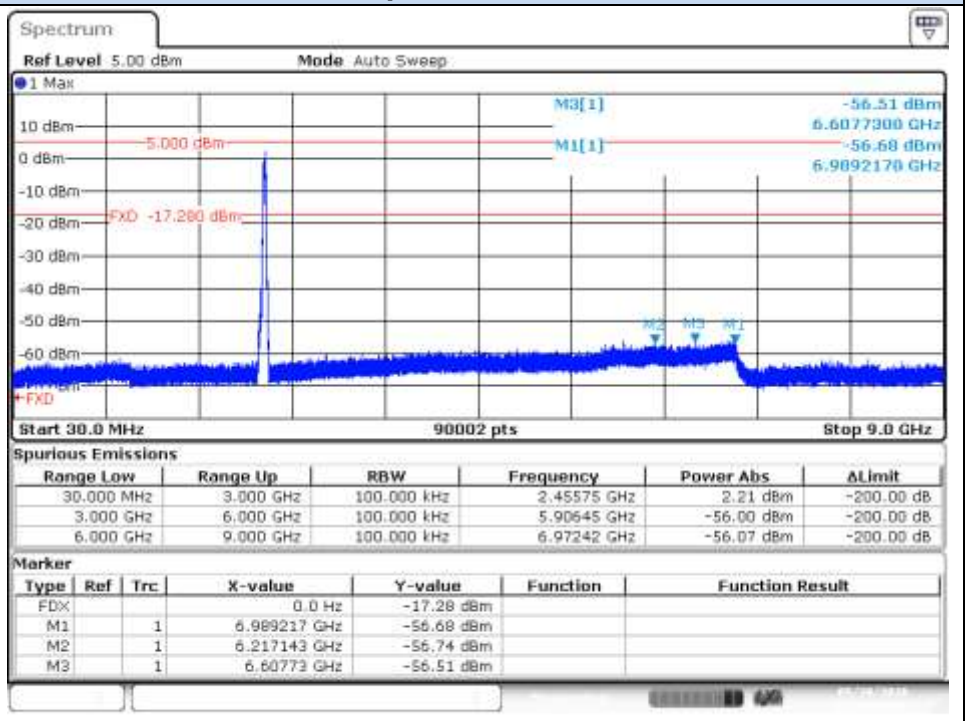
802.11n40 (MIMO), HT8 – Chain B, CH9F

Cond Spur, 30MHz – 9GHz



Spurious Emissions

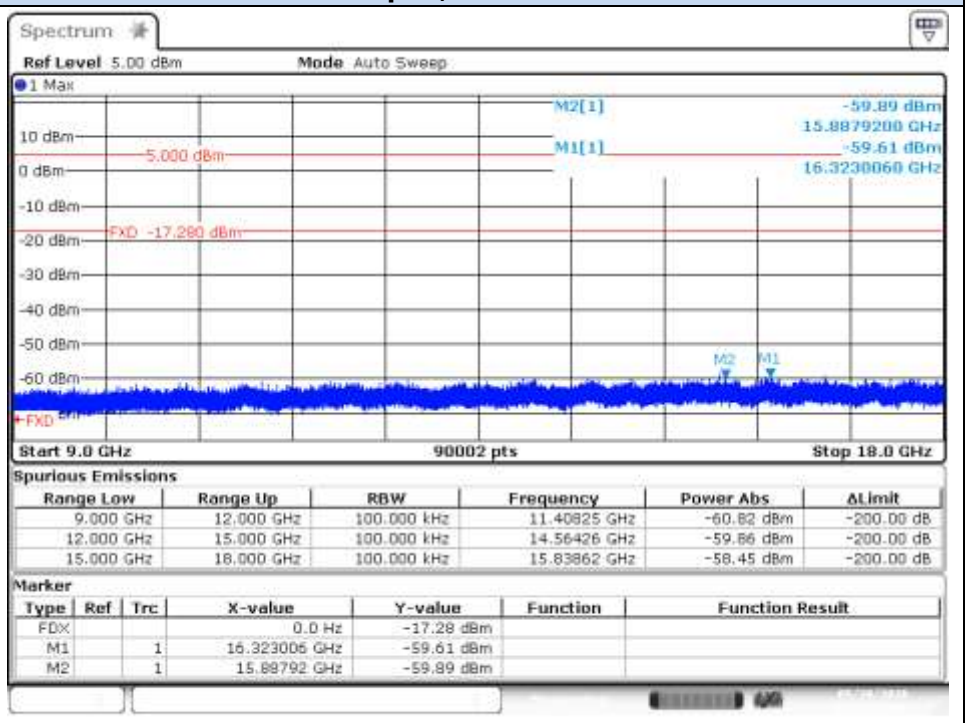
Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
30.000 MHz	3.000 GHz	100.000 kHz	2.45575 GHz	2.21 dBm	-200.00 dB
3.000 GHz	6.000 GHz	100.000 kHz	5.90645 GHz	-56.00 dBm	-200.00 dB
6.000 GHz	9.000 GHz	100.000 kHz	6.97242 GHz	-56.07 dBm	-200.00 dB

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
FDX			0.0 Hz	-17.28 dBm		
M1		1	6.989217 GHz	-56.68 dBm		
M2		1	6.217143 GHz	-56.74 dBm		
M3		1	6.60773 GHz	-56.51 dBm		

Date: 20.MAY.2016 11:56:39

Cond Spur, 9GHz – 18GHz



Spurious Emissions

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
9.000 GHz	12.000 GHz	100.000 kHz	11.40825 GHz	-60.82 dBm	-200.00 dB
12.000 GHz	15.000 GHz	100.000 kHz	14.56426 GHz	-59.86 dBm	-200.00 dB
15.000 GHz	18.000 GHz	100.000 kHz	15.83862 GHz	-58.45 dBm	-200.00 dB

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
FDX			0.0 Hz	-17.28 dBm		
M1		1	16.323006 GHz	-59.61 dBm		
M2		1	15.88792 GHz	-59.89 dBm		

Date: 20.MAY.2016 11:57:15

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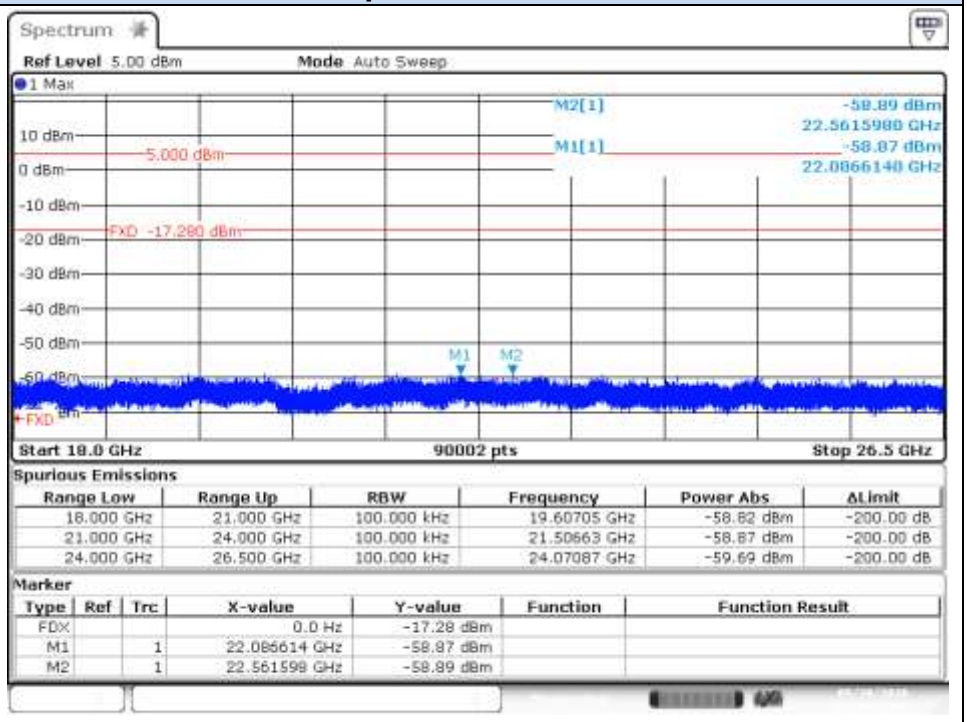
Cond Spur, 18GHz – 26.5GHz



Spurious Emissions

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
18.000 GHz	21.000 GHz	100.000 kHz	19.60705 GHz	-58.82 dBm	-200.00 dB
21.000 GHz	24.000 GHz	100.000 kHz	21.50663 GHz	-58.87 dBm	-200.00 dB
24.000 GHz	26.500 GHz	100.000 kHz	24.07087 GHz	-59.69 dBm	-200.00 dB

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
FDX			0.0 Hz	-17.28 dBm		
M1		1	22.086614 GHz	-58.87 dBm		
M2		1	22.561599 GHz	-58.89 dBm		

Date: 20.MAY.2016 11:58:18

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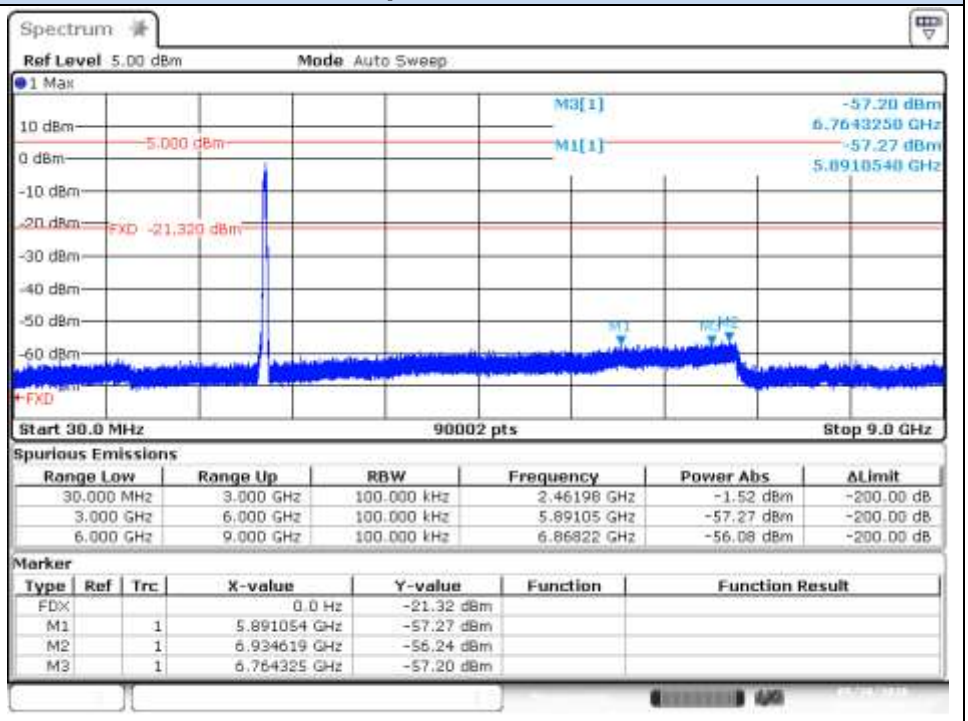
802.11n40 (MIMO), HT8 – Chain B, CH10F

Cond Spur, 30MHz – 9GHz



Spurious Emissions

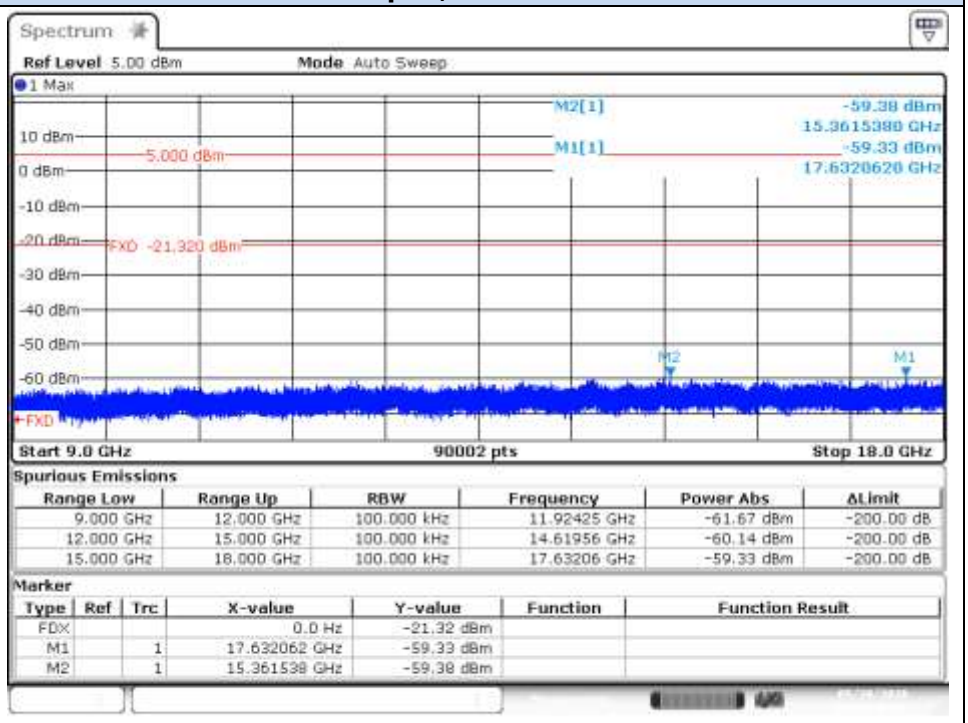
Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
30.000 MHz	3.000 GHz	100.000 kHz	2.46198 GHz	-1.52 dBm	-200.00 dB
3.000 GHz	6.000 GHz	100.000 kHz	5.89105 GHz	-57.27 dBm	-200.00 dB
6.000 GHz	9.000 GHz	100.000 kHz	6.86822 GHz	-56.08 dBm	-200.00 dB

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
FDX			0.0 Hz	-21.32 dBm		
M1		1	5.891054 GHz	-57.27 dBm		
M2		1	6.934619 GHz	-56.24 dBm		
M3		1	6.764325 GHz	-57.20 dBm		

Date: 20.MAY.2016 12:08:22

Cond Spur, 9GHz – 18GHz



Spurious Emissions

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
9.000 GHz	12.000 GHz	100.000 kHz	11.92425 GHz	-61.67 dBm	-200.00 dB
12.000 GHz	15.000 GHz	100.000 kHz	14.61956 GHz	-60.14 dBm	-200.00 dB
15.000 GHz	18.000 GHz	100.000 kHz	17.63206 GHz	-59.33 dBm	-200.00 dB

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
FDX			0.0 Hz	-21.32 dBm		
M1		1	17.632062 GHz	-59.33 dBm		
M2		1	15.361538 GHz	-59.38 dBm		

Date: 20.MAY.2016 12:08:45

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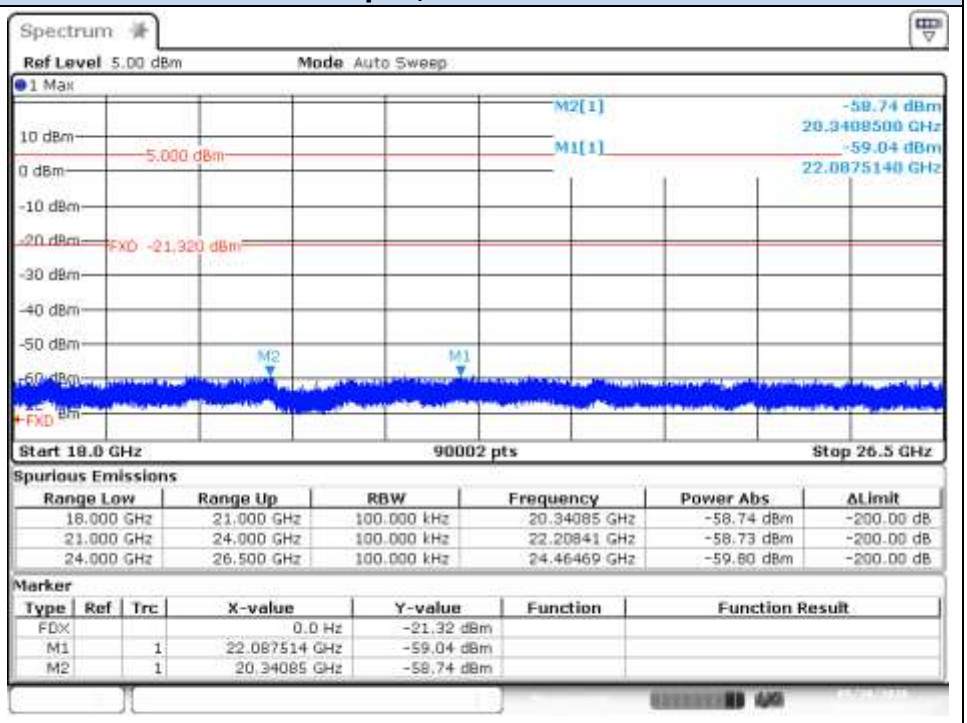
Cond Spur, 18GHz – 26.5GHz



Spurious Emissions

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
18.000 GHz	21.000 GHz	100.000 kHz	20.34085 GHz	-58.74 dBm	-200.00 dB
21.000 GHz	24.000 GHz	100.000 kHz	22.20841 GHz	-58.73 dBm	-200.00 dB
24.000 GHz	26.500 GHz	100.000 kHz	24.46469 GHz	-59.80 dBm	-200.00 dB

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
FDX			0.0 Hz	-21.32 dBm		
M1		1	22.087514 GHz	-59.04 dBm		
M2		1	20.34085 GHz	-58.74 dBm		

Date: 20.MAY.2016 12:07:14

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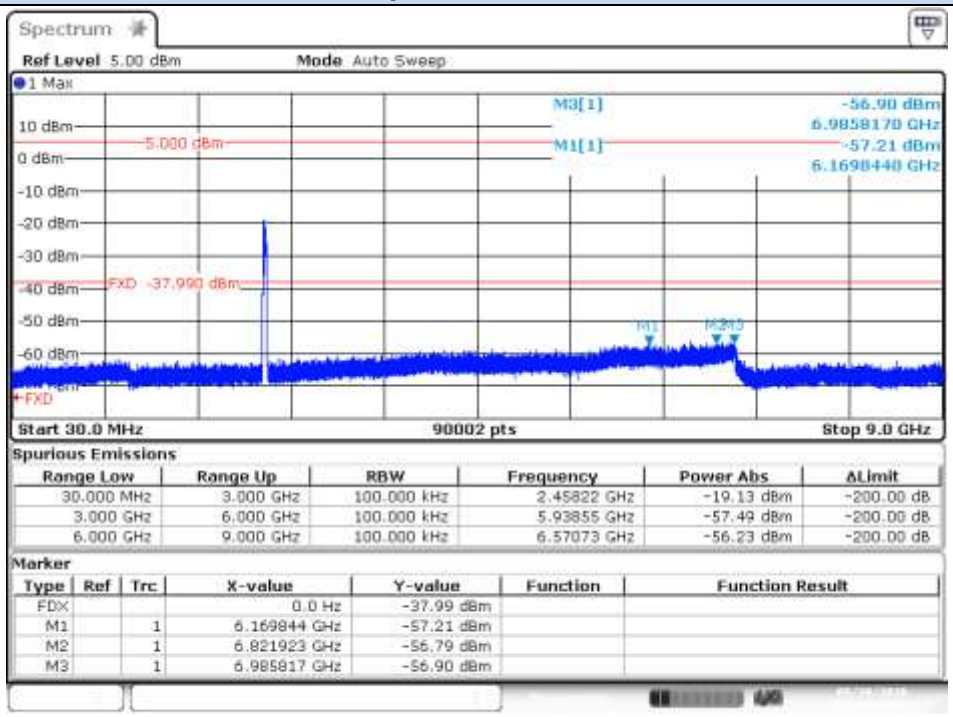
802.11n40 (MIMO), HT8 – Chain B, CH11F

Cond Spur, 30MHz – 9GHz



Spurious Emissions

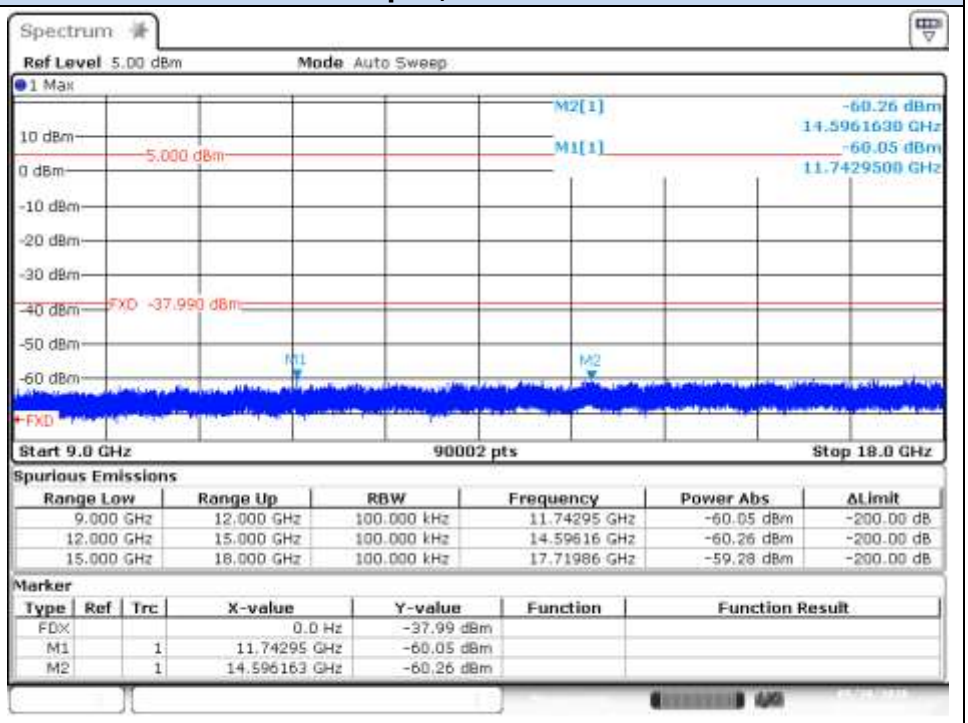
Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
30.000 MHz	3.000 GHz	100.000 kHz	2.45822 GHz	-19.13 dBm	-200.00 dB
3.000 GHz	6.000 GHz	100.000 kHz	5.93855 GHz	-57.49 dBm	-200.00 dB
6.000 GHz	9.000 GHz	100.000 kHz	6.57073 GHz	-56.23 dBm	-200.00 dB

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
FDX			0.0 Hz	-37.99 dBm		
M1		1	6.169844 GHz	-57.21 dBm		
M2		1	6.821923 GHz	-56.79 dBm		
M3		1	6.985817 GHz	-56.90 dBm		

Date: 20.MAY.2016 12:14:43

Cond Spur, 9GHz – 18GHz



Spurious Emissions

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
9.000 GHz	12.000 GHz	100.000 kHz	11.74295 GHz	-60.05 dBm	-200.00 dB
12.000 GHz	15.000 GHz	100.000 kHz	14.59616 GHz	-60.26 dBm	-200.00 dB
15.000 GHz	18.000 GHz	100.000 kHz	17.71986 GHz	-59.28 dBm	-200.00 dB

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
FDX			0.0 Hz	-37.99 dBm		
M1		1	11.74295 GHz	-60.05 dBm		
M2		1	14.596163 GHz	-60.26 dBm		

Date: 20.MAY.2016 12:15:10

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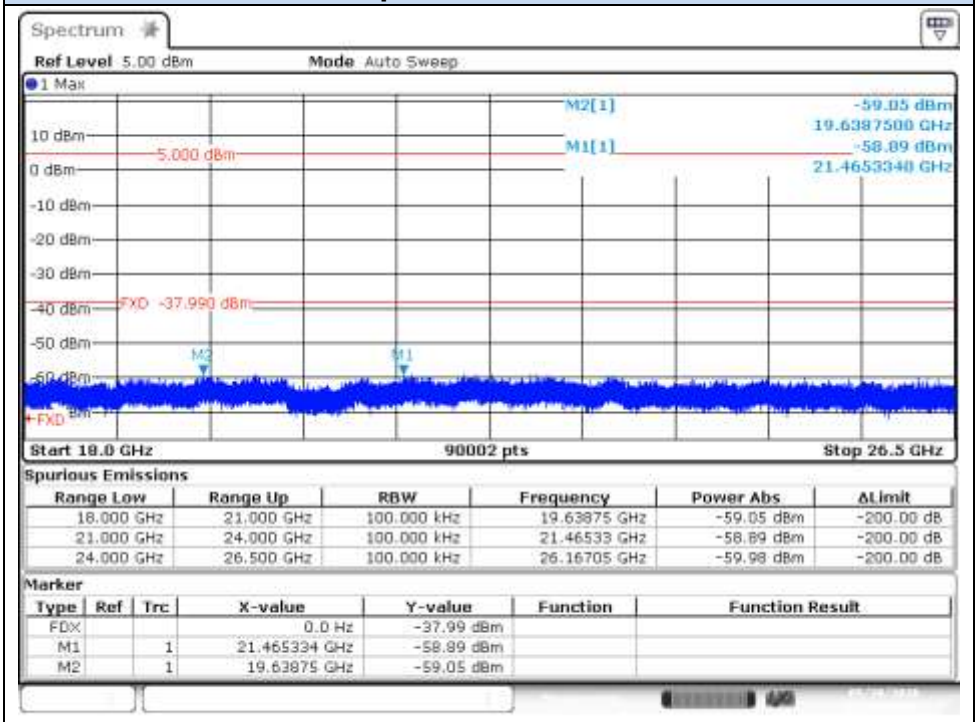
Cond Spur, 18GHz – 26.5GHz



Spurious Emissions

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
18.000 GHz	21.000 GHz	100.000 kHz	19.63875 GHz	-59.05 dBm	-200.00 dB
21.000 GHz	24.000 GHz	100.000 kHz	21.46533 GHz	-58.89 dBm	-200.00 dB
24.000 GHz	26.500 GHz	100.000 kHz	26.16705 GHz	-59.98 dBm	-200.00 dB

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
FDX			0.0 Hz	-37.99 dBm		
M1		1	21.465334 GHz	-58.89 dBm		
M2		1	19.63875 GHz	-59.05 dBm		

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B.4 Power Spectral Density

Test limits:

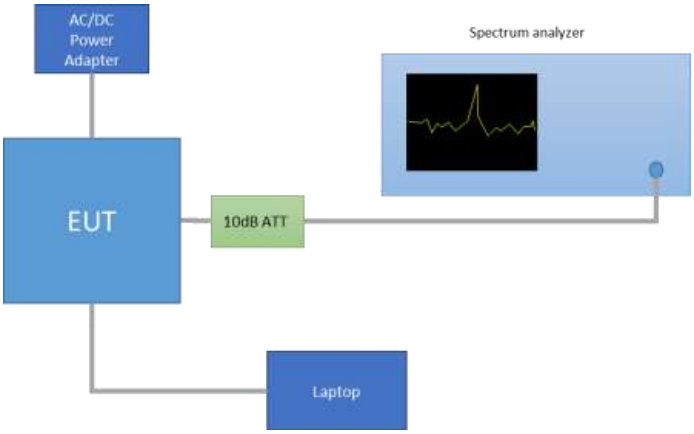
FCC part	RSS part	Limits
15.247 (e)	RSS-247 Clause 5.2 (2)	For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

Test procedure:

The peak power spectral density level in the fundamental emission was measured using the *Method PKPSD (peak PSD)* according to point 10.2 of KDB 558074 D01 DTS Meas Guidance. This method was used for 802.11b, 802.11g, 802.11n20 an 802.11n40 modes.

For MIMO mode, the *Measure and add 10 log(N_{ANT}) dB*, (where N_{ANT} is the number of outputs) technique was used according to the Guidance for Emission Testing of Transmitters with Multiple Outputs in the Same Band 662911 D01 Multiple Transmitter Output v02r01.
With this technique, spectrum measurements are performed at each output of the device, and the quantity 10 log(N_{ANT}) dB is added to each spectrum value before comparing to the emission limit. Number of outputs = 2.

The setup below was used to measure the power spectral density. The antenna terminal of the EUT is connected to the spectrum through an attenuator, and the spectrum analyzer reading is compensated to include the RF path loss.



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Results tables:

Mode	Rate	Channel	Frequency [MHz]	Antenna	PSD Peak [dBm]
802.11b	1Mbps	1	2412	SISO CHAIN A	-4.08
				SISO CHAIN B	-4.00
		7	2442	SISO CHAIN A	-4.38
				SISO CHAIN B	-4.39
		11	2462	SISO CHAIN A	-4.23
				SISO CHAIN B	-6.05
		12	2467	SISO CHAIN A	-7.99
				SISO CHAIN B	-8.29
		13	2472	SISO CHAIN A	-16.09
				SISO CHAIN B	-16.06
802.11g	6Mbps	1	2412	SISO CHAIN A	-5.35
				SISO CHAIN B	-5.35
		7	2442	SISO CHAIN A	-3.12
				SISO CHAIN B	-3.51
		11	2462	SISO CHAIN A	-5.65
				SISO CHAIN B	-7.22
		12	2467	SISO CHAIN A	-12.12
				SISO CHAIN B	-13.54
		13	2472	SISO CHAIN A	-28.42
				SISO CHAIN B	-26.88
802.11n20	HT0	1	2412	SISO CHAIN A	-4.78
				SISO CHAIN B	-5.24
		7	2442	SISO CHAIN A	-3.05
				SISO CHAIN B	-3.40
		11	2462	SISO CHAIN A	-5.50
				SISO CHAIN B	-6.91
		12	2467	SISO CHAIN A	-12.15
				SISO CHAIN B	-12.54
		13	2472	SISO CHAIN A	-26.65
				SISO CHAIN B	-26.76
802.11n40	HT0	3F	2422	SISO CHAIN A	-2.19
				SISO CHAIN B	-4.43
		7F	2442	SISO CHAIN A	-4.23
				SISO CHAIN B	-4.37
		9F	2452	SISO CHAIN A	-4.70
				SISO CHAIN B	-5.55
		10F	2457	SISO CHAIN A	-8.57
				SISO CHAIN B	-8.54
		11F	2462	SISO CHAIN A	-23.98
				SISO CHAIN B	-24.21

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MIMO modes					PSD Peak [dBm]	
Mode	**Rate**	**CH**	**Freq. [MHz]**	**Antenna**	**Measured Conducted**	**MIMO Compensated +10·log(N_{ant})**
802.11n20	HT8	1	2412	CHAIN A	-5.99	-2.99
				CHAIN B	-6.39	-3.39
		7	2442	CHAIN A	-4.87	-1.66
				CHAIN B	-5.55	-2.55
		11	2462	CHAIN A	-7.59	-4.59
				CHAIN B	-7.83	-4.83
		12	2467	CHAIN A	-12.92	-9.92
				CHAIN B	-13.99	-10.99
		13	2472	CHAIN A	-30.55	-27.55
				CHAIN B	-30.09	-27.09
802.11n40	HT8	3F	2422	CHAIN A	-5.50	-2.50
				CHAIN B	-4.64	-1.64
		7F	2442	CHAIN A	-5.25	-2.25
				CHAIN B	-4.96	-1.96
		9F	2452	CHAIN A	-6.51	-3.51
				CHAIN B	-5.19	-2.19
		10F	2457	CHAIN A	-9.50	-6.50
				CHAIN B	-9.61	-6.61
		11F	2462	CHAIN A	-25.18	-22.18
				CHAIN B	-26.50	-23.50

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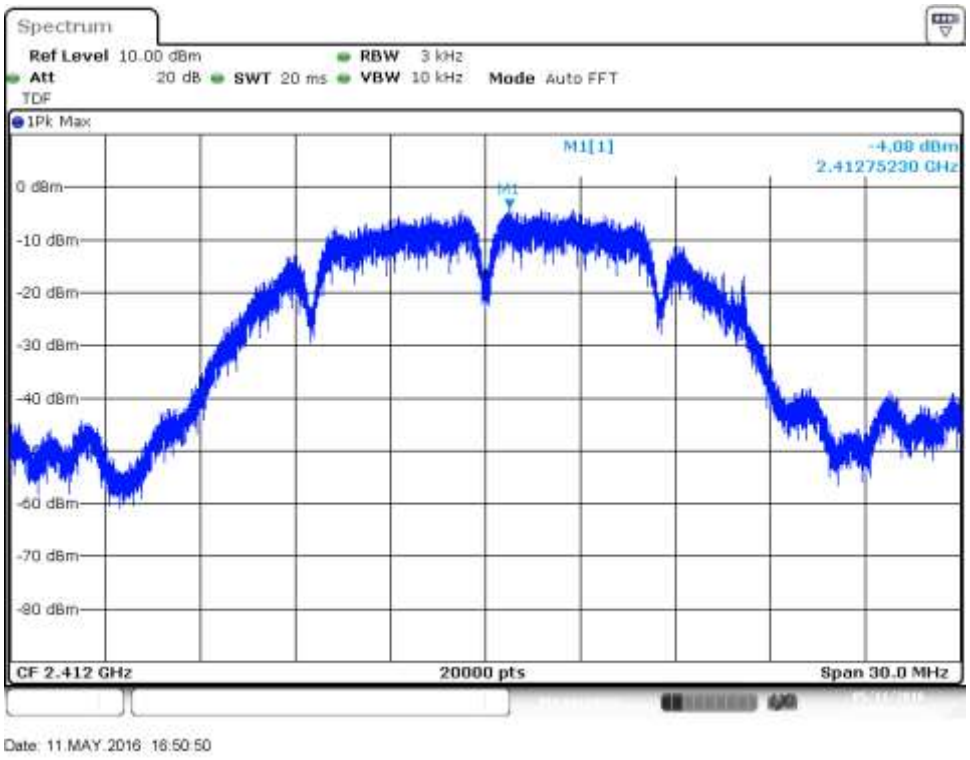
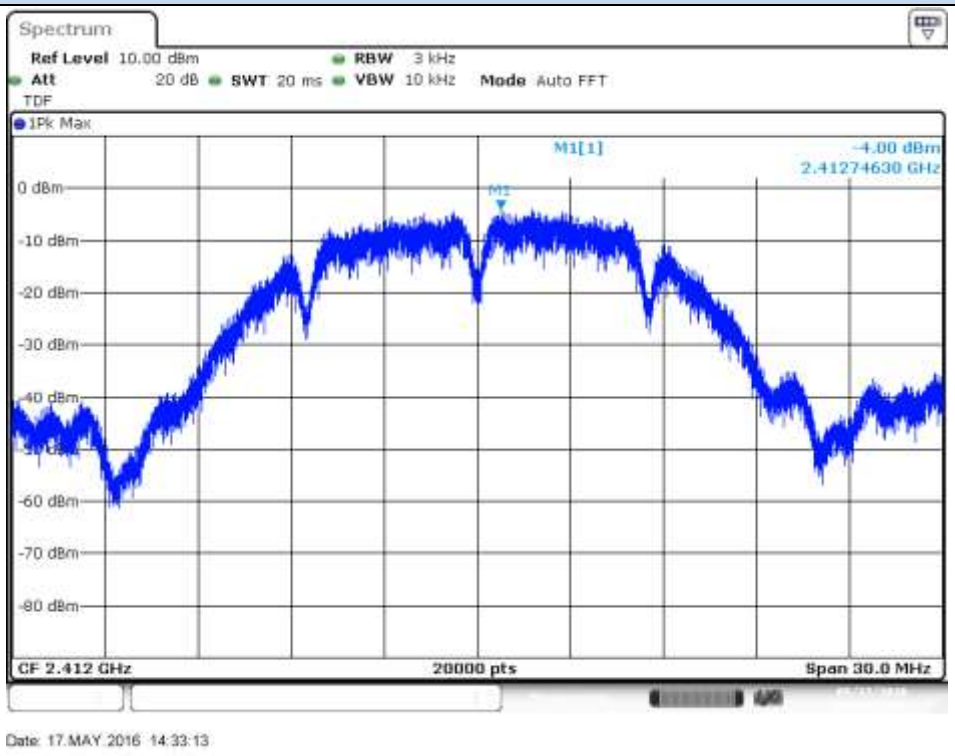
Results screenshot:

802.11b, 1Mbps

PSD Peak, Chain A – CH1



PSD Peak, Chain B – CH1



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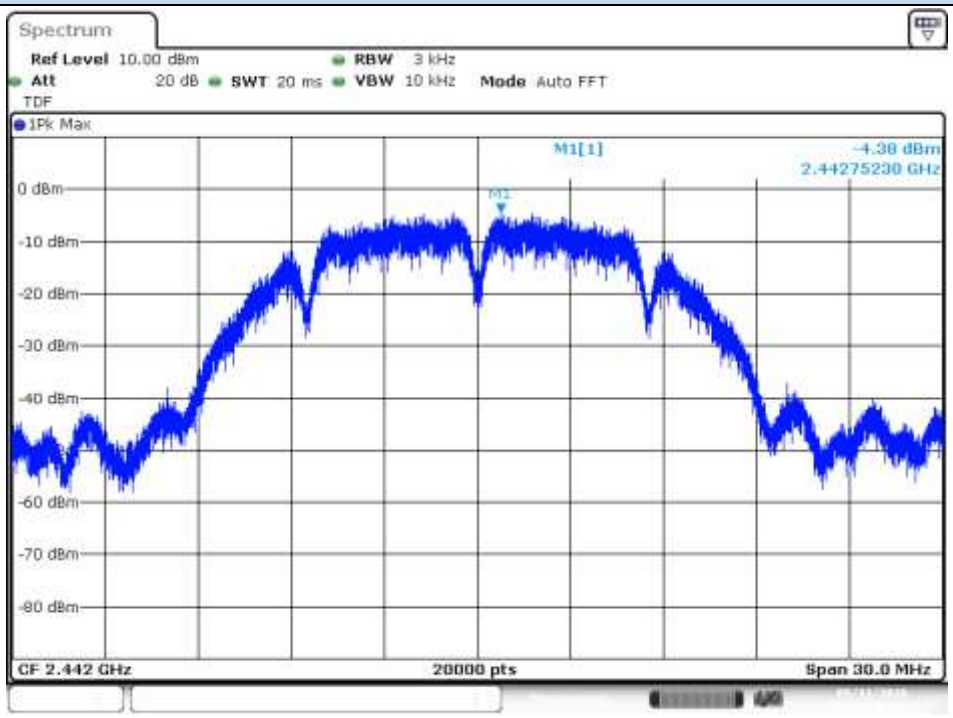
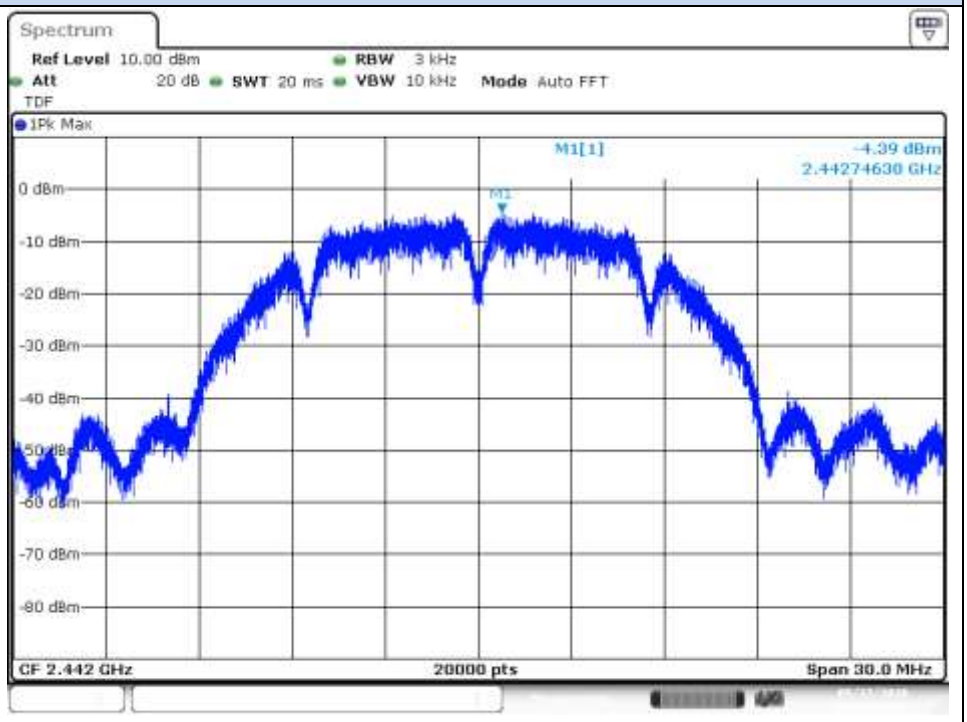
PSD Peak, Chain A – CH7



Date: 11.MAY.2016 18:01:40

PSD Peak, Chain B – CH7



Date: 17.MAY.2016 14:42:33

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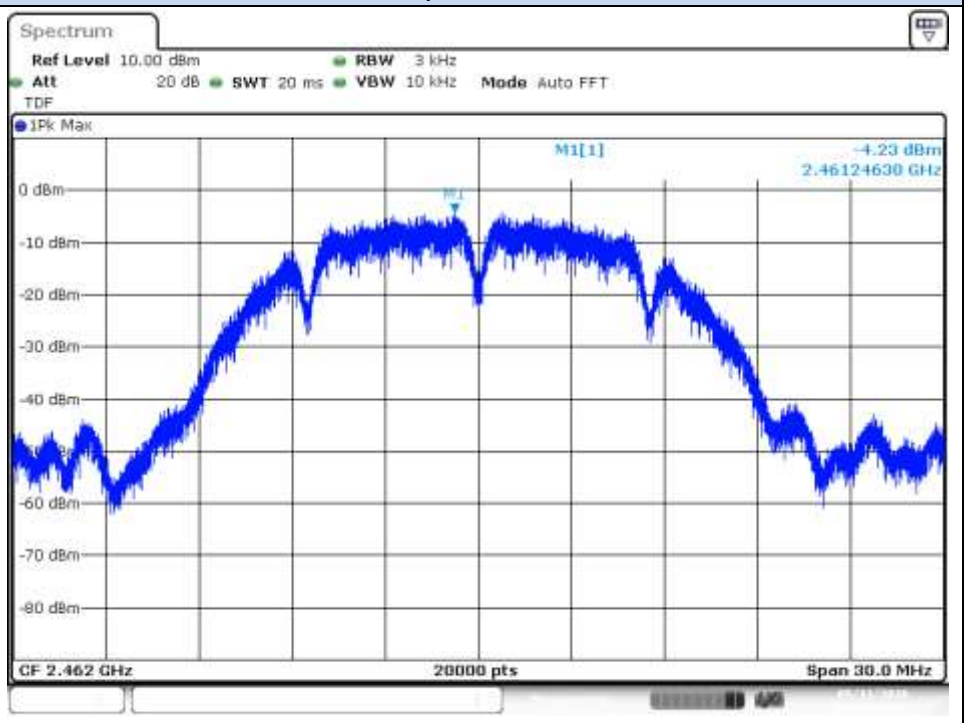
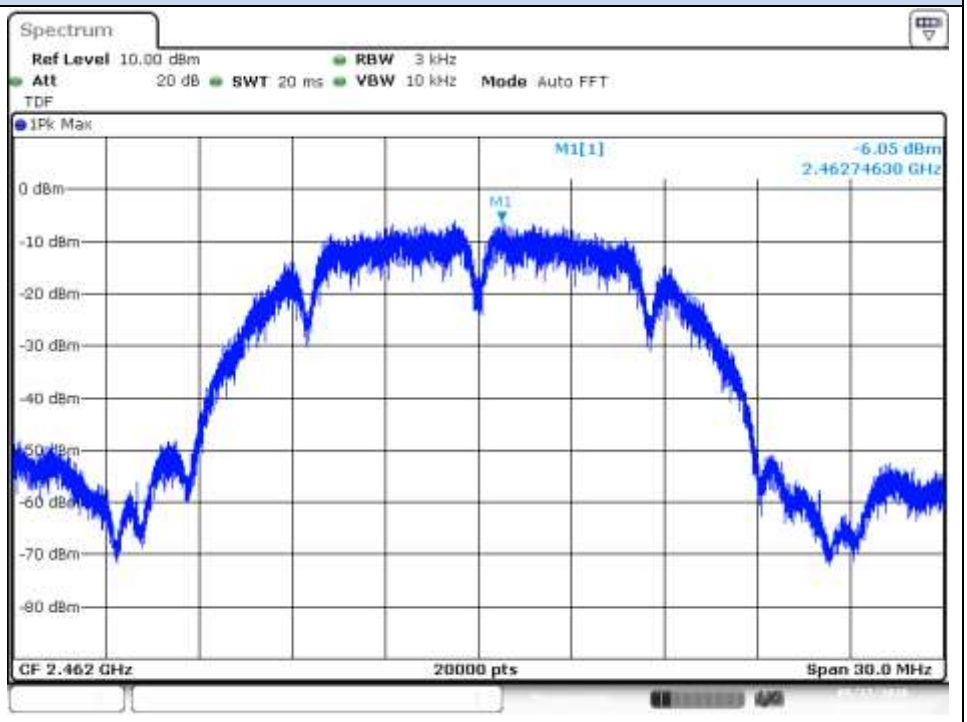
PSD Peak, Chain A - CH11



