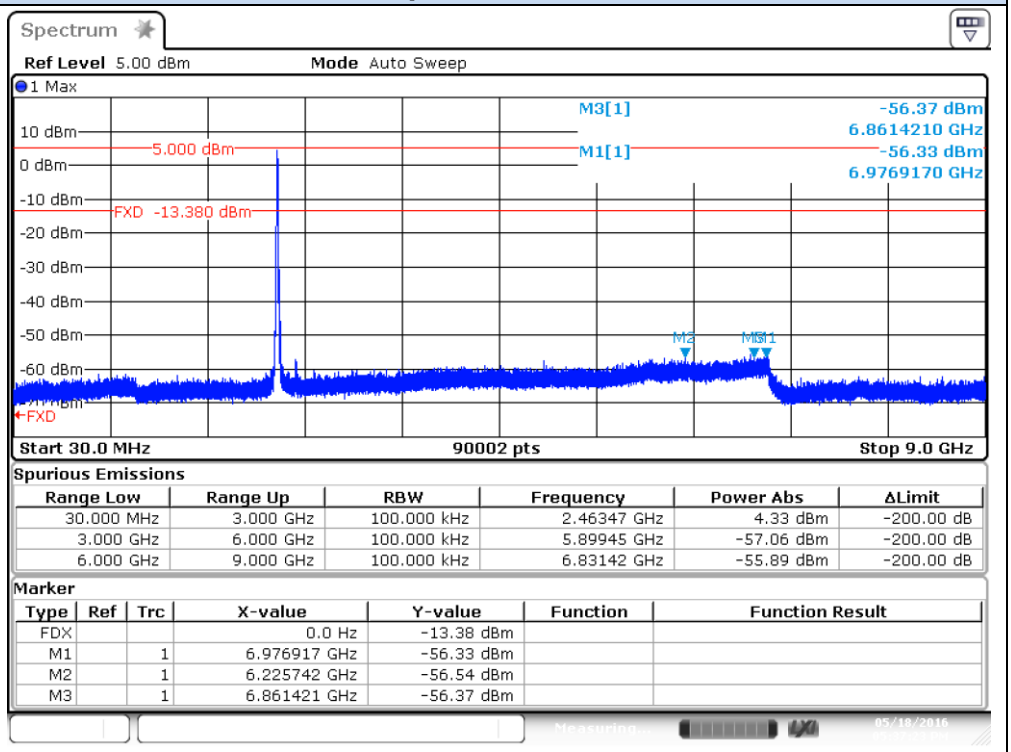
802.11b, 1Mbps – Chain A, CH11

Cond Spur, 30MHz – 9GHz



Spurious Emissions

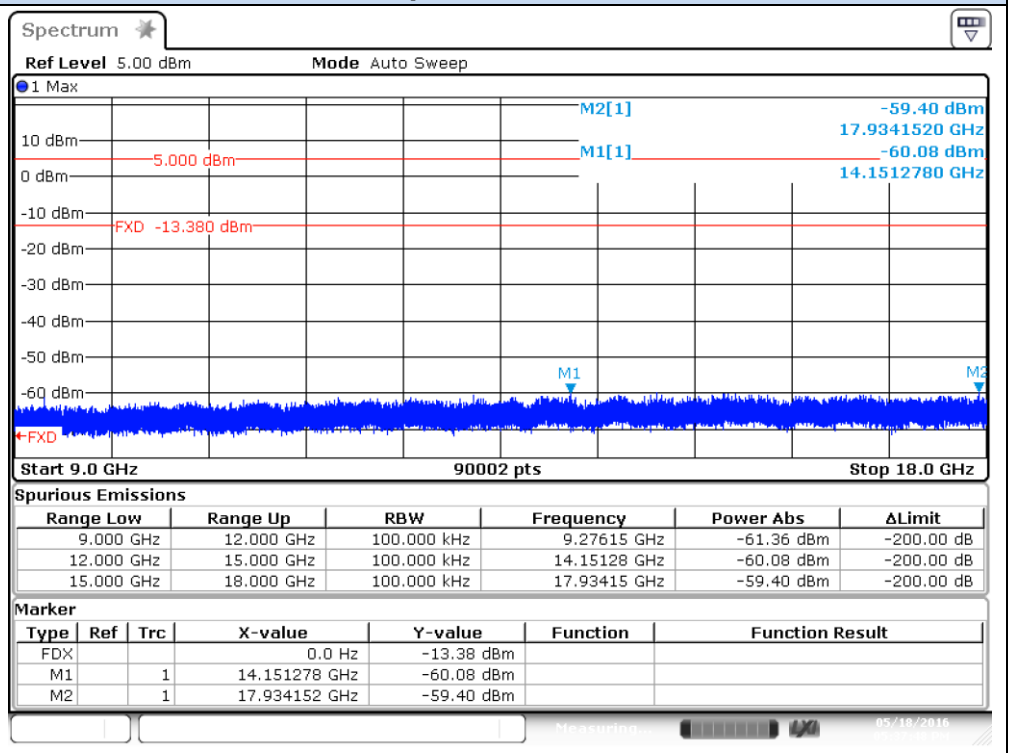
Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
30.000 MHz	3.000 GHz	100.000 kHz	2.46347 GHz	4.33 dBm	-200.00 dB
3.000 GHz	6.000 GHz	100.000 kHz	5.89945 GHz	-57.06 dBm	-200.00 dB
6.000 GHz	9.000 GHz	100.000 kHz	6.83142 GHz	-55.89 dBm	-200.00 dB

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
FDX			0.0 Hz	-13.38 dBm		
M1		1	6.976917 GHz	-56.33 dBm		
M2		1	6.225742 GHz	-56.54 dBm		
M3		1	6.861421 GHz	-56.37 dBm		

Date: 18.MAY.2016 17:37:22

Cond Spur, 9GHz – 18GHz



Spurious Emissions

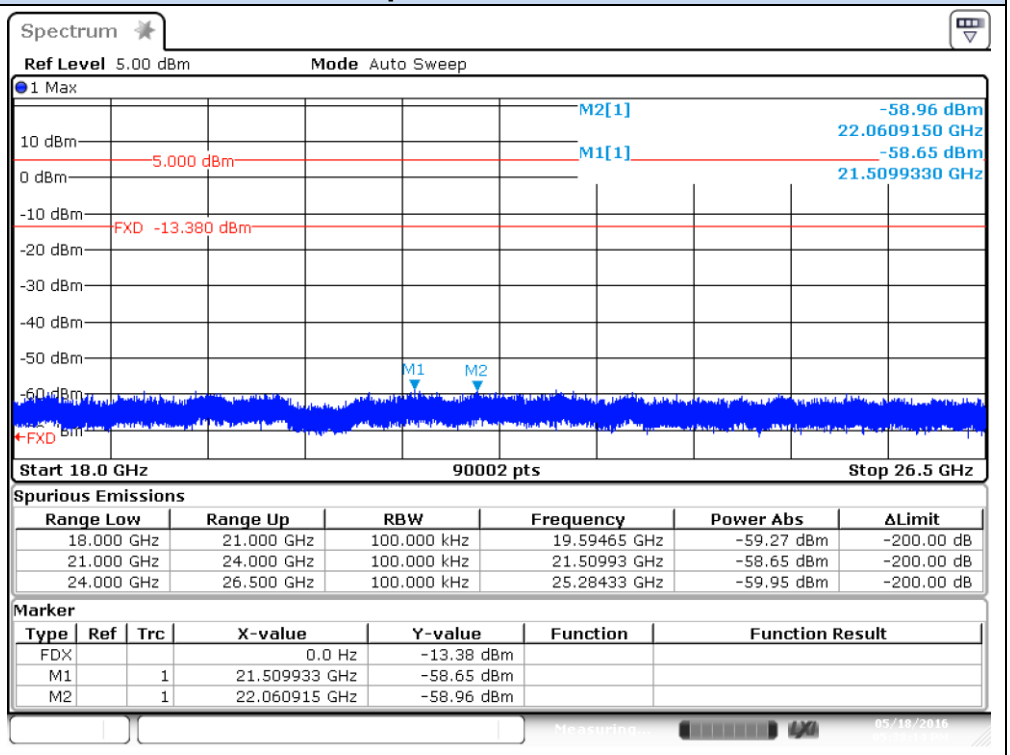
Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
9.000 GHz	12.000 GHz	100.000 kHz	9.27615 GHz	-61.36 dBm	-200.00 dB
12.000 GHz	15.000 GHz	100.000 kHz	14.15128 GHz	-60.08 dBm	-200.00 dB
15.000 GHz	18.000 GHz	100.000 kHz	17.93415 GHz	-59.40 dBm	-200.00 dB

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
FDX			0.0 Hz	-13.38 dBm		
M1		1	14.151278 GHz	-60.08 dBm		
M2		1	17.934152 GHz	-59.40 dBm		

Date: 18.MAY.2016 17:37:48

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	19.59465 GHz	-59.27 dBm	-200.00 dB
21.000 GHz	24.000 GHz	100.000 kHz	21.50993 GHz	-58.65 dBm	-200.00 dB
24.000 GHz	26.500 GHz	100.000 kHz	25.28433 GHz	-59.95 dBm	-200.00 dB

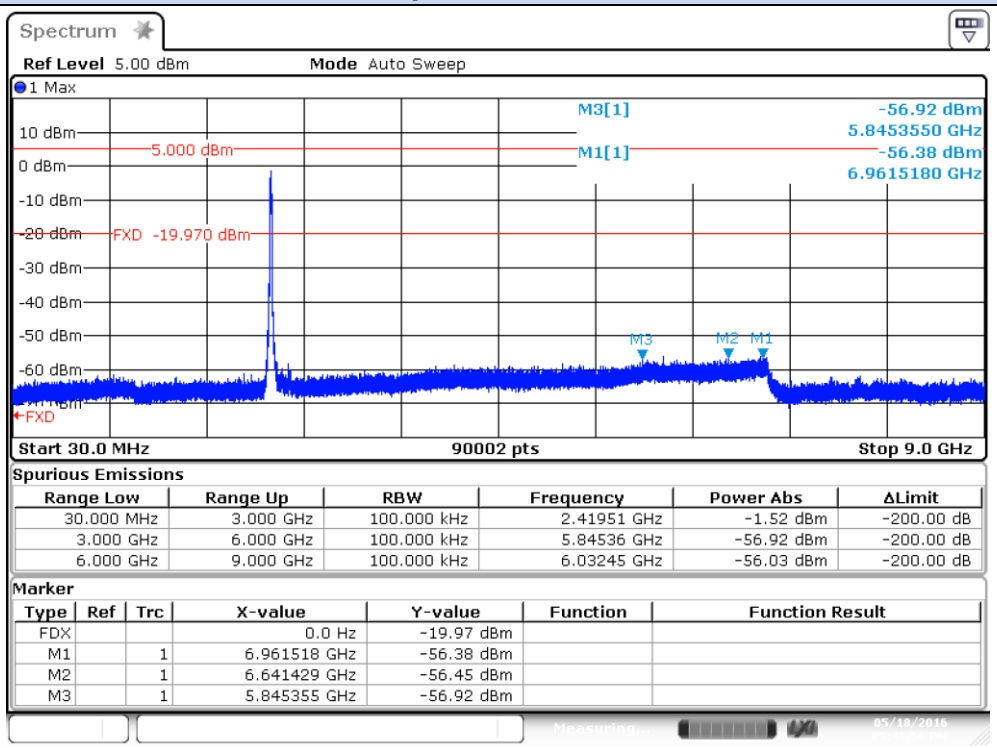
Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
FDX			0.0 Hz	-13.38 dBm		
M1		1	21.509933 GHz	-58.65 dBm		
M2		1	22.060915 GHz	-58.96 dBm		

Date: 18.MAY.2016 17:38:14

802.11g, 6Mbps – Chain A, CH1

Cond Spur, 30MHz – 9GHz



Spurious Emissions

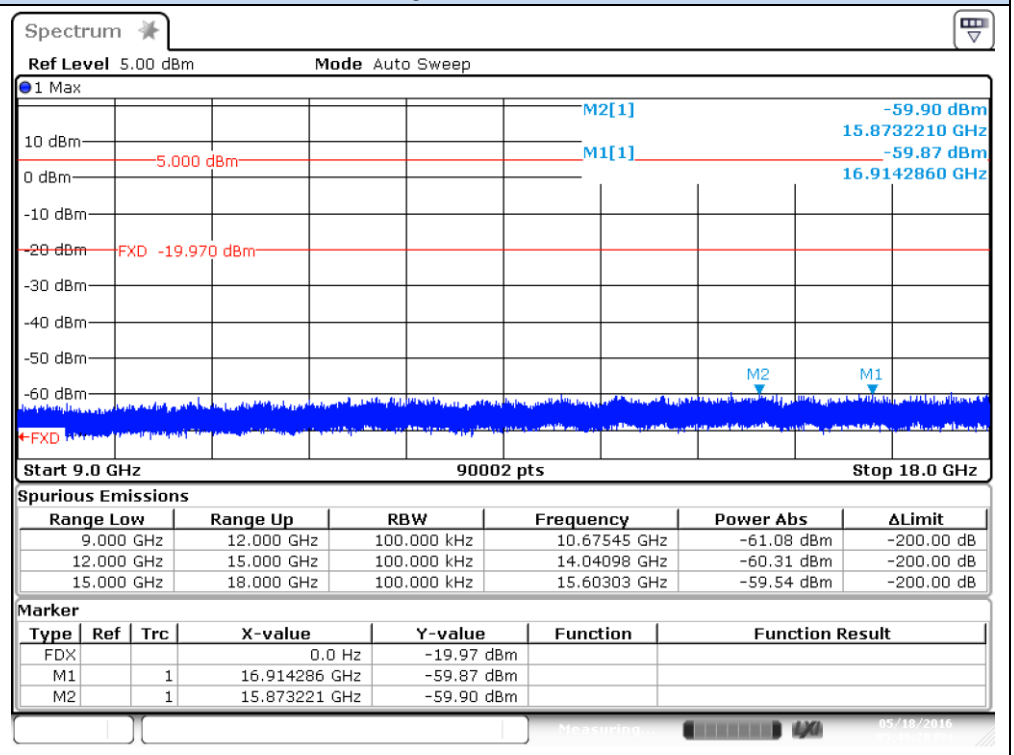
Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
30.000 MHz	3.000 GHz	100.000 kHz	2.41951 GHz	-1.52 dBm	-200.00 dB
3.000 GHz	6.000 GHz	100.000 kHz	5.84536 GHz	-56.92 dBm	-200.00 dB
6.000 GHz	9.000 GHz	100.000 kHz	6.03245 GHz	-56.03 dBm	-200.00 dB

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
FDX			0.0 Hz	-19.97 dBm		
M1		1	6.961518 GHz	-56.38 dBm		
M2		1	6.641429 GHz	-56.45 dBm		
M3		1	5.845355 GHz	-56.92 dBm		

Date: 18.MAY.2016 17:48:56

Cond Spur, 9GHz – 18GHz



Spurious Emissions

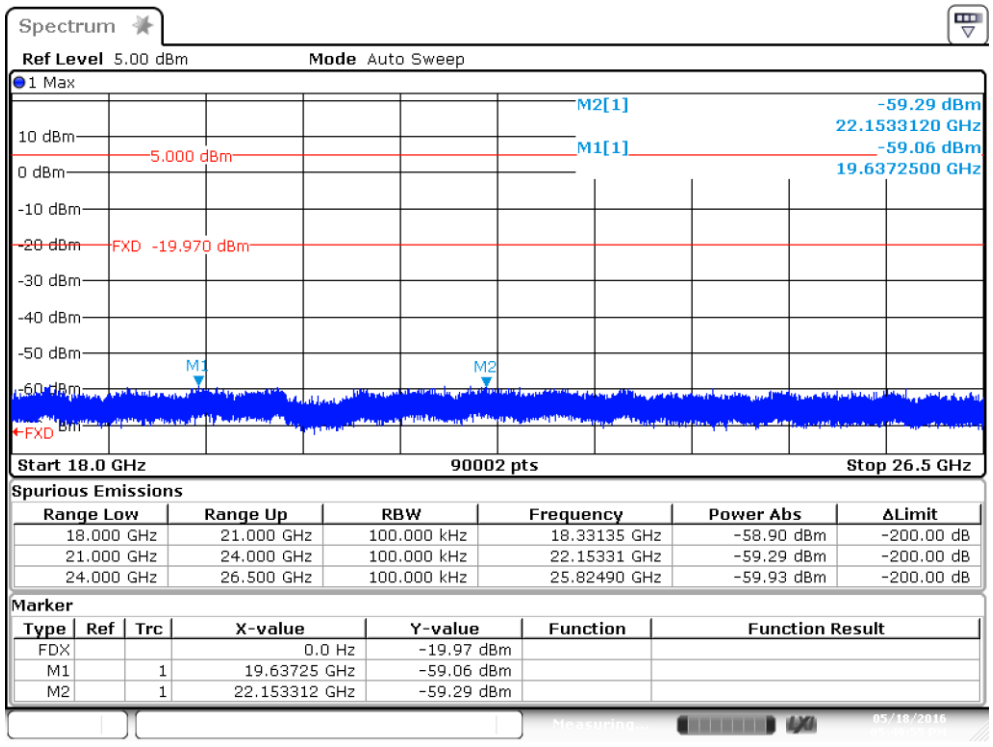
Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
9.000 GHz	12.000 GHz	100.000 kHz	10.67545 GHz	-61.08 dBm	-200.00 dB
12.000 GHz	15.000 GHz	100.000 kHz	14.04098 GHz	-60.31 dBm	-200.00 dB
15.000 GHz	18.000 GHz	100.000 kHz	15.60303 GHz	-59.54 dBm	-200.00 dB

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
FDX			0.0 Hz	-19.97 dBm		
M1		1	16.914286 GHz	-59.87 dBm		
M2		1	15.873221 GHz	-59.90 dBm		

Date: 18.MAY.2016 17:49:28

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	18.33135 GHz	-58.90 dBm	-200.00 dB
21.000 GHz	24.000 GHz	100.000 kHz	22.15331 GHz	-59.29 dBm	-200.00 dB
24.000 GHz	26.500 GHz	100.000 kHz	25.82490 GHz	-59.93 dBm	-200.00 dB

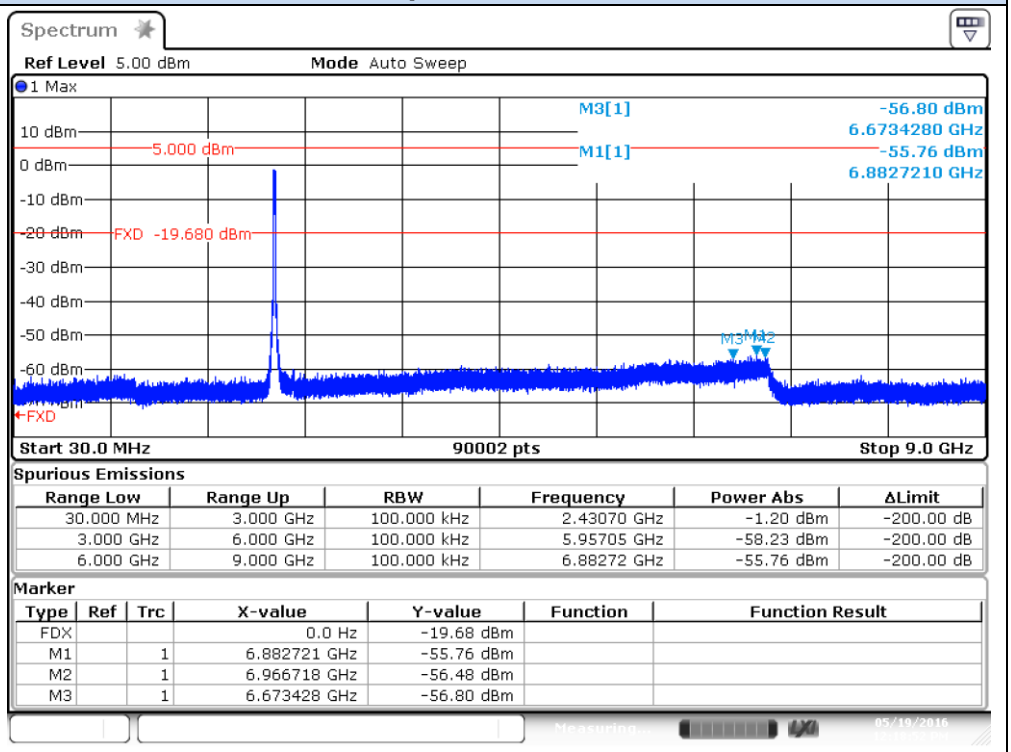
Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
FDX			0.0 Hz	-19.97 dBm		
M1		1	19.63725 GHz	-59.06 dBm		
M2		1	22.153312 GHz	-59.29 dBm		

Date: 18.MAY.2016 17:49:55

802.11g, 6Mbps, CH6

Cond Spur, 30MHz – 9GHz



Spurious Emissions

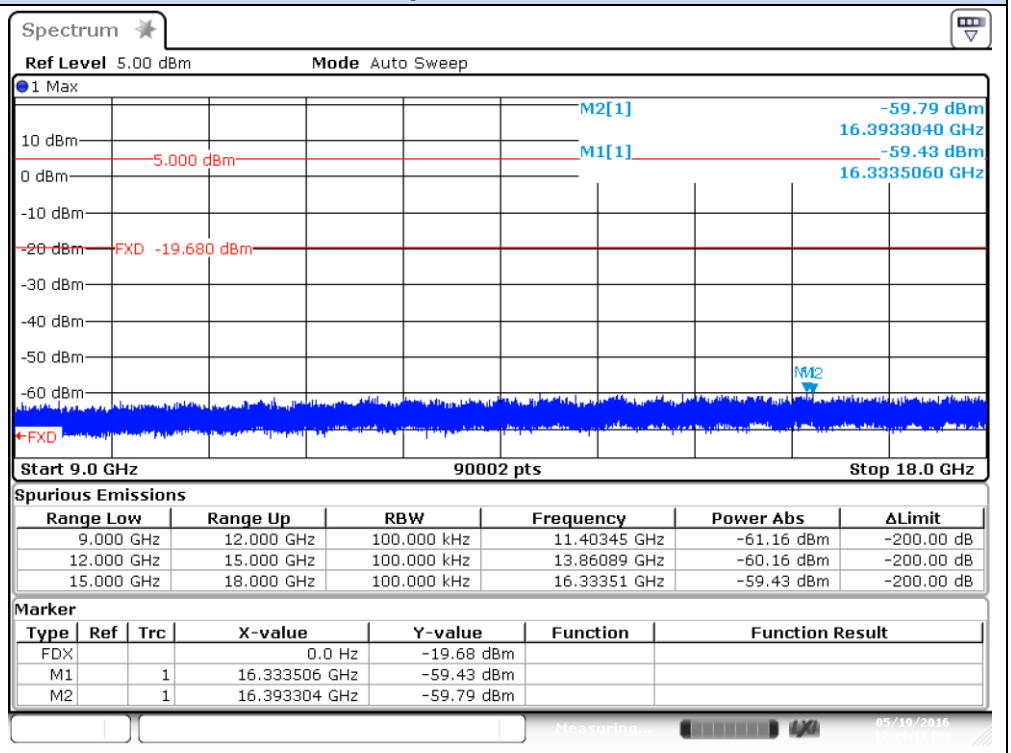
Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
30.000 MHz	3.000 GHz	100.000 kHz	2.43070 GHz	-1.20 dBm	-200.00 dB
3.000 GHz	6.000 GHz	100.000 kHz	5.95705 GHz	-58.23 dBm	-200.00 dB
6.000 GHz	9.000 GHz	100.000 kHz	6.88272 GHz	-55.76 dBm	-200.00 dB

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
FDX			0.0 Hz	-19.68 dBm		
M1		1	6.882721 GHz	-55.76 dBm		
M2		1	6.966718 GHz	-56.48 dBm		
M3		1	6.673428 GHz	-56.80 dBm		

