Ant 0, VP**

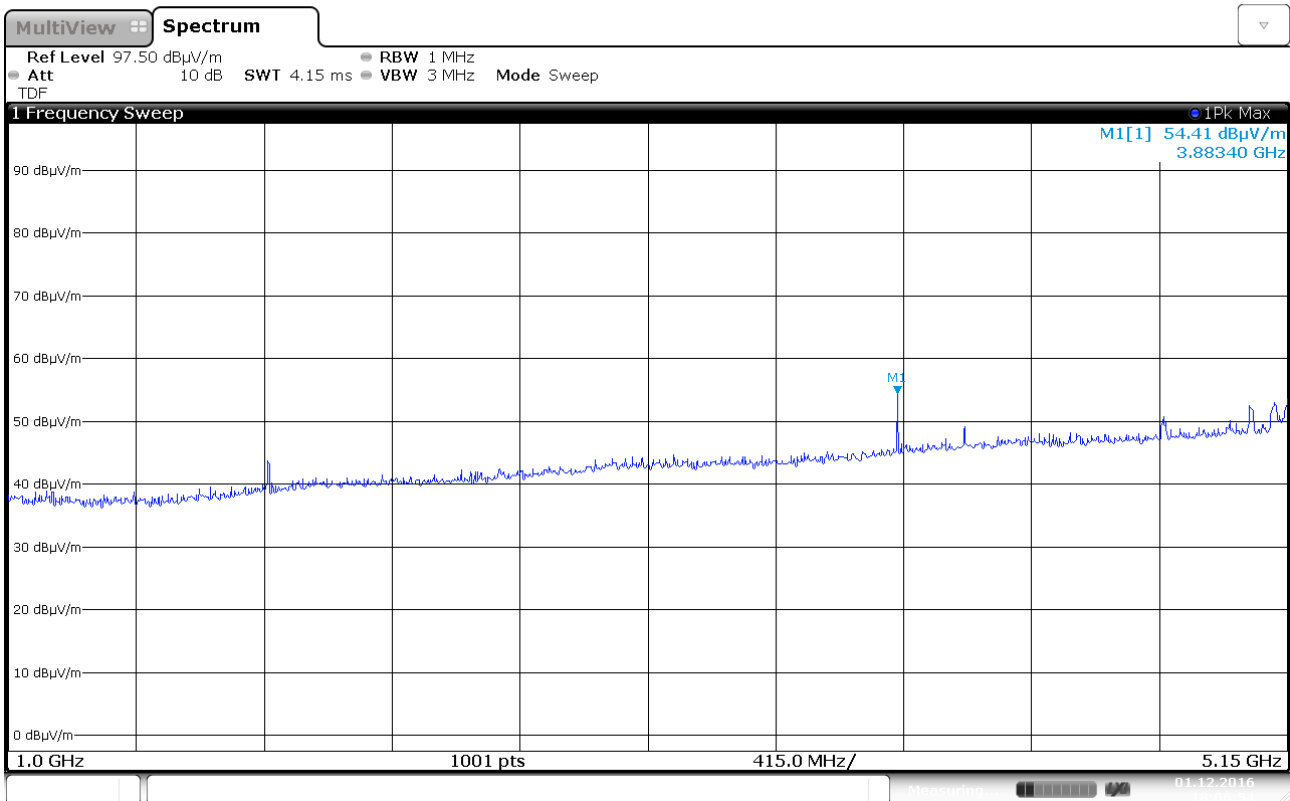




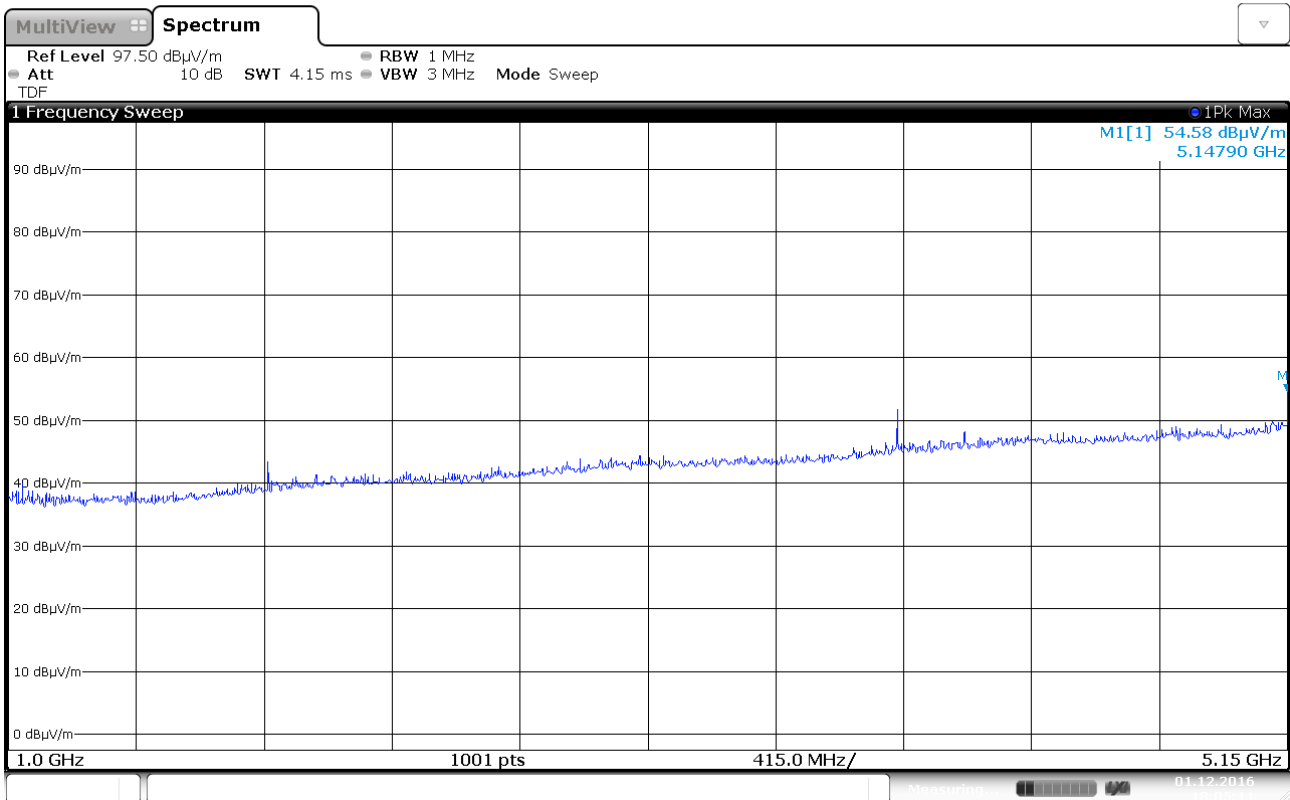
**Radiated Emissions, 1.0 – 5.15 GHz, 5180 MHz, 802.11a 6M, Ant 1, HP**



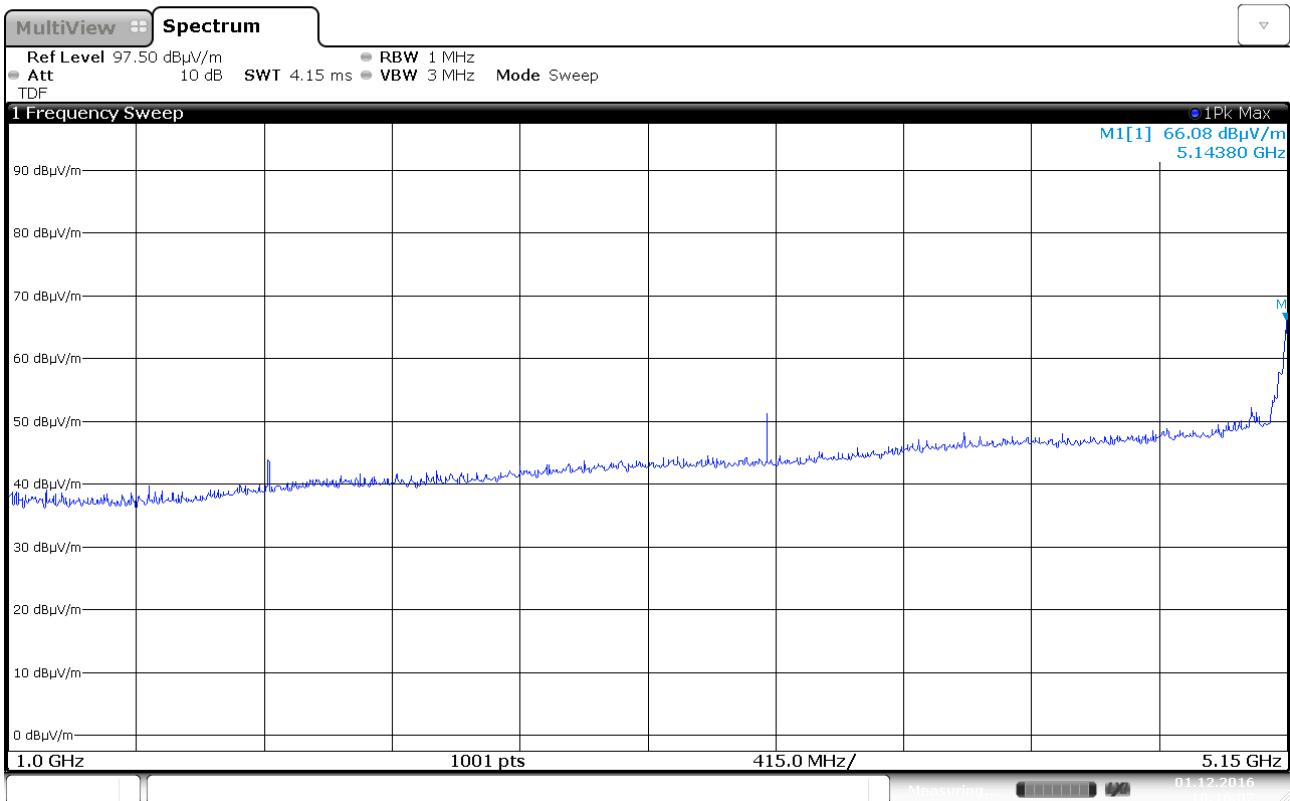
**Radiated Emissions, 1.0 – 5.15 GHz, 5180 MHz, 802.11a 6M, Ant 1, VP**



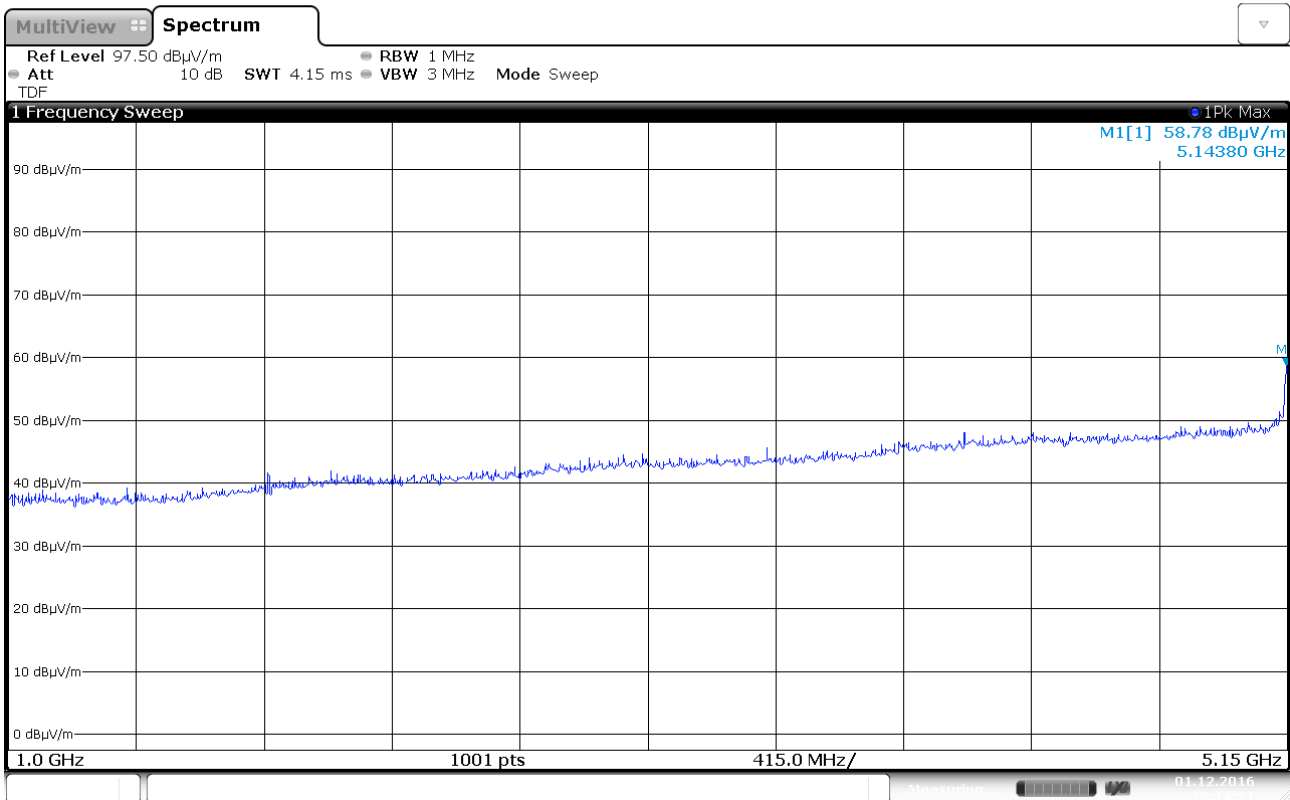
**Radiated Emissions, 1.0 – 5.15 GHz, 5180 MHz, 802.11n HT20, MIMO, HP**



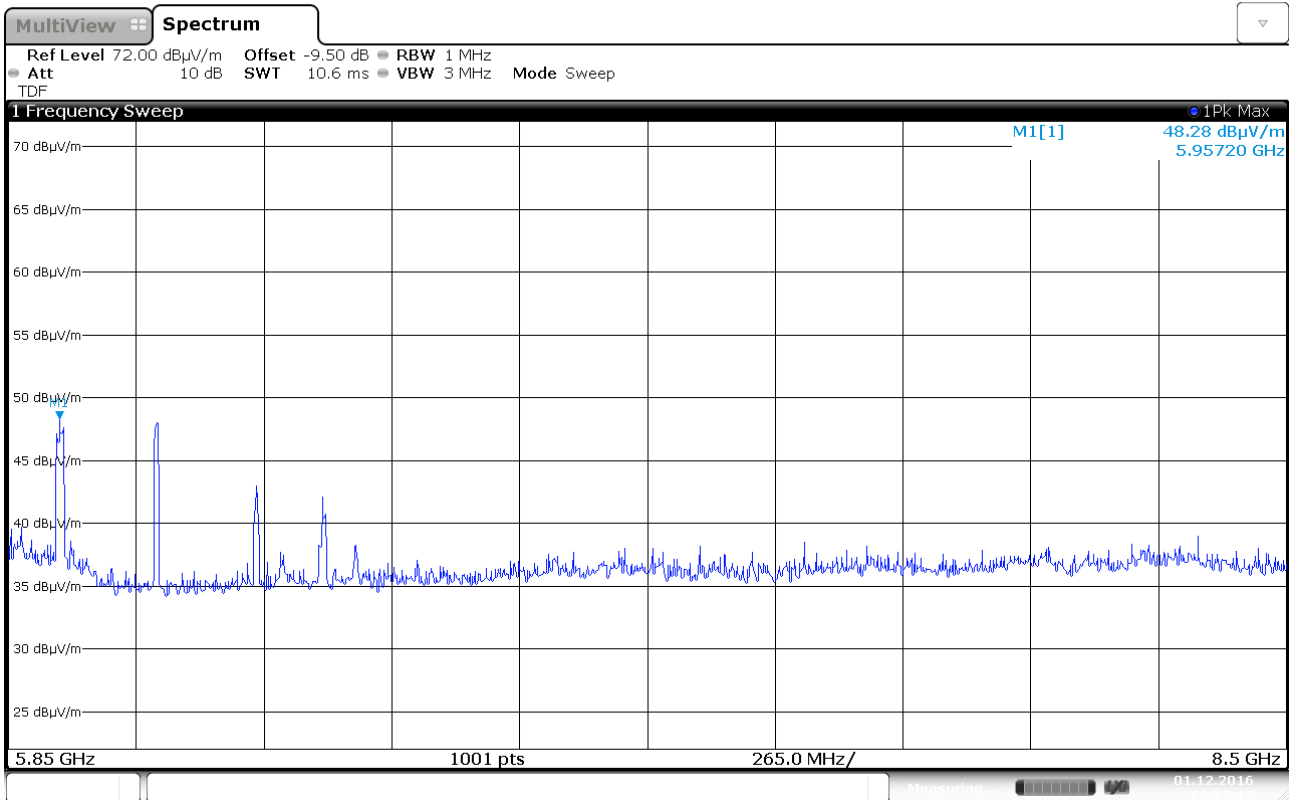
**Radiated Emissions, 1.0 – 5.15 GHz, 5180 MHz, 802.11n HT20, MIMO, VP**