Date: 11.MAY.2016 18:23:00

PSD Peak, Chain B - CH11



Date: 17.MAY.2016 15:15:41

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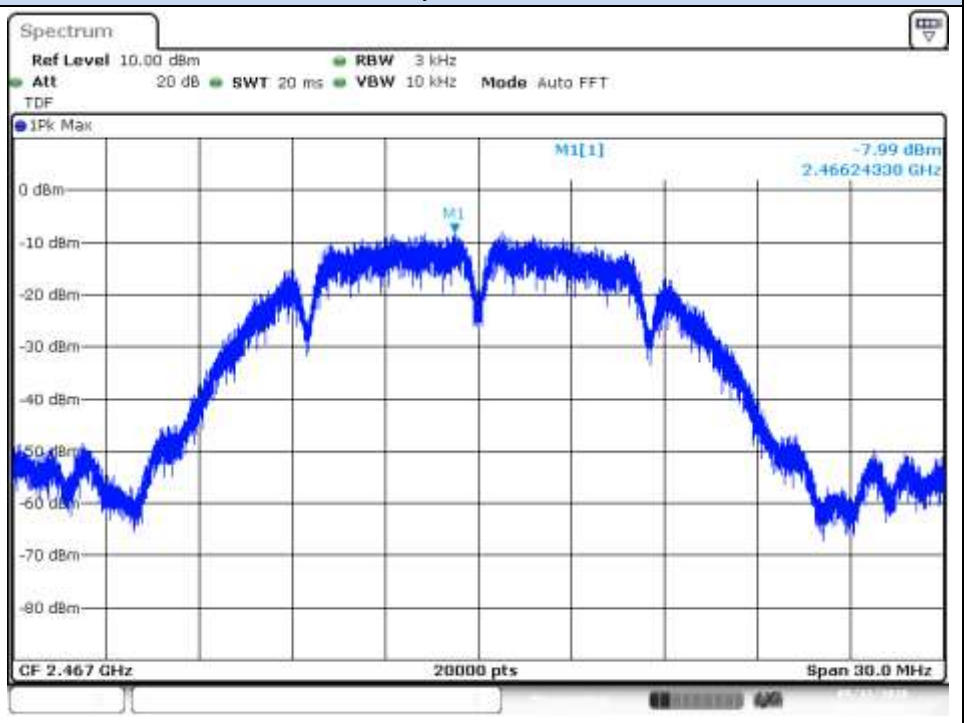
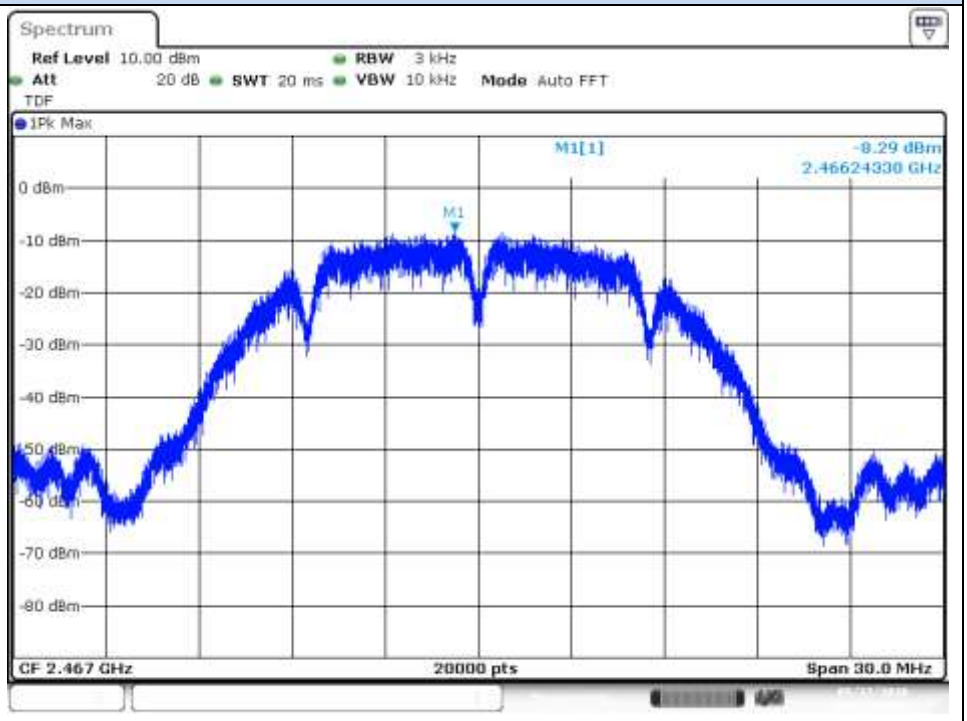
PSD Peak, Chain A – CH12



Date: 12.MAY.2016 09:57:44

PSD Peak, Chain B – CH12



Date: 17.MAY.2016 15:27:33

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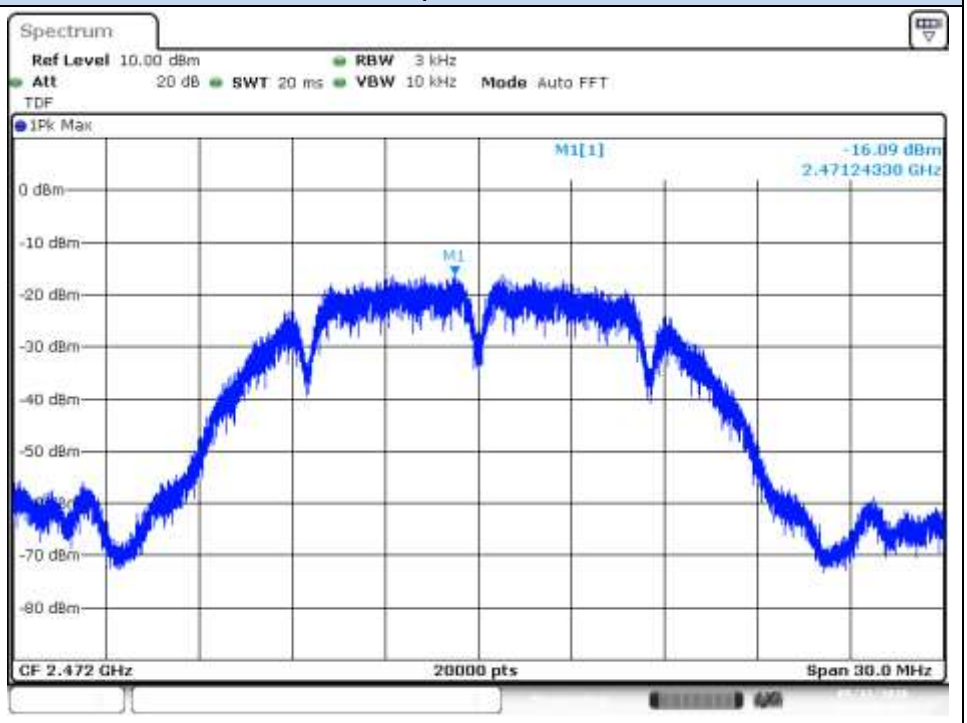
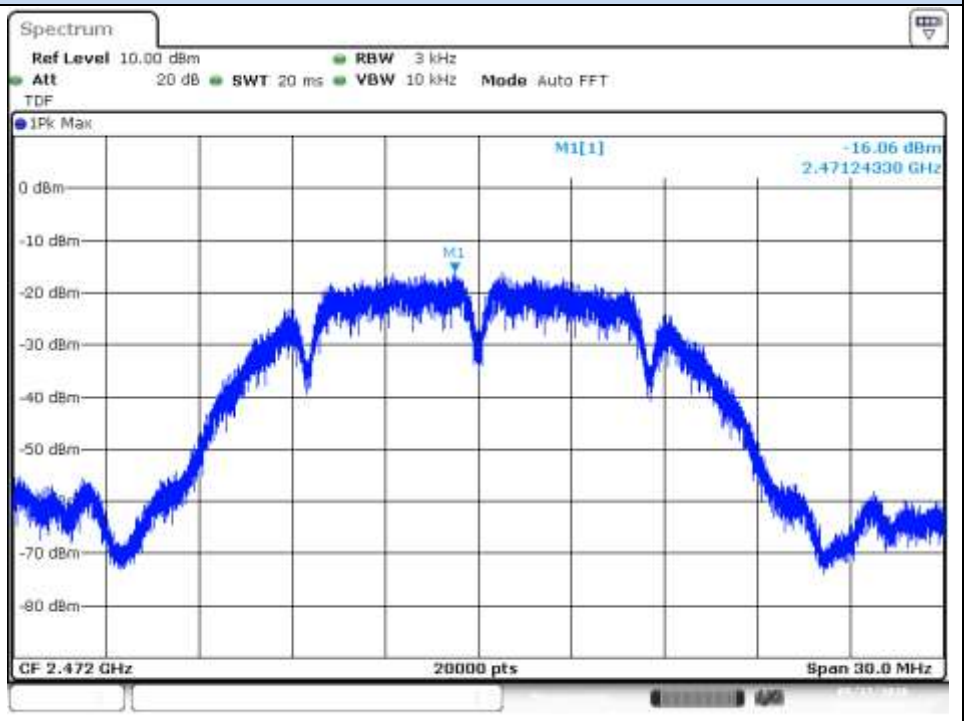
PSD Peak, Chain A – CH13



Date: 12.MAY.2016 10:37:03

PSD Peak, Chain B – CH13



Date: 17.MAY.2016 15:41:42

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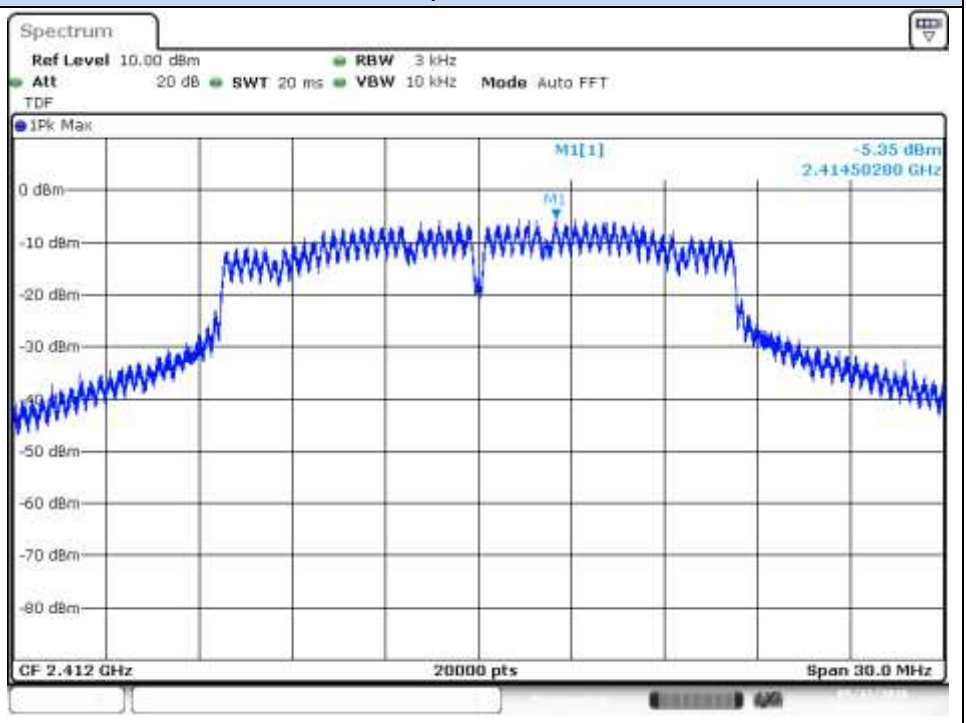
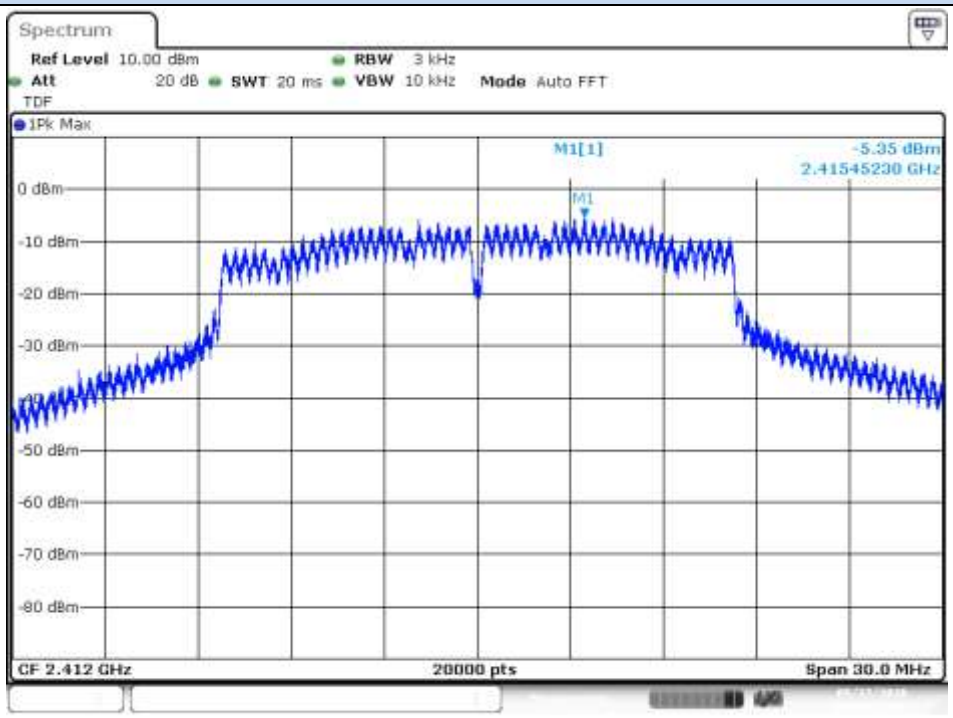
802.11g, 6Mbps

PSD Peak, Chain A – CH1



Date: 12.MAY.2016 10:54:11

PSD Peak, Chain B – CH1



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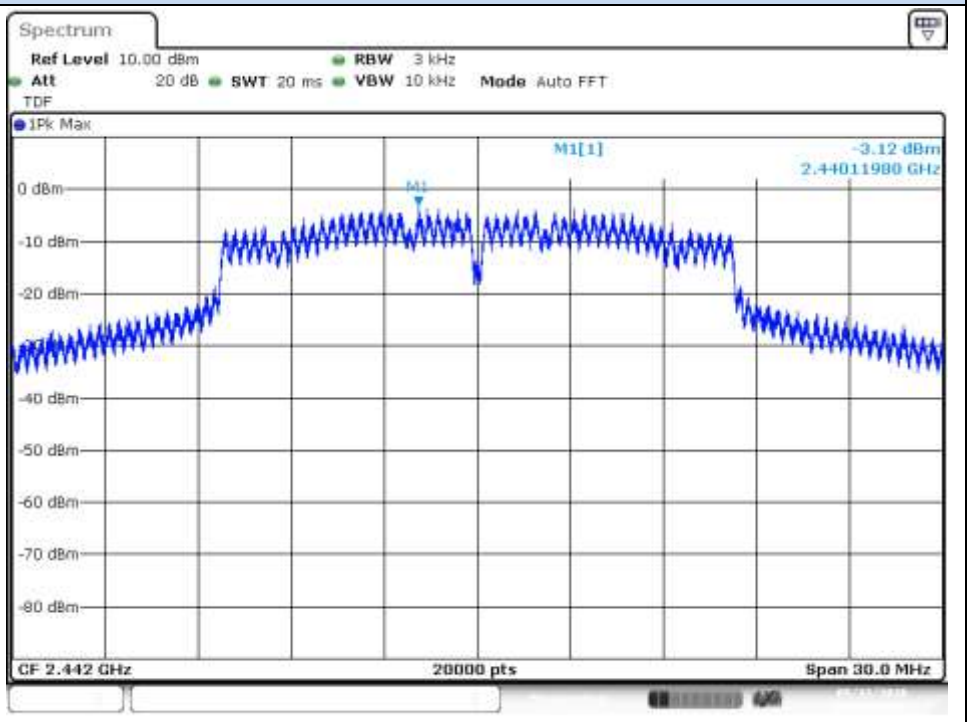
PSD Peak, Chain A – CH7



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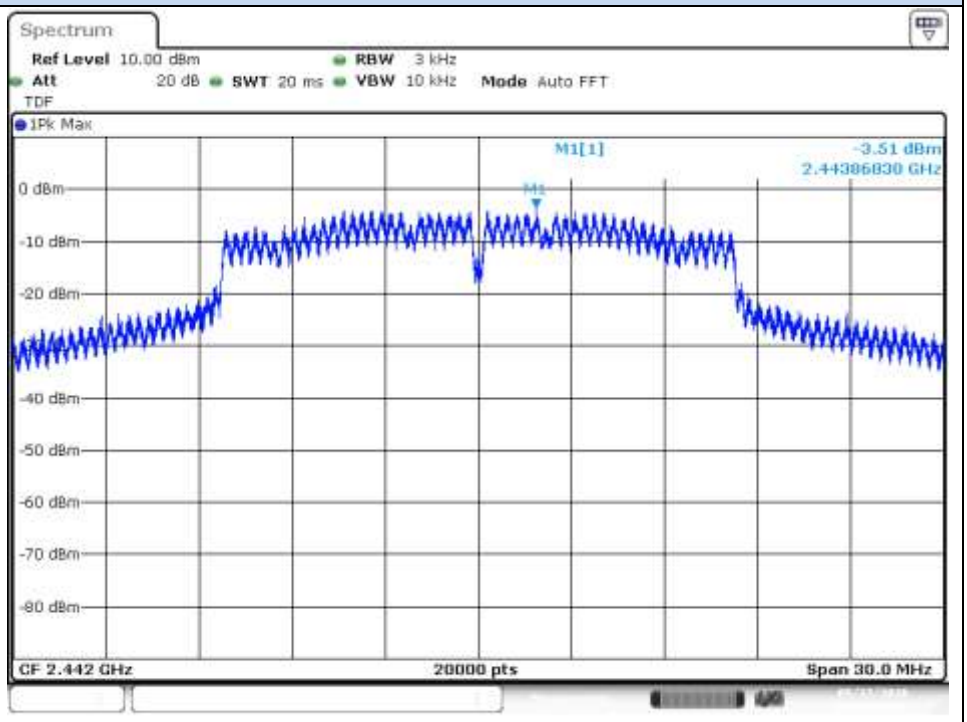
PSD Peak, Chain B – CH7



Date: 17.MAY.2016 16:02:30

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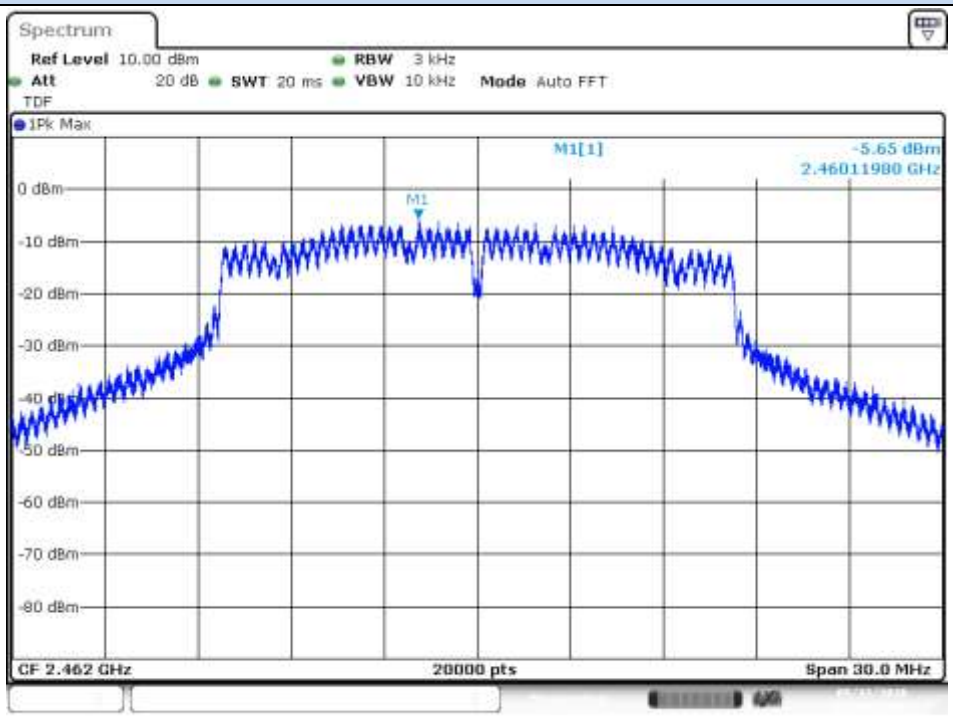
PSD Peak, Chain A - CH11



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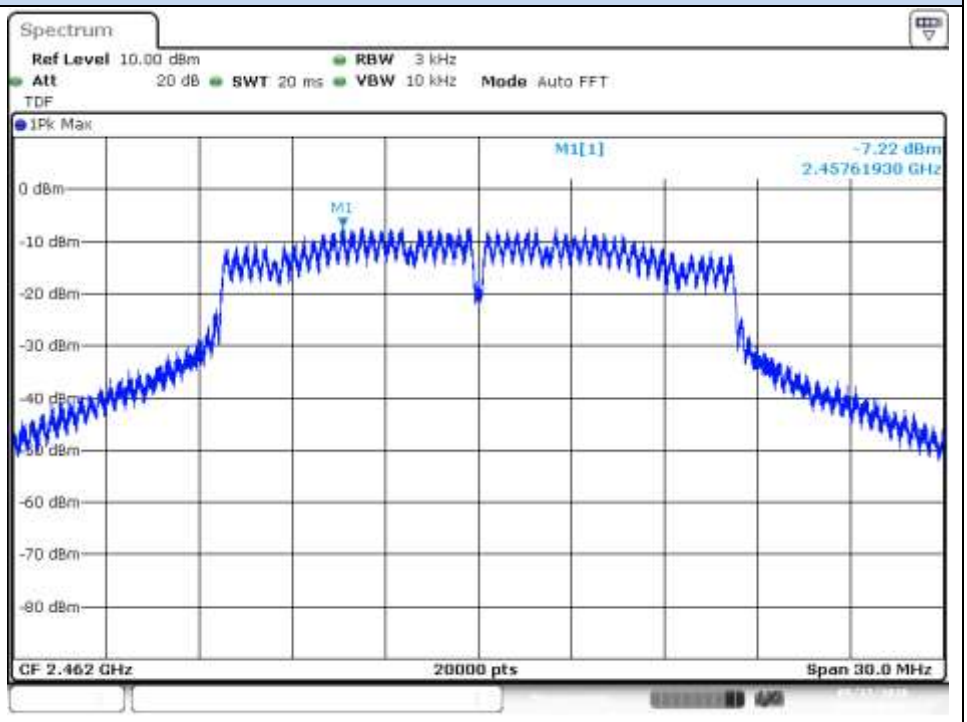
PSD Peak, Chain B - CH11



Date: 17.MAY.2016 16:13:47

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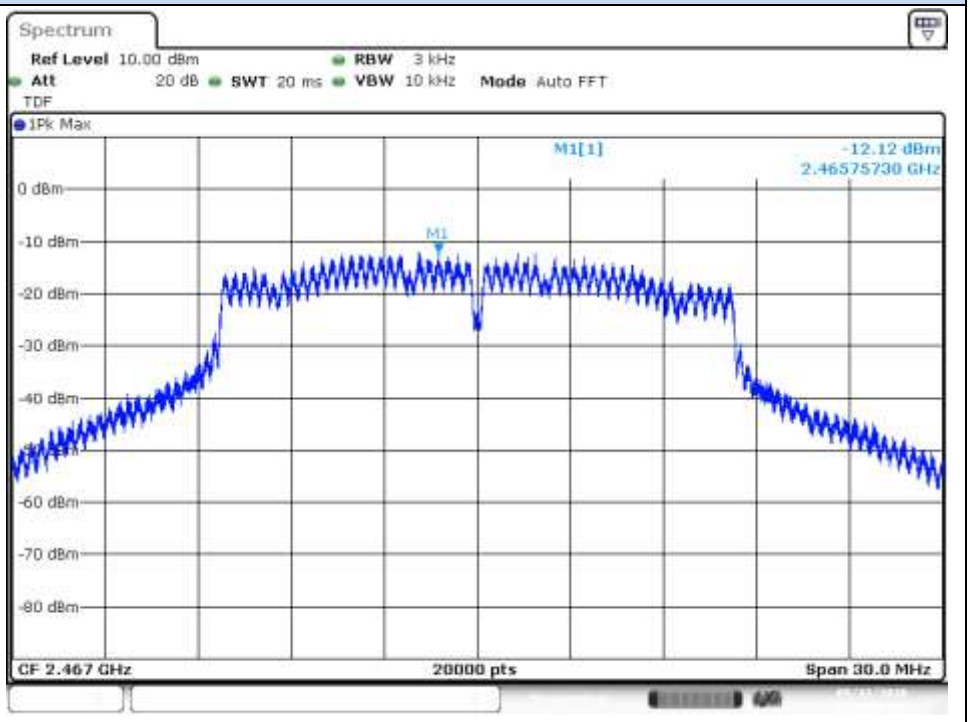
PSD Peak, Chain A – CH12



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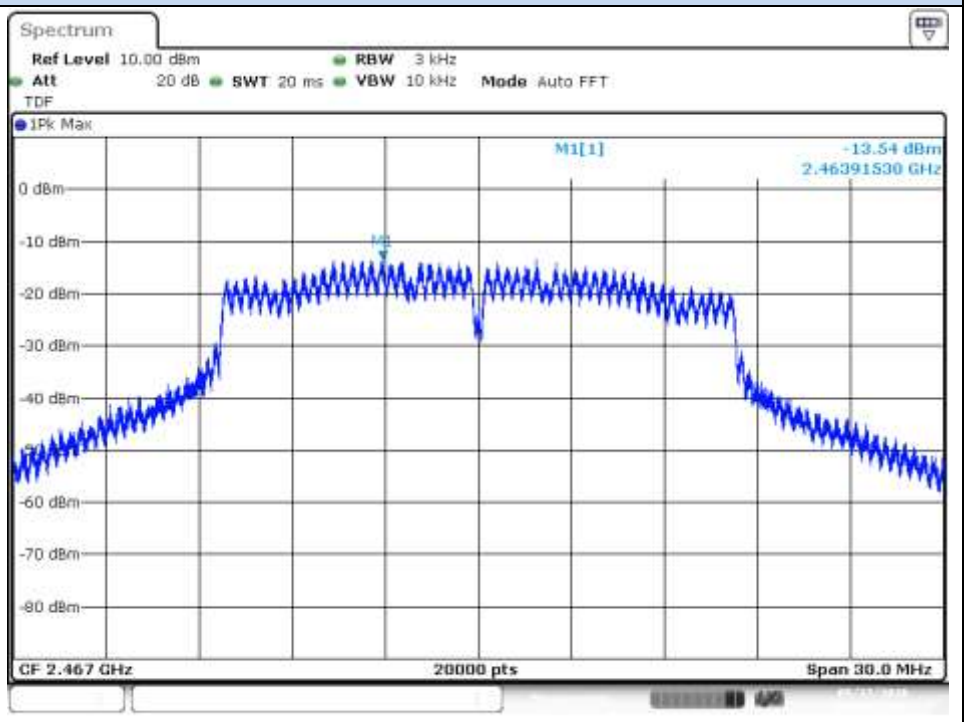
PSD Peak, Chain B – CH12



Date: 17.MAY.2016 16:24:52

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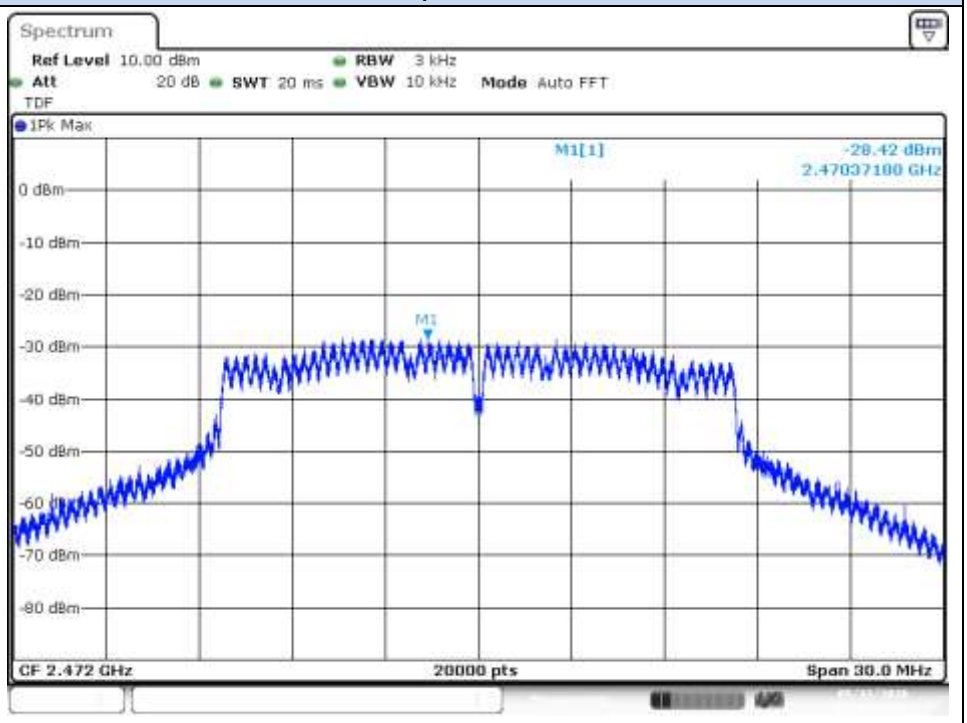
PSD Peak, Chain A – CH13



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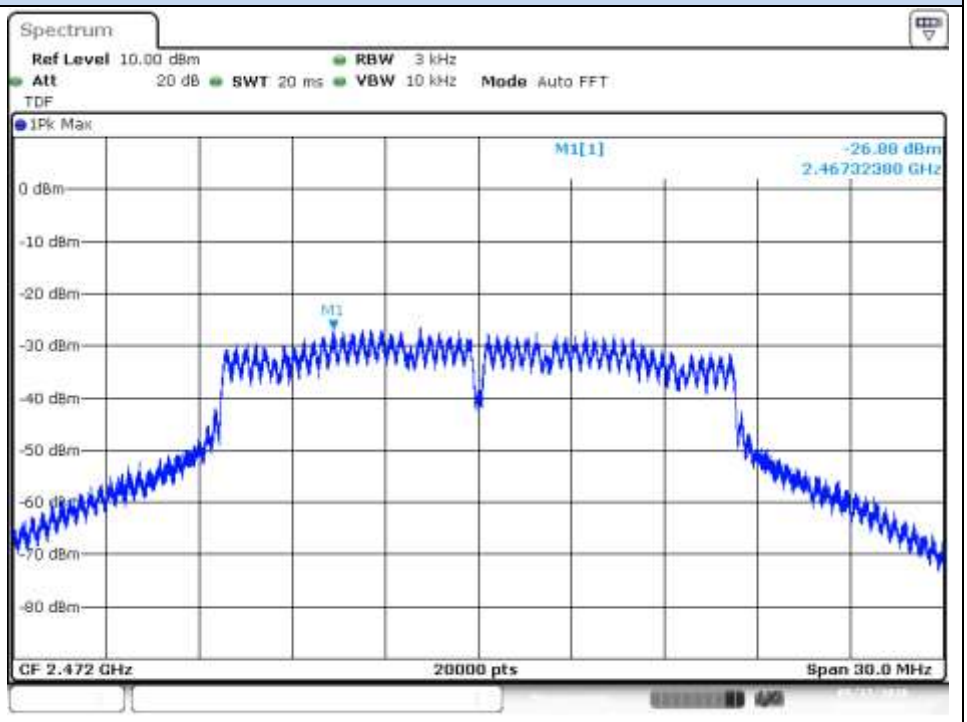

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802.11n20, HT0 (SISO)

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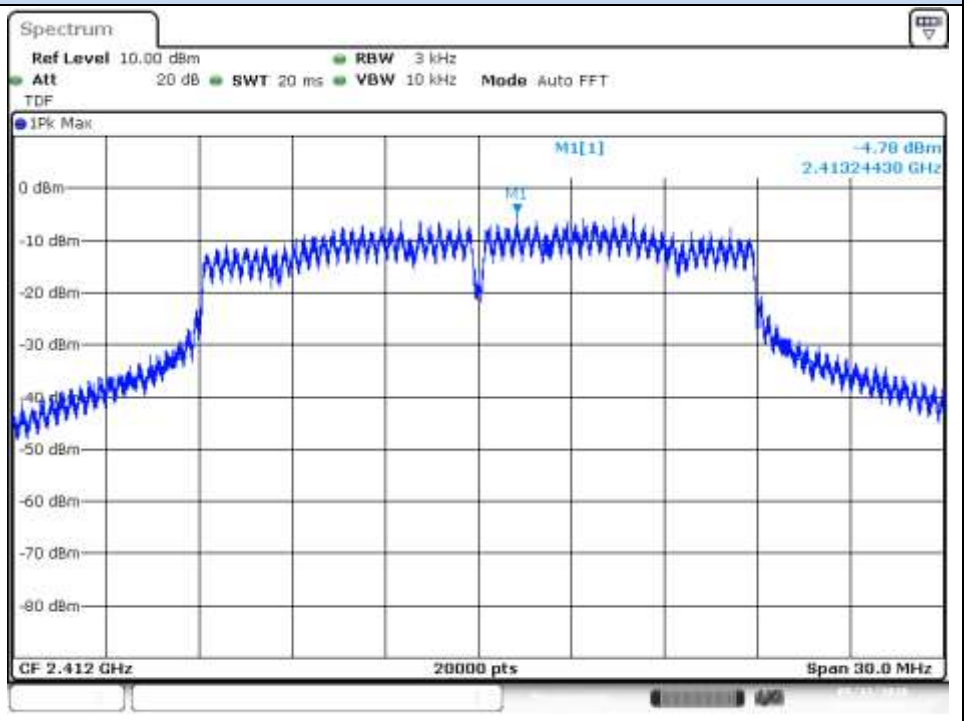

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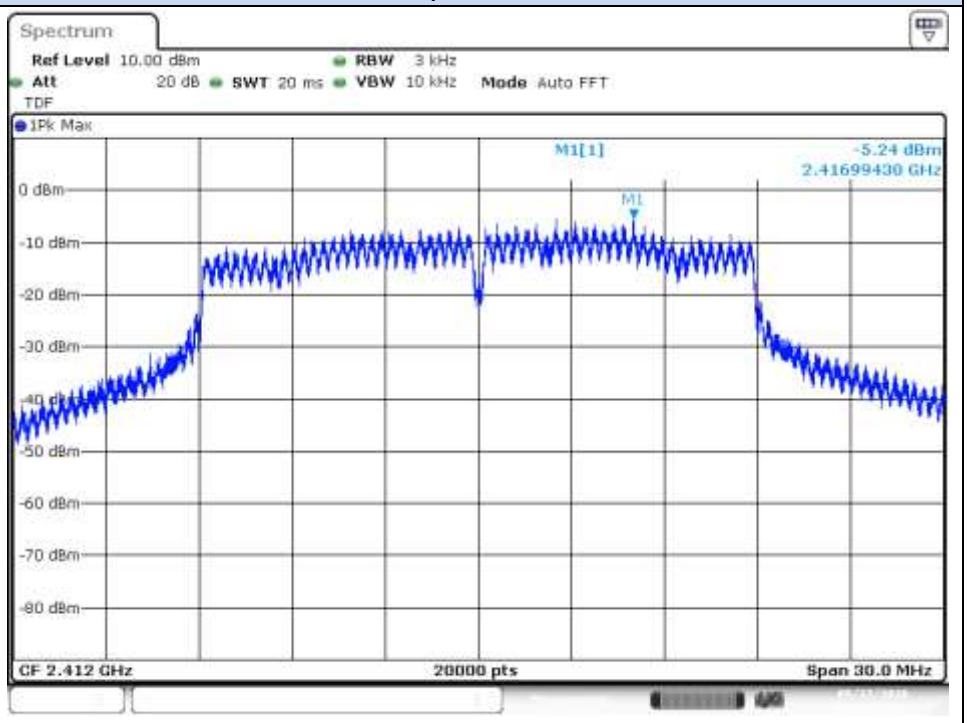

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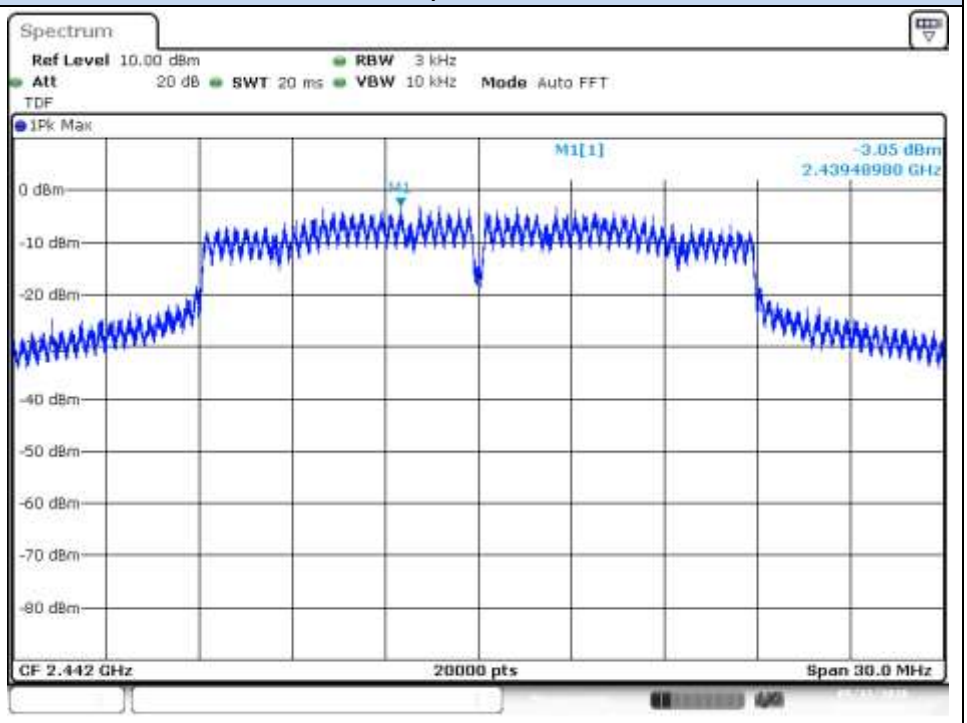
PSD Peak, Chain A – CH7



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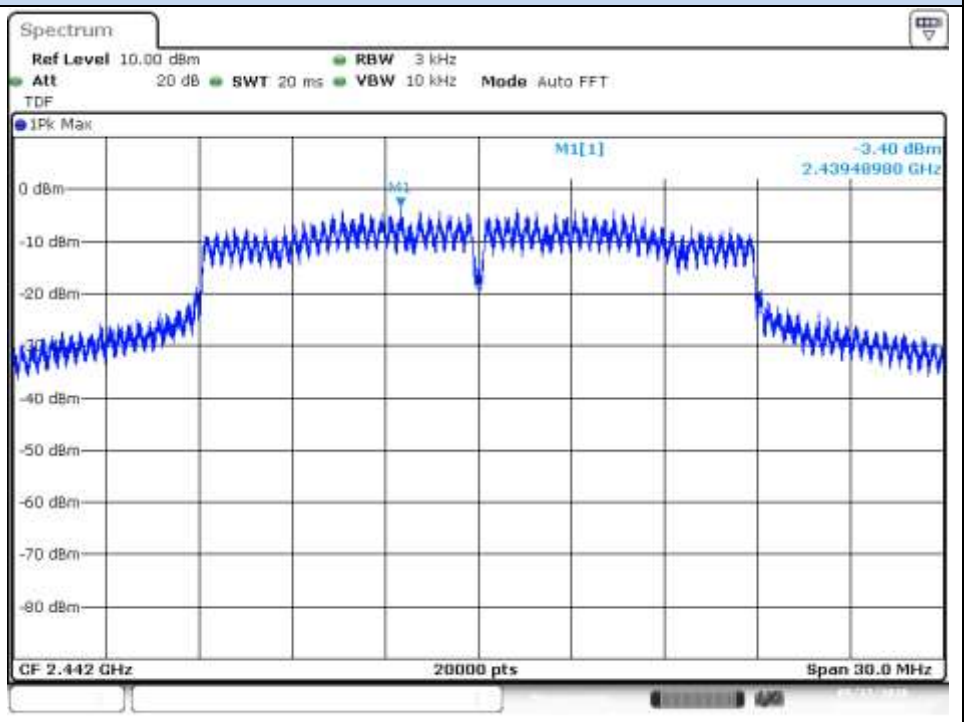

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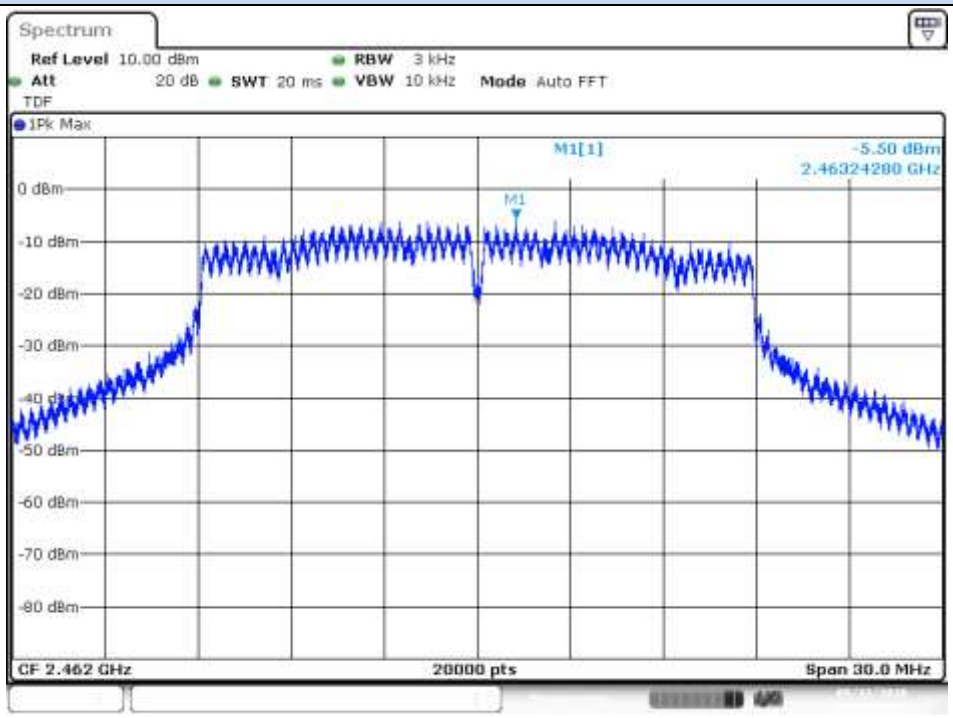

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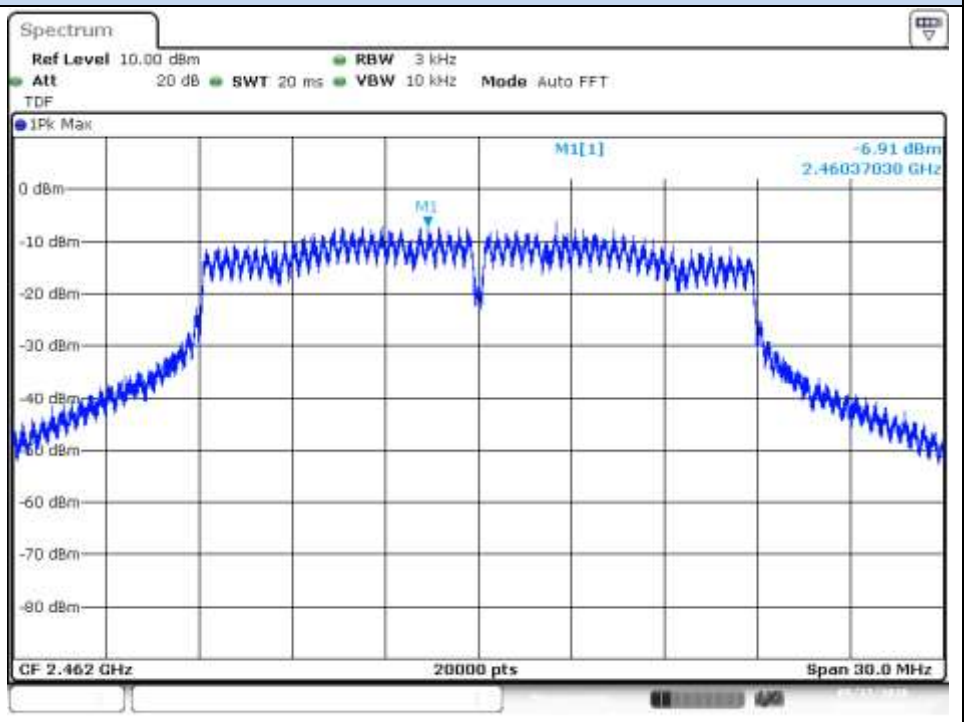

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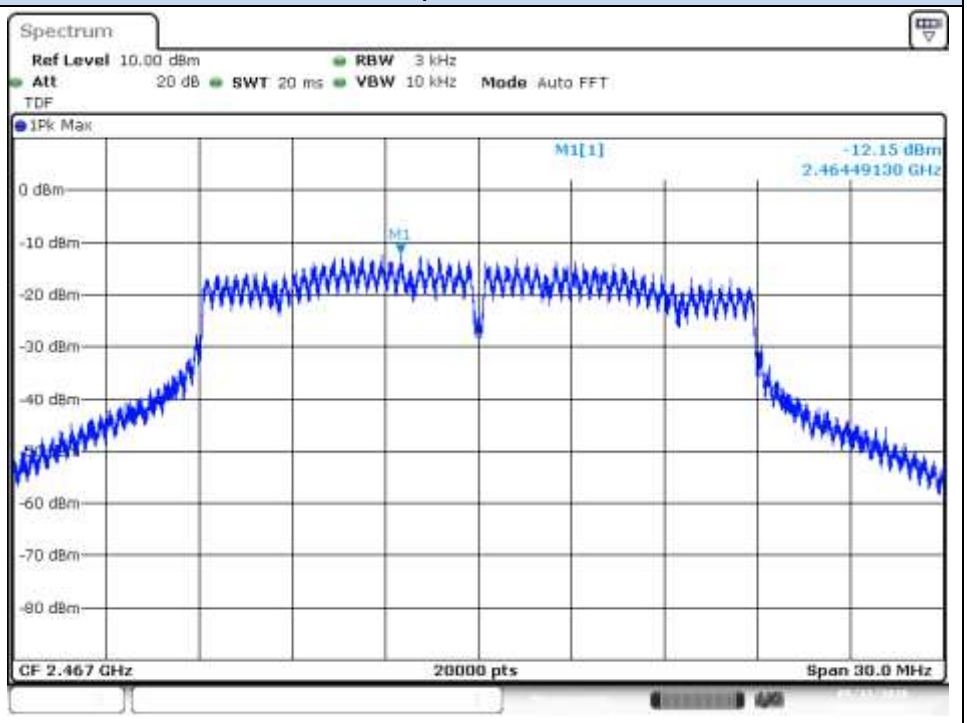