Date: 19.MAY.2016 12:18:53

Cond Spur, 9GHz – 18GHz



Spurious Emissions

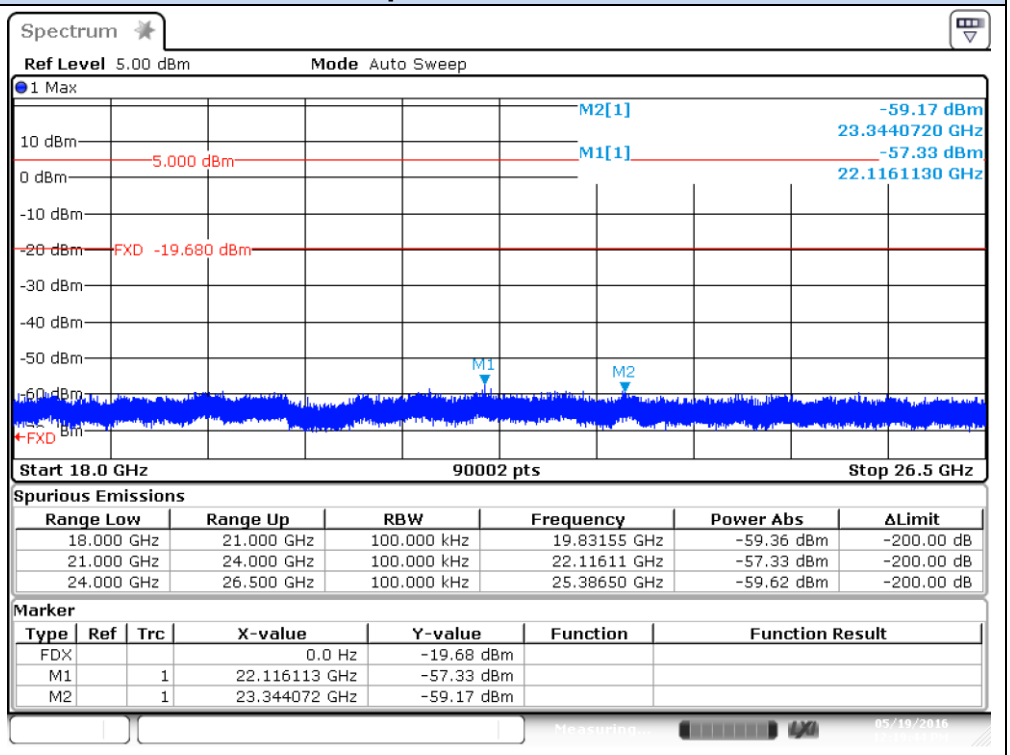
Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
9.000 GHz	12.000 GHz	100.000 kHz	11.40345 GHz	-61.16 dBm	-200.00 dB
12.000 GHz	15.000 GHz	100.000 kHz	13.86089 GHz	-60.16 dBm	-200.00 dB
15.000 GHz	18.000 GHz	100.000 kHz	16.33351 GHz	-59.43 dBm	-200.00 dB

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
FDX			0.0 Hz	-19.68 dBm		
M1		1	16.333506 GHz	-59.43 dBm		
M2		1	16.393304 GHz	-59.79 dBm		

Date: 19.MAY.2016 12:19:17

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	19.83155 GHz	-59.36 dBm	-200.00 dB
21.000 GHz	24.000 GHz	100.000 kHz	22.11611 GHz	-57.33 dBm	-200.00 dB
24.000 GHz	26.500 GHz	100.000 kHz	25.38650 GHz	-59.62 dBm	-200.00 dB

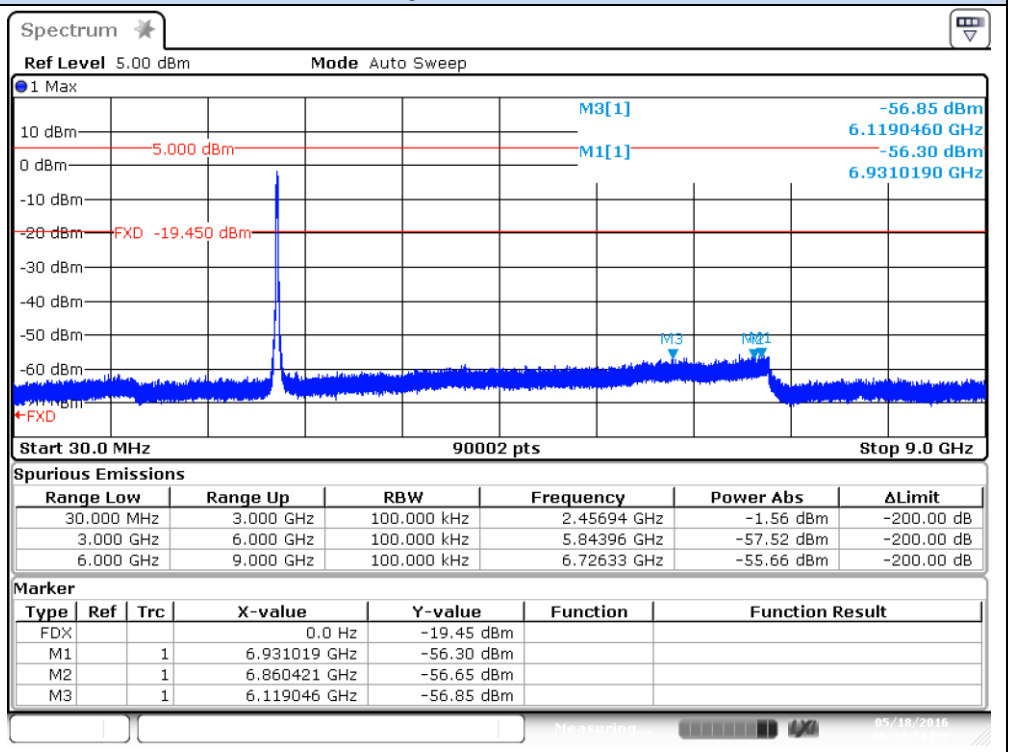
Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
FDX			0.0 Hz	-19.68 dBm		
M1		1	22.116113 GHz	-57.33 dBm		
M2		1	23.344072 GHz	-59.17 dBm		

Date: 19.MAY.2016 12:19:44

802.11g, 6Mbps , CH11

Cond Spur, 30MHz – 9GHz



Spurious Emissions

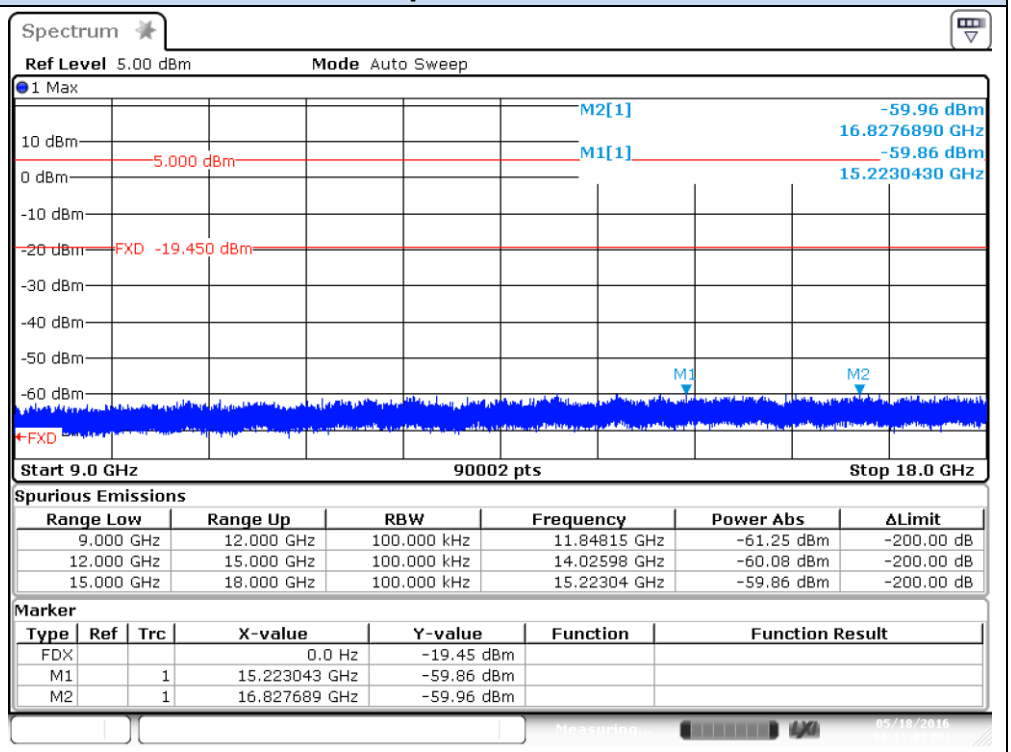
Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
30.000 MHz	3.000 GHz	100.000 kHz	2.45694 GHz	-1.56 dBm	-200.00 dB
3.000 GHz	6.000 GHz	100.000 kHz	5.84396 GHz	-57.52 dBm	-200.00 dB
6.000 GHz	9.000 GHz	100.000 kHz	6.72633 GHz	-55.66 dBm	-200.00 dB

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
FDX			0.0 Hz	-19.45 dBm		
M1		1	6.931019 GHz	-56.30 dBm		
M2		1	6.860421 GHz	-56.65 dBm		
M3		1	6.119046 GHz	-56.85 dBm		

Date: 18.MAY.2016 18:14:34

Cond Spur, 9GHz – 18GHz



Spurious Emissions

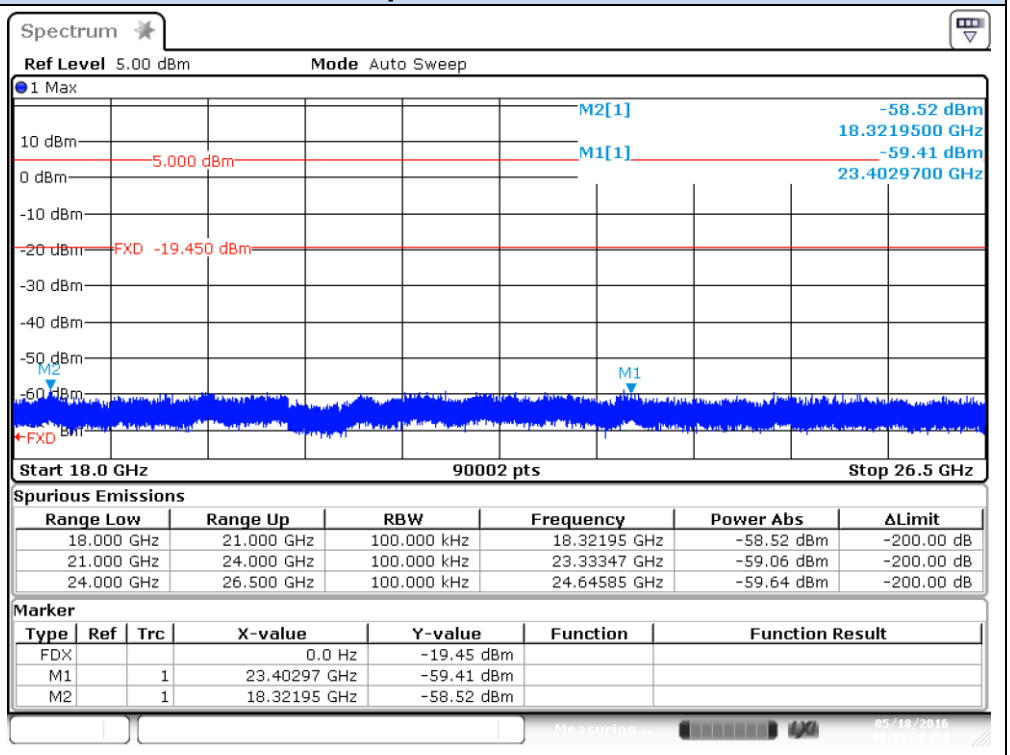
Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
9.000 GHz	12.000 GHz	100.000 kHz	11.84815 GHz	-61.25 dBm	-200.00 dB
12.000 GHz	15.000 GHz	100.000 kHz	14.02598 GHz	-60.08 dBm	-200.00 dB
15.000 GHz	18.000 GHz	100.000 kHz	15.22304 GHz	-59.86 dBm	-200.00 dB

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
FDX			0.0 Hz	-19.45 dBm		
M1		1	15.223043 GHz	-59.86 dBm		
M2		1	16.827689 GHz	-59.96 dBm		

Date: 18.MAY.2016 18:15:03

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	18.32195 GHz	-58.52 dBm	-200.00 dB
21.000 GHz	24.000 GHz	100.000 kHz	23.33347 GHz	-59.06 dBm	-200.00 dB
24.000 GHz	26.500 GHz	100.000 kHz	24.64585 GHz	-59.64 dBm	-200.00 dB

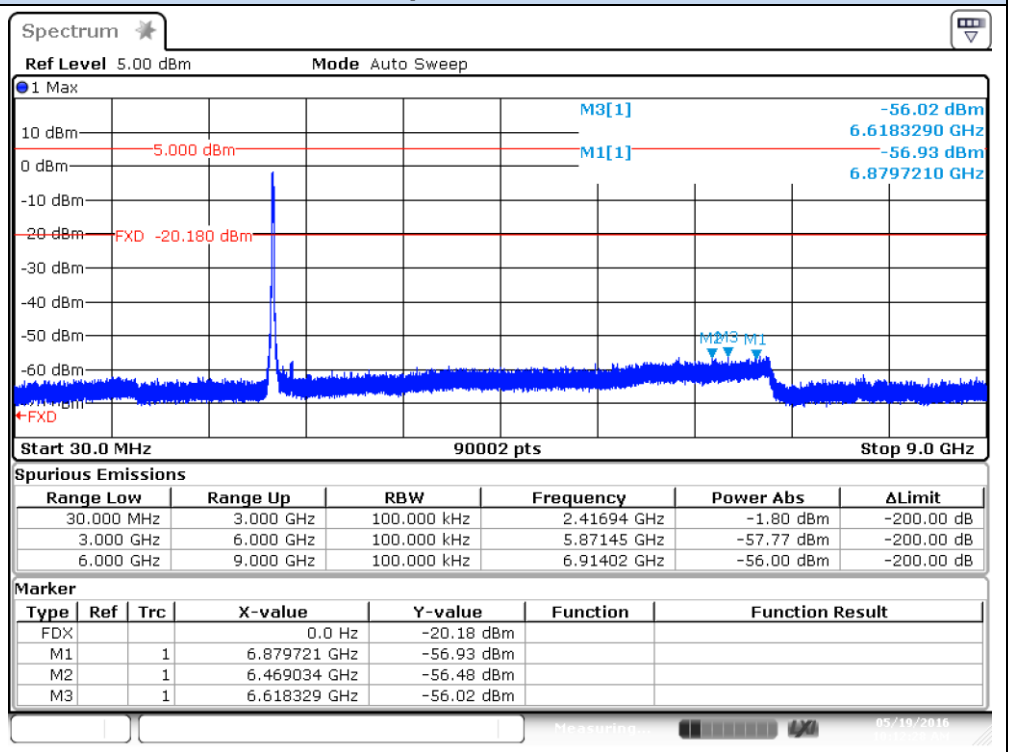
Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
FDX			0.0 Hz	-19.45 dBm		
M1		1	23.40297 GHz	-59.41 dBm		
M2		1	18.32195 GHz	-58.52 dBm		

Date: 18.MAY.2016 18:15:29

802.11n20, HT0 – Chain A, CH1

Cond Spur, 30MHz – 9GHz



Spurious Emissions

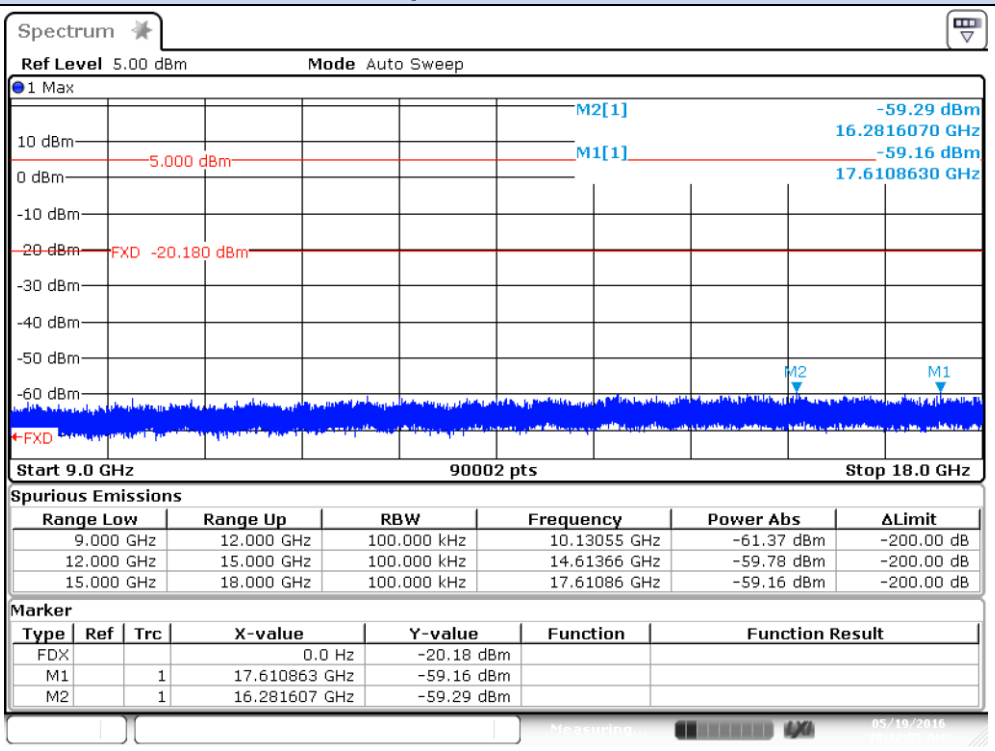
Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
30.000 MHz	3.000 GHz	100.000 kHz	2.41694 GHz	-1.80 dBm	-200.00 dB
3.000 GHz	6.000 GHz	100.000 kHz	5.87145 GHz	-57.77 dBm	-200.00 dB
6.000 GHz	9.000 GHz	100.000 kHz	6.91402 GHz	-56.00 dBm	-200.00 dB

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
FDX			0.0 Hz	-20.18 dBm		
M1		1	6.879721 GHz	-56.93 dBm		
M2		1	6.469034 GHz	-56.48 dBm		
M3		1	6.618329 GHz	-56.02 dBm		

Date: 19.MAY.2016 10:12:28

Cond Spur, 9GHz – 18GHz



Spurious Emissions

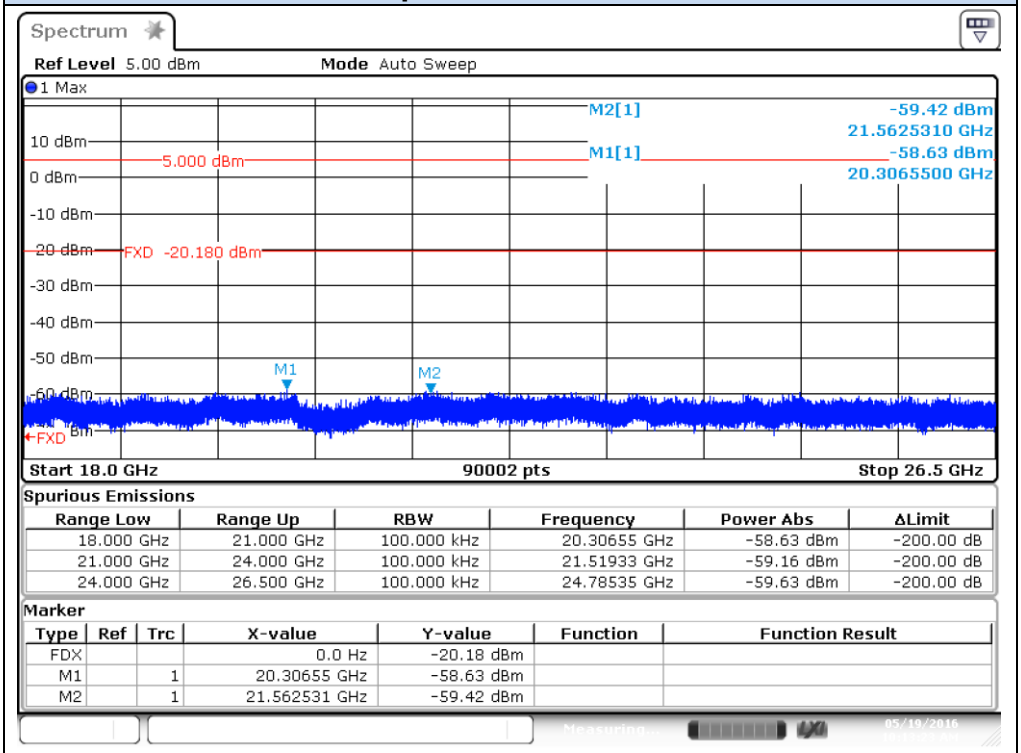
Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
9.000 GHz	12.000 GHz	100.000 kHz	10.13055 GHz	-61.37 dBm	-200.00 dB
12.000 GHz	15.000 GHz	100.000 kHz	14.61366 GHz	-59.78 dBm	-200.00 dB
15.000 GHz	18.000 GHz	100.000 kHz	17.61086 GHz	-59.16 dBm	-200.00 dB

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
FDX			0.0 Hz	-20.18 dBm		
M1		1	17.610863 GHz	-59.16 dBm		
M2		1	16.281607 GHz	-59.29 dBm		

Date: 19.MAY.2016 10:12:55

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	20.30655 GHz	-58.63 dBm	-200.00 dB
21.000 GHz	24.000 GHz	100.000 kHz	21.51933 GHz	-59.16 dBm	-200.00 dB
24.000 GHz	26.500 GHz	100.000 kHz	24.78535 GHz	-59.63 dBm	-200.00 dB

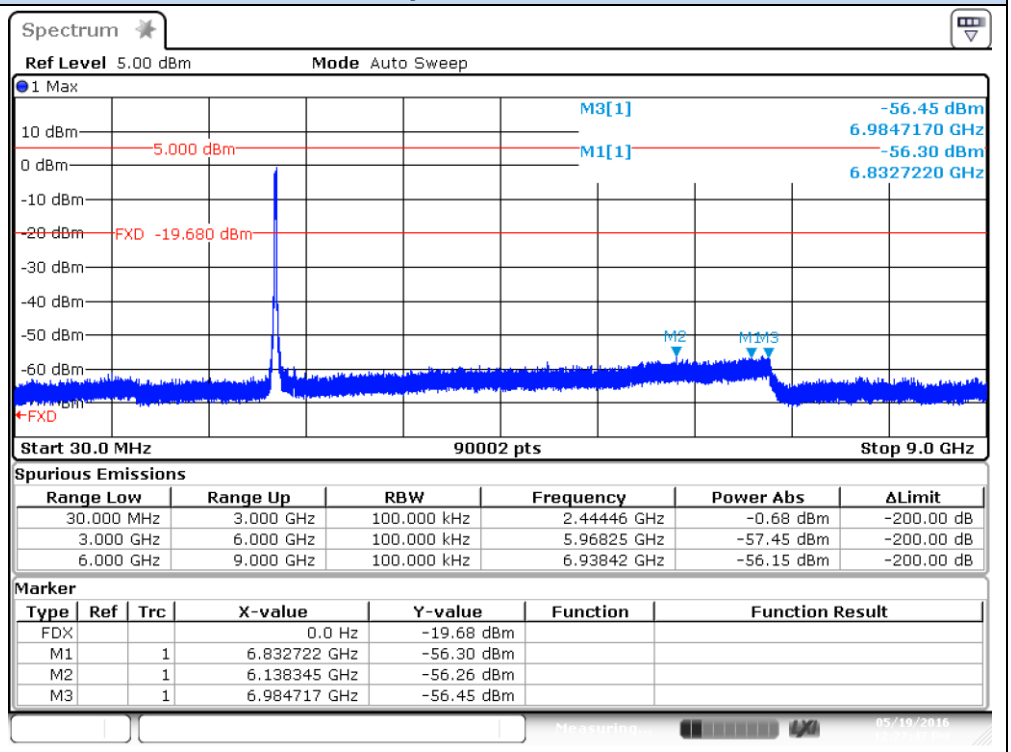
Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
FDX			0.0 Hz	-20.18 dBm		
M1		1	20.30655 GHz	-58.63 dBm		
M2		1	21.562531 GHz	-59.42 dBm		

Date: 19.MAY.2016 10:13:23

802.11n20, HT0 – Chain A, CH6

Cond Spur, 30MHz – 9GHz



Spurious Emissions

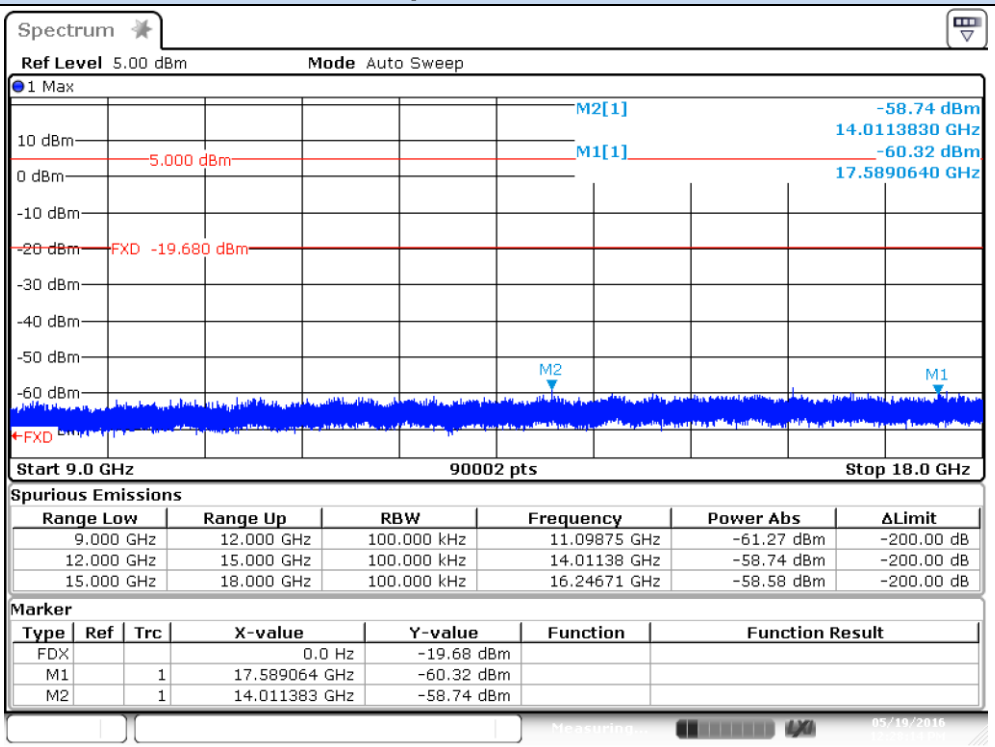
Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
30.000 MHz	3.000 GHz	100.000 kHz	2.44446 GHz	-0.68 dBm	-200.00 dB
3.000 GHz	6.000 GHz	100.000 kHz	5.96825 GHz	-57.45 dBm	-200.00 dB
6.000 GHz	9.000 GHz	100.000 kHz	6.93842 GHz	-56.15 dBm	-200.00 dB