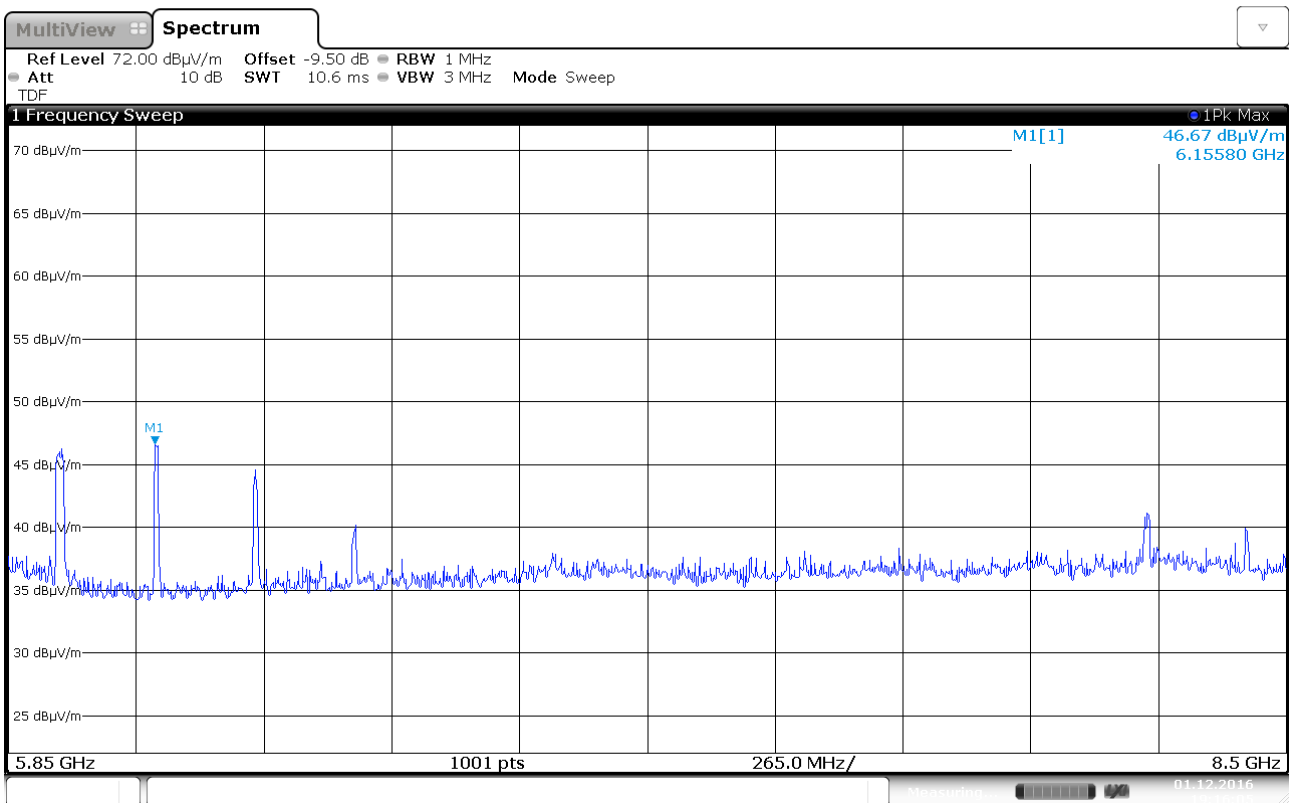
**Radiated Emissions, 1.0 – 5.15 GHz, 5190 MHz, 802.11n HT40, MIMO, HP**



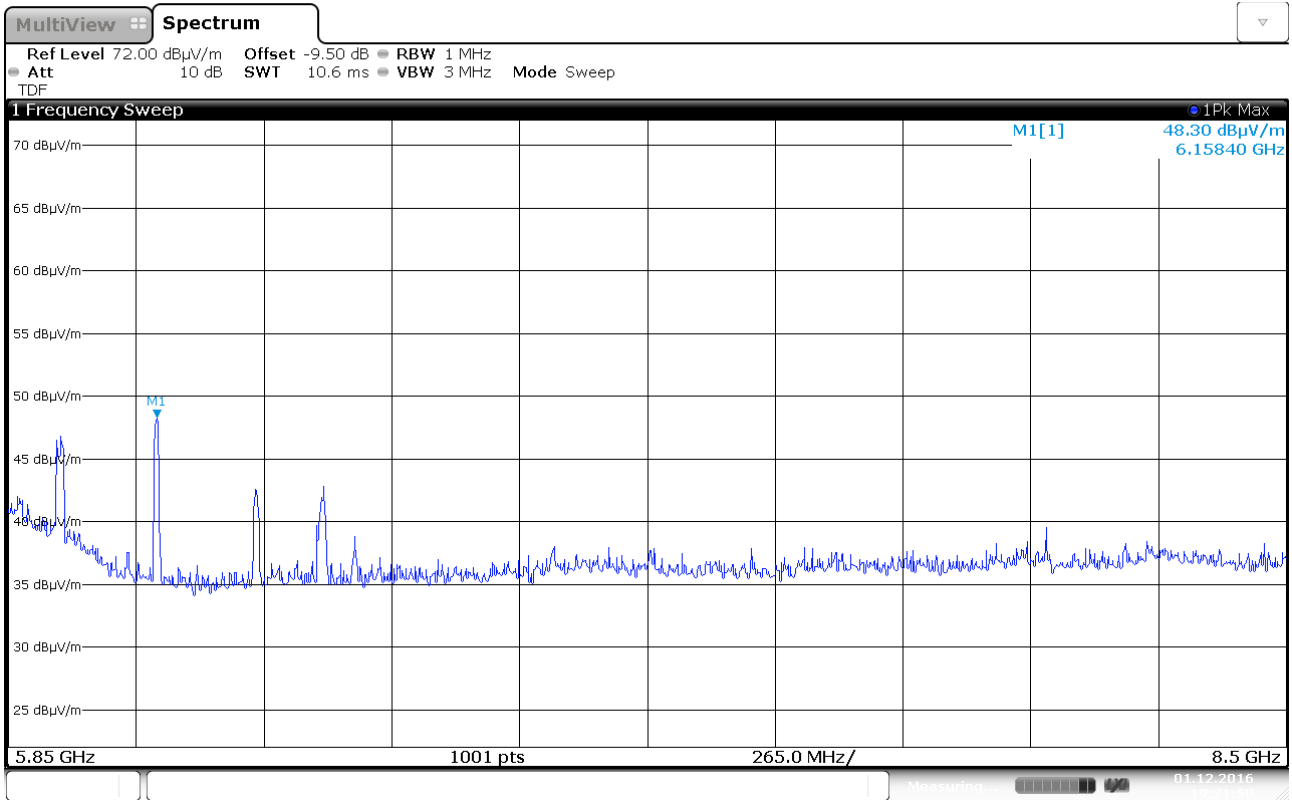
**Radiated Emissions, 1.0 – 5.15 GHz, 5190 MHz, 802.11n HT40, MIMO, VP**



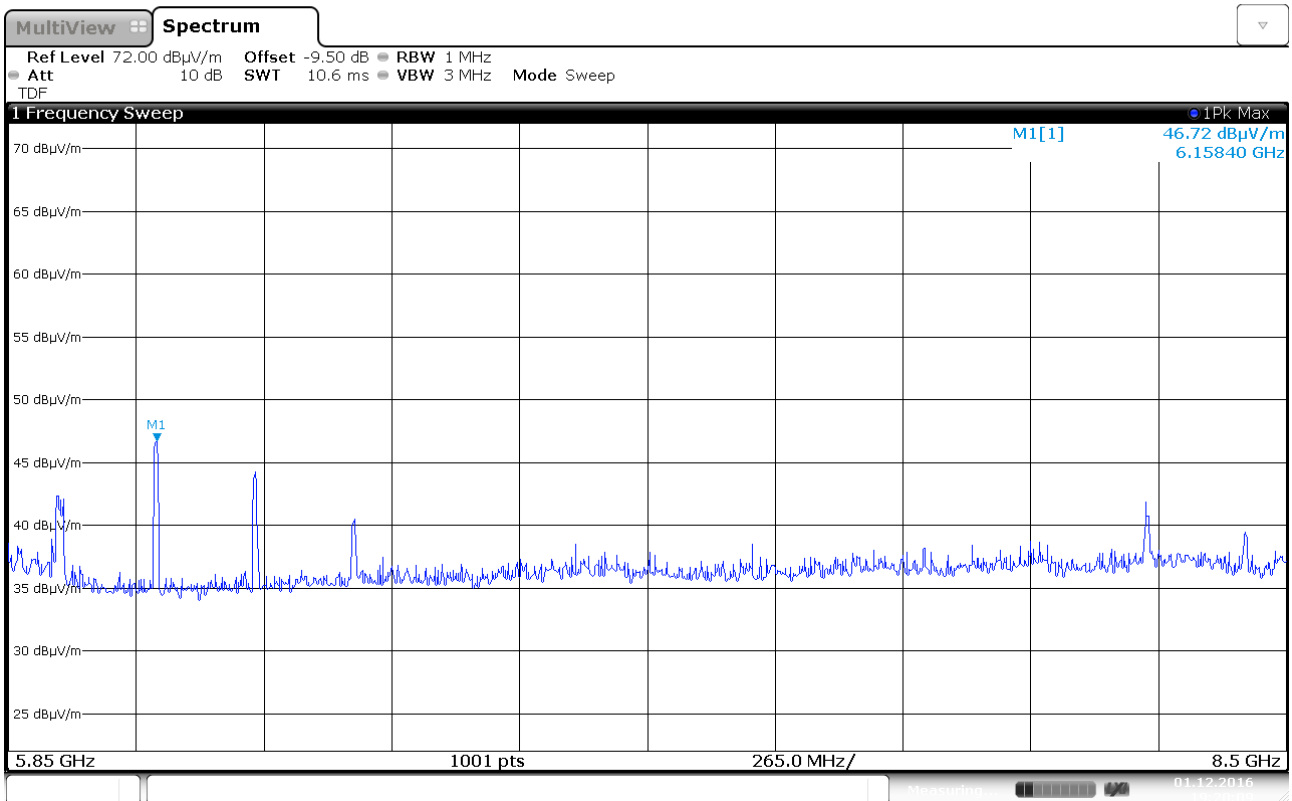
Radiated Emissions, 5.85 – 8.5 GHz, 5500 MHz, 802.11a 6M, Ant 0, HP



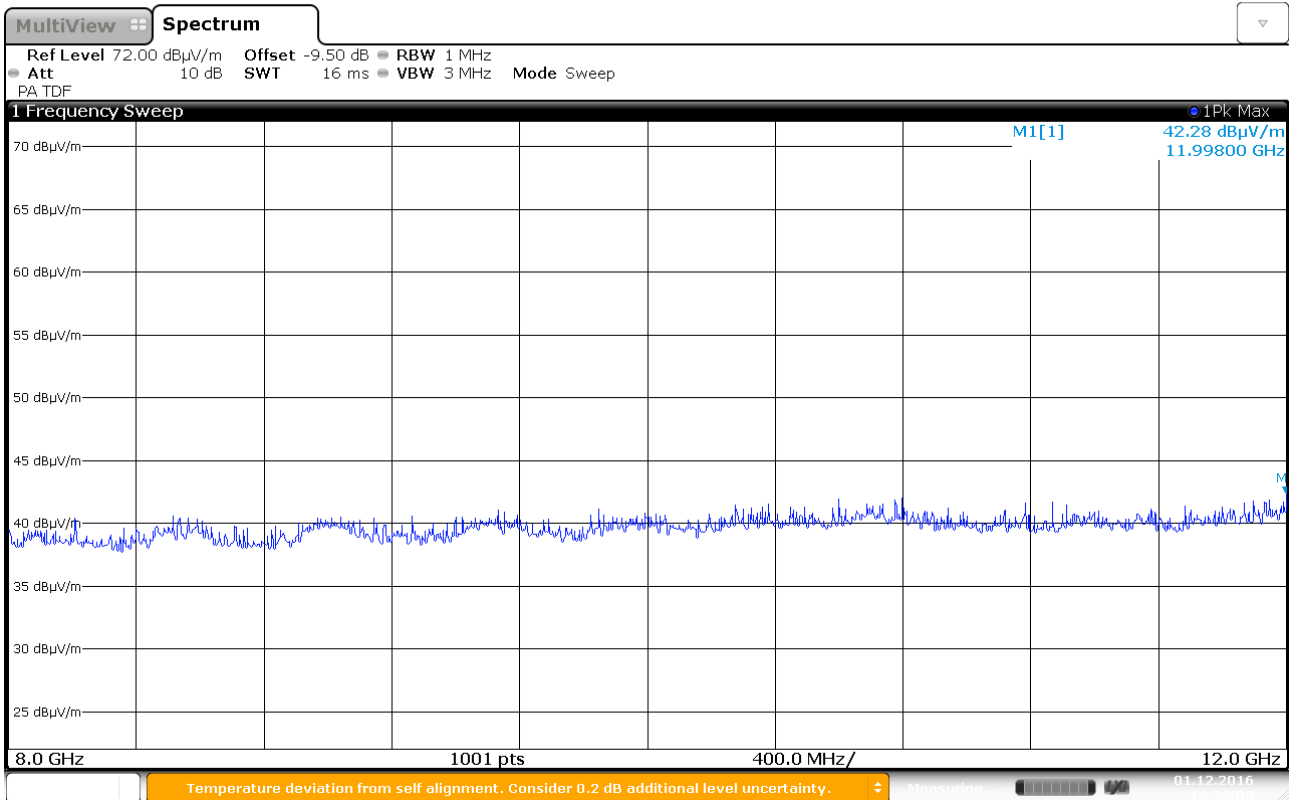
Radiated Emissions, 5.85 – 8.5 GHz, 5500 MHz, 802.11a 6M, Ant 0, VP