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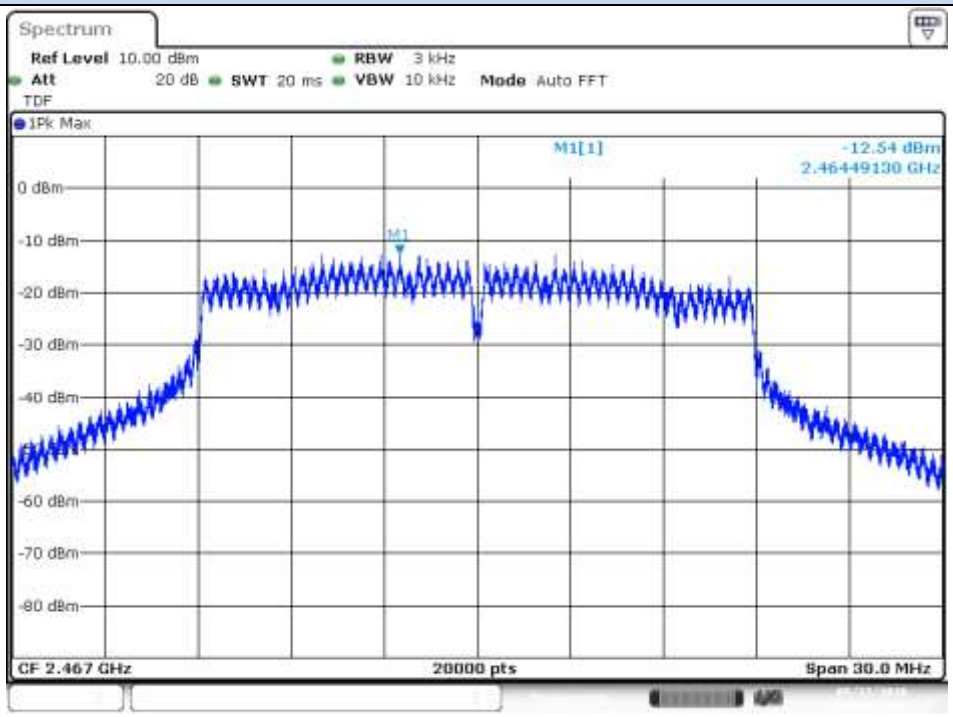

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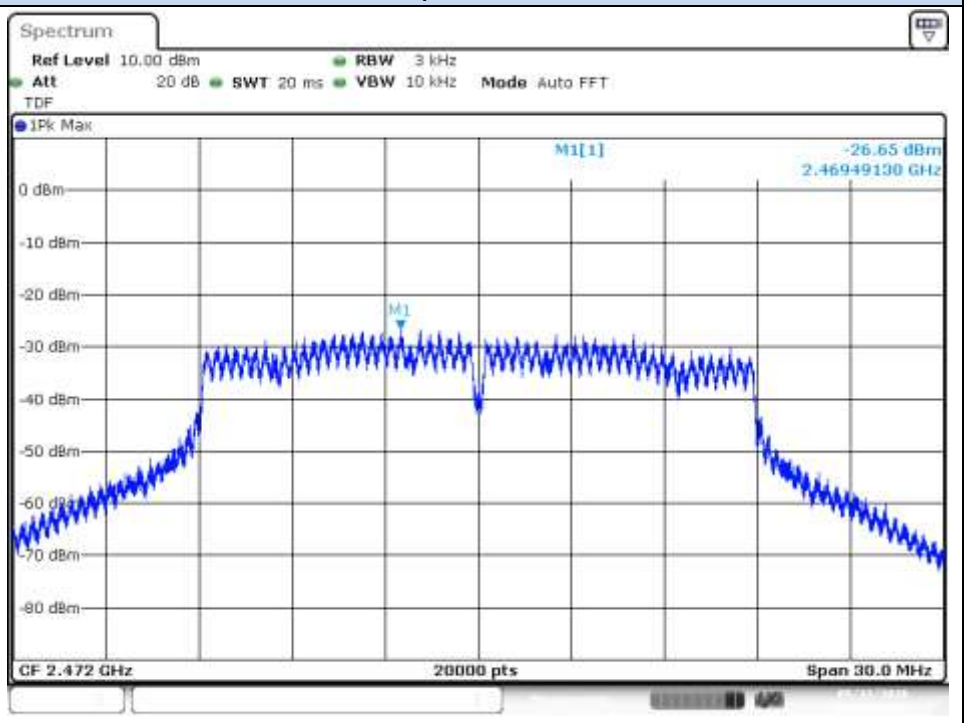

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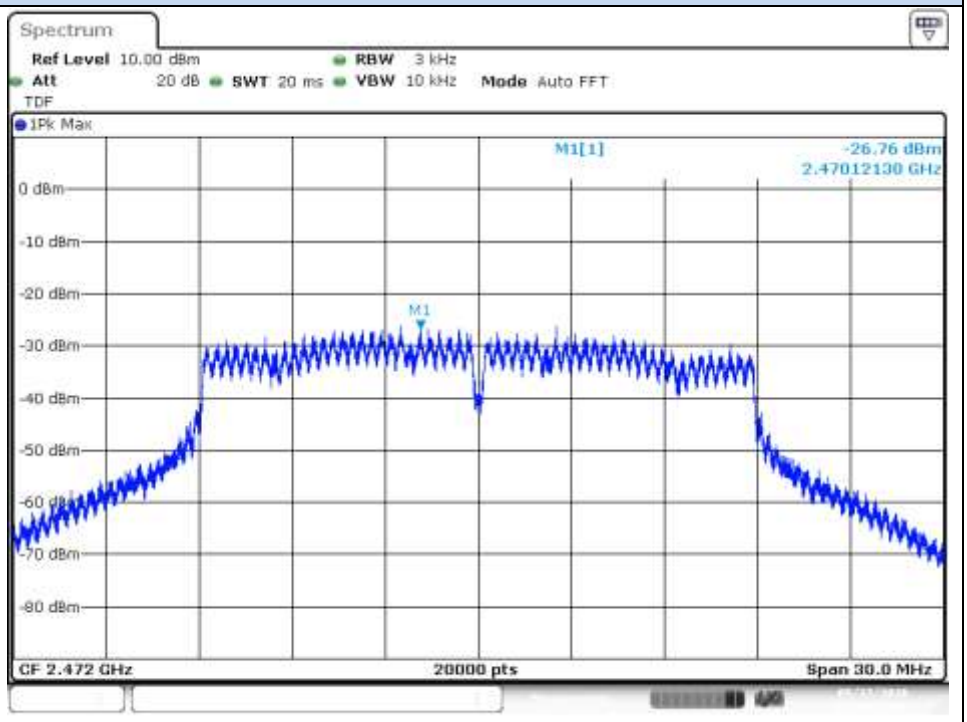

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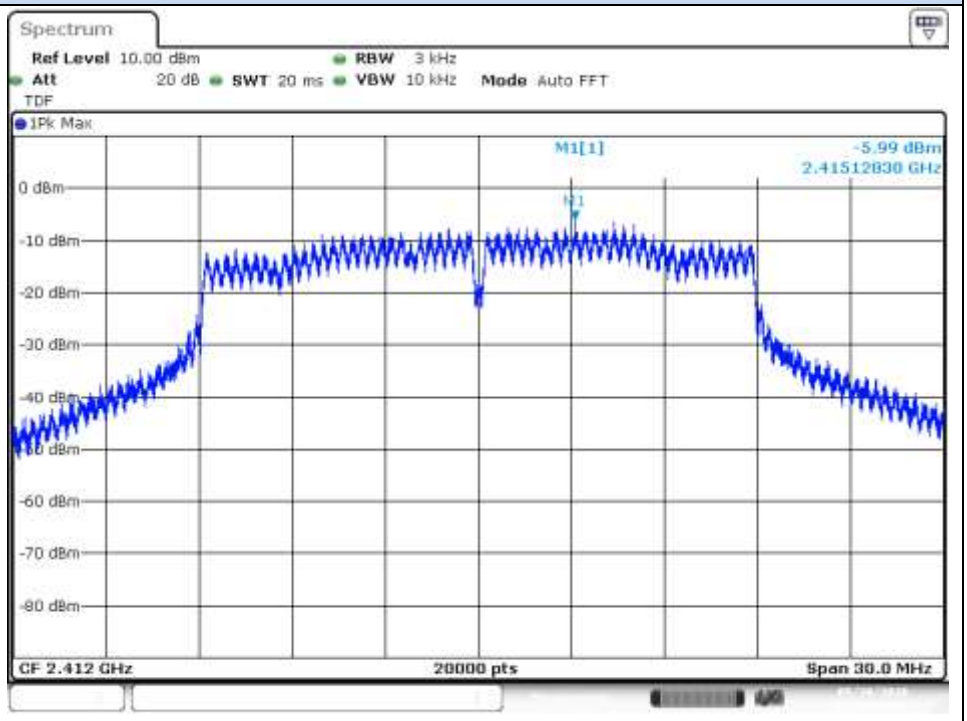
802.11n20, HT8 (MIMO)

PSD Peak, Chain A – CH1



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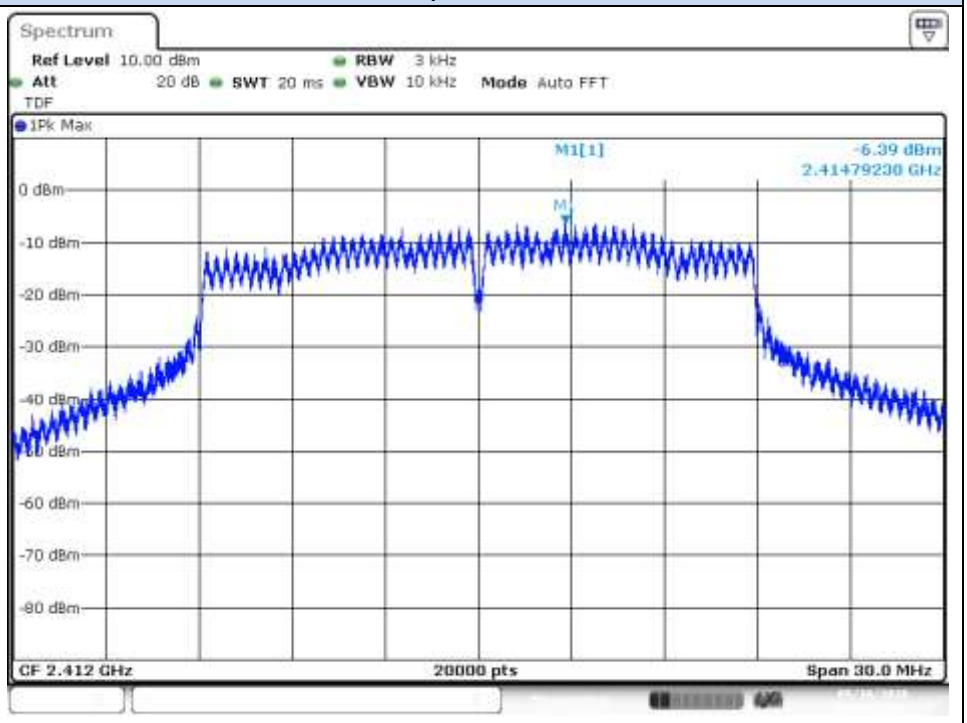

Date: 18.MAY.2016 10:33:42

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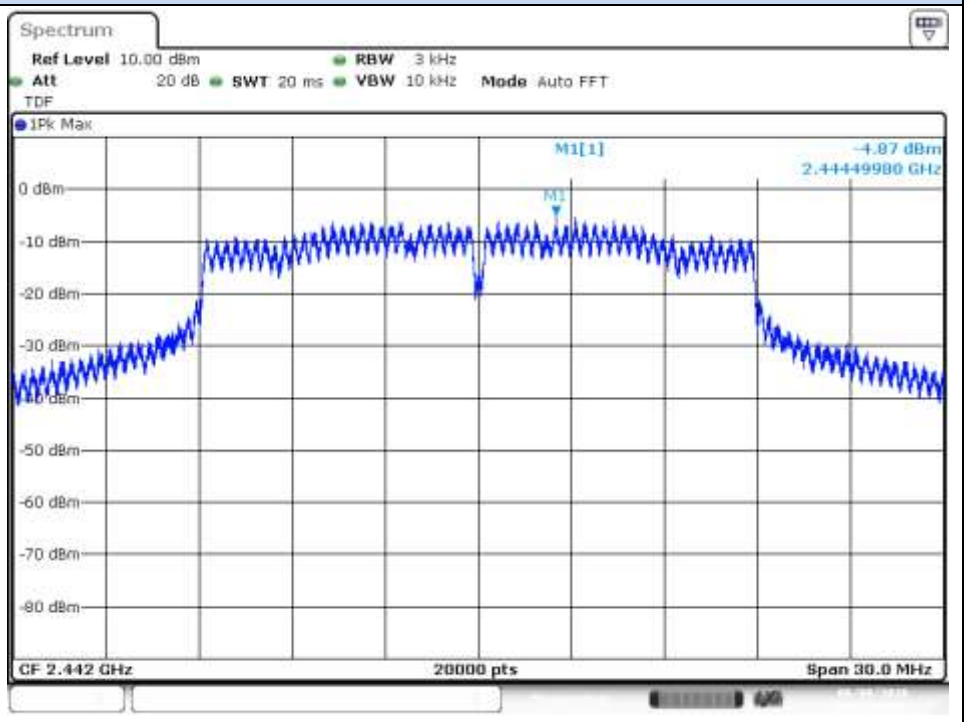
PSD Peak, Chain A – CH7



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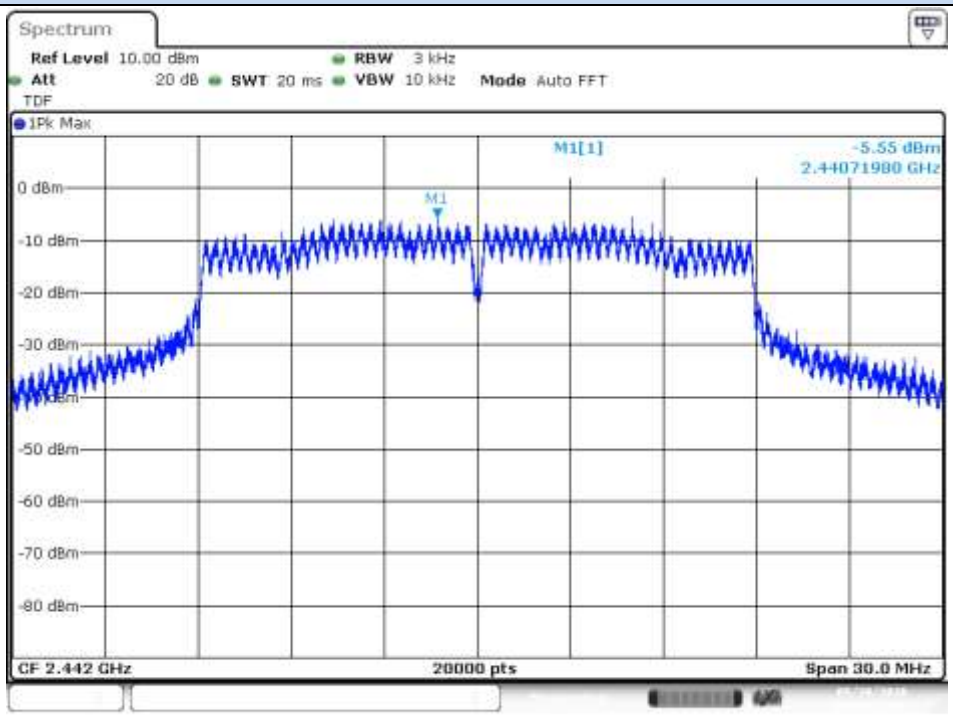

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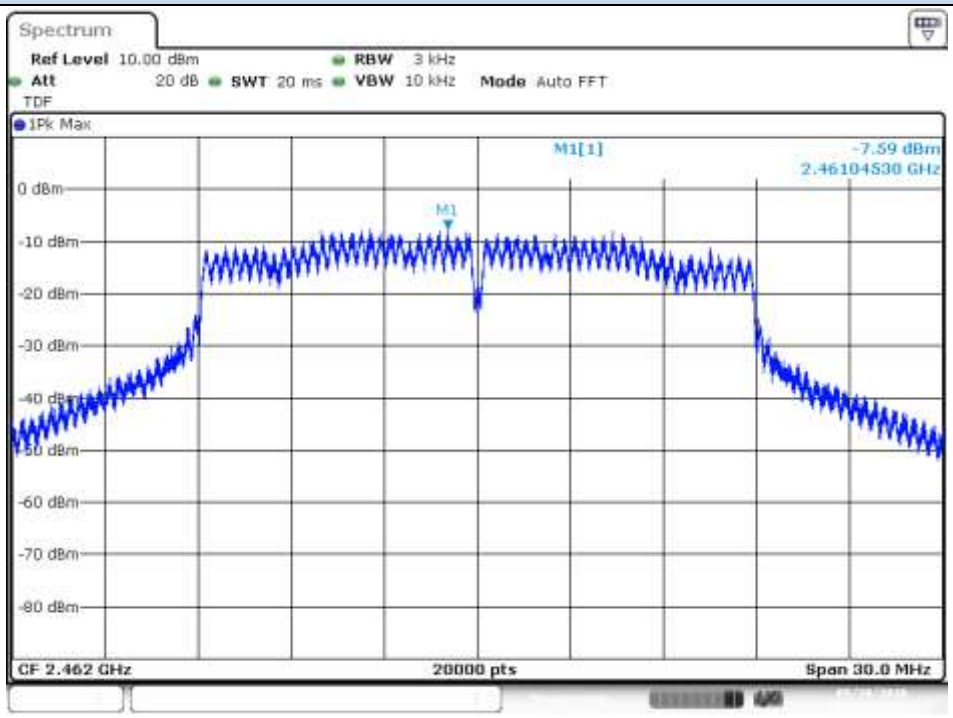

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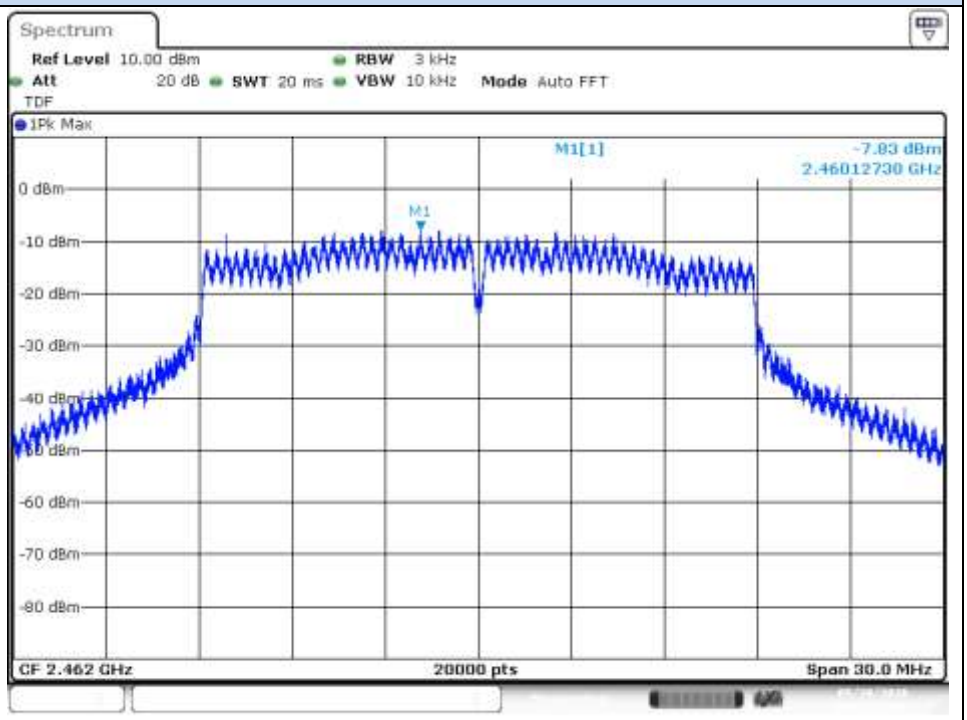

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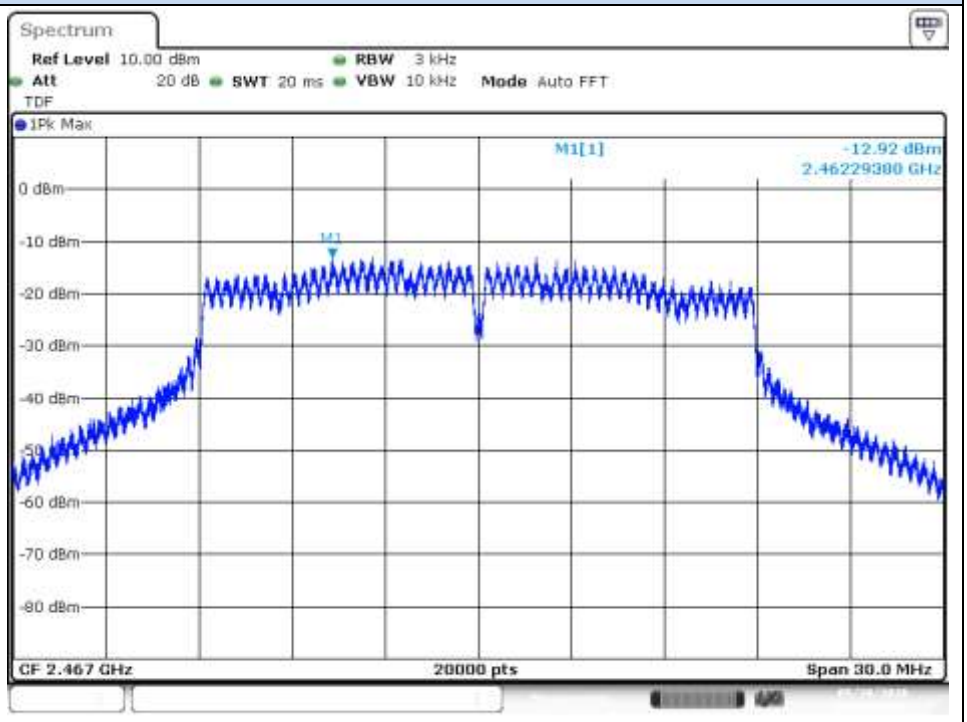

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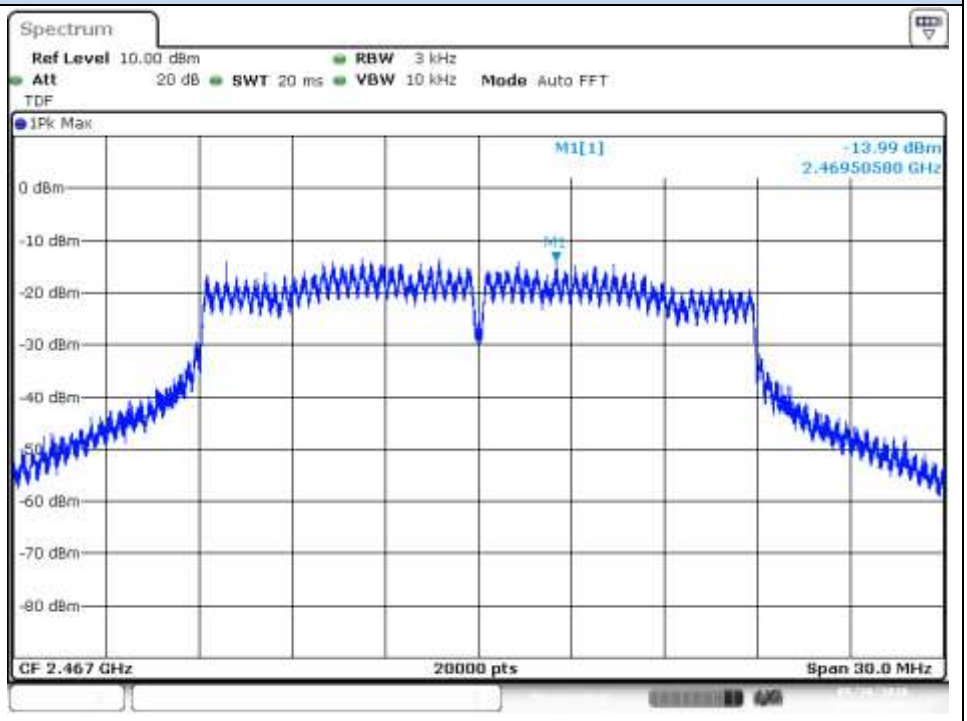

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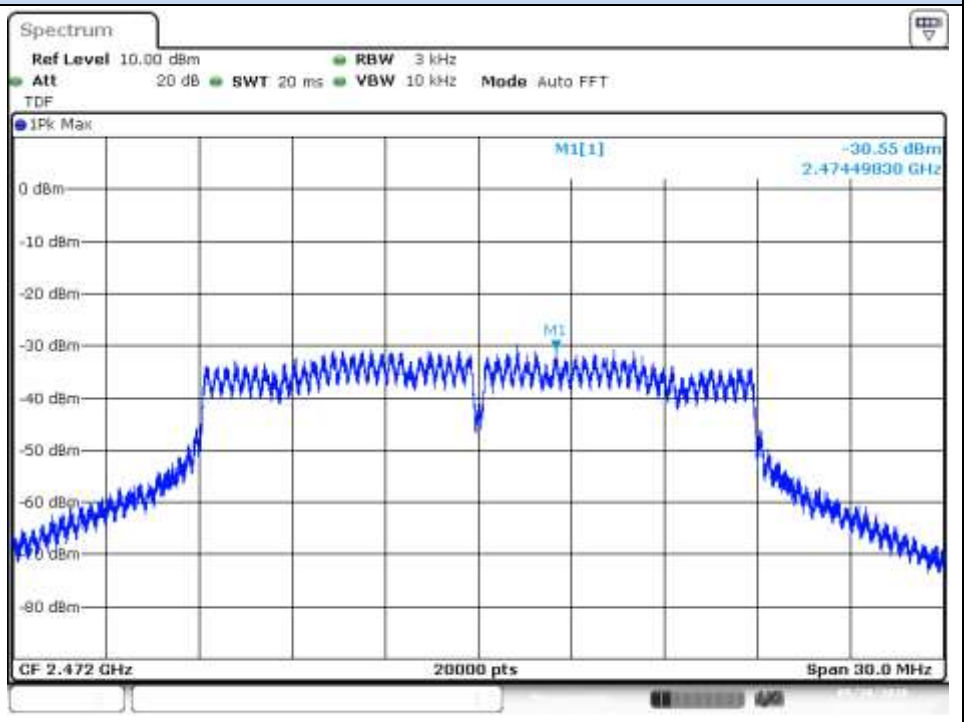

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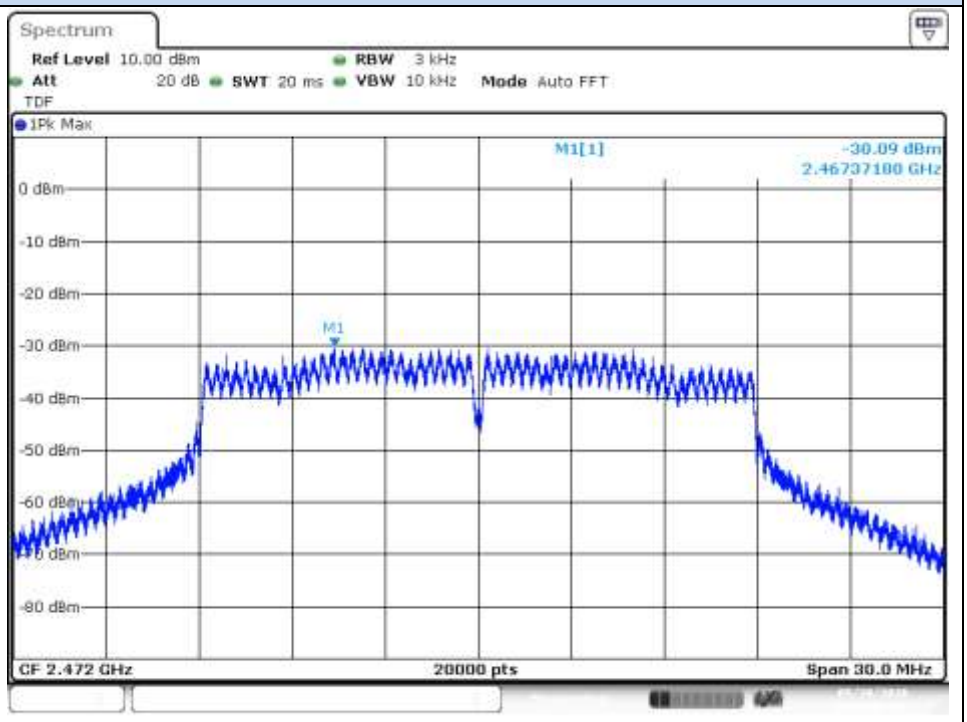

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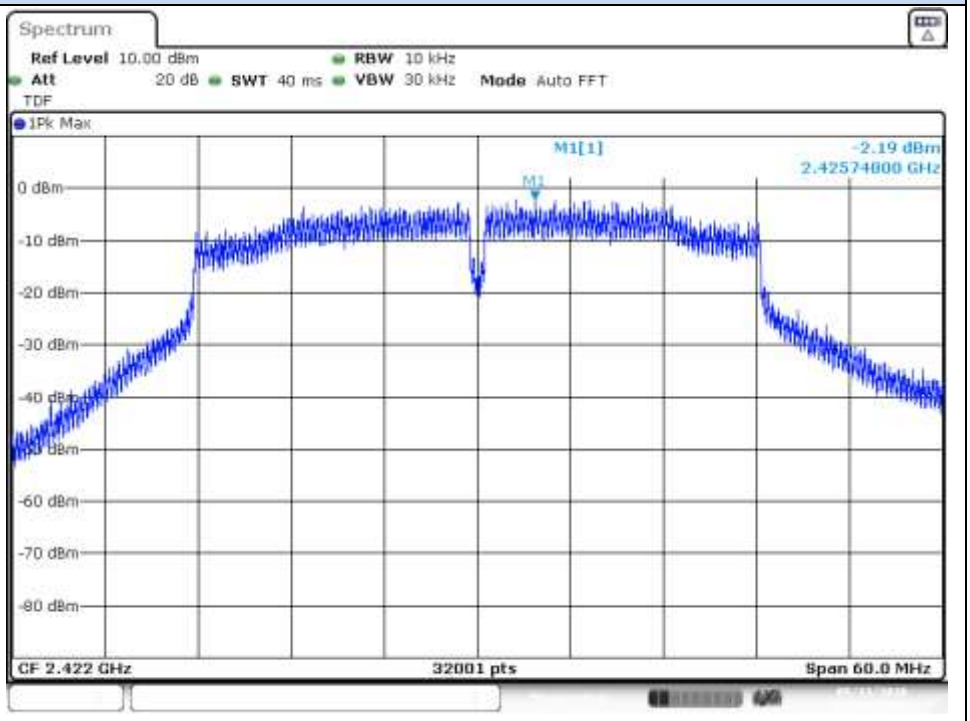
802.11n40, HT0 (SISO)

PSD Peak, Chain A – CH3F



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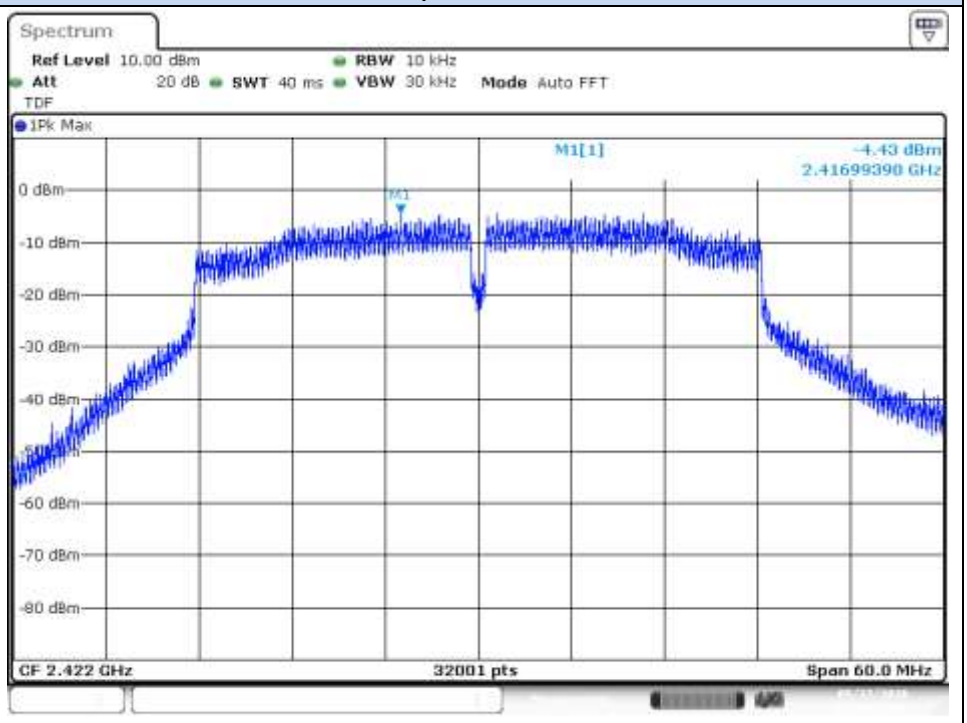
PSD Peak, Chain B – CH3F



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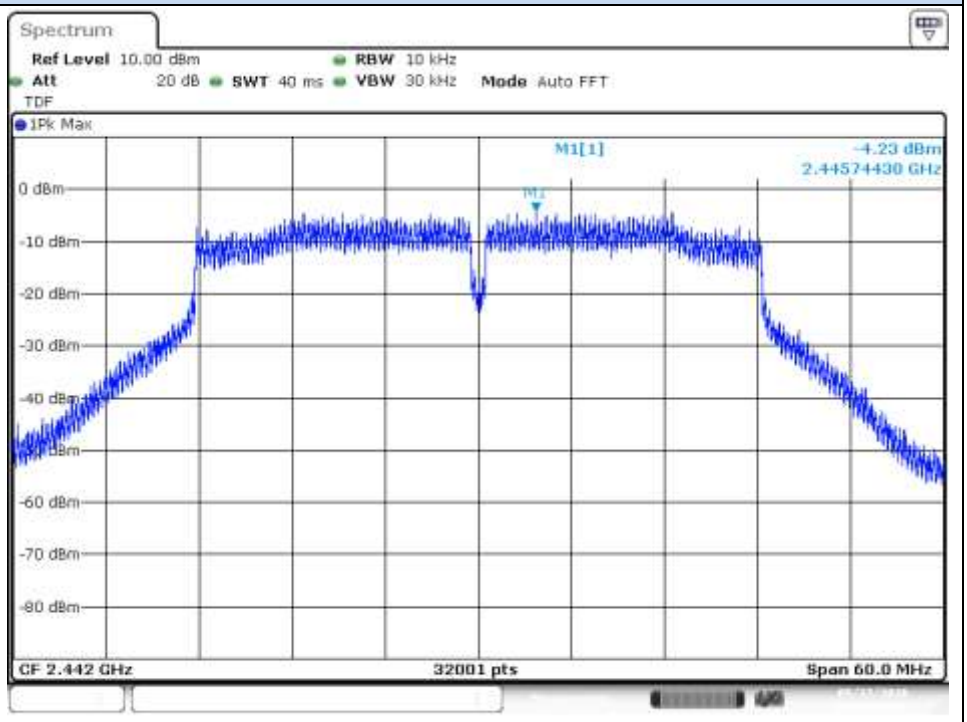
PSD Peak, Chain A – CH7F



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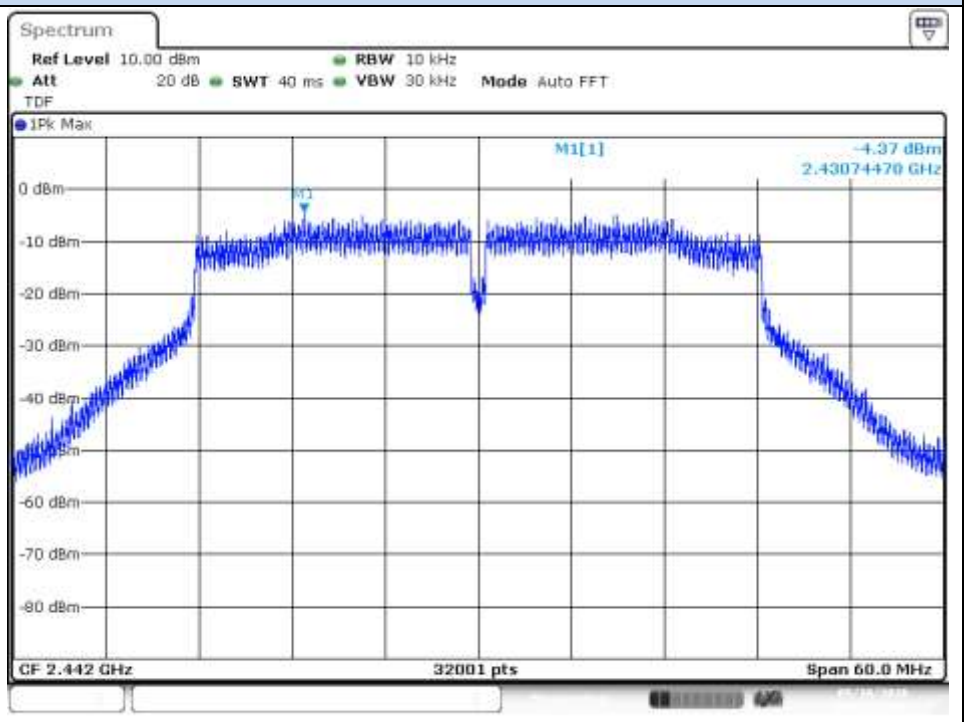

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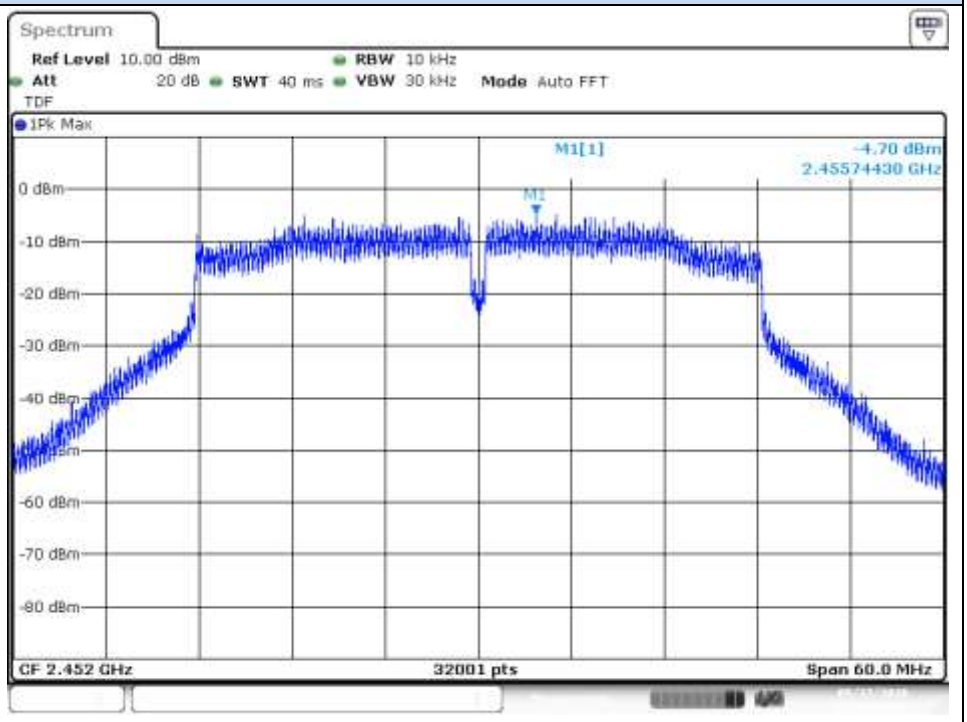

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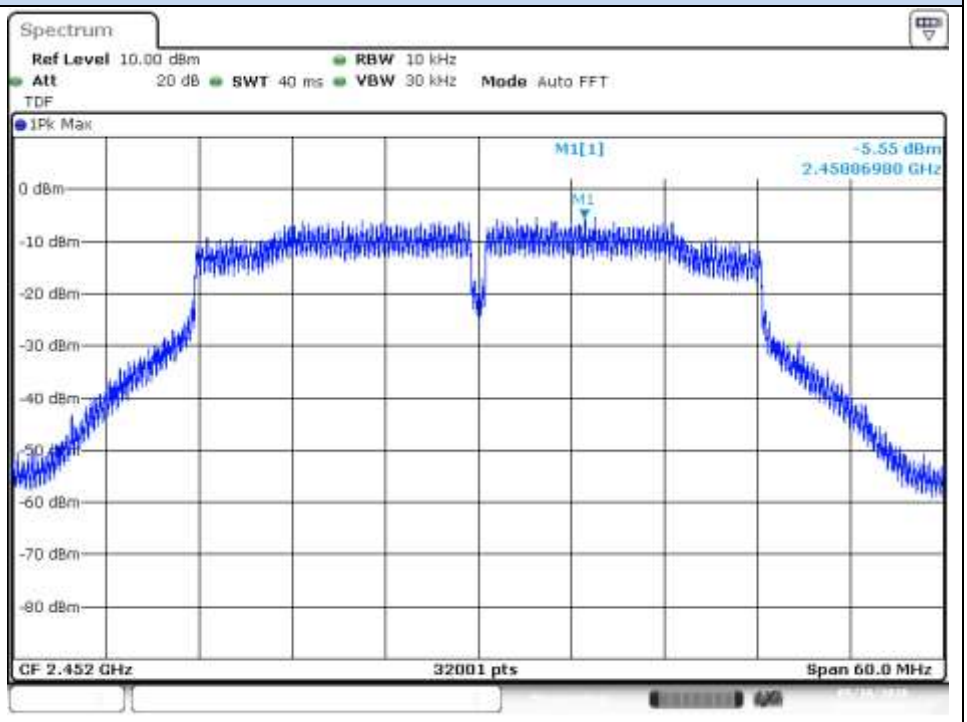

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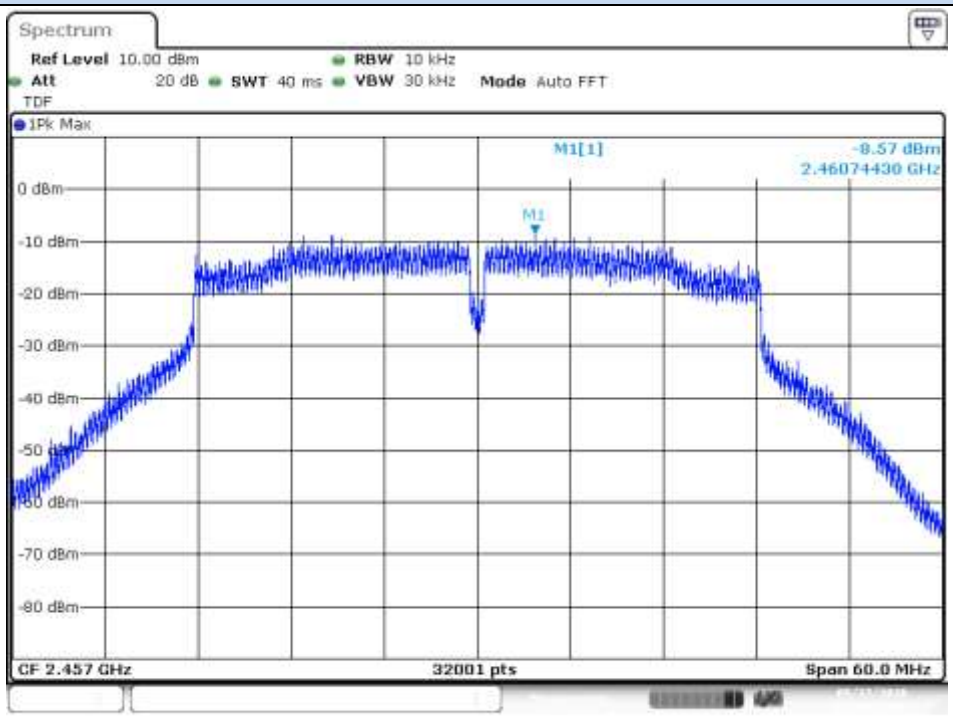

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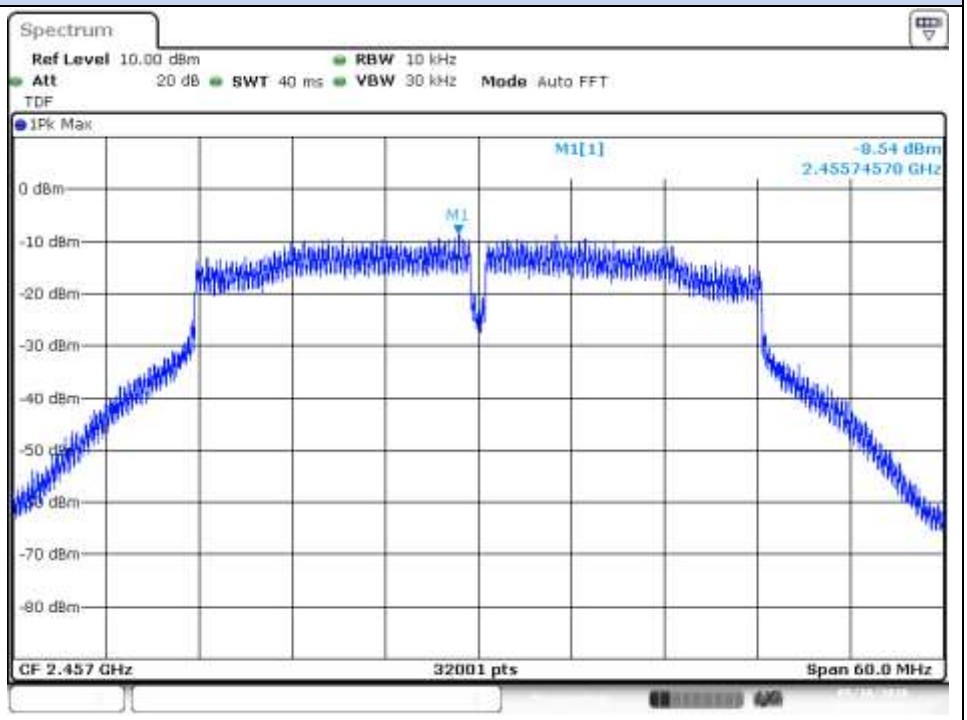