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
FDX			0.0 Hz	-19.68 dBm		
M1		1	6.832722 GHz	-56.30 dBm		
M2		1	6.138345 GHz	-56.26 dBm		
M3		1	6.984717 GHz	-56.45 dBm		

Date: 19.MAY.2016 12:27:47

Cond Spur, 9GHz – 18GHz



Spurious Emissions

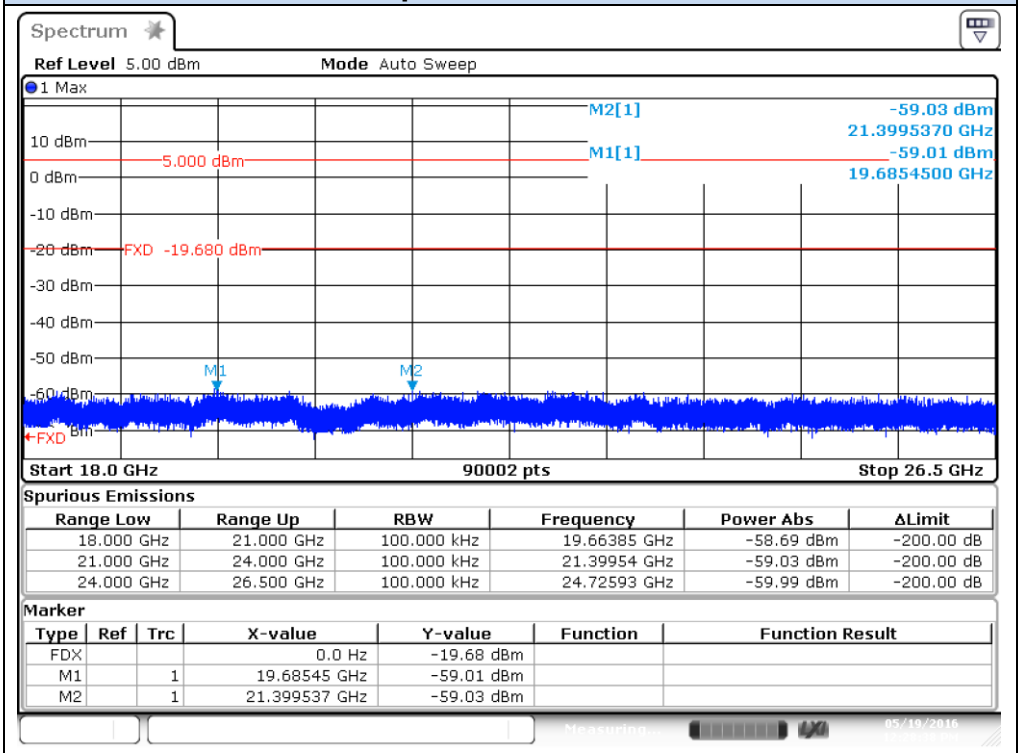
Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
9.000 GHz	12.000 GHz	100.000 kHz	11.09875 GHz	-61.27 dBm	-200.00 dB
12.000 GHz	15.000 GHz	100.000 kHz	14.01138 GHz	-58.74 dBm	-200.00 dB
15.000 GHz	18.000 GHz	100.000 kHz	16.24671 GHz	-58.58 dBm	-200.00 dB

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
FDX			0.0 Hz	-19.68 dBm		
M1		1	17.589064 GHz	-60.32 dBm		
M2		1	14.011383 GHz	-58.74 dBm		

Date: 19.MAY.2016 12:28:15

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	19.66385 GHz	-58.69 dBm	-200.00 dB
21.000 GHz	24.000 GHz	100.000 kHz	21.39954 GHz	-59.03 dBm	-200.00 dB
24.000 GHz	26.500 GHz	100.000 kHz	24.72593 GHz	-59.99 dBm	-200.00 dB

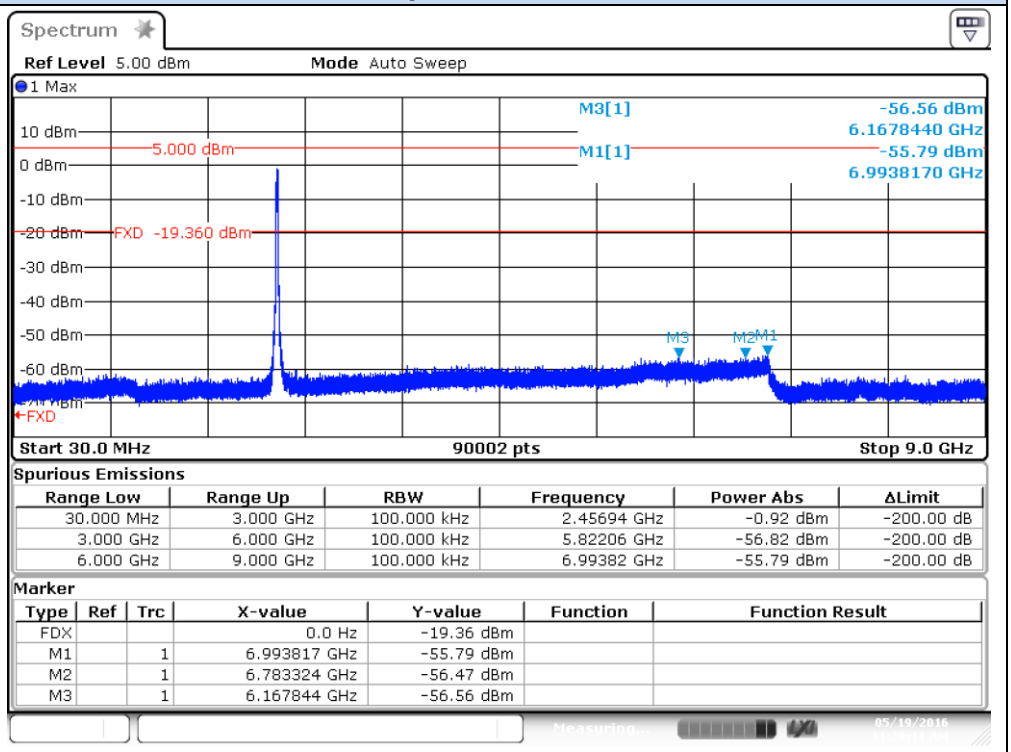
Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
FDX			0.0 Hz	-19.68 dBm		
M1		1	19.68545 GHz	-59.01 dBm		
M2		1	21.399537 GHz	-59.03 dBm		

Date: 19.MAY.2016 12:28:39

802.11n20, HT0 – Chain A, CH11

Cond Spur, 30MHz – 9GHz



Spurious Emissions

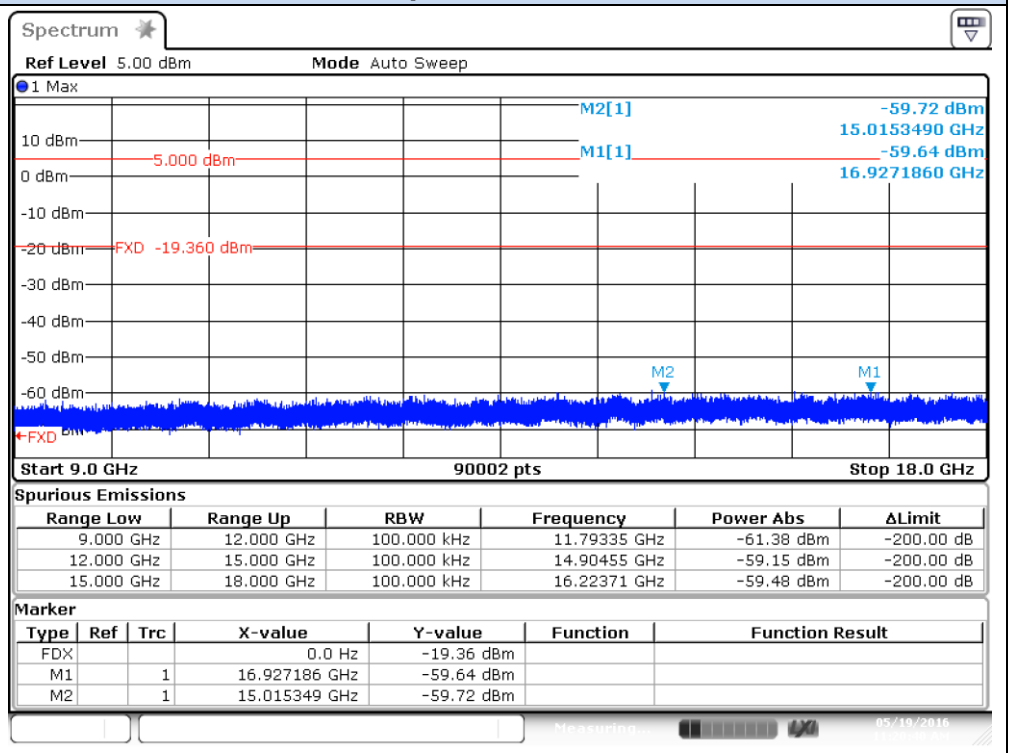
Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
30.000 MHz	3.000 GHz	100.000 kHz	2.45694 GHz	-0.92 dBm	-200.00 dB
3.000 GHz	6.000 GHz	100.000 kHz	5.82206 GHz	-56.82 dBm	-200.00 dB
6.000 GHz	9.000 GHz	100.000 kHz	6.99382 GHz	-55.79 dBm	-200.00 dB

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
FDX			0.0 Hz	-19.36 dBm		
M1		1	6.993817 GHz	-55.79 dBm		
M2		1	6.783324 GHz	-56.47 dBm		
M3		1	6.167844 GHz	-56.56 dBm		

Date: 19.MAY.2016 11:20:11

Cond Spur, 9GHz – 18GHz



Spurious Emissions

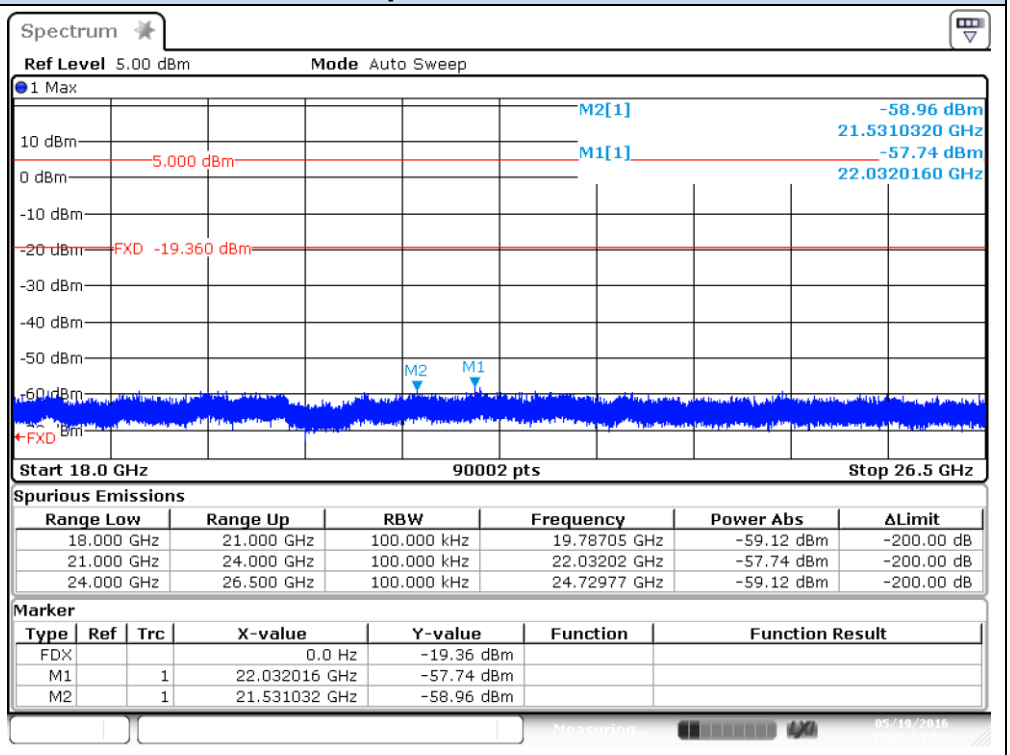
Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
9.000 GHz	12.000 GHz	100.000 kHz	11.79335 GHz	-61.38 dBm	-200.00 dB
12.000 GHz	15.000 GHz	100.000 kHz	14.90455 GHz	-59.15 dBm	-200.00 dB
15.000 GHz	18.000 GHz	100.000 kHz	16.22371 GHz	-59.48 dBm	-200.00 dB

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
FDX			0.0 Hz	-19.36 dBm		
M1		1	16.927186 GHz	-59.64 dBm		
M2		1	15.015349 GHz	-59.72 dBm		

Date: 19.MAY.2016 11:20:40

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	19.78705 GHz	-59.12 dBm	-200.00 dB
21.000 GHz	24.000 GHz	100.000 kHz	22.03202 GHz	-57.74 dBm	-200.00 dB
24.000 GHz	26.500 GHz	100.000 kHz	24.72977 GHz	-59.12 dBm	-200.00 dB

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
FDX			0.0 Hz	-19.36 dBm		
M1		1	22.032016 GHz	-57.74 dBm		
M2		1	21.531032 GHz	-58.96 dBm		

Date: 19.MAY.2016 11:21:13

B.4 Power Spectral Density

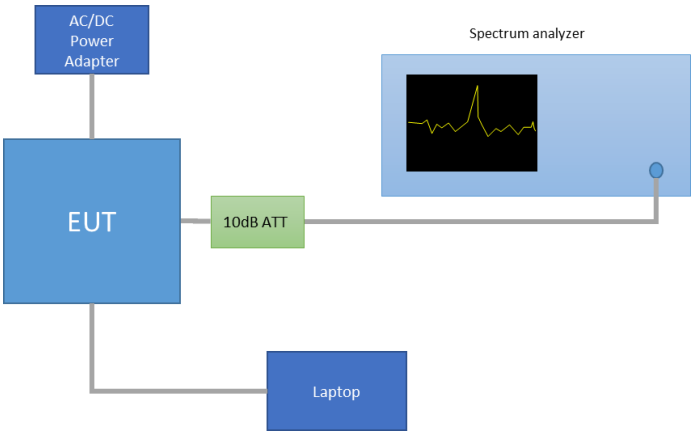
Test limits:

FCC part	Limits
15.247 (e)	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 and 802.11n20.

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.



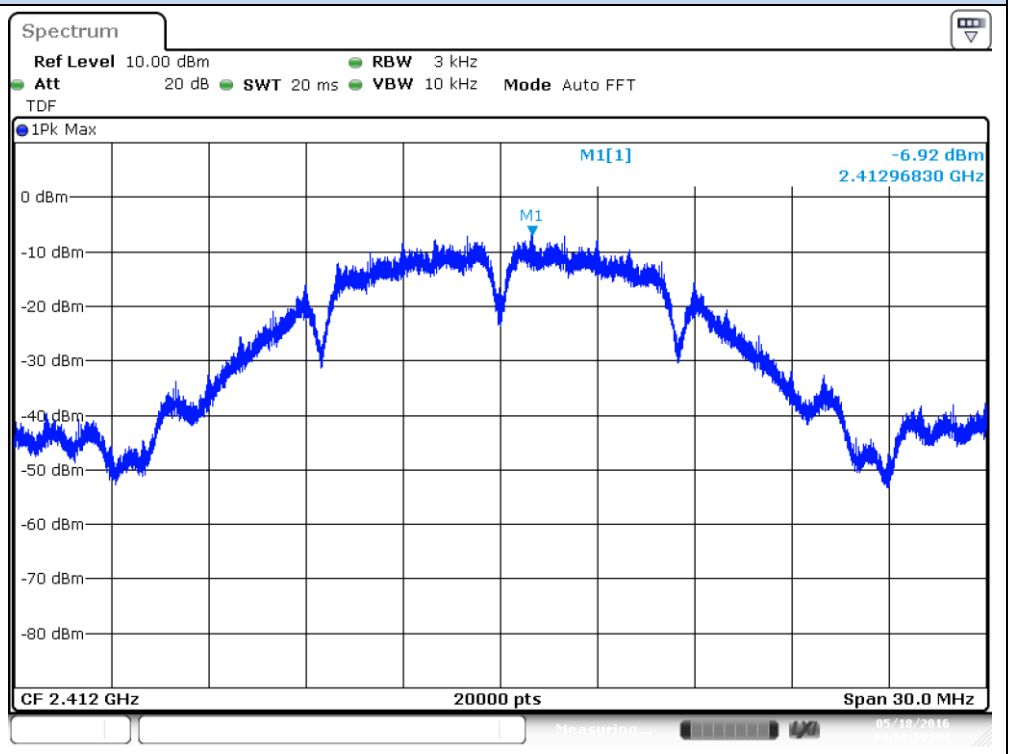
Results tables:

Mode	Rate	CH	Frequency [MHz]	Antenna	PSD Peak [dBm]
802.11b	1Mbps	1	2412	SISO CHAIN A	-6.92
		6	2437	SISO CHAIN A	-7.86
		11	2462	SISO CHAIN A	-6.92
802.11g	6Mbps	1	2412	SISO CHAIN A	-14.45
		6	2437	SISO CHAIN A	-12.22
		11	2462	SISO CHAIN A	-12.65
802.11n20	HT0	1	2412	SISO CHAIN A	-13.66
		6	2437	SISO CHAIN A	-13.55
		11	2462	SISO CHAIN A	-12.82

Results screenshot:

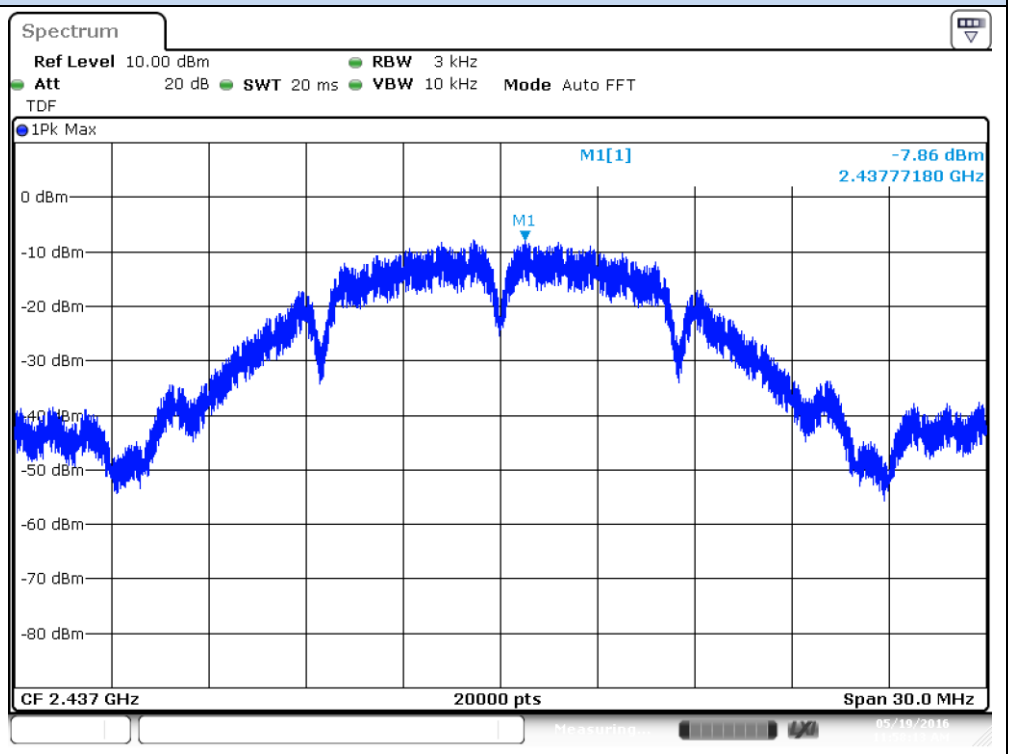
802.11b, 1Mbps

PSD Peak, Chain A – CH1



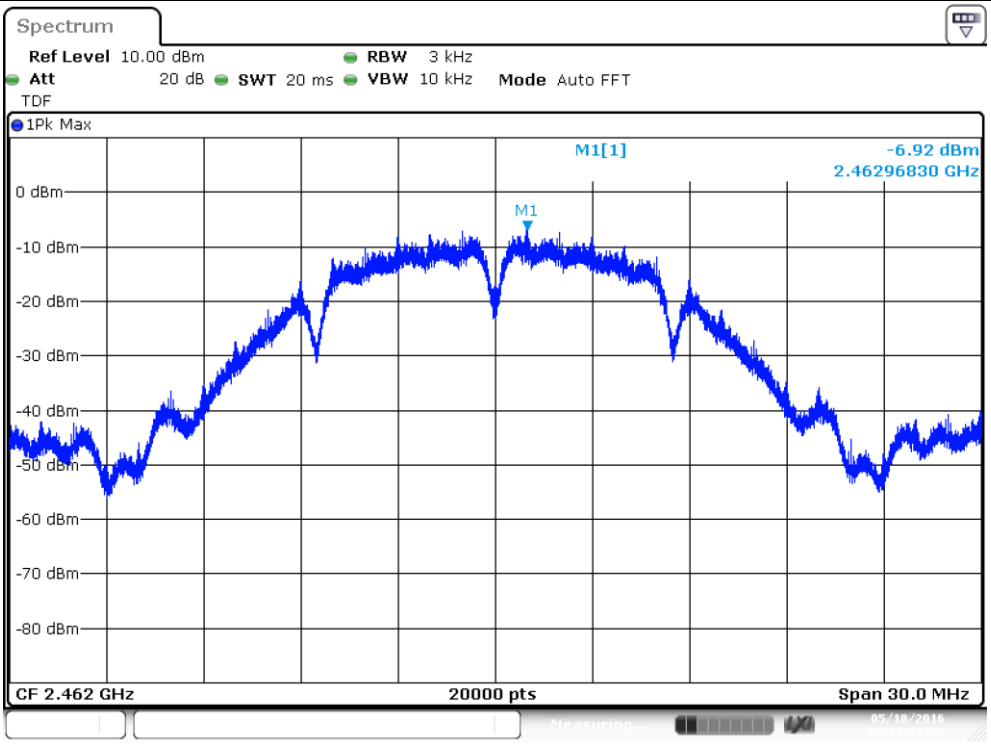
Date: 18.MAY.2016 16:59:59

PSD Peak, Chain A – CH6



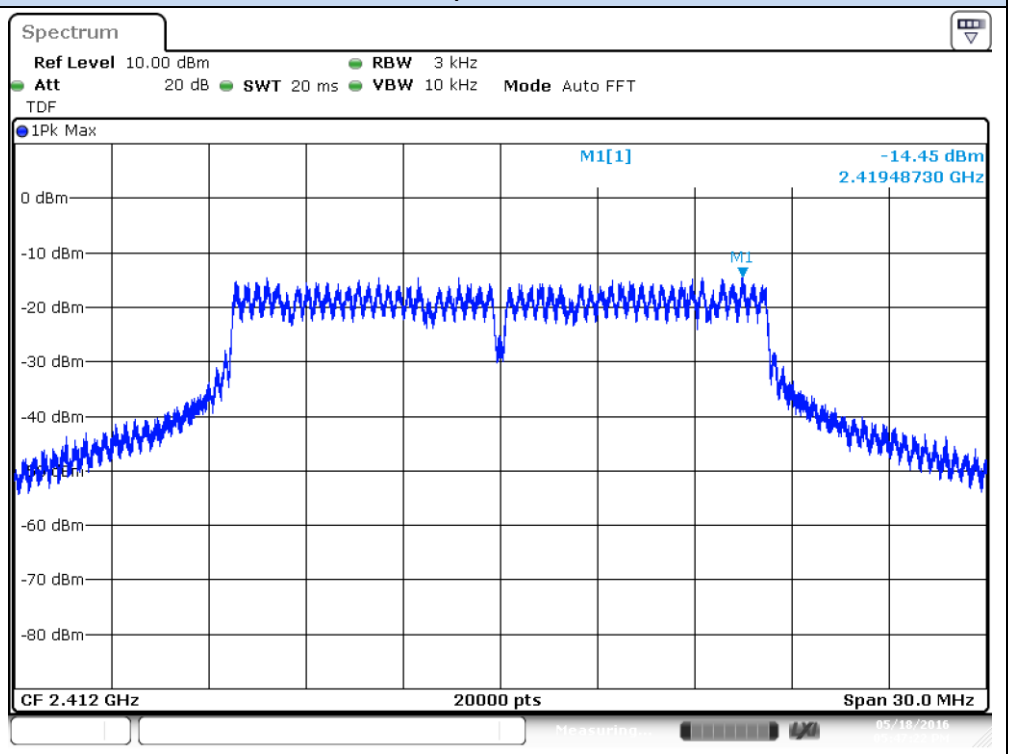
Date: 19.MAY.2016 11:58:14

PSD Peak, Chain A - CH11



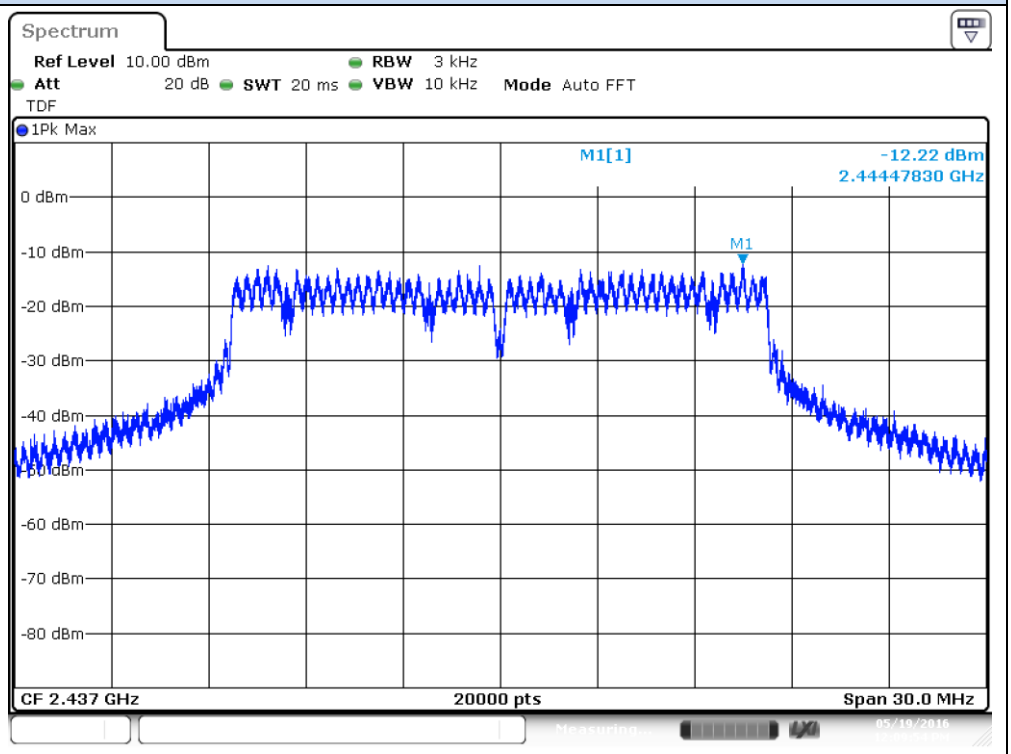
802.11g, 6Mbps

PSD Peak, Chain A – CH1



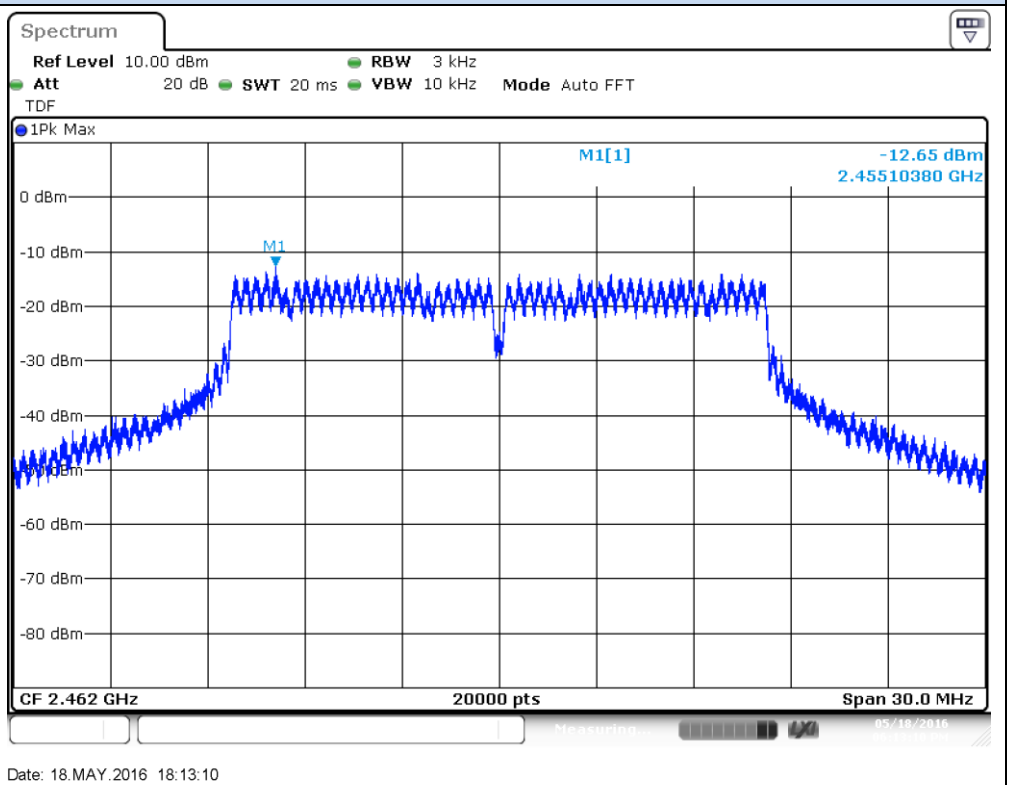
Date: 18.MAY.2016 17:47:22

PSD Peak, Chain A – CH6



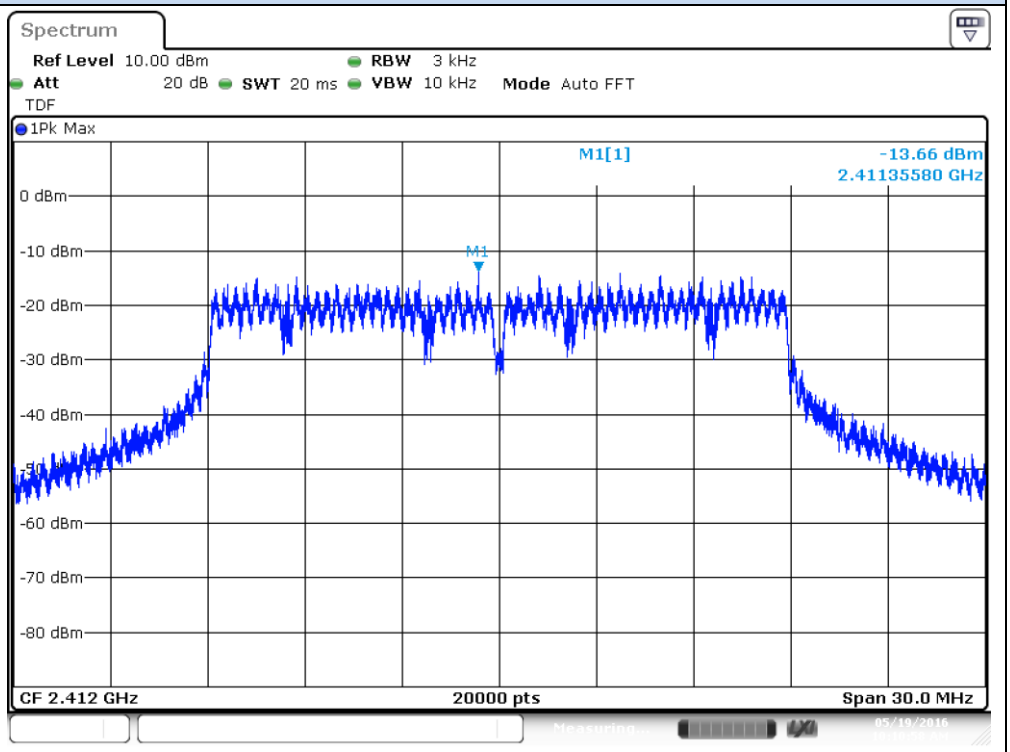
Date: 19.MAY.2016 12:09:54

PSD Peak, Chain A - CH11



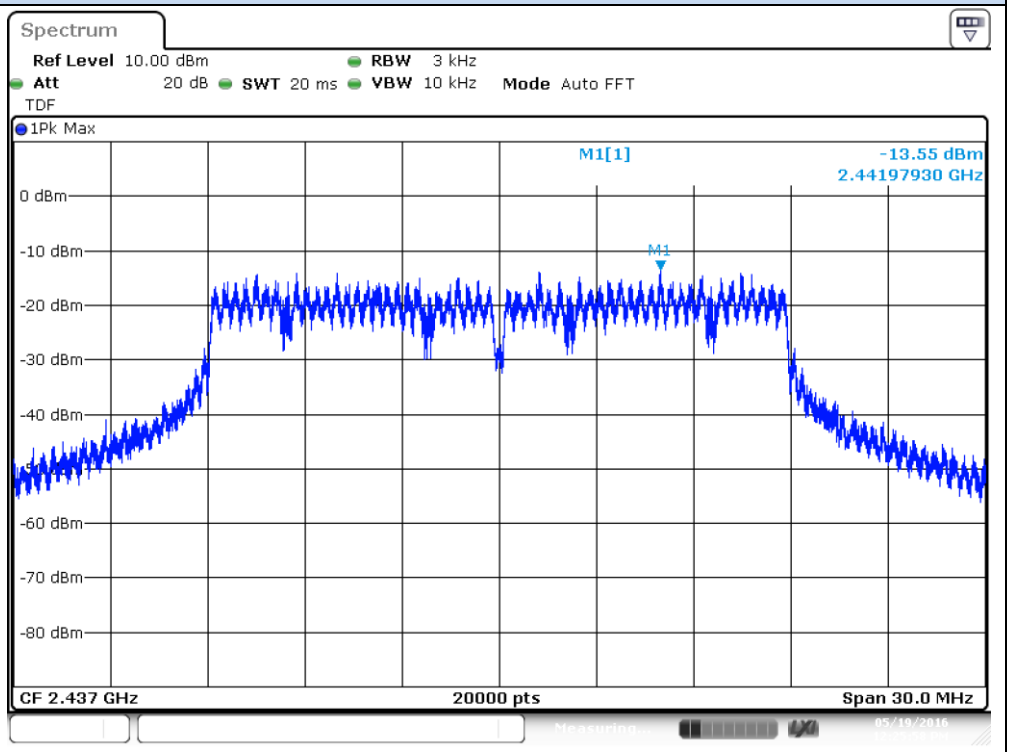
802.11n20, HT0

PSD Peak, Chain A - CH1



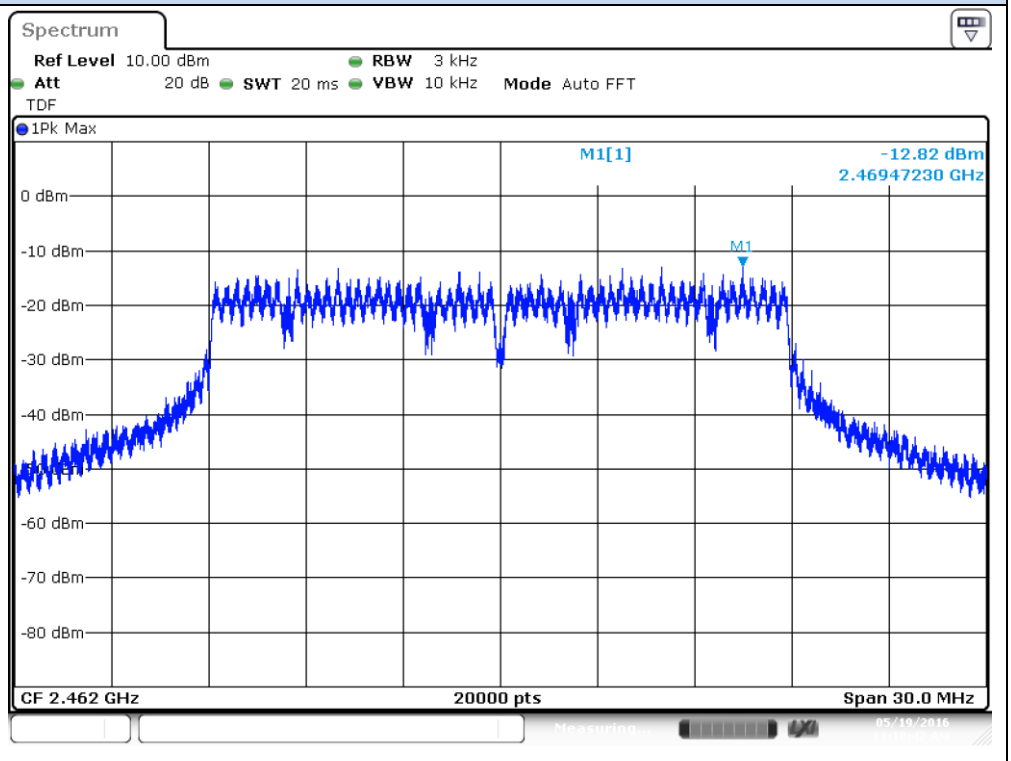
Date: 19.MAY.2016 10:10:59

PSD Peak, Chain A - CH6



Date: 19.MAY.2016 12:25:58

PSD Peak, Chain A - CH11



B.5 Radiated spurious emission

Standard references:

<table>
<tr><th>FCC part</th><th>Limits</th></tr>
<tr><td>15.247 (d)</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>960-25000</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>

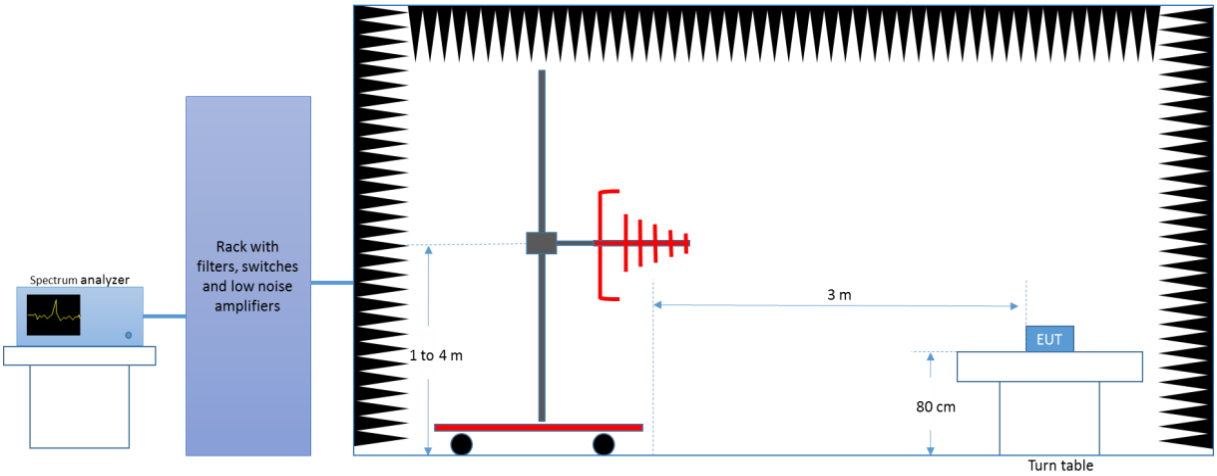
Test procedure:

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.

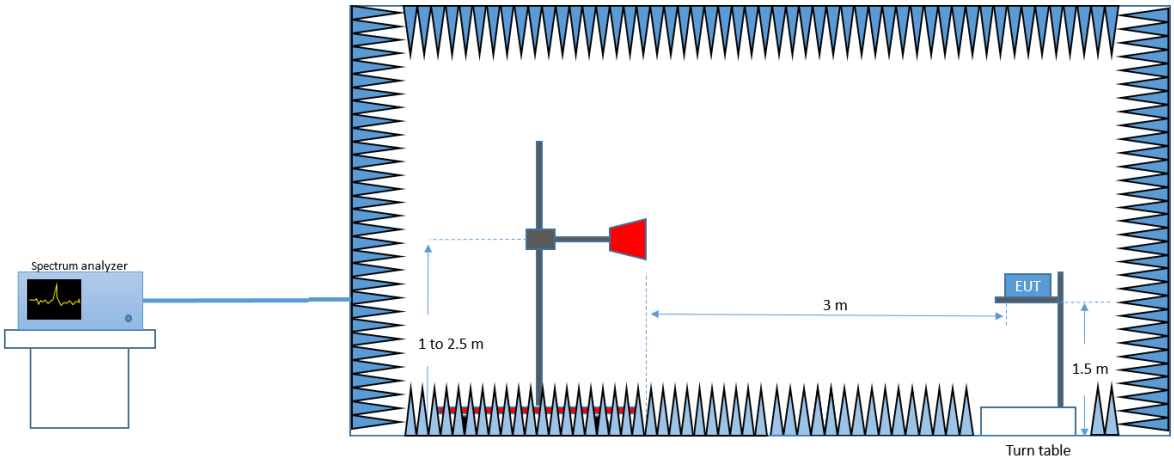
The resolution/video bandwidth used for the radiated measurement is as follows:

Freq. Range	RBW	VBW
30MHz – 1GHz	100kHz	300kHz
>1GHz	1MHz	3MHz

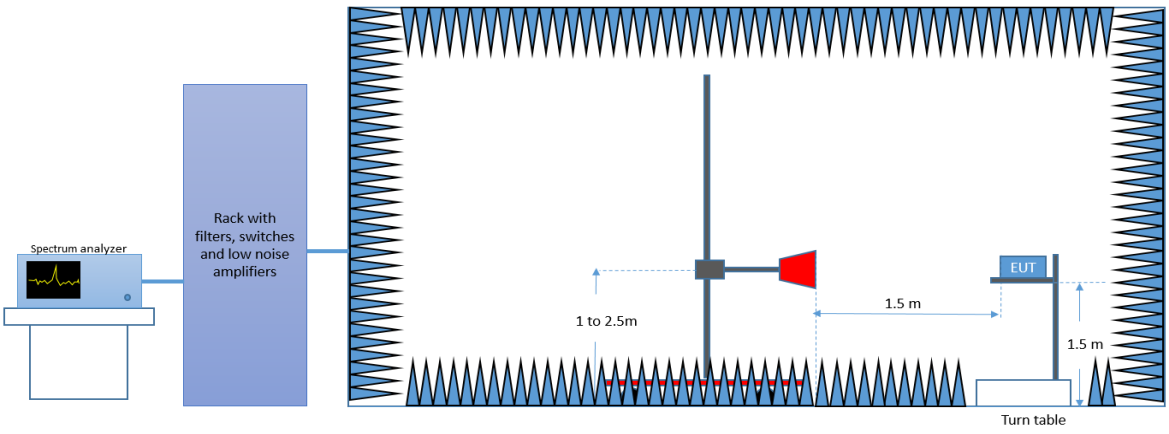
Radiated Setup < 1GHz



Radiated Setup 1GHz - 18GHz



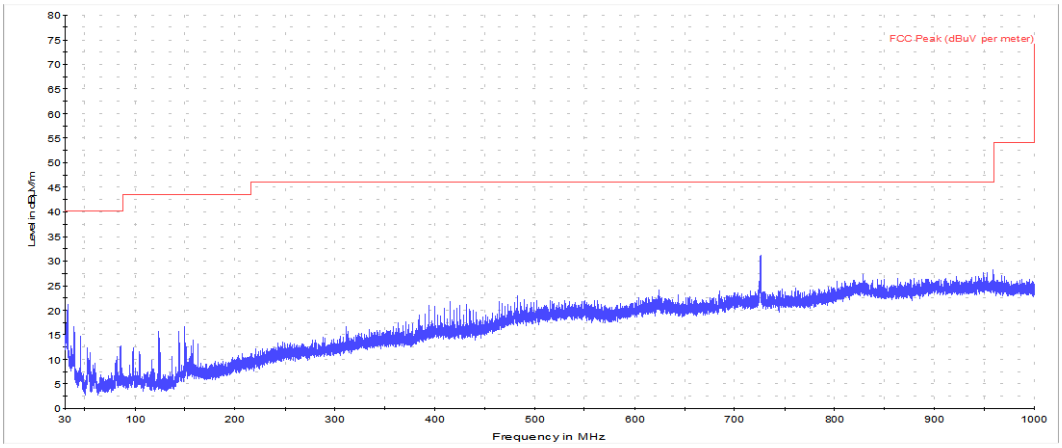
Radiated Setup > 18GHz



Test Results:

Radiated Spurious – 30MHz to 1GHz

Radiated Spurious – All Modes

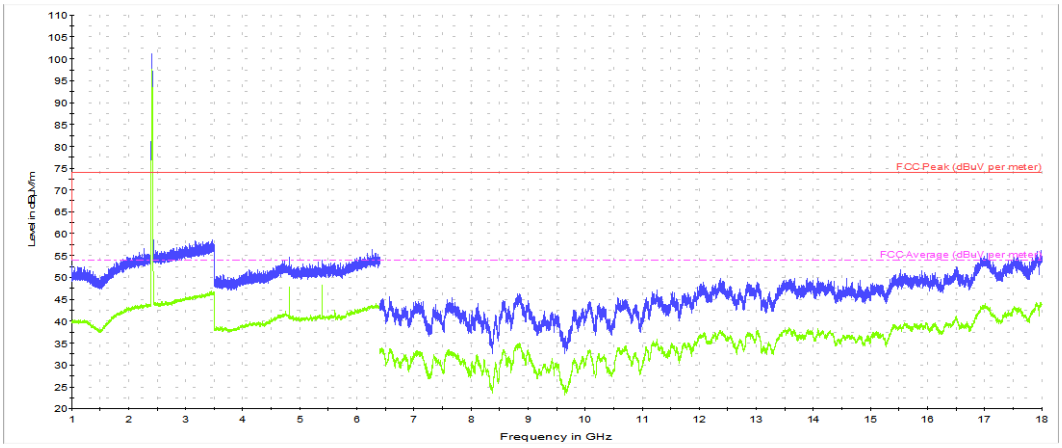


Frequency	Max Peak	Limit	Margin
MHz	dBµV/m	dBµV/m	dB
32	20.9	40	19.1

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

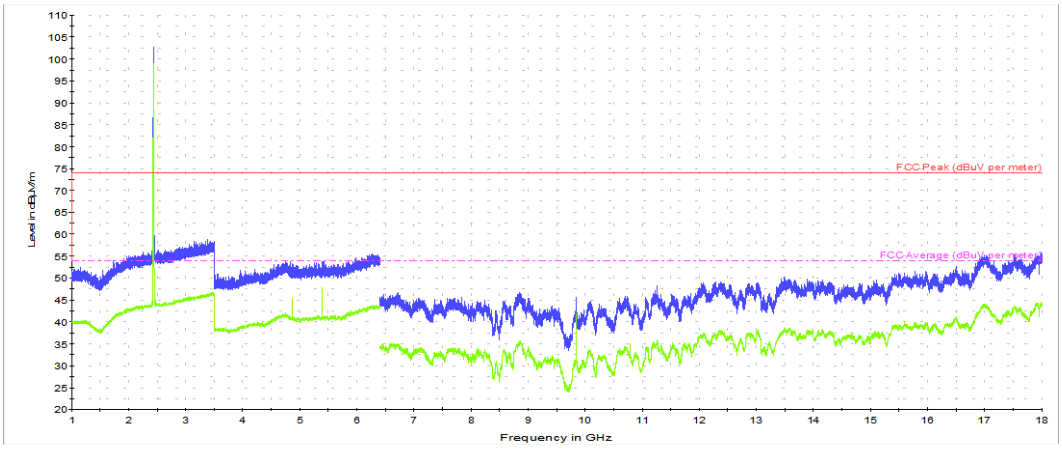
Radiated Spurious – 1 GHz to 18GHz
802.11b, 1Mbps

CH1



Frequency	Max Peak	AVG	Limit	Margin
MHz	dBµV/m	dBµV/m	dBµV/m	dB
4823	54.4	-	74	18.6
4823	-	48.4	54	5.6
5400	55.6		74	18.4
5400		49.2	54	4.8

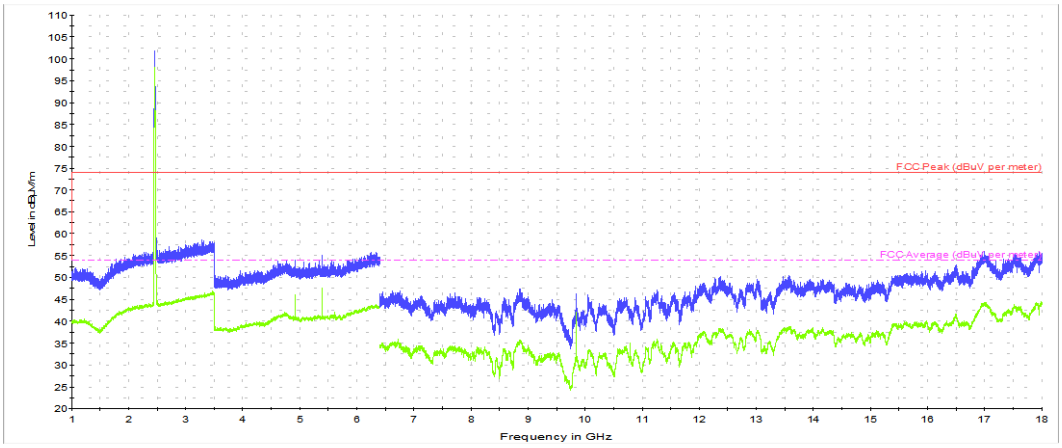
CH6



Peak measurements AVG measurements Limit FCC Peak Limit FCC AVG

Frequency	Max Peak	AVG	Limit	Margin
MHz	dBµV/m	dBµV/m	dBµV/m	dB
5400	55.8	-	74	18.2
5400	-	49.0	54	5.0