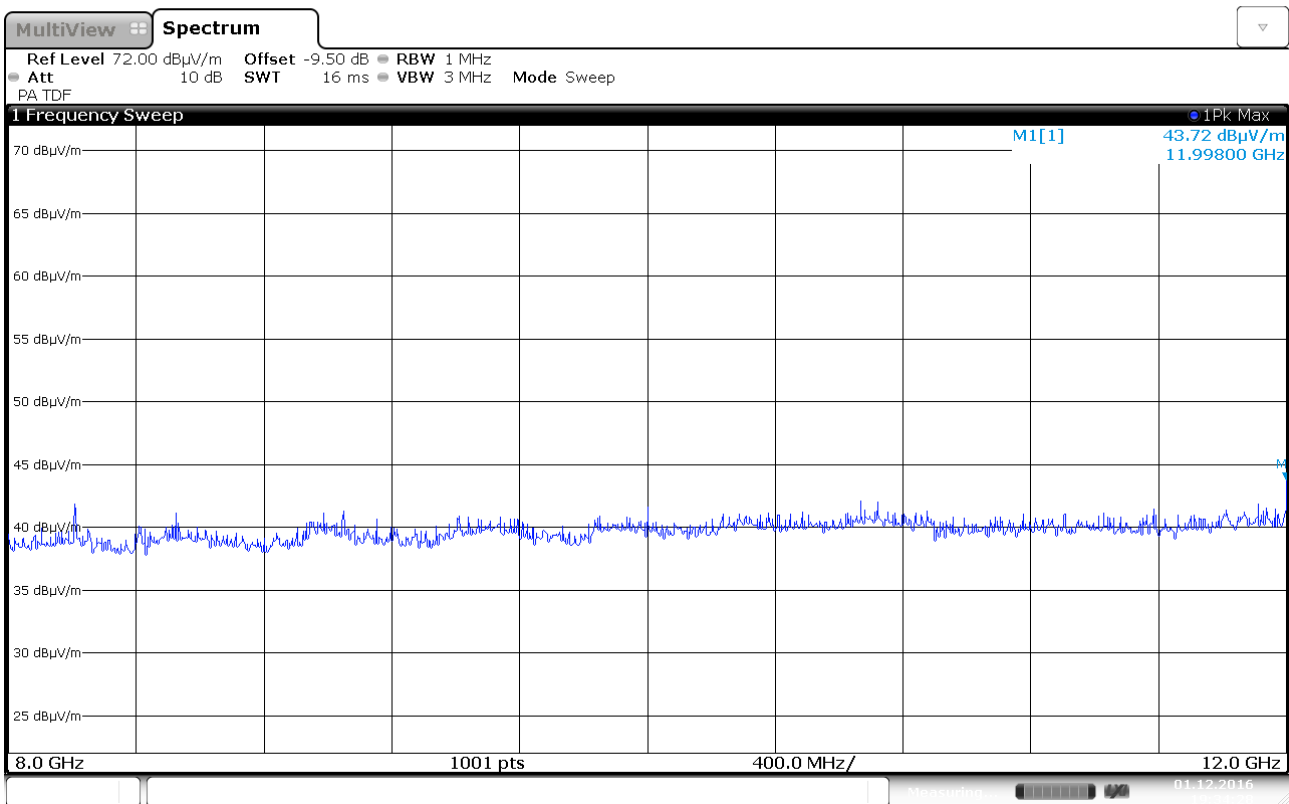
Radiated Emissions, 5.85 – 8.5 GHz, 5500 MHz, 802.11a 6M, Ant 1, HP



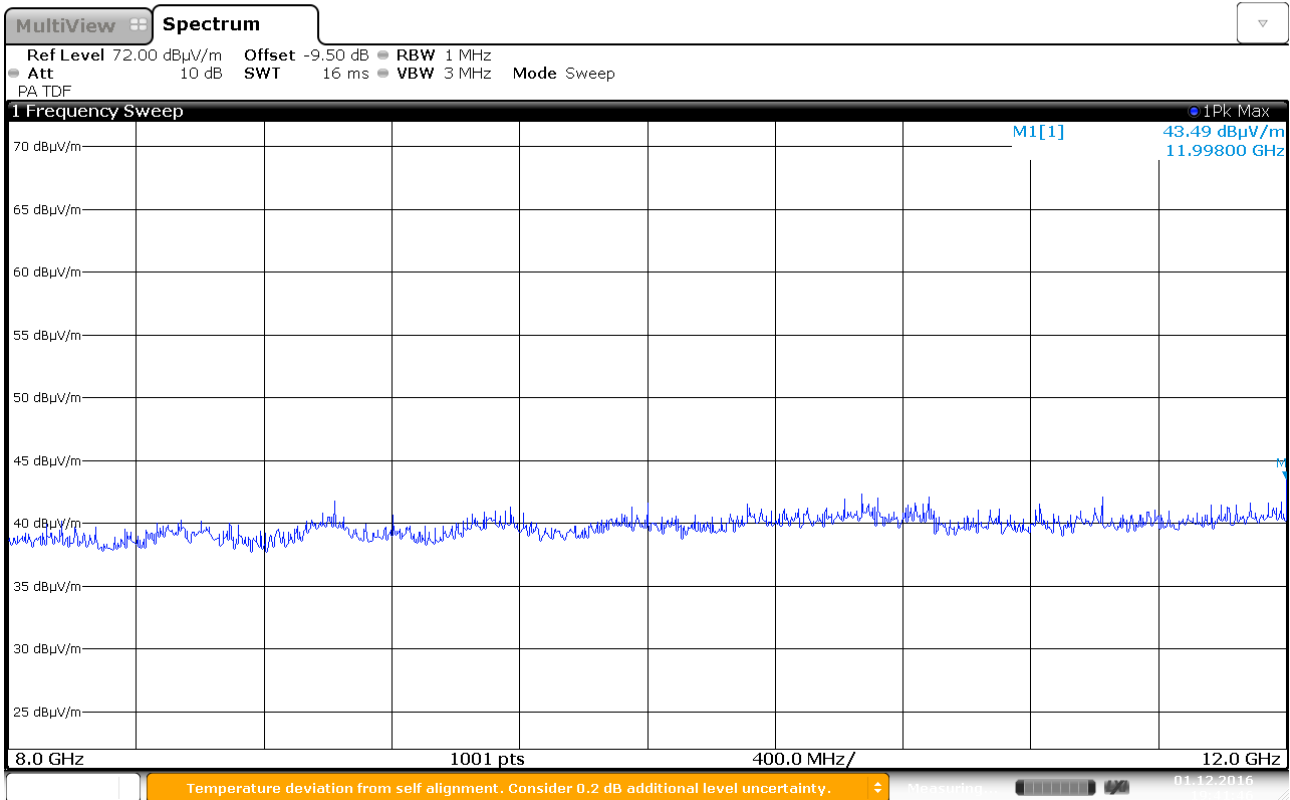
Radiated Emissions, 5.85 – 8.5 GHz, 5500 MHz, 802.11a 6M, Ant 1, VP



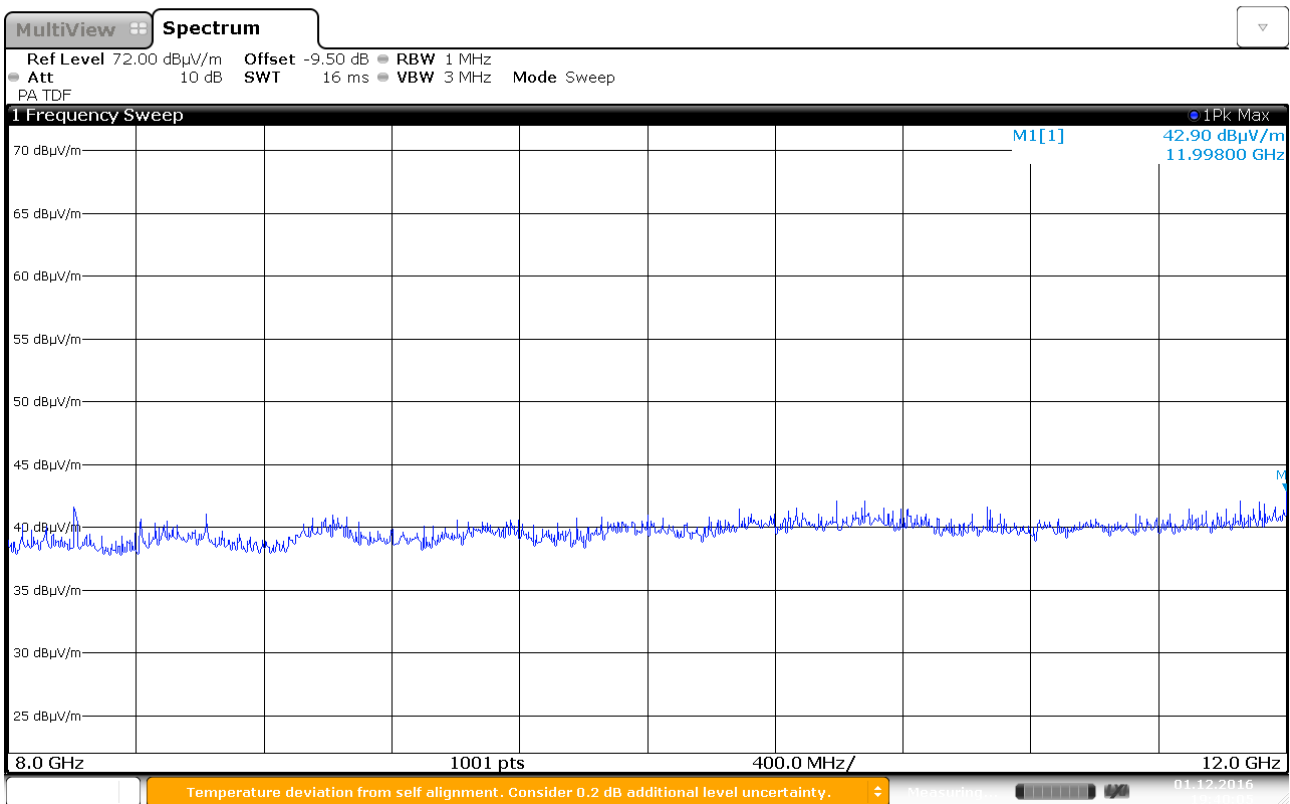
**Radiated Emissions, 8.0 – 12.0 GHz, 5500 MHz, 802.11a 6M, Ant 0, HP**



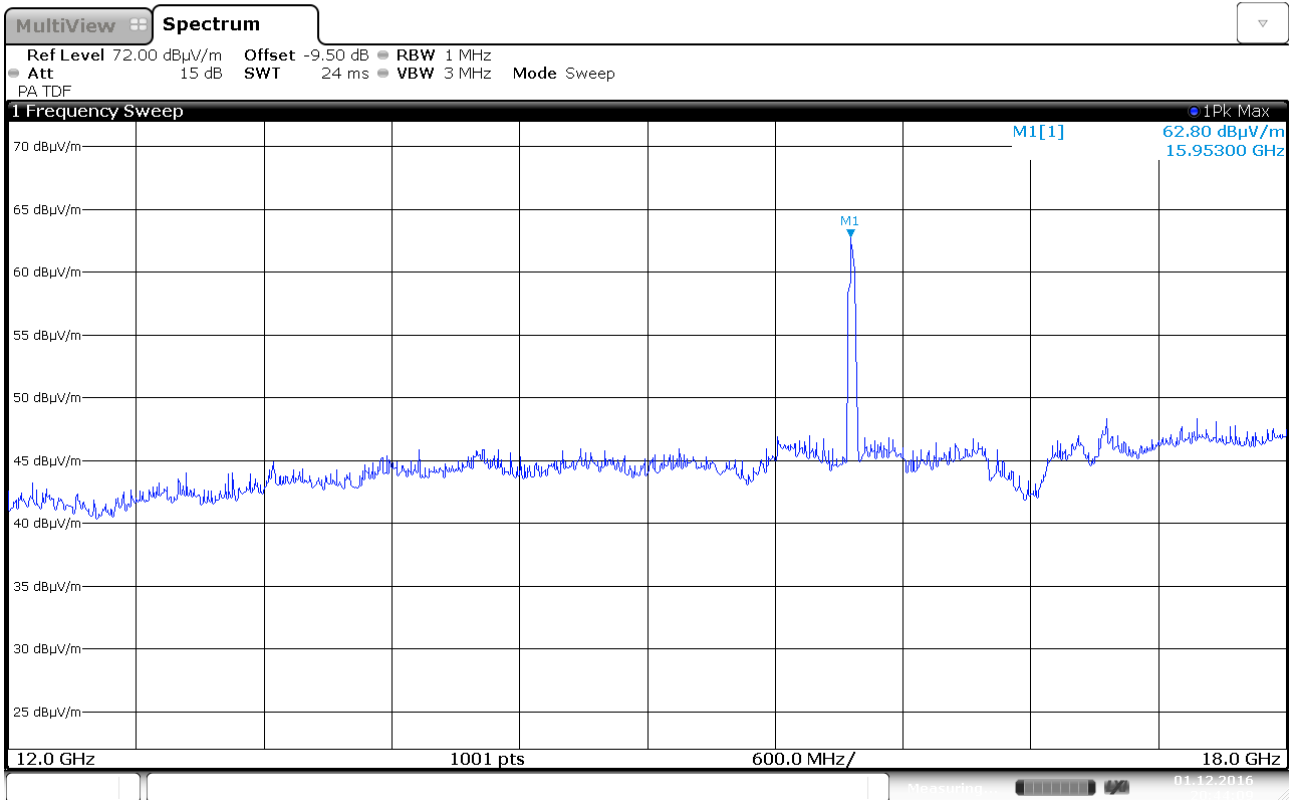
**Radiated Emissions, 8.0 – 12.0 GHz, 5500 MHz, 802.11a 6M, Ant 0, VP**



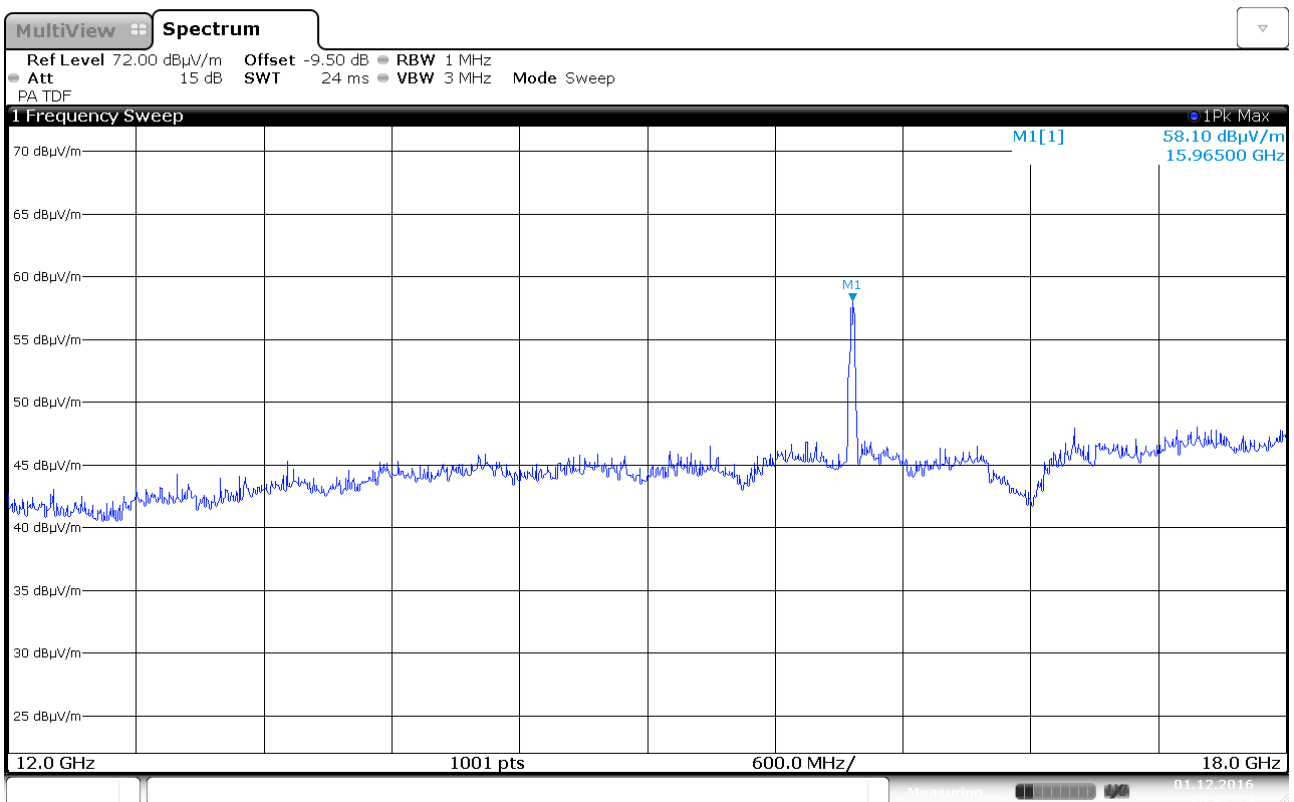
**Radiated Emissions, 8.0 – 12.0 GHz, 5500 MHz, 802.11a 6M, Ant 1, HP**