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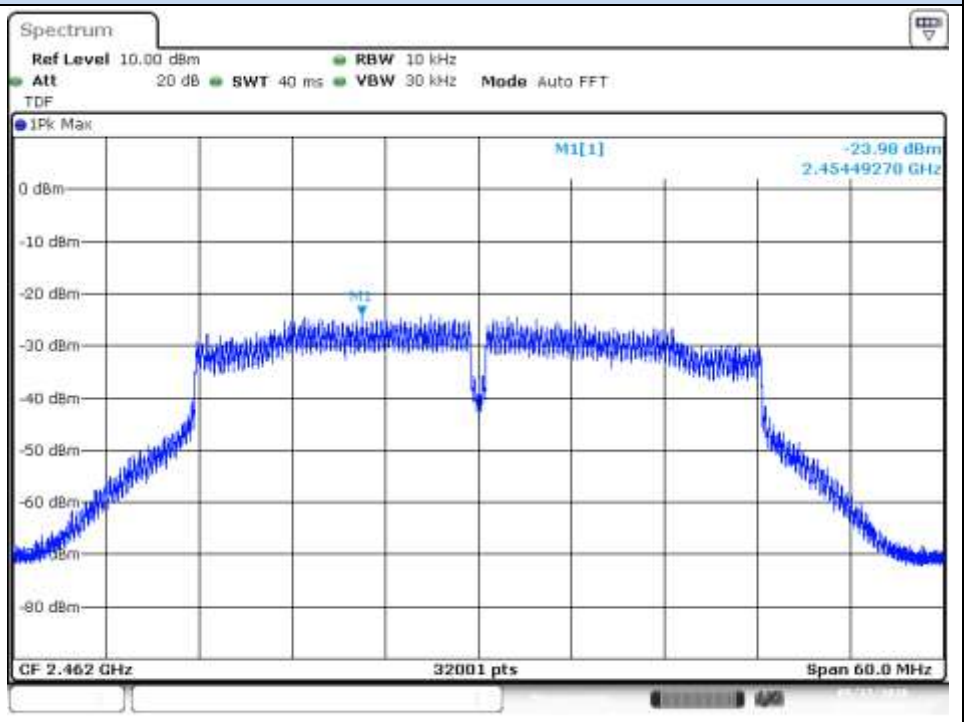

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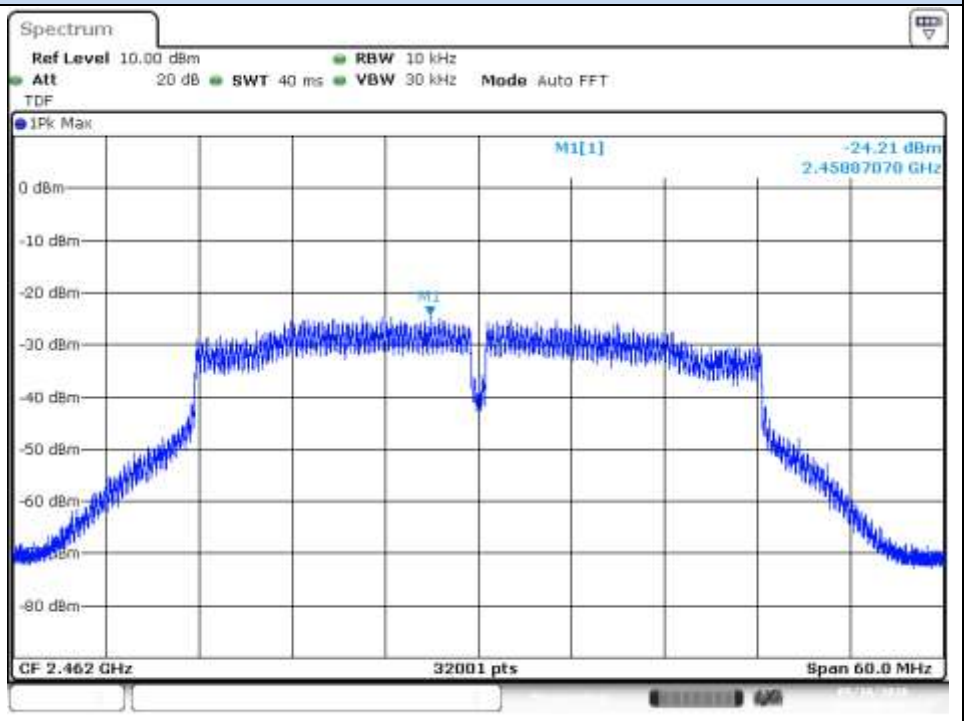

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802.11n40, HT8 (MIMO)

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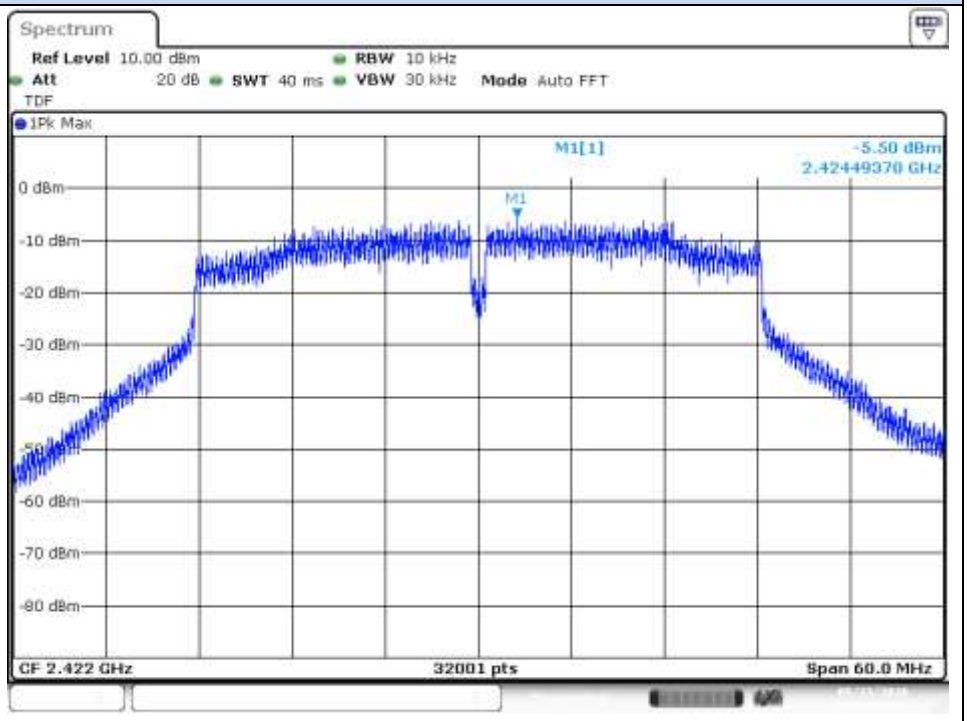

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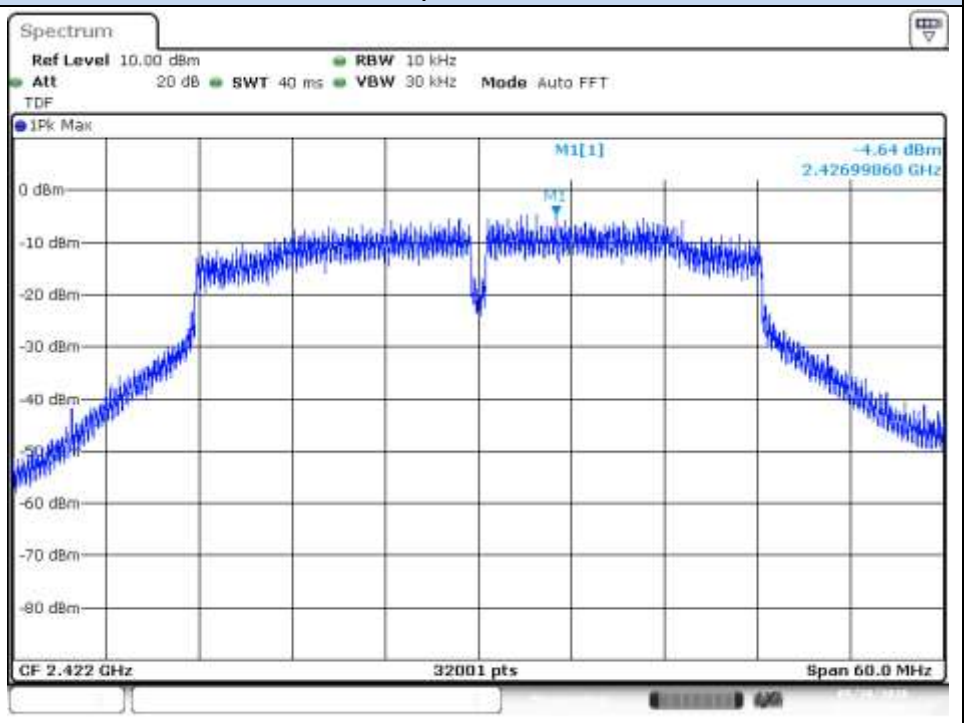

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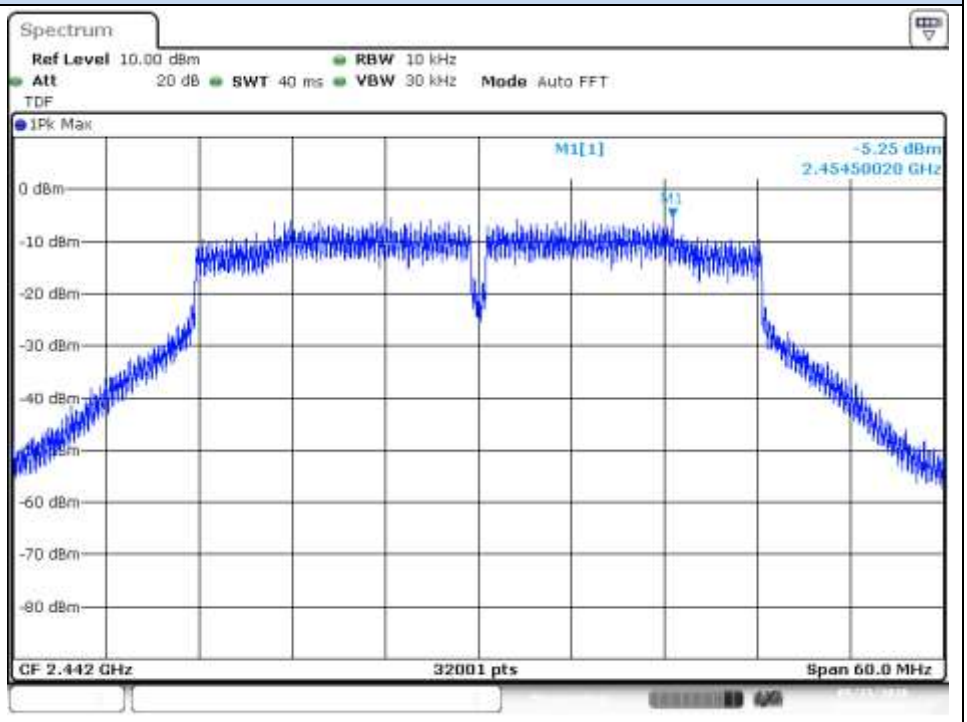

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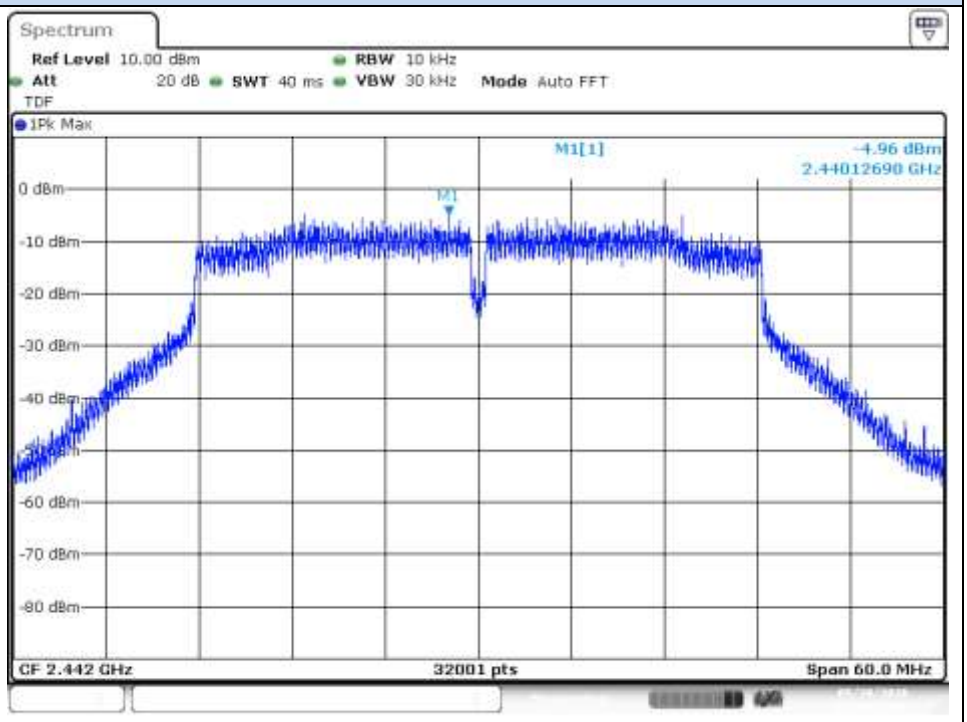

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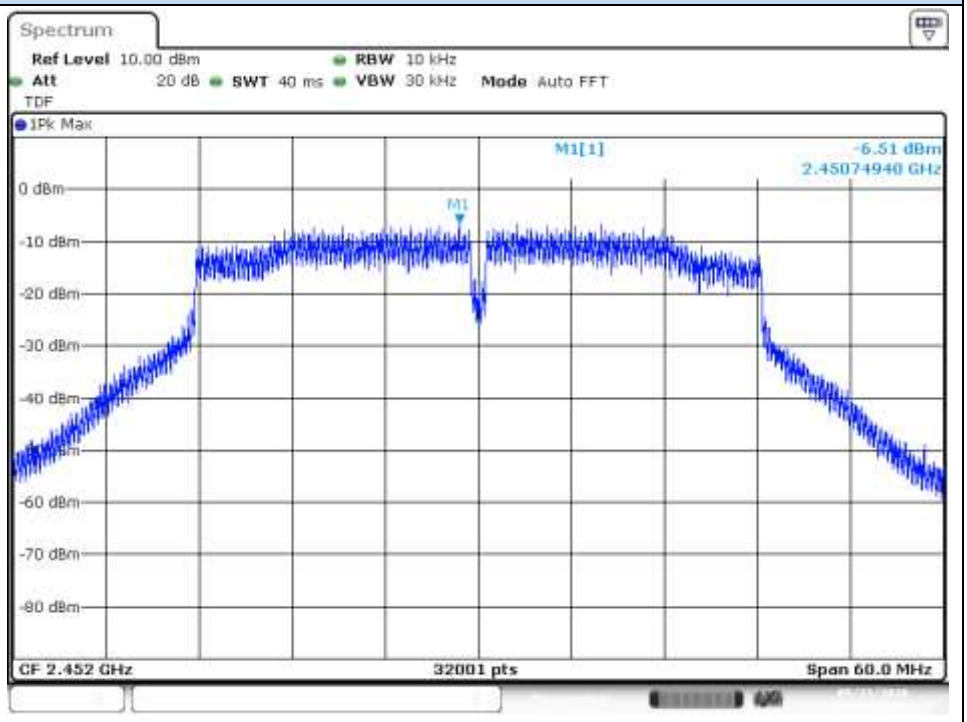

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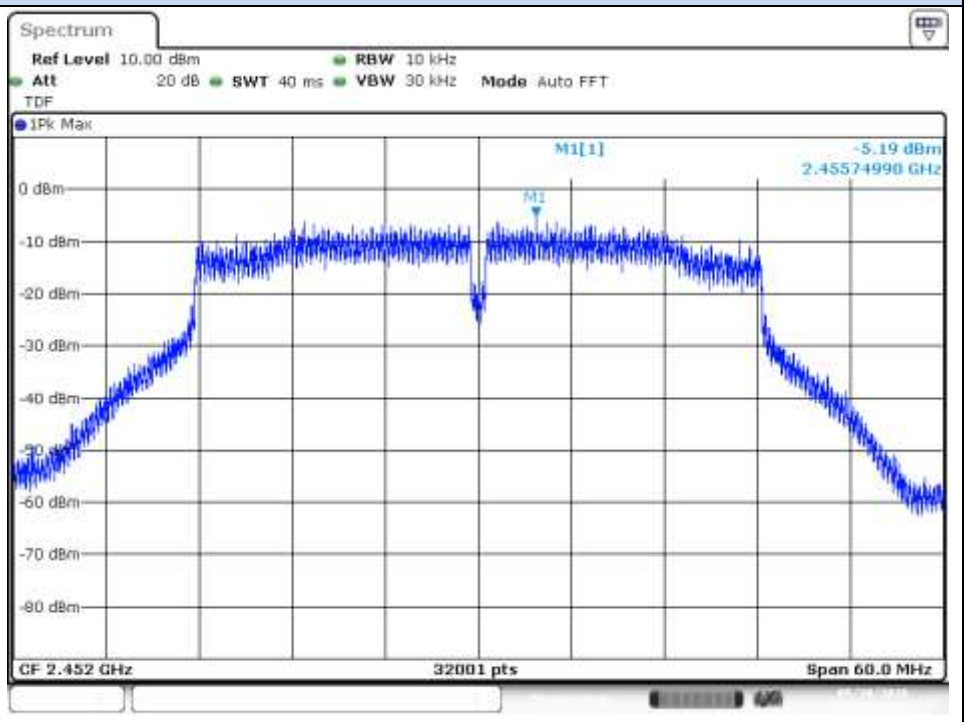

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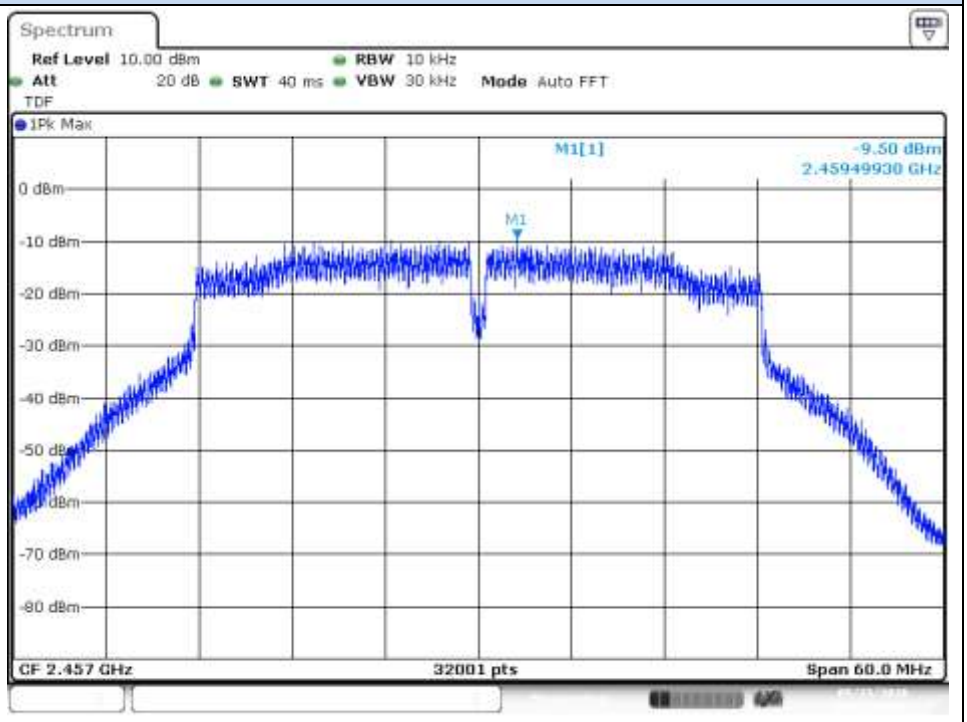

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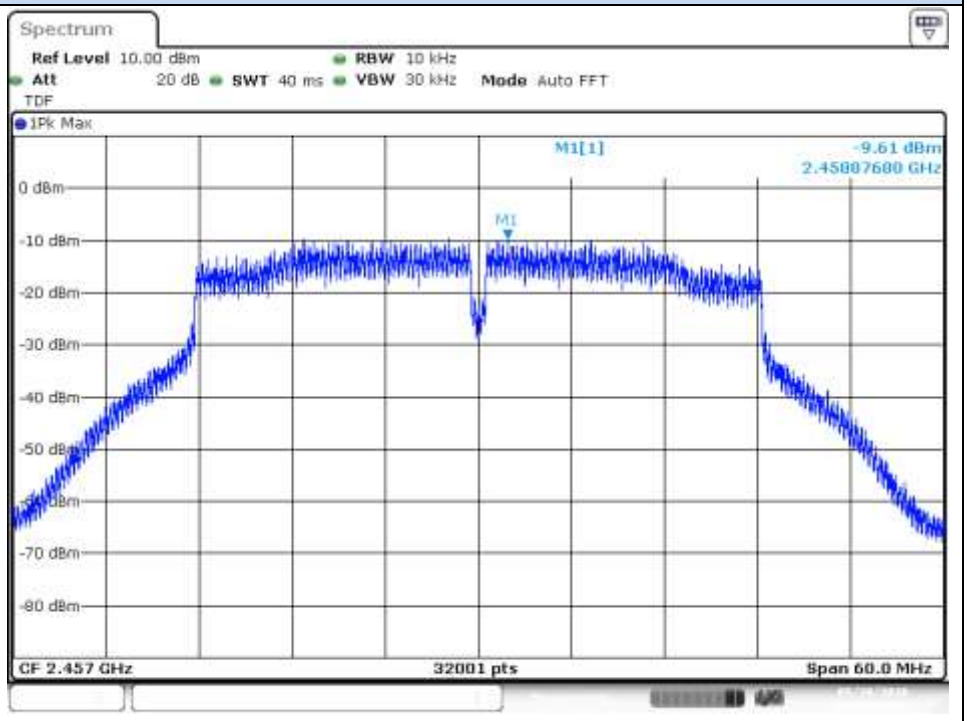

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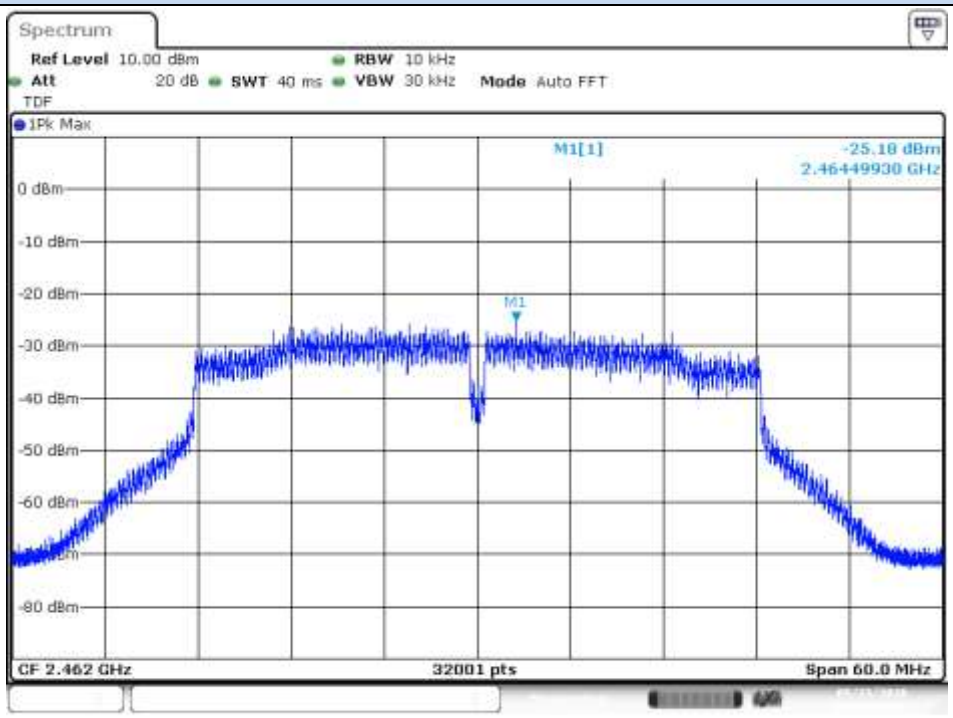
PSD Peak, Chain A – CH11F



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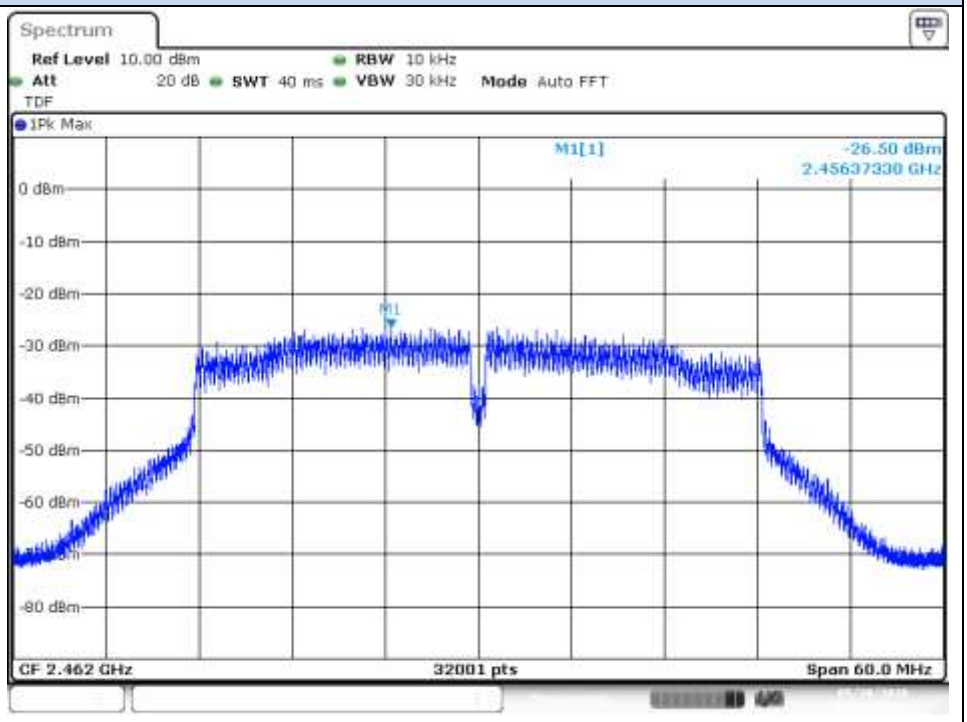


Date: 20.MAY.2016 12:13:22

Printed copies are not controlled documents

B.5 Radiated spurious emission

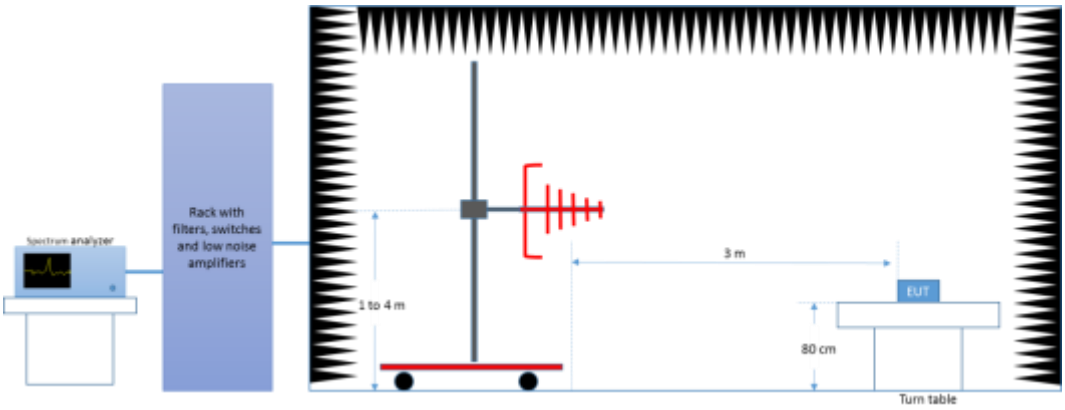
Standard references:

<table>
<tr><th>FCC part</th><th>RSS part</th><th>Limits</th></tr>
<tr><td>15.247 (d)</td><td>RSS-247
Clause 5.5</td><td>Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a):
<table>
<tr><th>Freq Range (MHz)</th><th>Field Strength (dBµV/m)</th><th>Field Strength (dBµV/m)</th><th>Meas. Distance (m)</th></tr>
<tr><td>0.009-0.490</td><td>2400/f(kHz)</td><td>-</td><td>300</td></tr>
<tr><td>0.490-1.705</td><td>24000/f(kHz)</td><td>-</td><td>300</td></tr>
<tr><td>1.705-30.0</td><td>30</td><td>-</td><td>30</td></tr>
<tr><td>30-88</td><td>100</td><td>40</td><td>3</td></tr>
<tr><td>88-216</td><td>150</td><td>43.5</td><td>3</td></tr>
<tr><td>216-960</td><td>200</td><td>46</td><td>3</td></tr>
<tr><td>Above 960</td><td>500</td><td>54</td><td>3</td></tr>
</table>
The emission limits shown in the above table are based on measurements employing CISPR quasi-peak detector except for the frequency bands 9-90 kHz. 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.
For average radiated emission measurements above 1000 MHz. there is also a limit specified when measuring with peak detector function corresponding to 20 dB above the indicated values in the table.</td></tr>
</table>

Test procedure:

The setups below were used to measure the radiated spurious emissions.
Depending of the frequency range and bands being tested, different antennas and filters were used.
The final measurement is done by varying the antenna height from 1 to 4 meters, the EUT azimuth over 360º and for both Vertical and Horizontal polarizations.
The radiated spurious emissions were measured on the worst case configuration selected from the chapter *B.2 Maximum Output Power and antenna gain* and using the lowest, middle and highest channels.

Radiated Setup < 1GHz



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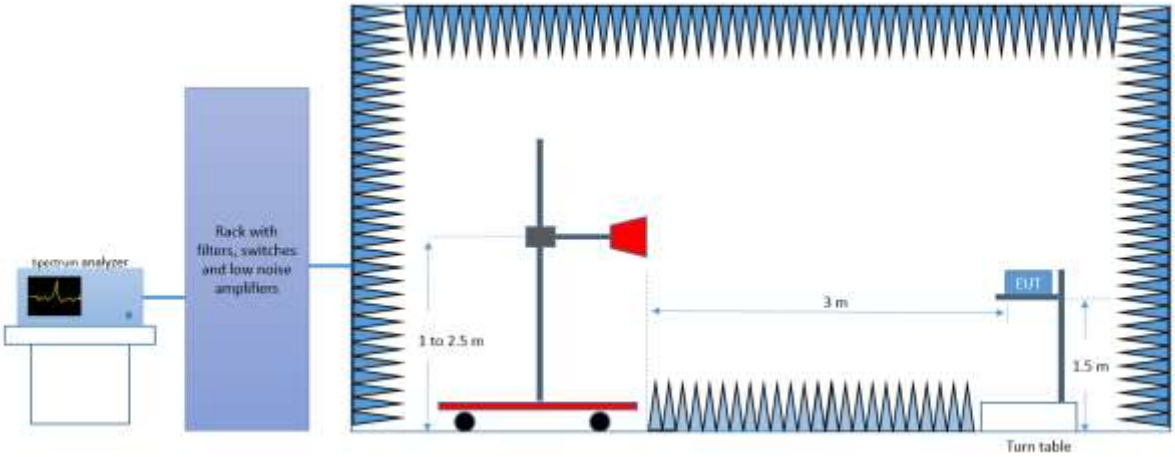
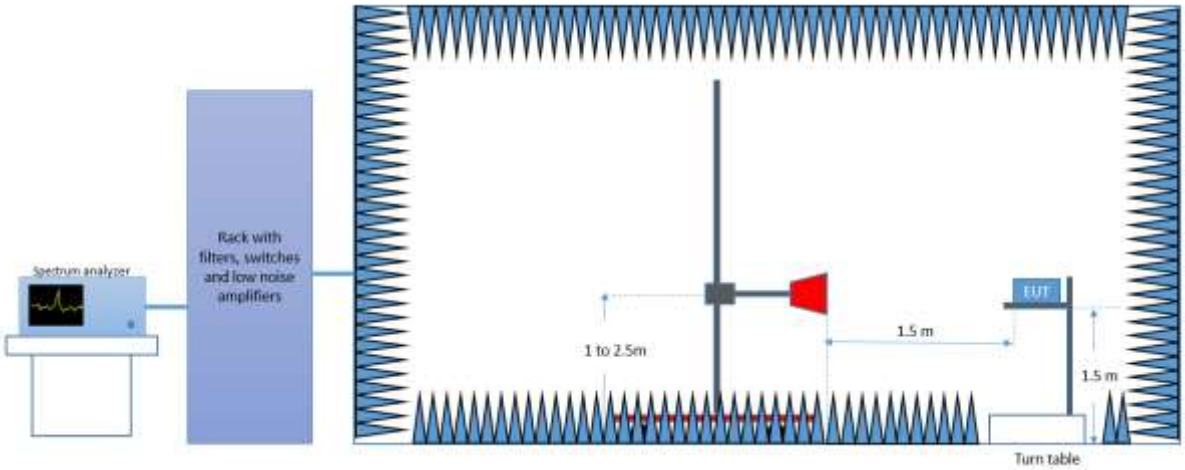
Radiated Setup 1GHz - 18GHz



Radiated Setup 18 GHz - 25 GHz



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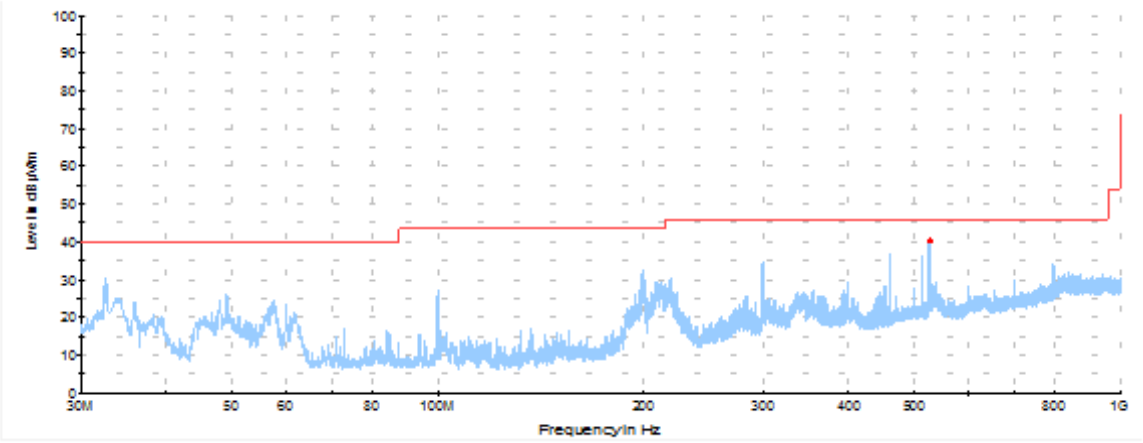
Test Results:

Radiated Spurious – 30MHz – 1GHz

Radiated Spurious – All Modes



Peak measurements Limit FCC Peak

Frequency	Max Peak	Limit	Margin
MHz	dBuV/m	dBuV/m	dB
526	40.2	46	5.9

Note 1: The spurious signals detected do not depend on either the operating channel or the modulation mode.

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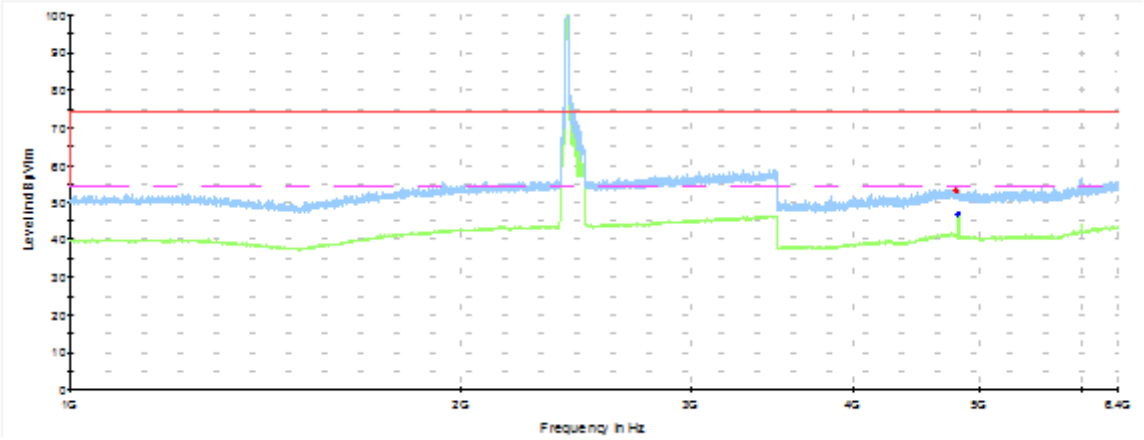
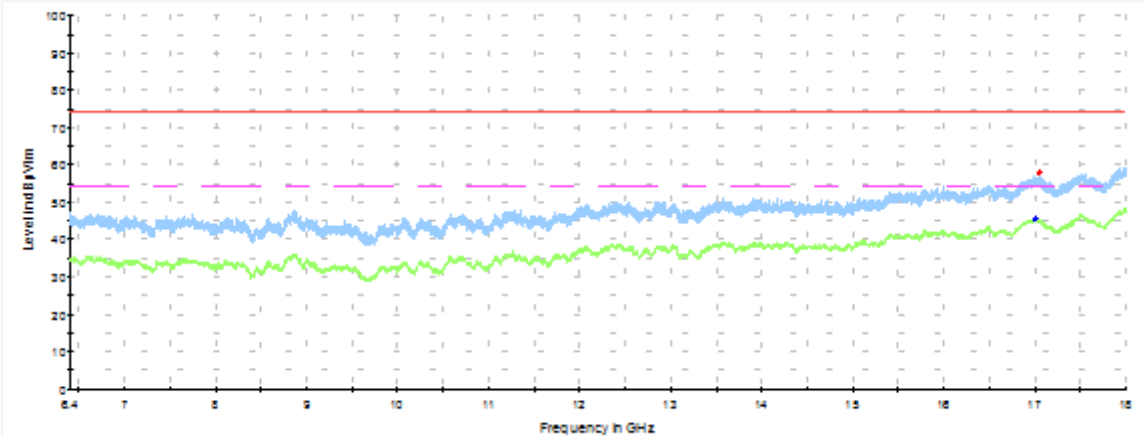
Radiated Spurious – 1 GHz to 18GHz
802.11b, 1Mbps, Chain A

Radiated Spurious – Ch1





Peak measurements Avg measurements Limit FCC Peak Limit FCC Avg

Frequency	Max Peak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
4800	53.2	-	74	20.8
4823	-	46.8	54	7.2
17005	57.7	-	74	16.3
17043	-	45.6	54	8.4

Radiated Spurious – Ch7

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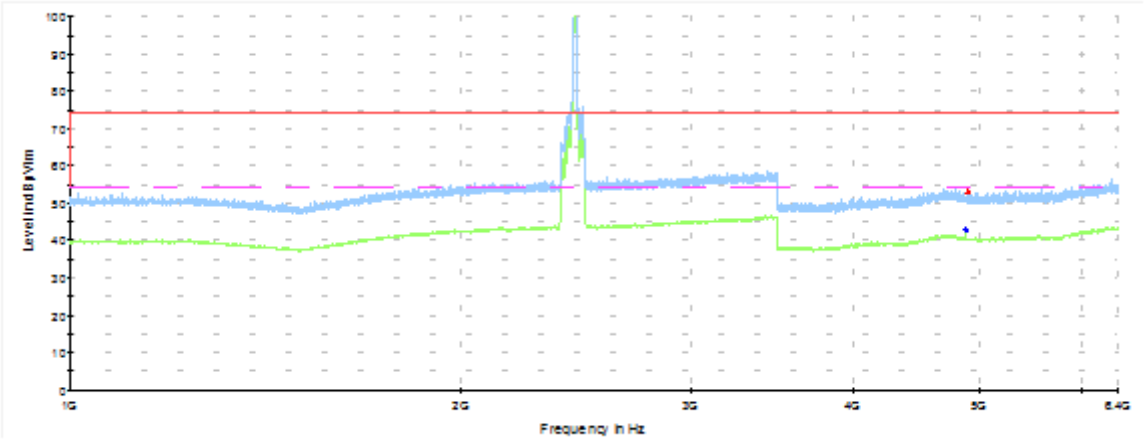

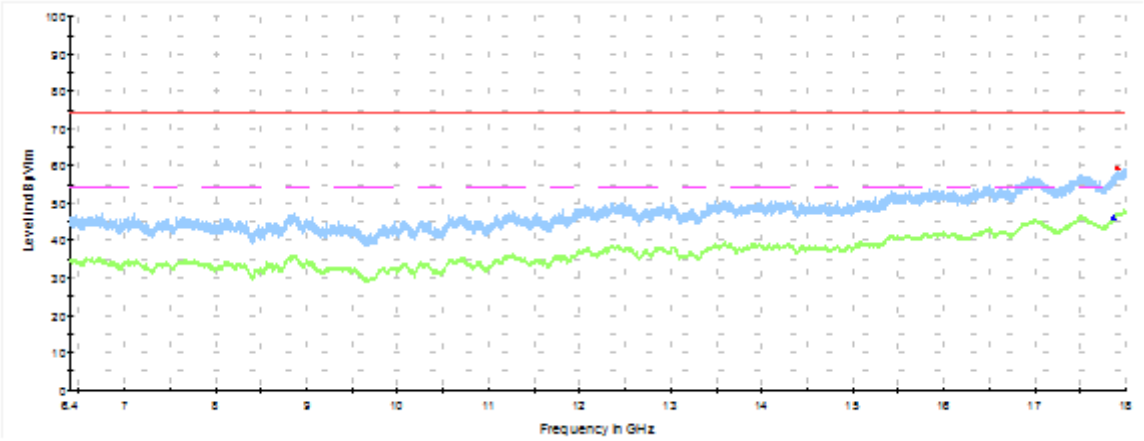

Peak measurements Avg measurements Limit FCC Peak Limit FCC Avg

Frequency	Max Peak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
4884	52.9	-	74	21.1
4903	-	43.0	54	11.0
17858	59.3	-	74	14.7
17858	-	46.0	54	8.0

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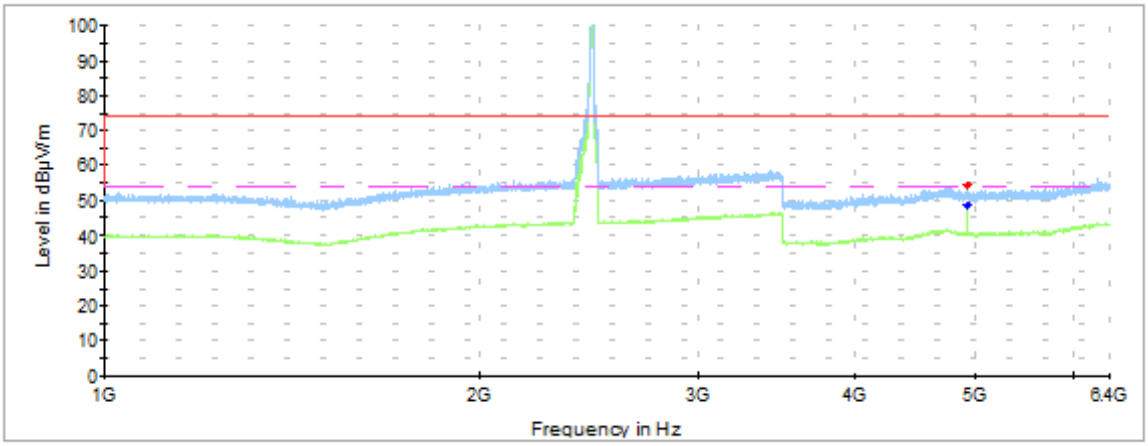
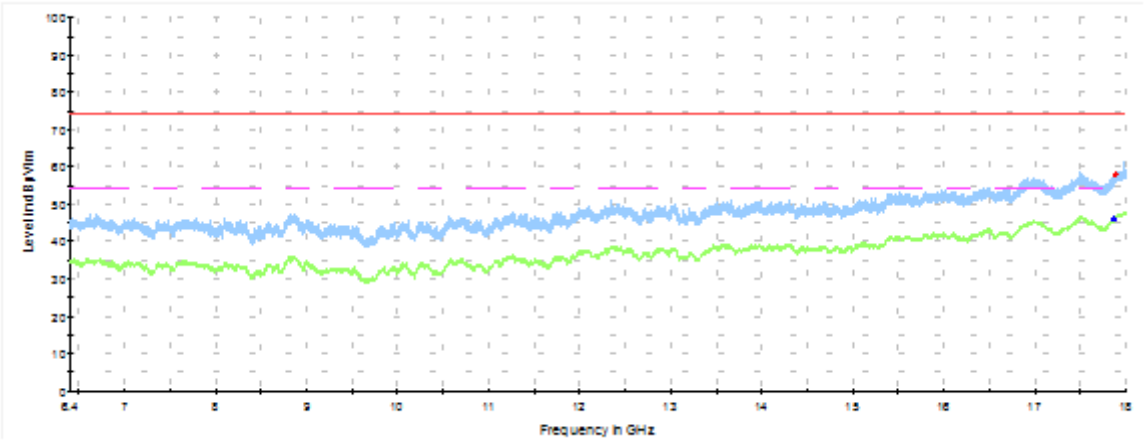
Radiated Spurious – Ch11





Peak measurements Avg measurements Limit FCC Peak Limit FCC Avg

Frequency	Max Peak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
4923	56.9	-	74	17.1
4923	-	50.9	54	3.1
17865	57.8		74	16.2
17865		46.1	54	7.9