CH11

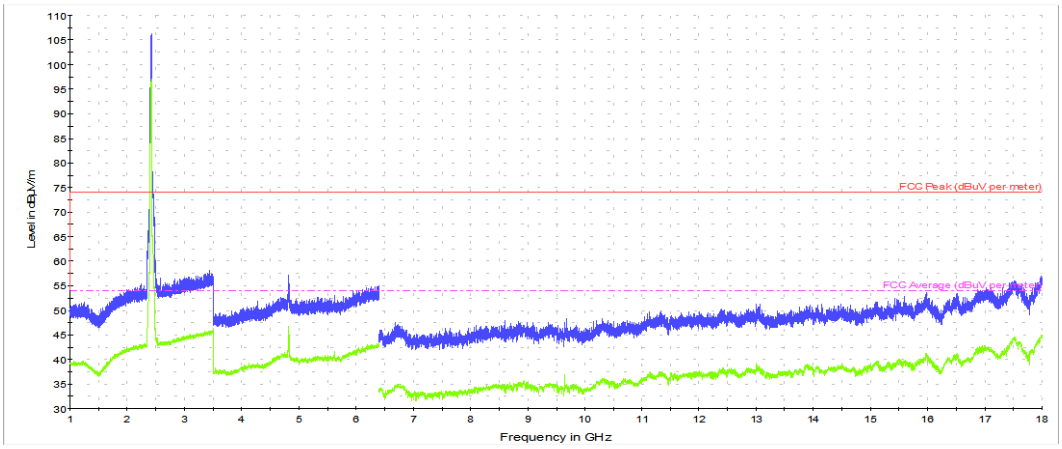


Peak measurements AVG measurements Limit FCC Peak Limit FCC AVG

Frequency	Max Peak	AVG	Limit	Margin
MHz	dBµV/m	dBµV/m	dBµV/m	dB
4923	54.3	-	74	19.7
4923	-	45.8	54	8.2
5400	54.9		74	19.1
5400		49.6	54	4.4

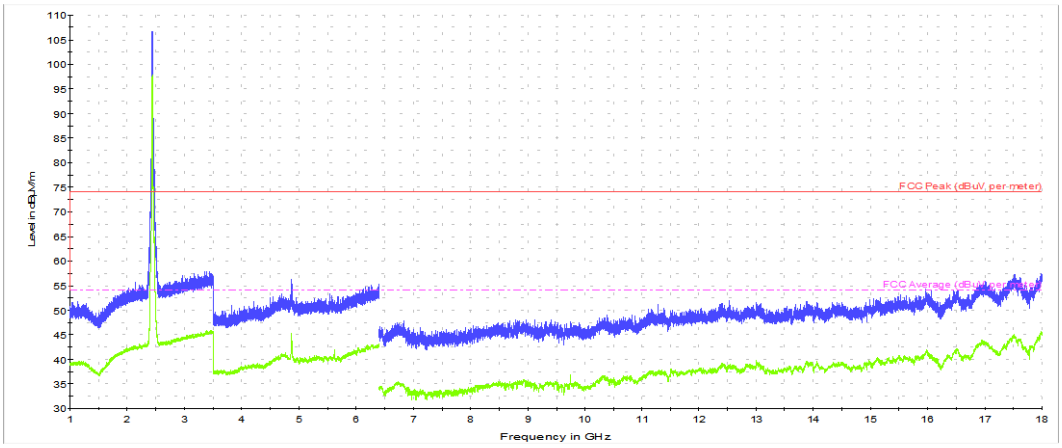
Radiated Spurious – 1 GHz to 18GHz
802.11g, 6Mbps

CH1



Frequency	Max Peak	AVG	Limit	Margin
MHz	dBµV/m	dBµV/m	dBµV/m	dB
4822	58.5	-	74	15.5
4822	-	46.1	54	7.9

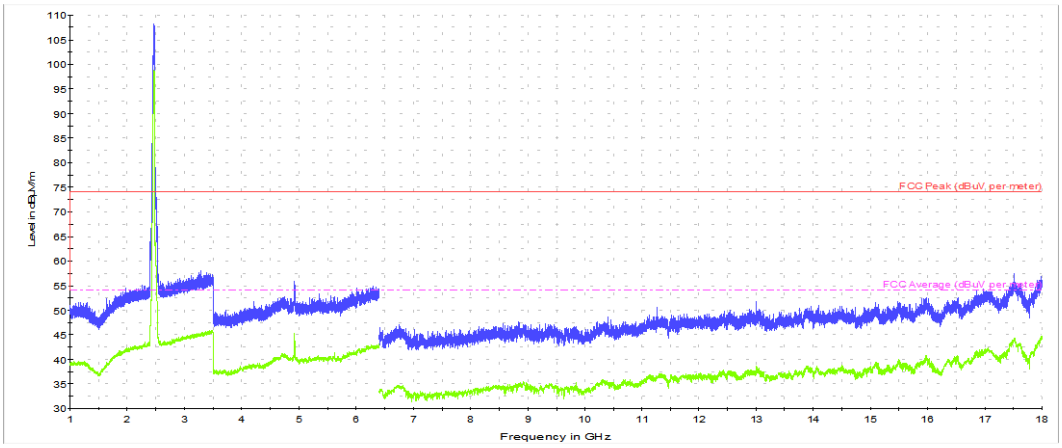
CH6



Peak measurements AVG measurements Limit FCC Peak Limit FCC AVG

Frequency	Max Peak	AVG	Limit	Margin
MHz	dBµV/m	dBµV/m	dBµV/m	dB
4874	56.4	-	74	17.6
4874	-	45.9	54	8.1

CH11

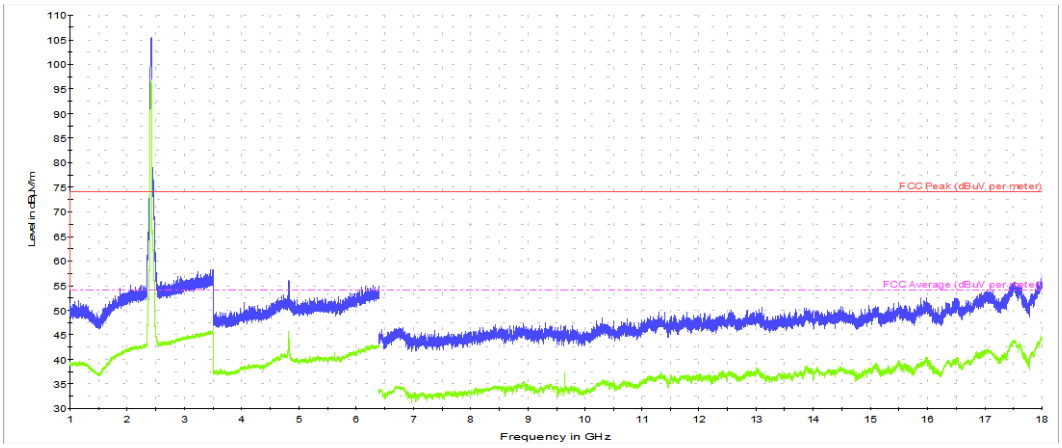


Peak measurements AVG measurements Limit FCC Peak Limit FCC AVG

Frequency	Max Peak	AVG	Limit	Margin
MHz	dBµV/m	dBµV/m	dBµV/m	dB
4922	57.0	-	74	17.0
4922	-	45.8	54	8.2

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

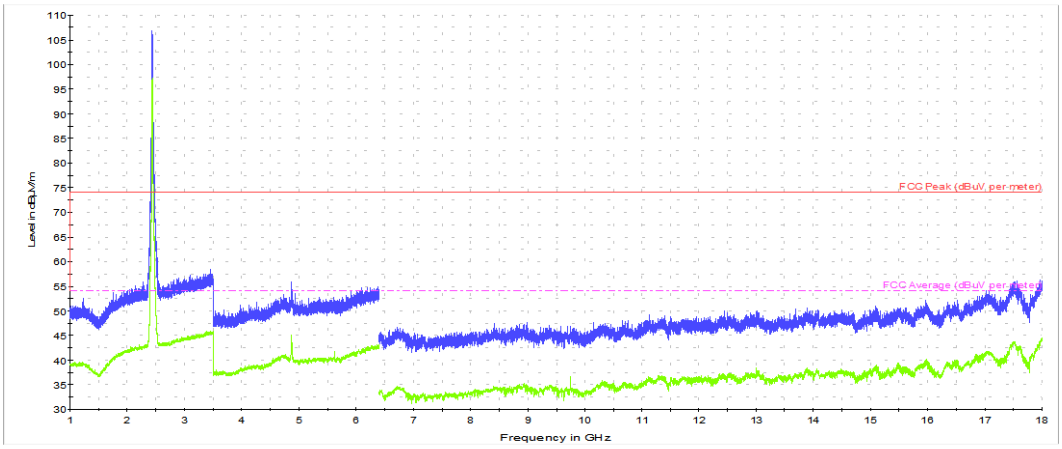
CH1



Peak measurements AVG measurements Limit FCC Peak Limit FCC AVG

Frequency	Max Peak	AVG	Limit	Margin
MHz	dBµV/m	dBµV/m	dBµV/m	dB
4824	56.4	-	74	17.6
4724	-	45.9	54	8.1

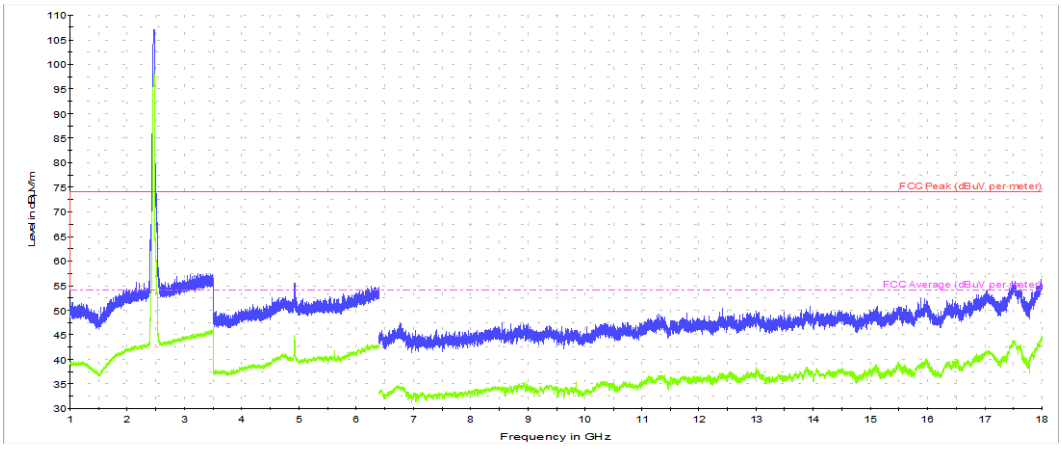
CH6



Peak measurements AVG measurements Limit FCC Peak Limit FCC AVG

Frequency	Max Peak	RMS	Limit	Margin
MHz	dBµV/m	dBµV/m	dBµV/m	dB
4877	55.9	-	74	18.1
4870	-	45.3	54	8.7

CH11

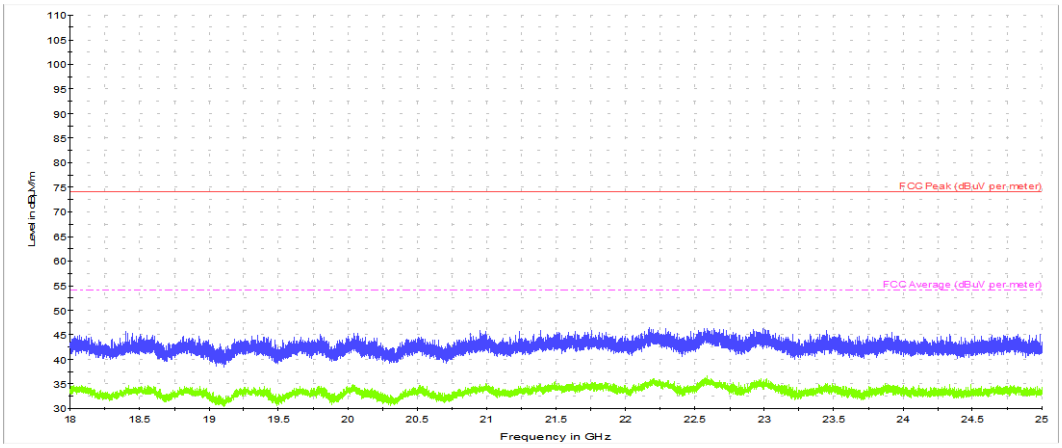


Peak measurements AVG measurements Limit FCC Peak Limit FCC AVG

Frequency	Max Peak	AVG	Limit	Margin
MHz	dBµV/m	dBµV/m	dBµV/m	dB
4924	56.4	-	74	17.6
4926	-	44.9	54	9.1

Radiated Spurious – 18 GHz to 25 GHz

Radiated Spurious – All Modes



Frequency	Max Peak	AVG	Limit	Margin
MHz	dBµV/m	dBµV/m	dBµV/m	dB
22169	46.5	---	74	17.5
22169	---	36.1	54	17.9

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

Annex C. Test Results BLE

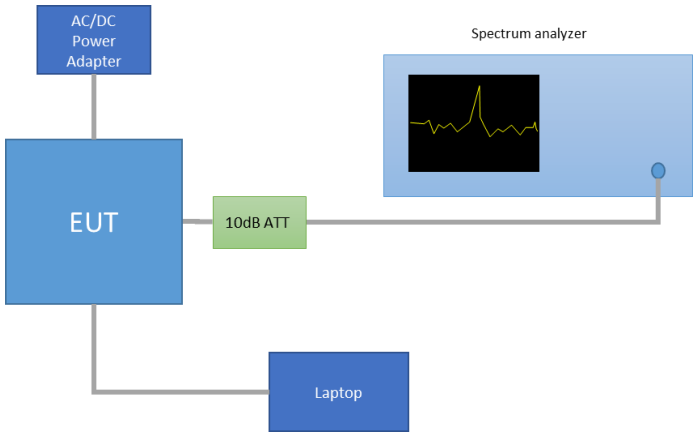
C.1 6dB & 99% Bandwidth

Test limits:

FCC part	Limits
15.247 (a) (2)	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.



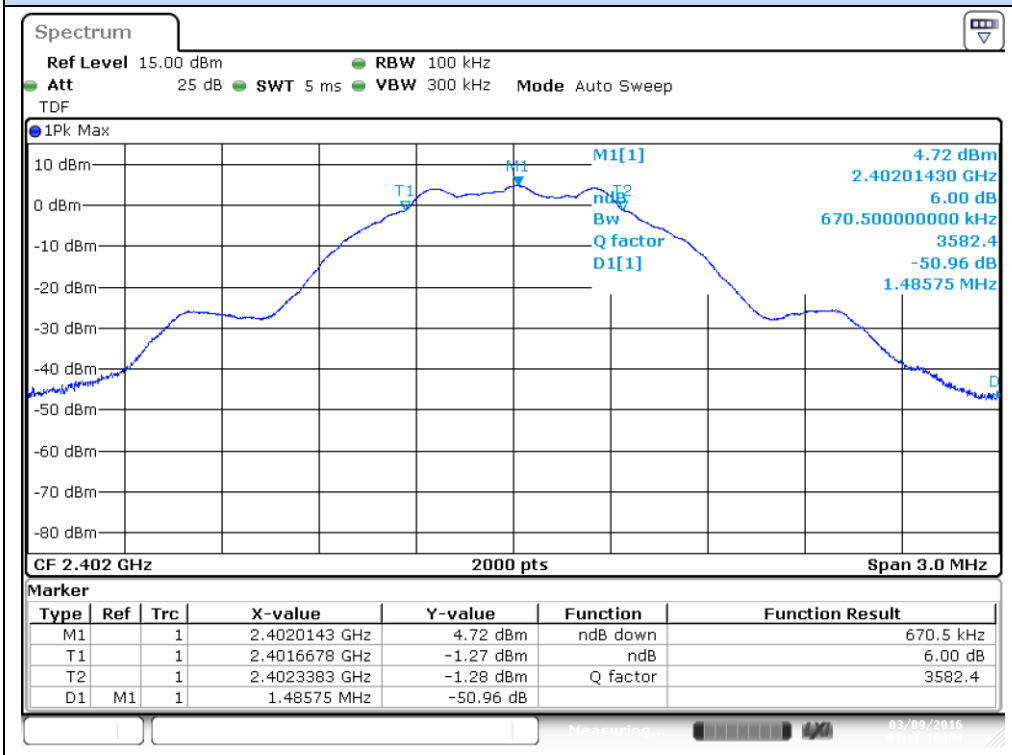
Results tables:

Mode	Channel	Frequency [MHz]	6dB BW [MHz]	99% BW [MHz]
BLE	0	2402	0.67	1.15
	19	2440	0.68	1.15
	39	2480	0.70	1.15

Results screenshot:

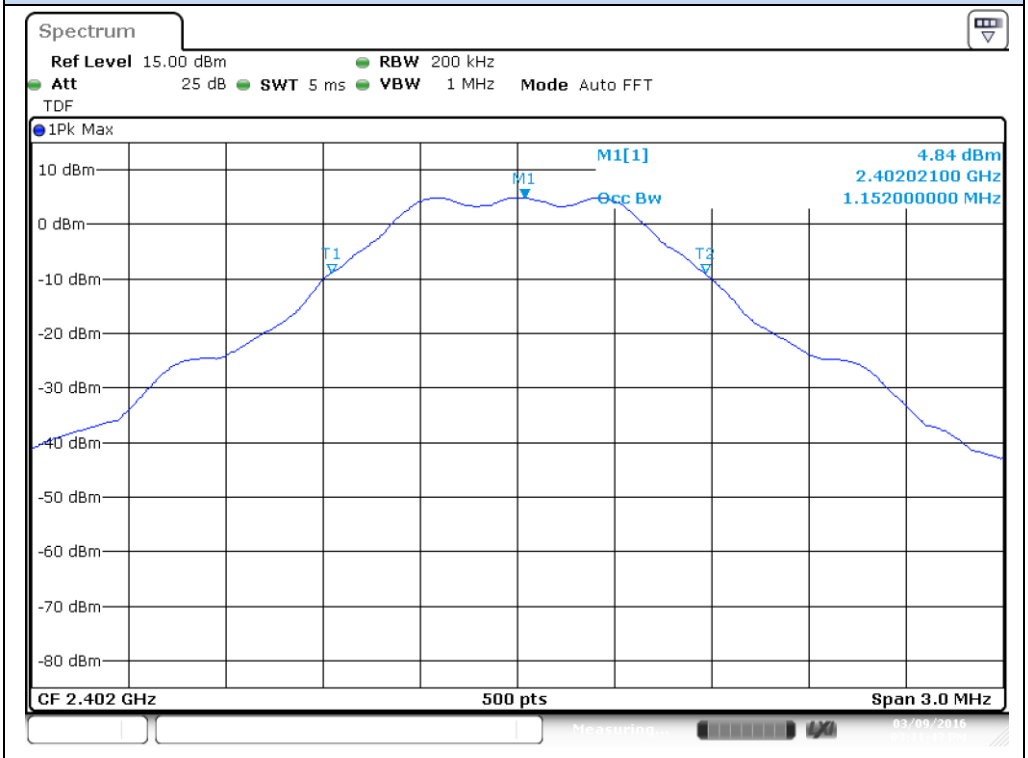
BLE

6dB BW – CH0



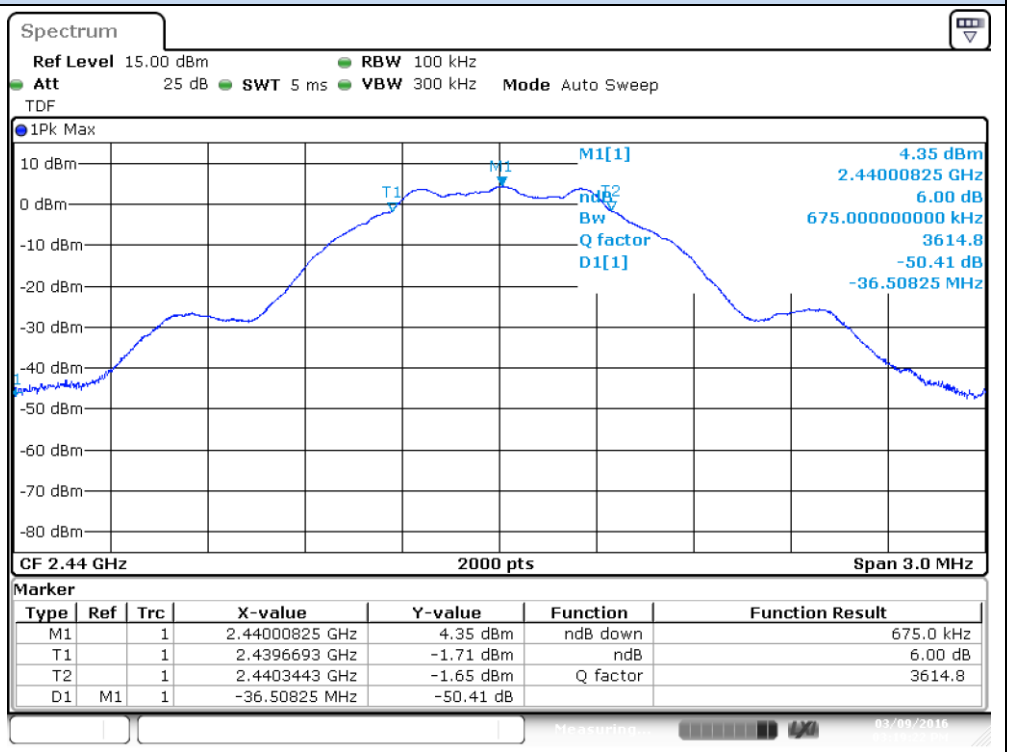
Date: 9.MAR.2016 15:11:15

99% BW – CH0



Date: 9.MAR.2016 15:11:43

6dB BW – CH19

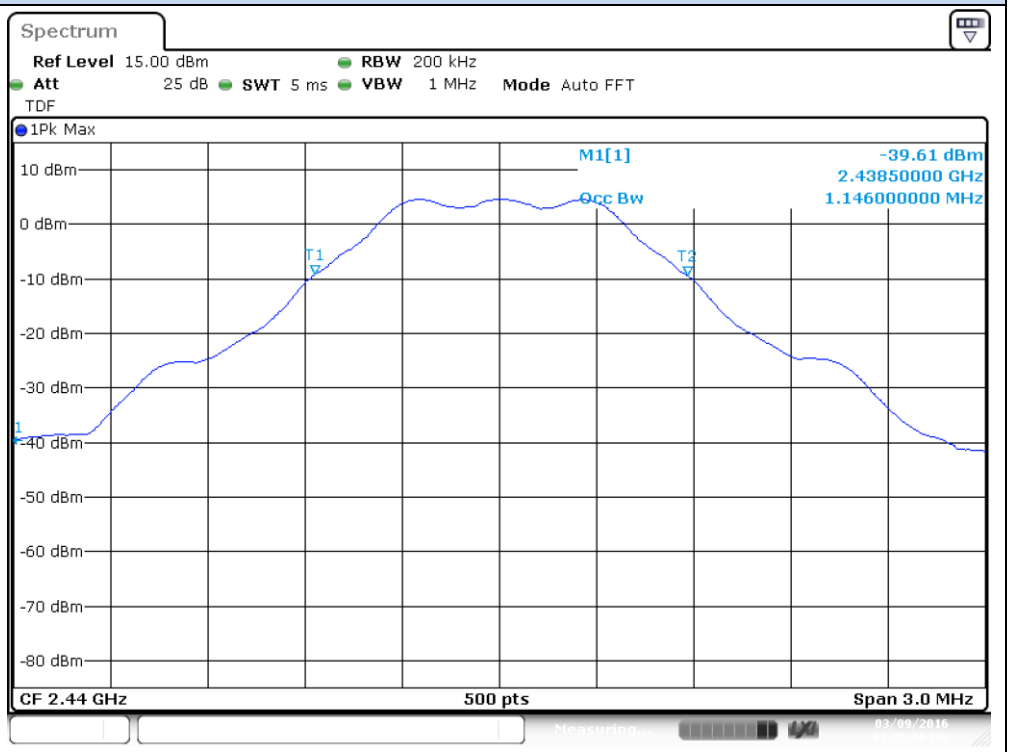


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.44000825 GHz	4.35 dBm	ndB down	675.0 kHz
T1		1	2.4396693 GHz	-1.71 dBm	ndB	6.00 dB
T2		1	2.4403443 GHz	-1.65 dBm	Q factor	3614.8
D1	M1	1	-36.50825 MHz	-50.41 dB		