**Radiated Emissions, 8.0 – 12.0 GHz, 5500 MHz, 802.11a 6M, Ant 1, VP**

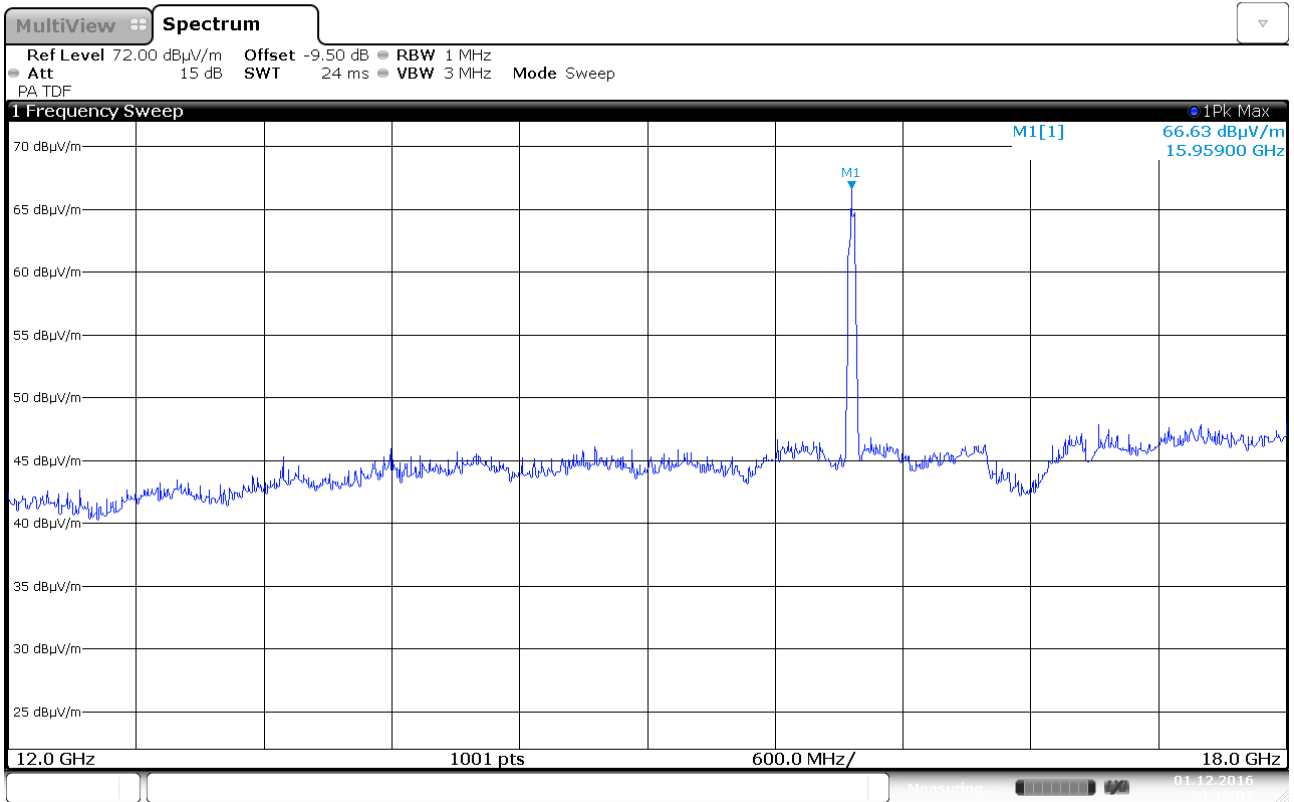


**Radiated Emissions, 12.0 – 18.0 GHz, 5320 MHz, 802.11a 6M, Ant 0, HP**

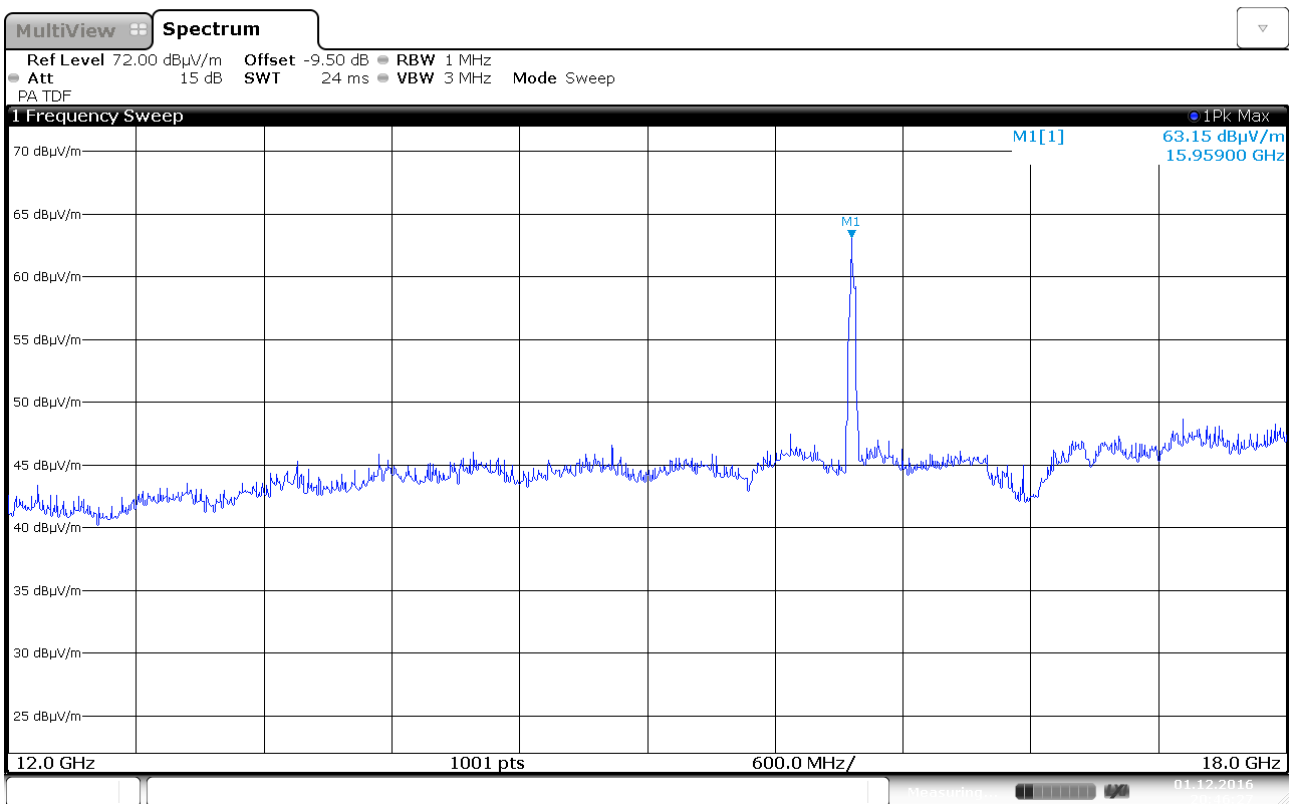


**Radiated Emissions, 12.0 – 18.0 GHz, 5320 MHz, 802.11a 6M, Ant 0, VP**

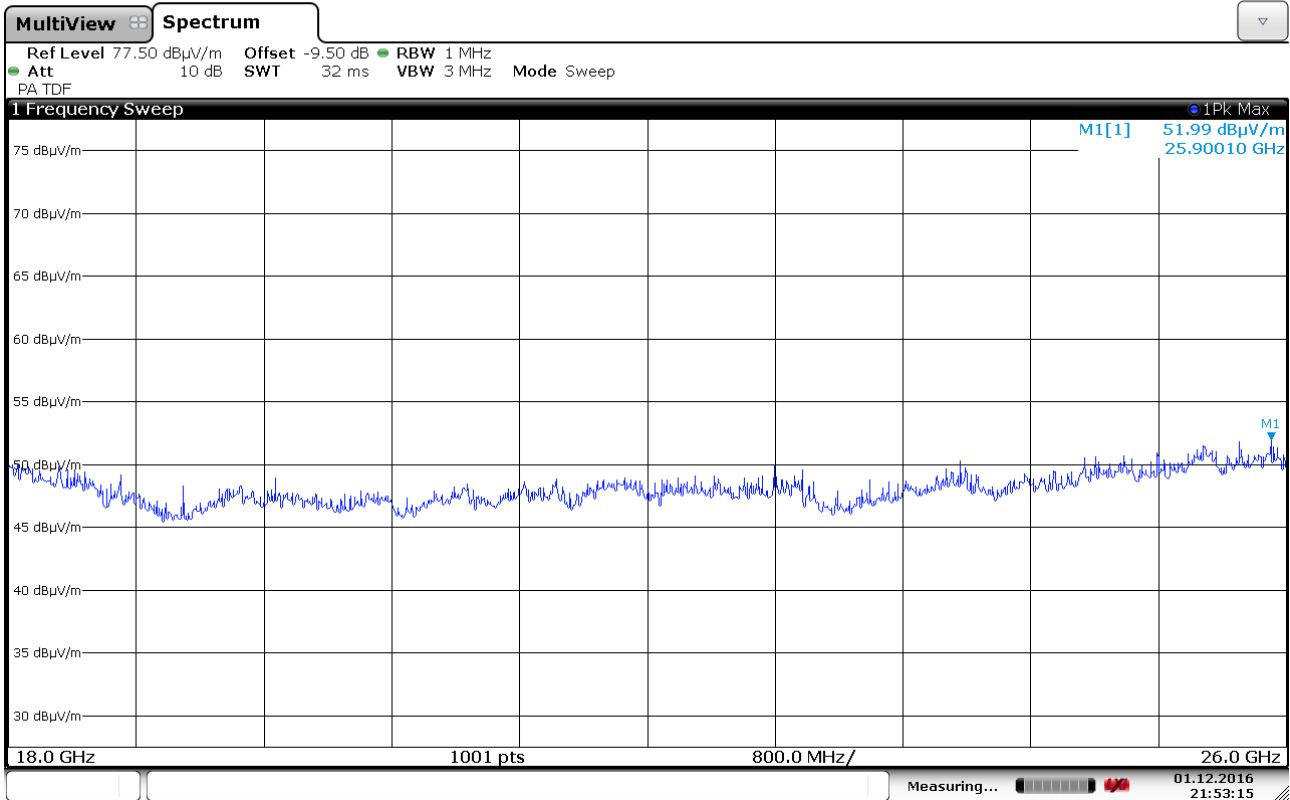




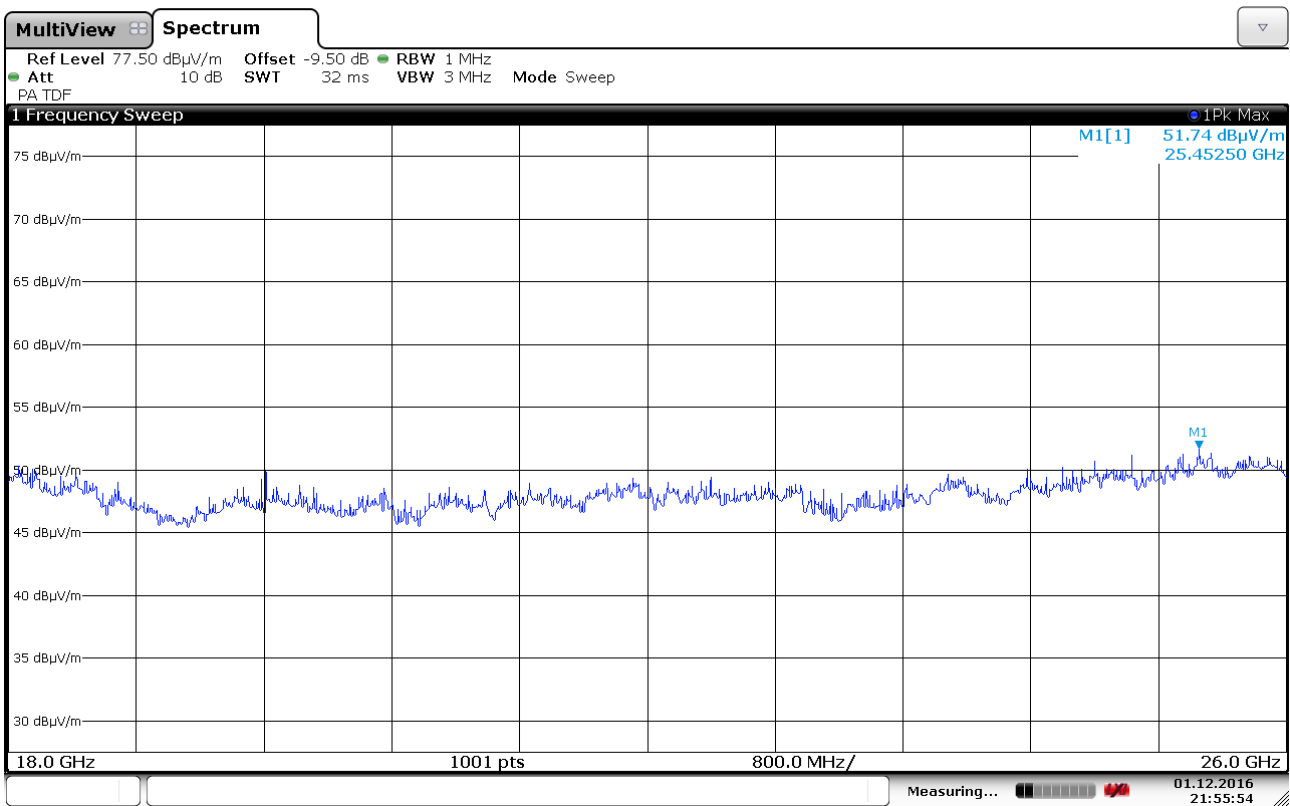
Radiated Emissions, 12.0 – 18.0 GHz, 5320 MHz, 802.11a 6M, Ant 1, HP



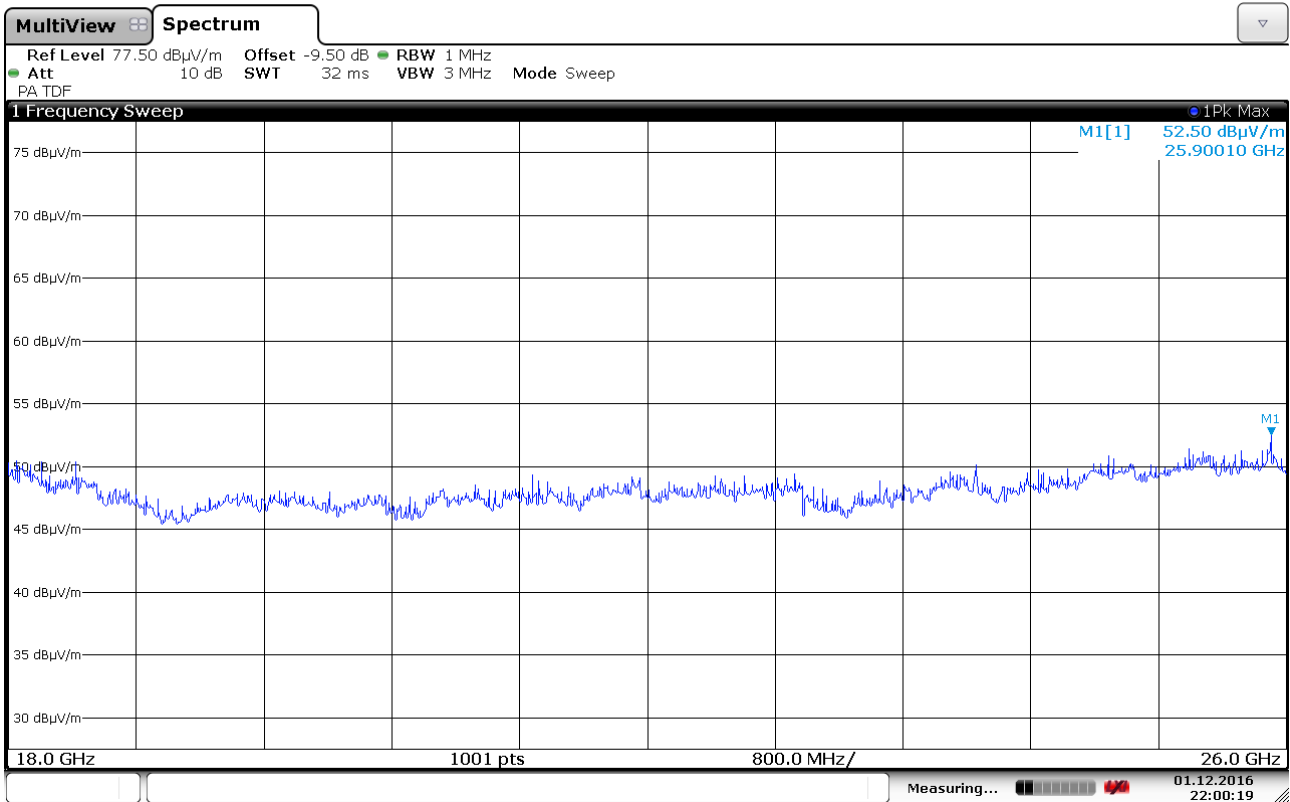
Radiated Emissions, 12.0 – 18.0 GHz, 5320 MHz, 802.11a 6M, Ant 1, VP