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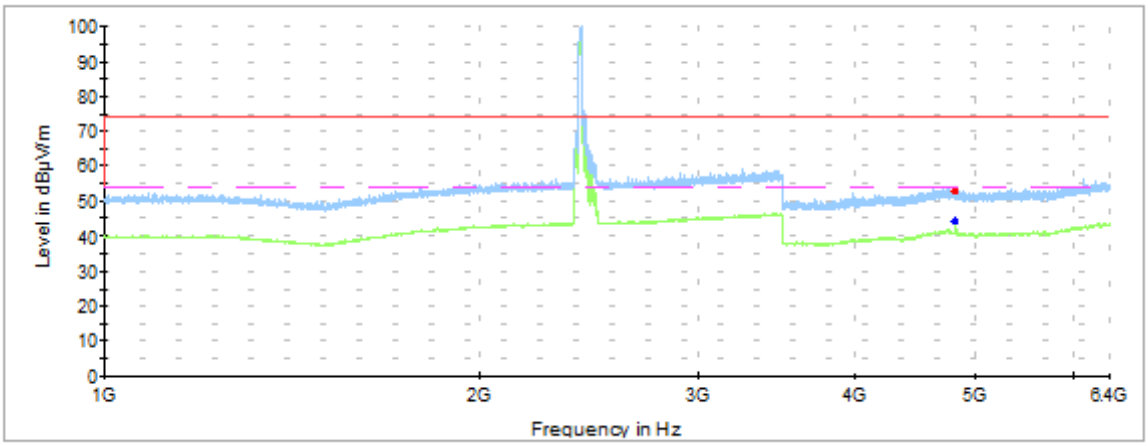
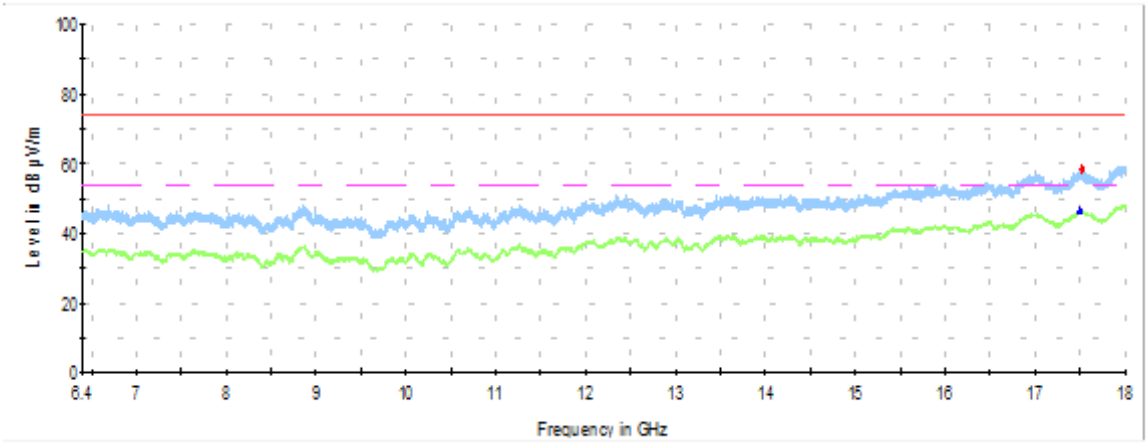
Radiated Spurious – 1 GHz to 18GHz
802.11b, 1Mbps, Chain B

Radiated Spurious – Ch1





Peak measurements Avg measurements Limit FCC Peak Limit FCC Avg

Frequency	Max Peak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
4823	54.2	-	74	19.8
4823	-	44.5	54	9.5
17502	58.3	-	74	15.7
17531	-	46.4	54	7.6

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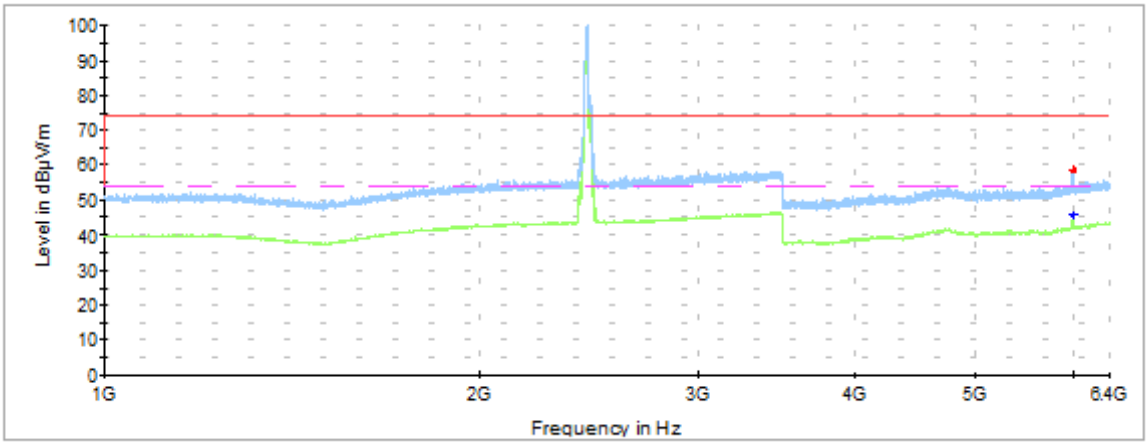
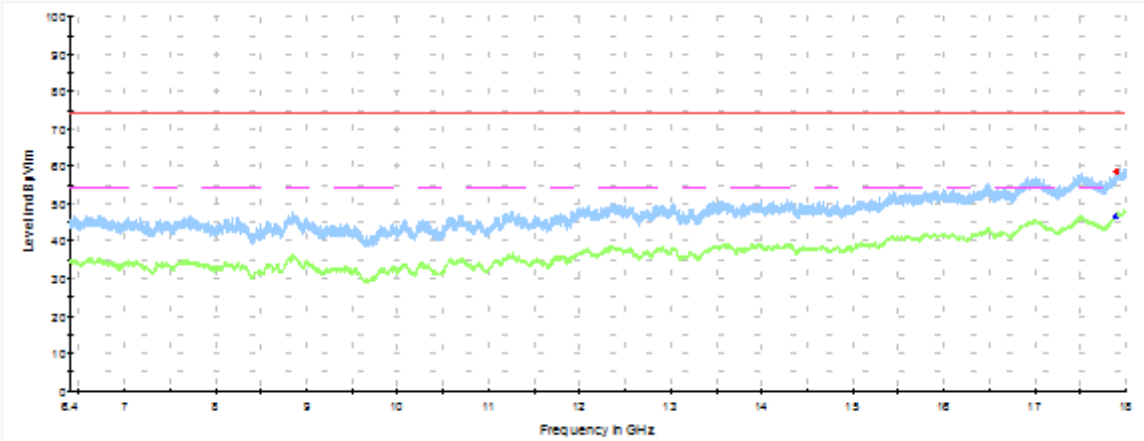
Radiated Spurious – Ch7





Peak measurements Avg measurements Limit FCC Peak Limit FCC Avg

Frequency	Max Peak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
5998	53.3	-	74	20.7
5998	-	41.9	54	12.1
17888	58.6	-	74	15.4
17901	-	46.4	54	7.6

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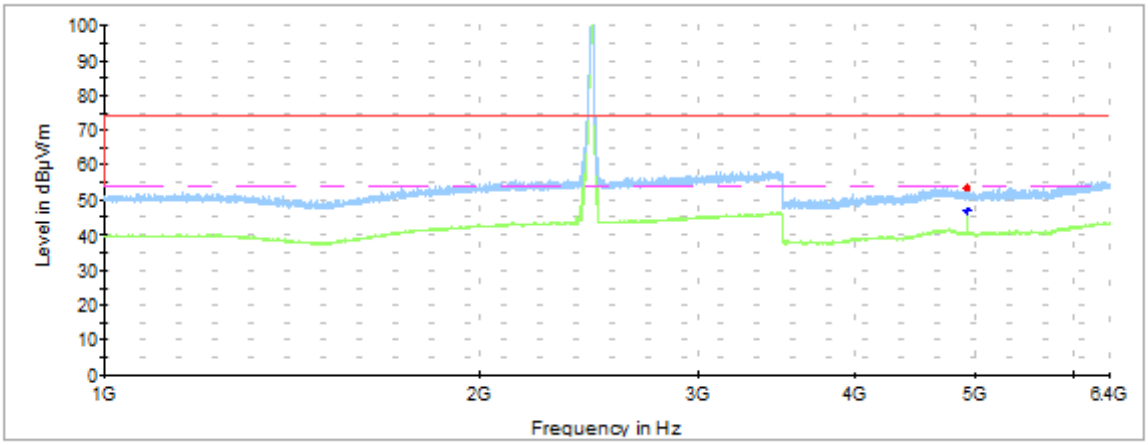
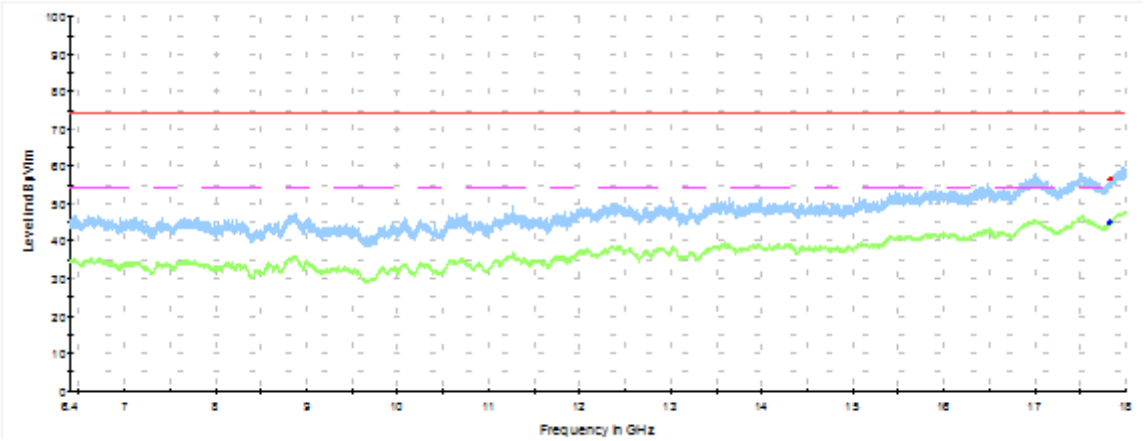
Radiated Spurious – Ch11





Peak measurements Avg measurements Limit FCC Peak Limit FCC Avg

Frequency	Max Peak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
4923	55.2	-	74	18.8
4923	-	48.9	54	5.1
17818	56.6	-	74	17.4
17824	-	45.0	54	9.0

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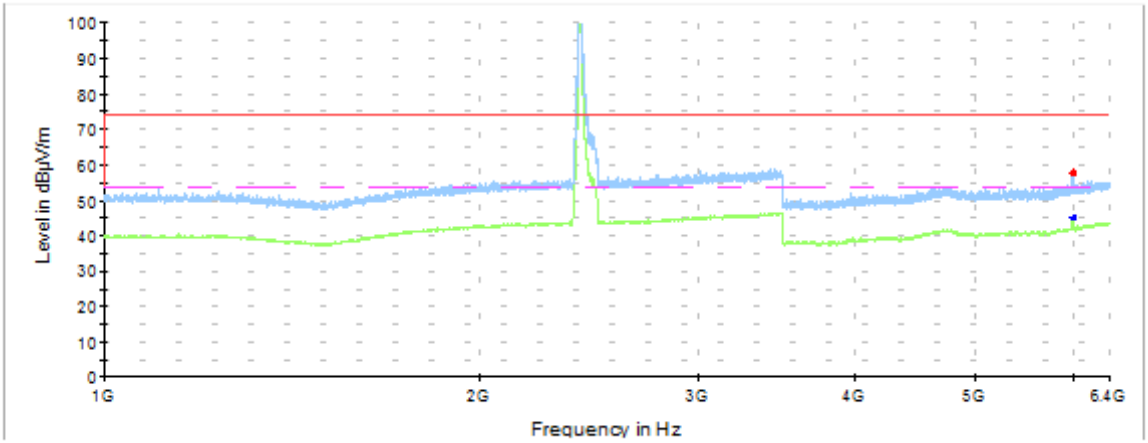
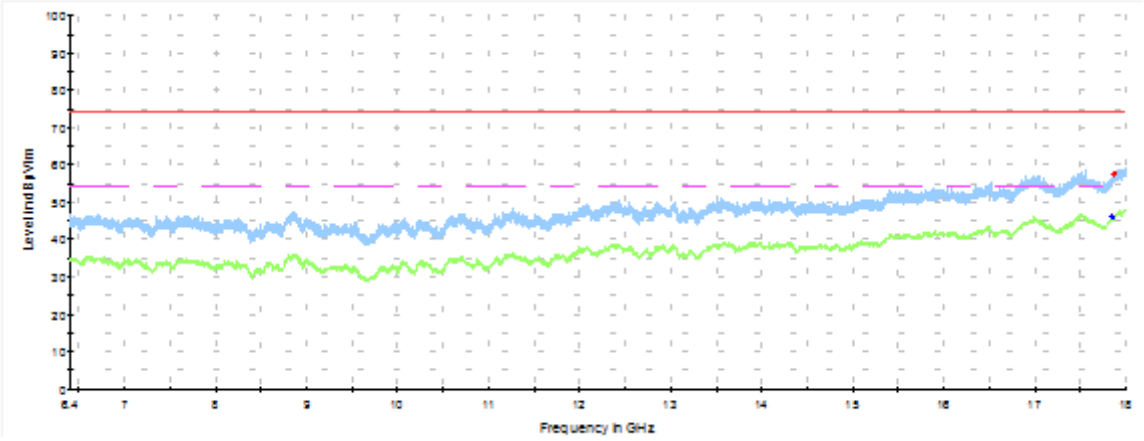
Radiated Spurious – 1 GHz to 18GHz
802.11g, 6Mbps, Chain A

Radiated Spurious – Ch1





Peak measurements Avg measurements Limit FCC Peak Limit FCC Avg

Frequency	Max Peak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
5994	53.9	-	74	20.1
5990	-	42.4	54	11.6
17856	57.6	-	74	16.4
17856	-	46.0	54	8.0

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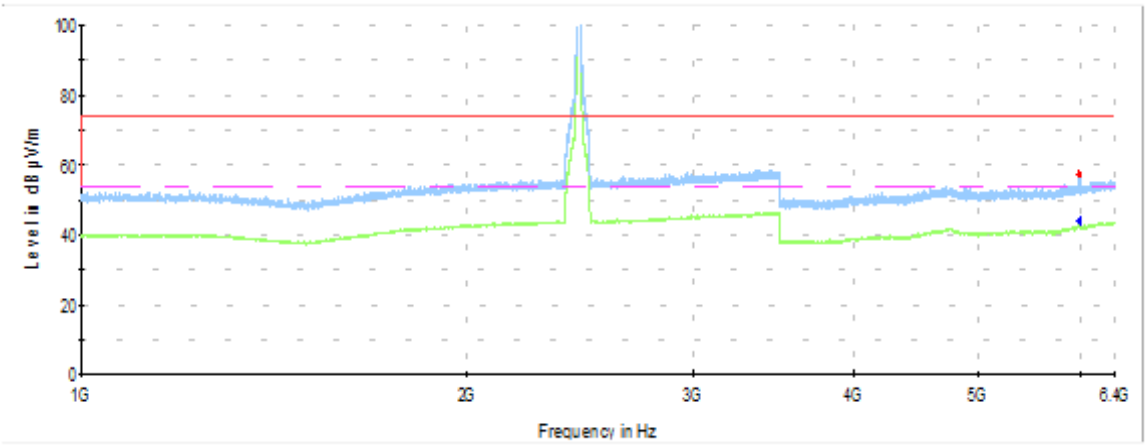
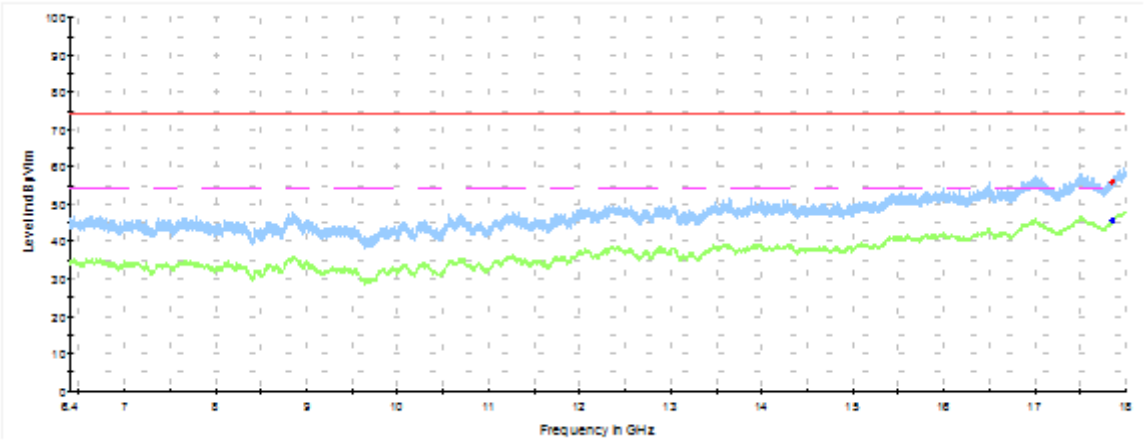
Radiated Spurious – Ch7





Peak measurements Avg measurements Limit FCC Peak Limit FCC Avg

Frequency	Max Peak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
5991	57.4	-	74	16.6
5991	-	44.1	54	9.9
17856	56.0	-	74	18.0
17863	-	45.8	54	8.3

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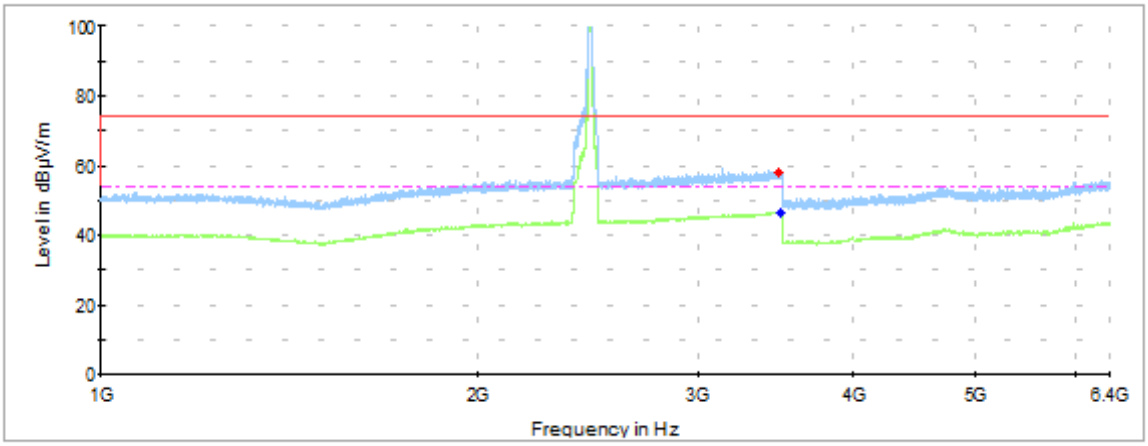
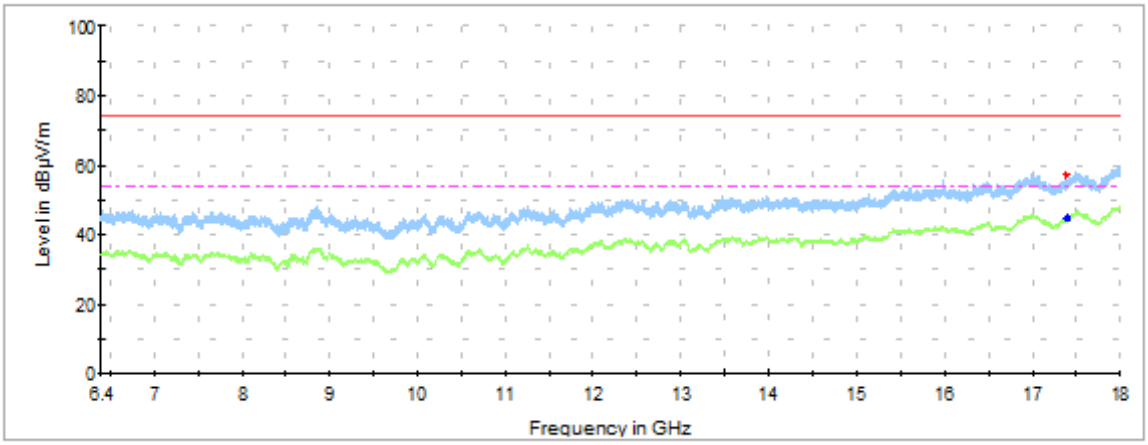
Radiated Spurious – Ch11





Peak measurements Avg measurements Limit FCC Peak Limit FCC Avg

Frequency	Max Peak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
3484	57.8	-	74	16.2
3484	-	46.2	54	7.8
17400	57.3	-	74	16.7
17400	-	44.5	54	9.5

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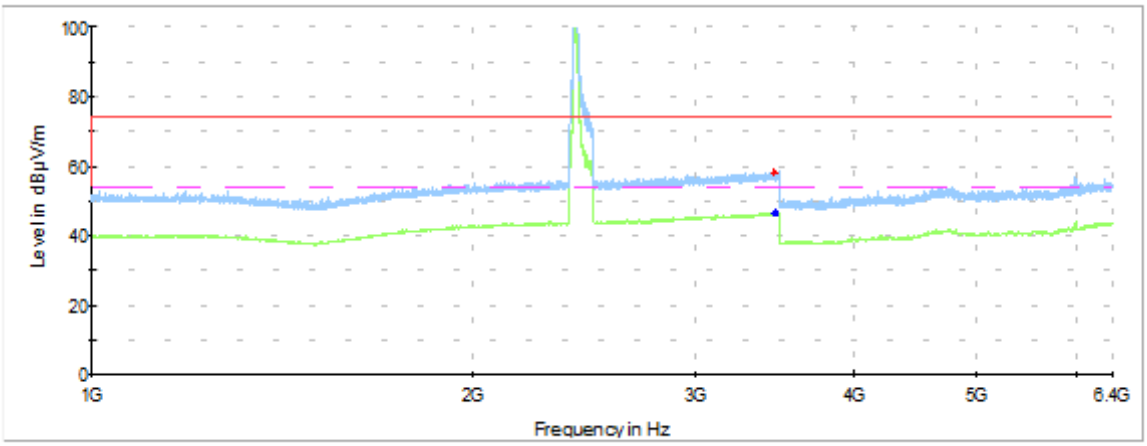
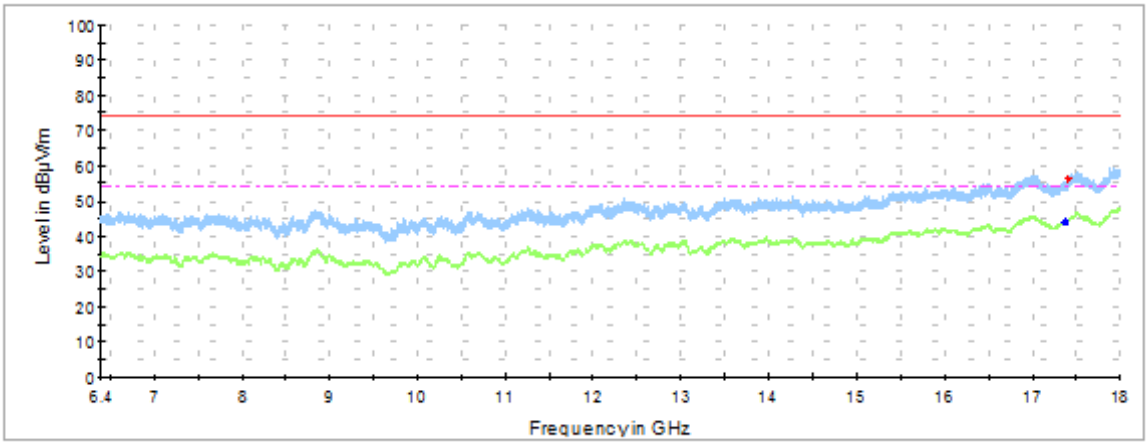
Radiated Spurious – 1 GHz to 18 GHz
802.11g, 6Mbps, Chain B

Radiated Spurious – Ch1





Peak measurements Avg measurements Limit FCC Peak Limit FCC Avg

Frequency	Max Peak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
3461	58.1	-	74	15.9
3461	-	46.4	54	7.6
17374	56.1	-	74	17.9
17414	-	44.0	54	10.0

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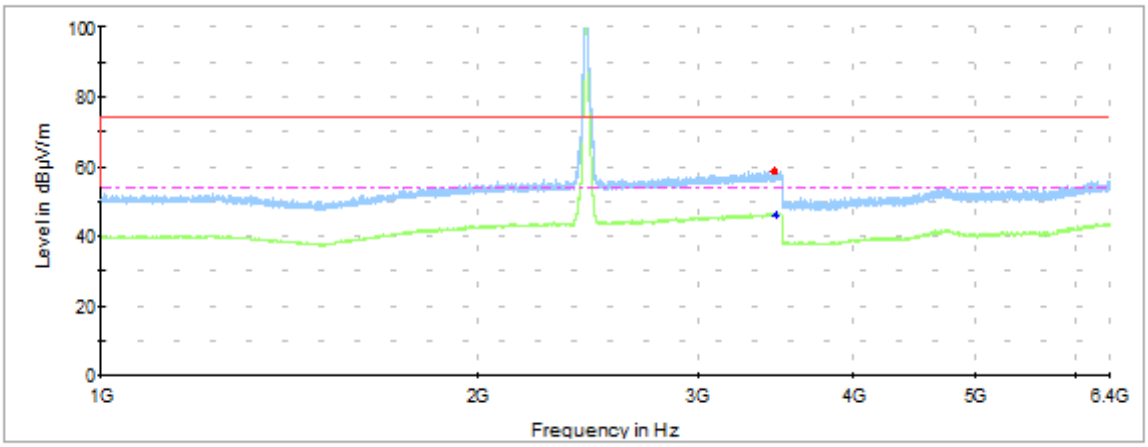
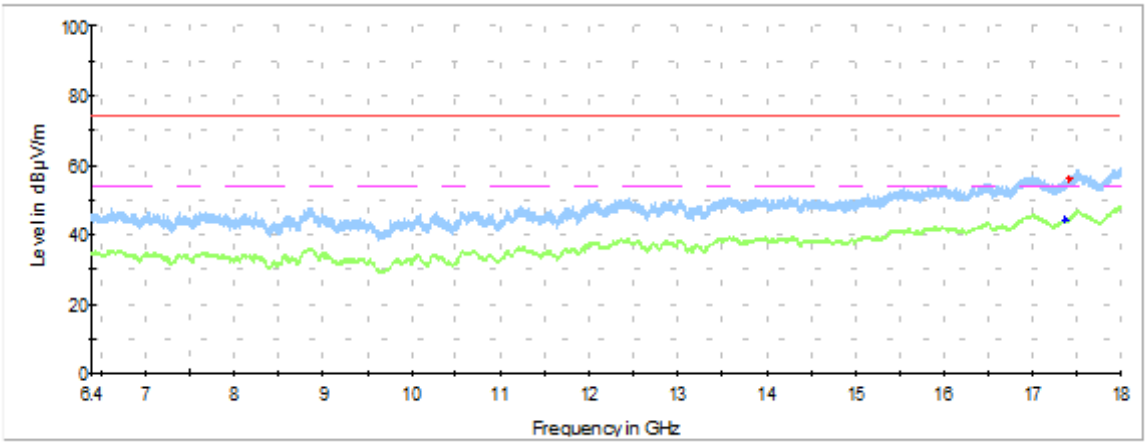
Radiated Spurious – Ch7





Peak measurements Avg measurements Limit FCC Peak Limit FCC Avg

Frequency	Max Peak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
3457	58.4		74	15.6
3460	-	46.1	54	7.9
17365	56.1	-	74	17.9
17410	-	44.2	54	9.8

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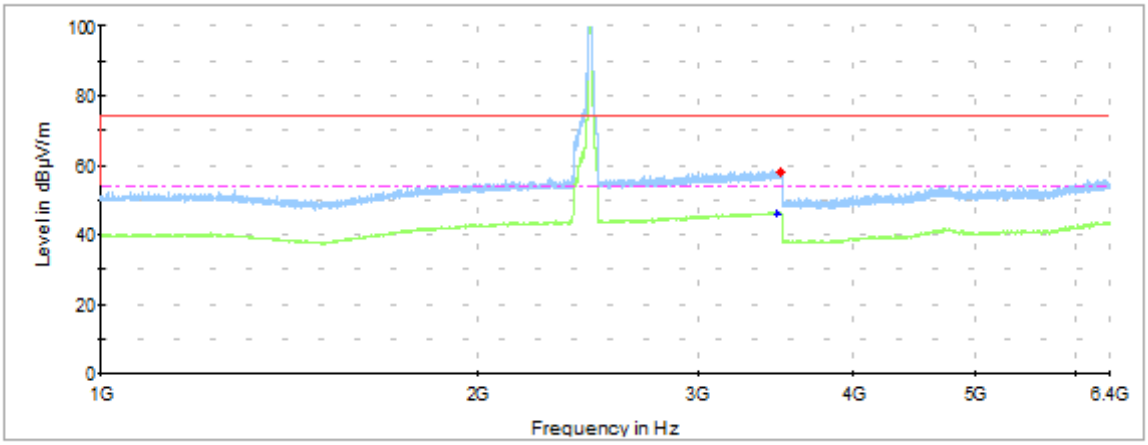
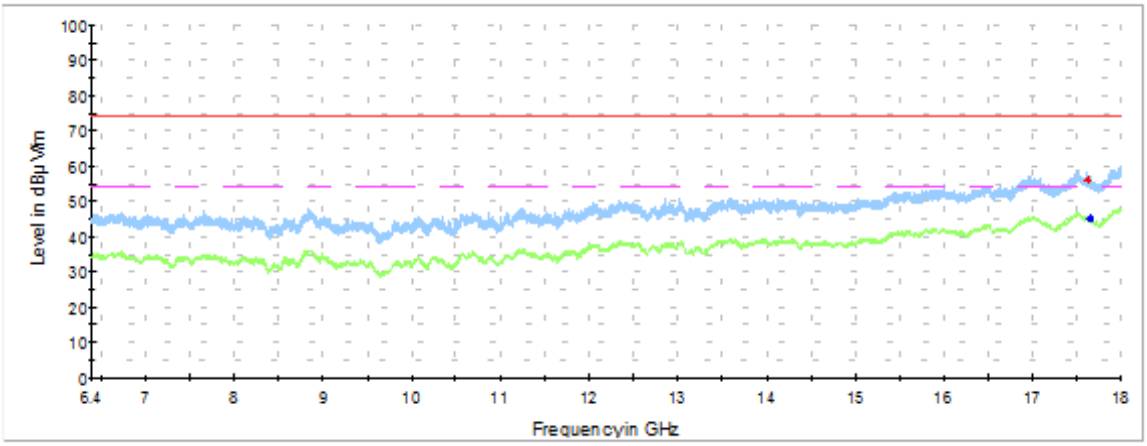
Radiated Spurious – Ch11





Peak measurements Avg measurements Limit FCC Peak Limit FCC Avg

Frequency	Max Peak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
3469	57.8	-	74	16.2
3493	-	46.0	54	8.0
17620	56.1	-	74	17.9
17646	-	45.0	54	9.0

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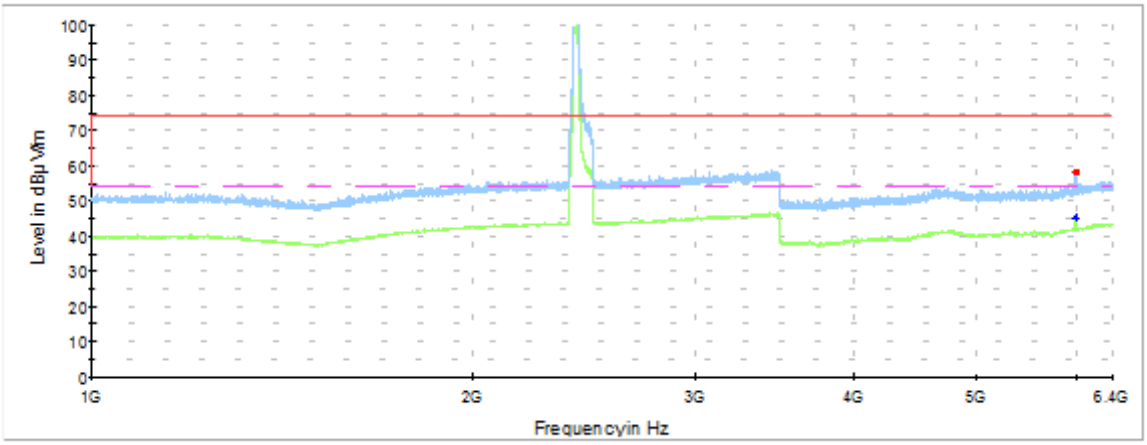
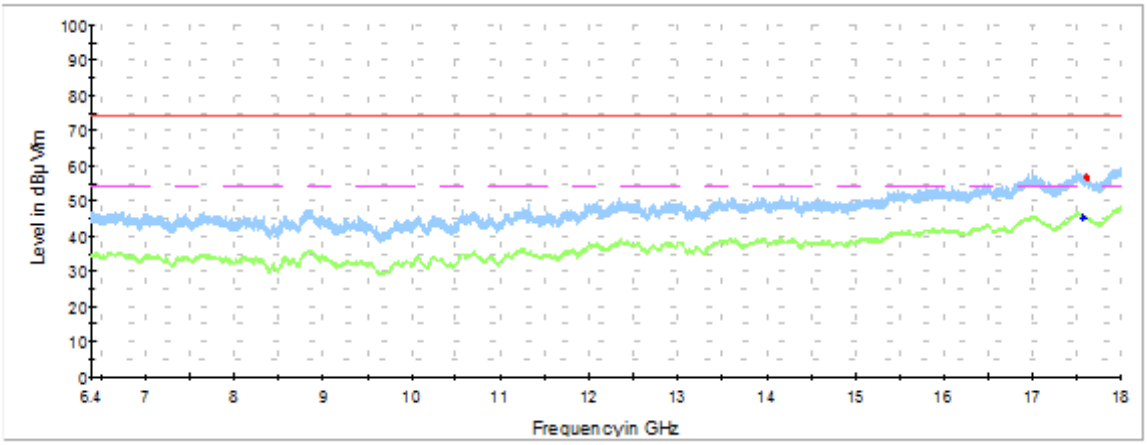
Radiated Spurious – 1 GHz to 18GHz
802.11n20, HT0, Chain A

Radiated Spurious – Ch1





Peak measurements Avg measurements Limit FCC Peak Limit FCC Avg

Frequency	Max Peak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
5993	58.0	-	74	16.0
5997	-	45.2	54	8.8
17563	56.7	-	74	17.3
17610	-	45.4	54	8.6

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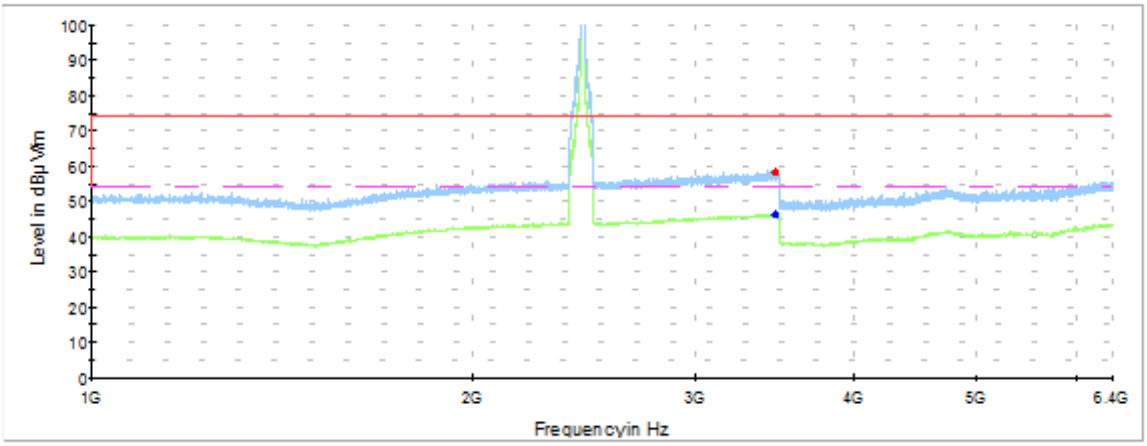
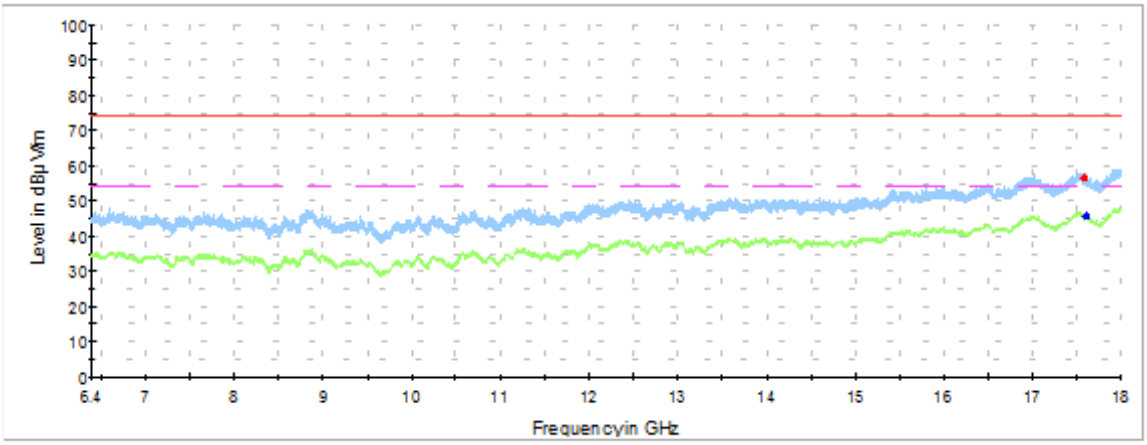
Radiated Spurious – Ch7





Peak measurements Avg measurements Limit FCC Peak Limit FCC Avg

Frequency	Max Peak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
3466	58.2	-	74	15.8
3468	-	46.1	54	7.9
17590	56.5	-	74	17.5
17590	-	45.7	54	8.3

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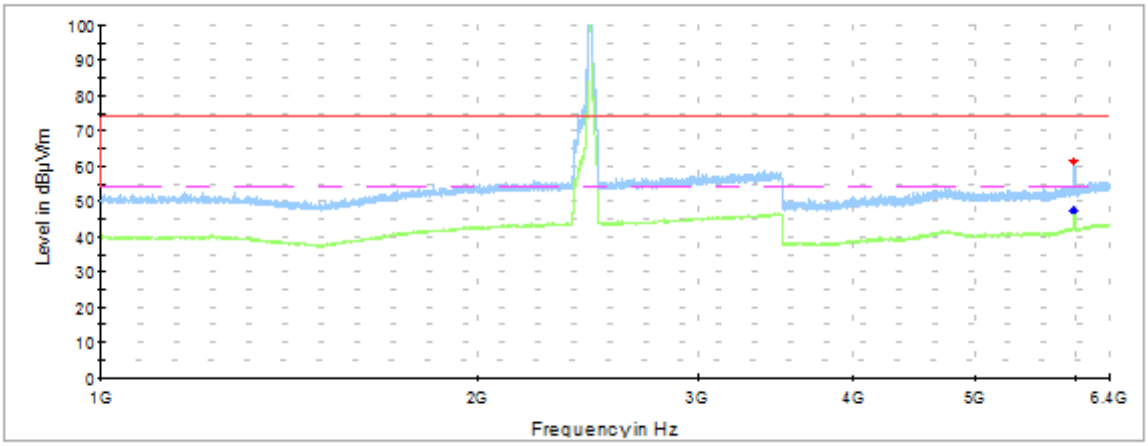
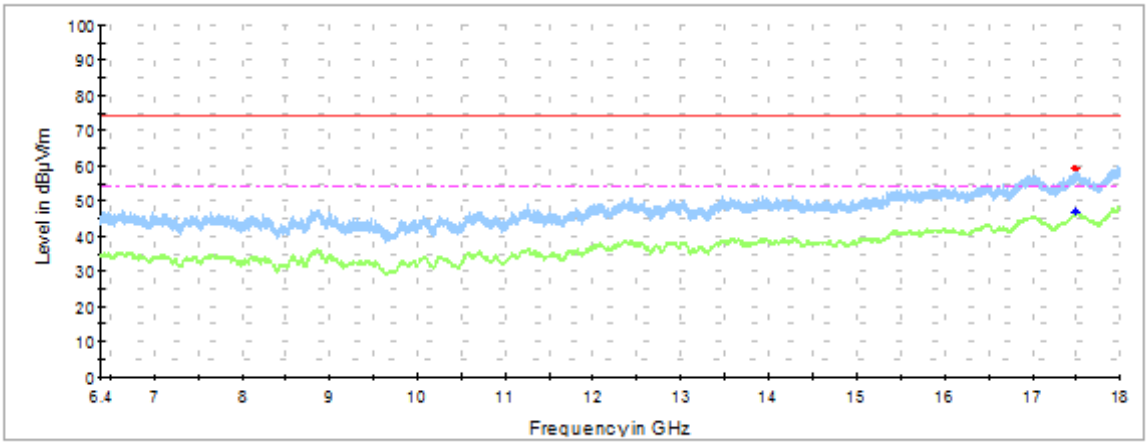
Radiated Spurious – Ch11





Peak measurements Avg measurements Limit FCC Peak Limit FCC Avg

Frequency	Max Peak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
5988	53.7	-	74	20.3
5988	-	42.2	54	11.8
17500	59.2	-	74	14.8
17500	-	46.9	54	7.1

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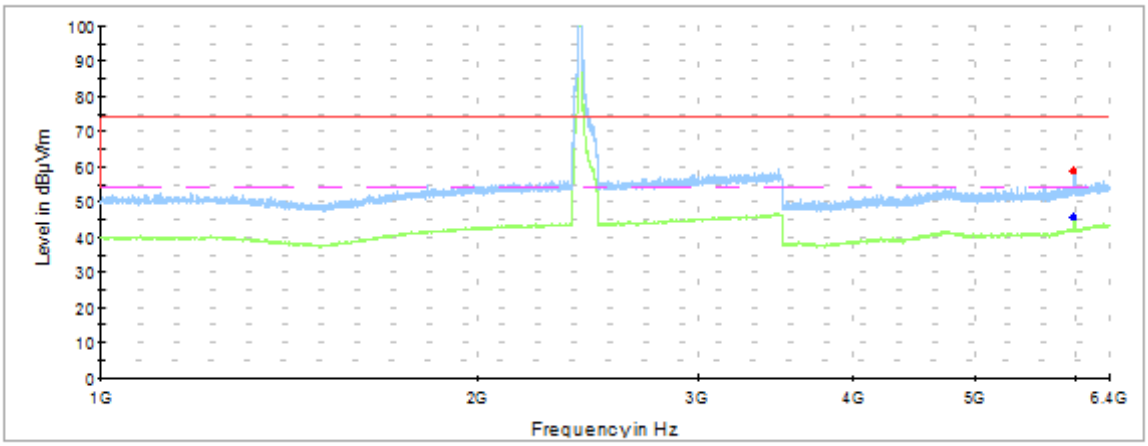
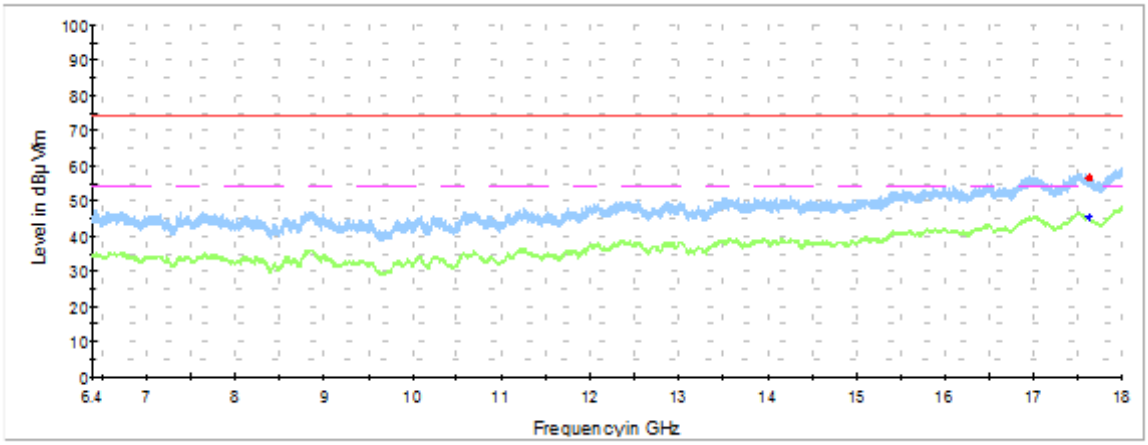
Radiated Spurious – 1 GHz to 18GHz
802.11n20, HT0, Chain B

Radiated Spurious – Ch1





Peak measurements Avg measurements Limit FCC Peak Limit FCC Avg

Frequency	Max Peak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
5995	53.3	-	74	20.7
5995	-	49.9	54	4.1
17618	56.5	-	74	17.5
17631	-	45.7	54	8.3

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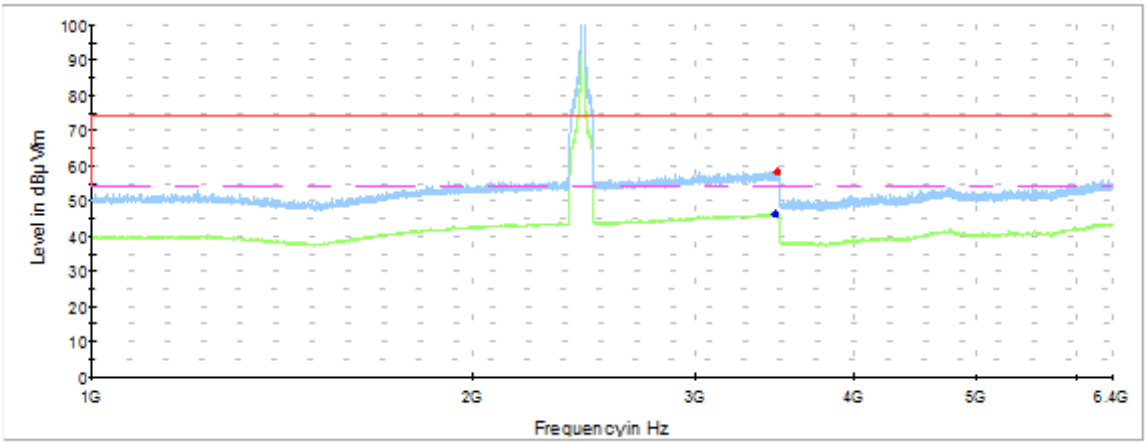
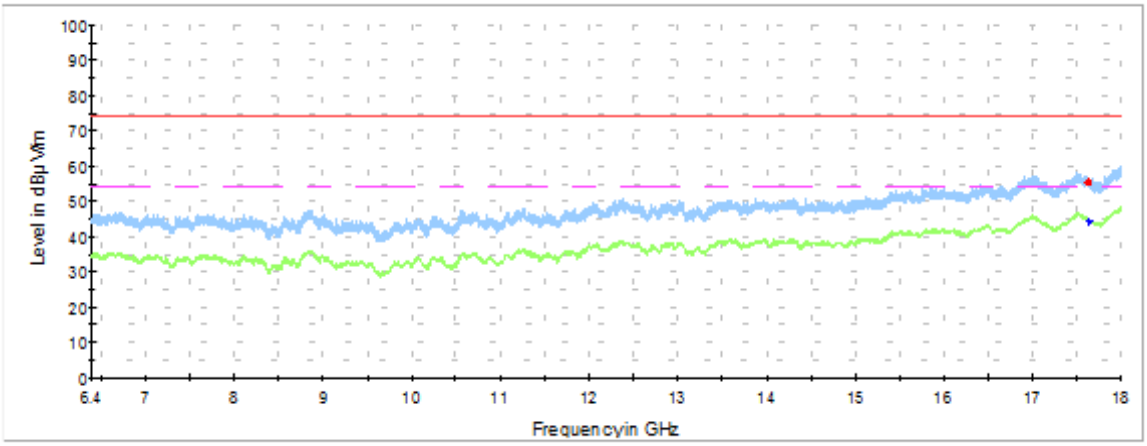
Radiated Spurious – Ch7