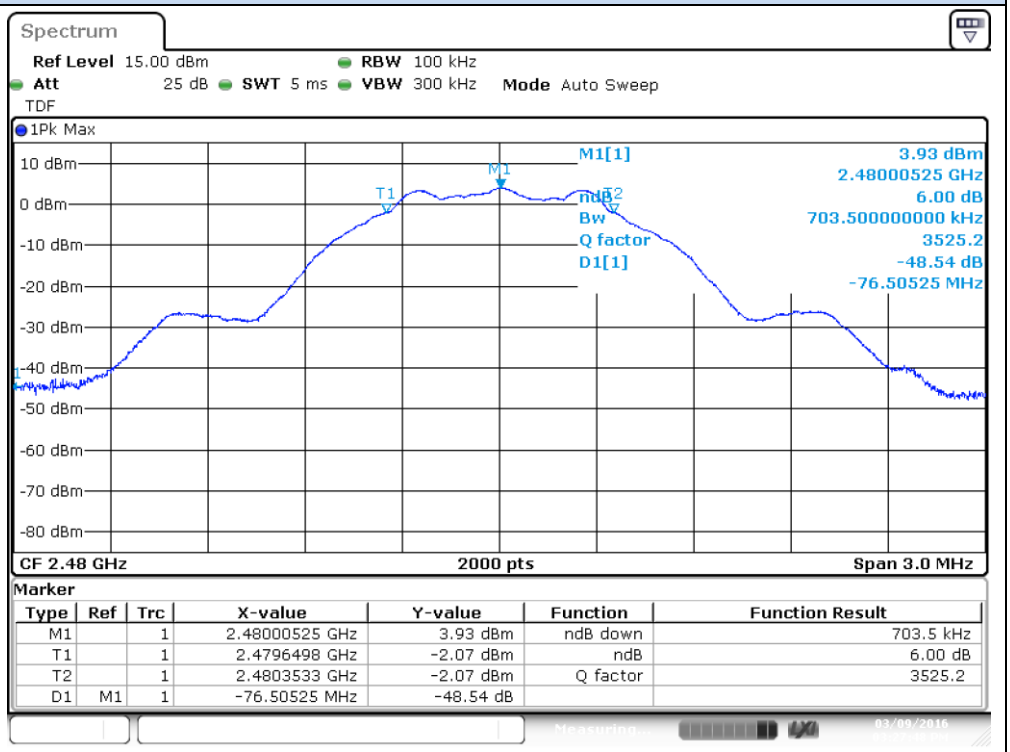
Date: 9.MAR.2016 15:19:23

99% BW – CH19



Date: 9.MAR.2016 15:20:06

6dB BW – CH39

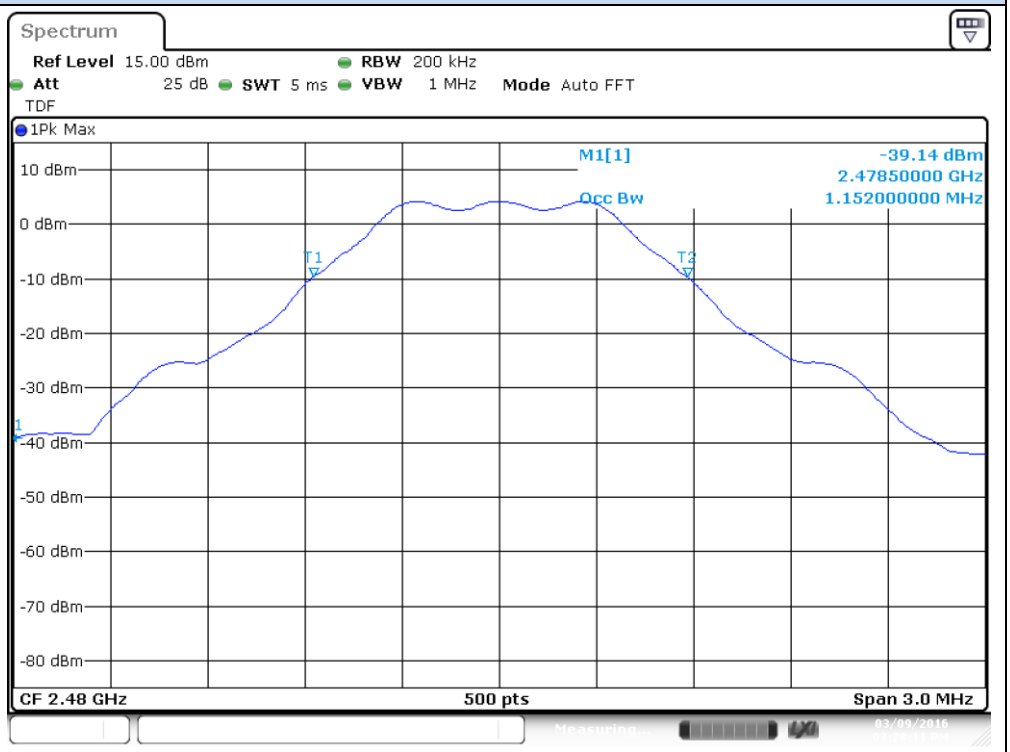


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.48000525 GHz	3.93 dBm	ndB down	703.5 kHz
T1		1	2.4796498 GHz	-2.07 dBm	ndB	6.00 dB
T2		1	2.4803533 GHz	-2.07 dBm	Q factor	3525.2
D1	M1	1	-76.50525 MHz	-48.54 dB		

Date: 9.MAR.2016 15:27:48

99% BW – CH39



Date: 9.MAR.2016 15:28:11

C.2 Maximum Output Power and antenna gain

Test limits:

FCC part	Limits
15.247 (b) (3)	(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.

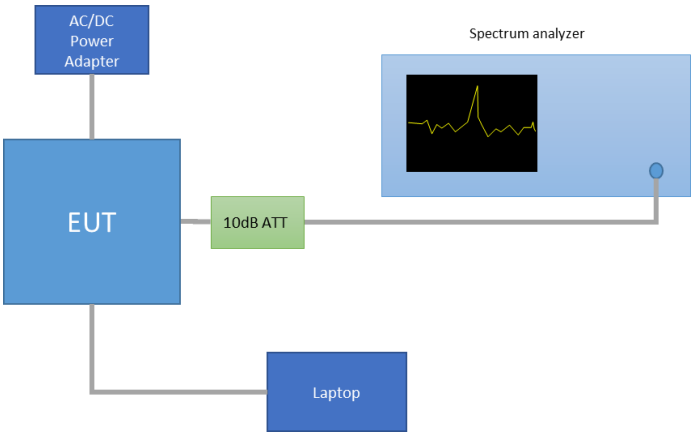
Test procedure:

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 maximum declared antenna gain is 1.5dBi.

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.



Results tables:

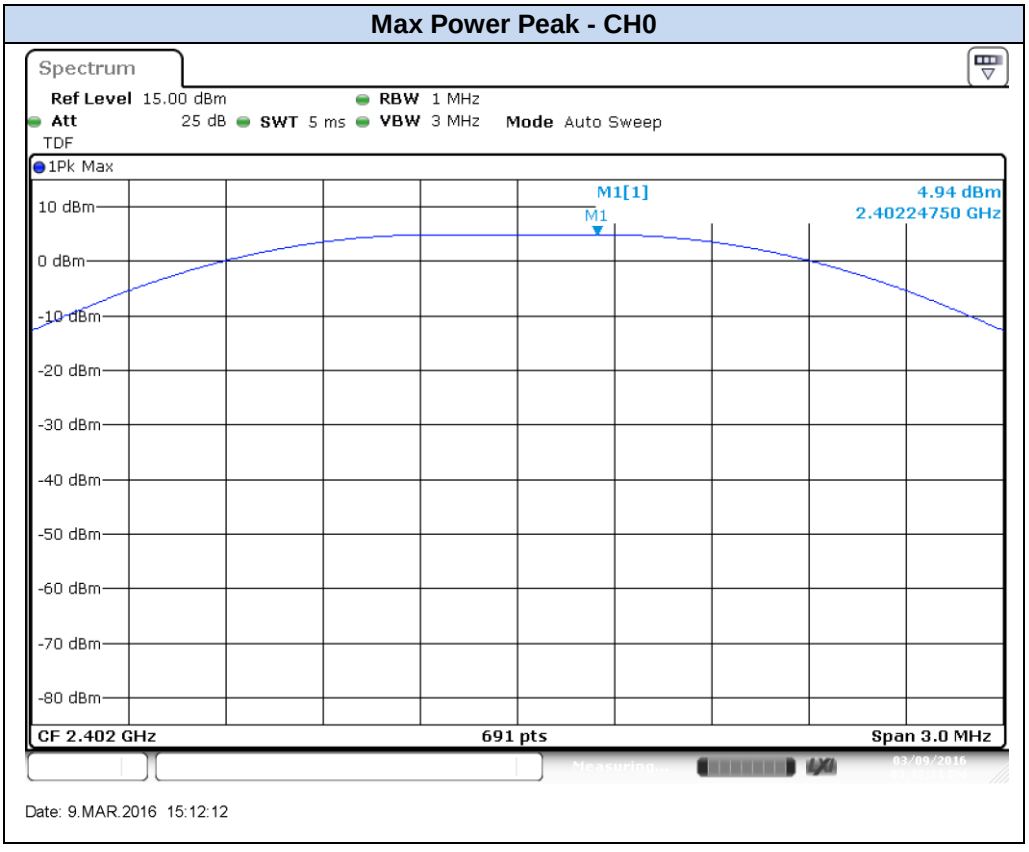
Mode	Meas. Duty Cycle [%]	CH	Frequency [MHz]	Peak Power [dBm]		Peak Output Power [mW]
				Measured Conducted Output Power	EIRP	
BLE	62.6	0	2402	4.94	6.44	**3.12**
		19	2440	4.61	6.11	2.89
		39	2480	4.21	5.71	**2.64**

Max Value
Min Value

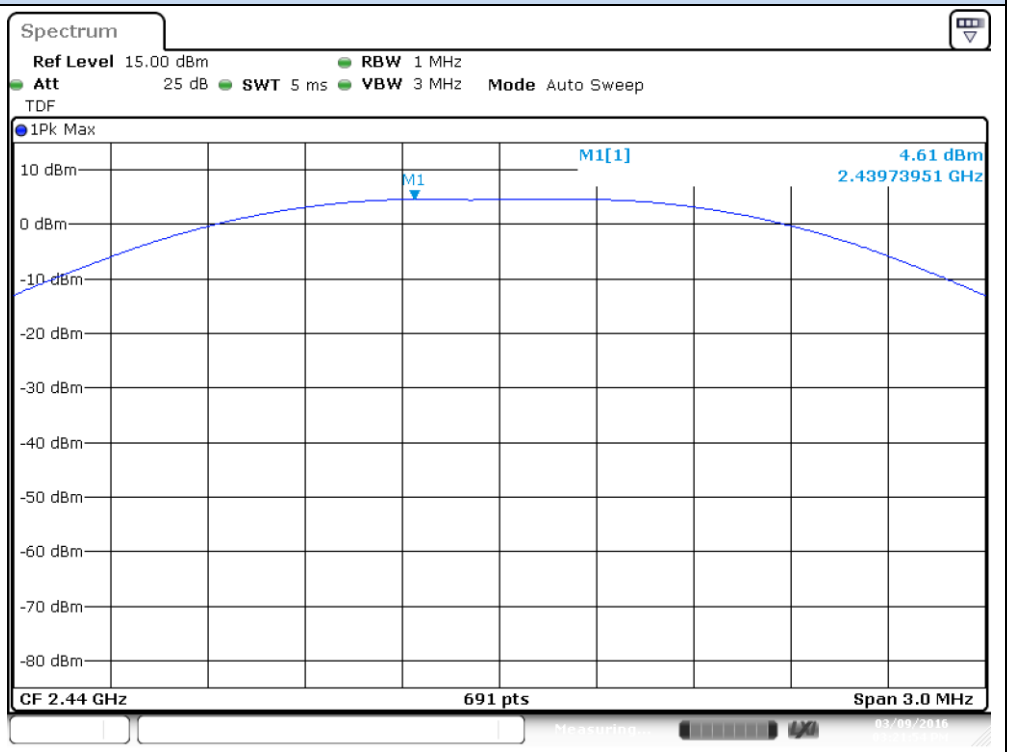
Results screenshot:

BLE

Max Power Peak - CH0

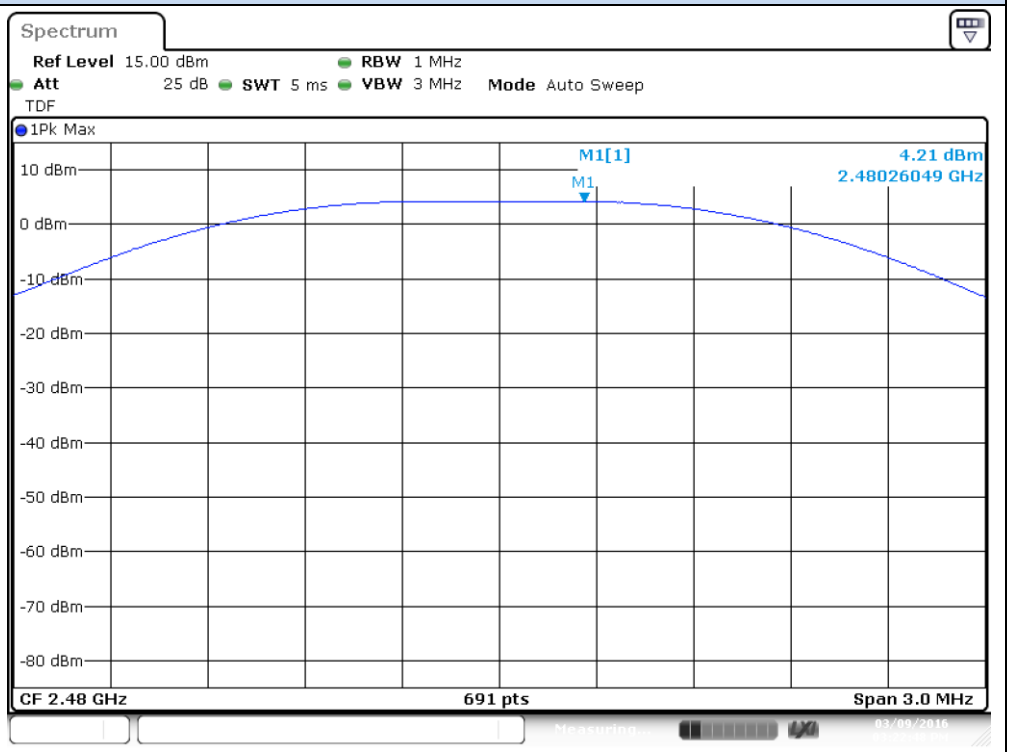


Max Power Peak - CH19



Date: 9.MAR.2016 15:21:55

Max Power Peak - CH39



Date: 9.MAR.2016 15:22:49

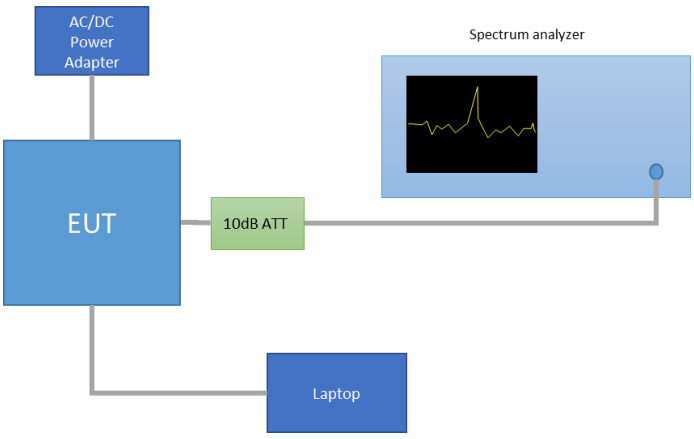
C.3 Out-of-band emissions (conducted)

Test limits:

<table>
<tr><th>FCC part</th><th>Limits</th></tr>
<tr><td>15.247 (d)</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>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>960-25000</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.



In case of Band Edge measurements falling in restricted bands, the declared Antenna Gain is also compensated in the graph. The maximum declared antenna gain is 1.5dBi.

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)
960-25000	3	500	54.0	-41.2

The resolution/video bandwidth used for the conducted spurious measurement (delta method) is as follows:

Freq. Range	RBW	VBW
30MHz – 26.5GHz	100kHz	300kHz

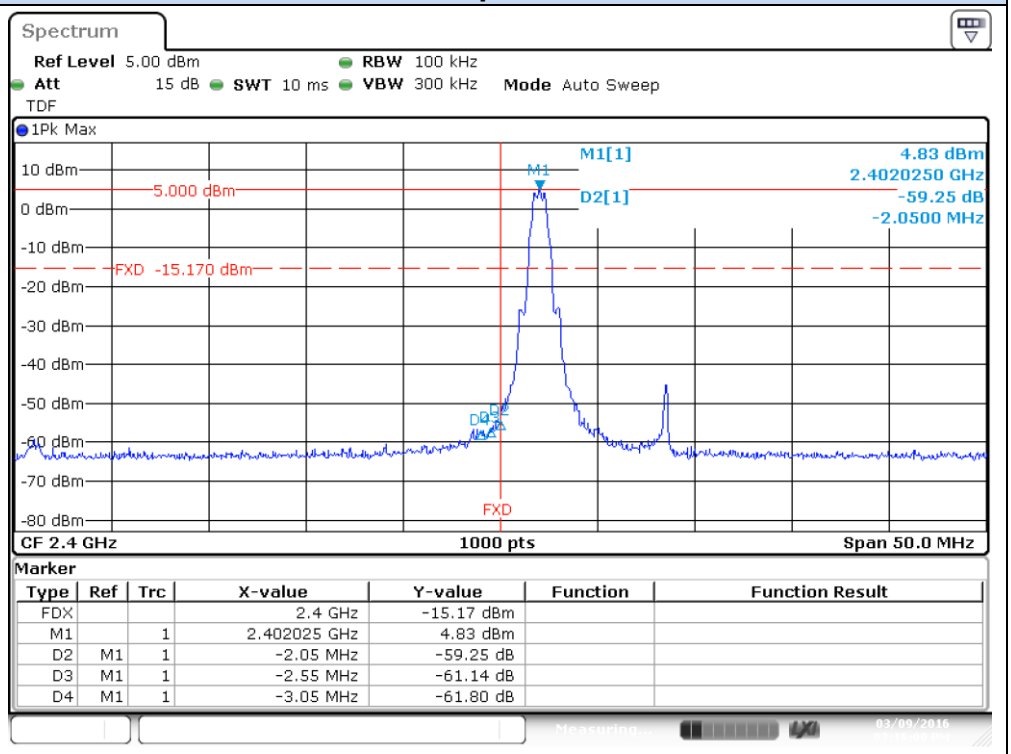
Note: the below PSD_{Peak} values are shown just as a reference for the compliance of the Out-of-band Measurements. Thus the RBW used for these measurements was 100 kHz.

Mode	**CH**	**Frequency [MHz]**	**PSD Peak [dBm]**
BLE	0	2402	4.72
	19	2440	4.35
	39	2480	4.72

Band Edge results Screenshot:

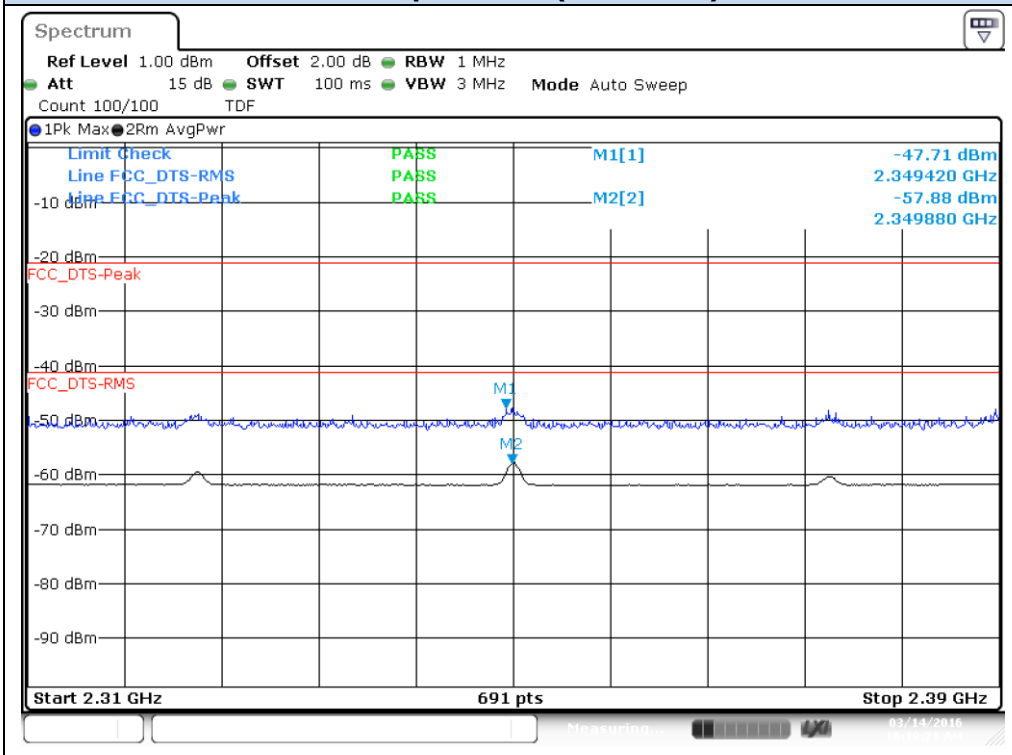
BLE

BE Low Freq Section, CH 0



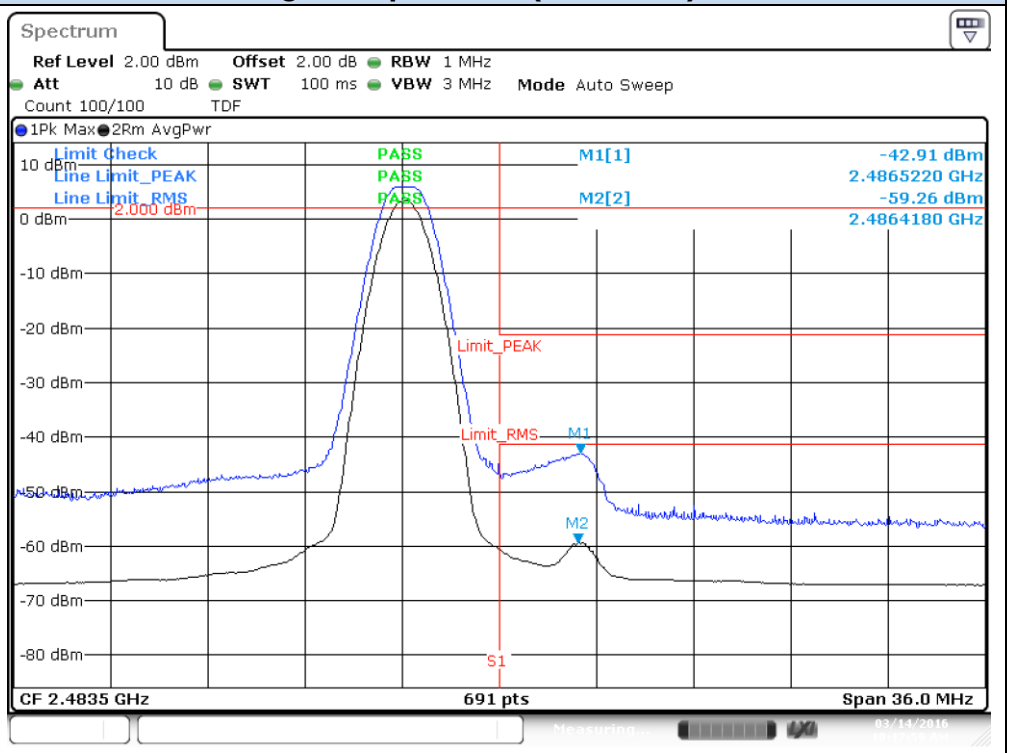
Date: 9.MAR.2016 15:16:00

BE Low Freq Section (restricted), CH0



Date: 14.MAR.2016 10:19:21

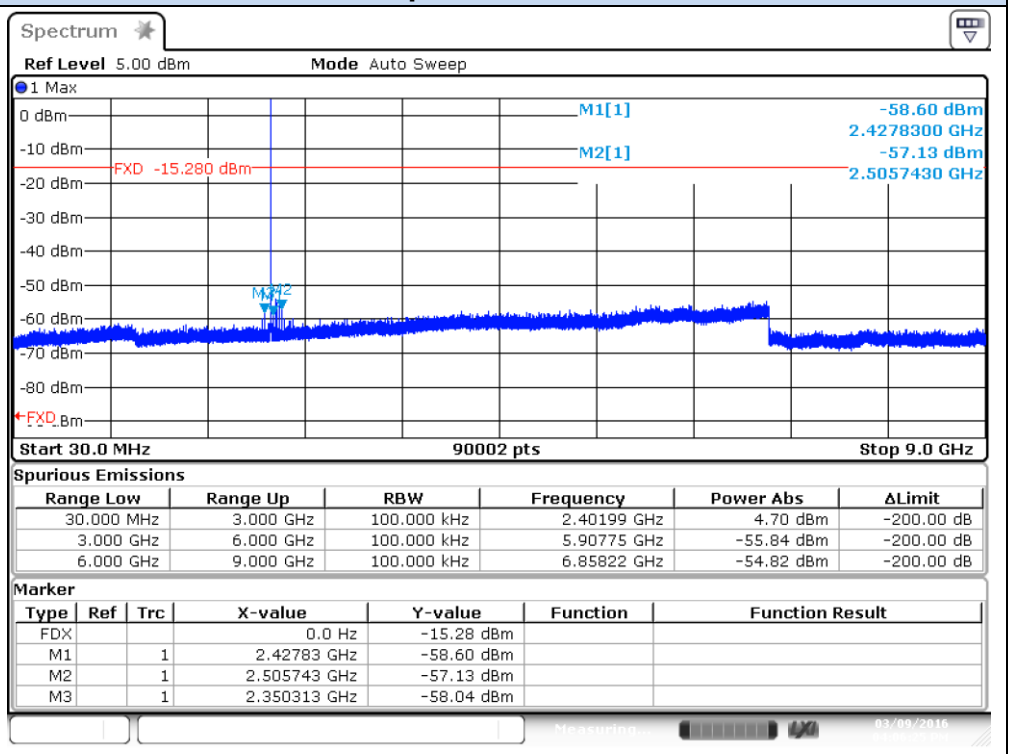
BE High Freq Section (restricted), CH39



Spurious results Screenshot:

BLE, CH0

Cond Spur, 30MHz – 9GHz



Spurious Emissions

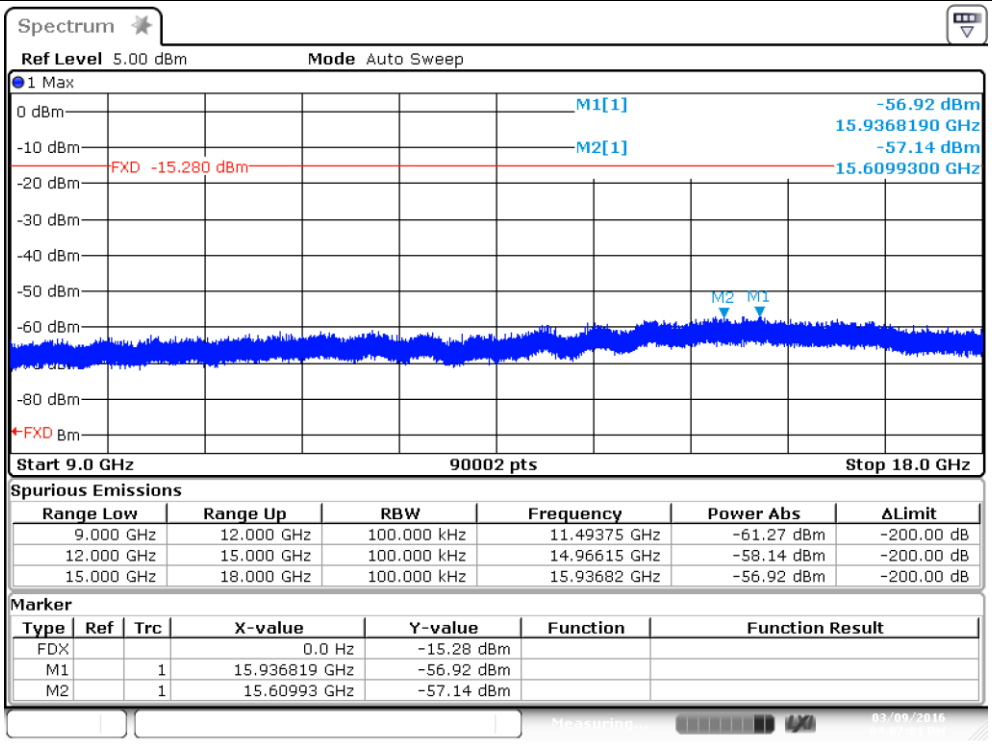
Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
30.000 MHz	3.000 GHz	100.000 kHz	2.40199 GHz	4.70 dBm	-200.00 dB
3.000 GHz	6.000 GHz	100.000 kHz	5.90775 GHz	-55.84 dBm	-200.00 dB
6.000 GHz	9.000 GHz	100.000 kHz	6.85822 GHz	-54.82 dBm	-200.00 dB

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
FDX			0.0 Hz	-15.28 dBm		
M1		1	2.42783 GHz	-58.60 dBm		
M2		1	2.505743 GHz	-57.13 dBm		
M3		1	2.350313 GHz	-58.04 dBm		

Date: 9.MAR.2016 16:06:25

Cond Spur, 9GHz – 18GHz



Spurious Emissions

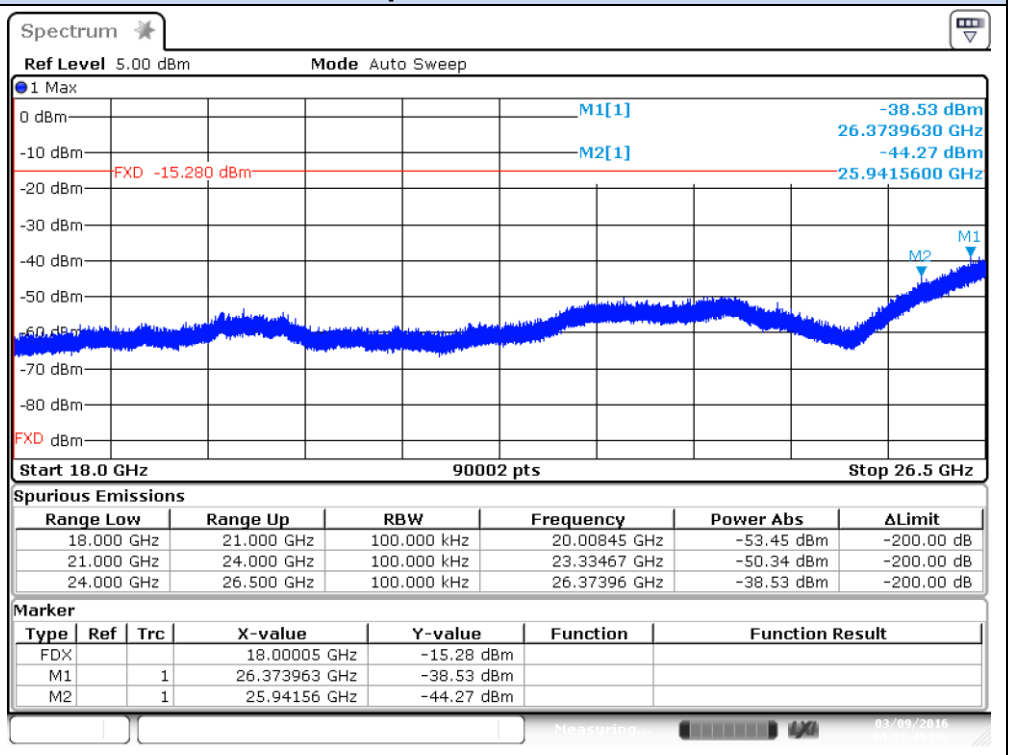
Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
9.000 GHz	12.000 GHz	100.000 kHz	11.49375 GHz	-61.27 dBm	-200.00 dB
12.000 GHz	15.000 GHz	100.000 kHz	14.96615 GHz	-58.14 dBm	-200.00 dB
15.000 GHz	18.000 GHz	100.000 kHz	15.93682 GHz	-56.92 dBm	-200.00 dB

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
FDX			0.0 Hz	-15.28 dBm		
M1		1	15.936819 GHz	-56.92 dBm		
M2		1	15.60993 GHz	-57.14 dBm		

Date: 9.MAR.2016 16:07:01

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	20.00845 GHz	-53.45 dBm	-200.00 dB
21.000 GHz	24.000 GHz	100.000 kHz	23.33467 GHz	-50.34 dBm	-200.00 dB
24.000 GHz	26.500 GHz	100.000 kHz	26.37396 GHz	-38.53 dBm	-200.00 dB

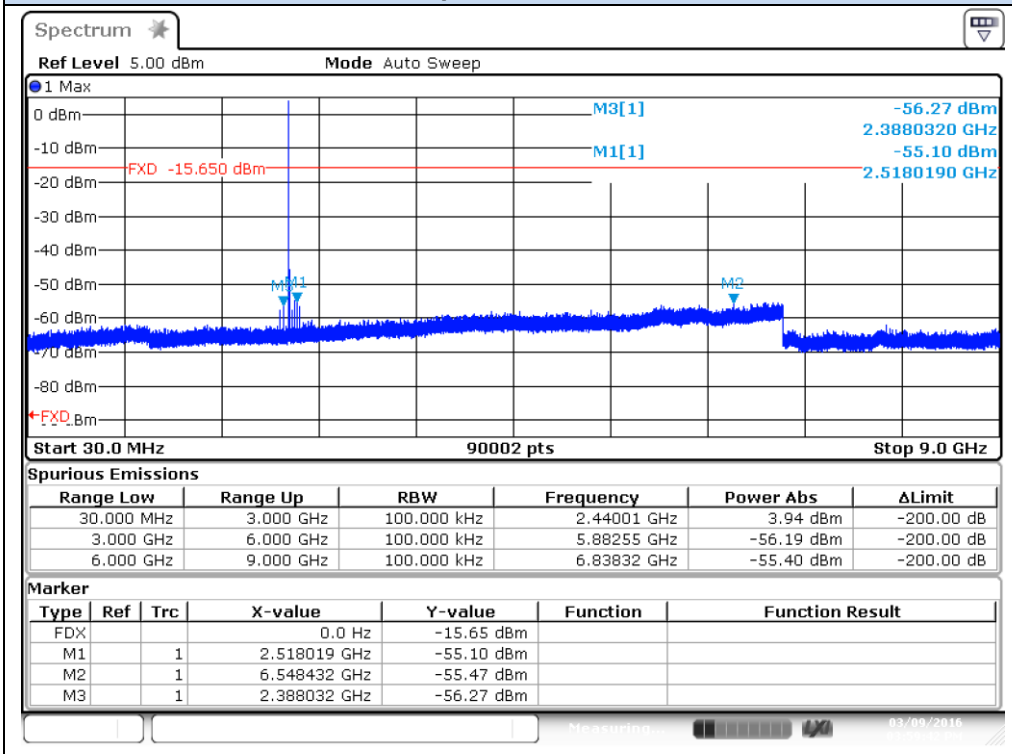
Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
FDX			18.00005 GHz	-15.28 dBm		
M1		1	26.373963 GHz	-38.53 dBm		
M2		1	25.94156 GHz	-44.27 dBm		

Date: 9.MAR.2016 16:07:50

BLE, CH19

Cond Spur, 30MHz – 9GHz



Spurious Emissions

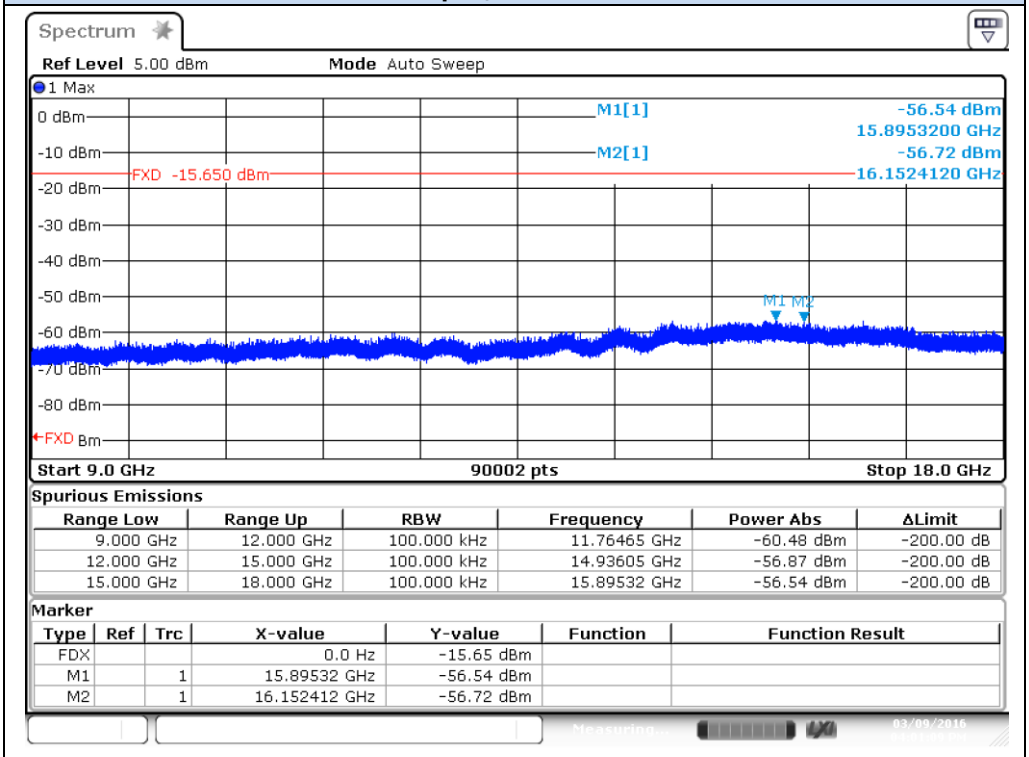
Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
30.000 MHz	3.000 GHz	100.000 kHz	2.44001 GHz	3.94 dBm	-200.00 dB
3.000 GHz	6.000 GHz	100.000 kHz	5.88255 GHz	-56.19 dBm	-200.00 dB
6.000 GHz	9.000 GHz	100.000 kHz	6.83832 GHz	-55.40 dBm	-200.00 dB

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
FDX			0.0 Hz	-15.65 dBm		
M1		1	2.518019 GHz	-55.10 dBm		
M2		1	6.548432 GHz	-55.47 dBm		
M3		1	2.388032 GHz	-56.27 dBm		

Date: 9.MAR.2016 15:59:42

Cond Spur, 9GHz – 18GHz



Spurious Emissions

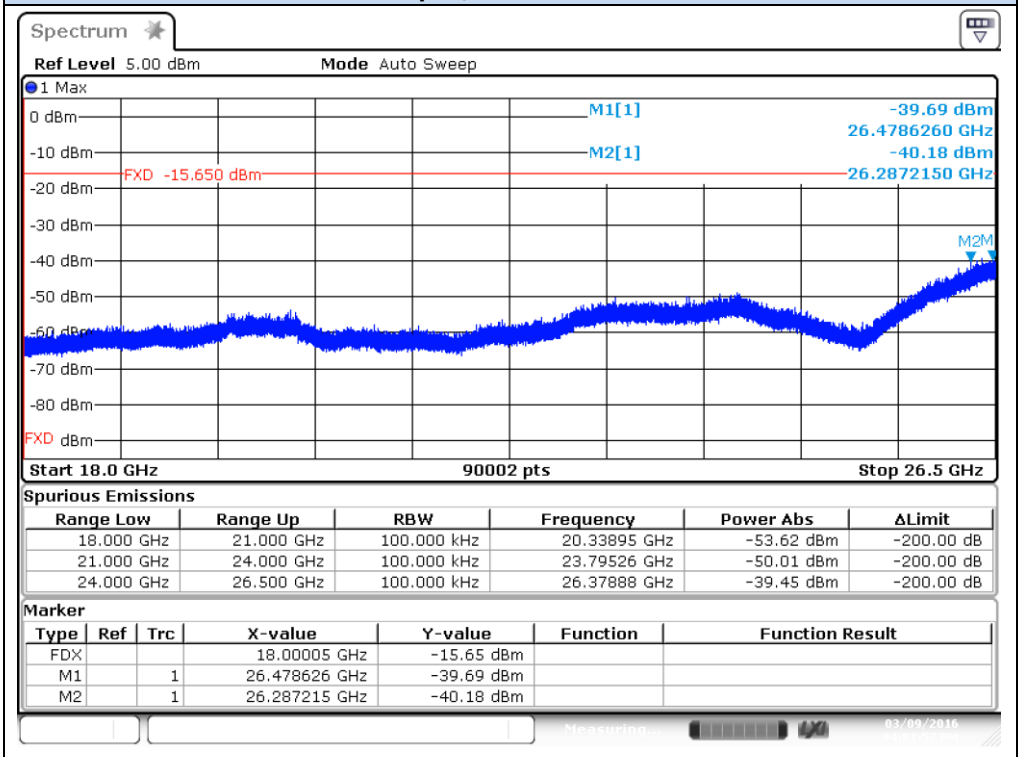
Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
9.000 GHz	12.000 GHz	100.000 kHz	11.76465 GHz	-60.48 dBm	-200.00 dB
12.000 GHz	15.000 GHz	100.000 kHz	14.93605 GHz	-56.87 dBm	-200.00 dB
15.000 GHz	18.000 GHz	100.000 kHz	15.89532 GHz	-56.54 dBm	-200.00 dB

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
FDX			0.0 Hz	-15.65 dBm		
M1		1	15.89532 GHz	-56.54 dBm		
M2		1	16.152412 GHz	-56.72 dBm		

Date: 9.MAR.2016 16:01:09

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	20.33895 GHz	-53.62 dBm	-200.00 dB
21.000 GHz	24.000 GHz	100.000 kHz	23.79526 GHz	-50.01 dBm	-200.00 dB
24.000 GHz	26.500 GHz	100.000 kHz	26.37888 GHz	-39.45 dBm	-200.00 dB

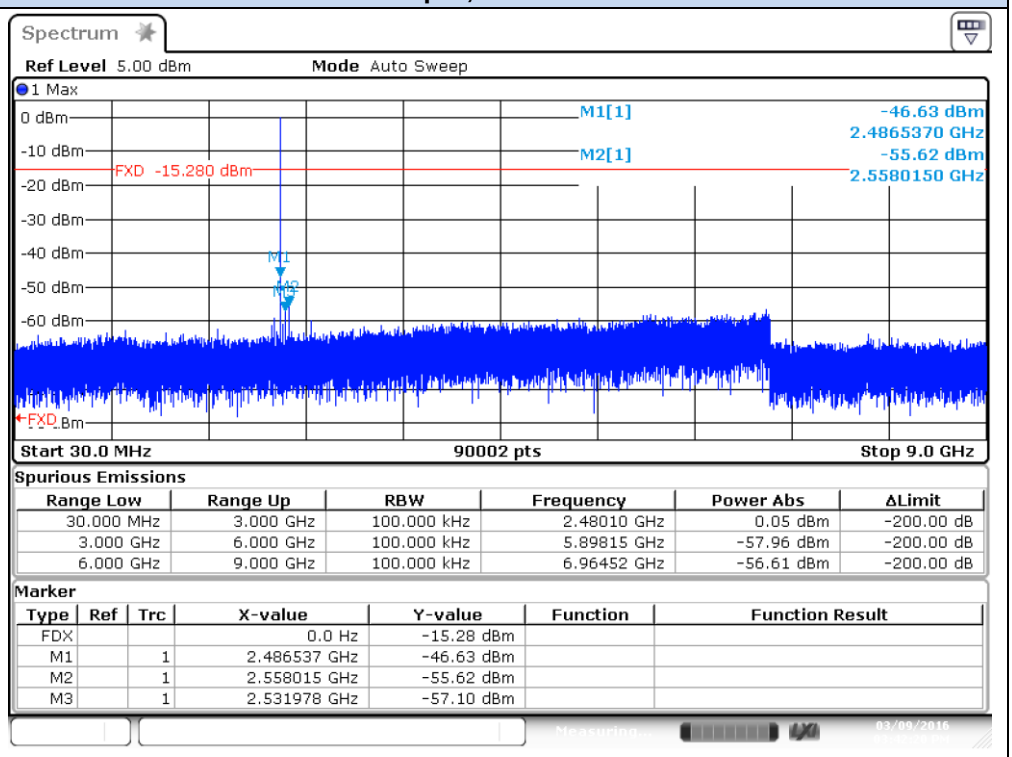
Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
FDX			18.00005 GHz	-15.65 dBm		
M1		1	26.478626 GHz	-39.69 dBm		
M2		1	26.287215 GHz	-40.18 dBm		

Date: 9.MAR.2016 16:01:57

BLE, CH39

Cond Spur, 30MHz – 9GHz



Spurious Emissions

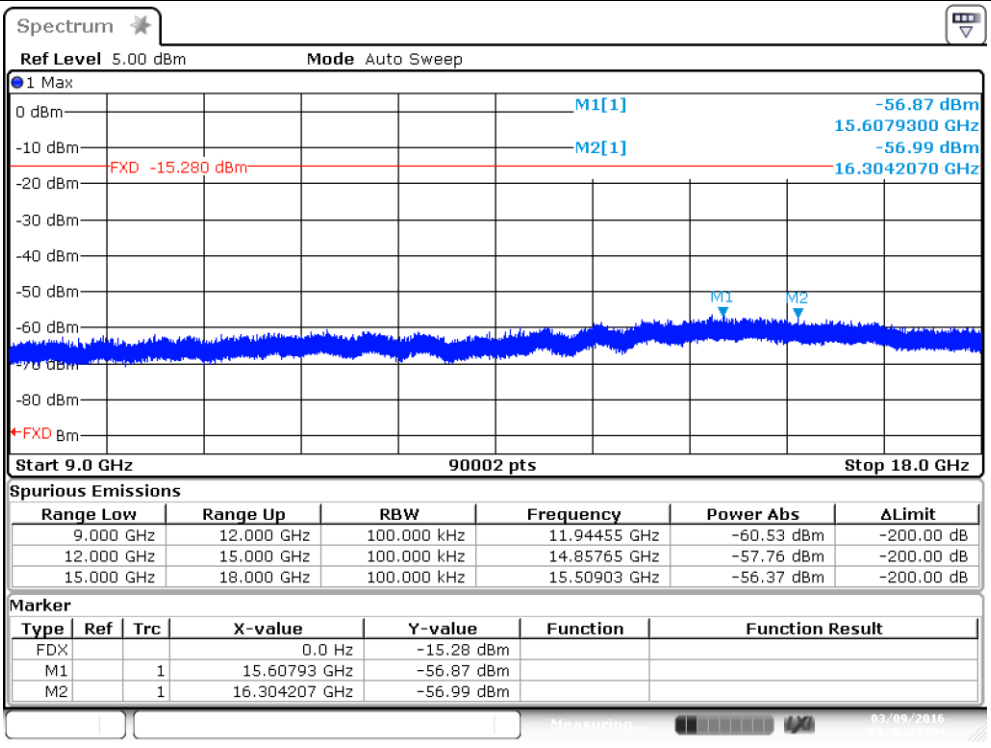
Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
30.000 MHz	3.000 GHz	100.000 kHz	2.48010 GHz	0.05 dBm	-200.00 dB
3.000 GHz	6.000 GHz	100.000 kHz	5.89815 GHz	-57.96 dBm	-200.00 dB
6.000 GHz	9.000 GHz	100.000 kHz	6.96452 GHz	-56.61 dBm	-200.00 dB

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
FDX			0.0 Hz	-15.28 dBm		
M1		1	2.486537 GHz	-46.63 dBm		
M2		1	2.558015 GHz	-55.62 dBm		
M3		1	2.531978 GHz	-57.10 dBm		

Date: 9.MAR.2016 15:42:20

Cond Spur, 9GHz – 18GHz



Spurious Emissions

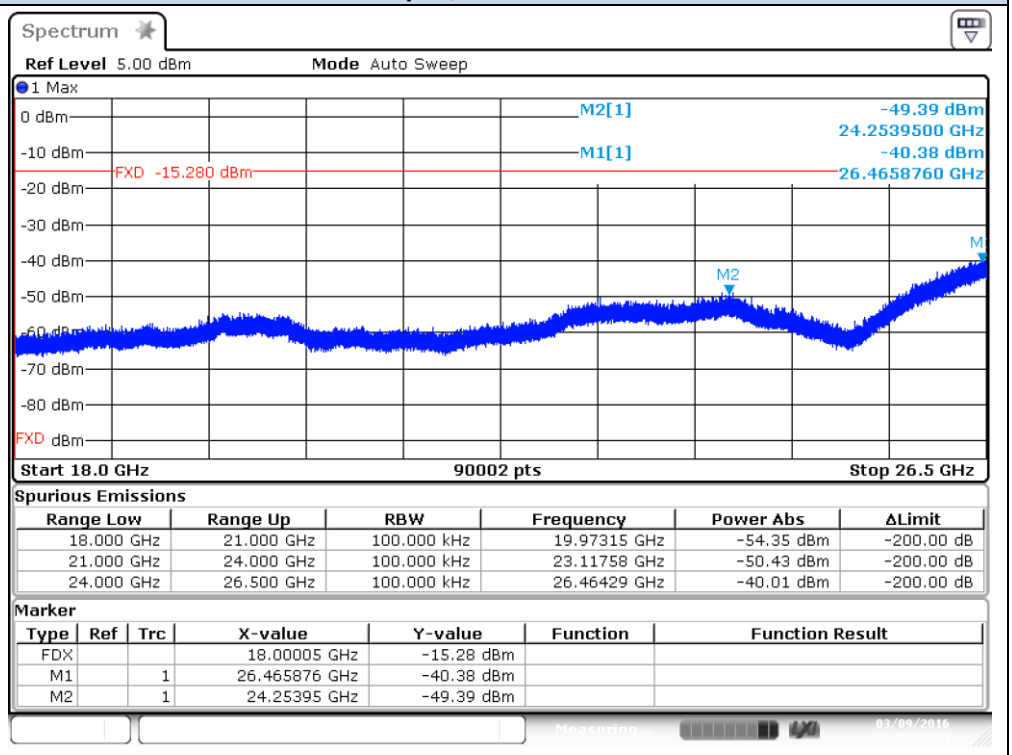
Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
9.000 GHz	12.000 GHz	100.000 kHz	11.94455 GHz	-60.53 dBm	-200.00 dB
12.000 GHz	15.000 GHz	100.000 kHz	14.85765 GHz	-57.76 dBm	-200.00 dB
15.000 GHz	18.000 GHz	100.000 kHz	15.50903 GHz	-56.37 dBm	-200.00 dB

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
FDX			0.0 Hz	-15.28 dBm		
M1		1	15.60793 GHz	-56.87 dBm		
M2		1	16.304207 GHz	-56.99 dBm		

Date: 9.MAR.2016 15:46:08

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	19.97315 GHz	-54.35 dBm	-200.00 dB
21.000 GHz	24.000 GHz	100.000 kHz	23.11758 GHz	-50.43 dBm	-200.00 dB
24.000 GHz	26.500 GHz	100.000 kHz	26.46429 GHz	-40.01 dBm	-200.00 dB

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
FDX			18.00005 GHz	-15.28 dBm		
M1		1	26.465876 GHz	-40.38 dBm		
M2		1	24.25395 GHz	-49.39 dBm		

Date: 9.MAR.2016 15:49:51

C.4 Power Spectral Density

Test limits:

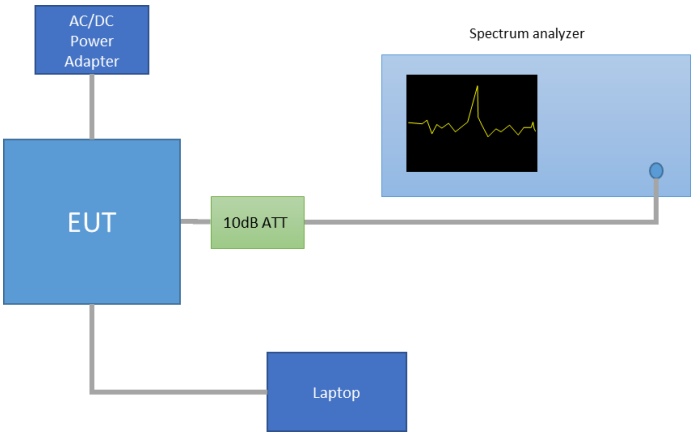
FCC part	Limits
15.247 (e)	For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance 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 maximum declared antenna gain is 1.5dBi.