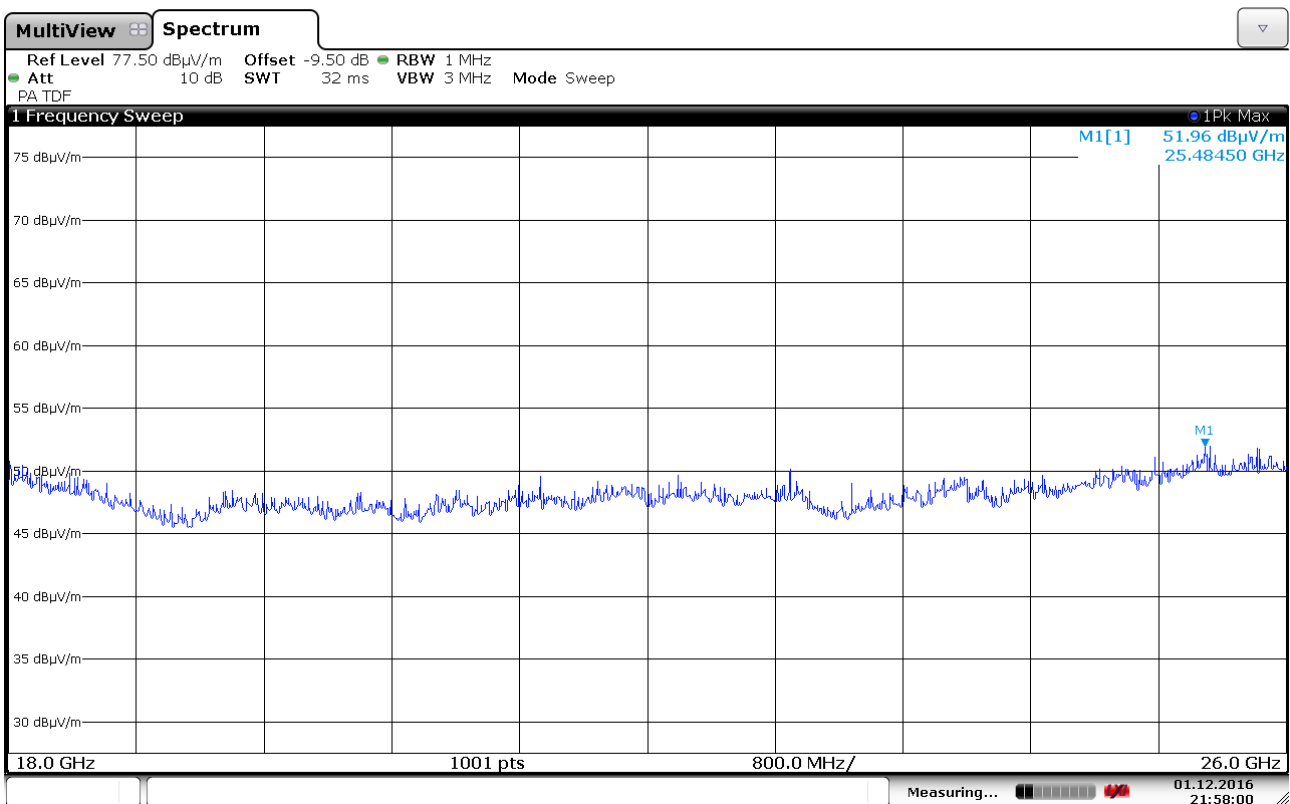
**Radiated Emissions, 18.0 – 26.0 GHz, 5320 MHz, 802.11a 6M, Ant 0, HP**



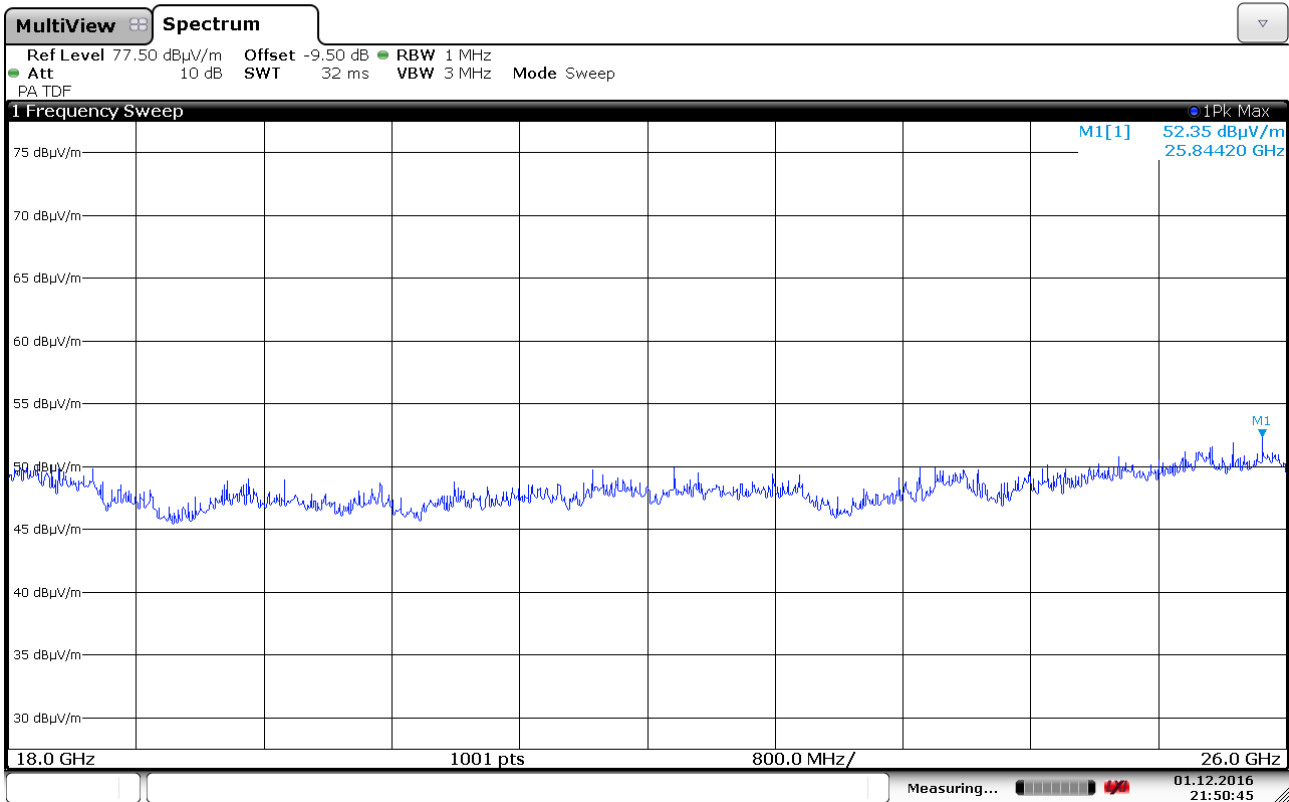
**Radiated Emissions, 18.0 – 26.0 GHz, 5320 MHz, 802.11a 6M, Ant 0, VP**



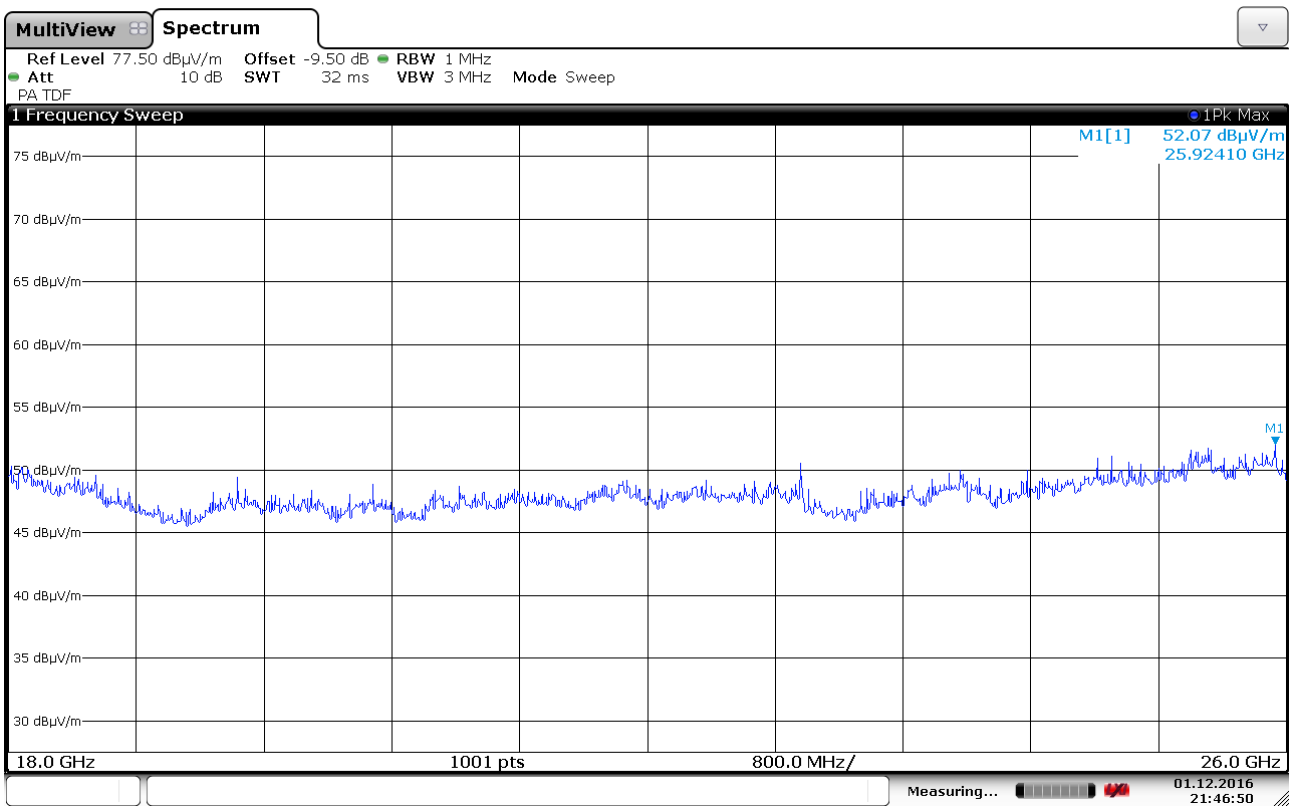
**Radiated Emissions, 18.0 – 26.0 GHz, 5320 MHz, 802.11a 6M, Ant 1, HP**



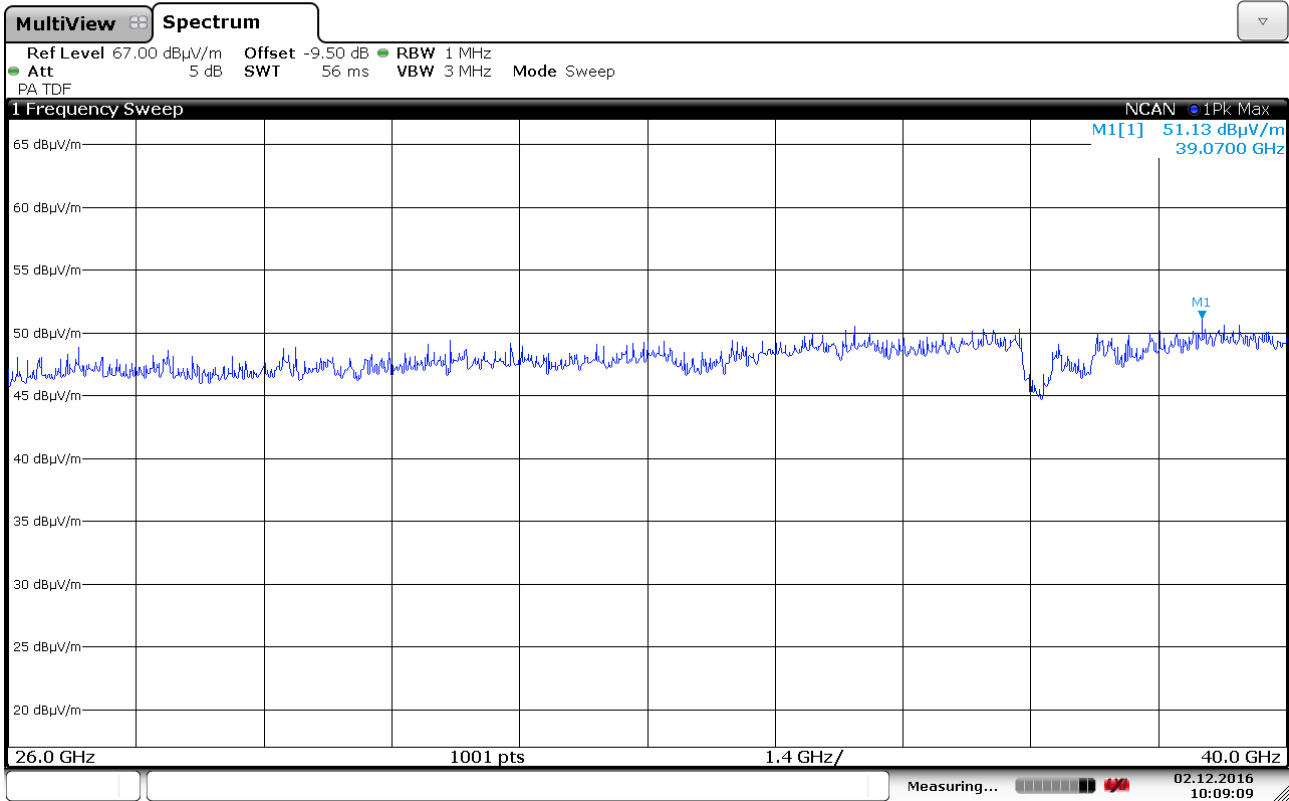
**Radiated Emissions, 18.0 – 26.0 GHz, 5320 MHz, 802.11a 6M, Ant 1, VP**



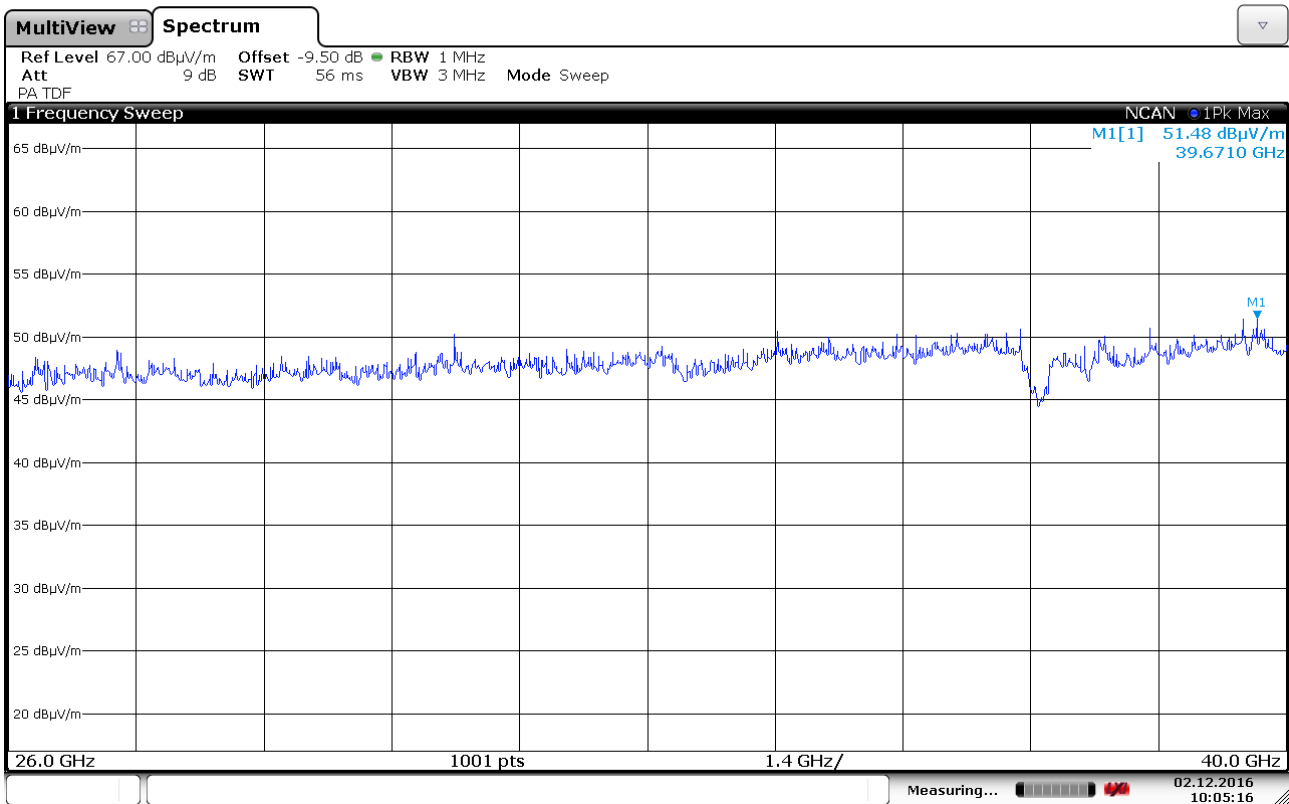
**Radiated Emissions, 18.0 – 26.0 GHz, 5320 MHz, 802.11n HT20, MIMO, HP**