Peak measurements Avg measurements Limit FCC Peak Limit FCC Avg

Frequency	Max Peak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
3469	58.1	-	74	15.9
3469	-	46.1	54	7.9
17628	55.3	-	74	18.7
17628	-	44.1	54	9.9

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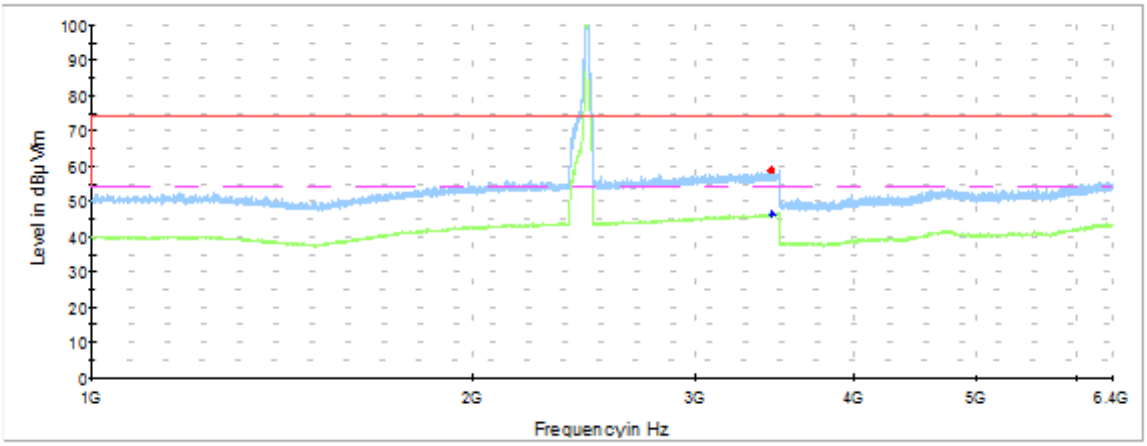
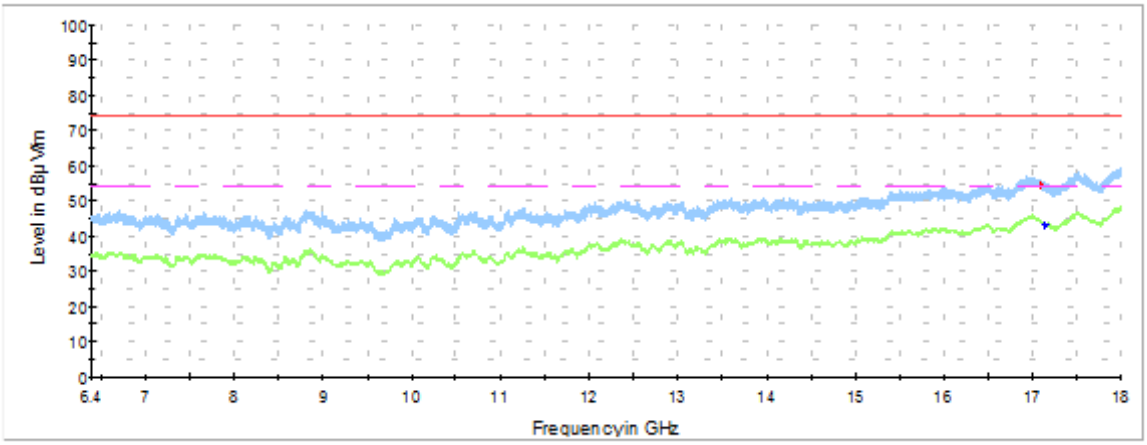
Radiated Spurious – Ch11





Peak measurements Avg measurements Limit FCC Peak Limit FCC Avg

Frequency	Max Peak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
3443	58.6	-	74	15.4
3453	-	46.3	54	7.7
17098	54.4	-	74	19.6
17135	-	43.0	54	11.0

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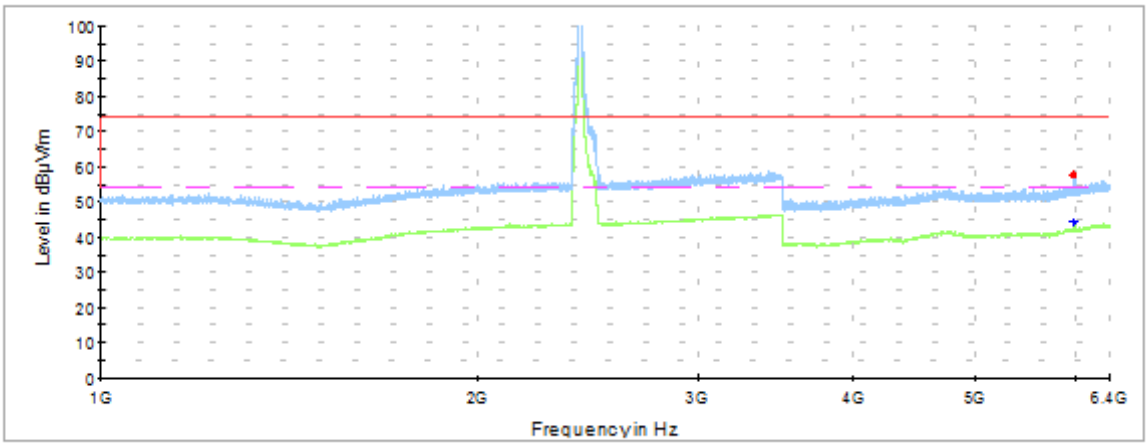
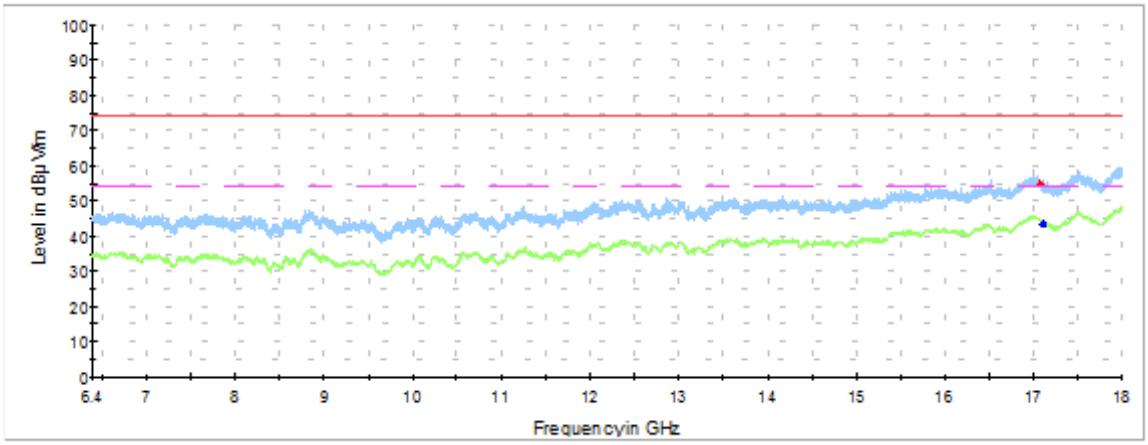
Radiated Spurious – 1 GHz to 18GHz
802.11n20, HT8 Chain A+B

Radiated Spurious – Ch1





Peak measurements Avg measurements Limit FCC Peak Limit FCC Avg

Frequency	Max Peak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
5995	54.0	-	74	20.0
5995	-	42.1	54	11.9
17107	55.1	-	74	18.9
17070	-	43.5	54	10.5

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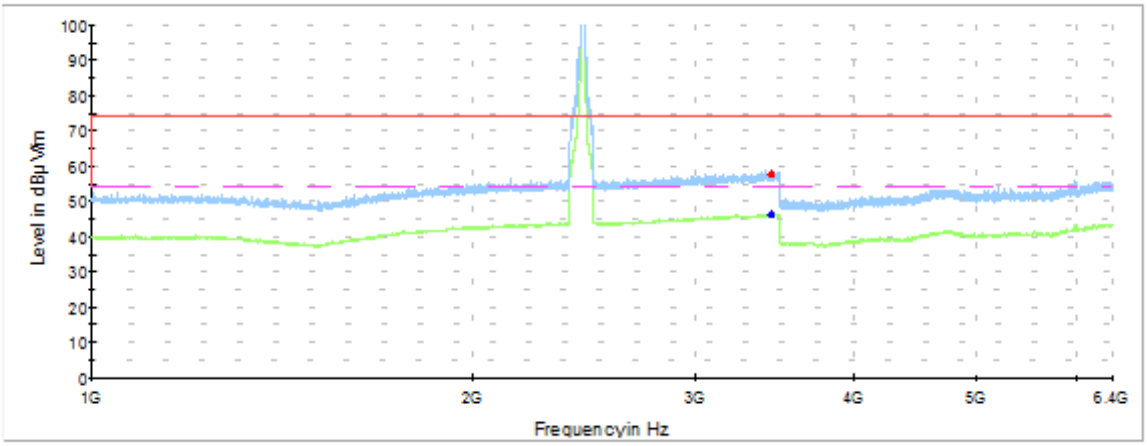
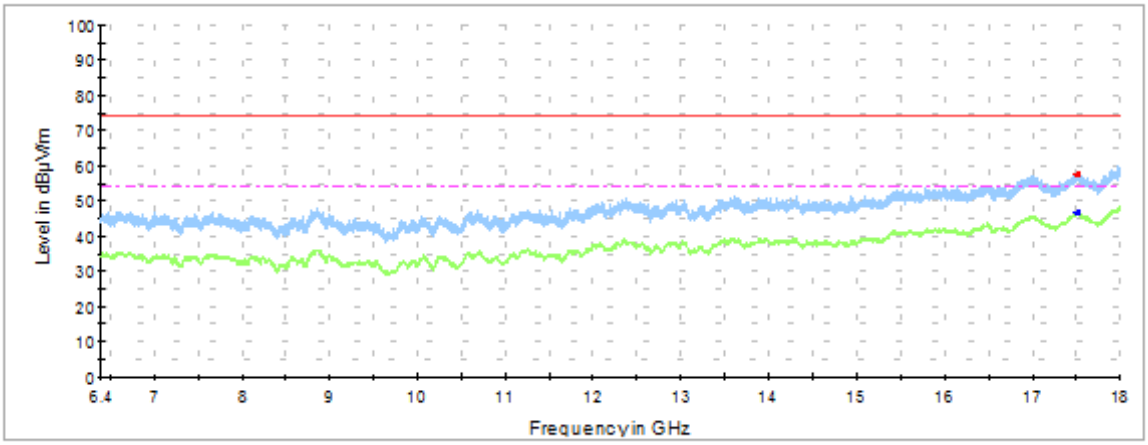
Radiated Spurious – Ch7





Peak measurements Avg measurements Limit FCC Peak Limit FCC Avg

Frequency	Max Peak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
3444	57.5	-	74	16.5
3445	-	46.1	54	7.9
17507	57.4	-	74	16.6
17509	-	46.8	54	7.2

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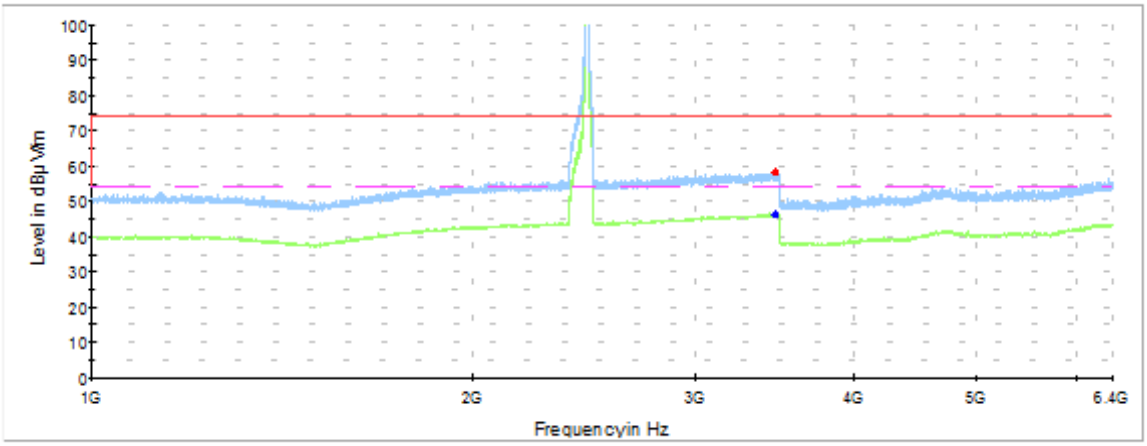
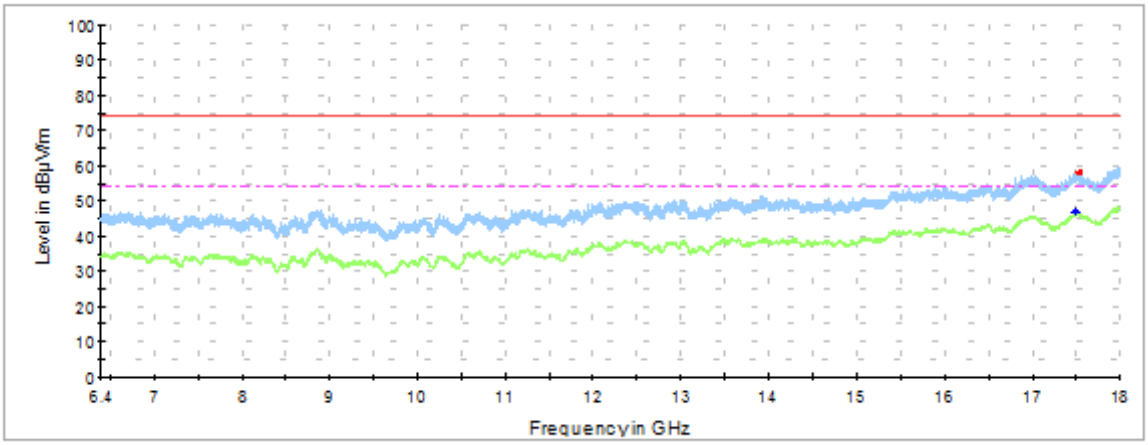
Radiated Spurious – Ch11





Peak measurements Avg measurements Limit FCC Peak Limit FCC Avg

Frequency	Max Peak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
3468	58.4	-	74	15.6
3468	-	46.2	54	7.8
17495	58.1	-	74	15.9
17533	-	46.8	54	7.2

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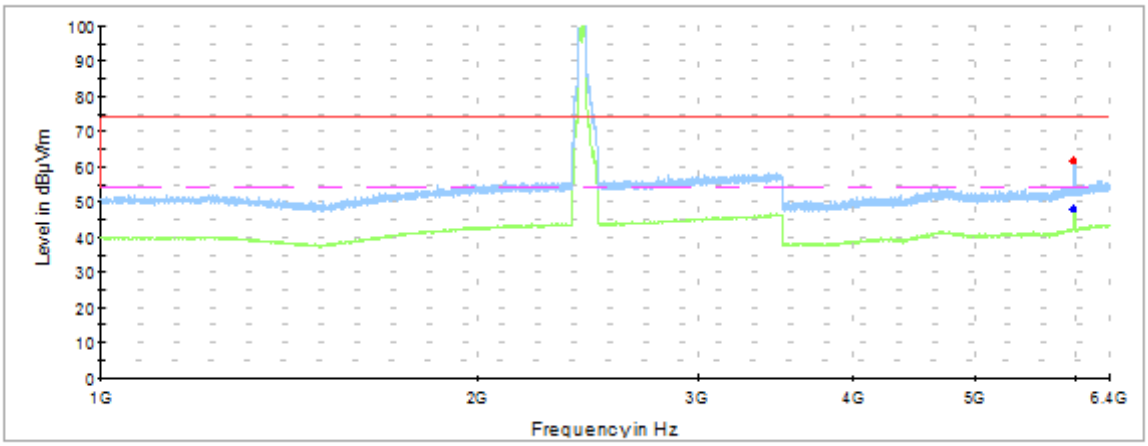
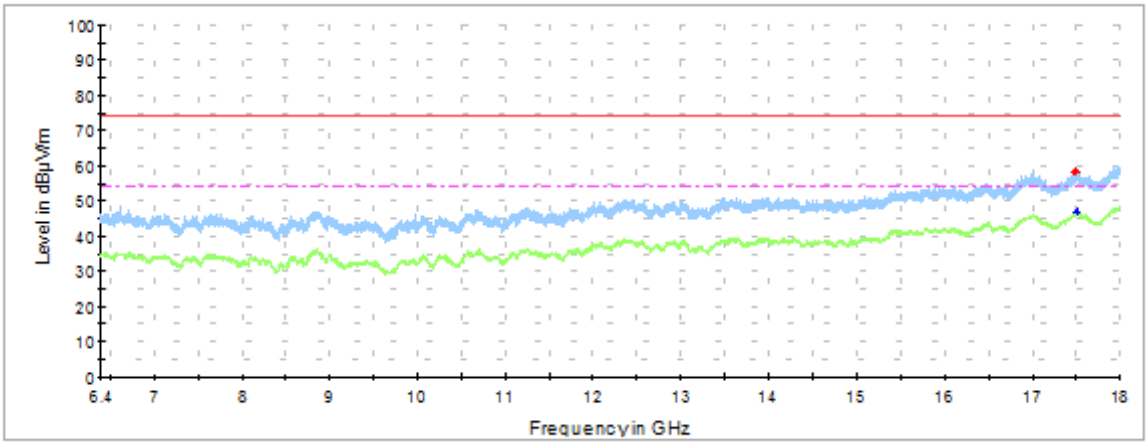
Radiated Spurious – 1 GHz to 18GHz
802.11n40, HT0, Chain A

Radiated Spurious – Ch3F





Peak measurements Avg measurements Limit FCC Peak Limit FCC Avg

Frequency	Max Peak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
5989	53.7	-	74	20.3
5992	-	42.6	54	11.4
17493	58.3	-	74	15.7
17510	-	46.9	54	7.1

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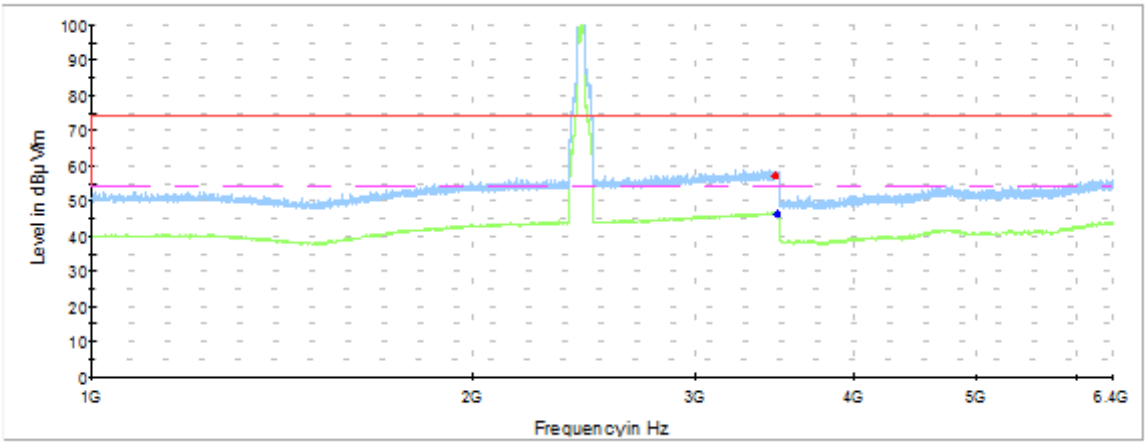
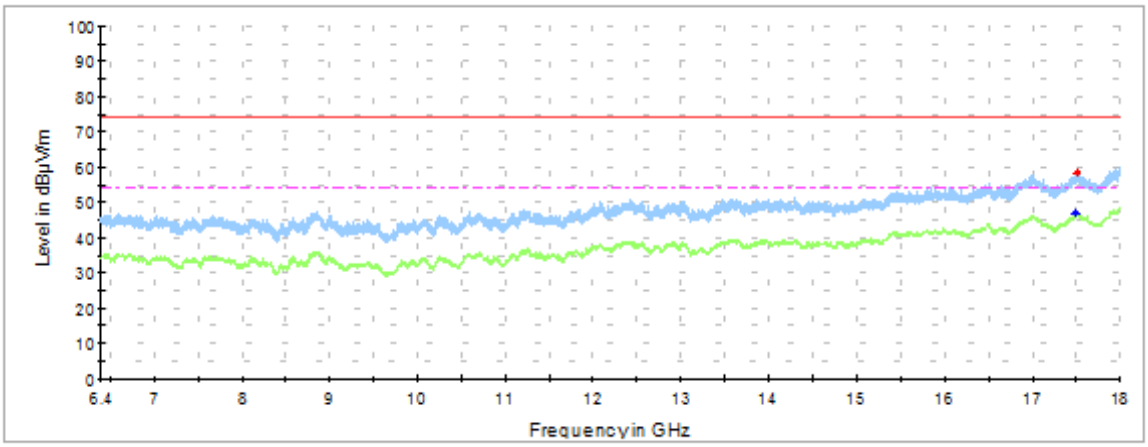
Radiated Spurious – Ch6F





Peak measurements Avg measurements Limit FCC Peak Limit FCC Avg

Frequency	Max Peak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
3468	57.2	-	74	16.8
3468	-	46.2	54	7.8
17500	58.4	-	74	15.6
17500	-	47.0	54	7.0

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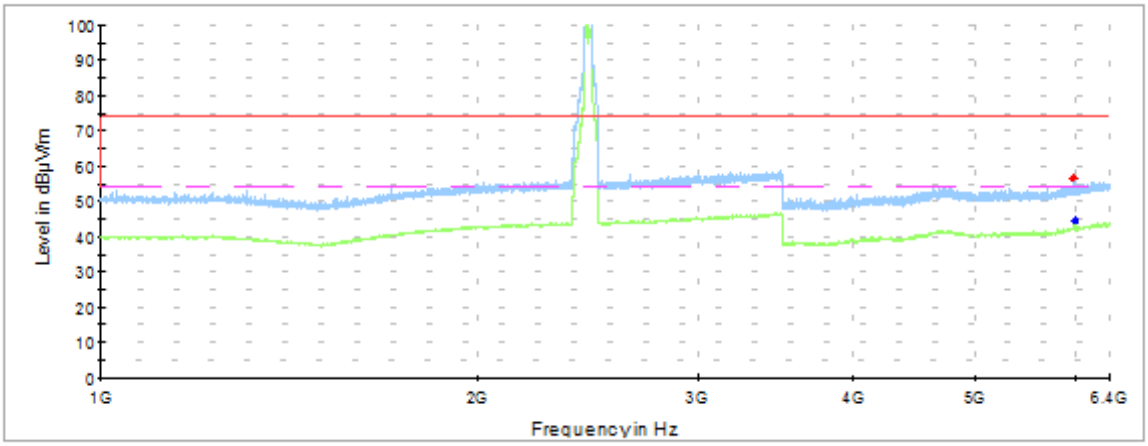
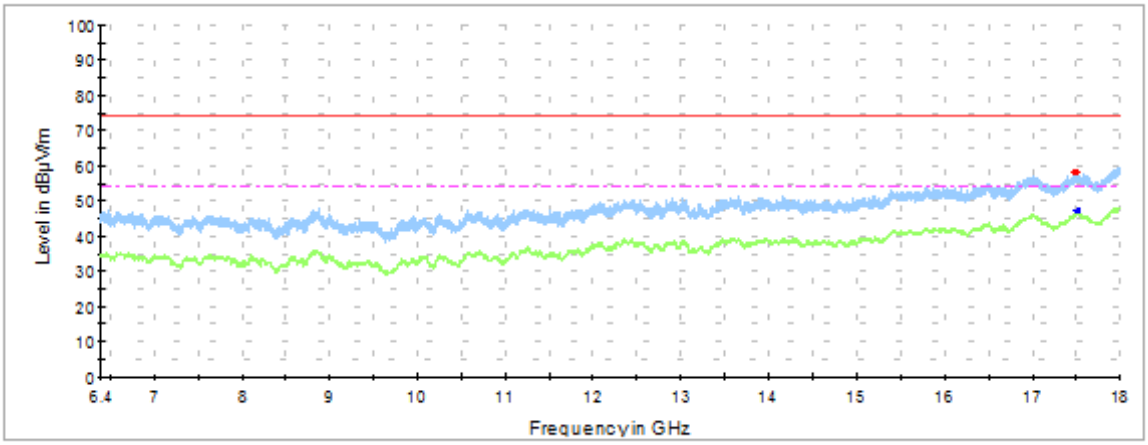
Radiated Spurious – Ch9F





Peak measurements Avg measurements Limit FCC Peak Limit FCC Avg

Frequency	Max Peak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
5995	53.4	-	74	20.6
5998	-	42.2	54	11.8
17491	58.1	-	74	15.9
17511	-	47.0	54	7.0

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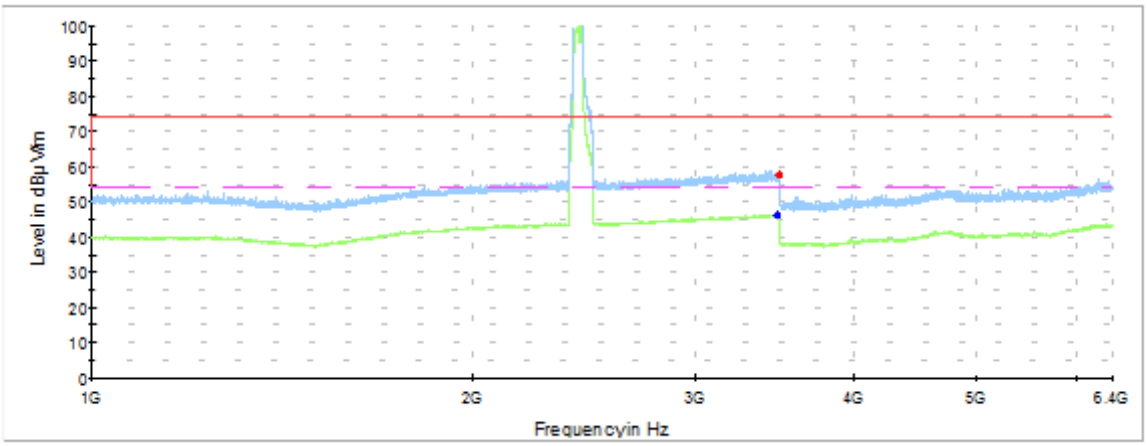
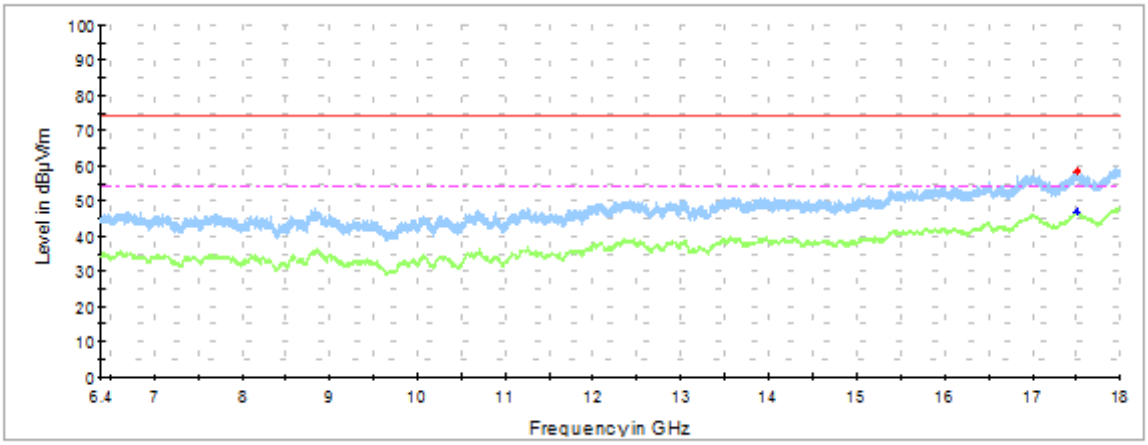
Radiated Spurious – 1 GHz to 18GHz
802.11n40, HT0, Chain B

Radiated Spurious – Ch3F





Peak measurements Avg measurements Limit FCC Peak Limit FCC Avg

Frequency	Max Peak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
3482	57.7	-	74	16.3
3482	-	46.0	54	8.0
17508	58.4	-	74	15.6
17512	-	47.0	54	7.0

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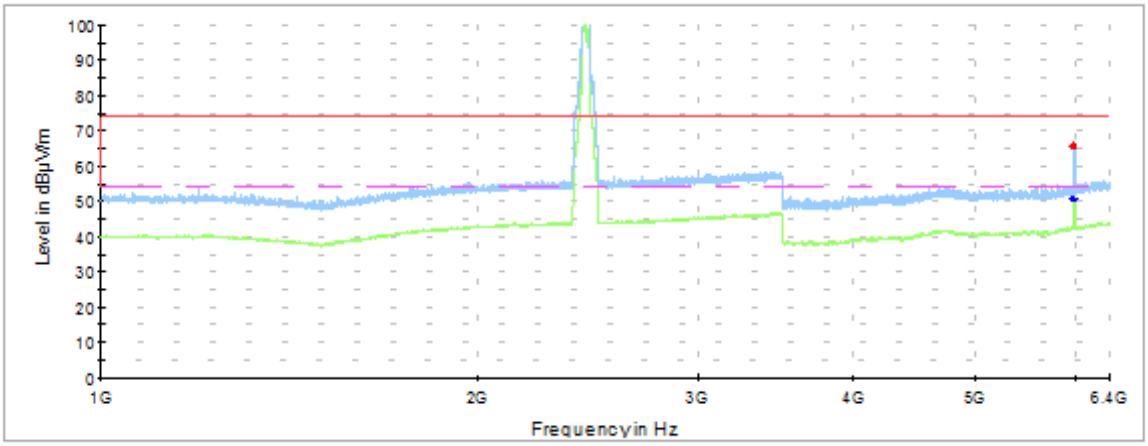
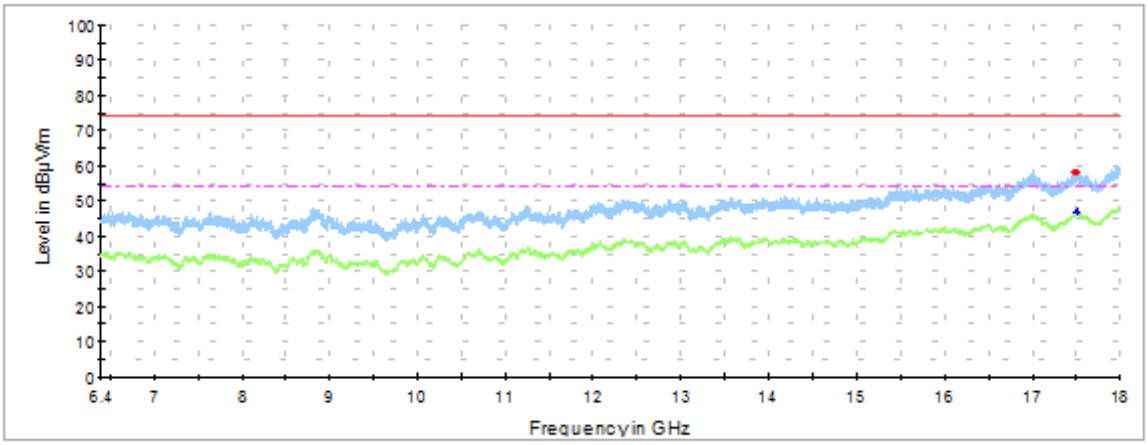
Radiated Spurious – Ch6F





Peak measurements Avg measurements Limit FCC Peak Limit FCC Avg

Frequency	Max Peak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
5991	59.6	-	74	14.4
5996	-	42.4	54	11.6
17497	58.0	-	74	16.0
17505	-	46.9	54	7.1

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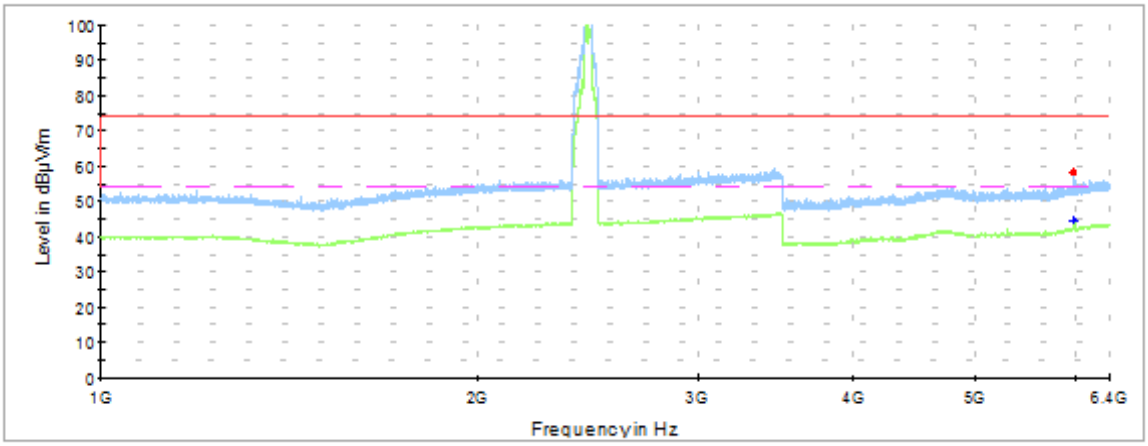
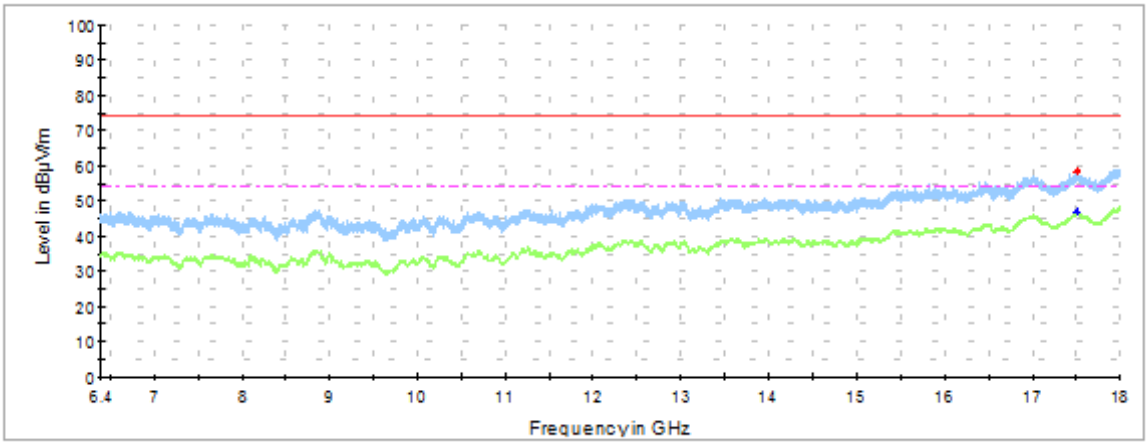
Radiated Spurious – Ch9F





Peak measurements Avg measurements Limit FCC Peak Limit FCC Avg

Frequency	Max Peak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
5994	54.5	-	74	19.5
5994	-	42.2	54	11.8
17508	58.4	-	74	15.6
17510	-	46.9	54	7.1

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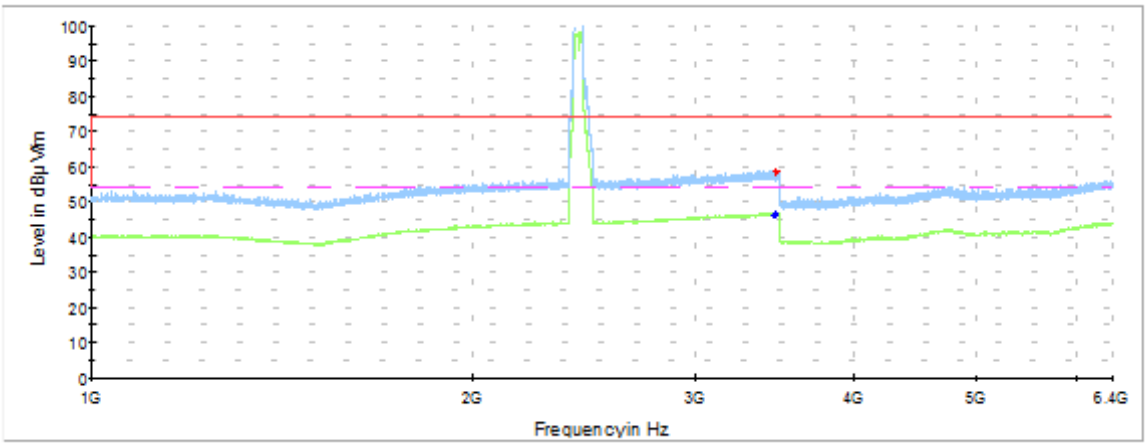
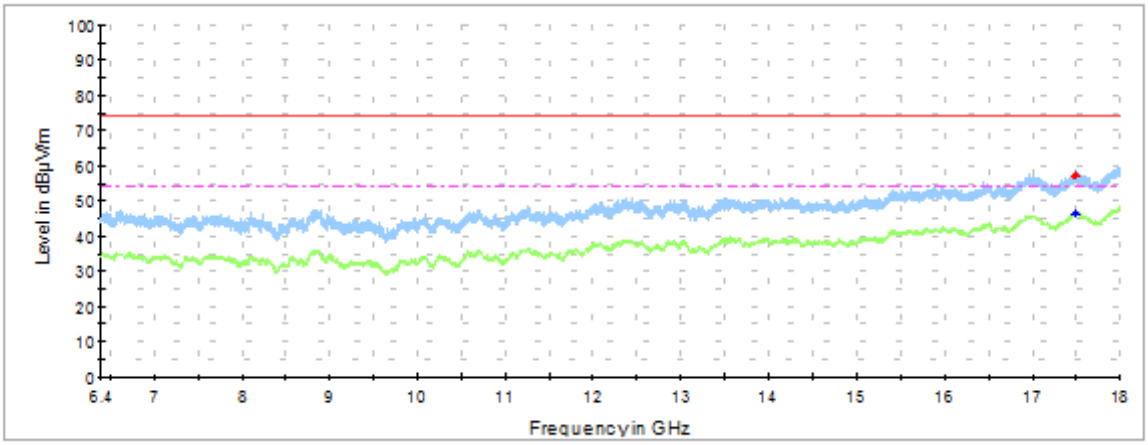
Radiated Spurious – 1 GHz to 18GHz
802.11n40, HT8, Chain A+B

Radiated Spurious – Ch3F





Peak measurements Avg measurements Limit FCC Peak Limit FCC Avg

Frequency	Max Peak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
3468	58.6	-	74	15.4
3476	-	46.5	54	7.5
17498	57.1	-	74	16.9
17501	-	46.4	54	7.6

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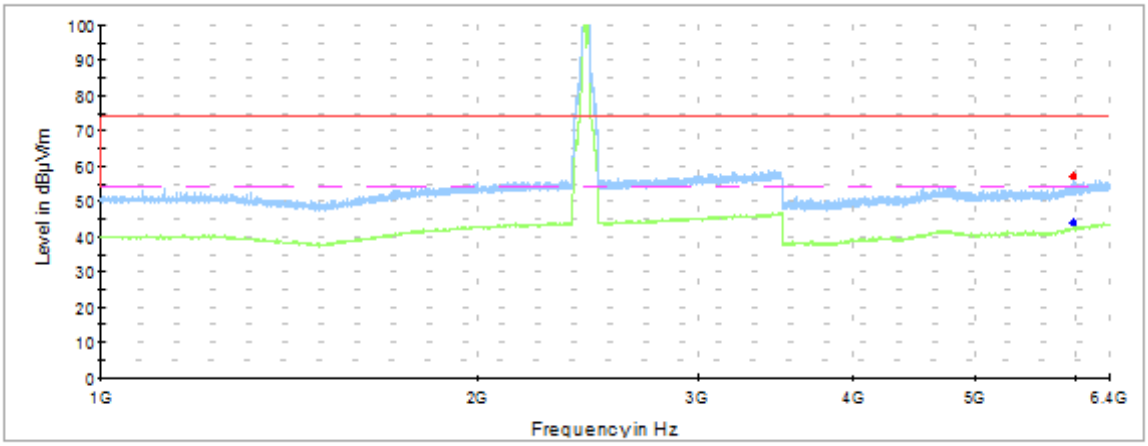
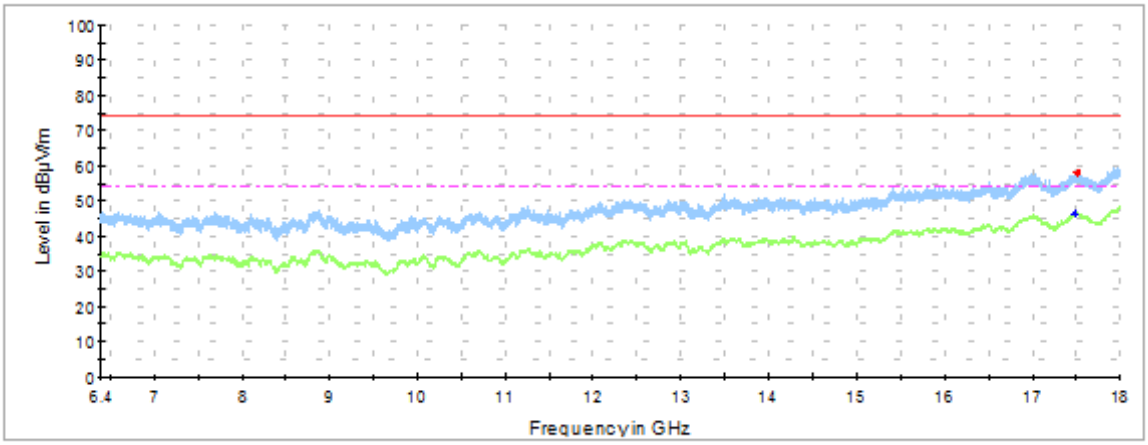
Radiated Spurious – Ch6F





Peak measurements Avg measurements Limit FCC Peak Limit FCC Avg

Frequency	Max Peak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
5992	53.9	-	74	20.1
5992	-	42.3	54	11.7
17487	57.9	-	74	16.1
17508	-	46.5	54	7.5

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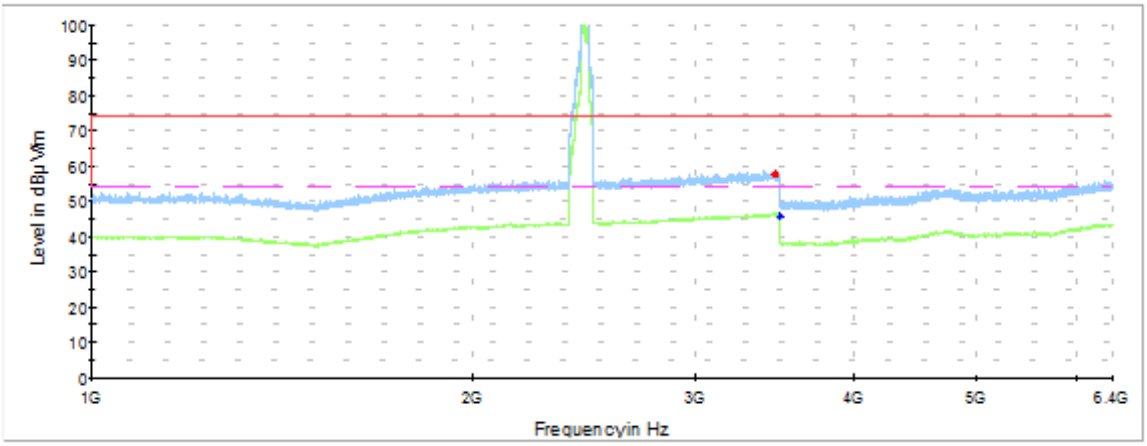
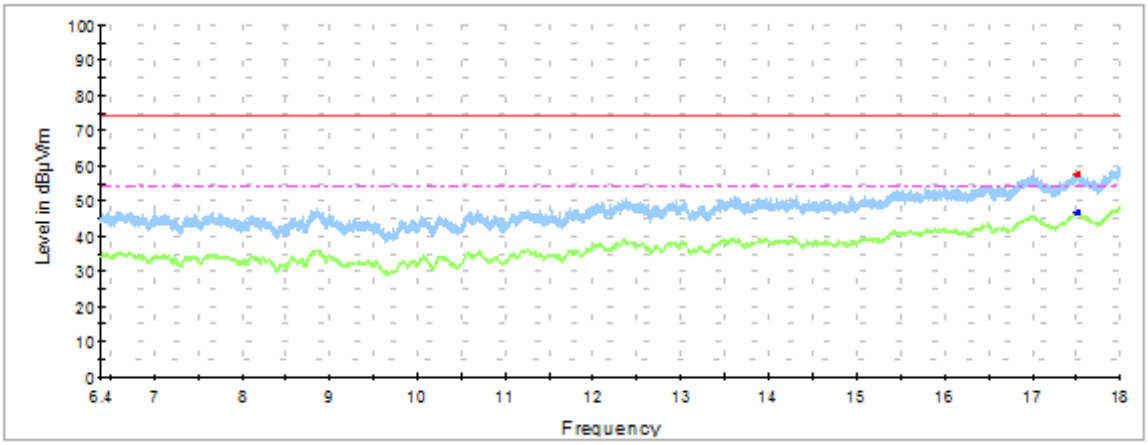
Radiated Spurious – Ch9F





Peak measurements Avg measurements Limit FCC Peak Limit FCC Avg

Frequency	Max Peak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
3468	57.5	-	74	16.5
3468	-	46.0	54	8.0
17507	57.4	-	74	16.6
17509	-	46.8	54	7.2

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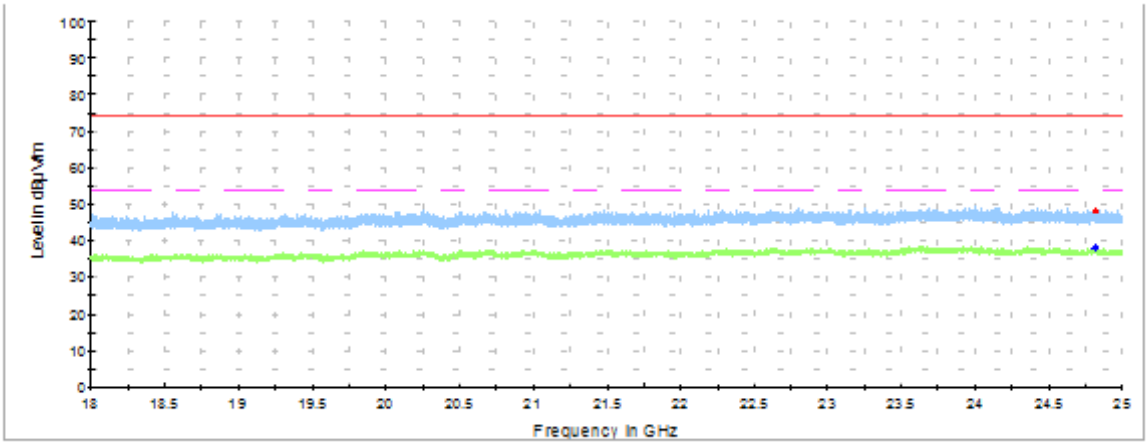
Radiated Spurious – 18 GHz – 25 GHz

Radiated Spurious – All Modes



Frequency	Max Peak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
24811	48.2	-	74	25.8
24811	-	38.0	54	16.0

Note 1: The spurious signals detected do not depend on either the operating channel or the modulation mode.