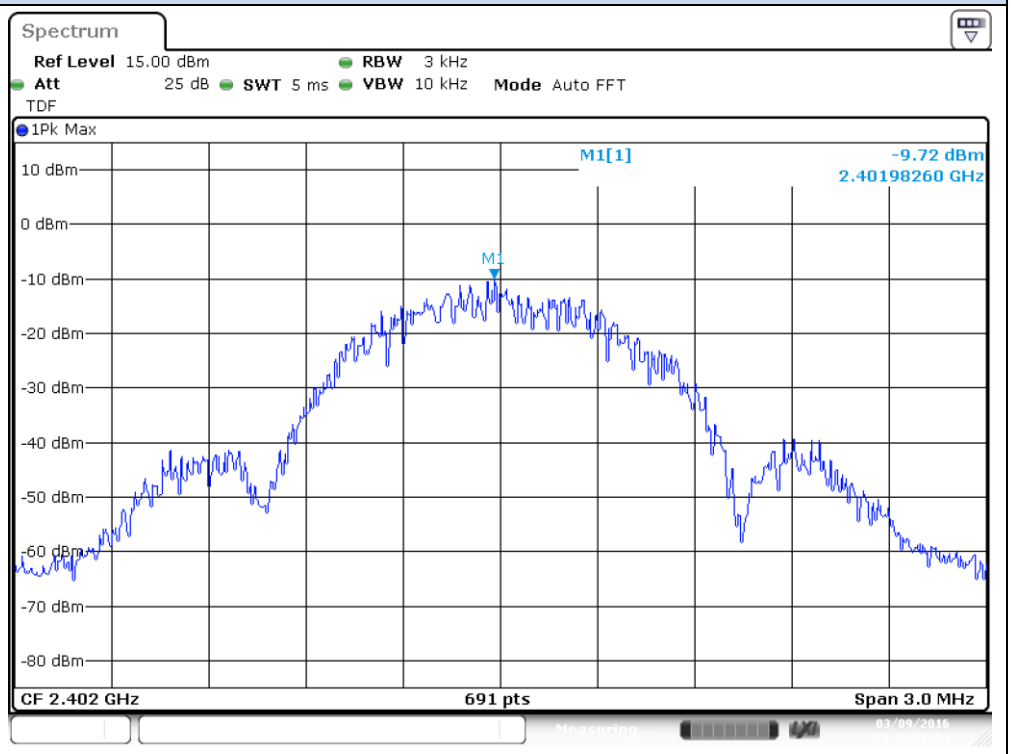
Results tables:

			PSD PEAK [dBm]
Mode	**CH**	**Frequency [MHz]**	**Measured Conducted**
BLE	0	2402	-9.72
	19	2440	-10.42
	39	2480	-10.60

Results screenshot:

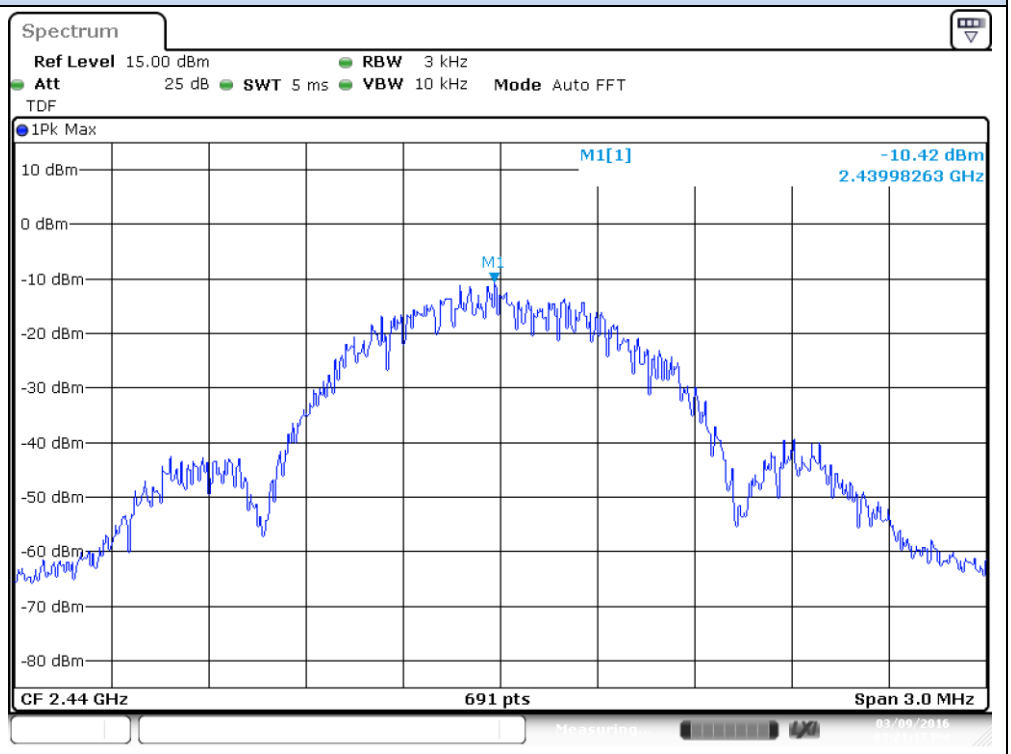
BLE

PSD PEAK - CH0



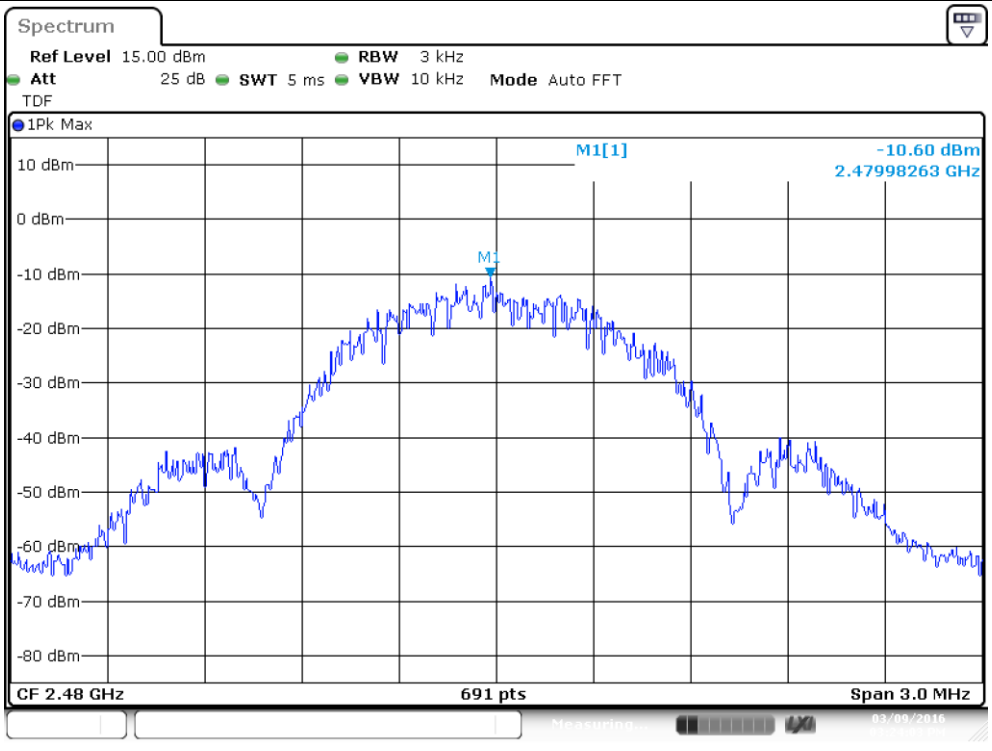
Date: 9.MAR.2016 15:13:29

PSD PEAK - CH19



Date: 9.MAR.2016 15:21:17

PSD PEAK - CH39



C.5 Radiated spurious emission

Standard references:

<table>
<tr><th>FCC part</th><th>Limits</th></tr>
<tr><td>15.247 (d)</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>960-25000</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>

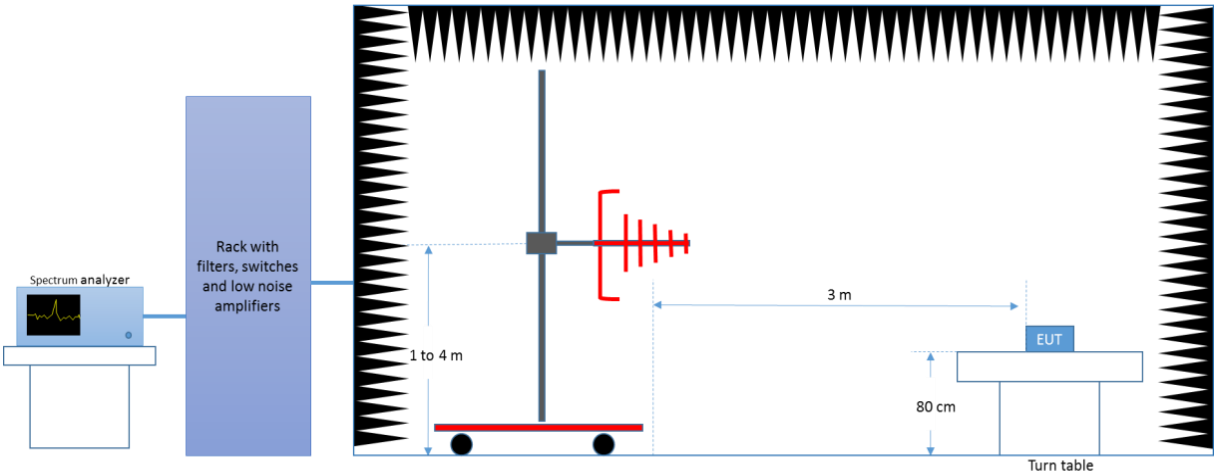
Test procedure:

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 *C.2 Maximum Output Power and antenna gain* and using the lowest, middle and highest channels.

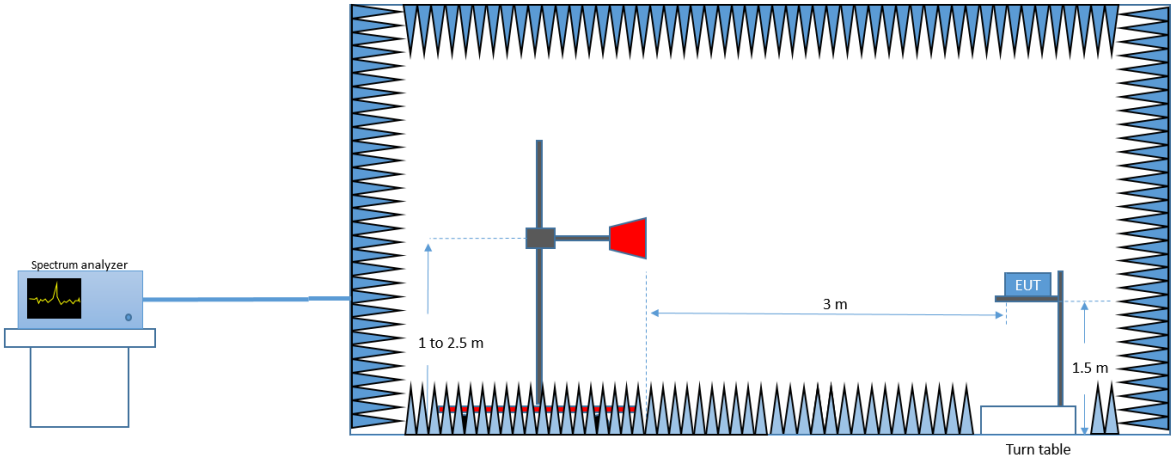
The resolution/video bandwidth used for the radiated measurement is as follows:

Freq. Range	RBW	VBW
30MHz – 1GHz	100kHz	300kHz
>1GHz	1MHz	3MHz

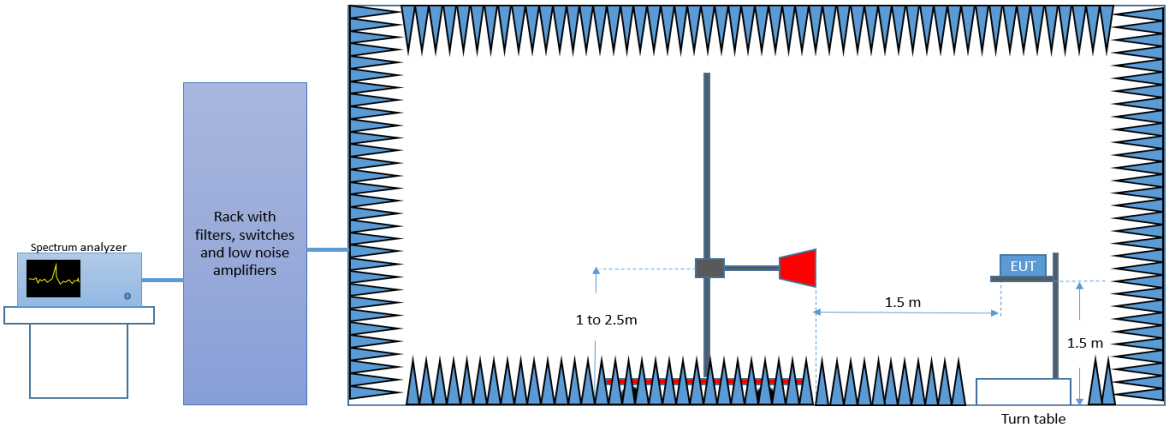
Radiated Setup < 1GHz



Radiated Setup 1GHz - 18GHz



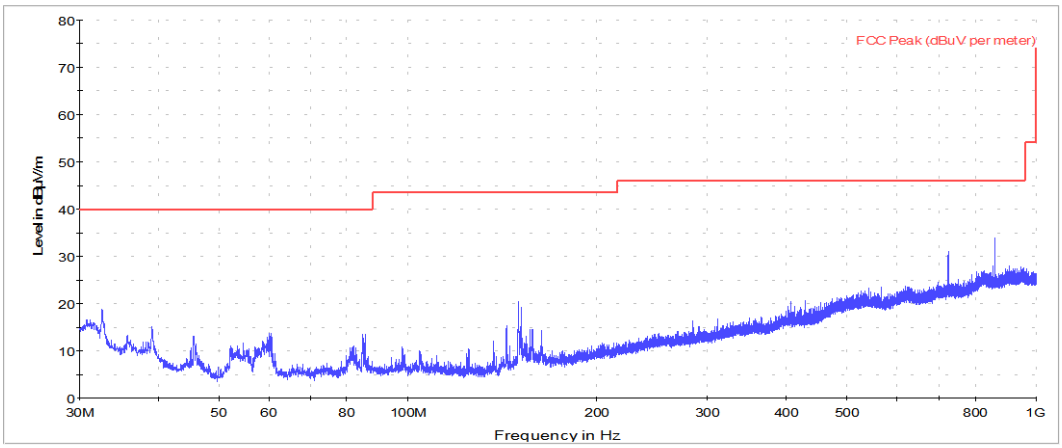
Radiated Setup > 18GHz



Test Results:

Radiated Spurious – 30MHz to 1GHz

Radiated Spurious – All Modes

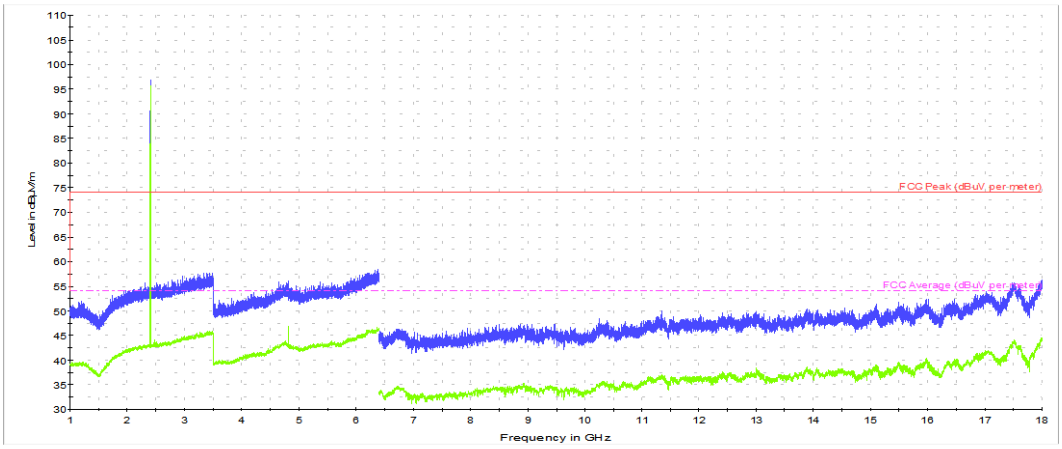


Frequency	Max Peak	Limit	Margin
MHz	dBµV/m	dBµV/m	dB
860	33.9	46	12.1

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

1 GHz – 18GHz, BLE

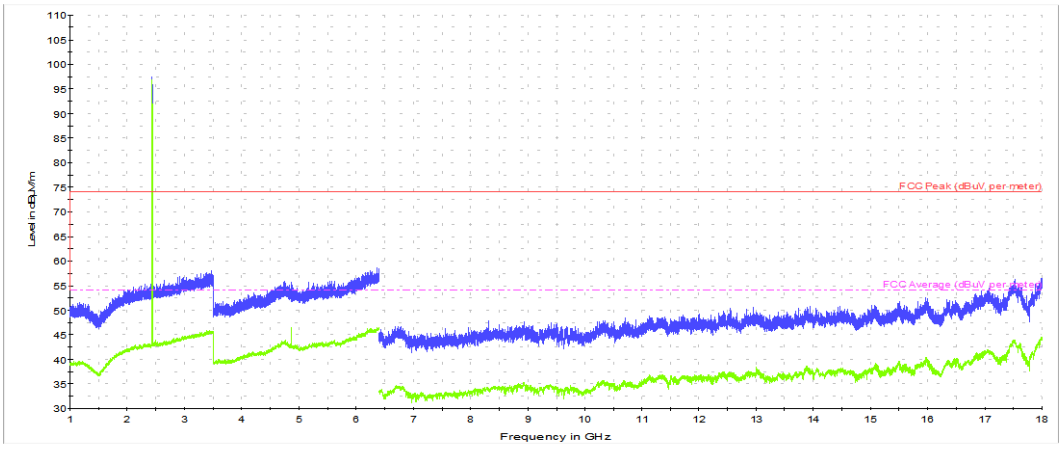
CH0



Peak measurements AVG measurements Limit FCC Peak Limit FCC AVG

Frequency	Max Peak	AVG	Limit	Margin
MHz	dBµV/m	dBµV/m	dBµV/m	dB
4808	54.0	-	74	20.0
4808	-	47.8	54	6.2

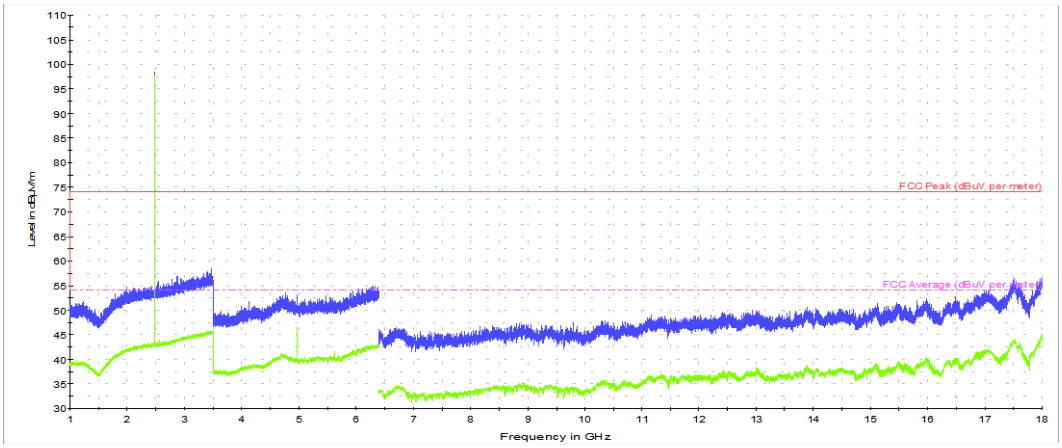
CH19



Peak measurements AVG measurements Limit FCC Peak Limit FCC AVG

Frequency	Max Peak	AVG	Limit	Margin
MHz	dBµV/m	dBµV/m	dBµV/m	dB
4879	55.3	-	74	18.7
4879	-	46.0	54	8.0

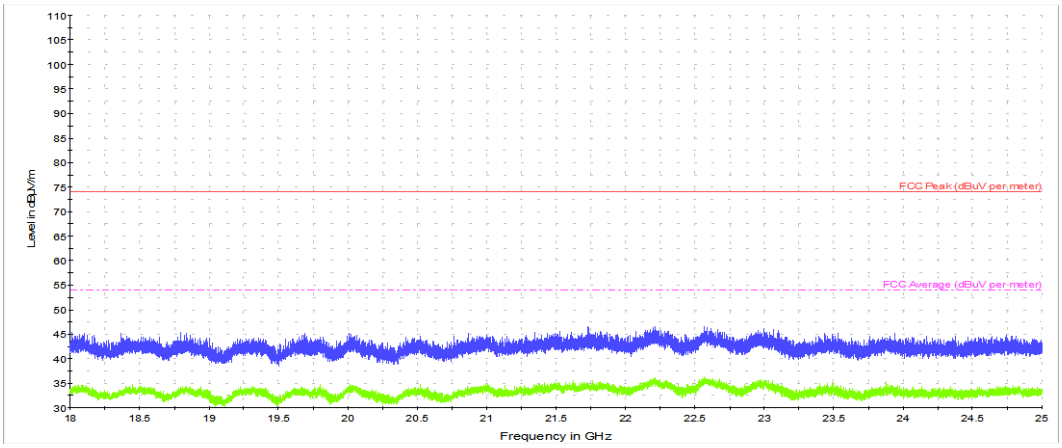
CH39



Frequency	Max Peak	AVG	Limit	Margin
MHz	dBµV/m	dBµV/m	dBµV/m	dB
4959	55.0	-	74	19.00
4959	-	46.1	54	7.9

Radiated Spurious – 18 GHz to 25 GHz

Radiated Spurious – All Modes



Frequency	Max Peak	AVG	Limit	Margin
MHz	dBµV/m	dBµV/m	dBµV/m	dB
22565	46.5	-	74	27.5
22565	-	36.4	54	17.6

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