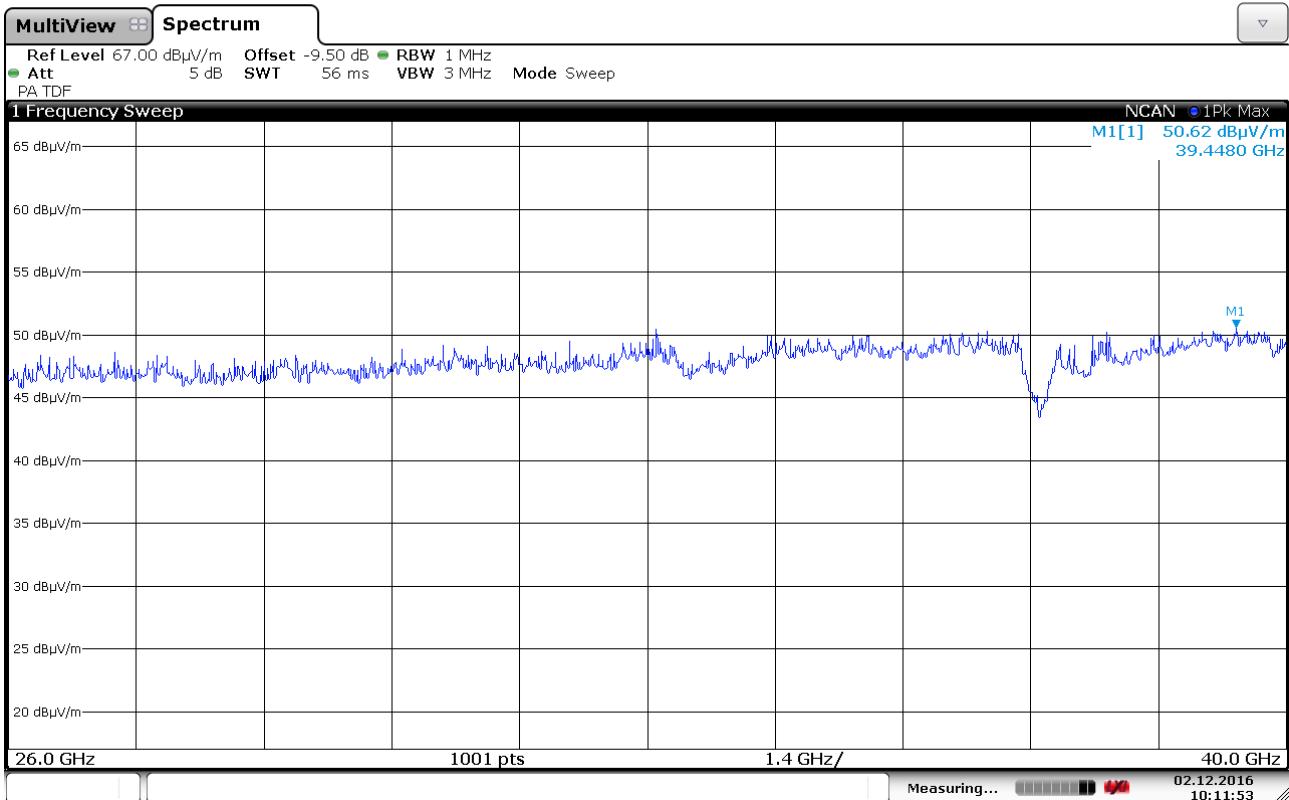
**Radiated Emissions, 18.0 – 26.0 GHz, 5320 MHz, 802.11n HT20, MIMO, VP**



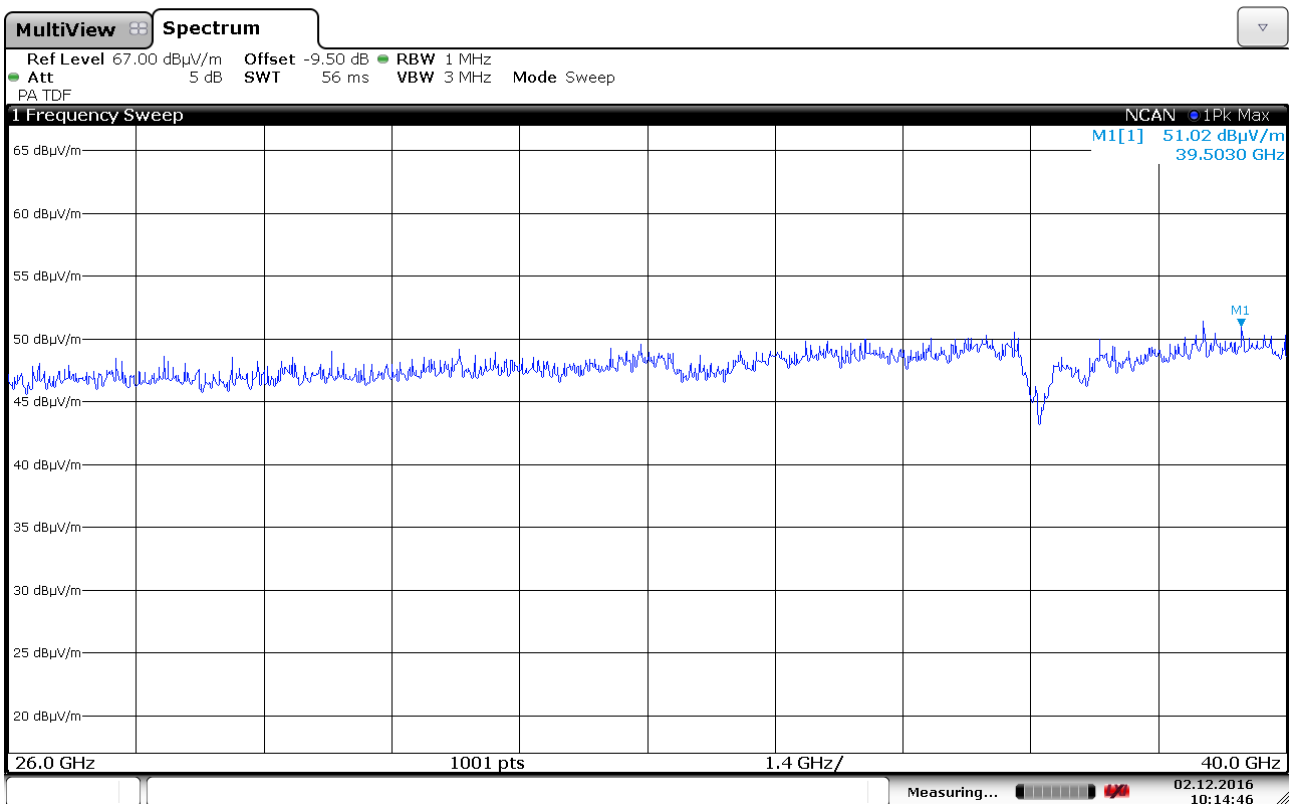
**Radiated Emissions, 26.0 – 40.0 GHz, 5300 MHz, 802.11a 6M, Ant 0, HP**



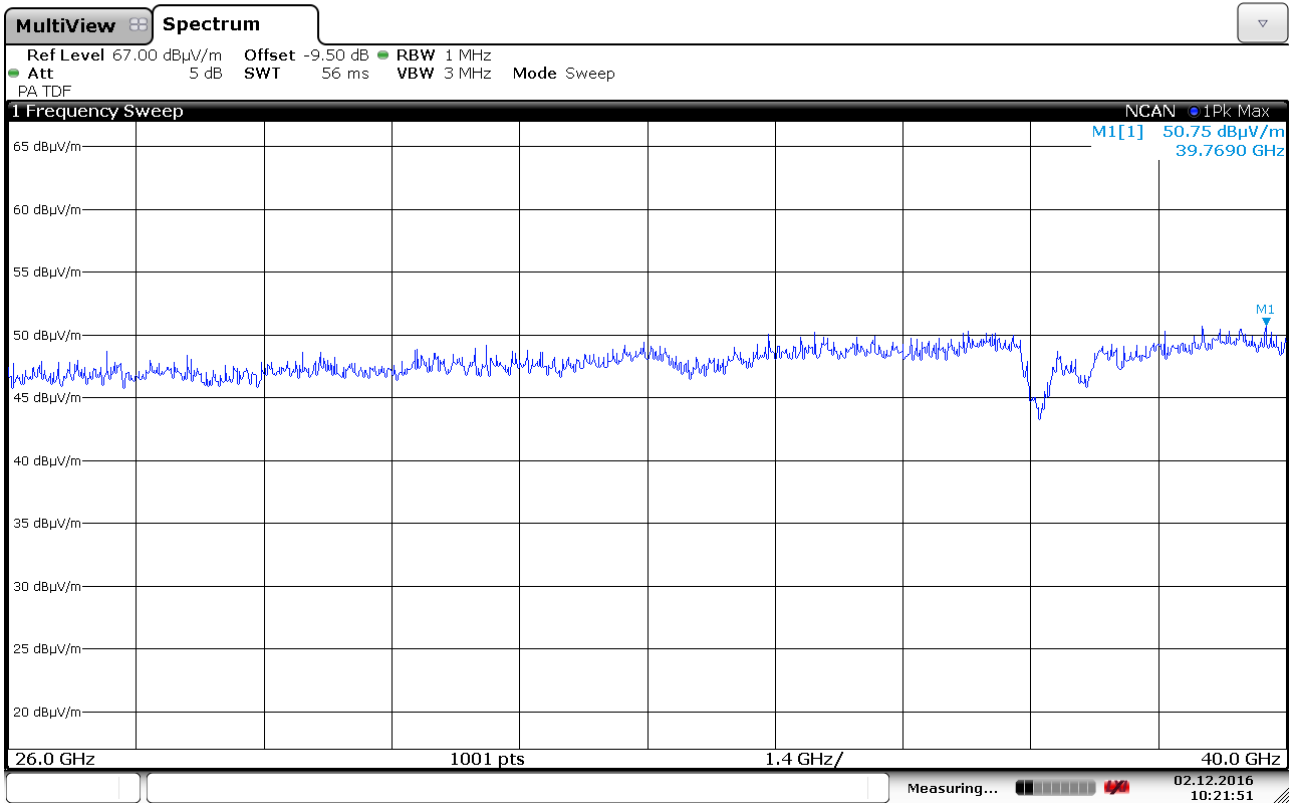
**Radiated Emissions, 26.0 – 40.0 GHz, 5300 MHz, 802.11a 6M, Ant 0, VP**



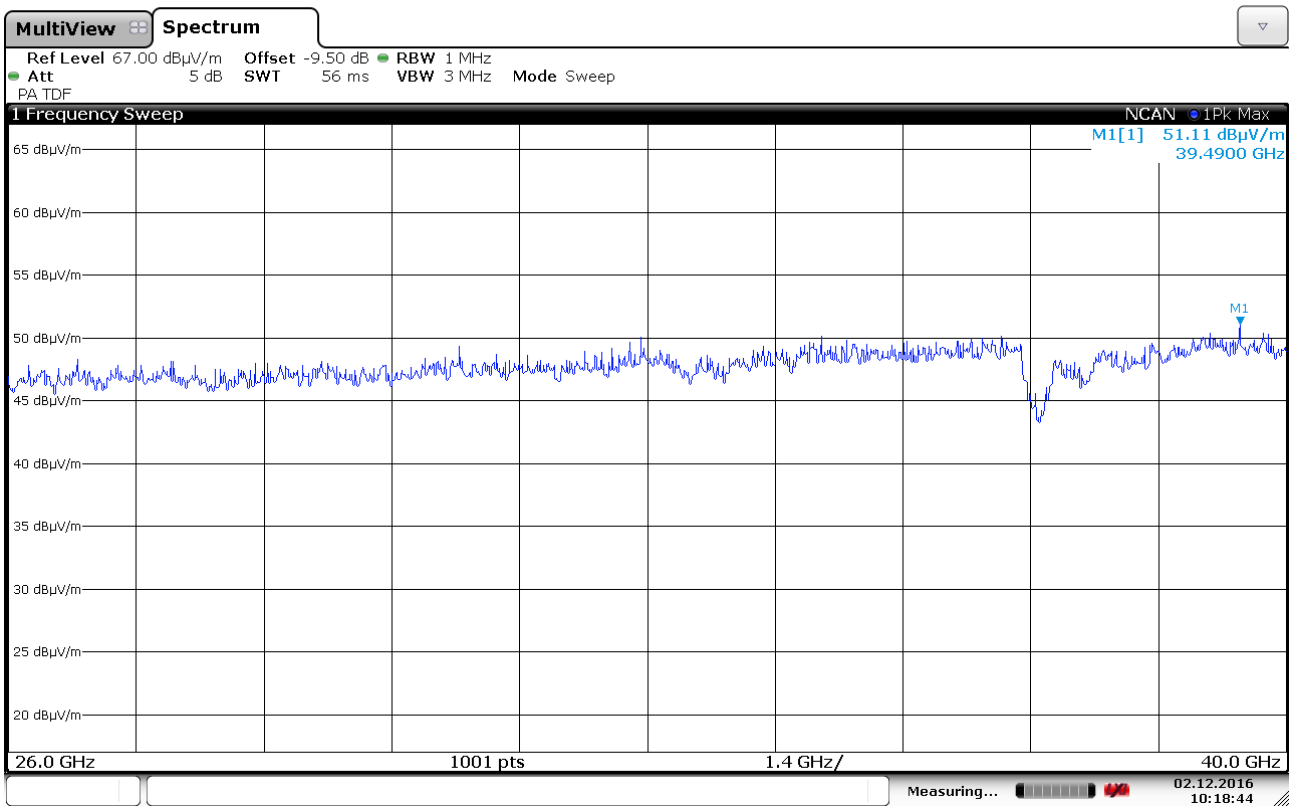
Radiated Emissions, 26.0 – 40.0 GHz, 5300 MHz, 802.11a 6M, Ant 1, HP