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Annex C. Test Results BLE

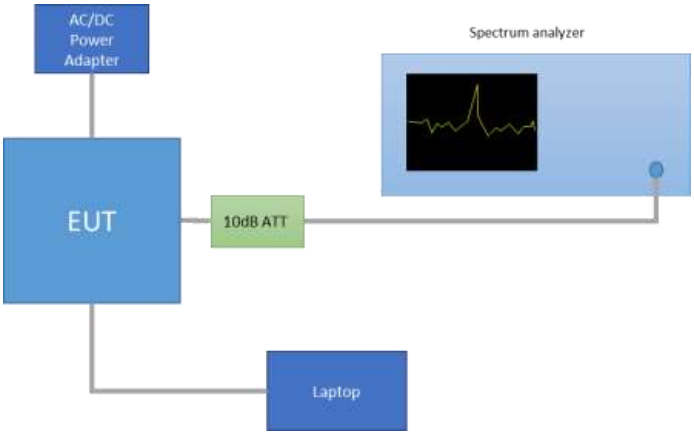
C.1 6dB & 99% Bandwidth

Test limits:

FCC part	RSS part	Limits
15.247 (a) (2)	RSS-247 Clause 5.2 (1)	Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

Test procedure:

The setup below was used to measure the 6dB & 99% Bandwidth. The antenna terminal of the EUT is connected to the spectrum through an attenuator, and the spectrum analyzer reading is compensated to include the RF path loss.



Results tables:

Mode	Channel	Frequency [MHz]	6dB BW [MHz]	99% BW [MHz]
BLE	0	2402	0.650	1.14
	19	2440	0.662	1.13
	39	2480	0.668	1.14

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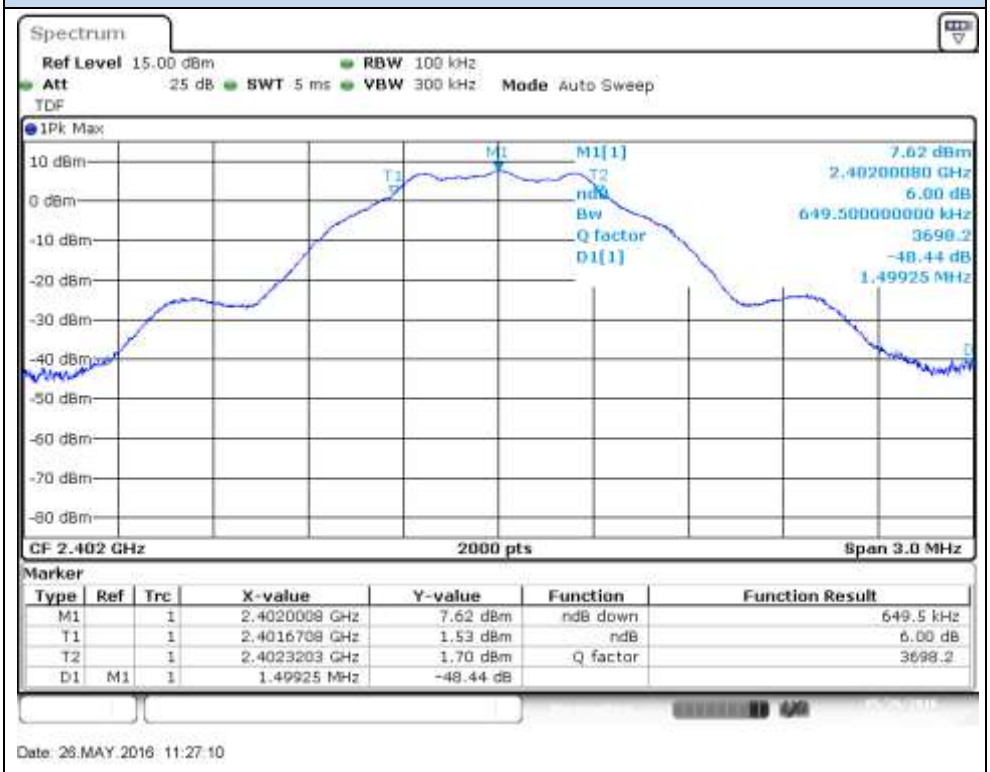
Results screenshot:

BLE

6dB BW – CH0



99% BW – CH0

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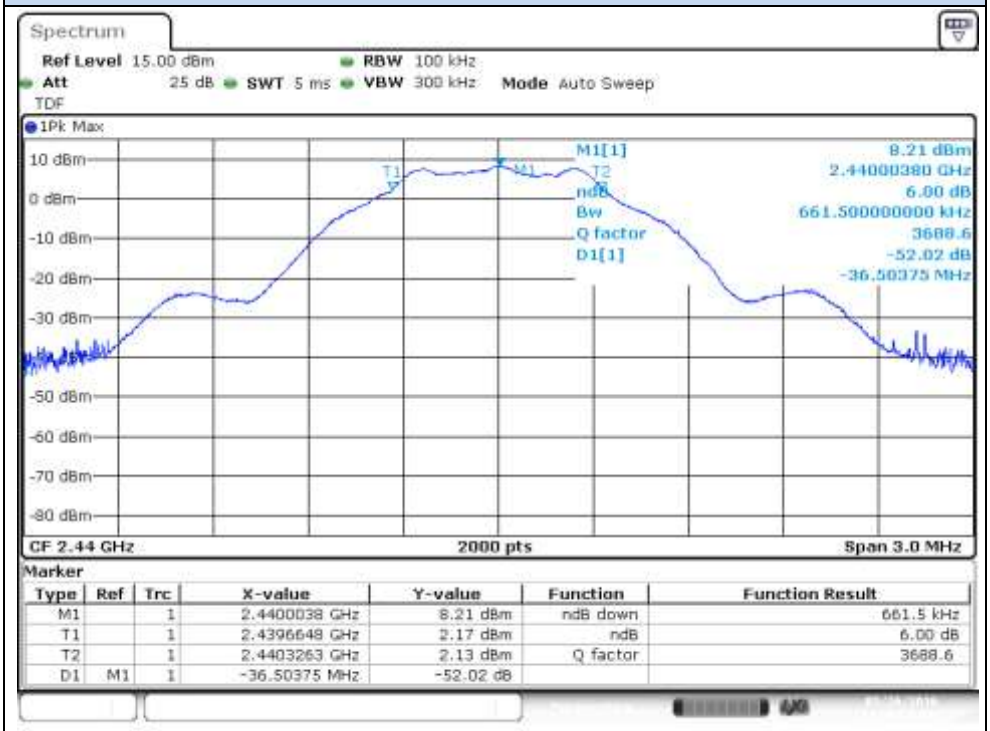
6dB BW – CH19



99% BW – CH19

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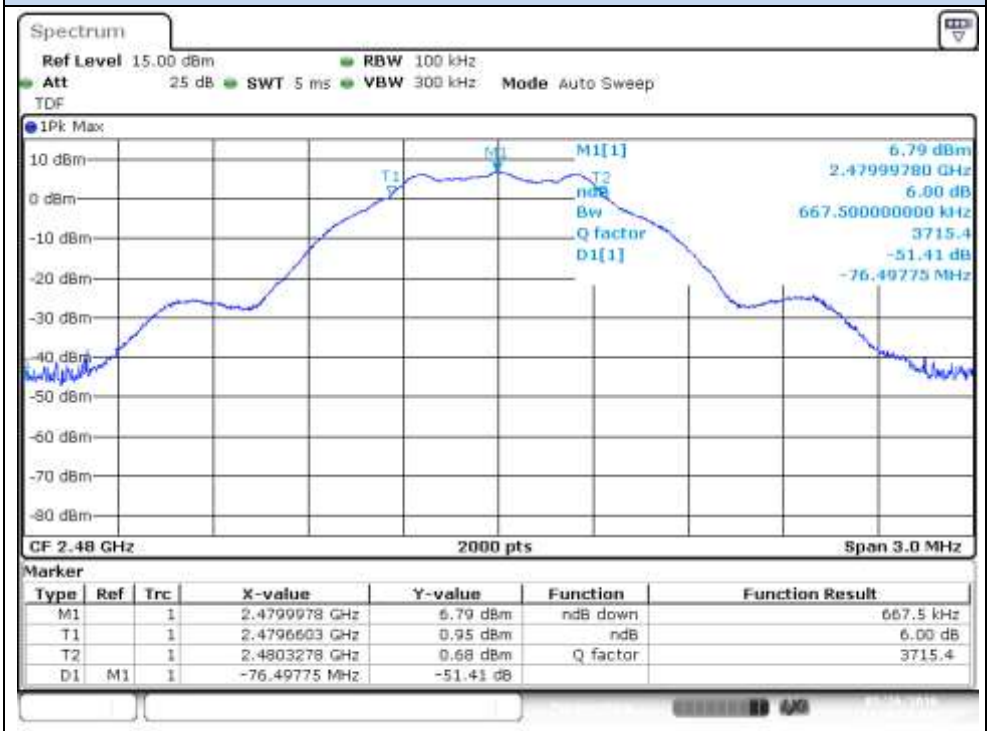
6dB BW – CH39

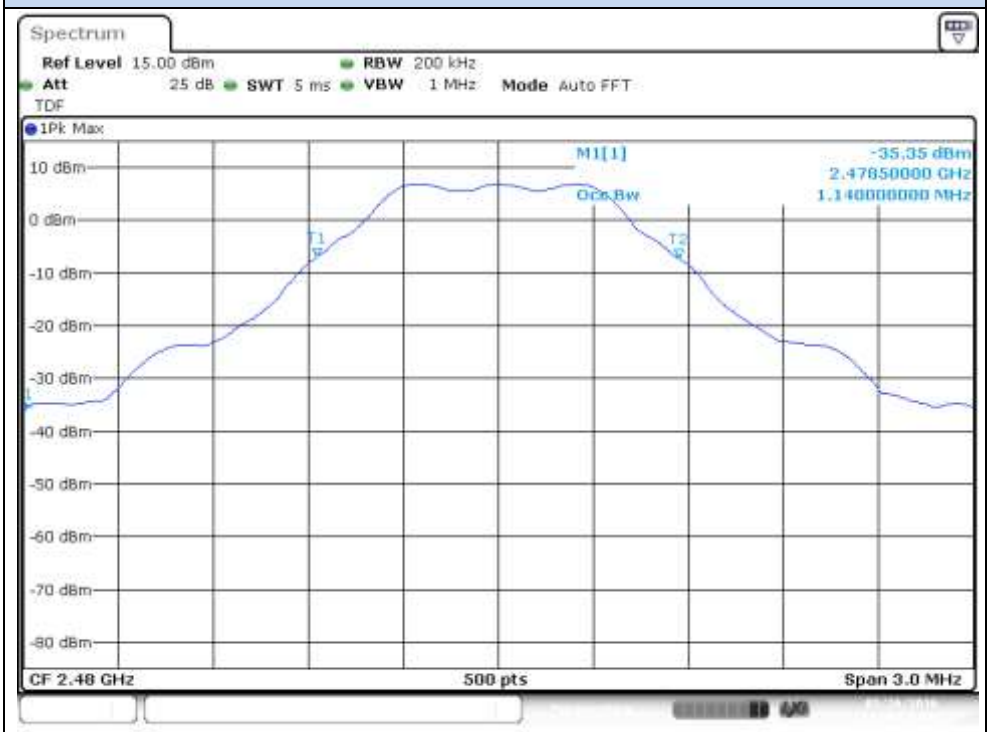


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4799978 GHz	6.79 dBm	ndB down	667.5 kHz
T1		1	2.4796603 GHz	0.95 dBm	ndB	6.00 dB
T2		1	2.4803278 GHz	0.68 dBm	Q factor	3715.4
D1	M1	1	-76.49775 MHz	-51.41 dB		

Date: 26.MAY.2016 11:38:15

99% BW – CH39



Date: 26.MAY.2016 11:38:47

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C.2 Maximum Output Power and antenna gain

Test limits:

FCC part	RSS part	Limits
15.247 (b) (3)	RSS-247 Clause 5.4 (4)	(b) The maximum peak conducted output power of the intentional radiator shall not exceed the following: (3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. (4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi.

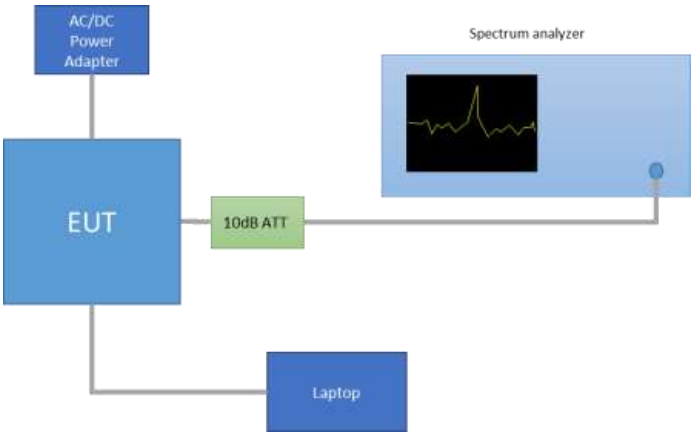
Test procedure:

The Maximum peak conducted output power was measured using the *RBW ≥ DTS bandwidth* method defined in paragraph 9.1.1 of FCC KDB 558074 D01 - Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247.

The Maximum conducted average output power was measured using the channel integration method according to Method AVGSA-2, defined in paragraph 9.2.2.4 of FCC KDB 558074 D01 - Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247.

The EIRP power (dBm) is calculated by adding the declared maximum antenna gain to the measured conducted power. The declared maximum antenna gain is 3.24dBi.

The setup below was used to measure the maximum conducted output power. The antenna terminal of the EUT is connected to the spectrum through an attenuator, and the spectrum analyzer reading is compensated to include the RF path loss.



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Results tables:

Mode	CH	Frequency [MHz]	Peak Power [dBm] Measured Conducted Output Power	EIRP	Peak Output Power [mW]
BLE	0	2402	7.75	10.99	5.96
	19	2440	8.33	11.57	**6.81**
	39	2480	6.92	10.16	**4.92**

Mode	Meas. Duty Cycle [%]	CH	Frequency [MHz]	Average Output Power* [dBm] Maximum Conducted Output Power	Maximum Conducted Output Power Duty cycle Compensated	EIRP	Average Output Power [mW]
BLE	63.2	0	2402	5.67	7.66	10.90	5.84
		19	2440	6.27	8.26	11.50	**6.70**
		39	2480	4.85	6.84	10.08	**4.83**

Max Value
Min Value

* Output Power RMS values are shown for indicative purpose only

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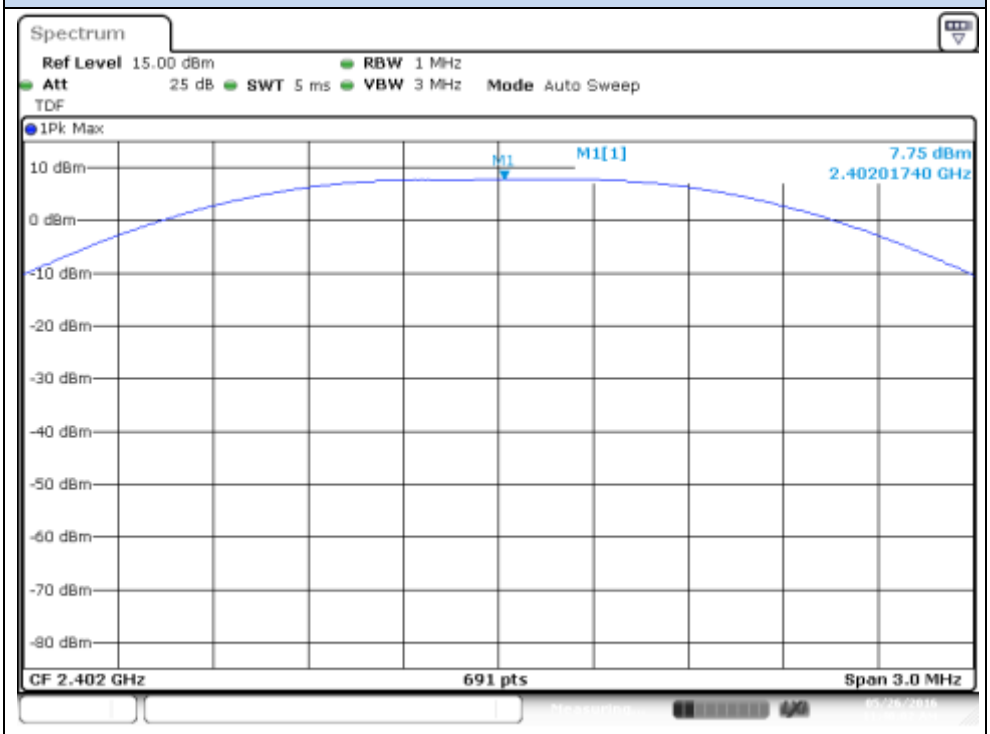
Results screenshot:

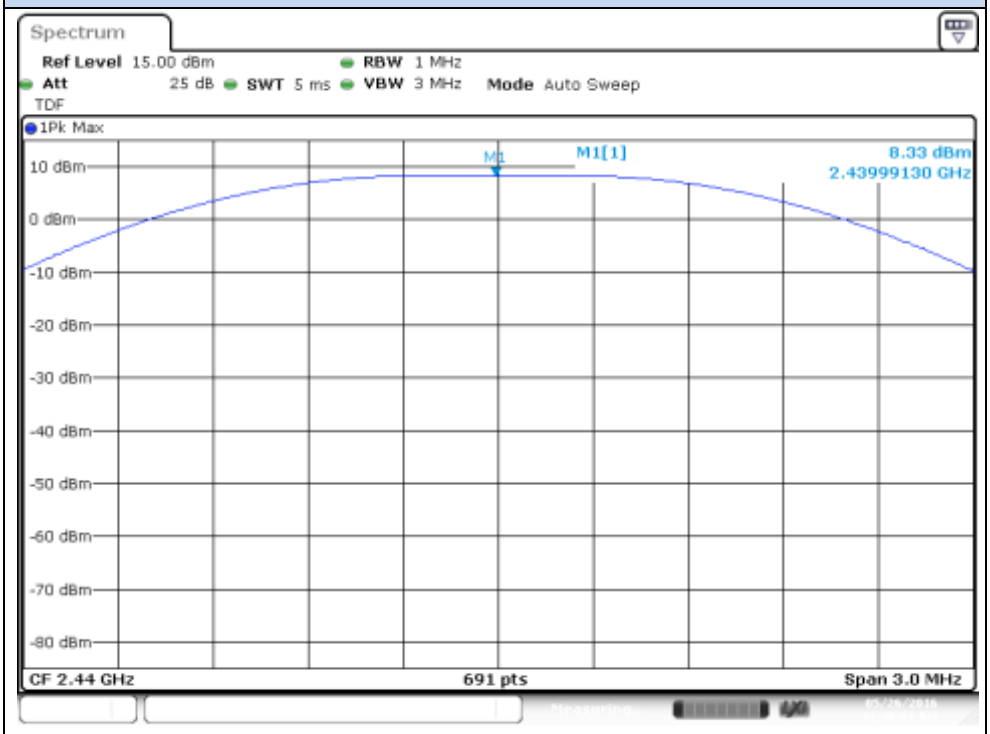
BLE

Max Power Peak - CH0



Date: 26.MAY.2016 11:40:03

Max Power Peak - CH19



Date: 26.MAY.2016 11:46:01

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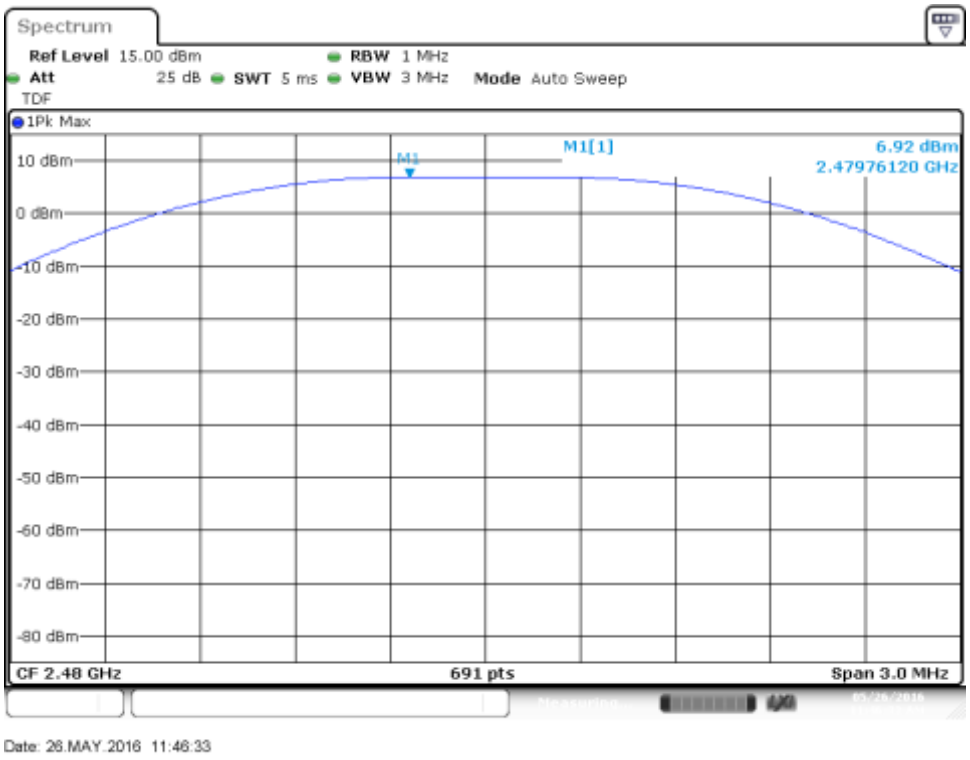
Max Power Peak - CH39



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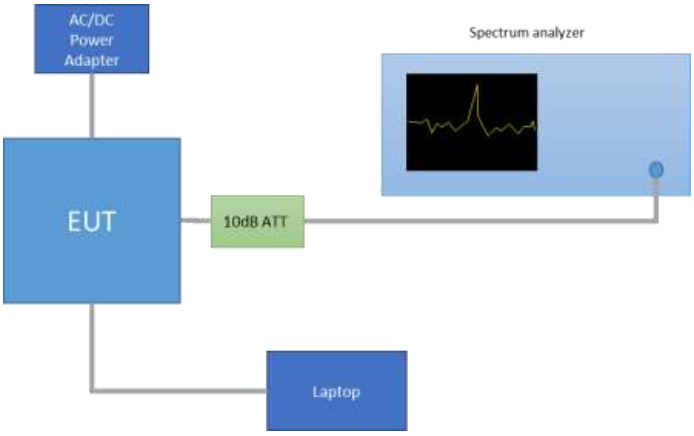
C.3 Out-of-band emissions (conducted)

Test limits:

<table>
<tr><th>FCC part</th><th>RSS part</th><th>Limits</th></tr>
<tr><td>15.247 (d)</td><td>RSS-247 Clause 5.5</td><td>In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.</td></tr>
<tr><td>15.209</td><td>RSS-247 Clause 6.2.2 (2)</td><td>Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a):
<table>
<tr><th>Freq Range (MHz)</th><th>Field Strength (µV/m)</th><th>Field Strength (dBµV/m)</th><th>Meas. Distance (m)</th></tr>
<tr><td>0.009-0.490</td><td>2400/f(kHz)</td><td>-</td><td>300</td></tr>
<tr><td>0.490-1.705</td><td>24000/f(kHz)</td><td>-</td><td>300</td></tr>
<tr><td>1.705-30.0</td><td>30</td><td>-</td><td>30</td></tr>
<tr><td>30-88</td><td>100</td><td>40</td><td>3</td></tr>
<tr><td>88-216</td><td>150</td><td>43.5</td><td>3</td></tr>
<tr><td>216-960</td><td>200</td><td>46</td><td>3</td></tr>
<tr><td>Above 960</td><td>500</td><td>54</td><td>3</td></tr>
</table>
The emission limits shown in the above table are based on measurements employing CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.
For average radiated emission measurements above 1000 MHz, there is also a limit specified when measuring with peak detector function, corresponding to 20 dB above the indicated values in the table.</td></tr>
</table>

Test procedure:

The setup below was used to measure the out-of-band emissions. The antenna terminal of the EUT is connected to the spectrum through an attenuator, and the spectrum analyzer reading is compensated to include the RF path loss.



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In case of Band Edge measurements falling in restricted bands, the declared Antenna Gain is also compensated in the graph. The declared maximum antenna gain is 3.24dBi.

For Band Edge measurements falling in restricted bands, the following limits in dBm were applied for the average detector after the conversion from the limits detailed above in dBµV/m, according to FCC 47 CFR part 15 - Subpart C – §15.209(a). The limits in dBm for peak detector are 20dB above the indicated values in the table.

§15.209(a)			Converted values	
Freq Range (MHz)	Distance (m)	Field strength (microvolts/meter)	Field strength (dB microvolts/meter)	Power (dBm)
Above 960	3	500	54.0	-41.2

Note: these PSD_{Peak} values are shown just as a reference for the compliance of the Out-of-band Measurements. Thus the RBW used for these measurements was 100kHz.

Mode	**CH**	**Frequency [MHz]**	**PSD Peak [dBm]**
BLE	0	2402	7.93
	19	2440	8.25
	39	2480	6.78

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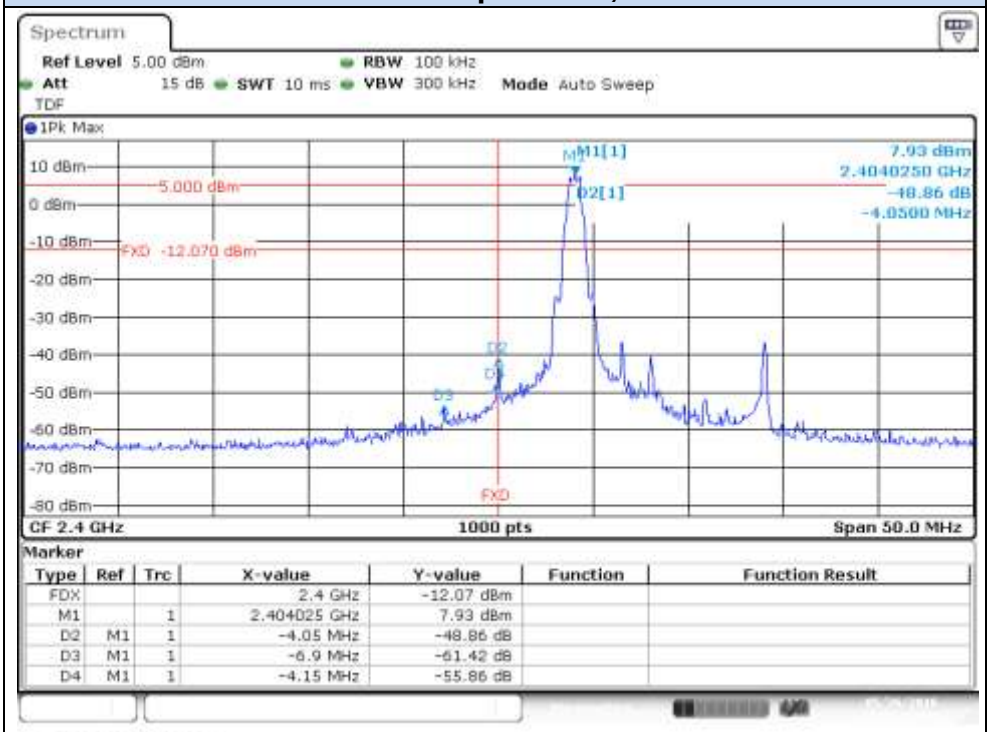
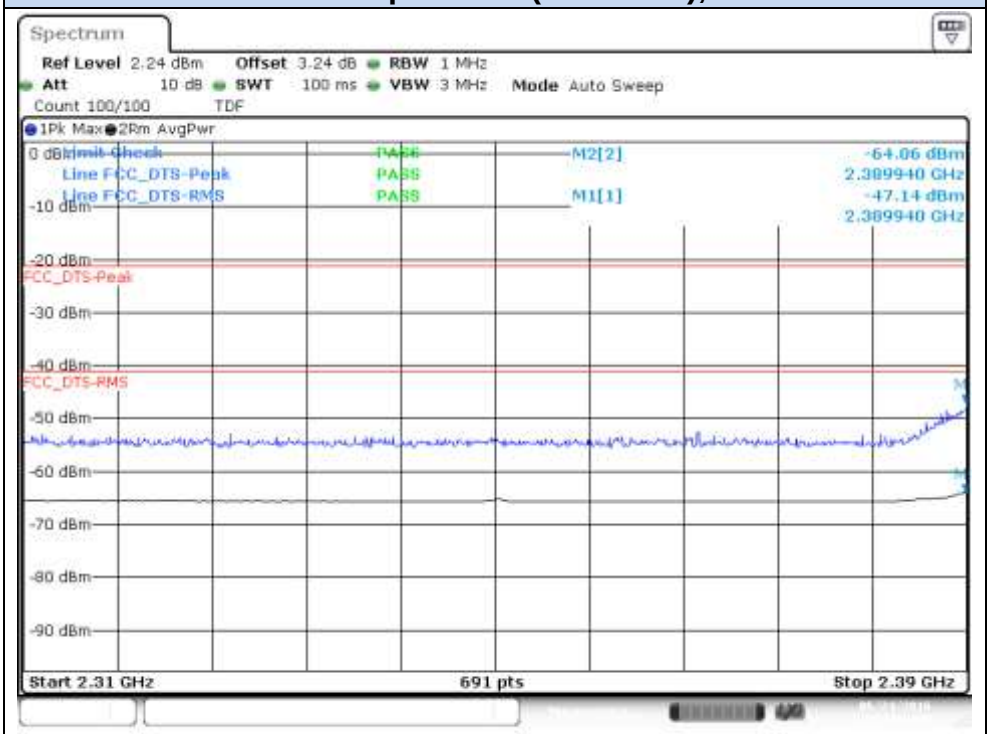
Band Edge results Screenshot:

BLE

BE Low Freq Section, CH 0



BE Low Freq Section (restricted), CH 0



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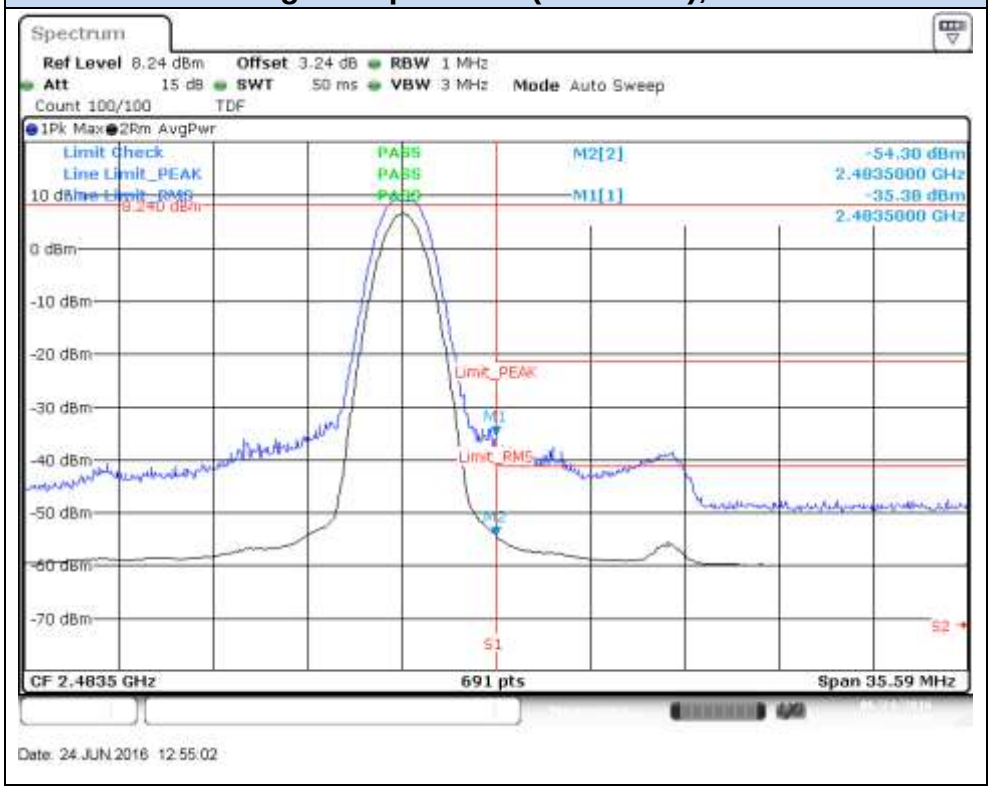
BE High Freq Section (restricted), CH39



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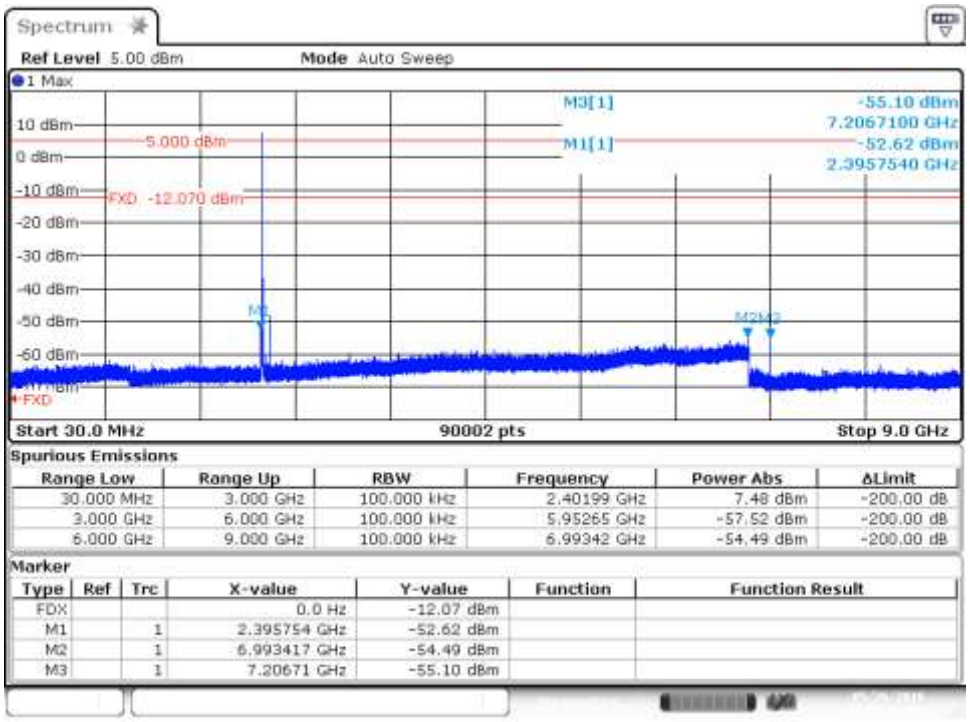
Spurious results Screenshot:

BLE, CH0

Cond Spur, 30MHz – 9GHz



Spurious Emissions

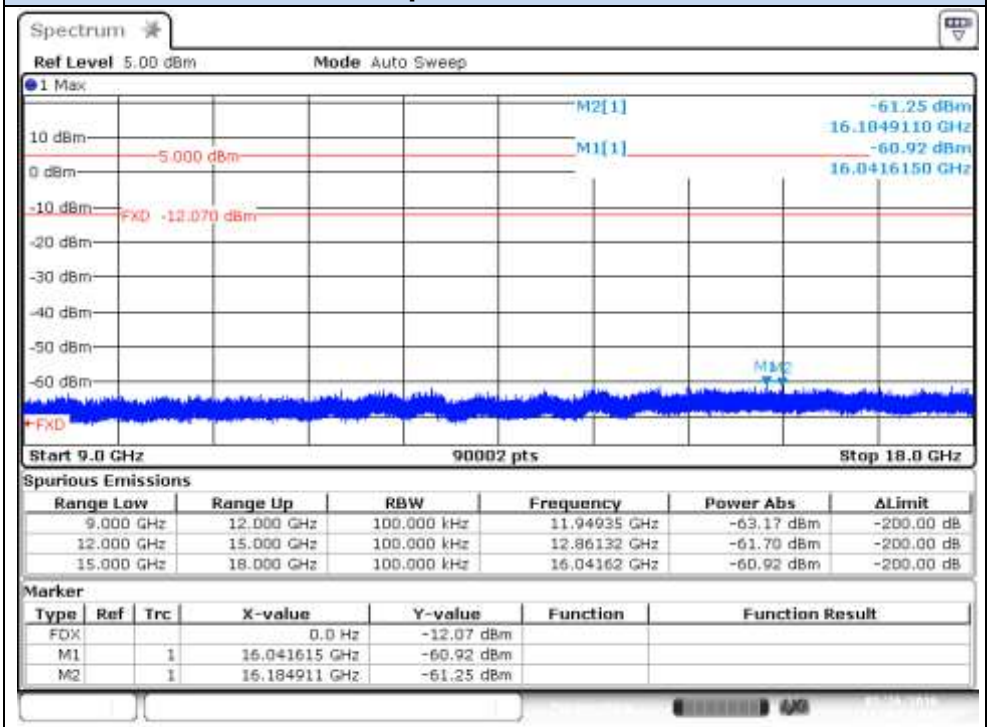
Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
30.000 MHz	3.000 GHz	100.000 kHz	2.40199 GHz	7.48 dBm	-200.00 dB
3.000 GHz	6.000 GHz	100.000 kHz	5.95265 GHz	-57.52 dBm	-200.00 dB
6.000 GHz	9.000 GHz	100.000 kHz	6.99342 GHz	-54.49 dBm	-200.00 dB

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
FDX			0.0 Hz	-12.07 dBm		
M1		1	2.395754 GHz	-52.62 dBm		
M2		1	6.993417 GHz	-54.49 dBm		
M3		1	7.20671 GHz	-55.10 dBm		

Date: 26.MAY.2016 11:57:03

Cond Spur, 9GHz – 18GHz



Spurious Emissions

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
9.000 GHz	12.000 GHz	100.000 kHz	11.94935 GHz	-63.17 dBm	-200.00 dB
12.000 GHz	15.000 GHz	100.000 kHz	12.86132 GHz	-61.70 dBm	-200.00 dB
15.000 GHz	18.000 GHz	100.000 kHz	16.04162 GHz	-60.92 dBm	-200.00 dB

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
FDX			0.0 Hz	-12.07 dBm		
M1		1	16.041615 GHz	-60.92 dBm		
M2		1	16.184911 GHz	-61.25 dBm		

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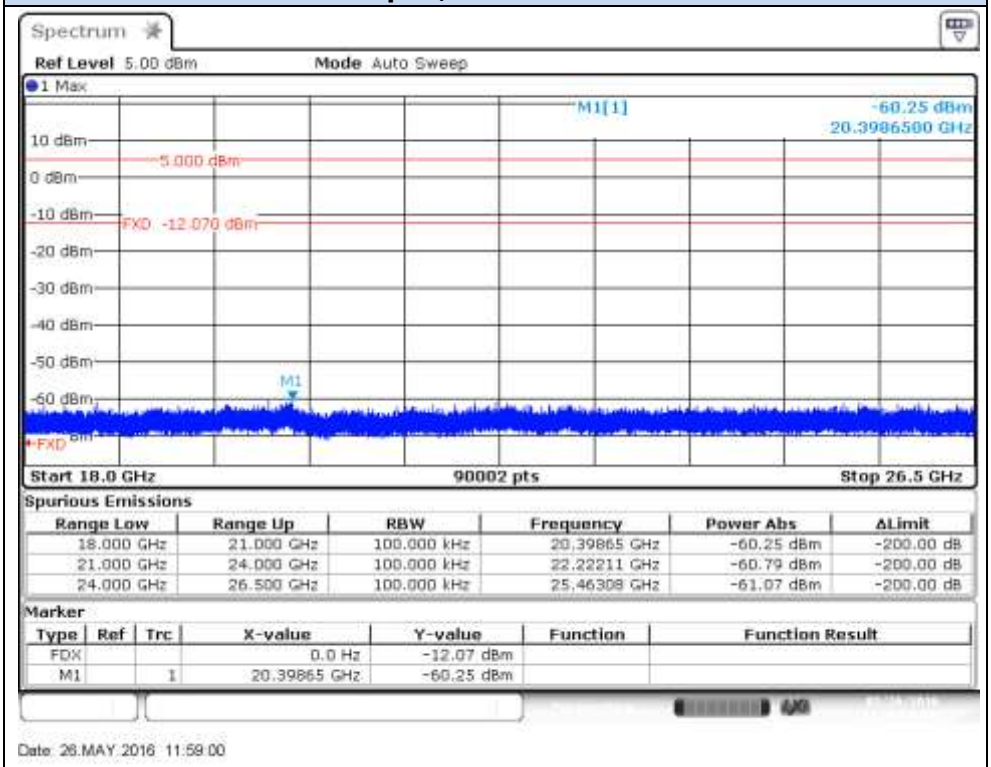
Cond Spur, 18GHz – 26.5GHz



Spurious Emissions

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
18.000 GHz	21.000 GHz	100.000 kHz	20.39865 GHz	-60.25 dBm	-200.00 dB
21.000 GHz	24.000 GHz	100.000 kHz	22.22211 GHz	-60.79 dBm	-200.00 dB
24.000 GHz	26.500 GHz	100.000 kHz	25.46308 GHz	-61.07 dBm	-200.00 dB

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
FDX			0.0 Hz	-12.07 dBm		
M1		1	20.39865 GHz	-60.25 dBm		

Date: 26.MAY.2016 11:59:00

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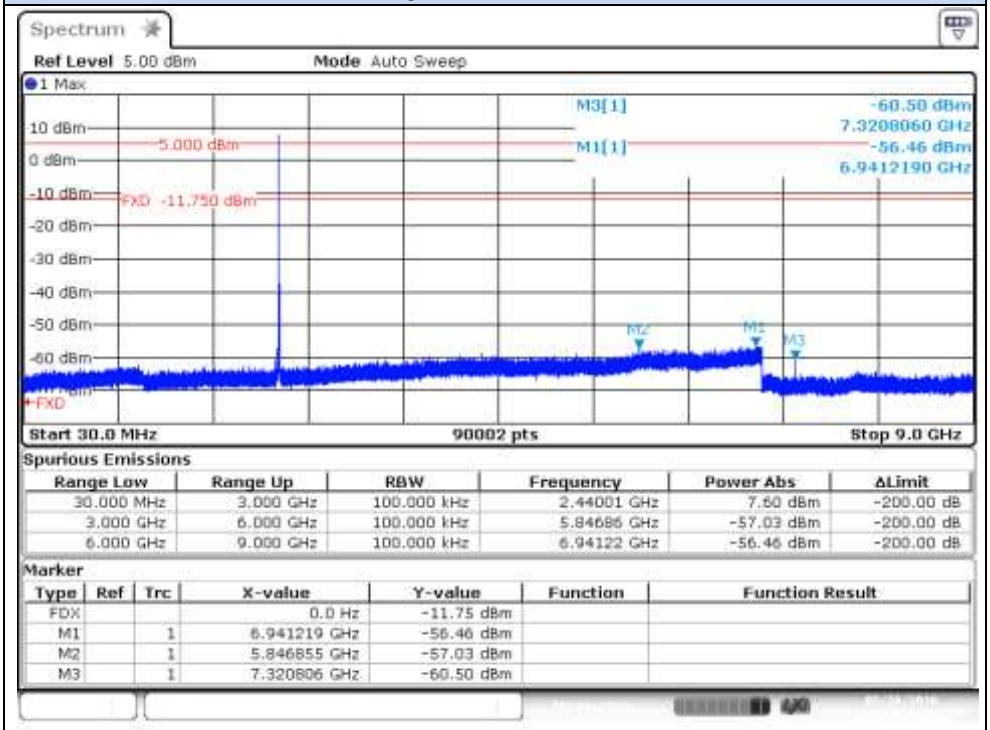
BLE, CH19