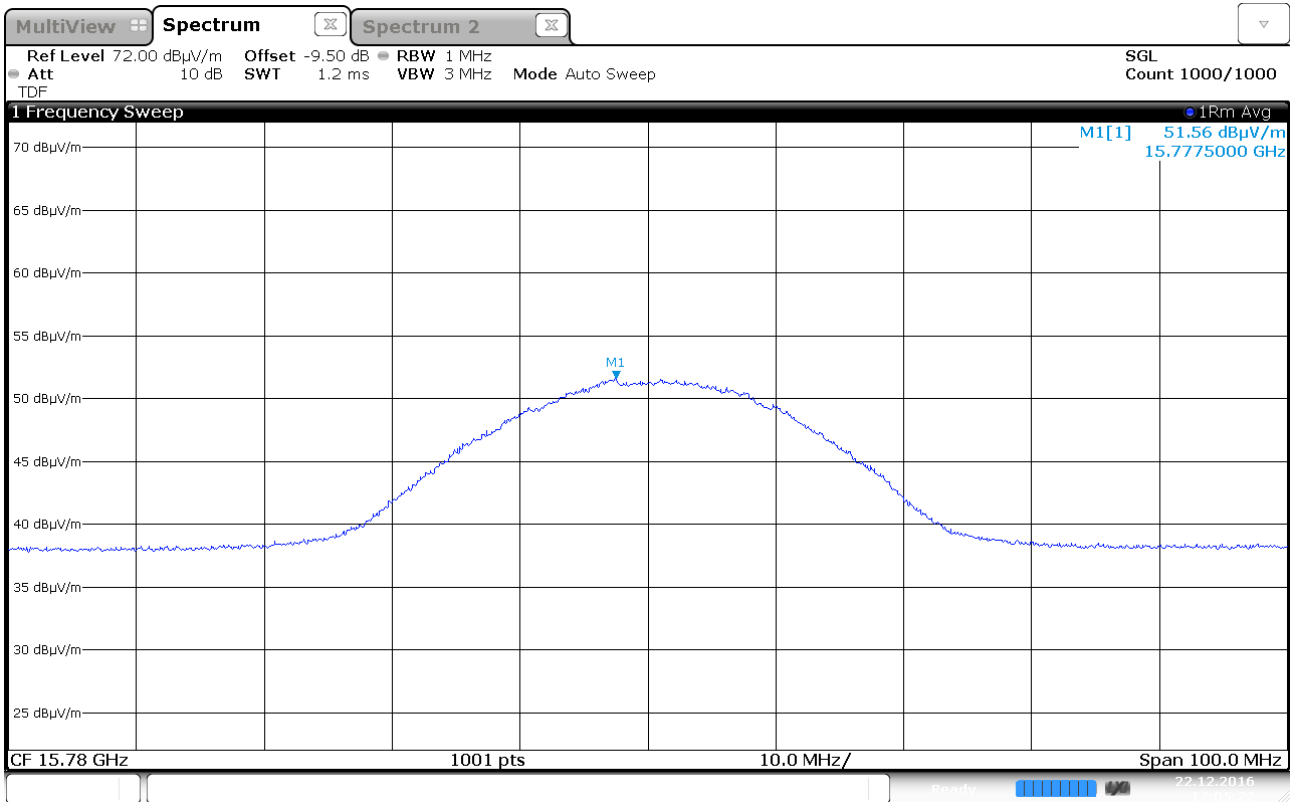
Radiated Emissions, 26.0 – 40.0 GHz, 5300 MHz, 802.11a 6M, Ant 1, VP



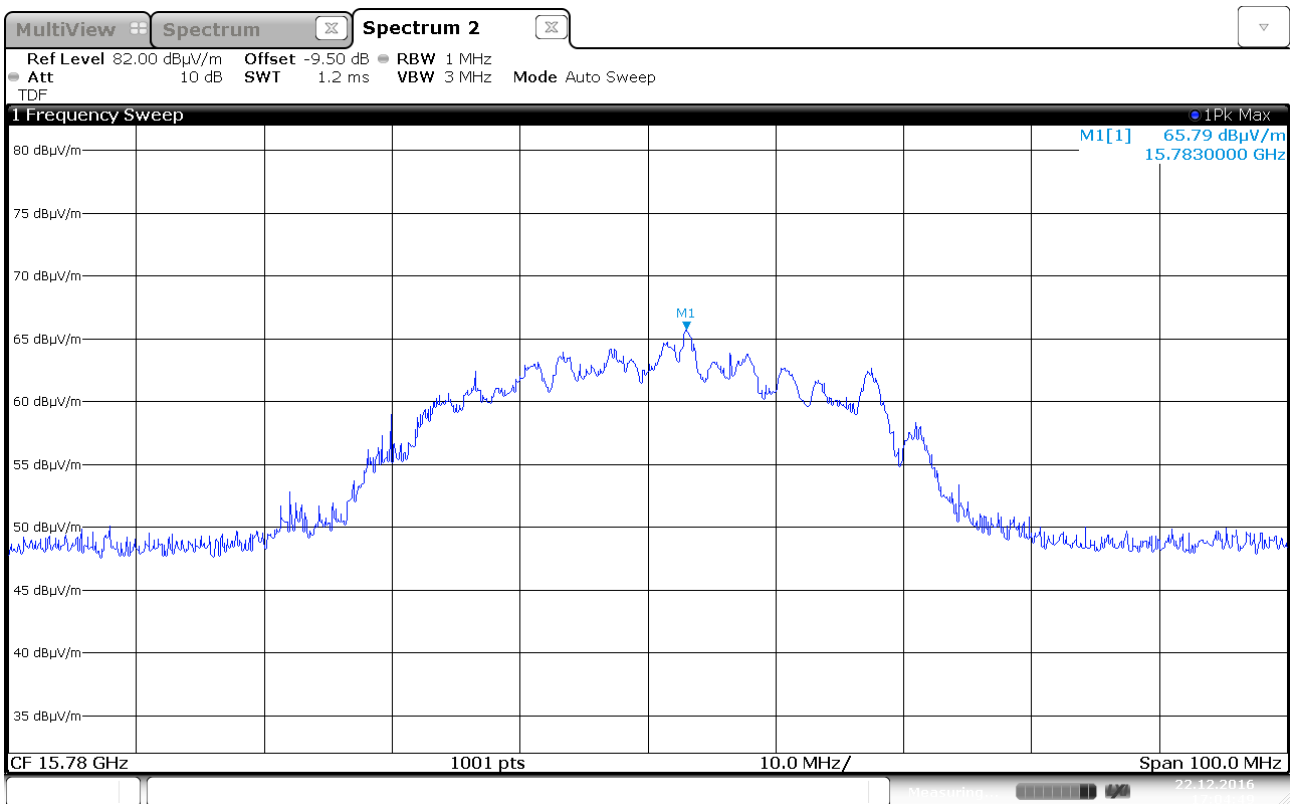
**Radiated Emissions, 26.0 – 40.0 GHz, 5300 MHz, 802.11n HT20, MIMO, HP**