Cond Spur, 30MHz – 9GHz



Spurious Emissions

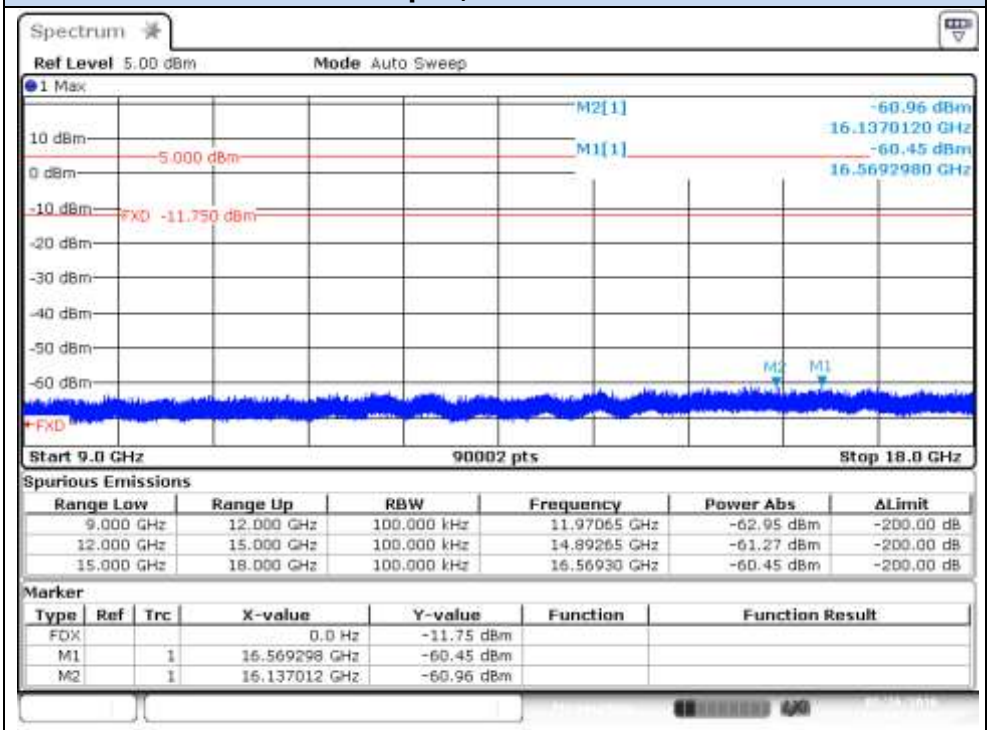
Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
30.000 MHz	3.000 GHz	100.000 kHz	2.44001 GHz	7.60 dBm	-200.00 dB
3.000 GHz	6.000 GHz	100.000 kHz	5.84686 GHz	-57.03 dBm	-200.00 dB
6.000 GHz	9.000 GHz	100.000 kHz	6.94122 GHz	-56.46 dBm	-200.00 dB

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
FDX			0.0 Hz	-11.75 dBm		
M1		1	6.941219 GHz	-56.46 dBm		
M2		1	5.846855 GHz	-57.03 dBm		
M3		1	7.320806 GHz	-60.50 dBm		

Date: 26.MAY.2016 15:12:24

Cond Spur, 9GHz – 18GHz



Spurious Emissions

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
9.000 GHz	12.000 GHz	100.000 kHz	11.97065 GHz	-62.95 dBm	-200.00 dB
12.000 GHz	15.000 GHz	100.000 kHz	14.89265 GHz	-61.27 dBm	-200.00 dB
15.000 GHz	18.000 GHz	100.000 kHz	16.56930 GHz	-60.45 dBm	-200.00 dB

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
FDX			0.0 Hz	-11.75 dBm		
M1		1	16.569298 GHz	-60.45 dBm		
M2		1	16.137012 GHz	-60.96 dBm		

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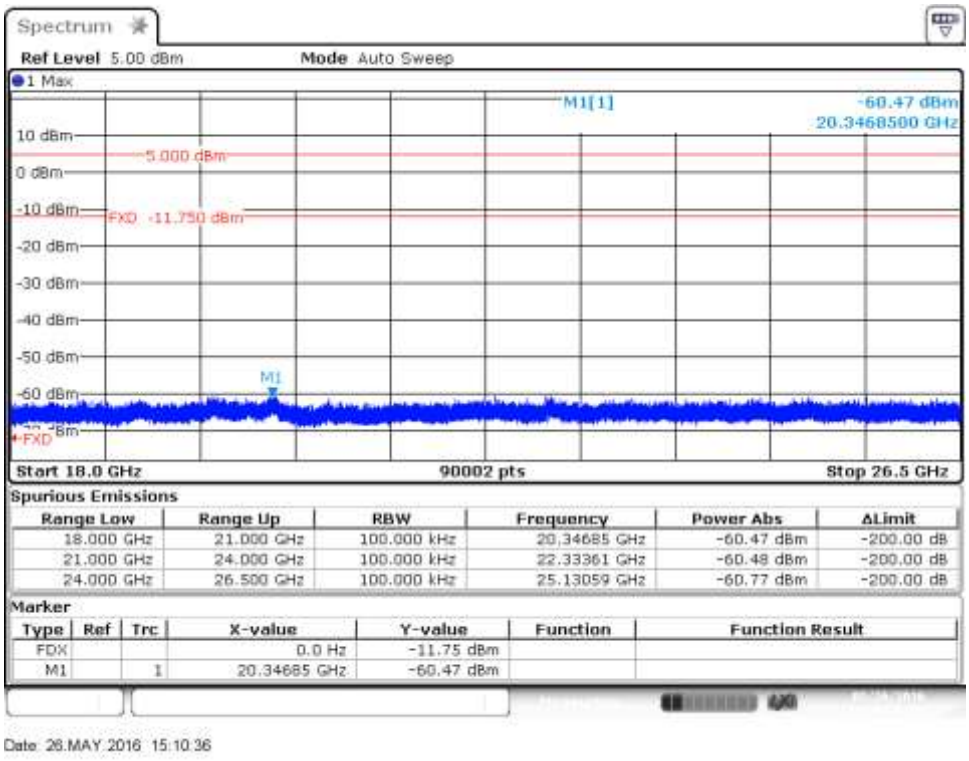
Cond Spur, 18GHz – 26.5GHz



Spurious Emissions

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
18.000 GHz	21.000 GHz	100.000 kHz	20.34685 GHz	-60.47 dBm	-200.00 dB
21.000 GHz	24.000 GHz	100.000 kHz	22.33361 GHz	-60.48 dBm	-200.00 dB
24.000 GHz	26.500 GHz	100.000 kHz	25.13059 GHz	-60.77 dBm	-200.00 dB

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
FDX			0.0 Hz	-11.75 dBm		
M1		1	20.34685 GHz	-60.47 dBm		

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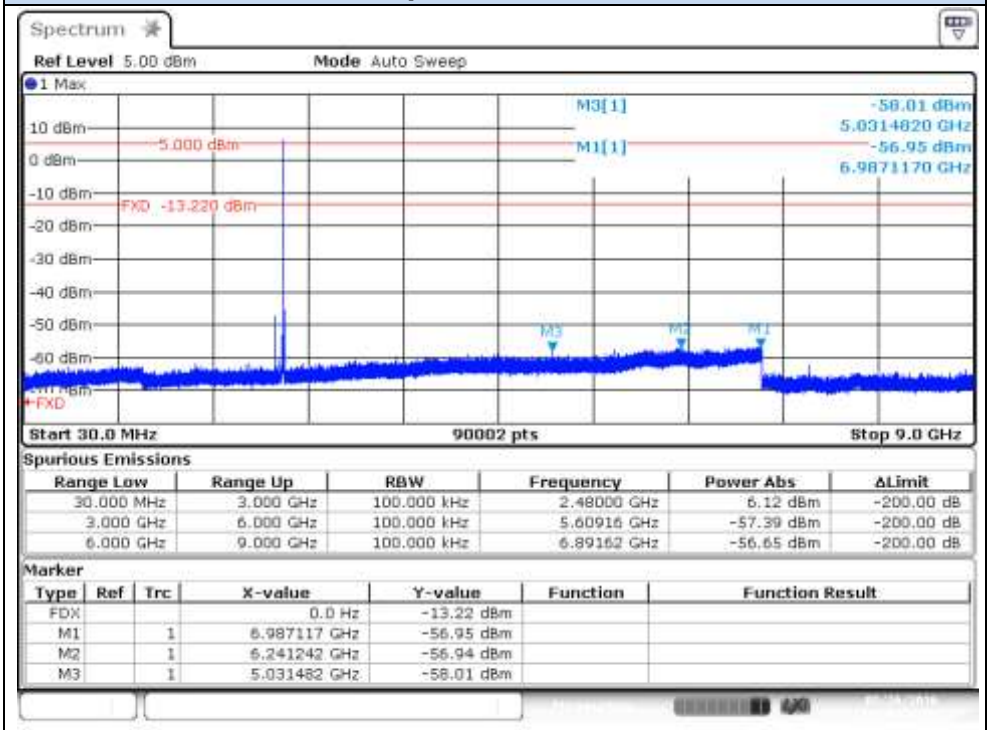
BLE, CH39

Cond Spur, 30MHz – 9GHz



Spurious Emissions

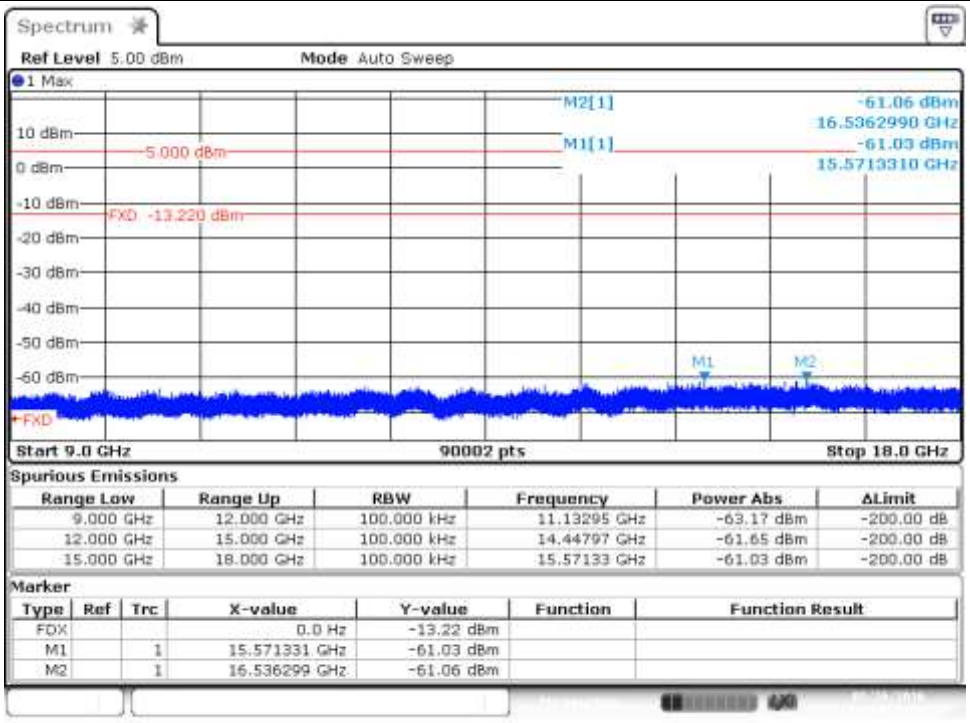
Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
30.000 MHz	3.000 GHz	100.000 kHz	2.48000 GHz	6.12 dBm	-200.00 dB
3.000 GHz	6.000 GHz	100.000 kHz	5.60916 GHz	-57.39 dBm	-200.00 dB
6.000 GHz	9.000 GHz	100.000 kHz	6.89162 GHz	-56.65 dBm	-200.00 dB

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
FDX			0.0 Hz	-13.22 dBm		
M1		1	6.987117 GHz	-56.95 dBm		
M2		1	6.241242 GHz	-56.94 dBm		
M3		1	5.031482 GHz	-58.01 dBm		

Date: 26.MAY.2016 15:16:33

Cond Spur, 9GHz – 18GHz



Spurious Emissions

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
9.000 GHz	12.000 GHz	100.000 kHz	11.13295 GHz	-63.17 dBm	-200.00 dB
12.000 GHz	15.000 GHz	100.000 kHz	14.44797 GHz	-61.65 dBm	-200.00 dB
15.000 GHz	18.000 GHz	100.000 kHz	15.57133 GHz	-61.03 dBm	-200.00 dB

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
FDX			0.0 Hz	-13.22 dBm		
M1		1	15.571331 GHz	-61.03 dBm		
M2		1	16.536299 GHz	-61.06 dBm		

Date: 26.MAY.2016 15:17:22

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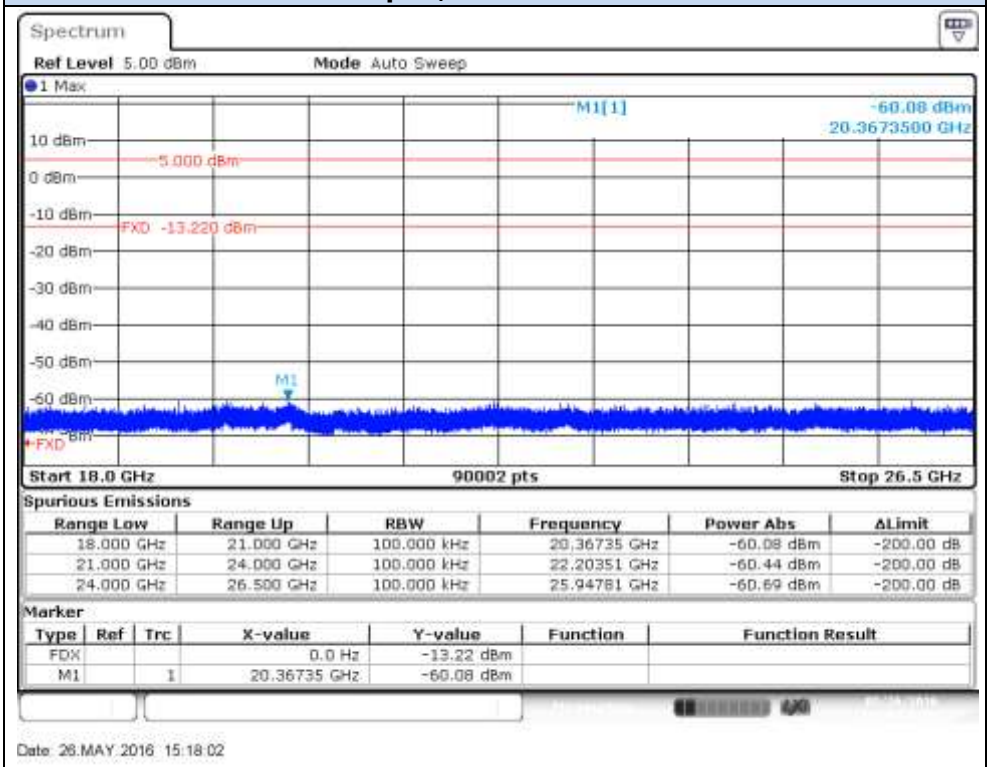
Cond Spur, 18GHz – 26.5GHz



Spurious Emissions

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
18.000 GHz	21.000 GHz	100.000 kHz	20.36735 GHz	-60.08 dBm	-200.00 dB
21.000 GHz	24.000 GHz	100.000 kHz	22.20351 GHz	-60.44 dBm	-200.00 dB
24.000 GHz	26.500 GHz	100.000 kHz	25.94781 GHz	-60.69 dBm	-200.00 dB

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
FDX			0.0 Hz	-13.22 dBm		
M1		1	20.36735 GHz	-60.08 dBm		

Date: 26.MAY.2016 15:18:02

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C.4 Power Spectral Density

Test limits:

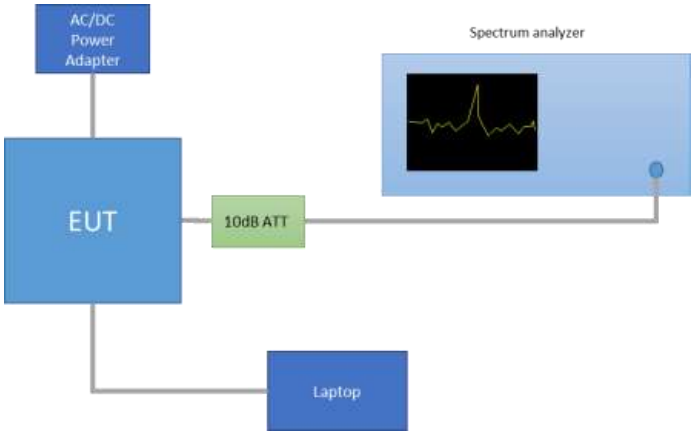
FCC part	RSS part	Limits
15.247 (e)	RSS-247 Clause 5.2 (2)	For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

Test procedure:

The maximum peak power spectral density level of the fundamental emission was measured using the method PKPSD, defined in paragraph 10.2 of FCC KDB 558074 D01 - Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247.

The setup below was used to measure the power spectral density. The antenna terminal of the EUT is connected to the spectrum through an attenuator, and the spectrum analyzer reading is compensated to include the RF path loss.

The declared maximum antenna gain is 3.24dBi.



Results tables:

Mode	CH	Frequency [MHz]	PSD Peak [dBm]
BLE	0	2402	-7.64
	19	2440	-6.88
	39	2480	-8.30

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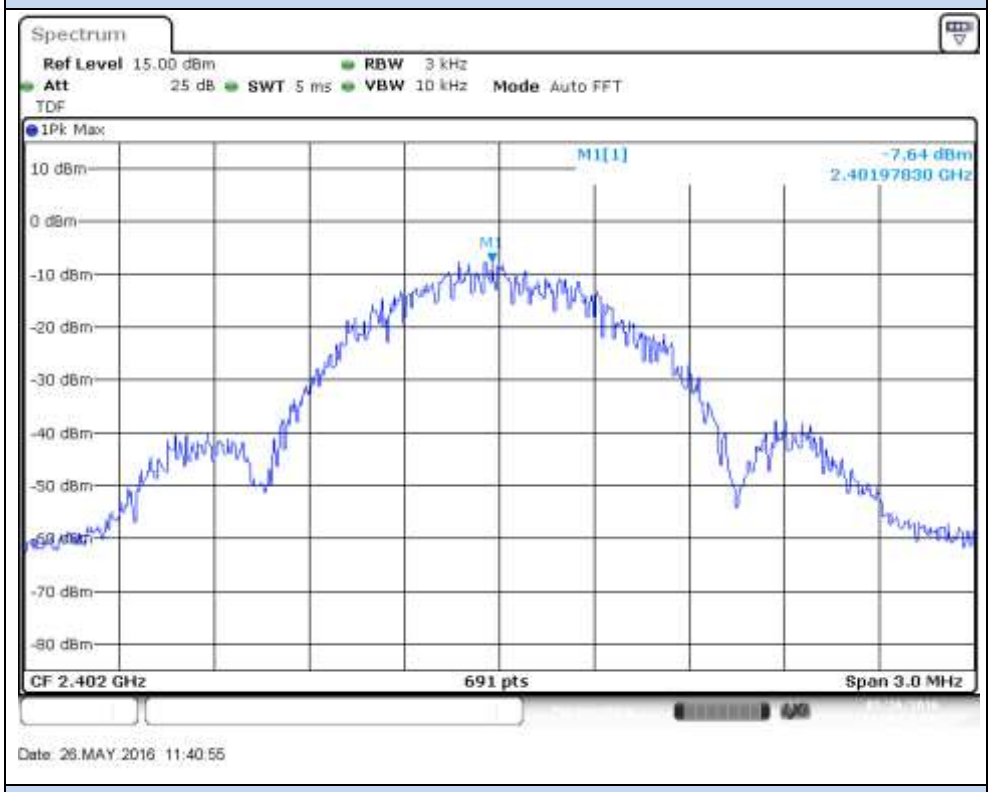
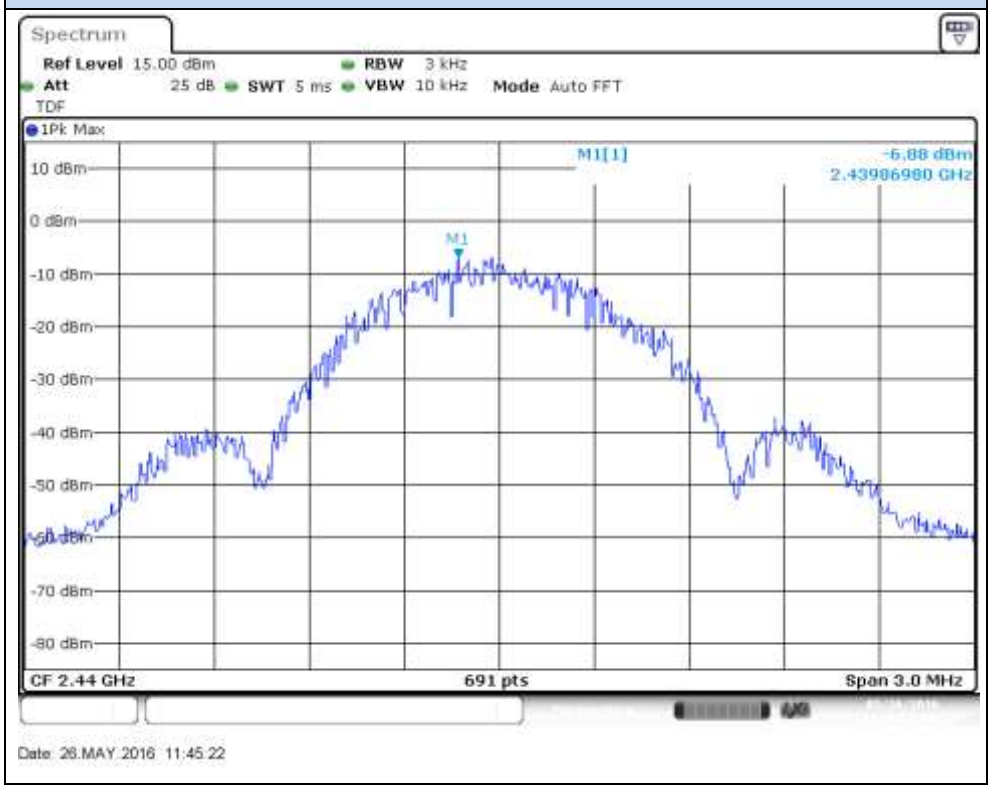
Results screenshot:

BLE

PSD Peak - CH0



PSD Peak - CH19



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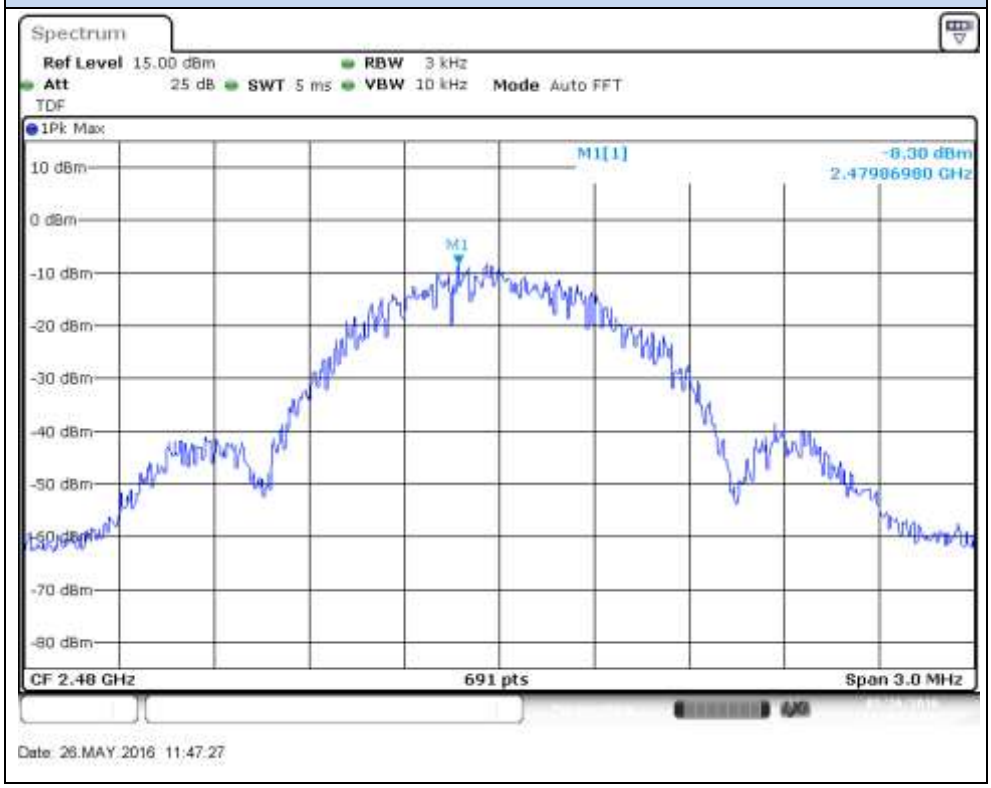
PSD PEAK - CH39



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C.5 Radiated spurious emission

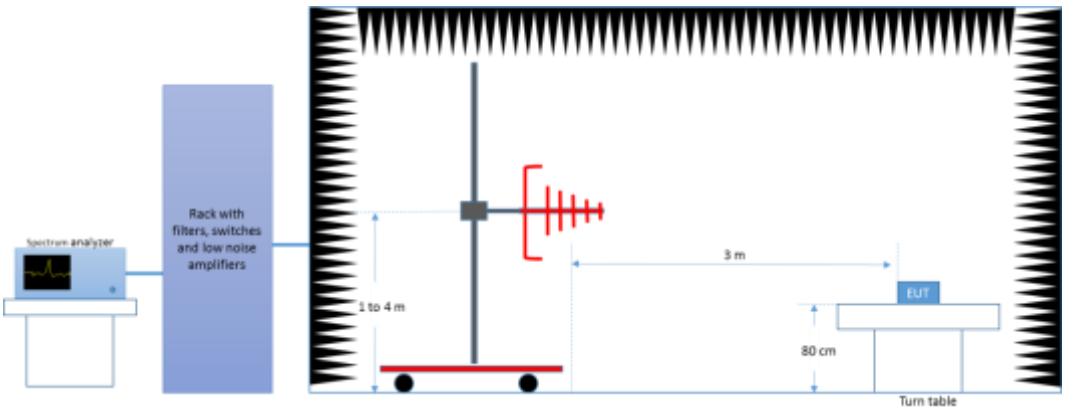
Standard references:

<table>
<tr><th>FCC part</th><th>RSS part</th><th>Limits</th></tr>
<tr><td>15.247 (d)</td><td>RSS-247
Clause 5.5</td><td>Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a):
<table>
<tr><th>Freq Range (MHz)</th><th>Field Strength (dBµV/m)</th><th>Field Strength (dBµV/m)</th><th>Meas. Distance (m)</th></tr>
<tr><td>0.009-0.490</td><td>2400/f(kHz)</td><td>-</td><td>300</td></tr>
<tr><td>0.490-1.705</td><td>24000/f(kHz)</td><td>-</td><td>300</td></tr>
<tr><td>1.705-30.0</td><td>30</td><td>-</td><td>30</td></tr>
<tr><td>30-88</td><td>100</td><td>40</td><td>3</td></tr>
<tr><td>88-216</td><td>150</td><td>43.5</td><td>3</td></tr>
<tr><td>216-960</td><td>200</td><td>46</td><td>3</td></tr>
<tr><td>Above 960</td><td>500</td><td>54</td><td>3</td></tr>
</table>
The emission limits shown in the above table are based on measurements employing CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.
For average radiated emission measurements above 1000 MHz, there is also a limit specified when measuring with peak detector function, corresponding to 20 dB above the indicated values in the table.</td></tr>
</table>

Test procedure:

The setups below were used to measure the radiated spurious emissions.
Depending of the frequency range and bands being tested, different antennas and filters were used.
The final measurement is done by varying the antenna height from 1 to 4 meters, the EUT azimuth over 360º and for both Vertical and Horizontal polarizations.
The radiated spurious emissions were measured on the worst case configuration selected from the chapter *B.2 Maximum Output Power and antenna gain* and using the lowest, middle and highest channels.

Radiated Setup < 1GHz



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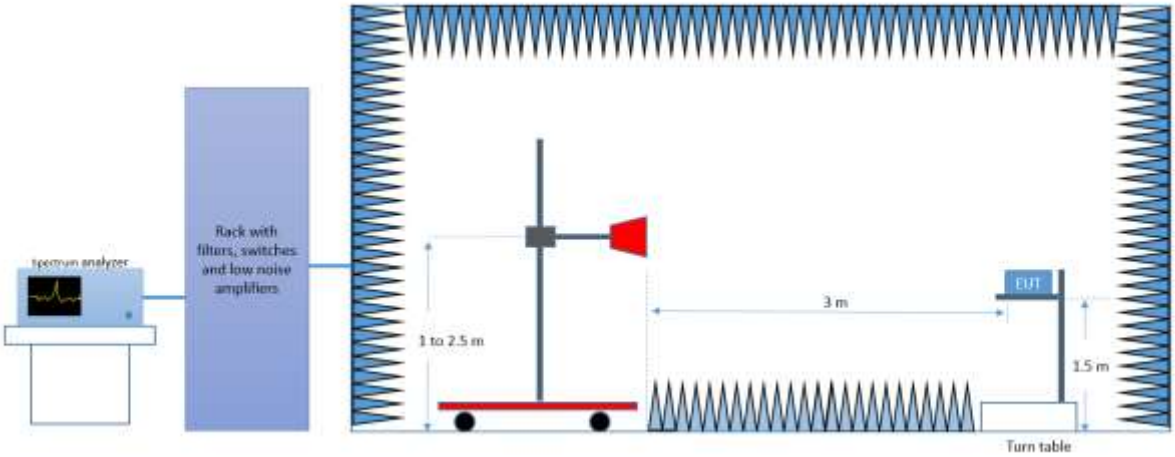
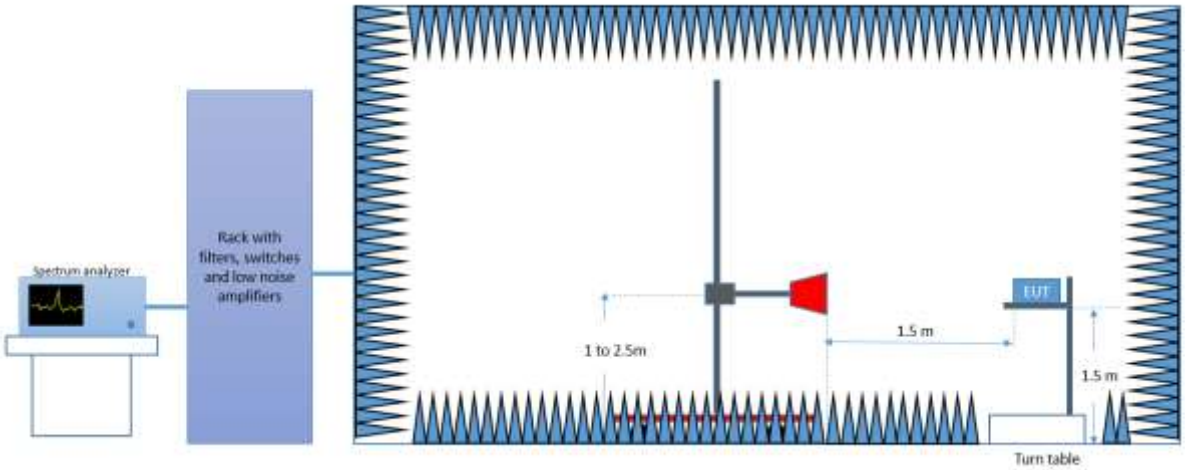
Radiated Setup 1GHz - 18GHz



Radiated Setup 18 GHz - 25 GHz



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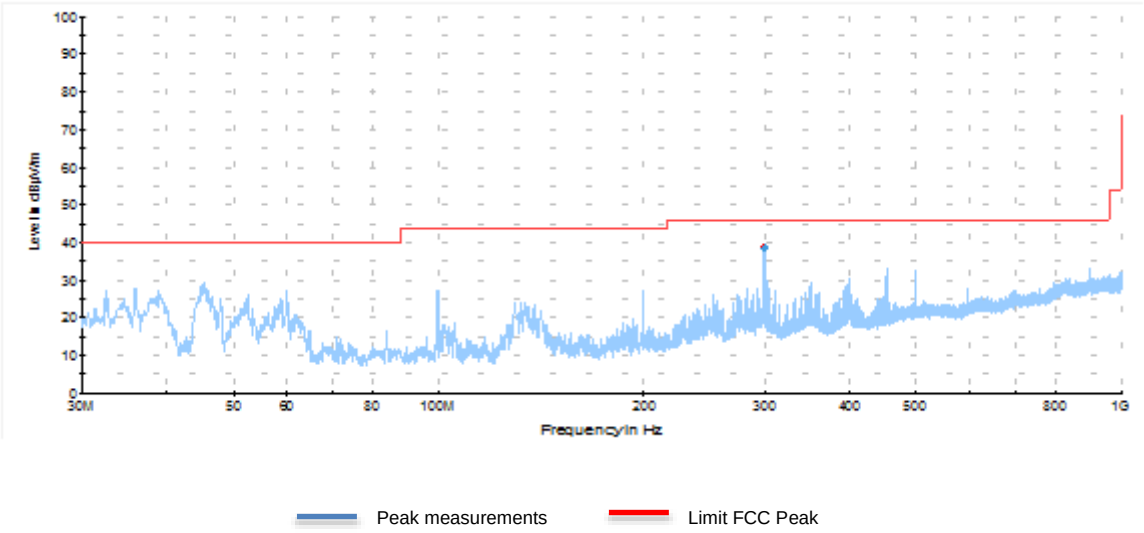
Test Results:

Radiated Spurious – 30MHz – 1GHz

Radiated Spurious – All Modes



Frequency	Max Peak	Limit	Margin
MHz	dBuV/m	dBuV/m	dB
300	38.6	46	7.46

Note 1: The spurious signals detected do not depend on either the operating channel or the modulation mode.

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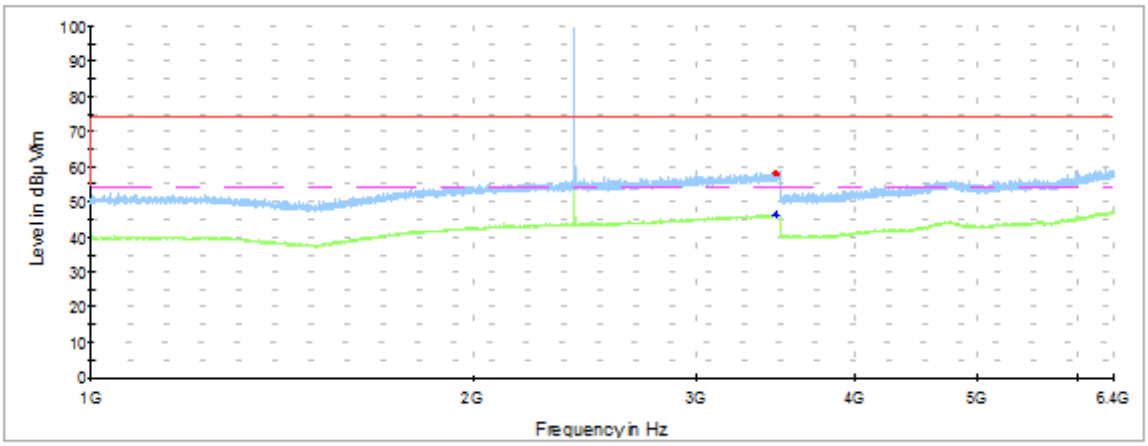
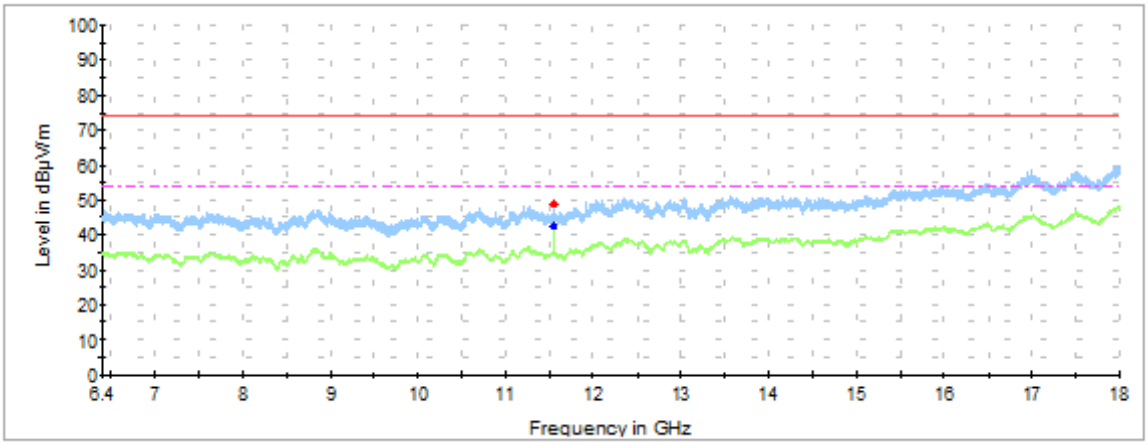
1 GHz – 18GHz, BLE

Radiated Spurious – CH0





Peak measurements Avg measurements Limit FCC Peak Limit FCC Avg

Frequency	MaxPeak	AvG	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
3466	58.2	-	74	15.8
3466	-	46.5	54	7.5
11549	48.5	-	74	25.5
11550	-	43.7	54	10.3

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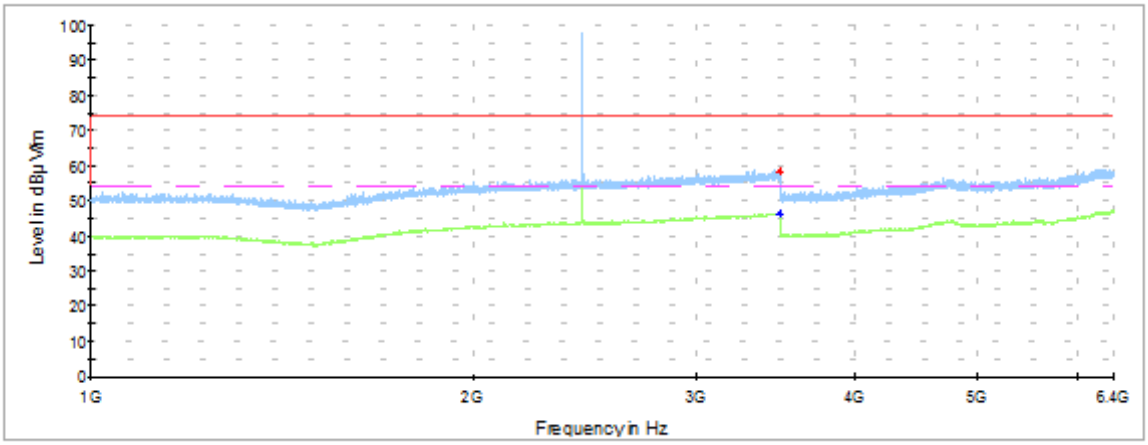
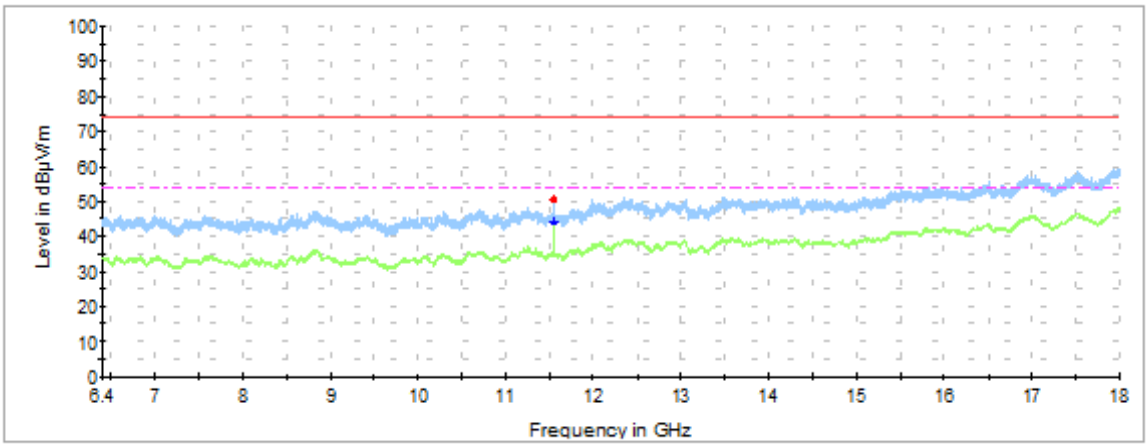
Radiated Spurious – CH19





Peak measurements Avg measurements Limit FCC Peak Limit FCC Avg

Frequency	MaxPeak	AvG	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
3490	58.3	-	74	15.7
3490	-	46.3	54	7.7
11549	49.8	-	74	24.2
11549	-	43.9	54	10.1

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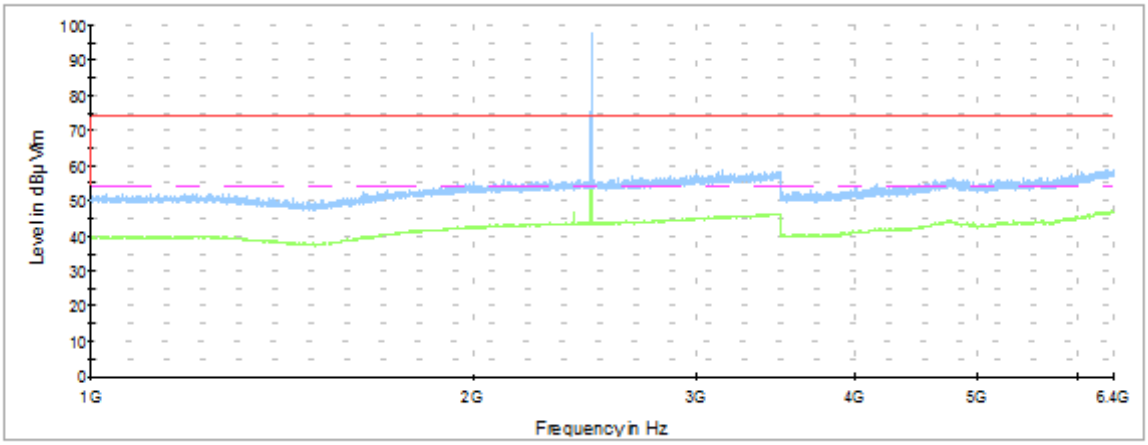
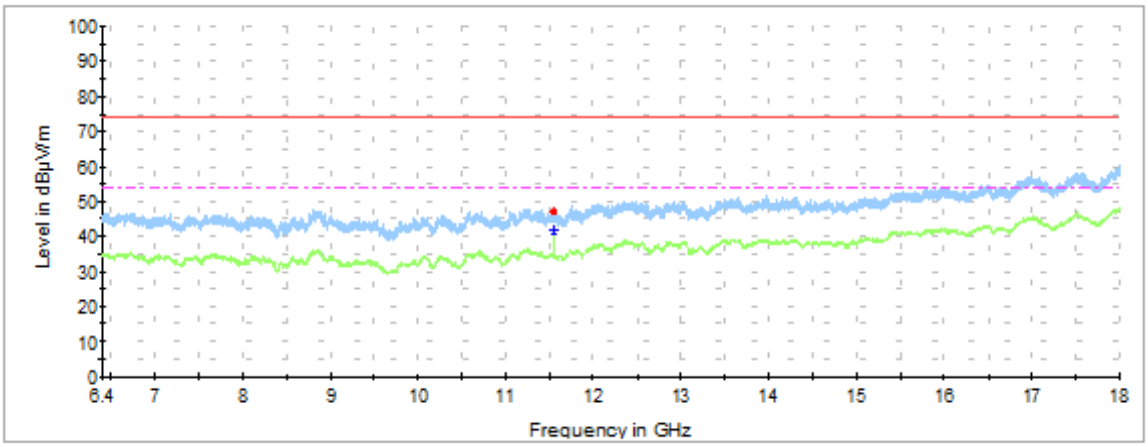
Radiated Spurious – CH39





Peak measurements Avg measurements Limit FCC Peak Limit FCC Avg

Frequency	MaxPeak	AvG	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
2395	55.6	-	74	18.4
2400	-	46.6	54	7.4
11550	49.1	-	74	24.9
11550	-	43.8	54	10.2

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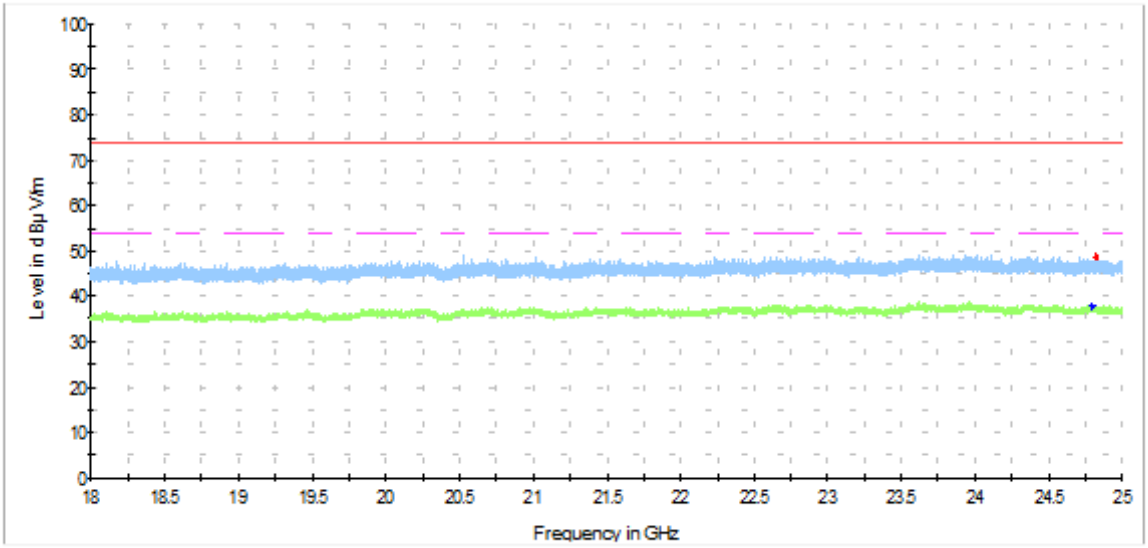
Radiated Spurious – 18 GHz – 25 GHz

Radiated Spurious – All Modes



Frequency	Max Peak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
24795	48.7	-	74	25.3
24822	-	37.7	54	16.3

Note 1: The spurious signals detected do not depend on either the operating channel or the modulation mode.

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