**Radiated Emissions, 26.0 – 40.0 GHz, 5300 MHz, 802.11n HT20, MIMO, VP**

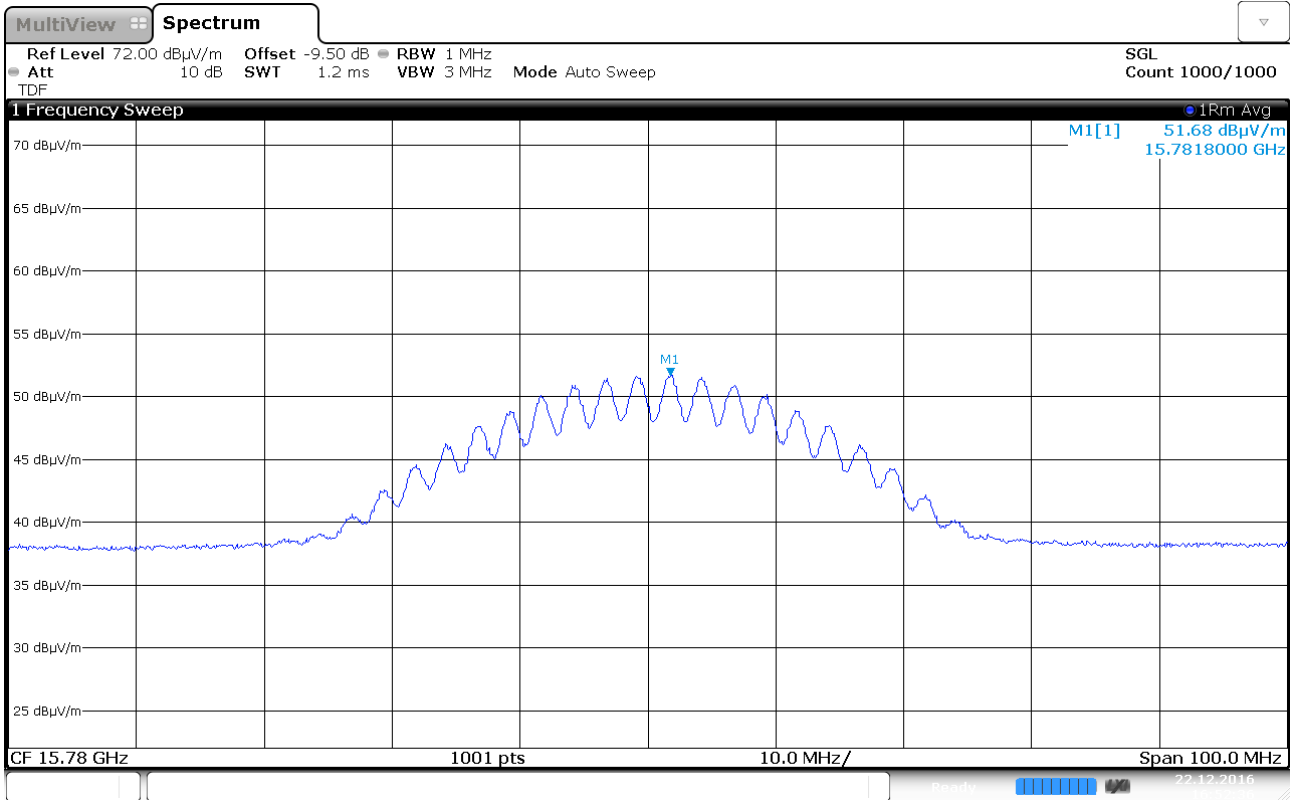


**Radiated Emissions Av, 15.78 GHz, 5260 MHz, 802.11a 6M, Ant1, HP**

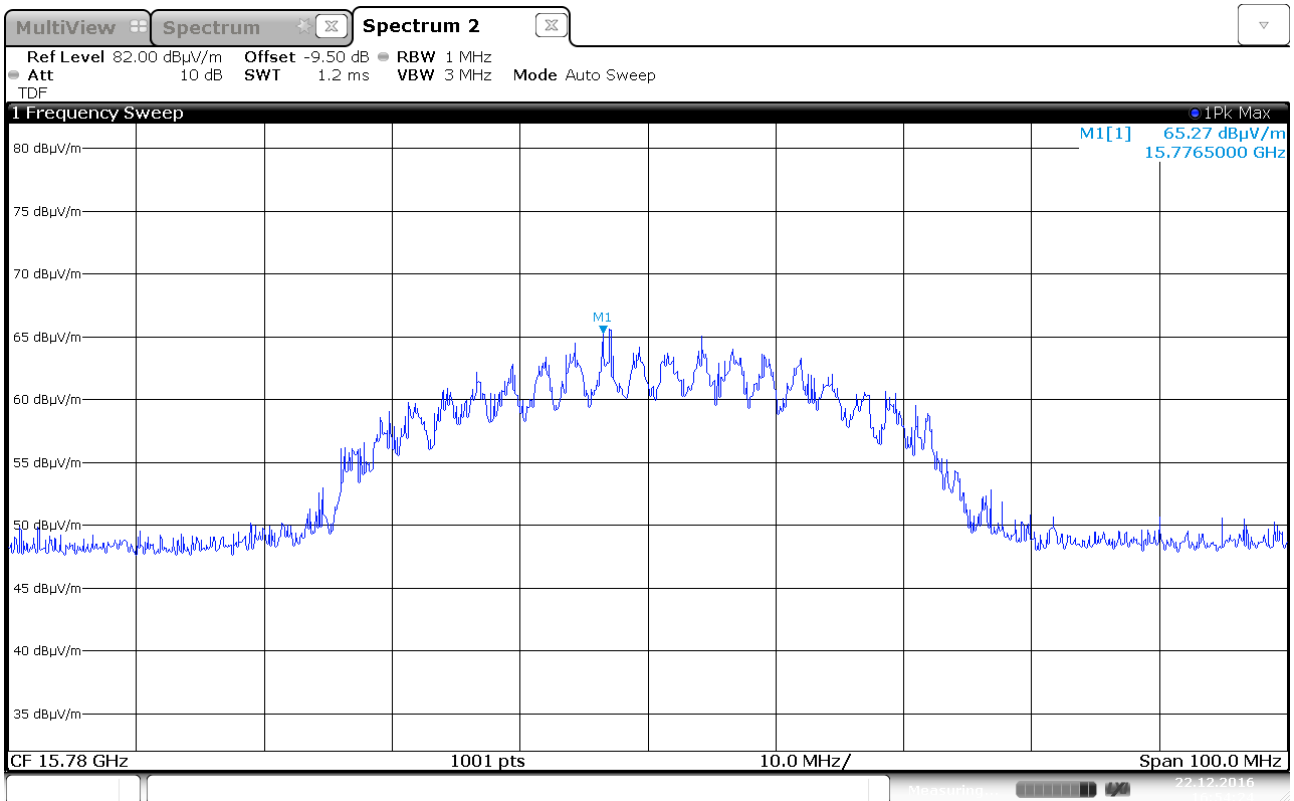


**Radiated Emissions Pk, 15.78 GHz, 5260 MHz, 802.11a 6M, Ant1, HP**

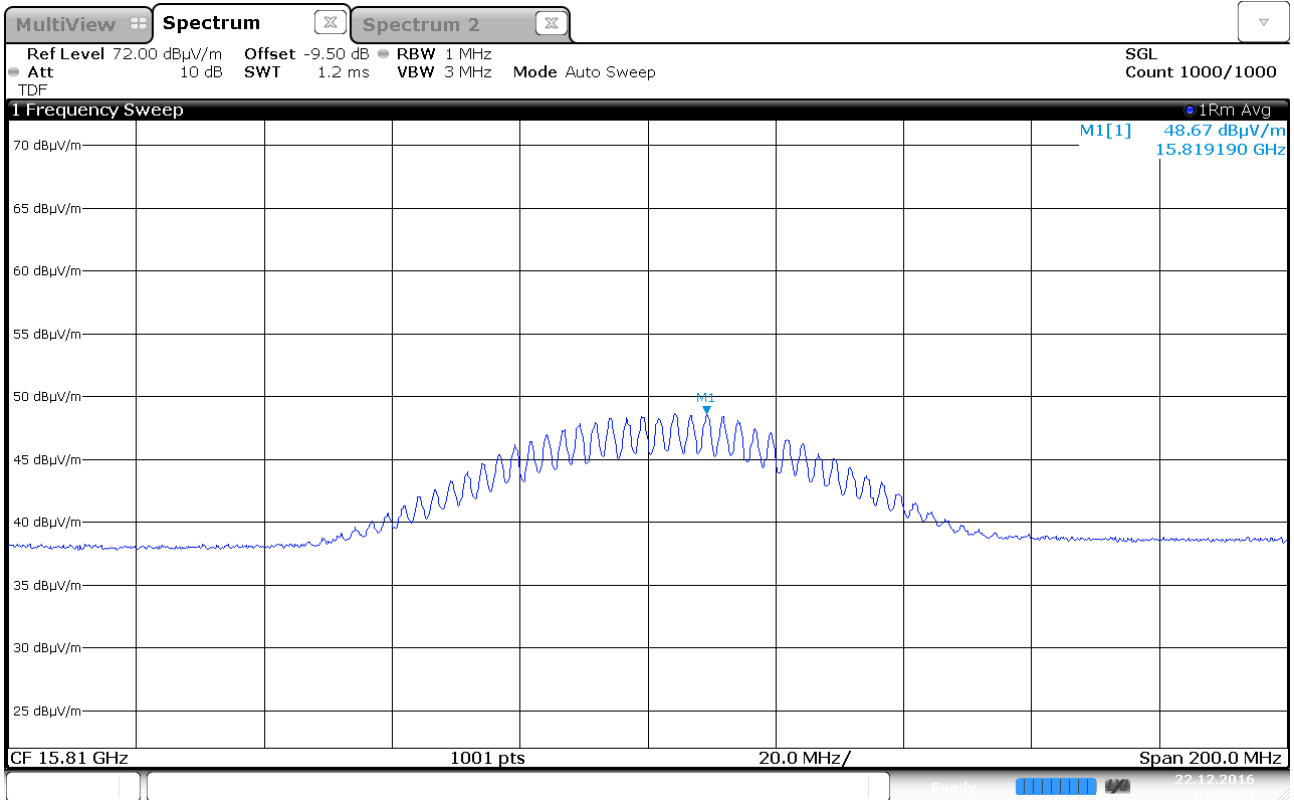




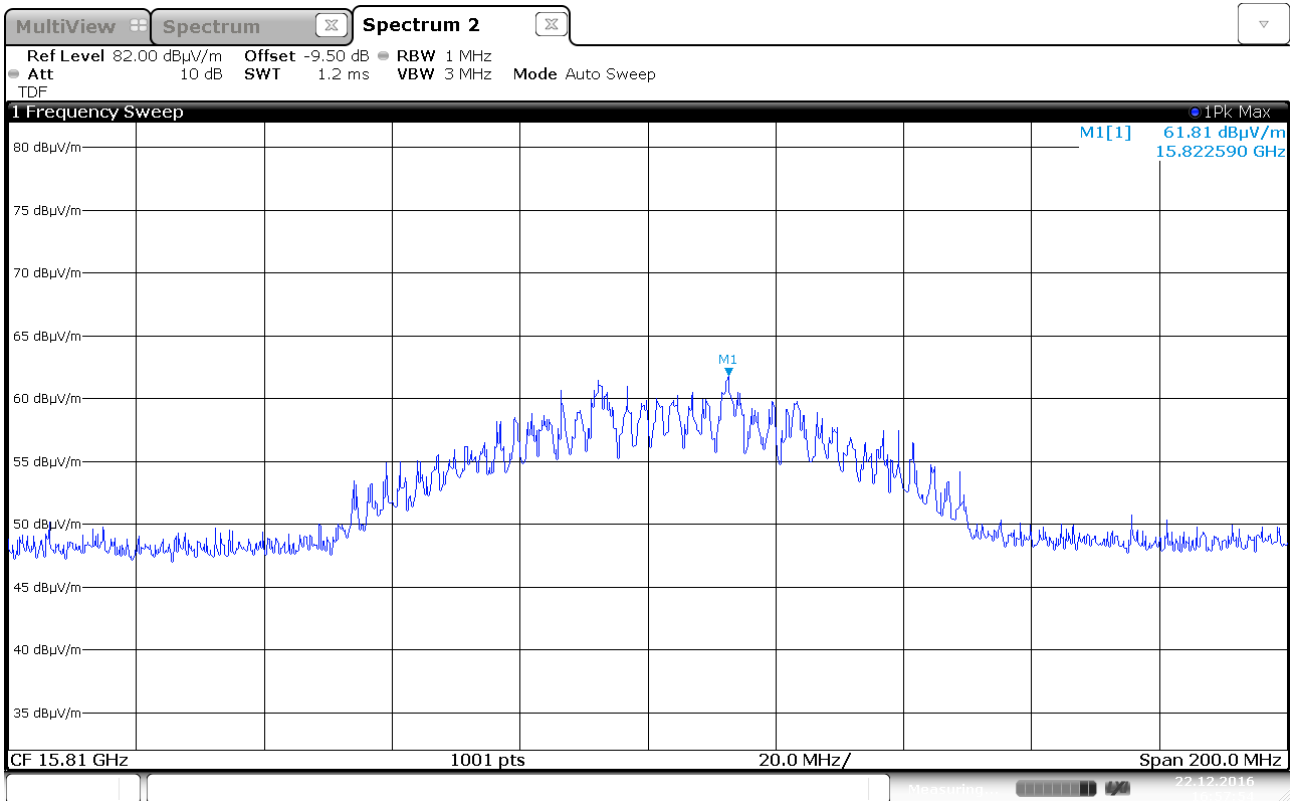
**Radiated Emissions Av, 15.78 GHz, 5260 MHz, 802.11n HT20, MIMO, HP**



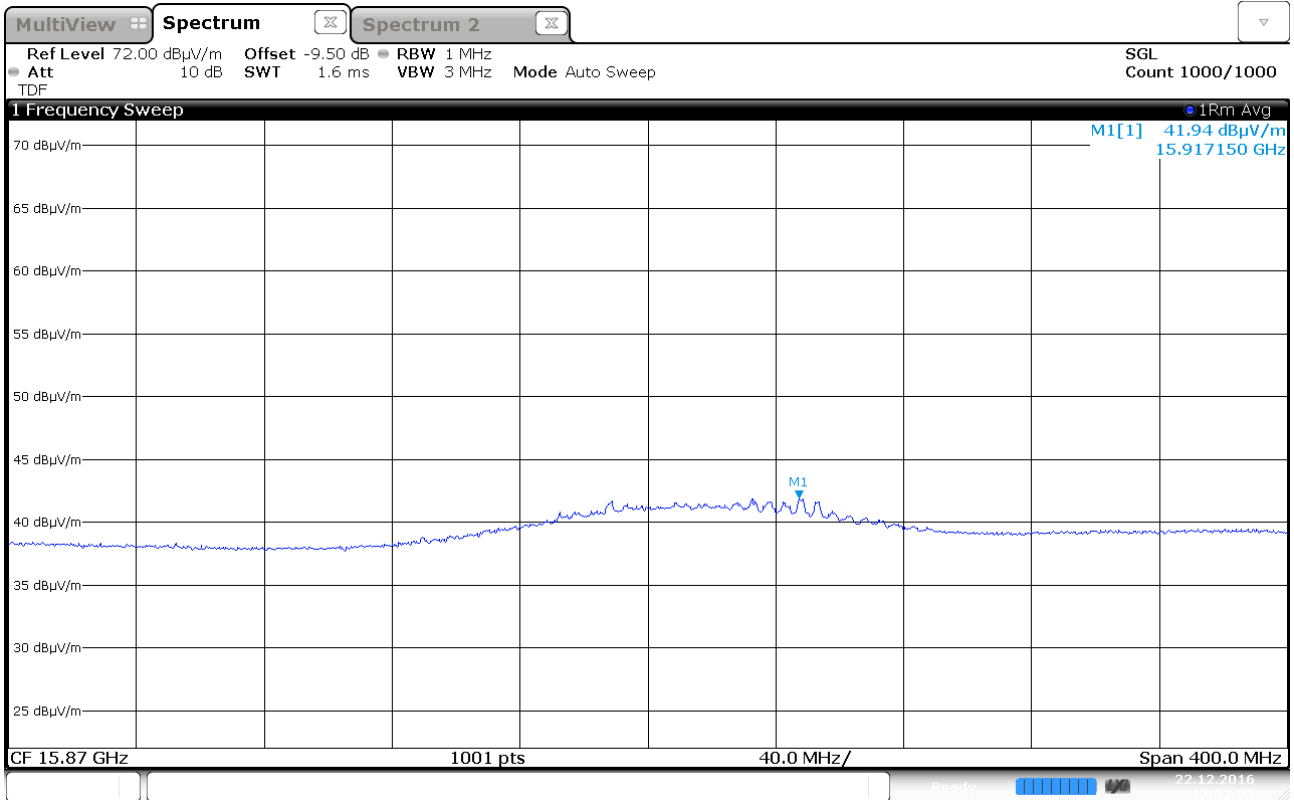
**Radiated Emissions Pk, 15.78 GHz, 5260 MHz, 802.11n HT20, MIMO, HP**



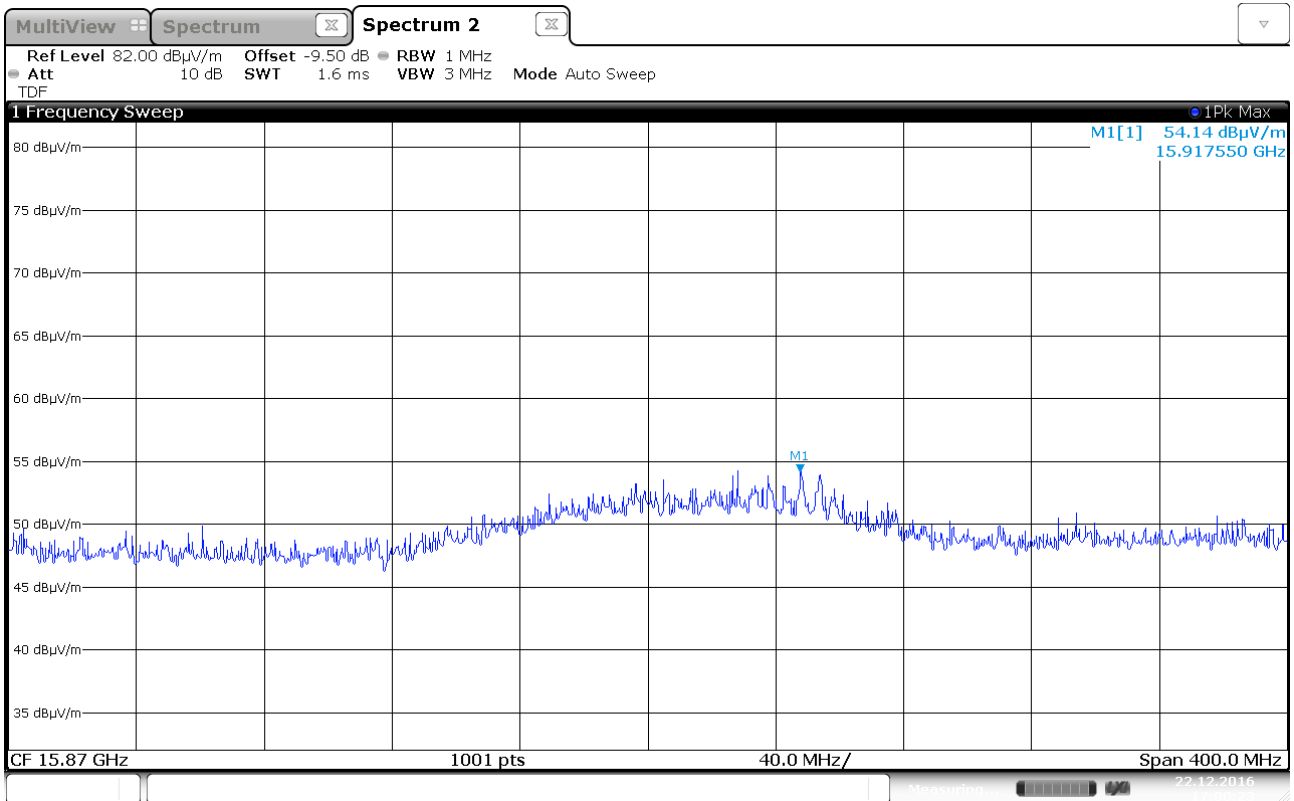
**Radiated Emissions Av, 15.81 GHz, 5270 MHz, 802.11n HT40, MIMO, HP**



**Radiated Emissions Pk, 15.81 GHz, 5270 MHz, 802.11n HT40, MIMO, HP**



**Radiated Emissions Av, 15.87 GHz, 5290 MHz, 802.11n HT80, MIMO, HP**



**Radiated Emissions Pk, 15.87 GHz, 5290 MHz, 802.11n HT80, MIMO, HP**

## 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

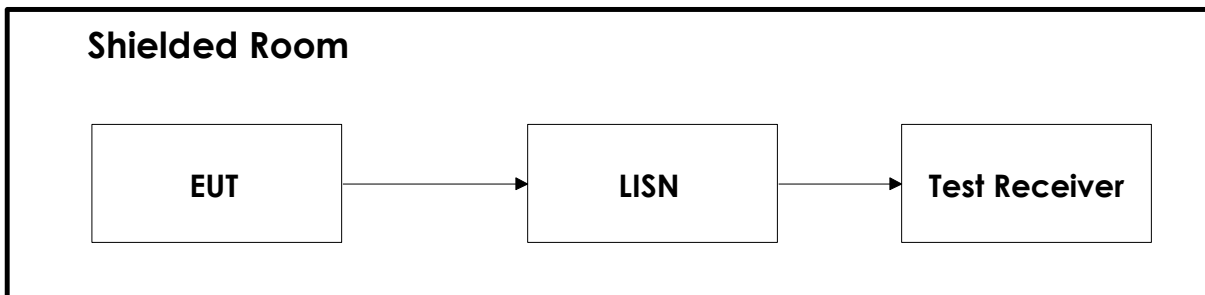
To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment and ancillaries are identified (numbered) by the Test Laboratory.

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	WHKX6.5/18G-8SS	Highpass Filter	Wainwright Instruments	LR 1619	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	JS4-26004000	Pre-amplifier	Miteq	LR 1591	2016.07	2017.07
8	6812B	AC Power Source	Agilent	LR1515	2015.12	2016.12
9	3115	Horn Antenna	EMCO	LR 1330	2016.10	2021.10
10	642	Antenna Horn	Narda	LR 220	2009.01	2019.01
11	PM7320X	Antenna Horn	Sivers Lab	LR 102	2009.01	2019.01
12	DBF-520-20	Antenna Horn	Systron Donner	LR 100	2009.01	2019.01
14	638	Antenna Horn	Narda	LR 1480	2010.06	2020.06
15	637	Antenna Horn	Narda	LR 099	2007.04	2017.04
16	HK116	Biconical Antenna	Rohde & Schwarz	LR 1260	2013.12	2018.12
17	HL223	LogPeriod Antenna	Rohde & Schwarz	LR 1261	2013.12	2018.12

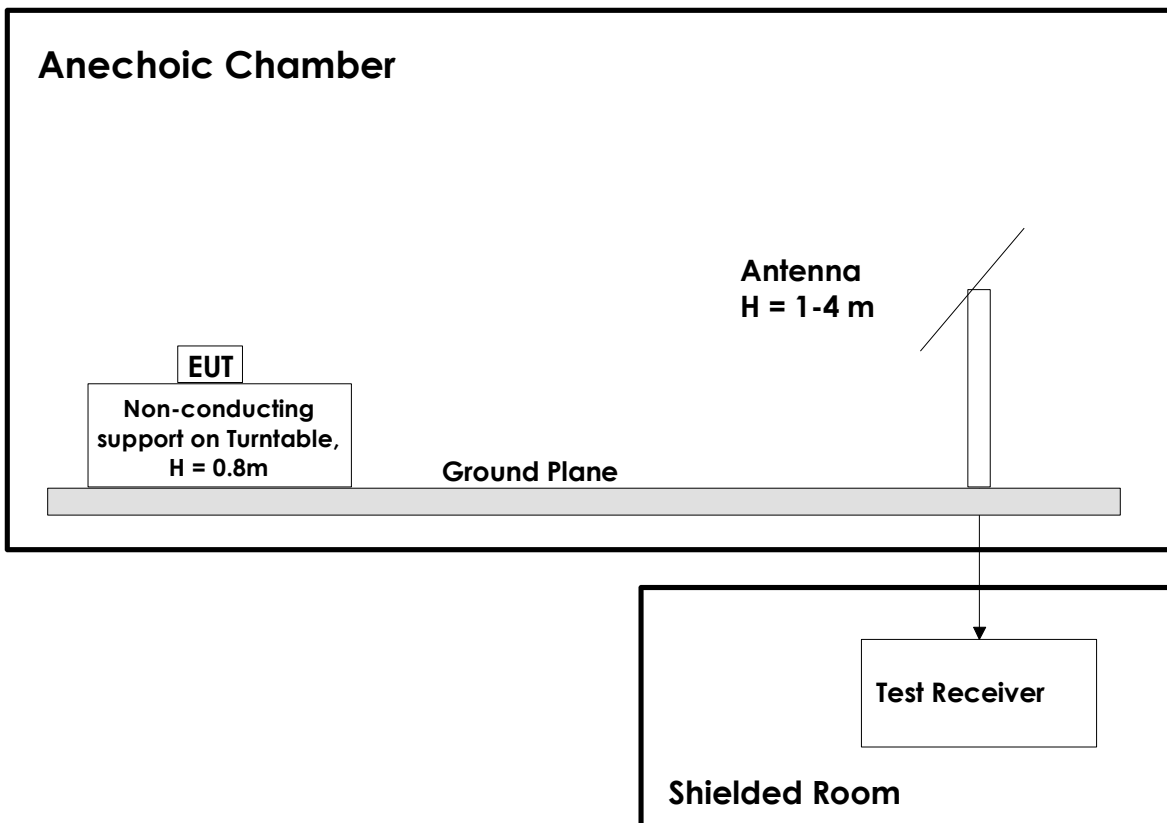
Test Software List			
Description	Manufacturer	Model	Version
EMC Software for Conducted tests	Rohde & Schwarz	EMC32	9.26.00

## 6 BLOCK DIAGRAM

### 6.1 Power Line Conducted Emission



### 6.2 Test Site Radiated Emission



This test set-up was used for the radiated measurements. The EUT support height was 0.8m for frequencies below 1 GHz and 1.5m for frequencies above 1 GHz.

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	2016.12.23	First edition	FS